IBM

Series/1

SC34-0937-0

Event Driven Executive Language Reference

Version 6.0

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Summary of Changes for Version 6.0

This document contains the following changes.

3151 Display Terminal

- Chapter 2, "Instruction and Statement Descriptions" has been updated to include the 3151 display in the READTEXT, TERMCTRL, and WAIT instructions everywhere a reference to the 3161 display appears.
- Appendix A, "Formatted Screen Subroutines" includes information for the 3151 display everywhere a reference to the 3161 display appears.

EDX Line Sharing Support

- The TERMCTRL instruction contains updates to the LOCK and UNLOCK parameters (3101, 3151, and 316x terminals) for use with line sharing.

4202 Proprinter XL

- The TERMCTRL instruction has been updated to include the 4202 printer everywhere a reference to the 4201 printer appears.

Extended Address Mode Support

- The BUFFKEY operand for the LCCIOCB instruction has been updated to allow values of 0 – 31 for the 4956 J and K processors.
- The PART operand for the LOAD instruction has been updated to allow 1 – 32 partitions for the 4956 J and K processors.
- The FKEY and TKEY operands for the MOVE instruction has been updated to allow 1 – 32 partitions for the 4956 J and K processors.
- The EXBREAK instruction cannot be used with extended address mode.

System Partition Statements

- References to the SYSTEM statement have been replaced by the appropriate system partition statement: SYSPARTS, SYSPARMS, SYSCOMM, or SYSEND.

Editorial/Usability Changes

- Numerous editorial and usability changes have been made throughout this book.

Contents

About This Book

This book contains details and examples of how to code the instructions and statements you can use to write Event Driven Language application programs.

Audience

This book is intended for application programmers who write and maintain programs using the Event Driven Language. You can learn the Event Driven Language by using the *Language Programming Guide*.

How This Book Is Organized

This book contains two chapters and six appendixes:

- *Chapter 1. Introduction* describes how instructions and statements are presented in this book. The chapter also describes the syntax rules for the language, defines key terms used throughout the book, and provides information about a number of special features available with the Event Driven Language.
- *Chapter 2. Instruction and Statement Descriptions* contains a detailed description of each EDL instruction and statement and shows the syntax of the instruction or statement, the required operands, and the default values. The instructions and statements are arranged in alphabetical order.
- *Appendix A. Formatted Screen Subroutines* contains a description of each of the formatted screen subroutines ($IMAGE routines) along with its syntax, required operands, and default values.
- *Appendix B. Programs Communication Through Virtual Terminals* contains a description of the virtual terminal facility that allows application programs to communicate as if they were EDX terminals.
- *Appendix C. Communicating with Programs in Other Partitions (Cross-Partition Services)* contains examples that show how programs can share data and communicate with other programs across partitions.
- *Appendix D. EDX Programs, Subroutines, and Inline Code* lists the syntax, options and default values for the Indexed Access Method, Multiple Terminal Manager, and Formatted Screen subroutines. In addition, the appendix describes a data management program and subroutines, a program for using partitioned data sets, and a copy code routine for identifying device types.
- *Appendix E. Creating, Storing, and Retrieving Program Messages* describes how to build and use formatted program messages in your EDL application programs.
- *Appendix F. Conversion Table* contains a table that shows the hexadecimal, binary, EBCDIC, and ASCII equivalents of decimal values. The table also shows transmission codes for communications devices.

Aids in Using This Book

This book contains the following aids to using the information it presents:

- A table of contents that lists the major headings in the book.
- An Instructions and Statements Chart that groups EDL instructions and statements by the common tasks they perform. The chart also lists the statements used during system generation.
- An index of the topics covered in this book.

Using the Enter and Attention Keys

This book uses the term "enter key" to mean the key that indicates that you have completed input to a screen and want the system to process the data you keyed in. It uses the term "attention key" to mean the key that indicates that you want to direct keyboard input to the operating system supervisor. If your keyboard does not have these keys, use the corresponding keys on your keyboard.

A Guide to the Library

Refer to the *Library Guide and Common Index* for information on the design and structure of the Event Driven Executive Library, for a bibliography of related publications, for a glossary of terms and abbreviations, and for an index to the entire library.

Contacting IBM about Problems

You can inform IBM of any inaccuracies or problems you find when using this book by completing and mailing the **Reader's Comment Form** provided in the back of the book.

If you have a problem with the IBM Series/1 Event Driven Executive services, refer to the *IBM Series/1 Software Service Guide,* GC34-0099.

Chapter 1. Introduction

The Event Driven Language (EDL) is a programming language designed for use on the Series/1 computer. The language enables you to write programs that perform specific tasks. This chapter describes how the various instructions and statements that make up the Event Driven Language are presented in this book. The chapter also includes:

- Definitions of terms commonly used throughout the book
- A list of syntax rules you need to know to code EDL instructions and statements
- A description of how to use parameter naming operands and the two software registers available to your program.

Note: For a detailed description of how to write and structure EDL programs, refer to the *Language Programming Guide*.

The Event Driven Language

The Event Driven Language is composed of **instructions** and **statements**. Instructions allow you to perform specific operations such as adding or subtracting data or printing a message on a terminal. Instructions generate object code that the system can process and execute. Statements enable you to define the parts of a program, define data and system resources, and format compiled output, but not all EDL statements generate object code. The system typically uses the code that is generated by statements to set up storage locations.

Because statements do not execute in the same manner as instructions, you should not place statements between the instructions in your programs. The exception to this rule is the four statements used to control the formatting of compiler listings: PRINT, SPACE, TITLE, and EJECT. You can code these statements between program instructions because the system ignores them after the compile operation.

The Format of EDL Instructions and Statements

EDL instructions and statements have the general format:

label	*operation*	*operands*

where these terms have the following meanings:

label The symbolic name you assign to an instruction or statement. You can use this name in your program to refer to that specific instruction or statement. In most cases, a label is optional.

operation The name of the instruction or statement you are coding.

operands These constitute the body of the instruction or statement. An operand can represent data that is required to complete an operation, or it can define how an operation is to be performed.

The Event Driven Language has two types of operands: **positional** operands and **keyword** operands. Positional operands must be coded in the position shown in the operand field for the instruction or statement. These operands appear in lowercase. Positional operands usually require a specific value, address, or label. Keyword operands can be coded in any order following the positional operands (if any) contained in an instruction or statement. These operands are in the form KEYWORD=. Keyword operands typically enable you to control how the system performs an operation.

Depending on the type of operation you are performing, you may need to code an operand with a specific value or label. For the purposes of this book, such values or labels are generally referred to as **parameters**. Figure 1-1 shows the syntax of the EDL ADD instruction.

```
label    ADD   opnd1,opnd2,count,RESULT=,PREC=,
               P1=,P2=,P3=
```

Figure 1-1. ADD Instruction Syntax

In the following example, operand 2 (a value of 5) is added to operand 1 (the contents in A). The system places the result of this operation in SUM, the location specified on the keyword operand RESULT=.

```
          •
          •
          •
          ADD     A,5,RESULT=SUM
          •
          •
          •
A         DATA    F'8'
SUM       DATA    F'0'
          •
          •
          •
```

The parameter for opnd1 in the above operation is A. The parameter specified for opnd2 is 5, and SUM is the parameter coded for the RESULT= operand.

Instruction and Statement Descriptions

This book describes each EDL instruction and statement beginning in Chapter 2. Each description begins with an explanation of what the instruction or statement does. This explanation is followed by a syntax box which shows the operands that make up the instruction or statement. Positional operands are shown in the order you must code them.

Each syntax box also contains a list with the following headings:

Required: You are required to code the operand or operands listed here.

Defaults: The system will supply the data shown if you do not specify the operand or operands listed here.

Indexable: You can use the two software registers, #1 and #2, for the operands listed here. See "Software Register Usage" on page 1-8 for further information on the software registers.

All operands that make up an instruction or statement are defined in a list following each syntax box. The operands are listed in the order they appear in the syntax box. The operand description details the use of the operand and any restrictions that may apply to its use.

Special Considerations

Certain IBM devices may require you to code an EDL instruction in a special way. Other devices offer additional features which expand the use of an instruction. Special considerations that can affect the way you use an instruction are described after the operand list.

Syntax Examples

Most instructions and statements in this book contain syntax examples. Syntax examples show the various ways you could code an instruction or statement. They generally consist of a single line of code.

Coding Examples

Many instructions and statements in this book also contain one or more coding examples. These examples consist of entire programs or pieces of programs. Coding examples illustrate how an instruction or statement works in relation to other instructions and statements in the language.

Return or Post Codes

If an instruction issues return or post codes, these are listed after the examples. Return and post codes are issued as follows:

Return codes Issued as a result of executing an EDL instruction to indicate whether the operation was a success or a failure. Return codes are returned in the first word of the task control block of the program or task issuing the instruction, unless otherwise stated. The label of the task control block (TCB) is the taskname (label) you specify on the PROGRAM or TASK statement. You can examine the return code from an instruction by referring to the taskname in your program or by using the TCBGET instruction.

The following example shows several ways you can check the return code:

```
START    PROGRAM   BEGIN
BEGIN    EQU       *
         READTEXT  ...
         IF        (START,EQ,-1),GOTO,MESSAGE
         TCBGET    RC,$TCBCO
         PRINTEXT  'ERROR RETURN CODE IS: '
         PRINTNUM  RC
          •
          •
          •
MESSAGE  PRINTEXT  'OPERATION IS SUCCESSFUL'
          •
          •
          •
RC       DATA      F'0'
```

Post codes Issued by the system to signal the occurrence of an event. Unless otherwise stated, post codes are returned in the first word of the event control block (ECB) that is posted when the event occurs. You must specify the ECB to be posted with an ECB statement.

Sample EDL Instruction

The following example shows how instructions and statements are presented in this book. A full description of the MESSAGE instruction and its operands appears in "MESSAGE – Retrieve a Program Message" on page 2-252.

The MESSAGE instruction retrieves a program message from a data set or module and displays or prints the message.

Syntax:

label	**MESSAGE msgno,COMP=,SKIP=,LINE=,SPACES=,** **PARMS=(parm1,...parm8),MSGID=,** **XLATE=,PROTECT=,P1=**
Required:	**msgno,COMP=**
Defaults:	**MSGID=NO,XLATE=YES,PROTECT=NO**
Indexable:	**none**

Operand	*Description*
msgno	Positional operand
COMP=	Keyword operand
SKIP=	Keyword operand
LINE=	Keyword operand
SPACES=	Keyword operand
PARMS=	Keyword operand
MSGID=	Keyword operand
XLATE=	Keyword operand
PROTECT=	Keyword operand
P1=	Parameter-naming operand

Syntax Example

Retrieve the first message in the disk data set to which the COMP statement points.

```
MSG1      MESSAGE    1,COMP=MSGSET
            •
            •
            •
          PROGSTOP
MSGSET  COMP      'ERRS',DS1,TYPE=DSK
```

Coding Example

The following example uses the MESSAGE instruction to retrieve a message contained in a disk data set. The program named TASK loads a second program, CALCPGRM. A WAIT instruction suspends the execution of TASK until CALCPGRM completes. When CALCPGRM finishes, it posts the ECB at label LOADECB. The MESSAGE instruction at label MSG1 retrieves the first message in the disk data set MSGDS1 on volume EDX002.

```
TASK      PROGRAM    START,DS ((MSGDS1,EDX002))
LOADECB   ECB
START     EQU        *
          •
          •
          •
          LOAD       CALCPGRM,EVENT=LOADECB
          WAIT       LOADECB
MSG1      MESSAGE    1,COMP=MSGSET,SKIP=1,PARMS=A,MSGID=YES
          •
          •
          •
          PROGSTOP
A         DATA       'CALCPGRM'
MSGSET    COMP       'STAT',DS1,TYPE=DSK
          ENDPROG
          END
```

Return Codes

The return codes are returned in the first word of the Task Control Block (TCB) of the program issuing the instruction. The label of the TCB is the label of your program or task (taskname).

Return Code	Description
−1	Successful completion.
301 − 316	Error while reading message from disk.
	•
	•
	•
335	Disk messages not supported (MINMSG support only).

Common Terms

The following list contains some terms commonly used in the *Language Reference*, along with their definitions:

constant A value or address that remains unchanged throughout program execution. The number 5 is an example of an integer constant. An address in a program, such as 009E, is an example of an address constant.

self-defining term A decimal, integer, or character that the computer treats as data and not as an address or pointer to data in storage. Self-defining terms include expressions such as C'A' and X'5B'

variable An area in storage, referred to by a label, that can contain any value during program execution. In the example below, the label A refers to an area in storage. The area contains the value 10. When the DIVIDE instruction executes, it divides the contents of A by 5. The system places the result of the operation in A. The variable A now contains a value of 2.

```
        DIVIDE  A,5
          •
          •
          •
A       DATA    F'10'
```

immediate Immediate data refers to the way you can use a self-defining term.

data If you code a self-defining term such as 8 for an operand in an instruction, you are using this term as "immediate data." Operand 2 in the following example uses immediate data. The MULTIPLY instruction multiplies the value of B by 8 and puts the result in B.

```
        MULTIPLY  B,8
```

precision The number of words in storage needed to contain a value in an operation.

Syntax Rules

This section contains syntax rules you should be aware of when coding programs in the Event Driven Language. These rules apply whether you are using the Event Driven Executive Compiler ($EDXASM) or the IBM Series/1 Macro Assembler ($S1ASM).

- An "alphabetic string" can contain one or more alphabetic characters (A – Z) and any of the following special characters: $, #, @
- An "alphanumeric string" can contain one or more alphabetic or numeric characters (0 – 9).
- You must code all instructions, statements, and keyword operands in upper case letters (as shown in the syntax descriptions starting in Chapter 2, "Instruction and Statement Descriptions" on page 2-1).
- When you code a keyword operand, you must also code the equal sign (=) that follows it as shown in the following example.

  ```
  PREC=
  ```

- Operands must be separated by commas. Operands also must be separated from the operation name by one or more blanks.
- An ellipsis (...) indicates that an operand may be repeated a variable (n) number of times.
- A vertical bar (|) between two operands indicates that you can use one operand or the other, but not both.
- All labels must be alphanumeric strings 1 – 8 characters in length. The first character of the label must be a letter or one of the following special characters: $, #, or @
- Instruction and statement labels must begin in column 1. Operation names can begin in column 2, but must not go beyond column 71.
- To continue a line of code on another line, code any nonblank character in column 72, for example an "X," and begin the next line in column 16. If the continuation line contains a blank between column 16 and column 71, the system ignores any information after that blank. The system concatenates the data on the continuation line to the data on the preceding line.

The number of continuation lines allowed is limited only by the maximum of 254 characters allowed in the operands field.

You can code operands through column 71 of the line to be continued, or you can break off the line after a comma following an operand. An example of breaking off the line before column 71 follows:

```
----+----1----+----2----+----3----+----4----+----5----+----6----+----7--

label    PRINTEXT ' 'ANNUAL STATUS AND RECOMMENDATION REPORT',         X
               SPACES=20,SKIP=1
```

- To include a comment following an instruction in your program, separate the comment from the operands field by at least one blank. You can reserve an entire line in the program for comments by coding an asterisk (*) in column 1. The system ignores everything on the line following the asterisk.

  Avoid the use of commas within comments for any of the following instructions or statements: DEQT, ECB, ENQT, IOCB, PROGSTOP, or QCB.

- The system interprets any label you assign a value to with the EQU statement as an address unless you code a plus sign (+) in front of the label. The plus sign indicates that the label represents a numeric value.

- The following labels are reserved for system use:
  - All labels beginning with a $
  - R0, R1, R2, R3, R4, R5, R6, R7, FR0, FR1, FR2, FR3
  - #1, #2
  - RETURN (except when used in the instruction to end a user subroutine)
  - SETBUSY
  - SUPEXIT
  - SVC.

  Note: You can refer to these labels within your program in the instruction operands.

- The maximum number of delimiters allowed in the operands field is 70. Delimiters are ( ) or , or '

- To indicate an apostrophe mark within a text message, code double apostrophe marks ('').

- The EDX arithmetic operators are + (plus), − (minus), * (multiply), and / (divide).

  You can use the plus and minus operators to create expressions that refer to specific addresses in your program. The expression B+2, for example, defines an address equal to the address of B plus 2 bytes. The expression C−A defines an address equal to the address of C minus the address of A. You can use the expressions you create with the plus and minus operators in all EDL instructions that allow you to code a label for an operand. You can use an expression instead of a label.

The multiply and divide operators are valid only when you use them in an arithmetic expression that you equate with a label. You equate arithmetic expressions with labels by using the EQU instruction. The multiply operator multiplies an address by the number of bytes you specify. The expression B*2 multiplies the address of B by 2. The divide operator divides an address by the number of bytes you specify. In the expression C/D, the address of C is divided by the value of D. See the EQU statement for examples that use the multiply and divide operators.

Each arithmetic expression can contain only one operator. For example, the expressions A+B, C−1 D*4, and E/2 are all valid. If you require an expression containing more than one operator, you can code it using multiple equate (EQU) statements. The EQU statement equates a label with a value. To compute the address of A+B−2, for example, you could code the following:

```
APB     EQU     A+B             EQUATE APB WITH A+B
APBM2   EQU     APB-2           EQUATE APBM2 WITH APB-2
```

An arithmetic expression normally consists of two terms separated by an operator. You can construct an expression, however, consisting of an operator followed by a symbol. In this case, the system assumes that the first term of the expression is 0. For example, if the value 2 is at location A, then +A is 2, −A is −2, *A is 0, and /A is 0.

- Operands that do not belong with an instruction are normally not flagged as errors when compiled under $EDXASM. The erroneous operand does not generate any code and does not affect the execution of the instruction.

Software Register Usage

Each task in your program has access to two software registers. You can use these registers to hold data during an operation or as a means of computing addresses. You can also use the registers as counters. The registers are named #1 and #2. With operands that are listed as "indexable," you can treat the registers in the same manner as any other variable. For example, you can code instructions in your program to set, modify, or test these registers.

In the example below, the MOVE instruction moves the value 0 into #1. The 0 value replaces any existing data in #1, thereby setting the software register to 0.

```
MOVE    #1,0            SET #1 TO ZERO
```

The MOVE instruction in the next example moves the contents of variable A into #2.

```
MOVE    #2,A            SET #2 TO THE CONTENTS OF A
```

An example of a register used as the second operand in an instruction is:

```
ADD     A,#1
```

Here, the ADD instruction adds the contents of #1 to the variable A, and places the result in A.

You may also want to place the address of a variable into a software register. You can accomplish this by using the MOVEA instruction. For example,

```
MOVEA   #2,BUFFER1
```

sets register #2 to the address of the variable BUFFER1.

Indexing with the Software Registers

You can use #1 and #2 to modify addresses in your program while the program is executing. The process is called "indexing" and #1 and #2 are referred to as "index registers." In the following example,

```
MOVE    A,(B,#1)
```

the MOVE instruction moves the contents specified by (B,#1) into variable A. The system treats the second operand of the MOVE instruction as an address because this operand is in the form,

```
(parameter,#r)
```

where *parameter* is either a label or an integer and *r* is either a 1 or a 2. If #1 in the preceding example contains a 5, then the data the system moves into variable A is located at the address of B plus 5 bytes. This sum is called the "indexed address." Note that only one of the variables in an operand with the (parameter,#r) format, either the parameter or the index register, can represent an address. The other variable must be an integer or a label preceded by a plus sign (+) that is equated to an integer. (Use the EQU statement to equate a label with an integer.)

The following example shows how you could use an index register to find the location of data in a buffer. The example uses a DO loop to find the value −350 in a buffer containing 1000 entries.

```
          •
          •
          •
          MOVE    #1,0
          DO      1000,TIMES
            IF      ((BUF,#1),EQ,-350),GOTO,FOUND
            ADD     #1,2
          ENDDO
          •
          •            (DID NOT FIND A MATCH)
          •
FOUND     MOVE    DISP,#1
          •
          •
          •
          PROGSTOP
BUF       BUFFER  1000,WORDS
```

The first MOVE instruction sets the index register, #1, to 0. A DO instruction is coded to perform the operations within the loop 1000 times. The IF instruction checks to see if the first word in the buffer BUF is equal to −350. If the first word is not equal to −350, the ADD instructions adds the value 2 to #1. When the loop repeats, (BUF,#1) points to the address of BUF plus two bytes (one word). With each succeeding loop, the program increments #1, and points to the next word in the buffer. BUF has a length of 1000 words (2000 bytes).

If the program finds the value −350 in the buffer, it executes the MOVE instruction at label FOUND. The MOVE instruction saves the displacement from the start of the buffer, which is contained in #1, at the location DISP.

Register Considerations

Because each task in a program has its own software registers, the values in #1 and #2 can vary from task to task. The system will use whatever values are in the software registers of the task that is executing.

If several different tasks call a subroutine, the subroutine uses the software registers belonging to the calling task. Overlay programs, however, are independent programs with their own tasks. They have their own registers and do not use the calling task's registers.

Using the Parameter Naming Operands (Px=)

Often, when you create a program, you do not know the exact data the program will use when it executes. Normally, you can code a label with a DATA, DC or TEXT statement. In the MOVE instruction, for example, you may not know the byte count until a previous instruction executes. When the instruction executes, it uses whatever data is stored at the location defined by the label. Sometimes, however, a label cannot be coded for instruction parameters.

In the following example, the number of bytes to move is dependent on the value of the variable called NUMBER. The count parameter of the MOVE instruction does not allow use of a label. So, multiple MOVE instructions are needed for every count parameter option. In the following example, only two values for NUMBER exist. A separate MOVE instruction is needed for each value. Note that this technique requires a great deal of storage.

```
            •
            •
            •
          IF (NUMBER,EQ,6)
            MOVE A,B,(6,bytes)
          ELSE
            IF (NUMBER,EQ,10)
              MOVE A,B,(10,bytes)
            ENDIF
          ENDIF
            •
            •
            •
A         TEXT    LENGTH=10
B         TEXT    LENGTH=10
NUMBER    DATA      F'0'
```

If the value of NUMBER is a 6, then 6 bytes are moved from location B to A. If the value of NUMBER is 10, 10 bytes are moved from location B to A.

The parameter naming operand (Px=) enables you to supply data to an instruction in your program without having to define it with a DATA, DC or TEXT statement.

The Px= operands correspond to other operands in the instruction syntax. P1= represents the first operand in an instruction, P2= represents the second operand, P3= represents the third operand, and so on. The number of parameter naming operands allowed within each instruction varies.

Figure 1-2 on page 1-11 shows the syntax for the MOVE instruction. The MOVE instruction has three parameter naming operands. P1= refers to *opnd1*, P2= refers to *opnd2*, and P3= refers to *count*.

```
label       MOVE    opnd1,opnd2,count,FKEY=,TKEY=,
                    P1=,P2=,P3=
```

Figure 1-2. MOVE Instruction Syntax

To use a Px= operand, you must first code it with a label. The label refers to a storage location within the instruction. The system refers to the label you assign to the Px= operand when your program executes. The system treats the label as the parameter of the operand to which the Px= operand refers. Once you assign a label to the Px= operand, you can use that label in other instructions in your program.

In the following example, a parameter naming operand (P3=) is used on the MOVE instruction to provide the number of bytes to be moved.

```
            •
            •
            •
          MOVE    A,B,(0,bytes),P3=NUMBER
            •
            •
            •
A         TEXT    LENGTH=10
B         TEXT    LENGTH=10
            •
            •
            •
```

This single line of code can replace the previous example. The system generates the label and data area NUMBER when it assembles the MOVE instruction. The count parameter of the MOVE instruction updates automatically when the variable called NUMBER contains the value 6 or 10. This method of coding does not require an IF instruction because the NUMBER variable is in the MOVE instruction. The system generates the variable called NUMBER from the Px= operand code. Storage is significantly reduced because it uses only one MOVE instruction.

In the following program, the GETVALUE instruction asks you for the number of bytes to move from B to A. Since the TEXT statement is only 10 bytes, the program checks for errors in data by making sure INPUT is between 1 and 10 bytes. When the GETVALUE instruction receives the value for INPUT, the system automatically updates the MOVE instruction's byte count field. At that point the data and characters moved from location B to A are printed on the terminal.

```
TEST      PROGRAM   START
START     EQU       *
RETRY     GETVALUE  INPUT,MESSAGE
          IF        (INPUT,LT,0),or,(INPUT,GT,10),GOTO,RETRY
          MOVE      A,B,(0,bytes),P3=INPUT
          PRINTEXT  A
          PRINTEXT  SKIP=1
          PROGSTOP
A         TEXT      '          ',LENGTH=10
B         TEXT      'ABCDEFGHIJ',LENGTH=10
MESSAGE   TEXT      'ENTER BYTE COUNT'
          ENDPROG
          END
```

Rules to Remember

You should remember the following rules when coding parameter naming operands in your program.

Coding Labels on Px= Operands

When the compiler sees a Px= operand, it generates the label that you specify. The compiler flags an error if you attempt to define that label again in your program.

Referring to Px= Operand Labels

You can refer to the label you code on the Px= operand more than once in your program. However, once you have defined a label with a Px= operand, you cannot use the same label on another Px= operand in the program.

Coding the Operand that Px= Replaces

When you code a Px= operand, you must still code a value or label for the operand that Px= replaces. The system does not process the Px= operand if the label you specified for it contains a 0 when the instruction executes. (The system defines the value of the label on the Px= operand to be 0 at compilation time.) The example that follows shows a case in which the system does not process the P2= operand until the instruction at GETDATA executes and supplies label B with a value other than 0.

```
CHECK    PROGRAM   START
START    EQU       *
ADDVAL   ADD       A,0,P2=B
         IF        (A,GT,10),GOTO,END
GETDATA  GETVALUE  B,'ENTER NUMBER FROM 1 TO 10 ',SKIP=1
         GOTO      ADDVAL
END      PRINTNUM  A,SKIP=1
         PROGSTOP
A        DATA      F'1'
         ENDPROG
         END
```

On the first pass through the program, the label B contains a 0. The system adds the value coded for operand 2 (0) to the value in A. After the GETVALUE instruction executes, B contains whatever value was entered at the terminal. The GOTO instruction passes control to the ADD instruction at the label ADDVAL. When the ADD instruction executes the second time, the system adds the value in B to the value in A. The system replaces the 0 value coded for operand 2 with the value entered in B.

Matching Operand and Px= Operand Data Types

The type of data that the Px= operand supplies in an instruction must match the type of data that is being replaced. For example, if you specify the label of an *address* for operand 2, P2= must also supply an *address*. If you specify a *constant* for operand 2, P2= must supply a *constant*.

In the example that follows, the ADD instruction contains a P2= operand. The P2= operand refers to operand 2 which is coded with the constant 5. Because the parameter coded for operand 2 is a constant, the P2= operand must replace this parameter with another constant to get the desired results. In this case, the MOVE instruction moves the value 2 into A. The system adds 2 to C and stores a result of 2 in SUM.

```
          •
          •
          •
        MOVE    A,2
        ADD     C,5,RESULT=SUM,P2=A
          •
          •
          •
C       DATA    F'0'
SUM     DATA    F'0'

          •
          •
          •
```

In the next example, operand 2 of the ADD instruction is coded with the label D. The label refers to the address of a data area. Because the parameter coded for operand 2 (D) is an address, the P2= operand must replace this parameter with another address to get the desired results. In this case, a MOVEA instruction moves the address of B into A. The system adds the contents of B to the contents of C and places the result in SUM.

```
          •
          •
          •
        MOVEA   A,B
        ADD     C,D,RESULT=SUM,P2=A
          •
          •
          •
B       DATA    F'2'
C       DATA    F'0'
D       DATA    F'5'
SUM     DATA    F'0'
```

Instruction and Operand Address Boundaries

Some functions of the Series/1 require that instructions conform to certain storage restrictions. These functions include those that deal with I/O data buffers, program entry points, branch-to labels, and general data areas. Requirements can be for byte, word, or doubleword alignment. The ALIGN instruction is used to ensure that boundary requirements are met. For additional information refer to "ALIGN – Instruction or Data to a Specified Boundary" on page 2-13. Check boundary requirements when establishing data areas and when assigning labels.

All storage addressing is defined by byte location. Instructions can refer to bits, bytes, byte strings, words, or doublewords as data operands. All fullword and doubleword operand addresses must be on even-byte boundaries. All fullword and doubleword operand addresses point to the most significant (leftmost) byte in the operand. Bit addresses are specified by a byte address and a bit displacement.

- All instructions must be on an even-byte boundary.
- The effective address for all branch-type instructions must be on an even-byte boundary to be valid.

If the rules of even-byte addressing are violated, a program check interrupt occurs with specification check set in the processor status word (PSW).

Chapter 2. Instruction and Statement Descriptions

This chapter presents the Event Driven Language (EDL) instructions and statements in alphabetical order. A description of the use of each instruction and statement is provided, followed by its syntax, required operands, and the default values the system uses when you do not specify certain operands. Each operand is listed and described. Examples and other information, such as return codes and post codes, also are provided. See "The Format of EDL Instructions and Statements" on page 1-1 for more details on how this book presents instructions and statements.

Note: The *Installation and System Generation Guide* contains the statements you use to define and generate your system. These statements are listed in the "Instructions and Statements Chart."

Instructions and Statements Chart

The chart on the following pages groups EDL instructions and statements by the common tasks they perform. The chart also lists the statements you use to define and generate a system.

Add Device Support	
DCB	EXCLOSE
EXIO	EXOPEN
EXBREAK	IDCB
Call Programs and Subroutines	
CALL	RETURN
CALLFORT	USER
SUBROUT	
Code Graphics Applications	
CONCAT	SCREEN
GIN	XYPLOT
PLOTGIN	YTPLOT
Control Program Logic	
DO	FINDNOT
ELSE	GOTO
ENDIF	IF
ENDDO	QUESTION
FIND	
Control Tasks	
ATTACH	PROGRAM
ATTNLIST	PROGSTOP
DETACH	PROGRAM
END	QBC
ENDATTN	RESET
ENDPROG	TASK
ENDTASK	WHERES
LOAD	
Control the Terminal	
ATTNLIST	IOCB
ENDATTN	RDCURSOR
ERASE	TERMCTRL
Convert Data	
CONVTB	FPCONV
CONVTD	GETEDIT
FORMAT	PUTEDIT

Define Data	
ALIGN	EQU
BUFFER	STATUS
DATA/DC	TEXT
Define I/O	
BSCIOCB	IODEF
CAIOCB	PROGRAM
IOCB	SBIO
End a Program	
END	
ENDPROG	
PROGSTOP	
Format and Identify Compiler Listings	
$ID	SPACE
EJECT	TITLE
PRINT	
Initiate and Terminate Telecommunications	
BSCCLOSE	NETHOST
BSCOPEN	NETINIT
CACLOSE	NETTERM
CAOPEN	TP CLOSE
CASTART	TP OPENIN
CASTOP	TP OPENOUT
NETCTL	
Manipulate Data	
ADD	HASHVAL
ADDV	IOR
AND	MOVE
CONCAT	MOVEA
DIVIDE	MULTIPLY
EOR	SETBIT
FADD	SHIFTL
FDIVD	SHIFTR
FMULT	SQRT
FPCONV	SUBTRACT
FSUB	

BG0555

Obtain Date and Time	Respond to Errors
GETTIME PRINTDATE PRINTIME	CATRACE FREESTG GETEDIT GETSTG LOAD READ SBIO SWAP TCBGET TCBPUT WRITE
Obtain and Release Resources	**Retrieve User-Written Messages**
DEQ DEQT ENQ ENQT FREESTG GETSTG STORBLK SWAP	COMP GETVALUE MESSAGE QUESTION READTEXT
	Refer to External Modules
	COPY CSECT ENTRY EXTRN WXTRN
Perform Communication I/O	**Send or Receive Terminal Data**
CAREAD CAWRITE CAPRINT NETGET NETPUT TP (FETCH) TP (READ) TP (RELEASE) TP (SET) TP (SUBMIT) TP (WRITE)	GETEDIT GETVALUE MESSAGE PRINTDATE PRINTNUM PRINTEXT PRINTIME PUTEDIT QUESTION READTEXT
Perform Disk, Diskette, and Tape I/O	**Set Timers**
CONTROL DSCB NOTE POINT READ WRITE	INTIME STIMER
Process Interrupts	**Synchronize Tasks**
ATTNLIST IODEF SPECPIRT	ECB INTIME POST STIMER WAIT
Queue Processing	**System Generation**
DEFINEQ FIRSTQ LASTQ NEXTQ	ADAPTER BSCLINE DISK EXIODEV HOSTCOMM SENSORIO SNALU SNAPU SYSTEM TAPE TERMINAL TIMER

BG0556

$ID – Identify System Release Level

The $ID statement enables you to record within an application program the EDX system release level that you use to compile the program. If you dump the program at a later date to diagnose a problem, the $ID statement eliminates the need to refer back to the original source listing to find out the system release level in use when the program was compiled.

The system release level coded with $ID appears as the last word in the dumped program.

Code the $ID statement between the ENDPROG and END statements of your program. This is an exception to the rule that ENDPROG and END must be the last two statements of your program.

The $ID statement generates a 1-word constant in the form of VMLP. Each parameter is packed into four bits and is specified in hexadecimal notation.

The $ID statement is already coded on all EDX supplied software.

Syntax

label	**$ID**	**V=,M=,L=,P=**
Required:	**None**	
Defaults:	**V=,M=, and P= default to the current release level of the EDX program product**	

Operand	*Description*
V=	The EDX system release level; it ranges from 0–9, A–F (hexadecimal).
M=	The EDX modification or revision level; it ranges from 0–9, A–F (hexadecimal).
L=	The unique identifier you assign to programs not prepared by IBM; it ranges from 1–9, A–F (hexadecimal). The value 0 is reserved for IBM use.
P=	The program temporary fix (PTF) release level; it ranges from 0–9, A–F (hexadecimal).

Syntax Examples

1) In the following example, only operand L, which is designated for your use, is coded. Operands V, M, and P are allowed to default to the current release level of the EDX program product.

```
          •
          •
          •
          ENDPROG
IDNOTE    $ID       L=2
          END
```

2) The $ID statement in the example below will cause the identifier, 3121, to be printed out as the last word in the program when it is dumped. The identifier shows that the program was compiled under EDX system release level 3, modification level 1, and program temporary fix 1. The 2 on the L= operand is for the programmer's use.

```
          •
          •
          •
          ENDPROG
IDNOTE    $ID      V=3,M=1,L=2,P=1
          END
```

ADD – Add Integer Values

The ADD instruction adds an integer value in operand 2 to an integer value in operand 1. The values can be positive or negative. To add floating-point values, use the FADD instruction.

See the DATA/DC statement for a description of the various ways you can represent integer data.

EDX does not indicate an overflow condition for this instruction.

Syntax:

label	**ADD**	**opnd1,opnd2,count,RESULT=,PREC=,** **P1=,P2=,P3=**
Required:	**opnd1,opnd2**	
Defaults:	**count=1,RESULT=OPND1,PREC=S**	
Indexable:	**opnd1,opnd2,RESULT**	

Operand	*Description*
opnd1	The label of the data area to which opnd2 is added. Opnd1 cannot be a self-defining term. The system stores the result of the ADD operation in opnd1 unless you code the RESULT operand.
opnd2	The value added to opnd1. You can specify a self-defining term or the label of a data area. The value of opnd2 does not change during the operation.
count	The number of consecutive values in opnd1 upon which the system performs the operation. The maximum value allowed is 32767.
RESULT=	The label of a data area or vector in which the result is placed. The data area you specify for opnd1 is not modified if you specify RESULT. This operand is optional.
PREC=xyz	Specify the precision of the operation in the form xyz, where x is the precision for opnd1, y is the precision for opnd2, and z is the precision of the result ("Mixed-Precision Operations" on page 2-7 shows the precision combinations allowed for the ADD instruction). You can specify single-precision (S) or double-precision (D) for each operand. Single precision is a word in length; double precision is two words in length. The default for opnd1, opnd2, and the result is single precision. If you code a single letter for PREC, the letter applies to opnd1 and the result. Opnd2 defaults to single precision. If, for example, you code PREC=D, opnd1 and the result are double precision and opnd2 defaults to single precision. If you code two letters for PREC, the first letter applies to opnd1 and the result, and the second letter applies to opnd2. With PREC=DD, for example, opnd1 and the result are double precision and opnd2 is double precision.

Px= Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Mixed-Precision Operations

The following table shows the precision combinations allowed with the ADD instruction:

opnd1	opnd2	Result	Precision
S	S	S	S
S	S	D	SSD
D	S	D	D
D	D	D	DD

Opnd2 is one or two words long depending on the precision you specify on the PREC= keyword. The length of opnd1 is equal to the operand's precision multiplied by the value of the count operand. SSSS is the default.

Coding Example

The following example moves the value 0 to index register #1. Next, the value 5 is added to #1. Index register #1 now contains the value 5. The contents of variable A are then added to each of three words starting at label V1. The results are placed in three words starting at label V2. The contents of V1 and A remain unchanged because the keyword RESULT is specified. The third ADD instruction adds 15 to the double-precision value at label E.

```
          •
          •
          •
        MOVE  #1,0              MOVE 0 TO #1
        ADD   #1,5              INCREASE #1 BY 5
        ADD   V1,A,3,RESULT=V2  ADD THE VALUE IN A TO EACH OF 3 WORDS
*                               STARTING AT V1 AND PLACE THE RESULT
*                               IN 3 WORDS STARTING AT V2
*
        ADD   E,15,PREC=D       ADD 15 TO DOUBLE-PRECISION VALUE E
*
A       DATA  F'10'
V1      DATA  F'1'
        DATA  F'2'
        DATA  F'3'
V2      DATA  F'0'
        DATA  F'0'
        DATA  F'0'
E       DATA  D'100000'
          •
          •
          •
```

The results from the previous coding example follow:

	Before		After
#1	F'0'	#1	F'5'
A	F'10'	A	F'10'
V1	F'1'	V1	F'1'
	F'2'		F'2'
	F'3'		F'3'
V2	F'0'	V2	F'11'
	F'0'		F'12'
	F'0'		F'13'
E	D'100000'	E	D'100015'

ADDV – Add Two Groups of Numbers (Vectors)

The add vector instruction (ADDV) adds two groups of numbers or "vectors." The number of times the operation occurs depends on the count you specify. The instruction adds each consecutive value in operand 2 to the corresponding value in operand 1.

Note: An overflow condition is not indicated by EDX.

Syntax:

label	**ADDV**	**opnd1,opnd2,count,RESULT=,PREC=,** **P1=,P2=,P3=**
Required:		**opnd1,opnd2,count**
Defaults:		**count=1,RESULT=opnd1,PREC=S**
Indexable:		**opnd1,opnd2,RESULT**

Operand	*Description*
opnd1	The label of the data area that is modified by opnd2. Opnd1 cannot be a self-defining term. Do not code the software registers, #1 or #2, for this operand. However, you can use the software registers to create an indexed address for opnd1.
opnd2	The value by which opnd1 is modified. You can specify a self-defining term or the label of a data area.
count	The number of consecutive values in both opnd1 and opnd2 upon which the system performs the operation. The maximum value allowed is 32767.
RESULT=	The label of a data area or vector in which the result is placed. The data area you specify for opnd1 is not modified if you specify RESULT. This operand is optional.
PREC=xyz	Specify the precision of the operation in the form xyz, where x is the precision for opnd1, y is the precision for opnd2, and z is the precision of the result. ("Mixed-Precision Operations" on page 2-10 shows the precision combinations allowed for the ADDV instruction.) You can specify single-precision (S) or double-precision (D) for each operand. Single precision is a word in length; double precision is two words in length. The default for opnd1, opnd2, and the result is single precision. If you code a single letter for PREC, the letter applies to opnd1 and the result. Opnd2 defaults to single precision. If, for example, you code PREC=D, opnd1 and the result are double precision and opnd2 defaults to single precision. If you code two letters for PREC, the first letter applies to opnd1 and the result, and the second letter applies to opnd2. With PREC=DD, for example, opnd1 and the result are double precision and opnd2 is double precision.

Px= Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Mixed-Precision Operations

The following table lists the precisions allowed with the ADDV instruction:

opnd1	opnd2	Result	Precision
S	S	S	S
S	S	D	SSD
D	S	D	D
D	D	D	DD

PREC=S is the default.

Syntax Example

The ADDV instruction in the following example adds each consecutive value in V1 to the corresponding value in V2. After the instruction executes, V1 contains 32F'3'

```
         ADDV   V1,V2,32        THE COUNT IS 32
          •
          •
          •
V1       DATA   32F'1'
V2       DATA   32F'2'
```

Coding Example

The following example moves the value 10 to X1 and the value 20 to X2. The first ADDV instruction adds the value in C1 to X1 and the value in C2 to X2. Because the keyword RESULT is specified, the values in C1, C2, X1, and X2 remain unchanged. The system places the results in D1 and D2. The second ADDV instruction adds the values of the five words, starting at B1, to the values of the five words starting at A1. The ADDV operation occurs in the following sequence: The value in B1 is added to the value in A1, the value in B2 is added to the value in A2, and so on through B5 and A5.

Results of the example follow on the next page.

```
          .
          .
          .
        MOVE   X1,10               MOVE 10 TO X1
        MOVE   X2,20               MOVE 20 TO X2
*
        ADDV   X1,C1,2,RESULT=D1   ADD VALUE OF C1 TO X1 AND
*                                  THEN C2 TO X2

*                                  PLACE RESULTS IN
*                                  LOCATIONS D1 and D2
*
        ADDV   A1,B1,5             ADD THE VALUE OF THE 5 WORDS
*                                  STARTING AT B1 TO THE 5 WORDS
*                                  STARTING AT A1
X1      DATA   F'0'
X2      DATA   F'0'
*
A1      DATA   F'1'
A2      DATA   F'2'
A3      DATA   F'3'
A4      DATA   F'4'
A5      DATA   F'5'
*
B1      DATA   F'10'
B2      DATA   F'20'
B3      DATA   F'30'
B4      DATA   F'40'
B5      DATA   F'50'
*
C1      DATA   F'5'
C2      DATA   F'10'
*
D1      DATA   F'0'
D2      DATA   F'0'
```

Results of the previous coding example follow:

	Before		After
X1	F'00'	X1	F'10'
X2	F'00'	X2	F'20'
A1	F'1'	A1	F'11'
A2	F'2'	A2	F'22'
A3	F'3'	A3	F'33'
A4	F'4'	A4	F'44'
A5	F'5'	A5	F'55'
B1	F'10'	B1	F'10'
B2	F'20'	B2	F'20'
B3	F'30'	B3	F'30'
B4	F'40'	B4	F'40'
B5	F'50'	B5	F'50'
C1	F'5'	C1	F'5'
C2	F'10'	C2	F'10'
D1	F'0'	D1	F'15'
D2	F'0'	D2	F'30'

ALIGN – Instruction or Data to a Specified Boundary

The ALIGN statement ensures that the next instruction or data item in a source statement list begins on a specified boundary: an odd byte, a word, or a doubleword. The ALIGN statement is nonexecutable and should only be used to align data within data areas.

When coding the ALIGN instruction, you can include a comment that will appear with the instruction on your compiler listing. If you include a comment, you must also code the **type** operand. The comment must be separated from the operand field by at least one blank and it cannot contain commas.

Syntax:

blank	**ALIGN**	**type**	**comment**

Required: **type (if you include a comment)**
Default: **WORD**
Indexable: **none**

Operand	*Description*
type	WORD (the default) or blank aligns data on a fullword boundary.
	BYTE aligns data on an odd-byte boundary.
	DWORD aligns data on a doubleword boundary.

Note: If the data field is already aligned at the boundary requested, no action results. WORD and BYTE align the data a maximum of 1 byte. DWORD aligns the data a maximum of 3 bytes.

Coding Example

The ALIGN statement in the following example aligns the data area labeled BUFF on a word boundary (even address).

```
Loc

0200        PROGNME   DC      C'EDX UTILITY'
020B                  ALIGN   WORD    ALIGN TO WORD BOUNDARY
020C        BUFF      DC      CL'64'
```

AND – Compare the Binary Values of Two Data Strings

The AND instruction compares the binary value of operand 2 with the binary value of operand 1. The instruction compares each bit position in operand 2 with the corresponding bit position in operand 1 and yields a result, bit by bit, of 1 or 0. If both of the bits compared are 1, the result is 1. If either or both of the bits compared are 0, the result is 0.

Syntax:

label	**AND**	**opnd1,opnd2,count,RESULT=,** **P1=,P2=,P3=**
Required:	**opnd1,opnd2**	
Defaults:	**count=(1,WORD),RESULT=opnd1,**	
Indexable:	**opnd1,opnd2,RESULT**	

Operand	*Description*
opnd1	The label of the data area to which opnd2 is compared. Opnd1 cannot be a self-defining term. The system places the result of the operation into opnd1 unless you code the RESULT operand. The length of opnd1 is equal to the operand's precision multiplied by the value of the count operand.
opnd2	The value compared to opnd1. You can specify a self-defining term or the label of a data area.
count	The number of consecutive values in opnd1 upon which the operation is to be performed. The maximum value allowed is 32767. The count operand can include the precision of the data. Select one precision which the system uses for opnd1, opnd2, and the resulting bit string. When specifying a precision, code the count operand in the form, `(n,precision)` where "n" is the count and "precision" is one of the following: **BYTE** Byte precision **WORD** Word precision (default) **DWORD** Doubleword precision The precision you specify for the count operand is the portion of opnd2 that is used in the operation. If the count is (3,BYTE), the system compares the first byte of data in opnd2 with the first three bytes of data in opnd1.
RESULT=	The label of a data area or vector in which the result is to be placed. When you specify this operand, the value of opnd1 does not change during the operation.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Syntax Examples

1) In the following example, the AND instruction turns off the rightmost four bits in DATA1 without affecting the other data field bits. After the instruction executes, DATA1 contains X'E0' (binary 1110 0000).

```
        AND   DATA1,MASK,(1,BYTE)
         •
         •
         •
DATA1   DC    X'E7'      binary 1110 0111
MASK    DC    X'F0'      binary 1111 0000
```

2) The AND instruction in this example compares opnd2 with the first three bytes of data in opnd1. The system places the result in RESULTX.

```
        AND   OPER1,OPER2,(3,BYTE),RESULT=RESULTX
         •
         •
         •
OPER1   DC    X'00'      binary 0000 0000
        DC    X'A5'      binary 1010 0101
        DC    X'01'      binary 0000 0001
OPER2   DC    X'FF'      binary 1111 1111
RESULTX DC    2F'0'      binary 0000 0000 0000 0000
```

After the AND operation, RESULTX contains X'00A5 0100' (binary 0000 0000 1010 0101 0000 0001).

3) In the following example, the AND instruction compares the first byte of data in TEST to the first three bytes of data in INPUT. The system stores the result in OUTPUT.

```
        AND   INPUT,TEST,(3,BYTE),RESULT=OUTPUT
         •
         •
         •
INPUT   DC    C'1.2'     binary 1111 0001 0100 1011 1111 0010
TEST    DC    C'0.0'     binary 1111 0000 0100 1011 1111 0000
OUTPUT  DC    3C'0'      binary 1111 0000 1111 0000 1111 0000
```

After the AND operation, the contents of OUTPUT are C'0.0' (binary 1111 0000 0100 1011 1111 0000).

ATTACH – Start a Task

The ATTACH instruction starts the execution of or "attaches" another task. If the task you specify has already been attached, no operation occurs. You deactivate tasks with the DETACH instruction.

The task to be attached is usually in the same partition as the ATTACH instruction. However, you can attach a task in another partition by using the cross-partition capability of ATTACH.

Note that the program load point of the attaching task is placed in the $TCBPLP field of the task being attached. The system, however, will not reference the $TCBPLP of the attached task if the attaching task is in another partition. To avoid this problem, put the load point of the task to be attached in the $TCBPLP field of the attaching task before the ATTACH instruction is executed. Be sure to restore it after the ATTACH instruction is completed.

See Appendix C, "Communicating with Programs in Other Partitions (Cross-Partition Services)" on page C-1 for an example of attaching a task in another partition. Refer to the *Language Programming Guide* for more information on cross-partition services.

The system records the address space in which a task is executing in the $TCBADS field of the task's task control block (TCB). When your program attaches a task, the system moves the address space in the program's TCB into the $TCBADS field of the attached task's TCB.

When the ATTACH instruction executes, the system stores the address of the terminal from which the main task was loaded in the $TCBCCB field of the attached task. In this way, the same terminal is active for both tasks.

If your program is to be link edited, place all TASKs to attach via the ATTACH instruction in the same module. The assembler will chain all the TASKs within the module it assembles. Your application program will have to chain the tasks together if they are not within the same module. Modify the correct field in the TCB to chain tasks accross modules.

Syntax:

label	**ATTACH taskname,priority,CODE=,** **P1=,P2=,P3=**
Required:	**taskname**
Defaults:	**CODE=-1**
Indexable:	**none**

Operand	*Description*
taskname	Label of the task to be attached. You must define this task with a TASK statement.
priority	The priority you assign to the task. This priority replaces the one you assigned on the TASK statement. It remains in effect unless it is overridden by a subsequent ATTACH instruction. See the TASK statement for a description of the valid priorities you can assign a task.
CODE=	A code word to be inserted in the first word of the task control block of the task being attached. This code word could help your program determine at what point the task is being attached. The attached task could examine the code word by referring to the taskname operand. The code word should be examined immediately upon entry into the attached task because execution of certain instructions (for example, I/O instructions) cause this word to be overlaid.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Coding Example

In the following example, the ATTACH instruction attaches a task that reads a record from a data set. The program begins by attaching TASK1. TASK1 is the label of a TASK statement. TASK1 prints the message at label P1 and reads a record from MYFILE into the buffer BUF. The MOVE instruction moves the first 8 bytes of BUF into the text buffer labeled REC. When TASK1 ends, it posts the event specified on the EVENT= operand of the TASK statement. The main program receives control and the WAIT instruction at label W1 checks to see if TASK1 has ended. The PRINTEXT instruction at label P2 prints the message 'PROGRAM COMPLETE', and the program ends.

```
SAMPLE      PROGRAM    START,DS=((MYFILE,EDX40))
START       EQU        *
            ATTACH     TASK1
W1          WAIT       EVENT
P2          PRINTEXT   'PROGRAM COMPLETE',SKIP=2
            PROGSTOP
BUF         BUFFER     256,BYTES
REC         TEXT       LENGTH=8
************************************************
TASK1       TASK       NEXT,EVENT=EVENT
NEXT        ENQT       $SYSPRTR
P1          PRINTEXT   '@TASK1 ATTACHED'
            READ       DS1,BUF,1
            MOVE       REC,BUF,(8,BYTES)
            DEQT       $SYSPRTR
            ENDTASK
************************************************
            ENDPROG
            END
```

ATTNLIST – Enter Attention-Interrupt-Handling Routine

The ATTNLIST statement provides entry to one or more attention-interrupt-handling routines.

With the ATTNLIST statement, you can produce a list of command names and associated routine entry points. When you press the attention key on a terminal, your program waits for you to enter a 1 – 8 character command. If the command you enter matches one that is specified in the list, the associated routine receives control. No action occurs if the command you enter is not contained in the list or if the system cannot find the entry point of the routine.

The character $ is reserved for system use and should not be used as the first character of a command name unless you are assigning PF keys. The characters ERAP are also reserved. All other character combinations are allowed. Your attention routines must end with an ENDATTN instruction.

Your program and the ATTNLIST routine execute asynchronously. When the ATTNLIST routine finishes, control passes to the instruction that was executing when you pressed the attention key. Figure 2-1 on page 2-21 shows the operation of the ATTNLIST instruction.

The attention list for programs you compile with $EDXASM can be up to 254 characters long and can contain a total of 24 ATTNLIST entries. Programs compiled under $EDXASM can contain one LOCAL ATTNLIST and one GLOBAL ATTNLIST statement. (See the SCOPE= operand for an explanation of LOCAL and GLOBAL ATTNLIST.) The Series/1 macro and host assemblers allow multiple attention lists with a maximum of 125 characters in each list.

ATTNLIST routines should execute quickly. Because the routines execute on hardware level 1, lengthy routines can slow the execution of other application programs or system tasks.

Notes:

1. You should not use the following instructions in an ATTNLIST routine: DEQT, DETACH, ENDTASK, ENQT, LOAD, PROGSTOP, READ, STIMER, TP, WAIT, and WRITE.
2. ATTNLIST routines cannot gain access to an enqueued terminal until the program that has exclusive access releases the terminal by issuing a DEQT or PROGSTOP instruction.
3. Do not use $DEBUG command names as command names in your attention list routine. Refer to the *Operator Commands and Utilities Reference* for a list of the $DEBUG command names.

Syntax:

label	**ATTNLIST (cc1,loc1,cc2,loc2,...,ccn,locn),SCOPE=**
Required:	**cc1,loc1**
Defaults:	**SCOPE=LOCAL**
Indexable:	**none**

Operand	*Description*
cc1	A command name consisting of 1 – 8 alphanumeric characters. Do not use the character $ as the first character of the command name unless you are assigning PF keys. For a description of using and assigning the 4979, 4978, 4980, and 3101 terminal program function (PF) keys to use ATTNLIST routines, refer to the *Operation Guide*.
loc1	Name of the routine to be called.
SCOPE =	GLOBAL, allows the ATTNLIST command routines to be used on any terminal assigned to the same storage partition. LOCAL, limits the use of ATTNLIST commands to the specific terminal (assigned to the same partition) from which the program containing the commands was loaded. A program can have one LOCAL ATTNLIST and one GLOBAL ATTNLIST.

Syntax Example

The ATTNLIST statement that follows allows you to use the PCODE1 routine by pressing the attention key and entering PC1. To use the PCODE2 routine, you would press the attention key and enter PC2.

```
         ATTNLIST    (PC1,PCODE1,PC2,PCODE2)
          •
          •
          •
PCODE1   MOVE        CODE,1
         ENDATTN
          •
          •
          •
PCODE2   POST        EVENT,2
         ENDATTN
```

Coding Examples

1) The following example uses the ATTNLIST statement to control the printing of repetitive test patterns. Once the test pattern begins printing, it can only be stopped by pressing the attention key and entering the command "CA."

The program begins printing a test pattern consisting of 10 numbers. You can expand the test pattern to include 24 special characters by pressing the PF1 key.

If you press the PF2 key, the test pattern includes the alphabet, the 10 numbers (0 – 9), and the 24 special characters.

```
TESTLOOP    PROGRAM   START
            ATTNLIST  (CA,CANCEL,$PF1,PF1,$PF2,PF2)
CANCEL      EQU       *
            MOVE      SWITCH,99
            ENDATTN
PF1         EQU       *
            MOVE      SWITCH,1
            ENDATTN
PF2         EQU       *
            MOVE      SWITCH,2
            ENDATTN
START       EQU       *
            ENQT
            DO        WHILE,(SWITCH,NE,99)
               PRINTEXT   '@1234567890'
               IF         (SWITCH,GE,1)
               PRINTEXT   '|#$%¢&*()_-+=!¬":;?/>.<,'
               ENDIF
               IF         (SWITCH,EQ,2)
               PRINTEXT   'ABCDEFGHIJKLMNOPQRSTUVWXYZ'
               ENDIF
            ENDDO
            DEQT
            PROGSTOP
SWITCH      DATA        F'0'
            ENDPROG
            END
```

2) The following example also illustrates coding of the ATTNLIST statement. However, it uses PF keys to call ATTNLIST instead of entering a command.

```
ATTEST      PROGRAM     ATLIST
            ATTNLIST    ($PF1,PCODE1,$PF3,PCODE3)
PCODE1      PRINTEXT    'PF1 KEY WAS PRESSED@'
            MOVE        VAR,1
            ENDATTN
PCODE3      PRINTEXT    'PF1 KEY WAS PRESSED@'
            MOVE        VAR,3
            ENDATTN
ATLIST      EQU         *
            DO          (WHILE,(VAR,NE,1)
            MOVE        #1,#2
            ENDDO
            PROGSTOP
VAR         DATA        X'0000'
            ENDPROG
```

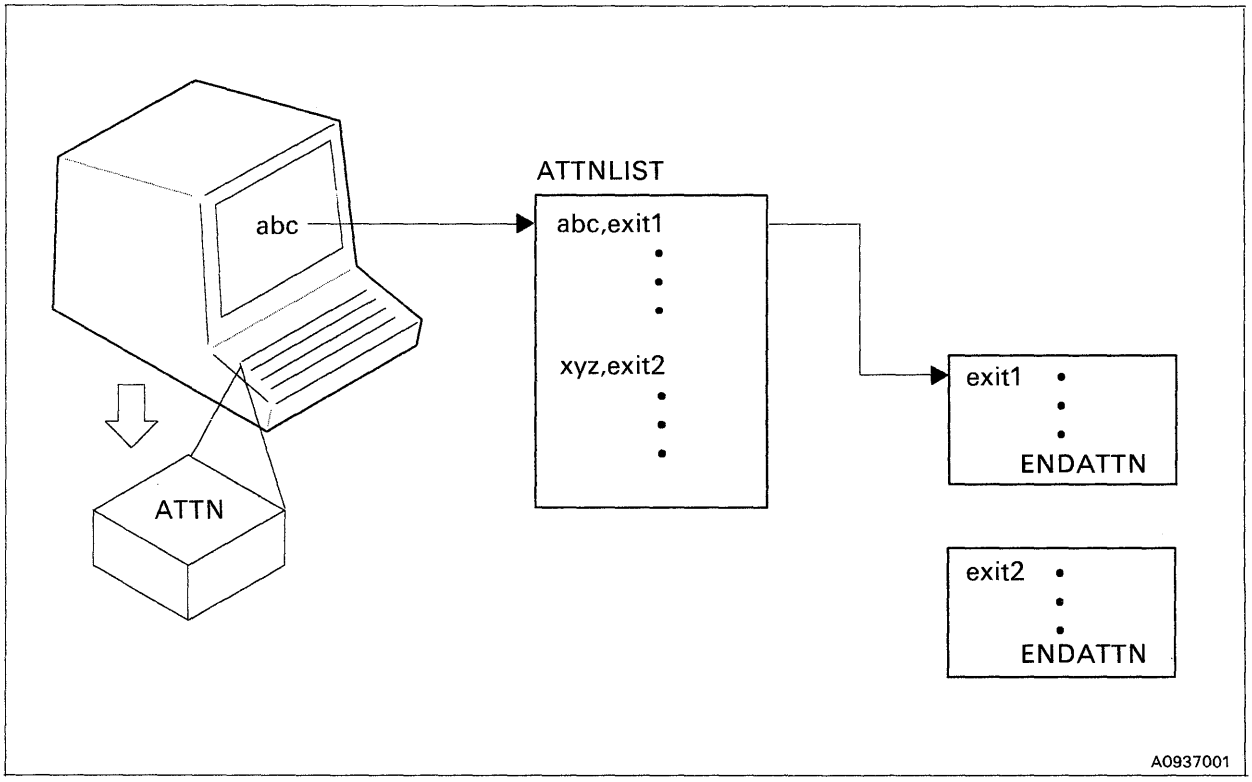


Figure 2-1. Function of ATTNLIST

BSCCLOSE – Free a BSC Line for Use by Other Tasks

The BSCCLOSE instruction frees a binary synchronous line for use by other tasks. If the line is a switched line (TYPE=SM or SA), this instruction disconnects it.

Syntax:

label	**BSCCLOSE bsciocb,ERROR=,P1=,P2=**
Required:	**bsciocb**
Defaults:	**none**
Indexable:	**bsciocb**

Operand	*Description*
bsciocb	The label or indexed location of the BSCIOCB statement associated with the close operation.
ERROR=	The label of the instruction to be executed if an error occurs while closing the line. If you do not code this operand, control passes to the next sequential instruction. In either case, the return code reflects the results of the operation.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Return Codes

All BSC instruction return codes are listed with the BSCWRITE instruction under "Return Codes" on page 2-36.

BSCIOCB – Specify BSC Line Address and Buffers

The BSCIOCB statement specifies the line address and buffer(s) needed to perform BSCCLOSE, BSCOPEN, BSCREAD, and BSCWRITE operations.

If you are sending variable-length records, the length field (length1 operand) must contain the actual length of the message to be written. Reset the value coded for the length field to the buffer length before issuing a READ. Figure 2-2 on page 2-24 lists the number of buffers required for each type of BSCREAD and BSCWRITE operation.

Syntax:

label	**BSCIOCB**	**lineaddr,buffer1,length1,buffer2, length2,pollseq,pollsize,P1=,P2=, P3=,P4=,P5=,P6=,P7=**
Required:	**lineaddr**	
Defaults:	**none**	
Indexable:	**none**	

Operand	*Description*
label	The label of the BSCIOCB. The BSCCLOSE, BSCOPEN, BSCREAD, and BSCWRITE instructions refer to this label. Other instructions can use the label to obtain additional status information stored in the first word of the BSCIOCB. After text is successfully received, this word contains the address of the last character received. For all other conditions, the word contains the Interrupt Status Word from the Series/1 BSC Adapter.
lineaddr	The hardware address, in hexadecimal, of the line on which the operation is to be performed.
buffer1	The label of the first buffer used in an I/O operation. This buffer is located in the target address space. The target address space is determined during a BSCOPEN operation and is defined in $TCBADS. This address space is used as the address space of the buffer until another BSCOPEN operation changes it.
length1	The length, in bytes, of the first buffer.
buffer2	The label of the second buffer used in an I/O 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 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.

The polling and selection sequences consist of one to seven characters followed by: ENQ,(Read or Write Initial)[1]. You can find specific sequences for a given device in the device component description manual. Generally, a 3-byte pollsize is sufficient for a sequence of address,address,ENQ[1] between Series/1 processors. The device type tributary determines the actual sequence.

Px= Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

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 2-2. Required Buffers for BSCREAD and BSCWRITE

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

BSCOPEN – Prepare a BSC Line for Use

The BSCOPEN instruction prepares a binary synchronous line for use by a task. The instruction acquires use of the BSC line and prepares it for a subsequent read or write operation.

If the line is a switched manual line (TYPE=SM), BSCOPEN requests a Data Terminal Ready acknowledgement and waits for the telephone connection to be established. If the line is a switched auto-answer line (TYPE=SA), BSCOPEN waits indefinitely for the ring interrupt and then requests a Data Terminal Ready acknowledgement.

Note: BSCOPEN assumes that point-to-point lines have Data Terminal Ready (DTR) permanently set on.

Syntax:

label	**BSCOPEN**	**bsciocb,ERROR=,X21RN=,P1=,P2=,P3=**
Required:	**bsciocb**	
Defaults:	**none**	
Indexable:	**bsciocb**	

Operand	*Description*
bsciocb	The label or indexed location of the BSCIOCB statement associated with the open operation.
ERROR=	The label of the instruction to be executed if an error occurs while opening the line. If you do not code this operand, control passes to the next sequential instruction. In either case, the return code reflects the results of the operation.
X21RN=	The label of the data area containing the name of a member in the X.21 Circuit Switched Network Support connection data set. This member contains the connection information for this BSCOPEN. See "X21RN Coding Example" on page 2-26 for the layout of the data area. This parameter must be coded for auto-call (TYPE=SE or TYPE=SM) if the default data set name is not used. This parameter is optional for direct call (TYPE=DC) and is ignored for all other connection types. (The default name and the data set contents are explained in the *Communications Guide*.)
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

X21RN Coding Example

The following example shows how to code the data area referred to by the X21RN operand. This data area contains the name of the X.21 Circuit Switched Network connection record data set. The data area must be eight characters long. If the data set name contains fewer than 8 characters, the remaining positions in the data area must contain blanks. (Refer to the *Communications Guide* for additional information about the connection data set.)

```
          •
          •
          •
       BSCOPEN     BSCIOCB,X21RN=MYDS
          •
          •
          •
MYDS   DC          CL8'X21RNDS '     DATA SET NAME
```

Return Codes

The following are the return codes for X.21 Circuit Switched Network. All other BSC instruction return codes are listed with the BSCWRITE instruction under "Return Codes" on page 2-36.

Return Code	Condition
−32	System is unable to find X.21 support. IPL the system.
−31	Not enough storage available to handle the number of X.21 requests. Use the $DISKUT2 SS command to allocate more storage for $X21. You can issue three simultaneous requests for every 256 bytes of storage allocated.
−30	Your supervisor does not contain X.21 support.
−29	System does not have enough storage available to load the X.21 support or the connection record data set, $$X21DS, is not on the IPL volume.
−27	Unrecoverable hardware error. If $LOG is active, check the error log record for the X.21 device for more details.
−26	Hardware error for the 2080 feature card. Invalid interrupt received.
−25	Connection failed.
−24	Time expired for the completion of a call request. Call request failed.
−23	You cancelled a call request with an SNADACT or $C command.
−22	Call request failed due to Public Data Network problems. Call progress signals invalid.
−21	Call request failed due to Public Data Network problems. Call progress signals incomplete.
−20	Call request failed and network would not allow the request to be retried. If $LOG is active, check the error log record for the X.21 device for more details.
−19	Number of retries exhausted for the call request. If $LOG is active, check the error log record for the X.21 device for more details.

Return Code	Condition
−18	Hardware error for the 2080 feature card. I/O request could not be completed.
−17	No call request in progress.
−16	The Network information field of the X.21 connection record has no plus sign or only a plus sign.
−15	The value in the Retry or Delay field of the X.21 connection record exceeds the maximum value allowed.
−14	The Retry or Delay field of the X.21 connection record contains a negative value.
−13	A comma must separate the Retry, Delay, and Network information fields of an X.21 connection record.
−12	The Retry or Delay field of the X.21 connection record contains an invalid character.
−11	System does not have enough storage to execute a call request.
−10	Not enough storage in partition 1 for X.21 to execute a request.
−9	Either the connection record was never created or an EDL instruction failed.
−1	Successful completion.
0	You cancelled a call request with an SNADACT or $C command.
1	Registration or cancellation request processed.
2	Redirection activated.
3	Redirection deactivated.

BSCREAD – Read Data from a BSC Line

The BSCREAD instruction reads data from a binary synchronous line. If the read operation is successful, the first word of the associated BSCIOCB contains the address of the last character read.

Syntax:

label	**BSCREAD**	**type,bsciocb,ERROR=,END=,CHAIN=, TIMEOUT=,P1=,P2=,P3=**
Required:	**type,bsciocb**	
Defaults:	**CHAIN=NO,TIMEOUT=YES**	
Indexable:	**bsciocb**	

Operand	*Description*
type	The type of read operation you want to perform. The read operations listed below are described in detail under "BSCREAD Types" on page 2-30. **C** Read Continue **D** Read Delay **E** Read End **I** Read Initial **P** Read Poll **Q** Read Inquiry **R** Read Repeat **U** Read User.
bsciocb	The label or indexed location of the BSCIOCB statement associated with the read operation.
ERROR=	The label of the instruction to be executed if an error occurs (return codes 10 through 99). If you do not code this operand, control passes to the next sequential instruction. In either case, the return code reflects the results of the operation.
END=	The label of the instruction to be executed if an ending condition occurs (return codes 1 through 6). If you do not code this operand, control passes to the next sequential instruction. In either case, the return code reflects the results of the operation.

CHAIN= YES, to cause a write operation to take place before the read operation. Code CHAIN=YES for Read Poll (type P) and Read User (type U). The system chains the DCB for the read operation to the DCB for the write operation.

You must provide the address of the data for the write operation in the buffer2 field of the BSCIOCB instruction. This buffer is located in the target address space as defined by $TCBADS during a BSCOPEN operation. You also must define the length (in bytes) of the data for the write operation in the length2 field of the BSCIOCB.

Your program receives an error return code if the address of the data or the length of the data for the write operation is zero. No write or read operation is performed.

NO, to cause the read operation to take place before any write operation.

Note: You can code CHAIN=YES to respond to a POLL with an EOT and then immediately set up the next read poll operation. This may be necessary in direct-connect environments where the Series/1 is a tributary to an extremely fast polling device.

TIMEOUT=

YES, to cause a time-out error to occur if the access method does not receive data within three seconds during a receive operation. Normally, the access method attempts to recover from the error the number of times that you coded on the RETRIES operand of the BSCLINE statement that defines this line. Retry on time-out is not performed by the access method for the following BSCREAD and BSCLINE types:

BSCREAD Type	BSCLINE Type
I	PP,MC
P	any
U	any

NO, to prevent a time-out error from occurring if the access method does not receive data within three seconds during a receive operation.

Px= Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Return Codes

All BSC instruction return codes are listed with the BSCWRITE instruction under "Return Codes" on page 2-36.

BSCREAD Types

Type *Operation*

C **Read Continue** – Reads subsequent blocks of data after an initial block has been received with a Read Initial.

D **Read Delay** – Acknowledges that a block of data was correctly received and asks the transmitting station to wait before sending the next block. You can issue several Read Delays before resuming transmission of data with a Read Continue.

E **Read End** – Acknowledges that a block of data was correctly received and asks the transmitting station to stop sending data. You should issue only one Read End during a single transmission. Once you issue the Read End, issue Read Continues until you actually receive an EOT.

I **Read Initial** – Reads the first block of data in a transmission. After a successful Read Initial operation, issue Read Continues until you receive an EOT.

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

In a multipoint controller operation (TYPE=MC), Read Initial polls a tributary station and, if the response to polling is positive, reads the message text.

For a multipoint tributary operation (TYPE=MT), Read Initial writes a positive response (ACK-0) and reads the message block that follows.

P **Read Poll** – Reads the poll or select sequence received when the Series/1 is acting as a tributary station on a multipoint line (TYPE=MT). If the operation is successful, the specified buffer contains the sequence received starting with the second station (control unit) address character. The access method does not check the contents of the received data stream, including control characters.

Once it is polled or selected, your program should check the next operation requested and issue the appropriate Read/Write Initial operation.

If you code CHAIN=YES, you can provide data to be transmitted by a write operation before the Read Poll operation. For example, you can provide three synchronization (SYN) characters and an EOT to be transmitted before the Read Poll operation.

Q **Read Inquiry** – Reads an ENQ character. Read Inquiry returns an invalid sequence error if ENQ or EOT is not received. If EOT is received, the access method takes the END= exit, if specified.

R **Read Repeat** – Requests that the last block of data be retransmitted following an unsuccessful read operation.

The RETRIES operand on the BSCLINE statement determines the number of times the read operation attempts to recover from a common error condition. You can use Read Repeat, however, to attempt further recovery depending on the actual error encountered.

U **Read User** – Receives data without issuing a response. The access method does not check the data or attempt any error recovery.

If you code CHAIN=YES, you can provide data to be transmitted by a write operation before the Read User operation.

Return Codes

All BSC instruction return codes are listed with the BSCWRITE instruction under "Return Codes" on page 2-36.

BSCWRITE – Write Data to a BSC Line

The BSCWRITE instruction writes 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**

Operand	*Description*
type	The type of write operation you want to perform. The write operations listed below are described in detail under "BSCWRITE Types" on page 2-33.

- **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
- **N** Write NAK (negative acknowledgement)
- **Q** Write Inquiry
- **U** Write User
- **UX** Write User Transparent

bsciocb The label or indexed location of the BSCIOCB statement associated with the write operation.

ERROR= The label of the instruction to be executed if an error occurs (return codes 10 through 99). If you do not code the operand, control passes to the next sequential instruction. In either case, the return code reflects the results of the operation.

END= The label of the instruction to be executed if an ending condition occurs (return codes 1 through 6). If you do not code this operand, control passes to the next sequential instruction. In either case, the return code reflects the results.

CHECK= YES, to allow normal checking of the response to occur. This parameter is only valid for type CV or CVX operations.

NO, to prevent the response from being checked for protocol validity. CHECK=NO provides a chained write-to-read operation similar to Write User and Read User.

Px= Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

BSCWRITE Types

Type	*Operation*
C	**Write Continue** – Writes subsequent blocks of data after an initial block has been written with a Write Initial operation. Write Continue writes the message text and reads a response from the receiving station.
CV	**Write Continue Conversational** – Writes subsequent blocks of data after an initial block has been written in conversational mode. Write Continue Conversational writes the message text and reads a response into your buffer. The access method checks acknowledgement sequences and attempts error recovery when necessary. If text is received, a –2 return code is returned instead of the normal –1.
CVX	**Write Continue Conversational Transparent** – Writes subsequent blocks of transparent data after an initial block has been written in conversational mode. Write Continue Conversational Transparent writes the message text and the ending characters DLE ETX. It then reads a response into your buffer. The access method checks acknowledgement sequences and attempts error recovery when necessary. If text is received, a –2 return code is returned instead of the normal –1.
CX	**Write Continue Transparent** – Writes subsequent blocks of transparent data after an initial block has been written. Write Continue Transparent writes the message text and the ending characters DLE ETX. The operation then reads a response from the receiving station.
CXB	**Write Continue Transparent Block** – Writes subsequent blocks of transparent data after an initial block has been written. This operation is the same as BSCWRITE type CX except that it uses ETB as the ending character instead of ETX. Write Continue Transparent Block writes the message text and the ending characters DLE ETB. It then reads a response from the receiving station.

D **Write Delay** – Informs the remote station that the transmission of the next block of data will be delayed. You can perform several Write Delay operations before data transmission resumes.

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

E **Write End** – Informs the remote station that the previous block of data completed the write operation. Write End writes an EOT.

EX **Write End Transparent** – Writes a transparent EOT (DLE EOT). You can use this operation to notify the receiving station on a switched line that the transmitting station is disconnecting from the line.

I **Write Initial** – Writes the first block of data in a transmission. Write Initial establishes the correct initial sequence (depending on the type of line), writes the first block, and checks the response.

For a point-to-point operation (TYPE=PT,SA,SM), Write Initial:

- Writes an ENQ to gain use of the line
- Reads a positive response (ACK-O)
- Writes the message text
- Reads the response to the message text.

In a multipoint controller operation (TYPE=MC), Write Initial:

- Selects a tributary station
- Waits for a positive response to the selection
- Writes the message text
- Reads the response to the message text.

For a multipoint tributary operation (TYPE=MT), Write Initial:

- Writes the message text
- Reads a response from the controller station.

IV **Write Initial Conversational** – Writes the first block of data for a transmission in conversational mode.

Write Initial Conversational establishes the correct initial sequence (depending on the type of line), writes the first block of the message text, and reads a response into your buffer. The access method checks acknowledgement sequences and attempts error recovery when necessary. If text is received, a −2 return code is returned instead of the normal −1.

For a point-to-point operation (TYPE=PT,SA,SM), Write Initial Conversational:

- Writes an ENQ to gain use of the line
- Reads a positive response (ACK-O)
- Writes the message text
- Reads the response to the message text.

In a multipoint controller operation (TYPE=MC), Write Initial:

- Selects a tributary station
- Waits for a positive response to the selection
- Writes the message text
- Reads the response to the message text.

For a multipoint tributary operation (TYPE=MT), Write Initial:

- Writes the message text
- Reads a response from the controller station.

IVX **Write Initial Conversational Transparent** – Writes the first block of transparent data of a transmission in conversational mode.

Write Initial Conversational Transparent establishes the correct initial sequence (depending on the type of line), writes the first block of the message text and the ending characters DLE ETX. It then reads a response into your buffer. The access method checks acknowledgement sequences and attempts error recovery when indicated. If text is received, a −2 return code is returned instead of the normal −1.

For point-to-point operation (TYPE=PT,SA,SM), Write Initial Conversational Transparent:

- Writes an ENQ to gain use of the line
- Reads a positive response (ACK-O)
- Writes the message text
- Writes the required ending characters DLE ETX
- Reads the response to the message text.

In a multipoint controller operation (TYPE=MC), Write Initial:

- Selects a tributary station
- Waits for a positive response to the selection
- Writes the message text
- Writes the required ending characters DLE ETX
- Reads the response to the message text.

For a multipoint tributary operation (TYPE=MT), Write Initial:

- Writes the message text
- Writes the required ending characters DLE ETX
- Reads a response from the controller station.

IX **Write Initial Transparent** – Writes the first block of transparent data in a transmission. Write Initial Transparent establishes the correct initial sequence (depending on the type of line), writes the first block of transparent data, and checks the response. The access method ends the message text with DLE ETX.

IXB **Write Initial Transparent Block** – Same as Write Initial Transparent (IX) except that ETB is used as the ending character instead of ETX.

Q **Write Inquiry** – Writes an ENQ character and reads the response into your buffer. The response is either a control sequence or text.

Use this operation to request that a response to a message block be retransmitted. The access method retries the operation if it times out.

N **Write NAK** – Writes a NAK (negative acknowledgement) character. Use this operation to respond "device not ready" to polling or selection when the Series/1 operates as a tributary station on a multipoint line (TYPE=MT).

U **Write User** – Transmits a character stream. The access method does not perform an associated read operation or attempt error recovery.

UX **Write User Transparent** – Transmits a transparent character stream. The access method does not perform an associated read operation or attempt error recovery.

The operation concludes with one of the following character pairs contained in BSCIOCB buffer2: DLE ETX, DLE ETB, or DLE ENQ.

Return Codes

Return codes are returned in the first word of the task control block (TCB) of the program or task issuing the instruction. The label of the TCB is the label of your program or task (taskname).

Return Code	Condition
−32	System is unable to find X.21 support. IPL the system. [7]
−31	Not enough storage available to handle the number of X.21 requests. Use the $DISKUT2 SS command to allocate more storage for $X21. You can issue three simultaneous requestsfor every 256 bytes of storage allocated. [7]
−30	Your supervisor does not contain X.21 support. [7]
−29	System does not have enough storage available to load the X.21 support or the connection record data set, $$X21DS, is not on the IPL volume. [7]
−27	Unrecoverable hardware error. If $LOG is active, check the error log record for the X.21 device for more details. [7]
−25	Connection failed. [7]
−24	Time expired for the completion of a call request. Call request failed. [7]
−23	You cancelled a call request with a $C command. [7]
−22	Call request failed due to Public Data Network problems Call progress signals invalid. [7]
−21	Call request failed due to Public Data Network problems. Call progress signals incomplete. [7]
−20	Call request failed and network would not allow request to be retried. If $LOG is active, check the error log record for the X.21 device for more details. [7]
−19	Number of retries exhausted for the call request. If $LOG is active, check the error log record for the X.21 device for more details. [7]

Return Code	Condition
−18	Hardware error for the 2080 feature card. I/O request could not be completed. 7
−16	The Network information field of the X.21 connection record has no plus sign or only a plus sign. 7
−15	The value in the Retry or Delay field of the X.21 connection record exceeds the maximum value allowed. 7
−14	The Retry or Delay field of the X.21 connection record contains a negative value. 7
−13	A comma must separate the Retry, Delay, and Network information fields of an X.21 connection record. 7
−12	The Retry or Delay field of the X.21 connection record contains an invalid character. 7
−11	System does not have enough storage to execute a call request. 7
−10	Not enough storage in partition 1 for X.21 to execute a request. 7
−9	An EDL instruction failed. If $LOG is active, check the error log record for the X.21 device to find the failing instruction. 7
−2	Text received in conversational mode.
−1	Successful completion.
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
10	Time-out occurred. 1
11	Unrecovered transmission error (BSC error). 1
12	Invalid sequence received. 3
13	Invalid multipoint tributary write attempt. 2
14	Disregard this block sequence received. 1
15	Remote station busy (WACK received). 1
16	Your supervisor does not contain X.21 support. 7
17	The connection type you defined on the BSCLINE statement is not valid for the X.21 Circuit Switched Network. 7
18	The 2080 feature card is incorrectly jumpered for use with the X.21 Circuit Switched Network. 7
19	The X.21 network has been deactivated (DCE CLEAR). 7
20	Wrong length record − long (No COD). 6
21	Wrong length record − short (write only). 2
22	Invalid buffer address. 2

Return Code	Condition
23	Buffer length zero. [2]
24	Undefined line address. [2]
25	Line not opened by calling task. [2]
26	Registration or cancellation request processed. [7]
27	Redirection activated. [7]
28	Redirection deactivated. [7]
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]

Notes:

1. Retried up to the limit specified in the RETRIES= operand of the BSCLINE statement.
2. Not retried.
3. Retried during write operation 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.
7. Returned only if your system contains support for the X.21 Circuit Switched Network.

BUFFER – Define a Storage Area

The BUFFER statement defines a data storage area. The standard buffer contains an index word, a length word, and a data buffer.

The index word indicates the number of data items (words or bytes) stored in the buffer, but only when incremented by your program. A label assigned to the index word in your program will enable you to increment and reset the index word from the program. The system sets the index word to 0 when it creates the buffer. The length word indicates the total length of the buffer in data items (words or bytes).

Certain instructions, for example INTIME and SBIO allow you to add new entries sequentially to a buffer by referring to and incrementing the index word.

You can use a BUFFER statement to define the storage area needed for use with the Host Communications Facility TP READ/WRITE instruction. The use of the BUFFER statement to set up a temporary I/O buffer for a terminal is explained under the IOCB statement.

READTEXT and GETEDIT instructions can be used to modify the BUFFER statement. PRINTEXT and PUTEDIT instructions use the BUFFER statement to determine the number of values to print.

Figure 2-3 on page 2-41 shows the physical layout of a buffer.

Syntax:

label	**BUFFER length,item,INDEX=**
Required:	**length**
Defaults:	**item=WORD**
Indexable:	**none**

Operand	*Description*
length	The length of the buffer in terms of the data item (words or bytes) you specify. The system allocates two words of control information, the index word and the length word, in addition to the buffer itself. The length must not exceed 16380 words or 32760 bytes. If your program includes a READ instruction that will use the buffer, the buffer area should be a multiple of 256 bytes. **Note:** When filling a buffer, you should be careful not to exceed the buffer size. The system does not check for an overflow condition.

item Code BYTE or BYTES if the buffer length is defined in terms of bytes. Code WORD or WORDS if the buffer length is defined in terms of words. The default for this operand is WORD.

Code BYTE or BYTES if you are using the BUFFER statement with a CALL $IMOPEN instruction.

Code TPBSC to generate a buffer for use with the TP READ/WRITE instruction (Host Communications Facility). The count operand reflects the length of the buffer in bytes when you code TPBSC.

INDEX= The label of the buffer index word. Do not code this operand if you coded TPBSC for the item operand. You can think of this operand as a pointer to the next available data location in the buffer.

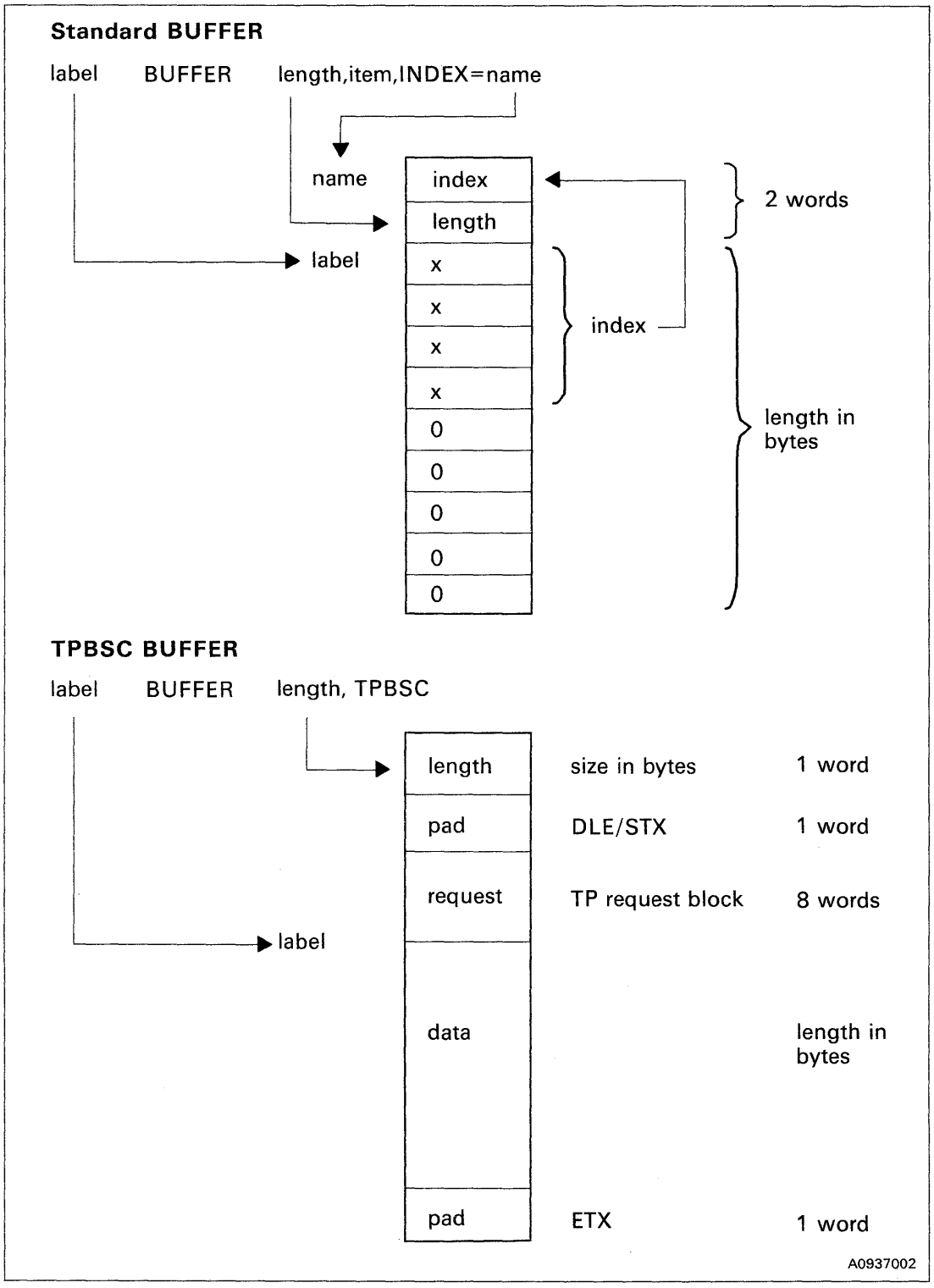


Figure 2-3. Physical Layout of a Buffer

Coding Example

The BUFFER statement labeled BUFF defines a 102-word storage area. The first word of this area is labeled INDX as coded on the keyword INDEX. The second word contains the count of the total number of BUFFER entries. The remaining 100 words are the actual BUFFER storage area.

```
          •
          •
          •
        SUBROUT   STORE
        IF        (INDX,GE,198)
          ENQT      $SYSPRTR
          PRINTEXT  '@BUFFER IS FULL'
          DEQT
          RETURN
        ENDIF
        MOVEA     #1,BUFF               MOVE ADDR OF BUFF
        ADD       #1,INDX               INCREMENT #1
        MOVE      (0,#1),DATA1,(1,WORD) MOVE DATA TO BUFF
        ADD       INDX,2                INCREMENT BUFFER INDEX
        RETURN
BUFF    BUFFER    100,WORDS,INDEX=INDX
DATA1   DATA      F'0'
```

CACLOSE – Close a Channel Attach Port

The CACLOSE instruction ends the connection between your application program and a Channel Attach port and disables the port from receiving interrupts from the System/370.

Syntax:

label	**CACLOSE caiocb,ERROR=,P1=**
Required:	**caiocb**
Defaults:	**none**
Indexable:	**caiocb**

Operand	*Description*
caiocb	The label or indexed location of the Channel Attach I/O control block defined for this port.
ERROR=	The label of the instruction to be executed if an error occurs. If you do not code this operand, control passes to the next instruction after the CACLOSE and your program must test for errors before issuing a WAIT.
P1=	Parameter naming operand. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code this operand.

Syntax Examples

1) The following example closes a port defined by the CAIOCB at USERIOCB.

```
CLOSE10   CACLOSE   USERIOCB
```

2) This example closes a port defined by the CAIOCB at the indexed location of USER plus the contents of #1. If an error occurs, the instruction at label E1 receives control.

```
CLOSEFC   CACLOSE   (USER,#1),ERROR=E1
```

Return and Post Codes

Return codes are returned in the first word of the task control block of the program or task issuing the instruction. A return code other than −1 indicates that the link module found an error before the instruction performed an I/O operation. Your program must check the return code before it issues a WAIT because a WAIT should only be used if an I/O operation is being performed.

CACLOSE post codes are returned to the first word of the CAIOCB you defined for the instruction.

For detailed explanations of the return and post codes, refer to *Messages and Codes*.

Post Code	Hex	Return Code	Explanation
	FE0C	−500	Data pending from host.
−1	FFFF	−1	Successful.
501	01F5		EXIO error; device not attached.
502	01F6		EXIO error; busy.
503	01F7		EXIO error; busy after reset.
504	01F8		EXIO error; command reject.
505	01F9		EXIO error; intervention required.
506	01FA		EXIO error; interface data check.
507	01FB		EXIO error; controller busy.
508	01FC		EXIO error; channel command not allowed.
509	01FD		EXIO error; no DDB found.
510	01FE		EXIO error; too many DCBs chained.
511	01FF		EXIO error; no residual status address.
512	0200		EXIO error; zero bytes specified for residual status.
513	0201		EXIO error; broken DCB chain.
516	0204		EXIO error; device already opened.
524	020C		Timeout.
	0234	564	User's CAIOCB not linked to port.
567	0237	567	System error; CAPGM terminating.
	0238	568	Port not opened.

Note: Channel Attach codes 501 − 513 are the same as the EXIO post codes 1 − 13 respectively.

CAIOCB – Create a Channel Attach Port I/O Control Block

The CAIOCB statement creates a Channel Attach port I/O control block that contains the information your program requires to use a port.

You supply the device address, the port number, and the label of the first buffer control area. You must provide a CAIOCB for all operations to a port. Do not try to modify the CAIOCB during program execution.

Syntax:

label	**CAIOCB**	**address,PORT=,BUFFER=**
Required:	**label,address,PORT=,BUFFER=**	
Defaults:	**none**	
Indexable:	**none**	

Operand	*Description*
label	The label of the CAIOCB for use with the CAOPEN, CACLOSE, CAREAD, and CAWRITE instructions.
address	A 2-digit hexadecimal device address.
PORT=	The number of the port (0–31) for which this I/O control block is being created.
BUFFER=	The label of a 3-word area containing: • First word – the address of the buffer to be used for the first read. • Second word – the number of bytes to be used. • Third word – the partition number of the buffer. If this word is zero, the system assumes the buffer is in the partition in which you loaded your program.

Syntax Example

The following statement creates a Channel Attach port I/O control block for port 3. The device address is 10.

```
USERIOCB  CAIOCB    10,PORT=3,BUFFER=AREA
```

CALL – Call a Subroutine

The CALL instruction executes a system subroutine or a subroutine that you write. You can pass up to five parameters as arguments to the subroutine. If the subroutine you call is a separate object module to be link-edited with your program, you must code an EXTRN statement with the subroutine name in the calling program. Figure 2-4 on page 2-48 shows an example of a primary task calling a subroutine which in turn calls a second subroutine.

Syntax:

label	**CALL**	**name,par1,...,par5,P1=,...,P6=**
Required:	**name**	
Defaults:	**none**	
Indexable:	**none**	

Operand	*Description*
name	The name of the subroutine to be executed.
par(n)	The parameters you want to pass to the subroutine. You can pass up to five single-precision integers or the labels of single-precision integers or null parameters to the subroutine. The CALL instruction replaces the parameters specified in the subroutine with the parameters you specify. For example, the instruction replaces the first parameter of the subroutine with par1, the second parameter with par2, and so on. If the parameter name is enclosed in parentheses, for example (par1), the instruction passes the address of the variable to the subroutine parameter. The address can be the label of the first word of any type of data item or data array. Within the subroutine it will be necessary to move the passed address of the data item into one of the index registers, #1 or #2, in order to refer to the actual data item location in the calling program. If the parameter name enclosed in parentheses is the label of an EQU instruction, the instruction passes the value of that label as the parameter. If the parameter to be passed is the label of an EQU instruction, you can code a plus sign (+) in front of that label. The plus sign causes the value equated to the label to be passed to the subroutine. If you do not code a plus sign in front of the label, the instruction assumes that the value equated to the label is an address and passes the data at that address as the parameter.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Syntax Examples

1) Call the PROG subroutine and pass it a value of 5.

```
CALL   PROG,5
```

2) Call the PROG subroutine and pass it a value of 5 and the null parameter 0.

```
CALL   PROG,5,
```

3) Call the SUBROUT subroutine and pass it the contents of PARM1, the address of PARM2, and the value of the equated label FIVE.

```
CALL   SUBROUT,PARM1,(PARM2),+FIVE
```

Coding Example

The following coding example shows a use of the CALL instruction. The main routine calls the subroutine READREC. A relative record number is passed to the subroutine as RECNUMBR and is received as RECORD#.

Two methods of passing an address to a subroutine are illustrated. First, at label MA, the address of ENDFILE is moved to EOF. Then EOF is passed to the subroutine as a parameter of a CALL instruction.

Second, in the same CALL instruction, the address of READERR is passed to the subroutine by enclosing the label in parentheses. When EOF and READERR are passed to the subroutine, they are referred to as EOFEXIT and ERREXIT, respectively.

The EOFEXIT and ERREXIT parameters are addresses. In order to branch to the locations these parameters represent, they must be enclosed in parentheses as the object of a GOTO instruction.

The subroutine uses the relative record number defined by RECORD# to read the data file. An end-of-file condition causes a branch to the appropriate exception routine whose address is contained in EOFEXIT.

A read error will cause a branch to the location whose address is contained in ERREXIT. If no exception condition is encountered, control is returned to the calling routine by the RETURN instruction.

```
            •
            •
            •
MA          MOVEA    EOF,ENDFILE
            CALL     READREC,RECNUMBR,EOF,(READERR)
            GOTO     CONTINU
READERR     EQU      *
            PRINTEXT '@ ERROR ENCOUNTERED READING DISK FILE RECORD NUMBER'
            PRINTNUM RECNUMBR
            PROGSTOP
ENDFILE     EQU      *
            PRINTEXT '@ END OF INPUT DATA FILE REACHED'
            PROGSTOP
CONTINU     EQU      *
             •
             •
             •
            SUBROUT  READREC,RECORD#,EOFEXIT,ERREXIT
            READ     DS1,DISKBUFR,1,RECORD#,END=ENDEXIT,ERROR=ERRORXIT
            RETURN
ENDEXIT     EQU      *
            GOTO     (EOFEXIT)
ERRORXIT    EQU      *
            GOTO     (ERREXIT)
             •
             •
             •
```

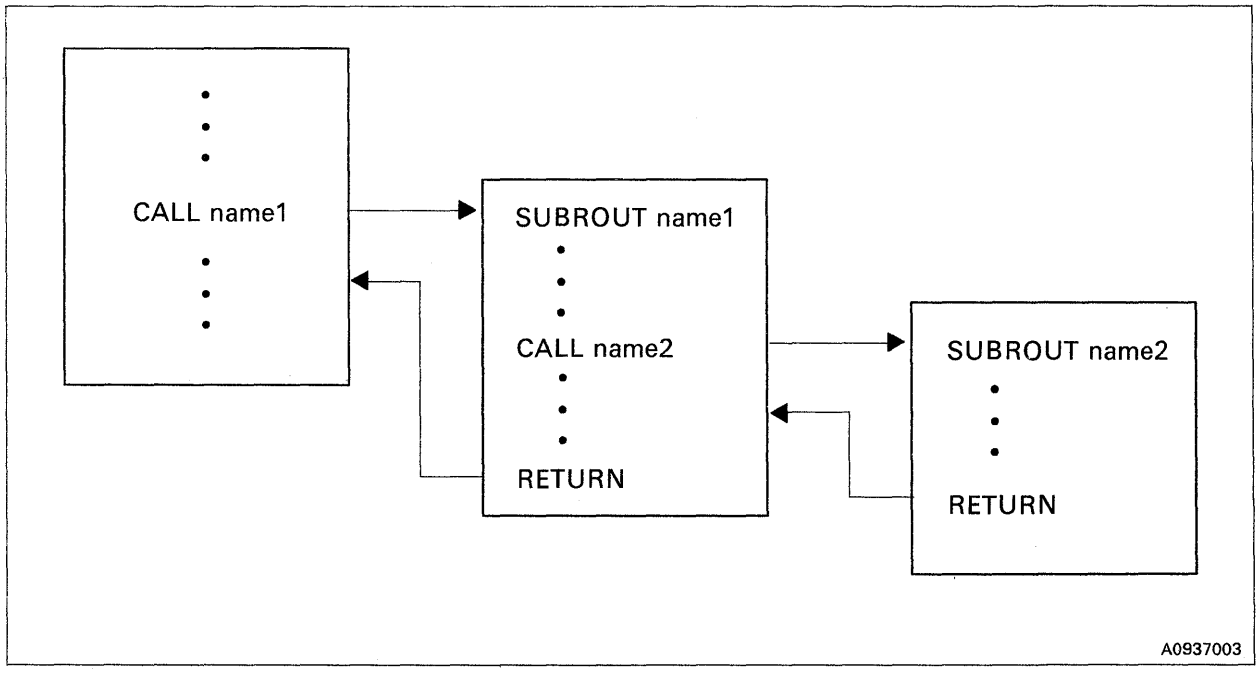


Figure 2-4. Execution of Subroutines

CALLFORT – Call a FORTRAN Subroutine or Program

The CALLFORT instruction calls a FORTRAN program or subroutine from an Event Driven Executive program. If you call a FORTRAN main program, the name you specify for the name operand is the name you coded on the FORTRAN PROGRAM statement or the default name, MAIN, if no PROGRAM statement was coded. If you call a FORTRAN subroutine, specify the name of the subroutine for the name operand. You can pass parameters to FORTRAN subroutines. Standard FORTRAN subroutine conventions apply to the use of CALLFORT.

If separate tasks within an EDL program each contain CALLFORT instructions, the tasks should not execute concurrently because the FORTRAN subroutines are serially reusable and not reentrant.

For a more complete description of the use of the CALLFORT instruction, refer to the *IBM Series/1 Event Driven Executive FORTRAN IV Program 5719-FO2 User's Guide*, SC34-0315.

Syntax:

label	**CALLFORT name,(a1,a2,...,an),P=(p1,p2,..pn)**
Required:	**name**
Defaults:	**none**
Indexable:	**none**

Operand	*Description*
name	The name of a FORTRAN program or subroutine, consisting of 1–6 alphanumeric characters, that begins with an alphabetic character. You must also code this name, or entry point, on an EXTRN statement.
a1,a2,an	A list of parameters or arguments (a1,a2, and so on) that you want to pass to the subroutine. The argument can be a constant, a variable, or the name of a buffer. If you are passing the subroutine only one argument, you do not have to enclose it in parentheses.
p1,p2,pn	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands. Each name in this list can be up to 8 characters long. The system assigns the first name in the list to the first argument, the second name in the list to the second argument, and so on.

Syntax Examples

1) Call the SORT1 subroutine.

```
SAMPLE  PROGRAM   START
        EXTRN     SORT1
START   EQU       *
        CALLFORT  SORT1
```

2) Call the SUM subroutine and pass it an integer constant of 5.

```
SAMPLE  PROGRAM   START
        EXTRN     SUM
START   EQU       *
        CALLFORT  SUM,5
```

3) Call the SUM subroutine and pass it variables A and B.

```
SAMPLE  PROGRAM   START
        EXTRN     SUM
START   EQU       *
        CALLFORT  SUM,(A,B)
          •
          •
          •
A       DATA      F'5'
B       DATA      F'0'
```

4) Call the SUM subroutine and pass it variables A and B. Assign the label INPUT to argument A and OUTPUT to argument B.

```
SAMPLE  PROGRAM   START
        EXTRN     SUM
START   EQU       *
        CALLFORT  SUM,(A,B),P=(INPUT,OUTPUT)
          •
          •
          •
A       DATA      F'5'
B       DATA      2F'0'
```

CAOPEN – Open a Channel Attach Port

The CAOPEN instruction establishes a connection between your application program and a Channel Attach device port.

You must issue a CAOPEN instruction before your program can use a port for data transfer. When your program opens a Channel Attach port, it has exclusive use of the port until the port is closed. The system rejects any request to open a port already opened.

Syntax:

label	**CAOPEN**	**caiocb,ERROR=,P1=**
Required:	**caiocb**	
Defaults:	**none**	
Indexable:	**caiocb**	

Operand	*Description*
caiocb	The label or indexed location of the Channel Attach port I/O control block you defined for this port.
ERROR=	The label of the instruction to be executed if an error occurs. If you do not code this operand, control passes to the next instruction after the CAOPEN and your program must test for errors before issuing a WAIT.
P1=	Parameter naming operand. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code this operand.

Syntax Examples

1) Open a port defined by the CAIOCB at label USERIOCB.

```
OPEN10    CAOPEN    USERIOCB
```

2) Open a port defined by the CAIOCB at the indexed location of USER plus the contents of #1. If an error occurs, the instruction at label E1 receives control.

```
OPENFC    CAOPEN    (USER,#1),ERROR=E1
```

Return and Post Codes

Return codes are returned in the first word of the task control block of the program or task issuing the instruction. A return code other than −1 indicates that the link module found an error before the instruction performed an I/O operation. Your program must check the return code before it issues a WAIT because a WAIT should only be used if an I/O operation is being performed.

CAOPEN post codes are returned to the first word of the CAIOCB you defined for the instruction.

For detailed explanations of the return and post codes, refer to *Messages and Codes.*

Post Code	Hex	Return Code	Explanation
−1	FFFF	−1	Successful.
501	01F5		EXIO error; device not attached.
502	01F6		EXIO error; busy.
503	01F7		EXIO error; busy after reset.
504	01F8		EXIO error; command reject.
505	01F9		EXIO error; intervention required.
506	01FA		EXIO error; interface data check.
507	01FB		EXIO error; controller busy.
508	01FC		EXIO error; channel command not allowed.
509	01FD		EXIO error; no DDB found.
510	01FE		EXIO error; too many DCBs chained.
511	01FF		EXIO error; no residual status address.
512	0200		EXIO error; zero bytes specified for residual status.
513	0201		EXIO error; broken DCB chain.
516	0204		EXIO error; device already opened.
520	0208		Interrupt error.
524	020C		Timeout.
	0227	551	Device not started.
	0228	552	Stop in progress.
	022C	556	Port out of range.
	022D	557	Port already open.
	022E	558	Read buffer not provided.
	022F	559	Read buffer count = 0.
567	0237	567	System error; CAPGM terminating.
	023A	570	Device in diagnostic mode.

Note: Channel Attach codes 501 − 513 are the same as the EXIO post codes 1 − 13, respectively.

CAPRINT – Print Channel Attach Trace Data

The CAPRINT instruction prints the entire trace area on your printer or terminal. Use this instruction for problem determination. Tracing is disabled while printing is being done.

Syntax:

label	**CAPRINT**	**address,event,TITLE=,CONSOLE=,ERROR=, P1=,P2=,P3=,P4=**
Required:	**address**	
Defaults:	**CONSOLE=$SYSPRTR**	
Indexable:	**EVENT,TITLE**	

Operand	*Description*
address	A 2-digit hexadecimal device address.
event	The label or indexed location of the event to be posted when printing has completed. If you do not code this operand, your program is not posted when printing completes.
TITLE=	The label or indexed location of a 2-word area defining the title on the trace data listing. The first word contains the address of the title. The second word contains the length, in bytes, of the title. If you do not code this operand, no title appears on the trace data listing. TITLE= cannot exceed 72 bytes if you are using the $CHANUT1 utility.
CONSOLE=	The label of the IOCB statement that defines the terminal used as the output device for this trace print request.
ERROR=	The label of the instruction to be executed if an error occurs. If you do not code this operand, control passes to the next instruction after the CAPRINT and your program must test for errors before issuing a WAIT.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Syntax Examples

1) Print trace data for the device at address 10 on $SYSPRTR.

```
PRINT10   CAPRINT   10,ERROR=ERROR2
```

2) Print trace data for the device at address FC on PRTR2. When the printing completes, the instruction posts the event at the indexed location of address A plus the contents of #1.

```
PRINTFC   CAPRINT   FC,(A,#1),TITLE=HEAD,                    X
                    CONSOLE=PRTR2,ERROR=E1
```

Return Codes

Return codes are returned in the first word of the task control block of the program or task issuing the instruction. A return code indicates that the link module found an error before the instruction performed an I/O operation. Your program must check the return code before it issues a WAIT because a WAIT should only be used if an I/O operation is being performed.

For detailed explanations of the return codes, refer to *Messages and Codes.*

Hex	Return Code	Explanation
0227	551	Device not started.
0228	552	Stop in progress.
022A	554	Device not found.

CAREAD – Read from a Channel Attach Port

The CAREAD instruction reads data from a Channel Attach port. The operation occurs at the port you specify in the CAIOCB statement.

Syntax:

label	**CAREAD**	**caiocb,thisbuf,nextbuf,ERROR=,** **P1=,P2=,P3=**
Required:	**caiocb,thisbuf,nextbuf**	
Defaults:	**none**	
Indexable:	**caiocb,thisbuf,nextbuf**	

Operand	*Description*
caiocb	The label or indexed location of the Channel Attach port I/O control block defined for this port.
thisbuf	The label of a 3-word area containing: • First word – the address of the buffer receiving the data from this read • Second word – the number of bytes to be read into the buffer • Third word – the partition number of the buffer
nextbuf	The label of a 3-word area containing: • First word – the address of the buffer to be used for the next read • Second word – the number of bytes to be read into the buffer • Third word – the partition number of the buffer.
ERROR=	The label of the instruction to be executed if an error occurs. If you do not code this operand, control passes to the next instruction after the CAREAD, and your program must test for errors before issuing a WAIT.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Syntax Examples

1) Read data from the port defined by the CAIOCB at label USERIOCB. The address of the buffer receiving the data is in the 3-word area at label BUF1.

```
READ10    CAREAD    USERIOCB,BUF1,BUF2
```

2) Read data from the port defined by the CAIOCB at the indexed location of USER plus the contents of #1. The address of the buffer receiving the data is in the 3-word area at the indexed location of BUF1 plus the contents of #2.

```
READFC    CAREAD   (USER,#1),(BUF1,#2),                    X
               (BUF2,#1),ERROR=E1
```

Return and Post Codes

Return codes are returned in the first word of the task control block of the program or task issuing the instruction. A return code other than −1 indicates that the link module found an error before the instruction performed an I/O operation. Your program must check the return code before it issues a WAIT because a WAIT should only be used if an I/O operation is being performed.

CAREAD post codes are returned to the first word of the CAIOCB you defined for the instruction. For detailed explanations of the return and post codes, refer to *Messages and Codes.*

Post Code	Hex	Return Code	Explanation
−1	FFFF	−1	Successful.
501	01F5		EXIO error; device not attached.
502	01F6		EXIO error; busy.
503	01F7		EXIO error; busy after reset.
504	01F8		EXIO error; command reject.
505	01F9		EXIO error; intervention required.
506	01FA		EXIO error; interface data check.
507	01FB		EXIO error; controller busy.
508	01FC		EXIO error; channel command not allowed.
509	01FD		EXIO error; no DDB found.
510	01FE		EXIO error; too many DCBs chained.
511	01FF		EXIO error; no residual status address.
512	0200		EXIO error; zero bytes specified for residual status.
513	0201		EXIO error; broken DCB chain.
516	0204		EXIO error; device already opened.
524	020C		Timeout.
520	0208		Interrupt error.
521	0209		Negative acknowledgement (write only).
522	020A		Buffer overlay (read only).
523	020B		Protocol error.
	022E	558	Buffer not provided.
	022F	559	Buffer count = 0.
	0232	562	Write buffer not provided.
	0233	563	Write buffer count = 0.
	0234	564	Users CAIOCB not linked to port.
567	0237	567	System error; CAPGM terminating.
	0238	568	Port not opened.

Note: Channel Attach codes 501 − 513 are the same as the EXIO post codes 1 − 13, respectively.

CASTART – Start Channel Attach Device

The CASTART instruction starts a Channel Attach device. Your program must start the Channel Attach device before it can open any of the device's ports.

The first CASTART instruction you issue loads the Channel Attach device handler program, initializes the control blocks for the device, and prepares the device to accept interrupts from the System/370. Subsequent CASTART instructions connect to the device handler program initially loaded.

Syntax:

label	CASTART	**address,ecb,ERROR=,P1=,P2=**
Required:	**address,ecb**	
Defaults:	**none**	
Indexable:	**ecb**	

Operand	*Description*
address	A 2-digit hexadecimal device address.
ecb	The label or indexed location of the event to be posted upon completion of the CASTART operation.
ERROR=	The label of the instruction to be executed if an error occurs. If you do not code this operand, control passes to the next instruction after the CASTART, and the program must test for errors before issuing a WAIT.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Syntax Example

The CASTART instruction in the following example starts the device at address 10. When the start operation ends, the instruction posts the event at $ECB.

```
START10   CASTART   10,$ECB
```

Return and Post Codes

Return codes are returned in the first word of the task control block of the program or task issuing the instruction. A return code other than −1 indicates that the link module found an error before the instruction performed an I/O operation. Your program must check the return code before it issues a WAIT because a WAIT should only be used if an I/O operation is being performed.

CASTART post codes are returned to the first word of of the event control block (ECB) you defined in the instruction.

For detailed explanations of the return and post codes, refer to *Messages and Codes.*

Post Code	Hex	Return Code	Explanation
−1	FFFF	−1	Successful.
501	01F5		EXIO error; device not attached.
502	01F6		EXIO error; busy.
503	01F7		EXIO error; busy after reset.
504	01F8		EXIO error; command reject.
505	01F9		EXIO error; intervention required.
506	01FA		EXIO error; interface data check.
507	01FB		EXIO error; controller busy.
508	01FC		EXIO error; channel command not allowed.
509	01FD		EXIO error; no DDB found.
510	01FE		EXIO error; too many DCBs chained.
511	01FF		EXIO error; no residual status address.
512	0200		EXIO error; zero bytes specified for residual status.
513	0201		EXIO error; broken DCB chain.
516	0204		EXIO error; device already opened.
524	020C		Timeout.
525	0200		Not a Channel Attach device.
	0228	552	Stop in progress.
	022A	554	Device not found.
567	0237	567	System error; CAPGM terminating.
	0239	569	Device already started.

Note: Channel Attach codes 501 − 513 are the same as the EXIO post codes 1 − 13, respectively.

CASTOP – Stop a Channel Attach Device

The CASTOP instruction stops a Channel Attach device and disables the device from receiving interrupts from the System/370. Your program can stop a device only if no ports are open. When your program stops the last device, the Channel Attach device handler program ends.

Syntax:

label	**CASTOP**	**address,ecb,ERROR=,P1=,P2=**
Required:	**address,ecb**	
Defaults:	**none**	
Indexable:	**ecb**	

Operand	*Description*
address	A 2-digit hexadecimal device address.
ecb	The label or indexed location of the event to be posted upon completion of the CASTOP operation.
ERROR=	The label of the instruction to be executed if an error occurs. If you do not code this operand, control passes to the next instruction after the CASTOP, and your program must test for errors before issuing a WAIT.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Syntax Example

The CASTOP instruction in the following example stops the device at address 10. When the operation ends, the instruction posts the event at $ECB.

```
STOP10    CASTOP    10,$ECB
```

Return and Post Codes

Return codes are returned in the first word of the task control block of the program or task issuing the instruction. A return code other than −1 indicates that the link module found an error before the instruction performed an I/O operation. Your program must check the return code before it issues a WAIT because a WAIT should only be used if an I/O operation is being performed.

CASTOP post codes are returned to the first word of the event control block (ECB) you defined in the instruction.

For detailed explanations of the return and post codes, refer to *Messages and Codes.*

Post Code	Hex	Return Code	Explanation
−1	FFFF	−1	Successful.
501	01F5		EXIO error; device not attached.
502	01F6		EXIO error; busy.
503	01F7		EXIO error; busy after reset.
504	01F8		EXIO error; command reject.
505	01F9		EXIO error; intervention required.
506	01FA		EXIO error; interface data check.
507	01FB		EXIO error; controller busy.
508	01FC		EXIO error; channel command not allowed.
509	01FD		EXIO error; no DDB found.
510	01FE		EXIO error; too many DCBs chained.
511	01FF		EXIO error; no residual status address.
512	0200		EXIO error; zero bytes specified for residual status.
513	0201		EXIO error; broken DCB chain.
516	0204		EXIO error; device already opened.
524	020C		Timeout.
	0227	551	Device not started.
	0228	552	Stop in progress.
	0229	553	Device in use.
	022A	554	Device not found.
567	0237	567	System error; CAPGM terminating.
	023A	570	Device in diagnostic mode.
599	0257		$CAPGM has ended.

Note: Channel Attach codes 501 − 513 are the same as the EXIO post codes 1 − 13, respectively.

CATRACE – Control Channel Attach Tracing

The CATRACE instruction controls the collection of I/O trace data for a Channel Attach device. You can turn tracing on or off.

This instruction collects Channel Attach trace data in processor storage which can slow system performance. For this reason, you should use the CATRACE instruction primarily for problem determination.

Syntax:

label	**CATRACE address,ENABLE=,ERROR=,P1=**
Required:	**address**
Defaults:	**ENABLE=YES**
Indexable:	**none**

Operand	*Description*
address	A 2-digit hexadecimal device address.
ENABLE=	YES (the default), to turn on or enable tracing.
	NO, to turn off or disable tracing.
ERROR=	The label of the instruction to be executed if an error occurs. If you do not code this operand, control passes to the next instruction after the CATRACE and your program must test for errors.
P1=	Parameter naming operand. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code this operand.

Syntax Examples

1) Turn on tracing for the device at address 10.

```
TRACE10   CATRACE   10
```

2) Turn off tracing for the device at address FC. If an error occurs, the instruction at label E1 receives control.

```
TRACEFC   CATRACE   FC,ENABLE=NO,ERROR=E1
```

Return Codes

Return codes are returned in the first word of the task control block of the program or task issuing the instruction. A return code indicates that the link module found an error before the instruction performed an I/O operation. Your program must check the return code before it issues a WAIT because a WAIT should only be used if an I/O operation is being performed.

For detailed explanations of the return codes, refer to *Messages and Codes.*

Hex	Return Code	Explanation
0227	551	Device not started.
0228	552	Stop in progress.
022A	554	Device not found.
0235	565	Trace already on.
0238	566	Trace already off.

CAWRITE – Write to a Channel Attach Port

The CAWRITE instruction sends data to a Channel Attach port. The operation occurs at the port you specify in the CAIOCB statement.

Syntax:

label	**CAWRITE caiocb,buffer,ERROR=,P1=,P2=**
Required:	**caiocb,buffer**
Defaults:	**none**
Indexable:	**caiocb,buffer**

Operand	*Description*
caiocb	The label or indexed location of the Channel Attach port I/O control block defined for this port.
buffer	The label of a 3-word area containing: • First word – the address of the buffer containing the data to be sent. • Second word – the number of bytes to be sent. • Third word – the partition number of the buffer. If this word is zero, the system assumes the buffer is in the partition in which you loaded your program.
ERROR=	The label of the instruction to be executed if an error occurs. If you do not code this operand, control passes to the next instruction after the CAWRITE, and your program must test for errors before issuing a WAIT.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Syntax Examples

1) Write data to a port defined by the CAIOCB at label USERIOCB. BUFA is the label of the 3-word area that contains the address of the buffer from which the data is to be sent.

```
WRITE10   CAWRITE   USERIOCB,BUFA
```

2) Write data to a port defined by the CAIOCB at a location specified in #1. The address of the buffer containing the data to be sent is specified in a 3-word area located at an address in #2.

```
WRITEFC   CAWRITE   #1,#2,ERROR=ERROR1
```

Return and Post Codes

Return codes are returned in the first word of the task control block of the program or task issuing the instruction. A return code other than −1 indicates that the link module found an error before the instruction performed an I/O operation. Your program must check the return code before it issues a WAIT because a WAIT should only be used if an I/O operation is being performed.

CAWRITE post codes are returned to the first word of the CAIOCB you defined for the instruction. For detailed explanations of the return and post codes, refer to *Messages and Codes.*

Post Code	Hex	Return Code	Explanation
−1	FFFF	−1	Successful.
501	01F5		EXIO error; device not attached.
502	01F6		EXIO error; busy.
503	01F7		EXIO error; busy after reset.
504	01F8		EXIO error; command reject.
505	01F9		EXIO error; intervention required.
506	01FA		EXIO error; interface data check.
507	01FB		EXIO error; controller busy.
508	01FC		EXIO error; channel command not allowed.
509	01FD		EXIO error; no DDB found.
510	01FE		EXIO error; too many DCBs chained.
511	01FF		EXIO error; no residual status address.
512	0200		EXIO error; zero bytes specified for residual status.
513	0201		EXIO error; broken DCB chain.
516	0204		EXIO error; device already opened.
520	0208		Interrupt error.
521	0209		Negative acknowledgement (write only).
522	020A		Buffer overlay (read only).
523	020B		Protocol error.
524	020C		Timeout.
	022E	558	Buffer not provided.
	022F	559	Buffer count = 0.
	0232	562	Write buffer not provided.
	0233	563	Write buffer count = 0.
	0234	564	Users CAIOCB not linked to port.
567	0237	567	System error; CAPGM terminating.
	0238	568	Port not opened.

Note: Channel Attach codes 501 − 513 are the same as the EXIO post codes 1 − 13, respectively.

COMP – Define Location of Message Text

The COMP statement points to a data set or module that contains formatted program messages. The MESSAGE, READTEXT, GETVALUE, and QUESTION instructions refer to the label of the COMP statement when retrieving program messages.

The COMP statement also assigns a 4-character prefix to the messages your program obtains. This prefix, the number of the message being retrieved, and the message text are the components that make up a complete program message.

You must code at least one COMP statement in a program that retrieves program messages. The message utility, $MSGUT1, formats the messages you write for your programs. Refer to the *Operator Commands and Utilities Reference* for a description of this utility. See Appendix E, "Creating, Storing, and Retrieving Program Messages" on page E-1 for more information.

Syntax:

label	**COMP 'idxx',name,TYPE=**
Required:	**label,'idxx',name**
Defaults:	**TYPE=STG**
Indexable:	**none**

Operand	*Description*
label	The label you specified for the COMP= keyword on a MESSAGE, READTEXT, GETVALUE, or QUESTION instruction.
'idxx'	A 4-character prefix that identifies the messages your program obtains through this COMP statement. The system displays this prefix with the message text when you code MSGID=YES on a MESSAGE, READTEXT, GETVALUE or QUESTION instruction.
name	The name of the module or data set that contains the formatted messages. For a module, this is the name you assigned to the module with the STG option of the message utility, $MSGUT1. This name can be up to 8 characters long. **Note:** You must link-edit the message module with your program. For a disk or diskette data set, specify the name in the form DSx, where "x" indicates the position of the message data set in the list of data sets you defined on the PROGRAM statement. DS1, for example, refers to the first data set in the list. DS2 refers to the second data set in the list, and so on. The valid range for "x" is 1–9. If your program contains a DSCB instruction, you can use the label you coded on the DS#= operand for this operand.
TYPE=	STG (the default), if the messages reside in a module that you link-edit with your program. DSK, if the messages reside in a disk or diskette data set.

Syntax Examples

1) The COMP statement in this example points to the message module PROMPTS. The MESSAGE instruction, which retrieves the first message in PROMPTS, refers to the label of the COMP statement. Because the MESSAGE instruction contains MSGID = YES, the system displays the prefix PROM and the number of the message before the message text.

```
         MESSAGE   1,COMP=A,SKIP=1,MSGID=YES
          •
          •
          •
         PROGSTOP
A        COMP      'PROM',PROMPTS,TYPE=STG
```

2) The COMP statement in this example points to the message data set MESSAGE1 on volume EDX002. The GETVALUE instruction, which retrieves the fifth message from MESSAGE1, refers to label of the COMP statement.

```
MESSAGE  PROGRAM   START,DS=(MESSAGE1,EDX002)
          •
          •
          •
         GETVALUE  INPUT,5,SKIP=1,COMP=B
         PROGSTOP
B        COMP      'MSG1',DS1,TYPE=DSK
```

CONCAT – Concatenate Two Character Strings

The CONCAT instruction concatenates two character strings, or a character string and a graphic-control character. The instruction places the contents of string2 to the right of any contents in string1. The resulting character string remains in string1.

CONCAT changes the character count of string1 after the operation to reflect the original contents of string1 plus the concatenated data from string2. Truncation on the right occurs if the combined counts exceed the physical length of string1.

Note: To use the CONCAT statement, you must specify an AUTOCALL to $AUTO,ASMLIB during program preparation (link-edit.)

Syntax:

label	**CONCAT string1,string2,RESET,REPEAT=,P1=,P2=**
Required:	**string1,string2**
Defaults:	**REPEAT=1**
Indexable:	**none**

Operand	*Description*
string1	The label of a data string to which the contents of string2 are concatenated.
string2	The data to be concatenated to string1. You can code the label of a character string, a 1-character constant (left-justified, for example C'A' or X'07'), or a symbol representing one of the following ASCII graphic-control characters: GS, BEL, ESC, ETB, ENQ, FF, CR, LF, SUB, or US.
RESET	Resets the character count of string1 to zero before starting the CONCAT operation. The count is not reset if you omit this operand.
REPEAT=	The number of times string2 is to be concatenated to string1. For example, if string2 contains C' ' and you code REPEAT=5, five blanks are concatenated to the contents of string1. Code a positive integer for this operand.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Syntax Examples

1) Concatenate ESC to TEXT1. Reset the character count of TEXT1 before the operation.

```
CONCAT   TEXT1,ESC,RESET
```

2) Concatenate the control character FF to TEXT1.

```
CONCAT   TEXT1,FF
```

CONTROL – Perform Tape Operations

The CONTROL instruction allows you to execute tape functions. You can space forward or backward a specified number of records or files (a file is the data between the beginning tapemark and the ending tapemark). You can also write tapemarks, rewind the tape, erase the tape, set the tape drive offline, or rewind the tape and set the tape drive offline. With the 4968 tape unit, the CONTROL instruction allows you to write at a density of 1600 bits per inch or 3200 bits per inch.

In addition, you can use the CONTROL instruction to close tape data sets. You should close all tape data sets. If you do not close data sets, you must control the tape drive directly with the various CONTROL functions.

When you close an SL (standard-label) output tape, the CONTROL instruction writes the following trailer label: TM EOF1 TM TM. The instruction writes the following label when you close an NL (nonlabeled) tape: TM TM.

Input tapes are automatically rewound as the result of a close operation. An attempt to write a tapemark to an unexpired file is an error condition.

If you have two tape drives on one controller and they receive concurrent rewind requests, one tape drive waits for the other to complete. To allow concurrent rewinds to multiple standard label tape drives on one controller, you must issue the "CONTROL DSxx,REW" instruction to each open tape drive.

Syntax:

label	**CONTROL DSx,type,count,END=,ERROR=,WAIT=,P1=,P3=**
Required:	**DSx,type**
Defaults:	**count=1,WAIT=YES**
Indexable:	**count**

Operand	*Description*
DSx	The data set you want to use. Code DSx, where "x" is the relative number of the data set in the list of data sets you defined on the PROGRAM statement. DS1, for example, points to the first data set in the list; DS2 points to the second data set, and so on. You can substitute a DSCB name defined by a DSCB statement for this operand.
type	The CONTROL function to be performed. The following functions are available: **FSF** Forward space file (tapemark). Regardless of where the tape is currently positioned, the tape searches forward the number of tape marks indicated in the count operand. If the specified number of tapemarks indicated by the count field is not on the tape, the positioning of the tape is unpredictable.

BSF Backward space file (tapemark). The tape searches backward until the next tapemark is read. The default value for count is 1. If the tape is at load point when your program issues this command, the load point return code is returned.

FSR Forward space record. The tape will space forward past the number of records specified in the count field. The default value for count is 1.

BSR Backward space record. The tape spaces backward past the number of records specified in the count field. The default value for count is 1. If the tape is at load point when your program issues this command, the load point return code is returned.

WTM Write tapemark. This function writes a tapemark on the tape. If the count field is coded, successive tapemarks are written according to the count value.

REW Rewind tape to load point (beginning of tape).

ROFF Rewind tape and set the tape drive to offline.

OFF Set tape drive to offline.

CLSRU Close tape data set and allow it to be reused (reopened by another task without an intervening $VARYON command). For standard-label tapes, the tape is repositioned to the HDR1 label of the data set. For nonlabeled tapes, the tape is positioned to the beginning of the first data record. You can use $VARYON to change the file number being processed or you can use a CONTROL function.

Once you close a tape data set, you must call DSOPEN to open the data set before you can use it again. You can call DSOPEN with the CALL instruction or call the subroutine implicitly by having the name of the data set in another program header.

CLSOFF Close tape data set, rewind tape, and set the tape drive to offline.

DEN16 Sets the density of the 4968 tape unit to 1600 bits per inch. This function is not valid for other tape devices.

To set the density, the tape must be at the load point.

DEN32 Sets the density of the 4968 tape unit to 3200 bits per inch. This function is not valid for other tape devices.

To set the density, the tape must be at the load point.

ERASE Erases forward from the point where the tape is positioned to a point five feet beyond the end-of-tape marker (EOT). The function then rewinds the tape and unloads it.

The system sends out a device interrupt when the tape is at the load point and ready.

count The number of files or records to be skipped or the number of tapemarks to be written. You can code a constant or the label of a count value. The default is count = 1.

END = The label of the first instruction of the routine to be called if the system detects an "end-of-data-set" (EOD) condition (return code = 10). If you do not specify this operand, the system treats an EOD as an error. Do not code this operand if you code WAIT = NO.

If END is not coded, a tapemark being encountered is also treated as an error. The physical position of the tape, under this condition, is the read/write head position immediately following the tapemark. See the CONTROL close functions for the repositioning of the data set. Remember also that the count field might not be decremented to zero.

ERROR = The label of the first instruction of the routine to be called if an error condition occurs during this operation. If you do not specify this operand, control passes to the next sequential instruction in your program and you must test the return code in the first word of the task control block for errors. Do not code this operand if you code WAIT = NO.

WAIT = If WAIT is not coded, or if it is coded as WAIT = YES, the current task will be suspended until the operation is complete. If the function selected is CLSRU or CLSOFF, then WAIT = YES is the only valid option for this operand, and any other option will be ignored.

For functions other than close, if the operand is coded as WAIT = NO, control is returned after the operation is initiated and a subsequent WAIT DSx must be issued in order to determine when the operation is complete.

END and ERROR cannot be coded if WAIT = NO is coded. You must subsequently test the return code in the Event Control Block (ECB) named DSx or in the first word of the task control block (TCB) (referred to by "taskname"). Two codes are of special significance. A −1 indicates a successful end of operation. A +10 indicates an "End of Data Set" and may be of logical significance to the program rather than being an error. For programming purposes, any other return codes should be treated as errors.

Px = Parameter naming operands. See "Using the Parameter Naming Operands (Px =)" on page 1-10 for a detailed description of how to code these operands.

Syntax Examples

1) The instruction closes the tape data set specified by DS1, rewinds the tape, and sets the tape drive offline.

```
CONTROL   DS1,CLSOFF
```

2) The instruction causes the tape data set specified by DS2 to be spaced forward 16 data records.

```
CONTROL  DS2,FSR,16
```

Coding Example

The following program uses the CONTROL FSF command, at label C1, to advance the "master name file" to the third data set on a nonlabeled tape. The program asks the operator if he or she wants to search the file for a particular name. If the answer is yes, the program requests the file name.

At label C2, a CONTROL FSR command advances the tape file to record 90. If the end-of-file is reached before the tape is positioned to the target record, control passes to an error routine (not shown).

The program then reads a record and compares the name field in it to the name the operator entered. This sequence continues until the program finds the name the operator entered or until the end-of-file is reached.

Assuming the program finds the name, it prints the name (and accompanying file information) and the record for the names before and after it.

If the name is the first on the file (INDEX = 1), the program can only print the name and the record that immediately follows it. Therefore, the CONTROL BSR command, at label C3, uses the P3= parameter naming operand to determine dynamically how many records to back space. The count is 1, if the name is in the first data record on the file, or 2, if the name is not in the first data record on the file.

A DO loop at label LOOP2 reads the name records and prints them. If the end-of-file is reached before the last record can be printed, the program passes control to an error routine (not shown).

At label C4, the tape is backspaced past the tapemark preceding the name file and at label C5, the tape is positioned to the first record on the file. Control then passes to the beginning of the program.

```
FILESRCH  PROGRAM   START,DS=(NAMEFILE,TAPE01)
START     EQU       *
C1        CONTROL   DS1,FSF,3,ERROR=DS1ERROR
INQUIRE   EQU       *
          QUESTION  '@DO YOU WISH TO SEARCH THE MASTER NAME FILE ?',NO=END
          PRINTEXT  '@PRECEEDING AND SUCCEEDING NAMES WILL ALSO BE LISTED'
          READTEXT  NAME,'@ENTER SUBJECT NAME UP TO 12 CHARACTERS'
C2        CONTROL   DS1,FSR,90,END=DS1ENDF1,ERROR=DS1ERROR
          MOVE      INDEX,0
LOOP      EQU       *
          ADD       INDEX,1
          READ      DS1,BUFR,END=DS1ENDF2
          IF        (BUFR,NE,NAME,(12,BYTES))
          GOTO      LOOP
          ENDIF
          IF        (INDEX,LE,1)
            PRINTEXT '@NAME AT BEGINNING OF FILE - ONLY 2 LISTED'
            MOVE  COUNT,2
          ELSE
            MOVE  COUNT,3
            MOVE  INDEX,2
          ENDIF
C3        CONTROL   DS1,BSR,2,P3=INDEX
          DO        1,TIMES,P1=COUNT
          READ      DS1,BUFR,END=LASTONE
          MOVE      BUFR,TEXT,(50,BYTES)
          PRINTEXT  TEXT,SKIP=1
          ENDDO
C4        CONTROL   DS1,BSF
C5        CONTROL   DS1,FSF
          GOTO      INQUIRE
************************************
          DATA      X'3232'
TEXT      DATA      50C' '
NAME      TEXT      LENGTH=12
DS1ERROR  EQU       *
           •
           •
           •
DS1ENDF1  EQU       *
           •
           •
           •
DS1ENDF2  EQU       *
           •
           •
           •
LASTONE   EQU       *
           •
           •
           •
```

Tape Return Codes and Post Codes

Tape return codes are returned in the first word of the task control block of the program that issues the instruction.

Return Code	Condition
−1	Successful completion.
1	Exception but no status.
2	Error reading cycle steal status.
3	I/O error; retry count exhausted.
4	Error issuing READ CYCLE STEAL STATUS.
6	I/O error issuing I/O operations.
10	End of data; a tape mark was read.
21	Wrong length record.
22	Device not ready.
23	File protected.
24	End of tape.
25	Load point.
26	Unrecoverable I/O error.
27	SL data set not expired.
28	Invalid blocksize.
29	Offline, in use, or not open.
30	Incorrect device type.
31	Close incorrect address.
32	Block count error during close.
33	Close detected on EOV1.
34	Write − Defective reel of tape.

The following post codes are returned to the event control block (ECB) of the calling program.

Post Code	Condition
−1	Function successful.
101	TAPEID not found.
102	Device not offline.
103	Unexpired data set on tape.
104	Cannot initialize BLP tapes.

CONVTB – Convert Numeric String to EBCDIC

The CONVTB instruction converts both integer and floating-point values to an EBCDIC character string. You can also convert floating-point values to E notation.

Syntax:

label	**CONVTB opnd1,opnd2,PREC=,FORMAT=,P1=,P2=**
Required:	**opnd1,opnd2**
Defaults:	**PREC=S,FORMAT=(6,0,I)**
Indexable:	**opnd1,opnd2**

Operand	*Description*
opnd1	The label of a storage area where the converted results are to be placed. The system stores the results beginning at the label referred to by this operand. The converted results are in EBCDIC. Opnd1 must be a different storage location than opnd2.
opnd2	The label of a storage area containing the value to be converted to EBCDIC. You must know the form (precision) of the data. The following opnd2 types are supported: Single-precision integer – 1 word Double-precision integer – 2 words Single-precision floating-point – 2 words Extended-precision floating-point – 4 words
PREC=	The form of opnd2. The valid precisions are: S – Single-precision integer D – Double-precision integer F – Single-precision floating-point L – Extended-precision floating-point
FORMAT=	The format (w,d,t) of the value after the system converts it: **w** Width of the EBCDIC field in bytes. If the field will contain a decimal point or sign character (+ or –), include it in the count. **d** Number of digits to the right of the decimal point. This is valid for floating-point variables only. Code a 0 for integer values. **t** Type of EBCDIC Data. Code I for integer data, F for floating-point data (XXXX.XXX), or E for a number in exponent (E) notation. See the value operand under the DATA/DC statement for a description of E notation format.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Notes:

1. Conversion routines assume that the type of variable to be converted is specified by the PREC operand. If the PREC operand is not specified, and if the variable is not of the default precision, incorrect results can occur.
2. Exponent (E) notation should be used for floating-point numbers greater than 10^{12}. Otherwise, a conversion error will occur.

Syntax Examples

1) The CONVTB instruction in the following example uses an integer value.

```
          CONVTB   TEXTA,VALUE,PREC=S,FORMAT=(8,0,I)
            •
            •
            •
VALUE     DATA     F'12345'
TEXTA     TEXT     LENGTH=8
```

The value 12345 in the variable VALUE is converted to EBCDIC at TEXTA in the following format (b represents a blank):

bbb12345

If conversion of double-precision integers is required, PREC = D is coded.

2) In this example, the CONVTB instruction uses floating-point values.

```
          CONVTB   TEXTB,VALUE,PREC=F,FORMAT=(15,4,F)
          CONVTB   TEXT1,VALUE1,PREC=L,FORMAT=(20,14,E)
            •
            •
            •
VALUE     DATA     E'62421.16'
VALUE1    DATA     L'4926139.2916'
TEXTB     TEXT     LENGTH=15
TEXT1     TEXT     LENGTH=20
```

The result of the CONVTB operation (where b represents a blank) is:

TEXTB = bbbbb62421.1600

TEXT1 = b.49261392916000Eb07

Coding Example

This example demonstrates one use of the CONVTB instruction.

```
HEADER   EQU      *
         READTEXT TITLE,TITLEMSG
         PRINTEXT SKIP=4
*
CONVERT  EQU      *
         CONVTB   ENUMEXP,BNUMEXP
         PRINTEXT '@NUMBER OF EXPERIMENTS CONDUCTED :',SKIP=1
         PRINTEXT ENUMEXP
*
         CONVTB   EMANHRS,BMANHRS,PREC=F,FORMAT=(10,2,F)
         PRINTEXT '@TOTAL MANHOURS EXPENDED ON PROJECT :', SKIP=1
         PRINTEXT EMANHRS
*
         CONVTB   EAVERAGE,BAVERAGE,PREC=L,FORMAT=(20,14,E)
         PRINTEXT '@AVERAGE PENETRATION IN CONCRETE (MILLIMETERS):'
*
         PRINTEXT EAVERAGE
            •
            •
            •
BNUMEXP  DATA     F'0'       BINARY VALUE - # EXPERIMENTS
ENUMEXP  TEXT     LENGTH=6   EBCDIC VALUE - # EXPERIMENTS
BMANHRS  DATA     L'0'       BINARY VALUE - MAN-HOURS USED
EMANHRS  TEXT     LENGTH=8   EBCDIC VALUE - MAN-HOURS USED
BAVERAGE DATA     L'0'       BINARY VALUE - AVERAGE RESULT
EAVERAGE TEXT     LENGTH=20  EBCDIC VALUE - AVERAGE RESULT
TITLE    TEXT     LENGTH=40
TITLEMSG TEXT     'ENTER A 40 CHARACTER TITLE FOR YOUR REPORTS'
```

If, for example, the initial value of BNUMEXP is X'0038', the value of BMANHRS is X'431B0C00', and the value of BAVERAGE is X'4087915E8CA84482', the results of the program would appear as follows:

```
NUMBER OF EXPERIMENTS CONDUCTED : 56

TOTAL MAN-HOURS EXPENDED ON PROJECT : 432.75

AVERAGE PENETRATION IN CONCRETE (MILLIMETERS) : .52956191000000E+00
```

Return Codes

The return codes are returned in the first word of the task control block (TCB) of the program or task issuing the instruction. The label of the TCB is the label of your program or task (taskname).

Return Code	Description
−1	Successful completion.
3	Conversion error.

CONVTD – Convert EBCDIC String to Numeric String

The CONVTD instruction converts an EBCDIC character string to an integer or floating-point numeric string.

Syntax:

label	**CONVTD opnd1,opnd2,PREC=,FORMAT=,P1=,P2=**
Required:	**opnd1,opnd2**
Defaults:	**PREC=S,FORMAT=(6,0,I)**
Indexable:	**opnd1,opnd2**

Operand	*Description*
opnd1	The label of a storage area where the converted results are to be placed. Opnd1 must be a different storage location than opnd2. Make sure that you reserve enough space to accommodate the results.

Single-precision integer	– 1 Word
Double-precision integer	– 2 Words
Single-precision floating-point	– 2 Words
Extended-precision floating-point	– 4 Words

opnd2 A label that points to the first character of the EBCDIC character string. You can code the following range of data values:

Single-precision integer:	–32768 to 32767
Double-precision integer:	–2147483648 to 2147483647
Single-precision floating-point:	6 decimal digits*
Extended-precision floating-point:	15 decimal digits*

*Valid range is from 10^{-85} through 10^{75}

The EBCDIC field should contain only those characters that are valid for the operation being performed. For example:

- Integers –

  Leading blanks
  Sign character + or –
  Digits 0 through 9
  Trailing blanks

- Floating-point –

  Leading blanks
  Sign character + or –
  Digits 0 through 9
  Decimal point
  The character E, if E notation, followed by a sign character, + or –, or the digits 0 through 9.

If the system finds any other character during the conversion, it takes the following action:

- If the delimiters , or / are found within a string:

  The system stops the conversion and returns a "successful completion" code (–1). Opnd1 contains the data the system converted before it found the delimiter.

- If the delimiter , or / or * or . is the first character found in a string:

  The system returns a "field omitted" code (2). The variable you defined in opnd1 (the target field) remains unchanged.

- If all blanks are found in opnd2:

  The system places zeros in opnd1 and returns a "successful completion" code (–1).

- If any other character (for example, an alphabetic character) is found within a string:

  The system returns a code of 1, "invalid data encountered during conversion." Data converted before the system found the invalid character is stored in opnd1.

- If only an invalid character is found in opnd2 or the value being converted is too large or too small:

  The system returns a "conversion error" (3). The contents of the variable you defined for opnd1 (the target field) are unknown.

The following table shows the results of several conversion operations using the default format (6,0,I):

Input	Return Code	Output
12	−1	12
12,	−1	12
12/	−1	12
(blanks)	−1	0
12C	1	12
12.B	1	12
12 C	1	12
,	2	Target field unchanged
/	2	Target field unchanged
*	2	Target field unchanged
	2	Target field unchanged)
A	3	Target field unchanged
1234567	3	Value of target field unknown

PREC= The form of opnd1. The valid precisions are:

- **S** Single-precision integer
- **D** Double-precision integer
- **F** Single-precision floating-point
- **L** Extended-precision floating-point.

FORMAT= The format (w,d,t) of the value to be converted:

- **w** Width of the EBCDIC field in bytes. If the field will contain a decimal point or sign character (+ or −), include it in the count.
- **d** Number of digits to the right of the decimal point. This option is valid only for floating-point variables. Code a 0 for integer values.
- **t** Type of EBCDIC Data. Code I for integer data, F for floating-point data (XXXX.XXX), or E for a number in exponent (E) notation. See the value operand under the DATA/DC statement for a description of E notation format.

Px= Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Syntax Examples

1) The following CONVTD instruction uses an integer value.

```
         CONVTD   VALUE,TEXT,PREC=S,FORMAT=(8,0,I)
           •
           •
           •
VALUE    DATA     F'0'
TEXT     TEXT     '12345',LENGTH=8
```

Note: The value in EBCDIC, 12345, will be converted to a single-precision binary value and stored at VALUE as X'3039'. Double-precision integers can also be converted by using the PREC=D parameter and using a 2-word variable at VALUE.

2) The CONVTD instruction in this example uses floating-point values.

```
         CONVTD   VALUE,TEXT1,PREC=F,FORMAT=(5,1,F)
         CONVTD   VALUE1,TEXT2,PREC=L,FORMAT=(15,0,E)
           •
           •
           •
VALUE    DATA     2F'0'
VALUE1   DATA     4F'0'
TEXT1    TEXT     '100.5',LENGTH=10
TEXT2    TEXT     '0.1005E3',LENGTH=15
```

Note: Both values shown in the TEXT statements result in the same binary data values being stored in the two DATA statements. The only difference is that at VALUE1, an extended-precision value is stored.

Coding Example

The following example demonstrates one use of the CONVTD instruction:

```
CONVERT  EQU      *
         READTEXT UNIT,'@ENTER UNIT NUMBER'
         CONVTD   BUNIT,UNIT,PREC=S,FORMAT=(6,0,I)
*
         READTEXT MILES,'@ENTER MILES FROM FIRE '
         CONVTD   BMILES,MILES,PREC=F,FORMAT=(10,4,F)
*
         READTEXT RESPONSE,'@ENTER UNIT RESPONSE TIME '
         CONVTD   BRESPONS,RESPONSE,PREC=L,FORMAT=(15,8,E)
           •
           •
           •
UNIT     TEXT     LENGTH=6          EBCDIC VALUE/UNIT ID
BUNIT    DATA     F'0'              BINARY VALUE/UNIT ID
MILES    TEXT     LENGTH=10         EBCDIC VALUE/MILES FROM FIRE
BMILES   DATA     D'0'              BINARY VALUE/MILES FROM FIRE
RESPONSE TEXT     LENGTH=15         EBCDIC VALUE/RESPONSE TIME
BRESPONS DATA     2D'0'             BINARY VALUE/RESPONSE TIME
```

Assuming that unit #6553 took 42.45292378 minutes to respond to an alarm for a fire 41.5429 miles from the station, the results of the CONVTD operations would be:

opnd1	Before	After
BUNIT	X'0000'	X'1999'
BMILES	X'00000000'	X'42298AFB'
BRESPONS	X'0000000000000000'	X'422A73F2D016AE42'

opnd2	Before	After
UNIT	6553bb	X'F6F5F5F34040'
MILES	41.5429bbb	X'F4F14BF5F4F2F9404040'
RESPONSE	42.45292378bbbb	X'F4F24BF4F5F2F9F2F3F7F840404040'

Return Codes

The return codes are returned in the first word of the task control block (TCB) of the program or task issuing the instruction. The label of the TCB is the label of your program or task (taskname).

Return Code	Description
−1	Successful completion.
1	Invalid data encountered during conversion.
2	Field omitted.
3	Conversion error.

COPY – Copy Source Code into Your Source Program

The COPY statement copies source code into your source program. The operation occurs each time you compile or assemble the program containing the COPY statement.

The source code you copy must be in a disk or diskette data set. The source code must not contain a COPY statement. The system copies the source code into your source program immediately following the COPY statement.

To prevent the system from printing the source code in your listing each time you compile your program, code PRINT OFF before the COPY statement and PRINT ON following it. See the program example given in "PRINT – Control Printing of a Compiler Listing" on page 2-304 for more detail.

Syntax:

blank	**COPY**	**name**
Required:	**name**	
Defaults:	**none**	
Indexable:	**none**	

Operand	*Description*
name	The name of the data set on disk or diskette that contains the source code to be copied into your source program.

Notes:

1. When using the $EDXASM compiler, if the source code to be copied is not on volume ASMLIB, you must code a *COPYCOD statement in the $EDXL data set to indicate on what volume the source code resides. $EDXL is on volume ASMLIB. Refer to the *Customization Guide* for an explanation of the *COPYCOD statement.
2. For details on using the COPY statement with the Series/1 macro assembler, refer to IBM Series/1 Event Driven Executive Macro Assembler (5719-ASA).
3. For details on using the COPY statement with the System/370 macro assembler, refer to the *IBM System/370 Program Preparation Facility*, SB30-1072.

System Equates

This section contains the equate names for some commonly used system control blocks. Coding the COPY statement with the equate name gives you a listing of the control block. You can use the equates in the control block listing to refer to and obtain data from fields within the control block. When you compile programs with the host or Series/1 macro assemblers, the system includes the following equate names in your program when it encounters a PROGRAM statement: PROGEQU, TCBEQU, DDBEQU, CMDEQU, and DSCBEQU.

The *Internal Design* contains a complete list of the control blocks in the system. The control block equates reside on volume ASMLIB and end with the characters EQU.

BSCEQU Provides a map of the control block built by the BSCLINE system definition statement.

Note: BSCEQU is also the name of a macro in the macro libraries that the host and Series/1 macro assemblers use. Do not attempt to copy BSCEQU when using either of the macro assemblers.

CCBEQU Provides a map of the control block (CCB) built by the TERMINAL system definition statement.

CMDEQU Provides a map of the supervisor's emulator command table built by the PROGRAM statement.

DDBEQU Provides a map of the device data block (DDB) built by the DISK system definition statement.

DDODEFEQ
Provides a table that defines the format of disk directory control entries (DCEs) and member entries.

DSCBEQU Provides a map of the data set control block (DSCB) built by the PROGRAM or DSCB statements.

ERRORDEF
Provides equates for use in checking the return codes from the LOAD, READ, WRITE, and SBIO instructions.

FCBEQU Provides a map of an Indexed Access Method file control block (FCB) for use with the EXTRACT subroutine.

IAMEQU Provides a set of symbolic parameter values for use in constructing parameter lists for calls to Indexed Access Method subroutines.

PROGEQU Provides maps of the program header, built by the PROGRAM statement, and the supervisor's communication vector table (CVT).

TCBEQU Provides a map of the task control block (TCB) built by the TASK or PROGRAM statements.

STOREQU Provides a map of the storage control block built by the STORBLK statement.

Coding Example

The following example uses a COPY statement to copy the source code labeled CHKBUFR into a source program.

```
          •
          •
          •
          CALL      CHKBUFR,BUFRSIZE,(EOBUFFER)
            •
            •
            •
          COPY      CHKBUFR
            •
            •
            •
```

When the source program is compiled, the COPY statement copies the following code into the source program:

```
          SUBROUT   CHKBUFR,BUFFLEN,BUFFEND
          SUBTRACT  BUFFLEN,1
          IF        (BUFFLEN,GE,MAX)
          GOTO      (BUFFEND)
          ENDIF
          ADD       BUFFLEN,1
          RETURN
            •
            •
            •
MAX       DATA      F'256'
            •
            •
            •
```

CSECT – Identify Object Module Segments

The CSECT instruction names a program module to identify its location within the program output from $EDXLINK.

The CSECT instruction is optional and if it is omitted, the program module has a blank name.

Program modules assembled by $EDXASM can have multiple CSECT instructions. However, all CSECTs, after the first one, generate ENTRY instead of CSECT definitions.

Program modules assembled by the Series/1 Macro Assembler or host assembler are also permitted to have multiple CSECT instructions in a single assembly. These assemblers will generate a separate program module for each uniquely-named CSECT.

Syntax:

label	**CSECT**
Required:	**label**
Defaults:	**none**
Indexable:	**none**

Operand	*Description*
label	The label must be the name of the program module for the first CSECT. For following CSECTs the label must be an entry name.

Coding Example

In module A, the first CSECT statement signifies that the program can be entered at label GETTIME. In module B, the CSECT statement defines label GOTTIME as being an entry point. The ENTRY statement in module A will allow the time to be printed without the 'THE TIME IS NOW' text.

MODULE A

```
            •
            •
            •
GETTIME     CSECT
            ENTRY     GETTIME2
            EXTRN     GOTTIME
              •
              •
              •
GETTIME     EQU       *
            PRINTEXT  '@THE TIME IS NOW'
GETTIME2    EQU       *
            PRINTIME
            GOTO      GOTTIME
              •
              •
              •
```

MODULE B

```
              •
              •
              •
GOTTIME     CSECT
            EXTRN     GETTIME
              •
              •
              •
TIME        EQU       *
            GOTO      GETTIME
GOTTIME     EQU       *
              •
              •
              •
```

DATA/DC – Define Data

The DATA/DC statement defines the data you are using in your program. You can represent data in the following forms: binary, integer, hexadecimal, character, floating-point, or address.

Within a single DATA statement, you can define one or more character strings or variables. With programs you compile under $EDXASM, you can code up to 10 separate data specifications on a single DATA statement by separating the individual specifications with commas. However, a DATA statement can contain only 8 hexadecimal digits (4 bytes). When you assemble programs under $S1ASM, a DATA statement can contain only one data specification.

Syntax:

label	**DATA**	**dup type value**
label	**DC**	**dup type value**
Required:	**type, value**	
Defaults:	**dup = 1**	
Indexable:	**none**	

Operand	*Description*
dup	Duplication factor for the data type you define.
type	Data type or form of data representation. The valid data types are:

Code	Data Type	Storage Format
C	EBCDIC	8-bit code for each character
X	Hexadecimal	4-bit code for each digit
B	Binary	1 bit for each digit (not allowed with $EDXASM)
F	Integer, signed fullword	2 bytes
H	Integer, signed halfword	1 byte
D	Integer, signed doubleword	4 bytes
E	Floating-point	Floating-point binary; 4 bytes
L	Floating-point	Floating-point binary; 8 bytes
A	Address	Value of address or expression; 2 bytes

Note: A halfword definition may cause data to fall on an odd-byte boundary. Fullword data must, however, be on an even-byte boundary to be accessed as a byte or as bytes. For this reason, use the ALIGN statement when coding data areas. See "ALIGN – Instruction or Data to a Specified Boundary" on page 2-13 or "Instruction and Operand Address Boundaries" on page 1-13 for additional information.

value The value to be assigned to the data area. This operand is also the field length for some data types. The value is enclosed in quotes for all data types except A, in which the value is enclosed in parentheses.

Notes:

1. Except for A-type data (address), the value must be a self-defining term and cannot be defined with an EQU statement.
2. The maximum number of hexadecimal digits you can specify for this operand is 8; the maximum number of characters you can specify is 15.
3. For programs compiled under $EDXASM, the value operand can define a maximum of 65535 bytes.

Considerations when Defining Data

The allowable ranges for data values are:

Single-precision integer − 32768 to 32767
Double-precision integer − 2147483648 to 2147483647
Single-precision floating-point − 6 decimal digits (valid range is from 10^{-85} to 10^{75})
Extended-precision floating-point − 15 decimal digits (valid range is from 10^{-85} to 10^{75})

You can express floating-point values as real numbers with decimal points (for example 1.234) or in exponent (E) notation. E notation uses the form:

SX.XXESYY

where:

S = Optional sign character (+ or −); default is (+)
X = Characteristic of 1 to 6 numeric digits for PREC=E, or 15 digits for PREC=L
. = Decimal point anyplace within characteristic
E = Designation of E notation
YY = Mantissa, range −85 to +75; the base is 10 (for example, 3.1415E-2 = .031415)

When coding character strings (C), you can specify a field length by coding the type as CLn, where "n" is the length of the field in bytes. If the length of the character string you specify is less than the field length chosen, the balance of the field to the right of the string is filled with blanks. To specify the field length for hexadecimal values (X), code the type as XLn. If the length of the hexadecimal value you specify is less than the field length chosen, the balance of the field to the left of the value is filled with zeros.

Neither $EDXASM nor $S1ASM supports such complex data expressions as:

```
DATA  A(B-C)
```

where B is an external label.

Syntax Examples

The following examples show some of the ways that you can define data in your program.

1) Hexadecimal 30F in binary. This format is not allowed with $EDXASM.

```
BINCON   DATA   B'001100001111'
```

2) An integer constant of 1.

```
A        DATA   F'1'
```

3) 128 words of 0.

```
BUF      DC     128F'0'
```

4) The EBCDIC string 'XYZ'.

```
CHAR     DATA   C'XYZ'
```

5) 80 EBCDIC blanks.

```
BLANK    DC     80C' '
```

6) The character '$' followed by seven blanks.

```
C8       DC     CL8'$'
```

7) The integer 241 in hexadecimal.

```
HEXV     DATA   X'00F1'
```

8) The address of 'BUF'.

```
ADDR     DATA   A(BUF)
```

9) The 2-word integer constant 100000.

```
DBL      DATA   D'100000'
```

10) The floating-point value 1.234.

```
F1       DATA   E'1.234'
```

11) Four floating-point values of 0.123 (4 bytes for each value).

```
F2       DATA   4E'0.123'
```

12) Four extended-precision floating-point values of 12345678.9 (8 bytes for each value).

```
L2       DATA   4L'12345678.9'
```

13) An extended-precision floating-point value in exponent (E) form.

```
L3       DATA   L'123456E-40'
```

14) A word with a value of 1 and a doubleword with a value of 2.

```
MANY     DATA   F'1',D'2'
```

15) The hexadecimal string X'0001'.

```
X       DC      XL2'1'
```

16) The hexadecimal string X'000123'.

```
Y       DC      XL3'123'
```

DCB – Create a Device Control Block

The DCB statement creates a standard device control block (DCB) for use with EXIO. For additional information on DCBs refer to the description manual for the processor in use.

Syntax:

```
label    DCB    PCI=,IOTYPE=,XD=,SE=,DEVMOD=,DVPARM1=,
                DVPARM2=,DVPARM3=,DVPARM4=,CHAINAD=,
                COUNT=,DATADDR=

Required:  label
Defaults:  PCI=NO,IOTYPE=OUTPUT,XD=NO,SE=NO
Indexable: none
```

Operand	*Description*
PCI=	YES, to cause the device to present a program-controlled interrupt at the completion of the DCB fetch before data transfer. NO (the default), does not cause the device to present a program-controlled interrupt.
IOTYPE=	INPUT, for operations involving transfer of data from device to processor or for bidirectional transfers under one DCB operation. OUTPUT (the default), for operations involving transfer of data from processor to device or for control operations involving no data transfer.
XD=	YES, if the DCB is a nonstandard type. NO (the default), if the DCB is a standard type.
SE=	YES, to allow the device to suppress the reporting of certain exception conditions. NO (the default), to report all exception conditions.
DEVMOD=	The byte that describes functions unique to a particular device. This byte is in word 0 of the device's DCB. Code two hexadecimal digits.
DVPARM1=	The value of device-dependent parameter word 1. Code as four hexadecimal digits or the label of an EQU preceded by a plus sign (+).
DVPARM2=	The value of device-dependent parameter word 2. Code as four hexadecimal digits or the label of an EQU preceded by a plus sign (+).
DVPARM3=	The value of device-dependent parameter word 3. Code as four hexadecimal digits or the label of an EQU preceded by a plus sign (+).

DVPARM4=
The value of device-dependent parameter word 4. Code as four hexadecimal digits or, if SE=YES, the label of the first byte to which residual status data is to be transferred. The length of the residual status area is device dependent.

CHAINAD=
The label of the next DCB in the chain if chained DCBs are desired.

COUNT= The number of data bytes to be transferred. Code a decimal number from 0 to 32767 or the label of an EQU preceded by a plus sign (+).

DATADDR=
The label of the first byte of data to be transferred.

For information on the contents of DVPARM1 – DVPARM4 and DEVMOD, refer to the description manual of the device you are using.

Syntax Examples

1) The DCB labeled WR1DCB is for an output operation in which the 120-byte field labeled MSG1 will be transferred to the device. IOTYPE= defaults to OUTPUT. The device places any status information from the operation in RESTAT.

```
WR1DCB   DCB  SE=YES,DVPARM1=0300,DVPARM2=3048,DVPARM3=1100,          X
               DVPARM4=RESTAT,CHAINAD=WR2DCB,COUNT=120,               X
               DATADDR=MSG1
          •
          •
          •
MSG1     DATA  120X'00'
RESTAT   DATA  2F'0'
```

2) The DCB labeled WR2DCB is for a type of device-control operation. IOTYPE defaults to OUTPUT but no data transfer occurs because the statement does not contain the DATADDR or COUNT operands. The device places any status information from the operation in RESTAT.

```
WR2DCB   DCB   SE=YES,DVPARM1=20A0,DEVMOD=6F,DVPARM4=RESTAT
          •
          •
          •
RESTAT   DATA  2F'0'
```

Coding Example

For a coding example using a DCB statement, see the example following the description of the EXIO instruction.

DEFINEQ – Define a Queue

The DEFINEQ statement defines the queue descriptor (QD) and a set of queue entries (QEs) used by FIRSTQ, LASTQ, and NEXTQ. DEFINEQ can optionally define a pool of data storage areas or data buffers. For additional information refer to the discussion of queue processing in the *Language Programming Guide*.

Syntax:

label	**DEFINEQ COUNT=,SIZE=**
Required:	**label, COUNT=**
Defaults:	**SIZE=2 (2 bytes of data for each element in the free queue chain)**
Indexable:	**none**

Operand	*Description*
label	The label of the queue that this statement creates.
COUNT=	The number of 3-word queue entries (QEs) to be generated. The system also generates a 3-word queue descriptor (QD) and assigns the first word of the QD the label of the DEFINEQ statement. "Queue Layout" describes the structure of a queue. The COUNT operand must be specified using a self-defining term; an equated value is not allowed. This operand must also be a positive number greater than 0.
SIZE=	The size, in bytes, of each buffer (data area) to be included in the buffer pool in the initial queue. The system generates as many buffers as you specified in the COUNT operand. It initializes each buffer to binary zeros. Each QE in the queue contains the address of an associated buffer in the buffer pool. If you do not specify the SIZE operand, the system places all QEs in the free chain and the queue is defined as empty. If you specify SIZE, the system includes all QEs in the active chain and the queue is defined as full.

Queue Layout

A queue is composed of a queue descriptor (QD) and one or more queue entries (QEs). Figure 2-5 on page 2-95 shows the layout of a queue.

The DEFINEQ statement generates a 3-word QD. Word 1 of the QD is a pointer to the most recent entry in a chain of active QEs. Word 2 is a pointer to the oldest entry in a chain of active QEs. Word 3 is a pointer to the first QE in a chain of free QEs. If the queue is empty, words 1 and 2 contain the address of the queue (the address of the QD). If the queue is full, word 3 contains the address of the queue.

DEFINEQ also generates several 3-word QEs. Word 1 of the oldest QE in the active chain points back to the QD. For the rest of the QE's in the active chain, word 1 is a pointer to the next most recent QE in the chain.

Word 2 of the most recent QE in the active chain points back to the QD. For the rest of the QEs in the active chain, word 2 is a pointer to the next oldest QE in the chain.

Word 3 of a QE in the active chain is a queue entry. The entry is a 16-bit word that can be a data item or the address of an associated data buffer.

When a QE is in the free chain, word 3 is a pointer to the next element in the free chain. Word 3 of the last QE in the free chain is a pointer back to the QD.

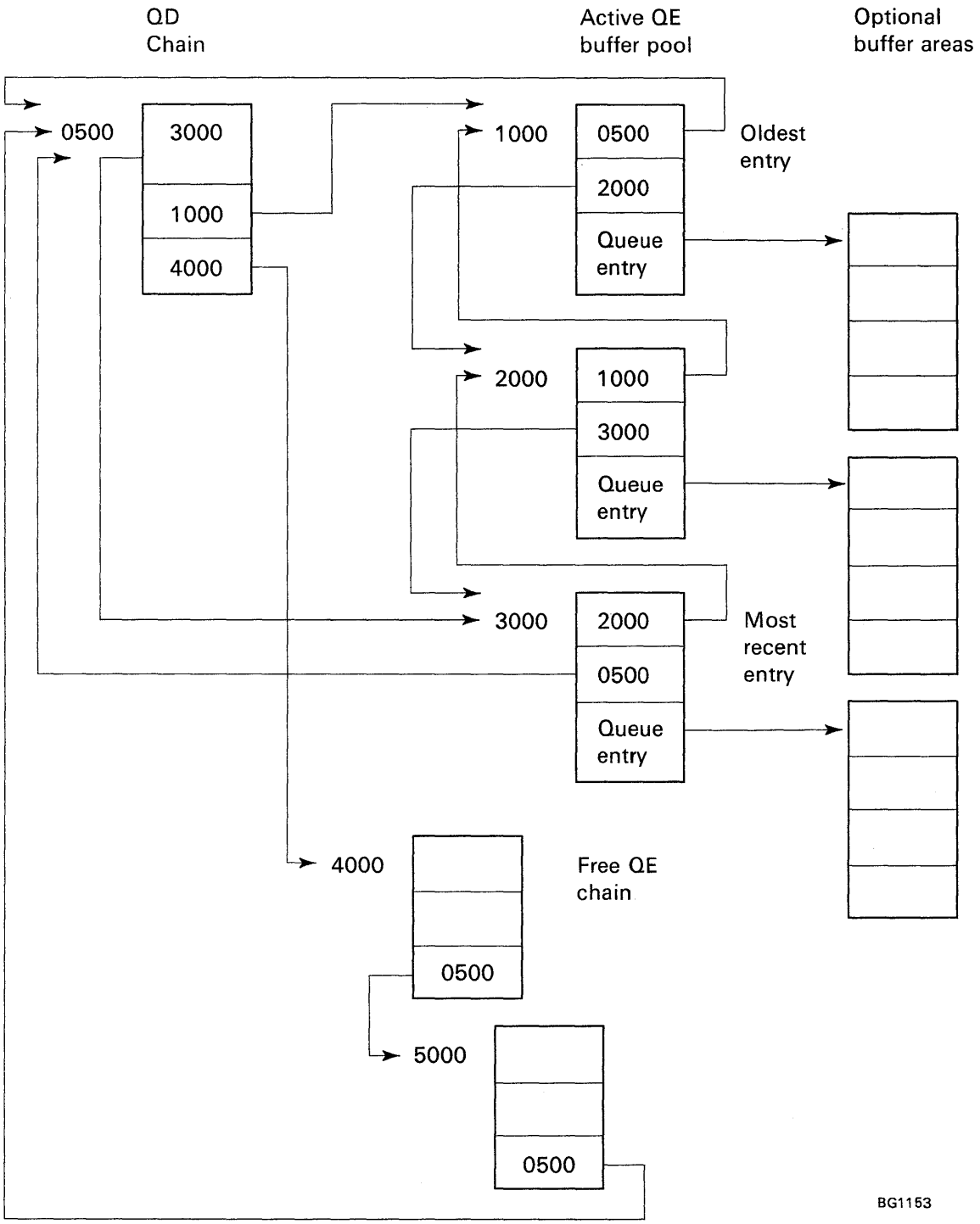


Figure 2-5. Layout of a Queue

Syntax Examples

1) The following statement generates a 3-word queue descriptor (QD), followed by four 3-word queue entries (QE). All four of the QEs are placed in the QE free chain.

```
QUE1     DEFINEQ   COUNT=4
```

2) The following statement generates a 3-word QD, followed by two 3-word QEs and two 6-word queue data areas (one 6-word area for each of the QEs) initialized to binary zeros. Because the SIZE operand is specified, all QEs are included in the active chain and the queue is defined as full.

```
QUE2     DEFINEQ   COUNT=2,SIZE=12
```

DEQ – Release a Resource for Use

The DEQ instruction releases exclusive control of a resource *other* than a terminal by releasing control of the queue control block (QCB) associated with that resource.

You acquire exclusive control of the QCB associated with a resource with the ENQ instruction. (See the ENQ instruction for more information.) Your program must release exclusive control of, or "dequeue," a QCB associated with a resource before other programs can use the resource again. Note that any task may dequeue a QCB, even if it is not the owner of that QCB.

DEQ normally assumes that the QCB for the resource is defined in the same partition as the current program. However, your program can dequeue a QCB in another partition by using the cross-partition service capability of DEQ. See Appendix C, "Communicating with Programs in Other Partitions (Cross-Partition Services)" on page C-1 for an example that dequeues a resource in another partition. Refer to the *Language Programming Guide* for more information on cross-partition services.

When you use the $S1ASM macro assembler or the host assembler, the DEQ instruction causes the assembler to generate a QCB for a resource at the end of the program. When you use $EDXASM, no QCBs are generated; you must use the QCB statement to generate the QCBs your program requires.

Syntax:

label	**DEQ**	**qcb,code,P1=,P2=**
Required:	**qcb**	
Defaults:	**code=−1**	
Indexable:	**qcb**	

Operand	*Description*
qcb	The label of the QCB to be dequeued. This must be the same label used for the ENQ instruction and is usually the label of a QCB statement.
code	A code word to be inserted into the queue control block (QCB) associated with the resource. Your program can examine the code word by referring to the label of the QCB. A code of 0 is interpreted by the ENQ instruction to mean that the resource is unavailable for use; all nonzero codes show that the resource is available. You must code a self-defining term for this operand.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Coding Example

See "ENQ – Gain Exclusive Control of a Resource other than a Terminal" on page 2-125 for an example using the DEQ instruction.

DEQT – Release a Terminal for Use

The DEQT instruction releases control of the terminal that your program acquired control of with an ENQT instruction.

When an ENQT instruction redefines the characteristics of a terminal through an IOCB statement, DEQT restores the terminal characteristics defined on the TERMINAL definition statement. (Refer to the *Installation and System Generation Guide* for information on the TERMINAL statement.) DEQT also causes partially full buffers to be written to the terminal, completes all pending I/O, and forces the cursor or forms to the next line (carriage return.) In addition, you can use the DEQT instruction to end spooling to a printer assigned to your program.

Your program also releases exclusive control of a terminal when it executes a PROGSTOP instruction.

The supervisor places a return code in the first word of the task control block (taskname) whenever a DEQT instruction causes a terminal I/O operation to occur. If the return code is not a −1, the address of this instruction will be placed in the second word of the task control block (taskname+2). The terminal I/O return codes are described at the end of the PRINTEXT and READTEXT instructions in this manual and also in *Messages and Codes.*

When coding the DEQT instruction, you can include a comment that will appear with the instruction on your compiler listing. If you include a comment, you must also code the CLOSE operand. The comment must be separated from the operand field by at least one blank and it cannot contain commas.

Syntax:

label	**DEQT**	**CLOSE= comment**
Required:	**none**	
Defaults:	**CLOSE=NO**	
Indexable:	**none**	

Operand	*Description*
CLOSE=	This operand provides additional control for spool jobs. Code CLOSE=YES to logically end a spool job. Logically ending a SPOOL job allows the executing program to create separate printed output on the spool device. This operand has no effect on the DEQT instruction if the device to which the DEQT is directed is not a spool device, or if spool is not active. Code CLOSE=ALL to end all spool jobs associated with this task and all other tasks in the program that have previously issued a DEQT instruction. Coding CLOSE=NO (the default) has no affect on the DEQT instruction or spool operation.

Syntax Examples

1) Release control of the system printer, $SYSPRTR.

```
        ENQT    $SYSPRTR
          •
          •
          •
        DEQT
```

2) Release control of the device TTY1.

```
        ENQT    TERM1,BUSY=ALTERN
          •
          •
          •
        DEQT    CLOSE=NO        THIS IS A COMMENT
          •
          •
          •
        PROGSTOP
TERM1   IOCB    TTY1,PAGSIZE=24
```

DETACH – Deactivate a Task

The DETACH instruction removes a task from operational status. A task can only detach itself. If a program reattaches a task, execution begins with the instruction following the DETACH in the reattached task.

Syntax:

label	**DETACH code,P1=**
Required:	**none**
Defaults:	**code = −1**
Indexable:	**none**

Operand	*Description*
code	The posting code to be inserted in the terminating ECB ($TCBEEC) of the task being detached. A complete list of TCB equates is in the *Internal Design*.
P1=	Parameter naming operand. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code this operand.

Coding Example

The following program announces the start of each race at a racetrack.

TASKA is the program's primary task. It starts, or "attaches," TASKB, which enqueues the track announcement board at label RACEBORD (code not shown). TASKB then prints the time of day and the number of the race that is about to begin. When TASKB completes, it executes a DETACH instruction and detaches itself from the program.

When the primary task reattaches TASKB at label A2, the GOTO instruction immediately following the DETACH instruction executes. The GOTO instruction passes control back to the beginning of the TASKB and execution resumes at the label BEGIN.

```
TASKA     PROGRAM   START
START     EQU       *
            •
            •
            •
          ATTACH    TASKB
            •
            •
            •
A2        ATTACH    TASKB
            •
            •
            •
          PROGSTOP
            •
            •
            •
TASKB     TASK      BEGIN
BEGIN     EQU       *
          ENQT      RACEBORD
          ADD       NUMBER,1
          PRINTEXT  '@THE TIME IS NOW'
          PRINTIME
          PRINTEXT  ' AND RACE# '
          PRINTNUM  NUMBER
          PRINTEXT  ' OF THE DAY IS ABOUT TO BEGIN '
          DEQT
          DETACH
          GOTO      BEGIN
NUMBER    DATA      F'0'
          ENDTASK
          ENDPROG
          END
```

DIVIDE – Divide Integer Values

The DIVIDE instruction divides an integer value in operand 1 by an integer value in operand 2. The values can be positive or negative. To divide floating-point values, use the FDIVD instruction.

See the DATA/DC statement for a description of the various ways you can represent integer data.

The system stores the remainder of the operation (an integer) in the first word of the task control block (TCB). This remainder will be lost if a subsequent instruction issues a return code and updates the TCB. The remainder is double-precision only if operand 2 is double precision.

The system indicates an overflow for the DIVIDE operation by placing a X'80000000' in the first two words of the TCB. X'80000000' is also the result of a divide by zero operation.

Syntax:

label	**DIVIDE**	**opnd1,opnd2,count,RESULT=,PREC=,** **P1=,P2=,P3=**
Required:	**opnd1,opnd2**	
Defaults:	**count=1,RESULT=opnd1,PREC=S**	
Indexable:	**opnd1,opnd2,RESULT**	

Operand	*Description*
opnd1	The label of the data area containing the value divided by opnd2. Opnd1 cannot be a self-defining term. The system stores the result of the DIVIDE operation in opnd1 unless you code the RESULT operand.
opnd2	The value by which opnd1 is divided. You can specify a self-defining term or the label of a data area. The value of opnd2 does not change during the operation.
count	The number of consecutive values on which the system performs the operation. The maximum value is 32767.
RESULT=	The label of a data area or vector in which the result is placed. The data area you specify for opnd1 is not changed if you specify RESULT. This operand is optional.
PREC=xyz	Specify the precision of the operation in the form xyz, where the precision for opnd1 is x. The precision for opnd2 is y, and the precision of the result is z ("Mixed-precision Operations" on page 2-104 shows the precision combinations allowed for the DIVIDE instruction). You can specify single precision (S) or double precision (D) for each operand. Single precision is a word in length; double precision is two words in length. The default for opnd1, opnd2, and the result is single precision.

If you code a single letter for PREC, the letter applies to opnd1 and the result. Opnd2 defaults to single precision. If, for example, you code PREC=D, opnd1 and the result are double precision and opnd2 defaults to single precision.

If you code two letters for PREC, the first letter applies to opnd1 and the result, and the second letter applies to opnd2. With PREC=DD, for example, opnd1 and the result are double precision and opnd2 is double precision.

Px= Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Mixed-precision Operations

The following table lists the precision combinations allowed for the DIVIDE instruction:

opnd1	opnd2	Result	Precision
S	S	S	S
S	S	D	SSD
D	S	D	D
D	D	D	DD
D	S	S	DSS

PREC=S is the default.

Syntax Example

The following DIVIDE instruction divides the value at location DATA by a value at a location defined by the label TAB plus the contents of index register 1. Both operands are single precision because no precision is specified.

```
DIVIDE   DATA,(TAB,#1)
```

Coding Example

The following example uses the DIVIDE instruction to determine the amount of time an experiment required in hours, minutes, and seconds. If the data area labeled TIME contained a value of 4796 (seconds), the first DIVIDE instruction would place a result of 1 in HOURS. It would also leave a remainder of 1196 in the first word of the TCB. The label of the TCB is TASK, the label of the PROGRAM statement.

The second DIVIDE instruction at label GETMINS would divide the remainder by 60 and place a result of 19 in MINUTES and a remainder of 56 in the TCB. This remainder represents the number of seconds and would be moved into SECONDS. The program would print out a final result of 1 hour, 19 minutes, and 56 seconds.

```
TASK      PROGRAM  START
START     EQU      *
           •
           •
           •
NEXTIME   EQU      *
           •
           •
           •
GETHOURS  EQU      *
          DIVIDE   TIME,3600,RESULT=HOURS   NUMBER OF HOURS
GETMINS   EQU      *
          DIVIDE   TASK,60,RESULT=MINUTES   NUMBER OF MINUTES
GETSECS   EQU      *
          MOVE     SECONDS,TASK,(1,WORD)    GET REMAINDER
PRINTIME  EQU      *
          PRINTEXT ' ELAPSED TIME IN HOURS:MINUTES:SECONDS'
          PRINTNUM HOURS
          PRINTEXT ' : '
          PRINTNUM MINUTES
          PRINTEXT ' : '
          PRINTNUM SECONDS
          GOTO     NEXTIME                  CONVERT ANOTHER COUNT
           •
           •
           •
TIME      DATA     D'0'                     BEGINNING VALUE
HOURS     DATA     F'0'                     NUMBER OF ELAPSED HOURS
MINUTES   DATA     F'0'                     NUMBER OF ELAPSED MINUTES
SECONDS   DATA     F'0'                     NUMBER OF ELAPSED SECONDS
```

DO – Perform a Program Loop

The DO instruction begins a program loop. A loop is a set of one or more instructions that executes repeatedly until a condition you specify in the DO instruction is satisfied. You must end the DO loop with an ENDDO instruction.

You can code a loop within another loop. This technique is called "nesting." You can include up to 20 nested loops within your initial DO-ENDDO structure.

There are three forms of the DO instruction. DO UNTIL and DO WHILE provide a means of looping until or while a condition is true. The third form of the DO instruction causes a loop to be executed a specific number of times. In all of these forms, a branch out of the loop is allowed.

You also can use the DO instruction to perform a loop while or until a certain bit is on (set to 1) or off (set to 0).

The syntax box shows the DO UNTIL and DO WHILE forms of the DO instruction with a single conditional statement. You can specify several conditional statements, however, by using the AND and OR keywords. These keywords allow you to join conditional statements. The keywords are described in the operands list and examples using the keywords are shown under "Syntax Examples with DO and ENDDO" on page 2-109.

Syntax:

label	**DO**	**count,TIMES,INDEX=,P1=**
label	**DO**	**UNTIL,(data1,condition,data2,width)**
label	**DO**	**WHILE,(data1,condition,data2,width)**
Required:	**count or one conditional statement with UNTIL or WHILE**	
Defaults:	**width is WORD**	
Indexable:	**count or data1 and data2 in each statement**	

Operand	*Description*
count	The number of times the loop is to be executed. You can specify a constant or the label of a variable. The maximum value is 32767. The system completes one loop each time it encounters the ENDDO instruction. **Note:** If count=0, the system executes the loop one time.
TIMES	This optional operand serves only as a comment for the count operand.
INDEX=	The label of a data area that the system resets to 0 before starting the DO loop and increases by 1 each time the instruction following the DO instruction executes. The first time the DO loop executes, the index has a value of 1.
UNTIL	This operand defines a loop that executes until the condition you specify is true. The loop executes at least once, even if the condition is initially true.

WHILE This operand defines a loop that executes as long as the condition you specify is true. The loop does not execute if the condition is initially false.

data1 The label of a data item to be compared to data2 or the label of the data area that contains the bit to be tested. This operand is valid only in a conditional statement with UNTIL or WHILE.

condition An operator that indicates the relationship or condition to be tested. Only code this operand in a conditional statement with UNTIL or WHILE. The valid operators for the DO instruction are as follows:

EQ – Equal to
NE – Not equal to
GT – Greater than
LT – Less than
GE – Greater than or equal to
LE – Less than or equal to

ON – Bit is on
OFF – Bit is off

data2 The data to be compared to data1 or the position, in data1, of the bit to be tested. Only code this operand in a conditional statement with UNTIL or WHILE. You can specify immediate data or the label of a variable. Immediate data can be an integer from 1 – 32768 or a hexadecimal value from 1 – 65535 (X'FFFF').

Bit 0 is the leftmost bit of the data area.

width Specifies an integer number of bytes or one of the following:

BYTE – Byte (8 bits)
WORD – Word (16 bits)
DWORD – Doubleword (32 bits)
FLOAT – Single-precision floating point (32 bits)
DFLOAT – Extended-precision floating point (64 bits)

Code this operand only in a conditional statement using UNTIL or WHILE. The default is WORD.

AND Enables you to join conditional statements when you code DO UNTIL or DO WHILE. Code the operand between the conditional statements you want to join. With DO UNTIL, the AND indicates that the loop should execute *until* all the conditional statements that the operand joins are true. With DO WHILE, the AND indicates that the loop should execute *while* all the conditional statements the operand joins are true.

You can join several pairs of conditional statements with several AND operands. You also can use the AND and OR operands within the same DO instruction.

OR Enables you to join conditional statements when you code DO UNTIL or DO WHILE. Code the operand between the conditional statements you want to join. With DO UNTIL, the OR indicates that the loop should execute *until* one of the conditional statements the operand joins is true. With DO WHILE, the OR indicates that the loop should execute *while* any of the conditional statements the operand joins is true. See the syntax examples for this instruction.

You can join several pairs of conditional statements with several OR operands. You also can use the AND and OR operands within the same DO instruction.

P1= Parameter naming operand. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code this operand.

Rules for Evaluating Statement Strings Using AND and OR

The IF and DO instructions permit logically connected statements in the form of either:

statement,OR,statement

statement,AND,statement

More than two statements may be logically connected in an instruction. Logically connected statement strings are not evaluated according to normal Boolean reduction. Instead, the string is evaluated to be true or false by evaluating each sequence of:

statement, conjunction

to be true or false as follows:

- The expression is evaluated from left to right.
- If the condition is true and the next conjunction is **OR**, or if there are no more conjunctions, the string is true and evaluation ceases.
- If the condition is true and the next conjunction is **AND**, the next conjunction is checked.
- If the condition is false and the next conjunction is **OR**, the next condition is checked.
- If the condition is false and the next conjunction is **AND**, or if there are no more conjunctions, the string is false and the evaluation ceases.

The order of the statements and the conjunctions in a statement string determines the evaluation of the string. It may be possible, by reordering the sequence of statements and conjunctions, to produce a statement string that will be evaluated to the same results as Boolean reduction of the statement. For example, the statement string:

(A,EQ,B),AND,(C,GT,D),OR,(E,LT,F)

could be reordered as

(E,LT,F),OR,(A,EQ,B),AND,(C,GT,D)

without changing the results if evaluated by Boolean reduction. As a statement string in the IF or DO instructions, however, the two forms produce different evaluations. If A is not equal to B, but E is less than F, the first statement string will be evaluated false and the evaluation will cease as soon as (A,EQ,B,) is evaluated; however, the second statement string will be evaluated true if E is less than F, as would be expected from Boolean reduction for either the first or second statement string.

Syntax Examples with DO and ENDDO

See the IF instruction for more samples of conditional statements.

1) Execute a loop 100 times.

```
DO    100
 •
 •
 •
ENDDO
```

2) Execute a loop the number of times specified in N. The TIMES operand serves as a comment.

```
DO    N,TIMES
 •
 •
 •
ENDDO
```

3) Execute a loop until the first 4 bytes of A are less than the first 4 bytes of B.

```
DO    UNTIL,(A,LT,B,4)
 •
 •
 •
ENDDO
```

4) Execute a loop until A contains a floating-point value equal to 1000.

```
DO    UNTIL,(A,EQ,1000,FLOAT)
 •
 •
 •
ENDDO
```

5) Execute a loop while the first word of B is not equal to the first word of C.

```
DO    WHILE,(B,NE,C)
 •
 •
 •
ENDDO
```

6) Execute a loop while the first 4 bytes of A are less than the first 4 bytes of B.

```
DO    WHILE,(A,LT,B,4)
 •
 •
 •
ENDDO
```

7) Execute a loop until the third bit starting at label A is a 1.

```
DO    UNTIL,(A,ON,2)
 •
 •
 •
ENDDO
```

8) Execute a loop until the bit number contained in BIT1, starting at label A, is a 0.

```
DO      UNTIL,(A,OFF,BIT1)
 •
 •
 •
ENDDO
```

9) Execute a loop until A equals.B *and* A equals C.

```
DO      UNTIL,(A,EQ,B),AND,(A,EQ,C)
 •
 •
 •
ENDDO
```

10) Execute a loop while A is not equal to 1, *or* while the first doubleword in D is equal to the first doubleword in E, *and* while register 1 is not equal to 14.

```
DO      WHILE,(A,NE,1),OR,(D,EQ,E,DWORD),AND,(#1,NE,14)
 •
 •
 •
ENDDO
```

11) This example shows a nested DO loop.

```
DO      UNTIL,(A,EQ,B,DFLOAT),OR,(#1,EQ,1000)
 •
 •
 •
  DO    10,TIMES
 •
 •
 •
  ENDDO
ENDDO
```

12) This example shows a nested DO loop that is also within an IF-ELSE-ENDIF structure.

```
DO      WHILE,(A,GT,B,DWORD)
  IF      (CHAR,EQ,C'A',BYTE)
     DO     40,TIMES
       •
       •
       •
     ENDDO
  ELSE
    •
    •
    •
  ENDIF
ENDDO
```

Coding Example

The following example shows three DO loops.

The first DO loop, at label D1, executes twice and ends. The second DO loop, at label D2, executes at least once and continues to loop until the value of INDEX1 is greater than or equal to 2.

The third DO loop, at label D3, executes as long as (WHILE) the value of INDEX2 is less than or equal to 1. If the condition is not initially true, the third loop does not execute at all.

```
          •
          •
          •
D1        DO    2,TIMES,INDEX=INDEX
            MOVE  INDEX1,0
D2          DO    UNTIL,(INDEX1,GE,2)
                ADD   INDEX1,1
                MOVE  INDEX2,0
D3              DO    WHILE,(INDEX2,LE,1)
                  ADD      INDEX2,1
                  PRINTNUM INDEX,3,3,4
                ENDDO
            ENDDO
          ENDDO
          •
          •
          •
INDEX     DATA   F'1'
INDEX1    DATA   F'1'
INDEX2    DATA   F'1'
          •
          •
          •
```

The above example generates the following printout:

```
1          1          1
1          1          2
1          2          1
1          2          2
2          1          1
2          1          2
2          2          1
2          2          2
```

DSCB – Create a Data Set Control Block

The DSCB statement creates a data set control block (DSCB). A DSCB provides the information the system requires to use a data set within a particular volume.

The first 3 words of every DSCB contain the event control block (ECB) information. You can refer to fields within a DSCB by using the DSCB equate table, DSCBEQU.

Syntax:

	DSCB DS#=,DSNAME=,VOLSER=,DSLEN=
Required:	**DS#=,DSNAME=**
Defaults:	**VOLSER=null, DSLEN=0**
Indexable:	**none**

Operand	*Description*
DS#=	The alphanumeric label that is used to refer to a DSCB in disk or tape I/O instructions. This label will be assigned to the first word (ECB) of the generated DSCB. Specify 1–8 characters.
DSNAME=	The data set name field within the DSCB. Specify 1–8 characters.
VOLSER=	The volume label to be assigned to the volume label field of the DSCB. Specify 1–6 characters. A null entry (blanks) will be generated if you do not specify VOLSER. **Note:** If the DSCB is for a tape data set, you must specify VOLSER prior to DSOPEN. In addition, you must supply the 1–6 character tape drive ID if there is no volume label. The tape drive ID is assigned during system generation with the TAPE definition statement.
DSLEN=	The size of the referenced direct access space. If no number is specified, this value will be set to 0. This parameter is not used if the DSOPEN routine will be used to open the DSCB.

When a data set is defined using the DSCB statement it must be opened before attempting disk or tape I/O operations such as READ or WRITE. The routines DSOPEN and $DISKUT3 are provided for this purpose. DSOPEN must be copied into your program with the COPY statement and then called with the CALL instruction. The $DISKUT3 utility is loaded with the LOAD instruction. For more information on DSOPEN and $DISKUT3 see Appendix D or refer to the *Language Programming Guide*.

Syntax Example

The following DSCB statement creates a data set control block with the label INDATA.

```
DSCB   DS#=INDATA,DSNAME=MASTER,VOLSER=EDX003
```

ECB – Create an Event Control Block

The ECB statement generates a 3-word event control block (ECB) that defines an event. The system places a value in the first word of the control block when an event has occurred. When the system signals the occurrence of an event in the ECB, the ECB is said to have been "posted."

Normally this statement is not needed for application programs you assemble with the host or Series/1 macro assemblers. The host and Series/1 macro assemblers automatically generate a control block for an event named in a POST instruction.

You must code the necessary ECBs in programs assembled under $EDXASM, except for those ECBs created when you code the EVENT= operand on the PROGRAM or TASK statement.

You can code a maximum of 25 ECB statements in a program. If your program requires more than 25 ECBs, you must create them using DATA statements. An example of how to create an ECB is shown following the description of this statement.

When coding the ECB statement, you can include a comment that will appear with the statement on your compiler listing. If you include a comment, you must also specify the code operand. The comment must be separated from the operand field by at least one blank and it cannot contain commas.

Syntax:

label	**ECB**	**code**	**comment**
Required:	**label**		
Defaults:	**code = −1**		
Indexable:	**none**		

Operand	*Description*
label	The label of the event that you specify in a POST instruction.
code	Initial value of the code field (word 1). If this word is not a zero when a WAIT is issued, no wait occurs unless the WAIT has RESET coded. You must leave the comment section blank if you plan to take the default (−1) for this operand.

Syntax Example

The ECB statement:

```
ECB1      ECB
```

is equivalent to coding,

```
ECB1      DATA    F'-1'
          DATA    2F'0'
```

The ECB statement:

```
ECB2      ECB     0     CODE IS 0, NOT DEFAULT
```

is equivalent to coding,

```
ECB2      DATA    F'0'
          DATA    2F'0'
```

EJECT – Continue Compiler Listing on a New Page

The EJECT statement causes the next line of the listing to appear at the top of a new page. This statement provides a convenient way to separate sections of a program. It does not change the page title if you are using one.

You can place EJECT within executable instructions.

Syntax:

blank	**EJECT**
Required:	**none**
Defaults:	**none**
Indexable:	**none**

Operand	*Description*
none	none

Coding Example

See the PRINT statement for an example using EJECT.

ELSE – Specify Action for a False Condition

The ELSE statement defines the start of the false-path code associated with the preceding IF instruction. The end of the false-path code is the next ENDIF statement.

When coding the ELSE statement, you may include a comment that will appear with the instruction on your compiler listing. If you include a comment, we recommend that the first character of the comment text not be a special character. If the comment starts with one or more special characters, it must be separated from the instruction by a comma with a blank on each side.

Syntax:

label	**ELSE**
Required:	**none**
Defaults:	**none**
Indexable:	**none**

Operand	*Description*
none	none

Syntax Examples

The examples for IF, ELSE, and ENDIF are shown following the IF instruction.

END – Signal End of Source Statements

The END statement signals the compiler that the program contains no further source statements.

END must be the last statement in a program, a separately compiled task, or a subroutine. Unpredictable results can occur if you do not code an END statement.

Syntax:

blank	**END**
Required:	**none**
Defaults:	**none**
Indexable:	**none**

Operand	*Description*
none	none

Coding Example

The following example enqueues $SYSLOG, prints the time and date, dequeues $SYSLOG, and ends. END is the last statement in the program.

```
PRINDATE    PROGRAM   START
START       EQU       *
            ENQT      $SYSLOG
            PRINTIME
            PRINDATE
            DEQT
            PROGSTOP
            ENDPROG
            END
```

ENDATTN – End Attention-Interrupt-Handling Routine

The ENDATTN instruction ends an attention-interrupt-handling routine, as described under ATTNLIST, and is the last instruction of that routine.

Syntax:

label	**ENDATTN**
Required:	**none**
Defaults:	**none**
Indexable:	**none**

Operand	*Description*
none	none

Coding Example

See the ATTNLIST statement for an example using the ENDATTN instruction.

ENDDO – End a Program Loop

The ENDDO statement defines the end of a DO loop. It must be preceded by a DO instruction.

Syntax:

label	**ENDDO**
Required:	**none**
Defaults:	**none**
Indexable:	**none**

Operand	*Description*
none	none

Coding Example

See the examples following the DO instruction.

ENDIF – End an IF-ELSE Structure

The ENDIF statement indicates the end of an IF-ELSE structure. If ELSE is coded, ENDIF indicates the end of the false-condition code associated with the preceding IF instruction. If ELSE is not coded, ENDIF indicates the end of the true code associated with the preceding IF instruction.

When coding the ENDIF statement, you can include a comment that will appear with the instruction on your compiler listing. If you include a comment, we recommend that the first character of the comment text not be a special character. If the comment starts with one or more special characters, it must be separated from the instruction by a comma with a blank on each side.

Syntax:

label	**ENDIF**
Required:	**none**
Defaults:	**none**
Indexable:	**none**

Operand	*Description*
none	none

Syntax Examples

The examples for IF, ELSE, and ENDIF are shown following the IF instruction.

ENDPROG – End a Program

The ENDPROG statement ends a program. It must be the next to the last statement in your program (except when you include a $ID statement). The last statement must be END. You can code the RETURN= operand on the ENDPROG statement to acquire the system-return subroutine support without link-editing the subroutine with your program.

The ENDPROG statement generates a task control block (TCB) for the main program. You can locate the TCB by referring to the label on the PROGRAM statement.

Syntax:

blank	**ENDPROG RETURN=**
Required:	**none**
Defaults:	**RETURN=NO (if your program contains a USER instruction, the default is YES)**
Indexable:	**none**

Operand	*Description*
RETURN=	RETURN=YES generates the $$RETURN subroutine in your program. $$RETURN enables you to return to an EDL program from an assembler subroutine when you code `BAL RETURN,R1` in the assembler subroutine. When you specify RETURN=YES, it is not necessary to link-edit the $$RETURN subroutine to your program. If your program has a USER instruction coded, then the RETURN operand is not necessary on the ENDPROG statement. The USER instruction causes the system module $$RETURN to be generated as part of your program. RETURN=NO is the default value for the RETURN operand unless your program contains a USER instruction. If you code RETURN=NO or allow the default, the system module is not generated as part of your program. RETURN=EXTRN generates an external reference to the system subroutine $$RETURN. If you code RETURN=EXTRN, you must link-edit the $$RETURN subroutine to your program.

Syntax Example

The ENDPROG statement precedes the END statement.

```
          •
          •
          •
          PROGSTOP
FIELD     DATA      F'0'
MESSAGE   TEXT      'ENTER YOUR NAME :'
          ENDPROG
          END
```

ENDTASK – End a Task

The ENDTASK instruction defines the end of a task. Each task, except the primary task, requires one ENDTASK as its final instruction. When this instruction executes, the task is detached. If another ATTACH is issued, execution begins at the first instruction of the task.

ENDTASK actually generates two instructions: DETACH and GOTO start, where "start" is the label of the first instruction to be executed when the system attaches the task.

Syntax:

label	**ENDTASK code,P1=**
Required:	**none**
Defaults:	**code = −1**
Indexable:	**none**

Operand	*Description*
code	The post code can be any 1-word value. This code will be inserted in the terminating ECB ($TCBEEC) of the task being detached. A complete list of TCB equates is in the *Internal Design.*
P1=	Parameter naming operand. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code this operand.

Coding Example

The main program in the following example, PROGA, attaches both TASKA and TASKB during execution. Both tasks must be coded within the main program; you cannot code the tasks in subprograms that are later link-edited with the main program. The main program code always ends with the ENDPROG and END statements (unless you code an intervening $ID statement). The task source code always ends with the ENDTASK statement.

The first ATTACH instruction starts TASKA. TASKA begins by setting its post code to −1. If an error occurs, the task ends with a post code of 999. The second ATTACH instruction starts TASKB.

The IF instruction at label CHECK examines the post code of TASKA to see if the task ended successfully. If the task did not end successfully, another ATTACH instruction reattaches TASKA. Because TASKA can only end with an ENDTASK statement, execution always resumes at the instruction following the BEGINA label.

If TASKB detaches at the DETACH instruction, execution resumes at the instruction following the DETACH. If TASKB detaches at the ENDTASK statement, the task resumes execution at BEGINB.

```
PROGA    PROGRAM  START
START    EQU      *
          •
          •
          •
         ATTACH   TASKA
          •
          •
          •
         ATTACH   TASKB
          •
          •
          •
CHECK    IF       ($TCBEEC+TASKA,NE,-1)
           ATTACH   TASKA
         ENDIF
          •
          •
          •
         ATTACH   TASKB
          •
          •
          •
         PROGSTOP
          •
          •
          •
TASKA    TASK     BEGINA
BEGINA   EQU      *
         MOVE     CODE,-1
          •
          •
          •
         IF       (RESULT,EQ,ERROR)
           MOVE     CODE,999
         ENDIF
         ENDTASK  1,P1=CODE
*
TASKB    TASK     BEGINB
BEGINB   EQU      *
         ADD      C,D
          •
          •
          •
         DETACH
          •
          •
          •
         ENDTASK
         ENDPROG
         END
```

ENQ – Gain Exclusive Control of a Resource other than a Terminal

The ENQ instruction gains exclusive control of a resource *other* than a terminal by acquiring control of the queue control block (QCB) associated with that resource. Use ENQ to gain control of logical or physical resources such as sensor-based I/O devices, subroutines, and data sets. The task remains the owner of the QCB until the QCB is dequeued.

Note: Use the ENQT instruction to acquire exclusive use of any resource you define with a TERMINAL statement, such as a display station or printer.

When several programs need to use the same resource, the ENQ instruction can ensure serial (one at a time) use of the resource. Programs try to acquire control of, or "enqueue," a specific QCB before trying to use the resource. If the QCB is "busy," the program can wait for the resource to become available or execute another routine.

In general, there are two types of resources, system and user. System resources can be shared serially by all programs and are defined by labels that are known across the system. The QCBs associated with these resources must reside in $SYSCOM, the system common area. (Refer to the *Installation and System Generation Guide* for a discussion of $SYSCOM.) User resources are shared serially by different parts of one user program and are identified by labels known only within that program. The QCBs associated with these resources reside within the program.

You must define each QCB contained in a program compiled under $EDXASM with the QCB statement. The QCB statement generates the 5-word queue control block in your program. The Series/1 and host macro assemblers automatically create a required QCB if you include a DEQ instruction naming the QCB in your program.

ENQ normally assumes that the QCB to be enqueued is in the same partition as the current program. However, your program can enqueue a QCB in another partition by using the cross-partition capability of ENQ. See Appendix C, "Communicating with Programs in Other Partitions (Cross-Partition Services)" on page C-1 for an example of enqueuing a resource in another partition. Refer to the *Language Programming Guide* for more information on cross-partition services.

Syntax:

label	**ENQ**	**qcb,BUSY=,P1=**
Required:	**qcb**	
Defaults:	**none**	
Indexable:	**qcb**	

Operand	*Description*
qcb	The label of the QCB to be enqueued.
BUSY=	The label of the instruction to receive control if the QCB you try to enqueue is in use. If you do not code this operand and the QCB is in use, the system suspends the execution of your program until the resource associated with the QCB becomes available.
P1=	Parameter naming operand. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code this operand.

Coding Example

The following example shows the use of ENQ and DEQ instructions.

The ENQ instruction attempts to enqueue the queue control block labeled SBRTNQCB. If the first word of the QCB contains a zero, the subroutine labeled SUBRTN is being used by another program. The program, in this case, would wait for the resource to become available. If the first word of the QCB is not a zero, the program can call SUBRTN.

When SUBRTN ends, it places a code of 99 in RETURNCD. The DEQ instruction releases exclusive control of the QCB and places the value of RETURNCD (99) in the first word of the QCB. The nonzero value in the QCB serves as a signal to other programs that the resource associated with the QCB is available.

```
          •
          •
          •
         ENQ       SBRTNQCB
         CALL      SUBRTN
         DEQ       SBRTNQCB,0,P2=RETURNCD
          •
          •
          •
         SUBROUT   SUBRTN
          •
          •
          •
         MOVE      RETURNCD,99
         RETURN
          •
          •
          •
SBRTNQCB QCB       -1
          •
          •
          •
```

ENQT – Gain Exclusive Control of a Terminal

The ENQT instruction acquires exclusive control of a terminal. To acquire exclusive control of a terminal is to "enqueue" it. A "terminal" is any device, such as a display station or printer, that you define with a TERMINAL statement during system generation.

Your program releases exclusive control of a terminal when it executes a DEQT or PROGSTOP instruction. Once your program enqueues a terminal, it must release control of that terminal with a DEQT instruction before attempting to enqueue another terminal.

When coding the ENQT instruction, you can include a comment that will appear with the instruction on your compiler listing. If you include a comment, you must specify at least one operand with the instruction. The comment must be separated from the operand field by one or more blanks and it cannot contain commas.

Syntax:

label	**ENQT**	**name,BUSY=,SPOOL=,P1= comment**
Required:	**none**	
Defaults:	**SPOOL=YES**	
	name – label of the terminal that is currently in use by the program	
Indexable:	**none**	

Operand	*Description*
name	The label of an IOCB statement or one of two special device names: $SYSLOG or $SYSPRTR. $SYSLOG is the name of the system display station; $SYSPRTR is the name of the system printer. Your program enqueues the terminal from which you loaded it if you allow this operand to default. When you specify $SYSLOG or $SYSPRTR, the system refers to the TERMINAL statement you set up for each of these devices during system generation. Do not code an IOCB statement for these devices. When you want to specify a terminal other than $SYSLOG or $SYSPRTR, you can code the label of an IOCB statement for this operand. The ENQT instruction refers to the IOCB statement for the name of the terminal you want to control. The name on the IOCB statement is the name you assigned to the terminal during system generation. By referring to an IOCB statement, you also can redefine certain terminal characteristics. You can, for example, reset screen or page margins, or change a terminal from a roll screen device to a static screen device. (See the IOCB statement for a description of the terminal characteristics you can redefine.) The terminal characteristics you specify with an IOCB statement remain in effect until you release control of the terminal.

BUSY= The label of the instruction to receive control if the terminal you try to enqueue is in use. If you do not code this operand and the terminal is in use, the system suspends the execution of your program until the terminal you request becomes available.

SPOOL= YES, the default, to allow the system to send spooled output to the spool device you enqueue when the spool facility is active. This operand has no effect if the spool facility is not active or if the device you enqueue is not a spool device.

NO, to prevent the system from sending spooled output to the spool device you enqueue when the spool facility is active.

This operand remains in effect until your program executes a DEQT or PROGSTOP instruction.

P1= Parameter naming operand. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code this operand.

Special Considerations

You should note the following considerations when using the ENQT instruction:

- If your program has exclusive control of a terminal and loads another program, the system dequeues the terminal unless you coded DEQT=NO on the LOAD instruction. See "LOAD – Load a Program" on page 2-243 for a description of the DEQT operand.
- ATTNLIST instructions cannot gain access to an enqueued terminal.
- If your program attempts to enqueue a terminal it already controls, the ENQT instruction can change the characteristics of the terminal in use if it refers to an IOCB statement that defines new terminal characteristics.
- If an ENQT instruction refers to an IOCB that sets up the limits of a logical screen, the output for that screen starts at the top of the working area. The system, however, does not immediately move the cursor to this location. Your program can position the cursor at the top of the working area by issuing a TERMCTRL DISPLAY.
- To preserve the correct current line pointer when the system sends spooled output to an enqueued terminal, code a TERMCTRL DISPLAY as the last I/O instruction. Do this before your program issues an ENQT instruction redefining the characteristics of that terminal.

Syntax Examples

1) Enqueue the system printer, $SYSPRTR.

```
        ENQT    $SYSPRTR
          •
          •
          •
        DEQT
```

2) Enqueue the device TTY1. The ENQT instruction refers to the IOCB labeled TERM1 for the name of the device. If TTY1 is not available, the program passes control to the label ALTERN and enqueues $SYSLOG.

```
TEST    PROGRAM  START
TERM1   IOCB     TTY1,PAGSIZE=24
START   EQU      *
        ENQT     TERM1,BUSY=ALTERN
          •
          •
          •
        DEQT
ALTERN  ENQT     $SYSLOG
          •
          •
          •
```

Coding Example

The first ENQT instruction in the program attempts to enqueue $SYSPRTR. If the device is busy, the program displays a message and attempts to enqueue an alternate printer ($SYSLIST). If the alternate printer is busy, the program waits for it. When the program obtains a printer, it executes the CALL instruction at the label GOTPRTR. The DEQT instruction at the label RELEASE releases exclusive control of the enqueued printer (either $SYSPRTR or $SYSLIST).

```
          •
          •
          •
GETPRTR   EQU      *
          ENQT     $SYSPRTR,BUSY=BUSYEXIT
          GOTO     GOTPRTR
BUSYEXIT  EQU      *
          PRINTEXT '$SYSPRTR IS BUSY. ATTEMPTING TO ENQT ALTERNATE'
          ENQT     PRTRIOCB
GOTPRTR   EQU      *
          CALL     SUBRTN
          •
          •
          •
RELEASE   EQU      *
          DEQT
          PROGSTOP
PRTRIOCB  IOCB     $SYSLIST
          ENDPROG
          END
```

ENTRY – Define a Program Entry Point

The ENTRY statement defines one or more labels as being entry points within a program module. Each ENTRY statemant allows a maximum of 10 labels. These entry-point labels can be referred to by instructions in other program modules that are link-edited with the module that defines the entry-point label. The program modules that refer to an entry-point label must contain either an EXTRN or WXTRN statement for the label.

Syntax:

blank	**ENTRY**	**one or more relocatable symbols separated by commas**
Required:	**one symbol**	
Defaults:	**none**	
Indexable:	**none**	

Operand	*Description*
symbol	One or more symbols that appear as instruction labels within the program module.

Coding Example

In module A, the first ENTRY statement signifies that the program can be entered at label GETTIME. In module B, the entry defines label GOTTIME as being an entry point. Both of these labels are also used with EXTRN statements so that their addresses can be resolved when the two modules are link-edited together. The second ENTRY statement in module A allows the time to be printed without 'THE TIME IS NOW ' text.

MODULE A

```
            •
            •
            •
          ENTRY     GETTIME
          ENTRY     GETTIME2
          EXTRN     GOTTIME
            •
            •
            •
GETTIME   EQU       *
          PRINTEXT  '@THE TIME IS NOW '
GETTIME2  EQU       *
          PRINTIME
          GOTO      GOTTIME
            •
            •
            •
```

MODULE B

```
            •
            •
            •
          ENTRY     GOTTIME
          EXTRN     GETTIME
            •
            •
            •
TIME      EQU       *
          GOTO      GETTIME
GOTTIME   EQU       *
            •
            •
            •
```

Note: The two ENTRY statements in module A also could be coded as follows:

```
          ENTRY  GETTIME,GETTIME2
```

EOR – Compare the Binary Values of Two Data Strings

The Exclusive OR instruction (EOR) compares the binary value of operand 2 with the binary value of operand 1. The instruction compares each bit position in operand 2 with the corresponding bit position in operand 1 and yields a result, bit by bit, of 1 or 0. If the bits compared are the same, the result is 0. If the bits compared are not the same, the result is 1. If both input fields are identical, the resulting field is 0. If one or more bits differ, the resulting field contains a mixture of 0s and 1s.

Syntax:

label	**EOR**	**opnd1,opnd2,count,RESULT=,** **P1=,P2=,P3=**
Required:	**opnd1,opnd2**	
Defaults:	**count=(1,WORD),RESULT=opnd1**	
Indexable:	**opnd1,opnd2,RESULT**	

Operand *Description*

opnd1 The label of the data area to be compared with opnd2. Opnd1 cannot be a self-defining term. The system stores the result of the operation in this operand unless you code the RESULT operand.

This operand can be a byte, word, or doubleword.

opnd2 The value compared with opnd1. You can specify a self-defining term or the label of a data area. This operand can be a byte, word, or doubleword.

count The number of consecutive values in opnd1 on which the operation is to be performed. The maximum value allowed is 32767.

The count operand can include the precision of the data. Select one precision that the system uses for opnd1, opnd2, and the resulting bit string. When specifying a precision, code the count operand in the form,

```
(n,precision)
```

where "n" is the count and "precision" is one of the following:

BYTE – byte precision
WORD – word precision (default)
DWORD – doubleword precision

The precision you specify for the count operand is the portion of opnd2 that is used in the operation. If the count is (3,BYTE), the system compares the first byte of data in opnd2 to the first three bytes of data in opnd1.

RESULT= The label of a data area or vector in which the result is to be placed. When you specify RESULT, the value of opnd1 does not change during the operation. This operand is optional.

Px= Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Syntax Examples

1) The EOR instruction compares the first byte of data in D to the first byte of data in C and places the result in R.

```
         EOR   C,D,(1,BYTE),RESULT=R
          •
          •
          •
C        DATA  X'92'       binary 1001 0010
D        DATA  X'8F'       binary 1000 1111
R        DATA  X'00'
```

After the operation, R contains:

X'1D' – hexidecimal

0001 1101 – binary.

2) The EOR instruction compares the first byte of data in OPER2 to the first three bytes of data in OPER1. The result of the operation is stored in RESULTX.

```
         EOR    OPER1,OPER2,(3,BYTE),RESULT=RESULTX
          •
          •
          •
OPER1    DC     X'00'      binary 0000 0000
         DC     X'A5'      binary 1010 0101
         DC     X'01'      binary 0000 0001
OPER2    DC     X'FF'      binary 1111 1111
RESULTX  DC     2F'0'
          •
          •
          •
```

After the operation, RESULTX contains:

X'FF5A FE00' – hexidecimal

1111 1111 0101 1010 1111 1110 0000 0000 – binary.

3) The EOR instruction compares the first byte of data in TEST to the first three bytes of data in INPUT. The result of the operation is stored in OUTPUT.

```
         EOR    INPUT,TEST,(3,BYTE),RESULT=OUTPUT
          •
          •
          •
INPUT    DC     C'1.2'     binary  1111 0001 0100 1010 1111 0010
TEST     DC     C'0.0'     binary  1111 0000
OUTPUT   DC     3C'0'      binary  1111 0000 1111 0000 1111 0000
          •
          •
          •
```

After the operation, OUTPUT contains:

0000 0001 1011 1010 0000 0010 – binary.

EQU – Assign a Value to a Label

The EQU statement assigns a value to a label. The value is a word in length. You can use the label you define with the EQU statement as an operand in other instructions that permit the use of labels. The "value" the statement assigns, or equates, to a label can consist of an integer constant, another label, an expression containing an arithmetic operator (for example, A+2), or an asterisk (*). See "Syntax Rules" on page 1-6 for a description of the four arithmetic operators: + (plus), – (minus), * (multiply), and / (divide).

Syntax:

label	**EQU**	**value**
Required:label,value		
Defaults:	**none**	
Indexable:	**none**	

Operand	*Description*
label	The label to be assigned a value. Do not define this label elsewhere in your program.
value	An integer constant, another label, an expression containing an arithmetic operator, or an asterisk (*). The asterisk points to the next available storage location in a program. It allows you to generate convenient labels that you can use within your program. Do not confuse this use of an asterisk with the arithmetic operator that signifies multiplication (*). Your program must define any labels you code for this operand before the system processes the EQU statement. For example, if you code: `A  EQU  B` you must have defined the label B in your program previously.

Special Considerations

Here are some things to consider when you use the EQU statement in your program:

- When you use the label on the EQU statement as an operand in another instruction, the system interprets the label as a storage address unless you include a plus (+) sign before it. The system interprets a label preceded by a plus sign as a constant.
- Because EQU assigns a word value to a label, a byte-precision move of a label preceded by a plus sign would only move the leftmost byte of the word. If you equated the label A to the value 4 (X'0004'), for example, the system would move only the value X'00'.
- If you equate a DATA or DC statement with a label, the system interprets the label as the address of the DATA or DC statement. If you try to use this label with a plus sign, however, the label will no longer point to the data when the load point of the program changes.

- You can equate a hexadecimal value to a label if the value can fit in a word (for example, X'FED1'). You can also equate one or two EBCDIC characters with a label (for example, C'AB'). You cannot form EQU expressions with the following types of data: H, D, E, and A. (See DATA/DC for a description of each of these data types.)

Syntax Examples

1) Assign a value of 2 (X'0002') to A.

```
A       EQU     2
```

2) Assign the value of A to label B. If A has a value of 5 (X'0005'), B also has a value of 5.

```
B       EQU     A
```

3) Assign the value of B plus 2 bytes to label A.

```
A       EQU     B+2
```

4) CALLA is equivalent to CALLSUB. The asterisk (*) points to the next available storage location in the program.

```
        GOTO    CALLA
         •
         •
         •
CALLA   EQU     *
CALLSUB CALL    PROGA
```

5) Move the contents at address X'0002' to C.

```
A       EQU     2
        MOVE    C,A
```

6) Move A, a value of 2, to C.

```
A       EQU     2
        MOVE    C,+A
```

7) Move 7 to the indexed location of A plus #1.

```
A       EQU     2
        MOVE    (A,#1),7
```

8) Add the value of C (X'0002') to D (X'0008'). The example defines the labels B and A before they appear in the EQU statements.

```
SAMPLE  PROGRAM  START
B       DATA     F'2'
START   EQU      *
        •
        •
        •
C       EQU      B
        ADD      D,C
        PROGSTOP
A       DATA     F'8'
D       EQU      A
```

9) A has a word value of X'0005'. The leftmost byte (value X'00') moves to location C.

```
A       EQU    5
        MOVE   C,+A,(1,BYTE)
```

10) Equate C to the address of F'0'. Move a value of 0 into TEMP.

```
C       EQU    *
        DATA   F'0'
        MOVE   TEMP,C
```

11) HERE has a value of 20. Move a value of 0 to address X'0014'.

```
HERE    EQU    20
        MOVE   HERE,0
```

Coding Example

The following program moves data from three storage locations labeled A, C, and E. Label A is equal to the address of B times 2. Label C is equal to the address of D divided by 4. Label E is equal to the address of F divided by 5.

If the address of B is X'0052', the arithmetic expression B*2 refers to address X'00A4'. If the address of D is X'0054', the arithmetic expression D/4 refers to address X'0015'. For label F, if the address is X'0056', the arithmetic expression F/5 yields the address X'0017'. The system disregards the remainder in an arithmetic expression using the divide operator.

```
OPERATOR   PROGRAM    START
START      EQU        *
            •
            •
            •
M1         MOVE       HOLD1,A
M2         MOVE       HOLD2,C
M3         MOVE       HOLD3,E
            •
            •
            •
           PROGSTOP
HOLD1      DATA       F'0'
HOLD2      DATA       F'0'
HOLD3      DATA       F'0'
B          DATA       F'1'
D          DATA       F'2
F          DATA       F'3'
*******************************
A          EQU        B*2
C          EQU        D/4
E          EQU        F/5
*******************************
           ENDPROG
           END
```

ERASE – Erase Portions of a Display Screen

The ERASE instruction clears or blanks a portion of a display screen. The instruction is only for terminals that have static screens. You can specify a static screen with the SCREEN operand of the TERMINAL statement or the IOCB instruction.

With a 4978, 4979 or 4980 terminal, the ERASE instruction clears a portion of the screen by setting that portion to a no data (null characters) condition. For a 3101 terminal in block mode, the instruction normally clears a portion of the screen by writing unprotected blanks to that area.

The ERASE instruction works differently on a 4978, 4979, or 4980 terminal than it does on a 3101 terminal in block mode. These differences are described under "31xx Display Considerations" on page 2-139.

The supervisor places a return code in the first word of the task control block (taskname) whenever an ERASE instruction causes a terminal I/O operation to occur. If the return code is not a −1, the address of this instruction will be placed in the second word of the task control block (taskname+2). The terminal I/O return codes are described at the end of the PRINTEXT and READTEXT instructions in this manual and also in *Messages and Codes*.

Note: Any references to **31xx** terminals means 3101, 3151, 3161, 3163, and 3164 terminals, unless otherwise noted.

Syntax:

label	**ERASE**	**count,MODE=,TYPE=,SKIP=,LINE=,SPACES=**
Required:	**none**	
Defaults:	**count=maximum,MODE=FIELD,TYPE=DATA,**	
	SKIP=0,LINE=current line,SPACES=0	
Indexable:	**count,SKIP,LINE,SPACES**	

Operand	*Description*
count	The number of bytes to be erased. Both nonprotected and protected characters contribute to the count, even if only nonprotected characters are to be erased. The ERASE instruction can erase up to an entire logical screen.
MODE=	FIELD, to end the erase operation when the display characters change from nonprotected to protected, or when the operation reaches the end of the current line. LINE, to end the erase operation at the end of the current line. SCREEN, to end the erase operation at the end of the logical screen.

When the ERASE instruction erases the number of bytes you specified for the count, the operation will end. It will do so even though the condition you specified on the MODE operand is not satisfied. The MODE operand determines the end of the erase operation if you do not code a count value or if the condition you specify for MODE= occurs before the instruction erases the number of bytes in count.

TYPE= DATA, to erase only unprotected characters.

ALL, to erase both protected and unprotected characters.

SKIP= The number of lines to be skipped before the system does an I/O operation. For example, if your cursor is at line 2 on a display screen and you code SKIP=6, the system does the I/O operation on line 8. For a printer, the SKIP operand controls the movement of forms.

The SKIP operand causes the system to display or print the contents of the system buffer.

If you specify a value greater than or equal to the logical page size, the system divides this value by the page size and uses the remainder in place of the value you specify.

LINE= The line number on which the system is to do an I/O operation. Code a value between zero and the number of the last usable line on the page or logical screen. The line count begins at the top margin you defined for the printer or display screen. LINE=0 positions the cursor at the top line of the page or screen you defined; LINE=1 positions the cursor at the second line of the page or screen.

For printers, if you code a value less than or equal to the current line number, the system does the I/O operation at the specified line on the next page or logical screen. For static screens, if you code a value within the limits of the logical screen, the system does the I/O operation on the line you specified.

If you code a value greater than the last usable line number, the system divides this value by the logical page size and uses the remainder as the line number on which to do the I/O operation. For example, if you code LINE=22 and your static screen has a logical page size of 20, the I/O operation occurs on the second line of the logical screen.

The LINE operand causes the system to print or display the contents of the system buffer.

SPACES= The number of spaces to indent before the system does an I/O operation. SPACE=0, the default, positions the cursor at the beginning of the left side of the page or screen. If the value you specify is beyond the limits of the logical screen or page, the system indents the next line by the excess number of spaces.

When you code the LINE or SKIP operands with SPACES, the system begins indenting from the left margin of the page or screen. If you specify SPACES without coding LINE or SKIP, the system begins indenting from the last cursor position on the line.

31xx Display Considerations

The following considerations apply to the use of the ERASE instruction on a 31xx terminal in block mode.

If you code an ERASE instruction in with TYPE=DATA, the system ignores the count value. The instruction erases from the current cursor position to the end of the screen, clearing all unprotected data.

If you code TYPE=ALL on the ERASE instruction, the erase operation ends when the instruction erases the number of bytes in count, or when the operation reaches the end of a logical screen (whichever happens first). The default for count, when you code TYPE=ALL, is from the current cursor position to the end of the screen.

The system clears the entire 31xx screen if the cursor is in the home position (line zero,space zero), and an ERASE instruction with a count of 1920 executes.

The MODE operand on the ERASE instruction is affected by the TYPE operand in the following ways:

- MODE defaults to MODE=SCREEN if you code TYPE=DATA. The system forces the MODE operand to SCREEN even if you code MODE=LINE or MODE=FIELD.
- You can code the MODE=SCREEN or MODE=LINE if you code TYPE=ALL.
- The system forces the MODE operand to MODE=LINE if you code MODE=FIELD with TYPE=ALL.

If you code an ERASE instruction after a READTEXT instruction and the READTEXT buffer or TEXT statement is smaller than the number of characters actually transmitted by the 31xx, you will need a delay between the READTEXT and ERASE instructions. The delay is necessary because your program should not issue an ERASE instruction until the 31xx completes sending the screen buffer. Depending on your application, you can use either an STIMER or WAIT KEY instruction to cause the delay.

Syntax Examples

1) Erase 4 bytes of unprotected data. End operation if protected data or the end of the line is reached.

```
ERASE  4,MODE=FIELD,TYPE=DATA
```

2) Erase the entire screen of protected and unprotected data.

```
ERASE  LINE=0,SPACES=0,MODE=SCREEN,TYPE=ALL
```

3) Erase all protected and unprotected data on line 1 of the screen.

```
ERASE  LINE=1,MODE=LINE,TYPE=ALL
```

Coding Examples

1) The following example is part of a program a company uses to update its personnel files. The example shows how you can use the ERASE instruction to erase portions of a display screen, and it begins by enqueuing the terminal from which the program is loaded. The ENQT instruction refers to the label of an IOCB instruction that sets up a static screen for the terminal. This example assumes that the enqueued terminal is a 4978 or 4980.

The ERASE instruction at label E1 clears the entire screen, erasing both protected and unprotected characters (TYPE=ALL). Once the program erases the screen, it asks the operator to enter the employee's name and address in the three fields it displays on the screen. The WAIT key at label W1 prevents the program from reading the data until the operator presses the enter key. When the operator presses the enter key, the first READTEXT instruction reads in the data from the name field, the second READTEXT instruction reads in the data from the street field, and the third READTEXT instruction reads in data from the city field.

After the READTEXT instructions execute, the ERASE instructions at labels E2 through E4 erase all the data the operator entered on the screen. The ERASE instruction at label E2 clears the name field and ends after erasing 71 bytes of unprotected data. The count value overrides the MODE=SCREEN operand. The ERASE instruction at label E3 defaults to MODE=FIELD and clears the street field. The instruction stops erasing when it reaches the end of the line. The last ERASE instruction at label E4 clears the city field and continues to erase to the end of the line because MODE=LINE is coded.

```
          •
          •
          •
          ENQT     TERMINAL
E1        ERASE    MODE=SCREEN,TYPE=ALL,LINE=0
          PRINTEXT MSG1,LINE=4,SPACES=2,PROTECT=YES
          PRINTEXT MSG2,LINE=5,SPACES=2,PROTECT=YES
          PRINTEXT FIELD1,LINE=6,SPACES=2,PROTECT=YES
          PRINTEXT FIELD2,LINE=7,SPACES=2,PROTECT=YES
          PRINTEXT FIELD3,LINE=8,SPACES=2,PROTECT=YES
W1        WAIT     KEY
          READTEXT NAME,LINE=6,SPACES=11,MODE=LINE
          READTEXT STREET,LINE=7,SPACES=11,MODE=LINE
          READTEXT CITY,LINE=8,SPACES=11,MODE=LINE
E2        ERASE    71,MODE=SCREEN,TYPE=DATA,LINE=6,SPACES=11
E3        ERASE    LINE=7,SPACES=11
E4        ERASE    MODE=LINE,LINE=8,SPACES=11
          DEQT
          PROGSTOP
TERMINAL  IOCB     SCREEN=STATIC
MSG1      TEXT     'ENTER EMPLOYEE'S NAME, STREET ADDRESS, AND CITY'
MSG2      TEXT     'IN THE LABELED FIELDS.  PRESS ENTER WHEN FINISHED'
FIELD1    TEXT     ' NAME  : '
FIELD2    TEXT     ' STREET: '
FIELD3    TEXT     ' CITY  : '
NAME      TEXT     LENGTH=40
STREET    TEXT     LENGTH=60
CITY      TEXT     LENGTH=30
          ENDPROG
          END
```

2) The example that follows is similar to Example 1 but uses a 31xx terminal in block mode. The example begins by enqueuing the 31xx terminal. The IOCB instruction labeled TERMINAL sets up a static screen and a temporary I/O buffer for the device. The buffer area, labeled BUFFER, is 1920 bytes long.

As shown in Example 1, the ERASE instruction at label E1 erases the entire screen of protected and unprotected data. The program then issues a message asking the operator to enter the employee's name and address in three fields: NAME, STREET, and CITY. The program creates unprotected fields for the operator's input with the PRINTEXT instructions at labels P1, P2, and P3.

The WAIT key at label W1 prevents the program from reading the data until the operator presses the SEND key. When the operator presses the SEND key, the READTEXT instruction reads the entire display screen (protected and unprotected data) into the buffer area. A READTEXT instruction on 31xx terminals in block mode starts reading at the beginning of the display screen if it does not issue a prompt message. The program reads the entire screen into the buffer area and then moves the desired data from the name, street, and city fields into three text buffers.

The ERASE instructions at label E2 through E4 erase all the employee data the operator entered on the screen. TYPE=ALL is coded on the ERASE instructions so that the count operand is not ignored. The ERASE instruction at label E2 clears the name field and ends after erasing 71 bytes of unprotected and protected data. The count value overrides the MODE=SCREEN operand. The ERASE instruction at label E3 clears the street field and also ends after erasing 71 bytes of protected and unprotected data. Because the instruction has TYPE=ALL, the system changes the default MODE=FIELD to MODE=LINE. The last ERASE instruction at label E4 clears the city field and ends after erasing 20 bytes of protected and unprotected data.

Note: The coding of the data fields in this example differs slightly from Example 1 to allow for the attribute byte at the beginning of each field.

```
          .
          .
          .
          ENQT     TERMINAL
E1        ERASE    MODE=SCREEN,TYPE=ALL,LINE=0
          PRINTEXT MSG1,LINE=4,SPACES=1,PROTECT=YES
          PRINTEXT MSG2,LINE=5,SPACES=1,PROTECT=YES
          PRINTEXT FIELD1,LINE=6,SPACES=2,PROTECT=YES
P1        PRINTEXT NAME,LINE=6,SPACES=10,PROTECT=NO
          PRINTEXT FIELD2,LINE=7,SPACES=2,PROTECT=YES
P2        PRINTEXT STREET,LINE=7,SPACES=10,PROTECT=NO
          PRINTEXT FIELD3,LINE=8,SPACES=2,PROTECT=YES
P3        PRINTEXT CITY,LINE=8,SPACES=10,PROTECT=NO
W1        WAIT     KEY
          READTEXT BUFFER,TYPE=ALL,MODE=LINE,LINE=0,SPACES=0
          MOVEA    #1,BUFFER
          MOVE     NAME,(492,#1),(40,BYTES)
          MOVE     STREET,(572,#1),(60,BYTES)
          MOVE     CITY,(652,#1),(7,BYTES)
E2        ERASE    71,MODE=SCREEN,TYPE=ALL,LINE=6,SPACES=11
E3        ERASE    71,LINE=7,SPACES=11,TYPE=ALL
E4        ERASE    20,MODE=SCREEN,LINE=8,SPACES=11,TYPE=ALL
          DEQT
          PROGSTOP
TERMINAL  IOCB     SCREEN=STATIC,BUFFER=BUFFER
MSG1      TEXT     'ENTER EMPLOYEE'S NAME, STREET ADDRESS, AND CITY'
MSG2      TEXT     'IN THE LABELED FIELDS.  PRESS ENTER WHEN FINISHED'
FIELD1    TEXT     'NAME  :'
FIELD2    TEXT     'STREET:'
FIELD3    TEXT     'CITY  :'
NAME      TEXT     LENGTH=40
STREET    TEXT     LENGTH=60
CITY      TEXT     LENGTH=30
BUFFER    BUFFER   1920,BYTES
          ENDPROG
          END
```

EXBREAK – Break Circular Chained DCBs

The EXBREAK instruction enables you to break a circular chain of DCBs. Once you initiate the I/O with an EXIO start I/O request, you can "break" the chained DCBs at whichever DCB you specify in the EXBREAK instruction.

When using this instruction, code operands 1 and 2 as absolute values.

Note: You cannot use the EXBREAK instruction with extended address mode support.

Syntax:

label	**EXBREAK devaddr,dcb,ERROR=,P1=,P2=**
Required:	**devaddr,dcb**
Defaults:	**none**
Indexable:	**none**

Operand	*Description*
devaddr	The device address. Specify two hexadecimal digits.
dcb	The number of the DCB in the chain of DCBs where the break will occur. EXBREAK will turn this DCB's chaining flag off. The number must be a self-defining term. It cannot be a label or variable.
ERROR=	The label of the first instruction to be executed if an error occurs during the execution of this instruction.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Syntax Example

The following example removes the chaining flag in DCB number 2 for the EXIO device at address X'08'.

```
EXOPEN      08,EXIOADDR
EXIO        PREPARE
              •
              •
              •
EXIO        CIRCIOCB
EXBREAK     08,02
```

Return Codes

Return Code	Description
19	DCB specified in the EXBREAK instruction was not in the valid range.
20	DCB specified in EXBREAK instruction was found, but the chaining bit was not on.
21	Device address specified in the EXBREAK instruction has no circular chained I/O in progress.

Special Consideration

I/O activity continues until the I/O operation detects the DCB with the chain bit off.

EXCLOSE – Close an EXIO Device

The EXCLOSE instruction closes, or disables, an EXIO device that you opened with the EXOPEN instruction.

Syntax:

label	**EXCLOSE devaddr,ERROR=,P1=**
Required:	**devaddr**
Defaults:	**none**
Indexable:	**none**

Operand	*Description*
devaddr	The device address. Specify two hexadecimal digits.
ERROR=	The label of the first instruction to be executed if an error occurs during the execution of this instruction.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Syntax Example

Close the EXIO device at the address X'08'.

```
EXOPEN   08,EXIOADDR
EXIO     PREPARE
 •
 •
 •
EXCLOSE  08
```

EXIO – Execute I/O

The EXIO instruction executes a command in an immediate device control block (IDCB) that you define using the IDCB statement. This instruction can execute only in a static partition. Attempting to read or write to a dynamic partition will produce unpredictable results.

See "EXBREAK – Break Circular Chained DCBs" on page 2-143 for information on breaking circular chained I/O.

Syntax:

label	**EXIO**	**idcb,ERROR=,P1=**
Required:	**idcb**	
Defaults:	**none**	
Indexable:	**idcb**	

Operand	*Description*
idcb	The label of an IDCB statement.
ERROR=	The label of the first instruction to be executed if an error occurs during the operation. This instruction will not be executed if an error is detected at the occurrence of an interrupt caused by the command. The condition code (ccode) returned at interrupt time is posted in an ECB (see the EXOPEN instruction). **Note:** If the ECB being posted has not been reset, then the system posts the ECB provided for posting after an exception interrupt. A "device busy" bit is set on by the EXIO instruction if a START command is executed. It is reset after the device interrupts if the operation is complete. If a device fails to interrupt or complete an operation, it will be necessary to reset the "device busy" bit so that another command may be executed. The device busy bit can be reset by issuing an EXIO instruction to the appropriate IDCB that points to an IDCB instruction with COMMAND=RESET.
P1=	Parameter naming operand. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code this operand.

Coding Example

In the following example, the first instruction (EXOPEN) specifies that, for the device at address X'08', information returned after an EXIO device interrupt is to be returned at the addresses pointed to by the 3 words following the EXIOADDR label.

The first EXIO instruction prepares the device at address X'08' so it can interrupt on level 1.

The second EXIO instruction resets the device so any incomplete I/O operation is ended.

The third EXIO instruction issues a START I/O command with the IDCB labeled STARTRD. The STARTRD IDCB uses the DCB labeled WRITEDCB. WRITEDCB is built for an ACCA device so that a WRITE operation will be executed with the receiving station having the capability to BREAK the transmission. The TIMER1 (pre and posttransmit delays) value is set to 33 milliseconds and the TIMER2 value (HALF-DUPLEX TURNAROUND) is set to 6.6 milliseconds. There is to be no DCB chaining and 12 bytes of data are to be transmitted starting at the address labeled MSG.

```
OPEN      EQU     *
          EXOPEN  08,EXIOADDR
          EXIO    PREPARE
           •
           •
           •
          EXIO    RESET
           •
           •
           •
          EXIO    STARTRD,ERROR=IOERROR
          EXCLOSE 08
           •
           •
           •
IOERROR   EQU     *
          PRINTEXT '@IOERROR OCCURRED DURING INITIALIZATION@'
           •
           •
           •
MSG       DATA  X'54484953'
          DATA  X'20414E20'
          DATA  X'41534349'
*
PREPARE   IDCB  COMMAND=PREPARE,ADDRESS=08,LEVEL=1,IBIT=1
RESET     IDCB  COMMAND=RESET,ADDRESS=08
STARTRD   IDCB  COMMAND=START,ADDRESS=08,DCB=WRITEDCB
*
WRITEDCB  DCB   IOTYPE=OUTPUT,DEVMOD=03,DVPARM1=0,DVPARM2=0002,       X
               DVPARM3=000A,DVPARM4=0, CHAINAD=0,COUNT=12,DATADDR=MSG
*
EXIOADDR  DATA  A(EXIO1)          POINTER TO 3-WORD INTERRUPT BLOCK
          DATA  A(EXECBS)         ADDRESS OF ECB ADDRESSES
          DATA  A(EXSCSDCB)       ADDRESS OF START CYCLE STEAL STATUS DCB
EXIO1     DATA  F'0'              INTERRUPT ID WORD
          DATA  F'0'              LSR AT INTERRUPT
          DATA  F'0'              ADDRESS OF ECB POSTED
*
EXECBS    DATA  A(EXCEND)         CONDITION CODE 0 ECB ADDR
          DATA  F'0'              NOT USED
          DATA  A(EXEXECP)        CONDITION CODE 2 ECB
          DATA  A(EXDEND)         CONDITION CODE 3 ECB ADDR
*
EXSCSDCB  DCB   IOTYPE=INPUT,COUNT=6,DATADDR=EXSCSWDS
*                                 START CYCLE STEAL STATUS DCB
EXSCSWDS  DATA  3F'0'
EXCEND    ECB   0                 CONTROLLER END ECB
EXEXECP   ECB   0                 EXCEPTION ECB
EXDEND    ECB   0                 DEVICE END ECB
```

Note: Additional examples using EXIO are shown in the *Customization Guide*.

Return Codes

The following codes are issued by the EXIO, EXOPEN, and EXBREAK instructions and are returned in word 0 of the TCB. Word 1 of the TCB contains the supervisor instruction address.

Return Code	Condition
−1	Command accepted.
1	Device not attached.
2	Busy.
3	Busy after reset.
4	Command reject.
5	Intervention required.
6	Interface data check.
7	Controller busy.
8	Channel command not allowed.
9	No DDB found.
10	Too many DCBs chained.
11	No address specified for residual status.
12	EXIODEV specified zero bytes for residual status.
13	Broken DCB chain (program error).
16	Device already opened.
17	Device not opened or already closed.
18	Attempt to read or write to dynamic partition failed. Use a static partition.
19	DCB specified in the instruction was not in the valid range.
20	DCB specified in EXBREAK instruction was found, but the chaining bit was not on.
21	Device address specified in the instruction has no circular chained I/O in progress.

Interrupt Codes

The following codes are issued when an EXIO instruction completes successfully but the hardware performing the operation encounters an error. The hardware interrupt condition codes are returned in bits 4 – 7 of the ECB (word 0). If bit 0 is on, then bits 8 – 15 equal the device address.

Return Code	Condition
0	Controller end.
1	Program Controlled Interrupt (PCI).
2	Exception.
3	Device end.
4	Attention.
5	Attention and PCI.
6	Attention and exception.
7	Attention and device end.
8	Not used.
9	Not used.
10	SE on and too many DCBs chained.
11	SE on and no address specified for residual status.
12	SE on and EXIODEV specified no bytes for residual status.
13	Broken DCB chain.
14	ECB to be posted not reset.
15	Error in Start Cycle Steal Status (after exception).

EXOPEN – Open an EXIO Device

The EXOPEN instruction opens an EXIO device and specifies the locations where information is to be returned after an EXIO device interrupt. EXOPEN does not reset device status or device busy.

Syntax:

label	**EXOPEN devaddr,listaddr,ERROR=,P1=,P2=**
Required:	**devaddr,listaddr**
Defaults:	**none**
Indexable:	**listaddr**

Operand ***Description***

devaddr The device address. Specify 2 hexadecimal digits.

listaddr The label of a 3-word list containing the following addresses:

Word 1 The address of a 3-word block where, after an interrupt, the system will store:

1. Interrupt ID word
2. Level status register at time of the interrupt
3. Address of ECB posted.

Note: If this address is zero, the information is not returned.

Word 2 The address of a list of ECB addresses. The interrupt condition code (ccode) received from the device will determine which ECB in the list will be posted. A ccode=0 will cause posting at the first ECB in the list, and so on. The same ECB can be specified for more than one condition code. The ECB specified for ccode=2 (exception) will be posted in the event of a program error. The posting code contains:

Bit 0 of the posting code is on (1). Bits 4–7 contain the ccode; bits 8–15 contain the device address.

Interrupt condition codes are shown in "Return Codes" on page 2-148.

Word 3 The address of a DCB statement containing the parameters of a start cycle steal status operation. This operation will be started by the system, using this DCB, if an exception interrupt is received from this device. If this address is zero, the operation is not performed.

ERROR= The label of the first instruction to be executed if an error is encountered during the execution of this instruction.

Px= Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Note: Refer to the description manual for the processor in use for more information on interrupt ID, level status register, interrupt condition codes, and DCBs. Refer to the description manual for the device in use for information on the causes of various condition codes and the status information available using start cycle steal status.

Coding Example

The EXOPEN instruction specifies that, for the device at address X'08', information returned after an EXIO device interrupt is to be returned at the addresses pointed to by the 3 words following the EXIOADDR label.

```
OPEN      EQU     *
          EXOPEN  08,EXIOADDR
           •
           •
           •
          EXCLOSE 08
           •
           •
           •
EXIOADDR  DATA  A(EXIO1)          POINTER TO 3-WORD INTERRUPT BLOCK
          DATA  A(EXECBS)         ADDRESS OF ECB ADDRESSES
          DATA  A(EXSCSDCB)       ADDRESS OF START CYCLE STEAL STATUS DCB
EXIO1     DATA  F'0'              INTERRUPT ID WORD
          DATA  F'0'              LSR AT INTERRUPT
          DATA  F'0'              ADDRESS OF ECB POSTED
*
EXECBS    DATA  A(EXCEND)         CONDITION CODE 0 ECB ADDR
          DATA  F'0'              NOT USED
          DATA  A(EXEXECP)        CONDITION CODE 2 ECB
          DATA  A(EXDEND)         CONDITION CODE 3 ECB ADDR
*
EXSCSDCB  DCB   IOTYPE=INPUT,COUNT=6   START CYCLE STEAL STATUS DCB
EXSCSWDS  DATA  3F'0'
EXCEND    ECB   0                 CONTROLLER END ECB
EXEXECP   ECB   0                 EXCEPTION ECB
EXDEND    ECB   0                 DEVICE END ECB
```

Return Codes and Interrupt Codes

For a list of return codes and interrupt condition codes, see the EXIO instruction.

EXTRN – Resolve External Reference Symbols

The EXTRN and WXTRN statements identify labels that are not defined within an object module. These labels reside in other object modules that will be link-edited to the module containing the EXTRN or WXTRN statements. The system resolves the reference to an EXTRN or WXTRN label when you link-edit the object module containing the EXTRN or WXTRN statement with the module that defines the label. The module that defines the label must contain an ENTRY statement for that label. (See the ENTRY statement for more information.)

If the system cannot resolve a label during the link-edit, it assigns the label the same address as the beginning of the program. You can include up to 255 EXTRN and WXTRN symbols in your program.

WXTRN labels are resolved only by labels that are contained in modules included by the INCLUDE statement in the link-edit process or by labels found in modules called by the AUTOCALL function. However, WXTRN itself does not trigger AUTOCALL processing.

Only labels defined by EXTRN statements are used as search arguments during the AUTOCALL processing function of $EDXLINK. Any additional external labels found in the module found by AUTOCALL are used to resolve both EXTRN and WXTRN labels. Refer to the description of $EDXLINK in the *Operator Commands and Utilities Reference* for further information.

The main difference between the WXTRN and EXTRN statements is that you must resolve an EXTRN label at link-edit time. It is not necessary to resolve a WXTRN label at link-edit time. The unresolved label coded as an EXTRN receives an error return code from the link process. The same unresolved label coded as a WXTRN receives a warning return code. Both the error and the warning codes indicate unresolved labels. If you know that your application program does not need a label resolved, code it as a WXTRN and your program should execute successfully. Your application will not execute correctly, however, if you try to reference an unresolved label coded in your application program as a WXTRN.

Syntax:

blank	**EXTRN**	**label**
blank	**WXTRN**	**label**
Required:	**one label**	
Defaults:	**none**	
Indexable:	**none**	

Operand	*Description*
label	An external label. You can code up to 10 labels, separated by commas, on a single EXTRN or WXTRN statement.

Coding Example

The following coding example shows a use of the EXTRN statement.

The labels DATA1, DATA2, LABEL1, and LABEL2 are defined outside this module. The ADD instruction adds the values at DATA1 and DATA2 although the values are defined outside the module where they are being added. The GOTO instructions also can pass control to the two externally defined labels, LABEL1 and LABEL2.

Each of the external labels could have been entered on a separate line, or all three of the EXTRN labels could have been entered with a single EXTRN statement.

```
          •
          •
          •
          EXTRN    DATA1,DATA2
          EXTRN    LABEL1
          WXTRN    LABEL2
          •
          •
          •
          ADD      DATA1,DATA2,RESULT=INDEX
          IF       (INDEX,GT,6)
             GOTO  LABEL1
          ELSE
             GOTO  LABEL2
          ENDIF
          •
          •
          •
INDEX     DATA     F'0'
          •
          •
          •
```

FADD – Add Floating-Point Values

The floating-point add instruction (FADD) adds a floating-point value in operand 2 to a floating-point value in operand 1. You can use positive or negative values.

You must code FLOAT=YES on the PROGRAM statement of a program using floating-point instructions in its initial task and on the TASK statement of every task containing floating-point instructions.

Syntax:

label	**FADD opnd1,opnd2,RESULT=,PREC=,P1=,P2=,P3=**
Required:	**opnd1,opnd2**
Defaults:	**RESULT=opnd1,PREC=FFF**
Indexable:	**opnd1,opnd2,RESULT**

Operand	*Description*
opnd1	The label of the data area to which opnd2 is added. Opnd1 cannot be a self-defining term. The system stores the result of the operation in opnd1 unless you code the RESULT operand.
opnd2	The value added to opnd1. You can specify a self-defining term or the label of a data area. The valid range for this operand is from −32768 to +32767.
RESULT=	The label of a data area in which the result is to be placed. When you specify RESULT, the value of opnd1 does not change during the operation. This operand is optional.
PREC=	All possible combinations of single and extended precision are permitted. An immediate value for opnd2 will be converted to a single-precision value regardless of any other method of precision specification discussed in the following paragraphs. The PREC operand is specified as xyz where x, y, and z are characters representing the precision of opnd1, opnd2, and the RESULT operands, respectively. Either 2 or 3 characters can be specified depending on whether the RESULT operand was coded. Permissible characters are: F – Single-precision (32 bits) L – Extended-precision (64 bits) * – Default (single-precision) The default is single precision.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Index Registers

You cannot use the index registers (#1 and #2) as operands in floating-point operations because they are only 16 bits in length. You can, however, use the software registers to specify the address of a floating-point operand.

Syntax Examples

1) The FADD instruction adds two single-precision floating-point values and stores the result in RESULTF.

```
FLOAT    PROGRAM   START,FLOAT=YES
          •
          •
          •
         FADD      OP1F,OP2F,RESULT=RESULTF,PREC=FFF
          •
          •
          •
OP1F     DC        E'1.5'
OP2F     DC        E'0.2'
RESULTF  DC        E'0'
```

After the FADD operation, RESULTF contains the value 1.70 .

2) The FADD instruction adds two extended-precision floating-point values and stores the result in RESULTL.

```
FLOAT    PROGRAM   START,FLOAT=YES
          •
          •
          •
         FADD      OP1L,OP2L,RESULT=RESULTL,PREC=LLL
          •
          •
          •
OP1L     DC        L'50000.5'
OP2L     DC        L'40.4'
RESULTL  DC        L'0'
```

After the FADD operation, RESULTL contains the value 50040.90 .

3) The FADD instruction adds two single-precision floating-point values written in exponent (E) notation. The result is stored in RESULTFE.

```
FLOAT    PROGRAM   START,FLOAT=YES
          •
          •
          •
         FADD      OP1FE,OP2FE,RESULT=RESULTFE,PREC=FFF
          •
          •
          •
OP1FE    DC        E'2.5E+1'       Equals decimal 25.0
OP2FE    DC        E'0.5E-1'       Equals decimal .05
RESULTFE DC        E'0'
```

After the FADD operation, RESULTFE contains the value .2505E+02 . This value is equal to the decimal value 25.05 .

Return Codes

Return codes are returned in the first word of the task control block (TCB) of the program or task issuing the instruction. The label of the TCB is the label of your program or task (taskname). You must test for the return code immediately after the floating-point instruction is executed or the code may be destroyed by any instructions that follow.

Return Code	Description
−1	Successful completion.
1	Floating-point overflow.
5	Floating-point underflow.

FDIVD – Divide Floating-Point Values

The floating-point divide instruction (FDIVD) divides a floating-point value in operand 1 by a floating-point value in operand 2. You can use positive or negative values.

You must code FLOAT=YES on the PROGRAM statement of a program that uses floating-point instructions in its initial task and on the TASK statement of every task containing floating-point instructions.

Syntax:

label	**FDIVD**	**opnd1,opnd2,RESULT=,PREC=,** **P1=,P2=,P3=**
Required:	**opnd1,opnd2**	
Defaults:	**RESULT=opnd1,PREC=FFF**	
Indexable:	**opnd1,opnd2,RESULT**	

Operand	*Description*
opnd1	The label of the data area containing the value divided by opnd2. Opnd1 cannot be a self-defining term. The system stores the result of the operation in opnd1 unless you code the RESULT operand.
opnd2	The value by which opnd1 is divided. You can specify a self-defining term or the label of a data area. The valid range for this operand is from −32768 to +32767.
RESULT=	The label of a data area in which the result is to be placed. When you code RESULT, the value of opnd1 does not change during the operation.
PREC=	All possible combinations of single and extended precision are permitted. An immediate value for opnd2 will be converted to a single-precision value regardless of any other method of precision specification discussed in the following paragraphs. The PREC operand is specified as xyz where x, y, and z are characters representing the precision of opnd1, opnd2, and the RESULT operands, respectively. Either 2 or 3 characters can be specified depending on whether the RESULT operand was coded. Permissible characters are: F – Single-precision (32 bits) L – Extended-precision (64 bits) * – Default (single-precision) The default is single precision.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Index Registers

You cannot use the index registers (#1 and #2) as operands in floating-point operations because they are only 16 bits in length. You can, however, use the software registers to specify the address of a floating-point operand.

Syntax Examples

1) The FDIVD instruction divides two single-precision floating-point values and stores the result in RESULTF.

```
FLOAT    PROGRAM   START,FLOAT=YES
          •
          •
          •
         FDIVD     OP1F,OP2F,RESULT=RESULTF,PREC=FFF
          •
          •
          •
OP1F     DC        E'1.5'
OP2F     DC        E'0.2'
RESULTF  DC        E'0'
```

After the FDIVD operation, RESULTF contains the value 7.50 .

2) The FDIVD instruction divides two extended-precision floating-point values and stores the result in RESULTL.

```
FLOAT    PROGRAM   START,FLOAT=YES
          •
          •
          •
         FDIVD     OP1L,OP2L,RESULT=RESULTL,PREC=LLL
          •
          •
          •
OP1L     DC        L'50000.5'
OP2L     DC        L'40.4'
RESULTL  DC        L'0'
```

After the FDIVD operation, RESULTL contains the value 1237.64 .

3) The FDIVD instruction divides two single-precision floating-point values written in exponent (E) notation. The result is stored in RESULTFE.

```
FLOAT    PROGRAM   START,FLOAT=YES
          •
          •
          •
         FDIVD     OP1FE,OP2FE,RESULT=RESULTFE,PREC=FFF
          •
          •
          •
OP1FE    DC        E'2.5E+1'       Equals decimal 25.0
OP2FE    DC        E'0.5E-1'       Equals decimal .05
RESULTFE DC        E'0'
```

After the FDIVD operation, RESULTFE contains the value .5000E+03 . This value is equal to the decimal value 500 .

Return Codes

Return codes are returned in the first word of the task control block (TCB) of the program or task issuing the instruction. The label of the TCB is the label of your program or task (taskname). You must test for the return code immediately after the floating-point instruction is executed or the code may be destroyed by any instructions that follow.

Return Code	Description
−1	Successful completion.
1	Floating point overflow.
3	Floating point divide check (divide by 0).
5	Floating point underflow.

FIND – Locate a Character

The FIND instruction searches a character string for the first occurrence of a specific character (byte).

Syntax

label	**FIND**	**character,string,length,where,** **notfound,DIR=,P1=,P2=,P3=,P4=,P5=**
Required:	**character, string, length, where, notfound**	
Defaults:	**DIR=FORWARD**	
Indexable:	**string, length, and where**	

Operand	*Description*
character	The character that is the object (target) of the search. You can specify a text character or a hexadecimal value.
string	The label of the string to be searched. The search will begin at the address of the label.
length	The number of bytes to be searched. You can code a positive integer or the label of a data area containing a positive integer.
where	The label of a data area where the address of the target character is to be stored if it is found. If the target character is not found, this data area remains unchanged.
notfound	The label of the instruction to be executed if the target character is not found.
DIR=	FORWARD (the default), to search from left to right. REVERSE, to search from right to left.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Syntax Examples

1) The FIND instruction searches the first 20 bytes of MSG1 for the character '$'. If it finds a $, it stores the address of the character in the data area labeled POINTER. If the instruction does not find a $, it passes control to the instruction at label NOTFOUND. The direction of search is from left to right.

```
FIND    C'$',MSG1,20,POINTER,NOTFOUND
```

2) The FIND instruction searches for the string X'05' beginning at the address contained in index register 1. The search continues for the length value stored in the data area labeled LSTR. If the instruction finds the X'05' string, it stores the address of the string in the data area labeled POINTER. If the instruction does not find the string, it passes control to the instruction at label NOGOOD. The direction of the search is left to right.

```
FIND    X'05',(0,#1),LSTR,POINTER,NOGOOD
```

Coding Example

To determine if a hyphen has been included in a 40-byte parts inventory number, the FIND instruction could be used as follows:

```
          •
          •
          •
GETPART# EQU      *
         READTEXT PARTNUM,'ENTER REQUESTED PART NUMBER',              X
               SKIP=1
*
FINDASH  EQU      *
         FIND     C'-',PARTNUM,40,POINTER,NOTVALID
         MOVEA    #1,PARTNUM                  GET PARTNUM ADDRESS
         SUBTRACT POINTER,#1,RESULT=LENGTH    FIND LENGTH OF PREFIX
         IF  (LENGTH,LE,1),GOTO,BADPREFX      IF FEWER THAN 2, REJECT IT
*
         IF  (LENGTH,LE,4),GOTO,GETCOST       IF FEWER THAN 5, IT'S OK
*
BADPREFX EQU      *                           ELSE REJECT IT
         PRINTEXT PARTNUM,SKIP=1
         PRINTEXT ' IS INVALID (PREFIX NOT OF ALLOWABLE SIZE)'
         GOTO     GETPART#                    RETRY
*
NOTVALID EQU      *
         PRINTEXT PARTNUM,SKIP=1
         PRINTEXT ' IS INVALID (MISSING HYPHEN) - REENTER'
         GOTO     GETPART#                    RETRY
*
GETCOST  EQU      *
          •
          •
          •
PARTNUM  TEXT     LENGTH=40              TEXT BUFFER FOR PART #
POINTER  DATA     F'0'                   POINTER TO ADDR OF CHAR
LENGTH   DATA     F'0'                   LENGTH OF PART # PREFIX
```

If the part number entered was 1213-9234, and the label PARTNUM was at address X'2040', the instruction would place a result of X'2044' in the data area labeled POINTER. The data area labeled LENGTH would contain a value of 4, and the program would branch to the label GETCOST.

FINDNOT — Locate the First Different Character

The FINDNOT instruction searches a character string for the first occurrence of a character (byte) that is different than the character you specify.

Syntax:

label	**FINDNOT character,string,length,where, notfound,DIR=,P1=,P2=,P3=,P4=,P5=**
Required:	**character, string, length, where, notfound**
Defaults:	**DIR=FORWARD**
Indexable:	**string, length, and where**

Operand	*Description*
character	FINDNOT searches for a character that is different than the one you specify for this operand. You can specify a text character or a hexadecimal value.
string	The label of the string to be searched. The search will begin at the address of the label.
length	The number of bytes to be searched. You can code a positive integer or the label of a data area containing a positive integer.
where	The label of a data area where the address of the first different character is to be stored if it is found. If a different character is not found, this data area remains unchanged.
notfound	The label of the instruction to be executed if a different character is not found.
DIR=	FORWARD (the default), to search from left to right. REVERSE, to search from right to left.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Syntax Examples

1) The FINDNOT instruction searches for the first nonblank character, starting at label INPUT. The search continues for 80 bytes. If a nonblank character is found, the character's address is stored in the data area labeled CPOINTER. If no characters are found during the 80-byte search, the FINDNOT instruction passes control to the instruction at label ALLBLANK. The direction of the search is from left to right.

```
FINDNOT   C' ',INPUT,80,CPOINTER,ALLBLANK
```

2) This instruction searches for the first bit string other than X'40'. The search starts at label CARD+79 and continues for 80 bytes. If a bit string other than X'40' is found, the address of the bit string is stored in the data area labeled LASTCHAR. If no bit string other than X'40' is found during the search, the FINDNOT instruction passes control to the instruction at label ALLBLANK. The direction of search is from right to left.

```
        FINDNOT   X'40',CARD+79,80,LASTCHAR,ALLBLANK,DIR=REVERSE
```

Coding Example

To reduce fixed-length, 80-byte records to variable-length records, the FINDNOT instruction could be used as follows:

```
          •
          •
          •
NEXTCARD  EQU      *
          ADD      CARDNUM,1
          •
          •
          •
FINDLAST  EQU      *
          FINDNOT  X'40',CARD+79,80,POINTER,BLANKCRD,                X
                DIR=REVERSE
*
GOTCHAR   EQU      *
          MOVEA    #1,CARD          GET ADDRESS CARD BUFFER
          SUBTRACT POINTER,#1,                                       X
                RESULT=LENGTH      GET NOMINAL LENGTH
          ADD      LENGTH,1         BUMP TO TRUE LENGTH
          MOVE     (0,#2),LENGTH    STORE LENGTH OF DATA
          ADD      #2,2             BUMP BUFFER POINTER
          MOVE     (0,#2),CARD,(1,BYTES),                            X
                P3=LENGTH          STORE CARD DATA
          ADD      #2,LENGTH        BUMP BUFFER BY DATA SIZE
          GOTO     NEXTCARD         GET ANOTHER CARD
*
BLANKCRD  EQU      *
          PRINTEXT ' CARD # '       PRINT MESSAGE ON
          PRINTNUM CARDNUM          LISTING INDICATING THAT
*                                   THE CARD WAS BLANK
          PRINTEXT ' IS REJECTED AS BLANK'
          ADD      BLANKS,1         INCR. BLANK CARD COUNT
          GOTO     NEXTCARD         GET ANOTHER CARD
*
CARDNUM   DATA     F'0'                    CARDS READ COUNTER
POINTER   DATA     F'0'                    POINTER TO ADDR OF CHAR
CARD      DATA     CL80' '                 STORAGE BUFFER
BLANKS    DATA     F'0'                    BLANK CARD COUNTER
          •
          •
          •
```

If the data on the card occupied the first 15 character positions and the next available buffer location (indexed by register #2) was X'5C00', POINTER would return as X'5C0E'. LENGTH would compute as X'000F' (X'000E' + X'0001'). Locations X'5C00' – X'5C01' would contain X'000F' and addresses X'5C02' through X'5C10' would receive the data. Register #2 would then be set to X'5011' and another card would be searched.

FIRSTQ – Acquire the First Queue Entry in a Chain

The FIRSTQ instruction acquires the first (oldest) entry in a queue. You define a queue with the DEFINEQ statement. A queue entry can contain data or the address of a data buffer.

When you acquire the oldest entry with the FIRSTQ instruction, the second oldest entry becomes the first or oldest entry in the queue. After you acquire the contents of the oldest entry, the system adds the entry to the free chain of the queue.

Syntax:

label	**FIRSTQ qname,loc,EMPTY=,P1=,P2=**
Required:	**qname,loc**
Defaults:	**none**
Indexable:	**qname,loc**

Operand	*Description*
qname	The name of the queue from which the entry is to be fetched. The queue name is the label of the DEFINEQ statement that creates the queue.
loc	The label of a word of storage where the entry is placed. You can use the index registers, #1 and #2.
EMPTY=	The first instruction of the routine to be called if a "queue empty" condition is detected during the execution of this instruction. If you do not specify this operand, control returns to the next instruction after the FIRSTQ. A return code of −1 in the first word of the task control block indicates that the operation completed successfully. A return code of +1 indicates that the queue is empty.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Coding Example

See the example of queuing instructions in the example following the NEXTQ instruction.

Return Codes

The return codes are returned in the first word of the task control block (TCB) of the program or task issuing the instruction. The label of the TCB is the label of your program or task (taskname).

Return Code	Description
−1	Successful completion.
1	Queue is empty.

FMULT – Multiply Floating-Point Values

The floating-point multiply instruction (FMULT) multiplies a floating-point value in operand 1 by a floating-point value in operand 2. You can use positive or negative values.

You must code FLOAT=YES on the PROGRAM statement of a program that uses floating-point instructions in its initial task and on the TASK statement of every task containing floating-point instructions.

Syntax:

label	**FMULT opnd1,opnd2,RESULT=,PREC=,** **P1=,P2=,P3=**
Required:	**opnd1,opnd2**
Defaults:	**RESULT=opnd1,PREC=FFF**
Indexable:	**opnd1,opnd2,RESULT**

Operand	*Description*
opnd1	The label of the data area containing the value multiplied by opnd2. Opnd1 cannot be a self-defining term. The system stores the result of the operation in opnd1 unless you code the RESULT operand.
opnd2	The value by which opnd1 is multiplied. You can specify a self-defining term or the label of a data area. The valid range for this operand is from −32768 and +32767.
RESULT=	The label of a data area in which the result is placed. When you specify RESULT, the value of opnd1 does not change during the operation.
PREC=	All possible combinations of single and extended precision are permitted. An immediate value for opnd2 will be converted to a single-precision value regardless of any other method of precision specification discussed below. The PREC operand is specified as xyz, where x, y, and z are characters representing the precision of opnd1, opnd2, and the RESULT operands, respectively. Either 2 or 3 characters must be specified depending on whether the RESULT operand was coded. Permissible characters are: F – Single-precision (32 bits) L – Extended-precision (64 bits) * – Default (single-precision) The default is single-precision.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Index Registers

You cannot use the index registers (#1 and #2) as operands in floating-point operations because they are only 16 bits in length. You can, however, use the software registers to specify the address of a floating-point operand.

Syntax Examples

1) The FMULT instruction multiplies two single-precision floating-point values and stores the result in RESULTF.

```
FLOAT    PROGRAM   START,FLOAT=YES
           •
           •
           •
         FMULT     OP1F,OP2F,RESULT=RESULTF,PREC=FFF
           •
           •
           •
OP1F     DC        E'1.5'
OP2F     DC        E'0.2'
RESULTF  DC        E'0'
```

After the FMULT operation, RESULTF contains the value .30.

2) The FMULT instruction multiplies two extended-precision floating-point values and stores the result in RESULTL.

```
FLOAT    PROGRAM   START,FLOAT=YES
           •
           •
           •
         FMULT     OP1L,OP2L,RESULT=RESULTL,PREC=LLL
           •
           •
           •
OP1L     DC        L'50000.5'
OP2L     DC        L'40.4'
RESULTL  DC        L'0'
```

After the FMULT operation, RESULTL contains the value 2020020.20.

3) The FMULT instruction multiplies two single-precision floating-point values written in exponent (E) notation. The result is stored in RESULTFE.

```
FLOAT    PROGRAM   START,FLOAT=YES
           •
           •
           •
         FMULT     OP1FE,OP2FE,RESULT=RESULTFE,PREC=FFF
           •
           •
           •
OP1FE    DC        E'2.5E+1'       Equals decimal 25.0
OP2FE    DC        E'0.5E-1'       Equals decimal .05
RESULTFE DC        E'0'
```

After the FMULT operation, RESULTFE contains the value .1250E+01. This value is equal to the decimal value 1.250.

Return Codes

Return codes are returned in the first word of the task control block (TCB) of the program or task issuing the instruction. The label of the TCB is the label of your program or task (taskname). You must test for the return code immediately after the floating-point instruction is executed or the code may be destroyed by subsequent instructions.

Return Code	Description
−1	Successful completion.
1	Floating-point overflow.
5	Floating-point underflow.

FORMAT – Format Data for Display or Storage

The FORMAT statement specifies the type of conversion to be performed when data is transferred from storage to a text buffer by a PUTEDIT instruction, or from a text buffer to storage by a GETEDIT instruction.

The FORMAT statement must be contained in the assembly in which it is referred to and cannot be placed within a sequence of executable instructions.

Note: The FORMAT statement can be continued on multiple lines, but each line (except the last) must be coded through column 71 and must have a continuation symbol in column 72. Commas cannot be used to continue a line before column 71.

Syntax:

label	**FORMAT (list),gen**
Required:	**(list)**
Defaults:	**gen = BOTH**
Indexable:	**none**

Operand ***Description***

list The format you want the data to be in after it is converted.

The valid options are:

Item Type	Definition
I	Integer numeric
F	Floating-point numeric
E	Floating-point numeric E notation
H	Literal alphanumeric data, enclosed in quotes
X	Blanks
A	Alphanumeric data.

gen GET, if this FORMAT statement is for the exclusive use of GETEDIT instruction.

PUT, if this format statement is for the exclusive use of PUTEDIT instructions.

BOTH, if this format statement can be used with GETEDIT and PUTEDIT instructions. BOTH, the default, requires more storage than either GET or PUT.

The PUTEDIT instruction retrieves each variable in the list, converts it according to the respective item specification in the FORMAT statement, and loads it into the text buffer specified. Spaces (blanks), line control characters (@), and self-defining terms can be inserted.

The GETEDIT instruction moves data from the text buffer, converts it as specified in the FORMAT statement, and stores it at specified addresses. Characters in the input buffer may be skipped.

The slash (/) in a FORMAT statement associated with a GETEDIT instruction acts as a delimiter, performing the same function as a comma.

Successive items in the buffer transfer list are converted and moved according to successive specifications in the FORMAT statement until all items in the list are transferred. If there are more items in the list than there are specifications in the FORMAT statement, control transfers to the beginning of the FORMAT statement and the same specifications are used again until the list is exhausted. The entire transfer is treated as a single record.

No check is made to see that the specifications in a FORMAT statement correspond in mode with the list items in the GETEDIT or PUTEDIT instructions. It is your responsibility to ensure that integer variables are associated with I-type format specification and real variables with F-type or E-type format specifications. You must also ensure that ample storage is available for transfer of data in a PUTEDIT operation.

Conversion of Numeric Data

The following specifications, or conversion codes, are available for the conversion of numeric data:

Item Type	Form	Definition
I	Iw	Integer numeric
F	Fw.d	Floating-point numeric
E	Ew.d	Floating-point numeric E notation

where:

w is an unsigned integer constant specifying the total field length of the data. This specification may be greater than that required for the actual digits to provide spacing between numbers; however, the maximum width allowed is 40 for I or F specifications.

d is an unsigned integer constant specifying the number of decimal places to the right of the decimal point. The allowable range is 0 to w − 1 for F-type specifications and 0 to w − 6 for E-type specifications.

Note: The decimal point between the w and d portions of the specification is required.

The following discussion of conversion codes deals with loading a text buffer, using PUTEDIT, in preparation for printing a line. The concepts, however, apply to all permissible text buffer operations.

Integer Numeric Conversion: General form is **Iw**.

The specification Iw loads a text buffer with an EBCDIC character string representing a number in integer form; "w" print positions are reserved for the number. The number is right-justified. If the number to be loaded is greater than w−1 positions and the number is negative, an error condition will occur. A print position must be reserved for the sign if negative values are possible. Positive values do not require a position for the sign. If the number has fewer than "w" digits, the leftmost print positions are filled with blanks. If the quantity is negative, the position preceding the leftmost digit contains a minus sign.

The following examples show how each quantity on the left is converted, according to the specification "I3":

Internal Value	Value in the Buffer
721	721
−721	***
−12	−12
8114	***
0	0
−5	−5
9	9

Note that all error fields are stored and printed as asterisks.

Floating-Point Numeric Conversion: General form is **Fw.d**.

For F-type conversion, "w" is the total field length and "d" is the number of places to the right of the decimal point. For output, the total field length must include positions for a sign, if any, and a decimal point. The sign, if negative, is also loaded. For output, "w" should be at least equal to d+2.

If insufficient positions are reserved by "d," the number is rounded upwards. If excessive positions are reserved by "d," zeros are filled in from the right for the insignificant digits.

If the integer portion of the number has fewer than w−d−1 digits, the leftmost print positions are filled with blanks. If the number is negative, the position preceding the leftmost digit contains a minus sign.

The following examples show how quantities are converted according to the specification F5.2:

Internal Value	Value in the Buffer
12.17	12.17
−41.16	*****
−.2	−0.20
7.3542	b7.35
−1.	−1.00
9.03	b9.03
187.64	*****

Notes:

1. A "b" represents a blank character stored in the text buffer.
2. Internal values are shown as their equivalent decimal value, although actually stored in floating-point binary notation requiring two or four words of storage.
3. All error fields are stored and printed as asterisks.
4. Numbers for F-conversion input need not have the decimal point appearing in the input field (in the text buffer). If no decimal point appears, space need not be allocated for it. The decimal point is supplied when the number is converted to an internal equivalent; the position of the decimal point is determined by the format specification. However, if the position of the decimal point within the field differs from the position in the format specification, the position in the field overrides the format specification. For example, for a specification of F5.2, the following conversions would be performed:

Text Buffer Characters	Converted Internal Value
12.17	12.17
b1217	12.17
121.7	121.7

Floating-Point Number Conversion (E-notation): General form is **Ew.d**.

For E-type conversion, "w" is the total field length and "d" is the number of places to the right of the decimal point. For output, the total field length must include enough positions for a sign, a decimal point, and space for the E-notation (4 digits). For output, "w" should be at least equal to d+6. For input, "d" is used for the default decimal position if no decimal is found in the input character string.

If insufficient positions are reserved by "d," the digits to the right of "d" digits are truncated. If excessive positions are reserved by "d," zeros are filled in from the right for the insignificant digits.

The following examples show how each value on the left is converted according to the specification E10.4:

Internal Value	Value in the Buffer
12.17	b.1217Eb02
−41.16	−.4116Eb02
−.2	−.2000Eb00
7.3542	b.7354Eb01
−1.	−.1000Eb01
9.03	b.9030Eb01
.00187	b.1870E−02

Notes:

1. A "b" represents a blank character stored in the text buffer.
2. Internal values are shown in their equivalent decimal value, although actually stored in floating-point binary requiring 2 or 4 words of storage.
3. All error fields are stored and printed as asterisks.
4. Numbers for E-conversion need not have the decimal point appearing in the input field (in the text buffer). If no decimal point appears, you need not allocate space for it. The decimal point is supplied when the number is converted to an internal equivalent; the position of the decimal point is determined by the format specification. However, if the position of the decimal point within the field differs from the position in the format specification, the position in the field overrides the format specification. For example, for a specification of E7.2, the following conversions would be performed:

Text Buffer Characters	Converted Internal Value
12.17E0	12.17
b1217E1	121.7
121.7E−2	1.217

Alphanumeric Data Specification

The following specifications are available for alphanumeric data:

Item Type	Form	Definition
H	'data'	Literal alphanumeric data
A	A	Alphanumeric data
X	X	Insert blanks (output) or skip input fields

The H-specification is used for alphanumeric data that a program does not change, such as printed headings.

The A-specification is used for alphanumeric data in storage that a program operates on, such as a line that is to be printed.

The X-specification is used to bypass one or more input characters or to insert blanks (spaces) on an output line.

Literal Specification: General form is **H**.

The H-specification is used to create alphanumeric constants. The maximum length for a literal is 255.

Literals must be enclosed in apostrophes. For example:

```
FORMAT ('INVENTORY REPORT')
```

The apostrophe (') and ampersand (&) characters within literal data are represented by two successive characters. For example, the characters DO & DON'T must be represented as:

```
FORMAT ('DO && DON''T')
```

Literal data can be used only in loading a text buffer; it is invalid in a GETEDIT instruction. All characters between the apostrophes (including blanks) are loaded into the buffer in the same relative position they appear in the FORMAT statement. The lines:

```
FM   FORMAT ('THIS IS alphanumeric DATA',3X,A6)
     •
     •
     •
     PUTEDIT  FM,TEXT,(ALP)
```

cause the following record to be loaded into the buffer labeled TEXT.

```
THIS IS alphanumeric DATA    EASY12
```

Literal data may also be included with variable data.

For example, the instructions:

```
FM   FORMAT  ('TOTAL OF',I2,' VALUES = ',F5.2)
     •
     •
     •
     PUTEDIT  FM,TEXT,(TOTAL,VALUE)
```

cause a record such as the one in the following example to be loaded into the buffer.

```
TOTAL OF 5 VALUES = 35.42
```

Alphanumeric Specification: General form is **Aw**.

The specification Aw is used to transmit alphanumeric data to or from data areas in storage. It causes the first w characters to be stored into or loaded from the area of storage specified in the text buffer transfer list. For example, the statements:

```
FM   FORMAT (A4)
       •
       •
       •
     GETEDIT  FM,TEXT,(ERROR)
```

cause four alphanumeric characters to be transferred from the buffer TEXT into the variable named ERROR.

The following statements:

```
FM    FORMAT  ('XY=',F9.3,A4)
        •
        •
        •
      PUTEDIT  FM,TEXT,(A,ERROR,B,ERROR)
```

may produce the following line:

```
 XY= 5976.000....XY= 6173.500....
```

In this example, the ellipsis (....) represents the contents of the character string field ERROR.

The A-specification provides for storing alphanumeric data into a field in storage, manipulating the data (if required), and loading it back to a text buffer.

The alphanumeric field can be defined using the DATA statement or the TEXT statement. On input (GETEDIT) the alphanumeric field is set to blanks before data conversion. The alphanumeric data is left justified in the field.

Blank Specification: General form is **X**.

The X-specification allows you to insert blank characters into an output buffer record and to skip characters of an input buffer record.

When the nX specification is used with an input record, "n" characters are skipped before the transfer of data begins. When the nX specification is used with an output record, "n" characters are inserted before the transfer of data begins. For example, if a buffer has four 10-position fields of integers, the statement:

```
FORMAT  (I10,10X,I10,I10)
```

could be used to avoid transferring the second field.

When the X-specification is used with an output record, "n" positions are set to blanks, allowing for spaces on a printed line. For example, the statement:

```
FORMAT  (F6.2,5X,F6.2,5X,F6.2,5X)
```

can be used to set up a line for printing as follows:

```
-23.45bbbbbb17.32bbbbbb24.67bbbbb
```

where b represents a blank.

Blank Lines in Output Records

You can insert blank lines between output records by using consecutive slashes (/). The slash causes a line-control character to be inserted into the buffer. The number of blank lines inserted between output records depends on the number and placement of the slashes within the statement.

If there are "n" consecutive slashes at the beginning or end of a format specification, "n" blank lines are inserted between output records. For "n" consecutive slashes elsewhere in the format specification, the number of blank lines inserted is n−1. For example, the statements:

```
     PUTEDIT  FM,TEXT,(X,(Y,D),Z)
       •
       •
       •
FM   FORMAT  ('SAMPLE OUTPUT',/,I5////I9,I4//)

X    DC      F'-1234'
Y    DC      D'111222333'
Z    DC      F'22'
TEXT TEXT    LENGTH=50
```

result in the following output:

```
SAMPLE OUTPUT
-1234

(3 blank lines)

111222333  22

(2 blank lines)
```

Repetitive Specification

You can repeat a specification, within the limits of the text buffer size, by coding an integer from 1 to 255 before the specification.

For example,

```
(2F10.4)
```

is equivalent to:

```
(F10.4,F10.4)
```

and uses less storage.

You can use a parenthetical expression with a multiplier (repeat constant) to repeat data fields according to the format specifications contained within the parentheses. All item types are permitted within the parenthetical expression except another parenthetical expression. You can specify multiple parenthetical expressions within the same FORMAT statement. For example, the statement:

```
FORMAT   (2(F10.6,F5.2),I4,3(I5))
```

is equivalent to:

```
FORMAT   (F10.6,F5.2,F10.6,F5.2,I4,I5,I5,I5)
```

Storage Considerations

In general, the fewer items in the FORMAT list, the less storage required. An item is defined as a single conversion specification, a literal data string, one or more grouped record delimiters, or a parenthetical multiplier. For example, the following format statements all have three items:

```
FORMAT  (I5,I5,I6)

FORMAT  (I5,3I5,'ITEM 3')

FORMAT  (3(I5),3I5)

FORMAT  (I5/,I5)

FORMAT  (I5,///,I5)

FORMAT  (/,/,/)

FORMAT  (2(/),/)

FORMAT  (2(1X),2X)

FORMAT  (I5/,2X)
```

Coding Example

The following example begins by executing a PRINTEXT instruction that prints a message requesting the model year and serial numbers for the automobile of interest. The first GETEDIT actually reads the two requested numbers into a TEXT statement labeled TEXT1.

The GETEDIT instruction searches the TEXT1 data and converts the first entry to a single-precision variable called LIST1. The second entry is converted to a double-precision variable called LIST2. Both LIST1 and LIST2 are then converted back to EBCDIC and displayed on the printer by the first PUTEDIT instruction using the PE1FMT FORMAT statement. The PUTEDIT instruction and FORMAT statement determine the layout of the data as it is displayed.

The GETEDIT instruction following label GE2 takes the data already entered into TEXT1 with the preceding READTEXT and again converts it into the two binary variables called LIST1 (single-precision) and LIST2 (double-precision). Because ACTION=STG, a READTEXT must be issued before executing the GETEDIT.

The PUTEDIT instruction at label PE2 converts the two variables back to EBCDIC and places them into the TEXT2 statement as formatted by the PE2FMT FORMAT statement. Again, the keyword ACTION=STG prevents the data from being printed until the following PRINTEXT instruction is executed.

```
GE1      EQU      *
         PRINTEXT '@ENTER MODEL YEAR AND SERIAL NUMBER@'
         GETEDIT  GE1FMT,TEXT1,(LIST1,(LIST2,D)),                    X
               ACTION=IO,ERROR=ERR1
*
PE1      EQU      *
         ENQT     $SYSPRTR
         PUTEDIT  PE1FMT,TEXT2,(LIST1,(LIST2,D)),                    X
               ACTION=IO
*

GE2      EQU      *
         READTEXT TEXT1,'@ENTER YOUR DEPT. AND SYSTEM ID NUMBER@'
*
         GETEDIT  GE2FMT,TEXT1,(LIST1,(LIST2,D)),                    X
               ACTION=STG,ERROR=ERR1
*
PE2      EQU      *
         PUTEDIT  PE2FMT,TEXT2,(LIST1,(LIST2,D)),ACTION=STG
         ENQT     $SYSPRTR
         PRINTEXT TEXT2
         DEQT
          •
          •
          •
ERR1     EQU      *
         PRINTEXT '@GETEDIT GE1 HAS FAILED@'
         GOTO     ERROROUT
*
ERR2     EQU      *
         PRINTEXT '@GETEDIT GE2 HAS FAILED@'
         GOTO     ERROROUT
*
GE1FMT   FORMAT   (I4,1X,I8)
PE1FMT   FORMAT   ('MDL. YR. = ',I4,6X,:'SER. NO. = ',I8)
GE2FMT   FORMAT   (I3,1X,I6)
PE2FMT   FORMAT   ('DEPT. = ',I3,4X,'SYST. ID. = ',I6)
LIST1    DATA     F'0'
LIST2    DATA     D'0'
TEXT1    TEXT     LENGTH=13
TEXT2    TEXT     LENGTH=42
ERROROUT EQU      *
```

FPCONV – Convert to or from Floating Point

The FPCONV instruction converts integer values to or from floating-point numbers by using the optional floating-point hardware feature.

You must code FLOAT=YES on the PROGRAM statement of programs whose primary task uses floating-point instructions and on the TASK statement of every task containing floating-point instructions.

Syntax:

label	**FPCONV**	**opnd1,opnd2,COUNT=,PREC=,** **P1=,P2=,P3=**
Required:	**opnd1,opnd2**	
Defaults:	**COUNT=1,PREC=FS**	
Indexable:	**opnd1,opnd2**	

Operand	*Description*
opnd1	The label of the data area to receive the result of the conversion.
opnd2	The label of the data area that contains the value to be converted. You can also code an integer number between −32768 and +32767.
COUNT=	The number of values in opnd2 to be converted and stored at locations beginning at opnd1. If opnd2 is immediate data, it is converted and placed in the storage area defined by opnd1 in the number of consecutive locations defined by this operand.
PREC=xy	Defines the precision of opnd1 and opnd2 and the type of data (integer or floating-point) you coded for these operands. Specify the precision and data type in the form PREC=xy, where "x" is the precision and data type for opnd1 and "y" is the precision and data type for opnd2. Opnd1 and opnd2 cannot be the same data type. The valid precisions and data types for "x" and "y" are as follow: S - Single-precision integer (1 word) D - Double-precision integer (2 words) F - Single-precision floating-point value L - Extended-precision floating-point value * - Use default (FS)
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Syntax Examples

1) Convert five double-precision integers beginning at label B to extended-precision floating-point values. Store the result beginning at label A.

```
FPCONV  A,B,COUNT=5,PREC=LD
```

2) Convert an extended-precision floating-point value at label L4 to a double-precision integer. Store the result beginning at label X.

```
FPCONV  X,L4,PREC=DL
```

3) Convert a single-precision integer value at label C to a single-precision floating-point value. Store the result beginning at the indexed location (6,#1).

```
FPCONV  (6,#1),C
```

4) Convert an extended-precision floating-point value at the indexed location of (X,#1) to a double-precision integer. Store the result beginning at the indexed location (Y,#2).

```
FPCONV  (X,#1),(Y,#2),PREC=DL
```

Coding Example

The example estimates the number of hours required for a plane, carrying a specified load weight, to travel to a destination a given number of miles from its departure point.

The FPCONV instruction at label FP1 converts a single-precision integer to single-precision floating-point value. This instruction uses the default precision.

The FPCONV instruction, at label FP2, converts a double-precision integer to a single-precision floating-point value.

At label FP3, the FPCONV instruction converts two single-precision integers to single-precision floating-point values. The values to be converted are indexed and the parameter naming operand (P1=) allows the result field locations to be assigned dynamically.

The FPCONV instruction at label FP4 converts a single-precision floating-point value to a single-precision integer.

```
CONVERT  PROGRAM  START,FLOAT=YES
START    EQU      *
         GETVALUE MILES,'@ENTER MILES TO DESTINATION'
FP1      FPCONV   FMILES,MILES
         GETVALUE FREIGHT,'@POUNDS OF CARGO ?',FORMAT=(10,0,I),TYPE=D
FP2      FPCONV   FFREIGHT,FREIGHT,PREC=FD
         READTEXT TYPE,'@ENTER PLANE TYPE'
         CALL     FINDTYPE,TYPE
         MOVEA    #1,BUFR
         MOVEA    RESULT,FFUELUSE
           •
           •
           •
FP3      FPCONV   *,(32,#1),COUNT=2,P1=RESULT
         CALL     CALCTIME
           •
           •
           •
FP4      FPCONV   ELAPSED,FELAPSED,PREC=SF
         PRINTEXT '@NUMBER OF HOURS OF ELAPSED FLIGHT TIME '
         PRINTNUM ELAPSED
           •
           •
           •
BUFR     DATA     256H'0'
TYPE     TEXT     LENGTH=4
MILES    DATA     F'0'
FREIGHT  DATA     D'0'
ELAPSED  DATA     F'0'
*
FMILES   DATA     E'0'
FFREIGHT DATA     E'0'
FFUELUSE DATA     E'0'
FSPEED   DATA     E'0'
FELAPSED DATA     E'0'
           •
           •
           •
```

FREESTG – Free Mapped and Unmapped Storage Areas

The FREESTG instruction releases the mapped and unmapped storage areas you obtained with the GETSTG instruction.

Note: "Mapped storage" is the physical storage you defined on the PARTS operand of the SYSPARTS statement during system generation. "Unmapped storage" is any physical storage that you did not include on the PARTS operand of the SYSPARTS statement.

Syntax:

label	**FREESTG name,TYPE=,ERROR=,P1=**
Required:	**name**
Defaults:	**TYPE=ALL**
Indexable:	**none**

Operand	*Description*
name	The label of a STORBLK statement. The STORBLK statement defines the mapped and unmapped storage areas that your program uses.
TYPE=	ALL, the default, to release the mapped storage area and all the unmapped storage areas your program acquired with GETSTG instruction. UNMAP, to release only the unmapped storage areas your program acquired with the GETSTG instruction.
ERROR=	The label of the first instruction of the routine to be called if an error occurs during the execution of this instruction.
P1=	Parameter naming operand. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code this operand.

Syntax Examples

1) Release the mapped storage area and all unmapped storage areas defined by the STORBLK statement labeled BLOCK.

```
FREESTG    BLOCK
```

2) Release only the unmapped storage areas defined by the STORBLK statement labeled BLOCK.

```
FREESTG    BLOCK,TYPE=UNMAP
```

3) Release the mapped storage area and all unmapped storage areas defined by the STORBLK statement labeled BLOCK. The label of the first instruction of the error routine is OUT.

```
FREESTG    BLOCK,TYPE=ALL,ERROR=OUT
```

Coding Example

See the SWAP instruction for an example that uses the FREESTG instruction.

Return Codes

The return codes are returned in the first word of the task control block (TCB) of the program or task issuing the instruction. The label of the TCB is the label of your program or task (taskname).

Return Code	Description
−1	Successful completion.
1	No storage entires exist in storage control block.
2	Error occurred while freeing the mapped storage area.
100	No unmapped storage support in the system.

FSUB – Subtract Floating-Point Values

The floating-point subtract instruction (FSUB) subtracts a floating-point value in operand 2 from a floating-point value in operand 1. You can use positive or negative values.

You must code FLOAT=YES on the PROGRAM statement of a program that uses floating-point instructions in its initial task and on the TASK statement of every task containing floating-point instructions.

Syntax:

label	**FSUB**	**opnd1,opnd2,RESULT=,PREC=,** **P1=,P2=,P3=**
Required:	**opnd1,opnd2**	
Defaults:	**RESULT=opnd1,PREC=FFF**	
Indexable:	**opnd1,opnd2,RESULT**	

Operand	*Description*
opnd1	The label of the data area from which opnd2 is subtracted. Opnd1 cannot be a self-defining term. The system stores the result of the operation in opnd1 unless you code the RESULT operand.
opnd2	The value subtracted from opnd1. You can specify a self-defining term or the label of a data area. The valid range for this operand is from −32768 to +32767.
RESULT=	The label of a data area in which the result is to be placed. When you specify RESULT, the value of opnd1 does not change during the operation.
PREC=	All possible combinations of single and extended precision are permitted. An immediate value for opnd2 will be converted to a single-precision value regardless of any other method of precision specification discussed below. The PREC operand is specified as xyz, where x, y, and z are characters representing the precision of opnd1, opnd2, and the RESULT operands, respectively. Either 2 or 3 characters must be specified depending on whether the RESULT operand was coded. Permissible characters are: **F** Single-precision (32 bits) **L** Extended-precision (64 bits) ***** Default (single-precision) The default is single-precision.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code this operand.

Index Registers

You cannot use the index registers (#1 and #2) as operands in floating-point operations because they are only 16 bits in length. You can, however, use the software registers to specify the address of a floating-point operand.

Syntax Examples

1) The FSUB instruction subtracts two single-precision floating-point values and stores the result in RESULTF.

```
FLOAT    PROGRAM   START,FLOAT=YES
          •
          •
          •
         FSUB      OP1F,OP2F,RESULT=RESULTF,PREC=FFF
          •
          •
          •
OP1F     DC        E'1.5'
OP2F     DC        E'0.2'
RESULTF  DC        E'0'
```

After the FSUB operation, RESULTF contains the value 1.30.

2) The FSUB instruction subtracts two extended-precision floating-point values and stores the result in RESULTL.

```
FLOAT    PROGRAM   START,FLOAT=YES
          •
          •
          •
         FSUB      OP1L,OP2L,RESULT=RESULTL,PREC=LLL
          •
          •
          •
OP1L     DC        L'50000.5'
OP2L     DC        L'40.4'
RESULTL  DC        L'0'
```

After the FSUB operation, RESULTL contains the value 49960.10.

3) The FSUB instruction subtracts two single-precision floating-point values written in exponent (E) notation. The result is stored in RESULTFE.

```
FLOAT    PROGRAM   START,FLOAT=YES
          •
          •
          •
         FSUB      OP1FE,OP2FE,RESULT=RESULTFE,PREC=FFF
          •
          •
          •
OP1FE    DC        E'2.5E+1'       Equals decimal 25.0
OP2FE    DC        E'0.5E-1'       Equals decimal .05
RESULTFE DC        E'0'
```

After the FSUB operation, RESULTFE contains the value .2495E+02. This value is equal to the decimal value 24.95.

Return Codes

Return codes are returned in the first word of the task control block (TCB) of the program or task issuing the instruction. The label of the TCB is the label of your program or task (taskname). You must test for the return code immediately after the floating-point instruction is executed or the code may be destroyed by subsequent instructions.

Return Code	Description
−1	Successful completion.
1	Floating-point overflow.
5	Floating-point underflow.

GETEDIT – Collect and Store Data

The GETEDIT instruction acquires data from a terminal or storage area, converts the data according to a FORMAT list, and stores the data in your program at the locations specified by the data list.

When you use the GETEDIT instruction in your program, you must link-edit your program using the "autocall" option of $EDXLINK. Refer to the *Language Programming Guide* for information on how to link-edit programs.

The supervisor places a return code in the first word of the task control block (taskname) whenever a GETEDIT instruction causes a terminal I/O operation to occur. If the return code is not a −1, the address of this instruction will be placed in the second word of the task control block (taskname + 2). The terminal I/O return codes are described at the end of the PRINTEXT and READTEXT instructions in this manual and also in *Messages and Codes*. See Figure 2-6 on page 2-193 for an illustration of how the GETEDIT instruction works.

Note: Any references to **31xx** terminals means 3101, 3151, 3161, 3163, and 3164 terminals, unless otherwise noted.

Syntax:

label	**GETEDIT**	**format,text,(list),(format list),** **ERROR=,ACTION=,SCAN=,SKIP=,LINE=,** **SPACES=,PROTECT=**
Required:	**text, (list), and either format** **or (format list)**	
Defaults:	**ACTION=IO,SCAN=FIXED,PROTECT=NO**	
Indexable:	**none**	

Operand	*Description*
format	The label of a FORMAT statement or the label to be attached to the format list optionally included in this statement. This statement or list will be used to control the conversion of the data. This operand is required if the program is compiled with $EDXASM.
text	The label of a TEXT statement defining a storage area for character data. If data is moved from a terminal, this area stores the data as an EBCDIC character string before it is converted and moved into the variables.
list	A description of the variables or locations that will contain the desired data. The list will have one of the following forms: ((variable,count,type),...) **or** (variable,...) **or** ((variable,count),...) **or** ((variable,type),...)

where:

variable is the label of a variable or group of variables to be included.

count is the number of variables that are to be converted.

type is the type of variable to be converted. The type can be:

- **S** Single-precision integer (default)
- **D** Double-precision integer
- **F** Single-precision floating-point
- **L** Extended-precision floating-point

The type defaults to S for integer format data and to F for floating-point format data.

format list Refer to the FORMAT statement description for coding FORMAT operands that are to be used by GETEDIT instructions. This operand is not allowed if the program is compiled with $EDXASM. If you wish to refer to this format statement from another GETEDIT instruction, then both the format and format list operands must be coded.

ERROR= The label of the routine to receive control if the system detects an error during the GETEDIT operation. The system returns a return code to the task even if you do not code this operand.

Errors that might cause the system to call the error routine are:

- Use of an incorrect format list
- Field omitted (attempt is made to convert the rest)
- Not enough data in input text buffer to satisfy the data list
- Conversion error (value too large).

ACTION= IO (the default), causes a READTEXT instruction to be executed before conversion.

STG, causes the conversion of a text buffer that has been previously obtained. The data must be in EBCDIC.

SCAN= FIXED, data elements in the input text buffer must be in the format described in the format statement. That is, if a field width is specified as 6, then there are 6 EBCDIC characters used for the conversion. Leading and trailing blanks are ignored.

FREE, data elements in the input text buffer must be separated by delimiters: blank, comma, or slash. If A-format-type items are included, they must be enclosed in apostrophes; for example, `'xyz'`. This allows you to include any alphanumeric characters except the apostrophe.

SKIP= The number of lines to be skipped before the system does an I/O operation. For example, if your cursor is at line 2 on a display screen and you code SKIP=6, the system does the I/O operation on line 8. For a printer, the SKIP operand controls the movement of forms.

The SKIP operand causes the system to display or print the contents of the system buffer.

If you specify a value greater than or equal to the logical page size, the system divides this value by the page size and uses the remainder in place of the value you specify. For roll screens, the logical page size equals the screen's bottom margin minus the number of history lines and the screen's top margin.

LINE= The line number on which the system is to do an I/O operation. Code a value between zero and the number of the last usable line on the page or logical screen. The line count begins at the top margin you defined for the printer or display screen. LINE=0 positions the cursor at the top line of the page or screen you defined; LINE=1 positions the cursor at the second line of the page or screen. For roll screens, line 0 equals the screen's top margin plus the number of history lines.

For printers and roll screens, if you code a value less than or equal to the current line number, the system does the I/O operation at the specified line on the next page or logical screen. For static screens, if you code a value within the limits of the logical screen, the system does the I/O operation on the line you specified.

If you code a value greater than the last usable line number, the system divides this value by the logical page size and uses the remainder as the line number on which to do the I/O operation. For example, if you code LINE=22 and your roll screen has a logical page size of 20, the I/O operation occurs on the second line of the logical screen.

The LINE operand causes the system to print or display the contents of the system buffer.

SPACES= The number of spaces to indent before the system does an I/O operation. SPACES=0, the default, positions the cursor at the beginning of the left side of the page or screen. If the value you specify is beyond the limits of the logical screen or page, the system indents the next line by the excess number of spaces.

When you code the LINE or SKIP operands with SPACES, the system begins indenting from the left margin of the page or screen. If you specify SPACES without coding LINE or SKIP, the system begins indenting from the last cursor position on the line.

PROTECT= Code PROTECT=YES if the input text is *not* to be printed on the terminal. This operand is effective only for devices that require the processor to echo input data for printing.

The PROTECT operand does not apply to the 31xx in block mode.

31xx Display Considerations

When using a 31xx in block mode, the attribute byte associated with the prompt message and the input data will depend on the current TERMCTRL SET,ATTR in effect. The default is SET,ATTR=HIGH (high intensity) for the attribute byte.

Syntax Examples

1) The following GETEDIT instruction converts the first four characters to an integer and stores them at A. It converts the next six characters to a single-precision floating-point value and stores them at B. The next two characters are bypassed, and the last 10 characters are converted to an extended-precision floating-point value (because of the E-type specification) and are stored at C.

```
        GETEDIT   FM,TEXT1,(A,(B,F),(C,L))
          •
          •
          •
TEXT1   TEXT      LENGTH=24
FM      FORMAT    (I4,F6.2,2X,E10.4)
```

2) This GETEDIT instruction converts four integer values contained in the text buffer XSCREEN to a single hexadecimal word. The GETEDIT instruction places the results in the location SCREEN.

```
        GETEDIT   FM1,XSCREEN,((SCREEN,S)),ACTION=STG
          •
          •
          •
FM1     FORMAT    (I4),GET
XSCREEN TEXT      LENGTH=4
```

Coding Example

The example begins by executing a PRINTEXT instruction that issues a message requesting the model year and serial numbers for the automobile of interest. The first GETEDIT actually reads the two requested numbers with a TEXT statement labeled TEXT1.

The GETEDIT instruction searches the TEXT1 data and converts the first entry to a single-precision variable called LIST1. The second entry is converted to a double-precision variable called LIST2. The first PUTEDIT instruction, using the FORMAT statement labeled PE1FMT, converts LIST1 and LIST2 back to EBCDIC and displays these values on the printer. The PUTEDIT instruction and FORMAT statement determine the layout of the data as it is displayed.

The GETEDIT instruction after label GE2 takes the data already entered into TEXT1 with the preceding READTEXT and converts it into the two binary variables called LIST1 (single-precision) and LIST2 (double-precision). Because ACTION=STG, a READTEXT must be issued before executing the GETEDIT.

The PUTEDIT instruction at label PE2 converts the two variables back to EBCDIC and places them into the TEXT2 statement as formatted by the PE2FMT FORMAT statement. Again, the keyword ACTION=STG prevents the data from being printed until the following PRINTEXT instruction is executed.

```
GE1      EQU      *
         PRINTEXT '@ENTER MODEL YEAR AND SERIAL NUMBER@'
         GETEDIT  GE1FMT,TEXT1,(LIST1,(LIST2,D)),                    X
                  ACTION=IO,ERROR=ERR1
*
PE1      EQU      *
         ENQT     $SYSPRTR
         PUTEDIT  PE1FMT,TEXT2,(LIST1,(LIST2,D)),ACTION=IO
         DEQT
*
GE2      EQU      *
         READTEXT TEXT1,'@ENTER YOUR DEPT. AND SYSTEM ID NUMBER@'
*
         GETEDIT  GE2FMT,TEXT1,(LIST1,(LIST2,D)),                    X
               ACTION=STG,ERROR=ERR1
*
PE2      EQU      *
         PUTEDIT  PE2FMT,TEXT2,(LIST1,(LIST2,D)),ACTION=STG

         ENQT     $SYSPRTR
         PRINTEXT TEXT2
         DEQT
           •
           •
           •
ERR1     EQU      *
         PRINTEXT '@GETEDIT GE1 HAS FAILED@'
         GOTO     ERROROUT
*
ERR2     EQU      *
         PRINTEXT '@GETEDIT GE2 HAS FAILED@'
         GOTO     ERROROUT
GE1FMT   FORMAT   (I4,1X,I8)
PE1FMT   FORMAT   ('MDL. YR. = ',I4,6X,'SER. NO. = ',I8)
GE2FMT   FORMAT   (I3,1X,I6)
PE2FMT   FORMAT   ('DEPT. = ',I3,4X,'SYST. ID. = ',I6)
LIST1    DATA     F'0'
LIST2    DATA     D'0'
TEXT1    TEXT     LENGTH=13
TEXT2    TEXT     LENGTH=42
ERROROUT EQU      *
```

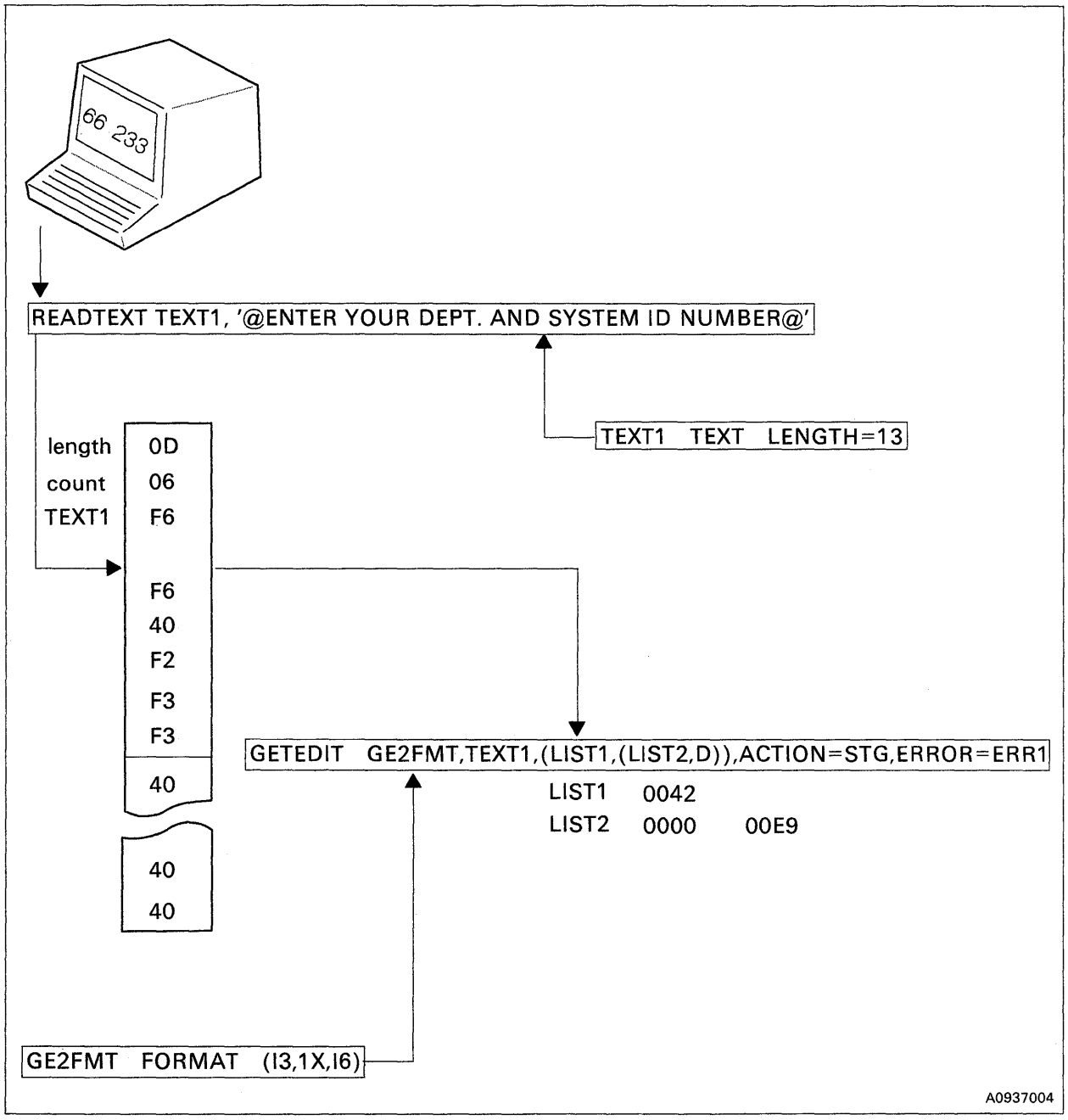


Figure 2-6. GETEDIT Overview

Return Codes

Return codes are returned in the first word of the task control block (TCB) of the program or task issuing the instruction. The label of the TCB is the label of your program or task (taskname).

For several errors, the system returns the return code with the highest value.

Return Code	Description
−1	Successful completion.
1	Invalid data encountered during conversion.
2	Field omitted.
3	Conversion error.

GETSTG – Obtain Mapped and Unmapped Storage Areas

The GETSTG instruction obtains mapped and unmapped storage areas.

The SWAP instruction allows your program to use the unmapped storage areas you acquire with the GETSTG instruction. You release mapped and unmapped storage areas with the FREESTG instruction.

Note: "Mapped storage" is the physical storage you defined on the PARTS operand of the SYSPARTS statement during system generation. "Unmapped storage" is any physical storage that you did not include on the PARTS operand of the SYSPARTS statement. This instruction obtains unmapped storage areas only from the partition in which the program is executing.

Syntax:

label	**GETSTG name,TYPE=,ERROR=,P1=**
Required:	**name**
Defaults:	**TYPE=ALL**
Indexable:	**none**

Operand	*Description*
name	The label of a STORBLK statement. The STORBLK statement specifies the size of the mapped storage area and the number of unmapped storage areas the GETSTG instruction can obtain.
TYPE=	MAP, to acquire only the mapped storage area you defined on the STORBLK statement. NEXT, to acquire one of the unmapped storage areas you defined on the STORBLK statement. The instruction also obtains the mapped storage area if it has not acquired it already. ALL, the default, to acquire all the unmapped storage areas you defined on the STORBLK statement. The instruction also obtains the mapped storage area if it has not acquired it already.
ERROR=	The label of the first instruction of the routine to be called if an error occurs during the execution of this instruction.
P1=	Parameter naming operand. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code this operand.

Syntax Examples

1) Obtain all the unmapped storage areas and the mapped storage area defined on the STORBLK statement labeled BLOCK.

```
GETSTG   BLOCK,TYPE=ALL
```

2) Obtain only the mapped storage area defined on the STORBLK statement labeled BLOCK.

```
GETSTG   BLOCK,TYPE=MAP
```

3) Obtain one of the unmapped storage areas defined on the STORBLK labeled BLOCK. The label of the first instruction of the error routine for this instruction is OUT.

```
GETSTG   BLOCK,TYPE=NEXT,ERROR=OUT
```

Coding Example

See the SWAP instruction for an example that uses the GETSTG instruction.

Return Codes

Return codes are returned in the first word of the task control block (TCB) of the program or task issuing the instruction. The label of the TCB is the label of your program or task (taskname).

Return Code	Description
−1	Successful completion.
1	A mapped storage entry already exists in the storage control block.
2	Mapped storage area is not available in the system.
99	No unmapped storage table exists.
100	No unmapped storage support in system.
3	Unmapped storage is not available or only partial storage was obtained. Check the second word of the TCB. A zero shows that no unmapped storage is available. A nonzero value equals the number of unmapped storage areas obtained by the instruction.
4	All unmapped storage entries in the storage control block are in use.

GETTIME – Get Date and Time

The GETTIME instruction places the contents of the system's time-of-day clock in a 3-word table that you define in your program. The 3 words contain the hours, minutes, and seconds, in that order. You also can specify that the date be stored in an additional 3 words, resulting in a 6-word table containing hours, minutes, seconds, month, day, and year. Use this instruction when you want to store the time of day and date as you collect data.

The maximum time on the clock is 23.59.59. At midnight, the supervisor resets the time-of-day clock to 0 and increases the date by 1. The supervisor resets the month and year as necessary.

Syntax:

label	**GETTIME loc,DATE=,P1=**
Required:	**loc**
Defaults:	**DATE=NO**
Indexable:	**loc**

Operand	*Description*
loc	The label of a 3-word table where the system stores the time of day as hours, minutes, and seconds; or the label of a 6-word table where the time of day and the date are stored as hours, minutes, seconds, month, day, and year. The time and date are in hexadecimal format.
DATE=	YES, to obtain the date as well as the time of day. If the task control block code word, $TCBCO, contains a −2, the date is in the form: day, month, year. If $TCBCO contains a −1, the date is in the form: month, day, year. The format of the date was specified on the SYSPARMS statement during system generation. NO, to obtain only the hours, minutes, and seconds, in that order.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Syntax Example

This GETTIME instruction obtains the time and date and places the result in a 6-word table beginning at the label TAB.

```
        GETTIME   TAB,DATE=YES
```

The following example shows the possible contents of TAB (in hexadecimal format) after the GETEDIT operation:

```
TAB   000D   (hours)
      0018   (minutes)
      0005   (seconds)
      0006   (month)
      001B   (day)
      0053   (year)
```

The time and date shown is 13:24:05 on June 27, 1983.

Coding Example

The following program demonstrates a method of acquiring the system date and time then displaying both on a terminal according to the coded FORMAT statement.

```
DTERTN    PROGRAM   START
START     EQU       *
          ENQT      $SYSLOG
          GETTIME   TAB,DATE=YES
          PUTEDIT   FORMAT,TEXT,((TAB,6,S)),LINE=8,ERROR=ERR
          GOTO      DONE
*
ERR       EQU       *
          IF        DTERTN+2,NE,-1
          MOVE      CODE,DTERTN+2
          PRINTEXT  '@RETURN CODE:
          GOTO      DONE
          ENDIF
*
DONE      EQU       *
          DEQT
          PROGSTOP
CODE      TEXT      LENGTH=2
TAB       DATA      6F'0'
TEXT      TEXT      LENGTH=36
FORMAT    FORMAT    ('TIME ',I2,':',I2,':',I2,10X,                X
               'DATE ',I2,'/',I2,'/',I2)
          ENDPROG
          END
```

GETVALUE – Read a Value Entered at a Terminal

The GETVALUE instruction reads one or more integer values, or a single floating-point value, entered at a terminal. The values can be decimal or hexadecimal, and of single or double precision. The system treats invalid characters as delimiters.

The supervisor places a return code in the first word of the task control block (taskname) whenever a GETVALUE instruction causes a terminal I/O operation to occur. If the return code is not a −1, the address of this instruction will be placed in the second word of the task control block (taskname+2). The terminal I/O return codes are described at the end of the PRINTEXT and READTEXT instructions in this manual and also in *Messages and Codes.*

Note: Any reference to **31xx** terminals means 3101, 3151, 3161, 3163 and 3164 terminals, unless otherwise noted.

Syntax:

```
label     GETVALUE loc,pmsg,count,MODE=,PROMPT=,
                   FORMAT=,TYPE=,SKIP=,LINE=,SPACES=,
                   COMP=,PARMS=(parm1,...,parm8),
                   MSGID=,P1=,P2=,P3=

Required:  loc
Defaults:  MODE=DEC,PROMPT=UNCOND,count=1 (word)
           FORMAT=(6,0,I),TYPE=S,SKIP=0
           LINE=current line,SPACES=0,MSGID=NO
Indexable: pmsg,SKIP,LINE,SPACES
```

Operand	*Description*
loc	The label of the variable to receive the input value. If your program requests more than one value, the system stores the successive values in successive words or doublewords depending on the precision you specify in the count operand.
pmsg	The prompt message. Code the label of a TEXT statement or an explicit text message enclosed in single quotes. The GETVALUE instruction issues this prompt according to the parameter you code for the PROMPT keyword. To retrieve a prompt message from a data set or module containing formatted program messages, code the number of the message you want displayed or printed. You must code a positive integer or a label preceded by a plus sign (+) that is equated to a positive integer. If you retrieve a prompt message from storage, you must also code the COMP= operand. See Appendix E, "Creating, Storing, and Retrieving Program Messages" on page E-1 for more information.

count The number of integer values to be entered. If the FORMAT parameter is used, the count is forced to 1 regardless of the value specified. The precision specification can be substituted for the count specification. If the precision is substituted for the count, the count defaults to 1. The precision can accompany the count in the form of a sublist: (count,precision). The default value for precision is word, or the keyword WORD can be specified. If double-precision is desired, code the precision keyword DWORD. Only the WORD and DWORD precisions can be specified.

With conditional prompting, the system issues the prompt message if you do not enter advance input. Once a prompt message has been issued, however, you may enter one or more values. Omitted values leave the corresponding internal variables unchanged and are indicated by coding two consecutive delimiters. The delimiters allowed between values are the characters slash (/), comma (,), period (.), or blank ( ). The number of values entered is stored at taskname+2 when the instruction completes.

MODE= HEX, for hexadecimal input.

DEC, the default, for decimal input.

PROMPT= COND (conditional), to prevent the system from displaying the prompt message if you enter a value before the prompt.

UNCOND (unconditional), to have the system display the prompt message without exception. UNCOND is the default.

FORMAT= The format of the value to be read in. Use the FORMAT operand where the default is not desired. The count parameter is ignored. The format is specified as a 3-element list (w,d,f), defined as follows:

w A decimal value equal to the maximum field width expected from the terminal. Count the decimal point as part of the field width.

d A decimal value equal to the number of digits to the right of an assumed decimal point. (An actual decimal point in the input will override this specification.) For integer variables, code this value as zero.

f Format of the input data. Code I for integer data, F for floating-point data (XXXX.XXX), or E for floating-point data in E notation. See the value operand under the DATA/DC statement for a description of E notation format.

Note: You can use the floating-point format for data even if you do not have floating-point hardware installed in your system. Floating-point hardware is required, however, to do floating-point arithmetic.

The first FORMAT operand to execute generates a work area that all subsequent FORMAT operands will use also. The generated work area is nonreentrant in a multitasking environment, and all tasks must use the ENQ/DEQ functions to serialize access to it.

Note: If you code the FORMAT parameter and you are entering advanced input (PROMPT=COND) for multiple GETVALUE statements, a blank must be used to separate the input values. No other delimiters are valid.

TYPE= The type of variable to receive the input. Use this operand with FORMAT= only. The valid types are:

- **S** Single-precision integer (1 word)
- **D** Double-precision integer (2 words)
- **F** Single-precision floating-point (2 words)
- **L** Extended-precision floating-point (4 words)

SKIP= The number of lines to be skipped before the system does an I/O operation. For example, if your cursor is at line 2 on a display screen and you code SKIP=6, the system does the I/O operation on line 8. For a printer, the SKIP operand controls the movement of forms.

The SKIP operand causes the system to display or print the contents of the system buffer.

If you specify a value greater than or equal to the logical page size, the system divides this value by the page size and uses the remainder in place of the value you specify. For roll screens, the logical page size equals the screen's bottom margin minus the number of history lines and the screen's top margin.

LINE= The line number on which the system is to do an I/O operation. Code a value between zero and the number of the last usable line on the page or logical screen. The line count begins at the top margin you defined for the printer or display screen. LINE=0 positions the cursor at the top line of the page or screen you defined; LINE=1 positions the cursor at the second line of the page or screen. For roll screens line 0 equals the screen's top margin plus the number of history lines.

For printers and roll screens, if you code a value less than or equal to the current line number, the system does the I/O operation at the specified line on the next page or logical screen. For static screens, if you code a value within the limits of the logical screen, the system does the I/O operation on the line you specified.

If you code a value greater than the last usable line number, the system divides this value by the logical page size and uses the remainder as the line number on which to do the I/O operation. For example, if you code LINE=22 and your roll screen has a logical page size of 20, the I/O operation occurs on the second line of the logical screen.

The LINE operand causes the system to print or display the contents of the system buffer.

SPACES= The number of spaces to indent before the system does an I/O operation. SPACES=0, the default, positions the cursor at the beginning of the left side of the page or screen. If the value you specify is beyond the limits of the logical screen or page, the system indents the next line by the excess number of spaces.

When you code the LINE or SKIP operands with SPACES, the system begins indenting from the left margin of the page or screen. If you specify SPACES without coding LINE or SKIP, the system begins indenting from the last cursor position on the line.

COMP= The label of a COMP statement. You must specify this operand if the GETVALUE instruction is retrieving a prompt message from a data set or module containing formatted program messages. The COMP statement provides the location of the message. (See the COMP statement for more information.)

PARMS= The labels of data areas containing information to be included in a message you are retrieving from a data set or module containing formatted program messages. You can code up to eight labels. If you code more than one label, you must enclose the list in parentheses.

Note: To use this operand, you must have included the FULLMSG module in your system during system generation. Refer to the *Installation and System Generation Guide* for a description of this module.

MSGID= YES, if you want the message number and 4-character prefix to be printed at the beginning of the message you are retrieving from a data set or module containing formatted program messages. See the COMP statement operand "idxx" for a description of the 4-character prefix.

NO (the default), to prevent the system from printing or displaying this information at the beginning of the message.

Note: To use this operand, you must have included the FULLMSG module in your system during system generation. Refer to the *Installation and System Generation Guide* for a description of this module.

Px= Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

31xx Display Considerations

When using a 31xx in block mode, the attribute byte associated with any prompt message and the input data will depend on the current TERMCTRL SET,ATTR in effect. The default is SET,ATTR=HIGH (high intensity) for the attribute byte. Also TERMCTRL SET,STREAM=NO should be in effect when the GETVALUE instruction is executed for a 31xx in block mode.

Syntax Examples

The syntax examples for this instruction use the following data areas:

```
MSG     TEXT    'ENTER NEXT NUMBER'
A       DC      F'0'
B       DC      F'0'
C       DC      F'0'
D       DC      D'0'
E       DC      D'0'
F       DC      E'0.0000'
L       DC      L'0.000'
```

1) Read a single-precision integer of up to 6 decimal digits into data area A.

```
GETVALUE   A,MSG

GETVALUE   A,MSG,TYPE=S,FORMAT=(6,0,I)
```

2) Read 3 consecutive single-precision integers (of 6 decimal digits or fewer) into data areas A, B, and C.

```
GETVALUE   A,MSG,(3,WORD)
```

3) Read a double-precision integer of up to 10 decimal digits into doubleword data area D.

```
GETVALUE   D,MSG,DWORD

GETVALUE   D,MSG,TYPE=D,FORMAT=(10,0,I)
```

4) Read 2 consecutive single-precision integers (of 6 decimal digits or fewer) into data areas B and C.

```
GETVALUE   B,MSG,2
```

5) Read 2 consecutive double-precision integers (of 10 decimal digits or fewer) into data areas D and E.

```
GETVALUE   D,MSG,(2,DWORD)
```

6) Ignore the count and read a single-precision integer of up to 4 decimal digits into data area A.

```
GETVALUE   A,MSG,3,TYPE=S,FORMAT=(4,0,I)
```

7) Read a double-precision integer of up to 6 decimal digits into doubleword data area E.

```
GETVALUE   E,MSG,TYPE=D,FORMAT=(6,0,I)
```

8) Read a single-precision floating-point (F-format) number of 7 digits, with 4 digits to the right of an assumed decimal point, into data area F.

```
GETVALUE   F,MSG,TYPE=F,FORMAT=(8,4,F)
```

9) Read an extended-precision floating-point (E-format) number of 8 digits, with 3 digits to the right of an assumed decimal point, into data area E.

```
GETVALUE   G,MSG,TYPE=L,FORMAT=(9,3,E)
```

Coding Examples

1) If, in the following example, the operator entered 55 23A5 68 in response to the prompt from the third GETVALUE, the first three of five storage locations in DATA3 would assume the values 0055, 23A5, and 0068, respectively. The other 2 word locations would remain unchanged (X'0000').

```
          •
          •
          •
        GETVALUE  DATA,MESSAGE
        GETVALUE  DATA2,'@ENTER A: ',PROMPT=COND
        GETVALUE  DATA3,MSG,5,MODE=HEX
          •
          •
          •
MESSAGE TEXT      'ENTER YOUR AGE'
MSG     TEXT      'DATA :'
DATA    DATA      F'0'
DATA2   DATA      F'0'
DATA3   DATA      5F'0'
          •
          •
          •
```

2) In the following example, the GETVALUE instruction, at label G1, prints a message then reads a value entered by an operator. Note that the message in single quotes is printed and provides an unconditional prompt. Also, the value read uses the following defaults: decimal, integer, 1−6 digits, and single-precision.

The GETVALUE at G2 issues a prompt only if there is no advance input and it reads 1 hexadecimal input value. Default values are in effect for the FORMAT and TYPE parameters.

The GETVALUE at G3 reads a variable number of hexadecimal input values, using the default FORMAT and TYPE parameters.

The G4 GETVALUE uses the FORMAT parameter to read a single, floating-point value of up to 9 digits in length and then places the result in a doubleword field.

```
          •
          •
          •
G1      GETVALUE COUNT,'@ HOW MANY WORDS OF STORAGE ? '
G2      GETVALUE DATA,'@ ENTER START ADDRESS',MODE=HEX,PROMPT=COND
        MOVE     #1,DATA
        AND      #1,X'FFFE'            INSURE EVEN STORAGE ADDRESS
        PRINTEXT '@ CURRENT VALUE(S) NOW :'
        PRINTNUM (0,#1),1,MODE=HEX,P2=COUNT
        MOVE     KOUNT,COUNT
G3      GETVALUE DATA,'@ ENTER NEW VALUE(S)',1,P3=KOUNT,MODE=HEX
          •
          •
          •
G4      GETVALUE FLOAT,'@ ENTER DATA',FORMAT=(9,2,F),TYPE=D
          •
          •
          •
```

3) In this example, the GETVALUE instruction displays a prompt message contained in the disk data set MSGSET on volume EDX002. Because +MSG9 equals 9, the system retrieves the ninth message in MSGSET.

```
SAMPLE   PROGRAM   START,200,DS=((MSGSET,EDX002))
                     •
                     •
                     •
         GETVALUE  PNUMB,+MSG9,PROMPT=COND,COMP=MSGSTMT
                     •
                     •
                     •
MSG9     EQU       9
PNUMB    DATA      F'0'
MSGSTMT  COMP      'SRCE',DS1,TYPE=DSK
```

Message Return Codes

The system issues the following GETVALUE return codes when you retrieve a prompt message from a data set or module containing formatted program messages. The return codes are returned in the first word of the task control block (TCB) of the program or task issuing the instruction. The label of the TCB is the label of your program or task (taskname).

Return Code	Description
−1	Message successfully retrieved.
301−316	Error while reading message from disk. Subtract 300 from this value to get the actual return code. See the disk return codes following the READ or WRITE instruction for a description of the code.
326	Message number out of range.
327	Message parameter not found.
328	Instruction does not supply message parameter(s).
329	Invalid parameter position.
330	Invalid type of parameter.
331	Invalid disk message data set.
332	Disk message read error.
333	Storage resident module not found.
334	Message parameter output error.
335	Disk messages not supported (MINMSG support only).

GIN – Enter Unscaled Cursor Coordinates

The GIN instruction allows you to specify unscaled cursor coordinates interactively. The instruction rings the bell, displays cross-hairs, and waits for you to position the cross-hairs and enter a single character. GIN then stores the coordinates of the cross-hair cursor. It also stores the character you entered, if you request this.

Cursor coordinates are unscaled. The PLOTGIN instruction obtains coordinates scaled by the use of a PLOTCB control block.

Syntax:

label	**GIN**	**x,y,char,P1=,P2=,P3=**
Required:	**x,y**	
Defaults:	**no character returned**	
Indexable:	**none**	

Operand	*Description*
x	The location where the x cursor coordinate value is to be stored.
y	The location where the y cursor coordinate value is to be stored.
char	The location where the character you select is to be stored. The character is stored in the right-hand byte. The left byte is set to zero. If you do not code this operand, the instruction does not store the selected character.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Syntax Example

Store the x coordinate in X and the y coordinate in Y. Store the character in the location CHAR.

```
GIN     X,Y,CHAR
```

GOTO – Go to a Specified Instruction

The GOTO instruction allows you to pass control, or "branch," to another instruction in the program.

The statement can:

- Pass control directly to the label of an instruction.
- Pass control to an address defined by a label.
- Pass control to one of the labels in a list based on the value of an index word.

GOTO can also be used as an operand of the IF instruction.

Syntax:

label	**GOTO**	**loc,P1=**
label	**GOTO**	**(loc),P1=**
label	**GOTO**	**(loc0,loc1,loc2,...,locn),index,P1=,P2=**
Required:	**loc**	
Defaults:	**none**	
Indexable:	**index**	

Operand	*Description*
loc	The label of the instruction to receive control. Enclose this label in parentheses if the label points to a data area containing the address of the next instruction to be executed. It may also be a displacement value from index register #1 or #2. The instruction you branch to must be on a fullword boundary.
loc0,loc1,...,locn	The labels in a list of instruction labels that can receive control depending on the value of the index word. The label at loc1 receives control if the index value is equal to 1. The label at loc2 receives control if the index value is equal to 2, and so on. The first label, loc0, is the label of the instruction that receives control if the value of the index word is not in the range of loc1 – locn. The number of instruction labels in the list plus 1 must not exceed 50.
index	The label of an index word containing a value that determines the label to branch to in a list of labels.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Syntax Examples

1) Branch to the label EXIT.

```
        GOTO    EXIT
```

2) Move the address of the ADD instruction into HOLD and branch to that address.

```
        MOVEA   HOLD,NEXT
         •
         •
         •
        GOTO    (HOLD)
         •
         •
         •
NEXT    ADD     A,B
         •
         •
         •
HOLD    DATA    F'0'
```

3) The branch depends on the value in INDEX. If the value in INDEX is 1, the instruction branches to label L1. If the value in INDEX is 2, the instruction branches to label L2. Any other value in INDEX causes the instruction to branch to ERR.

```
        GOTO  (ERR,L1,L2),INDEX
```

Another example using GOTO is shown under "Syntax Examples with IF, ELSE, and ENDIF" on page 2-215.

HASHVAL – Condense a Character String

The HASHVAL instruction generates a value that is the sum of the binary values of a specified character string. You can use this value to provide a compressed form of character strings. Although other applications are possible, the following two uses are most common:

- You can use the hash value as an element in a list of nearly unique 1-byte values corresponding to a list of character strings. Your program can search this list for a match condition using a computed hash value.
- You can use the hash value as an index into a table of up to 256 bytes.

Because there are far more combinations of 8-byte character strings than can be represented in one byte, duplicate hash values can result from unique character strings. Using a hash technique should provide help in dealing with this potential condition. When the number of duplicate hash values exceeds approximately one half of the total number of character strings, the hash technique begins to lose its advantage.

The algorithm used to get the hash value is as follows:

1. The character string is padded with blanks on the right to the length specified in the instruction; then, if required, the string is padded with zeros to make a total of eight characters.
2. The first four bytes are added to the second four bytes to form a partial result.
3. The first two bytes of the partial result are then added to the second two bytes, forming a second partial result.
4. The resulting two bytes are then added together forming the final result or 1-byte hash total.

Syntax:

label	**HASHVAL 'character string',RANGE=,LENGTH=, TYPE=**
Required:	**'character string'**
Defaults:	**RANGE=256,LENGTH=8,TYPE=DATA**
Indexable:	**none**

Operand *Description*

character string
Code the actual character string and enclose it in quotes. The maximum length is 8 bytes (characters) unless specified as less with the LENGTH operand. If fewer characters are coded than the default or specified length, the string is padded to the right with blanks to fill the field.

RANGE= A value from 1 to 256 that specifies the maximum range of resulting hash values (the modulus function). The resulting hash value is the remainder of the 1-byte sum divided by either the range value specified or the default value of 256.

LENGTH= A value from 1 to 8 that specifies the maximum number of characters to be used in calculating the hash value. If you specify a character string with fewer characters than the maximum, the system pads the character string to the right with blanks until it equals the length specification.

TYPE= EQU, assigns the resulting hash value the label you coded for the HASHVAL instruction.

DATA (the default), does not equate the final hash value with the instruction label.

Syntax Examples

1) Generate a hash value of X'7F'.

```
HASHVAL  'EIGHTCNT'
```

2) Generate a hash value of X'5C'.

```
HASHVAL  'FOUR'
```

3) Generate a hash value of X'5A'. The value is not padded with blanks because LENGTH=4.

```
HASHVAL  'FOUR',LENGTH=4
```

4) Generate a hash value of X'2A' (X'5C' modulus 50).

```
HASHVAL  'FOUR',RANGE=50
```

5) Generate a hash value of X'5C' and assign the HASHVAL label this value (LABEL EQU X'5C').

```
LABEL    HASHVAL  'FOUR',TYPE=EQU
```

IDCB – Create an Immediate Device Control Block

The IDCB statement creates a standard immediate device control block that specifies a hardware operation. You must use this statement when doing EXIO processing.

Note: Refer to the description manual for the processor in use for more information on IDCBs.

Syntax:

label	**IDCB**	**COMMAND=,ADDRESS=,DCB=,DATA=, MOD4=,LEVEL=,IBIT=**
Required:	**label,COMMAND=,ADDRESS=**	
Defaults:	**LEVEL=1,IBIT=ON**	
Indexable:	**not applicable**	

Operand ***Description***

COMMAND=
The specific I/O operation. Code one of the keywords from the following list. In the following keyword list the resulting hexadecimal command code is shown in parentheses. An x represents a character that is filled in by the value specified by MOD4.

READ	Transfer a byte or word from the device.	(0x)
READ1	Same as READ plus function bit set.	(1x)
READID	Read the device-identification word.	(20)
RSTATUS	Read the device status.	(2x)
WRITE	Transfer a byte or word to the device.	(4x)
WRITE1	Same as WRITE plus function bit set.	(5x)
PREPARE	Prepare the device for interrupts or initialization.	(60)
CONTROL	Initiate a control action to the device.	(6x)
RESET	Initiate a device reset operation.	(6F)
START	Initiate a cycle-steal operation.	(7x)
SCSS	Initiate a start-cycle-steal-status operation.	(7F)

ADDRESS= The device address as two hexadecimal digits.

DCB= The label of a DCB statement. See your hardware description manual to determine whether you need to code this operand for the operation you want to perform.

DATA= The data word to be transferred to the device by a WRITE, WRITE1, or CONTROL command. Code the actual data as four hexadecimal digits.

MOD4= A 4-bit device-dependent value that modifies the command code specified by the COMMAND operand. Code one hexadecimal digit.

LEVEL = The hardware interrupt level to be assigned to the device by a PREPARE command.

IBIT = ON (the default), to allow the device to present interrupts.

OFF, if the device should not present interrupts.

Syntax Examples

1) Transfer data to the device and set the function bit.

```
IDCB1    IDCB COMMAND=WRITE1,ADDRESS=00,DATA=0041
```

2) Prepare the device for interrupts on hardware level 3.

```
PREPIDCB IDCB COMMAND=PREPARE,ADDRESS=E4,LEVEL=3,IBIT=ON
```

3) Start a cycle steal operation for the device.

```
WR1IDCB  IDCB COMMAND=START,ADDRESS=E1,DCB=WR1DCB
```

IF – Test If a Condition Is True or False

The IF instruction determines whether a conditional statement is true or false and, based on its decision, determines the next instruction to execute.

A conditional statement can compare two data items or ask whether a bit is "on" (set to 1) or "off" (set to 0). The instruction syntax shows the general format of conditional statements used with the IF instruction.

You can compare data in two ways: *arithmetically* or *logically*. When you compare data arithmetically, the system interprets each number as a positive or negative value. The system, for example, interprets X'0FFF' as 4095. It interprets X'FFFF', however, as a −1. Although X'FFFF' seems to be a larger hexadecimal number than X'0FFF', the system recognizes the former as a negative number and the latter as a positive number. X'FFFF' is a negative number to the system because the leftmost bit is "on."

When you compare data logically, the system compares the data areas byte by byte. The system interprets X'FFFF' not as a −1 but as a string of 2 bytes with all bits "on."

With EBCDIC or ASCII character data, the system makes a logical comparison of the characters byte by byte. In a logical comparison of a capital 'A' (X'C1') with a capital "H" (X'C8'), the system recognizes the capital A to be "less than" the capital H. By comparing character data logically, you can use the IF instruction to sort items alphabetically ("a" is less than "c" which is greater than "b").

The syntax box shows the IF instruction with a single conditional statement. You can specify several conditional statements on a single IF instruction, however, by using the AND and OR keywords. These keywords allow you to join conditional statements. "Rules for Evaluating Statement Strings Using AND and OR" on page 2-108 provides additional information regarding use of the IF instruction. The keywords are described in the operands list and examples using the keywords are shown following the instruction description.

Syntax:

label	**IF**	**(data1,condition,data2,width)**
label	**IF**	**(data1,condition,data2,width),GOTO,loc**
Required:	**one conditional statement**	
Defaults:	**width is WORD for arithmetic comparison**	
Indexable:	**data1 and data2 in each statement**	

Operand	*Description*
data1	The label of a data item to be compared to data2 or the label of the data area that contains the bit to be tested.
condition	An operator that indicates the relationship or condition to be tested. The valid operators for the IF instruction are as follows:

Arithmetic and Logical Comparisons	*Testing a Bit Setting*
EQ – Equal to	ON or OFF
NE – Not equal to	
GT – Greater than	
LT – Less than	
GE – Greater than or equal to	
LE – Less than or equal to	

data2 The label of a data item to be compared to data1 or the label of the data area that contains the bit in data1 to be tested. For an arithmetic comparison, specify immediate data or the label of a data area. Immediate data can be an integer from 0 to 32767, or a hexadecimal value from 0 to 65535 (X'FFFF'). For a logical comparison, specify the label of a data area. For a bit comparison, specify immediate data.

When you check a bit setting, remember that bit 0 is the leftmost bit of the data area.

width Specify an integer number of bytes in the range of 1 to 65535 for a logical comparison (no default). For a bit comparison, specify an immediate data area in words. This form specifies that both DATA1 and DATA2 are storage locations; an immediate operand is not permitted.

For an arithmetic comparison, you can specify one of the following:

BYTE	Byte (8 bits)
WORD	Word (16 bits), the default
DWORD	Doubleword (32 bits)
FLOAT	Single-precision floating-point (32 bits)
DFLOAT	Extended-precision floating-point (64 bits)

GOTO If the statement is true and GOTO is coded, control passes to the instruction at the address specified in the loc operand. If the statement is false, execution proceeds sequentially.

If GOTO is not coded, THEN is assumed and the next instruction is determined by the IF-ELSE-ENDIF structure. If the condition is true, execution proceeds sequentially. If the condition is false, execution continues with the next ELSE statement (if one is coded) or ENDIF statement.

loc Used with GOTO to specify the address of the instruction to be executed if the statement is true. The instruction must be on a fullword boundary.

AND Enables you to join conditional statements. Code the operand between the conditional statements you want to join. The AND operand indicates that each of the conditional statements must be true before a program will execute. See the syntax examples for this instruction.

You can join several pairs of conditional statements by using several AND operands. You also can use the AND and OR operands within the same IF instruction.

OR Enables you to join conditional statements. Code the operand between the conditional statements you want to join. The OR operand indicates that one of the conditional statements must be true before a program will execute.

You can join several pairs of conditional statements by using several OR operands. You also can use the OR and AND operands within the same IF instruction.

Notes:

1. See "Rules for Evaluating Statement Strings Using AND and OR" on page 2-108 for information on use of the OR and AND operands to connect statements logically within the IF instruction.
2. Code the word THEN after the conditional statement to make the program easier to read. See Syntax Example 2.

Syntax Examples with IF, ELSE, and ENDIF

1) If A equals B, pass control to the instruction at label ERROR. This is an arithmetic comparison.

```
IF   (A,EQ,B),GOTO,ERROR
```

2) If the first 4 bytes of A are greater than or equal to the first four bytes of B, pass control to the instruction at label RETRY. This is a logical comparison.

```
IF   (A,GE,B,4),GOTO,RETRY
```

3) If C is not equal to D, execute the code that follows the IF instruction. This is an arithmetic comparison.

```
IF   (C,NE,D),THEN
  •
  •
  •
ENDIF
```

4) If register #1 is equal to 1, execute the code that follows the IF instruction; if #1 is not equal to 1, execute the code following the ELSE statement. This is an arithmetic comparison.

```
IF   (#1,EQ,1)
  •
  •
  •
ELSE
  •
  •
  •
ENDIF
```

5) If the first three bytes of A are less than the first three bytes of B, execute the code following the IF instruction. If the first three bytes of A are greater than or equal to the first three bytes of B, execute the code following the ELSE statement. This is a logical comparison.

```
IF    (A,LT,B,3)
   •
   •
   •
ELSE
   •
   •
   •
ENDIF
```

6) Test whether A is equal to B and whether C is equal to D. If both conditional statements are true, execute the code that follows the IF instruction; if either one or both of the conditional statements are false, execute the code following the ELSE statement. This is an arithmetic comparison.

```
IF    (A,EQ,B),AND,(C,EQ,D)
   •
   •
   •
ELSE
   •
   •
   •
ENDIF
```

7) If A equals B and X is greater than Y, instructions x1, x2, and x3 will execute. If A equals B, but X is not greater than Y, instructions x1 and x3 will execute. If A does not equal B, only instruction x4 executes.

```
IF  (A,EQ,B)
 x1
  IF  (X,GT,Y)
    x2
  ENDIF
 x3
ELSE
 x4
ENDIF
```

8) If the third bit starting at label A is a 1, execute the code following the IF instruction. If the third bit starting at label A is a 0, execute the code following the ELSE statement.

```
IF    (A,ON,2)
   •
   •
   •
ELSE
   •
   •
   •
ENDIF
```

9) If the bit in A at the position defined by BIT1 is a 0, execute the code following the IF instruction. If the bit is not a 0, set the value of the bit to 0.

```
IF      (A,OFF,BIT1)
   •
   •
   •
ELSE
 SETBIT  A,BIT1,OFF
ENDIF
```

Sample Conditional Statements

Arithmetic Comparisons	**Comments**
(A,EQ,0)	A equal to 0, WORD
(A,EQ,X'0022')	A equal to hexadecimal 22, WORD
(A,NE,B)	A not equal to B, WORD
(DATA1,LT,DATA2,WORD)	DATA1 less than DATA2, WORD
(CHAR,EQ,C'A',BYTE)	CHAR equal to 'A', BYTE
(XVAL,GT,Y,DWORD)	XVAL greater than Y, DWORD
((A,#1),EQ,1)	(A,#1) equal to 1, WORD
((A1,#1),LE,(B1,#2))	(A1,#1) LE (B1,#2), WORD
(#1,EQ,1)	#1 equal to 1, WORD
(#1,GT,#2)	#1 greater than #2, WORD
((C,#2),EQ,CHAR,BYTE)	(C,#2) equal to CHAR, BYTE
(F1,GT,0,FLOAT)	F1 greater than 0, FLOAT
(L2,LT,L3,DFLOAT)	L2 less than L3, DOUBLEWORD FLOATING-POINT
((BUF,#1),LE,1,FLOAT)	(BUF,#1) less than or equal 1, FLOAT
D EQU 2	D has a word value of X'0002'
IF (B,EQ,+D,BYTE)	B equal to X'00' (leftmost byte of D)
Logical Comparisons	**Comments**
(A,EQ,B,8)	A equal to B, 8 bytes
((BUF,#1),NE,DATA,3)	(BUF,#1) not equal to DATA, 3 bytes
(A,EQ,B,2)	A equal to B, 2 bytes
(DATA1,LT,DATA2,3)	DATA1 less than DATA2, 3 bytes
((BUF,#1),GE,DATA,4)	(BUF,#1) greater than or equal to DATA, 4 bytes
Testing a Bit	**Comments**
(A,ON,B)	The bit at position B in data area A is a 1
(A,OFF,C'BB')	The bit at the hexadecimal displacement represented by the characters 'BB' in data area A is a 0. Actual displacement is X'C2C2'.
(DATA1,ON,X'413C')	Bit at displacement X'413C' in DATA1 is a 1.

Sample Conditional Statement Strings

```
(A,EQ,B),AND,(A,EQ,C)
(A,NE,1),OR,(D,EQ,E,DWORD),AND,(#1,NE,14)
(F,EQ,G,8),AND,(#1,EQ,#2),AND,(X,EQ,1),OR,(RESULT,GT,0)
(DATA,EQ,C'/',BYTE),OR,(DATA,EQ,C'*',BYTE)
((BUF,#1),NE,(BUF,#2)),OR,(#1,EQ,#2)
```

INTIME – Provide Interval Timing

The INTIME instruction provides two forms of interval timing information, reltime and loc. The first form, reltime, is a 2-word area in your program where INTIME stores a value each time an INTIME instruction executes. This value is equal to the elapsed time since system IPL. The count is expressed in milliseconds and is in double-precision integer format. The maximum value for reltime is reached after approximately 49 days of continuous operation. The system resets the counter to 0 at that time.

The second form, loc, is a single-precision integer variable where INTIME stores the time in milliseconds since the previous execution of an INTIME instruction in this task. The maximum interval between calls to INTIME (that is, the maximum value that can be stored at loc) is 65,535 milliseconds (65.535 seconds).

Note: Each task in the system has available to it one software-driven timer that operates with a precision of 1 millisecond. Use the STIMER instruction to operate this timer in any task.

Syntax:

label	**INTIME**	**reltime,loc,INDEX,P2=**
Required:	**reltime,loc**	
Defaults:	**no indexing**	
Indexable:	**loc**	

Operand	*Description*
reltime	The label of a 2-word table where a relative time marker can be stored. This field should be defined by DATA 2F'0'. The relative time marker is a double-precision count, in milliseconds, that indicates the relative time at which the last INTIME was issued. It should be initialized to 0. Proper use of this parameter allows you to measure different intervals from the same origin in time.
loc	The label of a buffer of data area where interval time data is to be stored. When reltime = 0, as after initialization, the first interval returned will also be 0.
INDEX	Automatic indexing is to be used. The operand loc must be defined by a BUFFER statement when INDEX is used.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Coding Example

When the INTIME instruction executes, it places the number of milliseconds that have elapsed since system IPL in the UPTIME variable. Because the LOC variable refers to a BUFFER statement and automatic indexing is used, the interval count since execution of the previous INTIME instruction will be placed in the next available BUFFER location. The PRINTEXT and PRINTNUM instructions print the data on the appropriate forms.

```
GETTIME  EQU     *
         INTIME  UPTIME,INTERVAL,INDEX     GET TIME IN MILLISECONDS
         DIVIDE  UPTIME,1000,DWORD         CONVERT TIME TO SECONDS
         DIVIDE  UPTIME,3600,DWORD         DIVIDE TO GET HOURS
         DIVIDE  TASK,60,RESULT=MIN        DIVIDE THE REMAINDER TO
*                                          GET MINUTES
         ENQT    $SYSPRTR
         PRINTEXT '@ADDITIONAL 100 BARRELS OF OIL                    X
               PROCESSED AT HR:MIN'
         PRINTNUM UPTIME,TYPE=D
         PRINTNUM MIN
         PRINTEXT '@AFTER BEGINNING OF PROCESSING RUN@'
         PRINTEXT '@CURRENT BATCH TOOK '
         MULT    ENTRIES,2,RESULT=INDX
         MOVEA   #1,INTERVAL
         ADD     #1,INDX
         DIVIDE  (0,#1),1000,RESULT=SECONDS
         PRINTNUM SECONDS
         PRINTEXT ' SECONDS TO PRODUCE@'
         DEQT
           •
           •
           •
UPTIME   DATA    2F'0'
MIN      DATA    F'0'
SECONDS  DATA    F'0'
INTERVAL BUFFER  1000,WORDS,INDEX=ENTRIES
INDX     DATA    F'0'
```

IOCB – Define Terminal Characteristics

The IOCB statement defines a terminal name and terminal characteristics for use with the ENQT instruction. You can use this statement to change such terminal characteristics as screen or page margins temporarily. You define these and other terminal characteristics during system generation. When your program releases control of a terminal, the characteristics you defined with the IOCB statement are no longer in effect.

When coding the IOCB instruction, you can include a comment that will appear with the instruction on your compiler listing. If you include a comment, you must specify at least one operand with the instruction. The comment must be separated from the operand field by one or more blanks and it cannot contain commas.

Do not code PAGSIZE, TOPM, BOTM, LEFTM, RIGHTM, or NHIST IOCB instruction operands for a 31xx in block mode.

Note: Any references to **31xx** terminals means 3101, 3151, 3161, 3163, and 3164 terminals, unless otherwise noted.

Syntax:

label	**IOCB**	**name,PAGSIZE=,TOPM=,BOTM=,LEFTM=, RIGHTM=,SCREEN=,NHIST=,OVFLINE=, BUFFER= comment**
Required:	**none**	
Defaults:	**see discussion below**	
Indexable:	**none**	

Operand *Description*

name The name of a terminal as defined by the label on a TERMINAL definition statement used in system generation. Refer to the *Installation and System Generation Guide* for a description of the TERMINAL definition statement. This operand generates an 8-character EBCDIC string, padded as necessary with blanks, whose label is the label on the IOCB instruction. It may, therefore, be modified by the program. If unspecified, the string is blank and implicitly refers to the terminal that is currently in use by the program.

Note: Except for the BUFFER operand, the following operands have default values established by the TERMINAL definition statement

PAGSIZE= The physical page size (form length) of the I/O medium. Specify an integer between 1 and the maximum value taht is meaningful for the device. For printers, specify the number of lines per page. For screen devices, specify the size of the screen in lines. This operand is not required for the 4978, 4979, or 4980 display terminal.

If you specify this operand, BOTM must be between TOPM plus NHIST, and PAGSIZE−1. Otherwise, unpredictable results will occur.

TOPM= The top margin (a decimal number between zero and PAGSIZE−1) to indicate the top of the logical page within the physical page for the device. The default is 0.

BOTM= The bottom margin, the last usable line on a page. Its value must be between TOPM+NHIST and PAGSIZE−1. The default is PAGSIZE−1. If an output instruction would cause the line number to increase beyond this value, then a page eject, or wrap to line zero, is done before the operation is continued.

LEFTM= The left margin, the character position at which input or output begins. The default is 0. Specify a decimal value between zero and LINSIZE−1.

RIGHTM= A value (between LEFTM and LINSIZE−1) that determines the last usable character position within a line. Position numbering begins at zero.

If a BUFFER statement is not specified, the default is LINSIZE−1. If a BUFFER statement is specified, the value you specify should be one less than the buffer size value.

SCREEN= ROLL, the default, for screens that are to be operated similar to a typewriter. For screen devices that are attached through the teletypewriter adapter, ROLL indicates that the system will pause when a screen-full condition occurs during continuous output.

STATIC, for a full-screen mode of operation, if full-screen mode is supported for the device. For a 31xx terminal, STATIC is valid only for block mode.

NHIST= The number of history lines to be retained when a page eject is performed on the 4978, 4979, or 4980 display. The default is 0. The line at TOPM+NHIST corresponds to logical line zero for the terminal I/O instructions. When a page eject (LINE=0) is performed, the screen area from TOPM to TOPM+NHIST−1 will contain lines from the previous page.

OVFLINE=

YES, if output lines that exceed the right margin are to be continued on the next line.

NO, the default, if the lines are not to be continued.

The overflow condition occurs when the system buffer (or a buffer in an application program) becomes full and the application program has taken no action to write the buffer to the device.

BUFFER= If the application requires a temporary I/O buffer of a different size from that defined by the LINSIZE parameter on the TERMINAL statement, then set this operand with the label of a BUFFER statement allocating the desired number of bytes. The buffer size then temporarily replaces the LINSIZE value and is also the maximum amount that can be read or written at a time. For data entry applications that require full screen data transfers, for example, this avoids the need for allocation of a large buffer within the resident supervisor.

Note that when the buffer size is greater than the 80-byte line size of the 4978, 4979, and 4980 displays, all data transfers take place as if successive lines of the display were concatenated. Screen positions are still designated, however, by the LINE and SPACES parameters with respect to an 80-byte line.

If the buffer size is less than the 80-byte line size of the 4978, 4979, or 4980 display, the logical screen boundaries are adjusted accordingly. If the RIGHTM is not specified or has a value greater than the buffer size, it is adjusted to one less than the buffer size value. Portions of the screen outside this range are not accessible by the application program.

Direct I/O Considerations

If the temporary buffer is not directly addressed by a terminal I/O instruction, then it acts as a normal system buffer of size RIGHTM + 1. It may also be used, however, for direct terminal I/O. Direct terminal I/O occurs when the buffer, defined by an active IOCB, is directly addressed by a PRINTEXT or READTEXT instruction. In this case the data is transferred immediately and the new line character (for carriage return, line feed, and so on) is not recognized.

When doing direct output operations, you must insert the output character count in the index word of the BUFFER before the PRINTEXT (output) instruction. This mode of operation allows the transfer of large blocks (larger than can be accommodated by a TEXT buffer) of data to and from buffered devices such as the 4978, 4979, 4980, and 31xx displays or buffered teletypewriter terminals. On execution of DEQT, the buffer defined by the TERMINAL statement is restored.

Coding Example

The following example shows a use of the IOCB instruction.

In this program an ENQT instruction enqueues an IOCB whose label is TERMINAL. The IOCB instruction refers to a terminal that was assigned the label TERM24 during system generation. If no terminal named TERM24 had been defined in the system generation, the terminal currently in use by the program would be used by default. The IOCB defines a logical static screen that is 40 columns wide and 12 rows deep, in the middle of the physical display.

The terminal does not use the system-defined buffer for I/O operations, but instead uses a program-defined data buffer area called BUFR. The terminal retains the characteristics defined in the IOCB until the program executes a DEQT or PROGSTOP instruction.

```
          •
          •
          •
GETPRTR   EQU    *
          ENQT   TERMINAL
          •
          •
          •
TERMINAL  IOCB   TERM24,TOPM=6,BOTM=17,LEFTM=20,RIGHTM=59,            C
                 SCREEN=STATIC,BUFFER=BUFR
BUFR      BUFFER 480,BYTES
          •
          •
          •
```

IODEF – Assign a Symbolic Name to a Sensor-Based I/O Device

The I/O definition statement (IODEF) defines the hardware address and attributes of a sensor-based I/O device and assigns a label to that device.

The device label consists of two characters that define the type of sensor-based I/O device you are using, followed by a number from one to 99 that identifies the individual device. The types of devices are: AI (Analog Input), AO (Analog Output), DI (Digital Input), DO (Digital Output), and PI (Process Interrupt).

You use the label assigned by IODEF to code a sensor-based I/O instruction (SBIO). The SBIO instruction only refers to the label of the I/O device. You specify the actual physical address of the device and the device attributes on the IODEF statement. (See the SBIO instruction for more details on using the symbolic device name.) The WAIT and POST instructions refer to the IODEF Process Interrupt statement.

Each IODEF statement creates an SBIO control block (SBIOCB). The control block provides the link between the IODEF statement and the SBIO instruction that refers to it. The control block also provides a location into which your program can read data or from which it can write data. The system stores data in the control block if you have not specified another storage location on the SBIO instruction. The contents of the SBIOCB are described in the *Internal Design*.

Each type of sensor-based I/O device requires a specific type of IODEF statement. You must group all IODEF statements that refer to the same type of device together in your application program. In addition, you must place all IODEF statements in your program before the SBIO instructions that refer to them.

In EDL, All IODEF statements must be in the same assembly module as the TASK or ENDPROG statement. If the SBIO instructions are to be in a separate module, you can provide symbolic names using ENTRY/EXTRN statements. You must create a separate IODEF for each task; different tasks cannot use the same IODEF statement.

The syntax of the IODEF statement for each device type (AI, AO, DI, DO, and PI) appears on the following pages.

IODEF (Analog Input)

Syntax:

label	**IODEF AIx,ADDRESS=,POINT=,RANGE=,ZCOR=**
Required:	**AIx,ADDRESS=,POINT=**
Defaults:	**RANGE=5V, ZCOR=NO**
Indexable:	**none**

Operand	*Description*
AIx	Analog Input, where "x" is the number (1 – 99) you assign to an I/O device to identify it in your application program. If you include more than one IODEF AIx statement in the program, you must group these statements together.
ADDRESS=	A 2-digit hexadecimal address.
POINT=	The analog input point. The point is 0 – 7 for AI relay or 0 – 15 for AI solid state.
RANGE=	Range for the multirange amplifier. 5V = 5 Volts 500MV = 500 Millivolts 200MV = 200 Millivolts 100MV = 100 Millivolts 50MV = 50 Millivolts 20MV = 20 Millivolts 10MV = 10 Millivolts
ZCOR=	YES, to use the zero-correction facility of AI. NO (the default), not to use the zero-correction facility.

Syntax Example

Define an analog input device with the label AI1.

```
INPUT   IODEF  AI1,ADDRESS=72,POINT=1,RANGE=50MV,ZCOR=YES
```

IODEF (Analog Output)

Syntax:

label	**IODEF AOx,ADDRESS=,POINT=**
Required:	**AOx,ADDRESS=**
Defaults:	**POINT=0**
Indexable:	**none**

Operand	*Description*
AOx	Analog Output, where "x" is the number (1 – 99) you assign to an I/O device to identify it in your application program. If you include more than one IODEF AOx statement in the program, you must group these statements together.
ADDRESS=	A 2-digit hexadecimal address.
POINT=	The analog output point. The point range is 0 – 1.

Syntax Example

Define an analog output device with the label AO2.

```
OUTPUT    IODEF  AO2,ADDRESS=75,POINT=1
```

IODEF (Digital Input)

Syntax:

label	**IODEF**	**DIx,TYPE = GROUP,ADDRESS =** **or** **DIx,TYPE = SUBGROUP,ADDRESS = ,BITS = (u,v)** **or** **DIx,TYPE = EXTSYNC,ADDRESS =**
Required:	**All**	
Defaults:	**none**	
Indexable:	**none**	

Operand	*Description*
DIx	Digital input, where "x" is the number (1 − 99) you assign to an I/O device to identify it in your application program. If you include more than one IODEF DIx statement in the program, you must group these statements together.
TYPE =	The type of DI operation you are performing. Code one of the following:
	GROUP The I/O operations will use the entire group of 16 DI points. DI operates in unlatched mode.
	SUBGROUP The I/O operations will use a subset of the 16-bit group. The subgroup is stored right-adjusted in the input word with the leftmost bits set to 0. DI operates in unlatched mode.
	EXTSYNC The I/O operations will use the hardware external synchronization feature for DI. You must code the count field on the associated SBIO instructions. DI operates in latched mode.
ADDRESS =	A 2-digit hexadecimal address.
BITS = (u,v)	The portion of the 16-point group you are using when you specify TYPE = SUBGROUP. The portion starts at bit u (0 to 15) for a length of v (1 to 16 − u).

Syntax Example

Define a digital input device with the label DI1.

```
INPUT   IODEF  DI1,TYPE=GROUP,ADDRESS=49
```

IODEF (Digital Output)

Syntax:

label	**IODEF**	**DOx,TYPE = GROUP,ADDRESS =** **or** **DOx,TYPE = SUBGROUP,ADDRESS = ,BITS = (u,v)** **or** **DOx,TYPE = EXTSYNC,ADDRESS = ,BITS = (u,v)**
Required:	**All**	
Defaults:	**none**	
Indexable:	**none**	

Operand *Description*

DOx Digital output, where "x" is the number (1 – 99) you assign to an I/O device to identify it in your application program. If you include more than one IODEF DOx statement in the program, you must group these statements together.

TYPE = The type of DO operation you are performing. Code one of the following:

- **GROUP** The I/O operations will use the entire group of 16 DO points.
- **SUBGROUP** The I/O operations will use a subset of the 16-bit group. Bits that are not part of the subset you specify remain unchanged.
- **EXTSYNC** The I/O operations will use the hardware external synchronization feature for DO. You must code the count field on the associated SBIO instructions.

ADDRESS =
A 2-digit hexadecimal address.

BITS = (u,v) The portion of the 16-point group you are using when you specify TYPE = SUBGROUP. The portion starts at bit u (0 to 15) for a length of v (1 to 16 – u).

Syntax Examples

1) Define a digital output device with the label DO1. The I/O operations will use the entire group of 16 DO points (TYPE = GROUP).

```
OUTPUT    IODEF  DO1,TYPE=GROUP,ADDRESS=4B
```

2) Define a digital output device with the label DO2. The I/O operations will use the hardware external synchronization feature (TYPE = EXTSYNC).

```
OUTPUT2   IODEF  DO2,TYPE=EXTSYNC,ADDRESS=4A
```

IODEF (Process Interrupt)

Syntax:

label	**IODEF**	**PIx,ADDRESS=,BIT=,SPECPI=** **or** **PIx,ADDRESS=,TYPE=BIT,BIT=,SPECPI=** **or** **PIx,ADDRESS=,TYPE=GROUP,SPECPI=**
Required:	**PIx, ADDRESS=**	
Defaults:	**none**	
Indexable:	**none**	

Operand *Description*

PIx Process interrupt, where "x" is the number (1 – 99) you assign to an I/O device to identify it in your application program. If you include more than one IODEF PIx statement in the program, you must group these statements together.

ADDRESS=
A 2-digit hexadecimal address.

BIT= The bit number (0&ndash15) used for PI.

TYPE= Indicates when the system will call the special process interrupt routine you provide. Code one of the following:

GROUP The supervisor gives control to the special interrupt routine you provide if an interrupt occurs on any bit in the PI group. The PI group is not read or reset; reading or resetting the PI group is the responsibility of your routine.

Control returns to the supervisor with a branch to the entry point SUPEXIT. You must include the module $EDXATSR with your program to use SUPEXIT. If the routine processes the interrupt on level 0, it can issue a Series/1 hardware exit level instruction (LEX) instead of returning to SUPEXIT. Issuing the LEX instruction greatly improves performance.

Note: To use TYPE=GROUP, you must be familiar with the operation of the Series/1 process interrupt feature. Your routine must contain all the instructions necessary to read and reset the process interrupt group to which it refers.

BIT The supervisor gives control to the special interrupt routine you provide only when an interrupt occurs on the bit specified in the BIT= operand.

When control returns to the supervisor, the contents of R1 must be the same as when the system called your routine and R0 must contain either 0 or a POST code. If R0 contains a POST code, R3 must contain the address of an ECB to be posted by the POST instruction.

Register 7 contains the supervisor return address on entry. If your routine is in partition 1, you can return control to the supervisor by using the assembler instruction **BXS (R7)**. The SPECPIRT instruction allows you to return control to the supervisor from any partition. (See the SPECPIRT instruction for a coding description.)

SPECPI= The label of the first instruction of a special process interrupt routine. You must write the routine in Series/1 assembler language.

The supervisor executes the routine when the defined interrupt occurs. This routine bypasses the normal supervisor response and allows you to handle process interrupts quickly.

You can include more than one special process interrupt routine in your program.

Syntax Examples

1) Define a process interrupt device with the label PI1.

```
A     IODEF  PI1,ADDRESS=48,BIT=2
```

2) Define a process interrupt device with the label PI2.

```
B     IODEF  PI2,ADDRESS=49,BIT=15
```

Coding Examples

1) The supervisor passes control to the special interrupt routine FASTPI1 when an interrupt occurs on bit 3.

```
        IODEF    PI2,ADDRESS=48,BIT=3,TYPE=BIT,SPECPI=FASTPI1

FASTPI1 EQU      *

        MVW      R1,SAVER1     SAVE R1
        •
        •
        •
        MVA      PI2,R3        PUT THE ADDR OF PI2 IN R3
        MVWI     3,R0          POSTING CODE IN R0
        MVW      SAVER1,R1     RESTORE R1
        SPECPIRT               RETURN TO SUPERVISOR
```

2) The supervisor passes control to the special interrupt routine labeled FASTPI2 when an interrupt occurs on any one of the PI group bits at address 49.

```
        IODEF PI6,ADDRESS=49,TYPE=GROUP,SPECPI=FASTPI2
        •
        •
        •
FASTPI2 EQU      *
```

IOR – Compare the Binary Values of Two Data Strings

The Inclusive OR instruction (IOR) compares the binary value of operand 2 with the binary value of operand 1. The instruction compares each bit position in operand 2 with the corresponding bit position in operand 1 and yields a result, bit by bit, of 1 or 0. If either or both of the bits compared is 1, the result is 1. If neither of the bits compared is 1, the result is 0.

Syntax:

label	**IOR**	**opnd1,opnd2,count,RESULT=,** **P1=,P2=,P3=**
Required:	**opnd1,opnd2**	
Defaults:	**count=(1,WORD),RESULT=opnd1**	
Indexable:	**opnd1,opnd2,RESULT**	

Operand	*Description*
opnd1	The label of the data area to be compared with opnd2. Opnd1 cannot be a self-defining term.
opnd2	The value to be compared with opnd1. You can specify a self-defining term or the label of a data area.
count	Specify the number of consecutive values in opnd1 on which the operation is to be performed. The maximum value allowed is 32767. The count operand can include the precision of the data. Select one precision that the system uses for opnd1, opnd2, and the resulting bit string. When specifying a precision, code the count operand in the form, `(n,precision)` where "n" is the count and "precision" is one of the following: **BYTE** Byte precision **WORD** Word precision (default) **DWORD** Doubleword precision The precision you specify for the count operand is the portion of opnd2 that is used in the operation. If the count is (3,BYTE), the system compares the first byte of data in opnd2 with the first three bytes of data in opnd1.
RESULT=	The label of the data area or vector in which the result is to be placed. When you specify RESULT, the value of opnd1 does not change during the operation. This operand is optional.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Syntax Examples

1) Compare X'F008' with the contents of STRING and place the result in the data area labeled ANS.

```
          IOR   STRING,X'F008',RESULT=ANS
           •
           •
           •
STRING    DATA  X'0F08'     binary 0000 1111 0000 1000
ANS       DATA  F'0'        binary zeros
```

After the IOR operation, ANS contains:

Hexadecimal — X'FF08'

Binary — 1111 1111 0000 1000

2) Compare the contents of OPER2 to the first three doublewords beginning at label OPER1 and place the result in the data area labeled RESULTX.

```
          IOR    OPER1,OPER2,(3,DWORD),RESULT=RESULTX
           •
           •
           •
           •
OPER1     DC     X'FFFF'     binary 1111 1111 1111 1111
          DC     X'0000'     binary zeros
          DC     X'8888'     binary 1000 1000 1000 1000
          DC     X'4567'     binary 0100 1010 0110 0111
          DC     X'1111'     binary 0001 0001 0001 0001
          DC     X'AAAA'     binary 1010 1010 1010 1010
OPER2     DC     2X'AAAA'
RESULTX   DC     6F'0'
```

After the operation, RESULTX contains:

Hexadecimal — X'FFFF AAAA AAAA EAEF BBBB AAAA'

3) Compare the first byte of data in TEST to the first three bytes of data in INPUT. Place the result in the data area labeled OUTPUT.

```
          IOR    INPUT,TEST,(3,BYTE),RESULT=OUTPUT
           •
           •
           •
INPUT     DC     C'1.2'   binary  1111 0001 0100 1010 1111 0010
TEST      DC     C'0.0'   binary  1111 0000
OUTPUT    DC     3C'0'    binary  1111 0000 1111 0000 1111 0000
           •
           •
           •
```

After the operation, OUTPUT contains:

Binary — 1111 0001 1111 1010 1111 0010

The LASTQ instruction acquires the last (most recent) entry in a queue. You define a queue with the DEFINEQ statement. The queue entry can contain data or the address of a data buffer. After you acquire the contents of the queue entry, the system adds the entry to the free chain of the queue.

Syntax:

label	**LASTQ**	**qname,loc,EMPTY=,P1=,P2=**
Required:	**qname,loc**	
Default:	**none**	
Indexable:	**qname,loc**	

Operand	*Description*
qname	The name of the queue from which the entry is to be fetched. The queue name is the label on the DEFINEQ statement that creates the queue.
loc	The label of a word of storage where the entry is placed. #1 or #2 can be used.
EMPTY=	Specify the first instruction of the routine to be called if a "queue empty" condition is detected during the execution of this instruction. If this operand is not specified, control returns to the next instruction after the LASTQ. A return code of −1 in the first word of the task control block indicates that the operation completed successfully. A return code of +1 indicates that the queue is empty.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Coding Example

See the examples following the NEXTQ instructions.

Return Codes

The return codes are returned in the first word of the task control block (TCB) of the program issuing the instruction. The label of the TCB is the label of your program or task (taskname).

Return Code	Description
−1	Successful completion.
1	Queue is empty

LCCIOCB — Specify Device Subchannel Command and Buffer

The LCCIOCB statement specifies the device subchannel command and buffer for Local Communications Controller instructions.

Refer to the *Communications Guide* for programming considerations and an example of the LCCIOCB statement.

Syntax:

label	**LCCIOCB**	**ADDRESS=,BUFFER=,BUFFKEY=,RINGADR=, COMMAND=,ATTNECB=,P1=,P2=, P3=,P4=,P5=**
Required:	**label,ADDRESS=,COMMAND=**	
Defaults:	**None**	
Indexable:	**None**	

Operand ***Description***

ADDRESS=

The hexadecimal device address of the subchannel on which the system will perform the operation.

BUFFER= The label of the area from which to send and receive data.

BUFFKEY=

The number (0—31, depending on your processor) of the address that contains the buffer. If you omit this operand, the buffer must be in the same address space as the requesting program.

RINGADR=

A 1-byte hexadecimal address designating the label of an area storing data you send or receive. After a receive operation completes, the system updates the field to indicate the sending ring address.

Note: Ring addresses are determined when the attachment card is installed. If you are unsure of your ring address, issue the RA command of $LCCUT1 to determine what it is.

COMMAND=

Indicate one of the following options.

Receive Operations:

RSP. Receive specific data. This operation receives data from the ring address specified by the RINGADR operand. If your system issues this command to subchannel 1, the device times out if it receives no data within seven seconds.

RUS. Receive unsolicited data. This operation receives data from any ring address. This type of receive does not involve a time out.

Send Operations Received on Subchannel 0:

SIPL. Send IPL request. This send places the specified ring address in the IPL state. The next command you issue should be a send containing the bootstrap loader.

ST. Send status request. This send requests the hardware status from the specified ring address. Issue a receive to subchannel 0 before this send.

SREQ. Send request. You may send up to 1000 bytes of data with this message.

RREQ. Receive request. You may receive up to 1000 bytes of data with this message.

BC. Broadcast. Broadcast up to 1000 bytes of data to all Series/1s on the ring.

Send Operations Received on Subchannel 1:

SSP. Send specific data. This command sends up to 64K bytes of data to the specified ring address.

SSPE. Send specific data end. This command sends up to 64K bytes of data to the specified ring address and indicates to the receiving Series/1 that data transfer is complete.

SUN. Send unsolicited data. This command sends up to 64K bytes of data to the specified ring address.

SUSE. Send unsolicited data end. This command sends up to 64K bytes of data to the specified ring address and indicates to the receiving Series/1 that data transfer is complete.

Control Operations:

CLR. Clear the ring.

RBP. Reset bypass. This command connects this LCC device to the ring.

SBP. Set bypass. This command disconnects this LCC device from the ring.

ATTNECB=

The label of the attention ECB that will be posted when your system receives an attention interrupt. When the attention task has finished processing the request, the task should detach itself to wait for another attention interrupt.

Px= Parameter-naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Use the following guide when using parameter naming operands for the LCCIOCB statement.

Parameter	*Operand*
P1	ADDRESS=
P2	BUFFER=
P3	BUFFKEY= (one byte)
	RINGADDR= (one byte)
P4	COMMAND=
P5	ATTNECB=

LCCCLOSE – Close the Device Subchannel

The LCCCLOSE instruction closes the device subchannel and allows no further interrupts. Issue it to end I/O immediately and to post any waiting ECBs with a HALT status code.

Refer to the *Communications Guide* for programming considerations and an example of the LCCCLOSE instruction.

Syntax:

label	**LCCCLOSE IOCB=,ERROR=**
Required:	**IOCB=**
Defaults:	**None**
Indexable:	**IOCB=**

Operand	*Description*
IOCB	The label of the LCCIOCB statement associated with the close operation. Close processing uses this statement to determine which subchannel to close.
ERROR=	The label of the next instruction to be executed if an error occurs during closing of the subchannel. If ERROR= is omitted, control returns to the next sequential instruction.

Return Codes

Return Code	Description
−1	Successful completion.
4	The $DDBTYPE field of the DDB does not specify Local Communications Controller.

LCCCNTL – Initiate Control Functions

The LCCCNTL instruction initiates control functions to the Local Communications Controller device.

Refer to the *Communications Guide* for programming considerations and an example of the LCCCNTL instruction.

Syntax:

label	**LCCCNTL IOCB=,ERROR=,WAIT=**
Required:	**IOCB=**
Defaults:	**WAIT=YES**
Indexable:	**IOCB=**

Operand	*Description*
IOCB	The label of the LCCIOCB statement to be associated with the control operation.
ERROR=	The label of the next instruction to be executed if an error occurs. ERROR= is valid only when WAIT=YES. If ERROR= is omitted, control returns to the next sequential instruction.
WAIT=	An indicator of whether or not the current task is suspended until the operation ends. YES, the task is suspended until the operation ends. NO, control returns after the system initiates the operation. Issue a subsequent WAIT to determine when the operation is complete.

Return Codes

Return Code	Description
−1	Successful completion.
4	The $DDBTYPE field of the DDB does not specify Local Communications Controller.
6	An unrecoverable I/O error occured.
7	The Local Communications Controller subchannel is not open or the task issuing the LCC instruction is not the same task that issued the LCCOPEN instruction.
8	I/O in progress.
13	Request ended by CLOSE.

LCCOPEN – Open Device Subchannel

The LCCOPEN instruction opens and prepares the device subchannel for interrupts.

Refer to the *Communications Guide* for programming considerations and an example of the LCCOPEN instruction.

Syntax:

label	**LCCOPEN IOCB=,ERROR=**
Required:	**IOCB=**
Defaults:	**None**
Indexable:	**IOCB=**

Operand	*Description*
IOCB=	The label of the LCCIOCB statement associated with the open operation. Open processing uses this statement to determine which subchannel to open.
ERROR=	The label of the next instruction the system should execute if an error occurs during opening of the subchannel. If ERROR= is omitted, control returns to the next sequential instruction.

Return Codes

Return Code	Description
−1	Successful completion.
4	The $DDBTYPE field of the DDB does not specify Local Communications Controller.
5	Subchannel already open.
6	An unrecoverable error occurred during the Local Communications Controller RESET BYPASS command.
12	The DDB indicates that device initialization was not completed successfully.

LCCRECV – Receive Data from a Series/1 on a Ring

The LCCRECV instruction allows reception of data from another Series/1 on the ring.

Refer to the *Communications Guide* for programming considerations and an example of the LCCRECV instruction.

Syntax:

label	**LCCRECV IOCB=,ERROR=,WAIT=**
Required:	**IOCB=**
Defaults:	**WAIT=YES**
Indexable:	**IOCB=**

Operand	*Description*
IOCB=	The label of the LCCIOCB statement associated with the receive operation.
ERROR=	The label of the next instruction the system should execute if an error occurs during a receive operation. ERROR= is valid only when WAIT=YES. If ERROR= is omitted, control returns to the next sequential instruction.
WAIT=	YES, the task is suspended until the operation ends. NO, control returns after the system initiates the operation. A subsequent WAIT must be issued to determine when the operation is complete.

Return Code	Description
−1	Successful completion.
4	The $DDBTYPE field of the DDB does not specify Local Communications Controller.
6	An unrecoverable I/O error occurred.
7	The Local Communications Controller subchannel is not open or the task issuing the LCC instruction is not the same task that issued the LCCOPEN instruction. I/O in progress.
9	The record length specified is less than the length of the data received; no data movement will take place.
10	A DCB specification check occurred.
11	An invalid address was specified; a protect check occurred, or the address is past the end-of-storage.

Return Code	Description
13	Request ended by CLOSE.
14	The cycle-steal status command failed.
15	The cycle-steal status data, bytes 4 and 5, are available in the LCCIOCB.

LCCSEND – Send Data to a Series/1 on a Ring

The LCCSEND instruction allows you to send data to another Series/1 on the ring.

Refer to the *Communications Guide* for programming considerations and an example of the LCCSEND instruction.

Syntax:

label	**LCCSEND IOCB=,ERROR=,WAIT=**
Required:	**IOCB=**
Defaults:	**WAIT=YES**
Indexable:	**IOCB=**

Operand	*Description*
IOCB=	The label of the LCCIOCB statement associated with the send operation.
ERROR=	The label of the next instruction the system should execute if an error occurs. ERROR= is valid only when WAIT=YES. If ERROR= is omitted, control returns to the next sequential instruction.
WAIT=	YES, the task is suspended until the operation ends. NO, control returns after the system initiates the operation. A subsequent WAIT must be issued to determine when the operation is complete.

Return Codes

Return Code	Description
−1	Successful completion.
4	The $DDBTYPE field of the DDB does not specify Local Communications Controller.
6	An unrecoverable I/O error occurred (LCCOPEN, LCCRECV, and LCCSEND).
7	The Local Communications Controller subchannel is not open or the task issuing the LCC instruction is not the same task that issued the LCCOPEN instruction.
8	I/O in progress.
9	The record length specified is less than the length of the data received; no data movement will take place.
10	A DCB specification check occurred.
11	An invalid address was specified; a protect check occurred, or the address is past the end-of-storage.

Return Code	Description
13	Request ended by CLOSE.
14	The cycle-steal-status command failed.
15	The cycle-steal-status data, bytes 2 and 3, are available in the LCCIOCB.

LOAD – Load a Program

The LOAD instruction allows one program to load another main program or overlay program from a program library on disk or diskette. The loaded program runs parallel with, and independently of, the loading program, regardless of whether it is a main program or an overlay. The loading program may, however, synchronize its own execution with the loaded program.

The LOAD instruction also allows you to load a program in another partition and to pass that program parameters. See Appendix C, "Communicating with Programs in Other Partitions (Cross-Partition Services)" on page C-1 for an example of such a cross-partition operation. Refer to the *Language Programming Guide* for more information on cross-partition services. See "Coding the LOAD Instruction for Extended Address Mode" on page 2-248 for information on coding the LOAD instruction for the extended address mode.

A program can be loaded in two ways:

- As an independent program in its own contiguous storage area
- As an overlay program within the storage area allocated for the loading program.

The advantages of the independent LOAD operation are:

- Main storage is allocated only when required
- More than one program may be loaded for simultaneous execution.

The advantages of the overlay LOAD operation are:

- The availability of main storage can be guaranteed by the loading program since it is within its own storage area
- The loaded program is brought into storage more quickly than by an independent LOAD.

Figure 2-7 on page 2-247 illustrates the two ways of loading a program.

You can test the first word of the task control block (TCB) of the loading program to determine the result of the load operation. The label of the TCB is the label of the program (taskname). If this word is −1, the operation was successful.

When a LOAD instruction loads either an independent program or an overlay, the address of the currently active terminal of the loading program is stored in the program header of the program being loaded.

Syntax:

```
label    LOAD    progname,parmname,DEQT=
                 DS=(dsname1,...,dsname9),EVENT=,
                 LOGMSG=,PART=,ERROR=,STORAGE=,P2=
                      or
label    LOAD    PGMx,parmname,DS=(DSx,...),DEQT=,
                 EVENT=,ERROR=,P2=

Required:    progname or PGMx
Defaults:    LOGMSG=YES,STORAGE=0,DEQT=YES
Indexable:   none
```

Operand	*Description*
progname	The 1 – 8 character name of a program stored in an Event Driven Executive library. You can specify the volume from which to load the program by separating the program name and the volume name by a comma and enclosing both in parentheses. To load program PROGA on volume EDX003, you would code: (PROGA,EDX003). The program must reside on disk or diskette. The volume name can be 1 – 6 characters long.
PGMx	The parameter "x" is a number from 1 to 9 that specifies which of the overlay programs defined in the PROGRAM statement is to be loaded. PGMx is not valid with PART; overlay programs are loaded in space included with the loading program.
parmname	The label of the first word in a list of consecutive parameter words to be passed to the loaded program. (See the PROGRAM statement for the maximum length of this list.)
DEQT=	YES (the default), dequeues the terminal currently in use by the loading program. NO, prevents the terminal from being dequeued when the LOAD instruction executes. Coding DEQT=NO also forces the LOGMSG operand to LOGMSG=NO. **Note:** Allow this operand to default or code DEQT=YES for a virtual terminal program.
DS=	The names of the data sets to be passed to the loaded program. If your program loads another program, you can pass the loaded program the names of 1 to 9 data sets. This operand enables the main program to define, during the load operation, the names of the data sets the loaded program will use. On the PROGRAM statement of the program to be loaded, the data set list contains the sequence "??" for each missing data set name. This sequence indicates that the data set name will be supplied at load time. (See the PROGRAM statement for more information.)

For example, if the PROGRAM statement in the program to be loaded contained the data set list:

```
...DS=(PARMFILE,??,RESULTS)
```

the LOAD instruction in the main program,

```
LOAD  MYPROG,DS=(MYDATA)
```

would pass the data set name MYDATA to the loaded program and produce the following list for the loaded program:

```
...DS=(PARMFILE,MYDATA,RESULTS)
```

The LOAD instruction, in this case, replaces the sequence "??" with the data set name MYDATA.

When the main program loads an overlay program, you must code DSx, where "x" is the relative position (number) of the data set in the list of data set names on the PROGRAM statement of the main program.

The parameter "x" can be a number from 1 to 9. For example, to pass the second data set name in a list to an overlay program named OVPGM, you would code:

```
LOAD   OVPGM,DS=DS2
```

All unspecified data set names in the program being loaded must be resolved at LOAD time or the load operation will fail.

If the main program passes a tape data set to another program, the main program's data set control block (DSCB) is no longer associated with the tape data set. This allows the loaded program to have access to the tape data set using the main program's DSCB. When the loaded program ends, the system closes the tape data. If the main program needs to use the tape data set again, the main program must call DSOPEN or load $DISKUT3 to reopen the tape data set.

LOGMSG=

YES (the default), to print or display the "PROGRAM LOADED" message on the terminal being used by the program.

NO, to avoid printing or displaying this message.

EVENT= The label of an event (ECB statement) that the system posts complete when the loaded program issues a PROGSTOP.

By issuing a LOAD and a subsequent WAIT for this event, the main program can synchronize its own execution with the loaded program. The ECB, however, must not be reset with a RESET instruction or with the RESET operand of a WAIT instruction, or synchronization may be lost.

Notes:

1. If you specify this operand, the main program must wait for the loaded program to end. Otherwise, the system will post the ECB when the loaded program ends even though the main program may no longer be active. The results, in such a case, are unpredictable.
2. If a program check occurs, the ECB will be posted with the value of the PSW. Refer to the *Problem Determination Guide* for information on the PSW.

PART= The number of the partition in which you want to load the program. If you do not code this operand, the system loads the program in the same partition as the main program. See Appendix C, "Communicating with Programs in Other Partitions (Cross-Partition Services)" on page C-1 for an example of loading a program in another partition. See "Coding the LOAD Instruction for Extended Address Mode" on page 2-248 for information on coding the PART= operand for extended address mode support.

You can code one of the following:

- A number from 1 to 32 (partition 1 to 32, depending on your processor)
- PART=ANY, to load the program in any available partition.
- The label of a 1-word data area that contains the partition number.

If the data area contains a 0, the system loads the program in any available partition.

Do not use this operand if the main program loads an overlay program.

ERROR= The label of the first instruction of the routine to receive control if an error condition occurs during the load operation. If you do not code this operand, control passes to the instruction following the LOAD instruction and you can test for errors by referring to the return code in the first word of the task control block (TCB).

STORAGE=

The number of bytes of additional storage to be added to the loaded program. This operand overrides the value of the STORAGE operand on the PROGRAM statement of the program to be loaded.

Some application programs have a minimum storage requirement; be sure you know what it is before using this override. The load operation will fail if the loaded program requires more storage than is available. (See the PROGRAM statement for more information on allocating program storage.)

This operand does not override the STORAGE operand on the PROGRAM statement if you code a 0 or allow the operand to default.

Do not use this operand if the main program loads an overlay program.

P2= Parameter naming operand. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code this operand.

The following figure illustrates two ways the system can load a program.

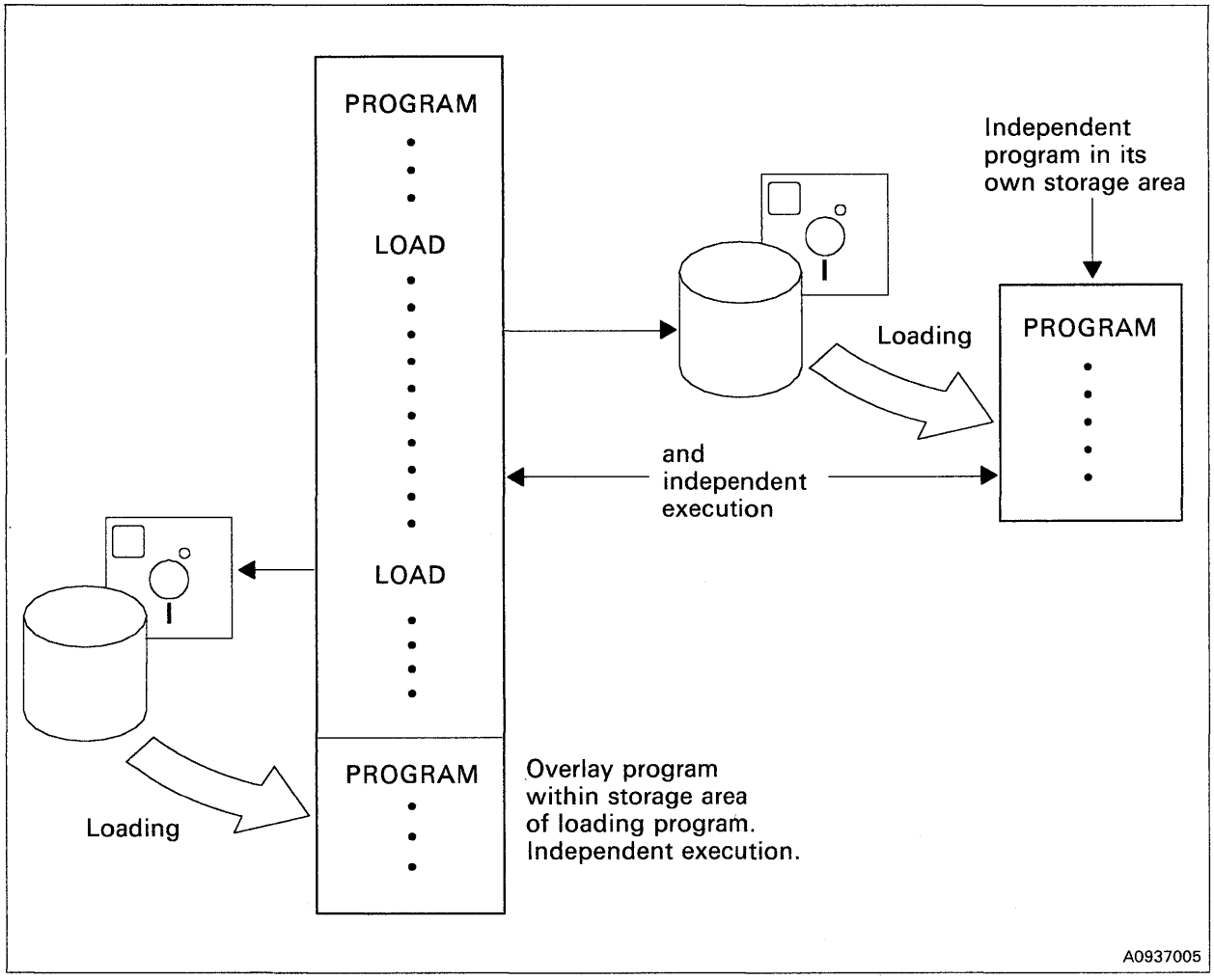


Figure 2-7. Two Ways of Loading a Program

Coding the LOAD Instruction for Extended Address Mode

When you use the LOAD instruction with extended address mode support, you have several options for the PART= operand. The PART= operand indicates the number of the partition in which you want to load the program. If you do not code this operand, the system loads the program in the same partition as the main program.

Note: Do not use the PART= operand if the main program loads an overlay program.

You can code one of the following for the PART= operand:

- A partition number from 1 to 32 (depending on your processor).
- PART=ANY to load the program into any available partition. If you specified LOADER=(S,) in the $SRPROF data set, then the loader will try to load the program into one of the static partitions only.
- PART=DYNAMIC to load the program in any available dynamic partition. This option overrides the LOADER=(S,) option in the $SRPROF data set.
- PART=STATIC to load the program in any available static partition.
- The label of a 1-word data area that contains the partition number. If the data area contains a 0, the system loads the program into any available partition depending on what you specified in $SRPROF.

Syntax Example

In the following example, the system tries to load program PGMA into any available static partition.

```
LOAD   PGMA,PART=STATIC
```

Note: If you specify the PART= operand as ANY, STATIC, or DYNAMIC, then the order of the partitions into which the system attempts to load a program depends on the LOADER= statement in the IPL configuration data set, $SRPROF. Refer to the *Installation and System Generation Guide* for an explanation of $SRPROF and static and dynamic partitions.

Return Codes

The return codes are returned in the first word of the task control block (TCB) of the program issuing the instruction.

Return Code	Condition
−1	Successful completion.
61	$LOADER (the transient loader) is not included in the system.
62	In an overlay request, no overlay area exists.
63	In an overlay request, the overlay area is in use.
64	No space available for the transient loader.
65	In an overlay load operation, the number of data sets passed by the LOAD instruction does not equal the number required by the overlay program.
66	In an overlay load operation, no parameters were passed to the loaded program.
67	A disk(ette) I/O error occurred during the load process.
68	Reserved.
69	Reserved.
70	Not enough main storage available for the program.
71	Program not found on the specified volume.
72	Disk or diskette I/O error while reading directory.
73	Disk or diskette I/O error while reading program header.
74	Referenced module is not a program.
75	Referenced module is not a data set.
76	One of the data sets was not found on referenced volume.
77	Invalid data set name.
78	LOAD instruction did not specify required data set(s).
79	LOAD instruction did not specify required parameters(s).
80	Invalid volume label specified (two or more programs referenced the same volume).
81	Cross partition LOAD requested, support not included at system generation.
82	Requested partition number greater than number of partitions in the system.
83	Load instruction attempted to access a 1024-bytes-per-sector diskette without $IO1024 preloaded in storage.

Note: If the program being loaded is a sensor I/O program and a sensor I/O error is detected, the return code will be a sensor I/O return code, not a load return code.

MECB – Create a List of Events

The MECB statement creates a control block for use by a WAITM instruction. The control block contains control information and a list of the ECBs for the events on which the WAITM instruction must wait.

You can specify labels for several of the fields in the MECB so that you can get access to them from your application program. The fields you can get access to are:

- The number of events posted
- The pointer to the last (most recent) event posted
- The post code received by each event in the list.

You must use the ECB statement to code the necessary ECBs in programs assembled under $EDXASM, except for those ECBs specified with the EVENT= operand on the LOAD instruction or on the PROGRAM or TASK statement. In programs assembled with the host or Series/1 macro assemblers, the system automatically generates an ECB for an event named in a POST instruction.

See "WAITM – Wait for One or More Events in a List" on page 2-553 for the description and syntax of the WAITM instruction. See "ECB – Create an Event Control Block" on page 2-113 for the description and syntax of the ECB statement.

Note: To use the MECB statement, you must have included the SWAITM module in your system and specified the MECBLST keyword on the SYSPARMS statement during system generation. (Refer to the *Installation and System Generation Guide* for additional information.)

Syntax:

label	**MECB**	**(ecb1,ecb2,...ecbn),nwait,MAXECB=,CODE=, NUMP=,LAST=,P1=(lbl1,lbl2,...lbln),P2=**
Required:	**label**	
Defaults:	**nwait=1, CODE=-1, MAXECB=number of ECB labels coded**	
Indexable:	**none**	

Operand ***Description***

ecb1,ecb2,...,ecbn
The label of each ECB you are including in the MECB list. The system generates additional blank entries if the number of labels is less than the value coded for MAXECB=.

nwait The number of events that must occur before the waiting program can continue.

MAXECB= The number of events (ECBs) in the MECB list. If this value is larger than the number of ECB labels coded, the system generates blank entries to make up the difference.

CODE= The initial value of the MECB post code. If this word is not 0 when your program issues the WAITM instruction, the system does not wait unless the WAITM instruction has the RESET operand coded. (The default is −1.)

NUMP= The label for the field containing the number of events posted.

LAST= The label for the pointer to the last event posted.

P1=(...) Parameter naming operand. Specify labels for the fields in the MECB that contain the post code for the respective ECBs. (The system places the post code received by an ECB in the first word of the MECB entry for that ECB.)

P2= Parameter naming operand. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Syntax Example

Wait for two of the three specified events to occur before continuing. Place labels on the pointer to the last event that occurred and on the post codes.

```
MECB1   MECB   (ECB1,ECB2,ECB3),2,LAST=LASTECB,P1=(POST1,POST2,POST3)
```

MESSAGE – Retrieve a Program Message

The MESSAGE instruction retrieves a formatted program message from a data set or module and displays or prints the message. See Appendix E, "Creating, Storing, and Retrieving Program Messages" on page E-1 for more information.

The instruction also allows you to include data or text generated by your program within the message.

Note: Any references to **31xx** terminals means 3101, 3151, 3161, 3163, and 3164 terminals, unless otherwise noted.

Syntax:

label	**MESSAGE msgno,COMP=,SKIP=,LINE=,SPACES=, PARMS=(parm1,...,parm8),MSGID=, XLATE=,PROTECT=,P1=**
Required:	**msgno,COMP=**
Defaults:	**MSGID=NO,XLATE=YES,PROTECT=NO**
Indexable:	**none**

Operand	*Description*
msgno	The number of the message you want displayed or printed. This operand must be a positive integer or a label preceded by a plus sign (+) and equated to a positive integer.
COMP=	The label of the COMP statement that points to the data set or module that contains the formatted program messages. See the COMP statement description for more information.
SKIP=	The number of lines to be skipped before the system prints or displays the message. If your cursor is at line 2 on a display screen and you coded SKIP=6, the system displays the message on line 8. For a printer, the SKIP operand controls forms movement. The SKIP operand causes the system to display or print the contents of the system buffer. If you specify a value greater than or equal to the logical page size, the system divides this value by the page size and uses the remainder in place of the value you specify. For roll screens, the logical page size equals the screen's bottom margin minus the number of history lines and the screen's top margin.
LINE=	The line number on which the message is to be printed or displayed. Code a value from 0 to the number of the last usable line on the page or logical screen. The line count begins at the top margin you defined for the printer or display screen. LINE=0 positions the cursor at the top line of the page or screen you defined; LINE=1 positions the cursor at the second line of the page or screen. For roll screens, line 0 equals the screen's top margin plus the number of history lines.

For printers and roll screens, if you code a value less than or equal to the current line number, the system prints or displays the message at the specified line on the next page or logical screen. For static screens, if you code a value within the limits of the logical screen, the system displays the message on the line you specified.

If you code a value greater than the last usable line number, the system divides this value by the logical page size and uses the remainder as the line number on which to print the message. For example, if you code LINE=22 and your roll screen has a logical page size of 20, the message appears on the second line of the logical screen.

The LINE operand causes the system to print or display the contents of the system buffer.

SPACES= The number of spaces to indent before the system prints or displays the message. SPACES=0, the default, positions the cursor at the beginning of the left side of the page or screen. If the value you specify is beyond the limits of the logical screen or page, the system indents the next line by the excess number of spaces.

When you code the LINE or SKIP operands with SPACES, the system begins indenting from the left margin of the page or screen. If you specify SPACES without coding LINE or SKIP, the system begins indenting from the last cursor position on the line.

PARMS= The labels of data areas containing information to be included in the message. You can code up to eight labels. If you code more than one label, you must enclose the list in parentheses.

Note: To use this operand, you must have included the FULLMSG module in your system during system generation. Refer to *Installation and System Generation Guide* for a description of this module.

MSGID= YES, if you want the message number and 4-character prefix to be printed at the beginning of the message you are retrieving from a data set or module containing formatted program messages. See the COMP statement operand "idxx" for a description of the 4-character prefix.

NO (the default), to avoid printing this information.

Note: To use this operand, you must have included the FULLMSG module in your system during system generation. Refer to *Installation and System Generation Guide* for a description of this module.

XLATE= NO, to send the message to the terminal as is, without translation. Code this option if the message contains special characters that should not be altered or interpreted by the terminal.

YES (the default), to cause translation of characters from EBCDIC to the code the terminal uses to display the message.

With a 31xx in block mode, XLATE=NO also prevents the system from inserting the attribute byte and escape sequences into the message, and overrides the effects of TERMCTRL SET,STREAM=YES.

Note: For a description of 31xx escape sequences, refer to the appropriate display terminal description manual.

PROTECT=

YES, to write protected characters to a static screen device that supports this feature, such as an IBM 4978, 4979, 4980, or 31xx in block mode. Protected characters cannot be typed over.

NO (the default), to avoid writing protected characters to a static screen.

P1= Parameter naming operand. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code this operand.

Note: $TCBADS must contain the address space of the task control block when the MESSAGE statement is executed.

Syntax Examples

1) Retrieve and print the first message in the disk data set to which the COMP statement points.

```
MSG1    MESSAGE   1,COMP=MSGSET
          •
          •
          •
        PROGSTOP
MSGSET  COMP      'ERRS',DS1,TYPE=DSK
```

2) Retrieve and print the fifth message in the module to which the COMP statement points. Insert the parameter "ACCOUNTS" in the message.

```
MSG2    MESSAGE   +MSG,PARMS=A,COMP=MSGSET
          •
          •
          •
        PROGSTOP
MSG     EQU       5
A       DATA      C'ACCOUNTS'
MSGSET  COMP      'ERRS',ERRORS,TYPE=STG
```

Coding Example

The following example uses the MESSAGE instruction to retrieve and print a message contained in a disk data set. The program TASK loads a second program called CALCPGRM. A WAIT instruction suspends the execution of TASK until CALCPGRM completes. When CALCPGRM finishes, it posts the ECB at label LOADECB. The MESSAGE instruction at label MSG1 retrieves the first message in the disk data set MSGDS1 on volume EDX002. The first message in this data set is:

< <PROGRAM> > HAS FINISHED PROCESSING/*

The MESSAGE instruction inserts the parameter CALCPRGM into the "PROGRAM" field of the message and displays the message as follows:

STAT0001 CALCPGRM HAS FINISHED PROCESSING

Because the MESSAGE instruction contains MSGID=YES, the number of the message and the 4-character prefix "STAT" appear at the beginning of the message. The COMP statement assigns the 4-character prefix to the message.

```
TASK     PROGRAM   START,DS=((MSGDS1,EDX002))
LOADECB  ECB
START    EQU       *
          •
          •
          •
         LOAD      CALCPGRM,EVENT=LOADECB
         WAIT      LOADECB
MSG1     MESSAGE   1,COMP=MSGSET,SKIP=1,PARMS=A,MSGID=YES
          •
          •
          •
         PROGSTOP
A        DATA      'CALCPGRM'
MSGSET   COMP      'STAT',DS1,TYPE=DSK
         ENDPROG
         END
```

Return Codes

The return codes are returned in the first word of the task control block (TCB) of the program or task issuing the instruction. The label of the TCB is the label of your program or task (taskname).

Return Code	Description
−1	Successful completion.
301−325	Error while reading message from disk. Subtract 300 from this value to get the actual return code. See the disk return codes following the READ or WRITE instruction for a description of the code.
326	Message number out of range.
327	Message parameter not found.
328	Instruction does not supply message parameter(s).
329	Invalid parameter position.
330	Invalid type of parameter.
331	Invalid disk message data set.
332	Disk message read error.
333	Storage-resident module not found.
334	Message parameter output error.
335	Disk messages not supported (MINMSG support only).

MOVE – Move Data

The MOVE instruction moves data from operand 2 to operand 1. If operand 2 is "immediate data," it must meet the requirements listed in the opnd2 description.

For an example of moving data across partitions, see Appendix C, "Communicating with Programs in Other Partitions (Cross-Partition Services)" on page C-1. Refer to the *Language Programming Guide* for more information on cross-partition services.

Syntax:

label	**MOVE**	**opnd1,opnd2,count,FKEY=,TKEY=,** **P1=,P2=,P3=**
Required:	**opnd1,opnd2**	
Defaults:	**count=(1,WORD)**	
Indexable:	**opnd1,opnd2**	

Operand	*Description*
opnd1	The label of the data area to receive the data from opnd2. Opnd1 cannot be a self-defining term.
opnd2	The value moved into opnd1. You can specify a self-defining term or the label of a data area. If opnd2 is a self-defining term, it must be one of the following: • An integer, whose value is from −32768 to +32767 • An EBCDIC character string of one or two bytes, enclosed in single quotes, and preceded by the constant type indicator C • A hexadecimal character string of 1 to 4 hexadecimal digits, enclosed in single quotes, and preceded by the constant type indicator X.
count	The number of consecutive values on which the operation is to be performed. Do not code a label for count. The maximum value allowed for the count operand is 32767. The count operand can include the precision of the data. Since these operations are parallel (the two operands and the result are implicitly of the same precision) only one precision specification is required. That specification may take one of the following forms: **BYTE** Byte precision **WORD** Word precision (the default) **DWORD** Doubleword precision **FLOAT** Single-precision floating-point **DFLOAT** Extended-precision floating-point You can substitute the precision specification for the count specification, in which case the count defaults to 1, or the precision specification can accompany the count in the form of a sublist: (count,precision). For example, MOVE A,B,BYTE is equivalent to MOVE A,B,(1,BYTE). When using the sublist form of the count operand, you must specify both the count and the precision.

For all precisions other than BYTE, opnd1 and opnd2 must specify even addresses.

The precision is always BYTE when you do a cross-partition MOVE operation. For example, MOVE A,B,(4,DWORD) becomes MOVE A,B,(16,BYTE). This precision change is important to remember when you use the P3= operand to change the count. The instruction,

```
.MOVE  A,B,(4,WORD),FKEY=0,P3=COUNT
```

really has a count of 8 bytes. If you want to change the count to (2,WORD), you must move a value of 4 into COUNT.

If FLOAT or DFLOAT precision is specified, the system converts the immediate data field to floating-point format.

If BYTE precision is specified and opnd2 is immediate data, the system moves different bytes of opnd2 depending on which assembler is used. The macro assembler causes the system to to move the leftmost byte of opnd2.

For example, if the following is coded:

```
Q     EQU   X'1234'
      MOVE  HERE,+Q,(1,BYTE)
```

The system moves X'34' to location HERE if the instruction is assembled with a macro assembler. The system moves X'12' to location HERE if the instruction is assembled with $EDXASM.

FKEY= This operand provides a cross-partition capability for opnd2 of MOVE. FKEY designates the address key of the partition containing opnd2 (the address key is one less than the partition number). FKEY can specify either an immediate value from 0 to 31 (depending on your processor) or the label of a word containing a value from 0 to 31. If FKEY is not specified, opnd2 is in the same partition as the MOVE instruction. If FKEY is specified, opnd2 cannot be immediate data or an index register. However, it can contain an index register in the (parameter,#r) format. See "Software Register Usage" on page 1-8 for further information.

TKEY= This operand provides a cross-partition capability for opnd1 of MOVE. TKEY designates the address key of the partition containing opnd1 (the address key is one less than the partition number). TKEY can specify either an immediate value from 0 to 31 (depending on your processor) or the label of a word containing a value from 0 to 31. If TKEY is not specified, opnd1 must be in the same partition as the MOVE instruction. If TKEY is specified, opnd1 cannot be an index register. However, opnd1 can contain an index register if it is of the format (parameter,#r). See "Software Register Usage" on page 1-8 for further information.

If you specify TKEY and opnd2 is immediate data, opnd2 is always one word in length regardless of the precision specified. The values you code for the precision and the count operand determine the amount of data that is moved.

When you specify byte precision in a cross-partition move and opnd2 is immediate data, the system reads an entire word of data and moves that word one byte at a time. For example, if opnd2 is X'F5', the system reads that value as X'00F5' and moves X'00' as the first byte.

Px= Parameter naming operands. If P3 is coded, only the count operand is altered. The precision specification remains unchanged. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to use these operands.

Syntax Examples

The following syntax examples show the variety of ways you can code the MOVE instruction:

1) Move a word of B to A.

```
MOVE   A,B
```

2) Move 64 EBCDIC blanks to TEXT.

```
MOVE   TEXT,C' ',(64,BYTE)
```

3) Move 16 words of V2 to V1.

```
MOVE   V1,V2,16
```

4) Move the contents of index register 1 to SAVE.

```
MOVE   SAVE,#1
```

5) Move contents of INDEX into index register 2.

```
MOVE   #2,INDEX
```

6) Move four doublewords of C to D.

```
MOVE   D,C,(4,DWORD)
```

7) Move a single-precision floating-point value from F1 to F2.

```
MOVE   F2,F1,(1,FLOAT)
```

8) Move the address of $START into index register 1.

```
MOVE   #1,+$START
```

9) Move 6 doubleword floating-point numbers (24 words) from L1 to LR.

```
MOVE   LR,L1,(6,DFLOAT)
```

10) Move 10 floating-point zero values to the indexed address of (BUF,#1).

```
MOVE   (BUF,#1),0,(10,FLOAT)
```

11) Move one word from $START in partition 1 to HERE.

```
MOVE   HERE,$START,FKEY=0
```

12) Move the contents of index register 2 to the indexed address (0,#1) in a partition defined by KEY.

```
MOVE   (0,#1),#2,TKEY=KEY
```

13) Move 4 words of blanks to the indexed address ($NAME,#1) in partition 1. Operand 2 must be a word value.

```
MOVE   ($NAME,#1),C'  ',(4,WORD),TKEY=0
```

14) Move the leftmost byte value X'00' to B when assembling with $EDXASM. Move the rightmost byte value X'02' to B when assembling with the macro assemblers. A has a value of X'0002'.

```
A      EQU   2
        •
        •
        •
       MOVE   B,+A,(1,BYTE)
```

15) Move the 4-byte character string '3333' to the indexed address (HERE,#1) in partition 1.

```
MOVE   (HERE,#1),C'3',(4,BYTE),TKEY=0
```

16) Move the character string '22222222' to the indexed address (HERE,#1) in partition 1.

```
MOVE   (HERE,#1),C'12',(8,BYTE),TKEY=0
```

Only one character may be specified in immediate mode. When assembled with the macro assembler the system takes the rightmost character. In this example the character string has been truncated and 8 characters of 2 have been moved.

17) Move the data string X'0505050505' to the indexed address (THERE,#1) in partition 1.

```
MOVE   (THERE,#1),X'05',(5,BYTE),TKEY=0
```

MOVEA – Move an Address

The MOVEA instruction moves the address of operand 2 to operand 1.

Syntax:

label	**MOVEA opnd1,opnd2,P1=,P2=**
Required:	**opnd1,opnd2**
Defaults:	**none**
Indexable:	**opnd1**

Operand	*Description*
opnd1	The label of the data area to receive the address of opnd2. This operand must be a word in length.
opnd2	The label of the data area whose address is moved to opnd1.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Syntax Examples

1) Move the address of A into PTR.

```
MOVEA  PTR,A
```

2) Move the address of B plus 4 bytes into PTR.

```
MOVEA  PTR,B+4
```

MULTIPLY – Multiply Integer Values

The MULTIPLY instruction multiplies an integer value in operand 1 by an integer value in operand 2. The values can be positive or negative. To multiply floating-point values, use the FMULT instruction.

See the DATA/DC statement for a description of the various ways you can represent integer data.

The supervisor places X'80000000' in the first two words of the task control block if an overflow condition occurs during double-precision multiplication.

Note: You can abbreviate the instruction as MULT.

Syntax:

label	**MULTIPLY opnd1,opnd2,count,RESULT=,PREC=,** **P1=,P2=,P3=**
Required:	**opnd1,opnd2**
Defaults:	**count=1,RESULT=opnd1,PREC=S**
Indexable:	**opnd1,opnd2,RESULT**

Operand	*Description*
opnd1	The label of the data area containing the value to be multiplied by opnd2. Opnd1 cannot be a self-defining term. The system stores the result of the MULTIPLY operation in opnd1 unless you code the RESULT operand.
opnd2	The value by which opnd1 is multiplied. You can specify a self-defining term or the label of a data area. The value of opnd2 does not change during the operation.
count	The number of consecutive values in opnd1 on which the operation is to be performed. The maximum value allowed is 32767.
RESULT=	The label of a data area or vector in which the result is placed. The variable you specify for opnd1 is not changed if you specify RESULT. This operand is optional.
PREC=xyz	Specify the precision of the operation in the form xyz, where x is the precision for opnd1, y is the precision for opnd2, and z is the precision of the result ("Mixed-Precision Operations" on page 2-262 shows the precision combinations allowed for the MULTIPLY instruction). You can specify single precision (S) or double precision (D) for each operand. Single precision is a word in length; double precision is two words in length. The default for opnd1, opnd2, and the result is single precision. If you code a single letter for PREC, the letter applies to opnd1 and the result. Opnd2 defaults to single precision. If, for example, you code PREC=D, opnd1 and the result are double precision and opnd2 defaults to single precision.

If you code two letters for PREC, the first letter applies to opnd1 and the result, and the second letter applies to opnd2. With PREC=DD, for example, opnd1 and the result are double precision and opnd2 is double precision.

Px= Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Mixed-Precision Operations

The following table lists the precision combinations allowed for the MULTIPLY instruction:

opnd1	opnd2	Result	Precision
S	S	S	S (the default)
S	S	D	SSD
D	S	D	D
D	D	D	DD

Syntax Examples

1) Multiply a value in C by a value in D and put the result in E. The result of the operation is double precision.

```
MULT   C,D,RESULT=E,PREC=SSD
```

2) Multiply a double-precision value in A by 10. The result of the operation is double precision.

```
MULT   A,10,PREC=D
```

3) Multiply the single-precision values at X and X+2 by 10.

```
MULTIPLY   X,10,2
```

Coding Example

The MULTIPLY instruction at label M1 multiplies a full-word value in the data area labeled HOURS by 60. The instruction places the result in the data area labeled MINUTES. MINUTES is defined with the P2= parameter naming operand on the MULTIPLY instruction labeled M2.

At label M2, the second operand, defined with the parameter naming operand P2=, is multiplied by the value located at label SIXTY. The result is placed in the data area labeled SECONDS.

The first pair of MULTIPLY instructions uses the single-precision default for opnd1, opnd2, and RESULT=.

The third MULTIPLY instruction, at M3, multiplies the doubleword value at label MILLISEC by 1000, and places the doubleword result in MILLISEC.

The last MULTIPLY instruction, at label M4, multiplies the value at label OP11 by the value at label OP12, and places the result in the data area labeled RESULTX. Because the count operand equals 2, this instruction also multiplies the value at label OP21 by the value at label OP12, and places the result at RESULTX+2.

```
          •
          •
          •
M1        MULTIPLY HOURS,60,RESULT=MINUTES
M2        MULT     SIXTY,0,RESULT=SECONDS,P2=MINUTES
          MOVE     MILLISEC,0
          MOVE     MILLISEC+2,SECONDS
M3        MULT     MILLISEC,MILLI,PREC=DSD
          •
          •
          •
M4        MULTIPLY OP11,OP12,2,RESULT=RESULTX
          •
          •
          •
HOURS     DATA     F'0'
SECONDS   DATA     F'0'
SIXTY     DATA     F'60'
MILLISEC  DATA     D'0'
MILLI     DATA     F'1000'
OP11      DATA     F'1'
OP21      DATA     F'2'
OP12      DATA     F'3'
RESULTX   DATA    2F'0'
          •
          •
          •
```

NETCTL – Controlling SNA Message Exchange

The NETCTL instruction controls the exchange of status and error information between your Series/1 application program and the host program.

You can use the instruction to:

- Send error or status messages to the host application program
- Receive error or status messages from the host application program.

Before you can use the NETCTL instruction, you must establish a session with the host. You can use NETCTL to receive status information regardless of which session partner has the right-to-send.

Syntax:

label	**NETCTL**	**LU=,BUFF=,TYPE=,EXIT=,** **P1=,P2=**
Required:	**LU=**	
Defaults:	**TYPE=RECV**	
Indexable:	**none**	

Operand	*Description*
LU=	A 1-word field containing the number of the logical unit (LU) and the number of the physical unit (PU) to be used for the session. The high-order byte identifies the PU and can be any value from 0 to 4 (0 indicates use PU #1 and is the same as specifying 1). The low-order byte is the LU number. LU= can be any value from 1 to 32.
BUFF=	The label of a 6-byte status area that is used when you code TYPE=RECV, TYPE=REJECT, or TYPE=LUSTAT. If you do not specify RECV, REJECT, or LUSTAT for the TYPE operand, the BUFF operand is ignored. The use of the status area is as follows: • If you specify TYPE=RECV, the status received from the host is placed in this area. The format of the status information varies depending on what type of information it is. The NETCTL return codes indicate the type of status information received. If the return code indicates message reject, status message, or request for right-to-send, the status area is as follows: **Message reject** The first two bytes of the area are the system sense code. The next two bytes are the user sense code. If you do not select message resynchronization support for the session, the last two bytes are the message number of the message rejected by the host. If you do select message resynchronization support for the session, the message rejected by the host is always the last message sent.

Status message The first two bytes of the area are the status value. The next two bytes are the status extension field.

Request for right-to-send The first two bytes of the area are the signal value. The next two bytes are the signal extension field.

- If you specify TYPE=REJECT, you must supply the sense codes indicating the reason the host message is unacceptable. The first two bytes of the area are the system sense code. The next two bytes are the user sense code. If you do not specify the sense codes,the host receives a system sense code of X'081C' (Request Not Executable) along with a user sense code of X'0000' (No-operation).

  The host message rejected is always the last message received from the host.

- If you specify TYPE=LUSTAT, you must supply the status codes to be sent to the host. The first two bytes of the area are the status value. The next two bytes are the status extension field.

TYPE= The control operation to be performed. Code one of the following:

RECV Receive status information from the host. The return code indicates the type of status information received. If applicable, the area specified in the BUFF operand receives data associated with the status. RECV is the default.

ACCEPT Send the host a message acceptance, if necessary, for the message received.

REJECT Send the host a message rejection for the message received. The sense code, containing the reason for the rejection, is returned in the area specified in the BUFF operand.

CANCEL Cancel a partially transmitted message.

QEC Ask the host to temporarily stop transmitting messages after the current message.

RELQ Ask the host to resume sending messages. This operand is valid only if you have issued TYPE=QEC previously.

SIG Ask the host to give the right-to-send to the Series/1 SNA application.

LUSTAT Send status information to the host. The 4-byte status code to be sent is contained in the area you specified with the BUFF operand.

RTR Notify the host that the SNA application is ready to receive the next message.

The BUFF parameter is required if TYPE=RECV, REJECT, or LUSTAT.

EXIT= The label of the error-processing routine for your program. Control passes to this label if any return code other than −1 is returned to your program.

Px= Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Coding Examples

The examples presented here illustrate various ways in which you can use the NETCTL instruction to control the exchange of messages.

1) Receiving Status from Host

This example shows the use of a NETCTL instruction to receive status information from the host program. The location STATUS receives the status data (if any).

```
         NETCTL   LU=NETLU,TYPE=RECV,BUFF=STATUS
           •
           •
           •
NETLU    DATA   F'1'
STATUS   DATA   F'6'
```

2) Rejecting a Message

This example shows a NETCTL instruction that rejects a message received from the host program.

```
         NETCTL   LU=NETLU,TYPE=REJECT,BUFF=STATUS
           •
           •
           •
NETLU    DATA   F'1'
STATUS   DATA   F'6'
```

3) Sending Status to Host

In this example, a NETCTL instruction sends status information to the host program. The location STATUS receives the status data.

```
         NETCTL   LU=NETLU,TYPE=LUSTAT,BUFF=STATUS
           •
           •
           •
NETLU    DATA   F'1'
STATUS   DATA   F'6'
```

Return Codes

The NETCTL return codes are placed in the first word of the task control block ($TCBCO) of the task that issued the instruction.

The positive return codes from NETCTL TYPE=RECV have bit-significant values to allow for efficient analysis in the Series/1 SNA application. The bit positions have the following meanings:

....1 End of transaction received.
....1. Right-to-send received.

The following values are returned in combination with the above bit-significant information:

X'0010'	Status message received.
X'0020'	Message being received from host canceled.
X'0030'	Session termination request received.
X'0050'	Request for right-to-send received.
X'0060'	Host permission to resume sending received.
X'0070'	Message sent to host rejected.

The valid combinations of the values and bit positions are listed in the following decimal return codes.

Return Code	Condition
−26	No status available.
−25	Not right-to-send.
−24	The selected PU is not active.
−23	Invalid PU number.
−22	Session reset. CLEAR and SDT commands received.
−21	More than two tasks running under this LU. Limit is two tasks.
−20	UNBIND HOLD received.
−19	$SNA not currently loaded.
−18	Session quiesced.
−17	Status available.
−16	Session abnormally terminated by host.
−15	NETTERM in progress.
−14	SNA system error.
−13	Invalid request.
−12	Invalid LU number.
−11	Instruction must be issued under program linked to $NETCMD.
−10	Session does not exist.
−9	LU is busy with another operation.
−8	$SNA is deactivating.
−7	SNA is in the process of loading or unloading and is not usable temporarily.
−1	Operation successful.
1	END BRACKET received.
2	CHANGE DIRECTION received.
16	LUSTAT received.
17	LUSTAT with EB received.
18	LUSTAT with CD received.
32	CANCEL received.
33	CANCEL with EB received.
34	CANCEL with CD received.
48	SHUTDOWN received.
80	SIGNAL received.
96	RELQ received.
112	Negative response received.

The valid combinations of the values and bit positions are listed in the following decimal return codes.

NETGET – Receive Messages from the SNA Host

The NETGET instruction allows your application to receive messages from the host application program. Before you can use the NETGET instruction, you must establish a logical-unit-to-logical-unit session.

When you issue the NETGET instruction, Series/1 SNA passes messages received from the host's application program into a buffer area provided by NETGET. If the buffer area is not large enough to contain the complete message, you can issue additional NETGET instructions.

NETGET supplies a return code when it receives the complete message.

Syntax:

label	**NETGET**	**LU=,BUFF=,BYTES=,RECLEN=,** **EXIT=,P1=,P2=,P3=,P4=**
Required:	**LU,BUFF,BYTES,RECLEN**	
Defaults:	**none**	
Indexable:	**none**	

Operand	*Description*
LU=	A one-word field containing the number of the logical unit (LU) and the number of the physical unit (PU) to be used for the session. The high-order byte identifies the PU and can be any value from 0 to 4 (0 indicates use PU #1 and is the same as specifying 1). The low-order byte is the LU number. It can be any value from 1 to 32.
BUFF=	The buffer area where the message or partial message is to be received.
BYTES=	A word value containing the length, in bytes, of the buffer area you specified in the BUFF operand.
RECLEN=	A word value to receive the actual length, in bytes, of the message or partial message received.
EXIT=	The label of the error-processing routine for your program. Control passes to this label if a return code less than −1 is returned to your application.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands. For NETGET, Px= corresponds to the following parameters: **P1** LU **P2** BUFF **P3** BYTES **P4** RECLEN

Coding Example

This example issues a NETGET instruction to receive a message or partial message stored at address INBUFF. In addition:

- The LU is number 1 at location NETLU.
- The length of the input area is at location INBLEN.
- The length of the message or partial message received is stored at location COUNT.

```
         NETGET   LU=NETLU,BUFF=INBUFF,BYTES=INBLEN,                C
               RECLEN=COUNT
           •
           •
           •
NETLU    DATA  F'1'
INBUFF   DATA  XL80
INBLEN   DATA  F'80'
COUNT    DATA  F'0'
```

Return Codes

The NETGET return codes are placed in the first word of the task control block ($TCBCO) of the task that issued the instruction.

The positive return codes from NETGET contain bit-significant values to allow for efficient analysis in the Series/1 SNA application. The bit positions have the following meaning:

....1	Function management header received.
....1.	End of message received.
.... .1..	Right-to-send received.
.... 1...	Response to message requested.
....1	End of transaction received.
....1.	Start of transaction received.

The valid combinations of the bit positions are listed in the following decimal return codes:

Return Code	Condition
−26	Host initiated transaction.
−25	No messages available.
−24	The selected PU is not active.
−23	Invalid PU number.
−22	Session reset. CLEAR and SDT commands received.
−21	More than two tasks running under this LU. Limit is two tasks.
−20	UNBIND HOLD received.
−19	$SNA not currently loaded.

Return Code	Condition
−17	Status available.
−16	Session abnormally terminated by host.
−15	NETTERM in progress.
−14	SNA system error.
−13	Invalid request.
−12	Invalid LU number.
−11	Instruction must be issued under program linked to $NETCMD.
−10	Session does not exist.
−9	LU is busy with another operation.
−8	$SNA is deactivating.
−7	SNA is in the process of loading or unloading and is not usable temporarily.
−1	Operation successful.
1	FMH received.
2	End of message received.
3	End of message and FMH received.
6	End of message and right-to-send received.
7	End of message, FMH, and right-to-send.
10	End of message received, response requested received.
11	End of message, and FMH received, response requested.
14	End of message, and right-to-send received, response requested.
15	End of message, FMH, and right-to-send received, response requested.
18	End of transaction and end of message received.
19	End of transaction, end of message and FMH received.
26	End of transaction and end of message received, response requested.
27	End of transaction, end of message and FMH received, response requested.
32	Start of transaction received.
33	Start of transaction and FMH received.
34	Start of transaction and end of message received.
35	Start of transaction, end of message, and FMH received.
38	Start of transaction, end of message, and right-to-send received.
39	Start of transaction, end of message, FMH, and right-to-send received.
42	Start of transaction, end of message, and response requested.
43	Start of transaction, end of message, and FMH received, response requested.
46	Start of transaction, end of message, and right-to-send received, response requested.

Return Code	Condition
47	Start of transaction, end of message, FMH, and right-to-send received, response requested.
50	Start and end of transaction, and end of message received.
51	Start and end of transaction, end of message and FMH received.
58	Start and end of transaction, and end of message received response requested.
59	Start and end of transaction, end of message and FMH received, response requested.

NETHOST – Build an SNA Host ID Data List

The NETHOST instruction generates an assembly-time host ID data list that defines logical unit (LU) requirements and session resources.

Certain operands in the NETHOST instruction can affect the performance of other LU operations. You may, therefore, need the help of the host system programmer when coding the instruction. You also may require the host system programmer's knowledge of SNA protocols.

Syntax:

label	**NETHOST ISAPPID=,ISMODE=,ISPASWD=,ISQUEUE=, ISRQID=,ISUSFLD=,SSCPID=**
Required:	**ISAPPID=,ISMODE=**
Defaults:	**ISPASWD=,ISRQID=,ISUSFLD= (all default to 8 blanks) ISQUEUE=NO,SSCPID=6X'00' (bytes)**
Indexable:	**none**

Operand *Description*

ISAPPID= A 1–8 character name that identifies the host user program identification (APPLID) to be used for a session. Trailing blanks are ignored by NETINIT.

ISMODE= A 1–8 character name that identifies the set of rules and protocol for a session. The system services control point (SSCP) also uses the name to build the CINIT request.

ISPASWD=

A 1–8 character password used to verify the identity of a Series/1 user. The default of 8 blanks causes NETINIT to generate a null (zero length) field in the INITSELF command. NETINIT ignores trailing blanks.

ISQUEUE=

YES, to place the INITSELF request in a queue if it cannot be executed immediately.

NO (the default), to prevent the request from being held in a queue.

ISRQID= The 1–8 character name that identifies the Series/1 user initiating a request. You can also use ISRQID to establish authority for you to use a particular resource. The default of eight blanks causes NETINIT to generate a null (zero length) field in the INITSELF command. NETINIT ignores trailing blanks.

ISUSFLD= A 1 – 20 character string for carrying data you specify. Network services request processors do not process this data. The Series/1 SNA support passes the data to the primary logical unit (PLU). The default of eight blanks causes NETINIT to generate a null (zero length) field in the INITSELF command. NETINIT ignores trailing blanks.

SSCPID= The system services control point (SSCP) identification for the network to be attached. You can code this operand using 0 – 12 hexadecimal digits. A 0 value specifies the session is to be opened with any SSCP attached.

You can specify any 6-byte binary value. However, to be meaningful, the bit representation must match the identification of the attached SSCP. The default is 6 bytes containing zeros.

NETINIT – Establish an SNA Session

The NETINIT instruction initiates a request for establishing a session with the host application program. The established session remains in effect until you end it by issuing a NETTERM instruction.

Note: In coding your program, you can (if the system resources are available) establish multiple sessions for each task. All tasks using these sessions must be within the same program.

Syntax:

label	**NETINIT**	**LU=|HOLDLU=,HOSTID=,MSGDATA=, SESSPRM=,ATTNEV=,RDSCB=,ERRCODE=, FULLDPX=,ACQUIRE=,RESYNC=,RTYPE=, LUSWAIT=,MSGPRIO=,PTHRU=,PACB=, EXIT=,P1=,P2=,P3=,P4=,P5=,P6=,P7=**
Required:	**LU=|HOLDLU=,HOSTID=,PACB=(if PTHRU=YES)**	
Defaults:	**LUSWAIT=YES,MSGPRIO=255,PTHRU=NO, ACQUIRE=YES,RESYNC=YES,RTYPE=DISK, FULLDPX=NO**	
Indexable:	**none**	

Operand	*Description*
LU=	A one-word field containing the number of the logical unit (LU) and the number of the physical unit (PU) to be used for the session. The high-order byte identifies the PU and can be any value from 0 to 4 (0 indicates use PU #1 and is the same as specifying 1). The low-order byte is the LU number. It can be any value from 0 to 32. If you code the LU number with a value of 0, the Series/1 SNA support returns the LU number in the second code word of the TCB ($TCBC02), along with the PU number. If you specify this operand, you cannot specify the HOLDLU operand on this instruction.
HOLDLU=	The LU number of the session to be reestablished after receiving an UNBIND HOLD. A one-word field containing the number of the logical unit (LU) and the number of the physical unit (PU) to be used for the session. The high-order byte identifies the PU and can be any value from 0 to 4 (0 indicates use PU #1 and is the same as specifying 1). The low-order byte is the LU number. It can be any value from 1 to 32.
HOSTID=	The label of the NETHOST data definition.
MSGDATA=	The label of a 6-byte data area where the SNA support stores information about messages exchanged during the session. If RESYNC=YES or INIT, the following considerations apply: • If RTYPE=DISK, MSGDATA is ignored. • If RTYPE=STG, MSGDATA is required.

SNA uses the data area you specify with MSGDATA for resynchronization data. SNA returns the resynchronization data on successful completion of an SNA operation. The resynchronization data is reserved for SNA use only and must be supplied on the NETINIT instruction when the session is restarted.

If RESYNC=NO, MSGDATA is optional. When you specify MSGDATA, SNA uses the area to hold message data. When a NETPUT LAST=YES operation is successful, SNA stores the number assigned to the message sent to the host in the first and second bytes of the data area. The remaining bytes of the area are reserved for SNA use only.

SESSPRM= The label of a data area where SNA stores session-establishment parameters (BIND) received from the host. The area contains the parameters after the NETINIT operation completes successfully. This area must be 256 bytes.

ATTNEV= The address of an event control block (ECB) to be posted when an attention event occurs while no SNA operations are active. You should issue a NETGET instruction to determine whether the event is for status information or data if the session is not a pass-through session. If the session is a pass-through session (PTHRU=YES), the post code in the first word of the ECB indicates the new status of the pass-through session. ATTNEV is recommended for pass-through operations.

RDSCB= The address of an opened data set control block (DSCB) to be used by SNA resynchronization processing. Code this operand only if you specify RTYPE=DISK.

ERRCODE= The label of a 4-byte data area where SNA stores extended error information. If you code this operand and the SNA operation returns a negative return code (other than −1), this data field identifies the SNA instruction and the related SNA function that failed, plus the return code of the SNA function. A breakdown of the data area follows:

- Byte 1 — The SNA operation in progress when the error was encountered:

  00 NETINIT
  01 NETPUT
  02 NETGET
  03 NETCTL
  05 NETTERM

- Byte 2 — The Event Driven Executive or SNA base function that reported the error. The following hexadecimal codes are returned:

  01 NETOPEN
  02 NETRECV
  03 NETSEND
  04 NETCLOSE
  05 NETBIND
  06 NETUBND
  08 BIND event post code
  0A READ

0B WRITE
0C Session termination

Note: Refer to *IBM Series/1 Event Driven Executive Systems Network Architecture and Remote Job Entry Guide*, SC34-0773 for additional information on the return codes for these functions.

- Bytes 3 and 4 — The error return code from the Event Driven Executive or SNA base function.

FULLDPX= YES, to establish a session in a duplex transmission mode.

Note: If you code FULLDPX=YES, you cannot use message resynchronization and attention event processing.

NO (the default), to establish a session in a half-duplex transmission mode.

ACQUIRE= YES (the default), to cause SNA to initiate the session for your application program.

NO, to indicate that the host is to initiate the session.

RESYNC= YES (the default), to use the contents of the resynchronization data set during session establishment.

NO, to disable session resynchronization. You must specify RESYNC=NO if PTHRU=YES or if FULLDPX=YES.

INIT, to initialize the contents of the resynchronization data set during establishment of a session.

RTYPE= DISK (the default), to save session resynchronization data on disk. You must code the RDSCB operand if you specify this parameter.

STG, to save session resynchronization data in storage. You must code the MSGDATA operand if you specify this parameter.

This operand is ignored if you code RESYNC=NO.

Note: Your program must open and close the 256-byte resynchronization data set.

LUSWAIT= YES (the default), to force NETINIT to wait for the LU SSCP session to activate. You must specify LUSWAIT=YES if PTHRU=YES.

NO, to force NETINIT to fail if the LU SSCP session is not active.

MSGPRIO= The message priority for all outgoing messages for this LU while in session. This value overrides the value specified on the SNALU statement for the LU.

When the session ends, the value reverts back to the value on the SNALU statement. This operand specifes the order of messages as they are presented to SDLC. If messages are queued to SDLC waiting to be sent, then higher priority messages will be placed in the queue ahead of all lower priority messages. Specify MSGPRIO as any number from 1 to 255, with 1 as the highest priority. 255 is the default.

PTHRU= YES, means the session is part of a pass-through session and all messages are to be passed through the Series/1 to the remotely attached LUs. PTHRU=YES is valid only when used in conjunction with Primary SNA. ATTNEV is recommended for pass-through sessions.

NO, indicates the messages are to be handled by the application issuing the NETINIT. This is the default.

PACB= PACB establishes the logical connection between two remotely-connected applications and is valid only when PTHRU=YES. The primary side of the pass-through session establishes communications with the remote secondary application using NETOPEN. The secondary side establishes communications with the remote primary application using NETINIT. You must issue NETINIT and NETOPEN for a pass-through session to exist. The second command (whether NETINIT or NETOPEN) must specify PACB to link the two commands. Do no specify PACB on the forst command issued for the pass-through session. For NETINIT, PACB contains the session Access Control Block (ACB) returned to the application when NETOPEN is issued.

EXIT= The label of the error-processing routine for the Series/1 application. Control passes to this label if a return code other than −1 is returned to your program.

Px= Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands. Px= corresponds to the following parameters:

P1	LU/HOLDLU
P2	MSGDATA
P3	SESSPRM
P4	ATTNEV
P5	RDSCB/PACB
P6	ERRCODE
P7	MSGPRIO

Coding Examples

The examples presented here illustrate various ways you can use the NETINIT instruction to establish a session.

1) Session with Resynchronization Data to Disk

This example illustrates establishing a session where the resynchronization data resides on a disk. In addition:

- Series/1 SNA initiates the session with the host. SNA saves the extended error information at location SAVERC.
- The resynchronization data set RDSCB is RESTART.
- The LU is number 1, on PU 1, specified at location NETLU.
- NETINIT should wait if the LU-SSCP session is not active.
- Priority for all outbound messages is 40 while the LU is in session.

```
         NETINIT  LU=NETLU,HOSTID=SNAID,ACQUIRE=YES,                C
                  ERRCODE=SAVERC,RESYNC=YES,RTYPE=DISK,             C
                  RDSCB=RESTART
           •
           •
           •
NETLU    DATA     F'1'
SAVERC   DATA     4F'0'
RESTART  DSCB     DS#=RSYNC,DSNAME=RSYNDSCB
SNAID    NETHOST  ISAPPID=IMS,ISMODE=INQUIRY
```

2) Session with Resynchronization Data to Storage

This example illustrates establishing a session where the resynchronization data resides in storage. In addition:

- Series/1 SNA support waits for the host to initiate the session.
- SNA initializes the contents of the resynchronization data set when the session starts.
- SNA saves the resynchronization data at address RDATA.

```
         NETINIT  LU=NETLU,HOSTID=SNAID,ACQUIRE=NO,                C
               RESYNC=INIT,RTYPE=STG,MSGDATA=RDATA
           •
           •
           •
NETLU    DATA     F'1'
RDATA    DATA     6F'0'
SNAID    NETHOST  ISAPPID=CICS,ISMODE=INQUIRY
```

3) Session without Resynchronization

This example illustrates establishing a session without resynchronization support. SNA saves the message numbers at address MDATA.

- NETINIT for any LU on PU #3.
- NETINIT should fail if the LU-SSCP session is not active.
- Priority for all outbound messages is 80 while the LU is in session.

```
         NETINIT LU=NETLU,      ANY LU ON PU 3                     C
               HOSTID=SNAID,    SPECIFY WHICH HOST APPL             C
               ACQUIRE=NO,      LET THE HOST START THE SESSION      C
               RESYNC=NO,       NO MESSAGE RESYNCHRONIZATION USED   C
               MSGDATA=MDATA,   PASS BACK THE SEQUENCE NUMBERS      C
               LUSWAIT=NO,      FAIL IF LU-SSCP SESSION IS INACTIVE C
               MSGPRIO=MPRIO    MESSAGE PRIORITY IS 80
                  •
                  •
                  •
NETLU    DATA  X'0300'          PU NUMBER 3, ANY LU
MDATA    DATA  6F'0'            MSGDATA AREA
SNAID    NETHOST ISAPPID=JES2,ISMODE=RMT26 TALK TO JES2 APPL ON HOST
MPRIO    DATA  F'80'            MESSAGE PRIORITY = 80
```

Return Codes

NETINIT return codes are placed in the first word of the task control block ($TCBCO) of the task that issued the instruction.

If you code the ERRCODE operand on the NETINIT instruction, additional error information is returned, when appropriate, to the area you specified. Refer to the *IBM Series/1 Event Driven Executive Systems Network Architecture and Remote Job Entry Guide*, SC34-0773 for a description of this extended error code information.

The positive return codes from NETINIT have bit-significant values to allow for efficient analysis in the Series/1 SNA application. For a description of the bit-significant values, refer to the *Systems Network Architecture and Remote Job Entry Guide*.

The following are the decimal return codes that could be returned from a NETINIT operation:

Return Code	Condition
−33	Invalid message priority specified.
−32	No NETTERM HOLD=YES issued.
−31	STSN error.
−30	BIND from host rejected.
−27	No logical unit available.
−26	Logical unit already open.
−24	The selected PU is not active.
−23	Invalid PU number.
−19	$SNA not currently loaded.
−16	Session abnormally terminated by host.
−15	NETTERM in progress.
−14	SNA system error.
−12	Invalid LU number.
−8	$SNA is deactivating.
−7	SNA is in the process of loading or unloading and is not usable temporarily.
−1	Operation successful.
2	Unpresented message from host lost.
4	Partially presented message from host lost.
17	Message flow to host cold-started, no messages to host lost. Message flow from host cold-started, no messages from host lost.
19	Message flow to host cold-started. Message flow from host cold-started, message from host lost.
32	Message to host lost.
49	Message flow to host cold-started, message to host lost. Message flow from host cold-started no messages from host lost.
81	Message flow to host cold-started, message to host possibly lost. Message flow from host cold-started, no messages from host lost.

NETPACT – Activate a Specific PU

The NETPACT instruction makes it possible for you to start a PU from an application program.

Syntax:

label	**NETPACT PU=,PART#=,IDSSCP=,EXIT=** **P1=,P2=,P3=**
Required:	**PU=**
Defaults:	**none**
Indexable:	**none**

Operand	*Description*
PU=	A 1-word field containing the number of the PU to be started. Valid values are 1–4.
PART#=	A one-word field containing the partition number where the PU control blocks are to be loaded. If specified, this value overrides the value specified in SNAINIT for the PU. Valid values are 0–8. 0 indicates that the PU can be loaded into any static partition.
IDSSCP=	Specifies a three byte field containing the SSCP id for the PU if the PU is on a switched line. If specified, this value overrides the value specified on the SNAPU statement when the PU was defined. The SSCP is a 5-nibble value and must be left justified in the field.
EXIT=	The label of the error-processing routine for the Series/1 application. Control passes to this label if any return code other than –1 is returned to your application.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Coding Example

The following example illustrates starting a PU from an application program.

- The PU being started is number 4.
- The program loads the PU into partition #4.
- The program overrides the SSCPID given in the SNA PU statement with 000C1.

```
        NETPACT PU=NETPU,       START PU #4                          C
             PART#=PART,        OVERRIDE THE PARTITION # IN SNAINIT  C
             IDSSCP=SSCPID      OVERRIDE THE SSCPID IN THE GEN
          •
          •
          •
NETPU   DATA  F'4'              PU NUMBER 4
SSCPID  DATA  3X'000C10'        SSCP ID (LAST NYBBLE IGNORED)
PART    DATA  F'4'              PARTITION NUMBER 4
```

Return Codes

Return Code	Condition
−9	Error reading SNA initialization dataset (SNAINIT).
−8	Invalid partition number in SNAINIT for PU requested to be activated.
−7	Invalid partition number. You coded a partition number out of the required range (0 through 8).
−6	Load failed for $SNA.
−5	$SNA is unusable. All PUs are deactivated and $SNA is waiting to unload. The request to activate a PU is ignored.
−4	PU load of control blocks failed.
−3	$SNA is deactivating all PUs. When they are deactivated $SNA will attempt to unload. The request to activate a PU is ignored.
−2	Invalid PU number.
−1	PU load successful.
1	SNA and PU load successful.
2	PU already activated.

NETPUT — Send Messages to the SNA Host

The NETPUT instruction transmits messages from a Series/1 application program to the host application program. You can issue a NETPUT instruction only after establishing a session successfully.

You can send a complete message to the host with one NETPUT operation, or, if necessary, you can send a single message with multiple NETPUT operations.

You must have the right-to-send for the NETPUT operation to be successful. If you are receiving and need to send, issue the NETCTL instruction with TYPE=SIG to request the right-to-send. When no transaction is active on the session, both you and the host have the right-to-send.

You can cancel a message during transmission to the host by issuing a NETCTL instruction with TYPE=CANCEL. The host discards any part of the message it has already received. See the NETCTL instruction for more coding information.

Syntax:

label	**NETPUT**	**LU=,BUFF=,BYTES=,EOT=,FMH=,INVITE=,** **LAST=,VERIFY=,EXIT=,P1=,P2=,P3=**
Required:		**LU=,BUFF=,BYTES=**
Defaults:		**EOT=NO,FMH=NO,INVITE=YES,** **LAST=YES,VERIFY=NO**
Indexable:		**none**

Operand	*Description*
LU=	A one-word field containing the number of the logical unit (LU) and the number of the physical unit (PU) to be used for the session. The high-order byte identifies the PU and can be any value from 0 to 4 (0 indicates use PU #1 and is the same as specifying 1). The low-order byte is the LU number. It can be any value from 1 to 32.
BUFF=	The message, or partial message, to be sent.
BYTES=	A word containing the number of bytes in the message or partial message to be sent.
EOT=	YES, to end the transaction after the message is sent. NO (the default), to avoid ending the transaction after the message is sent. This operand is recognized only on the first NETPUT instruction you issue for a message.
FMH=	YES, if the message contains function management (FM) headers. NO (the default), if the message does not contain FM headers. This operand is recognized only on the first NETPUT instruction you issue for a message.

INVITE= YES (the default), to give the host the right to send after this message is transmitted.

NO, if you do not want to give the host the right to send.

This operand is ignored unless you specify LAST=YES (see the LAST operand).

LAST= YES (the default), if this is the last NETPUT operation for the message.

NO, if this is not the last NETPUT operations for the message.

VERIFY= YES, if the host should verify that it received the message.

NO (the default), if you do require verification.

This operand is ignored if you do not specify LAST=YES.

EXIT= The label of the error-processing routine for the Series/1 application. Control passes to this label if any return code other than −1 is returned to your application.

Px= Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Coding Examples

The examples presented here illustrate various ways you can use the NETPUT instruction to send messages.

1) Sending a Message with a Single NETPUT

This example illustrates sending a message to the host using one NETPUT instruction. In addition:

- The LU is number 1 at location NETLU.
- The message to be sent is at location OUTBUFF.
- The length of the message to be sent is at location BYTECNT.
- The data is to be sent as a complete message.
- The host receives the right-to-send.
- Function management headers are included in the data.

```
         NETPUT   LU=NETLU,BUFF=OUTBUFF,BYTES=BYTECNT,              C
               INVITE=YES,FMH=YES,LAST=YES
           •
           •
           •
NETLU    DATA  F'1'
OUTBUFF  DATA  CL80'MESSAGE'
BYTECNT  DATA  F'80'
```

2) Sending a Message with Multiple NETPUT Operations

This example illustrates one message being sent to the host with three NETPUT instructions. In addition:

- The lengths of the "partial messages" to be sent are at locations BYTECNT1, BYTECNT2, and BYTECNT3.
- The host should verify that it received the message.
- The transaction ends after sending the message.

```
         NETPUT   LU=NETLU,BUFF=OUTBUFF1,BYTES=BYTECNT1,              C
               EOT=YES,LAST=NO

         NETPUT   LU=NETLU,BUFF=OUTBUFF2,BYTES=BYTECNT2,              C
               LAST=NO

         NETPUT   LU=NETLU,BUFF=OUTBUFF3,BYTES=BYTECNT3,              C
               VERIFY=YES,LAST=YES
           •
           •
           •
NETLU    DATA  F'1'
OUTBUFF1 DATA  CL40'MESSAGE PART 1'
OUTBUFF2 DATA  CL20'MESSAGE PART 2'
OUTBUFF3 DATA  CL20'MESSAGE PART 3'
BYTECNT1 DATA  F'40'
BYTECNT2 DATA  F'20'
BYTECNT3 DATA  F'20'
```

Return Codes

NETPUT return codes are placed in the first word of the task control block ($TCBCO) of the task that issued the instruction.

The positive return codes from NETPUT have bit-significant values to allow for efficient analysis in the Series/1 SNA application. The bit positions have the following meaning:

....1 Host attempted to start a transaction.

The valid combinations of the bit positions are listed in the following decimal return codes:

Return Code	Condition
−26	Bracket state manager is pending begin bracket (sent RTR). Issue a NETGET.
−25	Not right-to-send.
−24	The selected PU is not active.
−23	Invalid PU number.
−22	Session reset. CLEAR and SDT commands received.
−21	More than two tasks running under this LU. The limit is two tasks.
−20	UNBIND HOLD received.
−19	$SNA not currently loaded.
−18	Session quiesced.
−17	Status available.
−16	Session abnormally terminated by host.
−15	NETTERM in progress.
−14	SNA system error.
−13	Invalid request.
−12	Invalid LU number.
−11	Instruction must be issued under program linked to $NETCMD.
−10	Session does not exist.
−9	LU is busy with another operation.
−8	$SNA is deactivating.
−7	SNA is in the process of loading or unloading and is not usable temporarily.
−1	Operation successful.
1	Host attempted to start transaction.

NETTERM — End an SNA Session

The NETTERM instruction releases the logical communications path previously established between session partners with the NETINIT instruction. NETTERM ends the session and releases the Series/1 resources used for the session.

You can use the system resources freed with the NETTERM instruction to establish other sessions.

At any time, either the host program or your application program can end the session.

Syntax:

label	**NETTERM LU=,HOLD=,TYPE=,EXIT=,P1=**
Required:	**LU=**
Defaults:	**HOLD=NO,TYPE=NORMAL**
Indexable:	**none**

Operand	*Description*
LU=	A one-word field containing the number of the logical unit (LU) and the number of the physical unit (PU) to be used for the session. The high-order byte identifies the PU and can be any value from 0 to 4 (0 indicates use PU #1 and is the same as specifying 1). The low-order byte is the LU number. It can be any number from 1 to 32.
HOLD=	YES, to keep session resources if the host issues a BIND command following the NETTERM instruction. NO (the default), to end the session and release all session resources. Code this operand only when the host issues an UNBIND HOST command.
TYPE=	The type of session termination requested by the Series/1 application. Specify one of the following: **NORMAL** — The Series/1 application requests the host LU to terminate the session. NORMAL is the default. **QUICK** — The Series/1 application requests VTAM to terminate the session between itself and the host LU. **IMMED** — The Series/1 applications requests that the Series/1 SNA support terminate the session between itself and the host LU, without waiting for any response from the host. **Note:** TYPE=IMMED may not be supported by all host systems.
EXIT=	The label of the error-processing routine for your program. Control passes to this label if any return code other than −1 is returned to your application.

Px= Parameter naming operand. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Coding Example

The following example shows the use of the NETTERM instruction to end a session. The LU address for the ended session is at address NETLU.

```
         NETTERM LU=NETLU
           •
           •
           •
NETLU    DATA   F'1'
```

Return Codes

The NETTERM return codes are placed in the first word of the task control block ($TCBCO) of the task that issued the instruction.

The positive return codes from NETTERM have bit-significant values to allow for efficient analysis in the Series/1 SNA application. The bit positions have the following meaning:

....1 Message from host rejected during termination.
....1. Message to host rejected during termination.
.... .1.. Message to host aborted during termination.
.... 1... Message from host aborted during termination.

The valid combinations of the bit positions are listed in the following decimal return codes:

Return Code	Condition
−25	No UNBIND HOLD received.
−24	The selected PU is not active.
−23	Invalid PU number.
−20	UNBIND HOLD received.
−19	$SNA never loaded.
−16	Session abnormally terminated by host.
−15	NETTERM in progress.
−14	SNA system error.
−12	Invalid LU number.
−11	Instruction must be issued under program linked to $NETCMD.
−10	Session does not exist.
−7	SNA is in the process of loading or unloading and is not usable temporarily.
−1	Operation successful.

Return Code	Condition
1	Negative response sent during NETTERM.
2	Negative response received during NETTERM.
3	Negative response received during NETTERM and negative response sent during NETTERM.
4	CANCEL sent during NETTERM.
5	CANCEL sent during NETTERM and negative response sent.
6	CANCEL sent during NETTERM and negative response received during NETTERM.
7	CANCEL sent during NETTERM, negative response received during NETTERM, and negative response sent during NETTERM.
8	CANCEL received during NETTERM.
9	CANCEL received during NETTERM and negative response sent during NETTERM.

NEXTQ – Add Entries to a Queue

The NEXTQ instruction allows you to add entries to a queue defined with the DEFINEQ statement. The system removes a queue entry from the free chain of the queue and places the entry in the queue's active chain.

Syntax:

label	**NEXTQ qname,loc,FULL=,P1=,P2=**
Required:	**qname,loc**
Default:	**none**
Indexable:	**qname,loc**

Operand	*Description*
qname	The name of the queue in which to place the entry. The queue name is the label of the DEFINEQ statement that creates the queue.
loc	The label of a word of storage which will become an entry in the queue. This might be a single word of data or the address of an associated data area. If loc is coded as #1 or #2 then the contents of the selected register will become the entry in the queue.
FULL=	The label of the first instruction of the routine to be called if a "queue full" condition is detected during the execution of this instruction. If you do not specify this operand, control returns to the next instruction after the NEXTQ. A return code of −1 in the first word of the task control block indicates that the operation completed successfully. A return code of +1 indicates that the queue is full.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Coding Examples

1) The following example uses each of the queuing instructions. The program defines a queue area that contains four 6-word buffers. The FIRSTQ instruction obtains the oldest entry in TIMEBUF. The GETTIME instruction obtains the date and time and updates the contents of the entry obtained by FIRSTQ. The program stores the new time and date in TIMEQ1 and TIMEQ2. When all buffers are allocated, the queue entries are printed on a first-in-first-out basis, then on a last-in-first-out basis, and the buffers used are freed. Each queue instruction executes 8 times.

```
QTEST    PROGRAM   START
START    FIRSTQ    TIMEBUF,LOC
         IF        (QTEST,EQ,1),GOTO,EMPTY
         GETTIME   *,DATE=YES,P1=LOC
         NEXTQ     TIMEQ1,LOC,FULL=ERROR1
         NEXTQ     TIMEQ2,LOC,FULL=ERROR1
         ADD       CTR,1
         GOTO      START
*
EMPTY    FIRSTQ    TIMEQ1,OUTADDR1,EMPTY=CHKCTR
         LASTQ     TIMEQ2,OUTADDR2,EMPTY=CHKCTR
         ENQT      $SYSPRTR
         PRINTEXT  SKIP=1
         PRINTNUM  *,6,6,P1=OUTADDR1
         PRINTEXT  SPACES=5
         PRINTNUM  *,6,6,P1=OUTADDR2
         DEQT
         NEXTQ     TIMEBUF,OUTADDR1
         GOTO      EMPTY
*
CHKCTR   IF        (CTR,GE,8),GOTO,DONE
         GOTO      START
ERROR1   PRINTEXT  '@TIMEQ PREMATURELY FULL@'
DONE     PROGSTOP
*
*  DATA AREA
*
TIMEBUF  DEFINEQ   COUNT=4,SIZE=12
TIMEQ1   DEFINEQ   COUNT=10
TIMEQ2   DEFINEQ   COUNT=10
CTR      DATA      F'0'
         ENDPROG
         END
```

2) In this example, index register 1 points to a block of storage in a buffer area. The NEXTQ instruction places the address of that location (contained in register #1) into the queue defined by the QUE1 label. If the queue is full, the program branches to the FULLQUE1 label. Otherwise, the MOVE instruction places 32 bytes of data, beginning at the address labeled DATAREC, into the buffer area. The ADD instruction updates #1 so that it points to the next sequential block of storage in the buffer.

```
         SUBROUT NEXTQUE1
*
         NEXTQ   QUE1,#1,FULL=FULLQUE1
         MOVE    (0,#1),DATAREC,(32,BYTES)
         ADD     #1,32
         RETURN
*
FULLQUE1 EQU     *
         PRINTEXT '@QUE1 QUEUE BUFFER FULL'
         GOTO    ENDIT
           •
           •
           •
QUE1     DEFINEQ  COUNT=8
           •
           •
           •
ENDIT    EQU     *
         PROGSTOP
DATAREC  DATA    16F'0'
```

Return Codes

The return codes are returned in the first word of the task control block (TCB) of the program or task issuing the instruction. The label of the TCB is the label of your program or task (taskname).

Return Code	Description
−1	Successful completion.
1	Queue is full.

NOTE – Store Next-Record Pointer

The NOTE instruction causes the value of a data set's next-record-pointer, which is maintained by the system, to be stored in your program. The next-record-pointer is the relative record number that will be retrieved by the next sequential READ or WRITE instruction.

Syntax:

label	**NOTE**	**DSx,loc,PREC=,P2=**
Required:	**DSx,loc**	
Defaults:	**PREC=S**	
Indexable:	**loc**	

Operand	*Description*
DSx	Code DSx, where "x" is the relative position (number) of a data set in the list of data sets you define on the PROGRAM statement. The first data set is DS1, the second is DS2, and so on. A DSCB name defined by a DSCB statement can be used in place of DSx.
loc	This operand specifies the address of a fullword or doubleword of storage that will contain the next-record-pointer as the result of executing a NOTE instruction. This value can be used as the relative record number (relrecno) in a subsequent POINT or direct READ or WRITE operation. When this operand is coded as an indexable value or as an address label, the PREC operand can be used to further define whether relrecno is to be a single-word or double-word value. If the PREC operand is coded as PREC=D, then the range of relrecno is extended beyond the 32767 value to the limit of a double-word value.
PREC=	This optional operand further defines the relrecno operand only when relrecno is coded as an address or as an indexable value. The default value is S and has the same effect on relrecno as coding PREC=S. That effect is to limit the value of relrecno to single-word precision or a value of X'7FFF' (32767). Coding PREC=D gives a double-word precision attribute to the relrecno operand and, therefore, extends its maximum value range to a double-word value.
P2=	Parameter naming operand. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code this operand.

Syntax Examples

1) The following NOTE instruction is valid for records that do not exceed a length of 32767.

```
NOTEL1   NOTE    DS2,LOCS
           •
           •
           •
LOCS     DATA    F'0'
```

2) The NOTE instruction in this example is valid for records that exceed 32767 because the variable LOCD is double-word precision.

```
NOTEL2   NOTE    DS3,LOCD,PREC=D
           •
           •
           •
LOCD     DATA    D'0'
```

PLOTGIN – Enter Scaled Cursor Coordinates

The PLOTGIN instruction allows you to specify scaled cursor coordinates interactively. The instruction uses the coordinates you specify to plot curves. PLOTGIN rings the bell and displays the cross-hair cursor. It waits for you to position the cross-hairs and enter a single character. The cursor coordinates you enter are scaled with the use of the plot control clock (PLOTCB). A description of the control block follows this instruction.

Syntax:

label	**PLOTGIN x,y,char,pcb,P1=,P2=,P3=,P4=**
Required:	**x,y,pcb**
Defaults:	**no character returned**
Indexable:	**none**

Operand	*Description*
x	The location where the x cursor coordinate value is to be stored.
y	The location where the y cursor coordinate value is to be stored.
char	The location where the character you select is to be stored. The character is stored in the rightmost byte. The left byte is set to 0. If you do not code this operand, the instruction does not store the selected character.
pcb	Label of an 8-word plot control block.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Plot Control Block (PLOTCB)

The plot control block defines the size and position of the plot area on the screen and the data values associated with the edges of the plot area. The PLOTCB consists of eight words of data defined by DATA statements.

You must build a PLOTCB in your graphics program when using the PLOTGIN, XYPLOT or YTPLOT instructions. The format of the control block is:

```
label   DATA   F'xls'
        DATA   F'xrs'
        DATA   F'xlv'
        DATA   F'xrv'
        DATA   F'ybs'
        DATA   F'yts'
        DATA   F'ybv'
        DATA   F'ytv'
```

You must specify an explicit value for all eight statements. The required values are defined below:

xls x screen location at left edge of plot area

xrs x screen location at right edge of plot area

xlv x data value plotted at left edge of plot

xrv x data value plotted at right edge of plot

ybs y screen location at bottom edge of plot

yts x screen location at top edge of plot

ybv y data value plotted at bottom edge of plot

ytv y data value plotted at top edge of plot.

Syntax Example

Read x and y cursor coordinates and store them in X and Y, respectively. Store characters in the data area labeled CHAR. The plot control block is at label PCB.

```
          PLOTGIN     X,Y,CHAR,PCB
           •
           •
           •
PCB       DATA        F'500'
          DATA        F'1000'
          DATA        F'0'
          DATA        F'10'
          DATA        F'100'
          DATA        F'600'
          DATA        F'-5'
          DATA        F'5'
```

POINT — Set Next-Record Pointer

The POINT instruction causes the value of a data set's next-record-pointer, which is maintained by the system, to be set to a new value. The system uses this new value in later sequential READ or WRITE operations.

Syntax:

label	**POINT DSx,relrecno,PREC=,P2=**
Required:	**DSx,relrecno**
Defaults:	**PREC=S**
Indexable:	**relrecno**

Operand	*Description*
DSx	Code DSx, where "x" is the relative position (number) of the data set in the list of data sets you define on the PROGRAM statement. The first data set is DS1, the second is DS2, and so on. A DSCB name defined by a DSCB statement can be substituted for DSx.
relrecno	This operand sets a new value in the system-maintained next-record-pointer. This parameter can be either a constant or the label of the value to be used. If this value is coded as a self-defining term, or an equated value which is preceded by a plus sign (+), then it is assumed to be a single-word value and is, therefore, generated as an inline operand. Because this is a one-word value, it is limited to a range of 1 to 32767. When this operand is coded as an indexable value or as an address, the PREC operand can be used to further define whether relrecno is to be a single-word or double-word value. If the PREC operand is coded as PREC=D, then the range of relrecno is extended beyond the 32767 value to the limit of a double-word value (2147483647).
PREC=	This operand further defines the relrecno operand when you code an address or an indexable value for relrecno. PREC=S (the default) limits the value of the relrecno operand to a single-precision value of 32767 (X'7FFF'). PREC=D extends the maximum range for the relrecno operand to a doubleword value of 2147483647 (X'7FFFFFFF').
P2=	Parameter naming operand. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code this operand.

Syntax Examples

1) The following POINT instruction is valid for records that do not exceed a length of 32767.

```
POINTL1  POINT   DS2,LOCS
           •
           •
           •
LOCS     DATA    F'0'
```

2) This POINT instruction is valid for records that exceed 32767 because the variable LOCD is double-word precision.

```
POINTL2  POINT   DS3,LOCD,PREC=D
           •
           •
           •
LOCD     DATA    D'0'
```

POST – Signal the Occurrence of an Event

The POST instruction signals the occurrence of an event.

A POST instruction normally assumes the event is in the same partition as the executing program. However, it is possible to POST an event in another partition using the cross-partition capability of POST. See Appendix C, "Communicating with Programs in Other Partitions (Cross-Partition Services)" on page C-1 for an example of posting an event in another partition. You can find more information on cross-partition services in the *Language Programming Guide*.

Syntax:

label	**POST**	**event,code,P1=,P2=**
Required:	**event**	
Defaults:	**code=-1**	
Indexable:	**event**	

Operand	*Description*
event	The label of an event control block (ECB) that defines the event. You must code an ECB statement in your program if you compile the program under $EDXASM. $S1ASM and the S/370 host assembler generate the ECB for the event named in the POST instruction. You do not need to code an ECB statement when using either of these macro assemblers. Process interrupts are special events that can be simulated with a POST. This is useful when one task is waiting for a process interrupt and a second task wishes to start the first, as in a program termination sequence. In this case, issue a POST PIx, where "x" is a process interrupt number from 1–99 as specified in an IODEF statement.
code	A value, other than 0, to be inserted into the control block for the event. You may want to use this value as a flag that indicates a certain condition or status. To check the code value, refer to the label of the ECB statement.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Coding Examples

1) The POST instruction in the following example posts the event control block labeled ECB1 when TASK1 is finished processing. TASK1 reads a record from the data set MYFILE and places the record in the buffer labeled BUF. The primary task, PRINTOUT, waits for ECB1 to be posted before it continues processing. When the POST instruction posts ECB1, the primary task enqueues the system printer and prints the first 50 bytes of the record.

```
PRINTOUT    PROGRAM   START,DS=((MYFILE,EDX40))
START       EQU       *
            ATTACH    TASK1
            WAIT      ECB1
            ENQT      $SYSPRTR
            MOVE      REC,BUF,25
            PRINTEXT  REC,SKIP=1
             •
             •
             •
            PROGSTOP
BUF         BUFFER    256,WORD
ECB1        ECB
REC         TEXT      LENGTH=50
************************************************
TASK1       TASK      NEXT
NEXT        READ      DS1,BUF,1
            POST      ECB1
            ENDTASK
            ENDPROG
            END
```

2) The following example posts an ECB labeled ECB1 which is declared as external to the assembly module.

```
            EXTRN       ECB1
                     •
                     •
                     •
            MOVEA       B,ECB1
            POST        *,P1=B
                     •
                     •
                     •
            END
```

PRINDATE – Display the Date on a Terminal

The PRINDATE instruction prints the date on a terminal. The system prints the date in the form MM/DD/YY or DD/MM/YY, depending on the option coded on the SYSPARMS statement when the supervisor was generated.

Note: You must include timer support in the system and have timer hardware installed to use the PRINDATE instruction. Otherwise, a program check will occur.

The supervisor places a return code in the first word of the task control block (taskname) whenever a PRINDATE instruction causes a terminal I/O operation to occur. If the return code is not a −1, the address of this instruction will be placed in the second word of the task control block (taskname+2). The terminal I/O return codes are described at the end of the PRINTEXT and READTEXT instructions in this manual and also in *Messages and Codes.*

Note: Any references to **31xx** terminals means 3101, 3151, 3161, 3163, and 3164 terminals, unless otherwise noted.

Syntax:

label	**PRINDATE**
Required:	**none**
Defaults:	**none**
Indexable:	**none**

Operand	*Description*
none	none

31xx Display Considerations

If you are using a 31xx in block mode, it will display the output from a PRINDATE instruction according to the SET,ATTR and SET,STREAM operands of a TERMCTRL statement currently in effect. For details on these operands see "TERMCTRL – Request Special Terminal Function" on page 2-426.

Coding Example

The following example prints the date and a message on the system printer.

```
        .
        .
        .
ENQT      $SYSPRTR
PRINTEXT  '@ THE DATE IS '
PRINDATE
```

The data appears in one of two formats, depending on the option coded on the DATEFMT keyword of the SYSPARMS statement during system generation.

If the SYSPARMS statement has DATEFMT=MMDDYY (the default), the PRINDATE instruction in the above example would produce the following result on February 25, 1984:

```
THE DATE IS 02/25/84.
```

If the SYSPARMS statement has DATEFMT=DDMMYY, the result of the PRINDATE operation would be:

```
THE DATE IS 25/02/84.
```

PRINT – Control Printing of a Compiler Listing

The PRINT statement controls the printing of the compiler listing. Because no instructions or constants are generated in the object program by this statement, it can be placed between executable instructions in your source statement data set.

A program can contain any number of PRINT statements. Each PRINT statement controls the printing of the compiler listing until another PRINT statement is encountered.

Syntax:

blank	**PRINT**	**ON/OFF,GEN/NOGEN,DATA/NODATA**
Required:	**none**	
Defaults:	**(Initially) ON,GEN,NODATA**	
Indexable:	**none**	

The GEN/NOGEN option is not supported by $EDXASM.

Operand	*Description*
ON	A listing is printed.
OFF	No listing is printed, except for the PRINT OFF statement itself.
GEN	The listing includes all object code generated by the compiler. (Not supported by $EDXASM.)
NOGEN	No object code appears with the instructions in the listing. Error messages appear regardless of NOGEN. The PRINT instruction also appears in the listing. (Not supported by $EDXASM.)
DATA	Constants are printed out in full in the listing.
NODATA	Only the leftmost 8 bytes of constants are printed on the listing.

Coding Example

The following sample program is compiled under $EDXASM using the formatting aids PRINT, TITLE, SPACE, and EJECT. The TITLE statement places the program title, "Compiler Listing Control Demonstration," at the top of each page of the listing. PRINT OFF stops the printing of the listing, which is resumed when the system encounters the PRINT ON statement. In this case, the MOVE instruction between two PRINT statements is omitted.

The SPACE statement inserts a specified number of blank lines between instructions, improving the readability of the listing. When the EJECT statement is reached, the printer ejects the page and begins printing the next line of the listing at the top of a new page. PRINT DATA causes the hexadecimal value of the first TEXT statement to be printed out in full in the left-hand column of the listing. When the default, PRINT NODATA, is coded before the second TEXT statement, the system prints only the leftmost 8 bytes of constants.

Sample Program:

```
         TITLE    'COMPILER LISTING CONTROL DEMONSTRATION'
DEMO     PROGRAM  START
START    EQU      *
         PRINT    OFF
         MOVE     COUNT,0
         PRINT    ON
LOOP     EQU      *
         ADD      COUNT,1
         SPACE    5
         IF       (COUNT,LE,10)
            PRINTEXT MESSAGE1
            PRINTNUM COUNT
         SPACE    2
         ELSE
            IF    (COUNT,LE,20)
               PRINTEXT MESSAGE2
               PRINTNUM COUNT
            ENDIF
         ENDIF
         SPACE    4
         IF       (COUNT,GT,20)
            PRINTEXT '@TERTIARY TEST MESSAGE NUMBER '
            PRINTNUM COUNT
            PROGSTOP
         ELSE
         GOTO LOOP
         ENDIF
         EJECT
COUNT    DATA  F'0'
         PRINT DATA
MESSAGE1 TEXT     '@PRIMARY TEST MESSAGE NUMBER '
         PRINT NODATA
MESSAGE2 TEXT     '@SECONDARY TEST MESSAGE NUMBER '
         ENDPROG
         END
```

Compiler Listing:

```
                                        COMPILER LISTING CONTROL DEMONSTRATION

LOC     +0   +2   +4   +6   +8          SOURCE STATEMENT


0000   0008 D7D9 D6C7 D9C1 D440  DEMO      PROGRAM    START
000A   0000 00E8 0168 0000 0000
0014   016C 0000 0000 0000 0100
001E   016A 0000 0000 0000 0000
0028   0000 0000 0000 0000 0000
0032   0000
0034                               START     EQU        *
                                             PRINT      OFF
003A                               LOOP      EQU        *
003A   8032 00A4 0001                        ADD        COUNT,1



0040   90A2 00A4 000A 0056                   IF         (COUNT,LE,10)
0048   0026 00A8                                PRINTEXT  MESSAGE1
004C   0028 00A4 0001                           PRINTNUM  COUNT

0052   00A0 0068                             ELSE
0056   90A2 00A4 0014 0068                      IF       (COUNT,LE,20)
005E   0026 00C8                                   PRINTEXT  MESSAGE2
0062   0028 00A4 0001                              PRINTNUM  COUNT
0068                                         ENDIF
0068                                      ENDIF



0068   E0A2 00A4 0016 00A0                   IF         (COUNT,GT,20)
0070   8026 1E1E 7CE3 C5D9 E3C9                PRINTEXT  '@TERTIARY TEST MESSAGE NUMBER '
007A   C1D9 E840 E3C5 E2E3 40D4
0084   C5E2 E2C1 C7C5 40D5 E4D4
008E   C2C5 D940
0092   0028 00A4 0001                           PRINTNUM  COUNT
0098   0022 FFFF                                PROGSTOP
009C   00A0 00A4                             ELSE
00A0   00A0 003A                             GOTO  LOOP
00A4                                      ENDIF



                                        COMPILER LISTING CONTROL DEMONSTRATION

LOC     +0   +2   +4   +6   +8          SOURCE STATEMENT


00A4   0000                        COUNT     DATA  F'0'
                                             PRINT DATA
00A6   1E1D 7CD7 D9C9 D4C1 D9E8    MESSAGE1  TEXT     '@PRIMARY TEST MESSAGE NUMBER '
00B0   40E3 C5E2 E340 D4C5 E2E2
00BA   C1C7 C540 D5E4 D4C2 C5D9
00C4   4040
                                             PRINT NODATA
00C6   201F 7CE2 C5C3 D6D5 C4C1    MESSAGE2  TEXT     '@SECONDARY TEST MESSAGE NUMBER '
00E8   0000 0000 0000 0234 0000              ENDPROG
                                             END
```

PRINTEXT – Display a Message on a Terminal

The PRINTEXT instruction allows you to print or display a message on any enqueued terminal, not only the loading terminal. As the default terminal, the loading terminal requires no ENQT instruction to perform a PRINTEXT. The PRINTEXT instruction also allows you to control cursor or forms movement.

The PRINTEXT instruction generally does cursor or forms movement before writing the message to the terminal.

Output for the terminal normally accumulates in the system buffer (or user buffer, if provided). The system writes this output to the terminal when it encounters a new line character (@), a forms control operand (SKIP, LINE, or SPACES), a PROGSTOP instruction, or a DEQT instruction for a terminal.

The supervisor places a return code in the first word of the task control block (taskname) whenever a PRINTEXT instruction causes a terminal I/O operation to occur. If the return code is not a −1, the address of this instruction will be placed in the second word of the task control block (taskname+2). The terminal I/O return codes are described at the the end of this instruction and the READTEXT instruction and also in *Messages and Codes.*

Note: Any references to **31xx** terminals mean 3101, 3151, 3161, 3163, and 3164 terminals, unless otherwise noted.

Syntax:

label	**PRINTEXT msg,SKIP=,LINE=,SPACES=,XLATE=, MODE=,PROTECT=,CAPS=,P1=**
Required:	**At least one operand from the following list: SKIP, LINE, SPACES, or msg**
Defaults:	**SKIP=0,LINE=(current line),SPACES=0, XLATE=YES,PROTECT=NO**
Indexable:	**msg,LINE,SKIP,SPACES**

Operand	*Description*
msg	The label of a TEXT statement which defines the message to be displayed or printed, or the actual message enclosed in apostrophes. You can also code the label of a BUFFER statement. When using a BUFFER statement, you must: • Code the buffer label on the BUFFER= operand of the IOCB statement for the terminal your program enqueues. • Move the number of characters to be printed into the index field of the BUFFER statement (msg−4). When you use a BUFFER statement, the system does not recognize the new line character (@), and the operation executes immediately.

The maximum line size for a terminal depends on how the TERMINAL definition statement was coded during system generation. Refer to the TERMINAL statement in the *Installation and System Generation Guide* for information on default sizes.

SKIP= The number of lines to be skipped before the system does an I/O operation. For example, if your cursor is at line 2 on a display screen and you code SKIP=6, the system does the I/O operation on line 8. For a printer, the SKIP operand controls the movement of forms.

The SKIP operand causes the system to display or print the contents of the system buffer.

If you specify a value greater than or equal to the logical page size, the system divides this value by the page size and uses the remainder in place of the value you specify. For roll screens, the logical page size equals the screen's bottom margin minus the number of history lines and the screen's top margin.

LINE= The line number on which the system is to do an I/O operation. Code a value from 0 to the number of the last usable line on the page or logical screen. The line count begins at the top margin you defined for the printer or display screen. LINE=0 positions the cursor at the top line of the page or screen you defined; LINE=1 positions the cursor at the second line of the page or screen. For roll screens line 0 equals the screen's top margin plus the number of history lines.

For printers and roll screens, if you code a value less than or equal to the current line number, the system does the I/O operation at the specified line on the next page or logical screen. For static screens, if you code a value within the limits of the logical screen, the system does the I/O operation on the line you specified.

If you code a value greater than the last usable line number, the system divides this value by the logical page size and uses the remainder as the line number on which to do the I/O operation. For example, if you code LINE=22 and your roll screen has a logical page size of 20, the I/O operation occurs on the second line of the logical screen.

The LINE operand causes the system to print or display the contents of the system buffer.

SPACES= The number of spaces to indent before the system does an I/O operation. SPACES=0, the default, positions the cursor at the beginning of the left side of the page or screen. If the value you specify is beyond the limits of the logical screen or page, the system indents the next line by the excess number of spaces.

When you code the LINE or SKIP operands with SPACES, the system begins indenting from the left margin of the page or screen. If you specify SPACES without coding LINE or SKIP, the system begins indenting from the last cursor position on the line.

XLATE= YES (the default), to cause translation of characters from EBCDIC to the code the terminal uses to display the message.

NO, to send the message to the device as is, without translation. If you code XLATE=NO for output to a printer, the printer support suppresses the left margin. This option might be used, for example, to send graphic control characters and data.

With a 31xx in block mode, XLATE=NO also prevents the system from inserting the attribute byte and escape sequences into the message and overrides the effects of TERMCTRL SET,STREAM=YES.

Note: For a description of 31xx escape sequences, refer to the appropriate display terminal description manual.

If the terminal requires that characters be sent in mirror image and you code XLATE=NO, it is your responsibility to provide the proper bit representation. For more details on mirror image, refer to the *Communications Guide*.

MODE= LINE, to prevent the system from interpreting each @ character it finds in the text as a request for a new line.

For 4978, 4979, and 4980 screens accessed in STATIC mode, the coding of MODE=LINE and the SPACES operand causes protected fields to be skipped over as the data is transferred to the screen ("scatter write" operation). Protected positions do not contribute to the count. For a 31xx in block mode with a static screen, the protected fields are overwritten.

Do not code this operand if you want the system to recognize @ as a new line character.

PROTECT=

YES, to write protected characters to a static screen device that supports this feature, such as an IBM 4978, 4979, 4980 and 31xx in block mode. Protected characters are displayed and cannot be typed over.

NO (the default), not to write protected characters to a static screen.

When the PRINTEXT instruction is being coded for a Series/1-to-Series/1 operation, it is recommended that this operand be coded PROTECT=YES.

CAPS= Code this operand to convert a PRINTEXT message to uppercase characters. This operand is valid only for EBCDIC data that is defined by a TEXT or BUFFER statement.

Code CAPS=Y to convert all data defined by a TEXT or BUFFER statement to uppercase characters. When specifying CAPS=Y, you must link edit your program using the autocall feature of $EDXLINK.

To convert a specific number of bytes to uppercase, code that number with the CAPS operand. Capitalization starts from the first byte of the message text. For example, CAPS=3 capitalizes the first three bytes of data defined by the TEXT or BUFFER statement.

The count you specify should not exceed the length of the TEXT or BUFFER statement that defines the message. If the length is exceeded, the operation is still performed, but data beyond the TEXT or BUFFER statement may be modified.

When you code a value with the CAPS operand, the system does an inclusive OR (IOR) of an X'40' byte to each EBCDIC byte. (See Coding Example 3 at the end of this section). A lowercase "a" (X'81'), for example, is converted to an uppercase "A" (X'C1'). Characters already capitalized remain unchanged. The IOR operation is done before the PRINTEXT instruction executes. The data is converted to uppercase in the application program.

Notes:

1. Only CAPS=Y is valid when you use the P1= operand with this instruction.
2. Coding XLATE=NO and the CAPS operand causes an assembly error.
3. When using the 4975 printer, do not code the CAPS operand if you are using the spacing character and a space modifier to increase the spacing between printed characters. See "4975 Spacing Capabilities" on page 2-311 for details on how to use the spacing character and the space modifier. This note does not refer to the 4975-01A ASCII Printer.

Px= Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Buffer Considerations

When a buffer overflow condition occurs, what happens to accumulated data depends on how the system definition TERMINAL statement or IOCB statement is coded. If the TERMINAL or IOCB statement contains OVFLINE=YES, the system writes the data in the buffer to the terminal and then uses the available buffer space for overflow data.

If the TERMINAL or IOCB statement contains OVFLINE=NO, any data following a buffer overflow condition is lost. Until the system writes the buffer data to the terminal, an imbedded @ will not be recognized following a buffer overflow condition. (For details on the TERMINAL definition statement, refer to the *Installation and System Generation Guide*.)

When using direct I/O or when the keyword XLATE=NO is coded, the output to a terminal is written immediately.

31xx Display Considerations

A 31xx in block mode normally will write an attribute byte before the output data. The attribute byte controls the characteristics of the field that it precedes. One such characteristic, intensity, can be either HIGH or LOW and the field can be either blinking or nonblinking, depending on how the SET,ATTR operand was coded on the TERMCTRL statement in effect. If no attribute byte is desired, such as when writing to an existing formatted screen, code TERMCTRL ATTR=NO before using the PRINTEXT instruction. TERMCTRL ATTR=YES should then be coded to restore the writing of attribute bytes.

When the TERMCTRL statement that is in effect is coded STREAM=NO or is allowed to default to NO by not coding this operand, terminal I/O support provides the attribute byte for you. Terminal I/O also provides escape sequences for you under this condition. For a description of 31xx escape sequences, refer to the appropriate display terminal description manual.

If the last TERMCTRL statement was coded SET,STREAM=YES, then the SET,ATTR operand is not considered. Under this condition, terminal I/O support does not provide any attribute bytes or escape sequences.

With either STREAM=YES or NO, translation of data from EBCDIC will be performed. See the XLATE operand description.

If you are using a 31xx in block mode, the system does not recognize a new-line character (@).

Note: Do not press the SEND key on a 31xx terminal while the system is doing a PRINTEXT operation to that terminal. The SEND key can affect the data being displayed.

4975 Spacing Capabilities

The following information refers to spacing capabilities only on the 4975 printer. It does not refer to such capabilities on the 4975-01A ASCII nor any other model printer.

When using the 4975 printer in draft mode, you can increase the amount of space left between printed characters on a line by inserting special spacing characters into the TEXT or BUFFER statement that defines the PRINTEXT message.

To insert additional space between characters, you must include the spacing character X'27' followed by a space modifier. The space modifier defines the percentage of additional space to be included. It is a hexadecimal value in the form 'Fx', where "x" is a number from 0 to 9. The space modifier 'F0' adds no additional space, 'F1' adds 10 percent additional space, and 'F2' adds 20 percent additional space. 'F9' adds 90 percent additional space and is the maximum value you can specify.

You must insert the spacing character and the space modifier into the TEXT or BUFFER statement at each point where you want additional space. The second coding example at the end of this section shows one way to do this operation.

All printers with the exception of the 4975-01A ASCII Printer treat X'00' as a blank. The 4975-01A ASCII Printer ignores X'00' and treats it as a null character. This may cause a spacing difference if you send X'00' in your PRINTEXT instruction.

Syntax Examples

1) Print the contents of a TEXT statement at label TEXT1.

```
PRINTEXT  TEXT1
```

2) Print the text message within quotes on a new line (the new line character @ is not printed).

```
PRINTEXT  '@START OF PROGRAM'
```

3) Add four to the current cursor position and print the contents of a text statement at label TEXT2.

```
PRINTEXT  TEXT2,SPACES=4
```

4) If not currently at the first line of a page or screen, skip to a new page and then skip two lines and print the contents of a text statement at TEXT3.

```
PRINTEXT  TEXT3,LINE=1,SKIP=2
```

5) Skip one line. If any output is residing in the system buffer or the terminal I/O buffer, the system prints it before doing the SKIP operation.

```
PRINTEXT  SKIP=1
```

6) Write out the contents of the text statement at the label CODES and do not translate the data.

```
PRINTEXT  CODES,XLATE=NO
```

Coding Examples

1) The PRINTEXT instruction at label P1 sends an untranslated message to an ASCII terminal indicating that a program has begun processing. The example then uses a set of PRINTEXT instructions to print the title of a report on the system printer.

```
TERMMSG  EQU      *
         ENQT     ASCIITEM
P1       PRINTEXT UNXLATED,XLATE=NO
         DEQT
*
HEADER   EQU      *
         ENQT     $SYSPRTR          GET EXCLUSIVE ACCESS TO PRINTER

         PRINTEXT COMPANY,LINE=3,SPACES=39
         PRINTEXT 'ANNUAL INVENTORY REPORT',SPACES=40,SKIP=2
         PRINTEXT 'SCHEDULE D',SPACES=46,SKIP=1
*
PROCESS  EQU      *
           •
           •
           •
         DC       X'1F1F'           DEFINE LENGTH/COUNT BYTES
UNXLATED DC       X'53434845'
         DC       X'44554C45'
         DC       X'20442050'
         DC       X'524F4345'
         DC       X'5353494E'
*
         DC       X'47204841'
         DC       X'53204245'
         DC       X'47554E'
*
COMPANY  TEXT     ' SMITH & JONES CORPORATION'
ASCIITEM IOCB     ACCA64
```

The message written to the ASCII terminal would be displayed as:

```
SCHEDULE D PROCESSING HAS BEGUN
```

The sequence of lines issued to the enqueued printer would appear as:

```
                                                    (line 0)
                                                    (line 1)
                                                    (line 2)
          SMITH & JONES CORPORATION                 (line 3)
                                                    (line 4)
           ANNUAL INVENTORY REPORT                  (line 5)
                SCHEDULE D                          (line 6)
                                                    (line 7)
                                                    (line 8)
```

Note that the line numbers at the right are for reference purposes only and are not part of the printed output.

2) This example shows how to print a message using the character spacing capabilities of the 4975 printer. The MOVE instruction at M1 moves the number of bytes in the PRINTEXT message into CNT+1. After index registers moves the first character of the text message into the buffer BUF. The MOVE instruction at label M2 inserts the spacing character (X'27') 0, a DO loop and the space modifier (X'F5') into the buffer. The ADD instructions update the pointers. The loop continues until it moves the entire text message into the buffer. The spacing character and the space modifier are inserted between each character in the message.

After the loop completes, the message in the buffer is printed. The spacing between characters in the printed message has increased by 50 percent.

```
SPACING PROGRAM   START
START   EQU       *
M1      MOVE      CNT+1,MSG-1,(1,BYTE)   FIND NUMBER OF BYTES IN MESSAGE
        MOVE      #1,0                   INITIALIZE #1
        MOVE      #2,0                   INITIALIZE #2
*
* THE FOLLOWING LOOP INSERTS SPACING CHARACTERS INTO THE DATA STREAM
*
        ENQT      $SYSPRTR               ENQUEUE 4975 PRINTER
        DO        0,TIMES,P1=CNT         DO FOR NUMBER OF MESSAGE BYTES
        MOVE      (BUF,#2),(MSG,#1),(1,BYTE)  MOVE THE MESSAGE CHARACTER
M2      MOVE      (BUF+1,#2),FRACT,(2,BYTE)   INSERT SPACING CHARACTER
*                                              AND SPACE MODIFIER
        ADD       #1,1                   INCREMENT POINTERS
        ADD       #2,3                   INCREMENT POINTERS
        ENDDO
        MOVE      CNT,#2                 GET TOTAL NUMBER OF CHARACTERS
*                                        TO PRINT
        MOVE      BUF-1,CNT+1,(1,BYTE)
        PRINTEXT  BUF,SKIP=1             PRINT THE MESSAGE
        DEQT
        PROGSTOP
*
FRACT   DATA      X'27F5'                THE SPACING CHARACTER AND
*                                        SPACE MODIFIER
MSG     TEXT      'THIS IS A TEST MESSAGE'
BUF     TEXT      LENGTH=230
        ENDPROG
        END
```

The message, after the spacing operation, appears as follows:

```
T H I S   I S   A   T E S T   M E S S A G E
```

If no additional spacing is added, the message appears as follows:

```
THIS IS A TEST MESSAGE
```

3) When you code a value with the CAPS operand, the system generates an IOR instruction to capitalize the specified data. The example below shows the use of the CAPS operand and how you can achieve the same results by coding an IOR instruction directly in your application program.

With the CAPS operand

```
            .
            .
            .
          PRINTEXT  A,CAPS=5
            .
            .
            .
A         TEXT      LENGTH=5
```

Without the CAPS operand

```
            .
            .
            .
          IOR       A,X'40',(5,BYTES)
          PRINTEXT  A
            .
            .
            .
A         TEXT      LENGTH=5
```

4) The following example shows how you can use the PRINTEXT instruction to highlight characters in printed output.

```
SAMPLE   PROGRAM   START
START    EQU       *
         ENQT      $SYSPRTR
         PRINTEXT 'AN EXAMPLE OF',MODE=LINE
         PRINTEXT  'HIGHLIGHTING OF CHARACTERS',MODE=LINE
         TERMCTRL  DISPLAY
         PRINTEXT  'HIGHLIGHTING OF CHARACTERS',MODE=LINE,
               SPACES=27
         TERMCTRL  DISPLAY
         PRINTEXT  'ON THE PRINTER',MODE=LINE,SPACES=54
         PROGSTOP
         ENDPROG
         END
```

The highlighted characters appear in bold in the sample below:

AN EXAMPLE OF **HIGHLIGHTING OF CHARACTERS** ON THE PRINTER

Request Special Terminal Function (4975-01A)

To request special terminal control function on the 4975-01A ASCII Printer, you must issue a data stream. A data stream provides terminal control capabilities for the 4975-01A ASCII Printer similar to those provided by the TERMCTRL statement. Unlike the TERMCTRL statement, however, a data stream requires terminal control statements called code extension sequences. These sequences of hexadecimal control characters provide print control instructions that the printer interprets to print the text.

This section contains some of the basic sequences required in a data stream on the 4975-01A ASCII Printer. For more information on code extension sequences used with the 4975-01A ASCII Printer, refer to the *IBM 4975 Printer Model 01A (7 Bit Code) Description*, GA34-1595.

Do not confuse the 4975-01A ASCII Printer with other 4975 printers. The 4975-01A ASCII Printer uses the International Standards Organization Standard 7-Bit Coded Character Set for Information Processing Interchange (ISO-7). Other 4975 printers do not use this character set, and they use TERMCTRL statements, not data streams. See "4975 Printer" on page 2-498 for information about TERMCTRL statements for other 4975 model printers.

Although most existing programs will generate output on the 4975-01A ASCII Printer, this printer ignores TERMCTRL statements.

Code Extension Sequences

Code extension sequences tell the 4975-01A ASCII Printer how to interpret data that will follow. Among the sequences your printer interprets is one that indicates the type of unit spacing. It is called the Positioning Unit Mode (PUM) sequence. Two choices are available for unit spacing: lines-and-characters PUM and decipoint PUM. The first produces lines and characters per inch; the second allows you to space units of text precisely within a fraction of an inch called a decipoint. (A decipoint is one tenth of a point, a point is 1/12 of a pica, and a pica is 1/6 of an inch.) There are 720 decipoints in one inch.

Setting Lines-and-Characters Positioning Unit Mode (PUM)

The 4975-01A ASCII Printer prints text in lines-and-characters PUM when you code the hexadecimal characters 1B5B31316C in your data stream before you indicate the actual lines and characters spacing increments. The printer interprets these characters as follows:

Hex	Byte	Field
1B	0	Control Sequence Introducer
5B	1	Control Sequence Introducer
31	2	Numeric Parameter for PUM
31	3	Numeric Parameter for PUM
6C	4	Final Character

However, since lines and characters per inch is the system default, you do not need to include this PUM code unless decipoint PUM was requested previously and you want to *reset* spacing on the 4975-01A Printer to lines and characters PUM.

Set Spacing Increment (SPI)

In order to set spacing increments in lines and characters or decipoints on the 4975-01A ASCII Printer, include SPI code in the data stream after the PUM code. The SPI code used for indicating lines and characters or decipoints is 1B5Bnp3Bnp2047, where the "np" means numeric parameter. The first numeric parameter indicates vertical spacing or lines per inch; the second indicates horizontal positioning or characters per inch.

Numeric parameters in a data stream are simply code equivalents for decipoint spacing values. Numeric parameter values for *each digit* of a decipoint value range from 30 to 39 for 0 to 9 respectively. For example, the np value 35 equals 5 decipoints, and the np value 313230 equals 120 decipoints. Decipoint values allowed in a data stream range from 1 to 120; np coded equivalents range from 31 to 313230.

When you specify lines and characters per inch, you may find it easier to think of decipoint values in terms of points.

The following table illustrates the relationship among the np values, decipoint values, points, and inch equivalents.

np	Decipoint Value	Points	Inch Equivalent
313230	120	12	6 lines per inch
3930	90	9	8 lines per inch
3732	72	7.2	10 characters per inch
3438	48	4.8	15 characters per inch

A 12-point vertical type spacing results in 6 lines per inch. A request for 9-point vertical type spacing allows 8 lines per inch. Horizontal spacing of 7.2 points results in 10 characters per inch. 4.8 points allows more characters per inch, 15. These are the only options available on the 4975-01A ASCII Printer in lines and characters PUM. The default number of lines per inch is 6. The default number of characters per inch is 10.

If you want to use any of these parameters, code the following in hexadecimal ("cpi" means characters per inch; "lpi" means lines per inch):

Coded SPI Parameter	Inch Equivalent
1B5B39303B34382047	8 lpi, 15 cpi
1B5B3B34382047	6 lpi, 15 cpi
1B5B39303B2047	8 lpi, 10 cpi
1B5B3B2047	6 lpi, 10 cpi
1B5B3132303B37322047	6 lpi, 10 cpi

The hexadecimal code has the following meanings:

Hex	Byte	Field
1B	0	Control Sequence Introducer
5B	1	Control Sequence Introducer
30 – 39	+n	Numeric Parameter (vertical)
3B	+1	Separator
30 – 39	+n	Numeric Parameter (horizontal)
20	+1	Intermediate Character
47	+1	Final Character

The +n represents the np value and can be 1 to 3 bytes.

Setting Decipoint Positioning Unit Mode (PUM)

If you want to space text more precisely than lines and characters PUM will allow, you can use the decipoint PUM parameters. The 4975-01A ASCII Printer prints text in decipoint PUM when you code the hexadecimal characters 1B5B313168 in your data stream before you code specific decipoint horizontal and vertical spacing numeric parameters (np). The SPI code that follows this PUM code allows data to be positioned in any increment of decipoints.

The printer interprets these characters as follows (see "Set Spacing Increment (SPI)" on page 2-317 for how to code SPI):

Hex	Byte	Field
1B	0	Control Sequence Introducer
5B	1	Control Sequence Introducer
31	2	Numeric Parameter for PUM
31	3	Numeric Parameter for PUM
68	4	Final Character

The following table illustrates the relationship between the np values and the decipoint values.

np	Decipoint Value
313230	120
313130	110
3930	90
3830	80
3730	70
3330	30

Resetting to Initial State (RIS)

To reset the printer to its initial state, code the hexadecimal characters 1B63. The initial state is the printer's state when it was switched on. This code sequence can replace coding for printer defaults. The printer interprets these characters as follows:

Hex	Byte	Field
1B	0	Escape Character
63	1	Final Character

Data Stream Example

The following program example demonstrates how to change print density on the 4975-01A ASCII Printer.

Once enqueued, the printer prints text in lines and characters per inch PUM, the default positioning unit mode. Lines and characters will automatically print with a density of 6 lines and 10 characters per inch. The ASCII printer retains any print density information you specify until you request new values by numeric parameter specification or the RIS sequence.

The XLATE= NO operand used in this example sends the message to the device without translation. Results of the program follow the example.

```
PGM      PROGRAM     START
*
START    EQU         *
*
         ENQT         ASCIPRNT      ENQT ON THE PRINTER
         PRINTEXT    'THIS IS 6 LINES/INCH, 10 CHARACTERS/INCH (DEFAULT)'
         PRINTEXT     SKIP=1
         PRINTEXT    'THIS IS 6 LINES/INCH, 10 CHARACTERS/INCH (DEFAULT)'
*
         PRINTEXT    -P815,XLATE=NO  CHANGE PRINT DENSITY TO 8 LPI 15 CPI
*
         PRINTEXT    'THIS IS 8 LINES/INCH, 15 CHARACTERS/INCH',SKIP=1
         PRINTEXT    'THIS IS 8 LINES/INCH, 15 CHARACTERS/INCH',SKIP=1
*
         PRINTEXT    P615,XLATE=NO  CHANGE PRINT DENSITY TO 8 LPI 15 CPI
         PRINTEXT    'THIS IS 6 LINES/INCH, 15 CHARACTERS/INCH',SKIP=1
         PRINTEXT    'THIS IS 6 LINES/INCH, 15 CHARACTERS/INCH',SKIP=1
*
         DEQT                      DEQT THE PRINTER
         PROGSTOP
*
ASCIPRNT    IOCB     $SYSPRT2      IOCB FOR THE 4975-01A
*
            DC       X'0909'       DATA TO DEFINE TEXT STRING LENGTH
P815        DC       X'1B5B'       BEGINNING SEQUENCE
            DC       X'3930'       SPECIFIES 8 LPI
            DC       X'3B'         SEPARATOR
            DC       X'3438'       SPECIFIES 15 CPI
            DC       X'2047'       ENDING SEQUENCE
*
            ALIGN    WORD          ALIGN DATA STREAM
*
            DC       X'0707'       DATA TO DEFINE TEXT STRING LENGTH
*
P615        DC       X'1B5B'       BEGINNING SEQUENCE
*                                  NO PARAMETER, MEANS 6 LPI (DEFAULT)
            DC       X'3B'         SEPARATOR
            DC       X'3438'       SPECIFIES 15 CPI
            DC       X'2047'       ENDING SEQUENCE
*
         ENDPROG
         END
```

The program produces the following output:

```
THIS IS 6 LINES/INCH, 10 CHARACTERS/INCH (DEFAULT)
THIS IS 6 LINES/INCH, 10 CHARACTERS/INCH (DEFAULT)
THIS IS 8 LINES/INCH, 15 CHARACTERS/INCH
THIS IS 8 LINES/INCH, 15 CHARACTERS/INCH
THIS IS 6 LINES/INCH, 15 CHARACTERS/INCH
THIS IS 6 LINES/INCH, 15 CHARACTERS/INCH
```

Terminal I/O Return Codes

The terminal I/O return codes are listed here as well as following the READTEXT instruction. A complete list of all return codes can also be found in *Messages and Codes*. You must select the group of codes that represents the particular device type you are using. The terminal I/O return code groups are:

- General Terminal I/O
- Virtual Terminal
- ACCA/Serial Printer Devices
- Interprocessor Communication
- General Purpose Interface Bus
- Series/1-to-Series/1 Adapter.

If you combine message output and forms movement (SKIP= or LINE=) on the same statement, the system processes this as two distinct I/O requests. The forms movement, which is processed first, causes actual output to the device. If an I/O error occurs, the system places a return code in the first word of the TCB.

The message output causes the transfer of datd to a system buffer, but causes no actual I/O. However, this transfer also causes a return code (usually −1) to be placed in the first word of the TCB.

If your application checks the return code after a combined PRINTEXT, it may be missing an I/O error. To prevent this from happening, specify TERMERR= on the PROGRAM statement, or separate forms movement and message output into two PRINTEXT instructions and check the return code after each one.

General Terminal I/O Return Codes

The return codes are returned in the first word of the task control block of the program issuing the instruction.

Return Code	Condition
−1	Successful completion.
1	Device not attached.
2	System error (busy condition).
3	System error (busy after reset).
4	System error (command reject).
5	Device not ready.
6	Interface data check.
7	Overrun received.
8	Printer power has been switched off and switched back on or a power failure has occurred.
9	Printer I/O error retry count exhausted. IOS3101 has detected an invalid data stream from the 3101/316x and 3151 terminals.
> 10	A code greater than 10 can indicate multiple errors. To determine the errors, subtract 10 from the code and convert the result to an 8-bit binary value. Each bit (numbering from the left) represents an error as follows: **Bit 0** Unused **Bit 1** System error (command reject) **Bit 2** Not used **Bit 3** System error (DCB specification check) **Bit 4** Storage data check **Bit 5** Invalid storage address **Bit 6** Storage protection check **Bit 7** Interface data check.

Notes:

1. If the return code is for devices supported by IOS2741 (2741, PROC) and a code greater than 128 is returned, subtract 128; the result then contains status word 1 of the ACCA. Refer to the *IBM Series/1 Asynchronous Communications Feature Description*, GA34-0243 to determine this error condition.
2. If your program receives a return code of 5 while attempting to perform a PRINTEXT operation on a 4975 printer, the program should retry the operation a maximum of three times.

Virtual Terminal Return Codes

The return codes are returned in the first word of the task control block of the program issuing the instruction.

Return Code	Transmit Condition	Receive Condition
X'8F'	Not applicable.	LINE=nn received.
X'8E'	Not applicable.	SKIP=nn received.
−2	Not applicable.	Line received (no CR).
−1	Successful completion.	New line received.
1	Not attached.	Not attached.
5	Disconnect.	Disconnect.
8	Break.	Break.

A further description of each of the virtual terminal return codes follows:

LINE=nn (X'8Fnn')
Returned for a READTEXT or GETVALUE instruction if the other program issued an instruction with a LINE= operand. This operand tells the system to perform an I/O operation on a certain line of the page or screen. The return code allows the receiving program to reproduce on an actual terminal the output format intended by the sending program.

SKIP=nn (X'8Enn')
The other program issued an instruction with a SKIP= operand. This operand tells the system to skip several lines before performing an I/O operation.

Line Received (−2)
Indicates that an instruction (usually READTEXT or GETVALUE) has sent information but has not issued a carriage return to move the cursor to the next line. The information is usually a prompt message.

New Line Received (−1)
Indicates transmission of a carriage return at the end of the data. The cursor is moved to a new line. This return code and the Line Received return code help programs to preserve the original format of the data they are transmitting.

Not attached (1)
A virtual terminal does not or cannot refer to another virtual terminal.

Disconnect (5)
The other virtual terminal program ended because of a PROGSTOP or an operator command.

Break (8)
Indicates that both virtual terminal programs are attempting to perform the same type of operation. When one program is reading (READTEXT or GETVALUE), the return code means the other program has stopped sending and is waiting for input. When one program is writing (PRINTEXT or PRINTNUM), the return code means the other program is also attempting to write.

If you defined only one virtual terminal with SYNC=YES, then that task always receives the break code. If you defined both virtual terminals with SYNC=YES, then the task that last attempted the operation receives the break code.

ACCA/Serial Printer Return Codes

The return codes are returned in the first word of the task control block of the program issuing the instruction.

Return Code	Condition
−1	Successful completion.
80	Attachment detected that Data Set Ready is down for an asynchronous printer.
96	4224 printer is not responding (MODE=VERIFY).

Bits	Value	Description
1−8	ISB	In the case of I/O completion error or when an error is reported as an attention interrupt, refer to the hardware description manual for status on the device you are using.
9	On	Interpret return code as a word value.
10	On	Error reported as an attention interrupt.
11	On	I/O error on write operation.
12	On	I/O error on read operation.
10−12	Off	All 3 bits off: immediate I/O error.
13−15		Immediate I/O condition code +1.

Interprocessor Communication Return Codes

The return codes are returned in the first word of the task control block of the program issuing the instruction.

CODTYPE=	Return Code	Condition
EBCDIC	FDFF	End of transmission (EOT).
EBCDIC	FEFF	End of record (NL).
EBCDIC	FCFF	End of subrecord (EOSR).
EBCD/CRSP	1F	End of transmission (EOT).
EBCD/CRSP	5B	End of record (NL).
EBCD/CRSP	(None)	End of subrecord (EOSR).

General Purpose Interface Bus Return Codes

The return codes are returned in the first word of the task control block of the program issuing the instruction.

Return Code	Condition
−1	Successful completion.
1	Device not attached.
2	Busy condition.
3	Busy after reset.
4	Command reject.
6	Interface data check.
256 +	ISB: Read exception.
512 +	ISB: Write exception.
1024	Attention received during an operation (may be combined with an exception condition).

Series/1-To-Series/1 Return Codes

The return codes are returned in the first word of the task control block of the program issuing the instruction.

Return Code	Condition
−1	Successful.
1	Device not attached.
2	System error (busy condition).
3	System error (busy after reset).
4	System (command reject).
5	Device not ready (not reported for S/1-S/1).
6	Interface data check.
7	Overrun recieved (not reported for S/1-S/1).
138, 154	An error has occurred that can only be determined by displaying the device cycle steal status word with the TERMCTRL STATUS function and checking the bits to determine the cause of the error.
1002	Other system not active.
1004	Checksum error detected.
1006	Invalid operation code or sequence.
1008	Time-out on data transfer.
1010	TERMCTRL ABORT issued by responding processor.
1012	Device reset (TERMCTRL RESET) issued by the other processor.
1014	Microcode load to attachement failed during IPL.
1016	Invalid or unsolicited interrupt occurred.
1050	TERMCTRL ABORT issued and no operation pending.
1052	TERMCTRL IPL attempted by slave processor.
1054	Invalid data length.

PRINTIME – Display the Time on a Terminal

The PRINTIME instruction prints the time of day on the currently enqueued terminal. The system prints the time in the form HH:MM:SS (hours, minutes, seconds), according to a 24-hour clock. You set the 24-hour clock with the $T command.

Note: To use the PRINTIME instruction, you must have installed timer hardware and included timer support in the system during system generation. A program check will occur if you try to use this instruction without the proper hardware or software support.

The supervisor places a return code in the first word of the task control block (taskname) whenever a PRINTIME instruction causes a terminal I/O operation to occur. If the return code is not a −1, the address of this instruction will be placed in the second word of the task control block (taskname+2). The terminal I/O return codes are described at the end of the PRINTEXT and READTEXT instructions in this manual and also in *Messages and Codes.*

Note: Any references to **31xx** terminals means 3101, 3151, 3161, 3163, and 3164 terminals, unless otherwise noted.

Syntax:

label	**PRINTIME**
Required:	**none**
Defaults:	**none**
Indexable:	**none**

Operand	*Description*
none	none

31xx Display Considerations

If you use a 31xx in block mode, the current TERMCTRL command in effect will control the output. For details on the TERMCTRL SET,ATTR and SET,STREAM operands, see the discussion under "TERMCTRL – Request Special Terminal Function" on page 2-426.

Coding Example

The following coding example prints a message on the system printer, followed by the current time of day.

```
 •
 •
 •
ENQT     $SYSPRTR
PRINTEXT '@ THE TIME IS '
PRINTIME
DEQT
 •
 •
 •
```

If, for example, the PRINTIME instruction executes at 10 minutes and 13 seconds past 2 o'clock in the afternoon, the instruction prints the following message on the system printer:

```
THE TIME IS  14:10:13
```

PRINTNUM — Display a Number on a Terminal

The PRINTNUM instruction displays or prints a floating-point value or one or more integer values on a terminal in the format that you specify. The output can appear in decimal or hexadecimal form.

If the PRINTNUM output is too large for the system buffer, the system first fills the buffer, prints that data, and then stores the excess data in the buffer area. The next I/O operation forces the exeess data to be printed or displayed before any other output.

The supervisor places a return code in the first word of the task control block (taskname) whenever a PRINTNUM instruction causes a terminal I/O operation to occur. If the return code is not a −1, the address of this instruction will be placed in the second word of the task control block (taskname+2). However, if an I/O error occurs during this instruction, terminal I/O will not pass control to any terminal error routine. The terminal I/O return codes are described at the end of the PRINTEXT and READTEXT instructions in this manual and also in *Messages and Codes*.

Note: Any references to **31xx** terminals means 3101, 3151, 3161, 3163, and 3164 terminals, unless otherwise noted.

Syntax:

label	**PRINTNUM loc,count,nline,nspace,MODE=,FORMAT=,** **TYPE=,SKIP=,LINE=,SPACES=,PROTECT=,** **P1=,P2=,P3=,P4=**
Required:	**loc**
Defaults:	**count=1,nspace=1,MODE=DEC,PROTECT=NO,** **FORMAT=(6,0,I),TYPE=S,** **SKIP=0,LINE=current line,SPACES=0** **If nline is not specified, then it is** **determined by the terminal margin settings.**
Indexable:	**loc,SKIP,LINE,SPACES**

Operand	*Description*
loc	The label of the first value to be printed or displayed. Successive values are taken from successive words or doublewords.
count	The number of values to be printed or displayed. You can substitute a precision for the count, in which case the count defaults to 1. The valid precisions are WORD (the default) and DWORD (doubleword). You can also express the count in the form: (count,precision).
nline	The number of values to be printed or displayed on each line.
nspace	The number of spaces left between values. Code the nline operand before coding this operand.

MODE= HEX, for hexadecimal output.

DEC, the default, for decimal output.

FORMAT= The format of the value to be printed or displayed. If you code this operand, the system ignores the count, nline, nspace, and MODE= operands.

The format is FORMAT=(w,d,f) where:

w An integer value equal to the width of the data field to be printed or displayed. If the data contains a decimal point or sign character (+ or −), include it in the count.

d The number of digits to the right of the decimal point. For the integer format, this value must be 0; for the floating-point F format, it must be less than or equal to w−2, and for the floating-point E format, less than or equal to w−6.

f Format of the output data. Code I for integer data, F for floating-point data (XXXX.XXX), or E for floating-point data in E notation. See the value operand under the DATA/DC statement for a description of E notation format.

Note: You can use the floating-point format for data even if you do not have floating-point hardware installed in your system. Floating-point hardware is required, however, to do floating-point arithmetic.

The first FORMAT operand to execute generates a work area which all subsequent FORMAT operands also use. The generated work area is nonreentrant in a multitasking environment, and all tasks must use the ENQ and DEQ instructions to acquire serial access to it.

TYPE= The type of variable that contains the data you want to print or display. Code this operand only when you code the FORMAT operand.

S Single-precision integer (1 word)
D Double-precision integer (2 words)
F Single-precision floating-point (2 words)
L Extended-precision floating-point (4 words).

SKIP= The number of lines to be skipped before the system does an I/O operation. For example, if your cursor is at line 2 on a display screen and you code SKIP=6, the system does the I/O operation on line 8. For a printer, the SKIP operand controls the movement of forms.

The SKIP operand causes the system to display or print the contents of the system buffer.

If you specify a value greater than or equal to the logical page size, the system divides this value by the page size and uses the remainder in place of the value you specify. For roll screens, the logical page size equals the screen's bottom margin minus the number of history lines and the screen's top margin.

LINE= The line number on which the system is to do an I/O operation. Code a value from 0 to the number of the last usable line on the page or logical screen. The line count begins at the top margin you defined for the printer or display screen. LINE=0 positions the cursor at the top line of the page or screen you defined; LINE=1 positions the cursor at the second line of the page or screen. For roll screens, line 0 equals the screen's top margin plus the number of history lines.

For printers and roll screens, if you code a value less than or equal to the current line number, the system does the I/O operation at the specified line on the next page or logical screen. For static screens, if you code a value within the limits of the logical screen, the system does the I/O operation on the line you specified.

If you code a value greater than the last usable line number, the system divides this value by the logical page size and uses the remainder as the line number on which to do the I/O operation. For example, if you code LINE=22 and your roll screen has a logical page size of 20, the I/O operation occurs on the second line of the logical screen.

The LINE operand causes the system to print or display the contents of the system buffer.

SPACES= The number of spaces to indent before the system does an I/O operation. SPACES=0, the default, positions the cursor at the beginning of the left side of the page or screen. If the value you specify is beyond the limits of the logical screen or page, the system indents the next line by the excess number of spaces.

When you code the LINE or SKIP operands with SPACES, the system begins indenting from the left margin of the page or screen. If you specify SPACES without coding LINE or SKIP, the system begins indenting from the last cursor position on the line.

PROTECT=

Code PROTECT=YES to write protected characters to a device for which this feature is supported.

Px= Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

31xx Display Considerations

If you use a 31xx in block mode, the most recent TERMCTRL command will control the output. For details about TERMCTRL SET,ATTR and SET,STREAM operands, see "TERMCTRL – Request Special Terminal Function" on page 2-426.

Syntax Examples

1) Print the first value in A in integer format.

```
PRINTNUM  A
```

2) Print the first 10 values in BUF1 in integer format.

```
PRINTNUM  BUF1,10
```

3) Print the first value in AX in hexadecimal form.

```
PRINTNUM  AX,MODE=HEX
```

4) Print the first 10 values in BUF2, put five values on each line, and print three spaces between each value.

```
PRINTNUM  BUF2,10,5,3
```

5) Print the first 10 doublewords of BZ in hexadecimal form.

```
PRINTNUM  BZ,(10,DWORD),MODE=HEX
```

6) Print 8 numbers, four in a line, with 5 spaces between the numbers.

```
PRINTNUM  NUMBERS,8,4,5
```

Coding Example

The following example uses the PRINTNUM instruction to display a floating-point value and an integer value on a terminal. The system displays the values on the terminal you use to load the program.

The program first asks you to enter a floating-point number. The GETVALUE instruction places the number you enter in FLCOUNT. At label LOOP1, the program begins a loop that adds the floating-point number in FLCOUNT to the contents of FLSUM ten times. The second GETVALUE instruction asks you to enter an integer. It places the value you enter in INTCOUNT. The DO loop at label LOOP2 adds the integer value in INTCOUNT to the contents of INTSUM ten times.

The PRINTNUM instruction at PRINT1 displays the contents of FLSUM in floating-point format. The PRINTNUM instruction at PRINT2 displays the contents of INTSUM in integer format.

```
PROG1    PROGRAM  START,FLOAT=YES
START    EQU      *
         GETVALUE FLCOUNT,'ENTER FLOATING POINT NUMBER: '          X
               TYPE=F,FORMAT=(4,3,F)
LOOP1    DO       10,TIMES
           FADD     FLSUM,FLCOUNT
         ENDDO
         GETVALUE INTCOUNT,'ENTER INTEGER NUMBER: '
LOOP2    DO       10,TIMES
           ADD      INTSUM,INTCOUNT
         ENDDO
         PRINTEXT '@FLOATING POINT RESULT= '
PRINT1   PRINTNUM FLSUM,FORMAT=(5,2,F),TYPE=F
         PRINTEXT '@INTEGER RESULT= '
PRINT2   PRINTNUM INTSUM
         PROGSTOP
INTCOUNT DATA     F'0'
FLCOUNT  DATA     E'0.000'
FLSUM    DATA     E'00.00'
INTSUM   DATA     F'0'
         ENDPROG
         END
```

PROGRAM – Define Your Program

The PROGRAM statement defines the primary task of your program and the resources your program uses. PROGRAM is the first statement you code in every application program assembled using $EDXASM or $S1ASM.

You can only omit the PROGRAM statement when you are compiling a subprogram under $EDXASM. (See the MAIN operand for a definition of a subprogram.) When program assembly is to be done by the Host or Series/1 macro assemblers, you must code a PROGRAM statement even for subprograms.

Syntax:

```
taskname    PROGRAM start,priority,EVENT=,
                    DS=(dsname1,...,dsname9),PARM=n,
                    PGMS=(pgmname1,...,pgmname9),TERMERR=,
                    FLOAT=,MAIN=,ERRXIT=,STORAGE=

Required:   taskname,start (except when MAIN=NO)
Defaults:   priority=150,PARM=0,FLOAT=NO,MAIN=YES,
                    STORAGE=0
Indexable:  none
```

Operand	*Description*
taskname	The label you assign to the primary task of the program. The system generates a control block for each task in the program. This control block is known as a task control block (TCB). The system generates the TCB when it encounters an ENDPROG statement. The label of the primary task's TCB is the label you specify with this operand. The supervisor uses the TCB to store instruction return codes. By referring to the TCB (the taskname) in your program, you can determine if an operation completed successfully.
start	The label of the first instruction to be executed in your program. The instruction must be on a fullword boundary.
priority	The priority of the program's primary task. The system uses priorities to establish the order in which it executes tasks. Tasks with high priorities are executed before tasks with low priorities. The range is from 1 (highest priority) to 510 (lowest priority). Priorities 1 – 255 imply foreground operation and are executed on hardware interrupt level 2. Priorities 256 – 510 imply background operation and are executed on interrupt level 3.
EVENT=	The label of the event to be posted when the system detaches the primary task. Use this operand only if another task will issue a WAIT for this event. Do not code an event control block (ECB) with this label because the system generates the ECB for you. An error message appears at the end of the program compiler listing if this event is defined more than once.

DS= Names of 1–9 disk, diskette, or tape data sets to be used by this program. Each name is composed of 1–8 alphanumeric characters, the first of which must be alphabetic. Only one tape data set for each tape volume can be specified.

If your program retrieves formatted messages from a disk or diskette data set, you must specify the data set name with this operand. The COMP statement in your program provides the location of the message by referring to the data set list on the PROGRAM statement.

The system automatically generates one data set control block (DSCB) in the program header for each data set you specify on the DS operand of the PROGRAM statement. The system gives each DSCB the name DSx, where x is the position of a data set in the list of data sets you code on this operand. The DSCB named DS1, for example, corresponds to the first data set in the DS= list. You can refer to fields within a DSCB with the expression DSx+name, where "name" is a label defined in the DSCB equate table, DSCBEQU. You must include the following statement in your source program when you refer to DSCB fields:

```
COPY   DSCBEQU
```

If the special characters ## are found in a program header in place of a volume name, the name of the volume from where the main program was loaded is substituted for the ## characters. This allows data sets specified in the program header to reside on the same volume as the main program.

All tape data sets are of the form (DSN,VOLUME). The specification of tape data sets is dependent on the type of label processing being done.

For standard label (SL) processing the DSN is the data set name as it is specified in the HDR1 label. VOLUME is the volume serial as it is specified in the VOL1 label.

When doing no label (NL) processing or bypass label processing (BLP) the volume must be specified as the 1–6 digits that represent the tape unit ID. The tape unit ID was assigned at system generation time. The DSN is ignored during NL or BLP processing, but it must be supplied for syntax checking purposes. It also provides identification of the data set for things such as error logging.

If more than one disk or diskette logical volume is being used, a volume label must be specified if the data set resides on other than the IPL volume. The data set name and volume are separated by a comma and enclosed in parentheses. In addition, the entire list of data set/volume names is enclosed in a second set of parentheses. For example:

```
...,DS=((MYDS,MYVOL))
```

refers to the data set MYDS on volume MYVOL.

In the following example:

```
...,DS=((ACTPAY,EDX001),(DSDATA2,EDX003))
```

DS= refers to the data set ACTPAY on volume EDX001 and to DSDATA2 on volume EDX003.

If you do not specify a volume, the default is the IPL volume. When one data set is used and it is in the IPL volume, no parentheses are required. For example:

```
...,DS=CUSTFIL
```

When more than one data set is used and they reside in the IPL volume, the data set names are separated by commas and enclosed in parentheses. For example:

```
...,DS=(CUSTFIL,VENDFIL)
```

Four special data set names are recognized: ??, $$EDXLIB, and $$ or $$EDXVOL. A data set control block (DSCB) is created just as for any other data set name. However, special processing occurs when the program is loaded for execution.

If the sequence "??" is used as a data set name, the final data set name and volume specification is done at program load time. If the program is loaded by another program, this information must be contained in the DS operand of the LOAD instruction. If the program is loaded using the system command "$L", the system will query the operator for these names. If the specified sequence is of the form,

```
...DS=((string,??)):
```

where "string" is 1 – 8 alphanumeric characters, you will receive the following prompt message:

```
string(NAME,VOLUME)
```

If the specified sequence is of the form,

```
...DS=??
```

you will receive the prompt message,

```
DSn(NAME,VOLUME):
```

where "n" is a digit from 1 to 9.

If $$EDXLIB or $$ is used as a data set name with disks, the entire volume is opened for processing as if it were a single data set. The library directory and any data sets on the volume are accessible. Symbol $$ also can be used to reserve a DSCB in the program header so that it can be filled in and opened (using DSOPEN) after execution begins.

With diskettes, $$EDXVOL only references records on cylinder 0. If a single-density diskette is used, $$EDXVOL references records 1 to 26. With a double-density diskette, $$EDXVOL references records 1 to 39. Symbol $$ and $$EDXLIB reference diskette records beginning with cylinder 1.

Note: $$EDXLIB or $$EDXVOL can be used as data set names when using multivolume diskettes if you refer to a specific volume on the diskette and do not refer to the volume label (VOL1).

PARM= A word count specifying the length of a parameter list to be passed to this program at load time. Each word in the list can be referred to by the name $PARMx, where "x" is the position or number of the word in the list beginning with 1. The maximum length of this list is 742 words less 33 for each data set name you specified in the DS operand and each overlay program name you specified in the PGMS operand.

This operand is valid for programs to be loaded by a LOAD instruction. The list address is specified as an operand of that instruction. The list would be filled in by the loading program and there are no restrictions on its contents. If a program is loaded using $L and it has a PARM specification, the parameters will be initialized to 0.

PGMS= The names of 1 – 9 programs that can be loaded as overlay programs during the execution of this program. Programs are specified by name only if they reside on the IPL volume or by (name,volume) if they reside elsewhere. The same coding rules that apply to the DS operand apply to this operand.

The system reserves space within this program for the largest of the overlay programs identified in this list, thus ensuring that space will be available for the overlays when the program is executed.

You load program overlays with the LOAD instruction. Only one overlay program can execute at a time because each uses the same storage area. See the description of the LOAD instruction for additional information.

Note: You can code this operand only in a main program and not on the PROGRAM statement of an overlay program. In addition, you cannot code this operand for tape data sets.

The system automatically generates one DSCB in the program header for each overlay program you specify on the PGMS operand of the PROGRAM statement. The system gives each DSCB the name PGMx, where "x" is the position of an overlay in the list of overlay programs you code on this operand. The DSCB named PGM1, for example, corresponds to the first data set in the PGMS= list. You can refer to fields within a DSCB with the expression PGMx+name, where "name" is a label defined in the DSCB equate table, DSCBEQU. You must include the following statement in your source program when you refer to DSCB fields:

```
COPY   DSCBEQU
```

If the special characters ## are found in a program header in place of a volume name, the name of the volume from where the main program was loaded is substituted for the ## characters. This allows overlays specified in the program header to reside on the same volume as the main program.

TERMERR =

The label of the routine to receive control if an unrecoverable terminal I/O error occurs.

If such an error occurs, the first word of the task control block (TCB) contains the return code indicating the error. The second word of the TCB contains the address of the instruction that was executing when the error occurred.

If TERMERR is not coded, the return code is available in the task code word. Use of TERMERR, however, is the recommended method for detecting errors because the task code word is subject to modification by numerous system functions. It may not, therefore, always reflect the true status of terminal I/O operations.

FLOAT = YES, if the primary task uses floating-point instructions.

NO (the default), if the primary task does not use floating-point instructions.

MAIN = YES, if this program contains the primary task.

NO, if this program does not contain the primary task. For example, code MAIN = NO if this program is a subroutine or any other section of a program that is being prepared separately and will later be link-edited to a main program. Such a program is called a subprogram. When a subprogram is to be assembled by $EDXASM, the PROGRAM statement can be omitted entirely.

MAIN = NO suppresses the generation of the program header and the task control block, thereby reducing the storage size of the subprogram. If MAIN = NO is specified, then none of the other operands of the PROGRAM statement are meaningful.

You link-edit program modules with the $EDXLINK utility. For information on the $EDXLINK utility, refer to the *Operator Commands and Utilities Reference*

Note: Subprograms must not contain TASK, ENDTASK, IODEF, or ATTNLIST statements.

ERRXIT = The label of a 3-word area that points to a routine that is to receive control if a hardware error or program exception occurs while the primary task is executing. This task error exit routine must be prepared to completely handle any type of program or machine error. Refer to the *Language Programming Guide* for additional information on the use of task error exit routines.

If the primary task is part of a program that shares resources such as QCBs, ECBs, or Indexed Access Method update records with other programs, it is often necessary to release these resources even though your program cannot continue because of an error. The supervisor does not release resources for you, but the task error exit facility allows you to take whatever action is appropriate.

The format of the task error exit area is:

WORD 1 The count of the number of parameter words that follow (always F'2').

WORD 2 The address of your error exit routine.

WORD 3 The address of a 24-byte area in which the Level Status Block (LSB) and Processor Status Word (PSW) from the point of error are placed before the exit routine is entered. Refer to a Series/1 processor description manual for a description of the LSB and PSW.

A default task error exit routine is available to aid in problem diagnosis and correction. (Refer to the *Language Programming Guide* for a detailed description of this routine and how to use it in your application program.)

STORAGE=

The number of bytes of additional storage the system should allocate for this program when the program is loaded for execution. This provides a dynamic increment of storage at load time. This value can be overridden by a parameter on the LOAD instruction, dynamically altering the space available to the program. The address and length of the additional storage is contained in the variables $STORAGE and $LENGTH, respectively, and can be referred to by your program during execution. Do not use this operand if you are loading the program as an overlay.

The amount of storage is rounded up to a multiple of 256 bytes. $LENGTH contains the number of 256-byte pages that are available for current execution. If no dynamic area is specified, $LENGTH contains 0 and $STORAGE contains the address of the program's primary task.

Storage can be any value from 0 to 65535 minus the size of the program itself. If the storage required is not available at LOAD time, the program will not be loaded.

The amount of storage required by a program for such things as buffers, queues, or data often varies depending on its input. Dynamic storage provides a way to adjust the amount of storage available without recompiling your program. The PROGRAM statement can be used to define the amount of dynamic storage for either minimal or typical processing requirements and the LOAD instruction can be used to expand the work space when processing will require more storage. For example, on a daily basis a program may have to read about 1000 bytes of data into storage, analyze it and format it into a report. Once a month it may be required to process 30 days worth of data (30000 bytes) in the same way. Instead of wasting 29000 bytes of storage every day, dynamic storage can be used to adjust the size to meet requirements.

Syntax Examples

1) TASK1 is the label of the primary task and the label of the first executable instruction is START. The priority of TASK1 is the default priority, 150.

```
TASK1    PROGRAM   START
```

2) The primary task, TASK2, has a priority of 300 and starts at the label BEGIN. The program uses floating-point instructions.

```
TASK2    PROGRAM   BEGIN,300,FLOAT=YES
```

3) The primary task, TASK3, starts at GOPROG. One data set, NAME1, is defined and is located in the volume from which the main program will be loaded. Disk I/O instructions in the program refer to NAME1 by the symbolic name DS1.

```
TASK3    PROGRAM   GOPROG,DS=((NAME1,##))
```

4) The primary task, TASK4, starts at START4 and uses one tape data set. The data set is on a standard labeled tape where the VOL1 label contains 110011 as the volume serial number and the HDR1 label contains MYDATA as the data set name. You write such labels using the INITIALIZE function of the $TAPEUT1 utility.

```
TASK4    PROGRAM   START4,DS=((MYDATA,110011))
```

5) The primary task, TASK5, starts at START5 and uses one tape data set. The tape data set is either on a no label tape or bypass label processing is being used and the tape device ID is TU088.

```
TASK5    PROGRAM   START5,DS=(($$EDXVOL,TU088))
```

6) The primary task, TASK6, starts at START6. Two data sets are defined. The name of the first data set will be specified at program load time. The second data set has the name NAME2 and resides on the logical volume named EDX002. Two overlays are defined, OLAY1 and OLAY2. A 1000-byte area will be appended to the program and its address placed in $STORAGE.

```
TASK6    PROGRAM  START6,DS=(??,(NAME2,EDX002)),
```

7) The primary task, TASK7, starts at START7 and uses 4 data sets. MYDS1 is a disk or diskette data set on the IPL volume. MYDS2 is a tape data set on standard labeled tape number 100001. The program prompts the operator for the last two data sets. The prompt for the third data set appears as OUTPUT(NAME,VOLUME); the prompt for the fourth data set appears as DS4(NAME,VOLUME). The operator can specify the third and fourth data sets as disk, diskette, or tape data sets.

```
TASK7    PROGRAM  START7,DS=(MYDS1,(MYDS2,100001),
                      (OUTPUT,??),??)
```

PROGSTOP – Stop Program Execution

The PROGSTOP instruction ends program execution and releases the storage allocated to the program. You can have more than one PROGSTOP instruction in a program. You are responsible for ensuring that any secondary tasks in a program are inactive before a PROGSTOP statement is executed by the primary task. The results of executing a PROGSTOP in a program with multiple active tasks are unpredictable.

You are also responsible for assuring that no asynchronous events remain outstanding. If your program contains an ECB for an event that has not yet occurred, you must WAIT on the event before issuing a PROGSTOP. The following instructions can generate asynchronous events: READ, WRITE, STIMER, LOAD, ENQ, and ENQT. Also, if another program can post your program, you must wait for the post or prohibit the other program from posting before the PROGSTOP executes.

PROGSTOP does a close (CONTROL CLSOFF) for any open tape data set that was defined by the PROGRAM statement or passed by another program.

PROGSTOP will do a DEQT of the terminal currently in use by the program.

When coding the PROGSTOP instruction, you can include a comment which will appear with the instruction on your compiler listing. If you include a comment, you must specify at least one operand with the instruction. The comment must be separated from the operand field by one or more blanks and it may not contain commas.

Syntax:

label	**PROGSTOP code,LOGMSG=,P1= comment**
Required:	**none**
Defaults:	**code = -1, LOGMSG=YES**
Indexable:	**none**

Operand	*Description*
code	The posting code to be inserted in the EVENT named in the associated LOAD instruction. The PROGSTOP instruction causes the system to post the ECB for this event, following the post code rules. **Note:** If a program check occurs, the ECB will be posted with the value of the PSW. Refer to the *Problem Determination Guide* for information on the PSW. This operand must be a self-defining term other than 0.

LOGMSG=

Code either YES or NO to show whether a "PROGRAM ENDED" message is to be displayed on the terminal being used by this program.

Notes:

1. Programs loaded by the virtual terminal facility do not recognize the LOGMSG operand. Therefore, if a program is loaded by a virtual terminal, the program-ended message is never displayed.
2. If you coded LOGMSG=YES, but another task has control of the terminal when your program ends, the system does not display the program-ended message.
3. If LOGMSG=YES and the return code is not equal to −1, PROGSTOP will display the return code.

P1= Parameter naming operand. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code this operand.

PUTEDIT – Collect and Store Data from a Program

The PUTEDIT instruction obtains data from variables within a program, converts the data to a character string, and either stores the data in a storage area or sends it to a terminal.

PUTEDIT uses the specified FORMAT statement and the data list to convert and move elements one by one into a storage area.

When you use the PUTEDIT instruction in your program, you must link-edit your program using the "autocall" option of $EDXLINK. Refer to the *Language Programming Guide* for information on how to link-edit programs.

The supervisor places a return code in the first word of the task control block (taskname) whenever a PUTEDIT instruction causes a terminal I/O operation to occur. If the return code is not a −1, the address of this instruction will be placed in the second word of the task control block (taskname+2).

The system will not pass control to a terminal error routine if an I/O error occurs while this instruction is executing. The terminal I/O return codes are described at the end of the PRINTEXT and READTEXT instructions in this manual and also in *Messages and Codes*.

Note: Any references to **31xx** terminals means 3101, 3151, 3161, 3163, and 3164 terminals, unless otherwise noted.

Syntax:

label	**PUTEDIT**	**format,text,(list),(format list),** **ERROR=,ACTION=,SKIP=,LINE=,SPACES=,** **PROTECT=,MODE=**
Required:	**text, (list), and either format** **or (format list)**	
Defaults:	**ACTION=IO,PROTECT=NO,MODE=none**	
Indexable:	**none**	

Operand	*Description*
format	The label of a FORMAT statement or the name to be attached to the format list optionally included within this instruction. This statement or list will be used to control the conversion of the data. This operand is required if the program is compiled with $EDXASM.
text	The label of a TEXT statement defining a storage area for character data. If data is moved to a terminal, this area stores the data (as an EBCDIC character string) after it is converted from the variables and before it is sent to the terminal. **Note:** The TEXT statement must be large enough to contain all the EBCDIC characters generated by this instruction.

list A description of the variables or locations which contain the input data, having the form:

((variable,count,type),...)
or
(variable,...)
or
((variable,count),...)
or
((variable,type),...)

where:

variable The label of a variable or group of variables that are to be converted to EBCDIC.

count The number of variables that are to be converted.

type The type of variable to be converted:

S Single-precision integer (Default)
D Double-precision integer
F Single-precision floating-point
L Extended-precision floating-point.

type defaults to S for integer format data and to F for floating-point format data.

format list A FORMAT list. If you want to refer to this format statement from another PUTEDIT instruction, then both the format and format list operands must be coded. See the FORMAT statement for coding instruction operands that are to be referred to by PUTEDIT instructions.

This operand is not allowed if the program is assembled with $EDXASM.

ERROR= The label of the first instruction of the routine to receive control if an error occurs during the PUTEDIT operation. The system returns a return code to the task even if you do not code this operand.

Errors that might cause the system to call the error routine are:

- Use of incorrect format list
- Not enough space in text buffer to satisfy the data list.

ACTION= IO (the default), causes a PRINTEXT to be executed following the data conversion. If output is being directed to a 31xx in block mode, see "PRINTEXT – Display a Message on a Terminal" on page 2-307 for special considerations.

STG, causes the conversion and movement of data into a text buffer. No I/O takes place.

SKIP= The number of lines to be skipped before the system performs an I/O operation. For example, if your cursor is at line 2 on a display screen and you code SKIP=6, the system does the I/O operation on line 8. For a printer, the SKIP operand controls the movement of forms.

The SKIP operand causes the system to display or print the contents of the system buffer.

If you specify a value greater than or equal to the logical page size, the system divides this value by the page size and uses the remainder in place of the value you specify. For roll screens, the logical page size equals the screen's bottom margin minus the number of history lines and the screen's top margin.

LINE= The line number on which the system is to perform an I/O operation. Code a value from 0 to the number of the last usable line on the page or logical screen. The line count begins at the top margin you defined for the printer or display screen. LINE=0 positions the cursor at the top line of the page or screen you defined; LINE=1 positions the cursor at the second line of the page or screen. For roll screens, line 0 equals the screen's top margin plus the number of history lines.

For printers and roll screens, if you code a value less than or equal to the current line number, the system performs the I/O operation at the specified line on the next page or logical screen. For static screens, if you code a value within the limits of the logical screen, the system performs the I/O operation on the line you specified.

If you code a value greater than the last usable line number, the system divides this value by the logical page size and uses the remainder as the line number on which to perform the I/O operation. For example, if you code LINE=22 and your roll screen has a logical page size of 20, the I/O operation occurs on the second line of the logical screen.

The LINE operand causes the system to print or display the contents of the system buffer.

SPACES= The number of spaces to indent before the system performs an I/O operation. SPACES=0, the default, positions the cursor at the beginning of the left side of the page or screen. If the value you specify is beyond the limits of the logical screen or page, the system indents the next line by the excess number of spaces.

When you code the LINE or SKIP operands with SPACES, the system begins indenting from the left margin of the page or screen. If you specify SPACES without coding LINE or SKIP, the system begins indenting from the last cursor position on the line.

PROTECT=

YES, to write protected characters to a static screen device that supports this feature, such as an IBM 4978, 4979, 4980, or 31xx terminal in block mode. Protected characters cannot be typed over nor displayed.

NO (the default), to inhibit writing protected characters to a static screen device.

MODE= Tells the system whether you want imbedded @ characters interpreted as new-line designators. Code LINE if the text includes imbedded @ characters which are not to be interpreted as new-line designators.

For 4978, 4979, and 4980 screens accessed in static mode, the coding of MODE=LINE and the spaces parameter (SPACES=) causes the system to skip over protected fields as the data is transferred to the screen. (Protected fields do not contribute to the count.)

For a 31xx in block mode with a static screen, the system overwrites protected fields.

Do not code this parameter if you want the system to interpret @ characters as new line designators.

31xx Display Considerations

When using a 31xx in block mode, the output will be controlled by the most recent TERMCTRL command. For details on the discussion under TERMCTRL SET,ATTR and SET,STREAM operands, see "TERMCTRL – Request Special Terminal Function" on page 2-426.

Syntax Example

This example converts the integer A into the first four positions of TEXT1 followed by a carriage return command. Then, the next six positions will contain the variable B followed by two spaces. The literal 'DATA=' then follows with the extended-precision variable C converted into the last 10 positions.

```
        PUTEDIT   FM,TEXT1,(A,(B,F),(C,L))
          •
          •
          •
TEXT1   TEXT      LENGTH=28
FM      FORMAT    (I4/F6.2,2X,'DATA=',E10.4)
```

Coding Example

The program issues a PRINTEXT instruction that requests the model year and serial numbers for the automobile of interest. The first GETEDIT reads the two requested numbers into a TEXT statement labeled TEXT1.

The GETEDIT instruction searches the TEXT1 data and converts the first entry to a single-precision variable called LIST1. The second entry is converted to a double-precision variable called LIST2. The first PUTEDIT instruction, using the FORMAT statement labeled PE1FMT, converts LIST1 and LIST2 back to EBCDIC and displays these values on the screen or printer. The PUTEDIT and FORMAT statements determine the layout of the data as it is displayed.

The GETEDIT instruction after label GE2 takes the data already entered into TEXT1 with the preceding READTEXT and converts it into the two binary variables called LIST1 (single-precision) and LIST2 (double-precision). Because ACTION=STG, a READTEXT must be issued before executing the GETEDIT.

The PUTEDIT instruction at label PE2 converts the two variables back to EBCDIC and places them into the TEXT2 statement as formatted by the PE2FMT FORMAT statement. Again the keyword ACTION=STG prevents the data from being displayed until the following PRINTEXT instruction is executed.

```
GE1       EQU      *
          PRINTEXT '@ENTER MODEL YEAR AND SERIAL NUMBER@'
          GETEDIT  GE1FMT,TEXT1,(LIST1,(LIST2,D)),ACTION=IO,ERROR=ERR1
*
PE1       EQU      *
          ENQT     $SYSPRTR
          PUTEDIT  PE1FMT,TEXT2,(LIST1,(LIST2,D)),ACTION=IO
          DEQT
*
GE2       EQU      *
          READTEXT TEXT1,'@ENTER YOUR DEPT. AND SYSTEM ID NUMBER@'
*
          GETEDIT  GE2FMT,TEXT1,(LIST1,(LIST2,D)),                    X
                ACTION=STG,ERROR=ERR1
*
PE2       EQU      *
          PUTEDIT  PE2FMT,TEXT2,(LIST1,(LIST2,D)),ACTION=STG
*
          ENQT     $SYSPRTR
          PRINTEXT TEXT2
          DEQT
           •
           •
           •
ERR1      EQU      *
          PRINTEXT '@GETEDIT GE1 HAS FAILED@'
          GOTO     ERROROUT
*
ERR2      EQU      *
          PRINTEXT '@GETEDIT GE2 HAS FAILED@'
          GOTO     ERROROUT
*
ERROROUT   •
           •
           •
GE1FMT    FORMAT   (I4,1X,I8)
PE1FMT    FORMAT   ('MDL. YR. = ',I4,6X,'SER. NO. = ',I8)
GE2FMT    FORMAT   (I3,1X,I6)
PE2FMT    FORMAT   ('DEPT. = ',I3,4X,'SYST. ID. = ',I6)
LIST1     DATA     F'0'
LIST2     DATA     D'0'
TEXT1     TEXT     LENGTH=13
TEXT2     TEXT     LENGTH=42
```

Return Codes

The return codes are returned in the first word of the task control block (TCB) of the program or task issuing the instruction. The label of the TCB is the label of your program or task (taskname).

Return Code	Description
−1	Successful completion.
3	Conversion error.

QCB – Create a Queue Control Block

The QCB statement generates a 5-word queue control block (QCB) for use with the ENQ and DEQ instructions.

Normally this statement will not be needed in application programs if the program is to be assembled by the Host or Series/1 macro assemblers. In this case queue control blocks are generated for you automatically as a consequence of naming a QCB in a DEQ instruction. However, this statement can be used for special purposes such as controlling the location of the QCB within a program. You must code any necessary QCBs in programs you compile with $EDXASM.

A program can contain a maximum of 25 QCB statements. If more than 25 QCBs are required, you must create them with the DATA statement. For example:

```
QCB1    QCB
```

is equivalent to coding,

```
QCB1    DATA    F'-1'
        DATA    2F'0'
        DATA    2F'0'
```

When coding the QCB statement, you can include a comment that will appear with the statement on your compiler listing. If you include a comment, you must also specify the code operand. The comment must be separated from the operand field by at least one blank and it cannot contain commas.

Syntax:

label	**QCB**	**code**	**comment**
Required:	**label**		
Defaults:	**code = -1**		
Indexable:	**none**		

Operand	*Description*
label	The label of the QCB statement. The ENQ and DEQ instructions refer to this label.
code	Initial value of the code field (word 1). If this word is nonzero, the resource this QCB refers to is available for use by a program or task.

Coding Example

The QCB statement labeled SBRTNQCB generates a 5-word queue control block (QCB). The ENQ instruction checks the QCB to see if the subroutine named SUBRTN is being used by another program or task. The initial value of the QCB is 99, indicating that the resource is initially available for use.

```
         ENQ     SBRTNQCB
         CALL    SUBRTN
         DEQ     SBRTNQCB
          •
          •
          •
         SUBROUT SUBRTN
          •
          •
          •
         RETURN
          •
          •
          •
SBRTNQCB QCB     99
```

QUESTION – Ask Operator for Input

The QUESTION instruction allows the terminal operator to choose the direction of a conditional branch in a program. The prompt message (normally in the form of a question) is printed unconditionally, after which the operator may enter Y (or any string beginning with Y) for yes, or N (or any string beginning with N) for no. Note that advance input may accompany the response. If an invalid response is entered, the operator is prompted until a Y or N is entered. The QUESTION instruction must be issued only to terminals which have input capability for response to the prompt.

The supervisor places a return code in the first word of the task control block (taskname) whenever a QUESTION instruction causes a terminal I/O operation to occur. If the return code is not a −1, the address of this instruction will be placed in the second word of the task control block (taskname+2). The terminal I/O return codes are described at the end of the PRINTEXT and READTEXT instructions in this manual and also in *Messages and Codes.*

Note: Any references to **31xx** terminals means 3101, 3151, 3161, 3163, and 3164 terminals, inless otherwise noted.

Syntax:

label	**QUESTION pmsg,YES=,NO=,SKIP=,LINE=,SPACES=,** **COMP=,PARMS=(parm1,...,parm8),** **MSGID=,P1=**
Required:	**pmsg and either YES= or NO=**
Defaults:	**If the operator enters a response and you have not coded a keyword for that response (YES= or NO=), the system executes the next instruction in the program.** **MSGID=NO**
Indexable:	**pmsg,SKIP,LINE,SPACES**

Operand	*Description*
pmsg	The prompt message. Code either the label of a TEXT statement or an explicit text message enclosed in single quotes. To retrieve a prompt message from a data set or module containing formatted program messages, code the number of the message you want displayed or printed. You must code a positive integer or a label preceded by a plus sign (+) that is equated to a positive integer. If you retrieve a prompt message from storage, you must also code the COMP= operand. See Appendix E, "Creating, Storing, and Retrieving Program Messages" on page E-1 for more information.
YES=	The label of the instruction at which execution will continue if the answer is YES.
NO=	The label at which execution will continue if the answer is NO.

SKIP= The number of lines to be skipped before the system does an I/O operation. For example, if your cursor is at line 2 on a display screen and you code SKIP=6, the system does the I/O operation on line 8. For a printer, the SKIP operand controls the movement of forms.

The SKIP operand causes the system to display or print the contents of the system buffer.

If you specify a value greater than or equal to the logical page size, the system divides this value by the page size and uses the remainder in place of the value you specify. For roll screens, the logical page size equals the screen's bottom margin minus the number of history lines and the screen's top margin.

LINE= The line number on which the system is to do an I/O operation. Code a value from 0 to the number of the last usable line on the page or logical screen. The line count begins at the top margin you defined for the printer or display screen. LINE=0 positions the cursor at the top line of the page or screen you defined; LINE=1 positions the cursor at the second line of the page or screen. For roll screens, line 0 equals the screen's top margin plus the number of history lines.

For printers and roll screens, if you code a value less than or equal to the current line number, the system does the I/O operation at the specified line on the next page or logical screen. For static screens, if you code a value within the limits of the logical screen, the system does the I/O operation on the line you specified.

If you code a value greater than the last usable line number, the system divides this value by the logical page size and uses the remainder as the line number on which to do the I/O operation. For example, if you code LINE=22 and your roll screen has a logical page size of 20, the I/O operation occurs on the second line of the logical screen.

The LINE operand causes the system to print or display the contents of the system buffer.

SPACES= The number of spaces to indent before the system does an I/O operation. SPACES=0, the default, positions the cursor at the beginning of the left side of the page or screen. If the value you specify is beyond the limits of the logical screen or page, the system indents the next line by the excess number of spaces.

When you code the LINE or SKIP operands with SPACES, the system begins indenting from the left margin of the page or screen. If you specify SPACES without coding LINE or SKIP, the system begins indenting from the last cursor position on the line.

COMP= The label of a COMP statement. You must specify this operand if the QUESTION instruction is retrieving a prompt message from a data set or module containing formatted program messages. The COMP statement provides the location of the message. (See the COMP statement description for more information.)

PARMS= The labels of data areas containing information to be included in a message you are retrieving from a data set or module containing formatted program messages. You can code up to eight labels. If you code more than one label, you must enclose the list in parentheses.

Note: To use this operand, you must have included the FULLMSG module in your system during system generation. Refer to the *Installation and System Generation Guide* for a description of this module.

MSGID= YES, if you want the message number and 4-character prefix to be printed at the beginning of the message you are retrieving from a data set or module containing formatted program messages. See the COMP statement operand "idxx" for a description of the 4-character prefix.

NO (the default), to prevent the system from printing or displaying this information at the beginning of the message.

Note: To use this operand, you must have included the FULLMSG module in your system during system generation. Refer to the *Installation and System Generation Guide* for a description of this module.

P1= Parameter naming operand. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code this operand.

Special Considerations

To use the QUESTION instruction with a static screen, you must create an unprotected input area for the answer to the QUESTION prompt. The QUESTION instruction regards the first nonblank character following the QUESTION prompt as the answer to the prompt message. One or more blanks can precede the answer, but they are not required.

31xx Terminals

If you use a 31xx in block mode, the most recent TERMCTRL SET,ATTR will control the attribute bytes used for the prompt and response.

Neither a TERMCTRL SET,ATTR=BLANK nor SET,STREAM=YES should be in effect when a QUESTION instruction executes.

Syntax Examples

1) Ask the operator if he or she wants to start a second routine. If the operator answers YES, branch to the label ROUTINE2. If the operator answers NO, execute the next instruction.

```
         QUESTION  TEXT3,YES=ROUTINE2        NO = NEXT STATEMENT
           •
           •
           •
ROUTINE2 EQU       *
           •
           •
           •
TEXT3    TEXT      'GO TO SECOND ROUTINE?'
```

2) Ask the operator if he or she wants to perform an operation again. If the operator answers NO, branch to the label EXIT. If the operator answers YES, execute the next instruction.

```
         QUESTION  'DO IT AGAIN?',NO=EXIT   YES = NEXT STATEMENT
           •
           •
           •
EXIT     EQU       *
         PROGSTOP
```

3) Ask the operator if he or she wants to restart an operation. If the operator answers YES, branch to the label INITIAL. If the operator answers NO, branch to the label END.

```
INITIAL  EQU       *
           •
           •
           •
         QUESTION  'RESTART?',YES=INITIAL,NO=END
           •
           •
           •
END      EQU       *
         PROGSTOP
```

Coding Example

In the following example, the QUESTION instruction displays a prompt message contained in MSGMOD, a storage-resident message area. Because +MSG77 equals 77, the system retrieves message 77 in MSGMOD.

```
         QUESTION   +MSG77,COMP=MSGSTMT,YES=OKAY
           •
           •
           •
OKAY     EQU        *
         PROGSTOP
           •
           •
           •
MSG77    EQU        77
MSGSTMT  COMP       'SRCE',MSGMOD,TYPE=STG
```

Message Return Codes

The system issues the following return codes when you retrieve a prompt message from a data set or module containing formatted program messages. The return codes are returned in the first word of the task control block (TCB) of the program or task issuing the instruction. The label of the TCB is the label of your program or task (taskname).

Return Code	Description
−1	Message successfully retrieved.
301 − 316	Error while reading message from disk. Subtract 300 from this value to get the actual return code. See the disk return codes following the READ or WRITE instruction for a description of the code.
326	Message number out of range.
327	Message parameter not found.
328	Instruction does not supply message parameter(s).
329	Invalid parameter position.
330	Invalid type of parameter.
331	Invalid disk message data set.
332	Disk message read error.
333	Storage-resident module not found.
334	Message parameter output error.
335	Disk messages not supported (MINMSG support only).

RDCURSOR – Store Static Screen Cursor Position

The RDCURSOR instruction stores the cursor position in a set of data areas you specify. The cursor position is defined as the line number and the number of spaces the cursor is indented from the left margin of the logical screen. RDCURSOR is only valid for terminals with a static screen. For information on defining a static screen, see the SCREEN= operand of the IOCB statement or refer to the *Language Programming Guide.*

The supervisor places a return code in the first word of the task control block (taskname) whenever a RDCURSOR instruction causes a terminal I/O operation to occur. If the return code is not a −1, the address of this instruction will be placed in the second word of the task control block (taskname+2). The terminal I/O return codes are described at the end of the PRINTEXT and READTEXT instructions in this manual and also in *Messages and Codes.*

If you code RDCURSOR after a WAIT KEY instruction for a 3101 in block mode, use a PF key and not the SEND key to end the wait. If you use the SEND key, it positions the cursor at the beginning of the next line and RDCURSOR cannot capture the screen coordinates.

Syntax:

label	**RDCURSOR**	**line,indent**
Required:	**line,indent**	
Defaults:	**none**	
Indexable:	**line,indent**	

Operand	*Description*
line	The label of the variable in which the cursor position, relative to the top margin of the logical screen, is to be stored. If the cursor lies outside the line range of the logical screen, then a value of −1 is stored.
indent	The label of the variable in which the cursor position, relative to the left margin of the logical screen, is to be stored. If the cursor position is not within the left and right margins of the logical screen, then a value of −1 is stored.

Coding Example

This example defines a terminal with an IOCB statement, then issues an ENQT instruction to that terminal. The terminal name is DISP2. An ERASE instruction clears the screen. The example uses the RDCURSOR instruction to find the cursor position. RDCURSOR puts the relative line position of the logical screen in the variable labeled LN. It puts the spaces value or column position in the variable labeled COL. Because the exact position of the cursor is known, any terminal I/O issued to this terminal can position the cursor using the LN and COL values as a reference point.

After additional processing, index register #1 is set to a value of 2 with a MOVE instruction. A second RDCURSOR instruction is issued and #1 is used to increase the storage locations by a value of 2 where the new locations are to be stored. This RDCURSOR places the cursor line number and spaces in variables NEXT1 and NEXT2, respectively. NEXT1 and NEXT2 then become the new reference point of the cursor for any additional I/O operations.

```
TUBE      IOCB      DISP2,SCREEN=STATIC   DEFINE THE TERMINAL TO BE
*                                         USED
           •
           •
           •
          ENQT                           GET EXCLUSIVE ACCESS OF
*                                         DISP2
          ERASE     MODE=SCREEN,TYPE=ALL  CLEAR THE SCREEN
*
          RDCURSOR  LN,COL                GET CURSOR POSITION AND PUT
*                                         LINE NUMBER IN LN AND SPACES
*                                         IN COL
           •
           •
           •
          MOVE      #1,2                  SET #1 TO 2
          RDCURSOR  (LN,#1),(COL,#1)      GET CURSOR POSITION AND PUT
*                                         VALUES IN NEXT1 AND NEXT2
*                                         COL

          DEQT                            RELEASE EXCLUSIVE CONTROL OF
*                                         THE TERMINAL
           •
           •
           •
LN        DATA      F'0'
NEXT1     DATA      F'0'
COL       DATA      F'0'
NEXT2     DATA      F'0'
```

When the first RDCURSOR is issued, if the cursor is on the third line of the logical screen and ten spaces from the left margin, then, following the execution of the RDCURSOR, variable LN will contain 3 and variable COL will contain 10.

When the second RDCURSOR is executed, if the cursor is outside the logical screen, then both NEXT1 and NEXT2 will be set to a value of −1.

READ – Read Records from a Data Set

The READ instruction retrieves one or more records from a disk, diskette, or tape data set and places them in a buffer area you define. You must allocate enough buffer space for the operation.

You can read disk or diskette data sets either sequentially or directly. These data sets are read in 256-byte record increments. The *Operator Commands and Utilities Reference* describes the format of a record created with the text editor, $FSEDIT. (For information on using 1024-byte-per-sector diskettes, refer to the *Installation and System Generation Guide.*) You can only read tape data sets sequentially. A READ operation for tape can retrieve a record from 18 to 32767 bytes long.

You have the option to place a disk read request at the top of the disk I/O chain. Such requests are made with the disk immediate READ option. A disk immediate read request will be serviced before others in the chain. A coding example follows in this section. For additional information see "Coding Example – Disk Immediate Read" on page 2-364. The disk immediate READ operation will function only for the primary part of a data set with extents. The system converts disk immediate read requests to extent parts of a dataset to regular READ operations.

The READ instruction can take advantage of the cross-partition capability that enables your program to share data with a program or task in another partition. Appendix C, "Communicating with Programs in Other Partitions (Cross-Partition Services)" on page C-1 contains an example of a cross-partition READ operation. You can find more information on cross-partition services in the *Language Programming Guide.*

Syntax:

label	**READ**	**DSx,loc,count,relrecno|blksize,END=,** **ERROR=,WAIT=,PREC=,P1=,P2=,P3=,P4=**
Required:	**DSx,loc**	
Defaults:	**count=1,relrecno=0 or blksize=256,** **WAIT=YES,PREC=S**	
Indexable:	**loc,count,relrecno or blksize**	

Operand	*Description*
DSx	The data set from which you are reading. Code DSx, where "x" is a positive integer that indicates the relative position (number) of the data set in the list of data sets you defined on the PROGRAM statement. The value can range from 1 to the maximum number of data sets defined in the list. The maximum range is from 1–9. You can substitute a DSCB name defined by a DSCB statement for DSx.
loc	The label of the buffer area where the data is to be placed. When reading disk or diskette data sets, you must make sure that this area is a multiple of 256 bytes. When reading tape data sets, this area must equal or exceed the value you code for the blksize operand.

READ normally assumes the buffer is in the same partition as the currently executing program. You can read records into a buffer in another partition, however, by using the cross-partition capability of the READ instruction.

count The number of contiguous records to be read. The maximum value for this field is 255. If the program sets the field to 0, no I/O operation is performed. A count of the actual number of records read is returned in the second word of the task control block if WAIT=YES is coded. Note, however, if the incorrect blocksize is specified, the correct blocksize is stored in the second word of the TCB, not the number of records transferred. If an end-of-data condition occurs (fewer records remaining in the data set than specified by the count field), the system reads the remaining records and returns an end-of-data return code to the program.

relrecno The number of the record that is to be read from a disk or diskette data set. The record number is relative to the first record in the data set, and the numbering starts with 1. You can code a positive integer or the label of a data area containing the value.

You can request a sequential read operation by coding a 0 or by allowing this operand to default. If an end-of-data (EOD) indicator was previously set, an EOD is returned when the logical EOD is encountered. If the EOD indicator has not been set, the EOD returned represents the physical end-of-data.

A value other than 0 indicates that a direct READ is requested. An EOD indication is returned if an attempt is made to access a record outside the physical data set.

If you code a self-defining term, or an equated value indicated by a plus sign (+), then it is assumed to be a single-word value and is, therefore, generated as an inline operand. Because this is a one-word value, it is limited to a range of 1 to 32767 (X'7FFF').

If you code an indexable value or an address for this operand, the PREC operand can be used to further define whether relrecno is to be a single-word or double-word value.

PREC=D extends the maximum range of relrecno beyond the 32767 value to the limit of a double-word value (2147483647 or X'7FFFFFFF').

A sequential READ starts with relative record number 1 or the record number specified by a POINT instruction. The supervisor keeps track of sequential READ instructions and increments an internal next-record-pointer for each record read in sequential mode (relrecno is 0). Direct READ operations (relrecno is not 0) can be intermixed with sequential operations, but this does not change the next-record-pointer used by sequential operations.

blksize The number of bytes to be read from a tape data set. The range is from 18 to 32767. You can code a self-defining term or the label of a data area containing the value. The default for this operand is 256 bytes of data. If you code 0 *or* do not code this operand, the instruction reads the default number of bytes.

The first word of the TCB contains the return code for the READ operation. If the specified blksize does not equal the actual blksize, the ERROR path will be taken and the second word of the TCB will contain the actual blksize. Note, however, that the blksize is stored only in the second word of the TCB if you code WAIT=YES or allow the WAIT= operand to default to YES. If you code WAIT=NO and the blksize specification is incorrect, you can check the $DSCBR3 field in the DSCB for the actual number of records read or the actual blksize.

Do not code this operand in a READ instruction containing the relrecno operand.

PREC= This operand further defines the relrecno operand when you code an address or an indexable value for that operand. PREC=S (the default) limits the value of relrecno to single-word precision or to a value of 32767 (X'7FFF').

Coding PREC=D gives the relrecno operand a doubleword precision and extends the range of its maximum value to a doubleword value of 2147483647 (X'7FFFFFFF').

Do not code this operand in a READ instruction containing the blksize operand.

END= The label of the first instruction of the routine to be called if an end-of-data set condition is detected during the READ operation (return code=10). If you do not code this operand, the system treats an end-of-data set condition as an error.

For tape data sets, if END is not coded, the system treats reading a tapemark as an error. The physical position of the tape, under this condition, is the read/write head position immediately following the tapemark. See the CONTROL instruction close functions for repositioning of the data set. Remember also that the count field might not be decremented to 0.

Do not code this operand if you code WAIT=NO.

You can set or change the end-of-data by using the SE command of $DISKUT1. Refer to the *Operator Commands and Utilities Reference* for additional information.

ERROR= The label of the first instruction of the routine to be called if an error condition occurs during the execution of this operation. If you do not specify this operand, control passes to the instruction following the READ instruction and you must test the return code in the first word of the task control block for errors.

Do not code this operand if you code WAIT=NO.

WAIT= YES (the default), to suspend the current task until the operation is complete.

NO, to return control to the current task after the operation is initiated. Your program must issue a subsequent WAIT DSx to determine when the operation is complete.

You cannot code the END and ERROR operands if you code WAIT=NO. You must subsequently test the return code in the Event Control Block (ECB) named DSx or in the first word of the task control block (TCB). The label of the TCB is the label of your program or task.

Two codes are of special significance. A −1 indicates a successful end of operation. A +10 indicates an "End of Data Set" and may be of logical significance to the program rather than being an error. For programming purposes, any other return codes should be treated as errors.

Px= Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Syntax Examples

1) The following READ instruction reads a single 327-byte record from a standard label (SL) tape. If an end-of-data set tape mark is detected, control passes to the statement named END1. If an error occurs, control passes to the statement named ERR.

```
ABC     PROGRAM  START1,DS=((MYDATA,234567))
START1  READ     DS1,BUFF,1,327,END=END1,ERROR=ERR,WAIT=YES
```

2) The following READ instruction does the same as in the previous example except that two records are read into your storage buffer (BUFF2). BUFF2 must be at least 654 bytes long.

```
ABCD    PROGRAM  START2,DS=((MYDATA,234567))
START2  READ     DS1,BUFF2,2,327,END=END1,ERROR=ERR,WAIT=YES
```

Coding Example – Read

The READ instruction in this example reads the next sequential record from the first relative data set specified in the list of data sets in the PROGRAM statement. If end-of-file is encountered during the read, the program passes control to the NOTFOUND label. If an unrecoverable I/O error is encountered, the program passes control to the label DSKRDERR. Otherwise, the instruction reads the record and places the data in the 256-byte buffer area labeled DISKBUFF.

```
READ     PROGRAM   LOOKUP,DS=(CHART1,CHART2)
LOOKUP   EQU       *
         READ      DS1,DISKBUFF,1,0,ERROR=DSKRDERR,END=NOTFOUND
         MOVEA     #1,DISKBUFF
         DO        16,TIMES
            IF       ((0,#1),EQ,$NAME,(16,BYTE)),GOTO,GOTNAME
            ENDIF
            ADD      #1,16
         ENDDO
         GOTO      LOOKUP
*
NOTFOUND EQU     *
         PRINTEXT '@EMPLOYEE FILE DOES NOT CONTAIN EMPLOYEE NAME '
         PRINTEXT $NAME
         GOTO    ENDIT
*
DSKRDERR EQU     *
         PRINTEXT '@UNRECOVERABLE DISK READ ERROR ON EMPLOYEE FILE'
         GOTO    ENDIT
*
GOTNAME  EQU     *
ENDIT    PROGSTOP
DISKBUFF BUFFER   265.BYTES
         ENDPROG
         END
```

Coding Example – Disk Immediate Read

There are situations in which you have 1 or more applications already active on a Series/1 and you want to perform a disk read without having to wait for the completion of active programs. Use the disk immediate read option to make such requests. This special READ request is placed at the top of a disk I/O chain and serviced before other requests.

The following coding example illustrates how to code $DSCBPRI to set the priority read bit in the DSCB. Any READ request made directly after $DSCBPRI is set executes immediately. The bit resets automatically to continue normal operations as soon as the prioritized instruction completes.

```
PROG1   PROGRAM   START
        COPY      DSCBEQU
        •
        •
        •
START   EQU
        •
        •
        •
        IOR       INDATA+$DSCBFLG,+$DSCBPRI  SET PRIORITY READ BIT IN DSCB
        READ      INDATA,BUF,1,1             READ A RECORD
        •
        •
        •
        ENDPROG
BUF     DC        128F'0'
        DSCB      DS#=INDATA,DSNAME=TEST
        END
```

Disk and Tape Return Codes

Disk and tape I/O return codes are returned in two places:

- The first word of the DSCB (either DSn or DSCB name) named DSn, where "n" is the number of the data set.
- The first word of the task control block (TCB). The label of the TCB is the label of your program or task (taskname).

The possible return codes and their meaning for disk and tape are shown in tables later in this section.

If a tape error occurs, the read/write head positions itself immediately following the record in which the error occurred. This indicates that a retry has been attempted, but was unsuccessful. The count field, in the READ instruction, may or may not have been set to 0 under this condition.

You can get detailed information on an error by using the $LOG utility to capture the I/O error. Refer to the *Problem Determination Guide* for information on how to use $LOG.

Note: If an error is encountered during a sequential I/O operation, the relative record number for the next sequential request is not updated. This can cause errors on all following sequential I/O operations.

Disk/Diskette Return Codes

Return Code	Condition
−1	Successful completion.
1	I/O error and no device status present (this code may be caused by the I/O area starting at an odd byte address).
2	I/O error trying to read device status.
3	I/O error retry count exhausted.
4	Read device status I/O instruction error.
5	Unrecoverable I/O error.
6	Error on issuing I/O instruction.
7	A no record found condition occurred, a seek for an alternate sector was performed, and another no record found occurred, for example. No alternate is assigned.
8	A system error occurred while processing an I/O request for a 1024-byte sector diskette.
9	Device was offline when I/O was requested.
10	READ request is beyond the end of the data set. Write request is beyond the end of the nonextended data set.
11	Data set not open or device marked unusable when I/O was requested.
12	DSCB was not OPEN; DDB address = 0.
13	If extended deleted record support was requested ($DCSBFLG bit 3 on), the referenced sector was not formatted at 128 bytes/sector or the request was for more than one 256-byte sector. If extended deleted record support was not requested ($DSCBFLG bit 3 off), a deleted sector was encountered during I/O.
14	The first sector of the requested record was deleted.
15	The second sector of the requested record was deleted.
16	The first and second sectors of the requested record were deleted.
17	Cache fetch error. Contact your IBM customer engineer.
18	Invalid cache error. Contact your IBM customer engineer.
19	Insufficient table space for data set extent.
20	Insufficient disk storage available for a new extent. No directory member entry available.
21	Insufficient disk storage available for extent. Directory member entry is available, but no storage on volume for allocation of the extent data area.
24	End of tape.
30	Device not a tape.

Tape Return Codes and Tape Post Codes

Return Code	Condition
−1	Successful completion.
1	Exception but no status.
2	Error reading cycle steal status.
3	I/O error; retry count exhausted.
4	Error issuing READ CYCLE STEAL STATUS.
6	I/O error issuing I/O operations.
10	End of data; a tape mark was read.
21	Wrong length record.
22	Device not ready.
23	File protected.
24	End of tape.
25	Load point.
26	Unrecoverable I/O error.
27	SL data set not expired.
28	Invalid blocksize.
29	Offline, in use, or not open.
30	Incorrect device type.
31	Close incorrect address.
32	Block count error during close.
33	Close detected on EOV1.
34	Write − Defective reel of tape.

The following post codes are returned to the event control block (ECB) of the calling program.

Post Code	Condition
−1	Function successful.
101	TAPEID not found.
102	Device not offline.
103	Unexpired data set on tape.
104	Cannot initialize BLP tapes.

READTEXT – Read Text Entered at a Terminal

The READTEXT instruction reads an alphanumeric character string entered by the terminal operator.

The instruction can also print or display a prompt message to request input.

The supervisor places a return code in the first word of the task control block (taskname) whenever a READTEXT instruction causes a terminal I/O operation to occur. If the return code is not a −1, the address of this instruction will be placed in the second word of the task control block (taskname+2). The terminal I/O return codes are described under "Terminal I/O Return Codes" on page 2-377 and also in *Messages and Codes.*

Note: Any references to **31xx** terminals means 3101, 3151, 3161, 3163, and 3164 terminals, unless otherwise noted.

Syntax:

```
label     READTEXT loc,pmsg,PROMPT=,ECHO=,TYPE=,MODE=,
                   XLATE=,SKIP=,LINE=,SPACES=,CAPS=,
                   COMP=,PARMS=(parm1,...,parm8),MSGID=,
                   P1=,P2=

Required:  loc
Defaults:  PROMPT=UNCOND,ECHO=YES,TYPE=DATA,
           MODE=WORD,XLATE=YES,SKIP=0,LINE=current line,
           SPACES=0,MSGID=NO
Indexable: loc,pmsg,SKIP,LINE,SPACES
```

Operand	*Description*
loc	This operand is normally the label of a TEXT statement defining the storage area which is to receive the data. The storage area can be defined by DATA or DC statements, but you must adhere to the format of the TEXT statement. To satisfy the length specification, the input is either truncated or padded to the right with blanks, as necessary. The TEXT statement count field is also updated. If a static screen is in use, null characters are not translated into blanks. The loc operand can also be the label of a BUFFER statement referred to by an IOCB statement. If this is the case, the input is direct; that is, the maximum input count is taken from the word at loc−2, imbedded blanks are allowed, and the final input count is placed in the buffer index word at loc−4. If the length specification is greater than the system buffer size, then the length is limited to the buffer size. If a user buffer is specified on an IOCB statement and you have issued an ENQT to the corresponding terminal, then the user buffer size will apply to the input length.

The maximum line size for the terminal is established by the TERMINAL statement used to define the terminal during system generation. Refer to the TERMINAL statement in the *Installation and System Generation Guide* for information on the default sizes.

pmsg The prompt message. Code the label of a TEXT statement or an explicit text message enclosed in single quotes. The READTEXT instruction issues this prompt according to the parameter you code for the PROMPT keyword.

To retrieve a prompt message from a data set or module containing formatted program messages, code the number of the message you want displayed or printed. You must code a positive integer or a label preceded by a plus sign (+) that is equated to a positive integer. If you retrieve a prompt message, you must also code the COMP= operand. See Appendix E, "Creating, Storing, and Retrieving Program Messages" on page E-1 for more information.

PROMPT=

COND (conditional), to prevent the system from displaying the prompt message if you enter text before the prompt.

If you code PROMPT=COND without specifying a prompt message, the instruction does not wait for input if advance input is not presented; instead, the receiving TEXT buffer is filled with blanks and its input count is set to 0.

UNCOND (unconditional), to have the system display the prompt message without exception. UNCOND is the default.

ECHO= YES (the default), to allow the input text to be printed on the terminal.

NO, if the input text is not to be printed on the terminal. This operand is effective only for devices that require the processor to echo input data for printing.

Note: The ECHO operand in READTEXT is equivalent to PROTECT=YES in other terminal I/O instructions.

MODE= WORD (the default), to end the READTEXT operation when the system encounters a blank character (space). Leading blanks, however, are ignored. Lowercase input characters, including terminal control characters, are converted to uppercase automatically. The 4978 and 4980 terminals, however, leave characters in uppercase or lowercase as entered. A 31xx terminal in block mode with a static screen separates all fields by blanks.

LINE, if the string to be read can include imbedded blanks. Any lowercase characters entered are left in lowercase. For a 31xx terminal in block mode with a static screen and with TYPE=ALL coded, a blank precedes each field.

Any portion of the input that extends beyond the count indicated in the receiving TEXT statement is ignored and is not retained as advance input.

For a 4978, 4979, or 4980 with a static screen, the READTEXT operation normally ends when the instruction fills the entire text field, when it reaches a protected field, or when it reaches the end of the logical line. For a 31xx terminal in block mode, the READTEXT operation normally ends when the instruction fills the entire text field or when it reaches the end of the screen. However, the TYPE operand determines what fields are read in.

The input operation may continue beyond the logical screen boundary to the end of the physical screen. In this case, input continues from the end of each physical screen line to the beginning of the next line.

TYPE= The type of data to be transferred from a 4978, 4979, 4980, or a 31xx terminal in block mode with a static screen.

When a READTEXT has been issued to a 31xx terminal in block mode, any changed fields are reset to an unmodified condition.

Code TYPE=DATA (the default) to transfer only data fields.

Code TYPE=ALL to transfer both protected and data (unprotected) fields.

Code TYPE=MODDATA to transfer only those data fields that have been changed by the terminal operator (4978, 4980, or 31xx terminals in block mode) for static screens.

Code TYPE=MODALL to transfer, along with each changed data field, the protected fields that precede it.

If coded for a 31xx terminal in block mode with static screens, TYPE=MODALL defaults to TYPE=MODDATA.

XLATE= NO, if the input line is not to be translated to EBCDIC. The character-delete and line-delete codes lose their line-editing functions under this option, and MODE=LINE is implied.

For a 31xx terminal in block mode, terminal I/O support does not remove the escape sequences or attribute bytes from the data stream. Also, the TERMCTRL SET,ATTR or TERMCTRL SET,STREAM operands are ignored while the instruction executes. For a description of 31xx escape sequences, refer to the appropriate display terminal description manual.

If the terminal transmits characters in mirror image format and XLATE=NO is coded, the characters will be placed in storage in the terminal's native format.

YES (the default), causes the supervisor to translate the terminal's binary code to EBCDIC, the standard Series/1 representation of data. Code XLATE=YES when you are coding a READTEXT instruction for Series/1-to-Series/1 communication.

SKIP= The number of lines to be skipped before the system performs an I/O operation. For example, if your cursor is at line 2 on a display screen and you code SKIP=6, the system performs the I/O operation on line 8. For a printer, the SKIP operand controls the movement of forms.

The SKIP operand causes the system to display or print the contents of the system buffer.

If you specify a value greater than or equal to the logical page size, the system divides this value by the page size and uses the remainder in place of the value you specify. For roll screens, the logical page size equals the screen's bottom margin minus the number of history lines and the screen's top margin.

LINE= The line number on which the system is to perform an I/O operation. Code a value from 0 to the number of the last usable line on the page or logical screen. The line count begins at the top margin you defined for the printer or display screen. LINE=0 positions the cursor at the top line of the page or screen you defined; LINE=1 positions the cursor at the second line of the page or screen. For roll screens, line 0 equals the screen's top margin plus the number of history lines.

For printers and roll screens, if you code a value less than or equal to the current line number, the system performs the I/O operation at the specified line on the next page or logical screen. For static screens, if you code a value within the limits of the logical screen, the system performs the I/O operation on the line you specified.

If you code a value greater than the last usable line number, the system divides this value by the logical page size and uses the remainder as the line number on which to perform the I/O operation. For example, if you code LINE=22 and your roll screen has a logical page size of 20, the I/O operation occurs on the second line of the logical screen.

The LINE operand causes the system to print or display the contents of the system buffer.

SPACES= The number of spaces to indent before the system performs an I/O operation. SPACES=0, the default, positions the cursor at the beginning of the left side of the page or screen. If the value you specify is beyond the limits of the logical screen or page, the system indents the next line by the excess number of spaces.

When you code the LINE or SKIP operands with SPACES, the system begins indenting from the left margin of the page or screen. If you specify SPACES without coding LINE or SKIP, the system begins indenting from the last cursor position on the line.

For an IBM 31xx terminal in block mode, if no prompt message is specified, a READTEXT instruction will read data from the beginning of the screen and will ignore any cursor positioning by this operand.

CAPS= Converts EBCDIC data received in a READTEXT operation to uppercase characters. This operand is valid only for data that is defined by a TEXT or BUFFER statement.

Code CAPS=Y to convert all the data defined by a TEXT or BUFFER statement to uppercase characters. When specifying CAPS=Y, you must link-edit your program using the autocall feature of $EDXLINK.

To convert a specified number of bytes to uppercase, code that number with the CAPS operand. Capitalization starts from the first byte of the data received. For example, CAPS=3 capitalizes the first three bytes of data defined by the TEXT or BUFFER statement.

The count you specify should not exceed the length of the TEXT or BUFFER statement that contains the data. If the length is exceeded, the operation is still performed, but data beyond the TEXT or BUFFER statement may be modified.

When you code a value with the CAPS operand, the system performs an inclusive OR (IOR) of a X'40' byte to each EBCDIC byte. (See Coding Example 2 at the end of this section.) A lowercase "a" (X'81'), for example, is converted to an uppercase "A" (X'C1'). Characters already capitalized remain unchanged. The IOR operation is performed after the READTEXT instruction reads in the data.

Notes:

1. Coding XLATE=NO and the CAPS operand causes an assembly error.
2. If you specify MODE=WORD with the CAPS operand, the CAPS operand has no effect. MODE=WORD automatically converts lowercase input characters to uppercase.

COMP= The label of a COMP statement. You must specify this operand if the READTEXT instruction is retrieving a prompt message from a data set or module containing formatted program messages. The COMP statement provides the location of the message. (See the COMP statement description for more information.)

PARMS= The labels of data areas containing information to be included in a message you are retrieving from a data set or module containing formatted program messages. You can code up to eight labels. If you code more than one label, you must enclose the list in parentheses.

Note: To use this operand, you must have included the FULLMSG module in your system during system generation. Refer to the *Installation and System Generation Guide* for a description of this module.

MSGID= YES, if you want the message number and 4-character prefix to be printed at the beginning of the message you are retrieving from a data set or module containing formatted program messages. See the COMP statement operand "idxx" for a description of the 4-character prefix.

NO (the default), to prevent the system from printing or displaying this information at the beginning of the message.

Note: To use this operand, you must have included the FULLMSG module in your system during system generation. Refer to the *Installation and System Generation Guide* for a description of this module.

Px= Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Advance Input Considerations

Input that you enter before a program requests it (advance input) normally resides in the system buffer. When your program issues a READTEXT instruction, the instruction immediately reads the advance input from the buffer. If a terminal output operation takes place just before the READTEXT operation, however, the READTEXT instruction does not read the advance input because the terminal output operation has used the system buffer.

31xx Display Considerations

When using a 31xx in block mode, special considerations are required. The most recent TERMCTRL SET,ATTR or its default value determines both the attribute byte to be used for a prompting message and the field to be read. The TERMCTRL SET,ATTR, or its default value, allows the fields for the prompt (if used) and response to be programmed according to one of the attributes allowed by the 31xx. After the data is read from the device, terminal I/O support will remove all the escape sequences from the 31xx data stream before transferring it to your application program. (For a description of 31xx escape sequences, refer to the appropriate display terminal description manual.

In static screen mode, if there is no prompt message, the read will start from the beginning of the screen, regardless of any SKIP, LINE, or SPACES parameters in effect, because the 31xx in block mode does not have a direct read capability.

If a TERMCTRL SET,STREAM=YES is in effect, the data read is converted to EBCDIC. However, the escape sequences and attribute bytes are not removed from the data stream.

A TERMCTRL SET,ATTR=NO has no effect on input data.

Input operations for just the 3151, 3161, 3163, and 3164 terminals operating in block mode are the same as for 31xx terminals except as noted below.

- Wrapped Fields

  The 3151, 3161, 3163, and 3164 terminals in block mode with static screens wrap unprotected fields while 3101 block mode terminals do not. A wrapped unprotected field extends from the last character position on the screen to the first character position on the screen.

  To prevent data from wrapping, ensure that the first character position on the screen is protected from operator input. The first character should be either a protected data character or a field attribute character.

- Input Location Size

  If your buffer is specified for terminal input (with the IOCB statement), the buffer length must be adjusted for terminal escape sequences. Block mode 3151, 3161, 3163, and 3164 terminal escape sequences are, as a general rule, longer than 3101 block mode terminal escape sequences. An input buffer which was previously used for a 3101 block mode terminal may need to be increased for 3151, 3161, 3163, and 3164 block mode terminals.

- Input Translation

  Terminal I/O support will remove only start fields and set buffer address escape sequences from input data. Applications generating their own output data streams with escape sequences such as set character attribute should also issue the corresponding READTEXT operation with XLATE=NO. Unpredictable results will occur if the terminal I/O support attempts to remove escape sequences other than start field and set buffer address.

Syntax Examples

1) Read text into the data area labeled OPTION. The prompt, "ENTER OPTION," is conditional.

```
      READTEXT OPTION,'ENTER OPTION: ',PROMPT=COND
        •
        •
        •
OPTION TEXT LENGTH=2
```

2) Read text into the data area labeled NAME. The prompt, "ENTER YOUR NAME," is unconditional.

```
      READTEXT NAME,'ENTER YOUR NAME: '
        •
        •
        •
NAME TEXT LENGTH=44
```

3) Read text into the data area labeled PASSWORD. The prompt, "ENTER PASSWORD," is unconditional.

```
      READTEXT PASSWORD,'ENTER PASSWORD: ',PROTECT=YES
        •
        •
        •
PASSWORD TEXT LENGTH=8
```

4) Read text into the data area labeled NEXTLINE. The text string can include imbedded blanks because MODE=LINE.

```
      READTEXT NEXTLINE,MODE=LINE
        •
        •
        •
NEXTLINE TEXT LENGTH=80
```

Coding Examples

1) The following example uses a series of READTEXT instructions to set up a logon sequence for employees using an online time-sharing system.

The WELCOME message is displayed on the third line of the screen. This message is followed on the fifth line of the screen by a prompt message requesting entry of a LOGON command. The LOGMSG2 prompt always appears because PROMPT defaults to unconditional. An unconditional PROMPT is then displayed requesting entry of an employee number. If a blank is entered, the logon process ends. Otherwise, the code verifies that the employee number is six digits long. If the employee number is not six digits, a branch to EMPLOYEE causes a retry.

The READTEXT for the password is conditional so that the prompt is not displayed if there is advanced input accompanying a proper length ID number. The READTEXT contains the MODE=LINE keyword so that the text can contain embedded blanks.

A proper match of ID and password is made by calling subroutine CHKPASS. A correct match causes a branch to the GOODPASS label; otherwise, the next sequential instruction is executed which is the beginning of an error routine.

A maximum of four incorrect passwords are examined for each logon attempt. If logon is not successful by the fourth attempt, the process ends.

If the logon is accepted, a READTEXT is issued for a title line. This title line is used on system reports that are produced during the current logon session.

```
LOGON    EQU      *
         PRINTEXT LOGMSG1,LINE=3,SPACES=35
         READTEXT LOGCMD,LOGMSG2,LINE=5,SPACES=35
*
EMPLOYEE EQU   *
         READTEXT EMPNUM,'@ENTER YOUR EMPLOYEE NUMBER'
         IF       (EMPNUM,EQ,BLANK,(1,BYTE)),GOTO,LOGON
         IF       (EMPNUM-1,NE,6),GOTO,EMPLOYEE
*
GETPASS  EQU    *
         READTEXT PASSWORD,'@ENTER PASSWORD',PROMPT=COND,MODE=LINE, X
               TYPE=ALL
*
*                    VERIFY ID NUMBER & PASSWORD
*
         CALL     CHKPASS
         IF       (PASSCHK,EQ,-1),GOTO,GOODPASS
*
BADPASS  EQU    *
         PRINTEXT 'INVALID PASSWORD FOR USERID',SKIP=1
         PRINTEXT EMPNUM
         ADD      BADWORD,1
         IF       (BADWORD,LT,4),GOTO,GETPASS
         MOVE     BADWORD,0
         GOTO     LOGON
           •
           •
           •
         SUBROUT  CHKPASS
           •
           •
           •
         MOVE     PASSCHK,-1
         RETURN
           •
           •
           •
GOODPASS EQU   *
         READTEXT TITLE,TITLEMSG,SKIP=1,MODE=LINE
           •
           •
           •
LOGMSG1  TEXT     ' WELCOME TO ONLINE TIME SHARING'
LOGMSG2  TEXT     ' PLEASE ENTER YOUR LOGON COMMAND'
LOGCMD   TEXT     LENGTH=2
EMPNUM   TEXT     LENGTH=6
PASSWORD TEXT     LENGTH=3
TITLE    TEXT     LENGTH=60
TITLEMSG TEXT     'ENTER A 60 CHARACTER TITLE FOR                    X
               YOUR REPORTS'
BADWORD  DATA     F'0'
BLANK    DATA     C' '
PASSCHK  DATA     F'0'      CODE WORD TO INDICATE
*                           VALIDITY OF PASSWORD
```

2) When you code a value with the CAPS operand, the system generates an IOR instruction to capitalize the specified data. The following example shows the use of the CAPS operand and how you can achieve the same results by coding an IOR instruction directly in your application program.

With the CAPS operand:

```
          •
          •
          •
          READTEXT   A,CAPS=5,MODE=LINE
          •
          •
          •
A         TEXT       LENGTH=5
```

Without the CAPS operand:

```
          •
          •
          •
          READTEXT   A IOR A,X'40',(5,BYTES)
          •
          •
          •
A         TEXT       LENGTH=5
```

3) In the following example, the READTEXT instruction displays a prompt message contained in MSGMOD, a storage-resident message area. Because +MSG8 equals 8, the system retrieves the eighth message in MSGMOD.

```
          READTEXT   NAME,+MSG8,PROMPT=COND,COMP=MSGSTMT
          •
          •
          •
MSG8      EQU        8
          •
          •
          •
          PROGSTOP
NAME      TEXT       LENGTH=8
MSGSTMT   COMP       'SRCE',MSGMOD,TYPE=STG
```

Message Return Codes

The system issues the following return codes when you retrieve a prompt message from a data set or module containing formatted program messages. The return codes are returned in the first word of the task control block (TCB) of the program or task issuing the instruction. The label of the TCB is the label of your program or task (taskname).

Return Code	Description
−1	Message successfully retrieved.
301 − 316.	Error while reading message from disk. Subtract 300 from this value to get the actual return code. See the disk return codes following the READ or WRITE instruction for a description of the code.
326	Message number out of range.
327	Message parameter not found.
328	Instruction does not supply message parameter(s).
329	Invalid parameter position.
330	Invalid type of parameter.
331	Invalid disk message data set.
332	Disk message read error.
333	Storage-resident module not found.
334	Message parameter output error.
335	Disk messages not supported (MINMSG support only).

Terminal I/O Return Codes

The terminal I/O return codes are all listed here and following the PRINTEXT instruction. A complete list of all return codes also can be found in *Messages and Codes*. You must select the group of codes that represents the particular device type you are using. A list of the terminal I/O return code groups follows:

- General Terminal I/O
- Virtual Terminal
- ACCA/Serial Printer Devices
- Interprocessor Communication
- General Purpose Interface Bus
- Series/1-to-Series/1 Adapter.

General Terminal I/O Return Codes

The return codes are returned in the first word of the task control block of the program issuing the instruction.

Return Code	Condition
−1	Successful completion.
1	Device not attached.
2	System error (busy condition).
3	System error (busy after reset).
4	System error (command reject).
5	Device not ready.
6	Interface data check.
7	Overrun received.
8	Printer power has been switched off and switched back on or a power failure has occurred.
9	Printer I/O error retry count exhausted. IOS3101 has detected an invalid data stream from the 3101/316x and 3151 terminals.
>10	A code greater than 10 can indicate multiple errors. To determine the errors, subtract 10 from the code and convert the result to an 8-bit binary value. Each bit (numbering from the left) represents an error as follows: **Bit 0** Unused **Bit 1** System error (command reject) **Bit 2** Not used **Bit 3** System error (DCB specification check) **Bit 4** Storage data check **Bit 5** Invalid storage address **Bit 6** Storage protection check **Bit 7** Interface data check.

If the return code is for devices supported by IOS2741 (2741, PROC) and a code greater than 128 is returned, subtract 128; the result then contains status word 1 of the ACCA. Refer to the *IBM Series/1 Asynchronous Communications Feature Description*, GA34-0243 for help in determining the special error condition.

Virtual Terminal Return Codes

The return codes are returned in the first word of the task control block of the program issuing the instruction.

Return Code	Transmit Condition	Receive Condition
X'8F'	Not applicable.	LINE=nn received.
X'8E'	Not applicable.	SKIP=nn received.
−2	Not applicable.	Line received (no CR).
−1	Successful completion.	New line received.
1	Not attached.	Not attached.
5	Disconnect.	Disconnect.
8	Break.	Break.

A further description of the virtual terminal return codes follows.

LINE=nn (X'8Fnn')
Returned for a READTEXT or GETVALUE instruction if the other program issued an instruction with a LINE= operand. This operand tells the system to do an I/O operation on a certain line of the page or screen. The return code enables the receiving program to reproduce on an actual terminal the output format intended by the sending program.

SKIP=nn (X'8Enn')
The other program issued an instruction with a SKIP= operand. This operand tells the system to skip several lines before doing an I/O operation.

Line Received (−2)
Indicates that an instruction (usually READTEXT or GETVALUE) has sent information but has not issued a carriage return to move the cursor to the next line. The information is usually a prompt message.

New Line Received (−1)
Indicates transmission of a carriage return at the end of the data. The cursor is moved to a new line. This return code and the Line Received return code help programs to preserve the original format of the data they are transmitting.

Not attached (1)
A virtual terminal does not or cannot refer to another virtual terminal.

Disconnect (5)
The other virtual terminal program ended because of a PROGSTOP or an operator command.

Break (8)
Indicates that both virtual terminal programs are attempting to do the same type of operation. When one program is reading (READTEXT or GETVALUE), the return code means the other program has stopped sending and is waiting for input. When one program is writing (PRINTEXT or PRINTNUM), the return code means the other program is also attempting to write.

If you defined only one virtual terminal with SYNC=YES, then that task always receives the break code. If you defined both virtual terminals with SYNC=YES, then the task that last attempted the operation receives the break code.

ACCA/Serial Printer Return Codes

The return codes are returned in the first word of the task control block of the program issuing the instruction.

Return Code	Condition
−1	Successful completion.
80	Attachment detected that Data Set Ready is down for an asynchronous printer.
96	4224 printer is not responding (MODE=VERIFY).

Bits	Value	Description
1−8	ISB	In the case of I/O completion error or when an error is reported as an attention interrupt, refer to the hardware description manual for status on the device you are using.
9	On	Interpret return code as a word value.
10	On	Error reported as an attention interrupt.
11	On	I/O error on write operation.
12	On	I/O error on read operation.
10−12	Off	All 3 bits off: immediate I/O error.
13−15		Immediate I/O condition code +1.

Interprocessor Communication Return Codes

The return codes are returned in the first word of the task control block of the program issuing the instruction.

CODTYPE=	Return Code	Condition
EBCDIC	FDFF	End of transmission (EOT).
EBCDIC	FEFF	End of record (NL).
EBCDIC	FCFF	End of subrecord (EOSR).
EBCD/CRSP	1F	End of transmission (EOT).
EBCD/CRSP	5B	End of record (NL).
EBCD/CRSP	(None)	End of subrecord (EOSR).

General Purpose Interface Bus Return Codes

The return codes are returned in the first word of the task control block of the program issuing the instruction.

Return Code	Condition
−1	Successful completion.
1	Device not attached.
2	Busy condition.
3	Busy after reset.
4	Command reject.
6	Interface data check.
256 +	ISB: Read exception.
512 +	ISB: Write exception.
1024	Attention received during an operation (may be combined with an exception condition).

Series/1-To-Series/1 Return Codes

The return codes are returned in the first word of the task control block of the program issuing the instruction.

Return Code	Condition
−1	Successful.
1	Device not attached.
2	System error (busy condition).
3	System error (busy after reset).
4	System (command reject).
5	Device not ready (not reported for S/1-S/1).
6	Interface data check.
7	Overrun recieved (not reported for S/1-S/1).
138, 154	An error has occurred that can only be determined by displaying the device cycle steal status word with the TERMCTRL STATUS function and checking the bits to determine the cause of the error.
1002	Other system not active.
1004	Checksum error detected.
1006	Invalid operation code or sequence.
1008	Time-out on data transfer.
1010	TERMCTRL ABORT issued by responding processor.
1012	Device reset (TERMCTRL RESET) issued by the other processor.
1014	Microcode load to attachement failed during IPL.

Return Code	Condition
1016	Invalid or unsolicited interrupt occurred.
1050	TERMCTRL ABORT issued and no operation pending.
1052	TERMCTRL IPL attempted by slave processor.
1054	Invalid data length.

RESET – Reset an Event or Process Interrupt

The RESET instruction resets an event or a Process Interrupt.

When an event occurs for which a task is waiting, the task will again become active. If the task subsequently issues another WAIT instruction for the same event, without taking any special action, the event is still defined as having occurred and no wait would be performed. It is necessary to define the event as not occurred to cause a new wait. This is the function of the RESET instruction.

The RESET instruction need not be used for the event defined by the EVENT operand of either a PROGRAM or a TASK statement. RESET must not be used for this event before executing the ATTACH instruction, since RESET will cause the ATTACH to operate as though the task were already attached.

Events are named logical entities which are represented in storage by a system control block called an Event Control Block (ECB). Resetting an event is done physically by setting the first word of its ECB to 0.

Note: Specify the address key of an event to be reset with the task target address key, $TCBADS.

Syntax:

label	**RESET**	**event,P1=**
Required:	**event**	
Defaults:	**none**	
Indexable:	**event**	

Operand	*Description*
event	The label of the event being reset. For process interrupt, use PIx, where x is a user process interrupt number in the range 1–99.
P1=	Parameter naming operand. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code this operand.

Coding Example

The RESET instruction at label RES1 refers to a specific ECB and can operate only on the ECB labeled ECB1.

The RESET instruction at label RES2 uses the parameter naming operand, P1=, to supply the address of the ECB on which RESET is to operate. The application program then ensures that the address of the ECB that is to be cleared is moved to the label named by the P1= operand in the RESET instruction:

```
          •
          •
          •
RES1      RESET  ECB1
          WAIT   ECB1
            •
            •
            •
          MOVEA  ANYECB,WAITECB
RES2      RESET  ECB1,P1=ANYECB
            •
            •
            •
ECB1      ECB
WAITECB   ECB
            •
            •
            •
            •
```

RETURN – Return to the Calling Program

The RETURN instruction provides linkage back to a calling program from a subroutine. Each subroutine must contain at least one RETURN instruction.

Syntax:

label	**RETURN**
Required:	**none**
Defaults:	**none**
Indexable:	**none**

Operand	*Description*
none	none

Coding Example

In the example, each of the three RETURN instructions at labels RET1, RET2, and RET3 causes task execution to resume at the instruction following the RETURN1 label. This occurs because each of the instructions passes control to the instruction following the subroutine call.

```
          •
          •
          •
        CALL    DISKERR,MSGNUMBR
RETURN1 EQU     *
          •
          •
          •
        SUBROUT DISKERR,MSGNO
        IF (MSGNO,EQ,1)
           PRINTEXT '@ DISK DATA SET HAS REACHED END-OF-FILE'
RET1       RETURN
        ELSE
           IF (MSGNO,EQ,2)
              PRINTEXT '@ DISK DATA SET IS NOT CATALOGUED'
RET2          RETURN
           ELSE
              PRINTEXT '@ DISK DATA SET IS READ-ONLY'
           ENDIF
        ENDIF
RET3    RETURN
```

SBIO – Specify a Sensor-Based I/O Operation

The SBIO instruction specifies the sensor-based I/O operation you want to perform.

The instruction has a separate format for analog input, analog output, digital input, and digital output operations. Each of these formats is shown on the following pages.

Options available with the SBIO instruction allow you to:

- Automatically index using a previously defined BUFFER statement.
- Automatically update a buffer address after each operation.
- Use a short form of the instruction, omitting the "loc" operand (data location), to imply a data address within the SBIO control block.

You can also provide PULSE output and manipulate portions of the 16-bit I/O group with the BITS=(u,v) keyword.

The SBIO instruction refers to a 3-to-4-character device label assigned with an IODEF statement. The IODEF statement contains the actual hardware address and the attributes you defined for the I/O device. (See IODEF for a description of how to code the statement.)

SBIO Control Block

Each IODEF statement you code creates a sensor-based input/output control block (SBIOCB) in your application program. The SBIOCB acts as a link between the SBIO operation and the device information contained in the IODEF statement. The SBIOCB, which contains a data I/O area and an event control block (ECB), also serves as a location where the supervisor can either store data (for AI and DI operations) or can fetch data (for AO and DO operations).

When your program executes an SBIO instruction, the supervisor either reads or writes data from or to a location in the IOCB with the label of a specified I/O point (for example, AI1, DI2, DO33, AO1). An application program can refer to these locations in the same way it refers to any other variable. This fact allows you to use the short form of the SBIO instruction (for example, SBIO DI1) and to refer to the label (DI1) in other instructions. You can equate device labels with more descriptive labels. For example, you could equate the device label DI15 with the label SWITCH as follows:

```
SWITCH EQU  DI15
```

You must code the device label, however, in the SBIO instruction.

Each control block also contains an ECB to be used by those operations that require the supervisor to respond to an interrupt and to "post" an operation as complete. Such operations include analog input (AI), process interrupt (PI), and digital I/O with external synchronization (DI/DO). For process interrupt, the label on the ECB is the same as the symbolic I/O point (PI3, for example). For analog and digital I/O, the label is the same as the symbolic I/O point with the suffix "END" (for example, DIxEND).

SBIO Analog Input

Syntax:

```
label    SBIO    AIx,ERROR=,P1=
           or
label    SBIO    AIx,loc,ERROR=,P1=,P2=
           or
label    SBIO    AIx,loc,INDEX,EOB=,ERROR=,P1=,P2=
           or
label    SBIO    AIx,loc,opnd3,SEQ=,ERROR=,P1=,P2=,P3=

Required:    AIx
Defaults:    no indexing, SEQ=NO
Indexable:   loc
```

Operand	*Description*
AIx	The label you assigned to an analog input device on the associated IODEF statement. AIx acts as the label of a single data storage location if you do not specify the loc operand.
loc	Buffer address or location where the system will store analog input. If you do not code the loc operand, the supervisor stores data from the operation in the SBIOCB created for the instruction.
EOB=	You can use this operand for buffer operations with automatic indexing. Code the label of a branch to be taken if: 1. The SBIO operation uses the last element of the buffer you defined. A return code of $OK is placed in the task name. 2. The buffer is full when the SBIO operation begins. The branch occurs without executing the SBIO instruction and the system places a return code of $BFRPFE in the task name. **Note:** If your program branches to the label you defined, you must reset the buffer count.
opnd3	Code INDEX to specify that the system is to do automatic indexing of a buffer you defined. You must define the buffer with a BUFFER statement. If you code a label or a constant for opnd3, the operand is the number of consecutive AI points to be used in the operation or the number of times to repeat the operation on the same point. The SEQ operand determines the function of the operand.
SEQ=	NO (the default), to repeat the operation on the same point the number of times indicated by opnd3. YES, to use the number of consecutive AI points indicated by opnd3 in the operation.

The input voltage converted by the analog-to-digital converter (ADC) is represented in a 16-bit data word by 11 binary bits plus a sign bit, depending on the amplifier range you select. Bits 13−15 of this word contain the binary number representing the range of the AI reading. Bit 12 is 0. (Refer to the *IBM Series/1 4982 Sensor Input/Output Unit Description*, GA34-0027 for a detailed discussion of the analog-to-digital conversion.)

ERROR= The label of the instruction to be executed if the SBIO instruction is unsuccessful after two retries. If you do not code ERROR=, execution proceeds sequentially. In either case, the first word of the task control block contains the return code.

Px= Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Coding Example

This example shows a sensor-based I/O operation using the SBIO instruction and an IODEF statement to read analog input.

```
        IODEF AI1,ADDRESS=72,POINT=5
*
        SBIO  AI1                 DATA INTO LOCATION AI1
        SBIO  AI1,DAT             DATA INTO LOCATION DAT
        SBIO  AI1,BUF,INDEX       AI1 INTO NEXT LOC OF 'BUF'
        SBIO  AI1,(BUF,#1)        AI1 INTO LOCATION (BUF,#1)
        SBIO  AI1,BUF,2,SEQ=YES   READ 2 SEQUENTIAL AI POINTS INTO
*                                 NEXT 2 LOCATIONS OF 'BUF'
*
        SBIO  AI1,BUF,2,SEQ=NO    READ THE SAME POINT TWO TIMES
                                  AND PUT THE INFORMATION IN TWO
                                  LOCATIONS OF 'BUF'
```

Return Codes

The return codes for all SBIO instruction formats are listed under "SBIO (Digital Output)" on page 2-393.

SBIO (Analog Output)

Syntax:

label	**SBIO**	**AOx,ERROR=,P1=**
	or	
label	**SBIO**	**AOx,loc,ERROR=,P1=,P2=**
	or	
label	**SBIO**	**AOx,loc,INDEX,EOB=,ERROR=,P1=,P2=**
Required:	**AOx**	
Defaults:	**no indexing**	
Indexable:	**loc**	

Operand	*Description*
AOx	The label you assigned to an analog output device on the associated IODEF statement. AOx acts as the label of a single data storage location if you do not specify the loc operand.
loc	An explicit constant or the address of the location of the output data. If you do not code the loc operand, the supervisor fetches data from the SBIOCB created for the instruction.
EOB=	You can use this operand for buffer operations with automatic indexing. Code the label of a branch to be taken if: 1. The SBIO operation uses the last element of the buffer you defined. A return code of $OK is placed in the task name. 2. The buffer is logically empty when the SBIO operation begins. The branch occurs without executing the SBIO instruction and the system places a code of $BFRPFE in the task name. **Note:** If your program branches to the label you defined, you must reset the buffer count.
opnd3	Code INDEX to specify that the system is to do automatic indexing of a buffer you defined. You must define the buffer with a BUFFER statement.
ERROR=	The label of the instruction to be executed if the SBIO instruction is unsuccessful after two retries. If you do not code ERROR=, execution proceeds sequentially. In either case, the first word of the task control block contains the return code.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Coding Example

This example shows a sensor-based I/O operation using the SBIO instruction and an IODEF statement to write analog output.

```
        IODEF AO1,ADDRESS=63
*
        SBIO  AO1                 SET AO1 TO VALUE IN 'AO1'
        SBIO  AO1,DATA            SET AO1 TO VALUE IN 'DATA'
        SBIO  AO1,1000            SET AO1 TO 1000
        SBIO  AO1,(0,#1)          SET AO1 TO VALUE IN (0,#1)
        SBIO  AO1,BUF,INDEX       SET AO1 TO VALUE IN NEXT
```

Return Codes

The return codes for all SBIO instruction formats are listed under "SBIO (Digital Output)" on page 2-393.

SBIO (Digital Input)

Syntax:

label	**SBIO**	**DIx,ERROR=,P1=**
	or	
label	**SBIO**	**DIx,loc,ERROR=,P1=,P2=**
	or	
label	**SBIO**	**DIx,loc,INDEX,EOB=,ERROR=,P1=,P2=**
	or	
label	**SBIO**	**DIx,loc,BITS=(u,v),LSB=,ERROR=,P1=,P2=**
	or	
label	**SBIO**	**DIx,loc,opnd3,ERROR=,P1=,P2=,P3=**

Required: **DIx**
Defaults: **no indexing,LSB=15**
Indexable: **loc**

Operand	*Description*
DIx	The label you assigned to a digital input device on the associated IODEF statement. DIx acts as the label of a single data storage location if you do not specify the loc operand.
loc	Buffer address or location where the system will store digital input. If you do not code the loc operand, the supervisor stores data from the operation in the SBIOCB created for the instruction.
EOB=	You can use this operand for buffer operations with automatic indexing. Code the label of a branch to be taken if: 1. The SBIO operation uses the last element of the buffer you defined. A return code of $OK is placed in the task name. 2. The buffer is full when the SBIO operation begins. The branch occurs without executing the SBIO instruction and the system places a code of $BFRPFE in the task name. **Note:** If your program branches to the label you defined, you must reset the buffer count.
opnd3	Code INDEX to specify that the system is to do automatic indexing of a buffer you defined. You must define the buffer with a BUFFER statement. If opnd3 is the label of a variable or a constant representing the count of external synchronization read cycles, you must specify EXTSYNC (external synchronization) in the associated IODEF statement. Specifying EXTSYNC also provides a latched DI operation. The system reads the entire 16-bit group. If you specify EXTSYNC on the IODEF statement but do not code opnd3, the system does a single unsynchronized I/O operation.
BITS=(u,v)	The portion of a DI group to be read starting at bit u, for a length v. Bits are numbered from 0−15. Bit u is the relative bit number starting at 0, within the group or subgroup defined in the IODEF statement.

LSB= Input data is right justified to this bit with all unused bits set to 0. Code this operand only if you coded BITS=. The default is bit 15.

ERROR= The label of the instruction to be executed if the SBIO instruction is unsuccessful after two retries. If you do not code ERROR=, execution proceeds sequentially. In either case, the first word of the task control block contains the return code.

Px= Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Coding Example

This example shows a sensor-based I/O operation using the SBIO instruction and three IODEF statements to read digital input.

```
        IODEF DI1,TYPE=GROUP,ADDRESS=49
        IODEF DI2,TYPE=SUBGROUP,ADDRESS=48,BITS=(7,3)
        IODEF DI3,TYPE=EXTSYNC,ADDRESS=62
*
        SBIO  DI1                     DATA INTO LOC 'DI1'
        SBIO  DI1,DATA                DI1 INTO LOC 'DATA'
        SBIO  DI1,(0,#1)              DI1 INTO LOC (0,#1)
        SBIO  DI1,BUF,INDEX           DI1 INTO NEXT LOC OF 'BUF'
        SBIO  DI1,BDAT,BITS=(3,5)     BITS 3 TO 7 OF DI1 INTO 'BDAT'
*
        SBIO  DI2                     BITS 7-9 OF DI2 INTO 'DI2'
        SBIO  DI2,DAT2                BITS 7 TO 9 OF DI2 INTO 'DAT2'
        SBIO  DI2,D,BITS=(0,3)        BITS 7-9 OF DI2 INTO 'D'
        SBIO  DI2,E,BITS=(0,1)        BIT 7 OF DI2 INTO 'E'
        SBIO  DI2,F,BITS=(2,1),LSB=7  BIT 9 OF DI2 INTO
                                        LOCATION F BIT 7
        SBIO  DI3,G,128               READ 128 WORDS INTO 'G'
                                        USING EXTERNAL SYNC
```

Return Codes

The return codes for all SBIO instruction formats are listed under "SBIO (Digital Output)" on page 2-393.

SBIO (Digital Output)

Syntax:

```
label    SBIO    DOx,ERROR=,P1=
           or
label    SBIO    DOx,loc,ERROR=,P1=,P2=
           or
label    SBIO    DOx,loc,INDEX,EOB=,ERROR=,P1=,P2=
           or
label    SBIO    DOx,loc,BITS=(u,v),LSB=,ERROR=,P1=,P2=
           or
label    SBIO    DOx,loc,opnd3,ERROR=,P1=,P2=,P3=
           or
label    SBIO    DOx,(PULSE,dir),ERROR=

Required:    DOx
Defaults:    no indexing,LSB=15
Indexable:   loc
```

Operand	*Description*
DOx	The label you assigned to a digital output device on the associated IODEF statement. DOx acts as the label of a single data storage location if you do not specify the loc operand.
loc	An explicit constant or the address of the location of the output data. If you do not code the loc operand, the supervisor fetches data from the SBIOCB created for the instruction.
EOB=	You can use this operand for buffer operations with automatic indexing. Code the label of a branch to be taken if: 1. The SBIO operation uses the last element of the buffer you defined. A return code of $OK is placed in the task name. 2. The buffer is logically empty when the SBIO operation begins. The branch occurs without executing the SBIO instruction and the system places a code of $BFRPFE in the task name. **Note:** If your program branches to the label you defined, you must reset the buffer count.
opnd3	Code INDEX to specify that the system is to do automatic indexing of a buffer you defined. You must define the buffer with a BUFFER statement. If you specify a label or constant for opnd3, external synchronization is used.
BITS=(u,v)	Indicates that the specified value is to be written into a portion of the DO group starting at bit u for a length of v. This does not affect the condition of the other bits in the group. Bits are numbered from 0−15. Bit u is the relative bit number starting at 0, within the group or subgroup defined in the IODEF statement.

LSB= Output data is taken from the output word with this bit being the least significant bit. Use this operand only if you coded BITS=. The default is bit 15.

(PULSE,dir) Code this operand to generate a pulse on the digital output group or subgroup you specified. Allowable directions (dir) are ON (or UP) and OFF (or DOWN).

ERROR= The label of the instruction to be executed if the SBIO instruction is unsuccessful after two retries. If you do not code ERROR=, execution proceeds sequentially. In either case, the first word of the task code block contains the return code.

Px= Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Coding Examples

1) This example uses the SBIO instruction and three IODEF statements to write digital output.

```
        IODEF DO3,TYPE=GROUP,ADDRESS=4B
        IODEF DO12,TYPE=SUBGROUP,ADDRESS=4A,BITS=(5,4)
        IODEF DO13,TYPE=EXTSYNC,ADDRESS=4F
*
        SBIO  DO3                VALUE OF LOCATION 'DO3' to DO3
        SBIO  DO3,DODATA         VALUE OF 'DODATA' TO DO3
        SBIO  DO3,1023           SET DO3 TO 1023
        SBIO  DO3,(DATA,#1)      VALUE AT (DATA,#1) TO DO3
        SBIO  DO3,7,BITS=(3,3)   SET BITS 3 TO 5 OF DO3 TO 7
*
        SBIO  DO12,15            SET BITS 5 TO 8 OF DO12 TO 15
        SBIO  DO12,X,BITS=(0,4), SET BITS 5 TO 8 OF DO12
*                                  TO VALUE IN 'X'
        SBIO  DO12,1,BITS=(0,1)  SET BIT 5 OF DO12 TO 1
        SBIO  DO13,Y,80          WRITE 80 LOCATIONS OF 'Y'
                                   TO DO13 EXTERNAL SYNC
```

2) This example shows pulse digital output.

```
        IODEF DO13,TYPE=SUBGROUP,BITS=(3,1)
        IODEF DO14,TYPE=SUBGROUP,BITS=(7,4)
*
        SBIO  DO13,(PULSE,UP)      PULSE DO13 BIT 3 TO ON
*                                    AND THEN OFF
        SBIO  DO14,(PULSE,DOWN)    PULSE DO14 BITS 7-10
*                                    OFF AND THEN ON
```

Return Codes

You can find the return code for an SBIO operation by referring to the first word in the task control block (TCB). The label of the TCB is the label of your program or task (taskname).

Each condition shown below has a return code and an equate for that condition. If you refer to the equate in your program rather than the actual return code, your source code will always be current. You can obtain these equates when using $EDXASM by coding COPY ERRORDEF before the ENDPROG statement in your program.

Return Code	EQU	Description
−1	$OK	Command successful.
90	$DNA	Device not attached.
91	$DNU	Busy or in exclusive use.
92	$BAR	Busy after RESET.
93	$CMDREJ	Command reject.
94	$INVREQ	Invalid request.
95	$IDC	Interface data check.
96	$CTLBSY	Controller busy.
97	$OVRVOLT	AI over voltage.
98	$INVRG	AI invalid range.
100	$INVCHA	AI invalid channel (point).
101	$INVCNT	AI invalid count field (AI/DI/DO count).
102	$BFRPFE	Buffer previously full or empty (indexing).
104	$DCMDREJ	Delayed command reject.

In the following example, the program branches to label REDO if the condition "AI over voltage" occurs. The program refers to the equate $OVRVOLT. Note the use of the leading plus sign (+) with the equate to specify that it is a constant.

```
        SBIO AI1,ERROR=AIERR
          •
          •
          •
AIERR   IF   (taskname,EQ,+$OVRVOLT),GOTO,REDO
```

SCREEN – Convert Graphic Coordinates to a Text String

The SCREEN instruction converts the x and y coordinates that represent a point on a screen to a 4-character text string that becomes the graphic address of the point.

Syntax:

label	**SCREEN text,x,y,CONCAT=,ENHGR=,P1=,P2=,P3=**
Required:	**text,x,y**
Defaults:	**CONCAT=NO,ENHGR=NO**
Indexable:	**none**

Operand	*Description*
text	Location of a text string at least 4 characters long.
x,y	Screen coordinates of a point to be translated. The range is 0–1023 for the full width of the screen and 0–779 for the screen height. You can extend this range by coding the ENHGR operand. Operands x and y can be locations containing data or explicit values, but both must be of the same type.
CONCAT=	Code CONCAT=YES to concatenate the results of the operation to the contents in text. The length of the text string is increased by 4 or 5 if you also code ENHGR=YES. The length of the text string is set to 5 if you code CONCAT=NO and ENHGR=YES. If you code CONCAT=NO and ENHGR=NO, the length of the text string is set to 4.
ENHGR=	YES, to extend the range for the full width of the screen to 0–4095 and to extend the range for the screen height to 0–3120. When you code ENHGR=YES, a 5-character graphic instruction is compiled. NO (the default), not to extend the range for the screen width or height.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Syntax Example

Convert coordinates 520 and 300 to a text string. Concatenate the string to the contents of TEXT1.

```
SCREEN    TEXT1,520,300,CONCAT=YES
```

SETBIT – Set the Value of a Bit

The SETBIT instruction sets the value of a bit to 1 or 0. The bit is "on" if it contains a 1 and "off" if it contains a 0.

You can test to see if a bit is "on" or "off" with the IF instruction. The DO instruction allows your program to do a loop while or until a certain bit is "on" or "off."

Syntax:

label	**SETBIT data1,data2,ON|OFF,P1=,P2=**
Required:	**data1,data2,ON or OFF**
Defaults:	**none**
Indexable:	**data1,data2**

Operand	*Description*
data1	The label of a data string that contains the bit to be set to 1 or 0.
data2	The location in data1 of the bit to be changed. You can code: • An integer or the label of an integer from 1 to 32767. • A hexadecimal value or the label of a hexadecimal value from 1 to 65535 (X'FFFF'). Bit 0 is the leftmost bit of the data area.
ON	Sets the value of the bit to 1.
OFF	Sets the value of the bit to 0.

Syntax Examples

1) Turn on the fifth bit in CONTROL.

```
         SETBIT   CONTROL,BIT,ON
           •
           •
           •
BIT      DATA     F'4'
```

2) Turn off the third bit in CONTROL.

```
         SETBIT   CONTROL,2,OFF
```

3) Turn on bit 15 in STATUS.

```
         SETBIT   STATUS,BIT,ON
           •
           •
           •
BIT      DATA     X'000E'
```

SHIFTL – Shift Data to the Left

The SHIFTL instruction shifts the contents of operand 1 to the left by the number of bit positions specified in operand 2. Vacated positions on the right are filled with zeroes. If operand 2 is a variable, it is assumed to be single-precision, and the shift count is its value.

Note: The precision of opnd2 should not exceed the precision of opnd1.

Syntax:

label	**SHIFTL opnd1,opnd2,count,RESULT=,** **P1=,P2=,P3=**
Required:	**opnd1,opnd2**
Defaults:	**count=1,RESULT=opnd1**
Indexable:	**opnd1,opnd2,RESULT**

Operand	*Description*
opnd1	The label of a data area containing the data to be shifted left. You cannot code a self-defining term.
opnd2	The value by which the first operand is shifted. Code a self-defining term or the label of a data area.
count	The number of consecutive values in opnd1 on which the operation is to be performed. The maximum value allowed is 32767. The count operand can include the precision of the data. Because these operations are parallel (the two operands and the result are implicitly of like precision) only one precision specification is required. That specification can take one of the following forms: **BYTE** Byte precision **WORD** Word precision **DWORD** Doubleword precision
RESULT=	The label of a data area or vector in which the result is to be placed. If you code this operand, opnd1 is not modified.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Syntax Example

The SHIFTL instruction in this example changes the value in the data area labeled A from X'82F1' to X'0BC4' by shifting the bit string two positions to the left.

```
          •
          •
          •
          SHIFTL A,2
          •
          •
          •
          PROGSTOP
A         DATA   X'82F1'     binary 1000 0010 1111 0001
          •
          •
          •
```

After the operation, A equals:

Hexadecimal — X'0BC4'

Binary — 0000 1011 1100 0100

SHIFTR – Shift Data to the Right

The SHIFTR instruction shifts the contents of operand 1 to the right by the number of bit positions specified in operand 2. Vacated positions on the left are filled with zeros. If operand 2 is a variable, it is assumed to be single-precision, and the shift count is its value.

Note: The precision of opnd2 should not exceed the precision of opnd1.

Syntax:

label	**SHIFTR opnd1,opnd2,count,RESULT=,** **P1=,P2=,P3=**
Required:	**opnd1,opnd2**
Defaults:	**count=1,RESULT=opnd1**
Indexable:	**opnd1,opnd2,RESULT**

Operand	*Description*
opnd1	The label of the data area to be shifted. You cannot code a self-defining term.
opnd2	The value by which the first operand is shifted. Code a self-defining term or the label of a data area.
count	The number of consecutive values in opnd1 on which the operation is to be performed. The maximum value allowed is 32767. The count operand can include the precision of the data. Because these operations are parallel (the two operands and the result are implicitly of like precision) only one precision specification is required. That specification can take one of the following forms: **BYTE** Byte precision **WORD** Word precision **DWORD** Doubleword precision
RESULT=	The label of a data area or vector in which the result is to be placed. If you code this operand, opnd1 is not modified.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Syntax Example

The SHIFTR instruction in this example shifts the contents of C 24 bits to the right and stores the result of the operation in the data area labeled E. The value in C remains the same.

```
          .
          .
          .
          SHIFTR C,24,DWORD,RESULT=E
          .
          .
          .
          PROGSTOP
C         DATA   X'A794B109'
E         DATA   X'00000000'
          .
          .
          .
```

Before:

C = X'A794B109'
or
binary 1010 0111 1001 0100 1011 0001 0000 1001

E = X'00000000'
or
binary 0000 0000 0000 0000 0000 0000 0000 0000

After:

C = X'A794B109'
or
binary 1010 0111 1001 0100 1011 0001 0000 1001

E = X'000000A7'
or
binary 0000 0000 0000 0000 0000 0000 1010 0111

SPACE — Insert Blank Lines in a Compiler Listing

The SPACE statement inserts one or more blank lines in a compiler listing.

Because this statement does not generate code or constants in the object program, it can be placed between executable instructions in your source statement data set.

Syntax:

blank	**SPACE**	**value**
Required:	**none**	
Defaults:	**value = 1**	

Operand	*Description*
value	A positive integer specifying the number of blank lines to be inserted. If no value is entered, the system inserts one blank. If the value exceeds the number of lines remaining on the page, the statement has the same effect as an EJECT statement.

Coding Example

See the PRINT statement for an example using SPACE.

SPECPIRT – Return from Process Interrupt Routine

The SPECPIRT instruction returns control to the supervisor from a special process interrupt (SPECPI) routine that you provide. If the routine is in partition 1, control returns to the supervisor with a branch instruction. To return to the supervisor from another partition, your routine must execute a Series/1 assembler SELB instruction after registers R0 and R3 are saved in the level status block (LSB) you select.

You can use SPECPIRT only when you specify TYPE=BIT on the IODEF (Process Interrupt) statement.

Syntax:

label	**SPECPIRT**
Required:	**none**
Defaults:	**none**
Indexable:	**none**

Operand	*Description*
none	none

SQRT – Find the Square Root

The SQRT instruction finds the square root of a double-precision integer variable. The instruction is implemented through the USER instruction facility. It is not included in the supervisor. To use the SQRT instruction you must link-edit your program with $EDXLINK and specify $$SQRT,ASMLIB on an INCLUDE statement.

Syntax:

label	**SQRT**	**rsq,root,rem,P1=,P2=,P3=**
Required:	**rsq,root,rem**	
Defaults:	**none**	
Indexable:	**none**	

Operand	*Description*
rsq	The label of a double-precision integer that the square root routine is to use. This value must be from 0 to 1073741823.
root	The label of a 1-word data area where the square root is to be stored.
rem	The label of a 1-word data area where the remainder is to be stored.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Syntax Example

Calculate the square root of the integer value in VALUE.

```
GETSQRT  EQU     *
         SQRT    VALUE,ROOT,REMAIN
                 •
                 •
                 •
VALUE    DATA    D'0'
ROOT     DATA    F'0'
REMAIN   DATA    F'0'
```

If the data area labeled VALUE contains the number 18611 (X'00004863'), the SQRT instruction would place a result of 136 (X'0088') in ROOT and a remainder of 115 (X'0073') in REMAIN.

STATUS – Set Fields to Check Host Status Data Set

The STATUS instruction defines the fields required to refer to a record in the "System Status Data Set" on the host computer.

TP SET, TP FETCH, and TP RELEASE refer to the label of the STATUS instruction. Refer to the *Communications Guide* for information on how to use the System Status Data Set.

Syntax:

label	**STATUS index,key,length,P1=,P2=,P3=**
Required:	**label,index,key**
Defaults:	**length=0**
Indexable:	**none**

Operand	*Description*
index	A 1–8 alphanumeric character string. This defines an index in the status data set. One or more entries may be associated with this index, each with a unique key field. We suggest that a unique index be specified for each Series/1, but this is not a requirement.
key	A 1–8 alphanumeric character string. The index and key together define a unique status data set entry. A different key might be used for each application program on a Series/1 which communicates to a host.
length	Specifies the length of an optional buffer to be used in the SET, FETCH, and RELEASE functions of the TP instruction. The maximum buffer length, which can be specified in bytes, is 256. If this operand is omitted, no buffer is defined. If a buffer is specified with a length greater than 0, then it can be named by using the Px= operand. The contents of the buffer can be stored in the System Status data set with a TP SET instruction. For a TP FETCH or TP RELEASE, this buffer will serve as an input area.
P1=	Parameter naming operand. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code this operand.

Coding Example

The following coding example shows a use of the STATUS instruction. The host communications facility (HCF) is required to execute the TP instructions that are used in this example.

In this example, a Series/1 program (PROGA) creates a message and sends it to the host computer. The sending Series/1 then waits for another Series/1 program (PROGB, possibly from a different Series/1) to receive the message and acknowledge the receipt by deleting the message.

The STATUS instruction in PROGA, at label STATUSA, defines the index and key needed to refer to a record. The TP SET instruction at label BEGINA makes an entry in the system status data. After creating the entry, PROGA goes into a loop of TP FETCH instructions that ends when the entry is not found.

The STATUS instruction in PROGB, at label STATUSB, defines the same index and key defined in PROGA. PROGB executes a TP FETCH instruction, at label TPB1, in an attempt to fetch the system status data set entry which it defined by the STATUS instruction parameters at label STATUSB.

If PROGA has not yet created the entry (through execution of the TP SET instruction at label BEGINA), an error occurs and PROGB will loop through the TP FETCH instruction until it does find an entry with the required index and key. After finding the entry, the TP RELEASE instruction deletes it and executes a PROGSTOP.

Deleting the entry causes the TP FETCH instruction in PROGA to take the error exit. PROGA then executes a PROGSTOP and ends.

```
PROGA    PROGRAM  BEGINA
STATUSA  STATUS   PROGID,KEYSTRNG
BEGINA   EQU      *
         TP       SET,STATUSA
TPLOOPA  EQU      *
         TP       FETCH,STATUSA,ERROR=ENDIT
         GOTO     TPLOOPA
ENDIT    PROGSTOP
           •
           •
           •
         ENDPROG
         END
```

```
PROGB    PROGRAM  TPLOOP
STATUSB  STATUS   PROGID,KEYSTRNG
TPLOOP   EQU      *
TPB1     TP       FETCH,STATUSB,ERROR=TPLOOPB
TPB2     TP       RELEASE,STATUSB
ENDALL   EQU      *
         PROGSTOP
           •
           •
           •
         ENDPROG
         END
```

STIMER – Set a System Timer

The STIMER instruction sets the system timer for the number of seconds or milliseconds that you specify. You can use the instruction to:

- Delay program execution
- Post an event control block (ECB) in your program after a certain interval has elapsed
- Produce a return code after a certain interval has elapsed.

To avoid unnecessary program delays, you can code the STIMER instruction before instructions that request input, such as READTEXT or GETVALUE. When the instruction prompts an operator for data, the STIMER instruction gives the operator a specific amount of time to respond. If the operator does not respond to the prompt within the interval you specify, your program can continue processing. The STIMER instruction also prevents a program from tying up a terminal indefinitely while waiting for a response.

Syntax:

```
label     STIMER   count,action,SECS,P1=,P2=
             or
label     STIMER   RESET

Required:   count or RESET
Defaults:   count in milliseconds
Indexable:  count
```

Operand	*Description*
count	A positive integer or the label of a positive integer (a word value) that specifies the timer setting in milliseconds or seconds. The minimum timer setting is either 1 millisecond or second. The maximum setting is either 65535 milliseconds or seconds. **Note:** When using a 4952, 4954, or 4956 processor, the minimum setting should not be less than 3 milliseconds.
action	Specifies how the system timer operates. You can code one of three options: WAIT, TIO, or ecbad. If you omit this operand and specify SECS, you must code a comma in its place to show that you have left the positional operand blank. In addition, if you do not code one of the three options, you must code a subsequent WAIT instruction with the keyword TIMER specified as the event for which you are waiting.

The timer options are as follows:

WAIT Suspends program execution until the interval you specified on the count operand has expired.

TIO Provides a return code of −5 in the task control block of the task containing the STIMER instruction when the interval you specified on count operand has expired. The first word of the task control block will contain the return code.

Use this option when you want to set a time limit on an instruction that requests operator input.

ecbad Code the label of an event control block (ECB) that the system posts when the interval you specified on the count operand has expired. The system places a value of −5 in the ECB.

Note: If the ECB to be posted is in another partition, you must move the address space of the ECB into $TCBADS before executing the STIMER instruction. The address space is equal to the partition number minus 1. An ECB in partition 2, for example, is in address space 1.

SECS Specifies that the value of the count operand is in seconds rather than milliseconds.

RESET Cancels the timer if the event the program is waiting for occurs before the interval on the timer has expired. You must code STIMER with RESET when you have specified TIO or ecbad on a previous STIMER instruction.

When you specify TIO, code an STIMER with RESET following the instruction that has the time limit on it. When you specify ecbad, code an STIMER with RESET following the WAIT instruction that waits for the ECB to be posted. Both uses of the RESET operand are shown in the coding examples for this instruction.

Px= Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Special Considerations

The following are some special considerations to keep in mind when you code the STIMER instruction:

- If you code an error exit routine that your program can call while a timer is set, you must reset the timer in your routine.
- Two STIMER instructions without an intervening WAIT will cause the interval specified by the first STIMER instruction to be replaced by the interval specified by the second STIMER instruction.
- With a 2741 terminal, if you use the TIO option of STIMER to set a timer for an instruction that requests input (for example, a READTEXT), normal program execution can be affected if the interval on the timer is allowed to expire. When the timer expires, the 2741 will be in a transmit state. For this reason, the device will be unable to do any output operations, such as a PRINTEXT. In this case, your program must reissue the instruction that requested input and an operator must respond to it by pressing the attention or RETURN key.

Syntax Examples

1) The STIMER instruction starts a 20-second timer. The WAIT instruction suspends task execution until the 20-second interval has elapsed. The WAIT instruction is required because the STIMER instruction does not specify one of the timer options.

```
S1      STIMER  20,,SECS
          •
          •
          •
        WAIT    TIMER
```

2) The STIMER instruction sets a timer for 30000 milliseconds. Execution does not resume until after that interval has elapsed.

```
S2      STIMER  30000,WAIT
```

3) The MOVE instruction moves a value of 100 into SECONDS. The parameter naming operand on the STIMER instruction, P1=, receives the value for the count operand. The STIMER instruction halts task execution for 100 seconds, then passes control to the instruction following the S3 label.

```
        MOVE    SECONDS,100
S3      STIMER  0,WAIT,SECS,P1=SECONDS
```

Coding Examples

1) In the following example, the STIMER instruction at label S1 sets a timer for 120 seconds. If the operator does not enter his name within that period, the system places a return code of −5 in the task control block of the task. If the operator enters his name within the time limit, the STIMER with RESET following the READTEXT instruction cancels the portion of time remaining on the timer.

```
          •
          •
          •
        ENQT
S1      STIMER    120,TIO,SECS
        READTEXT  INPUT,'ENTER YOUR NAME',SKIP=1
        STIMER    RESET
        DEQT
          •
          •
          •
```

2) In this example, the STIMER instruction at the label TIME sets a timer for 60 seconds. Because the instruction contains the label of the event control block TIMEOUT, the system will post TIMEOUT if the 60-second interval expires before an event occurs. The STIMER with RESET following the WAIT instruction will cancel any time remaining on the timer if the system posts the ECB being waited on before the 60 seconds have elapsed.

```
          •
          •
          •
        RESET    TIMEOUT
          •
          •
          •
TIME    STIMER   60,TIMEOUT,SECS
          •
          •
          •
        WAIT     TIMEOUT
        STIMER   RESET
          •
          •
          •
        PROGSTOP
TIMEOUT ECB
```

3) The STIMER instruction at label TIME1, in the following example, sets a timer for 180 seconds. When the interval expires, the system will post ECB1 unless the ECB is posted before that event. If the ECB is posted before the interval expires, the STIMER instruction at TIME2 prevents the system from posting the ECB again.

```
          •
          •
          •
         RESET    ECB1
         MOVE     TIME,180
         MOVEA    ECBADDR,ECB1
TIME1    STIMER   0,*,SECS,P1=TIME,P2=ECBADDR
         WAIT     ECB1
TIME2    STIMER   RESET
         IF       (ECB1,EQ,-5),GOTO,TIMEOUT
           •
           •
           •
TIMEOUT  PRINTEXT 'TIMER HAS EXPIRED'
         PROGSTOP
ECB1     ECB
```

4) In the following example, the STIMER instruction at label SET sets a timer for 600 milliseconds. If the operator does not respond to the prompt message within the time interval, the system places a return of −5 in the first word of the task control block (TCB). The STIMER instruction at label RESET cancels any remaining time on the timer if the operator responds to the prompt message within 600 milliseconds. The IF instruction tests the return code to see if the interval has expired.

```
DATA     PROGRAM  START
           •
           •
           •
SET      STIMER   600,TIO
         READTEXT HOLD,'ENTER YOUR WEIGHT',SKIP=1
RESET    STIMER   RESET
         IF       (DATA,EQ,-5),GOTO,TIMEOUT
           •
           •
           •
TIMEOUT  PRINTEXT 'TIMER HAS EXPIRED'
```

Return Code

The return code is returned in the first word of the task control block (TCB) of the program or task issuing the instruction. The label of the TCB is the label of your program or task (taskname).

Return Code	Description
−5	Interval has expired.

STORBLK – Define Mapped and Unmapped Storage Areas

The STORBLK statement defines the size and number of the storage areas your program can obtain with the GETSTG instruction. The SWAP instruction uses the mapped storage area which you define with this statement to gain access to the unmapped storage areas that you define.

Note: "Mapped storage" is the physical storage you defined on the PARTS operand of the SYSPARTS statement during system generation. " Unmapped storage" is any physical storage that you did not include on the PARTS operand of the SYSPARTS statement.

The STORBLK statement also creates a storage control block that:

- Contains the address of the mapped storage area your program acquires with GETSTG.
- Contains the location of and entries for the unmapped storage areas your program acquires with the GETSTG instruction.
- Records which unmapped storage area your program is using.

Your program can refer to the various fields in the storage control block by using the equates contained in the STOREQU module. To use these equates, code

```
COPY    STOREQU
```

in your program. The STOREQU equates that may be of most use to you when coding your program are shown following the instruction operands.

The system releases the mapped and unmapped storage areas you defined with a STORBLK statement if the program containing the statement issues a PROGSTOP, if a program check occurs, or if you cancel the program with the $C command. You can also release storage areas with the FREESTG instruction.

Syntax:

label	**STORBLK TWOKBLK=,MAX=,EXT=**
Required:	**label,TWOKBLK=,MAX=**
Defaults:	**EXT=(points to an address in the storage control block)**
Indexable:	**none**

Operand ***Description***

TWOKBLK=

The size of the mapped storage area in 2K-byte blocks. Each 2K-byte block is equal to 2048 bytes of storage. Code a positive integer. The unmapped storage areas you define with the MAX= operand will also be this size.

The maximum value you can specify for this operand is 31.

MAX= The number of unmapped storage areas your program requires. The GETSTG instruction obtains these unmapped storage areas for your program.

EXT= The label of an optional area outside the storage control block where the values that point to the unmapped storage areas can reside. The word size of this area must be equal to twice the value of the TWOKBLK parameter times the MAX parameter. For example, if you specify TWOKBLK=2 and MAX=8, the extension area would have to be 32 words long.

You must initialize each word of the extension area to −1 (X'FFFF').

If you do not code this operand, the STORBLK statement generates an area to store the values that point to the unmapped storage areas that your program obtains.

STOREQU Equates

You may find the following equates helpful when coding a program that uses unmapped storage:

$STORMAP Address of the mapped storage area.

$STORMPK Address space of the mapped storage area (partition number minus one).

Syntax Examples

1) Defines a mapped storage area of 40K bytes and two unmapped storage areas of 40K bytes each.

```
BLOCK     STORBLK    TWOKBLK=20,MAX=2
```

2) Defines a mapped storage area of 20K bytes and four unmapped storage areas of 20K bytes each.

```
BLOCK1    STORBLK    TWOKBLK=10,MAX=4
```

3) Defines a mapped storage area of 4K bytes and eight unmapped storage areas of 4K bytes each. The values that point to these unmapped storage areas reside in A. Note that the extension area is 32 words long because your program specifies TWOKBLK=2 and MAX=8. You must initialize the extension area to '−1'.

```
BLOCK2    STORBLK    TWOKBLK=2,MAX=8,EXT=A
A         DC         32F'-1'
```

4) Defines a mapped storage area of 2K bytes and 20 unmapped storage areas of 2K bytes each. The values that point to these unmapped storage areas reside in HOLD.

```
BLOCK2    STORBLK    TWOKBLK=1,MAX=20,EXT=HOLD
HOLD      DC         40F'-1'
```

Coding example

See the SWAP instruction for a coding example that contains the STORBLK statement.

SUBROUT – Define a Subroutine

The SUBROUT statement defines a callable subroutine. You can pass up to five parameters, or arguments, to the subroutine. The subroutine must include a RETURN instruction to provide linkage back to the calling task. Nested subroutines are allowed, and a maximum of 99 subroutines are permitted in each Event Driven Executive program. If a subroutine is to be assembled as an object module which can be link-edited, an ENTRY statement must be coded for the subroutine entry point name.

You can call a subroutine from more than one task. When called, the subroutine executes as part of the calling task. Because subroutines are not reentrant, you should ensure serial use of the subroutine with the ENQ and DEQ instructions.

Note: Do not code a TASK statement within a subroutine.

Syntax:

label	**SUBROUT name,par1,...,par5**
Required:	**name**
Defaults:	**none**
Indexable:	**none**

Operand	*Description*
name	Name of the subroutine.
par1,...	Names used within the subroutine for arguments or parameters passed from the calling program. These names must be unique to the complete program. All parameters defined outside the subroutine are known within the subroutine. Thus, only parameters which may vary with each call to a subroutine need to be defined in the SUBROUT statement. These parameters are defined automatically as single-precision values. For instance, assume you have two calls to the same subroutine. At the first, parameters A and C are to be passed, while at the second, B and C are to be passed. Because C is common to both, it need not be defined in the SUBROUT statement. However, a new parameter D would be specified to account for passing either A or B.

Coding Example

The CALL instruction in this example calls the subroutine named CHKBUFF. The calling program passes two parameters to the CHKBUFF subroutine. The first parameter, BUFFLEN, is a variable containing the maximum allowable buffer count. The second parameter, BUFFEND, is the address of the next instruction to be executed if the buffer is full.

```
         CALL     CHKBUFF,BLEN,BEND
          •
          •
          •
         SUBROUT  CHKBUFF,BUFFLEN,BUFFEND
*
         SUBTRACT BUFFLEN,1
         IF       (BUFFLEN,GE,MAX)
            GOTO  (BUFFEND)
         ENDIF
         ADD      BUFFLEN,1
         RETURN
*
*
MAX      DATA     F'256'
```

SUBTRACT – Subtract Integer Values

The SUBTRACT instruction subtracts an integer value in operand 2 from an integer value in operand 1. The values can be positive or negative. (See the DATA/DC statement for a description of the various ways you can represent integer data.) To subtract floating-point values. use the FSUB instruction.

You can abbreviate this instruction as SUB.

EDX does not indicate an overflow condition for this instruction.

Syntax:

label	**SUBTRACT opnd1,opnd2,count,RESULT=,PREC=,** **P1=,P2=,P3=**
Required:	**opnd1,opnd2**
Defaults:	**count=1,RESULT=opnd1,PREC=S**
Indexable:	**opnd1,opnd2,RESULT**

Operand	*Description*
opnd1	The label of the data area from which opnd2 is subtracted. Opnd1 cannot be a self-defining term. The system stores the result of the SUBTRACT operation in opnd1 unless you code the RESULT operand.
opnd2	The value subtracted from opnd1. You can specify a self-defining term or the label of a data area. The value of opnd2 does not change during the operation.
count	The number of consecutive values in opnd1 on which the operation is to be performed. The maximum value allowed is 32767.
RESULT=	The label of a data area or vector in which the result is placed. Opnd1 is not changed if you specify RESULT. This operand is optional.
PREC=xyz	Specify the precision of the operation in the form xyz, where x is the precision for opnd1, y is the precision for opnd2, and z is the precision of the result ("Mixed-Precision Operations" on page 2-417 shows the precision combinations allowed for the SUBTRACT instruction). You can specify single-precision (S) or double-precision (D) for each operand. Single-precision is one word in length; double-precision is two words in length. The default for opnd1, opnd2, and the result is single-precision. If you code a single letter for PREC, the letter applies to opnd1 and the result. Opnd2 defaults to single precision. If, for example, you code PREC=D, opnd1 and the result are double-precision and opnd2 defaults to single-precision. If you code two letters for PREC, the first letter applies to opnd1 and the result, and the second letter applies to opnd2. With PREC=DD, for example, opnd1 and the result are double-precision and opnd2 is double-precision.

Px= Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Mixed-Precision Operations

The following table lists the precision combinations allowed for the SUBTRACT instruction:

opnd1	opnd2	Result	Precision
S	S	S	S (the default)
S	S	D	SSD
D	S	D	D
D	D	D	DD

Syntax Examples

1) Subtract 2 from 5 and place the result of the operation in C.

```
          SUB    A,B,RESULT=C     SINGLE-PRECISION SUBTRACT
           •
           •
           •
          PROGSTOP
A         DATA   F'5'
B         DATA   F'2'
C         DATA   F'0'
           •
           •
           •
```

2) Subtract the value at the address defined by 2 plus the contents of #2 from the value in data area A. Replace the contents of A with the results of the operation.

```
           •
           •
           •
          SUB    A,(2,#2)   SUBTRACT DATA AT (2,#2) FROM A
           •
           •
           •
          PROGSTOP
A         DATA   F'10'
           •
           •
           •
```

SWAP – Gain Access to an Unmapped Storage Area

The SWAP instruction gains access to an unmapped storage area you obtained with the GETSTG instruction. Your program gives up the use of a block of mapped storage you obtained with GETSTG to gain access to one or more blocks of unmapped storage.

Note: "Mapped storage" is the physical storage you defined on the SYSPARTS statement during system generation. "Unmapped storage" is any physical storage that you did not include on the SYSPARTS statement.

Refer to the *Language Programming Guide* for more information on how to code programs that use unmapped storage.

Syntax:

label	**SWAP**	**name,number,ERROR=,P1=,P2=**
Required:	**name**	
Defaults:	**value of 0 for number**	
Indexable:	**none**	

Operand	*Description*
name	The label of a STORBLK statement that defines the mapped and unmapped storage areas this instruction uses.
number	The number of the unmapped storage area that you want to use. Your program has access to this area until it issues another SWAP instruction. The number must be from 0 to the maximum number of unmapped storage areas you defined on the STORBLK statement. You can code a positive integer or the label of a positive integer. By coding 0 for this operand, your programs regains access to the mapped storage area. It is your responsibility to keep track of the contents of each unmapped storage area.
ERROR=	The label of the first instruction of the routine to receive control if an error condition occurs while this instruction is executing.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Syntax Examples

1) Get access to the second unmapped storage area defined in the STORBLK statement, BLOCK.

```
        SWAP    BLOCK,2
```

2) Get access to the fourth unmapped storage area defined in the STORBLK statement, BLOCK.

```
        SWAP    BLOCK,A
         •
         •
         •
A       DATA    F'4'
```

Coding Example

The following program reads payroll data into three unmapped storage areas, updates the data, and writes the data back to a disk data set. The program begins by acquiring a mapped storage area of 2K bytes and three unmapped storage areas of 2K bytes apiece. The STORBLK statement at label A defines the size of the mapped storage area and the number of unmapped storage areas to be acquired.

The MOVE instruction at label M1 moves the address of the mapped storage area into register 1. The MOVE instruction uses the STOREQU equate $STORMAP to find the address. The MOVE instruction at label M2 moves the number of the first unmapped storage area the program uses into the COUNT field. The DO loop beginning at label LOOP1 executes a SWAP instruction that gives up access to the mapped storage area and uses its segmentation register to get access to the first unmapped storage area. The READ instruction reads 8 records into the first unmapped storage area. The program updates the COUNT field and reads 8 records into the next unmapped storage area.

When the program reads the payroll records into each of the unmapped storage areas, the COUNT field is reset to 1, and the loop at label LOOP2 begins. This DO loop moves the data in PAYCODE into the PAYCODE field of each record in the unmapped storage area. The WRITE instruction then writes the records back to the disk data set. The loop continues until the program has updated the records in each unmapped storage area.

The FREESTG instruction releases the mapped and unmapped storage areas acquired with the GETSTG instruction. This instruction also restores the segmentation register values for the mapped storage area.

```
PAYROLL   PROGRAM   START,DS=(PAYROLL)  GET MAPPED AND UNMAPPED AREAS
START     EQU       *                   GET MAPPED AREA ADDRESS FROM
          GETSTG    A,TYPE=ALL          STORAGE CONTROL BLOCK
M1        MOVE      #1,A+$STORMAP       FIRST UMMAPPED AREA
*
M2        MOVE      COUNT,1
*
LOOP1     DO        3                   FOR EACH UNMAPPED AREA
SWAP1       SWAP      A,COUNT           SUBSTITUTE UNMAPPED AREA
            READ      DS1,(0,#1),8      READ IN DATA FROM DISK
            ADD       COUNT,1           GET NEXT UNMAPPED AREA
          ENDDO
          MOVE      COUNT,1             FIRST UNMAPPED AREA
LOOP2     DO        3                   FOR EACH UNMAPPED AREA
SWAP2       SWAP     A,COUNT
LOOP3       DO       8                  FOR RECORDS IN UNMAPPED AREA
              MOVE     (+PYCD,#1),PAYCODE   UPDATE PAYCODE
              ADD      #1,256           NEXT RECORD
            ENDDO
            MOVE     #1,A+$STORMAP      GET MAPPED AREA ADDRESS
            WRITE    DS1,(0,#1),8       WRITE BACK TO DISK
           ADD      COUNT,1             GET NEXT UNMAPPED AREA
        ENDDO
        FREESTG   A,TYPE=ALL
        PROGSTOP
A       STORBLK   TWOKBLK=1,MAX=3
COUNT   DATA      F'0'
PAYCOD  DATA      F'0'
PYCD    EQU       10                  PAYCODE FIELD IS 10 BYTES
*                                     INTO RECORD
        COPY      STOREQU
        ENDPROG
        END
```

Return Codes

Return codes are returned in the first word of the task control block (TCB) of the program or task issuing the instruction. The label of the TCB is the label of your program or task (taskname).

Return Code	Description
−1	Successful completion.
1	The number of the unmapped storage area you request is beyond the number of areas defined on the STORBLK statement.
2	SWAP area is not initialized.
100	No unmapped storage support in the system.

TASK – Define a Program Task

The TASK statement defines a task that executes asynchronously with the task that starts or "attaches" it. The system executes tasks according to their priority. Use the PROGRAM statement to define the primary task or main program.

Each task in a program, except the primary task, begins with a TASK statement and must end with an ENDTASK statement.

If you want to link-edit your program, place all TASKS you wish to attach using the ATTACH instruction in the same module. The assembler will only chain TASKS within the module it assembles. Your application program will have to chain the TASKS together if they are not within the same module. Modify the correct field in the TCB to chain tasks across modules.

Code TASK statements only within main programs, not within subprograms (MAIN=NO on the PROGRAM statement).

Syntax:

taskname	**TASK**	**start,priority,EVENT=,TERMERR=,FLOAT=, ERRXIT=**
Required:	**taskname,start**	
Defaults:	**priority=150,FLOAT=NO**	
Indexable:	**none**	

Operand	*Description*
taskname	The label you assign to the task. The system generates a control block for each task in the program. Refer to this control block as the task control block (TCB). The system generates the TCB when it encounters an ENDPROG statement. The label of the task's TCB is the label you specify with this operand. The supervisor uses the TCB to store instruction return codes. By referring to the TCB (the taskname) in your program, you can determine if an operation completed successfully.
start	The label of the first instruction you want the system to execute when the task first attaches.
priority	The priority you assign to the task. The range is from 1 (highest priority) to 510 (lowest priority). Tasks with priorities 1–255 run on hardware interrupt level 2 and those with 256–510 run on hardware interrupt level 3. Priorities rank tasks according to their real-time needs for processor time. Priority assignments must, therefore, account for other programs expected to be executing simultaneously.
EVENT=	Name of an end event. This event will be posted as complete at end of this task. The attaching task can, if desired, synchronize its operation by issuing a WAIT for this event. Do not define this event name explicitly by an ECB since your system generates it automatically.

TERMERR =

The label of the routine to receive control if an unrecoverable terminal I/O error occurs.

If such an error occurs, the first word of the task control block (TCB) contains the return code indicating the error. The second word of the TCB contains the address of the instruction that was executing when the error occurred. If you do not code TERMERR, the return code is available in the task code word. You should use TERMERR for detecting errors because the task code word is subject to modification by numerous system functions. Therefore, it may not always reflect the true status of terminal I/O operations.

FLOAT = YES, if this task uses floating-point instructions.

NO (the default), if this task does not use floating-point instructions.

ERRXIT = Specifies the label of a three-word list. That list points to a routine which is to receive control if a hardware error or program exception occurs while this task is executing. Prepare the task error exit routine to handle any type of program or machine error completely. Refer to the *Language Programming Guide* for additional information on the use of task error exit routines. It is often necessary to release resources even though your program cannot continue because of an error. This is the case if the primary task is part of a program which shares resources with other programs. These resources may be, for example, QCBs, ECBs, or Indexed Access Method update records. The supervisor does not release resources for you, but the task error exit facility allows you to take whatever action is appropriate.

The format of the task error exit list is:

WORD 1 The count of the number of parameter words which follow (always F'2').

WORD 2 The address of the user's error exit routine.

WORD 3 The address of a 24-byte area. Two types of informational code are placed here from the point where an error occurred before the exit routine is entered. These are the Level Status Block (LSB) and the Processor Status Word (PSW). Refer to a Series/1 processor description manual for a description of the LSB and PSW.

A default task error exit routine is available to aid in problem diagnosis and correction. (Refer to the *Language Programming Guide* for a detailed description of this routine and how to use it in your application program.)

Coding Example

The following example shows the use of the TASK statement in a program with multiple tasks. The program reads a record from the data set MYFILE and prints the first 8 bytes of that record. The program begins by attaching TASK1. TASK1 is the label of a TASK statement. TASK1 prints the message at label P1 and reads a record from MYFILE into the buffer BUF. The MOVE instruction moves the first 8 bytes of BUF into the text buffer labeled REC. When TASK1 ends, it signals the event by posting the ECB at label ECB1.

The main program attaches the task at label TASK2. The WAIT instruction at label W1 checks ECB1 to see if TASK1 has completed. TASK2 then enqueues the printer and prints the contents of REC. When TASK2 ends, it posts the event specified on the EVENT= operand of the TASK statement. The main program receives control and the WAIT instruction at label W2 checks to see if TASK2 has ended. The PRINTEXT instruction at label P4 prints the message "PROGRAM COMPLETE" and the program ends.

```
READTASK    PROGRAM    START,DS=((MYFILE,EDX40))
START       EQU        *
            ATTACH     TASK1
            ATTACH     TASK2
W2          WAIT       EVENT
P4          PRINTEXT   'PROGRAM COMPLETE',SKIP=2
            PROGSTOP
ECB1        ECB
BUF         BUFFER     256,BYTES
REC         TEXT       LENGTH=8
************************************************
TASK1       TASK       NEXT
NEXT        ENQT       $SYSPRTR
P1          PRINTEXT   '@TASK1 ATTACHED'
            READ       DS1,BUF,1
            MOVE       REC,BUF,(8,BYTES)
            POST       ECB1
            DEQT       $SYSPRTR
            ENDTASK
************************************************
TASK2       TASK       W2,EVENT=EVENT
W1          WAIT       ECB1
            ENQT       $SYSPRTR
P2          PRINTEXT   '@TASK2 ATTACHED',SKIP=1
P3          PRINTEXT   REC,SKIP=1
            DEQT       $SYSPRTR
            ENDTASK
************************************************
            ENDPROG
            END
```

TCBGET – Get Task Control Block Data

The TCBGET instruction obtains data from a specified field in the task control block (TCB) of the currently executing task.

Syntax:

label	**TCBGET opnd1,opnd2,P1=**
Required:	**opnd1**
Defaults:	**$TCBVER (opnd2)**
Indexable:	**opnd1**

Operand	*Description*
opnd1	The label of a one-word data area where the system stores the specified TCB field.
opnd2	This operand determines which TCB field the system will copy. If you do not code this operand, the default $TCBVER will be used. $TCBVER contains the address of the current TCB. Code this operand using any of the TCB equate names. Some examples are: **$TCBCO** The first word of the TCB. **$TCBCO2** The second word of the TCB. **$TCBADS** The current address key. **$TCBVER** The address of the current TCB. You will find a complete list of TCB equates in the *Internal Design.* **Note:** Spell entries for this operand as specified in the TCB equates. The EDX assembler may not flag ones you spell incorrectly.
P1=	Parameter naming operand. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code this operand.

Syntax Examples

1) The following example does not include code for opnd2. Therefore, it defaults to $TCBVER. The system stores the contents of $TCBVER (current TCB address) at variable A.

```
LABEL1   TCBGET    A
           •
           •
           •
A        DATA      F'0'
```

2) In this example, the contents of the TCB field $TCB are stored in software register 1.

```
LABEL2   TCBGET    #1,$TCBCO
```

TCBPUT – Store Data in a Task Control Block

The TCBPUT instruction stores a value in the specified field of the task control block (TCB) of the currently executing task.

Syntax:

label	**TCBPUT opnd1,opnd2,P1=**
Required:	**opnd1**
Defaults:	**$TCBCO (opnd2)**
Indexable:	**opnd1**

Operand	*Description*
opnd1	The TCB field opnd2 points to and the data your system stores in opnd1. You can specify the label of a one-word data area containing the data to be stored or you can specify a self-defining term.
opnd2	This operand specifies which TCB field the system will modify. Use the following names and corresponding fields in opnd2: **$TCBCO** The first word of the TCB. **$TCBCO2** The second word of the TCB. **$TCBADS** The current address key. A complete list of TCB equates is in the *Internal Design*. **Note:** Spell entries for this operand as specified in the TCB equates. The EDX assembler may not flag ones you spell incorrectly.
P1=	Parameter naming operand. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code this operand.

Syntax Examples

1) The following program example moves the value 7 into the first word of the TCB. It allows opnd2 to default to $TCBCO.

```
LABEL1   TCBPUT    +7
```

2) Your system adds 6 to the contents of the word at the address to which #2 points. It then stores the result in the $TCBADS field of the current TCB.

```
LABEL2   TCBPUT    (6,#2),$TCBADS
```

TERMCTRL – Request Special Terminal Function

The TERMCTRL instruction requests the execution of special terminal-control functions. The functions available with the TERMCTRL instruction vary depending on the device you are using.

The supervisor places a return code in the first word of the task control block (taskname) whenever a TERMCTRL instruction causes a terminal I/O operation to occur. If the return code is not a −1, your system places the address of this instruction in the second word of the task control block (taskname+2). The terminal I/O return codes are described at the end of the PRINTEXT and READTEXT instruction sections in this book and in this section with TERMCTRL instruction descriptions for individual printers. Return codes are also located in *Messages and Codes.*

TERMCTRL Functions Chart

The chart on the following pages shows the devices to which you can issue a TERMCTRL instruction, and the various functions available with each device. The device names appear across the top of the chart and the functions for these devices are listed down the left side of the chart. You will find the syntax of the TERMCTRL instruction for each of these devices on the pages that follow the chart.

All 3151, 3161, 3163, and 3164 devices listed below describe operations in 3101 emulation block mode. Refer to each device's respective hardware manual for information on other types of operations. The 4975 terminal device described on this chart does not include the 4975-01A ASCII Printer because this printer uses data streams and not TERMCTRL statements to control its operations. ("Request Special Terminal Function (4975-01A)" on page 2-316 explains data streaming on the 4975-01A ASCII Printer.)

Functions	2741	3101C	3101B	3151B	3161B	3163B	3164B
BARCODE							
BLANK FIELD			X	X	X	X	X
BLANK SCREEN			X	X	X	X	X
BLINK CURSOR							
BLINK FIELD			X	X	X	X	X
BOLD							
CHARSET							
DELFONT							
DENSITY							
DISABLE							
DISPLAY	X	X	X	X	X	X	X
DOUBLESTRIKE							
DOUBLEWIDTH							
ENABLE							
ENABLEA							
ENABLEAT							
ENABLET							
GETSTORE							
HIGH/LOW intensity			X	X	X	X	X
INITFONT							
ITALICS							
LOADFONT							
LOCK/UNLOCK keyboard			X	X	X	X	X
LPI (LINE SPACING)							
OVERSCORE							
PRINT COLOR							
PRINT DENSITY							
PF							
PUTSTORE							
RESTORE							
RING							
RINGT							
SET keyword		X	X	X	X	X	X
SETFONT							
SET lines per inch							
SUB/SUPERSCRIPT							

Functions	2741	3101C	3101B	3151B	3161B	3163B	3164B
TONE			X	X	X	X	X
UNBLINK							
UNDERSCORE							
Special Functions				X	X	X	X

Note: This chart describes the 3151, 3161, 3163, and 3164 terminals in 3101 block emulation mode only. The device suffix B designates 3101 block mode or its emulation and C designates 3101 character mode.

Functions	4013	4201/4202	4224	4973	4974
BARCODE			X		
BLANK FIELD					
BLANK SCREEN					
BLINK CURSOR					
BLINK FIELD					
BOLD		X	X		
CHARSET			X		
DELFONT			X		
DENSITY		X	X		
DISABLE					
DISPLAY	X	X	X	X	X
DOUBLESTRIKE		X	X		
DOUBLEWIDTH		X	X		
ENABLE					
ENABLEA					
ENABLEAT					
ENABLET					
GETSTORE					X
HIGH/LOW intensity					
INITFONT			X		
ITALICS			X		
LOADFONT			X		
LOCK/UNLOCK keyboard					
LPI (LINE SPACING)		X	X		
OVERSCORE		X	X		
PRINT COLOR			X		
PRINT DENSITY		X	X		
PF					
PUTSTORE					
RESTORE		X	X		
RING					
RINGT					
SET keyword	X	X	X		
SETFONT		X	X		
SET lines per inch		X	X	X	X
SUB/SUPERSCRIPT		X	X		
TONE					

Functions	4013	4201/4202	4224	4973	4974
UNBLINK					
UNDERSCORE		X	X		
Special Functions					

Functions	4975	4978	4980	4979	5219	5224	5225
BARCODE							
BLANK FIELD							
BLANK SCREEN		X	X	X			
BLINK CURSOR							
BLINK FIELD		X	X				
BOLD							
CHARSET							
DELFONT							
DENSITY							
DISABLE							
DISPLAY	X	X	X	X	X	X	X
DOUBLESTRIKE							
DOUBLEWIDTH							
ENABLE							
ENABLEA							
ENABLEAT							
ENABLET							
GETSTORE		X	X				
HIGH/LOW intensity							
INITFONT							
ITALICS							
LOADFONT							
LOCK/UNLOCK keyboard		X	X		X		
LPI (LINE SPACING)							
OVERSCORE							
PRINT COLOR							
PRINT DENSITY							
PF							
PUTSTORE		X	X				
RESTORE							
RING							
RINGT							
SET keyword		X	X	X			
SETFONT							
SET lines per inch	X				X	X	X
SUB/SUPERSCRIPT							

Functions	4975	4978	4980	4979	5219	5224	5225
TONE		X	X				
UNBLINK		X	X				
UNDERSCORE							
Special Functions	X				X	X	X

FUNCTIONS	5262	ACCA/MODEM	ACCA	TTY	VIRT	GPIB	S1/S1
BARCODE							
BLANK FIELD							
BLANK SCREEN							
BLINK CURSOR							
BLINK FIELD							
BOLD							
CHARSET							
DELFONT							
DENSITY							
DISABLE		X					
DISPLAY	X			X	X	X	
DOUBLESTRIKE							
DOUBLEWIDTH							
ENABLE		X					
ENABLEA		X					
ENABLEAT		X					
ENABLET		X					
GETSTORE							
HIGH/LOW intensity							
INITFONT							
ITALICS							
LOADFONT							
LOCK/UNLOCK keyboard							
LPI (LINE SPACING)							
OVERSCORE							
PRINT COLOR							
PRINT DENSITY							
PF					X		
PUTSTORE							
RESTORE							
RING		X					
RINGT		X					
SET keyword		X	X	X	X		
SETFONT							
SET lines per inch	X						
SUB/SUPERSCRIPT							
TONE							

FUNCTIONS	5262	ACCA/MODEM	ACCA	TTY	VIRT	GPIB	S1/S1
UNBLINK							
UNDERSCORE							
Special Functions	X					X	X

Note: "ACCA" and "ACCA with MODEM" are listed as devices in this chart.

2741 Communications Terminal

Syntax:

label	**TERMCTRL DISPLAY**
Required:	**DISPLAY**
Defaults:	**none**
Indexable:	**none**

Operand	*Description*
DISPLAY	Causes any buffered output to be written to the 2741.

Coding Example

The following example displays the contents of the buffer on a 2741 terminal.

```
TERMCTRL  DISPLAY        DISPLAY BUFFER
```

3101, 3151, 3161, 3163, and 3164 Display Terminals (Block Mode)

This section describes the use of TERMCTRL instructions with 3101 display terminals in block mode.

Note: For purposes of this section, all references to the 3101 terminal in block mode will also apply to 3151, 3161, 3163, and 3164 terminals in 3101 block mode emulation since they operate in the same way.

The 3101 in block mode uses an attribute byte at the beginning of a data field. The attribute byte defines the characters of the field as protected, unprotected, modified, or not modified. The attribute byte also defines the display mode as high intensity, low intensity, blinking, or nondisplay. The data field extends up to the next attribute byte or to the end-of-screen, whichever occurs first. The attribute byte appears as a protected blank on the screen. The attribute byte controls the way data is displayed on the screen.

I/O operations directed to the 3101 in block mode result in a 3101 data stream being transferred between the 3101 and processor storage. The 3101 data stream consists of escape sequences, attribute characters, and data. For input operations, the 3101 transfers a 3101 data stream into processor storage. For output operations, a 3101 data stream must be built in processor storage to be transferred to the 3101. The 3101 interprets the escape sequences as control commands.

Terminal I/O allows you to write messages in any display mode to a 3101 in block mode. The 3101 block mode support inserts the correct attribute bytes in the 3101 data stream for you before the write operation. Terminal I/O also allows you to enter data in any display mode for a roll screen read operation. The 3101 block mode support places the correct attribute byte at the beginning of the input field. The data you enter takes on the display mode defined by the attribute byte.

You set the display mode for input and output operations with the ATTR operand. To specify the ATTR operand, you must code the SET function. Do not include other operands in the instruction when you are defining the attribute byte. Once set from a program with the TERMCTRL SET,ATTR= instruction, the attribute byte set will remain in effect until you change it again. There are two ways to change it for the 3101 terminal in block mode. One way is to issue another TERMCTRL SET,ATTR= instruction from an application program. The other way is to request a new attribute byte for the terminal with the $TERMUT1 utility.

When you code STREAM=YES, the system ignores the attribute byte specified with the ATTR operand. Neither the system nor a DEQT or PROGSTOP instruction resets the attribute byte in this case; the attribute byte remains set even after the program has ended.

The STREAM operand gives you control over whether terminal I/O will remove or insert 3101 special characters during input or output operations. To specify the STREAM operand, you must code the SET function. Once a program issues the TERMCTRL SET,STREAM= instruction to a 3101 in block mode, the STREAM remains in effect until the program issues another TERMCTRL SET,STREAM= instruction to the terminal or until you change the STREAM option with the $TERMUT1 utility. A DEQT or PROGSTOP instruction does not reset the option you select with the STREAM operand, and it remains in effect even after the program has ended.

The ACCA TERMCTRL functions are also applicable to a 3101 in block mode. For a description of those functions, see "ACCA Attached Devices" on page 2-519.

Syntax:

label	**TERMCTRL function,ATTN=,ATTR=,STREAM=**
Required:	**function**
Defaults:	**STREAM=NO**
Indexable:	**none**

Operand	*Description*	
function:		
	TONE	Causes the 3101 in block mode to sound the audible alarm.
	DISPLAY	Causes the system to write to the device any buffered output. In addition, for 3101 block mode, the cursor position is updated accordingly.
	LOCK	Locks the keyboard for a 3101 in block mode. **Note:** If you are using the EDX line sharing support, this function also will obtain exclusive use of the shared line if an ENQT has already been issued.
	UNLOCK	Unlocks the keyboard for a 3101 in block mode. **Note:** If you are using EDX line sharing support, this function will release the shared line.
	SET	The action of the SET function for a 3101 in block mode depends on how you code the ATTN=, ATTR=, and STREAM= operands.
ATTN=	YES, to enable the attention and PF key functions. NO, to disable the attention and PF key functions.	
ATTR=	high (the default), for a display mode of high intensity for both input and output. LOW, for a display mode of low or normal intensity for both input and output. BLINK, causes a blinking display for both input and output. BLANK, prevents the display of input or output characters. This mode is useful for reading data, such as a password, that should not be displayed on the screen. Change this option when you no longer require it. The terminal is unable to display data while ATTR=BLANK is in effect.	

NO, for output, specifies that no attribute byte is to be placed in the data stream. For input, the attribute byte depends on the current TERMCTRL SET,ATTR=. If a SET,ATTR= has not been issued, the system uses the default, ATTR=HIGH.

YES, clears a previous TERMCTRL SET,ATTR=NO instruction. This operand has no effect if the previous TERMCTRL SET,ATTR= instruction does not contain ATTR=NO.

STREAM= YES, for output operations, shows that you have already supplied in the text or buffer area the attribute bytes and escape sequences the terminal needs for an output operation. For input operations, it allows you to receive the entire 3101 data stream in processor storage exactly as it is transmitted by the device.

If you code STREAM=YES in your application program, issue a TERMCTRL SET,STREAM=NO before a PROGSTOP or DETACH instruction to restore the default.

Note: Certain terminal I/O instructions, such as GETEDIT, GETVALUE, and QUESTION, are not recommended for use with STREAM=YES. You also should be familiar with the 3101 device and terminal I/O internals to use this option effectively.

NO, for output operations, shows that the system should insert the required escape sequences and attribute bytes in the text or buffer area before displaying data on the 3101 screen. For input operations, it allows the system to remove 3101 special characters from the 3101 data stream before returning control to your program.

The default is STREAM=NO.

For either YES or NO, conversion to and from EBCDIC takes place for both input and output. The only exception to this occurs when you code XLATE=NO on a READTEXT or PRINTEXT instruction. Then, for the duration of that instruction, the system ignores the STREAM option you coded and no EBCDIC conversion takes place. The system does not insert or remove any 3101 special characters.

4013 Graphics Terminal

Syntax:

label	**TERMCTRL function,ATTN=**
Required:	**function**
Defaults:	**none**
Indexable:	**none**

Operand	*Description*
function:	
	SET Enables the attention function for the device (when ATTN=YES) or disables the attention function for the device (when ATTN=NO).
	DISPLAY Causes the system to write to the 4013 any buffered output.
ATTN=	YES, to enable the attention function.
	NO, to disable the attention function.
	The ATTN operand is required when function is SET.

Coding Example

The following example displays the contents of the buffer on a 4013 terminal. The program then disables the attention key and loads an application program named PAYROLL. When the PAYROLL program returns control to the loading program, the instructions at ENABLE1, enables the attention key before the program stops.

```
          TERMCTRL  DISPLAY        DISPLAY BUFFER
DISABLE1  TERMCTRL  SET,ATTN=NO    DISABLE ATTENTION FUNCTION
          LOAD      PAYROLL,DS=(EMPFILE,ADDRFILE)
           •
           •
           •
ENABLE1   TERMCTRL  SET,ATTN=YES   ENABLE ATTENTION FUNCTION
          PROGSTOP
```

4201/4202 Printer

The 4201 and 4202 printers provide the same basic support as other ASCII printers.

Note: Throughout this book, references to the 4201 printer also include the 4202 printer, since they operate in the same manner.

The system translates text data you send to the 4201 using the table you specify at system generation (CODTYPE=) unless you specify XLATE=NO in the PRINTEXT instruction. Code XLATE=NO in the PRINTEXT instruction to activate the 4201 data streaming mode.

Note: Many of following functions are available through the $TERMUT1 utility. Refer to the *Operator Commands and Utilities Reference* for information on the use of the $TERMUT1 utility with the 4201 printer.

Syntax:

label	**TERMCTRL DISPLAY**
Required:	**DISPLAY**
Defaults:	**none**
Indexable:	**none**

Operand	*Description*
DISPLAY	Causes the system to write to the 4201 any buffered output, and causes a carriage return to occur on the 4201.

Syntax Example

The following example displays the contents of the buffer on a 4201 printer.

```
TERMCTRL  DISPLAY        DISPLAY BUFFER
```

Syntax:

label	**TERMCTRL function,STATE=**
Required:	**function**
Defaults:	**STATE=START**
Indexable:	**none**

Operand	*Description*
function:	
UNDER	Turns the continuous underscore function on or off.
OVER	Turns the continuous overscore function on or off.
DSTRIKE	Turns the double strike print function on or off. This function yields NLQ (near letter quality) printing for the 4201.
DWIDE	Turns the double width print function on or off. With this function, the character being printed is adjusted to occupy twice its current width.
BOLD	Turns the bold (emphasized) print function on or off. With this function, each dot printed is accompanied by a second dot appearing just to the right of and partially overlapping the first dot. This gives the appearance of a thicker print stroke.
STATE=	Specifies the status of the function. Once you activate any of the operands described above, the operand remains active until you issue a TERMCTRL with STATE=STOP. Select a state for the function with the following parameters:

Parameter	*Description*
START	Turns the function on.
STOP	Turns the function off.

Syntax Example

The following example starts bold printing on a 4201 printer.

```
TERMCTRL  BOLD,STATE=START    BEGIN BOLD PRINTING
```

Syntax:

label	**TERMCTRL SCRIPT,TYPE=,STATE=**
Required:	**SCRIPT,TYPE=**
Defaults:	**STATE=START**
Indexable:	**none**

Operand	*Description*
SCRIPT	Turns one of two different print modes on or off.
TYPE=	Specifies your choice of script types.

Parameter	*Description*
SUB	Subscript print mode.
SUPER	Superscript print mode.

The 4201 prints subscripts and superscripts by using half-high NLQ characters. Subscript and superscript modes cannot be in effect at the same time.

STATE= Specifies the status of the function. Once you activate any of the operands described above, that operand remains active until you issue a TERMCTRL with STATE=STOP. Select a state for the function with the following parameters:

Parameter	*Description*
START	Turns the function on.
STOP	Turns the function off.

Note: If either subscript mode or superscript mode is activated, specifying TERMCTRL SCRIPT,STATE=STOP will deactivate that mode regardless of whether you specify TYPE=SUB or TYPE=SUPER.

Syntax Example

The following example stops superscripting on a 4201 printer.

```
TERMCTRL  SCRIPT,TYPE=SUPER,STATE=STOP     STOP SUPERSCRIPT
```

Syntax:

label	**TERMCTRL LPI,HEIGHT =**
Required:	**LPI**
Defaults:	**HEIGHT = 36**
Indexable:	**HEIGHT =**

Operand	*Description*
LPI	Alters the line spacing (height of a line). Issuing this command will not cause buffered output to be printed.
HEIGHT =	A 1-word value from 1 to 255 in 1/216 inch increments that specifies line height. The default, HEIGHT = 36 (36/216 inch), results in 6 lines per inch. To get 8 lines per inch, specify HEIGHT = 27 (27/216 of an inch). To calculate line height values, divide 216 by the desired number of lines per inch. To maximize printer accuracy, choose a height which is a multiple of 3.

The line spacing you choose in combination with the logical page size (line count) must match the physical length of the forms. For example, a line height of 27/216 inch or 8 lines per inch along with a logical page size of 88 matches a physical page size of 11 inches.

See "Special Considerations" on page 2-453 for additional information about page size.

Syntax Example

The following example sets lines per inch to 8 on a 4201 printer.

```
TERMCTRL  LPI,HEIGHT=27     SET LPI TO 8 LINES PER INCH
```

Syntax:

label	**TERMCTRL SETFONT,FONTID=**
Required:	**SETFONT,FONTID=**
Defaults:	**none**
Indexable:	**FONTID=**

Operand	*Description*
SETFONT	Set font specifies the new active font for subsequent printing.
FONTID=	A 1-word font ID that specifies the font you select as the active font. You can select one of the permanent printer fonts or one you have defined.

Code	*Font Name*
0	Normal quality (standard font). This is equivalent to the 4224 DP (Data Processing) font.
2	NLQ (near letter quality) font, not proportionally spaced.
4	Normal quality font you loaded in data streaming mode.
6	NLQ font you loaded in data streaming mode.

Note: The near letter quality font (2) is the same as double strike print mode.

Syntax Example

The following example sets the near letter quality font for use on the 4201 printer.

```
TERMCTRL  SETFONT,FONTID=2     SET LOCAL NLQ FONT
```

Syntax:

label	**TERMCTRL PDEN,DENSITY=**
Required:	**PDEN**
Defaults:	**DENSITY=NORMAL**
Indexable:	**DENSITY=**

Operand	*Description*
PDEN	Sets the print density to 10, 12, or 17.1 characters per inch. This command provides the same function as SET,PDEN=.
DENSITY=	A word value specifying the desired density.

Mnemonic	*Description*
LARGE	10 CPI
NORMAL	12 CPI
DENSE	17.1 CPI

Note: Print density DENSE cannot be combined with BOLD or DOUBLE STRIKE print modes or with the Near Letter Quality font (2). This is a hardware restriction which assures that the printed output is legible.

Syntax Example

The following example sets the print density to 12 characters per inch on the 4201 printer.

```
TERMCTRL  PDEN,DENSITY=NORMAL  DENSITY IS 12 CPI
```

Syntax:

label	**TERMCTRL SET,keyword or RESTORE**
Required:	**SET**
Defaults:	**none**
Indexable:	**CHARSET=,PDEN=,PMODE=**

Operand	*Description*
SET	Allows any of the following functions. You must code one of the four operands (LPI=, CHARSET=, PDEN=, PMODE=) or RESTORE. The 4201 printer support does not allow the DCB= operand since the 4201 is a serial device driven by control characters and escape sequences. You can code only one print operand on each TERMCTRL instruction. When specifying parameters on the PMODE= or PDEN= operands, you can code the parameter name, an indexed value, or an address. Existing applications that contain TERMCTRL SET do not need to be reassembled to run on the 4201 printer. See "Special Considerations" on page 2-453 for additional information. To use the TERMCTRL SET, you must link module $4975 with your application. Equivalent TERMCTRL instructions that do not require a link with this module are:

SET Function	*Equivalent Code*
SET,PDEN	PDEN,DENSITY=
SET,LPI	LPI,HEIGHT=
SET,PMODE	SETFONT,FONTID=
SET,RESTORE	RESTORE

LPI=	Sets the number of lines per inch. Code either 6 (6 lines per inch) or 8 (8 lines per inch). LPI causes any buffered output to be printed. The system also resets the current output position to the beginning of the left margin.
PMODE=	Specifies the print mode to be used.

Parameter	*Description*
DRAFT	The font is Normal Quality (Local Font ID X'00').
TEXT1	The font is Normal Quality (Local Font ID X'00').
TEXT	Near Letter Quality (Local Font ID X'02'). The font is not proportionally spaced.

PDEN = Specifies the density of printed characters on each line. The three values for this operand are described below:

Parameter	*Description*
NORM	The printer sets density to 17.1 characters per inch. This allows a maximum of 136 characters per line.
COMP	The printer sets density to 17.1 characters per inch, compressed density. This allows a maximum of 136 characters per line.
EXPD	The printer sets density to 10 characters per inch, expanded density. This allows a maximum of 80 characters per line.

CHARSET =

This is a null operation. The only character set available for 4975 emulation is PC character set 2 (PC2). Specifying a unique translation table at system generation provides some flexibility by allowing you to establish a correspondence between code points and ASCII printable images. This is done by creating your own translation table and then properly coding the CODTYPE parameter on the terminal statement.

RESTORE Resets the 4201 printer to its default state by setting PDEN, PMODE, and LPI to those values you specified with the CT command of $TERMUT1 or to their initial values. These values are:

Operand	*Initial Value*
PDEN	EXPD
PMODE	DRAFT
LPI	6

When you change printer functions with a TERMCTRL statement, code the RESTORE option on another TERMCTRL statement to restore the default values before your program ends.

Syntax Example

The following example uses the TERMCTRL SET instruction to print buffered output, to set the current output position at the beginning of the left margin and to prepare the printer to print 6 lines per inch on the 4201 printer.

```
TERMCTRL  SET,LPI=6              SELECT 6 LPI
```

Syntax:

Label	**TERMCTRL RESTORE**
Required:	**RESTORE**
Defaults:	**none**
Indexable:	**none**

Operand	*Description*
RESTORE	RESTORE resets the printer to its default state. The state variables PDEN, SETFONT, LPI, BOLD, DSTRIKE, and DWIDE are set to those values specified by the CT command of the $TERMUT1 utility or, if the CT command has not been used, to the following default values:

Operand	*Default*
PDEN	LARGE (10 CPI)
SETFONT	0 (4201 DP Font)
LPI	6
BOLD	off
DSTRIKE	off
DWIDE	off

When you change printer functions with a TERMCTRL statement, code the RESTORE option on another TERMCTRL statement to restore the default values before your program ends.

Syntax Example

The following example restores the six printer defaults on the 4201 printer.

```
TERMCTRL  RESTORE       RESTORE DEFAULT SETTINGS
```

Coding Example

The following example demonstrates coding for 4201 printer functions described above.

```
TEST4201 PROGRAM   START
*
START    EQU       *
*****************************************************************
*  INPUT PRINTER NAME AND ENQUEUE ON PRINTER.                   *
*****************************************************************
         READTEXT  PRINTER,'@ENTER 4201 PRINTER NAME:  '
         MOVE      IOCB4201,PRINTER,(8,BYTES)
         ENQT      IOCB4201
*****************************************************************
*  DEMONSTRATE UNDERSCORE / OVERSCORE FUNCTIONS.                *
*****************************************************************
         TERMCTRL  RESTORE             RESTORE PRINTER DEFAULTS
         PRINTEXT  SKIP=1
         PRINTEXT  'YOU MAY WISH TO '
         TERMCTRL  UNDER               BEGIN UNDERSCORE
         PRINTEXT  'UNDERSCORE'
         TERMCTRL  UNDER,STATE=STOP    STOP UNDERSCORE
         PRINTEXT  ' OR '
         TERMCTRL  OVER                BEGIN OVERSCORE
         PRINTEXT  'OVERSCORE'
         TERMCTRL  OVER,STATE=STOP     STOP OVERSCORE
         PRINTEXT  ' A POINT,'
         PRINTEXT  'OR YOU MAY WISH ',SKIP=1
         TERMCTRL  UNDER               BEGIN UNDERSCORE
         TERMCTRL  OVER                BEGIN OVERSCORE
         PRINTEXT  'TO DO BOTH.'
         TERMCTRL  UNDER,STATE=STOP    STOP UNDERSCORE
         TERMCTRL  OVER,STATE=STOP     STOP OVERSCORE
         PRINTEXT  SKIP=2
*****************************************************************
*  DEMONSTRATE BOLD, DOUBLE STRIKE, AND DOUBLE WIDE FUNCTIONS.  *
*****************************************************************
         PRINTEXT  'YOU MAY WISH TO '
         TERMCTRL  BOLD                BEGIN BOLD PRINT
         PRINTEXT  'BE BOLD'
         TERMCTRL  BOLD,STATE=STOP     STOP BOLD PRINT
         PRINTEXT  ' OR TO '
         TERMCTRL  DSTRIKE             BEGIN DOUBLE STRIKE
         PRINTEXT  'STRIKE TWICE.'
         TERMCTRL  DSTRIKE,STATE=STOP  STOP DOUBLE STRIKE
         PRINTEXT  SKIP=2
         TERMCTRL  DWIDE               BEGIN DOUBLE WIDE
         PRINTEXT  'DOUBLE WIDE MODE'
         TERMCTRL  DWIDE,STATE=STOP    STOP DOUBLE WIDE
         PRINTEXT  ' ALWAYS GETS ATTENTION.'
         PRINTEXT  SKIP=2
```

```
*****************************************************************
*  DEMONSTRATE THE THREE PRINT DENSITIES.                       *
*****************************************************************
        TERMCTRL  PDEN,DENSITY=DENSE
        PRINTEXT  'YOU MAY PREFER THE ALPHABET AT 17.1 CHARACTERS '
        PRINTEXT  'PER INCH:'
        PRINTEXT  '(ABCDEFGHIJKLMNOPQRSTUVWXYZ)',SKIP=1
        PRINTEXT  SKIP=2
        TERMCTRL  PDEN,DENSITY=NORMAL
        PRINTEXT  'OR PERHAPS A MORE NORMAL 12:'
        PRINTEXT  '(ABCDEFGHIJKLMNOPQRSTUVWXYZ)',SKIP=1
        PRINTEXT  SKIP=2
        TERMCTRL  PDEN,DENSITY=LARGE
        PRINTEXT  'YOU MAY ALSO TRY 10 CPI:'
        PRINTEXT  '(ABCDEFGHIJKLMNOPQRSTUVWXYZ)',SKIP=1
        PRINTEXT  SKIP=2
*****************************************************************
*  DEMONSTRATE THE NLQ FONT IN COMPARISON TO DOUBLE STRIKE.     *
*****************************************************************
        PRINTEXT  'YOU WILL FIND THAT THE '
        TERMCTRL  SETFONT,FONTID=2    SELECT NLQ FONT
        PRINTEXT  'NLQ FONT'
        TERMCTRL  SETFONT,FONTID=0    SELECT DP FONT
        PRINTEXT  ' IS INDISTINGUISHABLE'
        PRINTEXT  'FROM ',SKIP=1
        TERMCTRL  DSTRIKE             BEGIN DOUBLE STRIKE
        PRINTEXT  'DOUBLE STRIKE'
        TERMCTRL  DSTRIKE,STATE=STOP  STOP DOUBLE STRIKE
        PRINTEXT  ' AND THE '
        TERMCTRL  SETFONT,FONTID=2    SELECT NLQ FONT
        TERMCTRL  DSTRIKE             BEGIN DOUBLE STRIKE
        PRINTEXT  'COMBINATION OF THE TWO.'
        TERMCTRL  SETFONT,FONTID=0    SELECT DP FONT
        TERMCTRL  DSTRIKE,STATE=STOP  STOP DOUBLE STRIKE
        PRINTEXT  SKIP=2
*****************************************************************
*  DEMONSTRATE SUBSCRIPT AND SUPERSCRIPT FUNCTIONS.             *
*****************************************************************
        PRINTEXT  'TO MAKE STEAM, ONE NEEDS H'
        TERMCTRL  SCRIPT,TYPE=SUB
        PRINTEXT  '2'
        TERMCTRL  SCRIPT,TYPE=SUB,STATE=STOP
        PRINTEXT  'O AND LOTS OF MC'
        TERMCTRL  SCRIPT,TYPE=SUPER
        PRINTEXT  '2'
        TERMCTRL  SCRIPT,TYPE=SUPER,STATE=STOP
        PRINTEXT  '.'
        PRINTEXT  SKIP=2
```

```
*****************************************************************
*  DEMONSTRATE DIFFERENT LINE SPACING.                          *
*****************************************************************
         TERMCTRL  LPI,HEIGHT=216
         PRINTEXT  'A LINE HEIGHT OF 216 YIELDS 1 LINE  PER INCH'
         CALL      PRINT
         PRINTEXT  SKIP=1
*
         TERMCTRL  LPI,HEIGHT=72
         PRINTEXT  'A LINE HEIGHT OF  72 YIELDS 3 LINES PER INCH'
         CALL      PRINT
         PRINTEXT  SKIP=1
*
         TERMCTRL  LPI,HEIGHT=24
         PRINTEXT  'A LINE HEIGHT OF  24 YIELDS 9 LINES PER INCH'
         CALL      PRINT
*****************************************************************
*  RESTORE PRINTER DEFAULTS AND RELEASE THE PRINTER.            *
*****************************************************************
         PRINTEXT  LINE=0              ISSUE PAGE EJECT
         TERMCTRL  RESTORE
         DEQT
         PROGSTOP
*****************************************************************
*  SUBROUTINE PRINT - PRINT THREE LINES                         *
*****************************************************************
         SUBROUT   PRINT
         PRINTEXT  LINE1,SKIP=1
         PRINTEXT  LINE2,SKIP=1
         PRINTEXT  LINE3,SKIP=1
         RETURN
*****************************************************************
*  DATA AREA                                                    *
*****************************************************************
IOCB4201 IOCB                          I/O CONTROL BLOCK
PRINTER  TEXT      LENGTH=8            PRINTER NAME
LINE1    TEXT      '******************* LINE 1 *******************'
LINE2    TEXT      '******************* LINE 2 *******************'
LINE3    TEXT      '******************* LINE 3 *******************'
         ENDPROG
         END
```

The following output results from the preceding example on the 4201 printer.

```
YOU MAY WISH TO UNDERSCORE OR OVERSCORE A POINT,
OR YOU MAY WISH TO DO BOTH.

YOU MAY WISH TO BE BOLD OR TO STRIKE TWICE.

DOUBLE WIDE MODE ALWAYS GETS ATTENTION.

YOU MAY PREFER THE ALPHABET AT 17.1 CHARACTERS PER INCH:
(ABCDEFGHIJKLMNOPQRSTUVWXYZ)

OR PERHAPS A MORE NORMAL 12:
(ABCDEFGHIJKLMNOPQRSTUVWXYZ)

YOU MAY ALSO TRY 10 CPI:
(ABCDEFGHIJKLMNOPQRSTUVWXYZ)

YOU WILL FIND THAT THE NLQ FONT IS INDISTINGUISHABLE
FROM DOUBLE STRIKE AND THE COMBINATION OF THE TWO.

TO MAKE STEAM, ONE NEEDS H2O AND LOTS OF MC2.

A LINE HEIGHT OF 216 YIELDS 2015INE  PER INCH



********** LINE 1 **********



********** LINE 2 **********



********** LINE 3 **********



A LINE HEIGHT OF  72 YIELDS 3 LINES PER INCH

********** LINE 1 **********

********** LINE 2 **********

********** LINE 3 **********

A LINE HEIGHT OF  24 YIELDS 9 LINES PER INCH
********** LINE 1 **********
********** LINE 2 **********
********** LINE 3 **********
```

Special Considerations

Applications that run currently on the 4975-02L printer will run (without complete 4201 printer function) on the 4201 printer without reassembly with certain exceptions described below. However, a new system generation is required and applications must be relinked to include a modified $4975 module.

In order to take advantage of any new printer function on the 4201 printer, modify and reassemble 4975-02L printer applications. If you decide to modify your application, you can avoid relinking with module $4975 by converting TERMCTRL SET commands to the corresponding 4201-only commands that follow:

4975-02L Instruction	4201 Instruction
SET,LPI=	LPI,HEIGHT=
SET,PMODE=	SETFONT,FONTID=
SET,PDEN=	PDEN,DENSITY=
SET,CHARSET=	not available
SET,RESTORE	RESTORE

- Not all $TERMUT1 and $TERMUT2 utility functions of the 4975-02L are available for the 4201 printer. Refer to the *Operator Commands and Utilities Reference* for information.
- The 4201 does not generate hardware status. Therefore, nothing is logged to the EDX error log file for the 4201.

  Applications which print on a 4975-02L will run on the 4201 printer with special consideration made for the following:

  - SET,PMODE=DRAFT activates font ID 0 (DP).
  - SET,PMODE=TEXT1 is the same as SET PMODE=DRAFT.
  - SET,PMODE=TEXT activates font ID 2 (NLQ), which is not proportionally spaced.
  - SET,CHARSET is a null operation.
  - The DCB= operand is not supported on the 4201 printer.
  - The print densities for the 4201 printer are 17.1, 12, and 10 characters per inch.
- The 4201 printer maintains physical page size in inches. You select the initial physical page size by setting the appropriate switch. The 4201 printer support maintains logical page size as a line count. Whenever you change logical page size with ENQT, DEQT, or $TERMUT1, be sure to alter line height so that (physical page size in inches) x (lines per inch) = (logical page size).

- If you switch the power off and then on, the 4201 printer resets the following functions as shown:

Function	*Hardware Default*
BOLD	Off
DSTRIKE	Off
DWIDE	Off
LPI	6 LPI
OVER	Off
PDEN	10 CPI
SETFONT	Data Processing
SUBSCRIPT	Off
SUPERSCRIPT	Off
UNDER	Off

- If you specify MODE=PAGE on the TERMINAL statement for the 4201/4202 printer, you define it as a page printer. When printer I/O crosses a page boundary, the printer support issues a form feed to start on a new page and line feeds to position the paper to the correct line.

  The printer maintains physical page size in inches; the software that supports the printer maintains logical page size as a count of lines per page. When you specify MODE=PAGE and then change the logical page size using ENQT or $TERMUT1, the printer support sends a control sequence to the 4201/4202 that changes the physical page size to a value (in inches) of:

  (logical page size) / (current LPI (lines per inch))

  For example, if the logical page size is 88 and the current value for LPI is 8, the physical page size becomes 11 inches. A subsequent change to LPI does not change the physical page size until the next time you change the logical page size.

  Each time you change the page size, the printer support assumes the new forms have been inserted in the printer at the top-of-forms position. Make certain the hardware top-of-forms indicator is set to this position To do this for the 4201/4202 printer, switch the printer off then on again.

  If the serial printer support detects a page change, it issues line feeds for the top margin before printing any data. The space the top margin occupies depends on the size of the top margin (in lines) and the current value for LPI.

  If your application varies line height within a page, the logical line pointer and the physical line pointer get out of sync. To allow for this, use the following procedure:

  1. Issue a TERMCTRL LPI to select the greatest density to be used on the page.
  2. ENQT on an IOCB, choosing a PAGSIZE such that PAGSIZE/LPI is equal to the physical forms size in inches.
  3. Print data and change LPI as needed without crossing the physical page boundary.
  4. Issue a PRINTEXT LINE=0 to advance to a new page. This causes a form feed to be sent to the printer to realign the logical and physical line pointer.

For example, if your form length is 11 inches (with 1/2 inch top and bottom margins) and your application uses both 6 LPI and 8 LPI on a page, your application should:

1. Issue TERMCTRL LPI,HEIGHT=27 to select 8 LPI.
2. ENQT on an IOCB with PAGSIZE=88, TOPM=4, and BOTM=83.
3. Print data and change LPI as needed.
4. When the page has been filled, issue a PRINTEXT LINE=0.

- If your application issues PRINTEXT XLATE=NO (data streaming), the printer support issues no control characters (such as line feed or carriage return) to the printer for that PRINTEXT instruction.

Return Codes

Return Code	Condition
600	Invalid TERMCTRL command for the attached printer.
602	Invalid TERMCTRL – operand value exceeds 255.
611	Invalid density specification (PDEN).
612	Invalid line spacing specification (LPI).
640	Invalid font ID.

4224 Printer

The 4224 printer is a serial printer. It provides support for both ASCII and EBCDIC character sets. The system translates text data you send to the 4224 using the translation table you identified at system generation unless you specify XLATE=NO in the PRINTEXT statement or code CODTYPE=EBCDIC in the terminal statement. Code XLATE=NO in the PRINTEXT statement to activate the 4224 data streaming mode.

Note: Many of following functions are available through the $TERMUT1 utility. Commands related to the loading of printable images for the 4224 printer are available through the $TERMUT2 utility. Refer to the *Operator Commands and Utilities Reference* for information on the use of these utilities with the 4224 printer.

Syntax:

label	**TERMCTRL DISPLAY**
Required:	**DISPLAY**
Defaults:	**none**
Indexable:	**none**

Operand	*Description*
DISPLAY	Causes the system to write to the 4224 any buffered output, and causes a carriage return to occur on the 4224.

Syntax Example

The following example displays the contents of the 4224 printer buffer.

```
TERMCTRL  DISPLAY        DISPLAY BUFFER
```

Syntax:

label	**TERMCTRL SET,operand or RESTORE**
Required:	**SET**
Defaults:	**none**
Indexable:	**CHARSET=,PDEN=,PMODE=**

Operand	*Description*
SET	Allows any of the following functions. You must code one of the four operands (LPI=, CHARSET=, PDEN=, PMODE=) or RESTORE. The 4224 printer support does not allow the DCB= operand since the 4224 printer is a serial device driven by control characters and escape sequences. You can code only one print operand on each TERMCTRL instruction. When specifying parameters on the PMODE=, PDEN=, and CHARSET= operands, you can code the parameter name, an indexed value, or an address. Existing applications that contain TERMCTRL SET do not need to be assembled to run on the 4224 printer. See "Special Considerations" on page 2-488 for additional information. To use TERMCTRL SET, you must link module $4975 with your application. Equivalent TERMCTRL instructions that do not require a link with this module are:

SET Function	*Equivalent Code*
SET,PDEN	PDEN,DENSITY=
SET,LPI	LPI,HEIGHT=
SET,PMODE	SETFONT,FONTID=
SET,RESTORE	RESTORE

LPI=	Sets the number of lines per inch. Code either 6 (6 lines per inch) or 8 (8 lines per inch). LPI causes any buffered output to be printed. The system also resets the current output position to the beginning of the left margin.
PMODE=	Specifies the print mode to be used.

Parameter	*Description*
DRAFT	All characters are equal in width and printing is done with a single pass of the print head. The font is Data Processing Quality (Font ID 1).
TEXT	Character width varies and printing is done with a single pass of the print head. The font is proportionally spaced Near Letter Quality (Font ID 5).

TEXT1 Character width varies. Printing is done with a single pass of the print head. The font is proportionally spaced Text Quality (Font ID 4).

TERMCTRL SETFONT with the proper FONTID= operand coded is equivalent to SET,PMODE=. A description of the SETFONT command follows in this section. The default value for PMODE= is the same as the default value for SETFONT, 1, the data processing font. Other 4224 printer commands that affect print characteristics may also have an effect on PMODE.

Note: When you specify TEXT or TEXT1, the printer automatically resets the density to EXPD. You can select another print density in this case. However, the densities available are only approximations since the width of each character varies.

While TEXT or TEXT1 is in effect, the available print densities are:

Parameter	*Description*
NORMAL	10 characters per inch (approximately).
DENSE	12 characters per inch (approximately).
LARGE	8 characters per inch (approximately).

PDEN= Specifies the density of printed characters on each line. The three values for this operand are described below:

Parameter	*Description*
NORM	The printer sets density to 15 characters per inch. This allows a maximum of 198 characters per line.
COMP	The printer sets density to 15 characters per inch, compressed density. This allows a maximum of 198 characters per line.
EXPD	The printer sets density to 10 characters per inch, expanded density. This allows a maximum of 132 characters per line.

CHARSET=

This is a null operation. To select a character set for languages other than English, run offline test 303 to select a default character set and code CODTYPE=EBCDIC on the TERMINAL statement.

For normal 4224 printer operation, the TERMCTRL CHARSET instruction can be used in conjunction with TERMCTRL INITFONT and TERMCTRL SETFONT to select one of the printer-provided character sets. See TERMCTRL CHARSET for more information.

RESTORE Resets the 4224 printer to its default state by setting PDEN, PMODE, and LPI to those values you specified with the CT command of $TERMUT1 or to their initial values. These initial values are:

Operand	*Initial Value*
PDEN	EXPD
PMODE	DRAFT
LPI	6

When you change printer functions with a TERMCTRL instruction, code the RESTORE option on another TERMCTRL instruction to restore the original values before your program ends.

PMODE can be altered by using $TERMUT1 to change the value of SETFONT.

Syntax Example

The following example demonstrates use of the TERMCTRL SET instruction on the 4224 printer to select the data processing quality font.

```
TERMCTRL  SET,PMODE=DRAFT       SET DATA PROCESSING FONT
```

Syntax:

label	**TERMCTRL**	**BARCODE,loc,count,XCOORD=,YCOORD=, ORIENT=,BARTYPE=,MOD=,HEIGHT=, WIDTH=,P2=,P3=,P4=,P5=,P6=,P7=,P8=, P9=,P10=**
Required:	**BARCODE,loc,count,XCOORD=,YCOORD=,MOD=**	
Defaults:	**ORIENT=HORZ,BARTYPE=CODE3#9,HEIGHT=0 WIDTH=NARROW**	
Indexable:	**loc,count**	

Operand *Description*

BARCODE Causes the 4224 to print a bar code. The printer defers the actual printing of the bar code until other data being printed causes the print head to reach the specified "X" and "Y" coordinates. Issue the BARCODE command at the top of a page to be sure the printer receives it before the print head reaches the point where the bar code is to be placed.

If the bar code is sent to the printer after the print head has passed the starting point of the desired print location, the 4224 may try to print what it can of the bar code and will generate a hardware error indicating an invalid request for backward movement of the print head. For this reason, applications must issue a BARCODE command before the print head reaches the point on the physical page where the bar code is to begin.

Since bar code printing is completely independent of immediate (normal) printing, the application must anticipate where the bar code will be placed and skip the appropriate number of spaces and lines to avoid overwriting. Select the location of a bar code on a page with the XCOORD= and YCOORD= operands.

The 4224 prints bar codes in black only, regardless of the currently active color.

ORIENT= Orientation of the bar code. Allowable values are:

Parameter	*Description*
HORZ	Orient the bar code horizontally, the default.
VERT	Orient the bar code vertically.

loc The label of characters the system will encode and print in the bar code you selected. The system *does not* translate this data before sending it to the printer.

count Count of characters the system will encode and print in the bar code you selected. Valid counts are listed below for each bar code type under BARTYPE=.

XCOORD=

Word value in 1/1440 inch units specifying the location on the current page where the bar code will be printed (upper left corner of the bar code). The printer resolves the coordinates to the nearest increment it supports (1/144 inch). Specify the X coordinate relative to the left edge of the physical page.

YCOORD=

Word value in 1/1440 inch units specifying the location on the current page where the bar code will be printed (upper left corner of the bar code). The printer resolves the coordinates to the nearest increment it supports (1/144 inch). Specify the Y coordinate relative to the top of the page.

BARTYPE=

Word value specifying the type of bar code desired.

Mnemonic	Count (Bytes)	Bar Code Description
CODE3#9	1 – 50	Code 3 of 9
MSI	1 – 50	MSI (MSI Data Corporation)
UPC#A	11	Uniform Product Code – Type A
UPC#E	10	Uniform Product Code – Type E
UPC#2	2	UPC – Magazine and Paperback (two digit)
UPC#5	5	UPC – Magazine and Paperback (five digit)
EAN#8	7	European Article Number – Type 8
EAN#13	12	European Article Number – Type 13
INDUST	1 – 50	Two of Five Industrial
MATRIX	1 – 50	Two of Five Matrix
LEAVED	1 – 50	Two of Five Interleaved.

Note: You can select supplemental encoding EAN#2 and EAN#5 by specifying bartypes UPC#2 and UPC#5 respectively.

MOD= Modifier word value specifying the unique characteristics of the bar code. The first byte of this field is based on the type of bar code selected and should be coded as specified for the modifier byte as described in the IBM *4224 Printer Product and Programming Description Manual*, GC31-2550.

The second byte of this field contains eight bit flags as follows:

Bit	Value	Description
8	Off	Print human-readable code (HRI)
	ON	Do not print human-readable code (HRI)
9 – 10	Off	Printer placement of HRI
11	Off	Do not print * with code 3 of 9
	ON	Print * with code 3 of 9

Bit	Value	Description
12	Off	Barcode data is ASCII
	ON	Barcode data is EBCDIC
13 – 15		Reserved.

The characters to be encoded in the bar code are NOT translated prior to being sent to the printer. You must set bit 12 of the MOD= keyword parameter to indicate whether the bar code data is ASCII data or EBCDIC data.

WIDTH= Width (in thousandths of an inch) of a single unit of the bar code.

Mnemonic	*Description*
NARROW	Width is .014 of an inch.
WIDE	Width is .021 of an inch.

HEIGHT= Height of the bar code in 1/1440 inch units. A value of 0 directs the printer to select the optimum height. Optimum height selected by the printer depends on the type bar code being printed. The formula for calculating the optimum bar code height varies for each bar code. There are twelve different technical specifications (one for each bar code type) that contain the details of optimum height calculation. For additional information, refer to the IBM *4224 Printer Product and Programming Description Manual*, GC31-2550.

Px= Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Note: If the 4224 printer flashes an error code when you attempt to print a bar code, then either the software and hardware top of forms are out of sync or you issued the barcode after the print head passed the bar code starting point. To synchronize the top of forms:

1. Change top margin to 0.
2. Use $E to set the software top of forms.
3. Physically adjust the paper.
4. Press the "STOP" button on the 4224.
5. Press the "TOP OF FORMS" button on the 4224.
6. Press the "START" button on the 4224.

You can cause the 4224 printer to advance to top-of-forms by sending X'0C' to the printer using PRINTEXT XLATE=NO.

Syntax Example

The following is an example of using the BARCODE operand for the 4224 printer. It orients a UPC-A bar code for horizontal printing using characters from the label BARDATA and a count of 11. This bar code will have optimal height and a width of .021 inch.

```
TERMCTRL  BARCODE,BARDATA,11,XCOORD=720,                X
      YCOORD=720,BARTYPE=UPC#A,MOD=X'0008',             X
      HEIGHT=0,WIDTH=WIDE
```

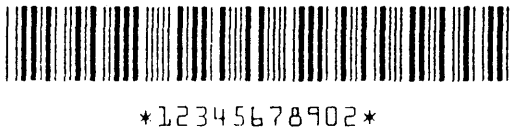
Coding Example

The following program further demonstrates the use of the BARCODE command on the 4224 printer.

```
TEST4224 PROGRAM   START
*
START    EQU       *
*****************************************************************
*  INPUT PRINTER NAME AND ENQUEUE ON PRINTER.                   *
*****************************************************************
         READTEXT  PRINTER,'@ENTER 4224 PRINTER NAME:  '
         MOVE      IOCB4224,PRINTER,(8,BYTES)
         ENQT      IOCB4224
         TERMCTRL  RESTORE            RESTORE PRINTER DEFAULTS
*****************************************************************
* ISSUE A DEFERRED CODE 3 OF 9 BAR CODE.  THE TOP LEFT CORNER   *
* LIES 1 INCH FROM THE LEFT EDGE OF THE PHYSICAL PAGE AND       *
* 2 INCHES FROM THE TOP OF THE PHYSICAL PAGE. THE MODIFIER WORD *
* CAUSES BOTH THE CHECK CHARACTER (2) AND THE '*' TO BE PRINTED.*
* IT ALSO INDICATES THAT THE DATA IS EBCDIC.  HEIGHT=0 TELLS    *
* THE 4224 TO SELECT THE OPTIMUM HEIGHT. THE WIDTH IS NARROW.   *
*****************************************************************
         TERMCTRL  BARCODE,BARDATA,+COUNT,BARTYPE=CODE3#9,        X
               XCOORD=+INCHES#1,YCOORD=+INCHES#2,                 X
               MOD=X'0218',HEIGHT=0,WIDTH=NARROW
*****************************************************************
*  RESTORE PRINTER DEFAULTS AND RELEASE THE PRINTER.            *
*****************************************************************
         PRINTEXT  LINE=0             FORCE BAR CODE TO BE PRINTED
         TERMCTRL  RESTORE
         DEQT
         PROGSTOP


*****************************************************************
*  DATA AREA                                                    *
*****************************************************************
INCHES#1 EQU       1440               1440/1440 = 1 INCH
INCHES#2 EQU       2880               2880/1440 = 2 INCHES
IOCB4224 IOCB                         I/O CONTROL BLOCK
PRINTER  TEXT      LENGTH=8           PRINTER NAME
BARDATA  DATA      C'1234567890'      DATA FOR BAR CODE
COUNT    EQU       *-BARDATA          COUNT OF BAR CODE DIGITS
         ENDPROG
         END
```

The following output results from the preceding example on the 4224 printer.



12345678902

Syntax:

Label	**TERMCTRL RESTORE**
Required:	**RESTORE**
Defaults:	**none**
Indexable:	**none**

Operand	*Description*
RESTORE	Resets the printer to its default state. The state variables PDEN, SETFONT, LPI, BOLD, DSTRIKE, DWIDE, and PCOLOR are set to those values specified by the CT command of the $TERMUT1 utility or, if the CT command has not been set, to the following default values:

Operand	*Default*
PDEN	LARGE (10 CPI)
LPI	36/216 (6 LPI)
BOLD	Off
DSTRIKE	Off
DWIDE	Off
PCOLOR	Black
SETFONT	1 (DP Font)

When you change printer functions with a TERMCTRL statement, code the RESTORE option on another TERMCTRL statement to restore the default values before your program ends.

Syntax Example

The following example restores seven printer defaults on the 4224 printer.

```
TERMCTRL  RESTORE       RESTORE DEFAULT SETTINGS
```

Syntax:

label	**TERMCTRL INITFONT,FONTID=,OLDFONT=**
Required:	**INITFONT,FONTID=,OLDFONT=**
Defaults:	**none**
Indexable:	**FONTID=,OLDFONT=**

Operand	*Description*
INITFONT	Initializes or modifies a font you have defined. If the font does not exist, the system allocates storage and initializes the font. If the font already exists, the system modifies it. This and other functions related to initializing and loading fonts are available through $TERMUT2. Refer to the *Operator Commands and Utilities Reference* for additional information.
FONTID=	A 1-word font ID of the font you are initializing or modifying.
OLDFONT=	A 1-word font ID that specifies a previously initialized font or a printer-provided font that the printer will use to initialize the characteristics of the font you are creating or modifying. Any character set and print characteristics associated with the original font are carried over to the font you are creating or modifying. Depending on the "original" font ID you selected, the "carry-over" to the new font may be a print style or the characteristics of a totally self-defining font. A self-defining font includes a print style and character set.

Syntax Example

The following example allocates storage on the 4224 printer and initializes a new font whose ID is 32 with the characteristics and print style of the printer-provided data processing font.

```
TERMCTRL  INITFONT,FONTID=32,OLDFONT=1
```

Syntax:

label	**TERMCTRL LOADFONT,loc,FONTID=**
Required:	**LOADFONT,loc,FONTID=**
Defaults:	**none**
Indexable:	**loc,FONTID=**

Operand ***Description***

LOADFONT

Loads printer memory with the print images of specific code points. A print image is a bit pattern used to form a printable character. A code point is the internal representation of a character as a 1-byte hexadecimal value. The character set and font characteristics that are associated with the printable images you load with this command replace existing ones.

Use LOADFONT to alter an existing font or create a brand new font. If you wish to create a font, first issue the INITFONT operand to reserve memory and establish the initial character set and print characteristics of that font. Then, issue the LOADFONT command. Once a font is in memory, you can select it to be the active font by issuing the SETFONT operand.

This and other functions related to initializing and loading fonts are available through $TERMUT2. Refer to the *Operator Commands and Utilities Reference* for additional information.

You create a completely new character set and font by sending a new dot representation for each of the 255 code points. Alternatively, only some of the characters and their print styles can be altered by sending fewer than 255 printable images. You cannot alter code point X'00'.

loc The label of the 6-byte font header and the binary data that form the print images known as character cells. This binary data is sent untranslated to the printer. The font header must begin on a full-word boundary. This data has the following format:

Byte	*Contents*
0 – 1	Count of bytes of printable image data. Count does not include 6-byte font header.
2	Value specifying the width of the character cells in dots. For monospaced DP fonts, the correct value is X'0A'. For monospaced TEXT and NLQ fonts, the correct value is X'14'. For proportionally spaced TEXT and NLQ fonts, the width may vary from X'01' to X'FF'.
3	Value specifying the height of the character cells: • X'09' for DP and text quality. • X'12' for NLQ (Near Letter Quality).
4	Hexadecimal code point which is the starting point for the characters to be altered. Code point X'00' is an invalid starting code point. You cannot download a print image for code point X'00'.
5	Value specifying the number of characters to be altered. This is always less than the count in bytes 0 and 1 because it takes multiple bytes to form the print image of a single code point. The maximum value of this count is 255, indicating that code points X'01' to X'FF' are being downloaded. The starting code point plus the number of characters to be altered must be no greater than 256. For example, if the starting code point is X'F0', a character count greater than X'10' would be invalid.
6 – N	Binary data which forms the printable images.

FONTID= A 1-word ID the printer uses to identify which existing font it should alter.

The 4224 printer has storage available to contain fonts and deferred bar code tasks you define. The size of printer storage varies among the different models of the 4224 printer. The space occupied by an individual font varies.

Multiple bytes of binary data are required to define each vertical slice of the character cell. The slice data for each code point is presented in a contiguous format, run together.

For example, if the slice data is nine bits high, the first eight bits (from top to bottom) of the leftmost slice occupy byte one. The lowest bit of slice one occupies the high order bit of byte two, followed by the top seven bits of slice two, and so on.

The contiguous format does not occur from one code point to the next. The top dot of the leftmost slice of each code point is always the high order bit of the first byte of image data for that code point.

A simple font would have printable images that are 9 dots high and 10 dots wide. Such a font would occupy 12 bytes of printer storage for each code point defined. For example, if 64 code points were being defined, the new font would occupy X'300' bytes of storage in the printer.

A detailed font would have character cells that are 12 dots high and 20 dots wide. Such a font would occupy 30 bytes of printer storage for each code point defined. For example, if 255 code points were being defined, the new font would occupy X'1DE2' bytes of storage in the printer.

Printer memory allows a maximum of 15 fonts at one time.

Coding Example

The following example loads print images for nine code points and prints those images on the 4224 printer. This example also causes the 4224 printer to print in three colors.

```
FONT     PROGRAM   START
*****************************************************************
*  DEMONSTRATE THE DOWNLOAD FONT CAPABILITY OF THE 4224 PRINTER *
*****************************************************************
PRINTER  IOCB      PRTR4224            IOCB FOR ENQUEUING PRINTER
START    EQU       *
         ENQT      PRINTER             OBTAIN EXCLUSIVE USE
*****************************************************************
*  MUST MAKE 'NLQPR' THE ACTIVE FONT PRIOR TO TERMCTRL INITFONT *
*****************************************************************
         TERMCTRL  SETFONT,FONTID=+NLQPR
         PRINTEXT  ' FROM THE CITY OF ',SKIP=1
*****************************************************************
*   INITIALIZE 'NEWFONT' TO HAVE THE SAME PRINT CHARACTERISTICS *
*   AS THE STANDARD NEAR LETTER QUALITY, PROPORTIONALLY-SPACED  *
*   FONT (NLQPR).  CHARACTER CELLS WILL BE 18 DOTS HIGH AND 12  *
*   DOTS WIDE.                                                  *
*****************************************************************
```

```
         TERMCTRL  INITFONT,FONTID=+NEWFONT,OLDFONT=+NLQPR
         TCBGET    RETCODE,$TCBCO      CHECK FOR ERROR
         IF        (RETCODE,NE,-1),GOTO,INITERR
*****************************************************************
*   DOWNLOAD THE NEW CHARACTERS TO 'NEWFONT'                    *
*****************************************************************
         TERMCTRL  LOADFONT,FONTADDR,FONTID=+NEWFONT
         TCBGET    RETCODE,$TCBCO      CHECK FOR ERROR
         IF        (RETCODE,NE,-1),GOTO,LOADERR
*****************************************************************
*   MAKE 'NEWFONT' THE ACTIVE FONT                              *
*   ISSUE SOME PRINT MODE COMMANDS FOR BETTER EFFECT            *
*****************************************************************
         TERMCTRL  SETFONT,FONTID=+NEWFONT
         TERMCTRL  DWIDE,STATE=START   DOUBLE WIDE PRINT MODE
         TERMCTRL  DSTRIKE,STATE=START DOUBLE STRIKE PRINT MODE
         TERMCTRL  PCOLOR,COLOR=CYAN   COLOR CYAN
*****************************************************************
*   THIS TABLE INDICATES WHICH CODE POINTS ARE ALTERED          *
*                                                               *
*       CODE POINT     ASCII CHAR            NEW IMAGE          *
*      ------------   ------------       --------------------  *
*           31             1             CURSIVE B (UPPERCASE)  *
*           32             2             CURSIVE O (LOWERCASE)  *
*           33             3             CURSIVE C (LOWERCASE)  *
*           34             4             CURSIVE A (LOWERCASE)  *
*           35             5             CURSIVE R (UPPERCASE)  *
*           36             6             CURSIVE T (LOWERCASE)  *
*           37             7             CURSIVE N (LOWERCASE)  *
*           38             8             CURSIVE F (UPPERCASE)  *
*           39             9             CURSIVE L (LOWERCASE)  *
*****************************************************************
         PRINTEXT  '1234 54627'        PRINT 'BOCA RATON'
         TERMCTRL  PCOLOR,COLOR=BLACK
         PRINTEXT  ','
         TERMCTRL  PCOLOR,COLOR=MAGENTA
         PRINTEXT  '894'               PRINT 'FLA'
         TERMCTRL  PCOLOR,COLOR=BLACK
         TERMCTRL  DWIDE,STATE=STOP
         PRINTEXT  '.'
         PRINTEXT  SKIP=1
*****************************************************************
*   RELEASE THE STORAGE IN THE PRINTER ALLOCATED FOR 'NEWFONT'  *
*****************************************************************
         TERMCTRL  RESTORE             RESTORE PRINTER DEFAULTS
         TERMCTRL  DELFONT,FONTID=+NEWFONT
         DEQT                          RELEASE CONTROL OF PRINTER
*
         QUESTION  'TRY AGAIN ?',YES=START,SKIP=5
         PROGSTOP
*
INITERR  DEQT
         PRINTEXT  'ERROR WITH INITFONT, RETURN CODE= ',SKIP=1
         PRINTNUM  RETCODE
         PRINTEXT  SKIP=1
         PROGSTOP
*
```

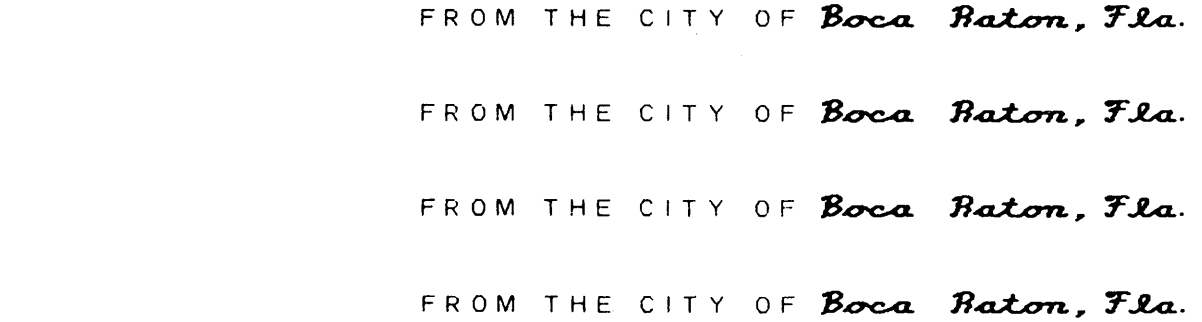
```
LOADERR  DEQT
         PRINTEXT  'ERROR WITH LOADFONT, RETURN CODE= ',SKIP=1
         PRINTNUM  RETCODE
         PRINTEXT  SKIP=1
         PROGSTOP
*****************************************************************
*   DATA AREA                                                   *
*****************************************************************
CYAN     DC        A(#CYAN)          COLOR CYAN
MAGENTA  DC        A(#MAGENTA)       COLOR MAGENTA
BLACK    DC        A(#BLACK)         COLOR BLACK
NEWFONT  EQU       127               NEW FONT ID
NLQPR    EQU       5                 NLQ PROPORTIONALLY-SPACED ID
RETCODE  DC        F'0'              RETURN CODE
FONTADDR DC        A(COUNT)          TOTAL LENGTH OF BINARY DATA
         DC        X'0C'             WIDTH = 12 BITS
         DC        X'12'             HEIGHT = 18 BITS (NLQ)
         DC        X'31'             STARTING CODE POINT
         DC        X'09'             NUMBER OF CODE POINTS ALTERED
BIDATA   EQU       *                 BINARY DATA TO FORM PRINT IMAGES
*
*   UPPERCASE 'B';  CODE POINT - X'31'
*
         DC        X'00008C00'
         DC        X'2200F10F'
         DC        X'CC7C4110'
         DC        X'20481812'
         DC        X'06088284'
         DC        X'11120383'
         DC        X'000000'
*
*   LOWERCASE 'O';  CODE POINT - X'32'
*
         DC        X'00020001'
         DC        X'0001C000'
         DC        X'88004100'
         DC        X'20400810'
         DC        X'020800C4'
         DC        X'002E0004'
         DC        X'000100'
*
*   LOWERCASE 'C';  CODE POINT - X'33'
*
         DC        X'00200004'
         DC        X'0001C000'
         DC        X'88004100'
         DC        X'20400810'
         DC        X'02040061'
         DC        X'00008000'
         DC        X'200010'
```

```
*
*   LOWERCASE 'A';  CODE POINT - X'34'
*
         DC        X'00040002'
         DC        X'00010000'
         DC        X'F8004100'
         DC        X'20400810'
         DC        X'0208009E'
         DC        X'00384000'
         DC        X'100004'
*
*   UPPERCASE 'R';  CODE POINT - X'35'
*
         DC        X'00020400'
         DC        X'4200E10F'
         DC        X'C07C8010'
         DC        X'20080802'
         DC        X'021C8148'
         DC        X'108C03C0'
         DC        X'000000'
*
*   LOWERCASE 'T';  CODE POINT - X'36'
*
         DC        X'00010000'
         DC        X'80004008'
         DC        X'20021000'
         DC        X'9F007820'
         DC        X'E8040201'
         DC        X'00804000'
         DC        X'100004'
*
*   LOWERCASE 'N';  CODE POINT - X'37'
*
         DC        X'00400020'
         DC        X'00087001'
         DC        X'E0004000'
         DC        X'20000800'
         DC        X'02180099'
         DC        X'00184000'
         DC        X'100008'
*
*   UPPERCASE 'F';  CODE POINT - X'38'
*
         DC        X'60062400'
         DC        X'49101388'
         DC        X'38827021'
         DC        X'E00BA003'
         DC        X'08008200'
         DC        X'20800800'
         DC        X'010000'
```

```
*
*   LOWERCASE 'L';  CODE POINT - X'39'
*
         DC        X'00020000'
         DC        X'40001000'
         DC        X'08000401'
         DC        X'FE0101C0'
         DC        X'81882181'
         DC        X'07804000'
         DC        X'100008'
COUNT    EQU       *-BIDATA
*
         ALIGN     WORD
*********************************************************************
*   EXAMPLE OF HOW THE DATA WAS OBTAINED FOR UPPERCASE 'F'          *
*********************************************************************
* STEP 1 -                                                          *
*   MAKE A PATTERN OF DOTS CORRESPONDING TO THE HEIGHT AND WIDTH    *
*   OF THE CHARACTER CELL.  EACH DOT CORRESPONDS TO A BIT AND       *
*   MUST EITHER BE ON OR OFF.  PLACE THE NUMBER SIGN ('#') OVER     *
*   THE DOTS WHICH MUST BE TURNED ON TO FORM THE IMAGE.             *
*                                                                   *
*                 . # # # # # # # # # # .                           *
*                 # . . # . . . # . . . #                           *
*                 # . . # . . # . . . . .                           *
*                 . # # . . . # . . . . .                           *
*                 . . . . . . # . . . . .                           *
*                 . . . . . # . . . . . .                           *
*                 . . . # # # # # # # . .                           *
*                 . . # . . # . . . . . .                           *
*                 . . . . . # . . . . . .                           *
*                 . . . . # . . . . . . .                           *
*                 . . . . # . . . . . . .                           *
*                 . . . . # . . . . . . .                           *
*                 . . . # . . . . . . . .                           *
*                 # . . # . . . . . . . .                           *
*                 # . . # . . . . . . . .                           *
*                 . # # . . . . . . . . .                           *
*                 . . . . . . . . . . . .                           *
*                 . . . . . . . . . . . .                           *
*                                                                   *
*********************************************************************
```

```
*****************************************************************
* STEP 2 -                                                      *
*   STARTING FROM THE TOP LEFT HAND CORNER AND WORKING DOWN,    *
*   REPLACE EACH DOT WITH A '0', AND EACH '#' WITH A '1'.       *
*   THEN SEPARATE THE BINARY DATA INTO GROUPS OF FOUR BITS.     *
*                                                               *
*                  0110 0000 0000 0110 00                       *
*                  10 0100 0000 0000 0100                       *
*                  1001 0001 0000 0001 00                       *
*                  11 1000 1000 0011 1000                       *
*                  1000 0011 0111 0000 00                       *
*                  10 0001 1110 0000 0000                       *
*                  1011 1001 0000 0000 00                       *
*                  11 0000 1000 0000 0000                       *
*                  1000 0010 0000 0000 00                       *
*                  10 0000 1000 0000 0000                       *
*                  1000 0000 0000 0000 00                       *
*                  01 0000 0000 0000 0000                       *
*                                                               *
*****************************************************************
* STEP 3 -                                                      *
*   CONVERT THE DATA TO HEXADECIMAL                             *
*                                                               *
*                   6  0  0  6  2                               *
*                    4  0  0  4                                 *
*                   9  1  0  1  3                               *
*                    8  8  3  8                                 *
*                   8  2  7  0  2                               *
*                    1  E  0  0                                 *
*                   B  A  0  0  3                               *
*                    0  8  0  0                                 *
*                   8  2  0  0  2                               *
*                    0  8  0  0                                 *
*                   8  0  0  0  1                               *
*                    0  0  0  0                                 *
*                                                               *
*--------------------  END OF EXAMPLE  ------------------------*
*
        ENDPROG
        END
```

The previous program example set colors from the default, black, to cyan, and then to magenta. Cyan and magenta portions of the actual output appear as red in the following output example.



Syntax:

label	**TERMCTRL SETFONT,FONTID=**
Required:	**SETFONT,FONTID=**
Defaults:	**none**
Indexable:	**FONTID=**

Operand	*Description*
SETFONT	Specifies the new active font for subsequent printing. This can be only a print style such as NLQ (local font ID 3), or it can be a totally self-defining font such as OCR-A (local font 16), which includes both print style and a character set. It can also be a font you defined (local font IDs 32−127), which can include print images you loaded. Print images you load are completely self-defining for individual code points.
FONTID=	A 1-word font ID that specifies the font you select as the active font. You can select one of the permanent printer fonts or one you have defined. Font IDs exceeding 255 are invalid.

Code	*Font Name*
1	DP (Data Processing) at current print density.
2	Text at current print density.
3	NLQ (Near Letter Quality) at current print density.
4	Text; proportionally spaced.
5	NLQ; proportionally spaced.
6−15	Reserved.
16	OCR-A (Optical Character Recognition).
17	OCR-B.
31	Reserved.
32−127	Fonts you have defined.
128−255	Reserved.

When an OCR font is selected, the OCR character set and print density (LARGE) will become temporarily activated. When another font is subsequently selected, the previous print characteristics will be restored.

If any of the highlighting controls (SCRIPT, DSTRIKE, ITALICS, UNDER, OVER) are in effect when an OCR font is selected, the OCR characters may be unreadable by automatic identification equipment.

Selecting fonts 4 or 5 automatically resets print density to LARGE and redefines print densities while the font is active. You can select a new print density. However, since the fonts are proportionally spaced, and the width of each character varies, the number of characters per inch are approximations. While fonts 4 or 5 are in effect, the available print densities are:

Mnemonic	*Print Density*
LARGE	8 characters per inch, approximately.
NORMAL	10 characters per inch, approximately.
DENSE	12 characters per inch, approximately.

The following table shows the TERMCTRL SET instruction for the 4975-02L and the corresponding TERMCTRL SETFONT command on the 4224. If you code TERMCTRL SET,PMODE=, then $4975 must be linked with your application. If you code TERMCTRL SETFONT,FONTID=, $4975 is not needed.

4975-02L Instruction	**4224 Instruction**
SET,PMODE=DRAFT	SETFONT,FONTID=1
SET,PMODE=TEXT	SETFONT,FONTID=5
SET,PMODE=TEXT1	SETFONT,FDONTID=4

If the selected font is a printer-provided font and it is being selected for the first time, the 4224 printer initializes the font. This initialization binds the default character set, which was selected during printer set-up or with the CHARSET command, to the font being initialized. For those fonts that define their own character sets (OCR-A, OCR-B), no such binding occurs. If you delete a printer-provided font with the DELFONT command, you can reinitialize it with the SETFONT command.

Syntax Example

The following example specifies the proportionally-spaced near-letter-quality font as the new active font on the 4224 printer.

```
TERMCTRL  SETFONT,FONTID=5   SET NEW FONT
```

Syntax:

label	**TERMCTRL CHARSET,CHARID=,FONTID=**
Required:	**CHARSET**
Defaults:	**CHARID=PC2,FONTID=255**
Indexable:	**CHARID=,FONTID=**

Operand	*Description*
CHARSET	Used in conjunction with INITFONT to assign a specific character set to a font you define. Also used to establish a character set as the default for subsequent initializations of printer-provided fonts. To select the language character set for Japanese katakana, specify CHARID=KANA on the TERMCTRL statement and CODTYPE=EBCDIC during system generation. **Note:** You can select one of a variety of languages other than English by running offline test 303 to select the default character set and by specifying CODTYPE=EBCDIC on the terminal statement. Once you have done this, you do not need to issue the TERMCTRL CHARSET statement.
CHARID=	A word value that specifies the character set from which the printer will assign graphic characters. The following is a list of available character sets:

Parameter	*Description*
PC1	Select the PC character set 1 (ASCII).
PC2	Select the PC character set 2, the default (ASCII).
INT1	Select the International 1 character set (EBCDIC).
INT5	Select the International 5 character set (EBCDIC).
APL	Select the APL character set (EBCDIC).
KANA	Select the Japanese katakana character set (EBCDIC).

Both PC1 and PC2 are subsets of the standard PC ASCII character set.

With PC1, code points X'00'−X'1F' are control characters (as opposed to printable characters). Code points X'80'−X'9F' are control characters corresponding exactly to code points X'00'−X'1F'. Code point X'7F' is also a control character. All other code points are printable characters.

With PC2, code points X'00' – X'1F' are control characters except for code points X'03' – X'06' and X'15', which are printable characters. Code points X'20' – X'FF' are also printable characters.

Character set INT5 supersedes character set INT1. Character set INT1 is provided for compatibility purposes.

Note: APL and Japanese katakana character set selections are valid only with a font of DP quality.

FONTID = A 1-word font ID that specifies to which font the character set will be assigned. On a subsequent font change, this character set will be the active one.

Values of 1 – 31 are invalid. When FONTID = specifies a font you defined (32 – 127) that has been previously initialized with the INITFONT operand, the printer assigns the character set you specified with the CHARID = operand to this local font.

When FONTID = 255, the character set specified with CHARID = becomes the default character set for subsequent initializations of printer-provided fonts. This character set is bound to these fonts during execution of the TERMCTRL SETFONT command. The only exception to this is printer fonts that define their own character sets such as OCR-A and OCR-B. These fonts are initialized without regard to the default character set.

When FONTID = 255, CHARID = must not be APL or KANA.

The initial default character set should be set using customer test 303 during printer set-up. Refer to the *Installation and System Generation Guide* for set-up information.

Syntax Example

The following example establishes INT5 as the active character set on the 4224 printer with near letter quality print.

```
TERMCTRL  CHARSET,CHARID=INT5,FONTID=255  ESTABLISH DEFAULT
TERMCTRL  SETFONT,FONTID=3                ACTIVATE NLQ FONT
```

Coding Example

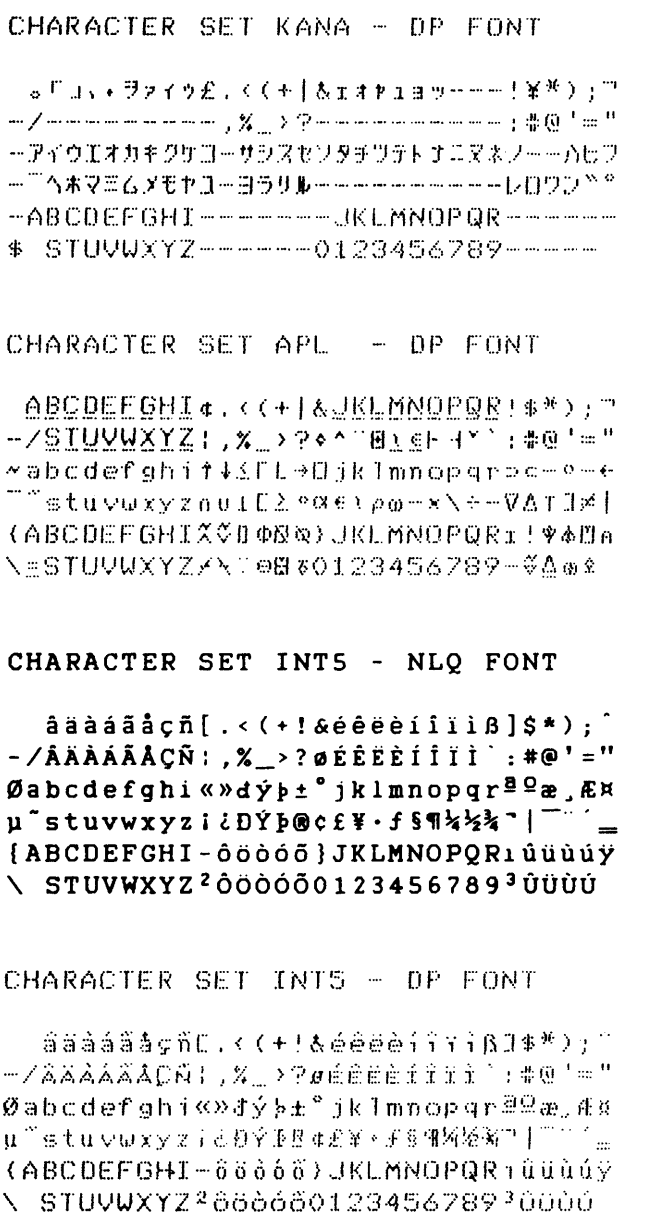
The following example demonstrates coding for the CHARSET command on the 4224 printer.

```
CHARSET  PROGRAM   START,TERMERR=ERROR
*****************************************************************
* DEMONSTRATE CHARACTER SET SELECTION ON THE 4224 PRINTER.      *
*****************************************************************
START    EQU       *
*****************************************************************
*  INPUT PRINTER NAME AND ENQUEUE PRINTER.                      *
*****************************************************************
         READTEXT  PRINTER,'@ENTER 4224 PRINTER NAME:  '
         MOVE      IOCB4224,PRINTER,(8,BYTES)
         ENQT      IOCB4224
         TERMCTRL  RESTORE             RESTORE PRINTER DEFAULTS
*****************************************************************
* GENERATE CODE POINTS X'20'-X'FF' IN SEVEN GROUPS.             *
*****************************************************************
         MOVEA     #1,CHAR1            POINT TO 1ST DATA AREA
         DO        +SEVEN,TIMES        THERE ARE SEVEN GROUPS
           DO        +COUNT,TIMES      GROUP SIZE IS 'COUNT'
             MOVE      (0,#1),NEXT+1,BYTE   SAVE CURRENT CODE POINT
             ADD       NEXT,+ONE       COMPUTE NEXT CODE POINT
             ADD       #1,+ONE         INCREMENT DATA POINTER
           ENDDO                       END OF INNER LOOP
           ADD       #1,+TWO           POINT TO NEXT DATA AREA
         ENDDO                         END OF OUTER LOOP
         ENQT      PRINTER
         TERMCTRL PCOLOR,COLOR=BLUE    USE THE COLOR BLUE
*****************************************************************
* PRINTER-PROVIDED FONT 1 IS INITIALIALIZED AUTOMATICALLY.      *
* INITIALIZE LOCAL FONT 33 AND MAKE IT THE ACTIVE FONT.         *
* BIND CHARACTER SET KATAKANA TO LOCAL FONT 33.                 *
*****************************************************************
         TERMCTRL INITFONT,FONTID=33,OLDFONT=1
         TERMCTRL SETFONT,FONTID=33
         TERMCTRL CHARSET,CHARID=KANA,FONTID=33
         PRINTEXT 'CHARACTER SET KANA - DP FONT ',SKIP=2,XLATE=NO
         CALL     PRINT                PRINT CHARS X'20' - X'FF'
*****************************************************************
* BIND CHARACTER SET APL TO LOCAL FONT 33;  CALL PRINT ROUTINE. *
*****************************************************************
         TERMCTRL CHARSET,CHARID=APL,FONTID=33
         PRINTEXT 'CHARACTER SET APL  - DP FONT ',SKIP=2,XLATE=NO
         CALL     PRINT                PRINT CHARS X'20' - X'FF'
*****************************************************************
* MAKE INT5 THE DEFAULT CHARACTER SET FOR ALL SUBSEQUENT        *
* INITIALIZATIONS OF PRINTER-PROVIDED FONTS.                    *
* INITIALIZE FONT 3; BIND DEFAULT CHARACTER SET INT5 TO FONT 3. *
*****************************************************************
         TERMCTRL CHARSET,CHARID=INT5,FONTID=255
         TERMCTRL SETFONT,FONTID=3
         PRINTEXT 'CHARACTER SET INT5 - NLQ FONT',SKIP=2,XLATE=NO
         CALL     PRINT                PRINT CHARS X'20' - X'FF'
```

```
*****************************************************************
* DELETE AND REINITIALIZE PRINTER-PROVIDED FONT 1 IN ORDER      *
* TO BIND DEFAULT CHARACTER SET INT5 TO FONT 1.                 *
*****************************************************************
         TERMCTRL DELFONT,FONTID=1
         TERMCTRL SETFONT,FONTID=1
         PRINTEXT 'CHARACTER SET INT5 - DP FONT',SKIP=2,XLATE=NO
         CALL     PRINT               PRINT CHARS X'20' - X'FF'
*****************************************************************
* MAKE PC2 THE DEFAULT CHARACTER SET FOR ALL SUBSEQUENT         *
* INITIALIZATIONS OF PRINTER-PROVIDED FONTS.                    *
* ISSUE A FORMFEED TO SYNCHRONIZE SOFTWARE AND HARDWARE SPACING.*
* DELETE LOCAL FONT 33 AND RESTORE THE PRINTER DEFAULT STATE    *
* LEAVING CHARACTER SET INT5 BOUND TO FONTS 1 AND 3.            *
*****************************************************************
         TERMCTRL CHARSET,CHARID=PC2,FONTID=255
         PRINTEXT LINE=0
         TERMCTRL DELFONT,FONTID=33
         TERMCTRL RESTORE
         DEQT
         PROGSTOP
*****************************************************************
* SUBROUTINE PRINT:                                             *
*   PRINT CODE POINTS X'20'-X'FF' ON SEVEN CONSECUTIVE LINES.   *
*****************************************************************
         SUBROUT  PRINT
         MOVEA    #1,CHAR1
         DO       +SEVEN,TIMES
           PRINTEXT (0,#1),XLATE=NO,SKIP=1
           ADD      #1,+TEXTSIZE
         ENDDO
         PRINTEXT SKIP=1
         RETURN
*****************************************************************
* ERROR HANDLER:                                                *
*   PRINT RETURN CODE AND ADDRESS OF INSTRUCTION CAUSING ERROR. *
*****************************************************************
ERROR    EQU      *
         TCBGET   RETCODE,$TCBCO
         TCBGET   ADDRESS,$TCBCO2
         DEQT
         PRINTEXT '@TERMINAL ERROR '
         PRINTNUM RETCODE,MODE=HEX
         PRINTEXT '  OCCURRED AT ADDRESS '
         PRINTNUM ADDRESS,MODE=HEX
         PRINTEXT SKIP=1
         PROGSTOP
*****************************************************************
* EQUATES                                                       *
*****************************************************************
ONE      EQU      1
TWO      EQU      2
SEVEN    EQU      7
COUNT    EQU      32
```

```
*****************************************************************
* DATA AREA                                                     *
*****************************************************************
IOCB4224 IOCB     DUMMY               PRINTER IOCB
PRINTER  TEXT     LENGTH=8            PRINTER NAME
RETCODE  DC       F'0'                RETURN CODE OF ERROR
ADDRESS  DC       F'0'                ADDRESS OF BAD INSTRUCTION
NEXT     DC       F'32'               NEXT CODE POINT
CHAR1    TEXT     LENGTH=32           CODE POINTS X'20'-X'3F'
CHAR2    TEXT     LENGTH=32           CODE POINTS X'40'-X'5F'
CHAR3    TEXT     LENGTH=32           CODE POINTS X'60'-X'7F'
CHAR4    TEXT     LENGTH=32           CODE POINTS X'80'-X'9F'
CHAR5    TEXT     LENGTH=32           CODE POINTS X'A0'-X'BF'
CHAR6    TEXT     LENGTH=32           CODE POINTS X'C0'-X'DF'
CHAR7    TEXT     LENGTH=32           CODE POINTS X'E0'-X'FF'
TEXTSIZE EQU      CHAR2-CHAR1         TOTAL SIZE OF TEXT LINE
         ENDPROG
         END
```

The preceding example produces the following output on the 4224 printer.



Syntax:

label	**TERMCTRL DELFONT,FONTID=**
Required:	**DELFONT,FONTID=**
Defaults:	**none**
Indexable:	**FONTID**

Operand	*Description*
DELFONT	Deletes a font you have initialized previously with the exception of the currently active font. When you delete a font, your printer releases the storage it allocated for that font. Any images you sent to the font being deleted are lost.
FONTID=	A 1-word font ID that specifies the local font you intend to delete. When FONTID=255, the printer deletes all fonts except the currently active one. If the font you specify with the FONTID= operand is one provided by the printer, you can reinitialize it using the SETFONT operand. You must reinitialize fonts you define with TERMCTRL INITFONT.

Syntax Example

The following example deletes the font with ID 32 on the 4224 printer.

```
TERMCTRL  DELFONT,FONTID=32        DELETE LOCAL FONT 32
```

Syntax:

label	**TERMCTRL PDEN,DENSITY=**
Required:	**PDEN**
Defaults:	**DENSITY=NORMAL**
Indexable:	**DENSITY=**

Operand ***Description***

PDEN Alters the print density to 10, 12, or 15 characters per inch.

This command provides the same function as SET,PDEN=. It is provided so that new applications for the 4224 do not need to be linked with module $4975.

DENSITY=

A word value specifying the desired density.

Mnemonic	*Description*
LARGE	10 CPI
NORMAL	12 CPI
DENSE	15 CPI

If either NORMAL or DENSE is selected and the currently active font is OCR, the printed OCR characters will be unreadable by Automatic Identification equipment.

The 4224 densities differ from the 4975-02L densities as follows:

4975-02L Mnemonic	4975-02L Density	4224 Mnemonic	4224 Density
COMP	20 CPI	DENSE	15 CPI
NORM	15 CPI	NORMAL	12 CPI
EXPD	10 CPI	LARGE	10 CPI

The following table indicates comparable interpretations for the TERMCTRL SET instruction on the 4975-02L and the TERMCTRL PDEN instruction on the 4224 printer.

4975-02L Instruction	4224 Instruction
SET,PDEN=NORM	PDEN,DENSITY=DENSE
SET,PDEN=COMP	PDEN,DENSITY=DENSE
SET,PDEN=EXPD	PDEN,DENSITY=LARGE

Syntax Example

The following example sets the print density to 15 characters per inch on the 4224 printer.

```
TERMCTRL  PDEN,DENSITY=DENSE     SET DENSITY TO 15 CPI
```

Syntax:

label	**TERMCTRL function,STATE=**
Required:	**function**
Defaults:	**STATE=START**
Indexable:	**none**

Operand	*Description*	
function:		
	UNDER	Turns the continuous underscore function on or off.
	OVER	Turns the continuous overscore function on or off.
	ITALICS	Turns the continuous italics print function on or off.
	DSTRIKE	Turns the double strike print function on or off. With this function, each dot printed is printed twice. This gives the print stroke a darker appearance.
	DWIDE	Turns the double width print function on or off. In this mode the character being printed is adjusted to occupy twice its current width.
	BOLD	Turns the bold (emphasized) print function on or off. In this mode, each dot printed is accompanied by a second dot appearing just to the right of and partially overlapping the first dot. This gives the appearance of a thicker print stroke.
STATE=	Specifies the status of the function. Once you activate any of the operands described above, that operand remains active until you issue a TERMCTRL with STATE=STOP. Select a STATE for the function with one of the following parameters:	

Parameter	*Description*
START	Turns the function on.
STOP	Turns the function off.

Syntax Example

The following example starts the double width print mode on a 4224 printer.

```
TERMCTRL  DWIDE,STATE=START    BEGIN DOUBLE-WIDTH PRINT
```

Syntax:

label	**TERMCTRL SCRIPT,TYPE=,STATE=**
Required:	**SCRIPT,TYPE=**
Defaults:	**STATE=START**
Indexable:	**none**

Operand	*Description*
SCRIPT	Turns one of two different print modes on or off.
TYPE=	Specifies the choice of a script type.

Operand	*Description*
SUB	Subscript print mode.
SUPER	Superscript print mode.

The 4224 prints subscripts and superscripts by using half-high NLQ characters. Subscript and superscript modes cannot be in effect at the same time.

STATE= Specifies the status of the function. Once SCRIPT mode is activated, it remains active until you issue a TERMCTRL SCRIPT with STATE=STOP. Select a state for the function with the following operands:

Parameter	*Description*
START	Turns the function on.
STOP	Turns the function off.

Syntax Example

The following example starts subscripting on a 4224 printer.

```
TERMCTRL  SCRIPT,TYPE=SUB,STATE=START   START SUBSCRIPT MODE
```

Syntax:

label	**TERMCTRL LPI,HEIGHT=**
Required:	**LPI**
Defaults:	**HEIGHT=36**
Indexable:	**HEIGHT=**

Operand	*Description*
LPI	Alters line spacing (height of a line).
HEIGHT=	A 1-word value in 1/216 inch increments that specifies line height. The default, HEIGHT=36 (36/216 inch), results in 6 lines per inch. To get 8 lines per inch, specify HEIGHT=27 (27/216 of an inch). To calculate line size values, divide 216 by the desired number of lines per inch. To maximize printer accuracy, choose a height that is a multiple of 3.

The line spacing you choose in combination with the logical page size (line count) must match the physical length of the forms. For example, a line height of 27/216 inch or 8 lines per inch along with a logical page size of 88 matches a physical page size of 11 inches.

See "Additional 4224 Printer Information" on page 2-490 for additional information about page size.

The following table indicates comparable interpretations for the TERMCTRL SET instruction on the 4975-02L and the TERMCTRL LPI instruction on the 4224.

4975-02L Instruction	4224 Instruction
SET,LPI=6	LPI,HEIGHT=36
SET,LPI=8	LPI,HEIGHT=27

Syntax Example

The following example specifies three lines per inch on the 4224 printer by resetting the line height.

```
TERMCTRL  LPI,HEIGHT=72          SET LPI to 3
```

Syntax:

label	**TERMCTRL PCOLOR,COLOR =**
Required:	**PCOLOR**
Defaults:	**COLOR = BLACK**
Indexable:	**COLOR =**

Operand	*Description*
PCOLOR	Specifies the color that the printer uses to print text. Eight colors are available with the subtractive ribbon. Four colors (black, red, green, and blue) are available with the accent ribbon. If you install the wrong ribbon and the color you request is not available, the printer uses the default color (black).
COLOR =	The following values are valid:

Parameter	*Description*
BLUE	Select the color blue.
RED	Select the color red.
MAGENTA	Select the color magenta.
GREEN	Select the color green.
CYAN	Select the color turquoise/cyan.
YELLOW	Select the color yellow.
BLACK	Select the color black.
BROWN	Select the color brown.

Syntax Example

The following example specifies magenta as the active color on the 4224 printer.

```
TERMCTRL  PCOLOR,COLOR=MAGENTA   PRINT IN MAGENTA
```

Return Codes

Return Code	Condition
600	Invalid TERMCTRL command for the attached printer.
602	Invalid TERMCTRL – operand value exceeds 255.
610	Invalid character set specification (CHARSET).
611	Invalid density specification (PDEN).
612	Invalid line spacing specification (LPI).
613	Invalid color specification (PCOLOR).
616	Invalid font ID – must be user font ID.
617	Invalid font ID – cannot be reserved font ID.
620	Invalid barcode orientation.
621	Invalid barcode data count.
622	Invalid barcode type.
623	Modifier incompatible with BARCODE selected.
624	Invalid barcode width.
630	Invalid character cell width for font download.
631	Invalid character cell height for font download.
632	Invalid code point – X'00' cannot be downloaded.
633	Starting code point plus the number of characters to be modified exceeds 256 for font download.
634	Count of image data bytes not consistent with other parameters for font download. The following equation describes the relationship: (Number of Code Points) * (Height * Width / 8 *rounded to the nearest whole number*) = Number of image bytes.

Error Logging

The 4224 printer sends status to the Series/1 to report conditions such as out of paper and forms jam. Printer support will log such status conditions to the system error log data set. These status conditions are reported as permanent errors. Errors will appear in the standard EDX logging format. Refer to the *Problem Determination Guide* for additional information on the log format.

The ISB will contain a status byte indicating the cause of any problem. Refer to the IBM *4224 Printer Product and Programming Description Manual*, GC31-2550 to interpret this status byte.

Special Considerations

The 4224 printer support provides the same basic support as a 4975-02L. This includes support for the following EDL statements:

- PRINTDATE
- PRINTEXT
- PRINTNUM
- PRINTIME
- TERMCTRL.

Applications that currently run on the 4975-02L printer will run on the 4224 printer without reassembly with the exceptions noted in this section. However, a new system generation is required and applications must be relinked to include the modified $4975 module.

To take advantage of any new function provided by the 4224 printer, you must modify and reassemble your 4975-02L printer applications. If you decide to modify your application, you can avoid relinking with module $4975 by replacing the TERMCTRL SET instructions in your program with corresponding TERMCTRL instructions for the 4224 printer as follows:

4975-02L Instruction	4224 Instruction
SET,LPI=	LPI,HEIGHT=
SET,PMODE=	SETFONT,FONTID=
SET,PDEN=	PDEN,DENSITY=
SET,CHARSET=	(OFFLINE TEST 303)
SET,RESTORE	RESTORE

If you decide not to reassemble your application, note the following:

- PMODE=TEXT on the 4224 printer produces near letter quality, proportionally-spaced characters with a single pass of the print head (FONTID=5). PMODE=TEXT directs the 4224 to reset the print density to large and to redefine horizontal densities. See TERMCTRL SET for more information. PMODE=TEXT on the 4975-02L printer produces TEXT quality, proportionally-spaced characters with two passes of the print head. PMODE=TEXT directs the 4975-02L to select the appropriate density for the proportionally-spaced characters.
- PMODE=TEXT1 on both the 4975-02L and the 4224 printer produces TEXT quality proportionally-spaced characters with a single pass of the print head (FONTID=4 on the 4224). PMODE=TEXT1 directs the 4975-02L to select the appropriate density for the proportionally-spaced characters. PMODE=TEXT1 directs the 4224 to reset the print density to large and to redefine horizontal densities. See TERMCTRL SET for more information.
- PMODE=DRAFT on both the 4975-02L and the 4224 produces data processing quality, monospaced characters with a single pass of the print head.

  Note: Near letter quality is a higher quality type than text quality.
- The TERMCTRL DCB= operand of the 4975-02L is not supported on the 4224 printer.
- TERMCTRL SET,CHARSET= is a null operation on the 4224 printer. You can select a character set for languages other than English by running offline test 303. See TERMCTRL SET,CHARSET= for additional information.
- TERMCTRL SET,PMODE=TEXT or TEXT1 on the 4975-02L printer produces approximately 5 CPI. TERMCTRL SET,PMODE=TEXT or TEXT1 on the 4224 printer, however, produces approximately 8, 10, or 12 CPI (depending on the density selected).

  To produce approximately 5 CPI on the 4224 printer, simulating the 4975-02L, issue TERMCTRL DWIDE and TERMCTRL PDEN,DENSITY=NORMAL after issuing TERMCTRL SET,PMODE=TEXT or TEXT1.

- TERMCTRL SET,PDEN= values (print densities in characters per inch) for the 4975-02L and 4224 printers differ in the following manner:

Density	4975-02L Printer	4224 Printer
Compressed	COMP=20	COMP=15
Normal	NORM=15	NORM=15
Expanded	EXPD=10	EXPD=10

- If you switch the 4224 printer off and then on, it resets the following functions as shown:

Function	*Hardware Default*
BARCODE	Deleted (if pending)
BOLD	Off
CHARSET	Offline test 303 value
DSTRIKE	Off
DWIDE	Off
ITALICS	Off
Loaded fonts	Deleted
LPI	Offline test 302 value
OVER	Off
PCOLOR	Black
PDEN	Offline test 302 value
SETFONT	Offline test 302 value
SUBSCRIPT	Off
SUPERSCRIPT	Off
UNDER	Off

- Data streaming mode is supported to allow the user access to features of the 4224 printer not implemented. Issuing a PRINTEXT with XLATE=NO activates data streaming mode.

  Text data to be sent to the 4224 printer is not translated when XLATE=NO is coded. Each PRINTEXT, XLATE=NO is counted by the printer support as a single line even though multiple physical lines may be printed. Therefore, when switching from untranslated mode to translated mode, you may want to issue a PRINTEXT LINE=0 before issuing translated commands in order to synchronize the hardware and the software. For details on the printer data stream, refer to the IBM *4224 Printer Product and Programming Description Manual*, GC31-2550.

Additional 4224 Printer Information

- Not all $TERMUT1 and $TERMUT2 utility functions of the 4975-02L printer are available directly on the 4224 printer. Refer to information on the use of these utilities with the 4224 and 4975-02L printers in the *Operator Commands and Utilities Reference*.

- The 4224 printer maintains physical page size in inches. You select the initial physical page size using offline test 302. The 4224 printer support maintains logical page size as a line count. Whenever you change logical page size with ENQT, DEQT, or $TERMUT1, be sure to alter line height so that: (physical page size in inches) x (lines per inch) = (logical page size).

- The 4224 printer supports both ASCII and EBCDIC character sets. The different models of the 4224 are indistinguishable to the EDX printer support. Variations among the printer models are as follows:
  - Model 301 — runs at 200 characters per second (top speed). It has only one color (black).
  - Model 302 — runs at 400 characters per second (top speed). It has only one color (black).
  - Model 3C2 — runs at 400 characters per second (top speed). It supports up to eight colors depending on which ribbon is installed.
- If the green light on the 4224 flashes after you have cancelled your application, you can empty the printer's buffer as follows:
  1. Press the STOP button on the 4224 printer.
  2. Press the ALT and CANCEL buttons to clear the 4224 print buffer.
  3. Press the START button on the 4224 printer.
- PRINTEXT instructions issued to the 4224 printer return the ACCA return codes listed under "PRINTEXT – Display a Message on a Terminal" on page 2-307.
- To interpret the ISB after an I/O completion error, refer to the hardware manual of the Series/1 attachment being used to drive the 4224 printer (MFA or 2095/2096). To interpret the ISB after an error is reported as an attention interrupt, refer to the IBM *4224 Printer Product and Programming Description Manual*, GC31-2550.
- If you have issued an ENQT with an IOCB and provided a local buffer to be used instead of the terminal control block (CCB) buffer, remember the following.
  - Do not alter the buffer in any way (except for direct I/O) during the time when the buffer is in use as a system buffer.
  - The printer support issues additional I/O operations because the same buffer must be used for both application data and TERMCTRL data. This degrades performance.
  - The logical right margin on the 4224 printer is automatically set to buffer size plus left margin minus 1, regardless of the value you specify for RIGHTM=. If you exceed the physical right margin of the 4224, the extra data is printed on the next line.
- If you specify MODE=PAGE on the TERMINAL statement for the 4224 printer, you define it as a page printer. When printer I/O crosses a page boundary, the printer support issues a form feed to start on a new page and line feeds to position the paper to the correct line.

  The printer maintains physical page size in inches; the software that supports the printer maintains logical page size as a count of lines per page. When you specify MODE=PAGE and then change the logical page size using ENQT or $TERMUT1, the printer support sends a control sequence to the 4224 that changes the physical page size to a value (in inches) of:

  (logical page size) / (current LPI (lines per inch))

  For example, if the logical page size is 88 and the current value for LPI is 8, the physical page size becomes 11 inches. A subsequent change to LPI does not change the physical page size until the next time you change the logical page size.

Each time you change the page size, the printer support assumes the new forms have been inserted in the printer at the top-of-forms position. Make certain the hardware top-of-forms indicator is set to this position To do this:

1. Press the STOP button on the 4224 printer.
2. Press the TOP-OF-FORM button on the 4224 printer.
3. Press the STARTbutton on the 4224 printer.

If the serial printer support detects a page change, it issues line feeds for the top margin before printing any data. The space the top margin occupies depends on the size of the top margin (in lines) and the current value for LPI.

If your application varies line height within a page, the logical line pointer and the physical line pointer get out of sync. To allow for this, use the following procedure:

1. Issue a TERMCTRL LPI to select the greatest density to be used on the page.
2. ENQT on an IOCB, choosing a PAGSIZE such that PAGSIZE/LPI is equal to the physical forms size in inches.
3. Print data and change LPI as needed without crossing the physical page boundary.
4. Issue a PRINTEXT LINE=0 to advance to a new page. This causes a form feed to be sent to the printer to realign the logical and physical line pointer.

For example, if your form length is 11 inches (with 1/2 inch top and bottom margins) and your application uses both 6 LPI and 8 LPI on a page, your application should:

1. Issue TERMCTRL LPI,HEIGHT=27 to select 8 LPI.
2. ENQT on an IOCB with PAGSIZE=88, TOPM=4, and BOTM=83.
3. Print data and change LPI as needed.
4. When the page has been filled, issue a PRINTEXT LINE=0.

- If your application issues PRINTEXT XLATE=NO (data streaming), the printer support issues no control characters (such as line feed or carriage return) to the printer for that PRINTEXT instruction.

Programming Aids

All mnemonics have associated equates that can be used to generate values during execution. The equate is the same as the mnemonic, but it has a # in front of it. You can find the equates in the copy code module EQU4224.

The bar code orientation mnemonics have the following equates:

Mnemonic	Equate	Equate Value
HORZ	#HORZ	0
VERT	#VERT	1

The BARTYPE= mnemonics have the following equates:

Mnemonic	Equate	Equate Value
CODE3#9	#CODE3#9	1
MSI	#MSI	2
UPC#A	#UPC#A	3
UPC#E	#UPC#E	5
UPC#2	#UPC#2	6
UPC#5	#UPC#5	7
EAN#8	#EAN#8	8
EAN#13	#EAN#13	9
INDUST	#INDUST	10
MATRIX	#MATRIX	11
LEAVED	#LEAVED	12

The WIDTH= mnemonics have the following equates:

Mnemonic	Equate	Equate Value
NARROW	#NARROW	14
WIDE	#WIDE	21

The CHARID= mnemonics have the following equates:

Mnemonic	Equate	Equate Value
KANA	#KANA	0
PC1	#PC1	1
PC2	#PC2	2
INT1	#INT1	3
INT5	#INT5	4
APL	#APL	5

The DENSITY= mnemonics have the following equates:

Mnemonic	Equate	Equate Value
LARGE	#LARGE	0
NORMAL	#NORMAL	1
DENSE	#DENSE	2

The PCOLOR= mnemonics have the following equates:

Mnemonic	Equate	Equate Value
BLUE	#BLUE	1
RED	#RED	2
MAGENTA	#MAGENTA	3
GREEN	#GREEN	4
CYAN	#CYAN	5
YELLOW	#YELLOW	6
BLACK	#BLACK	8
BROWN	#BROWN	16

Equate values should never be hard-coded. Either the mnemonic should be used (when the value is known at assembly time), or the equate should be used (for run time recognition).

Coding Example

The following example demonstrates accessing a color at run time.

```
         MOVE      #1,+#BLUE          USE COLOR BLUE
         TERMCTRL  PCOLOR,COLOR=#1    SET DESIRED COLOR
         •
         •
         •
         TERMCTRL  PCOLOR,COLOR=SKYBLUE   SET COLOR BLUE
         •
         •
         •
         MOVEA     #1,SKYBLUE         POINT TO BLUE
         TERMCTRL  PCOLOR,COLOR=(0,#1)    SET DESIRED COLOR
         •
         •
         •
SKYBLUE  DATA      A(+#BLUE)          COLOR BLUE
```

All equates for the 4224 printer are word values. Be sure to define them as such in storage with the data definition A(+equate).

4973 Printer

Syntax:

label	**TERMCTRL function,LPI=,DCB=**
Required:	**function**
Defaults:	**none**
Indexable:	**none**

Operand	*Description*	
function:		
	SET	Sets the number of lines per inch and causes any buffered output to be printed. The system also resets the current output position to the beginning of the left margin. When you specify SET, you must also specify LPI.
	DISPLAY	Causes the system to write to the 4973 any buffered output.
LPI=		The number of lines per inch (either 6 or 8) the 4973 is to print. This operand is required when the SET function is specified.
DCB=		The label of an 8-word device control block you define with the DCB statement. The 4973 support code provides an IDCB that points to this DCB and issues a START I/O instruction to the device. The system does a wait operation and control returns to you after the interrupt is received from the device. If the post-cursor bit is set on in word 0 of the DCB, the terminal support updates the internal cursor position according to word 1 of the DCB. If an error occurs, an error return is made according to normal terminal I/O conventions. Do not code any other operands when you specify this operand on the TERMCTRL statement. You cannot have another DCB chained to the one specified by the DCB operand. You should be familiar with the 4973 hardware and terminal I/O internals when you use this operand.

Syntax Examples

1) Print the contents of the buffer.

```
WRITEPTR  TERMCTRL  DISPLAY
```

2) Set printer to print eight lines per inch.

```
          TERMCTRL  SET,LPI=8
```

3) Set printer to print six lines per inch.

```
          TERMCTRL  SET,LPI=6
```

4974 Printer

Syntax:

label	**TERMCTRL function,opnd1,opnd2,count,TYPE=,LPI=,** **DCB=**
Required:	**function**
Defaults:	**none**
Indexable:	**opnd1,opnd2**

Operand *Description*

function:

SET Sets the number of lines per inch and causes any buffered output to be printed. The system also resets the current output position to the beginning of the left margin.

When you specify SET, you must also specify LPI.

DISPLAY Causes the system to write to the 4974 any buffered output.

PUTSTORE Transfers control data from the processor to the 4974 wire image buffer. If PUTSTORE is specified, operands opnd1, opnd2, count, and TYPE are required.

GETSTORE Transfers control data from the 4974 wire image buffer to the processor. If GETSTORE is specified, opnd1, opnd2, count, and TYPE are required.

opnd1 The address in the processor from which or to which the information is to be transferred. Required with function PUTSTORE or GETSTORE.

opnd2 The address in the 4974 wire image buffer to which or from which the information is to be transferred. Required with function PUTSTORE or GETSTORE.

count The number of bytes to be transferred. Required with function PUTSTORE or GETSTORE.

TYPE= The type of PUTSTORE or GETSTORE operation to be performed.

1, to transfer data between the processor and the 4974 wire image buffer. If 1 is specified, function must be either PUTSTORE or GETSTORE.

2, to show that the 4974 wire image buffer is to be initialized with the standard 64-character EBCDIC set. If the count operand is zero, no data is transferred. If the count is 8 or less, each bit of the data string shows replacement (1) or nonreplacement (0) of the corresponding character in the standard set with the alternate character as defined in the attachment. If 2 is specified, function must be PUTSTORE.

LPI= The number of lines per inch, either 6 or 8, the 4974 is to use for printing. This operand is required when the SET function is coded.

DCB= The label of an 8-word device control block you define with the DCB statement. The 4974 support code provides an IDCB that points to this DCB and issues a START I/O instruction to the device. The system performs a wait operation and control returns to you after the interrupt is received from the device.

If the post-cursor bit is set on in word 0 of the DCB, the terminal support updates the internal cursor position according to word 1 of the DCB. If an error occurs, an error return is made according to normal terminal I/O conventions.

Do not code any other operands when you specify this operand on the TERMCTRL statement. You cannot have another DCB chained to the one specified by the DCB operand. You should be familiar with the 4974 hardware and terminal I/O internals when you use this operand.

Coding Examples

1) This example initializes the 4974 wire image buffer to the standard EBCDIC character set. The example also replaces the standard dollar sign ($) with its alternate, the English pound sterling symbol (hex code 5B), and replaces the standard cent sign (¢) with its alternate, the dollar sign ($) (hex code 4A).

```
         ENQT     PTR1       ENQUEUE PRINTER
           •
           •
           •
         TERMCTRL PUTSTORE,REPLACE,0,2,TYPE=2
           •
           •
           •
REPLACE  DATA     X'1200'
PTR1     IOCB     T4974
```

2) If RDWRFLAG in the following example equals 0, the TERMCTRL instruction transfers 768 bytes of control data from the processor to the 4974 wire image buffer. If the RDWRFLAG is not 0, the instruction transfers 768 bytes of control data from the 4974 wire image buffer to the processor.

```
        ENQT     PTR1       ENQUEUE PRINTER
           •
           •
           •
           •
        SUBROUT  SETPRNTR,RDWRFLAG
        IF       (RDWRFLAG,EQ,0)     IF WRITE WIRE IMAGE OPERATION
          TERMCTRL PUTSTORE,BUFF,0,768,TYPE=1
          ELSE                       ELSE READ WIRE IMAGE BUFFER
          TERMCTRL GETSTORE,BUFF,0,768,TYPE=1
        ENDIF
        RETURN
BUFF    DATA     768H'0'            BUFFER AREA FOR 4974 WIRE IMAGE
PTR1    IOCB     T4974
```

4975 Printer

Syntax:

label	**TERMCTRL function,LPI= or print operand,DCB=**
Required:	**function**
Defaults:	**none**
Indexable:	**CHARSET,PDEN,PMODE**

Operand ***Description***

function:

SET If you do not specify the LPI operand, you must code the SET function along with one of four print operands that allow you to set and control the special print functions available with the 4975 Model 1 and Model 2 printers. (See "SET Function Operands" for a description of each of the print operands.)

Note: You must code the SET function along with either the LPI operand or one of the print operands.

DISPLAY Causes the system to write to the 4975 any buffered output. No operands are valid with this function.

LPI= The number of lines per inch (either 6 or 8) the 4975 is to print. Use this operand only with the SET function.

LPI= causes any buffered output to be printed. The system also resets the current output position to the beginning of the left margin.

DCB= The label of an 8-word device control block you define with the DCB statement. The 4975 support code provides an IDCB that points to this DCB and issues a START I/O instruction to the device. The system does a wait operation and control returns to you after the interrupt is received from the device.

If the post-cursor bit is set on in word 0 of the DCB, the terminal support updates the internal cursor position according to word 1 of the DCB. If an error occurs, an error return is made according to normal terminal I/O conventions.

Do not code any other operands when you specify this operand on the TERMCTRL statement. You cannot have another DCB chained to the one specified by the DCB operand. You should be familiar with the 4975 hardware and terminal I/O internals when you use this operand.

SET Function Operands

The SET function operands allow you to:

- Specify the print mode on a 4975 Model 2 printer (PMODE).
- Specify the density of printed characters (PDEN).
- Specify the language character set (CHARSET).
- Restore the default values for the printer (RESTORE).

Changing the printer functions of PDEN, PMODE, CHARSET, and LPI with a TERMCTRL instruction does not cause a permanent change to the default values established at system generation time. Using the CT command of $TERMUT1, however, does change the default values permanently.

You can code only one print operand on each TERMCTRL statement. When specifying parameters on the PMODE, PDEN, and CHARSET operands, you can code the parameter name, an indexed value, or an address. A given address must not have the same name as the allowable parameters.

To simplify the coding of addresses and indexed values, the system provides an equate table, EQU4975. The parameter equate is the parameter name preceded by a "$" sign. For example, the parameter equate for the Italian character set, ITAL, is $ITAL. Before using addresses or indexed values with the TERMCTRL statement, you must copy the equate module (EQU4975) into your application program with a COPY statement.

Note: To use the SET function operands, you must link-edit your program with $EDXLINK and specify an autocall to $AUTO,ASMLIB. Refer to the *Operator Commands and Utilities Reference* for details on the AUTOCALL option of $EDXLINK.

Operand ***Description***

PMODE= Specifies the print mode to be used on a 4975 model 2 printer.

Parameter	*Description*
DRAFT	Print in draft-processing mode (all characters are equal in width). The 4975 Model 1 printer prints only in draft-processing mode.
TEXT	Print in text-processing mode with two passes of the print head (character width is variable).
TEXT1	Print in text-processing mode with a single pass of the print head. This option produces characters that do not have a full complement of dots. It can be used to check the format of printed output.

PDEN= Specifies the density of printed characters on each line. You can select compressed, "normal," and expanded character density for the 4975 Model 2 printer. The 4975 Model 1 printer supports "normal" or expanded character density. If you code compressed for the 4975 Model 1 printer, the density defaults to expanded.

In draft mode, the compressed density is 20 characters per inch, the "normal" density is 15 characters per inch, and the expanded density is 10 characters per inch.

In text mode (PMODE=TEXT or TEXT1), the size of individual characters varies (the letter "i", for example, is narrower than the letter "m"), and the number of characters per inch depends on the mix of characters in the data stream.

Parameter	*Description*
NORM	Print in "normal" or typewriter-like characters. In draft mode, you can print up to 198 characters on a line.
COMP	Print in compressed characters. In draft mode, you can print up to 230 characters on a line.

EXPD Print in expanded characters. In draft mode, you can print up to 132 characters on a line.

When you code the PDEN= operand, be sure the line length of your TEXT or BUFFER statement does not exceed the maximum line length for the density you choose.

CHARSET=

Specifies the language character set to be used. The CHARSET operand changes the default character set specified during system generation. (Refer to the TERMINAL statement for the 4975 printer in the *Installation and System Generation Guide*.)

The character set coded with the CHARSET operand becomes the new default for the printer. You can change the default character set with another TERMCTRL statement or with the $TERMUT1 utility. (Refer to the *Operator Commands and Utilities Reference* for details on how to use the $TERMUT1 utility.)

The following character sets are available on the 4975 printer:

AUGE	Austrian and German
BELG	Belgian
BRZL	Brazilian
DNNR	Danish and Norwegian
FRAN	French
FRCA	French Canadian
INTL	International (multinational)
ITAL	Italian
JAEN	Japanese and English
KANA	Japanese katakana
PORT	Portuguese
SPAN	Spanish (Spain)
SPNS	Spanish (other)
SWFI	Swedish and Finnish
UKIN	English (United Kingdom)
USCA	English (United States and Canada).

RESTORE Returns the printer to its default values for PDEN, PMODE, CHARSET, and LPI. The system restores the current values to those set with the last CT command of the $TERMUT1 utility or, if the CT command has not been used, to values specified at system generation.

When you change printer functions with a TERMCTRL statement, code the RESTORE option on another TERMCTRL statement to restore the original default values before your program ends.

Notes:

1. If any of the print operands are issued to devices other than the 4975, 5219, 5224, 5225, or 5262 printers, they will be ignored, and a return code of −1 will be returned to the issuing program.
2. Do not confuse the 4975-01A ASCII printer with the 4975 printer. The 4975-01A ASCII printer uses data streaming and not TERMCTRL statements in operation. (See "Request Special Terminal Function (4975-01A)" on page 2-316 for information on coding a data stream for the 4975-01A ASCII printer.)

Syntax Examples

1) Print the contents of the buffer.

```
WRITEPTR  TERMCTRL  DISPLAY
```

2) Set printer to print eight lines per inch.

```
          TERMCTRL  SET,LPI=8
```

3) Set printer to print six lines per inch.

```
          TERMCTRL  SET,LPI=6
```

Coding Example

The following example shows three ways you can specify a parameter on one of the SET function print operands. In the TERMCTRL instruction labeled T1, the CHARSET operand is coded with the parameter name of the Italian character set (ITAL). In the TERMCTRL instruction labeled T2, the CHARSET operand is coded with an address which contains the equate value for the Italian character set. The MOVEA instruction at label INDEX moves the equate value contained in TABLE into register #1. The CHARSET operand on the TERMCTRL instruction labeled T3 points to a character set at the address defined by the contents of register #1 plus 2.

```
            •
            •
            •
          COPY      EQU4975
            •
            •
            •
T1        TERMCTRL  SET,CHARSET=ITAL     CODING THE PARAMETER NAME
T2        TERMCTRL  SET,CHARSET=ITALIAN  CODING AN ADDRESS
INDEX     MOVEA     #1,TABLE
T3        TERMCTRL  SET,CHARSET=(2,#1)   CODING AN INDEXED VALUE
            •
            •
            •
TABLE     DATA      A(+$AUGE)            NOTE THAT $AUGE AND $ITAL
ITALIAN   DATA      A(+$ITAL)            ARE EQUATE VALUES
```

Return Codes

Return codes are returned in the first word of the task control block (TCB) of the program or task issuing the instruction. The label of the TCB is the label of your program or task (taskname). The supervisor places the address of the instruction that produced the return code in the second word of the TCB (taskname+2).

Return Code	Condition
301	Invalid TERMCTRL request. Returned for SET function options PDEN, PMODE, and CHARSET. No terminal error exit taken.
302	PRINTEXT message exceeds line width. Terminal error exit taken.

4978 Display

Syntax:

label	**TERMCTRL function,opnd1,opnd2,count,TYPE=,ATTN=,**
Required:	**function**
Defaults:	**none**
Indexable:	**opnd1,opnd2**

Operand	*Description*	
function:		
	BLANK	Prevents displaying input or output characters on the 4978 screen. The contents of the internal buffer remain unchanged. If you specify BLANK, no other operands are required.
	DISPLAY	Causes the system to display the screen contents if previously blanked by the BLANK function, to display any buffered output, and to update the cursor position accordingly.
	TONE	Causes the system to sound the audible alarm, if one is installed.
	BLINK	Sets the cursor to the blinking state.
	UNBLINK	Sets the cursor to the nonblinking state.
	LOCK	Locks the keyboard.
	UNLOCK	Unlocks the keyboard.
	SET	Enables the attention function for the device (when ATTN=YES) or disables the attention function for the device (when ATTN=NO).
	PUTSTORE	Transfers data from the processor to storage in the 4978. If this function is specified, opnd1, opnd2, count, and TYPE= are required.
	GETSTORE	Transfers data from storage in the 4978 to the processor. If this function is specified, operands opnd1, opnd2, count, and TYPE are required.
opnd1	The address in the processor from which or to which the data is to be transferred.	
opnd2	The address in 4978 storage to which or from which data is to be transferred.	
count	The number of bytes to be transferred.	
ATTN=	YES, to enable the attention function.	
	NO, to disable the attention function.	
	This operand must be used with the SET function.	

TYPE= **1,** to indicate access to the character image buffer (a 2048-byte table, 8 bytes for each of the EBCDIC codes).

2, to indicate access to the control store (4096 bytes). The end condition (required when writing the control store) can be indicated by setting bit 0 on in the second operand. For example, to write the last 1024 bytes of the control store (#2 contains the control store address), code the following:

```
TERMCTRL  PUTSTORE,BUFFER,(X'8000',#2),1024,TYPE=2
```

4, to indicate transfer of the field table from the device to the processor. If this option is specified, function must be GETSTORE. The input area must be defined with a BUFFER statement. At completion of the operation, the number of field addresses stored (addresses of unprotected fields) is placed in the control word at BUFFER−4.

5, to indicate transfer of the field table from the device to the processor. If this option is specified, function must be GETSTORE. A field table is transferred as for TYPE=4, but the addresses are those of the protected fields.

6, to indicate that the field table transferred contains only the addresses of changed fields. If this option is specified, function must be GETSTORE.

7, to indicate that the field table transferred contains the addresses of the protected portions of changed fields. If this option is specified, function must be GETSTORE.

DCB= The label of an 8-word device control block you define with the DCB statement. The 4978 support code provides an IDCB that points to this DCB and issues a START I/O instruction to the device. The system does a wait operation and control returns to you after the interrupt is received from the device.

If the post-cursor bit is set on in word 0 of the DCB, the terminal support updates the internal cursor position according to word 1 of the DCB. If an error occurs, an error return is made according to normal terminal I/O conventions.

Do not code any other operands when you specify this operand on the TERMCTRL statement. You cannot have another DCB chained to the one specified by the DCB operand. You should be familiar with the 4978 hardware and terminal I/O internals when you use this operand.

Coding Examples

1) The first TERMCTRL instruction prevents the displaying of characters on the 4978 screen. The second TERMCTRL instruction restores the displaying of characters on the screen. The third TERMCTRL instruction transfers data from storage in the 4978 to the processor.

```
      TERMCTRL  BLANK              BLANK SCREEN
        •
        •                    MODIFY DISPLAY
        •
      PRINTEXT  LINE=A,SPACES=B    DEFINE CURSOR POSITION
      TERMCTRL  DISPLAY            ENABLE DISPLAY

      TERMCTRL  GETSTORE,BUFFER,0,2048,TYPE=1   READ 4978
*                                               IMAGE STORE
```

2) The following example shows several uses for the TERMCTRL instruction.

```
        TERMCTRL  TONE            ISSUE TONE TO ALERT OPERATOR
        TERMCTRL  UNLOCK          UNLOCK KEYBOARD
        TERMCTRL  BLINK           SET CURSOR TO BLINK MODE
GETID   READTEXT  TXT1,'@ PLEASE ENTER YOUR ID #,LINE=3
        IF        (TXT1-1,EQ,0),GOTO,GETID
        TERMCTRL  UNBLINK         RESET CURSOR TO UNBLINK
*
GETPASS PRINTEXT  '@ PLEASE ENTER YOUR PASSWORD'
        TERMCTRL  BLANK           INHIBIT DISPLAY OF PASSWORD
        WAIT      KEY             WAIT FOR ENTER KEY
        READTEXT  TXT2            GET USER'S ENTRY
        CALL      CHKPASS         CALL PASSWORD VERIFY ROUTINE
*
        IF        (PASSCHK,NE,-1),GOTO,ENDIT   IF PASSWORD
*                                  DOES NOT MATCH USER ID, EXIT
        TERMCTRL  SET,ATTN=NO     DISABLE ATTENTION KEY
         •
         •
         •
        TERMCTRL  DISPLAY         CLEAR THE BUFFER
*
ENDIT   PRINTEXT  '@ SESSION IS ENDING'
        PRINTEXT  '@ SYSTEM IS AVAILABLE AT 7 AM MON - FRI'
        TERMCTRL  SET  ATTN=YES           ENABLE THE ATTENTION KEY
        TERMCTRL  LOCK                    LOCK THE KEYBOARD
         •
         •
         •
        SUBROUT   CHKPASS,PASSCHK
         •
         •
         •
        RETURN
         •
         •
         •
TXT1    TEXT      LENGTH=30
TXT2    TEXT      LENGTH=30
```

4979 Display

Syntax:

label	**TERMCTRL function,ATTN=,DCB=**
Required:	**function**
Defaults:	**none**
Indexable:	**none**

Operand	*Description*
function:	
	BLANK Prevents displaying input or output characters on the 4979 screen. The contents of the internal buffer remain unchanged. If you specify BLANK, no other operands are required.
	DISPLAY Causes the system to display the screen contents if previously blanked by the BLANK function, to display any buffered output, and to update the cursor position accordingly.
	LOCK Locks the keyboard.
	UNLOCK Unlocks the keyboard.
	SET Enables the attention function for the device (when ATTN=YES) or disables the attention function for the device (when ATTN=NO).
ATTN=	YES, to enable the attention function. NO, to disable the attention function. This operand must be used with the SET function.
DCB=	The label of an 8-word device control block you define with the DCB statement. The 4979 support code provides an IDCB that points to this DCB and issues a START I/O instruction to the device. The system does a wait operation and control returns to you after the interrupt is received from the device. If the post-cursor bit is set on in word 0 of the DCB, the terminal support updates the internal cursor position according to word 1 of the DCB. If an error occurs, an error return is made according to normal terminal I/O conventions. Do not code any other operands when you specify this operand on the TERMCTRL statement. You cannot have another DCB chained to the one specified by the DCB operand. You should be familiar with the 4979 hardware and terminal I/O internals when you use this operand.

Coding Example

The first TERMCTRL instruction prevents the displaying of characters on the 4979 screen. The second TERMCTRL instruction restores the displaying of characters on the screen.

```
TERMCTRL  BLANK                BLANK SCREEN
   •
   •                       MODIFY DISPLAY
   •
PRINTEXT  LINE=A,SPACES=B      DEFINE CURSOR POSITION
TERMCTRL  DISPLAY              ENABLE DISPLAY
```

4980 Display

Syntax:

label	**TERMCTRL function,opnd1,opnd2,count,TYPE=,ATTN=, DCB=**
Required:	**function**
Defaults:	**none**
Indexable:	**opnd1,opnd2**

Operand	*Description*	
function:		
	BLANK	Prevents displaying input or output characters on the 4980 screen. The contents of the internal buffer remain unchanged. If you specify BLANK, no other operands are required.
	DISPLAY	Causes the system to display the screen contents if previously blanked by the BLANK function, to display any buffered output, and to update the cursor position accordingly.
	TONE	Causes the system to sound the audible alarm, if one is installed.
	BLINK	Sets the cursor to the blinking state.
	UNBLINK	Sets the cursor to the nonblinking state.
	LOCK	Locks the keyboard.
	UNLOCK	Unlocks the keyboard.
	SET	Enables the attention function for the device (when ATTN=YES) or disables the attention function for the device (when ATTN=NO).
	PUTSTORE	Transfers data from the processor to storage in the 4980. If you specify PUTSTORE, opnd1, opnd2, count, and TYPE are required.
	GETSTORE	Transfers data from storage in the 4980 to the processor. If you specify GETSTORE, operands opnd1, opnd2, count, and TYPE are required.
opnd1	The address in the processor from which or to which the data is to be transferred.	
opnd2	The address in 4980 storage to which or from which data is to be transferred.	
count	The number of bytes to be transferred.	
ATTN=	YES, to enable the attention function.	
	NO, to disable the attention function.	
	This operand must be used with the SET function.	

TYPE= You may want to change the image and/or control stores on a 4980 terminal from an application program. For information on doing so, see to "$RAMSEC – Replace Terminal Control Block (4980)" on page D-23

1, to show access to the character image buffer (a 4096-byte table, 8 bytes for each of the EBCDIC codes).

2, to show access to the control store.

4, to show transfer of the field table from the device to the processor. If this option is specified, function must be GETSTORE. The input area must be defined with a BUFFER statement. At completion of the operation, the number of field addresses stored (addresses of unprotected fields) is placed in the control word at BUFFER−4.

5, to show transfer of the field table from the device to the processor. If this option is specified, function must be GETSTORE. A field table is transferred as for TYPE=4, but the addresses are those of the protected fields.

6, to show that the field table transferred contains only the addresses of changed fields. If this option is specified, function must be GETSTORE.

7, to show that the field table transferred contains the addresses of the protected portions of changed fields. If this option is specified, function must be GETSTORE.

8, to show that transfer of the microcode from the processor to the device is in progress.

9, to show that the last segment of the microcode is being sent from the processor to the device.

10, to show that the last segment of the control store is being sent from the processor to the device.

For example, to write the last 1024 bytes of the control store (#2 contains the control store address), code the following:

```
TERMCTRL  PUTSTORE,BUFFER,(0,#2),1024,TYPE=10
```

DCB= The label of an 8-word device control block you define with the DCB statement. The 4980 support code provides an IDCB that points to this DCB and issues a START I/O instruction to the device. The system does a wait operation and control returns to you after the interrupt is received from the device.

If the post-cursor bit is set on in word 0 of the DCB, the terminal support updates the internal cursor position according to word 1 of the DCB. If an error occurs, an error return is made according to normal terminal I/O conventions.

Do not code any other operands when you specify this operand on the TERMCTRL statement. You cannot have another DCB chained to the one specified by the DCB operand. You should be familiar with the 4980 hardware and terminal I/O internals when you use this operand.

5219 Printer

Syntax:

label	**TERMCTRL function,STREAM=,LPI= or print operand,** **DCB=**
Required:	**function**
Defaults:	**STREAM=NO**
Indexable:	**CHARSET,PDEN**

Operand ***Description***

function:

SET Sets the number of lines per inch when coded with the LPI operand. If you do not specify the LPI operand, you must code the SET function along with one of the three print operands that allow you to set and control the special print functions available with the 5219 printer. (See "SET Function Operands" on page 2-510 for a description of each of the print operands.)

Note: You must code the SET function along with either the LPI operand or one of the print operands.

DISPLAY Causes the system to write any buffered output to the printer. No operands are valid with this function.

STREAM= YES, to show that you have already coded the escape sequences the printer needs to do an output operation in the buffer area. For the required escape sequences, refer to the *IBM 5219 Printer Models D01 and D02 Programmer's Reference Guide*, GA23-1025.

NO (the default), to show that the 5219 is in a mode that emulates the 4975 printer.

LPI= The number of lines per inch (either 6 or 8) the printer is to print. Use this operand with the SET function only.

DCB= The label of an 8-word device control block you define with the DCB statement. The printer support code provides an IDCB that points to this DCB and issues a START I/O instruction to the device. The system does a wait operation and control returns to you after the interrupt is received from the device.

If the post-cursor bit is set on in word 0 of the DCB, the terminal support updates the internal cursor position according to word 1 of the DCB. If an error occurs, an error return is made according to normal terminal I/O conventions.

Do not code any other operands when you specify this operand on the TERMCTRL statement. You cannot have another DCB chained to the one specified by the DCB operand. You should be familiar with the printer hardware and terminal I/O internals to use this operand

SET Function Operands

The SET function operands allow you to:

- Select the density of printer characters on a line (PDEN).
- Select a language character set (CHARSET).
- Restore the default values for the printer (RESTORE).

Changing the printer functions of PDEN, PMODE, CHARSET, and LPI with a TERMCTRL instruction does not cause a permanent change to the default values established at system generation time. Using the CT command of $TERMUT1, however, does change the default values permanently.

You can code only one print operand on each TERMCTRL statement. When specifying parameters on the PDEN and CHARSET operands, you can code the parameter name, an indexed value, or the label of a data area that contains the parameter name. A label must not have the same name as the allowable parameters.

To simplify the coding of labels and indexed values, the system provides an equate table, EQU4975. The parameter equate is the parameter name preceded by a "$" sign. For example, the parameter equate for the Italian character set, ITAL, is $ITAL. Before coding labels or indexed values with the TERMCTRL statement, you must copy the equate module (EQU4975) into your application program with a COPY statement.

Note: To change the print density and character set on a 5219, you must physically change the print wheel. When the PDEN, CHARSET, or RESTORE operands are coded on the TERMCTRL instruction, they cause the 5219 printer to stop printing and signal the operator. At that time, the operator can change the print wheel. The operator must then press the start button to resume printing. Refer to the *IBM Series/1 5219 Printer Models D01 and D02 Setup Procedures/Operator Guide,* GA23-1019, for information on how to change the print wheel.

Operand ***Description***

PDEN= Specifies the density of printed characters on each line. You can select "normal" or expanded character density.

Note: All printed characters are of equal width.

NORM Print in "normal" or typewriter-like characters. You can print up to 198 characters on a line (15 characters per inch).

EXPD Print in expanded characters. You can print up to 132 characters on a line (10 characters per inch).

When you code the PDEN operand, be sure the line length of your TEXT or BUFFER statement does not exceed the maximum line length for the density you choose.

CHARSET =

Specifies the language character set the printer uses. The CHARSET operand changes the default character set you specified during system generation. (Refer to the *Installation and System Generation Guide* for the 5219 TERMINAL statement.)

The character set coded with the CHARSET operand becomes the new default for the printer. You can change the default character set with another TERMCTRL statement or with the $TERMUT1 utility. (Refer to the *Operator Commands and Utilities Reference* for details on how to use the $TERMUT1 utility.)

The following character sets are available on the printer:

AUGE	Austrian and German
BELG	Belgian
BRZL	Brazilian
DNNR	Danish and Norwegian
FRAN	French
FRCA	French Canadian
INTL	International (multinational)
ITAL	Italian
JAEN	Japanese and English
KANA	Japanese katakana
PORT	Portugese
SPAN	Spanish (Spain)
SPNS	Spanish (other)
SWFI	Swedish and Finnish
UKIN	English (United Kingdom)
USCA	English (United States and Canada).

RESTORE Returns the printer to its default values for PDEN, CHARSET, and LPI. The system restores the current values to those set with the last CT command of the $TERMUT1 utility or, if the CT command has not been used, to values specified at system generation.

When you change printer functions with a TERMCTRL statement, code the RESTORE option on another TERMCTRL statement to restore the original default values.

Notes:

1. If any of the print operands are issued to devices other than the 4975, 5219, 5224, 5225, or 5262 printers, they will be ignored, and a return code of −1 will be returned to the issuing program.
2. Do not confuse the 4975-01A ASCII printer with the 4975 printer. The 4975-01A ASCII printer uses data streaming and not TERMCTRL statements in operation. (See "Request Special Terminal Function (4975-01A)" on page 2-316 for information on coding a data stream for the 4975-01A ASCII printer.)

Syntax Examples

1. Print the contents of the buffer.

```
WRITEPTR  TERMCTRL  DISPLAY
```

2. Set the printer to print eight lines per inch.

```
TERMCTRL  SET,LPI=8
```

3. Set the printer to print six lines per inch.

```
TERMCTRL  SET,LPI=6
```

Coding Example

The following example shows how you can specify the escape sequences for a 5219 printer and turn on data streaming. In the example, the labels M1 through M7 supply the requested printer commands into the buffer. Label M8 is the test message. The forms feed command at label FF is moved into the buffer by the instruction at label M1. This command ejects the printer page. The instruction at label M9 contains the number of words being placed in the buffer. The STREAM operand on the TERMCTRL instruction at label M10 is coded STREAM=YES to show that you have supplied the required escape sequences. If STREAM=NO were coded, the system would supply the default escape sequences. The instructions at labels M11 through M14 reset the printer and turn off data streaming.

Note: The labels M1 through M14 are shown for explanation purposes only and should not be coded in an actual program.

```
          •
          •
          •
          MOVEA    #1,BUFF                      GET BUFFER ADDRESS
M1        MOVE     (0,#1),FF,(1,BYTE)           FORMS FEED
M2        MOVE     (1,#1),SICWP,(5,BYTES)       SET INITIAL CONDITION
                                                    FOR WORD PROCESSING
M3        MOVE     (6,#1),SHF,(4,BYTES)         SET HORIZONTAL FORMAT
M4        MOVE     (10,#1),SVF,(4,BYTES)        SET VERTICAL FORMAT
M5        MOVE     (14,#1),SCD,(6,BYTES)        SET CHARACTER DENSITY
M6        MOVE     (20,#1),SLD,(4,BYTES)        SET LINE DENSITY
M7        MOVE     (24,#1),PPM,(11,BYTES)       PAGE PRESENTATION
M8        MOVE     (35,#1),TESTMSG,(14,BYTES)   MOVE MESSAGE INTO BUFFER
M9        MOVE     BUFFINDX,49                  SET NO. OF BYTES TO PRINT
          ENQT     P5219                        ENQT ON 5219
M10       TERMCTRL SET,STREAM=YES               TURN ON DATA STREAMING
          PRINTEXT BUFF                         PRINT
          •
          •
          •
M11       MOVE     (0,#1),FF,(1,BYTE)           FORMS FEED
M12       MOVE     (1,#1,SICDP,(5,BYTES)        RESET INITIAL CONDITION
                                                   TO DATA PROCESSING
M13       MOVE     BUFFINDX.6                   SET NO. OF BYTES TO PRINT
          PRINTEXT BUFF                         PRINT
M14       TERMCTRL SET,STREAM=NO                TURN OFF DATA STREAMING
          •
          •
          •
*
FF        DATA   X'0C'              FORMS FEED
SICWP     DATA   X'2BD20345'        INITIAL CONDITION FOR WORD PROCESSING
          DATA   X'01'
SHF       DATA   X'2BC10284'        HORIZONTAL FORMAT OF 132 COLS PER LINE
SVF       DATA   X'2BC2023C'        VERTICAL FORMAT OF 60 LINES PER PAGE
SCD       DATA   X'2BD20429'        CHARACTER DENSITY OF 10 PER INCH
          DATA   X'000A'
SLD       DATA   X'2BC6020C'        LINE DENSITY OF 6 LINES PER INCH
PPM       DATA   X'2BD20948'        PAGE PRESENTATION MEDIA:
          DATA   X'00000102'
*                      |---------- PAPER
*                        |-------- SOURCE DRAWER 2
          DATA   X'000102'
*                     |------------ DESTINATION DRAWER 1
*                       |---------- STANDARD QUALITY
SICDP     DATA   X'2BD20345'        INITIAL CONDITION FOR DATA PROCESSING
          DATA   X'FF'
          •
          •
          •
P5219     IOCB   P5219,BUFFER=BUFF
BUFF      BUFFER 1024,BYTES
BUFFINDX  EQU    BUFF-4
BUFFADDR  DATA   A(BUFF)
TESTMSG   DATA   CL14'THIS IS A TEST'
          •
          •
          •
```

Return Codes

Return codes are returned in the first word of the task control block (TCB) of the program or task issuing the instruction. The label of the TCB is the label of your program or task (taskname). The supervisor places the address of the instruction that produced the return code in the second word of the TCB (taskname+2).

Return Code	Description
301	Invalid TERMCTRL statement. Returned for SET function operands PDEN and CHARSET. No terminal error exit is taken.
302	PRINTEXT message exceeds line width. Terminal error exit is taken.

5224, 5225, and 5262 Printers

Syntax:

label	**TERMCTRL function,STREAM=,LPI= or print operand, DCB=**
Required:	**function**
Defaults:	**STREAM=NO**
Indexable:	**CHARSET,PDEN**

Operand ***Description***

function:

SET Sets the number of lines per inch when coded with the LPI operand. If you do not specify the LPI operand, you must code the SET function along with one of three print operands that allow you to set and control the special print functions available with the 5224, 5225, and 5262 printers. (See "SET Function Operands" on page 2-516 for a description of each of the print operands.)

Note: You must code the SET function along with either the LPI operand or one of the print operands.

DISPLAY Causes the system to write to the printer any buffered output. No operands are valid with this function.

STREAM= YES, to show that you have already coded the escape sequences the printer needs to perform an output operation in the text or buffer area. For the required escape sequences, refer to the *IBM Series/1 Printer Attachment 5220 Series Description,* GA34-0242 or the *IBM Series/1 Data streaming Instructions for the 5220 Series Printer Attachment,* GA34-0269.

NO (the default), to show that the system should insert the required escape sequences in the text or buffer area before the printer performs an output operation.

LPI= The number of lines per inch (either 6 or 8) the printer is to print. Use this operand only with the SET function.

DCB= The label of an 8-word device control block you define with the DCB statement. The printer support code provides an IDCB that points to this DCB and issues a START I/O instruction to the device. The system does a wait operation and control returns to you after the interrupt is received from the device.

If the post-cursor bit is set on in word 0 of the DCB, the terminal support updates the internal cursor position according to word 1 of the DCB. If an error occurs, an error return is made according to normal terminal I/O conventions.

Do not code any other operands when you specify this operand on the TERMCTRL statement. You cannot have another DCB chained to the one specified by the DCB operand. You should be familiar with the printer hardware and terminal I/O internals when you use this operand.

SET Function Operands

The SET function operands allow you to:

- Select the density of printed characters on a line (PDEN).
- Select a language character set (CHARSET).
- Restore the default values for the printer (RESTORE).

Changing the printer functions of PDEN, CHARSET, and LPI with a TERMCTRL instruction does not cause a permanent change to the default values established at system generation time. Using the CT command of $TERMUT1, however, does change the default values permanently.

You can code only one print operand on each TERMCTRL statement. When specifying parameters on the PDEN and CHARSET operands, you can code the parameter name, an indexed value, or the label of a data area that contains the parameter name. A label must not have the same name as the allowable parameters.

To simplify the coding of labels and indexed values, the system provides an equate table, EQU4975. The parameter equate is the parameter name preceded by a "$" sign. For example, the parameter equate for the Italian character set, ITAL, is $ITAL. Before coding labels or indexed values with the TERMCTRL statement, you must copy the equate module (EQU4975) into your application program with a COPY statement.

Operand ***Description***

PDEN= Specifies the density of printed characters on each line. You can select "normal" or expanded character density.

Note: All print characters are of equal width.

NORM Print in "normal" or typewriter-like characters. You can print up to 198 characters on a line (15 characters per inch).

EXPD Print in expanded characters. You can print up to 132 characters on a line (10 character per inch).

When you code the PDEN= operand, be sure the line length of your TEXT or BUFFER statement does not exceed the maximum line length for the density you choose.

CHARSET=

Specifies the language character set the printer uses. The CHARSET operand changes the default character set you specified during system generation. (Refer to the TERMINAL statement for the 5224, 5225, and 5262 printers in the *Installation and System Generation Guide*.)

The character set coded with the CHARSET operand becomes the new default for the printer. You can change the default character set with another TERMCTRL statement or with the $TERMUT1 utility. (Refer to the *Operator Commands and Utilities Reference* for details on how to use the $TERMUT1 utility.)

The following character sets are available on the printer:

AUGE	Austrian and German
BELG	Belgian
BRZL	Brazilian
DNNR	Danish and Norwegian
FRAN	French
FRCA	French Canadian
INTL	International (multinational)
ITAL	Italian
JAEN	Japanese and English
PORT	Portugese
SPAN	Spanish (Spain)
SPNS	Spanish (other)
SWFI	Swedish and Finnish
UKIN	English (United Kingdom)
USCA	English (United States and Canada).

RESTORE Returns the printer to its default values for PDEN, CHARSET, and LPI. The system restores the current values to those set with the last CT command of the $TERMUT1 utility or, if the CT command has not been used, to values specified at system generation.

When you change printer functions with a TERMCTRL statement code the RESTORE option on another TERMCTRL statement to restore the original default values before your program ends.

Notes:

1. If any of the print operands are issued to devices other than the 4975, 5219, 5224, 5224, or 5262 printers, they will be ignored, and a return code of −1 will be returned to the issuing program.
2. Do not confuse the 4975-01A ASCII printer with the 4975 printer. The 4975-01A ASCII printer uses data streaming and not TERMCTRL statements in operation. (See "Request Special Terminal Function (4975-01A)" on page 2-316 for information on coding a data stream for the 4975-01A ASCII printer.)

Syntax Examples

1) Print the contents of the buffer.

```
WRITEPTR  TERMCTRL  DISPLAY
```

2) Set printer to print 8 lines per inch.

```
          TERMCTRL  SET,LPI=8
```

3) Set printer to print 6 lines per inch.

```
          TERMCTRL  SET,LPI=6
```

Coding Example

The following example shows three ways you can specify a parameter on one of the SET function print operands. In the TERMCTRL instruction labeled T1, the CHARSET operand is coded with the parameter name of the Italian character set (ITAL). In the TERMCTRL instruction labeled T2, the CHARSET operand is coded with the label that points to the equate value for the Italian character set. The MOVEA instruction at label INDEX moves the equate value contained in TABLE into register #1. The CHARSET operand on the TERMCTRL instruction labeled T3 points to a character set at the address defined by the contents of register #1 plus 2.

```
            •
            •
            •
          COPY      EQU4975
            •
            •
            •
T1        TERMCTRL  SET,CHARSET=ITAL      CODING THE PARAMETER NAME
T2        TERMCTRL  SET,CHARSET=ITALIAN   CODING AN ADDRESS
INDEX     MOVEA     #1,TABLE
T3        TERMCTRL  SET,CHARSET=(2,#1)    CODING AN INDEXED VALUE
            •
            •
            •
TABLE     DATA      A(+$AUGE)             NOTE THAT $AUGE AND $ITAL
ITALIAN   DATA      A(+$ITAL)             ARE EQUATE VALUES
```

Return Codes

Return codes are returned in the first word of the task control block (TCB) of the program or task issuing the instruction. The label of the TCB is the label of your program or task (taskname). The supervisor places the address of the instruction that produced the return code in the second word of the TCB (taskname+2).

Return Code	Description
301	Invalid TERMCTRL statement. Returned for SET function operands PDEN and CHARSET. No terminal error exit is taken.
302	PRINTEXT message exceeds line width. Terminal error exit is taken.

ACCA Attached Devices

When your program issues a TERMCTRL instruction to a device attached to an ACCA card, the functions available to your program depend on whether the device uses a modem. If the device uses a modem, you can code all the functions and the ATTN operand.

If a 3101 in block mode is attached to the ACCA card, additional 3101 TERMCTRL functions are available. For a description of those functions see "3101, 3151, 3161, 3163, and 3164 Display Terminals (Block Mode)" on page 2-436.

Syntax:

label	**TERMCTRL function,ATTN=**
Required:	**function**
Defaults:	**none**
Indexable:	**none**

Operand	*Description*
function:	
SET	Enables the attention function for the device (when ATTN=YES) or disables the attention function for the device (when ATTN=NO).
RING	Waits until the modem presents the Ring Indicator (RI) to the Series/1. It provides no timeout.
RINGT	Waits until the modem presents the Ring Indicator (RI) to the Series/1. If no Ring Indicator (RI) occurs after 60 seconds, this instruction ends and returns an error condition. That information returns to your application program in the first word of the task control block (TCB).
ENABLE	Activates Data Terminal Ready (DTR) if not jumpered on and waits for the modem to return Data Set Ready (DSR). No timeout is provided.
ENABLET	Activates Data Terminal Ready (DTR) if not jumpered on and waits for the modem to return Data Set Ready (DSR). If Data Set Ready (DSR) is not returned within 15 seconds, this instruction ends and returns an error condition. That information returns to your application program in the first word of the task control block (TCB).
ENABLEA	Activates Data Terminal Ready (DTR) if not jumpered on and waits for the modem to return Data Set Ready (DSR). When Data Set Ready (DSR) is returned, an answer tone activates for three seconds. The modem must allow for the control of the answer tone.
ENABLEAT	Combines the functions of ENABLET and ENABLEA.

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

ATTN= YES, to enable the attention and PF key functions.

NO, to disable the attention and PF key functions.

This operand must be used with the SET function.

Coding Example

The TERMCTRL instruction at label T1 waits until the Series/1 receives the Ring Indicator from the modem. At label T2, the TERMCTRL instruction waits for the Data Set Ready indicator. The TERMCTRL instruction at label T3 disconnects the modem.

```
         ENQT      ACCATERM                ENQUEUE TARGET TERMINAL
         IF        (LINETYPE,EQ,+SWITCHED) IF SWITCHED
             IF    (DIALTYPE,EQ,+ANSWER)   IF CPU TO ANSWER
T1               TERMCTRL RING            WAIT FOR RING INTERRUPT
             ENDIF
T2         TERMCTRL ENABLET                THEN WAIT FOR DATA SET
*                                          READY
         ENDIF
          •
          •
          •
         IF        (LINETYPE,EQ,+SWITCHED) IF SWITCHED LINE
T3         TERMCTRL  DISABLE               DISABLE LINE
         ENDIF
         DEQT                              RELEASE THE TERMINAL
         PROGSTOP
DIALTYPE DATA  F'-1'
ANSWER   EQU   0
LINETYPE DATA  F'0'
SWITCHED EQU  -1
ACCATERM IOCB  $SYSLOGA
```

General Purpose Interface Bus

The Event Driven Executive provides support for the General Purpose Interface Bus (GPIB) Adapter, RPQ D02118. This support allows an application program to control and access a set of interconnected devices attached to the adapter by a single cable or "bus." These devices could include printers, plotters, graphics display units, and programmable laboratory equipment.

The I/O operations directed to the attached devices and the GPIB bus control are the responsibilities of the application program. The application must, for example, perform device selection and polling, and begin all data transfer operations.

For additional details on the GPIB, refer to the *Communications Guide*.

Syntax:

label	**TERMCTRL function,command,options,data**
Required:	**command**
Defaults:	**none**
Indexable:	**data**

Operand	*Description*	
function:		
	DISPLAY	Causes the system to write to the adapter any buffered output. No other operands should be coded with DISPLAY.
	GPIB	Indicates a GPIB function. The operation is determined by other operands coded on the TERMCTRL instruction.
command:		
	CON	The Configure Bus command is used to assign talker/listener roles to devices and can be used to transfer up to 100 bytes of configuration information from programming information. The data delimiter is a double quote and comma (",) and can be used to separate segments of configuration or programming information. The combination double quote and semicolon (":) characters will end the data transfer.
	DCL	The Device Clear command causes the system to initialize all devices. The initialized state is device dependent.
	GET	The Group Execute Trigger command causes the specified listener devices to have their predefined basic operation initiated (device dependent).
	GTL	The Go To Local command causes the specified listener devices to respond to both the interface message and panel controls.

IFC The Interface Clear command causes the bus to enter an inactive state. The timer override option cannot be specified with this command.

LLO The Local Lock Out command causes the specified listener devices to respond to interface control messages but not device panel controls.

MON The Monitor command allows the transfer of data between devices on the bus. One device must have been previously addressed as a talker and at least one as a listener by a configure operation.

PPD The Parallel Poll Disable command selectively disables the specified listener devices and prevents them from participating in a parallel poll sequence.

PPE The Parallel Poll Enable command places the specified listener devices in a response mode.

PPU The Parallel Poll Unconfigure forces into a parallel poll idle state all devices which are currently able to respond to a parallel poll.

READ The Read command allows the transfer of data into storage from a device on the bus. The device must previously have been assigned as a talker. Any listener devices will receive the data, also.

REN The Remote Enable command allows specified listener devices to respond to further operations.

RPPL The Results of Parallel Poll command reads the result of the latest parallel poll into storage. The address specified in the data operand contains the results and is returned as one byte.

RSB The read adapter Residual Status Block operation retrieves an adapter status block after an operation which requested suppress exception (SE). The status information is returned in the location specified by the data operand of the TERMCTRL instruction.

RSET The Reset Adapter command resets the GPIB adapter and clears any pending interrupts.

SDC The Selected Device Clear command causes the system to reset the specified listener devices.

SPD The Serial Poll Disable command disables the serial poll status reporting ability of the devices previously enabled.

SPE The Serial Poll Enable command initializes the specified talker devices to present status in response to a parallel poll.

SPL Serial Poll Status reads the results of the latest serial poll into storage.

STAT Read Adapter Cycle Steal Status returns the GPIB adapter cycle steal status resulting from a previous operation. The status information is returned in the storage location indicated by the data operand of this command.

WPPL The Write Parallel Poll command does a parallel poll of the devices that were previously enabled by a PPE command.

WRIT A Write Data operation places device programming information or data on the bus for those devices specified as listeners.

options: When using more than one option, separate options with commas and enclose them all in parentheses.

EOI The End-or-Identity terminator is a signal used by a talker to indicate the last byte of a block of data. The adapter ends a read operation with fewer than the specified number of characters if a talker signals an end-or-identity condition. The adapter can establish an EOI condition by requesting the EOI option. EOI is valid for the following commands: CON, MON, READ, and WRIT. You cannot specify EOI together with the end-of-string (EOS) option.

EOS The End-of-String terminator ends a read operation immediately. EOS is valid only for the MON and READ commands, but it cannot be coded in the same instruction with the EOI option.

SE The Suppress Exception prevents the reporting of exception conditions because of incorrect length records (ILR). An ILR exception occurs when a GPIB read is ended with fewer than the specified number of characters read. The contents of the residual status block (RSB) is meaningful only for this condition. SE is valid only for the commands MON and READ.

TO The Timer Override option causes the adapter to wait for an operation to complete. All GPIB commands can specify TO except for RSET, RSB, STAT, IFC, WPPL, RPPL, and SPL.

data Use this operand to specify additional information for the commands STAT, RSB, or RPPL, or for the option EOS.

Use it to specify the label of an address where a program will store status data when you code it with commands STAT, RSB, or RPPL.

Specify either the EOS character or the address of a word which contains, in bits 8 – 15, the EOS character when you use it with the EOS option.

Series/1-to-Series/1

The Event Driven Executive provides support for the Series/1-to-Series/1 Attachment, RPQ D02241 and RPQ D02242. This attachment allows an application to communicate with two or more Series/1 processors over a communications link.

Either Series/1 processor can begin a data transfer operation. To complete data transfer operations, issue a read (READTEXT), write (PRINTEXT), or control (TERMCTRL) instruction through an application program. Call the issuing processor the "initiating" processor. Call the processor that must respond with the opposite instruction the "responding" processor.

For TERMCTRL operations, the required state of the "other" processor (initiating or responding) depends on the particular type of TERMCTRL operation you want to perform.

Syntax:

label	**TERMCTRL function,opnd1,opnd2,count,WAIT=**
Required:	**function**
Defaults:	**WAIT=NO**
Indexable:	**opnd1,opnd2**

Operand ***Description***

function:

ABORT Causes a write ABORT operation. The responding processor will cause the operation on the beginning processor to end the last operation. A return code of 1010 is returned in the task code word. If the operation is attempted but no request is pending from the initiating processor, an error code is returned.

Both the initiating and responding processors must have active Series/1-to-Series/1 application programs for this request to be meaningful. The ABORT function is only valid for the responding processor.

IPL Causes the initiating processor to send an IPL request to the responding processor. The processor initiating the IPL transfers from the address opnd1 indicates, the number of bytes its count operand specifies. Opnd2 indicates the the address key from which the storage load will be sent.

The responding processor receives a system reset from the attachment then enters load mode and receives the storage load.

RESET Causes a device reset to the attachment specified by the most recent ENQT instruction. This will clear any pending interrupt or busy condition.

RESET can be issued anytime, by either processor, regardless of the state of the other processor.

STATUS Obtains status information from the responding processor. Opnd1 specifies the address of a 2-word block of storage that will receive the header data. The header data represents requests that the initiating processor issues. If you code opnd2, it is the target address of the diagnostic jumper word plus the 11 cycle-steal-status words. You can read cycle-steal-status words only following an error.

opnd1 Use this operand with the IPL and STATUS functions. When you use it with IPL, it specifies the address from which you wish to send the storage load to the responding processor.

When you use opnd1 with the STATUS function, it specifies an address where the 2-word header is to be stored.

You can use the contents of the 2-word header to determine the attached processor operations as follows:

Word 1 Bits 0 – 1 = 0.

Bit 2 = 0, then the responding processor has issued a READTEXT.

Bit 2 = 1, then the responding processor issued a PRINTEXT.

Bits 4 – 7 are the checksum value.

Bits 8 – 15 = 0.

Word 2 Specifies the number of bytes to be transferred.

opnd2 Use this operand with the IPL and STATUS functions. When you use it with IPL, it specifies the address key for the storage load. Code an integer specifying the address key (the partition number minus 1).

When you use this operand with the STATUS function, it specifies two addresses. One is the address in which to place the 1-word jumper status. The other is the 11-word cycle steal status information.

The status words can be used to determine the status of the attachments as follows:

Word 0 Jumper word

Bits 0 – 7 = 00000000 RPQ D02242

= 00000001 RPQ D02241

= 00000010 RPQ D)2241

= 00000011 is invalid

Bit 8 = RPQ D02241 is active

Bit 9 = RPQ D02242 is active

Words 1 – 12 Contain the attachment cycle steal status. These words will be zero unless an error has occurred on the device.

Note: *IBM Series/1-to-Series/1 Attachment RPQs D02241 & D02242 Custom Feature*, GA34-1561 provides further descriptions of the bit settings and the contents of words 1 – 12.

count The count operand is used with the IPL function to specify the number of bytes to be sent to the processor receiving the IPL.

WAIT This operand, when coded WAIT = YES, prevents control from being returned to the initiating processor until the responding processor issues a successful READTEXT or PRINTEXT operation. Note that neither a TERMCTRL ABORT nor TERMCTRL RESET can override this operand when it is coded WAIT = YES. The default for this operand is WAIT = NO.

Teletypewriter Attached Devices

This can be a teletypewriter-equivalent device such as a 3101 operated in character mode or an ASR 33/35 connected to a teletypewriter adapter.

Syntax:

label	**TERMCTRL function,ATTN=**
Required:	**function**
Defaults:	**none**
Indexable:	**none**

Operand	*Description*	
function:		
	SET	Enables the attention function for the device (when ATTN=YES) or disables the attention function for the device (when ATTN=NO).
	DISPLAY	Causes any buffered output to be written to the teletypewriter.
ATTN=	YES, to enable the attention function.	
	NO, to disable the attention function.	
	This operand must be used with the SET function.	

Syntax Examples

1) Display the contents of the buffer.

```
TERMCTRL  DISPLAY        DISPLAY THE BUFFER
```

2) Disable the attention key function.

```
TERMCTRL  SET,ATTN=NO
```

3) Enable the attention key function.

```
TERMCTRL  SET,ATTN=YES
```

Virtual Terminal

Virtual terminal support uses the PRINTEXT and READTEXT instructions to communicate between programs. It requires two TERMINAL configuration statements and the supervisor module IOSVIRT. Virtual terminal support provides synchronization logic. For details on virtual terminal other than TERMCTRL operands, refer to the *Communications Guide*.

Syntax:

label	**TERMCTRL function,code,ATTN=**
Required:	**function**
Defaults:	**none**
Indexable:	**none**

Operand ***Description***

function:

DISPLAY Causes any buffered output to be transmitted across the virtual channel.

PF Causes a simulated attention interrupt or program function key interrupt to be presented if the program is communicating with another program in the same processor (DEVICE=VIRT) or with a program in another processor (DEVICE=PROC).

If the code is not specified or is 0, the keyboard task responds to the next READTEXT with ">" and waits for an attention list code to be returned. If the code has a nonzero value ("x"), the attention list code $PFx is generated automatically, and the ">" response does not occur.

The code can be a self-defining term or a variable containing the desired value.

SET Enables the attention function for the device (when ATTN=YES) or disables the attention function for the device (when ATTN=NO).

code The attention or PF key value to be presented when using the PF function. This operand determines the attention or function key value.

ATTN= YES, enables attention function acknowledgement by the system.

NO, disables attention function acknowledgement by the system.

A systems ability to send attention interrupts is not affected in either case. Each setting of this operand controls terminal operations until reset.

This operand must be used with the SET function.

Coding Example

The following example can be used for program communication using virtual terminal support when attention list processing is implemented with the PF key evaluation.

The TERMCTRL instruction at label T1 disables the attention key for the virtual terminal device. At label T2, the TERMCTRL instruction presents a program function key interrupt.

```
         ENQT     B                          GET VIRTUAL CHANNEL B
         LOAD     PGM4,LOGMSG=NO             LOAD COMMUNICATING PGM
         ENQT     A                          GET VIRTUAL CHANNEL A
T1       TERMCTRL SET,ATTN=NO                DISABLE ATTENTION KEY
         READTEXT LINE,MODE=LINE             GET OUTPUT FROM PGM4
         TCBGET   RETURNCD,$TCBCO            GET RETURN CODE
         DEQT     A                          RELEASE CHANNEL A
         IF       (RETURNCD,EQ,5),GOTO,ENDIT
*                                            IF PGM4 ENDED, STOP
           IF     (LINE,EQ,ENTRCMD,(13,BYTE)) IF PGM4
*                                            REQUESTS INPUT COMMAND
T2           TERMCTRL PF,4                   SEND PF4 (SEARCH VOLUME)
           ENDIF
            •
            •
            •
           PROGSTOP
ENTRCMD    DATA   C'ENTER COMMAND'
```

TEXT — Define a Text Message or Text Buffer

The TEXT statement defines a message or a storage area for character data. You can store character data in either EBCDIC or ASCII code.

You can use the PRINTEXT instruction to print or display a message on a terminal. The READTEXT instruction can be used to read a character string from a terminal into the storage area defined by the TEXT statement.

READTEXT and GETEDIT instructions described in this manual can be used to modify the TEXT statement. PRINTEXT and PUTEDIT instructions, also described in this manual, use the TEXT statement to determine the number of values to print.

In storage, the first word of each TEXT statement contains a length byte and a count byte. The length byte (byte 0) contains the size of the storage area in bytes. The count byte (byte 1) shows the actual number of characters in the storage area.

Figure 2-8 on page 2-532 shows the structure of the TEXT statement.

Syntax:

label	**TEXT**	**'message',LENGTH=,CODE=**
Required:	**'message' or LENGTH=**	
Defaults:	**CODE=E EBCDIC is the standard internal representation of all character data**	
Indexable:	**none**	

Operand	*Description*
label	The label of the first byte of text. The GETEDIT, PUTEDIT, READTEXT, and PRINTEXT instructions refer to this label.
'message'	Any character string defined between apostrophes. The count field will equal the actual number of characters between apostrophes. If you do not code this operand, you must code LENGTH, and the storage area is filled with EBCDIC blanks. You should not code this operand if you use the storage area initially for input. If the LENGTH operand is not coded and the count value is even, then LENGTH=count. However, if the count value is odd, then LENGTH=count+1. Use two apostrophes to represent each printable apostrophe. The symbol "@" causes a carriage return or line feed to occur on roll screen terminals.
LENGTH=	The size (in bytes) of the storage area. The maximum value you can code is 254. If you do not code this operand, you must code the 'message' operand, and LENGTH equals the number of characters between the apostrophes.

The system truncates messages that exceed the length of the storage area. If the message does not fill the storage area, the system pads the area to the right of message with EBCDIC blanks.

Note: With $S1ASM, TEXT has a maximum length of 98 and a default length of 64.

If you do not code the 'message' operand, the system fills the storage area with EBCDIC blanks and the count byte is equal to the length byte.

CODE= Defines the data type. Code E for EBCDIC or A for ASCII. E is the default.

Syntax Examples

1) The PRINTEXT instruction displays the phrase "A MESSAGE" on a terminal.

```
          •
          •
          •
          PRINTEXT   MSG1
          •
          •
          •
MSG1      TEXT       'A MESSAGE'
          •
          •
          •
```

2) The PRINTEXT instruction displays the phrase "ABC " on a terminal. Because the text buffer length is 10 bytes and the message is only 3 bytes long, the system fills the buffer space to the right of the message with blanks. CODE=A sets the character data type to ASCII.

```
          •
          •
          •
          PRINTEXT  MSG2
          •
          •
          •
          PROGSTOP
MSG2      TEXT      'ABC',LENGTH=10,CODE=A
          •
          •
          •
```

3) The READTEXT instruction waits for a response entered from a terminal. The system will place the response in the TEXT statement labeled MSG#. If the response has fewer than 30 characters, the system pads the storage area to a length of 30 bytes. If the response is more than 30 characters, the system truncates it after reading 30 bytes.

```
          •
          •
          •
          READTEXT  MSG#,'ENTER YOUR HOMETOWN'
          •
          •
          •
          PROGSTOP
MSG#      TEXT      LENGTH=30
          •
          •
          •
```

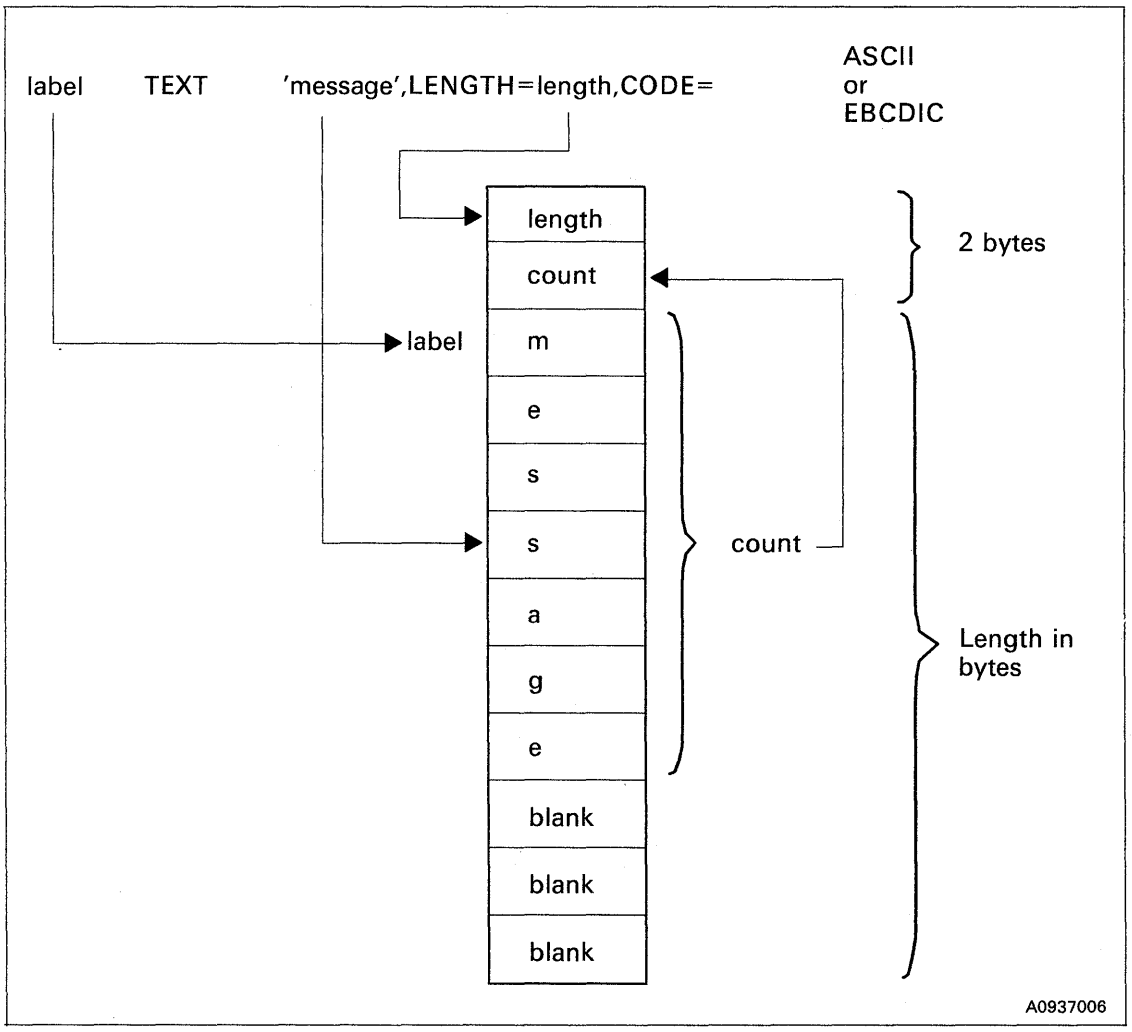


Figure 2-8. TEXT Statement

TITLE – Place a Title on a Compiler Listing

The TITLE statement places a title at the top of each page of the compiler listing. A program can contain more than one TITLE statement. Each statement generates a new title on the page that follows it. The system repeats this title on each page until it encounters another TITLE statement.

Syntax:

blank	**TITLE**	**message**
Required:	**message**	
Defaults:	**none**	

Operand	*Description*
message	For the macro and host assemblers, you can code an alphanumeric character string up to 100 characters in length. The string must be enclosed in apostrophes. The $EDXASM compiler will accept an alphanumeric string of up to 48 characters. The string must be enclosed in apostrophes and must be all on one line.

Coding Example

See the PRINT statement for an example using TITLE.

TP Instruction – Perform Host Communications Facility Operations

The Host Communications Facility instruction (TP) can do the following operations:

- Write to a host data set (TP WRITE)
- Read from a host data set (TP READ)
- Submit a background job to the host system (TP SUBMIT)
- Get the time and date from the host system (TP TIMEDATE)
- Set the occurrence of a Series/1 event so it can be tested by a program running on the host system (TP SET)
- Test for the occurrence of an event set by the host system (TP FETCH)
- Erase the record, on the host system, of an event that occurred on either the Series/1 or the host system (TP RELEASE.)

You perform each operation using a different format of the TP instruction. Other TP instruction formats prepare the Series/1 for an operation (TP OPENIN/TP OPENOUT) or end an operation (TP CLOSE). Each of the TP formats is described on the following pages. Refer to the *Communications Guide* for sample programs using the TP instruction formats.

TP (CLOSE) – End a Transfer Operation

TP CLOSE ends a transfer operation. Use this instruction to end an operation begun with TP OPENOUT or TP OPENIN.

Notes:

1. If an error occurs, the system automatically closes an open data set. The only time you must issue a TP CLOSE is when a data set transfer is being ended and no errors have occurred. This situation would occur, for instance, if only 10 records were being written to or read from a data set capable of containing 20 records.
2. Always test the return code after you issue a TP CLOSE because some errors are only detected at this time (return codes 50 and 51, for example).
3. While you have an open data set, no one else is able to use the facility.

Syntax:

label	**TP**	**CLOSE,ERROR=**
Required:	**CLOSE**	
Defaults:	**none**	
Indexable:	**none**	

Operand	*Description*
CLOSE	Ends a transfer operation.
ERROR=	The label of the first instruction of the routine to be called if an error condition occurs during this operation. If you do not code this operand, control passes to the next sequential instruction, and you must test for errors.

Return Codes

All return codes for the TP instruction are listed under TP (WRITE).

TP (FETCH) – Test for a Record in the System-Status Data Set

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**	

Operand	*Description*
FETCH	Tests for the existence of a specific record in the system-status data set on the host system and reads in the associated data record.
stloc	The label of a STATUS instruction. See the STATUS instruction for more details.
length	Specify 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=	The first instruction of the routine to be called if an error condition occurs during this operation. If you do not code this operand, control is returned to the next sequential instruction and you must test for errors.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Return Codes

All return codes for the TP instruction are listed under TP (WRITE).

TP (OPENIN) – Prepare to Read Data from a Host Data Set

TP OPENIN prepares the Series/1 to read data from a host data set.

Syntax:

label	**TP**	**OPENIN,dsnloc,ERROR=,P2=**
Required:	**OPENIN,dsnloc**	
Defaults:	**none**	
Indexable:	**dsnloc**	

Operand	*Description*
OPENIN	Prepares the Series/1 to read data from a host data set.
dsnloc	The label of a TEXT statement that specifies the name of a host data set of standard format. The data set can be a sequential data set or a partitioned data set with member name included.
ERROR=	The first instruction of the routine to be called if an error condition occurs during this operation. If you do not code this operand, control is returned to the next sequential instruction and you must test for errors.
P2=	Parameter naming operand. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code this operand.

Return Codes

All return codes for the TP instruction are listed under TP (WRITE).

TP (OPENOUT) — Prepare to Transfer Data to a Host Data Set

TP OPENOUT prepares the Series/1 to transfer data to a host data set.

Syntax:

label	**TP**	**OPENOUT,dsnloc,ERROR=,P2=**
Required:	**OPENOUT,dsnloc**	
Defaults:	**none**	
Indexable:	**dsnloc**	

Operand	*Description*
OPENOUT	Prepares the Series/1 to transfer data to a host data set.
dsnloc	The label of a TEXT statement that specifies the name of a host data set of standard format. The data set can be a sequential data set or a partitioned data set with member name included.
ERROR=	The first instruction of the routine to be called if an error condition occurs during this operation. If you do not code this operand, control is returned to the next sequential instruction and you must test for errors.
P2=	Parameter naming operand. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code this operand.

Return Codes

All return codes for the TP instruction are listed under TP (WRITE).

TP (READ) – Read a Record from the Host

TP READ reads 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**	

Operand	*Description*
READ	Reads a data record from the host system.
buffer	The label of the data buffer where the record is to be stored. This buffer should be generated with, or should conform to the specifications of, a BUFFER statement specifying TPBSC.
count	The maximum number of bytes to be read. For variable-length records, this count includes the 4-byte Record Descriptor Word (RDW). Refer to the *Communications Guide* for more details on variable-length records.
END=	The first instruction of the routine to be called if an "end-of-data-set" condition is detected (return code 300). If you do not specify this operand, the system treats the end of data set condition as an error.
ERROR=	The first instruction of the routine to be called if an error condition occurs during the execution of this operation. If you do not specify this operand, control is returned to the next sequential instruction and you must test for errors.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Return Codes

All return codes for the TP instruction are listed under TP (WRITE).

TP (RELEASE) – Delete a Record in the System-Status Data Set

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**	

Operand	*Description*
RELEASE	Deletes a specific record in the system-status data set on the host system and reads the associated data record.
stloc	The label of a STATUS instruction. See the STATUS instruction for more details.
length	Specify 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=	The first instruction of the routine to be called if an error condition occurs during this operation. If you do not code this operand, control is returned to the next sequential instruction and you must test for errors.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Return Codes

All return codes for the TP instruction are listed under TP (WRITE).

TP (SET) – Write a Record in the System-Status Data 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**	

Operand	*Description*
SET	Writes a record in the system-status data set on the host system.
stloc	The label of a STATUS instruction. See the STATUS instruction for more details.
length	Specify 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=	The first instruction of the routine to be called if an error condition occurs during this operation. If you do not code this operand, control is returned to the next sequential instruction and you must test for errors.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Return Codes

All return codes for the TP instruction are listed under TP (WRITE).

TP (SUBMIT) – Submit a Job to the Host

TP SUBMIT submits a job from the Series/1 to the host batch job stream.

Syntax:

label	**TP**	**SUBMIT,dsnloc,ERROR=,P2=**
Required:	**SUBMIT,dsnloc**	
Defaults:	**none**	
Indexable:	**dsnloc**	

Operand	*Description*
SUBMIT	TP SUBMIT submits a job from the Series/1 to the host batch job stream.
dsnloc	The label of a TEXT statement that specifies the name of a host data set containing the job (JCL and optional data) to be submitted. You can code either: **TEXT** "dsname" for a sequential data set. **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 using an intermediate host data set. To use this facility, code the following:

```
          •
          •
          •
        TP  SUBMIT,DIRECT
        TP  WRITE,buffer,80
*
* Code one  TP WRITE,buffer,80  for each job stream record
*
        TP  CLOSE
```

ERROR=	The first instruction of the routine to be called if an error condition occurs during this operation. If you do not code this operand, control is returned to the next sequential instruction and you must test for errors.
P2=	Parameter naming operand. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code this operand.

Return Codes

All return codes for the TP instruction are listed under TP (WRITE).

TP (TIMEDATE) – Get Time and Date from the Host

TP TIMEDATE obtains the 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**	

Operand	*Description*
TIMEDATE	Obtains the time of day (hours, minutes, and seconds) and the date (month, day, and year) from the host system.
loc	The label of a 6-word data area where time of day and date are stored in the order: hours, minutes, seconds, month, day, and year.
ERROR=	The label of the first instruction of the routine to be called if an error condition occurs during this operation. If you do not code this operand, control passes to the next sequential instruction and you must test for errors.
P2=	Parameter naming operand. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code this operand.

Return Codes

All return codes for the TP instruction are listed under TP (WRITE).

TP (WRITE) – Write a Record to the Host

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**	

Operand	*Description*
WRITE	Sends a data record to the host system.
buffer	The label of the data buffer that contains the record to be transmitted. This buffer should be generated with, or should 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 Record Descriptor Word (RDW).
END=	The label of the first instruction of the routine to be called if the system detects an end-of-data-set (EOD) condition (return code 400). If this operand is not specified, the system treats an EOD as an error.
ERROR=	The label of the first instruction of the routine to be called if an error condition occurs during the execution of this operation. If this operand is not specified, control passes to the next sequential instruction and you must test for errors.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Return Codes

Return codes are returned in the first word of the task control block (TCB) of the program or task issuing the instruction. The label of the TCB is the label of your program or task (taskname). Because program execution halts until the operation is complete, your program must test the return code to determine if the operation is successful.

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

Return Code	Condition	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

Return Code	Condition	Module
5	Host acknowledgement to request. code was neither ACK0, ACK1, WACK, nor NACK.	Supervisor
6	Retry count exhausted – last error was a time-out: 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
200	Data set not on volume specified for the 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

Return Code	Condition	Module
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	Insufficient I/O-buffer space available.	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
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

USER – Use Assembler Code in an EDL Program

The USER instruction allows you to use Series/1 assembler code within an EDL program.

Do not use Series/1 Assembler routines to issue input/output instructions to Series/1 standard devices. Use only standard EDL I/O instructions.

Your Series/1 assembler routine uses a set of hardware registers to perform operations. You should save the contents of these registers on entry into the routine. You must restore the register contents before returning control to the EDL program. Details of the conventions that must be followed are described under "Considerations when Coding Assembler Routines."

Syntax:

label	**USER**	**name,PARM=(parm1,...,parmn), P=(name1,...,namen)**
Required:	**name**	
Defaults:	**none**	
Indexable:	**none**	

Operand	*Description*
name	The entry point name of your Series/1 assembler routine.
PARM=	A list of parameters that are to be passed to your routine.
P=	A list of names to be attached to the PARM operands.

Considerations when Coding Assembler Routines

On entry to the Series/1 assembler routine, hardware register 1 points to your first parameter. If no parameters are passed to the routine, register 1 points to the address of the next instruction following the USER instruction. Hardware register 2 contains the address of the current task's TCB. Your routine must preserve the contents of register 2 for eventual return to the supervisor. The routine must also provide in register 1 the address of the next EDL instruction to be executed when returning to the supervisor.

If parameters are passed to the routine, register 1 must be increased within your routine by double the number of parameters used before returning to the supervisor. If you want to return to an instruction other than the instruction following the USER instruction, you can set register 1 to the address of the desired instruction. In all cases, the assembly language routine must exit by a branch to the label RETURN.

The USER instruction requires one of the following:

- Allowing the RETURN= operand on the ENDPROG statement in your program to default to RETURN=YES
- $EDXLINK used to include the $$RETURN and the $$SVC object modules.

The autocall feature of $EDXLINK also can be used. Refer to the *Language Programming Guide* for additional information on $EDXLINK.

Figure 2-9 shows the control flow to and from a Series/1 assembler routine.

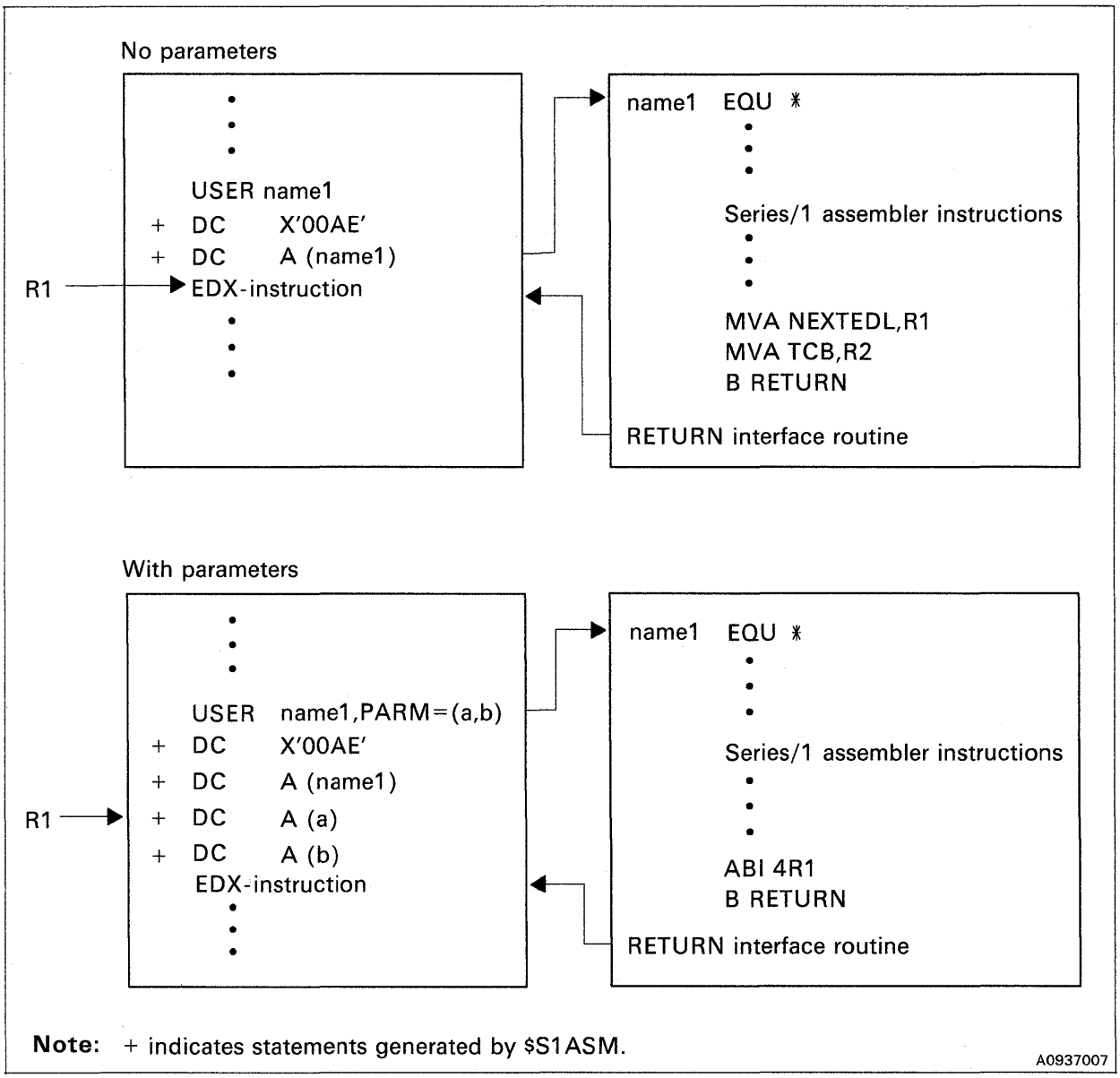


Figure 2-9. Calling a Series/1 Assembler Routine and Returning

You can pass parameters as constants, which will be stored in the calling list, or pass the symbolic names (addresses) of the parameters. In the latter case, the address of the parameter is contained in the calling list. If the parameter is a constant, it can be addressed through hardware register 1, which points to the first parameter on entry to the user routine.

The instruction,

```
MVW   (R1,0),R3
```

will load the parameter into register 3. The second parameter also can be loaded by:

```
MVW   (R1,2),R3
```

The following instruction shows how to acquire a parameter (in this case, the second) whose address is passed in the calling sequence.

```
MVW   (R1,2)*,R3
```

Your routine is free to use all the registers if registers 1 and 2 are set properly for return to the supervisor. The last instruction of your routine must branch to RETURN which is an entry point in the interface module $$RETURN. You must link-edit this module to the assembler routine with the $EDXLINK utility.

In the following example, an EDL program passes control to a Series/1 assembler routine with USER *+2. The routine passes control back to the EDL program with BAL RETURN,R1.

```
          •
          •
          •
        MOVE    A,B         STANDARD INSTRUCTION EXAMPLE
        ADD     A,10        ANOTHER INSTRUCTION
*
        USER    *+2         ENTRY TO ASSEMBLER CODE
        MVW     R2,SAVER2   SAVE HARDWARE REGISTER 2 (TCB)
          •
          •               ASSEMBLER CODE
          •
OK      EQU     *
        MVW     SAVER2,R2   RESTORE HARDWARE REGISTER 2 (TCB)
        BAL     RETURN,R1   SET HARDWARE REGISTER 1 AND RETURN
*
        MOVE    B,A         NOW BACK INTO THE EDL PROGRAM
        SUB     B,10
          •
          •
          •
```

If your EDL program contains assembler code, you must assemble the program using the Series/1 Macro or host assemblers. $EDXASM does not allow mixing Series/1 code with the EDL instructions. If your assembler routine is in a separate module, you must assemble the routine using one of the macro assemblers and link-edit that module to the EDL program with $EDXLINK.

For information regarding use of the USER command in logging errors, see "$USRLOG – Log Specific Errors From a Program" on page D-28.

WAIT – Wait for an Event to Occur

The WAIT instruction allows your program to wait for an event to occur, such as an I/O operation or a process interrupt. An event has an associated name specified by you. The initial status of any event defined by you is "event occurred" unless you explicitly reset the event with the RESET instruction before issuing the WAIT or reset the event in the WAIT instruction.

WAIT normally assumes the event is in the same partition as the currently executing program. However, it is possible to wait on an event in another partition using the cross-partition capability of the WAIT instruction. See
Appendix C, "Communicating with Programs in Other Partitions (Cross-Partition Services)" on page C-1 for an example that waits for an event to occur in another partition. For more information on cross-partition services, refer to the *Language Programming Guide*.

When compiling programs with $S1ASM or the host assembler, ECBs are generated automatically by the POST instruction when needed. When using $EDXASM, ECBs must be explicitly coded unless one of the system event names previously described is used (PIx, TIMER, DSn, and so on). When the WAIT is satisfied with a POST instruction, the post code is stored in both the ECB and the waiting task's TCB code location.

Syntax:

label	**WAIT**	**event,RESET,P1=**
Required:	**event**	
Defaults:	**event not reset before wait**	
Indexable:	**event**	

Operand	*Description*
event	The label of the event for which the system is waiting. For process interrupt, use PIx, where "x" is a user process interrupt number in the range 1–99. For intervals set by STIMER, use TIMER as the event name. However, do not code RESET with TIMER; the system always resets the ECB associated with the TIMER option. For disk I/O events, use DSn or the DSCB name from a DSCB statement as the event name. For terminals, use KEY to cause the task to wait for an operator to press the enter key or any PF key. WAIT KEY suspends the issuing task until the enter key or a PF key is pressed. Pressing one of these keys ends the WAIT condition and execution resumes with the instruction following the WAIT KEY. There is no automatic transfer to an attention routine. The WAIT KEY instruction enqueues the currently active terminal and temporarily inhibits the ATTNLIST capability while the task is suspended by the WAIT instruction.

The key that has been pressed can be identified by the value stored in the second word of the task control block (taskname+2). The program function keys generate values as follows: PF1 generates a value of 1, PF2 generates a value of 2, and so on. The enter key generates a value of 0.

To determine which interrupt codes are returned for the 4978 PF key operations, refer to the "Control Chart for 4978 Display Station" shown under the command "C−Change a Key Definition" in the $TERMUT2 utility in the *Operator Commands and Utilities Reference.*

For a 3151, 3161, 3163, or 3164 terminal in block mode, pressing PF keys 13−24 will generate a value of zero in the second word of the task control block. PF keys 1−12 will generate their corresponding values.

For a 3101 in block mode, pressing the SEND key to satisfy a WAIT KEY will reset changed data tags.

If a READTEXT with TYPE=MODDATA is to be executed after the WAIT KEY, one of the PF keys must be pressed to satisfy the WAIT KEY instruction.

Any terminal I/O operation that takes place as a result of pressing the enter key to satisfy a WAIT KEY instruction will cause a return code to be placed in the first word of the task control block (taskname). If the return code is not a −1, the address of this instruction will be placed in the second word of the task control block (taskname+2). The terminal I/O return codes are described at the end of the PRINTEXT and READTEXT instructions in this manual and also in *Messages and Codes.*

RESET Reset (clear) the event before waiting. Using RESET will force the wait to occur even if the event has occurred and been posted as complete.

Do not code this operand when you want the system to wait for an event you specified on the EVENT operand of either a PROGRAM or a TASK statement.

P1= Parameter naming operand. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code this operand.

Coding Example

The WAIT instruction, at label W1, suspends execution of the primary task until the loaded task, PROG1, signals its completion by posting the ECB labeled LOADECB.

The WAIT instruction at W2 suspends task execution until the operator presses a PF1 key, PF2 key, or the enter key. When one of those keys has been pressed, the task uses the key number, stored in task word 1, to determine what action to take.

The WAIT at label W3 suspends task execution until a 60-second timer has elapsed (it was set by the preceding STIMER instruction).

```
TASK     PROGRAM  BEGIN
LOADECB  ECB
BEGIN    EQU      *
           •
           •
           •
         LOAD     PROG1,EVENT=LOADECB
W1       WAIT     LOADECB
           •
           •
           •
         PRINTEXT '@PRESS PF KEY 1 OR 2 TO INDICATE YOUR SELECTION '
W2       WAIT     KEY
         IF       (TASK+2,EQ,1)
            GOTO RTN1
         ELSE
            IF    (TASK+2,EQ,2)
           •
           •
           •
         STIMER   60000
W3       WAIT     TIMER
            •
            •
            •
```

WAITM – Wait for One or More Events in a List

The WAITM instruction waits for one or more events to occur from a list of events that you specify with an MECB statement. These events can include I/O operations or any process interrupts for which you have posted ECBs. Up to 64 WAITM operations can be active in the system at any one time. This depends on the value you specified on the SYSPARMS statement at system generation time.

See "MECB – Create a List of Events" on page 2-250 for information on how to code the MECB statement.

WAIT normally assumes the event is in the same partition as the currently executing program. However, it is possible to wait on an event in another partition using the cross-partition capability of the WAIT instruction. See Appendix C, "Communicating with Programs in Other Partitions (Cross-Partition Services)" on page C-1 for an example that waits for an event to occur in another partition. For more information on cross-partition services, refer to the *Language Programming Guide*.

Notes:

1. To use the WAITM instruction, you must have included the SWAITM module in your system and modified the MECBLST keyword on the SYSPARMS statement during system generation. (Refer to the *Installation and System Generation Guide* for additional information.)
2. The WAITM instruction uses 1024 bytes of storage in partition 1.
3. The system processes the WAITM instruction in the same manner as the WAIT instruction.

label	**WAITM**	**mecb,RESET,P1=**
Required:	**mecb**	
Defaults:	**none**	
Indexable:	**mecb**	

Operand	*Description*
mecb	The label of the MECB statement that defines the list of events.
RESET	Reset (clear) the events before waiting. Using RESET forces the wait to occur even if the events have occurred and have been posted complete.
P1=	Parameter naming operand. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code this operand.

Syntax Example

Wait with reset on a list labeled MECB1.

```
WAITM    MECB1,RESET
  •
  •
  •
```

Post Codes

The following post codes are returned in the first word of the MECB.

Post Code	Description
X'FFFF'	Successful completion.
X'BAD0'	WAITM instruction not supported (SWAITM module not in system).
X'BAD1'	Too many WAITM operations active in system (maximum is 20).
X'BAD2'	Cannot reset MECB because another program is using it.
X'BAD3'	Invalid number of events specified.

WHERES – Locate an Executing Program

The WHERES instruction locates another program executing elsewhere in the system. Note that it is not operable with programs you are unable to cancel. These programs are those for which names in storage have been changed. As a result, they do not cancel with the $C command. To locate another program, WHERES searches each partition in ascending order from partition number 1 to determine if the program is contained in that partition. It indicates results of that search by placing a return code in the first word of the task control block. If more than one copy of the program exists, the system reports only the first copy found.

The WHERES instruction does the cross-partition service communication among independently loaded programs. The address key value can be used as input to the cross-partition options of WAIT, POST, READ, WRITE, ATTACH, ENQ, DEQ, BSCREAD, BSCWRITE, and MOVE. The address can be used with an application-defined convention to gain addressability to data or code routines within another program. One such technique is to get the contents of the $STORAGE word from the located program's header and use that to address data which the program has previously placed in its dynamic area. WHERES also can be used to determine if a particular program is already loaded, thereby avoiding the need to load another copy. See Appendix C, "Communicating with Programs in Other Partitions (Cross-Partition Services)" on page C-1 for examples using the WHERES instruction.

Syntax:

label	**WHERES progname,address,KEY=,P1=,P2=,P3=**
Required:	**progname, address**
Defaults:	**none**
Indexable:	**none**

Operand	*Description*
progname	The label of an 8-byte area containing the 1 – 8 character program name of the program to be located. If the label has fewer than eight characters, the program name must be left-justified and padded with blanks on the right. The program name must begin on a full-word boundary.
address	The label of a word in which the load-point address of the located program will be returned if the program is found. This address is the first byte of the program and is also the beginning of the program header. If the program is not located, a –1 is stored at this location.
KEY=	The label of a word in which the address key of the partition containing the located program will be returned if the program is found. The address key is one less than the partition number.

Px= Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands. P3 is the name of the KEY operand.

Coding Example

The following example demonstrates a use of the cross-partition service WHERES instruction. $TCBADS is not changed by the WHERES instruction.

```
GETNAME  EQU      *
         READTEXT PGMNAME,'@ENTER THE PROGRAM                        X
               NAME TO BE FOUND'
         IF       (PGMNAME-1,EQ,0,BYTE),GOTO,GETNAME
FINDNAME EQU      *
         WHERES   PGMNAME,ADDRESS,KEY=ADDRKEY    IF THE PROGRAM IS
*                                  FOUND, ADDRESS WILL CONTAIN THE
*                                  ENTRY POINT ADDRESS AND ADDRKEY
*                                  WILL CONTAIN THE ADDRESS KEY
         IF       (TASKNAME,NE,-1),GOTO,NOPGM
         ADD      ADDRKEY,1,RESULT=PARTNUM
         PRINTEXT '@PROGRAM ',SKIP=2
         PRINTEXT PGMNAME
         PRINTEXT ' WAS FOUND IN PARTITION # '
         PRINTNUM PARTNUM
         PRINTEXT ' (ADDRESS SPACE '
         PRINTNUM ADDRKEY
         PRINTEXT ') AT LOAD POINT '
         PRINTNUM ADDRESS
         GOTO     TRYAGAIN
*
NOPGM    EQU      *
         PRINTEXT PGMNAME
         PRINTEXT ' WAS NOT FOUND IN ANY ADDRESS SPACE'
*
TRYAGAIN EQU      *
         PRINTEXT PGMNAME
         QUESTION '@DO YOU WISH TO TRY ANOTHER SEARCH',YES=GETNAME
*
ENDIT    EQU      *
*        GOTO     STOPPER
*          .
PGMNAME  TEXT     LENGTH=8        STORE AREA FOR PROGRAM NAME
ADDRESS  DATA     F'0'            PROGRAM'S PARTITION LOAD POINT
ADDRKEY  DATA     F'0'            ADDRESS SPACE KEY
PARTNUM  DATA     F'0'            PARTITION NUMBER (ADDRKEY + 1)
```

The READTEXT acquires the name of the program for which you are searching. If the enter key is pressed without typing a response to the READTEXT instruction, the READTEXT and its PROMPT are issued again.

If the program is found, the program name, the address space in which it was located, and the partition number are displayed on the terminal. Otherwise, the system displays a not-found message.

You are always queried by the QUESTION instruction as to whether you wish to try another search. If your reply is no, the program ends. If your reply is yes, the program branches to GETNAME and the program executes again.

Return Codes

Return codes are returned in the first word of the task control block (TCB) of the program or task issuing the instruction. The label of the TCB is the label of your program or task (taskname).

Code	Description
−1	Program found.
0	Program not found.

WRITE – Write Records to a Data Set

The WRITE instruction transfers one or more records from a buffer area to a disk, diskette, or tape data set.

You can transfer (write) data sets to disk or diskette either sequentially or directly by relative record. Records are 256 bytes long. The *Operator Commands and Utilities Reference* describes the format of a record created with the text editor of $FSEDIT.

For tape data sets, you can write data sequentially only. Tape records can be from 18 to 32767 bytes long.

The WRITE instruction can take advantage of the cross-partition capability that enables your program to share data with a program or task in another partition. Appendix C, "Communicating with Programs in Other Partitions (Cross-Partition Services)" on page C-1 contains an example of the cross-partition WRITE operation. You can find more information on cross-partition services in the *Language Programming Guide*.

Syntax:

label	**WRITE**	**DSx,loc,count,relrecno|blksize,PREC=,** **END=,ERROR=,WAIT=,P1=,P2=,P3=,P4=**
Required:	**DSx,loc**	
Defaults:	**count=1, relrecno=0 or blksize=256,** **WAIT=YES, PREC=S**	
Indexable:	**loc, count, relrecno or blksize**	

Operand	*Description*
DSx	The data set to which you are writing. Code DSx, where "x" is a positive integer that indicates the relative position (number) of the data set in the list of data sets you defined on the PROGRAM statement. The value can range from 1 to the maximum number of data sets defined in the list. The maximum range is from 1–9. You can substitute a DSCB name defined by a DSCB statement for DSx.
loc	The label of the buffer area from which data is to be transferred. WRITE normally assumes the buffer is in the same partition as the currently executing program. You can transfer records from a buffer in another partition, however, by using the cross-partition capability of the WRITE instruction.
count	The number of contiguous records you want written. The maximum value for this field is 255. If you code 0 for this field, no I/O operation will be performed. A count of the actual number of records transferred will be returned in the second word of the task control block. If fewer records remain in the data set than specified by the count field, the system writes as many records as will fit in the space left on the disk data set. It then returns an end-of-data-set return code to the program. This is known as an end-of-data-set condition.

relrecno The location, by relative record number, where the system is to write a record. The record number is relative to the first record in the data set and the numbering starts with 1. You can code a positive integer or the label of a data area containing the value.

You can request a sequential write operation by coding a 0 or by allowing this operand to default. Sequential WRITE instructions start with relative record 1 or the relative record number specified by a POINT instruction. The supervisor keeps track of sequential WRITE instructions and increments an internal next-record-pointer for each record written in sequential mode (relrecno is 0). Direct WRITE operations (relrecno is not 0) can be intermixed with sequential operations, but this does not change the next-record-pointer used by sequential operations.

If you code a self-defining term for this operand, or an equated value indicated by a plus sign (+), then it is assumed to be a single-word value and is generated as an in-line operand. Because this is a one-word value, it is limited to a range of 1 to 32767 (X'7FFF').

If you code an indexable value or an address for this operand, the PREC operand can be used to further define whether relrecno is to be a single-word or double-word value.

If the PREC operand is coded as PREC=D, then the range of relrecno is extended beyond the 32767 value to the limit of a double-word value (2147483647 or X'7FFFFFFF').

blksize The size, in bytes, of the record the system is to write to a tape data set. The range is from 18 to 32767. You can code a self-defining term or the label of a data area containing the value. If you do not code this operand or code a 0, the system uses the default value of 256 bytes.

Do not code this operand in a WRITE instruction containing the relrecno operand.

PREC= This operand further defines the relrecno operand when you specify an address or indexable value for that operand. PREC=S (the default) limits the value of relrecno to single-word precision or to a maximum value of 32767 (X'7FFF').

Coding PREC=D gives the relrecno operand a doubleword precision and extends the range of its maximum value to a doubleword value of 2147483647 (X'7FFFFFFF').

Do not code this operand in a WRITE instruction containing the blksize operand.

END= The label of the first instruction of the routine to be called if an end-of-data-set condition is detected during the WRITE operation (return code=10). If you do not code this operand, the system treats an end-of-data-set (EOD) condition as an error.

For tape, if an end-of-tape (EOT) condition is detected, the EOT path will be taken with return code 24, even though the block was successfully written. See the CONTROL instruction for setting the proper end-of-data (EOD) indicators for an output tape. Multiple blocks (if specified by the count field) might not have been successfully written. The second word of the TCB contains the actual number of blocks written.

Do not code this operand if you code WAIT=NO.

You can set or change the end-of-data by using the SE command of $DISKUT1. Refer to the *Operator Commands and Utilities Reference* for additional information.

ERROR= The label of the first instruction of the routine to be called if an error condition occurs during the execution of this operation. If you do not code this operand, control passes to the instruction following the WRITE instruction and you must test for any errors.

For tape, if END is not coded, the system treats an EOT as an error and returns an EOT return code. The ERROR path is taken for all return codes other than EOT or a −1. An attempt to write to a tape which has an unexpired date is also an error.

Do not code this operand if you code WAIT=NO

WAIT= YES (the default), to suspend the current task until the operation is complete.

NO, to return control to the current task after the operation is initiated. Your program must issue a subsequent WAIT DSx to determine when the operation is complete.

You cannot code the END and ERROR operands if you code WAIT=NO. You must subsequently test the return code in the Event Control Block (ECB) named DSx or in the first word of the task control block (TCB). The label of the TCB is the label of the program or task (taskname).

Two codes are of special significance. A −1 indicates a successful end of operation. A +10 indicates an End-of-Data-Set and may be of logical significance to the program rather than an error. For programming purposes, any other return codes should be treated as errors.

Px= Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Special Considerations

If your program is writing data to a diskette and you remove the diskette between write operations and replace it with another diskette, the system writes data to the second diskette before detecting an error.

Syntax Examples for Tape WRITE

1) This WRITE instruction writes a single 1000-byte record from location BUFF1 to a tape data set named OUTDATA. OUTDATA is on a standard-label (SL) tape that has volume serial number 1025.

```
TASK1  PROGRAM  START1,DS=((OUTDATA,1025))
         •
         •
         •
START1 WRITE    DS1,BUFF1,1,1000,ERROR=ERR
```

2) This WRITE instruction writes two records to the tape data set. Each record is 502 bytes in length. Record 1 is located at BUFF2, record 2 is located at BUFF2 + 502 bytes.

```
TASK2  PROGRAM  START2,DS=((OUTDATA,1025))
         •
         •
         •
START2 WRITE    DS1,BUFF2,2,502,ERROR=ERR
```

Coding Example

The WRITE instruction writes 256 bytes of data, beginning at the location labeled DISKBUFF, into the next sequential record of the first data set specified in the PROGRAM statement. If an end-of-file condition occurs during the write attempt, the program passes control to the label EOFILE. If an unrecoverable I/O error is encountered during the WRITE operation, the program will branch to the DSKWRERR label.

```
SAMPLE   PROGRAM   DS=(CHART1,CHART2)
           •
           •
           •
NXTEMPLY EQU     *
           •
           •
           •
         MOVEA   #1,DISKBUFF
         MOVE    (000,#1),NAME,(50,BYTE)
         MOVE    (050,#1),STRTADDR,(50,BYTE)
         MOVE    (100,#1),CITY,(50,BYTE)
         MOVE    (150,#1),ZIP,(6,BYTE)
         MOVE    (200,#1),JOBTITLE,(50,BYTE)
         MOVE    (250,#1),JOBDESC,(50,BYTE)
         WRITE   DS1,DISKBUFF,1,0,END=EOFILE,ERROR=DSKWRERR
         GOTO    NXTEMPLY
*
EOFILE   EQU     *
         PRINTEXT '@** EMPLOYEE FILE HAS EXCEEDED AVAILABLE DISK SPACE'
         GOTO    ENDIT
*
DSKWRERR EQU     *
         PRINTEXT '@UNRECOVERABLE DISK WRITE ERROR ON EMPLOYEE FILE'
         GOTO    ENDIT
         PROGSTOP
DISKBUFF BUFFER   256,BYTES
         ENDPROG
         END
```

Disk and Tape Return Codes

Disk and tape I/O return codes are returned in two places:

- The first word of the DSCB (either DSn or DSCB name) named DSn, where n is the number of the data set to which you are referring.
- The first word of the task control block (TCB). The label of the TCB is the label of your program or task (taskname).

The possible return codes and their meaning for disk and tape are shown in tables later in this section.

If a tape error occurs, the read/write head positions itself immediately following the record in which the error occurred. This indicates that a retry has been attempted but was unsuccessful. The count field, in the WRITE instruction, may or may not have been set to zero under this condition.

You can get detailed information on an error by using the $LOG utility to capture the I/O error. Refer to the *Problem Determination Guide* for information on how to use $LOG.

Note: If an error is encountered during a sequential I/O operation, the relative record number for the next sequential request is not updated. This will cause errors on all following sequential I/O operations.

Disk/Diskette Return Codes

Return Code	Condition
−1	Successful completion.
1	I/O error and no device status present (this code may be caused by the I/O area starting at an odd byte address).
2	I/O error trying to read device status.
3	I/O error retry count exhausted.
4	Read device status I/O instruction error.
5	Unrecoverable I/O error.
6	Error on issuing I/O instruction.
7	A no record found condition occurred, a seek for an alternate sector was performed, and another no record found occurred, for example. No alternate is assigned.
8	A system error occurred while processing an I/O request for a 1024-byte sector diskette.
9	Device was offline when I/O was requested.
10	READ request is beyond the end of the data set. Write request is beyond the end of the nonextended data set.
11	Data set not open or device marked unusable when I/O was requested.
12	DSCB was not OPEN; DDB address = 0.
13	If extended deleted record support was requested ($DCSBFLG bit 3 on), the referenced sector was not formatted at 128 bytes/sector or the request was for more than one 256-byte sector. If extended deleted record support was not requested ($DSCBFLG bit 3 off), a deleted sector was encountered during I/O.
14	The first sector of the requested record was deleted.
15	The second sector of the requested record was deleted.
16	The first and second sectors of the requested record were deleted.
17	Cache fetch error. Contact your IBM customer engineer.
18	Invalid cache error. Contact your IBM customer engineer.
19	Insufficient table space for data set extent.
20	Insufficient disk storage available for a new extent. No directory member entry available.
21	Insufficient disk storage available for extent. Directory member entry is available, but no storage on volume for allocation of the extent data area.
24	End of tape.
30	Device not a tape.

Tape Return Codes and Post Codes

Return Code	Condition
−1	Successful completion.
1	Exception but no status.
2	Error reading cycle steal status.
3	I/O error; retry count exhausted.
4	Error issuing READ CYCLE STEAL STATUS.
6	I/O error issuing I/O operations.
10	End of data; a tape mark was read.
21	Wrong length record.
22	Device not ready.
23	File protected.
24	End of tape.
25	Load point.
26	Unrecoverable I/O error.
27	SL data set not expired.
28	Invalid blocksize.
29	Offline, in use, or not open.
30	Incorrect device type.
31	Close incorrect address.
32	Block count error during close.
33	Close detected on EOV1.
34	Write − Defective reel of tape.

The following post codes are returned to the event control block (ECB) of the calling program.

Post Code	Condition
−1	Function successful.
101	TAPEID not found.
102	Device not offline.
103	Unexpired data set on tape.
104	Cannot initialize BLP tapes.

WXTRN/EXTRN — Resolve Weak External Reference Symbols

The WXTRN and EXTRN statements identify labels that are not defined within an object module. These labels reside in other object modules that will be link-edited to the module containing the WXTRN or EXTRN statements. The system resolves the reference to an WXTRN or EXTRN label when you link-edit the object module containing the WXTRN or EXTRN statement with the module that defines the label. The module that defines the label must contain an ENTRY statement for that label. (See the ENTRY statement for more information.)

If the system cannot resolve a label during the link-edit, it assigns the label the same address as the beginning of the program. You can include up to 255 WXTRN and EXTRN symbols in your program.

WXTRN labels are resolved only by labels that are contained in modules included by the INCLUDE statement in the link-edit process or by labels found in modules called by the AUTOCALL function. However, WXTRN itself does not trigger AUTOCALL processing.

Only labels defined by EXTRN statements are used as search arguments during the AUTOCALL processing function of $EDXLINK. Any additional external labels found in the module found by AUTOCALL are used to resolve both WXTRN and EXTRN labels. Refer to the description of $EDXLINK in the *Language Programming Guide* for further information.

The main difference between the WXTRN and EXTRN statements is that you must resolve an EXTRN label at link-edit time. It is not necessary to resolve a WXTRN label at link-edit time. The unresolved label coded as an EXTRN receives an error return code from the link process. The same unresolved label coded as a WXTRN receives a warning return code. Both the error and the warning codes indicate unresolved labels. If you know that your application program does not need a label resolved, code it as a WXTRN and your program should execute successfully. However, your application will not execute correctly if you try to reference an unresolved label coded in your application program as a WXTRN.

Syntax:

blank	**WXTRN**	**label**
blank	**EXTRN**	**label**
Required:	**One label**	
Defaults:	**none**	
Indexable:	**none**	

Operand	*Description*
label	An external label. You can code up to 10 labels, separated by commas, on a single WXTRN or EXTRN statement.

Coding Example

The following coding example shows a use of the WXTRN statement.

The labels DATA1, DATA2, LABEL1, and LABEL2 are defined outside this module. The ADD instruction adds the values at DATA1 and DATA2 although the values are defined outside the module where they are being added. The GOTO instructions also can pass control to the two externally defined labels, LABEL1 and LABEL2.

Each of the external labels could have been entered on a separate line or all three of the EXTRN labels could have been coded on a single EXTRN statement.

```
          •
          •
          •
          EXTRN    DATA1,DATA2
          EXTRN    LABEL1
          WXTRN    LABEL2
          •
          •
          •
          ADD      DATA1,DATA2,RESULT=INDEX
          IF       (INDEX,GT,6)
             GOTO  LABEL1
          ELSE
             GOTO  LABEL2
          ENDIF
          •
          •
          •
INDEX     DATA     F'0'
          •
          •
          •
```

XYPLOT – Draw a Curve

The XYPLOT instruction draws a curve that connects points defined by arrays of x and y values. Data values are scaled to screen addresses according to the plot control block. (See the PLOTGIN instruction for a description of the plot control block.) Points outside the plot area are placed on the nearest boundary.

Syntax:

label	**XYPLOT**	**x,y,pcb,n,P1=,P2=,P3=,P4=**
Required:	**x,y,pcb,n**	
Defaults:	**none**	
Indexable:	**none**	

Operand	*Description*
x	The label of a data area containing an array of x data values.
y	The label of a data area containing an array of y data values.
pcb	The label of an 8-word plot control block.
n	The label of a data area that contains the number of points to be drawn.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Syntax Example

Draw a curve connecting the points specified by an x array at YAXISX and a y array at YAXISY. The data area labeled TWO contains the number of points to be drawn.

```
        XYPLOT    YAXISX,YAXISY,PCB,TWO
```

YTPLOT – Draw a Curve

The YTPLOT instruction draws a curve connecting points that are equally spaced horizontally and that have heights specified by an array of y values. Data values are scaled to screen addresses according to the plot control block. (See the PLOTGIN instruction for a description of the plot control block.) Points outside the range are placed on the boundary of the plot area.

Syntax:

label	**YTPLOT y,x1,pcb,n,inc,P1=,P2=,P3=,P4=,P5=**
Required:	**y,x1,pcb,n,inc**
Defaults:	**none**
Indexable:	**none**

Operand	*Description*
y	The label of a data area containing an array of y data values.
x1	The label of a data area containing the x data value associated with the first point.
pcb	The label of an 8-word plot control block.
n	The label of a data area containing the number of points to be drawn.
inc	The amount of space between points. This operand must be an explicit integer value greater than zero.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a detailed description of how to code these operands.

Syntax Example

Draw a curve with the heights specified by an array of y values at label YDATA. The data area labeled NPTS contains the number of points to be drawn. The instruction leaves one space between each point.

```
        YTPLOT    YDATA,X1,PCB,NPTS,1
```

Appendix A. Formatted Screen Subroutines

You can create, save, and modify formatted screen images using the $IMAGE utility. Refer to the $IMAGE description in the *Operator Commands and Utilities Reference* for information on creating or exchanging terminal screen images for various terminals. The formatted screen subroutines retrieve and display these images. This appendix describes each of the following subroutines and its operands:

- $IMDATA
- $IMDEFN
- $IMOPEN
- $IMPROT
- $PACK
- $UNPACK.

You can use the formatted screen subroutines with the following terminals:

- 4978 terminals
- 4979 terminals
- 4980 terminals
- 3101 terminals in block mode
- 3151 terminals in block mode
- 3161 terminals in block mode
- 3163 terminals in block mode
- 3164 terminals in block mode.

You can also use screen images created on a 4978, 4979, or 4980 on any of the terminals listed above by calling subroutines described in this appendix.

You must code an EXTRN statement for each subroutine name to which your program refers. You also must link-edit the subroutines with your application program. Specify $AUTO,ASMLIB as the autocall library to include the screen formatting subroutines. Refer to the *Operator Commands and Utilities Reference* for details on the AUTOCALL option of $EDXLINK.

You call the formatted screen subroutines using the CALL instruction. The following pages show the CALL instruction syntax for each subroutine.

If an error occurs, the terminal I/O return code is in the first word of the task control block (TCB). These errors can come from instructions such as PRINTEXT, READTEXT, and TERMCTRL.

$IMDATA Subroutine

The $IMDATA subroutine displays the initial data values for an image which is in disk storage format. Use $IMDATA:

- To display the unprotected data associated with a screen image, if the buffer contains a screen format retrieved with $IMOPEN.
- To "scatter write" the contents of a user buffer to the input fields of a displayed screen image.

Note: You must call $IMDATA if any of your unprotected fields have the right justify or must enter characteristics.

If the buffer is retrieved with $IMOPEN, the buffer begins with the characters "IMAG," or "IM31," and the buffer index (buffer−4) equals the data length excluding the characters "IMxx."

You can specify a user buffer containing application-generated data. Set the first 4 bytes of the buffer to the characters "USER" and set the buffer index (buffer−4) to the data length excluding the characters USER.

All or portions of the screen may be protected after $IMDATA executes. Because the operator cannot key data into protected fields, subsequent read instructions (such as QUESTION, GETVALUE, and READTEXT) should be directed to unprotected areas of the screen, or the protected areas should be erased.

Notes:

1. To use $IMDATA, you must code an EXTRN statement in your program. You must also link-edit the program with $EDXLINK and specify an autocall to $AUTO,ASMLIB.
2. Do not call both $IMDATA and $IMPROT by separate tasks to operate simultaneously. Problems will occur because both call the $IMDTYPE subroutine.

Syntax:

label	**CALL**	**$IMDATA,(buffer),(ftab),P2=,P3=**
Required:	**buffer,ftab (see note)**	
Defaults:	**none**	
Indexable:	**none**	

Operand	*Description*
buffer	The label of an area containing the image in disk-storage format.
ftab	The label of a field table constructed by $IMPROT giving the location (lines,spaces) and size (characters) of each unprotected data field of the image. **Note:** The ftab operand is required only if the application executes on a 3101, 3151, 3161, 3163, or 3164 terminal in block mode, or if a user buffer is used in $IMDATA.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a description of how to use these operands.

$IMDATA Return Codes

The return codes are returned in the second word of the task control block (TCB) of the program or task calling the subroutine. The label of the TCB is the label of your program or task (taskname). Refer to taskname+2.

Return Code	Condition
−1	Successful completion.
9	Invalid format in buffer.
12	Invalid terminal type.

$IMDEFN Subroutine

The $IMDEFN subroutine creates an IOCB for the formatted screen image. You can code the IOCB directly, but the use of $IMDEFN allows the image dimensions to be modified with the $IMAGE utility without requiring a change to the application program. $IMDEFN updates the IOCB to reflect OVFLINE=YES. Refer to the TERMINAL configuration statement in the *Installation and System Generation Guide* for a description of the OVFLINE parameter.

Once you define an IOCB for the static screen, the program can then acquire that screen through ENQT. Once the screen has been acquired, the program can call the $IMPROT subroutine to display the image and the $IMDATA subroutine to display the initial nonprotected fields.

Note: To use $IMDEFN, you must code an EXTRN statement in your program. You must also link-edit the program with $EDXLINK and specify an autocall to $AUTO,ASMLIB.

Syntax:

label	**CALL**	**$IMDEFN,(iocb),(buffer),topm,leftm,** **P2=,P3=,P4=,P5=**
Required:	**iocb,buffer**	
Defaults:	**topm=0,leftm=0**	
Indexable:	**none**	

Operand	*Description*
iocb	The label of an IOCB statement defining a static screen. The IOCB need not specify the TOPM, BOTM, LEFTM, nor RIGHTM parameters; these are "filled in" by the subroutine. The following IOCB statement would normally suffice: `label  IOCB  SCREEN=STATIC`
buffer	The label of an area containing the screen image in disk storage format. The format is described in the *Language Programming Guide*.
topm	This parameter indicates the screen position at which line 0 will appear. If its value is such that lines would be lost at the bottom of the screen, then it is forced to zero. This parameter must equal zero for all 3101, 3151, 3161, 3163, or 3164 terminal applications. The default is also zero.
leftm	This parameter indicates the screen position at which the left edge of the image will appear. If its value is such that characters would be lost at the right edge of the screen, then it is forced to zero. This parameter must equal zero for all 3101, 3151, 3161, 3163, or 3164 terminal applications. The default is also zero.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a description of how to use these operands.

Coding Example

```
         CALL    $IMDEFN,(IMGIOCB),(IMGBUFF),0,0
          •
          •
          •
         ENQT    IMGIOCB
          •
          •
          •
         PROGSTOP
IMGIOCB  IOCB    SCREEN=STATIC
IMGBUFF  BUFFER  1024,BYTES
```

$IMOPEN Subroutine

The $IMOPEN subroutine reads a formatted screen image from disk or diskette into your program buffer. You can also perform this operation by using the DSOPEN subroutine or by defining the data set at program load time, and issuing the disk READ instruction. Refer to the *Language Programming Guide* for a description of buffer sizes. $IMOPEN updates the index word of the buffer with the number of actual bytes read. To refer to the index word, code buffer−4.

Note: To use $IMOPEN, you must code an EXTRN statement in your program. You must also link-edit the program with $EDXLINK and specify an autocall to $AUTO,ASMLIB.

Syntax:

label	**CALL**	**$IMOPEN,(dsname),(buffer),(type),** **P2=,P3=,P4=**
Required:	**dsname,buffer**	
Defaults:	**type=C'4978'**	
Indexable:	**none**	

Operand	*Description*
dsname	The label of a TEXT statement which contains the name of the screen image data set. You can include a volume label, separated from the data set name by a comma.
buffer	The label of a BUFFER statement that defines the storage area into which the image data will be read. Allocate the storage in bytes, as in the following example: `label  BUFFER 1024,BYTES`
type	The label of a DATA statement that reserves a 4-byte area of storage and specifies the type of image data set to be read. The DATA statement must be on a full word boundary. Specify one of the following types:

C'4978' The system reads an image data set for a 4978 terminal with a 4978/4979/4980 terminal format. This is the default terminal format.

C'3101' The system reads an image data set for a 3101 terminal with a 31xx terminal format.

C'3161' The system reads an image data set for a 3151 or 3161 terminal with a 31xx terminal format.

C'3163' The system reads an image data set for a 3163 terminal with a 31xx terminal format.

C'3164' The system reads an image data set for a 3164 terminal with a 31xx terminal format.

Note: The 31xx terminal format is the format used for a 3101, 3151, 3161, 3163, and 3164 terminal.

C' ' The system reads an image data set whose format corresponds with the type of terminal enqueued. If neither a 4978, 4979, 4980, 3101, 3151, 3161, 3163, nor 3164 is enqueued (ENQT), the system assumes the default 4978 image format.

If you specify this type, $IMOPEN will try to use the format that corresponds with the device. If that is not available, $IMOPEN will use a 4978/4979/4980 screen image. This is the default condition when you do not code this parameter. For example, if you are enqueued on a 3161 terminal, $IMOPEN will attempt to open a 31xx screen image. If the screen image does not exist, $IMOPEN will use the 4978 screen image.

Px= Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a description of these operands.

Special Considerations

$IMAGE screens that have been saved using EDX version 5.2 and above require additional setup if they are opened by DSOPEN instead of by $IMOPEN. The first three words of the buffer must be as follows:

Word 1 C'IM'

Word 2 C'AG'

Word 3 xxxx, where xxxx is the address (in the buffer) where the 31xx terminal format resides.

Or:

0000, if the 31xx terminal format is not used.

The $IMAGE screen then is read in at BUFFER+6.

$IMOPEN Return Codes

The return codes are returned in the second word of the task control block (TCB) of the program or task calling the subroutine. The label of the TCB is the label of your program or task (taskname). Refer to taskname+2.

Return Code	Condition
−1	Successful completion.
0	Undefined error encountered.
1	Disk I/O error.
2	Buffer too small for 3101, 3151, 3161, 3163 or 3164 terminal information
3	Data set not found.
4	Incorrect header or data set length.
5	Input buffer too small.
6	Invalid volume name.

Return Code	Condition
7	No 3101 image available.
8	Data set name longer than 8 bytes.

$IMPROT Subroutine

The $IMPROT subroutine uses an image created by the $IMAGE utility to prepare the defined protected and blank nonprotected fields for display. At the option of the calling program, a field table can be constructed. The field table gives the location (LINE and SPACES) and length of each unprotected field.

Upon return from $IMPROT, your program can force the protected fields to be displayed by issuing a TERMCTRL DISPLAY. This is not required if a call to $IMDATA follows because $IMDATA forces the display of screen data.

All or portions of the screen may be protected after $IMPROT executes. Because the operator cannot key data into protected fields, subsequent read instructions (such as QUESTION, GETVALUE, and READTEXT) should be directed to unprotected areas of the screen, or the protected areas should be erased.

Notes:

1. To use $IMPROT, you must code an EXTRN statement in your program. You must also link-edit the program with $EDXLINK and specify an autocall to $AUTO,ASMLIB.
2. Do not call both $IMPROT and $IMDATA by separate tasks to operate simultaneously. Problems will occur because both call the $IMDTYPE subroutine.

Syntax:

label	**CALL**	**$IMPROT,(buffer),(ftab),P2=,P3=**
Required:	**buffer,ftab (see note)**	
Defaults:	**none**	
Indexable:	**none**	

Operand	*Description*
buffer	The label of an area containing the screen image in disk storage format. The format is described in the *Language Programming Guide*.
ftab	The label of a field table constructed by $IMPROT giving the location (lines, spaces) and size (characters) of each unprotected data field of the image. **Note:** The ftab operand is required only if the application executes on a 3101, 3151, 3161, 3163, or 3164 terminal in block mode, or if a user buffer is used in $IMDATA.
Px=	Parameter naming operands. See "Using the Parameter Naming Operands (Px=)" on page 1-10 for a description of how to use these operands.

The field table has the following form:

```
label-4          number of fields
label-2          number of words
label            line      * FIELD 1  (one word)
                 spaces                (one word)
                 size                  (one word)
label+6          line      * FIELD 2
                 spaces
                 size
                  •
                  •
                  •
label+6(n-1)               line        * FIELD n
                 spaces
                 size
```

The field numbers correspond to the following ordering: left to right in the top line, left to right in the second line, and so on to the last field in the last line. Storage for the field table should be allocated with a BUFFER statement specifying the desired number of words using the WORDS parameter. The buffer control word at label-2 is used to limit the amount of field information stored, and the buffer index word at buffer-4 is set with the number of fields for which information was stored, the total number of words being three times that value. If you do not want the field table, code 0 for this parameter.

$IMPROT Return Codes

The return codes are returned in the second word of the task control block (TCB) of the program or task calling the subroutine. The label of the TCB is the label of your program or task (taskname). Refer to taskname+2.

Return Code	Condition
-1	Successful completion.
9	Invalid format in buffer.
10	FTAB truncated due to insufficient buffer size.
11	Error in building FTAB from 3101 format; partial FTAB created.
12	Invalid terminal type.

$PACK Subroutine

The $PACK subroutine moves a byte string and translates it into compressed form.

Note: To use $PACK, you must code an EXTRN statement in your program. You must also link-edit the program with $EDXLINK and specify an autocall to $AUTO,ASMLIB.

Syntax:

label	**CALL**	**$PACK,source,dest,P2=,P3=**
Required:	**source,dest**	
Defaults:	**none**	
Indexable:	**none**	

Operand	*Description*
source	The label of a fullword containing the address of the string to be compressed. The length of the string is taken from the byte preceding this location, and the string could, therefore, be the contents of a TEXT buffer.
dest	The label of a fullword containing the address at which the compressed string is to be stored. At completion of the operation, this parameter is incremented by the length of the compressed string.

Compressed Data Format for $PACK/$UNPACK

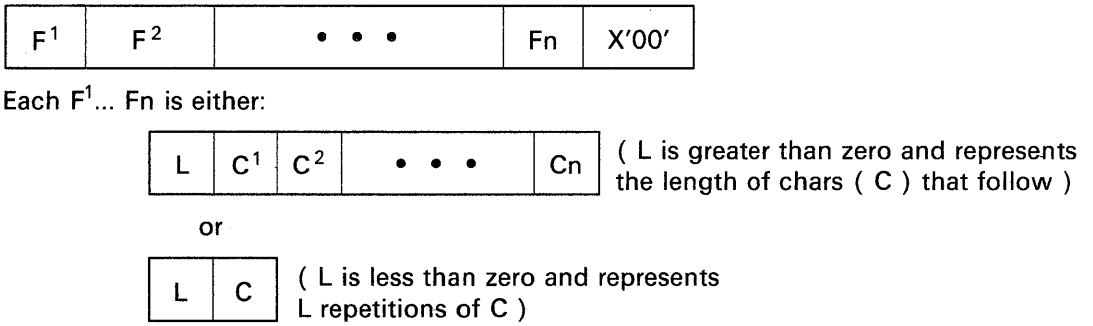


Figure A-1. Compressed Data Format

$UNPACK Subroutine

The $UNPACK subroutine moves a byte string and translates it to noncompressed form.

Note: To use $UNPACK, you must code an EXTRN statement in your program. You must also link-edit the program with $EDXLINK and specify an autocall to $AUTO,ASMLIB.

Syntax:

label	CALL	**$UNPACK,source,dest,P2=,P3=**
Required:	**source,dest**	
Defaults:	**none**	
Indexable:	**none**	

Operand	*Description*
source	The label of a fullword containing the address of a compressed byte string (see Appendix D for the compressed format). At completion of the operation, this parameter is increased by the length of the compressed string.
dest	The label of a fullword containing the address at which the expanded string is to be placed. The length of the expanded string is placed in the byte preceding this location. The $UNPACK subroutine can, therefore, conveniently be used to move and expand a compressed byte string into a TEXT buffer.

For $UNPACK compressed data format, see Figure A-1 on page A-11.

Appendix B. Program Communication Through Virtual Terminals

A "virtual terminal" is a logical EDX device that simulates the actions of a physical terminal. An EDL application program can acquire control of, or enqueue, a virtual terminal just as it would an actual terminal. By using virtual terminals, however, programs can communicate with each other as if they were terminal devices. One program (the primary) loads another program (the secondary) and takes on the role of an operator entering data at a physical terminal. The secondary program can be an application program or a system utility, such as $COPYUT1. You can use virtual terminals, for example, to provide simplified menus for running system utilities. An operator could load a virtual terminal program, select a utility to run, and allow the program to pass predefined parameters to the utility.

Virtual terminals simulate roll screen devices. The terminals communicate through EDL terminal I/O instructions contained in the virtual terminal programs. The programs use a set of virtual terminal return codes to synchronize communication. These return codes are shown under "Virtual Terminal Communication" on page B-2 and following the READTEXT and PRINTEXT instructions.

Requirements for Defining Virtual Terminals

You must define virtual terminals in pairs. You must include a TERMINAL definition statement for each virtual terminal in your system during system generation. Refer to *Installation and System Generation Guide* for details on how to code the TERMINAL statements for virtual terminals. You must also include the supervisor module IOSVIRT in your system during system generation.

The DEVICE operand of the TERMINAL statement defines a terminal as a virtual terminal. The ADDRESS operand of the TERMINAL statement contains the label of the other virtual terminal in the pair. The two TERMINAL statements must refer to each other in one of the following ways:

1) The TERMINAL statements below define a pair of virtual terminals. The SYNC=YES operand on the first TERMINAL statement (CDRVTA), indicates that the task enqueuing this virtual terminal will receive the return codes that provide program synchronization.

```
CDRVTA   TERMINAL  DEVICE=VIRT,ADDRESS=CDRVTB,SYNC=YES
CDRVTB   TERMINAL  DEVICE=VIRT,ADDRESS=CDRVTA
```

2) The TERMINAL statements that follow both contain SYNC=YES. In this case, the task that last attempted an operation will receive a return code for program synchronization.

```
CDRVTA   TERMINAL  DEVICE=VIRT,ADDRESS=CDRVTB,SYNC=YES
CDRVTB   TERMINAL  DEVICE=VIRT,ADDRESS=CDRVTA,SYNC=YES
```

Considerations for Coding a Virtual Terminal Program

When coding a program that enqueues a virtual terminal you should remember the following:

- The primary virtual terminal program loads the secondary program or system utility with a LOAD instruction. Code LOGMSG=NO on the LOAD statement if the secondary program is unable to issue a READTEXT for the message.
- The primary virtual terminal program can only communicate with one secondary program or system utility at a time.
- Your program enqueues a virtual terminal with an ENQT instruction. The primary program should enqueue the virtual terminal for the secondary program, load the secondary program, and enqueue a virtual terminal for itself.

  The IOCB statements to which the ENQT instructions refer can be in your primary program or in a secondary application program. The following example shows how a primary program would load the $TERMUT1 utility.

```
          •
          •
          •
          ENQT     SECOND
          LOAD     $TERMUT1,LOGMSG=NO,EVENT=ENDWAIT
          ENQT     PRIMARY
          •
          •
          •
          PROGSTOP
PRIMARY   IOCB     CDRVTA     NAME OF THE PRIMARY VIRTUAL TERMINAL
SECOND    IOCB     CDRVTB     NAME OF THE SECONDARY VIRTUAL TERMINAL
```

Virtual Terminal Communication

To send and receive data through the virtual terminals, application programs use terminal I/O instructions: READTEXT, PRINTEXT, GETVALUE, and PRINTNUM. Virtual terminals do not affect the operation of these instructions. Your program can also generate attention interrupts using TERMCTRL PF, which is described in this book under TERMCTRL (VIRTUAL).

Virtual terminal programs can use a set of return codes to synchronize their operations. Programs or tasks receive the virtual terminal return codes in the first word of their task control block. A program can obtain a return code by referring to the label on the PROGRAM statement.

The virtual terminal return codes and their descriptions follow:

Return Code	Transmit Condition	Receive Condition
X'8Fnn'	NA	LINE=nn received.
X'8Enn'	NA	SKIP=nn received.
−2	NA	Line received (no CR).
−1	Normal completion.	New line received.
1	Not attached.	Not attached.
5	Disconnect.	Disconnect.
8	Break.	Break.

LINE=nn (X'8Fnn')
Returned for a READTEXT or GETVALUE instruction if the other program issued an instruction with a LINE= operand. This operand tells the system to perform an I/O operation on a certain line of the page or screen. The return code enables the receiving program to reproduce on an actual terminal the output format intended by the sending program.

SKIP=nn (X'8Enn')
The other program issued an instruction with a SKIP= operand. This operand tells the system to skip a number of lines before performing an I/O operation.

Line Received (−2)
Indicates that an instruction (usually READTEXT or GETVALUE) has sent information but has not issued a carriage return to move the cursor to the next line. The information is usually a prompt message.

New Line Received (−1)
Indicates transmission of a carriage return at the end of the data. The cursor is moved to a new line. This return code and the Line Received return code help programs to preserve the original format of the data they are transmitting.

Not attached (1)
A virtual terminal does not or cannot refer to another virtual terminal.

Disconnect (5)
The other virtual terminal program ended. This is because you specified a PROGSTOP or an attention list process is complete.

Break (8)
Indicates that both virtual terminal programs are attempting to perform the same type of operation. When one program is reading (READTEXT or GETVALUE), the return code means the other program has stopped sending and is waiting for input. When one program is writing, (PRINTEXT or PRINTNUM), the return code means the other program is also attempting to write.

If you defined only one virtual terminal with SYNC=YES, then that task always receives the break code, whether or not it attempted the operation first. If you defined both virtual terminals with SYNC=YES, then the task that last attempted the operation receives the break code.

Sample Virtual Terminal Programs

The sample programs that follow show two types of virtual terminal communication. Both programs assume that the following TERMINAL statements were included during system generation:

```
CDRVTA    TERMINAL  DEVICE=VIRT,ADDRESS=CDRVTB,SYNC=YES
CDRVTB    TERMINAL  DEVICE=VIRT,ADDRESS=CDRVTA
```

1) In this example, the program named SENDER transmits data to the program named RECEIVER. RECEIVER prints the data it received on $SYSPRTR. SENDER is the primary program; RECEIVER is the secondary program.

The SENDER program begins by requesting data from an operator with a READTEXT instruction. SENDER then enqueues the first virtual terminal, loads RECEIVER, and enqueues the second virtual terminal. The DO loop at label CHECK1 issues a READTEXT instruction to determine if RECEIVER is ready to receive data. The instruction

```
READTEXT  LINE,MODE=LINE
```

gets the next line from the RECEIVER program. The loop continues until SENDER receives a return code of 8.

RECEIVER issues a PRINTEXT instruction and then a READTEXT instruction to indicate that it is ready to receive data. When RECEIVER executes the READTEXT, SENDER receives a return code of 8 that indicates both programs are attempting to perform the same operation. SENDER checks the first word of the TCB, finds the return code, exits the DO loop, and executes a PRINTEXT that transmits the operator data to RECEIVER. SENDER then enters a second DO loop at label CHECK2. In this loop, SENDER checks the TCB until it finds a return code of 5. The return code indicates that RECEIVER has printed the data and has completed.

```
SENDER      PROGRAM   START
            PRINT     OFF
            PRINT     ON
A           IOCB      CDRVTA              SYNC TERMINAL
B           IOCB      CDRVTB
START       EQU       *
            READTEXT  DATA,'ENTER DATA TO TRANSMIT ',MODE=LINE
            ENQT      B
            LOAD      RECEIVER,LOGMSG=NO,EVENT=DONE
            ENQT      A
CHECK1      DO        UNTIL,(RC,EQ,8)     DO UNTIL BREAK
             READTEXT   LINE,MODE=LINE
             TCBGET     RC,$TCBCO
            ENDDO
            PRINTEXT  DATA                SEND INPUT TO OTHER PROGRAM
CHECK2      DO        UNTIL,(RC,EQ,5)     DO UNTIL DISCONNECT
             READTEXT   LINE,MODE=LINE
             TCBGET     RC,$TCBCO
            ENDDO
            WAIT      DONE
            PROGSTOP
DONE        ECB
RC          DATA      F'0'
DATA        TEXT      LENGTH=80
LINE        TEXT      LENGTH=80
            ENDPROG
            END

*****************************************************************

RECEIVER    PROGRAM   START
START       EQU       *
            PRINTEXT  SKIP=1                SIGNAL TO SEND INPUT
            READTEXT  DATA,MODE=LINE
            ENQT      $SYSPRTR
            PRINTEXT  'THE DATA YOU SENT WAS : '
            PRINTEXT  DATA
            DEQT      $SYSPRTR
            PROGSTOP
DATA        TEXT      LENGTH=80
            ENDPROG
            END
```

2) This example shows how an application can use virtual terminals to process the prompt/reply sequence of the $INITDSK utility. The program initializes volume EDX003.

The replies to $INITDSK prompts begin at label REPLIES+2; each reply is 8 bytes in length (text plus length/count bytes). The program issues a READTEXT until $INITDSK requests input. The program then issues a PRINTEXT to send the reply to the $INITDSK prompt. After $INITDSK ends, the program sends a completion message to the terminal.

```
INIT     PROGRAM  BEGIN
         PRINT    OFF
         PRINT    ON
A        IOCB     A                        SYNC TERMINAL
B        IOCB     B
DEND     ECB
BEGIN    EQU      *
         ENQT     B
         LOAD     $INITDSK,LOGMSG=NO,EVENT=DEND
         ENQT     A                        GET SYNC TERMINAL
         MOVEA    #1,REPLIES+2
         DO       6,TIMES                  REPLY TO PROMPTS
           DO     UNTIL,(RETCODE,EQ,8)     BREAK CODE
             READTEXT  LINE,MODE=LINE      LOOP FOR PROMPT MESSAGES
             TCBGET    RETCODE,$TCBCO      SAVE RETURN CODE
           ENDDO
          PRINTEXT (0,#1)                  SEND REPLY
          ADD      #1,8                    NEXT REPLY
         ENDDO
         READTEXT LINE,MODE=LINE           PROGRAM END MESSAGE
         WAIT     DEND                     WAIT FOR END EVENT
         DEQT
         PRINTEXT 'EDX003 INITIALIZED'
         PROGSTOP
                  •
                  •
                  •
RETCODE  DATA     F'0'                  RETURN CODE
LINE     TEXT     LENGTH=80
REPLIES  EQU      *
         TEXT     'IV',LENGTH=6         COMMAND?
         TEXT     'EDX003',LENGTH=6     VOLUME?
         TEXT     'Y',LENGTH=6          CONTINUE?
         TEXT     '60',LENGTH=6         NUMBER OF DATA SETS?
         TEXT     'N',LENGTH=6          VERIFY?
         TEXT     'N',LENGTH=6          ALLOCATE $EDXNUC (Y/N)?
         TEXT     'EN',LENGTH=6         COMMAND?
         ENDPROG
         END
```

Appendix C. Communicating with Programs in Other Partitions (Cross-Partition Services)

EDL programs can communicate with other programs in the system through the use of the following instructions: LOAD, MOVE, STIMER, ATTACH, ENQ, DEQ, WAIT, POST, READ, and WRITE. These instructions enable your program to communicate with another program in the same partition or with a program in another partition. Communication between programs in different partitions is referred to as "cross-partition services."

To communicate with another program, your program must use the WHERES instruction to find the load-point address of the program and the partition where the program resides.

This appendix contains examples of how to communicate with programs in other partitions under the headings:

- "Transferring Data Across Partitions"
- "Starting a Task in Another Partition (ATTACH)" on page C-8
- "Synchronizing Tasks and the Use of Resources in Different Partitions" on page C-10.

Refer to the *Language Programming Guide* for more information on the use of cross-partition services in application programs.

When the system attaches a task, it updates the task control block (TCB) of the task to include the number of the address space where the task is executing. The address space value refers to a partition, and is equal to the partition number minus one. Address space 0, for example, is partition 1. The address space value is also known as the hardware address key. In most of the examples, the system uses the address key and an address your program supplies to provide communication across partitions. The equate that points to the address key in the TCB is $TCBADS.

Note: After issuing a cross-partition service request using $TCBADS, your program should immediately restore $TCBADS to its original value. This procedure can prevent unexpected or unpredictable results such as overlaying other applications with data or having a program wait indefinitely because an ECB was never posted or a DEQ instruction was never issued.

Transferring Data Across Partitions

You can transfer data across partitions using the cross-partition capabilities of the LOAD, MOVE, READ, and WRITE instructions.

Load and Pass Parameters to a Program in Another Partition (LOAD)

In the following example, PROGA loads PROGB into partition 2 and passes PROGB the parameters beginning at the label PROGASW1. After loading PROGB, PROGA waits for the event ENDWAIT, which the system posts when the loaded program ends.

The PARM= operand on PROGB's PROGRAM statement specifies the length of the parameter list that PROGB receives from PROGA. The system recognizes each word in the parameter list by the label $PARMx, where "x" indicates the position of the word in the list. $PARM1 refers to the first word in the list (PROGASW1) and $PARM2 refers to the second word in the list (PROGAKEY).

At the label PROMPT in PROGB, the program displays a prompt message that tells the operator how to cancel PROGB. The MOVEA instruction at label M1 moves the address of CANCELSW into PROGAWRK. The MOVE instruction at label M2 moves the first parameter (the address of PROGASW1) into software register 1. At label M2, PROGB moves the contents of PROGAWRK to the address (0,#1) in PROGA. The TKEY operand of the MOVE instruction supplies the address key of PROGA. PROGB begins a loop at label LOOP until the operator cancels the program.

When the operator presses the attention key and enters CA, the attention-interrupt-handling routine at label CANCEL in PROGA begins executing. At label M4, the routine moves a value of 1 to the address (0,#1) in PROGB. The TKEY operand on the MOVE instruction supplies the address key for PROGB. The address (0,#1) points to the address of CANCELSW. In PROGB, the IF instruction at label LOOP checks CANCELSW and finds that the variable contains a 1. The instruction passes control to the label STOP and PROGB ends. Control returns to PROGA because the system posts the event ENDWAIT when PROGB ends.

```
PROGA    PROGRAM  START,1,MAIN=YES
COMMAND  ATTNLIST (CA,CANCEL)
CANCEL   EQU      *
         MOVE     #1,PROGASW1
M4       MOVE     (0,#1),1,TKEY=1       CROSS-PARTITION MOVE
         ENDATTN
START    EQU      *
         TCBGET   PROGAKEY,$TCBADS      GET PROGA ADDRESS KEY
*
         LOAD     PROGB,PROGASW1,EVENT=ENDWAIT,LOGMSG=YES,PART=2
         IF       (PROGA,EQ,-1),THEN
           WAIT     ENDWAIT
         ELSE
           PRINTEXT  'LOAD FAILED',SKIP=1
         ENDIF
          .
          .
          .
         PROGSTOP
ENDWAIT  ECB
PROGASW1 DATA   A(PROGASW1)
PROGAKEY DATA   F'0'
         ENDPROG
         END

*****************************************************************

PROGB    PROGRAM START,509,PARM=2
START    EQU      *
          .
          .
          .
PROMPT   PRINTEXT 'TO CANCEL, ENTER: > CA',SKIP=1
         PRINTEXT SKIP=1
M1       MOVEA    PROGAWRK,CANCELSW
M2       MOVE     #1,$PARM1
M3       MOVE     (0,#1),PROGAWRK,TKEY=$PARM2    CROSS-PARTITION MOVE
LOOP     IF       (CANCELSW,EQ,1),GOTO,STOP
         GOTO     LOOP
STOP     EQU      *
         PROGSTOP -1,LOGMSG=NO
PROGAWRK DATA     F'0'
CANCELSW DATA     F'0'
         ENDPROG
         END
```

Move Data Across Partitions (MOVE)

The following example shows how to move data to a program in another partition. PROGA finds the program PROGB in storage, stores PROGB's address and address key, and moves data to the dynamic storage area of PROGB.

PROGA uses the WHERES instruction to find the load-point address and address key of PROGB. The WHERES instruction places the load-point address of PROGB in ADDRB and the address key of the program in KEYB.

The READTEXT instruction in PROGA asks the operator to enter up to 30 characters of data. The instruction stores the data in MSG. The MOVE instruction at label M1 moves the address key of PROGB into software register 2. The TCBGET instruction places the address of PROGA's task control block (TCB) in software register 1.

At label M2, the MOVE instruction moves the address of PROGB's dynamic storage area into the data area PROGBBUF in PROGA. The STORAGE= operand on the PROGRAM statement of PROGB causes the system to acquire a 256-byte storage area when it loads the program. The address of this storage area is in PROGB's program header (at $PRGSTG).

At label M3, PROGA saves it's address key in SAVEKEY. The MOVE instruction at M4 moves PROGB's address key to the address key field ($TCBADS) of the TCB. At M5, the MOVE instruction moves the address in PROGB's dynamic storage area to software register 2. PROGA, at M6, moves the data in MSG into PROGB's dynamic storage area. The TKEY operand on the MOVE instruction supplies the address key of PROGB. At M7, PROGA restores its address key from SAVEKEY.

Once PROGB receives the data, it moves the address of the dynamic storage area (contained in $STORAGE) to software register 1. The program moves 30 bytes of data from the dynamic storage area into MSG2, and prints the data it received.

```
PROGA    PROGRAM  START
         COPY     PROGEQU
         COPY     TCBEQU
START    EQU      *
         WHERES   PROGB,ADDRB,KEY=KEYB          FIND PROGB'S LOCATION
         IF       (PROGA,EQ,0),THEN
           PRINTEXT  'PROGRAM NOT FOUND',SKIP=1
           GOTO      DONE
         ENDIF
         READTEXT MSG,'@ENTER UP TO 30 CHARACTERS',MODE=LINE
M1       MOVE     #2,ADDRB
         TCBGET   #1,$TCBVER
M2       MOVE     PROGBBUF,($PRGSTG,#2),FKEY=KEYB
M3       MOVE     SAVEKEY,($TCBADS,#1)             SAVE PROGA'S KEY
M4       MOVE     ($TCBADS,#1),KEYB
M5       MOVE     #2,PROGBBUF
M6       MOVE     (0,#2),MSG,(30,BYTE),TKEY=KEYB
M7       MOVE     ($TCBADS,#1),SAVEKEY             RESTORE PROGA'S KEY
DONE     PROGSTOP
MSG      TEXT     LENGTH=30
PROGBBUF DATA     F'0'
PROGB    DATA     C'PROGB
PROGBUF  DATA     F'0'
SAVEKEY  DATA     F'0'
ADDRB    DATA     F'0'
KEYB     DATA     F'0'
         ENDPROG
         END

*****************************************************************

PROGB    PROGRAM  START,STORAGE=256
START    EQU      *
          •
          •
          •
         MOVE     #1,$STORAGE              GET STORAGE AREA ADDRESS
         MOVE     MSG2,(0,#1),(30,BYTE)
         PRINTEXT '@THE DATA THAT WAS PASSED IS :'
         PRINTEXT MSG2
         PROGSTOP
MSG2     TEXT     LENGTH=30
         ENDPROG
         END
```

Read Data to or Write Data from a Program in Another Partition

The following example reads data from a data set and stores that data in a buffer in another partition. The data set ACCOUNTS is in PROGA. The buffer is in PROGB. You could use the same coding techniques to write data to a program in another partition (WRITE).

PROGA uses the WHERES instruction to find the load-point address and address key of PROGB. The WHERES instruction places the load-point address of PROGB in ADDRB and the address key of the program in KEYB.

The MOVE instruction at label M1 moves the address key of PROGB into software register 2. The TCBGET instruction places the address of PROGA's task control block (TCB) in software register 1. At label M2, the MOVE instruction moves the address of PROGB's dynamic storage area into PROGBBUF in PROGA. The STORAGE= operand on the PROGRAM statement of PROGB causes the system to acquire a 256-byte storage area when it loads the program. The address of this storage area is in PROGB's program header (at $PRGSTG). At label M3, PROGA saves it's address key in SAVEKEY.

The MOVE instruction at M4 moves PROGB's address key to the address key field ($TCBADS) of the TCB. The READ instruction reads one record from the data set ACCOUNTS into PROGBBUF. Because PROGBBUF is the label of the P2= operand on the READ instruction, the system uses the contents of PROGBBUF as the location where the data is to be stored. After the cross-partition read operation, PROGA restores its address key from SAVEKEY.

Once PROGB receives the data, it moves the address of the dynamic storage area (contained in $STORAGE) to software register 1. The program moves 50 bytes of data from the dynamic storage area into OUTPUT and prints that data.

```
PROGA    PROGRAM  START,DS=ACCOUNTS
         COPY     PROGEQU
         COPY     TCBEQU
START    EQU      *
         WHERES   PROGB,ADDRB,KEY=KEYB          FIND PROGB'S LOCATION
         IF       (PROGA,EQ,0),THEN
           PRINTEXT  'PROGRAM NOT FOUND',SKIP=1
           GOTO      DONE
         ENDIF
M1       MOVE     #2,ADDRB
         TCBGET   #1,$TCBVER
M2       MOVE     PROGBBUF,($PRGSTG,#2),FKEY=KEYB
M3       MOVE     SAVEKEY,($TCBADS,#1)             SAVE PROGA'S KEY
M4       MOVE     ($TCBADS,#1),KEYB
         READ     DS1,*,P2=PROGBBUF                CROSS-PARTITION READ
         MOVE     ($TCBADS,#1),SAVEKEY             RESTORE PROGA'S KEY
DONE     PROGSTOP
SAVEKEY  DATA     F'0'
PROGB    DATA     C'PROGB   '
ADDRB    DATA     F'0'
KEYB     DATA     F'0'
         ENDPROG
         END

*****************************************************************

PROGB    PROGRAM  START,STORAGE=256
START    EQU      *
          •
          •
          •
         MOVE     #1,$STORAGE
         MOVE     OUTPUT,(0,#1),(50,BYTE)
         PRINTEXT '@THE DATA RECEIVED FROM PROGA IS :'
         PRINTEXT OUTPUT,SKIP=1
OUTPUT   TEXT     LENGTH=50
         ENDPROG
         END
```

Starting a Task in Another Partition (ATTACH)

The following example shows how you can use the ATTACH instruction to start, or "attach," a task in another partition. PROGA starts the task labeled TASKADDR in PROGB.

PROGB begins by printing the message "PROGB STARTED." The program then waits for an operator to press the enter key. (This example assumes that the operator will not press the enter key until the task labeled TASKADDR in PROGB has executed.)

PROGA uses the WHERES instruction to find the load-point address and address key of PROGB. The WHERES instruction places the load-point address of PROGB in ADDRB and the address key of the program in KEYB.

The TCBGET instruction places the address of PROGA's task control block (TCB) in software register 1. The MOVE instruction at label M1 saves PROGA's address key. At label M2, the MOVE instruction moves PROGB's address key to the address key field ($TCBADS) of the TCB.

The ADD instruction adds X'34' to the load-point of PROGB. This address points to the first word following PROGB's program header. The ADD instruction places the result of the operation in TASKADDR. Because TASKADDR is the label of the P1= operand on the ATTACH instruction, the system uses the contents of TASKADDR as the address of the task to be attached. After the cross-partition attach operation, PROGA restores its address key from SAVEKEY.

In PROGB, the task labeled TASKADDR is at the first word following the program header generated by the PROGRAM statement. When TASKADDR is attached, it enqueues the system printer, $SYSPRTR, and prints the message "SUBTASK IS ATTACHED." After TASKADDR ends, PROGB waits until an operator presses the enter key.

```
PROGA    PROGRAM  START
         COPY     PROGEQU
         COPY     TCBEQU
START    EQU      *
         WHERES   PROGB,ADDRB,KEY=KEYB          FIND PROGB'S LOCATION
         IF       (PROGA,EQ,0),THEN
           PRINTEXT  'PROGRAM NOT FOUND',SKIP=1
           GOTO      DONE
         ENDIF
         TCBGET   #1,$TCBVER
M1       MOVE     SAVEKEY,($TCBADS,#1)          SAVE PROGA'S KEY
M2       MOVE     ($TCBADS,#1),KEYB
         ADD      ADDRB,X'34',RESULT=TASKADDR   POINT TO TASK ADDRESS
         ATTACH   *,P1=TASKADDR                 CROSS-PARTITION ATTACH
M3       MOVE     ($TCBADS,#1),SAVEKEY          RESTORE PROGA'S KEY
          •
          •
          •
DONE     PROGSTOP
SAVEKEY  DATA     F'0'
PROGB    DATA     C'PROGB   '
ADDRB    DATA     F'0'
KEYB     DATA     F'0'
         ENDPROG
         END

*****************************************************

PROGB    PROGRAM  START
*******************************************
TASKADDR TASK     NEXT                      *
NEXT     ENQT     $SYSPRTR                  *
         PRINTEXT '@SUBTASK IS ATTACHED'    *
          •                                 *
          •                                 *
          •                                 *
         DEQT                               *
         ENDTASK                            *
*******************************************
START    EQU      *
         PRINTEXT '@PROGB STARTED'
         WAIT     KEY
          •
          •
          •
         PROGSTOP
         ENDPROG
         END
```

Synchronizing Tasks and the Use of Resources in Different Partitions

You can synchronize the execution of two or more tasks in different partitions by using the WAIT and POST instructions. The ENQ and DEQ instructions allow you to synchronize the use of a resource by tasks in different partitions.

Post an ECB in Another Partition (POST)

In the following example, PROGA posts an event control block (ECB) in another partition. PROGB contains the ECB that is posted. You could use the same coding techniques to wait for an event in another partition (WAIT).

PROGB begins by waiting for the event labeled ECB1 to be posted. PROGA uses the WHERES instruction to find the load-point address and address key of PROGB. The WHERES instruction places the load-point address of PROGB in ADDRB and the address key of the program in KEYB.

The TCBGET instruction places the address of PROGA's task control block (TCB) in software register 1. The MOVE instruction at label M1 saves PROGA's address key. At label M2, the MOVE instruction moves PROGB's address key to the address key field ($TCBADS) of the TCB.

The ADD instruction adds X'34' to the load-point of PROGB. This address points to the first word following PROGB's program header. The ADD instruction places the result of the operation in PROGBECB. Because PROGBECB is the label of the P1= operand on the POST instruction, the system uses the contents of PROGBECB as the address of the ECB to be posted. After the cross-partition post operation, PROGA restores its address key from SAVEKEY.

In PROGB, the ECB labeled ECB1 is at the first word following the program header generated by the PROGRAM statement. When PROGA posts ECB1, PROGB continues processing.

```
PROGA    PROGRAM  START
         COPY     TCBEQU
START    EQU      *
         WHERES   PROGB,ADDRB,KEY=KEYB     FIND PROGB'S LOCATION
         IF       (PROGA,EQ,0),THEN
           PRINTEXT  'PROGRAM NOT FOUND',SKIP=1
           GOTO      DONE
         ENDIF
         TCBGET   #1,$TCBVER
M1       MOVE     SAVEKEY,($TCBADS,#1)          SAVE PROGA'S KEY
M2       MOVE     ($TCBADS,#1),KEYB
         ADD      ADDRB,X'34',RESULT=PROGBECB   POINT TO PROGB ECB
         POST     *,-1,P1=PROGBECB              CROSS-PARTITION POST
M3       MOVE     ($TCBADS,#1),SAVEKEY          RESTORE PROGA'S KEY
          •
          •
          •
DONE     PROGSTOP
SAVEKEY  DATA     F'0'
PROGB    DATA     C'PROGB   '
ADDRB    DATA     F'0'
KEYB     DATA     F'0'
         ENDPROG
         END

*****************************************************

PROGB    PROGRAM  START
ECB1     ECB
START    EQU      *
         WAIT     ECB1         WAIT FOR ECB1 TO BE POSTED
          •
          •
          •
         PROGSTOP
         ENDPROG
         END
```

Enqueue a Resource in Another Partition (ENQ)

PROGA, in this example, attempts to enqueue a queue control block (QCB) in another partition. The QCB is located in PROGB. PROGA must enqueue the QCB before it can call the subroutine labeled COMMON, which is link-edited to the program. The COMMON subroutine, which is also link-edited to other programs in the system, can only be used by one program at a time.

PROGB begins by waiting for an operator to press the enter key. The program contains the QCB and should remain active while other programs in the system are using the COMMON subroutine.

PROGA uses the WHERES instruction to find the load-point address and address key of PROGB. The WHERES instruction places the load-point address of PROGB in ADDRB and the address key of the program in KEYB. The TCBGET instruction places the address of PROGA's task control block (TCB) in software register 1. The MOVE instruction at label M1 saves PROGA's address key. At label M2, the MOVE instruction moves PROGB's address key to the address key field ($TCBADS) of the TCB.

The ADD instruction adds X'34' to the load-point of PROGB. This address points to the first word following PROGB's program header. The ADD instruction places the result of the operation in PROGBQCB. Because PROGBQCB is the label of the P1= operand on the ENQ instruction, the system uses the contents of PROGBQCB as the address of the QCB to be enqueued.

If the first word of the QCB in PROGB contains a zero, the COMMON subroutine is being used by another program. PROGA, in this case, would pass control to the label CANTHAVE. The busy routine at CANTHAVE would begin by displaying the message "RESOURCE BUSY" and restoring PROGA's address key. If the first word of PROGB's QCB is not a zero, PROGA can call the COMMON subroutine by executing a CALL instruction. When COMMON finishes executing, PROGA dequeues the subroutine. After the cross-partition enqueue operation, PROGA restores its address key from SAVEKEY.

In PROGB, the QCB labeled QCB1 is at the first word following the program header generated by the PROGRAM statement. PROGB remains active until an operator presses the enter key on the terminal.

```
PROGA    PROGRAM  START
         COPY     TCBEQU
         EXTRN    ROUTINE
START    EQU      *
         WHERES   PROGB,ADDRB,KEY=KEYB          FIND PROGB'S LOCATION
         IF       (PROGA,EQ,0),THEN
           PRINTEXT  'PROGRAM NOT FOUND',SKIP=1
           GOTO      DONE
         ENDIF
         TCBGET   #1,$TCBVER
M1       MOVE     SAVEKEY,($TCBADS,#1)          SAVE PROGA'S KEY
M2       MOVE     ($TCBADS,#1),KEYB
         ADD      ADDRB,X'34',RESULT=PROGBQCB   POINT TO PROGB QCB
         ENQ      *,BUSY=CANTHAVE,P1=PROGBQCB   CROSS-PARTITION ENQUEUE
         CALL     ROUTINE
         DEQ
M3       MOVE     ($TCBADS,#1),SAVEKEY
         GOTO     DONE
CANTHAVE EQU      *                             BUSY ROUTINE
         PRINTEXT '@RESOURCE BUSY'
         MOVE     ($TCBADS,#1),SAVEKEY
          •
          •
          •
DONE     PROGSTOP
SAVEKEY  DATA     F'0'
PROGB    DATA     C'PROGB   '
ADDRB    DATA     F'0'
KEYB     DATA     F'0'
         ENDPROG
         END
```

The subroutine link-edited with PROGA looks like:

```
         SUBROUT  ROUTINE
         ENTRY    ROUTINE
         PRINTEXT '@SUBROUTINE HAS BEGUN'
          •
          •
          •
         RETURN
         END

*****************************************************

PROGB    PROGRAM  START
QCB1     QCB
START    EQU      *
         WAIT     KEY
         PROGSTOP
         ENDPROG
         END
```

Appendix D. EDX Programs, Subroutines, and In-Line Code

This appendix describes EDX programs, subroutines, and in-line code that you can run.

EDX Programs

The following pages describe the EDX programs:

- $DISKUT3
- $PDS
- $RAMSEC
- $SUBMITP
- $USRLOG.

$DISKUT3 – Manage Data from an Application Program

The $DISKUT3 program enables you to perform the following operations for disks and diskettes from your application program:

- Allocate a data set
- Allocate a data set with extents
- Open a data set
- Delete a data set
- Release unused space in a data set
- Rename a data set
- Set end-of-data indicator in a data set.

You can specify one or more of these operations at the same time. For example, you can open two data sets and allocate two other data sets with one request. Multiple operations save execution time.

You load $DISKUT3 with the LOAD instruction and pass it the address of a list of request block addresses. A word containing zeros indicates the end of the request block address list. Figure D-1 on page D-2 shows how the system maps the request blocks and addresses. The request blocks define the operation the system is to perform.

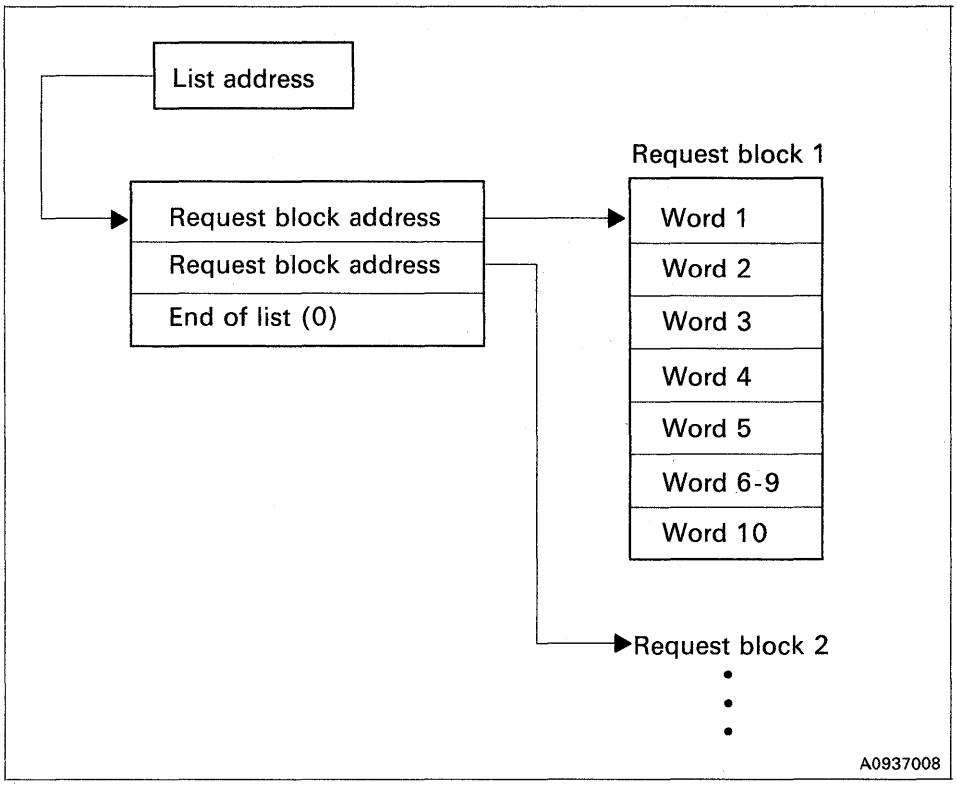


Figure D-1. Request Block Example

Note: Words 6 – 10 are needed only for request 8 (allocate with extents).

Request Block Contents

A request block consists of ten words.

Word 1: The value in the rightmost byte indicates the operation to be performed. The values are:

Value	Operation
1	Open a data set (OPEN).
2	Allocate a new data set (ALLOCATE).
3	Rename a data set (RENAME).
4	Delete a data set (DELETE).
5	Release unused space in a data set (RELEASE).
6	Set end-of-data indicator in a data set (SETEOD).
7	Reserved.
8	Allocate data set with extents (ALX).

The 8 leftmost bits are reserved for use as special-purpose flags:

Bit	Function
0	1 – Indicates that the system should wait if the requested volume is in use. 0 – Indicates that the system should not wait if the requested volume is in use
1	Reserved
2	Reserved
3	Reserved
4	Reserved
5	Reserved
6	Reserved
7	Reserved

For example, if word 1 contains X'8004', it tells the system to delete a data set, but to wait if the requested volume is busy.

Word 2: This word contains the address of an associated data set control block (DSCB). The DSCB describes the volume and data set you are using. You must specify a DSCB for each operation you request. In addition, you must fill in the data set name ($DSCBNAM) and volume ($DSCBVOL) fields of the DSCB.

Words 3 and 4: The contents of these words vary according to the operation you request. The contents for each operation follows:

Operation	*Contents*
ALLOCATE	Number of records to be allocated (must be in the range of 0 to 2147483647).
ALX	Number of extent records to be allocated for primary data set (must be in the range of 0 to 2147483647).
DELETE	Nothing required.
OPEN	Nothing required.
RELEASE	The new size of the data set in records (must be greater than zero and less than the current size.) The minimum size of an extended data set is the size of the primary and one extent.
RENAME	Word 4 contains the address of a 1–8 byte field containing the new data set name.
SETEOD	Word 4 contains the number of bytes in the last record if it is not yet full; otherwise this word is 0. $DISKUT3 places the value in request block word 4 into bytes 24–25 of the directory member entry (DME). If this value is nonzero, it represents the number of bytes in the last record that is considered not completely full. Bytes 20–23 of the DME indicate the value of $DSCBNEX minus 2. If this value is zero, your system considers the last record to be full and sets bytes 20–23 of the DME to the value of $DSCBNEX minus 1.

Word 5: This word specifies the data set type. The valid types are:

Code	Type
0	Undefined
1	Data
3	Program
−1	Unspecified

Code 0, 1, or 3 when you allocate a data set. Code 1 when you allocate data sets with extents. Code −1 when you open, rename, or delete a data set. Code 1 or −1 when releasing storage from an extent data set. When $DISKUT3 ends, the system sets word 5 to 0, 1, or 3, depending upon the type of the data set you specified. If your application sets this word to a value other than −1, $DISKUT3 compares the data set type you specified with the type of the existing data set. If the data sets are not alike, $DISKUT3 issues a return code of 17 and ends.

The system returns the DSCB in an open condition except when it deletes a data set. Therefore, when you allocate a data set, you do not need to perform an open operation or use DSOPEN.

Words 6 through 9: Contents of these words are reserved.

Word 10: Contents of this word are reserved except for ALX. It contains the maximum size each extent can reach.

If you include dynamic data set extent support, your data sets can grow dynamically when your application needs more space. For instance, if during a write operation the system reaches the end of a data set allocated with extents, it will automatically "extend" the data set provided volume directory and disk space exist.

Operation	*Contents*
ALX	Size of extents to be allocated. Must be in the range of 1 to 32767 records.

Note: Words 6−10 are required only when allocating with extents.

Special Considerations

Consider the following when using $DISKUT3:

- If you use $DISKUT3 to process data sets that occupy the same volume as your program, you can retrieve the volume name from the $PRGVOL field of the program header. To refer to $PRGVOL, you must include a COPY PROGEQU statement in your program.
- The system considers an attempt to delete a data set that does not exist a successful operation.
- The system considers an attempt to allocate an existing data set a successful operation if:
  - The existing data set is of the same type as the data set you specified for the operation.
  - The size of the existing data set is the same as size you requested in the operation.

- If you attempt to allocate an existing data set and the data set types match but not the sizes, your program receives a return code indicating whether the data set you requested is smaller or larger than the one that exists.
- The OPEN and SETEOD operations are valid for tape data sets.
- When you specify a new size for an extended data set using the release function, the actual size that results will include the *entire* extent necessary to accomodate that new size.
- The $LOG data set cannot be an extendable data set.
- System work data sets, such as edit work, $EDXASM work data sets, and $EDXLINK work data sets, cannot be extendable data sets.

$DISKUT3 Example

The following example uses four of the $DISKUT3 operations (OPEN, ALLOCATE, RENAME and ALX, allocate an extendable data set) in an application program. The LOAD instruction loads $DISKUT3 to open a data set (DATA3), allocate a new data set (DATA4), rename an existing data set (DATA1), and allocate data sets with extents (DATA5). DSK3EVNT, the label on the EVENT= operand, is the label of the event control block (ECB) to be posted when $DISKUT3 completes. LISTPTR1 is the label that points to the address of the list of request block addresses. The WAIT instruction waits for the system to post the completion of $DISKUT3.

```
TASK     PROGRAM GO,DS=((DATA1,EDX002),(DATA2,EDX003))
         COPY    DSCBEQU
GO       EQU     *
         •
         •
         •
         LOAD    $DISKUT3,LISTPTR1,EVENT=DSK3EVNT
         WAIT    DSK3EVNT
         •
         •
         •
         PROGSTOP
         •
         •
         •
DSK3EVNT ECB   0                SET ECB TO ZERO
LISTPTR1 DC    A(LIST1)         ADDRESS OF LIST OF REQUEST
*                                BLOCK ADDRESSES
LIST1    DC    A(REQUEST1)
         DC    A(REQUEST2)
         DC    A(REQUEST3)
         DC    A(REQUEST4)
         DC    F'0'             END OF LIST FLAG
REQUEST1 DC    F'1'             REQUEST:'OPEN' A DATA SET
         DC    A(DSY)           DSCB FOR 'DATA3'
         DC    D'0'             UNUSED FOR OPEN REQUESTS
         DC    F'-1'            UNUSED FOR OPEN REQUESTS
REQUEST2 DC    F'2'             REQUEST: 'ALLOCATE' A DATA SET
         DC    A(DSX)           DSCB FOR 'DATA4'
         DC    D'50'            ALLOCATE 50 RECORDS
         DC    F'1'             DATA SET TYPE IS 'DATA'
REQUEST3 DC    F'3'             REQUEST: 'RENAME' A DATA SET
         DC    A(DS1)           DSCB FOR 'DATA1'
         DC    F'0'             UNUSED FOR RENAME REQUEST
         DC    A(NEWNAME)       ADDRESS OF NEW DATA SET NAME
         DC    F'-1'            FOR RENAME REQUESTS
REQUEST4 DC    F'8'             ALLOCATE WITH EXTENTS ('ALX')
         DC    A(DSZ)           DSCB FOR 'DATA5'
         DC    D'1000'          SIZE OF PRIMARY DATA SET
         DC    F'1'             DATA SET TYPE IS DATA
         DC    4F'0'            RESERVED
         DC    F'100'           SIZE OF EXTENTS IN RECORDS
         DSCB  DS#=DSY,DSNAME=DATA3,VOLSER=EDX003
         DSCB  DS#=DSX,DSNAME=DATA4,VOLSER=EDX003
         DSCB  DS#=DSZ,DSNAME=DATA5,VOLSER=EDX003
NEWNAME  DC    CL8'RENAMED'     NEW DATA SET NAME
         ENDPROG
         END
```

$DISKUT3 Return Codes

$DISKUT3 return codes are returned to the first word of the data set control block (DSCB). When you specify more than one operation, $DISKUT3 performs the operations in the order you specify. The system issues a return code for each operation attempted.

Note: If you load $DISKUT3 and request more than one operation that refers to the same DSCB, the return code reflects the results of the last operation the system attempted using that DSCB.

Return Code	Condition
−1	Successful completion.
1	Invalid request code parameter (not 1 − 6, 8).
2	Volume does not exist (all functions).
3	Volume not specified ($JOBUTIL: ALLOCATE).
4	Insufficient space in library (ALLOCATE, ALX).
5	Insufficient space in directory (ALLOCATE, ALX, RELEASE).
6	Data set already exists (smaller than the requested allocation).
7	Insufficient contiguous space (ALLOCATE, ALX).
8	Disallowed data set name; for example, $$EDXVOL or $$EDXLIB (all functions except OPEN).
9	Data set not found (OPEN, RELEASE, RENAME).
10	New name pointer is zero (RENAME).
11	Disk is busy (ALLOCATE, ALX, DELETE, RELEASE, RENAME).
12	I/O error writing to disk (ALLOCATE, ALX, DELETE, RELEASE, RENAME).
13	I/O error reading from disk (all functions).
14	Data set name is all blanks (ALLOCATE, ALX, RENAME).
15	Invalid size specification (ALLOCATE, ALX).
16	Invalid size specification (RELEASE).
17	Mismatched data set type (DELETE, OPEN, RELEASE, RENAME).
18	Data set already exists (larger than the requested allocation)..
19	SETEOD only valid for data set of "data" type.
20	Load of $DISKUT3 failed ($RMU only).
21	Tape data sets are not supported.
23	Volume not initialized or Basic-Exchange Diskette has been opened.
24	Extent data set being allocated and data set type is a program.
25	Data set already exists and is not extendable.
26	Data set already exists and the primary data set is smaller than the requested allocation.
27	Data set already exists and the primary data set is larger than the requested allocation.

Return Code	Condition
28	Data set already exists. The primary data set is equal to but the extent data set is smaller than the requested allocation.
29	Data set already exists. The primary data set is equal to but the extent data set is larger than the requested allocation.

$PDS – Use Partitioned Data Sets

The display data base utility ($DIUTIL) uses a utility program, $PDS, to make partitioned data sets available for its use. Your programs also can use $PDS to get access to the members of a partitioned data set (such as report data members and realtime data members). You also can use any of the other functions of $PDS in your programs.

Use the LOAD instruction to execute $PDS in your program. $PDS can be used as an overlay program as well as a program loaded by another program.

$PDS allows you to:

- Open a member
- Allocate a member for a fixed number of records
- Allocate a member for the maximum number of records
- Release unused space from a member
- Delete a member
- Store the next record
- Store a record
- Fetch a record.

The types of members and their member codes are as follows:

Type of Member	Member Code
Report member	1
Graphic member	2
Graphic member 3D	3
Report data member	4
Plot curve data member	5
Realtime data member	6
Data members you define	7, 8, 9
You define	10 – n

Member types 1, 2, and 3 store commands that are used by $DIINTR to create a display. Member types 4, 5, and 6 contain data that is saved by your application program. Member types 7, 8, and 9 have the same format as member types 4, 5, and 6 but are for use by application programs. Member types 10 and up are for use by application programs.

Member types 4 through 9 are special members because they contain multiple records with a length of 1 to 32767 bytes. This feature allows the application program to Fetch and Store data by record number within a member. This technique could be used by an application program to update data members defined with the Display Utility Program Set.

You may create members in the following ways:

- Use $DIUTIL utility
  - Data member, member codes 4,5,6
  - User data members, member codes 7,8,9
  - User defined members, member codes 10 and up
  - Member codes 1,2,3 cannot be created by $DIUTIL
- Use $DICOMP program
  - Report member, member code 1
  - Graphic member, member code 2
  - Graphic 3D member, member code 3
- Use $PDS
  - All member types

Allocating a Data Set

A data set that is to be used by $PDS must be allocated using $DISKUT1. Records should be allocated for the directory as well as members. Each record in the directory of a partitioned data set can contain sixteen directory entries except the first record, which can contain fifteen. For example, if space is required for 40 members each with five records of space, you should allocate 203 records, 200 for members and three for the directory.

After a data set has been defined by $DISKUT1, it must be formatted for use by $PDS. $DIUTIL functions IN (Initialize), AL (Allocate), and BU (Build Data) are used for this purpose. $PDS can also be used to allocate members. Once members are allocated, they can be used by the application program. The $DIUTIL program is used to maintain the data set.

The data set to be used with $PDS consists of a directory area and a member area.

Directory Area Format

The first entry in the directory describes the data set and has the following format:

Byte	Usage
0 – 1	Next available record number for member
2 – 3	Total size of data set in records
4 – 5	Number of next directory entry
6 – 7	Total available directory entries allocated and unallocated
8 – 15	Unused space

Each succeeding directory entry is 16 bytes with the following format:

Byte	Usage
0 – 7	EBCDIC member name
8 – 9	First record number (relative to start of data set)
10 – 11	Number of records in member
12 – 13	Member code
14 – 15	Your code or clear screen indicator

Member Code (Bytes 12 – 13)	Description
– 1	Deleted member
0	Available space
1	Report member
2	Graphic member
3	Reserved
4	Report data member
5	Plot curve data member
6	Realtime data member
7 – 9	Data member you define
10 – n	Members you define

Your Code (Bytes 14 – 15)
Defined by you and stored by $PDS allocate or a value of 1 if clear screen (ESC,FF) is not to be sent on $DIINTR request.

$DIUTIL can be used to display this data for reference.

Member Area Format

Each member type has a unique format.

Member Types 1 – 3	Display Control Member
No specific format is defined. The data is generated by the $DICOMP Utility Program.	See "Display Control Member Format" for information about the contents of these members.

Member Type 4 Byte	Report Data Member Usage
0 – 7	Unused
8 – 9	Number of records
10 – 11	Record length in bytes (1 – 132)
12 – 13	Number of records available
14 – 15	Unused
16 – n	Data Area

Member Type 5 Byte	Plot Curve Data Member Usage
0 – 1	X Axis Range
2 – 3	Y Axis Range
4 – 5	X Base Line Value
6 – 7	Y Base Line Value
8 – 9	Number of records
10 – 11	Record length in bytes (1 – 32767)
12 – 13	Number of records available
14 – 15	Unused
16 – n	Data Area

Note: Each record can be larger than 4 bytes; however, relative bytes 0,1 must contain the X-coordinate value and bytes 2,3 must contain the Y-coordinate value.

Member Type 6 Byte	Real-Time Data Member Usage
0 – 7	Unused
8 – 9	Number of records
10 – 11	Record length in bytes (must be 16)
12 – 13	Number of records available
14 – 15	Unused
16 – n	Data Area

Member Type 7,8,9 Byte	Data Member You Define Usage
0 – 7	Unused
8 – 9	Number of records
10 – 11	Record length in bytes (1 – 32767)
12 – 13	Number of records available
14 – 15	Unused
16 – n	Data Area

Member type 10 – n	Member You Define

Display Control Member Format

Each of the display profile elements contained in the control members, type codes (1,2,3), is shown in this section. You may wish to use $PDS to access a control member. The application program could then generate a display profile command string and use $DIINTR to display the results. Following is the format of each of the display profile elements.

LB – Display Characters

Byte	Bits	Value	Content
0	0–3	1	Display characters code
0	4–7	0	Unused
1	0–7	1–72	Number of characters to display
2–n	0–7	EBCDIC	EBCDIC data to display

MP – Move Position

Byte	Bits	Value	Content
0	0–3	2	Move Position Code
0–1	4–7/0–7	0–1023	X Coordinate Value
2–3	0–7	0–1023	Y Coordinate Value

For 3D Members:

Byte	Bits	Value	Content
0	0–3	2	Move Position Code
0–1	4–15	0	Unused
2–3	0–15	–32768 – +32767	X Coordinate Value
4–5	0–15	–32768 – +32767	Y Coordinate Value
6–7	0–15	–32768 – +32767	Z Coordinate Value

LI – Draw Line

Byte	Bits	Value	Content
0	0–3	3	Draw Line Code
0–1	4–7/0–7	0–1023&	X Coordinate Value
2–3	0–7	0–1023	Y Coordinate Value

For 3D members:

Byte	Bits	Value	Content
0	0-3	3	Move Position Code
0-1	4-15	0	Unused
2-3	0-15	-32768 - +32767	X Coordinate Value
4-5	0-15	-32768 - +32767	Y Coordinate Value
6-7	0-15	-32768 - +32767	Z Coordinate Value

DR - Draw Symbol

Byte	Bits	Value	Content
0	0-3	4	Draw Symbol Code
0	4-7	1-15	Symbol ID
1	0-7	0-255	Symbol Modifier
2-3	0-7	0-32767	User's Symbol Number

OR

Byte	Bits	Value	Content
2	0-5	0	Unused
2	6	0-1	Start top (0) or bottom (1) for Arc
2-3	7/0-7	0-508	# of Y units in Arc

VA - Display Variable

Byte	Bits	Value	Content
0	0-3	5	Display Variable Code
0	4-7	0-7	Word Number within record
1	0-3	0-15	Function Code
1	4-7	0-3	Type Code
2-3	0-7	1-32767	Record number in Realtime Data Member
4	0-7	1-40	Field Width
5	0-7	0-39	Number of Decimals

JP – Jump

Byte	Bits	Value	Content
0	0–3	6	Jump Code
0	4–7	–0–7	Word number within record
1	0–7	0–2	Jump Modifier 0 = Unconditional 1 = Zero 2 = Nonzero
2–3	0–7	1–32767	Record number in Realtime Data Member
4–5	0–7	0–32767	Jump to Address (offset in words from beginning of Control Member)

DI – Direct Output to Another Device

Byte	Bits	Value	Content
0	0–3	8	Direct Output Code
0	4–7	0	Unused
1	0–7	0	Unused
2–9	0–7	EBCDIC	8-character name of output device (see ENQT instruction)

PC – Plot Curve from Plot Curve Data Member

Byte	Bits	Value	Content
0	0–3	9	Plot Curve Code
0	4–7	0	Unused
1	0–7	0 or EBCDIC	EBCDIC character for plot if character plot
2–9	0–7	EBCDIC	8-character member name of a plot data member

** – Display Report Line Items

Byte	Bits	Value	Content
0	0–3	10	Display Report Line Items
0	4–7	0	Unused
1	0–7	0	Unused
2–9	0–7	EBCDIC	8-character member name of a report data member

AD – Advance X,Y

Byte	Bits	Value	Content
0	0–3	11	Advance X,Y code
0–1	4–7/0–7	0–1023	X advance value (adjusted by +512)
2–3	0–7	0–1023	Y advance value (adjusted by +512)

For 3D Members:

Byte	Bits	Value	Content
0	0–3	11	Advance X,Y,Z Code
0–1	4–7/0–7	0–1023	X Advance Value (adjusted by +512)
2–3	0–7	0–1023	Y Advance Value (adjusted by +512)
4–5	0–7	0–1023	Z Advance Value (adjusted by +512)

IM – Insert Member

Byte	Bits	Value	Content
0	0–3	12	Insert Member Code
0	4–7	0	Unused
1	0–7	0	Unused
2–9	0–7	EBCDIC	8-character member name of a central member

LR – Draw Line Relative

Byte	Bits	Value	Content
0	0–3	13	Draw Line relative code
0–1	4–7/0–7	0–1023	Delta X Value (adjusted by +512)
2–3	0–7	0–1023	Delta Y Value (adjusted by +512)

For 3D Members:

Byte	Bits	Value	Content
0	0–3	13	Draw Line Relative Code
0–1	4–7/0–7	0–1023	Delta X Value (adjusted by +512)
2–3	0–7	0–1023	Delta Y Value (adjusted by +512)
4–5	0–7	0–1023	Delta Z Value (adjusted by +512)

RT – Change Realtime Data Member Name

Byte	Bits	Value	Content
0	0–3	14	Change Realtime Data Member Code
0	4–7	0	Unused
1	0–7	0	Unused
2–9	0–7	EBCDIC	8-character member name of a new realtime data member (for VA and +P codes)

TD – Display Time and Data

Byte	Bits	Value	Content
0	0–3	15	Display time and data code
0	4–7	0	Unused
1	0–7	0	Unused

$PDS Example

You get access to $PDS by loading it with the LOAD instruction. The following example shows how to open a member.

```
XYZ       PROGRAM    START, DS=(??)
START     EQU        *
           •
           •
           •
          READTEXT   #MCB,'ENTER MEMBER NAME@'.
           •
           •
           •
          LOAD       $PDS,$MCB,DS=(DS1),EVENT=#PDS,LOGMSG=NO
           •
           •
           •
          WAIT       #PDS
          IF         (#PDS,NE,-1),GOTO,ERROR
           •
           •
           •
 *  NORMAL PROCESSING OF OPENED MEMBER  *
           •
           •
           •
          READ       MBR,BUFF
           •
           •
           •
          WRITE      MBR,BUFF
           •
           •
           •
          PROGSTOP
           •
           •
           •
BUFF      DATA       128F'0'       DISK I/O BUFFER
$MCB      DATA       A(#MCB)       POINTER TO MEMBER CONTROL BLOCK
           •
           •
           •
#MCB      TEXT       LENGTH=8      MEMBER NAME
#MCBCMD   DATA       F'1'          $PDS COMMAND(OPEN)
#MCBDSA   DATA       A(MBR)        ADDRESS OF DSCB
#MCBDT0   DATA       F'0'          Data Field 0
#MCBDT1   DATA       F'0'          Data Field 1
#MCBDT2   DATA       F'0'          Data Field 2
#MCBDT3   DATA       F'0'          Data Field 3
           •
           •
           •
          DSCB       DS#=MBR,DSNAME=DUMMY,VOLSER=DUMMY
           •
           •
           •
          ENDPROG
          END
```

Member Control Block

The 20-byte member control block (MCB) is passed to the $PDS utility program by the PARM facility. The member control block (MCB) is filled in by your application program.

The format of the MCB is as follows:

Byte	Usage
0 – 7	EBCDIC Member Name
8 – 9	$PDS Command (see below)
10 – 11	Address of Callers DSCB
12 – 19	Data field 0 through 3 (see below)

$PDS Commands (Bytes 8 – 9)

Command	Function
1	Open Member
2	Allocate Member
3	Allocate Member (Maximum Space)
4	Release Space
5	Delete Member
6	Store Next Record
7	Store Record
8	Fetch Record

Command Descriptions

Open Member

The member specified in bytes 0 – 7 of the MCB is located and the DSCB specified in bytes 10 – 11 is filled in to point to the member.

Allocate Member

The member specified in bytes 0 – 7 of the MCB is dynamically allocated with the parameter specified in bytes 14 – 19.

Allocate Member (maximum space)

The member specified in bytes 0 – 7 of the MCB is dynamically allocated with the parameter specified in bytes 16 – 19. Maximum space is allocated.

Release Space

The member specified in bytes 0 – 7 of the MCB is located and unused space is returned to the available space in the data set. Bytes 14 – 15 must contain the number of records that the member will contain.

Delete Member

The member specified in bytes 0 – 7 of the MCB is located and marked for deletion.

Note: The space occupied by the deleted member is NOT returned to the available space in the data set. Use the utility $DIUTIL to reclaim deleted space.

Store Next Record

The member specified in bytes 0 – 7 of the MCB is located. The member header is used to determine which record is next, and data is stored in that record. Your data buffer address is located in bytes 14 – 15 of the MCB.

Store Record

The member specified in bytes 0 – 7 of the MCB is located. The record specified in bytes 12 – 13 is located and the data is stored in that record. Your data buffer address is located in bytes 14 – 15 of the MCB.

Fetch Record

The member specified in bytes 0 – 7 of the MCB is located. The record specified in bytes 12 – 13 is located. All the data is retrieved and stored in your data buffer. The data buffer address is located in bytes 14 – 15 of the MCB.

Data fields 0 through 3 must contain modifier information for the various $PDS commands. Also, these areas contain data following the action taken by the $PDS program. The following tables show the data required before executing $PDS and the data returned after $PDS has executed.

Before $PDS executes (N/A means not applicable):

Command	Data Word 0	Data Word 1	Data Word 2	Data Word 3
Open	N/A	N/A	N/A	N/A
Allocate	N/A	Records	Member Type Code	Your Code
Allocate Max	N/A	N/A	Member Type Code	Your Code
Release	N/A	Records	N/A	N/A
Delete	N/A	N/A	N/A	N/A
Store Next	N/A	Data Buffer Address	N/A	N/A
Store	Record	Data Buffer Address	N/A	N/A
Fetch	Record	Data Buffer Address	N/A	N/A

After $PDS executes (N/A means not applicable):

Command	Data Word 0	Data Word 1	Data Word 2	Data Word 3
Open	1st Record	Records	Member Type Code	Your Code
Allocate	1st Record	Records	Member Type Code	Your Code
Allocate Max	1st Record	Records	Member Type Code	Your Code
Release	N/A	N/A	N/A	N/A
Delete	N/A	N/A	N/A	N/A
Store Next	Record	Data Buffer Address	Records in Member	N/A
Store	Record	Data Buffer Address	Records in Member	N/A
Fetch	Record	Data Buffer	Records	N/A

$RAMSEC – Replace Terminal Control Block (4980)

$RAMSEC enables you to replace the current image and/or control stores in the terminal control block (CCB) from an application program by changing the data set names. Replacement data set names are held in the CCB to govern 4980 terminal operations requested after power off and on. They are held until a new $RAMSEC load or IPL occurs.

When you load $RAMSEC from a program, The LOAD instruction passes parameters that indicate the new data set names. You can load your own data sets in combination with any of the two data sets loaded by the initial control store program. The names of the system data sets are:

- Image store: $4980IS0
- Control store: $4980CS0.

In the following data sets, "x" represents any letter or special character that is allowed in a data set name. The characters 0 through 9 are reserved by EDX. These data sets must appear on the IPL volume. Required names for replacement data sets are:

- Image store: $4980ISx
- Control store: $4980CSx.

Meaning of the Parameter Listings

PARM1	*Meaning*
C'0Y'	When Y is the last character of the image store data set name, the system loads $4980ISY to the terminal. The system modifies the CCB to reflect the current data set.
X'0000'	The system loads $4980IS0, the system default image store, to the terminal. The system modifies the CCB to reflect the current image store data set.
X'0001'	The system loads the image store name currently in the CCB. It does not modify the CCB.
X'FFFF'	The system loads no image store nor does it modify the CCB.

PARM2	*Meaning*
C'0Y'	When Y is the last character of the control store data set name, the system loads $4980ISY to the terminal. The system does not modify the CCB to reflect this data sets name.
X'0000'	The system loads $4980CS0, the system default control store, to the terminal. The system modifies the CCB to reflect the current data set.
X'0001'	The system loads the control store name in the CCB. It does not modify the CCB.
X'FFFF'	The system loads no control store, nor does it modify the CCB.

PARM3	*Meaning*
2F'–1'	Reserved. Must be coded as indicated.

Note: The character X above indicates hexadecimal numbers. The character Y in the list above represents any character except the numbers 0 through 9, which are reserved by EDX.

Special Considerations

- To load a 4980 terminal other than the terminal on which your application is running, you must ENQT the other terminal before loading $RAMSEC.
- Do not specify DEQT=NO on the load instruction, even if you have had to ENQT on a terminal before loading $RAMSEC.
- You cannot replace the default image and control stores at IPL. The system always loads the default image and control stores.
- If you switch 4980 terminal off and then on, and your supervisor linkmap does not contain the PWRAM80 module, you will need to load the 4980 before using it again. To load the 4980, use the $TERMUT2 LT command. For additional information, refer to *Operator Commands and Utilities Reference*.

$RAMSEC Example

The following examples load $RAMSEC to change the image store. In either case, the system loads only the image store, $4980ISY, to the terminal. You can code the parameters as either binary values or characters. Only the rightmost byte, −1, is used by $RAMSEC. The leftmost byte is ignored for all data sets.

```
         MOVE    PARM1+1,C'Y',BYTE   MOVE IN LAST CHAR. OF IMAGE STORE
         LOAD    $RAMSEC,PARM1,EVENT=ECB1,PART=ANY
         WAIT    ECB1                WAIT FOR COMPLETION OF $RAMSEC
          •
          •
          •
PARM1    DC      X'FFFF'             IMAGE STORE PARM
PARM2    DC      X'FFFF'             CONTROL STORE PARM
PARM3    DC      2F'-1'              RESERVED - MUST BE -1
```

Equivalent code would be:

```
         LOAD    $RAMSEC,PARM1,EVENT=ECB1,PART=ANY
         WAIT    label               WAIT FOR COMPLETION OF $RAMSEC
          •
          •
          •
PARM1    DC      C'OY'               IMAGE STORE PARM
PARM2    DC      X'FFFF'             CONTROL STORE PARM
PARM3    DC      2F'-1'              RESERVED - MUST BE -1
```

$RAMSEC Return Codes

A PROGSTOP statement in $RAMSEC issues the following return codes to the application.

Return Code	Condition
−1	Successful operation.
1	Image store load failed.
2	Control store load failed.
3	Image store and control store load failed.
8	You did not enqueue 4980.
9	System not able to ENQT 4980 before loading $RAMSEC.

$SUBMITP – Submit a Job for Execution

The $SUBMITP program enables you to submit a job to the job queue processor, $JOBQ, from an application program. You load $SUBMITP from your program with the LOAD instruction and pass it a list of parameters. $SUBMITP can execute two job queue processor commands: SJ and SH. The SJ command submits a job for execution. The SH command submits a job and holds it until you release the job for execution using the RJ command. The RJ command is available under the $SUBMIT utility. (Refer to the *Operator Commands and Utilities Reference* for more information on $SUBMIT.)

You must pass the $SUBMITP program the following parameters (in the order shown):

1. The command name (SJ or SH)
2. The job priority (0 – 3; 0 is the highest priority)
3. Name of data set containing $JOBUTIL statements
4. Data set volume
5. Address (label) of word containing the job number.

The $SUBMITP program attempts to load the job queue processor if it is not already running. The program places the number of the job at the address of the label you specify in the parameter list.

You must code the EVENT= operand on a LOAD instruction that loads $SUBMITP. The system posts the label on the EVENT= operand when the $SUBMITP program ends. Coding a WAIT instruction following the LOAD instruction enables you to test to see if $SUBMITP submitted the job successfully. You can load $SUBMITP in another partition by specifying the PART= operand on the LOAD instruction.

$SUBMITP Example

The following example loads $SUBMITP to submit a job for execution.

```
         LOAD   $SUBMITP,PARMS,LOGMSG=NO,EVENT=FINISH
         WAIT   END
         IF     (END,NE,-1),GOTO,ERROR
          •
          •
          •
ERROR    EQU    *
          •
          •
          •
PARMS    EQU    *
         DATA   C'SJ'              COMMAND NAME
         DATA   X'0002'            JOB PRIORITY
         DATA   CL8'COMPILE'       DATA SET NAME
         DATA   CL6'EDX002'        VOLUME NAME
         DATA   A(JOB)             ADDRESS OF JOB NUMBER
          •
          •
          •
JOB      DATA   F'0'               JOB NUMBER RETURNED TO THIS WORD
FINISH   ECB
```

$SUBMITP Return Codes

$SUBMITP return codes are returned to the first word of the event control block you specify with the EVENT= operand of the LOAD instruction.

Return Code	Condition
−1	Job submitted successfully.
1	Job queue is full.
2	Invalid data found in job queue data set.
3	Disk I/O error is updating queue data set.
4	Cannot load $JOBQ.
5	Invalid command.

$USRLOG – Log Specific Errors From a Program

The USER instruction allows you to use Series/1 assembler code within an EDL program. See "USER – Use Assembler Code in an EDL Program" on page 2-547 for information on use of this instruction. Through this instruction, the $USRLOG subroutine enables you to log specific program errors from an application program. Use of this subroutine is explained below.

Syntax:

label	**USER**	**$USRLOG,PARM = (logtype,datatype, dataaddr,datakey,devaddr), P = (logtype,datatype,dataddr, datakey,devaddr)**
Required:	**logtype,datatype,dataaddr,datakey,devaddr**	
Defaults:	**none**	
Indexable:	**none**	

Operand	*Description*
logtype	The type of log record. Use one of the following values: **1** Soft error (device recoverable) **2** Hard (unrecoverable) error **3** Software (recoverable) error.
datatype	The type of control block data being logged. Values 0 to 127 are used by the supervisor; values 128 to 255 are reserved for your use. The actual hexadecimal value must be coded.
dataaddr	The address of the log data.
datakey	The address space key of the log data address.
devaddr	The device address.

$USRLOG Example

The following program example logs a buffer of ones (1s) with $USRLOG.

Define both $DEVLOG and $USRLOG as EXTRNs in programs calling $USRLOG to avoid assembler errors. Also, before executing the $USRLOG subroutine, you must link-edit your application program with the $$SVC, $$RETURN and $DEVLOG object modules.

```
*********************************************************
*       WHEN LINKING THIS LOG-CALLING PROGRAM, USE THE   *
*       FOLLOWING LINK CONTROL STATEMENTS                *
*       AUTOCALL  $AUTO,ASMLIB                           *
*       IN    LOGS,OBJLIB                                *
*       IN    $$SVC,ASMLIB                               *
*       IN    $DEVLOG,ASMLIB                             *
*       LINK  $LOGS,SRCLIB REP END                       *
*********************************************************
          EXTRN     $DEVLOG
          EXTRN     $USRLOG
START     EQU
          TCBGET    ADSO,$TCBADS       GET USER ADDRESS SPACE KEY
          MOVE      ADRSPACE,ADSO      MOVE INTO LOG PARM. LIST
          USER      $USRLOG            LOG RECORD
          PROGSTOP
ERRTYPE1  DC        F'3'               LOGTYPE
DATYPE1   DC        X'0080'            DATATYPE
DATADR1   DC        A(BUFFER)          DATA ADDRESS
ADRSPACE  DC        F'0'               ADDRESS SPACE OF BUFFER
DEVADR1   DC        X'0068'            DEVICE ADDRESS
BUFFER    DC        256C'1'            BUFFER OF ONES
ADSO      DC             F'0'
          ENDPROG
          END
```

To make $USRLOG code reentrant, you may need to disable the system while your program is modifying the parameter list. Disable the system by using the DIS assembler instruction. Note that the logging routine disables the system for a short time. The system is enabled after logging functions are complete. At that time $USRLOG passes control back to the program that called it.

Special Considerations

1. If LOGLOAD support loads $LOG, your system will automatically place error logs in the default error log data set, EDXLOGDS. You can also create an error log data set by loading $LOG and specifying EDXLOGDS or another error data set name. Your system allocates an error log data set at 200 records. You can change the size of this data set by reallocating the error log data set with $DISKUT1.
2. You can copy EDXLOGDS to another data set for backup purposes. Use $DISKUT2 to print error logs from a backup data set.

Tape Source Dump Program Example

The following sample program illustrates how to copy EDX source modules from the IEBUPDTE formatted tape. You may want to add additional code to perform error checking on your system.

You will need to compile this program after entering it into a source data set.

```
*************************************************************************
*                                                                       *
*       SAMPLE PROGRAM TO COPY EDX SOURCE TAPE TO SERIES/1 DISK         *
*                                                                       *
*************************************************************************
*  USER INSTRUCTIONS:  BEFORE STARTING THIS PROGRAM, BE SURE            *
*        THAT THE TAPE CONTAINING THE SOURCE CODE IS MOUNTED            *
*        AND ONLINE AND THAT AN EDX DISK VOLUME OF SUFFICIENT           *
*        SIZE HAS BEEN ALLOCATED TO RECEIVE THE DATA.  APPROX.          *
*        VOLUME SIZES NEEDED FOLLOWS:                                   *
*                                                                       *
*       TAPE          EDX VOLUME SIZE       VOLUME DIRECTORY          *
*       ----          ---------------       ----------------          *
*                                                                       *
*     5719-XS6        118,000 RECORDS     450 DIRECTORY ENTRIES       *
*     5719-XX7         44,000 RECORDS      95 DIRECTORY ENTRIES       *
*************************************************************************
TAPEDISK PROGRAM   START,DS=((NL,TAPE02)),PGMS=(($DISKUT3,EDX002))
START    EQU       *
*************************************************************************
***GET THE NAME OF THE SOURCE VOLUME TO WRITE THE TAPE RECORDS INTO ***
*************************************************************************
GETVOL   READTEXT  VOL,'ENTER SOURCE VOLUME NAME OR CA TO CANCEL '
*************************************************************************
*   IF CA ENTERED END PROGRAM                                           *
*************************************************************************
         IF        (VOL,EQ,C'CA'),GOTO,END      CHECK FOR 'CA'
*************************************************************************
*   PUT SOURCE VOLUME NAME IN DSCB AND BLANK THE DATA SET NAME FIELD    *
*************************************************************************
         MOVE      DSA+$DSCBVOL,VOL,(6,BYTES)   MOVE VOLUME NAME TO DSC
         MOVE      DSA+$DSCBNAM,C' ',(8,BYTES)  BLANK NAME FIELD IN DSC
LOOP     EQU       *
*************************************************************************
*   THE SUBROUTINE GETREC RETURNS EACH RECORD FROM TAPE IN LINEBUFF     *
*************************************************************************
         CALL      GETREC                       CALL SUBROUTINE GETREC
*************************************************************************
*   IF THE RETURN CODE IN RC IS NOT A -1, THERE WAS AN ERROR            *
*************************************************************************
         IF        (RC,NE,-1),GOTO,END          IF ANY ERROR, END
```

```
*********************************************************************
*   IF THE RECORD STARTS WITH '*/#' OR '//#' SKIP THE RECORD        *
*********************************************************************
         IF       (LINEBUFF,EQ,SKIP,3),GOTO,LOOP  CHECK TO SEE IF DATA
         IF       (LINEBUFF,EQ,SKP2,3),GOTO,LOOP  IS TO BE SKIPPED
*********************************************************************
* IF THE RECORD STARTS WITH './ ADD' THIS IS THE START OF A NEW MEMBER*
*********************************************************************
         IF       (LINEBUFF,EQ,CONTROL,6)      CHECK IF NEW MEMBER
*********************************************************************
*   ALLOCATE THE NEW MEMBER ON DISK                                 *
*********************************************************************
           CALL     NEWMEM                     CALL SUBROUTINE NEWMEM
*********************************************************************
*   IF THE RETURN CODE IN RC IS NOT A -1, THERE WAS AN ERROR        *
*********************************************************************
           IF       (RC,NE,-1),GOTO,END    IF ANY ERROR, END
           GOTO     LOOP
         ELSE
*********************************************************************
*   SKIPSW WILL BE '0' IF PROCESSING A VALID SOURCE MODULE          *
*   SKIPSW WILL BE '1' IF NOT PROCESSING A VALID SOURCE MODULE      *
*********************************************************************
           IF       (SKIPSW,EQ,1),GOTO,LOOP   SKIP UNTIL VALID MODULE
*********************************************************************
*   THE SUBROUTINE PUTREC WRITES EACH RECORD TO DISK                *
*********************************************************************
           CALL     PUTREC                     CALL SUBROUTINE PUTREC
*********************************************************************
*   IF THE RETURN CODE IN RC IS NOT A -1, THERE WAS AN ERROR        *
*********************************************************************
           IF       (RC,NE,-1),GOTO,END        IF ANY ERROR, END
         ENDIF
         GOTO     LOOP                       RETURN TO BEGINNING
END      EQU      *
         IF       (RC,NE,-1)
           PRINTEXT  'PROGRAM ENDED WITH RETURN CODE = '
           PRINTNUM  RC                        PRINT RETURN CODE
         ENDIF                                 IF ERROR
         PROGSTOP
         EJECT
*********************************************************************
*                                                                   *
*                                                                   *
*                     GET RECORD SUBROUTINE                         *
*                                                                   *
*          THIS SUBROUTINE PUTS THE SOURCE RECORDS INTO THE         *
*          LINE BUFFER (LINEBUFF)                                   *
*                                                                   *
*                                                                   *
*********************************************************************
```

```
         SUBROUT   GETREC
         IF        (COUNT,LE,0)                ALL RECS. PROCESSED ?
*************************************************************************
*   IF ALL OF THE RECORDS FROM THE TAPE BLOCK WERE PROCESSED,           *
*   READ THE NEXT TAPE RECORD                                           *
*************************************************************************
           CALL      READ                      YES, GET NEXT TAPE BLOCK
         ENDIF
         MOVE      LINEBUFF,(0,#1),(80,BYTES) MOVE DATA FRM TAPE BUFFER
         SUB       COUNT,1                    SUBTRACT 1 FROM COUNT
         ADD       #1,80                   INCREMENT #1 TO NEXT RECORD
         RETURN
*************************************************************************
*                                                                       *
*                                                                       *
*                     PUT RECORD SUBROUTINE                             *
*                                                                       *
*        THIS SUBROUTINE BLOCKS THE SOURCE RECORDS AND WRITES           *
*        THEM TO DISK                                                   *
*                                                                       *
*                                                                       *
*************************************************************************
         SUBROUT   PUTREC
         IF        (WRITESW,EQ,1)              IS THIS 2ND SOURCE RECORD
           MOVE      DISKBUFF+128,LINEBUFF,(80,BYTES)  YES
           WRITE     DSA,DISKBUFF              WRITE TO DISK
           MOVE      RC,TAPEDISK               SAVE RETURN CODE
           MOVE      DISKBUFF,X'40',(256,BYTES) CLEAR DISKBUFF TO BLANK
           MOVE      WRITESW,0                 NEXT RECORD WILL BE 1ST
         ELSE                                  SOURCE RECORD IN BLOCK
           MOVE      DISKBUFF,LINEBUFF,(80,BYTES)
           MOVE      WRITESW,1                 NEXT RECORD WILL BE 2ND
         ENDIF                                 SOURCE RECORD IN BLOCK
         RETURN
         EJECT
*************************************************************************
*                                                                       *
*                                                                       *
*                      NEW MEMBER SUBROUTINE                            *
*                                                                       *
*       THIS SUBROUTINE WILL CREATE A NEW MEMBER ON DISK USING          *
*       THE INFORMATION IN THE CONTROL RECORD                           *
*                                                                       *
*                                                                       *
*************************************************************************
         SUBROUT   NEWMEM
*************************************************************************
*    CHECK TO SEE IF THE DSCB WAS USED                                  *
*************************************************************************
```

```
         IF       (DSA+$DSCBNAM,NE,BLANK,8)   IF BLANK, 1ST TIME THRU
*************************************************************************
*    CHECK TO SEE IF THE DISK BUFFER NEEDS TO BE WRITTEN                *
*                  (PARTIAL RECORD)                                     *
*************************************************************************
           IF       (WRITESW,EQ,1)           LAST MEMBER HAD ODD COUNT
             WRITE    DSA,DISKBUFF           WRITE TO DISK, LAST HALF
             MOVE     RC,TAPEDISK            RECORD WILL BE BLANK.
             IF       (RC,NE,-1),GOTO,ENDNEW
             MOVE     WRITESW,0
           ENDIF
*************************************************************************
*    CALCULATE THE END OF DATA POINTER                                  *
*************************************************************************
           SUB      DSA+$DSCBNEX,1,RESULT=NEWSIZ,PREC=D
*************************************************************************
*    LOAD $DISKUT3 TO SET THE END OF DATA POINTER AND                   *
*    RELEASE THE UNUSED DISK SPACE                                      *
*************************************************************************
           LOAD     PGM1,LIST2,EVENT=UT3ECB
           WAIT     UT3ECB
           MOVE     RC,DSA
           IF       (RC,NE,-1),GOTO,ENDNEW
         ENDIF
*************************************************************************
*    CLEAR THE NAME IN THE DSCB                                         *
*************************************************************************
         MOVE     DSA+$DSCBNAM,C' ',(8,BYTES) MOVE BLANKS TO DSCB NAME
*************************************************************************
*    CHECK TO SEE IF MEMBER NAME IS VALID                               *
*************************************************************************
         IF       (LINEBUFF+24,EQ,C'#',BYTE)  NAME STARTS WITH '#'
           MOVE     SKIPSW,1                  SETUP TO SKIP TO NEXT
           GOTO     ENDNEW                    MEMBER.
         ENDIF                                IF VALID NAME
         MOVE     SKIPSW,0                    RESET THE SKIP SWITCH
*************************************************************************
*           MOVE NEW MEMBER NAME INTO THE DSCB AND LOAD                 *
*           $DISKUT3 TO DELETE IT IF IT ALREADY EXISTS                  *
*           AND THEN REALLOCATE IT.                                     *
*************************************************************************
         MOVE     DSA+$DSCBNAM,LINEBUFF+24,(8,BYTES)
         LOAD     PGM1,LIST1,EVENT=UT3ECB
         WAIT     UT3ECB
         MOVE     RC,DSA
ENDNEW   EQU      *
         RETURN
         EJECT
```

```
*************************************************************************
*                                                                       *
*                                                                       *
*                    READ TAPE RECORD SUBROUTINE                        *
*                                                                       *
*                                                                       *
*************************************************************************
         SUBROUT   READ
*************************************************************************
* READ SOURCE RECORDS FROM TAPE                                         *
*************************************************************************
         READ      DS1,BUFF,,3120,END=END      READ TAPE RECORD
         MOVE      RC,TAPEDISK
*************************************************************************
*    IF THE RECORD COUNT IS NOT 39, CALCULATE THE NUMBER                *
*    OF RECORDS IN THIS BLOCK                                           *
*************************************************************************
         IF        (RC,EQ,21)                WRONG LENGTH RECORD ERROR
           MOVE      RECL,TAPEDISK+2         GET RECORD LENGTH
           DIVIDE    RECL,80,RESULT=COUNT    CALCULATE RECORD COUNT
         IF        (COUNT,GT,39)             IS COUNT GREATER THAN 39?
           MOVE      RC,-1                   RESET RETURN CODE
         ELSE
           MOVE      COUNT,39                SET COUNT TO 39 RECORDS
         ENDIF
         MOVEA     #1,BUFF                   MOVE BUFFER ADDRESS TO #1
         RETURN
*************************************************************************
*      DATA AREA                                                        *
*************************************************************************
CONTROL  DATA      C'./ ADD'          RECORD HEADER FOR NEW MEMBER
COUNT    DATA      F'0'               TAPE BLOCKING COUNTER
RC       DATA      F'-1'              RETURN CODE SAVE AREA
SKIP     DATA      C'*/# '            RECORD HEADER TO SKIP
SKP2     DATA      C'//# '            RECORD HEADER TO SKIP
BLANK    DATA      C'        '        BLANK AREA FOR COMPARE
DISKBUFF DATA      128F'0'            DISK WRITE BUFFER AREA
BUFF     DATA      1560F'0'           TAPE READ BUFFER AREA
VOL      TEXT      LENGTH=6           TEXT AREA FOR VOLUME INPUT
         DSCB      DS#=DSA,DSNAME=DUMMY  DSCB USED BY $DISKUT3
LINEBUFF DATA      80C' '             TEMPORARY HOLD AREA
RECL     DATA      F'0'               TAPE READ BYTE COUNT LENGTH
WRITESW  DATA      F'0'               USED TO INDICATE FULL/HALF RECORD
SKIPSW   DATA      F'0'               SET WHEN SKIPPING RECORDS
UT3ECB   ECB       0                  $DISKUT3 END ECB
*
LIST1    DATA      A(LIST1A)          $DISKUT3 LIST POINTER
*
LIST1A   DATA      A(DELETE)          POINTER TO DELETE
         DATA      A(ALLOCATE)        POINTER TO ALLOCATE
         DATA      F'0'               END OF LIST INDICATOR
```

```
*
DELETE   DATA     X'8004'            REQUEST A DELETE
         DATA     A(DSA)             DSCB NAME
         DATA     D'0'
         DATA     F'-1'              TYPE IS ANY
*
ALLOCATE DATA     X'8002'            REQUEST AN ALLOCATE
         DATA     A(DSA)             DSCB NAME
         DATA     D'3500' MUST BE AS LARGE AS THE LARGEST SOURCE MEMBER
         DATA     F'1'               TYPE IS DATA
*
LIST2    DATA     A(LIST2A)          $DISKUT3 LIST POINTER
*
LIST2A   DATA     A(SEOD)            POINTER TO SET END OF DATA
*
RELLST   DATA     A(RELEASE)         POINTER TO RELEASE SPACE
         DATA     F'0'               END OF LIST INDICATOR
*
SEOD     DATA     X'8006'            REQUEST SET END OF DATA
         DATA     A(DSA)             DSCB NAME
         DATA     D'0'
         DATA     F'-1'
*
RELEASE  DATA     X'8005'            REQUEST RELEASE UNUSED SPACE
         DATA     A(DSA)             DSCB NAME
NEWSIZ   DATA     D'0'
         DATA     F'-1'
*********************************************************************
*        COPY THE DSCB EQUATES INTO THE PROGRAM                     *
*********************************************************************
         PRINT    OFF
         COPY     DSCBEQU
         PRINT    ON
         ENDPROG
         END
*********************************************************************
*     END OF SAMPLE PROGRAM                                         *
*********************************************************************
```

EDX Subroutines

This section describes the following EDX subroutines:

- DSOPEN
- Formatted Screen Subroutines (syntax only)
- Indexed Access Method (syntax only)
- Multiple Terminal Manager (syntax only)
- SETEOD
- UPDTAPE.

You call these subroutines in your application program with the CALL instruction.

The following syntax conventions are used for the subroutines listed in this appendix.

- Operands shown in brackets [ ] are optional
- Operands not shown in brackets are required
- Default values are italicized
- The OR symbol | indicates mutually exclusive operands or parameters.

DSOPEN – Open a data set

You can open a data set from an application program with the DSOPEN copy code. By initializing a DSCB, DSOPEN opens a disk, diskette, or tape data set for input and/or output operations. The results of DSOPEN processing are identical to the implicit open performed by $L or LOAD for data sets specified in the PROGRAM statement.

Note: Only one DSCB can be open to a tape at a time. If a tape has been opened, a close must be issued before another open can be requested.

DSOPEN performs the following functions:

- Verifies that the specified volume is online
- Verifies that the specified data set is in the volume
- Initializes the DSCB.

To use DSOPEN, you must first copy the source code into your program by coding:

```
COPY  DDODEF
COPY  TCBEQU
COPY  PROGEQU
COPY  DDBEQU
COPY  DSCBEQU
        •
        •
        •
COPY  DSOPEN
```

Note: You must code the equates in the order given.

During execution, DSOPEN is called with the CALL instruction as follows:

```
CALL  DSOPEN,(dscb)
```

DSOPEN Error Exit Labels

The DSOPEN subroutine contains labels for a number of error exits. By moving the address of your error routine into the area defined by the DSOPEN label, the subroutine will perform the error routine you supply. The routine you supply can not be another subroutine. If you move a zero into the area defined by the DSOPEN label (except for $$EXIT), the subroutine passes control to the first instruction following the CALL instruction for DSOPEN. The labels are as follows:

Label	*Description*
$DSNFND	Data set name not found in directory If DSOPEN can not find the data set, then it does not fill in the DSCB.
$DSBVOL	Volume not found in disk directory. The system set the DDB pointer in the DSCB to 0 ($DSCBVDE does not equal 0).
$DSIOERR	Read error occurred while DSOPEN was searching the directory. See the READ instruction return codes for more information.

$$EXIT Exit address. If $$EXIT is 0 and $DSCBNAME equals $$ or $$EDXVOL, then DSOPEN initializes the DSCB to the first record (first recond in the library) of the volume specified in the $DSCBVOL. If $$EXIT is 0 and $DSCBNAME is $$EDXVOL, then DSOPEN initializes the DSCB to the first record of the device where the volume specified on $DSCBVOL resides.

$DSDCEA Address of area for DSOPEN to store the DCE (Directory Control Entry). This label contains a 0 if this area does not exist.

DSOPEN Considerations

You must have a 256-byte work area labeled DISKBUFR in your program as follows:

```
DISKBUFR  DC    128F'0'
```

The DSCB to be opened can be DS1 to DS9 or a DSCB defined in your program with a DSCB statement. The DSCB must be initialized with a 6-character volume name in $DSCBVOL and an 8-character data set name in $DSCBNAM. The volume name can be specified as six blanks, which causes the IPL volume to be searched for the data set.

After DSOPEN processing, #1 contains the number of the directory record containing the member entry and #2 contains the displacement within DISKBUFR to the member entry. The fields $DSCBEND and $DSCBEDB contain the next available logical record data, if any, placed in the directory by SETEOD.

Only one data set on any tape volume may be open at any one time. Multiple data sets, in a program header, or if opened by DSOPEN, cannot refer to more than one data set per tape volume. If this is attempted, the second open attempt will fail and take the Invalid VOLSER error exit.

DSOPEN Example

The following is an example using of the DSOPEN subroutine. The name of the subroutine that calls DSOPEN is USROPEN.

USROPEN opens a data set and returns information about the data set to a 10-word area in the program. Figure D-2 on page D-41 shows the information that USROPEN will return if the DSOPEN subroutine successfully opens the data set.

The call to the USROPEN subroutine would appear as follows:

```
        CALL   USROPEN,(label)
```

where (label) is the address of the 10-word area.

At entry to USROPEN, #1 equals A (the DSCB to be opened). This DSCB must have the fields $DSCBNAM and $DSCBVOL filled with the name of the opened data set and the name of the data set volume, respectively.

In order not to receive information about the opened data set after the DSOPEN operation, the call to USROPEN would be coded as follows:

```
CALL   USROPEN,0
```

When USROPEN completes, #1 and #2 are as they were on entry. If DSOPEN takes an error exit during the operation, USROPEN will return the appropriate return code. The return codes set up for USROPEN are as follows:

Return Code	Condition
−1	Operation completed successfully. Data set is open, and if requested, the DM parameters were transferred to a specified area.
2	Data set not found. The data set requested was not found on the volume specified.
3	Volume not found. The volume that the data set is supposed reside on does not exist or is not on line.
6	While DSOPEN was attempting to open the data set, an unrecoverable I/O error occurred on the volume directory.
18	Directory not initialized or is not in correct format.

```
         SUBROUT   USROPEN,OPNDMEP     10-WORD DATA AREA
          •
          •
          •
         MOVE      OPNS#1,#1           SAVE #1
         MOVE      OPNS#2,#2           SAVE #2
*****************************************************************
*  SET UP DSOPEN ERROR EXITS                                    *
*****************************************************************
         MOVEA     $DSNFND,OPNDNF      DATA SET NAME NOT FOUND
         MOVEA     $DSBVOL,OPNVNF      VOLUME NOT FOUND
         MOVEA     $DSIOERR,OPNIOE     ERROR READING DIRECTORY
         MOVEA     $DSBLIB,OPNLIB      VOLUME NOT INITIALIZED
         MOVE      $$EXIT,0            ALLOW $$, $$EDXLIB, $$EDXVOL
*
         CALL      DSOPEN,OPNS#1       CALL DSOPEN
         IF        (OPNDMEP,NE,0)      IF ADDRESS OF DME PARAMETER AREA
*                                       IS PASSED, TRANSFER DM PARAMETER
*                                       INFORMATION FROM DISKBUFFR
           MOVE      #1,OPNDMEP
           MOVE      (0,#1),(DISKBUFR+$$FPMT,#2),8
         ENDIF
OPNXIT   MOVE      #1,0,P2=OPNS#1      RESTORE #1
         MOVE      (0,#1),#2           #2 INTO DSCB
         MOVE      #2,0,P2=OPNS#2      RESTORE #2
         RETURN
*
OPNDNF   MOVE      #2,2                DATA SET NOT FOUND CODE
         GOTO      OPNXIT              CLEAN UP AND RETURN
*
OPNVNF   MOVE      #2,3                VOLUME NOT FOUND CODE
         GOTO      OPNXIT              CLEAN UP AND RETURN
*
OPNLIB   MOVE      #2,18               VOLUME NOT INTIALIZED CODE
         GOTO      OPNXIT              CLEAN UP AND RETURN
*
OPNIOE   MOVE      #2,6                DIRECTORY I/O ERROR CODE
         GOTO      OPNXIT              CLEAN UP AND RETURN
         END
```

After DSOPEN opens the data set, USROPEN fills in the 10-word data area at label OPNDMEP with the following information about the opened data set.

Offset	Contents
0	DMEKIND – Data set type: 0 – Unspecified 1 – Date member (sequential or direct) 3 – Program member
2	DMELA – The load address, if the data set is a program (0 – relocatable) DMERL – The logical record length, if the data set contains data (usually 256).
4	DMEMS – If the member is a data set, its size in bytes (doubleword) DMEER – If the data set contains data, the number of the physical record that contains the last logical record (doubleword)
8	DMEEP – If the data set is a program, its entry point. DMEEO – If the data set contains data, the offset in the EOD physical record of the first byte that is not in a logical record.
10	DMERS – If the data set is a program, the size of its relocation dictionary in bytes. This field is reserved if the data set is not a program.
12	DMEEOF – For data sets containing data, bit 0 equals 1 if DMEER is valid. This field is reserved for programs.

Figure D-2. Information Returned from DSOPEN

Formatted Screen Subroutines (Syntax Only)

See Appendix A, " Formatted Screen Subroutines" on page A-1 for a description of each subroutine and its operands.

All parameters coded in these subroutines must be labels.

Syntax:

```
label    CALL    $IMOPEN,(dsname,volume),(buffer),
                   [(type. C'4978'|C'3101'|C' '),]
                   [P2=,P3=,P4=]

label    CALL    $IMDEFN,(iocb),(buffer)[,topm,leftm,P2=,P3=,P4=]

label    CALL    $IMPROT,(buffer)[,(ftab),P2=,P3=]

label    CALL    $IMDATA,(buffer),(ftab)[,P2=,P3=]

label    CALL    $PACK,source,dest[,P2=,P3=]

label    CALL    $UNPACK,source,dest[,P2=,P3=]
```

Indexed Access Method (Syntax Only)

Refer to the IBM Series/1 Event Driven Executive Indexed Access Method (5719-AM4) for a description of each of the following subroutines.

Syntax:

```
label   CALL    IAM,(DELETE|DELETC),iacb,(key)

label   CALL    IAM,(DISCONN),iacb

label   CALL    IAM,(ENDSEQ),iacb

label   CALL    IAM,(EXTRACT),iacb,(buff),(size),(type)

label   CALL    IAM,(GET|GETC|GETR|GETCR),iacb,(buff),(key),
                  (mode/krel)

label   CALL    IAM,(GETB|GETBC),iacb,(recptr),(key),(mode/krel)

label   CALL    IAM,(GETNB|GETNBC),iacb,(recptr),(key)

label   CALL    IAM,(GETSEQ|GETSEQC|GETSEQCR|GETSEQR),iacb,(buff),
                  (key),(mode/krel)

label   CALL    IAM,(LOAD),iacb,(dscb),(opentab),(mode)

label   CALL    IAM,(PROCESS),iacb,(dscb),(opentab),(mode)

label   CALL    IAM,(PUT|PUTC),iacb,(buff)

label   CALL    IAM,(PUTDE|PUTDEC),iacb,(buff)

label   CALL    IAM,(PUTUP|PUTUPC),iacb,(buff)

label   CALL    IAM,(RELEASE),iacb
```

Multiple Terminal Manager (Syntax Only)

Refer to the *Multiple Terminal Manager Guide and Reference* for a description of each of the following subroutines.

Note: All parameters passed in Multiple Terminal Manager functions must be labels of either values, tables, buffers, or text strings.

Syntax:

```
label     CALL    ACTION,[(buffer),(length),(crlf)]

label     CALL    ASYNCH

label     CALL    BEEP

label     CALL    BLINK

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

label     CALL    CHALT

label     CALL    CHGPAN

lable     CALL    CRECVE

label     CALL    CSEND

label     CALL    CYCLE
label     CALL    FAN

label     CALL    FILEIO,(FCA),(buffer),(return code)

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

label     CALL    GETCUR,(row),(column)

label     CALL    LINK,(pgmname)

label     CALL    LINKON,(pgmname)

label     CALL    MENU

label     CALL    PSEUDO

label     CALL    SETCUR,(row),(column)

label     CALL    SETFMT,(dsname),(rc)

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

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

SETEOD – Set the Logical End-of-File on Disk

The copy code routine SETEOD allows you to indicate the logical end of file on disk. If your program does not use SETEOD when creating or overwriting a file, the READ end-of-data exception occurs at either the physical or logical end that was set by some previous use of the data set.

SETEOD places the relative record number of the last full physical record in the $$FPMF field of the directory member entry (DME).

Notes:

1. If the $DSCBEDB field is zero, the $$FPMF field is set to the next record pointer field ($DSCBNEX) minus one.
2. If the $DSCBEBD field is not zero, the $$FPMF field is set to the $DSCBNEX minus two.

If the last physical record is partially filled, the number of bytes contained in this record is placed in the $$FPMD of the DME. Otherwise, a zero is placed in this field. (This is done by copying the $DSCBEDB field of the DSCB directly into the DME.) (Further information on the DME can be found in &int..)

If the next record pointer field ($DSCBNEX) in the DSCB is 1 when SETEOD is executed, the DME is set to indicate that the data set is empty and $DSCBEND is set to X'−1', indicating that the data set is empty. If $DSCBEND is zero, the data set is unused.

You can use SETEOD before, during or after any READ or WRITE operation. It does not inhibit further I/O and can be used more than once. The only requirement is that the DSCB passed as input must have been previously opened.

The POINT instruction modifies the $DSCBNEX field. If SETEOD is used after a POINT instruction, the new value of $DSCBNEX is used by SETEOD.

SETEOD requires that the DSOPEN copy code, PROGEQU, TCBEQU, DDBEQU, and DSCBEQU be copied in your program. To use SETEOD, copy the source code into your program and allocate a work data set as follows:

```
         COPY  TCBEQU
         COPY  PROGEQU
         COPY  DDBEQU
         COPY  DSCBEQU
                 •
                 •
                 •
         COPY  DSOPEN
         COPY  SETEOD
DISKBUFR DC    128F'0'          WORK AREA FOR DSOPEN
```

You call SETEOD with the CALL instruction and pass it the DSCB and an I/O error exit routine pointer as parameters. In the following example,

```
         CALL   SETEOD,(DS1),(IOERROR)
```

DS1 points to a previously opened DSCB and IOERROR is the label of the program routine that receives control if an I/O error occurs.

UPDTAPE – Add Records to a Tape File

The copy code routine UPDTAPE allows you to add records to an existing (or new) tape file. The records added are placed after existing records on the file. On standard label tapes, the routine updates the block count counters in the EOF1 label.

To use UPDTAPE, you must copy the source code into your program by coding:

```
COPY  UPDTAPE
```

You call UPDTAPE with the CALL instruction and pass it the DSCB as a parameter. In the following example,

```
CALL   UPDTAPE,(DS1)
```

DS1 points to a previously opened DSCB.

After the CALL, you must check the return code in the first word of the DSCB for the tape return code. A −1 return code indicates that the tape is positioned correctly for writing records. (See the CONTROL instruction for a list of tape return codes.)

In-Line Code (EXTRACT)

This section describes how to find a device type by including the in-line copy code routine EXTRACT in your program. EXTRACT determines the device type from the device descriptor block. This routine can be useful for programs that perform operations on a variety of devices. For example, a program may not have to allocate a data set if the data set will reside on a tape. The program can use the EXTRACT routine, in this case, to determine if the device it will use is a tape device.

To use EXTRACT, you must copy the source code into your program. The routine requires the address of a DSCB in #1 and returns the address of a DSCB in #1.

The following example copies the EXTRACT code into the program and checks to see if the device is a tape unit. X'3186' is the device identifier of an IBM 4969 Magnetic Tape unit.

```
MOVEA #1,DS1
COPY  EXTRACT
IF    (#1,EQ,X'3186'),GOTO,TAPEDS
```

Appendix E. Creating, Storing, and Retrieving Program Messages

When designing EDL programs, place prompt messages and other message text in a separate message data set. You save storage space and coding time by doing so. The message utility, $MSGUT1, formats the messages in such a data set. The formatted messages can reside on disk, diskette, or in a module that you link-edit with your application program. The MESSAGE, GETVALUE, READTEXT, and QUESTION instructions enable your program to retrieve and print the appropriate message text when the program executes.

By placing messages in a separate data set, you also can change the text of a message without having to alter and recompile each program that uses that message. For more information on how to build and store program messages, refer to the &appl..

Creating and using your own messages involves the following steps:

1. Creating a data set for source messages
2. Entering the source messages into the data set
3. Formatting and storing the source messages using the message utility, $MSGUT1
4. Retrieving and printing the formatted messages.

The following pages cover each of these steps.

Creating a Data Set for Source Messages

You create a data set for source messages with one of the text editors described in the &util.. You can create one or more source message data sets and can store them on any volume. Messages can be simple statements or questions. They can also include any variable fields necessary to contain parameters supplied by your program.

Entering Source Messages into a Data Set

After creating a source message data set, enter your source messages using the following syntax rules:

- Begin each message in column 1.
- Precede each variable field with two *less than* symbols (< <) and follow each variable field with two *greater than* symbols (> >).
- End messages with the characters: /*
- Begin and end comments with double slashes (//comment//). A comment must be associated with a message.
- Use the *at sign* (@) to cause the message to skip to the next line.
- Continue a message on a new line by coding any nonblank character in column 72. Begin the continued line in column 1.

Source messages can be a maximum length of 250 bytes. You can calculate the length of a message by allowing one byte for each character in the text and one byte for each variable field.

The system identifies each message by its position in the source message data set. For example, the system assigns a message number of 3 to the third message in the source message data set. Once you format source messages with the $MSGUT1 utility, add any new messages you have to the end of the source message data set. Leave messages no longer needed in the source message data set or replace them with new messages to preserve the numbering scheme.

Coding Messages with Variable Fields

You may want to construct a message that can return information supplied or generated by your program. To do this, you can code a message with one or more variable fields. When you execute your program, the system inserts the appropriate parameters in these variable fields and prints a complete message. For example, to construct a message that tells a program operator how many records are in a particular data set on a particular volume, code the following:

```
THERE ARE <<SIZE>S> RECORDS IN <<DATA SET NAME>T> ON <<VOLUME>T>/*
```

The variable fields in the previous example are the number of records in the data set (SIZE), the data set name, and the volume name. The variable field names do *not* need to correspond with names in a program.

Note: To print or display a message with variable fields, you must have included the FULLMSG module in your system during system generation.

Set the variable fields off from the message text with two *less than* and two *greater than* symbols (< < > >). The symbols should enclose a description of the field. The system treats the field description as a comment. You can include up to 8 variable fields within a single message.

All variable fields must also contain a *control character* that describes the type of parameter your program will pass to the variable field. The previous example illustrates this point. "S" is the control character in the field < <SIZE>S>; "T" is the control character in the field < <VOLUME>T>. The following is a list of the valid control characters and their descriptions:

C Character data. Specify the number of characters allowed in the field by coding a value from 1 to 250 before the "C" (for example, < <NAME>8C>). There is no default.

T Text. No length is necessary. This control character is similar to "C" but you cannot specify the size of the variable field.

H Hexadecimal data. The length is four EBCDIC characters.

S Single-word integer. Specify a length for the data by coding a value from 1 to 6 before the "S." The default is six EBCDIC characters. The valid range for a single-word integer value is from −32768 to 32767.

D Double-word integer. Specify a length for the data by coding a value from 1 to 11 before the "D." The default is six EBCDIC characters. The valid range for a double-word integer value is from −2147483648 to 2147483647.

Your program passes parameters to a message in the order you specified the parameters in the EDL instruction. The following example shows a MESSAGE instruction with a parameter list (PARMS=):

```
SAMPLE    PROGRAM   START,DS=((MSGSET,EDX003))
                      •
                      •
                      •
          MESSAGE   2,COMP=ID,PARMS=(DSNAME,VOLUME,SIZE)
                      •
                      •
                      •
ID        COMP      'SRCE',DS1,TYPE=DSK
SIZE      DC        F'100'
DSNAME    TEXT      'DATA SET 1'
VOLUME    TEXT      'EDX002'
```

The MESSAGE instruction retrieves message number 2. The source message for message number 2 is:

```
<<DATA SET NAME>T> ON <<VOLUME>T> IS ONLY <<SIZE>S> RECORDS/*
```

When the MESSAGE instruction executes, the system places the first parameter (DSNAME) in the first variable field. It places the second parameter (VOLUME) in the second field, and the third parameter (SIZE) in the third field.

You may, however, want to alter or reword the message in the previous example. It is possible to change the order of variable fields in a source message without changing the order of the parameter list in the program. To do so, code an additional number after the control character. This number, from 1 to 8, points to the parameter that the system should insert into the variable field. The number corresponds to the position of the parameter in the parameter list. For example, <<NAME>C3> tells the system to retrieve the third parameter in the parameter list.

The order of the variable fields in message number 2 has been switched in the following example. Note that a number following the control character, however, points to the correct parameter for the variable field:

```
THERE ARE ONLY <<SIZE>S3> RECORDS IN <<DATA SET NAME>T1> ON          X

<<VOLUME>T2>/*
```

"S3" points to the third parameter in the list (SIZE), "T1" points to the first parameter in the list (DSNAME), and "T2" points to the second parameter in the list (VOLUME).

Sample Source-Message Data Set

The following is a sample of a source-message data set:

```
THIS IS A SAMPLE MESSAGE //THIS IS A SAMPLE COMMENT//  /*
OUTPUT TO SYSTEM PRINTER? /*
ENTER <<TYPE OF VALUE>T1> VALUE LESS THAN <<VALUE>S2> /*
THE PROGRAM HAS PROCESSED THE INPUT DATA./*
ENTER YOUR <<FIRST/LAST/FULL NAME>10C>/*
<<NUMBER>3S> RECORDS HAVE BEEN RECEIVED FROM <<SOURCE>8C>./*
THE ANSWER IS : <<VALUE>D> /*
SORRY, THE DATA YOU ENTERED IS <<ERROR>T>/*
THE DEVICE AT ADDRESS <<DEVICE ADDRESS>H1> IS                    X
IN USE/*
```

Formatting and Storing Source Messages (using $MSGUT1)

Once you have created a source-message data set, you must use the message utility, $MSGUT1, to convert the source messages into a form the system can use. The utility copies the source messages, formats them, and stores the formatted messages. (Refer to the &util. for a detailed explanation of how to use the message utility.)

You can store the formatted messages on disk or diskette or in a module. If you choose to store your formatted messages in a module, you must link-edit the module containing the messages to your application programs.

Each time you add new messages to the source-message data set, you must reformat the data set with $MSGUT1.

Note: If you included MINMSG in your system during system generation, your program can only retrieve formatted messages from a module.

Retrieving and Printing Formatted Messages

To retrieve a message from storage and include it in your program, you must code a COMP statement and any one of the following instructions: MESSAGE, GETVALUE, QUESTION, and READTEXT. (See the COMP statement and each of the instructions for information on how to retrieve and print formatted messages.)

The system retrieves program messages from the data set or module you allocated with $MSGUT1. If you store formatted messages on disk or diskette, you must include the data set that contains the messages on the PROGRAM statement for your program. The COMP statement must point to this message data set. If you store formatted message in a module, you must link-edit that module to your program. The COMP must also contain the name of this module.

Appendix F. Conversion Table

The following conversion table shows the hexadecimal, binary, EBCDIC, and ASCII equivalents of decimal values. The table also contains transmission codes for communications devices.

Decimal	Hex	Binary	EBCDIC	ASCII (see Notes 1 and 3)	EBASC* (see Notes 2 and 3)	EBCD	CRSP
0	00	0000 0000	NUL	NUL	NUL		
1	01	0001	SOH	SOH	NUL	space	space
2	02	0010	STX	STX	@	1	1,]
3	03	0011	ETX	ETX	@		
4	04	0100	PF	EOT	space	2	2
5	05	0101	HT	ENQ	space		
6	06	0110	LC	ACK	'		
7	07	0111	DEL	BEL	'	3	
8	08	1000		BS	DLE	4	5
9	09	1001	RLF	HT	DLE		
10	0A	1010	SMM	LF	P		
11	0B	1011	VT	VT	P	5	7
12	0C	1100	FF	FF	0		
13	0D	1101	CR	CR	0	6	6
14	0E	1110	SO	SO	p	7	8
15	0F	1111	SI	SI	p		
16	10	0001 0000	DLE	DLE	BS	8	4
17	11	0001	DC1	DC1	BS		
18	12	0010	DC2	DC2	H		
19	13	0011	TM	DC3	H	9	0
20	14	0100	RES	DC4	(		
21	15	0101	NL	NAK	(	0	Z
22	16	0110	BS	SYN	h	Ⓓ (EOA)	Ⓓ (EOA),9
23	17	0111	IL	ETB	h		
24	18	1000	CAN	CAN	CAN		
25	19	1001	EM	EM	CAN		
26	1A	1010	CC	SUB	X	RS	RS
27	1B	1011	CU1	ESC	X		
28	1C	1100	IFS	FS	8	upper case	upper case
29	ID	1101	IGS	GS	8		≡
30	1E	1110	IRS	RS	x		
31	1F	1111	IUS	US	x	Ⓒ (EOT)	Ⓒ (EOT)
32	20	0010 0000	DS	space	EOT	@	t
33	21	0001	SOS	!	EOT		
34	22	0010	FS	"	D		
35	23	0011		#	D	/	x
36	24	0100	BYP	$	$		
37	25	0101	LF	%	$	s	n
38	26	0110	ETB	&	d	t	u
39	27	0111	ESC	'	d		
40	28	1000		(	DC4		
41	29	1001		)	DC4	u	e
42	2A	1010	SM	*	T	v	d
43	2B	1011	CU2	+	T		
44	2C	1100		,	4	w	k
45	2D	1101	ENQ	-	4		
46	2E	1110	ACK	.	t		
47	2F	1111	BEL	/	t	x	c
48	30	0011 0000		0	form feed		
49	31	0001		1	form feed	y	l
50	32	0010	SYN	2	L	z	h

*The no-parity TWX code for any given character is the code that has the rightmost bit position off.

Decimal	Hex	Binary	EBCDIC	ASCII (see Notes 1 and 3)	EBASC* (see Notes 2 and 3)	EBCD	CRSP
51	33	0011		3	L		
52	34	0100	PN	4	,		
53	35	0101	RS	5	,		
54	36	0110	UC	6	1	SOA	
55	37	0011 0111	EOT	7	1	Ⓢ (SOA),comma	b
56	38	1000		8	FS		
57	39	1001		9	FS		
58	3A	1010		:	\		
59	3B	1011	CU3	;	\	index	index
60	3C	1100	DC4	<	<		
61	3D	1101	NAK	=	<	Ⓑ (EOB)	
62	3E	1110		>	|		
63	3F	1111	SUB	?	|		
64	40	0100 0000	space	@	STX	Ⓝ (NAK),-	!
65	41	0001		A	STX		
66	42	0010		B	B		
67	43	0011		C	B	i	m
68	44	0100		D	"		
69	45	0101		E	"	k	
70	46	0110		F	b	l	v
71	47	0111		G	b		
72	48	1000		H	DC2		
73	49	1001		I	DC2	m	'
74	4A	1010	¢	J	R	n	r
75	4B	1011	.	K	R		
76	4C	1100	<	L	2	o	i
77	4D	1101	(	M	2		
78	4E	1110	+	N	r		
79	4F	1111	]	O	r	p	a
80	50	0101 0000	&	P	line feed		
81	51	0001		Q	line feed	q	o
82	52	0010		R	J	r	s
83	53	0011		S	J		
84	54	0100		T	*		
85	55	0101		U	*		
86	56	0110		V	j		
87	57	0111		W	j	$	w
88	58	1000		X	SUB		
89	59	1001		Y	SUB		
90	5A	1010	!	Z	Z		
91	5B	1011	$	[	Z	CRLF	CRLF
92	5C	1100	*	\	:		
93	5D	1101	)	]	:	backspace	backspace
94	5E	1110	;	^	z	idle	idle
95	5F	1111	¬	—	z		
96	60	0110 0000	-	`	ACK		
97	61	0001	/	a	ACK	&	j
98	62	0010		b	F	a	g
99	63	0011		c	F		
100	64	0100		d	&	b	
101	65	0101		e	&		
102	66	0110		f	f		
103	67	0111		g	f	c	f

Decimal	Hex	Binary	EBCDIC	ASCII (see Notes 1 and 3)	EBASC* (see Notes 2 and 3)	EBCD	CRSP
104	68	1000		h	SYN	d	p
105	69	1001		i	SYN		
106	6A	1010	¦	j	V		
107	6B	1011	,	k	V	e	
108	6C	1100	%	l	6		
109	6D	1101		m	6	f	q
110	6E	1110	>	n	v	g	comma
111	6F	1111	?	o	v		
112	70	0111 0000		p	shift out	h	/
113	71	0001		q	shift out		
114	72	0010		r	N		
115	73	0011		s	N	i	y
116	74	0100		t	.		
117	75	0101		u	.		
118	76	0110		v	n	Ⓨ (YAK),period	
119	77	0111		w	n		
120	78	1000		x	RS		
121	79	1001		y	RS		
122	7A	1010	:	z	∧	horiz tab	tab
123	7B	1011	#	{	∧		
124	7C	1100	@	¦	>	lower case	lower case
125	7D	1101	'	}	>		
126	7E	1110	=	~	∿		
127	7F	1111	"	DEL	∿	delete	
128	80	1000 0000		NUL	SOH		
129	81	0001	a	SOH	SOH	space	space
130	82	0010	b	STX	A	=	±,[
131	83	0011	c	ETX	A		
132	84	0100	d	EOT	!	<	@
133	85	0101	e	ENQ	!		
134	86	0110	f	ACK	a		
135	87	0111	g	BEL	a	;	#
136	88	1000	h	BS	DC1	:	%
137	89	1001	i	HT	DC1		
138	8A	1010		LF	Q		
139	8B	1011		VT	Q	%	&
140	8C	1100		FF	1		
141	8D	1101		CR	1	'	¢
142	8E	1110		SO	q	>	*
143	8F	1111		SI	q		
144	90	1001 0000		DLE	horiz tab	*	$
145	91	0001	j	DC1	horiz tab		
146	92	0010	k	DC2	I		
147	93	0011	l	DC3	I	(	)
148	94	0100	m	DC4	)		
149	95	0101	n	NAK	)	)	Z
150	96	0110	o	SYN	i	D (EOA),"	(
151	97	0111	p	ETB	i		
152	98	1000	q	CAN	EM		
153	99	1001	r	EM	EM		
154	9A	1010		SUB	Y		
155	9B	1011		ESC	Y		
156	9C	1100		FS	9	upper case	upper case

Decimal	Hex	Binary	EBCDIC	ASCII (see Notes 1 and 3)	EBASC* (see Notes 2 and 3)	EBCD	CRSP
157	9D	1101		GS	9		
158	9E	1110		RS	y		
159	9F	1111		US	y	C (EOT)	C (EOT)
160	A0	1010 0000		Space	ENQ	¢	T
161	A1	0001		!	ENQ		
162	A2	0010	s	"	E		
163	A3	0011	t	#	E	?	X
164	A4	0100	u	$	%		
165	A5	0101	v	%	%	S	N
166	A6	1010 0110	w	&	e	T	U
167	A7	0111	x	'	e		
168	A8	1000	y	(	NAK		
169	A9	1001	z	)	NAK	U	E
170	AA	1010		*	U	V	D
171	AB	1011		+	U		
172	AC	1100		,	5	W	K
173	AD	1101		-	5		
174	AE	1110		.	u		
175	AF	1111		/	u	X	C
176	B0	1011 0000		0	return		
177	B1	0001		1	return	Y	L
178	B2	0010		2	M	Z	H
179	B3	0011		3	M		
180	B4	0100		4	-		
181	B5	0101		5	-		
182	B6	0110		6	m		
183	B7	0111		7	m	(S) (SOA),|	B
184	B8	1000		8	GS		
185	B9	1001		9	GS		
186	BA	1010		:	]		
187	BB	1011		;	]	index	index
188	BC	1100		<	=		
189	BD	1101		=	=	(B) (EOB),ETB	
190	BE	1110		>	}		
191	BF	1111		?	}		
192	C0	1100 0000	{	@	ETX	(N) (NAK),–	
193	C1	0001	A	A	ETX		
194	C2	0010	B	B	C		
195	C3	0011	C	C	C	J	M
196	C4	0100	D	D	#		
197	C5	0101	E	E	#	K	
198	C6	0 0110	F	F	c	L	V
199	C7	0111	G	G	c		
200	C8	1000	H	H	DC3		
201	C9	1001	I	I	DC3	M	"
202	CA	1010		J	S	N	R
203	CB	1011		K	S		
204	CC	1100	⌋	L	3	O	I
205	CD	1101		M	3		
206	CE	1110	⌊	N	s		
207	CF	1111		O	s	P	A
208	D0	1101 0000	}	P	vertical tab		
209	D1	0001	J	Q	vertical tab	Q	O

Decimal	Hex	Binary	EBCDIC	ASCII (see Notes 1 and 3)	EBASC* (see Notes 2 and 3)	EBCD	CRSP
210	D2	0010	K	R	K	R	S
211	D3	0011	L	S	K		
212	D4	0100	M	T	+		
213	D5	0101	N	U	+		
214	D6	0110	O	V	k		
215	D7	0111	P	W	k	!	W
216	D8	1000	Q	X	ESC		
217	D9	1001	R	Y	ESC		
218	DA	1010		Z	[		
219	DB	1011		[	[	CRLF	CRLF
220	DC	1100		\	;		
221	DD	1101		]	;	backspace	backspace
222	DE	1110		^	{	idle	idle
223	DF	1111		_	{		
224	EO	1110 0000	\	`	bell		
225	E1	0001		a	bell	+	J
226	E2	0010	S	b	G	A	G
227	E3	0011	T	c	G		
228	E4	0100	U	d	'	B	+
229	E5	0101	V	e	'		
230	E6	0110	W	f	g		
231	E7	0111	X	g	g	C	F
232	E8	1000	Y	h	ETB	D	P
233	E9	1001	Z	i	ETB		
234	EA	1010		j	W		
235	EB	1011		k	W	E	
236	EC	1100	⊢	l	7		
237	ED	1101		m	7	F	Q
238	EE	1110		n	w	G	comma
239	EF	1111		o	w		
240	F0	1111 0000	0	p	shift in	H	?
241	F1	0001	1	q	shift in		
242	F2	0010	2	r	O		
243	F3	0011	3	s	O	I	Y
244	F4	0100	4	t	/		
245	F5	0101	5	u	/		
246	F6	0110	6	v	o	Ⓨ (YAK), ¬	
247	F7	0111	7	w	o		
248	F8	1000	8	x	US		
249	F9	1001	9	y	US		
250	FA	1010	LVM	z	–	horiz tab	tab
251	FB	1011		{	–		
252	FC	1100		|	?	lower case	lower case
253	FD	1101		}	?		
254	FE	1110		~	DEL		
255	FF	1111		DEL	DEL	delete	

Notes:

1. ASCII terminals attached via #1310, #7850, #2095 with #2096, or #2095 with RPQ D02350.
2. ASCII terminals attached via #1610 or #2091 with #2092.
3. There are two entries for each character, depending on whether the parity is odd or even.

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Special Characters

A

B

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Y

Numerics

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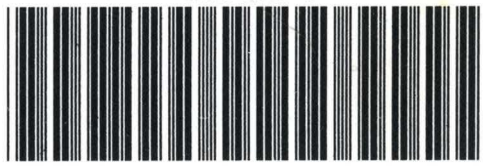

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