HEWLETT-PACKARD 9830A CALCULATOR
11272B EXTENDED I/O ROM

OPERATING MANUAL

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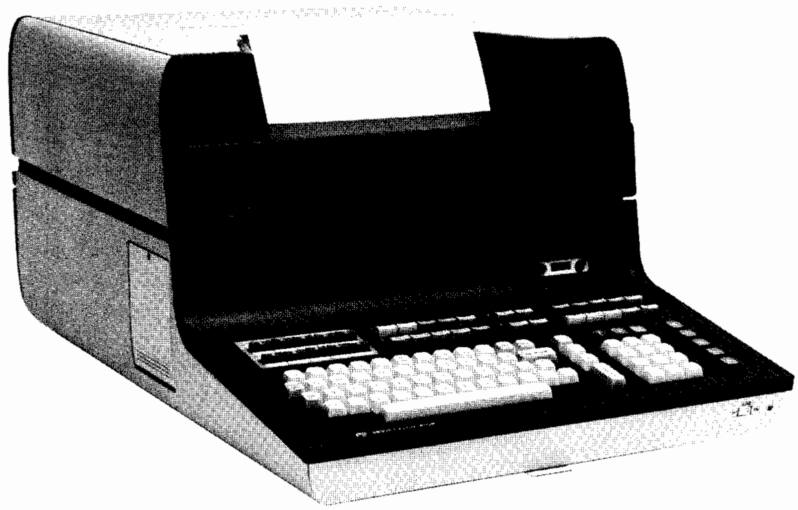
EXTENDED I/O ROM
11272B & OPTION 272



9830A CALCULATOR SHOWN WITH 9866A PRINTER

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(For World-wide Sales and Service Offices see rear of manual.)

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APPENDIX

PREFACE

The Extended I/O Read-Only-Memory (ROM) can be purchased as an accessory plug-in block or as an internal modification to the HP 9830A Calculator.

The Plug-in Version:

The 11272B Extended I/O ROM block is installable by the user. It plugs into any of the five slots behind the ROM door on the left side of the calculator.

The Calculator Modification:

The Option 272 Extended I/O ROM must be installed by qualified HP personnel. When it is installed, a decal showing the option number (Option 272) is attached to the inside of the ROM door.

Should you wish to add the option after you have received your calculator please order accessory number HP 11272F from the sales office nearest to you (see the back of this manual). The Option 272 will then be installed for you by our field personnel.

Once either version of the ROM (the plug-in block or the internal modification) has been installed, the operation is identical. Therefore, this manual makes no further distinction between the two types of ROM.

CHAPTER 1

GENERAL INFORMATION

INTRODUCTORY DESCRIPTION

The Extended I/O Read-Only-Memory (the Extended I/O ROM) provides additional statements to the HP 9830A's BASIC language, allowing a wide variety of devices to be attached to the calculator. Although the calculator recognizes ASCII* code, the Extended I/O ROM enables other codes to be input and output.

With access to data from a wide range of measuring devices, the calculator can be programmed to set experimental or test conditions and therefore can control research and production testing or sampling procedures.

Devices such as voltmeters, counters, teletypewriters, photoreaders and graphic plotters can be connected to the calculator. Direct conversion is provided at input from non-ASCII to ASCII code, and at output from ASCII to non-ASCII code. In addition, internal conversion from ASCII code is possible if the String Variables ROM is also installed in the calculator. Special functions are included for codes which cannot be immediately converted to ASCII code, such as codes of more than one byte length. Special functions may also be used for direct device-to-device transfer, for determining device status and for communication with the HP-IB (HP-Interface Bus).

SUPPLIED EQUIPMENT

One Operating Manual, HP Part Number 09830-90029, is supplied with the Extended I/O ROM.

INSPECTION PROCEDURE

Refer to the Complete Memory Test section in the 9830A Calculator System Test Instruction Booklet (HP Part No. 09830-90027) to verify operation of the ROM.

*American Standard Code for Information Exchange.

INSTALLING THE PLUG-IN ROM

The complete procedure to install a plug-in ROM is in the Operating and Programming Manual for the 9830A Calculator. Following are some reminders:

- The ROM can be installed in any of the five ROM slots.
- Switch the calculator off before installing or removing a ROM.
- The label on the ROM should be right-side-up and facing the ROM door when the ROM is properly installed.
- Ensure that the ROM is properly mated to the connector at the back of the slot before switching the calculator on.

OTHER REQUIREMENTS

It is assumed that you are familiar with the operating procedures and with the BASIC programming statements used with the 9830A Calculator. It is also assumed that you are familiar with the equipment which you plan to connect to the calculator, as outlined in the manuals supplied with that equipment.

CHAPTER 2

INTERFACE INFORMATION

INTERFACING THE HP 9830A CALCULATOR

The general I/O scheme for interfacing devices with the 9830A is shown in Figure 2-1. The four I/O connectors shown allow four peripheral devices to be connected to the calculator at one time.[1]

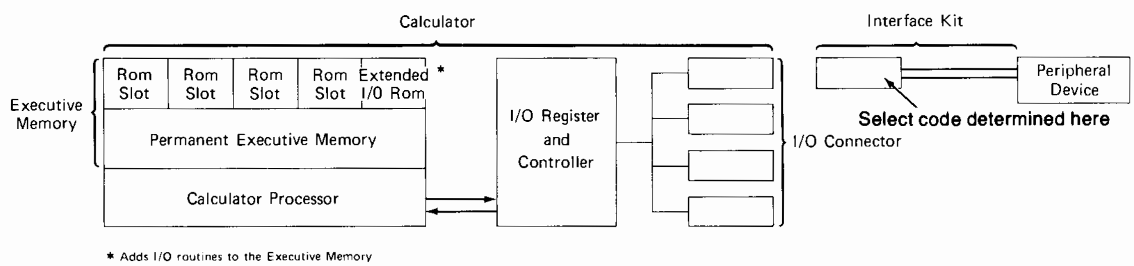


Figure 2-1. The 9830A Calculator and the I/O Scheme

Each device must be connected to the calculator with the appropriate interface card and cable. The interface card provides necessary electrical interface (signal conditioning, buffering, etc.) between the device and the calculator. Peripheral devices dedicated to the 9800 Series Calculators are supplied with all required interfacing hardware.

[1]Use of the HP 9868A I/O Expander permits up to thirteen devices to be connected to the calculator at one time.

INTERFACE KITS

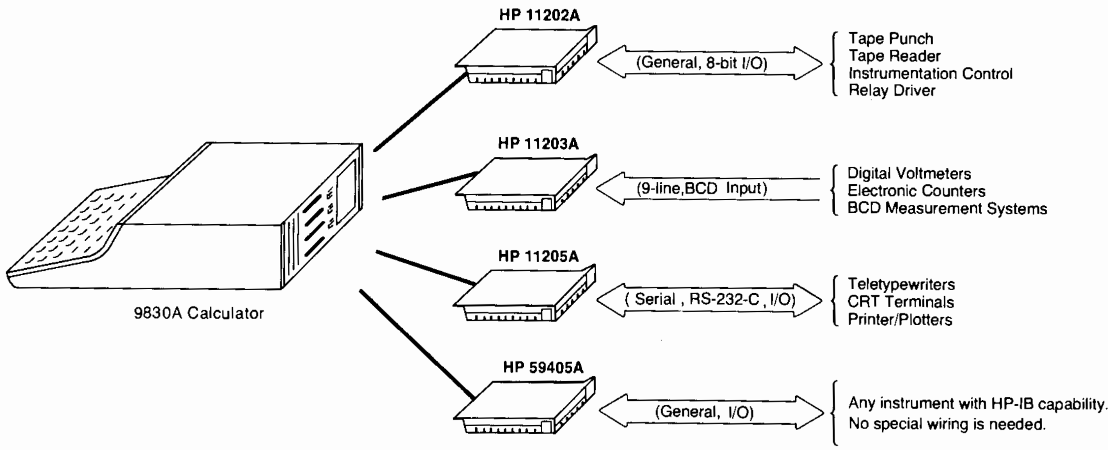


Figure 2-2. Interface Kits

The interface kits shown above allow non-9800 series peripherals to be interfaced to the 9830A. These kits are supplied with detailed hardware related information (electrical specifications, recommended interface circuits, etc.) enabling you either to interface your device directly to the 9830A Calculator or to build the necessary additional hardware required to interface the device. With the proper use of one of these interface kits, the operations described in this manual will enable the calculator to control your peripheral device. The calculator will then be able to send data to, or receive data from, your peripheral device, as appropriate.

A guide is available with detailed information on interfacing called "Selecting an HP Calculator Interface," HP Part No. 5951-7161. The HP Interface Bus makes it possible to plug-in up to 14 of the many HP-IB compatible peripherals to the 9830A. See the "Hewlett-Packard Interface Bus Users Guide", HP Part No. 59300-90002, for details.

PERIPHERAL SELECT CODES

Because several peripheral devices may be connected to the calculator at once, each device must have a unique address so that the calculator can specify the device which should respond to each operation. This address (or select code) consists of a one-digit or two-digit number and is determined on the interface card. The select codes for dedicated 9800 Series Peripherals are preset at the factory (e.g., the plotter's select code is set to 14); however, most of them can be changed, if desired, by the user. Interface kits contain switches permitting the user to set any one of nine select codes. A list of select code assignments is given in the Appendix.

Each peripheral I/O operation must specify a select code, so that the correct device responds to the operation, while all other devices ignore it.

INPUT-OUTPUT CODE

The I/O ROM enables the 9830A Calculator to send and receive data and to send commands using standard ASCII code. Conversion from non-ASCII code to ASCII code at input, and from ASCII code to non-ASCII code at output can be programmed. ASCII equivalent codes are given in the Appendix.

For input and output operations, all information exchange between the calculator and a peripheral device consists of data being transferred character-by-character in an 8-bit parallel fashion. The calculator generally sends and receives one 8-bit character at a time; if another character is to be sent or received, the calculator will wait until the device is ready.

SOFTWARE INTERRUPT

There is no provision for system interrupt operation when using the Extended I/O ROM (i.e., the peripheral device cannot initiate or call for an input or output operation). But, the status of a peripheral can be monitored using the STAT command (see Chapter 3) allowing a software interrupt. The calculator must be in complete control of each peripheral device while the device is involved in I/O operations. As mentioned earlier, if the device is not ready, the calculator will wait until the device is ready. However, the calculator can be taken out of the wait status by pressing STOP.

NOTES

CHAPTER 3

I/O OPERATIONS

This chapter describes the statements and functions available with the Extended I/O ROM. Applications and examples are shown in later chapters.

USAGE AND SYNTAX

The statements and functions provided in the Extended I/O ROM can be executed both in calculator mode and in program mode.

The following conventions are used throughout the remainder of this manual. The I/O statement syntax parameters are explained in Table 3-1. Square brackets are used in syntax descriptions to enclose the optional parameters. Colored words and symbols must appear in the program exactly as written in the syntax.

Table 3-1. Parameters Used in I/O Statements

Parameter	Explanation
select code	A numerical code, from 1 to 15, representing the address of the peripheral device (see the Appendix for a list of peripheral select codes).
string name	A single alphabetic character followed by a dollar sign ($); also, substring parameters can be specified, such as A$(5,10). Valid only when the 11274B String Variables ROM is installed in the calculator.
format	To reference a FORMAT statement, the line number of that statement; for free format data, an asterisk (*).
conversion table	The array name given to a conversion table. See 'Conversion Tables' later in this chapter.
variable list	A series of simple variables and arrays. Also, may include string names if the String Variables ROM is installed.
list	A series of variables, literals, expressions or numbers separated by commas.
FOR parameter (implied FOR...NEXT loop)	Input multiple data items from one record into an array.

THE ENTER STATEMENT

The ENTER statement enables the calculator to receive data from an external device. If the incoming data is not in ASCII code, conversion to ASCII code may be included in the ENTER statement through the use of an optional conversion table parameter described on page 3-11. Also, optional FOR parameters may be used to input multiple data items from one record into an array. A record is a sequence of characters ending with a line feed (LF).

Syntax:

ENTER (select code, format [, conversion table]) list

"Format" can be a line number reference to a FORMAT statement or an asterisk indicating free field format.

"List" can be simple variables, array variables, string variables, or an implied FOR...NEXT loop. The implied FOR...NEXT loop follows this form:

(FOR variable = $value_1$ TO $value_2$ [STEP $value_3$], array name (variable))

Example:

(FOR I = 1 TO 20 STEP 2, A(I)) } MAY ALSO BE NESTED TO 2 LEVELS

The ENTER statement causes the list of variables specified to be read from the device indicated by the select code. Character-by-character conversion to ASCII code is performed, if requested, until a standard ASCII line feed character (LF) is encountered.

Free-field Format

Free-field format is designated by an asterisk(*) in the ENTER Statement. Characters are entered as ASCII characters. All characters except 0 thru 9, +, −, and E are number delimiters. The line feed (LF) is the record delimiter. Spaces are ignored.

Example:

Data entered:

1.3,2-9,3,,4(LF)B1,2,3E5,+2(LF)

Program:

```
10 DIM A[5]
20 FOR I=1 TO 2
30 ENTER (1,*)(FORJ=1TO5,A[J])
40 PRINT A[1],A[2],A[3],A[4],A[5]
50 NEXT I
60 END
```

Output:

```
1.3        2.00000E-09     3        0        4
0          1               2        300000   2
```

When a + or − sign follows a number as "2-9" above, it is interpreted as exponential format. Two consecutive delimiters cause a zero to be entered as seen with the two consecutive commas in the example, and also the "LF" followed by "B".

FORMAT Specifications using the ENTER Statement

Fw.d Fixed-point format. Enters "w" number of characters with "d" number of decimal places. If the decimal point is part of the number being entered, then the "d" specification is ignored. If an "E" is in the field being entered, followed by one or two numbers, then the field is input using exponential format.

Example:

Data entered

123456E7-123987.(LF)

Program:

```
10 DIM C[4]
20 ENTER (1,30)(FORI=1TO4,C[I])
30 FORMAT 4F4.2
40 PRINT C[1],C[2],C[3],C[4]
50 END
```

Output:

```
12.34          560000000     -1.23          987
```

Notice in the example that no character delimiters are used. The "E" in the data is interpreted as exponential format; also note that the decimal point in "987." overrides the format specification.

Ew.d Exponential format. This format specification is the same as fixed-point format when entering data.

B Binary format. Each byte (8 bits) entered is stored as the decimal equivalent of a binary number, not as an ASCII character. For example, if the binary number 00100001 is entered, the decimal value 65 would be stored.

X Skip character format. This format specification causes individual characters to be skipped. For example, if four characters were to be skipped, 4X would be the format specification used.

/ Skip record format. This format specification causes all the characters between two consecutive line feeds to be skipped. A format specification of 3/, for example, would cause 3 records to be deleted.

" " Quote fields should not be used in FORMAT statements referenced by the ENTER statement. Error 84, improper format specification, will result.

If a standard ASCII left arrow (←) (decimal 95) is encountered, a backspacing operation is simulated. For example, if the input characters are 12←34, the resulting data values would be 134. If an escape (ESC)character (decimal 27) is encountered, a search is made for a line feed marking the end of the record. The ESC character is the same as the old alternate mode (ALT) character. The entire record containing ESC is ignored, and since the ENTER statement has not terminated, the next record is entered.

If the format of information to be entered from an external device is not known, the RBYTE function can be used to enter data byte-by-byte.

THE OUTPUT STATEMENT

OUTPUT is a general purpose statement used to send data or coded commands to an external device. If the external device requires non-ASCII code, conversion from ASCII to that code may be implemented through the use of the optional conversion table parameter.

Syntax:

OUTPUT(select code or string name, format [,conversion table]) list

"Format" can be a line number reference to a FORMAT statement or an asterisk for standard format. For information on the FORMAT statement, see the 9830A Operating and Programming Manual, part number 09830-90001.

"List" can be numbers, simple variables, array variables or string variables.

An automatic carriage return and line feed are output at the end of the OUTPUT statement. To suppress them, end the OUTPUT statement with a comma or semicolon.

Data can be output with the standard leading blanks suppressed. This is often required by devices such as network analyzers, digital voltmeters and others. The section on Suppressing Leading Blanks, later in this chapter, explains this subject.

Outputting into a String Variable

If a string variable[1] is specified instead of the select code, strings and variables can be output into a string variable. This is useful for generating characters which normally cannot be stored in the string directly. The conversion table parameter cannot be specified when outputting into a string variable.

Example:

The following program stores all of the values between 1 and 255 into the string variable, A$. Then, the string is printed on the calculator, 32 characters at a time.

Program listing:

```
10 DIM A$[255]
20 FOR I=1 TO 255
30 OUTPUT (A$[I,I],40)I;
40 FORMAT B
50 NEXT I
```

Output binary codes into A$, one character at a time.

```
60 I=1
70 OUTPUT (15,*)A$[I,I+31]
80 I=I+32
90 IF I+32<255 THEN 70
110 OUTPUT (15,*)A$[I,255]
120 END
```

Output A$, 32 characters at a time, on the 9866A printer.

[1]Valid only when the 11274B String Variables ROM is installed in the calculator.

Output:

```
*
!"#$%&'()*+,-./0123456789:;<=>?@
ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]↑_@     } section 1
ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]↑

!"#$%&'()*+,-./0123456789:;<=>?@
ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]↑_@     } section 2
ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]↑
```

Note that many characters are missing. This is because many ASCII characters are special characters. The 9866A printer does not have any characters corresponding to these special characters. Also, the output has two identical sections. This is because ASCII is an 8-bit code, but only 7 bits are data bits; the eighth bit is parity. Since there are 7 bits, there are 2^7 or 128 possible characters. Since the parity bit is ignored, the same characters are printed twice.

A different output device could be specified in lines 70 and 110 where the eighth bit is used for data. If that device uses the eighth bit, then up to 256 characters would be available.

THE CMD (COMMAND) STATEMENT

The CMD statement is a special output instruction used only to control instruments connected to the HP Interface Bus (HP-IB) at select code 13. For complete information, refer to the HP-IB User's Guide, HP Part No. 59300-90002.

I/O FUNCTIONS

Seven I/O functions allow data to be input, output, or manipulated on the bit level. Functions cannot stand alone with a line number; they return a value to an expression.

THE STAT (STATUS) FUNCTION

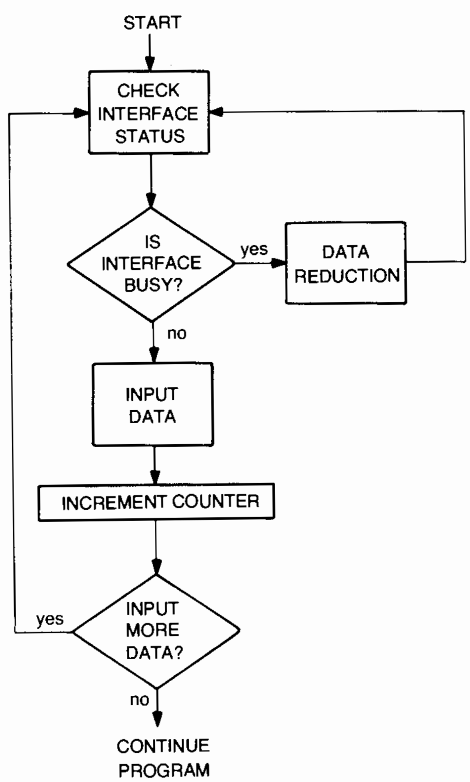
The STAT function interrogates the status of a peripheral. The result can be a value from 0 to 15, inclusive.

Syntax:

STAT select code

Generally, the status of a device is 1 when it is ready and 0 when it is busy. Status codes for most 9800 Series peripherals are listed in the Appendix. For the 9866A printer, the status remains at a fixed value once it is set, even though the peripheral may subsequently be turned off.

Although there is no provision for hard-wired peripheral interrupt operation, this flowchart and program show one method to provide software interrupt using the STAT function. In the following program, the calculator monitors an 11203A BCD Interface connected to a measurement device. When the interface is found to be busy (status bit is 0), the calculator performs some time-consuming data reduction. When the interface is ready (status bit is 1) the calculator goes thru the data-input routine.



Program:

```
110 FOR I=1 TO 20
120 IF STAT1=0 THEN 160
130 ENTER (1,*)A,B
140 NEXT I
150 GOTO 300
```

- •
- • Data Reduction Routine
- •

```
260 GOTO 120
```

THE ROTATE (ROT) FUNCTION

The ROTate function right-rotates a 16-bit integer value a specified number of places.

Syntax:

ROT (value, number of places)

The value is rotated the number of places specified. No bits are lost in the rotation. The usable range for value is between −32767 and +32767. Although the number of places rotated can be greater than 15, the actual rotation is from 0 to 15 locations.

Example:

```
10 A=5                               A = 0000 0000 0000 0101
20 B=ROT(A,2)                        B = 0100 0000 0000 0001
30 PRINT "ROT("A",2) = "B
40 END


ROT( 5     ,2) =   16385             result from line 30
```

THE INCLUSIVE OR (INOR) FUNCTION

The INclusive OR function performs a logic OR operation on the 16-bit binary equivalent of two decimal values.

Syntax:

INOR ($value_1$, $value_2$)

The two values have a usable range of integers from +32767 to −32767. The truth table for the OR function is:

A	B	A OR B
0	0	0
0	1	1
1	0	1
1	1	1

Example:

```
10 A=12
20 B=11
30 C=INOR(A,B)
40 PRINT A"OR"B" = "C
50 END
```

A = 0000 0000 0000 1100
B = 0000 0000 0000 1011
C = 0000 0000 0000 1111

```
 12   OR  11     =   15
```

result from line 40

THE BINARY AND (BIAND) FUNCTION

The BInary AND function performs the logic AND operation on the 16-bit binary equivalent of two decimal values.

Syntax:

BIAND ($value_1$, $value_2$)

Both values have a usable range of integers from +32767 to −32767. The truth table for the AND function is:

A	B	A AND B
0	0	0
0	1	0
1	0	0
1	1	1

Example:

```
10 A=20
20 B=24
30 C=BIAND(A;B)
40 PRINT A"AND"B" = "C
50 END
```

A = 0000 0000 0001 0100
B = 0000 0000 0001 1000
C = 0000 0000 0001 0000

```
 20   AND 24    =  16
```

result from line 40

THE WRITE BYTE (WBYTE) FUNCTION

The WBYTE function is used in the WRITE, PRINT, or OUTPUT statements to output a single 8-bit binary equivalent of a decimal value.

Syntax:

WBYTE value

The WRITE statement using FORMAT B is nearly the same as the WBYTE function, except that the final carriage return/line feed can be suppressed with the WRITE statement using FORMAT B and a comma or semicolon (, or ;) terminating the WRITE list.

Both examples print ASCII characters A through Z:

Program:

Automatically gives final CR/LF

```
10 FOR I=65 TO 90
20 PRINT WBYTEI;
30 NEXT I
40 END
```

; has no effect

Output:

```
ABCDEFGHIJKLMNOPQRSTUVWXYZ
```

Does not give final CR/LF

```
10 FORMAT B
20 FOR I=65 TO 90
30 WRITE (15,10)I;
40 NEXT I
50 END
```

Both required to suppress CR/LF (FORMAT B on line 10 and the ; on line 30)

There is no output.

THE READ BYTE (RBYTE) FUNCTION

The Read BYTE function is used to input 8 bits (1 byte) of data from an input device. This function is often used in the assignment statement (i.e., A = RBYTE 2) although it can be used in other statements.

Syntax:

RBYTE select code

Using this function in an assignment statement stores the decimal equivalent of the 8-bit value input from the select code specified.

Example:

```
10 A=RBYTE2      Stores the value from S.C.2 in A
20 PRINT A
30 GOTO 10
```

THE SPACE (SPA) FUNCTION

The SPAce function advances the printer or typewriter carriage the number of spaces specified, up to 71 spaces. Unlike the TAB function, which tabs to a specified column, the SPA function spaces from a previous output column the number of spaces specified.

Syntax:

SPA value

The space function works with the PRINT statement and the WRITE or OUTPUT statements when standard format (using an asterisk) is used [e.g., WRITE (15,*) SPA A"*"]. One space is given for the sign of the value.

Example:

```
10 FOR I=0 TO 5
20 PRINT SPAI;I
30 NEXT I
40 END
```

```
 0
  1
   2
    3
     4
      5
```

CONVERSION TABLES

A conversion table can be used in the ENTER and OUTPUT statements to convert groups of characters, or arrays of data from one code to another. As mentioned earlier, the calculator makes use of standard ASCII codes. Throughout this manual all non-ASCII codes (used by printers, card readers, paper tape readers, punches, typewriters, etc.) are referred to as foreign codes.

To create a conversion table, you have to store the codes in an integer array. The subscripts of the array correspond to the decimal equivalents of the characters in the foreign code. The decimal equivalents of the required ASCII characters are then stored in the appropriate array elements. The following is a simplified explanation of how a conversion table works.

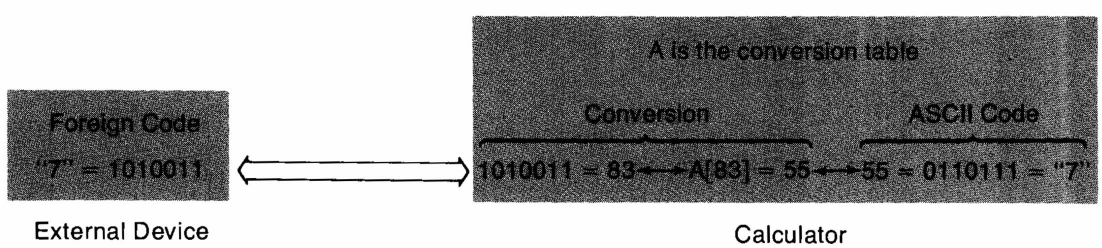
Assume that only the character "7" is to be input and output and that the external device uses some arbitrary foreign code. Suppose that in the foreign code the character "7" is represented by the binary number 1010011. Table x-x shows that 1010011 is equivalent to decimal 83, so 83 is used to determine the array element:

A[83]

In ASCII "7" is represented by the binary number 0110111; this is the bit-pattern which the calculator normally outputs (or receives) for the character "7". Table A-1 shows that 0110111 is equivalent to decimal 55, so you store the value 55 in the integer array, in the element to be determined by the foreign code as in the assignment statement:

A[83] = 55

As can be seen from the diagram below, when the external device inputs a "7" it sends bit-pattern 1010011. The calculator interprets this as 83, so it looks at element number 83 in the array and finds decimal 55; in the calculator the equivalent bit-pattern is 0110111 (see Table A-1), which is interpreted as the ASCII character "7". Conversely, when the calculator is to output the character "7," it looks for 55 in the array and finds it in the 83rd element. So the calculator outputs the bit-pattern for 83, which is 1010011. The external device interprets that bit-pattern as the character "7".



A conversion table must first be defined in a DIM statement as an integer array. For example,

```
10 DIM AI[150]
```

If you have a conversion table with more than 256 elements, you can use a two-dimensional array. Conversion tables using two-dimensional arrays are explained later in this chapter.

CONVERSION TABLES
(continued)

Conversion in the ENTER statement

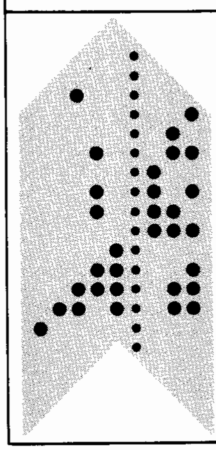
When a conversion table is referenced in an ENTER statement, the incoming foreign character-codes are used as subscripts to look up the ASCII equivalents in the conversion table. If a subscript is referenced which is not defined in a conversion table, ERROR 86 is displayed. Also, it is important that the line feed character be defined in the conversion table. For example A(108) = 10 would define the foreign code 108 as the ASCII line feed character 10.

Conversion in the OUTPUT statement

When the conversion table is referenced in an OUTPUT statement, the contents of the conversion table are searched sequentially for the outgoing ASCII character, and the subscript of the found element is the foreign code to be output. If a code is not found in the conversion table, no character is output.

Example of code conversion

Suppose you have a paper tape reader which uses EIA[2] coded tape. X and Y values are contained on the tape, separated by commas. The table below shows the tape punched with allowable codes, binary representation, the character, and the decimal equivalent codes for the EIA codes contained on the tape.

Eia Coded Tape	Binary	Character	Eia Decimal Code Equivalent
	00100000	0	32
	00000001	1	1
	00000010	2	2
	00010011	3	19
	00000100	4	4
	00010101	5	21
	00010110	6	22
	00000111	7	7
	00001000	8	8
	00011001	9	25
	00111011	,	59
	01101011	.	107
	10000000	Carr. Ret.	128

From the ASCII table in the Appendix, you can write a chart showing the ASCII decimal equivalents of the EIA codes.

[2]Electronic Industries Association standard code.

Character	EIA Decimal Equivalent (Subscript)	ASCII Decimal Equivalent (Value)
0	32	48
1	1	49
2	2	50
3	19	51
4	4	52
5	21	53
6	22	54
7	7	55
8	8	56
9	25	57
,	59	44
.	107	46
delimiter	128(CR)	10(LF)

Notice that the ASCII line feed (LF) is the delimiter used by the 9830A Calculator; this corresponds to the carriage return (CR) of the EIA code.

Now, a conversion table is made directly from the preceding EIA/ASCII chart. First, dimension an integer array for the conversion table:

```
10 DIM AI[128]
```

The conversion table must be dimensioned to have at least 128 elements because 128 is the largest subscript to be used, as can be seen from the decimal equivalent column in the EIA code chart.

Next the elements of the conversion table are defined:

```
20 A[32]=48
30 A[1]=49
40 A[2]=50
50 A[19]=51
60 A[4]=52
70 A[21]=53
80 A[22]=54
90 A[7]=55
100 A[8]=56
110 A[25]=57
120 A[59]=44
130 A[107]=46
140 A[128]=10
```

With the above instructions, definition of the conversion table is complete. Many elements in array A are undefined because the table does not have as many symbols as there are spaces for elements in the array.

CONVERSION TABLES
(continued)

The following statement inputs two characters and automatically converts the code:

```
150 ENTER (9,*,A)A,B
```

Remember, if any foreign code is not defined in the conversion table, ERROR 86 will occur at the ENTER statement.

Notice that the variable A and the conversion table A can appear in the same program. (Refer to "The ENTER Statement" for more discussion of the parameters shown.) With the above statement, EIA characters for the variables A and B are read from select code 9 (the paper tape reader) and converted to ASCII code by conversion table A.

Now assume that you have to output your variables to a tape punch with select code 3. To output variables A and B again, they must first be converted back to EIA code. The following statement will do this:

```
160 OUTPUT (3,*,A)A,B
```

Note that the same conversion table, A, is used in this case for both input and output.

When a conversion table is referenced in an ENTER statement, the calculator assumes that it has a foreign code and searches the subscripts of the conversion table array to find the element containing the equivalent ASCII code. The OUTPUT statement causes the calculator to assume that is has ASCII code and to search the values in the conversion table array to find the element whose subscript corresponds to the foreign code to be output. The output search is sequential, starting at the beginning of the array. Therefore, when the conversion table is used to output foreign code, and two or more elements in the array contain the same values, only the code having the lowest-valued subscript can be output.

TWO-DIMENSIONAL CONVERSION TABLES

A conversion table with more than 256 elements can be created by using a two-dimensional array. For example, conversion from one foreign code to another foreign code, such as device to device data transfer with code conversion, might require more than 256 elements.

The following example demonstrates the use of the two-dimensional conversion table. Rather than use a large array, such as an array of dimensions (2,256), this example uses an array of dimensions (2,3), for simplification. There are five symbols in this conversion table, and the decimal codes for these symbols in PQR code (which is being entered) and in XYZ code (which is to be output) are shown below.

Symbol	PQR Decimal Code	XYZ Decimal Code
A	2	21
B	3	22
C	4	23
D	5	24
E	6	25

The PQR/XYZ conversion table is defined in the following instruction.

```
10 DIM AI[2,3]
20 A[1,1]=21
30 A[1,2]=22
40 A[1,3]=23
50 A[2,1]=24
60 A[2,2]=25
```

The reason the two-dimensional conversion table works is because, at input instead of looking for an element with a particular subscript (as was assumed in the explanation of the one-dimensional table), the calculator looks for an element with a particular position in the array. Thus, if the PQR code for "5" is input (see above array), the calculator simply goes to the fourth element in the array and finds, in this case, the value "24" in XYZ code. In other words, the calculator doesn't look for element A(2,1); it looks for the fourth element. Conversely, if a "25", in XYZ code, is to be output, the calculator starts at the beginning of the array and counts the elements until it finds the value "25". It then outputs the number, in PQR code, corresponding to the number of elements counted, in this case "6".

Another way to express the relationship between the two subscripts and the decimal code that they represent is by using a formula. For any conversion table having dimensions (M,N), the decimal code, C, represented by the subscrips (I,J) is:

$$C = (I-1)*N+J$$

SUPPRESSING LEADING BLANKS

A special FORMAT specification causes leading blanks to be suppressed when using the OUTPUT statement. The FORMAT specifications Fw.d and Ew.d are used with w equal to 1000 and d equal to the number of decimal places to the right of the decimal point.

Example:

```
10 OUTPUT (15,20)-123.456789876
20 FORMAT F1000.9
30 END
```

```
-123.456789876
```

The value for the field width w can also be 1002 to 1014 to specify the maximum field width (2 to 14). If the value being output is too large for the field, "$" will fill the field.

Examples:

Values fit in field

```
10 OUTPUT (15,20)12345,-39
20 FORMAT 2F1007.0
30 END
```

```
12345-39
```

Values are too large for field

```
10 OUTPUT (15,20)12345,-39999
20 FORMAT 2F1005.0
30 END
```

```
$$$$$$$$$$
```

There is no field overflow when using 1000 for the field width.

This FORMAT specification works only with the OUTPUT statement.

CHAPTER 4

APPLICATIONS

This chapter contains some sample applications using the Extended I/O ROM. I/O techniques such as external data transfer, parity generation and absolute tape are explained in this chapter. 9800 Series peripherals such as the 9863A Tape Reader, the 9864A Digitizer, and the 9869A Calculator Card Reader are explained in later chapters.

EXTERNAL DATA TRANSFER

You can perform direct, byte-by-byte transfer of data from an input device to an output device without code translation.

Using an input device with select code 7 and an output device with select code 9,

```
10 WRITE (9,20)RBYTE7;
20 FORMAT B
30 GOTO 10
```

this program reads a byte of data from select code 7 and outputs the byte to select code 9 using binary format.

PARITY GENERATION

The following instructions create a parity conversion table which generates output with even parity.

```
10 DIM A[256]
20 FOR I=1 TO 256
30 A[I]=0
40 NEXT I
50 FOR I=10 TO 127
60 D=0  ←———— initialize bit counter
70 FOR J=1 TO 7
80 IF ROT(I,J)>0 THEN 100 ←— checks for one in most significant bit (neg. no)
90 D=D+1 ←———— add 1 to bit counter
100 NEXT J
110 IF BIAND(D,1)#0 THEN 140 check if D is odd or even
120 A[I]=I ←———— I has even parity
130 GOTO 150
140 A[128+I]=I←———— I has odd parity
150 NEXT I
```

PARITY GENERATION
(continued)

To use the conversion table, you would include an instruction such as the following:

```
160 OUTPUT (15,*,A)"ABCDEF12345!#$%"
```

The following instructions can be used to obtain a printout of the values in the parity conversion table.

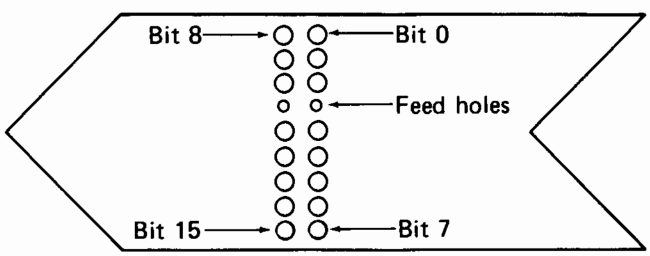
```
170 FOR I=1 TO 255 STEP 4
180 FOR J=I TO I+3
190 PRINT "A("J")="A[J];
200 NEXT J
210 PRINT
220 NEXT I
```

To create a conversion table for odd parity, statement 110 above should be changed to:

```
110 IF BIAND(D,1)=0 THEN 140
```

ABSOLUTE TAPE

Absolute tape contains instructions or data in word lengths, (2 bytes of 8 bits each) where each word is represented by two frames on the paper tape as follows:



Assuming select code 9 for the tape reader, the instruction for the calculator to read one word (two frames) from the tape into X would be:

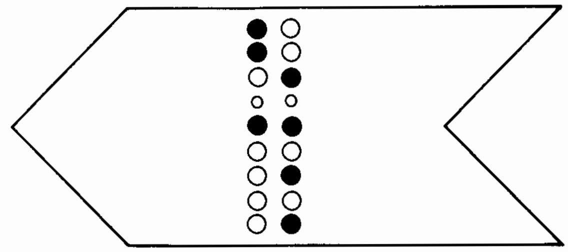
```
50 X=INOR(ROT(RBYTE9,8),RBYTE9)
```

To simplify explanation of the preceding statement, let us use A and B as temporary variables and separate the operations in the above instruction into separate program steps:

```
1 B=RBYTE9
2 A=ROT(B,8)
3 B=RBYTE9
4 X=INOR(A,B)
```

For the sample data word at right, the binary representation of B after step 1 would be:

```
  BYTE      BYTE
00000000  00001011
```



A Sample Data Word

One byte is read from the tape into the low-order bits of B. The high order bits (15-8) of B are initialized to zero.

The rotation, step 2, causes the following result in A.

00001011   00000000

When the second frame is read, the following result is contained in B.

00000000   10101100

The inclusive OR logic operation in step 4 yields the final result in X.

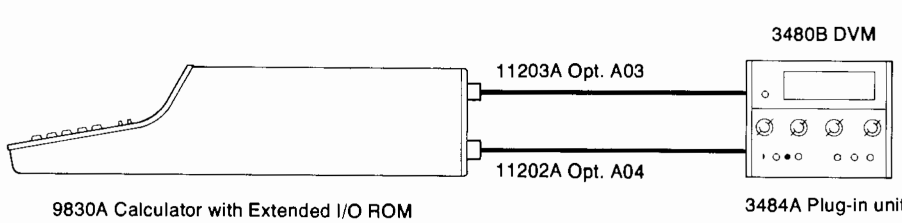
00001011   10101100

In octal code, this result is 005654; in decimal code, this is 2988.

EXTENDED I/O FOR INTERFACING

When entering data from peripherals such as voltmeters, frequency counters, and other measurement devices, the ENTER statement and RBYTE function are necessary. When outputting data to peripheral devices, the OUTPUT statement and WBYTE function are useful. The OUTPUT and WRITE statement are much alike, however, code conversion (see page 3-11) can only be done with the OUTPUT statement.

The following example illustrates the use of the ENTER statement for entering data samples from a digital voltmeter. The block diagram below shows the interface of a 9830A Calculator to an HP 3480B Digital Voltmeter and 3484A Multifunction Unit. The 11203A BCD Interface, which connects to the 3480B Digital Voltmeter, takes data from the 3480B and sends it to the calculator. The 11203A General Purpose Interface, which connects to the 3480A Plug-in unit, sends remote programming signals to the 3484A.



EXTENDED I/O FOR INTERFACING

(continued)

In the program section below, first an "@" character is sent to the 3484A to set the DC millivolt range. Then 5000 samples are taken. Line 60 sums the voltages for use in another part of the program.

The data-input rate for this program is about 21 samples per second. If a slower sampling rate is desired, a WAIT statement could be added to the program. For example, if about 10 samples per second is desired, WAIT 50 would be entered as line 55.

```
10 FORMAT B ◄────────── Dummy format used to suppress CR/LF in line 20
20 WRITE (1,10)"@";     { Sets millivolt range of 3484A plug-in unit at select code 1
                        { semicolon used to suppress CR/LF.
30 X=0 ◄─────────────── Initialize accumulator
40 FOR I=1 TO 5000
50 ENTER (2,*)A,B ◄──── Enter function code "A" and voltage sample "B"
60 X=X+B ◄───────────── Sum voltage
70 NEXT I
•
•
•
```

CHAPTER 5

9863A TAPE READER CONTROL

The HP Model 9863A Tape Reader is controlled by using the ENTER statement or RBYTE function described in Chapter 3. Numeric data can be used as input to the calculator, and, if the HP 11274B String Variables ROM is installed, alphabetic data can also be processed. Although the Extended I/O ROM is not necessary, programs can be entered from the 9863A Tape Reader.

NORMAL MODE

Although non-ASCII coded tape can be used with the 9863A Tape Reader, the examples in this section apply only to the use of ASCII coded tape. You can refer to "Conversion Tables" in Chapter 3 for information about the use of non-ASCII coded tape. Also, if you plan to use the tape reader for external data transfer, you can refer to "External Data Transfer" in Chapter 4.

Each ENTER statement causes a record to be read. A record is a sequence of data items separated by commas or semicolons, which ends with a line feed (LF). Commas and semicolons are called character delimiters; the line feed is called the record delimiter. For example, this sequence of ASCII characters is from a tape. Two records are shown:

12.8, −300, .99, 5E6 (LF) 15.0, 198, .32, 1.99E-6 (LF)

This short program reads and prints the individual data items:

Program:

```
10 DIM Y[4]
20 FOR I=1 TO 2
30 ENTER (7,*)(FORJ=1TO4,Y[J])
40 PRINT Y[1],Y[2],Y[3],Y[4]
50 NEXT I
60 END
```

Output:

```
12.8          -300          0.99          5000000
15             198          0.32          1.99000E-06
```

In the program, free-field format is used. Since commas are used to separate the data, there is no problem. But, to read a record which contains only numbers, such as:

972193425 (LF) 693345786 (LF) 667238425 (LF)

a different format specification would have to be used. If the numbers have 3 characters each, 3 numbers are contained in each record. To read the above 3 records, the following program could be used.

NORMAL MODE
(continued)

Program:

```
10 FOR I=1 TO 3
20 ENTER (7,30)A,B,C
30 FORMAT 3F3.0
40 PRINT A,B,C
50 NEXT I
60 END
```

Output:

```
972          193          425
693          345          786
667          238          425
```

In line 30, 3 characters are read; no numbers to the right of the decimal point are specified.

Using Strings

Alphabetic data can be entered if the 11274B String Variables ROM is installed in the calculator. This example shows how to enter string variable data into the calculator. The following alphanumeric characters are entered as strings:

ROGERS,ΔJOHNΔHT5-10,WT160 (LF) SMITH,ΔARTHURΔHT6-2,WT230(LF)

This program enters and prints the two records:

```
10 DIM A$[80]
20 FOR I=1 TO 2
30 ENTER (7,*)A$
40 PRINT A$
50 NEXT I
60 END
```

Output:

```
ROGERS, JOHN HT5-10,WT160
SMITH, ARTHUR HT6-2,WT230
```

The line feed (LF) is the string delimiter. Note that commas are interpreted as part of the string that is entered. To enter mixed string and numberic data, such as student names followed by grades:

ROGERS,ΔJOHNΔΔΔ80,75,83(LF)SMITH,ΔARTHURΔΔΔ90,93,88 (LF) this program can be used:

```
10 DIM A$[80]
20 PRINT "NAME"," ","AVG."
30 OUTPUT (15,40)
40 FORMAT 34"="
50 FOR I=1 TO 2
60 ENTER (7,*)A$[1,16],A,B,C
70 FIXED 0
80 PRINT A$,(A+B+C)/3
90 NEXT I
100 END
```

Output:

```
NAME                          AVG.
==================================
ROGERS, JOHN                  79
SMITH, ARTHUR                 90
```

In line 60, only 16 characters are entered into A$, then the numbers A, B, and C are entered. In line 80, the student name, A$, and the average of A, B, and C are printed.

PAPER TAPE PROGRAM STORAGE

The Extended I/O ROM is not needed to store programs on paper tape. Using the LIST# command, programs can be punched on paper tape. Then, with the 9863A tape reader, the PTAPE# command can be used to re-enter the program into the calculator. For example, store this short program in the calculator.

```
10 FOR I=1 TO 10
20 PRINT I
30 NEXT I
40 END
```

If a tape punch is at select code 2, then LIST#2 would store the program on paper tape. At a later time, the program can be re-entered into the calculator from the 9863A tape reader at select code 7. To do this, execute PTAPE# 7 when the tape reader is in NORMAL mode.

DATA MODE

The 9863A Tape Reader can be used in the data mode if a conversion table is used (see Conversion Tables in Chapter 3). A conversion table is necessary because the apostrophe (decimal 39) is sent as the end of character delimiter instead of the comma (decimal 44), and a comma (decimal 44) is sent to the calculator as the record delimiter instead of a line feed (decimal 10). The following lines generate the necessary conversion table:

```
10 DIM A[70]
20 FOR I=1 TO 70
30 A[I]=I
40 NEXT I
50 A[44]=10
```

In data mode, only numerics, plus and minus signs, and the letter E (decimal 69) for exponents are allowed. For this reason, only 70 characters are needed. In line 50, A(44) = 10 converts the decimal equivalent of a comma to the decimal equivalent of a line feed. The ENTER statement used would appear as follows:

```
60 ENTER (7,*,A)   (variables)
```

select code — free-field format — conversion table

The following example illustrates the use of the 9863A Tape Reader in data mode.

Data entered:

1.3,2-9,3,,4(LF)B1,2,3E5,+2(LF)

Program:

```
10 DIM A[70]
20 PRINT " A";" B";" C";" D";" E"
30 FOR I=1 TO 70
40 A[I]=I
50 NEXT I
60 A[44]=10
70 FOR I=1 TO 2
80 ENTER (7,*,A)A,B,C,D,E
90 PRINT A,B,C,D,E
100 NEXT I
110 END
```

Output:

```
A        B              C         D      E
1.3      2.00000E-09    3         4      0
1        2              300000    2      0
```

CHAPTER 6

9864A DIGITIZER CONTROL

The HP 9864A Digitizer is controlled by using the ENTER statement to accept data samples from the digitizer and by using the WRITE or OUTPUT statement to activate a BEEP sound. In these examples, we will assume the digitizer select code is 9.

THE "BEEP"

A WRITE or OUTPUT statement will cause the digitizer to sound its audible tone, which lasts about one-tenth of a second.

A series of these statements, when separated by WAIT or DISPLAY statements, produce a pattern of "beeps" which can be used to signal the operator during program operation.

The following statement causes a single "beep":

```
30 WRITE (9,*)
```

These program instructions produce a pattern of "beeps":

```
20 FOR I=1 TO 10
30 WRITE (9,*)
40 WAIT 100
50 NEXT I
```

DATA SAMPLES

The ENTER statement accepts X and Y coordinates from the digitizer and assigns the corresponding values to the variables specified.

```
60 ENTER (9,*)X,Y
```

When an ENTER statement is encountered, the calculator waits for a data sample to be sent from the digitizer.

If the digitizer is in the continuous mode when the ENTER statement is encountered, a data sample is sent immediately. However, if the digitizer is not in the continuous mode, then the data is not sent until either [S] or [C] (on the cursor) is pressed.

The maximum rate at which data samples can be transferred to the calculator is approximately 32 samples per second. Since the sample rate may be considerably slower because of program execution time, the operator must take care to move the cursor slowly in order to obtain the maximum practical sample density. The effects of sample rate and sample density are discussed in the Digitizer Peripheral Manual.

Example:

```
10 DIM A[256,2]
20 FOR I=1 TO 256
25 WRITE (9,*)
30 ENTER (9,*)A[I,1],A[I,2]
40 NEXT I
```

} takes approximately 13 seconds to run.

In the above example, data samples are stored in Array A. Column 1 of Array A contains X values, and column 2 contains Y values. A BEEP is added in line 25 to alert the operator that a data sample is about to be taken.

THE STOP KEY

If STOP is pressed while data samples are being taken from the digitizer, the ENTER operation is terminated and the continuous mode, if in effect, is deactivated.

THE SAMPLE DATA OVERLAY

Attach the Sample Data Overlay supplied with your digitizer to the platen (see Figure 6-1) and tape down all four corners of the overlay.

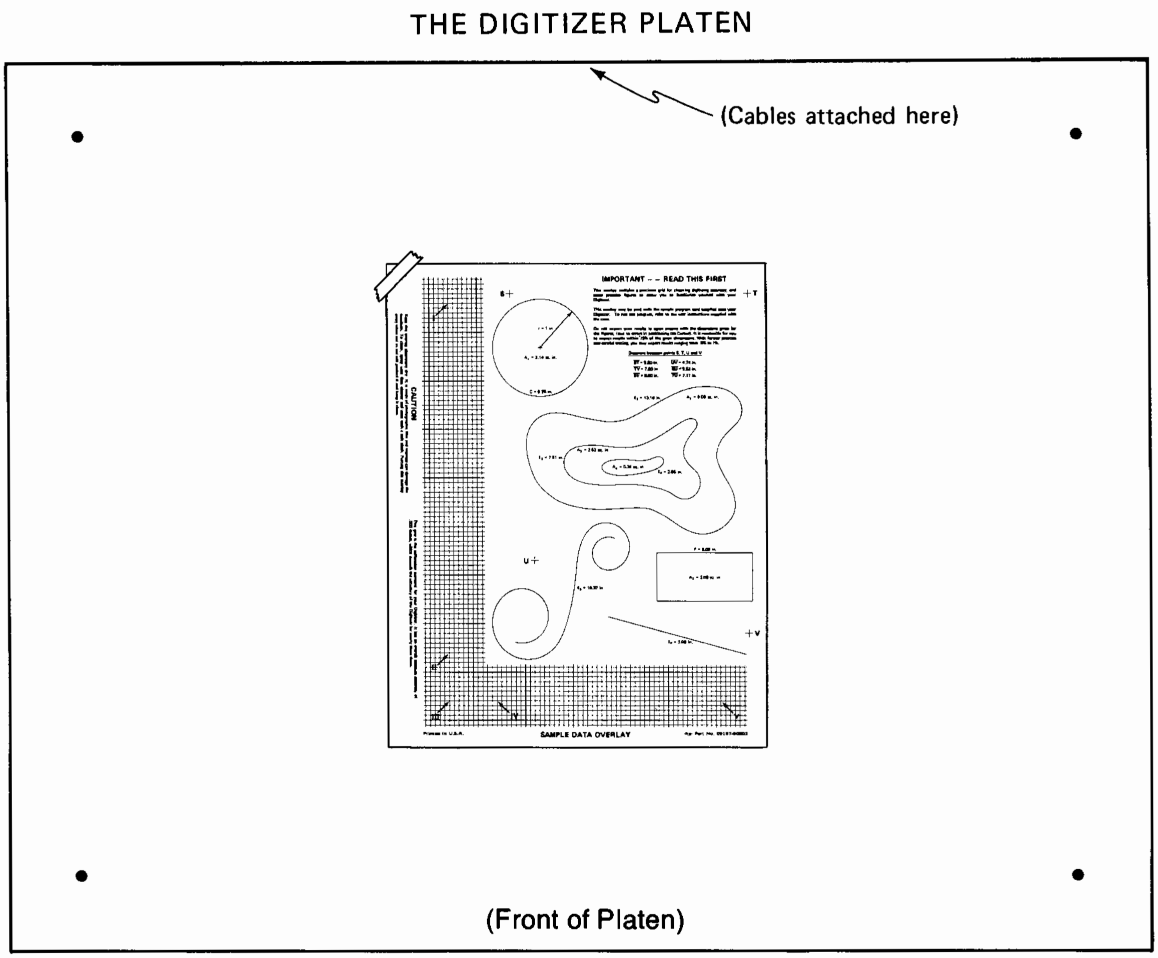


Figure 6-1. Document Alignment Procedure

To set the origin, press [O] on the cursor, with the cross-hairs over point U on the overlay.

Key in the following program:

```
10 WRITE (9,*)
20 ENTER (9,*)X,Y
30 PRINT X,Y
40 GOTO 10
```

Run the program by pressing RUN EXECUTE. The calculator is now waiting for a data sample from the digitizer. Press [S] several times; the digitizer supplies one data sample each time [S] is pressed.

To take continuous samples, first press [C] . Then slowly slide the cursor across the digitizing area (the corners of the digitizing area are indicated by the black dots on the platen). To stop continuous sampling, press [C] again.

To stop the program, press STOP.

DOCUMENT ALIGNMENT

The following program can be used to align a document on the digitizing surface.

```
10 ENTER (9,*)X,Y
20 IF X>0.1 THEN 80
30 IF X<-0.1 THEN 80
40 IF X#0 THEN 70
50 WRITE (9,*)
60 WAIT 100
70 WRITE (9,*)
80 DISP X;Y
90 GOTO 10
100 END
```

1. Attach the Sample Data Overlay (or any other document which is to be digitized) to the digitizing surface, as shown in Figure 6-1.

2. Place the cursor cross-hairs over point 1 (the upper left-hand corner of the document) and press [O] . Slide the cursor over to point 111 (the lower left-hand corner of the document) then, with the above program running in the calculator, position the cross-hairs **exactly** over point 111; press [C] . If point 111 is positioned exactly over the X axis, the digitizer will "beep" slowly. Whenever point 111 is positioned exactly over the X axis, the digitizer will "beep" more rapidly. Slowly move the cursor and the overlay (together) either right or left until the display equals .00 and the audible signal indicates alignment.

3. Without moving the overlay, tape the remaining three corners of the overlay (or document) to the platen. If necessary, retape the first corner.

4. Verify that the X axis of the document is in precise alignment with the platen by noting the display when the cross-hairs are positioned alternately over points 1 and 111 (return to step 2 if the X axis is not precisely aligned).

CHAPTER 7

9869A CARD READER CONTROL

The HP 9869A Card Reader can be used with the Extended I/O ROM. In addition to the standard features of the Extended I/O ROM, however, the Batch ROM, 11278B enables the reader to stack a number of separate programs and read educational basic data processing cards (HP 9320-2051). Also with the Batch ROM, fewer program statements are required (see the Batch Basic ROM Manual, part number 09830-90011).

The reader inputs information, which is stored on punched or marked data processing cards, to the 9830A Calculator at a rate of up to 300 cards per minute. Accessability to a key punch machine is a major factor in choosing which method of marking a card to use. See the 9869A Peripheral Manual for instructions on marking cards.

While the reader was developed primarily to read data from cards, it is possible to read program statements from cards. See "Running A Program", at the end of this chapter.

Although the reader reads the information on each data card only once before routing it to the output hopper, the data stored on one card can be used more than once because of two temporary memory storage locations called buffers. When power is switched on, the buffers are empty. They can be loaded with the first WRITE input statement (see page 7-2) and emptied with an ENTER statement, which transfers the information from the buffers to the calculator.

As mentioned in Chapter 3, I/O OPERATIONS, the ENTER statement enables the calculator to receive data from the reader. This empties the buffer automatically. If the incoming data is not in ASCII code, conversion to ASCII code may be included in the ENTER statement through the use of an optional conversion table parameter. Also, optional FOR parameters may be used to input multiple data from one data processing card into an array (see page 3-2). Each data processing card is considered a record and no line feed (LF) characters are needed to inform the calculator that a card (record) is complete.

Syntax:

ENTER (select code, format [,conversion table]) list

The ENTER statement causes the data on one card to be read from the reader. In the examples that follow, it is assumed that the reader select code is 1. See the 9869A Peripheral Manual for instructions on changing the select code. Also, see page 5-2 in this manual for information concerning the use of strings with the 9869A Card Reader.

OPERATING MODES

The reader responds to specific statement instructions by using operating modes. These modes instruct the reader how to pick and how to read cards. The card reader operates in a specified mode until it is instructed to switch modes. Each mode is represented by an alpha control character which is programmed either from the keyboard or from program cards.

The WRITE statement is used to set the operating mode of the card reader.

Syntax:

WRITE (select code,*)"alpha control character"

The following modes are represented by their respective alpha control characters:

Demand	D - to pick cards one at a time.
Continuous	C - to pick cards repeatedly.
Image	I - to transmit information from custom-made cards.
Normal	N - to transmit standard hollerith data cards.

The following functions are represented by their respective alpha control characters:

Reject/Select	J - to sort cards.
Bell	B - to ring the bell.
Abort	A - to abort the data on a card.
Stop	S - to deactivate the reader.
Retransmit	T - to re-use the data on a card.

See page 7-10 for more on the five functions above.

Demand Mode

In the DEMAND mode, cards are picked from the card deck one at a time.

The WRITE "D" statement switches the reader from any mode it is presently in to the DEMAND mode and activates the card reader. Once the card reader is activated, or ready, it remains ready. The green ready light indicates the card reader's status.

The WRITE statement is used as an input statement and the alpha control character, D, must be used to indicate the DEMAND mode.

The following statement causes the card reader to pick a single data card unless the input card hopper is empty, the output card hopper is full, or the buffer is full:

```
10 WRITE (1,*)"D"
```

In the statement above, the number 1 is the card reader's select code and the symbol, *, indicates a free-field input format. Notice that the control character, D, is written within quote marks to inform the card reader that the statement is an input instruction - in this case a DEMAND statement - not a simple WRITE output statement.

> **NOTE**
> Do not hold the SHIFT key down while pressing an alpha character key because this will result in the card reader interpreting a lower case letter. The card reader can differentiate between upper and lower case and it will ignore all statements with lower case letters. For example, in the statement above, the SHIFT key was used to enter both sets of quotation marks, but was released in order to enter the upper case D.

This statement must be executed each time a card is to be picked from the input card hopper. The card reader buffer must be empty before the WRITE "D" statement can be executed.

> **NOTE**
> The reader will try to pick a card when instructed to do so. If the reader does not sense that a card has been picked, it will try to pick two more times. If the reader fails to pick a card successfully by this time, it will become deactivated or "not ready". The status line will be set at 1 and the yellow "PICK FAIL" light will be switched on. The PICK FAIL light can be switched off by pressing the STOP key on the calculator keyboard. After removing the defective card, press the CONT key and the EXECUTE key on the calculator keyboard.

The following program causes the reader to transmit three data elements per card to the calculator. The calculator, in turn, instructs the printer to print this data after each card is read:

```
10 WRITE (1,*)"D"
20 ENTER (1,50)X,Y,Z
30 PRINT X,Y,Z
40 GOTO 10
50 FORMAT 3F10.2
60 END
```

It is necessary to instruct the reader to pick another data card after each ENTER statement (line 20) empties the buffer. This is accomplished with the GOTO statement (line 40).

> **NOTE**
> The display will show: ERROR 83 IN LINE 20 when the reader is finished reading cards (i.e., when the input hopper is empty or the output hopper is full).

OPERATING MODES
(continued)

The ERROR 83 display message can be avoided by including a test and a dummy data card for the last card read. The following program tests for the dummy data card on which the data is 1E99.

```
10 WRITE (1,*)"D"
20 ENTER (1,60)X,Y,Z
30 IF X=1E+99 THEN 70
40 PRINT X,Y,Z
50 GOTO 10
60 FORMAT 3F10.2
70 END
```

If a dummy data card is not used and additional cards are to be input, load the cards and press the CONT key and the EXECUTE key.

Continuous Mode

The CONTINUOUS mode is used to pick cards from the input card hopper continuously without being further instructed.

The WRITE (1,*)"C" statement switches the reader from any mode it is presently in to the CONTINUOUS mode and activates the reader. The green ready light indicates when the reader is activated.

The following statement causes the reader to pick data cards continuously until the input hopper is empty, the output hopper is full, or the buffer is full:

```
10 WRITE (1,*)"C"
```

The CONTINUOUS mode is faster than the DEMAND mode for inputting data. But a data card can be retransmitted, rejected, or aborted in the DEMAND mode only.

The following program causes the reader to transmit three data items on cards to the calculator. The calculator, in turn, instructs the printer to write this data:

```
10 WRITE (1,*)"C"
20 ENTER (1,50)X,Y,Z
30 PRINT X,Y,Z
40 GOTO 20
50 FORMAT 3F10.2
60 END
```

Notice that once the reader has been instructed to pick cards in the CONTINUOUS mode (line 10), there is no need to instruct it to pick individual cards again. The ENTER statement, however, must be re-executed for each card to clear the first buffer. This is accomplished by the GOTO statement (line 40).

Image Mode

In the IMAGE mode, the reader transmits the binary image of the cards in two 6-bit bytes directly to the calculator, without first converting it to ASCII code.

This mode makes it possible to input custom-made cards as well as standard hollerith cards. The number of possible combinations in this mode is 4,096 per column.

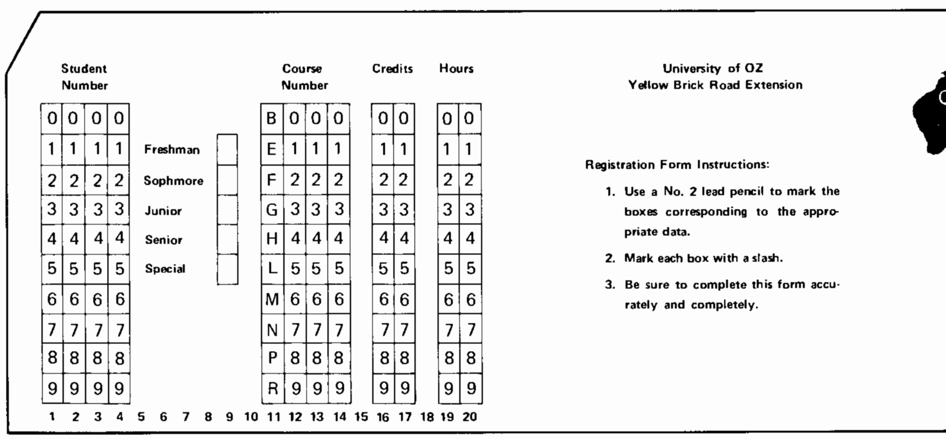
The alpha control character, I, must be used to indicate the IMAGE mode.

The following program causes the reader to switch to the IMAGE mode and pick custom-made cards one at a time.

Example:

The registrar of a small university wants to know how many hours of courses the average part-time student takes per week in one semester.

The registrar designed his own 40-column class registration cards to look like this:



The following program finds the average number of hours per week taken by part-time and full-time students. The program also lists cards in a reject column on which one column is marked more than once or on which the total number of hours per week is greater than 40. The 11274B String Variables ROM is required to run this program.

- **Initialize Program**

```
10 DIM A$[40],B$[13],C$[13],D$[12]
20 A=A0=E=F1=F2=P1=P2=0
30 B$=" +-0123456789"
40 C$="   BEFGHLMNPR"
50 D$="  FRSOJUSESP"
60 PRINT "CARDS:"
70 PRINT "REJECTED"TAB50"REPORTED"
80 PRINT
90 WRITE (1,*)"I"
```

The above program segment dimensions and defines the strings which will be used, sets the counters and flags to zero, prints headings, and sets the card reader to the IMAGE mode.

OPERATING MODES

(continued)

- **Read Card**

```
100 WRITE (1,*)"D"
110 FOR J=1 TO 20
120 X=INOR(ROT(RBYTE1,10),RBYTE1)
130 IF X=28 THEN 530
140 FOR I=11 TO 0 STEP -1
150 IF X >= 2↑I THEN 170
160 NEXT I
170 IF X=2↑I OR I=-1 THEN 220
180 A$[J,J]="$"
190 I=-1
200 E=1
210 GOTO 240
220 IF J=9 OR J=11 THEN 260
230 A$[J,J]=B$[I+2]
240 NEXT J
```

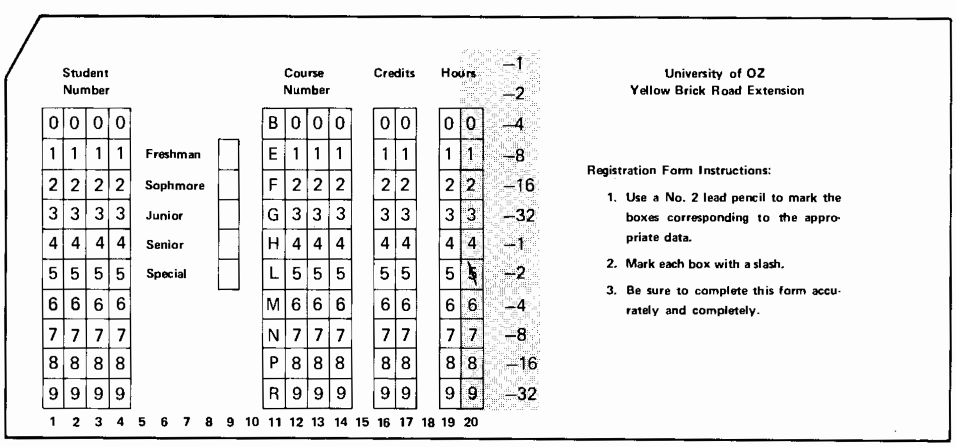
The above program segment picks a card and reads the first 20 columns, one by one. Line 120 combines two bytes of the 6 data bits to make 12 rows per column (see explanation below). It then tests whether this is the last data card (i.e., whether 0, 1, and 2 are marked in column 1), searches for a mark on each column and assigns a value from 2^0 to 2^{11} for each mark.

The program exits from the loop when a mark is found in the Jth column. The digit that matches the mark in each column is stored in the string, A$, as it is interpreted. The program will store a dollar sign ($) in the Jth column if there are two or more marks in it. If no mark is found, the error flag is set to its "on" position and variable I is set to −1 (a "no mark" value). At this point, the reader is instructed to read the card's next column. If a mark was made on the 9th or 11th column, a special character string is inserted instead of a digit.

Line 120 [X = INOR(ROT(RBYTE1,10),RBYTE1)] can be understood more easily when broken down as follows:

The reader reads two 6-bit bytes per column. The first byte consists of marks in rows 4 through 9 and the second byte includes the marks on the remaining rows in the column.

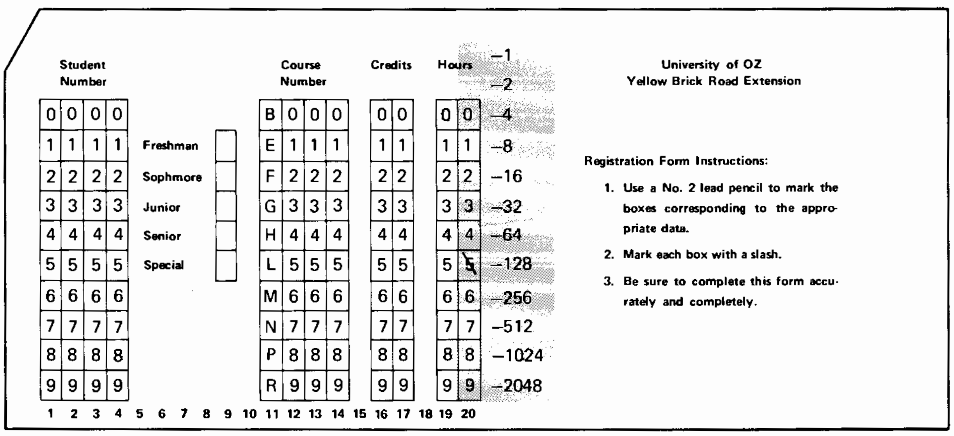
In binary code, marks in the rows of a column represent the following values:



When row 5 is marked on column 20 (above), the following intermediate results are obtained:

Operation	Resulting Intermediate Value
RBYTE1	2
ROT(2,10)	128
RBYTE1	0
INOR(128,0)	128

Notice that ROT(2,10) changes the value of the mark in row 5 from 2 to 128, as follows:



Line 120 defines X = 128 in this example. This value represents a binary code which is unique for any possible combination of marks on the column. In effect, line 120 has transformed a mark on row 5 to number 128.

OPERATING MODES

(continued)

• **Check Data**

```
250 GOTO 330
260 IF J=11 THEN 310
270 IF I>2 AND I<8 THEN 290
280 I=2
290 A$[7,9]=D$[(I-1)*2-1,(I-1)*2]
300 GOTO 240
310 A$[J,J]=C$[I+2]
320 GOTO 240
330 IF E THEN 460
340 IF A$[19,20]<"00" THEN 490
350 IF A$[19,20]>"40" THEN 490
360 PRINT TAB50,A$
370 WRITE (1,*)"A"
380 A=A+1
390 IF VAL(A$[19,20])<12 THEN 430
400 F1=F1+1
410 F2=F2+VAL(A$[19,20])
420 GOTO 100
430 P1=P1+1
440 P2=P2+VAL(A$[19,20])
450 GOTO 100
```

The above program segment instructs the reader to continue the program after the 20th column has been read. It checks for whether "Freshman," "Sophomore," "Junior," "Senior," or "Special" has been marked, sets column 11 to the proper course letter and determines whether the number of hours per week is greater than 40 or is not properly marked.

Time can be saved by instructing the reader to disregard the last 20 columns on each card since no information is included there. For this reason, an abort statement is used (lines 370, 500, 630). See Abort section, later in this chapter.

This program segment also performs statement 400 for cards which represent full-time students (12 or more hours per week) or statement 430 for part-time students. These statements keep a running total of full-time hours and part-time hours as well as the number of full-time and part-time students. After this information is stored, the reader picks another card.

• **Print Data**

```
460 PRINT "***";A$;"*** DOUBLE MARKINGS ***"
470 E=0
480 GOTO 500
490 PRINT "***";A$;"*** ERROR IN COL. 19-20 ***"
500 WRITE (1,*)"A"
510 A0=A0+1
520 GOTO 100
530 PRINT
540 PRINT "TOTAL CARDS READ=";A+A0;"REPORTED=";A
550 PRINT
560 IF  NOT P1 THEN 580
570 PRINT "PART-TIME=";P1;"HRS=";P2;"AVERAGE/STUDENT=";P2/P1
580 IF  NOT F1 THEN 600
590 PRINT "FULL-TIME=";F1;"HRS=";F2;"AVERAGE/STUDENT=";F2/F1
600 PRINT
610 PRINT "TOTAL STUDENT CLASS HOURS=";F2+P2
620 PRINT
630 WRITE (1,*)"A"
640 PRINT "DONE"
650 END
```

The above program segment instructs the printer to print a diagnostic message (either "DOUBLE MARKINGS" or "ERROR IN COL. 19-20") for rejected cards on the left side of the page and prints accepted cards on the right side of the page. the printer also records the number of cards read and accepted, the number of part-time and full-time students, the total number of hours per week for full-time and part-time students, the average number of hours per student per week and, finally, the total number of hours per week.

The reader will remain in the IMAGE mode until a NORMAL statement is received or the calculator STOP key is pressed.

Normal Mode

In the NORMAL mode, the reader converts the data on 128 character hollerith cards to ASCII code, before transmitting them to the calculator. Standard data processing cards can be used in this mode.

The reader is initialized to the NORMAL mode when the calculator STOP key is pressed or when power is turned on. The NORMAL mode can be set also with an appropriate statement.

The alpha control character, N, must be used to indicate the NORMAL mode.

The following statement causes the reader to switch to the NORMAL mode:

```
10 WRITE (1,*)"N"
```

CARD READER FUNCTIONS

Once one or two operating modes have been determined, it is possible to instruct the reader to perform a number of other functions. Each function must be re-executed each time it is to be performed.

The following functions are represented by their respective alpha control characters:

Reject/Select	J - to sort cards.
Bell	B - to ring the bell.
Abort	A - to abort the data on a card.
Stop	S - to deactivate the reader.
Retransmit	T - to re-use the data on a card.

Once again, the WRITE statement is used to indicate which function the reader is performing.

Syntax:

WRITE (select code, *) "alpha control character"

Reject/Select Function

The WRITE "J" statement is used to sort data cards and can be executed only if the reader includes Option 002, reject hopper.

REJECT/SELECT can be used only when the reader is in the DEMAND mode.

The following program causes the reader to sort all data cards on which variable X is negative or zero:

```
10 WRITE (1,*)"D"
20 ENTER (1,60)X,Y,Z
30 IF X>0 THEN 50
40 WRITE (1,*)"J"
50 GOTO 10
60 FORMAT 3F10.2
70 END
```

The display will show: ERROR 83 IN LINE 20 when the input hopper is empty or the reject hopper is full (approximately 40 cards). Unload the reject hopper and press the CONT key and the EXECUTE key on the calculator keyboard to continue the current program.

> **NOTE**
> Since the last data processing card cannot be rejected under any circumstances, a blank dummy card should be added to the end of the card deck. In this way, the last actual data card can be rejected and the dummy card will be routed to the output hopper automatically.

Bell Function

The WRITE "B" statement is used to signal the operator that a condition of the system has been reached; it can be executed only if the reader includes Option 004, bell.

The following program causes the reader to ring its bell after each group of 10 data cards has been read:

```
10 WRITE (1,*)"C"
20 FOR I=1 TO 10
30 ENTER (1,70)X,Y,Z
40 NEXT I
50 WRITE (1,*)"B"
60 GOTO 20
70 FORMAT 3F10.2
80 END
```

Abort Function

The WRITE "A" statement is used to ignore the data stored on a data card under certain conditions. See the sample program in the IMAGE section.

The ABORT function can be executed at any time in the program, but only when the reader is in the DEMAND mode.

The following program causes the reader to abort the data on a card if variable X is negative and print the data if the first data element is positive:

```
10 WRITE (1,*)"D"
20 ENTER (1,80)X,Y,Z
30 IF X<0 THEN 60
40 PRINT X,Y,Z
50 GOTO 10
60 WRITE (1,*)"A"
70 GOTO 10
80 FORMAT 3F10.2
90 END
```

NOTE

If the ABORT function is received before the contents of a card are completely read, the remaining data on the card is aborted (i.e., not transmitted). The entire aborted card's data is stored in the second buffer and can be re-used if needed. (See Retransmit section, below.)

CARD READER FUNCTIONS
(continued)

Stop Function

The WRITE "S" statement can be executed at any time in the program. It is used to deactivate the reader and clear the buffers.

In the DEMAND mode, the reader will finish transmitting the present card's data and then stop. In the CONTINUOUS mode, picking stops, but transmission of data continues until the buffer is empty.

The following program stops the reader and clears the buffers when the first negative data element appears in variable X and prints the data when variable X is equal to or greater than zero.

```
10 WRITE (1,*)"C"
20 ENTER (1,70)X,Y,Z
30 IF X<0 THEN 60
40 PRINT X,Y,Z
50 GOTO 20
60 WRITE (1,*)"S"
70 FORMAT 3F10.2
80 END
```

Retransmit Function

The WRITE "T" statement is used to enter the data from a particular card more than one time. It can re-use data on a card after the card is aborted or after other data on the same card has been used since the data remains in the second buffer until another card is read.

RETRANSMIT can be used only when the reader is in the DEMAND mode. It will re-use the data on the last card only.

The following program instructs the reader to retransmit and print the data on each card five times before reading the next data card.

```
10 WRITE (1,*)"D"
20 ENTER (1,100)X
30 FOR I=1 TO 5
40 WRITE (1,*)"T"
50 ENTER (1,*)Y
60 PRINT Y
70 NEXT I
80 GOTO 10
90 END
100 FORMAT F5.0
```

Two or more alpha control characters can be included in the same WRITE statement providing the characters do not cancel each other out. It is possible, for example, to write a program which would reject a card and simultaneously ring the bell when the first data element on that card is negative or zero by using a WRITE(1,*) "JB" statement, as follows:

```
10 WRITE (1,*)"D"
20 ENTER (1,60)X,Y,Z
30 IF X>0 THEN 50
40 WRITE (1,*)"JB"
50 GOTO 10
60 FORMAT 3F10.2
70 END
```

Conflicting alpha control characters ("IN" or "DC") cannot be contained in one WRITE statement in this manner.

RUNNING A PROGRAM

If the reader is to be used only to transfer data from cards to the calculator, the program can be input from the calculator keyboard. Be sure the data cards are stacked in the input hopper of the reader. Once the program is keyed in, press the RUN key and the EXECUTE key to pick and read the data cards and run the program.

The card reader can also be used to input program cards, as well as data cards. When using it to input program cards, the PTAPE# command is keyed in and executed.

Syntax:

PTAPE# select code

Each card can contain only one program statement with a line number because a line feed code (decimal 10) is sent at the end of each card. This code is the same as if the END OF LINE key was pressed from the calculator keyboard.

The CONTINUOUS PICK button on the front of the reader must be pressed after the PTAPE# statement is executed to pick the first card. Be sure the RUN statement is on the last card so that the program will be executed automatically.

NOTES

APPENDIX

STANDARD SELECT CODES

These select codes are the ones set by the factory.

Model #	Description	9830A Select Code
2570A	Coupler/Controller	4
9860A	Card Reader	12
9861A	Typewriter (11201A Interface)	15*
9862A	Plotter	14
9863A	Tape Reader	7*
9864A	Digitizer	9*
9865A	Cassette Memory	5
9866A	Thermal Printer	15
9867A/B	Mass Memory	11
9869A	Hopper Card Reader	1* 2
9870A	Card Reader	12
11202A	TTL Interface	1
11203A	BCD Input Interface	3*
11205A	Serial I/O Interface, RS-232-C	15*
11206A	Modem Interface	4*
11282A	Incremental Plotter Interface	14*
11284A	Data Communications Interface	1
59405A	HP Interface Bus	13
09830-67960	Internal Cassette Memory (9830A)	10

*These select codes are resettable.

Exceptions:

9861A - Select code 15 is hardwired on 11201A's with Serial Numbers lower than 1142A-00321.

9866A - Select code 15 is hardwired in the 9830A. No interface card is necessary to connect the 9830A to the 9866A.

11282A - Select code 14 is on position 0 of a select code switch. The 11282A can therefore have alternate select codes of one through nine.

Table A-1. ASCII character codes.

ASCII Char.	EQUIVALENT FORMS			KEY
	Binary	Octal	Dec [2]	9830A
NULL	00000000	000	0	—
SOH	00000001	001	1	—
STX	00000010	002	2	—
ETX	00000011	003	3	—
EOT	00000100	004	4	—
ENQ	00000101	005	5	—
ACK	00000110	006	6	—
BELL	00000111	007	7	—
BS	00001000	010	8	—
HTAB	00001001	011	9	—
LF	00001010	012	10	—
VTAB	00001011	013	11	—
FF	00001100	014	12	—
CR	00001101	015	13	—
SO	00001110	016	14	—
SI	00001111	017	15	—
DLE	00010000	020	16	—
DC_1	00010001	021	17	—
DC_2	00010010	022	18	—
DC_3	00010011	023	19	—
DC_4	00010100	024	20	—
NAK	00010101	025	21	—
SYNC	00010110	026	22	—
ETB	00010111	027	23	—
CAN	00011000	030	24	—
EM	00011001	031	25	—
SUB	00011010	032	26	—
ESC	00011011	033	27	—
FS	00011100	034	28	—
GS	00011101	035	29	—
RS	00011110	036	30	—
US	00011111	037	31	—

ASCII Char.	EQUIVALENT FORMS			KEY [1]
	Binary	Octal	Dec [2]	9830A
space	00100000	040	32	[Space Bar]
!	00100001	041	33	[SHIFT] [!/1]
"	00100010	042	34	—
#	00100011	043	35	[SHIFT] [#/3]
$	00100100	044	36	[SHIFT] [$/4]
%	00100101	045	37	[SHIFT] [%/5]
&	00100110	046	38	[SHIFT] [&/6]
'	00100111	047	39	[SHIFT] ['/7]
(	00101000	050	40	[(]
)	00101001	051	41	[)]
*	00101010	052	42	[*]
+	00101011	053	43	[+]
,	00101100	054	44	[,]
−	00101101	055	45	[−]
.	00101110	056	46	[.]
/	00101111	057	47	[/]
Ø	00110000	060	48	[0]
1	00110001	061	49	[1]
2	00110010	062	50	[2]
3	00110011	063	51	[3]
4	00110100	064	52	[4]
5	00110101	065	53	[5]
6	00110110	066	54	[6]
7	00110111	067	55	[7]
8	00111000	070	56	[8]
9	00111001	071	57	[9]
:	00111010	072	58	[*/:]
;	00111011	073	59	[+/;]
<	00111100	074	60	[SHIFT] [</,]
=	00111101	075	61	[=]
>	00111110	076	62	[SHIFT] [>/.]
?	00111111	077	63	[SHIFT] [?//]

ASCII Char.	EQUIVALENT FORMS Binary	Octal	Dec [2]	KEY [1] 9830A
@	01000000	100	64	(SHIFT) (RESULT)
A	01000001	101	65	(A)
B	01000010	102	66	(B)
C	01000011	103	67	(C)
D	01000100	104	68	(D)
E	01000101	105	69	(E)
F	01000110	106	70	(F)
G	01000111	107	71	(G)
H	01001000	110	72	(H)
I	01001001	111	73	(I)
J	01001010	112	74	(J)
K	01001011	113	75	(K)
L	01001100	114	76	(L)
M	01001101	115	77	(M)
N	01001110	116	78	(N)
O	01001111	117	79	(O)
P	01010000	120	80	(P)
Q	01010001	121	81	(Q)
R	01010010	122	82	(R)
S	01010011	123	83	(S)
T	01010100	124	84	(T)
U	01010101	125	85	(U)
V	01010110	126	86	(V)
W	01010111	127	87	(W)
X	01011000	130	88	(X)
Y	01011001	131	89	(Y)
Z	01011010	132	90	(Z)
[	01011011	133	91	—
\	01011100	134	92	—
]	01011101	135	93	—
^	01011110	136	94	(↑)
_	01011111	137	95	—

ASCII Char.	EQUIVALENT FORMS Binary	Octal	Dec [2]	KEY [1] 9830A
	01100000	140	96	—
a	01100001	141	97	(SHIFT) (A)
b	01100010	142	98	(SHIFT) (B)
c	01100011	143	99	(SHIFT) (C)
d	01100100	144	100	(SHIFT) (D)
e	01100101	145	101	(SHIFT) (E)
f	01100110	146	102	(SHIFT) (F)
g	01100111	147	103	(SHIFT) (G)
h	01101000	150	104	(SHIFT) (H)
i	01101001	151	105	(SHIFT) (I)
j	01101010	152	106	(SHIFT) (J)
k	01101011	153	107	(SHIFT) (K)
l	01101100	154	108	(SHIFT) (L)
m	01101101	155	109	(SHIFT) (M)
n	01101110	156	110	(SHIFT) (N)
o	01101111	157	111	(SHIFT) (O)
p	01110000	160	112	(SHIFT) (P)
q	01110001	161	113	(SHIFT) (Q)
r	01110010	162	114	(SHIFT) (R)
s	01110011	163	115	(SHIFT) (S)
t	01110100	164	116	(SHIFT) (T)
u	01110101	165	117	(SHIFT) (U)
v	01110110	166	118	(SHIFT) (V)
w	01110111	167	119	(SHIFT) (W)
x	01111000	170	120	(SHIFT) (X)
y	01111001	171	121	(SHIFT) (Y)
z	01111010	172	122	(SHIFT) (Z)
{	01111011	173	123	—
¦	01111100	174	124	—
}	01111101	175	125	—
~	01111110	176	126	—
DEL	01111111	177	127	—

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[1] When (SHIFT) is shown, the SHIFT key is held down while the following key is pressed. Where a key is not shown in the 9830A column, use a WRITE (FORMAT B) statement to output the decimal-equivalent number.

[2] Decimal numbers are used with WRITE BYTE, and WRITE (FORMAT B) statements.

To display the status code of a peripheral device, execute the STAT statement using the select code of the peripheral device.

Syntax:

STAT select code

Following is a table of status codes and their corresponding meanings for various peripheral devices.

Peripheral Device	Status Code	Meaning
9861A Typewriter	0	Switched OFF or not connected.
	1	Switched ON.
9862A Plotter (select code 14)	0	Not connected to calculator.
	9	Switched OFF.
	3	Ready, pen UP.
	11	Ready, pen DOWN.
9863A Tape Reader	0	Switched OFF or not connected.
	1	Switched ON.
9864A Digitizer	0	Switched OFF or not connected.
	1	Switched ON.
9865A Cassette Memory	0	Not connected to calculator.
	1	Switched ON; tape ready and unprotected.
	3	Switched ON; protected tape cassette.
	5	Switched ON; tape on clear leader and unprotected.
	7	Switched ON; tape on clear leader & protected tape cassette.
	11	Door open; tape is in but not on clear leader.
	15	Switched ON; door open or ajar; no tape in or tape on clear leader.
	14	Switched OFF.
9869A Card Reader	0	Not connected to calculator.
	1	Connected to calculator.

BINARY CODING AND CONVERSIONS

This section is a simplified explanation of binary number representations. For in depth information, refer to any text on the subject.

Binary is the base 2 number system, in which only 1's and 0's are used. By giving the 1's and 0's positional value, any decimal number can be represented. Integer-precision numbers are represented by binary in the 9830A. For example:

decimal 41 = binary 101001

Decimal	
10^1	10^0
10	1
4	1

Binary					
2^5	2^4	2^3	2^2	2^1	2^0
32	16	8	4	2	1
1	0	1	0	0	1

Binary-Decimal Conversions

To convert from binary to decimal, the positional values for ones are added up. From the above example, this would be

$$2^5 + 2^3 + 2^0 = 32 + 8 + 1 = 41$$

To convert from decimal to binary, the decimal number is repeatedly divided by 2. The remainder provides the binary equivalent. For example:

	Remainder (read up)
2) 41	1
2) 20	0
2) 10	0
2) 5	1
2) 2	0
2) 1	1

ASCII code

Binary is often used as a code to represent not only numbers, but also alphanumeric characters such as: A or , or ? or x or 2. One of the most common binary codes used is ASCII[1]. ASCII is an eight-bit code — seven data bits and one parity bit. The 9830A Calculator uses ASCII for alphanumeric character representation. The parity bit is not used by the 9830A, however, it is available.

Examples:

Character	ASCII Binary Code	ASCII Decimal Code
A	01000001	65
B	01000010	66
?	00111111	63

For a complete list of ASCII characters and their equivalent binary and decimal representations, see Table A-1.

[1]ASCII is an acronym for American Standard Code for Information Interchange.

Binary-Coded Decimal

Another often used code for representing numeric values is Binary Coded Decimal (BCD). BCD is a four-bit binary code. Each four bits represents a decimal digit from 0 through 9.

For example to convert BCD 010000110110 to decimal:

BCD representation	0100	0011	0110
Decimal Value	4	3	6

The equivalent decimal number is found by breaking up the binary number into groups of 4 bits (starting from the right) and converting these groupings into decimal. Full-precision and split-precision numbers are represented in BCD by the 9830A.

Octal-Binary Conversions

Octal is the base 8 number system. Octal numbers are often used since conversion from binary to octal and vice-versa is very easy.

To convert from binary to octal, the binary number is broken up into groups of three bits (starting from the decimal point to the left). The groupings of 3 bits represent an octal number.

For example to convert binary 10110100011001 to octal:

Binary Number	10	110	100	011	001
Octal Number	2	6	4	3	1

Note that only values from 0 through 7 are used in octal.

To convert from octal to binary, the reverse is done:

Octal Number	1	4	0	7	2	6
Binary Number	001	100	000	111	010	110

Other Codes

There are many other binary codes which are possible. Some of the more popular codes are Electronics Industries Association Code (EIA), Extended Binary Coded Decimal Interchange Code (EBCDIC), Baudot Code, and 6-bit Transcode. To do a conversion to ASCII, which is used by the 9830A Calculator, use the conversion table option in the ENTER or OUTPUT statements.

NOTES

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SYNTAX SUMMARY

The ENTER Statement

ENTER (select code, format [,conversion table]) list [FOR parameter]

The ENTER statement enables the calculator to receive data from an external device. If the incoming data is not in ASCII code, conversion to ASCII code can be performed using the optional conversion table parameter. The ENTER statement causes one record to be read from the device indicated by the select code. Character by character conversion to ASCII code is performed, if requested. The data is then handled in the same way as during a standard READ or INPUT statement.

The OUTPUT Statement

OUTPUT (select code or string name, format [,conversion table]) list

The OUTPUT statement is a general-purpose statement for sending data or coded commands to an external device. If the external device requires non-ASCII code, conversion from ASCII to that code is possible using the optional conversion table parameter.

The CMD (COMMAND) Statement

The CMD statement is a specialized output instruction used only to control instruments connected to the HP Interface Bus (HP-IB).

The STAT Function

STAT select code

The STAT function returns a value from 0 to 15 inclusive representing the status (on, off, wait, etc.) of a peripheral.

The RBYTE (READ BYTE) Function

RBYTE select code

The RBYTE function reads one byte of data from the device specified by the select code, regardless of the data structure.

The ROT (ROTATE) Function

ROT (value, number of places)

The ROT function performs right rotation on the binary equivalent of the value, the number of places specified.

The INOR (INCLUSIVE OR) Function

INOR ($value_1$, $value_2$)

The INOR function combines binary equivalents of $value_1$ and $value_2$ in an "inclusive or" logic operation.

The BIAND (BINARY AND) Function

BIAND ($value_1$, $value_2$)

The BIAND function combines binary equivalents of $value_1$ and $value_2$ in an AND logic operation.

The WBYTE (WRITE BYTE) Function

WBYTE value

The WBYTE function outputs the binary equivalent of the value length 8 bits. It is used in the WRITE, PRINT, or OUTPUT statements.

The SPA (SPACE) Function

SPA value

The SPA function advances the printer or typewriter carriage the number of spaces represented by the value.

ERROR NOTES

Indication	Meaning
ERROR 83	End of data reached or data contains more than ten blanks in a row.
ERROR 84	Invalid format specification.
ERROR 85	Numeric input has syntax error: multiple decimal points, more than one E, or other non-numerical input.
ERROR 86	Conversion table or code not found. Check for integer initialization in DIM or COM statement.

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