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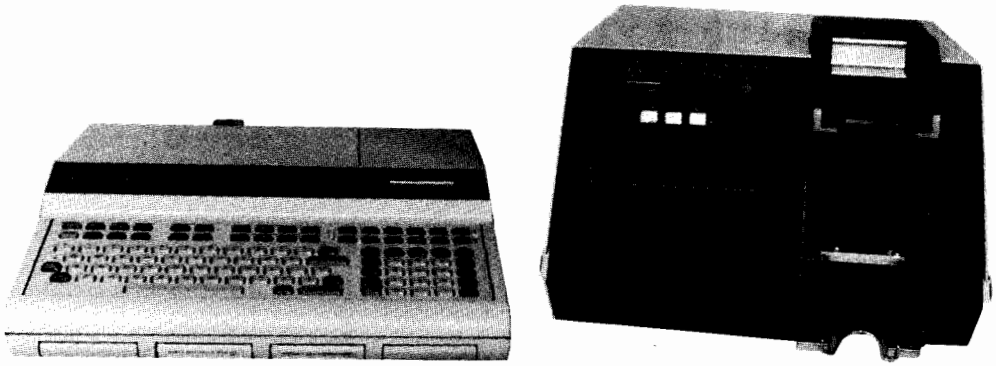
Hewlett-Packard 9825A Calculator
98032A Option 069 Interface
Card Reader Operating Note

Card Reader Operating Note



The HP 9825A Calculator and 9869A Card Reader

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

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Chapter 1
General Information

Introduction

The HP 9869A Card Reader is connected to an HP 9825A Calculator via a 98032A Option 069 Interface. This operating note shows how to connect that system and input data from the card reader using General I/O ROM operations.

The Interface Card

The Option 069 Card is a standard 98032A Interface which is prewired for use with a 9869A Card Reader. Diagrams of the added connector and the prewired configuration board are in Chapter 3. For all other information on the interface card, refer to its installation and service manual.

The General I/O ROM

The calculator requires a General I/O ROM to control the card reader. Additional I/O operations are available with an Extended I/O ROM; refer to the Extended I/O Programming Manual for details.

The Card Reader

The 9869A Card Reader is a high-speed device for reading data cards marked or punched using the ANSI[1] 128-character code (Hollerith); accessibility to a key-punch machine determines which method to use when marking cards. For technical specifications and instructions on marking cards, refer to the 9869A Operating and Service Manual.

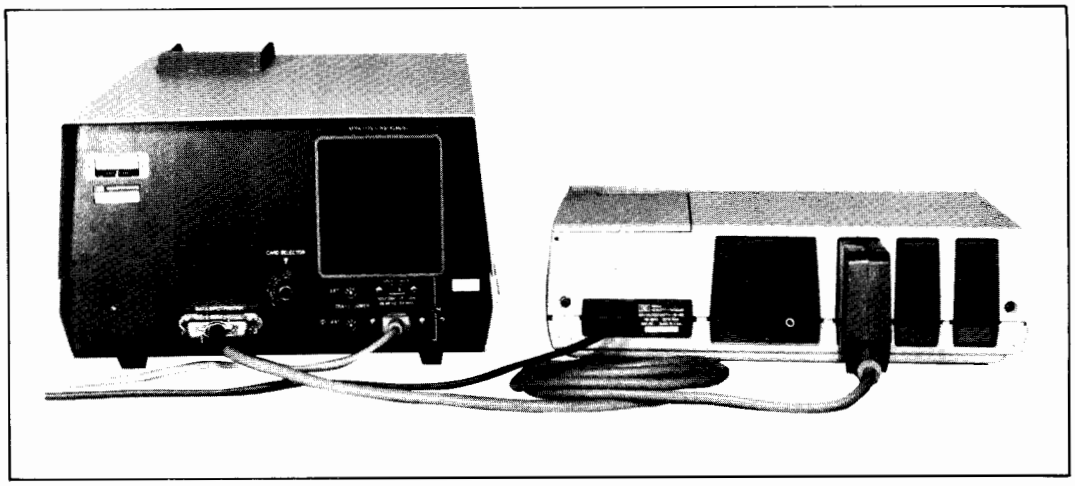
[1]American National Standards Institute.

Installation

CAUTION

BE SURE THAT THE CALCULATOR AND CARD READER ARE EACH SET UP ACCORDING TO THEIR INSTALLATION PROCEDURES **BEFORE** CONNECTING THE INTERFACE CARD. REFER TO THEIR RESPECTIVE MANUALS FOR INSTRUCTIONS.

Switch the calculator and card reader off before connecting the interface card. The card can be plugged into any I/O slot on the back of the calculator. The connector on the other end of the interface cable is then fastened to the input/output connector on the back of the card reader. Refer to the next illustration.

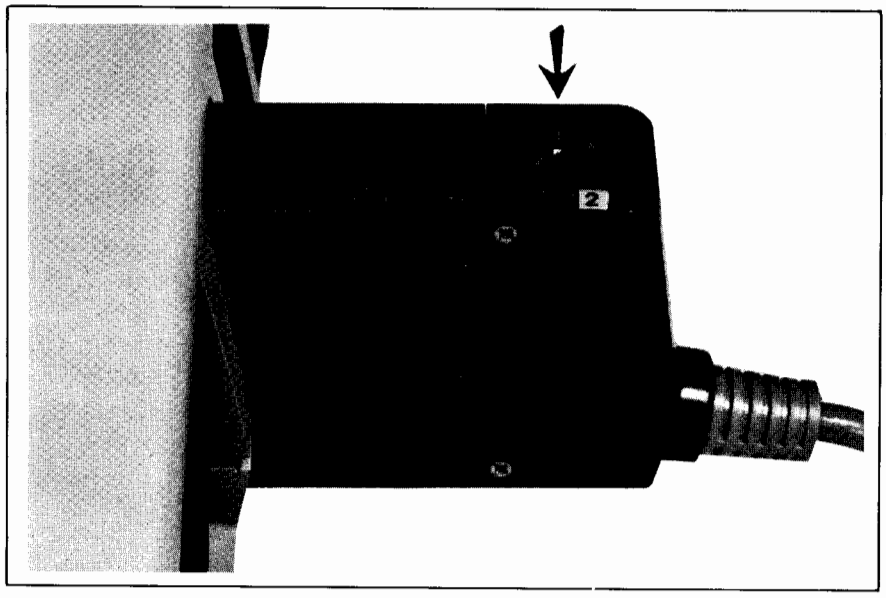


The Calculator/Card Reader Interface

To check operation of the calculator/card reader system, refer to the 9825A System Test Booklet, which is supplied with the calculator.

Select Code

The Option 069 Interface is set to select code 3 at the factory. To change the select code setting, use a small screwdriver to rotate the switch accessible through the interface rear housing (see the next photo). Do not set the switch to either select code 0 or 1, since these codes are reserved for calculator internal peripherals. Also, do not set more than one interface to the same select code. The examples in Chapter 2 assume that select code 3 is set.



Select Code Switch

Chapter 2
Card Reader Control

Introduction

This chapter describes the General I/O ROM operations most-often used to control a card reader: the read, write, and format statements and the read binary function. For more information on these and other General I/O operations, refer to the General I/O Programming Manual. This chapter assumes that you are already familiar with operating the 9825A Calculator, as described in its operating and programming manual.

The Data Buffer

As information on each data card is read, the card reader stores it in a temporary memory device called a **buffer**. When the card reader is switched on, the buffer is cleared. The buffer is loaded as cards are picked and then emptied by using read statements. The buffer can hold 160 card-columns of data. The buffer is also cleared when RESET is pressed.

Operating Modes

The card reader has two sets of operating modes: The **Demand** and **Continuous** modes determine how the cards are picked; the **Normal** and **Image** modes determine how each card-column of data is read. Each mode is set by sending the card reader an appropriate ASCII character and remains set until either the opposite mode is set or the card reader is reset. The mode control characters are listed below. Operation with each mode is described in the following pages.

Mode Control Characters

Mode	Character	Operation
Continuous	C	Cards are picked automatically, as needed.
Demand mode	D	Cards are picked one at a time.
Normal mode	N	Data is read, column by column, in Holerith code.
Image mode	I	Data is read in ½ column, 4-bit binary form.

Card Reader Functions

Functions such as bell, reject, and reset are controlled by using ASCII control characters. A complete list is below. An example use of each function is shown in the following pages.

Function Control Characters

Function	Character	Operation
Stop	S	Stops (resets) the card reader and cancels the operating mode(s).
Abort	A	Clears the buffer (Demand mode only).
Reject/Select	J	Outputs the currently picked card to the reject hopper (9869A Option 002 and Demand mode only).
Bell	B	Rings the card reader's bell (9869A Option 004).
Retransmit	T	Holds the data from the last card for retransmission (Demand mode only).

The Write Statement

The write statement is used to set operating modes and activate functions on the card reader. A simplified syntax is shown here:

wrt select code , "control character(s)"

This syntax uses the free-field output format to send control characters as free text. To retain free-field for this use, be sure that an unnumbered format statement (format 0) is not executed.

Once an operating mode is set, data cards are picked and the data is stored in the card reader buffer. Then use read or read binary to transfer the data to the calculator.

The Read Statement

red select code [, format no.], variable$_1$ [, variable$_2$...]

As the read statement is executed, the first data item in the buffer is stored in the first variable specified; the second item is stored in the second variable; etc. In general, the number of variables should correspond to the number of data items to be read from each card. String variable names can be used if the String ROM is in use. Each numeric data item can consist of the digits 0 through 9, plus and minus signs, a decimal point, and an "E" character (upper or lower case). All other characters are treated as input delimiters. The data item itself can assume the same form as any number entered from the keyboard.

The format number can be used to reference any of ten format statements. If a format number is not specified, and if a format statement has not been previously executed, a free-field input format is automatically used.

Free-Field Input Format

The free-field input format is set whenever either the calculator is reset (switched on, RESET, erase all, or run). To reset free-field after a format statement has been used, execute fmt ; before the read statement.

Using free-field allows reading numeric data in virtually any form, provided that each item is followed by at least one delimiter (any non-numeric character except a space[1]). For each variable in the read list, the calculator ignores all delimiters until a numeric character is read. Then, after reading the data item, reading any non-numeric character terminates and stores the data item. After the last variable in the read list has been filled, reading a LF (line feed) terminates the read operation. The card reader automatically places a LF in the buffer directly after the last character read from each card.

When using free-field, each data item must be separated by a non-numeric character except spaces. If you wish to use spaces as delimiters, format statements must be referenced.

Format Statements

Use of format statements provides more flexible and complete control of write and read statements. A format statement must be executed before the I/O statement referencing it and provides a list of specifications for use by the I/O statement. Then, as the I/O statement is executed, it references the last-executed format statement rather than free-field. A general format syntax is:

fmt [format no. ;] [spec$_1$[; spec$_2$...]]

The format number can be used to identify the statement for successive write or read statements. Each format number can be an integer constant from 0 thru 9; if not specified, 0 is assumed. When the calculator is reset (power on, RESET, run, or erase all) format number 0 is automatically assigned to specify free-field.

Data specs are used to determine which characters are input from a data input string, and in what form the data will appear. When a format statement is referenced by a read statement, the read operation is not terminated until a LF character is read (unless the edit spec % is used). A general data input spec syntax is on the next page.

[1]The absence of a punch or mark in a card-column indicates a space.

[r] f [w]

- r is the number of consecutive times the spec is to be used (if r is 1 it may be omitted). r and w must be integer constants.
- w is the width of the data field to be read. Omitting w specifies free-field read for the corresponding item(s).

A data spec like f10 calls for reading ten numeric characters; all non-numerics which precede a numeric are counted but not entered. If an "E" is read, a number of the form 1.dd is entered.

Most examples in this chapter use format statements, rather than the free-field format. For more information on the format specs, refer to the General I/O Programming Manual.

Pick Fails

The card reader tries to pick a card when instructed to do so. If the card reader does not sense that a card has been picked, it tries to pick two more times. If it fails to pick a card successfully three times, it will stop, set the status line to "1" and light the yellow PICK FAIL light. This causes the calculator to halt and display error G8. A pick fail also cancels the Continuous, Demand, and/or Image modes. The Image mode and the status line are explained at the end of this chapter.

Continuous Mode Operation

The Continuous mode allows the card reader to pick cards without being further instructed.

```
wrt 3, "C"
```

This statement causes the card reader to pick data cards continuously until the buffer is full and then automatically pick cards, as required, until either the input hopper is empty or the output hopper is full.

The following program causes the card reader to pick cards continuously, input the three data items on each card to the calculator, and print the data in the same order as it was read. It's assumed that each data item is separated by a comma (free-field is used) and that select code 3 is set. When in the continuous mode, the card reader picks each new card after half of the data in the buffer is output to the calculator.

Notice that once the card reader has been instructed to pick cards in the continuous mode, there is no need to instruct it to pick individual cards again. Re-executing the read statement empties the buffer, causing successive cards to be picked.

```
0: wrt 3,"C"
1: red 3,A,B,C
2: fxd 2;prt A,
 B,C
3: spc 2;gto 1
4: end
```

For reading data, the continuous mode is faster than the Demand mode. But the Reject, Abort and Retransmit functions can only be executed in the Demand mode.

Since the previous program doesn't count cards, it will halt and error G8 will appear when the card reader is finished reading cards (i.e., when the input hopper is empty of the output hopper is full). This error can be avoided by using a dummy card as the last card.

This program checks for a dummy card on which the first data item is 1E99 ◗

```
0: wrt 3,"C"
1: red 3,A,B,C
2: if A=1e99;
 gto 5
3: fxd 2;prt A,
 B,C
4: spc 2;gto 1
5: spc 2;end
```

The Stop Command

```
wrt 3, "S"
```

This statement halts the card reader, clears the buffer, and terminates the Continuous mode. Before the motor shuts off, however, the buffer must be emptied by using read statements.

> **NOTE**
>
> The card reader's motor can be shut-off immediately by either pressing [RESET] or switching the card reader off.

Demand Mode Operation

The Demand mode is used when cards are to be picked one at a time. The following statement causes the card reader to pick a single data card (unless the buffer is full, the input card hopper is empty, or the output card hopper is full).

This statement must be executed each time a card is to be picked. Also, the buffer must be empty before the Demand mode can be set.

```
wrt 3; "D"
```

For example, here is a program to read and print ten cards from the deck of Test Cards furnished with the card reader. Each card has the same five data items. One of the test cards is shown below.

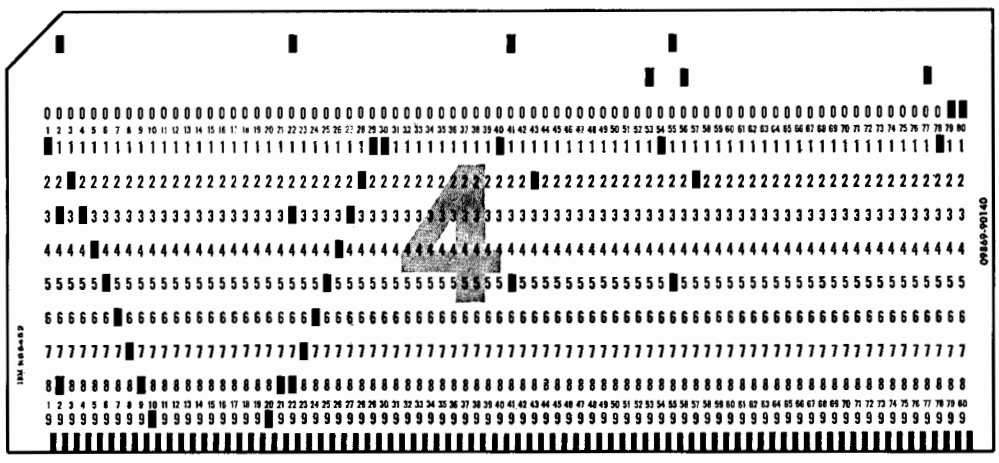
Line 2 reads the five data items, according to the format number 1 (line 0). Line 6 continues the program until ten cards are read.

```
0: fmt 1,4f15,
 f20
1: wrt 3,"D"
2: red 3.1,A,B,
 C,D,E
3: fxd 8
4: prt A,B,C,D,E
5: spc 1
6: if (F+1=F)<=1
 0;gto 1
7: spc 2;end
```

This printout was obtained by reading the test cards ➧

```
  1.23456789
 98.76543211
  1.00000000
 -1.00000000
-100.00000000

  1.23456789
 98.76543211
  1.00000000
-1.00000000
```



A 9869A Test Card

The Abort Command (Demand Mode Only)

```
wrt 3, "A"
```

The Abort function clears the first half of the card reader buffer, permitting another card to be read. The aborted data is held in the second half of the buffer, and can be re-used until another card is read; see the "Retransmit Function", later.

This program reads three data items from each card. If the first item is positive, the data is printed. If the item is negative, the data is aborted. Line 4 checks for a dummy card , as described on page 9.

```
0: fmt 1,3f10
1: wrt 3,"D"
2: red 3,1,A,B,C
3: if A<0;wrt 3,
 "A";sto 1
4: if A=1e99;
 sto 8
5: fxd 5
6: prt A,B,C
7: spc 2;sto 1
8: spc 2;end
```

The Reject/Select Function (Demand mode only)


```
wrt 3, "J"
```

This function is used to sort data cards and can be used only when the card reader has Option 002, reject hopper. The buffer must be emptied before the function will be executed.

For example, this program causes the card reader to sort all data cards on which the first data item is less than or equal to zero. It's assumed that each card contains more than one data item.

```
0: fmt 1,f8
1: wrt 3,"D"
2: red 3,1,A
3: if A<=0;wrt
 3,"J";sto 1
4: sto 1
5: end
```

The Retransmit Function (Demand mode only)

The Retransmit function enables previously-read or aborted data to be reused more than one time. This function transfers data back to the first half of the buffer, where it remains until it is either reread or another card is read. This function can be repeated as often as needed.

This program checks the first item on each card; if the item is negative the card is rejected. But if the item is positive, line 5 recalls the data to the buffer so that lines 6 through 8 can read and print it.

```
0: fmt 1,f15
1: fmt 2,5f10
2: wrt 3,"D"
3: red 3.1,A
4: if A<=0;wrt
 3,"J";gto 2
5: wrt 3,"T"
6: red 3.2,A,B,
 C,D,E
7: fxd 8
8: prt A,B,C,D,E
9: gto 2
10: end
```

NOTE

Since the last data card cannot be rejected under any circumstances, it's suggested that a blank card be added to the end of the card deck. This permits the last data card to be rejected, if desired.

The Stop Command

```
wrt 3, "AS"
```

This statement clears the buffer, halts the card reader, and terminates the Demand mode.

Additional Operations

The following operations can be done when either the Continuous or Demand mode is set.

The Bell Function

```
wrt 3, "B"
```

The Bell function is used to signal the operator that a predetermined system condition is reached. This function can be executed only if the card reader has Option 004, bell.

This program causes the card reader to ring its bell (actually, it's a beep) after each group of 10 data cards ♦

```
0: wrt 3,"C"
1: red 3,A,B,C
2: if (X+1→X)=10
 ;0→X;wrt 3,"B"
3: gto 1
4: end
```

The Read Binary Function

rdb (select code)

Once the card reader is set to an operation mode, the read binary function can be used to read each individual column on each data card. This feature is useful when reading cards on which the marking format may or may not be in standard 128-character Hollerith code (the common format for keypunched and marked cards). When read binary is executed, the information on each column is converted to a decimal code that's equivalent to the ASCII-coded character. Then the decimal code is used in the statement. A table of Hollerith-ASCII characters is in the 9869A Peripheral Manual.

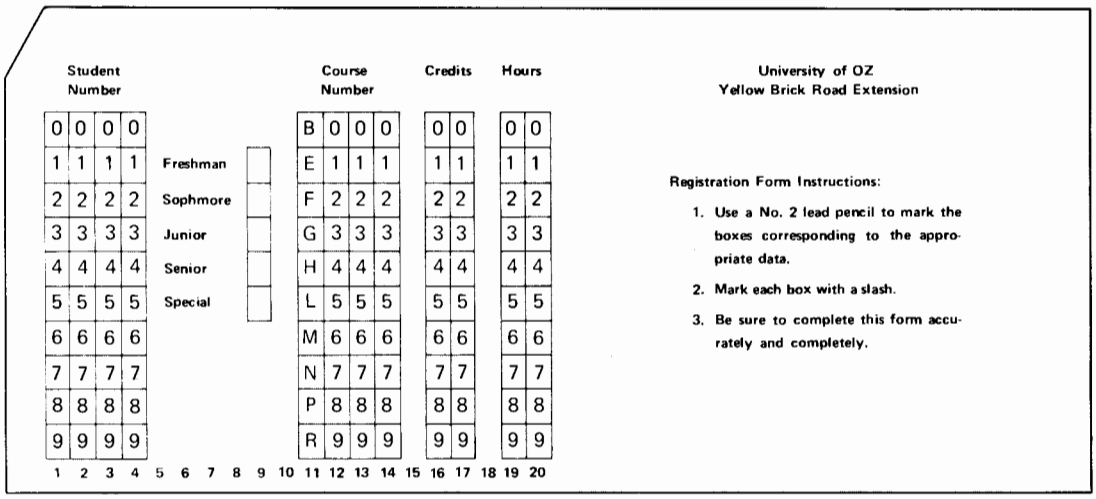
For example, here's a short program which reads and prints a code for each column on a data card. The program halts after reading the LF (decimal 10) which follows the last column.

```
0: wrt 3,"D"
1: fxd 0
2: prt rdb(3)→A
3: if A#10;jmp -
 1
4: spc 2;end
```

The beginning and end of the printout obtained by reading one of the 9869A Test Cards are shown below.

```
49                              50
46                              32
50                              32
51                              32
52                              32
53                              32
54                              32
55                              32
56                              32
57                              32
32                              32
32                              32
32                              32
32                              32
32                              32
32                              32
32                              32
32                              32
32                              32
32                              32
57                              32
56                              45
46                              49
55                              48
54                              48
53                              10
52
51
```

As another example, suppose that the registrar of a small university wishes to compare the average work-load per semester of both his part-time and full-time students. To solve this problem, he designs the following 40-column class registration card.



Then he writes this program. An analysis is in the next page.

```
0: 1→A;0→B
1: wrt 3,"D"
2: rdb(3)→rA;
 jmp (A+1→A)>20
3: if r1=84;wrt
 3,"AS";gto 10
4: X+1→X
5: 10(r19-48)+
 r20-48→B;if
 B<=40;if B>0;
 jmp 2
6: wrt 3,"J";Y+
 1→Y;gto 0
7: if B<=12;r23+
 B→r23;r24+1→r24
 ;jmp 2
8: r21+B→r21;
 r22+1→r22
9: wrt 3,"A";
 gto 0
10: spc 5;fxd 0
11: prt "Cards
 Accepted:",X-Y,
 "Cards Rejected
 :",Y
12: spc 2;prt "*
 **PART TIME***"
13: prt "Student
 s:",r24,"Hours:
 ",r23
14: fxd 2;prt
 "Avg.Hrs/Studen
 t:",r23/r24
15: spc 2;fxd 0;
 prt "***FULL
 TIME***"
16: prt "Student
 s:",r22,"Hours:
 ",r21
17: fxd 2;prt
 "Avg.Hrs/Studen
 t:",r21/r22
18: spc 2;fxd 0;
 prt "*****TOTAL
 S*****"
19: prt "Student
 s:",r22+r24,
 "Class Hours:",
 r21+r23
20: spc 2;prt
 "END";spc 3
21: end
```

- Line 0 initializes the working variables.
- Line 1 sets the Demand mode (the first card is picked).
- Line 2 transfers the first 20 columns of data to the calculator.
- Line 3 checks the data from column 1. If rows 0, 1, and 2 are marked (this corresponds to decimal code 84) the card is a "dummy" card which is places at the end of the card deck.
- Line 5 converts the decimal codes from columns 19 and 20 (stored in r19 and r20) to decimal numbers (hours). Then it checks to make sure that the number of hours is greater than 0 but less than 40. If not:
- Line 6 rejects the card and returns the program to pick the next card.
- Lines 7 and 8 accumulate full-time or part-time data from each card.
- Line 9 clears the buffer and returns the program to pick the next card.

The remainder of the program reduces the data gathered and produces the following printout (sample data is shown):

```
Cards Accepted:
                287
Cards Rejected:
                 13

***PART TIME***
Students:        75
Hours:          788
Ave.Hrs/Student:
              10.51

***FULL TIME***
Students:       225
Hours:         6458
Ave.Hrs/Student:
              28.70

*****TOTALS*****
Students:       300
Class Hours:
              7246

END
```

The Image Mode

By setting the Image mode, the information from each card column can be transferred to the calculator in two binary-coded 8-bit bytes, rather than in one decimal code as previously described. This is useful when more than one row per card-column is expected to contain information. The Image mode can be used only with the read binary function and can be specified when either Continuous or Demand mode is set.

This statement specifies the Image mode ◗

```
wrt 3; "I"
```

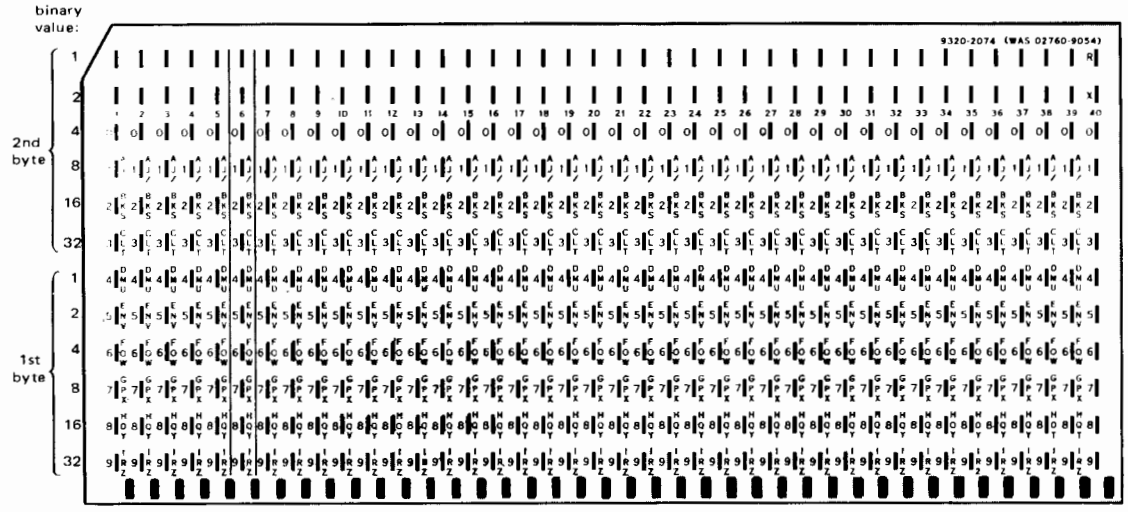
This statement cancels the Image mode and resets the Normal mode ◗

```
wrt 3; "N"
```

The Image mode is also cancelled by pressing [RESET] or by executing the Stop Command (see the following programs).

For example, use this program to read the card shown below ◗
A printout is shown below .

```
0: fxd 0
1: wrt 3,"DI"
2: rdb(3)→A;rdb(
 3)→B
3: prt A,B;spc 1
4: if (C+1→C)<=1
 6;jmp -2
5: wrt 3,"AS"
6: end
```



1	} column 1	25	
2		26	
3		27	
4		28	
5		29	
6		30	
7		31	} column 16
8		32	

Compare the printout for each card-column with the marks on the card. Notice that after the Image mode is set (line 1), the read binary functions input the decimal equivalent of the binary information on each half-column.

Here's a program that may be used to reject any card which has more than one mark per column on the first 20 columns (the registrar mentioned earlier could use this program to sort out poorly marked cards). An analysis of the program follows.

```
0: wrt 3,"DI"
1: rdb(3)→A
2: if A=28;sto
 11
3: if A#0;if
 A#1;if A#2;if
 A#4;if A#8;if
 A#16;ifA#32;
 sto 8
4: rdb(3)→B
5: if B#0;if
 B#1;if B#2;if
 B#4;if B#8;if
 B#16;if B#32;
 sto 8
6: if A=0;if
 B>0;sto 9
7: if A>0;if
 B=0;sto 9
8: wrt 3,"J";
 sto 0
9: if (C+1→C)<=2
 0;sto 1
10: wrt 3,"AD";
 0→A→B→C;sto 0
11: wrt 3,"AS"
12: end
```

- Line 0 sets the Demand and Image modes.
- Lines 1, 2, and 3 input the first half-column of data and determine if more than one row is marked.
- Line 2 checks for the last card, on which rows 0, 1, and 2 are marked in the first column.
- Lines 4 and 5 input the second half-column of data and determine if more than one row is marked in that half-column.
- Lines 5, 7, and 8 reject the card if more than one mark, or no mark, is found in the entire column.
- Line 9 counts the card columns. After 20 columns are read, line 10 picks another card.
- Line 11 clears the buffer, halts the card reader, and cancels the Image mode.

Card Reader Status Line

The card reader status line I6 is connected to interface line $\overline{\text{PSTS}}$ and can be monitored using the read status (rds) function. The status line corresponds to interface status bit 8 (decimal 256) and is 0 during any of these card reader conditions:

- A read lamp fails.
- The input hopper is full.
- The output hopper is full.
- A pick fail occurs.

The read status function and interface status bits are explained in Chapter 3 of the General I/O Programming Manual.

The General I/O ROM automatically monitors the status line while executing I/O operations; if any of those status conditions occurs, the program is halted and error G8 is displayed.

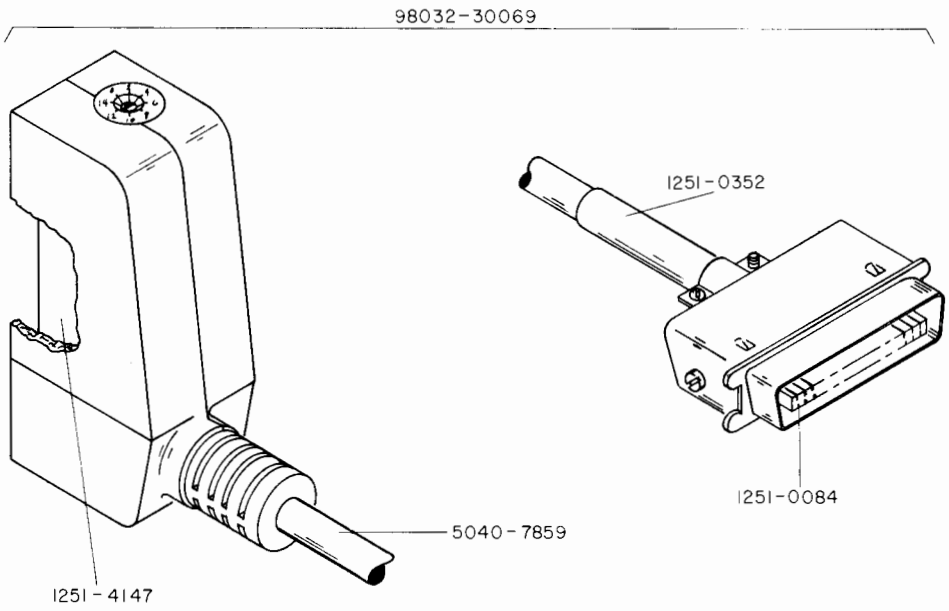
Here is a sequence which checks the status line before picking each new card. If the line is 0, "Check Card Reader" is displayed and the program halts.

```
4:     ●
5: if rds(3)<255
 ;jmp 3
6: dsp "Check
 Card Reader";
 stp
7: jmp -2
8: wrt 3,"D"
9:     ●
```

Chapter 3
Service

This chapter shows the cable wiring diagram and parts unique to the 98032A Option 069 Interface. Refer to the 98032A Installation and Service Manual for the standard interface wiring diagrams and parts list.

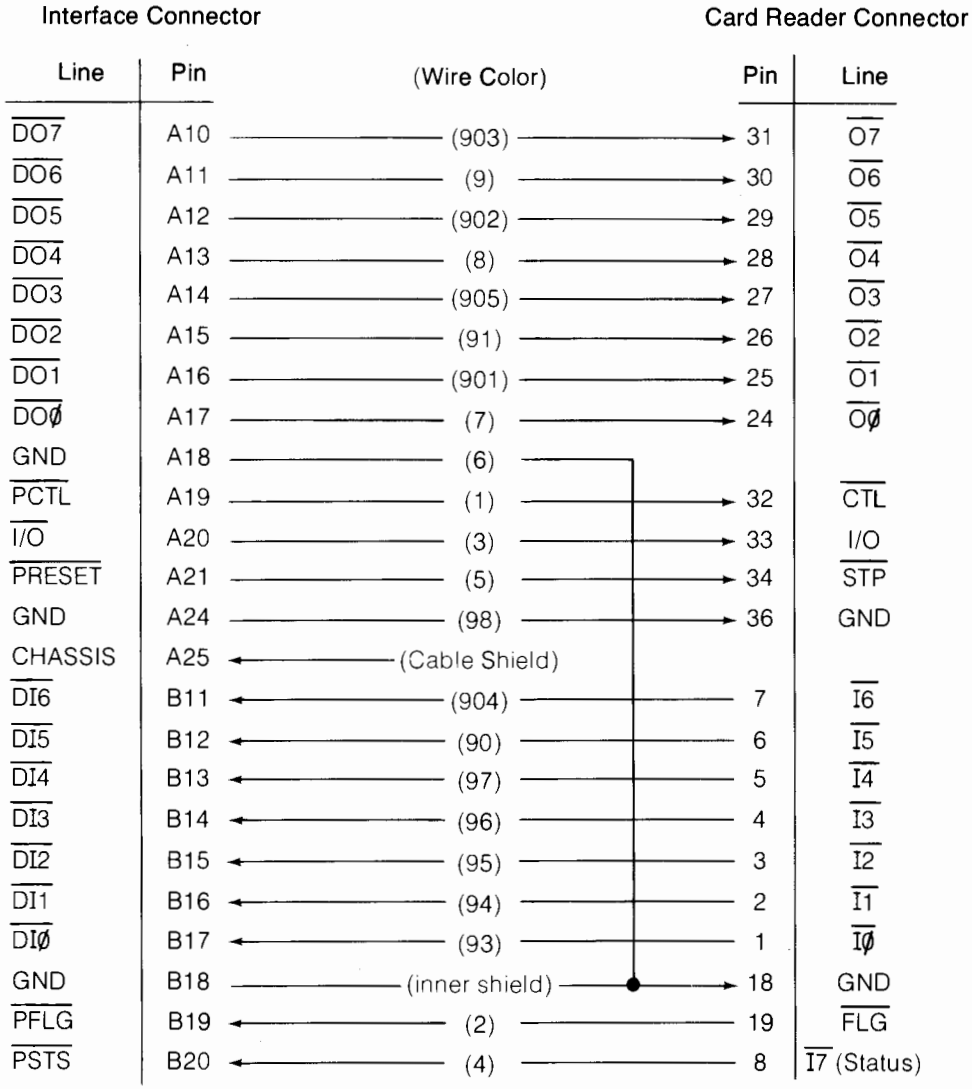
Option 069 Interface Cable



Replaceable Parts List

HP Part No.	Qty.	Description
98032-61606	1	Cable Assembly, Opt. 069
1251-4147	1	Connector, 2 × 25 (interface end)
5040-7859	1	Cable, Molded
1251-0084	1	Connector, 36 Pin (card reader end)
1251-0352	1	Bushing, Strain Relief
7120-4803	1	Label, Option 069
09825-90044	1	Operating Note

Cable Wiring Diagram

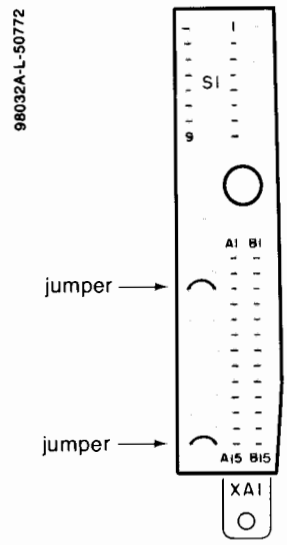


Wire color code is the same as resistor color code: The first number indicates the base color, second number indicates the wider strip, and third color indicates the narrower strip (e.g., 924 indicates white, red, yellow).

0 = Black
1 = Brown
2 = Red
3 = Orange
4 = Yellow
5 = Green
6 = Blue
7 = Violet
8 = Grey
9 = White

Configuration Board Jumpers

The Option 069 Interface has two wire jumpers on the configuration board (inside the interface rear housing), at positions 4 and E.



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(Circuit Side)

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