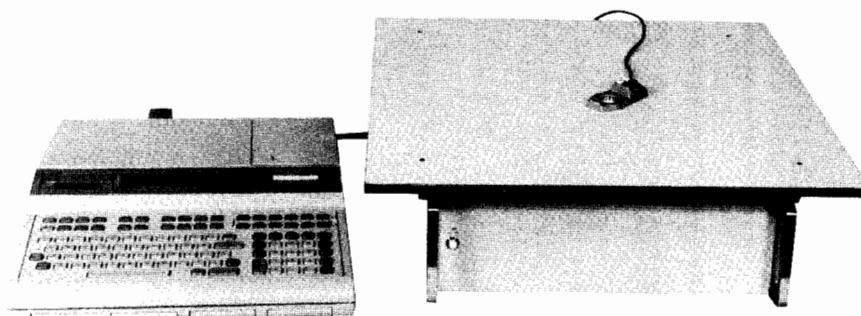


-hp
MELB

Hewlett-Packard 9825A Calculator
98032A Option 064 Interface
Digitizer Operating Note



Digitizer Operating Note



The HP 9825A Calculator and 9864A Digitizer

Hewlett-Packard Calculator Products Division
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Chapter 1

General Information



Introduction

The HP 9864A Digitizer is connected to an HP 9825A Calculator via a 98032A Option 064 Interface. This operating note shows how to connect that system and control the digitizer using General I/O ROM operations.

The Interface Card

The Option 064 Card is a standard 98032A Interface which is pre-wired for use with a 9864A Digitizer. A diagram of the added connector and a list of replaceable parts are in Chapter 3. For other information on the interface, refer to its installation and service manual.

The General I/O ROM

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

The Digitizer

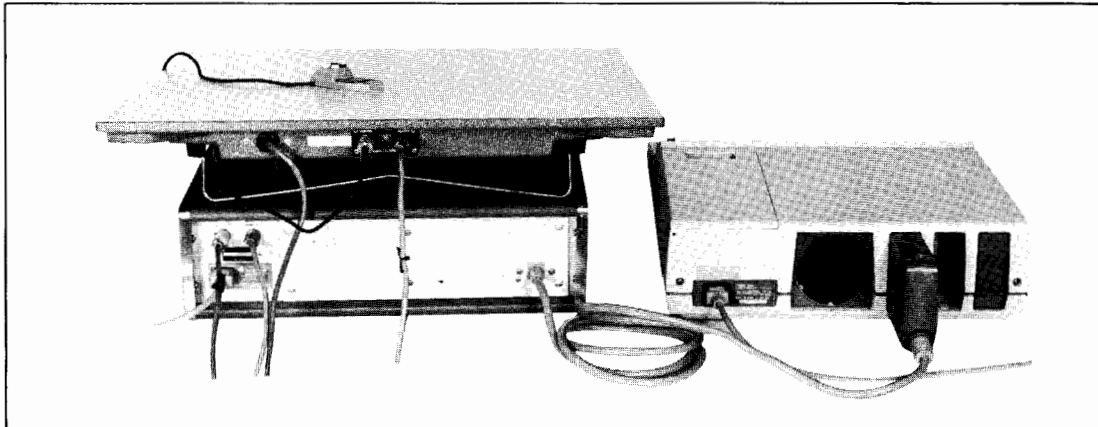
The 9864A Digitizer is used to read a curve or any irregular shape as a series of discrete x-y coordinates. The digitizer can read graphical data such as: X-rays, blueprints, strip-charts, or scope traces. The usable digitizing area is 17 × 17 inches (43.2 × 43.2 cm) minimum, and the resolution is 0.01 inch (0.25mm). Electrical and operational specifications for the digitizer are listed in the 9864A Peripheral Manual.

Installation

CAUTION

BE SURE THAT THE CALCULATOR AND DIGITIZER 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 digitizer off before connecting the interface card. The card can be plugged into any I/O slot on the back of the calculator. Refer to the next illustration.



The Calculator/Digitizer Interface

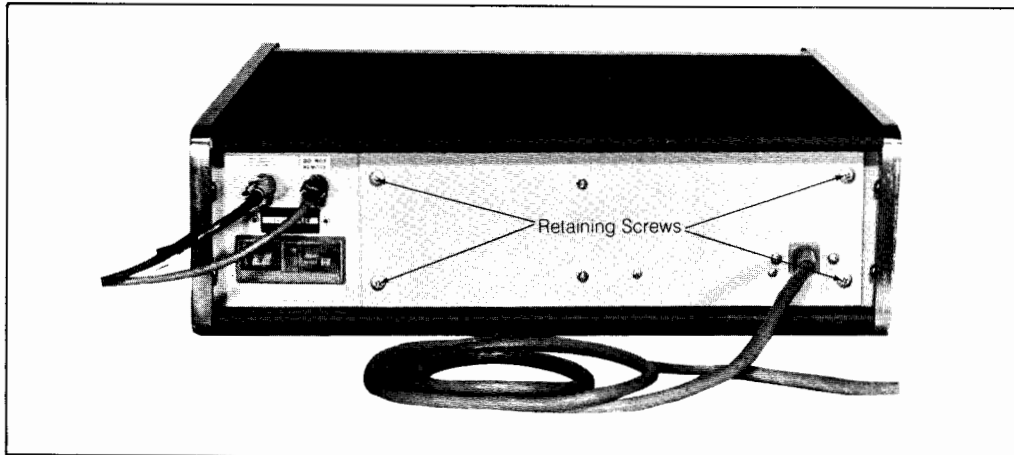
To check operation of the calculator/digitizer system, refer to the 9825A System Test Booklet which is supplied with the calculator.

If you purchased a 98032A Option 064 Interface to use with a digitizer having any other interface cable, follow this procedure to replace the interface:

WARNING

TO AVOID ELECTRICAL SHOCK, DISCONNECT THE AC POWER CORD BEFORE REMOVING THE REAR ACCESS PANEL.

1. Switch the digitizer off and disconnect its power cord from the ac outlet.
2. Rotate the four locking screws counterclockwise to release the rear access panel (see the next photo). Then remove the access panel.
3. Align the new access panel on the back panel and press it into place. Then rotate the retaining screws clockwise until they lock in place.

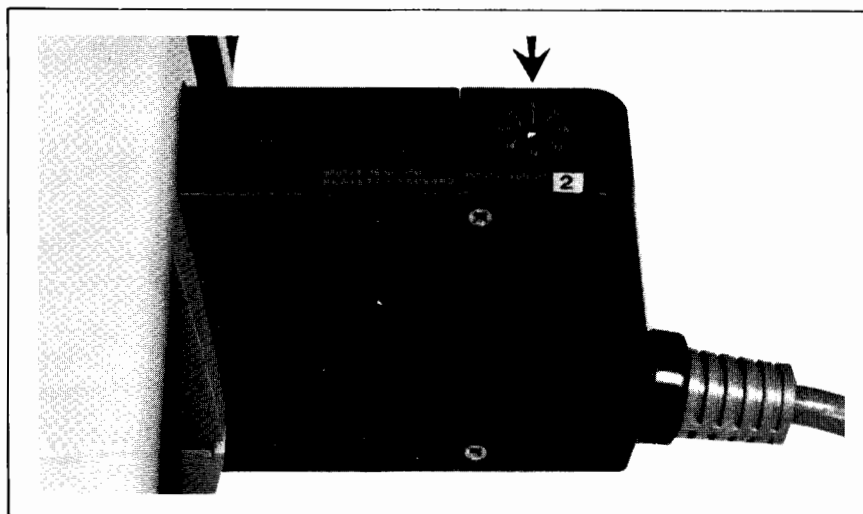


Digitizer Access Panel

Select Code

The Option 064 Interface is set to select code 4 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 the next chapter assume that the interface remains set at select code 4.



The Select Code Switch

4 General Information

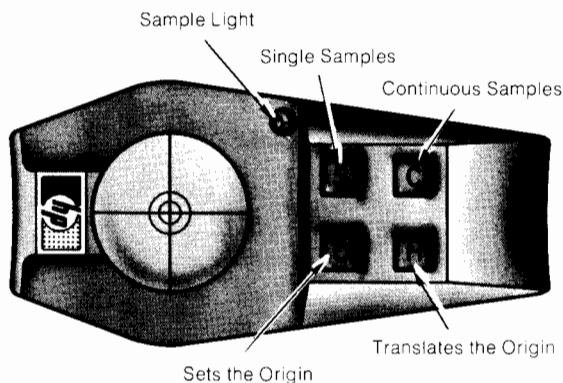
Chapter 2

Digitizer Control

This chapter describes the General I/O ROM operations most-often used to control the digitizer: the read and write control statements. For more information on these and other General I/O operations, see 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. You should also be familiar with digitizer operation, as explained in Chapter 2 of its peripheral manual.

Digitizer Controls

Except for the LINE switch on the mainframe, all digitizer controls are located on the cursor (see below). A brief review of those controls follows.



The Digitizer Cursor

Setting the Origin

The origin (coordinates 0,0) is set by placing the cross-hairs of the cursor over the point that is to be the origin, and then pressing . The origin may be set anywhere on the digitizing surface. The sample light indicates when the origin is set. Setting an origin cancels the Hold function, which is described later.

If you move the cursor improperly, such as by lifting it from the platen, the digitizer beeps and the sample light goes out to indicate that the origin is lost. The origin must be re-established before any further entries can be made.

Single Sample Mode

After a read statement is executed, pressing **S** enters the current coordinates of the cursor cross-hairs. **S** must be released and pressed again to take another data sample. The sample light blinks each time **S** is used to take a data sample.

Continuous Sample Mode

When the digitizer is placed in the Continuous mode, each data request causes a data sample to be taken automatically. The digitizer is placed in the Continuous mode by pressing **C**.

The digitizer remains in the Continuous mode until **C** is pressed again.

In the Continuous mode, the digitizer makes every entry as soon as the calculator requests it. The Continuous mode is useful when digitizing a figure composed of curved lines, since you can simply trace around the figure. Be careful how the cursor is moved, however, as any extraneous movement of the cursor will result in the entry of erroneous coordinates.

Pressing **O** while the Continuous mode is set sets a new origin. Improper cursor movement halts data sampling (the origin is lost) but does not cancel the Continuous mode. Pressing **RESET** cancels the Continuous mode.

The Hold Function

Pressing **H** activates the Hold function. It will remain active until either **H** is pressed again, or **O** is pressed. While Hold is active you may remove the cursor from the digitizing surface.

The digitizer can take single and continuous samples while Hold is active. The coordinates entered, however, will all correspond to the location of the cross-hairs at the time when Hold was activated. These coordinates will not change until Hold is deactivated and the cursor is moved.

The Hold function permits easy handling of documents larger than the digitizing surface. The hold feature enables the operator to translate (shift) the origin in any direction. Translation is accomplished as a genuine movement, rather than by simply setting a new origin. It is possible to continue to translate the origin until it is no longer located on the digitizing surface. When this happens, the coordinates of points on the digitizing surface will have ordinates and/or abscissas whose absolute values are greater than 17 inches (the size of the digitizing surface). By correctly translating the origin, it is possible to effectively locate the origin anywhere on the document, even though the document is larger than the digitizing surface.

The maximum values for x and/or y coordinates, when the origin is repeated by translated, are ± 99.99 inches. Further movement causes each value to "roll over" to +0.00. Refer to the Digitizer Peripheral Manual for more details on using the Hold function.



Maximum Sample Rate

The maximum rate at which the calculator can request and accept data samples from the digitizer is over 200 samples per second. Since the sample rate may be considerably slower due to program execution time, the operator must take care to move the cursor slowly, in order to obtain the maximum possible sample density. The effects of sample rate and sample density are discussed in the Digitizer Peripheral Manual.

The Read Statement

`red select code : Xcoordinate : Ycoordinate`

The read statement inputs one set of data coordinates from the digitizer. The free-field input format is used, since each data item is followed by a non-numeric character. The input sequence for each data sample is shown below.

$\pm \text{DD.DD}$, $\pm \text{DD.DD}$ (CR) (LF)
 X coordinate Y coordinate

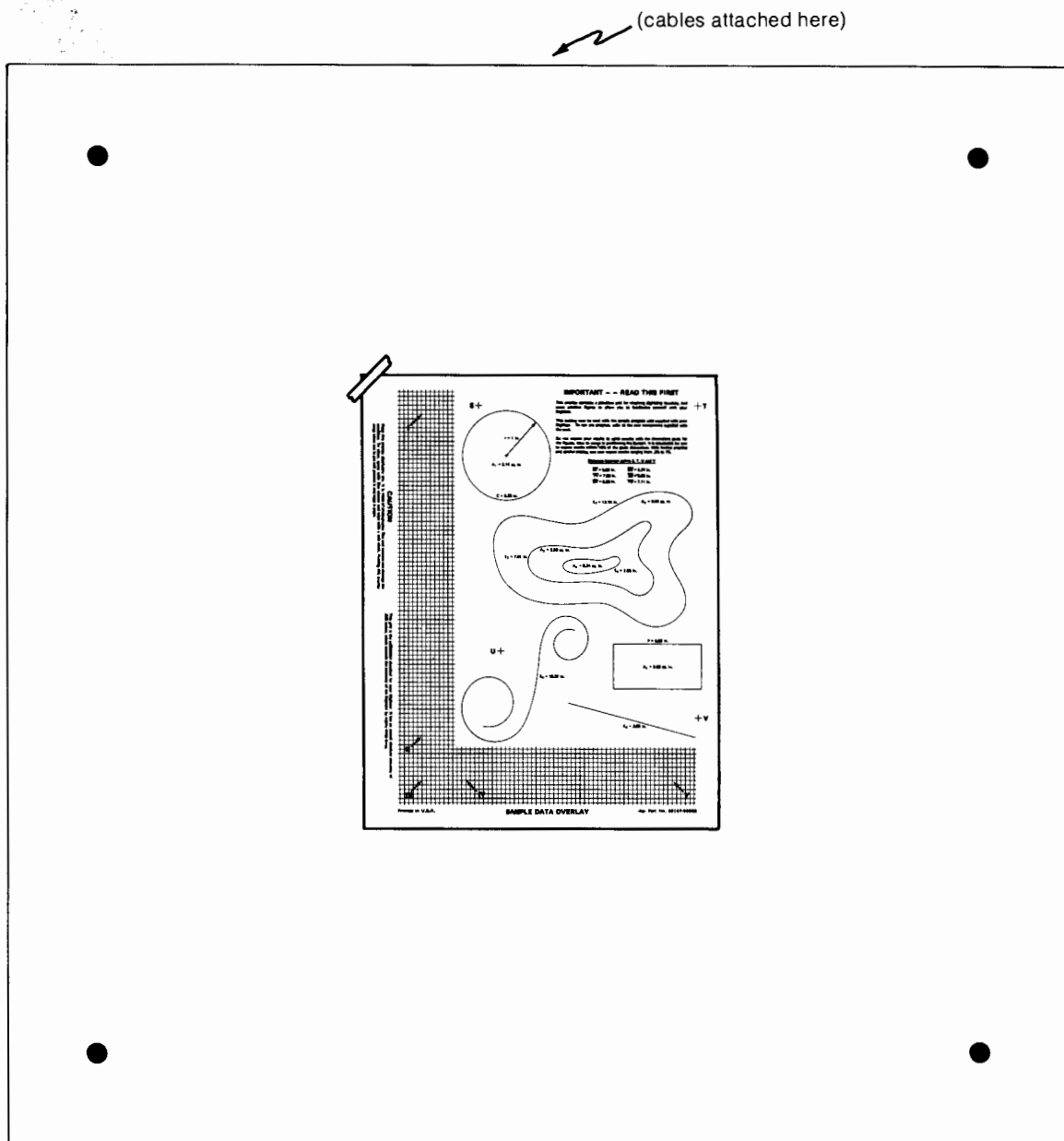
This program continually inputs and displays data samples. The digitizer interface is assumed to be set to select code 4.

```

0: fxd 2
1: red 4,X,Y
2: dsp "X=",X,
  "Y=",Y
3: jmp -2
4: end
  
```

To run the program, using the Sample Data Overlay supplied with the digitizer:

1. Attach the overlay to the digitizer platen, as shown in the next figure.
2. Set the origin (press **O** on the cursor) approximately over point U on the overlay. Press **RUN**. The calculator is now waiting for a data sample from the digitizer.
3. To take continuous samples, press **C** and slowly slide the cursor across the digitizing area; the corners of the digitizing area are indicated by the black dots on the platen. When the Continuous mode is used with this program, data points are being digitized at the rate of about 125 samples per second.
4. To stop the sampling, but not halt the program, press **C**. Now press **S** several times; the digitizer supplies one data sample each time **S** is pressed.
5. To stop the program, press **STOP**.



(front of the digitizer platen)

Sample Data Overlay on the Digitizer Platen

The Beep

```
wtc select code ; 0 ; wtc select code ; 1
```

The Beep syntax causes the digitizer to sound an audible tone which lasts about one-tenth of a second. A series of these sequences, when separated by wait statements, produces a pattern of beeps which can be used to signal the operator during program operation.

A practical use of the Beep syntax is shown in the next program. More information on the write control statement is in the General I/O Programming Manual.






Document Alignment

This program can be used to align a document on the digitizing surface. The general procedure used here is described in the Digitizer Peripheral Manual.

```

0: fxd 2
1: red 4,X,Y;
   dsp "X=",X
2: if X>.1;jmp -
   1
3: if X<-.1;jmp
   -2
4: if X=0;wtc 4,
   0;wtc 4,1;jmp -
   3
5: wtc 4,0;wtc
   4,1;wait 100;
   jmp -4
6: end

```

1. Attach the Sample Data Overlay, or another document which is to be digitized, to the digitizing surface as shown in the preceding figure.
2. Place the cursor cross-hairs exactly over point I (the upper left-hand corner of the document) and press .
3. On the calculator, press .
4. Slide the cursor to point III (the lower left-hand corner of the document); position the cross-hairs exactly over point III and press .

If point III is currently within ± 0.1 inch of the x axis as established over point I, the digitizer will beep repeatedly.

5. Slowly move the cursor and the overlay (together), either right or left, until the display equals 0.00 and the continuous signal indicates alignment.
6. Without moving the overlay, tape the remaining three corners of the document to the platen. If necessary, retape the first corner.

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 I and III. Return to step 3 if the x axis is not precisely aligned.

Line Length Program






The following program calculates the length of a curved or straight line represented by points digitized along the line. The line length is calculated by using the equation:

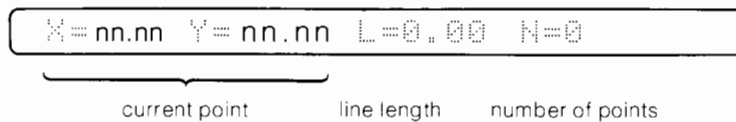
$$L = \sum (X_i - X_{i-2})^2 + (Y_i - Y_{i-1})^2$$



```





0: dsp "LINE
  LENGTH PROGRAM"
  ;wait 2000
1: dsp "DIGITIZE
  START POINT"
2: red 4,A,B
3: fmt 1,"X=",
  f.2," Y=",f.2,
  " L=",f.2,"
  N=",f.0;wrt .1,
  X,Y,L,N
4: red 4,X,Y
5: if res;ato 8
6: N+1→N
7: L+r((X-A)↑2+
  (Y-B)↑2)→L;X→A;
  Y→B;ato 3
8: fxd 0
9: prt "No. of
  Points =",N
10: fxd 2
11: prt "Line
  Length =",L
12: spc 2;end
  
```

To run the program:

1. Establish an origin on the document by positioning the cursor and pressing .
2. Start the program by pressing   .
3. Position the cursor at the beginning of the line and press . The display now indicates the current data point in this format:



4. Now digitize the line, using either  or . The current data is displayed after each sample. When the Continuous mode is used, points are taken at the rate of about 60 samples per second.

5. After the last point is taken, turn off the Continuous mode (if it's on) and press   and press  on the cursor. The final data is printed as shown here 

```

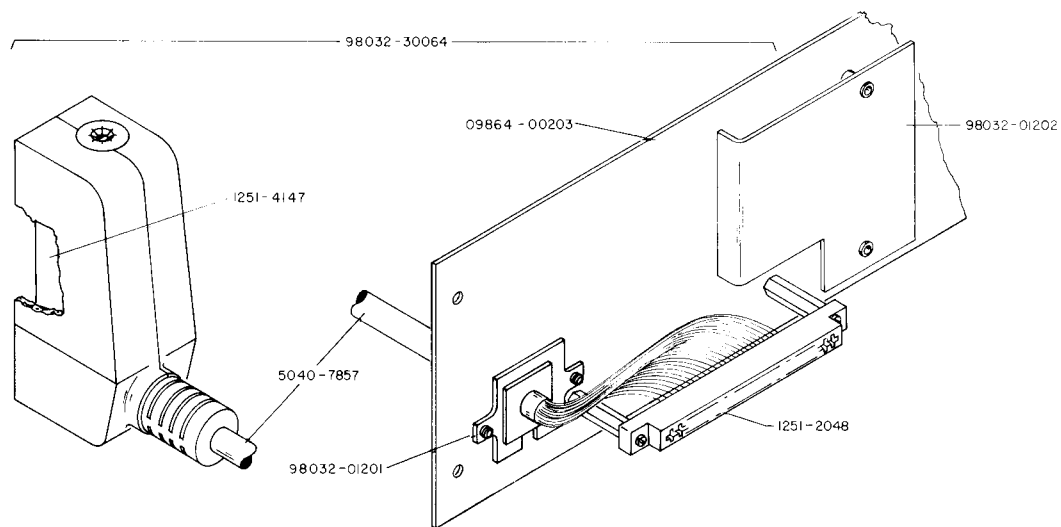
No. of Points =
                25
Line Length =
                2.03
  
```

Chapter 3

Service

This chapter shows the cable wiring diagram and parts unique to the 98032A Option 064 Interface. Refer to the 98032A Installation and Service Manual for the standard interface wiring diagrams and parts list.

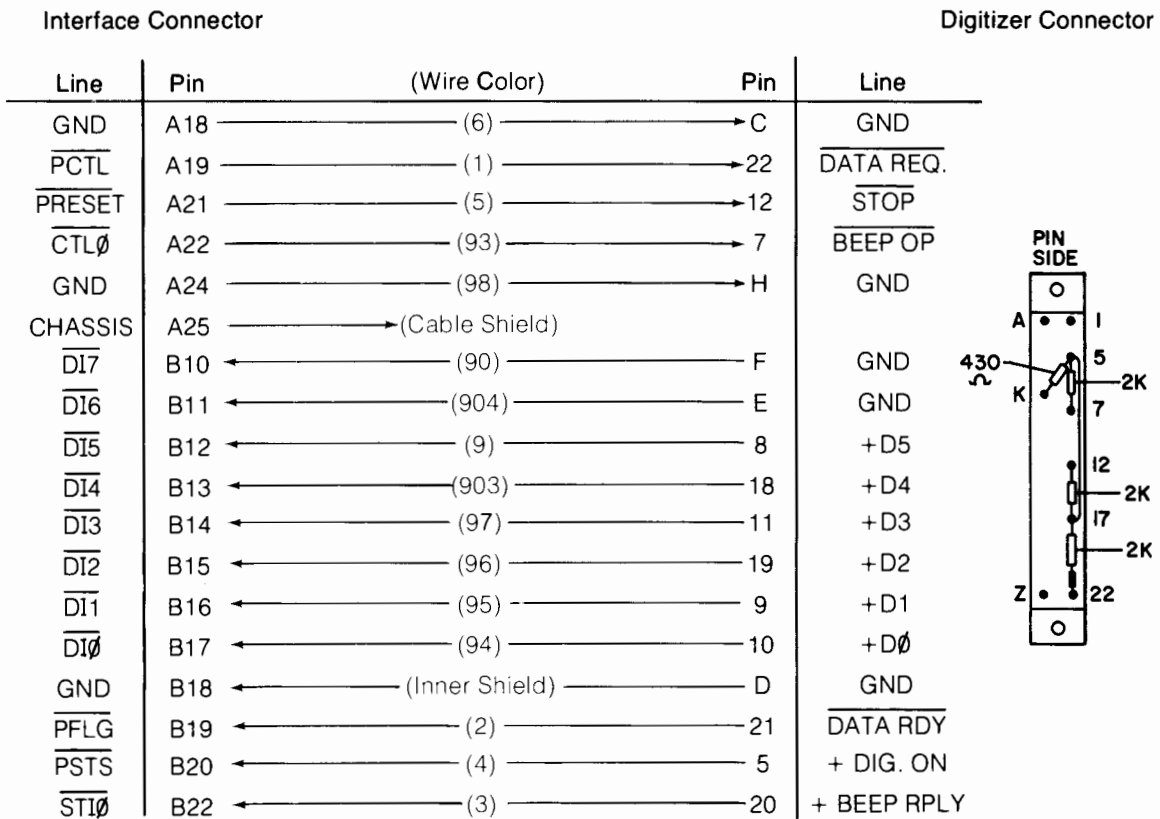
Option 064 Interface Cable



Replaceable Parts List

HP Part No.	Qty.	Description
98032-30064	1	Cable Assembly, Option 064
98032-01201	1	Bracket, Holding
98032-01202	1	Retainer, Card
9864-00203	1	Panel, Access
0683-2025	1	Res:Fixed, 430Ω, 5%, 1/4W.
0683-4315	3	Res:Fixed, 2KΩ, 5%, 1/4W.
1251-2048	1	Connector, 2×22 (Digitizer End)
1251-4147	1	Connector, 2×25 (Interface End)
5040-7857	1	Cable, Molded
0360-1617	6	Terminal, Forked
0380-0962	2	Standoff, Hex
1390-0088	4	Retainer, Fastener
1390-0214	4	Stud, Fastener
2200-0107	4	Screw, 4-40, .375 inches
2360-0117	4	Screw, 6-32, .375 inches
7120-4781	1	Label, Option 064
09825-90042	1	Operating Note

Cable Wiring Diagram

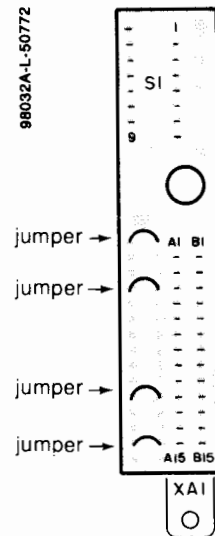


Wire color code is the same as resistor color code: The first number indicates the base color, second number indicates the wider strip, and third color indicates the narrower strip (e.g., 924 indicates white, red, yellow).

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

Configuration Board Jumpers

The Option 064 Interface has four wire jumpers installed on the configuration board, inside the interface rear housing, at locations 1, 4, B and E.



Option 064 Configuration Board
(Circuit Side)



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