HEWLETT-PACKARD 9820A CALCULATOR SYSTEM

ELECTRICAL INSPECTION BOOKLET

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INTRODUCTION

This booklet is designed to contain all the procedures for verifying the performance of a Model 20 Calculator System. The booklet has a removable binding, and as peripherals are added to your System, the necessary additional pages can be added to the booklet. The additional pages and an instruction sheet are packaged with the appropriate peripherals. Instructions for opening and closing the binding are given at the rear of this manual.

The procedures given in this booklet are applicable to any Model 20 Calculator, regardless of its memory size.

The electrical properties of any plug-in ROM can be verified using the procedures supplied in the unsupplemented booklet. A ROM can be completely checked independently of any peripherals that may be associated with it.

The pre-recorded programs supplied with the basic booklet are written in a language unique to the internal structure of the Model 20; as such, they cannot be listed, nor the magnetic cards duplicated, by ordinary means.

This booklet contains severals tests. Some of them automatically start over when they are finished. The USER'S RWM, INTERNAL RWM, and ROM tests print information pertaining to the number of times the test has been performed. The next number in the sequence 1, 2, 3, ... will be printed each time the required number of tests has been completed, as shown below:

USER'S RWM TEST – every 450 complete tests
INTERNAL RWM TEST – every 256 complete tests
ROM TEST – every 450 complete tests

The numbers of the sequence are printed on the left of the printer paper, and have no decimal points.

The time required for the USER'S RWM TEST depends upon the memory size of the Calculator. The time required for the other tests is relatively constant.

PROCEDURE FOR USING THIS BOOKLET

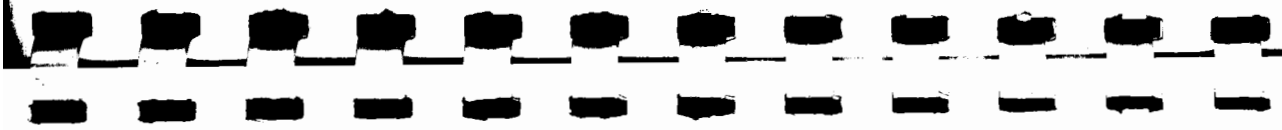
1. To check the Calculator alone, remove any ROM's and peripherals from the System. Complete the rest of this procedure, except ignore steps 2 and 3. Then perform the following tests:

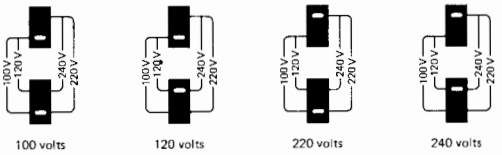
   ERASE TEST
   USER'S RWM TEST
   INTERNAL RWM TEST
   ROM TEST
   DISPLAY AND PRINTER TEST
   KEYBOARD TEST
   RECORD TEST

2. To electrically check any plug-in ROM, install it in a known good Calculator. Complete the rest of this procedure, except ignore step 3. Then perform the ROM TEST.

3. To check a peripheral other than a plug-in ROM, connect the peripheral and (if necessary) the appropriate ROM to a known good Calculator. Complete the rest of this procedure, and then perform the appropriate peripheral test.

4. Ensure that the Calculator has been properly turned on.





Switch Settings for the Various Nominal Powerline Voltages.

NOTE

A different fuse is required at each of the two voltage ranges of 100–120 vac and 220–240 vac. See the Operating and Programming Manual for further information.

Powerline Voltages and Fuses

NOMINAL VOLTAGE	OPERATING RANGE (–10%, +5% of nominal)	CALC. FUSE
100 volts	90 to 105 volts	2-amp
120 volts	108 to 126 volts	2-amp
220 volts	198 to 231 volts	1-amp
240 volts	216 to 252 volts	1-amp

WARNING

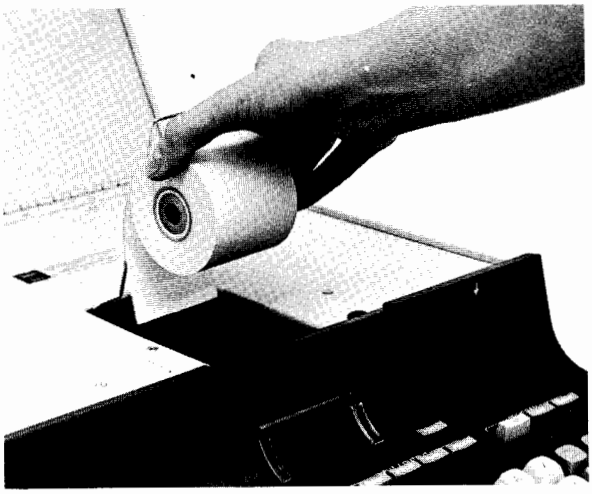
BEFORE CHANGING A FUSE, ENSURE THAT THE CALCULATOR IS DISCONNECTED FROM ANY POWER SOURCE.

Chapter 1 of the Operating and Programming Manual has complete procedures for preparing the Calculator for the application of ac power.

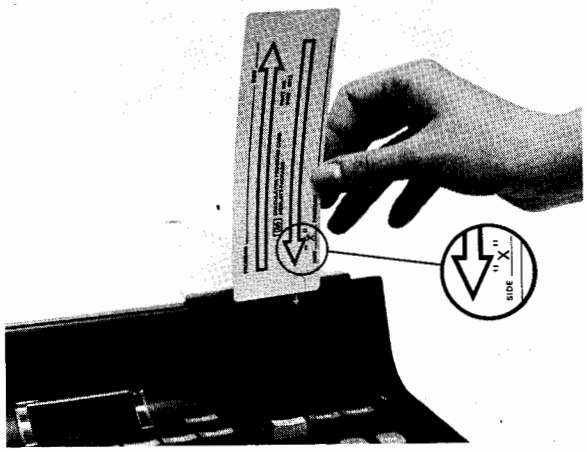
5. Ensure that the printer has been loaded with paper. Chapter 1 of the Operating and Programming Manual has a detailed procedure for loading printer paper. A condensed procedure is given here for convenience.
   a. Lift the access cover attached to the Calculator's top cover.
   b. Remove and discard the paper core of any previous roll.
   c. Insert the new roll such that the free paper end is positioned as shown in the photograph. Be sure that the bail drops back into place.
   d. Press the PAPER button until the paper advances through the printer mechanism and appears beyond the printer window.
   e. Lower the access cover.

6. While a particular test is in progress, do not press any keys, except as required by the test procedure.

7. In general, pressing STOP will not interrupt a test program; it will either erase the memory, or be ignored. Similarly, once stopped, a test usually cannot be restarted with RUN PROGRAM.



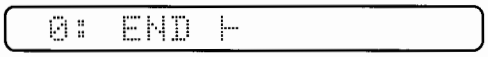
Loading Printer Paper.



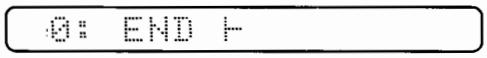
Inserting Side "X" of a Magnetic Card.

ERASE TEST

1. Turn the Calculator ON.
2. The display must be:



3. PRESS: [ERASE]
4. The display must be:



5. If these conditions are not met, do not proceed further; your Calculator is defective.

USER'S RWM TEST ON NEXT PAGE

USER'S RWM TEST

1. PRESS: ERASE LOAD EXECUTE

   Then insert either side marked 'A'. NOTE 15 will appear in the display if any ROM's are installed; if it does appear, ignore it.

2. PRESS: EXECUTE This starts the test.

CORRECT RESPONSE

USER'S RWM
(flashes six times)

TEST COMPLETE
(flashes once)

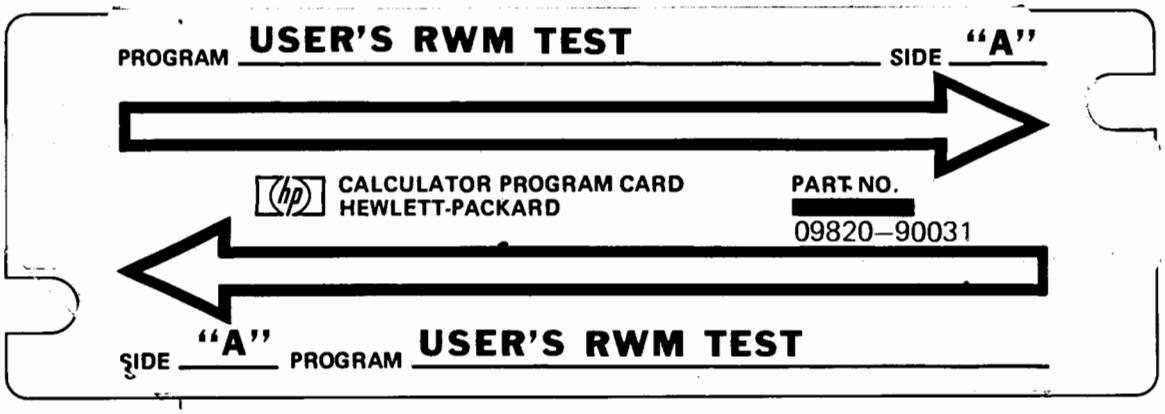
SAMPLE INCORRECT RESPONSE

```
020552                 <-- code for memory location
0000000000000000       <-- test pattern
0000000000001000       <-- incorrect response

020552
1111111100000000
1111111100001000
```

(repeated)

3. To terminate the test, press MEMORY ERASE. To restart the test, begin at step 1.



INTERNAL RWM TEST

1. PRESS: ERASE LOAD EXECUTE

Then insert the side marked 'B'. NOTE 14 will appear in the display. Press EXECUTE and insert the side marked 'C'.

2. PRESS: EXECUTE This starts the test.

CORRECT RESPONSE

INTERNAL RWM
(flashes six times)

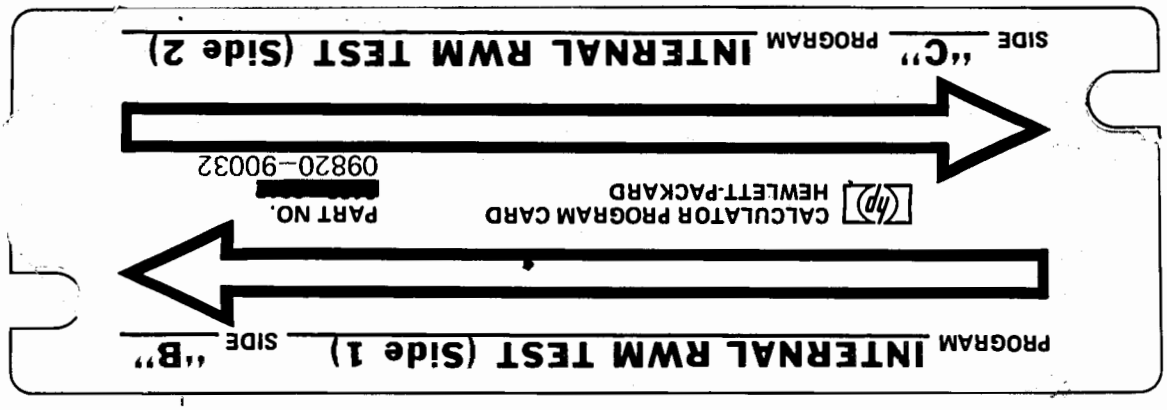
TEST COMPLETE
(flashes once)

SAMPLE INCORRECT RESPONSE

```
001550                  <-- code for memory location
1010101010101010        <-- test pattern
1010101010101110        <-- incorrect response
```

(repeated)

3. To terminate the test, press MEMORY ERASE. To restart the test, begin at step 1.



ROM TEST

1. PRESS: ERASE LOAD EXECUTE

   Insert the side marked 'D'. NOTE 14 will appear in the display. Press EXECUTE and insert the side marked 'E'.

2. PRESS: EXECUTE This starts the test.

3. Verify the display and the printout.

4. After the initial response has been verified, you may continue the test, but suppress the routine printout, by pressing DISPLAY. You should see the alternate response.

5. The initial type of response can be restored by pressing EXECUTE.

6. To terminate the test, press MEMORY ERASE. To restart the test, begin at step 1.

[redacted]

INITIAL CORRECT RESPONSE

```
ROM TEST
164003
045723
122625
020420
077476
070212
004115
031430
000000
000000
000000
000000
000000
000000
177744
022000

TEST OKAY
(repeated)
```

these numbers must be as shown

These codes vary according to what ROM's are installed. See ROM CODES. ① ② ③

Check against MEMORY SIZE CODE

Sample incorrect responses shown on next page.

ALTERNATE CORRECT RESPONSE

TEST COMPLETE

(flashing)

ROM CODES

Mathematics	000002 025754
Peripheral Control I	000001 067106
User Definable Function	000004 063264
Empty slot	000000 000000

MEMORY SIZE CODES

173 Maximum R registers	177744 020000
429 Maximum R registers	177744 022000

INITIAL INCORRECT RESPONSE

```
  ROM TEST
164003
045723
122625
020420
077476
070212
004115
031430
000004
063264
000000
000000
000000
000000
177744
022000
 CKSM BLOCK 09
000377
```

(repeated)

ALTERNATE INCORRECT RESPONSE

```
 CKSM BLOCK 09
000377
```

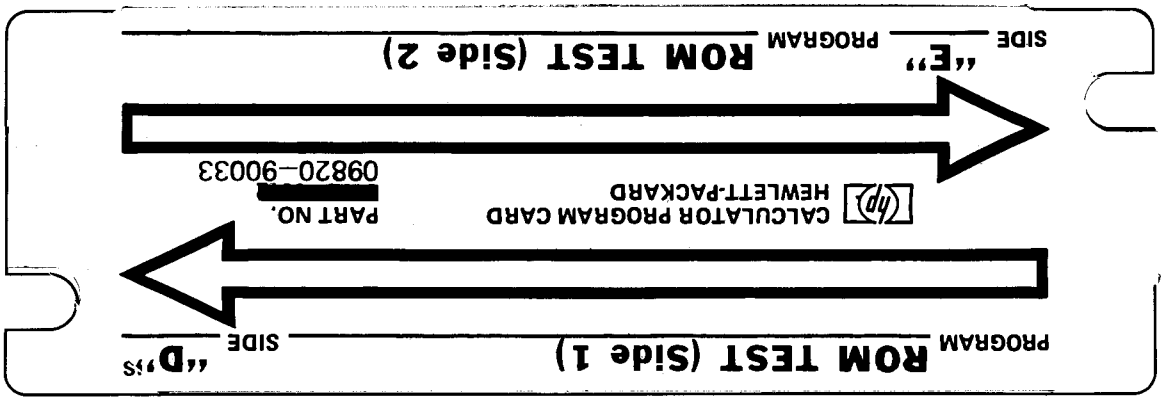
(repeated)

CKSM BLOCK 09 } Error in plug-in ROM
CKSM BLOCK 10 } located in slot ①

CKSM BLOCK 11 } Error in plug-in ROM
CKSM BLOCK 12 } located in slot ②

CKSM BLOCK 13 } Error in plug-in ROM
CKSM BLOCK 14 } located in slot ③

CKSM errors in other blocks refer to errors in the internal ROM of the basic Calculator.

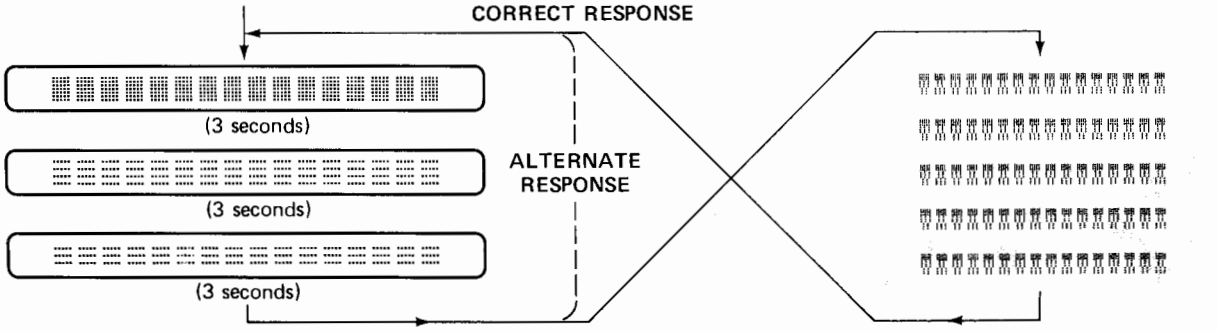


DISPLAY AND PRINTER TEST

1. PRESS: [ERASE] [LOAD] [EXECUTE] Insert either side marked 'F'.

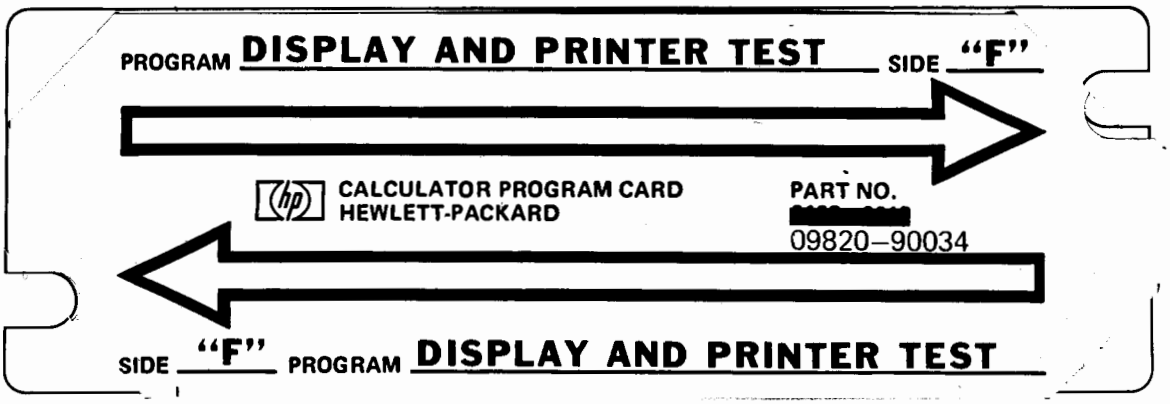
2. PRESS: [EXECUTE] This starts the test. Verify the display and the printout.

3. After the initial response has been verified, you may suppress the printout by pressing DISPLAY.



4. The initial type of response can be restored by pressing EXECUTE.

5. To terminate the test, press MEMORY ERASE. To restart the test, begin at step 1.



KEYBOARD TEST

Press the following sequence of keys and verify that the required displays appear.

PRESS	DISPLAY
ERASE	0: END ⊢
CLEAR	⊢
BACK	
FORWARD	⊢
RECALL	0: END ⊢

PRESS	DISPLAY
BACK BACK	0:
INSERT " A " ; FORWARD FORWARD	0: "A";END ⊢
DELETE	0: ⊢
ERASE CLEAR	⊢
A + 1 EXECUTE	1.000000000E 00
STORE	0: A+1→Z⊢

[redacted]

ERASE	0: END ⊢

CLEAR " , $ % & ' ?

SPACE

The 4 blank keys, top to bottom.

0 E F G H

"$%&'?£½¾ DEFGH

CLEAR " I J K L M

N O P Q R

S T U V W

IJKLMNOPQRSTUVW

PRESS

DISPLAY

CLEAR " . 0 1 2 3
4 5 6 7 8 9

" .0123456789

CLEAR " + − * / √‾
ENTER EXP ( ) , ;

" + − * / √‾ ↑ ( ) , ;

Note: " not included.

CLEAR " A B C →
X Y Z R( )

"ABC→XYZ:

CLEAR " > ≤ = ≠ STOP

">≤=≠!

CLEAR JUMP FLAG N 1 ;
IF A = B

JMP FLG 1;IF A=B

CLEAR SET CLEAR FLAG N

SFG

CLEAR SET CLEAR FLAG N SET CLEAR FLAG N

CFG

CLEAR END ; GO TO SUB

END ;GSB

PRESS	DISPLAY
CLEAR RETURN ; GO TO	RET ;GTO
CLEAR NORMAL ; TRACE	NOR ;TRC
CLEAR FIXED N ; FLOAT N	FXD ;FLT
CLEAR ENTER ; DISPLAY	ENT ;DSP
CLEAR PRINT ; SPACE N	PRT ;SPC
CLEAR LOAD ; RECORD	LOD ;REC

[redacted]

ERASE DISPLAY " B L I N K	
" , " SPACE " STORE	0:"BLINK";" "⊢
GO TO 0 STORE END RUN PROGRAM	BLINK (flashing)
STOP END LIST	

The printer should produce the following listing:

```
0:
DSP "BLINK";" "⊢
1:
GTO 0⊢
R426
```

this number may vary

Press PAPER and ensure that the printer paper advances.

RECORD TEST

1. This test requires either a blank (unrecorded) six-inch magnetic card, or one that is known to contain information other than the numerical data that is to be recorded during this test.

   Any magnetic card can be made into a blank card (that is, its information completely erased) by placing the card (dark side up) on a flat surface, and covering it with a piece of paper. Then take a strong magnet and rub it lengthwise over the card. The paper will prevent the surface of the card from being scratched.

2. PRESS: [ERASE]

   [1] [0] [0] [→] [A] [STORE]

   [A] [→] [R/S] [A] [;] [JUMP] [(] [A] [−]

   [1] [→] [A] [)] [=] [−] [1] [STORE]

   [END] [STORE]

   This listing may be obtained by pressing END LIST before proceeding to step 3. If the listing is incorrect, repeat step 2.

```
0:
100→A⊢
1:
A→RA;JMP (A-1→A)
=-1⊢
2:
END ⊢
R426
```

this number may vary

3. PRESS: [END] [RUN PROGRAM] The display should return as:

   −1.000000000E 00

4. PRESS: [RECORD] ["] [D] [A] ["] [,] [R/S] [1] [0] [0]

5. PRESS: [EXECUTE]

6. Insert either side of a six-inch magnetic card, meeting the criteria of step 1 of this test, into the card reader. Do **not remove the card from the card reader as it comes out** – this will free you from having to remember which side you inserted. The display must appear as shown:

7. PRESS: [ERASE] [LOAD] [EXECUTE]

8. Re-insert the same side of the card into the card reader. The display must again appear as:

```
NOTE 14
```

9. PRESS: STOP

1 0 0 → A STORE

IF A = R( ) A ; JUMP (A

– 1 → A) = – 1 STORE

FIXED N 0 ; DISPLAY 1 0 0

– A ; END STORE

This listing may be obtained by pressing END LIST before proceeding to step 10. If the listing is incorrect, repeat step 9.

```
0:
100→A⊢
1:
IF A=RA;JMP (A-1
→A)=-1⊢
2:
FXD 0;DSP 100-A;
END ⊢
R398
```

this number may vary

10. PRESS: END RUN PROGRAM

11. The display must appear as a number n, within the range $40 \leqslant n \leqslant 55$.

This test checks two things: first, that the card reader can record information on a card, and second, that the speed of the card reader motor is within proper limits. The speed test is performed by determining how many registers can be recorded on one side of a six-inch card. That is the number that appears in the display at the end of the test.

PLOTTER (PC I BLOCK) EXERCISER

The following procedure should be used to check operation of the Model 9862A Plotter when using the 11220A Peripheral Control I Block (the PC I Block should be installed in ROM Slot #3).

On the plotter:

1. Press LINE; the LINE indicator should light.

2. Place a sheet of 10 X 15 inch plotter paper, -hp- Part No. 9270–1004, on the platen and align the paper against the bottom and left-edge paper guides. Press CHART HOLD and smooth the paper on the platen.

3. Adjust the 'LOWER LEFT' Graph Limit controls to align the pen exactly over the lower-left corner of the grid on the paper. Then adjust the 'UPPER RIGHT' Graph Limit controls to align the pen over the upper-right corner of the grid.

On the calculator:

4. Switch the calculator ON and after the display appears, press ERASE, LOAD, EXECUTE.

   Insert side ONE of the PLOTTER (PC I BLOCK) EXERCISER card into the card reader. After NOTE 14 appears, press EXECUTE and insert side TWO into the card reader. To run the exerciser program, press END, RUN PROGRAM.

5. The resulting plot should duplicate the sample plot shown.

SAMPLE PLOT

Plotter alignment can be verified by comparing the plot with the following specifications:

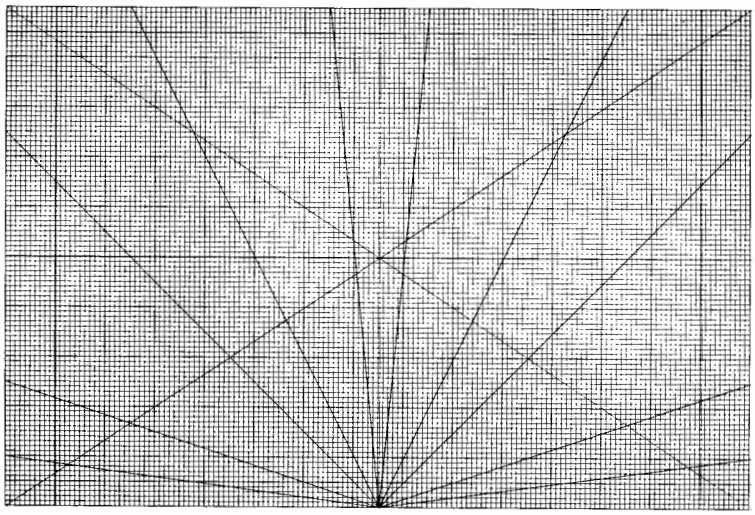
a. Alignment Verification – all vertical and horizontal lines (6) align within 0.010 in. of preprinted grid.

b. Linearity Verification – all dots (26) are within 0.030 in. of major divisions of preprinted grid.

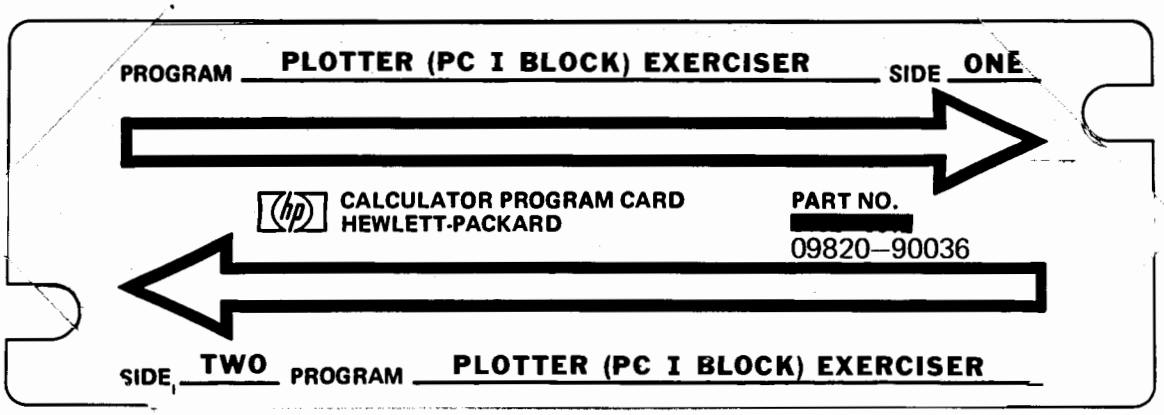
c. Retrace Verification – all retraced lines (10 radiating from bottom center and one diagonal from lower left) are open less than 0.015 in.

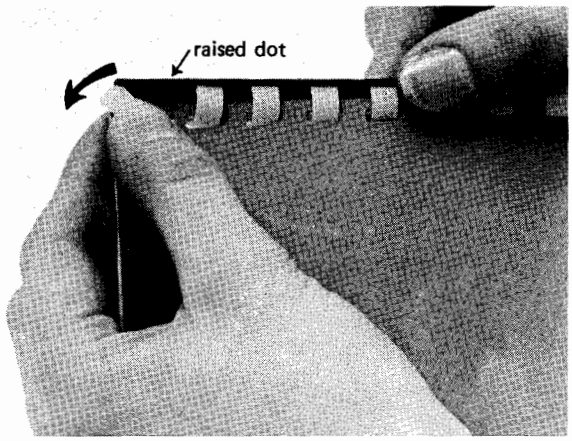
d. Servo Matching Verification – the single trace diagonal (from upper left) has inflections less than 0.015 in. in amplitude.

e. All angular lines bowed no more than 0.040 in. from the true straight line between end points.

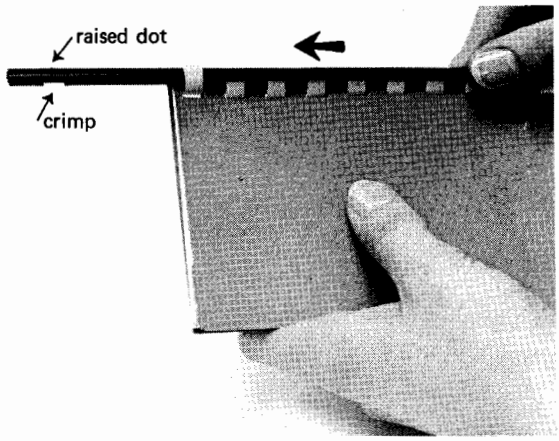


6. If the plotter fails to duplicate the sample plot, verify that the lower-left and upper-right corners are properly aligned; then repeat the foregoing procedure. If the sample plot still cannot be duplicated, contact the nearest -hp- Sales and Service Office; office locations are listed at the back of the Model 20 Calculator Operating and Programming Manual.

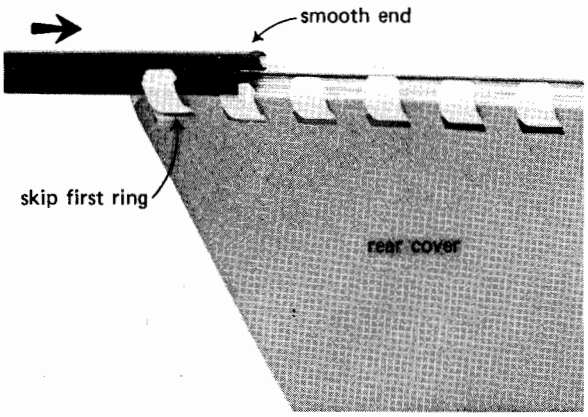




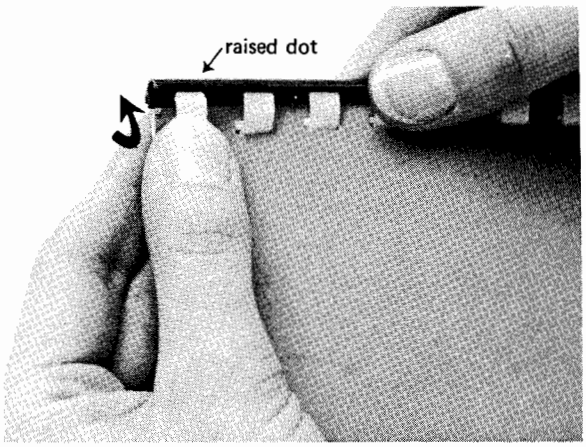
1 Unhook the end ring.



2 Slide the binding apart.



3 Engage the binding (-hp- Part No. 9282–0503), but skip the first ring.



4 Snap the ring into the groove.

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