

MANUAL

for

MODEL 2761A, OPTION 07

OPTICAL MARK READER

Serial Numbers Prefixed : 844-



HEWLETT-PACKARD

11000 Wolfe Road, Cupertino, Calif.

02760-9060

Printed in U. S. A.

5/69



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**UPDATING SUPPLEMENT FOR OPERATING AND SERVICE MANUAL**

1 MAY 1970

**MANUAL IDENTIFICATION**

Manual Serial No. Prefix: 844  
Manual Printed: 5/69  
Manual Part Number: 02760-9060

**SUPPLEMENT DESCRIPTION**

The purpose of this supplement is to adapt the manual to instruments containing production improvements made subsequent to the printing of the manual and to correct manual errors. Enter the new information (or the Change Number, if more convenient) into the appropriate places in the manual, identified at left.

**INSTRUMENT CHANGES**

Serial No. Prefix	Change
ALL	1-21
955	22-27
956	28-37


**ASSEMBLY CHANGES**

Ref Des	Description	HP Part No.	Rev	Changes
A1	Amplifier and Storage	02760-6032	914	8,13,18a,18b,18c,20
A101	Power Supply	02760-6107	849	11,12,14,15,19a,19c,19d,19e,19f

Changes 1 through 21 dated 21 Oct. 1969.  
Changes 22 through 37 dated 1 May 1970.



US-1

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CHANGE

DESCRIPTION

- 1 On the title page:
- a. Under "OPTICAL MARK READER", add Serial Numbers Prefixed: 844-.
  - b. Above "Printed in U.S.A.", add 02760-9060.
- 2 In figure 3-5, page 3-5:
- a. On amplifier and storage card A1, change "CH10", "CH11", "CH12", and "CH13" to CH11, CH12, CH13, and CH14, respectively.
  - b. On read head assembly A5, label the photodiode symbols and driver symbols of row 1 through edge of card as follows: V4 and Q4, V5 and Q5, V6 and Q6, V7 and Q7, V8 and Q8, V9 and Q9, V11 and Q11, V12 and Q12, V13 and Q13, V3 and Q3, V2 and Q2, V1 and Q1, V14 and Q14, and V16 and Q15.
- 3 In figure 4-2, page 4-5:
- a. Change pick roller REST POSITION from "1/32 (+1/32, -0)" to 1/32 (+1/64, -0).
- 4 Page 4-5, paragraph 4-22c, line 3, change "(1/16, +1/64, -0, below the feed deck)" to (1/32, +1/64, -0, below the feed deck).
- 5 Change page 4-7, paragraph 4-27 to read:
- Remove the Switch Cover (HP Part No. 02760-0032) by removing three screws: one is located under the pushbutton switches (located through the hole in the switch bracket); the other two are located behind the identification panel. Pull the switch cover aside.
- 6 Change page 4-7, paragraph 4-29 to read:
- Replace switch cover by replacing three screws removed in paragraph 4-27.
- 7 Page 4-13, paragraph 4-50, change lines one, two and three to read:
- Card Reading. Code 20 cards by marking all the preprinted boxes in the first, third, fifth, and seventh data columns. This test determines the reading capabilities of the 12 data channels. Proceed as follows.
- 8 Page 5-3, parts list table, change line 2 (reference designation C1) to read:
- C1;C: fxd, tant, 0.22  $\mu$ f, 10%, 35 VDCW; 0180-1735; 56289; 150D224X9035A2-DYS.
- 9 Page 5-9, parts list table, change line 13 (reference designation F1, 2) to read:
- F1; Fuse: 125V, 2A, Slow-Blow; 2110-0006; 71400; MDL2; 1; 10.
- 10 Page 5-9, parts list table, add: F2; Fuse: 250V, 1A, Slow-Blow; 2110-0007; 75915; 313001; 1; 1.



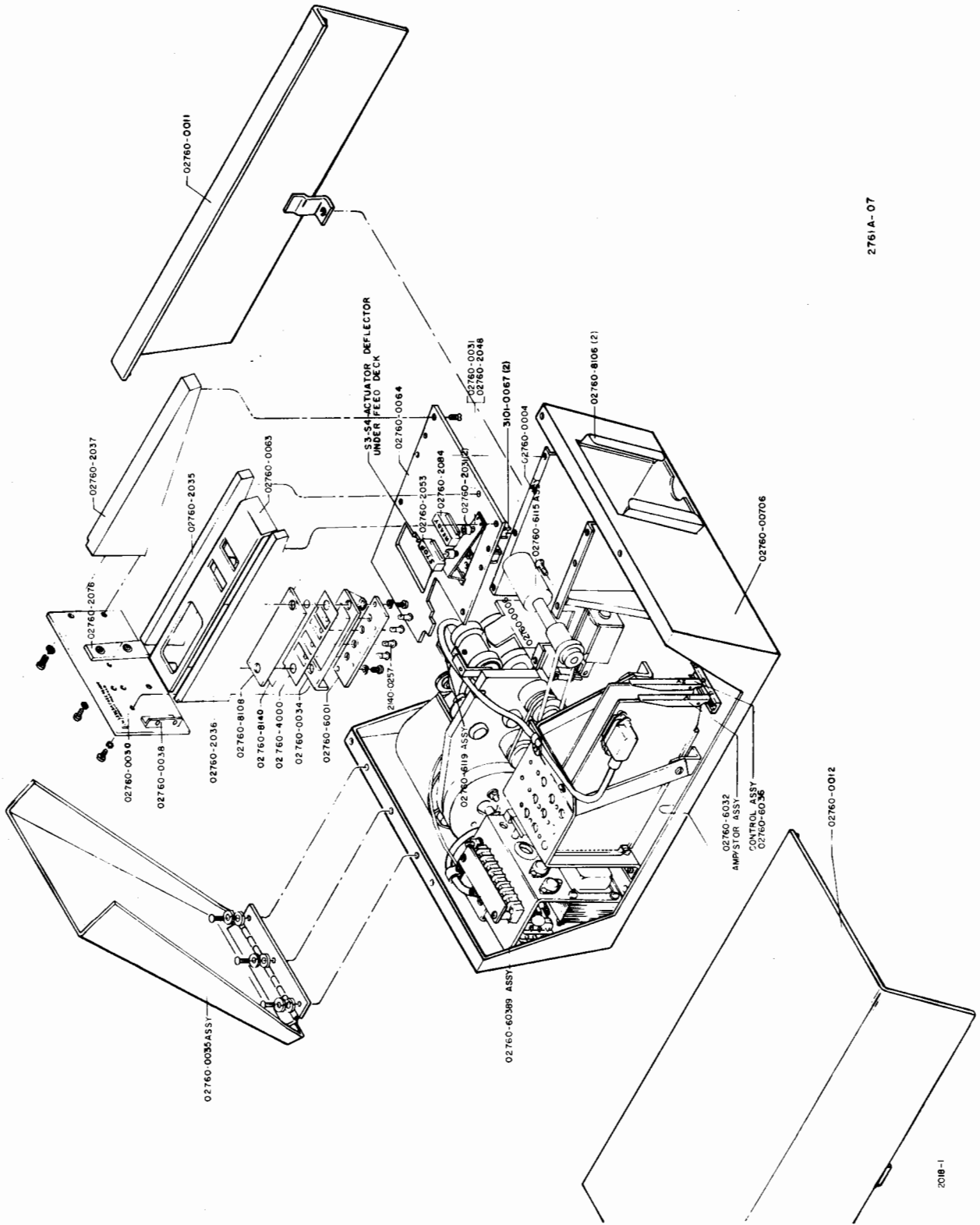
CHANGE

DESCRIPTION

- 11 Page 5-10, parts list table, change line 7 (reference designation CR7) to read:  
 CR7; Diode: breakdown, 17.8V, 400MW, 1902-3224; 28480;  
 1902-3224; 1; 1.
- 12 Page 5-10, parts list table, change line 11 (reference designation R2) to read:  
 R2; R: fxd, comp, 820 ohms, 5%, 1/2W; 0686-8215; 01121;  
 EB8215; 1; 1.
- 13 Page 5-11, parts list table, line 15, delete: "0180-0376; C: fxd. . . 284080 1"  
 and add 0180-1735; C: fxd, tant, 0.22  $\mu$ f, 10%, 35VDCW; 56289;  
 150D244X9035A2-DYS; 1.
- 14 Page 5-12, parts list table, line 9, delete: "0686-3315; R: fxd. . . EB3315 1"  
 and add 0686-8215; R: fxd, comp, 820 ohms, 5%, 1/2W; 01121; EB8215; 1.
- 15 Page 5-13, parts list table, line 17, delete: "1902-0594; Diode: Si, 18.2V, 1W;  
 28480; 1" and add 1902-3224; Diode: breakdown, 17.8V, 5%, 400MW;  
 28480; 1902-3224; 1.
- 16 Page 5-13, parts list table, add: 2100-0006; Fuse: 125V, 2A, Slow-Blow;  
 71400; MDL2; 1.
- 17 Page 5-13, parts list table, line 24, change: "2110-0007; Fuse: 125V, 1A,  
 Slow-Blow; 75915; 313001; 1" to: 2110-0007; Fuse: 250V, 1A,  
 Slow-Blow; 75915; 313001; 1.
- 18 Amplifier and Storage for 2761A-07 Schematic, D02760-6032-S:
  - a. Add to the revision table: C, PC1100, A-931-22.
  - b. At the top of the figure, change "REV 914" to REV 931.
  - c. Change the value of capacitor C1 located at the input of chan 13  
 from "0.47" to 0.22.
  - d. Change "chan 10 amplifier", "chan 11 amplifier", "chan 12 amplifier",  
 and "chan 13 amplifier" to chan 11 amplifier, chan 12 amplifier,  
 chan 13 amplifier, and chan 14 amplifier, respectively.
- 19 Power Supply Schematic, D02760-6107-S:
  - a. Change the value of capacitors C1 and C2 from ".015  $\mu$ f" to 0.01  $\mu$ f.
  - b. Change the value of fuse F2 from "2A" to 1A.
  - c. Change the value of resistor R2 from "330 ohms" to 820 ohms.
  - d. Change the breakdown voltage value of diode CR7 from  
 "18.2V, 1W" to 17.8V, 400MW.
  - e. Add to the revision table: D; R2 to 820 ohms, CR7 to 17.8V; WR.
  - f. Add REV 928 to "DEFINES CIRCUIT BOARD 02760-6007".

**CHANGE****DESCRIPTION**

- 20                    Amp and Storage Assembly, C02760-6032-1:
- a.    Change "CHAN 10", "CHAN 11", "CHAN 12", and "CHAN 13" to CHAN 11, CHAN 12, CHAN 13, and CHAN 14, respectively.
  - b.    Change the value of capacitor C1 (located in the bottom-center of the printed-circuit card) from ".47  $\mu$ f" to 0.22  $\mu$ f.
  - c.    Change the revision of the printed-circuit card from "A - 914 - 22" to A - 931 - 22.
  - d.    Add to the revision table: C, C1 to 0.22  $\mu$ f.
- 21                    After the last drawing in the manual (C02760-6107-2), add the attached Optical Mark Reader, Parallel Bit, Wiring Diagram, D-02760-9039-1.
- 22                    Page 4-4, paragraph 4-16. After paragraph 4-16, add paragraph 4-16a as follows:
- 4-16a. IDLER ROLLER TENSION. To adjust the idler roller tension, proceed as follows:
- a.    Loosen the number 8-32 hexagon nut shown as part no. 2580-0006 in figure 5-3.
  - b.    Turn the setscrew counterclockwise until the setscrew turns without resistance.
  - c.    Slide one tabulating card through the front and rear card gate with approximately 1-1/2 inches of the card pinched between the first drive wheel and idler wheels.
  - d.    Move the card in and out with approximately 1/4-inch movement and at the same time turn the setscrew clockwise. Stop turning the setscrew when the card will not move forward through the card gate without bending.
  - e.    Turn the setscrew 3/4 of a turn clockwise and tighten the number 8-32 hexagon nut.
- 23                    Change page 4-7, paragraph 25, step d to read: Replace all lamps with HP Part Number 2140-0335 or equivalent lamps.
- 24                    Change page 5-8, parts list table, A4 Read Head Assy, line two to read: DS1-DS7; Lamp: incd, 22V, 0.04 amp; 2140-0335; 24455; 370; 7.
- 25                    Change page 5-15, figure 5-1, read head lamp part numbers to read: 2140-0335.
- 26                    Replace figure 5-2 with attached figure 5-2.
- 27                    Replace figure 5-3 with attached figure 5-3.



2761A-07

Figure 5-2. 2761A-07 Reader, Exploded View No. 1









**CHANGE****DESCRIPTION**

- 28 Page 1-2, ACCESSORIES FURNISHED, Item 1:  
Delete: Power Cord, 7-1/2 feet, Part No. 8120-0078.
- 29 Page 4-8, Paragraph 4-33, Line 2:  
Change power supply schematic to read: A101, D02760-60389-S.
- 30 Page 4-11, paragraph 4-48, step d.  
a. Change line 1 (part no. 02760-9013-2/3) to read:  
(part no. 02760-9013-1/3).  
b. Change line 4 (part no. 02760-9013-1/3) to read:  
(part no. 02760-9013-2/3).  
c. Change the last line (0.3 ± 0.2 volts) to read: 3.0 ± 0.2 volts.
- 31 Page 5-2, Parts List Table:  
a. Change line 6 (stock no. 02760-6107) to read:  
A101; Power Supply Assembly; 02760-60389; 04404; 1; 0.  
b. Add under the heading "Miscellaneous": Power Cord, 7-1/2 feet;  
8120-1348; 70903; KHS-7041; 1.
- 32 Page 5-9, Parts List Table:  
a. Change line 4 (A101 Power Supply heading) to read:  
A101 Power Supply Assembly; 02760-60389; 04404.  
b. Change line 16 (reference designation J1) to read:  
J1; Conn: power, 3 pin male; 1251-2357; 28480; 1; 1.  
c. Change line 17 (reference designation K1) to read:  
K1; Relay: 24V, 1PDT; 0490-0127; 28480; 0490-0127; 1; 1.  
d. Change line 19 (reference designation S1) to read:  
S1; Switch: toggle, SPST, 250V; 3100-0030; 28480; 1; 1.
- 33 Page 5-10, Parts List Table:  
Change line 2 (reference designation T1) to read:  
T1; Transformer: power; 9100-3118; 28480; 1; 1.
- 34 Page 5-11, Parts List Table:  
Change line 23 (part no. 0490-0128) to read:  
0490-0127; Relay: 24V, 1PDT; 28480; 0490-0127; 1.
- 35 Page 5-13, Parts List Table:  
a. Change line 27 (part no. 3100-0001) to read:  
3100-0030; Switch: toggle, SPST, 250V; 28480; 1.  
b. Change line 33 (part no. 9100-2452) to read:  
9100-3118; Transformer: Power; 28480; 1.

**CHANGE**

**DESCRIPTION**

36

Page 5-14, Parts List Table:

Change line 7 (part no. 02760-6107) to read:  
02760-60389; Power Supply Assembly; 04404; 1.

37

Schematic, Card Reader Power Supply, D-02760-6107-S:

Change Power Supply Schematic D-02760-6107-S to read: D-02760-60389-S.

**MANUAL**

for

**MODEL 2761A, OPTION 008**

**OPTICAL MARK READER**

**Serial Numbers Prefixed 956-**



**HEWLETT-PACKARD**  
11000 Wolfe Road, Cupertino, Calif.

**02761-90012**  
Printed in U.S.A.

4/70



## PREFACE

The specifications for the 2761A-008 Optical Mark Reader are identical to the 2761A-07 Optical Mark Reader except for input power requirements. The 2761A-008 reader operates on 230-volt, 50 Hz power. All information in the attached Operating and Service Manual for the 2761A-07 Optical Mark Reader applies to the 2761A-008 reader, with the following exceptions:

✓ Page 1-1, Paragraph 1-7, POWER REQUIRED:

Change to read: 230V  $\pm$  10%, 50 Hz  $\pm$  5%, 130 watts ✓

✓ Page 2-2, Paragraph 2-8, step "c":

Delete: when only a 2-blade outlet . . . from the side of the  
adapter to ground. ✓

✓ Page 4-8, Paragraph 4-33, Line 2:

Change power supply schematic to read: A101, D02760-60390-S.



Page 5-2, Parts List Table:

✓ Change line 6 to read: A101; Power Supply Assembly; 02760-60390;  
04404; 1; 0

✓ Change line 7 to read: B1; Motor: 50 cycle, 230V, 1500 RPM;  
3140-0481; 28480; 1; 1

✓ Change line 8 to read: Pulley for B1; 02760-20886; 04404; 1; 1

Page 5-9, Parts List Table:

✓ Change line 4 to read: A101 Power Supply Assembly; 02760-60390;  
04404

✓ Add: F1; Fuse: 240V, 1A, Slow-Blow; 2110-0312; 75915; 312005;  
1; 10

✓ Change line 13 to read: F2; Fuse: 125V, 1A, Slow-Blow; 2110-0007;  
75915; 313001; 1; 10

Page 5-13, Parts List Table:

✓ Change line 24 to read: 2110-0006; Fuse: 125V, 1A, Slow-Blow;  
75915; 313001; 1



Page 5-13, Parts List Table (Continued):

- ✓ Change line 29 to read: 3140-0491; Motor: 50 cycle, 230V, 1500 RPM; 28480; 1

Page 5-14, Parts List Table:

- ✓ Change line 7 to read: 02760-60390; Power Supply Assembly; 04404; 1
- ✓ Change line 12 to read: 02760-20886; Pulley; 04404; 1

Figure 5-2, Exploded View No. 1:

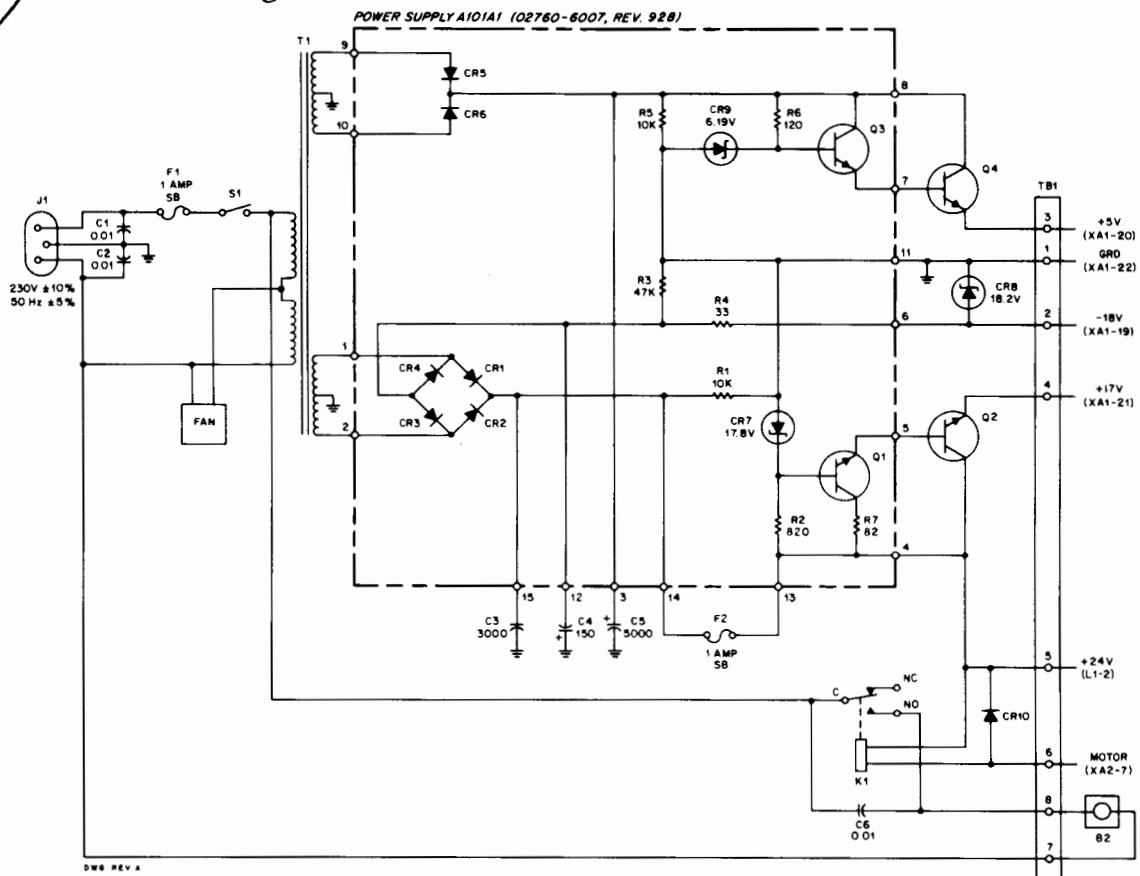
- ✓ Change power supply part number to read: 02760-60390.

Figure 5-3, Exploded View No. 2:

- ✓ Change motor part number to read: 3140-0491
- ✓ Change motor pulley part number to read: 02760-20886

Schematic, Card Reader Power Supply, D-02760-6107-S:

✓ Delete Power Supply Schematic D-07260-6107-S and add the following:

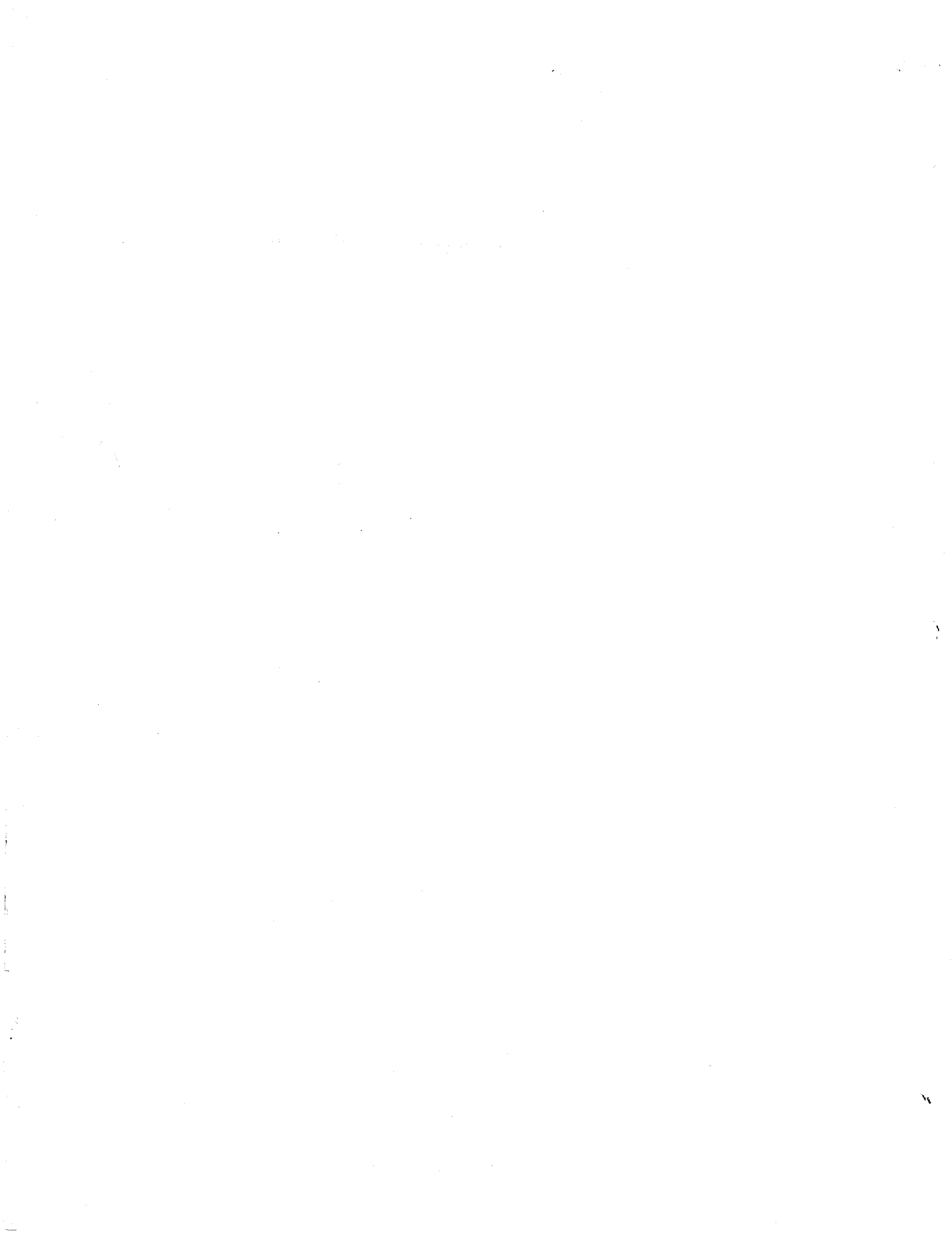


NOTES  
1 UNLESS OTHERWISE SPECIFIED, ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN MICROFARADS

Power Supply, Assembly Reference, C-02760-6107-2:

Delete Power Supply Assembly Reference, C-02760-6107-2.





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## SECTION I

## GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. The Hewlett-Packard 2761A Option 07 Optical Mark Reader reads both punched and marked tab cards, and is designed to be operated in conjunction with a digital computer or similar device. The Reader transfers data directly into the computer in 12-bit parallel form, one data column at a time. Since the data is not coded, the computer must perform any necessary code conversion. The Reader is shown in Figure 1-1.

1-3. INPUT DOCUMENT.

1-4. The input document is a standard tabulating card which may contain up to 80 twelve-bit data columns. The software of the computer determines the number of data columns and the maximum number of marks or punches per column which may be used. Black clock marks printed on the cards synchronize reading by the Reader with the data entry marks (or punched holes) on the card. (Tab card specification information required for printing of the cards is available at any HP Field Sales Office.)

1-5. CARD FEED.

1-6. In normal operation, card feed is controlled by a computer so that each card is fed on request. In this type of operation, the maximum reading rate is about 200 cards per minute. When the card reader is running without external control, the maximum reading rate is about 250 cards per minute.

1-7. SPECIFICATIONS.POWER REQUIRED

~~115V~~<sup>230V</sup> ± 10%, ~~60~~<sup>50</sup> Hz ± 5%, 130 watts

INPUT HOPPER AND STACKER CAPACITY

300 cards

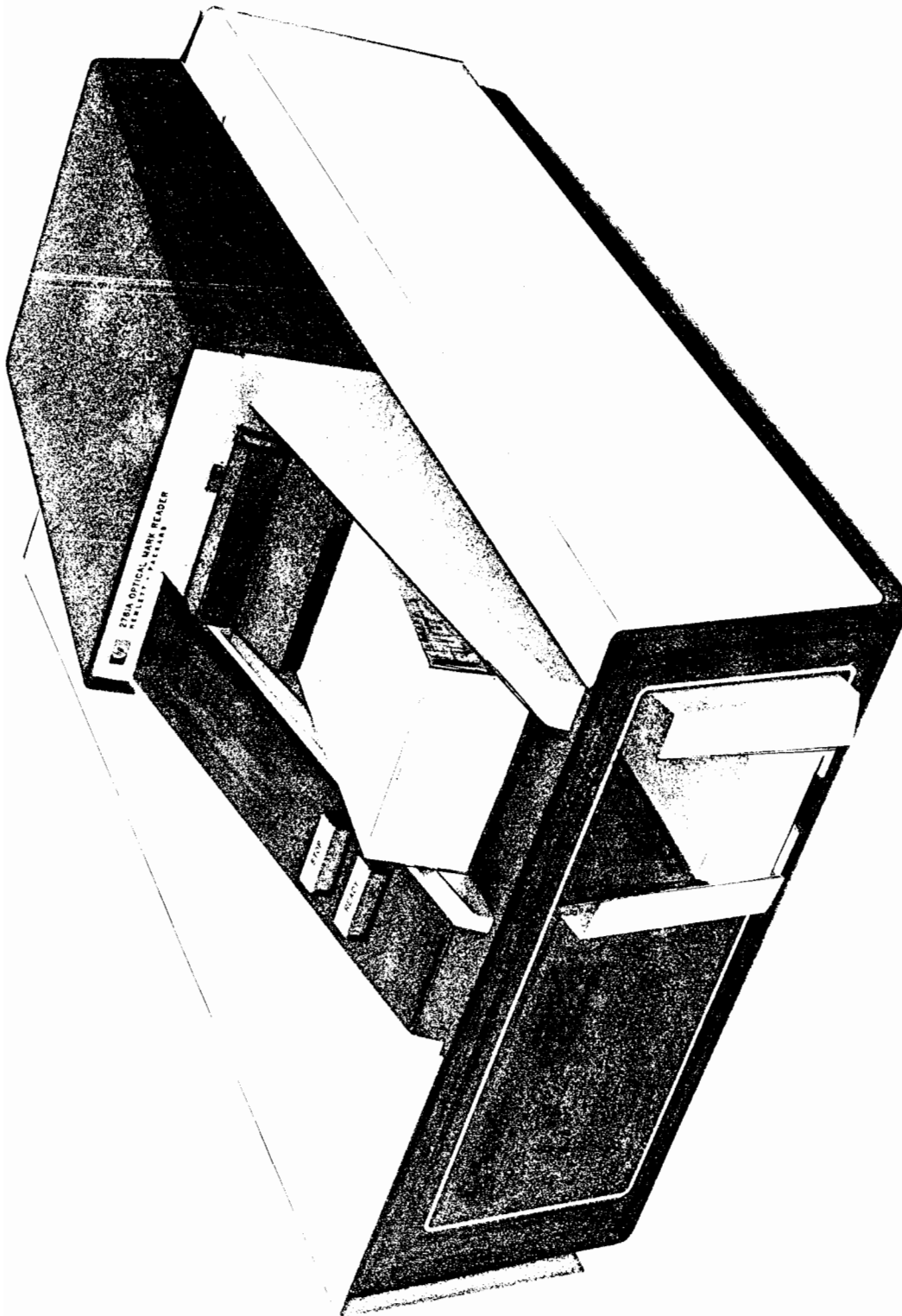


Figure I-1. 2761A-07 Optical Mark Reader

## CHARACTER INPUT RATE

80-Column Cards	455 char/sec $\pm 10\%$
40-Column Cards	227 char/sec $\pm 10\%$

## READER TIMING

Time Required to Read One Card	190 $\pm 10$ ms
Time Between Cards (External Control)	90, +40 -10, ms
Time Between Cards (Without External Control)	50 $\pm 25$ ms
Time Between Feed Signal and Data Input	90, +40 -10, ms

## ENVIRONMENTAL CONDITIONS

Operating Temperatures	0° to 55°C (32° to 131°F)
Relative Humidity	95% at 40°C (not applicable to cards)
Storage Temperature	-40° to +75°C (-40° to 167°F)

## WEIGHT

28 lb (12.7 kg) net, 37 lb (16.8 kg) shipping

## FINISH

Baked enamel, beige covers and dark brown base standard, other color combinations on special order.

## DIMENSIONS

Reader is fully enclosed for desk top use; it is 12-3/4 inches (324 mm) wide by 20 inches (508 mm) deep, including cable clearances, and is 9-1/4 inches (235 mm) high.

## ACCESSORIES FURNISHED

Accessory Kit, Part No. 02760-6130, consisting of:

1. Power cord, 7-1/2 feet, Part No. 8120-0078.
2. Extender card for servicing plug-in cards, Part No. 02760-6013.
3. Test card. Part No. 02760-9067.
4. Card Feed Weight, Part No. 02760-2085.
5. Feeler Gauges, 0.10-inch and 0.040-inch, Part Nos. 8750-0045 and 8750-0044, respectively.

Kit of Sample Entry Cards, Part No. 02760-9054.

## OPTIONAL ACCESSORIES

1. 12602A Interface Kit (for use with Hewlett-Packard computers).



## 2-7. INSTALLATION.

2-8. The Model 2761A-07 Reader is designed to operate from a 115-volt, 60-Hz power source, and is supplied with a detachable 3-wire power cable. A second cable for interconnecting the 2761A-07 Reader to an HP Computer is available in the optional 12602A Interface Kit. Refer to drawing D02760-9039-1 for a wiring diagram of the Reader. To install the Reader, proceed as follows:

- a. Set the rear-panel POWER switch to OFF.
- b. Connect the flat 3-socket connector of the ac power cable to the POWER connector on the back of the Reader.
- c. Connect the other plug connector (2-blades with round ground pin) to a 3-wire (grounded) power outlet. Exposed portions of the 2761A-07 are grounded through the round pin on the connector for safety; ~~when only a 2-blade outlet is available, use a connector adapter (HP stock number 1251-0048), then connect the short wire from the side of the adapter to ground.~~

## 2-9. SWITCHES AND INDICATORS.

2-10. The Reader contains the following switches and indicators:

### SWITCHES

POWER: This two-position toggle switch mounted on the rear of the Reader controls input power to the Reader.

READY: This momentary pushbutton switch mounted on the top-left of the Reader is used to indicate readiness of the Reader to receive computer commands.

STOP: This momentary pushbutton switch mounted on the top-left of the Reader stops Reader operation and inhibits Computer commands.

### INDICATORS

POWER: This indicator lights when the POWER switch is in the ON position.

ON-LINE: This indicator lights when the feed motor is running and when the Computer is ready for data. It is on continually when the Reader is not connected to the computer.

READY: This indicator lights when the READY switch is pressed if: the input hopper is not empty and the stacker is not full. The indicator light goes out when the STOP switch is pressed.

2-11. UPON-RECEIPT CHECKOUT.

2-12. To verify that the control and drive circuits of the Reader operate properly, perform the following:

- a. Set the POWER switch on the back of the Reader to ON. Verify that the POWER and ON-LINE indicators light. Verify that the feed motor starts.
- b. Place a stack of tab cards in the input hopper, face down, with the black clock marks on the right. Place the card feed weight on the stack, as far forward as possible.
- c. Press the READY switch. Verify that the READY indicator lights and that the cards feed into the Reader.
- d. Press the STOP switch. Verify that the READY indicator goes out and that the Reader completes feeding the current card, then stops feeding.
- e. Press the READY switch. Verify that the Reader resumes feeding and continues until the input hopper is empty. When the hopper is empty, verify that the READY indicator goes out.

2-13. CARD PREPARATION.

2-14. Twelve-level Hollerith format is the most-commonly used code. However, data is transferred to the Computer as a simple image of the marked card so any code format may be stored if a suitable Input/Output Driver is used by the Computer.

To operate the flip-flop (FF) a false signal must be applied to pin 5. The "nand" gate requirements are no longer met for MC1B, so its output immediately becomes true. Since the inputs at both pins 1 and 2 of MC1A are true, its output immediately goes false, latching the FF in the set condition. To latch the FF in the reset condition, an instantaneous false signal must be applied to pin 1; the output conditions of the gates reverse.

### 3-8. PHOTODIODES.

3-9. The Reader makes use of 15 photodiodes. A photodiode is a semiconductor device that allows current to flow with an increase of light on the base element. This Reader uses reflected light in its operation; the cards used are highly reflective. When a punched hole or a black pencil mark passes under a photodiode, there is a decrease in reflectivity and therefore a decrease in current in the photo diode, and the punched hole or mark is read.

### 3-10. MARK SENSING CIRCUITS.

3-11. The mark sensing circuits consist of a photodiode, an emitter-follower, a diode, and a degenerative feedback amplifier; see Figure 3-3.

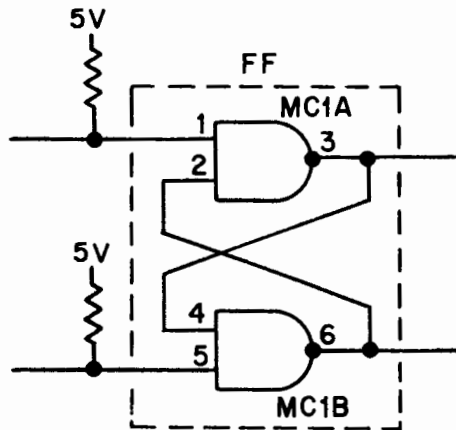


Figure 3-2. Typical "Nand" Gate Flip-Flop

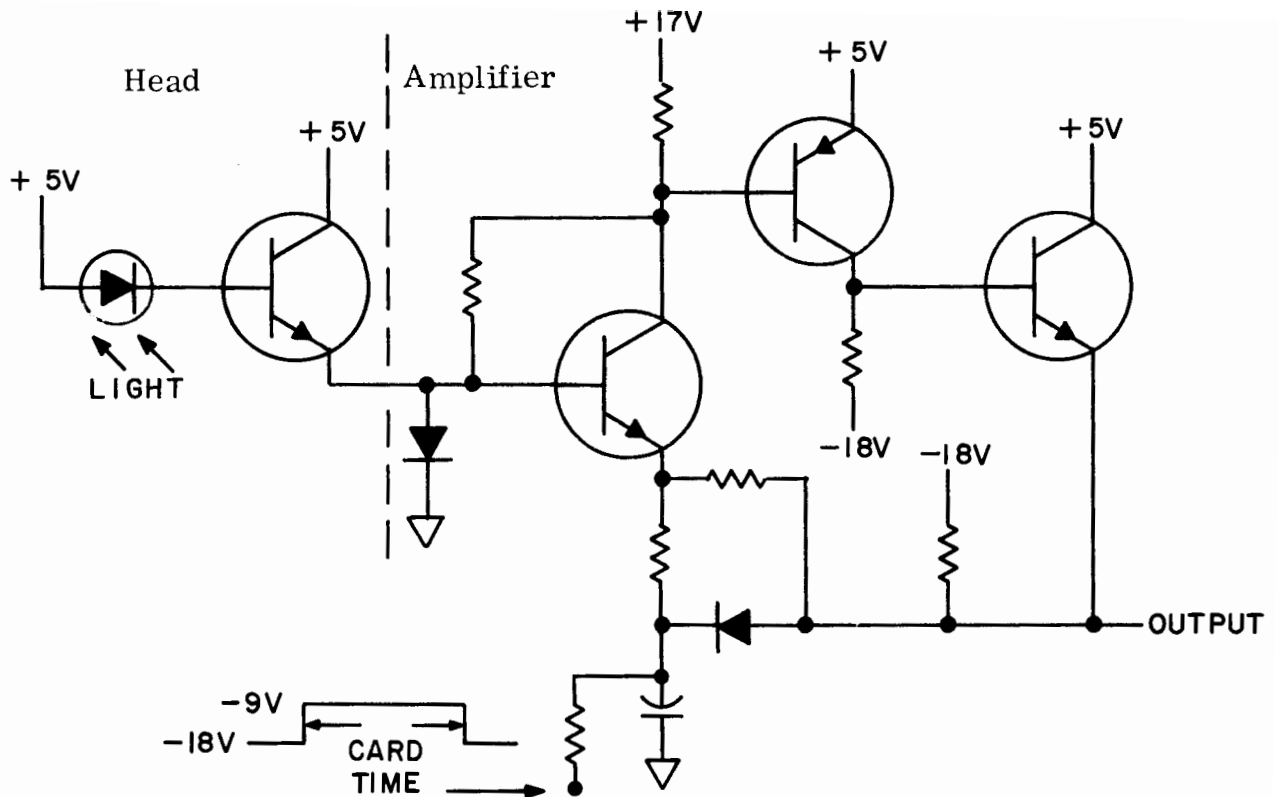


Figure 3-3. Mark Sensing Circuit

3-12. This circuit compensates for the conductive change of the photodiode due to thermal factors and for the conductive difference between individual photodiodes. The diode on the input of the amplifier acts as a logarithmic signal compressor, compressing high level signals more than low level signals. The amplifier stage is capable of high gain with 100% feedback in positive direction and a gain of 400 in the negative direction.

### 3-13. DIFFERENTIATORS.

3-14. A differentiator circuit is a resistive-capacitive network that is used to derive a sharp pulse from the leading or trailing edge of a broad pulse. The Reader uses several differentiators and in most cases, the differentiators clamp the positive-going excursion of a pulse to +3 volts. This is accomplished as indicated in Figure 3-4.

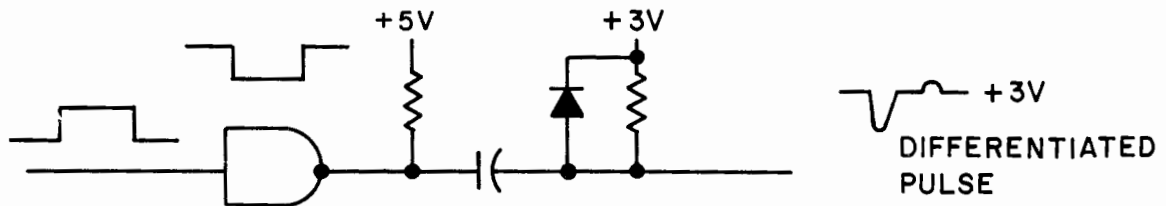


Figure 3-4. Differentiator Diagram

3-15. OVERALL OPERATION.

3-16. GENERAL.

3-17. The HP 2761A-07 Optical Mark Reader operates under control of a digital computer. When the Reader receives a Feed signal from the computer, it transports the card under a read head containing 15 photodiodes. The photodiodes detect the punched or marked information and transmit that information, in 12-bit parallel form, to the computer. The read head also detects the leading edge of the card, the trailing edge of the card, and each clock mark that is printed on the card. The Reader also transmits this information to the computer.

3-18. FUNCTIONAL DESCRIPTION.

3-19. Figure 3-5 provides a simplified logic diagram of the Reader and should be studied for an overall understanding of Reader operation. Figure 3-6 illustrates timing of the major Reader signals to and from the computer. The following detailed theory of operation should then be referred to for a complete explanation of Reader operation to the component level.

3-20. DETAILED THEORY OF OPERATION.

3-21. PROGRAM CONTROL CARD (Drawing D02760-6036-S).

3-22. The following paragraphs explain the generation of the Feed signals, and the Ready Indicator Status, No Card Flag, Feed Solenoid, On-Line Indicator, Extended Card-in-Gate, and Motor Relay signals.

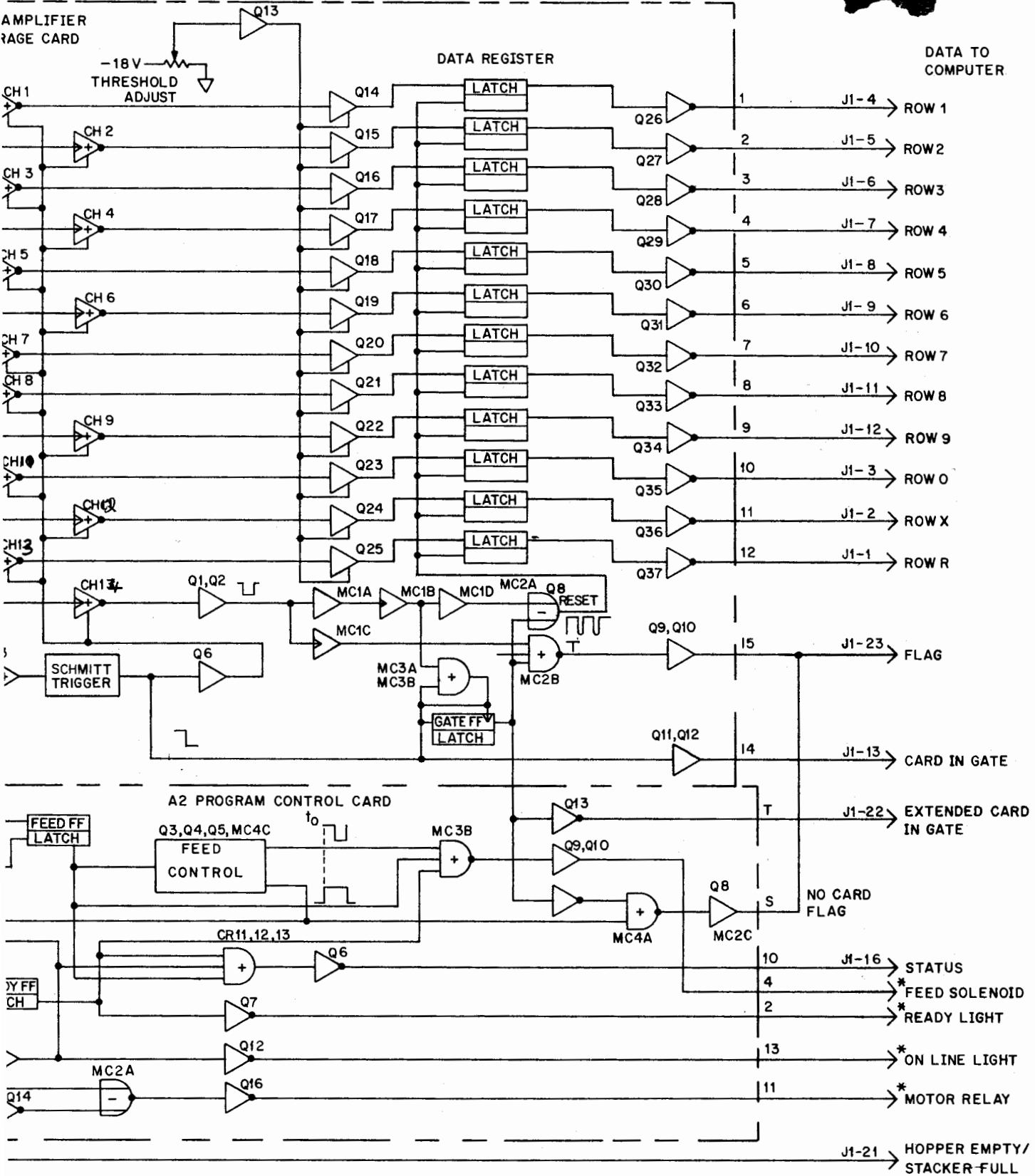
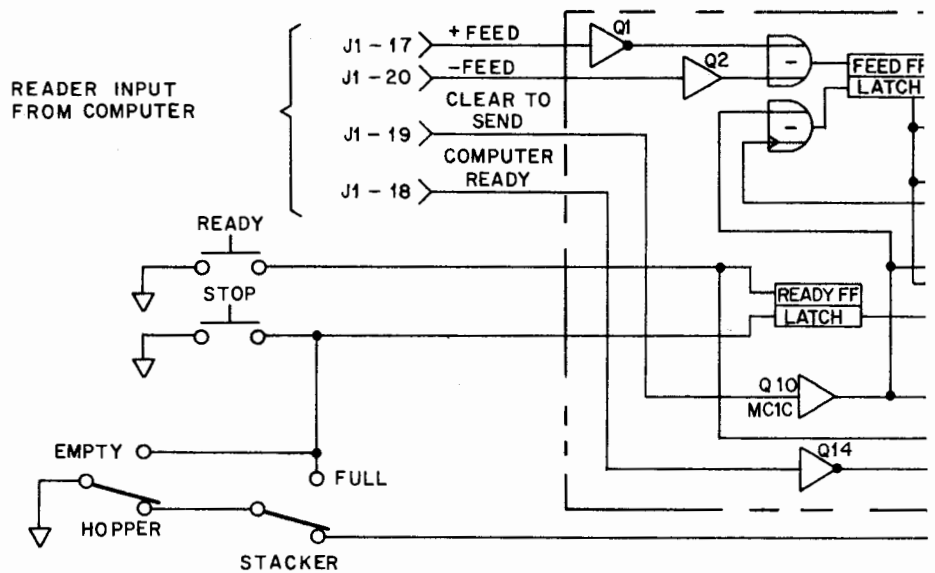
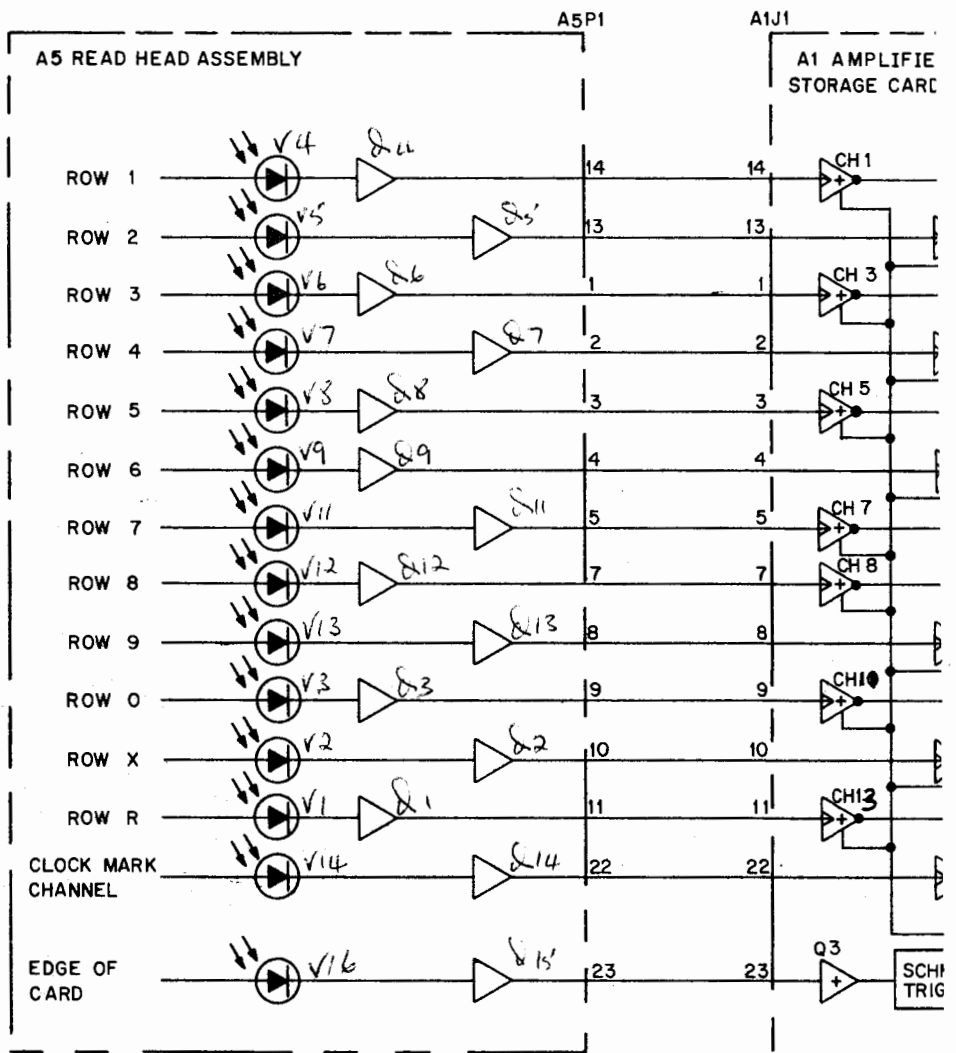


Figure 3-5. Simplified Control Logic



\* SIGNALS TO READER COMPONENTS.

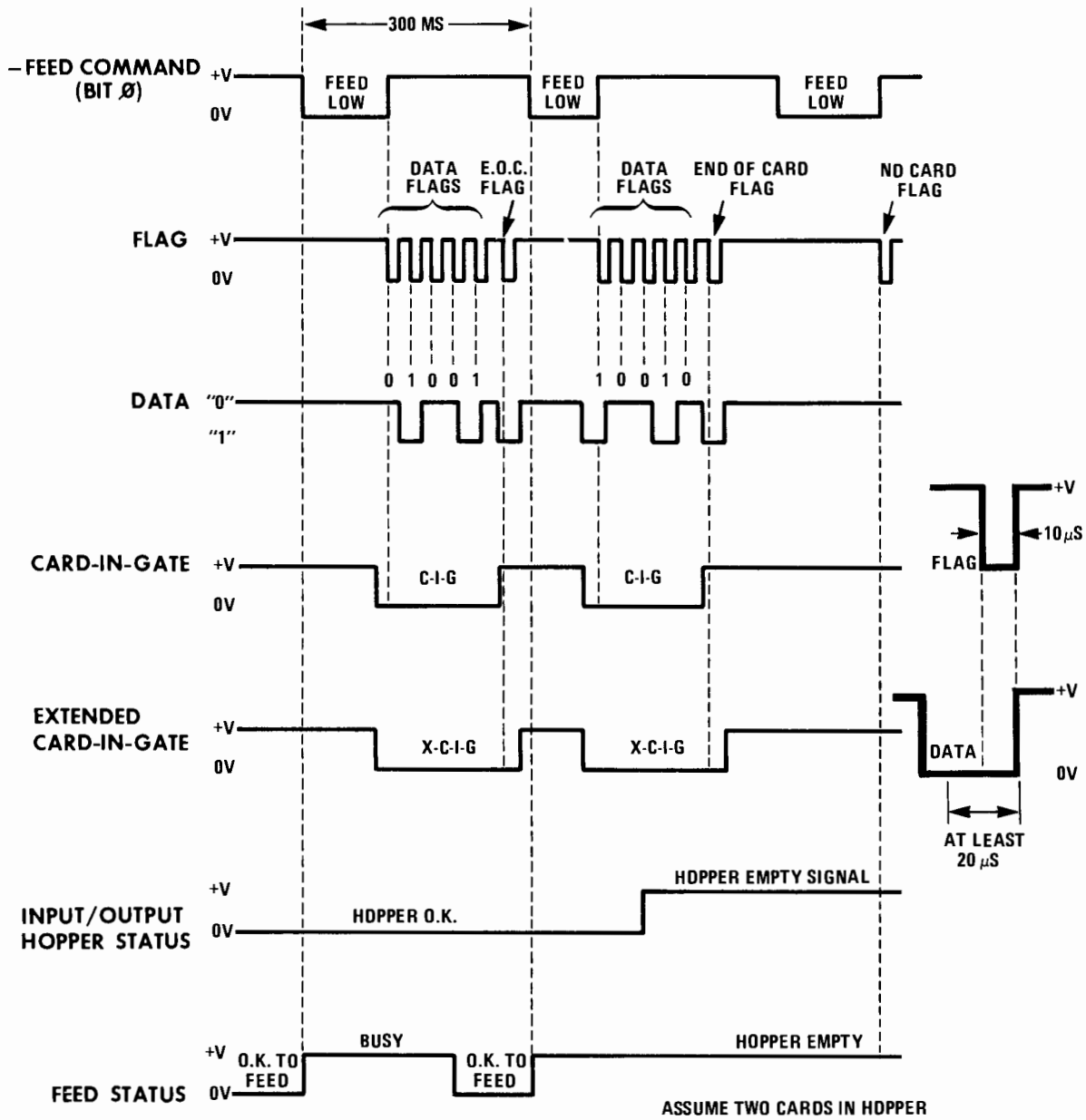


Figure 3-6. Optical Mark Reader Timing





3-23. PLUS AND MINUS FEED SIGNALS. A plus or a minus Feed signal issued by the Computer sets the Feed FF. The Feed FF enables a delay multivibrator formed by transistors Q3, Q4, and Q5 which, after a slight delay, resets the Feed FF and furnishes a pulse to gate MC4A for the generation of the No Card Flag signal. Gate MC1B inverts the low voltage from pin 12 of the Feed FF. The output of the Ready FF, the output of the Feed FF, and the output of Q5 turn off Q9 and turn on Q10. Transistor Q10 furnishes the ground to energize the feed solenoid

3-24. READY INDICATOR SIGNAL. The Ready Indicator signal becomes true when the READY switch is pressed, setting the READY FF. When the READY FF sets, transistor Q7 furnishes a ground for the READY indicator, turning the indicator on. The FF resets when the STOP switch is pressed, when the feed hopper becomes empty, or the stacker becomes full.

3-25. STATUS SIGNAL. The Status signal becomes true when the Reader has received the Clear-to-Send and Feed signals, and if the READY switch has been pressed. (Clear-to-Send and Feed signals are true when their input lines are open.) The Clear-to-Send signal turns on transistor Q11, and gate MC1C inverts the resulting false signal. The Feed signal sets the Feed FF. The two signals, with a true READY signal, back-bias diodes CR11, CR12, and CR13. Voltage divider resistors R22, R23, and R24 apply a positive voltage to the base of Q6, forcing it to conduct. The resulting "busy" Status signal is about +0.5 volts, with respect to ground.

3-26. NO-CARD-FLAG SIGNAL. The No Card Flag signal occurs if there is no Extended Card-in-Gate signal  $200 \pm 40$  milliseconds after the Feed signal is received. (See Figure 3-6 .) The No Card Flag signal is produced in four stages:

a. Before the Reader receives a Feed signal the base of transistor Q3 is held at +5 volts by diode CR3, and capacitor C4 is charged to +5 volts. At time  $T_0$ , the Feed FF is set by a Feed signal from the computer, reverse-biasing CR3 and allowing C4 to discharge through diode CR5 and resistor R16.

b. At time T1, ( $100 \pm 10$  milliseconds after the start of T $\emptyset$ ), transistor Q3 conducts and Q4 and Q5 cut-off. Capacitor C4 now charges toward +17 volts through CR4, R15, and R13.

c. At time T2 ( $90 \pm 30$  milliseconds after T1), Q3 again cuts-off, and Q4 and Q5 conduct. Capacitor C3 differentiates the trailing edge of the T1-T2 waveform, and the negative-going spike through C3 allows gate MC4D to output a true voltage.

d. At time T3, capacitor C6 differentiates the trailing edge of the pulse from gate MC4D and gate MC4B produces a positive-going square wave. Gate MC2D inverts the positive-true Extended-Card-in-Gate (XCIG) signal, disabling gate MC4A. If the XCIG signal is false, gate MC4A is enabled. The T3 pulse triggers gate MC4A, and MC2C inverts the resulting false signal. Transistor Q8 conducts, furnishing a circuit closure to ground which results in a No Card Flag signal.

3-27. FEED SOLENOID SIGNAL. At time T $\emptyset$ , the output of gate MC4C is true and remains true until time T1. The output of transistor Q5 resets the Feed FF at time T2 ( $200 \pm 40$  milliseconds after T $\emptyset$ ) causing the output of MC1B to go true. The output of MC3B is therefore false from time T $\emptyset$  to time T1, cutting off transistor Q9. Transistor Q10 conducts heavily, furnishing a ground path to energize the feed solenoid; the idler rollers then send the card through the Reader.

3-28. ON-LINE INDICATOR. The Clear-to-Send signal turns on transistor Q11, and gate MC1C inverts the resulting signal. Transistor Q12 amplifies the signal, furnishing a ground for the ON LINE indicator and turning it on.

3-29. EXTENDED CARD-IN-GATE SIGNAL. The Extended-Card-In-Gate signal originates in the Amplifier Storage card and is received by the Program Control card on pin U. Driver transistor Q13 produces a ground-level signal to the computer for the duration of the card being read plus the width of the pulse generated by the trailing edge of the card. (The trailing-edge pulse is generated in the Clock circuit of the Amplifier Storage card.)

3-30. MOTOR RELAY SIGNAL. A true Computer Ready signal on pin 18 of connector J1 turns on transistor Q14, furnishing a false input to gate MC2A. If this condition exists or the READY switch is pressed and held down, the output of MC2A becomes true and Q16 conducts, furnishing the Motor Relay signal to start the drive motor.

3-31. AMPLIFIER STORAGE CARD (D02760-6023-S).

3-32. The Amplifier Storage card contains data amplifier and storage circuits, a threshold adjust circuit, a reset circuit, a card-in-gate circuit, a clock circuit, and a flag circuit.

3-33. DATA AMPLIFIER AND STORAGE CIRCUIT. There are twelve identical data amplifier and storage circuits, and a clock circuit. For the purpose of this discussion, only channel 1 will be discussed.

3-34. After marks or punched holes have been sensed and amplified as discussed in Paragraphs 3-9 and 3-10, discriminator transistor Q14 acts as a fixed-bias triode, discriminating against noise and transients. The sensed mark or hole sets Flip-Flop MC4B, and driver Q26 makes the information available to the Computer.

3-35. THRESHOLD ADJUST CIRCUIT. Transistor Q13 and resistors R35, R36, and R37 make up the Threshold Adjust circuit for the discriminator transistors Q14 through Q25. Variable resistor R36 is adjusted so that Q13 operates in its active or linear range as an emitter follower. The base-to-emitter current requirement for the data channels (Q14 through Q25) varies with the number of marks or holes read. Transistor Q13 maintains the base of Q14 through Q25 at the correct voltage for the required current.

3-36. CARD-IN-GATE CIRCUIT. Emitter-follower Q3 buffers the low-level edge detect signal from the edge detector, and Q4 and Q5 amplify this signal. Transistors Q11 and Q12 further amplify the signal, producing a ground-level signal when a card is in the reading gate and an open signal when a card is not in the gate.

3-37. CLOCK AND EXTENDED CARD-IN-GATE CIRCUITS. Transistors Q1 and Q2 on the Amplifier Storage card amplify the clock signal received from the Channel 13 Clock Amplifier. The signal is then fed to two circuits. Gate MC1A in one circuit inverts the signal, and capacitor C2 and resistor R8 differentiate the signal. Diode CR2 clamps the positive portion of the differentiated signal to +3 volts. The result is a negative-going signal, corresponding in time with the trailing edge of the clock signal, to gate MC1B for use in generating the Reset signal, and the Flag and Extended Card-In-Gate signals to the computer. In the second circuit, C3 and R9 differentiate the clock pulse. Since this circuit does not contain an initial inverter, the resultant negative-going signal to gate MC1C corresponds in time with the leading edge of the clock signal. The output of gate MC1C is used in generating a reset signal to the Data Register and the Flag signal to the computer.

3-38. Capacitor C7 and resistor R21 differentiate the leading edge of the Card-In-Gate signal from transistor Q5 to ensure that the Gate FF begins the Card-in-gate period in a reset condition. The Gate FF then sets and remains set throughout the card-in-gate period by the signal from transistor Q5. The Gate FF resets when a differentiated trailing-edge signal is received from gate MC3B. This occurs on the trailing edge of the clock pulse generated when the read head detects the end of the card being read. When the Gate FF resets, the output of gate MC3D is a true Extended Card-In-Gate signal.

3-39. RESET CIRCUIT. The input to gate MC1D is from MC1B when clock marks follow the data columns on the card being read, or from MC1C when the clock marks are aligned on the data columns of the card being read. This is determined by jumper positions on the Amplifier Storage card (see drawing D02760-6032-S). Gate MC1D inverts the received signal and provides a pulse ( $20 \pm 10$  microsecond width) to MC2A. The output of MC2A will be false if the Gate FF is reset. Transistor Q8 inverts the false MC2A output signal and resets all Data Register flip-flops.

3-40. FLAG CIRCUIT. The input to gate MC2B is from MC1C when clock marks are located between data columns on the card being read, or from MC1B when the clock marks are aligned on the data columns being read. This is determined, as with the Reset circuit, by jumpers on the Channel Storage card (drawing D02760-6032-S). Gate MC2B is enabled by the set Gate FF, and the MC2B output goes false for each leading edge (jumper A-B) or trailing edge (jumper C-D) of the clock pulse. The output of MC2B is applied to transistors Q9 and Q10, the drivers which output the Flag signal to the computer.



3-41. READ HEAD ASSEMBLY (02760-6119-S).

3-42. The Read Head Assembly consists of 12 photodiodes for data detection and one for clock mark detection. It also contains an edge-detect circuit for generation of the Card-In-Gate signal. Photodiode V15 provides the reference voltage for transistor Q15. Variable resistor R3 adjusts the current delivered to photodiode V16 by Q15. The voltage output of V16 switches from  $+4.0 \pm 1.5$  volts (no card under the read head) to  $+0.3 \pm 0.2$  volts (with a card under the read head).



SECTION IV  
MAINTENANCE

4-1. GENERAL.

4-2. The HP 2761A-07 Card Reader maintenance consists of cleaning and disassembly instructions and troubleshooting procedures. The overall logic diagram, the interconnection diagram and the individual printed circuit card schematic diagrams provide adequate information for troubleshooting and correcting a Reader malfunction.

Note

Feed problems: Warped cards may cause feeding failures. If warped cards are to be fed, fan the cards in such a way as to minimize the warp. It may also be necessary to reduce the number of cards being stacked in the input hopper.

4-3. Periodic maintenance schedules are provided in Table 4-1 to facilitate keeping track of maintenance and inspection periods. If heavy usage (over 10,000 cards/day) is experienced, more frequent inspection will be needed.

4-4. COVER REMOVAL. (Refer to Figure 5-2.)

4-5. Various cabinet panels must be removed to perform maintenance procedures. To remove the left or right cover, remove the chassis screw on the underside of the cabinet and lift the cover off. The read head, idler rollers, and read head lamps are accessible through the hinged read head cover at the top rear of the cabinet. The power supply terminals and components, and the card cage are accessible through the left cover, and the drive motor, motor capacitor and access for removing jammed or mutilated cards are accessible through the right cover. For assistance in disassembling the reader covers on any assembly, see the exploded views in the parts list section, Section V.



Table 4-1. Inspection Schedules

STEP	DAILY INSPECTION	PARAGRAPH
1	Read Head Lamps	4-8
2	Pick Roller	4-10
3	Input Hopper	4-9
STEP	WEEKLY INSPECTION	PARAGRAPH
1	Moving Parts	4-13
2	Cleaning	4-14
3	Gate Assembly	4-15
4	Idler Rollers	4-16
5	Drive Belt	4-17
6	Pick Roller	4-20
7	Head Alignment	4-23

4-6. INSPECTION AND PERIODIC MAINTENANCE.

4-7. DAILY INSPECTION.

4-8. Certain visual checks should be made before Card Reader operation. Lift the optics cover and check that all seven read-head lamps are on. If any lamps are not on, refer to paragraph 4-24.

4-9. Ensure that paper scraps or foreign objects are not in the head assembly. Check that the input hopper is clean. If cleaning is required, refer to Paragraph 4-14.

4-10. Clean the pick roller as follows:

a. Start the reader and wash off the pick roller using a disposable wiper and a solvent such as isopropyl (rubbing) alcohol.

b. Dry the pick roller by wiping it with a clean, dry disposable wiper.

4-11. If a heavy usage (over 10,000 cards a day) is experienced, paragraphs 4-14, 4-16, and 4-20 of the weekly maintenance should be performed on a daily basis.

4-12. WEEKLY INSPECTION AND MAINTENANCE.

4-13. GENERAL. Check all moving parts, including belt, pick roller, polyurethane idler rollers, etc., for any visible signs of wear. Replace any worn parts if required.

4-14. CABINET CLEANING. Before cleaning the card reader cabinet, disconnect line power, remove side covers, and raise the read head cover. Using a vacuum cleaner with a brush attachment, or compressed air, carefully clean the Card Reader interior to remove dust and foreign particles. If the foreign matter in the input tray is other than dust, clean it using a disposable wiper moistened with isopropyl alcohol. Replace the covers after cleaning, and restore line power.

4-15. GATE ASSEMBLY. Check the dimensions on the gate assembly. The front gate should be  $0.040 \pm 0.002$  inch, and the rear gate  $0.010 (\pm 0.0005)$  inch. Use the feeler gauge provided with the Reader and check the 0.010-inch dimension on both corners, as well as the center, to insure that the rear gate and the bottom are parallel. Set the gate, if required, as follows:

- a. Loosen the two front panel screws and the rear gate screw.
- b. Place the 0.040-inch Feeler Gauge under the front gate only.
- c. Slide the rear gate down until it bears on the bottom plate; tighten the rear gate screw.
- d. Remove the gauge.
- e. Rock the gate assembly side-to-side to square the rear gate with the bottom gate.
- f. Tighten the two front panel screws.
- g. Loosen the rear gate.

h. Set the rear gate at .010 ( $\pm 0.0005$ ) inch and tighten the rear gate screw.

4-16. IDLER ROLLERS. Remove the right cover and turn on the Card Reader. Clean the outside diameter of the polyurethane idler rollers using a swab or disposable wiper, moistened with isopropyl alcohol. The idlers must not slip when a card is between the idler rollers and the drive wheels. If an idler roller does not provide sufficient friction to drive a card, it should be replaced.

4-17. DRIVE BELT TRACKING. Check that the drive belt is free of oil or any foreign substance. The drive belt must not ride against shaft hubs or the idler arm. Depending upon the conditions, clean the drive belt with isopropyl alcohol or replace it if required.

4-18. To replace the drive belt, remove the left cover and the circuit cards from the card cage. Figure 4-1 shows the belt path.

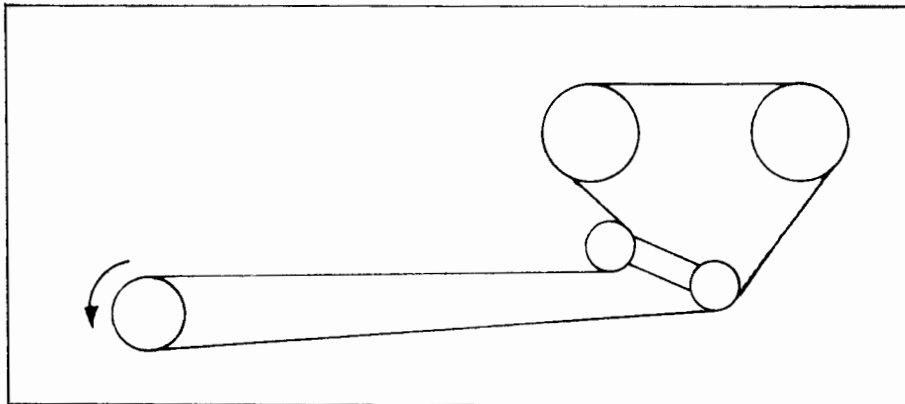


Figure 4-1. Belt Path

4-19. Replace the circuit boards after installing the drive belt, being sure that the boards are fully seated in their connectors and the top of the board ejector is in the locking channel.

4-20. PICK ROLLER. Clean the pick roller according to the instructions in Paragraph 4-10. Pick roller adjustment dimensions are shown in Figure 4-2.

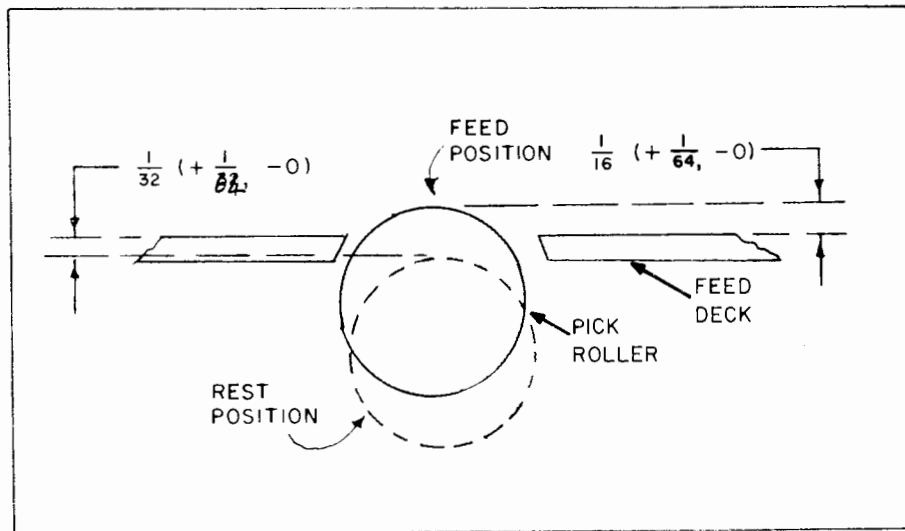


Figure 4-2. Pick Roller Adjustment

4-21. The pick roller is set in the feed position by the position of the feed solenoid on the main casting. The pick roller rest position is set by an adjusting screw on the feed actuator casting.

4-22. To adjust the pick roller location:

- a. Turn off power and remove the left cover.
- b. Loosen the two screws which clamp the solenoid bracket to the transport casting.
- c. If required, remove switch cover as described in Paragraph 4-27. This will give access to the Allen-head setscrew which sets the rest position of the feed roller ( $\frac{1}{16}$ ,  $+\frac{1}{64}$  -0, below the feed deck). Reset the screws. Tighten the lock nut and re-install the pick roller assembly.
- d. To set the feed position ( $\frac{1}{16}$ ,  $+\frac{1}{64}$  -0) loosen the two screws which

clamp the solenoid bracket to the transport casting, bottom the armature in the solenoid by pressing the armature, move the pick roller and solenoid assembly until the correct dimension is obtained. Then retighten the screws which clamp the solenoid bracket to the transport casting. Check that the solenoid travels freely.

e. If the pick roller (normal diameter: 0.950 inch) is worn to less than a 0.900 inch diameter, it must be replaced. If the pick roller is replaced, repeat steps "a" through "d".

f. Check that the solenoid armature is free and that its spring is returning the pick roller.

4-23. READ HEAD ALIGNMENT. For proper performance, it is important that the read head is aligned properly in the card reader. (See Figure 4-3.) The first check is to insure that the diodes are placed in the center of the data rows. Proceed as follows:

a. Insert a data card of the type the reader is intended to read, and stop the reader with the card partially through the head by removing the Program Control card. Feed the card manually, making sure that the card is aligned with the deck.

b. Check the read head position. Turn the reader on, the spots of light must be in the center of the data row.

c. To move the read head, remove the right cover, loosen the set screw in the end of the read-head support shaft (the shaft inserted into the main transport casting) and the two screws which hold the head bracket to the back of the identification panel. Slide the read head to its correct location and tighten the set screw and the two screws on the back of the identification panel. Next, check that the read head is square with respect to the card path.

d. Insert a card into the reader so the leading edge is even with the back of the read head.

e. If the read head and the leading edge of the card are not parallel, loosen the screw which clamps the read-head end-plate to the read head

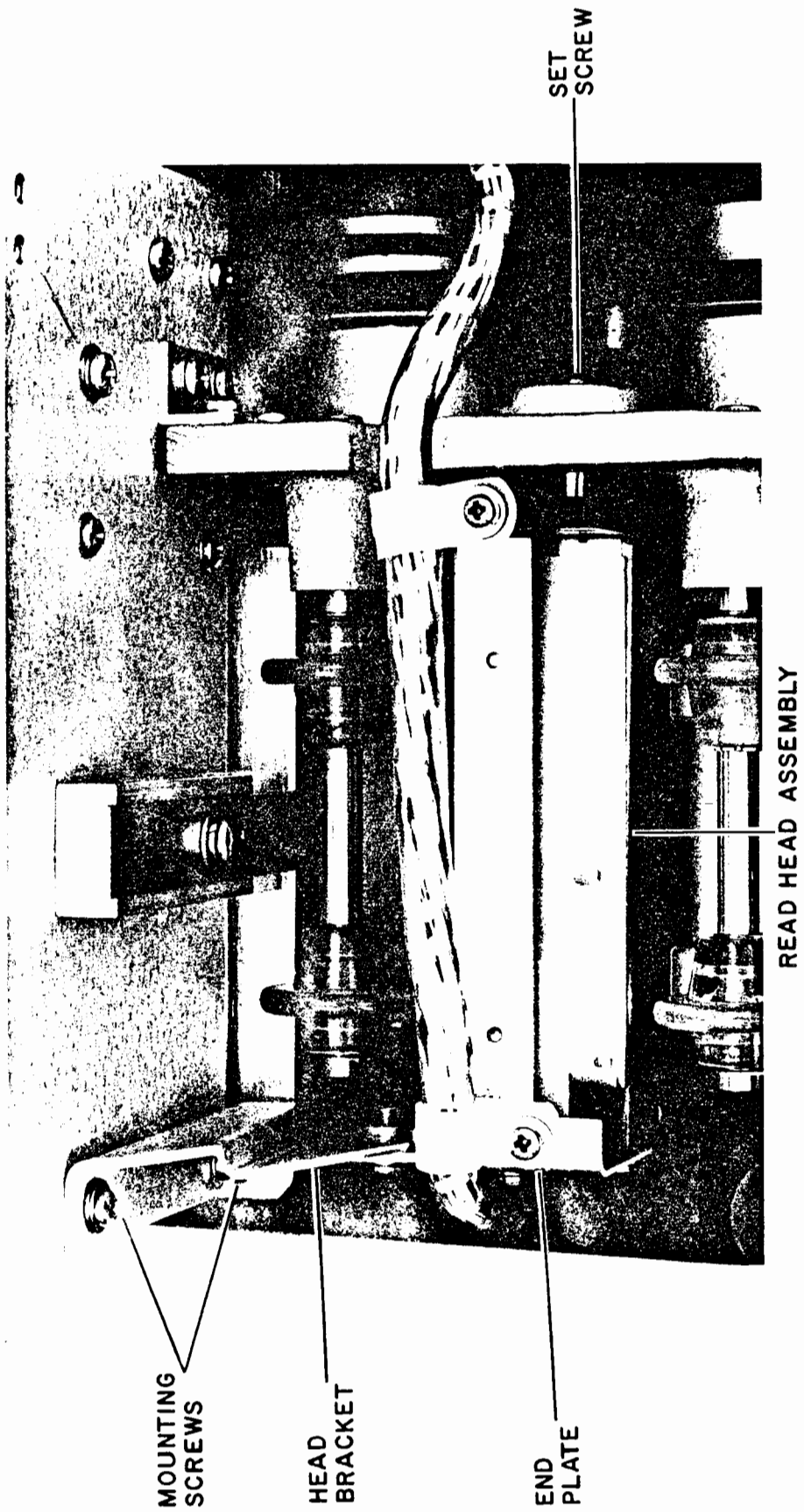


Figure 4-3. Read Head Alignment

bracket. Move the read head until it is parallel with the leading edge of the card, and tighten the set screw. Replace the Program Control card.

4-24. READ HEAD LAMP REPLACEMENT.

4-25. To remove lamps, the following operations are necessary:

- a. Lift up the Reader cover and remove both side panels.
- b. Remove the read head using a 5/64 Allen wrench; loosen the screw where the read head mounts on the casting. Use a posidrive screw driver to remove the No. 6 screw, where the read head attaches to the bracket. Remove the cable clamp holding the cable to the card cage. Remove the two screws holding plug connector A5P1 to the Channel Amplifier card connector A1J1.
- c. Remove the contact strip holding the bulbs by removing all nylon screws (Part No. 0570-0034 in Exploded View, Figure 5-1).
- d. Replace all lamps with HP Part Number 2140-0256 or equivalent lamps.
- e. Reassemble the contact strip.
- f. Reassemble the read head in the reverse order of step "b".
- g. Align the read head as described in Paragraph 4-23.

4-26. INDICATOR LAMP REPLACEMENT.

4-27. Remove the Switch Cover (HP Part No. 02760-0032) by removing ~~two~~<sup>three</sup> screws: one is located under the pushbutton switches (located through the hole on the switch bracket), ~~another is~~<sup>two are</sup> located behind the identification panel (top, centered behind switch cover). <sup>with nut</sup> Pull the switch cover aside.

4-28. Replace all lamps with HP Part No. 2140-0257, or equivalent, lamps. Lift the clips and move aside. Lift the bulb out and replace bulb and clip.

4-29. Replace Switch Cover by replacing ~~two~~<sup>three</sup> screws removed in Paragraph 4-27.

4-30. TROUBLESHOOTING.

4-31. Refer to the Troubleshooting Guide, Figure 4-4, to determine which of the remaining paragraphs in this section should be followed to remedy specific Reader malfunctions.

4-32. POWER SUPPLY.

4-33. There are no adjustments on the power supply. The voltages are fixed by zener diodes, (see Power Supply schematic, A101, D02760-~~6107~~<sup>60390</sup>-S).

4-34. When trouble with the power supply is suspected because the indicator lamps are not operating properly or the feed motor will not run, measure the supply voltages at A101TB1. The voltages should be as follows:

+5V terminal:	+5 ± 0.4 volts
+17V terminal:	+17 ± 1.0 volts
-18V terminal:	-18 ± 1.0 volts
+24V terminal:	+24 ± 2.0 volts

4-35. If any of the tolerances in Paragraph 4-34 are not met, remove the power supply. Place the power supply on a bench, apply power, and apply a load to each terminal, as follows, then proceed to Paragraph 4-36.

+5V terminal:	10 ohms, 5 watts
+17V terminal:	180 ohms, 5 watts
-18V terminal:	180 ohms, 5 watts
+24V terminal:	80 ohms, 10 watts

4-36. Perform the measurements listed in Paragraph 4-34. Determine the voltages which are out-of-tolerance, check fuse F2, and refer to Table 4-2.

4-37. PROGRAM CONTROL CARD.

4-38. The Program Control Card (D02760-6036-S) controls card feeding and motor turn-on as well as Status information. Paragraphs 4-39 through 4-51 should be completed with the Reader disconnected from the computer.



Table 4-2. Power Supply Checks

MALFUNCTION	REMEDY
+24V too low	Check CR1, CR2, C3
-18V too low:	Check R4, CR8
-18V too high	Check CR8, R4
+17V too low	Check +24V, and CR7, Q1, Q2
+17V too high	Check CR7, Q1, Q2
+5V too low	Check C5, CR5, CR6, CR3, Q3, Q4
+5V too high	Check Q3, Q4, CR9

4-39. MOTOR CONTROL. To verify motor control, set the POWER switch to ON. Verify that the POWER and ON-LINE indicators light and that the motor rotates. If either indicator is off, but the motor rotates, check the indicator lamps. Also, if the ON-LINE indicator is off, but the motor rotates, check the collectors of transistors Q11 and Q12 for  $+0.3 \pm 0.2$  volts. Check pin 8 of MC1 for  $+4.5 \pm 0.5$  volts. If both indicators are on, but the motor does not rotate, check the collectors of transistors Q14 and Q16 for  $+0.2$  to  $+0.6$  volts. Also check gate MC2A. Replace any component found defective.

4-40. Press the READY switch. Verify that the READY indicator lights. If not, check the READY indicator lamp, then verify  $+4.5 \pm 0.5$  volts at pin 3 of MC1 and verify  $+0.4 \pm 0.2$  volts at the collector of Q7.

4-41. Press the STOP switch. Verify that the READY indicator goes out. If not, check MC1D, MC1A, and Q7 for a short.

4-42. FEED MOTOR. Install cards in the input hopper and press the START switch. Verify that cards feed into the Reader. If not, verify the waveforms shown in Figure 4-4. Replace any component found defective.

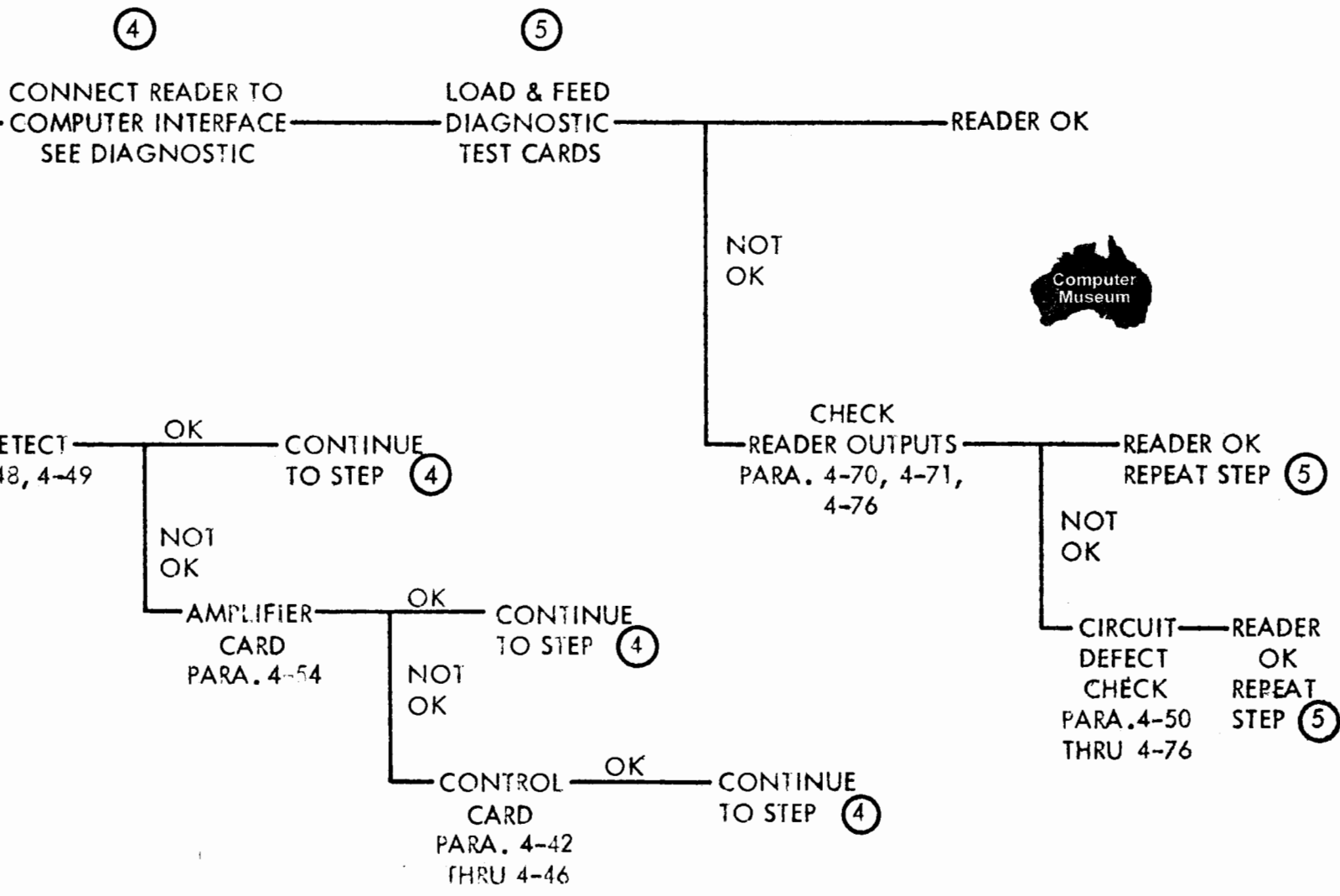
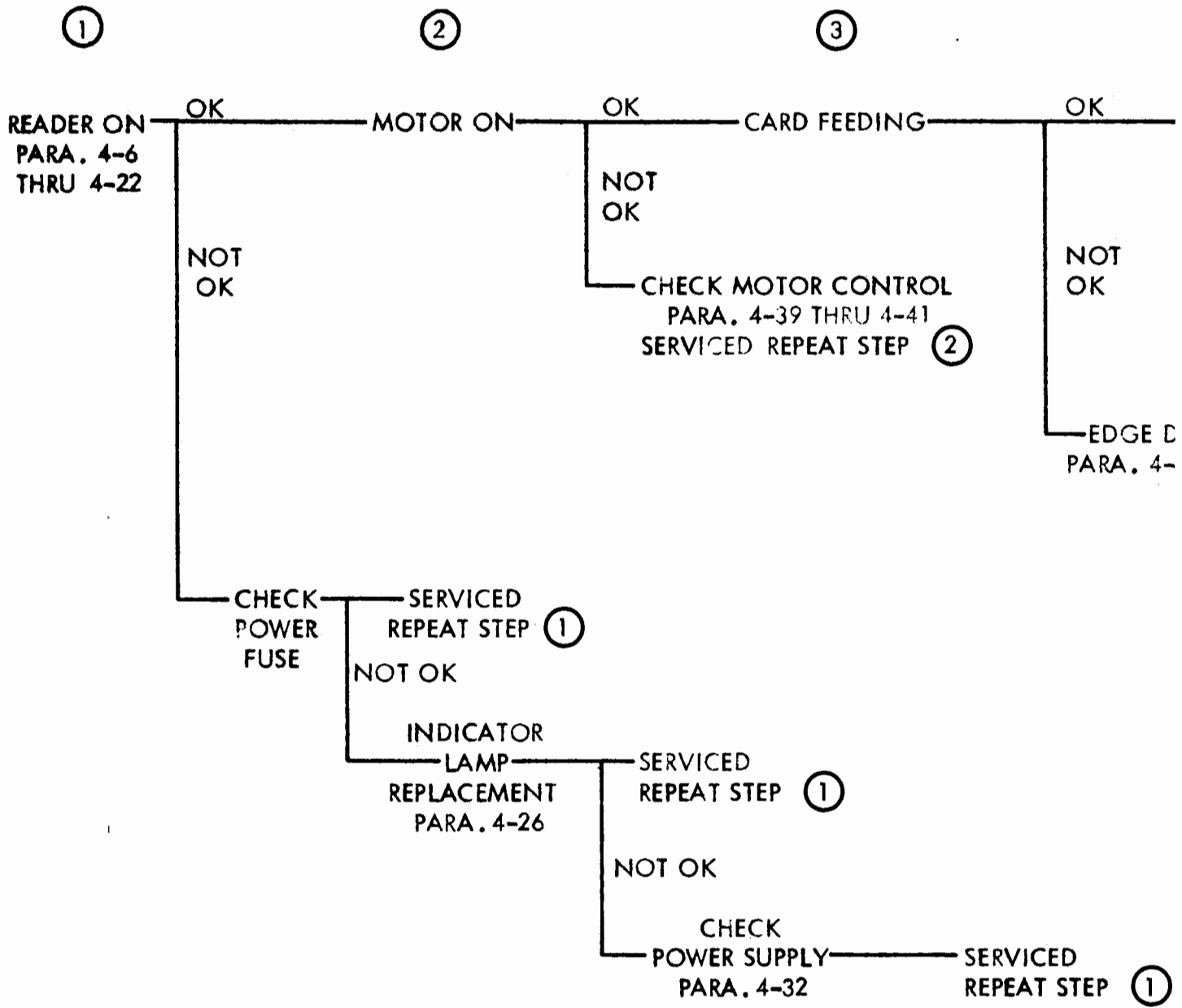


Figure 4-4. Troubleshooting Guide



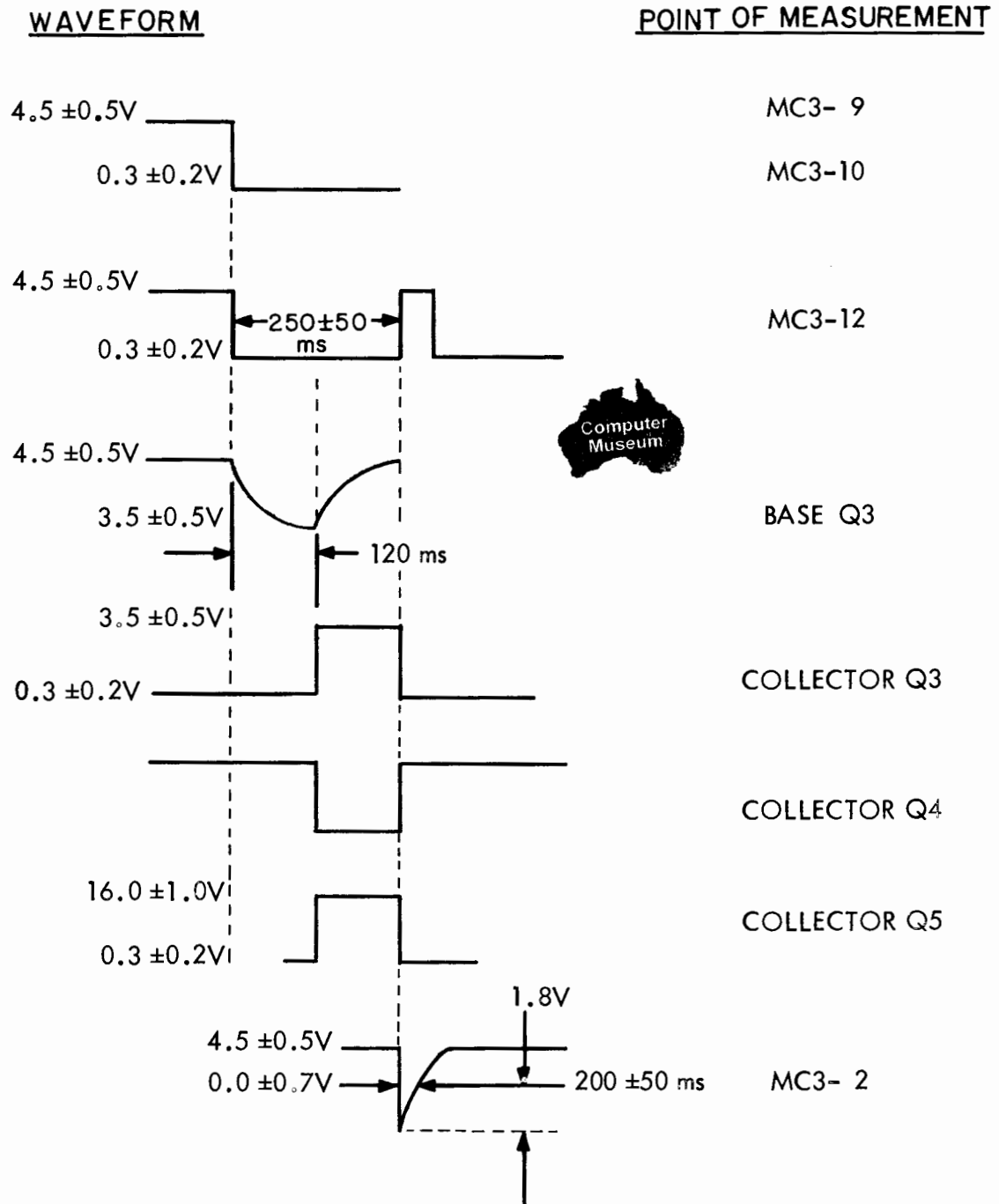
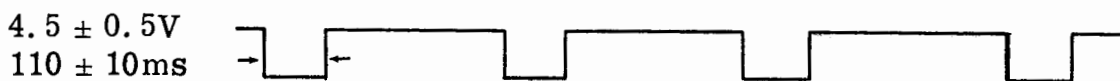
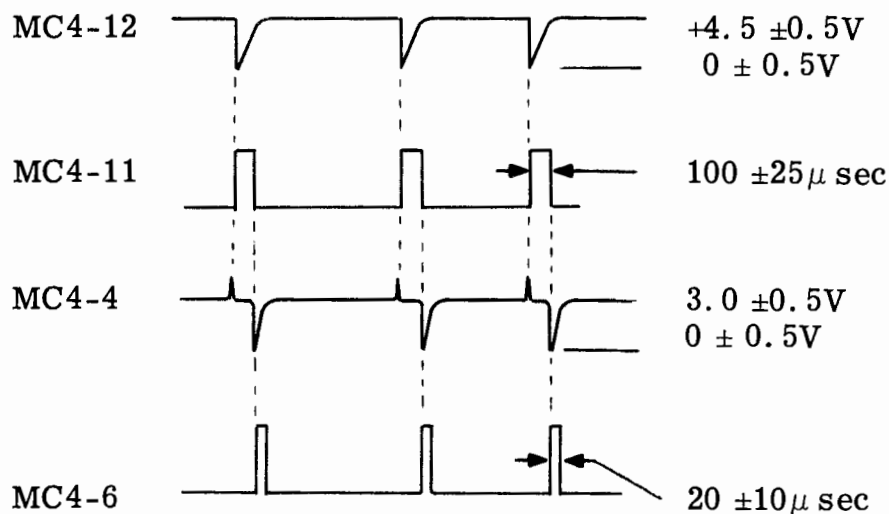


Figure 4-4. Feed Circuit Waveforms and Timing

4-43. STATUS. With an oscilloscope, monitor the waveform at the collector of transistor Q6. Verify that it resembles the following waveform. If it does not, check the cathodes of diodes CR11, CR12, and CR13. The cathodes of CR11 and CR13 should be  $+4.5 \pm 0.5$  volts. The cathode of CR12 should resemble the following waveform except that it should be inverted.



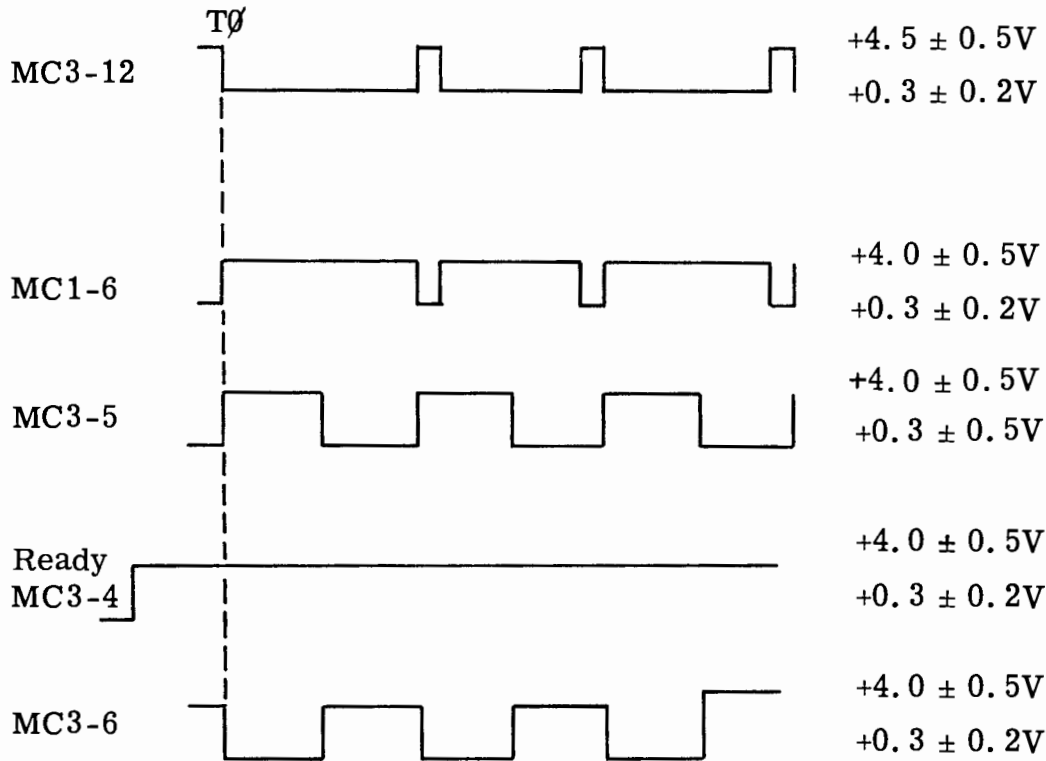
4-44. NO CARD FLAG. With an oscilloscope, monitor the waveform at the collector of transistor Q8. Verify that the waveform is identical to the waveform at MC4-3; if it is not check for the following waveforms:



4-45. EXTENDED CARD IN GATE. Place a load of 4.7K ohms between +5V and pin J1-22. With an oscilloscope, compare the waveform at the collector of transistor Q13 with the waveform at MC2-13. The waveform on the collector of Q13 must be inverted from the waveform at MC2-13. If not, check Q13.

4-46. FEED SIGNAL. With an oscilloscope, monitor the voltage on the collector of transistor Q10. The waveform should be a rounded square-wave, 22 to 26

volts peak-to-peak. The squarewave should be symmetrical, and the duration of one cycle shall be  $200 \pm 40$  milliseconds. If not, monitor the following points; replace components as necessary.



4-47. READ HEAD. The read head consists of two types of circuits; they are the Edge Detect Circuit and the Reading Channels.

4-48. Edge Detect Test Circuit. To test the Edge Detect Circuit, proceed as follows:

- a. Remove the read head from the casting (refer to exploded view, Figure 5-1).
- b. Plug connector A5P1 into connector A1J1. (Leave read head loose but not facing any direct light.)
- c. Connect a voltmeter (10V range), HP 412A VTVM or equivalent, to base of transistor Q3.
- d. Place the shaded part of the Test Card (Part No. 02760-9013-2/3) provided with the Reader in the read head. Turn variable resistor A5R3 clockwise, or counterclockwise until the meter reads 1.5 volts. Place the shaded portion of the Test Card (Part No. 02760-9013-1/3) in the read head. Verify that the meter reads more than 2.0 volts. Place the shaded portion of the Test Card (Part No. 02760-9013-3/3) in the read head. Verify that the meter reads  $0.3 \pm 0.2$  volts.

e. If the conditions in step "c" cannot be met, replace the read head or continue to step "g" and repair the read head. If the conditions are met, continue to step "e".

f. Measure the voltage at the connector A5J1, pin 23, or at the junction of Q15 and V16. This voltage should check as follows:

- 1) With a blank tab card in the reader, the voltage shall be less than +0.6 volts.
- 2) With the blank tab card removed from the reader, the voltage shall be more than +3 volts.

g. If the conditions of steps "a" through "e" were not met, continue to test. If the tests passed, continue to Amplifier and Storage card tests, Edge Detect section, Paragraph 4-53.

h. Remove transistor Q15.

i. Measure the current between connector pin A5J1-23 and +5V with an HP 412A Voltmeter, or equivalent. This current should be as follows:

- 1) With tab card in reader: between 0.05 and 0.5 ma
- 2) With card out of reader: less than 1/3 of "card in" value.

j. If either part of step "h" is not true, replace diode V16.

k. Measure the voltage between +5V and the junction of diode V15 and resistor R1. This voltage should be between 0.9 and 2.0 volts. If not, check and/or replace V15 and diode CR1.

l. Check resistors R1, R2, and R3 for resistance value. Replace any resistor found defective.

m. If the tests in steps "h" through "k" passed, replace transistor Q15 and repeat the instructions of Paragraphs 4-47 through 4-48.

4-49. Reassemble the read head on the Reader; make all the adjustments described in Read Head Alignment, Paragraph 4-23.

4-50. Card Reading. *See change No 7* ~~Mark all boxes on five data columns. Mark alternate rows heavily.~~ This test determines the reading capabilities of the 12 data channels. Proceed as follows:

a. Load the cards into the input hopper, then turn on power and press the READY switch. Verify that the cards feed properly.

b. Check the voltage waveform at the base of transistor Q101 through Q1301 on assembly A1 while reading a card (see D02760-6032-S); it should appear as shown in Figure 4-6. If it does not appear as shown, check diodes CR101 through CR1301 of assembly A1. If these diodes are not found defective, replace the photo diode corresponding to the malfunctioning channel. Remove the read head from the Reader, and disassemble the read head by removing the four screws on top of the printed circuit board. See exploded view, Figure 5-1.

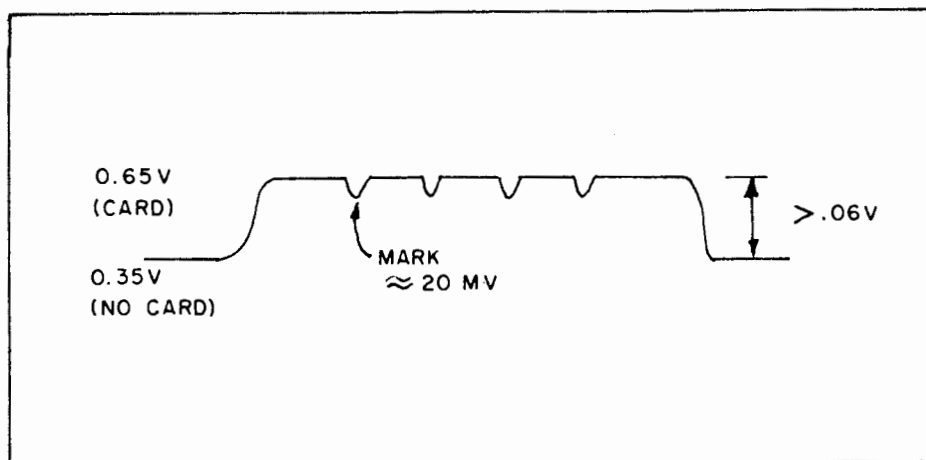


Figure 4-6. Mark Waveform

4-51. Sensitivity Adjustment. Turn variable resistor A1R36 clockwise for more sensitivity or counterclockwise for less sensitivity. The sensitivity adjustment is left to the discretion of the user. For example, if it is desired to discriminate against erasures, sensitivity should be set low and all cards must be heavily marked with No. 2 pencils.



4-52. AMPLIFIER AND STORAGE CARD (D02760-6032-S).

4-53. The Amplifier and Storage card should be checked only after determining that the read head is operating properly. Proceed as follows:

4-54. EDGE DETECT CIRCUIT. Measure the voltage at the base of transistor A1Q3 as described in step 4-48 "e". If not satisfactory, repeat the Read Head Test, steps 4-48 "a" through "d".

4-55. Transistors Q3, Q4 and Q5 make up sections of a Schmitt trigger. While reading a card, the waveform at the collector of transistor Q5 should be as shown in Figure 4-7.

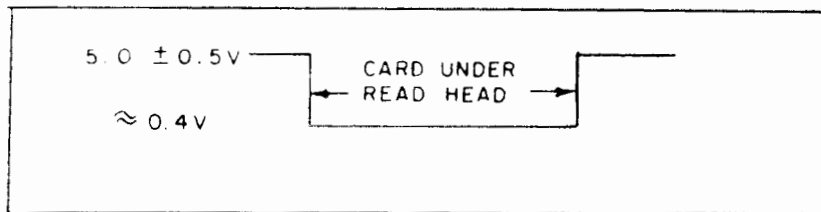


Figure 4-7. Schmitt Trigger Waveform

4-56. CLOCK CIRCUIT. Place the oscilloscope probe on the emitter of transistor Q1303 while reading a card. Each clock mark should produce a negative-going pulse as shown in Figure 4-8. If the waveform is not like that shown, replace Q1301, Q1302, Q1303, or troubleshoot the specific amplifier circuit.

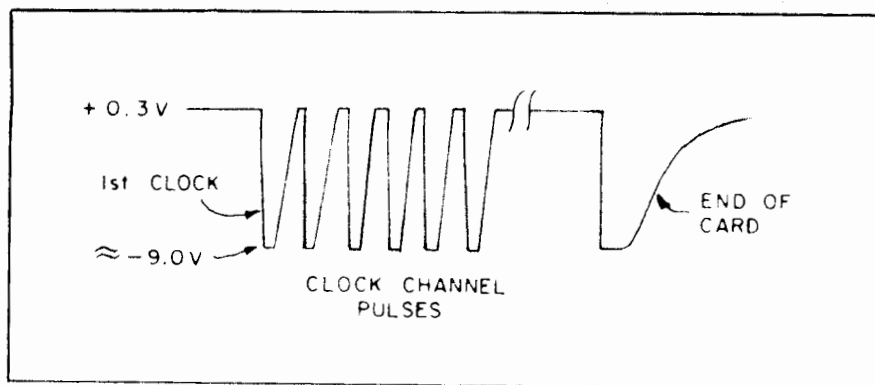


Figure 4-8. Clock-Mark Waveform

4-57. Place the oscilloscope probe on the collector of transistor Q2. The waveform should be as shown in Figure 4-9. If the waveform is not correct, troubleshoot the area of Q1 and Q2 and replace any components found defective.

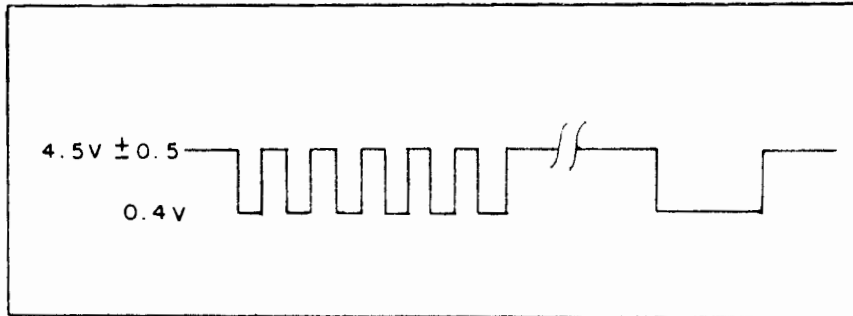
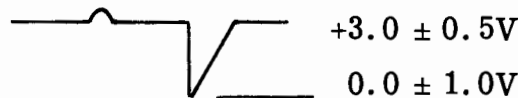


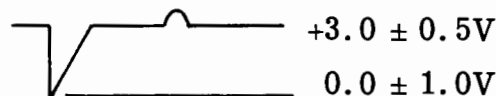
Figure 4-9. Waveform of Clock Marks at Schmitt Trigger

4-58. Check the voltage at the junction of resistors R33 and R34; it should be  $3.0 \pm .25$  volts. If not, check resistors R21, R23, R33, R34, R8, and R9, and diodes CR2, CR3, CR6, and CR7.

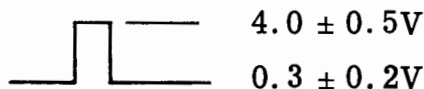
4-59. Monitor input pin 4 of gate MC1B with the oscilloscope. If the waveform is not as shown below, troubleshoot MC1A, capacitor C2, or resistor R7.



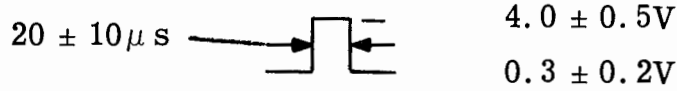
4-60. Monitor input pin 1 of gate MC1C with the oscilloscope. If the waveform is not as shown below, troubleshoot capacitor C3 or resistor R9.



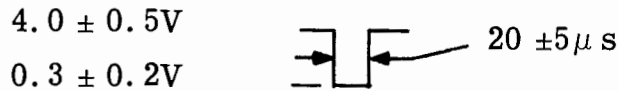
4-61. Monitor output pin 6 of gate MC1B with the oscilloscope. If the waveform is not as shown below, troubleshoot MC1B.



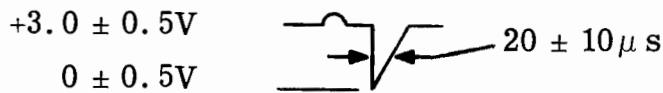
4-62. Monitor output pin 3 of gate MC1C with the oscilloscope. If the waveform is not as shown below for each clock pulse received, troubleshoot MC1C.



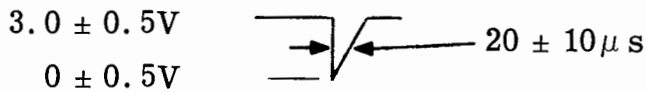
4-63. Monitor output pin 3 of gate MC3A with the oscilloscope at the end of the card being read. If the waveform is not as shown below, troubleshoot MC3A.



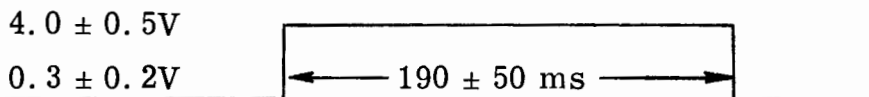
4-64. Monitor input pin 9 of gate MC2C with the oscilloscope at the end of the card being read. If the waveform is not as shown below, troubleshoot gate MC3B, capacitor C6, or resistor R22.



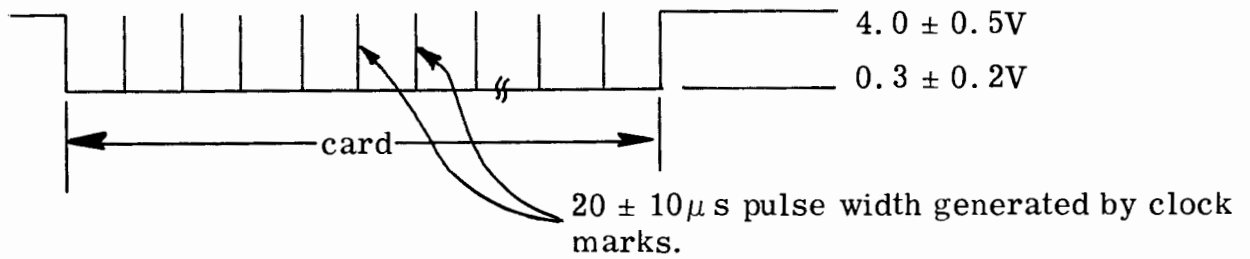
4-65. Monitor input pin 10 of gate MC2C with the oscilloscope at the beginning of a card. If the waveform is not as shown below, troubleshoot capacitor C7 or resistor R6.



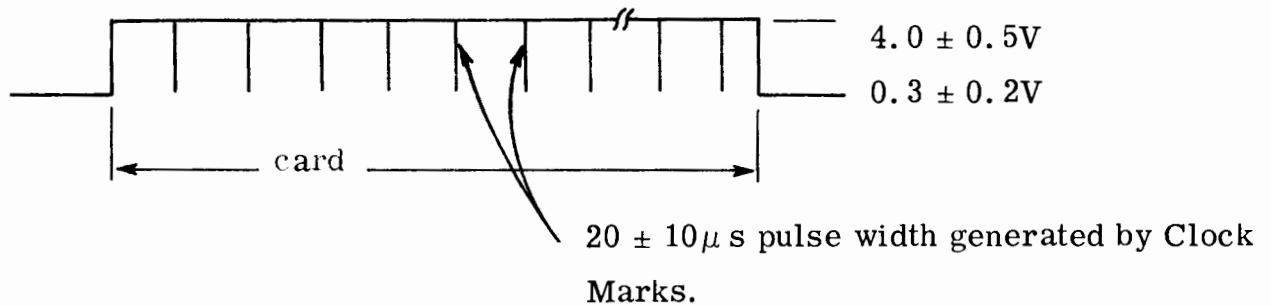
4-66. Monitor output pin 8 of gate MC2C with the oscilloscope while reading cards. If the waveform is not as shown below, troubleshoot MC2C.



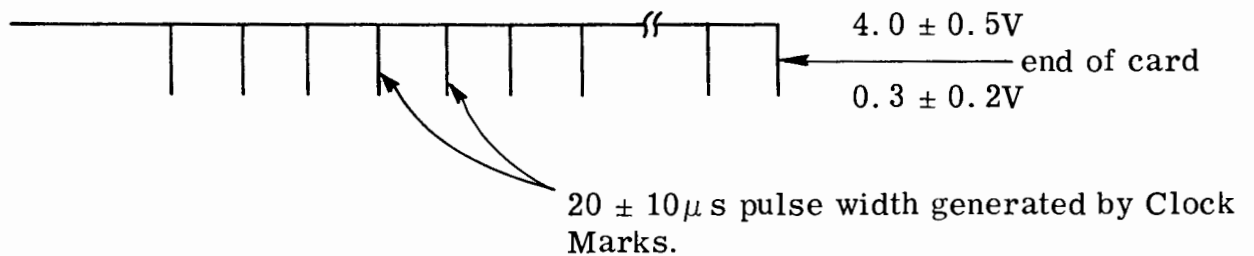
4-67. Monitor output pin 6 of gate MC2A with the oscilloscope while reading cards. If the waveform is not as shown below, troubleshoot MC2A.



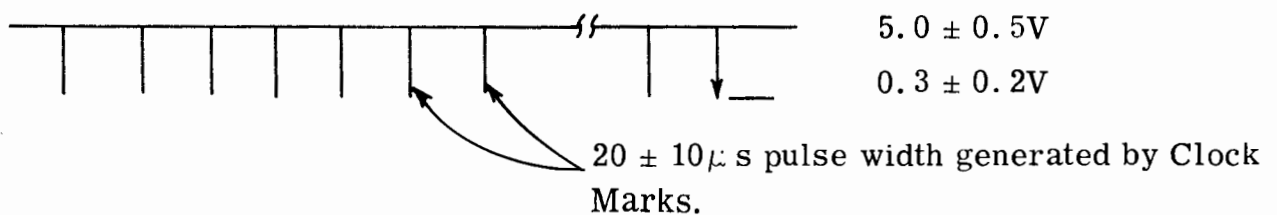
4-68. Monitor the collector of transistor Q8 with the oscilloscope. If the waveform is not as shown below, troubleshoot Q8 or flip-flops MC4A through MC9B.



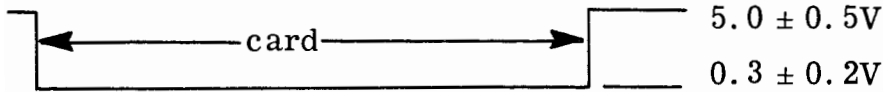
4-69. Monitor output pin 12 of gate MC2B with the oscilloscope while reading cards. If the waveform is not as shown below, troubleshoot MC2B.



4-70. Place a load of 4.7k ohms between +5V and pin J1-23 and monitor pin 23 with an oscilloscope while feeding cards. If the waveform is not as shown below, troubleshoot transistors Q9 and Q10.

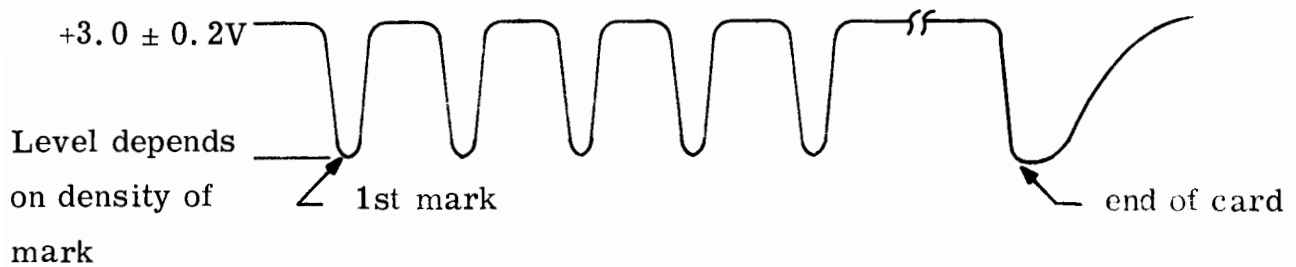


4-71. Place a load of 4.7k ohms between +5V and pin J1-13 and monitor pin 13 with an oscilloscope while feeding cards. If the waveform is not as shown below, while feeding cards, troubleshoot transistors Q11 and Q12.



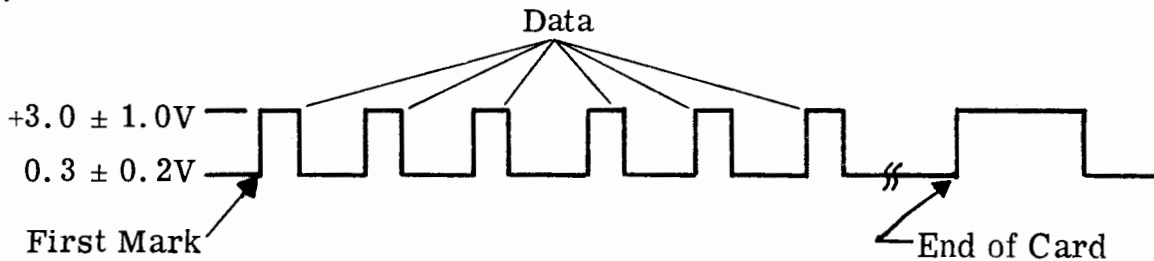
4-72. DATA CHANNELS. Turn Threshold Adjust variable resistor A1R36 20 turns counterclockwise.

4-73. Mark a tab card as described in Paragraph 4-50. The waveform on the emitter of transistor Q103 through Q1203 should be as shown.



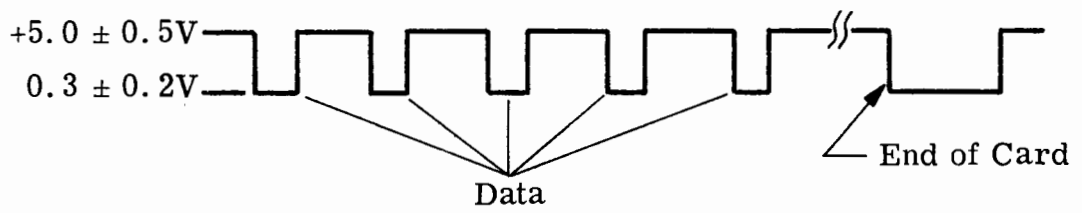
4-74. Turn variable resistor A1R36 12 turns clockwise.

4-75. Monitor output pins MC4A-3 through MC9A-3, and MC4B-8 through MC9B-8, in order, with the oscilloscope. Each waveform should be as follows:



4-76. Place a 4.7k ohm load on the following pins, in order, and then monitor each with an oscilloscope. Each waveform should be as shown below:

<u>Row</u>	<u>J1 Pins Monitored</u>
R	1
X	2
0	3
1	4
2	5
3	6
4	7
5	8
6	9
7	10
8	11
9	12





SECTION V  
REPLACEABLE PARTS



5-1. INTRODUCTION.

5-2. This section contains information for replacement parts for the 2761A-07 Optical Mark Reader. Table 5-1 lists replacement parts in alphanumerical order of their reference designations, with a description and HP and manufacturer's part numbers. Manufacturer's codes are identified in the back of this manual.

5-3. Figures 5-1 through 5-3 provide exploded views of the Optical Mark Reader. Parts location views for the printed circuit cards of the Reader are provided by drawings C02760-6036-1 and C02760-6032-1. A parts location view for the Reader power supply is on drawing D02760-6107-1.

5-4. ORDERING INFORMATION.

5-5. To order a replacement part, address the order to your local Hewlett-Packard field sales office. See the list at the back of this manual for field office addresses.

5-6. Specify the following information for each part when ordering:

- a. Hewlett-Packard part number.
- b. Circuit reference designation
- c. Description.



Reference Designation	Description	Stock No.	Mfr. Code	Mfr. Part No.	Qty.	1-Yr. Spa.
	<u>HP-2761A-Option 07</u>					
A1	Amplifier Card	02760-6032	04404		1	0
A2	Control Card	02760-6036	04404		1	0
A4	Read Head Assy.	02760-6119	04404		1	0
A5	Lamp Board	02760-6001	04404		1	0
A101	Power Supply Assy.	02760- <del>6107</del> <sup>6034</sup>	04404		1	0
B1	Motor: <sup>230</sup> <del>50</del> cycle, <sup>1500</sup> <del>1000</del> RPM	3140- <del>0478</del> <sup>0481</sup>	28480		1	1
	Pulley for B1	02760-2088 <del>5</del>	04404		1	1
B2	Fan: tubeaxial, 105-120V, 50-60Hz	3160-0088	82877	SP2A2	1	1
CR2	Pulley, Drive	02760-2045	04404		2	1
J1	Diode: Si, 200 PIV, 0.75A	1901-0026	28480		1	1
L1	Conn: female, 25 contact	1251-0064	71468	DBM-25S	1	1
S1, 2	Solenoid: 72Ω, 24V	02760-8113	04404		1	1
XA1	Switch: pushbutton	3101-0067	04404		2	1
XA2	Conn: PC, 22 contact	1251-1401	28480		1	1
	Conn: PC, 44 contact	1251-1399	28480		1	1
	<u>Miscellaneous:</u>					
	Pushbutton for S1 (Ready)	02760-8111	04404		1	
	Pushbutton for S2 (Stop)	02760-8112	04404		1	
	Belt: drive	1500-0769	04404		1	
	Lamp, Incandescent	2140-0257	04404		4	4

Reference Designation	Description	Stock No.	Mfr. Code	Mfr. Part No.	Qty.	1-Yr. Spa.
C1	A1 Amplifier Card C: fxd, elect, 0.47 uf, 10%, 35 VDCW	02760-6032 <del>0180-0016</del>	04404 28480		1	1
C2, 3, 6, 7, 8	C: fxd, mylar, 0.01 uf, 10%, 200 VDCW	0160-0161	56289	<del>192P10392-PTS</del> 150D2344 X 903542-20	5	1
C4, C11-C22	C: fxd, mica, 56pf, 5%, 300 VDCW	0140-0191	72136	DM15E560J-300V	13	3
C5	C: fxd, mylar, .001 uf, 10%, 200 VDCW	0160-0153	56289	192P10292-PTS	1	1
C9	C: fxd, elect, 150 uf, 10%, 6 VDCW	0180-1715	56289	150D157X9006R2-DYS	1	1
C10	C: fxd, elect, 60 uf, 20%, 6 VDCW	0180-0106	56289	150D606X0006B2-DYS	1	1
C101, 201, 301, 401, 501, 601, 701, 801, 901, 1001, 1101, 1201, 1301	C: fxd, elect, 10 uf, 10%, 20 VDCW	0180-0374	56289	150D106X9020B2-DYS	13	3
CR1, 4, 5, CR9-CR20	Diode: Ge, 100 MA at 0.85V, 60 PIV	1910-0016	28480		15	11
CR2, 3, 6, 7, 8, 101, 102, 201, 202, 301, 302, 401, 402, 501, 502, 601, 602, 701, 702, 801, 802, 901, 902, 1001, 1002, 1101, 1102, 1201, 1202, 1301, 1302	Diode: Si, 30V	1901-0040	28480		31	14
J1	Conn: rack and panel, 24 contact	1251-2037	02660	57-10240-3	1	1
MC1, MC3-MC9	Integrated Circuit: DTL	1820-0094	07263	U6A994659X	8	2

Reference Designation	Description	Ⓢ Stock No.	Mfr. Code	Mfr. Part No.	Qty.	1-Yr. Spa.
MC2	A1 Amplifier Board (Cont'd)					
Q1-Q5, Q8-Q37, Q101, 103, 201, 203, 301, 303, 401, 403, 501, 503, 601, 603, 701, 703, 801, 803, 901, 903, 1001, 1003, 1101, 1103, 1201, 1203, 1301, 1303	Integrated Circuit: DTL Transistor: Si, NPN	1820-0310 1854-0071	07263 01295	U6A996259X SKA-1124	1 61	1 20
Q6, 7, 102, 202, 302, 402, 502, 602, 702, 802, 902, 1002, 1102, 1202, 1302	Transistor: Si, PNP	1853-0036	04713	SPS-3612	15	11
R2, 10	R: fxd, met flm, 3.3K, 5%, 1/4W	0698-4266	75042	BE 56	2	1
R3, 6, 17	R: fxd, met flm, 2.2K, 5%, 1/4W	0698-4262	75042	BE 56	3	1
R1, 4, 33	R: fxd, met flm, 470Ω, 5%, 1/4W	0698-4246	19701	MF07C	3	1
R5, 12, 15, 37	R: fxd, met flm, 4.7K, 5%, 1/4W	0698-4270	19701	MF07C	4	1
R7, 14, 22	R: fxd, met flm, 1K, 5%, 1/4W	0698-4254	19701	MF07C	3	1
R8, 9, 13, 21, 23, 24, 27, 28, 30, 50-61	R: fxd, met flm, 10K, 5%, 1/4W	0698-4278	19701	MF07C	21	4
R11, 1304	R: fxd, met flm, 3.9K, 5%, 1/4W	0698-4268	75042	EE 56	2	1
R16	R: fxd, met flm, 1.5K, 5%, 1/4W	0698-4258	75042	EE 56	1	1
R18	R: fxd, met flm, 18K, 5%, 1/4W	0698-4284	19701	MF07C	1	1
R19, 20, 26	R: fxd, met flm, 5.6K, 5%, 1/4W	0698-4272	19701	MF07C	3	1

Reference Designation	Description	Ⓢ Stock No.	Mfr. Code	Mfr. Part No.	Qty.	1-Yr. Spa.
R25, 29, 31, 62-73	A1 Amplifier Card (Cont'd) R: fxd, comp, 180K, 5%, 1/4W	0683-1845	01121	CB 1845	15	3
R32	R: fxd, comp, 4.7 ohm, 5%, 1/2W	0698-0001	01121	EB47G5	1	1
R34	R: fxd, comp, 560 ohm, 5%, 1/4W	0683-1515	01121	CB1515	1	1
R35	R: fxd, met flm, 31.6K, 1%, 1/8W	0698-3160	75042	CEA T-0	1	1
R36	R: var, ww, 10K, 10%, 1W	2100-0451	09145	114/06	1	1
R38-49, 103, 203, 303, 403, 503, 603, 703, 803, 903, 1003, 1103, 1203, 1303	R: fxd, met flm, 100K, 5%, 1/4W	0698-4302	19701	MF07C	25	5
R101, 201, 301, 401, 501, 601, 701, 801, 901, 1001, 1101, 1201, 1301	R: fxd, comp. 1 Megohm, 5%, 1/4W	0683-1055	01121	CB 1055	13	3
R102, 202, 302, 402, 502, 602, 702, 802, 902, 1002, 1102, 1202, 1302	R: fxd, comp, 270K, 5%, 1/4±	0683-2745	01121	CB 2745	13	3
R104, 204, 304, 404, 504, 604, 704, 804, 904, 1004, 1104, 1204, 1304	R: fxd, met flm, 12K, 5%, 1/4W	0698-4280	19701	MF07C	13	3
R105, 205, 305, 405, 505, 605, 705, 805, 905, 1005, 1105, 1205, 1305	R: fxd, met flm, 422K, 1%, 1/8W	0698-3460	75042	BE 56	13	3

Reference Designation	Description	Stock No.	Mfr. Code	Mfr. Part No.	Qty.	1-Yr. Spa.
R106, 206, 306, 406, 506, 606, 706, 806, 906, 1006, 1106, 1206, 1306	<u>A1 Amplifier Card (Cont'd)</u> R: fxd, met flm, 1.47K, 1%, 1/8W	0757-1094	19701	MF5C T-0	13	3
R107, 2-7, 307, 407, 507, 607, 707, 807, 907, 1007, 1107, 1207, 1307	R: fxd, met flm, 150K, 5%, 1/4W	0698-4306	75042	BE 56	13	3
C1, 2, 23	<u>A2 Control Card</u> C: fxd, cer, 0.01 $\mu$ f, +80 -20%, 100VDCW	02760-6036	04404	TA	3	1
C4	C: fxd, elect, 15 $\mu$ f, 10%, 20VDCW	0150-0093	91418		1	1
C5	C: fxd, mylar, 0.1 $\mu$ f, 10%, 200VDCW	0180-1746	28480		1	1
C6	C: fxd, mylar, 0.01 $\mu$ f, 10%, 200VDCW	0160-0168	28480		1	1
C7, 8, 11, 15, 16, 18	C: fxd, mica, 56pf, 5%, 300VDCW	0160-0161	56289	192P10392-PTS	1	1
C9, 12, 13, 14, 17	C: fxd, cer, 0.1 $\mu$ f, +80 -20%, 50VDCW	0140-0191	72136	DM15E560J- 300V	6	1
C10	C: fxd, elect, 1 $\mu$ f, 10%, 35VDCW	0150-0121	56289	5C50B1-CML	5	1
C19	C: fxd, cer, 220pf, +80 -20%, 1000VDCW	0180-0291	56289	150D105X903A2- DYS	1	1
C20	C: fxd, elect, 56 $\mu$ f, 10%, 20VDCW	0160-2139	28480		1	1
C21, 22	C: fxd, elect, 22 $\mu$ f, 20%, 35VDCW	0180-0196	01295	SCM566GP015D2	1	1
CR1-CR6, CR8- CR13	Diode: Si, 30WV, 30MA	0180-0160	56289	150D226X0035R2- DYS	2	1
		1901-0040	28480		12	10

Reference Designation	Description	Stock No.	Mfr. Code	Mfr. Part No.	Qty.	1-Yr. Spa.
	<u>A2 Control Card (Cont'd)</u>					
CR7	Diode: Ge, 100MA at 0.85V, 60 PIV	1910-0016	28480		1	1
MC1, 2, 4	Integrated Circuit: DTL	1820-0094	07263	U6A994659X	3	1
MC3	Integrated Circuit: DTL	1820-0310	07263	U6A994659X	1	1
Q1, 2, 5, 6, 8, 9, 11, 13, 14, 15	Transistor: Si, NPN	1854-0071	01295	SKA - 1124	10	10
Q3, 4	Transistor: Si, PNP	1853-0036	28480		2	2
Q7, 12, 16	Transistor: Si, NPN	1854-0045	04713	SS2190	3	3
Q10	Transistor: Si, NPN	1854-0039	02735	2N3053	1	1
R1, 5, 39, 49	R: fxd, comp, 8.2K, 5%, 1/4W	0683-8225	01121	CB 8225	4	1
R2, 6, 40, 50, 55	R: fxd, met flm, 3.3K, 5%, 1/4W	0698-4266	19701	MF 07C		
R3, 41, 51	R: fxd, comp, 82K, 5%, 1/4W	0683-8235	01121	CB 8235	3	1
R4, 22, 29, 32, 35, 42, 43, 46, 52, 56, 66	R: fxd, met flm, 1K, 5%, 1/4W	0698-4254	19701	MF 07C	11	2
R8, 11, 13, 19, 20, 65	R: fxd, comp, 10K, 5%, 1/4W	0683-1035	01121	CB 1035	6	1
R9	R: fxd, comp, 51K, 5%, 1/4W	0683-5135	01121	CB 5135	1	1
R10, 24, 31, 34, 37, 45, 48, 54, 58	R: fxd, met flm, 100K, 5%, 1/4W	0698-4302	19701	MF 07C	9	2
R12	R: fxd, comp, 56K, 5%, 1/4W	0683-5635	01121	CB 5635	1	1
R14	R: fxd, met flm, 3.9K, 5%, 1/4W	0698-4268	75042	BE 56	1	1
R15	R: fxd, comp, 220K, 5%, 1/4W	0683-2245	01121	CB 2245	1	1
R16	R: fxd, comp, 18K, 5%, 1/4W	0683-1835	01121	CB 1835	1	1

Reference Designation	Description	Stock No.	Mfr. Code	Mfr. Part No.	Qty.	1-Yr. Spa.
R17	A2 Control Card (Cont'd)					
R18	R: fxd, met flm, 4.7K, 5%, 1/4W	0698-4270	75042	BE 56	1	1
R21	R: fxd, met flm, 150K, 5%, 1/4W	0698-4306	19701	MF 07C	1	1
R23, 26, 28, 30, 33, 36, 44, 47, 53, 57	R: fxd, comp, 15K, 5%, 1/4W	0683-1535	01121	CB 1535	1	1
R25, 27	R: fxd, comp, 5.6K, 5%, 1/4W	0683-5625	01121	CB 5625	10	2
R38	R: fxd, met flm, 470Ω, 5%, 1/4W	0698-4246	19701	MF 07C	2	1
R59, 60, 61	R: fxd, comp, 330Ω, 5%, 1/4W	0683-5135	01121	CB 5135	1	1
R62	R: fxd, comp, 4.7Ω, 5%, 1/4W	0683-0475	01121	CB 47G5	3	3
R63, 64	R: fxd, comp, 100Ω, 5%, 1/2W	0686-1015	01121	EB 1015	1	1
W1	R: fxd, comp, 3.3K, 5%, 1/2W Jumper: wire, insulated	0686-3325	01121	EB 3325	2	1
A1	8159-0005 04404	8159-0005	04404		1	0
DS1-DS7	A4 Read Head Assy.	02760-6119	04404			
P1, W1	PC Board Assy.	02760-6023	04404		1	0
V1-V9, V11-V16	Lamp: incd, 18V, 0.04 amp Plug: 27 conductor sleeved to W1 Photo-Duo-Diode	2140-0256	24455	370	7	7
C1	A1 PC Board Assy. C: fxd, elect, 1.5μf, 10%, 20VDCW	8120-1102	04404		1	1
CR1	Diode: Si, 30V	1990-0073	01295	H-61	15	11
Q1-Q9, Q11-Q14	Transistor: Si, NPN	02760-6023	04404			
Q15	Transistor: Si, PNP	0180-1745	56289	150D155X9020A2 DYS	1	1
R1, 2	R: fxd, met flm, 3.3K, 5%, 1/4W	1901-0040	28480		1	1
R3	R: var, cermet flm, 50K, 30%, 1/2W	1854-0023	07263	S-3620	13	11
R4	R: fxd, comp, 150K, 5%, 1/4W	1853-0036	04713	SPS-3612	1	1
		0698-4266	19701	MF 07C	2	1
		2100-2031	73138	62P-R50K	1	1
		0683-1545	01121	CB 1545	1	1

Reference Designation	Description	Stock No.	Mfr. Code	Mfr. Part No.	Qty.	1-Yr. Spa.
CR1	A5 Lamp Board	02760-6001	04404		1	1
DS1-DS4	Diode: Ge, 100MA at 0.85V, 60 PIV Lamp: incd, 6.3V, 0.075 A	1910-0016 2140-0257	28480 71744	CM8-668	4	4
F1	A101 Power Supply Assy.	02760- <del>6001</del>	04404		1	10
A1	<i>FUSE 240V 1A slow blow 2110</i> PC Board Assy.	<del>2110-0312</del> 02760-6007	<del>75915</del> 04404	312005	1	0
C1A/B	C: fxd, cer, 2 x .01μf, 20%, 250VDCW	0150-0119	56289	36C219A	1	1
C3	C: fxd, elect, 3000μf, +75 -10%, 30VDCW	0180-2107	56289	39D308G030JS4-DSB	1	1
C4	C: fxd, elect, 150μf, +75 -10%, 40VDCW	0180-1802	56289	39D157G040EJ4-DSB	1	1
C5	C: fxd, elect, 5000μf, +75 -10%, 10VDCW	0180-2106	56289	39D508G010HP4-DSB	1	1
C6	C: fxd, cer, 0.01μf, 20%, 1000VDCW	0150-0012	56289	29C214A3-CDH	1	1
CR8	Diode: breakdown, 18V, 10W	1902-1223	04713	1N2982RB	1	1
CR10	Diode: Si, 200 PIV, 0.75A	1901-0026	28480		1	1
<del>F1</del> F2	Fuse: 125V, 1A, Slow-Blow Fuseholder for F1 Fuseholder for F2	2110-0005 1400-0084 1400-0136	<del>75915</del> 75915 75915	<del>313001</del> 313001 342014 357001	1 1 1	10 1 1
J1	Conn: power, 3 pin male	1251-0148	28480		1	1
K1	Relay: 24V, 3PDT	0490-0128	77342	KA14DY	1	1
Q2,4	Transistor: Si, NPN	1854-0224	02735	40250	2	2
S1	Switch: toggle, SPST, 250V	3100-0001	28480		1	1



Reference Designation	Description	Stock No.	Mfr. Code	Mfr. Part No.	Qty.	1-Yr. Spa.
	<u>A101 Power Supply Assy. (Cont'd)</u>					
T1	Transformer: power	9100-2452	28480		1	1
TB1	Barrier Block: 8 terminal contacts	0360-1014	71785	353-18-08-001	1	1
	<u>A101A1 PC Board Assy.</u>	02760-6007	04404			
CR1, 2, 5, 6	Diode: Si, 100 PIV, 3A	1901-0200	14713	1N4998	4	4
CR3, 4	Diode: Si, 200 PIV, .75A	1901-0026	28480		2	2
CR7	Diode: breakdown, <sup>17.8V</sup> <del>18.2V</del> , <sup>400mW</sup> <del>1W</del>	1902- <del>0551</del> <sup>3224</sup>	28480	1902- <del>3</del> <sup>224</sup>	1	1
CR9	Diode: breakdown, 6.49V, 2%	1902-3119	28480		1	1
Q1, 3	Transistor: Si, NPN	1854-0039	02735	2N3053	2	2
R1, 5	R: fxd, comp, 10K, 5%, 1/2W	0686-1035	01121	EB1035	2	1
R2	R: fxd, comp, <sup>840</sup> <del>300</del> $\Omega$ , 5%, 1/2W	0686- <del>3015</del> <sup>8415</sup>	01121	EB <del>3015</del> <sup>8415</sup>	1	1
R3	R: fxd, comp, 47K, 5%, 1/2W	0686-4735	01121	EB4735	1	1
R4	R: fxd, met flm, 33 $\Omega$ , 5%, 2W	0764-0033	16299	C425	1	1
R6	R: fxd, comp, 120 $\Omega$ , 5%, 1/2W	0686-1215	01121	EB1215	1	1
R7	R: fxd, comp, 82 $\Omega$ , 5%, 1/2W	0686-8205	01121	EB8205	1	1

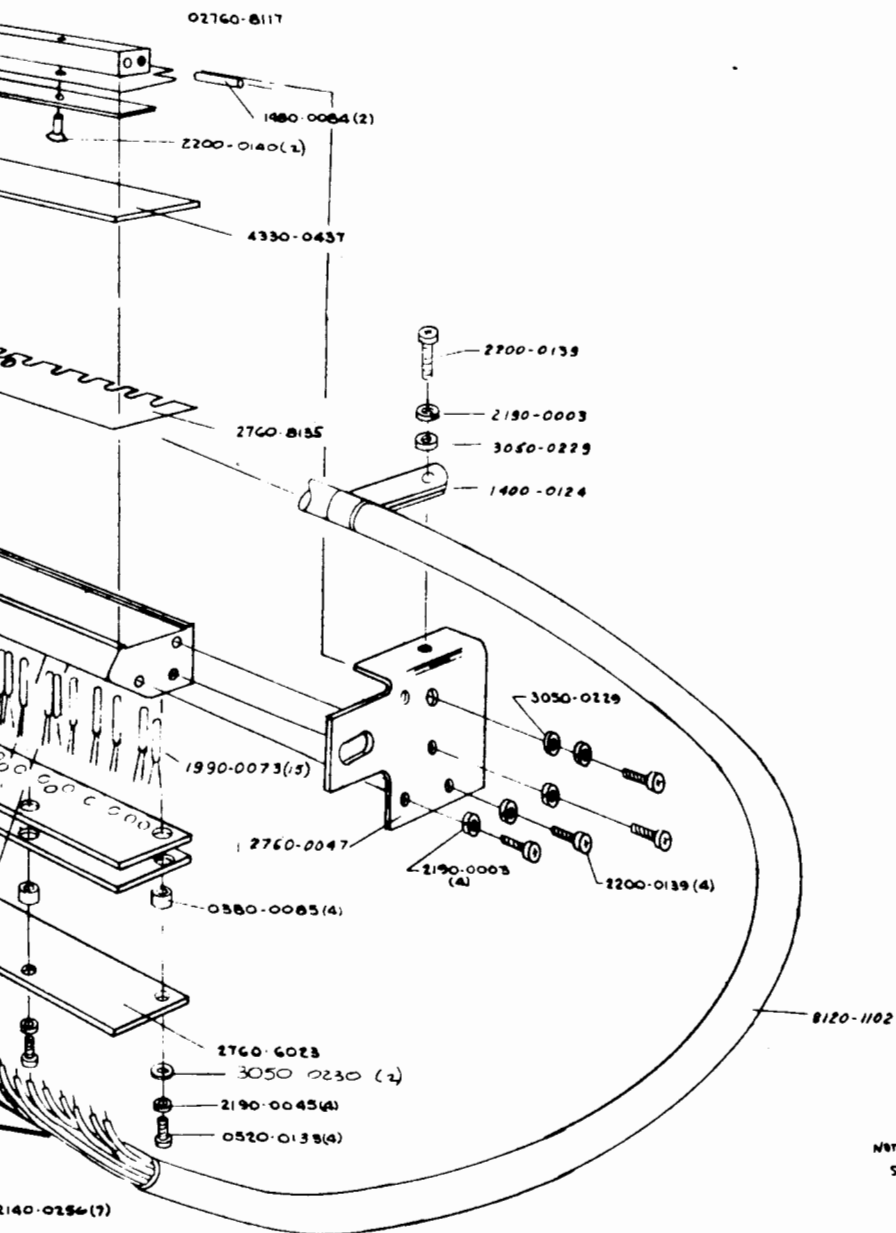
HP PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NO.	TQ
0140-0191	C:fxd, mica, 56 pf, 5%, 300 VDCW	72136	DMISE560J-300V	19
0150-0012	C:fxd, cer, 0.01 uf, 20%, 1000 VDCW	56289	29C214A3-CDH	1
0150-0093	C:fxd, cer, 0.01 uf, +80-20%, 100 VDCW	91418	TA	3
0150-0119	C:fxd, cer, 2X .01 uf, 20%, 250 VDCW	56283	36C219A	2
0150-0121	C:fxd, cer, 0.1 uf, +80-20%, 50 VDCW	56289	5C50B1-CML	5
0160-0153	C:fxd, mylar, .001 uf, 10%, 200 VDCW	56289	192P10292-PTS	1
0160-0161	C:fxd, mylar, 0.01 uf, 10%, 200 VDCW	56289	192P10392-PTS	6
0160-0168	C:fxd, mylar, 0.1 uf, 10%, 200 VDCW	28480		1
0160-2139	C:fxd, cer, 200 pf, +80-20%, 1000 VDCW	28480		1
0180-0106	C:fxd, elect, 60 uf, 20%, 6 VDCW	56289	150D606X0006B2DYS	1
0180-0160	C:fxd, elect, 22 uf, 20%, 35 VDCW	56289	150D226X0035BR2DYS	2
0180-0196	C:fxd, elect, 56 uf, 10%, 20 VDCW	01295	SCM566GP01502	1
0180-0291	C:fxd, elect, 1 uf, 10%, 35 VDCW	56289	150D105X903A2DYS	1
0180-0374	C:fxd, elect, 10 uf, 10%, 20 VDCW	56289	150D106X9020B2DYS	14
0180-0375	C:fxd, elect, 0.47 uf, 10%, 35 VDCW	<del>28480</del>	<del>150D334X9035A2-DYS</del>	<del>1</del>
0180-1715	C:fxd, elect, 150 uf, 10%, 6 VDCW	56289	150D157X9006R2DYS	1
0180-1745	C:fxd, elect, 1.5 uf, 10%, 20 VDCW	56289	150D155X9020A2DYS	1
0180-1746	C:fxd, elect, 15 uf, 10%, 20 VDCW	28480		1
0180-1802	C:fxd, elect, 150 uf, +75-10%, 40 VDCW	56289	39D1576040EJ4DSB	1
0180-2106	C:fxd, elect, 500 uf, +75-10%, 10 VDCW	56289	39D508G010HP4DSB	1
0180-2107	C:fxd, elect, 3000 uf, +75-10%, 30 VDCW	56289	39D308G030JS4DSB	1
0360-1014	Barrier Block: 8 Terminal contacts	71785	353-18-08-001	1
0490-0128	Relay: 24V, 3 PDT	77341	KA14DY	1
0683-0475	R:fxd, comp. 4.7 ohms, 5%, 1/4W	01121	CB47G5	3
0683-1035	R:fxd, comp. 10K, 5%, 1/4W	01121	CB1035	6
0683-1055	R:fxd, comp. 1 megohm, 5%, 1/4W	01121	CB1055	13
0683-1515	R:fxd, comp. 560 ohms, 15%, 1/4W	01121	CB1515	1
0683-1535	R:fxd, comp. 15K, 5%, 1/4W	01121	CB1535	1
0683-1545	R:fxd, comp. 150K, 5%, 1/4W	01121	CB1545	1
0683-1835	R:fxd, comp. 18K, 5%, 1/4W	01121	CB1835	1
0683-1845	R:fxd, comp. 180K, 5%, 1/4W	01121	CB1845	15
0683-2245	R:fxd, comp. 220K, 5%, 1/4W	01121	CB2245	1
0683-2745	R:fxd, comp. 270K, 5%, 1/4W	01121	CP2745	13

HP PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NO.	TQ
0683-5135	R:fxd, comp. 51K, 5%, 1/4W	01121	CBS135	2
0683-5625	R:fxd, comp. 5.6K, 5%, 1/4W	01121	CB5625	10
0683-5635	R:fxd, comp. 56K, 5%, 1/4W	01121	CB5635	1
0683-8225	R:fxd, comp. 8.2K, 5%, 1/4W	01121	CB8225	4
0683-8235	R:fxd, comp. 82K, 5%, 1/4W	01121	CB8235	3
0686-1015	R:fxd, comp. 100 ohm, 5%, 1/2W	01121	EB1015	1
0686-1035	R:fxd, comp. 10K, 5%, 1/4W	01121	CB1035	8
0686-1215	R:fxd, comp. 120 ohm, 5%, 1/2W	01121	EB1215	1
0686-8215	R:fxd, comp. 820 ohm, 5%, 1/2W	01121	EB8215	1
0686-3325	R:fxd, comp. 3.3K, 5%, 1/2W	01121	EB3325	2
0686-4735	R:fxd, comp. 47K, 5%, 1/2W	01121	EB4735	1
0686-8205	R:fxd comp, 82 ohm, 5%, 1/2W	01121	EB8205	1
0698-0001	R:fxd, comp. 4.7 ohm, 5%, 1/2W	01121	EB47G5	1
0698-3160	R:fxd, met flm, 31.6K, 1%, 1/8W	75042	CEA T-Q	1
0698-3460	R:fxd, met flm, 422K, 1%, 1/8W	75042	BE56	13
0698-4246	R:fxd, met flm, 470 ohms, 5%, 1/4W	19701	MF07C	5
0698-4254	R:fxd, met flm, 1K, 5%, 1/4W	19701	MF07C	19
0698-4258	R:fxd, met flm, 1.5K, 5%, 1/4W	75042	BE56	1
0698-4262	R:fxd, met flm, 2.2K, 5%, 1/4W	75042	BE56	4
0698-4266	R:fxd, met flm, 3.3K, 5%, 1/4W	75042	BE56	9
0698-4268	R:fxd, met flm, 3.9K, 5%, 1/4W	75042	BE56	3
0698-4270	R:fxd, met flm, 4.7K, 5%, 1/4W	19701	MF07C	5
0698-4272	R:fxd, met flm, 5.6K, 5%, 1/4W	19701	MF07C	3
0698-4278	R:fxd, met flm, 10K, 5%, 1/4W	19701	MF07C	20
0698-4280	R:fxd, met flm, 12K, 5%, 1/4W	19701	MF07C	12
0698-4284	R:fxd, met flm, 18K, 5%, 1/4W	19701	MF07C	1
0698-4302	R:fxd, met flm, 100K, 5%, 1/4W	19701	MF07C	34
0698-4306	R:fxd, met flm, 150K, 5%, 1/4W	75042	BE56	14
0757-1094	R:fxd, met flm, 1.47K, 1%, 1/8W	19701	MF5CT-O	13
0764-0033	R:fxd, met flm, 33 ohms, 5%, 2W	16299	C425	1
1251-0064	Conn: female, 25 contact	71468	DBM-25S	1
1251-0148	Conn: power, 3 pin male	28480		1
1251-1399	Conn: PC, 44 contact	28480		1

HP PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NO.	TQ
1251-1401	Conn: PC, 22 contact	28480		1
1251-2037	Conn: rack and panel, 24 contact	02660	57-10240-3	1
1400-0084	Fuseholder for F1	75915	342014	1
1400-0136	Fuseholder for F2	75915	357001	1
1500-0769	Belt: drive	04404		1
1820-0094	Integrated Circuit: DTL	07263	U6A994659X	11
1820-0310	Integrated Circuit: DTL	07263	U6A996259X	3
1853-0036	Transistor: Si, PNP	04713	SPS-3612	18
1854-0023	Transistor: Si, NPN	07263	S-3620	13
1854-0039	Transistor: Si, NPN	02735	2N3053	3
1854-0045	Transistor: Si, NPN	04713	SS2190	3
1854-0071	Transistor: Si, NPN	01295	SKA-1124	71
1854-0224	Transistor: Si, NPN	02735	40250	2
1901-0026	Diode: Si, 200 PIV, 0.75A	28480		4
1901-0040	Diode: Si, 30V	28480		44
1901-0200	Diode: Si, 100 PIV, 3A	14713	1N4998	4
1902-0504	Diode: <del>Si</del> , 17.8V, <del>1% 440mA</del> <i>5% 440mA PowerLab</i>	28480	1902-3224	1
1902-1223	Diode: breakdown, 18V, 10W	04713	1N2982RB	1
1902-3119	Diode: breakdown, 6.49V, 2%	28480		1
1910-0016	Diode: Ge, 100 MA at 0.85V, 60 PIV	28480		18
1990-0073	Photo-Duo-Diode	01295	H-61	15
2100-0451	R:var, ww 10K, 10%, 1W	09145	114/06	1
2100-2031	R:var, cermet flm, 50K, 30%, 1/2W	73138	62P-R50K	1
2110-0006	Fuse: <del>2.5V</del> , 1A, Slow-Blow	75915	313001	1
2140-0256	Lamp: Incd, 18V, 0.04 amp	24455	370	7
2140-0257	Lamp Incd, 6.3V, 0.075A	71744	CM8-668	12
3100-0001	Switch: toggle, SPST, 250V	28480		1
3101-0067	Switch: Pushbutton	04404		2
3140-0478	Motor: <del>50</del> cycle, <del>1.50V</del> , 1500 RPM	28480		1
3160-0088	Fan: tubeaxial, 105-120V, 50-60 Hz	82877	SP2A2	1
8120-1102	Plug: 27 conductor sleeved to W1	04404		1
8159-0005	Jumper: wire, insulated	04404		1
9100-2452	Transformer: Power	28480		1
2100-0006	FUSE 1.35V 2A <i>5.6 6.6 6.6</i>	71400	MD 4.7	1



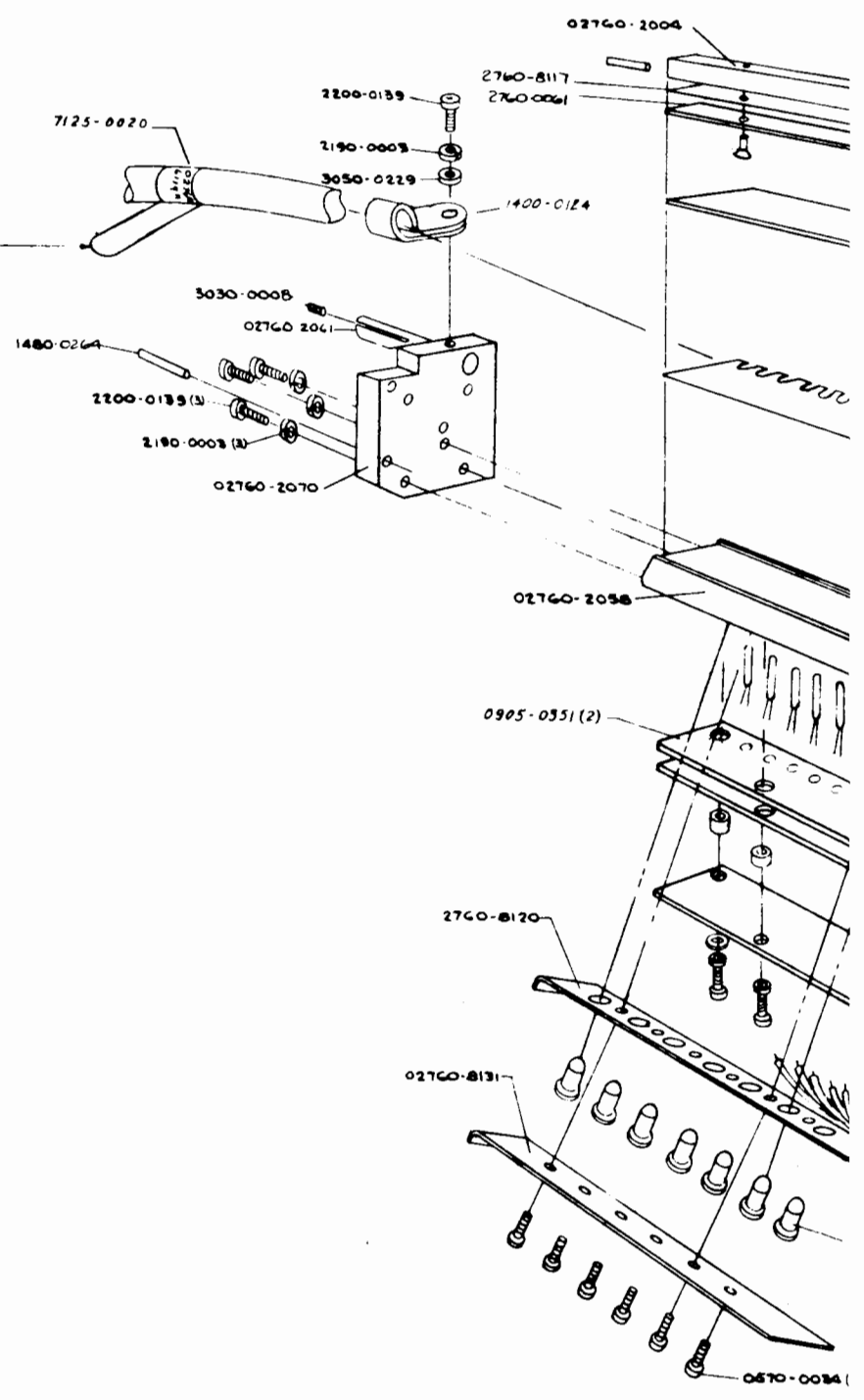
HP PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NO.	TQ
02760-2045	Pulley: Drive	04404		2
02760-6001	Lamp Board	04404		1
02760-6007	PC Board Assy	04404		1
02760-6023	PC Board Assy	04404		1
02760-6032	Amplifier Card	04404		1
02760-6036	Control Card	04404		1
02760- <del>6167</del> <sup>6168</sup>	Power Supply Assy	04404		1
02760-6119	Read Head Assy	04404		1
02760-8111	Pushbutton (READY)	04404		1
02760-8112	Pushbutton for S2 (STOP)	04404		1
02760-8113	Solenoid: 72 ohms, 24V	04404		1
02760-2088 <del>6</del>	Pulley	04404		1



NOTE:  
SEE 02760-6023H FOR WIRING INFORMATION

Figure 5-1.  
Exploded View of Read Head Assembly

\* ADD HEAD REVISION LETTER TO STOCK NO. TAN



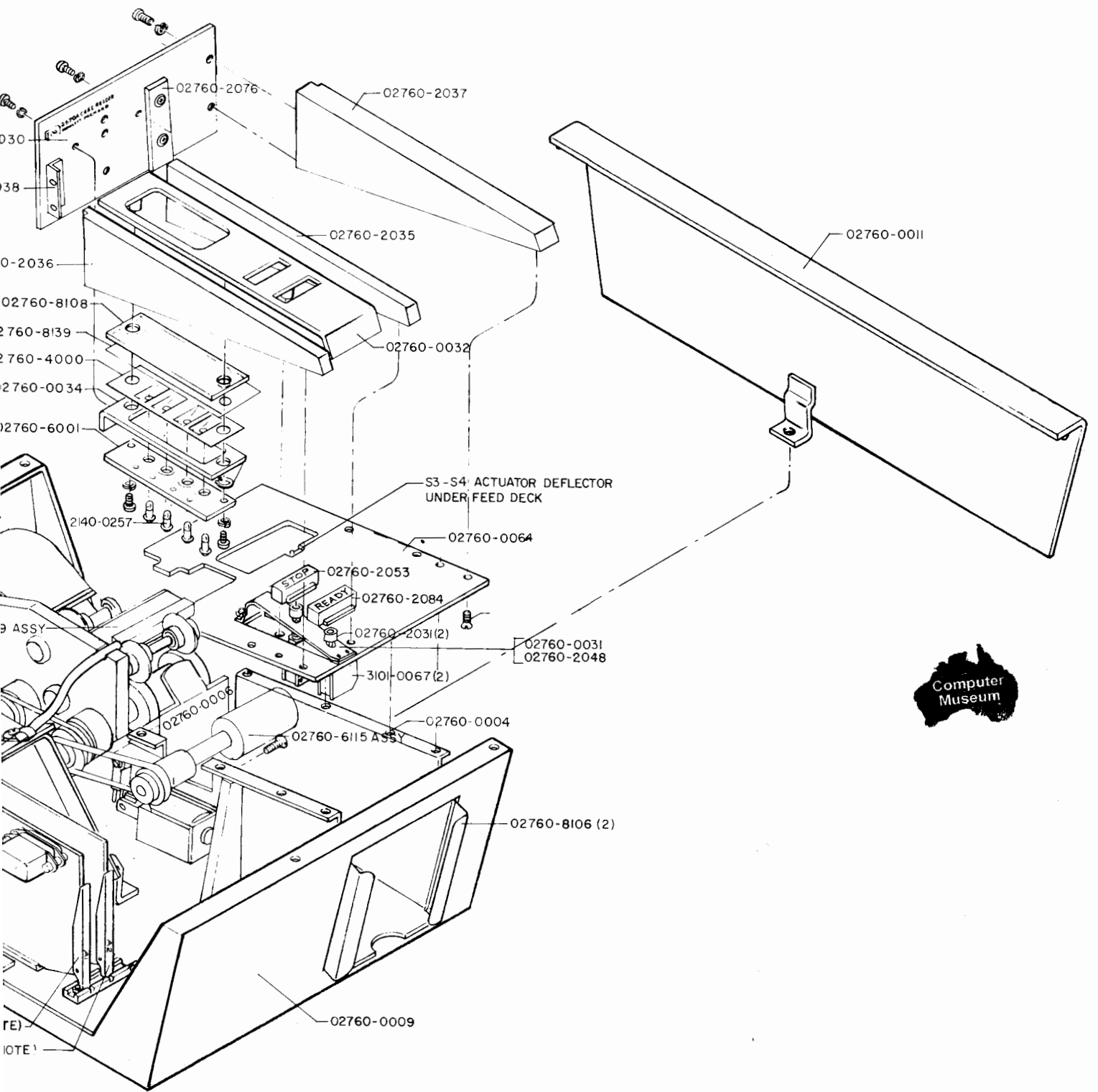
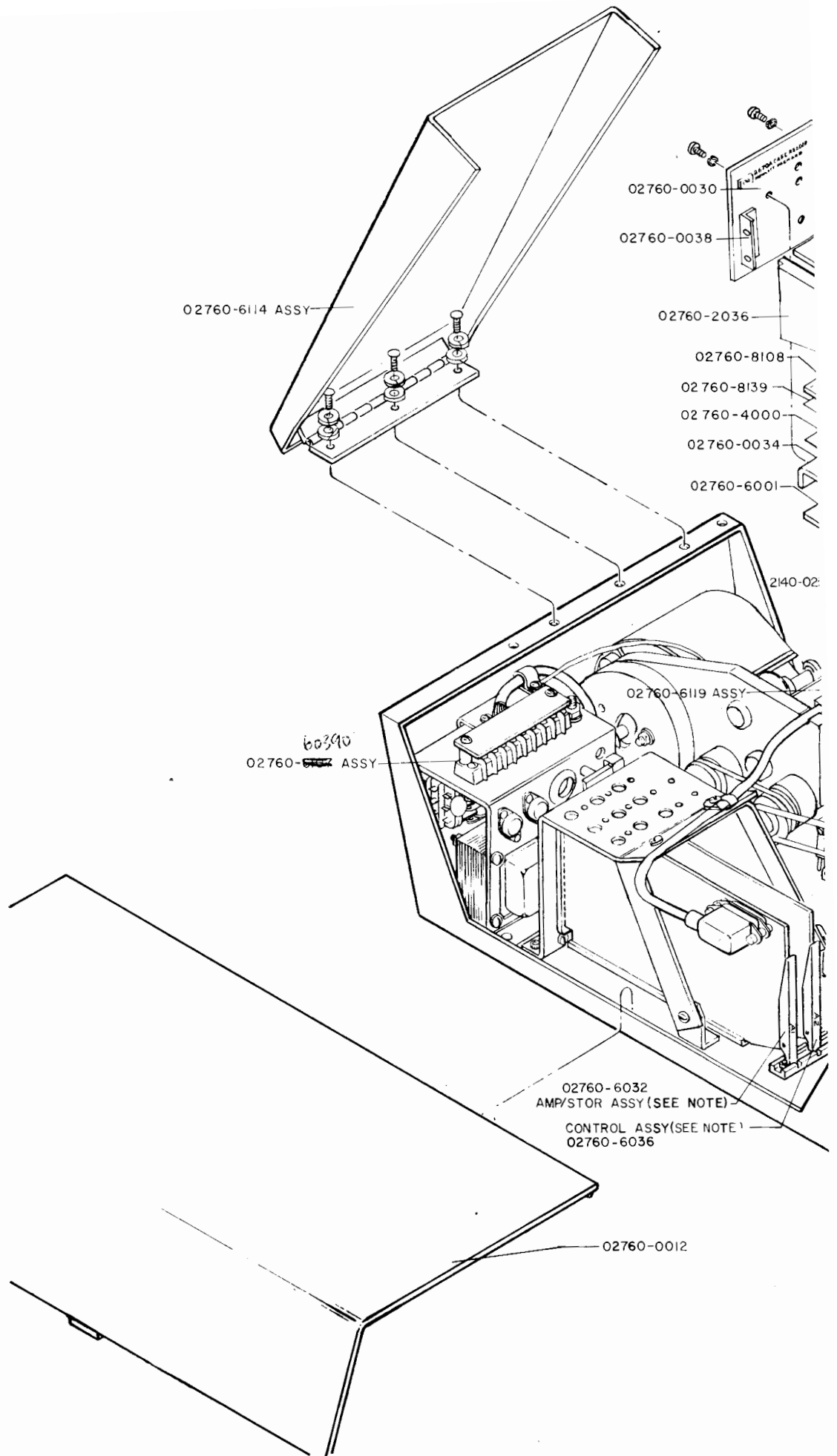


Figure 5-2. 2761A-07 READER, EXPLODED VIEW NO. 1





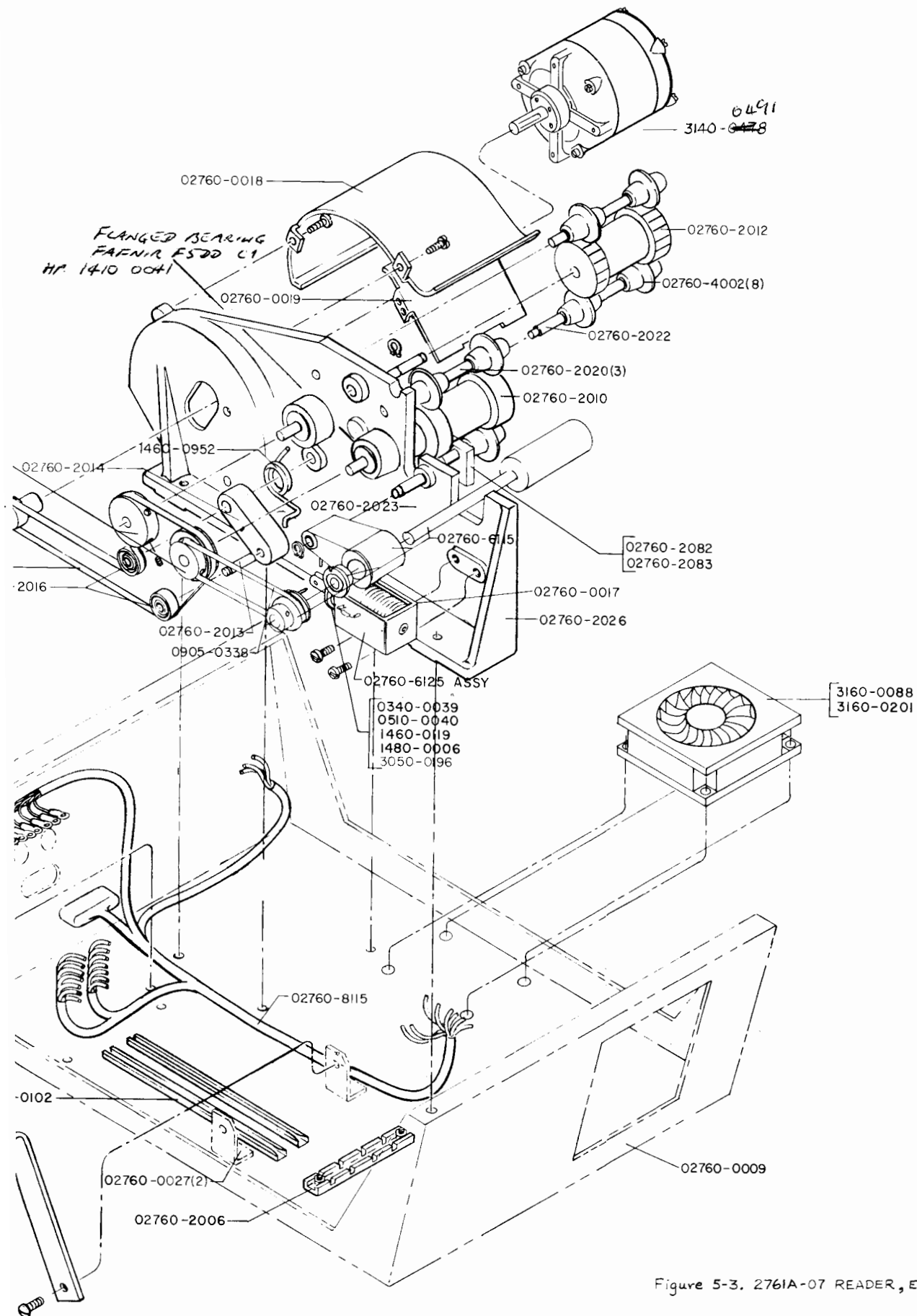
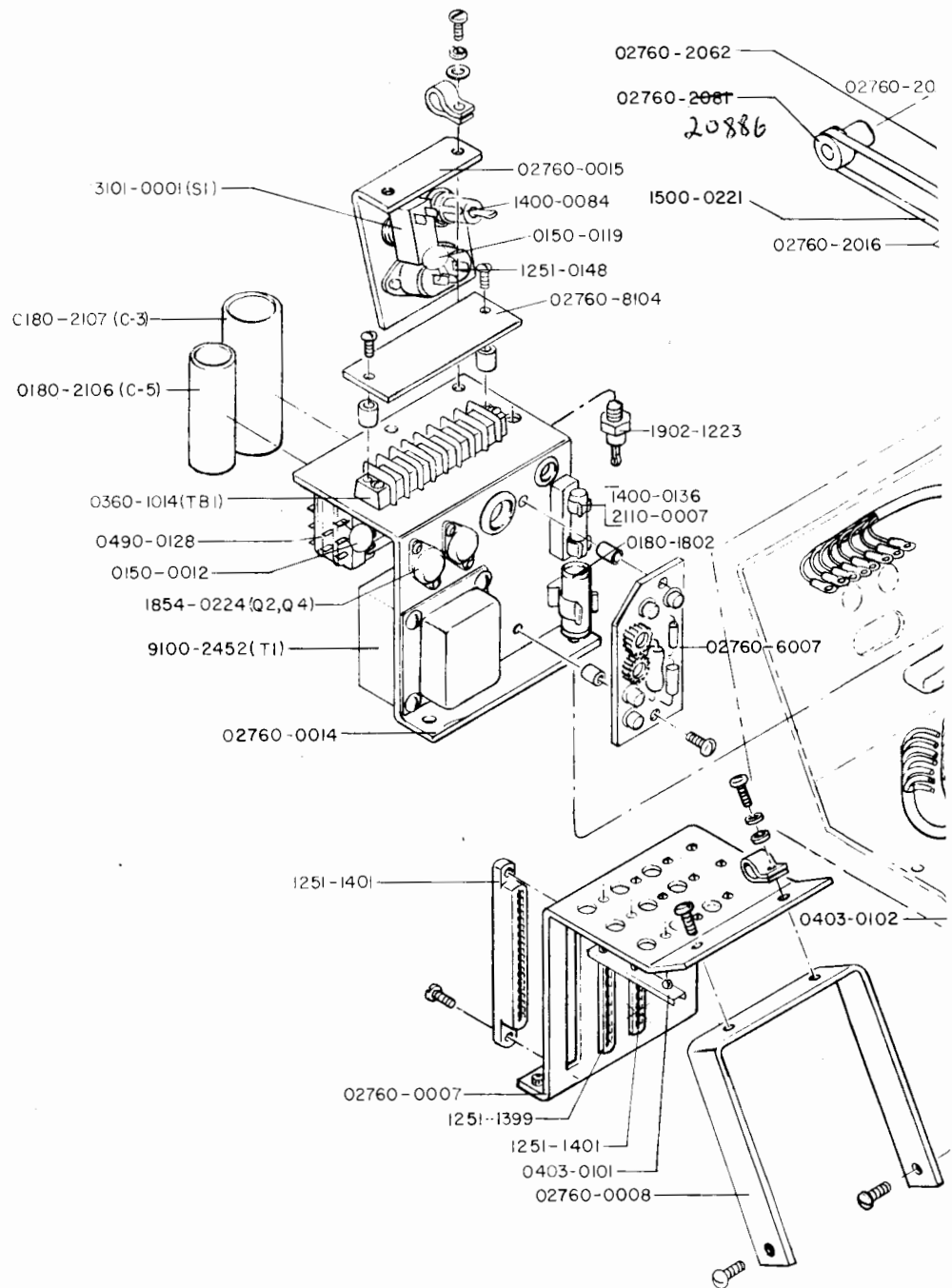
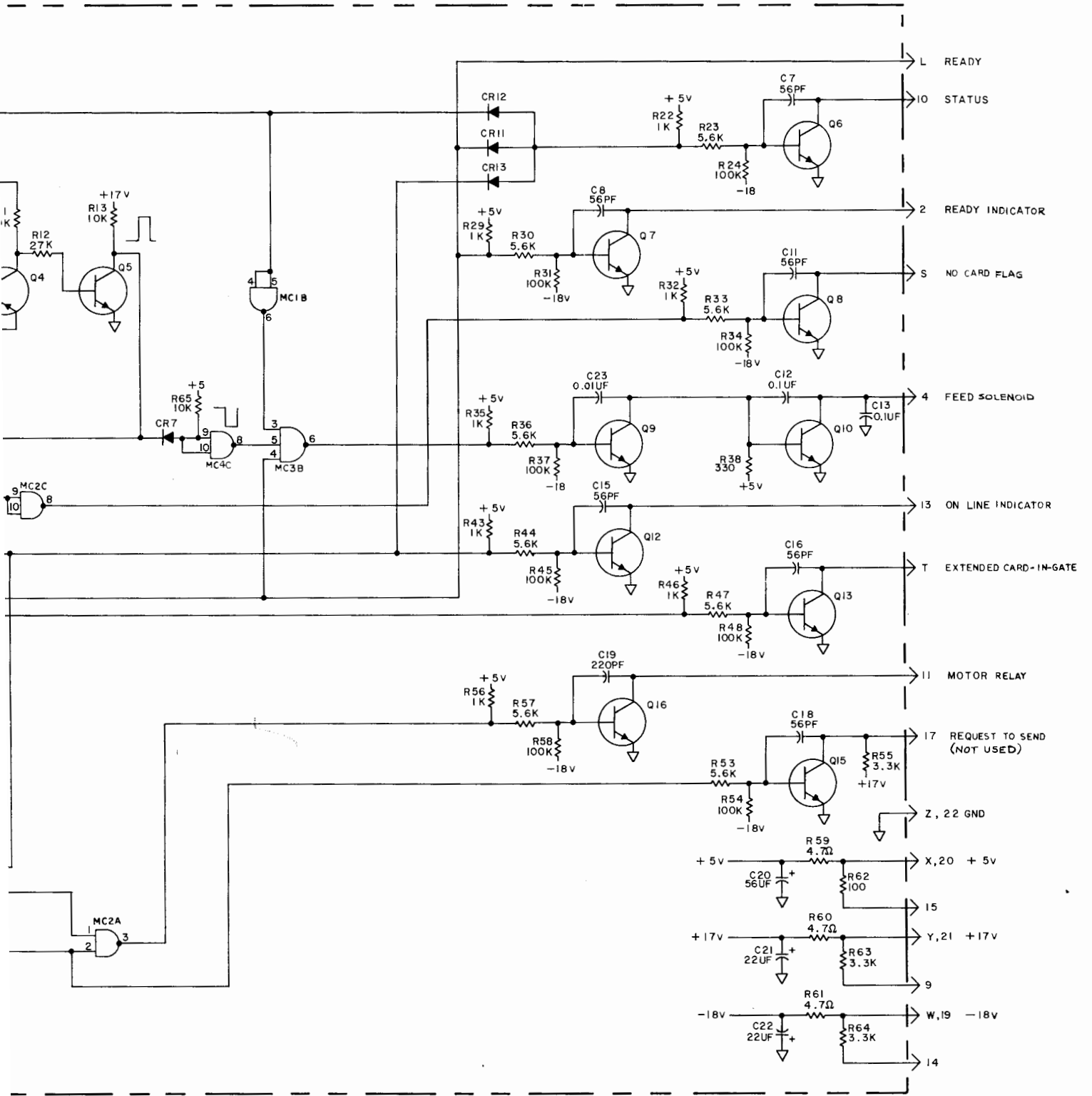
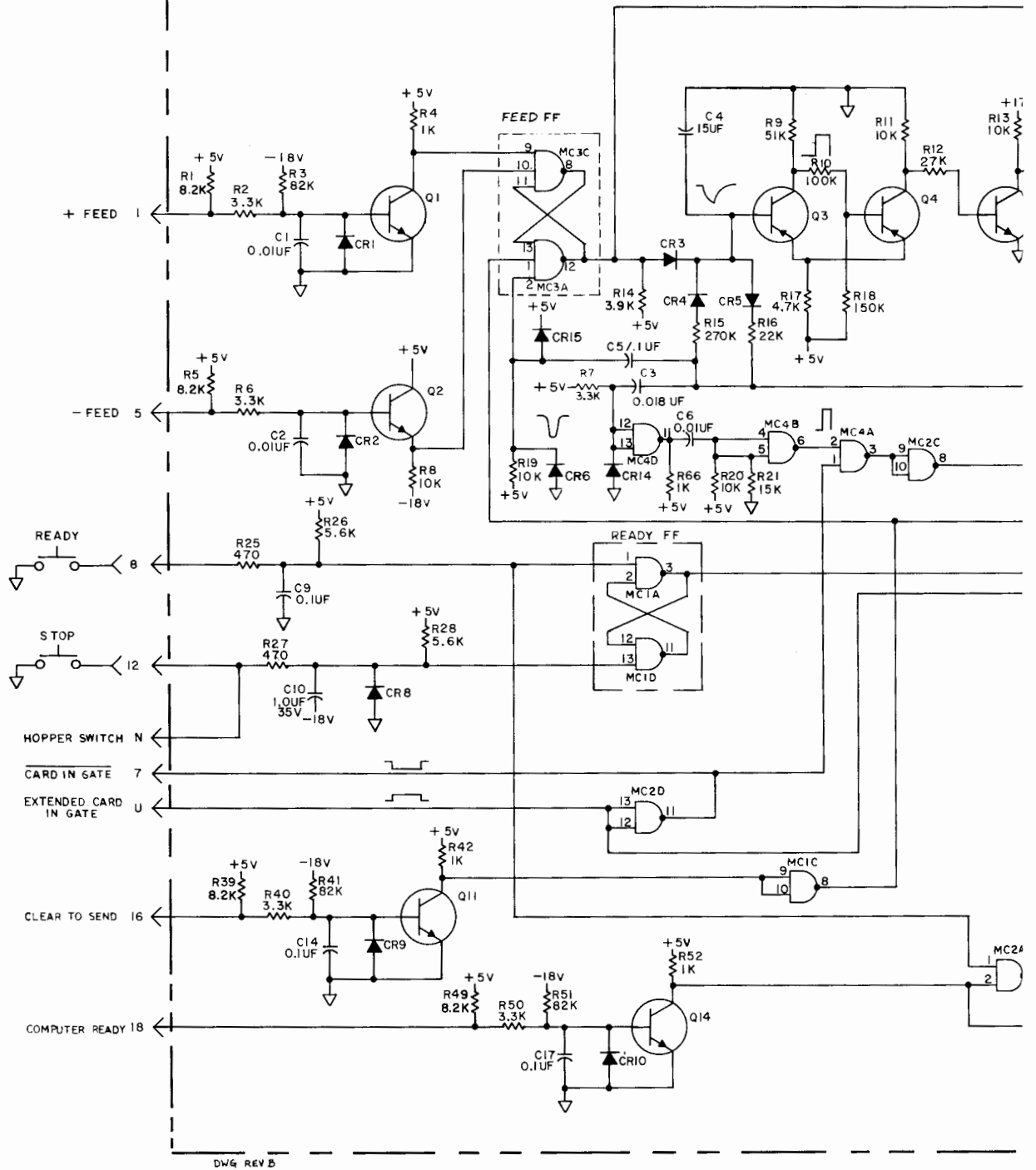


Figure 5-3. 2761A-07 READER, EXPLODED VIEW NO.2



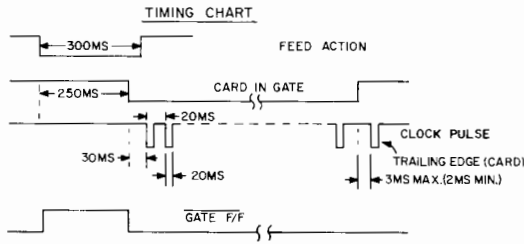
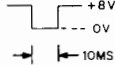
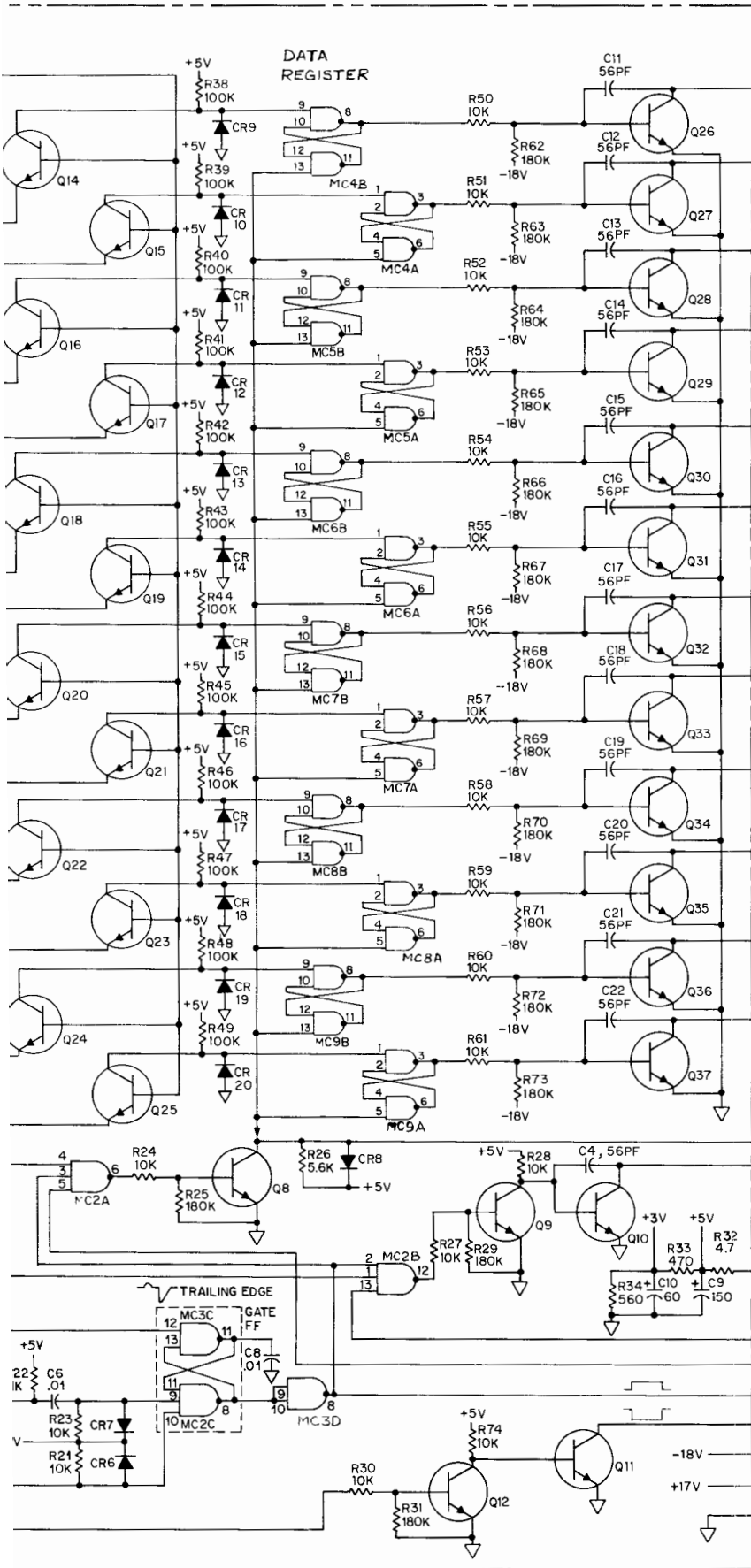


A2 PROGRAM CONTROL CARD(02760-6036, REV B51)



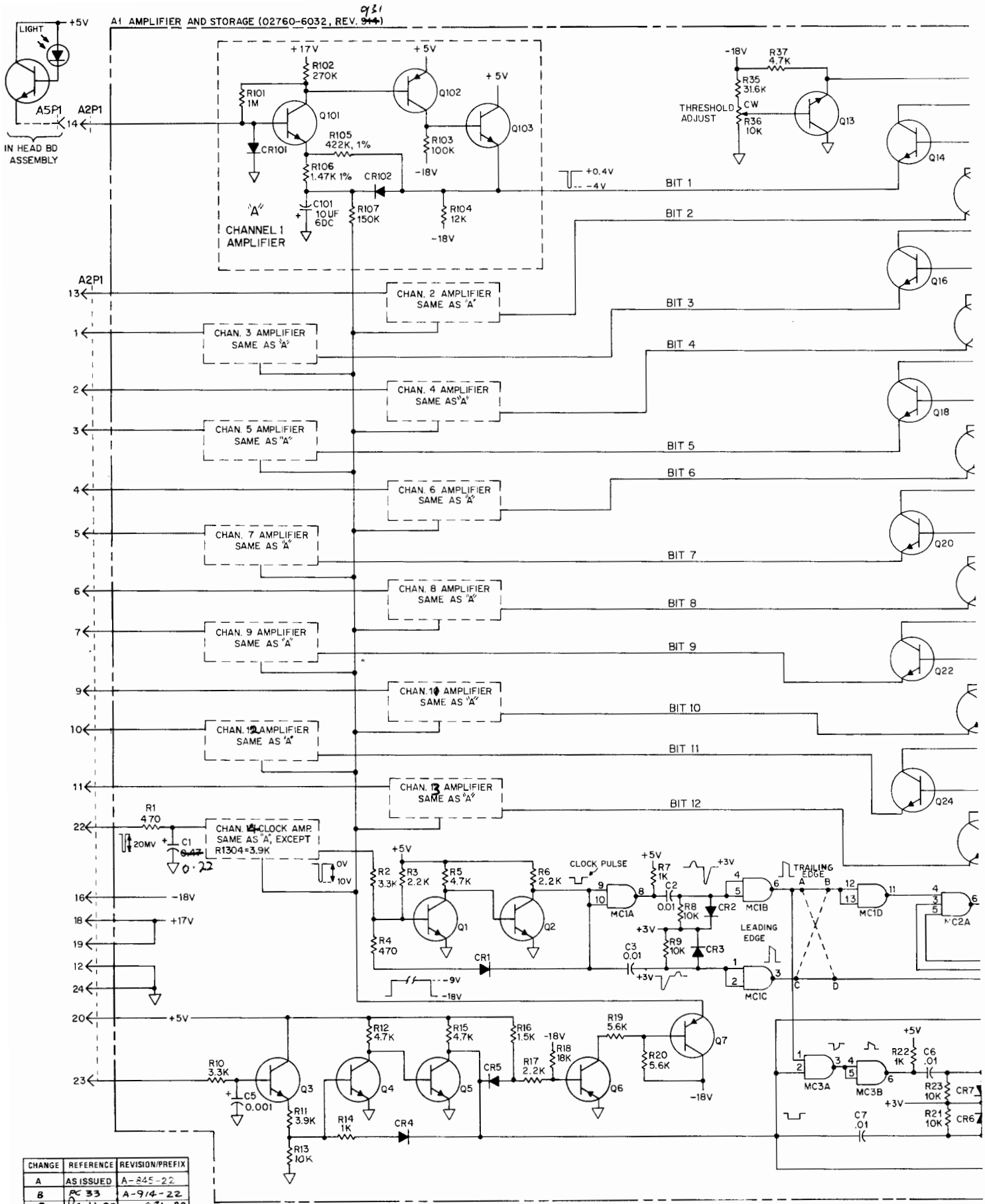
DW4 REV B

CHANGE	REFERENCE	REVISION/PREFIX
A	AS ISSUED	A-847-22
B	PC32	B-851-22

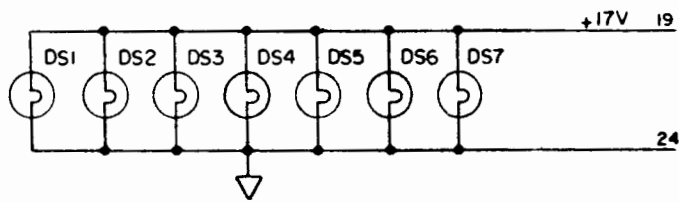
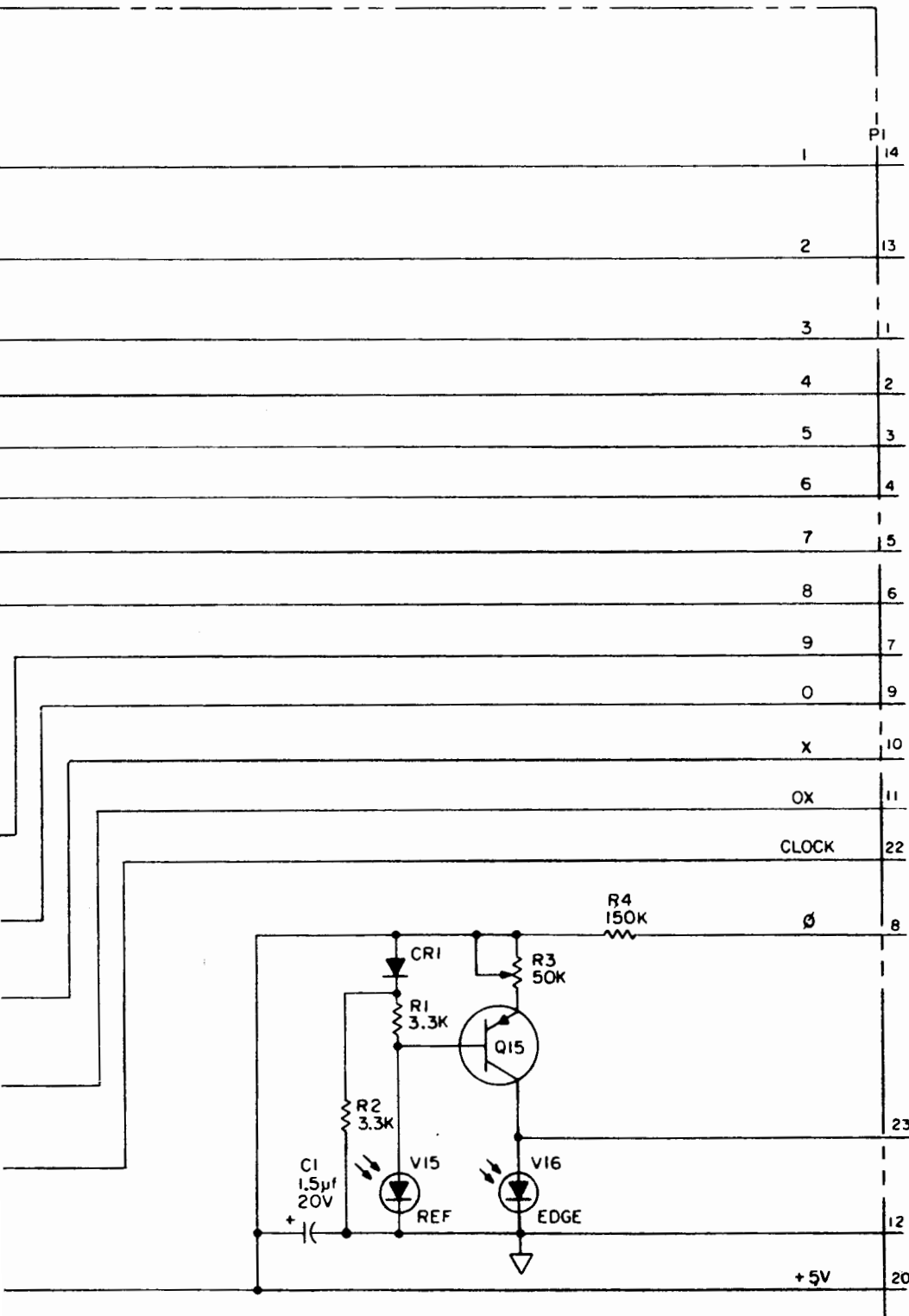


- NOTES  
UNLESS OTHERWISE INDICATED:
1. RESISTORS ARE IN OHMS
  2. CAPACITANCE IN MICROFARADS.
  3. PNP TRANSISTORS ARE 2N3906, NPN TRANSISTORS ARE 2N3391.
  4. DIODES ARE 1901-0040 EXCEPT CR1, 4, 5 WHICH ARE 1910-0016.
  5. MC1, MC3-MC9 ARE 1820-0094. MC2 IS 1820-0310. PIN 7 IS GROUND, PIN 14 IS +5V ON ALL MICROCIRCUIT PACKAGES

DATE	9/23/68
AMPLIFIER AND STORAGE FOR 2761A-07	
A1	
D02760-6032-S	
PALO ALTO DIVISION • HEWLETT-PACKARD CO	

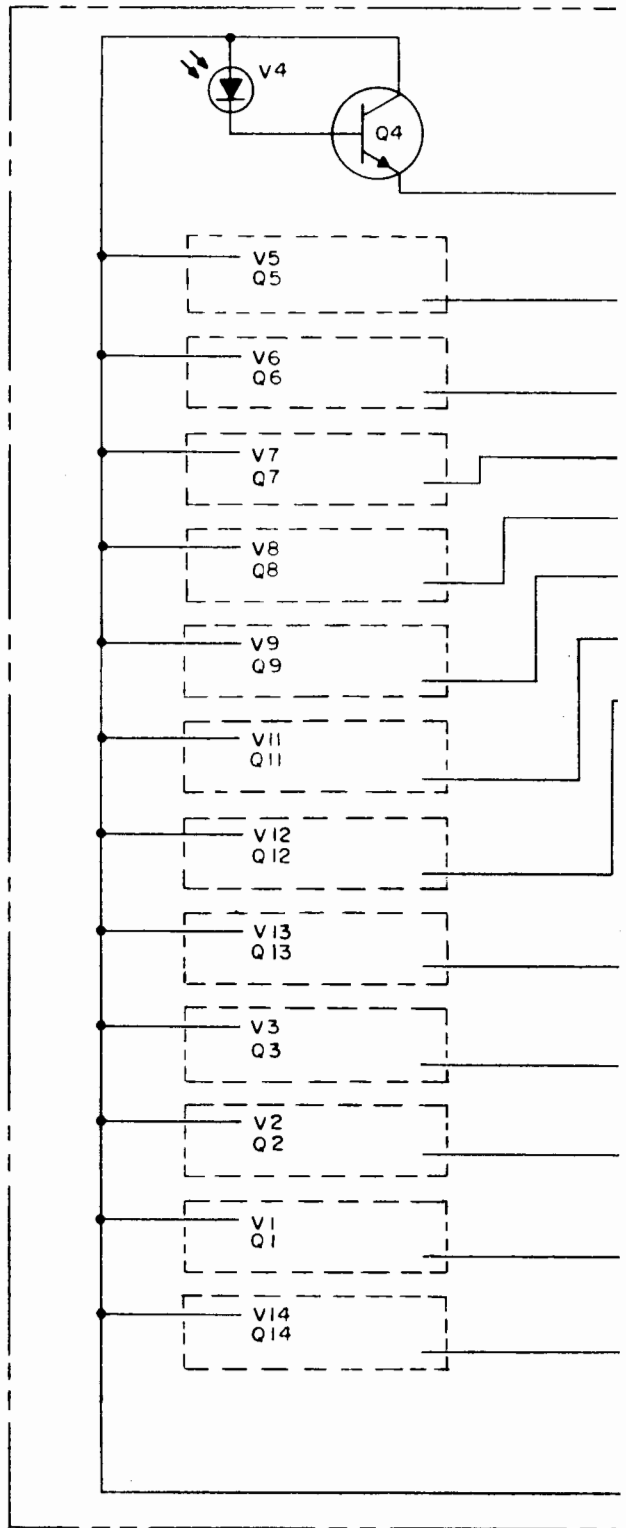


CHANGE	REFERENCE	REVISION/PREFIX
A	AS ISSUED	A-845-22
B	PC 33	A-914-22
C	PC 1100	A-931-22



DESIGN	D. RIED	DATE	1 OF 1
HP 2761 A READ HEAD ASSEMBLY A5			
02760-6119-S			
PALLADIUM ELECTRONICS COMPANY			



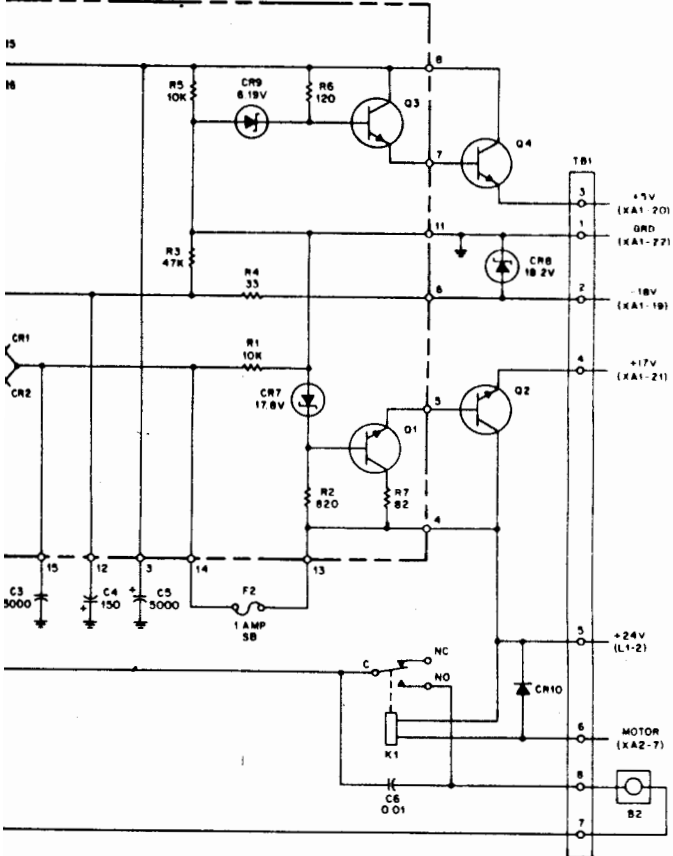


02760-6119-S

REVISIONS							
ISSUE	ZONE	DESCRIPTION	BY	CHKD	AP'D	AUTH	DATE
A		PROTO.	DP				
B		ADDED FAN COOL AC UNIT	DS				11-2-67
C		F1 & FZ, 1A TO 2A (PC 22-1063)	RL				6-16-67
D		R26 Replaced CR7 with 17.2V WR					

Supply, D-02760-6107-S:  
 Automatic D-07260-6107-S and add the

11A1 (02760-6007, REV. 928)



NOTES  
 1 UNLESS OTHERWISE SPECIFIED, ALL RESISTANCES  
 ARE IN OHMS AND ALL CAPACITANCES ARE IN  
 MICROFARADS

REVIEW  
 11-2-67 by C. [unclear]

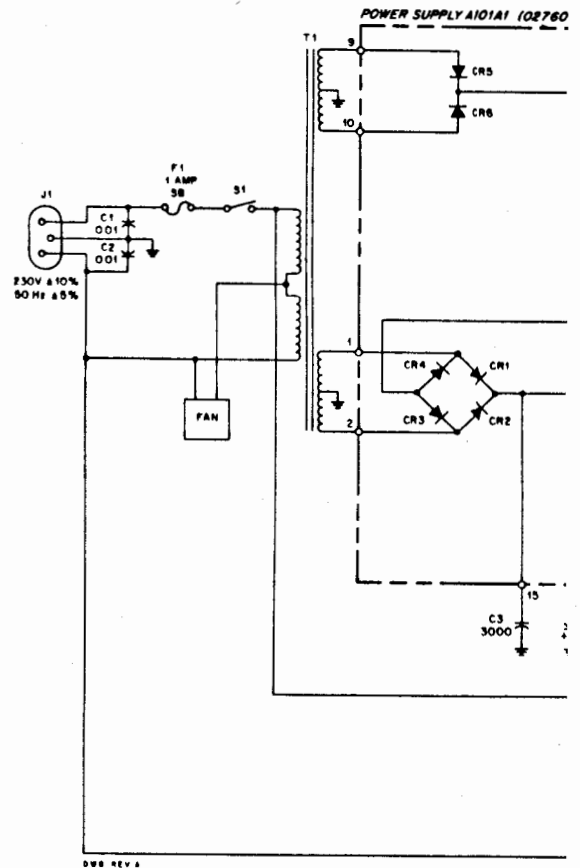
DESIGN  
 11-2-67 by [unclear]

VERSION	DATE	BY
-9		
-8		
-7		
-6		
-5		
-4		
-3		
-2		
-1		
0		

SEE B/M & C/I												
QTY	QTY	QTY	QTY	QTY	QTY	QTY	QTY	QTY	QTY	ITEM	PART NUMBER	DESCRIPTION
-9	-8	-7	-6	-5	-4	-3	-2	-1	-0			
LIST OF MATERIAL												
DRAWN: DP, DATE: 2-4-67										PART NO: 02760-6107		SCALE: —
CHECKED: JE, DATE: 6/1/67										TITLE: SCHEM.		HEWLETT PACKARD DATAMEC DIVISION MOUNTAIN VIEW CALIFORNIA
APPROVED: MB, DATE: 6/1/67										POWER SUPPLY CARD READER		
AUTHORIZED: [unclear]										FINISH: —		SHEET OF
INFORMATION IN THIS DRAWING MAY NOT BE DISSEMINATED WITH- OUT AUTHORIZATION OF HEWLETT PACKARD, DATAMEC DIVISION										DWG NO. D-02760-6107-S		S

HOLE CODE			
SYM	DESCRIPTION	TOL	QTY

Schematic, Card Reader Power Supply  
Delete Power Supply Schematic  
following:



115V  
AC

COMPONENT	LAST USED	OMITTED
RESISTOR	R6	
CAPACITOR	C6	
DIODE	CR10	
TRANSISTOR	Q4	
RELAY	K1	

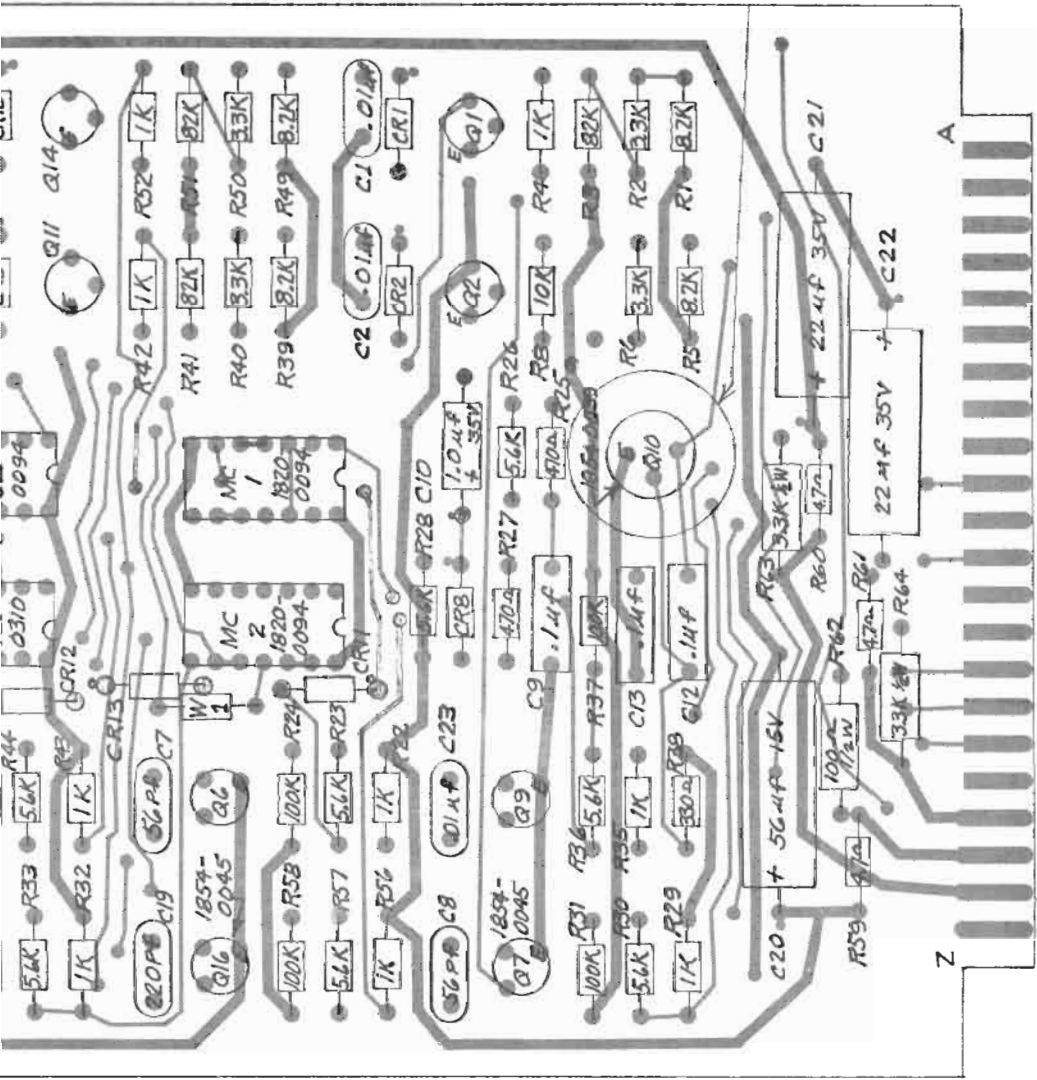
NOTES:

1. Nos. NOTED  $\diamond$  THUS, DENOTE  
TERMINAL POINTS ON CIRCUIT  
BOARD

ENGINEERING RESPONSIBILITY										SEPIA							
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38

SYM	REVISIONS	APPROVED	DATE
A	AS ISSUED	<i>[Signature]</i>	11/10/68
B	ADDED C3, R7, CR14 & CR15	<i>[Signature]</i>	11/6/69

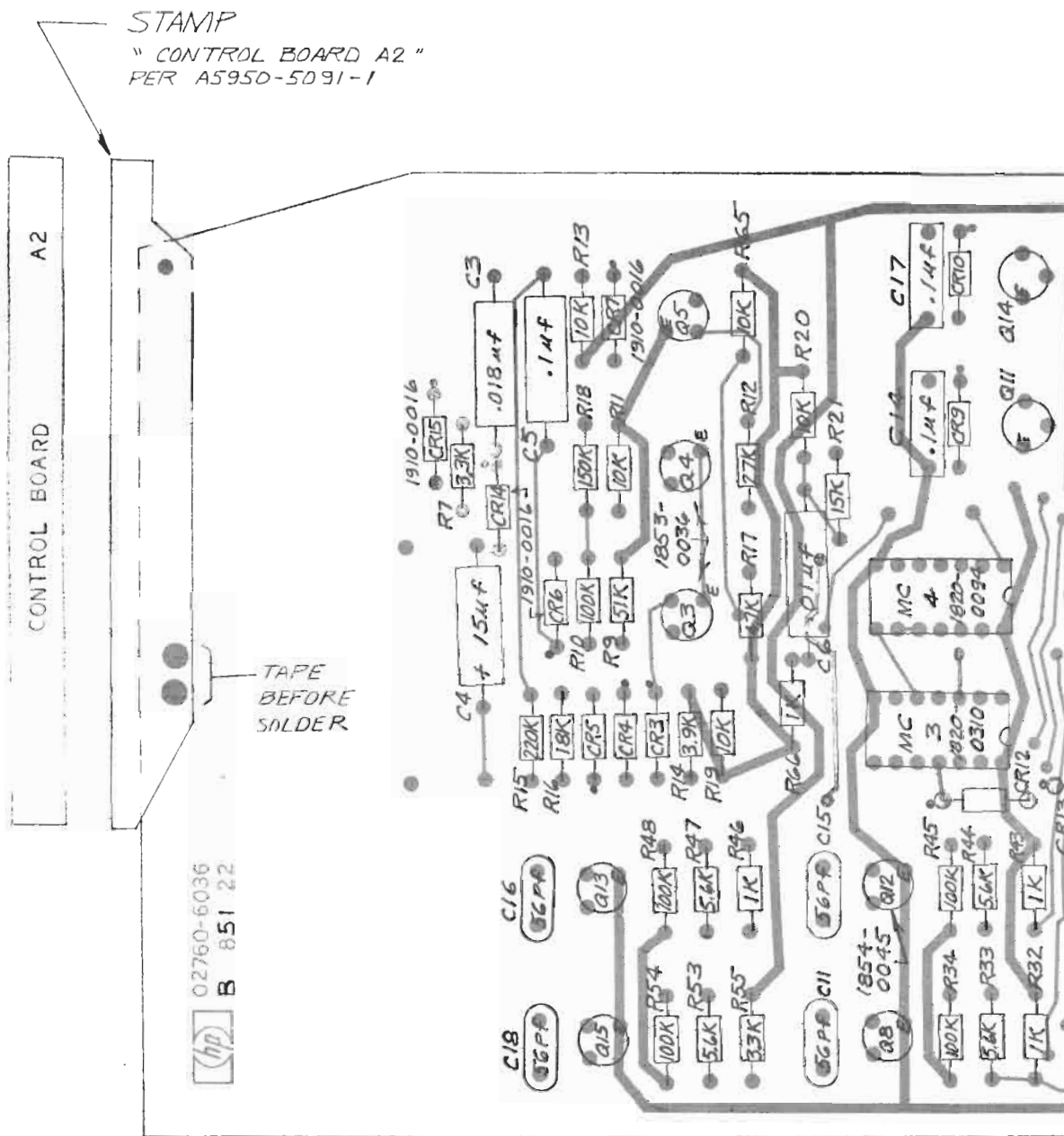
HEAT SINK  
1205-0011  
TRANS. PAD  
0340-0083



SECTION THRU SOLDER WAVE

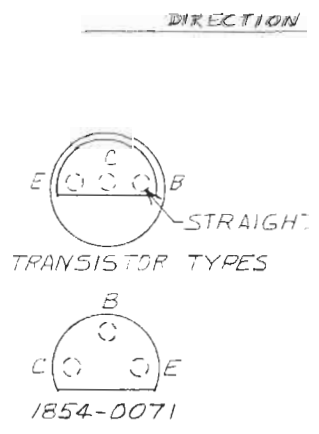
STRAIGHT LEAD  
TYPES

DO NOT SCALE THIS DRAWING	ITEM	QTY	BOARD-ETCHED	C2760-8036	MATL. DWG. NO.	MATL. SPEC.
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: .XX ± .02 .XXX ± .005	DRAWN BY	JEB	DATE	11-11-68	PROGRAM CONT. BD	HEWLETT-PACKARD
	ENGINEER	E. Touche	DATE	11-11-68	PERM. PRINT/SSY DWG.	PALO ALTO DIVISION
	RELEASE TO: PROB	DANZ-BARBERA	DATE	6/23/69	NEXT ASSEMBLY	2761A-97
SUPERSEDES DWG	FINISH	DRY-FILM	SCALE	2:1	PART NUMBER	C02760-6036-1



SCHMATIC C02760-6036-5

UNLESS OTHERWISE SPECIFIED:  
ALL RESISTORS IN OHMS, 1/4W, 5% COMP.  
ALL DIODES ARE SILICON, 1901-0040,  
ALL TRANSISTORS 1854-0071

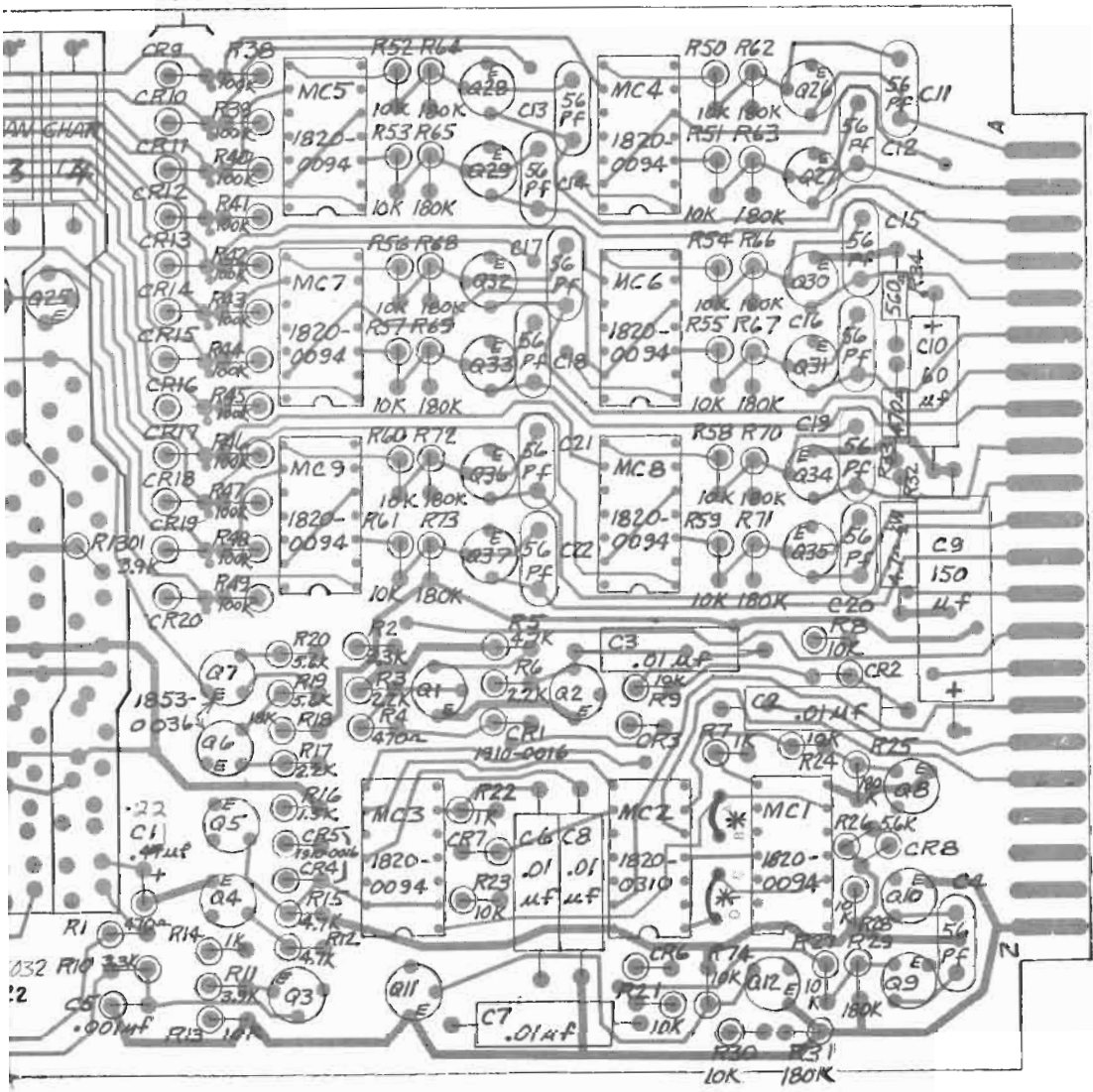


REVIEW  
12-9-68 BY RJV

ENGINEERING RESPONSIBILITY										SEPIA				SYM		REVISIONS		APPROVED		DATE	
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	A	AS ISSUED	<i>CE/DOE</i>	14/10/68
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	B	R1, R3 WERE 3.3K, R2 WAS 2.2K C1 WAS .1UF. R13 WAS 2.2K, C4, R1 & C10	<i>ST/T</i>	4/8/68

C1 to 0.22µF

1910-0016



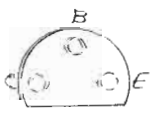
STAMP

DIRECTION THRU SOLDER WAVE

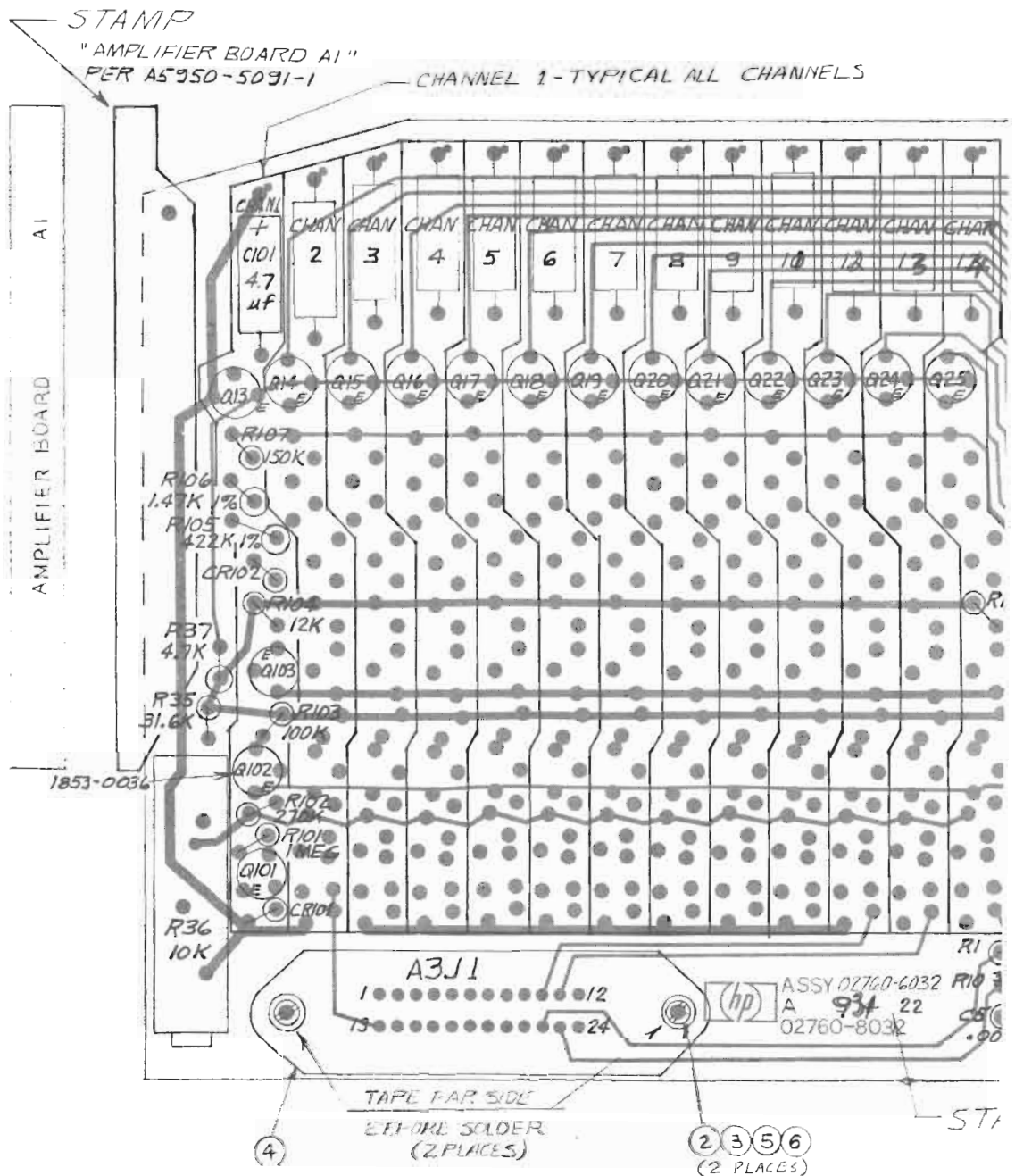
NOTE 2  
0.035

6	2	WASHER SPLIT, LK #2	2190-0045
5	2	WASHER - FLAT #2	3050-0230
4	1	CONNECTOR	1251-2037
3	2	SCREW 2-56 X 3/16	0520-0127
2	2	STANDOFF	0380-0814
1	1	BOARD - ETCHED	02760-6032

DIRE DRI FILMING  
PLACED IN JST TEST



UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES .XXX ± .02 .XXX ± .005		DRAWN BY: <b>JEB</b> DATE: <b>9-23-68</b> ENGINEER: <i>Jack</i> DATE: <i>9-23-68</i> RELEASE TO PROD: <i>6/23/69</i> SUPERSEDES: <i>6/23/69</i>	<b>AMP &amp; STORAGE</b> <b>ASSY DWG</b> TITLE: <b>2761A-07</b> NEXT ASSEMBLY: <b>DRI-FILM</b> FINISH:	<b>HEWLETT PACKARD</b> PALO ALTO DIVISION PART NUMBER: <b>02760-6032</b> <b>C02760-6032-1</b>			
DO NOT SCALE THIS DRAWING		ITEM	QTY	MATERIAL DESCRIPTION	MATL PART NO	MATL DWG NO	MATL SPEC



SCHEMATIC C02760-6032-S

UNLESS OTHERWISE SPECIFIED:  
 ALL RESISTORS IN OHMS, 1/4W, 5% COMP.  
 ALL CAPACITORS IN MICROFARADS  
 ALL DIODES ARE SILICON, 1301-0040,  
 MOUNTED CATHODE UP.  
 ALL TRANSISTORS 1854-0071

\* INSTALL #22 AWG WIRE JUMPERS  
 BETWEEN A-B & C-D.

NOTE:

1. COVER A3J1 BEFORE DR
2. THESE SCREWS REPLACED IN

DOC. REVIEW  
 DATE 4-8-68 BY [Signature]

PROCESS REVIEW  
 DATE 12-7-68 BY RJW



STRAIGHT LEAD

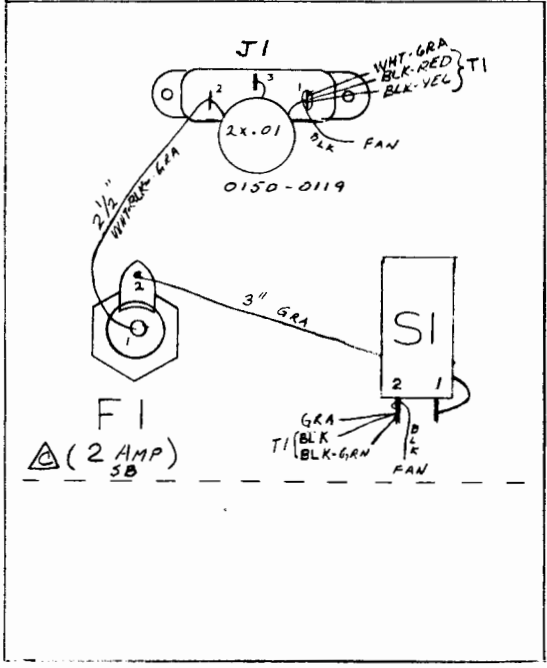
1854-0071

ENGINEERING RESPONSIBILITY										SEPIA							
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

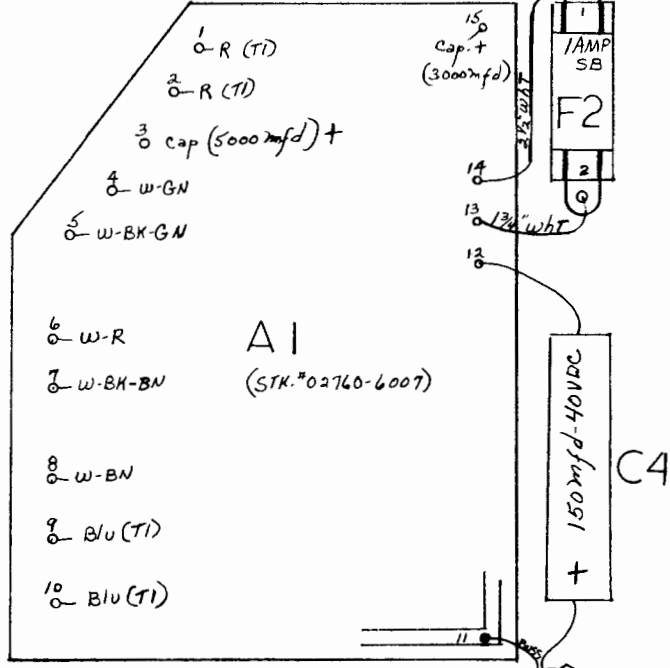
SYM		REVISIONS		APPROVED	DATE
A		REWORKED TO MFG. SAMPLE		C. Sam...	11-2-67
B		UPDATED		G. Sam...	6-2-68
C		2 AMP WAS 1 AMP PC# 22-1063		GR. / D...	5-9-69

01-0026

### BACK PLATE



### P.C. BD.



### PROCEDURE

- 1- Assemble & prefab Back Plate
- 2- Mount T.B.#1 & CRB to main Deck
- 3- Wire T.B.#1, CRB & 2 Transistors
- 4- Mount KI- T1 - Add Cable Clamp to T.1 Mount C3 & C5
- 5- Put 2 Red & 2 Blu (TI) thru Grommet & Lace the Post 1 1/2" (Connect to J1(1) & SI(1))
- 6- Finish Wiring on Back Side
- 7- Prefab A1 - mount C4 - finish wiring

Cut BLK, BLK-GRN 4 3/4" from cable clamp  
 " GRN, RED-YEL 4" " " "  
 " BLK-YEL, BLK-RED 3 1/2" " " "

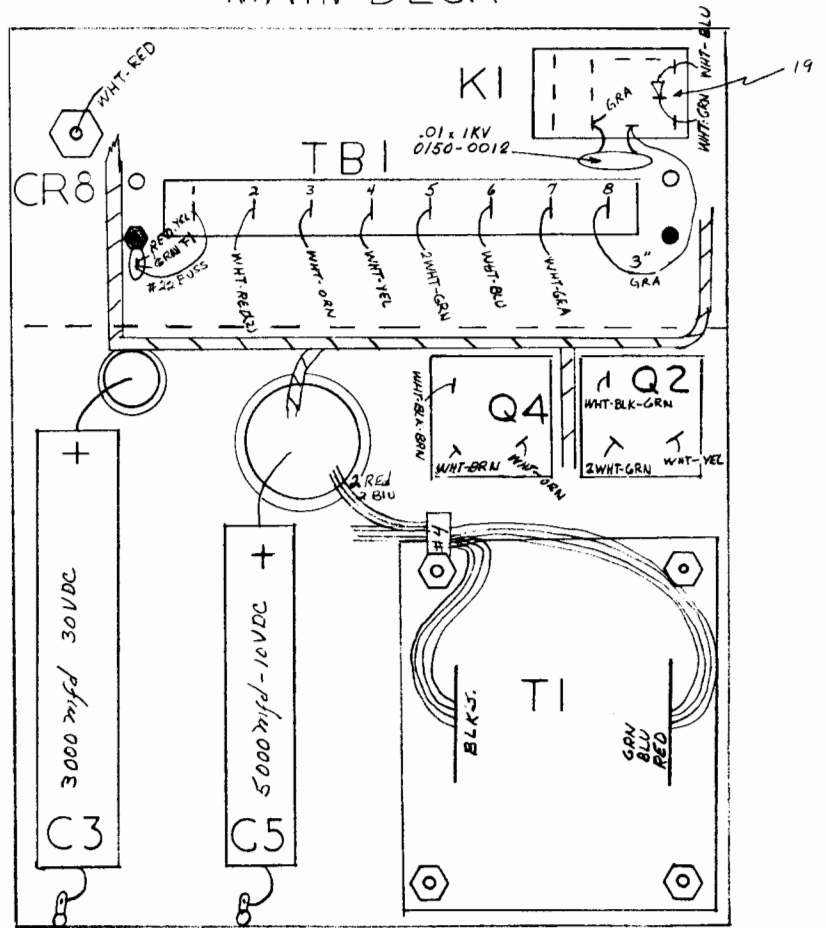


TOOLING REVIEW	
DATE 11-2-67	BY Dillon
8-8-68	Dillon

DO NOT SCALE THIS DRAWING		ITEM	QTY.	MATERIAL-DESCRIPTION	MATL-PART NO.	MATL-DWG. NO.	MATL-SPEC.
UNLESS OTHERWISE SPECIFIED. DIMENSIONS ARE IN INCHES. TOLERANCES .XX ± .02 .XXX ± .005		DRAWN BY	C. Voss	DATE	9/28/67	POWER SUPPLY ASSY. REF.	
		ENGINEER	R. Kashi	DATE	10/24/67	PERM. PRINT HEWLETT & PACKARD PALO ALTO DIVISION	
		RELEASE TO PROD.	P8100M	DATE	8/8/68	PART NUMBER	
SUPERSEDES DWG.				NEXT ASSEMBL.	2760A/2761A	CO2760-6107-2	
				FINISH	SCALE	SHEET OF	



# MAIN DECK



## Pt. to Pt. Jumpers

- 22GA-3" GRA - TBI(B)-KIA(C)
- 22GA-3" GRA - F1(SIDE)-S1(1)
- 22GA-2½" WHT-BLK-GRN F1(REAR)-J1(2)
- 22GA-2½" WHT. - A1(14)-F2(1)
- 22GA-1¾" WHT. A1(13)-F2(2)
- 20GA-#20 Spag. 1¾" Long (2 places)
- 22GA-#22 Buss 1¾" (2 places)
- Wiring Harness -(Str. No. 02760-8114)

<b>DOC. REVIEW</b>	
DATE 11-2-67	BY O. Saunders
8-17-68 O. Saunders	

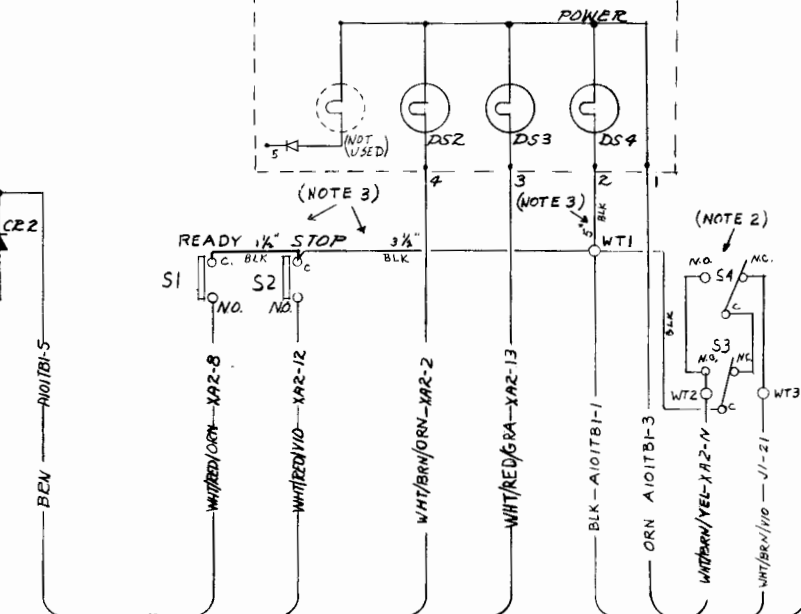
ENGINEERING RESPONSIBILITY										SEPIA									
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38		

D-02760-9039-1

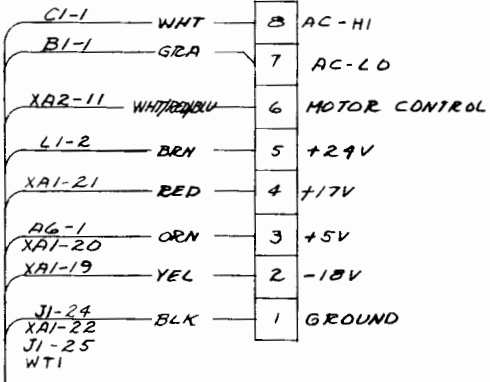
SYM	REVISIONS		APPROVED	DATE
	B	REDRAWN - SUPERSEDES C-1 C-2	CJ/MAB	12.08
C	ERRATA (CHAN 10 REMOVED)			
D	ADDED (CHAN 14)		GR	12.10.69



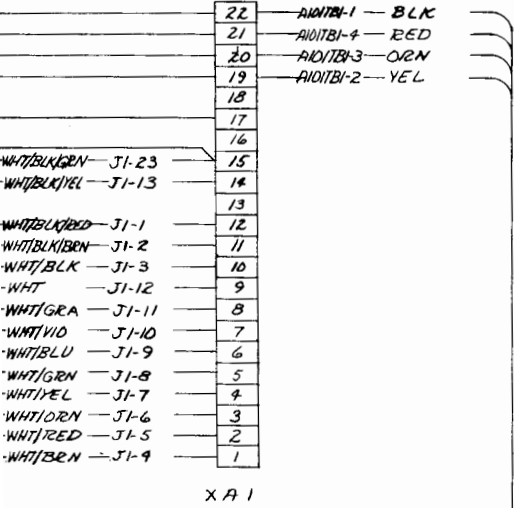
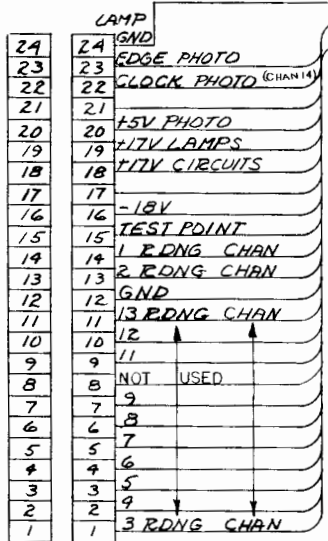
AG LAMP BOARD 02760-6001



POWER SUPPLY A101 A101B1



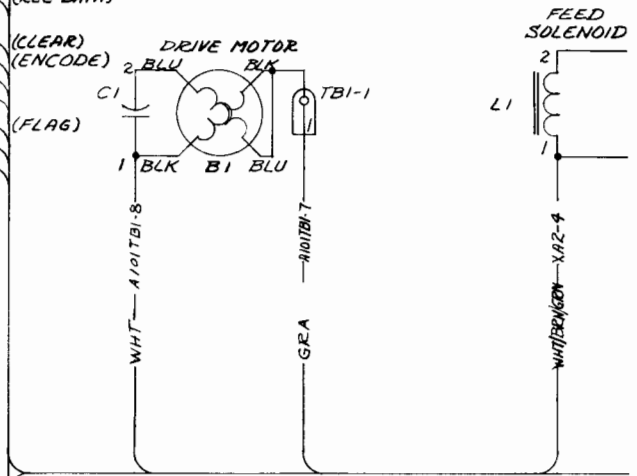
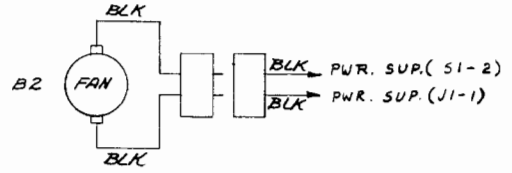
READ HEAD ASS'Y AS 02760-6119



ITEM	QTY.	MATERIAL DESCRIPTION	MATL. PART NO.	MATL. DWG. NO.	MATL. SPEC.
DO NOT SCALE THIS DRAWING					
UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES. TOLERANCES: XX ± .02, XXX ± .005					
22	1	WIRING DIAGRAM			
23	1	OPTICAL MARK READER - PARALLEL BIT			
24	1	PERM. PRINT			
25	1	HEWLETT-PACKARD			
26	1	PALO ALTO DIVISION			
27	1	PART NUMBER			
28	1	D-02760-9039-1			
29	1	SHEET OF			

I/O CONNECTOR

J1	Terminal	Wire Color	Function
1	XA1-12	WHT/BLK/RED	
2	XA1-11	WHT/BLK/BRN	
3	XA1-10	WHT/BLK	
4	XA1-1	WHT/BRN	
5	XA1-2	WHT/RED	
6	XA1-3	WHT/ORN	
7	XA1-4	WHT/YEL	
8	XA1-5	WHT/GRN	
9	XA1-6	WHT/BLU	
10	XA1-7	WHT/VID	
11	XA1-8	WHT/GRA	
12	XA1-9	WHT	
13	XA1-14	WHT/BLK/YEL	(XC1G)
14	XA2-15	WHT/ORN/GRA	
15	XA2-9	WHT/RED/YEL	
16	XA2-10	WHT/BRN/GRN	(BUSY STAT)
17	XA2-1	WHT/BRN/RED	(REC DATA)
18			
19	XA2-16	WHT/ORN/BLU	(CLEAR)
20	XA2-5	WHT/BRN/BLU	(ENCODE)
21	WT-3	WHT/BRN/VID	
22	XA2-T	WHT/YEL/GRN	(FLAG)
23	YA1-15	WHT/BRN/GRN	
24	A101TBI-1	BLK	
25	A101TBI-1	BLK	



PREFIX ASSEM; MAIN FRAME

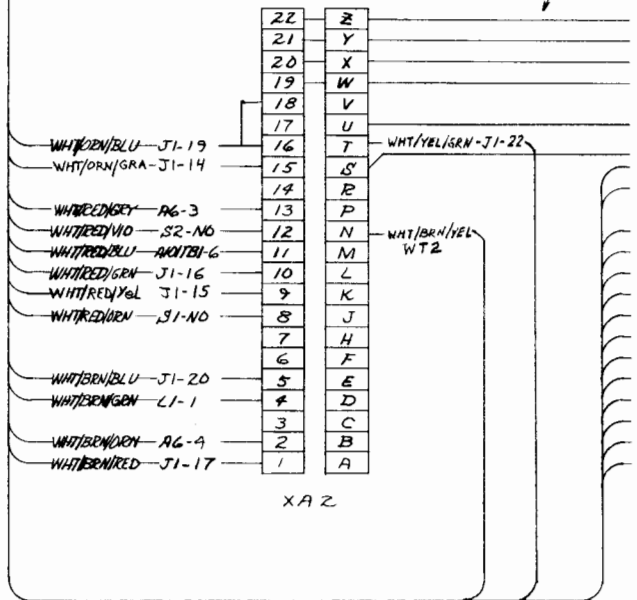
- A1-HEAD AMP. BD.
- A2-CONTROL BD.
- A5-READ HEAD ASSY.
- A6-LAMP BD.
- A101-POWER SUPPLY

NOTE:

- ① ALL CONNECTION W/O COLOR CODE ARE #18 TINNED COPPER WIRE (STK#8151-0011)
- ② REFER TO DWG. C-02760-6128-2 FOR WIRING S3, S4
- ③ PT. TO PT. JUMPER:
 

# 22GA. BLK	1 1/2"	S1C → S2C
" " "	3 1/2"	S2C → WT1
" " "	5"	WT1 → A6-2

(NOTE 1)



**TABLE 6-3.**  
**CODE LIST OF MANUFACTURERS**

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1 (Name to Code) and H4-2 (Code to Name) and their latest supplements. The date of revision and the date of the supplements used appear at the bottom of each page. Alphabetical codes have been arbitrarily assigned to suppliers not appearing in the H4 Handbooks.

Code No.	Manufacturer	Address	Code No.	Manufacturer	Address	Code No.	Manufacturer	Address
00000	U. S. A. Common	Any supplier of U. S.	05397	Union Carbide Corp., Linde Div., Kemet Dept.	Cleveland, Ohio	11242	Bay State Electronics Corp.	Waltham, Mass.
00136	McCoy Electronics	Mount Holly Springs, Pa.	05593	Illumintronic Engineering Co.	Sunnyvale, Calif.	11312	Teledyne Inc., Microwave Div.	Palo Alto, Calif.
00213	Sage Electronics Corp.	Rochester, N. Y.	05616	Cosmo Plastic	Cleveland, Ohio	11314	National Seal	Downey, Calif.
00287	Cemco Inc.	Danielson, Conn.	05624	(C.O. Electrical Spec. Co.)	Rockford, Ill.	11534	Duncan Electronics Inc.	Costa Mesa, Calif.
00334	Humidial	Colton, Calif.	05728	Tiffen Optical Co.	Roslyn Heights, Long Island, N. Y.	11711	General Instrument Corp., Semiconductor Div., Products Group	Newark, N. J.
00348	Microtron Co., Inc.	Valley Stream, N. Y.	05729	Metro-Tel Corp.	Westbury, N. Y.	11717	Imperial Electronic, Inc.	Buena Park, Calif.
00373	Garlock Inc.	Cherry Hill, N. J.	05783	Stewart Engineering Co.	Santa Cruz, Calif.	11870	Melabs, Inc.	Palo Alto, Calif.
00656	Aerovox Corp.	New Bedford, Mass.	05820	Wakefield Engineering Inc.	Wakefield, Mass.	12136	Philadelphia Handle Co.	Camden, N. J.
00779	Amp. Inc.	Harrisburg, Pa.	06004	Bassick Co., Div. of Stewart Warner Corp.	Bridgeport, Conn.	12361	Grove Mfg. Co., Inc.	Shady Grove, Pa.
00781	Aircraft Radio Corp.	Boonton, N. J.	06090	Raychem Corp.	Redwood City, Calif.	12574	Gulton Ind. Inc. Data System Div.	Albuquerque, N. M.
00815	Northern Engineering Laboratories, Inc.	Burlington, Wis.	06175	Bausch and Lomb Optical Co.	Rochester, N. Y.	12697	Clarostat Mfg. Co.	Dover, N. H.
00853	Sangamo Electric Co., Pickens Div.	Pickens, S. C.	06402	E. T. A. Products Co. of America	Chicago, Ill.	12728	Elmar Filter Corp.	W. Haven, Conn.
00866	Goe Engineering Co.	City of Industry, Cal.	06540	Amatrol Electronic Hardware Co., Inc.	New Rochelle, N. Y.	12859	Nippon Electric Co., Ltd.	Tokyo, Japan
00991	Carl E. Holmes Corp.	Los Angeles, Calif.	06555	Beede Electrical Instrument Co., Inc.	Penacook, N. H.	12881	Meltek Electronics Corp.	Clark, N. J.
00929	Microlab Inc.	Livingston, N. J.	06666	General Devices Co., Inc.	Indianapolis, Ind.	12930	Delta Semiconductor Inc.	Newport Beach, Calif.
01002	General Electric Co., Capacitor Dept.	Hudson Falls, N. Y.	06751	Semcor Div. Components Inc.	Phoenix, Ariz.	12954	Dickson Electronics Corp.	Scottsdale, Arizona
01009	Alden Products Co.	Brockton, Mass.	06812	Torrington Mfg. Co., West Div.	Van Nuys, Calif.	13103	Thermolloy	Dallas, Texas
01121	Allen Bradley Co.	Milwaukee, Wis.	06980	Varian Assoc. Eimac Div.	San Carlos, Calif.	13396	Telefunken (GmbH)	Hanover, Germany
01255	Litton Industries, Inc.	Beverly Hills, Calif.	07088	Kelvin Electric Co.	Van Nuys, Calif.	13835	Midland-Wright Div. of Pacific Industries, Inc.	Kansas City, Kansas
01281	TRW Semiconductors, Inc.	Lawndale, Calif.	07126	Digitran Co.	Pasadena, Calif.	14099	Sem-Tech	Newbury Park, Calif.
01295	Texas Instruments, Inc., Transistor Products Div.	Dallas, Texas	07137	Transistor Electronics Corp.	Minneapolis, Minn.	14193	Calif. Resistor Corp.	Santa Monica, Calif.
01349	The Alliance Mfg. Co.	Alliance, Ohio	07138	Westinghouse Electric Corp. Electronic Tube Div.	Elmira, N. Y.	14298	American Components, Inc.	Conshohocken, Pa.
01589	Pacific Relays, Inc.	Van Nuys, Calif.	07149	Filmohm Corp.	New York, N. Y.	14433	ITT Semiconductor, A Div. of Int. Telephone & Telegraph Corp.	West Palm Beach, Fla.
01930	Amerock Corp.	Rockford, Ill.	07233	Cinch-Graphix Co.	City of Industry, Calif.	14493	Hewlett-Packard Company	Loveland, Colo.
01961	Pulse Engineering Co.	Santa Clara, Calif.	07261	Avnet Corp.	Culver City, Calif.	14655	Cornell Dublier Electric Corp.	Newark, N. J.
02114	Ferroxcube Corp. of America	Saugerties, N. Y.	07263	Fairchild Camera & Inst. Corp. Semiconductor Div.	Mountain View, Calif.	14674	Corning Glass Works	Corning, N. Y.
02116	Wheelock Signals, Inc.	Long Branch, N. J.	07322	Minnesota Rubber Co.	Minneapolis, Minn.	14752	Electro Cube Inc.	San Gabriel, Calif.
02286	Cole Rubber and Plastics Inc.	Sunnyvale, Calif.	07387	Bircher Corp., The	Monterey Park, Calif.	14960	Williams Mfg. Co.	San Jose, Calif.
02660	Amphenol-Boig Electronics Corp.	Chicago, Ill.	07397	Sylvania Elect. Prod. Inc., Mt. View Operations	Mountain View, Calif.	15203	Webster Electronics Co.	New York, N. Y.
02735	Radio Corp. of America, Semiconductor and Materials Div.	Somerville, N. J.	07700	Technical Wire Products Inc.	Cranford, N. J.	15278	Scionics Corp.	Northridge, Calif.
02771	Vocaline Co. of America, Inc.	Old Saybrook, Conn.	07910	Continental Device Corp.	Hawthorne, Calif.	15291	Adjustable Bushing Co.	N. Hollywood, Calif.
02777	Hopkins Engineering Co.	San Fernando, Calif.	07933	Raytheon Mfg. Co., Semiconductor Div.	Mountain View, Calif.	15558	Micron Electronics	Garden City, Long Island, N. Y.
03508	G. E. Semiconductor Prod. Dept.	Syracuse, N. Y.	07980	Hewlett-Packard Co., Boonton Radio Div.	Rockaway, N. J.	15566	Amprobe Inst. Corp.	Lynbrook, N. Y.
03705	Apex Machine & Tool Co.	Dayton, Ohio	08145	U. S. Engineering Co.	Los Angeles, Calif.	15631	Cabletronics	Costa Mesa, Calif.
03797	Eldema Corp.	Compton, Calif.	08289	Blinn, Deibert Co.	Pomona, Calif.	15772	Twentieth Century Coil Spring Co.	Santa Clara, Calif.
03888	Pyrofilm Resistor Co., Inc.	Cedar Knolls, N. J.	08358	Burgess Battery Co.	Niagara Falls, Ontario, Canada	15801	Fenwal Elect. Inc.	Framingham, Mass.
03954	Singer Co., Diehl Div.	Sumerville, N. J.	08524	Deutsch Fastener Corp.	Los Angeles, Calif.	15818	Ameico Inc.	Mt. View, Calif.
04009	Arrow, Hart and Hegeman Elect. Co.	Hartford, Conn.	08664	Bristol Co., The	Waterbury, Conn.	16037	Spruce Pine Mica Co.	Spruce Pine, N. C.
04013	Taurus Corp.	Lambertville, N. J.	08717	Sloan Company	Sun Valley, Calif.	16179	Omni-Spectra Inc.	Detroit, Ill.
04062	Arco Electronic Inc.	Great Neck, N. Y.	08718	ITT Cannon Electric Inc., Phoenix Div.	Phoenix, Arizona	16352	Computer Diode Corp.	Lodi, N. J.
04222	Hi-Q Division of Aerovox	Myrtle Beach, S. C.	08792	CBS Electronics Semiconductor Operations, Div of C. B. S. Inc.	Lowell, Mass.	16688	Ideal Prec. Meter Co., Inc. De Jur Meter Div.	Brooklyn, N. Y.
04354	Precision Paper Tube Co.	Wheeling, Ill.	08984	Mel-Rain	Indianapolis, Ind.	16758	Delco Radio Div. of G. M. Corp.	Kokoma, Ind.
04404	Dymec Division of Hewlett-Packard Co.	Palo Alto, Calif.	09026	Babcock Relays Div.	Costa Mesa, Calif.	17109	Thermonetics Inc.	Canoga Park, Calif.
04651	Sylvania Electric Products, Microwave Device Div.	Mountain View, Calif.	09134	Texas Capacitor Co.	Houston, Texas	17474	Tranex Company	Mountain View, Calif.
04713	Motorola, Inc., Semiconductor Prod. Div.	Phoenix, Arizona	09145	Tech. Ind. Inc. Alohm Elect.	Burbank, Calif.	17675	Hamlin Metal Products Corp.	Akron, Ohio
04732	Filtron Co., Inc. Western Div.	Culver City, Calif.	09250	Electro Assemblies, Inc.	Chicago, Ill.	17745	Angstrom Prec. Inc.	No. Hollywood, Calif.
04773	Automatic Electric Co.	Northlake, Ill.	09569	Mallory Battery Co. of Canada, Ltd.	Toronto, Ontario, Canada	17870	McGraw-Edison Co.	Manchester, N. H.
04796	Sequoia Wire Co.	Redwood City, Calif.	10214	General Transistor Western Corp.	Los Angeles, Calif.	18042	Power Design Pacific Inc.	Palo Alto, Calif.
04811	Precision Coil Spring Co.	El Monte, Calif.	10411	Ti-Tal, Inc.	Berkeley, Calif.	18083	Clevite Corp., Semiconductor Div.	Palo Alto, Calif.
04870	P. M. Motor Company	Westchester, Ill.	10646	Carborundum Co.	Niagara Falls, N. Y.	18324	Signetics Corp.	Sunnyvale, Calif.
04919	Component Mfg. Service Co.	W. Bridgewater, Mass.	11236	CTS of Berne, Inc.	Berne, Ind.	18476	Ty-Car Mfg. Co., Inc.	Holliston, Mass.
05006	Twentieth Century Plastics, Inc.	Los Angeles, Calif.	11237	Chicago Telephone of California, Inc.	So. Pasadena, Calif.	18486	TRW Elect. Comp. Div.	Des Plaines, Ill.
05277	Westinghouse Electric Corp. Semi-Conductor Dept.	Youngwood, Pa.				18583	Curtis Instrument, Inc.	Mt. Kisco, N. Y.
05347	Ultronix, Inc.	San Mateo, Calif.				18873	E. I. DuPont and Co., Inc.	Wilmington, Del.
						18911	Durant Mfg. Co.	Milwaukee, Wis.
						19315	The Bendix Corp., Navigation & Control Div.	Teterboro, N. J.
						19500	Thomas A. Edison Industries, Div. of McGraw-Edison Co.	West Orange, N. J.
						19589	Concoa	Baldwin Park, Calif.
						19644	LRG Electronics	Horseheads, N. Y.
						19701	Electra Mfg. Co.	Independence, Kansas

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**TABLE 6-3.**  
**CODE LIST OF MANUFACTURERS (Cont'd)**

Code No.	Manufacturer	Address	Code No.	Manufacturer	Address	Code No.	Manufacturer	Address
20183	General Atronics Corp.	Philadelphia, Pa.	71436	Chicago Condenser Corp.	Chicago, Ill.	77252	Philadelphia Steel and Wire Corp.	
21226	Executone, Inc.	Long Island City, N. Y.	71447	Calif. Spring Co., Inc.	Pico-Rivera, Calif.			Philadelphia, Pa.
21335	Fafnir Bearing Co., The	New Britain, Conn.	71450	CTS Corp.	Elkhart, Ind.	77342	American Machine & Foundry Co. Potter & Brumfield Div.	Princeton, Ind.
21520	Fansteel Metallurgical Corp.	N. Chicago, Ill.	71468	ITT Cannon Electric Inc.	Los Angeles, Calif.	77630	TRW Electronic Components Div.	Camden, N. J.
23783	British Radio Electronics Ltd.	Washington, D. C.	71471	Cinema, Div. Aerovox Corp.	Burbank, Calif.	77638	General Instrument Corp., Rectifier Div.	
24455	G. E. Lamp Division		71482	C. P. Clare & Co.	Chicago, Ill.			Brooklyn, N. Y.
		Nela Park, Cleveland, Ohio	71590	Centralab Div. of Globe Union Inc.		77764	Resistance Products Co.	Harrisburg, Pa.
24655	General Radio Co.	West Concord, Mass.	71616	Commercial Plastics Co.	Milwaukee, Wis.	77969	Rubbercraft Corp. of Calif.	Torrance, Calif.
24681	Memcor Inc., Comp. Div.	Huntington, Ind.	71700	Cornish Wire Co., The	Chicago, Ill.	78189	Shakeproof Division of Illinois Tool Works	
26365	Gries Reproducer Corp.	New Rochelle, N. Y.	71707	Coto Coil Co., Inc.	New York, N. Y.			Elgin, Ill.
26462	Grobel File Co. of America, Inc.		71744	Chicago Miniature Lamp Works	Providence, R. I.	78283	Signal Indicator Corp.	New York, N. Y.
		Carlstadt, N. J.	71785	Cinch Mfg. Co., Howard B. Jones Div.	Chicago, Ill.	78290	Struthers-Dunn Inc.	Pitman, N. J.
26992	Hamilton Watch Co.	Lancaster, Pa.			Chicago, Ill.	78452	Thompson-Bremer & Co.	Chicago, Ill.
28480	Hewlett-Packard Co.	Palo Alto, Calif.	71984	Dow Corning Corp.	Midland, Mich.	78471	Tilley Mfg. Co.	San Francisco, Calif.
28520	Heyman Mfg. Co.	Kenilworth, N. J.	72136	Electro Motive Mfg. Co., Inc.	Williamstown, Conn.	78488	Stackpole Carbon Co.	St. Marys, Pa.
33173	G. E. Receiving Tube Dept.	Owensboro, Ky.	72619	Dialight Corp.	Brooklyn, N. Y.	78493	Standard Thomson Corp.	Waltham, Mass.
35434	Leclrohm Inc.	Chicago, Ill.	72656	Indiana General Corp., Electronics Div.		78553	Tinnerman Products, Inc.	Cleveland, Ohio
36196	Stanwyck Coil Products Ltd.				Keasby, N. J.	78790	Transformer Engineers	San Gabriel, Calif.
		Hawkesbury, Ontario, Canada	72699	General Instrument Corp., Cap. Div.	Newark, N. J.	78947	Ucinite Co.	Newtonville, Mass.
36287	Cunningham, W. H. & Hill, Ltd.		72765	Drake Mfg. Co.	Harwood Heights, Ill.	79136	Waldes Kohinoor Inc.	Long Island City, N. Y.
		Toronto Ontario, Canada	72825	Hugh H. Eby Inc.	Philadelphia, Pa.	79142	Veeder Root, Inc.	Hartford, Conn.
37942	P. R. Mallory & Co. Inc.	Indianapolis, Ind.	72928	Gudeman Co.	Chicago, Ill.	79251	Wenco Mfg. Co.	Chicago, Ill.
39543	Mechanical Industries Prod. Co.	Akron, Ohio	72964	Robert M. Hadley Co.	Los Angeles, Calif.	79727	Continental-Wirt Electronics Corp.	
40920	Miniature Precision Bearings, Inc.	Keene, N. H.	72982	Erie Technological Products, Inc.	Erie, Pa.			Philadelphia, Pa.
42190	Muter Co.	Chicago, Ill.	73061	Hansen Mfg. Co., Inc.	Princeton, Ind.	79963	Zierick Mfg. Corp.	New Rochelle, N. Y.
43990	C. A. Norgren Co.	Englewood, Colo.	73076	H. M. Harper Co.	Chicago, Ill.	80031	Mepco Division of Sessions Clock Co.	
44655	Ohmite Mfg. Co.	Skokie, Ill.	73138	Helipot Div. of Beckman Inst., Inc.				Morristown, N. J.
46384	Penn Eng. & Mfg. Corp.	Doylestown, Pa.			Fullerton, Calif.	80120	Schnitzer Alloy Products Co.	Elizabeth, N. J.
47904	Polaroid Corp.	Cambridge, Mass.	73293	Hughes Products Division of Hughes Aircraft Co.	Newport Beach, Calif.	80131	Electronic Industries Association. Any brand Tube meeting EIA Standards-Washington, DC.	
48620	Precision Thermometer & Inst. Co.				Hicksville, L. I., N. Y.	80207	Unimax Switch, Div. Maxon Electronics Corp.	
		Southampton, Pa.	73445	Amperex Elect Co.	New Haven, Conn.	80223	United Transformer Corp.	Wallingford, Conn.
49956	Microwave & Power Tube Div.	Waltham, Mass.	73506	Bradley Semiconductor Corp.	Hartford, Conn.	80248	Oxford Electric Corp.	New York, N. Y.
52090	Rowan Controller Co.	Westminster, Md.	73559	Carling Electric, Inc.	Trenton, N. J.	80294	Bourns Inc.	Chicago, Ill.
52983	Sanborn Company	Waltham, Mass.	73682	George K. Garrett Co., Div. MSL Industries Inc.		80294	Bourns Inc.	Riverside, Calif.
54294	Shallcross Mfg. Co.	Selma, N. C.	73734	Federal Screw Products Inc.	Philadelphia, Pa.	80411	Acro Div. of Robertshaw Controls Co.	
55026	Simpson Electric Co.	Chicago, Ill.	73743	Fischer Special Mfg. Co.	Chicago, Ill.	80486	All Star Products Inc.	Columbus, Ohio
55933	Sonolone Corp.	Elmsford, N. Y.	73793	General Industries Co., The	Cincinnati, Ohio	80509	Avery Label Co.	Defiance, Ohio
55938	Raytheon Co. Commercial Apparatus & Systems Div.	So. Norwalk, Conn.	73846	Goshen Stamping & Tool Co.	Elyria, Ohio	80583	Hammilund Co., Inc.	Monrovia, Calif.
56137	Spaulding Fibre Co., Inc.	Tonawanda, N. Y.	73899	JFD Electronics Corp.	Goshen, Ind.	80640	Stevens, Arnold, Co., Inc.	New York, N. Y.
56289	Sprague Electric Co.	North Adams, Mass.	73905	Jennings Radio Mfg. Corp.	Brooklyn, N. Y.	81030	International Instruments Inc.	Boston, Mass.
59446	Telex Corp.	Tulsa, Okla.	73957	Groov-Pin Corp.	San Jose, Calif.	81073	Grayhill Co.	Orange, Conn.
59730	Thomas & Betts Co.	Elizabeth, N. J.	74276	Signalite Inc.	Ridgefield, N. J.	81095	Triad Transformer Corp.	LaGrange, Ill.
60741	Triplet Electrical Inst. Co.	Bluffton, Ohio	74455	J. H. Winns, and Sons	Neptune, N. J.	81312	Winchester Elec. Div. Litton Ind., Inc.	Venice, Calif.
61775	Union Switch and Signal, Div. of Westinghouse Air Brake Co.		74861	Industrial Condenser Corp.	Winchester, Mass.			Oakville, Conn.
		Pittsburgh, Pa.	74868	R. F. Products Division of Amphenol-Borg Electronics Corp.	Chicago, Ill.	81349	Military Specification	
62119	Universal Electric Co.	Owosso, Mich.	74970	E. F. Johnson Co.	Danbury, Conn.	81483	International Rectifier Corp.	El Segundo, Calif.
63743	Ward-Leonard Electric Co.	Mt. Vernon, N. Y.	75042	International Resistance Co.	Waseca, Minn.	81541	Airpax Electronics, Inc.	Cambridge, Maryland
64959	Western Electric Co., Inc.	New York, N. Y.	75378	CTS Knights Inc.	Philadelphia, Pa.	81860	Barry Controls, Div. Barry Wright Corp.	
65092	Weston Inst. Inc. Weston-Newark	Newark, N. J.	75382	Kulka Electric Corporation	Sandwich, Ill.	82042	Carter Precision Electric Co.	Watertown, Mass.
66295	Witteck Mfg. Co.	Chicago, Ill.	75818	Lenz Electric Mfg. Co.	Mt. Vernon, N. Y.	82047	Sperti Faraday Inc., Copper Hewitt Electric Div.	Skokie, Ill.
66346	Minnesota Mining & Mfg. Co. Revere Mincom Div.		75915	Littlefuse, Inc.	Chicago, Ill.			Hoboken, N. J.
		St. Paul, Minn.	76005	Lord Mfg. Co.	Des Plaines, Ill.	82142	Jeffers Electronics Division of Speer Carbon Co.	
70276	Allen Mfg. Co.	Hartford, Conn.	76210	C. W. Marwedel	Erie, Pa.	82170	Fairchild Camera & Inst. Corp. Space & Defense System Div.	Du Bois, Pa.
70309	Allied Control	New York, N. Y.	76433	General Instrument Corp., Micamold Division	San Francisco, Calif.			Paramus, N. J.
70318	Allmetal Screw Product Co., Inc.				Newark, N. J.	82209	Maguire Industries, Inc.	Greenwich, Conn.
		Garden City, N. Y.	76487	James Millen Mfg. Co., Inc.	Malden, Mass.	82219	Sylvania Electric Prod. Inc. Electronic Tube Division	Emporium, Pa.
70485	Atlantic India Rubber Works, Inc.	Chicago, Ill.	76493	J. W. Miller Co.	Los Angeles, Calif.	82376	Astron Corp.	East Newark, Harrison, N. J.
70563	Amperite Co., Inc.	Union City, N. J.	76530	Cinch-Monadnock, Div. of United Carr Fastener Corp.		82389	Switchcraft, Inc.	Chicago, Ill.
70674	ADC Products Inc.	Minneapolis, Minn.			San Leandro, Calif.	82647	Metals & Controls Inc. Spencer Products	Attleboro, Mass.
70903	Belden Mfg. Co.	Chicago, Ill.	76545	Mueller Electric Co.	Cleveland, Ohio			Joliet, Ill.
70998	Bird Electronic Corp.	Cleveland, Ohio	76703	National Union	Newark, N. J.	82666	Research Products Corp.	Madison, Wis.
71002	Birnbach Radio Co.	New York, N. Y.	76854	Oak Manufacturing Co.	Crystal Lake, Ill.	82877	Rotron Mfg. Co., Inc.	Woodstock, N. Y.
71041	Boston Gear Works Div. of Murray Co. of Texas		77068	The Bendix Corp., Electrodynamics Div.		82893	Vector Electronic Co.	Glendale, Calif.
		Quincy, Mass.			N. Hollywood, Calif.			
71218	Bud Radio, Inc.	Willoughby, Ohio	77075	Pacific Metals Co.	San Francisco, Calif.			
71286	Camloc Fastener Corp.	Paramus, N. J.	77221	Phanostran Instrument and Electronic Co.				
71313	Cardwell Condenser Corp.				South Pasadena, Calif.			
		Lindenhurst L. I., N. Y.						
71400	Bussmann Mfg. Div. of McGraw-Edison Co.	St. Louis, Mo.						

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**TABLE 6-3.  
CODE LIST OF MANUFACTURERS (Cont'd)**

Code No.	Manufacturer	Address	Code No.	Manufacturer	Address	Code No.	Manufacturer	Address
83058	Carr Fastener Co.	Cambridge, Mass.	91418	Radio Materials Co.	Chicago, Ill.	97464	Industrial Retaining Ring Co.	Irvington, N. J.
83086	New Hampshire Ball Bearing, Inc.	Peterborough, N. H.	91506	Augat Inc.	Attleboro, Mass.	97539	Automatic & Precision Mfg.	Englewood, N. J.
83125	General Instrument Corp., Capacitor Div.	Darlington, S. C.	91637	Dale Electronics, Inc.	Columbus, Nebr.	97979	Reon Resistor Corp.	Yonkers, N. Y.
83148	ITT Wire and Cable Div.	Los Angeles, Calif.	91662	Elco Corp.	Willow Grove, Pa.	97983	Litton System Inc., Adler-Westrex Commun. Div.	New Rochelle, N. Y.
83186	Victory Eng. Corp.	Springfield, N. J.	91737	Gremer Mfg. Co., Inc.	Wakefield, Mass.	98141	R-Troncis, Inc.	Jamaica, N. Y.
83298	Bendix Corp., Red Bank Div.	Red Bank, N. J.	91827	K F Development Co.	Redwood City, Calif.	98159	Rubber Teck, Inc.	Gardena, Calif.
83315	Hubbell Corp.	Mundelein, Ill.	91886	Malco Mfg. Co., Inc.	Chicago, Ill.	98220	Hewlett-Packard Co., Moseley Div.	Pasadena, Calif.
83330	Smith, Herman H., Inc.	Brooklyn, N. Y.	91929	Honeywell Inc., Micro Switch Div.	Freeport, Ill.	98278	Microdot, Inc.	So. Pasadena, Calif.
83332	Tech Labs	Palisade's Park, N. J.	91961	Nahm-Bros. Spring Co.	Oakland, Calif.	98291	Sealectro Corp.	Mamaroneck, N. Y.
83385	Central Screw Co.	Chicago, Ill.	92180	Tru-Connector Corp.	Peabody, Mass.	98376	Zero Mfg. Co.	Burbank, Calif.
83501	Gavitt Wire and Cable Co. Div. of Amerace Corp.	Brookfield, Mass.	92367	Elgeet Optical Co. Inc.	Rochester, N. Y.	98731	General Mills Inc., Electronics Div.	Minneapolis, Minn.
83594	Burroughs Corp. Electronic Tube Div.	Plainfield, N. J.	92607	Tensolite Insulated Wire Co., Inc.	Tarrytown, N. Y.	98734	Paeco Div. of Hewlett-Packard Co.	Palo Alto, Calif.
83740	Union Carbide Corp. Consumer Prod. Div.	New York, N. Y.	92702	IMC Magnetics Corp.	Wesbury Long Island, N. Y.	98821	North Hills Electronics, Inc.	Palo Alto, Calif.
83777	Model Eng. and Mfg., Inc.	Huntington, Ind.	92966	Hudson Lamp Co.	Kearney, N. J.	98978	International Electronic Research Corp.	Burbank, Calif.
83821	Loyd Scriuggs Co.	Festus, Mo.	93332	Sylvania Electric Prod. Inc. Semiconductor Div.	Woburn, Mass.	99109	Columbia Technical Corp.	New York, N. Y.
83942	Aeronautical Inst. & Radio Co.	Lodi, N. J.	93369	Robbins & Myers Inc.	Palisades Park, N. J.	99313	Varian Associates	Palo Alto, Calif.
84171	Arco Electronics Inc.	Great Neck, N. Y.	93410	Stevens Mfg. Co., Inc.	Mansfield, Ohio	99378	Atlee Corp.	Winchester, Mass.
84396	A. J. Giesener Co., Inc.	San Francisco, Calif.	93929	G. V. Controls	Livingston, N. J.	99515	Marshall Ind., Capacitor Div.	Monrovia, Calif.
84411	TRW Capacitor Div.	Ogallala, Neb.	94137	General Cable Corp.	Bayonne, N. J.	99707	Control Switch Division, Controls Co. of America	El Segundo, Calif.
84970	Sarkes Tarzian, Inc.	Bloomington, Ind.	94144	Raytheon Co., Comp. Div., Ind. Comp. Operations	Quincy, Mass.	99800	Delevan Electronics Corp.	East Aurora, N. Y.
85454	Boonton Molding Company	Boonton, N. J.	94148	Scientific Electronics Products, Inc.	Loveland, Colo.	99848	Wilco Corporation	Indianapolis, Ind.
85471	A. B. Boyd Co.	San Francisco, Calif.	94154	Wagner Elect. Corp., Tung-Sol Div.	Newark, N. J.	99934	Renbrandt, Inc.	Boston, Mass.
85474	R. M. Bracamonte & Co.	San Francisco, Calif.	94197	Curtiss-Wright Corp. Electronics Div.	East Paterson, N. J.	99942	Hoffman Electronics Corp. Semiconductor Div.	El Monte, Calif.
85660	Koiled Kords, Inc.	Hamden, Conn.	94222	South Chester Corp.	Chester, Pa.	99957	Technology Instrument Corp. of Calif.	Newbury Park, Calif.
85911	Seamless Rubber Co.	Chicago, Ill.	94330	Wire Cloth Products, Inc.	Bellwood, Ill.			
86197	Clifton Precision Products Co., Inc.	Clifton Heights, Pa.	94682	Worcester Pressed Aluminum Corp.	Worcester, Mass.			
86579	Precision Rubber Products Corp.	Dayton, Ohio	94696	Magnecraft Electric Co.	Chicago, Ill.			
86684	Radio Corp. of America, Electronic Comp. & Devices Div.	Harrison, N. J.	95023	George A. Philbrick Researchers, Inc.	Boston, Mass.			
87034	Marco Industries	Anaheim, Calif.	95236	Allies Products Corp.	Dania, Fla.			
87216	Philco Corporation (Lansdale Division)	Lansdale, Pa.	95238	Continental Connector Corp.	Woodside, N. Y.			
87473	Western Fibrous Glass Products Co.	San Francisco, Calif.	95263	Leecraft Mfg. Co., Inc.	Long Island, N. Y.			
87664	Van Waters & Rogers Inc.	San Francisco, Calif.	95265	National Coil Co.	Sheridan, Wyo.			
87930	Tower Mfg. Corp.	Providence, R. I.	95275	Vilramon, Inc.	Bridgeport, Conn.			
88140	Cutler-Hammer, Inc.	Lincoln, Ill.	95348	Gordos Corp.	Bloomfield, N. J.			
88220	Gould-National Batteries, Inc.	St. Paul, Minn.	95354	Methode Mfg. Co.	Rolling Meadows, Ill.			
88698	General Mills, Inc.	Buffalo, N. Y.	95566	Arnold Engineering Co.	Marengo, Ill.			
89231	Graybar Electric Co.	Oakland, Calif.	95712	Dage Electric Co., Inc.	Franklin, Ind.			
89473	G. E. Distributing Corp.	Schenectady, N. Y.	95984	Siemon Mfg. Co.	Wayne, Ill.			
89665	United Transformer Co.	Chicago, Ill.	95987	Weckesser Co.	Chicago, Ill.			
90179	US Rubber Co., Consumer Ind. & Plastics Prod. Div.	Passaic, N. J.	96067	Huggins Laboratories	Sunnyvale, Calif.			
90970	Bearing Engineering Co.	San Francisco, Calif.	96095	Hi-Q Div. of Aerovox Corp.	Olean, N. Y.			
91146	ITT Cannon Elect, Inc., Salem Div.	Salem, Mass.	96256	Thordarson-Meissner Inc.	Mt. Carmel, Ill.			
91260	Connor Spring Mfg. Co.	San Francisco, Calif.	96296	Solar Manufacturing Co.	Los Angeles, Calif.			
91345	Miller Oval & Nameplate Co.	El Monte, Calif.	96330	Carlton Screw Co.	Chicago, Ill.			
			96341	Microwave Associates, Inc.	Burlington, Mass.			
			96501	Excel Transformer Co.	Oakland, Calif.			

THE FOLLOWING HP VENDORS HAVE NO NUMBER ASSIGNED IN THE LATEST SUPPLEMENT TO THE FEDERAL SUPPLY CODE FOR MANUFACTURERS HANDBOOK.

0000F	Malco Tool and Die	Los Angeles, Calif.
0000Z	Willow Leather Products Corp.	Newark, N. J.
000AB	ETA	England
000BB	Precision Instrument Components Co.	Van Nuys, Calif.
000CS	Hewlett-Packard Co., Colorado Springs	Colorado Springs, Colorado
000MM	Rubber Eng. & Development	Hayward, Calif.
000NN	A "N" D Mfg. Co.	San Jose, Calif.
000QQ	Cooltron	Oakland, Calif.
000WW	California Eastern Lab.	Burlington, Calif.
000YY	S. K. Smith Co.	Los Angeles, Calif.

