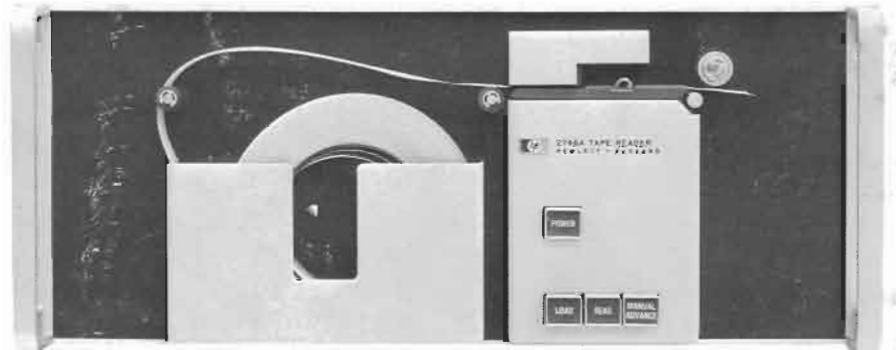


OPERATING AND SERVICE MANUAL

2748A TAPE READER



HEWLETT  PACKARD



# OPERATING AND SERVICE MANUAL

## 2748A TAPE READER



Serial Numbers Prefixed: 916-



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## SECTION I

### GENERAL INFORMATION

#### 1-1. INTRODUCTION.

1-2. This operating and service manual covers general information, installation, operation, theory of operation, and maintenance instructions for the Hewlett-Packard 2748A Tape Reader. (See figure 1-1.)

#### 1-3. GENERAL DESCRIPTION.

1-4. The tape reader photoelectrically detects coded data characters punched on perforated tape. A unidirectional mechanical-drive mechanism advances the tape through the read head where phototransistors are used to detect the data. The tape reader accepts 8-track, 1-inch tape. Reading rate is up to 500 characters-per-second. Forward tape drive after loading is initiated by an external step command or by actuating the MANUAL ADVANCE push-button on the instrument.

#### 1-5. IDENTIFICATION.

1-6. Hewlett-Packard uses a two-section eight digit serial number (000-00000) located on the rear panel to identify each instrument. The first three digits are a special prefix number used to identify a special instrument model. The last five digits identify each specific instrument. If the serial number prefix on your instrument does not agree with those on the title page of this manual, there are differences between your instrument and the instrument described in this manual. These differences are described in change sheets and manual supplements available at the nearest HP Field Sales Office.

1-7. Printed-circuit card revisions are identified by a letter and a date code stamped on the card. The letter code identifies the version of the etched trace pattern on the unloaded card. The date code refers to the electrical characteristics of the loaded card. If date codes stamped on printed-circuit cards do not agree with date codes shown on schematics in this manual for each printed-circuit card,

there are differences between your instrument and the instrument described in this manual. These differences are described in change sheets and manual supplements available at the nearest HP Field Sales Office.

#### 1-8. SPECIFICATIONS.

1-9. Specifications for the HP 2748A Tape Reader are listed in table 1-1.

Table 1-1. HP 2748A Tape Reader Specifications

<b>GENERAL</b>	
Power Requirement:	115V ac $\pm$ 10%, 60 Hz, 240 watts
Mounting:	Standard 19-inch rack
Panel Height:	7 inches
Width:	17 inches
Depth:	16 inches
Finish:	Light grey baked enamel and flat black, with black-filled panel engravings
Operating Temperature Range:	0° to +55°C (32° to 132°F)
Nonoperating Temperature Range:	-40° to +75°C (-40° to 167°F)
Relative Humidity:	95 percent at +25° to +40°C
<b>TAPE</b>	
Material:	Any diffuse material with less than 60 percent transmissivity
Code:	8 level
Width:	1 inch
<b>SPEED</b>	
Reading:	500 characters per second continuous, 150 characters per second start/stop
Stop Time:	Less than 500 $\mu$ sec
Start Time:	Less than 6 ms (up to full speed in 10 ms)

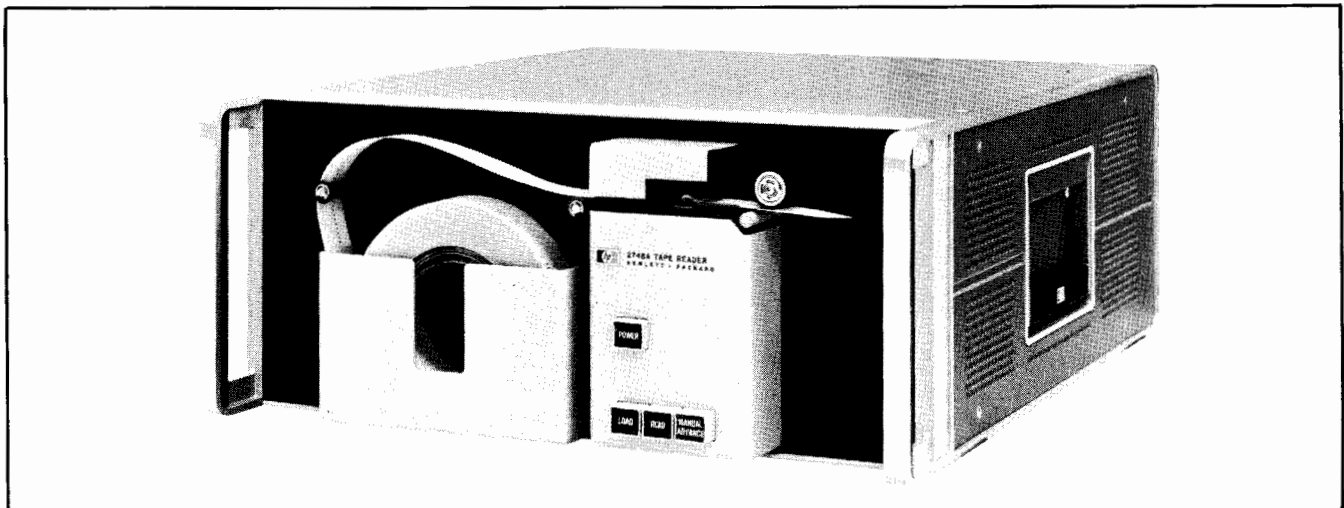


Figure 1-1. Hewlett-Packard 2748A Tape Reader



## SECTION II

### INSTALLATION AND OPERATION

#### 2-1. INTRODUCTION.

2-2. This section contains information on unpacking, inspection, installation, and operation for the HP 2748A Tape Reader.

#### 2-3. INSTALLATION.

##### 2-4. UNPACKING AND INSPECTION.

2-5. If the shipping carton is damaged upon receipt, request that the carrier's agent be present when the instrument is unpacked. Inspect the instrument for damage (scratches, dents, broken parts, etc.). If the instrument is damaged or fails to meet specifications, notify the carrier and the nearest Hewlett-Packard Field Office immediately. (Field Offices are listed at the back of this manual.) Retain the shipping container and the padding material for the carrier's inspection. The Hewlett-Packard Field Office will arrange for the repair or replacement of the damaged instrument without waiting for any claims against the carrier to be settled.

##### 2-6. RACK OR BENCH MOUNTING.

2-7. The tape reader is designed for either bench installation or mounting in a standard 19-inch rack. To mount the instrument in a rack, follow the instructions contained in the rack mounting kit furnished with the instrument. All necessary hardware is furnished as part of the rack mounting kit.

2-8. All necessary accessories are supplied except interconnecting cables and interface kits for interfacing with associated equipment. These cables will be supplied upon special order to the nearest Hewlett-Packard Field Office.

The maximum interconnecting cable length is 50 feet. Pin assignments for interfacing connector J2 are listed in table 2-1. Figure 2-1 shows the rear panel of the tape reader.

Table 2-1. Pin Assignments for Connector J2

CONNECTOR J2, PIN	FUNCTION
B	Data Bit 1
F	Data Bit 2
L	Data Bit 3
R	Data Bit 4
V	Data Bit 5
Z	Data Bit 6
d	Data Bit 7
j	Data Bit 8
HH	Ground
AA	Read Command
FF	Feedhole

##### 2-9. POWER REQUIREMENTS.

2-10. The tape reader operates from a 115-volt, 60-Hz power source and requires 240 watts of power. The instrument is protected from power overloads by a 4.0 ampere slow-blow type fuse which is located in a fuse holder on the rear panel. Check the ampere rating of the fuse supplied with the instrument before applying power.

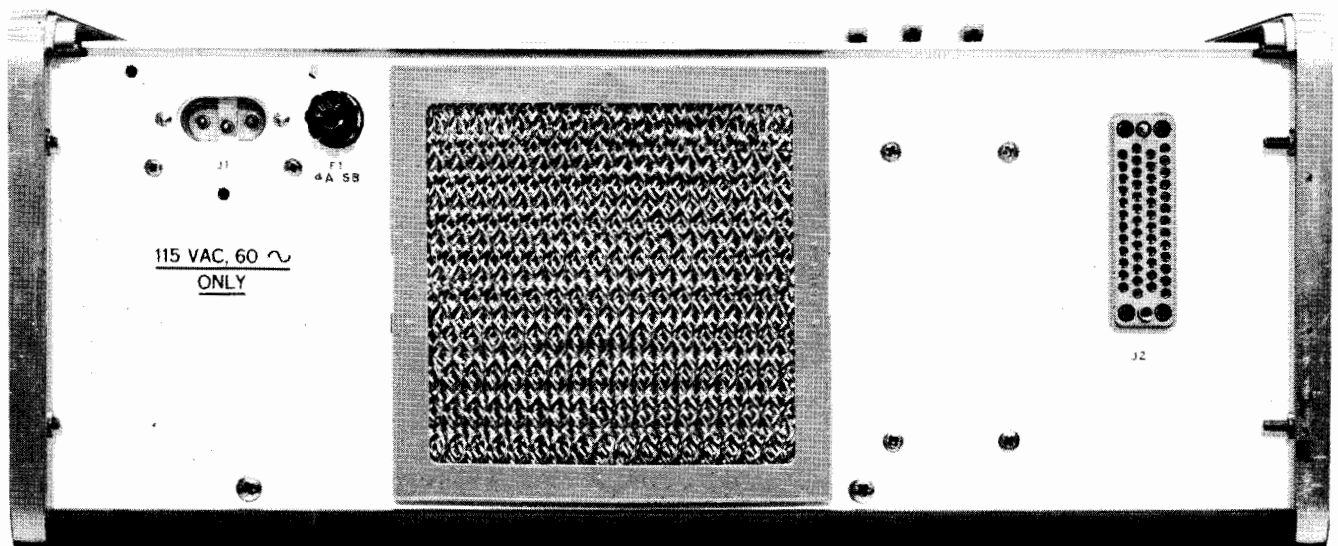


Figure 2-1. Tape Reader Rear Panel

2-11. A detachable three-conductor power cord is supplied with the instrument. When operating the instrument from a two-contact outlet, use a three-conductor to two-conductor adapter and connect the adapter ground wire to a suitable ground.

#### 2-12. LUBRICATION.

2-13. The tape reader was lubricated before shipment and normally should not require lubrication before initial operation. However, failure to check the instrument periodically for proper lubrication may result in serious and costly damage to the instrument. Complete lubrication intervals and procedures are provided in section IV of this manual.

#### 2-14. SHIPPING INSTRUCTIONS.

2-15. If the instrument is to be shipped to Hewlett-Packard for service or repair, attach a tag to the instrument identifying the owner and indicating the service or repair to be accomplished. Include the model number and full serial number of the instrument.

2-16. Place the instrument in the original container if available. If the original container is not available, a suitable container and packing material can be purchased from a local Hewlett-Packard Field Office.

2-17. If the original container is not used, wrap the instrument in heavy paper and place it in an inner container. Place adequate packing material around all sides of the instrument and place a cardboard strip over the front panel. Place the instrument and inner container in a heavy carton or wooden box and bind with strong tape or metal bands. Mark the shipping container "FRAGILE".

#### Note

In any correspondence, identify the instrument by model number and serial number prefix. Refer any questions to the nearest Hewlett-Packard Field Office.

### 2-18. OPERATING CONTROLS.

2-19. Operating controls for the tape reader consist of four switches mounted on the front panel. (See figure 2-2.) Functions of the controls are as follows:

a. **POWER** switch: Applies primary ac power to the instrument.

b. **LOAD** switch: Releases reader pinch roller and stops reader capstan to allow for tape threading. Feedhole signal is inhibited when this switch is engaged.

c. **READ** switch: Advances tape through instrument for reading if a read command is present.

d. **MANUAL ADVANCE** switch: Advances tape through instrument as long as switch is manually engaged. When switch is released, tape will not advance. Feedhole signal is inhibited when this switch is engaged.

### 2-20. OPERATING INSTRUCTIONS.

2-21. Operating instructions for the tape reader are given in the following paragraphs. Load tape in accordance with paragraph 2-22 and operate instrument as instructed in paragraph 2-25.

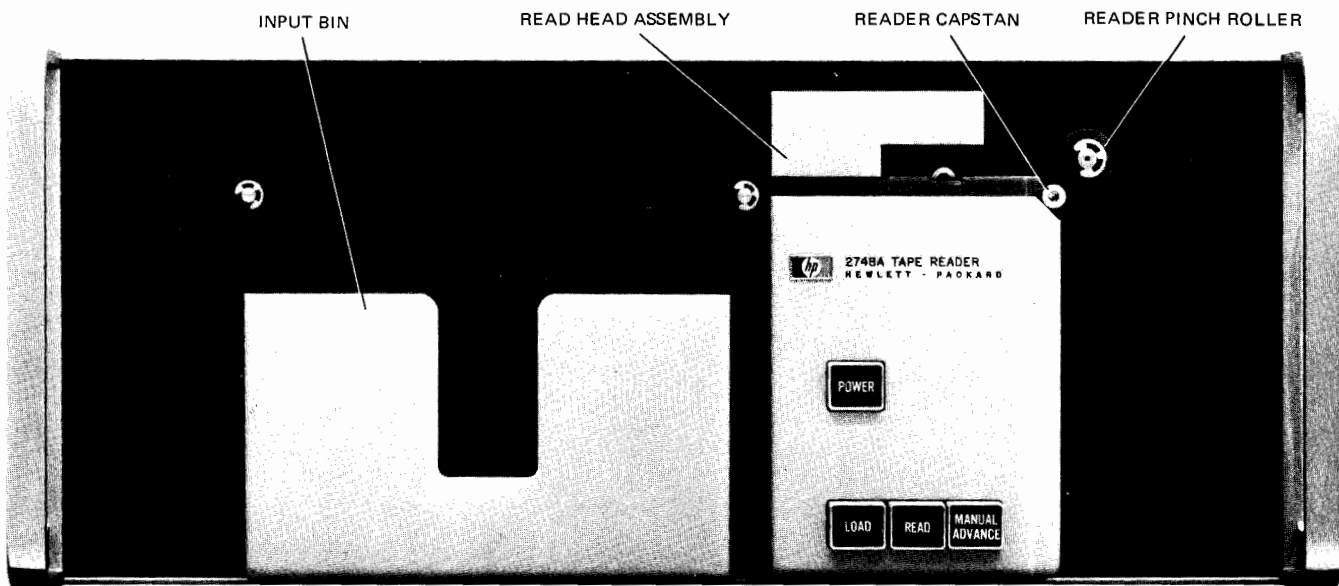


Figure 2-2. Tape Reader Front Panel

## 2-22. TAPE LOADING.

2-23. Before loading tape, energize the instrument by pressing the POWER switch. Press the LOAD switch to release the reader pinch roller.

2-24. Tape can be loaded in the tape reader in one of four ways, as shown in figure 2-3. Make certain that as the tape moves left to right, the characters appear in the original sequence punched and the feedholes are nearer the front panel of the instrument. Tape that is rolled can be loaded as shown in figure 2-3A or 2-3B, depending on the location of the feedholes. Long, unrolled lengths of tape should be loaded in accordance with figure 2-3C, and continuous loops of tape should be loaded as shown in figure 2-3D.

2-25. When threading tape through the read head assembly, hold the leader end of the tape between the thumb and forefinger of both hands as shown in figure 2-4A. With the tape drawn tightly and at an angle to the read head assembly as shown in figure 2-4B, begin sliding the tape into the slot in the read head. Hold the tape

down against the read head surface and slide the tape from left to right and back into the slot in the read head assembly (figure 2-4C). The tape should slip easily into the recessed tape guide slot and under the plastic-covered wire foot on the read head. The tape is shown in the final loaded position in figure 2-4D.

## 2-26. OPERATING PROCEDURES.

2-27. After the instrument has been loaded, all that is required to begin operation is to press either the READ switch or the MANUAL ADVANCE switch, depending on the desired mode of operation. If the READ switch is pressed, tape will advance through the read head as long as a continuous read command is present. The MANUAL ADVANCE switch does not require a read command to advance the tape; however, the switch must be held on continuously to advance the tape through the read head. If the MANUAL ADVANCE switch is used to advance the tape, the feedhole signal will be inhibited.

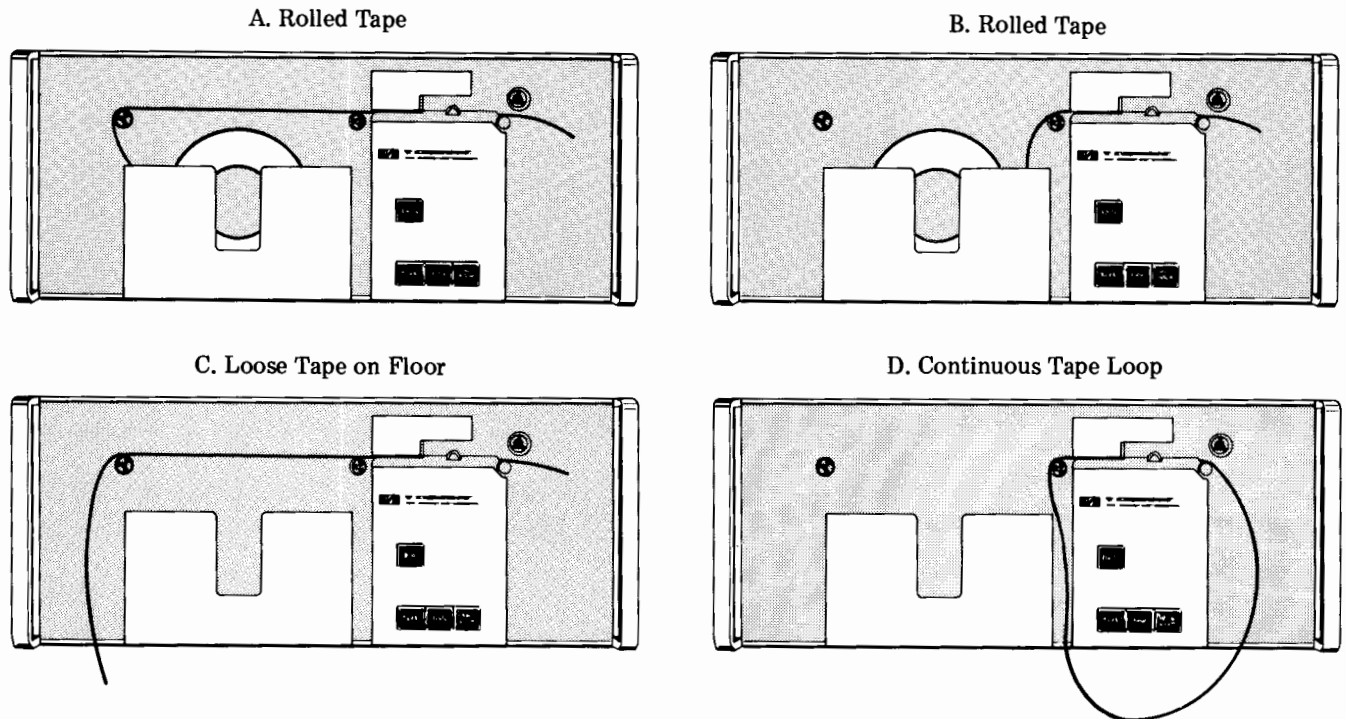
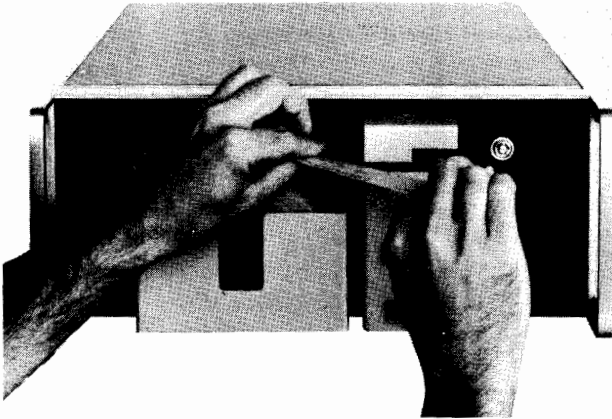


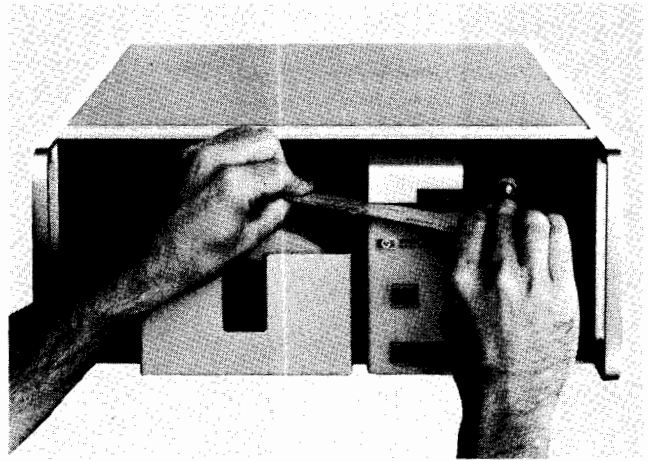
Figure 2-3. Tape Loading Diagram



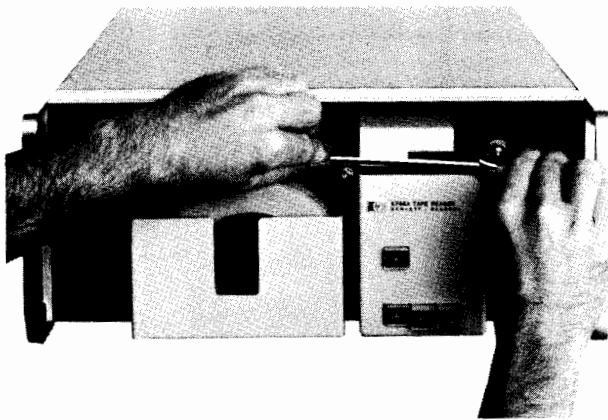
**A. APPROACHING READ HEAD ASSEMBLY WITH TAPE**



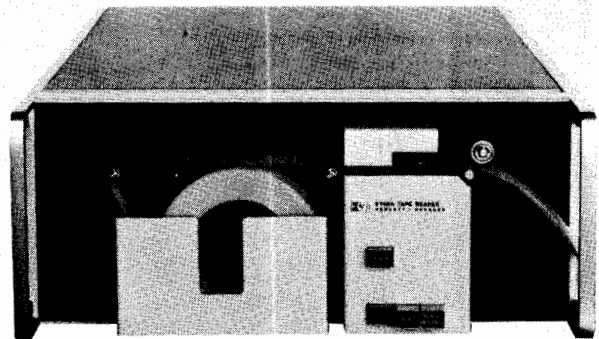
**B. INSERTING TAPE INTO SLOT IN READ HEAD ASSEMBLY**



**C. SLIDING TAPE INTO TAPE GUIDE SLOT**



**D. FINAL POSITION**



2037 - 1

**Figure 2 - 4. Tape Threading Diagram**

## SECTION III

### THEORY OF OPERATION

#### 3-1. INTRODUCTION.

3-2. This section contains an overall functional description and detailed circuit descriptions for the tape reader.

#### 3-3. OVERALL FUNCTIONAL DESCRIPTION.

3-4. A functional block diagram of the tape reader is shown in figure 3-1. During operation, the punched tape being read passes between a light source and light-sensitive phototransistors. When holes in the tape permit light to reach the phototransistors, respective data bit outputs (eight possible) and a single feedhole output from the phototransistors are applied to amplifiers. The data bits are further amplified by interface amplifiers and applied to the computer or controlling device that is interpreting the data. The feedhole output is used as the trigger to inform the computer when to read. The output from the feedhole phototransistor is used to fire a Schmitt trigger rather than being applied directly to the computer. Use of the Schmitt trigger ensures that each character is read only once.

3-5. While in the READ mode of operation (READ switch on), instrument operation is initiated by a read command from the computer. The read command is driven by an interface amplifier and applied to the instrument control circuitry. The control circuitry releases the brake and engages the reader capstan clutch and the tape is read.

3-6. Stop and go circuitry controls the brake and clutch solenoids and allows the instrument to read in a stop/go mode. When the read command is removed, the tape will be

stopped on the character initiating the stop without overshooting any characters. When the read command is restored, the tape reader will advance the tape, and reading begins on the character immediately after the character that initiated the stop.

#### 3-7. DETAILED CIRCUIT DESCRIPTIONS.

3-8. Detailed circuit descriptions of each of the functional circuits in the tape reader are provided in the following paragraphs. Schematic diagrams for each of these circuits are included in section IV of this manual.

#### 3-9. READ HEAD ASSEMBLY A5.

3-10. Read head assembly A5 consists of phototransistors, a lamp and an amplifier for each phototransistor, a reference voltage circuit, and a brake solenoid. A schematic diagram of the complete assembly is shown in figure 4-7.

3-11. The lamps are located in the upper portion of read head assembly A5 on subassembly A5A3 and are accurately positioned over the tape holes by placing the tips of the lamp envelopes in guide holes. The lamps are series connected to provide burnout protection. If a single lamp filament opens, the lamp circuit opens and all lamps will go off. This also provides some degree of protection against reading errors that might otherwise be caused by open lamp filaments.

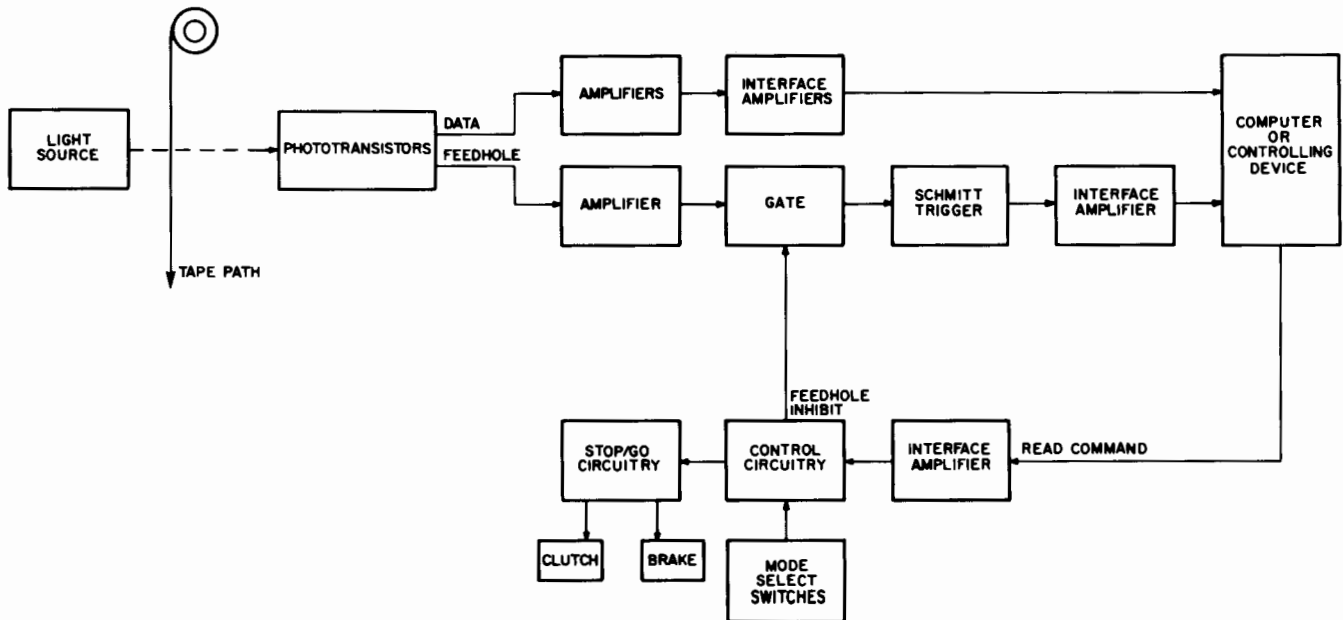


Figure 3-1. Tape Reader Functional Block Diagram

3-12. Subassembly A5A2 contains the phototransistors. Each phototransistor has been selected and matched during manufacture to ensure close grouping of sensitivities within any one phototransistor subassembly.

3-13. The reference voltage circuit is included to compensate for changes in phototransistor sensitivity due to temperature changes. The reference voltage circuit uses a lamp (A5A3DS1) and a phototransistor (A5A2V1) that are essentially the same as those used to read the tape and will therefore be affected by temperature changes to the same extent. Transistor A5A1Q10 and emitter-follower A5A1Q9 act together to form a low-gain operational amplifier. Before light shines on A5A2V1, the voltage at the base of A5A1Q10 is near ground. When light shines on A5A2V1, a negative-going voltage change occurs at the base of A5A1Q10. The output of A5A1Q10 (and A5A1Q9) then goes positive, causing a current to flow through A5A1R2 and A5A1R3 in an amount approximately equal to the collector-to-emitter current in A5A2V1, thus maintaining the voltage at the base of A5A1Q10 near ground. As light intensity or temperature increases, the current through A5A2V1 increases, and the output of amplifier A5A1Q9-A5A1Q10 increases in a proportional amount. In this manner, the desired reference voltage is maintained. The light path of the reference hole is enclosed to keep out dust and other debris that could obstruct the light path. Variable resistor A5A1R2 can be adjusted to compensate for differences in phototransistor sensitivities that may be experienced if it is necessary to replace a phototransistor subassembly.

3-14. During operation of the tape reader, the turn-on threshold level of the data amplifiers on A5A1 is controlled by the level of the reference voltage described previously. All eight data circuits are identical. Typically, if enough light hits A5A2V2, the collector-to-emitter current in A5A2V2 will exceed the sum of the current in A5A1R4 and the control current required to keep A5A1Q1 biased on, so A5A1Q1 will turn off. The voltage in the collector of A5A1Q1 will then rise to about +5.75 vdc. When the light path to A5A2V2 is blocked, A5A1Q1 conducts to saturation and the collector voltage drops to about 0 vdc.

3-15. The feedhole circuit is similar to that described above for the data circuits except that an emitter-follower is used as the output amplifier. Therefore, the negative-going output from the feedhole phototransistor is not inverted by the amplifier and the output at pin K of A1 is about 0 volts dc whenever a feedhole is sensed and +5.75 volts dc when the feedhole light path is cut off.

3-16. The brake circuit consists of a solenoid which energizes whenever a signal is received from control assembly A2. When the brake is de-energized, a spring-loaded iron disc in read head assembly A5 is held lightly against the paper tape. The spring prevents bouncing between the iron disc and the solenoid that could cause delays in stopping the tape when the brake is energized. When the solenoid is energized, the iron disc is attracted to the solenoid, clamping the punched tape between the braking surfaces of the solenoid and the iron disc.

### 3-17. INTERFACE ASSEMBLY A3.

3-18. The interface circuitry consists of nine common-emitter amplifiers, a Schmitt trigger with a diode inhibit gate, and an eight-input diode OR-gate. A complete schematic diagram of interface assembly A3 is shown in figure 4-8.

3-19. Transistors Q1 through Q9 amplify and invert the data bit signals from read head assembly A5 and apply the output signal to connector J2 on the rear panel of the instrument. Base-to-collector capacitors on each amplifier slow the rise and fall times of the inverter outputs to prevent cross coupling between the output signals and other circuits.

3-20. The feedhole circuit utilizes a Schmitt trigger to ensure that each character on the punched tape is read only once. The location and size relationship of the feedhole to the data holes in the punched tape is such that the data holes will always be in position to be read when the feedhole is in position. Because of this relationship, the leading edge of the feedhole is used as the timing element to trigger the computer or controlling device to read. The computer or controlling device will look at the data only when the feedhole output goes true. Figure 3-2 shows the timing diagram for the tape reader using idealized waveforms. In reality, the feedhole waveform probably looks more like that shown in figure 3-3. Note the noise and slight reversals on the waveform that are caused by lint or paper fibers on the edges of the holes. The Schmitt trigger hysteresis is designed to ignore any reversals such as these and thus avoid rereading a character. When pin 24 is near ground potential, Q11 is held off and feedholes are not passed on to the device receiving the data. Common-emitter amplifiers Q12 and Q13 invert the Schmitt trigger output twice before passing the signal on to connector J2. Capacitor C4 slows the rise and fall times of the signal from C13.

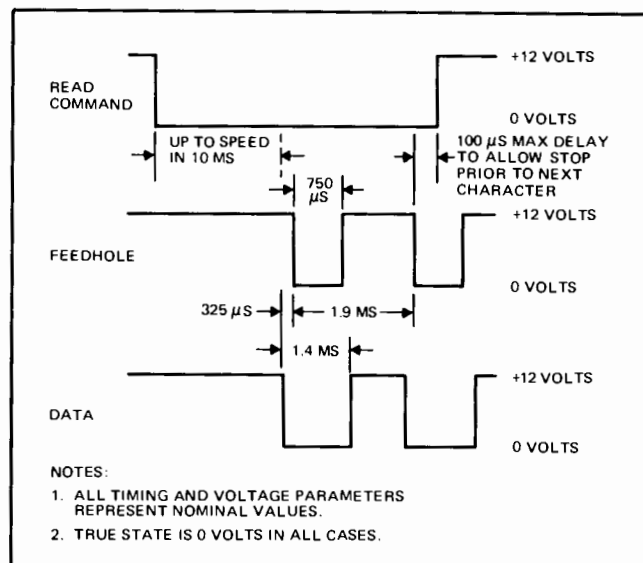


Figure 3-2. Tape Reader Timing Diagram



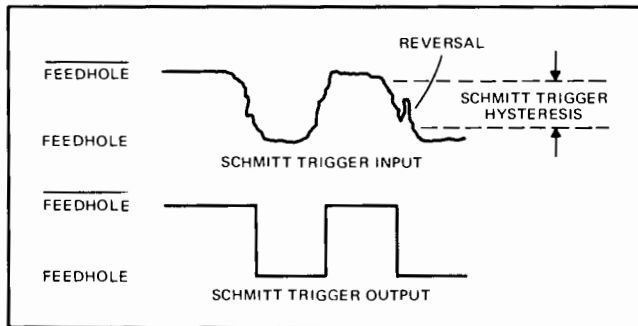


Figure 3-3. Feedhole Schmitt Trigger Input and Output Waveforms

3-21. Transistor Q9 inverts the READ command from the computer or controlling device and provides sufficient gain to drive the control circuitry on control assembly A2. Input RC network R80, R81, R83, R85, and C2 slows the circuit response to prevent transients from operating the circuit.

### 3-22. CONTROL CIRCUITRY.

3-23. The control circuitry includes flip-flops and gates on control assembly A2 and related components on the tape reader chassis. A schematic diagram of the control circuitry is shown in figure 4-9 and a logic diagram is shown in figure 4-6. Also, refer to the instrument operational chart, table 4-3, to determine the states of the control components for each mode of operation. The primary function of the control circuit is to interpret commands from the computer or controlling device, the read head, and various instrument switch settings and to originate appropriate signals to carry out these commands. Control assembly A2 outputs control the mechanical features of the tape reader to provide a specified mode of operation.

3-24. The brake and clutch circuit is designed to allow the tape being read to start and stop rapidly so that up to 150 characters-per-second may be read in the start/stop mode and the tape may be stopped on command without overshooting characters. The inductive reactance of the brake and clutch solenoids normally makes these components slow to energize. Inductor L1 allows a higher voltage to be applied to the component being energized. For example, when the brake goes off and the clutch is energized, the clutch initially resists any change in current as does inductor L1. The brake circuit is now open and the clutch is refusing to conduct much current. The inductance of L1 tries to maintain its current level by increasing the voltage at the junction of L1 and K3 from about +11 volts dc to over +100 volts dc. This higher voltage across the clutch allows a rapid current buildup, and the clutch is pulled in much more rapidly than would have been possible at +12 volts dc. The reverse is also true when the brake comes on and the clutch is de-energized.

3-25. A clamping circuit made up of A2CR15, A2CR16, and zener diode CR71 limits the voltage level in the collectors of Q24 and Q25 to +125 volts dc to prevent damage to these transistors. Shunt resistor R72 over-compensates for

the difference in current in the clutch and the brake and allows an extra high current to be switched into the brake solenoid when the brake is energized. Diodes A2CR14, A2CR17, and A2CR18 eliminate the possibility of the collectors of Q24 and Q25 being driven negative during the switching time. Diode A2CR17 also blocks current flow from TB1-2 through A2CR18 and R72, and back through the clutch when the clutch is de-energized. If this current path were not blocked, the release of the clutch would be delayed.

3-26. If the brake is energized without tape in the brake gap, the iron disc could be attracted to the brake solenoid by residual magnetism, even after the brake is de-energized. To overcome this charged condition of the brake surfaces, A2R36, A2C1, and A2C2 act as a degaussing circuit to demagnetize the surfaces of the brake.

3-27. The run flip-flop consists primarily of transistors A2Q1 and A2Q2. This flip-flop is set or reset by the READ switch on the instrument front panel. The run flip-flop provides isolation between the switch contacts and the other control circuitry. Without this isolation, switch contact bounce could be interpreted as a series of pulsed signals.

### 3-28. POWER SUPPLY ASSEMBLY A1.

3-29. Power supply assembly A1 consists of four power supply circuits, which provide output voltages of  $\pm 12$  volts dc, -45 volts dc, and -5 volts dc. See figure 4-10 for a complete schematic diagram of power supply assembly A1 and appendix A for the equivalent schematic diagram of voltage regulators A1U1 and A1U2. The following paragraphs discuss each of these circuits.

3-30. -12 VOLT CIRCUIT. The -12 volt circuit uses full-wave bridge rectifier A1CR1 through A1CR4 to convert ac voltage from one set of secondary windings on transformer T1 to dc voltage. Voltage regulation is provided by integrated circuit A1U1, which is connected to utilize foldback current limiting. The unregulated -12 volt input from the bridge rectifier is sampled at pin 3 of A1U1 and the regulated output is sampled at pin 4 of A1U1. A booster output at pin 2 of A1U1 is amplified by A1Q3 and applied to emitter-follower Q1. Resistor A1R12 in the output circuit of Q1 is used as the sensing device for overload protection. When the voltage across A1R12 becomes excessive, the higher voltage will be sensed by A1R12, and A1R12 and A1R13 will provide an input voltage to A1U1 that will cut off the -12 volt output until the voltage is restored to normal. A reference feedback voltage to pin 6 of A1U1 is adjustable by variable resistor A1R16, allowing the output voltage of the -12 volt circuit to be adjusted.

3-31. +12 VOLT CIRCUIT. The +12 volt circuit is similar to the -12 volt circuit in that an integrated circuit is used for voltage regulation and foldback current limiting is used for overload protection. The +12 volt circuit, however, uses a center-tapped rectifier to provide the dc voltage. Rectifier A1CR11-A1CR12 converts ac voltage from one set of secondary windings on transformer T1 to an unregulated

+12 volt supply. The unregulated voltage is sampled at pin 3 of A1U2 and the regulated output is sampled at pin 8 of A1U2. The booster output at pin 2 of A1U2 is amplified by A1Q8 and two emitter-follower amplifiers, Q9 and Q10, to give the output the desired gain. Resistor A1R54 is used as the sensing device for overload protection, and the combination of A1R54 and A1R55 provide the voltage to pin 1 of A1U2 that will cut off the +12 volt supply during an overload condition. A reference feedback voltage to pin 6 of A1U2 is adjustable by variable resistor A1R52 to allow adjustment of the +12 volt regulated output.

3-32. -45 VOLT CIRCUIT. Full-wave bridge rectifier A1CR6 through A1CR9 converts ac voltage from one set of secondary windings on transformer T1 to provide a -45 volt dc supply at pin U of power supply assembly A1. Current limiting is used to provide overload protection in the circuit. Regulation is provided by utilizing a differential amplifier which compares the -45 volt output with a regulated -12 volt dc reference voltage from the -12 volt circuit. The voltage developed at the junction of A1R25 and A1R26 is

applied to the base of A1Q4 and -12 volts is applied through A1R30 to the base of A1Q5, the other half of the differential amplifier. Resistor A1R30 matches the source impedance of each side of the differential amplifier. The output of the differential amplifier at the collector of A1Q5 is amplified by emitter-followers A1Q7 and Q2. The output current of the -45 volt circuit passes through resistor A1R35, which is used as the sensing device for overload protection. When the voltage across A1R35 becomes excessive, the voltage developed at the base of A1Q6 by voltage divider A1R36 and A1R37 turns on A1Q6. The collector voltage of A1Q6 then starts to go in the negative direction, causing A1Q7 to reduce the drive on Q2. Emitter-follower Q2 then begins to turn off, cutting off the -45 volt output until the current through A1R35 is restored to normal.

3-33. -5 VOLT CIRCUIT. The -5 volt circuit uses the -12 volt supply as a current source and a zener diode as a shunt voltage regulator. The -5 volt output is applied to pins K and 9 of power supply assembly A1. Load current in the circuit is limited by A1R18 and regulation is provided by breakdown diode A1CR5.

## SECTION IV MAINTENANCE

### 4-1. INTRODUCTION.

4-2. This section contains information and instructions necessary for maintenance, troubleshooting, and repair of the tape reader.

### 4-3. PREVENTIVE MAINTENANCE.

4-4. The tape reader is designed for a minimum of maintenance. Table 4-1 lists the schedules for periodic inspection, cleaning, and lubrication of the instrument.

Table 4-1. Preventive Maintenance Schedule

ROUTINE	SCHEDULE
Inspection (paragraph 4-5) Cleaning (paragraph 4-7) Lubrication (paragraph 4-10)	Monthly Weekly Quarterly

### 4-5. INSPECTION.

4-6. The tape reader should be periodically inspected for signs of mechanical and electrical defects. Electronic components that show signs of overheating, leakage, frayed insulation, and other signs of deterioration should be checked and a thorough investigation of the associated circuitry should be made to verify proper operation. Mechanical parts should be inspected for excessive wear, looseness, misalignment, corrosion, and other signs of deterioration.

### 4-7. CLEANING.

4-8. The tape reader should be kept free of dust, moisture, grease and foreign matter to ensure trouble-free operation. A dry, clean cloth, a soft bristled brush, or a cloth saturated with diluent lacquer or a similar cleaning compound may be used.

4-9. It is especially important that the area around the read head be kept clean. Check and clean the glass slide covering the phototransistors, the light holes, the brake surface, the drive capstan, and the plastic-covered wire foot that holds the tape flat against the read head. Accumulated lint around any of these parts can cause errors in readout. A stiff-bristle brush, a cotton swab and diluent lacquer, and compressed air can be used to clean the read head.

### WARNING

This instrument has dangerous line voltage present at various points within the chassis. Use extreme caution when working on the instrument with the cover removed, or serious injury or death to personnel may result.

### 4-10. LUBRICATION.

4-11. The tape drive motor has an oil wick located on the back end of the motor housing. This should be kept saturated with oil. If wick appears to be drying, oil with 2 or 3 drops of a light (20 weight) machine oil. Wipe all excess oil from the housing with a soft cloth.

#### Note

If the tape reader is being operated in extreme environmental temperature (hot or cold), the motor may require more frequent oiling than the schedule indicates. When first operating the instrument, check the oil wicks frequently to determine a suitable interval for the particular environment.

4-12. All other mechanical parts on the instrument are either permanently oiled during manufacture or are of a synthetic material that does not require lubrication.

### 4-13. ADJUSTMENT PROCEDURES.

4-14. The following paragraphs contain mechanical and electrical adjustment procedures for the tape reader. These procedures should be performed whenever parts are replaced that may affect adjustment or whenever the instrument is suspected to be out of adjustment for any reason.

### WARNING

This instrument has dangerous line voltage present at various points within the chassis. Use extreme caution when working on the instrument with the cover removed, or serious injury or death to personnel may result.

### 4-15. CLUTCH ADJUSTMENT.

4-16. The clutch should be adjusted any time a new clutch or any part that may affect clutch alignment has been replaced. Failure to properly align and adjust the

clutch will result in early clutch failure. A clutch alignment tool, Hewlett-Packard part no. 02748-2008 is required for proper clutch alignment. The tool is shown in figure 4-1. To adjust the clutch, proceed as follows:

a. With a feeler gauge, check clutch gap and adjust, if necessary, for a  $0.010 \pm 0.005$ -inch gap. Adjust gap by loosening screw in clutch plate, setting clutch plate on capstan shaft for proper clearance, and tightening screw in clutch plate. (See figure 4-2.)

b. Press POWER switch on.

c. Press and hold MANUAL ADVANCE switch and listen for excessive clutch noise. Press MANUAL ADVANCE switch several times to seat clutch in different positions and listen for clutch noise in each position. If excessive noise is present, recheck clutch gap and then proceed to step "d"; if there is not excessive noise, adjustment procedure is complete.

d. Remove drive capstan shaft and clutch plate from instrument.

e. Slide clutch alignment tool into drive capstan hole. Tool should slide easily into motor-end of clutch assembly without hanging up on clutch hub. If tool does not enter smoothly, remove four socket-head cap screws and washers that secure motor plate assembly to bearing carrier and move motor plate as necessary for proper alignment.

f. Replace four socket-head cap screws (without washers) and tighten. Verify proper alignment with clutch alignment tool. Remove clutch alignment tool.

g. Remove one socket-head cap screw at a time and replace washers, making certain that each screw is tightened before removing next screw.

h. Verify proper alignment with clutch alignment tool. If clutch is not properly aligned, repeat steps "e" through "g".

i. Replace capstan shaft and clutch plate, setting clutch gap for  $0.010 \pm 0.005$ -inch.

j. Repeat steps "b" and "c".

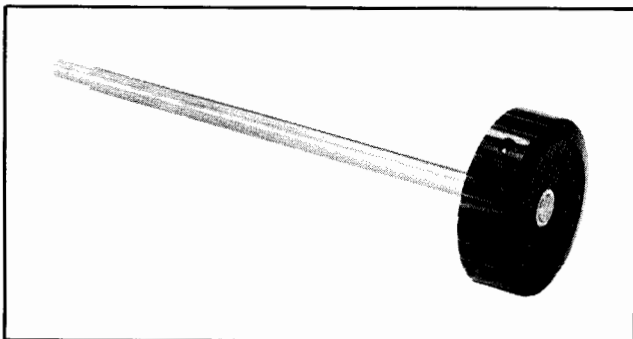


Figure 4-1. Clutch Alignment Tool

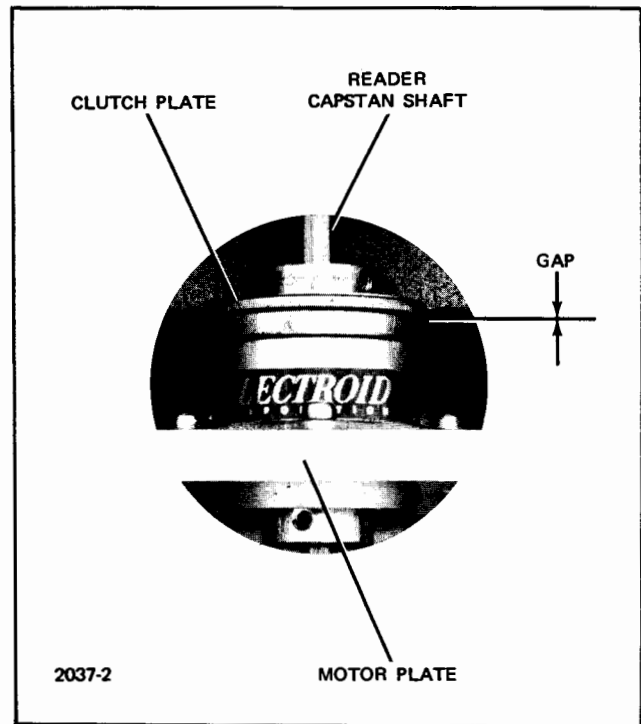


Figure 4-2. Clutch Adjustment

#### 4-17. PINCH ROLLER ADJUSTMENT.

4-18. The first part of the pinch roller adjustment procedure adjusts the force with which the pinch roller bears against the drive capstan. The last part of the procedure aligns the pinch roller with the drive capstan so that the pinch roller makes contact with the drive capstan along the entire length of the pinch roller. This procedure should be performed whenever parts are replaced that may affect the pinch roller spring tension or alignment, or anytime inspection indicates that adjustment is required. A spring scale with a resolution of 1 ounce is required to make the adjustment. To adjust the pinch roller, proceed as follows:

a. On tape reader, place POWER switch on and press READ switch. The pinch roller should be engaged against the drive capstan.

b. With spring scale, measure force with which the pinch roller bears against the drive capstan. The spring scale should indicate 10 to 14 ounces of force. To adjust pinch roller spring tension, remove top cover from instrument and bend spring bracket up or down with pliers to increase or decrease tension. Alternately check spring tension and bend spring bracket until desired results are obtained.

c. Press READ switch and observe contact surfaces between the pinch roller and the drive capstan. The surfaces must be in contact along the entire length of the pinch roller. If surfaces are mating properly, adjustment is complete; if not, proceed to step "d".

d. Disconnect power from instrument. Remove side covers and top extrusion from instrument. (Refer to parts location information in section V.)

e. Loosen both the top and bottom setscrews in the block at the front panel end of the pinch roller arm mounting shaft.

f. Reconnect power to instrument and press POWER switch on.

g. Press READ switch. If pinch roller makes contact at front end of capstan only, turn bottom setscrew in mounting shaft block in until the two surfaces are making proper contact. If contact is at back of capstan only, turn top setscrew in until contact is made along entire length of pinch roller. After setting pinch roller with one or the other of the two screws, turn the screw not used for the adjustment in until it is tight against the pinch roller mounting shaft and locks the adjustment.

h. Repeat step "g" until pinch roller and drive capstan are in contact along entire length of pinch roller.

#### 4-19. POWER SUPPLY ASSEMBLY A1 ADJUSTMENT.

4-20. The following paragraphs provide a procedure for adjusting the  $\pm 12$  volt variable resistors on power supply assembly A1. This procedure should be performed whenever the assembly is replaced or whenever parts are replaced that may affect the  $\pm 12$  volt output levels. The only equipment necessary to perform this adjustment is an HP 427A Voltmeter, or equivalent. To adjust power supply assembly A1, proceed as follows:

### WARNING

This instrument has dangerous line voltage present at various points within the chassis. Use extreme caution when working on the instrument with the cover removed, or serious injury or death to personnel may result.

- a. Remove top cover from instrument.
- b. Extend power supply assembly A1 with card extender (part no. 02758-6017).
- c. Press POWER switch on instrument on. Press READ switch.
- d. Connect voltmeter between pin B on A1 and ground.
- e. Adjust variable resistor A1R52 until voltmeter indicates  $+12 \pm 0.1$  volts dc.
- f. Connect voltmeter between pin 24 on A1 and ground.
- g. Adjust variable resistor A1R16 until voltmeter indicates  $-12 \pm 0.1$  volts dc.

#### 4-21. READ HEAD ASSEMBLY A5 ADJUSTMENT.

4-22. The following steps provide a procedure for adjusting the reference voltage variable resistor that determines the threshold level for the phototransistor on read head assembly A5. This procedure should be performed whenever read head assembly A5 or parts of the assembly are replaced that may affect the read head reference voltage.

4-23. The only equipment required to perform the adjustment procedure is an HP 427A Voltmeter, or equivalent.

4-24. To adjust the read head reference voltage, proceed as follows:

- a. Remove switch cover on front of tape reader and turn variable resistor A5A1R2 (see figure 4-3) to maximum clockwise position.
- b. On tape reader, press POWER switch on and press READ switch on.
- c. Interrupt feedhole phototransistor light path.
- d. Slowly turn A5A1R2 counterclockwise until voltage at each of pins B,F,L,R,V,Z,d,j, and FF on connector J2 goes to 0 volts.

#### Note

Turn A5A1R2 in small increments at a time, checking the voltages for each increment so that the threshold point where all pins go to 0 volts is reached, but not exceeded.

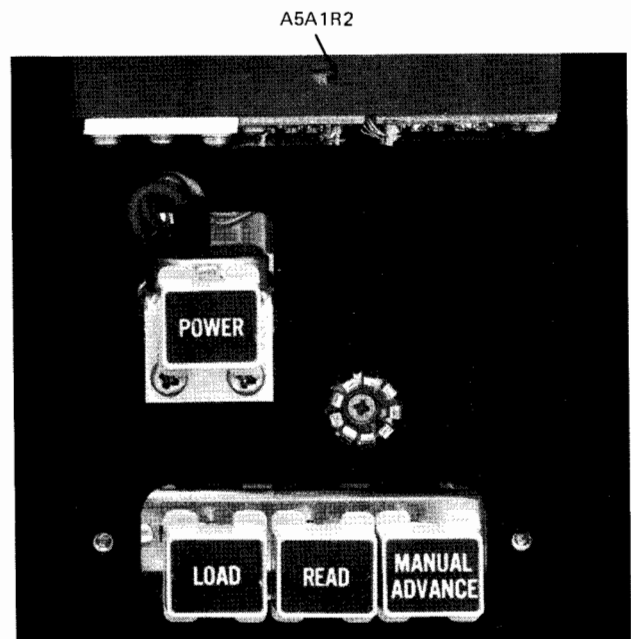


Figure 4-3. Phototransistor Reference-Voltage Variable Resistor Location

e. Measure reference voltage at A5, pin F with voltmeter.

f. Turn A5A1R2 counterclockwise until reference voltage at A5, pin F is two-thirds of the value measured in step "e".

"5" on the flow chart (figure 4-4) to isolate the problem to a particular assembly. Then, check the assembly by referring to the appropriate checkout procedure referenced on the flow chart. Checkout procedures in the following paragraphs need only be performed when directly referenced by a step on the flow chart.

**WARNING**

This instrument has dangerous line voltage present at various points within the chassis. Use extreme caution when working on the instrument with the cover removed, or serious injury or death to personnel may result.

**4-25. TROUBLESHOOTING.**

4-26. Troubleshooting information for the tape reader consists of a troubleshooting flow chart, checkout procedures for the instrument, and a logic diagram. When troubleshooting the instrument, perform steps "1" through

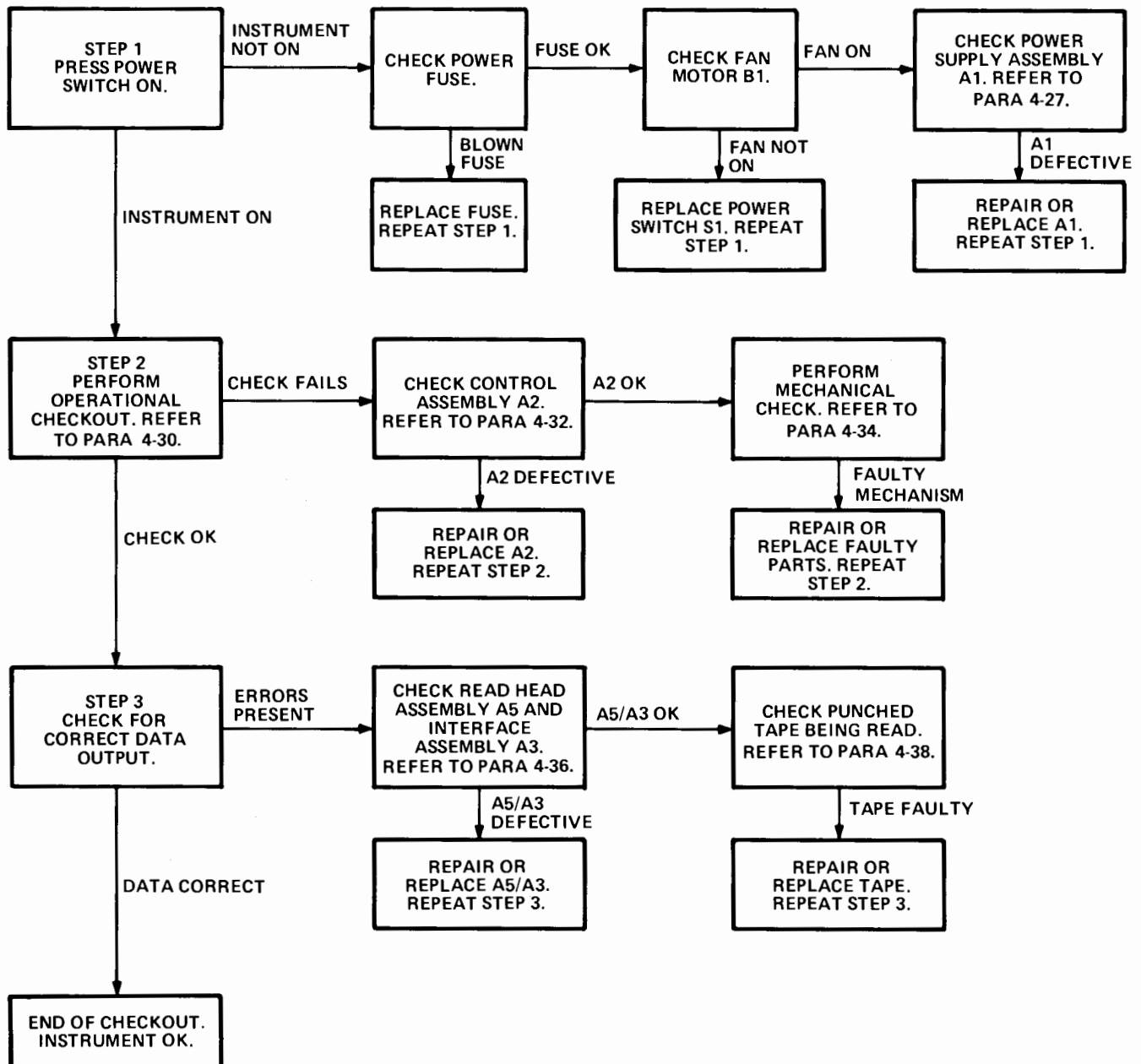


Figure 4-4. Troubleshooting Flow Chart

## 4-27. POWER SUPPLY ASSEMBLY A1 CHECKOUT.

4-28. Power supply assembly A1 can be checked by monitoring the +12 volts dc, -12 volt dc, -45 volts dc, and -5 volt dc outputs while varying the ac line voltage to ensure that the outputs remain within tolerance. Test equipment required is as follows (or equivalent):

- a. Variable AC Transformer (102 to 128 volts ac output)
- b. HP 427A Voltmeter
- c. HP 175A Oscilloscope
- d. HP 1750B Dual Trace Vertical Amplifier



4-29. To check power supply assembly A1, proceed as follows:

- a. Remove top cover from instrument. Extend power supply assembly A1 with card extender.
- b. Connect ac input of instrument to variable transformer and adjust variable transformer for 115 volts ac output.
- c. Press LOAD switch and set POWER switch to on.
- d. Press READ switch. Use voltmeter to measure output voltage and oscilloscope to measure ripple of +12 volt circuit as shown in step "1" of table 4-2 while varying line voltage from 102 to 128 volts ac.

e. Use voltmeter to measure output voltage and oscilloscope to measure ripple of -12 volt circuit as shown in step "2" of table 4-2 while varying line voltage from 102 to 128 volts ac.

f. Use voltmeter to measure output voltage and oscilloscope to measure ripple of -45 volt circuit as shown in step "3" of table 4-2 while varying line voltage from 102 to 128 volts ac.

g. Use voltmeter to measure output voltage of -5 volt circuit as shown in step "4" of table 4-2 while varying line voltage from 102 to 128 volts ac.

h. If power supply assembly A1 or parts on A1 are replaced, perform adjustment procedure described in paragraph 4-19.

## 4-30. OPERATIONAL CHECKOUT.

4-31. The operational checkout is performed by applying power to the instrument, setting switches and input commands for the desired mode of operation as shown in table 4-3, and verifying that the operating conditions of the instrument agree with the conditions listed in the second half of table 4-3 for each respective operating mode.

## 4-32. CONTROL ASSEMBLY A2 CHECKOUT.

4-33. If control assembly A2 is defective, a malfunction will generally be obvious during the operational check in paragraph 4-30. Malfunctions associated with control

Table 4-2. Power Supply Assembly A1 Checkout

STEP	MEASURE AT A1, PIN	OUTPUT VOLTAGE (DC)	MAXIMUM RIPPLE (MV P-P)	IF INDICATION IS ABNORMAL
1	B	+12 ± 0.1	71	Check A1CR11, A1CR12, A1Q8, Q9, Q10, A1U2, and A1R52 if voltage is not within tolerance. Check C23 if maximum allowable ripple is being exceeded. If voltage oscillates, check C22. Refer to voltage readings on schematic diagram, figure 4-10.
2	24	-12 ± 0.1	71	Check A1CR1 thru A1CR4, A1Q3, Q1, A1U1, and A1R16 if voltage is not within tolerance. Check C5 if maximum allowable ripple is being exceeded. If voltage oscillates, check C6. Refer to voltage readings on schematic diagram, figure 4-10.
3	12	-45 ± 2	71	Check A1CR6 thru A1CR9, A1Q4 thru A1Q7, and Q2 if voltage is not within tolerance. Check C3 if maximum allowable ripple is being exceeded. If voltage oscillates, check C4. Refer to voltage readings on schematic diagram, figure 4-10.
4	K	-5 ± 0.5	---	Check A1CR5 and A1R18 if voltage is not within tolerance. Refer to voltage readings on schematic diagram, figure 4-10.

Table 4-3. Operational Chart

MODE OF OPERATION		OPERATING CONDITION			
SWITCH SELECTED	INPUT COMMAND (J2-AA)	PAPER BRAKE	READER CAPSTAN DRIVEN	READER PINCH ROLLER	FEEDHOLE OUTPUT (J2-FF)
None	--	Off	No	Engaged	Inhibited
LOAD	--	Off	No	Released	Inhibited
READ	READ	Off	Yes	Engaged	Enabled
	$\overline{\text{READ}}$	On	No	Engaged	Enabled
MANUAL ADVANCE	--	Off	Yes	Engaged	Inhibited
NOTE: READ indicates that a read command is present. $\overline{\text{READ}}$ indicates the absence of a read command.					

assembly A2 can be traced to defective components by referring to the logic diagram (figure 4-6). Trace signal flow through the logic diagram, checking for signals that should be present for a given mode of operation and isolating improper signal interruption to faulty components.

#### 4-34. MECHANICAL CHECKOUT.

4-35. The steps below check several possible sources of mechanical trouble in the tape reader. If the instrument is not operating properly and the control circuitry (control assembly A2) has been checked and found to be functioning properly, the trouble may be traced to one or more of the following mechanical troubles. Replace any parts that are found to be defective. (Refer to removal and replacement procedures, paragraph 4-40.) Perform the mechanical checkout as follows:

- a. Remove top cover from instrument.
- b. Operate instrument and listen for excessive bearing or clutch noise. (Refer to paragraph 4-15 for clutch adjustment.)
- c. Check roller surfaces for excessive wear and contamination.
- d. Check mating roller surfaces during operation to ensure that there are no gaps in contact area between the two roller surfaces. (Refer to paragraph 4-17 for pinch roller adjustment.)
- e. Turn rotating parts by hand, with no power applied, to ensure that parts turn freely (no binding).

f. Check for cracked, broken, or loose parts and any signs of unusual wear or corrosion.

g. Check tape guide wire on read head assembly A5 for proper adjustment (0.008 to 0.020 inch gap between tape guide wire and glass cover).

#### 4-36. READ HEAD ASSEMBLY A5 AND INTERFACE ASSEMBLY A3 CHECKOUT.

##### Note

If read head assembly A5 is found to be defective during troubleshooting, the complete assembly may be replaced by a rebuilt assembly on an exchange basis by contacting a Hewlett-Packard Field Office.

4-37. Read head assembly A5 and interface assembly A3 may be checked by energizing the instrument and interrupting the light path to the phototransistors on A5 while monitoring the output for each data channel at connector J2. In this manner, a malfunction may be isolated to a specific channel and components for the respective channel can then be checked. While performing this checkout procedure, refer to the logic diagram for the instrument, figure 4-6. The only test equipment required is an HP 427A Voltmeter, or equivalent. To check A5 and A3, proceed as follows:

- a. Press LOAD switch. Press POWER switch on. All lamps on read head assembly A5 should light with approximately equal intensity.
- b. With voltmeter, measure voltage levels at pins of rear connector J2 with light path to phototransistors obstructed and then unobstructed as indicated in table 4-4.



Table 4-4. Read Head Assembly A5 and Interface Assembly A3 Checkout

MEASURE AT CONNECTOR J2 PIN	LIGHT PATH TO PHOTOTRANSISTORS	NORMAL INDICATION (VDC)	IF INDICATION IS ABNORMAL
B	Open	0, +0.5 -0	Check A3Q1, A5A1Q1, and A5A2V2.
	Closed	+12 ± 0.5	
F	Open	0, +0.5 -0	Check A3Q2, A5A1Q2, and A5A2V3.
	Closed	+12 ± 0.5	
L	Open	0, +0.5 -0	Check A3Q3, A5A1Q3, and A5A2V4.
	Closed	+12 ± 0.5	
R	Open	0, +0.5 -0	Check A3Q4, A5A1Q4, and A5A2V6.
	Closed	+12 ± 0.5	
V	Open	0, +0.5 -0	Check A3Q5, A5A1Q5, and A5A2V7.
	Closed	+12 ± 0.5	
Z	Open	0, +0.5 -0	Check A3Q6, A5A1Q6, and A5A2V8.
	Closed	+12 ± 0.5	
d	Open	0, +0.5 -0	Check A3Q7, A5A1Q7, and A5A2V9.
	Closed	+12 ± 0.5	
j	Open	0, +0.5 -0	Check A3Q8, A5A1Q8, and A5A2V10.
	Closed	+12 ± 0.5	

## Note

If a single phototransistor on A5A2 is defective, the complete phototransistor subassembly (A5A2) must be replaced.

c. Press READ switch. With voltmeter, measure voltage levels at pin FF of connector J2 with light path to phototransistors obstructed and then unobstructed. Open reading should be 0, +0.5 -0, volts dc; closed reading should be +12 ±0.5 volts dc. If indication is abnormal, check A3Q10, A3Q11, A3Q12, A3Q13, A5Q11, and A5V5.

d. Press LOAD switch. Remove switch cover from front of instrument and connect voltmeter to pin F of connector on read head assembly A5. Voltmeter should indicate between 2.0 and 11.5 volts dc and should be variable with variable resistor A5A1R2. If indication is abnormal, check A5A1Q9, A5A1Q10, A5A1R2, and A5A2V1.

e. Remove top cover from read head assembly A5 and carefully lift lamp subassembly out of position so that light no longer reaches phototransistors on A5A2. (Refer to removal and replacement information in paragraph 4-40.) Voltmeter should now indicate between 0.6 and 0.8 volts dc and should vary with variable resistor A5A1R2. If indication is abnormal, check A5A1Q9, A5A1Q10, A5A1R2, and A5A2V1.

f. Replace lamp subassembly and cover on read head assembly A5.

g. Press READ switch.

h. With voltmeter, measure voltage at pin J2-FF. With light path to phototransistors open, voltage should be 0, +0.5 -0, volts dc. With light path obstructed, voltage should be +12 ±0.5 volts dc. If indication is abnormal, check A3Q10 through A3Q13, A3CR91, A5Q11, and A5V5.

i. With a jumper wire, apply chassis ground to pin J2-AA. Use voltmeter to measure voltage at pin Z of interface assembly A3. Voltmeter should indicate +12 ±0.5 volts dc. Remove ground connection at pin J2-AA. Voltmeter should now indicate 0, +0.5 -0, volts dc. If indication is abnormal, check A3Q9. 6.7V

## 4-38. PUNCHED TAPE CHECKOUT.

4-39. The tape reader will perform satisfactorily with a wide variety of punched tapes, as long as the tape transmissivity is less than 60 percent and the tape has been punched within the tolerances shown in figure 4-5. However, the condition of the tape can cause serious difficulty in the operation of the instrument. Some of the more common

tape reader malfunctions can often be traced to the condition of the punched tape being read, especially if errors in readout are being obtained. Faulty conditions to look for when checking tape are as follows:

a. **Pulled Sprocket Holes:** Some tapes have an occasional elongated sprocket hole. This is usually caused by a mis-adjusted tape punch or a mis-loaded supply reel on the punch. If the sprocket holes arrive too soon because of this, the data holes may be completely ignored by the tape reader.

b. **Chad in Tape:** Chad fits tightly in tape holes and may cause misreading of the tape. Tape should never be fed from a chad box.

c. **Lint on Tape:** Lint on a tape can accumulate under the tape reader lamp and block off the light. Tapes and their containers should be kept clean.

d. **Ragged Edges:** A code hole that has been torn, leaving ragged edges, will normally be read correctly. But the bit of paper that folds back and covers the next hole may cause the following character to be misread.

e. **Oil Spots:** Normal oil-impregnated tapes should not affect instrument operation, but oil from other sources can. Lubricating oil may even bleach the color from the tape. Oil contamination is usually the result of allowing tape to stand for long periods in the head or tape holder of a tape punch.

#### 4-40. REMOVAL AND REPLACEMENT.

4-41. When disassembling the tape reader to replace parts, refer to the parts location diagrams in section V of this manual. Remove parts in accordance with the appro-

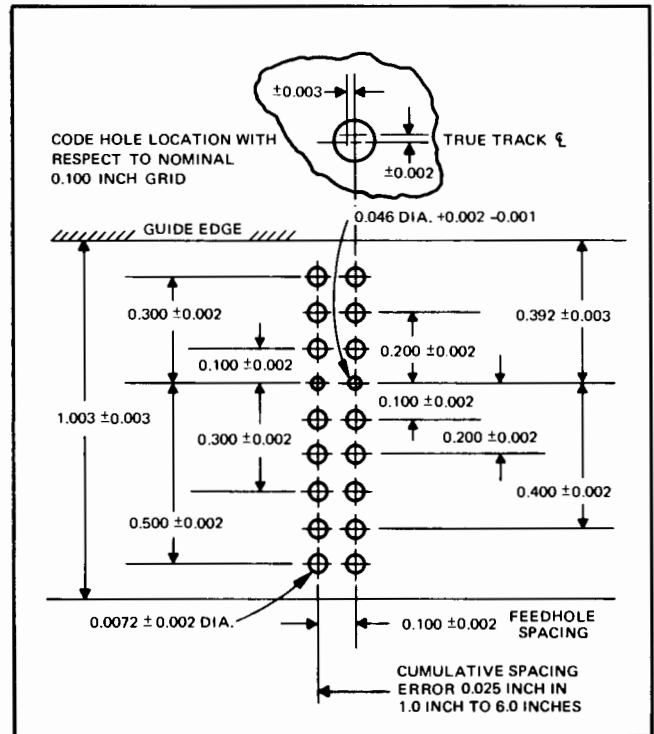


Figure 4-5. Punched Tape Specifications

appropriate portion of the exploded view and replace in the reverse order of disassembly. Refer to the index numbers for order of disassembly.

#### 4-42. ILLUSTRATIONS.

4-43. The following illustrations include a logic diagram, schematic diagrams, and printed-circuit card parts location drawings for the tape reader. Also included on the schematic diagrams are parts lists for each printed-circuit card assembly.

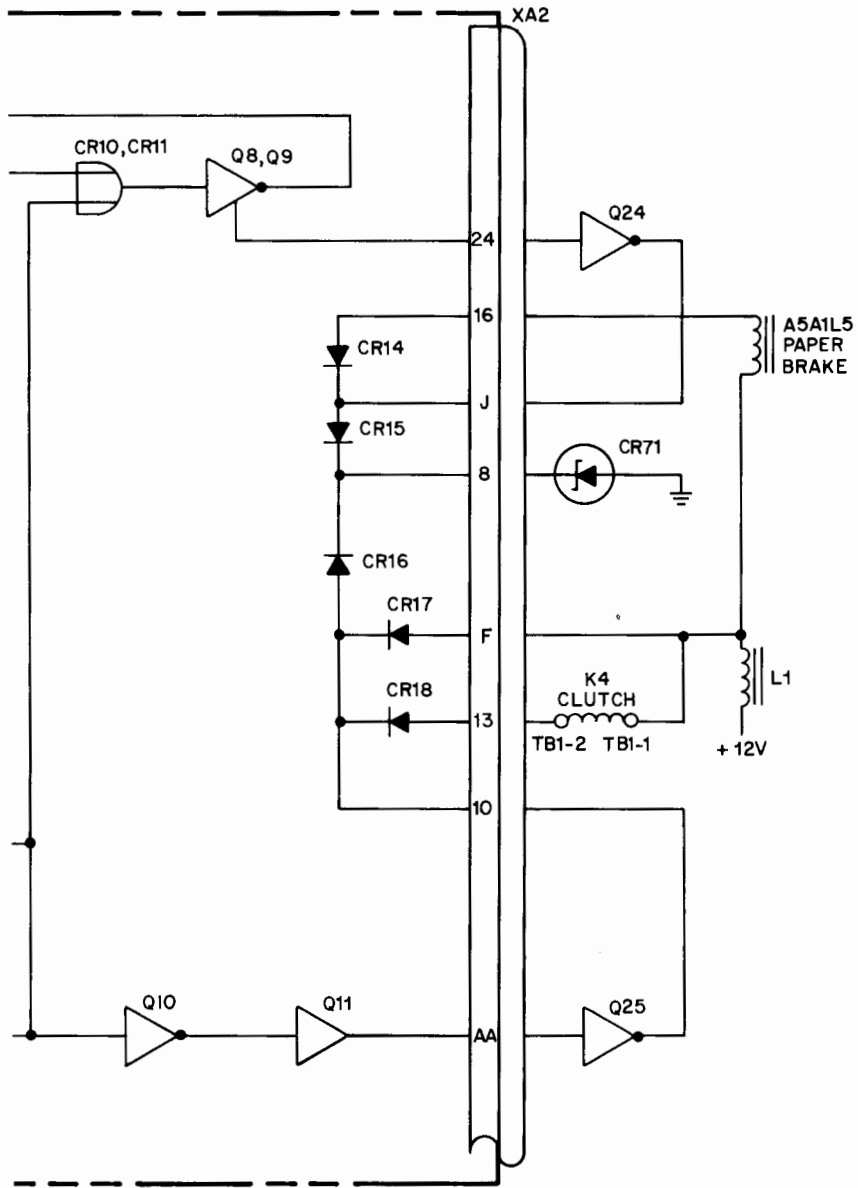
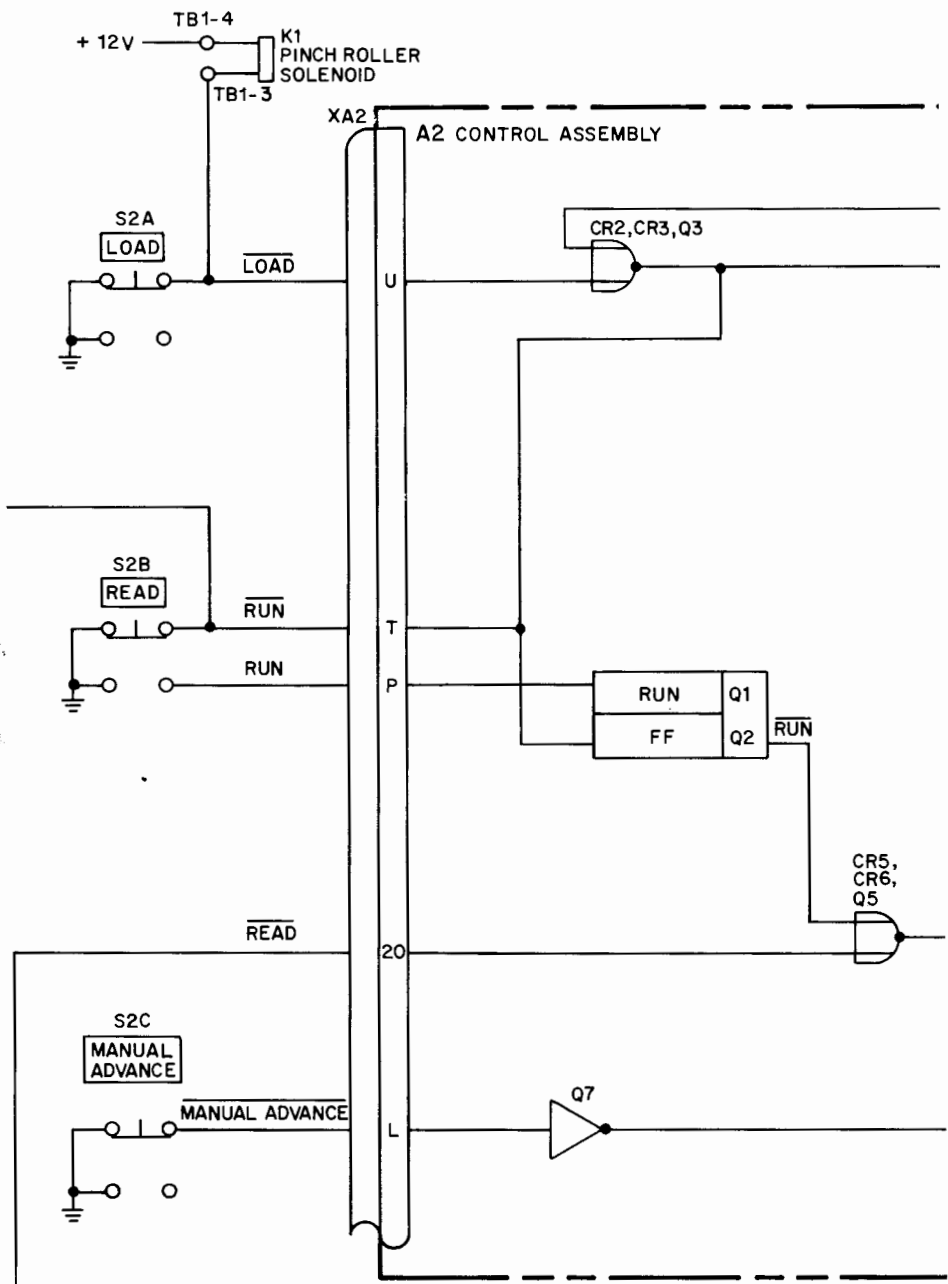
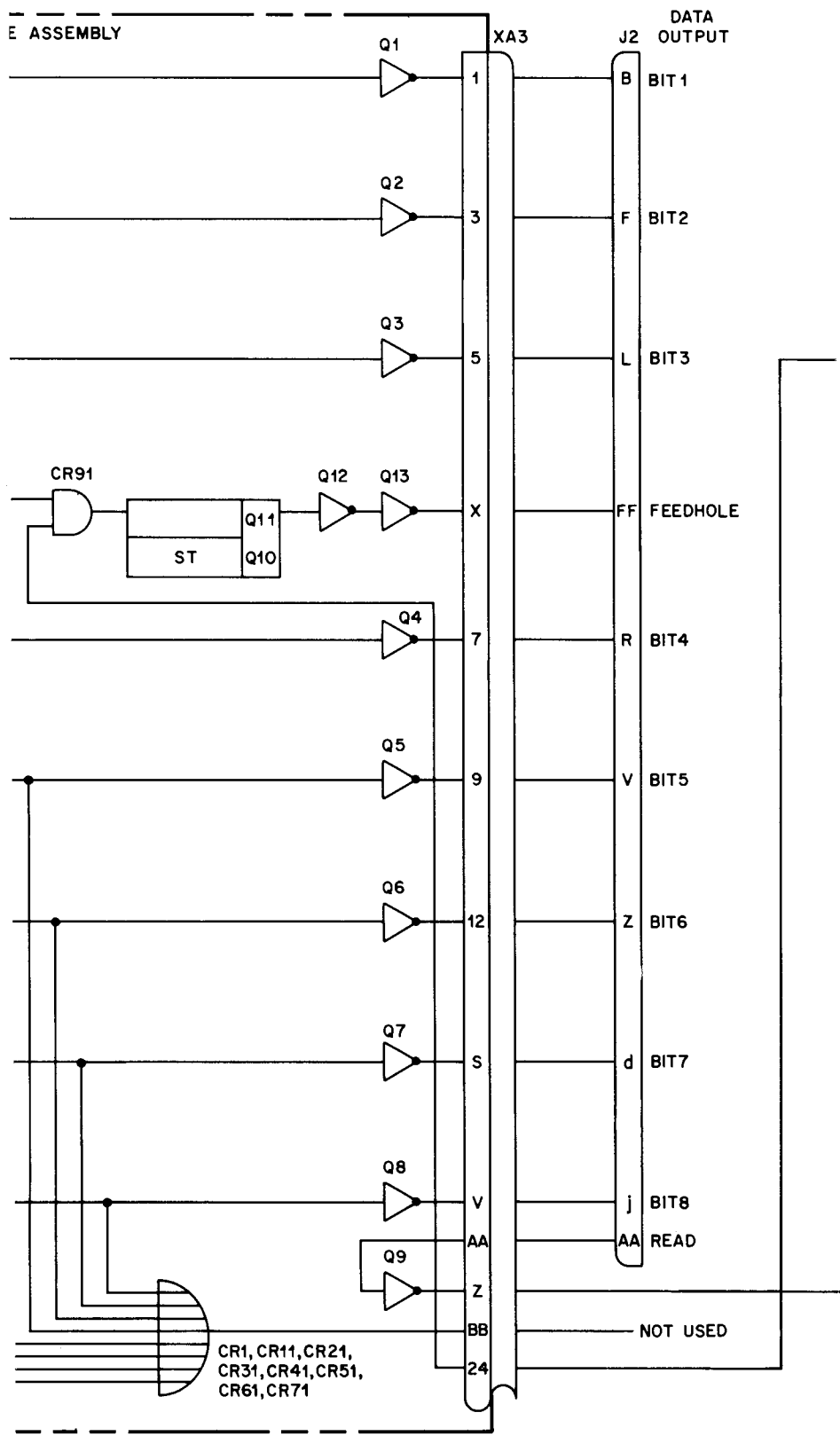
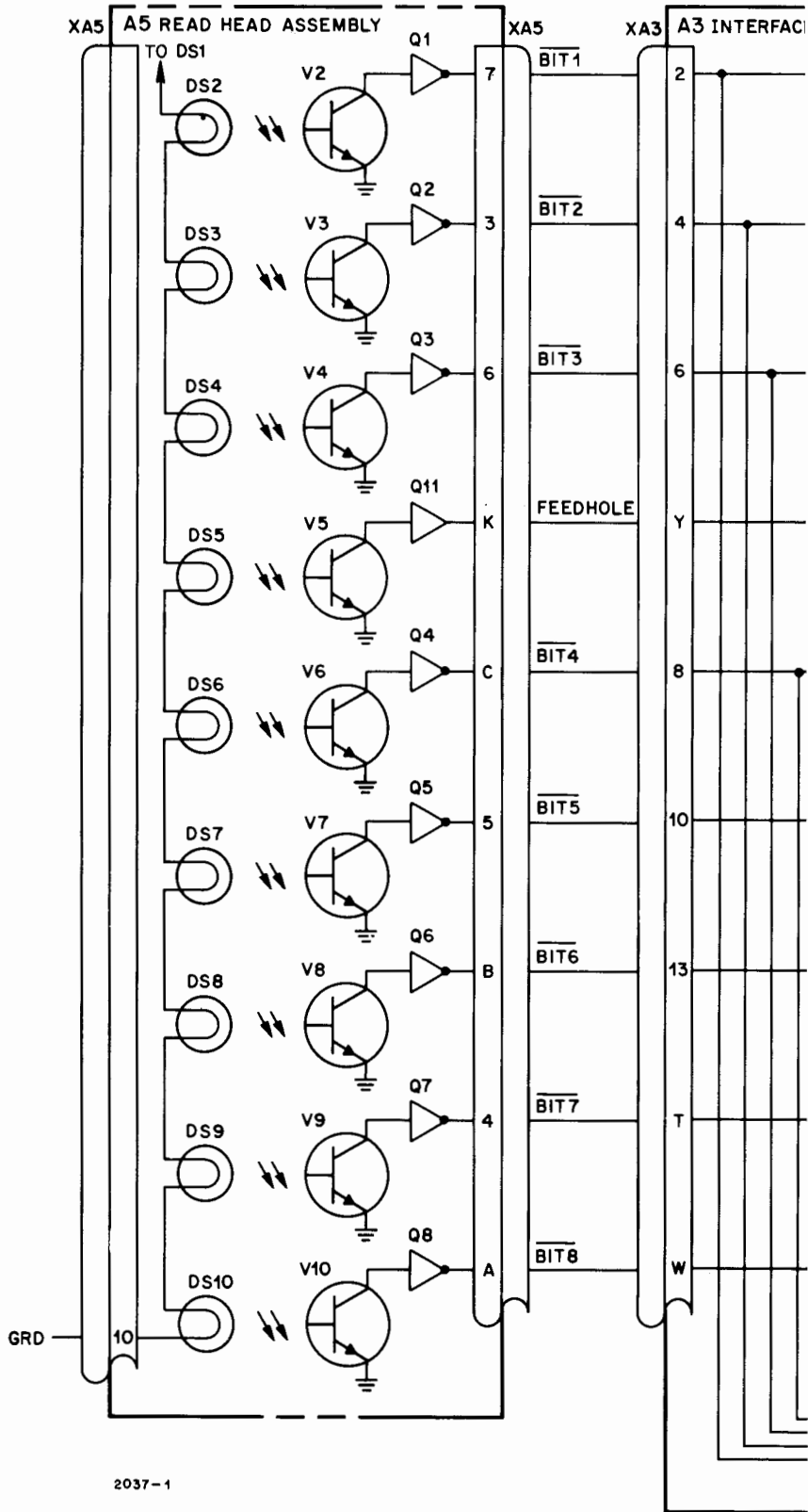


Figure 4-6. Tape Reader Logic Diagram







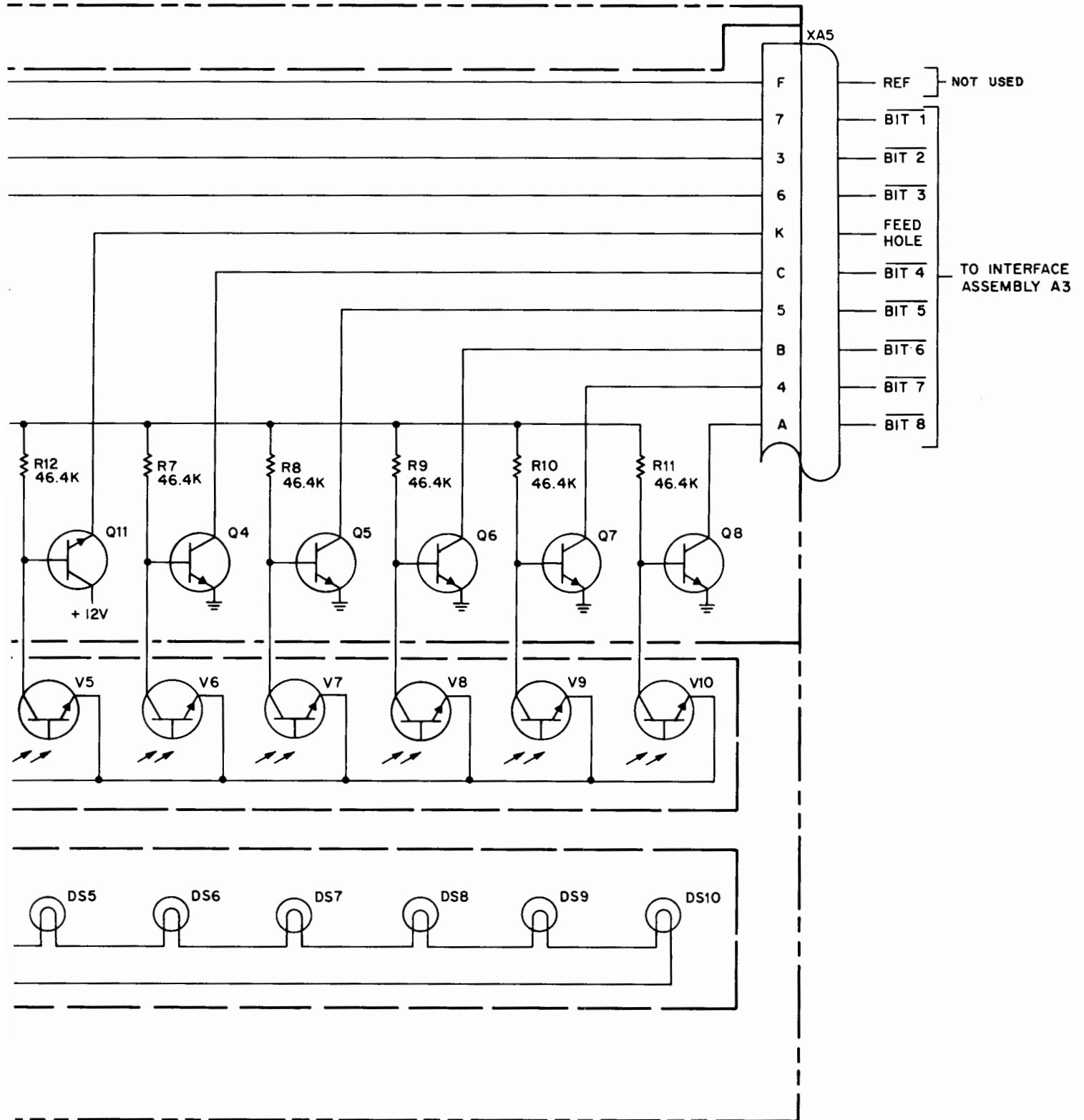
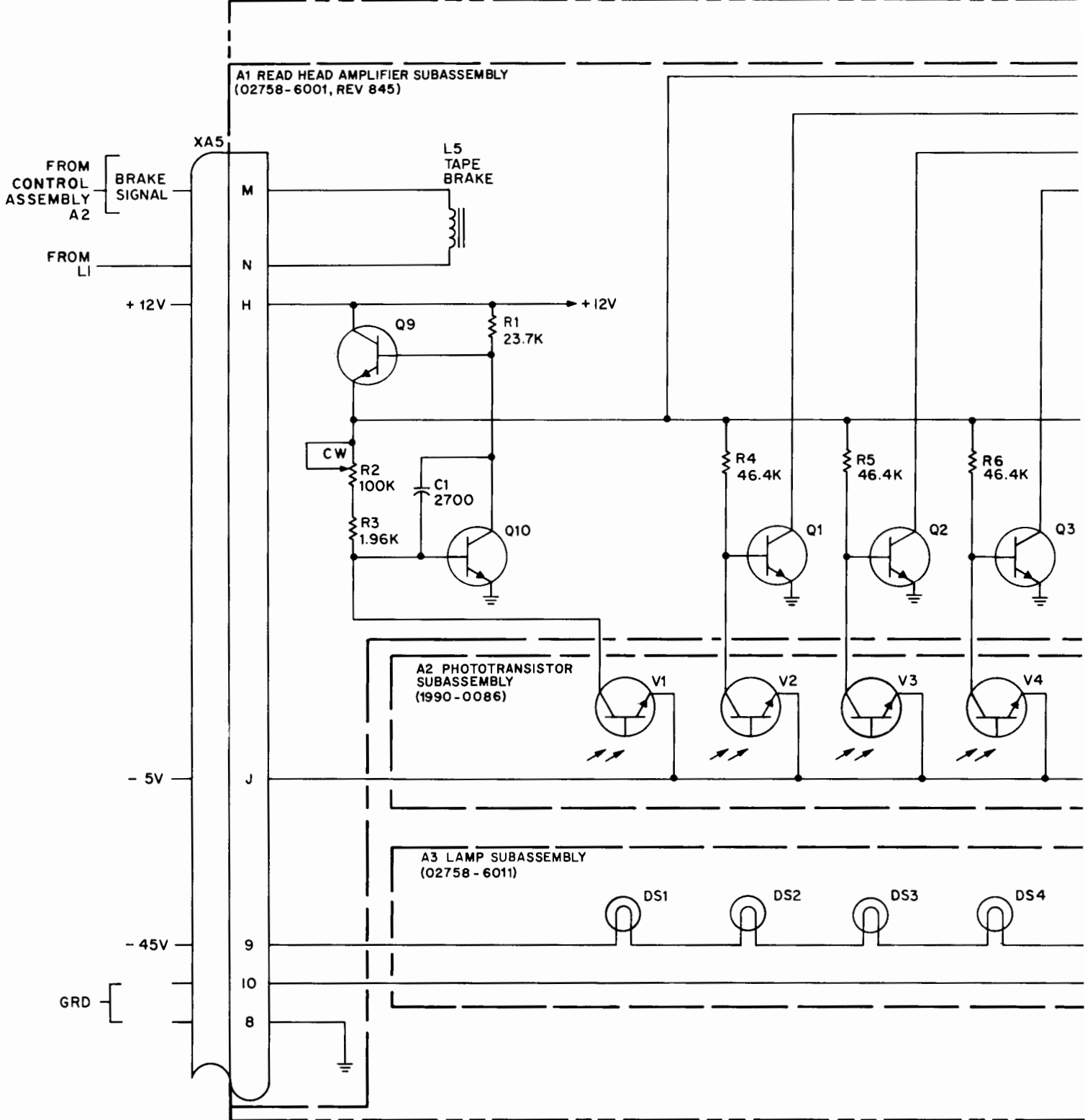


Figure 4-7. Read Head Assembly A5  
Schematic Diagram

A5 READ HEAD ASSEMBLY(5950-8702-2, REV.A)



DWG REV A

NOTES:

1. CAPACITANCE VALUES ARE IN PICOFARADS.



Table 4-5. Interface Assembly A3 Replaceable Parts

Reference Designation	Part No.	Description #	Note
A3	02758-6003	INTERFACE ASSEMBLY	
A3C1	0160-2204	C:FXD MICA 100 PF 5%	
A3C2	0160-C300	C:FXD MY 0.0027 UF 10% 200VDCW	
A3C3	0140-0200	C:FXD MICA 390 PF 5%	
A3C4	0160-2204	C:FXD MICA 100 PF 5%	
A3C11	0160-2204	C:FXD MICA 100 PF 5%	
A3C21	0160-2204	C:FXD MICA 100 PF 5%	
A3C31	0160-2204	C:FXD MICA 100 PF 5%	
A3C41	0160-2204	C:FXD MICA 100 PF 5%	
A3C51	0160-2204	C:FXD MICA 100 PF 5%	
A3C61	0160-2204	C:FXD MICA 100 PF 5%	
A3C71	0160-2204	C:FXD MICA 100 PF 5%	
A3CR1	1901-0081	DIODE:SILICON 50 VOLTS WORKING	
A3CR11	1901-0081	DIODE:SILICON 50 VOLTS WORKING	
A3CR21	1901-0081	DIODE:SILICON 50 VOLTS WORKING	
A3CR31	1901-0081	DIODE:SILICON 50 VOLTS WORKING	
A3CR41	1901-0081	DIODE:SILICON 50 VOLTS WORKING	
A3CR51	1901-0081	DIODE:SILICON 50 VOLTS WORKING	
A3CR61	1901-0081	DIODE:SILICON 50 VOLTS WORKING	
A3CR71	1901-0081	DIODE:SILICON 50 VOLTS WORKING	
A3CR91	1901-0081	DIODE:SILICON 50 VOLTS WORKING	
A3Q1- A3C13	1854-0071	TRANSISTOR:SILICON NPN	
A3R1	0658-3136	R:FXD MET FLM 17.8K OHM 1% 1/8W	
A3R2	0698-3156	R:FXD MET FLM 14.7K OHM 1% 1/8W	
A3R3	0757-0465	R:FXD MET FLM 100K OHM 1% 1/8W	
A3R6	0686-1035	R:FXD COMP 10K OHM 5% 1/2W	
A3R11	0698-3136	R:FXD MET FLM 17.8K OHM 1% 1/8W	
A3R12	0698-3156	R:FXD MET FLM 14.7K OHM 1% 1/8W	
A3R13	0757-0465	R:FXD MET FLM 100K OHM 1% 1/8W	
A3R16	0686-1035	R:FXD COMP 10K OHM 5% 1/2W	
A3R21	0698-3136	R:FXD MET FLM 17.8K OHM 1% 1/8W	
A3R22	0698-3156	R:FXD MET FLM 14.7K OHM 1% 1/8W	
A3R23	0757-0465	R:FXD MET FLM 100K OHM 1% 1/8W	
A3R26	0686-1035	R:FXD COMP 10K OHM 5% 1/2W	
A3R31	0698-3136	R:FXD MET FLM 17.8K OHM 1% 1/8W	
A3R32	0698-3156	R:FXD MET FLM 14.7K OHM 1% 1/8W	
A3R33	0757-0465	R:FXD MET FLM 100K OHM 1% 1/8W	
A3R36	0686-1035	R:FXD COMP 10K OHM 5% 1/2W	
A3R41	0658-3136	R:FXD MET FLM 17.8K OHM 1% 1/8W	
A3R42	0698-3156	R:FXD MET FLM 14.7K OHM 1% 1/8W	
A3R43	0757-0465	R:FXD MET FLM 100K OHM 1% 1/8W	
A3R46	0686-1035	R:FXD COMP 10K OHM 5% 1/2W	

# See introduction to this section for ordering information

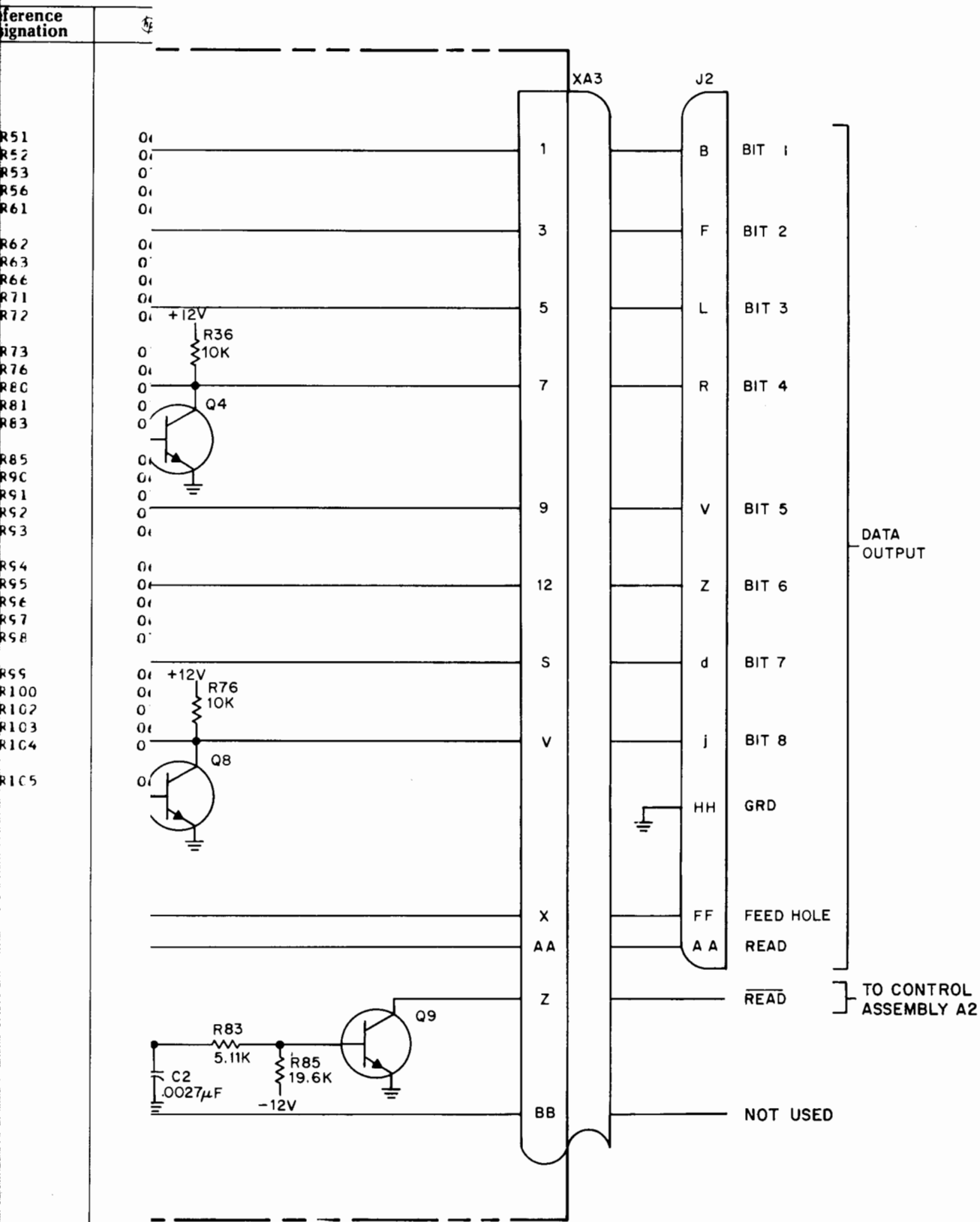
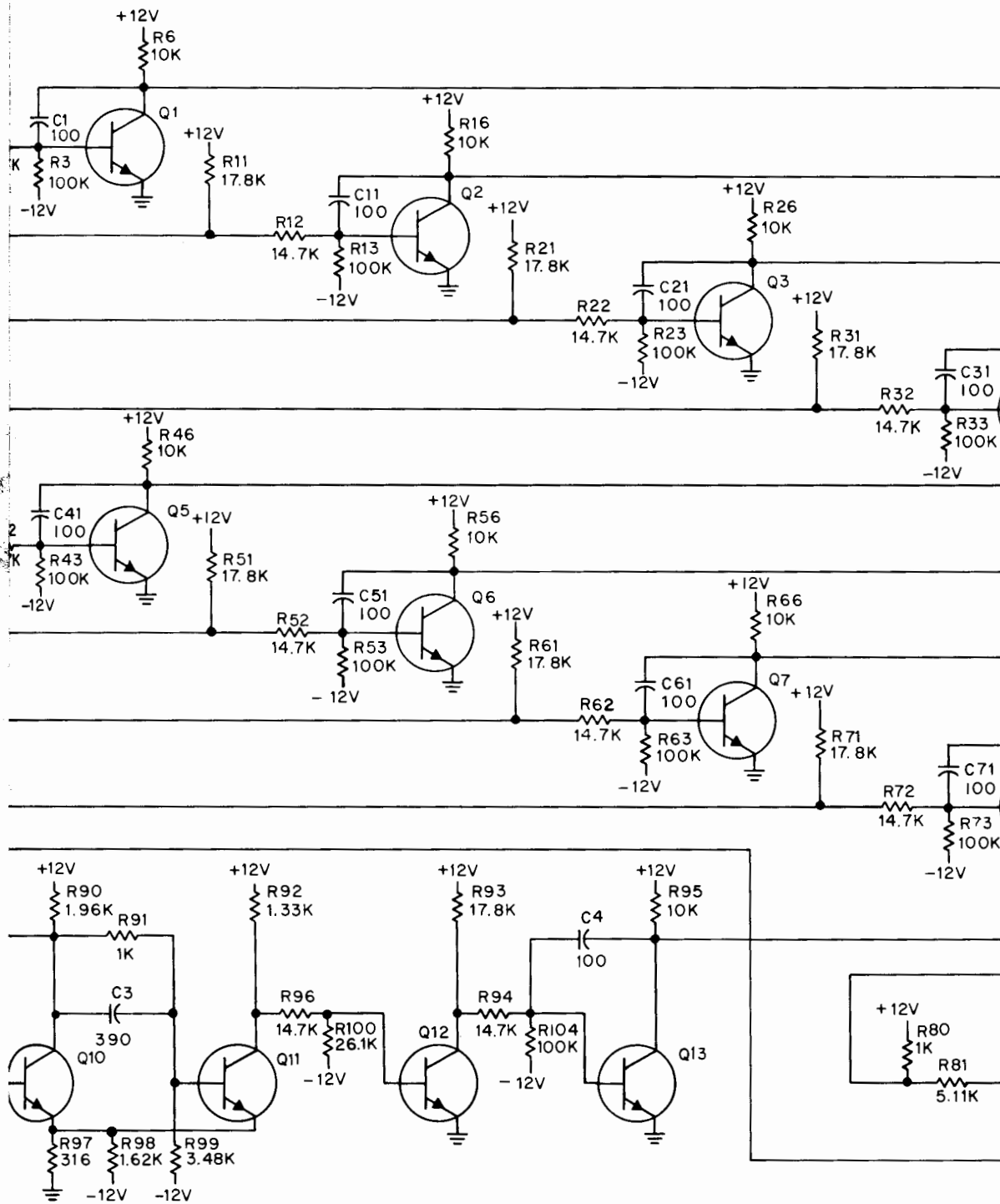


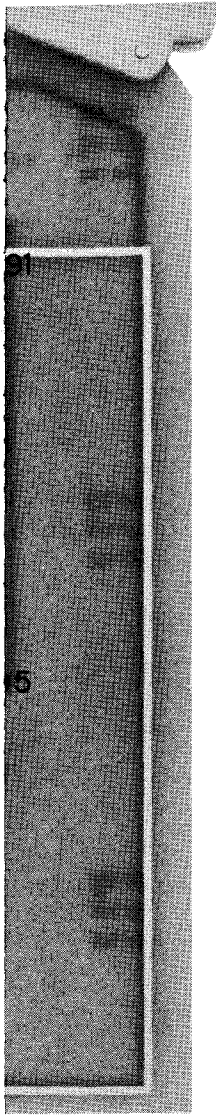
Figure 4-8. Interface Assembly A3 Schematic and Parts Location Diagrams



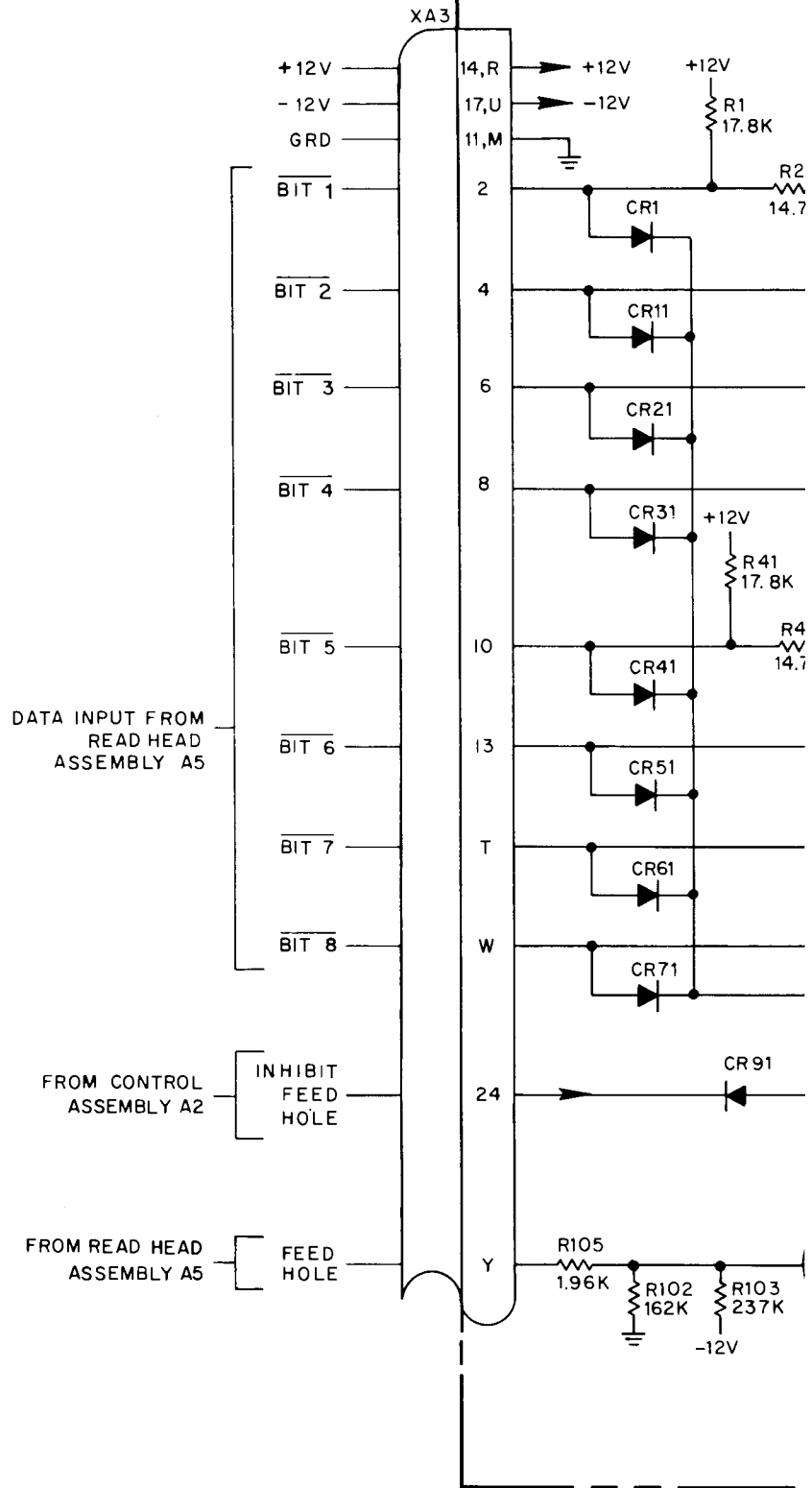
758-6003, REV 829



D:  
N OHMS.  
: IN PICO FARADS.



**A3 INTERFACE ASSEMBLY (02**



DWG REV A

**NOTES:**

1. UNLESS OTHERWISE SPECIFIC  
ALL RESISTANCE VALUES ARE IN  
ALL CAPACITANCE VALUES ARE IN

02758-6003  
A-829-22

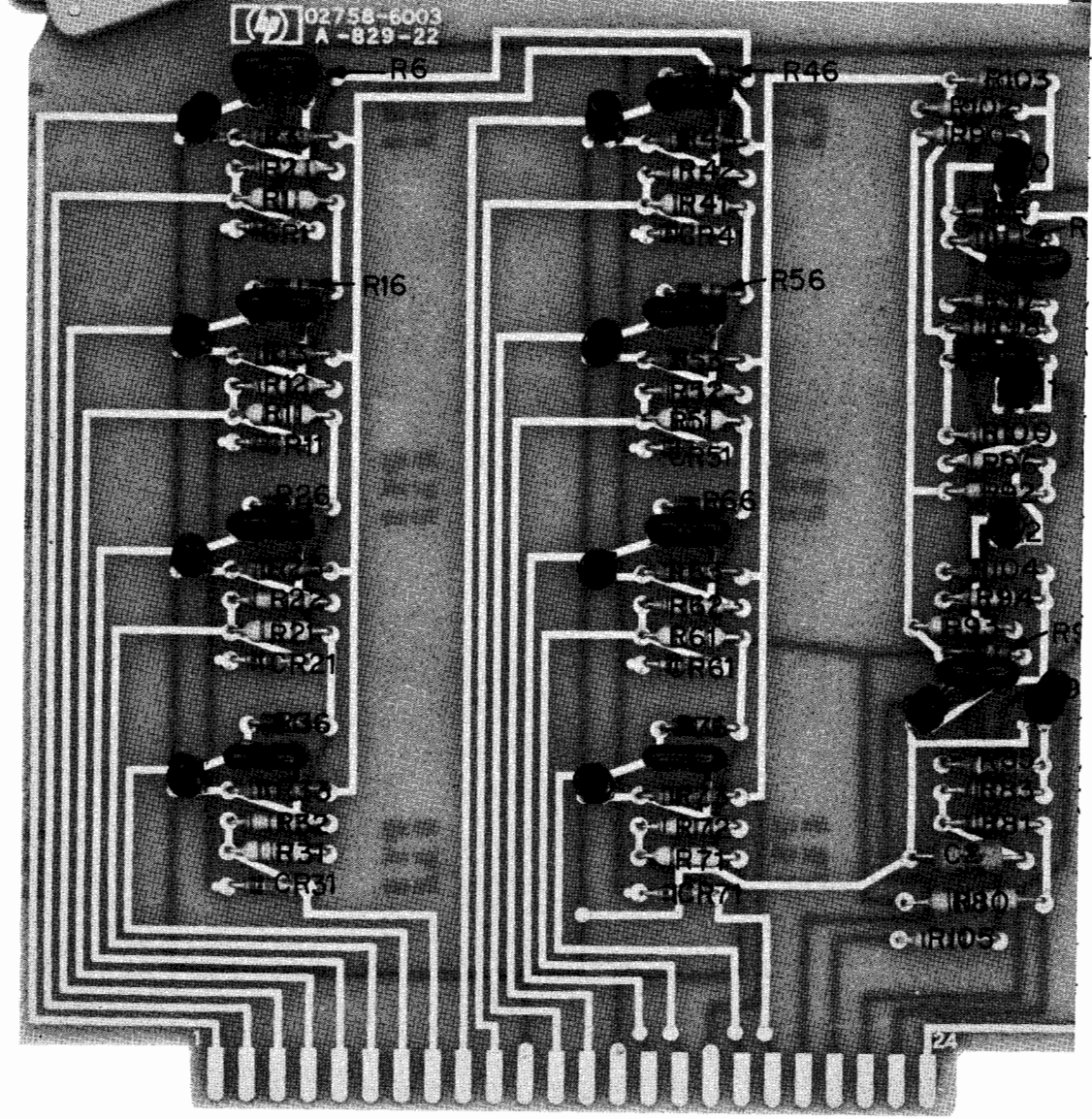


Table 4-5. Interface Assembly A3 Replaceable Parts (Cont'd)

Reference Designation	Part No.	Description #	Note
A3R51	0698-3136	K:FXD MET FLM 17.8K OHM 1% 1/8W	
A3R52	0698-3156	K:FXD MET FLM 14.7K OHM 1% 1/8W	
A3R53	0757-C465	R:FXD MET FLM 100K OHM 1% 1/8W	
A3R56	0686-1035	R:FXD COMP 10K OHM 5% 1/2W	
A3R61	0698-3136	R:FXD MET FLM 17.8K OHM 1% 1/8W	
A3R62	0698-3156	K:FXD MET FLM 14.7K OHM 1% 1/8W	
A3R63	0757-0465	R:FXD MET FLM 100K OHM 1% 1/8W	
A3R66	0686-1035	R:FXD COMP 10K OHM 5% 1/2W	
A3R71	0698-3136	R:FXD MET FLM 17.8K OHM 1% 1/8W	
A3R72	0698-3156	K:FXD MET FLM 14.7K OHM 1% 1/8W	
A3R73	0757-0465	R:FXD MET FLM 100K OHM 1% 1/8W	
A3R76	0686-1035	R:FXD COMP 10K OHM 5% 1/2W	
A3R8C	0757-0338	R:FXD MET FLM 1.00K OHM 1% 1/4W	
A3R81	0757-0438	K:FXD MET FLM 5.11K OHM 1% 1/8W	
A3R83	0757-0438	K:FXD MET FLM 5.11K OHM 1% 1/8W	
A3R85	0698-3157	R:FXD MET FLM 19.6K OHM 1% 1/8W	
A3R9C	0698-0083	K:FXD MET FLM 1.96K OHM 1% 1/8W	
A3R91	0757-0280	R:FXD MET FLM 1K OHM 1% 1/8W	
A3R92	0757-0317	R:FXD MET FLM 1.33K OHM 1% 1/8W	
A3R93	0698-3136	K:FXD MET FLM 17.8K OHM 1% 1/8W	
A3R94	0698-3156	R:FXD MET FLM 14.7K OHM 1% 1/8W	
A3R95	0686-1035	R:FXD COMP 10K OHM 5% 1/2W	
A3R96	0698-3156	K:FXD MET FLM 14.7K OHM 1% 1/8W	
A3R97	0698-3444	K:FXD MET FLM 316 OHM 1% 1/8W	
A3R98	0757-0428	K:FXD MET FLM 1.62K OHM 1% 1/8W	
A3R99	0698-3157	R:FXD MET FLM 3.48K OHM 1% 1/8W	
A3R100	0698-3159	K:FXD MET FLM 26.1K OHM 1% 1/8W	
A3R102	0757-C470	R:FXD MET FLM 162K OHM 1% 1/8W	
A3R103	0698-3266	K:FXD MET FLM 237K OHM 1% 1/8W	
A3R104	0757-0465	K:FXD MET FLM 100K OHM 1% 1/8W	
A3R105	0698-0083	R:FXD MET FLM 1.96K OHM 1% 1/8W	

# See introduction to this section for ordering information

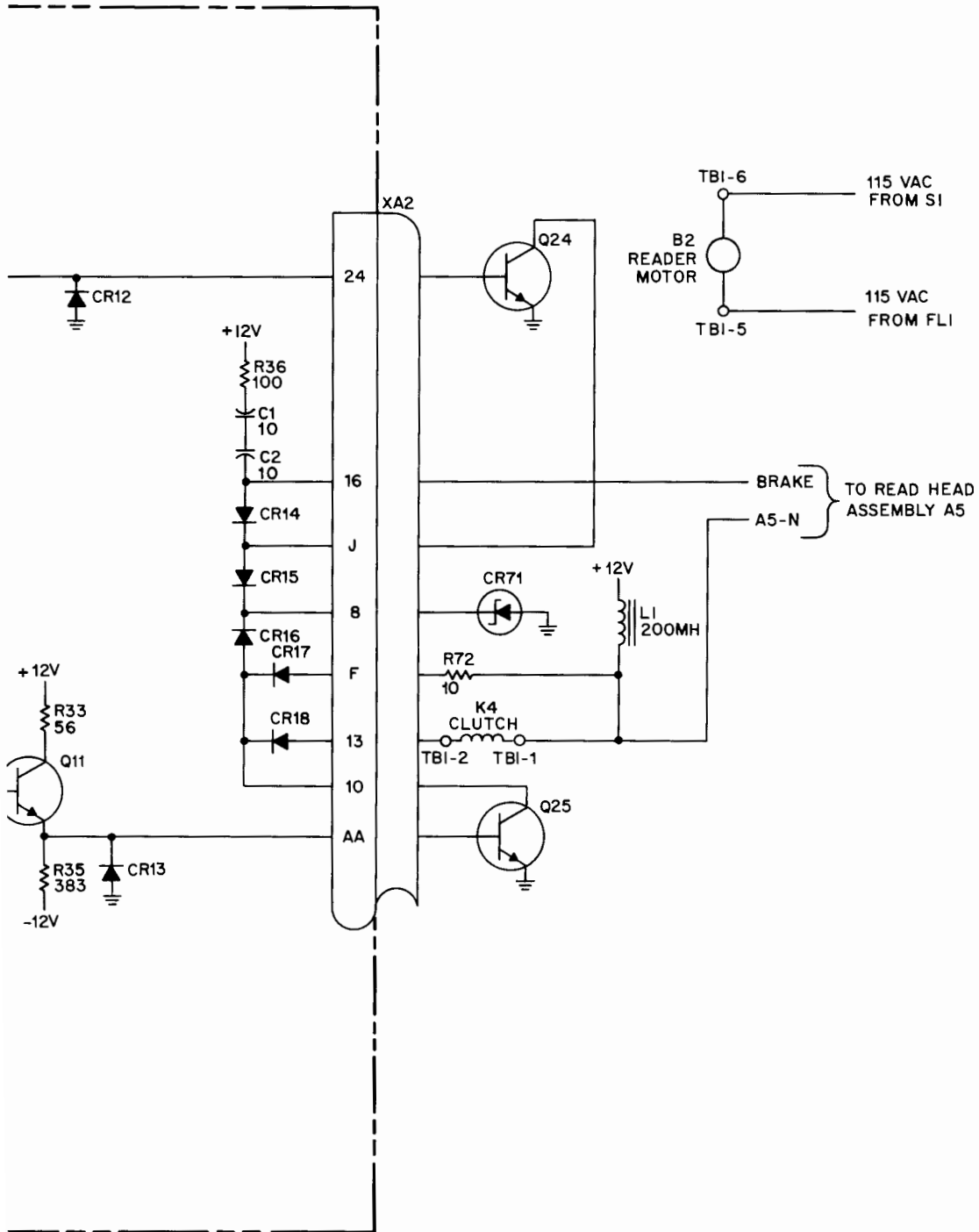
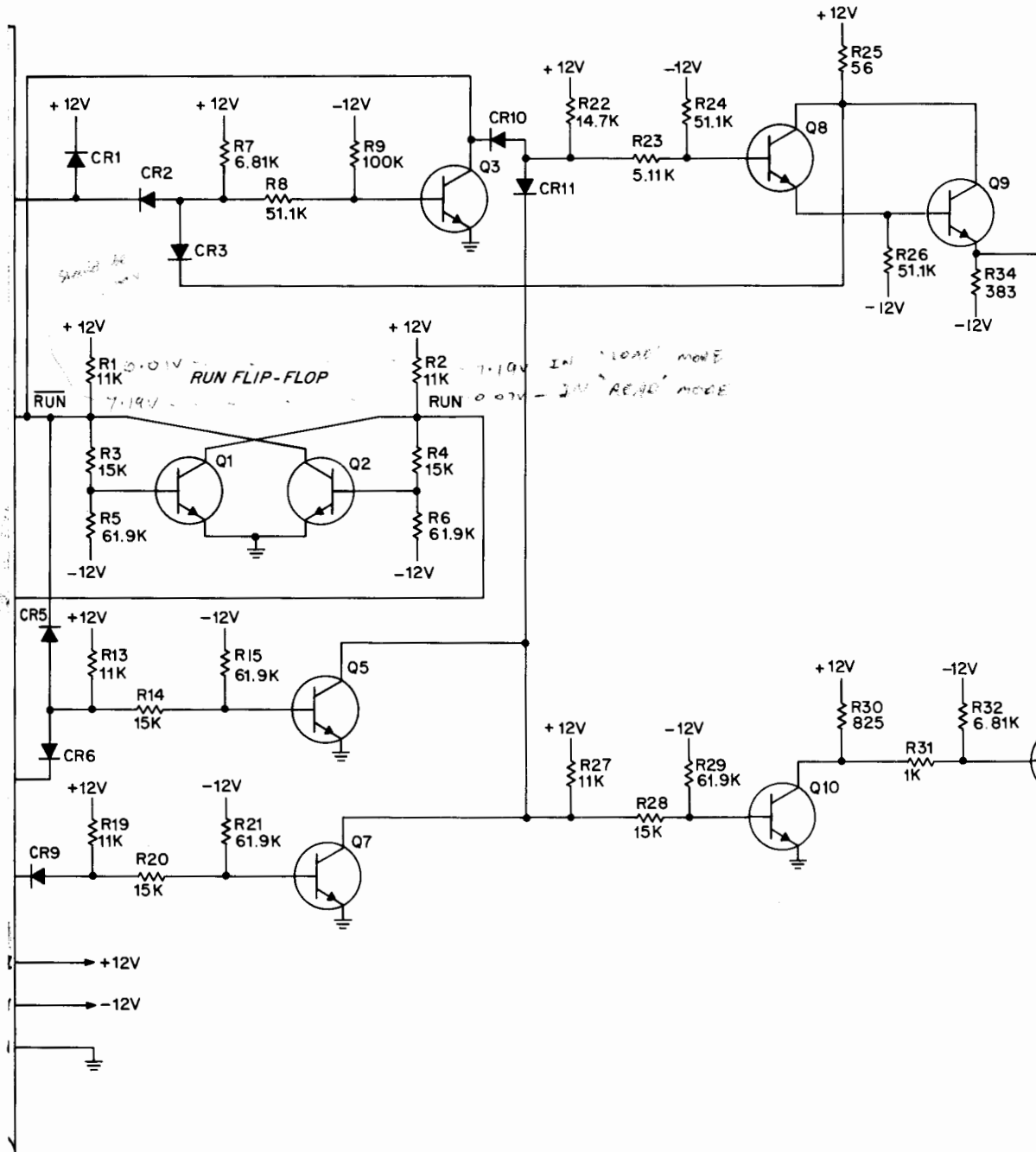


Figure 4-9. Control Assembly A2 Schematic and Parts Location Diagrams

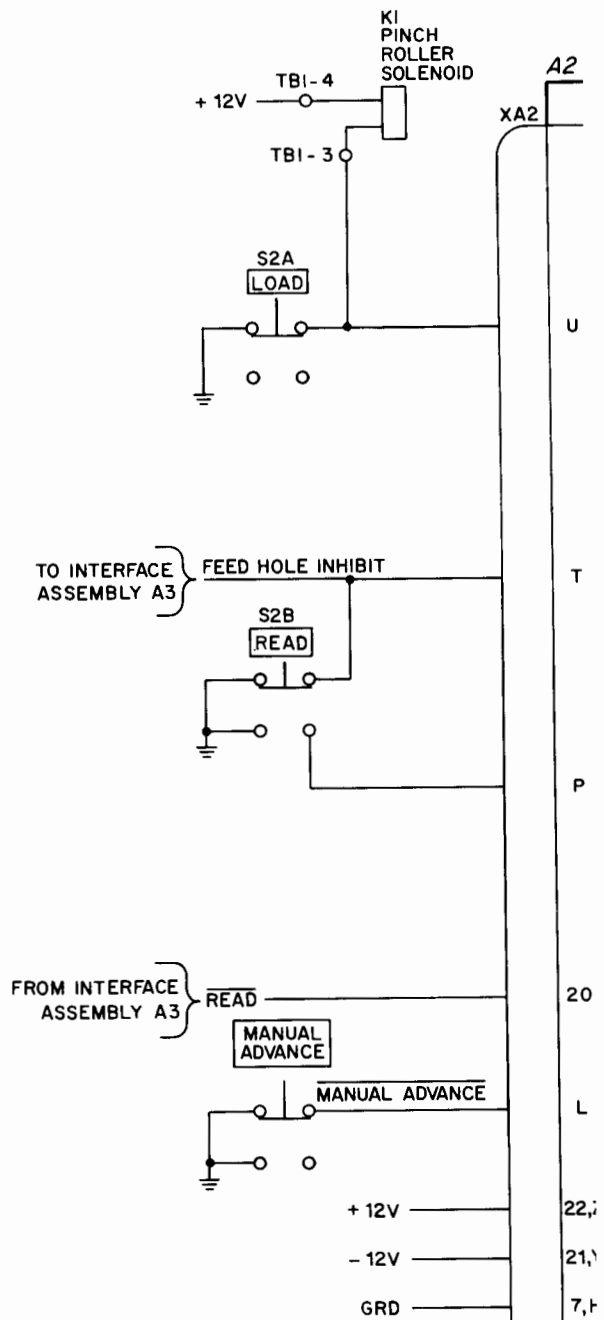
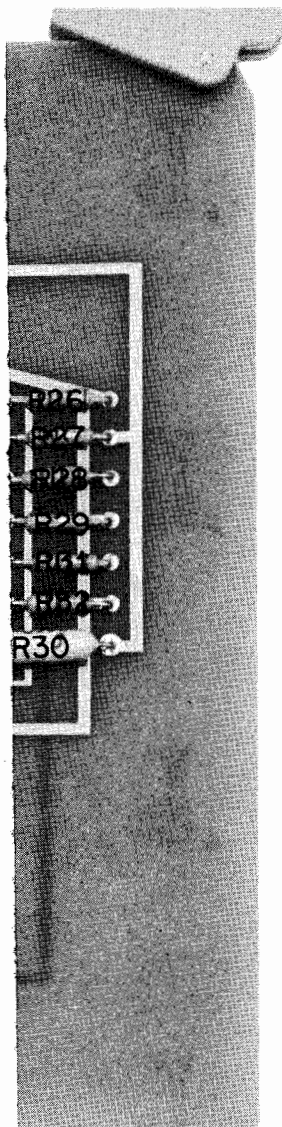
CONTROL ASSEMBLY (02748-6001, REV 927)



EV B

ES:  
 UNLESS OTHERWISE SPECIFIED -  
 ALL RESISTANCE VALUES ARE IN OHMS.  
 ALL CAPACITANCE VALUES ARE IN MICROFARADS.  
 PARTS SHOWN OUTSIDE OF BROKEN LINE ARE  
 MOUNTED ON MAIN CHASSIS.  
 INFORMATION SHOWN IN BOXES DENOTES NOMENCLATURE  
 STAMPED ON INSTRUMENT FRONT PANEL.



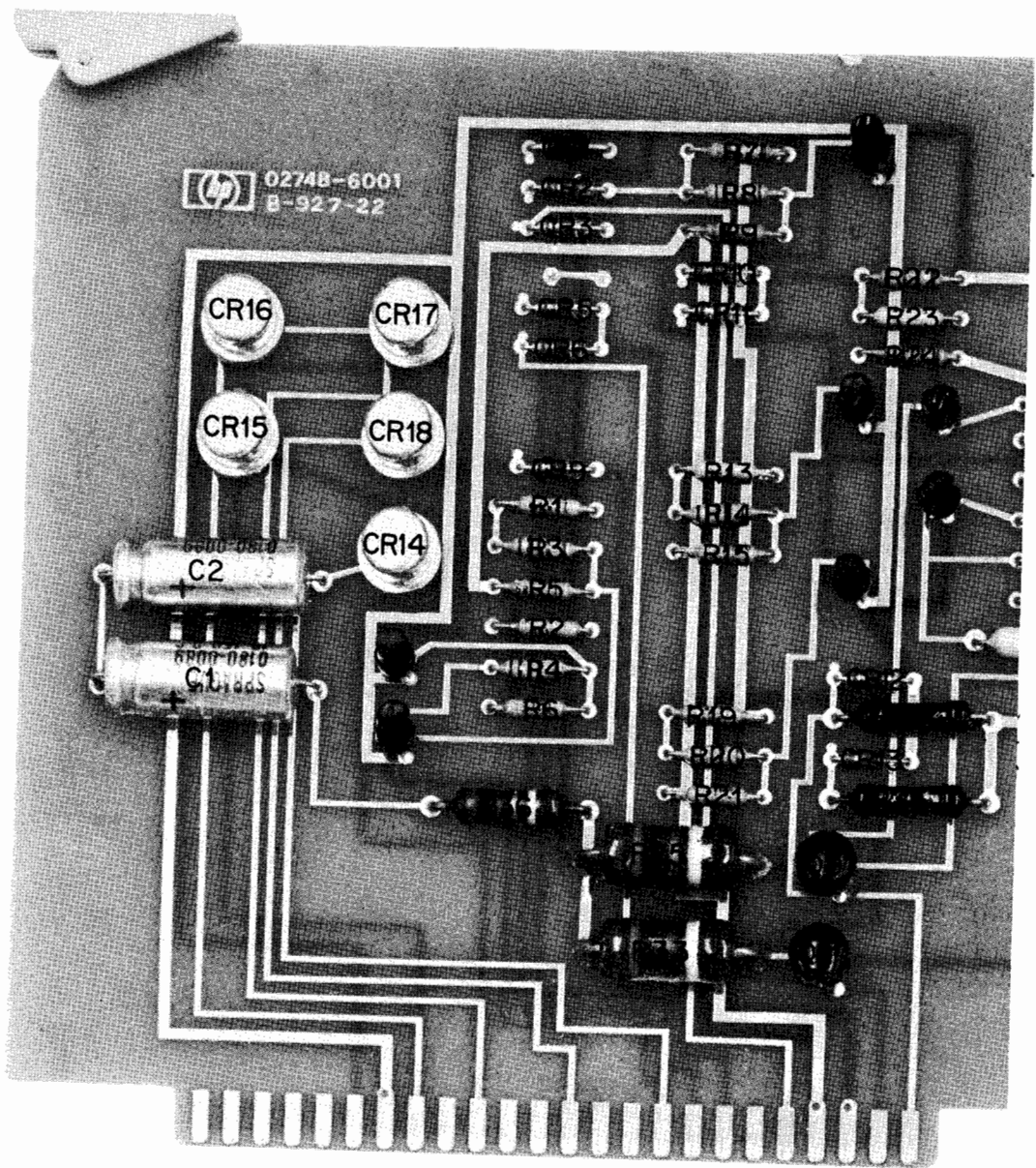


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- 1. L
- 2. F
- 3. [

02748-6001  
B-927-22



CR16 CR17  
CR15 CR18  
CR14

6000-0810  
C2  
6000-0810  
C1

R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14 R15 R16 R17 R18 R19 R20 R21 R22 R23 R24

Table 4-6. Control Assembly A2 Replaceable Parts

Reference Designation	Part No.	Description #	Note
A2	02748-6001	CONTROL ASSEMBLY	
A2C1	0180-0089	C:FXD ELECT 10UF-10%+100% 150VDCW	
A2C2	0180-0089	C:FXD ELECT 10UF-10%+100% 150VDCW	
A2CR1	1901-0049	DIODE:SILICON 50PIV	
A2CR2	1901-0081	DIODE:SILICON 50 VOLTS WORKING	
A2CR3	1901-0081	DIODE:SILICON 50 VOLTS WORKING	
A2CR5	1901-0081	DIODE:SILICON 50 VOLTS WORKING	
A2CR6	1901-0081	DIODE:SILICON 50 VOLTS WORKING	
A2CR9- A2CR13	1901-0081	DIODE:SILICON 50 VOLTS WORKING	
A2CR14- A2CR18	1901-0416	DIODE:SILICON 200PIV 3A	
A2C1	1854-0071	TRANSISTOR:SILICON NPN	
A2Q2	1854-0071	TRANSISTOR:SILICON NPN	
A2Q3	1854-0071	TRANSISTOR:SILICON NPN	
A2Q5	1854-0071	TRANSISTOR:SILICON NPN	
A2Q7	1854-0071	TRANSISTOR:SILICON NPN	
A2Q8	1854-0071	TRANSISTOR:SILICON NPN	
A2Q9	1854-0246	TRANSISTOR:SILICON NPN	
A2Q10	1854-0071	TRANSISTOR:SILICON NPN	
A2Q11	1854-0246	TRANSISTOR:SILICON NPN	
A2R1	0757-0443	R:FXD MET FLM 11.0K OHM 1% 1/8W	
A2R2	0757-0443	R:FXD MET FLM 11.0K OHM 1% 1/8W	
A2R3	0757-0446	R:FXD MET FLM 15.0K OHM 1% 1/8W	
A2R4	0757-0446	R:FXD MET FLM 15.0K OHM 1% 1/8W	
A2R5	0757-0460	R:FXD MET FLM 61.9K OHM 1% 1/8W	
A2R6	0757-0460	R:FXD MET FLM 61.9K OHM 1% 1/8W	
A2R7	0757-0439	R:FXD MET FLM 6.81K OHM 1% 1/8W	
A2R8	0757-0458	R:FXD MET FLM 51.1K OHM 1% 1/8W	
A2R9	0757-0465	R:FXD MET FLM 100K OHM 1% 1/8W	
A2R13	0757-0443	R:FXD MET FLM 11.0K OHM 1% 1/8W	
A2R14	0757-0446	R:FXD MET FLM 15.0K OHM 1% 1/8W	
A2R15	0757-0460	R:FXD MET FLM 61.9K OHM 1% 1/8W	
A2R19	0757-0443	R:FXD MET FLM 11.0K OHM 1% 1/8W	
A2R20	0757-0446	R:FXD MET FLM 15.0K OHM 1% 1/8W	
A2R21	0757-0460	R:FXD MET FLM 61.9K OHM 1% 1/8W	
A2R22	0698-3156	R:FXD MET FLM 14.7K OHM 1% 1/8W	
A2R23	0757-0438	R:FXD MET FLM 5.11K OHM 1% 1/8W	
A2R24	0757-0458	R:FXD MET FLM 51.1K OHM 1% 1/8W	
A2R25	0764-0013	R:FXD MET OX 56 OHM 5% 2W	
A2R26	0757-0458	R:FXD MET FLM 51.1K OHM 1% 1/8W	

# See introduction to this section for ordering information

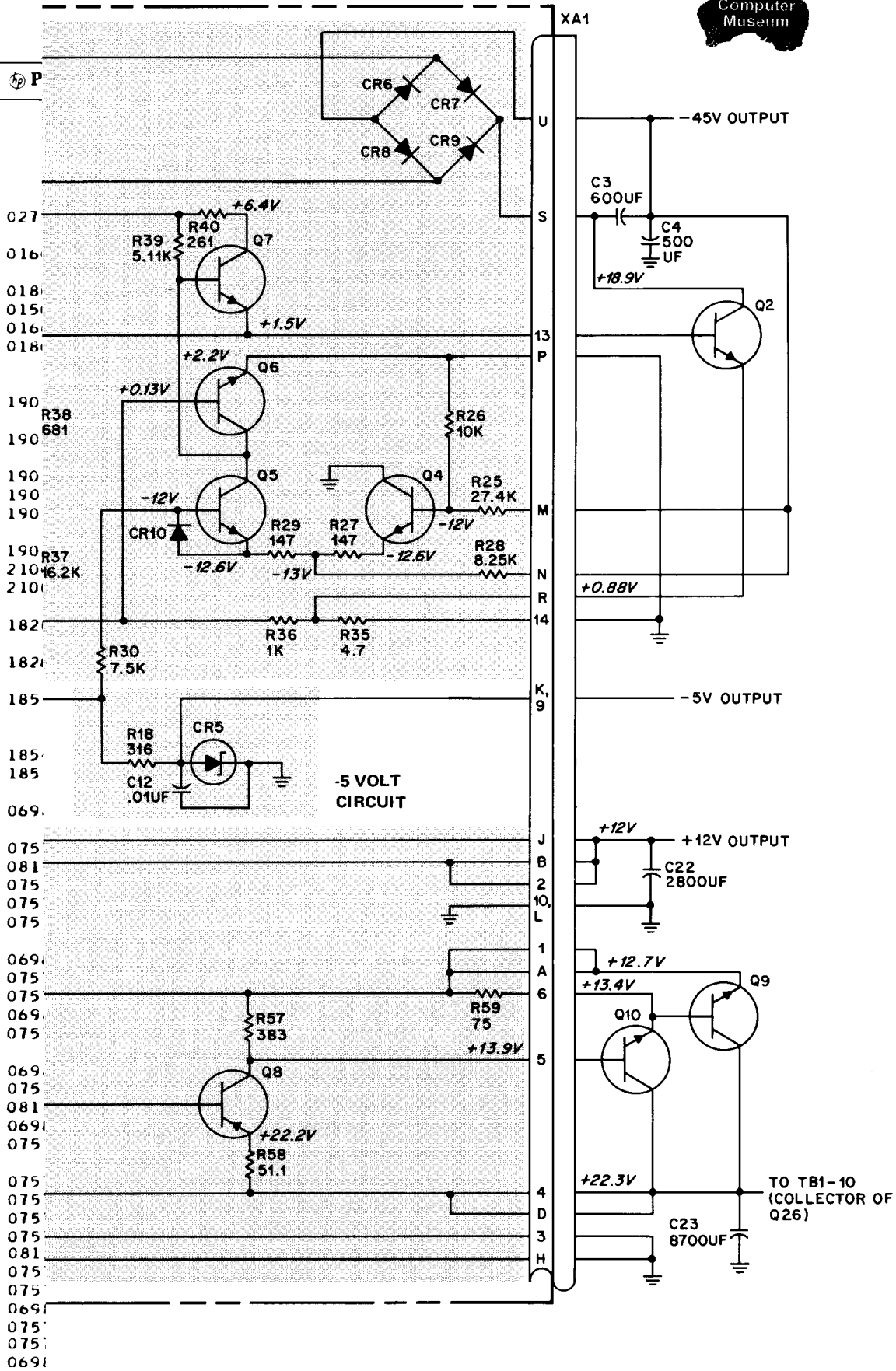
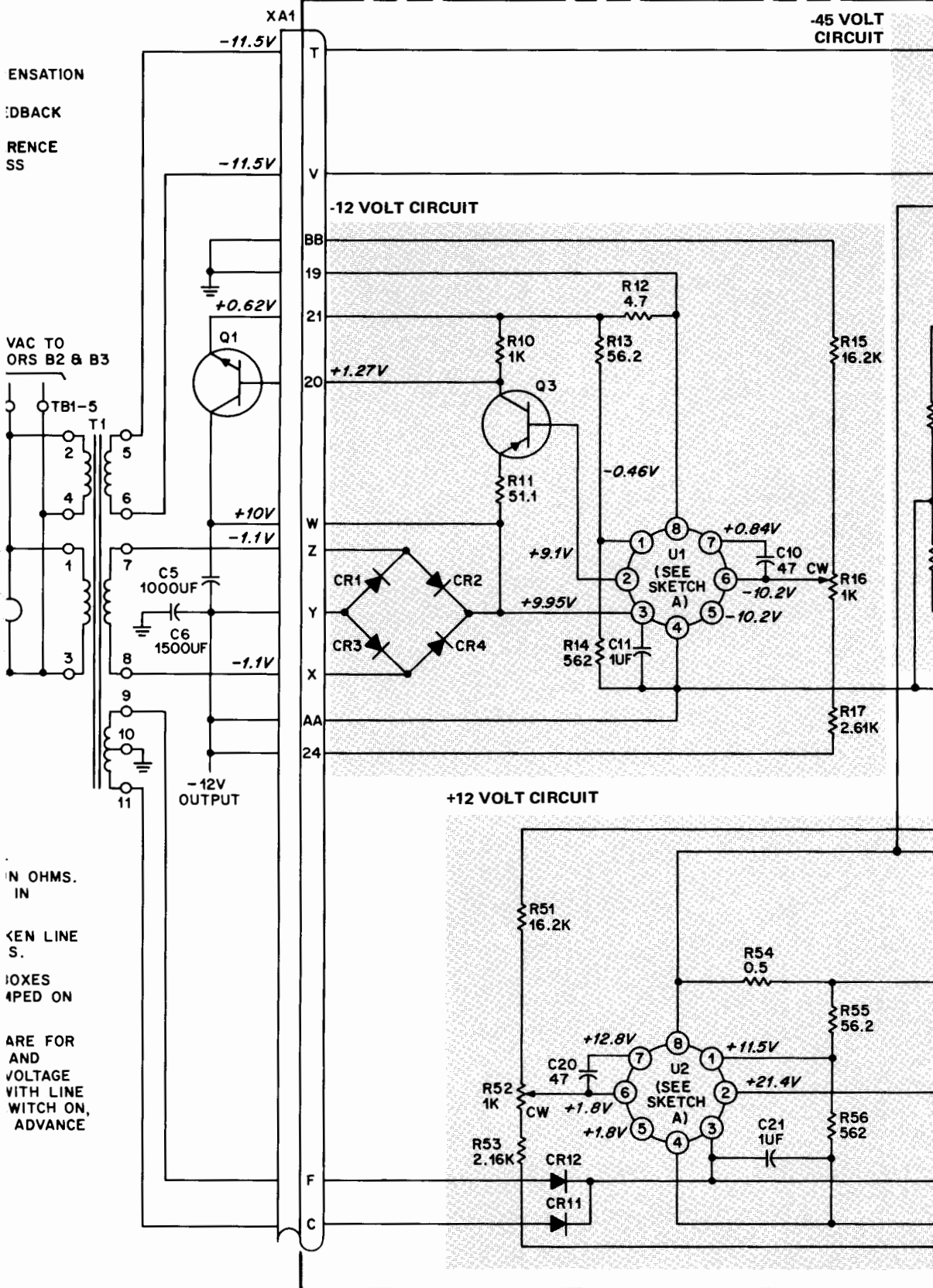


Figure 4-10. Power Supply Assembly A1 Schematic and Parts Location Diagrams

A1 POWER SUPPLY ASSEMBLY (02758-6004, REV B35)



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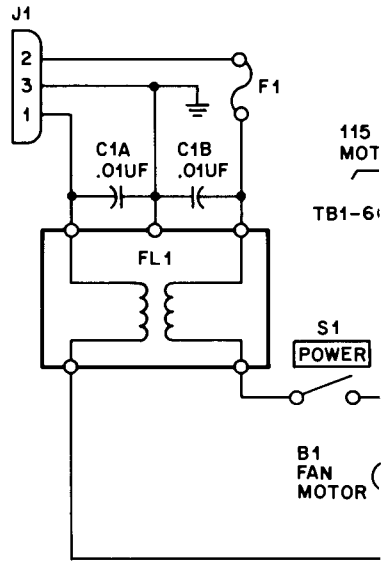
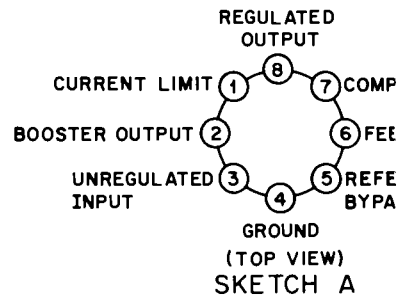
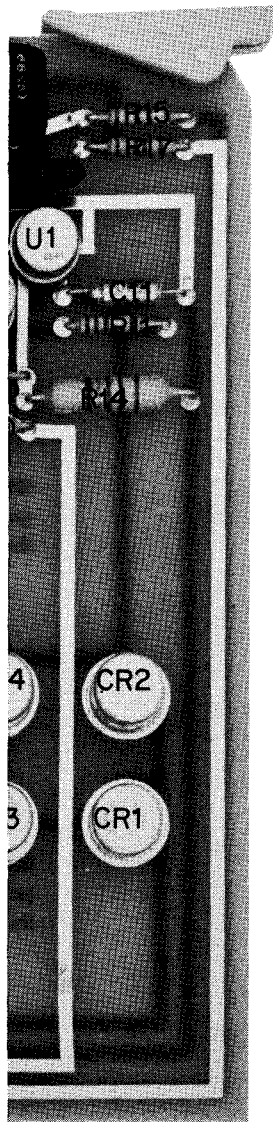
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IOXES  
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ARE FOR  
AND  
VOLTAGE  
VITH LINE  
WITCH ON,  
ADVANCE



- NOTES:
1. UNLESS OTHERWISE SPECIFIED- ALL RESISTANCE VALUES ARE IN OHMS. ALL CAPACITANCE VALUES ARE IN PICOFARADS.
  2. PARTS SHOWN OUTSIDE OF BOARD ARE MOUNTED ON MAIN CHASSIS.
  3. [RECTANGLE] INFORMATION SHOWN IN [RECTANGLE] DENOTES NOMENCLATURE FROM TAPE READER FRONT PANEL.
  4. REFERENCE VOLTAGES SHOWN FOR TROUBLESHOOTING PURPOSES REPRESENT NOMINAL VALUES. MEASUREMENTS WERE TAKEN AT 115 VOLTAGE AT 115 VAC, POWER SWITCH AND LOAD, READ, AND MANUAL SWITCHES OFF.

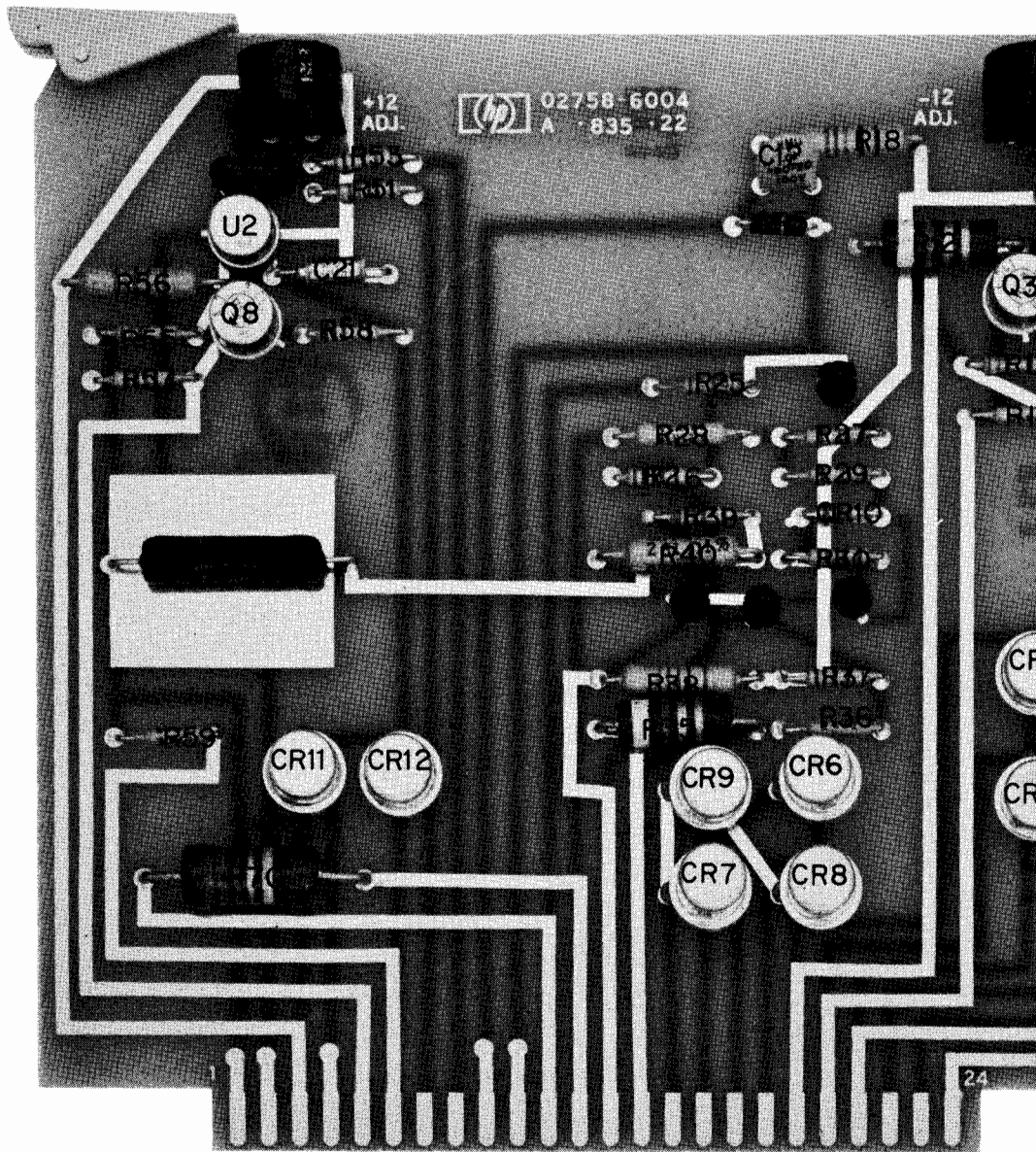


Table 4-7. Power Supply Assembly A1 Replaceable Parts

Reference Designation	Part No.	Description #	Note
A1	02758-6004	POWER SUPPLY ASSEMBLY	
A1C10	0160-2307	C:FXD MICA 47 PF 5%	
A1C11	0180-0291	C:FXD ELECT 1.0 UF 10% 35VDCW	
A1C12	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A1C2C	016C-2307	C:FXD MICA 47 PF 5%	
A1C21	0180-0291	C:FXD ELECT 1.0 UF 10% 35VDCW	
A1CR1- A1CR4	1901-0200	DIODE:SILICON 100 PIV 3A	
A1CR5	1902-0041	DIODE:BREAKDOWN 5.11V 5% 400MW	
A1CR6- A1CR9	1901-0200	DIODE:SILICON 100 PIV 3A	
A1CR10	1901-0081	DIODE:SILICON 50 VOLTS WORKING	
A1CR11	1901-0200	DIODE:SILICON 100 PIV 3A	
A1CR12	1901-0200	DIODE:SILICON 100 PIV 3A	
A1CR16	2100-1758	R:VAR WW 1K OHM 10% LIN 1/2W	
A1CR52	2100-1758	R:VAR WW 1K OHM 10% LIN 1/2W	
A1MC1	1820-0123	INTEGRATED CIRCUIT:VOLTAGE REGULATOR	
A1MC2	1820-0123	INTEGRATED CIRCUIT:VOLTAGE REGULATOR	
A1C3	1853-0041	TRANSISTOR:SILICON PNP	
A1C4- A1C7	1854-0071	TRANSISTOR:SILICON NPN	
A1C8	1853-0041	TRANSISTOR:SILICON PNP	
A1R1C	0698-3358	R:FXD MET FLM 1K OHM 0.5% 1/8W	
A1R11	0757-0394	R:FXD MET FLM 51.1 OHM 1% 1/8W	
A1R12	0811-1674	R:FXD WW 4.7 OHM 5% 2W	
A1R13	0757-0395	R:FXD MET FLM 56.2 OHM 1% 1/8W	
A1R14	0757-0815	R:FXD MET FLM 562 OHM 1% 1/2W	
A1R15	0757-0447	R:FXD MET FLM 16.2K OHM 1% 1/8W	
A1R18	0698-3402	R:FXD MET FLM 316 OHM 1% 1/2W	
A1R25	0757-0452	R:FXD MET FLM 27.4K OHM 1% 1/8W	
A1R26	0757-0442	R:FXD MET FLM 10.0K OHM 1% 1/8W	
A1R27	0698-3438	R:FXD MET FLM 147 OHM 1% 1/8W	
A1R28	0757-0752	R:FXD MET FLM 8.25K OHM 1% 1/4W	
A1R29	0698-3438	R:FXD MET FLM 147 OHM 1% 1/8W	
A1R30	0757-0440	R:FXD MET FLM 7.50K OHM 1% 1/8W	
A1R35	0811-1674	R:FXD WW 4.7 OHM 5% 2W	
A1R36	0698-3358	R:FXD MET FLM 1K OHM 0.5% 1/8W	
A1R37	0757-0447	R:FXD MET FLM 16.2K OHM 1% 1/8W	
A1R38	0757-0816	R:FXD MET FLM 681 OHM 1% 1/2W	
A1R39	0757-0438	R:FXD MET FLM 5.11K OHM 1% 1/8W	
A1R40	0757-1090	R:FXD MET FLM 261 OHM 1% 1/2W	
A1R53	0757-0447	R:FXD MET FLM 16.2K OHM 1% 1/8W	
A1R54	0813-0038	R:FXD WW 0.5 OHM 10% 5W	
A1R55	0757-0395	R:FXD MET FLM 56.2 OHM 1% 1/8W	
A1R56	0757-0815	R:FXD MET FLM 562 OHM 1% 1/2W	
A1R57	0698-3446	R:FXD MET FLM 383 OHM 1% 1/8W	
A1R58	0757-0394	R:FXD MET FLM 51.1 OHM 1% 1/8W	
A1R59	0757-0398	R:FXD MET FLM 75 OHM 1% 1/8W	
A1R7C	0698-3629	R:FXD MET UX 270 OHM 5% 2W	

# See introduction to this section for ordering information



# SECTION V REPLACEABLE PARTS



## 5-1. INTRODUCTION.

5-2. This section contains information for ordering replacement parts for the tape reader. Figures 5-1, 5-3, and 5-4 are parts location diagrams for the instrument. Figure 5-2 is an exploded view of the front panel assembly. Tables 5-1 through 5-4 are parts lists for the parts called out in figures 5-1 through 5-4, respectively. Index numbers for the parts in the figures and tables correspond to disassembly sequence for the instrument or assembly. Assembly order is the reverse of the disassembly order.

5-3. Separate parts lists and parts location diagrams are provided for each printed-circuit card. These are located in section IV of this manual, adjacent to the respective schematic diagrams for the cards. Parts are listed in these tables in alphanumeric order by reference designation. Table 5-5 is a total quantity listing of the parts for the cards only.

5-4. Tables 5-1 through 5-5 list the following information for each part:

- a. Hewlett-Packard part number

Note

When "Com1" appears in the HP PART NO. column for a particular part, that part should be available from normal commercial sources.

- b. Description of the part. (Refer to list of abbreviations below for explanation of abbreviations used in the DESCRIPTION column.)

- c. Typical manufacturer of the part as a five-digit code. (Refer to table 5-6 for a listing of the manufacturers that correspond to the codes.)

- d. Manufacturer's part number

- e. Total quantity of each part used in the instrument

Note

When the total quantity (TQ) column in the parts list indicates "REF" for a given part, the part has been listed previously in the table and the initial listing for the part should be referenced to determine the total quantity for that part.

5-5. Items in the DESCRIPTION column of the replaceable parts lists are indented to indicate item relationships, as follows:

DESCRIPTION

MAJOR ASSEMBLY

- . Subassembly
- . Attaching Parts for Subassembly
- .. Subassembly Parts
- .. Attaching Parts for Subassembly Parts

## 5-6. ORDERING INFORMATION.

5-7. To order replacement parts, address order or inquiry to the local Hewlett-Packard Field Office. (Refer to list at the end of this manual for addresses.) Specify the following information for each part ordered:

- a. Instrument model and serial number
- b. Hewlett-Packard stock number for each part
- c. Description of each part
- d. Circuit reference designation (if applicable).

REFERENCE DESIGNATIONS			
A = assembly	J = receptacle connector	TB = terminal board	
B = motor	K = relay	TP = test point	
BT = battery	L = inductor	U = integrated circuit	
C = capacitor	M = meter	V = vacuum tube, neon bulb, photocell, etc.	
CP = coupler	MC = microcircuit	VR = voltage regulator	
CR = diode	P = plug connector	W = cable, jumper	
DL = delay line	Q = transistor	X = socket	
DS = device signaling (lamp)	R = resistor	Y = crystal	
E = misc hardware	RT = thermistor	Z = tuned cavity, network	
F = fuse	S = switch		
FL = filter	T = transformer		
ABBREVIATIONS			
A = amperes	IMPG = impregnated	P/O = part of	
AC = alternating current	IN. = inch, inches	POLY = polystyrene	
AFC = automatic frequency control	INCD = incandescent	PORC = porcelain	
ALUM = aluminum	INCL = include(s)	POS = position(s)	
AL-ELECT = aluminum electrolytic	INS = insulation(ed)	POT = potentiometer	
ASSY = assembly	INT = internal	PP = peak-to-peak	
BFO = beat frequency oscillator	I/O = input/output	PT = point	
BE CU = beryllium copper	K = kilo = 1000	PWV = peak working voltage	
BH = binder head	LH = left hand	R = resistor	
BP = bandpass	LIN = linear taper	RECT = rectifier	
BRS = brass	LK WASH = lock washer	RF = radio frequency	
BWO = backward wave oscillator	LOG = logarithmic taper	RH = round head or right hand	
C = capacitor	LPF = low pass filter	RMO = rack mount only	
CCW = counterclockwise	M = milli = 10 <sup>-3</sup>	RMS = root-mean square	
CER = ceramic	MEG = mega = 10 <sup>6</sup>	RWV = reverse working voltage	
CMO = cabinet mount only	MET FLM = metal film	S-B = slow-blow	
COEF = coefficient	MET OX = metal oxide	SCR = screw	
COM = common	MFR = manufacturer	SE = selenium	
COMP = composition	MHz = megahertz	SECT = section(s)	
COMPL = complete	MINAT = miniature	SEMICON = semiconductor	
CONN = connector	MOM = momentary	SI = silicon	
CP = cadmium plate	MTG = mounting	SIL = silver	
CRT = cathode-ray tube	MY = Mylar	SL = slide	
CTL = capacitor-transistor logic	N = nano (10 <sup>-9</sup> )	SPDT = single-pole, double-throw	
CW = clockwise	N/C = normally closed	SPG = spring	
DC = direct current	NE = neon	SPL = special	
DEPC = deposited carbon	NI PL = nickel plate	SPST = single-pole, single-throw	
DPDT = double-pole, double-throw	NO = number	SR = split ring	
DPST = double-pole, single-throw	N/O = normally open	SST = stainless steel	
DR = drive	NPN = negative-positive-negative	STL = steel	
ELECT = electrolytic	NPO = negative positive zero (zero temperature coefficient)	TA = tantalum	
ENCAP = encapsulated	NRFR = not recommended for field replacement	TD = time delay	
EXT = external	NSR = not separately replaceable	TGL = toggle	
F = farads	OBD = order by description	THD = thread	
FH = flat head	OD = outer diameter	TI = titanium	
FIL H = fillister head	OH = oval head	TOL = tolerance	
FXD = fixed	OX = oxide	TRIM = trimmer	
G = giga (10 <sup>9</sup> )	P = peak	TTL = transistor-transistor logic	
GE = germanium	PC = printed circuit	TWT = traveling wave tube	
GL = glass	PF = picofarads = 10 <sup>-12</sup> farads	U (μ) = micro = 10 <sup>-6</sup>	
GRD = ground(ed)	PH = Phillips head	VAR = variable	
H = henries	PH BRZ = phosphor bronze	VDCW = direct current working volts	
HDW = hardware	PHL = Phillips	W/ = with	
HEX = hexagonal	PIV = peak inverse voltage	W = watts	
HG = mercury	PNP = positive-negative-positive	WIV = working inverse voltage	
HR = hour(s)		WW = wirewound	
HZ = hertz		W/O = without	
ID = inner diameter			
IF = intermediate frequency			

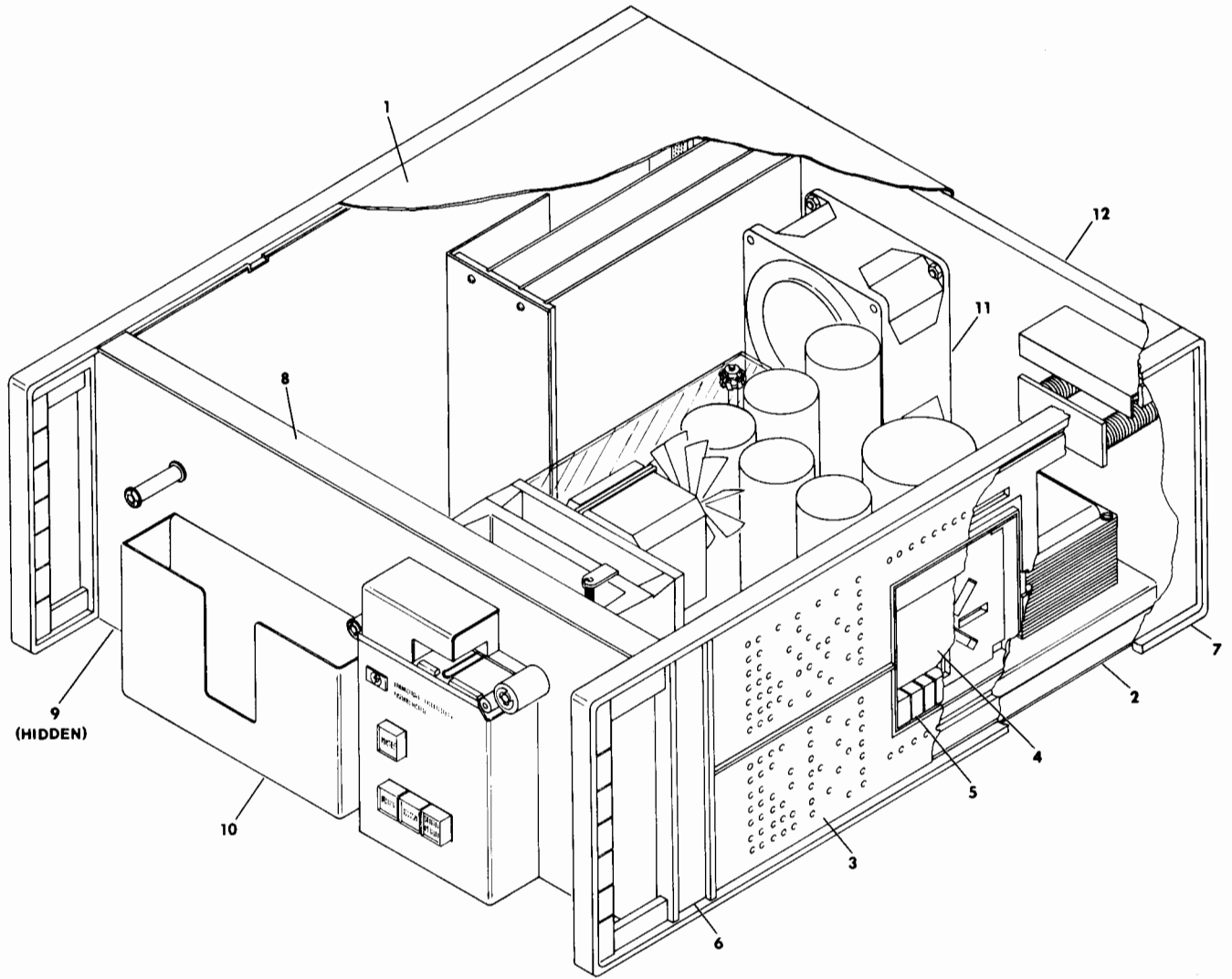


Figure 5-1. HP 2748A Tape Reader Parts Location Diagram

Table 5-1. HP 2748A Tape Reader Replaceable Parts

FIG. & INDEX NO.	HP PART NO.	DESCRIPTION	MFR. CODE	MFR.PART NO.	UNITS PER ASSY.	TQ
5-1-1	02748-00062	2748A TAPE READER • Top Cover (Attaching Parts)	28480	02748-00062	1	1
	Coml	• Screw, Machine, FH, No. 6-32, 5/8 in. --- X ---			4	8
2	02758-6019	• Bottom Cover (Attaching Parts)	28480	02758-6019	1	1
	Coml	• Screw, Machine, FH, No. 6-32, 5/8 in. --- X ---			4	REF
3	5000-0734	• Side Cover (Attaching Parts)	28480	5000-0734	1	2
	Coml	• Screw, Machine, FH, No. 6-32, 1/4 in. --- X ---			4	8
4	5060-0765	• Handle Retainer (Attaching Parts)	28480	5060-0765	1	2
	Coml	• Screw, Machine, PH, No. 8-32, 1/2 in. --- X ---			2	4
5	5060-0222	• Handle Assy, Side	28480	5060-0222	1	2
6	5000-0052	• Plastic Trim	28480	5000-0052	1	2
7	5060-0734	• Frame (Attaching Parts)	28480	5060-0734	1	2
	Coml	• Screw, Machine, FH, No. 8-32, 1/2 in.			4	8
	Coml	• Nut, Assembled Washer, No. 8-32, 5/8 in.			4	8
	Coml	• Screw, Machine, FH, No. 8-32, 5/8 in. --- X ---			5	10
	8	5020-0901	• Extrusion, Top	28480	5020-0901	1
9	5020-0900	• Extrusion, Bottom	28480	5020-0900	1	1
10		• Front Panel Assy (see fig 5-2)				
11		• Deck Assy (see fig 5-3)				
12		• Rear Panel Assy (see fig 5-4)				
	02748-6002	ACCESSORY not shown in fig. 5-1 Accessory Kit	28480	02748-6002		
	1251-0337	Connector, 50 pin	28480	1251-0337		
	1251-0339	Connector Housing	28480	1251-0339		
	1251-1908	Contacts	28480	1251-1908		
	8520-0017	Brush, Nylon	28480	8520-0017		
	5060-0777	Rack Mounting Kit	28480	5060-0777		
	02758-6017	Extender Board Assy	28480	02758-6017		

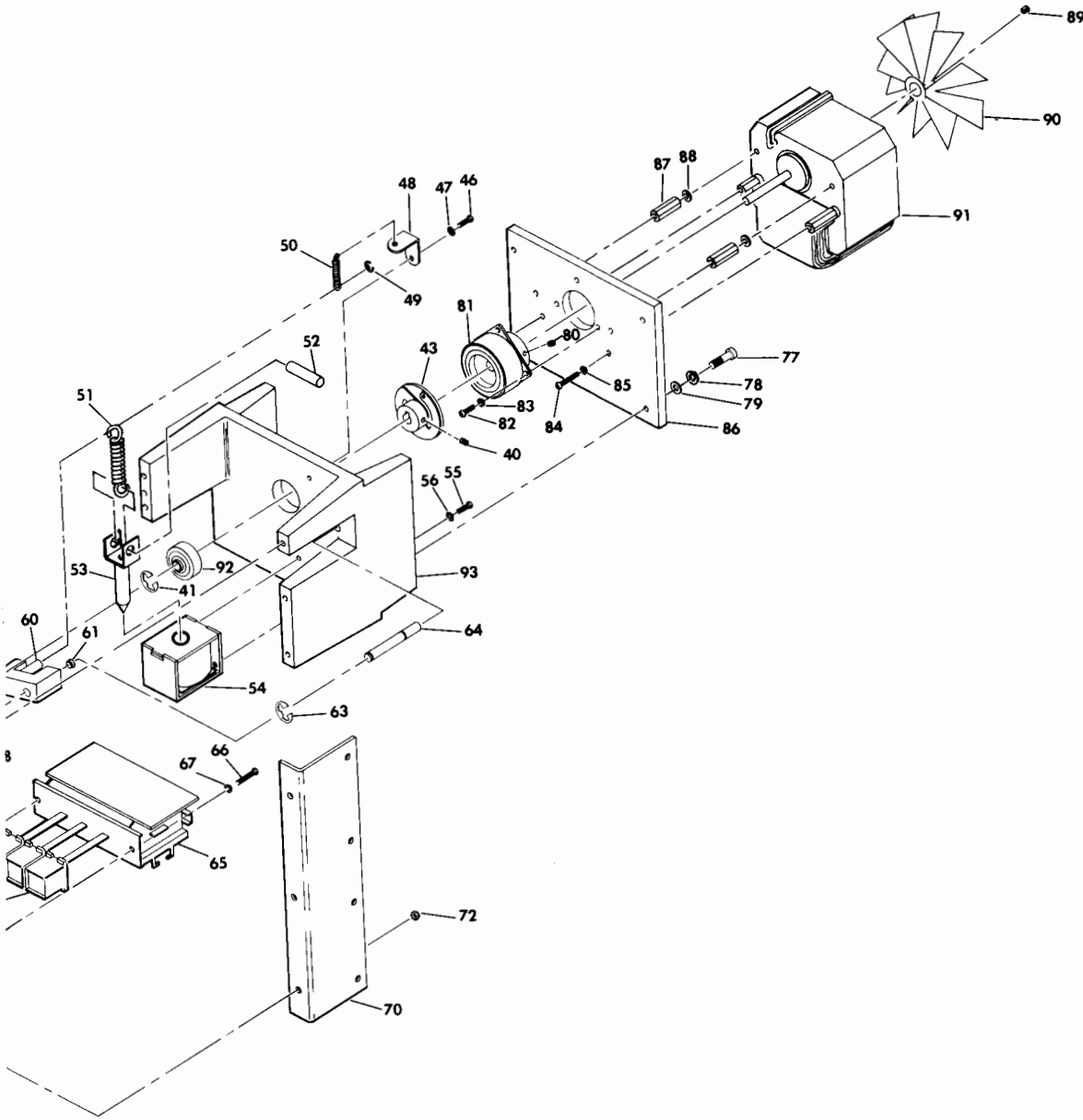


Figure 5-2. Front Panel Assembly Exploded View

2748A

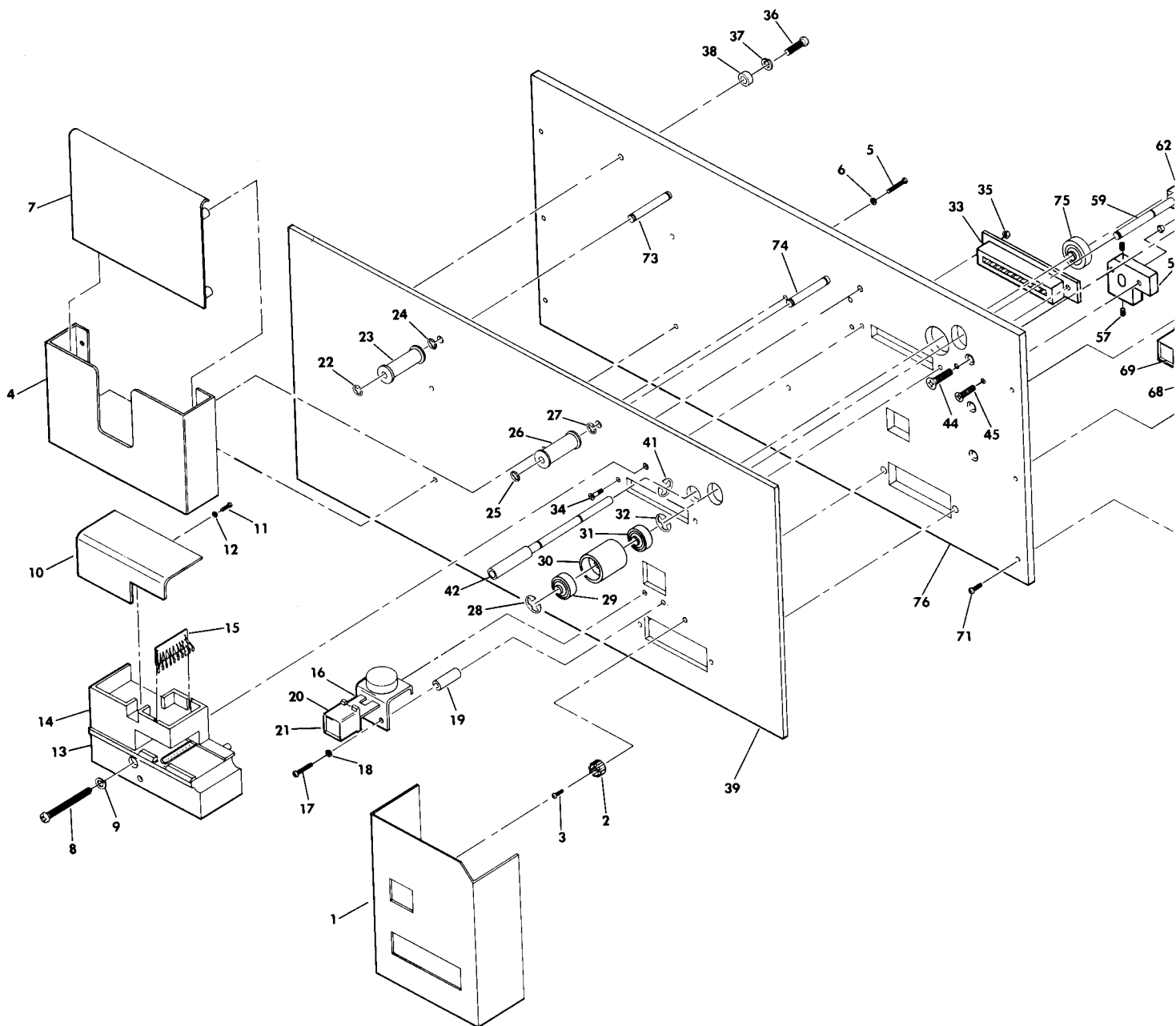



Table 5-2. Front Panel Assembly Replaceable Parts (Cont'd)

FIG. & INDEX NO.	HP PART NO.	DESCRIPTION	MFR. CODE	MFR.PART NO.	UNITS PER ASSY.	TQ
44	Coml	• Screw, Machine, FH, No. 8-32, 5/8 in.			1	1
45	Coml	• Screw, Machine, FH, No. 8-32, 1/2 in.			2	REF
46	Coml	• Screw, Machine, PH, No. 6-32, 3/8 in.			1	3
47	Coml	• Washer, Lock, No. 6			1	9
48	02758-0013	• Bracket, Spring	28480	02758-0013	1	1
49	Coml	• Ring, Retaining, Gripping, 1/8 in.			1	1
50	Coml	• Spring, • 1/8 in. OD			1	1
51	Coml	• Spring, • 1/4 in. OD			1	1
52	No Number	• Armature Pin (part of Solenoid, item 53) (Attaching Parts)				
	Coml	• Ring, Retaining, Gripping, 1/8 ---- X ----				
53	No Number	• Armature (part of Solenoid, item 53)				
54	0491-0046	• Solenoid (Attaching Parts)	73949	28DC-27-C-12U	1	1
55	Coml	• Screw, Machine, PH, No. 6-32, 3/8 in.			2	REF
56	Coml	• Washer, Lock, No. 6 ---- X ----			2	REF
57	Coml	• Set Screw, No. 8-32, 3/16 in.			2	2
58	2758-20466	• Spacer Block	28480	2758-20466	1	1
59	02758-2023	• Shaft, Load & Pinch Roller	28480	02758-2023	1	1
60	Coml	• Pin, Split 1/8 in, 1/2 in.			1	1
61	1410-0045	• Busing, bronze, .315 OD, .189 ID	28480	02758-2020	2	2
62	02758-2020	• Arm Load & Pinch Roller	28480	02758-2020	1	1
63	Coml	• Ring, Retaining, 3/16 in.			1	REF
64	02748-2001	• Shaft, Pinch Roller	28480	02748-2001	1	1
65	3101-0719	• Switch, Pushbutton (Attaching Parts)	28480	3101-0729	1	1
66	Coml	• Screw, Machine, FH, No. 6-32, 3/8 in.			2	2
67	Coml	• Washer, Lock, No. 6 ---- X ----			2	REF
68	0370-0118	• Pushbutton	28480	0370-0118	3	REF
69	02758-8006	• Label	28480	02758-8006	3	REF
70	02748-0004	• Panel, Bracket (Attaching Parts)	28480	02748-0004	2	2
71	Coml	• Screw, Machine, FH, No. 8-32, 1/2 in			6	8
72	Coml	• Nut, Plain, No. 8-32 ---- X ----			6	6
73	02748-2011	• Idler Shaft	28480	02748-2011	1	2
74	02748-2011	• Idler Shaft	28480	02748-2011	1	REF
75	Coml	• Bearing, Ball, Annular		1410-0015	1	REF
76	02748-2000	• Panel	28480	02748-2000	1	1
77	Coml	• Screw, Socket, Cap, No. 8-32, 5/8 in.			4	4
78	Coml	• Washer, Lock, No. 8			1	REF
79	Coml	• Washer, Flat, No. 8			4	4
80	Coml	• Setscrew, 4-40, 1/8 in.			1	REF
81	1500-0226	• Clutch (Attaching Parts)	16554	BEC-11CC-4-3	1	1
82	Coml	• Screw, Machine, Filh, No. 4-40, 5/16 in.			4	4
83	Coml	• Washer, Lock, No. 4 ---- X ----			4	REF
84	Coml	• Screw, Machine, PH, No. 6-32, 5/8 in.			4	4
85	Coml	• Washer, Lock, No. 6			4	REF
86	02748-2005	• Bearing Plate	28480	02748-2005	1	1
87	No Number	• Standoff (Part of Motor, item 88)				
88	Coml	• Washer, Flat, No. 6			4	4
89	3030-0001	• Set Screw, No. 8-32, 3/16 in.	28480	3030-0001	1	1
90	02758-2093	• Fan	28480	02758-2093	1	1
91	3140-0446	• Motor, Shaded Pole	28480	3140-0446	1	1
92	Coml	• Bearing, Ball, Annular	28480	1410-0015	1	REF
93	02748-2014	• Casting	28480	02748-2014	1	1

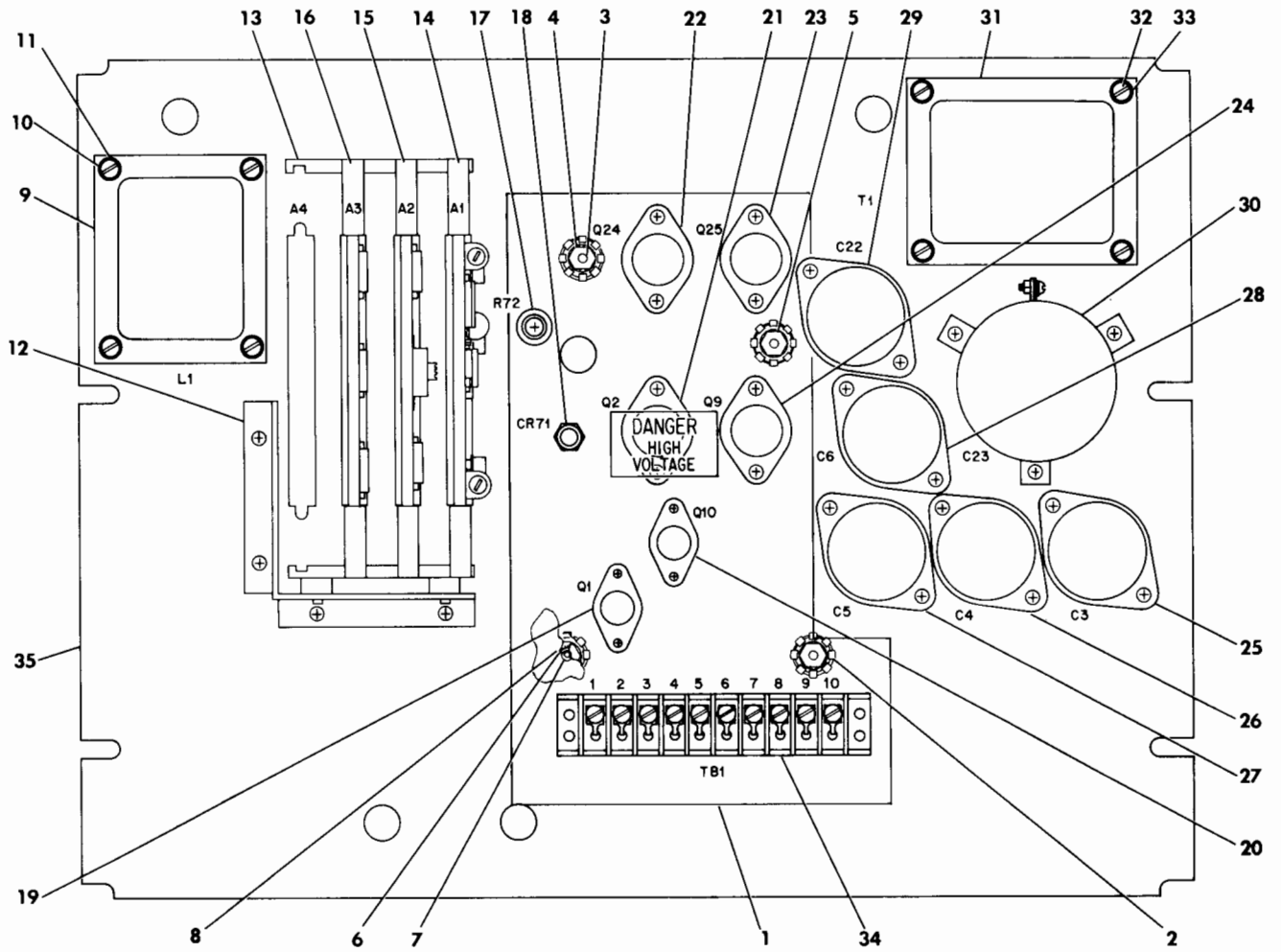


Figure 5-3. Deck Assembly Parts Location Diagram



Table 5-3. Deck Assembly Replaceable Parts

FIG. & INDEX NO.	HP PART NO.	DESCRIPTION	MFR. CODE	MFR.PART NO.	UNITS PER ASSY.	TQ
5-3-1	02758-20464	DECK ASSEMBLY	28480	02758-20464	1	1
	7120-0137	• High Voltage Shield	83309	3521	3	3
2	1390-0107	• Decal, High Voltage	13061	B10-B1	5	5
		• Button Latch (Attaching Parts)				
3	Coml	• Screw, Machine, FH, No. 6-32, 5/8 in.			4	4
4	Coml	• Nut, Assembled Washer, No. 6-32X 5/16 in.			4	4
5	Coml	• Washer, Flat, No. 6			4	4
	Coml	• Screw, Machine, FH, No. 6-32, 3/8 in.			4	8
		---- X ----				
6	02758-20465	• Spacer (Attaching Parts)	28480	02758-20465	4	4
7	Coml	• Screw, Machine, FH, No. 6-32, 3/8 in.			4	REF
8	Coml	• Washer, Lock, No. 6			4	4
		---- X ----				
9	9100-2801	• Choke, 2 Ohms, 1.0A (Attaching Parts)	28480	9100-2801	1	1
10	Coml	• Screw, Machine, slotted head, No. 8-32, 2-1/4 in.			4	8
11	Coml	• Washer, Nonmetallic, No. 8			4	8
	Coml	• Nut, Plain, Hexagon, No. 8-32			4	8
	Coml	• Washer, Lock, No. 8			4	8
	Coml	• Nut, Assembled Washer, No. 8-32			4	8
		---- X ----				
12	02758-0002	• PC Guide Bracket (Attaching Parts)	28480	02758-0002	1	1
	Coml	• Screw, Machine, PH, No. 6-32, 5/8 in.			4	6
	Coml	• Washer, Lock, No. 6			4	REF
		---- X ----				
13	02758-2008	• PC Guide (Attaching Parts)			1	1
	Coml	• Screw, Machine, PH, No. 6-32, 5/8 in.			2	REF
	Coml	• Washer, Lock, No. 6			4	REF
	Coml	• Spacer, 9/16 in.			2	2
	Coml	• Screw, Machine, PH, No. 6-32, 1-1/4 in.			2	2
	Coml	• Nut, Plain, Hexagon, No. 6-32			4	4
		---- X ----				
14	02758-6004	• Power Supply Assy A1 (see fig. 4-10)	28480	02758-6004	1	1
15	02748-6001	• Control Assy A2 (see fig. 4-9)	28480	02748-6001	1	1
16	02758-0003	• Interface Assy A3 (see fig. 4-8)	28480	02758-6003	1	1
17	0811-1655	• Resistor, fixed, WW, 10 ohms, 5%, 20W, R72	91637	0811-1655	1	1
18	1902-0035	• Diode, breakdown, 120V, 10W, CR71	28480	1902-0035	1	1
19	1854-0072	• Transistor, Si, NPN, Q1 (Attaching Parts)	02735	2N3054	1	2
	Coml	• Screw, Machine, PH, No. 6-32, 3/8 in.			2	12
	1200-0168	• Socket, Transistor, XQ1	28480	1200-0168	1	2
		---- X ----				
20	1854-0072	• Transistor, si, NPN, Q10 (Attaching Parts)	02735	2N3054	1	REF
	Coml	• Screw Machine, PH, No. 6-32, 3/8 in.			2	REF
	1200-0168	• Socket, Transistor (XQ10)	28480	1200-0040	1	REF
		---- X ----				
21	1854-0217	• Transistor, Si, NPN, Q2 (Attaching Parts)	02735	2N3442	1	4
	Coml	• Screw, Machine, PH, No. 6-32, 3/8 in.			2	REF
	1200-0041	• Socket, Transistor (XQ2)	28480	1200-0041	1	REF
		---- X ----				

Table 5-3. Deck Assembly Replaceable Parts (Cont'd)

FIG. & INDEX NO.	HP PART NO.	DESCRIPTION	MFR. CODE	MFR.PART NO.	UNITS PER ASSY.	TQ
22	1854-0217	• Transistor, Si, NPN, Q24 (Attaching Parts)	02735	2N3442	1	4
	Coml 1200-0041	• Screw, Machine, PH, No. 6-32, 3/8 in. • Socket, Transistor (XQ24) ---- X ----	28480	1200-0041	2 1	REF REF
23	1854-0217	• Transistor, Si, NPN, Q25 (Attaching Parts)	02735	2N3442	1	REF
	Coml 1200-0041	• Screw, Machine, PH, No. 6-32, 3/8 in. • Socket, Transistor (XQ25) ---- X ----	28480	1200-0041	2 1	REF REF
24	1854-0217	• Transistor, Si, NPN, Q9 (Attaching Parts)	02735	2N3442	1	REF
	Coml 1200-0041	• Screw, Machine, PH, No. 6-32, 3/8 in. • Socket, Transistor (XQ9) ---- X ----	28480	1200-0041	2 1	REF REF
25	0180-0046	• Capacitor, fxd, Elect, 600 $\mu$ f, -10 + 75%, 200VDCW, C3	56289	D32569-DFP	1	1
26	0180-0047	• Capacitor, fxd, Alum, 500 $\mu$ f, 75VDCW, C4	56289	D32443-DFP	1	1
27	0180-0056	• Capacitor, fxd, Elect, 1000 $\mu$ f, 50VDCW, C5	56289	D32429-DFP	1	1
28	0180-0198	• Capacitor, fxd, Elect, 1500 $\mu$ f, 50VDCW, C6	56289	D42962-DFP	1	1
29	0180-0204	• Capacitor, fxd, Al-elect, 2800 $\mu$ f, -10 +100%, 40VDCW, C22	56289	D37694-DFP	1	1
30	0180-1869	• Capacitor, fxd, Al-elect, 8700 $\mu$ f, +75 -10%, 50VDCW, C23 (Attaching Parts)	56289	32D8726050 BF2A-DQC	1	1
	Coml	• Screw, Machine, PH, No. 6-32, 3/8 in.			3	15
	Coml	• Washer, Lock, No. 6			1	5
	Coml	• Nut, Assembled, Washer, No. 6 ---- X ----			3	3
31	9100-1234	• Transformer, Power (Attaching Parts)	28480	9100-1234	1	1
32	Coml	• Screw, Machine, slotted head, No. 8-32,2-1/4 in.			4	REF
33	Coml	• Washer, Nonmetallic, No. 8			4	REF
	Coml	• Nut, Assembled Washer, No. 8-32, 11/32 in. ---- X ----			4	REF
34	0360-1156	• Barrier Block, 10 term. (Attaching Parts)	71785	353-18-10-001	1	1
	Coml	• Screw, Machine, PH, No. 6-32, 1/2 in. ---- X ----			2	2
35	02758-0004	• Deck	28480	02758-0004	1	1

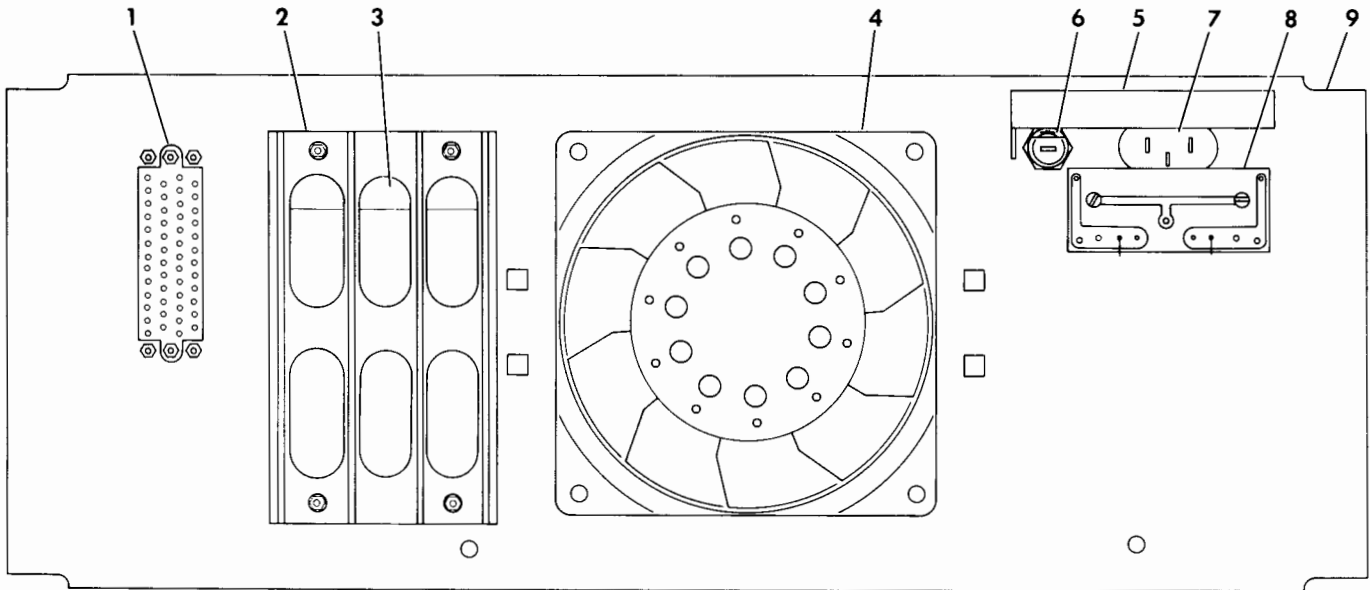


Figure 5-4. Rear Panel Assembly Parts Location Diagram

Table 5-4. Rear Panel Assembly Replaceable Parts

FIG. & INDEX	HP PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NO.	UNITS PER ASSY.	TQ	
5-4-1	1251-0338	REAR PANEL ASSEMBLY • Connector Insert, 50 pin (Attaching Parts)	95238	25-50-SS	1	1	
	Coml	• Screw, Machine, PH, No. 4-40, 3/8 in.			4	6	
	Coml	• Washer, Lock, No. 4			4	4	
2	02758-2008	• Nut, Plain, Hexagon, No. 4-40 ---- X ----	28480	02758-2008	4	4	
		• P.C. Guide (Attaching Parts)			1	1	
		Coml			• Screw, Machine, PH, No. 6-32, 5/8 in.	2	2
		Coml			• Screw, Machine, PH, No. 6-32, 1-1/4 in.	2	2
		Coml			• Washer, Lock, No. 6	4	8
3	02758-0003	• Spacer, 9/16 in.	28480	02758-0003	2	2	
		• Nut, Plain, Hexagon, No. 6-32 ---- X ----			4	4	
		• P.C. Guide Bracket (Attaching Parts)			1	1	
4	3160-0072	• Screw, Machine, PH, No. 6-32, 3/8 in.	23936	Model 2500	2	4	
		• Washer, Lock, No. 6 ---- X ----			2	REF	
		• Fan Assy, Tubeaxial (Attaching Parts)			1	1	
5	02758-0016	• Screw, Machine, FH, No. 6-32, 5/8 in.	28480	02758-0016	4	4	
		• Nut, Assembled Washer, No. 6-32, 5/16 in. ---- X ----			4	4	
		• Shield (Attaching Parts)			1	1	
6	1400-0084	• Screw, Machine, PH, No. 6-32, 3/8 in.	75915	342014	2	REF	
		• Washer, Lock, No. 6 ---- X ----			2	REF	
7	9100-2183	• Fuse, 4A, F1	28480	9100-2183	1	1	
		• Fuse Holder, XF1			1	1	
8	0150-0119	• Line Filter (Attaching Parts)	28480	5020-1917	1	1	
		• Screw, Machine, PH, No. 4-40, 3/8 in.			2	REF	
		• Washer, Lock, No. 4			2	2	
9	02748-0006	• Standoff ---- X ----	28480	5020-1917	2	2	
		• Capacitor, fixed, Cer, 2x.01 $\mu$ f, 20% 2500VDCW, C1			56289	32C219A-CDH	1
8	1251-0148	• Connector, Receptacle, power, J1	82389	AC3G	1	1	
		• Cover, Fan Filter			28480	5060-0878	1
9	02748-0006	• Rear Panel (Attaching Parts)	28480	02748-0006	1	1	
		• Screw, Machine, PH, No. 8-32, 3/8 in.			2	2	
		• Washer, Lock, No. 8			2	2	

Table 5-5. Printed-Circuit Card Replaceable Parts

Part No.	Description #	Mfr.	Mfr. Part No.	TQ
0140-C200	C:FXD MICA 390 PF 5%	28480	0140-0200	1
0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	91418	TA	1
0160-0300	C:FXD MY 0.0027 UF 10% 200VDCW	28480	0160-0300	1
0160-2204	C:FXD MICA 100 PF 5%	28480	0160-2204	9
0160-2307	C:FXD MICA 47 PF 5%	28480	0160-2307	2
0180-0089	C:FXD ELECT 10UF-10%+100% 150VDCW	56289	30D106G150DF4	2
0180-0291	C:FXD ELECT 1.0 UF 10% 35VDCW	28480	0180-0291	2
0686-1035	R:FXD COMP 10K OHM 5% 1/2W	01121	EB 1035	9
0698-0083	R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083	2
0698-3136	R:FXD MET FLM 17.8K OHM 1% 1/8W	28480	0698-3136	9
0698-3152	R:FXD MET FLM 3.48K OHM 1% 1/8W	28480	0698-3152	1
0698-3156	R:FXD MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156	11
0698-3157	R:FXD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157	1
0698-3159	R:FXD MET FLM 26.1K OHM 1% 1/8W	28480	0698-3159	1
0698-3266	R:FXD MET FLM 237K OHM 1% 1/8W	28480	0698-3266	1
0698-3358	R:FXD MET FLM 1K OHM 0.5% 1/8W	28480	0698-3358	2
0698-3402	R:FXD MET FLM 316 OHM 1% 1/2W	28480	0698-3402	1
0698-3404	R:FXD MET FLM 383 OHM 1% 1/2W	28480	0698-3404	2
0698-3438	R:FXD MET FLM 147 OHM 1% 1/8W	28480	0698-3438	2
0698-3444	R:FXD MET FLM 316 OHM 1% 1/8W	28480	0698-3444	1
0698-3446	R:FXD MET FLM 383 OHM 1% 1/8W	28480	0698-3446	1
0698-3629	R:FXD MET UX 270 OHM 5% 2W	28480	0698-3629	1
C757-0280	R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280	2
C757-0317	R:FXD MET FLM 1.33K OHM 1% 1/8W	28480	0757-0317	1
C757-0338	R:FXD MET FLM 1.00K OHM 1% 1/4W	28480	0757-0338	1
C757-0394	R:FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394	2
0757-0395	R:FXD MET FLM 56.2 OHM 1% 1/8W	28480	0757-0395	2
0757-0398	R:FXD MET FLM 75 OHM 1% 1/8W	28480	0757-0398	1
C757-0428	R:FXD MET FLM 1.62K OHM 1% 1/8W	28480	0757-0428	1
0757-0438	R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438	4
0757-0439	R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439	2
0757-0440	R:FXD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440	1
0757-0442	R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442	1
0757-0443	R:FXD MET FLM 11.0K OHM 1% 1/8W	28480	0757-0443	5
0757-0446	R:FXD MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446	5
0757-0447	R:FXD MET FLM 16.2K OHM 1% 1/8W	28480	0757-0447	3
0757-0452	R:FXD MET FLM 27.4K OHM 1% 1/8W	28480	0757-0452	1
0757-0458	R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458	3
0757-0460	R:FXD MET FLM 61.9K OHM 1% 1/8W	28480	0757-0460	5
0757-0465	R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465	10
0757-0470	R:FXD MET FLM 162K OHM 1% 1/8W	28480	0757-0470	1
0757-0731	R:FXD MET FLM 825 OHM 1% 1/4W	28480	0757-0731	1
0757-0752	R:FXD MET FLM 8.25K OHM 1% 1/4W	91637	MF-1/8-44	1
0757-0815	R:FXD MET FLM 562 OHM 1% 1/2W	28480	0757-0815	2
0757-0816	R:FXD MET FLM 681 OHM 1% 1/2W	28480	0757-0816	1
0757-1090	R:FXD MET FLM 261 OHM 1% 1/2W	28480	0757-1090	1
0760-0024	R:FXD MET UX FLM 100 OHM 5% 1W	28480	0760-0024	1
0764-0013	R:FXD MET UX 56 OHM 5% 2W	28480	0764-0013	4
0811-1674	R:FXD WW 4.7 OHM 5% 2W	28480	0811-1674	2
0813-0038	R:FXD WW 0.5 OHM 10% 5W	28480	0813-0038	1
1820-C123	INTEGRATED CIRCUIT:VOLTAGE REGULATOR	12040	LM300	2
1853-CC41	TRANSISTOR:SILICON PNP	02735	38640	2
1854-0C71	TRANSISTOR:SILICON NPN	28480	1854-0C71	24

# See introduction to this section for ordering information

Table 5-5. Printed-Circuit Card Replaceable Parts (Cont'd)

Part No.	Description #	Mfr.	Mfr. Part No.	TQ
1854-0246	TRANSISTOR:SILICON NPN	07263	2N3643	2
1901-0049	DIODE:SILICON 50PIV	28480	1901-0049	1
1901-0081	DIODE:SILICON 50 VOLTS WORKING	28480	1901-0081	19
1901-0200	DIODE:SILICON 100 PIV 3A	02735	1N4998	10
1901-0416	DIODE:SILICON 200PIV 3A	28480	1901-0416	5
1902-0041	DIODE:BREAKDOWN 5.11V 5% 400MW	28480	1902-0041	1
2100-1758	R:VAR WW 1K OHM 10% LIN 1/2W	28480	2100-1758	2
02748-6001	CONTROL ASSEMBLY	28480	02748-6001	1
02758-6003	INTERFACE ASSEMBLY	28480	02758-6003	1
02758-6004	POWER SUPPLY ASSEMBLY	28480	02758-6004	1

# See introduction to this section for ordering information

Table 5-6. 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.

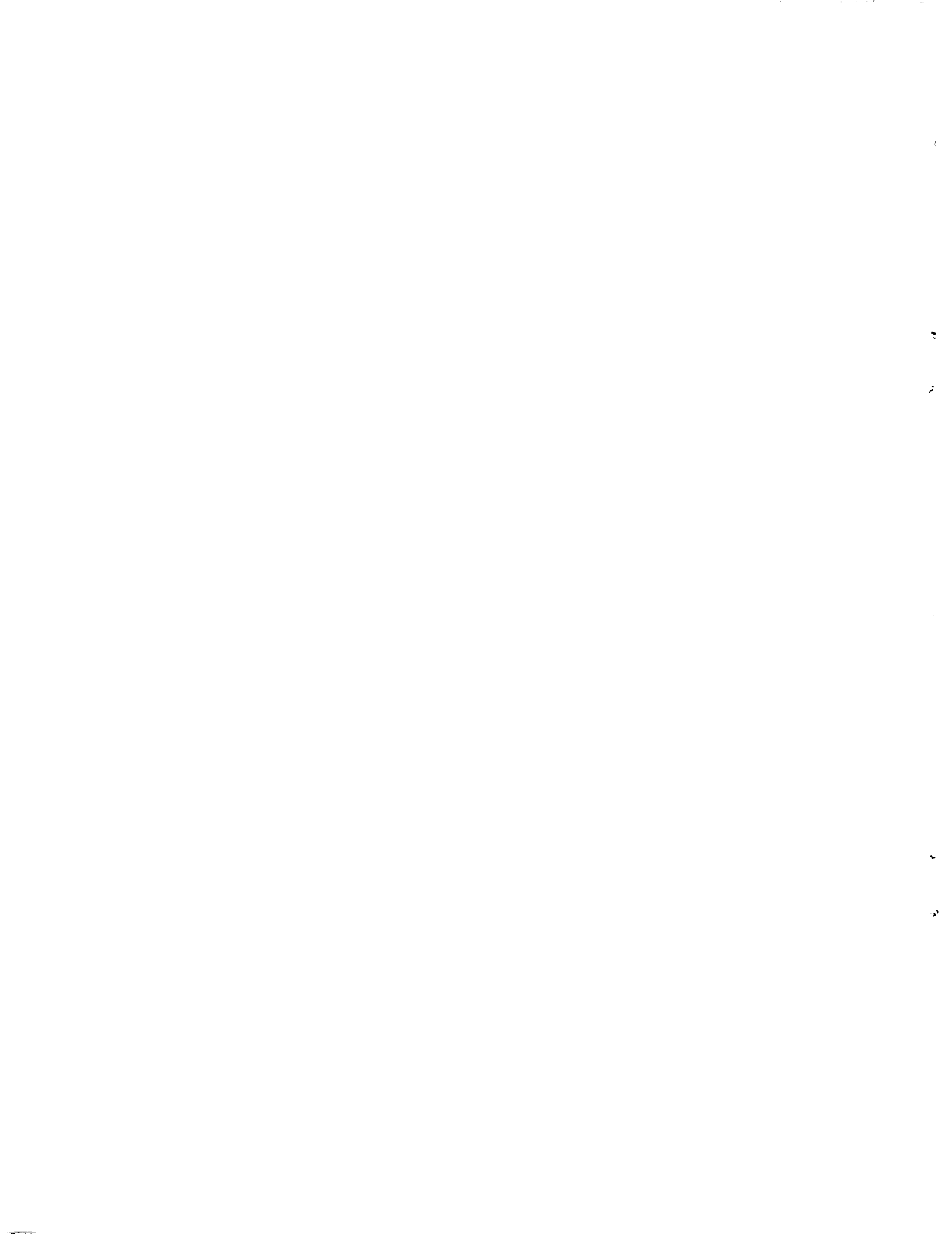
Code No.	Manufacturer	Address	Code No.	Manufacturer	Address	Code No.	Manufacturer	Address
00000	U. S. A. Common	Any supplier of U. S.	05245	Components Corp.	Chicago, Ill.	09145	Tech. Ind. Inc. Alohm Elect.	Burbank, Calif.
00136	McDoy Electronics	Mount Holly Springs, Pa.	05277	Westinghouse Electric Corp.		09250	Electro Assemblies, Inc.	Chicago, Ill.
00213	Sage Electronics Corp.	Rochester, N. Y.		Semi-Conductor Dept.	Youngwood, Pa.	09353	C & K Components Inc.	Newton, Mass.
00287	Cemco Inc.	Danielson, Conn.	05347	Ultronix, Inc.	San Mateo, Calif.	09569	Malfory Battery Co. of	
00334	Humidial	Colton, Calif.		Elect. Div.			Canada, Ltd.	Toronto, Ontario, Canada
00348	Microtron Co., Inc.	Valley Stream, N. Y.	55574	Viking Ind. Inc.	New York, N. Y.	09922	Burdny Corp.	Norwalk, Conn.
00373	Garlock Inc.	Cherry Hill, N. J.	05593	Icore Electro-Plastics Inc.	Sunnyvale, Calif.	10214	General Transistor Western Corp.	
00656	Aerovox Corp.	New Bedford, Mass.	05616	Cosmo Plastic				Los Angeles, Calif.
00779	Amp. Inc.	Harrisburg, Pa.		(c/o Electrical Spec. Co.)	Cleveland, Ohio	10411	Ti-Tal, Inc.	Berkeley, Calif.
00781	Aircraft Radio Corp.	Boonton, N. J.	05624	Barber Colman Co.	Rockford, Ill.	10646	Carborundum Co.	Niagara Falls, N. Y.
00815	Northern Engineering Laboratories, Inc.		05728	Tiffen Optical Co.		11236	CTS of Berne, Inc.	Berne, Ind.
		Burlington, Wis.			Roslyn Heights, Long Island, N. Y.	11237	Chicago Telephone of California, Inc.	
00853	Sangamo Electric Co., Pickens Div.	Pickens, S. C.	05729	Metro-Tel Corp.	Westbury, N. Y.			So. Pasadena, Calif.
00866	Goe Engineering Co.	City of Industry, Cal.	05783	Stewart Engineering Co.	Santa Cruz, Calif.	11242	Bay State Electronics Corp.	Waltham, Mass.
00891	Carl E. Holmes Corp.	Los Angeles, Calif.	05820	Wakefield Engineering Inc.	Wakefield, Mass.	11312	Teledyne Inc., Microwave Div.	Palo Alto, Calif.
00929	Microlab Inc.	Livingston, N. J.	06004	Bassick Co., Div. of Stewart Warner Corp.		11314	National Seal	Downey, Calif.
01002	General Electric Co., Capacitor Dept.				Bridgeport, Conn.	11453	Precision Connector Corp.	Jamaica, N. Y.
		Hudson Falls, N. Y.	06090	Raychem Corp.	Redwood City, Calif.	11534	Duncan Electronics Inc.	Costa Mesa, Calif.
01009	Alden Products Co.	Brockton, Mass.	06175	Bausch and Lomb Optical Co.	Rochester, N. Y.	11711	General Instrument Corp., Semiconductor	
01121	Allen Bradley Co.	Milwaukee, Wis.	06402	E. T. A. Products Co. of America	Chicago, Ill.		Div., Products Group	Newark, N. J.
01255	Litton Industries, Inc.	Beverly Hills, Calif.	06540	Anatom Electronic Hardware Co., Inc.		11717	Imperial Electronic, Inc.	Buena Park, Calif.
01281	TRW Semiconductors, Inc.	Lawndale, Calif.			New Rochelle, N. Y.	11870	Melabs, Inc.	Palo Alto, Calif.
01295	Texas Instruments, Inc.,		06555	Beede Electrical Instrument Co., Inc.		12040	National Semiconductor	Danbury, Conn.
	Transistor Products Div.	Dallas, Texas			Indianapolis, Ind.	12136	Philadelphia Handle Co.	Camden, N. J.
01349	The Alliance Mfg. Co.	Alliance, Ohio	06666	General Devices Co., Inc.	Indianapolis, Ind.	12361	Grove Mfg. Co., Inc.	Shady Grove, Pa.
01589	Pacific Relays, Inc.	Van Nuys, Calif.	06751	Components Inc., Ariz. Div.	Phoenix, Ariz.	12574	Gulton Ind. Inc. Data System Div.	
01670	Gudobrod Bros. Silk Co.	New York, N. Y.	06812	Torrington Mfg. Co., West Div.				Albuquerque, N. M.
01930	Amerock Corp.	Rockford, Ill.			Van Nuys, Calif.	12697	Clarostat Mfg. Co.	Dover, N. H.
01961	Pulse Engineering Co.	Santa Clara, Calif.	06980	Varian Assoc. Eimac Div.	San Carlos, Calif.	12728	Elmar Filter Corp.	W. Haven, Conn.
02114	Ferroxcube Corp. of America	Saugerties, N. Y.	07088	Kelvin Electric Co.	Van Nuys, Calif.	12859	Nippon Electric Co., Ltd.	Tokyo, Japan
02116	Wheelock Signals, Inc.	Long Branch, N. J.	07126	Digitran Co.	Pasadena, Calif.	12861	Metex Electronics Corp.	Clark, N. J.
02286	Cole Rubber and Plastics Inc.	Sunnyvale, Calif.	07137	Transistor Electronics Corp.	Minneapolis, Minn.	12930	Delta Semiconductor Inc.	Newport Beach, Calif.
02660	Amphenol-Borg Electronics Corp.	Broadview, Ill.	07138	Westinghouse Electric Corp.		12954	Dickson Electronics Corp.	Scottsdale, Arizona
02735	Radio Corp. of America, Semiconductor			Electronic Tube Div.	Elmira, N. Y.	13103	Thermolloy	Dallas, Texas
	and Materials Div.	Somerville, N. J.	07149	Filmohm Corp.	New York, N. Y.	13396	Telefunken (GmbH)	Hanover, Germany
02771	Vocaline Co. of America, Inc.		07233	Cinch-Graphik Co.	City of Industry, Calif.	13835	Midland-Wright Div. of Pacific Industries, Inc.	
		Old Saybrook, Conn.	07256	Silicon Transistor Corp.	Carle Place, N. Y.			Kansas City, Kansas
02777	Hopkins Engineering Co.	San Fernando, Calif.	07261	Avnet Corp.	Culver City, Calif.	14099	Sem-Tech	Newbury Park, Calif.
02875	Hudson Tool & Die Co.	Newark, N. J.	07263	Fairchild Camera & Inst. Corp.		14193	Calif. Resistor Corp.	Santa Monica, Calif.
03508	G. E. Semiconductor Prod. Dept.	Syracuse, N. Y.		Semiconductor Div.	Mountain View, Calif.	14298	American Components, Inc.	Conshohocken, Pa.
03705	Apex Machine & Tool Co.	Dayton, Ohio	07322	Minnesota Rubber Co.	Minneapolis, Minn.	14433	ITT Semiconductor, A Div. of Int. Telephone	
03797	Eldema Corp.	Compton, Calif.	07387	Birther Corp., The	Monterey Park, Calif.		& Telegraph Corp.	West Palm Beach, Fla.
03818	Parker Seal Co.	Los Angeles, Calif.	07397	Sylvania Elect. Prod. Inc., Mt. View Operations		14493	Hewlett-Packard Company	Loveled, Colo.
03877	Transitron Electric Corp.	Wakefield, Mass.			Mountain View, Calif.	14655	Cornell Dublier Electric Corp.	Newark, N. J.
03888	Pyrofilm Resistor Co., Inc.	Cedar Knolls, N. J.	07700	Technical Wire Products Inc.	Cranford, N. J.	14674	Corning Glass Works	Corning, N. Y.
03954	Singer Co., Dial Div.		07829	Bodine Elect. Co.	Chicago, Ill.	14752	Electro Tube Inc.	San Gabriel, Calif.
	Finderne Plant	Sumerville, N. J.	07910	Conventional Device Corp.	Hawthorne, Calif.	14960	Williams Mig. Co.	San Jose, Calif.
04009	Arrow, Hart and Hegeman Elect. Co.		07933	Raytheon Mfg. Co.,		15203	Webster Electronics Co.	New York, N. Y.
		Hartford, Conn.		Semiconductor Div.	Mountain View, Calif.	15287	Scronics Corp.	Northridge, Calif.
04013	Taurus Corp.	Lambertville, N. J.	07980	Hewlett-Packard Co., Boonton Radio Div.		15291	Adjustable Bushing Co.	N. Hollywood, Calif.
04062	Arco Electronic Inc.	Great Neck, N. Y.			Rockaway, N. J.	15558	Micron Electronics	
04222	Hi-Q Division of Aerovox	Myrtle Beach, S. C.	08145	U. S. Engineering Co.	Los Angeles, Calif.			Garden City, Long Island, N. Y.
04354	Precision Paper Tube Co.	Wheeling, Ill.	08289	Blinn, Delbert Co.	Pomona, Calif.	15566	Amprobe Inst. Corp.	Lynbrook, N. Y.
04404	Dymec Division of Hewlett-Packard Co.		08358	Burgess Bottery Co.		15631	Cabletronics	Costa Mesa, Calif.
		Palo Alto, Calif.			Niagara Falls, Ontario, Canada	15772	Twentieth Century Coil Spring Co.	
04651	Sylvania Electric Products, Microwave		08524	Deutsch Fastener Corp.	Los Angeles, Calif.			Santa Clara, Calif.
	Device Div.	Mountain View, Calif.	08664	Bristol Co., The	Waterbury, Conn.	15801	Fenwal Elect. Inc.	Framingham, Mass.
04673	Dakota Engi. Inc.	Culver City, Calif.	08717	Sloan Company	Sun Valley, Calif.	15818	Amelco Inc.	Mt. View, Calif.
04713	Motorola Inc., Semiconductor Prod. Div.		08718	ITT Cannon Electric Inc., Phoenix Div.		16037	Spruce Pine Mica Co.	Spruce Pine, N. C.
		Phoenix, Arizona			Phoenix, Arizona	16179	Omni-Spectra Inc.	Farmington, Mich.
04732	Fulton Co., Inc. Western Div.		08727	National Radio Lab. Inc.	Paramus, N. J.	16352	Computer Diode Corp.	Lodi, N. J.
		Culver City, Calif.	08792	CBS Electronics Semiconductor		16585	Boots Aircraft Nut Corp.	Pasadena, Calif.
04773	Automatic Electric Co.	Northlake, Ill.		Operations, Div of C. B. S. Inc.		16688	Ideal Prec. Meter Co., Inc.	
04796	Sequora Wire Co.	Redwood City, Calif.			Lowell, Mass.		De Jur Meter Div.	Brooklyn, N. Y.
04811	Precision Coil Spring Co.	El Monte, Calif.	08806	General Electric Co. Miniat. Lamp Dept.		16758	Delco Radio Div. of G. M. Corp.	Kokoma, Ind.
04870	P. M. Motor Company	Westchester, Ill.			Cleveland, Ohio	17109	Thermonetics Inc.	Canoga Park, Calif.
04919	Component Mfg. Service Co.		08984	Mel-Rain	Indianapolis, Ind.	17474	Tranex Company	Mountain View, Calif.
		W. Bridgewater, Mass.	09026	Babcock Relays Div.	Costa Mesa, Calif.	17554	Components Inc.	Biddeford, Ma.
05006	Twentieth Century Plastics, Inc.	Los Angeles, Calif.	09134	Texas Capacitor Co.	Houston, Texas	17675	Hamlin Metal Products Corp.	Akron, Ohio
						17745	Angstrom Prec. Inc.	No. Hollywood, Calif.

Table 5-6. Code List of Manufacturers (Continued)

Code No.	Manufacturer	Address	Code No.	Manufacturer	Address	Code No.	Manufacturer	Address
17870	McGraw-Edison Co.	Manchester, N. H.	62119	Universal Electric Co.	Owosso, Mich.	73899	JFD Electronics Corp.	Brooklyn, N. Y.
18042	Power Design Pacific Inc.	Palo Alto, Calif.	63743	Ward-Leonard Electric Co.	Mt. Vernon, N. Y.	73905	Jennings Radio Mfg. Corp.	San Jose, Calif.
18083	Clevite Corp., Semiconductor Div.	Palo Alto, Calif.	64959	Western Electric Co., Inc.	New York, N. Y.	73957	Groov-Pin Corp.	Ridgefield, N. J.
18324	Signetics Corp.	Sunnyvale, Calif.	65092	Weston Inst. Inc. Weston-Newark	Newark, N. J.	74276	Signalite Inc.	Neptune, N. J.
18476	Ty-Car Mfg. Co., Inc.	Holliston, Mass.	66295	Wittke Mfg. Co.	Chicago, Ill.	74455	J. H. Winns, and Sons	Winchester, Mass.
18486	TRW Elect. Comp. Div.	Des Plaines, Ill.	66346	Minnesota Mining & Mfg. Co. Revere	Mincom Div. St. Paul, Minn.	74861	Industrial Condenser Corp.	Chicago, Ill.
18583	Curtis Instrument, Inc.	Mt. Kisco, N. Y.	70276	Allen Mfg. Co.	Hartford, Conn.	74868	R. F. Products Division of Amphenol-Borg	Electronics Corp. Danbury, Conn.
18612	Vishay Instruments Inc.	Malvern, Pa.	70309	Allied Control	New York, N. Y.	74970	E. F. Johnson Co.	Waseca, Minn.
18873	E. I. DuPont and Co., Inc.	Wilmington, Del.	70318	Allmetal Screw Product Co., Inc.	Garden City, N. Y.	75042	International Resistance Co.	Philadelphia, Pa.
18911	Durant Mfg. Co.	Milwaukee, Wis.	70417	Amplex, Div. of Chrysler Corp.	Detroit, Mich.	75263	Keystone Carbon Co., Inc.	St. Marys, Pa.
19315	The Bendix Corp., Navigation & Control Div.	Teterboro, N. J.	70485	Atlantic India Rubber Works, Inc.	Chicago, Ill.	75378	CTS Knights Inc.	Sandwich, Ill.
19500	Thomas A. Edison Industries, Div. of McGraw-Edison Co.	West Orange, N. J.	70563	Amperite Co., Inc.	Union City, N. J.	75382	Kulka Electric Corporation	Mt. Vernon, N. Y.
19589	Concoa	Baldwin Park, Calif.	70674	ADC Products Inc.	Minneapolis, Minn.	75818	Lenz Electric Mfg. Co.	Chicago, Ill.
19644	LRC Electronics	Horseheads, N. Y.	70903	Belden Mfg. Co.	Chicago, Ill.	75915	Littlefuse, Inc.	Des Plaines, Ill.
19701	Electra Mfg. Co.	Independence, Kansas	70998	Bird Electronic Corp.	Cleveland, Ohio	76005	Lord Mfg. Co.	Erie, Pa.
20183	General Atomics Corp.	Philadelphia, Pa.	71002	Birnbach Radio Co.	New York, N. Y.	76210	C. W. Marwedel	San Francisco, Calif.
21226	Executione, Inc.	Long Island City, N. Y.	71034	Bliley Electric Co., Inc.	Erie, Pa.	76433	General Instrument Corp., Micamold Division	Newark, N. J.
21335	Fafnir Bearing Co., The	New Britain, Conn.	71041	Boston Gear Works Div. of Murray Co. of Texas	Quincy, Mass.	76487	James Millen Mfg. Co., Inc.	Malden, Mass.
21520	Fansteel Metallurgical Corp.	N. Chicago, Ill.	71218	Bud Radio, Inc.	Willoughby, Ohio	76493	J. W. Miller Co.	Los Angeles, Calif.
23042	Texscan Corp.	Indianapolis, Ind.	71279	Cambridge Thermionics Corp.	Cambridge, Mass.	76530	Cinch-Monadnock, Div. of United Carr	Fastener Corp. San Leandro, Calif.
23783	British Radio Electronics Ltd.	Washington, D. C.	71286	Camloc Fastener Corp.	Paramus, N. J.	76545	Mueller Electric Co.	Cleveland, Ohio
24455	G. E. Lamp Division	Nela Park, Cleveland, Ohio	71313	Cardwell Condenser Corp.	Lindenhurst L. I., N. Y.	76703	National Union	Newark, N. J.
24655	General Radio Co.	West Concord, Mass.	71400	Bussmann Mfg. Div. of McGraw-Edison Co.	St. Louis, Mo.	76854	Oak Manufacturing Co.	Crystal Lake, Ill.
24681	Memcor Inc., Comp. Div.	Huntington, Ind.	71436	Chicago Condenser Corp.	Chicago, Ill.	77068	The Bendix Corp., Electroynamics Div.	N. Hollywood, Calif.
24796	Parelo Inc.	San Juan Capistrano, Calif.	71447	Calif. Spring Co., Inc.	Pico-Rivera, Calif.	77075	Pacific Metals Co.	San Francisco, Calif.
26365	Gries Reproducer Corp.	New Rochelle, N. Y.	71450	CTS Corp.	Elkhart, Ind.	77221	Phanostran Instrument and Electronic Co.	South Pasadena, Calif.
26462	Grobet File Co. of America, Inc.	Carlstadt, N. J.	71468	ITT Cannon Electric Inc.	Los Angeles, Calif.	77252	Philadelphia Steel and Wire Corp.	Philadelphia, Pa.
26851	Compac, Hollister Co.	Hollister, Calif.	71471	Cinema, Div. Aerovox Corp.	Burbank, Calif.	77342	American Machine & Foundry Co. Potter & Brumfield Div.	Princeton, Ind.
26992	Hamilton Watch Co.	Lancaster, Pa.	71482	C. P. Clare & Co.	Chicago, Ill.	77630	TRW Electronic Components Div.	Camden, N. J.
27251	Specialties Mfg. Co., Inc.	Stratford, Conn.	71590	Centralab Div. of Globe Union Inc.	Milwaukee, Wis.	77638	General Instrument Corp., Rectifier Div.	Brooklyn, N. Y.
28480	Hewlett-Packard Co.	Palo Alto, Calif.	71616	Commercial Plastics Co.	Chicago, Ill.	77764	Resistance Products Co.	Harrisburg, Pa.
28520	Heyman Mfg. Co.	Kenilworth, N. J.	71700	Cornish Wire Co., The	New York, N. Y.	77969	Rubbercraft Corp. of Calif.	Torrance, Calif.
30817	Instrument Specialties Co., Inc.	Little Falls, N. J.	71707	Coto Coil Co., Inc.	Providence, R. I.	78189	Shakeproof Division of Illinois Tool Works	Elgin, Ill.
33173	G. E. Receiving Tube Dept.	Owensboro, Ky.	71744	Chicago Miniature Lamp Works	Chicago, Ill.	78277	Sigma	So. Braintree, Mass.
35434	Lectrohm Inc.	Chicago, Ill.	71785	Cinch Mfg. Co., Howard B. Jones Div.	Chicago, Ill.	78283	Signal Indicator Corp.	New York, N. Y.
36196	Stanwyck Coil Products Ltd.	Hawkesbury, Ontario, Canada	71984	Dow Corning Corp.	Midland, Mich.	78290	Struthers-Dunn Inc.	Pittsboro, N. J.
36287	Cunningham, W. H. & Hill, Ltd.	Toronto Ontario, Canada	72136	Electro Motive Mfg. Co., Inc.	Williamston, Conn.	78424	Speciality Leather Prod. Co.	Newark, N. J.
37942	P. R. Mallory & Co. Inc.	Indianapolis, Ind.	72619	Dialight Corp.	Brooklyn, N. Y.	78452	Thompson-Bremer & Co.	Chicago, Ill.
39543	Mechanical Industries Prod. Co.	Akron, Ohio	72656	Indiana General Corp., Electronics Div.	Keasby, N. J.	78471	Tilley Mfg. Co.	San Francisco, Calif.
40920	Miniature Precision Bearings, Inc.	Keene, N. H.	72699	General Instrument Corp., Cap. Div.	Newark, N. J.	78488	Stackpole Carbon Co.	St. Marys, Pa.
42190	Muter Co.	Chicago, Ill.	72765	Drake Mfg. Co.	Harwood Heights, Ill.	78493	Standard Thomson Corp.	Waltham, Mass.
43990	C. A. Noigren Co.	Englewood, Colo.	72825	Hugh H. Eby Inc.	Philadelphia, Pa.	78553	Tinnerman Products, Inc.	Cleveland, Ohio
44655	Ohmite Mfg. Co.	Skeikie, Ill.	72928	Gudeman Co.	Chicago, Ill.	78790	Transformer Engineers	San Gabriel, Calif.
46364	Penn Eng. & Mfg. Corp.	Daylestown, Pa.	72962	Elastic Stop Nut Corp.	Union, N. J.	78947	Ucinite Co.	Newtonville, Mass.
47904	Polaroid Corp.	Cambridge, Mass.	72964	Robert M. Hawley Co.	Los Angeles, Calif.	79136	Waldes Kohinor Inc.	Long Island City, N. Y.
48620	Precision Thermometer & Inst. Co.	Southampton, Pa.	72982	Erne Technological Products, Inc.	Erie, Pa.	79142	Veeder Root, Inc.	Hartford, Conn.
49956	Microwave & Power Tube Div.	Waltham, Mass.	73061	Hansen Mfg. Co., Inc.	Princeton, Ind.	79251	Wenco Mfg. Co.	Chicago, Ill.
52090	Rowan Controller Co.	Westminster, Md.	73076	H. M. Harper Co.	Chicago, Ill.	79727	Continental-Wirt Electronics Corp.	Philadelphia, Pa.
52983	Sanborn Company	Waltham, Mass.	73138	Helipot Div. of Beckman Inst., Inc.	Fullerton, Calif.	79963	Zierick Mfg. Corp.	New Rochelle, N. Y.
54294	Shaitcross Mfg. Co.	Selma, N. C.	73293	Hughes Products Division of Hughes Aircraft Co.	Newport Beach, Calif.	80031	Mepco Division of Sessions Clock Co.	Morrisstown, N. J.
55026	Simpson Electric Co.	Chicago, Ill.	73445	Amperex Elect Co.	Hicksville, L. I., N. Y.	80120	Schnitzer Alloy Products Co.	Elizabeth, N. J.
55933	Sonotone Corp.	Elmsford, N. Y.	73506	Bradley Semiconductor Corp.	New Haven, Conn.	80131	Electronic Industries Association. Any brand	Tube meeting EIA Standards-Washington, DC.
55938	Raytheon Co. Commercial Apparatus & Systems Div.	So. Norwalk, Conn.	73559	Cailling Electric, Inc.	Hartford, Conn.	80207	Unimax Switch, Div. Maxon Electronics Corp.	Wallingford, Conn.
56137	Spaulding Fibre Co., Inc.	Tonawanda, N. Y.	73586	Circle F Mfg. Co.	Trenton, N. J.	80223	United Transformer Corp.	New York, N. Y.
56289	Sprague Electric Co.	North Adams, Mass.	73682	George K. Garrett Co., Div. MSL Industries Inc.	Philadelphia, Pa.	80248	Oxford Electric Corp.	Chicago, Ill.
59446	Telex Corp.	Tulsa, Okla.	73734	Federal Screw Products Inc.	Chicago, Ill.	80294	Bourns Inc.	Riverside, Calif.
59730	Thomas & Betts Co.	Elizabeth, N. J.	73743	Fischer Special Mfg. Co.	Cincinnati, Ohio	80411	Acro Div. of Robertshaw Controls Co.	Columbus, Ohio
60741	Triplet Electrical Inst. Co.	Bluffton, Ohio	73793	General Industries Co., The	Elyria, Ohio			
61775	Union Switch and Signal, Div. of Westinghouse Air Brake Co.	Pittsburgh, Pa.	73846	Goshen Stamping & Tool Co.	Goshen, Ind.			







## UNITED STATES

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2003 Byrd Spring Road S.W.  
Huntsville 35802  
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### ARIZONA

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Scottsdale 85251  
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TWX: 910-950-1282

5737 East Broadway  
Tucson 85716  
Tel: (602) 298-2313  
TWX: 910-952-1162

### CALIFORNIA

3939 Lankershim Boulevard  
North Hollywood 91604  
Tel: (213) 877-1282  
TWX: 910-499-2170

1101 Embarcadero Road  
Palo Alto 94303  
Tel: (415) 327-6500  
TWX: 910-373-1280

2591 Carlsbad Avenue  
Sacramento 95821  
Tel: (916) 482-1463  
TWX: 910-367-2092

1055 Shafter Street  
San Diego 92106  
Tel: (714) 223-8103  
TWX: 910-335-2000

### COLORADO

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Englewood 80110  
Tel: (303) 771-3455  
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### CONNECTICUT

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