OPERATING AND SERVICE MANUAL

7901A
DISC DRIVE

HEWLETT hp PACKARD

HEWLETT hp PACKARD

CERTIFICATION

The Hewlett-Packard Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. The Hewlett-Packard Company further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards to the extent allowed by the Bureau's calibration facility.

HEWLETT PACKARD

OPERATING AND SERVICE MANUAL

7901A

DISC DRIVE

Serial Numbers Prefixed: 1235

Options Covered

This manual covers option 001 as well as the standard HP 7901A Disc Drive.

07901-90003

HEWLETT-PACKARD COMPANY
11000 WOLFE ROAD, CUPERTINO, CALIFORNIA, U.S.A.

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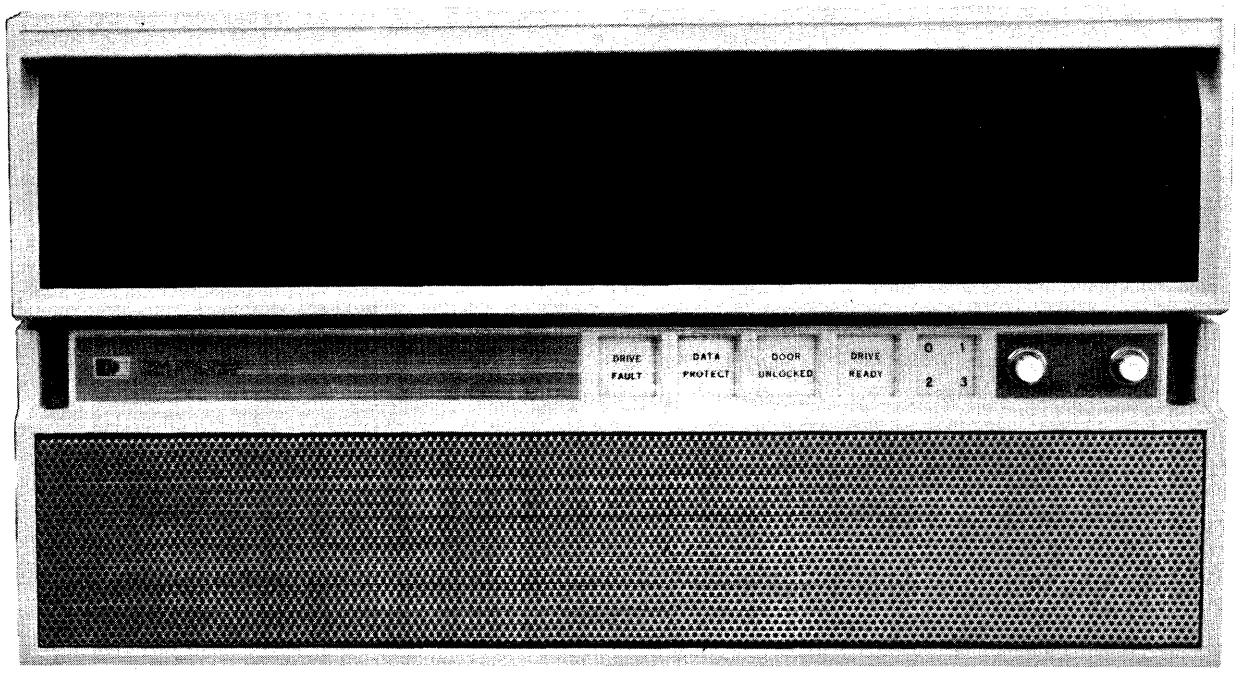

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Figure 1-1. Hewlett-Packard 7901A Disc Drive

SECTION I GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This manual contains the information required to install, operate, test, adjust, and troubleshoot the Hewlett-Packard 7901A Disc Drive. (See figure 1-1.) This section covers a general description, identification, specifications, options, accessories, related manuals, and other basic information.

1-3. The other sections in this manual provide information as follows:

a. SECTION II, INSTALLATION. Provides information relative to unpacking and inspection, power requirements, mounting, checkout, packing and shipping, etc.

b. SECTION III, OPERATION. Provides information relative to operating controls and indicators and the operating instructions for the disc drive.

c. SECTION IV, THEORY OF OPERATION. Provides an overall functional description and an overall block diagram.

d. SECTION V, MAINTENANCE. Provides preventive maintenance information, maintenance precautions, repair information, a list of required test equipment, performance tests, adjustment procedures, troubleshooting information, schematic diagrams, and printed-circuit assembly parts location diagrams.

e. SECTION VI, REPLACEABLE PARTS. Provides ordering information for all replaceable parts and assemblies and parts location drawings and parts listings.

1-4. GENERAL DESCRIPTION.

1-5. The disc drive (figure 1-1) is a random-access, mass-storage disc memory device, compactly designed for use as a peripheral unit in small- and medium-size computing systems. The disc drive has an average response time of less than 35 milliseconds and will store a total of 2.5 million eight-bit bytes. The disc drive head-positioning mechanism is a voice coil actuator that employs both position and velocity feedback. Position feedback comes from a precise photo-optical system that can position any actuator to within 0.0003 inch of its nominal position. Other significant features of the disc drive include 2200 bits per inch of data density and 2400 r/min spindle speed as standard, an integral power supply, and an absolute filtration system that eliminates environmental contamination. Up to four disc drives can be used with a single controller. A multiple installation of this type can be any combination of HP 7901A or 7900A Disc Drives.

1-6. IDENTIFICATION.

1-7. Hewlett-Packard identification can be made by reviewing the sticker on the rear panel (see figure 1-2). Hewlett-Packard products carry a model number, an option number listing, and a ten-digit serial number. The model number corresponds to the placarding on the front panel and the option number(s) indicates those options which the customer has specified, if any.

1-8. Hewlett-Packard identifies each unit with a two-section serial number (0000A-00000). The first four digits are a serial number prefix used to identify a particular unit configuration. The letter identifies the country in which the unit was manufactured. The last five digits identify each specific unit. If the serial number prefix on the unit does not agree with the prefix on the title page of this manual, there are differences between that unit and the unit described in this manual. These differences are described in manual supplements available at the nearest HP Sales and Service Office.

1-9. Printed-circuit assembly (PCA) revisions are identified by a letter, a series code, and a division code marked beneath the part number on the PCA. The letter identifies the revision of the etched-trace pattern on the unloaded PCA. The four-digit series code pertains to the electrical characteristics of the loaded PCA and the positions of the components. The two-digit division code identifies the division of Hewlett-Packard that manufactured the PCA. If the series code numbers do not correspond exactly with the code numbers on the schematic diagrams in this manual, the PCA's are different from those described in this manual. These differences are covered in manual supplements available at the nearest HP Sales and Service Office.

1-10. SPECIFICATIONS.

1-11. Specifications for the disc drive are listed in table 1-1.

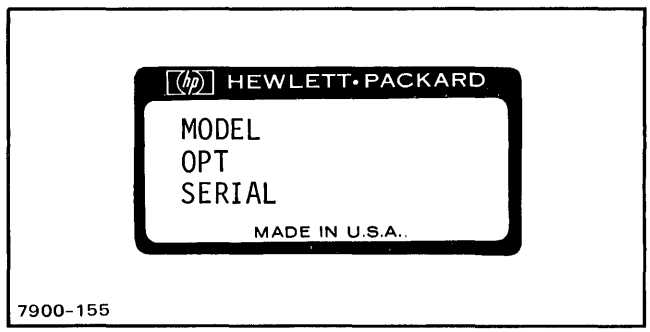


Figure 1-2. Identification Sticker

Table 1-1. HP 7901A Disc Drive Specifications

DEVICE TYPE

Moving head disc drive with 1 removeable, front-loading, single-disc cartridge with 2200 bpi recording surface.

DATA ACCESS

Head Positioning (Including Settling Time)

Track-to-Track (maximum)	10 milliseconds
67 tracks (maximum)	35 milliseconds
202 tracks (maximum)	65 milliseconds

Rotational Delay (Latency)

Average (1/2 revolution)	12.5 milliseconds
Maximum (1 revolution)	25.0 milliseconds

Data Transfer

Eight-Bit Bytes/Second	312k
Bits/Second (nominal)	2.5 million

Cartridge Change at 60 Hz Power

Stop Time	35 seconds
Start Time	30 seconds

DATA CAPACITY

Approximately 24 million bits structured as follows when in 24-sector format:

APPROXIMATE	TOTAL BITS PER	DATA BITS PER	DATA BYTES PER	SECTORS PER	TRACKS PER	CYLINDERS PER	RECORDING SURFACE PER
Byte	8	8					
Sector	2.6k	2k	256				
Track	60k	50k	6k	24			
Cylinder	120k	100k	12.5k	48	2		
Surface	12M	10M	1.25M	4.8k	200 + 3	200 + 3	
Drive	24M	20M	2.5M	9.6k	400	200	2

ENVIRONMENTAL

Operating Temperature	10° to 40°C 50° to 104°F
Non-Operating Temperature	-20° to 65°C -4° to 149°F
Relative Humidity (Without Condensation)	8% to 95%
Attitude (Pitch and Roll)	Accuracy of positioning is not affected by attitude of the disc drive.

Table 1-1. HP 7901A Disc Drive Specifications (Continued)

ENVIRONMENTAL (Continued)

Absolute Filtering System	75 cubic feet per minute
Vibration	10 to 55 Hz at 0.01 inch peak-to-peak excursion or at a continuous level of 0.25 G's.

GENERAL

Standard Features

Write Protect, Unit Select } Switch setting inside cartridge door.

Parallel connection of up to four drives per controller.

Power Required (Internal Power Supply)	100 Vac ± 10%, 50 Hz ± 2%, 4.1A, 1 phase 100 Vac ± 10%, 60 Hz ± 2%, 3.4A, 1 phase 120 Vac ± 10%, 50 Hz ± 2%, 3.4A, 1 phase 120 Vac ± 10%, 60 Hz ± 2%, 2.8A, 1 phase 200 Vac ± 10%, 50 Hz ± 2%, 2.0A, 1 phase 200 Vac ± 10%, 60 Hz ± 2%, 1.7A, 1 phase 220 Vac ± 10%, 50 Hz ± 2%, 1.8A, 1 phase 220 Vac ± 10%, 60 Hz ± 2%, 1.6A, 1 phase 240 Vac ± 10%, 50 Hz ± 2%, 1.7A, 1 phase 240 Vac ± 10%, 60 Hz ± 2%, 1.4A, 1 phase
Weight	Net, 107 lb (48.6 kg) Shipping, 174 lb (78.9 kg)
Dimensions	Fits standard EIA 19-inch rack 19 in. (483 millimeters) wide (ahead of mounting flange); 16-3/4 in. (425 millimeters) wide (behind mounting flange); 10-1/2 in. (267 millimeters) high; 22-15/16 in. (581 millimeters) deep (from mounting flange), 25-5/8 in. (651 millimeters) deep (overall).
Compatibility	Interface-compatible with HP 7900A Disc Drive (dual disc).

1-12. OPTIONS.

1-13. Options are factory modifications of a standard disc drive that are requested by the customer. Option 001 is available for 240 Vac, 50 Hz operation (equipped with IEC-approved power cord without plug) for the disc drive.

1-14. ACCESSORIES.

1-15. The following accessories may be ordered with the disc drive or separately from your local Hewlett-Packard Sales and Service Office (refer to the list at the back of the manual for addresses).

HP Model/Part Number	Description
13211A Option 001	Rack Slide Mounting Kit
12869A	Disc Cartridge
07901-60012	Service Extender Board
13212A	Multiunit Cable/with 7900/7901 interconnect boards
5060-0049	Preamp Extender Board

1-16. RELATED MANUALS.

1-17. To maintain the disc drive, refer to *HP 7900/13210 Disc Diagnostic Manual*, part no. 13041-60001 and *HP 13219A Disc Service Unit Manual*, part no. 13219-90000.

SECTION II INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains information on unpacking and incoming inspection, input power requirements, mounting, checkout, and packing and shipping for the disc drive.

2-3. UNPACKING AND INSPECTION.

2-4. If the carton is damaged upon receipt, request that the carrier's agent be present when the unit is unpacked. Inspect the unit for damage (scratches, dents, broken parts, etc). If the unit is damaged and fails to meet specifications, notify the carrier and the nearest HP Sales and Service Office immediately. (HP Sales and Service Offices are listed at the back of this manual.) Retain the shipping container and the packing material for the carrier's inspection. Hewlett-Packard will arrange for repair or replacement of the damaged unit without waiting for any claims against the carrier to be settled.

2-5. POWER REQUIREMENTS.

2-6. The disc drive may be operated continuously from primary power sources of 100, 120, 200, 220, or 240 Vac ±10%, single phase, 50/60 Hz. Prior to installing the disc drive, determine the primary power voltage, remove the bottom cover of the disc drive, and ensure that power supply strapping of TB1 is compatible with primary power voltage. Figure 2-1 shows the strapping of TB1 for various voltages.

2-7. POWER CABLE.

2-8. To protect operating personnel, the National Electrical Manufacturers Association (NEMA) recommends that the unit panel and chassis be grounded. This unit is equipped with a three-conductor power cable which grounds the unit.

2-9. MOUNTING.

2-10. Prior to rack mounting, remove the top cover in an environmentally clean area and remove the shipping clamp shown in figure 5-7. The shipping clamp is used to prevent internal movement that would cause damage to the heads or disc components during packaging or shipment. When removing the shipping clamp, use care not to bump or jar the heads or snag the head leads. The shipping clamp is secured in place by a pozi-drive screw. After loosening the pozi-drive screw, rotate the shipping clamp out of the way and re-tighten the pozi-drive screw. Replace the top cover.

Note: Retain the shipping clamp in the manner described above, to use for future shipping.

2-11. The unit is air cooled. Sufficient space (a one-inch minimum) should be allotted so that a free flow of air can be exhausted from the rear of the unit when it is in operation. The unit should be used in an area where the ambient temperature does not exceed 40°C. The air inlet is the screen at the lower front of the disc drive; the inlet must not be covered.

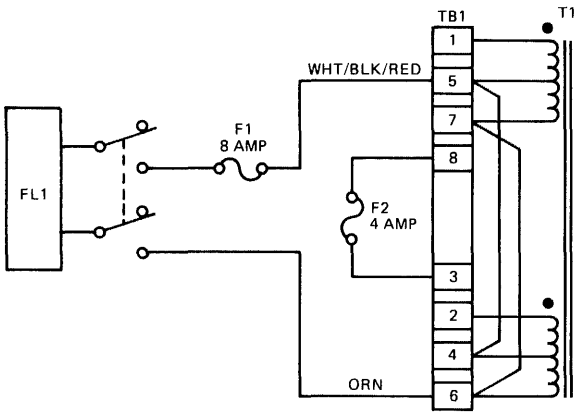
2-12. Mounting the disc drive in a rack cabinet requires that the rack mounting technique maintains isolation between the disc drive chassis and the rack cabinet. Disc drive front frame design maintains isolation between the disc drive front panel and the chassis. The HP 13211A option 001 Disc Drive Rack Mounting Kit is an available accessory for mounting the disc drive in an HP 29400 Series Cabinet with the required chassis isolation. The following procedure provides rack mounting instructions using the HP 13211A option 001 Disc Drive Rack Mounting Kit (figure 2-4 includes identification of the isolation technique). To mount the disc drive in an HP 29400 Series Cabinet using the HP 13211A option 001 Disc Drive Rack Mounting Kit, proceed as follows:

a. Place the disc drive on a table in an environmentally clean area. Attach the right and left chassis slides to the disc drive using eight number 8-32, 0.625-inch flat head screws, four on each side, as shown in figure 2-3.

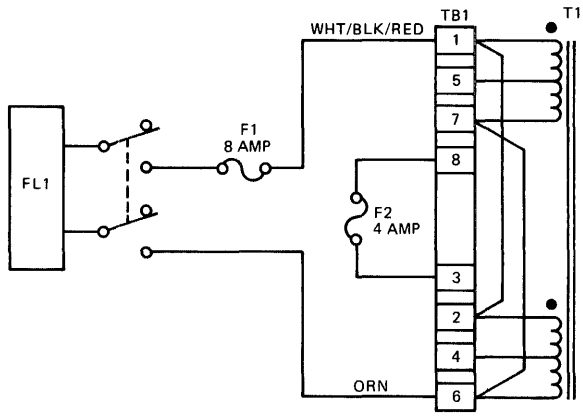
b. Attach the rack mount brackets to the rack cabinet using eight number 1/4-20, 0.5-inch hexagon head screws with eight number 1/4 split lock washers and eight number 1/4-20 spring nuts as shown in figure 2-4. Before securing to rack cabinet, ensure that the mounting brackets are level from the front to the rear.

Note: Align the mounting screw in conjunction with RETMA mounting pattern shown in figure 2-4. Proper alignment with the RETMA pattern will assure alignment of the disc drive chassis mounting holes with the RETMA pattern holes used for securing the disc drive front panel to the cabinet.

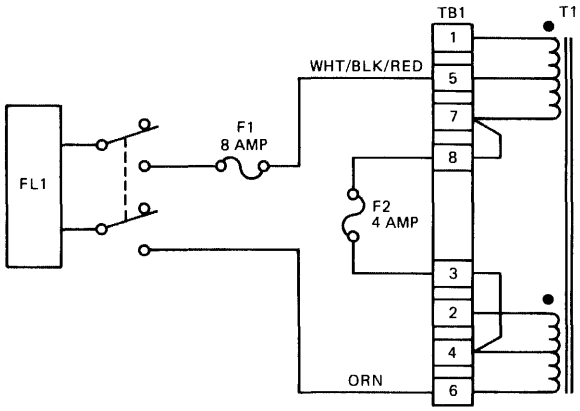
A minimum vertical clearance of 10-1/4 inches above the bottom front of the rack mount bracket must be maintained to allow for disc drive clearance.



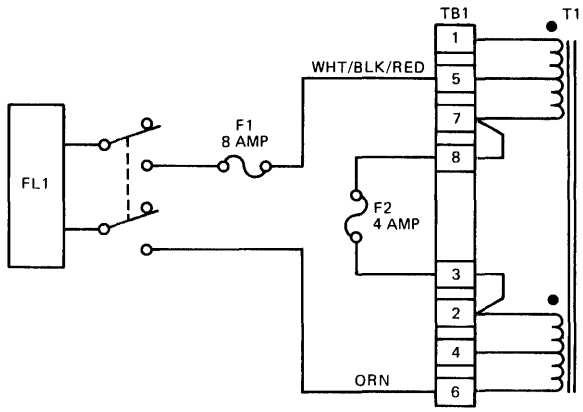
TB1 CONNECTIONS FOR 100 VOLTS PRIMARY POWER



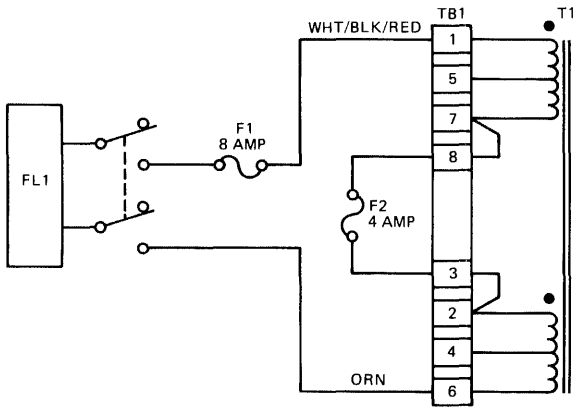
TB1 CONNECTIONS FOR 120 VOLTS PRIMARY POWER



TB1 CONNECTIONS FOR 200 VOLTS PRIMARY POWER



TB1 CONNECTIONS FOR 220 VOLTS PRIMARY POWER



TB1 CONNECTIONS FOR 240 VOLTS PRIMARY POWER

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Figure 2-1. Power Supply Strapping Diagrams

c. Extend the chassis slides out, as shown in figure 2-5, from the front of the rack cabinet. Lift the disc drive into place with the attached chassis slides so that the chassis slides on the disc drive slide into the extended chassis slides in front of the rack cabinet. Press in on the slide lock buttons located on the sides of the disc drive chassis slides and ensure that the buttons are in place in the holes in the extended chassis slides. While holding the slide lock buttons in, push the drive partially into the rack cabinet.

d. With the disc drive secure in the chassis slides, open the front panel and observe the four drive chassis mounting slots shown in figure 2-6. The holes will line up with the RETMA standard mounting holes if the rack mount brackets were correctly installed. Using four number 10-32, 0.5-inch flat head screws, secure the disc drive to the front of the rack cabinet.

CAUTION

The rack slide mounting kit must be used in its entirety; using only the four number 10-32, 0.5-inch flat head screws to secure the disc drive would result in damage to the disc drive and rack cabinet since the screws cannot support the disc drive weight.

If more than one disc drive is mounted in a rack cabinet, care should be taken to extend only one at a time for servicing or adjustments; otherwise, the rack cabinet might tip over.

2-13. CONNECTION INSTRUCTIONS.

2-14. Connect the disc drive to an appropriate ac source, as per paragraph 2-6.

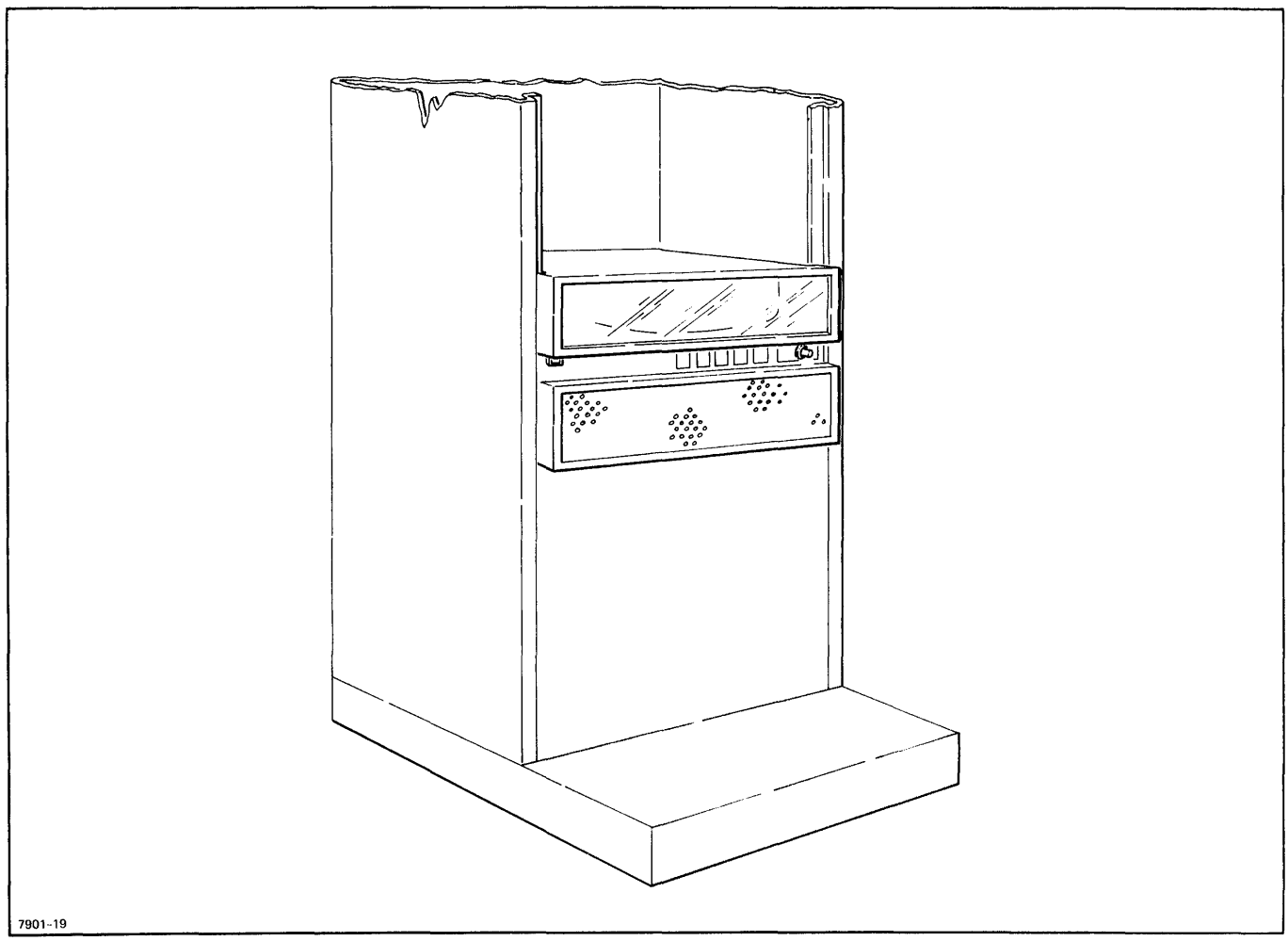


Figure 2-2. Disc Drive Cabinet Mounting

2-15. Refer to figures 5-12 and 5-14 for an overview of the chassis and assembly connector locations. Connector XA14 is reserved for the cable from the computer/ controller. Unless the disc drive is to be parallel-connected in a system, connector XA13/16 is occupied by termination assembly A16.

2-16. If the disc drive is to be parallel-connected in a system, a HP 13212A Multiunit Cable Kit (including 7901 interconnect board) is required. The interconnect board must be installed into connector XA13/16 in the first disc drive and into connector XA14 in the second, third, and fourth disc drives. In the last disc drive of the system, termination assembly A16 must be installed in connector XA13/16.

2-17. When one or more disc drives are installed, logical drive identification must be specified to the controller. The position of the unit select switch will determine the disc drive identification.

Note: Sector cylinder PCA A11 contains two gates that are jumpered to adapt the unit to disc cartridges with 32, 24, 16, 12, or 8 sectors. An inspection should be made for correct jumper connections prior to operation. A table and illustration of these jumper options are contained in figure 5-35.

2-18. SHIPPING INSTRUCTIONS.

2-19. USING ORIGINAL PACKAGING.

2-20. The same containers, part no. 9211-1691, and materials, part no. 9222-0355, used in factory packaging can be obtained through Hewlett-Packard Sales and Service Offices listed at the back of this manual. If the disc drive is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service or repair required, return address, model number, and full serial number. Also, mark the container FRAGILE to assure careful handling and with a caution that states: "Magnetic equipment suitable for air shipment if maintained at a distance of 15 feet or more from compass sensing devices." In any correspondence, refer to the unit by model number and full serial number.

CAUTION

Restore shipping clamp used in original shipment, as described in paragraph 2-10, to prevent internal movement of carriage and internal damage. If no shipping clamp is available, some means of fastening the carriage assembly to the linear motor must be used. The shipping clamp should be used whenever possible. Do not ship with cartridge installed.

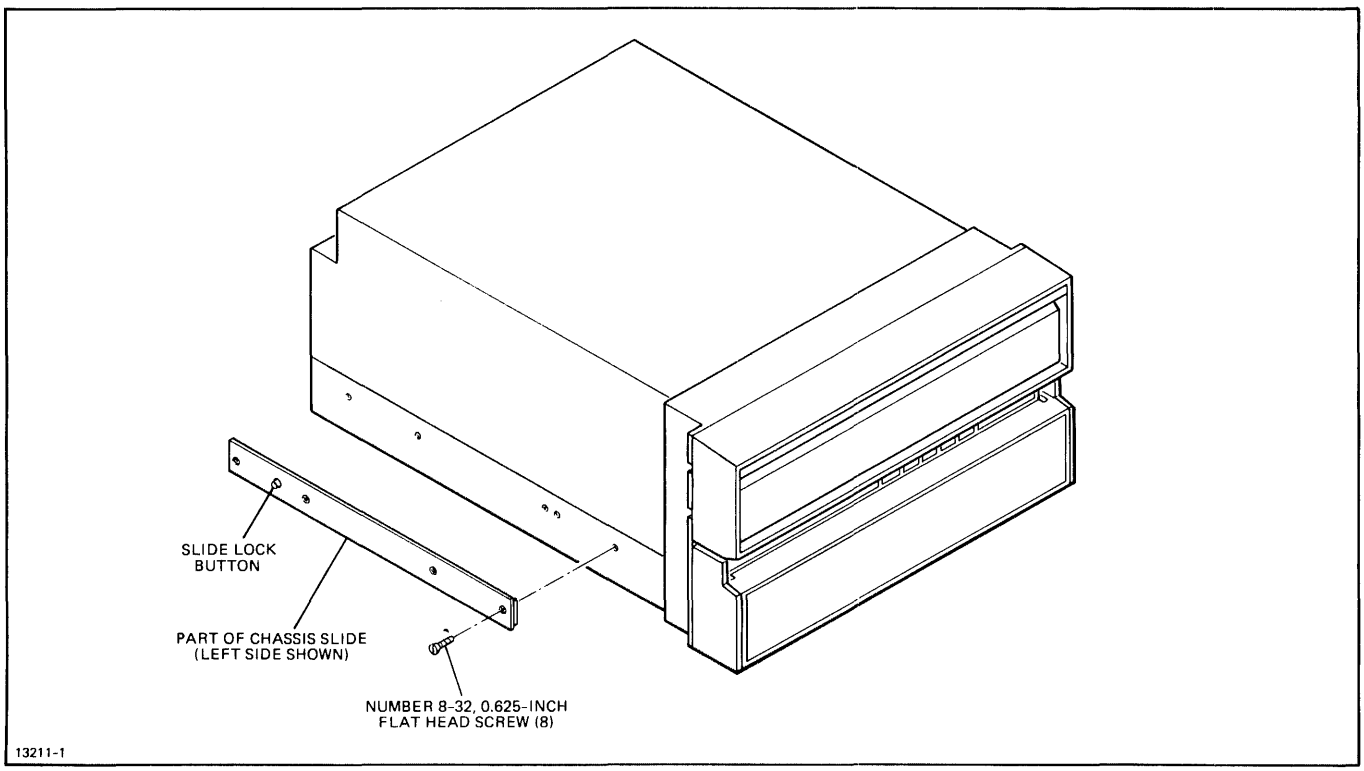
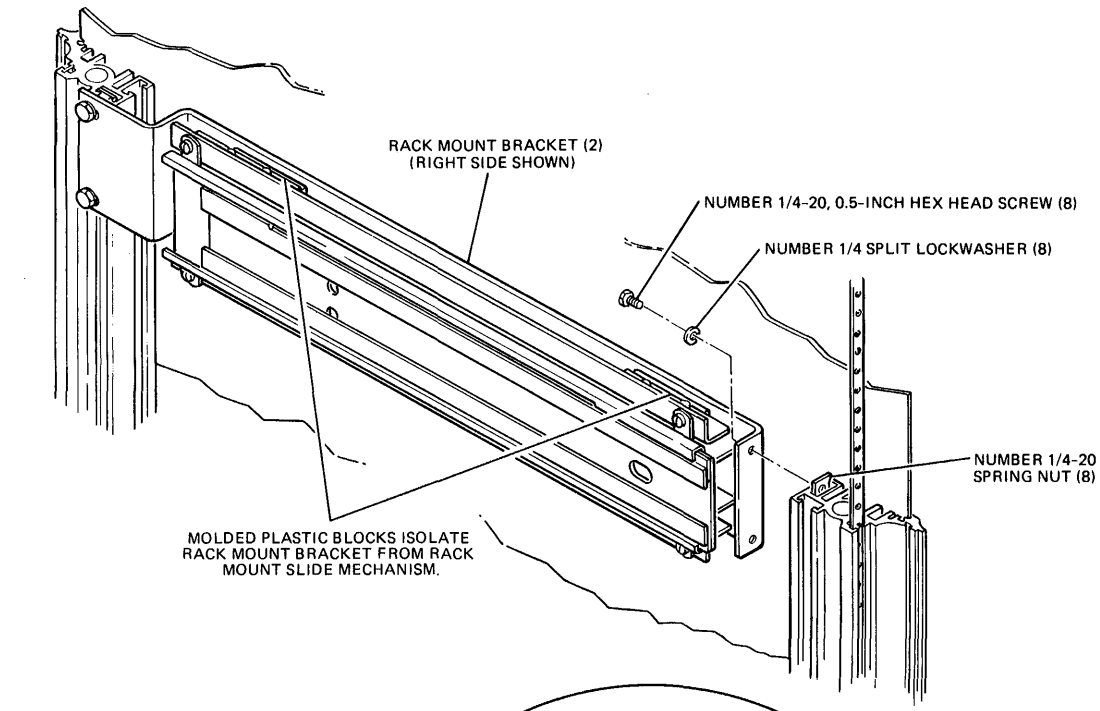
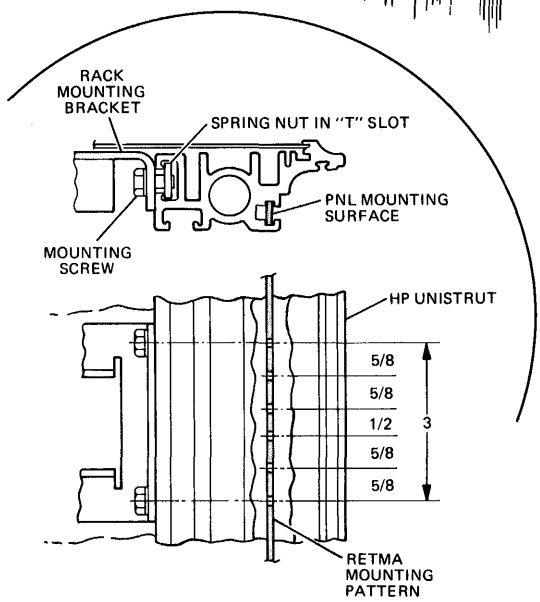


Figure 2-3. Chassis Slide Attachment





NOTES:

1. ALIGN THE MOUNTING SCREW IN CONJUNCTION WITH THE RETMA MOUNTING PATTERN SHOWN AT RIGHT. PROPER ALIGNMENT WITH THE RETMA PATTERN WILL ASSURE THE 7900A AND 7901A CHASSIS MOUNTING HOLES OF ALIGNMENT WITH THE RETMA PATTERN AT REFERENCE POINT A IN FIGURE 2-6.
2. ALL DIMENSIONS ARE IN INCHES.

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Figure 2-4. Rack Mount Bracket Attachment

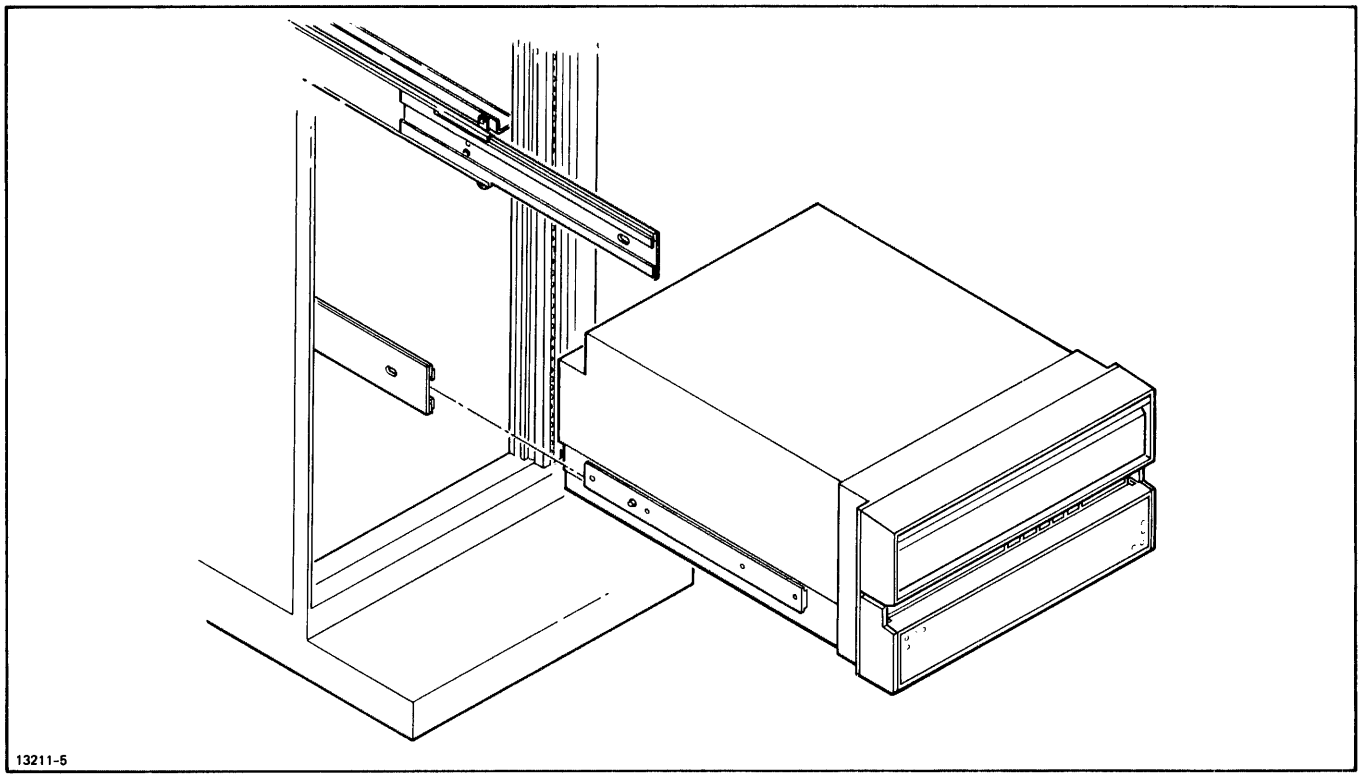


Figure 2-5. Disc Drive Slide Attachment

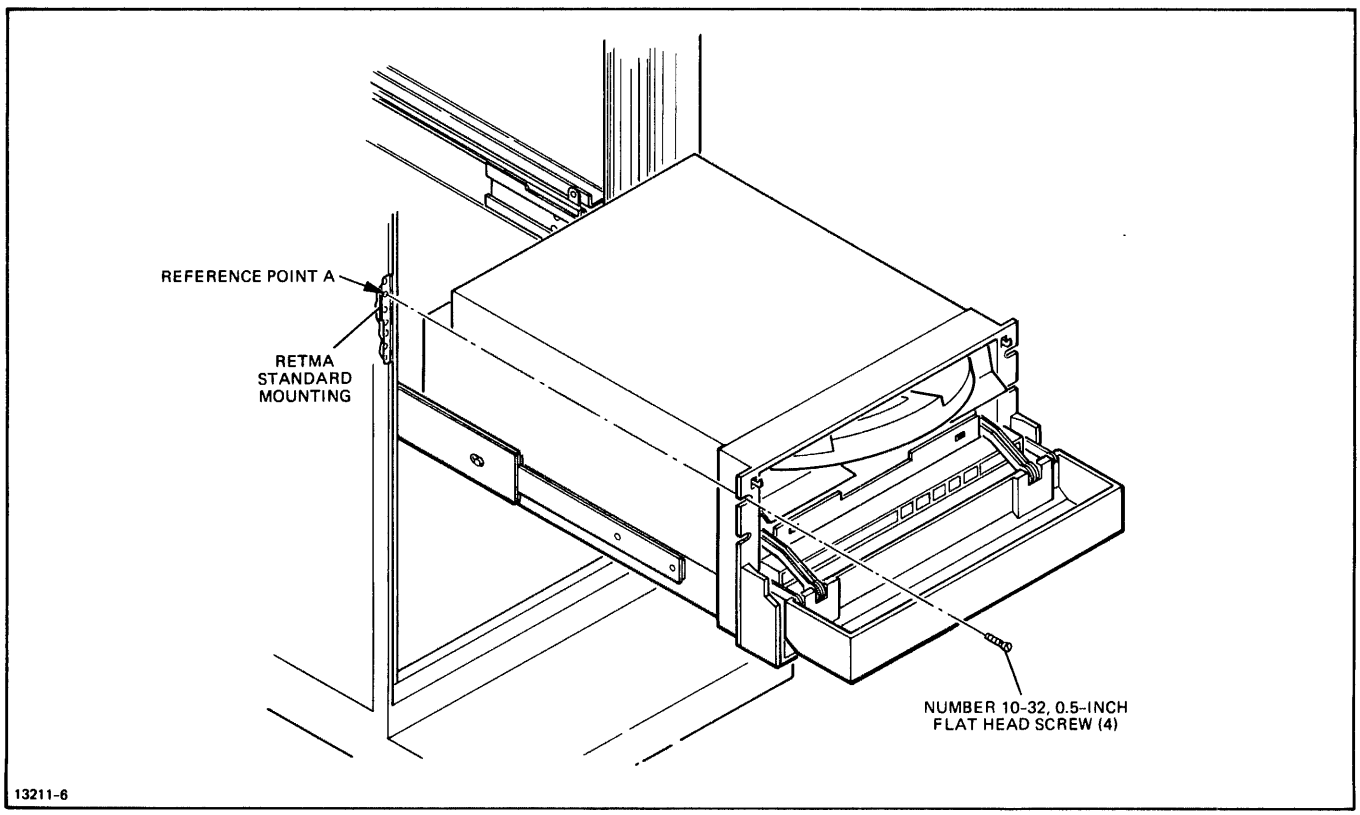


Figure 2-6. Disc Drive to RETMA Attachment

Note: In normal operation, there is a spring detent to hold the carriage in the most rearward position possible during cartridge change and power-off situations. The spring force of this detent is not sufficient to protect the carriage head assembly during shipment.

2-21. USING OTHER PACKAGING.

2-22. The following general instructions should be used for repackaging with commercially available materials:

CAUTION

Restore shipping clamp used in original shipment, as described in paragraph 2-10, to prevent internal movement of carriage and internal damage. If no shipping clamp is available, some means of fastening the carriage assembly to the linear motor must be used. Use extreme care not to damage the head assemblies or their leads. The shipping clamp should be used whenever possible. Do not ship with cartridge installed.

Note: In normal operation, there is a spring detent to hold the carriage in the most rearward position possible during cartridge change and power-off situations. The spring force of this detent is not sufficient to protect the carriage head assembly during shipment.

a. Wrap the unit in heavy paper or plastic. (If shipping to a Hewlett-Packard Sales and Service Office, attach a tag indicating the type of service required, return address, model number and full serial number.)

b. Use a strong shipping container. A double-wall carton made of 350-pound test material is adequate.

c. Use enough shock-absorbing material (3- to 4-inch layer) around all sides of the unit to provide firm cushioning and prevent movement inside the container. Protect the control panel with cardboard.

d. Seal the shipping container securely and mark it FRAGILE to assure careful handling, and with a caution that states: "Magnetic equipment suitable for air shipment if maintained at a distance of 15 feet or more from compass sensing devices."

e. In any correspondence, refer to the unit by model number and full serial number.

SECTION III OPERATION

3-1. INTRODUCTION.

3-2. Operating instructions for the disc drive are covered in this section of the manual.

3-3. OPERATING CONTROLS AND INDICATORS.

3-4. Front and rear panel controls, indicators, and terminals of the disc drive are identified in figure 3-1.

3-5. OPERATING INSTRUCTIONS.

3-6. To operate the disc drive, proceed as follows:

a. Set the DATA PROTECT switch (on the inside, right-hand side of drive) to the ON position if data protection is required.

b. Set SOFTWARE PROTECT-OVERRIDE switch to desired position (see figure 3-1).

c. Set UNIT SELECT switch for proper operation with the controller (see figure 3-1).

d. Press POWER switch on front panel to ON position. The lamp in the POWER switch will light and the DOOR UNLOCKED lamp will light.

e. Open the disc drive front door by pulling out and down from the upper inset edge of the front door.

f. Install a front-loading disc cartridge (2200 bpi surfaces) with the access-door end first.

CAUTION

If a head crash should occur, do not attempt to retrieve data by putting the damaged cartridge in another disc drive or a second head crash might occur.

g. Close the disc drive front door.

h. Press the disc drive LOAD switch to the ON position; the DOOR UNLOCKED lamp will go out. After a 30-second start-up time, the DRIVE READY lamp will light, indicating that the cartridge has been air purged and the disc drive heads are loaded. The DRIVE FAULT lamp will light only if an illegal memory operation is attempted, if some of the read/write circuitry failed, or if a seek operation did not finish within 850 milliseconds.

3-7. To change a cartridge in the disc drive, proceed as follows:

a. Press the disc drive LOAD switch to the OFF position. The DRIVE READY light will immediately go out.

b. Allow the spindle to halt (approximately 35 seconds).

c. The DOOR UNLOCKED indicator will light.

d. Open the disc drive front door by pulling out and down from the upper inset edge of the front door.

e. Remove the cartridge by grasping firmly and pulling out.

f. Install the new disc cartridge, access-door end first.

g. Close the disc drive front door.

h. Press the disc drive LOAD switch to the ON position. After a 30-second start-up time, the DRIVE READY lamp will light, indicating the heads have loaded and disc drive is awaiting a command from the disc drive controller.

3-8. To shut the unit off, proceed as follows:

a. Press the disc drive LOAD switch to the OFF position.

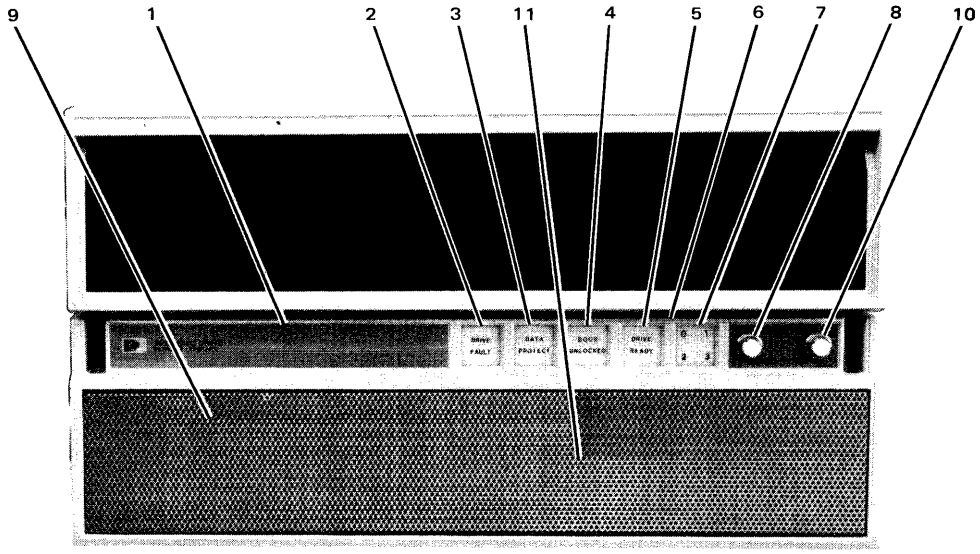
b. Allow the spindle to halt (approximately 35 seconds). The DOOR UNLOCKED indicator will light.

c. Set the disc power supply POWER switch to the OFF position. The drive POWER lamp on the disc drive will go off.

CAUTION

Power down the disc unit using the LOAD switch, not the POWER switch. If the unit is powered down using the POWER switch while the heads are loaded, the internal batteries must retract the heads. Unnecessary use of internal battery power to retract the heads might lead to a possible problem; head or disc damage will occur if the internal-battery protection feature fails.

FRONT PANEL FEATURES



1. UNIT SELECT switch (inside front panel). Position of switch provides logical identification of the disc drive to the controller. Up to four disc drives may be addressed by a single controller. Unit identification (0 thru 3) indicated on front panel.

2. DRIVE FAULT indicator lamp. Lights whenever an illegal memory operation is attempted, a malfunction occurs in the read/write hardware circuitry, or if a seek operation is not completed in 850 milliseconds.

3. DATA PROTECT indicator lamp. Lights whenever the DATA PROTECT switch is in the ON position. When lit, disc is protected against any write operations.

4. DOOR UNLOCKED indicator lamp. Lights when the spindle has stopped rotating and the carriage is retracted.

5. DRIVE READY indicator lamp. Lights when the disc drive motor has reached 2400 r/min, the cartridge has been purged of contaminated air by the filtration system, and the heads are in a loaded position over cylinder zero. Stays lit during legal memory operations.

6. DATA PROTECT switch (inside front panel). Turns data protection feature on or off. When activated, protects removable cartridge disc from any write operations.

7. UNIT SELECT indicator lamp. Lamp lights behind the unit number selected by UNIT SELECT switch.

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Figure 3-1. Disc Drive Front and Rear Panel Features (Sheet 1 of 2)

FRONT PANEL FEATURES

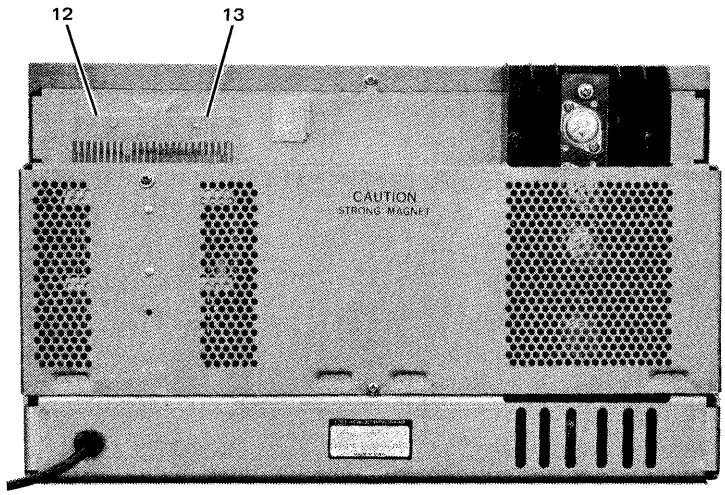
8. LOAD switch. Turns disc drive spindle motor on and off. When the LOAD switch is pressed (in), switch lamp lights, the front door latches are closed, and removal of the disc cartridge is prevented. In the UNLOAD position (switch out), the spindle motor is stopped and the front door can be opened to provide access to the disc cartridge.

9. Absolute filter pre-screen. Filter pre-screens air entering disc drive absolute filter.

10. POWER switch. Turns disc power supply on (lamp lights when switch is pressed) and off (lamp off when switch is out).

11. SOFTWARE PROTECT-OVERRIDE switch (hidden). When in the SOFTWARE PROTECT position, prevents a write operation in the address field of a sector. When in the OVERRIDE position, writing in sector address fields is enabled.

REAR PANEL FEATURES



12. Connector. Extender or termination printed-circuit assembly connector.

13. Connector. Extender printed-circuit assembly connector.

7901-21

Figure 3-1. Disc Drive Front and Rear Panel Features (Sheet 2 of 2)

SECTION IV THEORY OF OPERATION

4-1. INTRODUCTION.

4-2. This section describes the mechanical and electrical characteristics of the HP 7901A Disc Drive, and contains a detailed functional description of the disc drive logic.

4-3. MECHANICAL AND ELECTRICAL CHARACTERISTICS.

4-4. The Hewlett-Packard 7901A Disc Drive is a random access, mass storage device designed for use with small- to medium-sized computing systems. Through the use of removable and interchangeable single-disc cartridges, the disc drive provides the using system with access to large volume data storage, as well as fast, random access storage for high-activity programs and data. The disc drive utilizes interchangeable, front-loading, single-disc cartridges capable of storing up to 2.5 million bytes of information. Data storage areas on the disc may be addressed in direct fashion. A separate magnetic head is used for each disc surface to retrieve existing data, or to record new data.

4-5. The removable, single disc is mounted in a protective cartridge which acts as a guide during loading. When mounted in the drive, the disc is free to rotate within the cartridge. At operating speed, the heads are placed in flying position by a mechanical head-loading mechanism. An electromagnetically actuated carriage moves the heads to any one of 203 positions over the disc. The carriage assembly is supported on ball bearings which are spring loaded against stainless steel rails. Disc addressing and head selection are under the control of the using system.

4-6. The disc drive interfaces directly with the using system controller and receives all data inputs directly from the using system processor interface. Similarly, all data and drive status signals are either sent directly to the using system, or are transmitted to the using system through the controller.

4-7. There are three major functions the disc drive performs:

a. Provides a medium of data storage.

b. Supplies fast, accurate access to any desired storage area on the disc.

c. Supplies a method of data retrieval.

4-9. The data storage medium is a thin layer of magnetic material coated on the disc substrate. Access to store or retrieve data is provided by a carriage assembly that supports two read/write heads (one read/write head per disc surface). The carriage assembly (see figure 4-1) consists of a coil of wire free to move within the combined field of two permanent magnets. In essence, the coil and magnet form a linear motor that moves the carriage assembly.

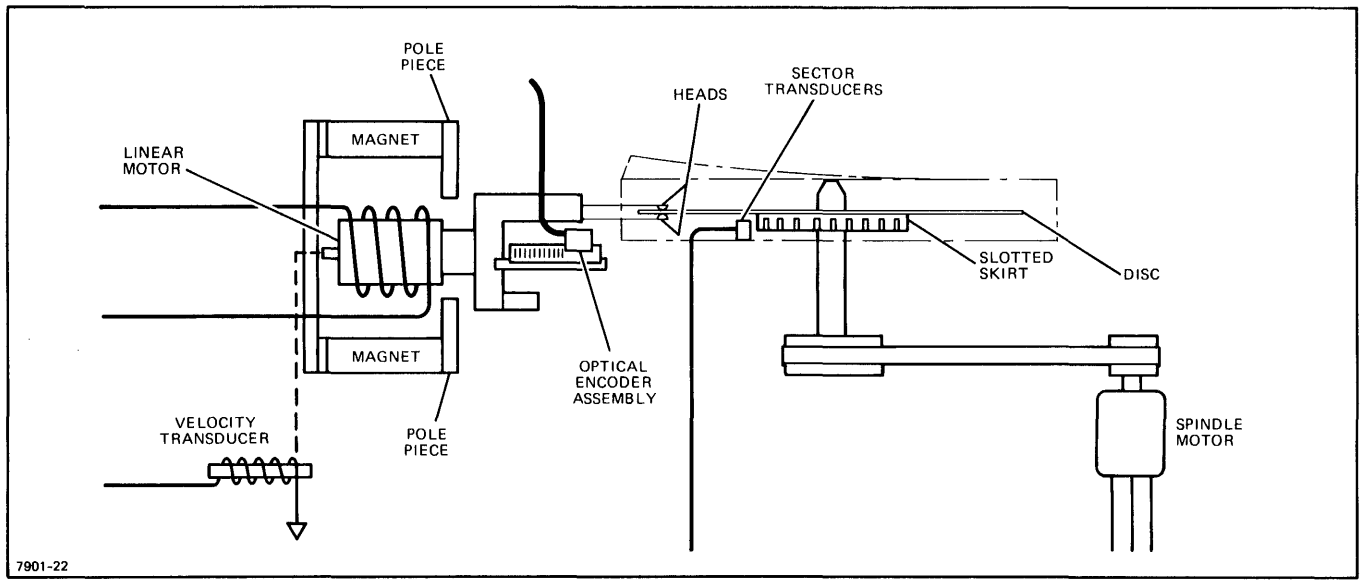


Figure 4-1. Disc Drive Overview

4-10. The head support arms are attached to the carriage assembly. Accurate positioning of the heads is accomplished by moving the carriage with signals generated by an extremely accurate optical transducer. High-speed damping is provided by the output of a velocity transducer also connected in the carriage servo control circuit.

4-11. There are 203 "cylinders" per disc, with each cylinder representing one position of the carriage assembly. The term cylinder encompasses both surfaces of the disc, therefore, there are 203 "tracks" per disc surface. Moving the carriage assembly to a particular cylinder places both heads over that cylinder. Selection of a head determines which track is to be used in an operation. An encoder, which is attached to the carriage assembly, distinguishes each cylinder position. One part of the encoder is used to detect the "home" position, which is defined as cylinder 000. Two other channels of the encoder provide coarse and fine carriage positioning information to center the heads over a desired cylinder. The encoder also updates a current cylinder address register as the carriage moves the heads from one cylinder to the next.

4-12. The disc is rotated by means of two pulleys, a belt, and a spindle motor. The spindle motor control circuits apply ac power for motor operation and the removal of power when exchanging disc cartridges or when the drive is not ready for use. Disc rotation is at a nominal speed of 2400 r/min which develops air pressure that forces the heads away from the disc surface. Supporting arms for the heads provide spring action that forces the heads toward the disc surface. At about 100 microinches from the disc surface the two forces are equal so the heads "fly" at this altitude.

4-13. A short, thin-walled, slotted skirt is attached to the disc hub. The skirt has 24 equally spaced slots, with a light source on one side and a photo cell on the other. These units are located on a sector transducer that provides the means for detecting angular (sector) position. If radial lines were drawn through the slots, the disc would be divided into 24 equal, pie-shaped segments (see figure 4-2). The area of a track between two of these radial lines is defined as a sector; thus each track has 24 sectors. The sectors are numbered from 00 through 23.

4-14. The addressing structure of the disc drive is shown in figure 4-2, which defines a controller operation with a four-unit disc drive installation. When a disc drive is combined with two or more (four units maximum) HP 7900A or HP 7901A Disc Drives, the controller selects an on-line unit by addressing a unit over two lines that are dedicated to this function. Operator-determined configuring in each disc drive provides the proper logic arrangement for controller-to-disc drive identification. A disc cylinder is selected when the controller issues a command to the disc drive and places the cylinder address on eight parallel outbus lines from the controller to the disc drive. A head and sector select function also uses the same eight outbus lines, accompanied by a separate enabling command from the controller to disc drive. A further function of the outbus lines is to carry write or read select commands. Specific functions of an active disc drive are monitored by the controller over a set of five parallel inbus lines and four separate status lines.

4-15. DETAILED FUNCTIONAL DESCRIPTION.

4-16. The disc drive consists of a spindle motor and control circuits to rotate the disc, a carriage and control circuits to position the heads, sector detection circuits to provide rotational position information, and read-write data control circuits. The following discussion describes drive enable and motor control, carriage position control, sector detection control, data control, and the disc drive power supply. An overall block diagram (figure 4-3) is used to support this discussion. Schematic diagrams located in section V also can be used as reference for discussion of signal development within an assembly. Rather than repeated reference to figure numbers, each assembly is identified by its alpha-numeric designation, eg, assembly A6, for reference.

4-17. DRIVE ENABLE AND MOTOR CONTROL.

4-18. The disc drive is placed in operation by setting controls on the unit to the desired position as detailed in section III. When the drive is to be used as one unit in a multiple (four maximum) disc drive installation, a switch that is part of unit select assembly A17 is set (position 0 through 3) to enable selection by the controller. The switch position lights an associated lamp on the front panel, and provides a logic output on the Select A and Select B lines to I/O multiplex assembly A12. The Select A and B logic is applied to a circuit that is used by the controller to select a disc drive for operation. When a match occurs between the Select A and B logic from assembly A17 and the Select 1 and 2 logic from the controller, and the Select Enable signal is high, I/O multiplex assembly A12 logic is enabled for interface operation between the disc drive and controller. Development of the Select Enable signal is described later in this discussion.

4-19. Select A and B logic in assembly A12 also is applied to the address decode circuit which provides unit identification to the controller at the request of the controller. During disc drive operation, all outputs from the decode circuit are high, except when the Attention signal is high and the controller pulses the $\overline{\text{Control Outbus 6}}$ line. The decoder responds to this request from the controller by providing a low output to the inbus circuit associated with the disc drive unit identifier. For example, if the Select A and Select B logic established the disc drive as unit 1, the decoder responds to a controller request by providing a low to the control inbus 1 circuit. In this manner the controller can identify each disc drive in an installation.

4-20. With power applied to a disc drive and the spindle motor not operating, the DOOR UNLOCKED lamp on indicator assembly A1 is lighted by a low $\overline{\text{Latch Drive}}$ signal from drive control assembly A10. The low $\overline{\text{Latch Drive}}$ signal, in turn, is developed by a low $\overline{\text{Speed Down}}$ output

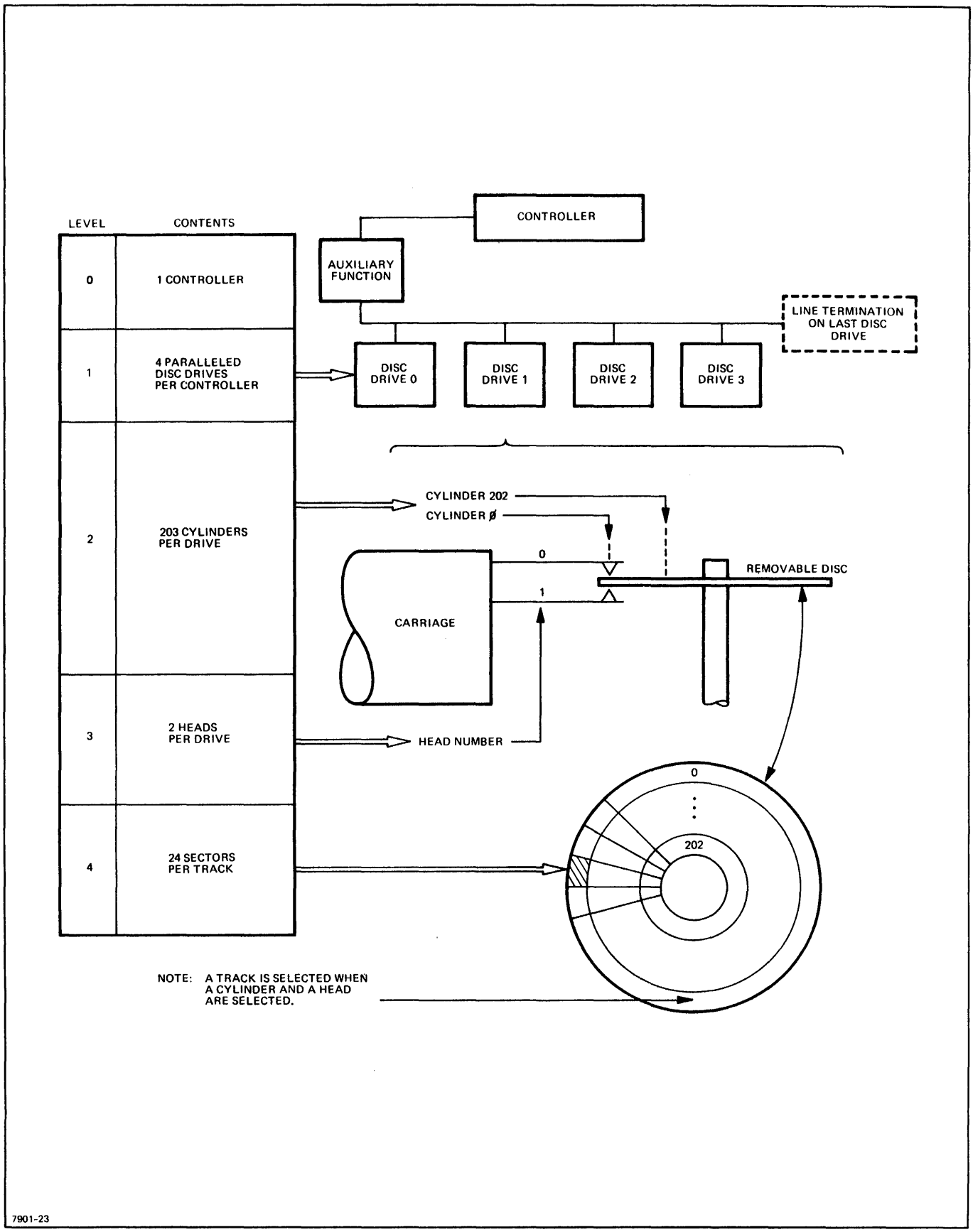


Figure 4-2. Disc Drive Addressing Structure

from sector cylinder assembly A11, and a low Carriage Retracted output from retract switch S8. The Speed Down output is low when spindle motor speed is below 0.2 percent of nominal, and the Carriage Retracted signal is low when the carriage is retracted.

4-21. Setting LOAD switch S2 on the disc drive front panel to the LOAD position lights the LOAD switch lamp and provides a high Load Switch output from assembly A1 to relay control circuits in drive control assembly A10. In assembly A10, the high Load Switch signal is applied to a motor latch circuit and to a gate that controls a Drive Ready output from the assembly. The motor latch circuit is controlled by the condition of the Load Switch and Carriage Retracted signals plus the output of an initial delay circuit. An initial delay is started when power is applied to the disc drive and various safety interlock conditions are satisfied. A power sense circuit monitors the output of the three voltage regulators in servo amplifier/regulator assembly A4, and provides a high output to the initial delay circuit. The high Encoder Lamp Interlock and low Interlock Line signals complete the input requirements to the Initial Delay logic. The Encoder Lamp Interlock output is high when the head encoder lamp has current, and low Interlock Line signal signifies the following disc drive safety interlocks are complete:

a. A cartridge is properly installed.

b. The disc drive door is closed.

c. The disc drive door is latched.

d. Printed-circuit assemblies A6 through A12 are properly installed in motherboard assembly A5.

4-22. During time-out of the initial delay circuit in assembly A10, an Initial Reset output is passed to sector cylinder assembly A11 to clear flip-flops in the speed-up sense circuit. Within assembly A10, the initial delay circuit also clears the Seek Timer flip-flop and the Drive Fault flip-flop and passes an R/W Reset signal to read/write control assembly A7.

4-23. Upon completion of the initial delay time-out in assembly A10, the reset signals are removed and the motor latch circuit is set for normal drive operation. At this time the drive ready delay circuit starts a time-out and a Energize Motor Relay output is sent to motor control assembly A3 to energize the motor relay. This action applies ac power to the motherboard fan motor and to the spindle motor that drives the disc. Concurrently, a Select Enable signal developed in assembly A10 is passed to the select circuit in I/O multiplex assembly A12. The Energize Motor Relay output is maintained during disc drive operation. However, if a condition occurs that causes the motor latch circuit in assembly A10 to change state, Energize Motor Relay signal goes high and power is removed from the spindle and fan motors. Simultaneously, a Retract output is passed to the Current Command line between encoder assembly A9 and servo amplifier/regulator A4. This action returns the carriage to the retracted position. A disc-drive restart requires new timing cycles through the initial delay and drive ready delay circuits in assembly A10.

4-24. Sector transducer assembly A2 supports a light source and photocell on opposite sides of the slotted skirt that extends down from the disc hub. As the disc and hub are rotated by the spindle motor, light passes through the slots and illuminates the photocells. The photocell develops electrical pulses (sector pulses) that are amplified and fed to speed-down and speed-up sense circuits in sector cylinder assembly A11. When the disc speed is below 0.2 percent of nominal, the Speed Down signal is low as discussed in paragraph 4-20. When disc speed exceeds this lower limit, the Speed Down signal is high, and makes the Latch Drive output from assembly A10 go high. Now the DOOR UNLOCKED lamp on indicator assembly A1 is extinguished. As disc speed exceeds 80 percent of nominal, the Speed Up output from the speed-up sense circuit in assembly A11 becomes low and is sent to assembly A10.

4-25. With the motor latch circuit set for normal operation, as described in paragraph 4-23, and the Speed Up signal low with no drive fault in assembly A10, an enabling signal is passed to the gate that senses time-out of the drive ready delay circuit. Upon completion of time-out, the Energize Servo Relay output becomes low and is passed to servo amplifier/regulator assembly A4 to energize servo relay K1. The relay connects the linear motor to servo amplifier circuits in assembly A4 that control the direction and speed of carriage movement. Carriage operation is discussed in subsequent paragraphs.

4-26. Encoder assembly A9 contains the A-, B- and C-channel amplifier logic to control carriage movement. Each amplifier circuit receives positioning information from the head position encoder. An operation started from the power-off condition finds the carriage retracted and the heads in a stored, or unloaded position. This provides a Heads Loaded output from assembly A9 to the home latch circuit in assembly A10. The home latch circuit develops low Servo Inhibit and high Seek Home signals that are passed back to assembly A9. The low Servo Inhibit signal disables the fine-position, reverse gate, and forward gate, thus disconnecting the channel A and B amplifier from the current command circuit. When Seek Home is high, the command servo home gate is turned on and connects the output of the channel C amplifier to the current command circuit. Channel-C positioning information from the head position encoder passes through assembly A9 to develop a Current command that is sent to assembly A4 to start the linear motor. When a zero crossing point is reached by the channel C amplifier in assembly A9, the carriage and heads are at the "home," or cylinder 000 position. At this time, the At Home and Heads Loaded lines from assembly A9 to assembly A10 become low and high, respectively.

4-27. The At Home signal in assembly A10 starts a delay cycle by setting a flip-flop in the home delay circuit. A Reset Counter output from the flip-flop is passed to assembly A11 to reset the destination address and current address registers. After the home delay circuit times out,

the home latch circuit is set for normal operation and removes the Servo Inhibit and Seek Home output to assembly A9. The high Heads Loaded signal in assembly A10 is applied to a seek timer circuit that is described later in this section, and to a gate that controls the Drive Ready indication.

4-28. With the Heads Loaded and Load Switch signals high in assembly A10, and after time-out of the drive ready delay circuit, the Drive Ready signal becomes high and is passed to I/O multiplex assembly A12. A low Drive Ready signal also sets a flip-flop in the first-status circuit to provide a high First-Status signal to assembly A12. A high Drive Ready signal also is applied to the output gate in the position delay circuit. While the carriage and heads are in the home position, a low Position Match signal is applied to the position delay circuit in assembly A10. Outputs from the position delay circuit inhibit the seek timer, provide a high Access Ready signal to assembly A12, and set the Attention flip-flop which provides a high Attention output to assembly A12. During the foregoing events, a low Drive Ready Lamp signal also is passed from assembly A10 to indicator assembly A1 to light the DRIVE READY lamp.

4-29. I/O multiplex assembly A12 interfaces the disc drive with the controller. With a match between the Select A and B logic from assembly A1 and the Select 1 and 2 logic from the controller, and with Select Enable high, the assembly logic is enabled. The high Drive Ready and Access Ready indications from assembly A10 are gated through to the controller as low Select and Drive Ready, and low Select and Access Ready indications. With Attention high in assembly A12, the controller can pulse the Control Outbus 6 line low to identify the disc drive unit number. This identification is made by making one of the Control Inbus 0 through 4 signals from assembly A12 to the controller go low. The low line is established by the Select A and B logic applied to the address decode circuit as discussed in paragraph 4-19. The controller also can determine first-status, seek check, data protect, software protect, or drive fault conditions over the Control Inbus 0 through 4 lines. These status indications are gated through assembly A12 when the controller makes the Control Outbus 7 line go low. Development of a first-status indication, as discussed in paragraph 4-28, and the seek check, data protect and drive fault functions are described in following paragraphs. The Software Protect signal in assembly A12 is developed by setting the SOFTWARE PROTECT switch on the disc drive chassis. The function is used to inhibit a write operation in the address field of a disc sector.

4-30. CARRIAGE POSITION CONTROL.

4-31. Carriage movement and position is controlled by encoder assembly A9 logic, which receives channel A, B and C information from the head encoder assembly, and by a Velocity Command received from sector cylinder assembly A11. Channel C information through assembly A9 is used to position the carriage and heads in the home position as discussed in paragraph 4-26. Further control of the carriage is achieved by the controller through I/O multiplex assembly A12. A low Set Cylinder signal from the controller to assembly A12 starts the carriage positioning process. This signal indicates that a cylinder address is present on the Control Outbus 0 through 7 lines and, in conjunction with the Access Ready signal from assembly A10, provides a Seek command to assembly A11. The low Set Cylinder signal in assembly A12 also develops a high Drive Set Cylinder signal that is passed to assembly A10 to clear the Attention flip-flop.

4-32. The cylinder address on the Control Outbus 0 through 7 lines is passed through isolation amplifiers in I/O multiplex assembly A12, and sent to sector cylinder assembly A11 on the Drive Outbus 0 through 7 lines. All lines are passed through an illegal-address decode circuit. If the cylinder address is legal (< cylinder 202), an enabling signal is applied, with a Seek command from assembly A12, to a gate that strobes the incoming cylinder address into the destination address register. The Seek command also makes the Cylinder Match output to assembly A9 go high which, in turn, makes the Position Match output to assembly A10 go high. In assembly A10, the high Position Match signal makes the Access Ready signal to I/O multiplex assembly A12 go low, and, in conjunction with the high Heads Loaded signal, starts the seek timer.

4-33. Time-out of the seek timer circuit in assembly A10 is approximately 850 milliseconds. If the carriage has not moved to the new cylinder address within that time period, the seek timer sets the Drive Fault flip-flop. A high Drive Fault signal is sent to I/O multiplex assembly A12 to develop a low output that is sent over the Control Inbus 4 line to the controller. In assembly A10, a low Drive Fault indication inhibits a gate in the servo relay circuit, which causes servo relay K1 in servo amplifier/regulator A4 to de-energize. This condition connects a Retract signal from assembly A4 through a carriage retract switch back to assembly A4 as a high Retract Switch Closed signal. A fixed voltage is applied to the linear motor through relay K1 causing the carriage to return to the retracted position. Concurrently, the Drive Ready indication from assembly A10 to assembly A12 goes low, the Drive Ready Lamp signal from assembly A10 to indicator assembly A1 goes high, and a low Drive Fault Lamp indication is sent to assembly A1. In assembly A1, the DRIVE FAULT lamp is lighted and the DRIVE READY lamp is extinguished. The disc drive is now in the original state and, with the LOAD switch still on, starts a cycle toward the home position and requires new controller commands as described under Drive Enable and Motor Control, paragraph 4-17.

4-34. During normal operation, with the seek timer circuit in assembly A10 continuing a time-out cycle, the cylinder address stored in the assembly A11 destination address register and the carriage address in the current address register are compared in the address difference adder circuit. If a seek is forward (away from cylinder 000), the Carry output is low. When a seek is conducted in the reverse direction, Carry is high. During a seek operation, the Cylinder Match output from assembly A11 also is high. The two conditions are applied to assembly A9 to determine the operation of the current command gates. A low Carry signal

with the high Cylinder Match turns on the forward gate, while a high Carry and high Cylinder Match turns on the reverse gate. During a forward seek operation, the forward gate is enabled and connects a high Velocity Command signal through a forward-velocity inverter to the current command circuit to assembly A4. A reverse seek operation finds the reverse gate enabled, and the high Velocity Command signal is connected directly to the current command circuit.

4-35. The Velocity Command input to assembly A9 is an analog signal supplied by a velocity curve generator in assembly A11. The difference value between the destination address register and current address register in assembly A11 is applied in binary form to the velocity decode and velocity curve generator circuits by the address difference adder circuit. A large difference between the two addresses provides a high-value Velocity Command signal. During a seek operation, the Forward Count signal or Reverse Count signal received from assembly A9 is used to update the current address register in assembly A11 as the carriage moves. As the difference between the current address and destination address becomes smaller, the Velocity Command signal to assembly A9 is reduced proportionally.

4-36. In assembly A9, the Velocity Command signal is passed through a gating circuit to the current command circuit between assembly A9 and servo amplifier/regulator assembly A4. A Current Command signal in assembly A4 is processed and fed to one of two drive amplifier circuits. One drive amplifier and an associated power amplifier are used to handle each Current-Command signal polarity. The enabled power amplifier applies current to the linear motor through a relay that is energized by the low Energize Servo Relay signal from assembly A10. As the linear motor moves the carriage in the direction dictated by the Current-Command signal polarity, a velocity transducer supplies a Tach-In voltage back to assembly A9. This voltage is proportional to carriage speed and direction, and provides damping characteristics to the Current Command output from assembly A9.

4-37. As the carriage moves in response to a Current Command signal, an optical encoder provides carriage position information. Three channels of position information, which are defined as the A, B and C channels, are sent to encoder assembly A9. The C-channel information is used to position the carriage in the home position as discussed in paragraph 4-26. The A and B channels, which are phase-separated by 90 degrees, are used to position heads over an addressed cylinder. The controlling conditions during original carriage movement are the high Cylinder Match, the condition of the Carry input from assembly A11, and the output of the B-channel shaper. When the heads reach the destination cylinder boundary, Cylinder Match becomes low and carriage positioning becomes the function of the A-channel shaper through the fine position gate. Positioning the heads at the zero point in a cylinder (physical center) is achieved by servo action between the A-channel output from the head position encoder and the linear motor. When the zero position in a cylinder is reached, a track center detector in the A-channel circuit provides a low Position Match output from assembly A9 to assembly A10. Receipt of the signal in assembly A10 develops the high Access Ready and Attention outputs which are applied to assembly A12 (refer to paragraphs 4-28 and 4-29).

4-38. Carriage movement toward a cylinder also provides an A-channel output that is applied to two differentiator circuits in assembly A9. One differentiator develops pulses when carriage movement is forward, and the other when the carriage is moving in a reverse direction. Each alternate zero-crossing of the A-channel input indicates the center of a cylinder, and a forward or reverse pulse is developed accordingly. These pulses are fed to assembly A11 via the forward count or reverse count lines, as applicable, to update the current address register. When the output of the destination address register and current address register are equal, outputs from the velocity decode circuit energize a gate to provide the low Cylinder Match output to assembly A9 with the results described in paragraph 4-37.

4-39. HEAD AND SECTOR CONTROL.

4-40. There are two heads per disc drive, one for each surface of the disc. The disc contains 203 cylinders; 203 tracks per surface, with 24 sectors per track. Carriage positioning places both heads over a selected cylinder. Head and sector select input signals then define the portion of the disc to be used in a read or write operation.

4-41. A head-and-sector select operation is initiated by the controller pulsing the Set Head and Sector control line into I/O multiplex assembly A12 and placing the head-and-sector address on the Control Outbus 0 through 7 lines. In assembly A12, the control signal is passed through an enabled select gate and is passed to sector cylinder assembly A11 as a low Drive Set Head and Sector signal. In assembly A11, the output is passed through the illegal sector decode circuit, and is used to strobe the sector address into the sector address register. The signal also is used to enable the Head Select flip-flop and a flip-flop in the sector compare circuit.

4-42. Head-and-sector address data from assembly A12 to assembly A11 is carried on the Drive Outbus 0 through 7 lines. In assembly A11, the data is passed through an illegal address decode circuit, with the decoded output passed to the illegal sector decode circuit. An illegal address or an illegal sector select produces a low Illegal Address output from assembly A11 that is described later in this discussion. The Drive Outbus 0 line into assembly A11 during a head-and-sector select operation provides an illegal head address check in the illegal sector decode circuit. The Drive Outbus 1 line carries the head address, the Drive Outbus 2 line is not used, and the Drive Outbus 3 through 7 lines carry the sector address.

4-43. A high Drive Outbus 1 line and low Drive Set Head and Sector signal in assembly A11 set the Head Address flip-flop, which provides a high Head 1 output. This signal is passed from assembly A11 to read/write control assembly A7. During normal operation in assembly A7 the head

select information is gated through to write drive/read preamplifier assembly A6 where the head-1 drive is enabled. When a low Drive Outbus 1 condition exists in assembly A11, the Head 1 output from the Head Address flip-flop is low and the head-0 drive is enabled in assembly A6.

4-44. The Control Outbus 3 through 7 lines from the controller assembly A12 carry the sector select logic, and are passed to assembly A11 on the Drive Outbus 3 through 7 lines. The sector address is compared with the output of the sector counter in a five-bit sector compare register. Four bits of the input address are applied directly to the head-and-sector address register by the Drive Outbus 4 through 7 lines. The most significant bit of the sector address, which is carried on Drive Outbus 3, is applied directly to the sector compare register through a separate flip-flop. Both the head-and-sector address register and the flip-flop connected in the Drive Outbus 3 line are clocked by the low Drive Set Head and Sector signal when the head-and-sector address is legal.

4-45. The sector counter in assembly A11 is set by the Sector Transducer pulse input from sector transducer assembly A2. A slotted skirt that is divided into 24 equal segments is mounted on the disc hub and rotates as the disc is turned by the spindle motor. A light source located on one side of the skirt and a photocell on the other provides electrical impulses as the skirt rotates. An index slot is located approximately one-quarter of a sector past the zero-sector slot and is used as a reference point for counting the sectors. Each revolution of the disc produces 24 sector pulses and an index pulse which are applied to assembly A11 on the Sector Transducer line.

4-46. Sector pulses are first applied to an adjustable time delay circuit to permit synchronization of the pulses with disc data. The pulses are then processed by two one-shot stages that provide sector pulse inputs to the speed-up sense circuit and speed-down sense circuit, and separate the sector pulses and index pulse. When sector pulse count rate in the speed-up sense circuit indicates that disc speed is above 80 percent nominal, the circuit develops a low Speed Up signal that is described in paragraph 4-24. The speed-down sense circuit develops a low Speed Down signal when the disc speed is below 0.2 percent of nominal as indicated by the sector pulse count rate.

4-47. Each index pulse clears the sector counter and Sector Pulse Input flip-flop. This action is followed by application of the sector pulses to the divide-by-24 counter. Output from the sector counter is fed to the sector compare register where a comparison between the sector address and the sector pulse count is made. When the two inputs are equal, a high Sector Compare output is passed through the fixed-status circuit in assembly A12 and sent to the controller as a low Select and Sector Compare indication. Sector pulses are also applied to a 24-microsecond one-shot that provides a Sector Pulse output to the fixed-status circuit in assembly A12. With select circuits enabled, a low Select and Sector Pulse indication is passed to the controller.

4-48. In the event that the Set Cylinder and Set Head and Sector signals are low at the same time in assembly A12, the Reseek Home line becomes low. In assembly A10, the condition causes the Home Latch to be set, and provides a low Servo Inhibit and high Seek Home condition as described in paragraph 4-26. After the carriage is returned to the home position, the controller must issue new cylinder and head-and-sector addresses.

4-49. In assembly A11, if an illegal cylinder address or an illegal head-and-sector address are detected by the illegal address decode and illegal sector decode circuits, a low Illegal Address output is sent to assembly A10. The signal sets a Seek Check flip-flop which provides an output to assembly A12. The controller obtains the Seek Check indication on the Control Inbus 1 line when the Control Outbus 7 line is low.

4-50. READ/WRITE CONTROL.

4-51. Read, write, and erase control of the disc drive is exercised when the controller makes the Control line go low and places the Read, Write, or Erase command on the Control Outbus 0 through 2 lines. The low Control Outbus 1 signal is used to request a read operation, while the low Control Outbus 0 and 2 signals request a write-erase operation. These inputs are passed through I/O multiplex assembly A12 and connected to read/write control assembly A7 via the Drive Outbus 0 through 2 lines. Connections also are made between the Control Outbus 3 and 4 circuits in assembly A12 and the Drive Outbus 3 and 4 lines to assembly A7. These latter two inputs control a pair of flip-flops in assembly A7 that provide Shift-In or Shift-Out signals that are not used in the disc drive.

4-52. When Control and Control Outbus 0 and 2 are low in assembly A12, the Drive Outbus 0 and 2 signals are sent from assembly A12 to assembly A7. Simultaneously, a Select-and-Control signal, which is the product of the low Control input to assembly A12, is passed to assembly A7. When the controller makes the Control Outbus 7 line in assembly A12 go low during the period that the Control line is low, a low Select-and-Control-and-Outbus 7 indication is sent to assembly A10 to clear the Attention flip-flop and remove the first-status indication to assembly A12.

4-53. The input circuits of the write, erase, and read logic of read/write control assembly A7 contain provisions to inhibit operation under certain conditions. An output from the read/write error detection circuit provides an Unsafe signal to the logic and inhibits a read or write operation when an error is detected in any circuit being monitored. The same error indication inhibits operation of the head select logic. When a data protect function is selected by setting DATA PROTECT switch S9 to the ON position, a write-erase function is inhibited, but a read operation can be performed. The output of two flip-flops that are connected in the shift-in, shift-out circuits in assembly A7 also are connected to the input of the read, write, and erase logic. These flip-flops are controlled by the Drive Outbus 3 and 4 inputs to assembly A7 from assembly

A12, and are low during a read or write operation. Since the flip-flops remain cleared, the control gate to the read-write logic remains enabled. The Shift-In and Shift-Out commands are connected through to assembly A9, but are not used.

4-54. Data transfer between the controller and disc drive occurs over a single, transmission-line pair that is shared by the write data and read data. Two line drivers that are controlled by the write and read logic, respectively, interface the single transmission pair with assembly A7 circuits. The write line driver provides write data interface between the transmission line and the write formatter circuit, while the read line driver interfaces the zero-crossing detector circuit to the line. During a normal write operation, the Drive Outbus 0 line enables the write gate which, in turn, enables the write line drive and the write formatter circuit. Data is passed from the transmission line through the driver to the write formatter which changes the pulse data to double-frequency square wave. As the write formatter is toggled by the data, the Write A and Write B lines carry the double-frequency square wave to the A- and B-gates in assembly A6 that develop write current for each data- or clock-bit input. Outputs from the gates are fed to the set of head-1 or head-0 write coils that are enabled. Selection of the enabled set of coils is made by energizing one of the two head drives as discussed in paragraph 4-43.

4-55. When the write gate in assembly A7 is enabled, a Write Gate signal is passed from assembly A7 to the write enable circuit in assembly A6. The write enable circuit inhibits the read enable gate and turns on the write-current sink to complete the A-gate and B-gate circuits to allow flow of write current through the selected head coil. Current flowing in the circuit is further controlled by a $\overline{\text{Decrease Write Current}}$ input from assembly A7 to assembly A6. This control is a product of a >Track-128 output from the destination address register in assembly A11. The output is high only when a cylinder address received from the controller is greater than 127. In assembly A6, the high >Track-128 output reduces the write current source by approximately 20 percent on disc cylinders 128 through 202 to optimize write characteristics over the entire disc.

4-56. An erase function produces two gaps on either side of the recorded data and occurs during the write operation. This provides a band between the data tracks, and prevents the head from reading the data on adjacent tracks during a read operation. An erase operation is initiated by making Drive Outbus 2 into assembly A7 go high when a write operation also has been selected. A low $\overline{\text{Erase Gate}}$ signal is passed from assembly A7 to assembly A6 and turns on an erase current gate sense circuit to apply a dc current through the erase coil of the selected head to provide an erase band on either side of the disc data track.

4-57. A read operation is enabled when Drive Outbus 1 becomes high in assembly A7. The enabled read gate turns on the read line driver and connects the zero-crossing detector to the transmission line pair. In assembly A6, the write enable circuit is disabled which permits the read enable gate and subsequent processing circuits to operate normally. As the heads fly over the selected cylinder, the data is retrieved from the disc surface in analog form and is gated through the read enable gate to a preamplifier. The output of the preamplifier is a signal of varying amplitude and frequency, with each signal peak representing a clock or data bit. The output is passed through a low-pass filter and a differentiator, whose output is an analog signal with each clock or data bit now represented by the zero-crossing point. Line-isolation drivers pass this Read A and B information from assembly A6 to the zero-crossing detector circuit in assembly A7 where an analog-to-double-frequency square wave conversion occurs. The information is then passed through a pulse generator where the information is transformed into serial data. The read data is then connected to the transmission line through the enabled read driver.

4-58. A read/write error detection circuit in assembly A7 monitors operation of various read/write functions in assemblies A6 and A7. The assembly A7 circuits that are monitored include the write, erase, and read gates. An ac write current detect circuit in assembly A7 provides a monitor indication of A- and B-gate operation in assembly A6, while the dc write current detect circuit in assembly A7 provides monitor indications for the write current sink in assembly A6. An erase detect line between the error detection circuit in assembly A7 and the erase current gate sense circuit in assembly A6 also provides monitor indications. The $\overline{\text{Multi-Head Detect}}$ line from assembly A6 to assembly A7 provides an error signal when both head drives are gated-on simultaneously. When an error occurs in any of the circuits, an associated cross-coupled gate in the read/write error detection circuit is toggled. Table 4-1 lists typical error conditions and indications at test points TP4, TP5, and TP6.

Table 4-1. Read/Write Fault Conditions

ILLEGAL CONDITION	A7TP4	A7TP5	A7TP6
Straddle erase current flowing without an erase gate.	1	0	0
A write gate without straddle erase current.	0	1	0
Simultaneous read gate and erase gate.	1	1	0
More than one head selected at once.	1	0	1
A write gate without ac write current (data).	1	0	1
DC write current without a write gate.	0	1	1
An erase gate without an Access Ready signal.	1	1	1

4-59. When an error condition exists, a R/W Unsafe signal is developed in assembly A7 and sets the Drive Fault flip-flop in assembly A7. This action produces the same drive fault conditions described in paragraph 4-33. The R/W unsafe condition also is gated through to the read/write input logic of assembly A7 to inhibit a read, write, and erase function, as well as the head select gates. When the carriage is retracted and the disc drive enable conditions are satisfied, an R/W Reset signal is developed in A10 and sent to assembly A7 to reset the read/write error detection circuit. Simultaneously, a low $\overline{\text{R/W Unsafe}}$ output in assembly A10 resets the Drive Fault flip-flop.

4-60. DISC DRIVE POWER SUPPLY.

4-61. The disc drive power supply (see figure 5-22), consists of a line filter, a transformer with two rectifiers that are chassis mounted, and three regulators that are located on servo amplifier/regulator assembly A4. A chassis-mounted terminal board in the transformer circuit provides strapping options that enable the disc drive to be used with various ac sources. A list of strapping options is contained in section II.

4-62. During operation, one rectifier-filter network supplies an unregulated +8 Vdc to assembly A4, and a second rectifier-filter network supplies a +20 and -20 Vdc to assembly A4. The +8 Vdc is applied to a series regulator in assembly A4 that provides a regulated +5 Vdc to the disc drive printed-circuit assemblies. The +20 Vdc input to assembly A4 is applied to a series regulator that supplies the regulated +12 Vdc to disc drive PCA's. An unregulated +20 Vdc also is provided by assembly A4 to assembly A1. The -20 Vdc input is also passed through a third series regulator that supplies a regulated -12 Vdc to the disc drive PCA's. Read/write control assembly A7 contains circuits that require a -5-Vdc supply. A zener diode filter network is connected in the regulated -12-Vdc supply to provide the -5 Vdc.

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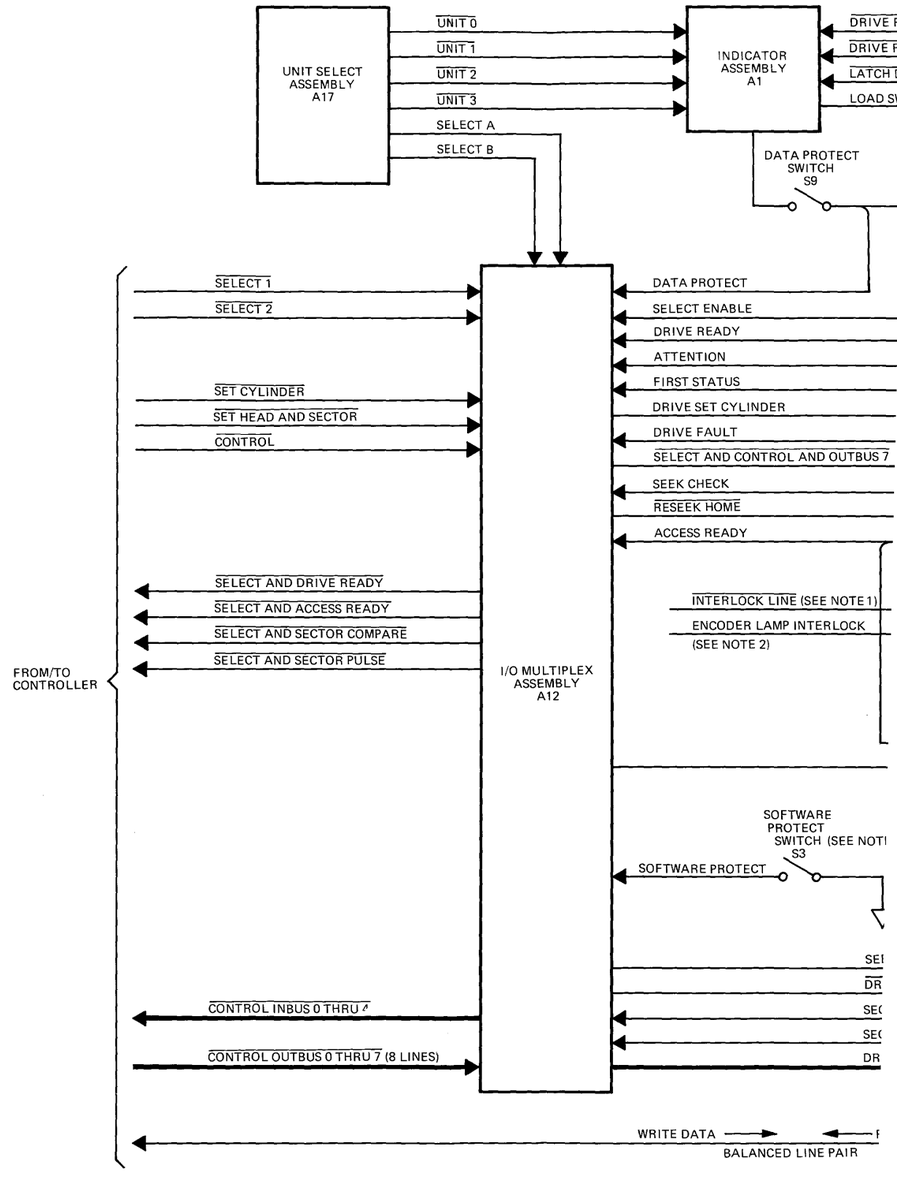
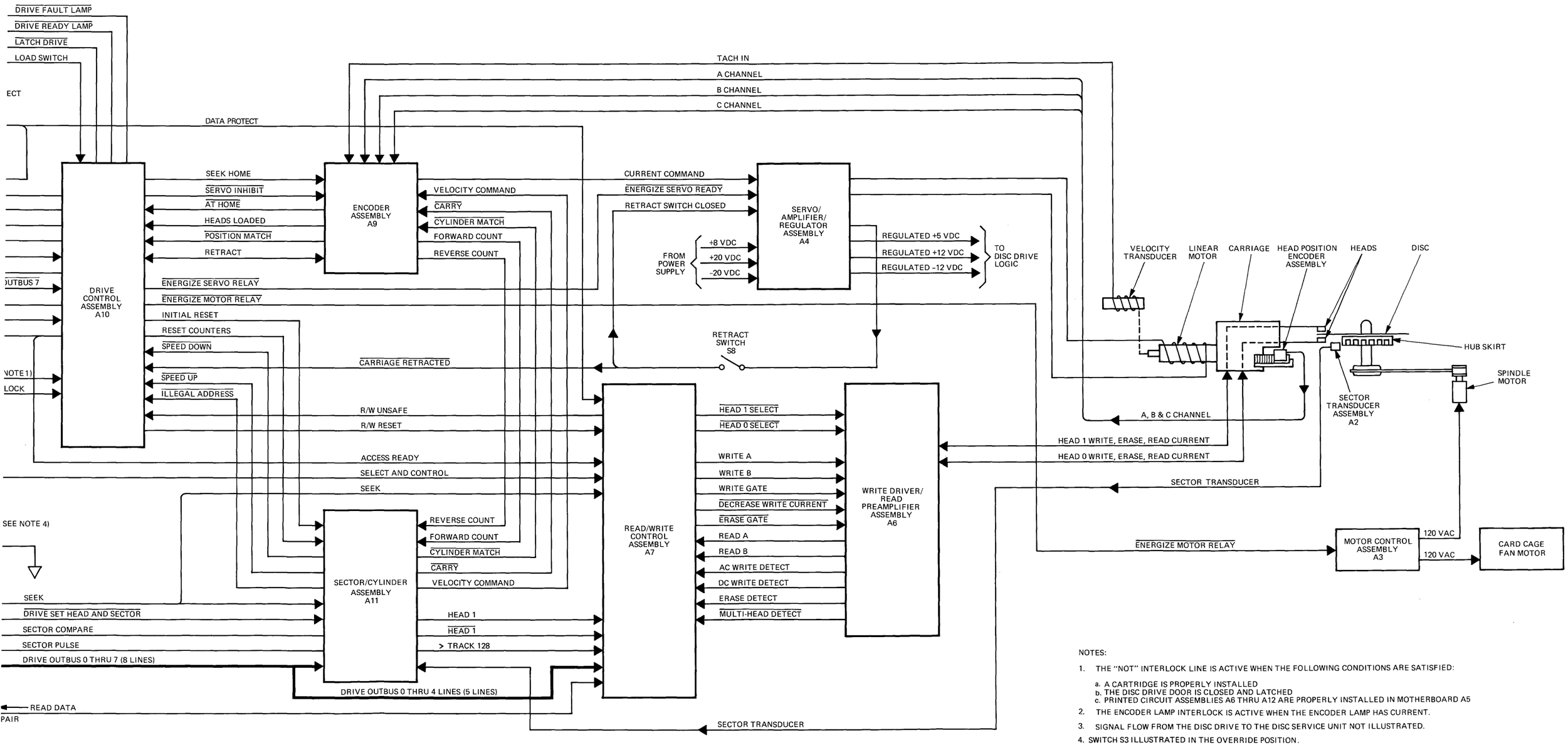

UNIT SELECT ASSEMBLY A17
UNIT 0
UNIT 1
UNIT 2
UNIT 3
SELECT A
SELECT B
INDICATOR ASSEMBLY A1
DRIVE F
DRIVE F
LATCH I
LOAD SW
DATA PROTECT SWITCH S9
SELECT 1
SELECT 2
SET CYLINDER
SET HEAD AND SECTOR
CONTROL
DATA PROTECT
SELECT ENABLE
DRIVE READY
ATTENTION
FIRST STATUS
DRIVE SET CYLINDER
DRIVE FAULT
SELECT AND CONTROL AND OUTBUS 7
SEEK CHECK
RESEEK HOME
ACCESS READY
SELECT AND DRIVE READY
SELECT AND ACCESS READY
SELECT AND SECTOR COMPARE
SELECT AND SECTOR PULSE
INTERLOCK LINE (SEE NOTE 1)
ENCODER LAMP INTERLOCK
(SEE NOTE 2)
FROM/TO CONTROLLER
I/O MULTIPLEX ASSEMBLY A12
SOFTWARE PROTECT SWITCH (SEE NOTE
S3
SOFTWARE PROTECT
SE
DR
SE
SE
DR
CONTROL INBUS 0 THRU 7
CONTROL OUTBUS 0 THRU 7 (8 LINES)
WRITE DATA
BALANCED LINE PAIR

7901-64



NOTES:

1. THE "NOT" INTERLOCK LINE IS ACTIVE WHEN THE FOLLOWING CONDITIONS ARE SATISFIED:
   a. A CARTRIDGE IS PROPERLY INSTALLED
   b. THE DISC DRIVE DOOR IS CLOSED AND LATCHED
   c. PRINTED CIRCUIT ASSEMBLIES A6 THRU A12 ARE PROPERLY INSTALLED IN MOTHERBOARD A5
2. THE ENCODER LAMP INTERLOCK IS ACTIVE WHEN THE ENCODER LAMP HAS CURRENT.
3. SIGNAL FLOW FROM THE DISC DRIVE TO THE DISC SERVICE UNIT NOT ILLUSTRATED.
4. SWITCH S3 ILLUSTRATED IN THE OVERRIDE POSITION.

Figure 4-3. HP 7901 Disc Drive, Block Diagram

SECTION V MAINTENANCE

5-1. INTRODUCTION.

5-2. This section contains disc drive maintenance precautions, a list of required test equipment, preventive maintenance information, general repair information, performance tests, adjustment procedures, troubleshooting information, parts lists, parts location diagrams, schematic diagrams and integrated-circuit details.

5-3. MAINTENANCE PRECAUTIONS.

WARNING

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

5-4. REQUIRED TOOLS AND TEST EQUIPMENT.

5-5. Table 5-1 lists tools and test equipment required to service the disc drive. Equivalent equipment may be substituted in each case.

5-6. PREVENTIVE MAINTENANCE.

5-7. The disc drive requires a minimum of maintenance. When the disc drive is placed in a severe environment, a greater frequency of preventive maintenance might be required (an environment that has an unusual amount of dust, smoke, oil vapor, etc is considered severe). The following discussion provides instructions for performing filter system checks, replacing the absolute filter, and procedures for inspecting and cleaning the disc drive. Preventive maintenance should be performed according to the schedule given in table 5-2.

CAUTION

Do not remove the disc drive top and bottom covers in severe environments. An environment free of dust, smoke, oil vapor, etc is necessary to protect against disc surface contamination.

Do not run the disc drive for extended periods without the front filter screen as this will shorten the life of the absolute filter. Also, do not run the disc drive without an absolute filter.

5-8. FILTER SYSTEM CHECKS.

5-9. Periodic checks should be made on the overall effectiveness of the filter system. Filter checks are made as follows:

a. Remove the top cover and apply power to the disc drive by pressing the POWER switch.

b. Open the drive front door and remove the disc cartridge (if one is installed).

c. Remove the cartridge receiver and close front door.

d. Manually press down on the cartridge interlock switch and press the LOAD switch.

e. Check for positive air flow through the filter outlet. If restricted air flow is evident, clean the filter screen and replace the absolute filter. (Refer to paragraph 5-10.)

f. Power down the disc drive by pressing the LOAD switch and replace the cartridge receiver using care not to contact the carriage assembly.

g. Replace the disc cartridge (if originally equipped) and top cover.

5-10. ABSOLUTE-FILTER REPLACEMENT.

5-11. The absolute filter should be changed once each six months in normal computer room environments. If evidence of restricted air flow exists, the contaminated filter should be changed immediately. To change the filter, proceed as follows:

a. Press POWER switch to remove power to the unit.

b. Remove bottom cover.

c. Loosen clip on blower housing.

d. Remove three capscrews that secure the filter assembly to the frame.

e. Remove the absolute filter.

f. Install a new absolute filter part no. 3150-0231, and tighten capscrews.

g. Replace clip to blower housing.

h. Replace bottom cover.

Table 5-1. Required Tools and Test Equipment

TEST EQUIPMENT AND TOOLS	RECOMMENDED MODEL AND PART NUMBER
Oscilloscope	HP 180A
Dual Channel Vertical Amplifier	HP 1801A
Time Base	HP 1821A
Probe, 10:1 (Quantity 3)	HP 10006A
Probe, 1:1	HP 10008A
Current Probe Kit	HP 456A
Digital Voltmeter	HP 3439A
DC Multi-Function Plug-In	HP 3444A
Probe	HP 10025A
Disc Service Unit	HP 13219A
Diagnostic Program	13041-60001
Extender Board	07900-60014
Alignment Cartridge	1535-0066
Head Adjustment Tool	07900-60044
Mylar Shim (0.005 Inch Thick)	1535-0861
Alcohol (6 oz. Bottle)	8500-0559
Head Cleaning Tool	07900-00091
Head Installation Tool (Quantity 2)	1460-1333, 1460-1334
Kimwipe Tissues (Type 900-5)	9300-0001
STANDARD TOOL KIT	
Posidrive Screw Driver	Stanley 2951
Posidrive Screw Driver	Stanley 2952
Long Nose Pliers	Xcelite 71CG
Wire Cutters	Xcelite 74CG
Screw Driver 4 x 1/4 Inch	Xcelite R-144
Screw Driver 4 x 1/8 Inch	Xcelite R-184
Wire Stripper	K-Miller 101-S
6-Inch Steel Rule	General 616
Soldering Iron	Ungar 6010
Inspection Mirror	G.C. Electric 6090-P
IC Pin Clip	A-P, Inc.
Socket Keys	Xcelite 99PS-40

5-12. INSPECTION.

5-13. Inspection routines should be performed according to schedule given in table 5-2. Inspection procedures are as follows:

a. Inspect read/write heads for contamination and damage.

b. Inspect carriage rails and bearings for cleanliness, wear, and damage.

c. Inspect encoder plate for contamination and signs of rubbing.

d. Inspect front door filter for cleanliness.

e. Inspect front door for cleanliness.

f. Inspect drive belt for fraying and possible damage.

g. Inspect all hardware for looseness or missing parts.

h. Inspect cables and connectors for damage or looseness.

i. Inspect spindle to ensure free rotation. Mounting screws must be tight.

j. Inspect spindle discharge contact for looseness and replace annually.

k. Inspect linear motor air gap for accumulated particles.

l. Inspect casting and cartridge receiver for cleanliness.

m. Check voltages from power supply for proper levels.

n. Inspect lamps and switches for proper operation.

Table 5-2. Preventive Maintenance Schedule

ITEM	SCHEDULE		
	2 MONTHS	6 MONTHS	12 MONTHS
Read/write heads	Clean with Kimwipes and filtered 91% isopropyl alcohol. (Refer to paragraph 5-16.)		
Carriage rails	a. Clean with Q-tips and filtered 91% isopropyl alcohol. (Refer to paragraph 5-17.) b. Inspect bearings for wear and ease of rotation. (Refer to paragraph 5-17.)		
Encoder plate	Clean with Q-tips and filtered 91% isopropyl alcohol. (Refer to paragraph 5-18.)		
Spindle	a. Clean with masking tape by pressing sticky side to exposed surface. (Refer to paragraph 5-21.) b. Inspect bearings for wear and ease of rotation. (Refer to paragraph 5-21.)		
Linear motor	Clean with masking tape by pressing sticky side to exposed portion of coil. (Refer to paragraph 5-21.)		
Front door filter	Clean with vacuum cleaner. (Refer to paragraph 5-19.)		
Casting and cartridge receiver	Clean with Kimwipes and filtered 91% isopropyl alcohol. (Refer to paragraph 5-22.)		
Drive belt	Inspect for wear and possible replacement.		
Power Supply	Check output voltages. Adjust if necessary. (Refer to paragraph 5-30.)		
Alignment of all adjustable parameters	Check and adjust if necessary (Refer to paragraph 5-28.)		
Absolute filter	Inspect for contamination. Replace if dirty. (Refer to paragraph 5-10.)	Replace.	
Static discharge contact	Inspect for looseness.		Replace.

5-14. CLEANING

5-15. Cleaning should be performed bi-monthly, or when an inspection discloses disc drive contamination. Cleaning materials include Kimwipe tissues and a filtered solution of 91 percent isopropyl alcohol mixed with 9 percent distilled or deionized water by volume (HP part number 8500-0559). The following description includes cleaning procedures for the read/write heads, carriage rails and bearings, encoder plate, front door filter, front door assembly, spindle and linear motor, and the casting and cartridge receiver.

CAUTION

Always use Kimwipe tissues (Type 900-S) and the recommended cleaning solution. Do not substitute. Many other tissues contain contaminating oils, and other solutions might contain impurities. Oil residue or solution impurities can cause disc drive damage.

5-16. READ/WRITE HEADS. Equipment required to clean the read/write heads include Kimwipe tissues, the recommended cleaning solution (refer to paragraph 5-15), a cleaning tool and an inspection mirror. To clean the heads, proceed as follows:

a. Press the LOAD switch to the released position. Remove the disc cartridge. Remove drive power by setting the POWER switch off.

b. Remove the disc drive top cover and cartridge receiver and install the head installation tools.

c. Fold one Kimwipe tissue (Type 900-S) into a rectangle (approximately 1 by 5 inches) and wrap it over the rounded edge of the head cleaning tool. A rubber band can be used to secure the Kimwipe to the tool for ease of handling. (See figure 5-1.)

d. Dampen (do not saturate) the Kimwipe with the isopropyl alcohol solution, part no. 8500-0559.

CAUTION

In making finger contact with the head and head assembly, note that the head shoes are mounted on fragile gimbals. Excessive force can cause damage to the heads.

e. Clean the heads by placing the tissue-covered tool between the head pin and gently wiping the head surfaces. Use the inspection mirror to confirm that all signs of oxide contamination are removed.

f. When the heads have been cleaned, remove all cleaning tools and replace cartridge receiver, and disc drive top cover.

g. Restore the disc drive to operational status.

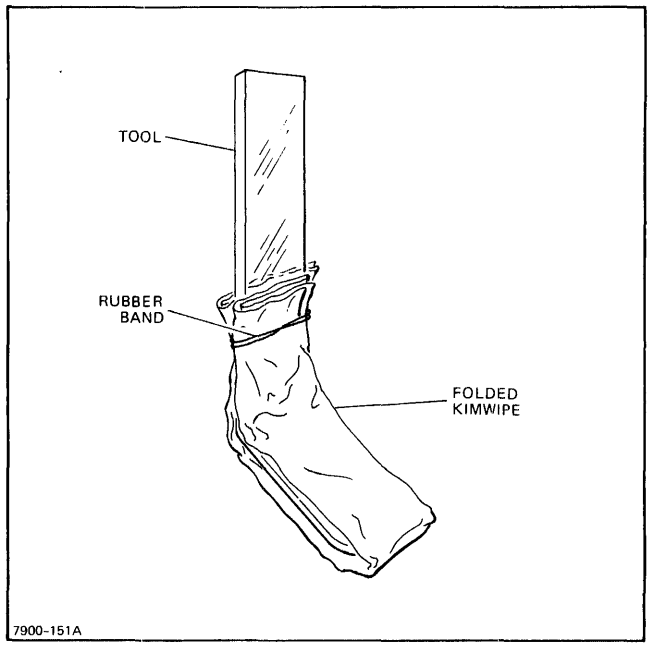


Figure 5-1. Prepared Head Cleaning Tool

5-17. CARRIAGE RAILS AND BEARINGS. The required cleaning materials for the carriage rails and bearings include Kimwipe tissues and isopropyl alcohol solution. Some amount of lubricant on the rails is allowable. Clean only when surface particles have accumulated. To clean the carriage rails and bearings proceed as follows:

a. Set the LOAD switch to the released position. Remove the disc cartridge. Remove drive power by setting the POWER switch off.

b. Remove the disc drive top cover and cartridge receiver.

CAUTION

Care must be taken not to saturate bearings. Excessive alcohol might damage the lubrication pack.

c. Dampen the Kimwipe tissue with alcohol and clean carriage rails and bearing outer-wear surfaces.

d. Replace the cartridge receiver and disc drive top cover.

e. Restore the disc drive to operational status.

5-18. ENCODER PLATE. The required encoder plate cleaning materials include Kimwipe tissues and isopropyl slcohol solution. To clean the encoder plate proceed as follows:

a. Set the LOAD switch to the released position. Remove the disc cartridge. Remove drive power by setting the POWER switch off.

b. Remove the disc drive top cover and cartridge receiver.

CAUTION

Exercise caution when cleaning. Excessive pressure might break the encoder glass.

c. Dampen a tissue and clean both sides of the encoder glass plate.

d. Replace the cartridge receiver and disc drive top.

e. Restore the disc drive to operational status.

5-19. FRONT DOOR FILTER. The front door filter is cleaned using a vacuum cleaner and the following procedures:

a. Set the LOAD switch to the released position. Remove drive power by setting the POWER switch off.

b. Press in on the front door screen at either the upper left or right corner. The front door screen should open out on the opposite side. Remove screen.

c. Remove the front door filter from the disc drive area before further cleaning.

d. Vacuum off any exterior dust particles on the front door filter.

e. Remove the foam plastic filter from the panel and vacuum the panel to remove any dust wedged between the intake holes.

f. Vacuum the foam plastic filter material of any exterior dust particles.

g. Connect the vacuum to a blower and blow out and away from the filter any dust particles. Do not blow dust through the plastic filter.

h. Return the foam plastic filter to the panel and install the front door screen in the disc drive.

i. Restore the disc drive to operational status.

5-20. FRONT DOOR ASSEMBLY. The required disc drive front door assembly cleaning materials include Kimwipe tissues, isopropyl alcohol solution, and anti-static glass cleaner, part number 8500-0039. To clean the disc drive and front door assembly proceed as follows:

a. Set the LOAD switch to the released position. Remove the disc cartridge. Remove drive power by setting the POWER switch off.

b. Remove the disc drive top cover, cartridge receiver, and bottom cover.

c. Clean and vacuum the entire casting and exposed enclosures to remove all foreign matter.

d. Replace cartridge receiver and disc drive top and bottom front covers.

e. Clean front door window using a tissue dampened with anti-static glass cleaner, part number 8500-0039.

f. Restore the disc drive to operational status.

5-21. SPINDLE AND LINEAR MOTORS. The motor cleaning materials include one roll of one-inch masking tape. To clean the spindle and linear motors, proceed as follows:

a. Set the LOAD switch to the released position. Remove the disc cartridge. Remove drive power by setting the POWER switch off.

b. Remove the disc drive top cover and cartridge receiver.

c. Remove watches and rings from your hands.

d. Wrap two or three turns of tape around one hand (sticky-side exposed).

e. Press the tape against all exposed magnetic areas of the spindle and voice coil until all foreign particles are removed.

f. Install a Kimwipe tissue between the heads.

g. Manually extend the carriage to expose the center piece in the linear motor.

h. Press tape against the exposed center piece of the motor until all foreign particles are removed.

CAUTION

Care must be taken to ensure that no masking tape is left on the motor or spindle, otherwise wear and contamination can occur.

i. Retract the carriage.

j. Remove the Kimwipe tissue from between the heads.

k. Replace the cartridge receiver and disc drive top cover.

l. Restore the disc drive to operational status.

5-22. CASTING AND CARTRIDGE RECEIVER. The casting and cartridge receiver cleaning materials include Kimwipe tissues and isopropyl alcohol solution. To clean the casting and cartridge receiver, proceed as follows:

a. Set the LOAD switch to the released position. Remove the disc cartridge. Remove drive power by setting the POWER switch off.

b. Remove the disc drive top cover and cartridge receiver.

c. Clean cartridge receiver using a tissue dampened with alcohol.

d. Clean exposed areas of casting using a tissue dampened with alcohol.

e. Replace the cartridge receiver and disc drive top cover.

f. Restore the disc drive to operational status.

5-23. REPAIR INFORMATION.

5-24. The etched printed-circuit assemblies (PCA's) used in Hewlett-Packard equipment are the plated-through type consisting of metal bonded to both sides of an insulating material. The metallic conductors are extended through the component holes by a plating process. Soldering can be performed on either side of the PCA with equally good results. Table 5-3 lists recommeneded tools and materials for use in repairing etched PCA's. Following are recommendations and precautions pertinent to PCA repair work.

a. Avoid unnecessary component substitution; damage to the PCA and/or adjacent components can result.

b. Do not use a high-power soldering iron on PCA's. Excessive heat might lift a conductor or damage the board.

CAUTION

Do not use a sharp metal object such as an awl or twist drill to remove solder. Sharp objects might damage the plated-through conductor.

c. Use a suction device (refer to table 5-3) or wooden toothpick to remove solder from component mounting holes.

d. After soldering, remove excess flux from the solder areas.

5-25. The following procedures are recommended when component replacement is necessary:

Note: Although not recommended when both sides of the PCA are accessible, axial lead components such as resistors and tubular capacitors can be replaced without unsoldering. Clip leads near body of defective component, remove component and straighten leads left in board. Wrap leads of replacement component one turn around original leads. Solder wrapped connection and clip off excess lead.

a. Remove defective component from board.

b. If component was unsoldered, remove solder from mounting holes with a suction device (refer table 5-3) or a wooden toothpick.

c. Shape leads of replacement component to match mounting hole spacing.

d. Insert component leads into mounting holes and position component as original was positioned. Do not force leads into mounting holes; sharp lead ends might damage the plated-through conductor.

Table 5-3. Printed-Circuit Assembly Repair Equipment

ITEM	USE	DESCRIPTION	RECOMMENDED MODEL
Soldering Tool	Soldering and unsoldering	Wattage rating: 47-1/2 to 56-1/2W Tip Temp: 850° to 900° F	Ungar #776 Handle with Ungar #4037 Heating Unit*
Soldering Tip*	Soldering and unsoldering	Shape: pointed	Ungar #PL111*
Suction Device	Removes molten solder from connection		Soldapullt by Edsyn Co., Arleta, California
Resin (Flux) Solvent	Removes excess flux from soldered area	Must not dissolve etched circuit base board material or conductor bonding agent	Freon Aceton Lacquer Thinner Isopropyl Alcohol (100% dry)
Solder	Component replacement, printed-circuit board repair, and wiring connections.	Resin (flux) core, high tin content (60/40 tin/lead). 18 gauge (AWG) preferred	

*For working on etched boards; for general purpose work, use Ungar #1237 Heating Unit (37.5W, tip temp of 750° to 800°F) and Ungar #PL113 1/8-inch chisel tip.

5-26. PERFORMANCE TESTS.

5-27. Disc drive performance is tested following initial installation or upon completion of any maintenance requirements. To test the unit proceed as follows:

a. Press the front panel POWER switch. The power switch lamp and DOOR UNLOCKED lamp on the front panel will light.

b. Press the front panel LOAD switch. The DOOR UNLOCKED lamp will go out. After a 30-second delay, the DRIVE READY lamp will light.

Note: If the DRIVE FAULT lamp lights, or if the DRIVE READY lamp fails to light, refer to the troubleshooting procedures in paragraph 5-49.

c. Run the disc drive diagnostic software program (HP part number 13041-60001) to establish whether the data read/write functions are being performed properly.

5-28. ALIGNMENT AND ADJUSTMENTS.

5-29. Disc drive alignment and adjustments are performed after repairs are made, or to optimize performance after long periods of use. Procedures are included for adjusting the +5-volt regulator, encoder plate clearance, encoder clearance, encoder parallelism adjustment, encoder alignment, servo adjustment, head alignment, sector circumferential and belt tension adjustment.

5-30. REGULATED +5 VDC SUPPLY.

5-31. Prior to performing an adjustment or alignment procedure, the output of the +5-Vdc regulator on servo amplifier/regulator assembly A4 should be checked and adjusted using the following procedures:

a. Set the LOAD switch to the released position. Remove the disc cartridge. Remove drive power by setting the POWER switch off.

b. Remove the disc drive top cover and cartridge receiver.

c. Press the POWER switch on.

d. Connect digital voltmeter to A4TP7. Adjust A4R1 for an indication of +5±0.1 volts.

5-32. ENCODER PLATE CLEARANCE.

5-33. The encoder plate clearance adjustment is normally required if the encoder plate is replaced for maintenance purposes. To adjust the encoder plate clearance, proceed as follows:

CAUTION

Exercise caution when touching the encoder glass. Excessive pressure might break the glass.

a. Loosen the encoder plate clamp screws. (See figure 5-2.)

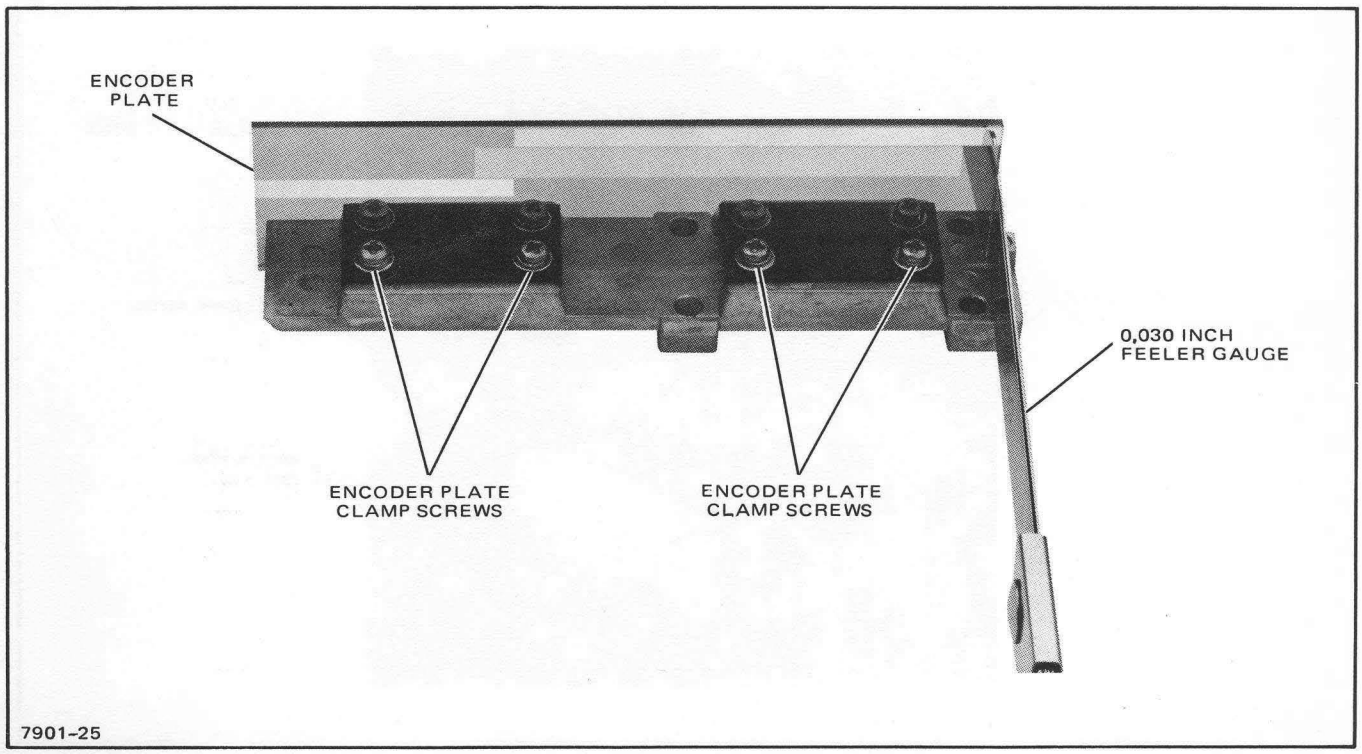


Figure 5-2. Encoder Plate Adjustments

b. Move the encoder glass away from the corner lip allowing the insertion of a 0.030-inch feeler gauge.

c. With the proper distance measured between the corner lip and the encoder plate, gently tighten the encoder plate clamp screws.

5-34. ENCODER CLEARANCE.

5-35. The encoder clearance adjustment is normally required if the encoder assembly or encoder plate is replaced or moved for maintenance purposes. To adjust the encoder clearance, proceed as follows:

a. Insert a Kimwipe tissue between the heads.

b. Disable linear motor L4 by removing connector A4P5 on servo amplifier/regulator assembly A4.

c. Manually extend the carriage and ensure that the clearance between the encoder plate and the reticle is between 0.005 and 0.008 inch at boths ends of travel. If this is not met, the encoder mounting screws must be loosened and the encoder housing moved. (See figure 5-3.)

d. Perform the encoder parallelism adjustment procedure.

Note: When checking or adjusting the encoder clearance, use non-metallic feeler gauge, part no. 1535-0648.

5-36. ENCODER PARALLELISM ADJUSTMENT.

5-37. This procedure is performed only if the encoder assembly is replaced or moved for maintenance purposes. To make parallelism checks and adjustments, proceed as follows:

Note: Steps a through e are performed to check parallelism. If an adjustment is not necessary, performance of steps f through h is not required.

a. Insert a folded Kimwipe tissue between the heads.

b. Disable linear motor L4 by removing connector A4TP5 on servo amplifier/regulator assembly A4.

c. Connect an oscilloscope to the in-phase (A) channel amplifier output at A9TP4 on encoder assembly A9.

d. Press the disc drive POWER switch to the on position.

e. Manually move the carriage and observe oscilloscope display. The waveform should be almost triangular with slight rounding of the peaks as shown in the "good" illustration in figure 5-4. If a "poor" display is obtained, proceed with steps f through h.

f. Loosen the encoder Allen head locking screw. (See figure 5-5.)

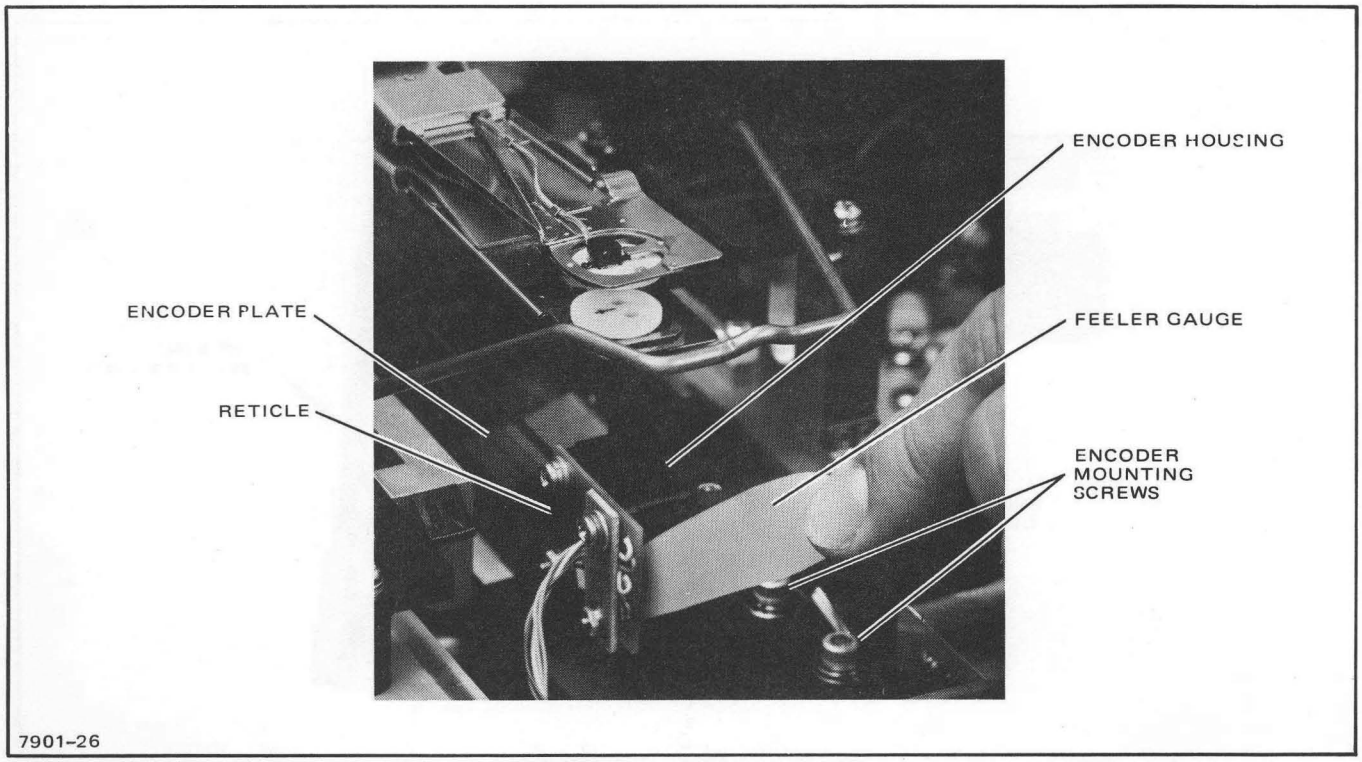


Figure 5-3. Encoder Adjustment

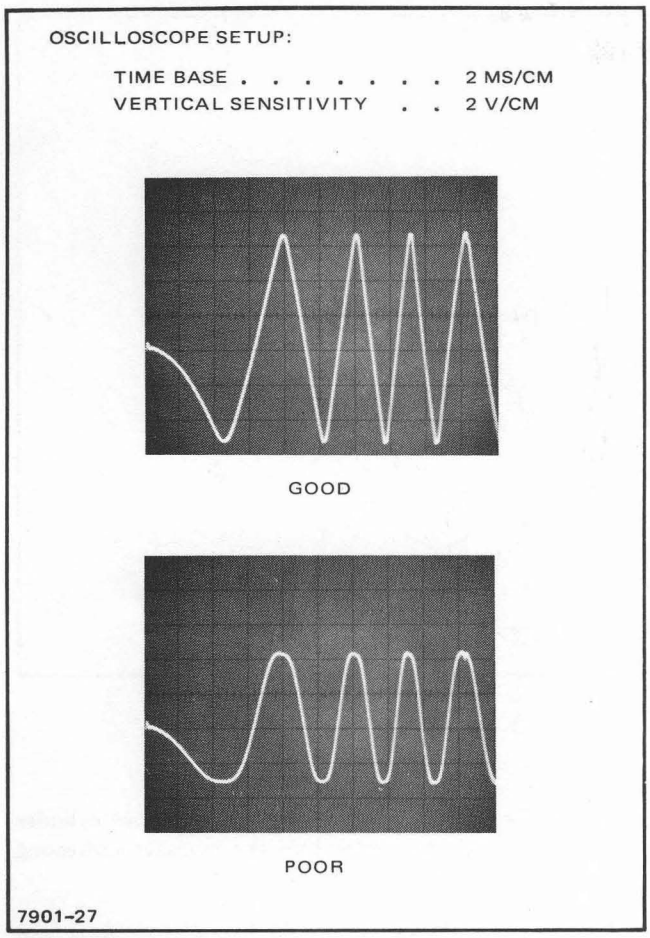


Figure 5-4. Encoder Parallelism Adjustment Waveforms

g. Move the carriage and adjust the encoder parallelism adjusting screw until optimum waveform is obtained. Waveform should compare favorably with the "good" illustration in figure 5-4.

Note: At the optimum point, the reticle mask marks are parallel to the encoder plate cylinder marks.

h. Tighten encoder locking screw and recheck oscilloscope display.

i. Perform the encoder alignment procedure.

5-38. ENCODER ALIGNMENT.

5-39. To align the encoder, proceed as follows:

a. Connect the oscilloscope to encoder assembly A9 channel A amplifier output test point A9TP4.

b. Manually move the carriage back and forth while making the following adjustments:

(1) Adjust the A GAIN variable resistor on encoder assembly A9 for 12 ± 0.5 volts peak-to-peak output. (See figure 5-6.)

(2) Adjust the A BAL variable resistor on encoder assembly A9 for an equal swing (±0.5 volts) above and below 0 volts. (See figure 5-6.)

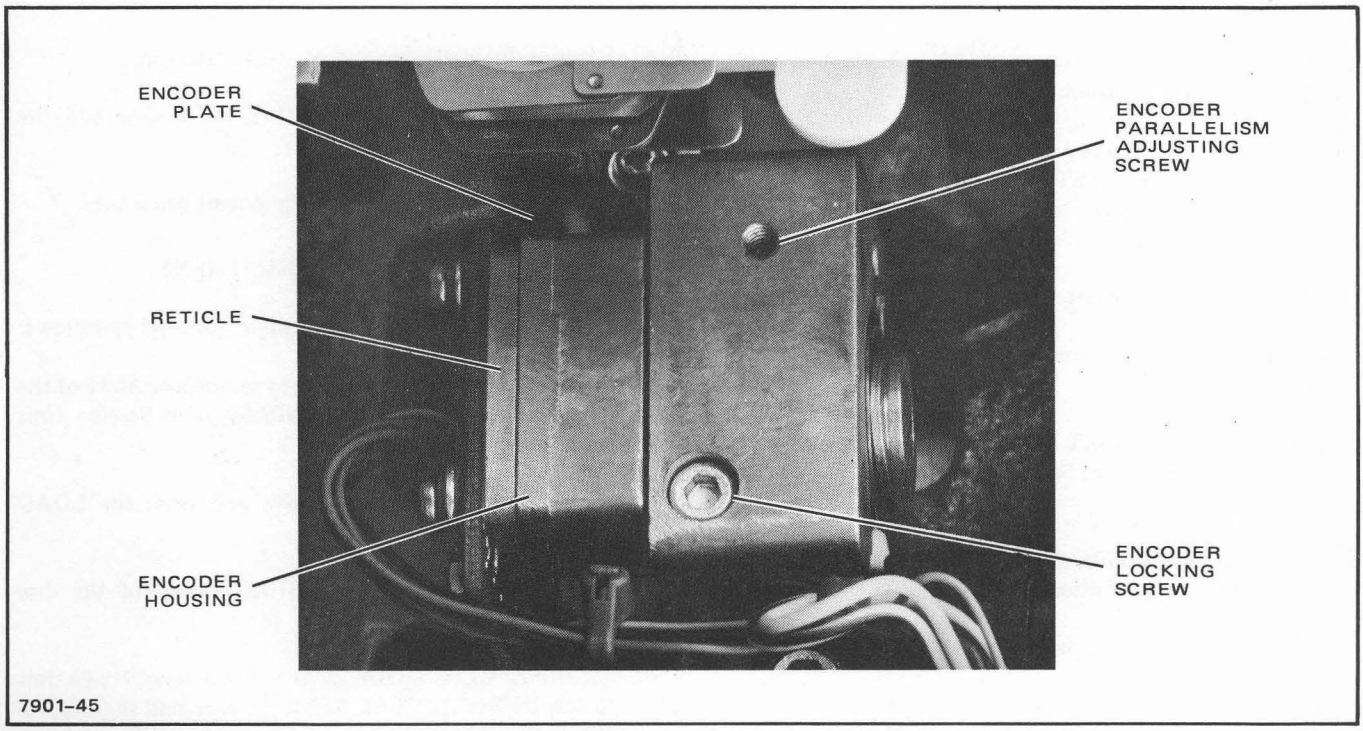


Figure 5-5. Encoder Parallelism Adjustments

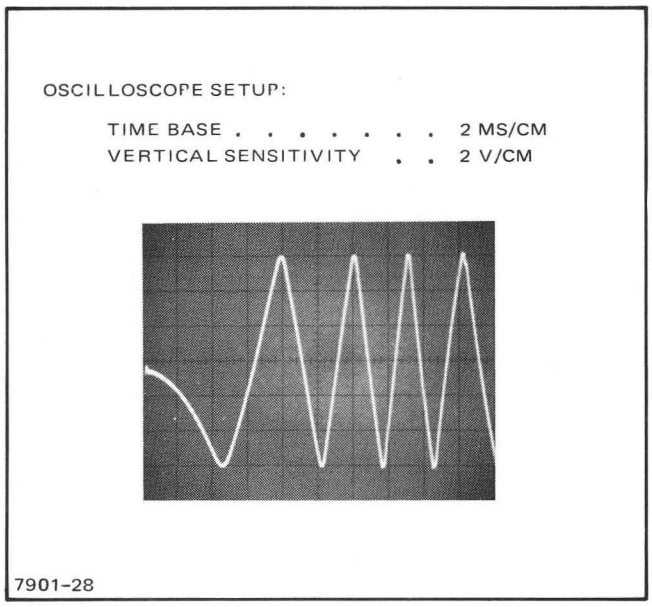


Figure 5-6. Encoder Alignment Waveform

c. Set the C BAL variable resistor on encoder assembly A9 at midrange.

d. Set the VEL COM variable resistor on sector cylinder assembly A11 fully counterclockwise; then advance it 1/4 turn clockwise.

e. Retract the carriage and turn off disc drive power.

f. Connect the disc service unit to the disc drive. (Refer to *HP 13219A Disc Service Unit Operating and Service Manual.*)

g. Connect linear motor L4 to A4P6 test plug on servo amplifier regulator assembly A4.

Note: Current is limited to the linear motor while in the TEST position, preventing possible damage to the motor during adjustments.

h. Remove the carriage detent. (See figure 5-7.)

i. Install cartridge receiver and a disc cartridge. Restore disc drive power.

j. Ensure that the RESET DRIVE FAULT switch on the disc service unit is on. Set the disc drive LOAD switch on.

Note: After 30 seconds, the carriage will extend to the home position (cylinder 000).

k. Connect the oscilloscope to channel C amplifier output A9TP2.

l. Adjust the C BAL variable resistor to obtain an oscilloscope deflection of 0 ±0.1 volts.

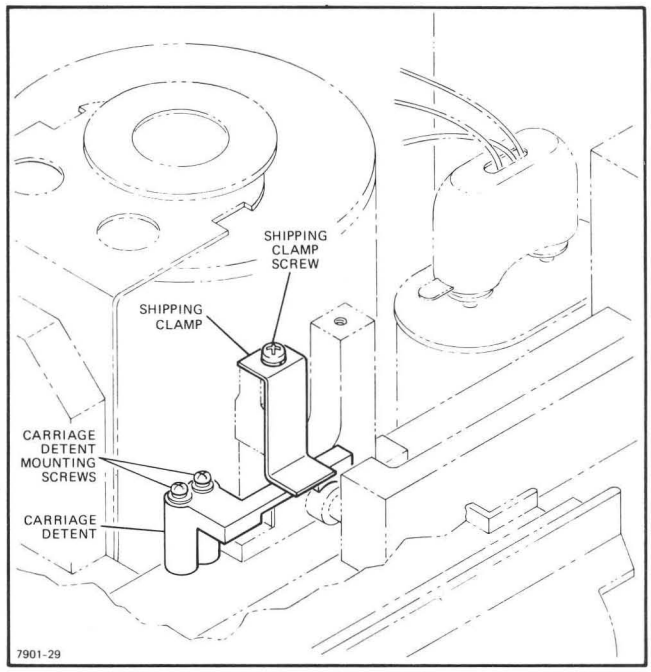


Figure 5-7. Carriage Detent

m. Using the disc service unit, perform one-cylinder increment tests to ensure that the cylinder addressing circuitry is functional.

n. Press the LOAD switch to the released position and remove disc drive power.

o. Reconnect linear motor L4 to connector A4P5 on servo amplifier regulator assembly A4.

p. Remove disc cartridge and cartridge receiver.

q. Install the carriage detent and replace receiver and disc cartridge.

r. Perform the servo amplifier adjustment procedure.

5-40. SERVO AMPLIFIER ADJUSTMENT.

5-41. To adjust the servo amplifier, proceed as follows:

a. Connect the disc service unit to connector A5J4 of the disc drive. (Refer to *HP 13219A Disc Service Unit Operating and Service Manual.*)

b. Apply power to the disc drive and press the LOAD switch.

c. Set the RESET DRIVE FAULT switch of the disc service unit to ON.

d. Set the ACCESS MODE switch of the disc service unit to the INCREMENTAL SEEK position and the DRIVE OPERATION control switch to ALLOW ACCESS mode. Press RUN switch.

e. Connect oscilloscope probe to A-channel amplifier test point A9TP4 on encoder assembly A9.

f. Synchronize oscilloscope with Set Cylinder signal at test point A10TP2 on drive control assembly A10.

g. Adjust A GAIN control A9R5 on encoder assembly A9 so that the position waveform is 12 volts peak-to-peak.

Note: The amplitude of the B-channel signal may vary between tracks. The waveform should never be less than 10 volts peak-to-peak during a single track seek. However, the amplitude may be less than 10 volts peak-to-peak during a multitrack seek.

h. Center the waveform with A BAL control A9R1 on encoder assembly A9 until positive and negative excursions are equal.

i. Program the disc service unit to alternately seek between cylinder 000 and 202. (Refer to *HP 13219A Disc Service Unit Operating and Service Manual.*)

j. Connect the oscilloscope to the ACCESS READY test point on the disc service unit.

k. Adjust VEL CMND variable resistor on cylinder address assembly A11 so that the Access Ready signal is low (0-volt) for 62 ±1 milliseconds.

l. Set the DRIVE OPERATION CONTROL switch of the disc service unit to ACCESS STOP.

m. Set the LOAD switch off and remove disc drive power.

n. Perform the head alignment procedure.

5-42. HEAD ALIGNMENT.

5-43. To align the disc drive heads, proceed as follows:

a. Turn on the disc drive power and set the DATA PROTECT switch to the PROTECT position.

b. Install the alignment cartridge, part no. 1535-0066.

c. Remove disc drive top cover.

d. Set TEST switch S1 on sector cylinder assembly A11 to TEST position (toward back of drive).

e. Press the LOAD switch.

f. Set the disc service unit to allow the disc drive to alternately seek between cylinders 000 and 128. The DELAY switch must be on. (Refer to *HP 13219A Disc Service Unit Operating and Service Manual.*)

g. Allow the disc drive to operate in this manner for approximately 25 minutes to stabilize disc drive temperature.

h. Using the disc service unit, position the carriage to cylinder 100 and select head 0.

i. Connect the oscilloscope to test point TP1 on read/write preamplifier assembly A6.

j. Connect the oscilloscope sync probe to IND test point A11TP3 on sector cylinder assembly A11.

k. Set the RESET DRIVE FAULT switch on the disc service unit to ON.

l. Loosen the locking screws that hold the heads in place. (See figure 5-8.)

m. Using the head adjusting tool as shown in figure 5-8, position the head to minimize amplitude modulation of the output signal. (See figure 5-9.)

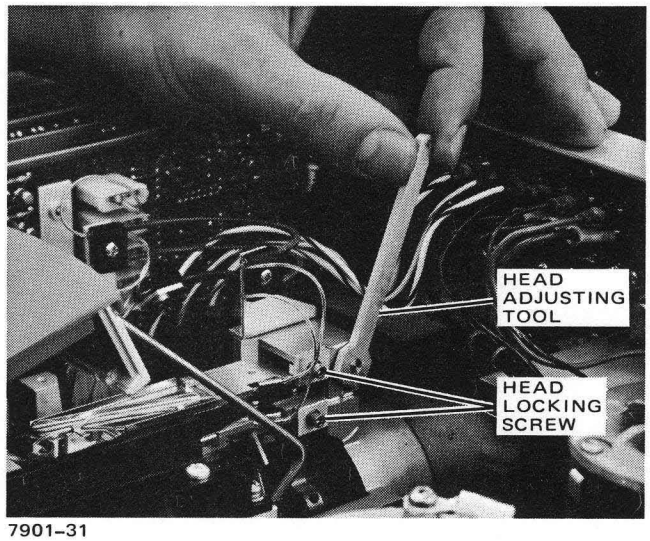
n. Tighten the locking screw and ensure that the adjustment has not changed.

o. Perform a seek to cylinder 95 and ensure that the circumferential adjustment waveform is present. (See figure 5-10.)

Note: If the waveform is not present, it is possible that the head was aligned to cylinder 105 instead of cylinder 100.

p. Using disc service unit, select head 1. (Refer to the *HP 13219A Disc Service Unit Operating and Service Manual.*)

q. Perform steps k through n for head 1.



7901-31

Figure 5-8. Head Alignment

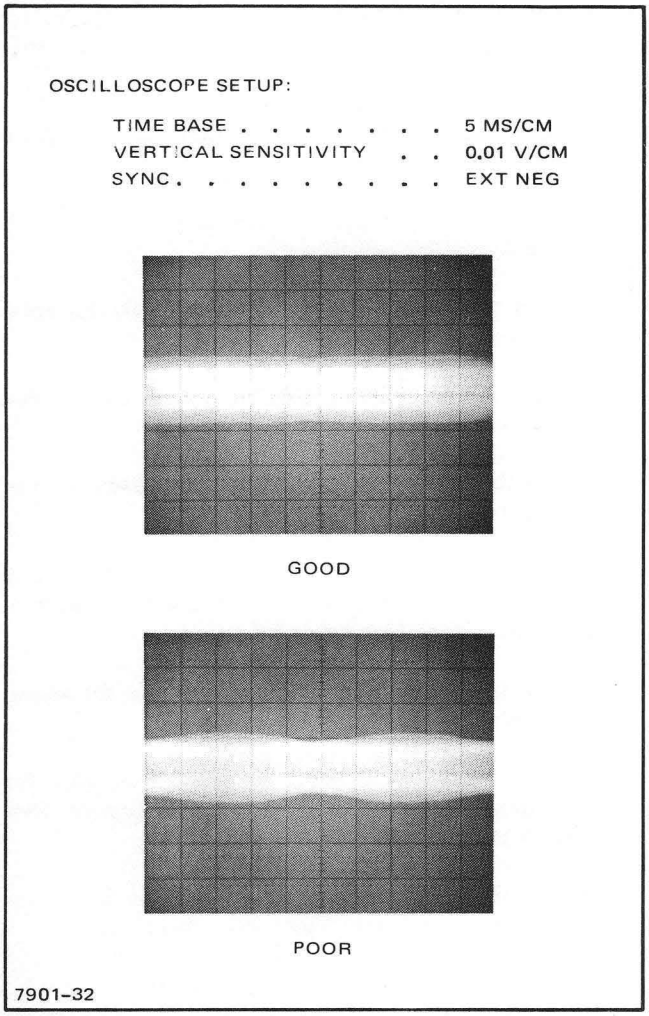


Figure 5-9. Head Alignment Waveforms

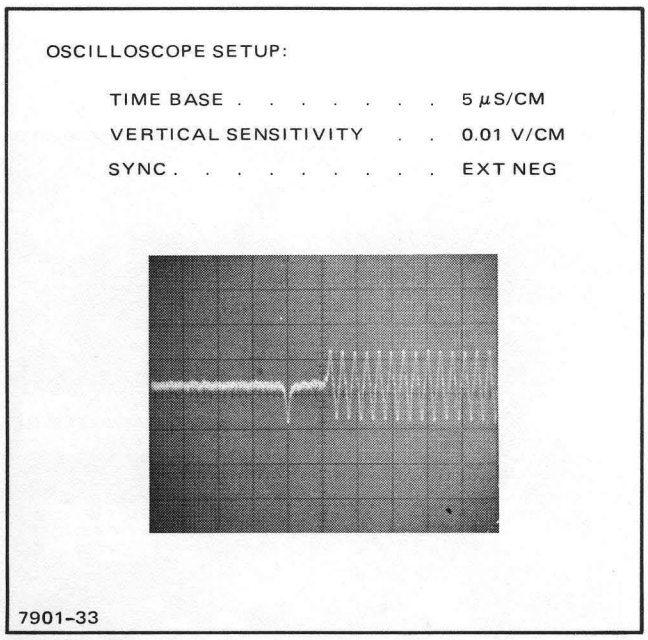


Figure 5-10. Sector Circumferential Waveform

5-44. SECTOR CIRCUMFERENTIAL ADJUSTMENT.

5-45. To adjust for minimum sector circumferential seek (or skew) proceed as follows:

a. Using the disc service unit, position the carriage at cylinder 95 and select head 0.

b. Connect the oscilloscope to test point TP1 of read/write preamplifier assembly A6.

c. Connect the sync probe to index test point A11TP3 on sector cylinder assembly A11.

d. Adjust SEC DLY resistor A11R36 on sector cylinder assembly A11 for a 20-microsecond delay from the leading edge of the index pulse (beginning of sweep) to the first data pulse.

e. Select head 1.

f. Observe the waveform and ensure that the first data pulse is present within ±6 microseconds of the pulse set in step d. (See figure 5-10.)

Note: If above requirement is not met, care should be taken to ensure that the heads are properly seated in the carriage assembly.

g. Adjust the SEC DLY resistor A11R36 to move the pulse halfway back towards the 20-microsecond point. This aligns both pulses so that the first pulse occurs at 20 ± 3 microseconds.

h. Return test switch S1 on sector cylinder assembly A11 to NORMAL position (toward front of drive.)

i. Remove any alignment tools and restore disc drive operation.

5-46. BELT TENSION ADJUSTMENT.

5-47. Adjust the spindle drive belt tension as follows:

a. Remove bottom cover.

b. Loosen the two posidrive screws on either side of the idler pulley. Manually adjust idler position so that drive belt is in contact with the idler and the belt runs centered on spindle motor pulley and spindle pulley.

c. Inspect for belt fraying or pulley wear.

d. Retighten posidrive screws and re-install bottom cover.

5-48. CARRIAGE VERNIER ADJUSTMENT.

a. Loosen the two mounting screws for the position scale on the upper deck assembly.

b. Use the Disc Service Unit to position the carriage at cylinder 100.

c. Using 0.005-inch thick Mylar shim, adjust the gap between the carraige vernier and position scale to 0.005 + 0.005 - 0.001 inch.

d. Return the carriage to cylinder 000.

e. Adjust the position scale so that the line marked "0" aligns with the line marked "0" on the carriage vernier. Tighten the two mounting screws.

f. Use the Disc Service Unit to incrementally seek between 000 and 202 to verify that the position scale does not touch the vernier.

5-49. TROUBLESHOOTING.

5-50. Troubleshooting the disc drive is accomplished by performing the appropriate diagnostic program procedures in the *Manual of Diagnostics*. More detailed troubleshooting can be accomplished by referring to flow diagrams, schematics, PCA component locations diagrams, and integrated-circuit pack diagrams given in figures 5-11 through 5-44. Replaceable parts for individual PCA's are listed in tables 5-4 through 5-15.

5-51. REMOVAL AND REPLACEMENT.

5-52. Replaceable parts are listed in section VI. Removal is accomplished by using figures 6-1 through 6-6 in conjunction with tables 6-1 through 6-6. Each figure and associated table lists replaceable items in order of removal. Replacement is made in the reverse order.

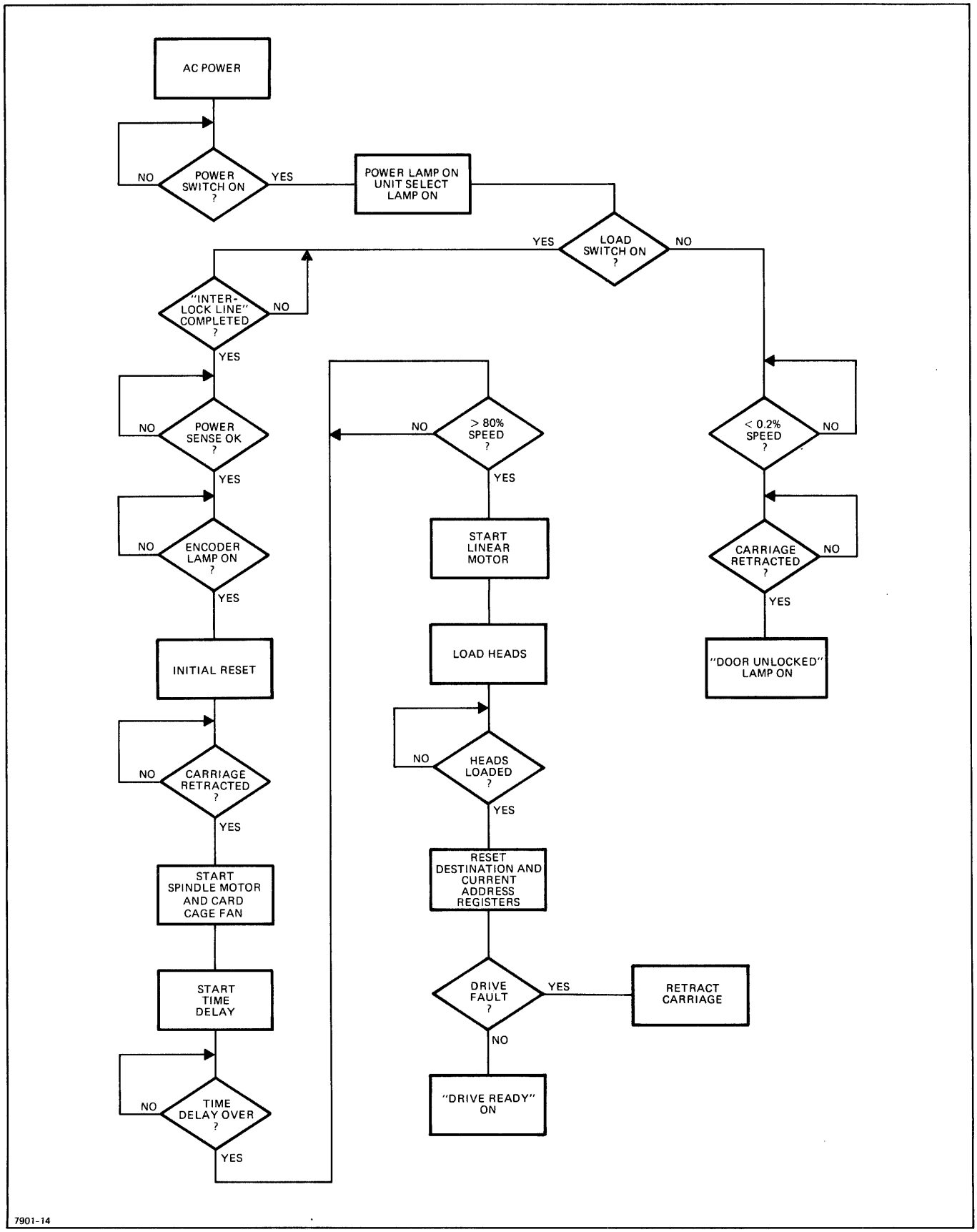


Figure 5-11. 7901A Turn-On Interlock Functional Sequence (Sheet 1 of 2)

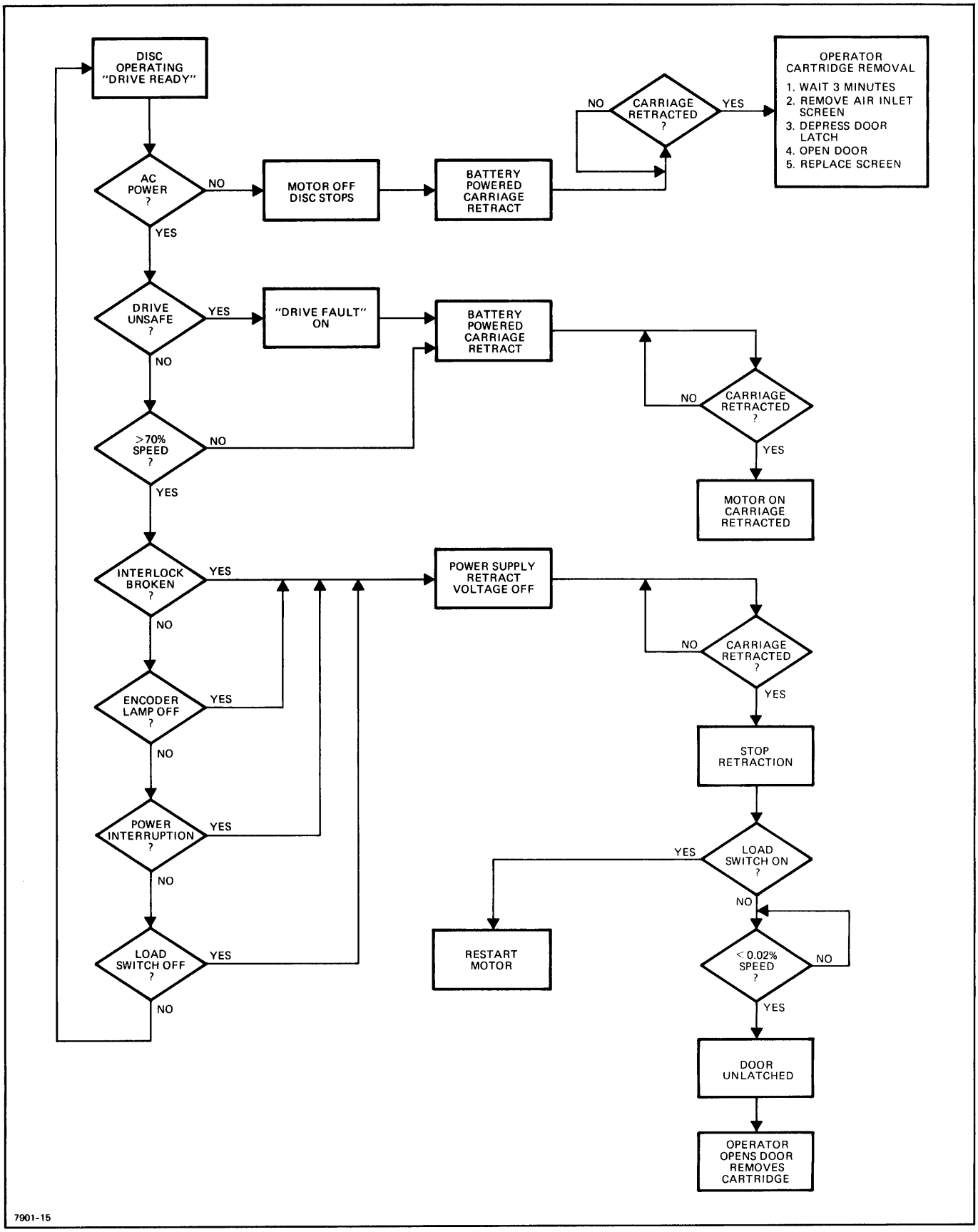
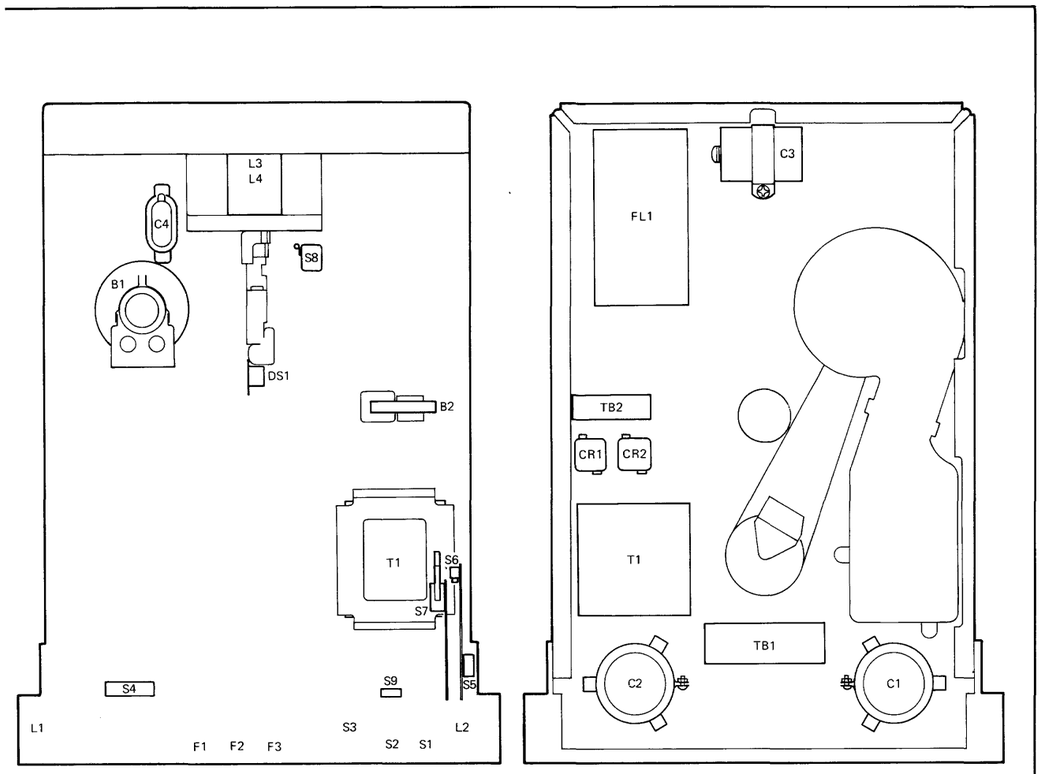


Figure 5-11. 7901A Turn-On Interlock Functional Sequence (Sheet 2 of 2)

Table 5-4. HP 7901A Disc Drive Chassis, Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			CHASSIS PARTS		
A1	07901-60014		INDICATOR ASSY:PC	28480	07901-60014
A2	07900-60054		SECTOR TRANSDUCER ASSY	28480	07900-60054
A3	07901-60008		MOTOR CONTROL ASSY:PC	28480	07901-60008
A4	07901-60009		SERV AMP/REG ASSY:PC	28480	07901-60009
A4	07901-60011		SERVO AMP/REG. ASSY, PC	28480	07901-60011
A5	07901-60010		MOTHER BOARD ASSY:PC	28480	07901-60010
A6	07901-60003		R/W PREAMP ASSY:PC	28480	07901-60003
A7	07901-60004		R/W PREAMP ASSY:PC	28480	07901-60004
A8	07901-60015		AUX FUNCTION ASSY:PC	28480	07901-60015
A9	07901-60006		ENCODER ASSY:PC	28480	07901-60006
A10	07901-60002		DRIVE CONTROL ASSY:PC	28480	07901-60002
A11	07901-60005		SECTOR/CYL ASSY:PC	28480	07901-60005
A12	07901-60007		I/O MULTIPLEXER ASSY:PC	28480	07901-60007
A13	07901-80011				
A14	07901-80011				
A16	07901-60013		TERMINATION ASSY:PC	28480	07901-60013
A17	07901-60028		UNIT SELECT SWITCH ASSY	28480	07901-60028
B1	3140-0761	1	MOTOR:INDUCTION SINGLE PHASE 2-POLE	08806	19HG
BT1	1420-0088	3	BATTERY:NICKEL CADMIUM 1.25V	05397	CH 500
BT2	1420-0088		BATTERY:NICKEL CADMIUM 1.25V	05397	CH 500
BT3	1420-0088		BATTERY:NICKEL CADMIUM 1.25V	05397	CH 500
C1	0180-2475	2	C:FXD AL ELECT 52,000UF +75-10% 25VDCW	56289	36D7182-DQB
C2	0180-2475		C:FXD AL ELECT 52,000UF +75-10% 25VDCW	56289	36D7182-DQB
C3	0180-2476	1	C:FXD AL ELECT 38,000UF +75-10% 15VDCW	56289	36D7162-DQB
C4	0160-0762	2	C:FXD PAPER 5 UF 10% 370VAC RMS	56289	200P3405TP1-DCT
CR1	1906-0032	2	DIODE ASSY:SINGLE PHASE F/W BRIDGE	28480	1906-0032
CR2	1906-0032		DIODE ASSY:SINGLE PHASE F/W BRIDGE	28480	1906-0032
DS1	07900-60026	1	ENCODER ASSY	28480	07900-60026
F1	2110-0016	1	FUSE:0.6A 250V SLOW-BLOW	75915	313-600S
F2	2110-0365	1	FUSE:4A/250V SLOW-BLOW	71400	MDA-4 AMP
F3	2110-0342	1	FUSE:8 AMP AT 250V	71400	ABC-8
FL1	9100-3303	1	FILTER:LINE	28480	9100-3303
L1	0491-0060	2	SOLENOID:96 OHM 24VDC	28480	0491-0060
L2	0491-0060		SOLENOID:96 OHM 24VDC	28480	0491-0060
L3	07900-60025	1	VELOCITY TRANS COIL	28480	07900-60025
L4	07900-60024	1	MOTOR:LINEAR	28480	07900-60024
S1	3101-1395	2	SWITCH:PUSHBUTTON DPDT-DB	76854	53-67280-121/A1H
S2	3101-1395		SWITCH:PUSHBUTTON DPDT-DB	76854	53-67280-121/A1H
S3	3101-1258	1	SWITCH:TOGGLE SPDT(POWER)	28480	3101-1258
S5	3101-1617	2	SWITCH:SENSITIVE SPDT 0.1A 125 VAC	28480	3101-1617
S6	3101-1617		SWITCH:SENSITIVE SPDT 0.1A 125 VAC	28480	3101-1617
S7	3101-1608	1	SWITCH:SENSITIVE SPDT 0.1A 125VAC	28480	3101-1608
S8	3101-1607	1	SWITCH:SENSITIVE SPDT 5A 125/250 VAC	28480	3101-1607
S9	3101-0070	1	SWITCH:SLIDE	79727	G-126
TB1	0360-1689	1	BARRIER BLOCK:9 TERMO.175" DIA MTG	71785	354-11-09-001
TB2	13215-20001	1	BLOCK:GROUND	28480	13215-20001
			NOTE: For further identification and illustrations of chassis parts, refer to Section VI.		



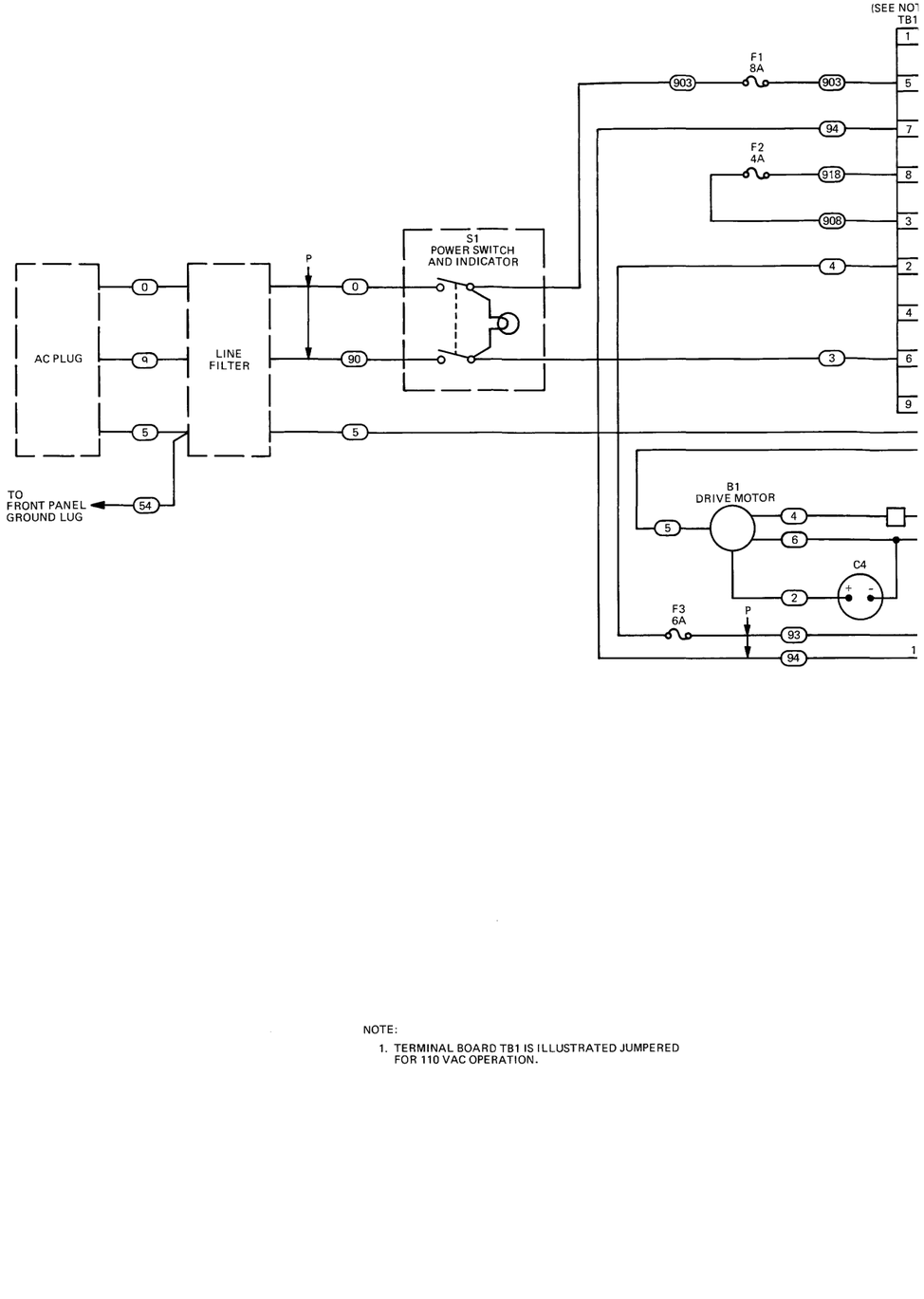
TOP VIEW
(COVER REMOVED)

BOTTOM VIEW
(COVER REMOVED)

B1	DRIVE MOTOR
B2	CARD CAGE FAN MOTOR
C1	-20V CAPACITOR (51,000 μF)
C2	+20V CAPACITOR (51,000 μF)
C3	+9V CAPACITOR (38,000 μF)
C4	MOTOR CAPACITOR (5 μF)
CR1	POWER RECTIFIER (20V)
CR2	POWER RECTIFIER (8V)
DS1	PHOTOCELL ASSEMBLY (ENCODER)
F1	6 AMPERE (MOTOR FUSE)
F2	4 AMPERE (MAIN LINE, 220 VAC)
F3	8 AMPERE (MAIN LINE, 110 VAC)
FL1	LINE FILTER
L1	LEFT HAND SOLENOID (DOOR)
L2	RIGHT HAND SOLENOID (DOOR)
L3	VELOCITY TRANSDUCER
L4	LINEAR MOTOR
S1	POWER SWITCH
S2	LOAD SWITCH
S3	SOFTWARE PROTECT SWITCH
S4	UNIT SELECT SWITCH
S5	LATCH SWITCH
S6	DOOR CLOSED SWITCH
S7	CARTRIDGE DOWN SWITCH
S8	CARRIAGE RETRACT SWITCH
S9	DATA PROTECT SWITCH
T1	POWER TRANSFORMER
TB1	POWER STRAPPING TERMINAL BOARD
TB2	LOGIC GROUND TERMINAL BOARD

7901-36

Figure 5-12. Disc Drive Chassis Mounted Components



NOTE:

1. TERMINAL BOARD TB1 IS ILLUSTRATED JUMPERED FOR 110 VAC OPERATION.

7901-63A

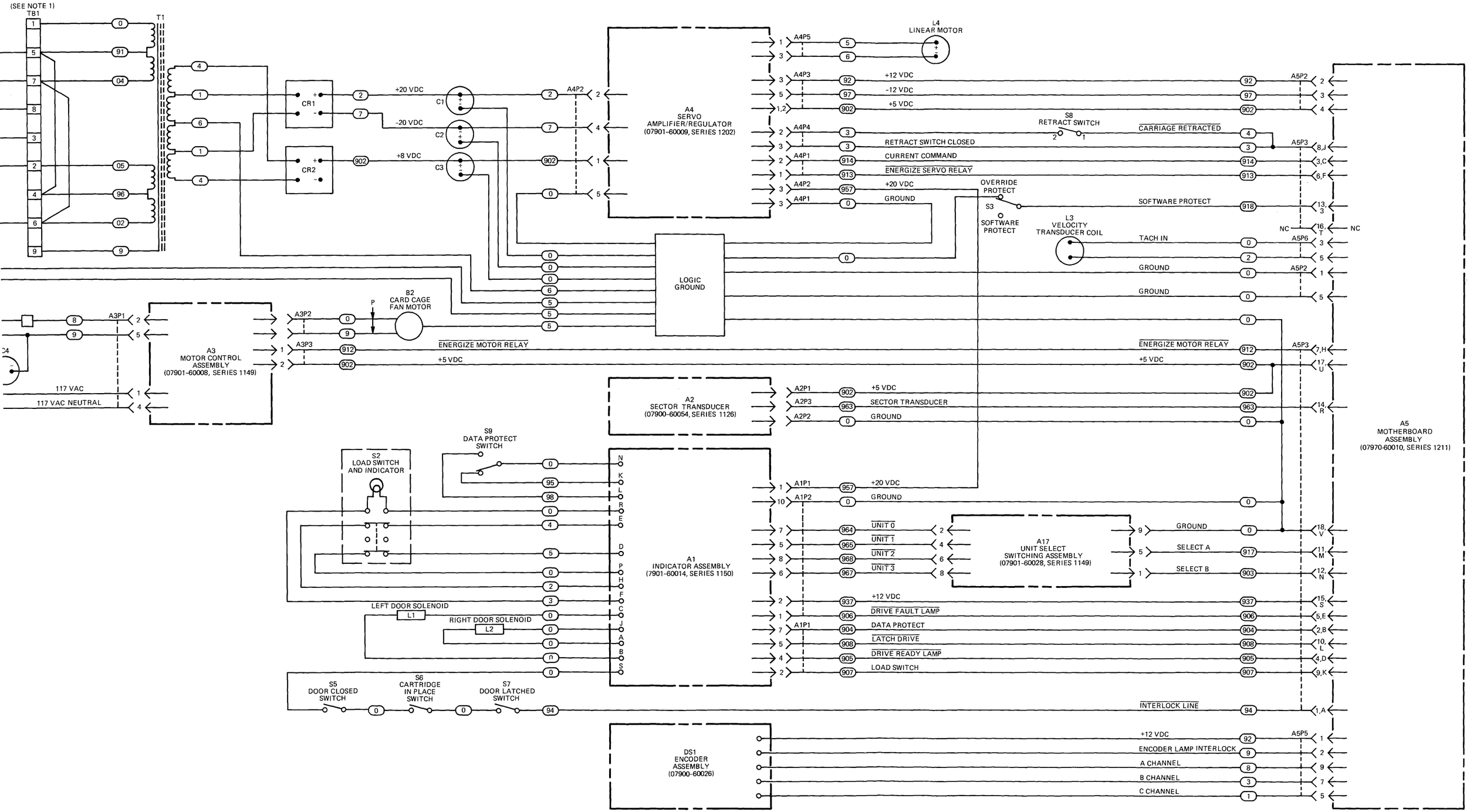
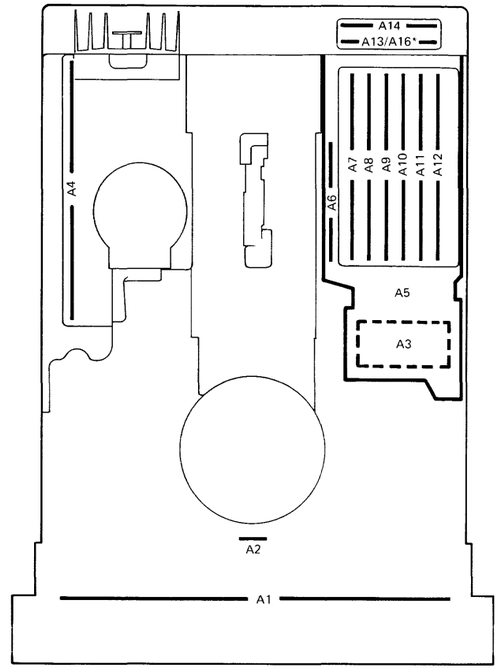


Figure 5-13. Disc Drive Chassis, Wiring Diagram



TOP VIEW
(COVER REMOVED)

REF DESIG	DESCRIPTION	PART NUMBER
A1	INDICATOR PC ASSEMBLY	7901-60014
A2	SECTOR TRANSDUCER	7900-60054
A3	MOTOR CONTROL PC ASSEMBLY	7901-60008
A4	SERVO AMPLIFIER/REGULATOR PC ASSEMBLY	7901-60009
A5	MOTHERBOARD PC ASSEMBLY	7901-60010
A6	WRITE DRIVER/READ PREAMPLIFIER PC ASSEMBLY	7901-60003
A7	READ/WRITE CONTROL PC ASSEMBLY	7901-60004
A8	AUXILIARY FUNCTION PC ASSEMBLY	7901-60015
A9	ENCODER PC ASSEMBLY	7901-60006
A10	DRIVE CONTROL PC ASSEMBLY	7901-60002
A11	SECTOR CYLINDER PC ASSEMBLY	7901-60005
A12	I/O MULTIPLEX PC ASSEMBLY	7901-60007
A13/A14	I/O INTERCONNECT PC ASSEMBLY	7901-80041
A15**	SERVICE EXTENDER PC ASSEMBLY	7901-60012
A16	TERMINATION PC ASSEMBLY	7901-60013

* A16 TERMINATION PC ASSEMBLY USED IN LAST UNIT OF MULTIPLE DRIVE INSTALLATIONS
** NOT SHOWN

7901-35

Figure 5-14. Disc Drive PC Assembly Locations

Table 5-5. Indicator PC Assembly A1 (07901-60014) Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	07901-60014	1	INDICATOR ASSY:PC	28480	07901-60014
A1CR1	1901-0026	6	DIODE:SILICON 0.75A 200PIV	04713	SR1358-8
A1CR2	1901-0026		DIODE:SILICON 0.75A 200PIV	04713	SR1358-8
A1DS1	2140-0343	8	LAMP:INCANDESCENT 14V 0.8A	98978	330
A1DS2	2140-0343		LAMP:INCANDESCENT 14V 0.8A	98978	330
A1DS3	2140-0343		LAMP:INCANDESCENT 14V 0.8A	98978	330
A1DS4	2140-0343		LAMP:INCANDESCENT 14V 0.8A	98978	330
A1DS5	2140-0343		LAMP:INCANDESCENT 14V 0.8A	98978	330
A1DS6	2140-0343		LAMP:INCANDESCENT 14V 0.8A	98978	330
A1DS7	2140-0343		LAMP:INCANDESCENT 14V 0.8A	98978	330
A1DS8	2140-0343		LAMP:INCANDESCENT 14V 0.8A	98978	330

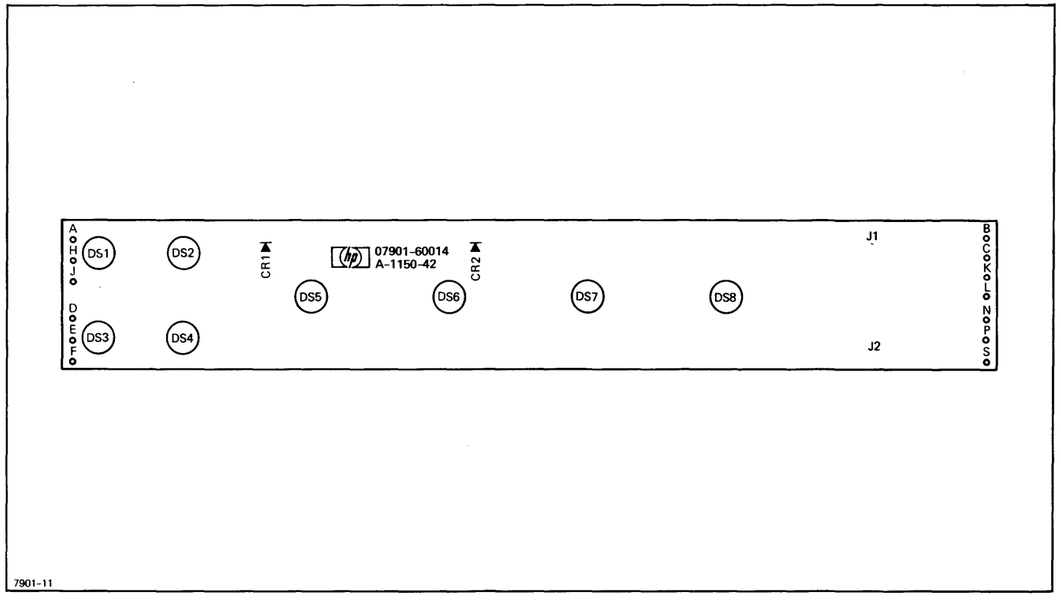
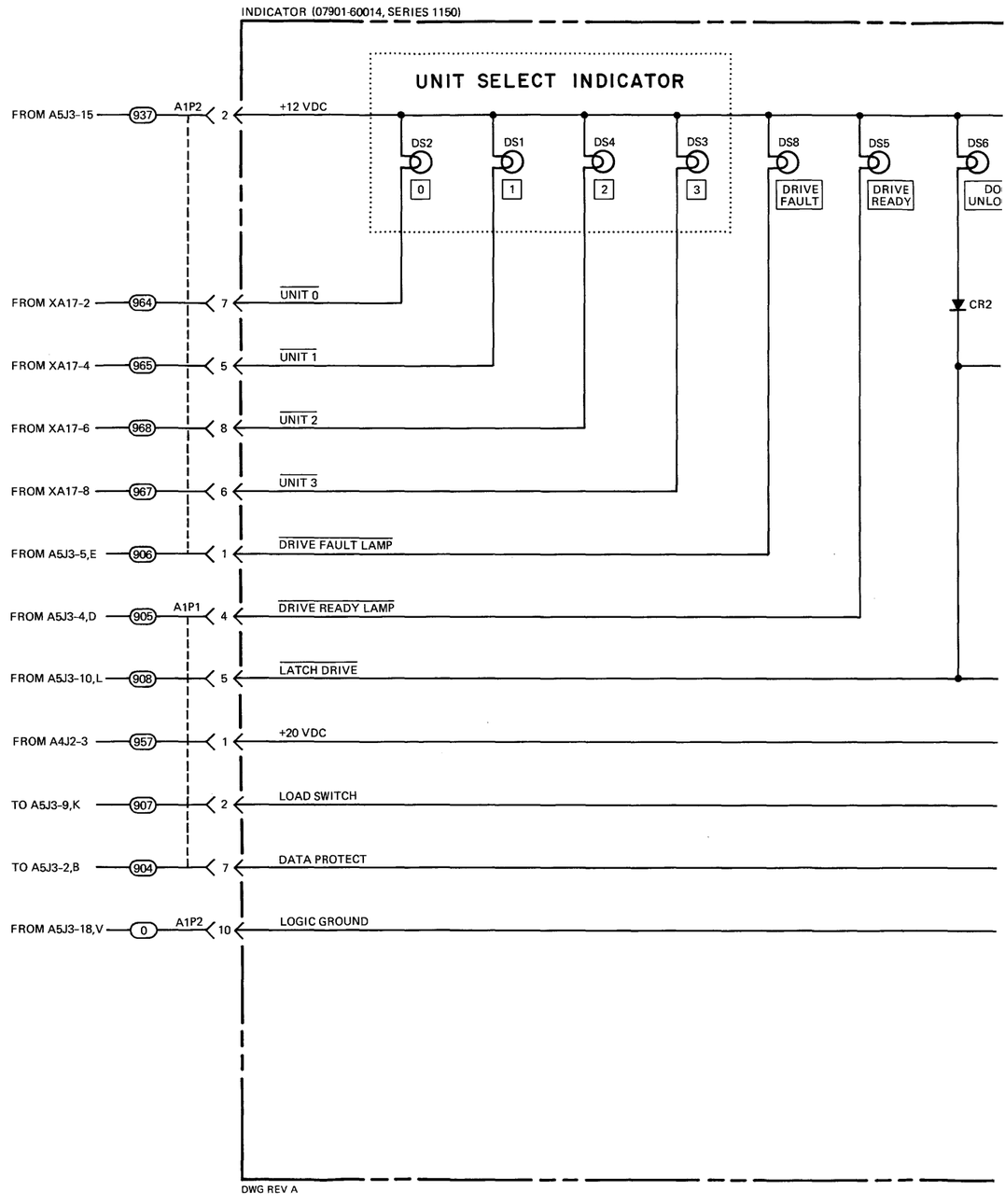


Figure 5-15. Indicator PC Assembly A1, Parts Location Diagram



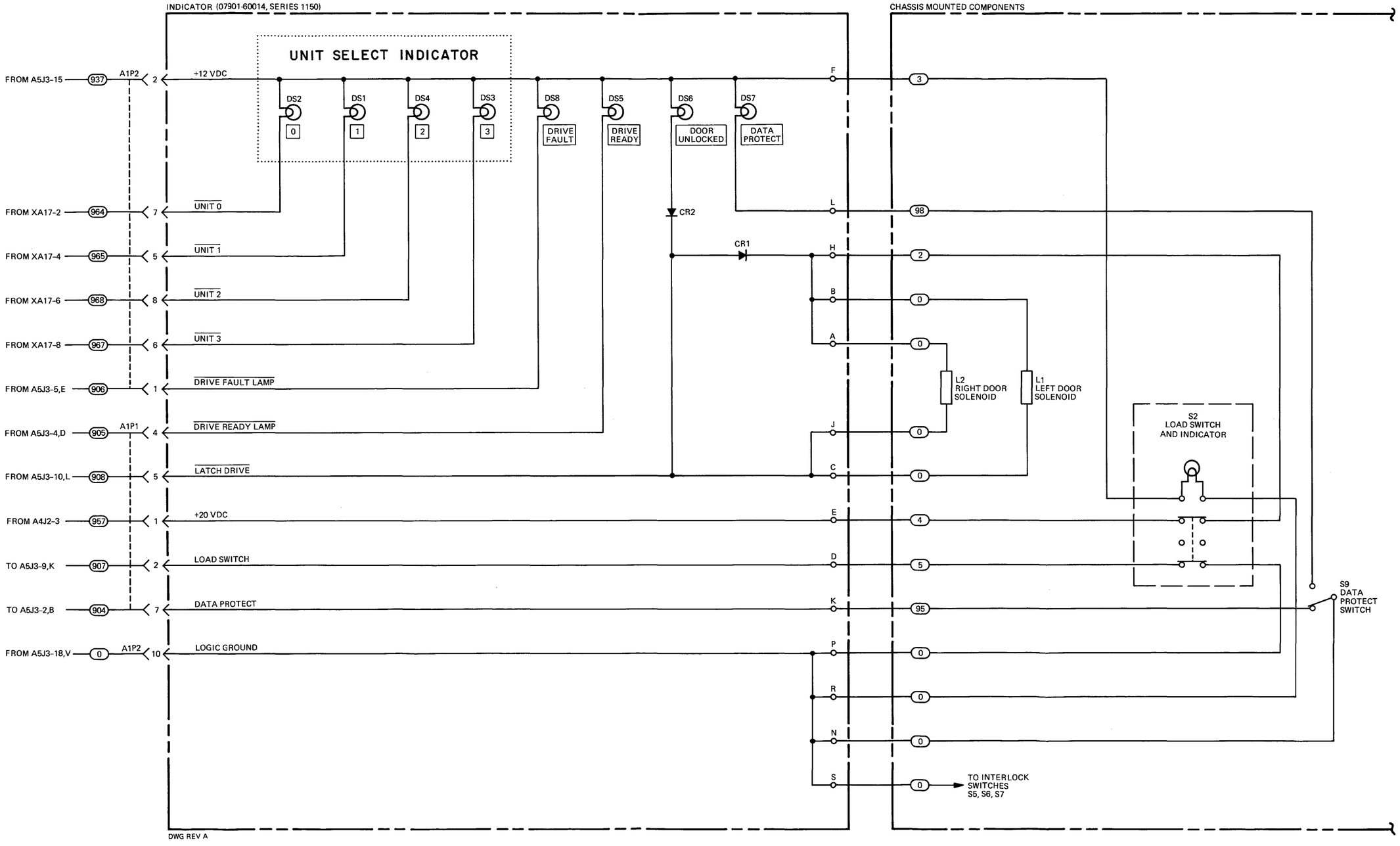


Figure 5-16. Indicator PC Assembly A1, Schematic Diagram

Table 5-6. Sector Transducer PC Assembly A2 (07900-60054) Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2	07900-60054	1	SECTOR TRANSDUCER ASSY	28480	07900-60054
A2DS1	2140-0094	1	LAMP:INCANDESCENT 5.3V	92966	7153
A2Q1	1990-0085	1	PHOTOTRANSISTOR:30V	07263	FPT-100
A2Q2	1854-0071	5	TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A2R1	0698-6283	1	R:FXD COMP 10 OHM 5% 1/8W	01121	BB 1005
A2R2	0698-7187	1	R:FXD COMP 2 MEGOHM 5% 1/8W	01121	BB 2055
A2R3	0698-6984	1	R:FXD COMP 470 OHM 5% 1/8W	28480	0698-6984
A2R4	0698-6725	1	R:FXD COMP 100K OHM 10% 1/8W	01121	BB 1041
A2R5	0698-5178	1	R:FXD COMP 1.5K OHM 5% 1/8W	28480	0698-5178

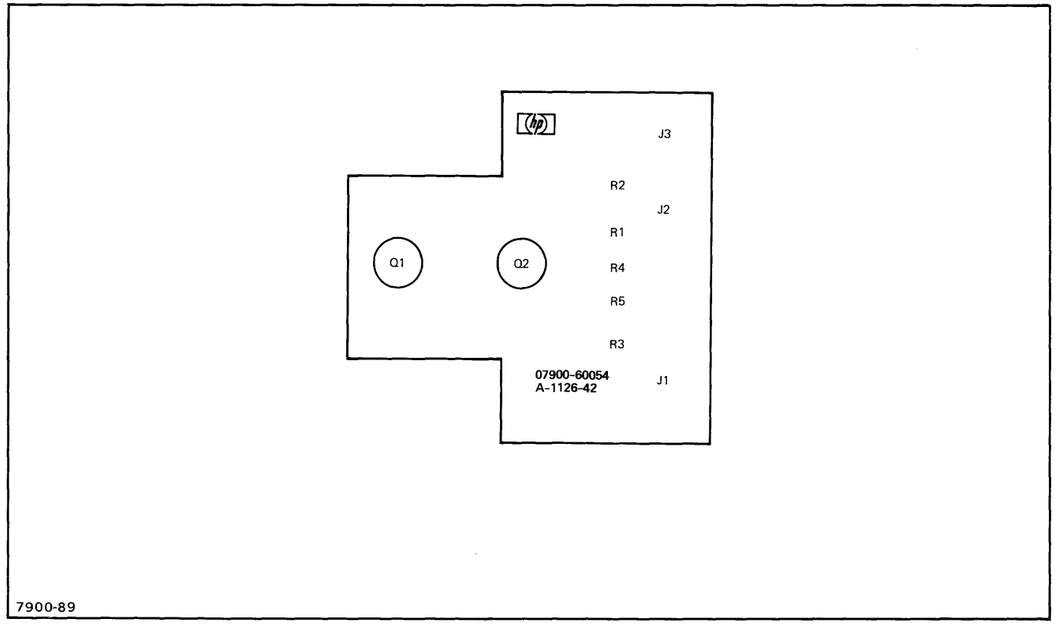


Figure 5-17. Sector Transducer PC Assembly A2, Parts Location Diagram

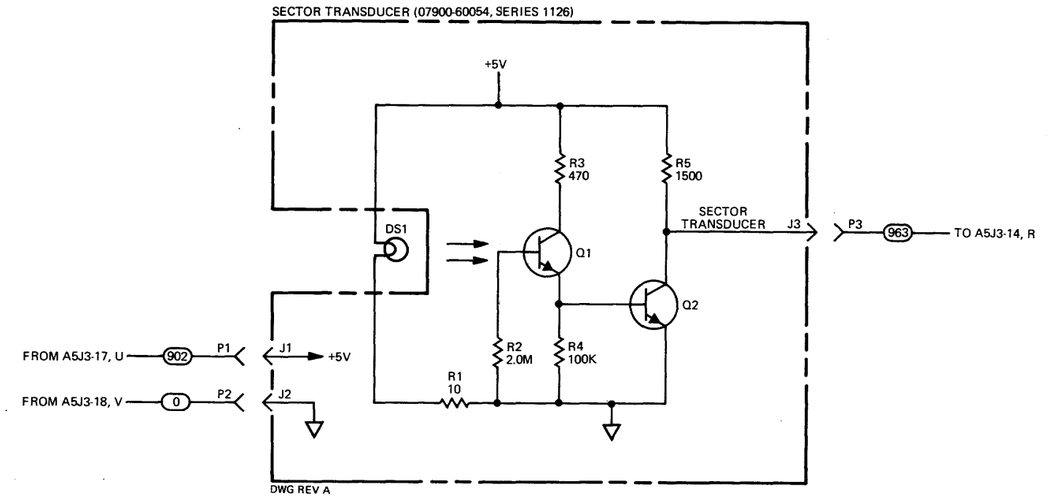


Figure 5-18. Sector Transducer Assembly A2, Schematic Diagram

Table 5-7. Motor Control PC Assembly A3 (07901-60008) Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3	07901-60008	1	MOTOR CONTROL ASSY:PC	28480	07901-60008
A3C1	0160-0269	2	C:FXD CER 0.1 UF 20% 500VDCW	56289	41C92A10-CDH
A3C2	0160-0269		C:FXD CER 0.1 UF 20% 500VDCW	56289	41C92A10-CDH
A3CR1	1902-0025	4	DIODE,BREAKDOWN:10.0V 5% 400 MW	28480	1902-0025
A3CR2	1902-0025		DIODE,BREAKDOWN:10.0V 5% 400 MW	28480	1902-0025
A3K1	0490-0373	1	RELAY:REED	28480	0490-0373
A3Q1	1884-0054	1	THYRISTOR	02735	40526
A3Q2	1884-0076	1	THYRISTOR:TRIAC 400V	86684	40430
A3R1	0686-6815	1	R:FXD COMP 680 OHM 5% 1/2W	01121	EB 6815
A3R2	0686-1015	2	R:FXD COMP 100 OHM 5% 1/2W	01121	EB 1015
A3R3	0812-0060	1	R:FXD WW 5K OHM 5% 5W	28480	0812-0060
A3R4	0686-1025	2	R:FXD COMP 1000 OHM 5% 1/2W	01121	EB 1025
A3R5	0686-1025		R:FXD COMP 1000 OHM 5% 1/2W	01121	EB 1025

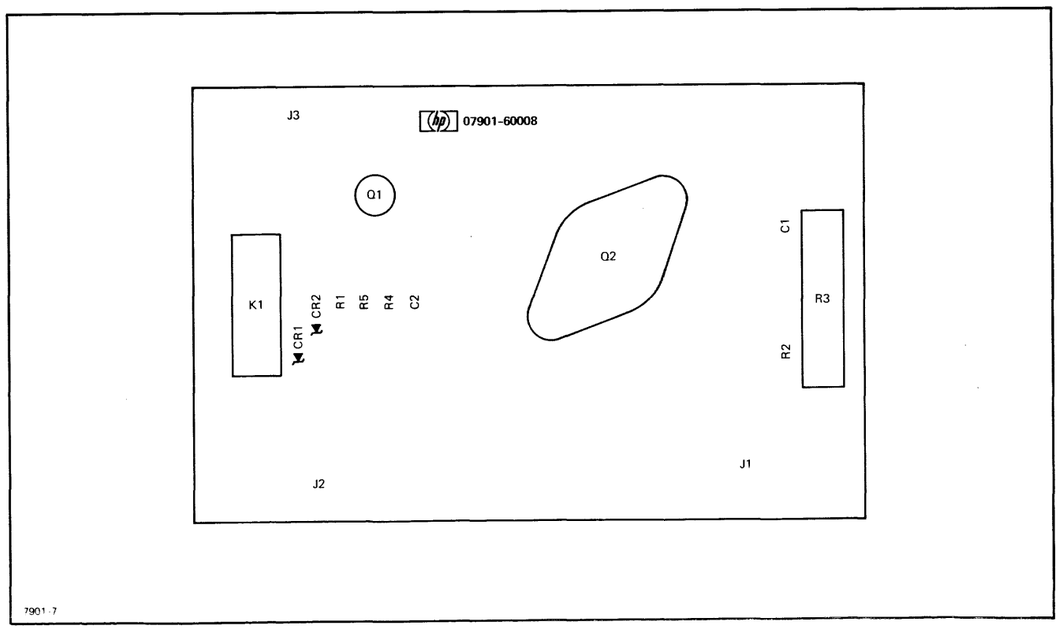
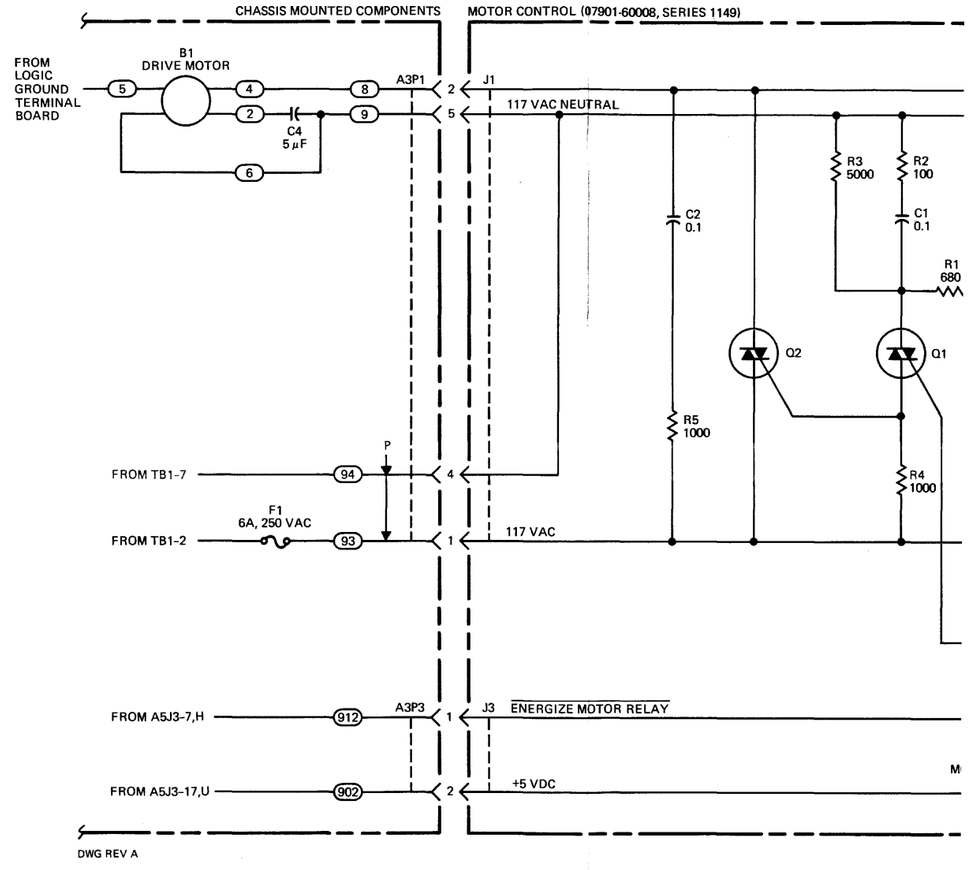
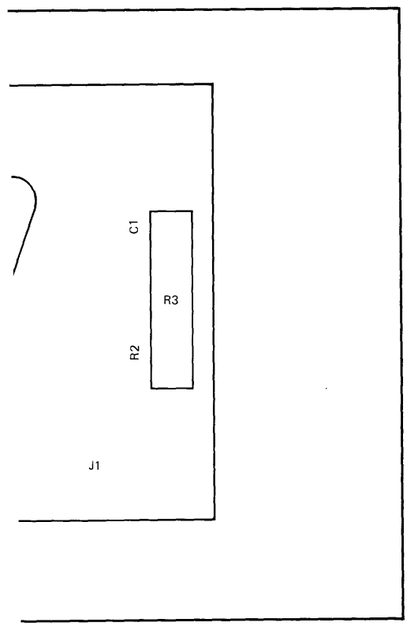


Figure 5-19. Motor Control PC Assembly A3, Parts Location Diagram



0008) Replaceable Parts

	Mfr Code	Mfr Part Number
	28480	07901-60008
	56289	41C92A10-CDH
	56289	41C92A10-CDH
HW	28480	1902-0025
HW	28480	1902-0025
	28480	0490-0373
	02735	40526
	86684	40430
	01121	EB 6815
	01121	EB 1015
	28480	0812-0060
	01121	EB 1025
	01121	EB 1025



Location Diagram

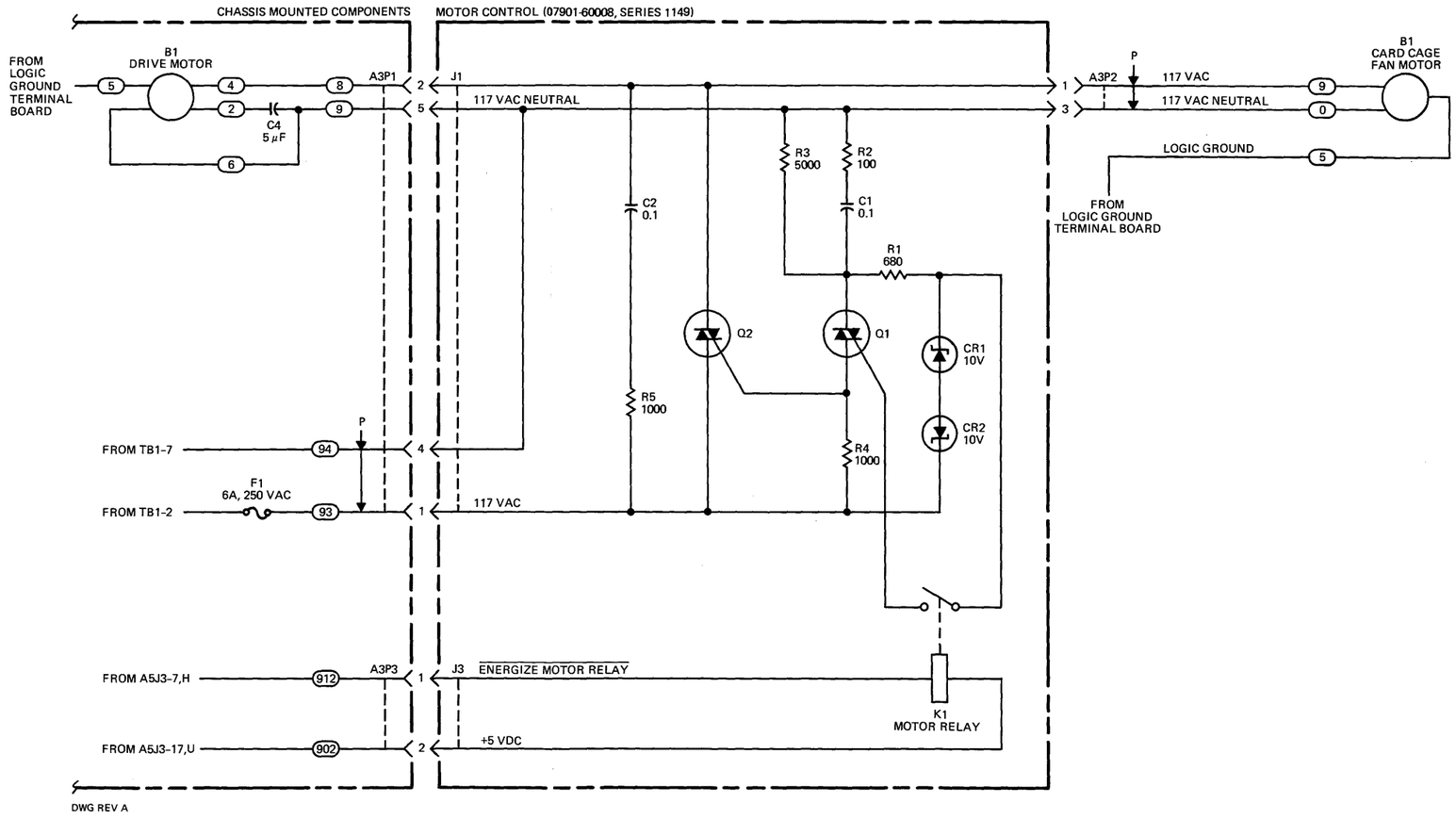


Figure 5-20. Motor Control PC Assembly A3, Schematic Diagram

Table 5-8. Servo Amplifier/Regulator PC Assembly A4 (07901-60009/60011), Replaceable Parts

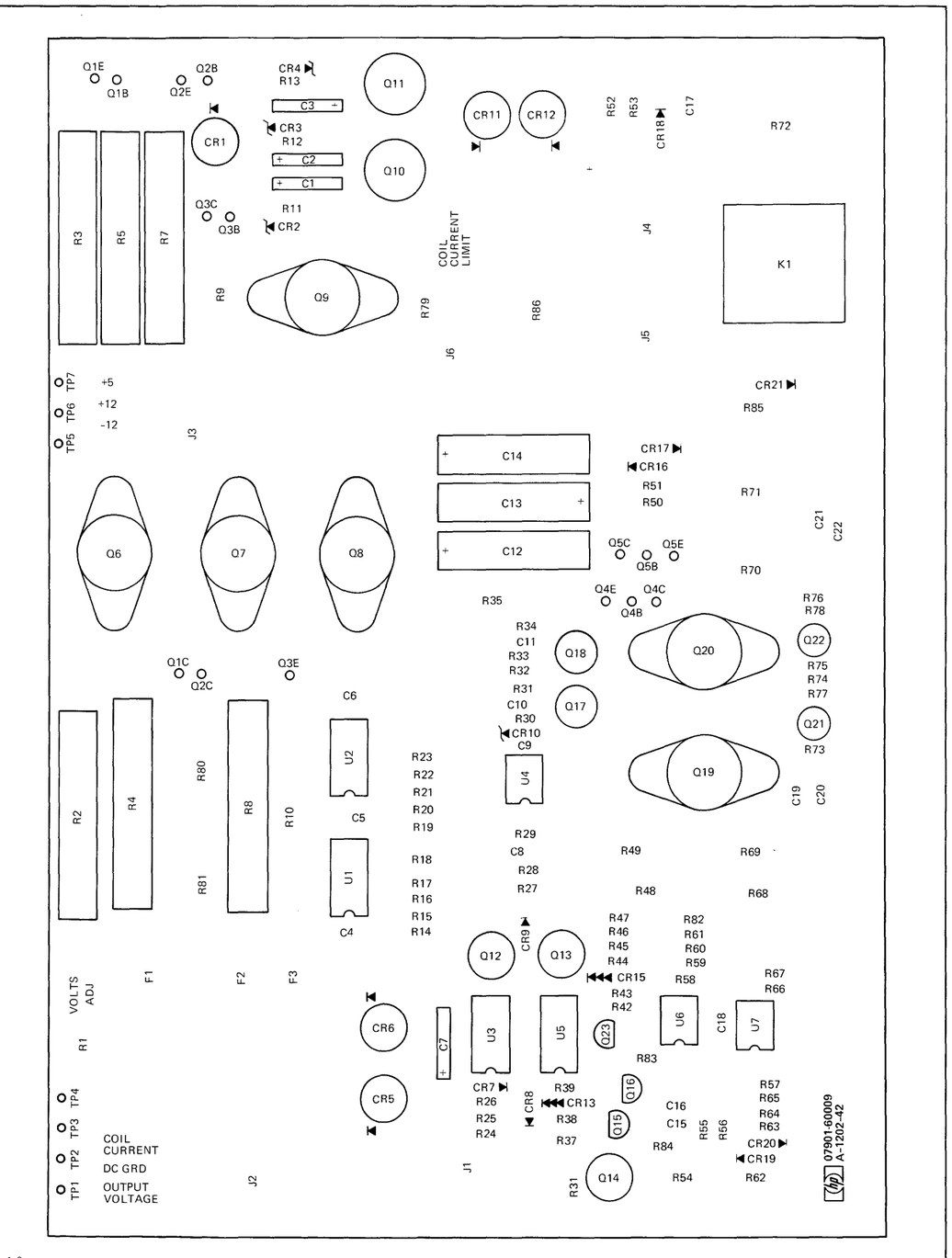
Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4	07901-60009	1	SERV AMP/REG ASSY:PC	28480	07901-60009
A4			(THIS ASSY INCLUDES A4Q1 THRU A4Q5)		
A4	07901-60011	1	SERVO AMP/REG. ASSY, PC	28480	07901-60011
A4			(THIS ASSY INCLUDES ALL PARTS EXCEPT		
A4			A4Q1 THRU A4Q5).		
A4C1	0180-0100	4	C:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A4C2	0180-0100		C:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A4C3	0180-0100		C:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A4C4	0160-0153	3	C:FXD MY 0.001 UF 10% 200VDCW	56289	192P10292-PTS
A4C5	0160-3454	1	C:FXD CER 220 PF 10% 500VDCW	56289	C067F501F221KS22-CDH
A4C6	0160-2055	7	C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A4C7	0180-0100		C:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A4C8	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A4C9	0150-0121	2	C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C5081S-CML
A4C10	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A4C11	0160-3460	1	C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023E101L503ZS22-CDH
A4C12	0180-0104	3	C:FXD ELECT 200 UF +75-10% 15VDCW	56289	30D207G015DF4-DSM
A4C13	0180-0104		C:FXD ELECT 200 UF +75-10% 15VDCW	56289	30D207G015DF4-DSM
A4C14	0180-0104		C:FXD ELECT 200 UF +75-10% 15VDCW	56289	30D207G015DF4-DSM
A4C15	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A4C16	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A4C17	0160-0167	1	C:FXD MY .082 UF 10% 200VDCW	56289	192P82392-PTS
A4C18	0160-0155	1	C:FXD MY 0.0033 UF 10% 200VDCW	56289	192P33292-PTS
A4C19	0160-0153		C:FXD MY 0.001 UF 10% 200VDCW	56289	192P10292-PTS
A4C20	0160-0153		C:FXD MY 0.001 UF 10% 200VDCW	56289	192P10292-PTS
A4C21	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A4C22	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A4CR1	1901-0418	5	DIODE:SI 3A 400PRRV	04713	SR1846-12
A4CR2	1902-0048	1	DIODE:BREAKDOWN 6.81V 5%	04713	SZ10939-134
A4CR3	1902-3203	2	DIODE BREAKDOWN:SILICON 14.7V 5%	28480	1902-3203
A4CR4	1902-3203		DIODE BREAKDOWN:SILICON 14.7V 5%	28480	1902-3203
A4CR5	1901-0418		DIODE:SI 3A 400PRRV	04713	SR1846-12
A4CR6	1901-0418		DIODE:SI 3A 400PRRV	04713	SR1846-12
A4CR7	1901-0040	5	DIODE:SILICON 30MA 30WV	07263	FDG1088
A4CR8	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A4CR9	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A4CR10	1902-3193	1	DIODE BREAKDOWN:13.3V 5%	28480	1902-3193
A4CR11	1901-0418		DIODE:SI 3A 400PRRV	04713	SR1846-12
A4CR12	1901-0418		DIODE:SI 3A 400PRRV	04713	SR1846-12
A4CR13	1901-0460	2	DIODE:SILICON 3-JUNCTION STABISTOR	03508	ST8523
A4CR15	1901-0460		DIODE:SILICON 3-JUNCTION STABISTOR	03508	ST8523
A4CR16	1901-0026	4	DIODE:SILICON 0.75A 200PIV	04713	SR1358-8
A4CR17	1901-0026		DIODE:SILICON 0.75A 200PIV	04713	SR1358-8
A4CR18	1901-0026		DIODE:SILICON 0.75A 200PIV	04713	SR1358-8
A4CR19	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A4CR20	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A4CR21	1901-0026		DIODE:SILICON 0.75A 200PIV	04713	SR1358-8
A4F1	2110-0030	1	FUSE:CARTRIDGE 5 AMP 125V SLOW BLOW	75915	313005
A4F2	2110-0036	2	FUSE:CARTRIDGE 8A 125V	75915	312008
A4F3	2110-0036		FUSE:CARTRIDGE 8A 125V	75915	312008
A4J1	1251-3130	2	CONNECTOR:POST TYPE 3 CONTACT	27264	A-2580-3-1
A4J2	1251-3128	2	CONNECTOR:POST TYPE, 5 CONTACT	27264	A-2580-5-6
A4J3	1251-3128		CONNECTOR:POST TYPE, 5 CONTACT	27264	A-2580-5-6
A4J4	1251-3130		CONNECTOR:POST TYPE 3 CONTACT	27264	A-2580-3-1
A4J5	1251-3222	2	CONTACT:POST	28480	1251-3222
A4J6	1251-3222		CONTACT:POST	28480	1251-3222
A4K1	0490-0983	1	RELAY:472 OHM 10A 24 COIL V	77342	KUP11D17-24V
A4Q1	1854-0063	3	TSTR:SI NPN	80131	2N3055
A4Q2	1854-0063		TSTR:SI NPN	80131	2N3055
A4Q3	1854-0063		TSTR:SI NPN	80131	2N3055
A4Q4	1854-0519	2	TSTR:SI NPN	28480	1854-0519
A4Q5	1854-0519		TSTR:SI NPN	28480	1854-0519
A4Q6	1854-0072	3	TSTR:SI NPN	80131	2N3054
A4Q7	1854-0072		TSTR:SI NPN	80131	2N3054
A4Q8	1853-0303	2	TSTR:SI PNP	80131	2N5956
A4Q9	1884-0088	1	THYRISTOR:SCR 200V	86684	2N3228
A4Q10	1884-0012	2	RECTIFIER:SILICON CONTROLLED 2N3528	02735	2N3528
A4Q11	1884-0012		RECTIFIER:SILICON CONTROLLED 2N3528	02735	2N3528
A4Q12	1853-0012	2	TSTR:SI PNP	80131	2N2904A
A4Q13	1854-0039	3	TSTR:SI NPN	80131	2N3053
A4Q14	1854-0039		TSTR:SI NPN	80131	2N3053
A4Q15	1854-0215	2	TSTR:SI NPN	80131	2N3904
A4Q16	1853-0036	3	TSTR:SI PNP	80131	2N3906
A4Q17	1854-0039		TSTR:SI NPN	80131	2N3053
A4Q18	1853-0012		TSTR:SI PNP	80131	2N2904A

Table 5-8. Servo Amplifier/Regulator PC Assembly A4 (07901-60009/60011), Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4Q19	1854-0072		TSTR:SI NPN	80131	2N3054
A4Q20	1853-0303		TSTR:SI PNP	80131	2N5956
A4Q21	1853-0036		TSTR:SI PNP	80131	2N3906
A4Q22	1854-0215		TSTR:SI NPN	80131	2N3904
A4Q23	1853-0036		TSTR:SI PNP	80131	2N3906
A4R1	2100-1757	1	R:VAR WW 500 OHM 5% TYPE V 1W	28480	2100-1757
A4R2	0811-3119	2	R:FXD WW 40 OHM 3% 10W	28480	0811-3119
A4R3	0811-3047	2	R:FXD WW 1.0 OHM 3% 10W	28480	0811-3047
A4R4	0811-3119		R:FXD WW 40 OHM 3% 10W	28480	0811-3119
A4R5	0811-3047		R:FXD WW 1.0 OHM 3% 10W	28480	0811-3047
A4R7	0811-3045	1	R:FXD WW 1.2 OHM 3% 10W	28480	0811-3045
A4R8	0811-3049	1	R:FXD WW 2.75 OHM 3% 10W	28480	0811-3049
A4R9	0811-3048	2	R:FXD WW 1.5 OHM 3% 5W	28480	0811-3048
A4R10	0761-0052	1	R:FXD MET OX 270 OHM 5% 1W	28480	0761-0052
A4R11	0683-6815	3	R:FXD COMP 680 OHM 5% 1/4W	01121	CB 6815
A4R12	0683-6815		R:FXD COMP 680 OHM 5% 1/4W	01121	CB 6815
A4R13	0683-6815		R:FXD COMP 680 OHM 5% 1/4W	01121	CB 6815
A4R14	0757-0430	1	R:FXD MET FLM 2.21K OHM 1% 1/8W	28480	0757-0430
A4R15	0698-3515	1	R:FXD FLM 5900 OHM 1% 1/8W	28480	0698-3515
A4R16	0757-0283	1	R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A4R17	0698-3700	1	R:FXD FLM 715 OHM 1% 1/8W	28480	0698-3700
A4R18	0757-0420	1	R:FXD MET FLM 750 OHM 1% 1/8W	28480	0757-0420
A4R19	0757-0402	2	R:FXD MET FLM 110 OHM 1% 1/8W	28480	0757-0402
A4R20	0698-4465	1	R:FXD FLM 931 OHM 1% 1/8W	28480	0698-4465
A4R21	0698-4002	2	R:FXD MET FLM 5K OHM 1% 1/8W	28480	0698-4002
A4R22	0698-4470	1	R:FXD FLM 6.98K OHM 1% 1/8W	28480	0698-4470
A4R23	0698-5672	1	R:FXD MET FLM 2.7K OHM 1% 1/8W	28480	0698-5672
A4R24	0683-3325	1	R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A4R25	0683-5615	1	R:FXD COMP 560 OHM 5% 1/4W	01121	CB 5615
A4R26	0683-4735	1	R:FXD COMP 47K OHM 5% 1/4W	01121	CB 4735
A4R27	0698-4002		R:FXD MET FLM 5K OHM 1% 1/8W	28480	0698-4002
A4R28	0698-5088	1	R:FXD FLM 12K OHM 1% 1/8W	28480	0698-5088
A4R29	0683-1015	6	R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A4R30	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A4R31	0757-0279	1	R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A4R32	0698-4619	1	R:FXD FLM 1.15K OHM 1% 1/4W	28480	0698-4619
A4R33	0757-0402		R:FXD MET FLM 110 OHM 1% 1/8W	28480	0757-0402
A4R34	0683-5605	1	R:FXD COMP 56 OHM 5% 1/4W	01121	CB 5605
A4R35	0811-0003	1	R:FXD WW 390 OHM 1% 1/4W	28480	0811-0003
A4R36	0683-4725	1	R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A4R37	0683-1035	1	R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A4R38	0683-1025	8	R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A4R39	0683-2225	2	R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A4R42	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A4R43	0683-2225		R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A4R44	0698-3451	2	R:FXD MET FLM 133K OHM 1% 1/8W	28480	0698-3451
A4R45	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A4R46	0683-5125	2	R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A4R47	0683-5125		R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A4R48	0761-0008	2	R:FXD MET OX 510 OHM 5% 1W	28480	0761-0008
A4R49	0698-3626	1	R:FXD MET OX 180 OHM 5% 2W	28480	0698-3626
A4R50	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A4R51	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A4R52	0686-1325	1	R:FXD COMP 1.3K OHM 5% 1/2W	01121	EB 1325
A4R53	0686-1015	1	R:FXD COMP 100 OHM 5% 1/2W	01121	EB 1015
A4R54	0757-0442	2	R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A4R55	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A4R56	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A4R57	0698-3451		R:FXD MET FLM 133K OHM 1% 1/8W	28480	0698-3451
A4R58	0683-4755	1	R:FXD COMP 4.7 MEGOHM 5% 1/4W	01121	CB 4755
A4R59	0698-3157	3	R:FXD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A4R60	0698-3157		R:FXD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A4R61	0698-3157		R:FXD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A4R62	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A4R63	0757-0280	2	R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A4R64	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A4R65	0757-0465	1	R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A4R66	0698-3150	2	R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A4R67	0698-3150		R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A4R68	0761-0008		R:FXD MET OX 510 OHM 5% 1W	28480	0761-0008
A4R69	0764-0013	1	R:FXD MET OX 56 OHM 5% 2W	28480	0764-0013
A4R70	0811-2490	3	R:FXD WW 0.1 OHM 3% 5W	28480	0811-2490
A4R71	0811-2490		R:FXD WW 0.1 OHM 3% 5W	28480	0811-2490
A4R72	0811-2490		R:FXD WW 0.1 OHM 3% 5W	28480	0811-2490
A4R73	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025

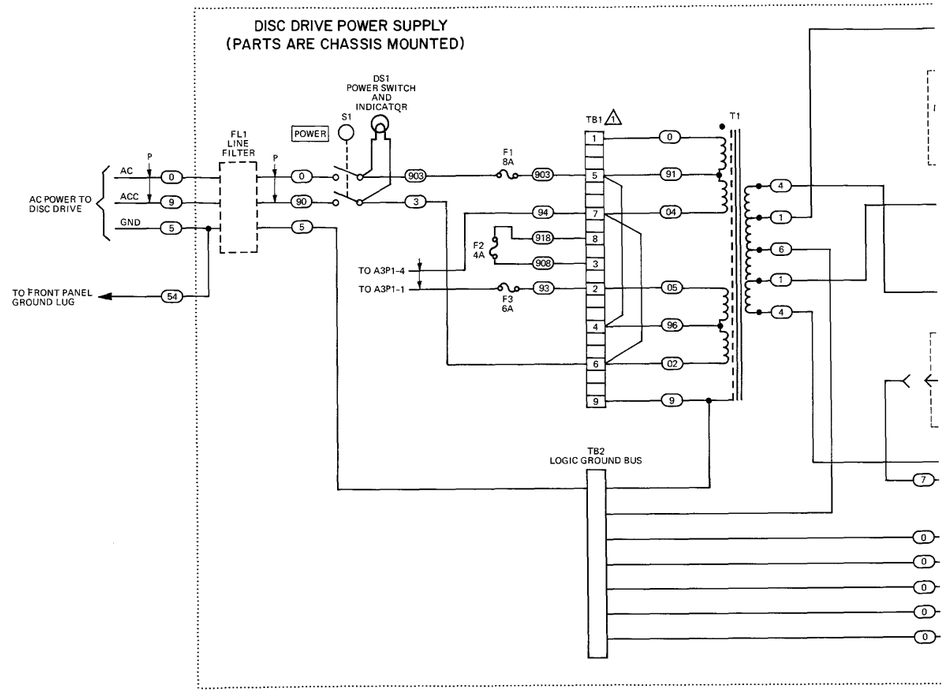
Table 5-8. Servo Amplifier/Regulator PC Assembly A4 (07901-60009/60011), Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4R74	0683-4705	2	R:FXD COMP 47 OHM 5% 1/4W	01121	CB 4705
A4R75	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A4R76	0683-4705		R:FXD COMP 47 OHM 5% 1/4W	01121	CB 4705
A4R77	0683-1815	2	R:FXD COMP 180 OHM 5% 1/4W	01121	CB 1815
A4R78	0683-1815		R:FXD COMP 180 OHM 5% 1/4W	01121	CB 1815
A4R79	0811-3048		R:FXD WW 1.5 OHM 3% 5W	28480	0811-3048
A4R80	0761-0021	2	R:FXD MET OX 1000 OHM 5% 1W	28480	0761-0021
A4R81	0761-0021		R:FXD MET OX 1000 OHM 5% 1W	28480	0761-0021
A4R82	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A4R83	0761-0069	1	R:FXD MET OX 5.1K OHM 5% 1W	28480	0761-0069
A4R84	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A4R85	0698-3618	1	R:FXD MET OX 82 OHM 5% 2W	28480	0698-3618
A4R86	0811-1898	2	R:FXD WW 20 OHM 5% 10W	28480	0811-1898
A4R87	0811-1898		R:FXD WW 20 OHM 5% 10W	28480	0811-1898
A4R88	0683-4715	3	R:FXD COMP 470 OHM 5% 1/4W	01121	CB 4715
A4R89	0683-4715		R:FXD COMP 470 OHM 5% 1/4W	01121	CB 4715
A4R90	0683-4715		R:FXD COMP 470 OHM 5% 1/4W	01121	CB 4715
A4R91	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A4U1	1820-0439	2	IC:VOLTAGE REGULATOR VIN=40V MAX.	07263	U6E7723393
A4U2	1820-0439		IC:VOLTAGE REGULATOR VIN=40V MAX.	07263	U6E7723393
A4U3	1820-0207	1	IC:TTL MONOSTABLE MULTIVIBRATOR	28480	1820-0207
A4U4	1820-0493	3	IC:OP. AMP. INTERNAL COMP.,8-PIN DIP	12040	LM307N
A4U5	1820-0054	1	IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A4U6	1820-0493		IC:OP. AMP. INTERNAL COMP.,8-PIN DIP	12040	LM307N
A4U7	1820-0493		IC:OP. AMP. INTERNAL COMP.,8-PIN DIP	12040	LM307N



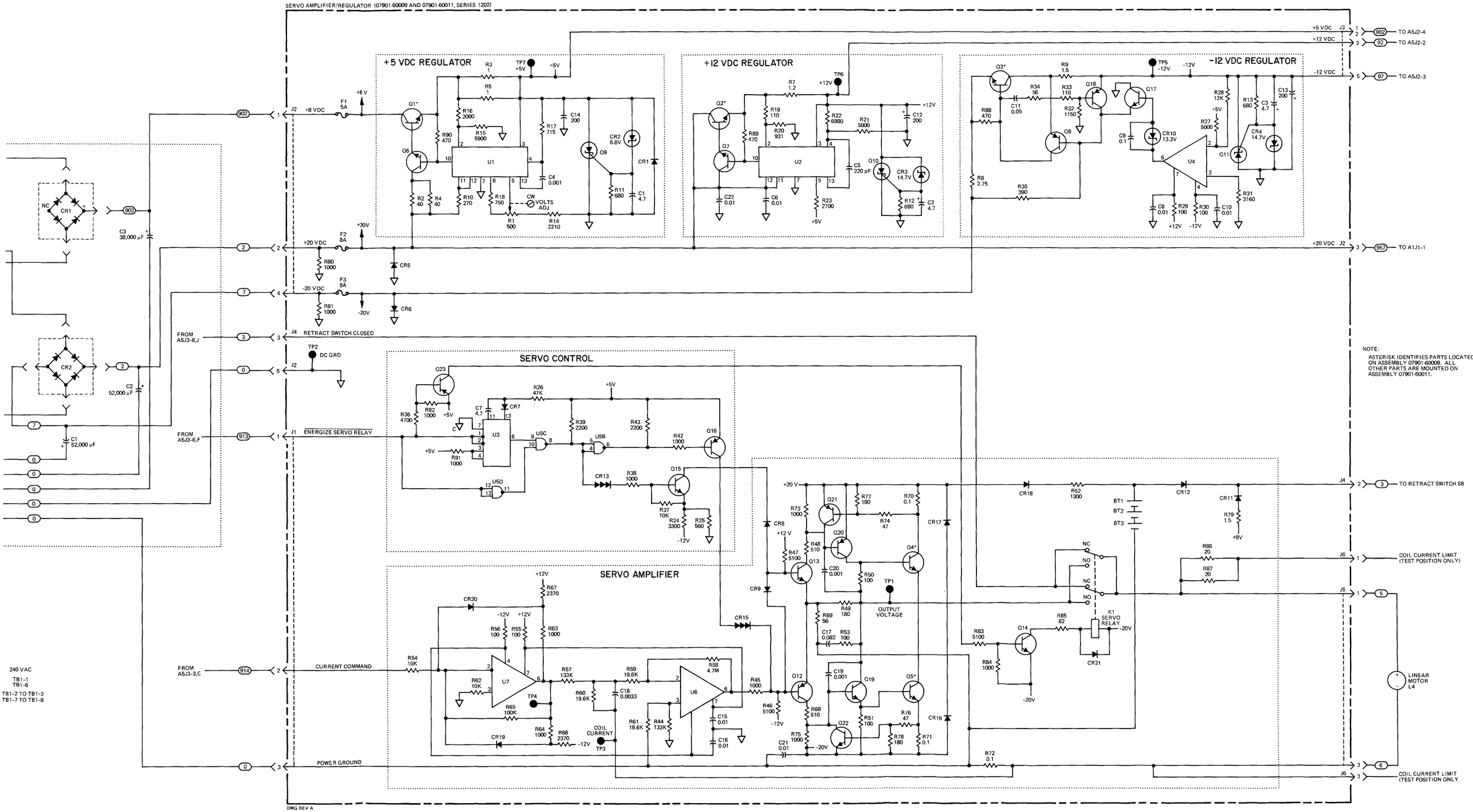
1-8

Figure 5-21. Servo Amplifier/Regulator PC Assembly A4, Parts Location Diagram



⚠ TERMINAL BOARD TB1 SHOWN CONNECTED FOR 110 VAC OPERATION.
FOLLOWING CONNECTIONS REQUIRED FOR INPUT AC VOLTAGES.

	INPUT VOLTAGE	110 VAC	120 VAC	200 VAC	240 VAC	240 VAC
LINE CONNECTIONS	WHT/BLK/RED	TB1-5 TB1-6	TB1-1 TB1-6	TB1-5 TB1-6	TB1-5 TB1-6	TB1-1 TB1-6
	ORANGE					
JUMPERS		TB1-4 TO TB1-5 TB1-6 TO TB1-7	TB1-1 TO TB1-2 TB1-6 TO TB1-7	TB1-3 TO TB1-4 TB1-7 TO TB1-8	TB1-2 TO TB1-3 TB1-7 TO TB1-8	TB1-2 TO TB1-3 TB1-7 TO TB1-8

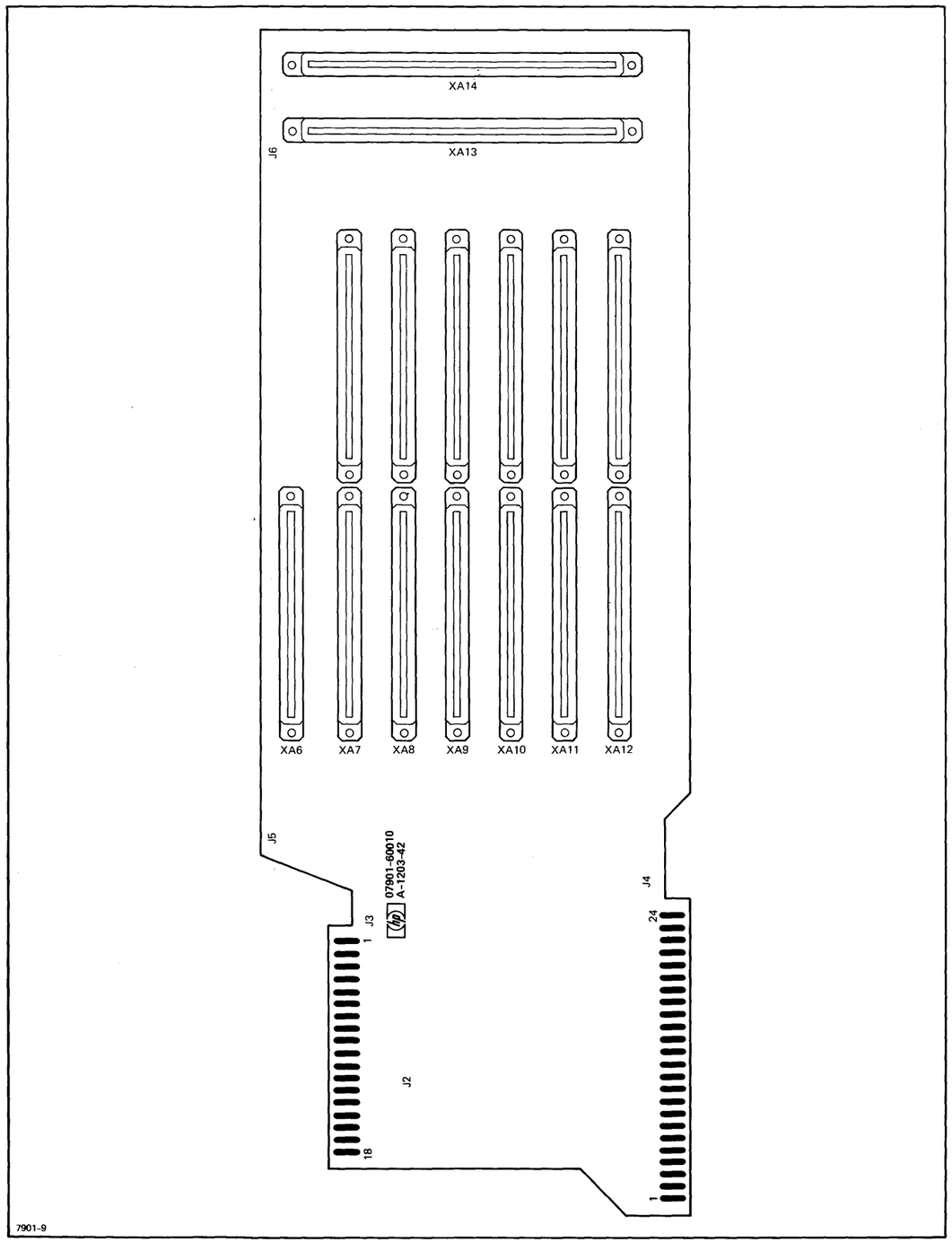


NOTE:
ASTERISK IDENTIFIES PARTS LOCATED ON ASSEMBLY 07901-60009. ALL OTHER PARTS ARE MOUNTED ON ASSEMBLY 07901-60011.

Figure 5-22. Disc Drive Power Supply and Servo Amplifier/ Regulator PC Assembly A4, Schematic Diagram

Table 5-9. Motherboard PC Assembly A5 (07901-60010) Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5	07901-60010	1	MOTHER BOARD ASSY:PC	28480	07901-60010
A5B2	3160-0255	1	FAN:CARD CAGE	28480	3160-0255
A5J1	1251-1886	13	CONN:PC 30-CONTACT (2X15)	71785	252-15-30-340
A5J2	1251-2025	2	CONNECTOR:PC (2 X 24) 48 CONTACT	71785	252-24-30-340



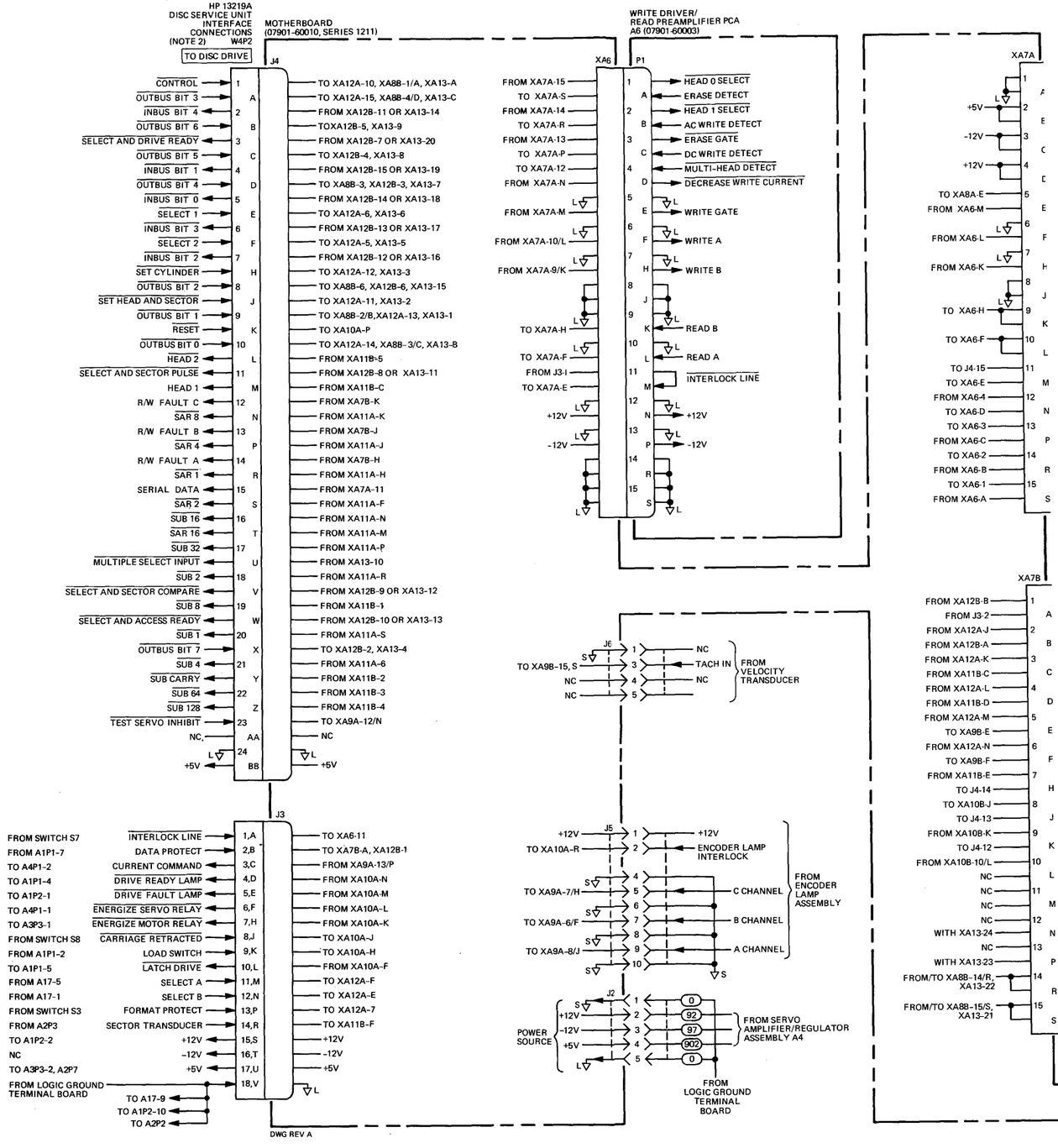
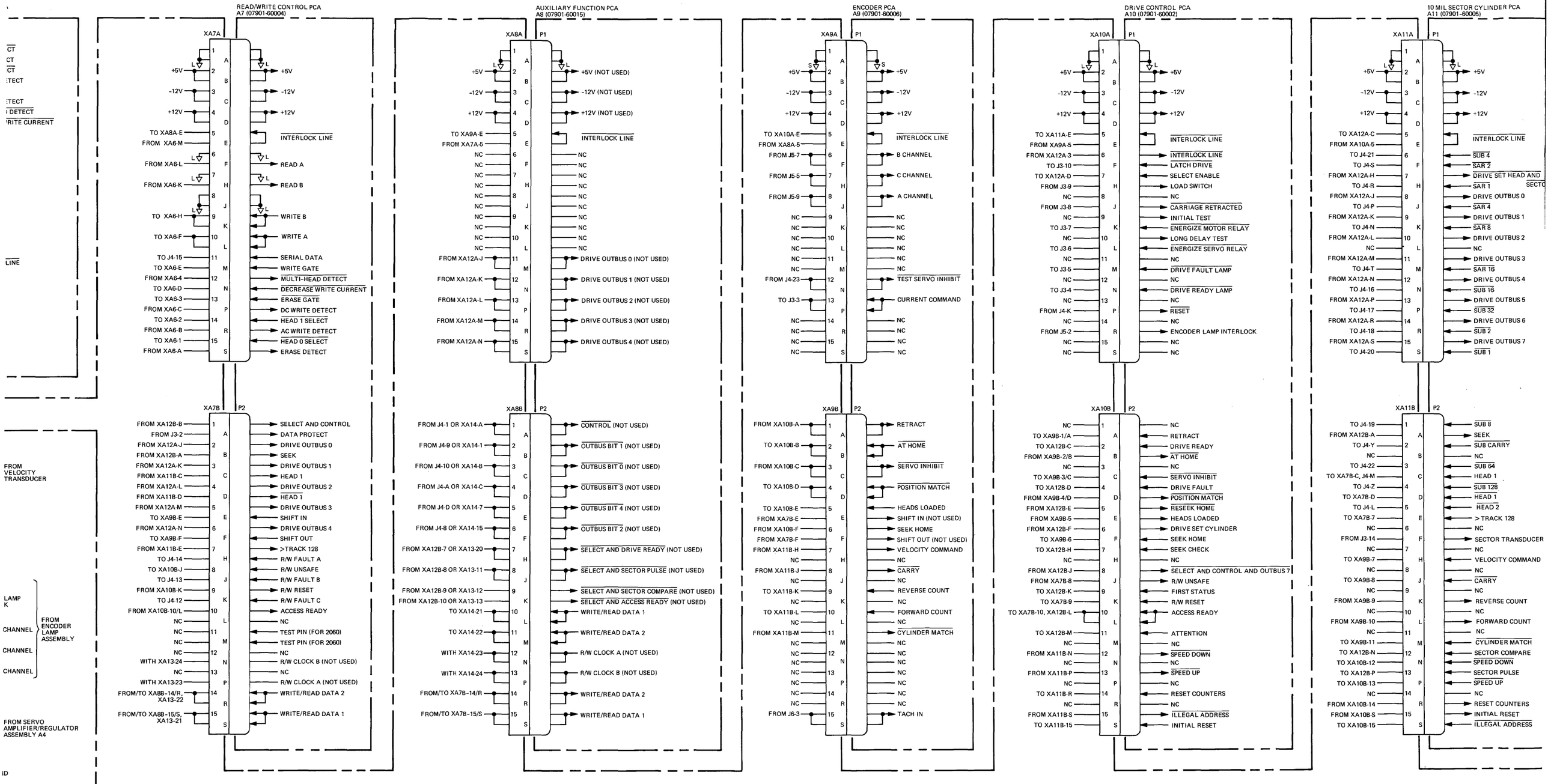
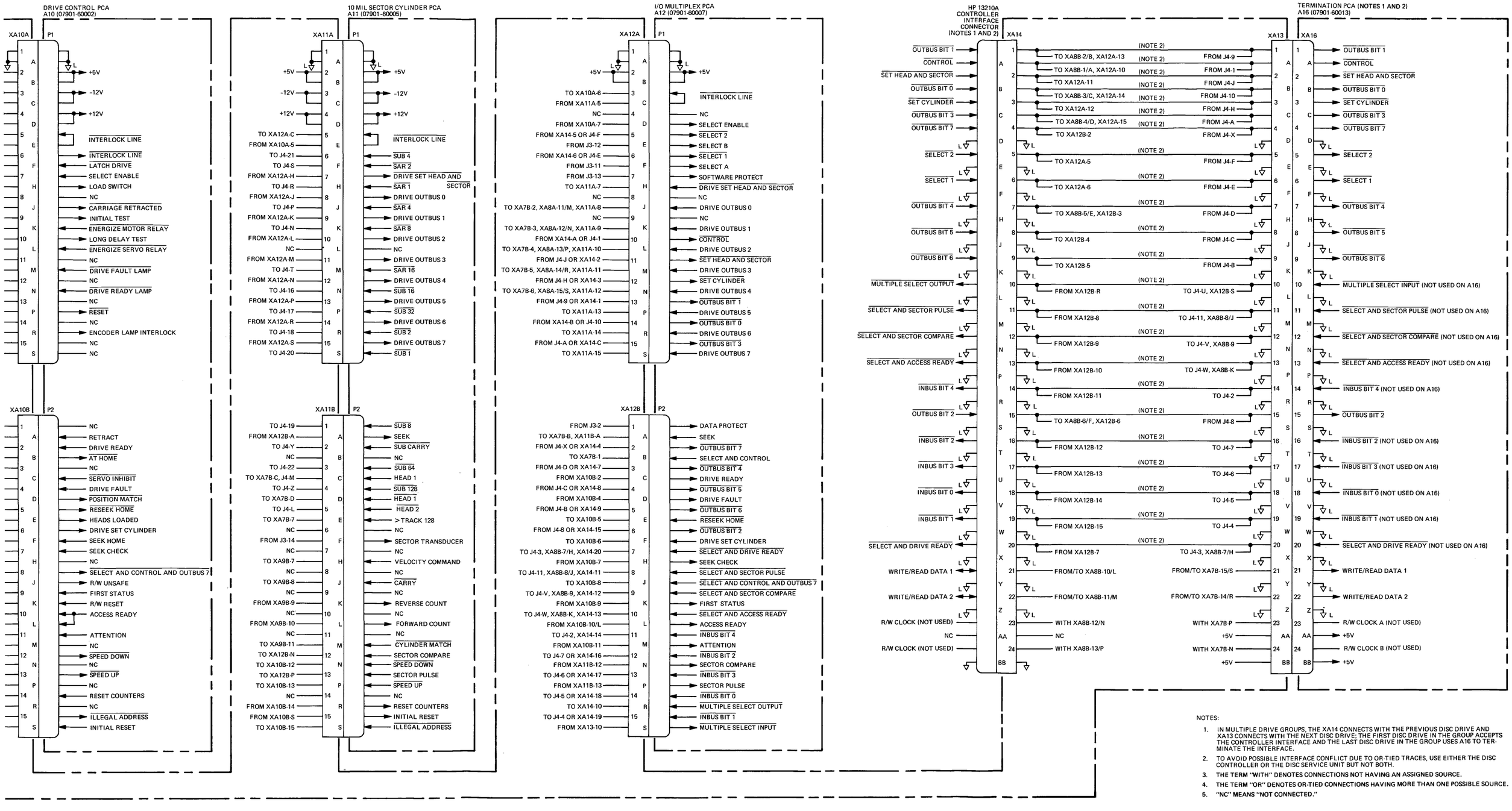


Figure 5-23. Motherboard PC Assembly A5, Parts Location Diagram


READ/WRITE CONTROL PCA
A7 (07901-60004)
XA7A
P1
+5V
-12V
+12V
TO XA8A-E
FROM XA6-M
INTERLOCK LINE
FROM XA6-L
READ A
FROM XA6-K
READ B
TO XA6-H
WRITE B
TO XA6-F
WRITE A
TO J4-15
SERIAL DATA
TO XA6-E
WRITE GATE
FROM XA6-4
MULTI-HEAD DETECT
TO XA6-D
DECREASE WRITE CURRENT
TO XA6-3
ERASE GATE
FROM XA6-C
DC WRITE DETECT
TO XA6-2
HEAD 1 SELECT
FROM XA6-B
AC WRITE DETECT
TO XA6-1
HEAD 0 SELECT
FROM XA6-A
ERASE DETECT
XA7B
P2
FROM XA12B-B
SELECT AND CONTROL
FROM J3-2
DATA PROTECT
FROM XA12A-J
DRIVE OUTBUS 0
FROM XA12B-A
SEEK
FROM XA12A-K
DRIVE OUTBUS 1
FROM XA11B-C
HEAD 1
FROM XA12A-L
DRIVE OUTBUS 2
FROM XA11B-D
HEAD 1
FROM XA12A-M
DRIVE OUTBUS 3
TO XA9B-E
SHIFT IN
FROM XA12A-N
DRIVE OUTBUS 4
TO XA9B-F
SHIFT OUT
FROM XA11B-E
>TRACK 128
TO J4-14
R/W FAULT A
TO XA10B-J
R/W UNSAFE
TO J4-13
R/W FAULT B
FROM XA10B-K
R/W RESET
TO J4-12
R/W FAULT C
FROM XA10B-10/L
ACCESS READY
NC
TEST PIN (FOR 2060)
TEST PIN (FOR 2060)
NC
WITH XA13-24
R/W CLOCK B (NOT USED)
NC
WITH XA13-23
R/W CLOCK A (NOT USED)
FROM/TO XA8B-14/R, XA13-22
WRITE/READ DATA 2
FROM/TO XA8B-15/S, XA13-21
WRITE/READ DATA 1
AUXILIARY FUNCTION PCA
A8 (07901-60015)
XA8A
P1
+5V (NOT USED)
-12V (NOT USED)
+12V (NOT USED)
TO XA9A-E
FROM XA7A-5
INTERLOCK LINE
NC
FROM XA12A-J
DRIVE OUTBUS 0 (NOT USED)
FROM XA12A-K
DRIVE OUTBUS 1 (NOT USED)
FROM XA12A-L
DRIVE OUTBUS 2 (NOT USED)
FROM XA12A-M
DRIVE OUTBUS 3 (NOT USED)
FROM XA12A-N
DRIVE OUTBUS 4 (NOT USED)
XA8B
P2
FROM J4-1 OR XA14-A
CONTROL (NOT USED)
FROM J4-9 OR XA14-1
OUTBUS BIT 1 (NOT USED)
FROM J4-10 OR XA14-B
OUTBUS BIT 0 (NOT USED)
FROM J4-A OR XA14-C
OUTBUS BIT 3 (NOT USED)
FROM J4-D OR XA14-7
OUTBUS BIT 4 (NOT USED)
FROM J4-8 OR XA14-15
OUTBUS BIT 2 (NOT USED)
FROM XA12B-7 OR XA13-20
SELECT AND DRIVE READY (NOT USED)
FROM XA12B-8 OR XA13-11
SELECT AND SECTOR PULSE (NOT USED)
FROM XA12B-9 OR XA13-12
SELECT AND SECTOR COMPARE (NOT USED)
FROM XA12B-10 OR XA13-13
SELECT AND ACCESS READY (NOT USED)
TO XA14-21
WRITE/READ DATA 1
TO XA14-22
WRITE/READ DATA 2
WITH XA14-23
R/W CLOCK A (NOT USED)
WITH XA14-24
R/W CLOCK B (NOT USED)
FROM/TO XA7B-14/R
WRITE/READ DATA 2
FROM/TO XA7B-15/S
WRITE/READ DATA 1
ENCODER PCA
A9 (07901-60006)
XA9A
P1
+5V
-12V
+12V
TO XA10A-E
FROM XA8A-5
INTERLOCK LINE
FROM J5-7
B CHANNEL
FROM J5-5
C CHANNEL
FROM J5-9
A CHANNEL
FROM J4-23
TEST SERVO INHIBIT
TO J3-3
CURRENT COMMAND
XA9B
P2
FROM XA10B-A
RETRACT
TO XA10B-B
AT HOME
FROM XA10B-C
SERVO INHIBIT
TO XA10B-D
POSITION MATCH
TO XA10B-E
HEADS LOADED
FROM XA7B-E
SHIFT IN (NOT USED)
FROM XA10B-F
SEEK HOME
FROM XA7B-F
SHIFT OUT (NOT USED)
FROM XA11B-H
VELOCITY COMMAND
FROM XA11B-J
CARRY
TO XA11B-K
REVERSE COUNT
TO XA11B-L
FORWARD COUNT
FROM XA11B-M
CYLINDER MATCH
FROM J6-3
TACH IN
DRIVE CONTROL PCA
A10 (07901-60002)
XA10A
P1
+5V
-12V
+12V
TO XA11A-E
FROM XA9A-5
INTERLOCK LINE
FROM XA12A-3
INTERLOCK LINE
TO J3-10
LATCH DRIVE
TO XA12A-D
SELECT ENABLE
FROM J3-9
LOAD SWITCH
FROM J3-8
CARRIAGE RETRACTED
TO J3-7
INITIAL TEST
TO J3-6
ENERGIZE MOTOR RELAY
TO J3-5
LONG DELAY TEST
TO J3-4
ENERGIZE SERVO RELAY
FROM J4-K
DRIVE FAULT LAMP
FROM J5-2
DRIVE READY LAMP
RESET
ENCODER LAMP INTERLOCK
XA10B
P2
NC
TO XA9B-1/A
RETRACT
TO XA12B-C
DRIVE READY
FROM XA9B-2/B
AT HOME
SERVO INHIBIT
TO XA9B-3/C
SERVO INHIBIT
TO XA12B-D
DRIVE FAULT
FROM XA9B-4/D
POSITION MATCH
FROM XA12B-E
RESEEK HOME
FROM XA9B-5
HEADS LOADED
FROM XA12B-F
DRIVE SET CYLINDER
TO XA9B-6
SEEK HOME
TO XA12B-H
SEEK CHECK
FROM XA12B-J
SELECT AND CONTROL AND OUTBUS 7
FROM XA7B-8
R/W UNSAFE
TO XA12B-K
FIRST STATUS
TO XA7B-9
R/W RESET
TO XA7B-10, XA12B-L
ACCESS READY
TO XA12B-M
ATTENTION
FROM XA11B-N
SPEED DOWN
FROM XA11B-P
SPEED UP
TO XA11B-R
RESET COUNTERS
FROM XA11B-S
ILLEGAL ADDRESS
TO XA11B-15
INITIAL RESET
10 MIL SECTOR CYLINDER PCA
A11 (07901-60005)
XA11A
P1
+5V
-12V
+12V
TO XA12A-C
FROM XA10A-5
INTERLOCK LINE
TO J4-21
SUB 4
TO J4-S
SAR 2
FROM XA12A-H
DRIVE SET HEAD AND SECTO
TO J4-R
SAR 1
FROM XA12A-J
DRIVE OUTBUS 0
TO J4-P
SAR 4
FROM XA12A-K
DRIVE OUTBUS 1
TO J4-N
SAR 8
FROM XA12A-L
DRIVE OUTBUS 2
NC
FROM XA12A-M
DRIVE OUTBUS 3
TO J4-T
SAR 16
FROM XA12A-N
DRIVE OUTBUS 4
TO J4-16
SUB 16
FROM XA12A-P
DRIVE OUTBUS 5
TO J4-17
SUB 32
FROM XA12A-R
DRIVE OUTBUS 6
TO J4-18
SUB 2
FROM XA12A-S
DRIVE OUTBUS 7
TO J4-20
SUB 1
XA11B
P2
TO J4-19
SUB 8
FROM XA12B-A
SEEK
TO J4-Y
SUB CARRY
NC
TO J4-22
SUB 64
TO XA7B-C, J4-M
HEAD 1
TO J4-Z
SUB 128
TO XA7B-D
HEAD 1
TO J4-L
HEAD 2
TO XA7B-7
>TRACK 128
NC
FROM J3-14
SECTOR TRANSDUCER
NC
TO XA9B-7
VELOCITY COMMAND
NC
TO XA9B-8
CARRY
NC
FROM XA9B-9
REVERSE COUNT
NC
FROM XA9B-10
FORWARD COUNT
NC
TO XA9B-11
CYLINDER MATCH
TO XA12B-N
SECTOR COMPARE
TO XA10B-12
SPEED DOWN
TO XA12B-P
SECTOR PULSE
TO XA10B-13
SPEED UP
NC
FROM XA10B-14
RESET COUNTERS
FROM XA10B-S
INITIAL RESET
TO XA10B-15
ILLEGAL ADDRESS
FROM VELOCITY TRANSDUCER
LAMP K
CHANNEL
CHANNEL
CHANNEL
FROM ENCODER LAMP ASSEMBLY
FROM SERVO AMPLIFIER/REGULATOR ASSEMBLY A4



NOTES:

1. IN MULTIPLE DRIVE GROUPS, THE XA14 CONNECTS WITH THE PREVIOUS DISC DRIVE AND XA13 CONNECTS WITH THE NEXT DISC DRIVE; THE FIRST DISC DRIVE IN THE GROUP ACCEPTS THE CONTROLLER INTERFACE AND THE LAST DISC DRIVE IN THE GROUP USES A16 TO TERMINATE THE INTERFACE.
2. TO AVOID POSSIBLE INTERFACE CONFLICT DUE TO OR-TIED TRACES, USE EITHER THE DISC CONTROLLER OR THE DISC SERVICE UNIT BUT NOT BOTH.
3. THE TERM "WITH" DENOTES CONNECTIONS NOT HAVING AN ASSIGNED SOURCE.
4. THE TERM "OR" DENOTES OR-TIED CONNECTIONS HAVING MORE THAN ONE POSSIBLE SOURCE.
5. "NC" MEANS "NOT CONNECTED."

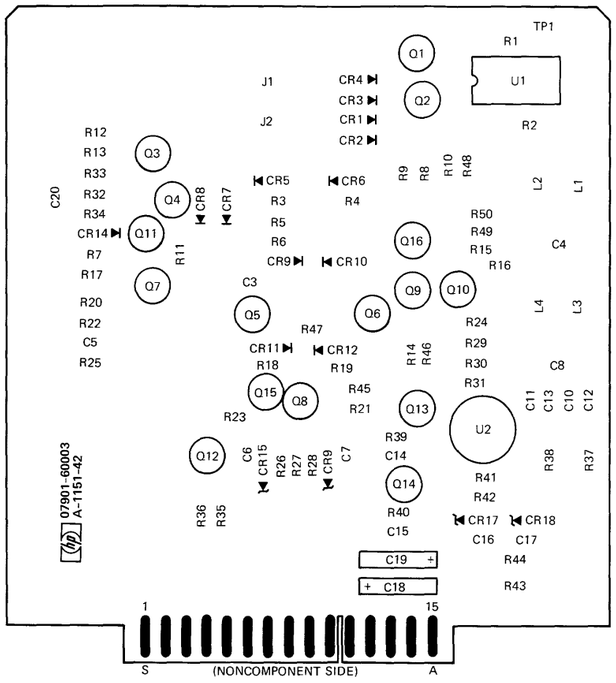
Figure 5-24. Motherboard PC Assembly A5, Schematic Diagram

Table 5-10. Write Driver/Read Preamplifier Assembly A6 (07901-60003) Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6	07901-60003	1	R/W PREAMP ASSY:PC	28480	07901-60003
A6C1	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A6C2	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A6C3	0160-2197	1	C:FXD MICA 10 PF 5%	72136	RDM15C100J3C
A6C4	0140-0193	2	C:FXD MICA 82 PF 5%	28480	0140-0193
A6C5	0160-0153		C:FXD MY 0.001 UF 10% 200VDCW	56289	192P10292-PTS
A6C6	0160-2199	2	C:FXD MICA 30 PF 5% 300VDCW	28480	0160-2199
A6C7	0160-2199		C:FXD MICA 30 PF 5% 300VDCW	28480	0160-2199
A6C8	0160-2255	1	C:FXD CER 8.2 PF 500VDCW	72982	301-000-COH0-829C
A6C10	0160-2198	2	C:FXD MICA 20 PF 5%	72136	RDM15C200J3C
A6C11	0160-2198		C:FXD MICA 20 PF 5%	72136	RDM15C200J3C
A6C12	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A6C13	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A6C14	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A6C15	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A6C16	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A6C17	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A6C18	0180-0116	11	C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A6C19	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A6C20	0160-3533	1	C:FXD MICA 470 PF 5% 100VDCW	00853	RDM15F471J1C
A6CR1	1901-0450	6	DIODE:SILICON	28480	1901-0450
A6CR2	1901-0450		DIODE:SILICON	28480	1901-0450
A6CR3	1901-0450		DIODE:SILICON	28480	1901-0450
A6CR4	1901-0450		DIODE:SILICON	28480	1901-0450
A6CR5	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6CR6	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6CR7	1901-0450		DIODE:SILICON	28480	1901-0450
A6CR8	1901-0450		DIODE:SILICON	28480	1901-0450
A6CR9	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6CR10	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6CR11	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6CR12	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6CR14	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6CR15	1902-3149	2	DIODE BREAKDOWN:9.09V 5%	28480	1902-3149
A6CR16	1902-3149		DIODE BREAKDOWN:9.09V 5%	28480	1902-3149
A6CR17	1902-0049	2	DIODE:BREAKDOWN 6.19V 5%	04713	SZ10939-122
A6CR18	1902-0049		DIODE:BREAKDOWN 6.19V 5%	04713	SZ10939-122
A6L1	9100-1627	2	COIL/CHCKE 39 UH 5%	82142	15-1315-2J
A6L2	9100-1627		COIL/CHOKE 39 UH 5%	82142	15-1315-2J
A6L3	9100-1623	2	COIL/CHOKE 27.0 UH 5%	99800	1537-48
A6L4	9100-1623		COIL/CHOKE 27.0 UH 5%	99800	1537-48
A6Q1	1855-0078	2	TSTR:SI FET	28480	1855-0078
A6Q2	1855-0078		TSTR:SI FET	28480	1855-0078
A6Q3	1853-0010	9	TSTR:SI PNP(SELECTED FROM 2N3251)	28480	1853-0010
A6Q4	1853-0010		TSTR:SI PNP(SELECTED FROM 2N3251)	28480	1853-0010
A6Q5	1854-0260	2	TSTR:SI NPN	80131	2N3227
A6Q6	1854-0260		TSTR:SI NPN	80131	2N3227
A6Q7	1853-0010		TSTR:SI PNP(SELECTED FROM 2N3251)	28480	1853-0010
A6Q8	1854-0045	9	TSTR:SI NPN	04713	2N956
A6Q9	1853-0010		TSTR:SI PNP(SELECTED FROM 2N3251)	28480	1853-0010
A6Q10	1854-0045		TSTR:SI NPN	04713	2N956
A6Q11	1854-0045		TSTR:SI NPN	04713	2N956
A6Q12	1853-0010		TSTR:SI PNP(SELECTED FROM 2N3251)	28480	1853-0010
A6Q13	1854-0045		TSTR:SI NPN	04713	2N956
A6Q14	1854-0045		TSTR:SI NPN	04713	2N956
A6Q15	1854-0045		TSTR:SI NPN	04713	2N956
A6Q16	1853-0010		TSTR:SI PNP(SELECTED FROM 2N3251)	28480	1853-0010
A6R1	0757-0428	2	R:FXD MET FLM 1.62K OHM 1% 1/8W	28480	0757-0428
A6R2	0757-0428		R:FXD MET FLM 1.62K OHM 1% 1/8W	28480	0757-0428
A6R3	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A6R4	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A6R5	0683-2035	2	R:FXD COMP 20K OHM 5% 1/4W	01121	CB 2035
A6R6	0683-2035		R:FXD COMP 20K OHM 5% 1/4W	01121	CB 2035
A6R7	0683-1225	4	R:FXD COMP 1200 OHM 5% 1/4W	01121	CB 1225
A6R8	0757-0447	3	R:FXD MET FLM 16.2K OHM 1% 1/8W	28480	0757-0447
A6R9	0757-0447		R:FXD MET FLM 16.2K OHM 1% 1/8W	28480	0757-0447
A6R10	0683-1045	6	R:FXD COMP 100K OHMS 5% 1/4W	01121	CB 1045
A6R11	0683-6215	4	R:FXD COMP 620 OHM 5% 1/4W	01121	CB 6215
A6R12	0683-6215		R:FXD COMP 620 OHM 5% 1/4W	01121	CB 6215
A6R13	0683-1225		R:FXD COMP 1200 OHM 5% 1/4W	01121	CB 1225
A6R14	0683-2225		R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A6R15	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A6R16	0683-1225		R:FXD COMP 1200 OHM 5% 1/4W	01121	CB 1225
A6R17	0683-6215		R:FXD COMP 620 OHM 5% 1/4W	01121	CB 6215
A6R18	0683-5135	3	R:FXD COMP 51K OHM 5% 1/4W	01121	CB 5135

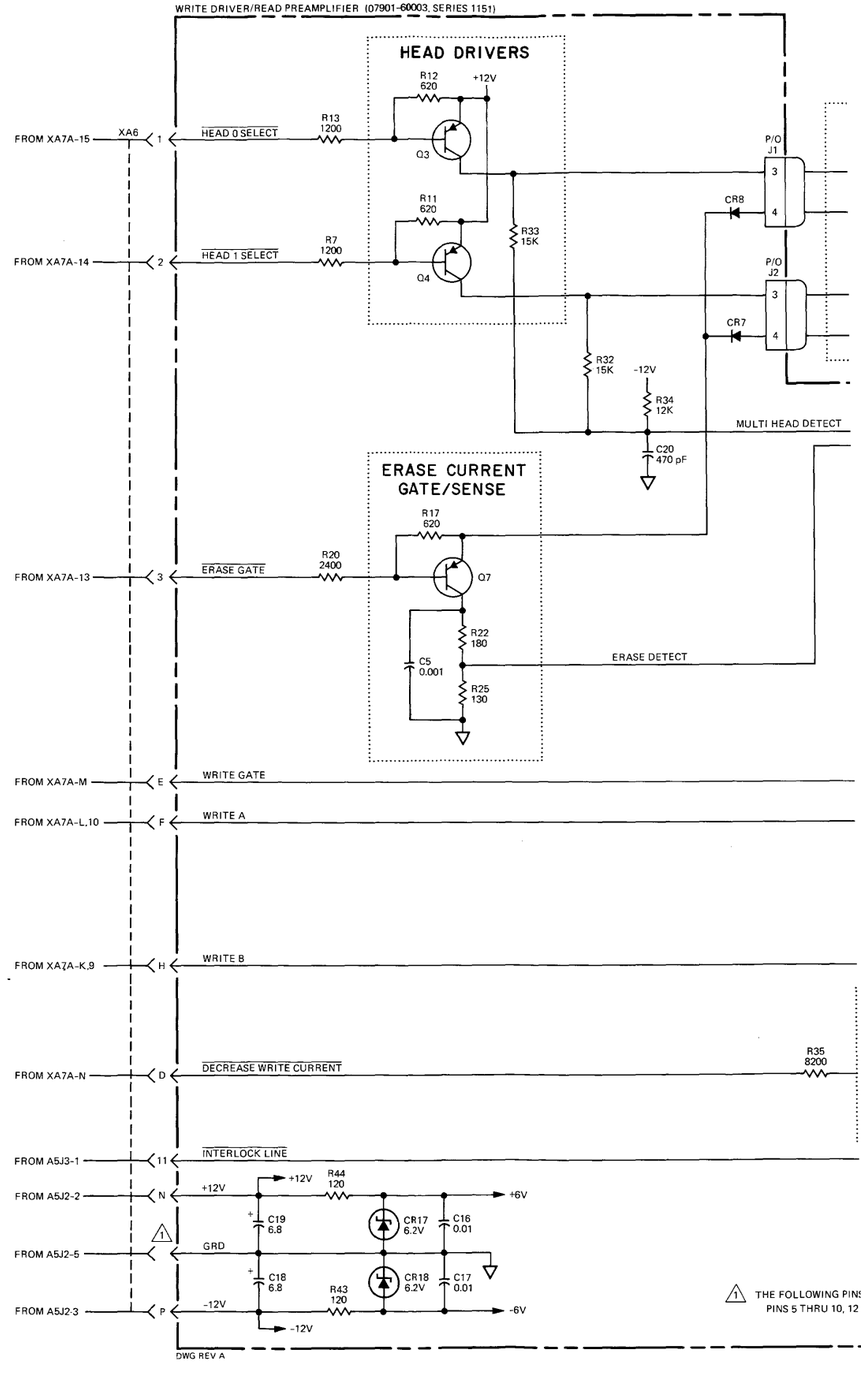
Table 5-10. Write Driver/Read Preamplifier Assembly A6 (07901-60003) Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6R19	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A6R20	0683-2425	1	R:FXD COMP 2400 OHM 5% 1/4W	01121	CB 2425
A6R21	0683-3325		R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A6R22	0686-1815	1	R:FXD COMP 180 OHM 5% 1/2W	01121	EB 1815
A6R23	0757-0279		R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A6R24	0757-0416	2	R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A6R25	0686-1315	1	R:FXD COMP 130 OHM 5% 1/2W	01121	EB 1315
A6R26	0683-5125		R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A6R27	0757-0382	1	R:FXD MET FLM 16.2 OHM 1% 1/8W	28480	0757-0382
A6R28	0683-5125		R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A6R29	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A6R30	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A6R31	0757-0279		R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A6R32	0683-1535	2	R:FXD COMP 15K OHM 5% 1/4W	01121	CB 1535
A6R33	0683-1535		R:FXD COMP 15K OHM 5% 1/4W	01121	CB 1535
A6R34	0683-1235	2	R:FXD COMP 12K OHM 5% 1/4W	01121	CB 1235
A6R35	0683-8225	1	R:FXD COMP 8200 OHMS 5% 1/4W	01121	CB 8225
A6R36	0683-6215		R:FXD COMP 620 OHM 5% 1/4W	01121	CB 6215
A6R37	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A6R38	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A6R39	0698-3132	2	R:FXD FLM 261 OHM 1% 1/8W	28480	0698-3132
A6R40	0698-3132		R:FXD FLM 261 OHM 1% 1/8W	28480	0698-3132
A6R41	0757-0279		R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A6R42	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A6R43	0686-1215	2	R:FXD COMP 120 OHM 5% 1/2W	01121	EB 1215
A6R44	0686-1215		R:FXD COMP 120 OHM 5% 1/2W	01121	EB 1215
A6R45	0683-2225		R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A6R46	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A6R47	0683-6225	2	R:FXD COMP 6200 OHM 5% 1/4W	01121	CB 6225
A6R48	0683-1045		R:FXD COMP 100K OHMS 5% 1/4W	01121	CB 1045
A6R49	0683-1225		R:FXD COMP 1200 OHM 5% 1/4W	01121	CB 1225
A6R50	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A6U1	1826-0064	1	IC:LIN VIDEO AMPL. DIFF. IN/OUT	07263	U6A7733393
A6U2	1820-0192	1	IC:VIDEO & WIDE BAND AMPL	28480	1820-0192



01-2

Figure 5-25. Write Driver/Read Preamplifier PC Assembly A6, Parts Location Diagram



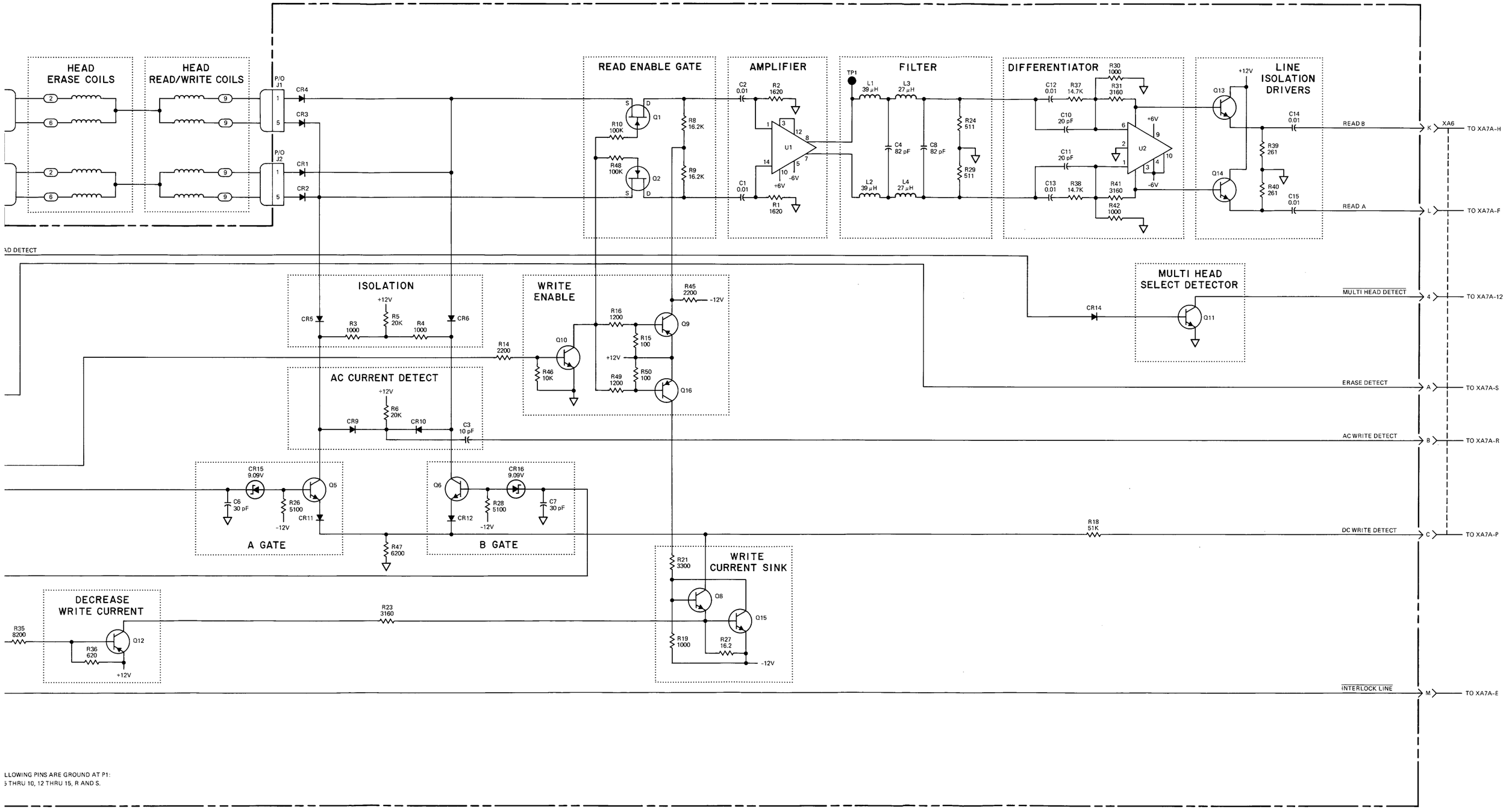


Figure 5-26. Write Driver/Read Preamplifier PC Assembly A6, Schematic Diagram

Table 5-11. Read/Write Control PC Assembly A7 (07901-60004) Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A7	07901-60004	1	R/W PREAMP ASSY:PC	28480	07901-60004
A7C1	0160-2055	14	C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7C2	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7C3	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7C4	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7C5	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7C6	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7C7	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7C8	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7C9	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7C10	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7C11	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7C12	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7C13	0180-1746	2	C:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A7C15	0160-3534	1	C:FXD MICA 510 PF 5% 100VDCW	00853	RDM15F511JIC
A7C16	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7C17	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7C18	0150-0121	1	C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50B1S-CML
A7C19	0160-0153	1	C:FXD MY 0.001 UF 10% 200VDCW	56289	192P10292-PTS
A7C20	0160-0300	1	C:FXD MY 0.0027 UF 200VDCW	56289	192P27292-PTS
A7C21	0160-0154	1	C:FXD MICA MY 0.0022 UF 10% 200VDCW	56289	192P22292-PTS
A7C22	0180-0229	1	C:FXD ELECT 33 UF 10% 10VDCW	28480	0180-0229
A7C23	0180-1746		C:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A7CR1	1902-3059	1	DIODE BREAKDOWN:SILICON 3.83V 5%	28480	1902-3059
A7CR2	1901-0040	1	DIODE:SILICON 30MA 30WV	07263	FDG1088
A7CR3	1902-0041	1	DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A7Q1	1854-0045	3	TSTR:SI NPN	04713	2N956
A7Q2	1853-0010	1	TSTR:SI PNP(SELECTED FROM 2N3251)	28480	1853-0010
A7Q3	1854-0045		TSTR:SI NPN	04713	2N956
A7Q4	1854-0045		TSTR:SI NPN	04713	2N956
A7R1	0683-3915	1	R:FXD COMP 390 OHM 5% 1/4W	01121	CB 3915
A7R2	0683-6225	1	R:FXD COMP 6200 OHM 5% 1/4W	01121	CB 6225
A7R3	0683-4705	1	R:FXD COMP 47 OHM 5% 1/4W	01121	CB 4705
A7R4	0683-3315	1	R:FXD COMP 330 OHM 5% 1/4W	01121	CB 3315
A7R5	0683-1025	2	R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A7R6	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A7R7	0683-1035	2	R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A7R8	0683-5125	1	R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A7R9	0683-5135	2	R:FXD COMP 51K OHM 5% 1/4W	01121	CB 5135
A7R10	0683-5135		R:FXD COMP 51K OHM 5% 1/4W	01121	CB 5135
A7R11	0757-0443	1	R:FXD MET FLM 11.0K OHM 1% 1/8W	28480	0757-0443
A7R12	0683-4725	2	R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A7R13	0683-1055	1	R:FXD COMP 1 MEGOHM 5% 1/4W	01121	CB 1055
A7R14	0683-2715	2	R:FXD COMP 270 OHM 5% 1/4W	01121	CB 2715
A7R15	0683-2715		R:FXD COMP 270 OHM 5% 1/4W	01121	CB 2715
A7R16	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A7R17	0698-3620	1	R:FXD MET OX 100 OHM 5% 2W	28480	0698-3620
A7R18	0683-2225	1	R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A7R19	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A7U11	1820-0477	1	IC:LINEAR OPERATIONAL AMPLIFIER	28480	1820-0477
A7U12	1820-0537	2	IC:TTL DUAL 4-INPT NAND GATE	28480	1820-0537
A7U13	1820-0537		IC:TTL DUAL 4-INPT NAND GATE	28480	1820-0537
A7U14	1820-0065	2	IC:TTL DUAL 4-INPT POS NAND GATE	01295	SN7420N
A7U15	1820-0068	1	IC:TTL TRIPLE 3-INPUT POS NAND GATE	12040	SN7410N
A7U16	1820-0054	4	IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A7U17	1820-0069		IC:TTL DUAL 4-INPT POS NAND GATE	01295	SN7420N
A7U21	1820-0398	2	IC:DIFF COMPARATOR AVOL=1K MIN.	12040	LM710C
A7U22	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A7U23	1820-0174	1	IC:TTL HEX INVERTER	01295	SN7404N
A7U24	1820-0511	1	IC:TTL QUAD 2-INPT AND GATE	01295	SN7408N
A7U25	1820-0239	2	IC:TTL QUAD 2-INPT NOR GATE	28480	1820-0239
A7U26	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A7U27	1820-0722	1	IC:TTL DUAL LINE DRIVER	01295	SN75109N
A7U31	1820-0398		IC:DIFF COMPARATOR AVOL=1K MIN.	12040	LM710C
A7U32	1820-0077	2	IC:TTL DUAL D F/F	01295	SN7474N
A7U33	1820-0577	1	IC:TTL HEX INVERTER/DRIVER W/OPEN COLL.	01295	SN7416N
A7U34	1820-0239		IC:TTL QUAD 2-INPT NOR GATE	28480	1820-0239
A7U35	1820-0077		IC:TTL DUAL D F/F	01295	SN7474N
A7U36	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A7U37	1820-0723	1	IC:TTL DUAL LINE RECEIVER W/STROBES	01295	SN75107N

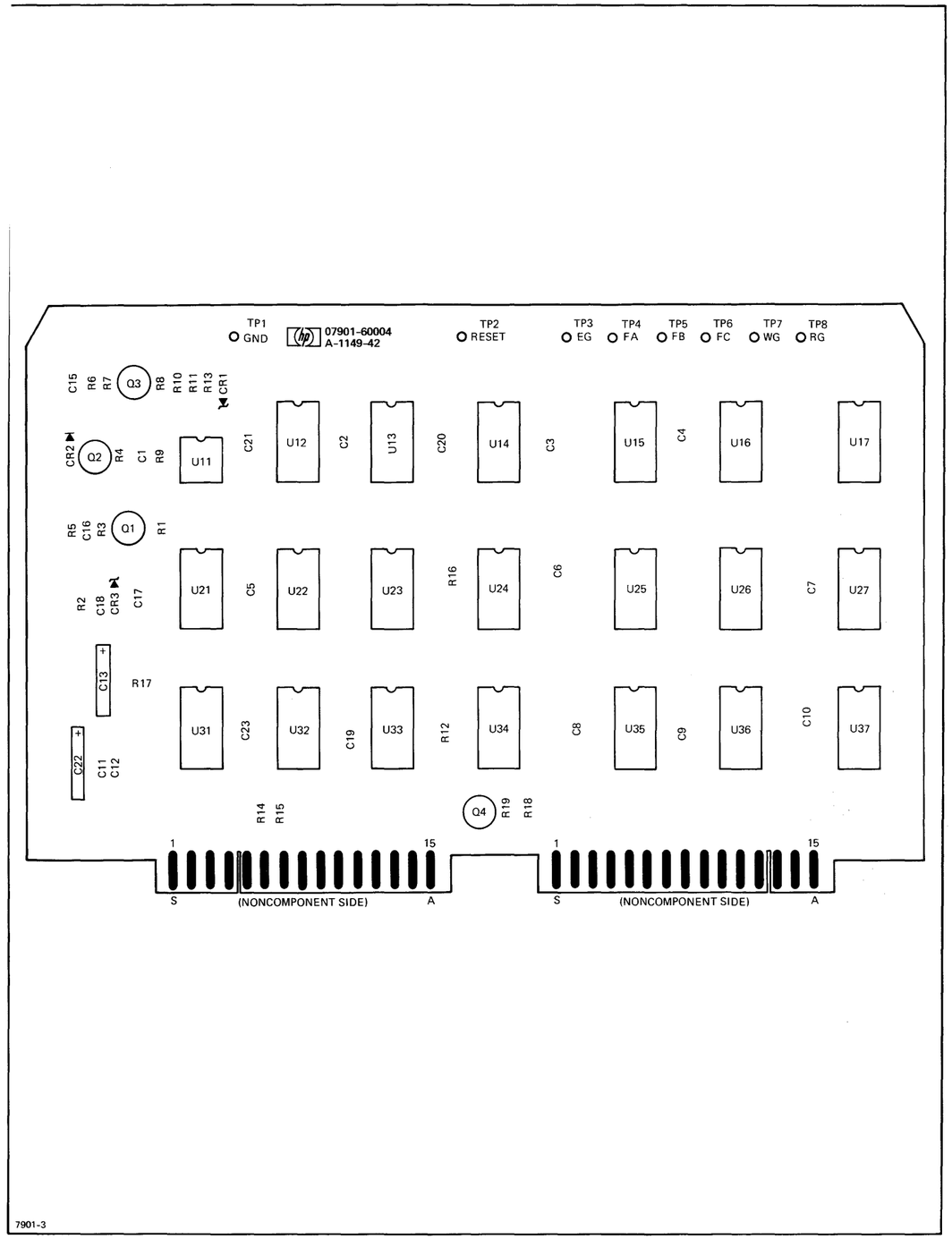
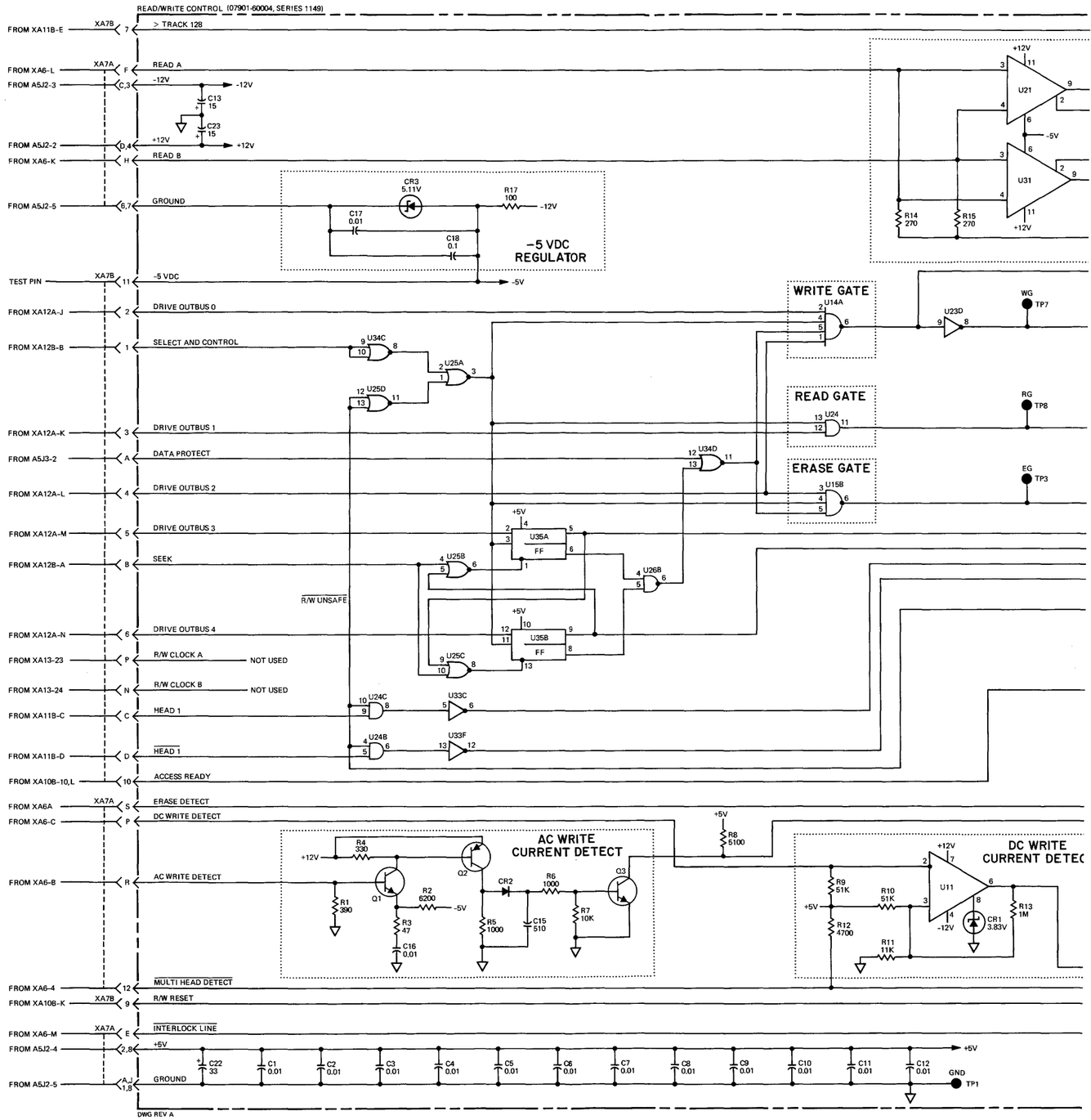


Figure 5-27. Read/Write Control PC Assembly A7, Parts Location Diagram



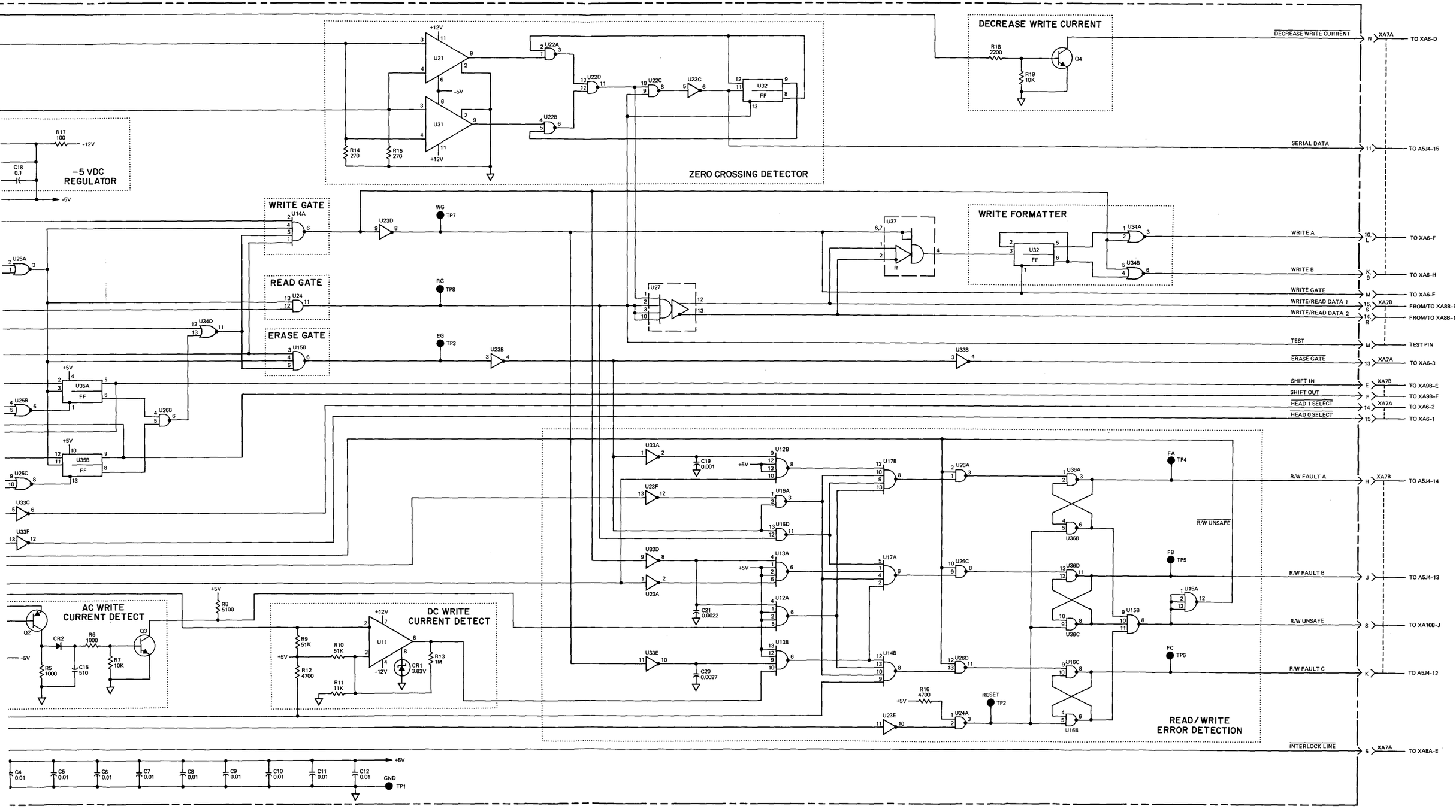


Figure 5-28. Read/Write Control PC Assembly A7, Schematic Diagram

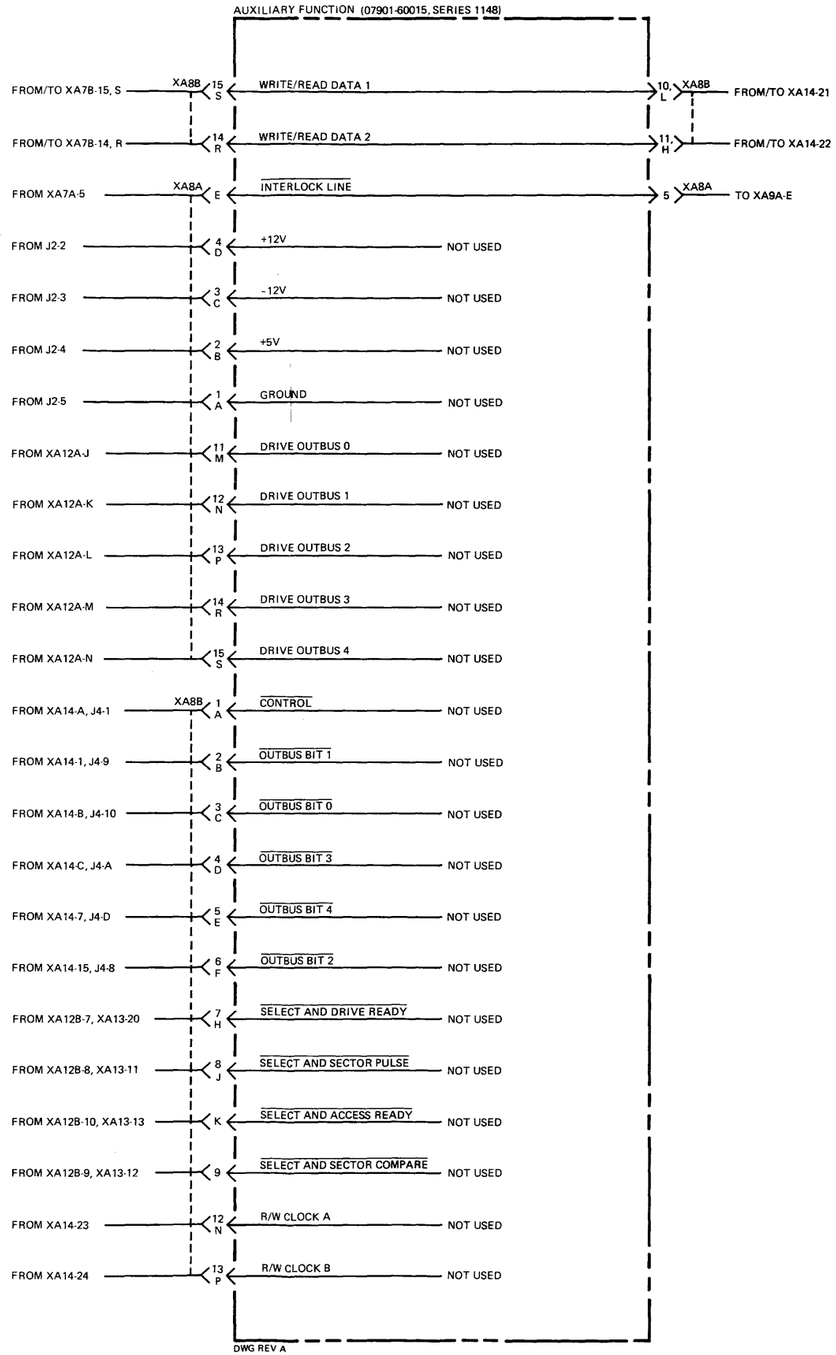


Figure 5-29. Auxiliary Function PC Assembly A8, Schematic Diagram

Table 5-12. Encoder PC Assembly A9 (07901-60006) Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A9	07901-60006	1	ENCODER ASSY:PC	28480	07901-60006
A9C1	0160-2204	2	C:FXD MICA 100PF 5%	72136	RDM15F101J3C
A9C2	0140-0205	1	C:FXD MICA 62 PF 5% 300VDCW	00853	RDM15E620J3C
A9C3	0160-2204		C:FXD MICA 100PF 5%	72136	RDM15F101J3C
A9C10	0180-0374	1	C:FXD TANT. 10 UF 10% 20VDCW	56289	1500106X9020B2-DYS
A9C11	0160-0153	2	C:FXD MY 0.001 UF 10% 200VDCW	56289	192P10292-PTS
A9C12	0160-0153		C:FXD MY 0.001 UF 10% 200VDCW	56289	192P10292-PTS
A9C14	0160-2055	4	C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A9C15	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A9C16	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A9C17	0180-0116	3	C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A9C18	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A9C19	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A9C20	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A9CR1	1901-0040	5	DIODE:SILICON 30MA 30WV	07263	FDG1088
A9CR2	1902-3059	3	DIODE BREAKDOWN:SILICON 3.83V 5%	28480	1902-3059
A9CR3	1902-3059		DIODE BREAKDOWN:SILICON 3.83V 5%	28480	1902-3059
A9CR4	1902-3059		DIODE BREAKDOWN:SILICON 3.83V 5%	28480	1902-3059
A9CR5	1901-0460	3	DIODE:SILICON 3-JUNCTION STABISTOR	03508	ST8523
A9CR6	1901-0460		DIODE:SILICON 3-JUNCTION STABISTOR	03508	ST8523
A9CR7	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A9CR8	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A9CR9	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A9CR10	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A9CR12	1901-0460		DIODE:SILICON 3-JUNCTION STABISTOR	03508	ST8523
A9Q1	1854-0071	2	TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A9Q2	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A9Q5	1855-0056	4	TSTR:SI FET	80131	2N4342
A9Q6	1855-0056		TSTR:SI FET	80131	2N4342
A9Q7	1855-0056		TSTR:SI FET	80131	2N4342
A9Q8	1855-0056		TSTR:SI FET	80131	2N4342
A9R1	2100-2514	2	R:VAR CERMET 20K OHM 10% LIN 1/2W	28480	2100-2514
A9R2	0683-1055	2	R:FXD COMP 1 MEGOHM 5% 1/4W	01121	CB 1055
A9R3	0698-3459	1	R:FXD MET FLM 383K OHM 1% 1/8W	28480	0698-3459
A9R4	0698-4002	2	R:FXD MET FLM 5K OHM 1% 1/8W	28480	0698-4002
A9R5	2100-2489	1	R:VAR FLM 5K OHM 10% LIN 1/2W	28480	2100-2489
A9R6	0683-1045	2	R:FXD COMP 100K OHMS 5% 1/4W	01121	CB 1045
A9R8	0683-4725	8	R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A9R12	0683-2235	3	R:FXD COMP 22K OHM 5% 1/4W	01121	CB 2235
A9R13	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A9R14	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A9R15	0683-5645	2	R:FXD COMP 560K OHM 5% 1/4W	01121	CB 5645
A9R17	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A9R18	0683-2235		R:FXD COMP 22K OHM 5% 1/4W	01121	CB 2235
A9R19	0686-4715	1	R:FXD COMP 470 OHM 5% 1/2W	01121	EB 4715
A9R20	2100-2514		R:VAR CERMET 20K OHM 10% LIN 1/2W	28480	2100-2514
A9R21	0683-5645		R:FXD COMP 560K OHM 5% 1/4W	01121	CB 5645
A9R22	0683-1055		R:FXD COMP 1 MEGOHM 5% 1/4W	01121	CB 1055
A9R24	0683-1025	9	R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A9R25	0683-3325	1	R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A9R26	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A9R27	0683-5125	1	R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A9R28	0683-1135	1	R:FXD COMP 11K OHM 5% 1/4W	01121	CB 1135
A9R29	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A9R30	0683-2245	1	R:FXD COMP 220K OHM 5% 1/4W	01121	CB 2245
A9R31	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A9R38	0683-1015	2	R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A9R39	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A9R40	0683-6825	2	R:FXD COMP 6800 OHM 5% 1/4W	01121	CB 6825
A9R41	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A9R42	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A9R43	0683-6825		R:FXD COMP 6800 OHM 5% 1/4W	01121	CB 6825
A9R47	0683-1035	9	R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A9R48	0683-2745	1	R:FXD COMP 270K OHM 5% 1/4W	01121	CB 2745
A9R49	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A9R50	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A9R51	0698-3457	1	R:FXD MET FLM 316K OHM 1% 1/8W	28480	0698-3457
A9R52	0683-6845	1	R:FXD COMP 680K OHM 5% 1/4W	01121	CB 6845
A9R53	0757-0458	1	R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A9R54	0757-0449	3	R:FXD FLM 20K OHM 1% 1/8W	28480	0757-0449
A9R55	0757-0449		R:FXD FLM 20K OHM 1% 1/8W	28480	0757-0449
A9R56	0683-1045		R:FXD COMP 100K OHMS 5% 1/4W	01121	CB 1045
A9R57	0757-0279	1	R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A9R58	0757-0449		R:FXD FLM 20K OHM 1% 1/8W	28480	0757-0449
A9R59	0698-3155	1	R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155

Table 5-12. Encoder PC Assembly A9 (07901-60006) Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A9R61	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A9R62	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A9R63	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A9R64	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A9R65	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A9R66	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A9R67	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A9R68	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A9R69	0757-0460	1	R:FXD MET FLM 61.9K OHM 1% 1/8W	28480	0757-0460
A9R72	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A9R73	0683-8235	1	R:FXD COMP 82K OHM 5% 1/4W	01121	EB 8235
A9R74	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A9R75	0757-0442	2	R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A9R76	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A9R77	0698-4002		R:FXD MET FLM 5K OHM 1% 1/8W	28480	0698-4002
A9R78	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A9R79	0683-4745	2	R:FXD COMP 470K OHM 5% 1/4W	01121	CB 4745
A9R80	0683-4745		R:FXD COMP 470K OHM 5% 1/4W	01121	CB 4745
A9R81	0683-2235		R:FXD COMP 22K OHM 5% 1/4W	01121	CB 2235
A9R82	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A9R84	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A9R85	0683-6835	1	R:FXD COMP 68K OHM 5% 1/4W	01121	CB 6835
A9U1	1820-0493	6	IC:OP. AMP. INTERNAL COMP.,8-PIN DIP	12040	LM307N
A9U2	1820-0493		IC:OP. AMP. INTERNAL COMP.,8-PIN DIP	12040	LM307N
A9U3	1820-0493		IC:OP. AMP. INTERNAL COMP.,8-PIN DIP	12040	LM307N
A9U4	1820-0477	3	IC:LINEAR OPERATIONAL AMPLIFIER	28480	1820-0477
A9U5	1820-0477		IC:LINEAR OPERATIONAL AMPLIFIER	28480	1820-0477
A9U8	1820-0493		IC:OP. AMP. INTERNAL COMP.,8-PIN DIP	12040	LM307N
A9U9	1820-0493		IC:OP. AMP. INTERNAL COMP.,8-PIN DIP	12040	LM307N
A9U10	1820-0174	1	IC:TTL HEX INVERTER	01295	SN7404N
A9U11	1820-0054	2	IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A9U12	1820-0239	2	IC:TTL QUAD 2-INPT NOR GATE	28480	1820-0239
A9U13	1820-0511	1	IC:TTL QUAD 2-INPT AND GATE	01295	SN7408N
A9U14	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A9U15	1820-0577	1	IC:TTL HEX INVERTER/DRIVER W/OPEN COLL.	01295	SN7416N
A9U16	1820-0477		IC:LINEAR OPERATIONAL AMPLIFIER	28480	1820-0477
A9U17	1820-0068	1	IC:TTL TRIPLE 3-INPUT POS NAND GATE	12040	SN7410N
A9U18	1820-0239		IC:TTL QUAD 2-INPT NOR GATE	28480	1820-0239
A9U19	1820-0493		IC:OP. AMP. INTERNAL COMP.,8-PIN DIP	12040	LM307N

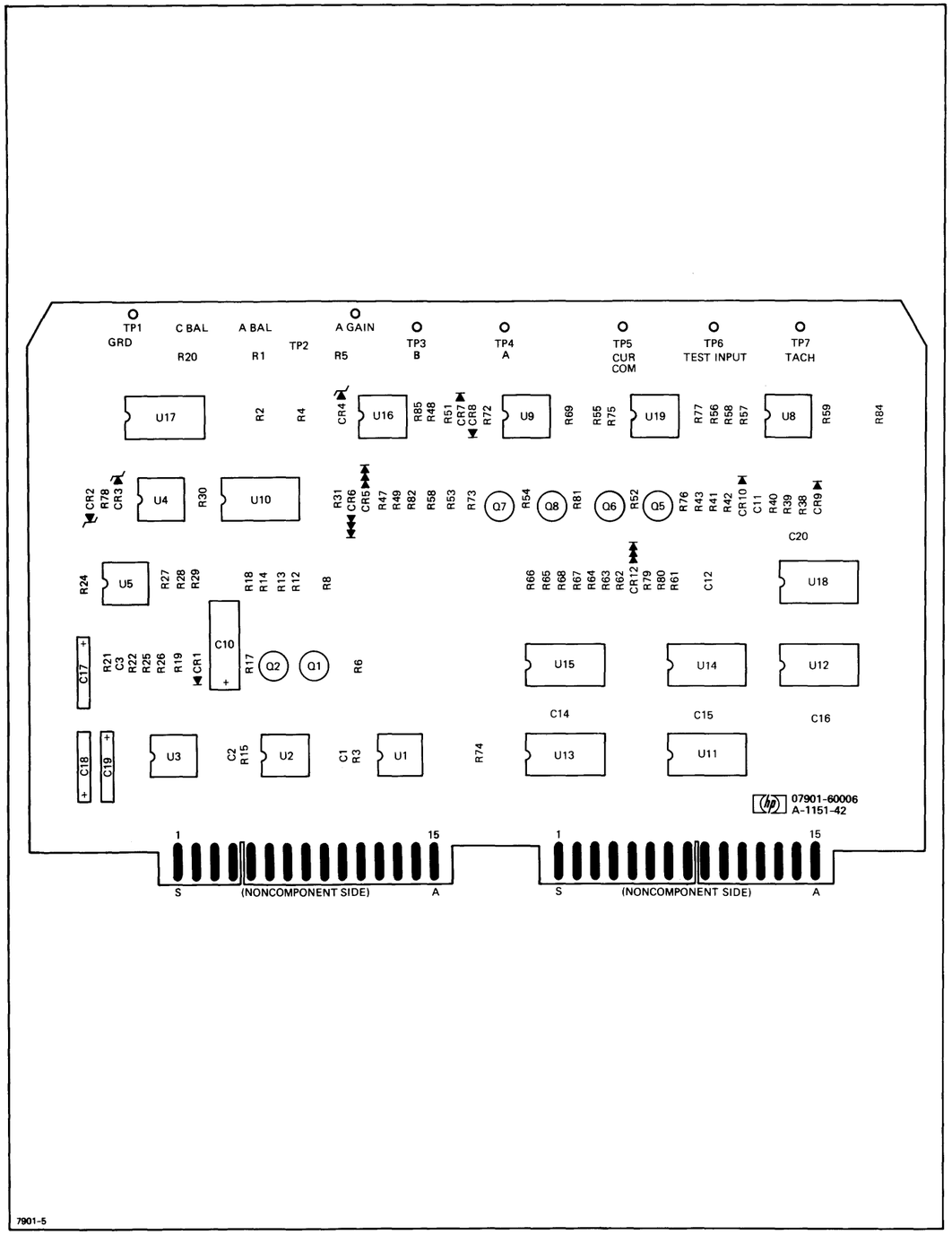
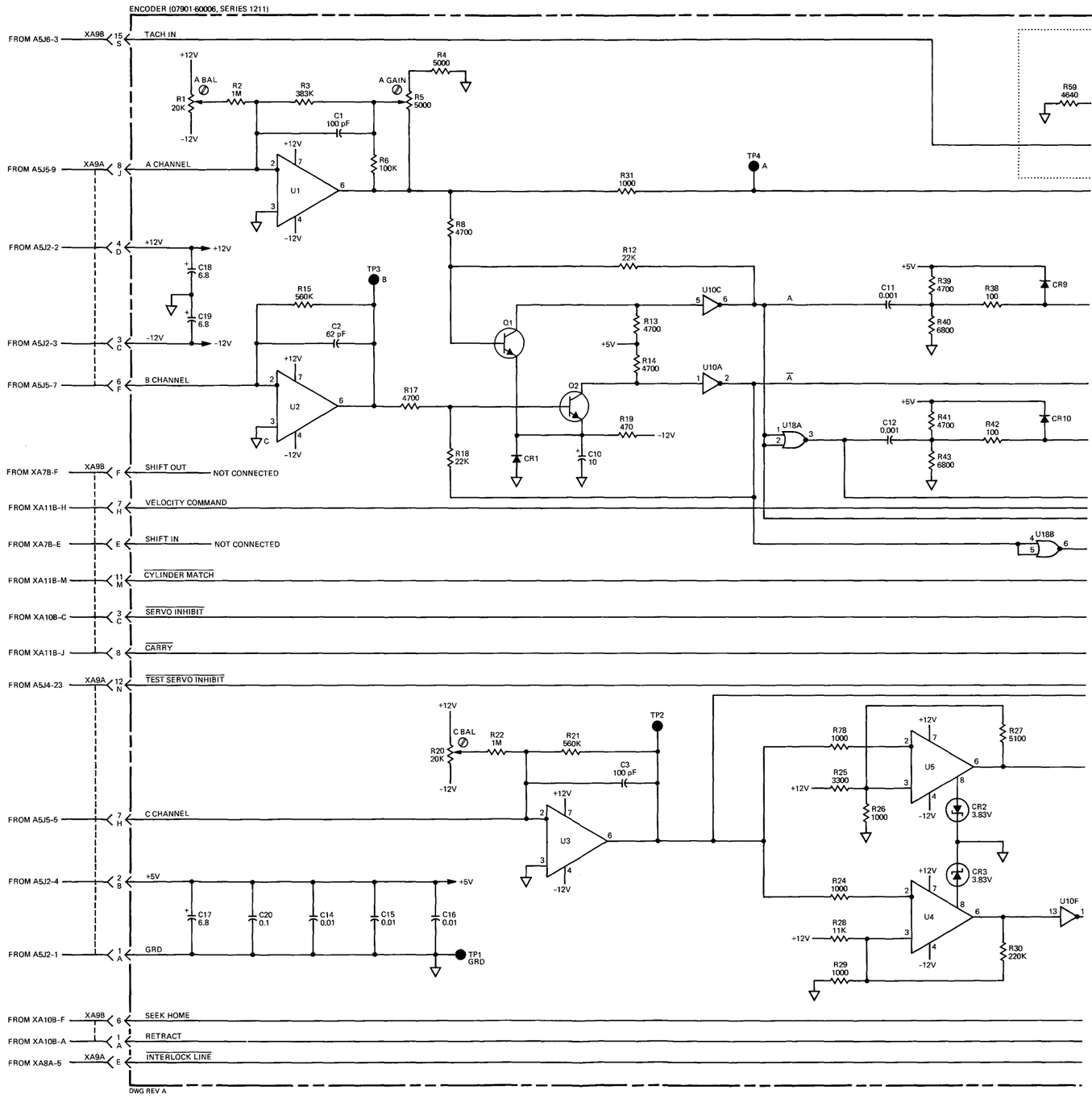


Figure 5-30. Encoder PC Assembly A9, Parts Location Diagram



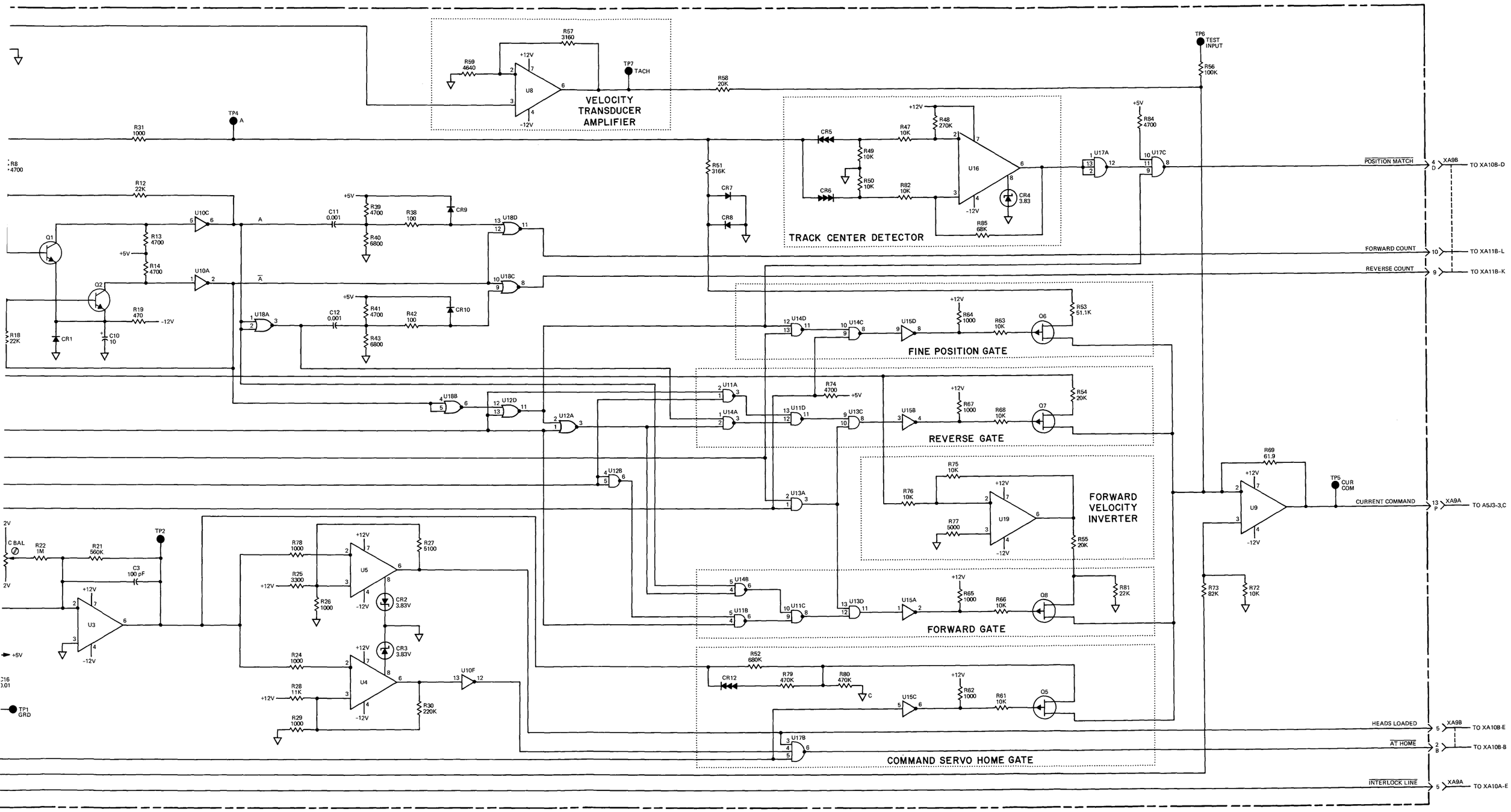


Figure 5-31. Encoder PC Assembly A9, Schematic Diagram

Table 5-13. Drive Control PC Assembly A10 (07901-60002) Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A10	07901-60002	1	DRIVE CONTROL ASSY:PC	28480	07901-60002
A10C1	0180-0197	1	C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A10C2	0160-0153	2	C:FXD MY 0.001 UF 10% 200VDCW	56289	192P10292-PTS
A10C3	0180-0291	2	C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A10C4	0160-0153		C:FXD MY 0.001 UF 10% 200VDCW	56289	192P10292-PTS
A10C5	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A10C6	0150-0121	2	C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50BIS-CML
A10C7	0180-0116	4	C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A10C8	0180-1835	1	C:FXD TA 68 UF 20% 15VDCW	56289	150D686X0015R2-DYS
A10C9	0160-2055	6	C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A10C10	0160-0157	1	C:FXD MY 0.0047 UF 10% 200VDCW	56289	192P47292-PTS
A10C11	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50BIS-CML
A10C12	0180-0100	1	C:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A10C13	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A10C14	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A10C15	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A10C16	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A10C17	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A10C18	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A10C19	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A10C22	0160-2441		C:FXD MY 0.00047 10% 200 VDCW	56289	292P47192-PTS
A10C23	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A10CR1	1901-0040	11	DIODE:SILICON 30MA 30WV	07263	FDG1088
A10CR2	1901-0026	1	DIODE:SILICON 0.75A 200PIV	04713	SR1358-8
A10CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A10CR4	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A10CR5	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A10CR6	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A10CR7	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A10CR8	1902-3059	2	DIODE BREAKDOWN:SILICON 3.83V 5%	28480	1902-3059
A10CR9	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A10CR10	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A10CR11	1902-0025	2	DIODE,BREAKDOWN:10.0V 5% 400 MW	28480	1902-0025
A10CR12	1902-0025		DIODE,BREAKDOWN:10.0V 5% 400 MW	28480	1902-0025
A10CR13	1902-0052	1	DIODE:BREAKDOWN 6.81V 2%	04713	SZ10939-134
A10CR14	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A10CR15	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A10CR16	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A10CR17	1902-3059		DIODE BREAKDOWN:SILICON 3.83V 5%	28480	1902-3059
A10Q1	1854-0215	7	TSTR:SI NPN	80131	2N3904
A10Q2	1854-0215		TSTR:SI NPN	80131	2N3904
A10Q3	1854-0072	1	TSTR:SI NPN	80131	2N3054
A10Q4	1854-0215		TSTR:SI NPN	80131	2N3904
A10Q5	1854-0215		TSTR:SI NPN	80131	2N3904
A10Q6	1854-0215		TSTR:SI NPN	80131	2N3904
A10Q7	1854-0215		TSTR:SI NPN	80131	2N3904
A10Q8	1854-0215		TSTR:SI NPN	80131	2N3904
A10R1	0683-2715	1	R:FXD COMP 270 OHM 5% 1/4W	01121	CB 2715
A10R2	0683-1025	3	R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A10R3	0683-1035	4	R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A10R4	0683-4725	7	R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A10R5	0698-3393	2	R:FXD MET FLM 28.7 OHM 1.0% 1/2W	28480	0698-3393
A10R6	0698-3393		R:FXD MET FLM 28.7 OHM 1.0% 1/2W	28480	0698-3393
A10R7	0683-3915	2	R:FXD COMP 390 OHM 5% 1/4W	01121	CB 3915
A10R8	0683-2235	1	R:FXD COMP 22K OHM 5% 1/4W	01121	CB 2235
A10R9	0683-3915		R:FXD COMP 390 OHM 5% 1/4W	01121	CB 3915
A10R10	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A10R11	0683-6845	2	R:FXD COMP 680K OHM 5% 1/4W	01121	CB 6845
A10R12	0683-2225	6	R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A10R13	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A10R14	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A10R15	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A10R16	0683-5645	1	R:FXD COMP 560K OHM 5% 1/4W	01121	CB 5645
A10R17	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A10R18	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A10R19	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A10R20	0757-0439	1	R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A10R21	0757-0279	1	R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A10R22	0757-0416	1	R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A10R23	0683-1045	2	R:FXD COMP 100K OHMS 5% 1/4W	01121	CB 1045
A10R24	0683-2225		R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A10R25	0683-2225		R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A10R26	0683-2225		R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A10R27	0683-1045		R:FXD COMP 100K OHMS 5% 1/4W	01121	CB 1045
A10R28	0683-2225		R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A10R29	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035

Table 5-13. Drive Control PC Assembly A10 (07901-60002) Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A10R30	0683-6845		R:FXD COMP 680K OHM 5% 1/4W	01121	CB 6845
A10R31	0683-2225		R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A10R32	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A10R34	0683-6825	1	R:FXD COMP 6800 OHM 5% 1/4W	01121	CB 6825
A10R35	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A10R36	0683-4715	1	R:FXD COMP 470 OHM 5% 1/4W	01121	CB 4715
A10R37	0686-1515	1	R:FXD COMP 150 OHM 5% 1/2W	01121	EB 1515
A10R38	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A10U11	1820-0477	2	IC:LINEAR OPERATIONAL AMPLIFIER	28480	1820-0477
A10U12	1820-0515	2	IC:TTL DUAL RE-TRIG/RE-SET MONO-MULTI	07263	U7B960259X
A10U13	1820-0054	2	IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A10U14	1820-0174	2	IC:TTL HEX INVERTER	01295	SN7404N
A10U15	1820-0077	2	IC:TTL DUAL D F/F	01295	SN7474N
A10U16	1820-0477		IC:LINEAR OPERATIONAL AMPLIFIER	28480	1820-0477
A10U17	1820-0537	2	IC:TTL DUAL 4-INPT NAND GATE	28480	1820-0537
A10U22	1820-0537		IC:TTL DUAL 4-INPT NAND GATE	28480	1820-0537
A10U23	1820-0068	2	IC:TTL TRIPLE 3-INPUT POS NAND GATE	12040	SN7410N
A10U24	1820-0535	2	IC:TTL DUAL PERI.2-INPT AND DRIVER	01295	SN75451P
A10U26	1820-0239	2	IC:TTL QUAD 2-INPT NOR GATE	28480	1820-0239
A10U27	1820-0515		IC:TTL DUAL RE-TRIG/RE-SET MONO-MULTI	07263	U7B960259X
A10U32	1820-0535		IC:TTL DUAL PERI.2-INPT AND DRIVER	01295	SN75451P
A10U33	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A10U34	1820-0174		IC:TTL HEX INVERTER	01295	SN7404N
A10U35	1820-0068		IC:TTL TRIPLE 3-INPUT POS NAND GATE	12040	SN7410N
A10U36	1820-0239		IC:TTL QUAD 2-INPT NOR GATE	28480	1820-0239
A10U37	1820-0077		IC:TTL DUAL D F/F	01295	SN7474N

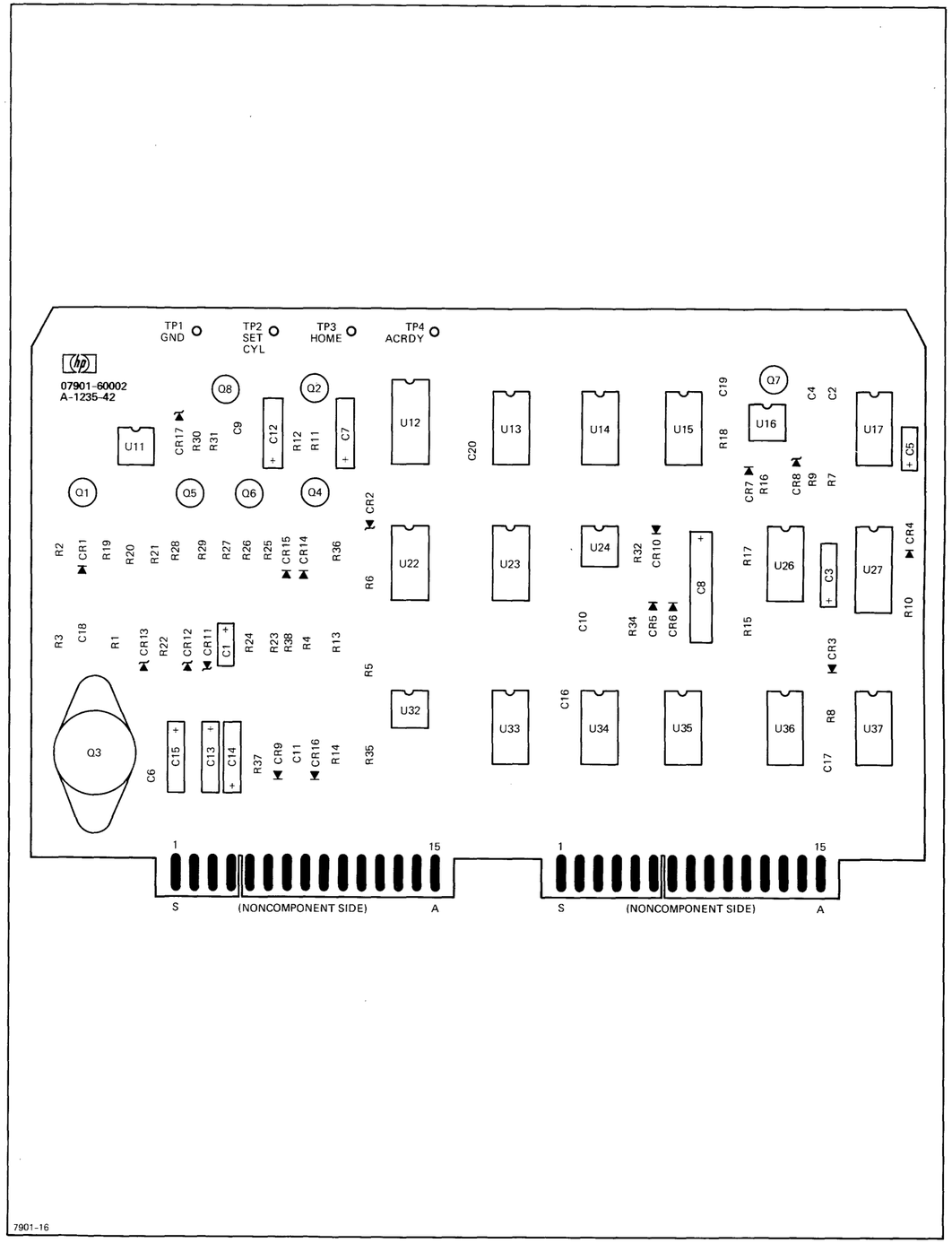
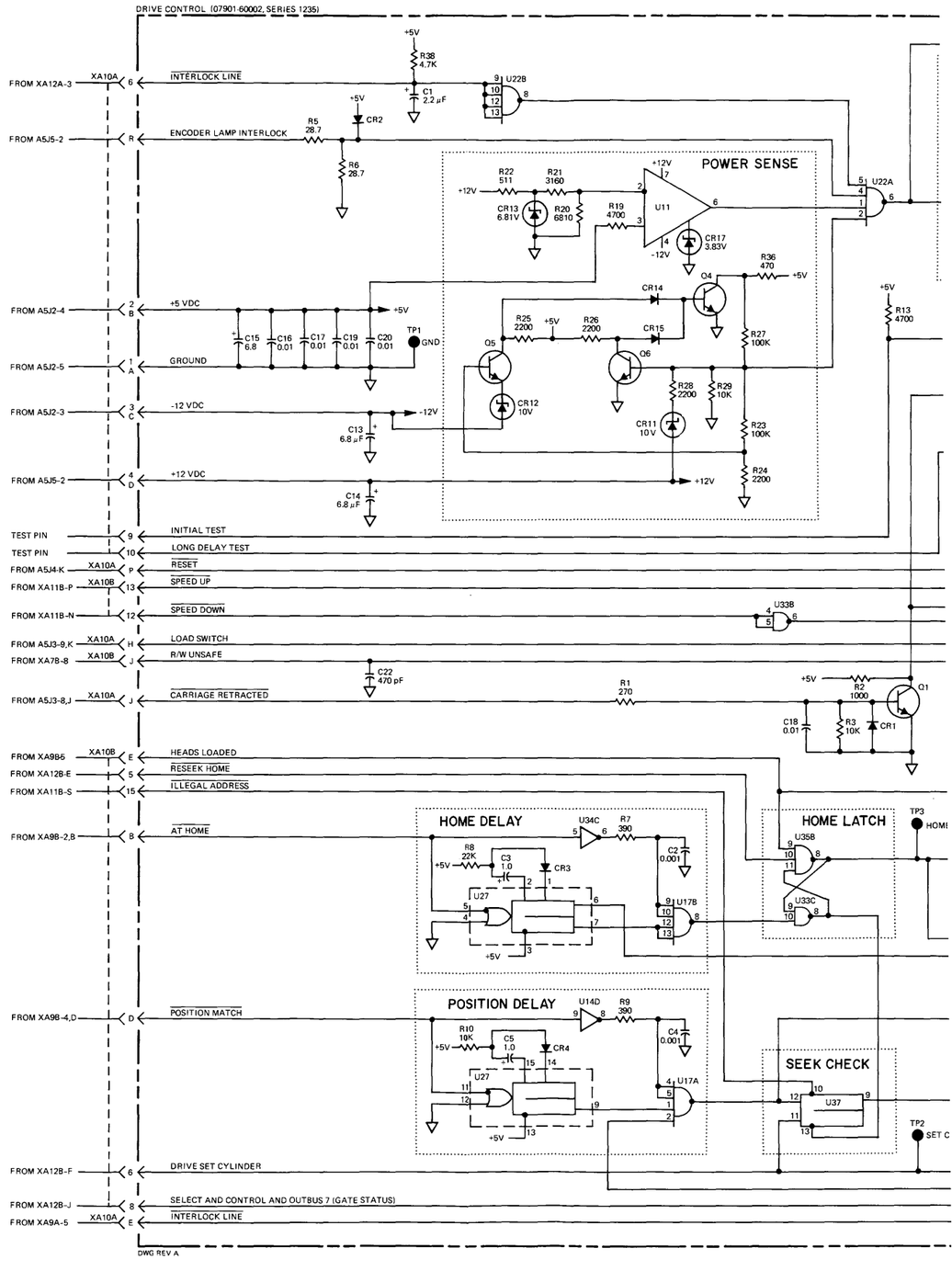


Figure 5-32. Drive Control PC Assembly A10, Parts Location Diagram



POWER SENSE
INITIAL DELAY
MOTOR LATCH
DRIVE READY DELAY
HOME DELAY
HOME LATCH
SEEK TIMER
POSITION DELAY
SEEK CHECK
FIRST STATUS
DRIVE FAULT
ATTENTION
SELECT ENABLE
INITIAL RESET
ENERGIZE MOTOR RELAY
RETRACT
ENERGIZE SERVO RELAY
DRIVE READY LAMP
DRIVE READY
LATCH DRIVE
FIRST STATUS
SERVO INHIBIT
R/W RESET
DRIVE FAULT
DRIVE FAULT LAMP
SEEK HOME
RESET COUNTERS
ATTENTION
ACCESS READY
SEEK CHECK
INTERLOCK LINE
LONG DELAY TEST
SPEED UP
DRIVE FAULT
LOAD SWITCH
HEADS LOADED
TIMEOUT
TO XA12A-D
TO XA11B-15
TO A5J3-7,H
TO XA9B-1,A
TO A5J3-6,F
TO A5J3-4,D
TO XA12B-C
TO A5J3-10,L
TO XA12B-K
TO XA9B-3,C
TO XA7B-9
TO XA12B-D
TO A5J3-5,E
TO XA9B-6
TO XA11B-R
TO XA12B-M
TO XA12B-L, XA7B-10
TO XA12B-H
TO XA11A-E
S 7 (GATE STATUS)

Figure 5-33. Drive Control PC Assembly A10, Schematic Diagram

Table 5-14. Sector Cylinder PC Assembly A11 (07901-60005) Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A11	07901-60005	1	SECTOR/CYL ASSY:PC	28480	07901-60005
A11C1	0160-0159	1	C:FXD MY 0.0068 UF 10% 200VDCW	56289	192P68282-PTS
A11C2	0160-0153	1	C:FXD MY 0.001 UF 10% 200VDCW	56289	192P10292-PTS
A11C4	0160-0161	1	C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A11C5	0160-0158	1	C:FXD MY 0.0056 UF 10% 200VDCW	56289	192P56292-PTS
A11C6	0180-0218	1	C:FXD ELECT 0.15 UF 10% 35VDCW	28480	0180-0218
A11C7	0180-0376	1	C:FXD ELECT 0.47 UF 10% 35VDCW	56289	150D474X9035A2-DYS
A11C8	0160-0167	1	C:FXD MY .082 UF 10% 200VDCW	56289	192P82392-PTS
A11C9	0180-0100	1	C:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A11C10	0180-0116	3	C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A11C11	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A11C12	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A11C13	0160-2055	8	C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A11C14	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A11C15	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A11C16	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A11C17	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A11C18	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A11C19	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A11C20	0160-3455	1	C:FXD CER 470 PF 10% 1000VDCW	56289	C067F102F471KS22
A11C21	0160-0154	1	C:FXD MICA MY 0.0022 UF 10% 200VDCW	56289	192P22292-PTS
A11C22	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A11CR1	1901-0040	15	DIODE:SILICON 30MA 30WV	07263	FDG1088
A11CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A11CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A11CR4	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A11CR5	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A11CR6	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A11CR7	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A11CR8	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A11CR9	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A11CR10	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A11CR11	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A11CR12	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A11CR13	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A11CR14	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A11CR15	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A11Q1	1853-0010	2	TSTR:SI PNP(SELECTED FROM 2N3251)	28480	1853-0010
A11Q2	1853-0010		TSTR:SI PNP(SELECTED FROM 2N3251)	28480	1853-0010
A11Q3	1854-0215	1	TSTR:SI NPN	80131	2N3904
A11R2	0698-3457	1	R:FXD MET FLM 316K OHM 1% 1/8W	28480	0698-3457
A11R3	0698-5092	1	R:FXD FLM 160K OHM 1% 1/8W	28480	0698-5092
A11R4	0757-0462	1	R:FXD MET FLM 75.0K OHM 1% 1/8W	28480	0757-0462
A11R5	0698-3161	2	R:FXD MET FLM 38.3K OHM 1% 1/8W	28480	0698-3161
A11R6	0698-3136	2	R:FXD MET FLM 17.8K OHM 1% 1/8W	28480	0698-3136
A11R7	0757-0288	1	R:FXD MET FLM 9.09K OHM 1% 1/8W	28480	0757-0288
A11R8	0698-3154	1	R:FXD MET FLM 4.22K OHM 1% 1/8W	28480	0698-3154
A11R9	1810-0020	2	RESISTOR NETWORK:MET FLM (7 RES)	28480	1810-0020
A11R10	1810-0020		RESISTOR NETWORK:MET FLM (7 RES)	28480	1810-0020
A11R11	0757-0280	1	R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A11R12	0683-2225	2	R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A11R13	0683-1055	1	R:FXD COMP 1 MEGOHM 5% 1/4W	01121	CB 1055
A11R14	0757-0401	1	R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A11R15	0757-0403	1	R:FXD MET FLM 121 OHM 1% 1/8W	28480	0757-0403
A11R16	0698-3439	1	R:FXD MET FLM 178 OHM 1% 1/8W	28480	0698-3439
A11R17	0698-3440	1	R:FXD MET FLM 196 OHM 1% 1/8W	28480	0698-3440
A11R18	0698-3437	1	R:FXD MET FLM 133 OHM 1% 1/8W	28480	0698-3437
A11R19	0698-3441	1	R:FXD MET FLM 215 OHM 1% 1/8W	28480	0698-3441
A11R20	2100-2489	1	R:VAR FLM 5K OHM 10% LIN 1/2W	28480	2100-2489
A11R21	0683-1015	1	R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A11R22	0757-0458	4	R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A11R23	0698-3156	1	R:FXD MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156
A11R24	0698-3136		R:FXD MET FLM 17.8K OHM 1% 1/8W	28480	0698-3136
A11R25	0698-3161		R:FXD MET FLM 38.3K OHM 1% 1/8W	28480	0698-3161
A11R26	0757-0458		R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A11R27	0757-0458		R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A11R28	0757-0458		R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A11R29	0683-1515	1	R:FXD COMP 150 OHM 5% 1/4W	01121	CB 1515
A11R30	0683-1025	1	R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A11R31	0683-4725	4	R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A11R32	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A11R33	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A11R34	0757-0455	2	R:FXD FLM 36.5K OHM 1% 1/8W	28480	0757-0455
A11R36	2100-2514	1	R:VAR CERMET 20K OHM 10% LIN 1/2W	28480	2100-2514
A11R37	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725

Table 5-14. Sector Cylinder PC Assembly A11 (07901-60005) Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A11R39	0757-0455		R:FXD FLM 36.5K OHM 1% 1/8W	28480	0757-0455
A11R40	0698-4007	1	R:FXD FLM 27.8K OHM 1% 1/8W	28480	0698-4007
A11R41	0698-3160	1	R:FXD MET FLM 31.6K OHM 1% 1/8W	28480	0698-3160
A11R42	0683-6845	1	R:FXD COMP 680K OHM 5% 1/4W	01121	CB 6845
A11R43	0683-2225		R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A11S1	3101-1213	1	SWITCH:TOGGLE DPST-DB SUB-MINIATURE	81640	T8001
A11U11	1820-0282	2	IC:TTL QUAD 2-INPT EXCL. OR GATE	01295	SN7486N
A11U12	1820-0239	2	IC:TTL QUAD 2-INPT NOR GATE	28480	1820-0239
A11U13	1820-0282		IC:TTL QUAD 2-INPT EXCL. OR GATE	01295	SN7486N
A11U14	1820-0537	1	IC:TTL DUAL 4-INPT NAND GATE	28480	1820-0537
A11U16	1820-0174	2	IC:TTL HEX INVERTER	01295	SN7404N
A11U17	1820-0515	3	IC:TTL DUAL RE-TRIG/RE-SET MONO-MULTI	07263	U7B960259X
A11U18	1820-0515		IC:TTL DUAL RE-TRIG/RE-SET MONO-MULTI	07263	U7B960259X
A11U19	1820-0515		IC:TTL DUAL RE-TRIG/RE-SET MONO-MULTI	07263	U7B960259X
A11U21	1820-0305	2	INTEGRATED CIRCUIT:BINARY FULL ADDER	01295	SN7483N
A11U22	1820-0233	2	IC:TTL SYNUP-ON 4-BIT BINARY COUNTER	01295	SN74193N
A11U23	1820-0305		INTEGRATED CIRCUIT:BINARY FULL ADDER	01295	SN7483N
A11U24	1820-0233		IC:TTL SYNUP-ON 4-BIT BINARY COUNTER	01295	SN74193N
A11U25	1820-0174		IC:TTL HEX INVERTER	01295	SN7404N
A11U26	1820-0077	3	IC:TTL DUAL D F/F	01295	SN7474N
A11U27	1820-0054	3	IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A11U28	1820-0077		IC:TTL DUAL D F/F	01295	SN7474N
A11U29	1820-0077		IC:TTL DUAL D F/F	01295	SN7474N
A11U31	1820-0493	1	IC:OP. AMP. INTERNAL COMP.,8-PIN DIP	12040	LM307N
A11U32	1820-0437	3	IC:TTL QUAD D F/F	04713	MC4015P
A11U33	1820-0437		IC:TTL QUAD D F/F	04713	MC4015P
A11U34	1820-0437		IC:TTL QUAD D F/F	04713	MC4015P
A11U35	1820-0706	1	IC:DIGITAL TTL 5-BIT COMPARATOR	04713	U7B932459X
A11U36	1820-0099	1	IC:TTL 4-BIT BINARY COUNTER	01295	SN7493N
A11U37	1820-0068	1	IC:TTL TRIPLE 3-INPUT POS NAND GATE	12040	SN7410N
A11U38	1820-0511	1	IC:TTL QUAD 2-INPT AND GATE	01295	SN7408N
A11U39	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A11U210	1820-0239		IC:TTL QUAD 2-INPT NOR GATE	28480	1820-0239
A11U310	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N

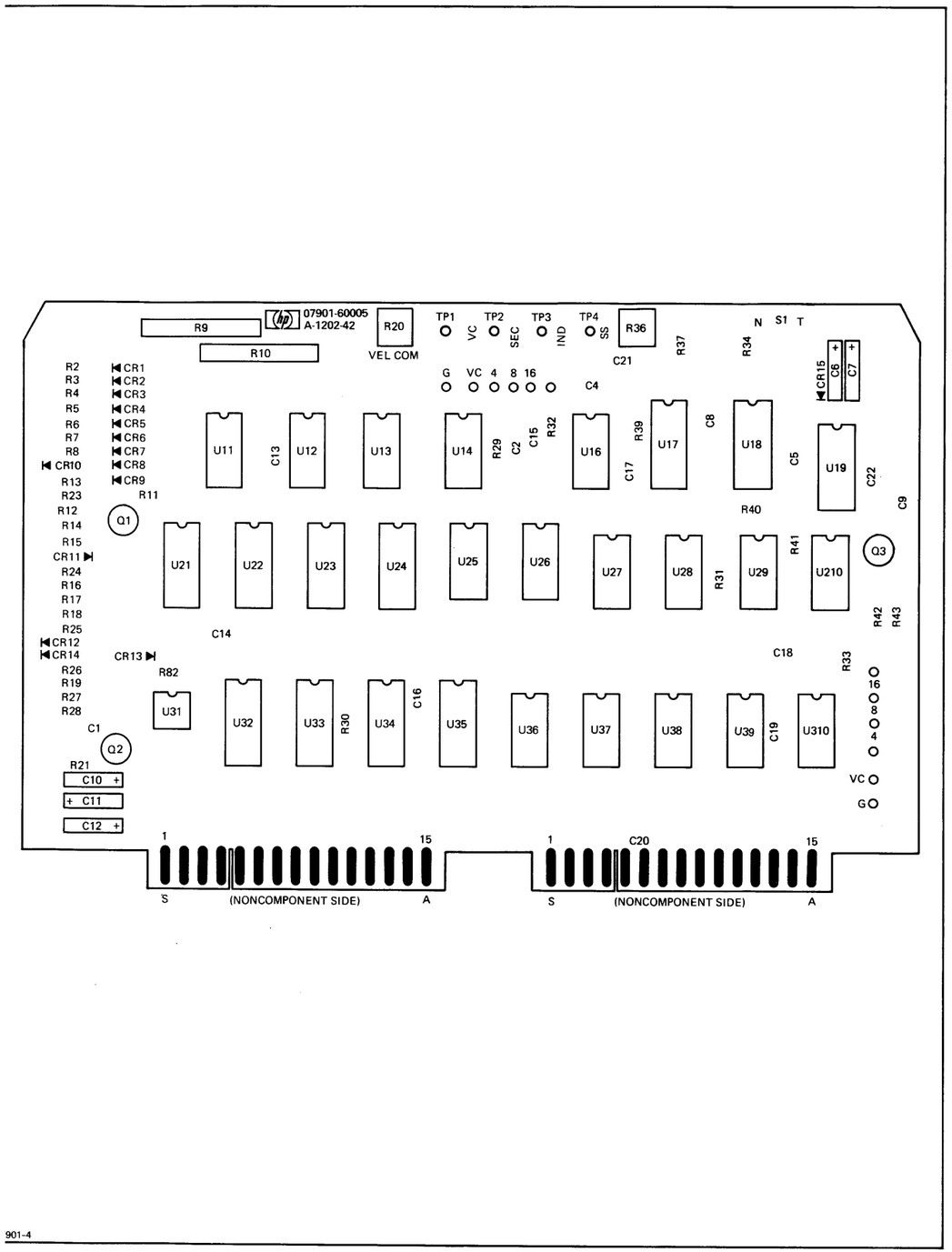


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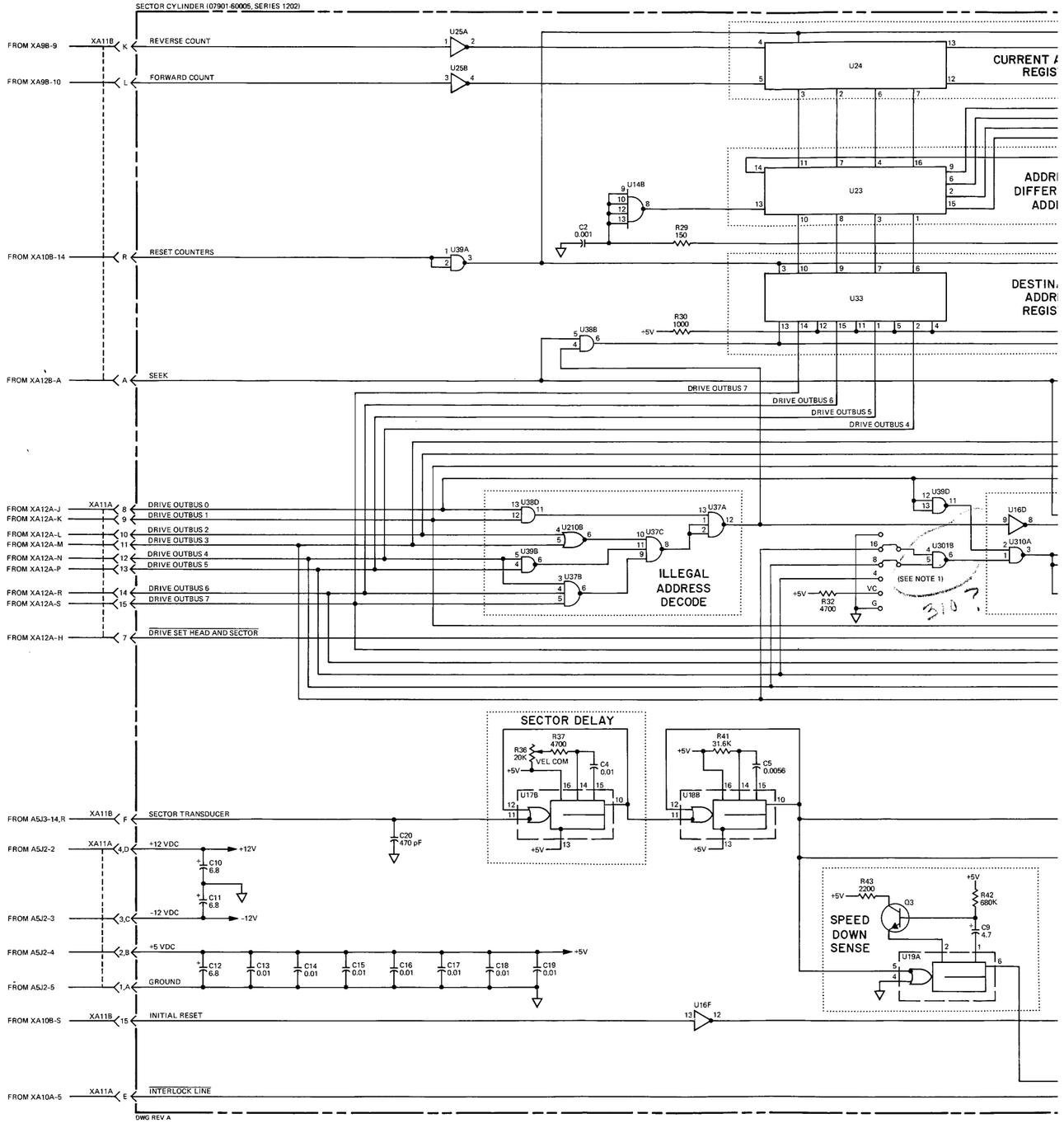
Figure 5-34. Sector Cylinder PC Assembly A11, Parts Location Diagram



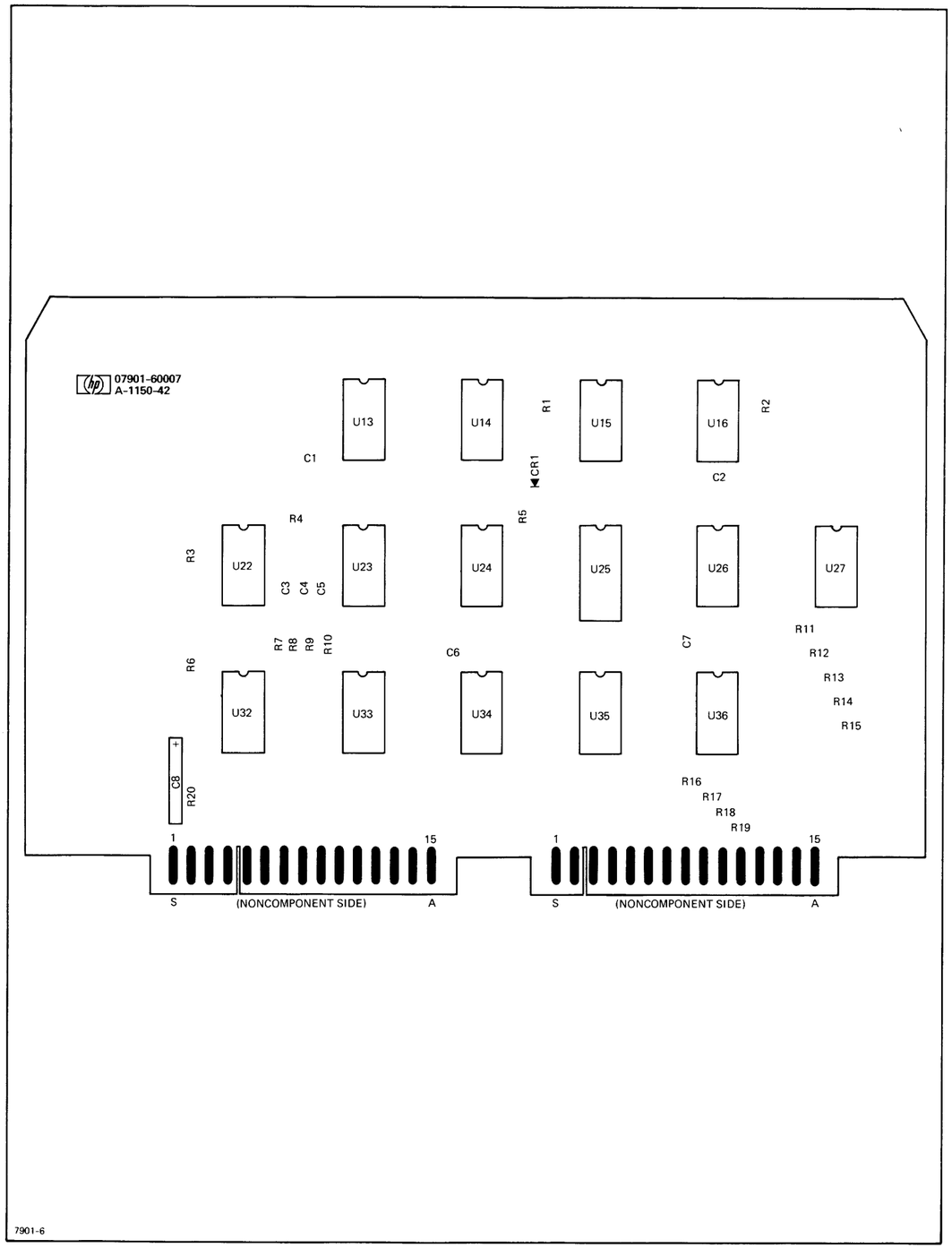
NOTES.
1. GATES U310B AND U310D CAN BE STRAPPED FOR 8, 12, 16, 24 OR 32 SECTOR OPERATION. GATES ARE ILLUSTRATED STRAPPED FOR 24 SECTOR PULSE OPERATION.

SECTOR SELECT OPTIONS		
SECTOR	JUMPER CONNECTIONS TO:	
	U310B	U310D
4	4 TO 4 VC TO 5	4 TO 13 VC TO 12
8	8 TO 5 VC TO 4	8 TO 13 VC TO 12
12	8 TO 5 4 TO 4	8 TO 12 4 TO 13
16	16 TO 4 VC TO 5	16 TO 13 VC TO 12
20	16 TO 4 4 TO 5	16 TO 13 4 TO 12
24	AS SHOWN	
32	BLANK PIN TO 4 G TO 5	BLANK PIN TO 13 G TO 12

Figure 5-35. Sector Cylinder PC Assembly A11, Schematic Diagram

Table 5-15. I/O Multiplex PC Assembly A12 (07901-60007) Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A12	07901-60007	1	I/O MULTIPLEXER ASSY:PC	28480	07901-60007
A12C1	0160-2055	4	C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A12C2	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A12C3	0160-3455	3	C:FXD CER 470 PF 10% 1000VDCW	56289	C067F102F471KS22
A12C4	0160-3455		C:FXD CER 470 PF 10% 1000VDCW	56289	C067F102F471KS22
A12C5	0160-3455		C:FXD CER 470 PF 10% 1000VDCW	56289	C067F102F471KS22
A12C6	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A12C7	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A12C8	0180-1701	1	C:FXD ELECT 6.8 UF 20% 6VDCW	28480	0180-1701
A12CR1	1901-0040	1	DIODE:SILICON 30MA 30WV	07263	FDG1088
A12R1	0683-1025	10	R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A12R2	0683-4725	7	R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A12R3	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A12R4	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A12R5	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A12R6	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A12R7	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A12R8	0683-1015	3	R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A12R9	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A12R10	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A12R11	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A12R12	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A12R13	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A12R14	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A12R15	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A12R16	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A12R17	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A12R18	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A12R19	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A12R20	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A12U13	1820-0239	1	IC:TTL QUAD 2-INPT NOR GATE	28480	1820-0239
A12U14	1820-0174	3	IC:TTL HEX INVERTER	01295	SN7404N
A12U15	1820-0054	4	IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A12U16	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A12U22	1820-0537	2	IC:TTL DUAL 4-INPT NAND GATE	28480	1820-0537
A12U23	1820-0537		IC:TTL DUAL 4-INPT NAND GATE	28480	1820-0537
A12U24	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A12U25	1820-0111	1	IC:TTL 1 CUT OF 10 DECODER	07263	U6B930159X
A12U26	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A12U27	1820-0577	2	IC:TTL HEX INVERTER/DRIVER W/OPEN COLL.	01295	SN7416N
A12U32	1820-0282	1	IC:TTL QUAD 2-INPT EXCL. OR GATE	01295	SN7486N
A12U33	1820-0174		IC:TTL HEX INVERTER	01295	SN7404N
A12U34	1820-0174		IC:TTL HEX INVERTER	01295	SN7404N
A12U35	1820-0511	1	IC:TTL QUAD 2-INPT AND GATE	01295	SN7408N
A12U36	1820-0577		IC:TTL HEX INVERTER/DRIVER W/OPEN COLL.	01295	SN7416N



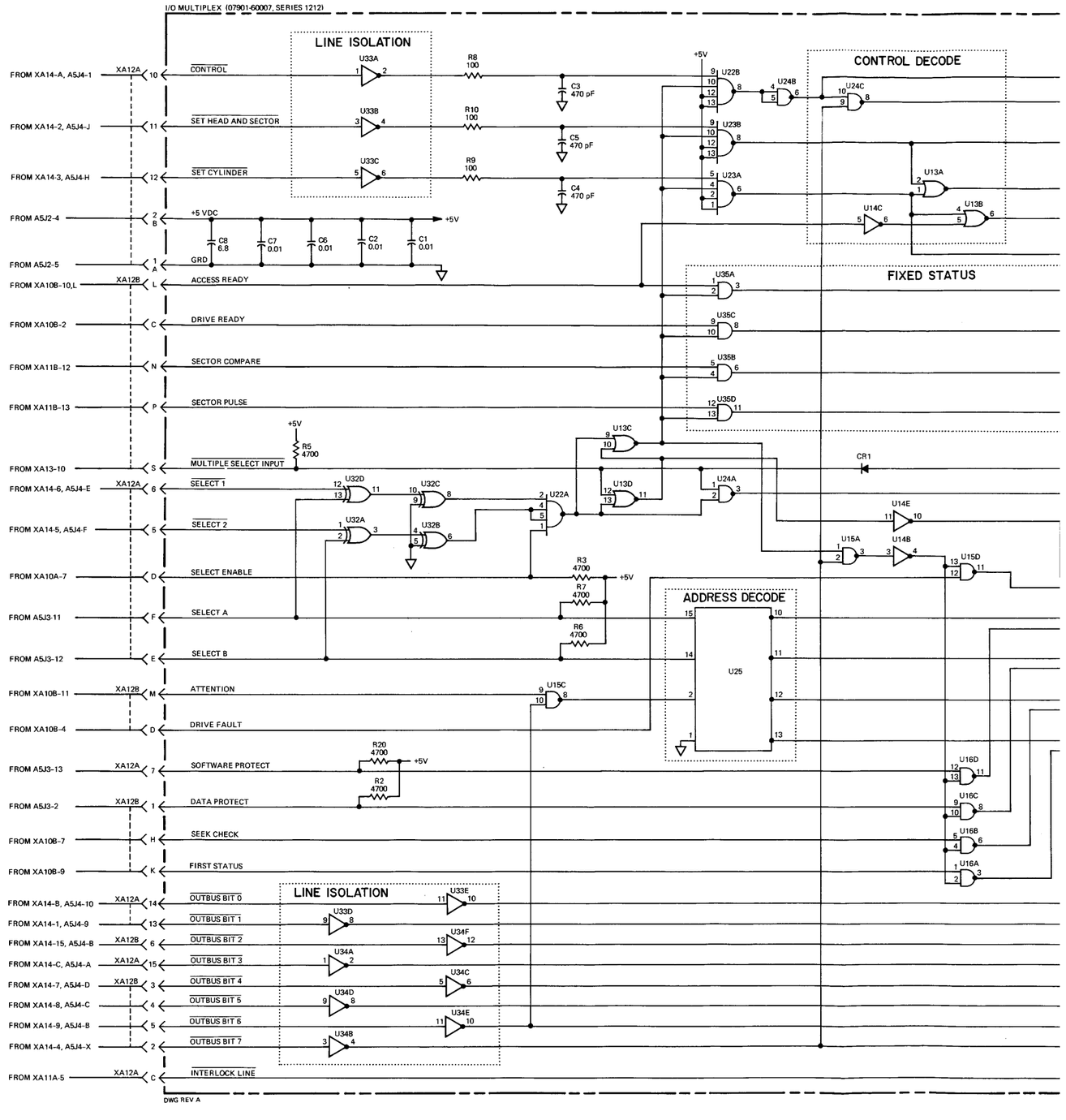
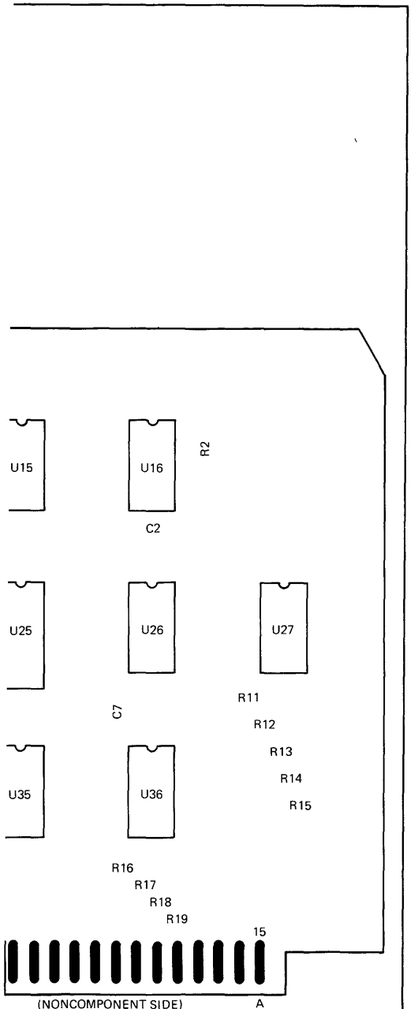


Figure 5-36. I/O Multiplex PC Assembly A12, Parts Location Diagram



rts Location Diagram

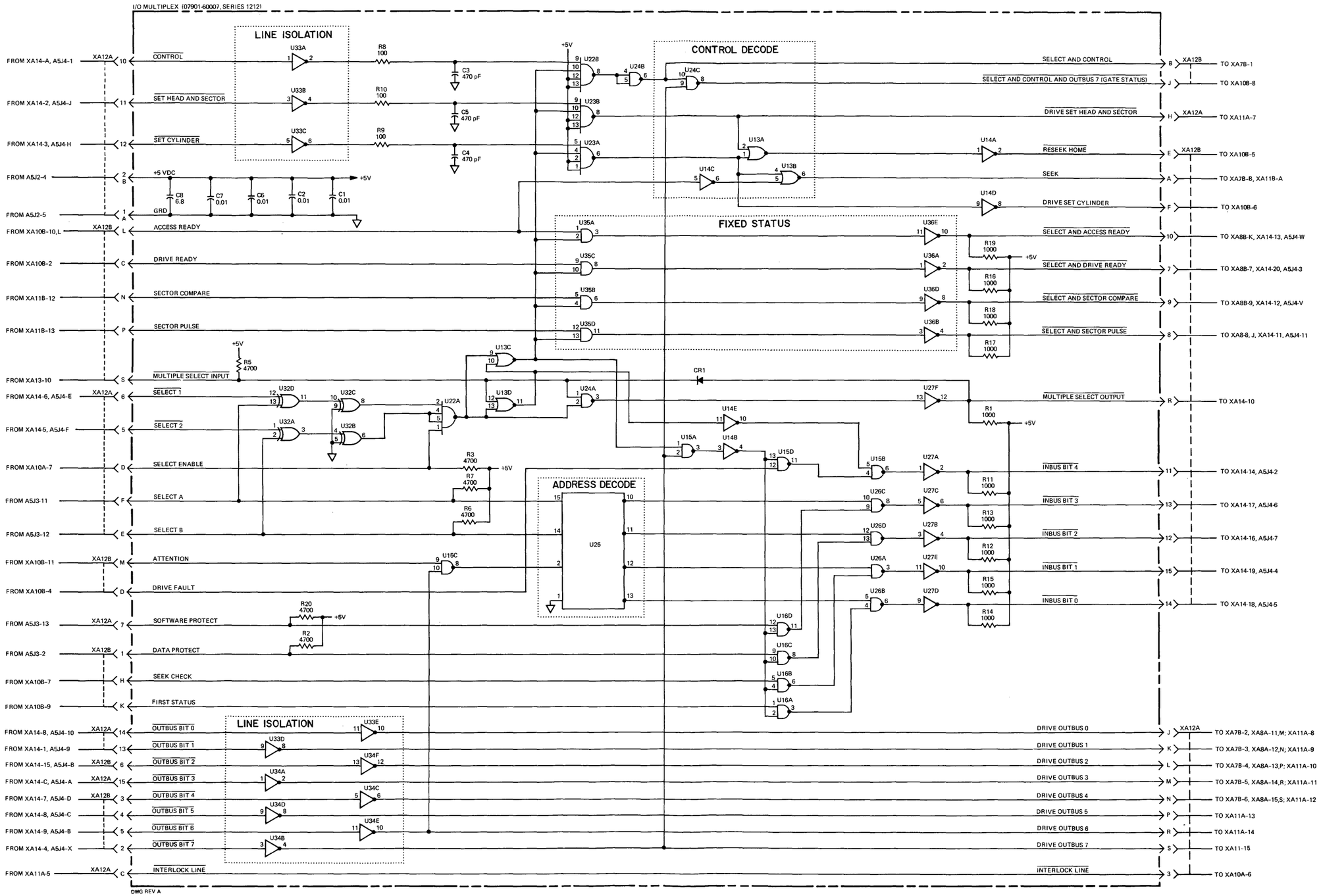
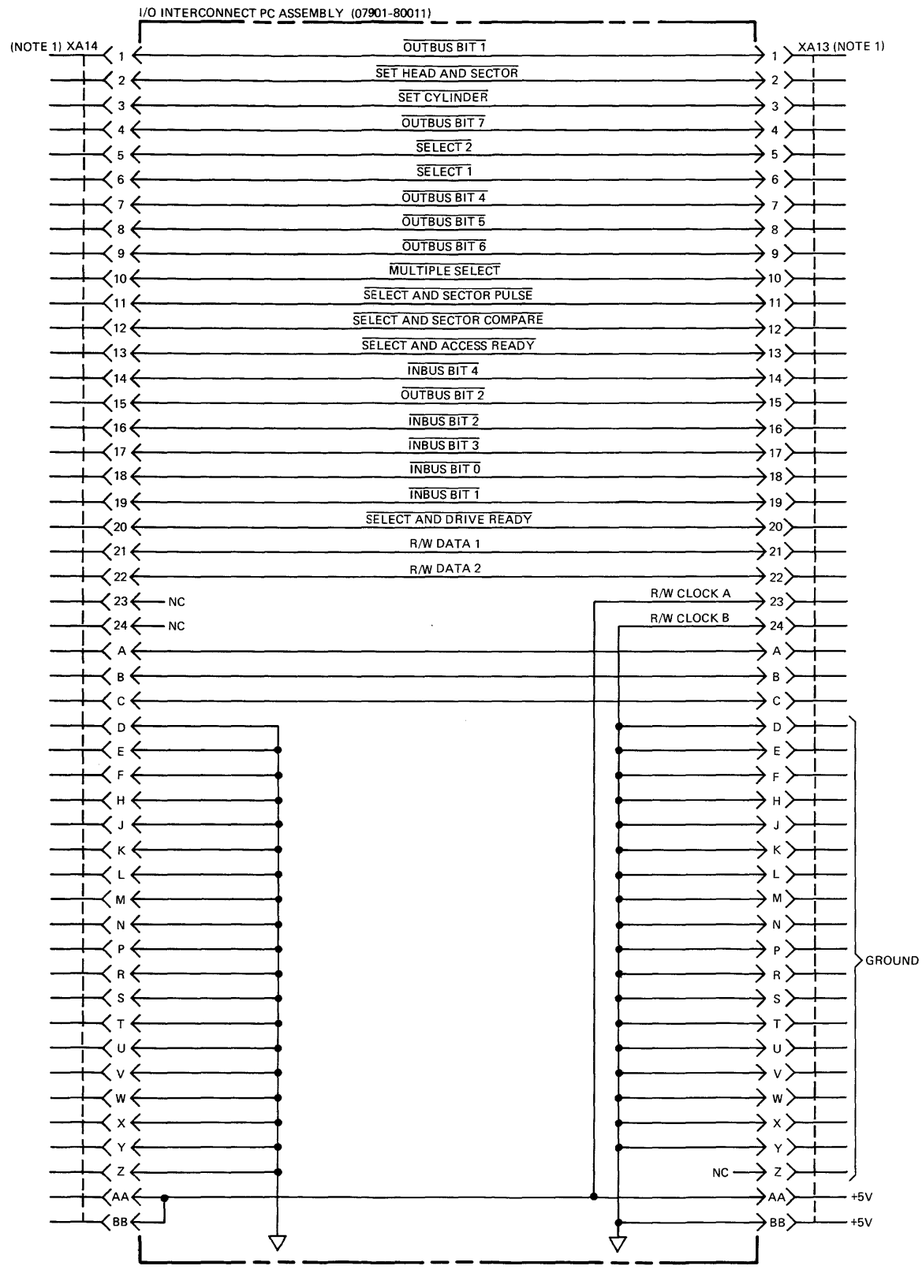


Figure 5-37. I/O Multiplex PC Assembly A12, Schematic Diagram



NOTE:

1. IN A SINGLE DISC DRIVE XA14 CONNECTS WITH THE CONTROLLER INTERFACE AND XA13 IS TERMINATED WITH A16. IN A MULTIPLE DRIVE GROUP XA14 CONNECTS WITH THE CONTROLLER INTERFACE (IF UNIT 0) OR WITH THE PRECEDING DISC DRIVE AND XA13 CONNECTS TO THE FOLLOWING DISC DRIVE OR IS TERMINATED WITH A16 (IF UNIT 3).

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Figure 5-38. I/O Interconnect PC Assembly A13/A14, Schematic Diagram

Table 5-16. Termination PC Assembly A16 (07901-60013) Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A16R1	0683-3315	13	R:FXD COMP 330 OHM 5% 1/4W	01121	CB 3315
A16R2	0683-3315		R:FXD COMP 330 OHM 5% 1/4W	01121	CB 3315
A16R3	0683-3315		R:FXD COMP 330 OHM 5% 1/4W	01121	CB 3315
A16R4	0683-3315		R:FXD COMP 330 OHM 5% 1/4W	01121	CB 3315
A16R5	0683-3315		R:FXD COMP 330 OHM 5% 1/4W	01121	CB 3315
A16R6	0683-3315		R:FXD COMP 330 OHM 5% 1/4W	01121	CB 3315
A16R7	0683-3315		R:FXD COMP 330 OHM 5% 1/4W	01121	CB 3315
A16R8	0683-3315		R:FXD COMP 330 OHM 5% 1/4W	01121	CB 3315
A16R9	0683-3315		R:FXD COMP 330 OHM 5% 1/4W	01121	CB 3315
A16R10	0683-3315		R:FXD COMP 330 OHM 5% 1/4W	01121	CB 3315
A16R11	0683-3315		R:FXD COMP 330 OHM 5% 1/4W	01121	CB 3315
A16R12	0683-3315		R:FXD COMP 330 OHM 5% 1/4W	01121	CB 3315
A16R13	0683-3315		R:FXD COMP 330 OHM 5% 1/4W	01121	CB 3315
A16R14	0683-7515	13	R:FXD COMP 750 OHM 5% 1/4W	01121	CB 7515
A16R15	0683-7515		R:FXD COMP 750 OHM 5% 1/4W	01121	CB 7515
A16R16	0683-7515		R:FXD COMP 750 OHM 5% 1/4W	01121	CB 7515
A16R17	0683-7515		R:FXD COMP 750 OHM 5% 1/4W	01121	CB 7515
A16R18	0683-7515		R:FXD COMP 750 OHM 5% 1/4W	01121	CB 7515
A16R19	0683-7515		R:FXD COMP 750 OHM 5% 1/4W	01121	CB 7515
A16R20	0683-7515		R:FXD COMP 750 OHM 5% 1/4W	01121	CB 7515
A16R21	0683-7515		R:FXD COMP 750 OHM 5% 1/4W	01121	CB 7515
A16R22	0683-7515		R:FXD COMP 750 OHM 5% 1/4W	01121	CB 7515
A16R23	0683-7515		R:FXD COMP 750 OHM 5% 1/4W	01121	CB 7515
A16R24	0683-7515		R:FXD COMP 750 OHM 5% 1/4W	01121	CB 7515
A16R25	0683-7515		R:FXD COMP 750 OHM 5% 1/4W	01121	CB 7515
A16R26	0683-7515		R:FXD COMP 750 OHM 5% 1/4W	01121	CB 7515
A16R27	0757-0417	4	R:FXD MET FLM 562 OHM 1% 1/8W	28480	0757-0417
A16R28	0757-0417		R:FXD MET FLM 562 OHM 1% 1/8W	28480	0757-0417
A16R29	0757-0417		R:FXD MET FLM 562 OHM 1% 1/8W	28480	0757-0417
A16R30	0757-0417		R:FXD MET FLM 562 OHM 1% 1/8W	28480	0757-0417
A16R31	0757-0398	4	R:FXD MET FLM 75 OHM 1% 1/8W	28480	0757-0398
A16R32	0757-0398		R:FXD MET FLM 75 OHM 1% 1/8W	28480	0757-0398
A16R33	0757-0398		R:FXD MET FLM 75 OHM 1% 1/8W	28480	0757-0398
A16R34	0757-0398		R:FXD MET FLM 75 OHM 1% 1/8W	28480	0757-0398

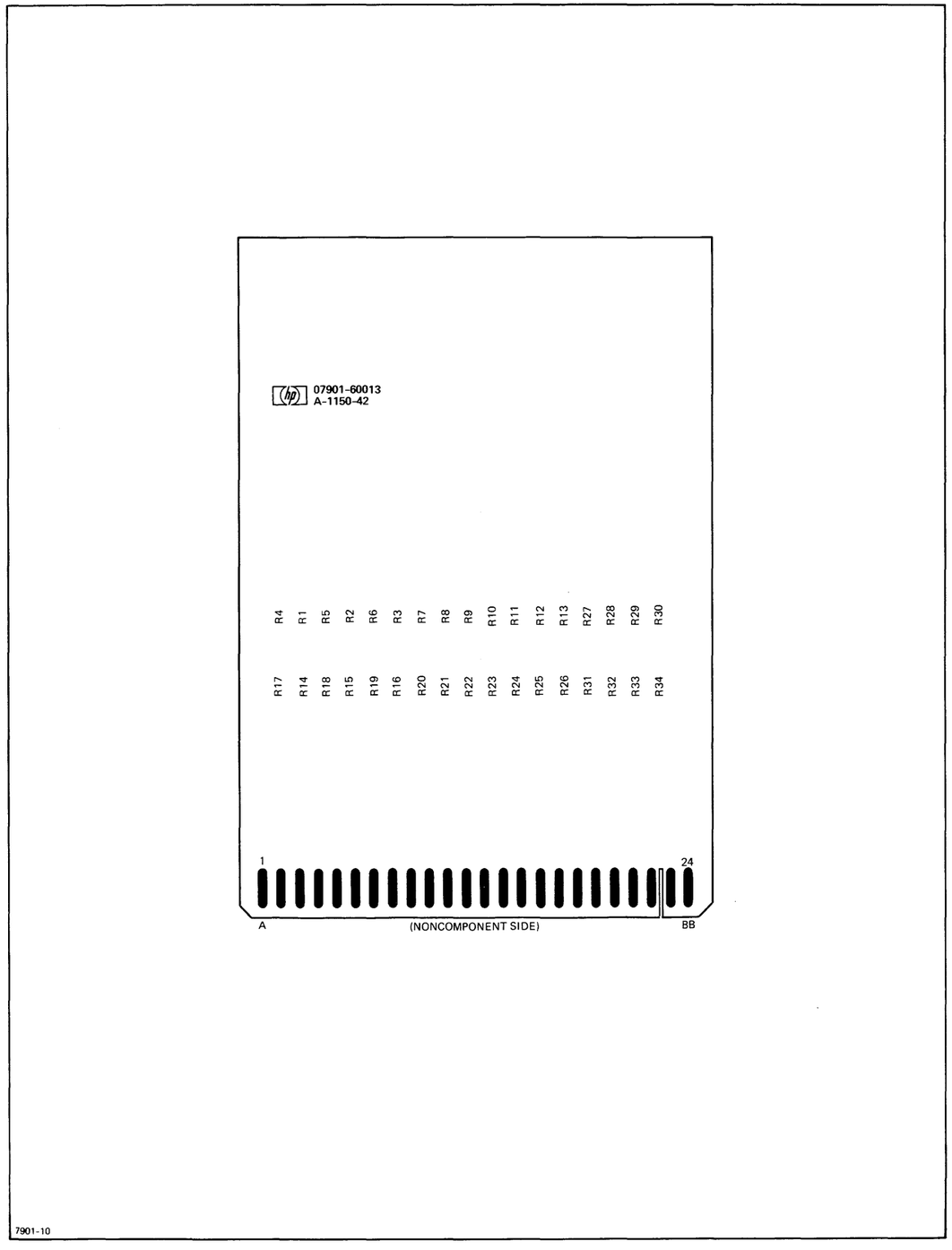


Figure 5-39. Termination PC Assembly A16, Parts Location Diagram

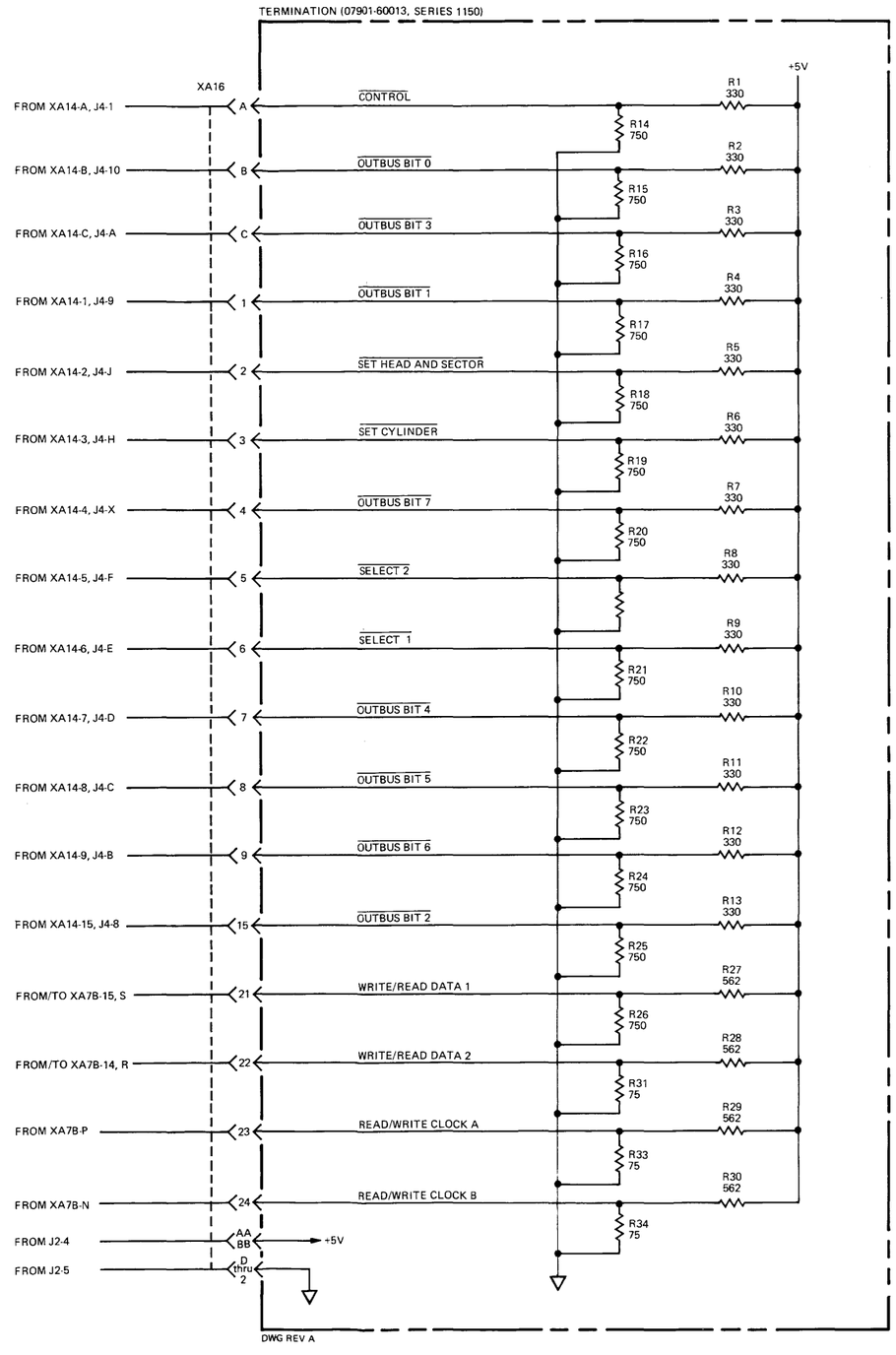


Figure 5-40. Termination PC Assembly A16, Schematic Diagram

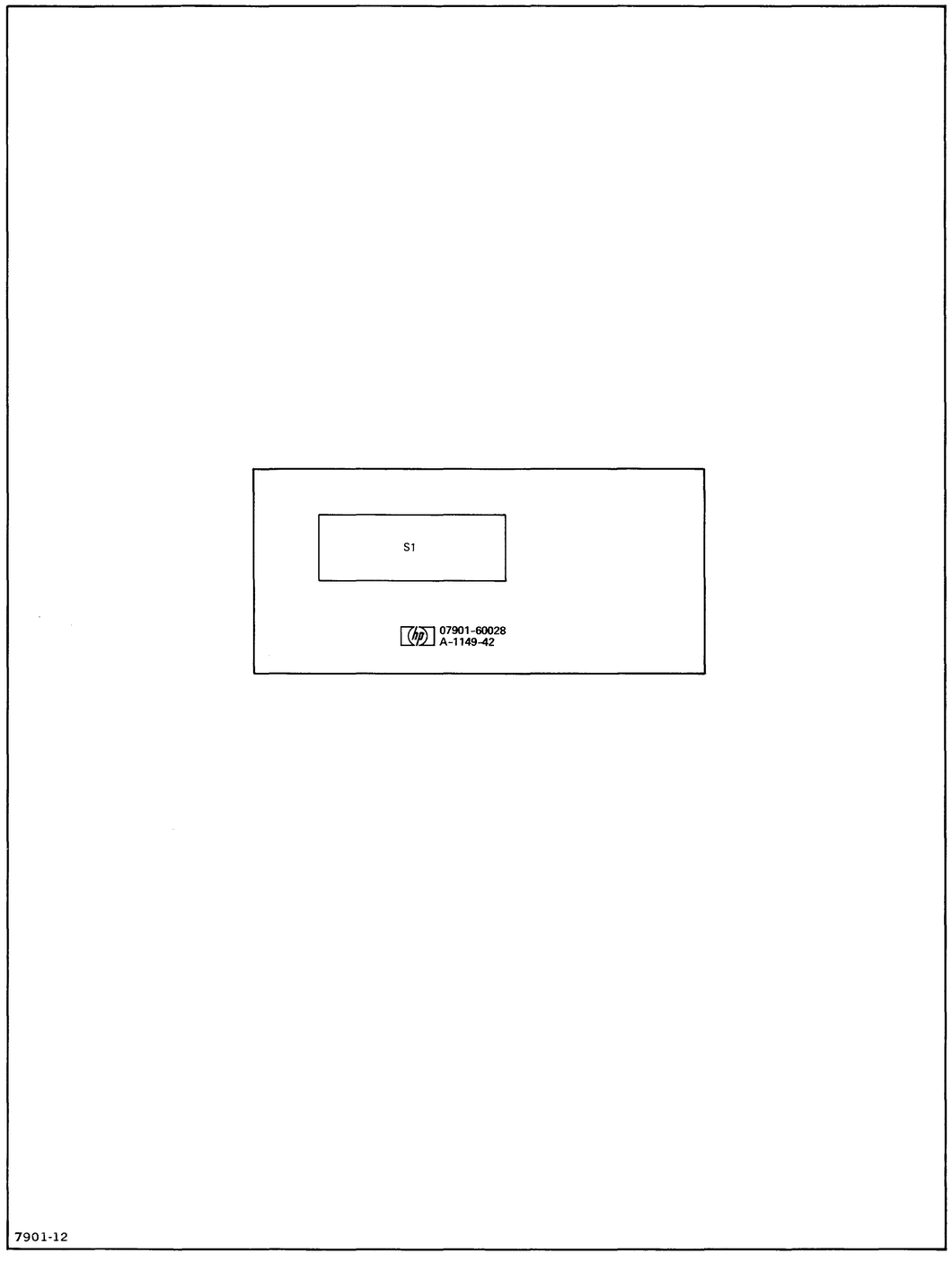


Figure 5-41. Unit Select Switching Assembly A17, Parts Location Diagram

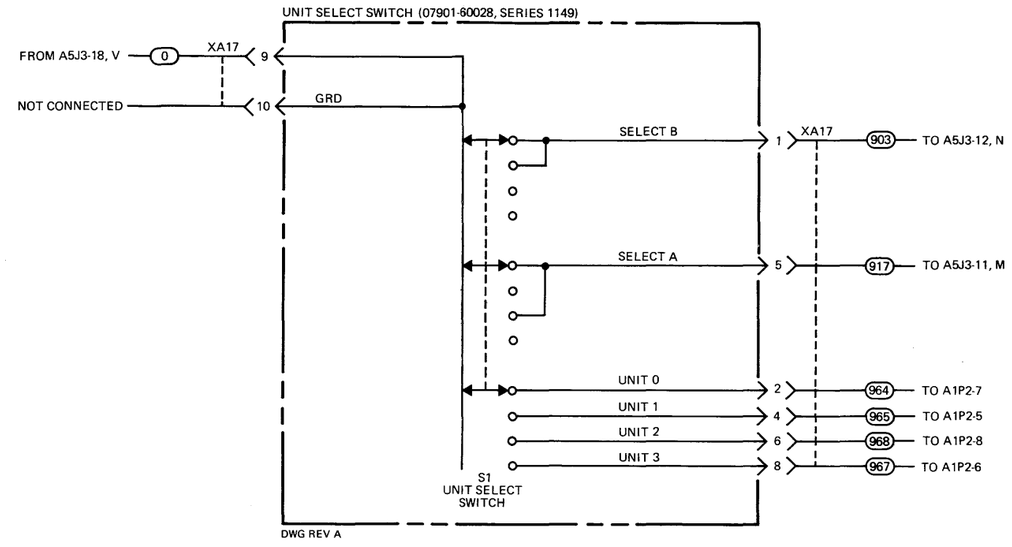


Figure 5-42. Unit Select Switching Assembly A17, Schematic Diagram

Table 5-17. Integrated Circuit Characteristics

CHARACTERISTIC NUMBER	INPUT LEVEL		OUTPUT LEVEL		OPEN INPUT ACTS AS	PROPOGATION DELAY	
	LOGIC 1 (VOLTS MIN)	LOGIC 0 (VOLTS MAX)	LOGIC 1 (VOLTS MIN)	LOGIC 0 (VOLTS MAX)		TO LOGIC 1 (NS)	TO LOGIC 0 (NS)
2	2.0	0.8	2.4	0.4	1	29	15
8	2.0(1)	0.8	2.4	0.4	1	35	50
12	2.0	0.8	2.4(2)	0.4	1	35	30
13	2.0(3)	0.8	2.4	0.4	1	55	60
29	2.0(4)	0.8(5)	2.4	0.4	1	135	135
35	2.0	0.8	2.4	0.4	1	(6)	(7)
44	1.8	1.1	2.5	0.4	1	15	15
47	3.0	-3.0	2.6	0.45	---	90	80
48	1.9	0.85	2.4	0.45	1	40	------
49	1.8	1.1	2.5	0.4	1	10	10
61	2.0	0.8	2.4	0.4	1	22	15
62	2.0	0.9	2.5	0.4	---	12	15
63	2.0	0.8	2.4	0.4	1	23 and 30	17 and 22
64	-----	6.5	2.5	4.0	---	------	------
66	1.5	1.1	2.4	0.4	1	27	22
67	2.0	0.8	-----	0.4	1	15	23
68	2.0	0.8	-----	------	---	15 and 25	15 and 25
69	2.0	0.8	2.4	0.4	---	25 and 15	25 and 15
72	1.9	1.1	2.6	0.45	1	60	35
73	1.9	0.85	2.4	0.45	1	27	27
74	2.0	0.8	2.4	0.4	1	42	45
75	Input voltage	± 15 min.	Output voltage	± 12 min.	—	—	—

NOTES:

(1) Required pulse widths 30 ns minimum.

(2) BSC0–BSC9 only one output = 0. BCD9 all outputs = 1.

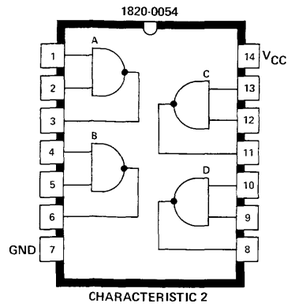
(3) Required pulse widths 16 ns minimum.

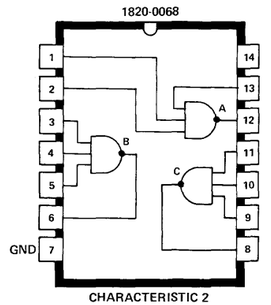
(4) +2.2V for pin 1.

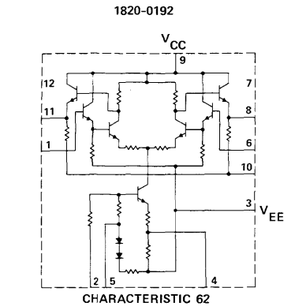
(5) +0.6V for pin 1.

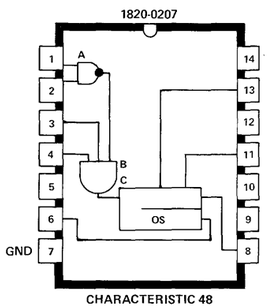
(6) Delay is 27 ns at output and 22 ns at carry/borrow.

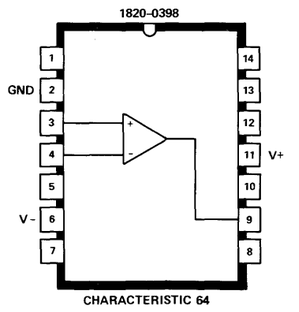
(7) Delay is 37 ns at output and 18 ns at carry/borrow.

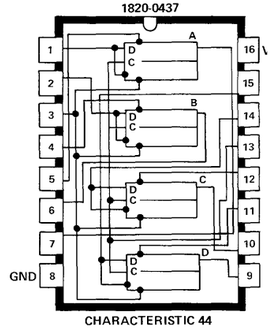


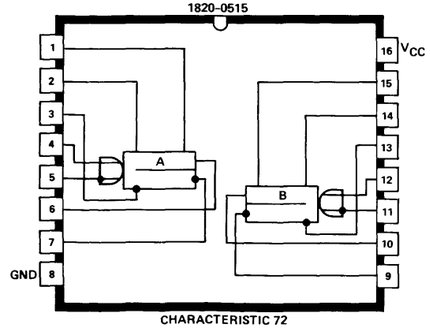


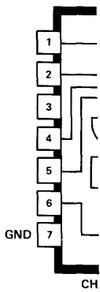






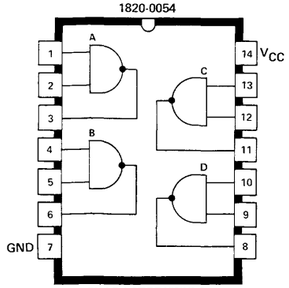






7901-71

1820-0054



CHARACTERISTIC 2

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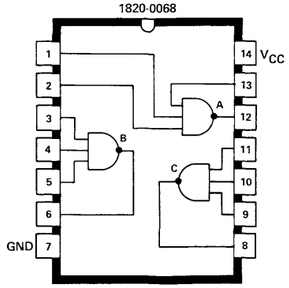

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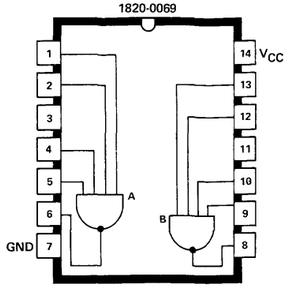

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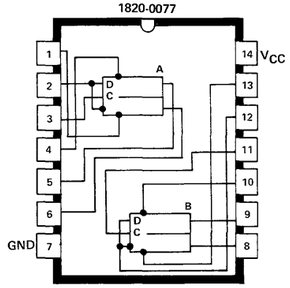

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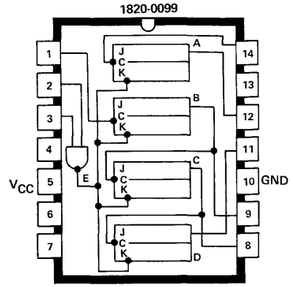

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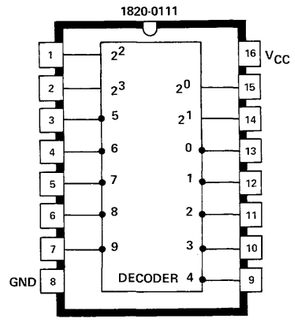

CHARACTERISTIC 12

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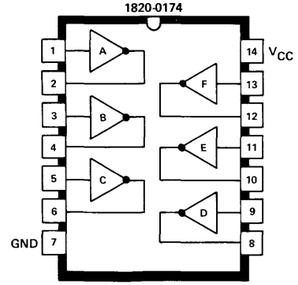

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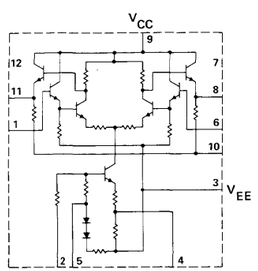
1820-0192



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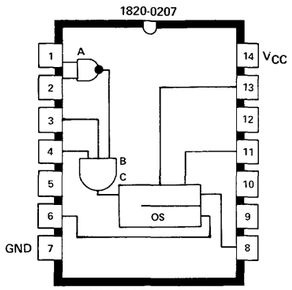

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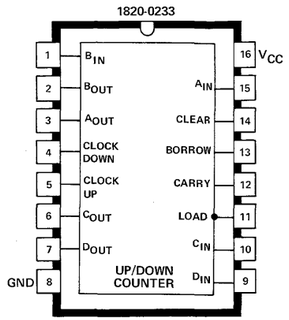

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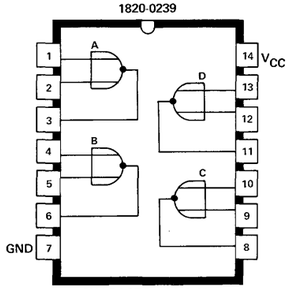

CHARACTERISTIC 49

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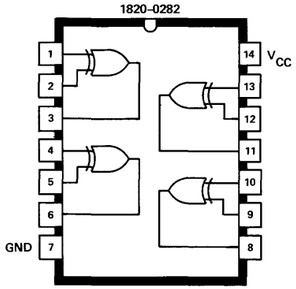

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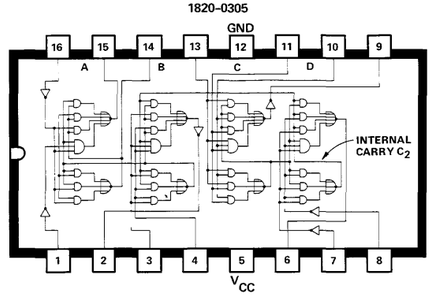

CHARACTERISTIC 13

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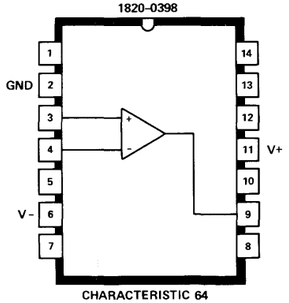

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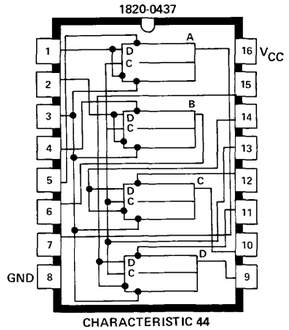

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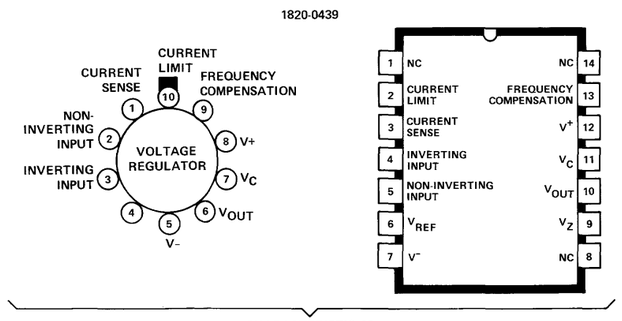

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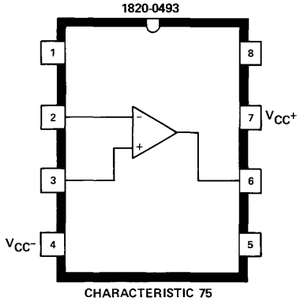

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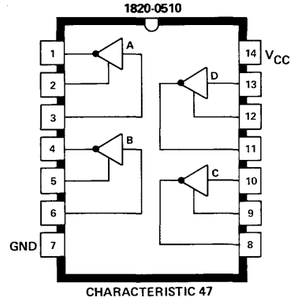

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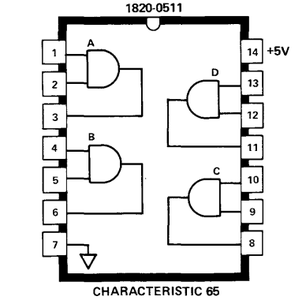
1820-0511



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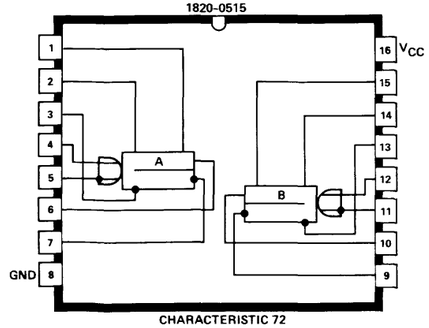

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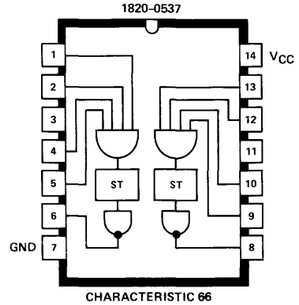

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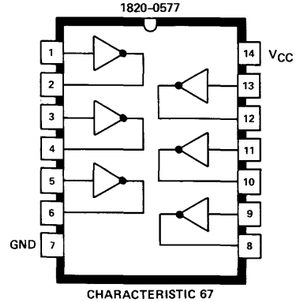

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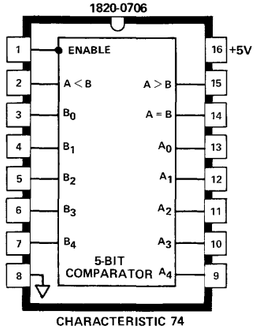
1820-0706



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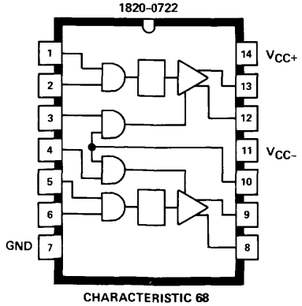

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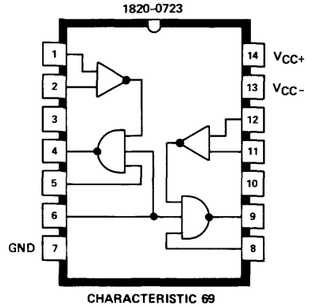
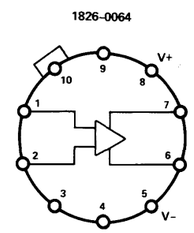


CHARACTERISTIC 69

1826-0064



CHARACTERISTIC 73

7901-71

Figure 5-43. Integrated Circuit Pin Layout

REPLACEABLE PARTS

SECTION VI

6-1. INTRODUCTION.

6-2. This section contains information for ordering replacement parts for the disc drive. Figures 6-1 through 6-6 are parts location diagrams for the unit and its assemblies. Tables 6-1 through 6-6 are parts lists for the parts identified in figures 6-1 through 6-6 respectively; table 6-7 lists reference designations and abbreviations; table 6-8 is a code list of manufacturer's listed in replaceable parts tables.

6-3. ORDERING INFORMATION.

6-4. To obtain replacement parts, address order or inquiry to the local Hewlett-Packard Sales and Service Office. (Refer to list at the back of this manual for addresses.) Specify the following information for each part ordered:

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

Table 6-1. HP 7901A Disc Drive, Replaceable Parts

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-1-		7901A DISC DRIVE (see figure 6-1)			1
1	07901-00015	* COVER, Top	82480	07901-00015	1
		(Attaching Parts)			
2	Coml	* SCREW, machine, no. 8-32, 0.312 in. pan head			6
3	Coml	* WASHER, split lock, no. 8			6
4	Coml	* WASHER, flat, no. 8			6
		– – – x – – –			
5	07901-00015	* COVER, bottom	28480	07901-00015	1
		(Attaching Parts)			
6	Coml	* SCREW, machine, no. 8-32, 0.312 in. pan head			9
		– – – x – – –			
7	07900-60030	* RECEIVER ASSEMBLY	28480	07901-60030	1
8	07901-60021	* FRONT PANEL ASSEMBLY (see figure 6-2)	28480	07901-60021	1
9	No Number	* UPPER DECK ASSEMBLY (see figure 6-3)			1
10	No Number	* LOWER DECK ASSEMBLY (see figure 6-4)			1
11	No Number	* REAR PANEL ASSEMBLY (see figure 6-5)			1

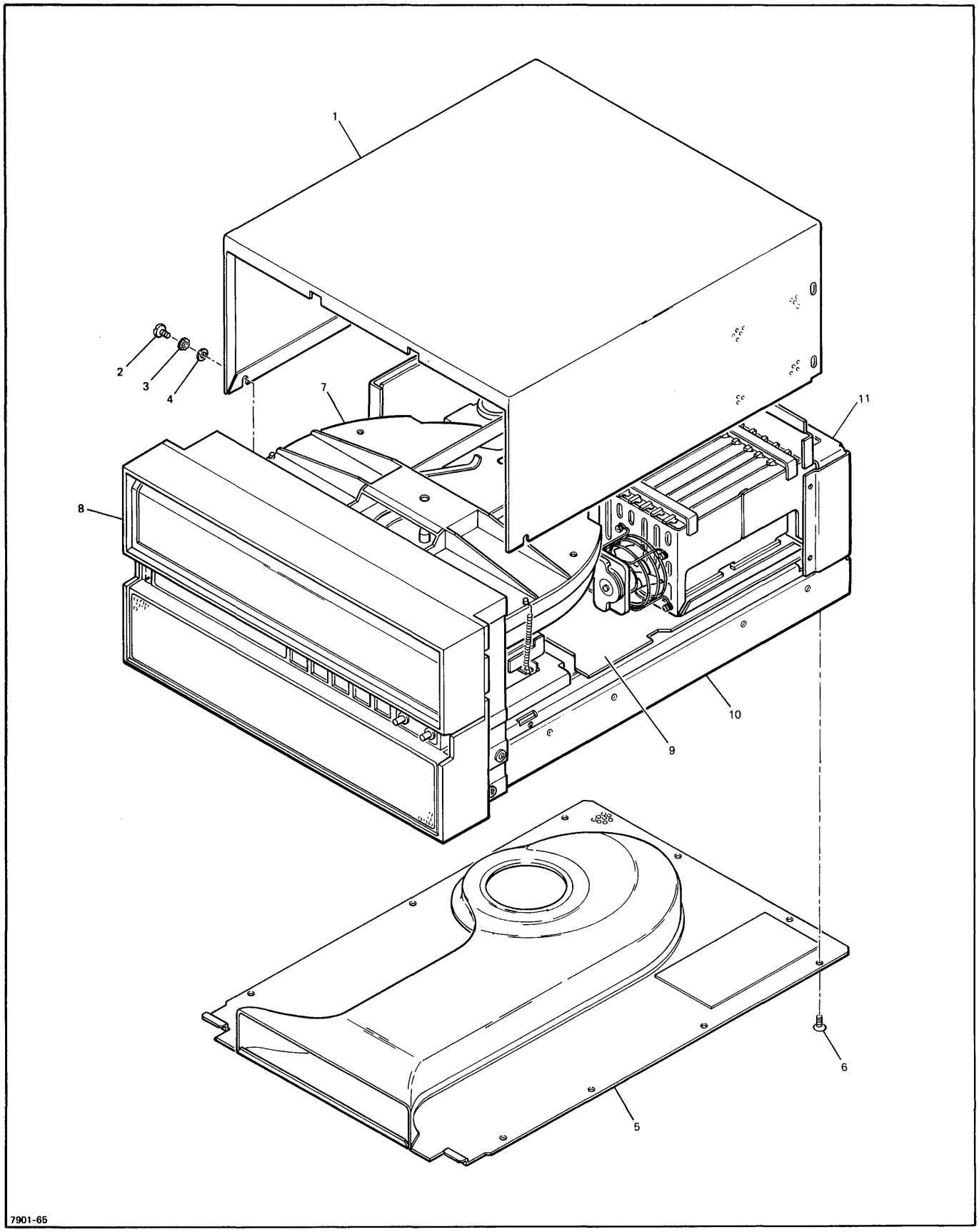
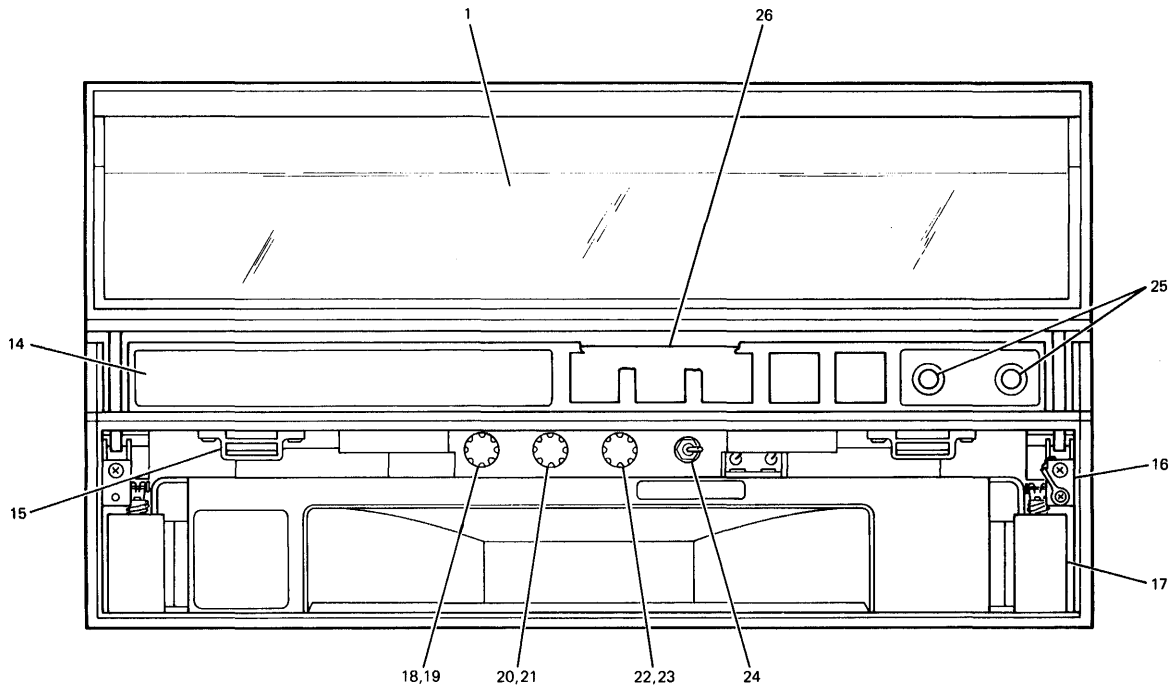


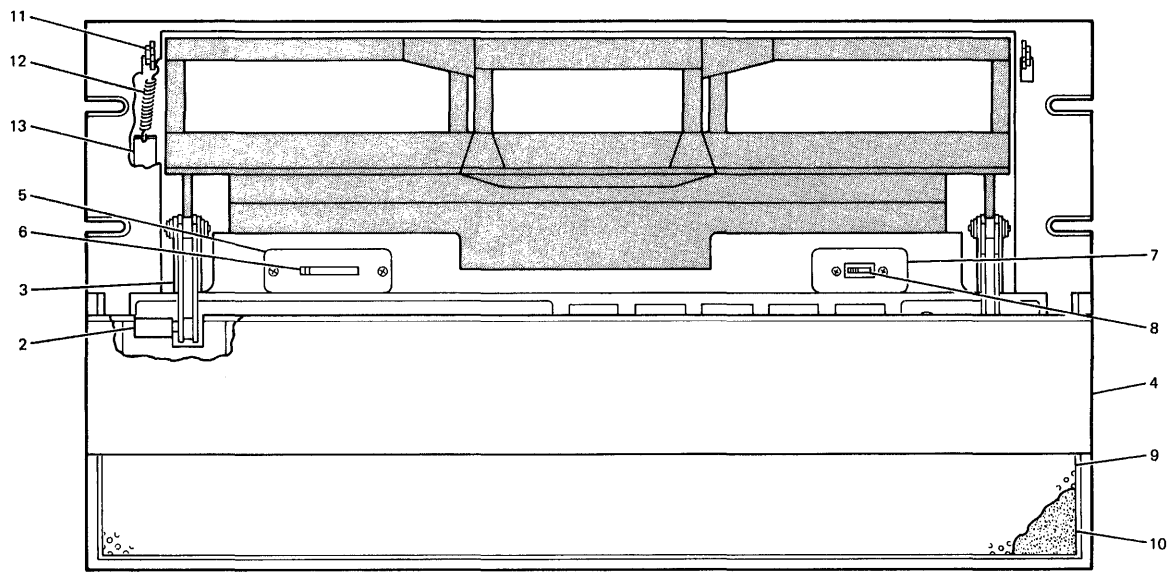
Figure 6-1. HP 7901A Disc Drive Parts Location Diagram

Table 6-2. Front Panel Assembly, Replaceable Parts

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-2-	07900-60021	FRONT PANEL ASSEMBLY (8, figure 6-1)	28480	07900-60021	1
1	07900-20029	* WINDOW, DOOR	28480	07900-20029	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 4-40, 0.375 in. pan head			6
	Coml	* WASHER, split lock, no. 4			6
	Coml	* WASHER, flat, no. 4			6
		– – – x – – –			
2	07900-20053	* LATCH PIVOT	28480	07900-20053	2
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 4-40, 0.375 in, skt head, cap			2
		– – – x – – –			
	07900-20051	**DRAG LINK PIVOT	28480	07900-20051	2
3	07900-60038	* DRAG LINK ASSEMBLY	28480	07900-60038	2
4	07900-20028	* FRONT DOOR	28480	07900-20028	1
5	7120-2863	* LABEL - UNIT SELECT	28480	7120-2863	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 2-56, 0.312 in. pan head			2
		– – – x – – –			
6	07901-60031	* SLIDE SWITCH ASSEMBLY (A17S1)	28480	07901-60031	1
7	7121-2862	* LABEL - DATA PROTECT	28480	7120-2862	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 2-56, 0.312 in. pan head			2
		– – – x – – –			
8	3101-0070	* SWITCH, slide, DPDT (S9)	79727	G-126	1
9	07900-00046	* FILTER SCREEN	28480	07900-00046	1
10	4208-0039	* FILTER, FOAM PLASTIC	28480	4208-0039	1
11	07900-00089	* DOOR LATCH	28480	07900-00089	2
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 4-40, 0.312 in. flat head			1
		– – – x – – –			
12	1460-1287	* SPRING, LATCH	28480	1460-1287	2
13	07900-00074	* BRACKET, SPRING	28480	07900-00074	2
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 4-40, 0.312 in. flat head			1
	Coml	* WASHER, lock, ext-tooth, no. 4			1
	Coml	* NUT, plain, hexagon, no. 4			1
		– – – x – – –			
14	7120-2861	* NAMEPLATE	28480	7120-2861	1
15	1390-0249	* CATCH, magnetic	00000	OBD	2
16	07900-00058	* CLAMP, drive pivot	28480	07900-00058	2
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 6-32, 0.625 in. pan head			1
	Coml	* WASHER, split lock, no. 6			1
		– – – x – – –			
17	0491-0060	* SOLENOID, 96 ohms, 24 Vdc (L1,2)	28480	0491-0060	2
		(Attaching Parts)			
	0400-0002	* GROMMET, rubber, 0.187 in. ID	73734	1656	2
	Coml	* SCREW, machine, no. 6-32, 0.250 in. flat head			2
		– – – x – – –			
18	2110-0342	* FUSE, 8 amp (F3)	00000	OBD	1
19	1400-0084	* FUSEHOLDER (XF3)	00000	OBD	1
20	2110-0365	* FUSE, 4 amp (F2)	00000	OBD	1
21	1400-0084	* FUSE HOLDER (XF2)	00000	OBD	1
22	2110-0016	* FUSE, 6 amp (F1)	00000	OBD	1
23	1400-0084	* FUSE HOLDER (XF1)	00000	OBD	1
24	3101-1258	* SWITCH, toggle, SPDT (S3)	28480	3101-1258	1
25	3101-1395	* SWITCH, pushbutton, DIDT-DB	76854	53-67280-121/AIM	2
26	0791-60014	* INDICATOR PC ASSEMBLY (S1,2)	28480	0791-60014	1



FRONT VIEW (DOOR CLOSED)
COVER WITH FILTER REMOVED FOR CLARITY



FRONT VIEW (DOOR OPEN)

7901-66

Figure 6-2. Front Panel Assembly, Parts Locations Diagram

Table 6-3. Upper Deck Assembly, Replaceable Parts

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-3-	No Number	UPPER DECK ASSEMBLY (9, figure 6-1)			1
1	07901-60004	* READ/WRITE CONTROL PC ASSEMBLY (A7) (see figure 5-27)	28480	07901-60004	1
2	07901-60015	* AUXILIARY FUNCTION PC ASSEMBLY (A8)	28480	07901-60015	1
3	07901-60006	* ENCODER PC ASSEMBLY (A9) (see figure 5-30)	28480	07901-60006	1
4	07901-60002	* DRIVE CONTROL PC ASSEMBLY (A10) (see figure 5-32)	28480	07901-60002	1
5	07901-60005	* SECTOR CYLINDER PC ASSEMBLY (A11) (see figure 5-34)	28480	07901-60005	1
6	07901-60007	* I/O MULTIPLEX PC ASSEMBLY (A12) (see figure 5-36)	28480	07901-60007	1
7	07901-60010	* MOTHER BOARD PC ASSEMBLY (A5) (see figure 5-23)	28480	07901-60010	1
8	07901-60003	* WRITE DRIVER/READ PREAMPLIFIER PC ASSEMBLY (A6) (see figure 5-25)	28480	07901-60003	1
9	3101-1607	* SWITCH, sensitive (S8)	28480	3101-1607	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 4-40, 0.625 in. pan head			2
	Coml	* WASHER, split lock, no. 4			2
	Coml	* WASHER, flat, no. 4			2
		– – – x – – –			
10	07900-40013	* CAM, UPPER HEAD	28480	07900-40013	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 6-32, 0.438 in. pan head, w/ext-tooth			4
	Coml	* WASHER, flat, no. 6			4
		– – – x – – –			
11	07900-20056	* BAIL, cartridge	28480	07900-20056	1
12	07900-20016	* RAIL, right	28480	07900-20016	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 8-32, 0.750 in. skt head, cap			4
	Coml	* WASHER, split lock, no. 8			4
		– – – x – – –			
13	3160-0255	* FAN ASSEMBLY (B2)	28480	3160-0255	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 6-32, 0.312 in. pan head			4
	Coml	* WASHER, split lock, no. 6			4
	Coml	* WASHER, flat, no. 6			4
		– – – x – – –			
14	07901-00010	* BRACKET, TRANSFORMER	28480	07901-00010	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 10-32, 2.750 in. pan head			4
	Coml	* WASHER, flat, no. 10			4
	Coml	* NUT, hexagon, no. 10			4
		– – – x – – –			
15	9100-3342	* TRANSFORMER, power (T1)	28480	9100-3342	1
16	07900-20062	* SPRING, HOLD-DOWN	28480	07900-20062	2
17	3101-1617	* SWITCH, sensitive, spst (S6)	28480	3101-1617	1
18	3101-1608	* SWITCH, sensitive, spst (S7)	28480	3101-1608	1
19	07900-00074	* SPRING, BRACKET	28480	07900-00074	2
20	07900-00060	* LINK, SUPPORT	28480	07900-00060	2
21	3101-1617	* SWITCH, sensitive, spst (S5)	28480	3101-1617	1
22	3101-0070	* SWITCH, slide, dpdt (S9)	28480	3101-0070	1
23	07900-60054	* SECTOR TRANSDUCER	28480	07900-60054	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 8-32, 0.375 in. pan head			2
	Coml	* WASHER, split lock, no. 8			2
	Coml	* WASHER, flat, no. 8			2
		– – – x – – –			
24	07901-60028	* UNIT SELECT SWITCH ASSEMBLY (A17) (see figure 5-41)	28480	07901-60028	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 4-40, 0.250 in. pan head			2
	Coml	* WASHER, split lock, no. 4			2
		– – – x – – –			

Table 6-3. Upper Deck Assembly, Replaceable Parts (Continued)

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-3-					
25	1530-1689	* SPINDLE	28480	1530-1689	1
26	07900-20065	* CRASH STOP ASSEMBLY	28480	07900-20065	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 8-32, 1.250 in. skt head, cap			2
	Coml	* WASHER, split lock, no. 8			2
		– – – x – – –			
27	07900-40023	* SPRING, crash stop	28480	07900-40023	2
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 4-40, 0.625 in. pan head			2
	Coml	* WASHER, split lock, no. 4			2
		– – – x – – –			
28	07900-20008	* RAIL, left	28480	07900-20008	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 8-32, 0.750 in. cap			4
	Coml	* WASHER, split lock, no. 8			4
		– – – x – – –			
29	07900-20027	* PIVOT BLOCK	28480	07900-20027	1
30	07900-40025	* DETENT, carriage	28480	07900-40025	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 6-32, 1.0 in. pan head			2
	Coml	* WASHER, split lock, no. 6			2
	Coml	* WASHER, flat, no. 6			2
		– – – x – – –			
31	07901-00041	* BRACE, power regulator	28480	07901-00041	1
32	3140-0761	* MOTOR, drive (B1)	28480	3140-0761	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 10-32, 0.625 in. pan head			4
	Coml	* WASHER, split lock, no. 10			4
	Coml	* WASHER, flat, no. 10			4
		– – – x – – –			
33	07901-60011	* SERVICE AMP/REG PC ASSEMBLY (A4) (see figure 5-21)	28480	07901-60011	1
34	0340-0761	* BOOT, insulator, neoprene	28480	0340-0761	1
35	0160-0762	* CAPACITOR, fxd, paper, 5 uF, ±10%, 370 Vdcw (C4)	28480	0160-0762	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 6-32, 0.375 in. pan head			1
	Coml	* NUT, hexagon, w/ext-tooth, no. 6			1
		– – – x – – –			
36	1400-0189	* CLAMP, capacitor	28480	1400-0189	1
37	No Number	* CARRIAGE ASSEMBLY (see figure 6-6)			1

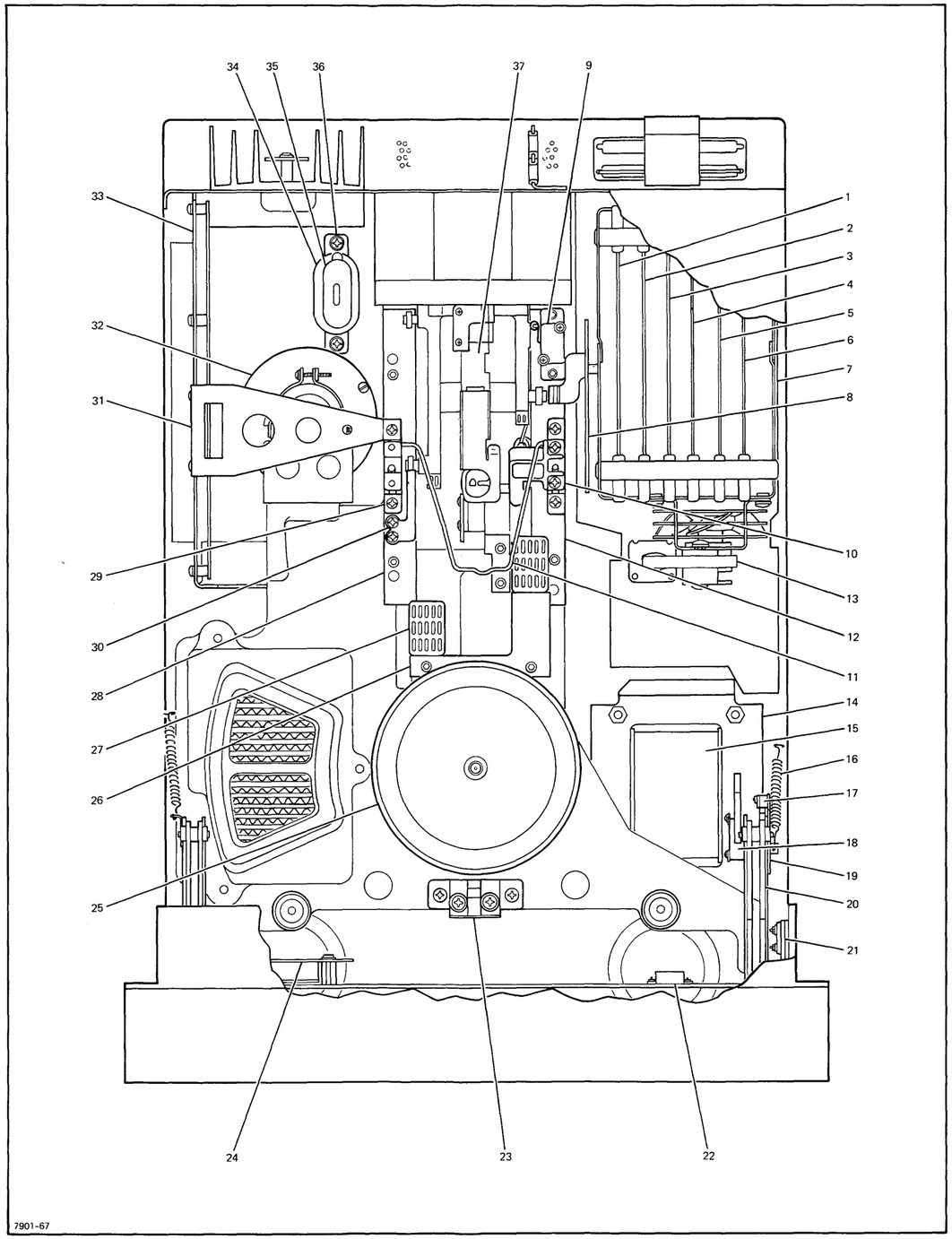


Figure 6-3. Upper Deck Assembly, Parts Location Diagram

Table 6-4. Lower Deck Assembly, Replaceable Parts

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-4-	No Number	LOWER DECK ASSEMBLY (10, figure 6-1)			1
1	0180-2475	* CAPACITOR, fxd, elect, 52,000 uF, -10 +75%, 25 Vdcw (C1,2)	56289	36D7182-DQB	2
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 8-32, 0.437 in. pan head			1
	Coml	* NUT, attached washer, ext-tooth, no. 8-32			1
		– – – x – – –			
2	0180-1958	* CLAMP, capacitor	28480	0180-1958	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 6-32, 0.312 in. pan head			3
	Coml	* WASHER, flat, no. 6			3
		– – – x – – –			
3	07901-00032	* COVER, terminal block	28480	07901-00032	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 8-32, 0.750 in pan head			2
		– – – x – – –			
4	0360-1689	* TERMINAL BLOCK, (TB1)	28480	0360-1689	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 8-32, 0.687 in pan head			2
	Coml	* WASHER, lock, split, no. 8			2
	Coml	* WASHER, flat, no. 8			2
		– – – x – – –			
5	1500-0314	* BELT, DRIVE	28480	1500-0314	1
6	07901-00001	* GROUND STRAP	28480	07901-00001	1
7	07901-20008	* PULLEY, spindle, 60 Hz	28480	07901-20008	1
	07901-20021	* PULLEY, spindle, 50 Hz (used on option 001 only)	28480	07901-20021	1
		(Attaching Parts)			
	Coml	* SCREW, no. 8-32, 0.750 in. skt head, cap			3
		– – – x – – –			
8	1906-0032	* RECTIFIER, POWER (CR1,2)	28480	1902-0032	2
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 6-32, 0.625 in. pan head			1
	Coml	* WASHER, split lock, no. 6			1
		– – – x – – –			
9	13215-20001	* GROUND BLOCK (TB2)	28480	13215-20001	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 6-32, 0.438 in. pan head, w/ext-tooth			2
	Coml	* WASHER, flat, no. 6			4
		– – – x – – –			
10	07901-00036	* COVER, motor control	28480	07901-00036	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 6-32, 1.25 in. pan head			2
	Coml	* WASHER, split lock, no. 6			2
	Coml	* WASHER, flat, no. 6			2
		– – – x – – –			
11	07901-60008	* MOTOR CONTROL PC ASSEMBLY	28480	07901-60008	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 6-32, 0.312, pan head			4
		– – – x – – –			
12	9100-3303	* LINEFILTER (FL1)	28480	9100-3303	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 8-32, 0.75 in pan head, w/ext-tooth			4
	Coml	* WASHER, fiber, no. 8 (between filter and chassis)			4
	Coml	* WASHER, fiber, no. 8 (inside filter)			4
		– – – x – – –			

Table 6-4. Lower Deck Assembly, Replaceable Parts (Continued)

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-4-					
13	1400-0745	* CLAMP, capacitor	28480	1400-0745	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 6-32, 0.375 in. pan head, w/ext-tooth			1
	Coml	* WASHER, flat, no. 6			1
		– – – x – – –			
14	0180-2476	* CAPACITOR, fxd, Al-elect, 38,000 uF, -10 +75%, 15 Vdcw (C3)	56289	36D7162-DQB	1
15	No Number	* IDLER PULLEY ASSEMBLY			1
	07901-20006	**IDLER PULLEY	28480	07901-20006	1
	1410-0066	**BEARING	28480	1410-0066	1
	1510-1161	**RETAINING RING (bevel side out)	28480	1510-1161	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 6-32, 0.250 in. pan head			1
	Coml	* WASHER, split lock, no. 6			1
		– – – x – – –			
16	07901-00033	* CLIP, FILTER	28480	07901-00033	1
		(Attaching Parts)			
	Coml	* SCREW, self tapping, no. 6-32, 0.250 in.			1
	Coml	* WASHER, flat, no. 6			1
		– – – x – – –			
17	3160-0250	* FAN ASSEMBLY	28480	3160-0250	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 8-32, 0.250 in. pan head w/ext-tooth			4
		– – – x – – –			
18	3150-0231	* AIR FILTER	28480	3150-0231	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 10-32, 0.750 in. skt head, cap			3
	Coml	* WASHER, split lock, no. 10			3
	Coml	* WASHER, flat, no. 10			3
		– – – x – – –			

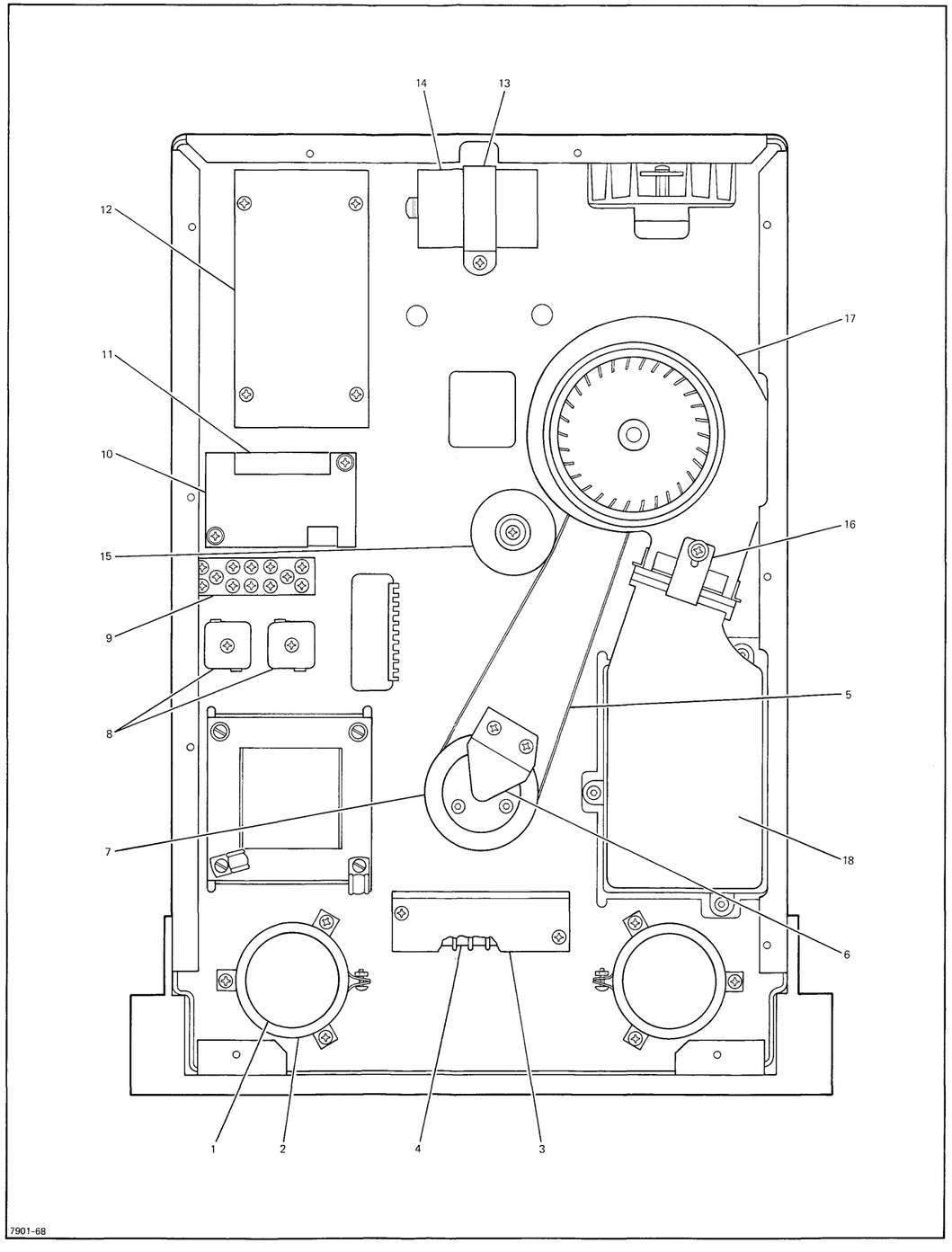


Figure 6-4. Lower Deck Assembly, Parts Location Diagram

Table 6-5. Rear Panel Assembly, Replaceable Parts

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-5-	No Number	REAR PANEL ASSEMBLY (11, figure 6-1)			1
1	07901-00035	* CLAMP, connector	28480	07901-00035	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 6-32, 0.375 in. pan head			1
	Coml	* WASHER, split lock, no. 6			1
	Coml	* WASHER, flat, no. 6			1
		– – – x – – –			
2	07901-60013	* TERMINATION PC ASSEMBLY	28480	07901-60013	1
3	07901-80041	* I/O INTERCONNECT PC ASSEMBLY	28480	07901-80041	1
4	07901-60033	* REAR PANEL	28480	07901-60033	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 6-32, 0.375 in. pan head			12
	Coml	* WASHER, split lock, no. 6			12
	Coml	* WASHER, flat, no. 6			12
		– – – x – – –			
5	8120-0050	* POWER CORD	28480	8120-0050	1
6	07901-60009	* HEAT SINK ASSEMBLY	28480	07901-60009	1

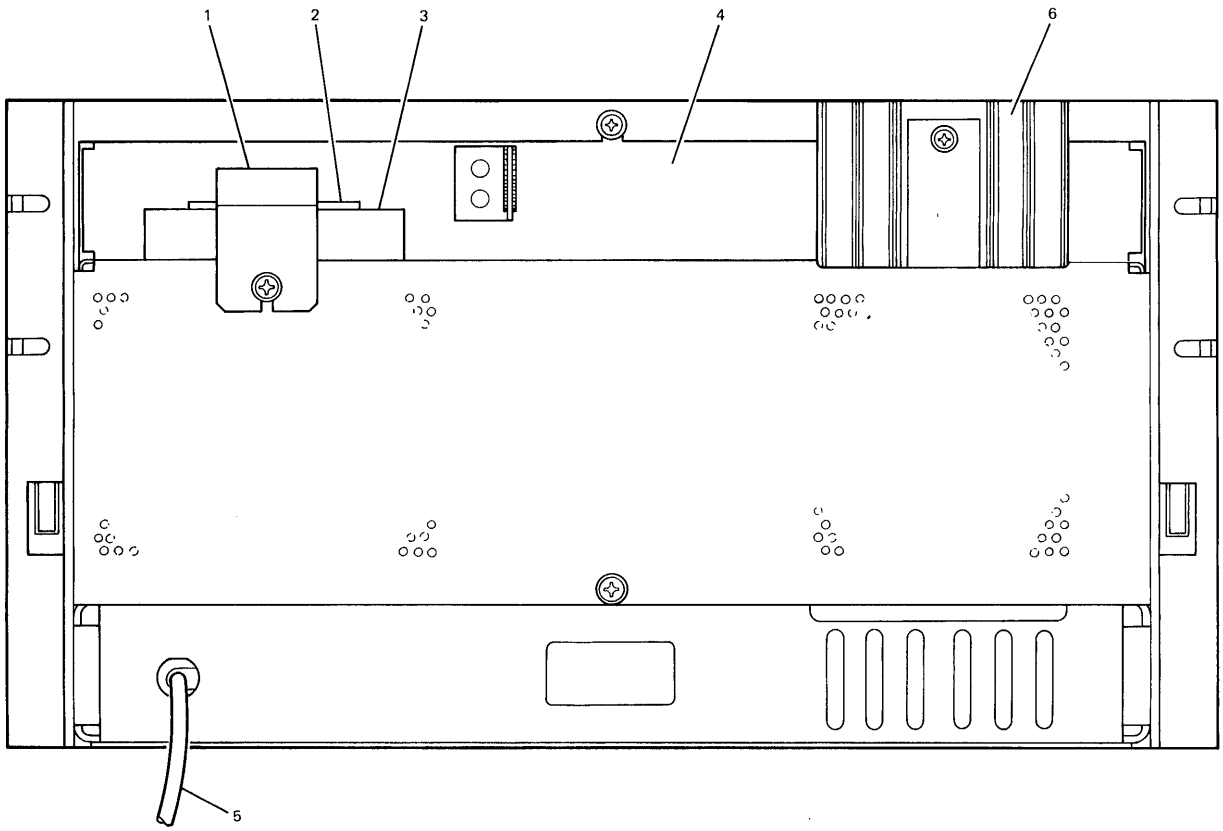


Figure 6-5. Rear Panel Assembly, Parts Location Diagram

Table 6-6. Carriage Assembly, Replaceable Parts

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-6-	No Number	CARRIAGE ASSEMBLY (37, figure 6-3)			1
1	07901-40032	* HEAD CABLE CLAMP	28480	07901-40032	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 4-40, 0.375 in. pan head			2
	Coml	* WASHER, split lock, no. 4			2
		– – – x – – –			
2	07901-00029	* HEAD CABLE BRACKET	28480	07901-00029	1
		(Attached Parts)			
	Coml	* SCREW, machine, no. 4-40, 0.250 in. pan head			2
	Coml	* WASHER, split lock, no. 4			2
		– – – x – – –			
3	07900-40033	* ENCODER PLATE CLAMP	28480	07900-40033	2
		(Attaching Parts)			
4	Coml	* SCREW, machine, no. 2-56, 0.375 in. pan head			2
5	Coml	* WASHER, split lock, no. 2			2
6	Coml	* WASHER, flat, no. 2			2
		– – – x – – –			
7	1000-0276	* ENCODER PLATE	28480	1000-0276	1
8	07900-60004	* DOWN HEAD ASSEMBLY	28480	07900-60004	1
9	07900-60001	* UP HEAD ASSEMBLY	28480	07900-60001	1
		(Attaching Parts for items 8 and 9)			
10	0050-1660	* CLAMP, head	28480	0050-1660	1
11	Coml	* SCREW, machine, no. 4-40, 1.0 in. hex head			2
12	Coml	* WASHER, split lock, no. 4			2
		– – – x – – –			
13	1410-1023	* BEARING	28480	1410-1023	5
		(Attaching Parts)			
	07900-20077	* SPACER	28480	07900-20077	1
	0570-1153	* SCREW, SHOULDERED	28480	0570-1153	1
		– – – x – – –			
14	07900-40026	* CRASH STOP WEDGE	28480	07900-40026	2
15	07901-60022	* COIL LEAD ASSEMBLY	28480	07901-60022	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 4-40, 0.438 in. cap head			1
		– – – x – – –			
16	1410-1023	* BEARING	28480	1410-1023	2
17	07900-20012	* SHAFT, bearing	28480	07900-20012	2
18	0510-0045	* RETAINING RING	28480	0510-0045	4
19	07900-00006	* SPRING, PRELOAD	28480	07900-00006	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 4-40, 0.250 in. pan head			2
	Coml	* WASHER, split lock, no. 4			2
		– – – x – – –			
20	07900-20014	* ENCODER PLATE HOLDER	28480	07900-20014	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 4-40, 0.375 in. hex head			2
	Coml	* WASHER, split lock, no. 4			2
		– – – x – – –			
21	07901-60018	* LINEAR MOTOR COIL L4	28480	07901-60018	1

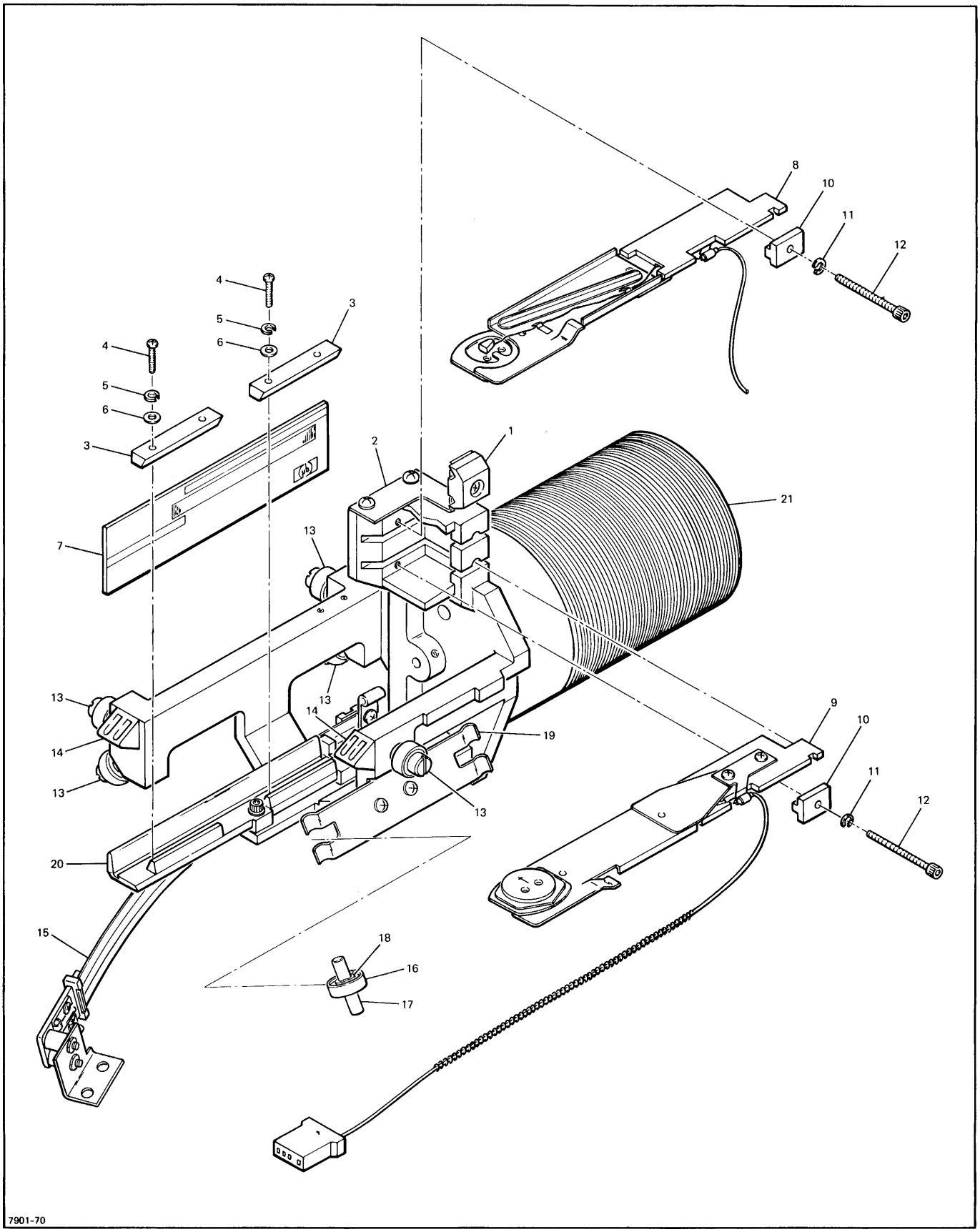


Figure 6-6. Carriage Assembly, Parts Location Diagram

Table 6-7. Reference Designations and Abbreviations

REFERENCE DESIGNATIONS

A	= assembly	K	= relay	TB	= terminal board
B	= motor, synchro	L	= inductor	TP	= test point
BT	= battery	M	= meter	U	= integrated circuit, non-repairable assembly
C	= capacitor	P	= plug connector	V	= vacuum tube, photocell, etc.
CB	= circuit breaker	Q	= semiconductor device other than diode or integrated circuit	VR	= voltage regulator
CR	= diode	R	= resistor	W	= jumper wire
DL	= delay line	RT	= thermistor	X	= socket
DS	= indicator	S	= switch	Y	= crystal
E	= Misc electrical parts	T	= transformer	Z	= tuned cavity, network
F	= fuse				
FL	= filter				
J	= receptacle connector				

ABBREVIATIONS

A	= amperes	gra	= gray	PCA	= printed-circuit assembly
ac	= alternating current	grn	= green	PWB	= printed-wiring board
Ag	= silver			phh	= phillips head
Al	= aluminum	H	= henries	pk	= peak
ar	= as required	Hg	= mercury	p-p	= peak-to-peak
adj	= adjust	hr	= hour(s)	pt	= point
assy	= assembly	Hz	= hertz	prv	= peak inverse voltage
		hdw	= hardware	PNP	= positive-negative-positive
b	= base	hex	= hexagon, hexagonal	pw	= peak working voltage
bp	= bandpass			porc	= porcelain
bpi	= bits per inch	ID	= inside diameter	posn	= position(s)
blk	= black	IF	= intermediate frequency	pozi	= pozidrive
blu	= blue	in.	= inch, inches		
brn	= brown	I/O	= input/output	rf	= radio frequency
brs	= brass	int	= internal	rdh	= round head
Btu	= British thermal unit	incl	= include(s)	rms	= root-mean-square
Be Cu	= beryllium copper	insul	= insulation, insulated	rwv	= reverse working voltage
		impgrg	= impregnated	rect	= rectifier
cpi	= characters per inch	incand	= incandescent	r/min	= revolutions per minute
coll	= collector	ips	= inches per second	RTL	= resistor-transistor logic
cw	= clockwise				
ccw	= counterclockwise	k	= kilo (10^3), kilohm	s	= second
cer	= ceramic			SB, TT	= slow blow
com	= common	lp	= low pass	Se	= selenium
crt	= cathode-ray tube			Si	= silicon
CTL	= complementary-transistor logic	m	= milli (10^{-3})	scr	= silicon controlled rectifier
cath	= cathode	M	= mega (10^6), megohm	sst	= stainless steel
Cd pl	= cadmium plate	My	= Mylar	stl	= steel
comp	= composition	mfr	= manufacturer	spcl	= special
conn	= connector	mom	= momentary	spdt	= single-pole, double-throw
compl	= complete	mtg	= mounting	spst	= single-pole, single-throw
		misc	= miscellaneous		
dc	= direct current	met. ox.	= metal oxide		
dr	= drive	mintr	= miniature	Ta	= tantalum
DTL	= diode-transistor logic			td	= time delay
depc	= deposited carbon	n	= nano (10^{-9})	Ti	= titanium
dpdt	= double-pole, double-throw	nc	= normally closed or no connection	tgl	= toggle
dpst	= double-pole, single-throw			thd	= thread
		Ne	= neon	tol	= tolerance
em	= emitter	no.	= number	TTL	= transistor transistor logic
ECL	= emitter-coupled logic	n.o.	= normally open		
ext	= external	np	= nickel plated		
encap	= encapsulated	NPN	= negative-positive-negative	U(μ)	= micro (10^{-6})
elctlt	= electrolytic	NPO	= negative-positive zero (zero temperature coefficient)		
		NSR	= not separately replaceable	V	= volt(s)
F	= farads	NRFR	= not recommended for field replacement	var	= variable
FF	= flip-flop			vio	= violet
flh	= flat head			Vdcw	= direct current working volts
flm	= film	OD	= outside diameter		
fxd	= fixed	OBD	= order by description	W	= watts
filh	= fillister head	orn	= orange	ww	= wirewound
		ovh	= oval head	wht	= white
G	= giga (10^9)	oxd	= oxide	WIV	= working inverse voltage
Ge	= germanium				
gl	= glass	p	= pico (10^{-12})	yel	= yellow
gnd	= ground(ed)	PC	= printed circuit		

Table 6-8. Code List of Manufacturers

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1 and H4-2, and the latest supplements.

CODE NO.	MANUFACTURER	ADDRESS
00853	Sangamo Electric Co., Pickens Div.	Pickens, S.C.
01121	Allen Bradley Co.	Milwaukee, Wis.
01295	Texas Instruments Inc., Semiconductor Components Div.	Dallas, Texas
02735	RCA Solid State & Receiving Tube Div.	Somerville, N.J.
03508	G.E. Co., Semiconductor Prod. Dept.	Syracuse, N.Y.
04713	Motorola Semiconductor Prod. Inc.	Phoenix, Ariz.
05397	Union Carbide Corp., Elect. Div.	New York, N.Y.
07263	Fairchild Camera & Inst. Corp., Semiconductor Div.	Mountain View, Cal.
08806	G.E. Co., Miniature Lamp Dept.	Cleveland, Ohio
12040	National Semiconductor Corp.	Danbury, Conn.
28480	Hewlett-Packard Co.	Palo Alto, Cal.
56289	Sprague Electric Co.	N. Adams, Mass.
70903	Belden Corp.	Chicago, Ill.
71400	Bussmann Mfg. Div., McGraw-Edison Co.	St. Louis, Mo.
71785	Cinch Mfg. Co. Div., TRW Inc.	Elk Grove Village, Ill.
72136	Electro Motive Mfg. Co. Inc.	Willimantic, Conn.
72982	Erie Technological Prod. Inc.	Erie, Pa.
75915	Littelfuse Inc.	Des Plaines, Ill.
76854	Oak Mfg. Co. Div., Oak Electro/ Netics Corp.	Crystal Lake, Ill.
77342	American Machine & Foundry Co., Potter & Brumfield Div.	Princeton, Ind.
79727	Continental-Wirt Electronics Corp.	Philadelphia, Pa.
80131	Electronic Industries Association	Washington, D.C.
81640	Control Switch Div., Controls Co. of America	Folcroft, Pa.
82142	Airco Speer Elect. Company	DuBois, Pa.
86684	RCA Electronic Components	Harrison, N.J.
92966	Hudson Lamp Co.	Kearny, N.J.
98978	International Elect. Research Corp.	Burbank, Cal.
99800	Delevan Electronics Corp.	E. Aurora, N.Y.

APPENDIX A

LOGIC SYMBOLOGY

A-1. INTRODUCTION.

A-2. This appendix covers basic logic information and symbology as used in this manual and related manuals.

A-3. LOGIC STATES.

A-4. The logic signals are always in one of two possible states, a "1" or a "0." These two states are also referred to as high (H) or low (L). The high and low states reflect the relative voltage levels of the signals; the high state is always relatively more positive than the low state. Note that both states may have actual voltage values that are positive, or both may be absolutely negative; the significance is in the *relative* levels of the two states. In the text of the manuals, logic states are normally described as "high" or "low."

A-5. The "not" bar associated with signal names is used to indicate whether the "active" state of the signal is high or low. For example, if the presence of data on a signal line is represented by a low signal, the signal name for the line might be "not" Data 1; if a signal clears the output register when the signal is low, the signal might be described as "not" Clear Output Register ($\overline{\text{COR}}$). The "not" bar must be considered an integral part of the signal name; this means that there are high states for "not" signals and low states for "not" signals, just as there are high and low states for signals without the "not" bar.

A-6. LOGIC SYMBOLOGY.

A-7. Three basic symbol shapes distinguish the major classes of logic circuits depicted in this manual. These are gates, regenerative switching elements, and amplifiers. Each symbol and a brief explanation of its operation is given in the following paragraphs.

A-8. In addition to the basic symbols, a general multipurpose symbol is used wherever a standardized logic symbol does not exist. A brief explanation of this multipurpose symbol is included.

A-9. INVERSION.

A-10. Logic inversion is indicated by an inversion dot at the input or output of a logic symbol. When this dot appears at the input of a logic symbol, the input will be effective when the input signal is low. When the dot appears at the output of a logic symbol the output will be of the opposite state to what would be delivered if the dot were not present.

A-11. GATES.

A-12. A gate is a circuit that produces a binary output when certain input conditions are met. The gate symbol has input lines connecting to one side of the symbol, and output lines connecting to the other side, as shown in figure A-1. Since the inputs and outputs are easily identifiable, the symbol can be shown left-facing, right-facing, or facing up or down.

A-13. There are four basic types of gates: "and," "or," "nand," and "nor," each named for the logic function that it performs. Each of these gates is described in the following paragraphs. In addition, a brief explanation of an "expander" gate is given following the descriptions of the basic logic gates.

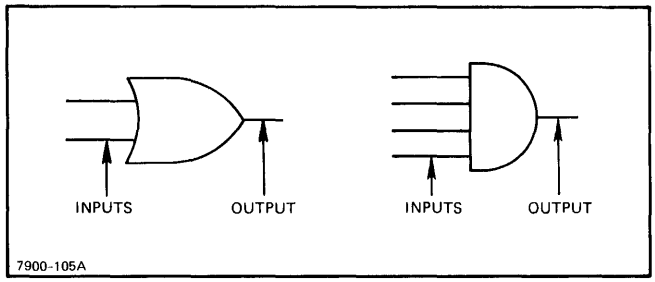
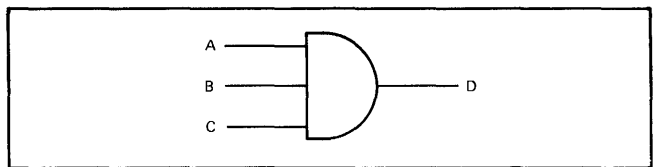


Figure A-1. Gate Symbols

A-14. "AND" GATE.

A-15. The "and" gate shown in figure A-2 performs a logical "and" function. It will produce a high output only when all of the input lines are high. Input A *and* input B *and* input C must be high for a high output to be generated.



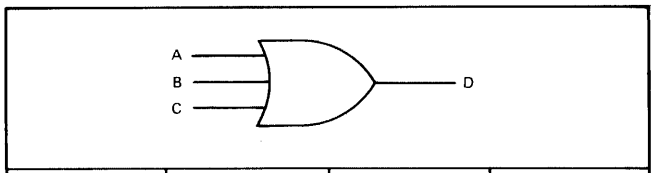
A	B	C	D
L	L	L	L
L	L	H	L
L	H	L	L
L	H	H	L
H	L	L	L
H	L	H	L
H	H	L	L
H	H	H	H

7900-106

Figure A-2. Three-Input "And" Gate Logic Symbol and Truth Table

A-16. "OR" GATE.

A-17. The "or" gate performs a logical "or" function. It produces a high output when one *or* more inputs are high. The truth table in figure A-3 shows the various states of a three-input "or" gate.



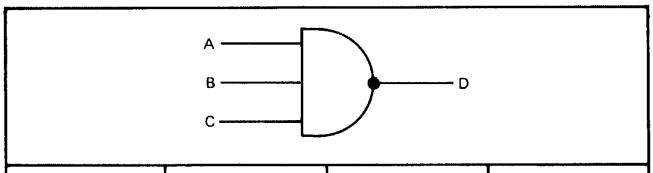
A	B	C	D
L	L	L	L
L	L	H	H
L	H	L	H
L	H	H	H
H	L	L	H
H	L	H	H
H	H	L	H
H	H	H	H

7900-107A

Figure A-3. Three-Input "Or" Gate Logic Symbol and Truth Table

A-18. "NAND" GATE.

A-19. The "nand" gate is similar to the "and" gate described previously, except that its output is inverted. The gate generates a low output when all inputs are high. The various states of a three-input "nand" gate are shown in the truth table in figure A-4.



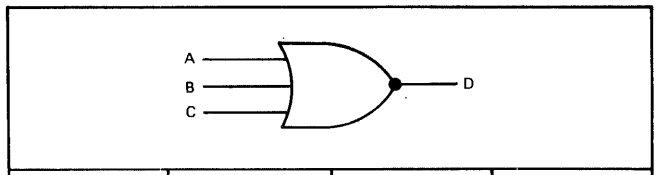
A	B	C	D
L	L	L	H
L	L	H	H
L	H	L	H
L	H	H	H
H	L	L	H
H	L	H	H
H	H	L	H
H	H	H	L

7900-108

Figure A-4. Three-Input "Nand" Gate Logic Symbol and Truth Table

A-20. "NOR" GATE.

A-21. The "nor" gate is identical to the "or" gate described previously, except that its output is inverted. The gate generates a low output when one or more inputs are high. The various states of a three-input "nor" gate are shown in the truth table in figure A-5.



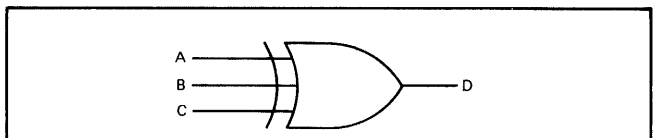
A	B	C	D
L	L	L	H
L	L	H	L
L	H	L	L
L	H	H	L
H	L	L	L
H	L	H	L
H	H	L	L
H	H	H	L

7900-109A

Figure A-5. Three-Input "Nor" Gate Logic Symbol and Truth Table

A-22. "EXCLUSIVE OR" GATE.

A-23. The "exclusive or" gate is a variation of the basic "or" gate. It has two or more input signals. The output is high when only one input is high. The truth table in figure A-6 shows the functioning of a three-input exclusive "or" gate.



A	B	C	D
L	L	L	L
L	L	H	H
L	H	L	H
L	H	H	L
H	L	L	H
H	L	H	L
H	H	L	L
H	H	H	L

7900-110A

Figure A-6. Three-Input "Exclusive Or" Gate Logic Symbol and Truth Table

A-24. EXPANDER GATE.

A-25. The expander gate provides a means for increasing the number of inputs to a gate. Figure A-7 shows a simplified method of illustrating this type of gate, and figure A-8 shows the actual connections between the gates involved. The X and $\overline{X}$ outputs of the expander gate are not logical opposites, but they do carry a voltage differential with respect to each other. When one or more inputs to the expander gate are low, there is a voltage difference of a few volts between X and $\overline{X}$. When all inputs to the expander gate are high, the voltage difference decreases; the two outputs of the expander then act as a high input to the expanded gate. The actual output-voltage differential of the expander gate depends on the type used.

A-26. When more than one expander gate is used, the gate outputs are connected as in parallel, as shown by the dashed lines in figure A-8.

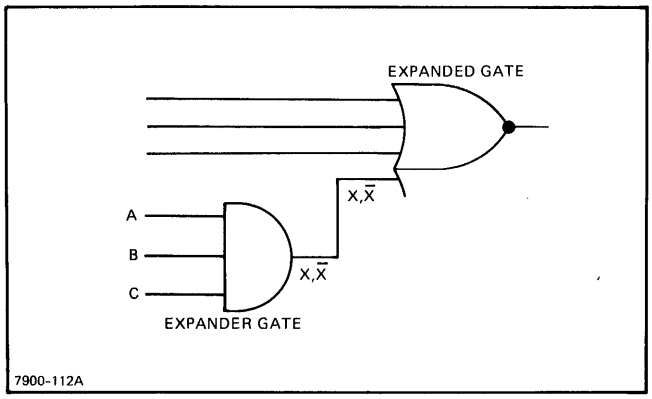


Figure A-7. Simplified Expander Gate Logic Symbol

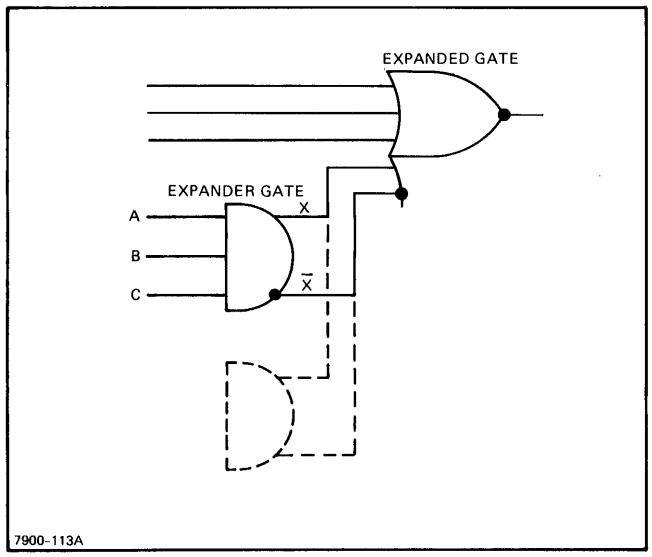


Figure A-8. Actual Expander Gate Logic Symbol

A-27. ENCODING GATE.

A-28. The encoding gate (figure A-9) has one input and multiple outputs. When the input is high, all outputs (B, C, and D) are high. When the input is low, the outputs are either low or high, in accordance with the state of the logic element to which each is connected.

A-29. A typical circuit for an encoding gate is shown in figure A-10. With A high, all diodes conduct and all outputs are clamped high. With A low, each diode is practically an open circuit, and points B, C, and D assume the voltage level of the circuit to which each is connected.

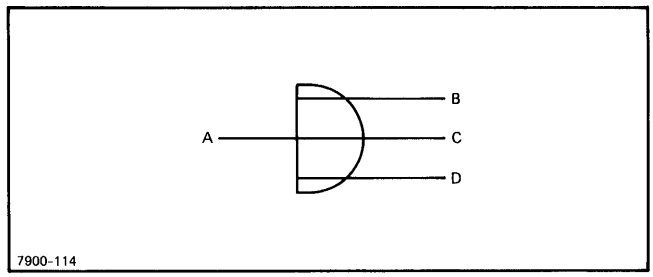


Figure A-9. Three-Input Encoding Gate, Logic Symbol

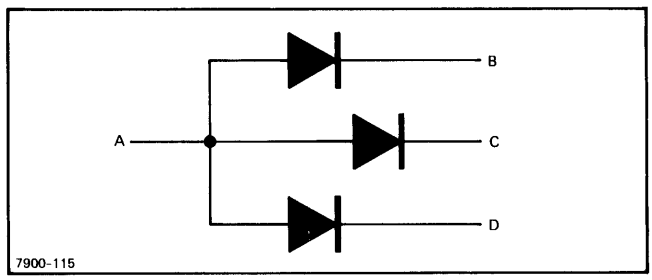


Figure A-10. Typical Encoding Gate Circuit

A-30. MULTIVIBRATORS.

A-31. The multivibrators described here are of four main types: flip-flops, Schmitt trigger circuits, one-shot multivibrators, and free-running multivibrators. All furnish a binary output. However, unlike gate circuits, the duration of a multivibrator output signal is not dependent on the duration of an input signal.

A-32. The basic logic symbol for a multivibrator is a rectangle as shown in figure A-11. Letters in the symbol indicate the type of multivibrator. The rectangle is divided horizontally, with the upper portion representing the "set side" and the lower portion representing the "clear side." The multivibrator is considered set when the output from the set side is high. It is considered cleared when the output from the clear side is high. To avoid confusion, the symbol is always oriented as shown in figure A-11; inputs on the left, outputs on the right.

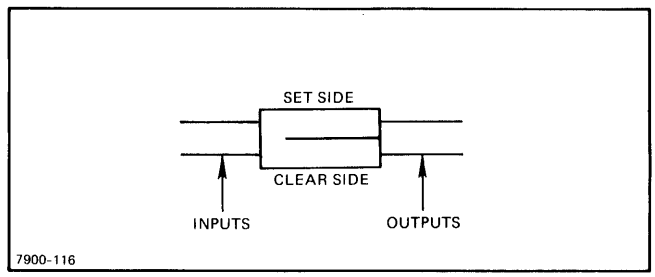


Figure A-11. Basic Logic Symbol Multivibrator

A-33. FLIP-FLOP.

A-34. The symbol for a flip-flop is shown in figure A-12. The letters "FF" preceded by the name of the flip-flop distinguish this symbol from other types of multivibrators. Additional identification, described later, identifies the particular type of flip-flop.

A-35. A flip-flop is a bistable switching device; an external signal is required to set the flip-flop and another to clear it. The flip-flop remains in its current state until switched to the opposite state by the appropriate external signal. Various forms of flip-flops exist, of which seven are described here: the R-S (reset-set), clocked R-S, J-K, clocked J-K, toggle, latch, and delay flip-flops.

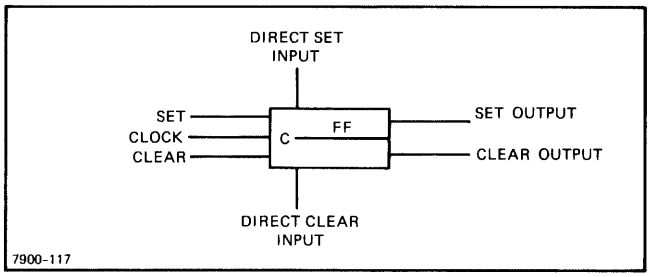
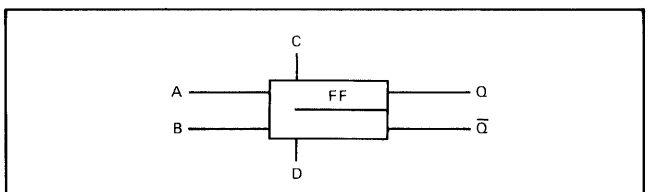


Figure A-12. General Flip-Flop Logic Symbol

A-36. R-S FLIP-FLOP. The symbol for the R-S flip-flop as shown in figure A-13 can be recognized by the fact that there is no information in the symbol identifying it as one of the other six types. The R-S flip-flop has a minimum of two input terminals (A and B in figure A-13) and one or two output terminals Q and $\overline{Q}$. One or two additional input terminals, C and D, may be used.

A-37. The R-S flip-flop is set by a high input at A (assuming no inverting dot at this point). It can also be set by a high input at C, if this input terminal is present. The flip-flop is cleared by a high input at B or D. Figure A-13 includes a truth table, showing the flip-flop outputs resulting from various input conditions.



INPUT		OUTPUT	
A	B	Q	$\overline{Q}$
L	L	No Change	
H	L	H	L
L	H	L	H
H	H	Indeterminate	

Figure A-13. R-S Flip-Flop, Logic Symbol, and Truth Table

A-38. After being set or cleared, the R-S flip-flop remains in that condition after termination of the set or clear pulse. If the flip-flop is either set or clear and it receives an input to place it in the existing state no change takes place in the state of the flip-flop.

A-39. Simultaneous high set and clear input signals normally are not permitted, and circuit design usually prevents occurrence of this condition at a time when the flip-flop outputs are used. If simultaneous set and clear inputs are received, both outputs of the flip-flop are high for the duration of the simultaneous inputs. The eventual state of the flip-flop is determined by the input that remains longest in the activating condition.

A-40. CLOCKED R-S FLIP-FLOP. The clocked R-S flip-flop is similar to the R-S flip-flop, but it has a clock pulse input as shown in figure A-14. The logic symbol can be recognized by the letter "C" at this input terminal. At the positive-going transition of the clock pulse, the flip-flop becomes set if input A is high, or it becomes clear if input B is high (assuming no inverting dot at the clock pulse input terminal). If inputs A and B are both low during the clock pulse, the flip-flop does not change state. It is not permissible that A and B both be high when the positive-going clock pulse transition takes place.

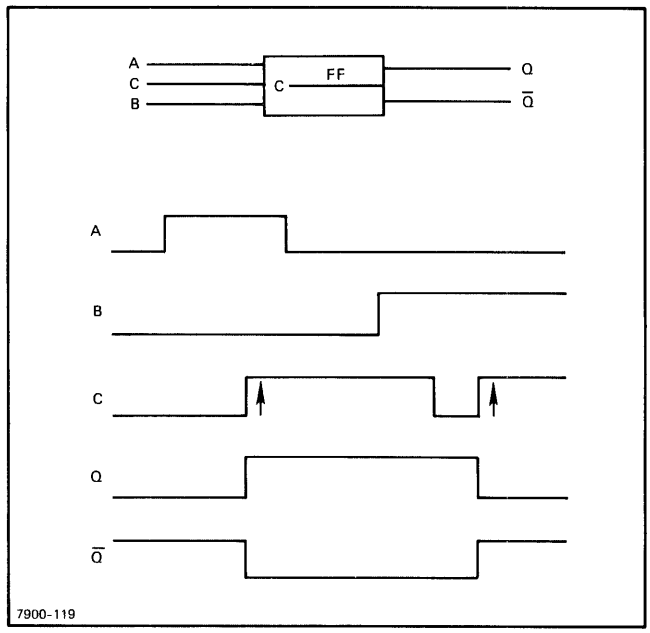


Figure A-14. Clocked R-S Flip-Flop, Logic Symbol, and Switching Waveforms

A-41. When the clocked R-S flip-flop has an inverting dot at the clock pulse input (figure A-15), the negative-going transition of the clock pulse is the transition that is effective in setting or clearing the flip-flop.

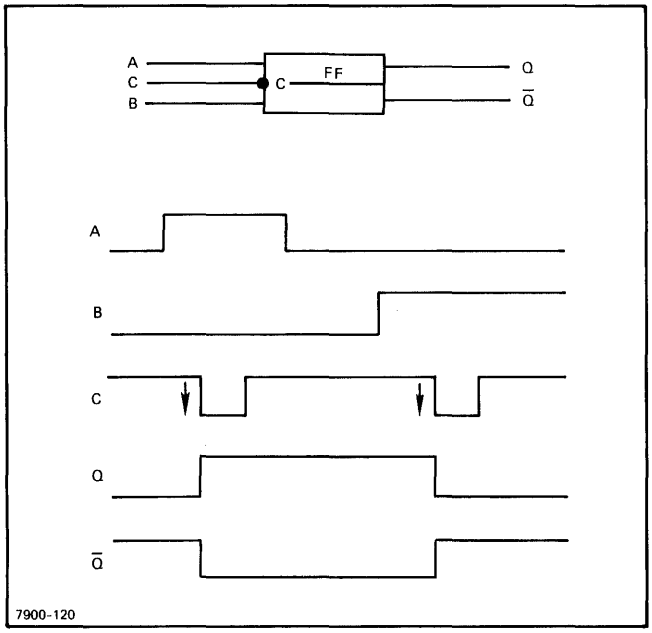


Figure A-15. R-S Flip-Flop with Inverted Clock Input, Logic Symbol, and Switching Waveforms

A-42. In some cases the clocked R-S flip-flop has a set and clear input at the top and bottom of the logic symbol (inputs D and E, figure A-16). These inputs are independent of the clock pulse, and are referred to as the direct set and direct clear inputs. They function as a result of a high or low level, rather than a positive- or negative-going transition. An inverting dot at the direct set or clear input indicates that a low level is required to set or clear the flip-flop. No dot indicates that a high level is required. The direct set and clear inputs are also used on other types of flip-flops.

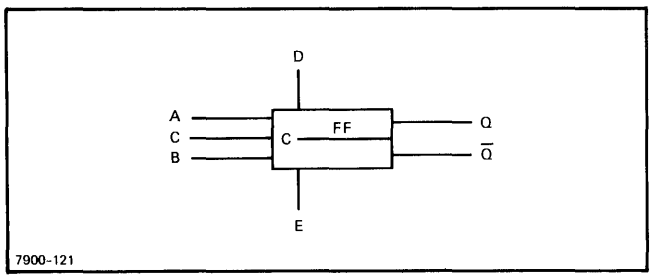


Figure A-16. Logic Symbol for Clocked R-S Flip-Flop with Direct Set and Direct Clear Inputs

A-43. TOGGLE FLIP-FLOP. The symbol for the toggle flip-flop as shown in figure A-17 can be recognized by the letter "T" in the symbol. This flip-flop has a single input. If there is no inverting dot at this input, each time the input signal becomes high, outputs Q and $\overline{Q}$ change state. Since two inputs are required to produce one complete cycle of the output, the toggle flip-flop functions as a divide-by-two element, and is commonly used in groups in counting circuits, with the output of one flip-flop driving the next. Figure A-17 shows the switching waveforms for one flip-flop.

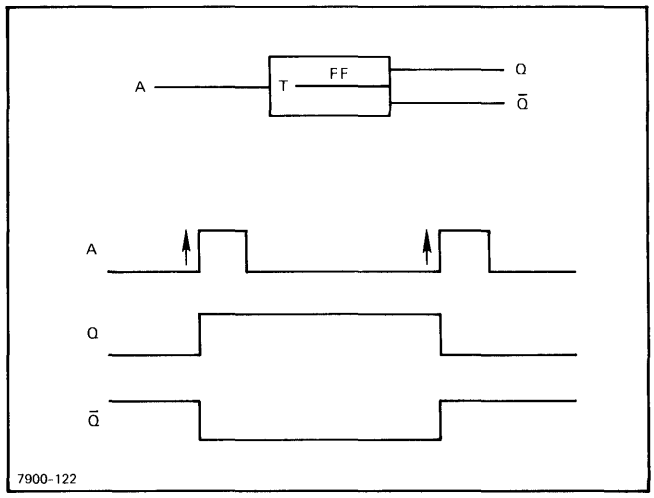


Figure A-17. Toggle Flip-Flop Logic Symbol and Switching Waveforms

A-44. If a toggle flip-flop symbol has an inverting dot at the input connection, the flip-flop changes state at the negative-going transition of the input. The symbol and waveforms for this type of flip-flop are shown in figure A-18.

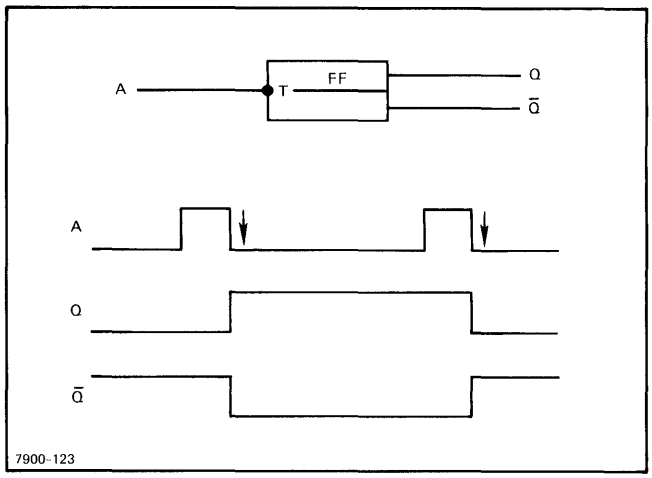


Figure A-18. Toggle Flip-Flop with Inverted Input, Logic Symbol, and Switching Waveforms

A-45. J-K FLIP-FLOP. In the J-K flip-flop, simultaneous high inputs for both set and clear will reverse the existing state of the flip-flop. This requires some method of storing two conditions, the previous output state and the new output state, until the clock pulse time. The set and clear inputs are labeled J and K respectively. In order to provide the necessary output storage the flip-flops are combined in a dual-rank configuration, together with the necessary gates to form a single logic element. For simplicity the internal dual-rank arrangement of the flip-flop is not usually shown. (See figure A-19.)

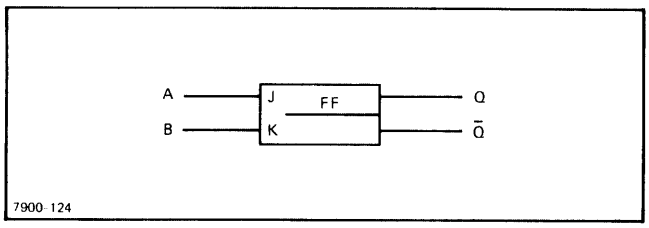
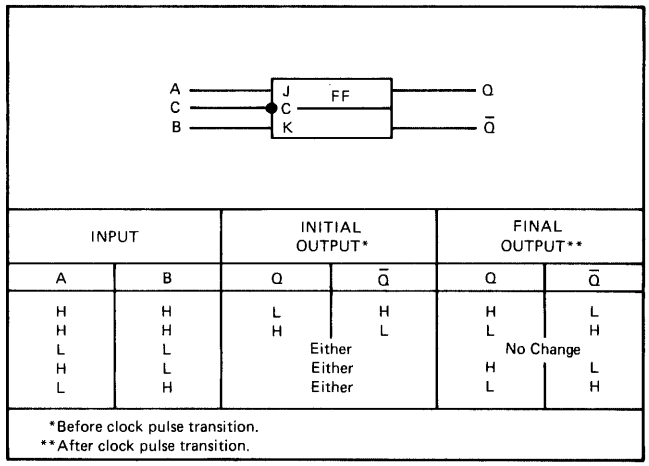


Figure A-19. J-K Flip-Flop Logic Symbol

A-46. CLOCKED J-K FLIP-FLOP. The clocked J-K flip-flop as shown in figure A-20 is similar to the clocked R-S flip-flop. However, simultaneous set and clear inputs to the J-K flip-flop are permissible. Under these conditions, the J-K flip-flop changes its state at the occurrence of each positive-going clock pulse transition. With an inverting dot at the clock pulse input, the flip-flop changes state at the negative-going clock pulse transition. If both J and K inputs are high, the flip-flop will toggle when a clock pulse is received.



INPUT		INITIAL OUTPUT*		FINAL OUTPUT**	
A	B	Q	$\bar{Q}$	Q	$\bar{Q}$
H	H	L	H	H	L
H	H	H	L	L	H
L	L	Either		No Change	
H	L	Either		H	L
L	H	Either		L	H

*Before clock pulse transition.
**After clock pulse transition.

7900-125

Figure A-20. Clocked J-K Flip-Flop Logic Symbol and Truth Table

A-47. The J-K flip-flop can also be operated with one high input and one low input. It then functions in the same manner as the clocked R-S flip-flop.

A-48. Figure A-20 includes a truth table showing operation of the J-K flip-flop. Note that with both inputs high at the time of clock pulse transition, the final state of the flip-flop (after clock pulse transition) depends on the state before the transition. With only one input high, the initial state of the flip-flop is immaterial.

A-49. In some cases the J-K flip-flop consists of two separate flip-flops, with the output of one applied to the input of the other. Usually, a single flip-flop logic symbol is used to illustrate this circuit. The clock pulse inverting dot, or the lack of it, indicates the clock pulse transition that affects the output flip-flop of the pair.

A-50. LATCHING FLIP-FLOP. The latching flip-flop shown in figure A-21 can be recognized by the letter "L" in the symbol. The flip-flop has a clock input and a data input. Although the logic symbol shows two input-signal connections to the flip-flop, in reality there is only a single, physical data input connection to the flip-flop. This single input separates inside the integrated circuit pack to form the two inputs shown. After separation, one input is inverted (indicated by the inverting dot) before application to the flip-flop.

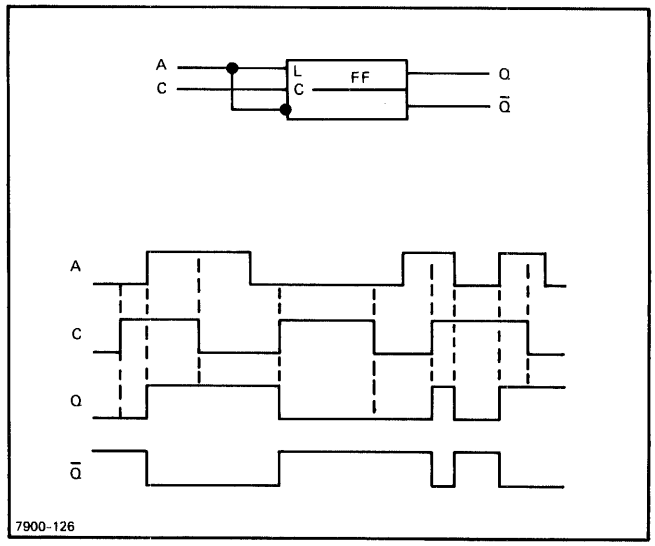


Figure A-21. Latching Flip-Flop Logic Symbol and Switching Waveforms

A-51. The set-side input is responsive to high signal levels at A in figure A-22, and the clear input is responsive to low signal levels at A. If there is no inverting dot at the clock input, this response takes place when the clock pulse is high. While the clock pulse remains high, the outputs follow any changes in the logic level at A as these changes take place. When the clock pulse becomes low, the flip-flop retains its current state, and no longer responds to changes of the input signal.

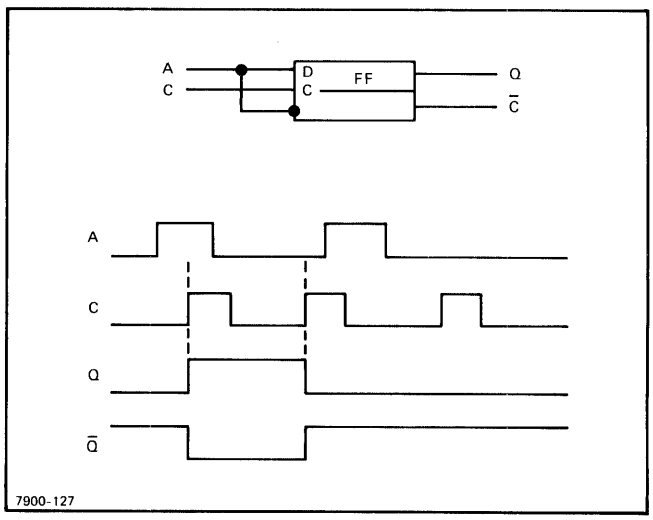


Figure A-22. Delay Flip-Flop Logic Symbol and Switching Waveforms

A-52. If the clock input connection of a latching flip-flop has an inverting dot, the flip-flop responds to the input signal while the clock pulse is low.

A-53. DELAY FLIP-FLOP. The delay flip-flop shown in figure A-22 is identified by a letter "D" inside the flip-flop symbol. This type of flip-flop is similar to the latching flip-flop, except that it responds to the input signal only at the transition of the clock pulse. The delay flip-flop thus does not follow changes in the input signal as these changes take place.

A-54. GATE FLIP-FLOP. The gate flip-flop is made up of two logic gates, connected as shown in figure A-23. The number of inputs to each gate can vary from that shown. The flip-flop can also be made up of two "nor" gates. The circuit may have a set output, a clear output, or both.

A-55. The gate flip-flop functions like an R-S flip-flop, but it has the advantage that it can "or" inputs without the addition of a separate "or" gate. Another reason for use of the gate flip-flop is that if two spare gates are available in integrated circuits on a circuit card, they can be employed as an R-S flip-flop without the need to add another integrated circuit to the card.

A-56. If the flip-flop is made up of two "nand" gates, as in figure A-23, it is set by a low input at either A or B. Similarly, it is cleared by a low input at C or D. When the flip-flop is in the quiescent state (not undergoing transition), the inputs at A, B, C, and D are all high.

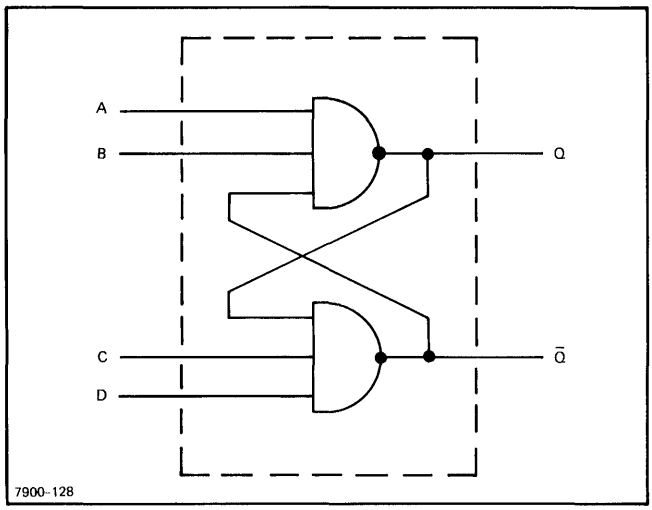


Figure A-23. "Nand" Gate Flip-Flop, Logic Symbol

A-57. A "nor" gate flip-flop is shown in figure A-24. In this type of flip-flop all inputs are low when the device is in the quiescent state. A high input at A sets the flip-flop, and a high input at B clears it. The outputs cross in the illustration in order to align the set and clear inputs with the set and clears outputs, respectively.

A-58. In most circuits using the "nand" or "nor" gate flip-flop, input signals are such that the flip-flop does not receive high set and clear input signals simultaneously. If circuit design does permit this to occur, both the set- and the clear-side outputs are high for the duration of the condition. The eventual state of the flip-flop is determined by the input that remains longest in the activating condition.

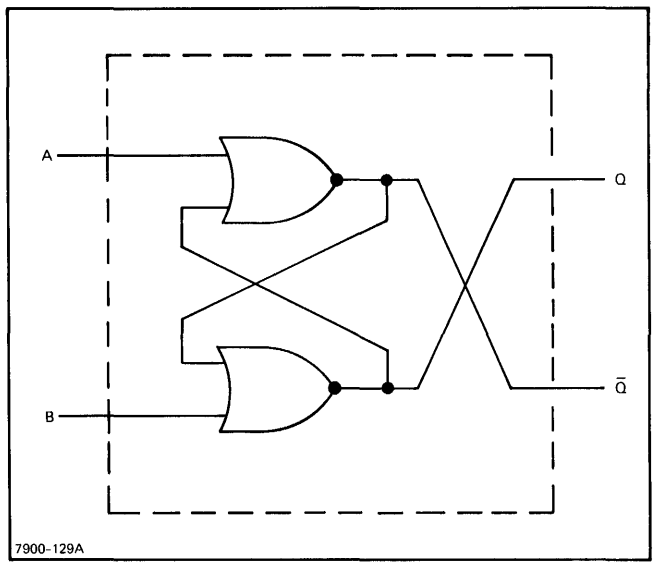


Figure A-24. "Nor" Gate Flip-Flop Logic Symbol

A-59. SCHMITT TRIGGER CIRCUIT.

A-60. The Schmitt trigger circuit shown in figure A-25 can be identified by the letters "ST" appearing in the logic-diagram symbol. Like the various types of flip-flops this circuit is a two-state device which does not perform a Boolean function. It serves for level sensing or signal squaring. It may have a set-side output, a clear-side output, or both.

A-61. When the input voltage at A is below a certain level, the Schmitt trigger is in the clear state. When the input voltage rises above the reference level, the trigger assumes the set state. Circuit constants establish the reference level.

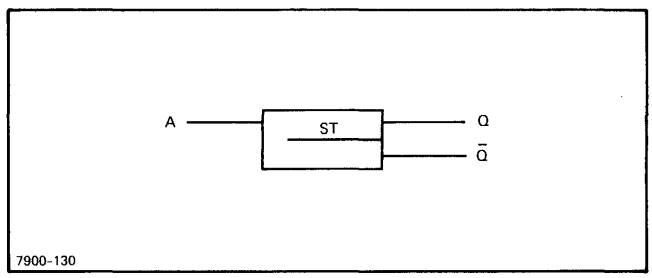


Figure A-25. Schmitt Trigger Circuit Logic Symbol

A-62. Switching between states takes place rapidly, and the Schmitt trigger is therefore useful for squaring signals that have poor rise and fall times. It can produce a square-wave from a sine wave. Other uses of the Schmitt trigger are voltage level restoration, and detection of the rise of the input signal above a given level.

A-63. ONE-SHOT MULTIVIBRATOR.

A-64. The one-shot multivibrator (figure A-26) is a monostable switching element, used to produce a pulse of predetermined duration. The device is triggered into its unstable state by an external signal. It returns to the stable state after a time interval determined by circuit constants.

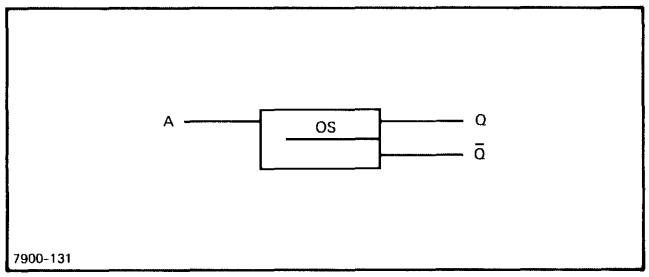


Figure A-26. One-Shot Multivibrator Logic Symbol

A-65. If there is no inverting dot at the input, triggering is accomplished when input A undergoes a positive-going transition. If there is an inverting dot, a negative-going transition is required. The one-shot multivibrator may have a set-side output, a clear-side output, or both.

A-66. The symbol for the one-shot multivibrator is always drawn with the orientation shown in figure A-26, with the input at the left and the output or outputs at the right.

A-67. FREE-RUNNING MULTIVIBRATOR.

A-68. The free-running multivibrator shown in figure A-27 can be distinguished by the letters "MV" appearing in the symbol. This device produces trains of complementary pulses at Q and $\overline{Q}$. Pulse width is determined by circuit constants.

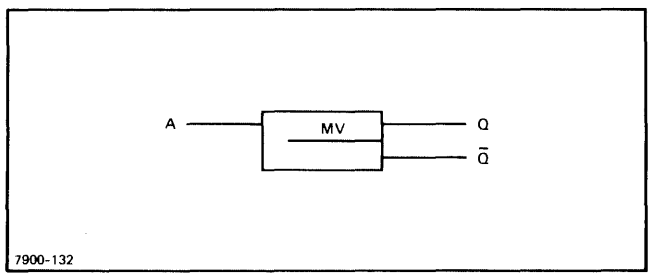


Figure A-27. Free-Running Multivibrator Logic Symbol

A-69. In some instances a control signal is applied to the free-running multivibrator. If there is no inverting dot at the signal input to the symbol, the multivibrator runs when the control signal is high, and stops when the signal is low. When it is stopped, the multivibrator is in the clear condition. If there is an inverting dot at the control signal input, a low input is required to bring the multivibrator into operation. This type of multivibrator is in the set condition when it is not running.

A-70. Figure A-28 shows typical waveforms for a controlled free-running multivibrator that runs when the control signal is high. The high and low portions of the output waveforms need not be of equal duration.

A-71. The symbol for the free-running multivibrator is always drawn with the orientation shown in figure A-28, with the input (if any) at the left, and the output or outputs at the right.

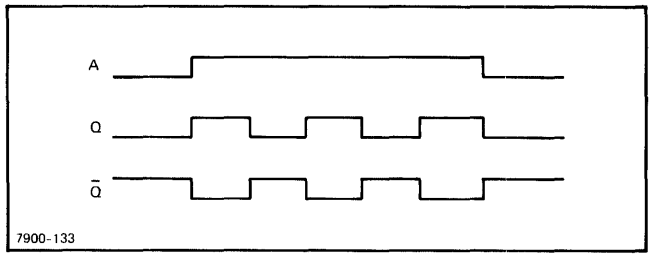


Figure A-28. Input and Output Waveforms of Controlled Free-Running Multivibrator

A-72. AMPLIFIER.

A-73. The symbol for an amplifier is shown in figure A-29. A differential amplifier is illustrated in figure A-30. Like gates, these symbols may be oriented in any of four positions.

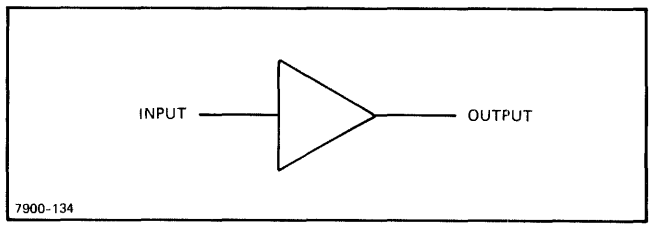


Figure A-29. Amplifier Logic Symbol

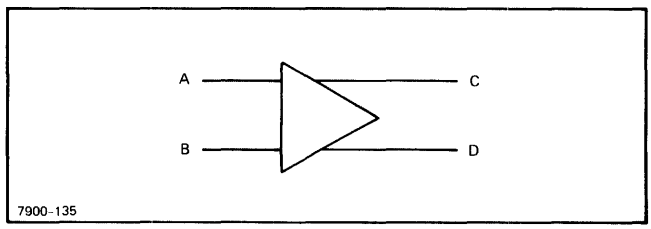


Figure A-30. Differential Amplifier Logic Symbol

A-74. In most instances, the amplifier symbol has a non-binary input. A circuit which restores the voltage level of a binary input, or which furnishes a low-impedance output from a binary input, is indicated by a one-input "and" gate symbol. An inverting dot at the output of an amplifier symbol indicates that the amplifier inverts the input signal.

A-75. Figure A-31 is the symbol for a phase splitter.

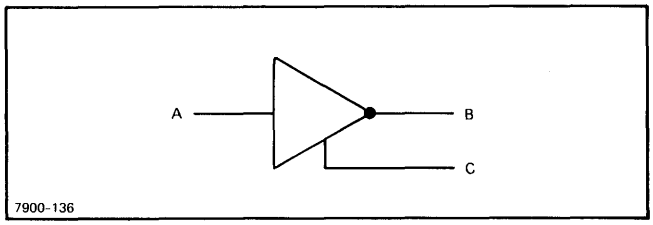


Figure A-31. Phase-Splitter Logic Symbol

A-76. MULTIPURPOSE LOGIC SYMBOL.

A-77. The multipurpose logic symbol is used to indicate a logic function that has not received a standardized logic symbol. The multipurpose symbol is also used to depict multiple logic elements that act together to perform a single overall logic function such as decoding, data storage, or counting. The symbol shown in figure A-32 may be of varying proportions (mostly commonly 2:1 or 1:2), but rectangular in shape. The symbol includes a descriptive name indicating the overall logic function performed. All active inputs should be labeled to indicate the effect on the overall function. Other descriptive information may be included as needed.

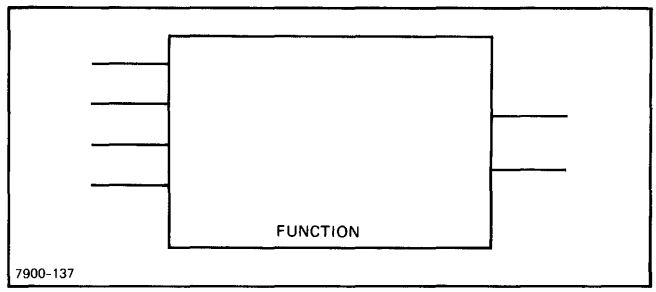


Figure A-32. Multipurpose Logic Symbol

A-78. Examples of nonstandard symbols are given in figure A-33. Figure A-33a shows a binary-to-octal decoder. Figure A-33b shows a four-bit up/down counter.

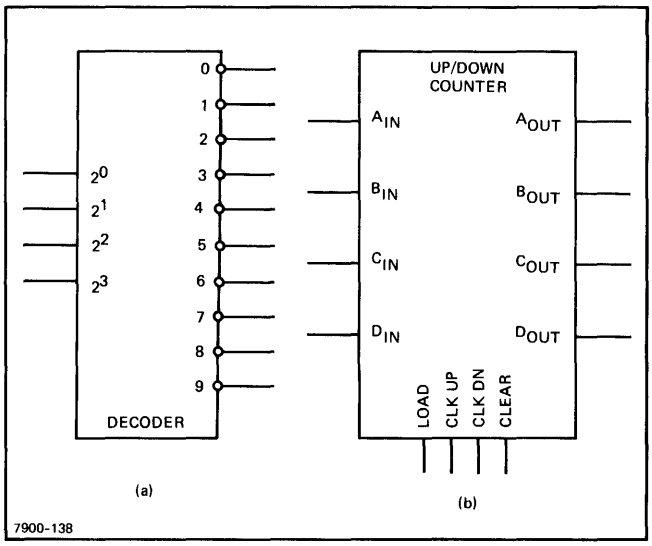


Figure A-33. Nonstandard Logic Symbols

EUROPE

AUSTRIA
Hewlett-Packard Ges.m.b.H
Handelska 52/3
P.O. Box 7
A-1205 **Vienna**
Tel: (0222) 33 66 06 to 09
Cable: HEWPAK Vienna
Telex: 75923 hewpak a

BELGIUM
Hewlett-Packard Benelux
S.A./N.V.
Avenue du Col-Vert, 1
B-1170 **Brussels**
Tel: (02) 72 22 40
Cable: PALOBEN Brussels
Telex: 23 494

DENMARK
Hewlett-Packard A/S
Datavej 38
DK-3460 **Birkerod**
Tel: (01) 81 66 40
Cable: HEWPACK AS
Telex: 16640 hp as

Hewlett-Packard A/S
Torvet 9
DK-8600 **Silkeborg**
Tel: (06)-82-71-66
Telex: 16640 hp as
Cable: HEWPACKAS

FINLAND
Hewlett-Packard Oy
Bulevardi 26
P.O. Box 12185
SF-00120 **Helsinki** 12
Tel: (90) 13730
Cable: HEWPACKOY-Helsinki
Telex: 17-1563 hel

FRANCE
Hewlett-Packard France
Quartier de Courtaboeuf
Boite Postale No. 6
F-91401 **Orsay**
Tel: (1) 907 78 25
Cable: HEWPACK Orsay
Telex: 60048

Hewlett-Packard France
4 Quai des Etroits
F-69321 **Lyon Cedex** 1
Tel: (78) 42 63 45
Cable: HEWPACK Lyon
Telex: 31617

Hewlett-Packard France
29 rue de la Gare
F-31700 **Blagnac**
Tel: (61) 85 82 29
Telex: 51957

GERMAN FEDERAL REPUBLIC
Hewlett-Packard Vertriebs-GmbH
Berliner Strasse 117
Postfach 560 140
D-6 Nieder-Eschbach/Ffm 56
Tel: (0611) 50-04-1
Cable: HEWPACKSA Frankfurt
Telex: 41 32 49 FRA

Hewlett-Packard Vertriebs-GmbH
Herrenbergerstrasse 110
D-7030 **Böblingen**, Württemberg
Tel: (07031) 66 72 87
Cable: HEPAK Böblingen
Telex: 72 65 739 bbn

Hewlett-Packard Vertriebs-GmbH
Vogelsanger Weg 38
D-4 **Düsseldorf**
Tel: (0211) 63 80 31/35
Telex: 85/86 533 hpdd d

Hewlett-Packard Vertriebs-GmbH
Wendenstr. 23
D-2 **Hamburg** 1
Tel: (0411) 24 05 51/52
Cable: HEWPACKSA Hamburg
Telex: 21 53 032 hphh d

Hewlett-Packard Vertriebs-GmbH
Unterhachinger Strasse 28
ISAR Center
D-8012 **Ottobrunn**
Tel: (0811) 601 30 61/7
Telex: 52 49 85
Cable: HEWPACKSA Müchen

(West Berlin)
Hewlett-Packard Vertriebs-GmbH
Wilmersdorfer Strasse 113/114
D-1000 **Berlin W.** 12
Tel: (0311) 3137046
Telex: 18 34 05 hpbln d

GREECE
Kostas Karayannis
18, Ermou Street
Athens 126
Tel: 3230-303
Cable: RAKAR Athens
Telex: 21 59 62 rkar gr

IRELAND
Hewlett-Packard Ltd.
224 Bath Road
Slough, SL1 4 DS, Bucks
Tel: Slough (0753) 33341
Cable: HEWPIE Slough
Telex: 84413

Hewlett-Packard Ltd.
The Graftons
Stamford New Road
Altrincham, Cheshire, England
Tel: (061) 928-8626
Telex: 668068

ITALY
Hewlett-Packard Italiana S.p.A.
Via Amerigo Vespucci 2
1-20124 **Milan**
Tel: (2) 6251 (10 lines)
Cable: HEWPACKIT Milan
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Hewlett-Packard Italiana S.p.A.
Piazza Marconi
1-00144 **Rome** - Eur
Tel: (6) 5912544 5, 5915947
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Telex: 61514

Hewlett-Packard Italiana S.p.A.
Vicolo Pastori, 3
I-35100 **Padova**
Tel: (49) 66 40 62
Telex: 32046 via Milan

Hewlett-Packard Italiana S.p.A.
Via Colli, 24
I-10129 **Turin**
Tel: (11) 53 82 64
Telex: 32046 via Milan

LUXEMBURG
Hewlett-Packard Benelux
S.A./N.V.
Avenue du Col-Vert, 1
B-1170 **Brussels**
Tel: (03/02) 72 22 40
Cable: PALOBEN Brussels
Telex: 23 494

NETHERLANDS
Hewlett-Packard Benelux, N.V.
Weerdestein 117
P.O. Box 7825
Amsterdam, Z 11
Tel: 020-42 77 77
Cable: PALOBEN Amsterdam
Telex: 13 216 hepa nl

NORWAY
Hewlett-Packard Norge A/S
Box 149
Nesveien 13
N-1344 **Haslum**
Tel: (02)-53 83 60
Telex: 16621 hpnas n

PORTUGAL
Telectra-Empresa Tecnica de Equipamentos
Electricos S.a.r.l.
Rua Rodrigo da Fonseca 103
P.O. Box 2531
P-**Lisbon** 1
Tel: (19) 68 60 72
Cable: TELECTRA Lisbon
Telex: 1598

SPAIN
Hewlett-Packard Española, S.A.
Jerez No 8
Madrid 16
Tel: 458 26 00
Telex: 23515 hpe

Hewlett-Packard Española, S.A
Milanesado 21-23
E-**Barcelona** 17
Tel: (3) 203 62 00
Telex: 52603 hpbe e

SWEDEN
Hewlett-Packard Sverige AB
Enighetsvägen 1-3
Fack
S-161 20 **Bromma** 20
Tel: (08) 98 12 50
Cable: MEASUREMENTS
Stockholm
Telex: 10721

Hewlett-Packard Sverige AB
Hagakersgatan 9C
S-431 41 **Mölndal**
Tel: (031) 27 68 00/01
Telex: 21 312 hpmindl s

SWITZERLAND
Hewlett Packard (Schweiz) AG
Zürcherstrasse 20
P.O. Box 64
CH-8952 **Schlieren** Zurich
Tel: (01) 98 18 21/24
Cable: HPAG CH
Telex: 53933 hpag ch

Hewlett-Packard (Schweiz) AG
Rue du Bois-du-Lan 7
P.O. Box 85
1217 Meyrin 2 Geneva
Tel: (022) 41 54 00
Cable: HEWPACKSA Geneva
Telex: 27333 hpsa ch

TURKEY
Telekom Engineering Bureau
Saglik Sok No. 15/1
Ayaspasa-Beyoglu
P.O. Box 437 Beyoglu
Istanbul
Tel: 49 40 40
Cable: TELEMATION Istanbul

UNITED KINGDOM
Hewlett-Packard Ltd.
224 Bath Road
Slough, SL1 4 DS, Bucks
Tel: Slough (0753) 33341
Cable: HEWPIE Slough
Telex: 84413

Hewlett-Packard Ltd.
"The Graftons"
Stamford New Road
Altrincham, Cheshire
Tel: (061) 928-8626
Telex: 668068

SOCIALIST COUNTRIES PLEASE CONTACT:
Hewlett-Packard Ges.m.b.H.
Handelskai 52/3
P.O. Box 7
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Ph: (0222) 33 66 06 to 09
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ALL OTHER EUROPEAN COUNTRIES CONTACT:
Hewlett-Packard S.A.
Rue du Bois-du-Lan 7
P.O. Box 85
CH-1217 Meyrin 2 **Geneva**
Switzerland
Tel: (022) 41 54 00
Cable: HEWPACKSA Geneva
Telex: 2.24.86

AFRICA, ASIA, AUSTRALIA

ANGOLA
Telectra Empresa Técnia
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17 Aminadav Street
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Tel: 36941 (3 lines)
Cable: BASTEL Tel-Aviv
Telex: MOTIL IL

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Yokogawa-Hewlett-Packard Ltd.
Ohashi Building
1-59-1 Yoyogi
Shibuya-ku, **Tokyo**
Tel: 03-370-2281/92
Telex: 232-2024YHP
Cable: YHPMARKET TOK 23-724

Yokogawa-Hewlett-Packard Ltd.
Nisei Ibaragi Bldg.
2-2-8 Kasuga
Ibaragi-Shi
Osaka
Tel: (0726) 23-1641
Telex: 5332-385 YHP OSAKA

Yokogawa-Hewlett-Packard Ltd.
Ito Building
No. 59, Kotori-cho
Nakamura-ku, **Nagoya** City
Tel: (052) 551-0215

Yokogawa-Hewlett-Packard Ltd.
Nitto Bldg.
2-4-2 Shinohara-Kita
Kohoku-ku
Yokohama 222
Tel: 045-432-1504
Telex: 382-3204 YHP YOK

Yokogawa-Hewlett-Packard Ltd.
Chuo Bldg.
Rm. 603 3,
2-Chome
IZUMI-CHO,
Mito, 310
Tel: 0292-25-7470

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Nairobi, Kenya
Tel: 57726
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Industrial Products Div.
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8th floor, DaeKyung Bldg.
107 Sejong Ro
Chongro-Ku, Seoul
Tel: 73-8924-7
Cable: AMTRACO Seoul

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P.O. Box 7213
RI-Beirut
Tel: 220846
Cable: ELECTRONUCLEAR Beirut

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MECOMB Malaysia Ltd.
2 Lorong 13/6A
Section 13
Petaling Jaya, **Selangor**
Cable: MECOMB Kuala Lumpur

MOZAMBIQUE
A. N. Goncalves, LDA.
4.1 Apt. 14 Av. D. Luis
P.O. Box 107
Lourenco Marques
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Abdullah Haroon Road
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Cable: FEMUS Rawalpindi

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Center Bldg.
Ayala Ave., Makati, Rizal
C.C.P.O. Box 1028
Makati, Rizal
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Cable: ELEMEX Manila

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Engineering Company Ltd.
9, Jalan Kilang
Red Hill Industrial Estate
Singapore, 3
Tel: 642361-3; 632611
Cable: MECOMB Singapore

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Area Office
P.O. Box 87
Alexandra Post Office
Singapore 3
Tel: 633022
Cable: HEWPACK SINGAPORE

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Hewlett Packard South Africa
(Pty.), Ltd.
P.O. Box 31716
Braamfontein Transvaal
Milnerton
30 De Beer Street
Johannesburg
Tel: 725-2080, 725-2030
Telex: 0226 JH
Cable: HEWPACK Johannesburg

Hewlett Packard South Africa
(Pty.), Ltd.
Breecastle House
Bree Street
Cape Town
Tel: 3-6019, 3-6545
Cable: HEWPACK Cape Town
Telex: 5-0006

Hewlett Packard South Africa
(Pty.), Ltd.
641 Ridge Road, Durban
P.O. Box 99
Overport, Natal
Tel: 88-6102
Telex: 567954
Cable: HEWPACK

TAIWAN
Hewlett Packard Taiwan
39 Chung Shiao West Road
Sec. 1
Overseas Insurance
Corp. Bldg. 7th Floor
Taipei
Tel: 389160,1,2, 375121,
Ext. 240-249
Telex: TP824 HEWPACK
Cable: HEWPACK Taipei

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UNIMESA Co., Ltd.
Chongkoinee Building
56 Suriwongse Road
Bangkok
Tel: 37956, 31300, 31307,
37540
Cable: UNIMESA Bangkok

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Uganda Tele-Electric Co., Ltd.
P.O. Box 4449
Kampala
Tel: 57279
Cable: COMCO Kampala

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Saigon
Tel: 20-805, 93398
Cable: PENTRA, SAIGON 242

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Tel: 73793
Cable: ARJAYTEE, Lusaka

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Co-ordination Office for
Mediterranean and Middle
East Operations
Via Marocco, 7
I-00144 Rome-Eur, Italy
Tel: (6) 59 40 29
Cable: HEWPACKIT Rome
Telex: 61514

OTHER AREAS NOT LISTED, CONTACT:
Hewlett-Packard
INTERCONTINENTAL
3200 Hillview Ave.
Palo Alto, California 94304
Tel: (415) 326-7000
(Feb. 71 493-1501)
TWX: 910-373-1267
Cable: HEWPACK Palo Alto
Telex: 034-8300, 034-8493

EUROPE

AUSTRIA
Hewlett-Packard Ges.m.b.H
Handelska 52/3
P.O. Box 7

Hewlett-Packard France
4 Quai des Etroits
F-69321 **Lyon Cedex** 1
Tel: (78) 42 63 45

(West Berlin)
Hewlett-Packard Vertriebs-GmbH
Wilmersdorfer Strasse 113/114
D-1000 **Berlin W.** 12

Hewlett-Packard Italiana S.p.A.
Via Colli, 24
I-10129 **Turin**
Tel: (11) 53 82 64

Hewlett-Packard Española, S.A
Milanesado 21-23
E-**Barcelona** 17
Tel: (3) 203 62 00

UNITED KINGDOM
Hewlett-Packard Ltd.
224 Bath Road
Slough, SL1 4 DS, Bucks

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