SERVICE MANUAL

7910
DISC DRIVE

Manual part no. 07910-90903
Microfiche part no. 07910-90803

Printed: APR 1981

HEWLETT PACKARD

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OPTIONS COVERED

This manual covers option 015 as well as the standard HP 7910 Disc Drive.

The Federal Communications Commission (in 47 CFR 15.805) has specified that the following notice be brought to the attention of the users of this product.

Warning: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio commmunications. As temporarily permitted by regulation it has not been tested for compliance with the limits for Class A computing devices pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

HEWLETT-PACKARD COMPANY
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PREFACE

This manual provides field service information for the Hewlett-Packard 7910 Disc Drive and is intended for use by service-trained personnel. The HP 7910 Disc Drive is a state-of-the-art, mass-memory (12 Mbyte) product and, because of its product design, a modular replacement philosophy has been implemented to minimize on-site repair time. On-site troubleshooting and repair is assured through the use of the information provided in this manual. For disc drive installation instructions, refer to the *HP 7910 Disc Drive Installation Manual,* part no. 07910-90902.

The contents of this manual are organized as follows:

- Section I provides the theory of operation for the disc drive.
- Section II provides the disc controller commands.
- Section III provides troubleshooting information which includes self-test information, an interconnection diagram, and signal distribution lists.
- Section IV provides step-by-step removal and replacement procedures for some of the major field-replaceable assemblies.
- Section V provides listings of all field-replaceable parts and an illustrated parts breakdown for the disc drive.

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SAFETY CONSIDERATIONS

KEEP WITH MANUAL

GENERAL - This product and related documentation must be reviewed for familiarization with safety markings and instructions before operation.

SAFETY SYMBOLS

Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect the product against damage.

Indicates hazardous voltages.

Indicates earth (ground) terminal (sometimes used in manual to indicate circuit common connected to grounded chassis).

WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

CAUTION

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

SAFETY EARTH GROUND - This is a safety class I product and is provided with a protective earthing terminal. An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the product must be made inoperative and be secured against any unintended operation.

BEFORE APPLYING POWER - Verify that the product is configured to match the available main power source per the input power configuration instructions provided in this manual.

If this product is to be energized via an auto-transformer (for voltage reduction) make sure the common terminal is connected to the earth terminal of the main power source.

SERVICING

WARNING

Any servicing, adjustment, maintenance, or repair of this product must be performed only by service-trained personnel.

Adjustments described in this manual may be performed with power supplied to the product while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.

Capacitors inside this product may still be charged even when disconnected from its power source.

To avoid a fire hazard, only fuses with the required current rating and of the specified type (normal blow, time delay, etc.) are to be used for replacement.

THEORY OF OPERATION

SECTION I

1-1. INTRODUCTION

This manual contains service information for the HP 7910H, HR, K, and KR Disc Drives. The 7910H and HR units contain a power supply and are intended for stand-alone table top (H model) or rack mount (HR model) operation. The 7910K and KR units do not include a power supply and are intended for mounting within a system cabinet (K model) or equipment rack (KR model).

The theory of operation for the HP 7910 Disc Drive contained in the following paragraphs provides a basic functional level description of the disc drive for service-trained personnel. This section, along with the other sections in this manual, contains the information necessary to enable a service-trained person to isolate a problem in the drive mechanism, a cable, or one of the replaceable PCA's.

1-2. HEWLETT-PACKARD INTERFACE BUS

The Hewlett-Packard Interface Bus (HP-IB) provides a standardized method to connect and transfer information between separate devices. HP-IB is Hewlett-Packard's implementation of IEEE Standard No. 488, *IEEE Standard Digital Interface for Programmable Instrumentation.*

The HP-IB transfers commands and data between the components of a system on 16 signal lines. The interface functions for each system component are performed within the component so only passive cabling is needed to connect the system. The cables connect all controllers and other devices of the system in parallel to the signal lines.

The eight Data I/O lines (DIO1 through DIO8) are reserved for the transfer of commands, data, and other messages in a byte-serial, bit-parallel manner. See figure 1-1. Data and message transfer is asynchronous, coordinated by the three handshake lines: Data Valid (DAV), Not Ready For Data (NRFD), and Not Data Accepted (NDAC). The other five lines are for management of bus activity.

Information is transmitted on the data lines under sequential control of the three handshake lines (DAV, NRFD and NDAC). No step in the sequence can be initiated until the previous step is completed. Information transfer can proceed as fast as devices can respond, but no faster than allowed by the slowest device presently addressed as active. This permits several devices to receive the same message byte concurrently.

Devices connected to the bus may be talkers, listeners, or controllers (see table 1-1). The controller-in-charge (CIC) dictates the role of each of the other devices by setting the ATN (attention) line true and sending talk or listen addresses on the data lines. Addresses are set into each device at the time of system configuration either by switches built into the device or by jumpers on a PC board. While the ATN line is true, all devices must listen to the data lines. When the ATN line is false, only devices that have been addressed will actively send or receive data. All others ignore the data lines. Several listeners can be active simultaneously but only one talker can be active at a

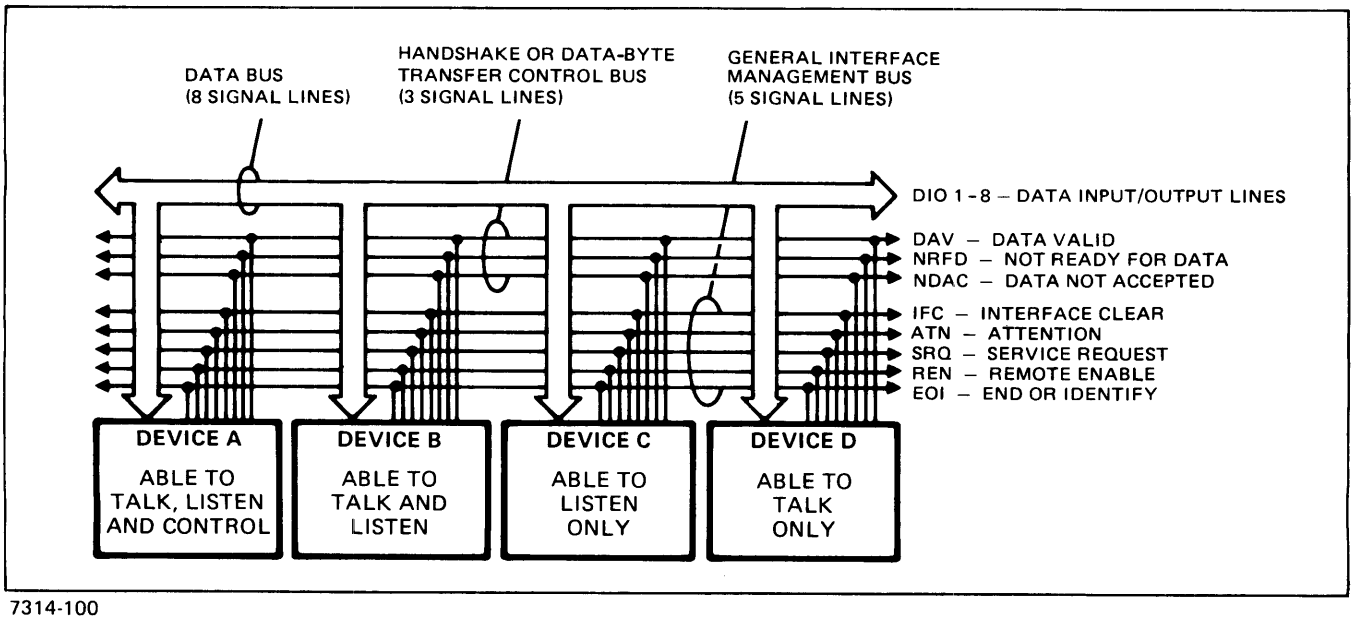

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Figure 1-1. HP-IB Signal Lines

Table 1-1. HP-IB Definitions

HP-IB TERM	DEFINITION	CONSIDERATIONS
TALKER	Any device capable of sending information over the HP-IB.	There can be *only one* TALKER sending information over the HP-IB channel at a time.
LISTENER	Any device capable of receiving information over the HP-IB. Note: Some devices can function as LISTENERS or TALKERS.	In a parallel poll system, there can be up to 8 LISTENERS receiving information over the HP-IB channel at the same time.
CONTROLLER	Any device that has been programmed to manage data flow between the TALKER and the LISTENER(s) in addition to being a TALKER and a LISTENER.	The CONTROLLER manages data flow by addressing one device as a TALKER and one or more devices as a LISTENER. There can be only one active CONTROLLER at any one time on the HP-IB channel. The active CONTROLLER is called the CONTROLLER-IN-CHARGE (CIC).
SYSTEM CONTROLLER	Any device that functions as a controller and is able to gain absolute control of the HP-IB through the use of the Interface Clear (IFC) line.	There can be *only one* SYSTEM CONTROLLER connected to the HP-IB channel.

time. Whenever a talk address is put on the data lines (while ATN is true), all other talkers will be automatically unaddressed.

The IFC (interface clear) line places the interface system in a known quiescent state. The REN (remote enable) line is used to select between two alternate sources of device programming data such as the front panel or the HP-IB. In a serial poll system, any active device can set the SRQ (service request) line true. This indicates to the controller-in-charge that some device on the bus wants attention. The 7910 does not use the SRQ line. The EOI (end or identify) line is used to indicate the end of a multiple-byte transfer sequence. In addition, when a controller-in-charge sets both the ATN and EOI lines true, each device capable of a parallel poll responds on the DIO line assigned to it. The 7910 is a parallel poll response device.

The HP 7910 Disc Drive is a device that can be connected directly to the HP-IB channel. The interface between the disc drive and the HP-IB channel is provided by the disc controller. The disc controller is an integral part of the disc drive and is provided with every HP 7910 Disc Drive.

1-3. POWER-ON SEQUENCE

When power is first applied to the disc drive, the controller PCA initiates self-test. During self-test the disc drive is tested to make sure it functions properly. When operating properly, the disc drive will perform the operations described in the following paragraphs.

As soon as the self-test sequence starts, the disc drive goes off-line from the HP-IB and the eight self-test display LED's will light for approximately two seconds. After the two-second wait, the self-test sequence checks most of the operational aspects of the controller. The microprocessor circuitry on PCA-A2 (see figure 1-2) sends a RUN signal to the interlock circuitry. The interlock circuitry checks the voltages provided from the power supply, the Clock signal from the controller, and for the presence of the RUN signal from the controller; if these interlock conditions are met, a START SPINDLE signal is issued to the spindle drive and speed control circuits on PCA-A4. The spindle drive and speed control circuits apply power to the spindle brake, which releases the spindle. These circuits then apply the proper voltages to the spindle to begin spindle rotation.

As the spindle begins to rotate, the disc also rotates and the heads, which were resting on the surface of the disc, begin to lift off the surface of the disc on a cushion of air. When the spindle reaches the operational speed of 3,000 rpm, a PHASE LOCK signal is generated by the spindle drive and speed control circuits and sent to the interlock circuitry. The interlock circuitry sends a READY signal to the actuator control circuitry on PCA-A4 and to the timing and control circuitry on PCA-A2. The actuator control circuitry unlocks the actuator arm lock (an audible clicking noise is heard) which releases the actuator arms (see figure 1-3), and then the disc drive performs several seek operations. After checking the seek operation, the controller writes a set data pattern on two different tracks on the outside surface of the disc (see figure 1-4) and then reads it back to check for accuracy. When this check is complete, the disc drive goes on-line to the HP-IB and controller

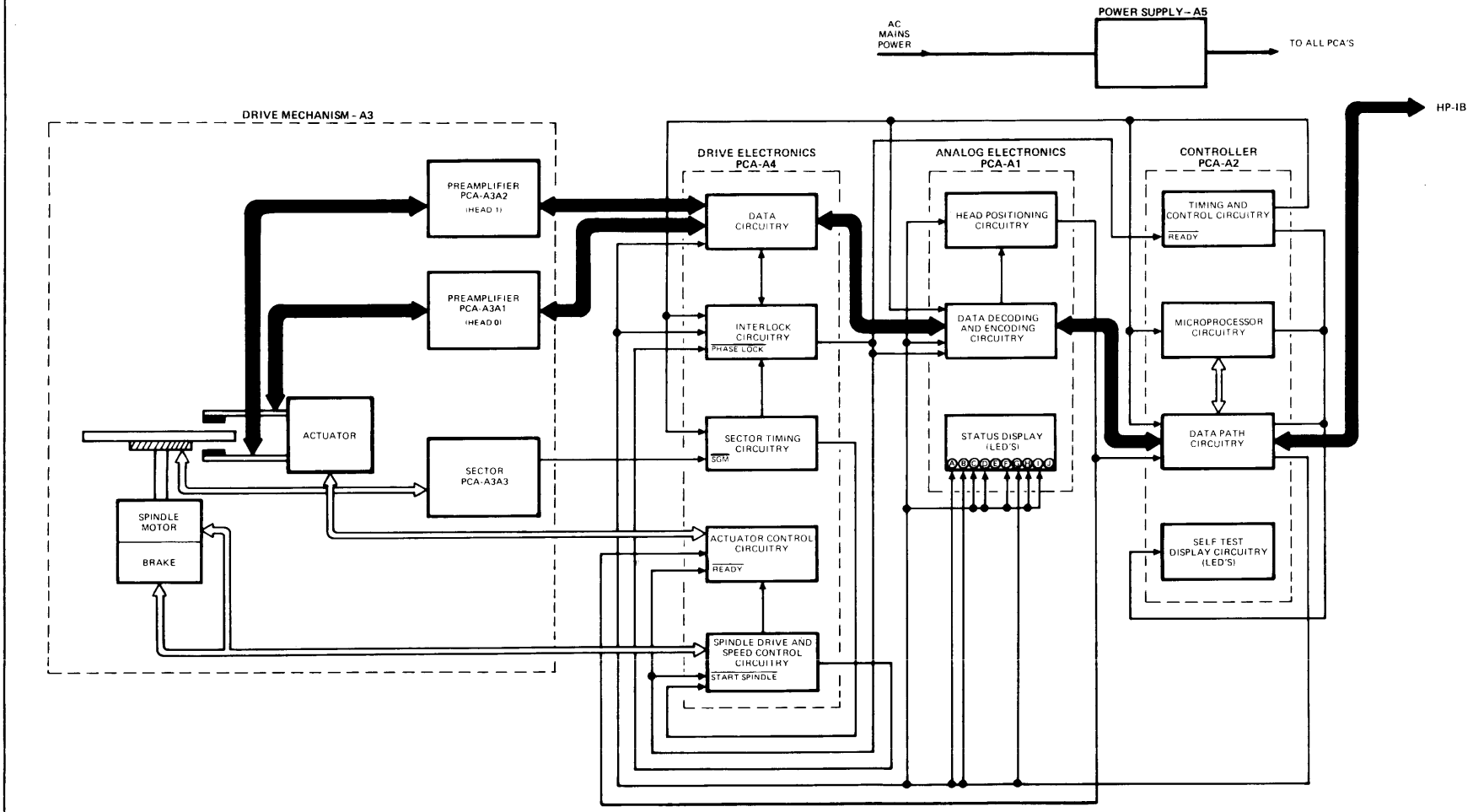

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Figure 1-2. Disc Drive Functional Block Diagram

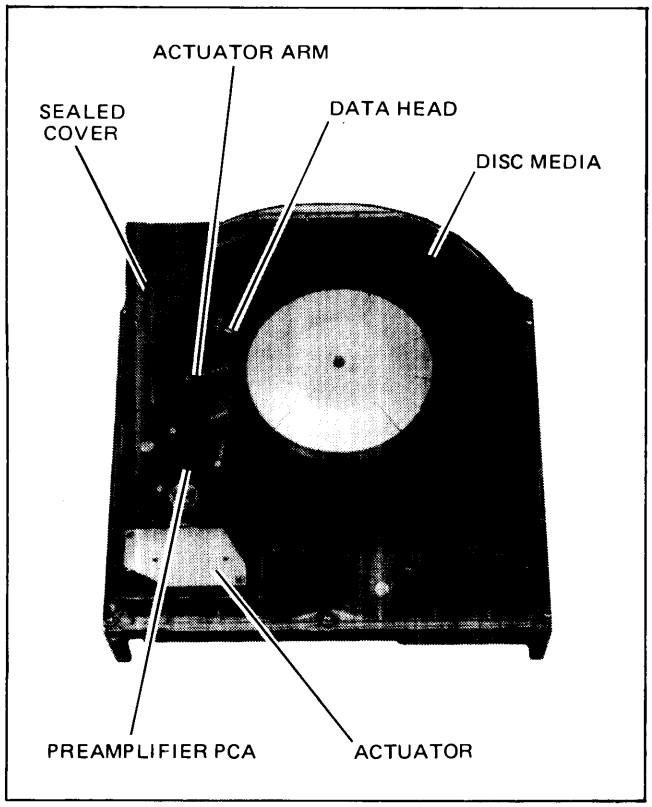

Figure 1-3. Drive Mechanism (Top View)

PCA-A2 signals the CIC that it is ready to accept commands.

At power-on the self-test sequence takes approximately 45 seconds. If self-test is performed after the disc drive is running it takes less than 10 seconds.

1-4. DISC DRIVE OPERATION

The disc drive is in a normal operating mode after power is applied, self-test is passed, and a signal has been sent to the CIC to indicate that the disc drive is operational. The paragraphs which follow describe several operations performed by the disc drive in a normal operating mode and some of the physical characteristics of the disc drive.

1-5. READ/WRITE HEADS

The HP 7910 Disc Drive uses a type of read/write head called a Winchester head. Winchester heads are designed to fly very close (approximately 17 microinches) to the surface of the disc. These heads are also designed to take off and land on the surface of the disc. After the disc begins to rotate, the heads rise above the surface of the disc on a cushion of air and remain above the surface of the disc while the disc is turning. When the disc begins to slow down, the heads land in the landing zone on the surface of the disc. (Refer to paragraph 1-6.)

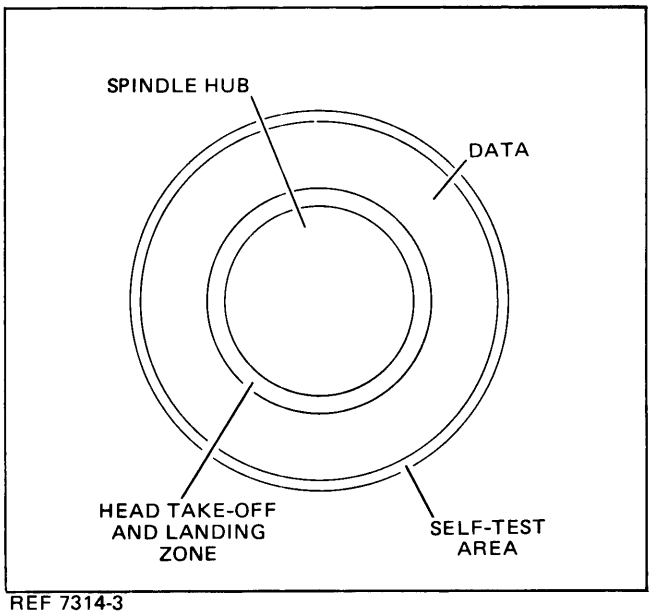

Figure 1-4. Disc Media Head Landing Zone

1-6. DISC MEDIA

The disc media used in the HP 7910 is a single 36-cm (14-in.) diameter disc which has a data surface on each side. Because the heads land and take off from the surface of the disc, the surface is coated with a thin film of oil to reduce wear due to friction. To reduce data errors, the disc (see figure 1-4) is divided into a data zone and a take-off and landing zone. Dividing the disc in this manner means that the head will not contact the data surface, which could cause errors due to head-media contact.

1-7. DISC FORMAT

Figure 1-5 shows the way the disc is formatted at the factory into 748 cylinder positions, with each cylinder consisting of an upper surface track and a lower surface track. The tracks are divided into 32 sectors, with an inter-sector gap between each sector. The sectors store the data and addressing information and the inter-sector gaps contain the data positioning (servo) information.

1-8. INTER-SECTOR GAP. The inter-sector gaps are the spaces between the sectors. (Refer to figure 1-6.) These areas on the disc are recorded at the factory and contain servo information for track following and for track location (track address).

1-9. SECTOR. The smallest addressable data storage area on the surface of the disc is a data sector (see figure 1-7). Accessing a data sector is accomplished when the controller specifies the address of the cylinder, head, and sector. Each data sector contains an 11-word preamble, a 128-word data field, and a 7-word postamble.

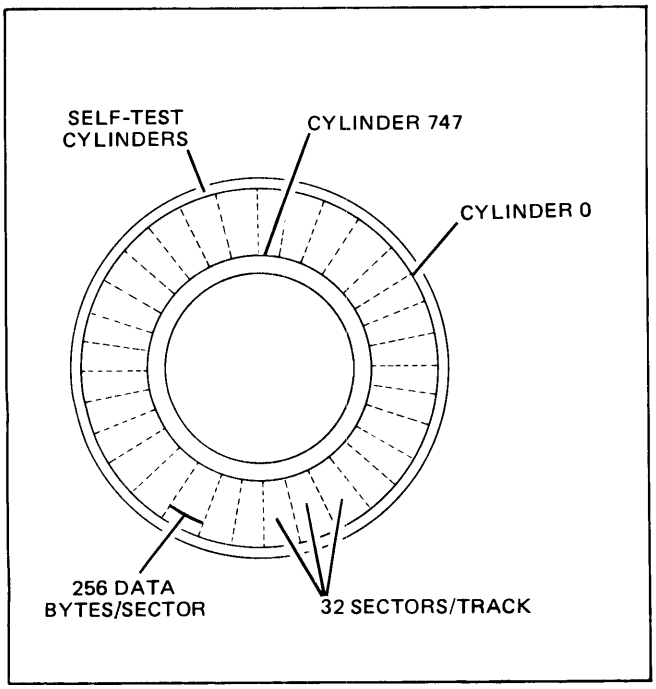

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Figure 1-5. Disc Format

The 11-word preamble is used for synchronization and addressing purposes. It is comprised of an 8-word sync field, a sync word, a cylinder address word, and a word which specifies the head and sector address and provides the spare, protected, and defective track status indicators.

The data field is used to store 128 words (256 bytes) of data. Each word is defined as being 16 bits. The preamble and postamble are generated and checked by the controller.

1-10. SPINDLE MOTOR

The spindle motor used in the HP 7910 Disc Drive is a direct drive dc motor. Hall-effect devices are used to sense the rotation of the spindle. This information is then sent to the spindle drive and speed control circuits on PCA-A4 (see figure 1-2), which use the information at spindle start-up and while the spindle is running.

Spindle motor speed is maintained by phase locked loop circuitry in the spindle drive and speed control circuits on PCA-A4. The signal of the actual spindle motor speed is derived from the sector PCA by the sector timing circuitry on PCA-A4 and sent to the spindle drive and speed control circuitry on PCA-A4. In the spindle drive and speed control circuitry, the actual spindle motor speed is compared to the rated speed of 3,000 rpm and this circuitry speeds up or slows down the spindle motor as needed.

1-11. SPINDLE MOTOR BRAKE

The spindle motor brake is located at the bottom of the spindle motor and is used to stop the disc after the heads have landed on the surface of the disc. The brake prevents prolonged dragging of the heads on the surface of the disc. The braking action begins whenever power is absent from the brake, and the braking action is released when power is applied to the brake.

1-12. ACTUATOR ASSEMBLY

The actuator is used to move the heads to the proper location over the disc. Figure 1-3 shows the actuator assembly in the drive mechanism. The actuator assembly consists of a dc motor and the actuator arms, which hold

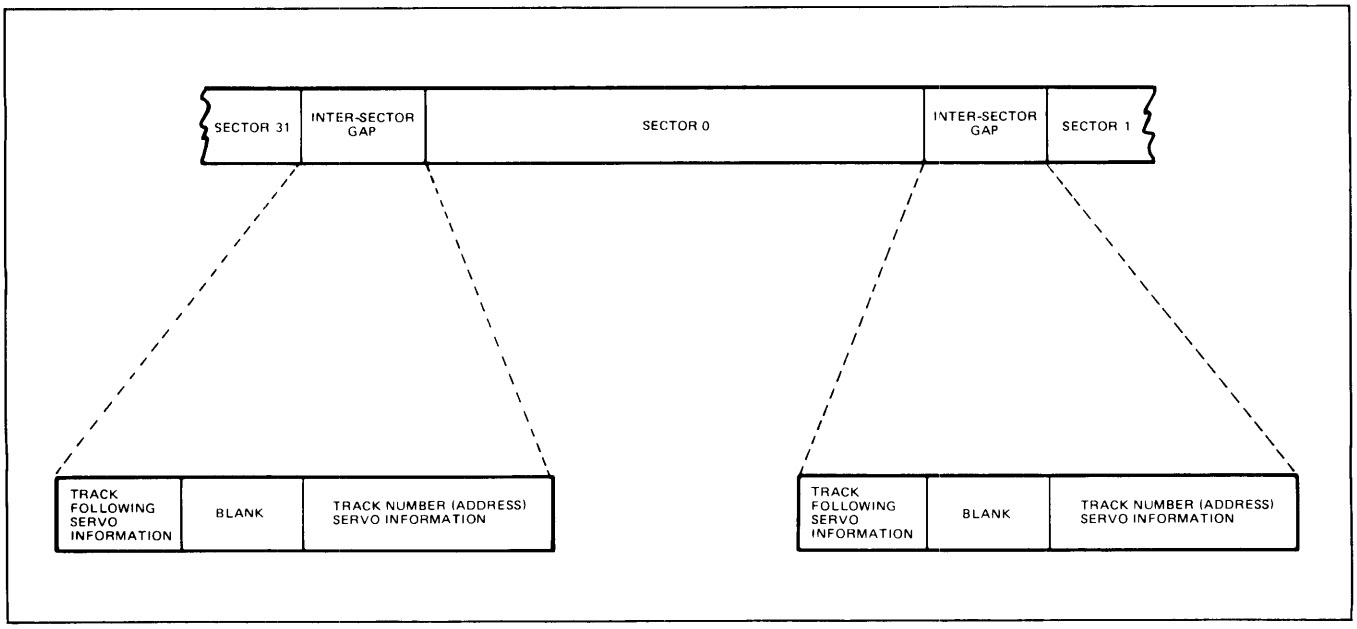

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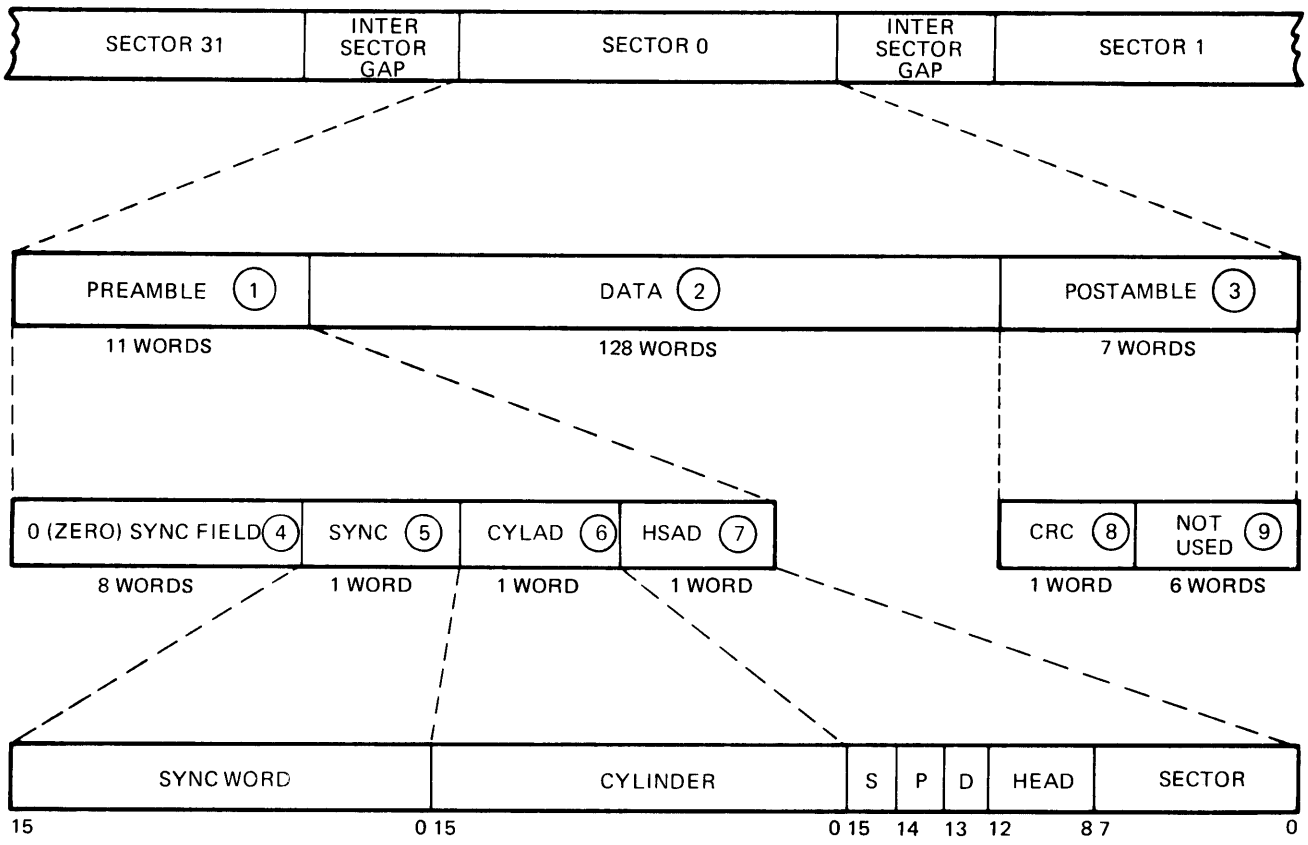
Figure 1-6. Inter-Sector Gap Format



(1) PREAMBLE – 11 WORDS FOR SYNCHRONIZATION AND ADDRESSING (FIRST 8 WORDS ARE USED FOR PHASE LOCKING ONTO THE DATA RATE.)

(2) DATA – 128 WORDS OF DATA

(3) POSTAMBLE – DATA CHECKING

(4) SYNC FIELD – 8 WORDS (128 BITS) OF 0'S

(5) SYNC – SYNC WORD – 100377_8

(6) CYLAD – CYLINDER – CYLINDER ADDRESS (BITS 15-0)

(7) HSAD – S – IF "1", SPARE TRACK IN ACTIVE USE (BIT 15)
P – IF "1", PROTECTED TRACK (BIT 14)
D – IF "1", DEFECTIVE TRACK (BIT 13)
HEAD – HEAD ADDRESS (BITS 12-8)
SECTOR – SECTOR ADDRESS (BITS 7-0)

(8) CRC – CYCLIC REDUNDANCY CHECK – 1 WORD OF CHECK INFORMATION

(9) NOT USED – RESERVED FOR FUTURE USE

7314-6

Figure 1-7. Sector Recording Format

the preamplifier PCA's and the heads. The dc motor in the actuator directly drives the actuator arms. This dc motor performs less than a full revolution to move the actuator arms and the heads across the entire surface of the disc.

1-13. HEAD POSITIONING

The heads are positioned over the track the controller addresses by performing a seek operation to find the track, and then a track following operation to remain on track. The following paragraphs describe the seek and track-following operations.

1-14. SEEK. A seek operation is defined as the movement of the head from one track to another track. The seek operation begins when the CIC requests data from the disc drive. The data path circuitry on PCA-A2 (see figure 1-2) receives the request from the CIC and begins a read operation to determine the present track address of the head.

To read a track address from the inter-sector gap, a signal must be generated to indicate when to decode the information. Underneath the disc media is a metal disc with 32 teeth. Each tooth marks the beginning of an inter-sector gap on the disc media. When the spindle is rotating, these teeth pass through an optical sensor on sector PCA-A3A3. The sector PCA generates a Sector Gap Measurement (SGM) signal every time a tooth passes through the optical sensor, which means at the start of every inter-sector gap. This signal is sent to the sector timing circuitry on PCA-A4 which uses the SGM signal to generate a Start Of Gap (SOG), a Gap Signal (GAP) to signal the presence of the inter-sector gap, and an End Of Gap (EOG) signal. The SOG signal indicates the start of the inter-sector gap. The GAP signal indicates an inter-sector gap is present under the head and the EOG signals the end of the inter-sector gap. These signals are sent to the interlock circuitry on PCA-A4 which sends a signal to the data decoding and encoding circuitry on PCA-A1. When this signal is present, the track address can be decoded from an inter-sector gap.

The microprocessor (controller PCA-A2) takes the present track address and the desired track address and determines, through the use of a stored algorithm, the amount of time required to apply full current to the actuator. This information is sent from the microprocessor to the data path circuitry on PCA-A2, which generates a Seek Control Word (SCW). The SCW is sent to the head positioning circuitry on PCA-A1 which then sends a command to the actuator control circuitry on PCA-A4. The actuator control circuitry applies the correct amount of current to the actuator.

The head positioning circuitry sends information from the SCW to the data circuitry on PCA-A4, which selects the head desired by the microprocessor circuitry on PCA-A2. As the head travels across the tracks of the disc, information from the disc is read and sent back to the microprocessor to give an instantaneous head position in the form of a track address. When the microprocessor determines the head position to be slightly less than halfway between the desired track and the initial head position (track address), the microprocessor on PCA-A2 sends a command to reverse the current through the actuator, which begins a deceleration of the actuator arm. The deceleration of the head is constantly adjusted by comparing the actual head position to a stored algorithm in the microprocessor circuitry on PCA-A2. This algorithm relates where the head is and where it should be and adjusts the reverse current to the actuator so the head will be on track when the seek is over. Once the microprocessor determines that the head is over the desired track, the microprocessor switches to the track following circuitry on analog electronics PCA-A1.

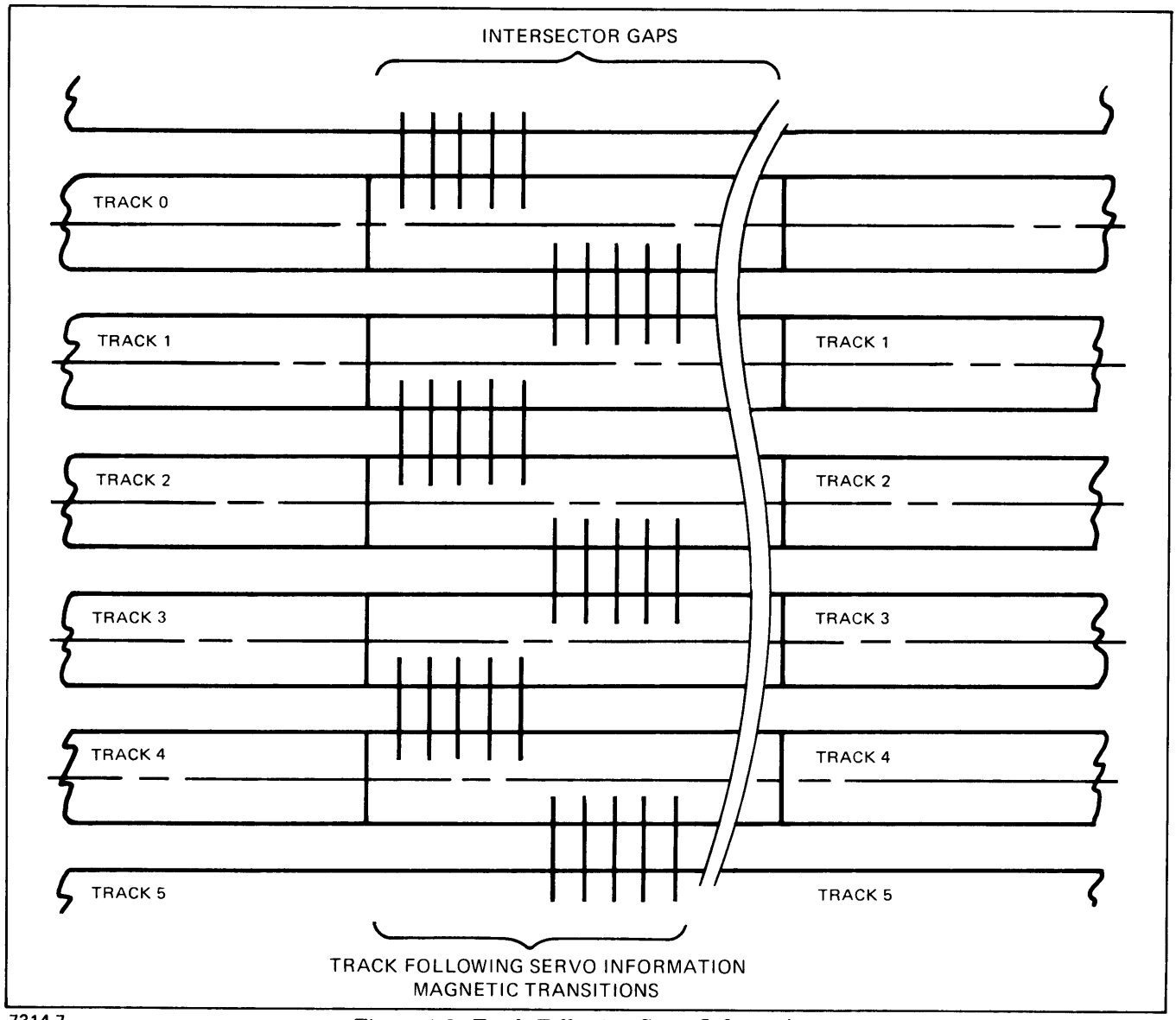
1-15. TRACK FOLLOWING. The seek operation, described in paragraph 1-14, can only position the head to within one-half track width of the center of the track; therefore, the track following circuitry is required to perform the fine position adjustment necessary to move the head directly over the center of the track.

The track following servo information (see figure 1-8) is recorded in the inter-sector gaps as groups of magnetic transitions. The signals are sent to the data decoding and encoding circuitry on PCA-A1 where it is processed to determine the amplitude and position of the signal. The amplitude of the magnetic transitions determines where the head is in relation to the center of the track. This head position information is sent to the head positioning circuitry, which processes the information into an actuator command. This command is sent to the actuator control circuitry on PCA-A4 and these circuits move the heads to the center of the track. When the heads are properly centered over the track, the head positioning circuitry on PCA-A1 sends an On Track (ONTRK) signal to the interlock circuitry on PCA-A4 and through the data path circuitry on PCA-A2 to the microprocessor on PCA-A2. The microprocessor circuitry is now able to enable a read or write data operation.

The track following circuitry is also used when the controller switches from one head to another. Head switching in this manner allows a fast access to the data in the same cylinder on the other side of the disc.

1-16. CYLINDER MODE OF OPERATION

A cylinder of information consists of an upper surface track and a lower surface track of information. (Refer to figure 1-9.) In the cylinder mode of operation, the controller begins by selecting head 0 and seeking to the desired track. After the head is over the center of the track, the controller reads or writes the track of information. When the controller has finished reading or writing the upper surface track, it switches to head 1 and by using the track following circuitry (see paragraph 1-15) the disc drive locates the same track on the lower surface. After the



7314-7

Figure 1-8. Track Following Servo Information

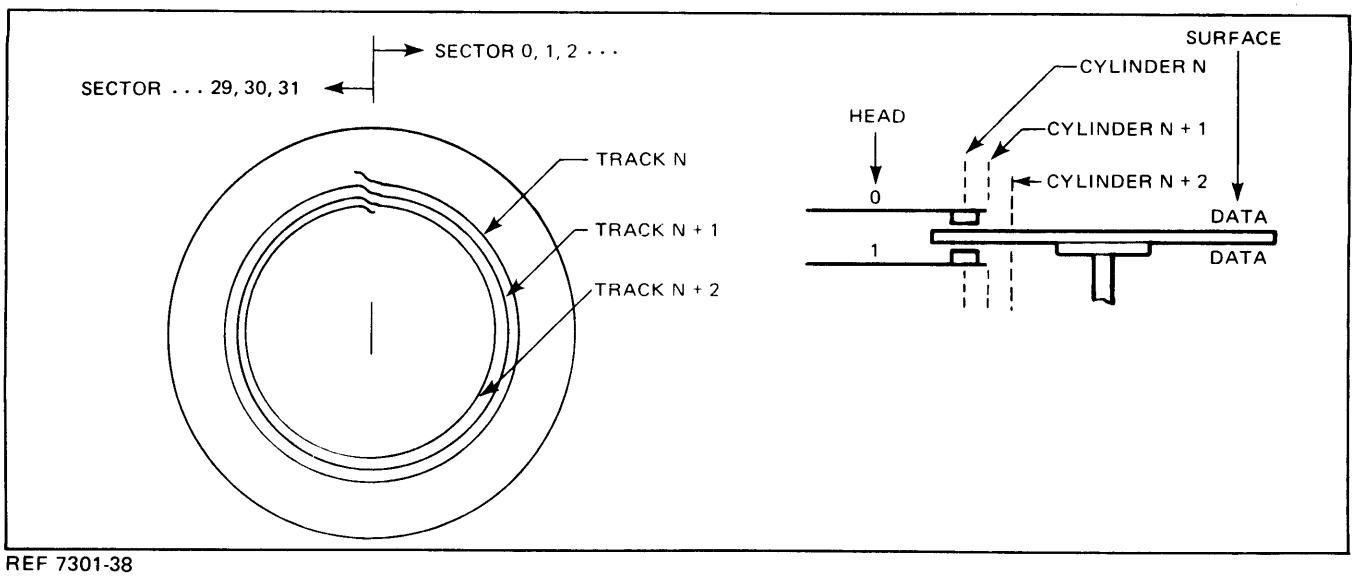


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Figure 1-9. Cylinder Mode of Operation

controller is finished with this lower surface track, it selects head 0 and a seek is performed to the next consecutive upper surface track. This process continues until there is no more data or no more storage space left on the disc.

1-17. DATA TRANSFER

1-18. BUFFERED OPERATION

Buffered operation allows slow-speed data transfers between the CIC and disc drive. During unbuffered operation, data is transferred directly to or from the disc at an average rate of 410 kbytes per second. During buffered operation, data is transferred to or from a storage buffer in the disc controller at the rate determined by the slowest device on the channel (HP-IB). Buffered data transfers are limited to one sector at a time due to the size of the storage buffer.

1-19. DATA DECODING AND ENCODING

The data decoding and encoding circuitry on PCA-A1 combines (encodes, formats) or separates (decodes) the clock signal and the binary data. During a write operation, figure 1-10 shows that the binary data and the clock are combined (encoded) and sent to the disc. During a read operation, figure 1-10 shows that the encoded data from the disc is separated into a clock signal and the binary data.

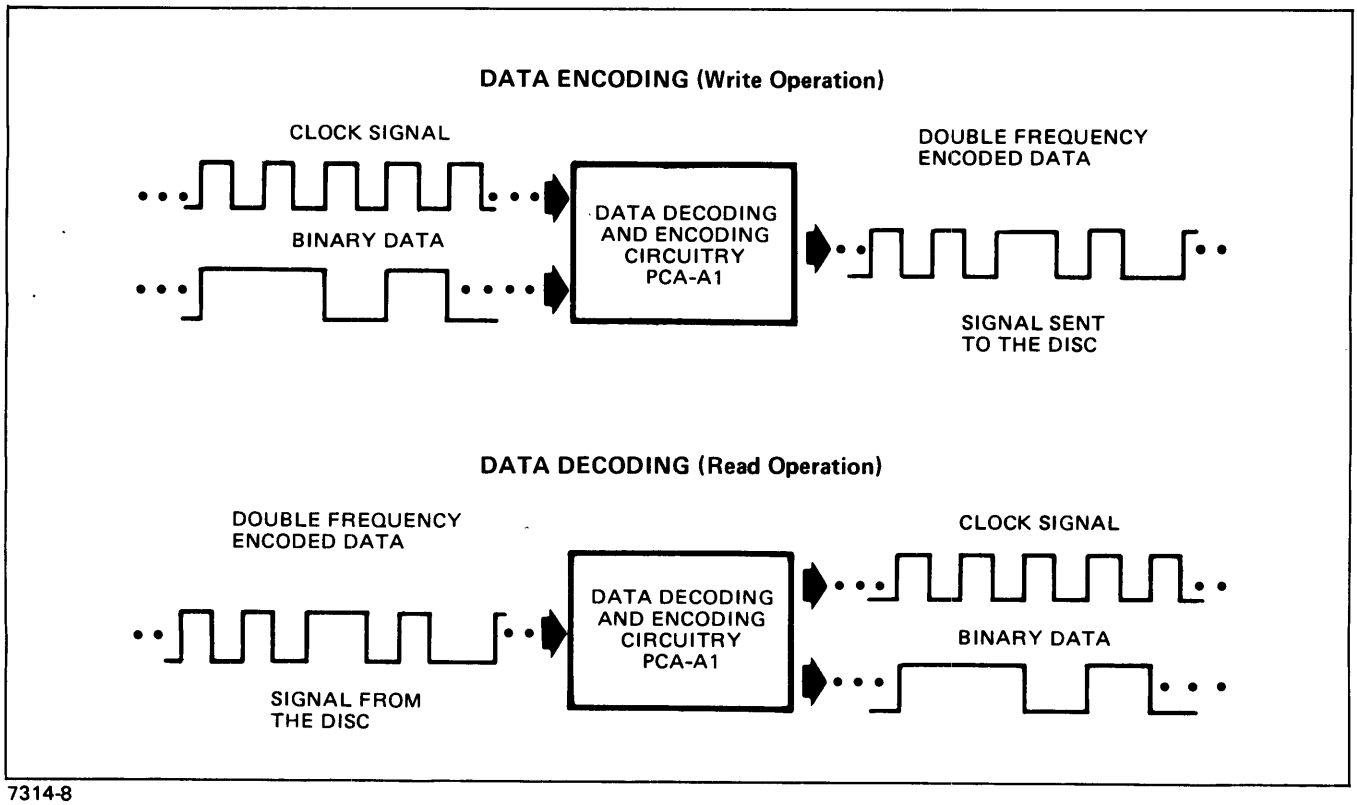
There are several methods to code binary data and a clock signal. The coding method employed in the HP 7910 Disc Drive is the double frequency (bi-phase mark) method. The double frequency method of coding data uses the following rules:

- A transition is made at each bit cell boundary.
- A transition is made in the middle of a bit cell for a logical 1.

Using the rules of double frequency coding, figure 1-11 illustrates three sets of binary data and the resulting double frequency coded signal.

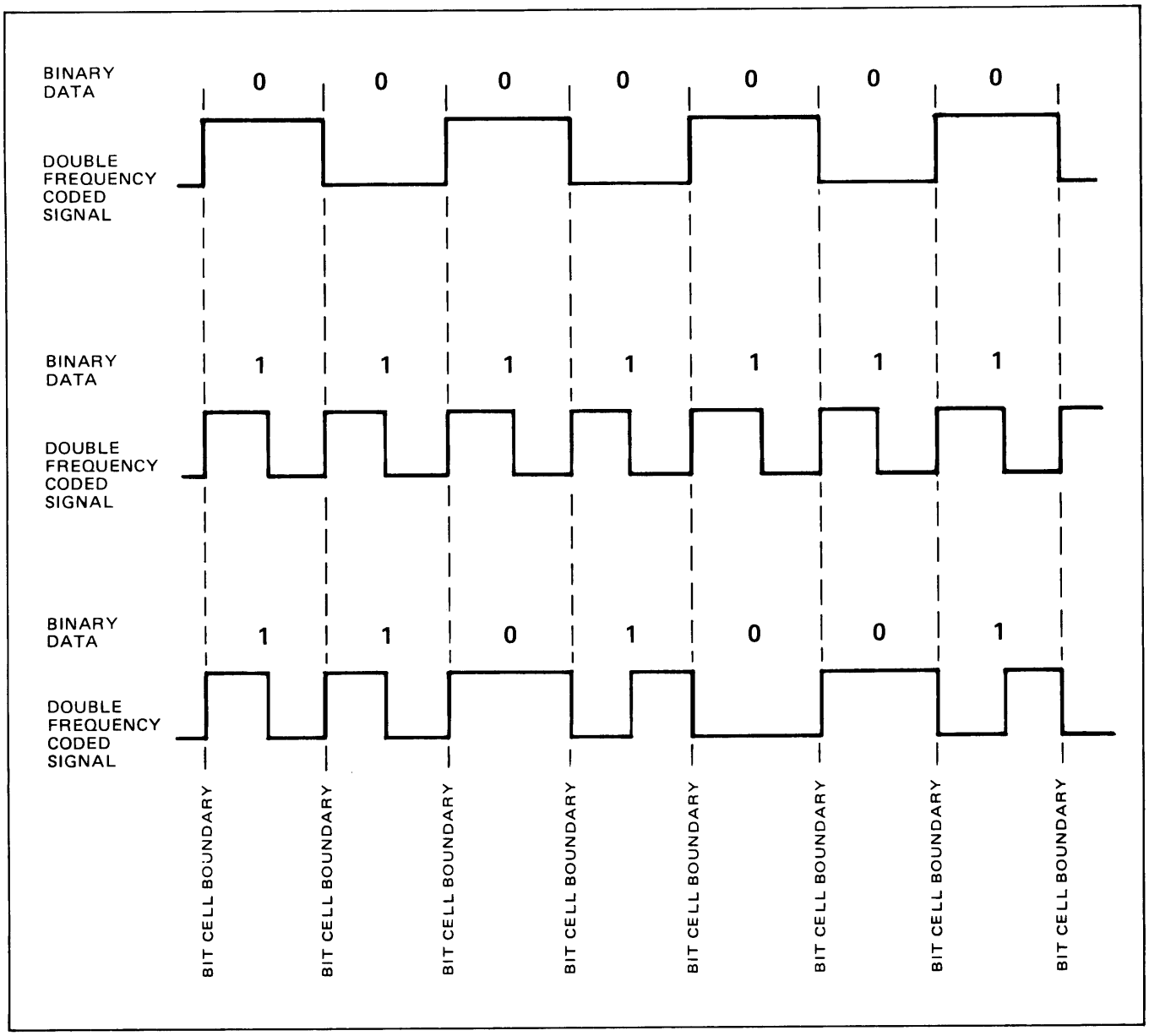
1-20. WRITING DATA

The sequence of events which allows the disc drive to write data, begins with the assertion of a command to write data from the HP-IB to the data path circuitry on PCA-A2 (see figure 1-2). The microprocessor circuitry and the data path circuitry begin a seek operation to move the head over the desired track. (Refer to paragraph 1-14.) After the seek operation is completed, the track following operation is used to position the head over the center of the track. (Refer to paragraph 1-15.) When the interlock circuitry on PCA-A4 verifies that the disc drive is ready, that the head is on track, and that the head is not in an inter-sector gap, a Write Enable (WE) command is sent to the data decoding and encoding circuitry on PCA-A1 and then to the data path circuitry and microprocessor circuitry on



7314-8

Figure 1-10. Data Encoding and Decoding



7314-9

Figure 1-11. Double Frequency Coding

PCA-A2. The microprocessor circuitry enables the start of data transfer through the data path circuitry which notifies the CIC that the disc drive is ready to accept data. The data comes over the HP-IB from the device addressed to talk in a parallel form, one byte at a time, and it is sent to the data decoding and encoding circuitry on PCA-A1 in a serial form, one bit at a time. The data decoding and encoding circuitry on PCA-A1 encodes the data with the Write Clock (WC) signal and sends it to the data circuitry on PCA-A4.

In a normal operation, the heads fly over the data surface of the disc on a cushion of air. When the head is near the outer edge of the disc (track 0) it flies at a greater distance above the surface of the disc than at track 700. This difference in the flying height is adjusted for, during the write operation, by the data circuitry. The data circuitry adjusts the current to the head depending on the track it is over. The encoded data is sent through the selected preamplifier PCA to the head and recorded on the surface of the disc.

1-21. READING DATA

The sequence of events which allows the disc drive to read data begins with the assertion of a command to read data from the CIC to the data path circuitry on PCA-A2 (see figure 1-2). The microprocessor circuitry and the data path circuitry on PCA-A2 begin a seek operation in order to move the head over the desired track. (Refer to paragraph 1-14.) After the seek operation is completed, the track following operation is used to position the head over the center of the track. (Refer to paragraph 1-15.) When the interlock circuitry on PCA-A4 verifies that the disc drive is ready, that the head is on track, and that the head is not in an inter-sector gap, a Read Data (RD) signal is sent

to the data circuitry on PCA-A4. The data circuitry accepts the data from the head preamplifier and multiplexes the output of both preamplifiers. This multiplexed output is then sent through a detector to detect zero crossings of the data signal from the disc. The multiplexed signal and the zero crossing information is sent to the data decoding and encoding circuitry on PCA-A1 for decoding of the disc information into a binary bit stream. The binary bit stream is sent in serial form to the data path circuitry on PCA-A2. The data path circuitry and the microprocessor circuitry shifts the information out in a parallel form one byte at a time over the HP-IB to the device(s) addressed to listen.

1-22. SPARE TRACKS AND ADDRESS VERIFICATION

The disc controller will execute its sparing algorithm at the beginning of all data operations and the VERIFY command, except INITIALIZE, BUFFERED INITIALIZE, READ FULL SECTOR, BUFFERED READ FULL SECTOR, BUFFERED WRITE FULL SECTOR, and WRITE FULL SECTOR. Sparing also occurs whenever any data operation (except the last six previously mentioned) has exceeded the track boundary and the disc controller continues on the next logical track. The sparing algorithm is as follows.

A sector preceding the sector to be transferred (always on the same track) is read by the controller without passing the data over the HP-IB. While it does so, the disc controller saves cylinder, head, and sector addresses as well as the track status bits (S, P, D) written in the sector. When the transfer is complete, a check is made for data errors. If an error occurred the information just read is not reliable, so the disc controller will repeat the process up to a total of 32 sectors until it either finds a good one or runs out of retries (in which case it interrupts the Controller-in-Charge (CIC) with Uncorrectable Data Error status). When the disc controller finds a good sector it checks to see if the D bit is set. If the D bit is set the disc controller checks that the cylinder and head addresses read during the verify are different from those in its target address registers. If there is a difference in the registers, a seek is issued to the cylinder and head read during the verify, and the original sector address; the disc controller then restarts the whole process of sparing. If the addresses read from the disc match those in the disc controller's target address register, the disc controller reports a "Defective Track" status to the CIC.

If the D bit is not set, the disc controller checks that the address written on the disc is the same as the one it was expecting. Normally this case will be true, as will be the case when a valid spare track is reached.

If the addresses do not match, the disc controller checks to see if the S bit was written on the sector and if so, reports an "Illegal Access to Spare Track" error status. If not, the disc controller flags a "Cylinder Miscompare" or "Head-Sector Miscompare" error status.

When no error occurs and the D bit is not set and the addresses compare, the disc controller restores its target sector address, sets S, P, and/or D (from the sector just read) in the status word, and begins the data transfer or sector verification.

1-23. SPARE TRACK ASSIGNMENT

Figure 1-12 illustrates the sparing algorithm. The following paragraphs describe how a spare track is generated.

In the disc controller, spare areas are assigned on a track-for-track basis. Although the spare track need not be on the same surface as the defective track, a systematic procedure must be adhered to by the operating system when assigning and generating the spare track; otherwise, the automatic spare track access algorithm may not work properly.

Briefly, when a defective track is first discovered (via a disc CRC error), the operating system must assign and initialize a spare track and initialize the bad track as defective. If this is done properly, the system can forget about the spare track; subsequent calls to the defective track will cause the disc controller to automatically seek to the spare track whose logical address is that of the defective track.

In initially assigning a spare track to one found defective, the system looks up (in its own table) the next available track for spare assignment. The system then initializes each sector of this track with the disc address of the defective track; in this way sectors of the spare and defective tracks correspond one-for-one. (The detailed steps of how to spare tracks are given in the following procedure.) The S bit (spare bit) is set to 1. Optionally, data may be copied from the defective track to the spare track during the initialization process by reading one sector at a time, ignoring all error status, and then initializing the corresponding sector of the spare track with the data from the defective track.

Following the initialization of the spare track, the system then initializes the defective track with the disc address of the spare track. The D bit (defective bit) of each is set to 1 to prompt the disc controller to initiate sparing. The system then deletes the just-assigned spare track from its table of available tracks and leaves further sparing operations to the disc controller.

The command steps necessary to generate a spare track are:

(1) Seek to the first sector of the track to be flagged defective.

(2) Read the sector, ignoring all error status.

(3) Seek to the same sector of the spare track.

(4) Perform an ADDRESS RECORD command with the defective track address. This command sets disc controller registers to the desired disc address without initiating a SEEK operation.

(5) Perform an INITIALIZE command, transferring the data from the defective sector to the spare sector. Be sure the S bit is set in the initialize command word.

(6) Repeat steps 1 through 5 for each sector of the track.

(7) Seek to the defective track.

(8) Verify one sector. This operation will get the disc controller to any spare track which may exist as the result of a previous spare track generation.

(9) Perform an ADDRESS RECORD command with the cylinder address set to 177777 (octal). This address cannot be accessed during normal operation.

(10) Initialize the entire track without intervening seeks. Make sure the S and D bits are clear.

(11) Seek to the defective track. Do *not* verify, as was done in step 8.

(12) Perform an ADDRESS RECORD command with the spare track address.

(13) Initialize as many sectors at a time as feasible (the data field is irrelevant). Be sure the D bit is set in the initialize command word.

(14) Repeat steps 12 and 13 until the entire track has been initialized defective.

Although it seems that the defective track is being initialized twice (true in most cases), this sequence is required in case a track previously initialized spare fails. This sequence additionally assures that the spare track which failed is given an address that can never be accessed during normal operation. Finally, if data is not being copied to the spare track, the spare track can be initialized spare as many sectors at a time as is feasible, just as steps 12 and 13 were used above to initialize the defective track.

1-24. AIR CIRCULATION AND FILTRATION

The air circulation and filtration system in the HP 7910 Disc Drive consists of two separate systems. Air is circulated in a closed system within the sealed portion of the disc drive mechanism through an absolute filter which traps 99 percent of all contaminants 0.3 micron or larger. The sealed portion of the disc drive mechanism contains a breather valve in the absolute filter to compensate for

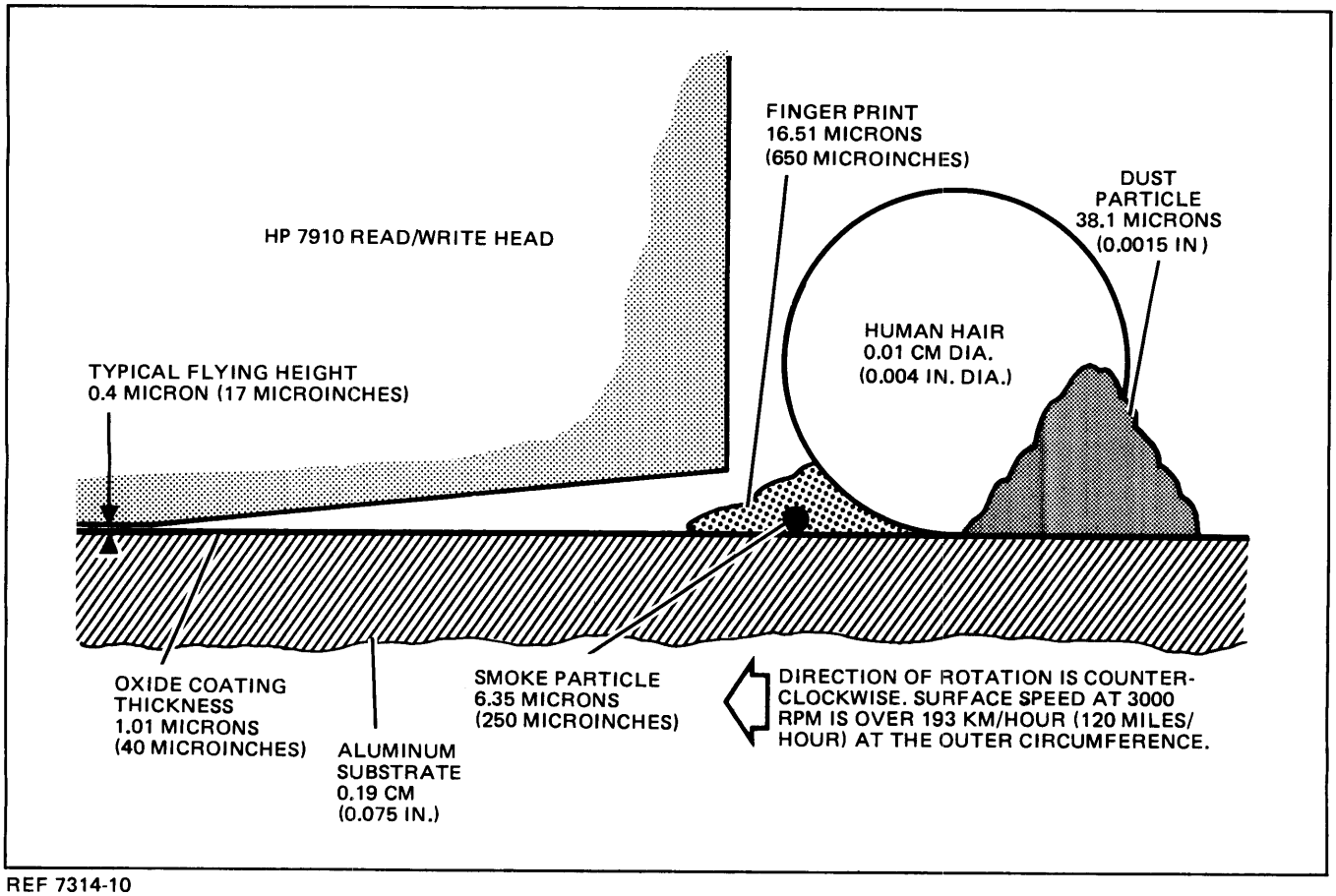


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Figure 1-13. Critical Elements and Contaminants

differences in altitude when operating or storing the disc drive. The second system consists of the cooling air which is cycled over the PCA's by an internal fan.

Figure 1-13 shows the critical elements involved in the read/write process, i.e., the flying height of the heads and the thickness of the oxide coating on the surface of the disc. The flying height is an average value due to surface irregularities of both the heads and the disc. Also, figure 1-13 shows the various types of contaminants and their size relationships. If a particle is hard enough and of the right size, it may scratch either the oxide coating or the head surface. Even if the particle is not hard enough to scratch, it may be large enough to alter the flying characteristics of the head, which could cause data errors.

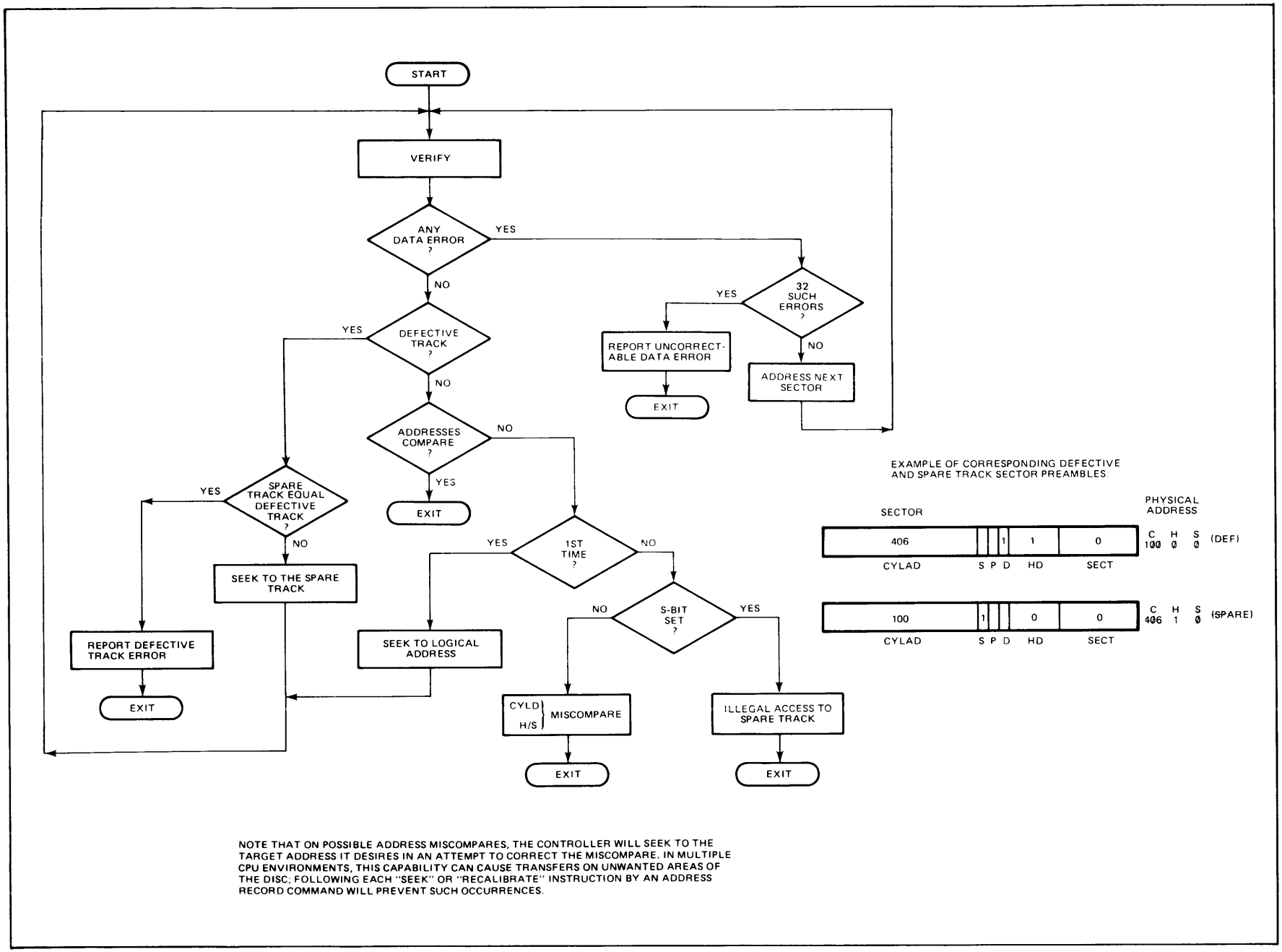
CAUTION

The drive mechanism is purged of contaminants and sealed at the factory to protect it from any outside source of contamination. Therefore, NO attempt should be made to repair the drive mechanism.

1-25. POWER-OFF SEQUENCE

When power is removed from the disc drive, the sequence of events is the same regardless of whether it is due to a power failure or a desired shutdown of the disc drive.

The spindle motor begins to slow down as soon as power is removed from the disc drive. As the spindle motor slows down, the spindle acts as an alternator and produces an ac voltage which is sent to the spindle drive and speed control circuits on PCA-A4 (see figure 1-2). The spindle drive and speed control circuitry rectifies the ac voltage to a dc voltage and sends it to the actuator control circuitry on PCA-A4 and to the spindle motor brake. The actuator control circuitry applies the dc voltage to the actuator to move the heads over the head landing zone (see figure 1-4). When the heads are over the landing zone, the actuator arm lock automatically locks the actuator in place. As the disc slows down, the heads begin landing on the surface of the disc and the voltage produced by the spindle motor rotation is reduced to a point where the spindle motor brake is applied. (Refer to paragraph 1-11). After the spindle motor brake is applied, the heads land on the surface of the disc and the disc stops rotating.



NOTE THAT ON POSSIBLE ADDRESS MISCOMPARES, THE CONTROLLER WILL SEEK TO THE TARGET ADDRESS IT DESIRES IN AN ATTEMPT TO CORRECT THE MISCOMPARE. IN MULTIPLE CPU ENVIRONMENTS, THIS CAPABILITY CAN CAUSE TRANSFERS ON UNWANTED AREAS OF THE DISC; FOLLOWING EACH "SEEK" OR "RECALIBRATE" INSTRUCTION BY AN ADDRESS RECORD COMMAND WILL PREVENT SUCH OCCURRENCES.

Figure 1-12. Basic Sparing Subroutine and Track Addressing

CONTROLLER INSTRUCTION SET

SECTION II

2-1. HP-IB COMMUNICATIONS

This section describes the formats and sequences for the HP-IB commands, messages, and transactions that occur between the Controller-In-Charge (CIC) and 7910 disc drive. The following paragraphs provide explanations of the terms used in this section.

Command — A unit of information transmitted over the channel (HP-IB) relating to a specific operation. Channel commands (usually a single byte) are used to manage operations on the interface channel (HP-IB) itself. Device commands (usually more than one byte) are used to control the operation of a device (such as the 7910) connected to the channel and are contained within the text of a command message.

Universal Command — A channel command that causes all devices on the bus to perform a predetermined interface function. See figure 2-1.

Primary Command — The primary I command is a channel command that begins the message sequence. It contains the command to listen or talk and the address of a particular device. The primary II command terminates the message with an unlisten or untalk command. See figure 2-1.

Secondary Command — The secondary command sets up the action required of the device in the text of the message. See figure 2-1.

Text — The text of the message can be 1 to n bytes depending on the required action. The required action can be to receive further qualifying information or instructions (such as a device command), to receive write data, to send read or status data, or to perform a specific operation such as a CLEAR.

Message — A unique sequence of command and text bytes transmitted over the channel during which the

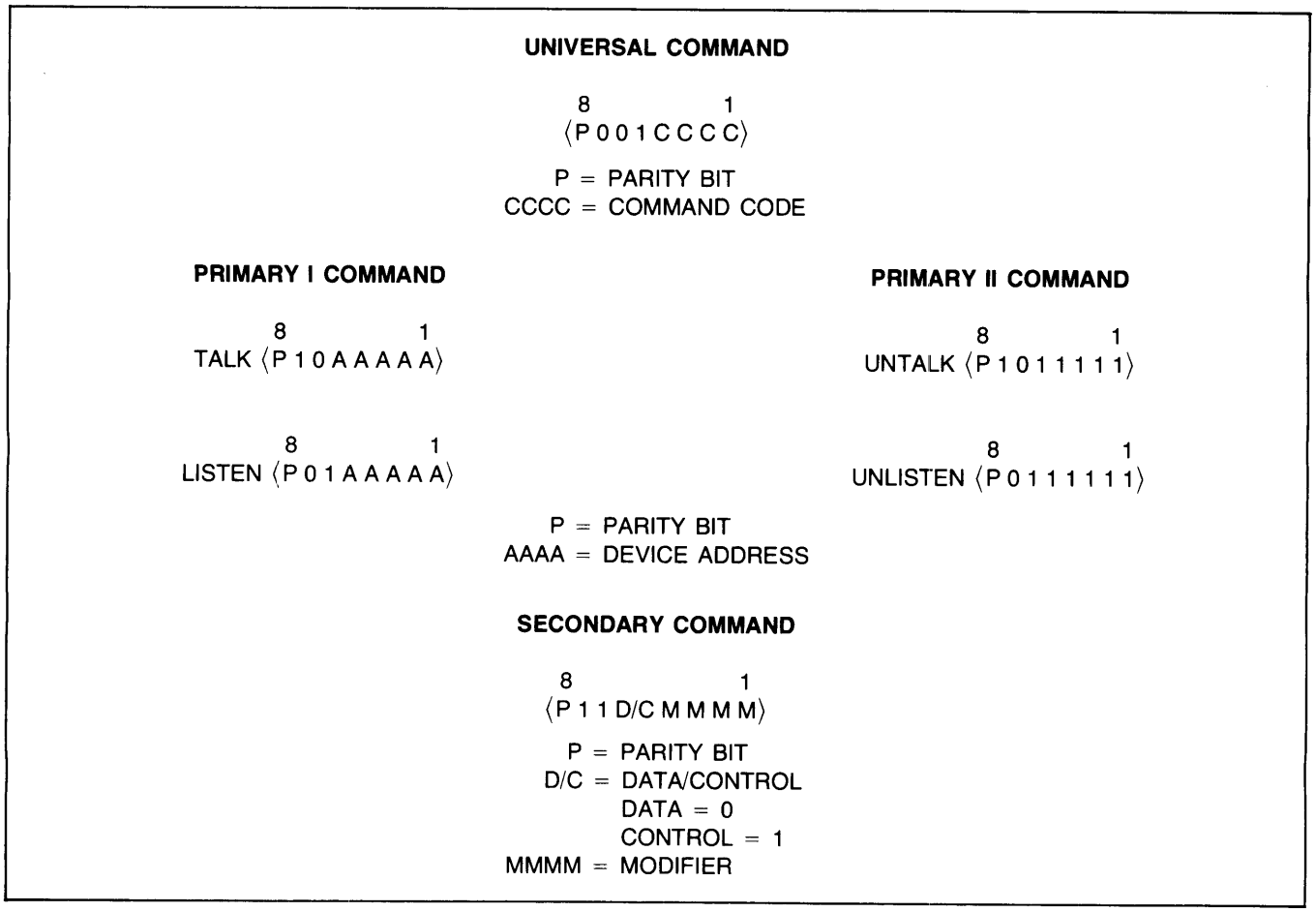


Figure 2-1. Command Byte Formats

communication link between the devices (e.g., CIC and disc drive) remains unbroken.

Command Message — A single message containing all the information required to address a device and initiate an operation, set up a programmable parameter, or set up for an operation that will be executed by an execution message.

Execution Message — A single message containing all the information required to carry out an operation previously set up with a command message.

Transaction — A complete process or operation carried out over the channel. Some transactions are completed with only a command message, and some require both a command message and an execution message.

2-2. CHANNEL MANAGEMENT

The following techniques are used by the CIC to manage the HP-IB: Parallel Poll and Universal Device Clear.

Parallel Poll — The CIC conducts a parallel poll on the HP-IB by asserting ATN and EOI simultaneously. Each peripheral device requiring service can then respond by asserting the DIO line corresponding to its address. The CIC then addresses only the device requiring service. If more than one device requires service, the CIC addresses the unit with the highest priority (lowest address) first. Parallel Poll Enable (PPE) and Parallel Poll Disable (PPD) are internal states of the 7910 controller. PPE occurs when the 7910 requires service from the CIC or is in an inactive state. PPD is the opposite state and occurs whenever the 7910 is active (e.g., busy executing a command). A Parallel Poll Response (PPR) from the 7910 will occur if the CIC asserts both ATN and EOI and if the 7910 is in the PPE state.

Universal Device Clear — A universal command is a channel command that causes all devices on the HP-IB to perform a predetermined interface function. Universal Device Clear clears information stored in the 7910 disc controller and places the disc drive in a known reset state. The Universal Clear command format is as follows:

(ATN)
8 1
⟨P0010100⟩

2-3. MESSAGE FORMAT

Each message contains the following components (see figure 2-2):

— Primary I Command (unidirectional from CIC to device)

— Secondary Command (unidirectional from CIC to device)

— Text (bidirectional)

— Primary II Command (unidirectional from CIC to device)

The CIC asserts ATN during primary and secondary commands to distinguish them from text information. The receiving device decodes the information contained in both the primary I and secondary commands to set up for the action to be specified in the text.

2-4. COMMAND FORMAT

The formats of the primary and secondary commands are shown in figure 2-1. P is an odd parity bit generated by the CIC. The state of bits 6 and 7 determine whether a command is primary, secondary, or universal. In a primary command, bits 1 through 5 are the device address; in a secondary command, bits 1 through 4 are the modifier field which sets up the receiving device for the particular action to be performed and bit 5 is the Data or Control (D/C) bit. A receiving device will only respond to the primary I command containing its specific address, but will respond to several authorized secondary commands. The action to be performed in the receiving device is dependent on the information contained in *both* the primary I and secondary commands. Therefore, a given secondary can follow different primaries. Each unique primary/secondary combination has its own meaning and will cause a unique action to be performed. Table 2-1 shows the

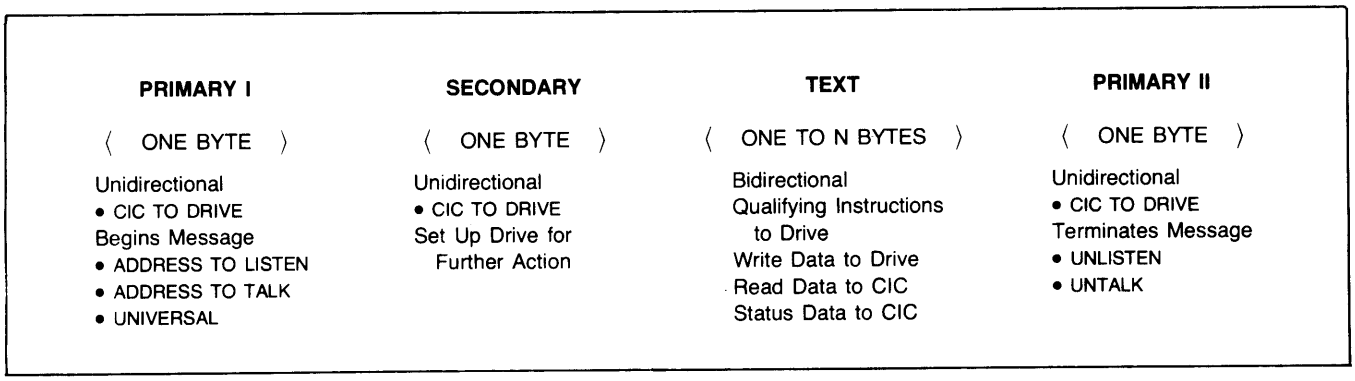


Figure 2-2. Message Format

Table 2-1. 7910 Secondary Command Sequences

SECONDARY COMMAND TITLE	PRIMARY COMMAND TYPE	SECONDARY COMMAND BREAKDOWN				
		P	COM'D FIELD	D/C	MODIFIER FIELD	DESCRIPTION
COMMAND MESSAGE SEQUENCES						
RECEIVE DISC COMMAND	LISTEN	P	1 1	0	1 0 0 0	Precedes unbuffered device command text bytes.
BUFFERED WRITE COMMAND	LISTEN	P	1 1	0	1 0 0 1	Precedes buffered write device command text bytes.
BUFFERED READ COMMAND	LISTEN	P	1 1	0	1 0 1 0	Precedes buffered read device command text bytes.
DEVICE CLEAR	LISTEN	P	1 1	1	0 0 0 0	Precedes clear text bytes.
SEND DEVICE-SPECIFIED-JUMP (DSJ) BYTE	TALK	P	1 1	1	0 0 0 0	Precedes DSJ byte supplied by disc.
INITIATE SELF TEST	LISTEN	P	1 1	1	1 1 1 1	Precedes self-test device command text bytes.
WRITE LOOPBACK DATA	LISTEN	P	1 1	1	1 1 1 0	Precedes loopback text bytes supplied to disc.
EXECUTION MESSAGE SEQUENCES						
RECEIVE WRITE DATA	LISTEN	P	1 1	0	0 0 0 0	Precedes write text bytes supplied to disc.
SEND READ DATA	TALK	P	1 1	0	0 0 0 0	Precedes read text bytes supplied by disc.
SEND DISC STATUS	TALK	P	1 1	0	1 0 0 0	Precedes status text bytes supplied by disc.
READ SELF-TEST RESULTS	TALK	P	1 1	1	1 1 1 1	Precedes self-test results text bytes supplied by disc.
READ LOOPBACK DATA	TALK	P	1 1	1	1 1 1 0	Precedes loopback text bytes supplied by disc.

7910 primary/secondary combinations and provides a brief description of each. The table also indicates whether the primary/secondary sequence is used in a command or execution message.

2-5. TRANSACTION FORMAT

There are four types of transactions that occur between the CIC and 7910 disc drive: 1) Control transactions which establish specific operating functions within the disc controller; 2) Status transactions which report the state of the disc drive or which identify any errors or unusual conditions which may have occurred; 3) Write transactions which transfer data from the CIC to the disc drive; and, 4) Read transactions which transfer data from the disc drive to the CIC. All channel and device commands fall into one of these categories. A summary of the HP-IB transactions that control 7910 operation is shown in table 2-2. The table shows the category and operation codes (in octal) of the device command text bytes in each transaction. The operation code is contained in the text of the command message.

Paragraphs 2-6 through 2-28 are detailed descriptions of each transaction. The following form is used in each transaction description:

Table 2-2. 7910 HP-IB Transaction Summary

TRANSACTION			MESSAGE TYPE	MESSAGE FORMAT			
TITLE	SEE PARA	CATEGORY		PRIMARY I L = LISTEN T = TALK	SECONDARY	TEXT	PRIMARY II
IDENTIFY	2-6	CONTROL	COMMAND	See para 2-6	See para 2-6	2 IDENT bytes supplied by drive	See para 2-6
			EXECUTION	None	None	No execution message required	None
DEVICE CLEAR	2-7	CONTROL	COMMAND	L + ADDRS	DEVICE CLEAR	2 bytes supplied to drive	UNLISTEN
			EXECUTION	None	None	No execution message required	None
SELF TEST	2-8	CONTROL	COMMAND	L + ADDRS	INITIATE SELF TEST	1 byte supplied to drive	UNLISTEN
			EXECUTION	T + ADDRS	READ SELF-TEST RESULTS	1 byte supplied by disc controller	UNTALK
LOOPBACK	2-9	CONTROL	COMMAND	L + ADDRS	WRITE LOOPBACK DATA	1 to 256 bytes supplied to drive	UNLISTEN
			EXECUTION	L + ADDRS	READ LOOPBACK DATA	1 to 256 bytes supplied by drive	UNTALK
SEEK	2-10	CONTROL	COMMAND	L + ADDRS	RECEIVE DISC COMMAND	6 bytes supplied to drive (OP CODE = 02_8)	UNLISTEN
			EXECUTION	None	None	No execution message required	None
ADDRESS RECORD	2-11	CONTROL	COMMAND	L + ADDRS	RECEIVE DISC COMMAND	6 bytes supplied to drive (OP CODE = 14_8)	UNLISTEN
			EXECUTION	None	None	No execution message required	None
END	2-12	CONTROL	COMMAND	L + ADDRS	RECEIVE DISC COMMAND	2 bytes supplied to drive (OP CODE = 25_8)	UNLISTEN
			EXECUTION	None	None	No execution message required	None
DSJ	2-13	STATUS	COMMAND	L + ADDRS	SEND DSJ BYTE	1 byte supplied by drive	UNTALK
			EXECUTION	None	None	No execution message required	None
REQUEST STATUS	2-14	STATUS	COMMAND	L + ADDRS	RECEIVE DISC COMMAND	2 bytes supplied to drive (OP CODE = 03_8)	UNLISTEN
			EXECUTION	T + ADDRS	SEND DISC STATUS	4 bytes supplied by drive	UNTALK
REQUEST DISC ADDRESS	2-15	STATUS	COMMAND	L + ADDRS	RECEIVE DISC COMMAND	2 bytes supplied to drive (OP CODE = 24_8)	UNLISTEN
			EXECUTION	T + ADDRS	SEND DISC STATUS	4 bytes supplied by drive	UNTALK

Table 2-2. 7910 HP-IB Transaction Summary (Continued)

TRANSACTION			MESSAGE TYPE	MESSAGE FORMAT			
TITLE	SEE PARA	CATEGORY		PRIMARY I L = LISTEN T = TALK	SECONDARY	TEXT	PRIMARY II
WRITE	2-16	WRITE	COMMAND	L + ADDRS	RECEIVE DISC COMMAND	2 bytes supplied to drive (OP CODE = 10_8)	UNLISTEN
			EXECUTION	L = ADDRS	RECEIVE WRITE DATA	1 to n bytes supplied to drive	UNLISTEN
BUFFERED WRITE	2-17	WRITE	COMMAND	L + ADDRS	BUFFERED WRITE COMMAND	2 bytes supplied to drive (OP CODE = 10_8)	UNLISTEN
			EXECUTION	L + ADDRS	RECEIVE WRITE DATA	1 to 256 bytes supplied to drive	UNLISTEN
WRITE FULL SECTOR	2-18	WRITE	COMMAND	L + ADDRS	RECEIVE DISC COMMAND	2 bytes supplied to drive (OP CODE = 11_8)	UNLISTEN
			EXECUTION	L + ADDRS	RECEIVE WRITE DATA	276 bytes supplied to drive	UNLISTEN
BUFFERED WRITE FULL SECTOR	2-19	WRITE	COMMAND	L + ADDRS	BUFFERED WRITE COMMAND	2 bytes supplied to drive (OP CODE = 11_8)	UNLISTEN
			EXECUTION	L + ADDRS	RECEIVE WRITE DATA	276 bytes supplied to drive	UNLISTEN
INITIALIZE	2-20	WRITE	COMMAND	L + ADDRS	RECEIVE DISC COMMAND	2 bytes supplied to drive (OP CODE = 13_8)	UNLISTEN
			EXECUTION	L + ADDRS	RECEIVE WRITE DATA	1 to n bytes supplied to drive	UNLISTEN
BUFFERED INITIALIZE	2-21	WRITE	COMMAND	L + ADDRS	BUFFERED WRITE COMMAND	2 bytes supplied to disc (OP CODE = 13_8)	UNLISTEN
			EXECUTION	L + ADDRS	RECEIVE WRITE DATA	1 to 256 bytes supplied to drive	UNLISTEN
COLD LOAD READ	2-22	READ	COMMAND	L + ADDRS	RECEIVE DISC COMMAND	2 bytes supplied to drive (OP CODE = 00_8)	UNLISTEN
			EXECUTION	T + ADDRS	SEND READ DATA	1 to n bytes supplied by drive	UNTALK
BUFFERED COLD LOAD READ	2-23	READ	COMMAND	L + ADDRS	BUFFERED READ COMMAND	2 bytes supplied to drive (OP CODE = 00_8)	UNLISTEN
			EXECUTION	T + ADDRS	SEND READ DATA	1 to 256 bytes supplied by drive	UNTALK

Table 2-2. 7910 HP-IB Transaction Summary (Continued)

TRANSACTION			MESSAGE TYPE	MESSAGE FORMAT			
TITLE	SEE PARA	CATEGORY		PRIMARY I L = LISTEN T = TALK	SECONDARY	TEXT	PRIMARY II
READ	2-24	READ	COMMAND	L + ADDRS	RECEIVE DISC COMMAND	2 bytes supplied to drive (OP CODE = 05_8)	UNLISTEN
			EXECUTION	T + ADDRS	SEND READ DATA	1 to n bytes supplied by drive	UNTALK
BUFFERED READ	2-25	READ	COMMAND	L + ADDRS	BUFFERED READ COMMAND	2 bytes supplied to drive (OP CODE = 05_8)	UNLISTEN
			EXECUTION	T + ADDRS	SEND READ DATA	1 to 256 bytes supplied by drive	UNTALK
READ FULL SECTOR	2-26	READ	COMMAND	L + ADDRS	RECEIVE DISC COMMAND	2 bytes supplied to drive (OP CODE = 06_8)	UNLISTEN
			EXECUTION	T + ADDRS	SEND READ DATA	1 to n bytes supplied by drive	UNTALK
BUFFERED READ FULL SECTOR	2-27	READ	COMMAND	L + ADDRS	BUFFERED READ COMMAND	2 bytes supplied to drive (OP CODE = 06_8)	UNLISTEN
			EXECUTION	T + ADDRS	SEND READ DATA	276 bytes supplied by drive	UNTALK
VERIFY	2-28	READ	COMMAND	L + ADDRS	RECEIVE DISC COMMAND	4 bytes supplied to drive (OP CODE = 07_8)	UNLISTEN
			EXECUTION	None	None	No execution message required	None

Function — A brief description of the operation of the transaction.

Transaction Format — A diagram showing the bit patterns of the primary and secondary commands and text bytes (where applicable), and the presence of ATN, EOI, PPE, and PPD.

Description — A functional description of the transaction.

Special Considerations — An explanation of any special considerations concerning the functional operation of the transaction.

2-6. IDENTIFY

FUNCTION

Returns two bytes by which the CIC recognizes the device as a 7910 disc drive.

TRANSACTION FORMAT

MESSAGE TYPE	MESSAGE FORMAT			
	PRIMARY I	SECONDARY	TEXT	PRIMARY II
COMMAND	UNTALK (ATN) ⟨P1011111⟩	SECONDARY WITH DEVICE ADDRESS (ATN) ⟨P11ADDRS⟩	SUPPLIED BY DRIVE (EOI BY DISC CONTROLLER) ⟨00000000⟩ ⟨00000001⟩ ID BYTE 1 ID BYTE 2	UNADDRESS (ATN) ⟨P1011110⟩
EXECUTION	NONE	NONE	NO EXECUTION MESSAGE REQUIRED	NONE

Note: The unique primary I/secondary command sequence of the IDENTIFY transaction places the 7910 into the Extended Talker (TE) mode. Refer to IEEE Standard No. 488-1978, *IEEE Standard Digital Interface for Programmable Instrumentation.*

DESCRIPTION

The IDENTIFY transaction is used by the CIC at power-on to identify the devices connected to the HP-IB. Each device has its own two-type identity code (0, 1 for the 7910) which the CIC can use to configure itself. The IDENTIFY transaction has no effect on the state of PPE/PPD.

2-7. DEVICE CLEAR

FUNCTION

Resets the 7910 to a known state.

TRANSACTION FORMAT

MESSAGE TYPE	MESSAGE FORMAT			
	PRIMARY I	SECONDARY	TEXT	PRIMARY II
COMMAND	LISTEN (ATN) ⟨P01ADDRS⟩	DEVICE CLEAR ⟨P1110000⟩ (PPD) ←	SUPPLIED TO DRIVE (EOI) (ATN) ⟨00000000⟩ ⟨P0000100⟩ SELECTED DEVICE CLEAR 1 (PPE) ←	(ATN) ⟨P0111111⟩
EXECUTION	NONE	NONE	NO EXECUTION MESSAGE REQUIRED	NONE

1 PPE OCCURS WHEN CLEAR HAS BEEN ACCOMPLISHED.

DESCRIPTION

This transaction clears only the device whose address appears in the primary I command. The information stored in the disc controller is cleared, and the disc drive is placed in a reset state.

2-8. SELF TEST

FUNCTION

The command message initiates the self-test section of the disc controller firmware. The execution message returns the result of the last self test performed by the disc controller.

TRANSACTION FORMAT

	MESSAGE FORMAT			
	PRIMARY I	SECONDARY	TEXT	PRIMARY II
COMMAND	LISTEN (ATN) ⟨P01ADDRS⟩	INITIATE SELF TEST ⟨P1111111⟩ (PPD) ←	SUPPLIED TO DRIVE (EOI) ⟨00000000⟩	UNLISTEN (ATN) ⟨P0111111⟩
EXECUTION	TALK (ATN) ⟨P10ADDRS⟩	READ SELF-TEST RESULTS (ATN) ⟨P1111111⟩ (PPD) ←	SUPPLIED TO DRIVE (EOI BY DISC CONTROLLER) ⟨FTTTT000⟩ SELF-TEST BYTE (PPE) ←	UNTALK (ATN) ⟨P1011111⟩

DESCRIPTION

Self test is described in section III of this manual. If a failure occurs, the controller PCA-A2 LED display indicates the test number (in binary) that failed. If the step number is 12 or less, that step number may be returned to the CIC in the self-test text byte of the execution message. TTTT is the binary representation of the test number which failed, and is a duplicate of LED's F, G, H, and I on the controller PCA-A2 LED display.

2-9. LOOPBACK

FUNCTION

Writes up to 256 data bytes from the device addressed to TALK by the CIC and reads it back to check for errors.

TRANSACTION FORMAT

MESSAGE TYPE	MESSAGE FORMAT			
	PRIMARY I	SECONDARY	TEXT	PRIMARY II
COMMAND	LISTEN (ATN) ⟨P01ADDRS⟩	WRITE LOOPBACK DATA (ATN) ⟨P1111110⟩ (PPD)	SUPPLIED TO DRIVE 1 TO 256 DATA BYTES (EOI) ⟨ ⟩ - - - - - - - - ⟨LAST BYTE⟩ (PPE)	UNLISTEN (ATN) ⟨P0111111⟩
EXECUTION	TALK (ATN) ⟨P10ADDRS⟩	READ LOOPBACK DATA ⟨P1111110⟩ (PPD)	SUPPLIED BY DRIVE 1 TO 256 DATA BYTES (EOI BY DISC CONTROLLER) ⟨ ⟩ - - - - - - - - ⟨LAST BYTE⟩ (PPE)	UNTALK (ATN) ⟨P1011111⟩

DESCRIPTION

This sequence is used to verify that the HP-IB cabling and the read/write buffers are operating correctly.

2-10. SEEK

FUNCTION

Specifies the current cylinder, head, and sector address of the disc drive. Moves the read/write heads to the specified cylinder.

TRANSACTION FORMAT

MESSAGE TYPE	MESSAGE FORMAT			
	PRIMARY I	SECONDARY	TEXT	PRIMARY II
COMMAND	LISTEN (ATN) ⟨P01ADDRS⟩	RECEIVE DISC COMMAND ⟨P1101000⟩ (PPD)	SUPPLIED TO DRIVE ⟨00000010⟩ ⟨00000000⟩ OP CODE = 02_8 ⟨CYLAD, UPPER⟩ ⟨CYLAD, LOWER⟩ (EOI) ⟨000HHHHH⟩ ⟨SECTOR ADDRS⟩ H = HEAD ADDRS △1 (PPE)	(ATN) ⟨P0111111⟩
EXECUTION	NONE	NONE	NO EXECUTION MESSAGE REQUIRED	NONE

△1 PPE OCCURS AFTER COMPLETION OF SEEK AND 9 SECTORS BEFORE TARGET SECTOR. PPE CONTINUES FOR 5 SECTORS, THEN PPD OCCURS UNTIL 9 SECTORS BEFORE TARGET SECTOR. PPE AND PPD WILL TOGGLE UNTIL ANOTHER SECONDARY COMMAND IS RECEIVED.

DESCRIPTION

The SEEK command sets the cylinder, head, and sector address passed by the command bytes into the disc controller address registers. The read/write heads are moved to the specified cylinder. The operation will terminate (parallel poll response enabled) as soon as the heads arrive at the target cylinder.

ERRORS

Refer to the REQUEST STATUS command description (paragraph 2-14) for details of the following possible errors:

- Data error (10).
- I/O program error (12).
- Status-2 error (drive not ready, access not ready, seek check, drive fault) (23).

If a seek check error resulted from an illegal cylinder address, the address is stored in the disc controller but the disc drive will not attempt a seek.

2-11. ADDRESS RECORD

FUNCTION

Specifies the current cylinder, head, and sector address of the disc controller only (not the disc).

TRANSACTION FORMAT

MESSAGE TYPE	MESSAGE FORMAT			
	PRIMARY I	SECONDARY	TEXT	PRIMARY II
COMMAND	LISTEN (ATN) ⟨P01ADDRS⟩	RECEIVE DISC COMMAND (ATN) ⟨P1101000⟩ (PPD)	SUPPLIED TO DRIVE ⟨00001100⟩ ⟨00000000⟩ OP CODE = 14_8 ⟨CYLAD, UPPER⟩ ⟨CYLAD, LOWER⟩ (EOI) ⟨000HHHHH⟩ ⟨SECTOR ADDRS⟩ H = HEAD ADDRS 1 (PPE)	UNLISTEN (ATN) ⟨P0111111⟩
EXECUTION	NONE	NONE	NO EXECUTION MESSAGE REQUIRED	NONE

1 PPE OCCURS AFTER ADDRESS INFORMATION IS STORED IN DISC CONTROLLER TARGET REGISTER.

DESCRIPTION

The ADDRESS RECORD command sets the cylinder, head, and sector address passed in the command bytes into the appropriate disc controller address registers. The disc is not accessed.

This command is primarily used to set the disc controller address registers to a different address than the physical disc address in preparation for initializing a defective or spare track.

ERRORS

Refer to the REQUEST STATUS command description (paragraph 2-14) for details of the following possible errors:

- I/O program error (12).
- Status-2 error (seek check) (23). Only generated if an illegal head and/or sector address is passed in data byte 5 and/or 6. An illegal cylinder address is stored and generates no error.

SPECIAL CONSIDERATIONS

Because an illegal cylinder address is stored in the disc controller, it becomes possible to initialize a track with an illegal track address. Some systems use this feature to flag defective tracks with, for example, a cylinder address of 177777_8, thereby guaranteeing they can never be accessed by any data transfer command which performs address verification. Such a scheme might be useful, for example, in deleting a track previously initialized spare which has later proven defective.

2-12. END

FUNCTION

Signals the end of a related sequence of disc commands or secondary operations.

TRANSACTION FORMAT

MESSAGE TYPE	MESSAGE FORMAT			
	PRIMARY I	SECONDARY	TEXT	PRIMARY II
COMMAND	LISTEN (ATN) ⟨P01ADDRS⟩	RECEIVE DISC COMMAND (ATN ⟨11001000⟩ (PPD) ←	SUPPLIED TO DRIVE (EOI) ⟨00010101⟩ ⟨00000000⟩ △1	UNLISTEN (ATN) ⟨P0111111⟩
EXECUTION	NONE	NONE	NO EXECUTION MESSAGE REQUIRED	NONE

△1 PPE DOES NOT OCCUR FOLLOWING END.

DESCRIPTION

This operation is used to avoid a timeout if no other operation is expected to be sent and the disc controller is waiting for a command. This operation should follow any string of operations once they have been completed. The ENCODED TERMINATION STATUS field (see REQUEST STATUS in paragraph 2-14) will be set to 00 (octal). The DSJ byte will be set to 0.

ERRORS

Refer to the REQUEST STATUS command description (paragraph 2-14) for details of the following possible error:

- I/O program error (12).

2-13. DEVICE-SPECIFIED JUMP (DSJ)

FUNCTION

Sends the DSJ byte to the CIC. The DSJ byte controls the sequence of the CIC program.

TRANSACTION FORMAT

MESSAGE TYPE	MESSAGE FORMAT			
	PRIMARY I	SECONDARY	TEXT	PRIMARY II
COMMAND	TALK (ATN) ⟨P10ADDRS⟩	SEND DSJ BYTE (ATN) ⟨P1110000⟩ (PPD)	SUPPLIED BY DRIVE (EOI BY DISC CONTROLLER ⟨000000SS⟩ S = STATUS BITS ⚠1	UNTALK (ATN) ⟨P1011111⟩
EXECUTION	NONE	NONE	NO EXECUTION MESSAGE REQUIRED	NONE

⚠1 PPE DOES NOT OCCUR FOLLOWING DSJ.

DESCRIPTION

The DSJ byte controls the flow of the HP-IB program. The value of the DSJ byte is added to the current value of the CIC program counter, and HP-IB program execution continues at the new program address. The DSJ byte can range from 0 to 2, defined as follows:

- DSJ byte = 0. Disc command (as opposed to secondary) is complete with no errors detected, or (HARD) CLEAR is completed. For all other control-type secondary sequences, the DSJ byte is the same after the sequence as before.
- DSJ byte = 1. Indicates an error (any error) during execution of a disc command or secondary.
- DSJ byte = 2. Initial DSJ value following power-on or completion of the self-test routines.

SPECIAL CONSIDERATIONS

The DSJ byte should always be tested before issuing a REQUEST STATUS command since normal execution of the command sets the DSJ byte to 0 (no error).

2-14. REQUEST STATUS

FUNCTION

Returns disc controller and disc drive status of the previous operation to the CIC.

TRANSACTION FORMAT

MESSAGE TYPE	MESSAGE FORMAT			
	PRIMARY I	SECONDARY	TEXT	PRIMARY II
COMMAND	LISTEN (ATN) ⟨P01ADDRS⟩	RECEIVE DISC COMMAND (ATN) ⟨P1101000⟩ (PPD)	SUPPLIED TO DRIVE (EOI) ⟨00000011⟩ ⟨00000000⟩ OP CODE = 03_8	UNLISTEN (ATN) ⟨P0111111⟩
EXECUTION	TALK (ATN) ⟨P10ADDRS⟩	SEND DISC STATUS (ATN) ⟨P1101000⟩	SUPPLIED BY DRIVE ⟨SPDSSSSS⟩ ⟨00000000⟩ STATUS 1 SSSSS = ENCODED TERMINATION STATUS ⟨E0000000⟩ ⟨DRIVE STATUS⟩ STATUS 2 E = STATUS 2 ERROR INDICATOR (PPE)	UNTALK (ATN) ⟨P1011111⟩

DESCRIPTION

The REQUEST STATUS command returns the status of the previous command or secondary operation to the CIC. The CIC sends the secondary with data bytes as shown, then follows with another secondary sequence. The disc controller returns two STATUS-1 bytes and two STATUS-2 bytes. The various fields in the status bytes are:

S, P, D. Meaningful only after commands which invoke address verification. Indicates that the final track accessed by the command has been flagged (initialized) spare, protected, or defective, respectively.

The DSJ byte is set to 1 for any of the conditions shown. It should be examined using the DSJ BYTE secondary before the REQUEST STATUS command is executed since execution of the command resets the DSJ byte to 0, unless an error occurs in execution of the command itself. The possible contents of the ENCODED TERMINATION STATUS field (octal) and their meanings are:

00 — **Normal completion.** Indicates one of two conditions:

- Normal completion; no error in the previous command (including the REQUEST STATUS command). The DSJ byte = 0.
- Condition at power-on or following self-test. The DSJ byte = 2.

01 — **Illegal opcode.** Data byte 1 of a secondary sequence contains an opcode (bits 5 – 1) other than one of those shown in table 2-1.

07 — **Cylinder miscompare.** During verification (without data error) of a sector address on a track to which a seek was issued, the contents of the cylinder address field of that sector do not match the contents of controller's target cylinder address. This status is transmitted only after the sequence of events listed below occur. When this status is received, the system should invoke diagnostic procedures.

a. Addresses do not compare as described above.

b. Controller generates at least one more seek to the address in its target cylinder address and target head and sector address register.

c. Controller again attempts to verify a sector.

d. Addresses still do not compare.

2-14. REQUEST STATUS (Continued)

10 — **Data error.** May occur for two reasons:

- The error detection hardware has detected a CRC error while executing a READ, BUFFERED READ, COLD LOAD READ, BUFFERED COLD LOAD READ, or VERIFY command. A REQUEST DISC ADDRESS command will return the address in which the error occurred.
- During address verification it is impossible to read (verify) any sector on the track without a CRC error.

11 — **Head/sector miscompare.** Similar to cylinder miscompare. Generated during address verification when the head or sector address in the disc controller registers fails to match that in the head or sector address field of the disc sector after two comparisons.

12 — **I/O program error.** May occur for two reasons:

- An unknown (unsupported) secondary was received by the disc controller.
- An incorrect HP-IB sequence was detected. For example, during a SEEK command, the disc controller expects to see one secondary, exactly five data bytes not tagged with EOI, and one data byte tagged with EOI, in that order. For a REQUEST STATUS command, the disc controller expects to see (in order) a secondary, two data bytes (the second only tagged with EOI), and a secondary. Any deviation from the expected order of an HP-IB sequence results in this error status.

16 — **Data overrun.** The data rate of the disc controller has exceeded that of the device(s) addressed to listen by the CIC causing data to be lost. The overrun is reported at the end of the sector in which it occurred. The contents of that sector, either on the disc or in the buffer, should be considered invalid. Data transferred during previous sectors is valid. This error is not reported for normal end of read transfers, although such end of transfers are detected via the disc controller overrun hardware. A REQUEST DISC ADDRESS command following a data overrun error will return the address in which the error occurred.

20 — **Illegal access to spare track.** During address verification, an address miscompare (cylinder or head/sector) has occurred and the S bit is set in the sector. This usually indicates a direct seek by the user to a spare track in active use, which is forbidden for all commands which use address verification.

21 — **Defective track.** This status is set, if the D bit is set, but the cylinder and head address of the spare track is the same as that of the defective track. This condition usually results from flagging (initializing) the track defective without assigning a spare track address. The disc controller would loop endlessly searching for a spare track if this condition were not tested.

23 — **Status-2 error (drive status error).** The disc controller is unable to complete a command due to some condition in the disc drive. The drive status byte may be examined for the reason. Status-2 errors are indicated by DRIVE STATUS bits 15, 14, 13, and 11.

26 — **Attempt to write on a protected track.** A WRITE or BUFFERED WRITE command has been attempted on a track which has been flagged protected (P bit set). No writing occurs. The check for P bit is not made for the INITIALIZE, WRITE FULL SECTOR, or BUFFERED WRITE FULL SECTOR command.

37 — **Drive attention.** Generated whenever a normal SEEK command completes (DSJ byte = 0).

DRIVE STATUS. Eight bits which convey various states of the disc drive to the disc controller and to the user:

Bit 15 — Access not ready (drive busy). The heads are not positioned over a valid track center as determined by the disc controller. This could be because of head motion during a seek or data transfer.

Bit 14 — Drive not ready. The heads are unloaded or a drive fault has occurred. Most drive faults also cause the heads to unload.

2-14. REQUEST STATUS (Continued)

Bit 13 — Seek check. May be caused by:

- An illegal cylinder address has been sent to the drive via a SEEK command or during address verification.
- An illegal head and/or sector address has been sent to the disc controller via a SEEK, ADDRESS RECORD, COLD LOAD READ, or BUFFERED COLD LOAD READ command.

Bit 12 — First status. Set when self-test is completed to identify this event to the user. The disc controller makes no use of this bit. The disc controller clears the first status bit after sending it to the CIC.

Bit 11 — Fault. A failure occurrence in the disc drive (e.g., seek not completed).

Bits 10, 9 — Not used.

Bit 8 — Drive Attention. The disc controller will report this status whenever the disc drive requests attention.

Bits 7 – 1 — Not used.

Bit 0 — Indicates a Status-2 error (true if bits 15, 14, 13, or 11 are true).

ERRORS

I/O program error (12). Refer to explanation above.

SPECIAL CONSIDERATIONS

The disc drive always does an automatic incremental seek to next track after reading sector 31 of the current track. A REQUEST STATUS command after a data transfer of sector 31 of a given track can cause the status-1 word to reflect track status (S, P, and D bits) of the new track as well as the status of the last function (the incremental auto-seek).

2-15. REQUEST DISC ADDRESS

FUNCTION

Returns the cylinder, head, and sector address currently stored in the disc controller registers.

TRANSACTION FORMAT

MESSAGE TYPE	MESSAGE FORMAT			
	PRIMARY I	SECONDARY	TEXT	PRIMARY II
COMMAND	LISTEN (ATN) ⟨P01ADDRS⟩	RECEIVE DISC COMMAND (ATN) ⟨P1101000⟩ (PPD)	SUPPLIED TO DRIVE (EOI) ⟨00010100⟩ ⟨00000000⟩ OP CODE = 24_8	UNLISTEN (ATN) ⟨P0111111⟩
EXECUTION	TALK (ATN) ⟨P10ADDRS⟩	SEND DISC STATUS (ATN) ⟨P1101000⟩	SUPPLIED BY DRIVE ⟨CYLINDER ADDRESS⟩ (UPPER BYTE) ⟨CYLINDER ADDRESS⟩ (LOWER BYTE) ⟨000HHHHH⟩ ⟨SECTOR ADDRESS⟩ (H = HEAD ADDRESS) (PPE)	UNLISTEN (ATN) ⟨P1011111⟩

DESCRIPTION

This command returns the cylinder, head, and sector address currently stored in the disc controller registers.

The REQUEST DISC ADDRESS command is mostly used after a multiple sector ends with a data error to find out which sector the error occurred in. The transfer can then be retried, starting with the erroneous sector.

The address in the registers will be that of the sector in error if a transfer ends with a data error, access not ready during data operation, or data overrun. Otherwise it will be that of the next logical sector to be transferred.

ERRORS

Refer to REQUEST STATUS command described in paragraph 2-14 for details of the following possible error:

- I/O program error (12).

2-16. WRITE

FUNCTION

Writes data from the HP-IB talker to the disc.

TRANSACTION FORMAT

MESSAGE TYPE	MESSAGE FORMAT			
	PRIMARY I	SECONDARY	TEXT	PRIMARY II
COMMAND	LISTEN (ATN) ⟨P01ADDRS⟩	RECEIVE DISC COMMAND (ATN) ⟨P1101000⟩ (PPD) ←¦	SUPPLIED TO DRIVE (EOI) ⟨00001000⟩ ⟨00000000⟩ OP CODE = 10_8	UNLISTEN (ATN) ⟨P0111111⟩
EXECUTION	LISTEN (ATN) ⟨P01ADDRS⟩	RECEIVE WRITE DATA (ATN) ⟨P1100000⟩	SUPPLIED TO DRIVE 1 TO N DATA BYTES (EOI) ⟨ ⟩- - - - - - - - ⟨LAST BYTE⟩ (PPE) ←¦	UNLISTEN (ATN) ⟨P0111111⟩

DESCRIPTION

The WRITE command causes the disc controller to write data from the HP-IB talker on the disc. Writing starts at the address currently stored in the disc controller address registers. This address will be one of the following (whichever occurred most recently):

- The cylinder, head, and sector address passed during a SEEK or ADDRESS RECORD command.
- Cylinder 0 and the head and sector addresses passed during a COLD LOAD READ or a BUFFERED COLD LOAD READ command.
- The cylinder, head, and sector address last transferred (if a data error occurred) or the one following the last one transferred without error.

The disc controller supplies the preamble and the postamble. The 256 bytes of the data field of each sector are fetched from the HP-IB talker and written on the disc until an error is detected or until the final data byte (one tagged with EOI) is received. If an error is detected the disc controller will fetch all data bytes until the CIC sends a byte tagged with EOI, but the bytes following the error will not be written on the disc. The CIC should retry the transfer starting with the address returned by the REQUEST DISC ADDRESS command. Data written in previous sectors is not valid. If there is no error and the final data byte is not the final byte of a sector, the disc controller will pad the remaining bytes in an arbitrary pattern.

ERRORS

Refer to the REQUEST STATUS command description in paragraph 2-14 for details of the following possible errors:

- Cylinder miscompare (07).
- Data error (10). (Only during address verification.)
- Head/sector miscompare (11).
- I/O program error (12).
- Data overrun (16).
- Illegal access to spare track (20).
- Defective track (21).
- Status-2 error (drive not ready, drive fault) (23).
- Attempt to write on protected track (26).

2-17. BUFFERED WRITE

FUNCTION

To allow writing of data in a buffered (one sector burst) mode. This command allows the use of the disc drive with a device connected to the HP-IB that has a slow data transfer rate (HP-IB data transfer rate less than 750 kilobytes per second).

TRANSACTION FORMAT

MESSAGE TYPE	MESSAGE FORMAT			
	PRIMARY I	SECONDARY	TEXT	PRIMARY II
COMMAND	LISTEN (ATN) ⟨P01ADDRS⟩	BUFFERED WRITE COMMAND (ATN) ⟨P1101001⟩ (PPD) ←	SUPPLIED TO DRIVE (EOI) ⟨00001000⟩ ⟨00000000⟩ OP CODE = 10_8 (PPE) ←	UNLISTEN (ATN) ⟨P0111111⟩
EXECUTION	LISTEN (ATN) ⟨P01ADDRS⟩	RECEIVE WRITE DATA (ATN) ⟨P1100000⟩	SUPPLIED TO DRIVE 256 DATA BYTES (EOI) ⟨ ⟩ - - - - - - - - ⟨LAST BYTE⟩ △1 (PPE) ←	UNLISTEN (ATN) ⟨P0111111⟩

△1 PPE OCCURS WHEN LAST BYTE IS TRANSFERRED FROM THE BUFFER TO THE DISC.

DESCRIPTION

The BUFFERED WRITE command causes the disc controller to write data from the HP-IB talker on the disc. Writing starts at the address currently stored in the disc controller registers. This address will be one of the following (whichever occurred most recently):

- The cylinder, head, and sector address passed during a SEEK or ADDRESS RECORD command.
- Cylinder 0 and the head and sector addresses passed during a COLD LOAD READ or a BUFFERED COLD LOAD READ command.
- The cylinder, head, and sector address last transferred (if a data error occurred) or the one following the last one transferred without error.

The disc controller supplies the preamble and the postamble. The 256 bytes of the data field of the sector is fetched from the HP-IB talker and placed in a buffer register in the disc controller. The information is written from the buffer register on the disc until an error is detected or until the final data byte (one tagged with EOI) is received. If an error is detected the disc controller will fetch all data bytes until the CIC sends a byte tagged with EOI, but the bytes following the error will not be written on the disc. The CIC should retry the transfer. If there is no error and the final data byte is not the final byte of a sector, the disc controller will pad the remaining bytes in an arbitrary pattern.

ERRORS

Refer to the REQUEST STATUS command description in paragraph 2-14 for details of the following possible errors:

- Cylinder miscompare (07).
- Data error (10). (Only during address verification.)
- Head/sector miscompare (11).
- I/O program error (12).
- Data overrun (16).
- Illegal access to spare track (20).
- Defective track (21).
- Status-2 error (drive not ready, drive fault) (23).
- Attempt to write on protected track (26).

2-17. BUFFERED WRITE (Continued)

SPECIAL CONSIDERATIONS

Because only one sector is transferred, the internal logical address used by the disc controller will be incremented automatically at the end of each BUFFERED WRITE operation if no error is encountered. Therefore, only one SEEK operation need be issued at the beginning of a multiple sector transfer when multiple BUFFERED WRITE operations are being issued to contiguous sectors.

2-18. WRITE FULL SECTOR

FUNCTION

Writes 276 bytes of each sector (preamble less sync field, data field, and postamble) from the HP-IB talker on the disc.

TRANSACTION FORMAT

MESSAGE TYPE	MESSAGE FORMAT			
	PRIMARY I	SECONDARY	TEXT	PRIMARY II
COMMAND	LISTEN (ATN) ⟨P01ADDRS⟩	RECEIVE DISC COMMAND (ATN) ⟨P1101000⟩ (PPD) ←	SUPPLIED TO DRIVE (EOI) ⟨00001001⟩ ⟨00000000⟩ OP CODE = 11_8	UNLISTEN (ATN) ⟨P0111111⟩
EXECUTION	LISTEN (ATN) ⟨P01ADDRS⟩	RECEIVE WRITE DATA (ATN) ⟨P1100000⟩	SUPPLIED TO DRIVE 256 DATA BYTES (EOI) ⟨ ⟩ - - - - - - - - ⟨LAST BYTE⟩ (PPE) ←	UNLISTEN (ATN) ⟨P0111111⟩

DESCRIPTION

The WRITE FULL SECTOR command fetches 276 bytes of each sector (the sync field is always provided by the disc controller) from the HP-IB talker and writes them on the disc. Writing begins at one of the following addresses (whichever occurred most recently):

- The cylinder, head, and sector address passed during a SEEK command.
- The cylinder and head addresses passed during a SEEK command and the sector address passed during an ADDRESS RECORD command.
- Cylinder 0 and the head and sector addresses passed during a COLD LOAD READ or a BUFFERED COLD LOAD READ command.
- The cylinder, head, and sector address last transferred (if a data error occurred) or the one following the last one transferred without error.

Data is fetched from the HP-IB talker and written on the disc until an error is detected or until the final data byte (one tagged with EOI) is received. If an error is detected, the disc controller will fetch all bytes until the CIC sends a byte tagged with EOI, but the bytes following the error will not be written on the disc. The CIC should retry the transfer starting with the address returned by the REQUEST DISC ADDRESS command. Data written in previous sectors is valid. If there is no error and the final data byte is not the final byte of a sector, the disc controller will pad the remaining bytes with an arbitrary pattern.

ERRORS

Refer to the REQUEST STATUS command description in paragraph 2-14 for details of the following possible errors:

- I/O program error (12).
- Status-2 error (drive not ready, drive fault) (23).

SPECIAL CONSIDERATIONS

The WRITE FULL SECTOR and READ FULL SECTOR commands are intended for use by diagnostic programs. The commands must be used with caution since all checks for integrity are off. Address verification is not performed, either at the start of transfer or when switching tracks. This means that disc address and track status checks are omitted and also that no spare track can be accessed through its associated defective track (although it may be accessed directly by seeking to it). Lack of address verification also accounts for the possibility of an I/O program error for a starting address.

2-18. WRITE FULL SECTOR (Continued)

In addition, if WRITE FULL SECTOR causes CRC errors in all 32 sectors of the same track, subsequent seeks plus all other operations will fail. The following precautions will prevent these operational failures: a) when using WRITE FULL SECTOR always put the proper sync word in the proper location, and b) do not cause CRC errors in all sectors of the same track with WRITE FULL SECTOR. Always leave at least one sector with valid CRC data.

Note: The use of a track lost due to an improper WRITE FULL SECTOR command can be recovered with the INITIALIZE command. If the track still has usable data on it, normal initialization will occur. If not, the disc drive will arbitrarily write a new sector 0 without regard to radial sector alignment.

2-19. BUFFERED WRITE FULL SECTOR

FUNCTION

Writes 276 bytes of each sector (preamble less sync field, data field, and postamble) from the HP-IB talker on the disc. This command allows the use of the disc drive with a device connected to the HP-IB that has a slow data transfer rate (HP-IB data transfer rate less than 750 kilobytes per second).

TRANSACTION FORMAT

MESSAGE TYPE	MESSAGE FORMAT			
	PRIMARY I	SECONDARY	TEXT	PRIMARY II
COMMAND	LISTEN (ATN) ⟨P01ADDRS⟩	BUFFERED WRITE COMMAND (ATN) ⟨P1101001⟩ (PPD) ←	SUPPLIED TO DRIVE (EOI) ⟨00001001⟩ ⟨00000000⟩ OP CODE = 11_8 (PPE) ←	UNLISTEN (ATN) ⟨P0111111⟩
EXECUTION	LISTEN (ATN) ⟨P01ADDRS⟩	RECEIVE WRITE DATA (ATN) ⟨P1100000⟩ (PPD) ←	SUPPLIED TO DRIVE 256 DATA BYTES (EOI) ⟨ ⟩ - - - - - - - - ⟨BYTE 256⟩ ⚠1 (PPE) ←	UNLISTEN (ATN) ⟨P0111111⟩

⚠1 PPE OCCURS WHEN LAST BYTE IS TRANSFERRED TO DISC.

DESCRIPTION

The BUFFERED WRITE FULL SECTOR command fetches 276 bytes of the sector (the sync field is always provided by the disc controller) from the HP-IB talker and writes them on the disc. Writing begins at one of the following addresses (whichever occurred most recently):

- The cylinder, head, and sector address passed during a SEEK command.
- The cylinder and head addresses passed during a SEEK command and the sector address passed during an ADDRESS RECORD command.
- Cylinder 0 and the head and sector addresses passed during a COLD LOAD READ or a BUFFERED COLD LOAD READ command.
- The cylinder, head, and sector address last transferred (if a data error occurred) or the one following the last one transferred without error.

Data is fetched from the HP-IB talker and written on the disc until an error is detected or until the final data byte (one tagged with EOI) is received. If an error is detected, the disc controller will fetch all bytes until the CIC sends a byte tagged with EOI, but the bytes following the error will not be written on the disc. The CIC should retry the transfer starting with the address returned by the REQUEST DISC ADDRESS command. Data written in previous sectors is valid. If there is no error and the final data byte is not the final byte of a sector, the disc controller will pad the remaining bytes with an arbitrary pattern.

ERRORS

Refer to the REQUEST STATUS command description in paragraph 2-14 for details of the following possible errors:

- I/O program error (12).
- Status-2 error (drive not ready, drive fault) (23).

SPECIAL CONSIDERATIONS

The BUFFERED WRITE FULL SECTOR and BUFFERED READ FULL SECTOR commands are intended for use by diagnostic programs. The commands must be used with caution since all checks for integrity are off. Address verification is not performed, either at the start of transfer or when switching tracks. This means that disc address

2-19. BUFFERED WRITE FULL SECTOR (Continued)

and track status checks are omitted and also that no spare track can be accessed through its associated defective track (although it may be accessed directly by seeking to it). Lack of address verification also accounts for the possibility of an I/O program error for a starting address.

In addition, if BUFFERED WRITE FULL SECTOR causes CRC errors in all 32 sectors of the same track, subsequent seeks plus all other operations will fail. The following precautions will prevent these operational failures: a) when using BUFFERED WRITE FULL SECTOR always put the proper sync word in the proper location, and b) do not cause CRC errors in all 32 sectors of the same track with BUFFERED WRITE FULL SECTOR. Always leave at least one sector with valid CRC data.

Note: The use of a track lost due to an improper BUFFERED WRITE FULL SECTOR command can be recovered with the BUFFERED INITIALIZE command. If the track still has usable data on it, normal initialization will occur. If not, the disc drive will arbitrarily write a new sector 0 without regard to radial sector alignment.

2-20. INITIALIZE

FUNCTION

Writes data from the HP-IB talker on the disc without checking address or track status on the disc. Sets new address and/or track status on the disc.

TRANSACTION FORMAT

MESSAGE TYPE	MESSAGE FORMAT			
	PRIMARY I	SECONDARY	TEXT	PRIMARY II
COMMAND	LISTEN (ATN) ⟨P01ADDRS⟩	RECEIVE DISC COMMAND (ATN) ⟨P1101000⟩ (PPD) ←	SUPPLIED TO DRIVE (EOI) ⟨SPD01011⟩ ⟨00000000⟩ OP CODE = 13_8	UNLISTEN (ATN) ⟨P0111111⟩
EXECUTION	LISTEN (ATN) ⟨P01ADDRS⟩	RECEIVE WRITE DATA (ATN) ⟨P1100000⟩	SUPPLIED TO DRIVE 1 TO N DATA BYTES (EOI) ⟨ ⟩ - - - - - - - - ⟨LAST BYTE⟩ (PPE) ←	UNLISTEN (ATN) ⟨P1111111⟩

DESCRIPTION

The INITIALIZE command writes data from the HP-IB talker on the disc, similar to the WRITE command, except that the address verification is bypassed, and the user may set the track status bits to be written in the SPD field of the sector. The INITIALIZE command is used to:

- Format or write data to a brand new disc.
- Flag tracks defective (D Bit) or spare (S Bit), and/or protected (P Bit). The S and D Bits are mutually exclusive; the P Bit may exist in any combination.
- Remove a data or address error introduced deliberately with the WRITE FULL SECTOR or the BUFFERED WRITE FULL SECTOR command while running the disc controller under a diagnostic program.

Writing starts at one of the following addresses (whichever occurred most recently):

- The cylinder, head, and sector address passed during a SEEK command.
- The cylinder and head addresses passed during a SEEK command and the sector address passed during an ADDRESS RECORD command.
- Cylinder 0 and the head and sector addresses passed during a COLD LOAD READ or a BUFFERED COLD LOAD READ command.
- The cylinder, head, and sector address last transferred (if a data error occurred) or the one following the last one transferred without error.

The disc controller supplies the preamble and the postamble. The SPD bits passed in secondary data byte 1 are written in the preamble as are the cylinder, head, and sector address currently stored in the disc controller registers. The 256 bytes of the data field of each sector are fetched from the HP-IB talker and written on the disc until an error is detected or until the final data byte (one tagged with EOI) is received. If an error is detected, the disc controller will fetch all data bytes until the CIC sends a byte tagged with EOI, but the bytes following the error will not be written on the disc. The CIC should retry the transfer starting with the address returned by the REQUEST DISC ADDRESS command. Data written in previous sectors is valid. If there is no error and the final data byte is not the final byte of a sector, the disc controller will pad the remaining bytes with an arbitrary pattern.

ERRORS

Refer to the REQUEST STATUS command description in paragraph 2-14 for details of the following possible errors:

2-20. INITIALIZE (Continued)

- I/O program error (12).
- Data overrun (16).
- Status-2 error (drive not ready, drive fault) (23).

SPECIAL CONSIDERATIONS

S, P, and D Bits — Bits 8, 7, and 6 of the secondary, data byte 1, are used to flag the track spare, protected, and/or defective, respectively. The S and D Bits are mutually exclusive; the P Bit may be used in any combination. Whichever combination of S, P, and D Bits are chosen, the same combination MUST be placed in all sectors of a given track or address verification may not work properly.

Note: If improper use of WRITE FULL SECTOR (normal or buffered) has caused a track to be lost, the INITIALIZE command (normal or buffered) will cause the disc drive to arbitrarily write a new sector 0 on that track without regard for radial sector alignment. See SPECIAL CONSIDERATIONS in paragraphs 2-18 and 2-19.

2-21. BUFFERED INITIALIZE

FUNCTION

Writes data from the HP-IB talker on the disc without checking address or track status on the disc. Sets new address and/or track status on the disc. This command allows the use of the disc drive with a device connected to the HP-IB that has a slow data transfer rate (HP-IB data transfer rate less than 750 kilobytes per second).

TRANSACTION FORMAT

MESSAGE TYPE	MESSAGE FORMAT			
	PRIMARY I	SECONDARY	TEXT	PRIMARY II
COMMAND	LISTEN (ATN) ⟨P01ADDRS⟩	BUFFERED WRITE COMMAND (ATN) ⟨P1101001⟩ (PPD) ←	SUPPLIED TO DRIVE (EOI) ⟨SPD01011⟩ ⟨00000000⟩ OP CODE = 13_8 (PPE) ←	UNLISTEN (ATN) ⟨P0111111⟩
EXECUTION	LISTEN (ATN) ⟨P01ADDRS⟩	RECEIVE WRITE DATA (ATN) ⟨P1100000⟩ (PPD) ←	SUPPLIED BY DRIVE 256 DATA BYTES (EOI) ⟨ ⟩- - - - - - - - ⟨LAST BYTE⟩ △1 (PPE) ←	UNLISTEN (ATN) ⟨P0111111⟩

△1 PPE OCCURS WHEN LAST BYTE IS TRANSFERRED FROM THE BUFFER TO THE DISC.

DESCRIPTION

The BUFFERED INITIALIZE command writes data from the HP-IB talker on the disc, similar to the WRITE command, except that the address verification is bypassed, and the user may set the track status bits to be written in the SPD field of the sector. The BUFFERED INITIALIZE command is used to:

- Format or write data to a brand new disc.
- Flag tracks defective (D Bit) or spare (S Bit), and/or protected (P Bit). The S and D Bits are mutually exclusive; the P Bit may exist in any combination.
- Remove a data or address error introduced deliberately with the WRITE FULL SECTOR or the BUFFERED WRITE FULL SECTOR command while running the disc controller under a diagnostic program.

Writing starts at one of the following addresses (whichever occurred most recently):

- The cylinder, head, and sector address passed during a SEEK command.
- The cylinder and head addresses passed during a SEEK command and the sector address passed during an ADDRESS RECORD command.
- Cylinder 0 and the head and sector addresses passed during a COLD LOAD READ or a BUFFERED COLD LOAD READ command.
- The cylinder, head, and sector address last transferred (if a data error occurred) or the one following the last one transferred without error.

The disc controller supplies the preamble and the postamble. The SPD bits passed in secondary data byte 1 are written in the preamble as are the cylinder, head, and sector address currently stored in the disc controller registers. The 256 bytes of the data field of each sector are fetched from the HP-IB talker and written on the disc until an error is detected or until the final data byte (one tagged with EOI) is received. If an error is detected, the disc controller will fetch all data bytes until the CIC sends a byte tagged with EOI, but the bytes following the error will not be written on the disc. The CIC should retry the transfer starting with the address returned by the REQUEST DISC ADDRESS command. Data written in previous sectors is valid. If there is no error and the final data byte is not the final byte of a sector, the disc controller will pad the remaining bytes with an arbitrary pattern.

2-21. BUFFERED INITIALIZE (Continued)

ERRORS

Refer to the REQUEST STATUS command description in paragraph 2-14 for details of the following possible errors:

- I/O program error (12).
- Data overrun (16).
- Status-2 error (drive not ready, drive fault) (23).

SPECIAL CONSIDERATIONS

S, P, and D Bits — Bits 8, 7, and 6 of the secondary, data byte 1, are used to flag the track spare, protected, and/or defective, respectively. The S and D Bits are mutually exclusive; the P Bit may be used in any combination. Whichever combination of S, P, and D Bits are chosen, the same combination MUST be placed in all sectors of a given track or address verification may not work properly.

Note: If improper use of WRITE FULL SECTOR (normal or buffered) has caused a track to be lost, the INITIALIZE (normal or buffered) command will cause the disc drive to arbitrarily write a new sector 0 on that track without regard to radial sector alignment. See SPECIAL CONSIDERATIONS in paragraphs 2-18 and 2-19.

2-22. COLD LOAD READ

FUNCTION

Provides an easy seek-read command for system bootstrap operations.

TRANSACTION FORMAT

MESSAGE TYPE	MESSAGE FORMAT			
	PRIMARY I	SECONDARY	TEXT	PRIMARY II
COMMAND	LISTEN (ATN) ⟨P01ADDRS⟩	RECEIVE DISC COMMAND (ATN) ⟨P1101000⟩ (PPD) ←	SUPPLIED TO DRIVE (EOI) ⟨00000000⟩ ⟨HHSSSSSS⟩ OP CODE = 00_8 H = HEAD S = SECTOR	UNLISTEN (ATN) ⟨P0111111⟩
EXECUTION	TALK ⟨P10ADDRS⟩	SEND READ DATA ⟨P1100000⟩	SUPPLIED BY DRIVE 1 TO N DATA BYTES ⟨ ⟩ - - - - - - - - ⟨LAST BYTE △1 ⟩	UNTALK (ATN) ⟨P1011111⟩ △2 (PPE) ←

△1 BYTE TRANSFER ACROSS HP-IB TERMINATES WITH ATN AND UNTALK.

△2 PPE OCCURS WHEN END OF CURRENT SECTOR PASSES UNDER HEAD.

DESCRIPTION

The COLD LOAD READ command automatically seeks to cylinder 0 and the head and sector passed in the secondary, data byte 2. Automatic incremental/decremental seeks at the end of logical cylinder are disabled. The disc controller then reads the 256 bytes of the data field from each sector until an error is detected or the disc controller is untalked by the CIC.

ERRORS

Refer to the REQUEST STATUS command description in paragraph 2-14 for details of the following possible errors:

- Cylinder miscompare (07).
- Data error (10).
- Head/sector miscompare (11).
- I/O program error (12).
- Data overrun (16).
- Illegal access to spare track (20).
- Defective track (21).
- Status-2 error (drive not ready, seek check, drive fault) (23).

SPECIAL CONSIDERATIONS

The disc drive always does an incremental seek to the next track after reading sector 31 of the previous track. This means that even after the last track of data has been read from the disc, the disc drive will still seek to the next track. An error message will be generated if this next track is a defective track without a specified spare location or a spare track (illegally accessed). To avoid generating this error message at the end of a transfer, the disc drive should be UNTALKED less than 100 milliseconds after the last sector of information is sent over the HP-IB.

2-23. BUFFERED COLD LOAD READ

FUNCTION

Provides an easy seek-read command for system bootstrap operations. This command allows the use of the disc drive with a device connected to the HP-IB that has a slow data transfer rate (HP-IB data transfer rate less than 750 kilobytes per second).

TRANSACTION FORMAT

MESSAGE TYPE	MESSAGE FORMAT			
	PRIMARY I	SECONDARY	TEXT	PRIMARY II
COMMAND	LISTEN (ATN) ⟨P01ADDRS⟩	BUFFERED READ COMMAND (ATN) ⟨P1101010⟩ (PPD) ←	SUPPLIED TO DRIVE (EOI) ⟨00000000⟩ ⟨HHSSSSSS⟩ OP CODE = 00_8 H = HEAD S = SECTOR	UNLISTEN (ATN) ⟨P0111111⟩
EXECUTION	TALK (ATN) ⟨P10ADDRS⟩	SEND READ DATA (ATN) ⟨P1100000⟩	SUPPLIED BY DRIVE 256 DATA BYTES ⟨ ⟩ - - - - - - - - ⟨LAST BYTE⟩ △1 (PPE) ←	UNTALK (ATN) ⟨P1011111⟩

△1 PPE OCCURS AFTER ONE FULL SECTOR OF DATA HAS BEEN TRANSFERRED FROM THE DISC TO THE BUFFER.

DESCRIPTION

The BUFFERED COLD LOAD READ command automatically seeks to cylinder 0 and the head and sector passed in the secondary, data byte 2. Automatic incremental/decremental seeks at the end of logical cylinder are disabled. The disc controller then reads the 256 bytes of the data field from the sector unless an error is detected.

ERRORS

Refer to the REQUEST STATUS command description in paragraph 2-14 for details of the following possible errors:

- Cylinder miscompare (07).
- Data error (10).
- Head/sector miscompare (11).
- I/O program error (12).
- Data overrun (16).
- Illegal access to spare track (20).
- Defective track (21).
- Status-2 error (drive not ready, seek check, drive fault) (23).

SPECIAL CONSIDERATIONS

The BUFFERED COLD LOAD READ command reads only one sector of data.

2-24. READ

FUNCTION

Reads data from the disc to the HP-IB.

TRANSACTION FORMAT

MESSAGE TYPE	MESSAGE FORMAT			
	PRIMARY I	SECONDARY	TEXT	PRIMARY II
COMMAND	LISTEN (ATN) ⟨P01ADDRS⟩	RECEIVE DISC COMMAND (ATN) ⟨P1101000⟩ (PPD) ←	SUPPLIED TO DRIVE (EOI) ⟨00000101⟩ ⟨00000000⟩ OP CODE = 05_8	UNLISTEN (ATN) ⟨P0111111⟩
EXECUTION	TALK (ATN) ⟨P10ADDRS⟩	SEND READ DATA (ATN) ⟨P1100000⟩ (PPD) ←	SUPPLIED BY DRIVE 1 TO N DATA BYTES ⟨ ⟩ - - - - - - - - ⟨LAST BYTE △1 ⟩	UNTALK (ATN) P1011111 △2 (PPE) ←

△1 BYTE TRANSFER ACROSS HP-IB TERMINATES WITH ATN AND UNTALK.

△2 PPE OCCURS WHEN END OF CURRENT SECTOR PASSES UNDER HEAD.

DESCRIPTION

The READ command causes the disc controller to read data from the disc, starting with the address currently stored in the disc controller address registers. This address will be one of the following (whichever occurred most recently):

- The cylinder, head, and sector address passed during a SEEK or ADDRESS RECORD command.
- Cylinder 0 and the head and sector addresses passed during a COLD LOAD READ or a BUFFERED COLD LOAD READ command.
- The cylinder, head, and sector address last transferred (if a data error occurred) or the one following the last one transferred without error.

The 256 bytes of the data field of each sector are transferred until an error is detected or the disc controller is untalked by the CIC.

ERRORS

Refer to REQUEST STATUS command description in paragraph 2-14 for details of the following possible errors:

- Cylinder miscompare (07).
- Data error (10).
- Head/sector miscompare (11).
- I/O program error (12).
- Data overrun (16).
- Illegal access to spare track (20).
- Defective track (21).
- Status-2 error (drive not ready, drive fault) (23).

2-24. READ (Continued)

SPECIAL CONSIDERATIONS

The disc drive always does an incremental seek to the next track after reading sector 31 of the previous track. This means that even after the last track of data has been read from the disc, the disc drive will still seek to the next track. An error message will be generated if this next track is a defective track without a specified spare location or a spare track (illegally accessed). To avoid generating this error message at the end of a transfer, the disc drive should be UNTALKED less than 100 milliseconds after the last sector of information is sent over the HP-IB.

2-25. BUFFERED READ

FUNCTION

To allow reading of data in a buffered (one sector burst) mode. This command allows the use of the disc drive with a device connected to the HP-IB that has a slow data transfer rate (HP-IB data transfer rate less than 750 kilobytes per second).

TRANSACTION FORMAT

MESSAGE TYPE	MESSAGE FORMAT			
	PRIMARY I	SECONDARY	TEXT	PRIMARY II
COMMAND	LISTEN (ATN) ⟨P01ADDRS⟩	BUFFERED READ COMMAND (ATN) ⟨P1101010⟩ (PPD) ←	SUPPLIED TO DRIVE (EOI) ⟨00000101⟩ ⟨00000000⟩ OP CODE = 05_8	UNLISTEN (ATN) ⟨P0111111⟩
EXECUTION	TALK (ATN) ⟨P10ADDRS⟩	SEND READ DATA (ATN) ⟨P1100000⟩	SUPPLIED BY DRIVE 256 DATA BYTES ⟨ ⟩ - - - - - - - - ⟨LAST BYTE⟩ (1) (PPE) ←	UNTALK (ATN) P1111111⟩

(1) PPE OCCURS AFTER ONE FULL SECTOR OF DATA HAS BEEN TRANSFERRED FROM THE DISC TO THE BUFFER.

DESCRIPTION

The BUFFERED READ command causes the disc controller to read data from the disc, starting with the address currently stored in the disc controller address registers. This address will be one of the following (whichever occurred most recently):

- The cylinder, head, and sector address passed during a SEEK or ADDRESS RECORD command.
- Cylinder 0 and the head and sector address passed during a COLD LOAD READ or a BUFFERED COLD LOAD READ command.
- The cylinder, head, and sector address last transferred (if a data error occurred) or the one following the last one transferred without error.

The 256 bytes of the data field of the sector is transferred unless an error is detected or the disc controller is untalked by the CIC.

ERRORS

Refer to REQUEST STATUS command description in paragraph 2-14 for details of the following possible errors:

- Cylinder miscompare (07).
- Data error (10).
- Head/sector miscompare (11).
- I/O program error (12).
- Data overrun (16).
- Illegal access to spare track (20).
- Defective track (21).
- Status-2 error (drive not ready, drive fault) (23).

2-25. BUFFERED READ (Continued)

SPECIAL CONSIDERATIONS

Because only one sector is transferred, the internal logical address used by the disc controller will be incremented automatically at the end of each BUFFERED READ operation if no error is encountered. Therefore, only one SEEK operation need be issued at the beginning of a multiple sector transfer when multiple BUFFERED READ operations are being issued to contiguous sectors. The buffered read data average transfer rate can be increased from 12.8K bytes/second to 38.4K bytes/second if three sectors of data per latency (one revolution) can be transferred instead of the usual one sector of data per latency. Up to three sectors of data per latency can be transferred if the desired sectors are spaced 10 sectors apart. After the initial seek to the desired track, the ADDRESS RECORD command is used to access the desired sectors.

2-26. READ FULL SECTOR

FUNCTION

Reads 276 bytes of each sector (preamble less sync field, data field, and postamble) and passes them over the HP-IB to the device(s) addressed to listen by the CIC.

TRANSACTION FORMAT

MESSAGE TYPE	MESSAGE FORMAT			
	PRIMARY I	SECONDARY	TEXT	PRIMARY II
COMMAND	LISTEN (ATN) ⟨P01ADDRS⟩	RECEIVE DISC COMMAND (ATN) ⟨P1101000⟩ (PPD) ←	SUPPLIED TO DRIVE (EOI) ⟨00000110⟩ ⟨00000000⟩ OP CODE = 06_8	UNLISTEN (ATN) ⟨P0111111⟩
EXECUTION	TALK (ATN) ⟨P10ADDRS⟩	SEND READ DATA (ATN) ⟨P1100000⟩	SUPPLIED BY DRIVE 256 DATA BYTES ⟨ ⟩ - - - - - - - - ⟨LAST BYTE ⚠1 ⟩	UNTALK (ATN) P1011111 ⚠2 (PPE) ←

⚠1 BYTE TRANSFER ACROSS HP-IB TERMINATES WITH ATN AND UNTALK.

⚠2 PPE OCCURS WHEN END OF CURRENT SECTOR PASSES UNDER HEAD.

DESCRIPTION

The READ FULL SECTOR command causes the disc controller to read 276 bytes of each sector (preamble less sync field, data field, and postamble) from the disc over the HP-IB to the device(s) addressed to listen by the CIC, starting with one of the following addresses (whichever occurred most recently):

- The cylinder, head, and sector address passed during a SEEK command.
- The cylinder and head addresses passed during a SEEK command and the sector address passed during an ADDRESS RECORD command.
- Cylinder 0 and the head and sector addresses passed during a COLD LOAD READ or a BUFFERED COLD LOAD READ command.
- The cylinder, head, and sector address last transferred (if a data error occurred) or the one following the last one transferred without error.

Data is transferred until an error is detected or until the disc controller is untalked by the CIC.

ERRORS

Refer to the REQUEST STATUS command description in paragraph 2-14 for details of the following possible errors:

- I/O program error (12).
- Status-2 error (drive not ready, drive fault) (23).

SPECIAL CONSIDERATIONS

The READ FULL SECTOR and WRITE FULL SECTOR commands are intended for use by diagnostic programs. They must be used with caution since all checks for integrity are off. Data error checking is suppressed. Address verification is not performed, either at the start of transfer or when switching tracks, which means that disc address and track status checks are omitted, and also that no spare track can be accessed through its associated defective track (although it may be accessed directly by seeking to it). Lack of address verification also accounts for the possibility of an I/O program error for a starting address.

2-27. BUFFERED READ FULL SECTOR

FUNCTION

Reads 276 bytes of each sector (preamble less sync field, data field, and postamble) and passes them to the HP-IB. This command allows the use of the disc drive with a device on the HP-IB that has a slow data transfer rate (HP-IB data transfer rate less than 750 kilobytes per second).

TRANSACTION FORMAT

MESSAGE TYPE	MESSAGE FORMAT			
	PRIMARY I	SECONDARY	TEXT	PRIMARY II
COMMAND	LISTEN (ATN) ⟨P01ADDRS⟩	BUFFERED READ COMMAND (ATN) ⟨P1101001⟩ (PPD) ←	SUPPLIED TO DRIVE (EOI) ⟨00000101⟩ ⟨00000000⟩ OP CODE = 06_8	UNLISTEN (ATN) ⟨P0111111⟩
EXECUTION	TALK (ATN) ⟨P10ADDRS⟩	SEND READ DATA (ATN) ⟨P1100000⟩	SUPPLIED BY DRIVE 256 DATA BYTES ⟨ ⟩ - - - - - - - - ⟨LAST BYTE⟩ (1) (PPE) ←	UNTALK (ATN) P1011111⟩

(1) PPE OCCURS AFTER ONE FULL SECTOR OF DATA HAS BEEN TRANSFERRED FROM THE DISC TO THE BUFFER.

DESCRIPTION

The BUFFERED READ FULL SECTOR command causes the disc controller to read 276 bytes of the sector (preamble less sync field, data field, and postamble) from the disc over the HP-IB to the device(s) addressed to listen by the CIC, starting with one of the following addresses (whichever occurred most recently):

- The cylinder, head, and sector address passed during a SEEK command.
- The cylinder and head addresses passed during a SEEK command and the sector address passed during an ADDRESS RECORD command.
- Cylinder 0 and the head and sector addresses passed during a COLD LOAD READ or BUFFERED COLD LOAD READ command.
- The cylinder, head, and sector address last transferred (if a data error occurred) or the one following the last one transferred without error.

Data is transferred until an error is detected or until the disc controller is untalked by the CIC.

ERRORS

Refer to the REQUEST STATUS command description in paragraph 2-14 for details of the following possible errors:

- I/O program error (12).
- Status-2 error (drive not ready, drive fault) (23).

SPECIAL CONSIDERATIONS

The BUFFERED READ FULL SECTOR and BUFFERED WRITE FULL SECTOR commands are intended for use by diagnostic programs. They must be used with caution since all checks for integrity are off. Data error checking is suppressed. Address verification is not performed, either at the start of transfer or when switching tracks, which means that disc address and track status checks are omitted, and also that no spare track can be accessed through its associated defective track (although it may be accessed directly by seeking to it). Lack of address verification also accounts for the possibility of an I/O program error for a starting address.

2-28. VERIFY

FUNCTION

Reads data from the disc without passing it over the HP-IB and checks the data for errors.

TRANSACTION FORMAT

MESSAGE TYPE	MESSAGE FORMAT			
	PRIMARY I	SECONDARY	TEXT	PRIMARY II
COMMAND	LISTEN (ATN) ⟨P01ADDRS⟩	RECEIVE DISC COMMAND (ATN) ⟨P1101000⟩ (PPD) ←	SUPPLIED TO DRIVE ⟨00000111⟩ ⟨00000000⟩ OP CODE = 07_8 ⟨SECTOR COUNT, UPPER⟩ ⟨SECTOR COUNT, LOWER⟩ (EOI) ⚠1 (PPE) ←	UNLISTEN (ATN) ⟨P0111111⟩
EXECUTION	NONE	NONE	NO EXECUTION MESSAGE REQUIRED	NONE

⚠1 PPE OCCURS UPON COMPLETION OF VERIFY.

DESCRIPTION

The VERIFY command reads data from the disc without passing it over the HP-IB. The data is checked for errors. The verify continues until an error is detected or the sector count passed with the command is exhausted. A sector count of 0 is interpreted as 65536 (decimal).

Except for not passing data over the HP-IB and not depending on an HP-IB untalk to signal the end of the command, the VERIFY command operates exactly like a READ command. Verification begins at the address stored in the disc controller address registers. This address will be one of the following (whichever occurred most recently):

- The cylinder, head, and sector address passed during a SEEK or ADDRESS RECORD command.
- Cylinder 0 and the head and sector addresses passed during a COLD LOAD READ or a BUFFERED COLD LOAD READ command.
- The cylinder, head, and sector address last transferred (if a data error occurred) or the one following the last one transferred without error.

ERRORS

Refer to the REQUEST STATUS command description in paragraph 2-14 for details of the following possible errors:

- Cylinder miscompare (07).
- Data error (10).
- Head/sector miscompare (11).
- I/O program error (12).
- Data overrun (16).
- Illegel access to spare track (20).
- Defective track (21).
- Status-2 error (drive not ready, drive fault) (23).

TROUBLESHOOTING

SECTION III

3-1. INTRODUCTION

WARNING

This disc drive does not contain operator-serviceable parts. To prevent electrical shock, refer all installation and maintenance activities to service-trained personnel.

This section contains information useful for troubleshooting the HP 7910 Disc Drive. Included in this section are self-test information, power supply requirements, and signal and power interconnection information.

3-2. TROUBLESHOOTING

The following paragraphs provide information for troubleshooting intermittent operation, and for using the self-test routine.

3-3. INTERMITTENT DISC DRIVE OPERATION

Intermittent disc drive operation may be caused by a failure of the disc drive fan to operate or improper air circulation. Drive electronics PCA-A4 has a thermocouple on the heat sink which causes the PCA to turn off if the heat sink becomes too hot. When drive electronics PCA-A4 goes off, so does the spindle motor. The disc drive will operate properly again when the heat sink on drive electronics PCA-A4 cools; but the failure will occur again if the airflow is inadequate. If this type of failure occurs, ensure that the fan (54, figure 5-4 or 53, figure 5-5) is operational and the air filter (2, figure 5-5) is clean before replacing any disc drive assembly.

3-4. SELF-TEST ROUTINE

The self-test routine is a resident program in controller PCA-A2, which the HP 7910 Disc Drive uses to ensure that the disc drive is operating properly or to diagnose a failure. The self-test routine consists of 52 tests which check most disc drive functions. The self-test routine can be initiated in three ways:

- Whenever power is applied to the HP 7910 Disc Drive, the self-test routine is executed. If a test fails, the self-test routine will stop at the failed test and display the failure on the self-test display. If the disc drive passes all 52 tests, it is operating properly.
- The controller-in-charge (CIC) can execute self-test by sending the INITIATE SELF-TEST command to the disc drive. The disc controller halts any ongoing operation and performs the self-test routine. If a test fails, the sequence will stop at the failed test and the disc drive will exit to a standby mode to wait for interrogation from the CIC. If the disc drive passes all 52 tests, it is operating properly and the disc drive exits to a standby mode to wait for interrogation from the CIC.
- Momentarily depressing the self-test switch on controller PCA-A2 causes the disc controller to halt any ongoing operation and perform the self-test routine. If a test fails, the self-test routine will stop at the failed test and display the failure on the controller PCA LED display. (Refer to paragraph 3-8.) If the disc drive passes all 52 tests, it is operating properly.

3-5. ANALOG ELECTRONICS PCA LED DISPLAY

The analog electronics LED display (see figure 3-1) is located on PCA-A1. During normal operation, the LED readout indicates the disc drive functions shown in figure 3-1. The analog electronics LED display can be used as a troubleshooting guide in conjunction with the self-test routine.

3-6. CONTROLLER PCA LED DISPLAY

The controller PCA LED display is a set of 10 LED's located on PCA-A2. (Refer to figure 3-1.) When the disc controller is performing the self-test routine, the self-test LED (the LED labeled * on controller PCA-A2) will be on for the duration of the self-test routine. If a self test should fail during the self-test routine, the LED's will display the binary bit pattern for the one test out of 52 that failed. (Refer to paragraph 3-8.)

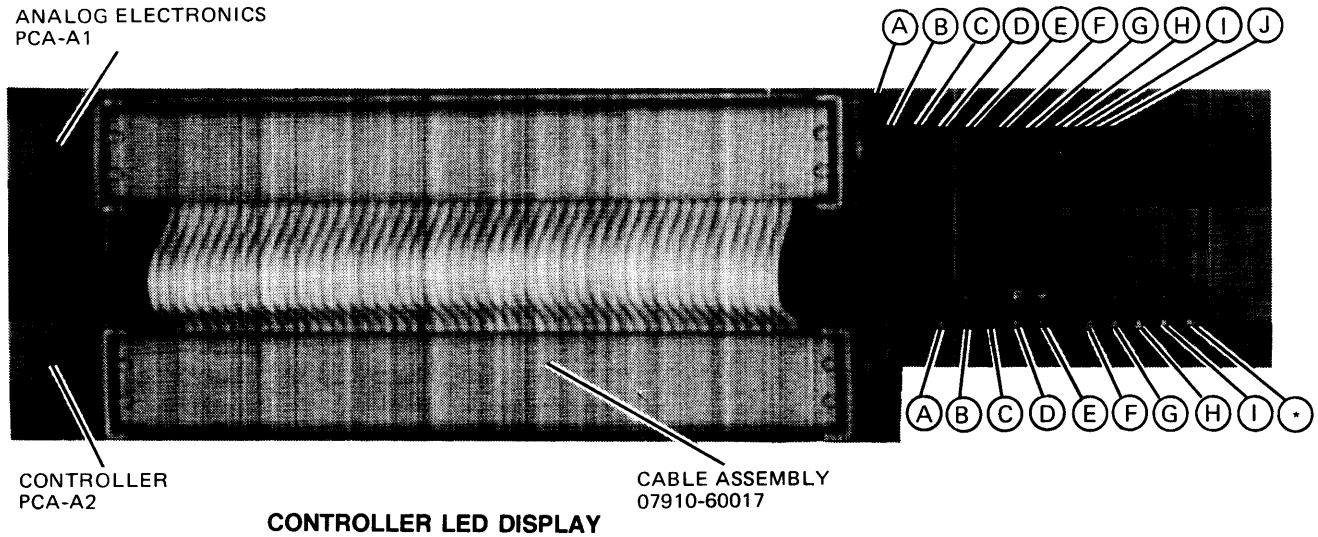
During normal operation of the disc drive, when the self-test LED (*) is off, the self-test display indicates the action of the disc drive functions shown in figure 3-1.

3-7. TROUBLESHOOTING THE POWER-ON SEQUENCE

The normal power-on sequence is described in section I. If a failure occurs during the power-on sequence, the self-test routine will stop at test no. 13. There is a delay of approximately 45 seconds before the self-test LED display on PCA-A2 indicates this condition. The analog elec-

ANALOG ELECTRONICS PCA LED DISPLAY

LED	FUNCTION	LED READOUT		CONTROL SOURCE (PCA)
		"ON"	"OFF"	
Ⓐ	Surface Select	Surface 1	Surface 0	Controller PCA-A2
Ⓑ	Actuator Control	Seek	Track Following	Controller PCA-A2
Ⓒ	Drive Electronics Status	Ready	Not Ready	Drive Electronics PCA-A4
Ⓓ	Track Status	OFF Track	ON Track	Analog PCA-A1
Ⓔ	Not Used	—	Normally OFF	—
Ⓕ	Spindle Motor Phase Lock	Phase Locked	Phase Unlocked	Drive Electronics PCA-A4
Ⓖ	Run Command	Run	Stop	Controller PCA-A2
Ⓗ	Write Enable	Enabled	Not Enabled	Drive Electronics PCA-A4
Ⓘ	Spindle Status	Start	No Start	Drive Electronics PCA-A4
Ⓙ	Not Used	—	Normally OFF	—



CONTROLLER LED DISPLAY

LED	FUNCTION	
Ⓐ	DMA	During normal operation of the disc drive, LED 'A' indicates that a DMA operation is taking place.
Ⓑ	WRITE	During normal operation of the disc drive, LED 'B' indicates that a WRITE operation is taking place.
Ⓒ	Not Used	
Ⓓ	READ	During normal operation of the disc drive, LED 'D' indicates that a READ operation is taking place.
Ⓔ	NOP	During normal operation of the disc drive, LED 'E' indicates that no operation (NOP) is taking place in the disc drive.
Ⓕ	SEEK	During normal operation of the disc drive, LED 'F' indicates that a SEEK operation is taking place.
Ⓖ	I/O	During normal operation of the disc drive, LED 'G' indicates that an I/O operation is taking place.
Ⓗ, Ⓘ	Not Used	
⊛	SELF TEST	LED "*" is on only when self-test routine is running.

NOTE

When the disc controller is NOT performing the self-test routine, (* LED off), LED's A, B, D, E, F, and G indicate the disc drive functions detailed a left. During the self-test routine (* LED on), LED's A through I indicate self-test patterns as described in table 3-2.

Figure 3-1. Analog Electronics and Controller PCA LED Displays

tronics LED display on PCA-A1 can be used to troubleshoot the power-on sequence. Table 3-1 shows the normal LED indication on PCA-A1 (○ indicates LED is OFF, ● indicates LED is ON) for each step in the power-on sequence, provides an explanation of each indication, and suggests corrective action in case of failure.

3-8. TROUBLESHOOTING WITH SELF-TEST ROUTINE

Table 3-2 lists the 56 self-test conditions (4 are not used) executed by the self-test routine. This table contains the following information:

- The number of the self-test condition.
- The self-test display pattern for each condition. The open circle (○) means the LED is off and the closed circle (●) means the LED is on.
- A description of the disc drive function the self test is checking during each test condition.
- The order of repair, which is a sequence of disc drive assemblies to check in order to correct the problem diagnosed by the self-test routine.

If a failure occurs during the self-test routine, match the self-test display on controller PCA-A2 to a LED pattern contained in table 3-1 to determine which test failed. After the failed test has been determined, the problem can be corrected by following the order of repair contained in table 3-2.

Extensive use of the self-test routine is the primary troubleshooting tool used to diagnose and correct a failure in the HP 7910 Disc Drive. When the self-test routine is used, the following procedure is recommended:

- If a test fails, repeat the self-test routine to determine whether the result of the second sequence is the same as that initially observed. (See paragraph 3-4.)
- Since the self-test routine involves data paths, loose or improperly mated connectors may provide the same symptoms as that of a faulty component. Before replacing an assembly, ensure that all the connectors and the removable PCA's are firmly in place.
- After an assembly has been replaced, repeat the self-test routine to ensure that the problem has been corrected. (See paragraph 3-4.)

3-9. POWER SUPPLY

3-10. HP 7910H AND HR

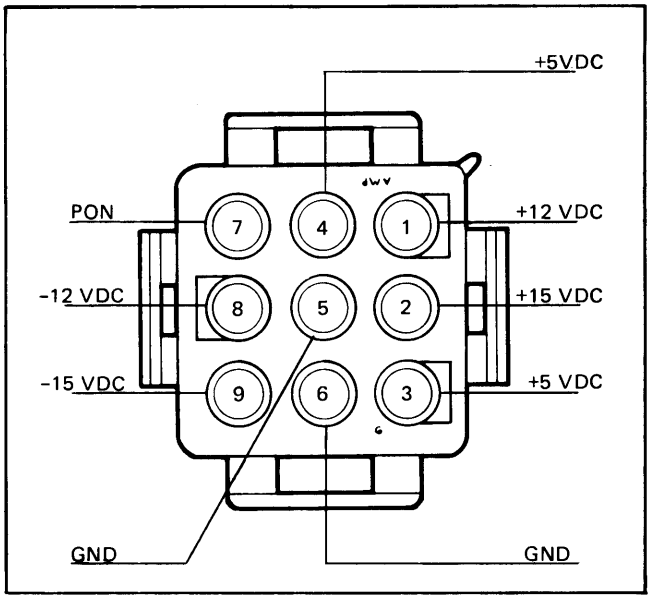
The power supply operating limits for the 7910H/HR are listed in table 3-3. Refer to paragraph 3-12 for cable and signal interconnection information.

Table 3-1. Power-On Sequence Troubleshooting

STEP	NORMAL LED INDICATION (ANALOG PCA-A1) A B C D E F G H I *	EXPLANATION	ORDER OF REPAIR
NOTE:	LED's C, D, E, F, G, H, I, and * on the controller PCA-A2 will be on for approximately 2 seconds during the power-on sequence. Refer to table 3-2, Test No. 1.		
1.	○ ○ ○ ○ ○ ○ ● ○ ○ ○	Microprocessor issues a RUN command approximately 2 seconds after power on. Failure to reach this step indicates that the Controller PCA-A2 is not generating RUN, or the Analog PCA-A1 is not receiving it.	1. Check power supply voltages (replace if necessary). 2. Check interconnections. 3. Controller PCA-A2. 4. Analog PCA-A1.
2.	○ ○ ○ ○ ○ ○ ● ○ ● ○	After the Drive Electronics PCA-A4 receives RUN, it checks the system clock, and drive voltages. If both are ok, START SPINDLE occurs, releasing the spindle brake and enabling the spindle motor drivers.	1. Check power supply voltages (replace if necessary). 2. Drive Electronics PCA-A4. 3. Controller PCA-A2. 4. Check interconnections. 5. Analog PCA-A1.
3.	○ ○ ○ ○ ○ ● ● ○ ● ○	As the spindle begins rotation, the drive mechanism electronics supplies pulses to the Drive Electronics PCA-A4. When the frequency of these pulses indicates that normal rotation speed has been reached, PHASE LOCK occurs.	1. Drive Electronics PCA-A4. 2. Check interconnections. 3. Drive mechanism A3. 4. Analog PCA-A1.
4.	○ ○ ● ○ ○ ● ● ○ ● ○	If RUN and START SPINDLE remain steady after PHASE LOCK, DRIVE READY occurs, allowing the 7910 to start the Self-Test routine.	1. Drive Electronics PCA-A4. 2. Check interconnections. 3. Analog PCA-A1.

3-11. HP 7910K AND KR

AC and DC power must be externally supplied to the 7910K/KR disc drives. AC power is required for fan operation and is connected directly to the fan in the K model, and applied through a standard NEMA 3-wire female plug in the KR model. Input DC power is applied to these drives at connector J2 mounted on the rear panel. (See figure 3-2.) Input voltage and current requirements are listed in table 3-4. Timing, grounding, and protection considerations are listed in table 3-5. Refer to paragraph 3-12 for cable and signal interconnection information.



REF 7314-14

Figure 3-2. HP 7910K/KR Input Power Connector J2

3-12. SIGNAL AND POWER INTERCONNECTIONS

The signal and power interconnections of the HP 7910 Disc Drive are documented as follows:

- Tables 3-6 through 3-10 provide wiring lists for the interconnection cable assemblies listed below. Signal distribution for the remaining cable assemblies is shown in figure 3-3.

Cable Assembly	Table
Drive Cable Assembly part no. 07910-60016	3-6
Controller Cable Assembly, part no. 07910-60017	3-7
Sector Cable Assembly, part no. 07910-60026	3-8
Connector Cable Assembly, part no. 07910-60027	3-9
HP-IB Cable Assembly, part no. 07910-60040	3-10

- Table 3-11 provides an alphabetic listing by signal mnemonic of the signals in the disc drive and indicates where the signal can be located in the disc drive.
- Table 3-12 (Power Distribution List) provides a listing of the voltages which operate the disc drive and the routing of the voltages within the drive.
- Figure 3-3 (Interconnection Diagram) contains the cabling and PCA interconnection information for the HP 7910 Disc Drive.

Table 3-2. Self Test

TEST NO.	SELF-TEST DISPLAY (LED'S) A B C D E F G H I *	DESCRIPTION OF SELF-TEST	ORDER OF REPAIR
1	○ ○ ○ ○ ○ ○ ○ ○ ● ●	This test checks some internal signals in Controller PCA-A2 and turns on eight of the LED's (C, D, E, F, G, H, I, and *) for approximately 2 seconds.	1. Power Supply (Check voltages, replace if necessary.) 2. Controller PCA-A2
2	○ ○ ○ ○ ○ ○ ○ ● ○ ●	This test manipulates data to produce known values in the internal registers of Controller PCA-A2.	Controller PCA-A2
3	○ ○ ○ ○ ○ ○ ○ ● ● ●	This test manipulates data to produce known values in the internal registers of Controller PCA-A2.	Controller PCA-A2
4	○ ○ ○ ○ ○ ○ ● ○ ○ ●	This test checks the ROM on Controller PCA-A2.	Controller PCA-A2
5	○ ○ ○ ○ ○ ○ ● ○ ● ●	This test checks the ROM on Controller PCA-A2.	Controller PCA-A2
6	○ ○ ○ ○ ○ ○ ● ● ○ ●	This test checks the ROM on Controller PCA-A2.	Controller PCA-A2
7	○ ○ ○ ○ ○ ○ ● ● ● ●	This test checks the ROM on Controller PCA-A2.	Controller PCA-A2
8	○ ○ ○ ○ ○ ● ○ ○ ○ ●	This test checks a portion of the I/O logic of Controller PCA-A2.	Controller PCA-A2
9	○ ○ ○ ○ ○ ● ○ ○ ● ●	This test checks the RAM on Controller PCA-A2.	Controller PCA-A2
10	○ ○ ○ ○ ○ ● ○ ● ○ ●	This test checks the RAM on Controller PCA-A2.	Controller PCA-A2
11	○ ○ ○ ○ ○ ● ○ ● ● ●	This test checks some internal flag logic of Controller PCA-A2.	Controller PCA-A2
12	○ ○ ○ ○ ○ ● ● ○ ○ ●	This test starts the disc drive and checks some internal signals associated with starting the disc drive.	1. Power Supply (Check voltages, replace if necessary.) 2. Check Interconnections (Replace cables, if necessary.) 3. Controller PCA-A2 4. Analog Electronics PCA-A1 5. Drive Electronics PCA-A4 6. Drive Mechanism A3

Table 3-2. Self Test (Continued)

TEST NO.	SELF-TEST DISPLAY (LED'S) A B C D E F G H I *	DESCRIPTION OF SELF-TEST	ORDER OF REPAIR
13	○ ○ ○ ○ ○ ● ● ○ ● ●	This test checks that the disc drive can become ready within 40 seconds. During the course of this test the LED's I and * will be on and LED H will be intermittently on. This is not a failure.	1. Power Supply (Check voltages, replace if necessary.) 2. Drive Electronics PCA-A4 3. Check Interconnections (Replace cables, if necessary.) 4. Controller PCA-A2 5. Drive Mechanism A3
14	○ ○ ○ ○ ○ ● ● ● ○ ●	This test checks the RUN signal and other internal circuitry on Drive Electronics PCA-A4.	Drive Electronics PCA-A4
15	○ ○ ○ ○ ○ ● ● ● ● ●	Not Used	Not Applicable
16	○ ○ ○ ○ ● ○ ○ ○ ○ ●	This test checks some internal signals in Controller PCA-A2 and Drive Electronics PCA-A4.	1. Controller PCA-A2 2. Drive Electronics PCA-A4
17	○ ○ ○ ○ ● ○ ○ ○ ● ●	This test checks some internal signals in Drive Electronics PCA-A4 and Controller PCA-A2.	1. Drive Electronics PCA-A4 2. Controller PCA-A2.
18	○ ○ ○ ○ ● ○ ○ ● ○ ●	This test attempts to move the heads to the outside crash stop. The test fails if the head fails to reach track 0 within six seconds.	1. Drive Electronics PCA-A4 2. Analog Electronics PCA-A1 3. Controller PCA-A2 4. Drive Mechanism A3
19	○ ○ ○ ○ ● ○ ○ ● ● ●	This test checks some internal signals in Analog Electronics PCA-A1 and Controller PCA-A2.	1. Analog Electronics PCA-A1 2. Controller PCA-A2.
20	○ ○ ○ ○ ● ○ ● ○ ○ ●	This test checks some internal signals associated with data transfer in Controller PCA-A2.	Controller PCA-A2
21	○ ○ ○ ○ ● ○ ● ○ ● ●	This test checks some internal signals associated with data transfer in Controller PCA-A2.	Controller PCA-A2
22	○ ○ ○ ○ ○ ○ ● ● ○ ●	This test checks some internal signals associated with data transfer in Controller PCA-A2.	Controller PCA-A2

Table 3-2. Self Test (Continued)

TEST NO.	SELF-TEST DISPLAY (LED'S) A B C D E F G H I *	DESCRIPTION OF SELF-TEST	ORDER OF REPAIR
23	○ ○ ○ ○ ● ○ ● ● ● ●	This test causes the heads to seek to track 0, surface 0 and checks some internal signals in the disc drive.	1. Drive Electronics PCA-A4 2. Analog Electronics PCA-A1 3. Controller PCA-A2 4. Drive Mechanism A3
24	○ ○ ○ ○ ● ● ○ ○ ○ ●	This test checks some internal signals on Drive Electronics PCA-A4 and Controller PCA-A2 associated with the seek operation of test no. 23.	1. Drive Electronics PCA-A4 2. Controller PCA-A2
25	○ ○ ○ ○ ● ● ○ ○ ● ●	This test checks some internal signals on Analog Electronics PCA-A1 associated with the seek operation of test no. 23.	1. Analog Electronics PCA-A1 2. Drive Mechanism A3
26	○ ○ ○ ○ ● ● ○ ● ○ ●	This test causes the heads to seek to track 747, surface 0 and checks some internal signals.	Drive Mechanism A3
27	○ ○ ○ ○ ● ● ○ ● ● ●	This test checks some internal signals associated with the seek operation of test no. 26.	Drive Mechanism A3
28	○ ○ ○ ○ ● ● ● ○ ○ ●	This test checks some internal signals associated with the seek operation of test no. 26.	Drive Mechanism A3
29	○ ○ ○ ○ ● ● ● ○ ● ●	This test causes the heads to seek to track 1, surface 1 and checks some internal signals.	Drive Mechanism A3
30	○ ○ ○ ○ ● ● ● ● ○ ●	This test checks some internal signals associated with the seek operation of test no. 29.	Drive Mechanism A3
31	○ ○ ○ ○ ● ● ● ● ● ●	This test checks some internal signals associated with the seek operation of test no. 29.	Drive Mechanism A3
32	○ ○ ○ ● ○ ○ ○ ○ ○ ●	This test performs a series of 10 seek operations and checks some internal signals.	Drive Mechanism A3
33	○ ○ ○ ● ○ ○ ○ ○ ● ●	This test checks some internal signals associated with the seek operations of test no. 32.	Drive Mechanism A3
34	○ ○ ○ ● ○ ○ ○ ● ○ ●	This test checks some internal signals associated with the seek operations of test no. 32.	Drive Mechanism A3
35	○ ○ ○ ● ○ ○ ○ ● ● ●	This test performs a seek to track −2, surface 0 and checks some internal signals. This track is not externally accessible and is used exclusively by self-test.	Drive Mechanism A3
36	○ ○ ○ ● ○ ○ ● ○ ○ ●	This test checks some internal signals associated with the seek operation of test no. 35.	Drive Mechanism A3

Table 3-2. Self Test (Continued)

TEST NO.	SELF-TEST DISPLAY (LED'S) A B C D E F G H I *	DESCRIPTION OF SELF-TEST	ORDER OF REPAIR
37	○ ○ ○ ● ○ ○ ● ○ ● ●	This test checks some internal signals associated with the seek operation of test no. 35.	Drive Mechanism A3
38	○ ○ ○ ● ○ ○ ● ● ○ ●	This test writes a known pattern of information into track −2, surface 0. This track is not externally accessible and is used exclusively by self-test.	1. Controller PCA-A2 2. Analog Electronics PCA-A1 3. Drive Mechanism A3
39	○ ○ ○ ● ○ ○ ● ● ● ●	Not Used	Not Applicable
40	○ ○ ○ ● ○ ● ○ ○ ○ ●	This test checks internal signals during a buffered read of track −2, surface 0.	1. Analog Electronics PCA-A1 2. Controller PCA-A2 3. Drive Mechanism A3
41	○ ○ ○ ● ○ ● ○ ○ ● ●	This test checks internal signals during a buffered read of track −2, surface 0.	1. Analog Electronics PCA-A1 2. Controller PCA-A2 3. Drive Electronics PCA-A46 4. Drive Mechanism A3
42	○ ○ ○ ● ○ ● ○ ● ○ ●	This test compares the sectors read from track −2, surface 0 with the known pattern that was written in track −2, surface 0 by test no. 38.	Controller PCA-A2
43	○ ○ ○ ● ○ ● ○ ● ● ●	This test checks internal signals during a buffered read of track −2, surface 0.	1. Analog Electronics PCA-A1 2. Controller PCA-A2 3. Drive Mechanism A3
44	○ ○ ○ ● ○ ● ● ○ ○ ●	This test fails if a data error occurs for any of the buffered read operations of track −2, surface 0.	1. Analog Electronics PCA-A1 2. Controller PCA-A2 3. Drive Electronics PCA-A4 4. Drive Mechanism A3
45	○ ○ ○ ● ○ ● ● ○ ● ●	This test compares the sectors read from track −2, surface 0 with the known pattern that was written in track −2, surface 0 by test no. 38.	Controller PCA-A2

Table 3-2. Self Test (Continued)

TEST NO.	SELF-TEST DISPLAY (LED'S) A B C D E F G H I *	DESCRIPTION OF SELF-TEST	ORDER OF REPAIR
46	○ ○ ○ ● ○ ● ● ● ○ ●	This test performs a seek to track −2, surface 1 and checks some internal signals. This track is not externally accessible and is used exclusively by self-test.	Analog Electronics PCA-A1
47	○ ○ ○ ● ○ ● ● ● ● ●	This test writes a known pattern of information into track −2, surface 1. This track is not externally accessible and is used exclusively by self-test.	1. Drive Mechanism A3 2. Analog Electronics PCA-A1 3. Controller PCA-A2
48	○ ○ ○ ● ● ○ ○ ○ ○ ●	Not Used	Not Applicable
49	○ ○ ○ ● ● ○ ○ ○ ● ●	Not Used	Not Applicable
50	○ ○ ○ ● ● ○ ○ ● ○ ●	This test checks internal signals during a buffered read of track −2, surface 1.	1. Drive Mechanism A3 2. Analog Electronics PCA-A1 3. Controller PCA-A2
51	○ ○ ○ ● ● ○ ○ ● ● ●	This test checks internal signals during a buffered read of track −2, surface 1.	1. Drive Mechanism A3 2. Analog Electronics PCA-A1 3. Controller PCA-A2 4. Drive Electronics PCA-A4
52	○ ○ ○ ● ● ○ ● ○ ○ ●	This test compares the sectors read from track −2, surface 0 with the known pattern that was written in track −2, surface 0 by test no. 47.	Controller PCA-A2
53	○ ○ ○ ● ● ○ ● ○ ● ●	This test checks internal signals during a buffered read of track −2, surface 1.	1. Drive Mechanism A3 2. Analog Electronics PCA-A1 3. Controller PCA-A2
54	○ ○ ○ ● ● ○ ● ● ○ ●	This test fails if a data error occurs for any of the buffered read operations of track −2, surface 1.	1. Drive Mechanism A3 2. Analog Electronics PCA-A1 3. Controller PCA-A2 4. Drive Electronics PCA-A4

Table 3-2. Self Test (Continued)

TEST NO.	SELF-TEST DISPLAY (LED'S) A B C D E F G H I *	DESCRIPTION OF SELF-TEST	ORDER OF REPAIR
55	○ ○ ○ ● ● ○ ● ● ● ●	This test compares the sectors read from track −2, surface 1 with the known pattern that was written in track −2, surface 1 by test no. 47.	Controller PCA-A2
56	○ ○ ○ ● ● ● ○ ○ ○ ●	This test checks some internal signals in Controller PCA-A2.	Controller PCA-A2

Table 3-3. HP 7910H/HR Power Supply Voltages

Power Supply PCA-A5A1 (HP 7910H/HR only)		
Connector	**Loaded Voltage Value**	**Unloaded Voltage Value**
P2-1	Ground	Ground
-2	Ground	Ground
-3	−28 Vdc minimum to −18 Vdc maximum	−30 Vdc maximum to −20 Vdc minimum
-4	18 Vdc minimum to 28 Vdc maximum	20 Vdc minimum to 30 Vdc maximum
-5	−12.5 Vdc minimum to −11.5 Vdc maximum with 100 mV maximum ripple	−12.5 Vdc minimum to 11.5 Vdc maximum
-6	11.5 Vdc minimum to 12.5 Vdc maximum with 100 mV maximum ripple	11.5 Vdc minimum to 12.5 Vdc maximum
-7	5.15 Vdc minimum to 5.65 Vdc maximum with 100 mV maximum ripple	4.95 Vdc minimum to 5.45 Vdc maximum
-8	6.55 Vdc minimum to 7.05 Vdc maximum	5.25 Vdc minimum to 5.75 Vdc maximum
-9	11.6 Vdc minimum to 15 Vdc maximum	11.6 Vdc minimum to 15 Vdc maximum
-10	11.8 Vdc minimum to 15.2 Vdc maximum	11.8 Vdc minimum to 15.2 Vdc maximum
P1-1	Ground	Ground
-2	15 Vac minimum to 21 Vac maximum	15 Vac minimum to 21 Vac maximum
-3	Ground	Ground
-4	15 Vac minimum to 21 Vac maximum	15 Vac minimum to 21 Vac maximum

Table 3-4. HP 7910K/KR Power Supply Voltage Requirements

+15 Vdc (Unregulated)	
Voltage Range (Loaded Value):	11.5 Vdc (minimum) to 18.0 Vdc (maximum), including ripple and noise*
Voltage Range (Unloaded Value):	13 Vdc (minimum) to 22 Vdc (maximum)
Maximum Ripple:	2V peak to peak, ripple plus noise to 20 MHz
Maximum Steady State Current:	4.0A
Starting Current:	6.5A peak, (@ 15V) for 40 seconds
−15 Vdc (Unregulated)	
Voltage Range (Loaded Value):	−18.0 Vdc (minimum) to −11.5 Vdc (maximum), including ripple*
Voltage Range (Unloaded Value):	−22 Vdc (minimum) to −13 Vdc (maximum)
Maximum Ripple:	2V peak to peak, ripple plus noise to 20 MHz
Maximum Steady State Current:	4.0A
Starting Current:	6.5A peak, (@ −15V) for 40 seconds
+12 Vdc (Regulated)	
Voltage Range (Loaded Value):	11.5 Vdc (minimum) to 12.5 Vdc (maximum), including ripple and noise
Voltage Range (Unloaded Value):	11.5 Vdc (minimum) to 12.5 Vdc (maximum)
Maximum Ripple:	100 mV peak to peak, ripple plus noise to 20 MHz
Maximum Current:	0.5A
−12 Vdc (Regulated)	
Voltage Range (Loaded Value):	−12.5 Vdc (minimum) to −11.5 Vdc (maximum), including ripple and noise
Voltage Range (Unloaded Value):	−12.5 Vdc (minimum) to −11.5 Vdc (maximum)
Maximum Ripple:	100 mV peak to peak, ripple plus noise to 20 MHz
Maximum Current:	0.3A
+5 Vdc (Regulated)	
Voltage Range (Loaded Value):	4.95 Vdc (minimum) to 5.35 Vdc (maximum), including ripple and noise
Voltage (Unloaded Value):	5.5 Vdc (maximum)
Maximum Ripple:	70 mV peak to peak, plus noise to 20 MHz
Maximum Current:	5.6A
AC Voltages	
• The HP 7910K Disc Drive requires 120 Vac, 0.25A for the fan. Connection is made directly to the fan lugs.	
• The HP 7910KR Disc Drive requires 120 Vac, 0.25A for the fan. Connection is made through a standard 3-wire NEMA female plug.	
* The +15 Vdc and −15 Vdc supply must track within 5% of each other.	

Table 3-5. HP 7910K/KR Power Supply Considerations

Power Supply Considerations

Power-On Sequence:

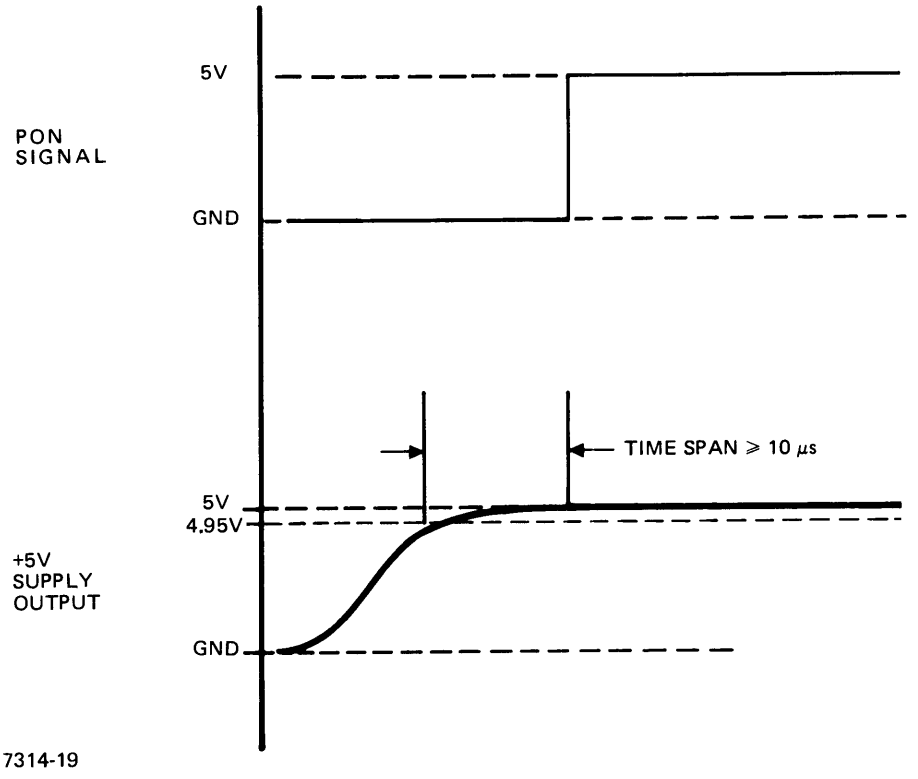
The +12 Vdc supply output must come on before or with the +5 Vdc supply output. (+12 Vdc supply output ≥ +5 Vdc supply output)

Power-Off Sequence:

The +12 Vdc supply output must stay on longer or go off with the +5 Vdc supply output. (+12 Vdc supply output ≥ +5 Vdc supply output.) The +12 Vdc and −12 Vdc supply outputs must go off at the same time as the +15 Vdc and −15 Vdc supply output.

PON Signal:

The PON signal is asserted (positive true, +5 Vdc) 10 microseconds (minimum delay) after the +5 Vdc supply is up to the operational level. The 10 microseconds or greater delay allows the disc controller to reset after the power is turned on.



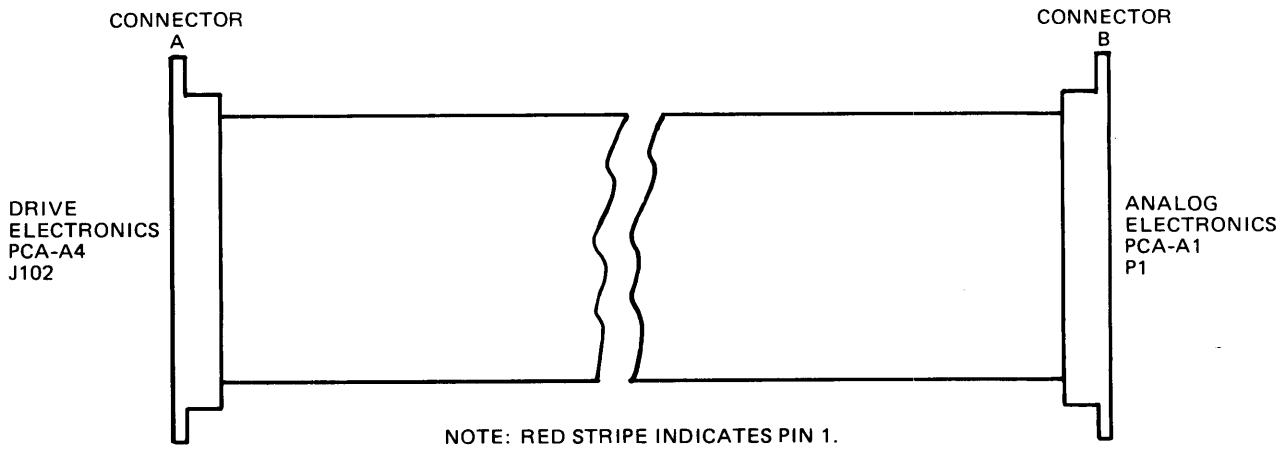
Grounding:

For safety reasons, the sheet metal chassis of the HP 7910K Disc Drive must be connected to the chassis of the system cabinet. The HP 7910H, HR, and KR are grounded whenever a power cord is connected.

Protection:

Overvoltage protection is required on the ±12 Vdc and +5 Vdc power supplies. Current limiting is required for the ±12 Vdc and +5 Vdc power supplies.

Table 3-6. Drive Cable Assembly, Part No. 07910-60016, Wiring List

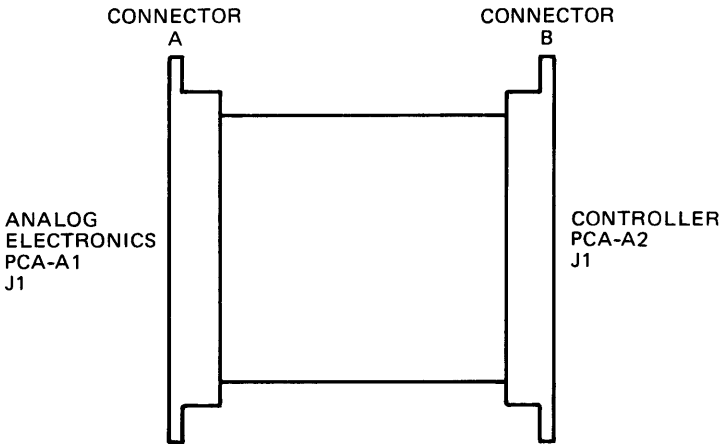


WIRING LIST

CONNECTOR A PIN ASSIGNMENT	SIGNAL	CONNECTOR B PIN ASSIGNMENT	CONNECTOR A PIN ASSIGNMENT	SIGNAL	CONNECTOR B PIN ASSIGNMENT
1	4.212 MHz (WC)	1	26	COS0	26
2	GND	2	27	GND	27
3	NC	3	28	$\overline{\text{READY}}$	28
4	NC	4	29	GND	29
5	+5V	5	30	$\overline{\text{RUN}}$	30
6	$\overline{\text{WE}}$	6	31	GND	31
7	+5V	7	32	$\overline{\text{SEEK}}$	32
8	NC	8	33	GND	33
9	GND (+5V RETURN)	9	34	$\overline{\text{GAP}}$	34
10	END DMA	10	35	GND	35
11	GND (+5V RETURN)	11	36	PAD0	36
12	NC	12	37	NAD0	37
13	$\overline{\text{GND}}$	13	38	GND	38
14	WRITE	14	39	NC	39
15	GND	15	40	GND	40
16	SUR0	16	41	$\overline{\text{EOG}}$	41
17	GND	17	42	GND (+12V RETURN)	42
18	$\overline{\text{ON TRACK}}$	18	43	NC	43
19	GND	19	44	$\overline{\text{SS}}$	44
20	WRITE DATA EDGES	20	45	NC	45
21	GND	21	46	$\overline{\text{PL}}$	46
22	COS1	22	47	+12V	47
23	GND (CHASSIS)	23	48	−12V	48
24	DZX	24	49	AC	49
25	GND (CHASSIS)	25	50	GND (−12V RETURN)	50

NOTE: Unless otherwise specified, GND indicates chassis ground.

Table 3-7. Controller Cable Assembly, Part No. 07910-60017, Wiring List



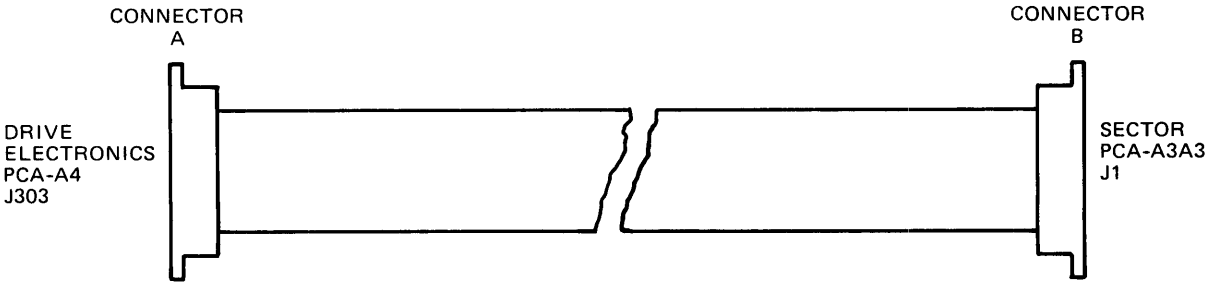
NOTE: RED STRIPE INDICATES PIN 1.

WIRING LIST

CONNECTOR A PIN ASSIGNMENT	SIGNAL	CONNECTOR B PIN ASSIGNMENT	CONNECTOR A PIN ASSIGNMENT	SIGNAL	CONNECTOR B PIN ASSIGNMENT
1	GND	1	26	SIP	26
2	$\overline{\text{WRITE}}$	2	27	$\overline{\text{RUN}}$	27
3	GND	3	28	$\overline{\text{SEEK}}$	28
4	4.212 MHz (WC)	4	29	$\overline{\text{READY}}$	29
5	GND	5	30	$\overline{\text{GCS}}$	30
6	WD	6	31	NOOP (NOP)	31
7	GND	7	32	SCW0	32
8	RD	8	33	SCW1	33
9	GND	9	34	SCW2	34
10	RC	10	35	SCW3	35
11	GND	11	36	SCW4	36
12	GND	12	37	SCW5	37
13	21 MHz CLOCK	13	38	NC	38
14	GND	14	39	END DMA	39
15	GND	15	40	DT0	40
16	$\overline{\text{GAP}}$	16	41	DT2	41
17	GND	17	42	DT1	42
18	$\overline{\text{EOG}}$	18	43	NC	43
19	GND	19	44	NC	44
20	SUR0	20	45	$\overline{\text{FORMAT}}$	45
21	NC	21	46	NC	46
22	COS0	22	47	NC	47
23	COS1	23	48	NC	48
24	$\overline{\text{ON TRACK}}$	24	49	NC	49
25	ODD/EVEN	25	50	NC	50

NOTE: Unless otherwise specified, GND indicates chassis ground.

Table 3-8. Sector Cable Assembly, Part No. 07910-60026, Wiring List



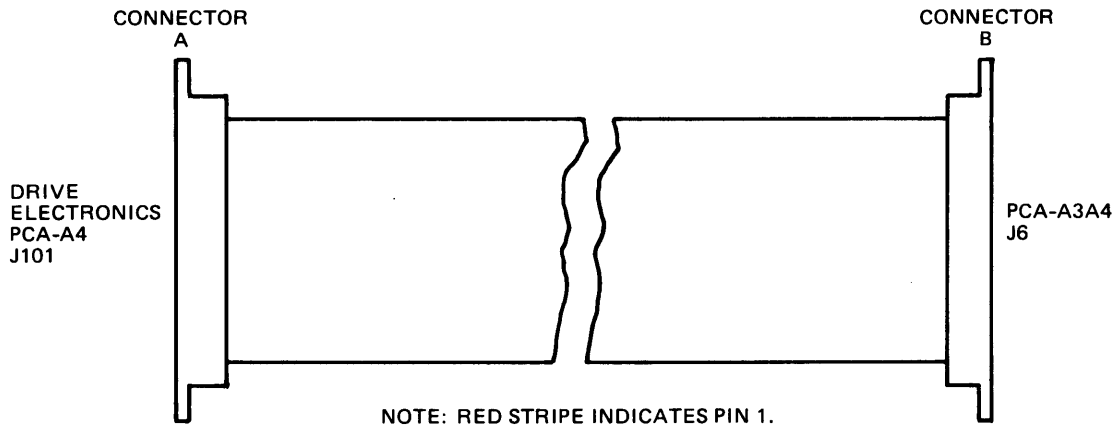
NOTE: RED STRIPE INDICATES PIN 1.

WIRING LIST

CONNECTOR A PIN ASSIGNMENT	SIGNAL	CONNECTOR B PIN ASSIGNMENT	CONNECTOR A PIN ASSIGNMENT	SIGNAL	CONNECTOR B PIN ASSIGNMENT
1	GND	1	6	GND	6
2	GND	2	7	+5V	7
3	−12V	3	8	GND	8
4	GND	4	9	+12 VR	9
5	$\overline{\text{SGM}}$	5	10	+12 VR	10

NOTE: Unless otherwise specified, GND indicates chassis ground.

Table 3-9. Connector Cable Assembly, Part No. 07910-60027, Wiring List

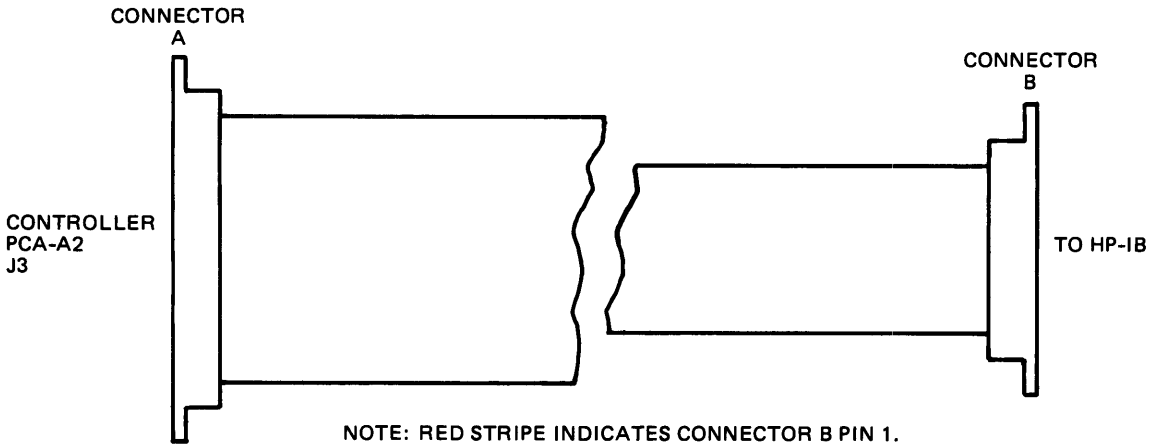


WIRING LIST

CONNECTOR A PIN ASSIGNMENT	SIGNAL	CONNECTOR B PIN ASSIGNMENT	CONNECTOR A PIN ASSIGNMENT	SIGNAL	CONNECTOR B PIN ASSIGNMENT
1	7417 GND	1	9	HC1	9
2	NC	2	10	HC0	10
3	GND (PREAMP)	3	11	WE1	11
4	+6.8V	4	12	WE2	12
5	−6.8V	5	13	NPO0	13
6	+5V	6	14	PPO0	14
7	DATA	7	15	NPO1	15
8	DATA	8	16	PPO1	16

NOTE: Unless otherwise specified, GND indicates chassis ground.

Table 3-10. HP-IB Cable Assembly, Part No. 07910-60040, Wiring List



NOTE: RED STRIPE INDICATES CONNECTOR B PIN 1.

WIRING LIST

CONNECTOR A PIN ASSIGNMENT	SIGNAL	CONNECTOR B PIN ASSIGNMENT	CONNECTOR A PIN ASSIGNMENT	SIGNAL	CONNECTOR B PIN ASSIGNMENT
1	NC		14	NFRD	7
2	NC		15	GND	24
3	GND	24	16	DAV	6
4	GND	24	17	REN	17
5	GND	24	18	EOI	5
6	ATN	11	19	DIO8	16
7	GND	24	20	DIO4	4
8	SRQ	10	21	DIO7	15
9	GND	24	22	DIO3	3
10	IFC	9	23	DIO6	14
11	GND	24	24	DIO2	2
12	NDAC	8	25	DIO5	13
13	NC		26	DIO1	1

NOTE: Unless otherwise specified, GND indicates chassis ground.

Table 3-11. Signal Distribution List

SIGNAL MNEMONIC	A1 ANALOG ELECTRONICS PCA							A2 CONTROLLER PCA							A4 DRIVE ELECTRONICS PCA							A3A4 CONNECTOR PCA						A3A3 SECT PCA	HP-IB CONN	COMMENTS
	P1	P2	P3	P4	J1	J2	J3	P1	P2	P3	P4	J1	J2	J3	J102	J101	J303	J402	J602	J604	J606	J1	J2	J3	J4	J5	J6	J1		
A						■																								
A-B						■																								
ABS POS						■																								
AC	■														49															
AD						■																								
AGC						■																								
ARM (ARM LOCK DRIVE)																				■				1	1					
ARM* (ARM LOCK DRIVE RETURN)																				■				2	2					
ARM COIL (2)																				■				3		2				
ARM COIL (6)																				■				4		3				
ATN														◪ 6															◪ 1	
A0													■ 0																	
A1													■ 29																	
A2													■ 28																	
A3													■ 27																	
A4													■ 26																	
A5													■ 25																	
A6													■ 24																	
A7													■ 23																	
A8													■ 22																	
A9													■ 21																	
A10													■ 20																	
A11													■ 19																	
A12													■ 18																	
A13													■ 17																	
A14													■ 16																	
A15													■ 15																	
B						■																								
BRDY						■																								
BRK (BRAKE DRIVE)																			■											
BRK* (BRAKE DRIVE RETURN)																			■											
CLK													■																	
COMMUTATION SIGNAL (SENSOR A)																		11												SPINDLE IS SOURCE
COMMUTATION SIGNAL (SENSOR B)																		10												SPINDLE IS SOURCE
COS0 (SOS0N)	26				22						■				26															
COS1 (SOS2N)	22				23						■				22															
DAC						■																								
DATA																■						6	6				8			
$\overline{\text{DATA}}$																■						1	1				7			
DATA EDGE (WRITE DATA EDGES)	■														20															

■ DENOTES SIGNAL SOURCE ◪ DENOTES BIDIRECTIONAL SIGNAL

Table 3-11. Signal Distribution List (Continued)

SIGNAL MNEMONIC	A1 ANALOG ELECTRONICS PCA							A2 CONTROLLER PCA							A4 DRIVE ELECTRONICS PCA							A3A4 CONNECTOR PCA						A3A3 SECT PCA	HP-IB CONN	COMMENTS
	P1	P2	P3	P4	J1	J2	J3	P1	P2	P3	P4	J1	J2	J3	J102	J101	J303	J402	J602	J604	J606	J1	J2	J3	J4	J5	J6	J1		
DAV														16															6	
DG																														
DT0												40																		
DT1												41																		
DT2												42																		
DZX	24																													
D0													33																	
D1													34																	
D2													35																	
D3													36																	
D4													37																	
D5													38																	
D6													39																	
D7													40																	
D8													41																	
D9													42																	
D10													43																	
D11													44																	
D12													45																	
D13													46																	
D14													47																	
D15													48																	
DIO1														26															1	
DIO2														24															2	
DIO3														22															3	
DIO4														20															4	
DIO5														25															13	
DIO6														23															14	
DIO7														21															15	
DIO8														19															16	
EGCD																														
END DMA	10				39										10															
$\overline{EOG}$ (EOGN)	41				18							18																		
EOI (EOT)														18															5	
FETCH																														
$\overline{FORMAT}$																														
FSCK																														
GAP																														
$\overline{GAP}$ (GAPN)	34				16	19						16																		
GAP/32																														

DENOTES SIGNAL SOURCE DENOTES BIDIRECTIONAL SIGNAL

Table 3-11. Signal Distribution List (Continued)

SIGNAL MNEMONIC	A1 ANALOG ELECTRONICS PCA							A2 CONTROLLER PCA							A4 DRIVE ELECTRONICS PCA							A3A4 CONNECTOR PCA						A3A3 SECT PCA	HP-IB CONN	COMMENTS
	P1	P2	P3	P4	J1	J2	J3	P1	P2	P3	P4	J1	J2	J3	J102	J101	J303	J402	J602	J604	J606	J1	J2	K3	J4	J5	J6	J1		
GCC							■																							
GCD							■																							
GCRS							■																							
$\overline{GCS}$ (GCSN)					■							30																		
GCTH							■																							
GC12						■																								
GC13						■																								
GND (HALL SENSOR)																		■												
GNI													7																	SOURCE OUTSIDE OF DRIVE
HCØ																■							7				10			
HC1																■						7					9			
IAKN													■																	
IDLE													■																	
IFC														10															3	
INTN													6																	SOURCE OUTSIDE OF DRIVE
IOENDN													3																	
IOGON													■																	
MDHLCKH		47																												SOURCE OUTSIDE OF DRIVE
MENDN													■																	
MGON													■																	
MOTOR (PHASE A+)																		■												
MOTOR (PHASE A-)																		■												
MOTOR (PHASE B+)																		■												
MOTOR (PHASE B-)																		■												
NADO	37														■															
NDAC														12															6	
NOOP (NOP)					31							■																		
NPOØ																13							■				13			
NPO1																15						■					15			
NRFD														14															7	
ODD/EVEN (ODD)					25							■																		
$\overline{ON\ TRACK}$ ($\overline{ONTRK}$)	18				■							24			18															
PADO	36														■															
$\overline{PHASE\ LOCK}$ ($\overline{PL}$)	46														■															
POS						■																								
PPOØ																14							■				14			
PPO1																16						■					16			
$\overline{RARM}$															45															SOURCE OUTSIDE OF DRIVE
RC					■							10																		
RD					■							8																		

■ DENOTES SIGNAL SOURCE ◪ DENOTES BIDIRECTIONAL SIGNAL

Table 3-11. Signal Distribution List (Continued)

SIGNAL MNEMONIC	A1 ANALOG ELECTRONICS PCA							A2 CONTROLLER PCA							A4 DRIVE ELECTRONICS PCA							A3A4 CONNECTOR PCA						A3A3 SECT PCA	HP-IB CONN	COMMENTS
	P1	P2	P3	P4	J1	J2	J3	P1	P2	P3	P4	J1	J2	J3	J102	J101	J303	J402	J602	J604	J606	J1	J2	K3	J4	J5	J6	J1		
RDATA						■																								
READY (READYN)	28				29							29			■															
REN														17															17	
RNW													1																	
RUN (RUNN)	30				27							■			30															
SCW0 (SIGN)					32							■																		
SCW1 (MSB)					33							■																		
SCW2					34							■																		
SCW3					35							■																		
SCW4					36							■																		
SCW5 (LSB)					37							■																		
SEEK (SEEKN)	32				28							■			32															
SGM																	5											■		
SHIELD																													12	
SIP (SPARE)					26							■																		
SRQ							8																						10	
SS	■																													
SS2												■																		
SUR0 (SS0)	16				20							■			16															
WA						■																								
WB						■																								
WD					■							■																		
WE						■																								
WE	6														■															
WE0																■							8				12			
WE1																■						8					11			
WND						■																								
WRITE (WE)	14				2							■			14															
XCLK								4																						SOURCE OUTSIDE OF DRIVE
4.212 MHz (WC)	1				4							■			1															
21 MHz CLOCK					13							■																		

■ DENOTES SIGNAL SOURCE ◪ DENOTES BIDIRECTIONAL SIGNAL

Table 3-12. Power Distribution List

SIGNAL MNEMONIC	A1 ANALOG ELECTRONICS PCA							A2 CONTROLLER PCA							A4 DRIVE ELECTRONICS PCA							A6 BACKPLANE PCA					A3A4 CONNECTOR PCA						A3A3 SECT PCA	A5 POWER SUPPLY (H/HR ONLY)			HP-IB CONN
	P1	P2	P3	P4	J1	J2	J3	P1	P2	P3	P4	J1	J2	J3	J102	J101	J303	J402	J602	J604	J606	J1	J3(A1)	J3(A2)	J4(A1)	J4(A2)	J1	J2	J3	J4	J5	J6	J1	P1	P2	P3	
+5V	5,7	1,2, 3,4		1,2, 3,4					1,2, 3,4		1,2, 3,4				5,7	6	7	4,7			8	4			1,2, 3,4	1,2, 3,4	5	5				6	7			■	
+6.8V (+6V)																■											4	4				4					
−6.8V (−6V)																■											2	2				5					
+12V	47	13,14		13,14					13,14		13,14				47							1			13,14	13,14									■	
SENSE SUPPLY (+9V to +11V)																	■																9,10				
−12V	48	7,8		7,8											8,48		3					2			7,8	7,8							3			■	
+15.5V																					2															■	
−15.5V																					4															■	
PON (TPON)									36		36		3									3			36	36										■	
PREAMP GND																■																3					
7417 GND																■																1					
GND (VOLTAGE RETURN)	9,11, 42,50														9,11, 42,50						6	5														■	
GND (CHASSIS)	2,13, 15,17, 19,21, 23,25, 27,29, 31,33, 35,38, 40	18,28, 45,46		18,28, 45,46	1,3, 5,7, 9,11, 12,14, 15,17, 19	33,34	25,26, 28,30, 32,34, 36,38, 40,42		45,46		45,46	1,3, 5,7, 9,11, 12,14, 15,17, 19,43, 45	2,14, 31,32, 49		2,13, 15,17, 19,21, 23,25, 27,29, 31,33, 35,38, 40		1,2, 4,6, 8,	5								18,28, 35,45, 46	18,28, 35,45, 46	3	3					1,2,4,6, 8,10				24

■ DENOTES SOURCE

POWER SUPPLY A5 (USED ONLY IN HP 7910H/HR DISC DRIVES)

NEUTRAL
GND
LINE
LINE FILTER & CONNECTOR
F1
LINE
VOLTAGE SELECT SWITCH
FAN
+5V RECTIFIER
±15V RECTIFIER
C402
C401
C403
SEE NOTE J2
J2
POWER SUPPLY PCA-A5A1
P1
P2
P3
F41

POWER SWITCH POSITIONS

100 VAC
120 VAC
220 VAC
240 VAC

F1: FUSE, 3A, 250V, SLO-BLOW, (100/120 VAC OPERATION), PART NO. 2110-0029.
FUSE, 1.5A, 250V, SLO-BLOW, (220/240 VAC OPERATION), PART NO. 2110-0304.

+5V PASS TRANSISTOR
2N6057

VOLTAGE REGLTR (-12V)
LM 220K-12

VOLTAGE REGLTR (+12V)
LM 340K-12

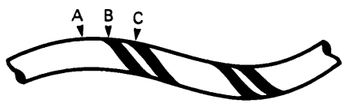
3.9 μF

F11
F12

F11, F12: FUSE, 2.5A, 250V, SLO-BLOW, PART NO. 2110-0380.

F41: FUSE, 10A, 250V, MEDIUM-BLOW, PART NO. 2110-0051.

NOTE: ENCIRCLED NUMBERS INDICATE WIRING COLOR CODE.



WIRE COLOR CODE

COLOR	1st DIGIT A	2nd DIGIT B	3rd DIGIT C
BLACK	0	0	0
BROWN	1	1	1
RED	2	2	2
ORANGE	3	3	3
YELLOW	4	4	4
GREEN	5	5	5
BLUE	6	6	6
VIOLET	7	7	7
GREY	8	8	8
WHITE	9	9	9

DC POWER CABLE ASSEMBLY, HP 7910H/HR PART NO

FAN

0

2

1

1

2

3

2

8

7

8

6

4

6

3

0

3

04

05

02

96

+5V RECTIFIER

6

±15V
RECTIFIER

2

4

F1: FUSE, 3A, 250V, SLO-BLOW,
(100/120 VAC OPERATION),
PART NO. 2110-0029.
FUSE, 1.5A, 250V, SLO-BLOW,
(220/240 VAC OPERATION),
PART NO. 2110-0304.

C402

C401

C403

9

0 0 98 94 5 3 92 8 97 96

1 2 3 4 5 6 7 8 9 10

P2

POWER
SUPPLY
PCA-A5A1

3 91 6 0 92 92 2 95 0

+12V −12V −15V GND +5V +5V +15V PON GND

1 2 3 4 5 6 7 8 9 10

F41

P3

5 0 98

3.9 μF 3.9 μF

VOLTAGE
REGLTR
(-12V)

LM 220K-12

3 0 94

3.9 μF 3.9 μF

VOLTAGE
REGLTR
(+12V)

LM 340K-12

P1

F11 F12

4 3 2 1

6 4 3 6

F11, F12: FUSE, 2.5A, 250V, SLO-BLOW,
PART NO. 2110-0380.

F41: FUSE, 10A, 250V, MEDIUM-BLOW,
PART NO. 2110-0051.

5

TO BACKPLANE PCA-A6, J1

4

TO DRIVE ELECTRONICS
PCA-A4, J606

9

3 2 92 0 92 0 91 6 95

+12V +15V +5V +5V GND GND PON −12V −15V

1 2 3 4 5 6 7 8 9

J2

NOTE:
J2 (MOUNTED ON REAR PANEL)
IS USED ONLY IN HP 7910K/KR
DISC DRIVES.

SEE NOTE
J2

5

4

9

4

CABLE ASSEMBLY, PART NO. 07910-60024

9 BRK*

9 BRK

1

2

J602

0 ARM

0 ARM*

2 ARM COIL

6 ARM COIL

1

2

3

4

J604

J101

J402

1 2 3 4 5 6 7 8 9 10 11 12

GND GND MOT(B-) +5V GND MOT(B+) +5V MOT (A-) COMSIG (B) COM SIG (A) MOT(A+)

0 0 4 2 0 2 2 9 6 5 1

J303

DRIVE
ELECTRON
PCA-A4

J102

J606

1 2 3 4 5 6 7 8

+15V −15V GND +5V

2 6 0 92

BLE ASSEMBLY, HP 7910H/HR PART NO. 07910-60065, HP 7910K/KR PART NO. 07910-60033

E ASSEMBLY, PART NO. 07910-60024

SEALED DRIVE MECHANISM

ACTUATOR

ARM LOCK

HEAD 0

HEAD 1

SECTOR

PCA-A3A3 J1

J1

SPINDLE MOTOR

BRAKE

CONNECTOR

PCA-A3A4

J2 J1 J5 J4

J6 J3

ARM 0 ARM* 0 ARMCOIL 2 ARM COIL 6

CONNECTOR CABLE ASSEMBLY, PART NO. 07910-60027. FOR PIN ASSIGNMENTS, SEE TABLE 3-9.

J101

16

J402

6 7 8 9 10 11 12

+5V 2 MOT (A–) 9 COM SIG (B) 6 COM SIG (A) 5 MOT (A+) 1

J303

10

DRIVE ELECTRONICS PCA-A4

SECTOR CABLE ASSEMBLY, PART NO. 07910-60026. FOR PIN ASSIGNMENTS, SEE TABLE 3-8.

11

J102

50

DRIVE CABLE ASSEMBLY, PART NO. 07910-60016. FOR PIN ASSIGNMENTS, SEE TABLE 3-6.

BACKPLANE PCA-A6

A1 J3 J4

A2 J3 J4

J1

1 +12V 3
2 –12V 91
3 PON 95
4 +5V 92
5 GND 0
6

CAUTION
DO NOT DISCONNECT OR CONNECT HP-IB CABLE FROM HP-IB CONNECTOR WITH POWER APPLIED.

NO CONNECTIONS (FOR FACTORY TESTING ONLY)

P1 P2 P3 P4

ANALOG ELECTRONICS PCA-A1

J1 J2 J3

NO CONNECTIONS (FOR FACTORY TESTING ONLY)

NO CONNECTIONS (FOR FACTORY TESTING ONLY)

P1 P2 P3 P4

CONTROLLER PCA-A2

J1 J2 J3

NO CONNECTIONS (FOR FACTORY TESTING ONLY)

HP-IB CONNECTOR

J1 ▶ HP-IB

26

HP-IB CABLE ASSEMBLY, PART NO. 07910-60040. FOR PIN ASSIGNMENTS SEE TABLE 3-10.

50

CONTROLLER CABLE ASSEMBLY, PART NO. 07910-60017. FOR PIN ASSIGNMENTS, SEE TABLE 3-7.

Figure 3-3. Interconnection Diagram

REMOVAL AND REPLACEMENT

SECTION IV

4-1. INTRODUCTION

WARNING

This disc drive does not contain operator-serviceable parts. To prevent electrical shock, refer all installation and maintenance activities to service-trained personnel.

WARNING

To avoid dangerous electrical shock, do not perform any removal/replacement operation until the ac mains power is removed from the power supply which provides dc power for the disc drive.

CAUTION

To avoid damage to the disc drive, do not move it when the disc is spinning.

This section provides removal and replacement procedures for field-replaceable disc drive assemblies that require special removal and replacement procedures. Removal and replacement of other parts can be done by referring to the illustrations contained in section V.

In this section references are made to illustrations and tables contained in Section V, Replaceable Parts, to aid in identifying and locating parts.

4-2. PRINTED CIRCUIT ASSEMBLIES

The only replaceable printed circuit assemblies (PCA's) are analog electronics PCA-A1, controller PCA-A2, drive electronics PCA-A4, and power supply PCA-A5A1 (only in HP 7910H/HR Disc Drives). Paragraphs 4-3 through 4-5 contain the procedures for removal and replacement of these PCA's.

4-3. CARD CAGE PCA'S

The card cage PCA's are analog electronics PCA-A1 and controller PCA-A2. To remove either one or both PCA's, proceed as follows:

a. Remove the ac power from the power supply which provides dc power for the disc drive.

b. For an HP 7910H, HR, or KR Disc Drive, remove the front panel assembly (1, figure 5-5).

c. Remove the PCA access cover (1, figure 5-4 or 35, figure 5-5) from the disc drive.

d. Remove the controller cable assembly (5, figure 5-4 or 10, figure 5-5) from the disc drive.

e. Remove the HP-IB cable assembly (2, figure 5-4 or 3, figure 5-5) from controller PCA-A2.

f. If applicable, remove analog electronics PCA-A1 (6, figure 5-4 or 11, figure 5-5) from the disc drive.

g. If applicable, remove controller PCA-A2 (7, figure 5-4 or 12, figure 5-5) from the disc drive.

To replace one or both of the PCA's follow the above steps in reverse order, ensuring that the PCA is replaced in the proper location in the card cage.

4-4. DRIVE ELECTRONICS PCA-A4

To remove drive electronics PCA-A4 (74, figure 5-4 or 86, figure 5-5) proceed as follows:

a. Remove the ac power from the power supply which provides dc power for the disc drive.

b. For an HP 7910HR, K, or KR Disc Drive, remove the disc drive from the system cabinet.

CAUTION

To avoid damage to the disc drive, avoid applying any sudden shocks to it.

c. Lift the disc drive so it is resting on the left side. (Refer to figure 4-1.)

d. Remove the bottom cover (13, figure 5-4 or 26, figure 5-5) from the disc drive enclosure.

e. Unlatch the four snap-slides (88, figure 5-4 or 100, figure 5-5) and lower drive electronics PCA-A4 far enough to remove the drive cable assembly (26, figure 5-4 or 38, figure 5-5).

f. Lower drive electronics PCA-A4 into the service position. (Refer to figure 4-1.)

g. Disconnect the cable connectors from drive electronics PCA-A4.

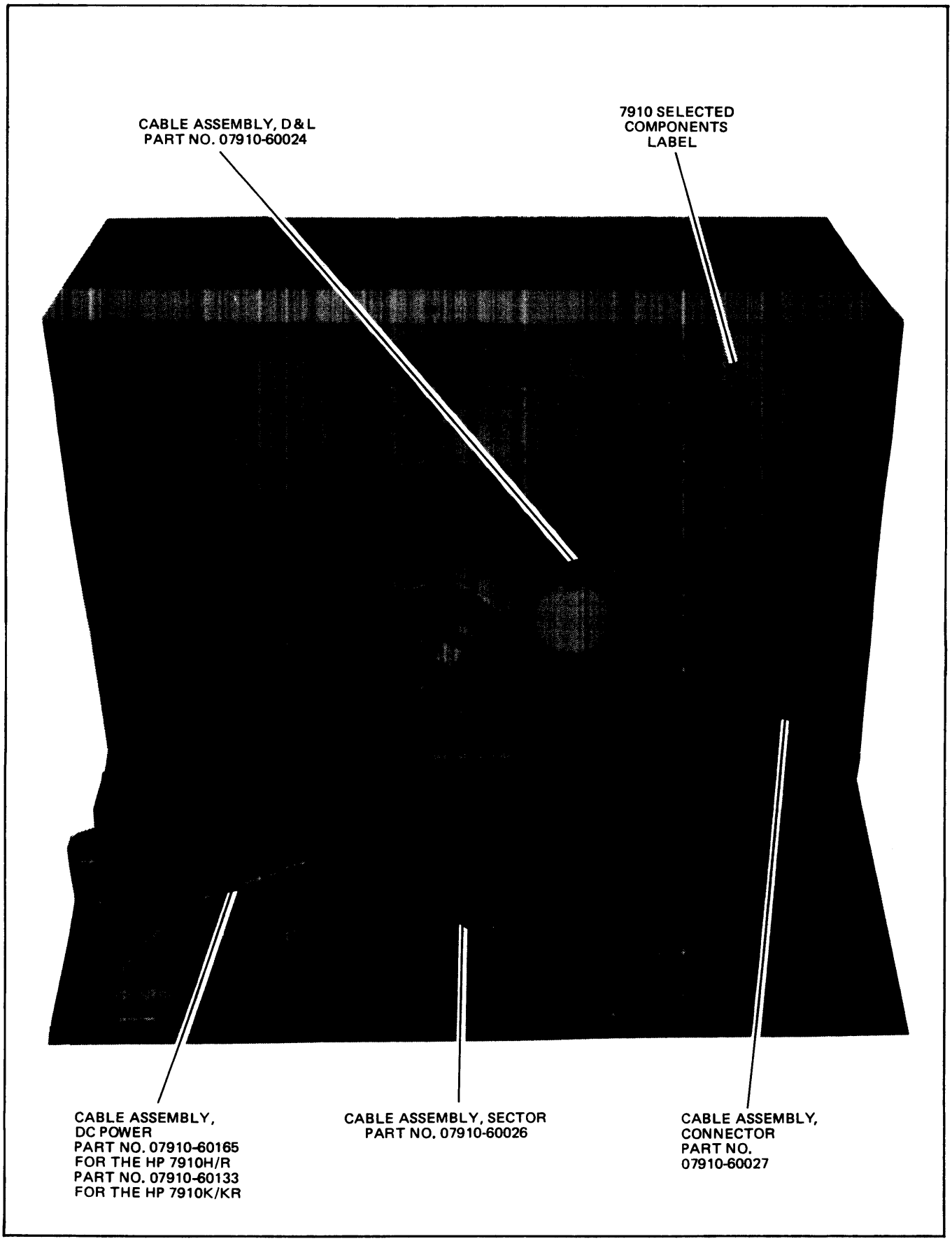


Figure 4-1. Drive Electronics PCA-A4 in the Service Position

h. Push drive electronics PCA-A4 into the operational position and latch the four snap-slides (88, figure 5-4 or 100, figure 5-5).

i. Remove the four screws (75, figure 5-4 or 87, figure 5-5) that attach the drive electronics PCA to the drive mechanism (92, figure 5-4 or 104, figure 5-5).

j. Unlatch the four snap-slides and remove drive electronics PCA-A4 from the drive mechanism.

k. Remove the plug-in resistor assembly (82, figure 5-4 or 94, figure 5-5) and the plug-in jumper assembly (83, figure 5-4 or 95, figure 5-5) from drive electronics PCA-A4. These plug-in assemblies are required for the replacement drive electronics PCA.

To replace drive electronics PCA-A4, follow the above steps in reverse order. When drive electronics PCA-A4 is replaced, ensure that the two plug-in assemblies (82 and 83, figure 5-4 or 94 and 95, figure 5-5) from the old drive electronics PCA are placed in the replacement drive electronics PCA. These plug-in assemblies are required for proper operation of the disc drive.

Note: Ensure that the jumpers on the plug-in jumper assembly (83, figure 5-4 or 95, figure 5-5) are in the same location as that shown on the label attached to the drive mechanism. (Refer to figure 4-1.)

4-5. POWER SUPPLY PCA-A5A1

This procedure applies only to HP 7910 H/HR Disc Drives. To remove power supply PCA-A5A1 (5, figure 5-6), proceed as follows:

a. Turn the power switch to the 0 (off) position. Remove the ac power cord from the ac mains power.

b. For an HP 7910H Disc Drive, follow substeps (1) through (3), otherwise proceed to step c.

(1) Remove the dress cover (7, figure 5-1) from the disc drive.

(2) Remove the two standoffs (14) which secure the HP-IB cable assembly to the rear cover (17).

(3) Remove the rear cover (17).

c. Remove the top cover (1, figure 5-6) from the power supply.

d. Remove the three cable connectors from power supply PCA-A5A1 (5).

e. Remove screws (6, 9, 10, and 13) and washers (7, 8, 11, 12, and 14) from the power supply assembly.

f. Remove power supply PCA-A5A1 from the power supply assembly.

To replace power supply PCA-A5A1, perform the above steps in reverse order.

4-6. POWER SUPPLY ASSEMBLY

This procedure applies only to the HP 7910H/HR Disc Drives which come with a factory power supply assembly (21, figure 5-1 or 6, figure 5-2). To remove the power supply assembly, proceed as follows:

a. Turn the power switch to the 0 (off) position. Remove the ac power cord from the ac mains power.

b. For an HP 7910H Disc Drive, follow substeps (1) through (3), otherwise proceed to step c.

(1) Remove the dress cover (7, figure 5-1) from the disc drive.

(2) Remove the two standoffs (14) which secure the HP-IB cable assembly to the rear cover (17).

(3) Remove the rear cover (17).

c. Remove the screws (22, figure 5-1 or 7, figure 5-2) which secure the power supply assembly to the rear panel (70, figure 5-5) of the disc drive.

CAUTION

To avoid damage to the power supply assembly, do not pull it away from the disc drive more than 8 cm (3 in.) before disconnecting the cables.

d. Pull the power supply assembly away from the disc drive 8 cm (3 in.) and disconnect the cable connected to the fan and disconnect connector P2 (37, figure 5-5) from J2.

e. Remove the power supply assembly from the disc drive.

To replace a power supply assembly, perform the above steps in reverse order. When the power supply assembly (21, figure 5-1 or 6, figure 5-2) is replaced, ensure that:

- The fan cable is connected to the fan.
- The voltage select switch (29, figure 5-6) is set to the proper value for the ac line voltage that the disc drive is operating on.

4-7. REMOVING THE DRIVE MECHANISM

CAUTION

To avoid damage to the drive mechanism, do not attempt to repair the components or PCA's inside or attached to the drive mechanism. Any attempt to repair these parts will contaminate the clean environment maintained inside the drive mechanism and will cause irreversible damage.

The drive mechanism (92, figure 5-4 or 104, figure 5-5) is replaced as a single unit. There are no field replaceable components in the drive mechanism. To remove a drive mechanism, proceed as follows:

a. Remove the ac power from the power supply which provides dc power for the disc drive.

b. For an HP 7910HR, K, or KR Disc Drive, remove the disc drive from the system cabinet.

c. For an HP 7910H/HR Disc Drive, remove the power supply assembly. (Refer to paragraph 4-6.)

d. For an HP 7910H, HR, or KR Disc Drive, remove the front panel assembly (1, figure 5-5).

e. For an HP 7910 HR or KR Disc Drive, remove the top cover (1, figure 5-2 or 1, figure 5-3).

f. For an HP 7910K, remove the top cover (10, figure 5-4). Remove the dc power cable assembly (25) from the top cover.

g. Remove the PCA access cover (1, figure 5-4 or 35, figure 5-5) from the disc drive.

h. Remove the HP-IB cable assembly (2, figure 5-4 or 3, figure 5-5) from the disc drive.

i. Remove the dc power cable assembly (25, figure 5-4 or 37, figure 5-5) from backplane PCA-A6.

j. For an HP 7910H, HR, or KR , remove the four screws (28, figure 5-5) from each side panel (27 and 30) which attach the rear panel (70) to the disc drive enclosure.

k. For an HP 7910K, remove the three screws (15, figure 5-4) from each side panel (14 and 17) which attach the rear panel (58) to the disc drive enclosure.

CAUTION

To avoid damage to the disc drive, avoid applying any sudden shocks to it.

l. Lift the disc drive so it is resting on the left side, as shown in figure 4-2.

m. Remove the bottom cover (13, figure 5-4 or 26, figure 5-5) from the disc drive enclosure.

n. Remove drive electronics PCA-A4 from the disc drive. (Refer to paragraph 4-4.)

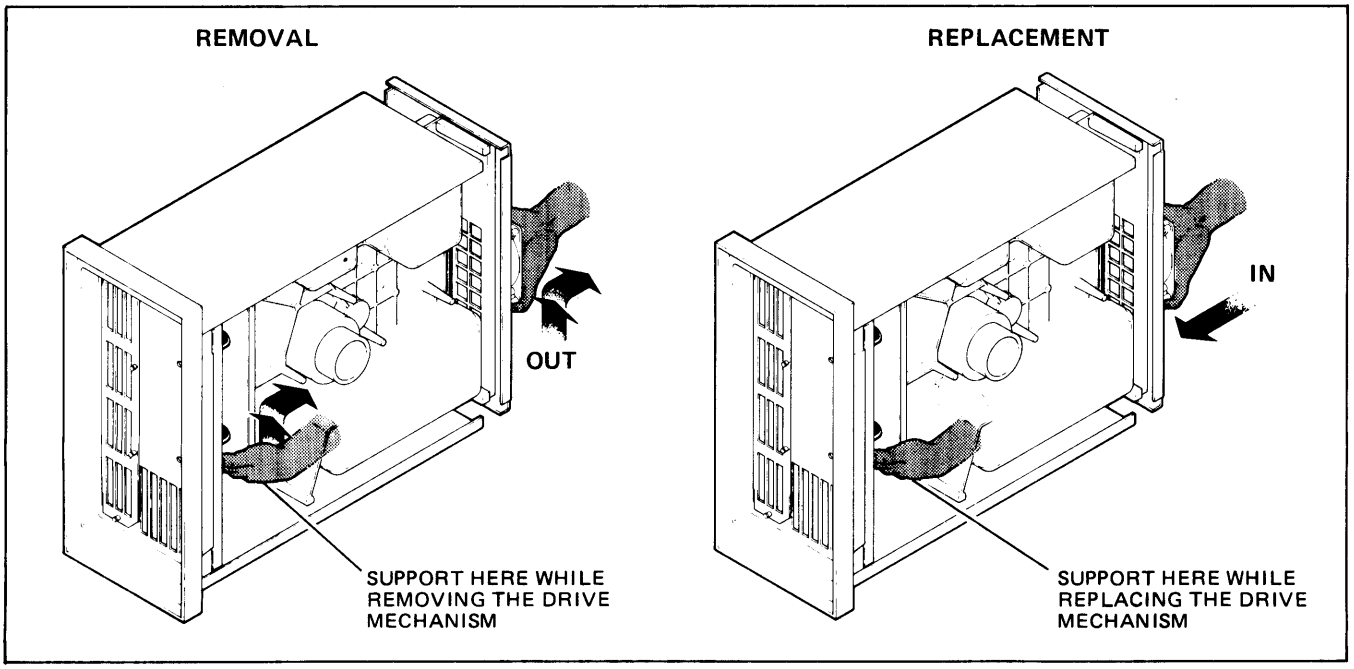


Figure 4-2. Drive Mechanism, Removal and Replacement

o. Remove the nuts (22, figure 5-4 or 33, figure 5-5) that hold the drive mechanism to the cross plate.

CAUTION

To avoid damage to the disc drive, avoid applying any sudden shocks to the drive mechanism when it is out of the disc drive enclosure.

p. Pull the drive mechanism out of the enclosure ensuring that the drive mechanism is supported by a hand in the location indicated in figure 4-2. Supporting the drive mechanism in this manner ensures that the drive mechanism will not receive a sudden shock when the front shock mounts (69, figure 5-4 or 81, figure 5-5) clear the holes in the cross plate (24, figure 5-4 or 36, figure 5-5).

q. Position the drive mechanism so that the bottom is resting on the work surface.

r. For an HP 7910H, HR, or KR Disc Drive, disconnect the dc power cable assembly connector (37, figure 5-5) from the rear panel (70).

s. Remove the rear panel (58, figure 5-4 or 70, figure 5-5) from the drive mechanism.

t. Remove the front and rear mounting brackets (70 and 64, figure 5-4 or 82 and 76, figure 5-5) from the drive mechanism.

u. Place the drive mechanism in the reusable transit case before transporting it.

4-8. REPLACING THE DRIVE MECHANISM

CAUTION

To avoid damage to the drive mechanism, transport the mechanism only in the transit case supplied with the replacement unit. See figure 4-3.

To replace a drive mechanism, proceed as follows:

a. Attach the front and rear mounting brackets (70 and 64, figure 5-4 or 82 and 76, figure 5-5) to the drive mechanism.

b. Attach the rear panel (58, figure 5-4 or 70, figure 5-5) to the drive mechanism.

c. On the dc power cable assembly (25, figure 5-4 or 37, figure 5-5), pull the 8-pin connector to the underside of the drive mechanism by going between the rear mounting bracket (64, figure 5-4 or 76, figure 5-5) and the drive mechanism (92, figure 5-4 or 104, figure 5-5).

d. For an HP 7910H, HR, or KR Disc Drive, connect the dc power cable connector (37, figure 5-5) to the rear panel (70).

CAUTION

To avoid damage to the disc drive, avoid applying any sudden shocks to the drive mechanism when it is out of the disc drive enclosure.

e. Slide the drive mechanism into the enclosure, ensuring that the drive mechanism is supported by a hand in the location indicated in figure 4-2. Supporting the drive mechanism in this manner ensures that the front shock mounts (69, figure 5-4 or 81, figure 5-5) can be inserted in the holes in the cross plate (24, figure 5-4 or 36, figure 5-5).

f. Attach the nuts and washers (22 and 23, figure 5-4 or 33 and 34, figure 5-5) that hold the drive mechanism to the cross plate.

g. Replace drive electronics PCA-A4 in the drive mechanism. (Refer to paragraph 4-4.)

h. Place the new plug-in resistor assembly (82, figure 5-4 or 94, figure 5-5) and the plug-in jumper assembly (83, figure 5-4 or 95, figure 5-5) provided with the replacement drive mechanism into drive electronics PCA-A4. Set the jumpers on the plug-in jumper assembly (83, figure 5-4 or 95, figure 5-5) to match the jumper locations pictured on the 7910 Selected Components label on the drive mechanism. (Refer to figure 4-1.)

i. Attach the bottom cover (13, figure 5-4 or 26, figure 5-5) to the disc drive enclosure.

CAUTION

To avoid damage to the disc drive, avoid applying any sudden shocks to it.

j. Turn the disc drive so it is resting on the bottom of the enclosure.

k. Attach the screws (15, figure 5-4 or 28, figure 5-5) that attach the rear panel (58, figure 5-4 or 70, figure 5-5) to the disc drive enclosure.

l. Attach the dc power cable assembly connector (25, figure 5-4 or 37, figure 5-5) to backplane PCA-A6.

m. For an HP 7910H/HR, replace the power supply assembly. (Refer to paragraph 4-6.)

n. Attach the HP-IB cable assembly (2, figure 5-4 or 3, figure 5-5) to the disc drive and to controller PCA-A2.

o. Attach the PCA access cover (1, figure 5-4 or 35, figure 5-5) to the disc drive.

p. For an HP 7910K, attach the dc power cable connector (25, figure 5-4) to the top cover (10). Attach the top cover to the disc drive enclosure.

q. For an HP 7910 HR or KR Disc Drive, attach the top cover (1, figure 5-2 or 1, figure 5-3) to the disc drive enclosure.

r. For an HP 7910H, attach the rear cover (17, figure 5-1) and the dress cover (7).

s. For an HP 7910HR, K, or KR Disc Drive, install the disc drive in the system cabinet.

t. For an HP 7910H, HR, or KR Disc Drive, attach the front panel assembly (1, figure 5-5).

u. Restore power to the disc drive.

4-9. DRIVE MECHANISM SHIPMENT

The following procedure provides instructions for packaging the drive mechanism for shipment.

CAUTION

To avoid damage to the drive mechanism, transport the mechanism only in the transit case supplied with the replacement unit. See figure 4-3.

To package a drive mechanism, proceed as follows:

a. Remove the drive mechanism from the disc drive enclosure. (Refer to paragraph 4-7.)

b. Remove drive electronics PCA-A4 from the drive mechanism. (Refer to paragraph 4-4.)

c. Remove all the removable cables (71, 72, 73, figure 5-4 or 83, 84, 85, figure 5-5) from the drive mechanism.

CAUTION

To avoid shipping damage of the drive mechanism, ensure that the bottom shipping cover is attached to the drive mechanism.

d. Attach the bottom shipping cover to the drive mechanism. (See figure 4-3.)

e. If the mechanism is being returned for servicing, attach a tag specifying the return address, type of service or repair required, model number, and full serial number.

Note: The drive mechanism shipping containers (transit case, packing foam, and packing box) can be ordered separately under part no. 07910-60075.

f. Place the drive mechanism, with the shipping cover attached, in the transit case. Ensure that the mechanism is oriented in the transit case as shown in figure 4-3.

Note: If the packing foam and packing box are not available, pack the transit case in a shipping carton large enough to surround it on all sides with at least two inches of styrofoam beads. Refer to the packing instructions located inside the top cover.

g. Place the transit case in the reusable drive mechanism packing box. (See figure 4-3.)

h. Seal the top of the box using 3-inch reinforced paper tape.

i. In any subsequent correspondence with Hewlett-Packard, refer to the drive mechanism by model number and full serial number.

4-10. AIR FILTER

The HP 7910H, HR, and KR have an air filter attached to the front panel. If this part requires removal for cleaning or replacement, proceed as follows:

Note: The filter should be cleaned or replaced at least once a year.

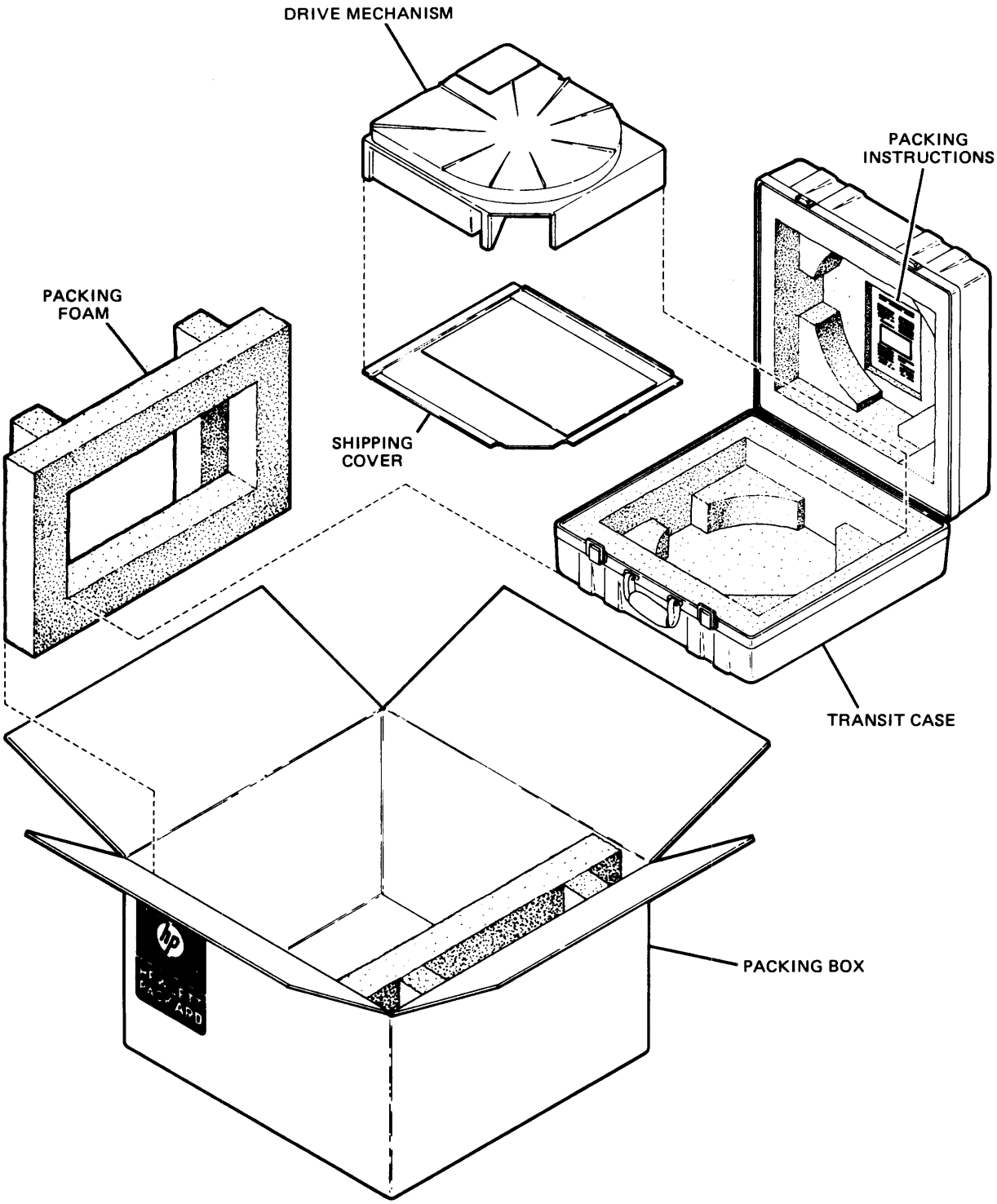
a. Remove the power from the power supply which provides dc power for the disc drive.

b. Remove the air filter (2, figure 5-5) by gently pulling it off of the front panel.

Note: The air filter can be cleaned by washing it in a solution of warm soapy water. Be sure to rinse the filter and let it dry before attaching it to the front panel.

c. Attach the new or cleaned air filter to the front panel by pressing it into place.

d. Attach the front panel (1) to the disc drive. Restore ac power to the disc drive.



NOTE:
THE DRIVE MECHANISM PART NUMBER (07910-60031) INCLUDES THE TRANSIT CASE, PACKING FOAM, AND PACKING BOX. THE TRANSIT CASE, PACKING FOAM, AND PACKING BOX CAN BE ORDERED SEPARATELY UNDER HP PART NO. 07910-60075.

7314-40A

Figure 4-3. Drive Mechanism Shipping Container

REPLACEABLE PARTS

SECTION V

5-1. INTRODUCTION

This section provides listings of all field-replaceable parts and an illustrated parts breakdown for the disc drive, as well as replaceable part ordering information.

Replaceable parts for the disc drive are listed in disassembly order in tables 5-1 through 5-6 and illustrated in figures 5-1 through 5-6. In each listing, attaching parts are listed immediately after the item they attach. Items in the DESCRIPTION column are indented to indicate relationship to the next higher assembly. In addition, the symbol "— — — x — — —" follows the last attaching part for that item. Indentation is as follows:

MAJOR ASSEMBLY
*Replaceable Assembly
*Attaching Parts for Replaceable Assembly
**Subassembly or Component Part
**Attaching Parts for Subassembly or Component Part

The replaceable parts listings provide the following information for each part:

a. FIG. & INDEX NO. The figure and index number which indicates where the replaceable part is illustrated.

b. HP PART NO. The Hewlett-Packard part number for each replaceable part.

c. DESCRIPTION. The description of each replaceable part. Refer to table 5-7 for an explanation of abbreviations used in the DESCRIPTION column.

d. MFR CODE. The five-digit code that denotes a typical manufacturer of a part. Refer to table 5-8 for a listing of manufacturers that correspond to the codes.

e. MFR PART NO. The manufacturer's part number of each replaceable part.

f. UNITS PER ASSEMBLY. The total quantity of each part used in the major assembly.

The MFR CODE and MFR PART NO. for common hardware items are listed as 00000 and OBD (order by description), respectively, because these items can usually be purchased locally.

5-2. ORDERING INFORMATION

To order replaceable parts for the disc drive, address the order to your local Hewlett-Packard Sales and Service Office. Sales and Service Offices are listed at the back of this manual. Specify the following information for each part ordered:

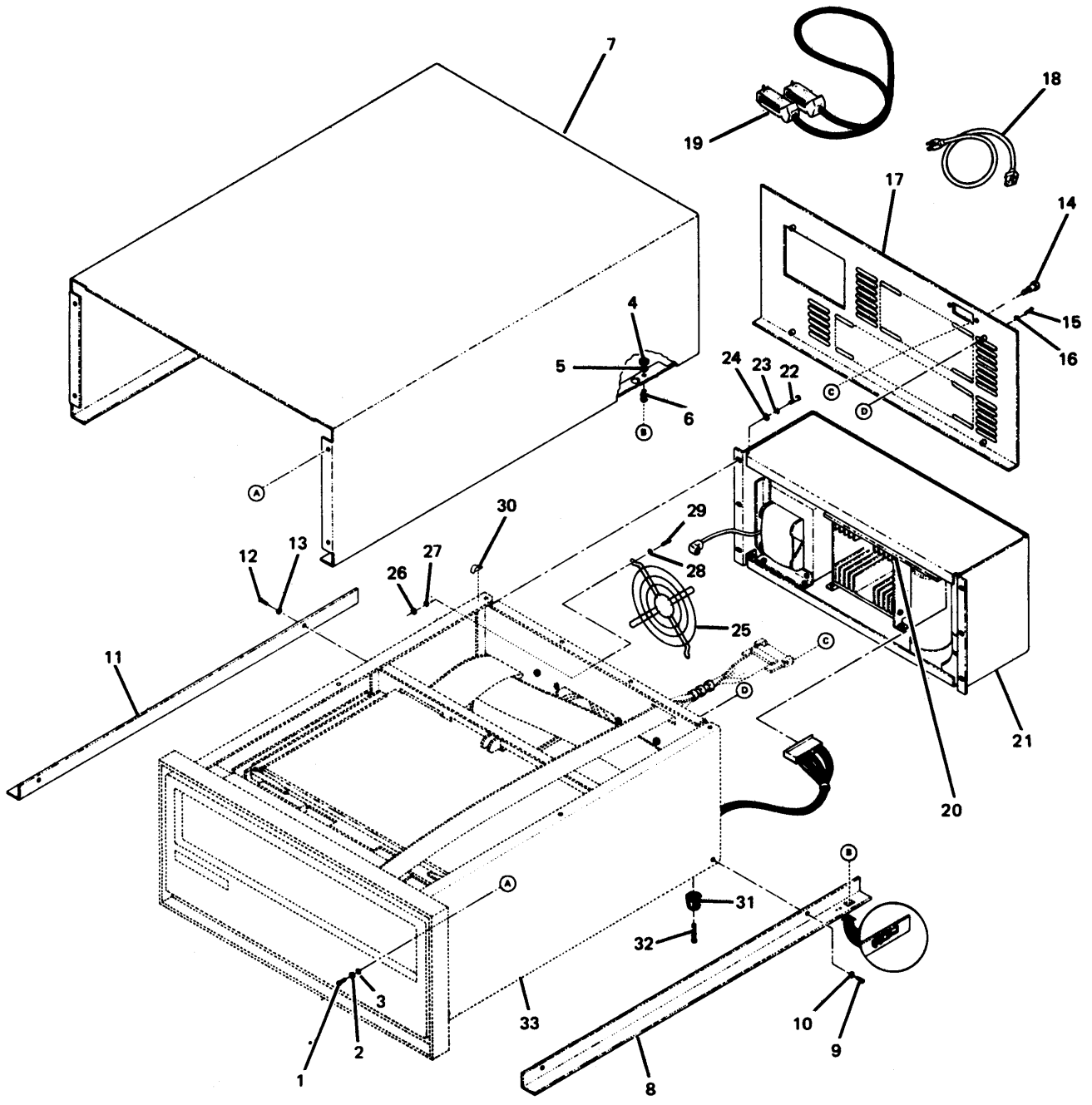
a. Model and full serial number.

b. Hewlett-Packard part number.

c. Complete description for each part as provided in the replaceable parts listings.

Table 5-1. HP 7910H Disc Drive, Replaceable Parts

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
5-1-	7910H	DISC DRIVE	28480	7910H	REF
1	2510-0109	*SCREW, machine, ph, pozi, 8-32, 0.625 in. long	00000	OBD	4
2	2190-0087	*WASHER, lock, helical, no. 8	00000	OBD	4
3	3050-0176	*WASHER, flat, no. 8	00000	OBD	4
4	2580-0015	*NUT, hex, 8-32	00000	OBD	2
5	2190-0087	*WASHER, lock, helical, no. 8	00000	OBD	2
6	1390-0374	*STUD, snap-slide	28480	1390-0374	2
7	07910-00030	*COVER, dress, top	28480	07910-00030	1
8	07910-00032	*BRACKET, right mounting	28480	07910-00032	1
		(Attaching Parts)			
9	2360-0199	*SCREW, machine, ph, pozi, 6-32, 0.437 in. long	00000	OBD	2
10	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	2
		— — — x — — —			
11	07910-00033	*BRACKET, left mounting	28480	07910-00033	1
		(Attaching Parts)			
12	2360-0199	*SCREW, machine, ph, pozi, 6-32, 0.437 in. long	00000	OBD	2
13	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	2
		— — — x — — —			
14	0380-0643	*STANDOFF, metric	00000	OBD	2
15	2360-0203	*SCREW, machine, ph, pozi, 6-32, 0.625 in. long	00000	OBD	4
16	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	4
17	07910-00031	*COVER, rear	28480	07910-00031	1
18	8120-1378	*POWER CORD, 100/120 Vac operation	28480	8120-1378	1
	8120-1860	*POWER CORD, 220/240 Vac operation (Option 15)	28480	8120-1860	REF
	8120-2857	*POWER CORD, 220/240 Vac operation (Option 15)	28480	8120-2857	REF
	8120-1369	*POWER CORD, 220/240 Vac operation (Option 15)	28480	8120-1369	REF
	8120-1351	*POWER CORD, 220/240 Vac operation (Option 15)	28480	8120-1351	REF
	8120-2104	*POWER CORD, 220/240 Vac operation (Option 15)	28480	8120-2104	REF
19	10833B	*CABLE ASSEMBLY, HP-IB	28480	10833B	1
20	07910-60028	*POWER SUPPLY PCA (A5A1) (5, figure 5-6)	28480	07910-60028	1
21	07910-60081	*POWER SUPPLY ASSEMBLY (A5)(See figure 5-6)	28480	07910-60081	1
		(Attaching Parts)			
22	2360-0195	*SCREW, machine, ph, pozi, 6-32, 0.312 in. long	00000	OBD	6
23	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	6
24	3050-0407	*WASHER, flat, no. 6	00000	OBD	6
		— — — x — — —			
25	3160-0099	*FAN GUARD	28480	3160-0099	1
		(Attaching Parts)			
26	2420-0003	*NUT, hex, 6-32	00000	OBD	4
27	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	4
28	3050-0228	*WASHER, flat, no. 6	00000	OBD	4
29	2360-0205	*SCREW, machine, ph, pozi, 6-32, 0.750 in. long	00000	OBD	4
		— — — x — — —			
30	07910-60062	*RFI GROUND STRIP	28480	07910-60062	19
31	0403-0004	*BUMPER FOOT	00000	OBD	4
		(Attaching Parts)			
32	2510-0107	*SCREW, machine, ph, pozi, 8-32, 0.500 in. long	00000	OBD	4
		— — — x — — —			
33	No Number	*MAINFRAME ASSEMBLY (See figure 5-5)	28480	No Number	1



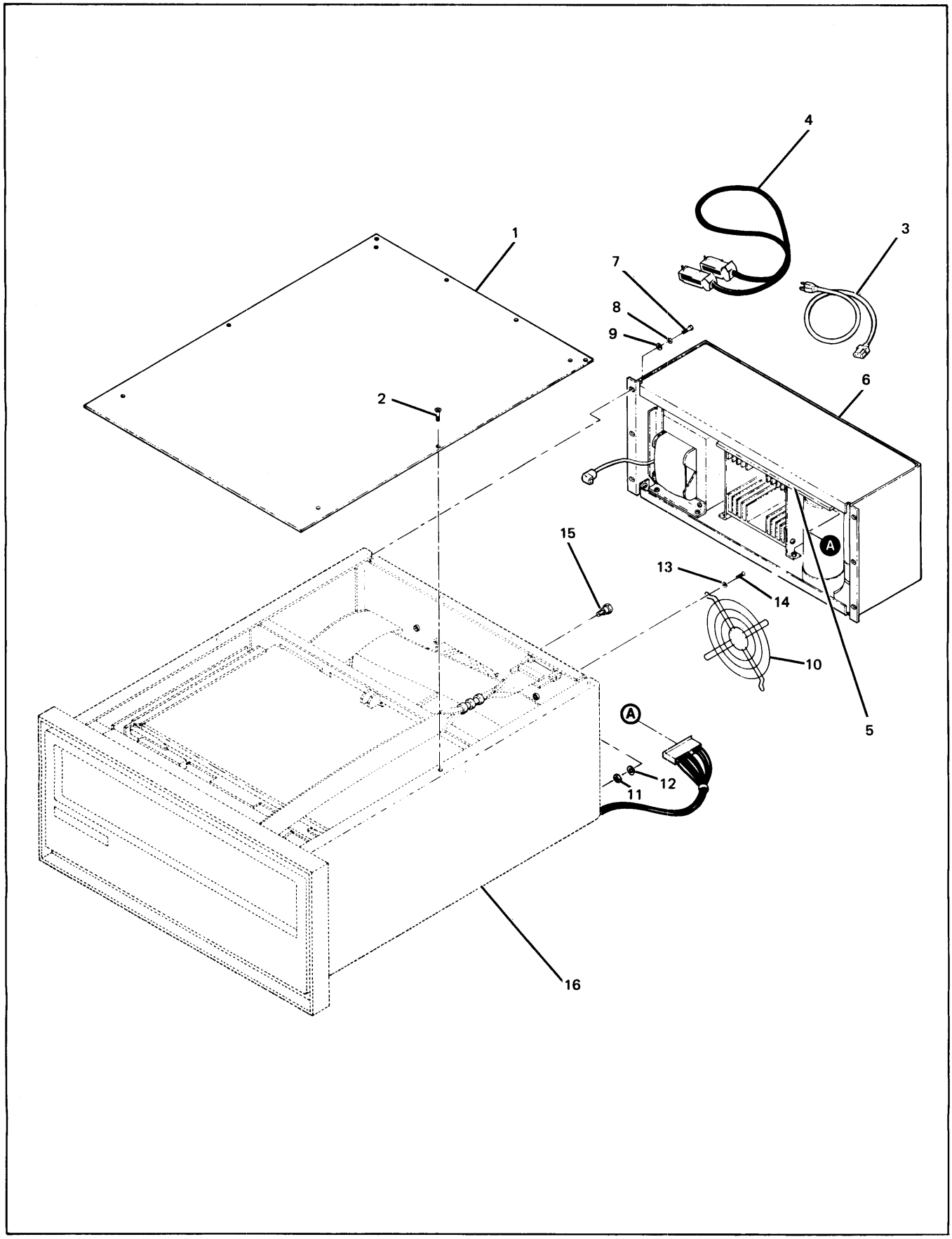
Note: Pairs of circled letters identify mating points for dashed mechanical connecting lines. For example: Ⓐ and Ⓐ connect the line between items 1 and 7.

REF 7314-22C

Figure 5-1. HP 7910H Disc Drive, Exploded View

Table 5-2. HP 7910HR Disc Drive, Replaceable Parts

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
5-2-	7910HR	DISC DRIVE	28480	7910HR	
1	07910-00017	*COVER, top	28480	07910-00017	1
		(Attaching Parts)			
2	2360-0192	*SCREW, machine, ph, pozi, 6-32, 0.312 in. long	00000	OBD	6
		— — — x — — —			
3	8120-1378	*POWER CORD, 100/120 Vac operation	28480	8120-1378	1
	8120-1860	*POWER CORD, 220/240 Vac operation (Option 15)	28480	8120-1860	REF
	8120-2857	*POWER CORD, 220/240 Vac operation (Option 15)	28480	8120-2857	REF
	8120-1369	*POWER CORD, 220/240 Vac operation (Option 15)	28480	8120-1369	REF
	8120-1351	*POWER CORD, 220/240 Vac operation (Option 15)	28480	8120-1351	REF
	8120-2104	*POWER CORD, 220/240 Vac operation (Option 15)	28480	8120-2104	REF
4	10833B	*CABLE ASSEMBLY, HP-IB	28480	10833B	1
5	07910-60028	*POWER SUPPLY PCA (A5A1) (5, figure 5-6)	28480	07910-60028	1
6	07910-60081	*POWER SUPPLY ASSEMBLY (A5) (See figure 5-6)	28480	07910-60081	1
		(Attaching Parts)			
7	2360-0195	*SCREW, machine, ph, pozi, 6-32, 0.312 in. long	00000	OBD	6
8	3050-0228	*WASHER, flat, no. 6	00000	OBD	6
9	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	6
		— — — x — — —			
10	3160-0099	*FAN GUARD	28480	3160-0099	1
		(Attaching Parts)			
11	2420-0003	*NUT, hex, 6-32	00000	OBD	4
12	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	4
13	3050-0228	*WASHER, flat, no. 6	00000	OBD	4
14	2360-0205	*SCREW, machine, ph, pozi, 6-32, 0.750 in. long	00000	OBD	4
		— — — x — — —			
15	0380-0643	*STANDOFF, metric	00000	OBD	2
16	No Number	*MAINFRAME ASSEMBLY (See figure 5-5)	28480	No Number	1

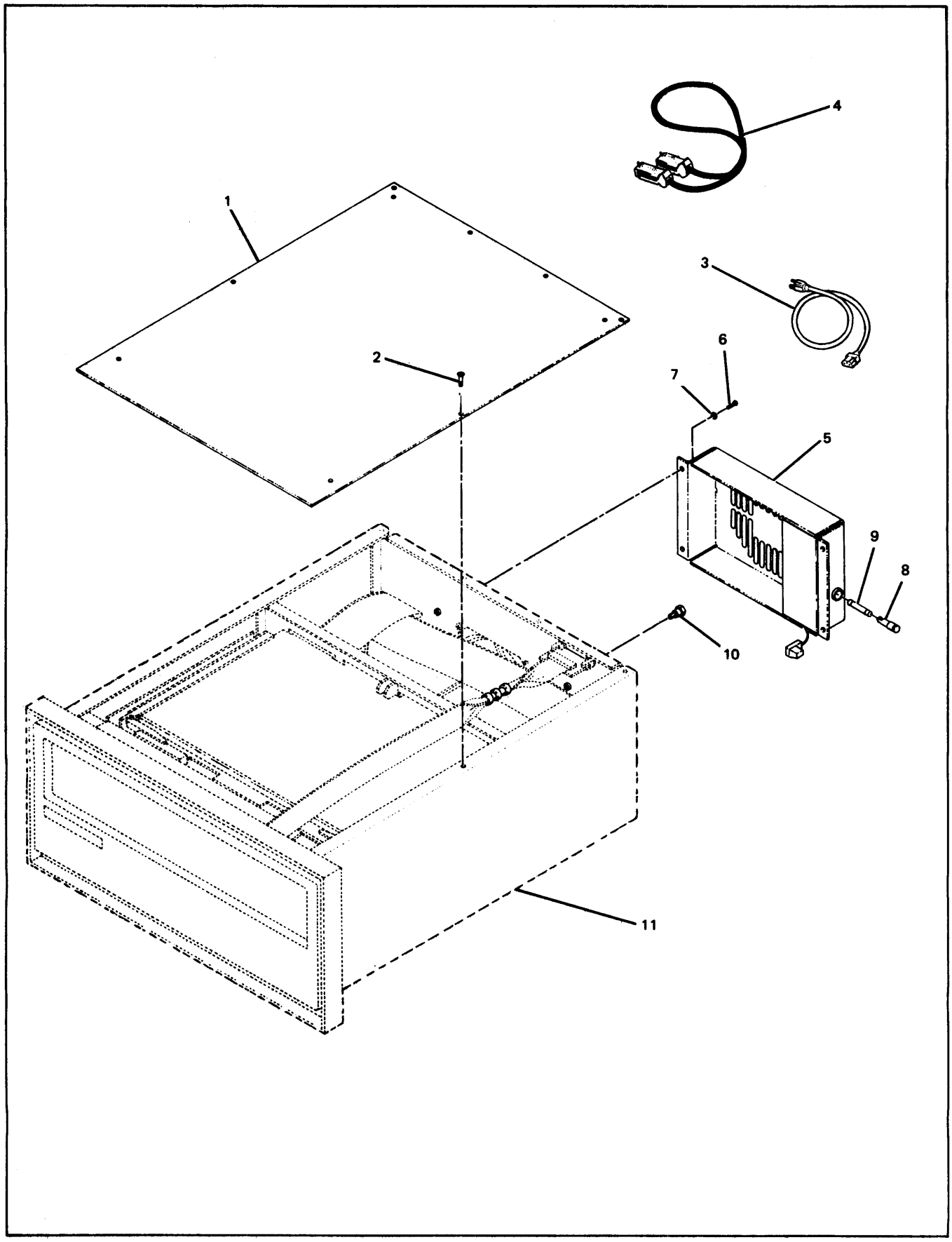


REF 7314-23C

Figure 5-2. HP 7910HR Disc Drive, Exploded View

Table 5-3. HP 7910KR Disc Drive, Replaceable Parts

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
5-3-	7910KR	DISC DRIVE	28480	7910KR	
1	07910-00017	*COVER, top	28480	07910-00017	1
		(Attaching Parts)			
2	2360-0192	*SCREW, machine, ph, pozi, 6-32, 0.312 in. long	00000	OBD	6
		— — — x — — —			
3	8120-1378	*POWER CORD, 100/120 Vac operation	28480	8120-1378	1
	8120-1860	*POWER CORD, 220/240 Vac operation (Option 15)	28480	8120-1860	REF
	8120-2857	*POWER CORD, 220/240 Vac operation (Option 15)	28480	8120-2857	REF
	8120-1369	*POWER CORD, 220/240 Vac operation (Option 15)	28480	8120-1369	REF
	8120-1351	*POWER CORD, 220/240 Vac operation (Option 15)	28480	8120-1351	REF
	8120-2104	*POWER CORD, 220/240 Vac operation (Option 15)	28480	8120-2104	REF
4	10833B	*CABLE ASSEMBLY, HP-IB	28480	10833B	1
5	07910-60063	*FAN COVER ASSEMBLY	28480	07910-60063	1
		(Attaching Parts)			
6	2360-0195	*SCREW, machine, ph, pozi, 6-32, 0.312 in. long	00000	OBD	4
7	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	4
		— — — x — — —			
8	2110-0565	**CAP, fuseholder	28480	2110-0565	1
9	2110-0004	**FUSE, 0.25A, 250V, fast-blo	71400	AGC-1/4	1
10	0380-0643	*STANDOFF, metric	00000	OBD	2
11	No Number	*MAINFRAME ASSEMBLY (See figure 5-5)	28480	No Number	1



REF 7314-24 B

Figure 5-3. HP 7910KR Disc Drive, Exploded View

Table 5-4. HP 7910K Disc Drive, Replaceable Parts

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
5-4-	7910K	DISC DRIVE	28480	7910K	
1	07910-00043	*PCA ACCESS COVER	28480	07910-00043	1
2	07910-60040	*CABLE ASSEMBLY, HP-IB	28480	07910-60040	1
		(Attaching Parts)			
3	0380-0643	*STANDOFF, metric	00000	OBD	2
4		Deleted			
		— — — x — — —			
5	07910-60017	*CABLE ASSEMBLY, controller	28480	07910-60017	1
6	07910-60103	*ANALOG ELECTRONICS PCA (A1)	28480	07910-60103	1
7	07910-60039	*CONTROLLER PCA (A2)	28480	07910-60039	1
8	2360-0195	*SCREW, machine, ph, pozi, 6-32, 0.312 in. long	00000	OBD	10
9	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	10
10	07910-00035	*COVER, top	28480	07910-00035	1
11	2360-0192	*SCREW, machine, ph, pozi, 6-32, 0.250 in. long	00000	OBD	6
12	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	6
13	07910-00040	*COVER, bottom	28480	07910-00040	1
14	07910-00039	*SIDE PANEL, right	28480	07910-00039	1
		(Attaching Parts)			
15	2360-0195	*SCREW, machine, ph, pozi, 6-32, 0.312 in long	00000	OBD	11
16	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	11
		— — — x — — —			
17	07910-00038	*SIDE PANEL, left	28480	07910-00038	1
		(Attaching Parts)			
18	2360-0195	*SCREW, machine, ph, pozi, 6-32, 0.312 in. long	00000	OBD	11
19	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	11
		— — — x — — —			
20	2360-0195	*SCREW, machine, ph, pozi, 6-32, 0.312 in. long	00000	OBD	2
21	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	2
22	2950-0004	*NUT, hex, 1/4-20	00000	OBD	2
23	2190-0740	*WASHER, lock, helical, 1-4 in.	00000	OBD	2
24	07910-00037	*PLATE, cross	28480	07910-00037	1
25	07910-60133	*CABLE ASSEMBLY, dc power	28480	07910-60133	1
26	07910-60016	*CABLE ASSEMBLY, drive	28480	07910-60016	1
		(Attaching Parts)			
27	2200-0147	*SCREW, machine, ph, pozi, 4-40, 0.500 in. long	00000	OBD	2
28	2190-0913	*WASHER, lock, helical, no. 4	00000	OBD	2
29	3050-0229	*WASHER, flat, no. 4	00000	OBD	2
		— — — x — — —			
30	07910-20025	*CARD GUIDE, left	28480	07910-20025	1
		(Attaching Parts)			
31	2420-0003	*NUT, hex, 6-32	00000	OBD	4
32	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	4
33	3050-0228	*WASHER, flat, no. 6	00000	OBD	4
34	2360-0201	*SCREW, machine, ph, pozi, 6-32, 0.500 in. long	00000	OBD	4
		— — — x — — —			
35	07910-20026	*CARD GUIDE, right	28480	07910-20026	1
		(Attaching Parts)			
	2420-0003	*NUT, hex, 6-32	00000	OBD	4
	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	4
	3050-0228	*WASHER, flat, no. 6	00000	OBD	4
	2360-0201	*SCREW, machine, ph, 6-32, 0.500 in. long	00000	OBD	4
		— — — x — — —			
36	07910-00016	*BRACKET, guide	28480	07910-00016	2
		(Attaching Parts)			
37	2200-0147	*SCREW, machine, ph, pozi, 4-40, 0.500 in.	00000	OBD	2
38	2190-0851	*WASHER, lock, helical, no. 4	00000	OBD	2
		— — — x — — —			

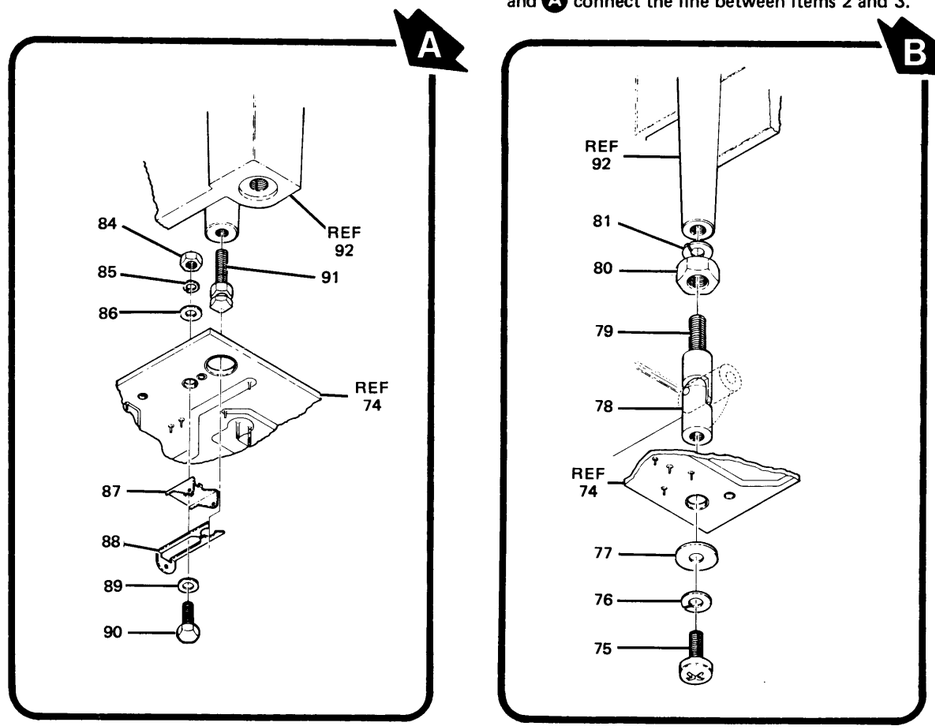
Table 5-4. HP 7910K Disc Drive, Replaceable Parts (Continued)

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
39	07910-20027	*CARD GUIDE, rear	28480	07910-20027	1
		(Attaching Parts)			
40	2360-0195	*SCREW, machine, ph, pozi, 6-32, 0.312 in. long	00000	OBD	2
41	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	2
42	3050-0228	*WASHER, flat, no. 6	00000	OBD	2
		— — — x — — —			
43	07910-60030	*BACKPLANE PCA (A6)	28480	07910-60030	1
		(Attaching Parts)			
44	2360-0195	*SCREW, machine, ph, pozi, 6-32, 0.312 in. long	00000	OBD	6
45	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	6
		— — — x — — —			
46	07910-00015	*CARD CAGE	28480	07910-00015	1
47	2940-0072	*SCREW, machine, ph, pozi, 1/4-20, 0.312 in. long	00000	OBD	2
48	2190-0740	*WASHER, lock, helical, 1/4 in.	00000	OBD	2
49	3160-0099	*FAN GUARD	28480	3160-0099	1
		(Attaching Parts)			
50	2420-0003	*NUT, hex, 6-32	00000	OBD	4
51	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	4
52	3050-0228	*WASHER, flat, no. 6	00000	OBD	4
53	2360-0205	*SCREW, machine, ph, pozi, 6-32, 0.750 in. long	00000	OBD	4
		— — — x — — —			
54	3160-0339	*FAN	28480	3160-0339	1
		(Attaching Parts)			
55	2420-0003	*NUT, hex, 6-32	00000	OBD	4
56	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	4
57	2360-0205	*SCREW, machine, ph, pozi, 6-32, 0.750 in. long	00000	OBD	4
		— — — x — — —			
58	07910-00036	*PANEL, rear	28480	07910-00036	1
59	2510-0103	*SCREW, machine, ph, pozi, 8-32, 0.375 in. long	00000	OBD	4
60	2190-0087	*WASHER, lock, helical, no. 8	00000	OBD	4
61	2950-0004	*NUT, 1/4-20	00000	OBD	2
62	2190-0740	*WASHER, lock, helical, 1/4 in.	00000	OBD	2
63	1520-0207	*MOUNT, shock	28480	1520-0207	2
64	07910-00020	*BRACKET, rear mounting	28480	07910-00020	1
65	2510-0103	*SCREW, machine, ph, pozi, 8-32, 0.375 in. long	00000	OBD	4
66	2190-0087	*WASHER, lock, helical, no. 8	00000	OBD	4
67	2940-0072	*SCREW, machine, ph, pozi, 1/4-20, 0,312 in. long	00000	OBD	4
68	2190-0740	*WASHER, lock, helical, 1/4 in.	00000	OBD	4
69	1520-0207	*MOUNT, shock	28480	1520-0207	2
70	07910-00019	*BRACKET, front mounting	28480	07910-00019	1
71	07910-60026	*CABLE ASSEMBLY, sector	28480	07910-60026	1
72	07910-60024	*CABLE ASSEMBLY, arm D&L	28480	07910-60024	1
73	07910-60027	*CABLE ASSEMBLY, connector	28480	07910-60027	1
74	07910-60102	*DRIVE ELECTRONICS PCA (A4)	28480	07910-60102	1
		(Attaching Parts)			
75	2510-0045	*SCREW, machine, ph, pozi, 8-32, 0.375 in. long	00000	OBD	4
76	2190-0073	*WASHER, lock, helical, no. 8	00000	OBD	4
77	3050-0001	*WASHER, flat, non-metallic, no. 8	00000	OBD	4
78	0380-0571	*PCA HINGE	00000	OBD	4
79	3030-0289	*SCREW, set, recess hex, cup point, 8-32, 0.625 in. long	00000	OBD	4
80	2580-0004	*NUT, hex, no. 8-32	00000	OBD	4
81	2190-0073	*WASHER, lock, helical, no. 8	00000	OBD	4
		— — — x — — —			
82	07910-60041	**PLUG-IN-RESISTOR ASSEMBLY (105 kΩ)	28480	07910-60041	1
	07910-60042	**PLUG-IN-RESISTOR ASSEMBLY (110 kΩ)	28480	07910-60042	REF
	07910-60043	**PLUG-IN-RESISTOR ASSEMBLY (115 kΩ)	28480	07910-60043	REF
	07910-60044	**PLUG-IN-RESISTOR ASSEMBLY (121 kΩ)	28480	07910-60044	REF

Table 5-4. HP 7910K Disc Drive, Replaceable Parts (Continued)

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
83	07910-60045	**PLUG-IN-JUMPER ASSEMBLY (with 0.825 kΩ resistor)	28480	07910-60045	1
	07910-60046	**PLUG-IN-JUMPER ASSEMBLY (with 1.62 kΩ resistor)	28480	07910-60046	REF
	07910-60047	**PLUG-IN-JUMPER ASSEMBLY (with 2.37 kΩ resistor)	28480	07910-60047	REF
	07910-60048	**PLUG-IN-JUMPER ASSEMBLY (with 3.16 kΩ resistor)	28480	07910-60048	REF
	07910-60049	**PLUG-IN-JUMPER ASSEMBLY (with 4.22 kΩ resistor)	28480	07910-60049	REF
	07910-60050	**PLUG-IN-JUMPER ASSEMBLY (with 5.11 kΩ resistor)	28480	07910-60050	REF
	07910-60051	**PLUG-IN-JUMPER ASSEMBLY (with 6.19 kΩ resistor)	28480	07910-60051	REF
	07910-60052	**PLUG-IN-JUMPER ASSEMBLY (with 6.81 kΩ resistor)	28480	07910-60052	REF
	07910-60053	**PLUG-IN-JUMPER ASSEMBLY (with 8.25 kΩ resistor)	28480	07910-60053	REF
	07910-60054	**PLUG-IN-JUMPER ASSEMBLY (with 9.09 kΩ resistor)	28480	07910-60054	REF
	07910-60055	**PLUG-IN-JUMPER ASSEMBLY (with 10 kΩ)	28480	07910-60055	REF
84	0610-0001	**NUT, hex, 2-56	00000	OBD	4
85	2190-0045	**WASHER, lock, helical, no. 2	00000	OBD	4
86	2190-0125	**WASHER, flat, no. 2	00000	OBD	4
87	1390-0289	**FASTENER, snapslide guide	28480	13900289	4
88	1390-0290	**FASTENER, snapslide latch	28480	1390-0290	4
89	1390-0288	**FASTENER, snap-slide washer	28480	13900288	4
90	07910-20017	**SCREW, snap-slide fastener	28480	07910-20017	4
91	1390-0470	*SNAP-SLIDE STUD	00000	OBD	4
92	07910-60031	*DRIVE MECHANISM ASSEMBLY	28480	07910-60031	1

NOTE: Pairs of circled letters identify mating points for dashed mechanical connecting lines. For example: (A) and (A) connect the line between items 2 and 3.



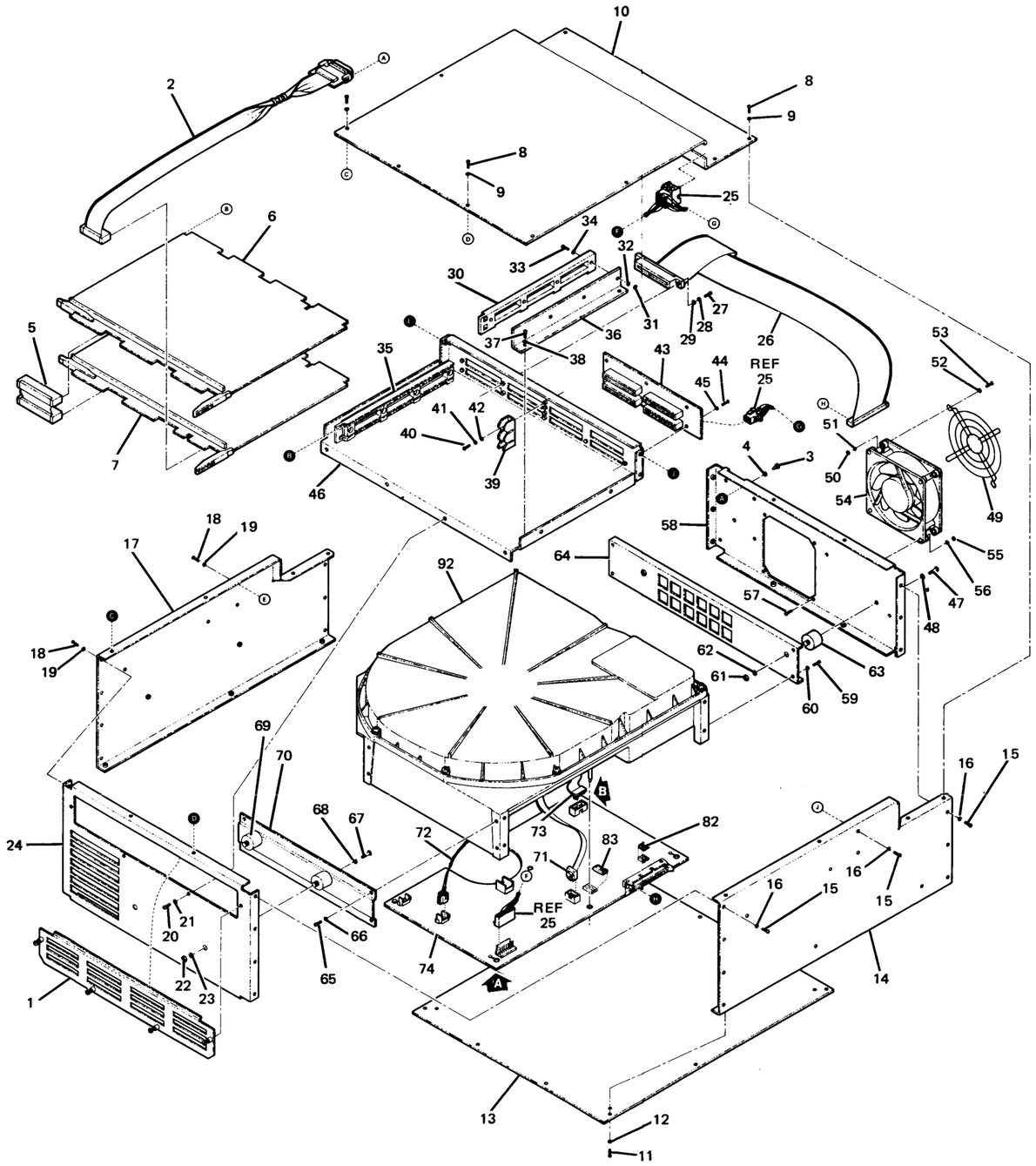


Figure 5-4. HP 7910K Disc Drive, Exploded View

REF 7314-25

Table 5-5. Mainframe Assembly, Replaceable Parts

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
5-5-	No Number	MAINFRAME ASSEMBLY (33, figure 5-1; 16, figure 5-2; 11, figure 5-3)	28480	No Number	REF
1	07910-60064	*FRONT PANEL ASSEMBLY	28480	07910-60064	1
2	4208-0251	*FILTER	28480	4208-0251	1
3	07910-60040	*CABLE ASSEMBLY, HP-IB	28480	07910-60040	1
		(Attaching Parts)			
4	0380-0643	*STANDOFF, hex, 6-32, 0.327 in.	00000	OBD	2
5		Deleted			
6	2200-0139	*SCREW, machine, ph, pozi, 4-40, 0.250 in. long (7910HR, KR only)	00000	OBD	2
7	2190-0913	*WASHER, lock, helical, no. 4 (7910HR, KR only)	00000	OBD	2
8	3050-0229	*WASHER, flat, no. 4 (7910HR, KR only)	00000	OBD	2
9	0590-0127	*NUT, sheetmetal, U-type, 4-40 (7910HR, KR only)	00000	OBD	2
		— — — x — — —			
10	07910-60017	*CABLE ASSEMBLY, controller	28480	07910-60017	1
11	07910-60103	*ANALOG ELECTRONICS PCA (A1)	28480	07910-60103	1
12	07910-60039	*CONTROLLER PCA (A2)	28480	07910-60039	1
13	07910-00010	*HANGER, left	28480	07910-00010	1
		(Attaching Parts)			
14	2420-0003	*NUT, hex, 6-32	00000	OBD	1
15	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	1
16	2360-0199	*SCREW, machine, ph, pozi, 6-32, 0.438 in. long	00000	OBD	1
		— — — x — — —			
17	07910-00009	*HANGER, right	28480	07910-00009	1
		(Attaching Parts)			
	2420-0003	*NUT, hex, 6-32	00000	OBD	1
	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	1
	2360-0199	*SCREW, machine, ph, pozi, 6-32, 0.438 in. long	00000	OBD	1
		— — — x — — —			
18	07910-00041	*LATCH STRIP	28480	07910-00041	1
		(Attaching Parts)			
19	2420-0003	*NUT, hex, 6-32	00000	OBD	2
20	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	2
21	2360-0199	*SCREW, machine, ph, pozi, 6-32, 0.438 in. long	00000	OBD	2
		— — — x — — —			
22	2510-0105	*SCREW, machine, ph, pozi, 8-32, 0.438 in. long	00000	OBD	4
23	2190-0087	*WASHER, lock, helical, no. 8	00000	OBD	4
24	5020-7335	*FRAME, front	28480	5020-7335	1
25	2360-0192	*SCREW, machine, ph, pozi, 6-32, 0.312 in. long	00000	OBD	6
26	07910-00017	*COVER, bottom	28480	07910-00017	1
27	07910-00012	*SIDE PANEL, right	28480	07910-00012	1
		(Attaching Parts)			
28	2360-0195	*SCREW, machine, ph, pozi, 6-32, 0.312 in. long	00000	OBD	12
29	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	12
		— — — x — — —			
30	07910-00011	*SIDE PANEL, left	28480	07910-00011	1
		(Attaching Parts)			
	2360-0195	*SCREW, machine, ph, pozi, 6-32, 0.312 in. long	00000	OBD	12
	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	12
		— — — x — — —			
31	2360-0195	*SCREW, machine, ph, pozi, 6-32, 0.312 in. long	00000	OBD	4
32	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	4
33	2950-0004	*NUT, hex, 1/4-20	00000	OBD	2
34	2190-0740	*WASHER, lock, helical, 1/4 in.	00000	OBD	2
35	07910-00043	*PCA ACCESS COVER	28480	07910-00043	1
36	07910-00037	*PLATE, cross	28480	07910-00037	1
37	07910-60165	*CABLE ASSEMBLY, dc power (for HP 7910H/HR Disc Drives)	28480	07910-60165	1
	07910-60133	*CABLE ASSEMBLY, dc power (for HP 7910KR Disc Drives)	28480	07910-60133	1

Table 5-5. Mainframe Assembly, Replaceable Parts (Continued)

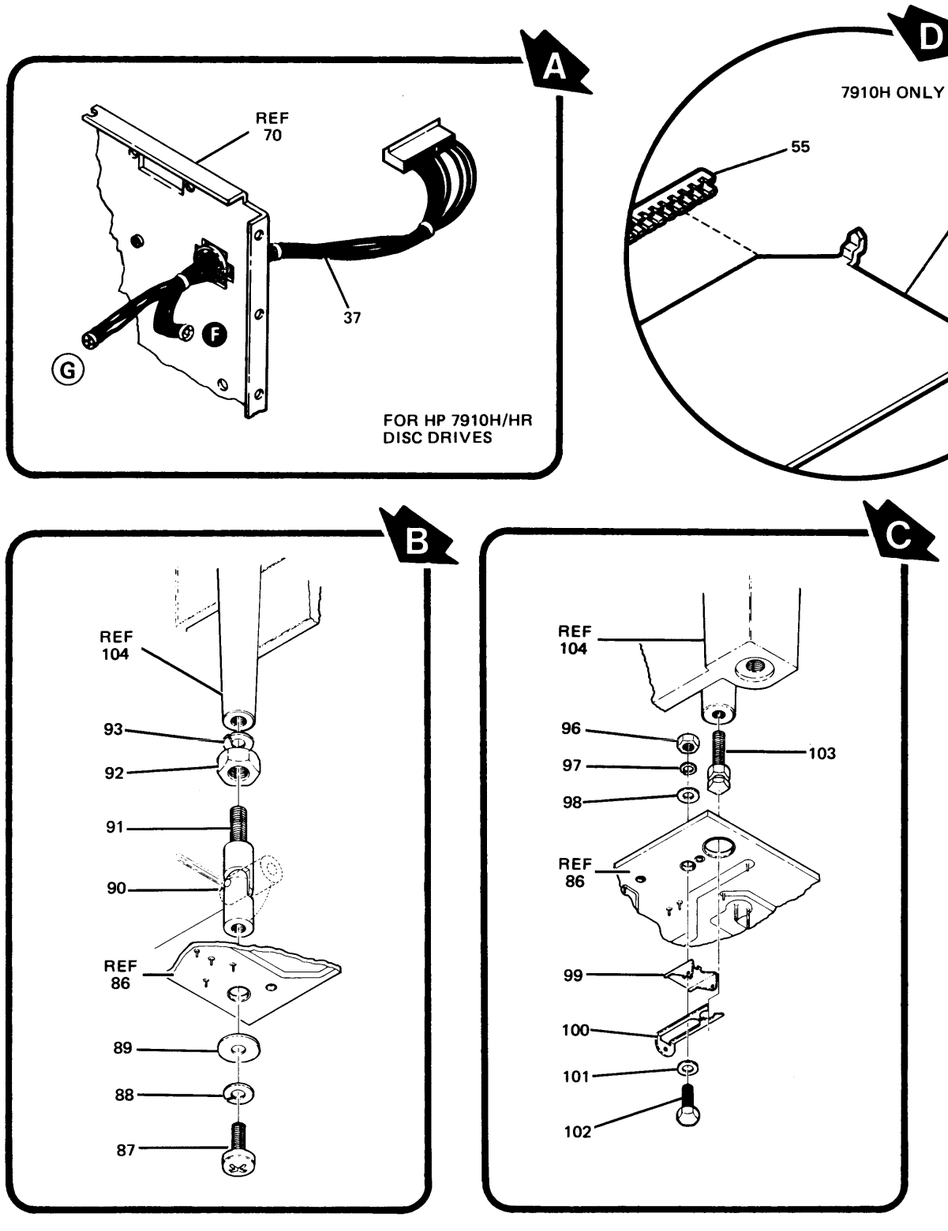
FIG INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
38	07910-60016	*CABLE ASSEMBLY, drive	28480	07910-60016	1
		(Attaching Parts)			
39	2200-0147	*SCREW, machine, ph, pozi, 4-40, 0.500 in. long	00000	OBD	2
40	2190-0913	*WASHER, lock, helical, no. 4	00000	OBD	2
41	3050-0229	*WASHER, flat, no. 4	00000	OBD	2
		— — — x — — —			
42	07910-20025	*CARD GUIDE, left	28480	07910-20025	1
		(Attaching Parts)			
43	2420-0003	*NUT, hex, 6-32	00000	OBD	4
44	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	4
45	3050-0228	*WASHER, flat, no. 6	00000	OBD	4
46	2360-0201	*SCREW, machine, ph, pozi, 6-32, 0.500 in. long	00000	OBD	4
		— — — x — — —			
47	07910-20026	*CARD GUIDE, right	28480	07910-20026	1
		(Attaching Parts)			
	2420-0003	*NUT, hex, 632	00000	OBD	4
	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	4
	3050-0228	*WASHER, flat, no. 6	00000	OBD	4
	2360-0201	*SCREW, machine, ph, pozi, 6-32, 0.500 in. long	00000	OBD	4
		— — — x — — —			
48	07910-00016	*BRACKET, guide	28480	07910-00016	2
		(Attaching Parts)			
49	2200-0147	*SCREW, machine, ph, pozi, 4-40, 0.500 in. long	00000	OBD	2
50	2190-0851	*WASHER, lock, helical, no. 4	00000	OBD	2
		— — — x — — —			
51	07910-20027	*CARD GUIDE, rear	28480	07910-20027	1
		(Attaching Parts)			
52	2360-0195	*SCREW, machine, ph, pozi, 6-32, 0.312 in. long	00000	OBD	2
53	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	2
54	3050-0228	*WASHER, flat, no. 6	00000	OBD	2
		— — — x — — —			
55	0400-0018	*GROMMET, notched, 0.052 in. groove width, 4.5 in. long	00000	0400-0018	2
56	0400-0018	*GROMMET, notched, 0.052 in. groove width, 1 in. long	00000	0400-0018	2
57	07910-00048	*SHIELD PLATE (7910H)	28480	07910-00048	1
	07910-00047	*SHIELD PLATE (7910HR, KR)	28480	07910-00047	1
		(Attaching Parts)			
58	2360-0199	*SCREW, machine, ph, pozi, 6-32, 0.438 in. long	00000	OBD	2
59	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	2
		— — — x — — —			
60	07910-60030	*BACKPLANE PCA (A6)	28480	07910-60030	1
		(Attaching Parts)			
61	2360-0195	*SCREW, machine, ph, pozi, 6-32, 0.312 in. long	00000	OBD	4
62	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	4
		— — — x — — —			
63	07910-00015	*CARD CAGE	28480	07910-00015	1
64	2940-0072	*SCREW, machine, ph, pozi, 1/4-20, 0.312 in. long	00000	OBD	2
65	2190-0740	*WASHER, lock, helical, 1/4 in.	00000	OBD	2
66	3160-0339	*FAN	28480	3160-0339	1
		(Attaching Parts)			
67	2420-0003	*NUT, hex, 6-32	00000	OBD	4
68	2190-0851	*WASHER, lock, helical, no. 6	00000	OBD	4
69	2360-0205	*SCREW, machine, ph, pozi, 6-32, 0.750 in. long	00000	OBD	4
		— — — x — — —			
70	07910-00014	*PANEL, rear	28480	07910-00014	1
71	2510-0103	*SCREW, machine, ph, pozi, 8-32, 0.375 in. long	00000	OBD	4
72	2190-0087	*WASHER, lock, helical, no. 8	00000	OBD	4
73	2950-0004	*NUT, hex, 1/4-20	00000	OBD	2
74	2190-0740	*WASHER, lock, helical, 1/4 in.	00000	OBD	2
75	1520-0207	*MOUNT, shock	28480	1520-0207	2
76	07910-00020	*BRACKET, rear mounting	28480	07910-00020	1

Table 5-5. Mainframe Assembly, Replaceable Parts (Continued)

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
77	2510-0103	*SCREW, machine, ph, pozi, 8-32, 0.375 in. long	00000	OBD	4
78	2190-0087	*WASHER, lock, helical, no. 8	00000	OBD	4
79	2940-0072	*SCREW, machine, ph, pozi, 1/4-20, 0.312 in. long	00000	OBD	4
80	2190-0740	*WASHER, lock, helical, 1/4 in.	00000	OBD	4
81	1520-0207	*MOUNT, shock	28480	1520-0207	2
82	07910-00019	*BRACKET, front mounting	28480	07910-00019	1
83	07910-60026	*CABLE ASSEMBLY, sector	28480	07910-60026	1
84	07910-60024	*CABLE ASSEMBLY, arm D & L	28480	07910-60024	1
85	07910-60027	*CABLE ASSEMBLY, connector	28480	07910-60027	1
86	07910-60102	*DRIVE ELECTRONICS PCA (A4)	28480	07910-60102	1
		(Attaching Parts)			
87	2510-0045	*SCREW, machine, ph, pozi, 8-32, 0.375 in. long	00000	OBD	4
88	2190-0073	*WASHER, lock, helical, no. 8	00000	OBD	4
89	3050-0001	*WASHER, flat, no. 8	00000	OBD	4
		— — — x — — —			
90	0380-0571	*PCA HINGE	00000	OBD	4
91	3030-0289	*SCREW, set, recess hex, cup point, 8-32, 0.625 in. long	00000	OBD	4
92	2580-0004	*NUT, hex, no. 8-32	00000	OBD	4
93	2190-0073	*WASHER, lock, helical, no. 8	00000	OBD	4
94	07910-60041	**PLUG-IN-RESISTOR ASSEMBLY (105 kΩ)	28480	07910-60041	1
	07910-60042	**PLUG-IN-RESISTOR ASSEMBLY (110 kΩ)	28480	07910-60042	REF
	07910-60043	**PLUG-IN-RESISTOR ASSEMBLY (115 kΩ)	28480	07910-60043	REF
	07910-60044	**PLUG-IN-RESISTOR ASSEMBLY (121 kΩ)	28480	07910-60044	REF
95	07910-60045	**PLUG-IN-JUMPER ASSEMBLY (with 0.825 kΩ resistor)	28480	07910-60045	1
	07910-60046	**PLUG-IN-JUMPER ASSEMBLY (with 1.62 kΩ resistor)	28480	07910-60046	REF
	07910-60047	**PLUG-IN-JUMPER ASSEMBLY (with 2.37 kΩ resistor)	28480	07910-60047	REF
	07910-60048	**PLUG-IN-JUMPER ASSEMBLY (with 3.16 kΩ resistor)	28480	07910-60048	REF
	07910-60049	**PLUG-IN-JUMPER ASSEMBLY (with 4.22 kΩ resistor)	28480	07910-60049	REF
	07910-60050	**PLUG-IN-JUMPER ASSEMBLY (with 5.11 kΩ resistor)	28480	07910-60050	REF
	07910-60051	**PLUG-IN-JUMPER ASSEMBLY (with 6.19 kΩ resistor)	28480	07910-60051	REF
	07910-60052	**PLUG-IN-JUMPER ASSEMBLY (with 6.81 kΩ resistor)	28480	07910-60052	REF
	07910-60053	**PLUG-IN-JUMPER ASSEMBLY (with 8.25 kΩ resistor)	28480	07910-60053	REF
	07910-60054	**PLUG-IN-JUMPER ASSEMBLY (with 9.09 kΩ resistor)	28480	07910-60054	REF
	07910-60055	**PLUG-IN-JUMPER ASSEMBLY (with 10 kΩ resistor)	28480	07910-60055	REF
96	0610-0001	**NUT, hex, 2-56	00000	OBD	4
97	2190-0045	**WASHER, lock, helical, no. 2	00000	OBD	4
98	2190-0125	**WASHER, flat, no. 2	00000	OBD	4
99	1390-0289	**FASTENER, snap-slide guide	28480	1390-0289	4
100	1390-0290	**FASTENER, snap-slide latch	28480	1390-0290	4
101	1390-0288	**FASTENER, snap-slide washer	28480	1390-0288	4
102	07910-20017	**SCREW, snap-slide fastener	28480	07910-20017	4
103	1390-0470	*SNAP-SLIDE STUD	00000	OBD	4
104	07910-60031	*DRIVE MECHANISM ASSEMBLY	28480	07910-60031	1

NOTE:
PAIRS OF CIRCLED LETTERS IDENTIFY MATING POINTS FOR DASHED MECHANICAL CONNECTION LINES.
FOR EXAMPLE: (A) AND (A) CONNECT THE LINE BETWEEN ITEMS 81 AND 33.

* 1. INDEX NUMBERS 4, 5, 6, 7, 8, AND 9 ARE NOT USED IN THE 7910H.
2. PART NUMBER FOR INDEX NO. 57 CHANGES TO 07910-00048 IN THE 7910H (SEE DETAIL D).
3. INDEX NO. 3 ATTACHES TO INDEX NO. 70 IN HR AND KR DRIVES ONLY (SEE FIGURES 5-2 AND 5-3).
INDEX NO. 3 PASSES THROUGH INDEX NO. 70 IN H DRIVE ONLY (SEE FIGURE 5-1).



REF 7314-26A

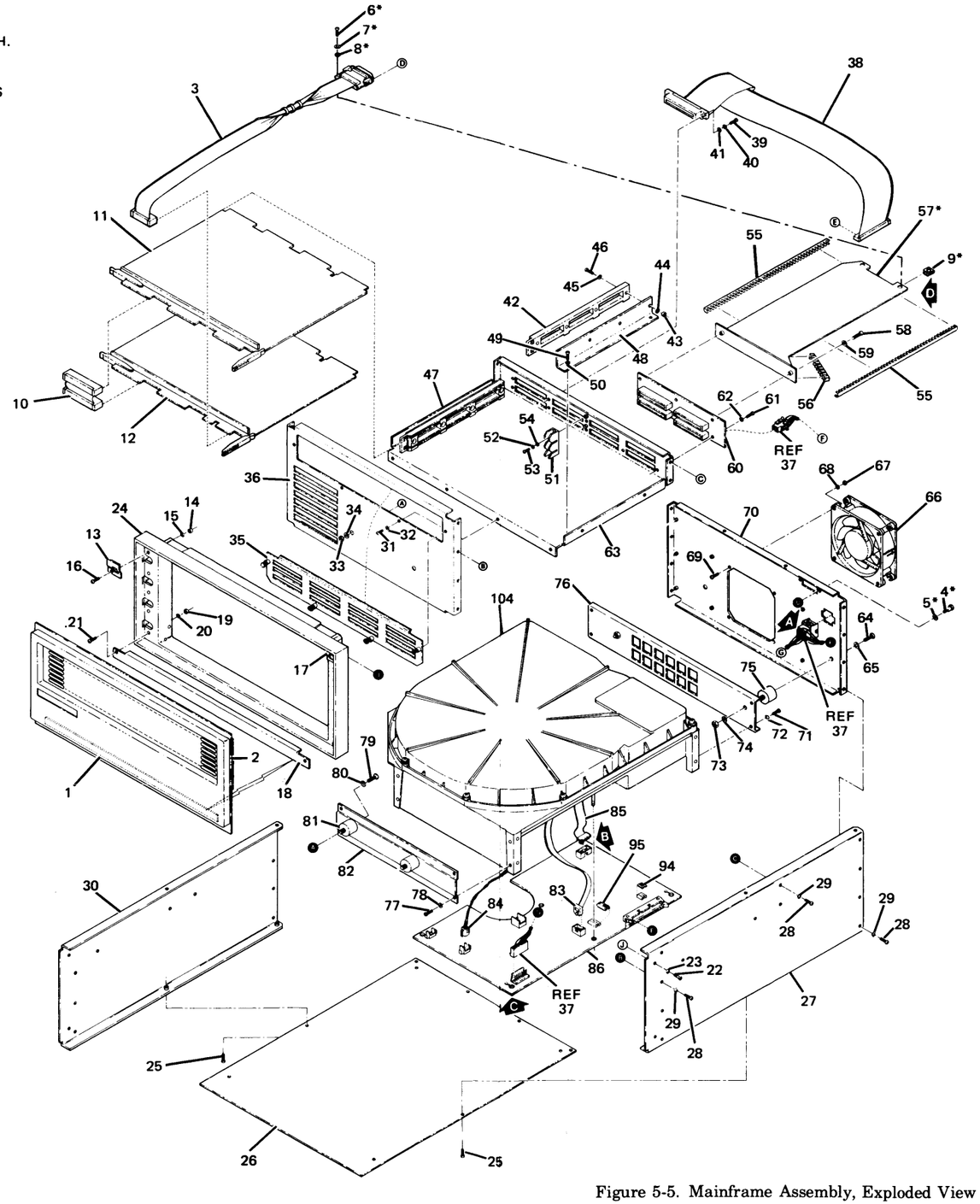


Figure 5-5. Mainframe Assembly, Exploded View