HEWLETT PACKARD

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SERVICE MANUAL

7906 DISC DRIVE

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MODELS COVERED

The main part of this manual covers the HP 7906M, S, MR, and SR Disc Drives. Appendix A covers the HP 7906H and HR Disc Drives.

OPTIONS COVERED

This manual covers option 015 as well as the standard HP 7906 Disc Drive.

FOR U.S.A. ONLY

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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 communications. 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.

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Change 0 (Original) ..... SEP 1981

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PREFACE

This manual provides field service information for the Hewlett-Packard 7906 Disc Drive. The HP 7906 Disc Drive is a state-of-the-art, mass-memory 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 use of the information provided in this manual and use of the Disc Service Unit, part no. 12995-60001 or 13354-60005, which simulates commands from the controller and displays disc drive responses.

The contents of this manual are organized as follows:

- Section I provides disc drive characteristics, a functional level block diagram discussion, interface information, and a discussion relative to each commandable operation, functional system, electrical assembly, and electro-mechanical assembly used in the disc drive.
- Section II provides preventive maintenance information, maintenance precautions, lists of all standard and special tools and test equipment required to service the disc drive, the preventive maintenance schedule, and all required preventive maintenance inspection and cleaning procedures.
- Section III provides step-by-step alignment and adjustment procedures for the disc drive.
- Section IV provides troubleshooting information, a discussion relative to the disc drive fault-finding LED's, an off-line troubleshooting procedure, and troubleshooting flowcharts.
- Section V provides step-by-step removal and replacement procedures for each field-replaceable electrical and electro-mechanical assembly used in the disc drive.
- Section VI provides listings of all field-replaceable parts and an illustrated parts breakdown for the disc drive, as well as replacement part ordering information.
- Appendix A provides changes and additions to the information contained in the main manual needed for HP 7906H Disc Drive service.

Documentation containing installation and operating instructions for the HP 7906 Disc Drive and associated equipment is supplied with each disc drive. This documentation consists of the following publications:

- *HP 7906 Disc Drive Installation Manual,* part no. 07906-90902.
- *HP 7906 Disc Drive User's Manual,* part no. 07906-90901.
- *HP 40019 Prefilter Assembly Installation and Service Manual,* part no. 40019-90901.
- *HP 29425 Cabinet Installation and Service Manual,* part no. 29425-90001. (Supplied only when the disc drive is delivered mounted in an HP 29425 Cabinet.)
- *HP 13037 Disc Controller Installation and Service Manual,* part no. 13037-90006. (Supplied only with the HP 7906M Disc Drive.)

WARNING

The HP 7906 Disc Drive contains magnetic material (spindle assembly and actuator assembly), a potential hazard to personnel during shipping. Special packaging and markings are required by the United States government for shipping. If reshipment of the disc drive becomes necessary, refer to the *HP 7906 Disc Drive Installation Manual,* part no. 07906-90902, for repackaging instructions. If reshipment of the spindle assembly and/or the actuator assembly becomes necessary, refer to section V of this manual for repackaging information.

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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 section contains a brief introduction to the HP 7906 Disc Drive addressing structure, the disc drive environment, the functional makeup of the disc drive, the format of the disc data surfaces, a list of mnemonics and abbreviations, and a description of the information interchange between the controller and disc drive. The section also contains a detailed discussion of each of the eight systems which compose the drive function. This discussion is supplemented by events flowcharts describing the response of the drive to each command received from the controller and drive action at power up and power down.

The disc drive contains two discs; one removable and the other fixed. (See figure 1-1.) The disc drive accesses the data on three surfaces with three read/write heads. Head-positioning and sector-counting information is derived from the fourth (servo) surface through the servo head on the fixed disc. There are 411 cylinders available for information storage. The cylinder address range is from zero to 410. Each cylinder consists of four tracks, one on each surface of the removable disc and two on the lower surface of the fixed disc. Each track is divided into 48 sectors. Sectors are addressed by specifying a head and sector address within a cylinder. Head addresses range from zero to three and sector addresses range from zero to 47.

The disc drive reads information off disc or writes information on disc on command from the HP 13037 Disc Controller (controller). As many as eight disc drives can be connected to one controller. Controller/disc drive communications occur on two buses. One set of read/write data lines per disc drive is used to transfer read/write data. One tag bus and one control bus are common to all units. The four-line tag bus carries 14 commands which the controller uses to control disc drive operations. The 16-line control bus is used for all other communications between the controller and disc drives. (Only 11 lines of the control bus are used.)

As shown in figure 1-2, the disc drive is composed of eight systems; a spindle rotating system, a head positioning system, an input/output (I/O) control system, a read/write system, a sector sensing system, a power system, an air circulation system, and a fault detection system. The spindle rotating system rotates the discs at a speed of 3600 revolutions per minute. The head positioning system positions the heads in response to controller direction and, under emergency fault conditions, retracts the heads off the discs. Temperature compensation in the head positioning system reduces head positioning offset on the removable disc to a minimum. This offset is caused by the initial temperature difference between the removable disc and the fixed disc, which contains the servo code. The I/O control system interfaces between the tag and control buses and the internal disc drive systems. The read/write system reads and writes data from the read/write data lines to the discs or vice versa. The sector sensing system constantly monitors the identity of the sectors currently under the heads. This information is transmitted to the controller through the I/O control system on request. The read/write system also requires this information to know on which sector of the disc to read or write. The power system supplies power to the disc drive components. The air circulation system supplies cooling air to the circuits and filtered air to the discs. The fault detection system is composed of several subsystems which sense fault conditions and light indicators, retract the heads, or take other appropriate action when a fault occurs.

1-2. TRACK FORMAT

Each track is divided into 48 equal data sectors which are derived by counting pulses from the servo track. (See figure 1-1.) Each sector has a sector number (sector address). The location of sector 0 is defined by an index mark. On fixed disc, the index mark is a unique pattern on each servo track which indicates the location of sector 0 on the single recording surface. On the removable disc, the index mark is a small notch in the center hub which is detected by a magnetic transducer. Since the index mark of the removable disc is randomly aligned with that of the fixed disc, two sets of sector counting electronics are provided in the sector sensing system. Each of the counters is incremented once each sector and set to zero each time its index marker is sensed.

1-3. SECTOR FORMAT

The smallest addressable data storage area in the disc drive is a sector. Accessing a sector is accomplished by specifying the address of the cylinder, head, and sector. (See figure 1-3.)

Each sector contains a sector address field, a data field, and data checking and error correction fields. The sector address field contains the cylinder, head, and sector addresses of the sector, as well as indicators for spare, defective, and protected tracks. The data field stores 128 words of data. Each data word is defined as 16-bits. Only the data field is transferred to and from the computer in most data operations. The preamble and postamble are normally generated and checked in the controller. All fields except the sync field are error-checked by the controller.

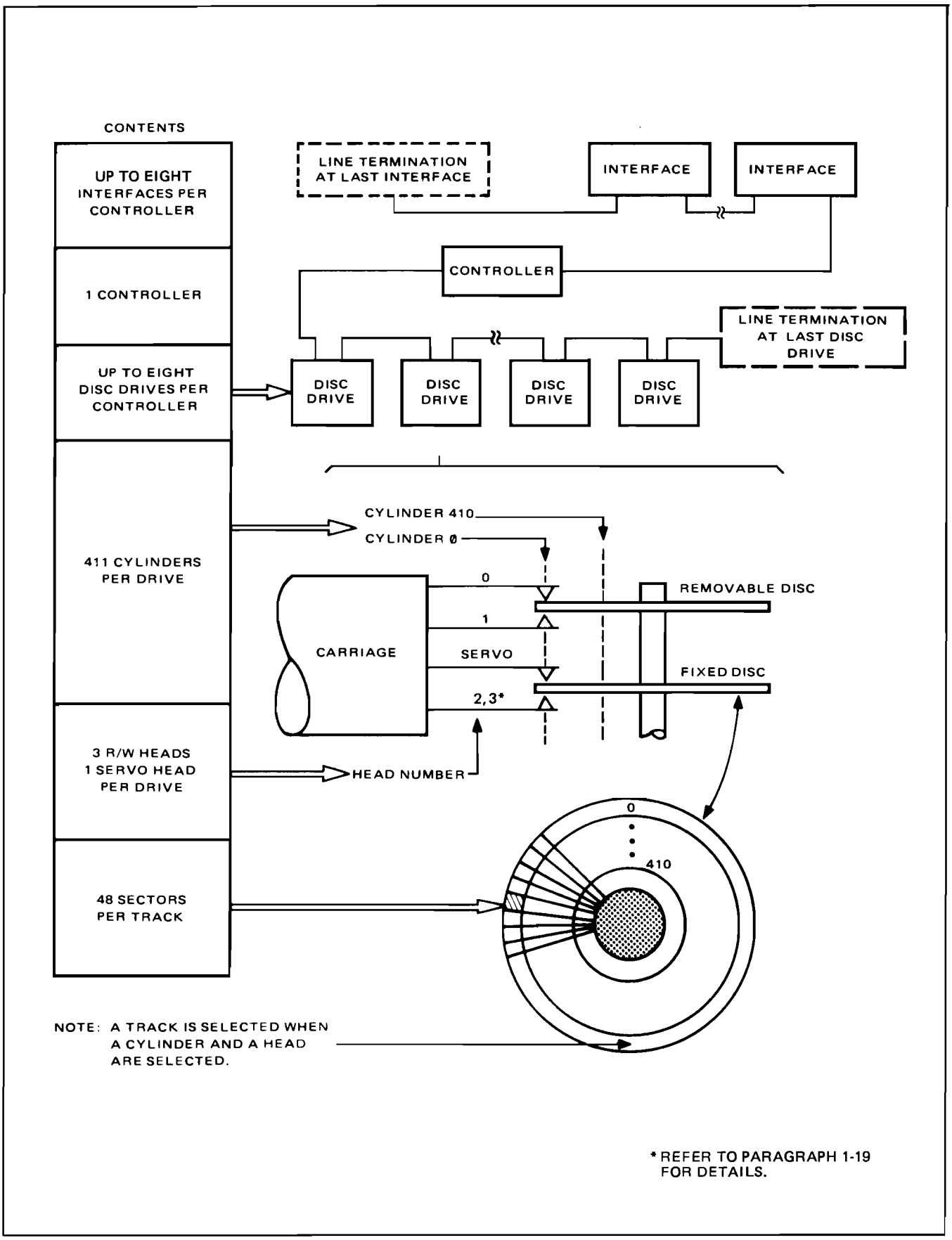

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Figure 1-1. Addressing Structure of HP 7906 Disc Drive

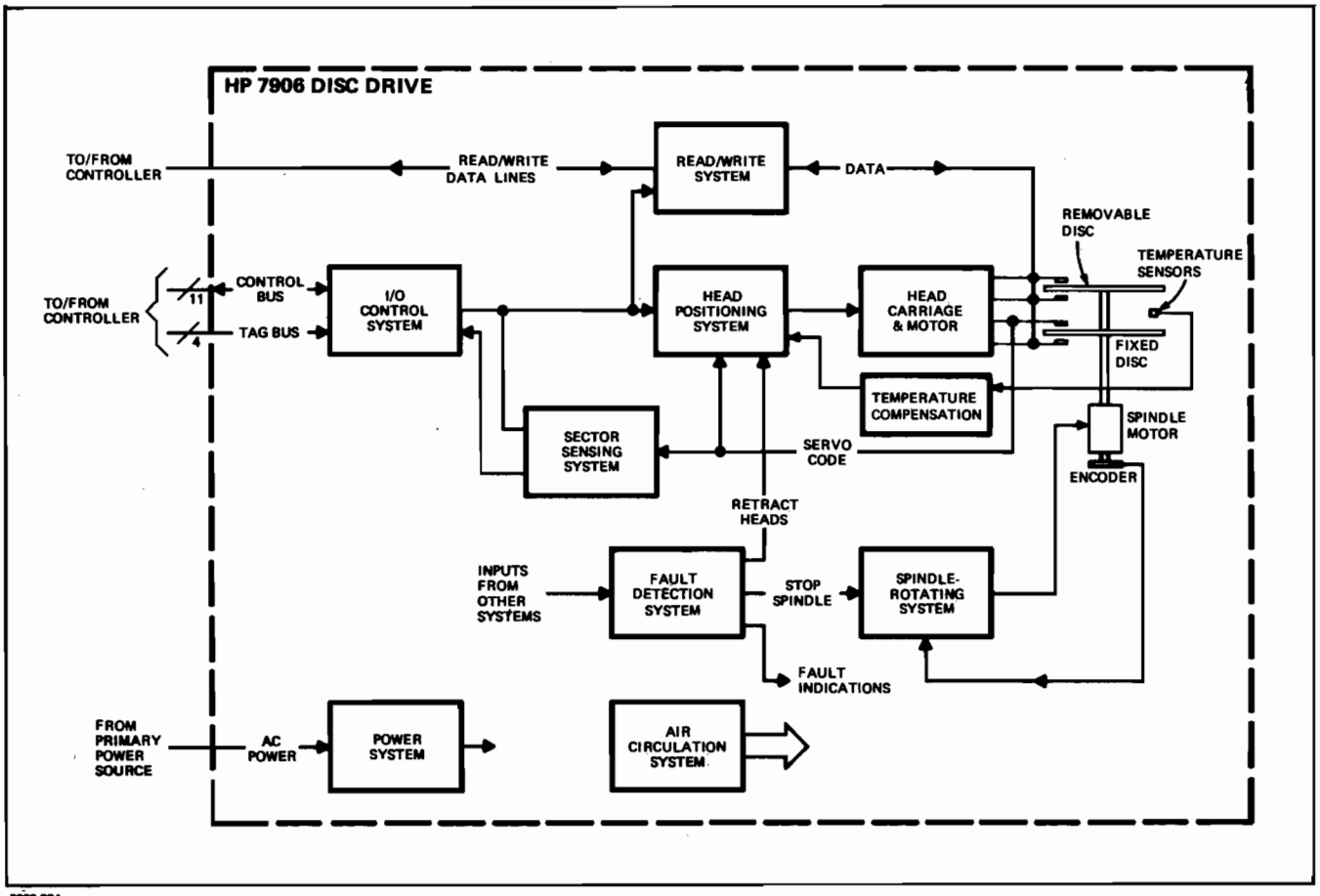


Figure 1-2. HP 7906 Disc Drive Overall Block Diagram

1-4. CONTROLLER SELECTION OF A DISC DRIVE

To enable the controller to communicate with one disc drive at a time, each disc drive is assigned an identity, from 0 through 7. The controller uses this identity to select the disc drive with which it wants to communicate. Any disc drive not selected is receptive to only four tag bus commands: Request Attention (RQA), Address Unit (ADU), Disconnect (DCN), and Clear (CLR). (See table 1-1 for a list of mnemonics and abbreviations and table 1-2 for a description of the tag bus commands, including reference to the related command events flowcharts.) With the disc drive selected, the control bus is available only to the selected disc drive for communication with the controller.

Each disc drive contains three attention flip-flops, each of which is set under different conditions within the disc drive. If any of the flip-flops is set, the controller is notified when it checks disc drive status during a Read (READ), Write (WRITE), Request Status (RQS), or Request Position (RQP) operation. The controller selects one disc drive with an Address Unit (ADU) command. Then the selected disc drive is enabled to respond to the remaining ten tag bus commands. Four of these commands, READ, WRITE, RQS, and RQP, enable the selected disc drive to supply data to the controller on the read/write data lines or information to the controller on the control bus. Since the selected disc drive is the only one enabled to respond to these commands, it is the only one enabled to send information or data to the controller.

1-5. CONTROL BUS INFORMATION TRANSFER

To implement seven of the tag bus commands, information transfer between the disc drive and controller is required. When one of these commands is active (refer to paragraph 1-6), the appropriate information is supplied on the control bus. Table 1-3 lists each such tag bus command, the four-bit tag bus word which represents the command to the disc drive, the direction of information flow (from the controller to drive or vice versa), and the information represented by each control bus line.

1-6. LOGIC SIGNAL NOTATION

In the drive logic circuits, a signal is applied to its destination at all times in one of two states; active or inactive. The signal is active when its voltage level (low or high) is such as to make the action occur for which the signal was designed (this is usually the same action as is referenced in the signal name).

Note: A bar over a signal name should be considered a part of the signal name and is read as a "not" in front of the signal name. For example, $\overline{\text{RETRACT}}$ should be interpreted as "not RETRACT".

Table 1-4 uses two example signals (SEN and $\overline{\text{SEN}}$) to present information on logic signal notation. Note that the action which both signals are intended to initiate is enabling of the servo. Each signal is active when the servo is enabled and inactive when the servo is not enabled.

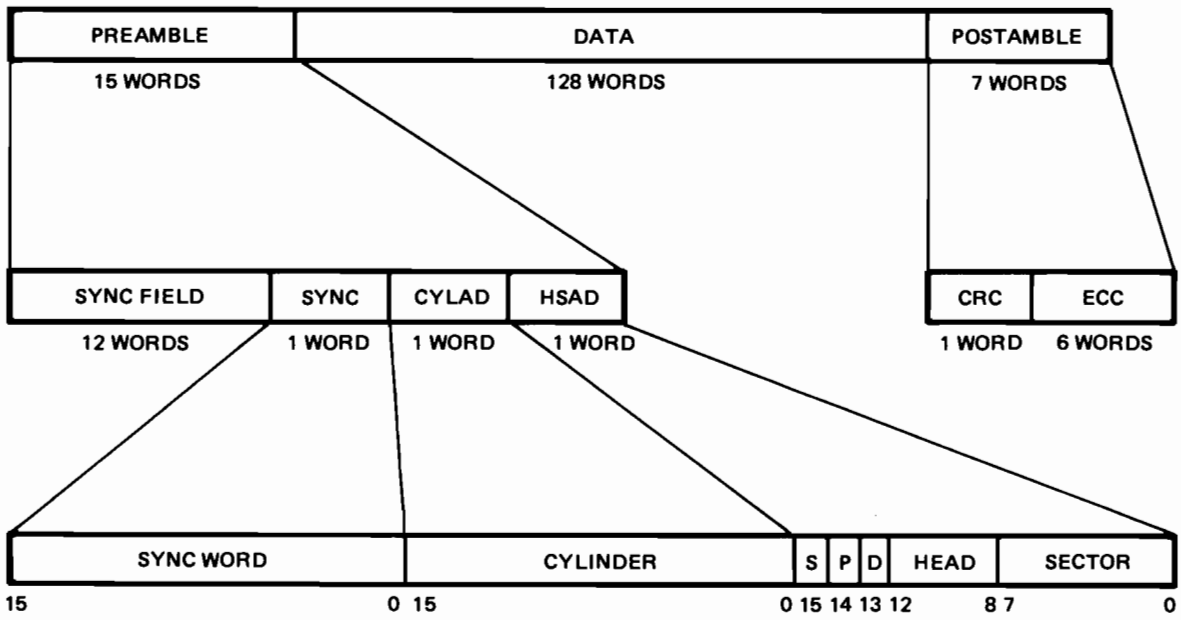
1-7. FUNCTIONAL DESCRIPTION

The following paragraphs describe the eight systems that perform the drive functions. To aid in identifying the drive circuits that carry out these functions, the events flowcharts accompanying the text are cross-referenced to the system functional diagrams contained in section IV of the manual.

1-8. I/O CONTROL SYSTEM

The I/O control system (figure 4-23) receives tag bus command inputs from the controller, receives information (on the control bus) which supplements the tag bus commands, and outputs the disc drive status signals and selected head and present sector information to the controller on the control bus when certain tag bus commands are received.

1-9. INPUT CONTROL. Unless selected by the controller, the I/O control system of a disc drive is receptive to only four tag bus commands: RQA, ADU, CLR, and DCN



PREAMBLE – 15 WORDS FOR SYNCHRONIZATION AND ADDRESSING
DATA – 128 WORDS OF DATA
POSTAMBLE – DATA CHECKING AND ERROR CORRECTION INFORMATION
SYNC FIELD – 12 WORDS (192 BITS) OF Ø'S
SYNC – SYNC WORD – 100376_8 IF ECC FIELD IS VALID
– 100377_8 OTHERWISE
CYLAD – CYLINDER – CYLINDER ADDRESS
HSAD – HEAD ADDRESS (LOGICAL)
SECTOR ADDRESS (LOGICAL)
S – IF "1", SPARE TRACK IN ACTIVE USE
P – IF "1", PROTECTED TRACK
D – IF "1", DEFECTIVE TRACK
CRC – CYCLIC REDUNDANCY CHECK – 1 WORD OF CHECK INFORMATION
ECC – ERROR CORRECTION CODE – 6 WORDS OF CHECK AND CORRECTION INFORMATION

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Figure 1-3. Sector Format

Table 1-1. Mnemonics and Abbreviations

MNEMONIC	NAME
ACRY	Access Ready
ACW	AC Write Current
ADDR	Address
ADR	Address Record
ADU	Address Unit
AGC	Automatic Gain Control
AGCF	AGC Fault
AT	Attention (test point)
ATTN	Attention
BB	Brushes Back
CC	Current Command
CIP	Cartridge-In-Place
CLA	Clear Attention
CLK	Clock
CLO	Clear Offset
CLR	Clear
CLS	Clear Status
CPS	Controller Preset
CRB	Carriage Back
CYL	Cylinder
DCN	Disconnect
DCW	DC Write Current
DGC	Data AGC
DIFF	Difference
DL	Door Locked
DPS	Destructive Preset
DRDY	Drive Ready
DRDYL	Drive Ready Lamp
DWA	Decrease Write Current (13 ma)
DWB	Decrease Write Current (6.5 ma)
DWC	Decrease Write Current (3.25 ma)
ECS	Energize Carriage Solenoid
ENA	Encoder Phase A
ENB	Encoder Phase B
FLT	Fault
FLTL	Fault Lamp
FWD	Forward
GATED AT	Gated Attention
HLDD	Heads Loaded
HS0	Head 0 Selected
HS1	Head 1 Selected
HS2	Head 2 Selected
ICA	Illegal Cylinder Address
ILF	Interlock Fault
LD	Lock Door
LIP	Lower Index Pulse
LP	Lower Pulse
LSB	Least Significant Bit
M-1	Match Minus One
MH	Multiple Heads
MHS	Multiple Heads Selected
NDPS	Non-Destructive Preset
NLD	Negative Level Detector

MNEMONIC	NAME
O/S	Offset
OSD	Offset Settling Delay
POR	Power-On Reset
POS	Position
PRT	Protect
PRTL	Protect Lower Disc
PRTU	Protect Upper Disc
R	Reset
RCL	Recalibrate
RDA	Read Data A
RDB	Read Data B
READ	Read
REF	Reference
RET	Retract
REV	Reverse
RH	Restore Home
RPS	Rotational Position Sensing
RQA	Request Attention
RQP	Request Position (sector)
RQS	Request Status
RS	Run Spindle
S	Set
SB	Servo Balanced
SC	Sector Compare
SCL	Sector Clock
SEN	Servo Enable
SK	Seek
SKC	Seek Complete
SKH	Seek Home
SKI	Seek Inhibit
SL	This Disc Drive Selected by Controller
SOF	Set Offset
SPD	Spindle Speed Down
SPU	Spindle Speed Up
STP	Set Timeout Period
SW	Switch
TAC	Tachometer
TCD	Track Centered
TEMP	Temperature
TO	Timeout
TTO	Temperature Timeout
UDS	Upper Disc Selected
UIX	Upper Index
UP	Upper Pulse
URG	Unselected Read Gate
USS	Upper Surface Selected
UWG	Unselected Write Gate
WDA	Write Data A
WDB	Write Data B
WEN	Write Enable
WRITE	Write
XMS	Transmit Sector
ZCR	Zero Crossing

Table 1-2. Tag Bus Commands

MNEMONIC	COMMAND	EVENTS FLOWCHART FIGURE NO.	ACTION
ADR	Address Record	1-10	The head identity and sector address present on the control bus are stored in the head and sector registers of the selected drive, provided they are legal (head selected is 0 thru 3 and sector addressed is 0 thru 47).
ADU	Address Unit	1-8	The controller supplements this command with the identity of the disc drive, supplied on the control bus, which it has selected. The drive thus selected is then enabled to respond to the SK, ADR, RCL, RQS, CLS, RQP, XMS, SOF, READ, and WRITE commands. Before being addressed by the controller, each disc drive is enabled to respond only to the RQA, ADU, DCN, and CLR commands.
CLR	Clear	1-20	Every disc drive connected to the controller resets its Select flip-flop, so that it is then in an unselected condition. Also, it resets its head and sector registers and most of its fault flip-flops. The fault flip-flops used to indicate the most critical faults (DPS) are reset.
CLS	Clear Status	1-18	The selected disc drive resets either its three attention flip-flops, or its First Status flip-flop, or both, as selected by the controller using bits 0 and 1 of the control bus.
DCN	Disconnect	1-19	All disc drives connected to the controller are set to the unselected condition by resetting their Select flip-flops. Thereafter, they can respond only to a RQA, ADU, DCN, or CLR command.
READ	Read One Record	1-12	The record in the sector addressed by the head and sector registers of the selected disc drive is read out to the controller on the read/write data lines. The current status of the selected disc drive is supplied to the controller, on the control bus, throughout the read operation.
RCL	Recalibrate	1-15	The heads of the selected disc drive seek to cylinder 0. Cylinder 0 is used by the head positioning servo as a reference It establishes its present position by keeping count of the number of cylinders it moves away from or toward cylinder 0.
RQA	Request Attention	1-7	Every disc drive connected to the controller, which has one of its attention flip-flops set, responds by activating the single line of the control bus assigned to it for identification purposes. For example, disc 3 activates line 3 if it has an attention flip-flop set. This notifies the controller of all drives ready for attention.
RQP	Request Position (Head and Sector)	1-16	The selected disc drive supplies the identity of the head and sector presently stored in its head and sector registers to the controller on the control bus.
RQS	Request Status	1-14	The selected disc drive supplies information concerning its present status to the controller on the control bus.
SK	Seek	1-9	The heads of the selected disc drive seek to the cylinder address present on the control bus, provided the cylinder address is a legal one (0 thru 410).

Table 1-2. Tag Bus Commands (Continued)

MNEMONIC	COMMAND	EVENTS FLOWCHART FIGURE NO.	ACTION
SOF	Set Offset	1-11	The amount and direction of head offset from track center is supplied, in 63 increments of 25 microinches each, by the controller on the control bus. The selected disc drive stores the offset data in its offset register and offsets the heads as required.
WRITE	Write One Record	1-13	The data supplied by the controller on the read/write bus is written, by the selected disc drive, into the sector addressed by its head and sector registers. The current status of the selected disc drive is supplied to the controller on the control bus throughout the write operation.
XMS	Transmit Sector	1-17	The selected disc drive stores the sector address, supplied by the controller on the control bus, in its sector address register, provided it is a legal sector (0 thru 47).

(see figures 1-7, 1-8, 1-20, and 1-19, respectively). This is true of all disc drives connected to the controller. When the controller activates the RQA command, every disc drive responds by placing its attention status (whether or not any of its three attention flip-flops are set) on the single control bus line (C0 through C7) which corresponds to its unit number.

The response of the disc drive occurs from 0 to 15 sectors before the sector identified in the sector address register (see figure 4-27) is positioned under the selected head. The amount of look-ahead is selectable in one-sector increments from 0 to 15, by strapping on PCA-A2. If all four straps are in place, the amount of look-ahead is 0 sectors. If no straps are used, the amount of look-ahead is 15 sectors. Rotational position sensing can be enabled or disabled with a plug on PCA-A2. This feature is used primarily in specific multi-CPU configurations to optimize the polling loop.

A disc drive is selected by the controller when control bus bits C0 through C2 match the number selected on Unit Select switch S3 while the ADU command is active. Once selected, it is receptive to all the remaining ten tag bus commands. When a disc drive is selected, a dot on an upper corner of the unit select identification indicator on the indicator panel is lighted.

1-10. OUTPUT CONTROL. The selected disc drive supplies its status to the controller on the control bus throughout a read or write operation and when the RQS command (see figure 1-14) is active. The status signals are as follows:

CONTROL BUS BIT	STATUS SIGNAL
C0	$\overline{\text{Access Ready}}$
C1	Drive Ready
C2	Seek Check (Illegal Sector Addressed, or Seek Check flip-flop output)
C3	First Status
C4	Fault
C5	Format mode
C6	Protect
C7	Attention
C8	Sector Compare
C9	Ground
C10	Drive Type

When the controller requests the current sector with the RQP command (see figure 1-16), the selected disc drive supplies the following information on the control bus:

CONTROL BUS BITS	INFORMATION
C0 thru C5	Identification of the sector currently under the selected head.
C6	Protect
C7	Attention
C8	Head 1 Selected
C9	Head 2 Selected
C10	Drive Type

Table 1-3. Control Bus Information

TAG BUS		CONTROL BUS		
COMMAND	**BINARY WORD**	**BITS**	**FROM CONTROLLER TO DISC DRIVE**	**FROM DISC DRIVE TO CONTROLLER**
READ	0000			Status:
		0		Access Ready
		1		Drive Ready
		2		Illegal head or sector selected or seek check
		3		First Status
		4		Fault condition
		5		Format mode
		6		Protect
		7		Attention
		8		Sector Compare
		9		Ground
		10		Drive Type
WRITE	0001			Status: (same as READ)
RQS	0010			Status: (same as READ)
RQA	0011	See note		Unit identity (one control bus bit corresponding to the identity of the disc drive as selected on its Unit Select switch. For example, the disc drive with "3" selected on its Unit Select switch will respond to the RQA command by activating control bus bit 3, provided it has one or more attention flip-flops set.)
DCN	0100			
CLR	0101			
RQP	0110	0-5		Address of sector presently under the selected head
		6		Protect
		7		Attention
		8		Head 1 Selected
		9		Head 2 Selected
		10		Drive Type

Table 1-3. Control Bus Information (Continued)

TAG BUS		CONTROL BUS		
COMMAND	BINARY WORD	BITS	FROM CONTROLLER TO DISC DRIVE	FROM DISC DRIVE TO CONTROLLER
Not used	0111			
SK	1000	C0-C8	Cylinder address	
ADR	1001	C0-C5	Sector address	
		C8-C9	Head identification	
ADU	1010	C0-C2	Unit (disc drive) identity	
RCL	1011			
XMS	1100	C0-C5	Sector address	
SOF	1101	C0-C5	Offset magnitude	
		C7	Offset sign (direction)	
CLS	1110	C0	Command to clear the three Attention flip-flops (attention signal)	
		C1	Command to clear the First Status flip-flop	
Not used	1111			

Note: One bit in the range 0-7 (provided the AT signal is active).

Table 1-4. Logic Signal Examples

SIGNAL NAME	CONDITION	VOLTAGE LEVEL	MESSAGE TRANSMITTED
SEN	Active	High	Servo enabled.
SEN	Inactive	Low	Servo not enabled.
$\overline{\text{SEN}}$	Active	Low	Servo enabled.
$\overline{\text{SEN}}$	Inactive	High	Servo not enabled.

1-11. ATTENTION CIRCUITS. The three Attention flip-flops each activate the AT signal under different circumstances. The Attn (ACRY) and Attn (RET) flip-flops are both reset whenever the heads leave the cylinder on which they were settled at the start of a seek operation. When the heads settle on the cylinder being sought, the Attn (ACRY) flip-flop is set to notify the controller that the seek operation is complete. If a seek to an illegal cylinder is initiated, the Attn (ACRY) flip-flop is not set. However, when the $\overline{\text{Strobe}}$ pulse which activated the SK signal becomes inactive, the Attn (ICA) flip-flop is set to notify the controller of the illegal seek request. If the RET signal becomes active, deactivating the DRDY signal, the Attn (RET) flip-flop is set to notify the controller of the fault condition.

1-12. SPINDLE ROTATING SYSTEM

Included in the spindle rotating system (figure 4-24) are the door lock circuits, the brush cycle circuits, and a servo loop which runs the spindle motor.

1-13. DOOR LOCK CIRCUITS. The door lock solenoid is de-energized, holding the door locked, if any one of the following conditions is met: a) RUN/STOP switch is in the RUN position, b) heads or brushes are not retracted, c) spindle is not stopped, d) an interlock fault (ILF signal active) occurs.

1-14. BRUSH CIRCUITS. The disc brushes are no longer required for disc drive operation. All brush circuitry and related hardware have been removed from disc drives with serial numbers prefixed 2040 and later. On earlier drives, the disc brushes (82, figure 6-3) should be removed as outlined in paragraph 5-24. **The installation of control PCA-A4, part no. 07906-60102, in an earlier drive will inhibit the operation of the existing brush circuitry. If the disc drive has control PCA-A4, part no. 07906-60002, installed, it is necessary for the brush mechanism to cycle, even though the brushes have been removed.** The brushes operate through a brush cycle while the spindle is getting up to normal speed after the RUN/STOP switch has been set to RUN. The brush motor turns a circular cam with a detent on its circumference. The brushes are mechanically linked to the cam so that, as the cam rotates, the brushes are extended across the surface of the disc. The "brushes-back" microswitch has a spring-loaded roller which runs along the circumference of the cam as it rotates. The switch is held open, deactivating the $\overline{BB}$ signal while the cam is rotating. When the cam has completed a revolution, the switch roller falls into the detent, closing the switch and activating the $\overline{BB}$ signal.

1-15. SPINDLE SERVO LOOP. The spindle servo is controlled by the Run Spindle flip-flop which activates the servo loop, provided the proper conditions exist and the RUN/STOP switch is set to RUN. The spindle servo senses the motor speed through the spindle motor phase encoder, compares the two feedback signals (Phase A and Phase B) with the output from an oscillator, and adjusts the motor speed as necessary to reduce the difference to zero.

The phase encoder consists of an encoder disc and an encoder assembly. The encoder disc rotates with the spindle and contains three slots of 60 degrees length. The three slots are separated by 60 degrees of non-slot area so that, at the radius at which the slots are located, the disc consists of six alternate slot/non-slot segments of 60 degrees each.

The encoder assembly consists of two identical circuits (Phase A and Phase B). Each circuit contains a light-emitting diode (LED), a phototransistor, and a transistor amplifier/inverter. The phototransistor circuits are located 30 degrees apart and are placed so that light from a LED shines through a disc slot to energize the associated phototransistor for three 60-degree segments of a disc revolution. When the light strikes a phototransistor, the output (Phase A or Phase B) is ground. Phase A lags Phase B by 30 degrees so that each signal is active for half of the time the other signal is active.

1-16. HEAD POSITIONING SYSTEM

The head positioning system (figure 4-25) positions the heads on any of the 411 cylinders with whatever offset is specified by the controller. It also retracts the heads under emergency conditions. During a power-up sequence (see figure 1-5), it automatically positions the heads on cylinder 0. It consists primarily of a head positioning servo loop, which moves the heads to the cylinder address stored in the new cylinder address register in response to a SK command (see figure 1-9); slew circuits, which move the heads to the home (cylinder 0) position in response to an RCL command (see figure 1-15) or during a power-up sequence; an offset register which stores offset from track center; ACRY circuits, which activate the DRDY signal and light the DRIVE READY lamp when the first seek operation is completed and also activate the ACRY signal when the heads are settled on the addressed cylinder; and an emergency retract circuit which retracts the heads if the head positioning servo is disabled or the ILF signal becomes active.

1-17. OFFSET. The amount of offset from track center on the removable disc is supplied to the offset register on the control bus in the form of a seven-bit binary word. Six bits specify the offset magnitude in 63 increments of 25 microinches each. The seventh bit specifies the direction (+ or −) from track center. The offset is stored in the register by a SOF tag bus command (see figure 1-11) and must be re-specified after each SK or RCL command.

1-18. SLEW CIRCUITS. The slew circuits move the heads, either forward or reverse, to the home (track 0) position when the RCL command is activated. If the heads are outside the outer guard band (no AGC signal) at the start of a slew operation, the heads slew forward until the heads pass over the outer guard band and the AGC signal becomes active. The active AGC signal clocks the Seek Home flip-flop, deactivating the SKH signal. This disables the slew circuits and the servo loop takes over control of the heads to position them over track 0 (which was stored in the new cylinder address register when it was cleared by the active $\overline{SKH}$ signal).

If the heads start from a position within the guard bands, the AGC signal is initially active and the heads slew reverse until the AGC signal becomes inactive. Then they slew forward until the AGC signal again becomes active. Activation of the AGC signal deactivates the SKH signal and the servo loop positions the heads over track 0.

1-19. HEAD POSITIONING SERVO LOOP. The servo loop contains circuits which compare the new cylinder address to the present cylinder address and generate a difference signal to the motor. The feedback circuits convert the servo code from the servo head to clock signals which step the present cylinder address counter as the heads cross tracks. The address of the cylinder to which the heads are to seek is stored in the new cylinder address register. The address of the cylinder on which the heads are presently located is stored in the present cylinder address counter. The comparator produces a difference signal from these two addresses. It also indicates, with the +DIFF signal, whether the difference is positive or negative. The differences signal is converted to an analog signal and adjusted to be of relatively lesser magnitude for lesser differences between the two addresses. This signal (CC) causes the motor to move the heads in the direction which will change the present cylinder address to be closer to the new cylinder address.

The servo code, from the servo head, is converted into the POS signal by the track follower circuits on PCA-A5. The POS signal, when the heads are crossing tracks (see figure 4-26), is a sawtooth waveform which crosses the zero line each time a track center is crossed. (It is 0 volts if the heads are stationary.) The cylinder clock generator on PCA-A3 generates a clock pulse to step the present cylinder address counter each time the POS signal crosses the zero line.(The +DIFF signal from the comparator tells the present cylinder address counter whether to count up or down.)

The clock pulse generator exhibits a characteristic such that, under certain conditions, it generates a clock pulse when the heads leave the track on which they were initially positioned at the start of the seek operation. Also, the same characteristic, under certain conditions, inhibits it from generating a clock pulse when the heads reach the track to which they are seeking. A clock pulse is generated whenever the POS signal behaves in one of the following ways:

a. Goes positive, with respect to ground, from a condition of being equal to, or less than, ground.

b. Becomes equal to, or less than, ground from a condition of being positive with respect to ground.

To block an undesired first clock pulse, the First Clk Inhibit flip-flop is reset by the SK signal and set (enabling subsequent clocks) by the TCD signal. When the MATCH signal is inactive, the TCD signal is active while the heads are within 1/4 track width of a track center. (The MATCH signal is active only when the address in the present cylinder address counter equals the address in the new cylinder address register.) When the heads approach the first track after leaving the track on which they were initially centered, the TCD signal becomes active. This sets the First Clk Inhibit flip-flop and enables clock pulses starting with the one which occurs when the first track is crossed.

Since the cylinder clock generator does not generate the last clock pulse, the track center detector does so when the heads approach within 3/4 track width of the cylinder being sought. It is notified, by the active MATCH-1 signal, that the next track approached will be the one sought. (The MATCH-1 signal becomes active when the address in the present cylinder address counter is one less than the address in the new cylinder address register.)

The last clock pulse steps the present cylinder address counter the last count so that it equals the address in the new cylinder address register. When this occurs, the MATCH signal becomes active and remains so as long as the two addresses are equal.

When the MATCH signal becomes active the TCD signal, which (while the heads are crossing tracks) is active as long as the heads are within 1/4 track width of any track center, becomes inactive again and the offset from track center for which it will be active is narrowed from 1/4 track width (approximately 1100 microinches) to 100 microinches. With the MATCH signal active, the FINE POSITION signal becomes active making the POS signal the source of the head positioning signal to the motor. When the servo loop has positioned the heads within 100 microinches of the track center, the TCD signal again becomes active. When this happens, the head offset from track center tolerated by the track center detector is widened to 200 microinches. With the heads centered on track, the FINE POSITION signal remains active, enabling the POS signal to keep the heads on track.

Note: Track center, as interpreted by the servo loop, is track center plus whatever offset amount is stored in the offset register and added to the feedback signal on track follower PCA-A5.

The cylinder width is halved on the lower surface of the fixed disc, thus creating two data tracks per cylinder. The data track center is one-quarter servo track width (1300 microinches) from the cylinder center. The two outermost data tracks have the cylinder address of 0 while the two innermost data tracks have the 410 cylinder address. These tracks are accessed by the same read/write head. The address of this head can be either head 2 or head 3. When the MATCH signal becomes active, the read/write head of the fixed disc is positioned over the desired track of the specific cylinder address by changing the gain of the +P and −P signals through the position amplifier. Consequently, the Position signal will always be zero when the desired track is reached.

When switching is performed between the removable disc heads and the fixed disc heads on the same cylinder, the ACRY signal will always be active. To allow the heads time to settle on track during this operation, the OSD signal is activated for a specific time period. The OSD signal holds off the sector compare signal and keeps the TCD signal active.

1-20. ACRY. When both FINE POSITION and TCD are active the $\overline{SB}$ signal is active. After a 1.3 millisecond delay to ensure that the heads are settled on the track, the HLDD and ACRY signals become active. The HLDD signal becomes active when the heads settle on the first cylinder sought after leaving the retracted position. Once active, it remains so until the RET signal becomes active. The DRIVE READY lamp is on while the DRDY signal is active. The ACRY signal, when active, indicates the heads are settled on a track.

1-21. EMERGENCY RETRACT CIRCUIT. The emergency retract circuit retracts the heads whenever the $\overline{SEN}$ signal becomes inactive or if the ILF signal becomes active. Even if the power fails, the heads will be retracted by the emergency retract circuits using power generated by the still-rotating spindle.

When activated, the emergency retract circuits are disabled by the active CRB signal, once the heads reach the retracted position.

1-22. TEMPERATURE COMPENSATION. When a cartridge is loaded into a warm disc drive, there will be an initial offset between the fixed disc (with the servo code) and the removable disc, caused by the initial temperature difference between the two discs. The temperature compensation circuit moves the read/write heads to reduce this offset.

Two thermistors placed near the edges of the fixed and removable discs sense the temperature difference of the two discs. The thermistors are connected to a bridge amplifier circuit which has the ΔT signal as its output. When the Spindle Speed Up ($\overline{SPU}$) signal becomes active, a 15-second delay is initiated. If the temperature difference between the two discs is less than 4 degrees Celsius at the end of the 15-second delay, the Temperature Time Out (TTO) signal becomes active. However, if the temperature difference between the two discs is greater than 4 degrees Celsius at the end of the 15-second delay, signal TTO will not become active until the ΔT signal is less than 4 degrees Celsius.

When signal TTO becomes active, the Drive Ready (DRDY) signal becomes active and the ΔT signal is sampled. This sampled signal begins an exponential decay that approximates the exponential nature of the temperature difference between the fixed disc and the removable disc. When head zero or head one is selected, the exponential signal is added to the input of the position amplifier. To compensate for the difference in radial expansion of the higher numbered tracks, the amplitude to the exponential signal is varied using signals DWA and DWB — the two most significant digits of the cylinder address. All of the temperature compensation circuitry, with the exception of the thermistors, is located on track follower PCA-A5.

1-23. SECTOR SENSING SYSTEM

The sector sensing system (figure 4-27) generates the unit attention states to the controller, on the control bus line which corresponds to the identity of the unit, in response to the tag bus RQA command (see figure 1-7). Also, it activates the URG or UWG signal to the read/write system to notify it when the addressed sector is under the selected head so it can begin reading from, or writing in, the sector. Near the end of the sector it disables reading and writing by deactivating the URG or UWG signal.

1-24. PRESENT SECTOR IDENTIFICATION. The servo code from the servo head is converted to a pulse train of 53,760 pulses per track (per revolution) by the circuits on track follower PCA-A5. Two sets of divide-by-1120 counters and sector counters (one set of counters for each disc) converts this pulse train to a count of 0 through 47. The 0 through 47 count identifies the sector presently under the heads for each disc. Each sector corresponds to 1120 pulses of the SCL pulse train from PCA-A5.

Two sets of counters, one for each disc, are necessary because the removable disc and fixed disc have no fixed relationship to each other. The divide-by-1120 counter and sector counter for the removable disc are reset to zero once per disc revolution by the upper index transducer (UIX) pulse. The fixed disc counters are reset by the $\overline{LIP}$ pulse which is derived by the index decoder on PCA-A5 from an index code, present on every track of the servo surface, which marks the beginning of the track.

The present sector identification for the lower disc is selected for further processing if the head register identifies the fixed disc as the selected surface. Otherwise the present sector identification for the upper disc is used.

1-25. SECTOR ADDRESS STORAGE. The sector address is supplied, by the controller, as a 6-bit binary word composed of control bus bits C0 through C5. Before the sector address is stored in the sector address register, control bus bits C4 and C5 are checked to be sure one of them is not active. If both are active, the sector address is greater than 47 and is therefore illegal. An illegal address is not stored in the register. The sector identity on control bus lines C0 through C5 is stored by the selected disc drive when either the ADR or XMS command (see figures 1-10 and 1-17, respectively) is active.

1-26. HEAD IDENTIFICATION STORAGE. Identification of the head to be used for reading or writing is done using the 2-bit binary word formed of control bus bits C8 and C9. The head identity is stored by the selected disc drive when the ADR command is active.

1-27. UNIT IDENTITY GENERATION. If the disc drive has any of its three attention flip-flops set and the controller has activated the RQA command (see figure 1-7) the sector sensing system activates the command bus line corresponding to its identification number. For example, if the disc drive has the number 5 selected on its unit select switch, it will activate command bus line C5 if one of its attention flip-flops is set.

A look-ahead capability is provided for this unit identity signal. A four-bit binary number can be added, by strapping, to the present sector identification. If all four jumpers are in place, the number added to the present sector identification is 0. If no jumpers are in place, the number added is 15, corresponding to a 15-sector look-ahead. The look-ahead signal is selectable on I/O PCA-A2. Refer to figure 4-27 for the location of the look-ahead jumpers on PCA-A2.

When the sector presently under the selected head plus the look-ahead number equals the addressed sector, the unit identity is generated on the appropriate control bus

line, provided the disc drive has an attention flip-flop set and the tag bus command RQA is active.

1-28. ENABLING READING OR WRITING. When the controller has selected reading or writing and the sector presently under the selected head matches the addressed sector, the Sector Compare (SC) signal is activated to enable the URG or UWG signal. This enables reading or writing. Each sector lasts for 1120 pulses of the divide-by-1120 counter. When count 1088 is reached, the SC signal is deactivated, stopping reading or writing in that sector.

1-29. READ/WRITE SYSTEM

The read/write system (figure 4-28) reads data from the addressed sector or writes data into it during a time period established by the sector sensing system. This time period begins when the start of the addressed sector is under the selected head and lasts until nearly the end of the sector. Both read data and write data passes between the controller and the disc drive on the same data lines. Head 0, 1, 2, or 3 is selected for reading or writing according to the head identity stored in the head register.

Write current is reduced for the higher numbered tracks (those closest to the spindle) as specified by the three most significant digits of the cylinder address ($\overline{DWA}$, $\overline{DWB}$, and $\overline{DWC}$) stored in the new cylinder address register. The $\overline{DWA}$ signal corresponds to the most significant digit and $\overline{DWC}$ corresponds to the third most significant digit. $\overline{DWC}$, when active, reduces the write current by 3.25 milliamperes. Write current is reduced by 6.5 milliamperes by $\overline{DWB}$ and 13 milliamperes by $\overline{DWA}$. Current is reduced in steps 64 tracks apart as follows:

TRACK SEGMENT	CURRENT REDUCTION (MA)
0-63	0
64-127	3.25
128-191	6.50
192-255	9.75
256-319	13.00
320-383	16.25
384-410	19.50

Four read/write fault conditions are sensed by the fault detection system. When any of the conditions exist, the fault detection system takes further action as detailed in following paragraphs. These conditions are as follows:

a. More than one head selected for reading or writing.

b. Absence of dc write current.

c. Absence of an ac write signal which is derived from write data.

d. Absence of the ACRY signal.

The fault system takes notice of the last three conditions only during write mode.

1-30. FAULT DETECTION SYSTEM

The disc drive contains six fault subsystems (figure 4-29) for monitoring important drive functions: the interlock fault subsystem, address fault subsystem, read/write fault subsystem, AGC fault subsystem, CRB fault subsystem, and timeout subsystem. Visual indication of the nine drive faults detected by the subsystem is provided by four light-emitting diodes (LED's) mounted on PCA-A4. The faults are indicated by coding the operation of two red LED's, one green LED, and one yellow LED. The coding for these LED's is as follows:

FAULT	LED(s) ILLUMINATED
CB	yellow
T	red
AGC	yellow, red
IL	green
W • $\overline{AR}$	yellow, green
R • W	green, red
W • $\overline{AC}$	yellow, green, red
MH	red, red
$\overline{W}$ • DC	red, red, yellow

The action of the readout system is included in the following description of the fault subsystems.

1-31. INTERLOCK FAULT SUBSYSTEM. This subsystem senses the presence of PCA's A2 through A6, A8, and A10, and monitors the −36, −24, −12, +5, +12, and +36 Vdc and 25 Vac power sources and the temperature on the heat sink located on power and motor control PCA-A8. (It also disables the +5 volt power source if the track formatter PCA and I/O sector PCA-A2 are both installed in the disc drive at the same time.) If any PCA is not firmly in place, if any of the monitored power sources fall below a specified value, or the temperature on the PCA-A8 heat sink increases beyond a specified value, the following conditions occur:

a. IL (green) LED lights.

b. FAULT indicator lights.

c. Heads are retracted (if they were loaded).

d. Head positioning servo disabled.

e. Door locked solenoid de-energized (door locked).

f. Spindle stops.

The +5 volt power source is monitored for overvoltage. If the voltage increases over a value of approximately +5.6 volts, the +5 volt power source is shorted to ground by a circuit located on motherboard PCA-A7.

1-32. ADDRESS FAULT SUBSYSTEM. The address fault sensing subsystem indicates (to the controller) when an illegal sector or illegal cylinder has been selected or if the heads are not settled on a track (ACRY active) when a SK command (see figure 1-9) occurs. When any of these conditions exist, control bus bit C2 is activated when the next READ, WRITE, or RQS tag bus command (see figures 1-12, 1-13, and 1-14, respectively) occurs.

1-33. READ/WRITE FAULT SUBSYSTEM. This subsystem senses five error conditions and classifies them as either a non-destructive write fault (NDWF) or a destructive write fault (DWF). Both non-destructive and destructive write faults light the DRIVE FAULT indicator. The heads are retracted and a 1.25-second timeout is initiated only by a destructive write fault. If the heads do not reach the retracted (carriage back) position within 1.25 seconds, the T (red) LED will be lighted.

The two non-destructive write fault conditions are as follows:

a. Heads not settled on a track in write mode (UWG signal active and ACRY signal inactive). The W • $\overline{AR}$ (yellow, green) LED's are lighted.

b. Read and write modes exist simultaneously (URG and UWG signals both active). The R • W (green, red) LED's are lighted.

A destructive write fault exists under the following conditions:

a. No data is being written in write mode (the ACW signal is inactive and the UWG signal is active). The W • $\overline{AC}$ (yellow, green, red) LED's are lighted.

b. Two or more heads selected for reading or writing (MHS signal active). The MH (red, red) LED's are lighted.

c. The heads are receiving write current while the drive is not in write mode (DCW signal active and UWG signal inactive). The color-coded readout for this fault is "red, red, yellow".

1-34. AGC FAULT SUBSYSTEM. An AGC fault occurs if the servo AGC signal is lost while the heads are located on or between cylinders 0 and 410 and the HLDD signal is active. The AGC (yellow, red) LED's are lighted and the heads are retracted when such a fault occurs.

1-35. CRB FAULT SUBSYSTEM. A CRB fault occurs when the heads are indicated as being in the retracted position while no RET signal has been registered by the HLDD flip-flop (CRB and DRDY signals simultaneously active). Under these conditions, the CB (yellow) LED is lighted and the heads are retracted.

1-36. TIMEOUT SUBSYSTEM. The timeout subsystem disables the disc drive if certain head positioning functions are not completed within a time set by the timeout subsystem. A 90-millisecond timeout is initiated each time the SK signal becomes active (table 1-5). A 1.25-second timeout is initiated each time the RH signal becomes active and each time the RET signal becomes inactive. A timeout is also initiated when the RET signal becomes active, provided it was not caused by a previous timeout or an active ILF signal. The standard used by the timeout subsystem to measure time is the STP signal which is derived from the spindle speed. If the timeout, once initiated, is not cancelled before the time limit, the following events occur:

a. T (red) LED lights.

b. DRIVE FAULT indicator lights.

c. Heads are retracted.

d. Head positioning servo is disabled.

e. Door locked solenoid is de-energized.

f. DRIVE READY indicator goes out.

g. Spindle stops rotating.

1-37. FAULT DETECTION SYSTEM RESET. The AGC fault, CRB fault, read/write fault, and address fault subsystems are reset when the ILF signal is active, when the POWER switch is set to ON, or when the RUN/STOP switch is set to RUN. Also, any timeout condition is cancelled if the ACRY signal is active or if the heads are retracted.

If the CLR tag bus command (see figure 1-20) is active ($\overline{CPS}$ signal active), the AGC fault subsystem, address fault subsystem, and the two non-destructive write fault (W • $\overline{AR}$ and R • W) circuits are reset.

1-38. AIR CIRCULATION AND FILTRATION SYSTEM

The air circulation and filtration system (see figure 1-4) consists of a single blower motor which rotates an impeller to draw cooling air into the disc drive through a prefilter duct assembly mounted on the bottom of the disc drive. Approximately one-third of the developed air flow passes through the lower portion of the absolute filter. This cooling air is directed through a flexible hose to the cooling air

Table 1-5. Timeout Conditions

TIMEOUT TYPE	INITIATING CONDITION	CANCELLING CONDITION
90 ms	Seek command (SK signal active).	Heads settle on a track within 90 milliseconds (ACRY signal active).
1.25 sec	Recalibrate command (RH signal active).	Heads settle on track 0 within 1.25 seconds (ACRY signal active).
1.25 sec	RET signal active and not caused by a timeout or an active ILF signal.	Heads reach retracted position within 1.25 seconds (CRB signal active).
1.25 sec	RET signal becomes inactive.	Heads settle on track 0 within 1.25 seconds. (Inactive RET signal activates SKH signal.)

duct where it is diverted into two separate paths. These two paths of cooling air flow along the fins of the heat sink on the power and motor control PCA-A8 and exhaust through the vent openings in the lower right-hand corner of the rear cover.

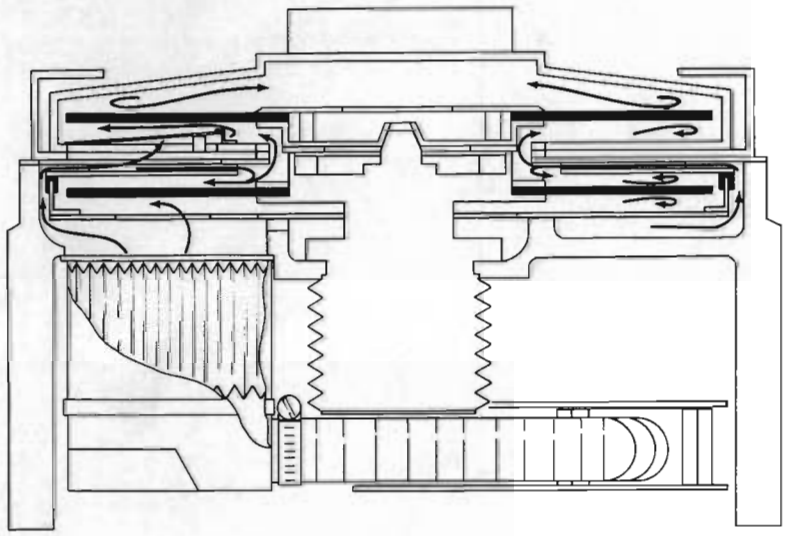
The remaining two-thirds of the developed air flow passes through the filtration element in the absolute filter where 99% of all contaminants 0.3 micron or larger are trapped. After the air is thoroughly filtered, it is injected into the fixed disc and removable cartridge cavities. This flow of cool, clean air serves three extremely important functions. First, it tends to purge all critical areas of any airborne contaminants. Secondly, it cools both the fixed disc and the disc in the removable cartridge. Thirdly, it maintains a positive pressure within the disc cavities to prevent any inward flow of airborne contaminants. View A shows a cutaway section of the fixed disc and removable cartridge cavities and the approximate air flow pattern within them.

View B shows the critical elements involved in the read/write process, i.e., the read/write gap, the flying height of the heads, and the thickness of the oxide coating on the disc surfaces. The flying height is an average value due to the surface irregularities of both heads and disc. Also shown in View B are various types of contaminants and their size relationships. A contaminant particle hard enough and of the right size may scratch either the oxide coating or the head surface. Even if not hard enough to scratch, it may be large enough to increase the head disc spacing, thereby causing data errors. Therefore, to prevent potential damage or data loses, it is extremely important to maintain the cleanliness of the air within the disc drive.

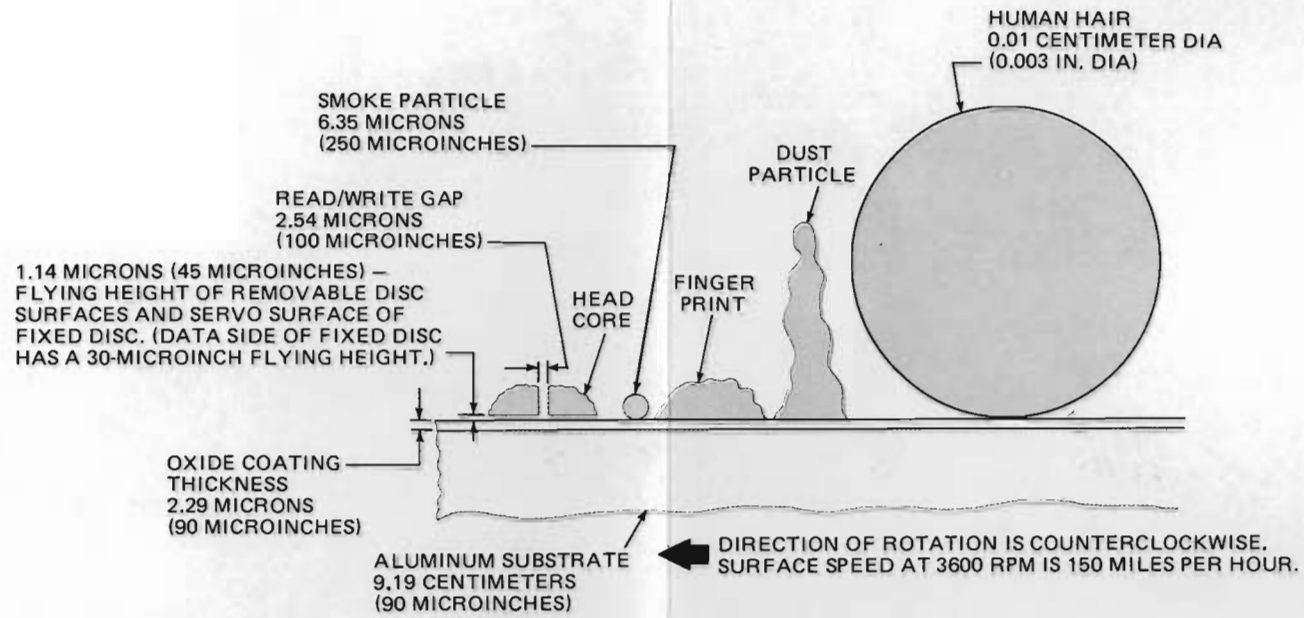
To ensure that clean air will be present, the disc drive must be operated in the specified environment and the air flow through the prefilter and the absolute filter checked on a regularly scheduled basis. When the drive is operated in the specified environment, the preventive maintenance schedule (refer to table 2-3) requires that a) the prefilter be checked for contamination, and b) the absolute filter output air pressure be measured every six months. When the disc drive is operated in a severe environment such as one in which unusual amounts of dust, smoke, moisture, oil vapor, and other foreign matter are present, prefilter contamination and absolute filter output air pressure should be checked more frequently. The procedures for making these checks are provided in paragraphs 2-12 and 2-13, respectively. The prefilter should be changed when it becomes contaminated and the absolute filter should be changed when the air flow becomes restricted and the output air pressure drops below the values specified in table 2-4. Replacement procedures for the prefilter and the absolute filter are provided in paragraphs 5-12 and 5-13, respectively.

1-39. POWER DISTRIBUTION SYSTEM

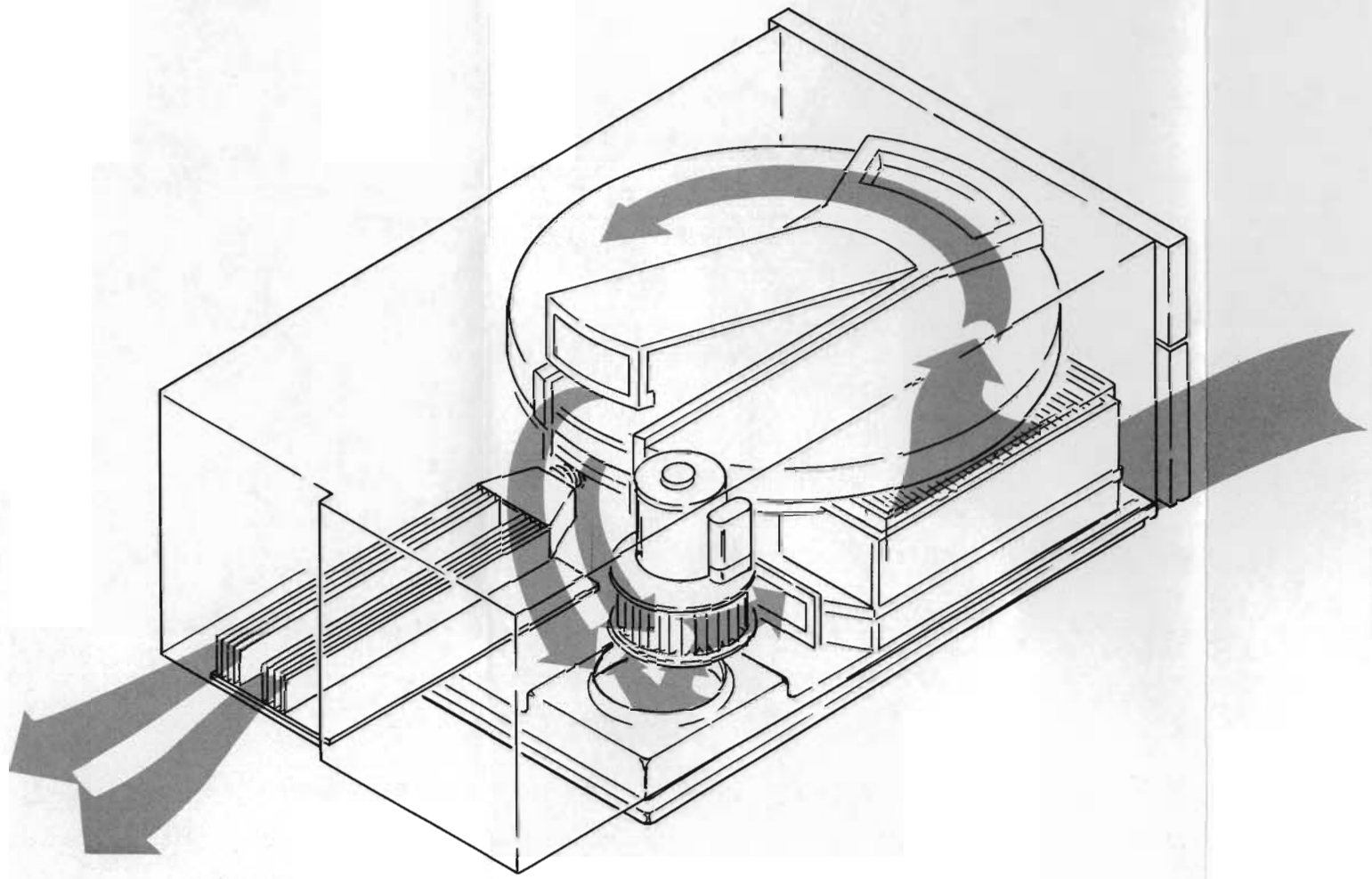
The power distribution system converts ac input power to 25 Vac and +5 Vdc, +12 Vdc, −12 Vdc, and −24 Vdc and distributes these voltages to the brush motor and PCA's. Figure 4-31 is a schematic representation of the power distribution system.



VIEW A

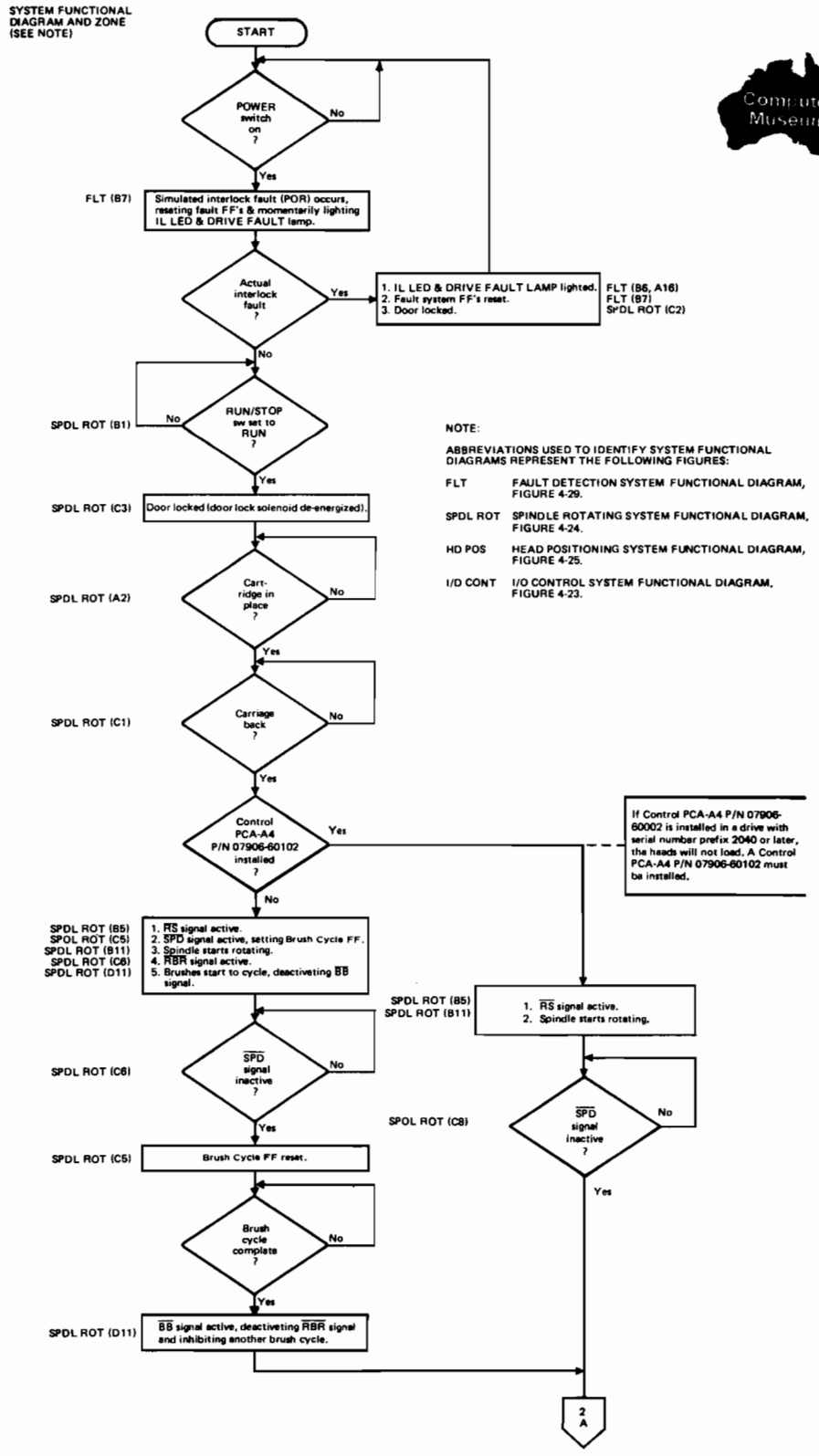


VIEW B



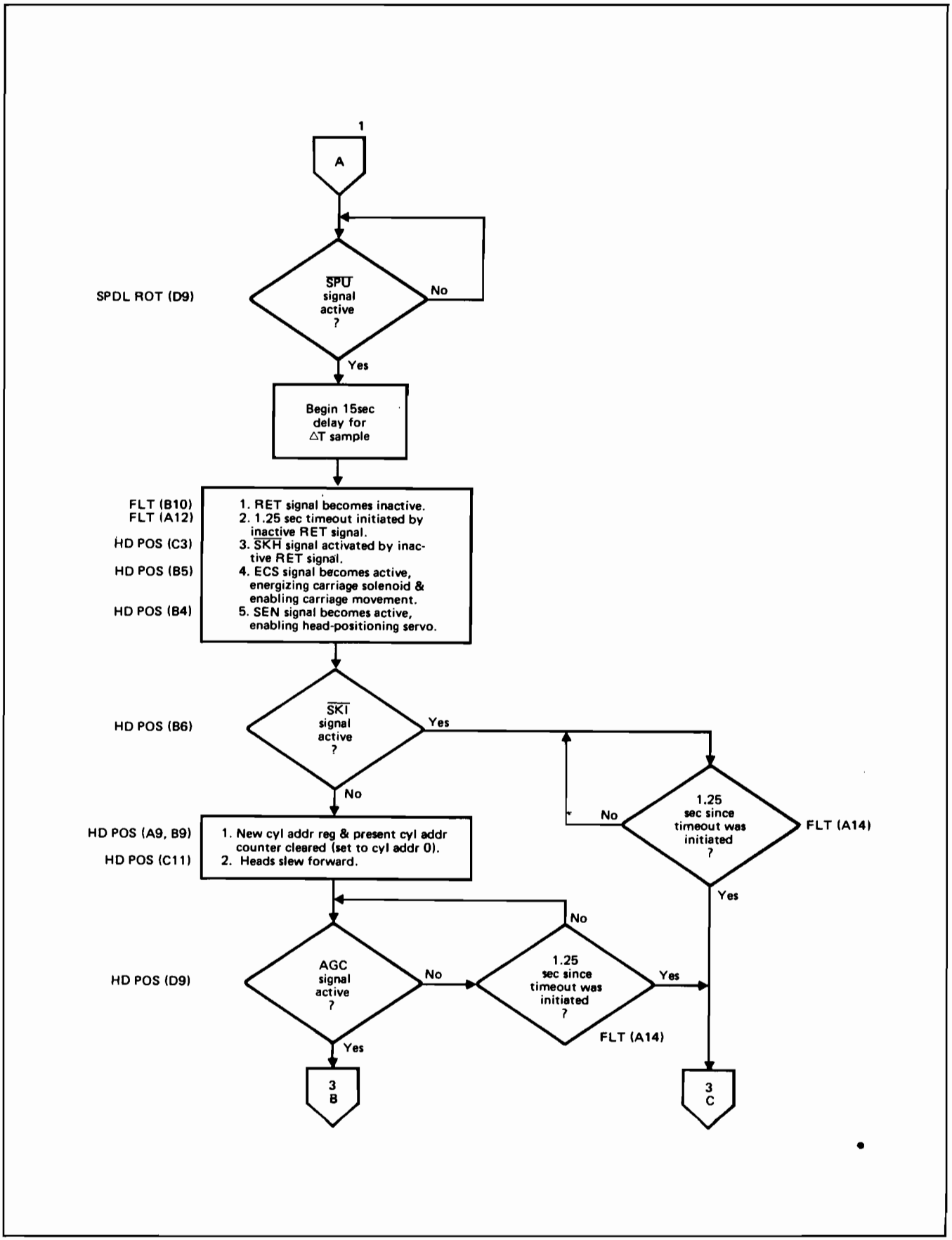
7300-85A

Figure 1-4. Air Circulation and Filtration System



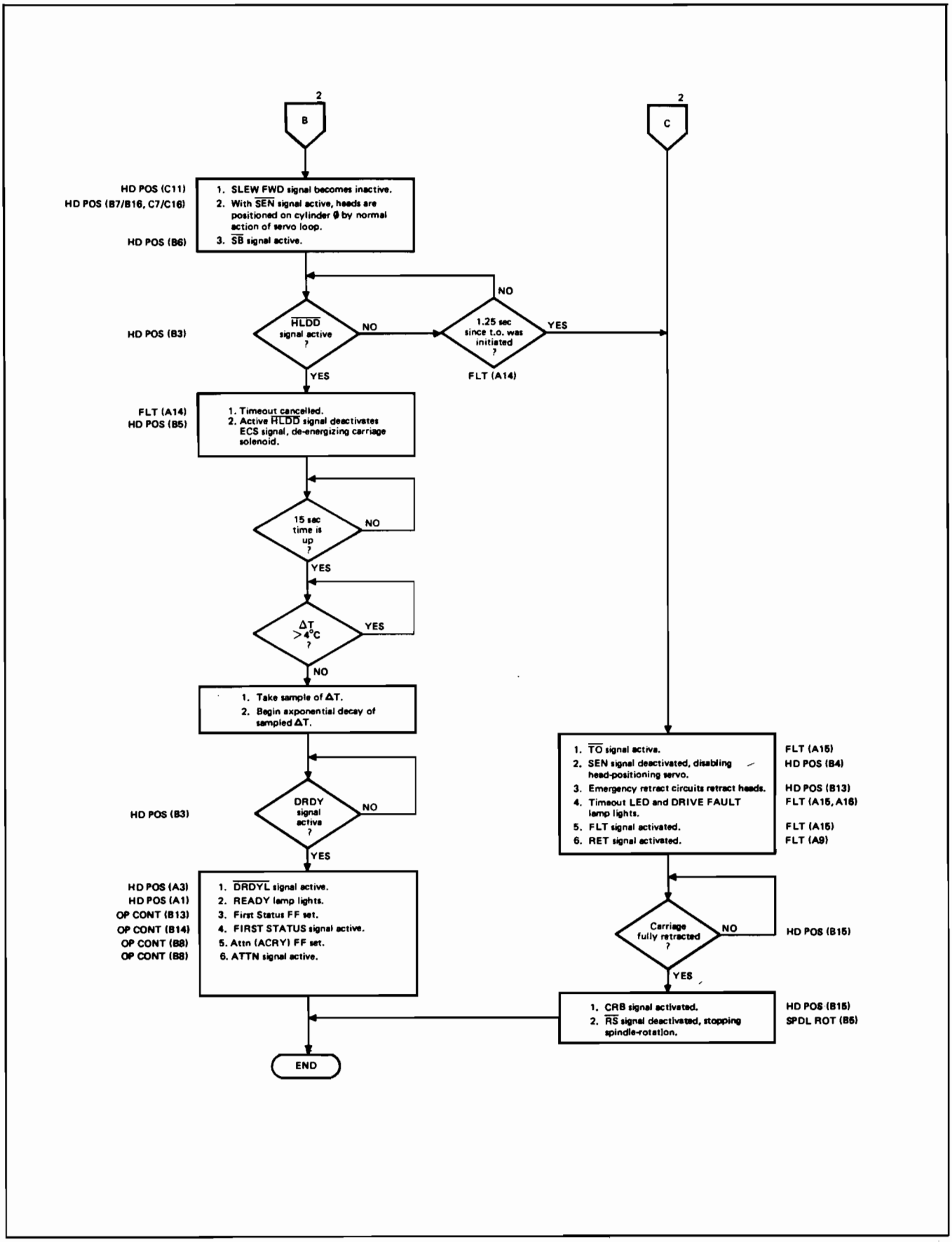
7300-38(1)C

Figure 1-5. Power-Up Events Flowchart (Sheet 1 of 3)



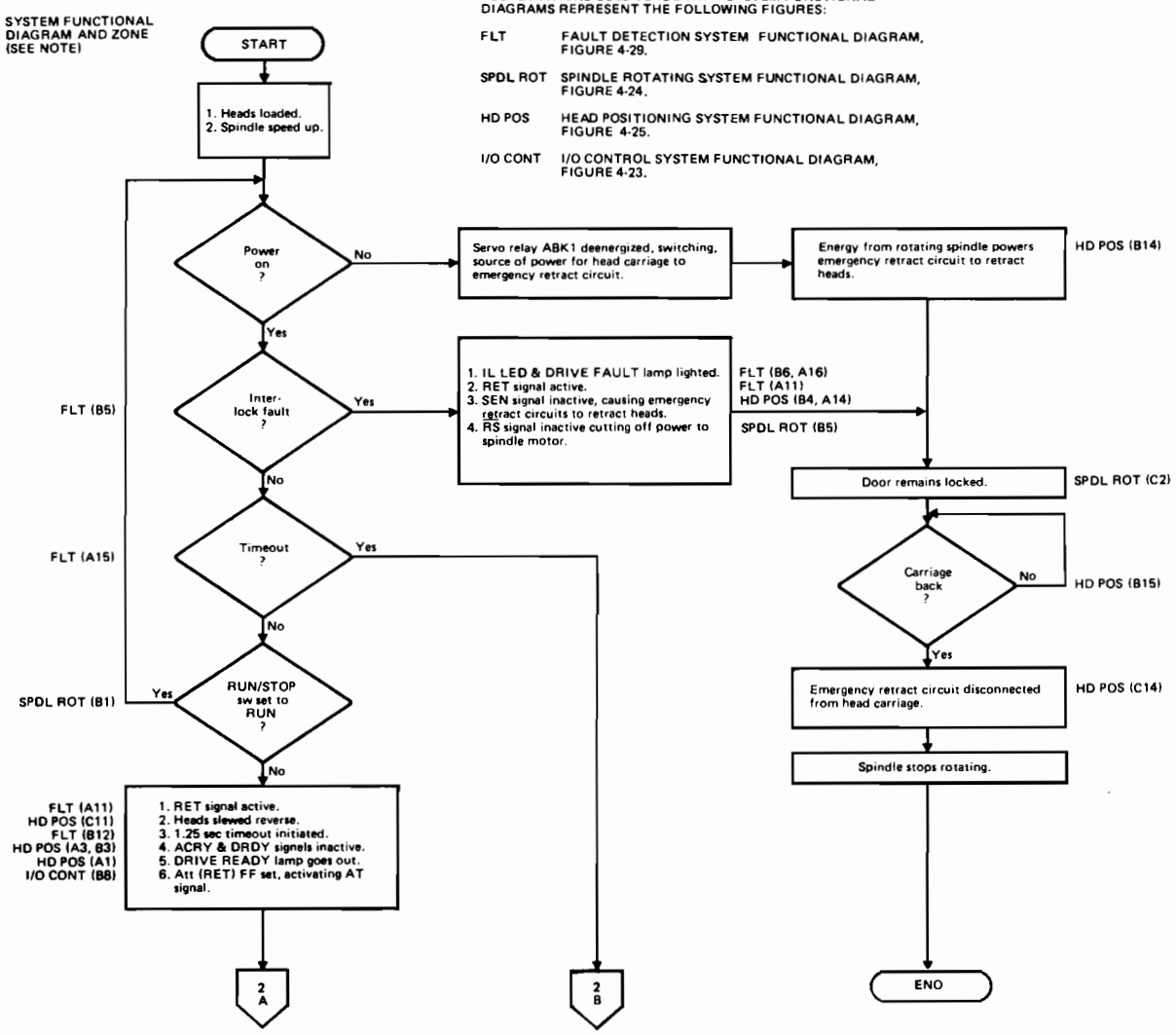
7300-38(2)C

Figure 1-5. Power-Up Events Flowchart (Sheet 2 of 3)



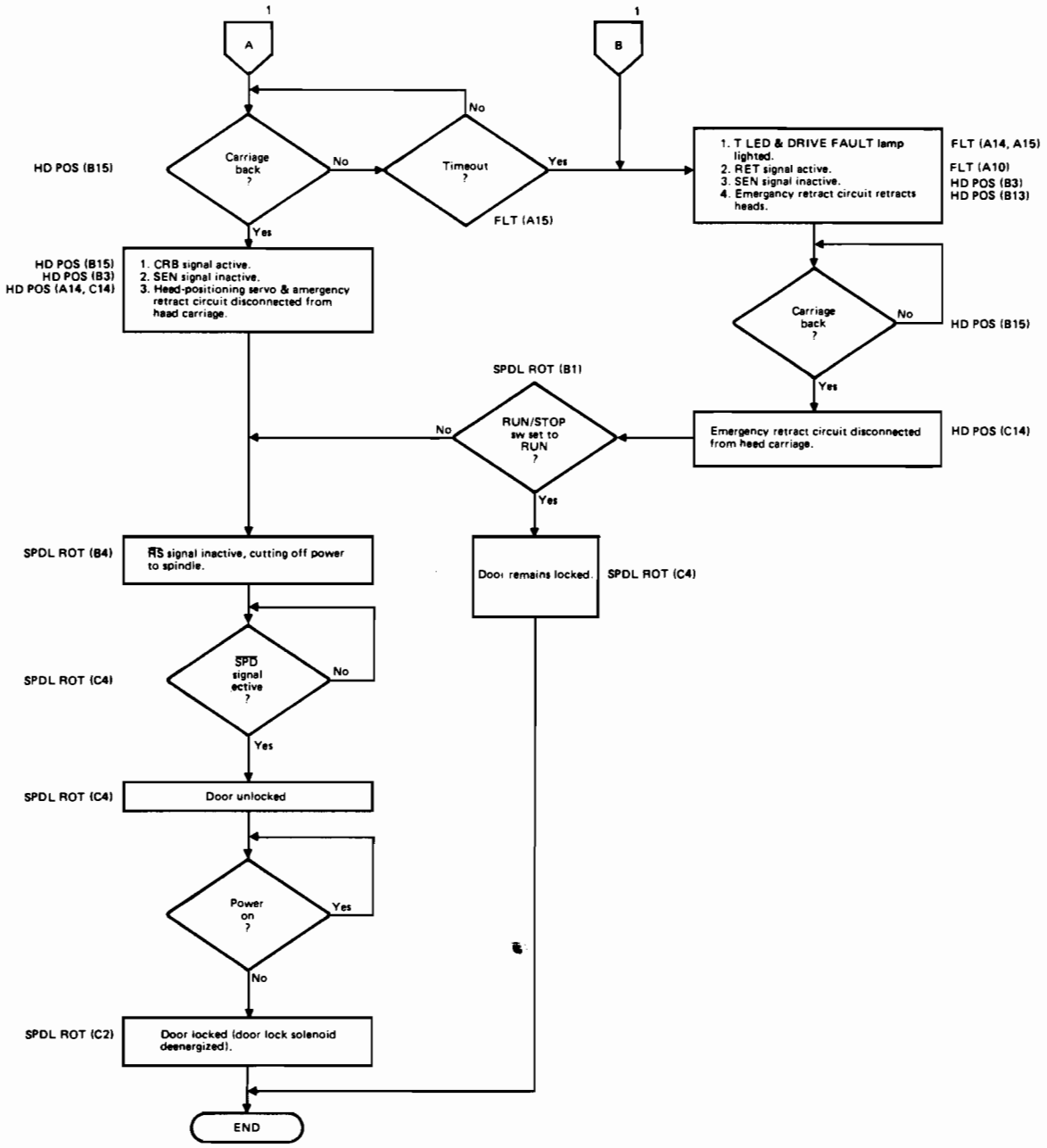
7300-38(3)D.

Figure 1-5. Power-Up Events Flowchart (Sheet 3 of 3)



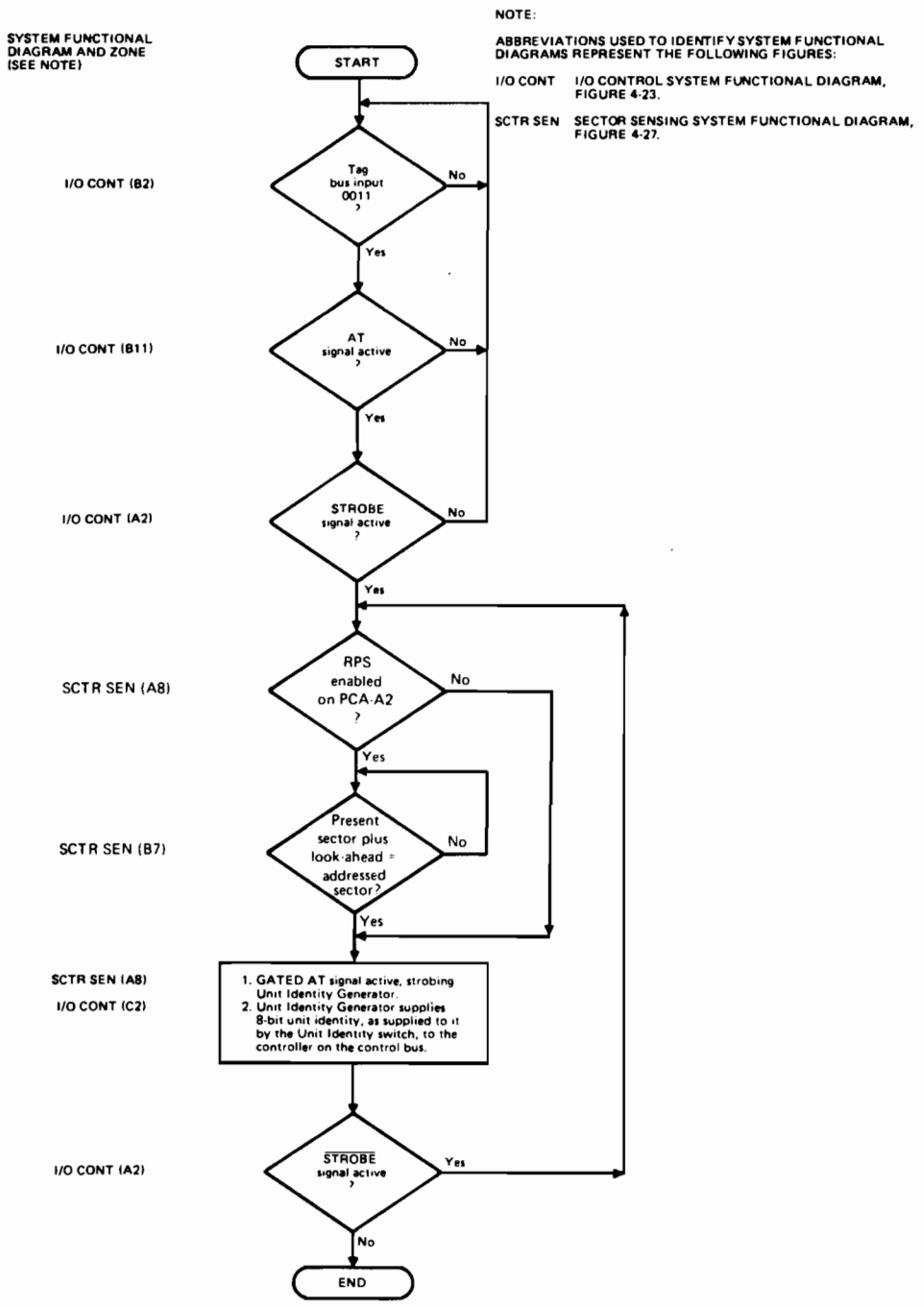
7300-39(1)8

Figure 1-6. Power-Down Events Flowchart (Sheet 1 of 2)



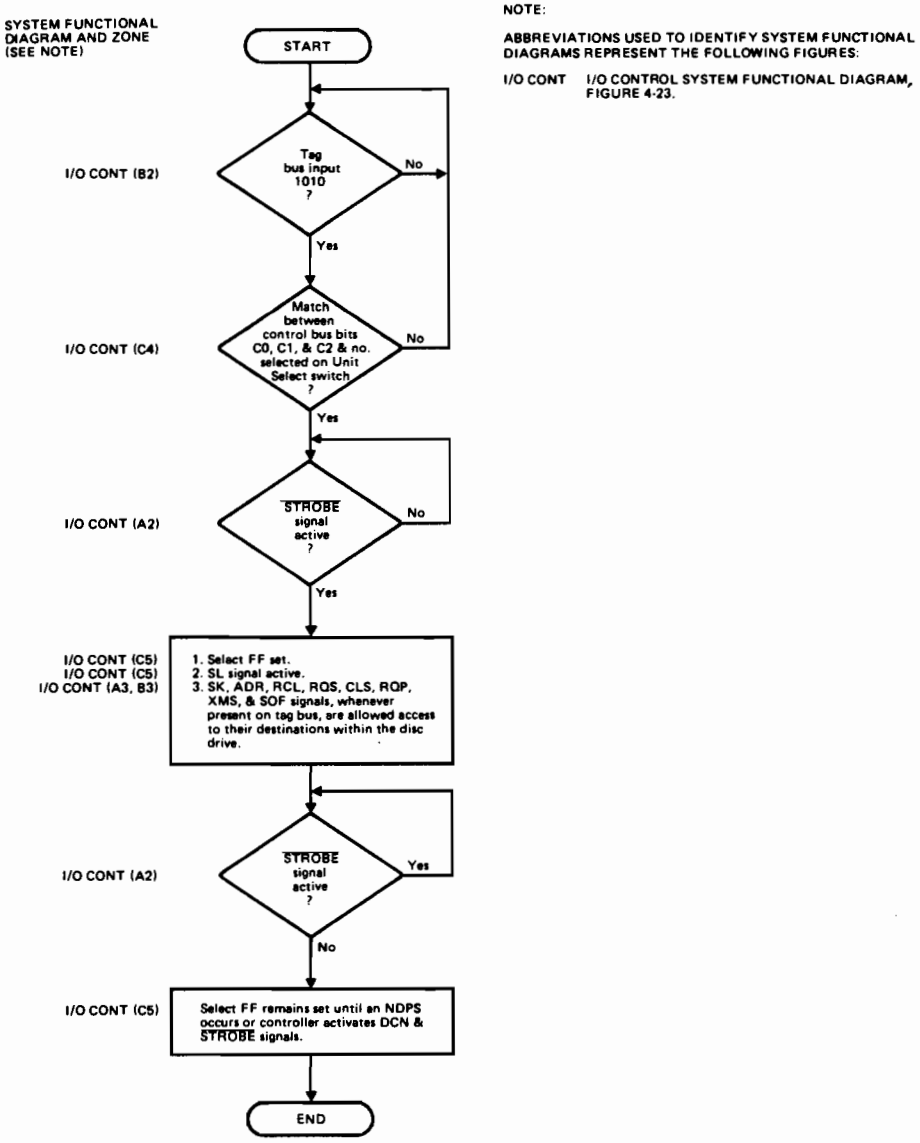
7300-39(2)8

Figure 1-6. Power-Down Events Flowchart (Sheet 2 of 2)



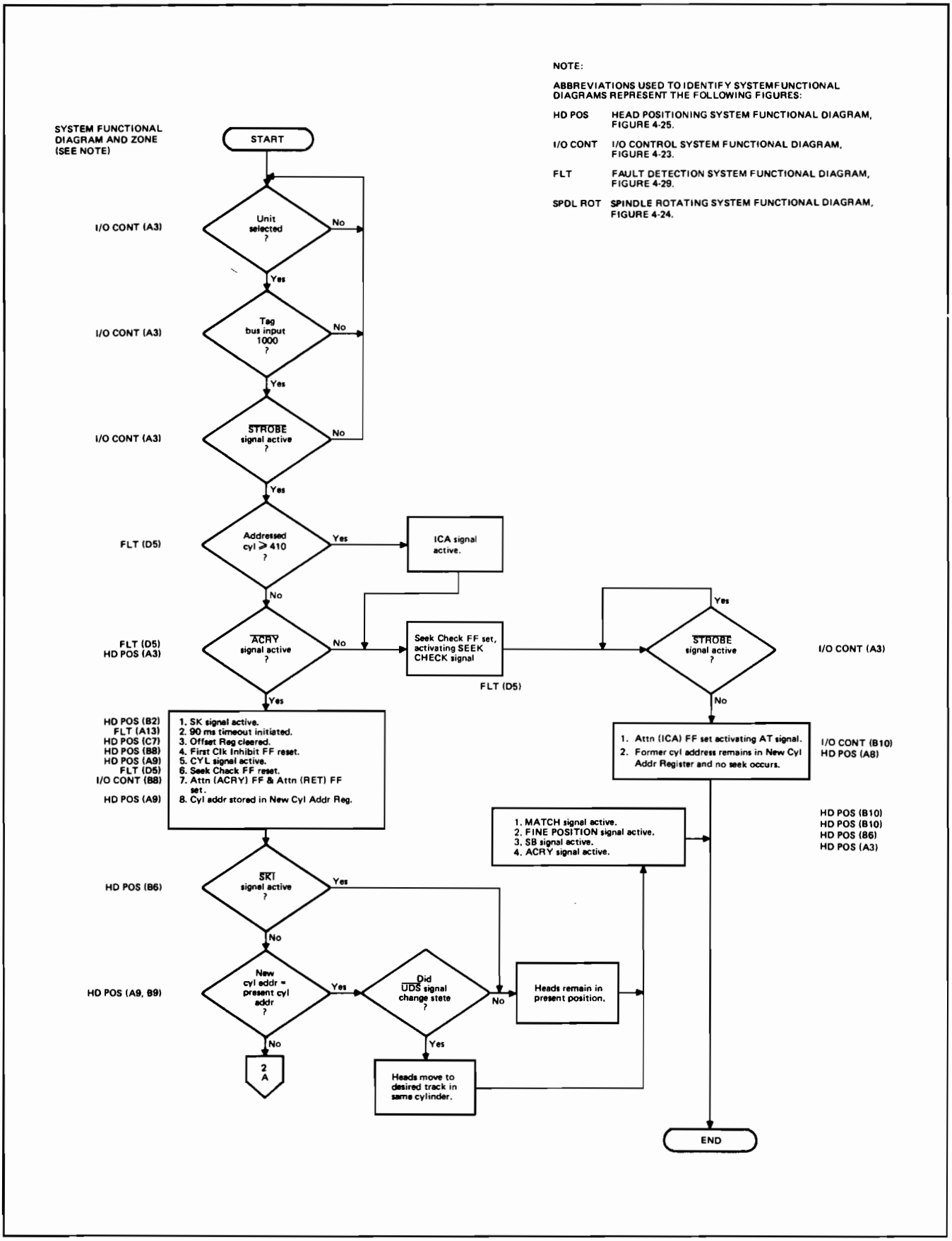
7300-40D

Figure 1-7. RQA Tag Bus Command Events Flowchart



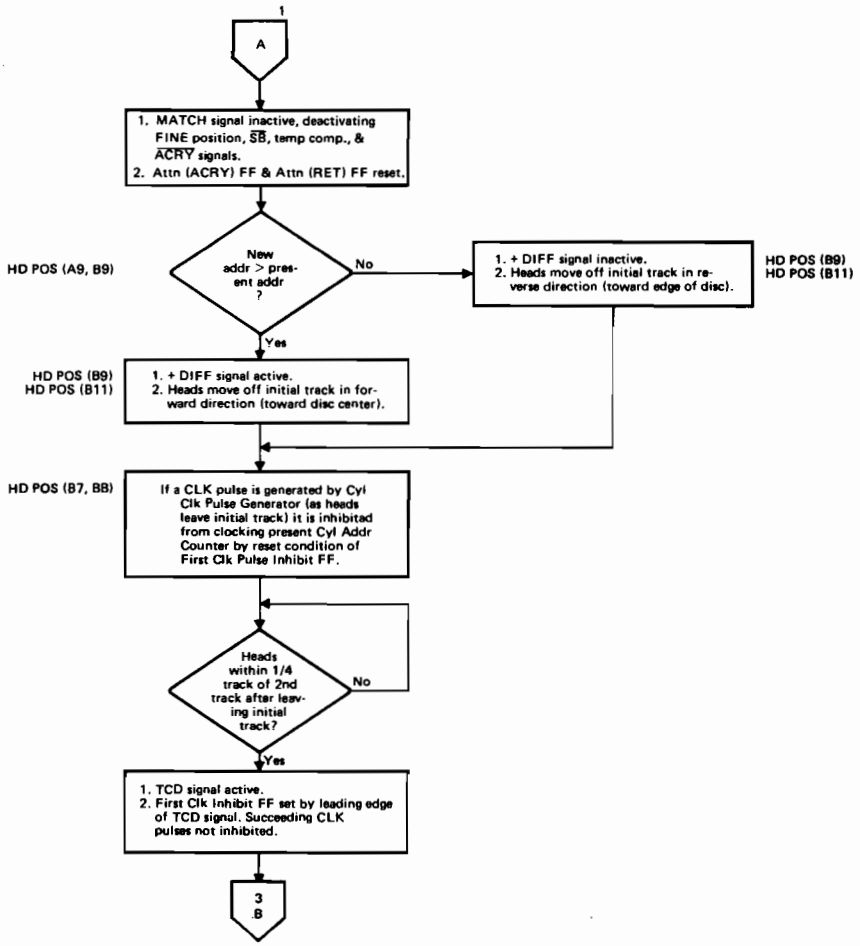
7300-418

Figure 1-8. ADU Tag Bus Command Events Flowchart



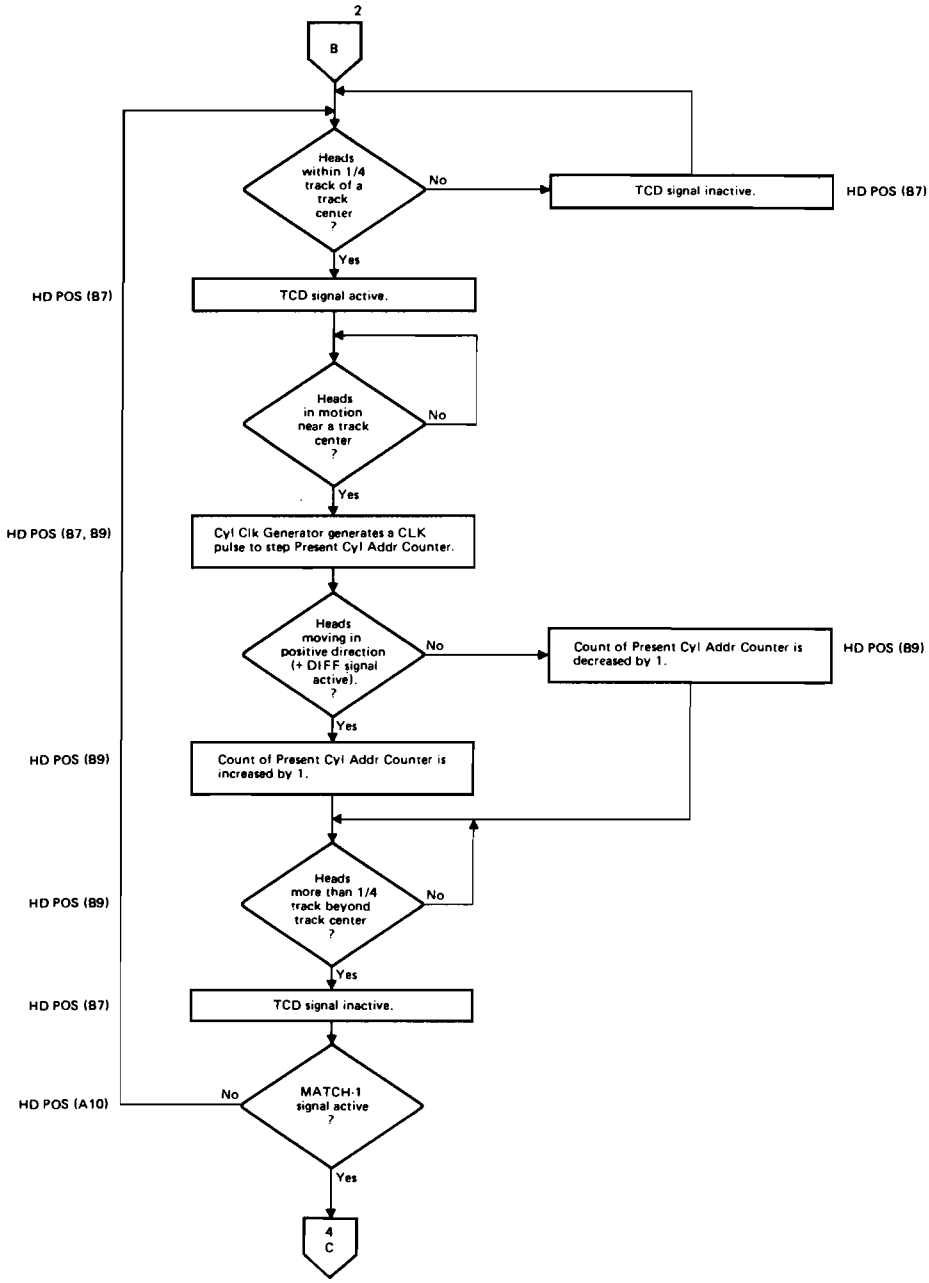
7300-42(1) C

Figure 1-9. SK Tag Bus Command Events Flowchart (Sheet 1 of 4)



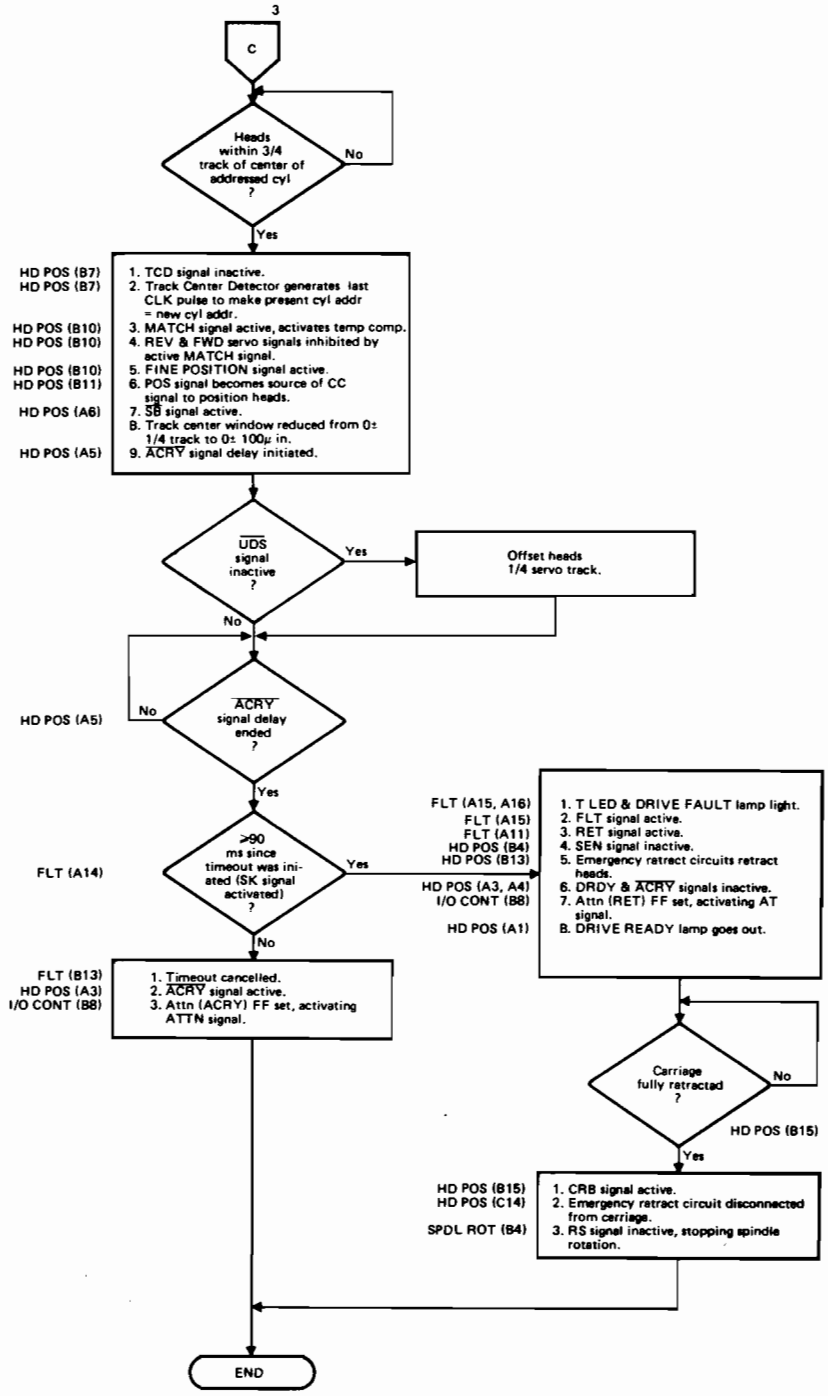
7300-42(2) B

Figure 1-9. SK Tag Bus Command Events Flowchart (Sheet 2 of 4)



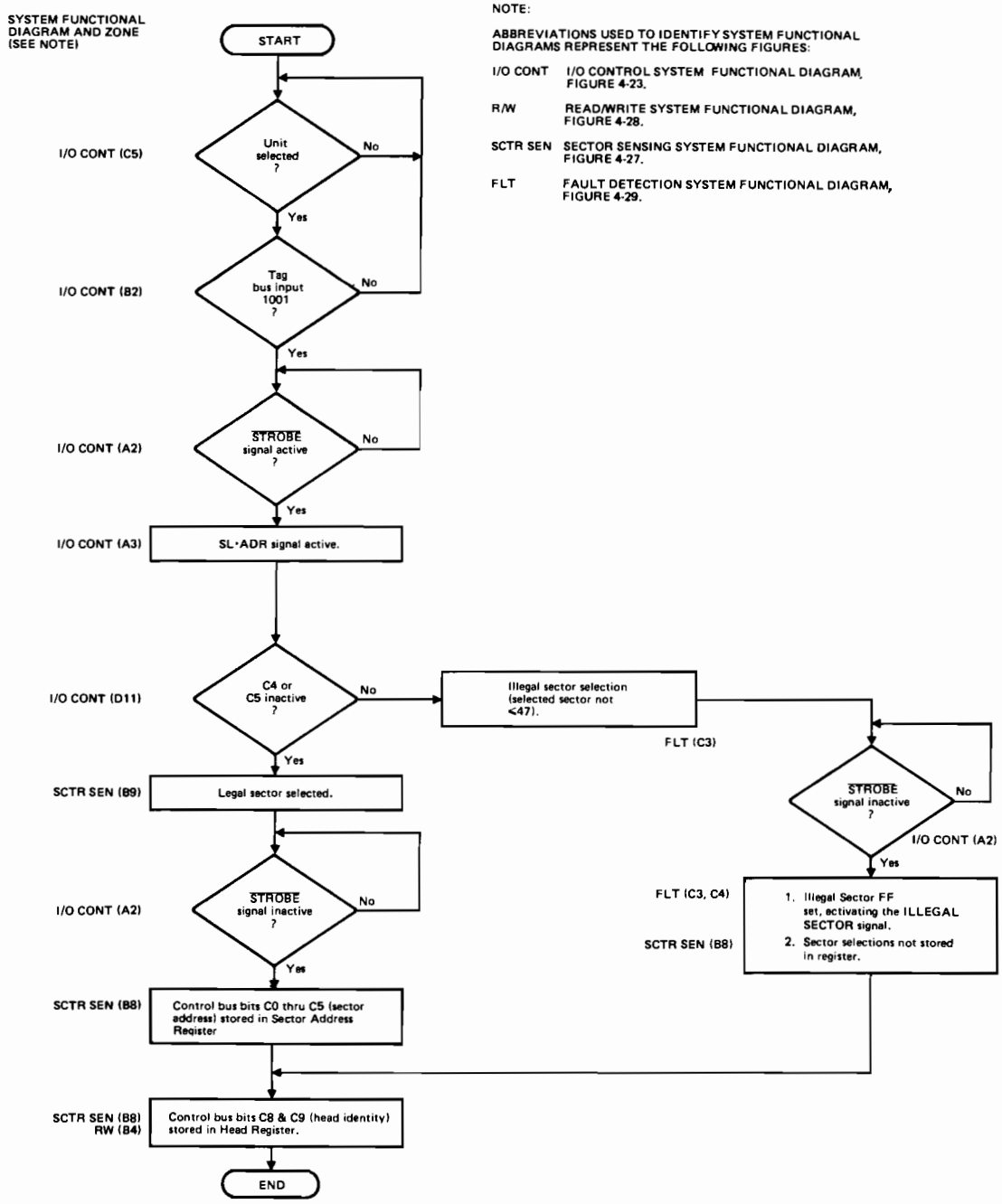
7300-42(3)A

Figure 1-9. SK Tag Bus Command Events Flowchart (Sheet 3 of 4)



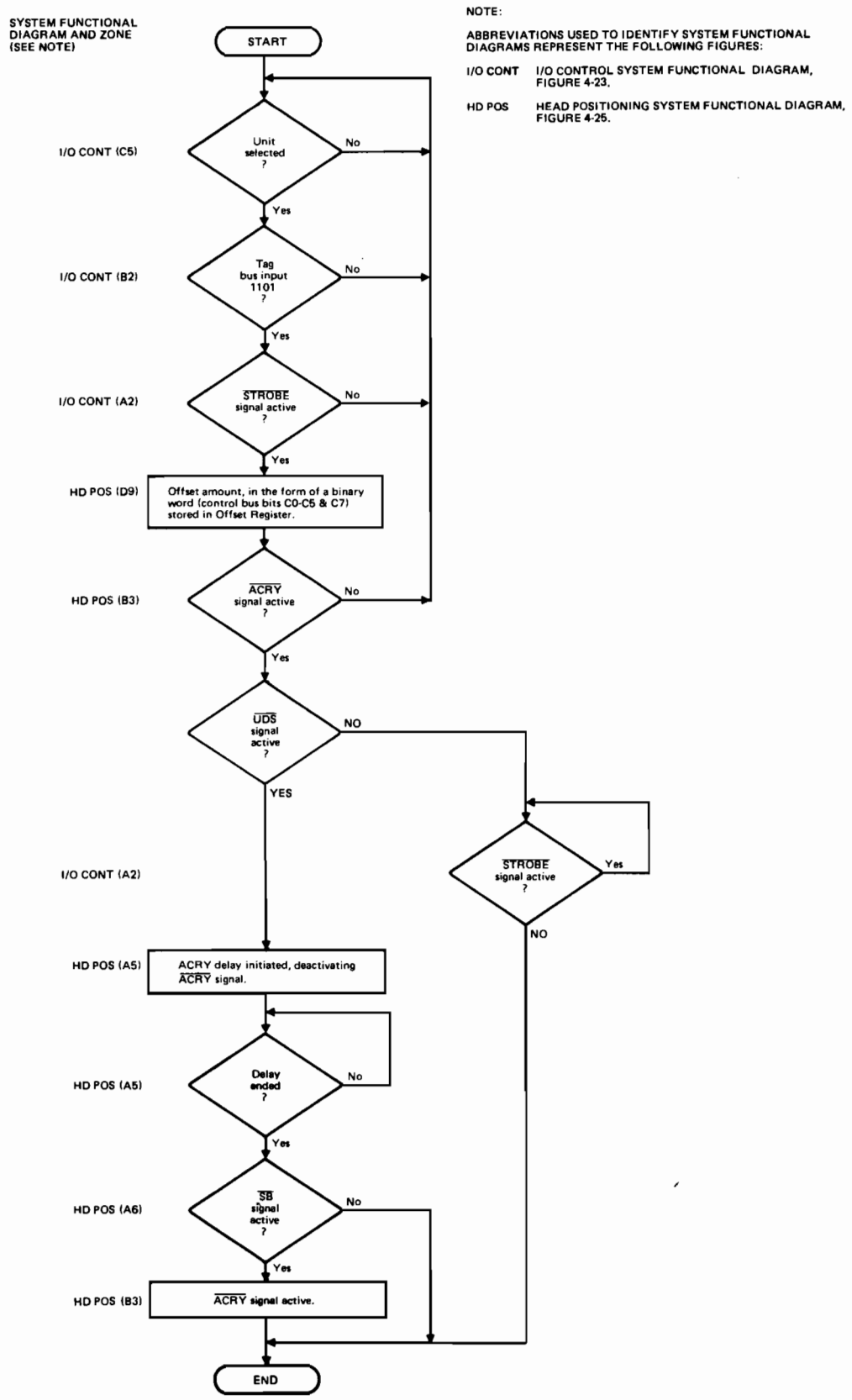
7300-42(4) C

Figure 1-9. SK Tag Bus Command Events Flowchart (Sheet 4 of 4)



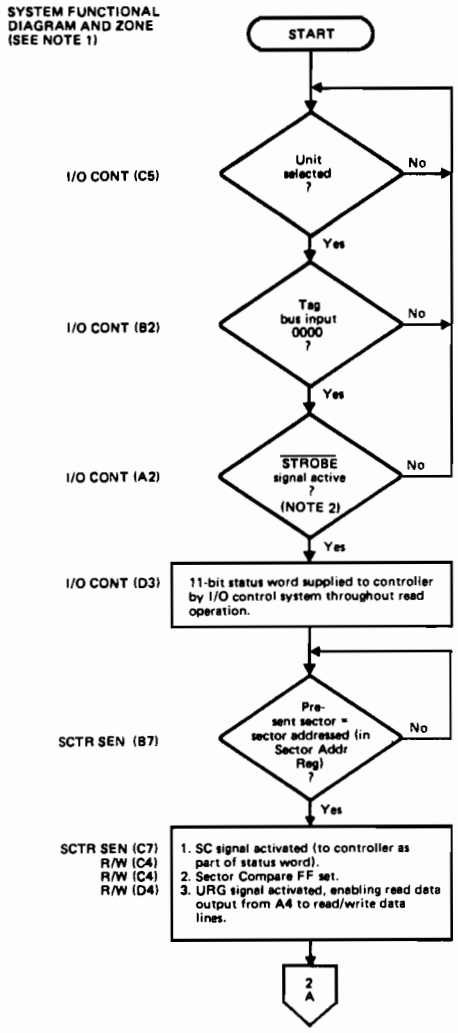
7300-43 C

Figure 1-10. ADR Tag Bus Command Events Flowchart



7300-44C

Figure 1-11. SOF Tag Bus Command Events Flowchart



NOTE:

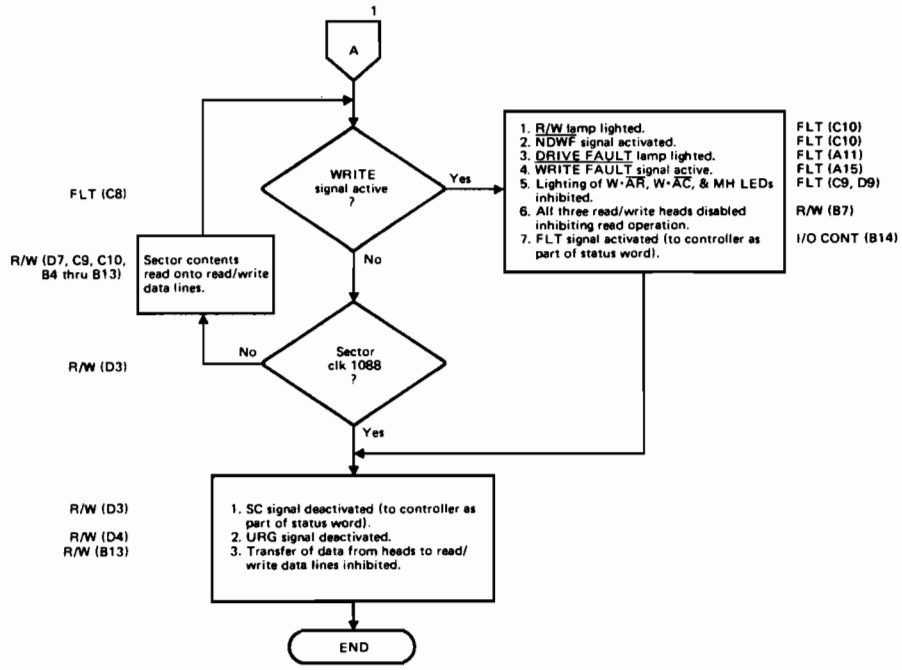
1. ABBREVIATIONS USED TO IDENTIFY SYSTEM FUNCTIONAL DIAGRAMS REPRESENT THE FOLLOWING FIGURES:

I/O CONT	I/O CONTROL SYSTEM FUNCTIONAL DIAGRAM, FIGURE 4-23.
SCTR SEN	SECTOR SENSING SYSTEM FUNCTIONAL DIAGRAM, FIGURE 4-27.
R/W	READ/WRITE SYSTEM FUNCTIONAL DIAGRAM, FIGURE 4-28.
FLT	FAULT DETECTION SYSTEM FUNCTIONAL DIAGRAM, FIGURE 4-29.

2. $\overline{\text{STROBE}}$ SIGNAL IS ACTIVE THROUGHOUT READ OPERATION

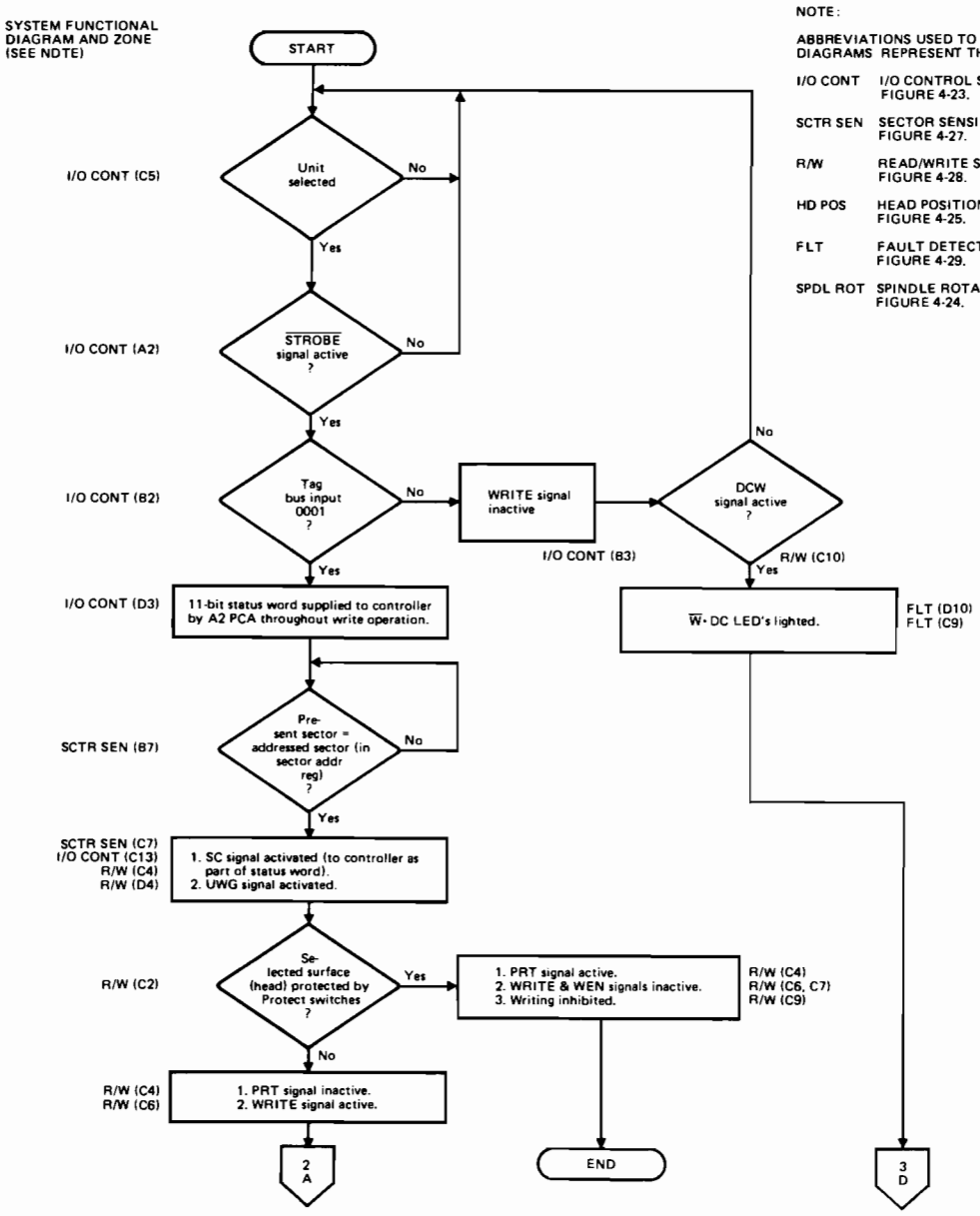
00-45(1)B

Figure 1-12. READ Tag Bus Command Events Flowchart (Sheet 1 of 2)



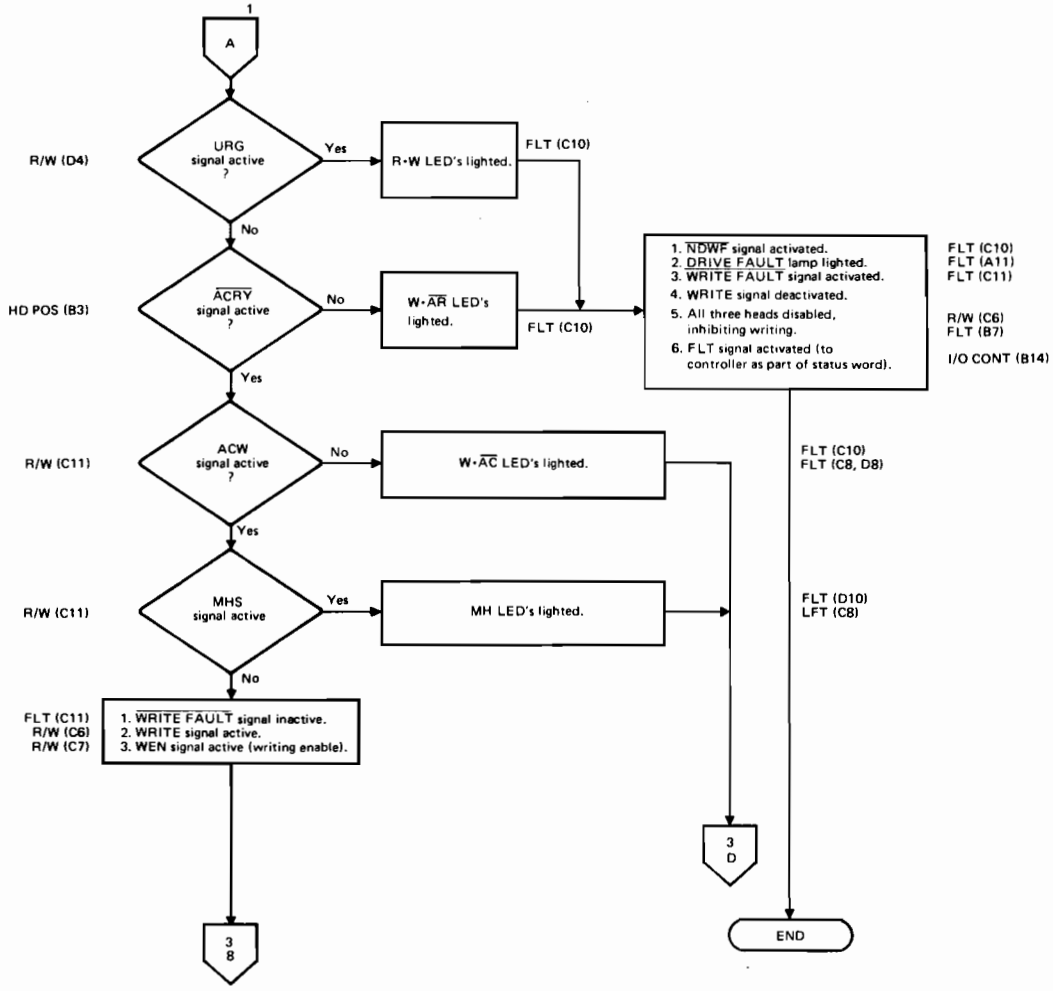
7300-45(2)A

Figure 1-12. READ Tag Bus Command Events Flowchart (Sheet 2 of 2)



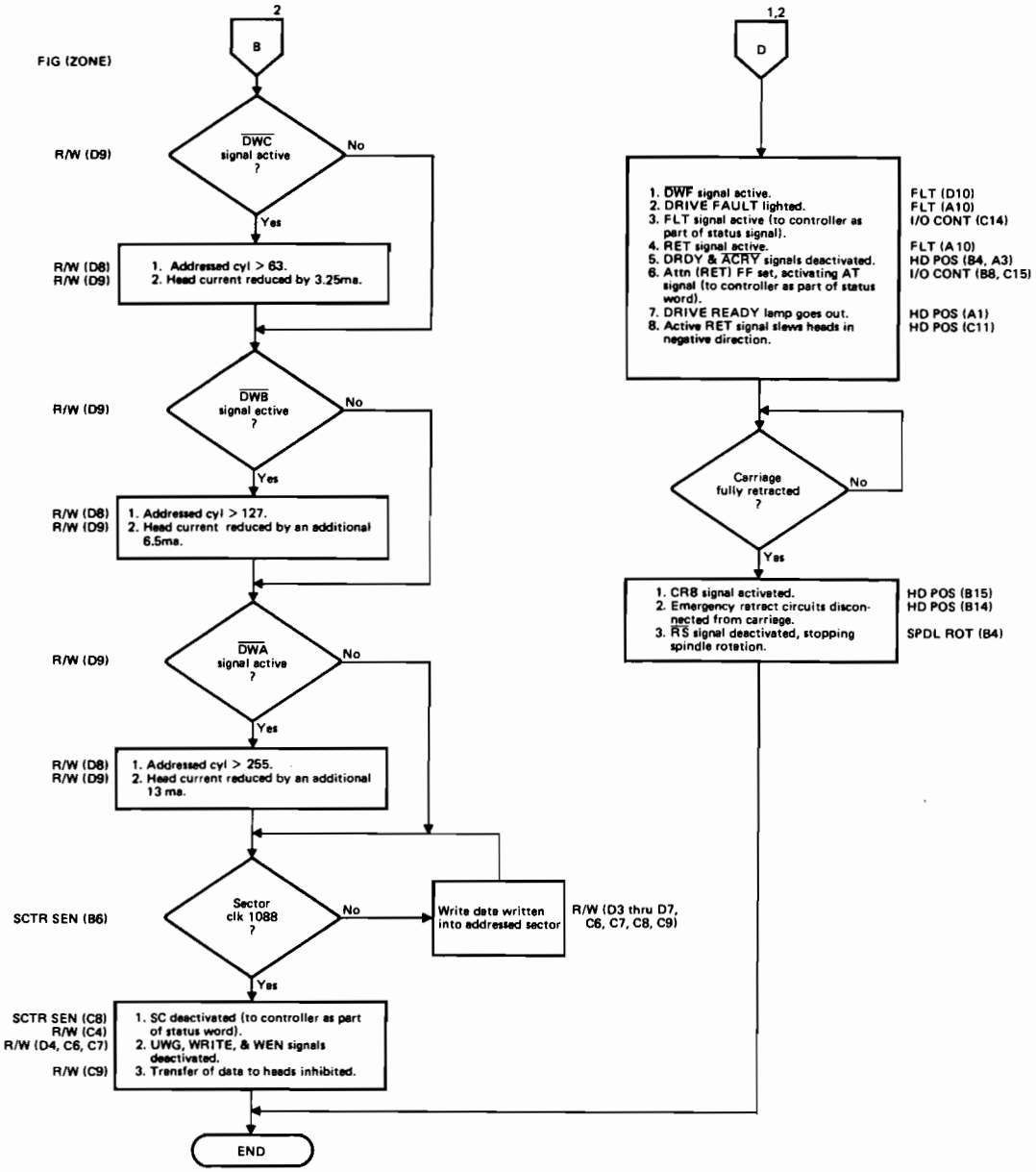
7300-48(1)b

Figure 1-13. WRITE Tag Bus Command Events Flowchart (Sheet 1 of 3)



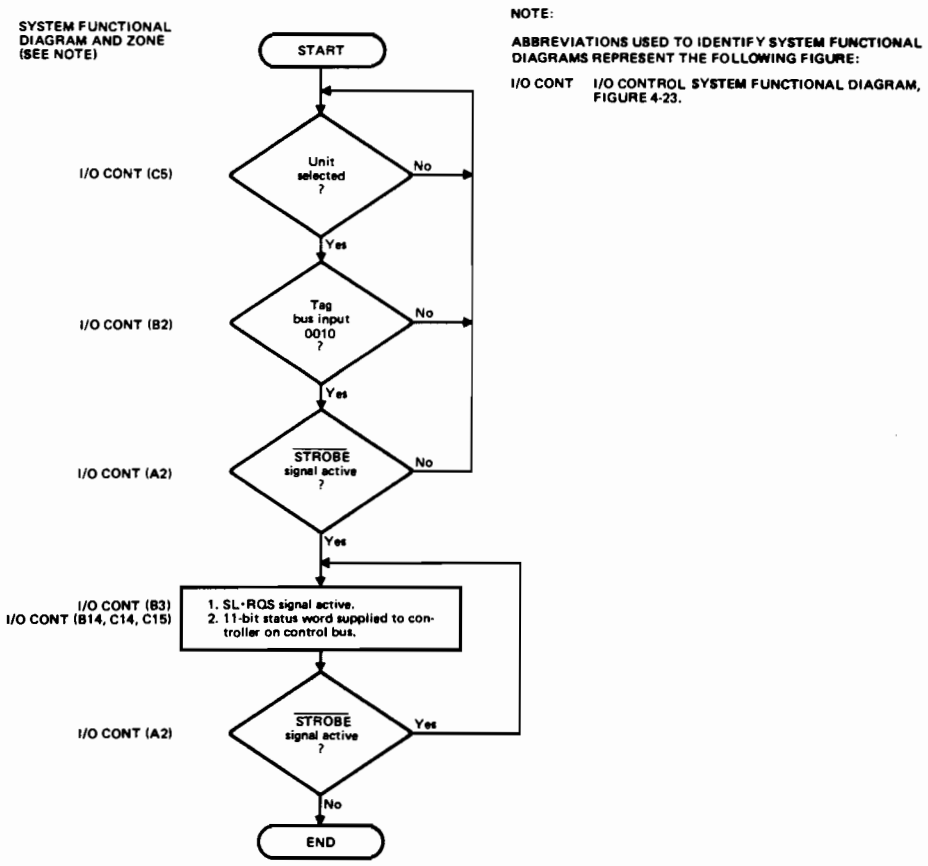
7300-46(2)B

Figure 1-13. WRITE Tag Bus Command Events Flowchart (Sheet 2 of 3)



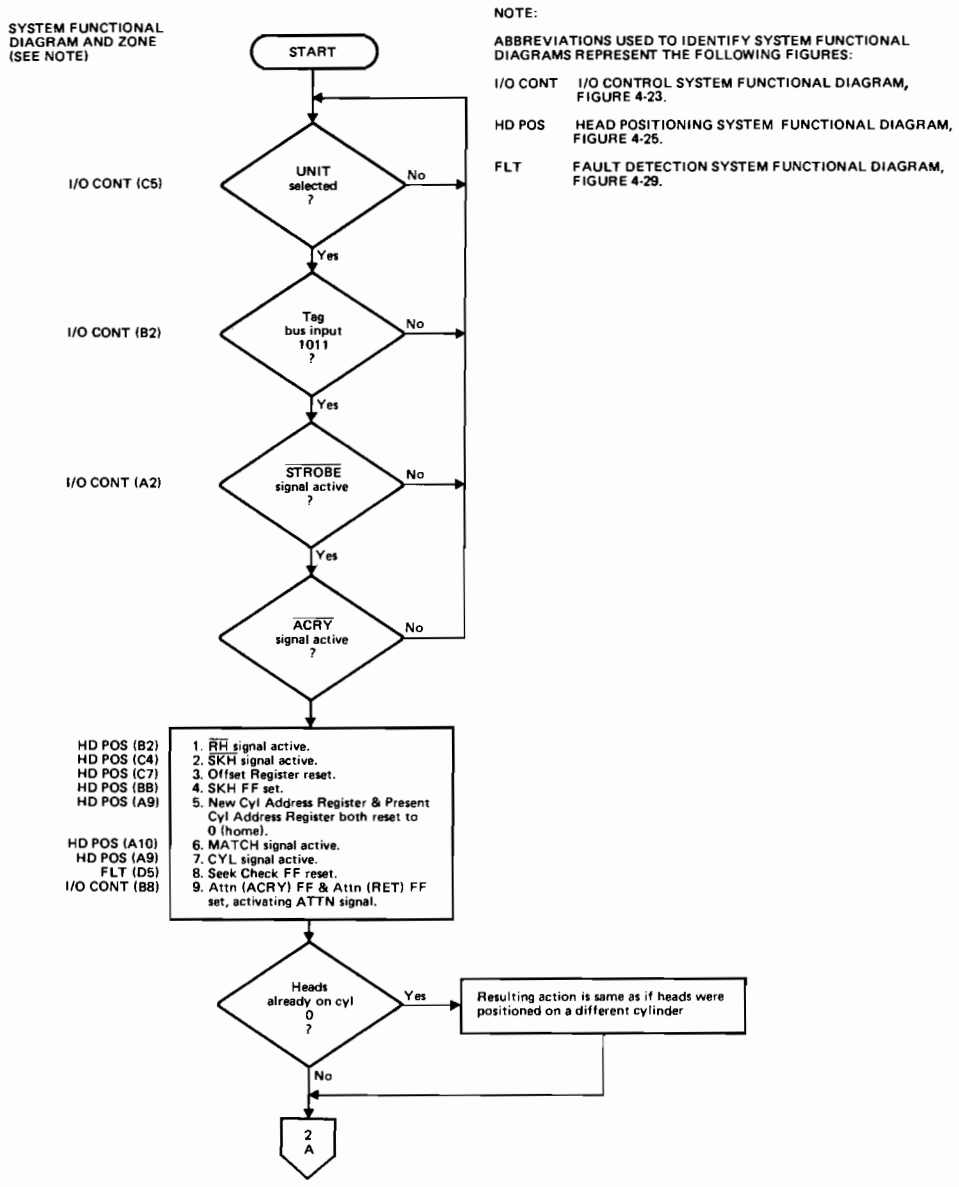
7300-46(3)8

Figure 1-13. WRITE Tag Bus Command Events Flowchart (Sheet 3 of 3)



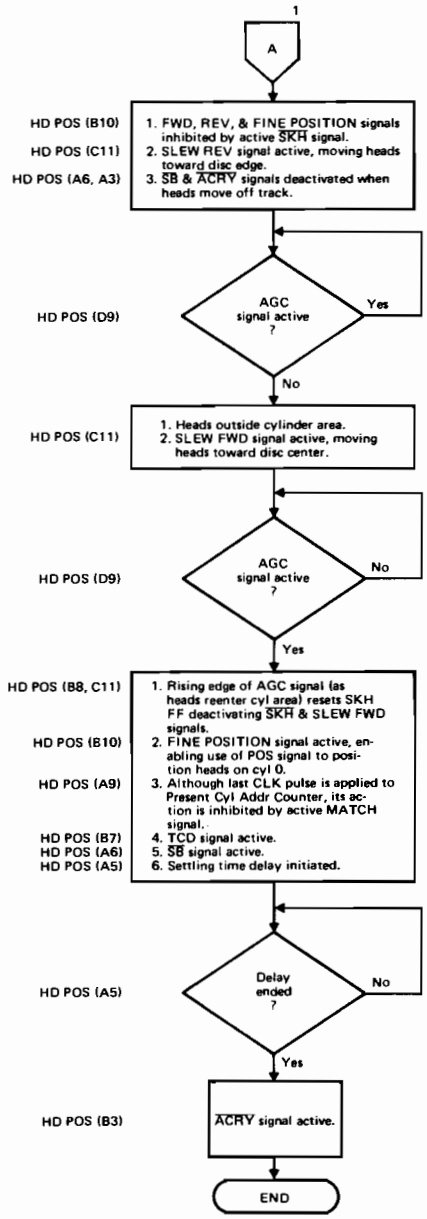
7300-47 C

Figure 1-14. RQS Tag Bus Command Events Flowchart



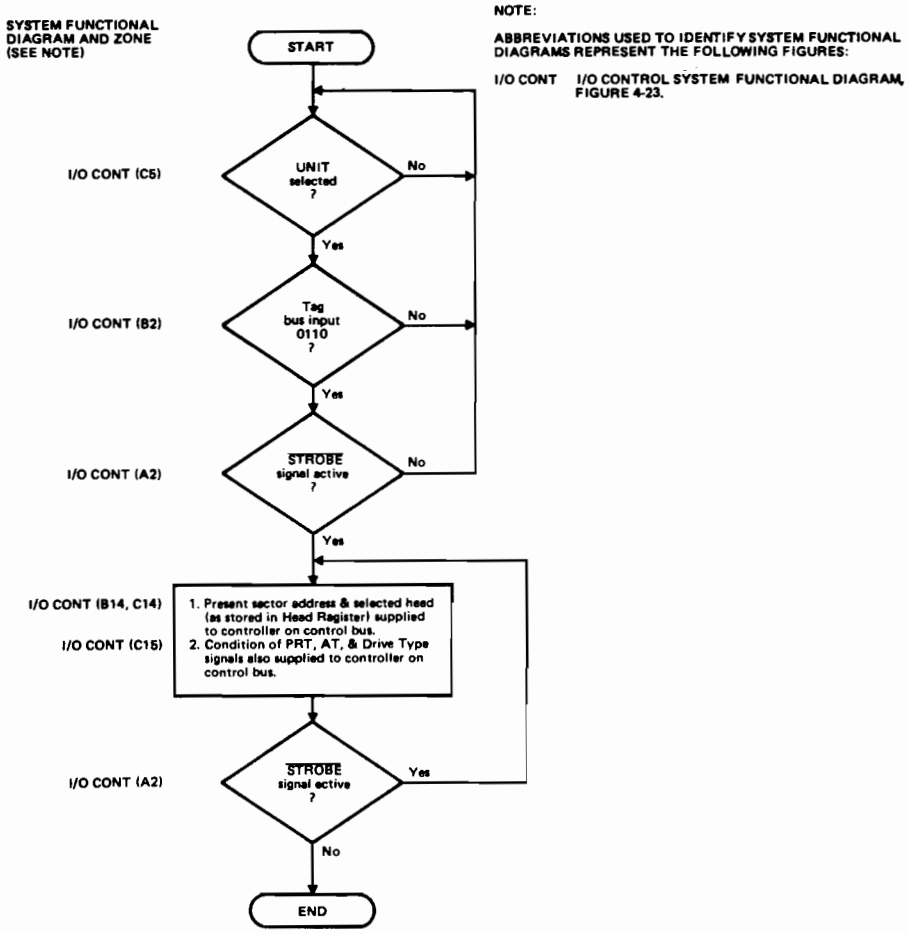
7300-48(1)B

Figure 1-15. RCL Tag Bus Command Events Flowchart (Sheet 1 of 2)



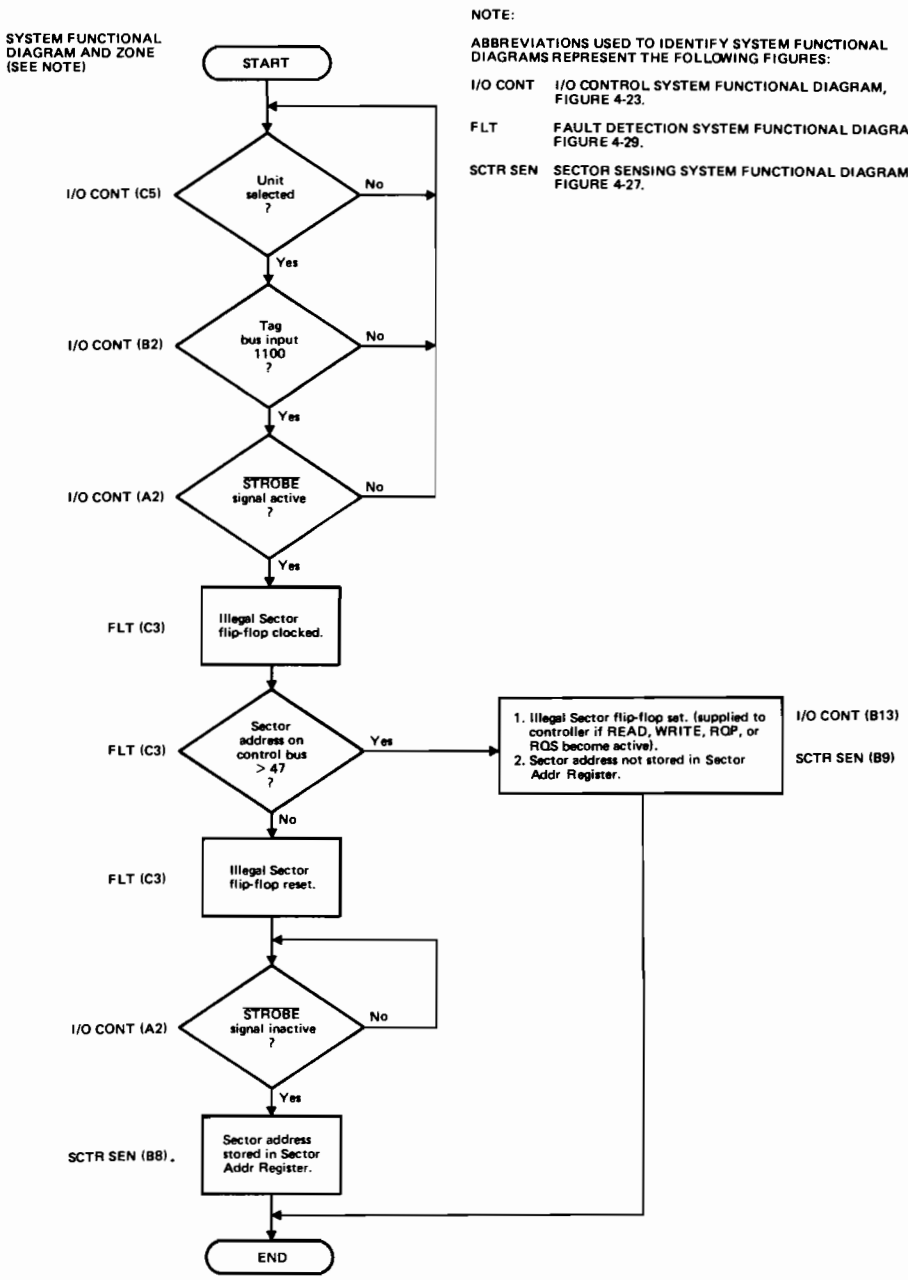
7300-48(2)A

Figure 1-15. RCL Tag Bus Command Events Flowchart (Sheet 2 of 2)



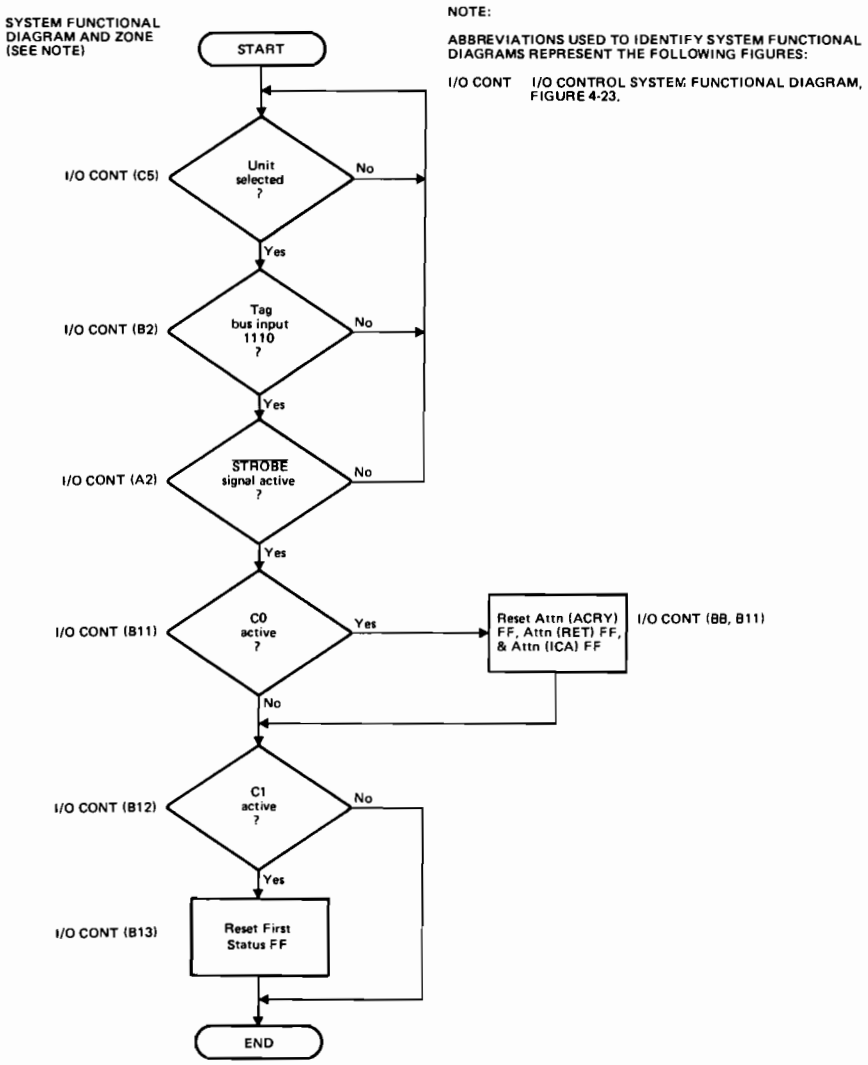
7300-49 C

Figure 1-16. RQP Tag Bus Command Events Flowchart



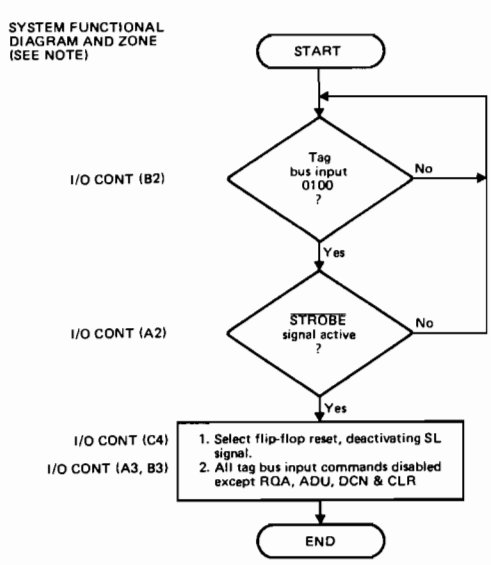
7300-508

Figure 1-17. XMS Tag Bus Command Events Flowchart



7300-518

Figure 1-18. CLS Tag Bus Command Events Flowchart



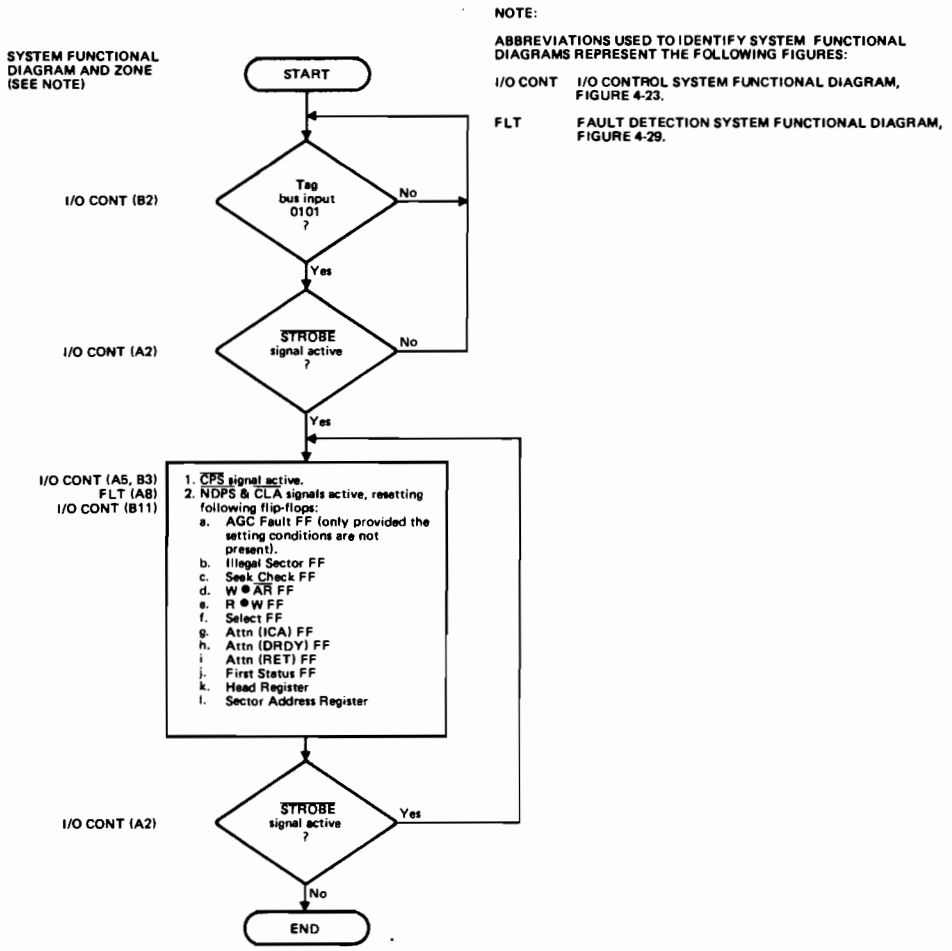
NOTE:

ABBREVIATIONS USED TO IDENTIFY SYSTEM FUNCTIONAL DIAGRAMS REPRESENT THE FOLLOWING FIGURES:

I/O CONT I/O CONTROL SYSTEM FUNCTIONAL DIAGRAM, FIGURE 4-23.

7300-528

Figure 1-19. DCN Tag Bus Command Events Flowchart



7300-53 C

Figure 1-20. CLR Tag Bus Command Events Flowchart

MAINTENANCE

SECTION II

2-1. INTRODUCTION

This section contains listings of the standard and special tools and test equipment required to service the disc drive, the preventive maintenance schedule, and all required preventive maintenance inspection and cleaning procedures.

WARNING

- **To avoid personnel injury and/or damage to equipment, observe all warnings and cautions stated in this manual, and as detailed below.**
- **Use extreme caution when working on the disc drive with the covers removed, because hazardous voltages are present inside the mainframe whenever the ac power cord is connected to an active ac power source.**
- **Ensure that the cabinet is equipped with an extender base or that the extendable legs are fully extended and locked in place before attempting to extend the disc drive. Do not extend more than one disc drive on its rack slides at any one time.**
- **Do not attempt to remove or change printed-circuit assemblies (PCA's), interconnecting cables, or extender PCA's without first removing power from the disc drive.**

CAUTION

- Do not remove the disc drive top cover in severe environments. An environment free from unusual amounts of dust, smoke, moisture, oil vapor, or other foreign matter is essential to protect against internal disc drive contamination when the top cover is removed.
- Do not run the disc drive for extended periods of time without the prefilter installed, because this will place an abnormal load on the absolute filter.
- Do not run the disc drive without an absolute filter, because severe contamination in the head/disc area will result which could cause head and/or disc surface damage.
- Use only the brands of cleaning material specified in table 2-1.
- Use only the type of alcohol specified in table 2-1. Many other types contain impurities that could cause damage.
- Avoid applying excessive pressure to the gimbal area of the heads while cleaning, because excessive pressure may alter or damage the flying characteristics of the heads which were precision-set by the manufacturer.
- Never place an inspection mirror between the heads or allow it to touch the heads, because this may alter or damage their flying characteristics.
- Do not use oil or other such lubricants anywhere in the disc drive.
- Remove watches, rings, or other such jewelry before working on the disc drive.
- Do not attempt to manually extend the carriage assembly, because the heads will mechanically load resulting in disc and/or head damage.

2-2. SERVICE TOOLS AND TEST EQUIPMENT

The following paragraphs list those standard and special tools and test equipment required to service the disc drive.

2-3. STANDARD TOOLS

Table 2-1 lists the standard tools required to service the disc drive. Equivalent tools may be used, when necessary.

2-4. STANDARD TEST EQUIPMENT

A digital voltmeter (HP 970A Digital Voltmeter, or equivalent battery-powered device suitable for measuring

primary ac line voltage) and an oscilloscope (HP 180A Oscilloscope or equivalent) are the only pieces of standard test equipment required to service the disc drive. The digital voltmeter is primarily used to measure power supply voltages, while the oscilloscope is primarily used to analyze waveforms during troubleshooting.

2-5. SPECIAL TOOLS

Table 2-2 lists the special tools required to service the disc drive. The more uncommon of these are illustrated in figure 2-1. Substitutions must not be made.

2-6. SPECIAL TEST EQUIPMENT

The Disc Service Unit (DSU), part no. 12995-60001 or 13354-60011 (see figure 2-2), is the only special test equipment required to service the disc drive. It is used for on-site preventive maintenance, alignment, adjustment, and troubleshooting of the disc drive.

The following equipment is supplied with each DSU:

- DSU Test Module, part no. 12995-60045 or 13354-60005.
- Head Alignment PCA, part no. 12995-60003 or 13354-60010.
- Head Alignment Preamplifier PCA, part no. 12995-60040.
- 20-pin Jumper Cable, part no. 12995-60009 or 13354-60013.
- 50-pin Jumper Cable, part no. 12995-60011 or 13354-60012.
- DSU Adapter, part no. 12995-60048.

The DSU test module simulates controller signals to the disc drive and processes disc drive responses for display.

Simulated signals are produced either manually or automatically to operate the disc drive under both static and dynamic conditions. All operations, including read and write, are limited to addressing and accessing. The actual writing of data is not performed and during a read operation, the DSU test module does not decode any data. Disc drive faults that occur during any operation are identified by four light-emitting diodes (LED's) located on control PCA-A4.

In the automatic mode (functions 1, 2, and 3), the DSU test module provides the means to automatically perform alternate, incremental, or random seek operations. These capabilities are used to exercise the disc drive to relax any mechanical stresses, to permit an adjustment of the seek time, and to verify the formatted servo surface.

Table 2-1. List of Standard Service Tools

TOOL	MANUFACTURER PART NO.
Alcohol, Isopropyl, filtered*	HP 8500-0559
Bit, 1/4-inch drive, hex key	HP 8710-0664
Bit, 1/4-inch drive, Pozidriv. #2	HP 8710-0903
Bit, 1/4-inch drive, slotted drive	HP 8710-0669
Bit, Extended Hex (for use with 1535-2653)	HP 8710-1223
Face Mask	HP 9301-0170
Finger Cot	HP 9300-0399
Inspection Mirror	HP 8830-0005
Kimwipe Tissues*	HP 9300-0001
Pin Extractor	HP 8710-0688
Pliers, Diagonal Cutting	Xcelite 74CG
Pliers, Long Nose	Xcelite 71CG
Q-tips	HP 8520-0023
Screwdriver, 4 x 1/4-inch	Xcelite R144
Screwdriver, 4 x 1/8-inch	Xcelite R184
Screwdriver, Pozidriv	Stanley 2951
Screwdriver, Pozidriv	Stanley 2952
Socket Set, 1/4-inch drive	Craftsman 44144
Soldering Iron	Ungar 6010
Steel Rule, 6-inch	General 616
Tape, Masking	HP 0460-0030
Texsleeves (including cleaning wand)	HP 9310-4406
Texwipes	HP 9310-4242
Wire Strippers	K-Miller 101-S
Wrench, Box, 7/16-inch	HP 8720-0017
Wrench, Torque, 0 to 12 inch-pounds	HP 1535-2653
Wrench, Torque, Variable, 80 inch-pounds	HP 8710-1007

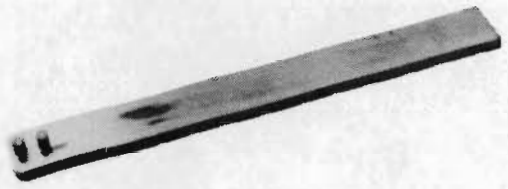
*Do not substitute.

CAUTION

Filtered isopropyl alcohol is a restricted article (flammable liquid). Transport in accordance with Department of Transportation regulations for hazardous materials.

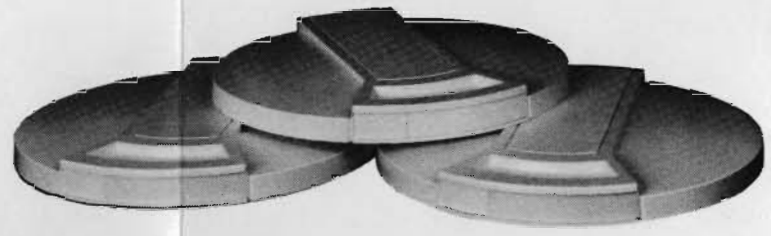
Table 2-2. List of Special Service Tools

TOOL	HP PART NO.
Actuator Assembly Radial Alignment Tool	12995-20022
Air Pressure Measuring Gauge	0101-0374
Air Pressure Probe Assembly	12995-60013
CE Head Alignment Cartridge	12995-60030
CE Servo Reference Cartridge	12995-60031
Dial Indicator	8750-0308
Dial Indicator Holder	12995-20017
Extender PCA	12995-60029
Extension Cable, Servo Head	12995-60038
Formatted Disc Cartridge	12940A
Hand Degausser	0950-1551
Head Initial Position Tool	12995-60012
Head Installation Tool	12995-60008
Head/Index Transducer Alignment Tool	12995-60007
Index Transducer Alignment Hub	12995-60005
Run/Stop Adapter Tool	07906-60082
Servo Formatting PCA	12995-60014
Torque Wrench, Initial Head, 3 inch-pounds	8710-0665
Temperature Compensation Test Fixture	07906-60012



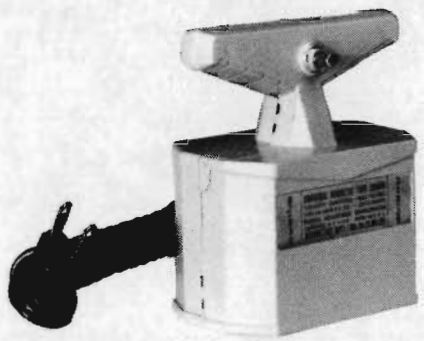
ACTUATOR ASSEMBLY RADIAL ALIGNMENT TOOL

AIR PRESSURE MEASURING GAUGE WITH PROBE ASSEMBLY

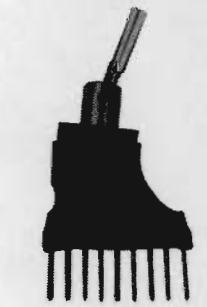


CE HEAD ALIGNMENT CARTRIDGE
CE SERVO REFERENCE CARTRIDGE
FORMATTED SCRATCH CARTRIDGE

DIAL INDICATOR WITH HOLDER

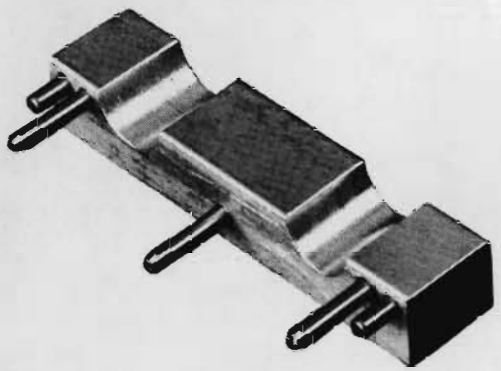


HAND DEGAUSSER

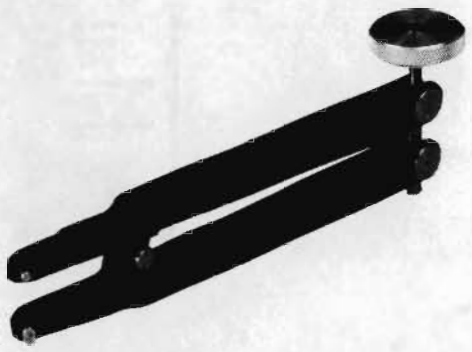


RUN/STOP ADAPTER TOOL

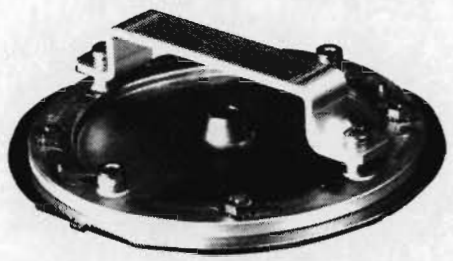
HEAD INITIAL POSITION TOOL



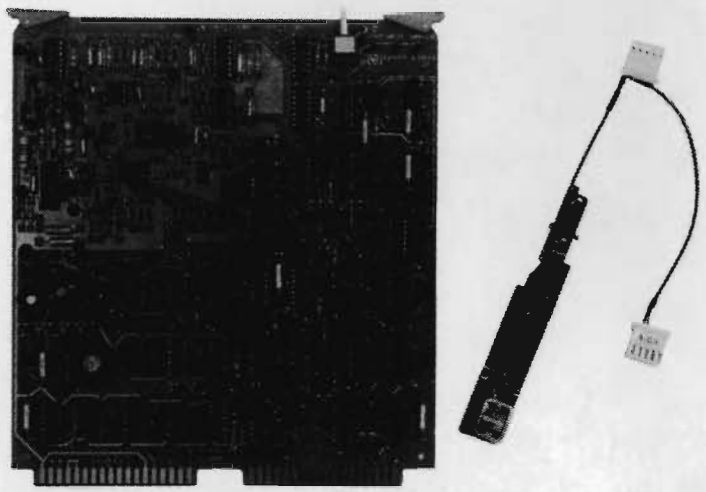
HEAD INSTALLATION TOOL



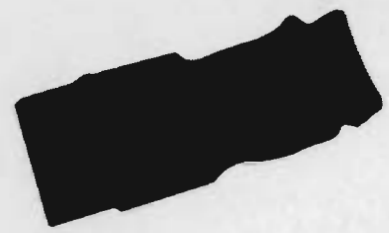
HEAD/INDEX TRANSDUCER ALIGNMENT TOOL



INDEX TRANSDUCER ALIGNMENT HUB



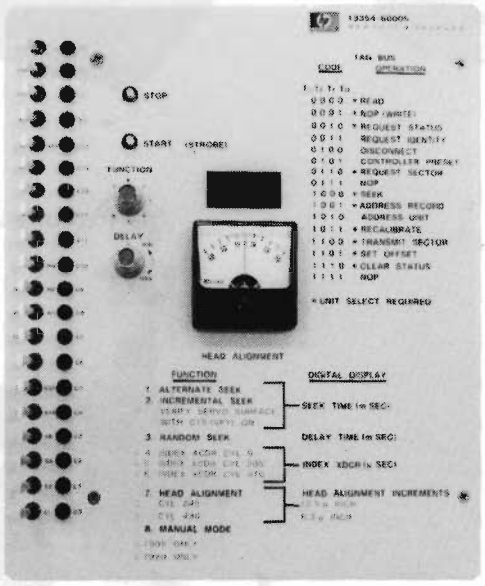
SERVO FORMATTING PCA WITH SERVO HEAD



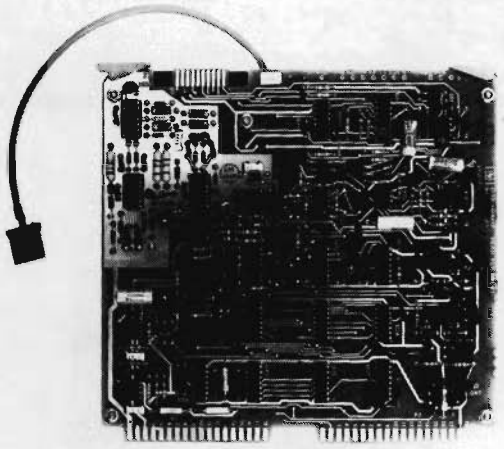
TEMPERATURE COMPENSATION TEST FIXTURE

TORQUE WRENCH

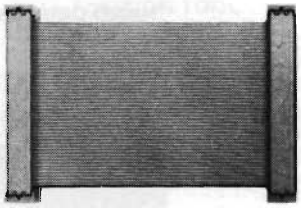
Figure 2-1. Special Service Tools



DSU TEST MODULE

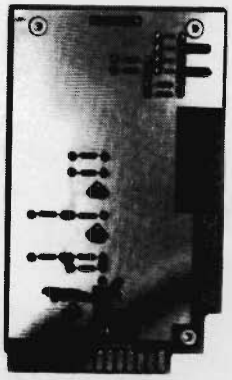


HEAD ALIGNMENT PCA



50 - PIN JUMPER CABLE

DSU ADAPTER



HEAD ALIGNMENT
PREAMPLIFIER PCA

20 - PIN JUMPER CABLE

7300-11A (1) THRU (3)

Figure 2-2. Disc Service Unit

In the alignment mode (functions 4, 5, 6, and 7), the DSU test module provides the means to automatically seek to a specific cylinder while displaying a time difference or dimensional offset. These capabilities are used to align the actuator assembly, index transducer, and data heads 0 and 1.

In the manual mode (function 8), the DSU test module provides the means to manually program cylinder addresses, head and sector addresses, unit addresses, and offset information onto the control bus lines and disc drive functions onto the tag bus lines. These capabilities are typically used for off-line checkout of the disc drive.

Response signals are available at test points on the various PCA's in the disc drive. A three-digit numerical display is provided on the DSU test module for measuring seek time, delay between seeks, radial head alignment, and circumferential head alignment. In addition, a meter is provided for measuring radial head alignment. In the manual mode, the state of each of the control bus lines and tag bus lines is displayed on LED's.

Instructions for using the DSU for alignment and adjustment purposes are provided in sections III and V of this manual and an off-line checkout procedure in which the DSU is used is provided in section IV.

2-7. PREVENTIVE MAINTENANCE SCHEDULE

The disc drive is designed for a minimum of preventive maintenance. A schedule for periodic inspection and cleaning of the disc drive is provided in table 2-3. When the disc drive is placed in a clean environment, it is recommended that the procedures listed in the schedule be performed at six-month intervals. When the disc drive is

Table 2-3. Preventive Maintenance Schedule

ITEM	ROUTINE
Prefilter	Check for contamination. Refer to paragraph 2-12. Replace as required. Refer to paragraph 5-12.
Absolute Filter	Measure absolute filter air pressure. Refer to paragraph 2-13. Replace as required. Refer to paragraph 5-13.
Data and Servo Heads	Inspect for contamination. See figure 2-3. Clean as required. Refer to paragraph 2-14.
Head Cables and Connectors	Inspect for looseness and/or damage. Replace as necessary.
Disc Brushes	Disc brushes are no longer required for disc drive operation. The brushes should be removed as outlined in paragraph 5-24.
Carriage Rails and Bearings	Check bearings for excessive wear and ease of rotation. Refer to paragraph 2-15. Replace as required.
Spindle Assembly	Clean as necessary. Refer to paragraph 2-16.
Spindle Ground Contact and Spring	Inspect spindle ground contact and spring for excessive wear and/or looseness. Replace as necessary.
Main Casting and Receiver Assembly	Clean as necessary. Refer to paragraph 2-17.
Power Supply	Check all power supply voltages. Refer to paragraph 3-3.
Temperature Compensation	Check operation of temperature compensation circuit. Refer to paragraph 3-4.
Mainframe Switches and Solenoids	Inspect for proper operation. Refer to paragraphs 3-5 through 3-11.
Adjustable Parameters	Check alignment of all adjustable parameters. If necessary, adjust. Refer to paragraphs 3-12 through 3-18.
Operator Control Panels and Switches	Inspect for proper operation.
Preventive Maintenance Label	Record date of preventive maintenance on label attached to top cover.

placed in a severe environment, a greater frequency of preventive maintenance may be required. An environment which has an unusual amount of dust, smoke, moisture, oil vapor, or other foreign matter is considered severe. The general operation of the disc drive should be verified before regular scheduled preventive maintenance is performed and again after it has been completed. If the disc drive is installed in an HP system, run the appropriate diagnostic tests in accordance with the instructions provided in the appropriate diagnostic manual. If the disc drive is installed in some other system, an off-line checkout may be performed in accordance with the instructions provided in section IV of this manual.

2-8. PREVENTIVE MAINTENANCE PROCEDURES

The following paragraphs provide a suggested inspection sequence and general instructions for cleaning the disc drive. Included are the necessary instructions for cleaning the data and servo heads, the carriage rails and bearings, the top surface of the spindle assembly, and the main casting and receiver assembly. Instructions for checking the components of the air circulation system are also provided.

2-9. GENERAL INSPECTION

Inspection routines should be performed according to the schedule listed in table 2-3. Whenever inspection reveals contamination, cleaning is prescribed. Refer to the recommended procedure in this section which is associated with the contaminated part. Whenever inspection reveals excessive wear and/or damage, replacement is prescribed. Refer to section V of this manual. A suggested inspection sequence follows:

a. Inspect the prefilter for contamination as outlined in paragraph 2-12.

b. Measure the air pressure at the output of the absolute filter as outlined in paragraph 2-13.

c. Inspect data and servo heads for contamination, excessive wear, and/or damage. See figure 2-3.

d. Inspect head cables and connectors for looseness and/or damage.

e. Check to see that the disc brushes have been removed as outlined in paragraph 5-24.

f. Inspect carriage rails and bearings for contamination, excessive wear, and/or damage.

g. Inspect the top surface of the spindle assembly for contamination, excessive wear, damage, and/or looseness.

h. Inspect the spindle ground contact and spring for excessive wear and/or looseness.

i. Inspect the main casting and receiver assembly for contamination, excessive wear, and/or damage.

j. Check the power supply voltages for accuracy as outlined in paragraph 3-3.

k. Check operation of the temperature compensation circuit as outlined in paragraph 3-4.

l. Check the mainframe switches and solenoids for proper operation as outlined in paragraphs 3-5 through 3-11.

m. Check the alignment of all adjustable parameters which require the DSU as outlined in paragraphs 3-12 through 3-18.

n. Inspect the operator control panel lamps and switches for proper operation.

o. Inspect all hardware for looseness and/or missing parts.

p. Following completion of the preventive maintenance procedures detailed above, record the date on the preventive maintenance label located on the disc drive top cover.

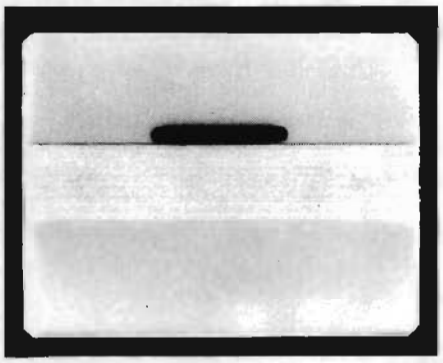
2-10. GENERAL CLEANING INFORMATION

To ensure trouble-free operation, the disc drive should be kept free from unusual amounts of dust, smoke, moisture, oil vapor, and other foreign matter. When inspection reveals disc drive contamination, a general cleaning is required. Use the recommended procedures in this section which are associated with the contaminated parts.

In general, cleaning materials include Kimwipe tissues, part no. 9300-0001; Texsleeves, part no. 9310-4406; Texwipes, part no. 9310-4242; and 91-percent isopropyl alcohol, part no. 8500-0559.

2-11. CHECKING AIR CIRCULATION SYSTEM. Periodic checks should be made on the overall effectiveness of the air circulation and filtration system. The following paragraphs provide procedures for checking the prefilter for contamination, and for measuring the air pressure at the output of the absolute filter.

Note: The prefilter element is contained in a prefilter duct assembly that replaces the bottom cover of the disc drive when the drive is installed in an HP 29400B-Series/29425 Cabinet. In operation, the blower in the disc drive draws air at room ambient temperature into the prefilter duct, through the prefilter ele-



TYPE OF CONTAMINATION:

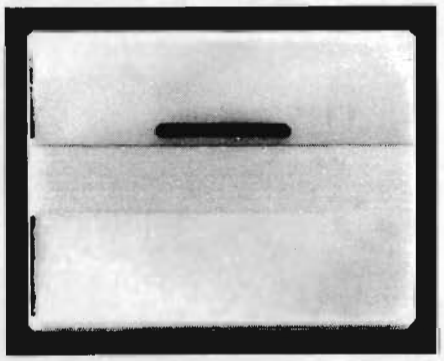
NONE. IDEAL HEAD CONDITION.

CAUSE:

NEW HEAD OR MINIMAL OPERATION IN A CLEAN ENVIRONMENT.

REMEDY:

NONE.



TYPE OF CONTAMINATION:

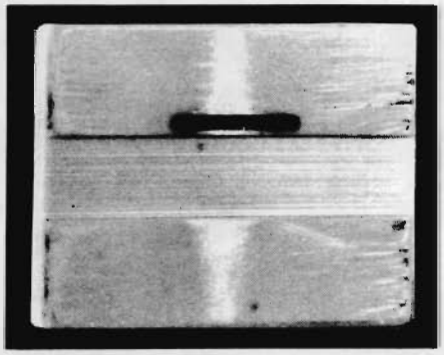
OXIDE BUILDUP ON TRAILING EDGE (DOWN HEAD SHOWN). TYPICAL OPERATING CONDITION.

CAUSE:

NEW MEDIA OR MANY HOURS OF OPERATION.

REMEDY:

CLEAN AS OUTLINED IN PARAGRAPH 2-14.



TYPE OF CONTAMINATION:

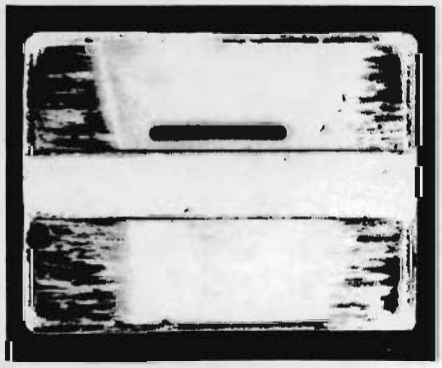
ABRASION AND PARTICULATE.

CAUSE:

MEDIA IS ABRASIVE OR EXCESSIVE MECHANICAL RUNOUT EXISTS.

REMEDY:

REPLACE DEFECTIVE HEAD AS OUTLINED IN PARAGRAPH 5-38. A DELAY IS PERMISSIBLE IF WIDTH OF ABRASION IS LESS THAN 0.13-cm (0.05-in.). IF DATA HEAD 0 OR DATA HEAD 1, REPLACE MEDIA. IF SERVO HEAD OR DATA HEAD 2, CHECK FIXED DISC RUNOUT AND FLATNESS AS OUTLINED IN PARAGRAPHS 5-33 AND 7-31. IF OUTSIDE TOLERANCE, REPLACE FIXED DISC.



TYPE OF CONTAMINATION:

ABRASION AND PARTICULATE.

CAUSE :

EXCESSIVE OPERATION ON ABRASIVE MEDIA. AIR FLOW RESTRICTED AND/ OR CONTAMINANTS PRESENT IN AIR CIRCULATION SYSTEM.

REMEDY:

REPLACE DEFECTIVE HEAD AS OUTLINED IN PARAGRAPH 5-38. REPLACE MEDIA. CHECK ABSOLUTE FILTER SEAL AND MEASURE ABSOLUTE FILTER OUTPUT AIR PRESSURE AS OUTLINED IN PARAGRAPH 2-13. CHECK PREFILTER FOR CONTAMINATION AS OUTLINED IN PARAGRAPH 2-12.

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Figure 2-3. Examples of Head Contamination

ment, and into the disc drive. A detailed description of the prefilter assembly is contained in the *HP 40019 Prefilter Assembly Installation and Service Manual*, part no. 40019-90901.

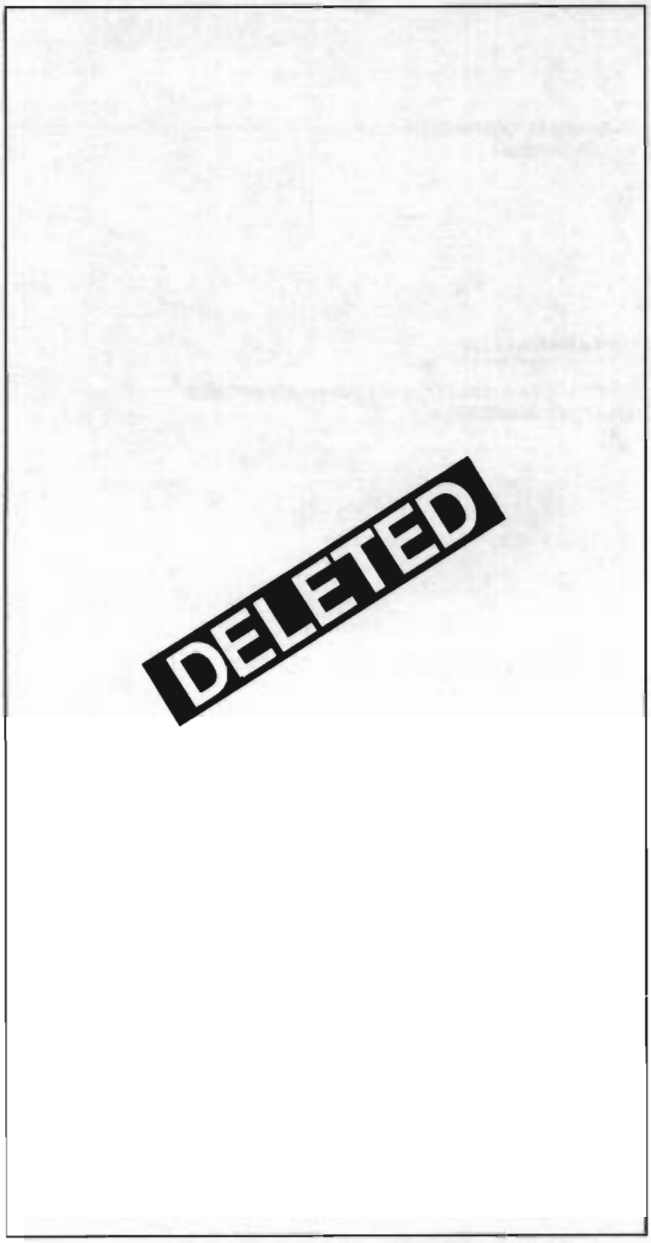

Figure 2-4. Disc Brush Wear Conditions

2-12. Checking Prefilter. The prefilter must be checked for contamination. To inspect the prefilter for contamination, proceed as follows:

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the prefilter grill assembly, if applicable.

c. Pull the filter element out of the prefilter duct and check filter for contamination. If necessary, replace the filter element. Refer to paragraph 5-12 for installation instructions.

2-13. Measuring Absolute Filter Air Pressure. The absolute filter should be changed whenever the air flow through it becomes restricted. A hole, located on the left side of the top cover and on the main casting as viewed from the front, is provided so that the air pressure at the output of the absolute filter can be measured. The Air Pressure Measuring Gauge, part no. 0101-0374 and Air Pressure Probe Assembly, part no. 12995-60013 are used to make this measurement.

Measure the absolute filter air pressure as follows:

a. Ensure that the control panel access door is closed and the lower front cover and the prefilter duct assembly are properly installed.

b. Reconnect the ac power cord and restore power to the disc drive as described in paragraph 5-3.

c. Carefully insert a disc cartridge, access-door end first, into the disc drive. Use only an HP 12940A Formatted Disc Cartridge.

d. Set the RUN/STOP switch to RUN.

e. Place the air pressure probe assembly through the top cover hole and over the hole provided in the main casting. See figure 2-5. Check that the meter reading is close to the value given for normal operation in table 2-4. If the reading is closer to the minimum acceptable value (0.35), note that the absolute filter may require replacement before the next six-month preventive maintenance inspection is due to be per-

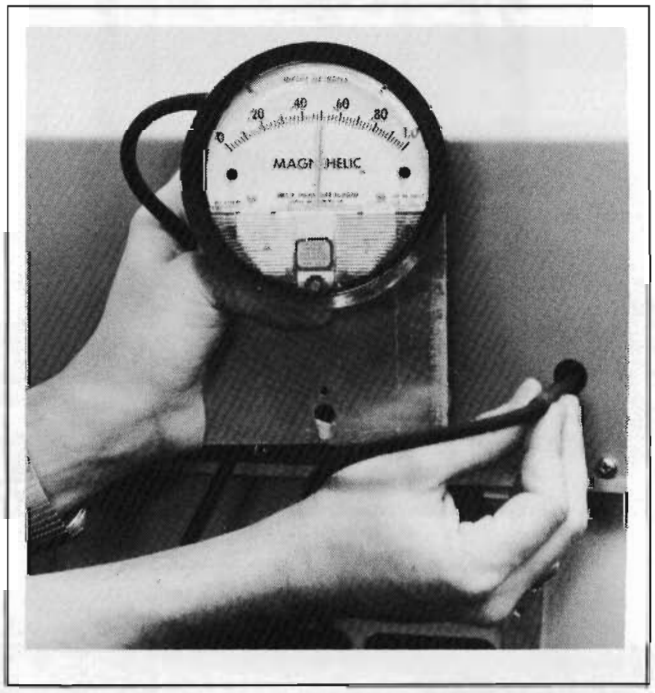

Figure 2-5. Measuring Absolute Filter Air Pressure

Table 2-4. Absolute Filter Minimum Air Pressure Specifications

LINE FREQUENCY (Hertz)	NORMAL OPERATION (inches of water)	MINIMUM ACCEPTABLE (inches of water)
50	0.50	0.35
60	0.70	0.35

formed. If the reading is below the minimum acceptable value, replace the absolute filter as outlined in paragraph 5-13. Remeasure the air pressure following installation of the new filter.

2-14. CLEANING DATA AND SERVO HEADS. The data and servo heads must be kept free from contamination. Whenever inspection reveals data or servo head contamination (see figure 2-3), cleaning is required. An Inspection Mirror, part no. 8830-0005; Texsleeves, including cleaning wand, part no. 9310-4406; and filtered 91-percent isopropyl alcohol, part no. 8500-0559, are required for head cleaning.

To clean data or servo heads, proceed as follows:

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the top cover as outlined in paragraph 5-6.

CAUTION

Use only Texsleeves as specified in table 2-1. Many other brands contain contaminating oils and/or lint which may leave a residue that could cause damage.

c. Place a Texsleeve on the end of the cleaning wand. (See figure 2-6.)

CAUTION

Use only the type of alcohol specified in table 2-1. Many other types contain impurities that could cause damage.

d. Dampen (do not saturate) the Texsleeve with filtered 91-percent isopropyl alcohol.

CAUTION

Avoid applying excessive pressure to the gimbal area of the heads while cleaning, since excessive pressure may alter or damage the flying characteristics of the heads which were precision-set by the manufacturer.

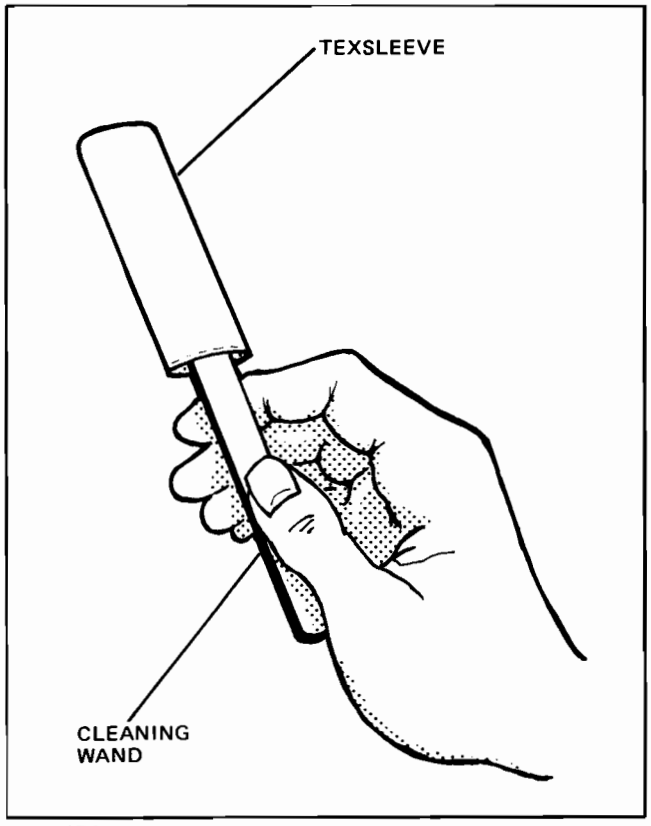

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Figure 2-6. Prepared Head Cleaning Tool

e. Clean each head by placing the prepared head cleaning tool between the head surfaces, then gently scrub the head face. The heads are most easily accessed from the left side of the disc drive as viewed from the front. Use only sufficient pressure to thoroughly wet the head and remove the contamination.

f. Replace the Texsleeve with a clean, dry Texsleeve.

g. Carefully remove all remaining contamination from the head surfaces. If the contamination cannot be removed, replace the head as outlined in paragraph 5-38.

CAUTION

Never place an inspection mirror between the heads or allow it to touch the heads, since this may alter or damage their flying characteristics.

h. Use an inspection mirror to confirm that all signs of contamination are removed. Place the inspection mirror near the side of the head to be examined.

i. Replace the top cover as outlined in paragraph 5-6.

j. Reconnect the ac power cord and restore power to the disc drive as described in paragraph 5-3 to return the disc drive to operational status.

2-15. CLEANING CARRIAGE RAILS AND BEARINGS. Carriage rail surfaces must be kept clean at all times. Any foreign matter on the surfaces will adversely affect carriage alignment. Whenever inspection reveals that the carriage rails and/or bearings are contaminated, cleaning is prescribed. Q-tips, part no. 8520-0023, and filtered 91-percent Isopropyl Alcohol, part no. 8500-0559 are required for cleaning these items.

To clean the carriage rails and/or bearings, proceed as follows:

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the top cover as outlined in paragraph 5-6.

CAUTION

Care must be taken to prevent alcohol from getting into the bearing lubrication pack, since excessive alcohol may cause damage. Never oil the carriage rails or bearings.

c. Clean the carriage rails and bearings with Q-tips slightly dampened with filtered 91-percent isopropyl alcohol. The carriage rails and bearings are most easily accessed from the left side of the disc drive as viewed from the front.

d. Replace the top cover as outlined in paragraph 5-6.

e. Reconnect the ac power cord and restore power to the disc drive as described in paragraph 5-3 to return the disc drive to operational status.

2-16. CLEANING SPINDLE ASSEMBLY. The top surface of the spindle assembly must be kept free from contamination. Whenever inspection reveals contamination, cleaning is prescribed. A roll of Masking Tape, part no. 0460-0030; Kimwipe Tissues, part no. 9300-0001; and filtered 91-percent Isopropyl Alcohol, part no. 8500-0559 are the required cleaning materials.

To clean the top surface of the spindle assembly, proceed as follows:

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the top cover as outlined in paragraph 5-6.

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

d. Press the tape against all exposed magnetic surfaces of the spindle assembly to remove all foreign particles.

CAUTION

Care must be taken to ensure that no masking tape is left on the top surface of the spindle assembly, since contamination could result.

e. Dampen (do not saturate) a Kimwipe tissue with filtered 91-percent isopropyl alcohol.

f. Gently wipe the top surface of the spindle assembly, including the spindle cone.

g. Replace the top cover as outlined in paragraph 5-6.

h. Reconnect the ac power cord and restore power to the disc drive as described in paragraph 5-3 to return the disc drive to operational status.

2-17. CLEANING MAIN CASTING AND RECEIVER ASSEMBLY. The main casting and receiver assembly must be kept free from contamination. Whenever inspection reveals contamination of the main casting and/or receiver assembly, cleaning is prescribed. A roll of Masking Tape, part no. 0460-0030; Kimwipe Tissues, part no. 9300-0001; and filtered 91-percent Isopropyl Alcohol, part no. 8500-0559 are required for cleaning these items.

To clean the main casting and/or receiver assembly, proceed as follows:

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the top cover as outlined in paragraph 5-6.

c. Remove the receiver assembly as outlined in paragraph 5-22.

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

e. Press the tape against all exposed surfaces of the main casting to remove all foreign particles.

f. Clean the exposed surfaces of the main casting with a Kimwipe tissue dampened with filtered 91-percent isopropyl alcohol.

g. Clean the surfaces of the receiver assembly with a Kimwipe tissue dampened with filtered 91-percent isopropyl alcohol.

h. Replace the receiver assembly and top cover as outlined in paragraphs 5-22 and 5-6, respectively.

i. Reconnect the ac power cord and restore power to the disc drive as described in paragraph 5-3.

j. Measure the absolute filter air pressure as detailed in paragraph 2-13. If pressure is below the minimum specifications listed in table 2-4, remove power from the disc drive as described in paragraph 5-3, and check that the receiver assembly is properly seated in the disc drive.

k. Reconnect the ac power cord and restore power to the disc drive as described in paragraph 5-3 to return the disc drive to operational status.

ALIGNMENT AND ADJUSTMENT

SECTION III

3-1. INTRODUCTION

This section contains step-by-step alignment and adjustment procedures for the disc drive. The section is divided into two subsections, since the service adjustments for the disc drive fall into two different categories, i.e., those that do not require the use of the disc service unit (DSU) and those that do require the DSU. The procedures provided in this section must be performed in the order presented. In each procedure, the parameter is first verified, then the adjustment is made, if necessary. It should be stressed that an adjustment should only be made a) after it has been determined that the parameter is truly out of tolerance, or b) after an assembly has been replaced. Never make an adjustment when the parameter is within the specified range. An adjustment sequence flowchart is provided in figure 3-6.

Note: The access information provided in this section is applicable to a disc drive mounted in an HP 29400B-Series Cabinet. Special procedures are required to access a disc drive mounted in an HP 29425 Cabinet. Refer to the *HP 29425 Cabinet Installation and Service Manual,* part no. 29425-90001, for this information.

3-2. SERVICE ADJUSTMENTS NOT REQUIRING USE OF DSU

The power supply adjustment, temperature compensation check, and adjustment of each mainframe switch and solenoid do not require the use of the DSU. An adjustment procedure for each is provided in the following paragraphs.

WARNING

This section does not contain operator-serviceable parts. To prevent electrical shock, refer all alignment and adjustment procedures to service-trained personnel.

3-3. POWER SUPPLY ADJUSTMENT

Power supply voltages are measured at test points provided on track follower PCA-A5 and on power and motor control PCA-A8. Only the +5 volt supply is adjustable.

To verify power supply voltages, proceed as follows:

CAUTION

Ensure that the DSU is disconnected from the disc drive before checking and/or adjusting the power supply voltages.

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the prefilter duct as outlined in paragraph 5-10.

c. Rotate the two quarter-turn fasteners used to secure power and motor control PCA-A8 to the bottom cover right bracket 1/4-turn counterclockwise.

d. Lower PCA-A8 into its service position.

e. Reconnect the ac power cord and restore power to the disc drive as described in paragraph 5-3.

f. Connect the digital voltmeter to each test point shown in figure 3-1 and measure the specified voltage. Next, connect the digital voltmeter to the +5 volt test point on track follower PCA-A5. Check that the voltage measured is between 4.95 and 5.05 Vdc. If not, adjust potentiometer A8R54 on power and motor control PCA-A8 until the voltage is within the specified range. If any other voltage is out of tolerance, troubleshooting is indicated. Refer to section IV of this manual.

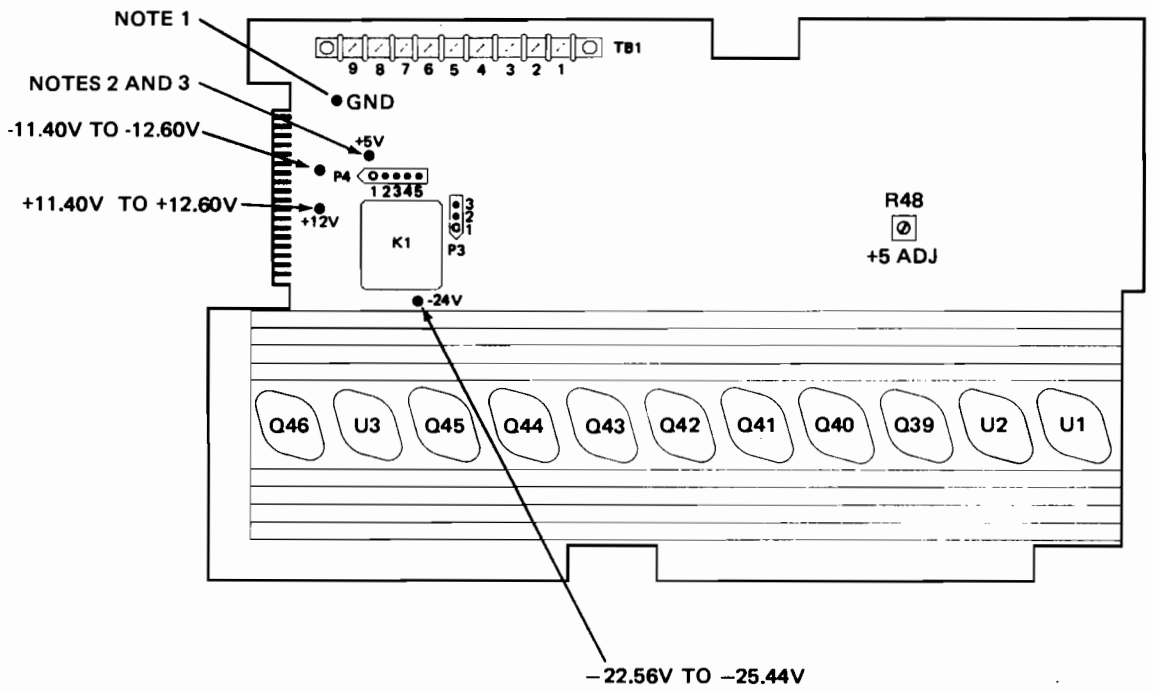
3-4. TEMPERATURE COMPENSATION CHECK

There is no adjustment for the temperature compensation circuit. Potentiometer A5R205, located on track follower PCA-A5, is factory preset and no field adjustment of the control should be attempted.

To verify operation of the temperature compensation circuit, proceed as follows.

CAUTION

Ensure that the disc service unit (DSU) is disconnected from the disc drive before verifying operation of the temperature compensation circuit.



NOTES:

1. CONNECT THE DIGITAL VOLTMETER GROUND LEAD TO THE GND TEST POINT SHOWN ABOVE.
2. MEASURE THE +5V VOLTAGE AT THE +5 VOLT TEST POINT ON PCA-A5. REFER TO PARAGRAPH 3-3F FOR DETAILS.
3. ENSURE THAT THE DSU IS DISCONNECTED FROM THE DISC DRIVE WHEN MEASURING THE +5V VOLTAGE.

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Figure 3-1. DC Voltage Specifications

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the top cover as outlined in paragraph 5-6.

c. Disconnect the temperature sensor cable connector from track follower PCA-A5.

d. Measure the resistance between the following pins of the temperature sensor cable connector. Ensure that a) each reading is within the tolerance given, and b) the resistance measured between pins 2 and 5 and between 3 and 5 is approximately the same value.

MEASURE BETWEEN PINS	RESISTANCE
1 and 5	short
*2 and 5	10 kΩ to 0.5 MΩ
*3 and 5	10 kΩ to 0.5 MΩ

*Readings must be within ±20% of each other.

If any resistance value is out of tolerance, replace the temperature sensor assembly. Refer to paragraph 5-28 for replacement instructions.

e. Connect the "A" side of the temperature compensation test fixture, part no. 07906-60012, to jack A5J1 on track follower PCA-A5.

f. Connect a digital voltmeter to the ΔT test point on PCA-A5.

g. Reconnect the ac power cord and restore power to the disc drive as described in paragraph 5-3.

h. Set the RUN/STOP switch to RUN.

i. Check that the voltage measured at the ΔT test point is between −3.95 and −4.35 Vdc.

Note: The above measurement must be made before the DRIVE READY indicator lights.

j. If the voltage measured in step i is out of tolerance, check the adjustment of the +5 Vdc supply as described in paragraph 3-3 and repeat step i. If the ΔT voltage is still out of tolerance, replace track follower PCA-A5. Refer to paragraph 5-16 for replacement instructions.

k. When the heads load, measure the voltage at the −P test point on PCA-A5. Check that the voltage is between −1.95 and −2.20 Vdc.

Note: This measurement must be made before the DRIVE READY indicator lights.

l. Two minutes after the DRIVE READY indicator lights, measure the voltage at the −P test point on PCA-A5. Check that the voltage is between −1.55 and −1.75 Vdc.

m. If the voltage measured at step k and/or step l is out of tolerance, replace track follower PCA-A5. Refer to paragraph 5-16 for replacement instuctions.

n. Set the RUN/STOP switch to STOP. Connect the "B" side of the temperature compensation test fixture to jack A5J1 on track follower PCA-A5.

o. Connect the digital voltmeter to the +P test point on PCA-A5.

p. Set the RUN/STOP switch to RUN. As soon as the heads load, check that the voltage is between +1.95 and +2.20 Vdc.

q. Approximately 30 seconds after the heads load, disconnect the temperature compensation test fixture from PCA-A5. The DRIVE READY indicator should light immediately.

r. If the voltage measured in step p is out of tolerance and/or the DRIVE READY indicator does not light, replace track follower PCA-A5. Refer to paragraph 5-16 for replacement instructions.

s. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

t. Reconnect the temperature sensor cable connector to PCA-A5.

3-5. MAINFRAME SWITCHES AND SOLENOIDS

There are four switches and two solenoids located on the mainframe that may require some slight adjustments from time to time. The mounting tolerances are designed to permit such adjustments. An adjustment procedure for each is provided in the following paragraphs.

3-6. BRUSHES-BACK SWITCH. The brushes-back switch is operative only on those drives with control PCA-A4, part no. 07905-60002, installed. The brushes-back switch is used to detect the relative position of the brushes before the heads are loaded. This switch should be adjusted so that it "clicks" when the roller passes across the notch in the cam from either direction. If the switch requires adjustment, loosen the retaining screws, reposition the switch, then retighten the retaining screws.

3-7. CARRIAGE-LATCH SOLENOID. The carriage-latch solenoid is used to restrain carriage assembly movement whenever the servo system is disabled. This solenoid should be adjusted so that the plunger is fully seated in the hole provided in the carriage assembly pivot bearing and clears the hole when the solenoid is energized. With power restored, ground the top terminal (brown lead) of the solenoid to energize it. Check to ensure that the plunger clears the hole provided in the carriage assembly pivot bearing. If it does not, remove the solenoid as outlined in paragraph 5-39. Loosen the two screws that secure the solenoid body to the bracket, reposition it, then reinstall the solenoid. If the plunger requires centering, loosen the retaining screws that secure the carriage-latch solenoid to the actuator assembly, resposition the solenoid, then retighten the retaining screws.

3-8. CARTRIDGE-IN-PLACE SWITCH. The cartridge-in-place switch is used to detect whether the removable disc cartridge is properly seated. This switch should be adjusted so that it "clicks" closed whenever a cartridge is installed and the cartridge access door is latched and "clicks" open as the cartridge is removed. If the switch requires adjustment, loosen the retaining screws, reposition the switch, then retighten the retaining screws.

3-9. DOOR LOCK SOLENOID. The door lock solenoid is used to electro-mechanically latch or unlatch the cartridge access door. This solenoid should be adjusted so that the door lock pawl properly latches the cartridge access door whenever the door lock solenoid is de-energized and unlatches the cartridge access door whenever the door lock solenoid is energized. If the solenoid requires adjustment, loosen the retaining screws, reposition the solenoid, then retighten the retaining screws. With power restored, ground the top terminal (orange lead) of the solenoid to energize it.

3-10. DOOR CLOSED SWITCH. The door closed switch is used to detect whether the door lock pawl has

mechanically latched the cartridge access door. This switch should only be adjusted after the door lock solenoid has been properly adjusted. It should be adjusted so that it "clicks" open just before the pawl is depressed enough to clear the latch opening the door. If the switch requires adjustment, loosen the retaining screws, reposition the switch, then retighten the retaining screws.

3-11. DOOR LOCKED SWITCH. The door locked switch is used to detect when the door lock solenoid latches or unlatches the cartridge access door. This switch should only be adjusted after the door lock solenoid has been properly adjusted. It should be adjusted so that it "clicks" closed just before the cartridge access door latches. The switch actuating lever should not touch the body of the switch when the door is held securely against the gussets. If the switch requires adjustment, loosen the retaining screws, reposition the switch, then retighten the retaining screws.

3-12. SERVICE ADJUSTMENTS REQUIRING USE OF DSU

The DSU is required to perform the seek time adjustment, actuator assembly radial alignment, index transducer alignment, and head alignment. An installation procedure for the DSU, an exercising procedure for the disc drive, and all required alignment and adjustment procedures which require the DSU are provided in the following paragraphs.

WARNING

This section does not contain operator-serviceable parts. To prevent electrical shock, refer the following adjustments to service-trained personnel.

3-13. DSU INSTALLATION

To install the DSU, proceed as follows:

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the top cover from the disc drive as outlined in paragraph 5-6.

c. Loosen the screw used to secure the PCA retainer to the card cage chassis.

d. Remove the PCA retainer.

e. Insert Head Alignment PCA, part no. 12995-60003 or 13354-60010, into the card guides for A1 as shown in figure 3-2. Ensure that the PCA is correctly oriented, then push it firmly into the connectors until it is fully seated. The component side of the PCA must face toward the right of the card cage chassis as viewed from the front.

f. Hang DSU Test Module, part no. 12995-60045 or 13354-60005, on the top right edge of the card cage chassis as shown in figure 3-2.

g. Disconnect the interconnecting cable connector from J1 on I/O sector PCA-A2.

h. Connect 50-pin Jumper Cable, part no. 12995-60011 or 13354-60012, between the 50-pin connector on the DSU test module and J1 on I/O sector PCA-A2. See figure 3-2.

i. Connect 20-pin Jumper Cable, part no. 12995-60009 or 13354-60013, between the 20-pin connector on the DSU test module and the 20-pin connector on the head alignment PCA. See figure 3-2.

j. Remove read/write preamplifier PCA-A6, as outlined in paragraph 5-17, steps c through g.

CAUTION

The head alignment preamplifier PCA must be installed whenever a CE head alignment cartridge or CE servo reference cartridge is to be used. Use of the head alignment preamplifier PCA will prevent any accidental damage to the prerecorded surfaces and provides more accurate head alignment readings.

k. Insert Head Alignment Preamplifier PCA, part no. 12995-60040, into the A6 connector as shown in figure 3-2. Ensure that the PCA is correctly oriented, then push it firmly into the connector until it is fully seated. The component side of the PCA must face toward the rear of the disc drive. Also, ensure that all four head connectors are correctly installed.

l. Connect the head cable connector from the head alignment PCA to the head connector located on the head alignment preamplifier PCA at the top edge in the center. See figure 3-2.

3-14. EXERCISING DISC DRIVE

Once the DSU has been installed, the disc drive should be exercised to relax any mechanical stresses. This is particularly important after installing a new disc drive or after one of the major mechanical assemblies has been replaced.

To exercise the disc drive, proceed as follows:

a. Reconnect the ac power cord and restore power to the disc drive as described in paragraph 5-3.

b. Carefully insert an HP 12940A Formatted Disc Cartridge, access-door end first, into the disc drive.

c. Set the RUN/STOP switch to RUN.

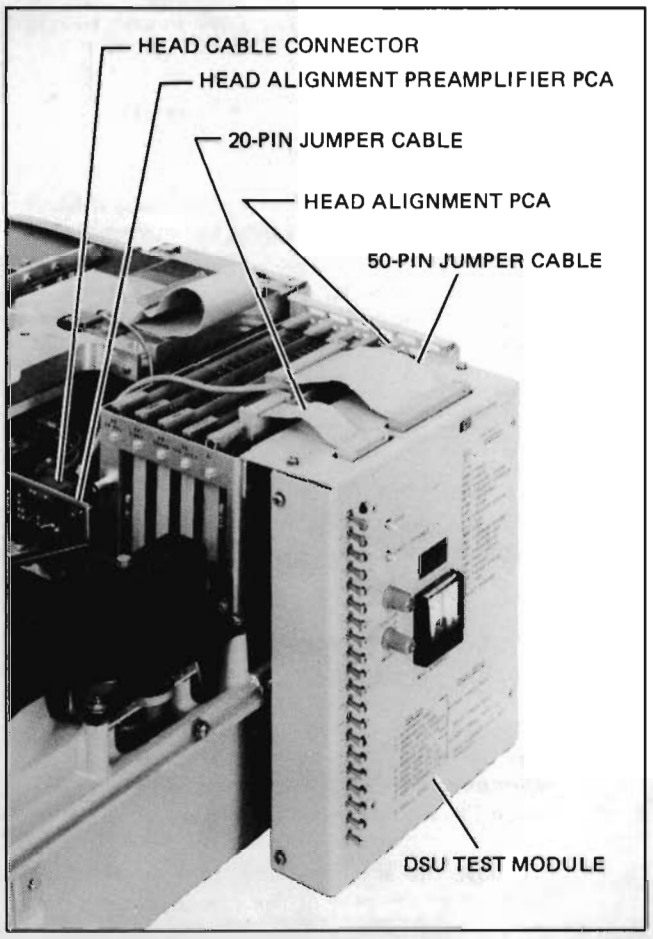

Figure 3-2. DSU Installed

d. Set the FUNCTION switch on the DSU test module to position 3 (RANDOM SEEK).

e. Rotate the DELAY potentiometer on the DSU test module fully clockwise to MAX.

Note: With the DELAY potentiometer set to MAX, a maximum delay between seek operations is introduced.

f. Press the START (STROBE) pushbutton on the DSU test module and allow the disc drive to perform a series of random seek operations.

g. After several seek operations have been performed, rotate the DELAY potentiometer on the DSU test module fully counterclockwise to MIN.

Note: With the DELAY potentiometer set to MIN, a minimum delay between seek operations is introduced.

h. If this is a new disc drive or if one of the major mechanical assemblies has just been replaced, allow the disc drive to run for at least 1 minute; otherwise, allow it to run for at least 5 to 10 seconds.

i. Press the STOP pushbutton on the DSU test module and proceed to paragraph 3-15.

3-15. SEEK TIME ADJUSTMENT

Seek time must be within the specified tolerance before verifying any one of the mechanical adjustments.

To verify the seek time adjustment, proceed as follows:

a. Set the FUNCTION switch on the DSU test module to position 1 (ALTERNATE SEEK).

b. Select cylinder address 0 on the upper bank of DSU test module switches (all 10 switches set to the left).

c. Select cylinder address 410 on the lower bank of DSU test module switches (switches 2, 8, 16, 128, and 256 set to the right).

d. Press the START (STROBE) pushbutton on the DSU test module and allow the disc drive to alternately seek between cylinders 0 and 410.

e. Rotate the DELAY potentiometer on the DSU test module until the seek time from cylinder 0 to 410 (forward seek operation) can be differentiated from the seek time from cylinder 410 to 0 (reverse seek operation).

Note: The two seek times displayed will most probably be different.

f. In each case, observe that the seek time displayed is between 42 and 45 milliseconds. If either seek time is out of tolerance, adjust potentiometer A3R92 on servo PCA-A3 until both readings are within the specified range.

g. Press the STOP pushbutton on the DSU test module and proceed to paragraph 3-16.

3-16. ACTUATOR ASSEMBLY RADIAL ALIGNMENT

The actuator assembly must be aligned so that the carriage rails are positioned on a radius with the center of the spindle assembly. This alignment is accomplished by monitoring the time difference between an index gap passing beneath data head 1 at tracks 0 and 410 and the index pulse generated by the index transducer.

To verify actuator assembly radial alignment, proceed as follows:

a. Set the RUN/STOP switch to STOP and remove any previously installed cartridge.

b. Carefully insert the CE Head Alignment Cartridge, part no. 12995-60030, access-door end first, into the disc drive.

c. Set the RUN/STOP switch to RUN.

d. Select head 1 on the lower bank of DSU test module switches (switch 256/H1 set to the right).

e. Set the FUNCTION switch on the DSU test module to position 4 (INDEX XDCR CYL 0).

f. Press the START (STROBE) pushbutton on the DSU test module and allow the disc drive to seek to cylinder 0.

Note: The indication on the HEAD ALIGNMENT meter will be fully deflected.

g. Observe the digital display and note the corrected value (time difference displayed in microseconds).

Notes:
1. Negative numbers are displayed as positive numbers subtracted from 100.

   For example:

   2.6 would be displayed as 02.6

   −2.6 would be displayed as 97.4

2. The index time plus/minus number for head 1 marked on the CE alignment cartridge represents the number of microseconds that the digital display is offset from zero when the actuator assembly radial alignment is being verified. For example, if the cartridge is marked −0.3, the corrected readings for the two examples given in note 1 (2.6 and −2.6) are +2.9 and −2.3, respectively. In each case, the index number is algebraically subtracted from the display reading. The index time number marked on the CE alignment cartridge must be used when verifying the actuator assembly radial alignment.
3. The two left-hand decimal points of the digital display may be lit. This indicates that index transducer alignment is outside the measurement range of the DSU. When this occurs, perform the index transducer alignment as outlined in paragraph 3-17, then verify actuator assembly radial alignment as outlined in paragraph 3-16.

h. Set the FUNCTION switch on the DSU test module to position 6 (INDEX XDCR CYL 410).

i. Press the START (STROBE) pushbutton on the DSU test module and allow the disc drive to seek to cylinder 410.

Note: The indication on the HEAD ALIGNMENT meter will be fully deflected.

j. Observe that the corrected value does not differ by more than ±1.0 microsecond from the corrected value noted in step g.

If the corrected values are within the specified tolerance, proceed to paragraph 3-17.

If the corrected values are out of tolerance, proceed as follows:

(1) Set the RUN/STOP switch to STOP.

(2) Remove power from the disc drive as described in paragraph 5-3.

WARNING

Hazardous voltages are present inside the disc drive mainframe whenever the ac power cord is connected to an active ac power source.

(3) Remove the ac power cord from the receptacle located at the rear of the disc drive.

(4) Remove the prefilter duct and rear cover as outlined in paragraphs 5-10 and 5-8, respectively.

(5) Rotate the two quarter-turn fasteners used to secure power and motor control PCA-A8 to the bottom cover right bracket 1/4-turn counterclockwise.

(6) Lower PCA-A8 into its service position.

(7) Loosen the four socket head cap screws used to secure the actuator assembly to the main casting.

(8) Retighten the two front screws to 80 in.-lbs and the two rear screws to 40 in.-lbs.

(9) Connect the ac power cord.

(10) Restore power to the disc drive as described in paragraph 5-3.

(11) Set the RUN/STOP switch to RUN.

(12) Repeat steps e through j and use the Actuator Assembly Radial Alignment Tool, part no. 12995-20022, to move the actuator assembly from side to side while the heads are positioned at cylinder 410. See figure 3-3.

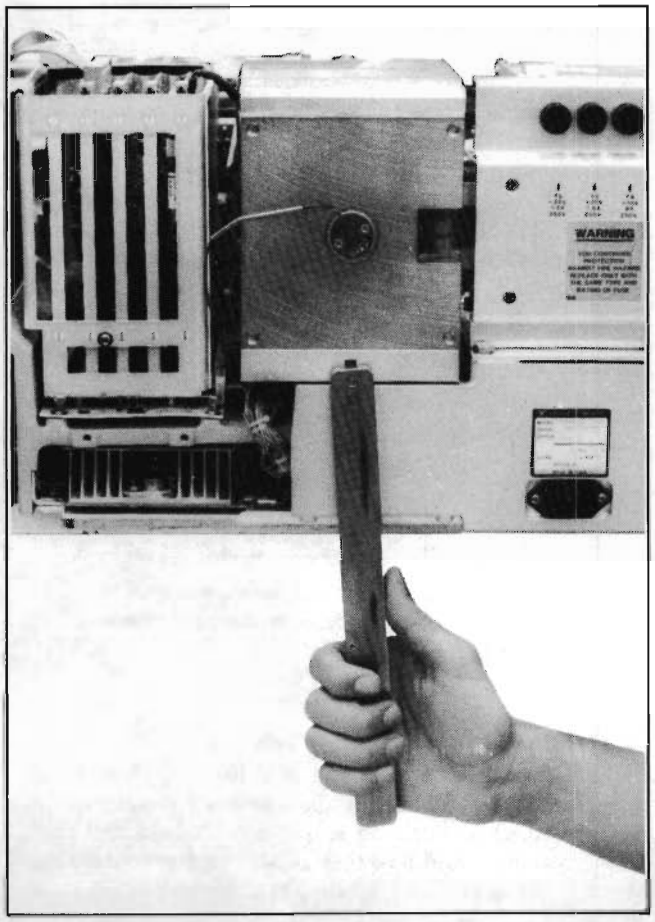

Figure 3-3. Using the Actuator Assembly Radial Alignment Tool

(13) Once the corrected value does not differ by more than ±0.5 microsecond from the corrected value noted in step g, set the RUN/STOP switch to STOP.

(14) Remove power from the disc drive as described in paragraph 5-3.

WARNING

Hazardous voltages are present inside the disc drive mainframe whenever the ac power cord is connected to an active ac power source.

(15) Remove the ac power cord from the receptacle located at the rear of the disc drive.

(16) Retighten all four socket-head cap screws to 80 in.-lbs.

(17) Connect the ac power cord.

(18) Restore power to the disc drive as described in paragraph 5-3.

(19) Set the RUN/STOP switch to RUN.

(20) Repeat steps e through j to recheck the alignment.

If the corrected value does not differ by more than ±1.0 microsecond from the corrected value noted in step g , remove power from the disc drive as described in paragraph 5-3, replace power and motor control PCA-A8, rear cover, and prefilter duct as outlined in paragraphs 5-18, 5-8, and 5-10, respectively, then proceed to paragraph 3-17.

If the corrected value is out of tolerance, repeat steps 1 through 3 and 7 through 20 of this adjustment procedure.

3-17. INDEX TRANSDUCER ALIGNMENT

The index transducer must be aligned to compensate for the allowable mechanical tolerances between disc drives, thereby ensuring data compatibility. The alignment of the index transducer is verified by monitoring the time difference between an index gap passing beneath data heads 0 and 1 at track 205, and the index pulse generated by the index transducer.

To verify index transducer alignment, proceed as follows:

a. Select head 0 on the lower bank of DSU test module switches (all 10 switches set to the left).

b. Set the FUNCTION switch on the DSU test module to position 5 (INDEX XDCR CYL 205).

c. Press the START (STROBE) pushbutton on the DSU test module and allow the disc drive to seek to cylinder 205.

Note: The indication on the HEAD ALIGNMENT meter will be fully deflected.

d. Observe the digital display and note the corrected value (time difference displayed in microseconds).

Notes: 1. Negative numbers are displayed as positive numbers subtracted from 100.

For example:

1.6 would be displayed as 01.6

−1.6 would be displayed as 98.4

2. The index time plus/minus numbers marked on the CE alignment cartridge represent the number of microseconds that the digital display is offset from zero when the index transducer is correctly aligned. For example, if the cartridge is marked

−0.3, the corrected readings for the two examples given in note 1 (1.6 and −1.6) are 1.9 and −1.3, respectively. In each case, the index time number is algebraically subtracted from the display reading. The index time numbers marked on the CE alignment cartridge must be used when verifying index transducer alignment. Use the index time number given for head 0 at cylinder 205 when calculating the corrected value in step d.

3. Index transducer alignment is outside the measurement range of the DSU when the two left-hand decimal points of the digital display are lit.

e. Select head 1 on the lower bank of DSU test module switches (switch 256/H1 set to the right).

f. Press the START (STROBE) pushbutton on the DSU test module and allow the disc drive to seek to cylinder 205.

Note: The indication on the HEAD ALIGNMENT meter will be fully deflected.

g. Observe the digital display and note the corrected value (time difference displayed in microseconds).

Note: Use the index time number for head 1 at cylinder 205 when calculating the corrected digital display value.

If the corrected values noted in steps d and g are within ±2.0 microseconds of zero and their sum is equal to 0.0 ±0.4 microsecond, proceed to paragraph 3-18.

If the corrected values noted in steps d and g are out of tolerance, proceed as follows:

(1) With power removed, remove the lower front cover as outlined in paragraph 5-9 (steps b through e).

CAUTION

Do not loosen the socket-head cap screw or shoulder screw used to secure the index transducer support to the main casting more than 1/4-turn counterclockwise. Failure to observe this caution may result in the index transducer falling onto the surface of the fixed disc.

(2) Loosen the socket-head cap screw and shoulder screw used to secure the index transducer support to the main casting 1/4-turn counterclockwise.

(3) Install Run/Stop Adapter Tool, part no. 07906-60082.

(4) Apply power to the disc drive and set the RUN/STOP switch to RUN.

(5) Repeat steps a through d and use the Head/Index Transducer Alignment Tool, part no. 12995-60007 to move the index transducer assembly from side-to-side while the heads are positioned at cylinder 205. See figure 3-4.

(6) Once the corrected value in step d is 00.0 ±0.2 microsecond, repeat steps e through g.

CAUTION

Never install a data head with a green-colored connector in any position other than head 2.

If the difference between the corrected values noted in steps d and g is greater than 4.0 microseconds, replace data heads 0 and 1 (one at a time) as outlined in paragraph 5-38 and repeat steps 5 and 6 of this adjustment procedure until the specified tolerance is achieved.

Note: The circumferential head alignment tolerance (skew error) of head 0 must be equal to the skew error of head 1 but opposite in sign and the magnitude of the total skew error must be equal to or less than 4.0 microseconds, otherwise the heads must be replaced.

(7) Once the corrected value in step d is 00.0 ±0.2 microsecond and the difference between the corrected values noted in steps d and g is less than or equal to 4.0 microseconds, use the head/index transducer alignment tool to move the index transducer assembly from side-to-side until the value displayed is one-half of that noted in step g.

(8) Retighten the socket-head cap screw and shoulder screw to 10 in.-lbs.

(9) Repeat steps a through g to recheck the alignment.

If the corrected values noted in steps d and g are within ±2.0 microseconds of zero and their sum is equal to 00.0 ±0.4 microsecond, set the POWER switch to OFF, remove the run/stop adapter tool, replace the lower front cover as outlined in paragraph 5-9, restore power, and proceed to paragraph 3-18.

Figure 3-4. Using the Index Transducer Alignment Tool

If the corrected values noted in steps d and g are out of tolerance, repeat steps 2 through 9 of this adjustment procedure.

3-18. HEAD ALIGNMENT

Data heads 0 and 1 are the only heads that must be in alignment to ensure data compatibility. This is accomplished by monitoring radial alignment.

To verify head alignment, proceed as follows:

a. Disconnect the temperature compensation cable connector from PCA-A5.

b. Set the FUNCTION switch on the DSU test module to position 3 (RANDOM SEEK).

c. Press the START (STROBE) pushbutton on the DSU test module and allow the disc drive to perform a series of random seek operations.

d. Rotate the DELAY potentiometer on the DSU test module fully counterclockwise (minimum delay) and then clockwise until the digital display indicates approximately 50 milliseconds.

e. From room ambient, allow at least 20 minutes for the disc drive and cartridge temperature to warm up and stabilize.

f. Press the STOP pushbutton on the DSU test module.

g. Select head 0 on the lower bank of DSU test module switches (all 10 switches set to the left).

h. Set the FUNCTION switch on the DSU test module to position 7 (HEAD ALIGNMENT CYL 245).

i. Press the START (STROBE) pushbutton on the DSU test module and allow the disc drive to seek to cylinder 245.

j. Observe that the indication on the HEAD ALIGNMENT meter first fully deflects to one side, then fully deflects to the other side, and finally returns to near center scale (takes approximately 1.5 seconds).

k. Observe the HEAD ALIGNMENT meter and the digital display.

Notes: 1. During head alignment, the HEAD ALIGNMENT meter is calibrated in 12.5-microinch increments. Each major division equals 125 microinches and each minor division equals 25 microinches.

2. The plus/minus number marked on the CE head alignment cartridge rep-

resents the number of 12.5-microinch increments (1/2 minor meter divisions) that the HEAD ALIGNMENT meter is offset from zero when the heads are correctly aligned. For example, if the cartridge is marked −3, the heads are correctly aligned when the meter reads −3. The correction marked on the cartridge must be observed when measuring and adjusting head alignment, as described in the following procedure.

3. The HEAD ALIGNMENT meter and the digital display should provide the same indication ±25 percent.

4. The most accurate indications are obtained from the HEAD ALIGNMENT meter.

5. Negative numbers are displayed as positive numbers subtracted from 1000.

   For example:
   10 would be displayed as 010
   −10 would be displayed as 990

6. Head alignment is outside the measurement range of the DSU when the two left-hand decimal points of the digital display are lit.

If the indication for head 0 is less than or equal to ±6 increments (±75 microinches of track center) on the HEAD ALIGNMENT meter, select head 1 on the lower bank of DSU test module switches (switch 256/H1 set to the right) and repeat steps i through k.

If the indication for head 1 is less than or equal to ±6 increments (±75 microinches of track center) on the HEAD ALIGNMENT meter, set the RUN/ STOP switch to STOP, and proceed to paragraph 3-19.

If the indication for head 0 and/or head 1 observed in step k is greater than ±6 increments (±75 microinches of track center), proceed as follows:

Note: Index transducer alignment must be verified following any adjustment of head alignment. Refer to paragraph 3-17 for instructions.

(1) Set the RUN/STOP switch to STOP.

(2) Loosen the head clamp retaining screw, then retighten to 3 in.-lbs using the Initial Head Torque Wrench, part no. 8710-0665.

(3) Set the RUN/STOP switch to RUN.

(4) Repeat steps i through k for the head to be aligned and use the Head/Index Transducer Alignment Tool, part no. 12995-60007, to move the head back and forth while the heads are positioned at cylinder 245. See figure 3-5.

Notes: 1. Head 0 is selected on the lower bank of DSU test module switches (all 10 switches set to the left).

2. Head 1 is selected on the lower bank of DSU test module switches (switch 256/H1 set to the right).

(5) Once the indication observed in step k is less than or equal to ±2 increments (±25 microinches of track center) on the HEAD ALIGNMENT meter, set the FUNCTION switch on the DSU test module to position 3 (RANDOM SEEK).

(6) Press the START (STROBE) pushbutton on the DSU test module and allow the disc drive to perform a series of random seek operations for at least 15 seconds.

(7) Press the STOP pushbutton on the DSU test module.

(8) Set the FUNCTION switch on the DSU test module to position 7 (HEAD ALIGNMENT CYL 245).

(9) Repeat steps i through k to recheck the alignment.

If the indication observed in step k is less than or equal to ±2 increments (±25 microinches of track center) on the HEAD ALIGNMENT meter, retighten the head clamp screw to 5 in.-lbs, using Torque Wrench, part no. 1535-2653. Set the FUNCTION swicth on the DSU test module to position 3 (RANDOM SEEK), press the START (STROBE) pushbutton on the DSU test module, and allow the disc drive to perform a series of random seek operations for at least 10 minutes.

If the indication observed in step k is greater than ±2 increments (±25 microinches of track center) on the HEAD ALIGNMENT meter, repeat steps 1 through 9 of this adjustment procedure.

(10) Press the STOP pushbutton on the DSU test module.

(11) Set the FUNCTION switch on the DSU test module to position 7 (HEAD ALIGNMENT CYL 245).

(12) Repeat steps i through k to recheck the alignment.

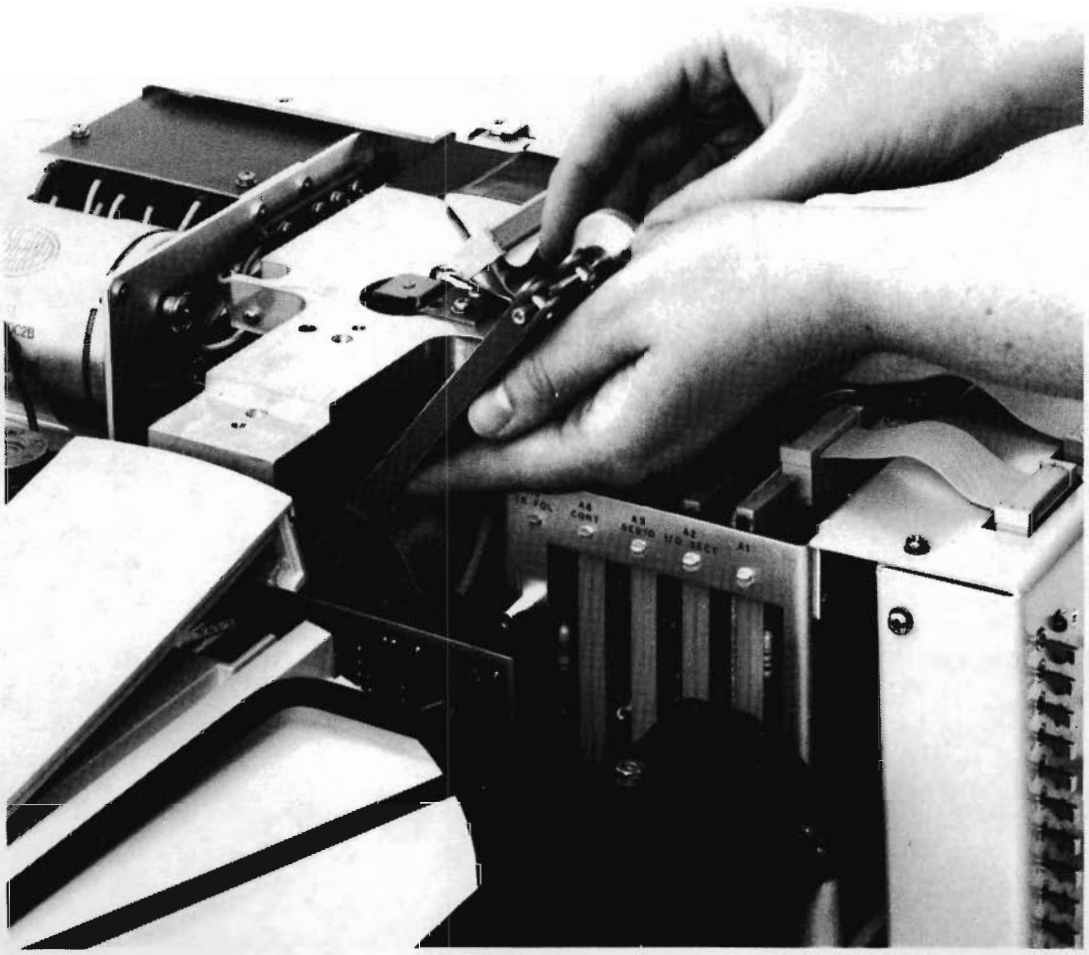

Figure 3-5. Using the Head Alignment Tool

If the indication observed in step k is less than or equal to ±4 increments (±50 microinches of track center) on the HEAD ALIGNMENT meter, set the RUN/STOP switch to STOP, and proceed to paragraph 3-19.

If the indication observed in step k is greater than ±4 increments (±50 microinches of track center) on the HEAD ALIGNMENT meter, repeat steps 1 through 12 of this adjustment procedure.

3-19. ON-LINE CHECKOUT

After all of the parameters have been verified, proceed as follows:

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the DSU.

c. Reconnect the temperature compensation cable connector to PCA-A5.

d. Remove the head alignment PCA.

e. Remove the head alignment preamplifier PCA and replace read/write preamplifier PCA-A6.

f. Replace the top cover and prefilter duct assembly, as described in paragraphs 5-6 and 5-10, respectively.

g. Restore the disc drive to the normal operating position in the equipment cabinet.

If the disc drive is installed in an HP system, run the system diagnostic tests in accordance with the instructions provided in the diagnostic manual. If the disc drive is installed in a non-HP system, an off-line checkout may be performed in accordance with the instructions provided in section IV of this manual.

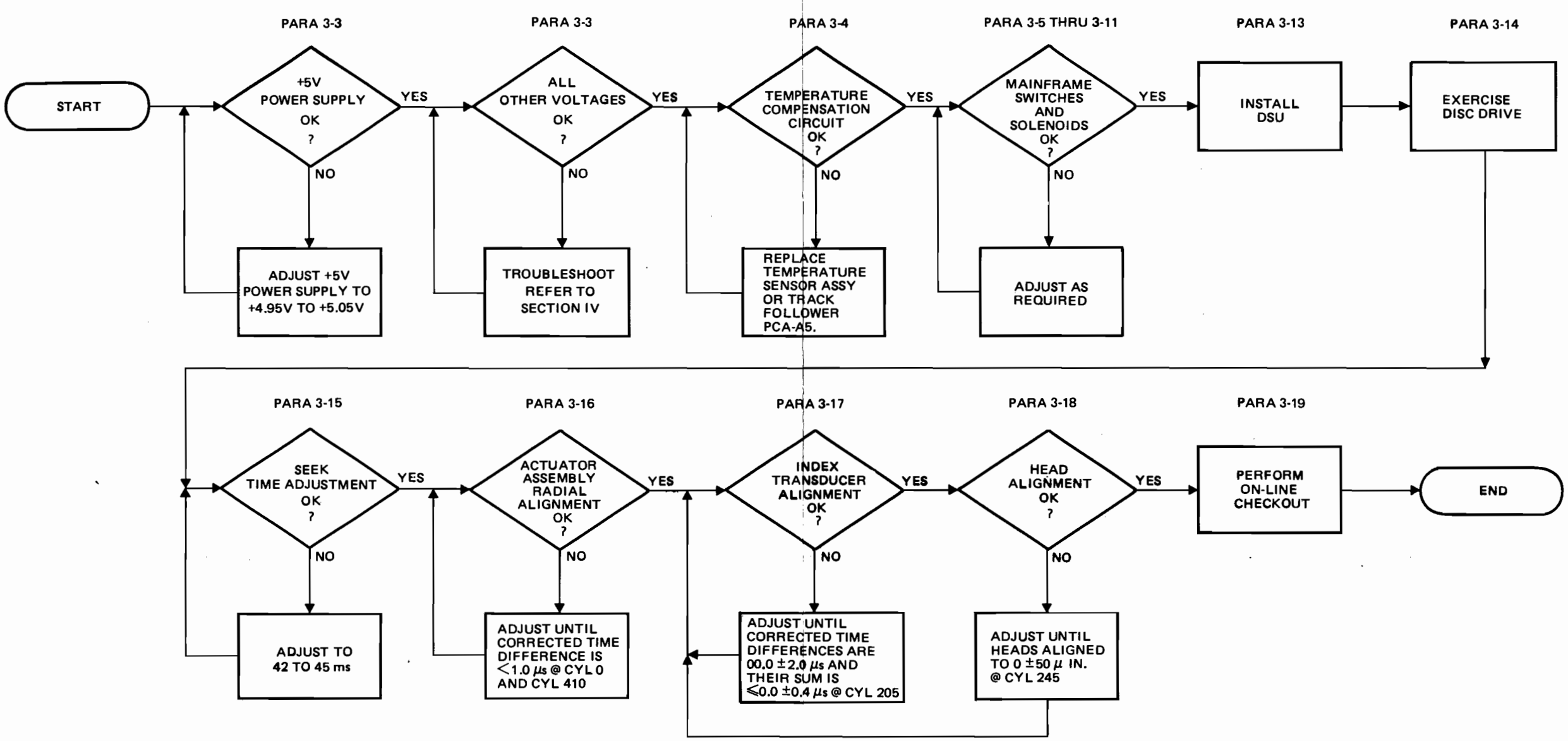

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Figure 3-6. Adjustment Sequence Flowchart

TROUBLESHOOTING

SECTION IV

This section contains information useful for troubleshooting the HP 7906 Disc Drive. Included are functional diagrams, troubleshooting flowcharts, wiring diagrams, and test waveforms. The information provided is for the isolation of malfunctions within the drive and not for equipment external to the drive.

WARNING

Troubleshooting instructions are intended for service-trained personnel only. To avoid potentially serious electrical shock, do not proceed further in this section unless qualified to do so.

4-1. DIAGNOSTIC TEST PROGRAMS

Diagnostic test programs for use with Hewlett-Packard systems containing disc drives are available from Hewlett-Packard. It is recommended that the user of an HP 7906 Disc Drive installed in non-HP systems have available a diagnostic test program with capabilities similar to those offered by Hewlett-Packard.

An HP-generated diagnostic tests the system devices which are associated with disc drive operation. In addition to this testing capability, the diagnostic can also be used to isolate a group of circuits within the drive as the possible cause of a malfunction. These include the read/write circuits, the head positioning circuits, and the head and sector storage circuits. It should be noted that the diagnostic is the only readily available means by which the user can check the ability of the drive's read/write circuits to write data on the disc surfaces, read it back from the disc surfaces, and store and retain the data. The disc service unit (DSU) will not issue a write command and does not check data generated by the drive in response to a read command.

The diagnostic is also able to determine the status of the drive (Drive Ready, Access Ready, Attention, First Status, Illegal Sector Selected, and Seek Command). It also monitors the on/off state of the DRIVE FAULT indicator.

The diagnostic can also be employed to detect patterns exhibited by intermittent errors. This may be done by running the diagnostic continuously over a period of time and checking for the conditions present at each occurrence of the error.

Detailed operating instructions for HP-supplied diagnostic test programs are contained in the documentation delivered with the software.

4-2. TROUBLESHOOTING FLOWCHARTS

If a malfunction can be associated with a certain circuit through knowledge of the drive, the service-trained user can go dirctly to the appropriate troubleshooting flowchart (figures 4-2 through 4-22) and following the instructions given, attempt to remedy the fault. Visual indication of the drive status, as described in table 4-1 is intended to aid in isolating the malfunction to a particular area of the drive. If the malfunction cannot be located in this manner, perform the procedure described in the power-up flowchart (figure 4-1). Failing this, the diagnostic test program should be used to isolate the fault. It should be noted that the power-up flowchart checks, in general, operation of the blower, power sources, door lock circuits, spindle rotating circuits, and head positioning circuits. The diagnostic test program, on the other hand, checks operation of the I/O control circuits, read/write circuits, sector sensing circuits, and the portions of the head positioning circuits that seek to a cylinder addressed by the disc controller.

4-3. POWER SOURCES

The troubleshooting procedures in this section assume that all power sources in the drive are within tolerance. If they are not, the cause of the trouble will be apparent (an IL drive fault will be indicated). The power distribution schematic diagram (figure 4-31) can be used to trace the source of the malfunction. If the +5 Vdc power source exceeds approximately +5.6 Vdc, a crowbar circuit in PCA-A7 disables the 5-volt regulator circuit, causing an IL drive fault indication.

4-4. VISUAL INDICATION OF DRIVE STATUS

Table 4-1 lists the response of the drive to certain conditions as evidenced by the appearance of the four drive fault light-emitting diodes (LED's) on control PCA-A4, the indicators on the operator control panel, and the drive mechanism. Two of the drive fault LED's are colored red, one is green, and one is yellow. By color coding the operation of the LED's, a number of drive faults can be indicated. These faults, and the LED's illuminated, are detailed in table 4-1. Also provided is a description of the circuit that implements the response, including its logic equation and location on the system functional diagram.

4-5. DISC SERVICE UNIT

nections that occur through the mainframe wiring har-

Troubleshooting 7906

Table 4-1. Visual Indication of Drive Status (Continued)

INDICATOR/ INDICATION	ACTIVE STATE		FUNCTIONAL DIAGRAM
	LOGIC EQUATION	CIRCUIT DESCRIPTION	
DRIVE FAULT indicator (continued)		d. ILF (Interlock Fault) signal active, caused by any one of the following: 1. Out of tolerance power supply (including blown fuses). 2. Excessive temperature condition, as sensed by switch A8S1. 3. Connector disconnected from Encoder PCA, Power PCA, or operator control panel. Note: On HP 7906A, operator control panel is not interlocked. 4. Card cage PCA's not properly seated. e. Destructive write fault, caused by any one of the following: 1. Drive in a write mode with no data signal applied. (W • $\overline{AC}$ LED's lit.) 2. More than one head selected for reading or writing. (MH LED's lit.) 3. DC write current is supplied to head drivers while drive not in write mode. ($\overline{W}$ • DC LED's lit.) f. Non-destructive write fault, caused by any one of the following: 1. Heads not settled on a cylinder [ACRY (Access Ready) signal inactive] while in the write mode. (W • $\overline{AR}$ LED's lit.) 2. Drive in both read and write mode at the same time. (R • W LED's lit.)	
IL drive fault indication (green LED)	None	LED is lit when any one of the following conditions is met: a. 25 Vac, +36 Vdc, +12 Vdc, +5 Vdc, −12 Vdc, −24 Vdc or −36 Vdc power source below tolerance or missing (blown fuse). b. PCA-A2, A3, A4, A5, or A6 improperly seated. c. PCA-A8 or A10 has improper wiring connection. d. Track formatter PCA and PCA-A2 both present in drive.	Fault Detection System, figure 4-29.

Table 4-1. Visual Indication of Drive Status (Continued)

INDICATOR/ INDICATION	ACTIVE STATE		FUNCTIONAL DIAGRAM
	LOGIC EQUATION	CIRCUIT DESCRIPTION	
AGC drive fault indication (yellow, red LED's)	HLDD • AGCF = HLDD • $\overline{AGC}$ • $\overline{SKH}$	LED's are lit when the AGC signal becomes inactive while the heads are loaded and are not doing a seek home.	Fault Detection System, figure 4-29.
CB drive fault indication (yellow LED)	CRB • DRDY	LED is lit when both of the following conditions are met: a. CRB (Carriage Back) signal active. b. DRDY (Drive Ready) signal active.	Fault Detection System, figure 4-29.
W • $\overline{AR}$ drive fault indication (yellow, green LED's)	WRITE • $\overline{ACRY}$	LED's are lit when both of the following conditions are met: a. Drive in write mode. b. ACRY (Access Ready) signal inactive.	Fault Detection System, figure 4-29.
R • W drive fault indication (green, red LED's)	URG • WRITE	LED's are lit when both of the following conditions are met: a. URG (Unselected Read Gate) signal active. b. WRITE (Write) signal active.	Fault Detection System, figure 4-29.
W • $\overline{AC}$ drive fault indication (yellow, green, red LED's)	WRITE • ACW	LED's are lit when the following condition is met: a. Drive in write mode, but no data signal present.	Fault Detection System, figure 4-29.
MH drive fault indication (red, red LED's)	MHS	LED's are lit when the following condition is met: a. More than one head selected for reading or writing.	Fault Detection System, figure 4-29.
$\overline{W}$ • DC drive fault indication (red, red, yellow LED's)	$\overline{WRITE}$ • DCW	LED's are lit when the following conditions are met: a. DC current supplied to head drivers. b. Drive not in write mode.	Fault Detection System, figure 4-29.

Table 4-1. Visual Indication of Drive Status (Continued)

INDICATOR/ INDICATION	ACTIVE STATE		FUNCTIONAL DIAGRAM
	LOGIC EQUATION	CIRCUIT DESCRIPTION	
T drive fault indication (red LED)	90 ms TO = (SK) ((SKC • (RET • CRB)) + (DPS • TO)) 1.25 sec TO = (SKH + RET • ILF • TO)((SKC • (RET • CRB)) + (DPS • TO))	LED is lit if the heads are not settled on the addressed cylinder (ACRY signal active) within 90 milliseconds after the SK signal becomes active. LED is also lit if any one of the following conditions is met: a. Heads not settled on a cylinder (ACRY signal active) within 1.25 seconds after the RH (Restore Home) signal becomes active. b. Carriage has not reached the retracted position [CRB (Carriage Back) signal active] within 1.25 seconds after RET (retrack) signal becomes active.] c. Heads not settled on cylinder 0 within 1.25 seconds after the RET signal becomes inactive. [The SKH (Seek Home) signal is automatically activated when the RET signal becomes inactive.]	Fault Detection System, figure 4-29.
Brushes start to cycle[1]	RS • SPD	The brush cycle starts when the RS (Run Spindle) signal is active and the spindle has not yet started to rotate. [SPD (Spindle Speed Down) signal active.]	Spindle Rotating System, figure 4-24.
After brush cycle[1] begins, brushes continue to cycle until cycle is complete.	BB	Once the brush cycle begins, continuation of the cycle depends upon the inactive condition of BB (Brushes Back) signal.	Spindle Rotating System, figure 4-24.
Brushes stop cycling[1]	SPD • BB	The brush cycle ends when the roller on the Brushes Back switch S9 engages a cam detent. This occurs after the cam has completed one revolution (one brush cycle). This activates the BB (Brushes Back) signal. Note: The SPD (Spindle Speed Down) signal must be inactive or the brushes will cycle again.	Spindle Rotating System, figure 4-24.
Spindle starts to rotate from a stationary state	RS • CIP • DL • TO • RUN • CRB • ILF	Spindle rotation occurs when all of the following conditions are met: a. Cartridge in place. b. Door locked. c. No IL drive fault. d. RUN/STOP switch set to RUN. e. Carriage fully retracted (CRB signal active).	Spindle Rotating System, figure 4-24.

[1] The brush cycle will be operative only on those drives with control PCA-A4, part no. 07906-60002, installed.

Table 4-1. Visual Indication of Drive Status (Continued)

INDICATOR/ INDICATION	ACTIVE STATE		FUNCTIONAL DIAGRAM
	LOGIC EQUATION	CIRCUIT DESCRIPTION	
Spindle continues to rotate	RS = $\overline{CRB}$ • $\overline{ILF}$	Once started, the spindle continues to rotate as long as both of the following conditions are met: a. Carriage not fully retracted. [CRB (Carriage Back) signal inactive.] b. ILF (Interlock Fault) signal inactive.	Spindle Rotating System, figure 4-24.
Heads seek to cylinder 0 (home) from the retracted position	SEN • ECS • $\overline{RET}$	During a power-up operation, the heads seek home when the RET (Retract) signal becomes inactive. This occurs when both of the following conditions are met: a. $\overline{BB}$ (Brushes Back) signal inactive.[1] b. $\overline{SPU}$ (Spindle Speed Up) signal active.	Head Positioning System, figure 4-25.
Heads seek from one cylinder to another	ACRY • SK • $\overline{ICA}$	The heads seek from one cylinder to another provided all of the following conditions are met: a. Heads are settled on a cylinder [ACRY (Access Ready) signal active.] b. The SK (Seek Command) signal from the controller is present. c. The address to which the heads are to seek is not an illegal one (>410).	Head Positioning System, figure 4-25.

[1] The brushes back ($\overline{BB}$) signal is only active on those drives with control PCA-A4, part no. 07906-60002, installed. If this control PCA is installed in a drive with serial numbers prefixed 2040 or later, the heads will not load. Control PCA-A4, part no. 07906-60102, must be installed for proper operation of these drives.

Table 4-2. Disc Service Unit (DSU) Functions 1, 2, 3, and 8

CONTROL/ INDICATOR	FUNCTION
	Function No. 1 — Alternate Seek
FUNCTION switch	Selects automatic Alternate Seek function (position 1).
START (STROBE) pushbutton	Starts operation of Alternate Seek function. Heads first seek to cylinder 0, then to the cylinder address selected on the upper bank of ten toggle switches, and then alternately between this address and the cylinder address selected on the lower bank of ten toggle switches. If either selected address is an illegal one (greater than 410), the heads seek to the legal address and remain there. If both addresses are illegal, no seek is performed.
STOP pushbutton	Stops operation of Alternate Seek function. Heads seek to cylinder 0 (home) and remain there.
Upper bank of 10 toggle switches (1 thru 512)	Select cylinder address to which heads seek after leaving cylinder 0.
Lower bank of 10 toggle switches (1 thru 512)	Select cylinder address to which heads seek after leaving cylinder address selected by upper bank of 10 toggle switches.
DELAY control	Selects time interval between seeks.
3-digit display	Indicates time interval for seek. Readout is in milliseconds.
	Function No. 2 — Incremental Seek
FUNCTION switch	Selects automatic Incremental Seek function (position 2).
START (STROBE) pushbutton	Starts operation of Incremental Seek function. Heads first seek to cylinder 0 and then to next address. Next address is determined by adding the numbers selected by the lowest nine (1 thru 256) switches on the lower bank of ten toggle switches. Incremental seeking of the heads to the next address continues until a next address greater than 410 is reached. When this occurs, the programmed next address number is subtracted from the preceding valid next address (410 or less), causing decremental seeking to the next address until cylinder 0 is reached. The heads continue this incremental and decremental seek action until the STOP pushbutton is pressed.
STOP pushbutton	Stops operation of Incremental Seek function. Heads seek to cylinder 0 (home) and remain there.
Lower bank of 9 toggle switches (1 thru 256)	Select amount by which current cylinder address is incremented (or decremented) for next seek.
DELAY control	Selects time interval between seeks.
3-digit display	Indicates time for seek. Readout is in milliseconds.
	Function No. 3 — Random Seek
FUNCTION switch	Selects automatic Random Seek function (position 3).
START (STROBE) pushbutton	Starts operation of Random Seek function. Heads first seek to cylinder 0 and then to cylinder addresses generated by the DSU in a pseudo-random sequence.

Table 4-2. Disc Service Unit (DSU) Functions 1, 2, 3, and 8 (Continued)

CONTROL/ INDICATOR	FUNCTION
	Function No. 3 — Random Seek (Continued)
STOP pushbutton	Stops operation of Random Seek function. Heads seek to cylinder 0 (home) and remain there.
DELAY control	Selects time interval between seeks.
3-digit display	Indicates time interval between seeks. Readout is in milliseconds.
	Function No. 8 — Manual Mode
FUNCTION switch	Selects Manual mode of operation (position 8).
START (STROBE) pushbutton	When pressed, activates STROBE signal applied to the tag bus decoder in I/O Control PCA-A2. This executes the command selected by tag bus switches 64 through 512 on the upper bank of 10 toggle switches. The STROBE signal is active as long as the START (STROBE) pushbutton is held down.
Upper 4 toggle switches (64 thru 512)	Select input command to be supplied on tag bus to drive. The toggle switch settings and the associated input commands are listed on the upper right-hand corner of the DSU front panel. The DSU does not issue a Write command.
T0 thru T3 LED indicators	Indicate the state of the tag bus bits (input command) selected by the upper 4 toggle switches (64 through 512).
Lower bank of 16 toggle switches (1 thru 512 and 1 thru 32)	Select state of control bus bits C0 through C15 for the following tag bus commands. Bits are strobed into the drive when the START (STROBE) pushbutton is pressed.

Command		Control Bits
Address Record (ADR) — 1001	C0 thru C5	Select sector address to be stored in drive Sector Address register.
	C8 and C9	Select head identity to be stored in drive Head register.
Address Unit (ADU) — 1010	C0 thru C2	Select identity of drive to be enabled for communication with DSU. (The identity of the drive is the number selected on the UNIT SELECT switch on the drive operator panel.)
Clear Status (CLS) — 1110	C0	Clears three Attention flip-flops in drive. This deactivates First Status signal. Note: If C0 and C1 are both selected, the Attention flip-flops and the First Status flip-flop are cleared.
Seek (SK) — 1000	C0 thru C8	Select cylinder address to which heads are to seek.
Set Offset (SOF) — 1101	C0 thru C5	Select offset magnitude in 53 increments of 25 microinches each.
	C6	Selects direction (+ or −) of offset.
Transmit Sector (XMS) — 1100	C0 thru C5	Select sector address to be stored in drive Sector Address register.

Table 4-2. Disc Service Unit (DSU) Functions 1, 2, 3, and 8 (Continued)

CONTROL/ INDICATOR	FUNCTION
C0 thru C15 LED indicators	**Function No. 8 — Manual Mode (Continued)** a. Indicate the state of the control bus bits selected by the lower band of 16 toggle switches when any one of the preceding six commands is selected. b. Indicate the status of the drive when any one of the following commands is selected: Read (READ) — 0000 Write (WRITE) — 0001 Request Status (RQS) — 0010 Coding for the LED's is as follows. With the exception of C0 (ACRY), a lighted LED indicates that the corresponding signal is active. C0, when lighted, indicates that signal ACRY is inactive. C0 — ACRY (Access Ready) C1 — DRDY (Drive Ready) C2 — Illegal sector selected or seek check C3 — First Status C4 — FLT (Fault) C5 — Format C6 — PRT (Protect) C7 — AT (Attention) C8 — SC (Sector Compare) C9 — Ground C10 — Drive Type C11 through C15 — Not used c. Indicate position information when Request Position (RQP) command is selected. Coding for the LED's is as follows: C0 thru C5 — Sector presently under selected head. C6 — RRT (Protect) C7 — AT (Attention) C8 and C9 — Identity of selected head (0 thru 3) C10 — Drive type C11 thru C15 — Not used

Table 4-3. Mnemonic Signal Sources

MNEMONIC	SIGNAL	SOURCE	
		FIG.	ZONE
$\overline{\text{ACRY}}$	Access Ready	4-25	A3
ACW	AC Write Current	4-28	C11
ADDR	Address	—	—
ADR	Address Record	4-23	A3
ADU	Address Unit	4-23	A3
AGC	Automatic Gain Control	4-25	D9
$\overline{\text{AGCF}}$	AGC Fault	4-25	B10
AT	Attention (test point)	4-23	B12
ATTN	Attention	4-23	B8
$\overline{\text{BB}}$	Brushes Back	4-24	D10
CC	Current Command	4-25	A12
CIP	Cartridge-In Place	4-24	A3
$\overline{\text{CLA}}$	Clear Attention	4-23	B11
CLK	Clock	4-25	B8
$\overline{\text{CLO}}$	Clear Offset	4-25	C8
CLR	Clear	4-23	B3
CLS	Clear Status	4-23	B3
CPS	Controller Preset	4-23	A5
CRB	Carriage Back	4-25	B15
CYL	Cylinder	4-25	A9
DCN	Disconnect	4-23	B3
DCW	DC Write Current	4-28	C11
DGC	Data AGC	4-28	B12
DIFF	Difference	4-25	B9
DL	Door Locked	4-24	A3
$\overline{\text{DPS}}$	Destructive Preset	4-29	B7
DRDY	Drive Ready	4-25	B3
$\overline{\text{DRDYL}}$	Drive Ready Lamp	4-25	A3
DWA	Decrease Write Current (13 mA)	4-28	D9
$\overline{\text{DWA}}$	Decrease Write Current (13 mA)	4-28	D9
DWB	Decrease Write Current (6.5 mA)	4-28	D9
$\overline{\text{DWB}}$	Decrease Write Current (6.5 mA)	4-28	D9
$\overline{\text{DWC}}$	Decrease Write Current (3.25 mA)	4-28	D9
ECS	Energize Carriage Solenoid	4-25	B5
ENA	Encoder Phase A	4-24	C8
ENB	Encoder Phase B	4-24	C7
FLT	Fault	4-29	A15
$\overline{\text{FLTL}}$	Fault Lamp	4-29	A15
FWD	Forward	4-25	B11
GATED AT	Gated Attention	4-27	A8
$\overline{\text{HS0}}$	Head 0 Selected	4-28	B7
$\overline{\text{HS1}}$	Head 1 Selected	4-28	B7
$\overline{\text{HS2}}$	Head 2 Selected	4-28	B7
$\overline{\text{HLDD}}$	Heads Loaded	4-25	A4
ICA	Illegal Cylinder Address	4-25	A8
$\overline{\text{ILF}}$	Interlock Fault	4-29	B5
$\overline{\text{LD}}$	Lock Door	4-24	C3
$\overline{\text{LIP}}$	Lower Index Pulse	4-27	B3
LP	Lower Pulse	4-27	C5
LSB	Least Significant Bit	4-25	A9
M-1	Match Minus One	4-25	A10
MH	Multiple Heads	4-29	D10
$\overline{\text{MHS}}$	Multiple Heads Selected	4-28	C11
$\overline{\text{NDPS}}$	Non-Destructive Preset	4-29	A8
NLD	Negative Level Detector	4-27	B2

MNEMONIC	SIGNAL	SOURCE	
		FIG.	ZONE
O/S	Offset	4-25	D9
OSD	Offset Settling Delay	4-27	C3
$\overline{\text{OSD}}$	Offset Settling Delay	4-27	C3
POR	Power-On Reset	4-29	B7
POS	Position	4-25	C9
PRT	Protect	4-28	C6
PRTL	Protect Lower Disc	4-28	C2
PRTU	Protect Upper Disc	4-28	C2
R	Reset	—	—
$\overline{\text{RBR}}$	Run Brushes	4-24	C6
RCL	Recalibrate	4-23	B3
RDA	Read Data A	4-28	B11
RDB	Read Data B	4-28	B11
READ	Read	4-23	B3
REF	Reference	4-27	B3
RET	Retract	4-29	A11
REV	Reverse	4-25	B11
$\overline{\text{RH}}$	Restore Home	4-25	B2
RQA	Request Attention	4-23	A3
RQP	Request Position (sector)	4-23	B3
RQS	Request Status	4-23	B3
$\overline{\text{RS}}$	Run Spindle	4-24	B5
S	Set	—	—
$\overline{\text{SB}}$	Servo Balanced	4-25	B6
SC	Sector Compare	4-27	C8
SCL	Sector Clock	4-27	B3
$\overline{\text{SEN}}$	Servo Enable	4-25	B5
SK	seek	4-23	A3
$\overline{\text{SKC}}$	Seek Complete	4-25	A4
$\overline{\text{SKH}}$	Seek Home	4-25	C4
$\overline{\text{SKI}}$	Seek Inhibit	4-25	C6
$\overline{\text{SL}}$	This Disc Drive Selected by Controller	4-23	C5
SOF	Set Offset	4-23	C3
$\overline{\text{SPD}}$	Spindle Speed Down	4-24	C8
$\overline{\text{SPU}}$	Spindle Speed Up	4-24	D9
STP	Set Timeout Period	4-24	A11
SW	Switch	—	—
$\overline{\text{TAC}}$	Tachometer	4-25	B12
TCD	Track Centered	4-25	B7
TEMP	Temperature	—	—
TO	Timeout	4-29	A15
TTO	Temperature Timeout	4-25	D12
$\overline{\text{UDS}}$	Upper Disc Selected	4-28	B4
$\overline{\text{UIX}}$	Upper Index	4-27	A2
UP	Upper Pulse	4-27	B5
$\overline{\text{URG}}$	Unselected Read Gate	4-28	D4
USS	Upper Surface Selected	4-28	B4
UWG	Unselected Write Gate	4-28	D4
WDA	Write Data A	4-28	C7
WDB	Write Data B	4-28	C7
WEN	Write Enable	4-25	C7
WRITE	Write	4-23	B3
XMS	Transmit Sector	4-23	B3
ZCR	Zero Crossing	4-25	D11

Table 4-4. Motherboard PCA-A7 Wiring List

SIGNAL		FROM	TO
MNEMONIC	NAME		
$\overline{\text{ACRY}}$	$\overline{\text{Access Ready}}$	A4P1-P	A1P1-N†, A2P1-J, A5P1-8*
ACW	AC Write Current	A6P1-F	A4P1-K
AGC	Automatic Gain Control	A5P1-16	A3P1-16, A4P1-17
$\overline{\text{AGCF}}$	$\overline{\text{AGC Fault}}$	A3P2-S	A4P2-S
ATT1	Attention 1	A4P2-E	A2P2-E
$\overline{\text{BB}}$	$\overline{\text{Brushes Back}}$	Brushes-Back switch (S9), A7P1-D	A4P2-T
C0	Control Data Bus Bit 0	A2P1-M	A3P1-11, A5P1-11
C1	Control Data Bus Bit 1	A2P1-10	A3P1-L, A5P1-L
C2	Control Data Bus Bit 2	A2P1-11	A3P1-M, A5P1-M
C3	Control Data Bus Bit 3	A2P1-L	A3P1-10, A5P1-10
C4	Control Data Bus Bit 4	A2P1-K	A3P1-9, A5P1-9
C5	Control Data Bus Bit 5	A2P1-H	A3P1-7, A5P1-7
C6	Control Data Bus Bit 6	A2P1-9	A3P1-K, A5P1-K
C7	Control Data Bus Bit 7	A2P1-8	A3P1-J, A5P1-J
C8	Control Data Bus Bit 8	A2P1-7	A3P1-H, A5P1-H
C9	Control Data Bus Bit 9	A2P1-F	A3P1-6, A5P1-6
CB1	Crowbar 1	A5P1-V	A2P1-U
CB2	Crowbar 2	A2P1-16	Motherboard (R5)
CC	Current Command	A3P2-1	A7P1-4, A8P1-M
(CIP)(DL)	Cartridge-in-Place and Door Locked	A7P1-H	A4P2-M
$\overline{\text{CLA}}$	$\overline{\text{Clear Attention}}$	A2P2-5	A4P2-5
$\overline{\text{CLO}}$	$\overline{\text{Clear Offset}}$	A3P2-U	A5P2-U
$\overline{\text{CPS}}$	$\overline{\text{Controller Preset}}$	A2P2-L	A4P2-R
CRB	Carriage Back	A7P1-13	A4P1-S
CYL	Cylinder	A3P2-11	A2P2-11, A4P2-11
DCW	DC Write Current	A6P1-5	A4P1-J
DDB	Differential Data Bus	A4P2-10	A7J3-3, A1P2-10
$\overline{\text{DDB}}$	$\overline{\text{Differential Data Bus}}$	A4P2-L	A7J3-2, A1P2-L

† Disc Service Unit
* Servo Formatter PCA

Table 4-4. Motherboard PCA-A7 Wiring List (Continued)

SIGNAL		FROM	TO
MNEMONIC	NAME		
DGC	Data AGC	A4P1-M	A6P1-H
$\overline{\text{DPS}}$	Destructive Preset	A4P2-P	A7P1-N, A8P1-12
DRDY	Drive Ready	A4P2-4	A2P2-4
$\overline{\text{DRDYL}}$	Drive Ready Lamp	A4P1-18	A7P1-R, A9P1-7
DWA	Decrease Write Current (13 mA)	A3P2-J	A5P2-11
$\overline{\text{DWA}}$	Decrease Write Current (13 mA)	A3P1-18	A6P1-A
DWB	Decrease Write Current (6.5 mA)	A3P2-K	A5P2-12
$\overline{\text{DWB}}$	Decrease Write Current (6.5 mA)	A3P1-13	A6P1-B
$\overline{\text{DWC}}$	Decrease Write Current (3.25 mA)	A3P1-12	A6P1-1
ECS	Energize Carriage Solenoid	A4P2-14	A7P1-F, A8P1-1
$\overline{\text{EIA}}$	Enable Illegal Address	A5P2-14	A3P2-14
FLT	Fault	A4P2-F	A2P2-F
$\overline{\text{FLTL}}$	Fault Lamp	A4P1-15	A7P1-T, A9P1-6
FMT	Format	FORMAT switch (S4), A7P1-J	A2P2-13
$\overline{\text{HS0}}$	Head Select 0	A4P1-11	A6P1-2
$\overline{\text{HS1}}$	Head Select 1	A4P1-10	A6P1-C
$\overline{\text{HS2}}$	Head Select 2	A4P1-9	A6P1-3
ICA	Illegal Cylinder Address	A3P1-F	A2P1-6
ILC	Circuit Board Interlock	A4P1-16	A1P1-13, A1P1-P; A2P1-14, A2P1-R; A3P1-15, A3P1-S; A5P1-17, A5P1-U; A5P2-1, A5P2-A; A6P1-15, A6P1-S; A7P1-A, A7P1-BB**
$\overline{\text{ILF}}$	Interlock Fault	A4P1-N	A7P1-14, A8P1-14
$\overline{\text{LD}}$	Lock Door	A4P2-2	A7P1-1, A8P1-P
$\overline{\text{LIP}}$	Lower Index Pulse	A5P2-3	A2P2-3, A3P2-F
LSB	Least Significant Bit	A3P2-16	A5P2-16
M	Match	A3P2-L	A5P2-10
MHS	Multiple Heads Selected	A6P1-6	A4P1-L

** All PCA's must be in place for continuity.

Table 4-4. Motherboard PCA-A7 Wiring List (Continued)

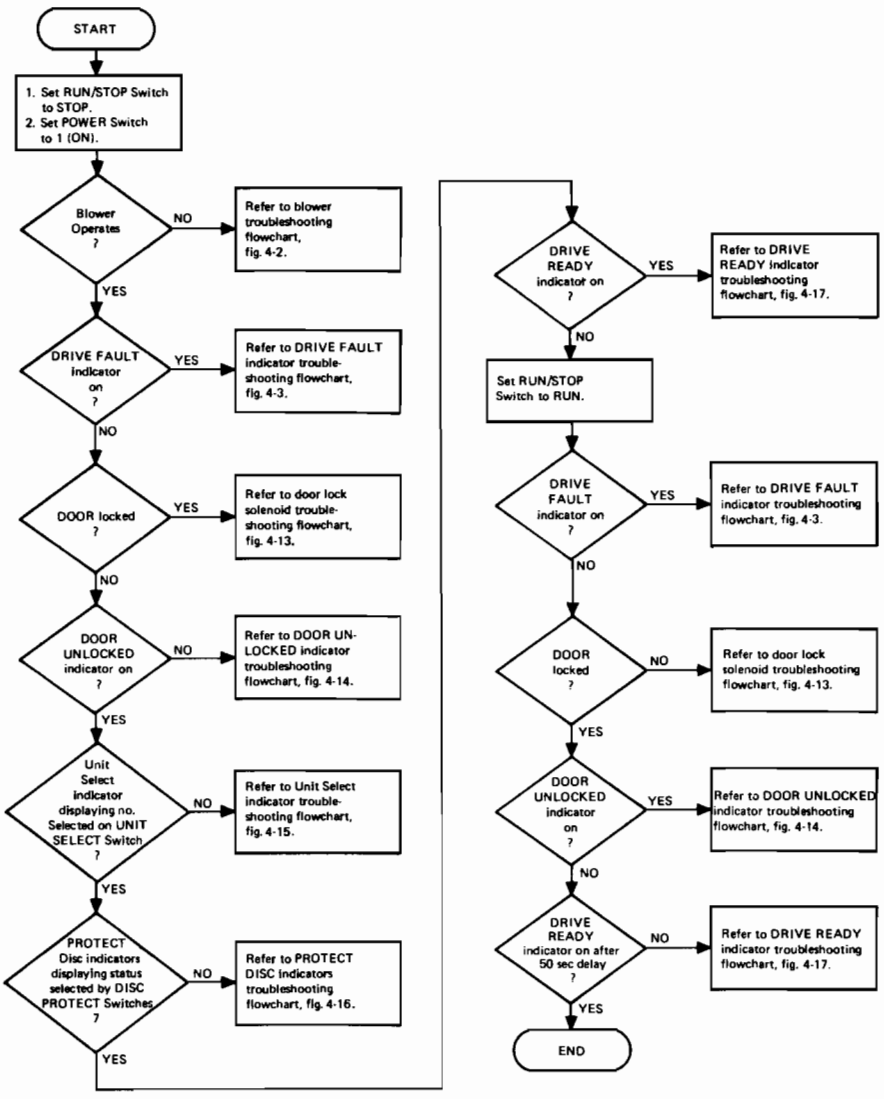
SIGNAL		FROM	TO
MNEMONIC	NAME		
$\overline{\text{NDPS}}$	Non-Destructive Preset	A4P2-D	A2P2-D, A1P2-D, A5P2-D
OSD	Offset Settling Delay	A5P2-5	A3P2-D
$\overline{\text{OSD}}$	Offset Settling Delay	A5P2-7	A2P2-C
POS	Position	A5P1-18	A3P1-V
PRT	Protect	A2P2-J	A4P2-J
PRTL	Protect Lower	LOWER DISC PROTECT switch (S5), A7P1-9	A2P1-18
PRTU	Protect Upper	UPPER DISC PROTECT switch (S6), A7P1-10	A2P1-V
$\overline{\text{RBR}}$	Run Brushes	A4P2-B	A7P1-2, A8P1-3
RDA	Read A	A6P1-13	A4P1-6
RDB	Read B	A6P1-14	A4P1-F
RET	Retract	A4P2-13	A3P2-13
$\overline{\text{RH}}$	Restore Home	A2P2-7	A4P2-H
$\overline{\text{RS}}$	Run Spindle	A4P2-1	A7P1-3, A8P1-L
$\overline{\text{RUN}}$	Run	RUN/STOP switch (S2), A7P1-B	A4P2-U
$\overline{\text{SB}}$	Servo Balanced	A3P2-17	A4P2-17, A5P2-17*
SCL	Sector Clock	A5P2-6	A2P2-6
SEL	Select	A2P2-8	A4P2-8, R6
$\overline{\text{SL}}$	This Drive Selected	A2P1-13	A7P1-7, A9P1-10
$\overline{\text{SEN}}$	Servo Enable	A4P2-7	A7P1-K, A8P1-K
SK	Seek	A2P2-N	A3P2-N, A4P2-12, A5P2-N
$\overline{\text{SKH}}$	Seek Home	A4P1-U	A3P1-U
$\overline{\text{SKI}}$	Seek Inhibit	A1P2-2	A3P2-2
SOF	Set Offset	A2P1-T	A4P2-N, A5P1-T
$\overline{\text{SPD}}$	Speed Down	A8P1-J, A7P1-E	A4P2-15

* Servo Formatter PCA.

Table 4-4. Motherboard PCA-A7 Wiring List (Continued)

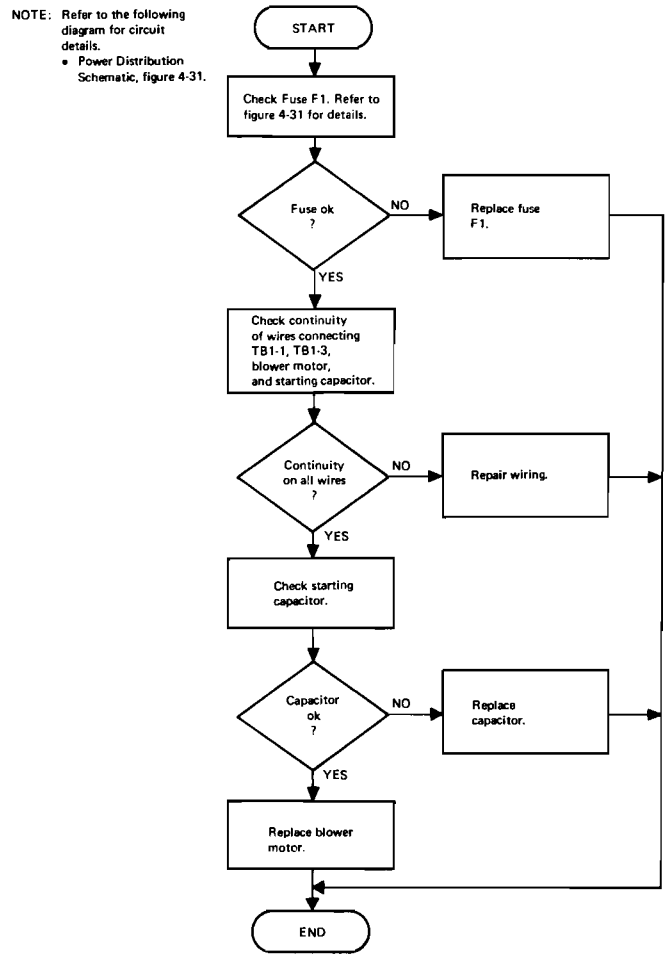
SIGNAL		FROM	TO
MNEMONIC	NAME		
$\overline{SPU}$	$\overline{Speed\ Up}$	A8P1-8, A3P2-E	A7P1-P, A4P2-C, A5P2-4
$\overline{STF}$	$\overline{Self\ Test\ Failed}$	A1P1-1	A7J1-15
$\overline{STOP}$	$\overline{Stop}$	RUN/STOP switch (S2), A7P1-C	A4P2-16
STP	Set Timeout Period	A8P1-11, A7P1-S	A4P1-V
TAC	Tachometer	Tachometer, A7J2-1	A3P2-B
$\overline{TAC}$	$\overline{Tachometer\ Return}$	Tachometer, A7J2-3	A3P2-C
TTO	Temperature Timeout	A5P2-8	A4P1-T
$\overline{UDS}$	$\overline{Upper\ Disc\ Select}$	A2P1-12	A5P1-12, A4P1-13
UIX	Upper Index Transducer	Upper Index Transducer, A7P1-L	A2P2-H
$\overline{UP}$	$\overline{Upper\ Index\ Pulse}$	A2P2-2	A1P2-B
URG	Unselected Read Gate	A2P2-K	A1P2-K*, A4P2-K
$\overline{USS}$	$\overline{Upper\ Surface\ Select}$	A2P1-N	A4P1-12, A5P1-13
$\overline{US0}$	$\overline{Unit\ Select\ 0}$	UNIT SELECT switch (S3), A7P1-5	A2P2-A
US1	Unit Select 1	UNIT SELECT switch (S3), A7P1-6	A2P2-1
$\overline{US2}$	$\overline{Unit\ Select\ 2}$	UNIT SELECT switch (S3), A7P1-8	A2P1-17
UWG	Unselected Write Gate	A2P2-9	A1P2-9*, A4P2-9
WDA	Write Data A	A4P1-7	A6P1-4
WDB	Write Data B	A4P1-8	A6P1-D
WEN	Write Enable	A4P1-H	A6P1-E

* Servo Formatter PCA.



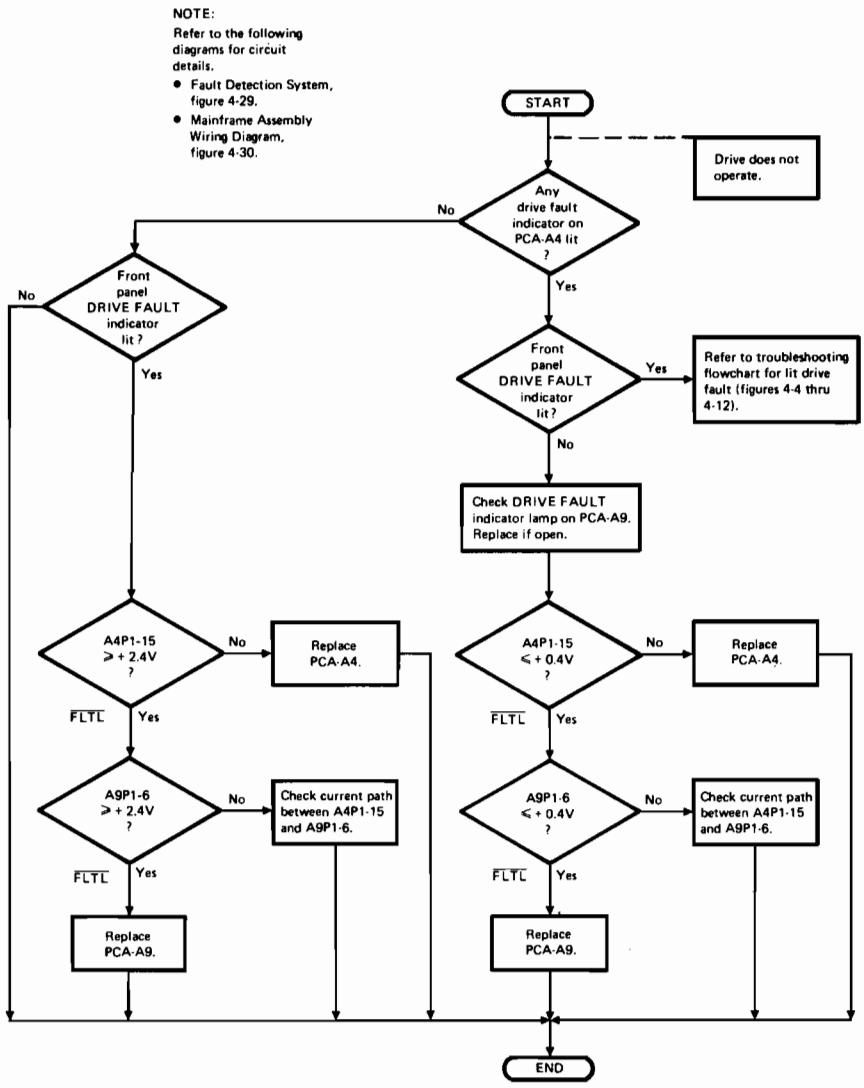
7300-61A

Figure 4-1. Power-Up Troubleshooting Flowchart



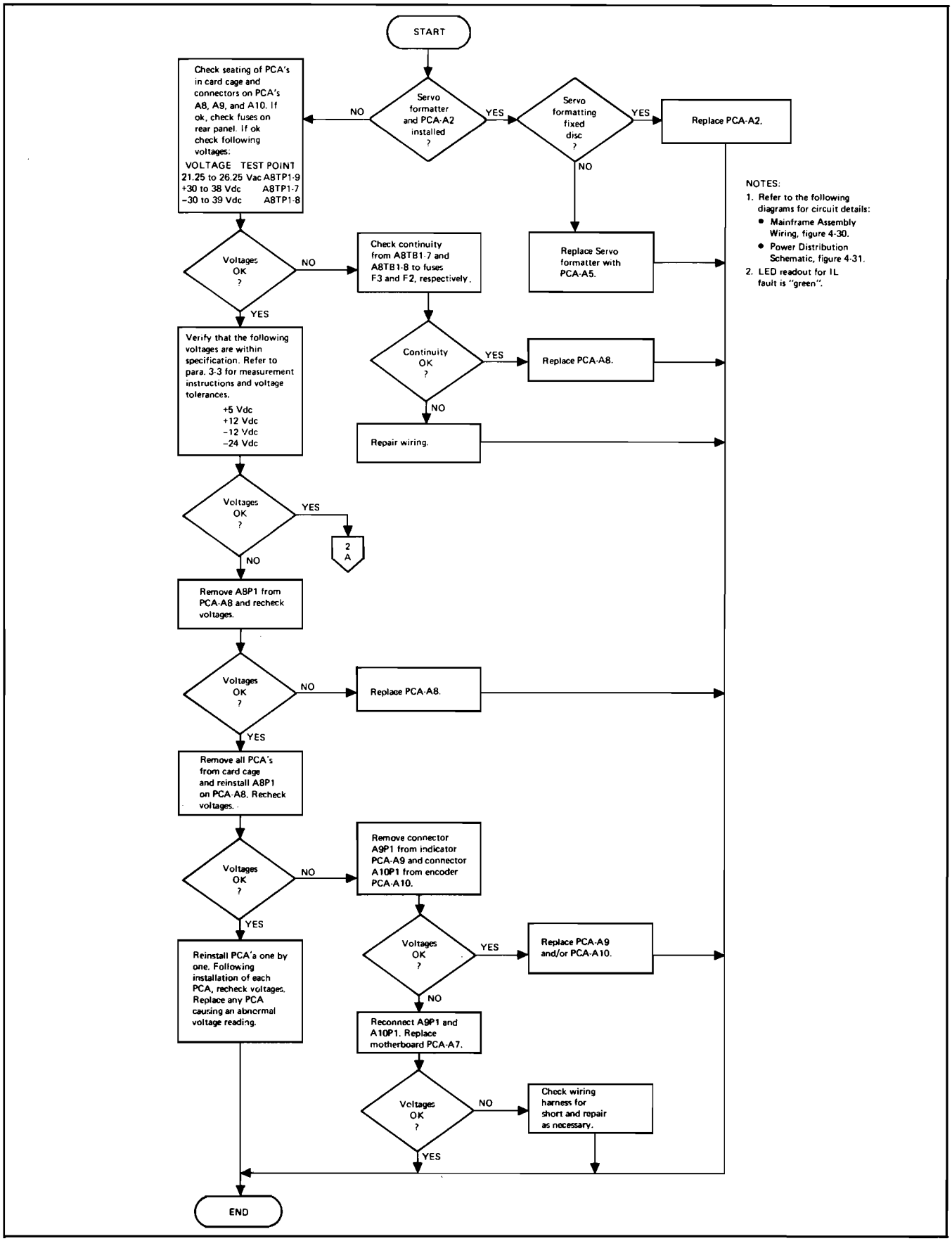
7300-62A

Figure 4-2. Blower Troubleshooting Flowchart



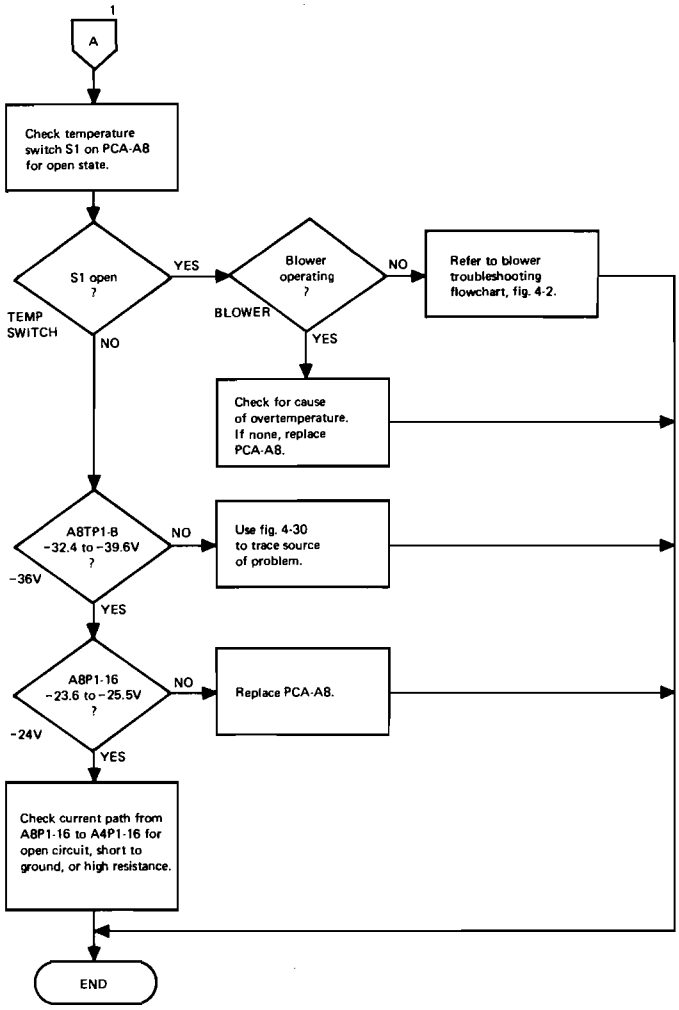
7300-63B

Figure 4-3. DRIVE FAULT Indicator Troubleshooting Flowchart



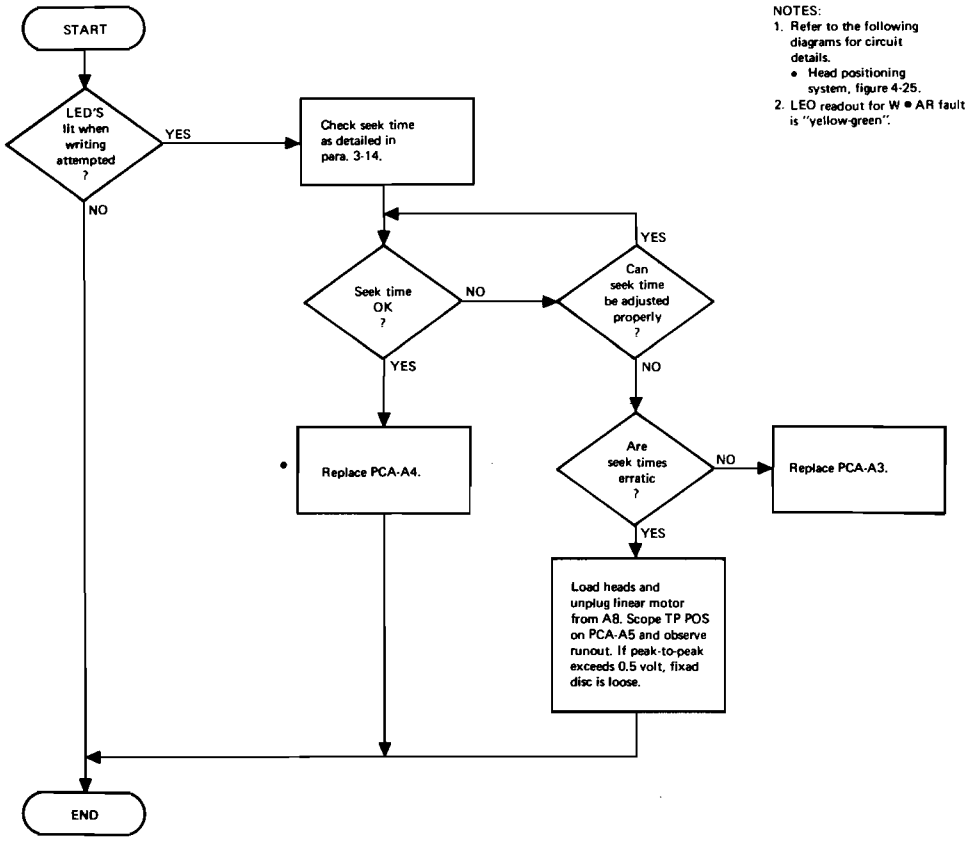
7300-64(1)D

Figure 4-4. IL Drive Fault Indicator Troubleshooting Flowchart (Sheet 1 of 2)



7300-64(2)A

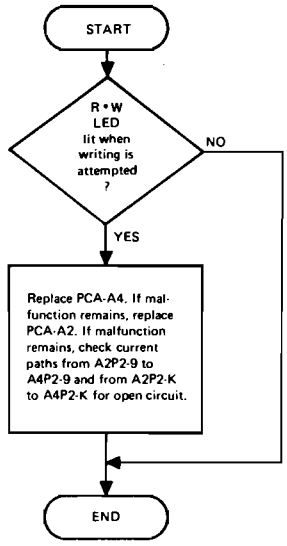
Figure 4-4. IL Drive Fault Indicator Troubleshooting Flowchart (Sheet 2 of 2)



7300-85A

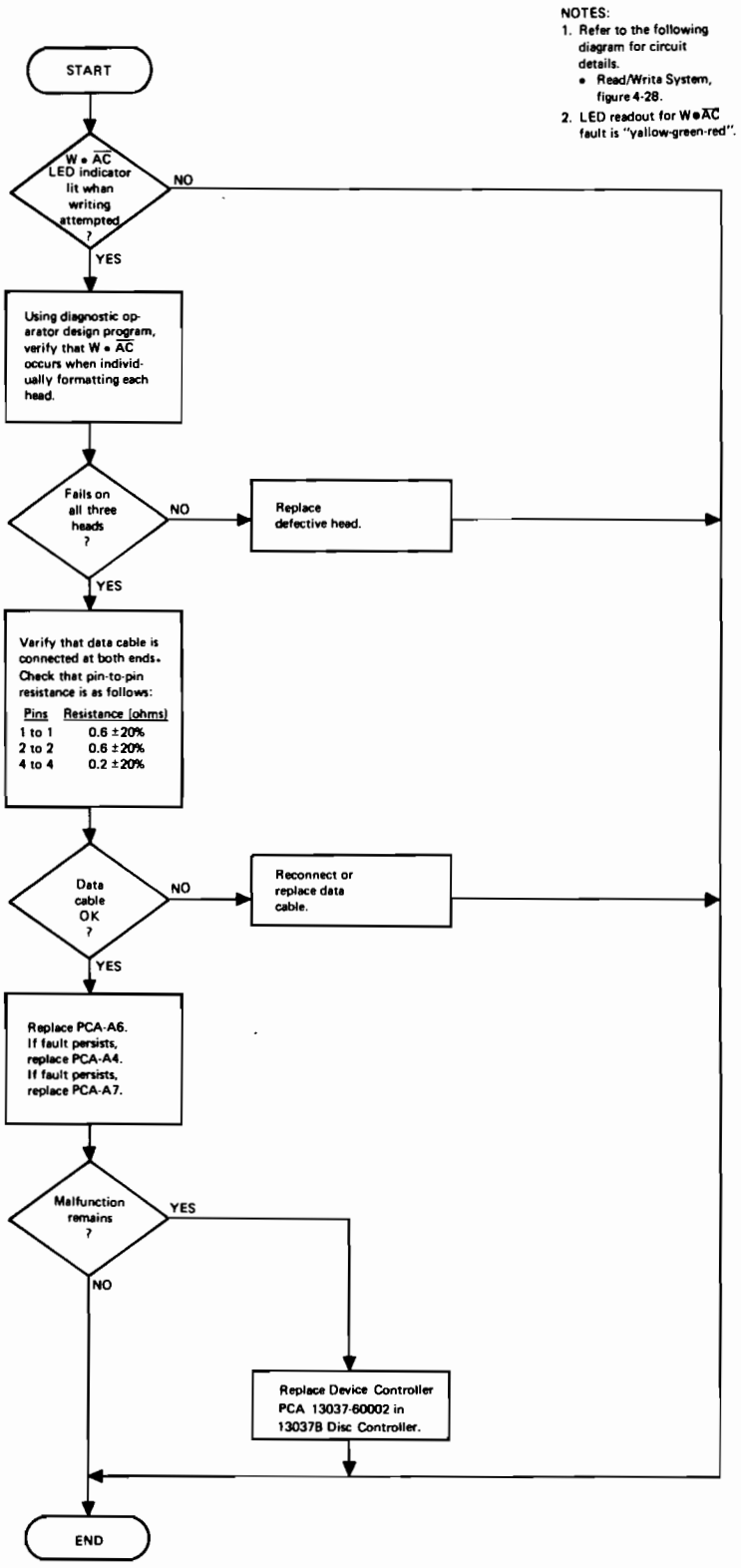
Figure 4-5. W • $\overline{AR}$ Drive Fault Indicator Troubleshooting Flowchart

NOTES:
1. Refer to the following diagram for circuit details.
   - Sector Sensing System, figure 4-27.
2. LED readout for R•W fault is "green-red".



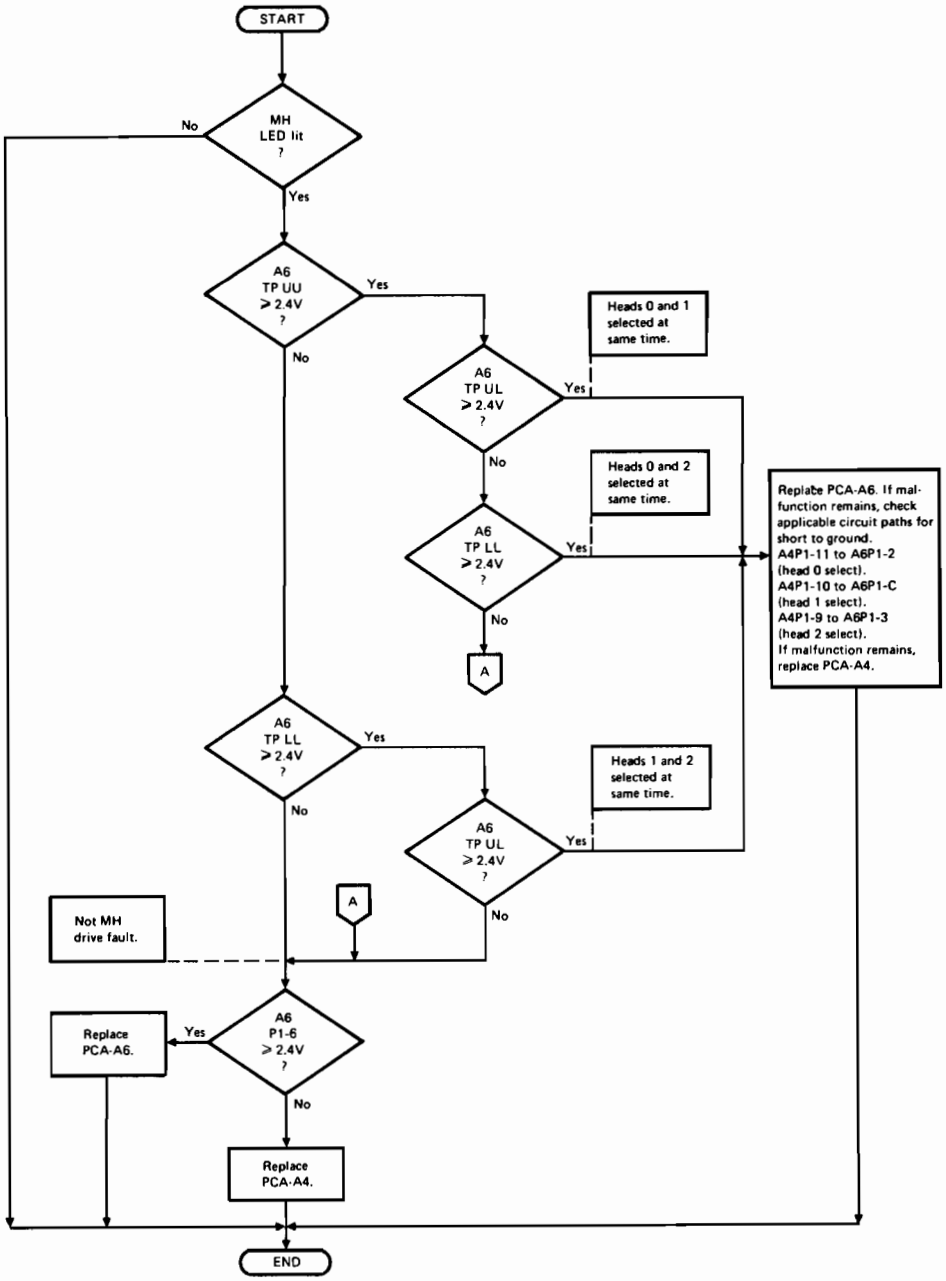
7300-66B

Figure 4-6. R • W Drive Fault Indicator Troubleshooting Flowchart



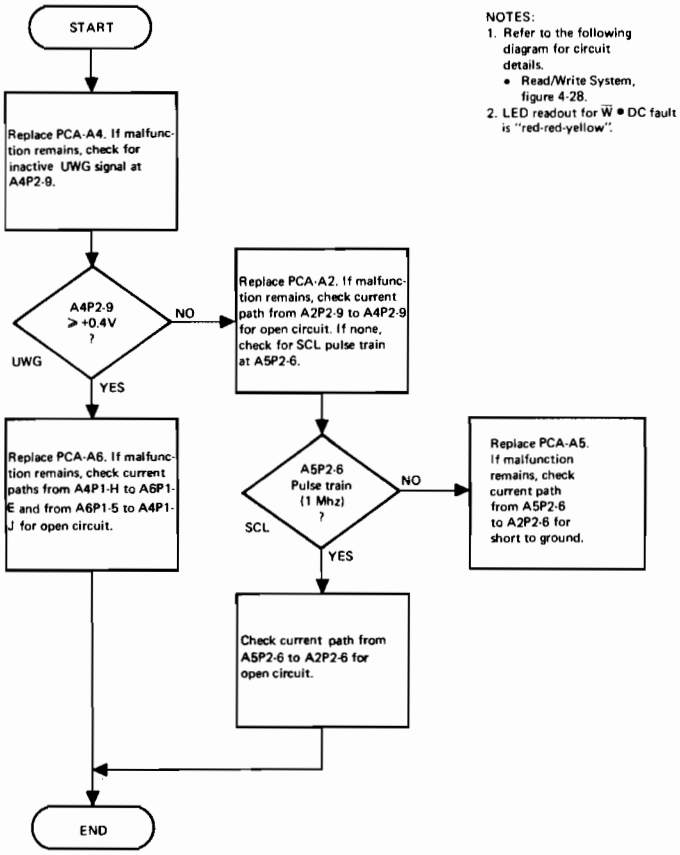
7300-67B

Figure 4-7. W • $\overline{AC}$ Drive Fault Indicator Troubleshooting Flowchart



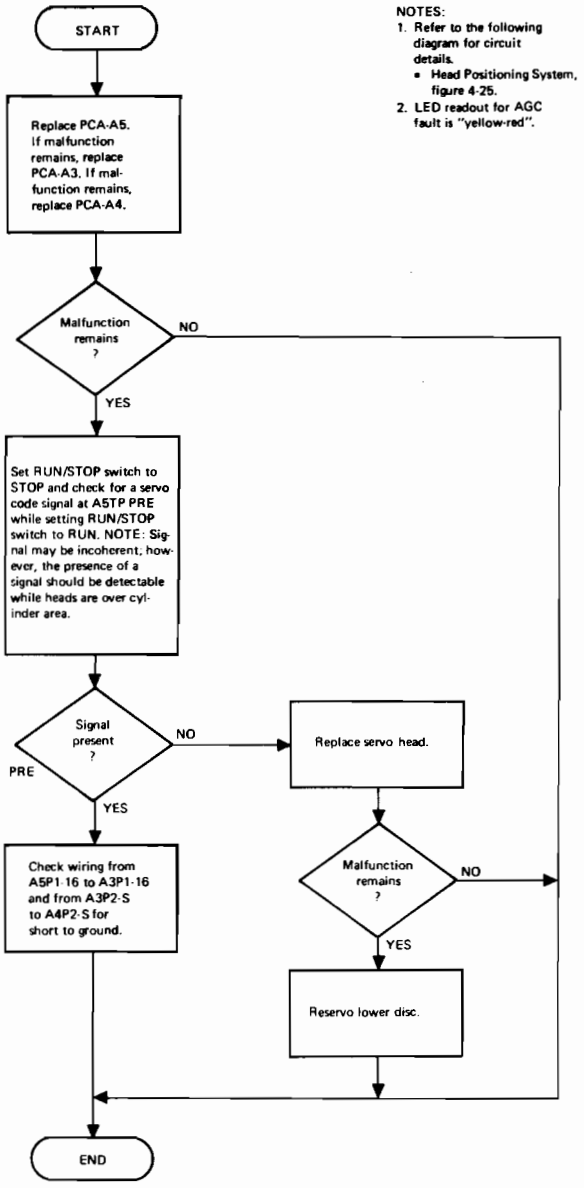
7300-68B

Figure 4-8. MH Drive Fault Indicator Troubleshooting Flowchart



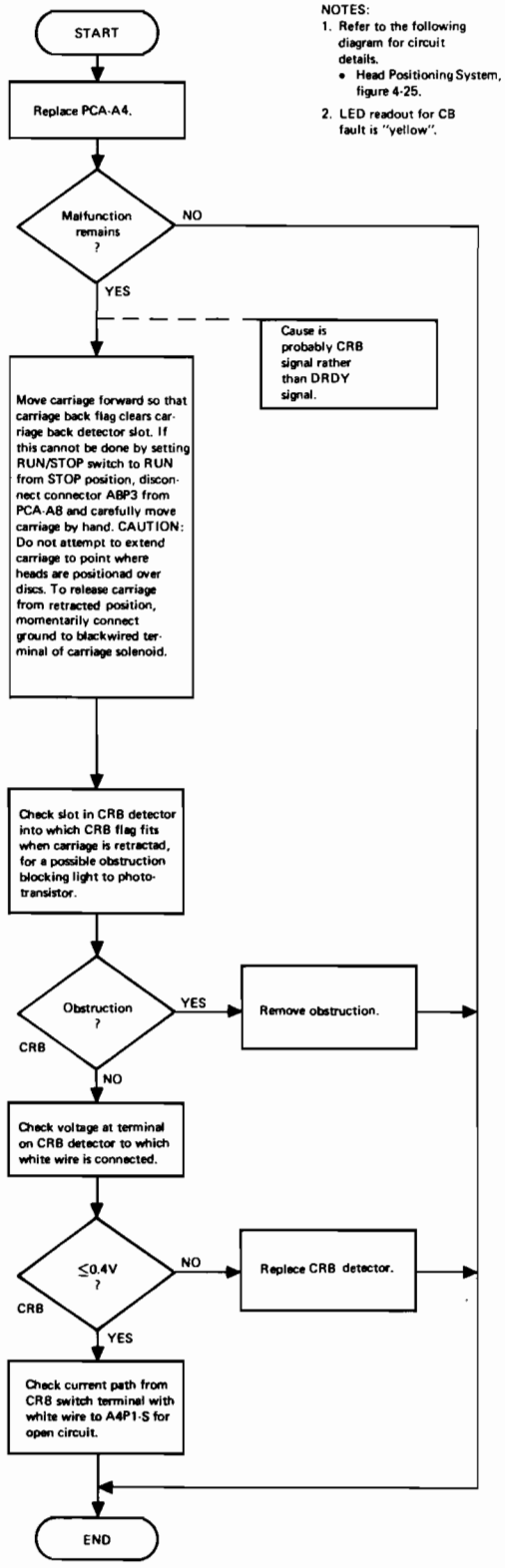
7300-89A

Figure 4-9. $\overline{W}$ • DC Drive Fault Indicator Troubleshooting Flowchart



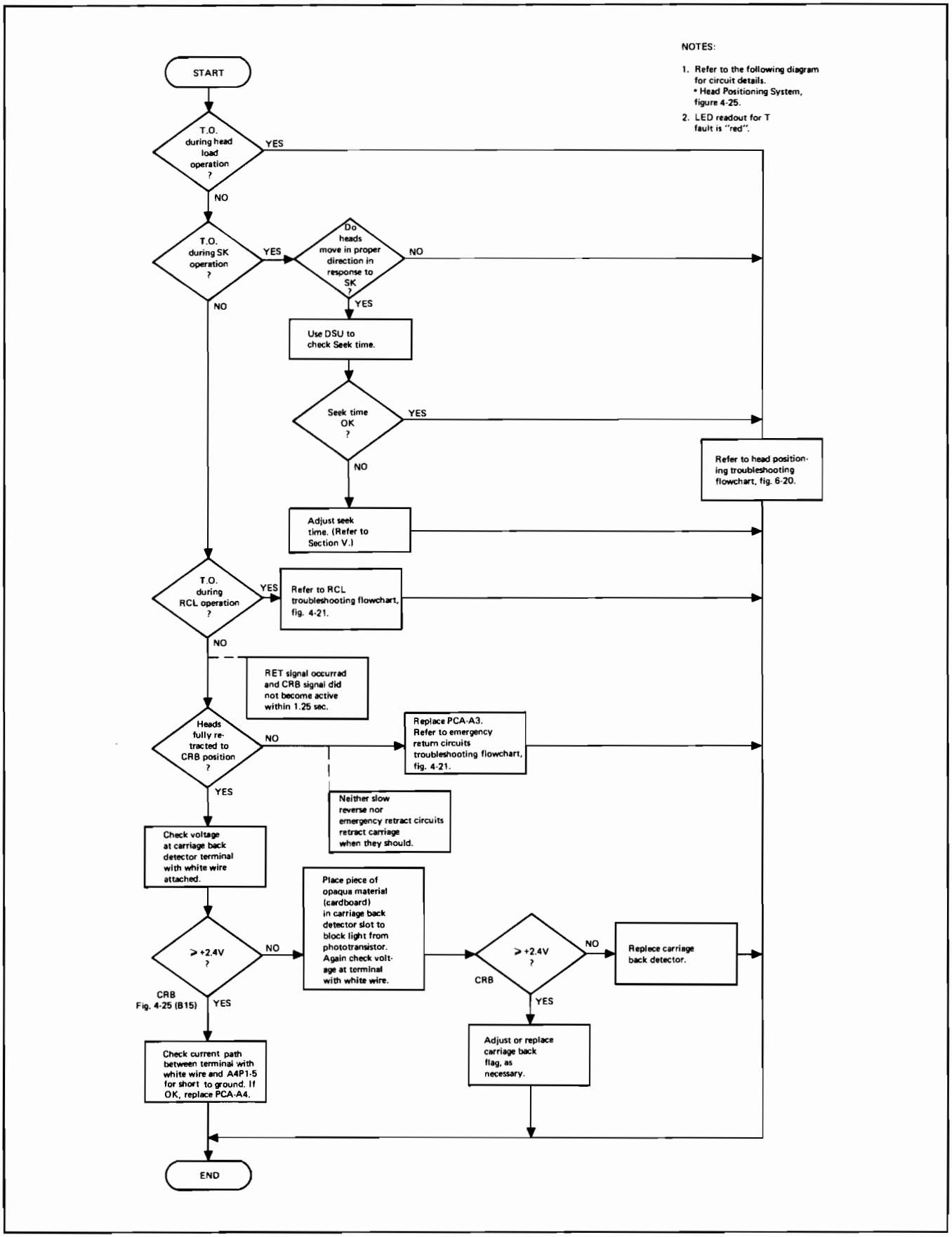
7300-70A

Figure 4-10. AGC Drive Fault Indicator Troubleshooting Flowchart



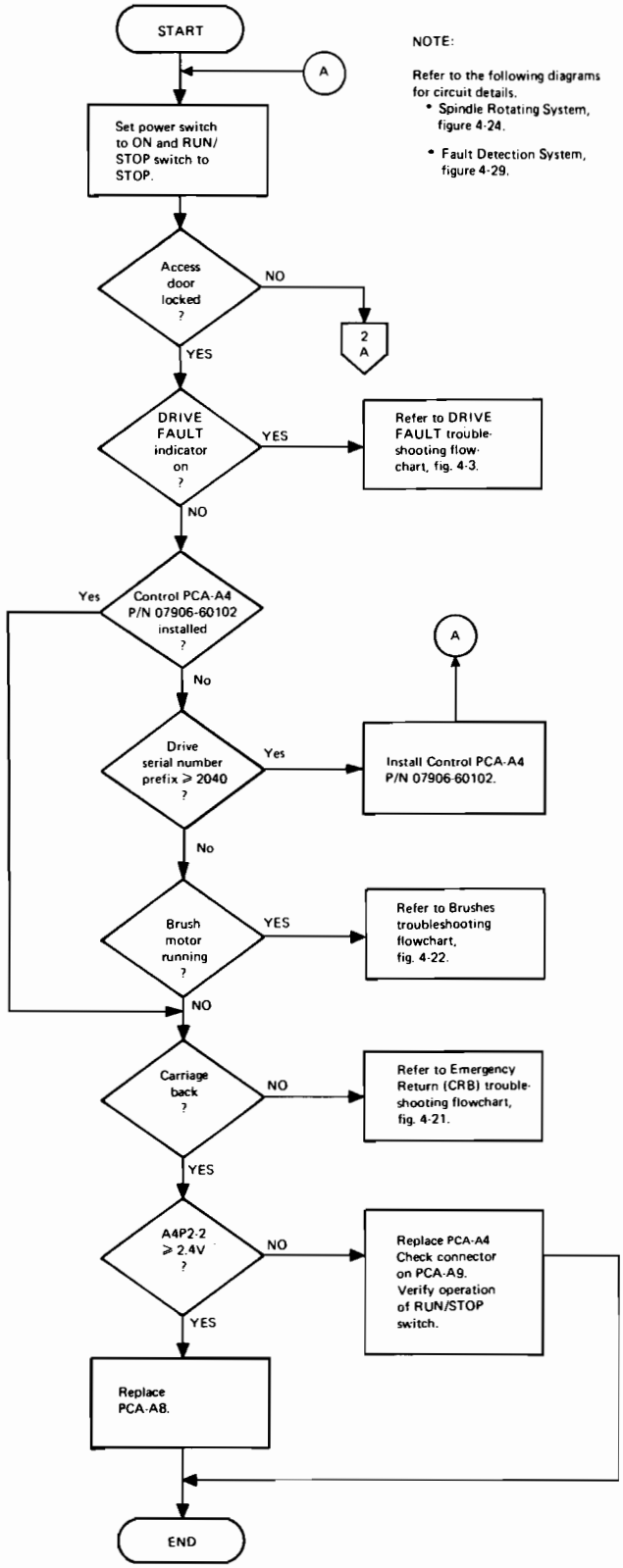
7300-71A

Figure 4-11. CB Drive Fault Indicator Troubleshooting Flowchart



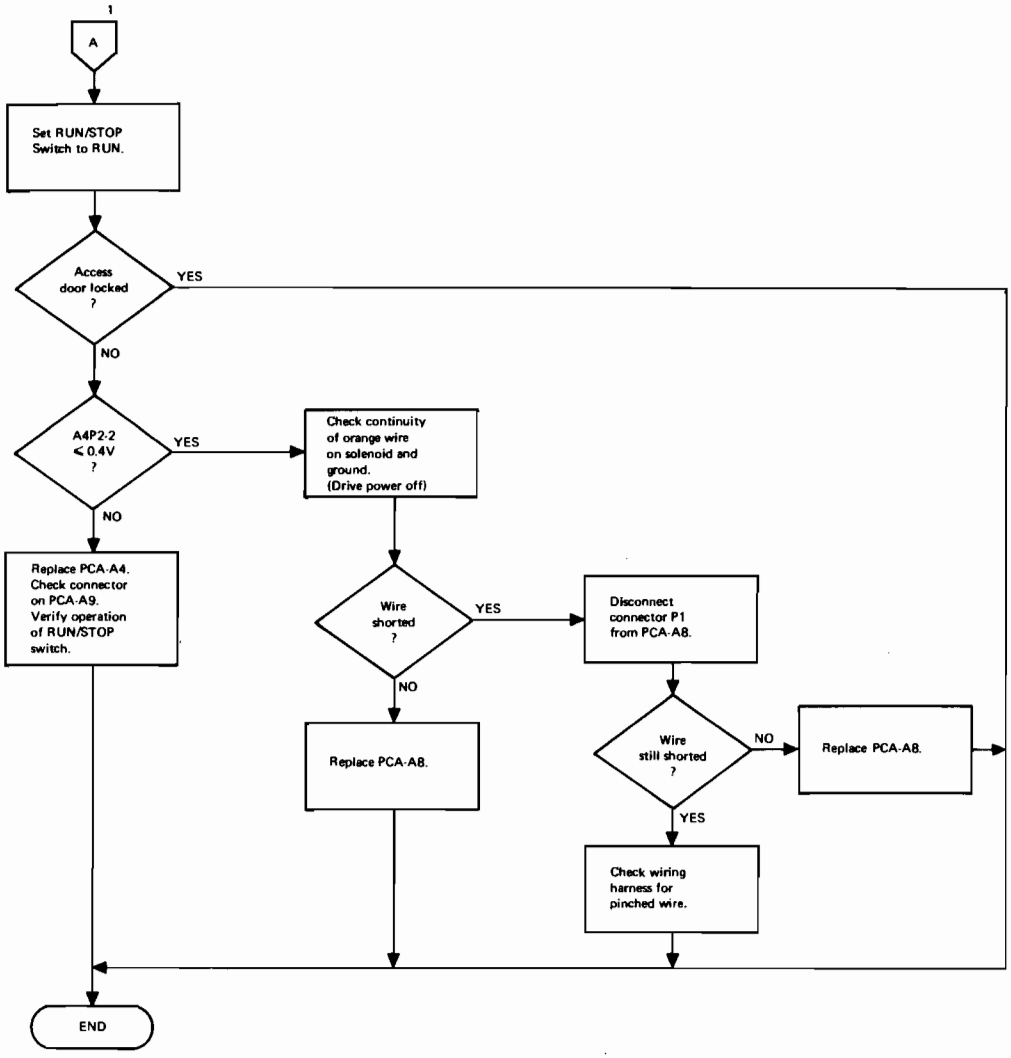
7300-72A

Figure 4-12. T Drive Fault Indicator Troubleshooting Flowchart



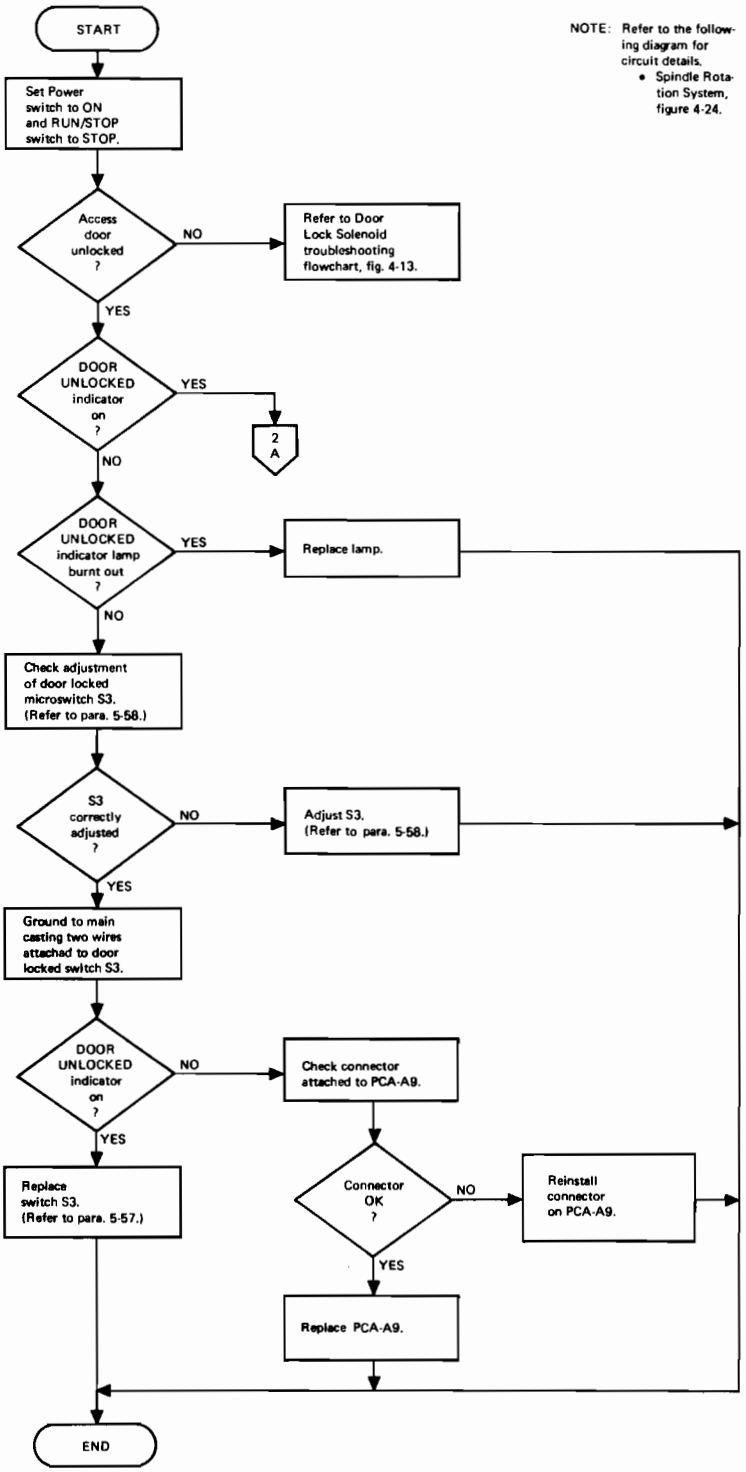
7300-73(1)A

Figure 4-13. Door Lock Solenoid Troubleshooting Flowchart (Sheet 1 of 2)



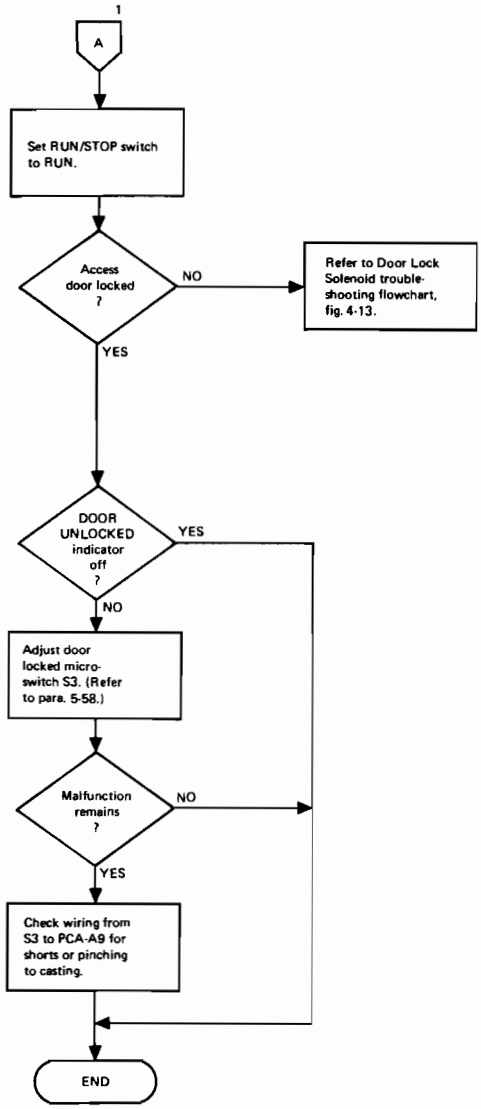
7300-73(2)

Figure 4-13. Door Lock Solenoid Troubleshooting Flowchart (Sheet 2 of 2)



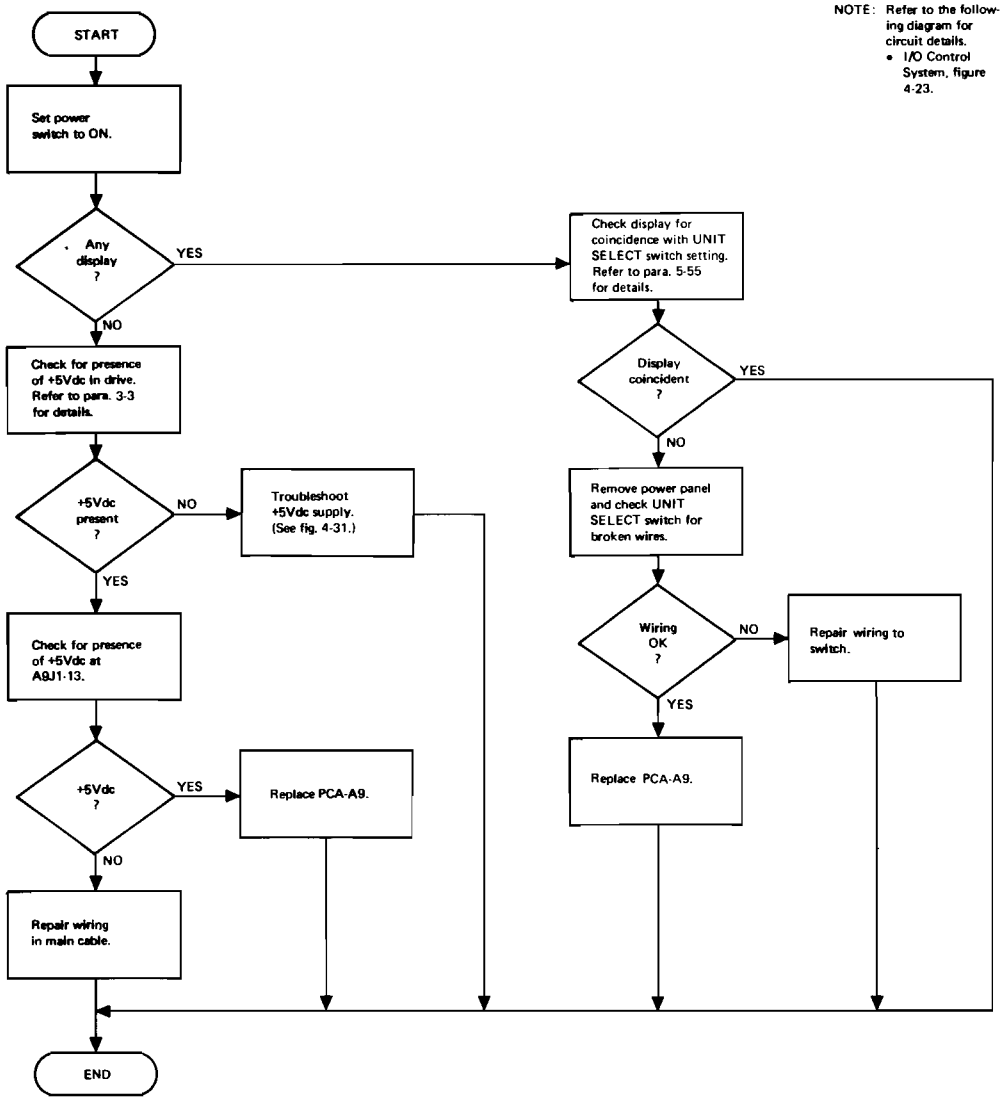
7300-74(1)A

Figure 4-14. DOOR UNLOCKED Indicator Troubleshooting Flowchart (Sheet 1 of 2)



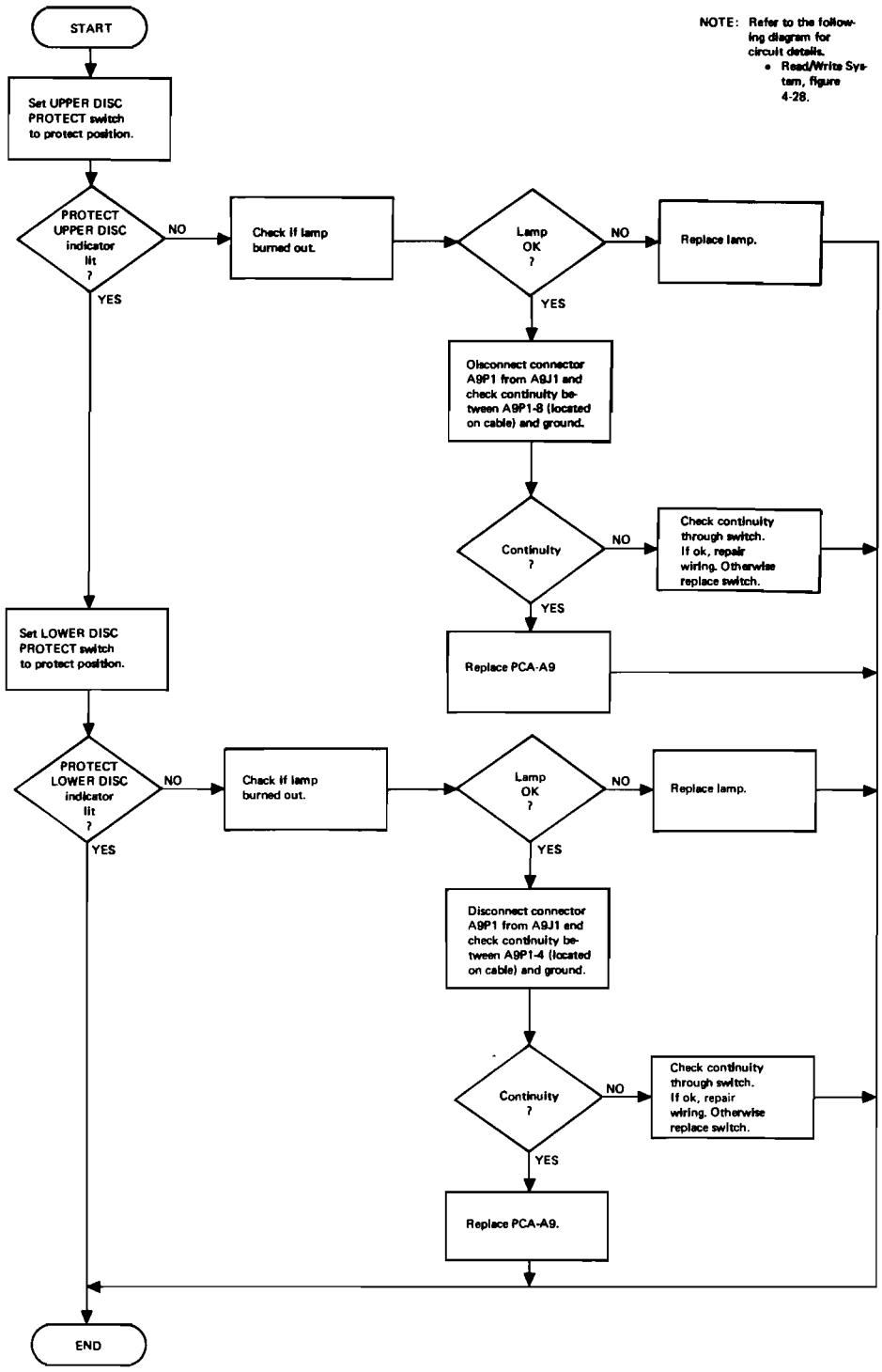
7300-74(2)A

Figure 4-14. DOOR UNLOCKED Indicator Troubleshooting Flowchart (Sheet 2 of 2)



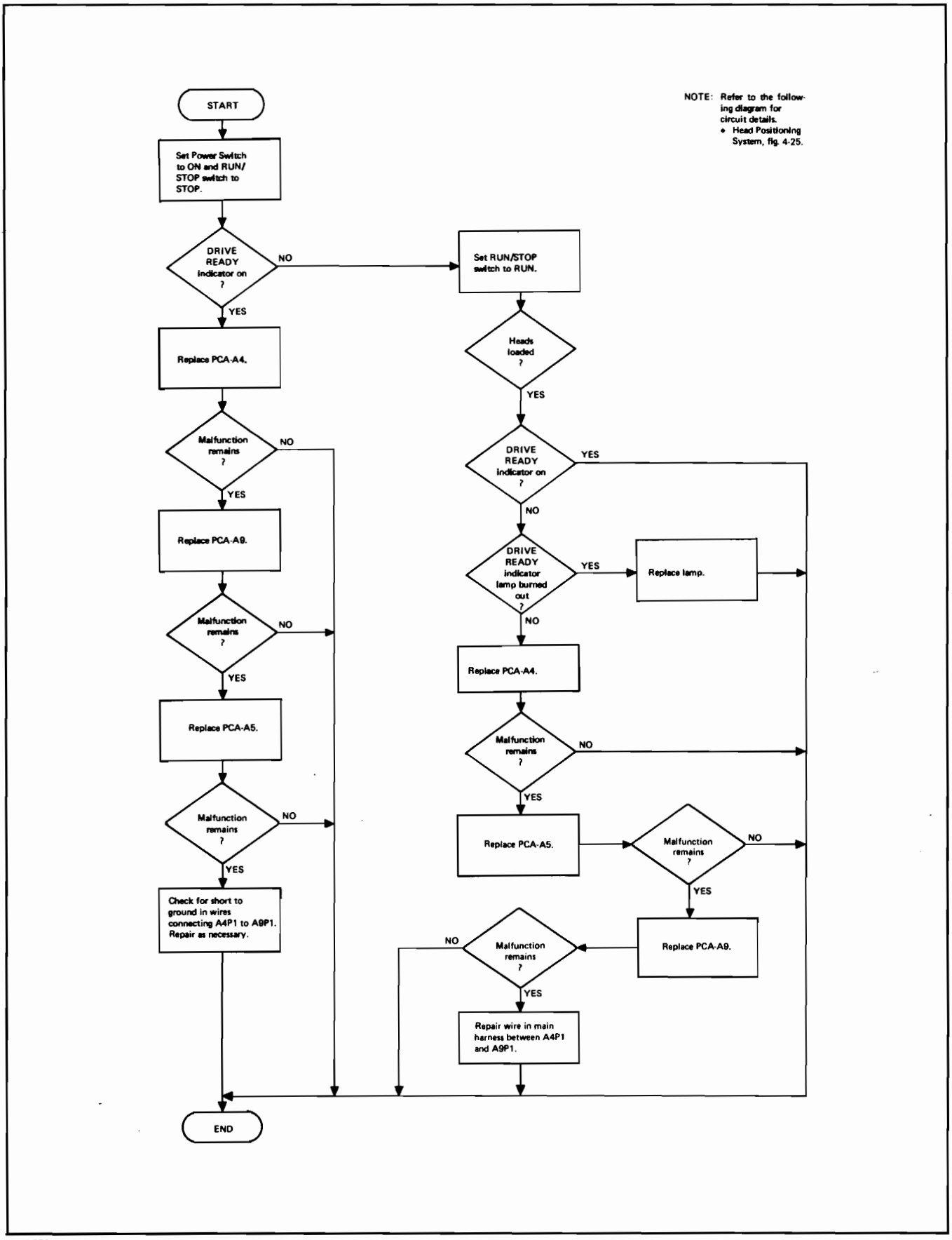
7300-75A

Figure 4-15. Unit Select Indicator Troubleshooting Flowchart



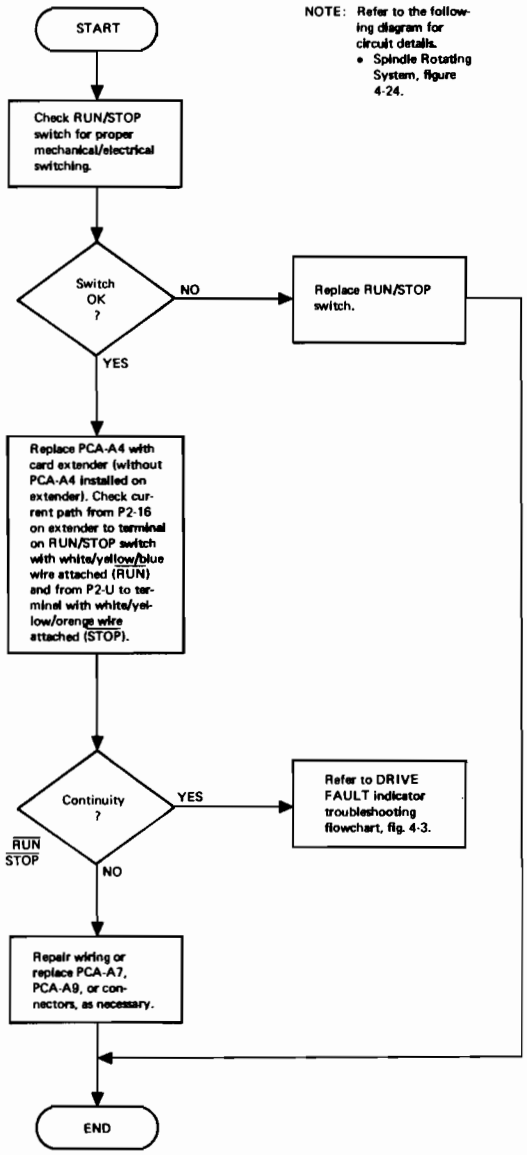
7300-76A

Figure 4-16. PROTECT DISC Indicator Troubleshooting Flowchart



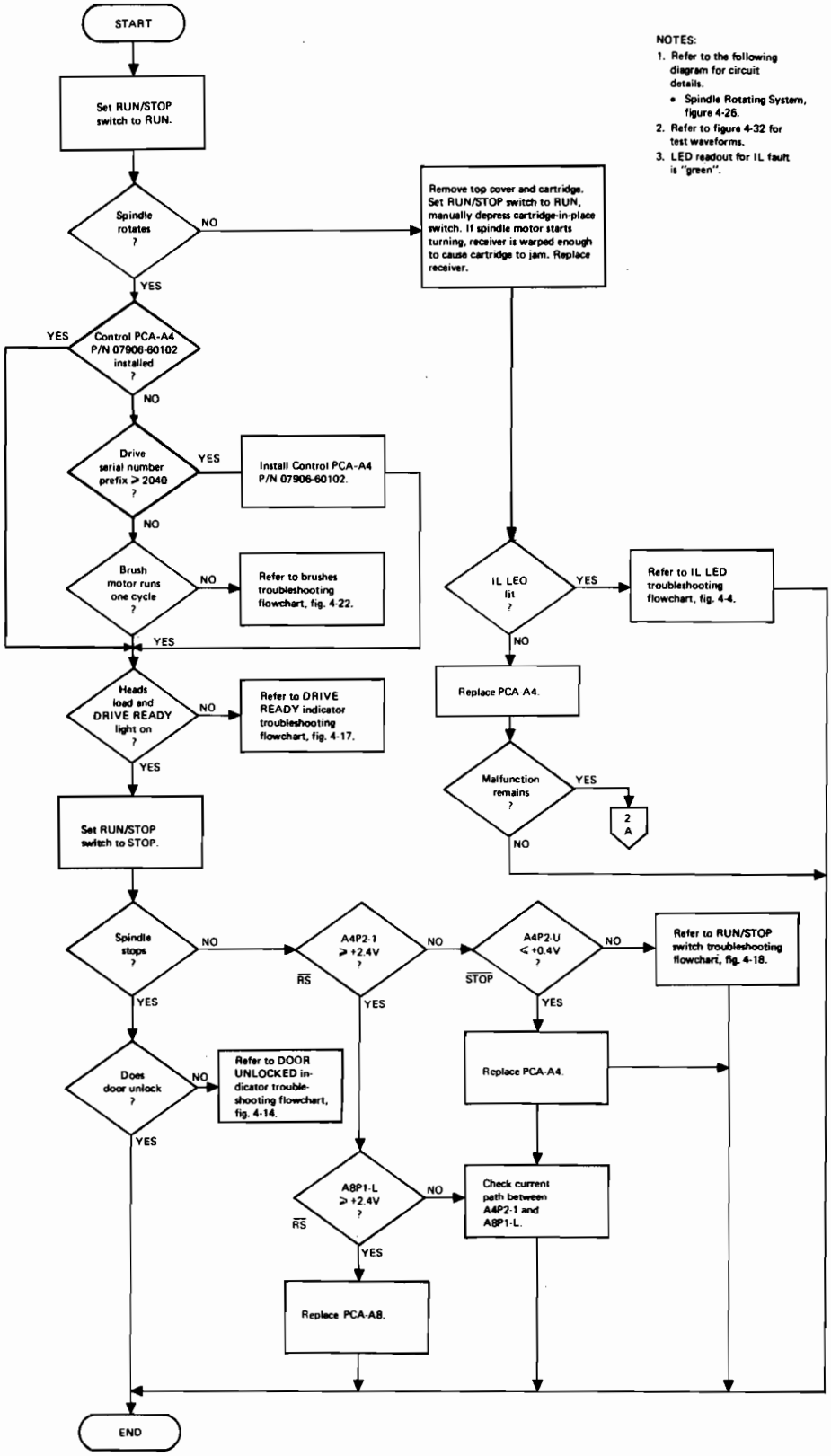
7300-77A

Figure 4-17. DRIVE READY Indicator Troubleshooting Flowchart



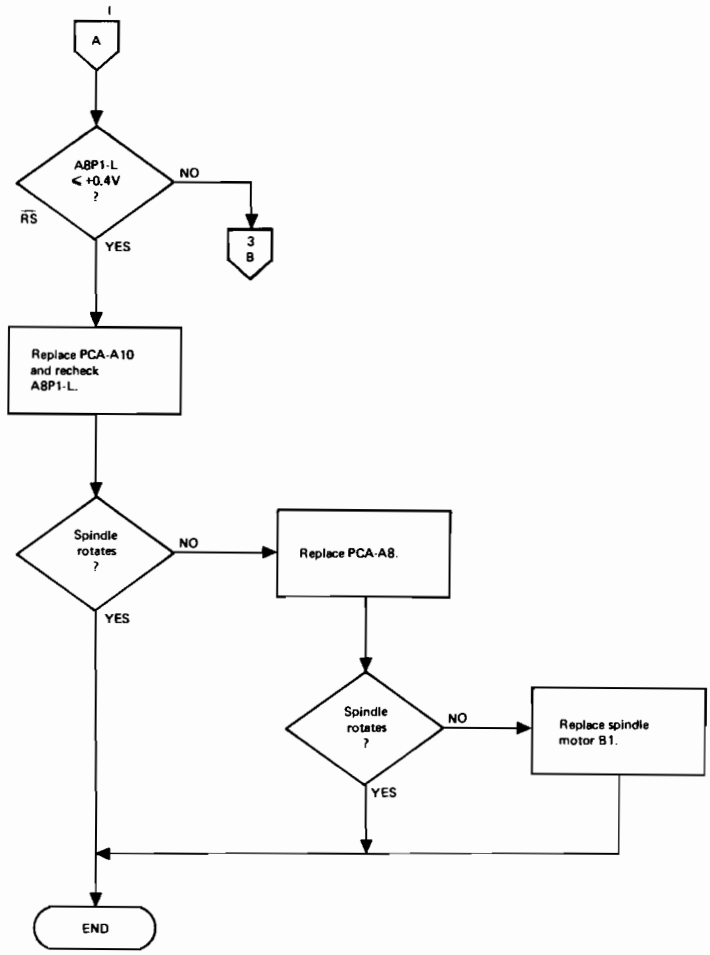
7300-78 A

Figure 4-18. RUN/STOP Switch Troubleshooting Flowchart



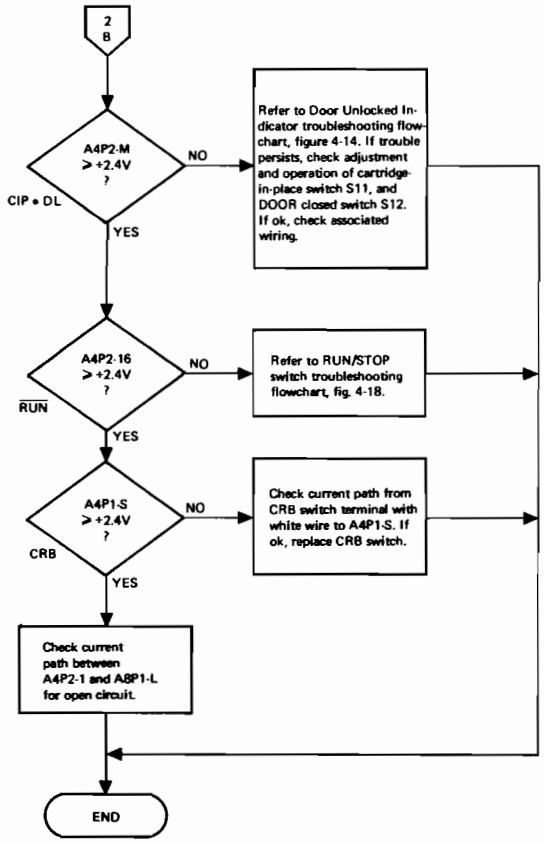
7300-79(1)B

Figure 4-19. Spindle Rotating Troubleshooting Flowchart (Sheet 1 of 3)



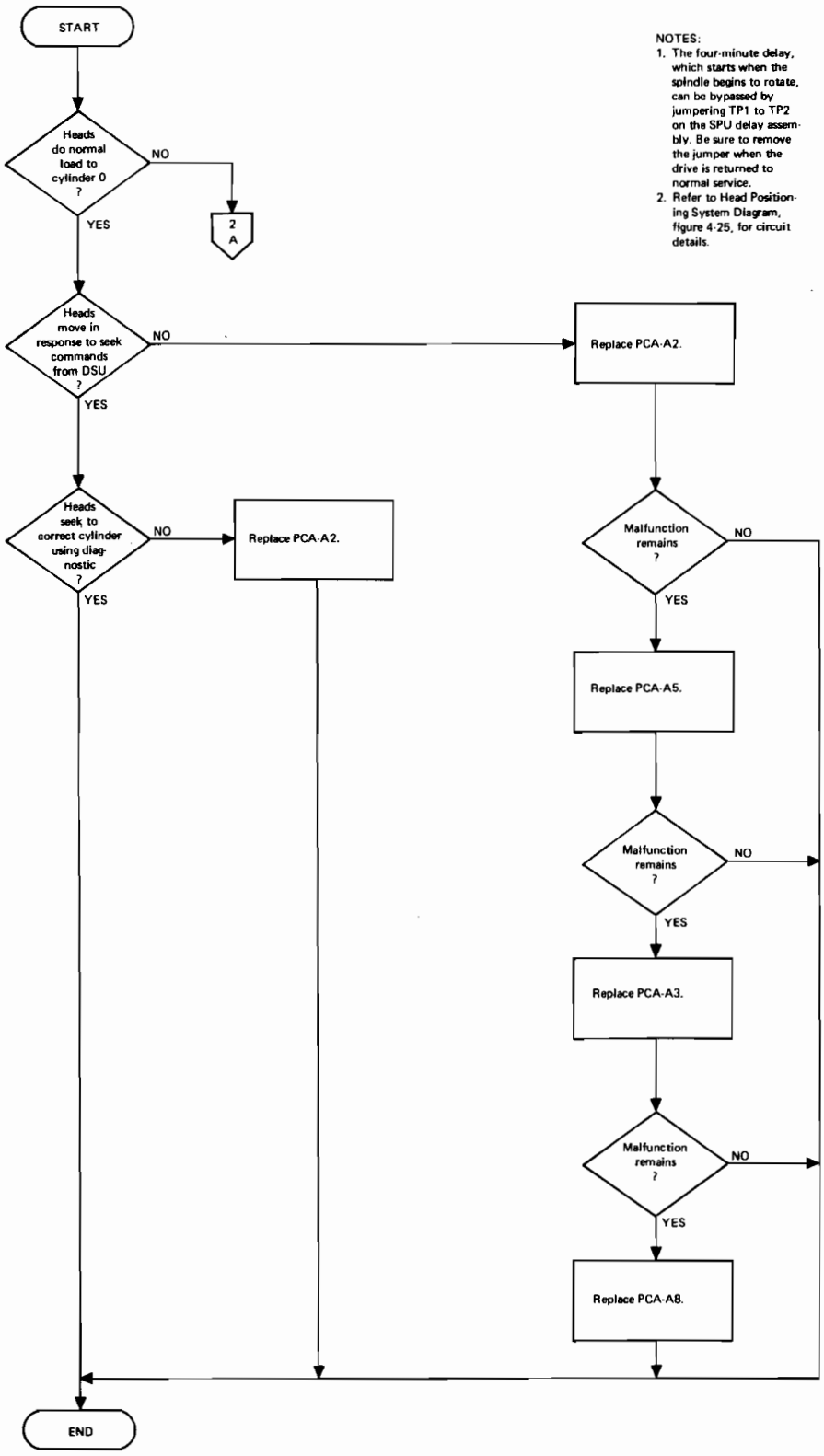
7300-79(2)A

Figure 4-19. Spindle Rotating Troubleshooting Flowchart (Sheet 2 of 3)



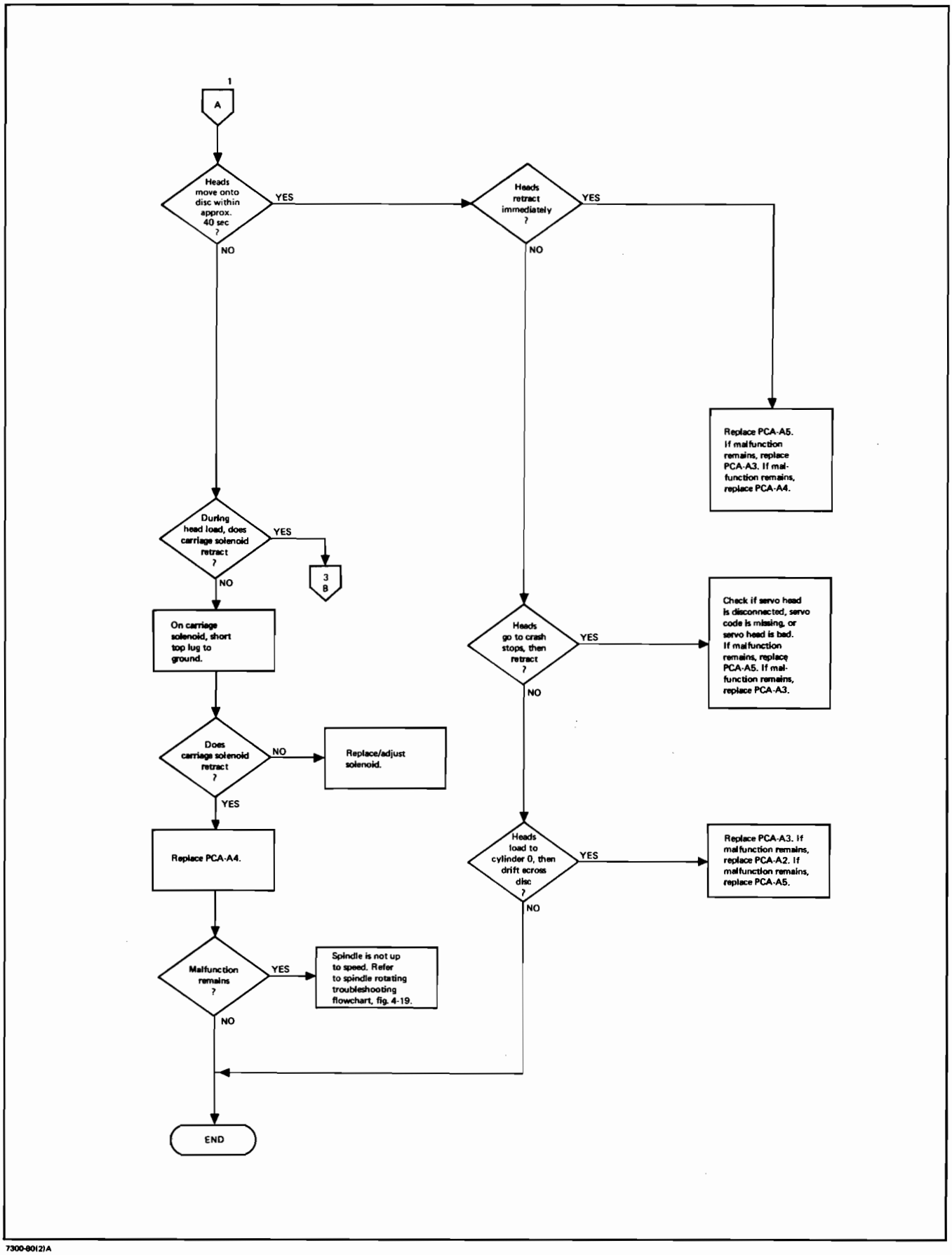
7300-79(31)A

Figure 4-19. Spindle Rotating Troubleshooting Flowchart (Sheet 3 of 3)



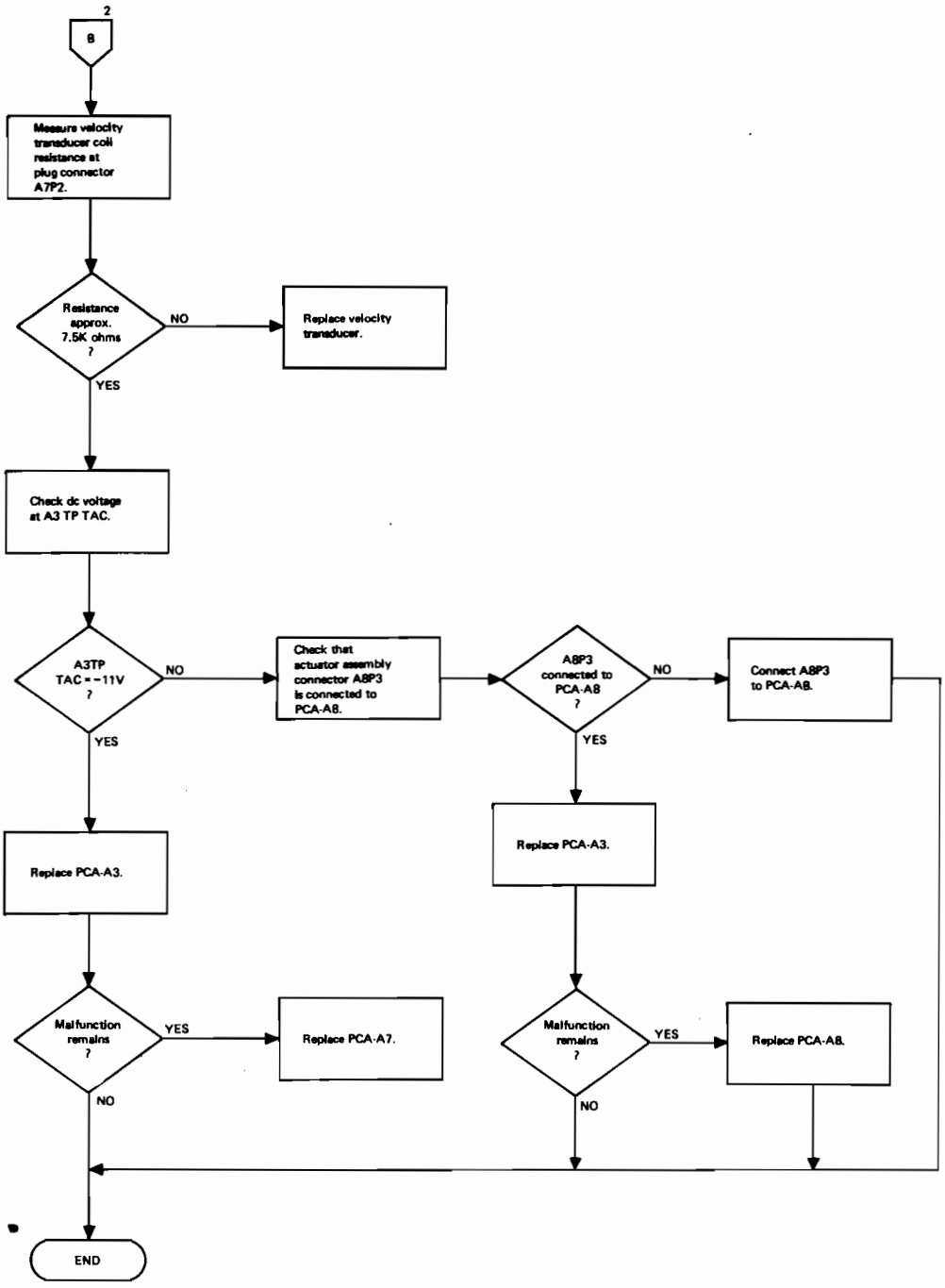
7300-80(1)A

Figure 4-20. Head Positioning Troubleshooting Flowchart (Sheet 1 of 3)



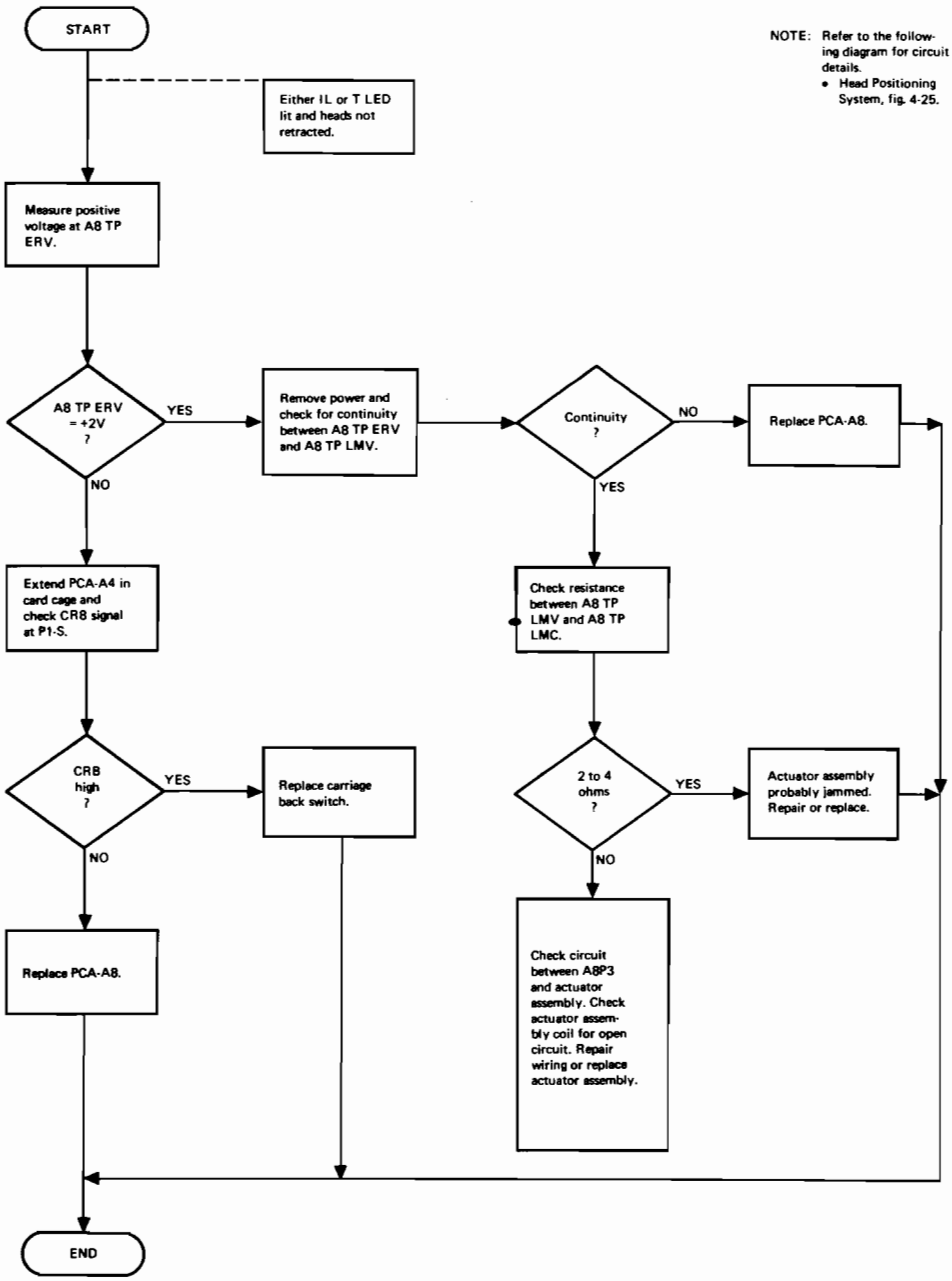
7300-80(2)A

Figure 4-20. Head Positioning Troubleshooting Flowchart (Sheet 2 of 3)



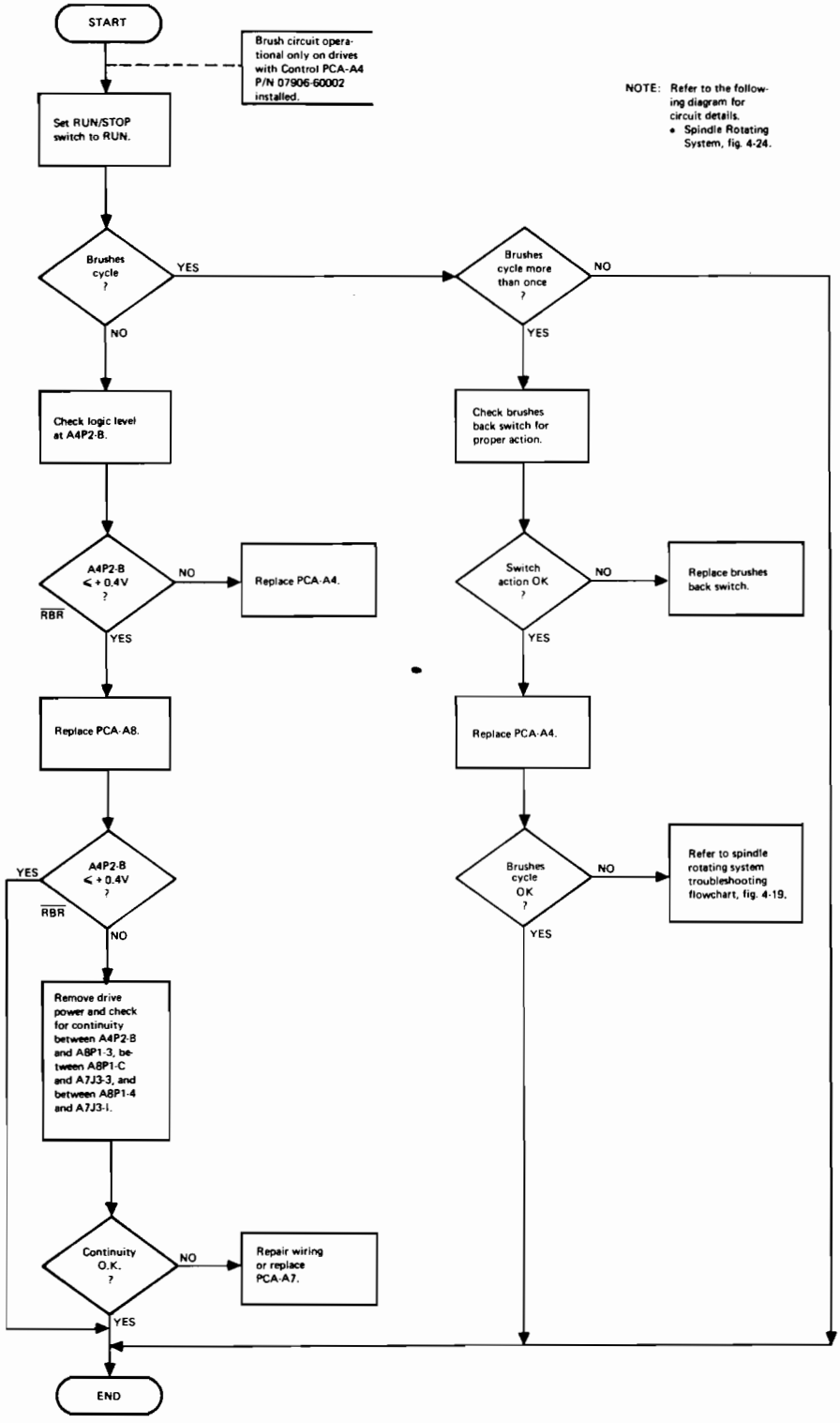
7300-80(3)A

Figure 4-20. Head Positioning Troubleshooting Flowchart (Sheet 3 of 3)



7300-81A

Figure 4-21. Emergency Return (CRB) Troubleshooting Flowchart



7300-82 B

Figure 4-22. Brushes Troubleshooting Flowchart

NOTES:
1. ALL D-TYPE FLIP-FLOPS ARE CLOCKED ON THE RISING EDGE OF THE CLOCK SIGNAL.
2. ABBREVIATIONS USED TO IDENTIFY SYSTEM FUNCTIONAL DIAGRAMS REPRESENT THE FOLLOWING FIGURES:
   SPDL — SPINDLE ROTATING SYSTEM, FIG. 4-24.
   HD POS — HEAD POSITIONING SYSTEM, FIG. 4-25.
   SCTR SEN — SECTOR SENSING SYSTEM, FIG. 4-27.
   R/W — READ/WRITE SYSTEM, FIG. 4-28.
   FLT — FAULT DETECTION SYSTEM, FIG. 4-29.

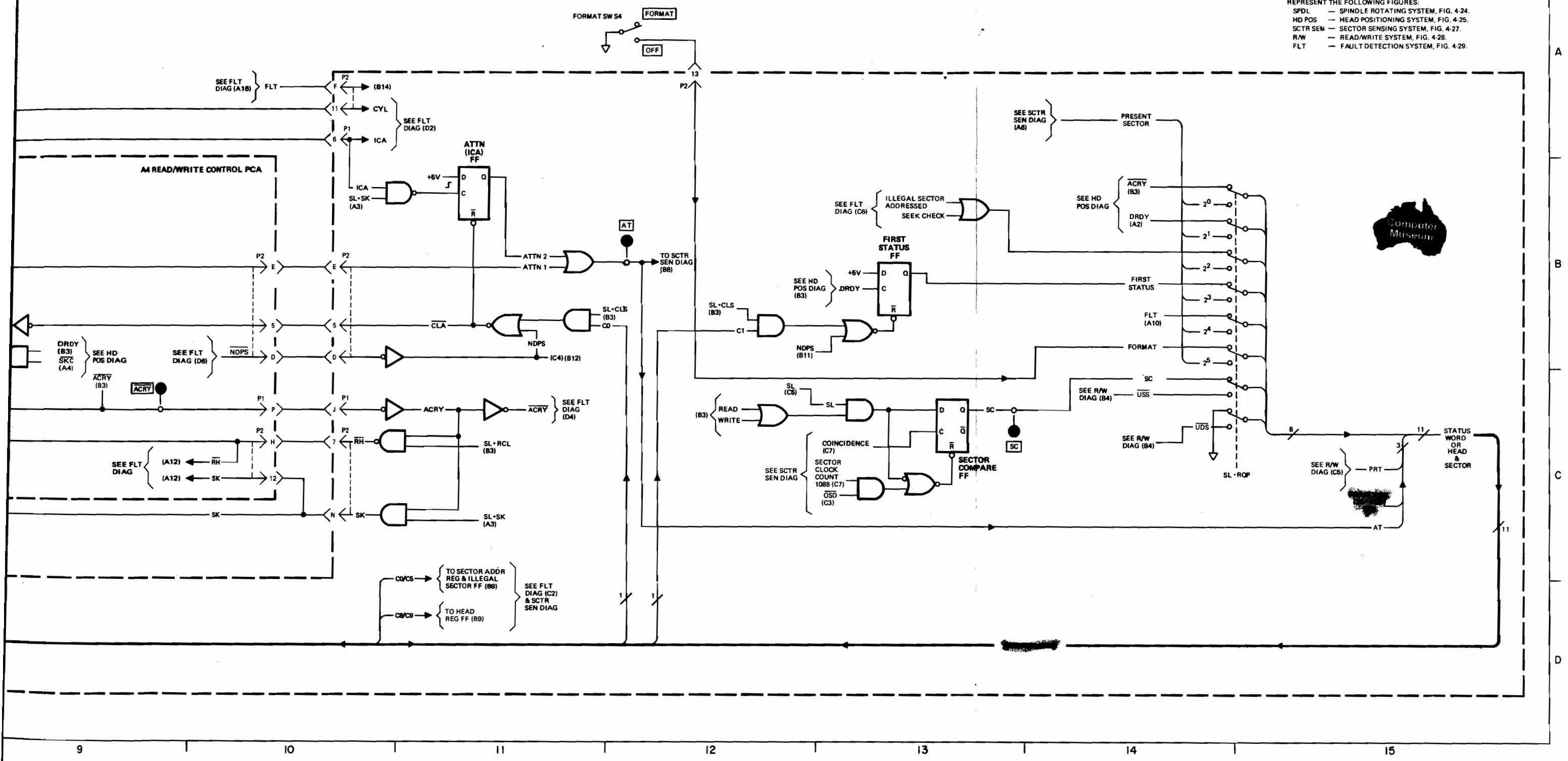
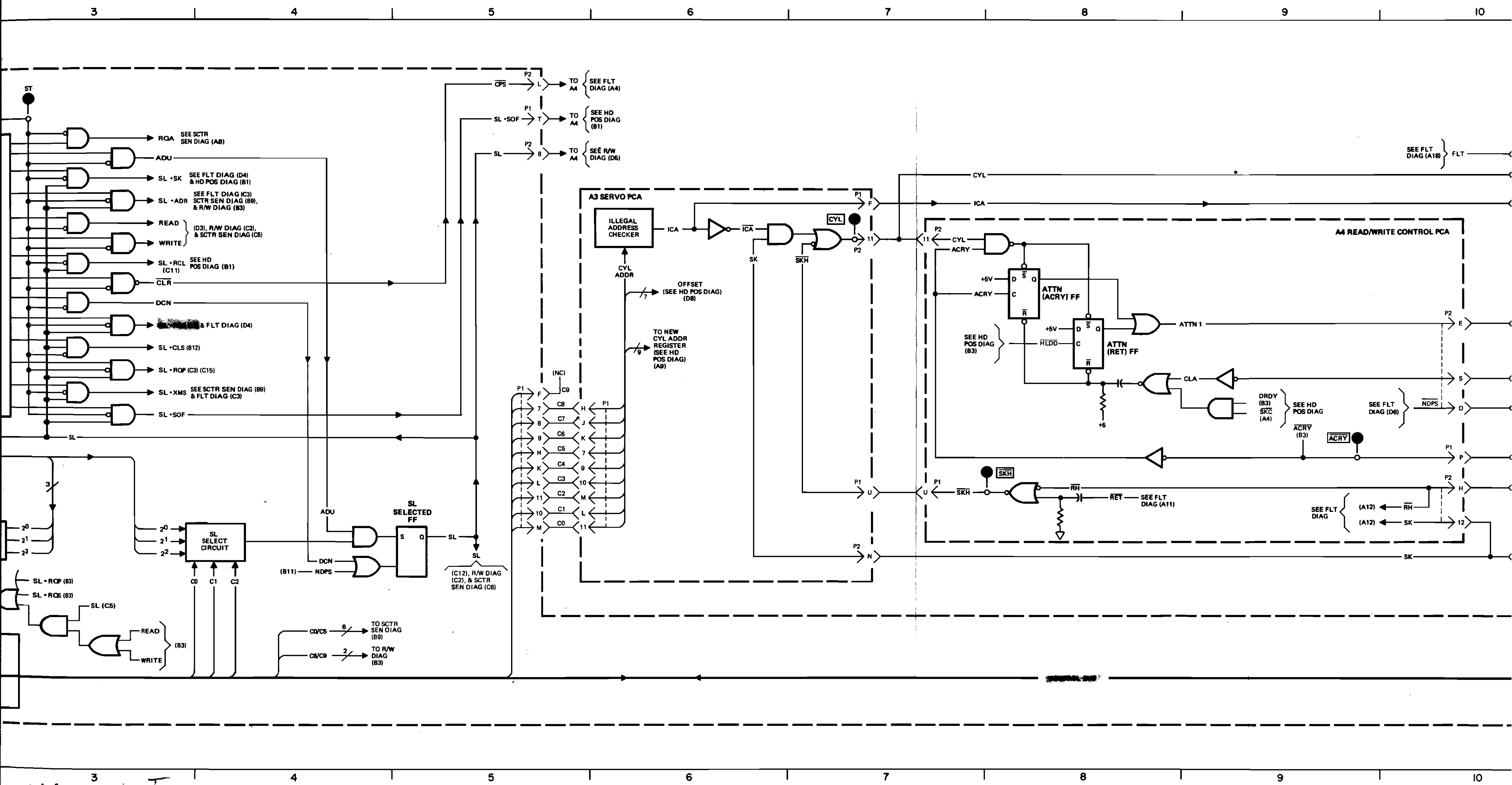
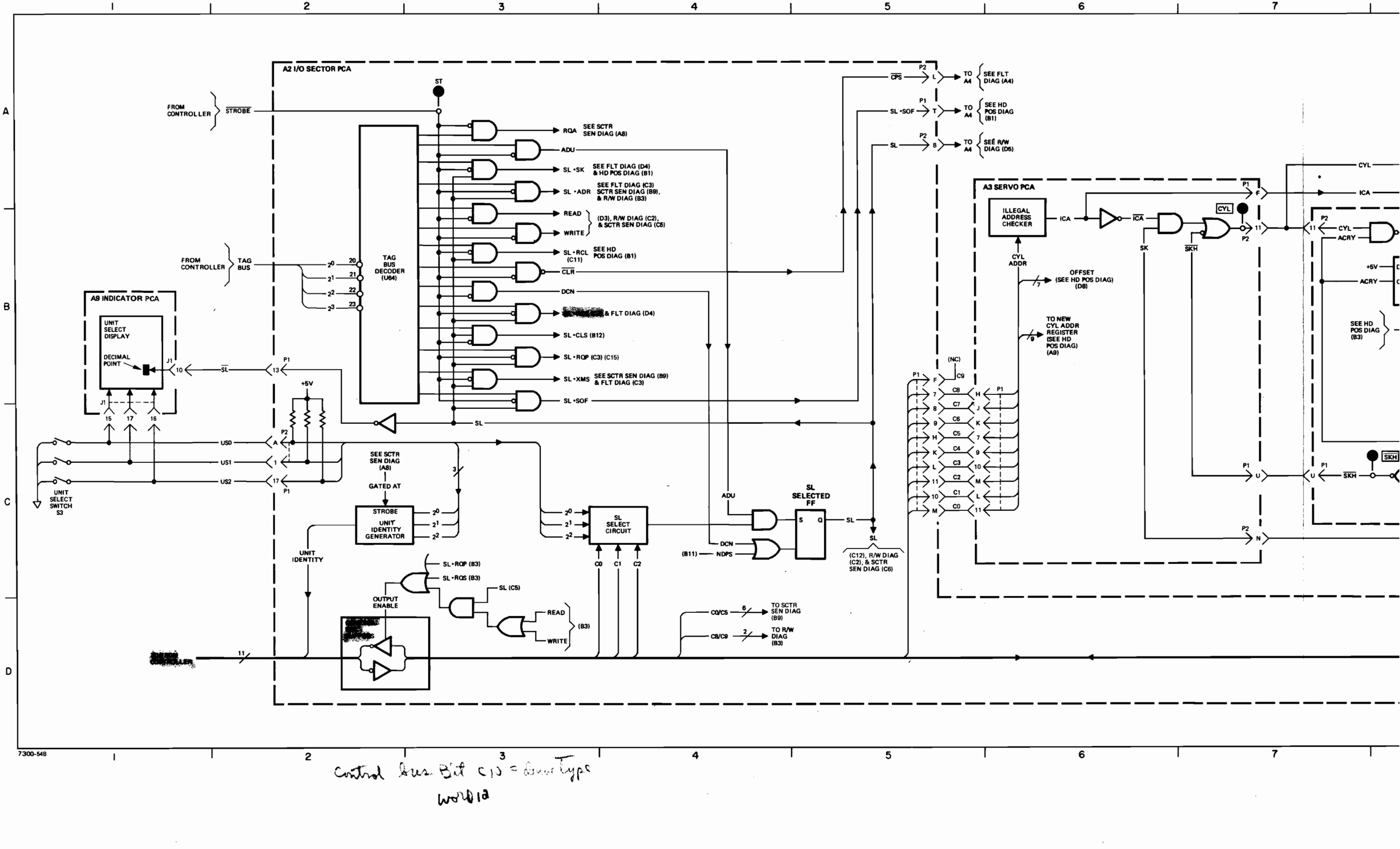


Figure 4-23. I/O Control System Functional Diagram



ST
RQA SEE SCTR SEN DIAG (A8)
ADU
SL • SK SEE FLT DIAG (D4) & HD POS DIAG (B1)
SL • ADR SEE FLT DIAG (C3) SCTR SEN DIAG (B9), & R/W DIAG (B3)
READ
WRITE
(D3), R/W DIAG (C2), & SCTR SEN DIAG (C5)
SL • RCL (C11) SEE HD POS DIAG (B1)
CLR
DCN
& FLT DIAG (D4)
SL • CLS (B12)
SL • RQP (C3) (C15)
SL • XMS SEE SCTR SEN DIAG (B9) & FLT DIAG (C3)
SL • SOF
SL
SL SELECT CIRCUIT
C0 C1 C2
SL • RQP (B3)
SL • RQS (B3)
SL (C5)
(B3)
(B11) NDPS
SL SELECTED FF
(C12), R/W DIAG (C2), & SCTR SEN DIAG (C6)
C0/C5 6 TO SCTR SEN DIAG (B9)
C8/C9 2 TO R/W DIAG (B3)
CPS
SL • SOF
TO A4 SEE FLT DIAG (A4)
TO A4 SEE HD POS DIAG (B1)
TO A4 SEE R/W DIAG (D6)
(NC)
A3 SERVO PCA
ILLEGAL ADDRESS CHECKER
CYL ADDR
ICA
OFFSET (SEE HD POS DIAG) (D8)
TO NEW CYL ADDR REGISTER (SEE HD POS DIAG) (A9)
SK
SKH
CYL
A4 READ/WRITE CONTROL PCA
ACRY
+5V
ATTN (ACRY) FF
ATTN (RET) FF
SEE HD POS DIAG (B3)
HLDD
ATTN 1
CLA
DRDY (B3)
SKC (A4)
SEE HD POS DIAG
ACRY (B3)
SEE FLT DIAG (D8)
NDPS
RH
RET SEE FLT DIAG (A11)
SEE FLT DIAG
(A12)
SEE FLT DIAG (A18)
FLT
P1 P2



7300-548

Control bus Bit C13 = Bus Type
word a

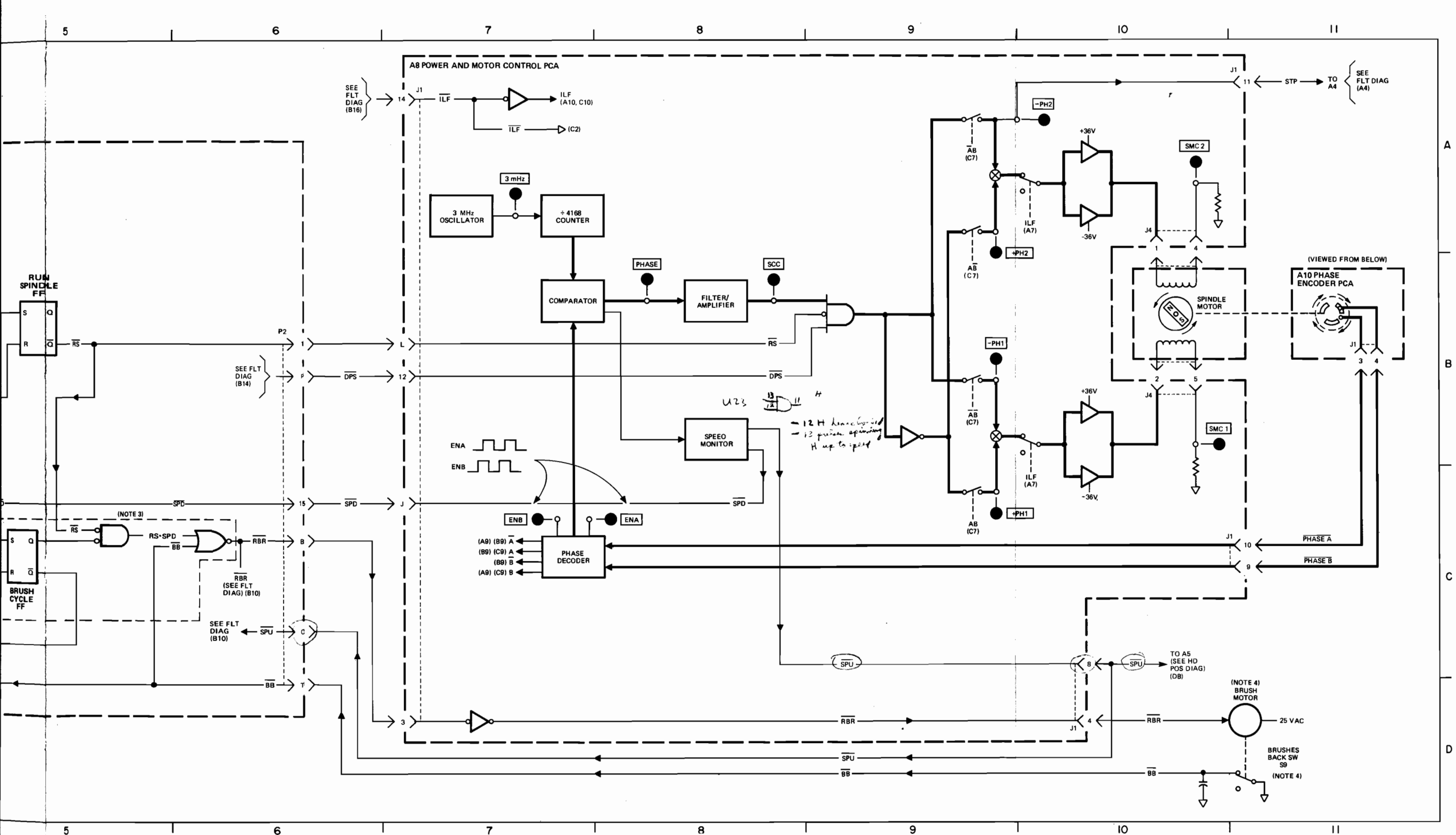
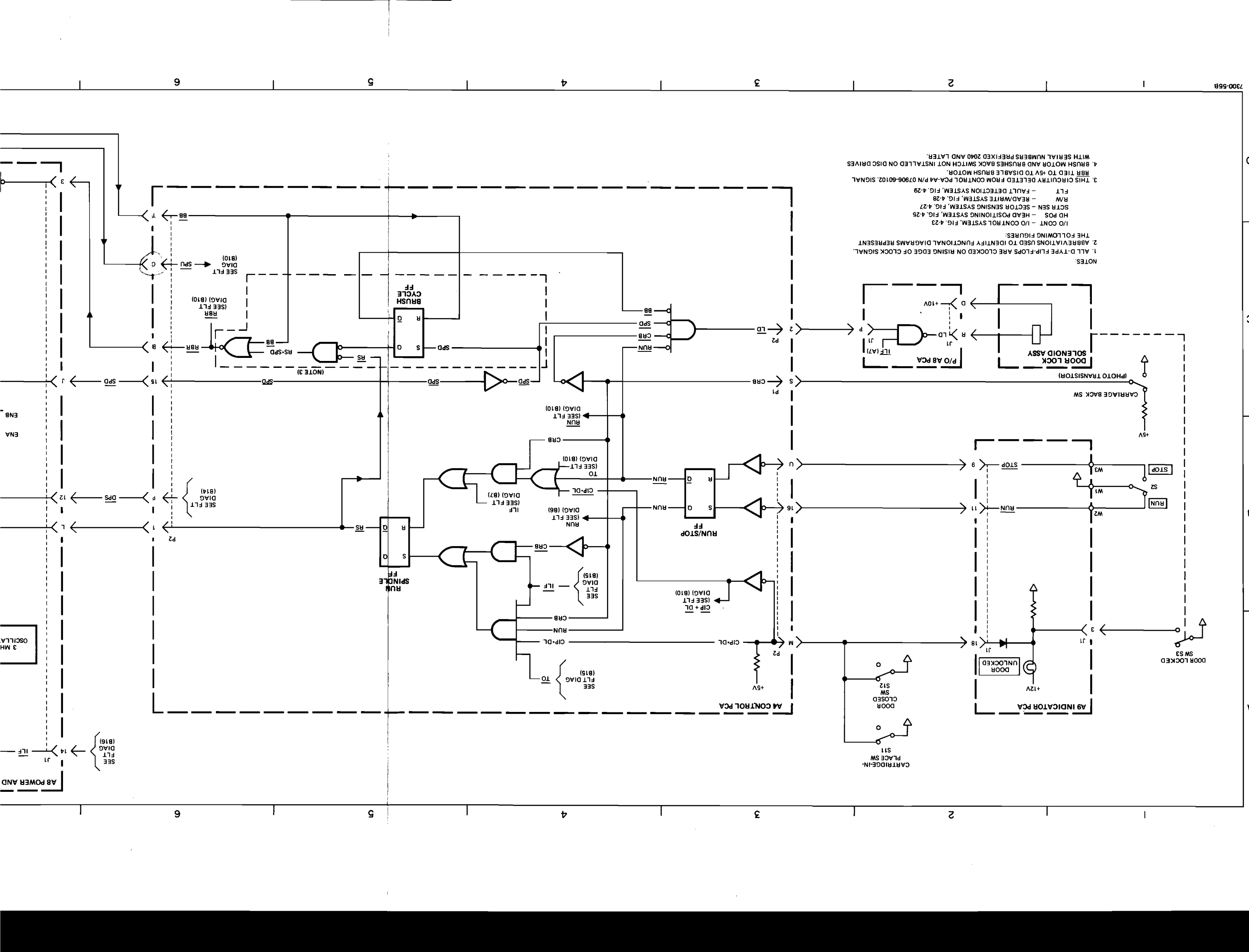
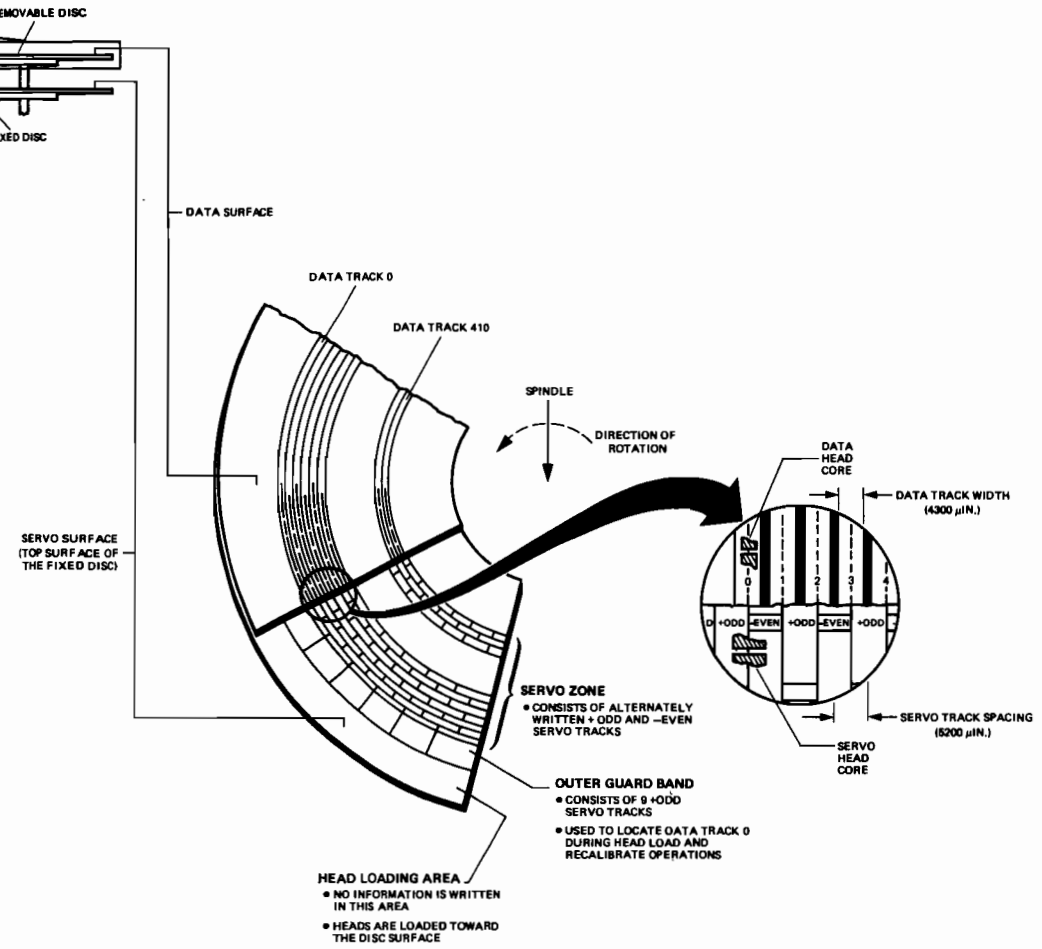


Figure 4-24. Spindle Rotating System Functional Diagram


NOTES:
1. ALL D-TYPE FLIP-FLOPS ARE CLOCKED ON RISING EDGE OF CLOCK SIGNAL.
2. ABBREVIATIONS USED TO IDENTIFY FUNCTIONAL DIAGRAMS REPRESENT THE FOLLOWING FIGURES:
I/O CONT – I/O CONTROL SYSTEM, FIG. 4-23
HD POS – HEAD POSITIONING SYSTEM, FIG. 4-25
SCTR SEN – SECTOR SENSING SYSTEM, FIG. 4-27
R/W – READ/WRITE SYSTEM, FIG. 4-28
FLT – FAULT DETECTION SYSTEM, FIG. 4-29
3. THIS CIRCUITRY DELETED FROM CONTROL PCA-A4 P/N 07906-60102. SIGNAL RBR TIED TO +5V TO DISABLE BRUSH MOTOR.
4. BRUSH MOTOR AND BRUSHES BACK SWITCH NOT INSTALLED ON DISC DRIVES WITH SERIAL NUMBERS PREFIXED 2040 AND LATER.
A4 CONTROL PCA
A9 INDICATOR PCA
A8 POWER AND
DOOR LOCK SOLENOID ASSY
P/O A8 PCA
CARRIAGE BACK SW
(PHOTO TRANSISTOR)
DOOR LOCKED SW S3
DOOR UNLOCKED
DOOR CLOSED SW S12
CARTRIDGE-IN-PLACE SW S11
RUN/STOP FF
BRUSH CYCLE FF
SPINDLE FF
RUN
STOP
+5V
+12V
+10V
SPD
CRB
RUN
CIP•DL
CIP + DL
RS
RBR
LD
ILF
DPS
BB
RS•SPD
(NOTE 3)
SEE FLT DIAG (B10)
SEE FLT DIAG (B15)
SEE FLT DIAG (B16)
SEE FLT DIAG (B14)
SEE FLT DIAG (B7)
SEE FLT DIAG (B6)
TO
3 MH
OSCILLA
ENA
ENB



NOTE:
WAVEFORM AND TRIGGER TEST POINTS ARE SHOWN ON THE HEAD POSITIONING SYSTEM FUNCTIONAL DIAGRAM, FIGURE 4-26, AT THE FOLLOWING LOCATIONS:

A5 'PRE' – (C13)
A5 'REF' – (D13)
A5 'POS' – (C9)
A5 'O/S' – (D9)

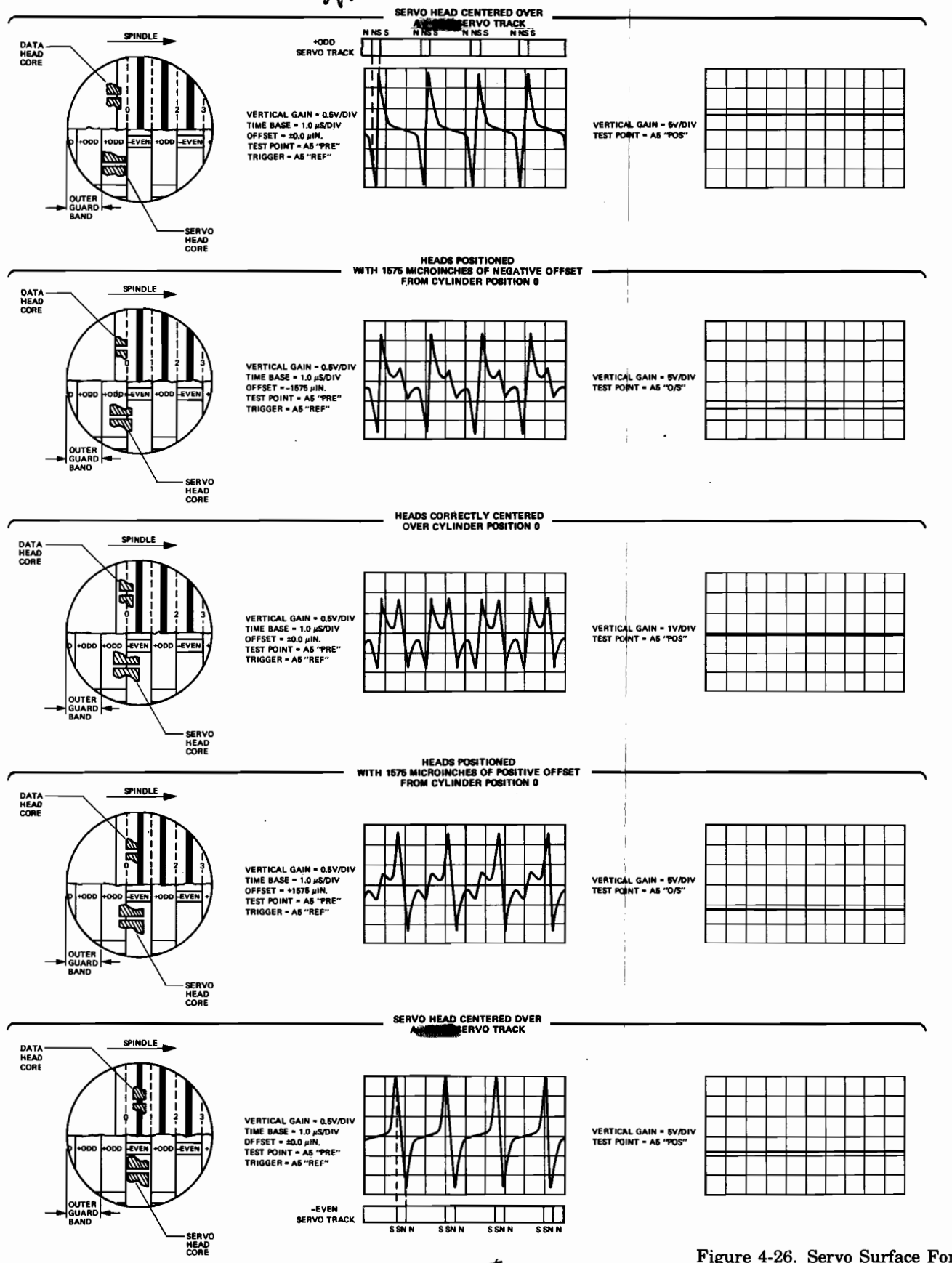


Figure 4-26. Servo Surface Format and Waveforms

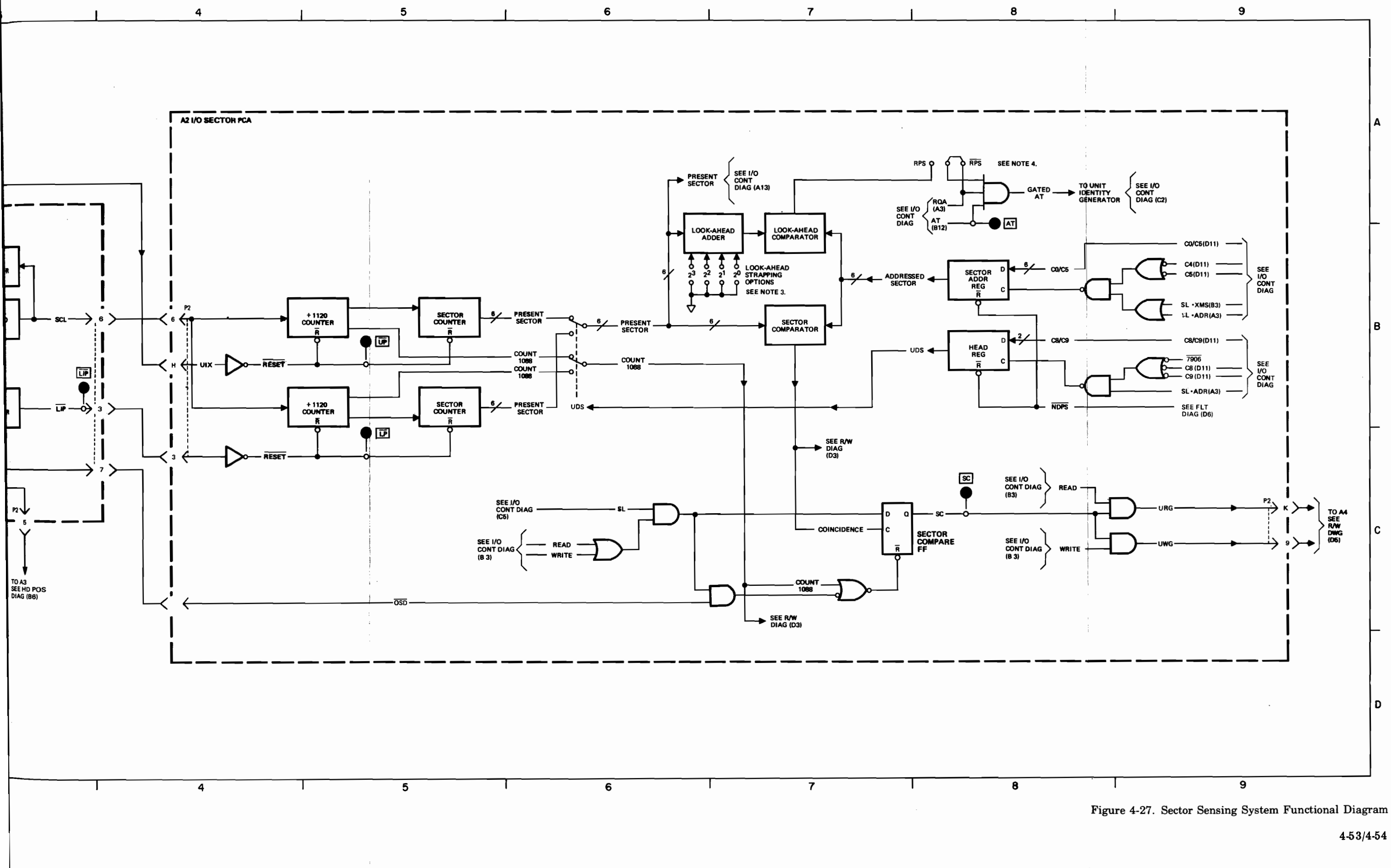


Figure 4-27. Sector Sensing System Functional Diagram

HEAD CARRIAGE

INDEX TRANSDUCER

UIX

A5 TRACK FOLLOWER PCA

SERVO CODE

AGC

PRE

REF

+8 COUNTER

PHASE-LOCKED LOOP

SCL

IDX

LEVEL DETECTORS

INDEX DECODER

LIP

SEE R/W DIAG (B4)

UDS

USS

SEE HD POS DIAG

M(810)

ACRY (B3)

OFFSET SETTLING DELAY

OSD

TO A3 SEE HD POS DIAG (B6)

A2 I/O SECTOR PCA

P2

+1120 COUNTER

SECTOR COUNTER

PRESENT SECTOR

UP

LP

RESET

COUNT 1088

UDS

SEE I/O CONT DIAG (A13)

LOOK-AHEAD ADDER

LOOK-AHEAD COMPARATOR

LOOK-AHEAD STRAPPING OPTIONS

SEE NOTE 3.

SECTOR COMPARATOR

SEE R/W DIAG (D3)

SEE I/O CONT DIAG (C5)

SL

SEE I/O CONT DIAG (B 3)

READ

WRITE

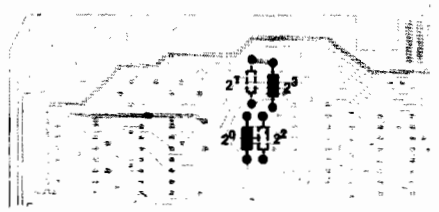
COINCIDENCE

NOTES:

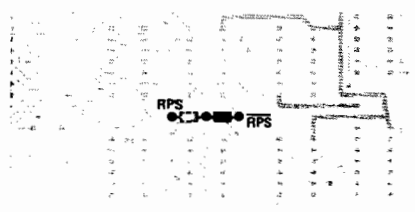
1. ALL D-TYPE FLIP-FLOPS ARE CLOCKED ON THE RISING EDGE OF THE CLOCK PULSE.
2. ABBREVIATIONS USED TO IDENTIFY SYSTEM FUNCTIONAL DIAGRAMS REPRESENT THE FOLLOWING FIGURES:

I/O CONT	– I/O CONTROL SYSTEM, FIG. 4-23
SPDL ROT	– SPINDLE ROTATING SYSTEM, FIG. 4-24
HD POS	– HEAD POSITIONING SYSTEM, FIG. 4-25
R/W	– READ/WRITE SYSTEM, FIG. 4-28
FLT	– FAULT DETECTION SYSTEM, FIG. 4-29

3. THE LOCATION OF THE LOOK-AHEAD STRAPPING JUMPERS ON I/O SECTOR PCA-A2 IS AS SHOWN BELOW.



4. THE LOCATION OF THE RPS/$\overline{RPS}$ JUMPER ON I/O SECTOR PCA-A2 IS AS SHOWN BELOW.



7300-58D

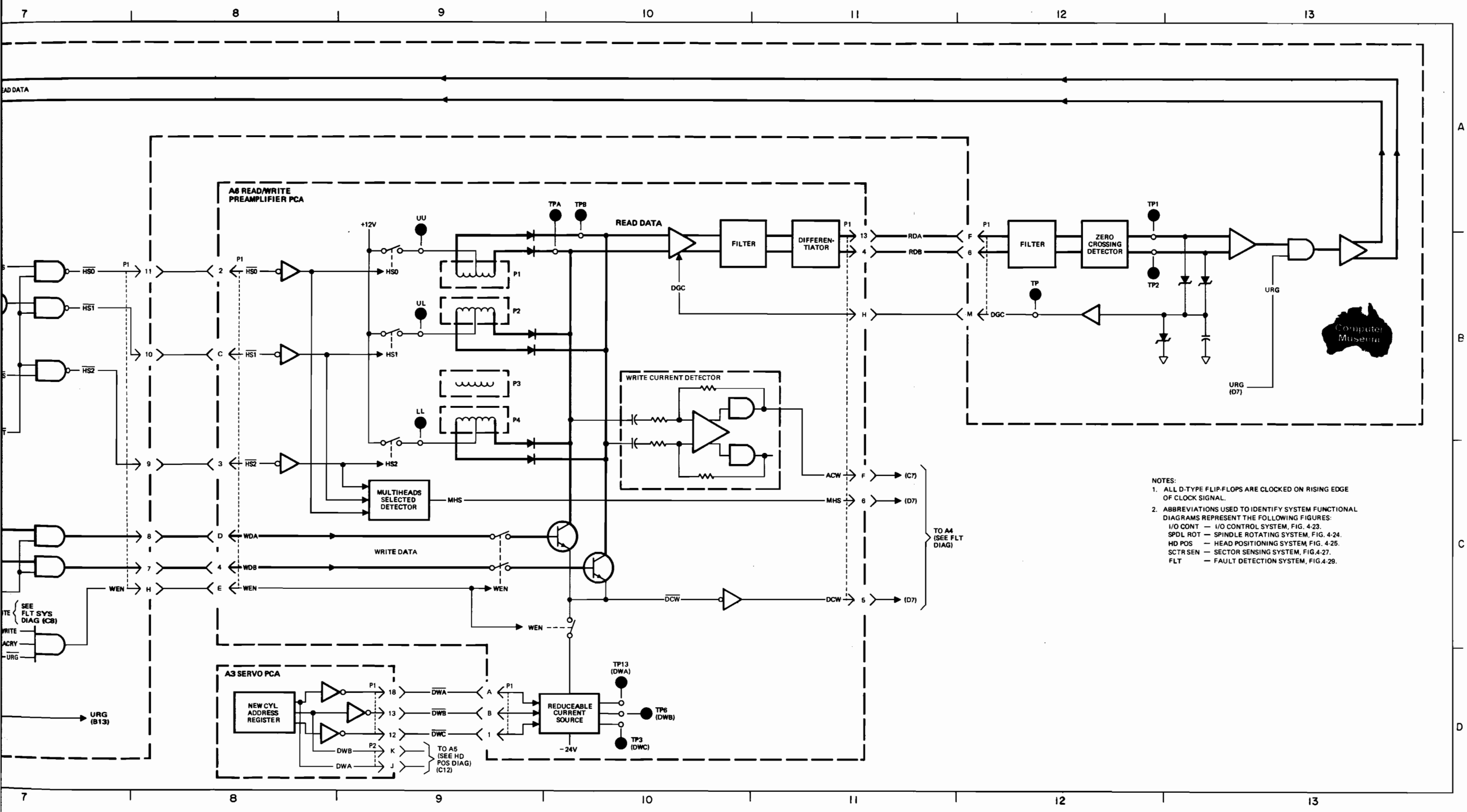
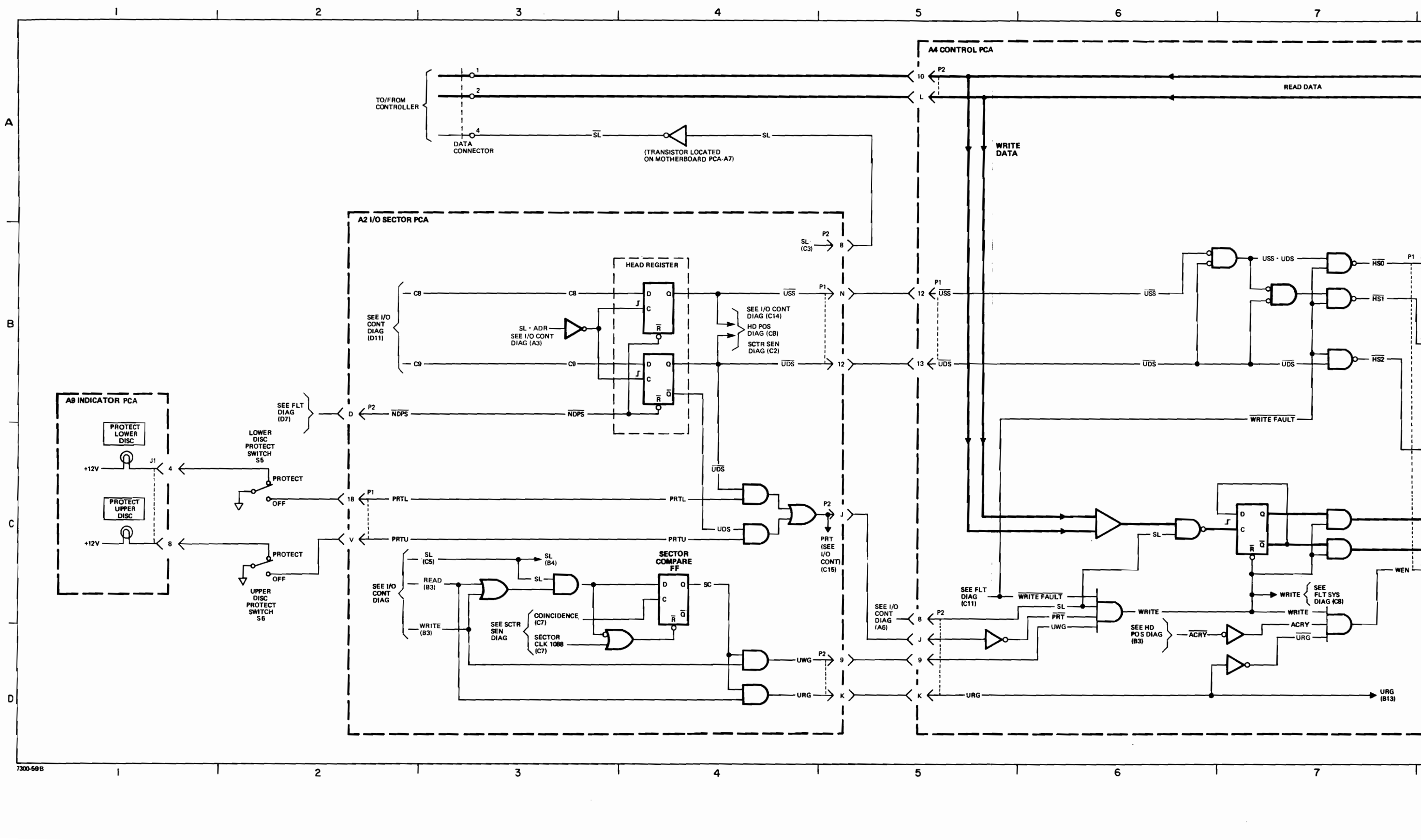
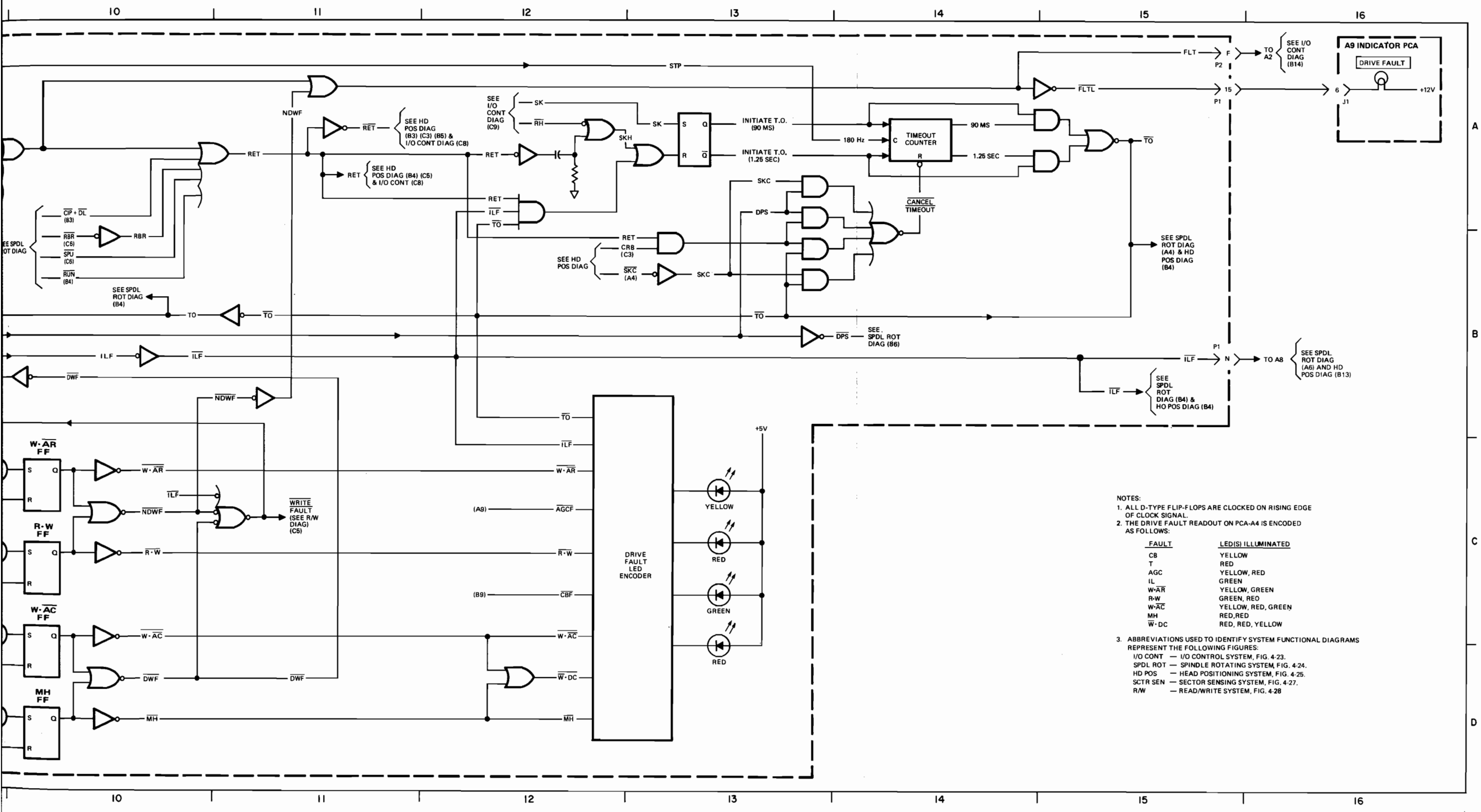


Figure 4-28. Read/Write System Functional Diagram


A4 CONTROL PCA
TO/FROM CONTROLLER
DATA CONNECTOR
SL
(TRANSISTOR LOCATED ON MOTHERBOARD PCA-A7)
READ DATA
WRITE DATA
A2 I/O SECTOR PCA
HEAD REGISTER
SEE I/O CONT DIAG (D11)
SL · ADR
SEE I/O CONT DIAG (A3)
SEE I/O CONT DIAG (C14)
HD POS DIAG (C8)
SCTR SEN DIAG (C2)
USS · UDS
WRITE FAULT
A9 INDICATOR PCA
PROTECT LOWER DISC
PROTECT UPPER DISC
+12V
LOWER DISC PROTECT SWITCH S5
UPPER DISC PROTECT SWITCH S6
PROTECT
OFF
SEE FLT DIAG (D7)
SECTOR COMPARE FF
SEE I/O CONT DIAG
SEE SCTR SEN DIAG
COINCIDENCE (C7)
SECTOR CLK 1088 (C7)
PRT (SEE I/O CONT) (C15)
SEE FLT DIAG (C11)
SEE I/O CONT DIAG (A6)
SEE HD POS DIAG (B3)
SEE FLT SYS DIAG (C8)
WEN
URG (B13)
7300-59B



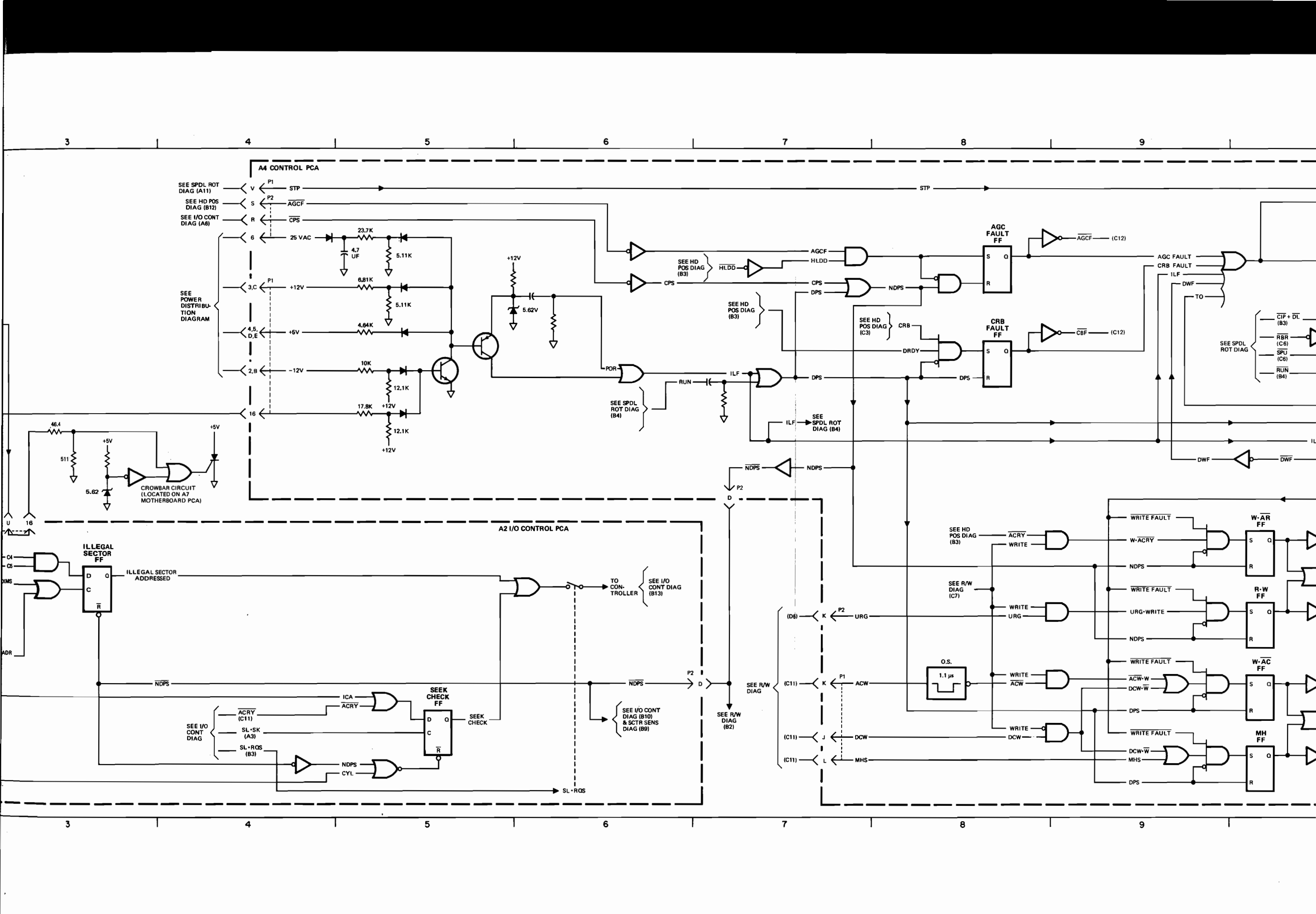
NOTES:

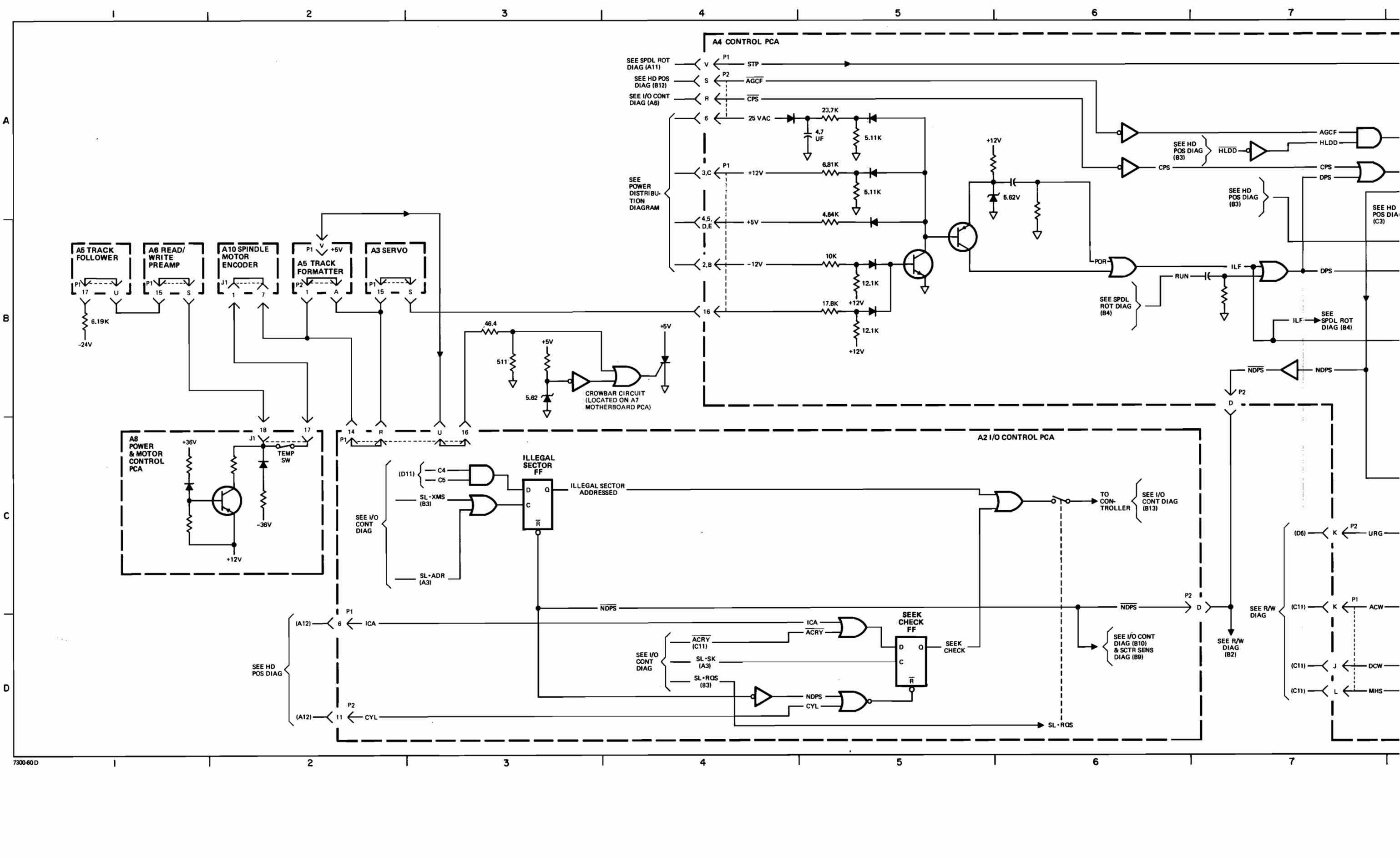
1. ALL D-TYPE FLIP-FLOPS ARE CLOCKED ON RISING EDGE OF CLOCK SIGNAL.
2. THE DRIVE FAULT READOUT ON PCA-A4 IS ENCODED AS FOLLOWS:

FAULT	LED(S) ILLUMINATED
CB	YELLOW
T	RED
AGC	YELLOW, RED
IL	GREEN
W·AR	YELLOW, GREEN
R·W	GREEN, REO
W·AC	YELLOW, RED, GREEN
MH	RED,RED
W·DC	RED, RED, YELLOW

3. ABBREVIATIONS USED TO IDENTIFY SYSTEM FUNCTIONAL DIAGRAMS REPRESENT THE FOLLOWING FIGURES:
   - I/O CONT — I/O CONTROL SYSTEM, FIG. 4-23.
   - SPDL ROT — SPINDLE ROTATING SYSTEM, FIG. 4-24.
   - HD POS — HEAD POSITIONING SYSTEM, FIG. 4-25.
   - SCTR SEN — SECTOR SENSING SYSTEM, FIG. 4-27.
   - R/W — READ/WRITE SYSTEM, FIG. 4-28

Figure 4-29. Fault Detection System Functional Diagram


3
4
5
6
7
8
9
A4 CONTROL PCA
SEE SPDL ROT DIAG (A11)
SEE HD POS DIAG (B12)
SEE I/O CONT DIAG (A6)
SEE POWER DISTRIBUTION DIAGRAM
V
S
R
6
3,C
4,5, D,E
2,B
16
P1
P2
STP
AGCF
CPS
25 VAC
+12V
+5V
-12V
23.7K
4.7 UF
5.11K
6.81K
4.64K
10K
12.1K
17.8K
5.62V
POR
RUN
ILF
SEE SPDL ROT DIAG (B4)
SEE HD POS DIAG (B3)
HLDD
NDPS
DPS
AGC FAULT FF
CRB FAULT FF
S
Q
R
AGC FAULT
CRB FAULT
DWF
TO
SEE SPDL ROT DIAG
CIP + DL (B3)
RBR (C6)
SPU (C6)
RUN (B4)
(C12)
CRB
DRDY
SEE HD POS DIAG (C3)
46.4
511
5.62
CROWBAR CIRCUIT (LOCATED ON A7 MOTHERBOARD PCA)
A2 I/O CONTROL PCA
ILLEGAL SECTOR FF
ILLEGAL SECTOR ADDRESSED
TO CON-TROLLER
SEE I/O CONT DIAG (B13)
C4
C5
XMS
ADR
SEEK CHECK FF
SEEK CHECK
ICA
ACRY (C11)
SL•SK (A3)
SL•ROS (B3)
CYL
SEE I/O CONT DIAG
SEE I/O CONT DIAG (B10) & SCTR SENS DIAG (B9)
SL•ROS
SEE R/W DIAG (B2)
SEE R/W DIAG
(D8)
(C11)
K
J
L
URG
ACW
DCW
MHS
O.S.
1.1 µs
WRITE
WRITE FAULT
W•ACRY
URG•WRITE
ACW•W
DCW•W
W•AR FF
R•W FF
W•AC FF
MH FF
SEE R/W DIAG
SEE HD POS DIAG (B3)
SEE R/W DIAG (C7)


A4 CONTROL PCA
SEE SPDL ROT DIAG (A11)
SEE HD POS DIAG (B12)
SEE I/O CONT DIAG (A6)
SEE POWER DISTRIBUTION DIAGRAM
STP
AGCF
CPS
25 VAC
23.7K
4.7 UF
5.11K
+12V
6.81K
+5V
4.64K
-12V
10K
12.1K
17.8K
5.62V
POR
RUN
ILF
HLDD
DPS
NDPS
SEE HD POS DIAG (B3)
SEE SPDL ROT DIAG (B4)
SEE HD POS DIA (C3)
A5 TRACK FOLLOWER
A6 READ/ WRITE PREAMP
A10 SPINDLE MOTOR ENCODER
A5 TRACK FORMATTER
A3 SERVO
6.19K
-24V
46.4
511
5.62
CROWBAR CIRCUIT (LOCATED ON A7 MOTHERBOARD PCA)
A8 POWER & MOTOR CONTROL PCA
+36V
-36V
TEMP SW
A2 I/O CONTROL PCA
ILLEGAL SECTOR FF
SEE I/O CONT DIAG
SL•XMS (B3)
SL•ADR (A3)
ILLEGAL SECTOR ADDRESSED
TO CON-TROLLER
SEE I/O CONT DIAG (B13)
SEEK CHECK FF
SEEK CHECK
ICA
ACRY (C11)
SL•SK (A3)
SL•RQS (B3)
CYL
SL•RQS
SEE HD POS DIAG
SEE I/O CONT DIAG (B10) & SCTR SENS DIAG (B9)
SEE R/W DIAG (B2)
SEE R/W DIAG
URG
ACW
DCW
MHS
7300-60D

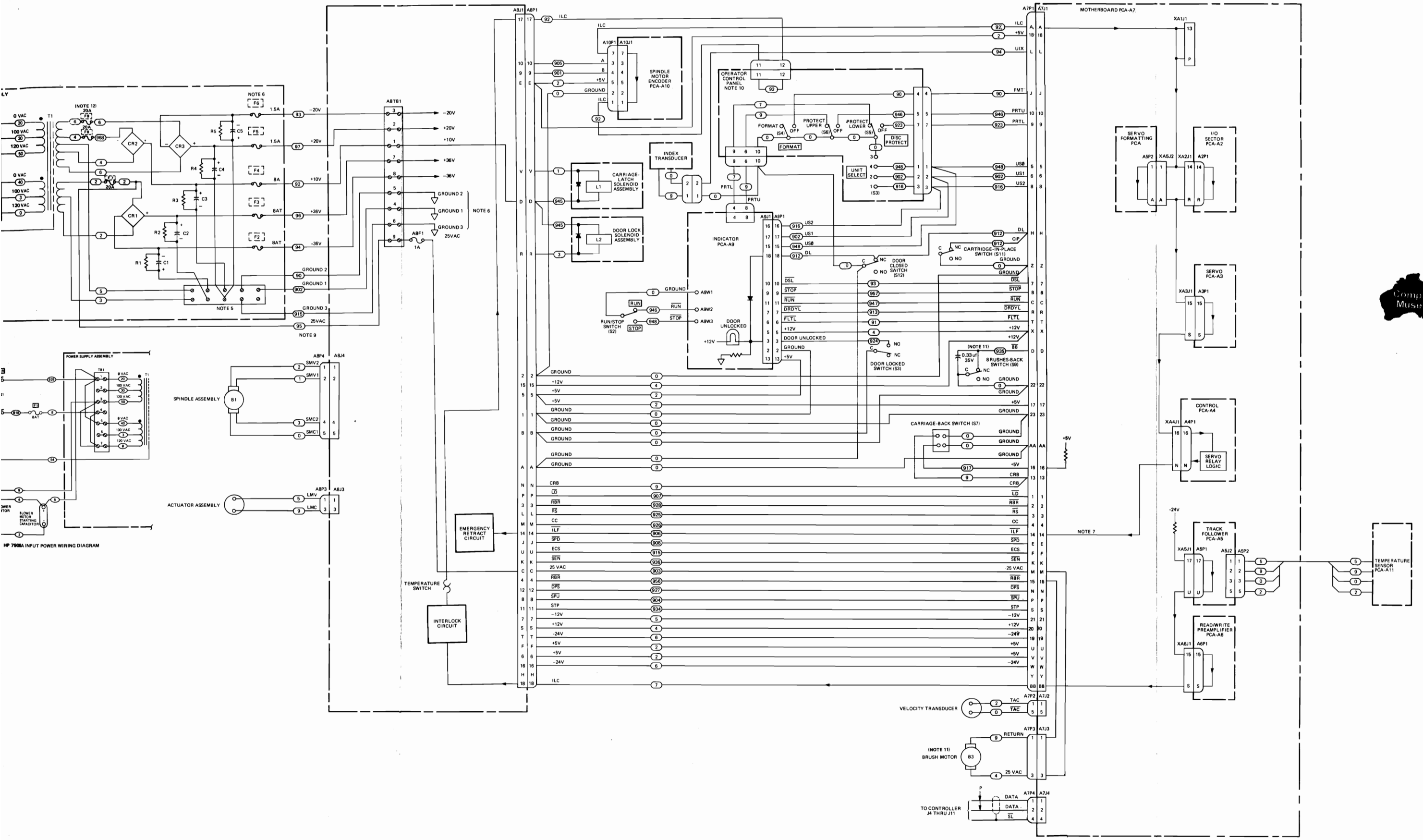


Figure 4-30. Mainframe Assembly Wiring Diagram

NOTES:
1. ENCIRCLED NUMBERS INDICATE WIRING COLOR CODE AS FOLLOWS:

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
GRAY	8	8	8
WHITE	9	9	9

2. AC POWER IS SUPPLIED BY CABLE FROM A POWER PANEL ASSEMBLY (NOT PART OF THE DISC DRIVE) IN THE HP 294258 CABINET (HP 7906M/S DISC DRIVE) OR ON THE PREFILTER DUCT ASSEMBLY (HP 7906M/R/SR DISC DRIVE). SCHEMATIC DIAGRAMS FOR THE POWER PANEL ASSEMBLIES ARE SHOWN BELOW. VALUES FOR LINE FUSE F1 ARE:

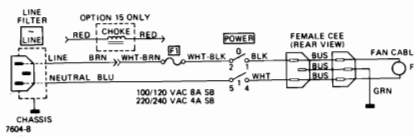
100 VAC – 8A SB 250V, 2110-0383
120 VAC – 8A SB 250V, 2110-0383
220 VAC – 4A SB 250V, 2110-0365
240 VAC – 4A SB 250V, 2110-0365

THE CABLE SUPPLYING POWER FROM THE HP 294258 CABINET POWER PANEL IS CABLE ASSEMBLY, PART NO. 8120-0575.

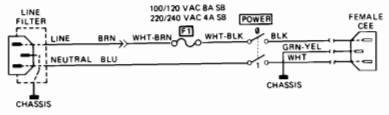
FOR A COMPLETE DESCRIPTION OF THE POWER PANEL ASSEMBLIES, REFER TO THE FOLLOWING PUBLICATIONS:

- HP 29425 CABINET INSTALLATION AND SERVICE MANUAL, PART NO. 29425-90001.
- HP 40019 PREFILTER ASSEMBLY INSTALLATION AND SERVICE MANUAL, PART NO. 40019-90901.

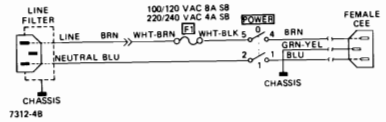
7604-4 A
HP 294258 CABINET POWER PANEL ASSEMBLY, P/N 29425-60009 AND 29425-60010 (USED ON 7906B DISC DRIVES WITH SERIAL NUMBERS PREFIXED 2017 AND PRIOR.)



7604-B
HP 294258 CABINET POWER PANEL ASSEMBLY, P/N 29425-60014 AND 29425-60015 (USED ON 7906B DISC DRIVES WITH SERIAL NUMBERS PREFIXED 2018 AND LATER.)



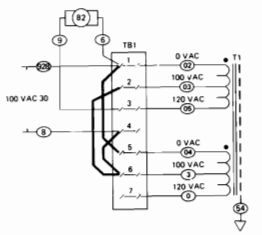
7312-4 A
HP 40019B PREFILTER ASSEMBLY, P/N 40019-60006 (OPTIONAL ON 7906B DISC DRIVES WITH SERIAL NUMBERS PREFIXED 2016 AND PRIOR.)



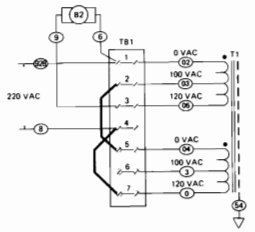
7312-4B
HP 40019B PREFILTER ASSEMBLY, P/N 40019-60012 (OPTIONAL ON 7906B DISC DRIVES WITH SERIAL NUMBERS PREFIXED 2017 AND LATER.)

3. THE HP 7906A DISC DRIVE INCLUDES A LINE FILTER, LINE FUSE, AND POWER ON/OFF SWITCH. SEE INPUT POWER WIRING DIAGRAM OPPOSITE. POWER SWITCH S1 AND FUSE F1 ARE MOUNTED ON THE DISC DRIVE OPERATOR CONTROL PANEL. VALUES FOR F1 ARE AS GIVEN IN NOTE 2. THE INPUT POWER WIRING DIAGRAM OPPOSITE SHOWS TERMINAL BOARD TB1 WIRED FOR 120 VAC. JUMPER WIRING FOR 100, 220, AND 240 VAC IS AS DESCRIBED IN NOTE 4.

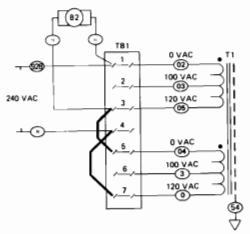
4. TERMINAL BLOCK TB1 IS SHOWN CONFIGURED FOR 120 VAC OPERATION. TB1 CONNECTIONS FOR 100, 220 AND 240 VAC PRIMARY POWER INPUTS ARE SHOWN BELOW:



TB1 CONNECTIONS FOR 100 VAC PRIMARY POWER



TB1 CONNECTIONS FOR 220 VAC PRIMARY POWER



TB1 CONNECTIONS FOR 240 VAC PRIMARY POWER

5. GROUND BLOCK CONNECTIONS MUST BE MADE AS SHOWN.

6. FUSES F2 THROUGH F9 AND ABF1 ARE AS FOLLOWS:

F2	8AT*, 250V, 2110-0383
F3	8AT*, 250V, 2110-0383
F4	8A, 250V, 2110-0342
F5	1.5A, 250V, 2110-0043
F6	1.5A, 250V, 2110-0043
F7	20A, 125V, 2110-0098
F8	20A, 125V, 2110-0098
F9	20A, 125V, 2110-0098
ABF1	1A, 125V, 2110-0099

* THE T INDICATES THAT A TIME DELAY FUSE MUST BE USED.

7. ONLY GROUND 1 LEAVES THE POWER AND MOTOR CONTROL PCA-A8.

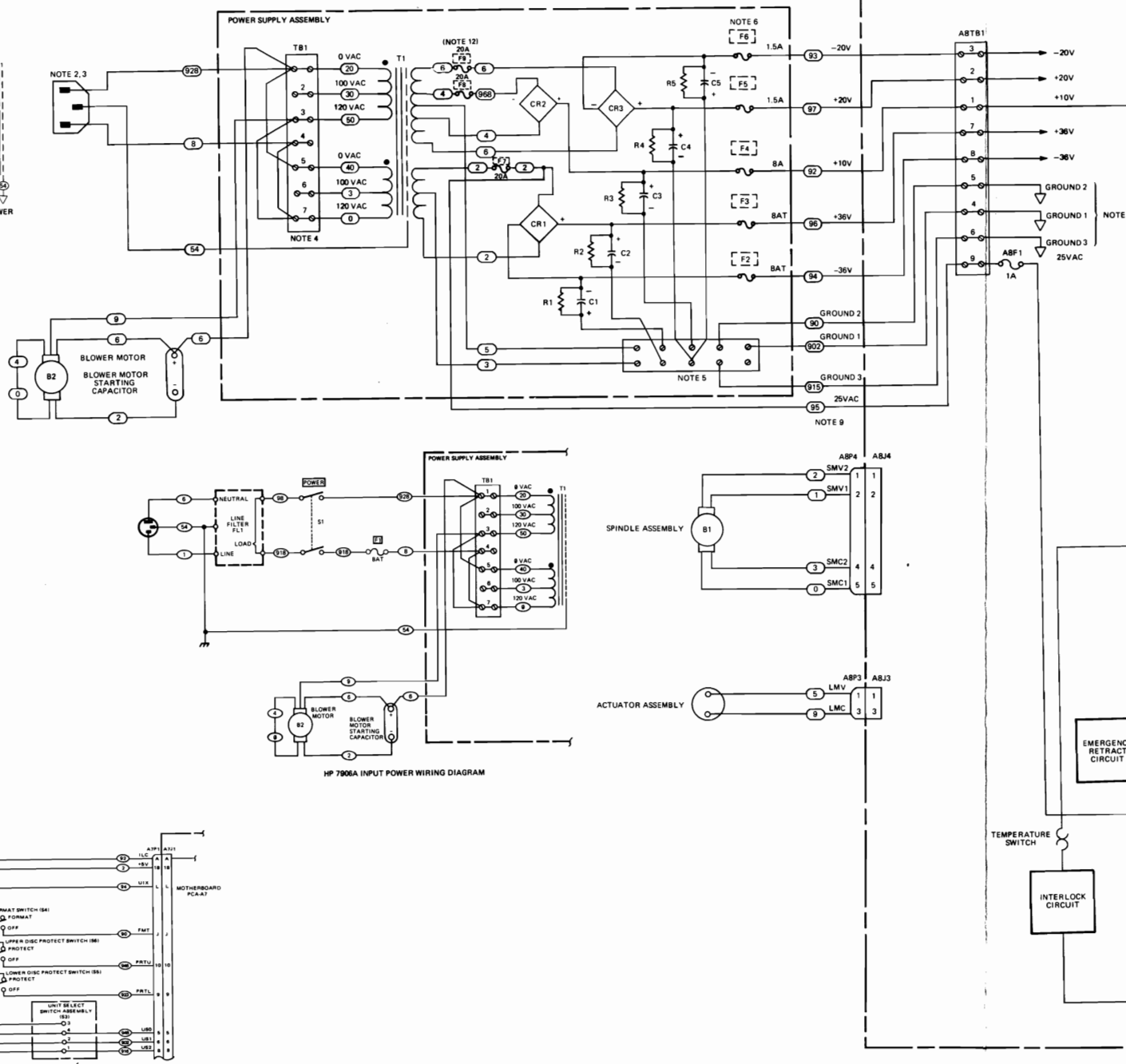
8. INTERLOCK LINE IS AT 18V EXCEPT UNDER FAULT CONDITION.

9. ON THE HP 7906A, THE COLOR CODE FOR THE GROUND 1 WIRE IS WHITE/BLACK (90); AND FOR THE GROUND 3 WIRE, WHITE/BLACK/RED (902).

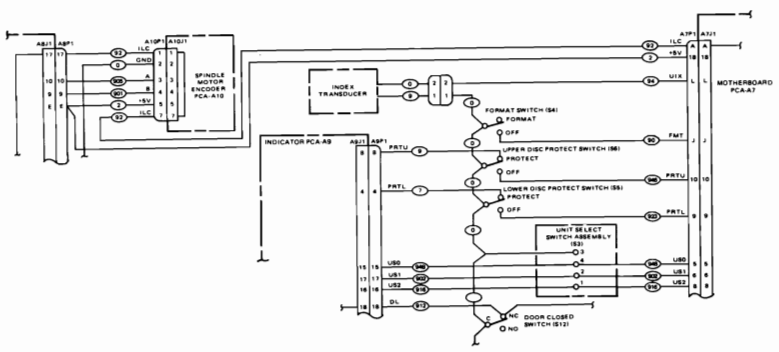
10. ON THE HP 7906A, OPERATOR CONTROL PANEL SWITCHES S3, S4, S5, AND S6 ARE WIRED DIRECTLY INTO CIRCUIT. ALSO, THE OPERATOR CONTROL PANEL IS NOT INCLUDED IN THE INTERLOCK CIRCUITRY. HP 7906A WIRING FOR THIS PORTION OF THE MAINFRAME ASSEMBLY WIRING DIAGRAM IS SHOWN BELOW.

11. BRUSHES-BACK SWITCH AND BRUSH MOTOR NOT INSTALLED ON DRIVES WITH SERIAL NUMBERS PREFIXED 2040 AND LATER. ALL BRUSH CIRCUITRY IS INOPERATIVE ON EARLIER DRIVES IF CONTROL PCA-A4, PART NO. 07906-60102, IS INSTALLED.

12. POWER SUPPLY PART NUMBERS 07905-60020 AND 07906-60014 DO NOT INCLUDE FUSES F7 THROUGH F9.



HP 7906A INPUT POWER WIRING DIAGRAM



HP 7906A SWITCH S3 - S6 WIRING DIAGRAM

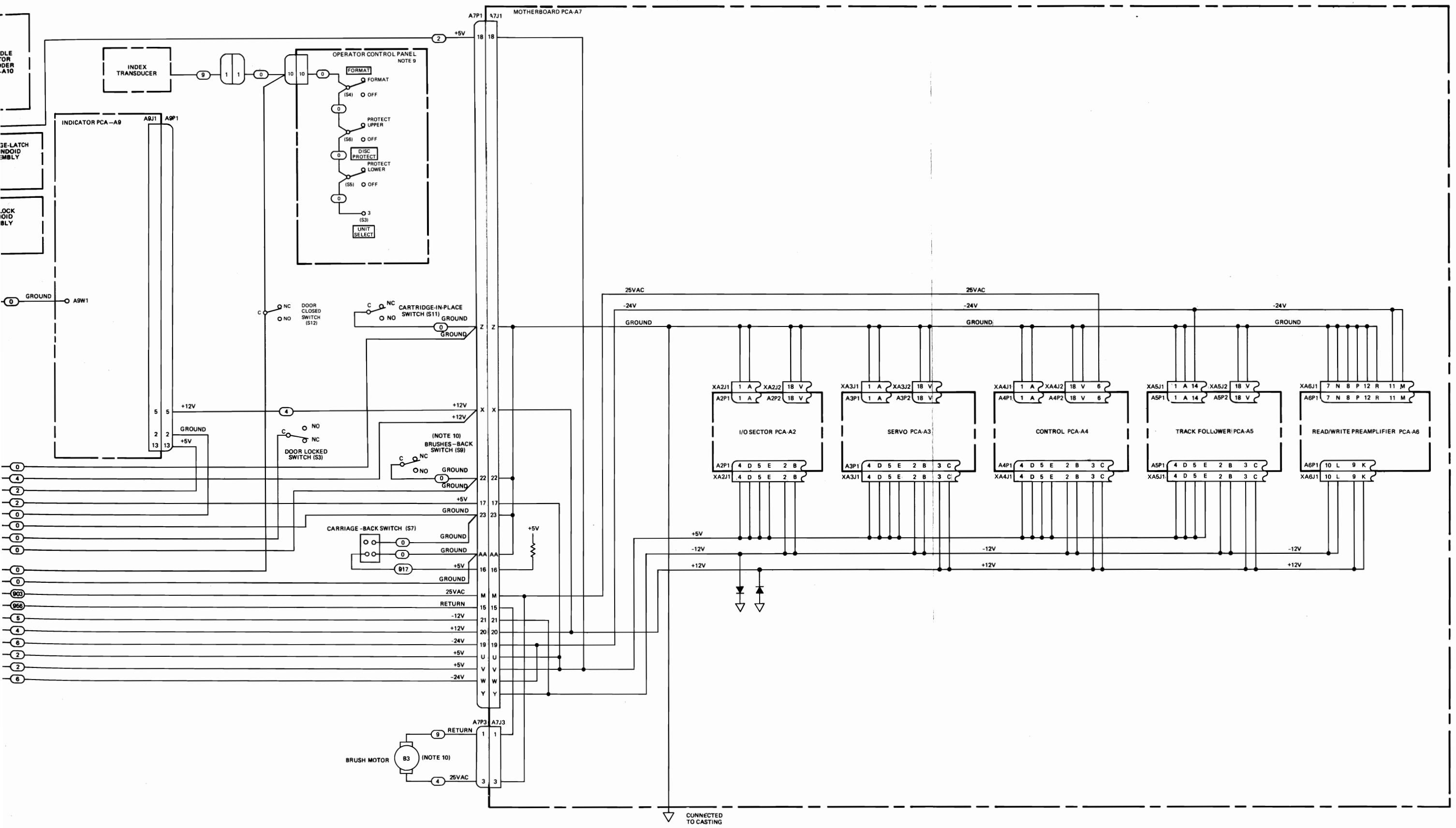


Figure 4-31. Power Distribution Schematic Diagram

* THE T INDICATES THAT A TIME DELAY FUSE MUST BE USED.

ABF1	1A, 125V, 2110-0099	
F9	20A, 125V, 2110-0098	
F8	20A, 125V, 2110-0098	
F7	20A, 125V, 2110-0098	
F6	1.5A, 250V, 2110-0043	
F5	1.5A, 250V, 2110-0043	
F4	8A, 250V, 2110-0342	
F3	8AT*, 250V, 2110-0383	
F2	8AT*, 250V, 2110-0383	

6. FUSES F2 THROUGH F9 AND ABF1 ARE AS FOLLOWS:

5. GROUND BLOCK CONNECTIONS MUST BE MADE AS SHOWN.

TB1 CONNECTIONS FOR 240 VAC PRIMARY POWER

TB1 CONNECTIONS FOR 100 VAC PRIMARY POWER

TB1 CONNECTIONS FOR 220 VAC PRIMARY POWER

4. TERMINAL BLOCK TB1 IS SHOWN CONFIGURED FOR 120 VAC OPERATION. TB1 CONNECTIONS FOR 100, 220, AND 240 VAC PRIMARY POWER INPUTS ARE SHOWN BELOW:

HP 7906A OPERATOR CONTROL PANEL WIRING

HP 7906A INPUT POWER WIRING

9. ON THE HP 7906A, OPERATOR CONTROL PANEL SWITCHES S2, S4, S5, AND S6 ARE WIRED DIRECTLY INTO CIRCUIT. THE HP 7906A WIRING FOR THIS PORTION OF THE POWER DISTRIBUTION SCHEMATIC DIAGRAM IS SHOWN BELOW.

10. BRUSHES-BACK SWITCH AND BRUSH MOTOR NOT INSTALLED ON DRIVES WITH SERIAL NUMBERS PREFIXED 2040 AND LATER. ALL BRUSH CIRCUITRY IS INOPERATIVE ON EARLIER DRIVES IF CONTROL PCA-A4, PART NO. 07906-60102, IS INSTALLED.

11. POWER SUPPLY PART NUMBERS 07905-60020 AND 07906-60014 DO NOT INCLUDE FUSES F7 THROUGH F9.

7. ONLY GROUND 1 LEAVES THE POWER AND MOTOR CONTROL PCA-A8

8. INTERLOCK LINE IS AT 18V EXCEPT UNDER FAULT CONDITION.

NOTES:

1 ENCIRCLED NUMBERS INDICATE WIRING COLOR CODE AS FOLLOWS:

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
GRAY	8	8	8
WHITE	9	9	9

2. AC POWER IS SUPPLIED BY CABLE FROM A POWER PANEL ASSEMBLY (NOT PART OF THE DISC DRIVE) IN THE HP 29425B CABINET (HP 7906M/S DISC DRIVE) OR ON THE PREFILTER DUCT ASSEMBLY (HP 7906M/SR DISC DRIVE). SCHEMATIC DIAGRAMS FOR THE POWER PANEL ASSEMBLIES ARE SHOWN BELOW. VALUES FOR LINE FUSE F1 ARE:

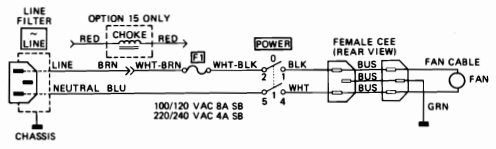
100 VAC – 8A SB 250V, 2110-0383
120 VAC – 8A SB 250V, 2110-0383
220 VAC – 4A SB 250V, 2110-0365
240 VAC – 4A SB 250V, 2110-0365

THE CABLE SUPPLYING POWER FROM THE HP 29425B CABINET POWER PANEL IS CABLE ASSEMBLY, PART NO. 8120-0575.

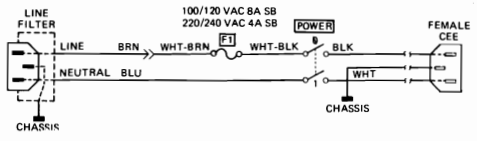
FOR A COMPLETE DESCRIPTION OF THE POWER PANEL ASSEMBLIES, REFER TO THE FOLLOWING PUBLICATIONS:

- HP 29425 CABINET INSTALLATION AND SERVICE MANUAL, PART NO. 29425-90001.
- HP 40019 PREFILTER ASSEMBLY INSTALLATION AND SERVICE MANUAL, PART NO. 40019-90901.

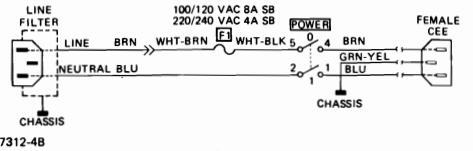
7604-4 A
HP 29425B CABINET POWER PANEL ASSEMBLY, P/N 29425-60009 AND 29425-60010
(USED ON 7906B DISC DRIVES WITH SERIAL NUMBERS PREFIXED 2017 AND PRIOR)



7604-8
HP 29425B CABINET POWER PANEL ASSEMBLY, P/N 29425-60014 AND 29425-60015
(USED ON 7906B DISC DRIVES WITH SERIAL NUMBERS PREFIXED 2018 AND LATER)



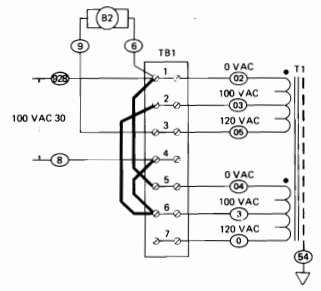
7312-4A
HP 40019B PREFILTER ASSEMBLY, P/N 40019-60006
(OPTIONAL ON 7906B DISC DRIVES WITH SERIAL NUMBERS PREFIXED 2016 AND PRIOR)



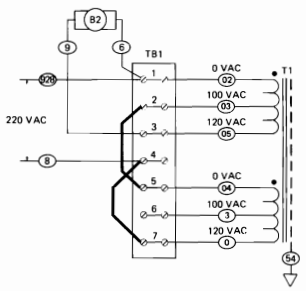
7312-4B
HP 40019B PREFILTER ASSEMBLY, P/N 40019-60012
(OPTIONAL ON 7906B DISC DRIVES WITH SERIAL NUMBERS PREFIXED 2017 AND LATER)

3. THE HP 7906A DISC DRIVE INCLUDES A LINE FILTER, LINE FUSE, AND POWER ON/OFF SWITCH. SEE INPUT POWER WIRING DIAGRAM OPPOSITE. POWER SWITCH S1 AND FUSE F1 ARE MOUNTED ON THE DISC DRIVE OPERATOR CONTROL PANEL. VALUES FOR F1 ARE AS GIVEN IN NOTE 2. THE INPUT POWER WIRING DIAGRAM OPPOSITE SHOWS TERMINAL BOARD TB1 WIRED FOR 120 VAC. JUMPER WIRING FOR 100, 220, AND 240 VAC IS AS DESCRIBED IN NOTE 4.

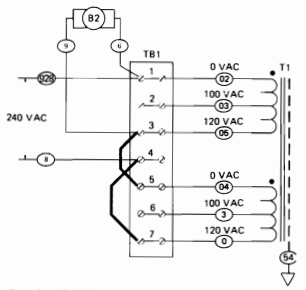
4. TERMINAL BLOCK TB1 IS SHOWN CONFIGURED FOR 120 VAC OPERATION. TB1 CONNECTIONS FOR 100, 220, AND 240 VAC PRIMARY POWER INPUTS ARE SHOWN BELOW:



TB1 CONNECTIONS FOR 100 VAC PRIMARY POWER



TB1 CONNECTIONS FOR 220 VAC PRIMARY POWER



TB1 CONNECTIONS FOR 240 VAC PRIMARY POWER

5. GROUND BLOCK CONNECTIONS MUST BE MADE AS SHOWN.

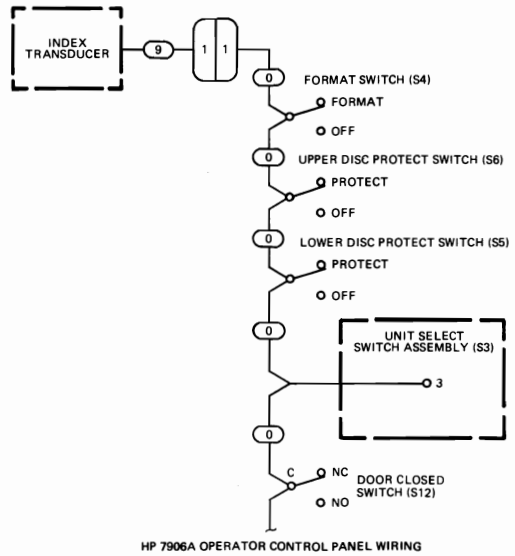
6. FUSES F2 THROUGH F9 AND A8F1 ARE AS FOLLOWS:

F2	8AT*, 250V, 2110-0383
F3	8AT*, 250V, 2110-0383
F4	8A, 250V, 2110-0342
F5	1.5A, 250V, 2110-0043
F6	1.5A, 250V, 2110-0043
F7	20A, 125V, 2110-0098
F8	20A, 125V, 2110-0098
F9	20A, 125V, 2110-0098
A8F1	1A, 125V, 2110-0099

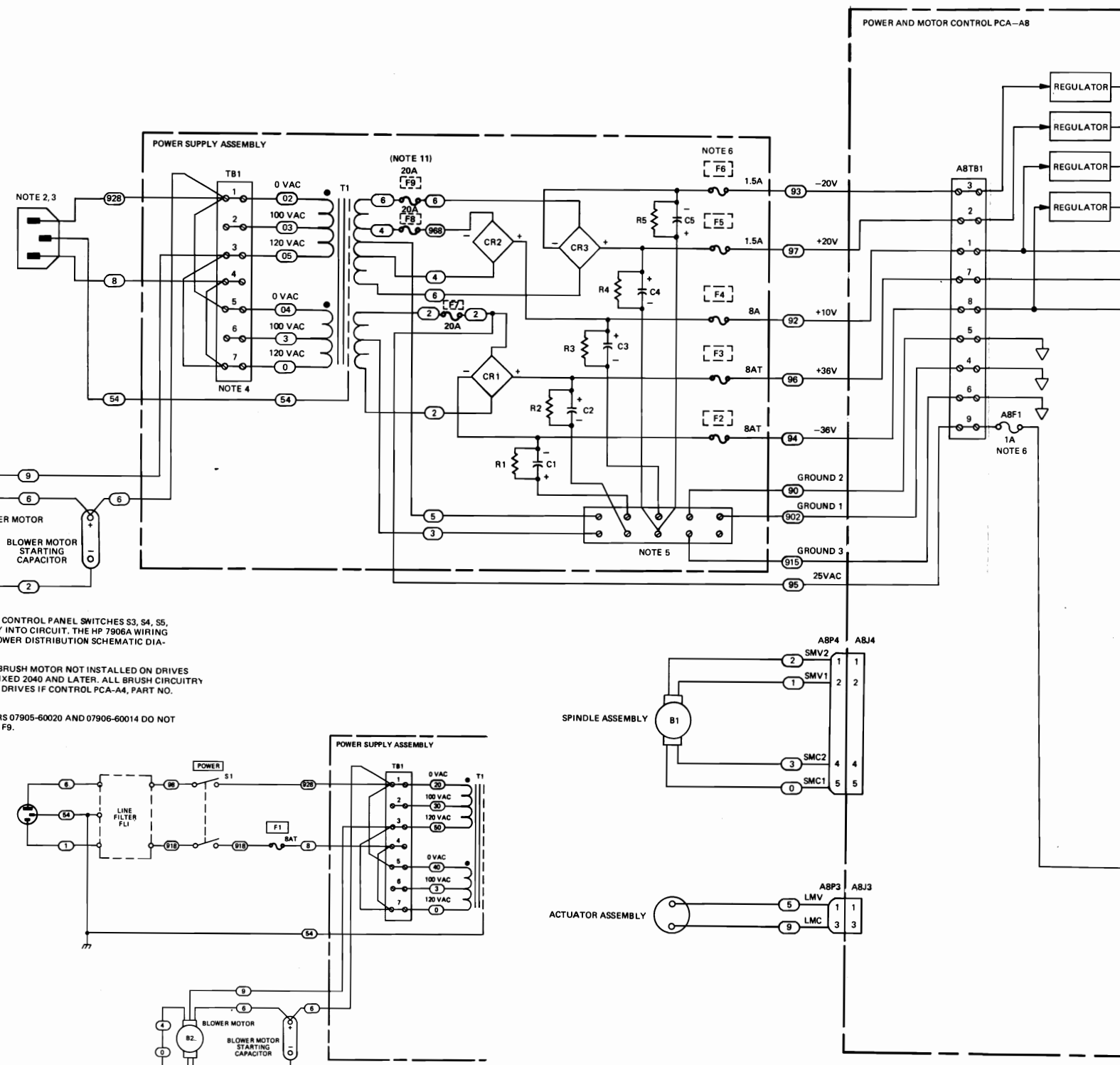
*THE T INDICATES THAT A TIME DELAY FUSE MUST BE USED.

7. ONLY GROUND 1 LEAVES THE POWER AND MOTOR CONTROL PCA-A8

8. INTERLOCK LINE IS AT 18V EXCEPT UNDER FAULT CONDITION.



HP 7906A OPERATOR CONTROL PANEL WIRING

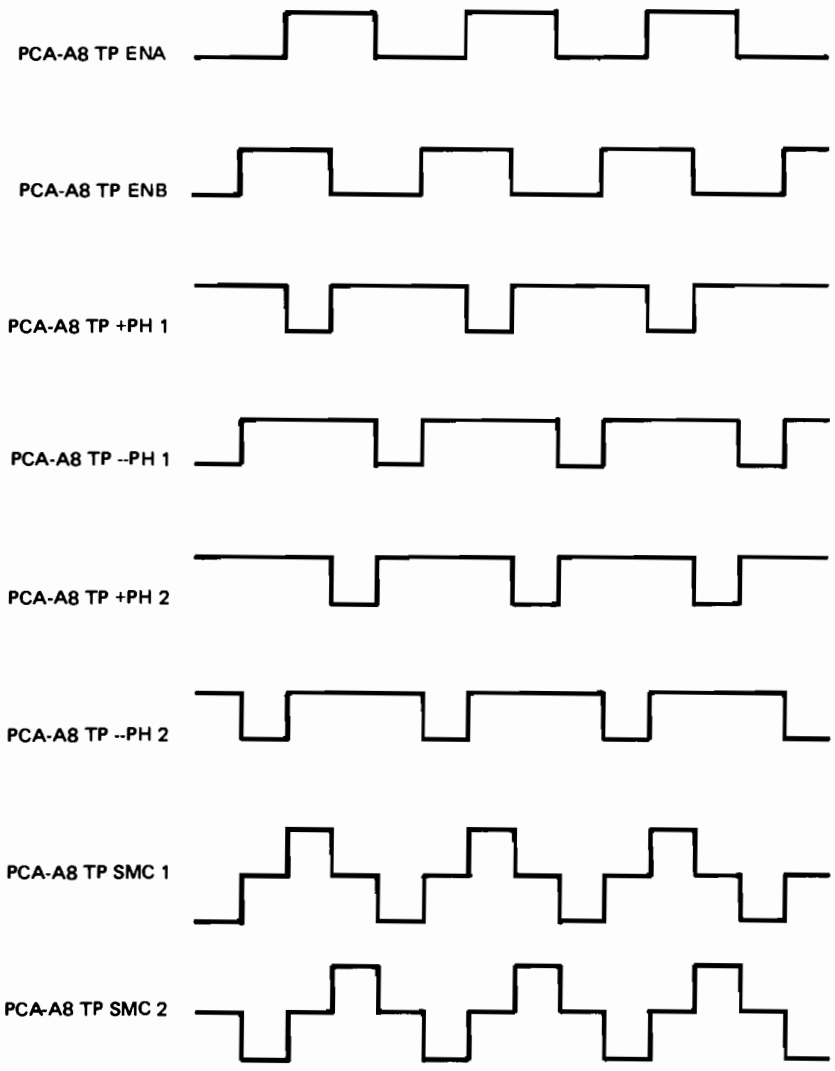


9. ON THE HP 7906A, OPERATOR CONTROL PANEL SWITCHES S3, S4, S5, AND S6 ARE WIRED DIRECTLY INTO CIRCUIT. THE HP 7906A WIRING FOR THIS PORTION OF THE POWER DISTRIBUTION SCHEMATIC DIAGRAM IS SHOWN BELOW.

10. BRUSHES-BACK SWITCH AND BRUSH MOTOR NOT INSTALLED ON DRIVES WITH SERIAL NUMBERS PREFIXED 2040 AND LATER. ALL BRUSH CIRCUITRY IS INOPERATIVE ON EARLIER DRIVES IF CONTROL PCA-A4, PART NO. 07906-60102, IS INSTALLED.

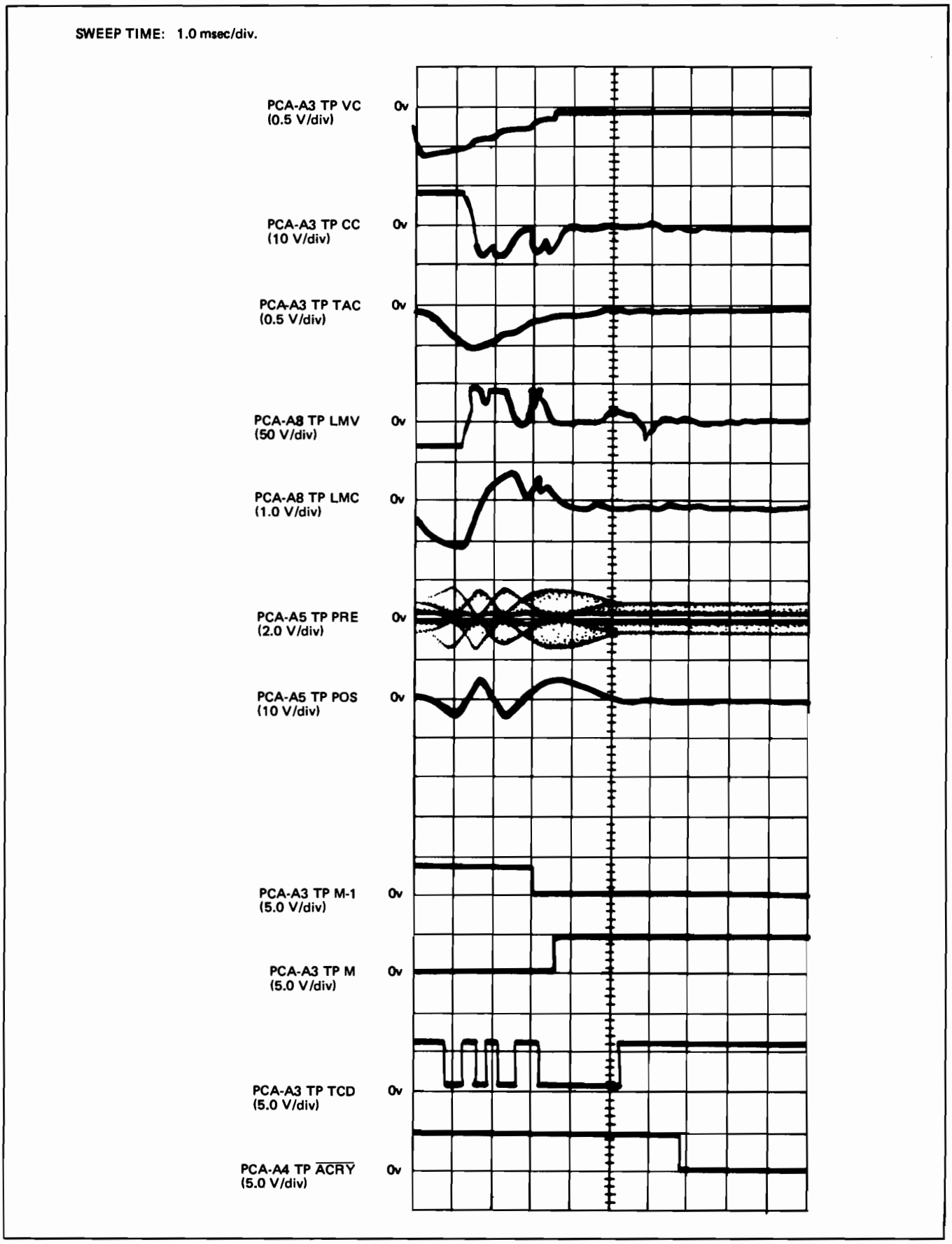
11. POWER SUPPLY PART NUMBERS 07905-60020 AND 07906-60014 DO NOT INCLUDE FUSES F7 THROUGH F9.

HP 7906A INPUT POWER WIRING



7300-83

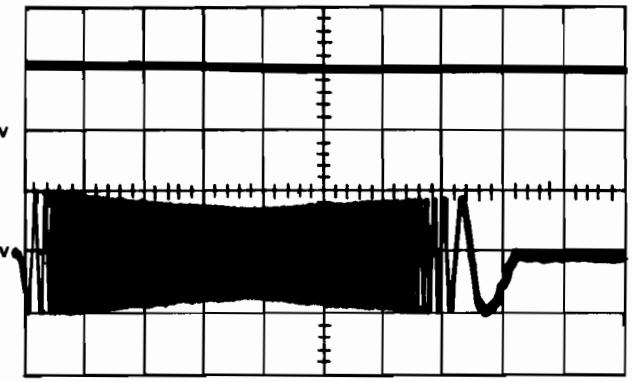
Figure 4-32. Spindle Rotating Test Waveforms



7300-84(1)

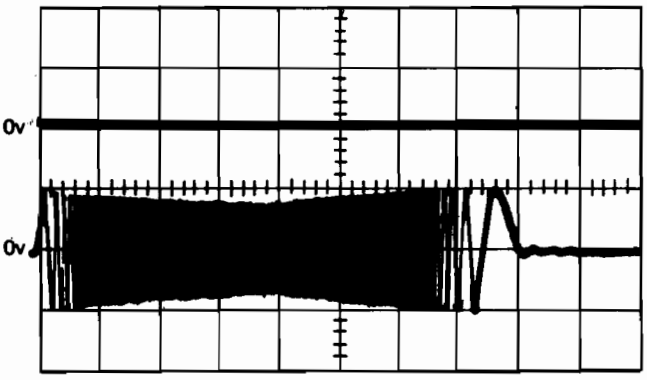
Figure 4-33. Head Positioning Test Waveforms (Sheet 1 of 4)

CHANNEL A: LSB (A3P2-16) (5 V/div.)
CHANNEL B: PCA-A5 TP POS (5 V/div)
TRIGGER: A(+)
SWEEP TIME: 5 msec/div.



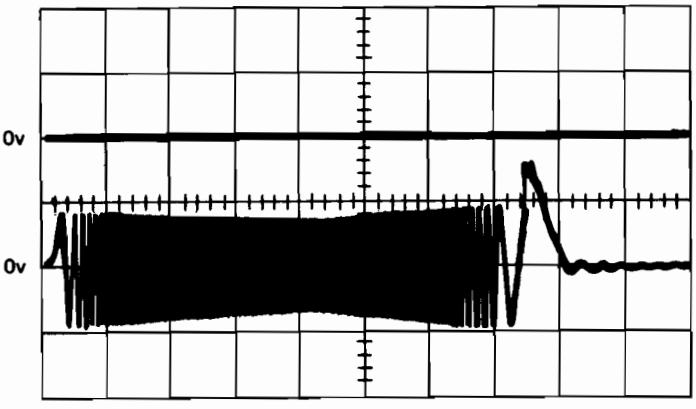
Seek from track 384 to track 1 (even track to odd track).

CHANNEL A: LSB (A3P2-16) (5 V/div)
CHANNEL B: PCA-A5 TP POS (5 V/div)
TRIGGER: A(–)
SWEEP TIME: 5 msec/div.



Seek from track 1 to track 384 (odd track to even track).

CHANNEL A: LSB (A3P2-16) (5 V/div.)
CHANNEL B: PCA-A5 TP POS (5 V/div.)
TRIGGER: A(–)
SWEEP TIME: 5 msec/div.



Seek from track 1, head 0, to track 384, head 2.

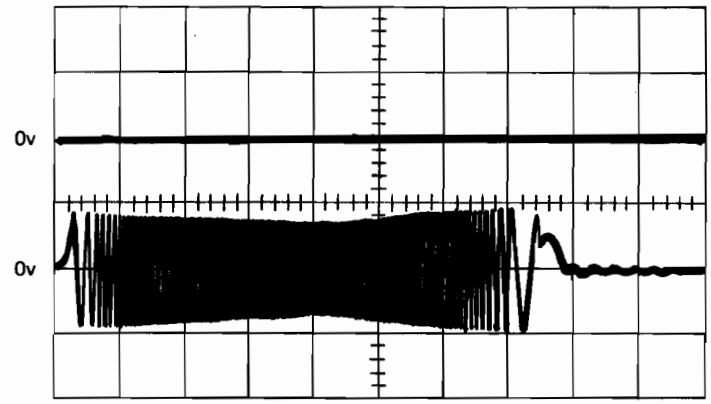
Figure 4-33. Head Positioning Test Waveforms (Sheet 2 of 4)

CHANNEL A: LSB (A3P2-16) (5 V/div.)

CHANNEL B: PCA-A5 TP POS (5 V/div.)

TRIGGER: A(–)

SWEEP TIME: 5 msec/div.



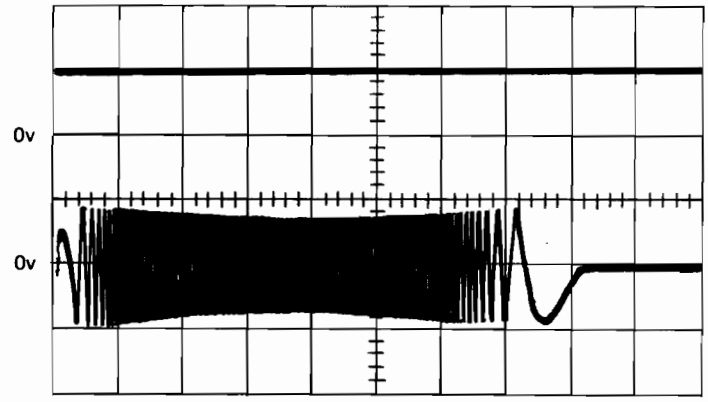
Seek from track 1, head 0 to track 384, head 3.

CHANNEL A: LSB (A3P2-16) (5 V/div.)

CHANNEL B: PCA-A5 TP POS (5 V/div.)

TRIGGER: A(+)

SWEEP TIME: 5 msec/div.



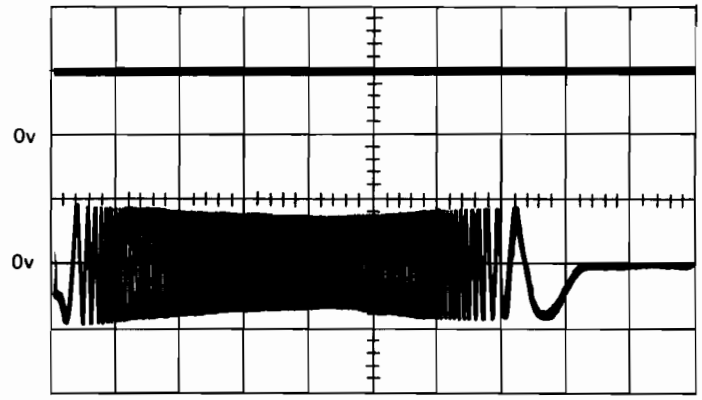
Seek from track 384, head 2 to track 1, head 0.

CHANNEL A: LSB (A3P2-16) (5 V/div.)

CHANNEL B: PCA-A5 TP POS (5 V/div.)

TRIGGER: A(+)

SWEEP TIME: 5 msec/div.



Seek from track 384, head 3 to track 1, head 0.

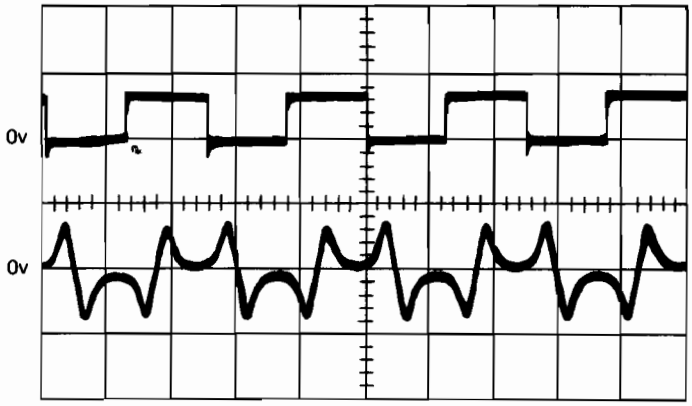
Figure 4-33. Head Positioning Test Waveforms (Sheet 3 of 4)

CHANNEL A: PCA-A5 TP REF (5 V/div.)

CHANNEL B: PCA-A5 TP PRE (2 V/div.)

TRIGGER: A(–)

SWEEP TIME: 1 usec/div.



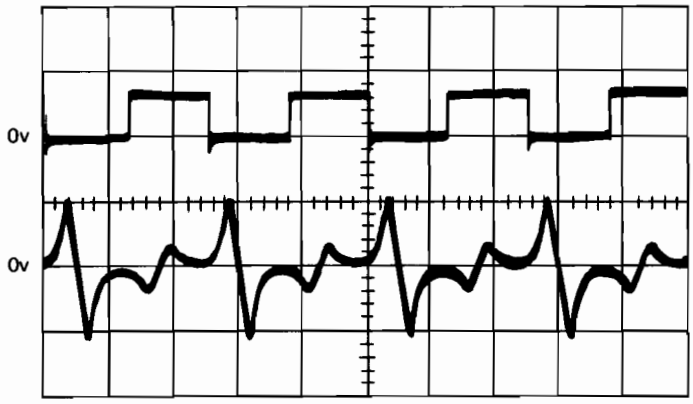
Head 0 selected, track 0.

CHANNEL A: PCA-A5 TP REF (5 V/div.)

CHANNEL B: PCA-A5 TP PRE (2 V/div.)

TRIGGER: A(–)

SWEEP TIME: 1 usec/div.



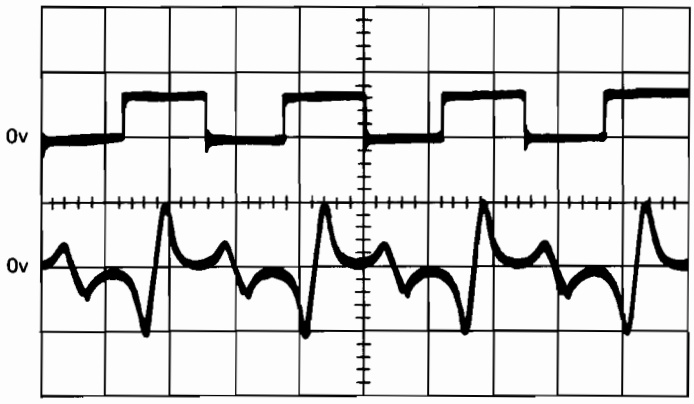
Head 2 selected, track 0.

CHANNEL A: PCA-A5 TP REF (5 V/div.)

CHANNEL B: (2 V/div.)

TRIGGER: A(–)

SWEEP TIME: 2 usec/div.



Head 3 selected, track 0.

Figure 4-33. Head Positioning Test Waveforms (Sheet 4 of 4)

REMOVAL AND REPLACEMENT

SECTION V

5-1. INTRODUCTION

This section provides detailed removal and replacement procedures for those disc drive assemblies which are field replaceable. The order in which these procedures is presented is based on which assemblies are most often removed or replaced, or whether one or more assemblies must be removed before another assembly can be removed. Throughout these procedures, references are made to index and figure numbers (those numbers in parentheses) which correspond to parts listings and illustrations found in section VI of this manual. These references may be used to locate a particular part to a given parts listing and/or illustration. A figure number is listed with an index number when an illustration is first referenced and it remains in effect until a new illustration is referenced.

Procedures are presented early in this section for removing power from the disc drive and for removing the service covers, since one or more of these items must always be removed before any of the assemblies can be removed. Also, it is assumed that most disc drives will be rack mounted, so a procedure is provided for extending the disc drive on its rack slides to permit easy access to each assembly. If the disc drive is not rack mounted or if it has been removed from the equipment cabinet, disregard any reference to this procedure.

WARNING

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

5-2. PREPARATION FOR SERVICE

The following paragraphs provide procedures for removing and restoring disc drive power and for sliding the disc drive out of the equipment cabinet for servicing.

Note: The access information provided in this section is applicable to a disc drive mounted in an HP 29400B-Series Cabinet. Special procedures are required to access a disc drive mounted in an HP 29425 Cabinet. Refer to the *HP 29425 Cabinet Installation and Service Manual,* part no. 29425-90001, for this information.

5-3. POWER REMOVAL AND RESTORATION

Most of the removal or replacement procedures presented in this section require that disc drive power be removed before they are performed. To remove power from the disc drive, proceed as follows:

a. If the disc drive is operating, set the RUN/STOP switch to STOP. The DRIVE READY indicator will go out immediately.

b. Allow the spindle to halt (approximately 25 seconds). The DOOR UNLOCKED indicator will light indicating that the spindle has stopped, the door lock solenoid is energized, and it is safe to open the cartridge access door.

c. Set the POWER switch on the power panel assembly to 0 (off). The disc drive Unit Select Identification and DOOR UNLOCKED indicators will go out.

d. Disconnect the ac power cord from the receptacle on the rear frame of the disc drive.

Note: The HP 7906A POWER switch is located on the disc drive control panel. Remove power from the HP 7906A as follows:

1. Push in on the bottom edge of the control panel access door to open it.
2. Set the POWER switch to OFF. The Unit Select Identification and DOOR UNLOCKED indicators will go off.
3. Disconnect the ac power cord from the receptacle on the rear frame of the disc drive.

Restore power to the disc drive by reversing this procedure.

5-4. EXTENDING DISC DRIVE

The disc drive can be extended on its rack slides to permit easy access to each assembly as follows:

a. Remove the lower front cover as outlined in paragraph 5-9.

b. Remove the 10-32 rack mounting screw from each rack mount plate (21, figure 6-1).

WARNING

Ensure that the cabinet is equipped with an extender base or that the extendable legs are fully extended and locked in place before attempting to extend the disc drive. Do not extend more than one disc drive on its rack slides at any one time.

CAUTION

Use care when extending the disc drive to avoid catching any of its cabling on the equipment cabinet, rack slides, or any other obstruction.

c. Slide the disc drive forward on its rack slides until it comes to a stop. The rack slides are designed to prevent the disc drive from being accidentally pulled all the way out of the equipment cabinet. With the disc drive extended in this position, all service covers and replaceable assemblies can easily be removed.

The disc drive is returned to its normal operating position by sliding it back into the equipment cabinet until it is fully seated. The two screws removed in step b can then be replaced, followed by the lower front cover.

5-5. SERVICE COVERS

There are four service covers which are easily removed to provide service access to each assembly. These are the top, bottom, rear, and lower front covers. A removal and installation procedure for each is provided in the following paragraphs.

WARNING

Use extreme caution when working on the disc drive with the covers removed, since hazardous voltages are present inside the mainframe whenever the ac power cord is connected to an active ac power source and serious injury might result.

5-6. TOP COVER

The top cover (1, figure 6-1) is removed from the disc drive as follows:

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Extend the disc drive from the equipment cabinet as outlined in paragraph 5-4.

c. Remove the four screws (2) and flat washers (3) from the top rear edge of the top cover.

d. Remove the two screws (4) from the top front edge of the top cover.

e. Lift the top cover first from the front of the drive and then from the rear of the drive. When the top cover is clear of its side retaining screws (6), carefully lift it up and away from the disc drive mainframe.

The top cover is installed by reversing this procedure.

5-7. BOTTOM COVER

The bottom cover (15, figure 6-1) is used for shipment of the disc drive only and is removed from the disc drive as follows:

Note: The bottom cover is replaced with a prefilter duct assembly when the disc drive is installed in an HP 29400B-Series/29425 Cabinet. Refer to paragraph 5-10 for removal and replacement procedures for the prefilter duct assembly. A complete description of the prefilter assembly is provided in the *HP 40019 Prefilter Assembly Installation and Service Manual,* part no. 40019-90901.

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Extend the disc drive from the equipment cabinet as outlined in paragraph 5-4.

c. Rotate the eight 1/4-turn fasteners (13) used to secure the bottom cover to the mainframe 1/4-turn counterclockwise.

d. Carefully lower the bottom cover from the disc drive.

The bottom cover is installed by reversing this procedure.

5-8. REAR COVER

The rear cover (7, figure 6-1) is removed from the disc drive as follows:

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the top cover (1) as outlined in paragraph 5-6.

c. Remove the screw and lock washer used to secure the cable clamp on the data cable to the card cage chassis (69, figure 6-3) then disconnect data cable connector A7P4 from motherboard PCA-A7 (66).

d. Remove the four screws (8 and 9, figure 6-1) and two lock washers (10) used to secure the rear cover to the disc drive mainframe.

The rear cover is installed by reversing this procedure.

5-9. LOWER FRONT COVER

The lower front cover is removed from the disc drive as follows:

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Push in on the bottom edge of the control panel access door to open it.

c. Loosen the two captive screws (40, figure 6-1) used to secure the lower front cover to the disc drive mainframe.

d. Carefully pull the lower front cover away from the mainframe just far enough so that main harness connector A9P1 can be disconnected from indicator PCA-A9 (23).

e. Disconnect A9P1 from PCA-A9.

The lower front cover is installed by reversing this procedure except that its two guide pins must be correctly positioned in the holes in the main casting (167, figure 6-3) and the control panel access door must be correctly positioned so that it does not interfere with proper seating of the lower front cover. Correct positioning of A9P1 should also be ensured.

5-10. PREFILTER DUCT ASSEMBLY

The prefilter duct assembly is removed from the disc drive as follows:

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. If the disc drive is installed in an HP 29400B-Series Cabinet, remove the prefilter grill assembly from the front of the prefilter duct.

c. Remove the filter element (64, figure 6-1) from the prefilter duct (67).

d. For a disc drive mounted in an HP 29400B-Series Cabinet, remove the prefilter panel from the cabinet.

e. If the disc drive is mounted *with* an HP 12904A Slide Mounting Kit, follow substeps (1) through (5), otherwise proceed to step f.

WARNING

Ensure that the cabinet is equipped with an extender base or that the extendable legs are fully extended and locked in place before attempting to extend the disc drive. Do not extend more than one disc drive on its rack slides at any one time.

(1) Open the control panel access door of the disc drive.

(2) Remove the two screws securing the lower front cover frame.

(3) Unplug the connector to indicator PCA-A9 and set the lower front cover frame aside.

(4) Remove the drive retaining screws from the front of the disc drive.

(5) Slide the disc drive out of the cabinet until it clears the front of the cabinet. Proceed with step g.

f. If the disc drive is mounted *without* an HP 12904A Slide Mounting Kit, work from the front or through the rear access door of the cabinet for the following steps. (Remove the side panels when working in an HP 29425 Cabinet.)

g. Detach the prefilter duct (67) by disengaging the two 1/4-turn fasteners (65).

Note: If the disc drive is not mounted with an HP 12904A Slide Mounting Kit, the 1/4-turn fasteners must be disengaged with an offset screwdriver.

h. Lower the front of the prefilter duct and after it has cleared the rubber gasket on the impeller cover, pull the duct out the front of the cabinet.

i. Remove the prefilter duct bracket (68/69) from the bottom cover brackets (16, 18) by disengaging the four 1/4-turn fasteners.

j. When shipment of the disc drive is required, attach the bottom cover, replace the lower front cover frame (if it was removed), and then refer to *HP 7906 Disc Drive Installation Manual,* part no. 07906-90902 for shipping instructions.

5-11. FILTERS

The disc drive air filtration and cooling system includes a removable absolute filter (100, figure 6-3). In addition, when the disc drive is installed in an HP 29400B-Series/29425 Cabinet, the bottom cover of the disc drive is replaced with a prefilter duct asembly containing a removable prefilter (64, figure 6-1). A complete description of the prefilter assembly is provided in the *HP 40019 Prefilter Assembly Installation and Service Manual,* part no. 40019-90901. The absolute filter and the prefilter are replaced as part of a scheduled preventive maintenance program. Removal procedures for the two filters are provided in the following paragraphs.

5-12. PREFILTER

The prefilter (part no. 3105-0329) is removed from the prefilter duct assembly for replacement and reinstalled as follows:

a. Remove the prefilter grill if fitted.

Note: In an HP 29400B-Series Cabinet, the prefilter grill is attached by magnets to the front of the cabinet below the disc drive; the prefilter grill is not fitted in an HP 29425 Cabinet.

b. Pull the prefilter (64, figure 6-1) out of the prefilter duct (67).

c. Insert a new prefilter into the prefilter duct with the airflow arrow pointing upwards.

d. Push the prefilter forward until it is fully seated in the prefilter duct.

e. Replace the prefilter grill, if fitted.

5-13. ABSOLUTE FILTER

The absolute filter (100, figure 6-3) is replaced from the front of the disc drive as follows:

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the lower front cover as outlined in paragraph 5-9.

c. Loosen the hose clamp retaining screw in the hose clamp (96) used to secure the hose (98) to the absolute filter.

d. Remove the hose from the absolute filter.

e. Remove the two knurled screws (99) used to secure the absolute filter to the main casting (167).

f. Pull down on the tab to release the absolute filter guide pin from the hole in the main casting.

g. Pull the absolute filter forward and out through the front of the disc drive.

h. Install a new absolute filter by pushing it through from the front of the disc drive. The protrusion at the rear of the absolute filter will cause it to seat correctly against the main casting air duct gasket.

i. Continue to push in and up until the guide pin is positioned in the hole in the main casting.

j. Replace the two knurled screws removed in step e.

k. Slide the hose clamp onto the hose.

l. Connect the hose to the absolute filter.

m. Tighten the hose clamp retaining screw.

n. Replace the lower front cover as outlined in paragraph 5-9.

5-14. INDICATOR LAMPS

The indicator lamps (26, figure 6-1) used to backlight the operator indicators on the lower front cover are replaced as follows:

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the lower front cover as outlined in paragraph 5-9.

c. Rotate the respective lamp contact on indicator PCA-A9 (23) counterclockwise to free the defective indicator lamp.

d. Replace the defective lamp.

e. Rotate the lamp contact to hold the new lamp in place.

f. Replace the lower front cover as outlined in paragraph 5-9.

5-15. PRINTED CIRCUIT ASSEMBLIES

Nine different printed-circuit assemblies (PCA's) are used in the disc drive. They are physically mounted in six different mounting configurations. Procedures are provided in the following paragraphs for replacing the four PCA's (A2 through A5) housed in the card cage chassis, read/write preamplifier PCA-A6, power and motor control PCA-A8, and indicator PCA-A9. Procedures for replacing motherboard PCA-A7 and spindle motor encoder PCA-A10 are provided later in this section.

5-16. CARD CAGE CHASSIS PCA'S

Each of the four PCA's housed in the card cage chassis (69, figure 6-3) is replaced as follows:

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the top cover (1, figure 6-1) as outlined in paragraph 5-6.

c. Loosen the screw (51, figure 6-3) used to secure the PCA retainer (53) to the card cage chassis.

d. Remove the PCA retainer.

e. Disconnect the interconnecting cable connector from J1 on the I/O sector PCA-A2 (54). If track follower PCA-A5 (57) is to be removed, also disconnect the servo head cable connector and the temperature sensor cable connector.

f. Simultaneously lift up on the two PCA extractor levers and slide the PCA up and out of the card cage chassis.

CAUTION

Ensure that the correct replacement PCA is inserted into its corresponding card guides, otherwise damage to the PCA could result.

CAUTION

If track follower PCA-A5 is replaced, refer to section III of this manual and perform a) the temperature compensation check (paragraph 3-4), and b) all of the adjustable parameter verification checks (paragraphs 3-15 through 3-18).

g. Insert the replacement PCA into the card guides (68). Ensure that it is correctly oriented, then push it firmly into the connectors until it is fully seated. The component side of each PCA faces toward the right of the card cage chassis as viewed from the front.

h. Replace the PCA retainer and tighten the screw loosened in step c.

i. Replace any cable connectors removed in step e.

j. Replace the top cover as outlined in paragraph 5-6.

5-17. READ/WRITE PREAMPLIFIER PCA-A6

Read/write preamplifier PCA-A6 (58, figure 6-3) is removed from the disc drive as follows:

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the top cover (1, figure 6-1) as outlined in paragraph 5-6.

c. Remove the PCA retaining screw (59, figure 6-3) and lockwasher (60).

d. Loosen the screw (31) used to secure the head connector retaining strap (30) to PCA-A6.

e. Remove the head connector retaining strap.

f. Disconnect each of the three read/write head connectors and the servo head connector from PCA-A6.

CAUTION

Use care when removing PCA-A6 to avoid catching it on the wiring in the surrounding area.

g. Carefully grasp the upper edge of PCA-A6 and pull it free from the connector on motherboard PCA-A7 (66), then remove it from the disc drive.

Read/write preamplifier PCA-A6 is installed by reversing this procedure. Ensure that the PCA is correctly oriented (the component side faces toward the rear of the disc drive), then push it firmly into the connector on motherboard PCA-A7 until it is fully seated. Also ensure that all four head connectors are correctly installed.

5-18. POWER AND MOTOR CONTROL PCA-A8

Power and motor control PCA-A8 (111, figure 6-3) is removed from the disc drive as follows:

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the prefilter duct (67, figure 6-1) as outlined in paragraph 5-10.

c. Rotate the two 1/4-turn fasteners (112, figure 6-3) used to secure PCA-A8 to the bottom cover right bracket (16, figure 6-1) 1/4-turn counterclockwise.

d. Lower PCA-A8 into its service position.

e. Remove the two screws (103, figure 6-3), flat washers (104), and nuts (105) used to secure the cooling air duct (102) to PCA-A8.

f. Remove the two screws (107) and flat washers (108) used to secure 36-pin edge connector A8P1 (106) to PCA-A8.

g. Disconnect A8P1 from PCA-A8 (see figure 5-1).

h. Disconnect spindle motor cable connector A8P4 from PCA-A8 (see figure 5-1).

i. Disconnect actuator assembly cable connector A8P3 from PCA-A8 (see figure 5-1).

j. Loosen the nine screws in terminal block A8TB1 and remove all nine transformer assembly leads (see figure 5-1).

k. Remove the three screws (109, figure 6-3) and flat washers (110) used to secure PCA-A8 to the hinged standoffs (115).

l. Remove PCA-A8 from the disc drive.

Power and motor control PCA-A8 is installed by reversing this procedure. Ensure that the PCA is correctly oriented. (The component side of the PCA faces toward the right side of the disc drive as viewed from the front when the PCA is lowered into its service position.) Also ensure that all cable connectors are properly installed and fully seated.

5-19. INDICATOR PCA-A9

Indicator PCA-A9 (23, figure 6-1) is removed from the disc drive as follows:

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the lower front cover as outlined in paragraph 5-9.

c. Unsolder the connections made at the RUN/STOP switch.

d. Remove the eight screws (24) and lock washers (25) used to secure PCA-A9 to the lower front cover.

e. Remove PCA-A9 from the lower front cover.

Indicator PCA-A9 is installed by reversing this procedure. Ensure that the leads removed in step c are properly replaced and soldered. See figure 4-30 for the correct wiring color code.

5-20. CARD CAGE CHASSIS

The card cage chassis (69, figure 6-3) is removed from the disc drive as follows:

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the top cover (1, figure 6-1) as outlined in paragraph 5-6.

c. Remove PCA-A6 retaining screw (59, figure 6-3) and lock washer (60).

d. Remove the card cage PCA's following the procedure detailed in paragraph 5-16.

e. From motherboard PCA-A7, unplug the red lead connected to diode CR3 (67).

f. Remove the six screws (64) and flat washers (65) used to secure the card cage chassis to motherboard PCA-A7.

g. Carefully lift the card cage chassis up and away from the disc drive.

The card cage chassis is installed by reversing the procedure. Ensure that all of the PCA's are correctly installed and properly seated. Check also that all cable connectors are properly installed.

5-21. MOTHERBOARD PCA-A7

Motherboard PCA-A7 (66, figure 6-3) is removed from the disc drive as follows:

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the top cover (1, figure 6-1) as outlined in paragraph 5-6.

c. Remove the card cage chassis from the disc drive following the procedure outlined in paragraph 5-20.

d. Remove read/write preamplifier PCA-A6 (58, figure 6-3) as outlined in paragraph 5-17.

e. Disconnect velocity transducer cable connector A7P2 and brush motor cable connector A7P3 from motherboard PCA-A7. The brush motor is not installed in disc drives with serial numbers prefixed 2040 and later.

f. Loosen the four fasteners used to secure motherboard PCA-A7 to the disc drive.

g. Carefully maneuver motherboard PCA-A7 up and away from the main casting just far enough to gain access to the 48-pin edge connector A7P1 (63). Disconnect A7P1 from PCA-A7.

h. Lift PCA-A7 up and away from the disc drive.

Motherboard PCA-A7 is installed by reversing this procedure.

5-22. RECEIVER ASSEMBLY

The receiver assembly accepts and holds the removable disc cartridge. It must be removed from time-to-time in order to access other assemblies in the disc drive. The removal procedure is as follows:

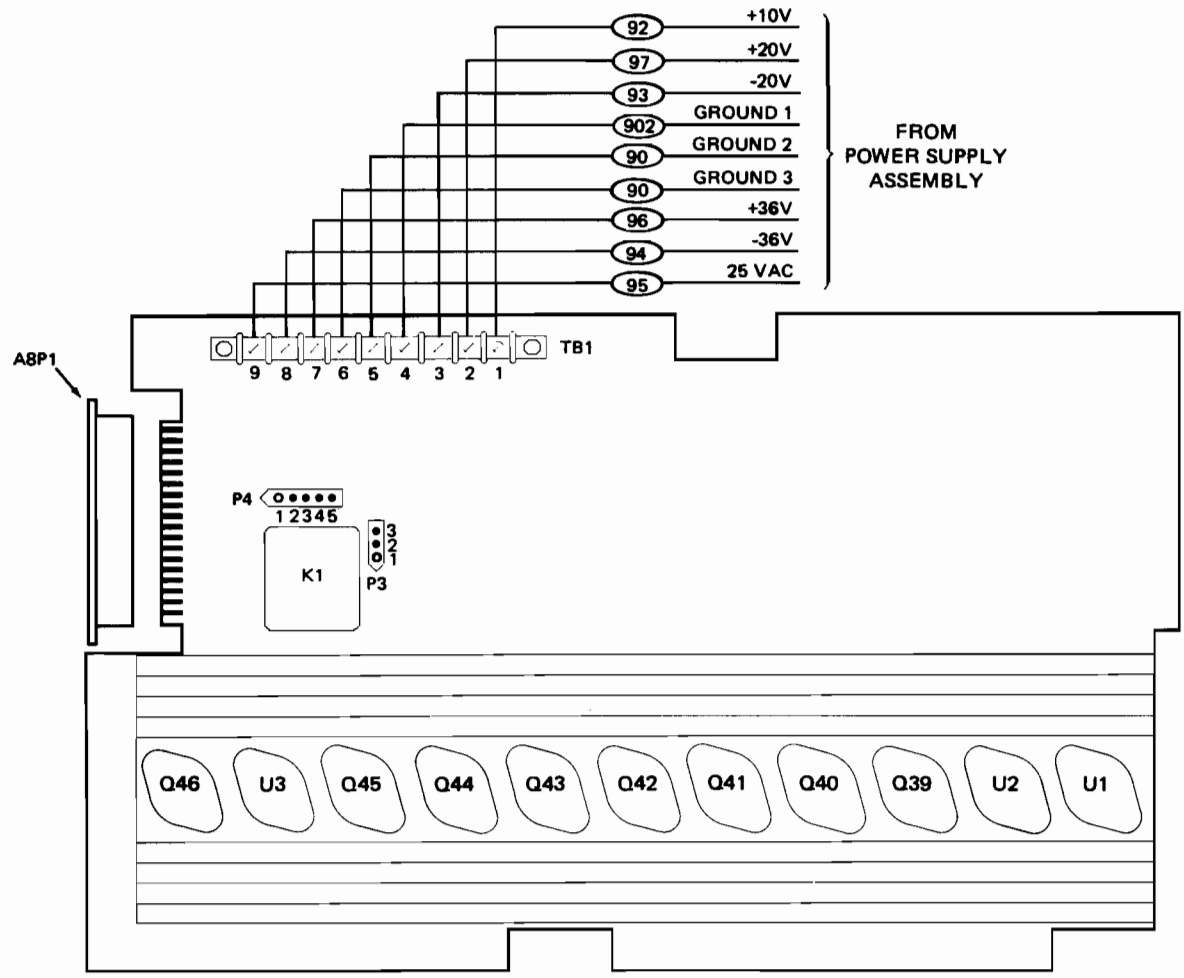
a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the top cover (1, figure 6-1) as outlined in paragraph 5-6.

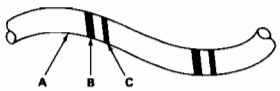
c. Press down on the door lock pawl, which is part of the door lock solenoid (124, figure 6-3), to unlatch the cartridge access door.

d. Open the cartridge access door.

e. Remove the two screws securing the left gusset plate (141) and remove the gusset.



NOTE: ENCIRCLED NUMBERS INDICATE WIRING COLOR CODE AS FOLLOWS:



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

7300-20B

Figure 5-1. Power and Motor Control PCA-A8

f. Carefully remove both springs (17, figure 6-2) from the spring brackets (18).

g. On the 7906B, remove the eight screws (5) used to secure the two receiver lips (4, 11) to the receiver assembly (36). On the 7906A, remove the four screws (10A) and flat washers (10B) used to secure the two receiver links (10C) to the cartridge access door frame (56, figure 6-1).

h. Carefully tilt the receiver assembly up toward the left of the disc drive (as viewed from the front) avoiding the switches and solenoid mounted on the right-hand gusset (140, figure 6-3).

i. Remove the receiver assembly from the disc drive.

The receiver assembly is installed by reversing this procedure. The left gusset is properly installed when the rear of the fold is flush with, or slightly forward of, the rear of the left rack mount plate. Ensure that both securing screws for the left gusset are screwed down tight. Following installation of the receiver assembly, measure the absolute filter air pressure as described in paragraph 2-13. If the pressure is below the limits specified, check that the receiver assembly is properly seated in the disc drive.

5-23. BRUSH CYCLE ASSEMBLY

All brush circuitry and related hardware have been removed from disc drives with serial numbers prefixed 2040 and later. The brush cycle assembly (77, figure 6-3) is operative only on earlier drives with control PCA-A4, part no. 07906-60002, installed. Replacement procedures for each replaceable subassembly are provided in the following paragraphs. The removal procedure for the entire brush cycle assembly is as follows:

a. Remove read/write preamplifier PCA-A6 (58) as outlined in paragraph 5-17.

b. Remove the receiver assembly as outlined in paragraph 5-22.

c. Loosen the four captive screws used to secure motherboard PCA-A7 (66) to the main casting (167) and slide the card cage chassis (69) and motherboard PCA-A7 back to provide access to the brush cycle assembly.

d. Disconnect brush motor cable connector A7P3 from motherboard PCA-A7.

e. Rotate the brush drive wheel counterclockwise to move the brush arms away from the attaching hardware and brushes-back switch (76).

f. Remove the two screws (75), flat washers (74), lock washers (73), and nuts (72) used to secure the brushes-back switch to the brush cycle assembly plate.

g. Set the brushes-back switch to one side of the working area.

h. Remove the two screws (94) and flat washers (95) used to secure the right-hand receiver cam (93) to the main casting.

i. Remove the receiver cam from the main casting.

CAUTION

Care must be exercised when removing the hardware used to attach the brush cycle assembly plate to the main casting because the brush arms may come into contact with the surfaces of the fixed disc.

j. Remove the three screws (70) and flat washers (71) used to secure the brush cycle assembly plate to the main casting.

k. Rotate the brush arms back into their retracted position.

l. Carefully lift the brush cycle assembly up to the right (as viewed from the front) and away from the disc drive.

The brush cycle assembly is installed by reversing this procedure. Ensure that the brushes-back switch is properly adjusted so that it "clicks" open whenever the indentation in the brush drive wheel and the switch arm are aligned, and it "clicks" closed whenever they are not. If the brushes-back switch requires adjustment, refer to paragraph 3-6.

5-24. DISC BRUSHES

The disc brushes (82, figure 6-3) are removed as follows:

a. Remove the brush cycle assembly (77) as outlined in paragraph 5-23.

b. Carefully pull both disc brushes from the brush arms.

c. Replace the brush cycle assembly as outlined in paragraph 5-23.

5-25. BRUSH MOTOR

The brush motor is operative only on earlier drives with control PCA-A4, part no. 07906-60002, installed. The brush motor (78, figure 6-3) is removed from the disc drive as follows:

a. Remove the brush cycle assembly (77) as outlined in paragraph 5-23.

b. Remove the two screws (79), lock washers (80), and nuts (81) used to secure the brush motor to the brush cycle assembly plate.

c. Loosen the set screw in the brush drive wheel to free it from the brush motor shaft.

d. Remove the brush motor from the brush cycle assembly plate.

The brush motor is installed by reversing this procedure.

5-26. BRUSHES-BACK SWITCH

The brushes-back switch is operative only on earlier drives with control PCA-A4, part no. 07906-60002, installed. The brushes-back switch (76, figure 6-3) is removed from the disc drive as follows:

a. Perform the brush cycle assembly (77) removal procedure as outlined in paragraph 5-23, steps a through f.

b. Unsolder the connections made at the brushes-back switch.

c. Remove the brushes-back switch from the brush cycle assembly plate.

The brushes-back switch is installed by reversing this procedure. Ensure that the leads removed in step b are properly replaced and soldered. See figure 4-30 for the correct wiring color code. Also, ensure that the brushes-back switch is properly adjusted so that it "clicks" open whenever the indentation in the brush drive wheel and the switch arm are aligned, and it "clicks" closed whenever they are not. If the brushes-back switch requires adjustment, refer to paragraph 3-6.

5-27. CARTRIDGE-IN-PLACE SWITCH

The cartridge-in-place switch (41, figure 6-2) is removed from the disc drive as follows:

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the top cover (1, figure 6-1) as outlined in paragraph 5-6.

c. Remove the two screws (42 and 43, figure 6-2) used to secure the cartridge-in-place switch bracket (44) to the top disc cover (52).

d. Remove the two screws (40), four flat washers (39), two lock washers (38), and two nuts (37) used to secure the cartridge-in-place switch to the cartridge-in-place switch bracket.

e. Unsolder the connections made at the cartridge-in-place switch.

f. Remove the cartridge-in-place switch from the cartridge-in-place switch bracket.

The cartridge-in-place switch is installed by reversing this procedure. Ensure that the leads removed in step e are properly replaced and soldered. See figure 4-30 for the correct wiring color code. Also, ensure that the cartridge-in-place switch is properly adjusted so that it "clicks" closed whenever a cartridge is installed and the cartridge access door is latched, and it "clicks" open as the cartridge is removed. If the cartridge-in-place switch requires adjustment, refer to paragraph 3-8.

5-28. TEMPERATURE SENSOR ASSEMBLY

The temperature sensor assembly (46, figure 6-2) is removed from the disc drive as follows:

a. Remove the top cover (1, figure 6-1) as outlined in paragraph 5-6.

b. Remove the screw (45, figure 6-2) used to secure the temperature sensor assembly to the top disc cover (52).

c. Remove the cable clamp securing the temperature sensor assembly cable to the actuator assembly (45, figure 6-3).

d. Unplug the temperature sensor assembly cable from track follower PCA-A5 (57).

e. Remove the temperature sensor assembly from the disc drive.

The temperature sensor assembly is installed following the reverse procedure. Ensure that the printed-circuit board on the assembly is positioned parallel to the beams of the actuator assembly before tightening the screw securing the sensor to the top disc cover.

5-29. INDEX TRANSDUCER

The index transducer (65, figure 6-2) generates an index pulse for each revolution of the removable disc. The removal procedure is as follows:

a. Remove the receiver assembly as outlined in paragraph 5-22.

b. Remove the two screws (42 and 43) used to secure the cartridge-in-place switch bracket (44) to the top disc cover (52).

c. Set the cartridge-in-place switch and bracket to one side of the working area.

d. Remove the eight screws (45) used to secure the top disc cover to the main casting (167, figure 6-3).

CAUTION

Care must be exercised whenever the top disc cover is removed to prevent any objects or contaminants from contacting the exposed upper surface of the fixed disc (69, figure 6-2).

e. Remove the top disc cover from the main casting.

f. Remove the two screws (53) and flat washers (54) used to secure the label plate (55) to the main casting.

g. Disconnect the 2-pin cable connector (58) from the main harness connector (56).

CAUTION

The upper surface of the fixed disc must be protected from accidental contact with the index transducer support (66) and its securing hardware before removing the support from the drive.

h. Place a folded Kimwipe tissue between the index transducer support and the exposed surface of the fixed disc.

i. Remove the two screws (59 and 60) and lock washer (61) used to secure the index transducer support to the main casting.

j. Lift the index transducer support back, then up from the disc drive.

k. Using Pin Extractor tool, part no. 8710-0688, remove the connector contacts (64) from the 2-pin cable connector.

l. Remove the two screws (62) and flat washers (63) used to secure the index transducer to the index transducer support.

m. Remove the index transducer from the index transducer support.

To install and mechanically align the index transducer, proceed as follows:

a. Secure the index transducer to the index transducer support using the two screws and flat washers removed in step l of the removal procedure.

b. Feed the two index transducer leads through the hole in the index transducer support, being careful not to damage the connections.

c. Insert the connector contact on the white lead into the hole (pin 1) at the rear of the 2-pin cable connector.

d. Insert the connector contact on the black lead into the hole (pin 2) at the rear of the 2-pin cable connector.

CAUTION

The upper surface of the fixed disc must be protected from accidental contact with the index transducer support and its securing hardware before replacing the support.

e. Place a folded Kimwipe tissue on the exposed surface of the fixed disc at the front.

f. Carefully replace the index transducer support, ensuring that it is perpendicular to the front of the disc drive.

g. Replace the two screws and lock washer removed in step i of the removal procedure, then tighten each to 10 in.-lbs.

Note: The lock washer is used on the socket-head cap screw.

h. Loosen the two screws used to secure the index transducer to the index transducer support 1/2-turn counterclockwise.

CAUTION

Use care not to rotate the spindle in either direction once the index transducer alignment hub is installed.

i. Place Index Transducer Alignment Hub, part no. 12995-60005, onto the spindle motor hub assembly as shown in figure 5-2.

j. Move the index transducer forward until the tip just touches the tab on the index transducer alignment hub. See figure 5-2, view A.

k. Tighten the two screws loosened in step h of this procedure.

l. Remove the index transducer alignment hub.

m. Remove the Kimwipe tissue.

n. Connect the 2-pin cable connector to the main harness connector.

o. Replace the label plate removed in step f of the removal procedure.

p. Replace the top disc cover removed in step e of the removal procedure.

q. Replace the cartridge-in-place switch and bracket removed in step b of the removal procedure.

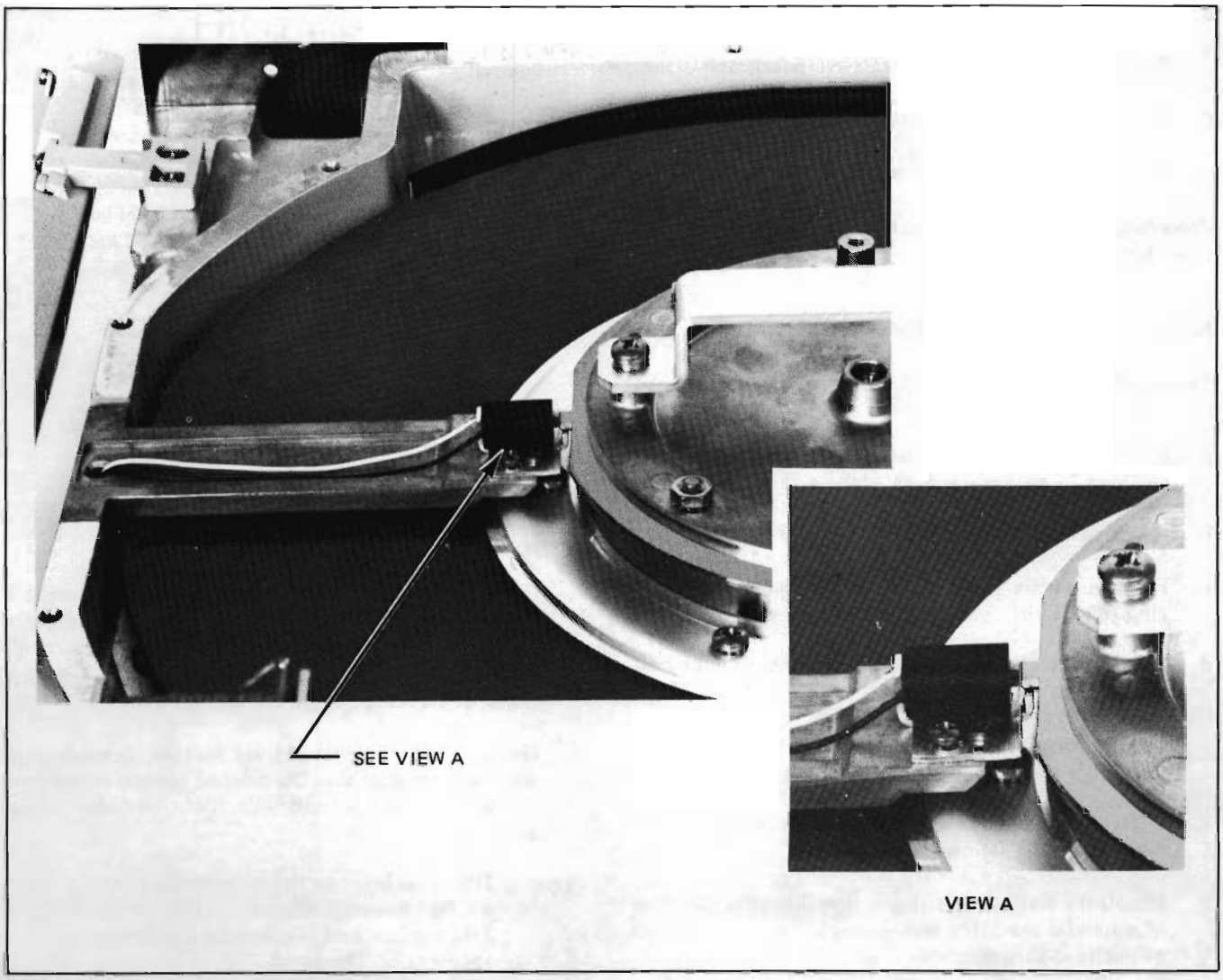


Figure 5-2. Using the Index Transducer Alignment Hub

r. Replace the receiver assembly as outlined in paragraph 5-22.

s. Ensure that the output of the index transducer is within specifications as follows:

(1) With the removable disc pack installed and spinning, monitor the signal at pin P2-H of I/O sector PCA-A2 with an oscilloscope.

(2) Check that the waveform observed is a positive-going pulse occurring every 16.67 milliseconds and having an amplitude of at least 9 volts. A typical amplitude is 12 volts.

(3) If the amplitude is below 9 volts, repeat steps i through l of the index transducer installation procedure and then repeat substeps (1) and (2) above. If the amplitude is still below 9 volts, the index transducer is defective and should be replaced.

t. Verify index transducer alignment as outlined in paragraph 3-17.

5-30. FIXED DISC

The fixed disc (69, figure 6-2) provides one data and one servo recording surface. Replacement of the fixed disc is only required if either surface becomes defective. If this should occur, the corresponding head may also require replacement. Refer to paragraph 5-38. The fixed disc must also be removed when the spindle assembly (70) requires replacement. Replacement of the fixed disc involves seven unique operations. These operations must be performed in the following order:

a. Fixed disc removal (paragraph 5-31).

b. Fixed disc installation (paragraph 5-32).

c. Fixed disc runout verification (paragraph 5-33).

d. Fixed disc flatness verification (paragraph 5-34).

e. Fixed disc servo surface formatting (paragraph 5-35).

f. Fixed disc servo surface verification (paragraph 5-36).

g. Fixed disc data surface formatting (paragraph 5-37).

Procedures for performing each of these operations are provided in the following paragraphs.

5-31. FIXED DISC REMOVAL

The fixed disc (69, figure 6-2) is removed from the disc drive as follows:

a. Remove the index transducer (65) and support (66) as outlined in paragraph 5-29, steps a through j.

b. Remove the Kimwipe tissue.

c. Remove the six screws (67) used to secure the clamp ring (68) to the spindle motor hub assembly.

d. Remove the clamp ring from the spindle motor hub assembly.

e. Gently grasp the fixed disc (by its outer edges only) and lift it up and away from the disc drive.

f. Carefully place the fixed disc on a flat surface lined with a layer of Kimwipe tissues.

g. Install the fixed disc (either a new disc or in the case of a spindle assembly replacement, the original disc) as outlined in paragraph 5-32.

5-32. FIXED DISC INSTALLATION

The fixed disc (69, figure 6-2) is installed as follows:

a. After the fixed disc has been removed as outlined in paragraph 5-31, clean the exposed area of the main casting (167, figure 6-3) vacated by the spindle assembly (70, figure 6-2) as outlined in paragraph 2-17, steps d through f.

b. Clean the top surface of the spindle assembly as outlined in paragraph 2-16, steps c through f.

CAUTION

Never touch the oxide layer on either side of the fixed disc. The thickness of a smudged fingerprint is several times greater that the flying height of the heads as they travel over the disc surfaces and this contamination could cause damage to the heads and/or the disc surfaces.

CAUTION

Hewlett-Packard strongly recommends wearing finger cots (9300-0399) and a face mask (9301-0170) while handling an exposed 7906 fixed disc (07906-60009). These precautions will help to eliminate skin oil and breath contaminants which cannot be removed from the disc with alcohol. This contamination can cause premature failure of the disc.

These precautions, currently employed by Hewlett-Packard and the media vendor, have helped to reduce the number of rejected discs.

Note: Put face mask on before finger cots. This will help to prevent hair oil from contaminating the finger cots.

c. Clean both recording surfaces of the fixed disc using a Texwipe 9 in. by 9 in. lintless cotton wipe slightly dampened with filtered 91-percent isopropyl alcohol. Wipe surface from inside to outside edge. Using a clean, dry Texwipe, wipe the surface again until dry.

d. Gently grasp the cleaned fixed disc (by its outer edge only) and place it onto the cleaned spindle motor hub assembly with its light side (data surface) facing downward.

Note: The oxide layer on the servo surface is of a different composition than that on the data surface and it presents a different appearance. The servo surface is darker and more brown in color while the data surface is lighter and more orange in color.

e. Replace the clamp ring removed in step d of the removal procedure.

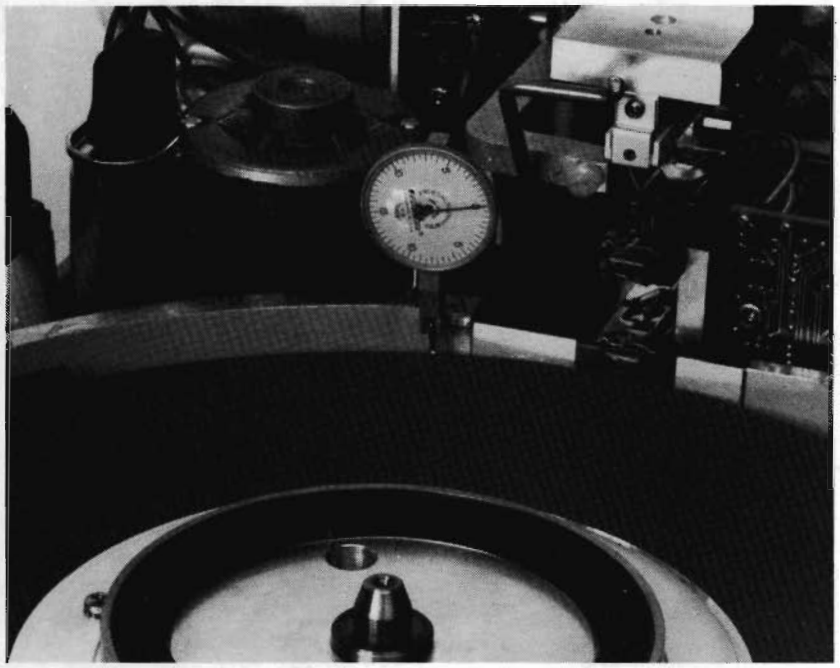
f. Replace the six screws removed in step c of the removal procedure.

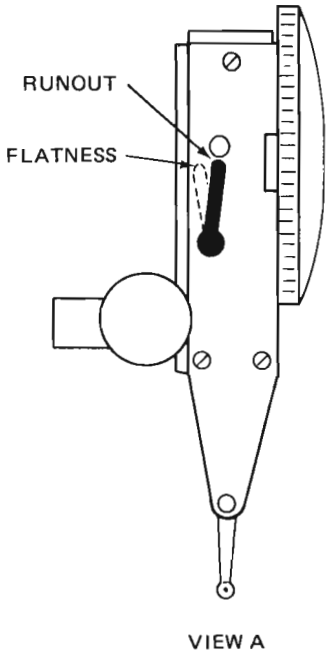
Note: Do not tighten these screws at this time.

g. Verify fixed disc runout as outlined in paragraph 5-33 and adjust, if necessary.

5-33. FIXED DISC RUNOUT VERIFICATION

Fixed disc runout must be adjusted to minimize vibrations caused by the mechanical unbalance of the disc when it reaches its operational speed of 3600 revolutions per minute. Runout is first verified and then if necessary, an adjustment is made. Use the following procedure:





7300-22
7300-23

Figure 5-3. Checking Fixed Disc Runout

a. Ensure that the fixed disc (69, figure 6-2) is correctly installed as outlined in paragraph 5-32.

b. Thread Dial Indicator Holder, part no. 12995-20017, into the hole in the main casting (167, figure 6-3) just to the left of the path taken by the heads. See figure 5-3.

c. Slide Dial Indicator, part no. 8750-0308, onto the dial indicator holder, position it so that the ball rests against the outer edge of the fixed disc, then secure it in place.

Note: The dial indicator has a two-position switch located on its left side (as viewed from the front). Ensure that this switch is set up toward the dial indicator when verifying fixed disc runout. See figure 5-3, view A.

d. Rotate the outer edge of the dial indicator until the pointer is aligned with zero.

Note: The dial indicator is calibrated in thousandths of an inch. Each major division equals 0.001-inch and each minor division equals 0.0005-inch.

e. Slowly rotate the spindle motor hub assembly clockwise and observe the indication on the dial indicator for at least one revolution.

If the indication observed in step e is less than or equal to 0.002-inch TIR (total indicated reading), torque the six screws (67, figure 6-2) to 8 in.-lbs, then repeat step e to recheck the runout. If the runout remains within the specified range, verify fixed disc flatness as outlined in paragraph 5-34.

Note: Each screw must be tightened a little at a time which has the effect of tightening all of them at the same time. Failure to apply an even pressure distribution around the clamp ring can distort or move the fixed disc.

If the indication observed in step e is greater than 0.002-inch TIR, proceed as follows:

(1) Slowly rotate the spindle motor hub assembly clockwise and observe the indication on the dial indicator for at least one revolution.

Note: The indication on the dial indicator may vibrate slightly due to the finishing characteristics of the oxide at the outer edge of the fixed disc. This vibration is normal and should be ignored.

(2) Determine the total extent of the deviation.

(3) Slowly rotate the spindle motor hub assembly until the lowest extreme of deviation is observed on the dial indicator.

(4) Gently tap or push on the outer edge of the fixed disc until the indication on the dial indicator is midway between the extremes determined in substep 2.

(5) Slowly rotate the spindle motor hub assembly clockwise and observe the dial indicator for at least one revolution. The indication should be less than or equal to 0.002-inch TIR.

If the indication observed in substep (5) is less than or equal to 0.002-inch TIR, torque the six screws (60) to be 8 in.-lbs, then repeat substep (5) to recheck the runout. If the runout remains within the specified range, verify fixed disc flatness as outlined in paragraph 5-34.

If the indication observed in substep (5) is greater than 0.002-inch TIR, repeat substeps (1) through (5) of this adjustment procedure.

5-34. FIXED DISC FLATNESS VERIFICATION

The fixed disc (69, figure 6-2) must present an extremely flat surface to the heads in order to minimize their up and down movement as they travel over the disc surfaces. Flatness is verified as follows:

a. Ensure that the fixed disc is correctly installed and that the runout is within the specified range as outlined in paragraphs 5-32 and 5-33, respectively.

b. Thread Dial Indicator Holder, part no. 12995-20017, into the hole in the main casting (167, figure 6-3) just to the left of the path taken by the heads. See figure 5-4.

CAUTION

Ensure that the ball is not positioned so that it rides over the chamfered area of the fixed disc because an incorrect indication will result.

c. Slide Dial Indicator, part no. 8750-0308, onto the dial indicator holder. Position it so that the ball rests on the top outer circumference of the fixed disc within 1/4 inch of the outer edge, then secure it in place. See figure 5-4.

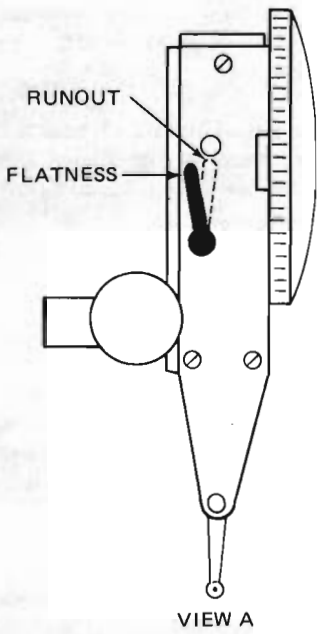
Note: The dial indicator has a two-position switch located on its left side (as viewed from the front). Ensure that this switch is set down away from the dial indicator when verifying fixed disc flatness. See figure 5-4, view A.

d. Rotate the outer edge of the dial indicator until the pointer is aligned with zero.

Note: The dial indicator is calibrated in thousandths of an inch. Each major division equals 0.001-inch and each minor division equals 0.0005-inch.

e. Slowly rotate the spindle motor hub assembly clockwise and observe the indication on the dial indicator for at least one revolution.

If the indication observed in step e is less than or equal to 0.004-inch TIR, skip to step f.



7300-24

Figure 5-4. Checking Fixed Disc Flatness

If the indication observed in step e is greater than 0.004-inch TIR, loosen the six screws (67, figure 6-2) used to secure the clamp ring to the spindle motor hub assembly, rotate the fixed disc 90 degrees, then reverify runout and flatness. If the indication observed in step e is still greater than 0.004-inch TIR, remove the fixed disc and inspect the mating surfaces between the fixed disc and the spindle motor hub assembly and clamp ring. Clean these surfaces as required, then reinstall the fixed disc and reverify runout and flatness.

f. Install and mechanically align the index transducer as outlined in the installation procedure in paragraph 5-29, steps e through t.

g. Inspect the servo head and data head 2 for contamination, excessive wear, and/or damage. See figure 2-3. If necessary, clean as outlined in paragraph 2-14 or replace as outlined in paragraph 5-38.

h. Format the servo surface as outlined in paragraph 5-35.

5-35. FIXED DISC SERVO SURFACE FORMATTING

Once the fixed disc (69, figure 6-2) has been installed, its runout and flatness have been verified, and the servo head and data head 2 have been inspected and/or replaced, the servo surface must be formatted (servo code written onto the upper surface). Use the following procedure:

CAUTION

Never attempt the formatting process without complete assurance that the motion control system is functioning properly.

a. Remove the data head from head positon 0 and install a servo head as outlined in paragraph 5-38. Use Head Initial Position Tool, part no. 12995-60012, to set the initial position of the head and tighten the captive head clamp screw to 5 in.-lbs, using Torque Wrench, part no. 1535-2653.

b. Install Servo Formatting PCA, part no. 12995-60014, as follows:

(1) Loosen the screw (51, figure 6-3) used to secure the PCA retainer (53) to the card cage chassis (69).

(2) Remove the PCA retainer.

(3) Disconnect the interconnecting cable connector from J1 on I/O sector PCA-A2 (54), then remove PCA-A2 from the card cage chassis.

(4) Disconnect the servo head cable connector and the temperature sensor cable connector from track follower PCA-A5 (57), then remove PCA-A5 from the card cage chassis.

(5) Insert the servo formatting PCA into the card guides (68) for A5 as shown in figure 5-5. Ensure that it is correctly oriented, then push it firmly into the connectors until it is fully seated. The component side of the PCA must face toward the right as viewed from the front.

c. Install Head Alignment Preamplifier PCA, part no. 12995-60040, as outlined in paragraph 3-13.

CAUTION

Under no circumstances are the head connections mentioned in steps d and e to be reversed. Also, ensure that the bottom cable loops down and the top cable loops up to eliminate any crosstalk between the two servo heads.

d. Connect the servo head in the servo head position to the third connector from the top on the head alignment preamplifier PCA and to the bottom connector on the servo formatting PCA (see figure 5-5).

e. Connect the servo head in head position 0 to the top connectors on both the head alignment preamplifier PCA and the servo formatting PCA (see figure 5-5).

f. Degauss the fixed disc as follows:

(1) Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

(2) Remove the prefilter duct (67, figure 6-1) as outlined in paragraph 5-10.

(3) Rotate the two 1/4-turn fasteners (112, figure 6-3) used to secure power and motor control PCA-A8 (111) to the bottom cover right bracket (16, figure 6-1) 1/4-turn counterclockwise.

(4) Lower PCA-A8 into its service position.

(5) Disconnect actuator assembly cable connector A8P3 from PCA-A8 (see figure 5-1).

WARNING

To avoid potentially serious electrical shock, make certain that the terminal block cover (24, figure 6-3) over power supply assembly terminal block TB1 is in place. Exercise caution at all times while degaussing the fixed disc.

(6) Restore power to the disc drive as described in paragraph 5-3.

(7) Set the RUN/STOP switch to RUN. The heads will not load since A8P3 is disconnected.

7300-25

Figure 5-5. Servo Formatting PCA Installed

CAUTION

Use care to avoid touching the spinning spindle motor hub assembly with the hand degausser. Also, do not release the power switch on the hand degausser while it is in the vicinity of the fixed disc because this will cause information to be written.

CAUTION

At no time during the degaussing procedure, allow the spindle motor to come up to full speed (approximately 30 seconds). This is to prevent the magnetic field of the spindle motor from becoming synchronized with the magnetic field of the hand degausser. When the spindle motor

nears full speed, release the cartridge-in-place switch and allow the spindle motor to slow down before overriding the cartridge-in-place switch again.

(8) Override the cartridge-in-place switch (41, figure 6-2) by pressing on the switch arm (see figure 5-6). As the spindle motor comes up to speed, press and hold the power switch on Hand Degausser, part no. 0950-1551, and slowly lower it into the position above the fixed disc shown in figure 5-6, view A.

(9) After several seconds, slowly draw the hand degausser up and away from the disc drive, then slowly lower it into the position shown in figure 5-6, view B.

(10) After several seconds, slowly draw the hand degausser up and away from the disc drive.

(11) Repeat substeps (8) through (10) two more times.

(12) Set the RUN/STOP switch to STOP.

(13) Remove power from the disc drive as described in paragraph 5-3.

(14) Connect the actuator assembly cable connector to power and motor control PCA-A8 at connector A8P3.

(15) Return PCA-A8 to its normal operating position and secure it in place.

(16) Replace the prefilter duct as outlined in paragraph 5-10.

g. Carefully insert CE Servo Reference Cartridge, part no. 12995-60031, access-door end first, into the disc drive.

h. Restore power to the disc drive as described in paragraph 5-3.

i. Set the RUN/STOP switch to RUN. The heads will load and the START LED (light-emitting diode) on the servo formatting PCA will light.

j. From room ambient, allow at least 20 minutes for the disc drive and cartridge temperature to warm up and stabilize.

CAUTION

Ensure that the disc drive does not encounter any shock or vibration during the write cycle (when the WRITE LED is flashing). Such disturbances may cause incorrect formatting.

k. Press the START pushbutton on the servo formatting PCA. The START LED will go out and the WRITE LED will begin to flash.

During the formatting process, the disc drive will incrementally seek across the entire servo surface (inner guard band, cylinders 0 through 410, and outer guard band). Each track is erased with a polarity that corresponds to the servo code to be written and then the servo code is written. After the write cycle is completed, the WRITE LED will go out and the COMPLETE LED will light.

l. Verify the servo surface as outlined in paragraph 5-36.

5-36. FIXED DISC SERVO SURFACE VERIFICATION

Servo surface verification is required after servo surface formatting to ensure that the servo surface of the fixed disc was correctly formatted. Use the following procedure:

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Disconnect the two servo head cable connectors from the servo formatting PCA, then remove the PCA from the card cage chassis (69, figure 6-3).

c. Replace I/O sector PCA-A2 (54) and track follower PCA-A5 (57). Do not connect temperature sensor cable.

d. Install head alignment PCA, part no. 12995-60003 or 13354-60010, and DSU Test Module, part no. 12995-60045 or 13354-60005, as outlined in paragraph 3-13.

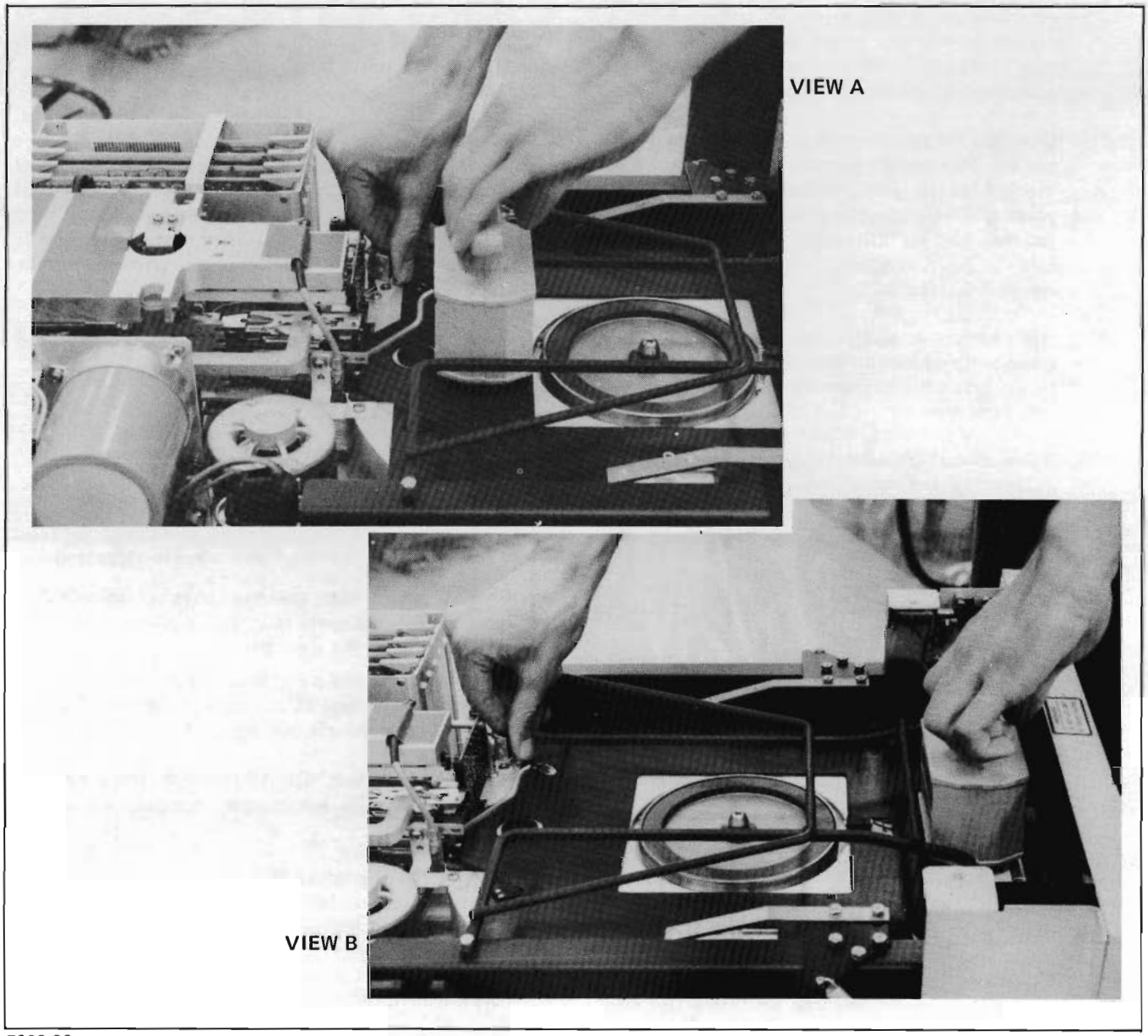
e. Connect the free servo head cable connector from the servo head in the servo head position to track follower PCA-A5.

f. Connect the free servo head cable connector from the servo head in head position 0 to the head alignment PCA head cable connector using DSU Adapter, part no. 12995-60048.

Note: Proper orientation of the DSU adapter is essential for servo surface verification. The end with the three adjacent pins must be connected to the servo head cable connector while the other end must be connected to the head alignment PCA head cable connector.

g. Restore power to the disc drive as described in paragraph 5-3.

h. With CE Servo Reference Cartridge, part no. 12995-60031, still installed, set the RUN/STOP switch to RUN. The heads will load to cylinder 0.



7300-26
7300-27

Figure 5-6. Using the Hand Degausser

i. Align the servo head in head position 0 as outlined in the adjustment procedure in paragraph 3-18, substeps (1) through (12).

Note: The servo code written during the formatting process is offset by half a track from the servo code written on the CE servo reference cartridge. Therefore, the servo head in head position 0 must be moved back toward the actuator assembly by this half track width.

j. Select the verify mode on the upper bank of DSU test module switches (switch 32 set to the right).

k. Select cylinder address 1 on the lower bank of DSU test module switches (switch 1 set to the right).

l. Set the FUNCTION switch on the DSU test module to position 2 (INCREMENTAL SEEK).

m. Press the START (STROBE) pushbutton on the DSU test module and allow the disc drive to perform at least one full series of incremental and decremental seek operations from cylinder 0 to 410 and back to 0.

Note: The disc drive will continue to perform a series of incremental seek operations from cylinder 0 to 410, then perform a series of decremental seek operations from cylinder 410 to 0, then repeat the process indefinitely until either a) a verify error is encountered, or b) the STOP pushbutton on the DSU test module is pressed. If a verify error is encountered,

the disc drive will stop and the magnitude of the error will be displayed on the DSU test module HEAD ALIGNMENT meter. In this case, repeat steps i through n of this procedure. If the alignment of the servo head in head position 0 is within tolerance, reformat the servo surface, then reverify it.

n. Observe the DSU test module HEAD ALIGNMENT meter.

If the indication displayed is less than or equal to ±10 increments (±125 microinches) on the DSU test module HEAD ALIGNMENT meter, proceed to step o.

If the indication displayed is greater than ±10 increments (±125 microinches) on the DSU test module HEAD ALIGNMENT meter, a verify error is indicated. The disc drive will stop and the magnitude of the error will be displayed on the DSU test module HEAD ALIGNMENT meter. In this case, repeat steps i through n of this procedure. If the alignment of the servo head in head position 0 is within tolerance, reformat the servo surface, then verify it again.

o. Press the STOP pushbutton on the DSU test module.

p. Remove the servo head in head position 0 and install a data head as outlined in paragraph 5-38.

q. Check the alignment of all adjustable parameters as outlined in paragraphs 3-12 through 3-18.

5-37. FIXED DISC DATA SURFACE FORMATTING

Once the fixed disc has been installed, its runout and flatness verified, the servo head and data head 2 inspected and/or replaced, and the servo surface formatted and verified, the data surface must be formatted (preamble and postamble written onto the lower surface). If the disc drive is installed in an HP system, refer to the appropriate diagnostic manual. Once formatted, perform the on-line checkout as outlined in paragraph 3-19.

5-38. DATA AND SERVO HEADS

A separate data head is provided for each of the three data surfaces and a servo head is provided for the servo surface. If a head becomes defective, it must be replaced. Heads must also be removed from time-to-time in order to access other assemblies in the disc drive. The removal procedure is as follows:

a. Remove the card cage chassis (69, figure 6-3) and motherboard PCA-A7 (66) as outlined in paragraphs 5-20 and 5-21, respectively.

b. Install Head Installation Tool, part no. 12995-60008, on the head to be removed as shown in figure 5-7.

c. Hold the head in place by applying a slight pressure to the head installation tool, then loosen the captive head clamp screw.

CAUTION

Never lay a head down on its slider surface because this may alter or damage its flying characteristics.

d. Remove the head with the head installation tool attached from the disc drive.

To install a head and mechanically set its initial position, proceed as follows:

a. Install the head installation tool on the replacement head as follows:

(1) Grasp the head and head installation tool as shown in figure 5-8, view A.

Note: Hold the head installation tool so that the inscription on its side is legible; i.e., UP when working with data head 1 or 2 and DN when working with data head 0 or the servo head.

(2) Position the large pin at the bottom of the head installation tool into the rectangular hole in the head arm as shown in figure 5-8, views B and C and observe the curvature of the unflexed head.

(3) Gently deflect the center of the head arm upward to position it above the other large pin at the top of the head installation tool as shown in figure 5-8, view D.

b. Clean the replacement head as outlined in paragraph 2-14, steps c through h.

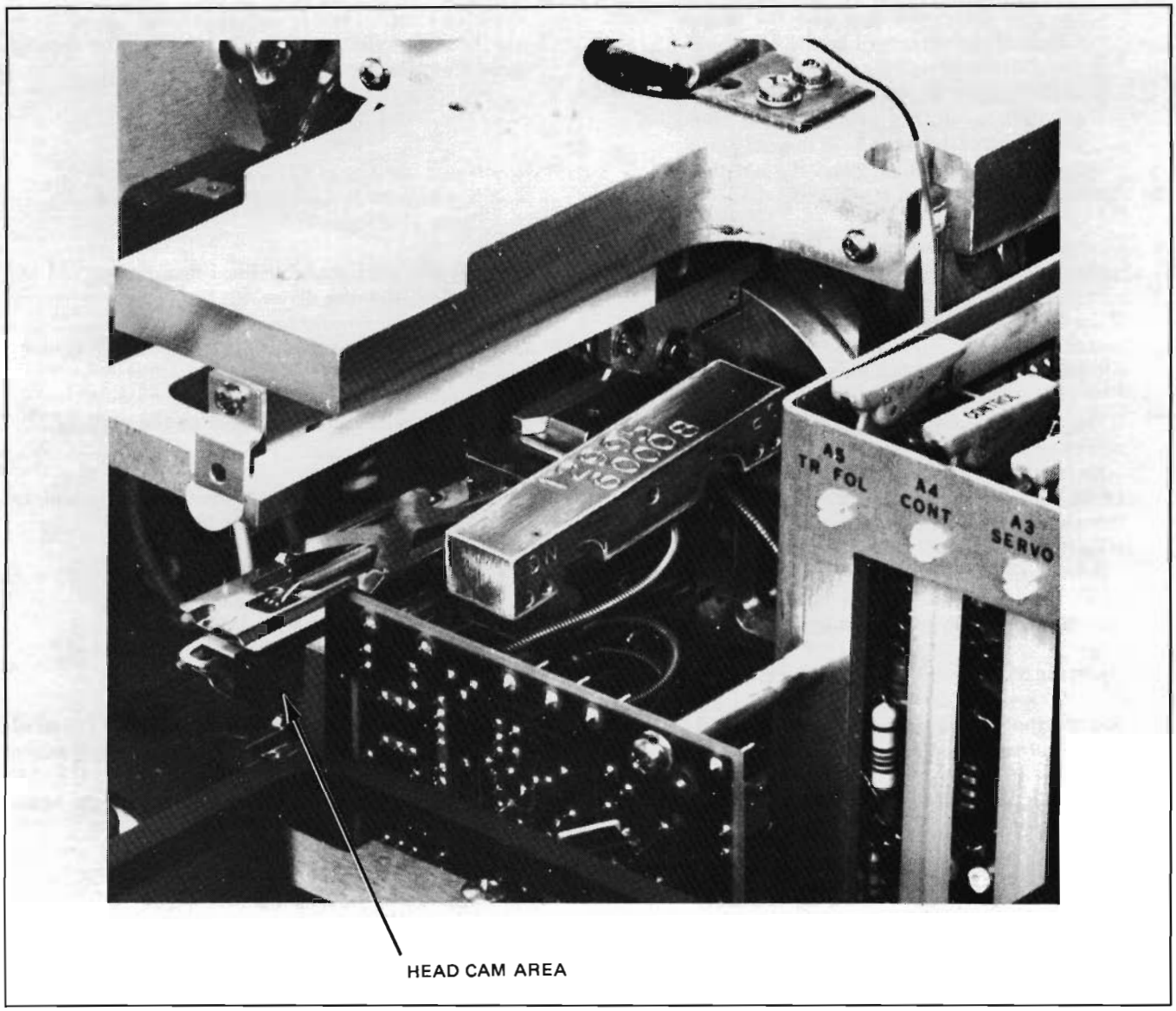
c. Grasp the head installation tool and position the head on the proper head cam, then slide it back until it mates with the proper slot in the carriage assembly. See figure 5-7.

d. Slightly tighten the captive head clamp screw, then remove the head installation tool.

CAUTION

Never install a data head with a green-colored connector in any position other than head 2.

e. If installing one of the data heads, insert Head Initial Position Tool, part no. 12995-60012, as shown in figure 5-9, gently push the head back against the tool, then tighten the captive head clamp screw to 3 in.-lbs using Initial Head Torque Wrench, part no. 8710-0665. If installing data head 2, tighten the captive head clamp screw to 5 in.-lbs using Torque Wrench, part no. 1535-2653.



7300-28

Figure 5-7. Head Installation Tool Installed

If installing the servo head, ensure that it properly mates with the slot and pin in the carriage assembly, then tighten the captive head clamp screw to 5 in.-lbs using Torque Wrench, part no. 1535-2653.

f. Replace the card cage chassis and motherboard PCA-A7 as outlined in paragraphs 5-20 and 5-21, respectively.

g. Verify index transducer alignment and head alignment as outlined in paragraphs 3-17 and 3-18.

5-39. CARRIAGE-LATCH SOLENOID

The carriage-latch solenoid (37, figure 6-3) is removed from the disc drive as follows:

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

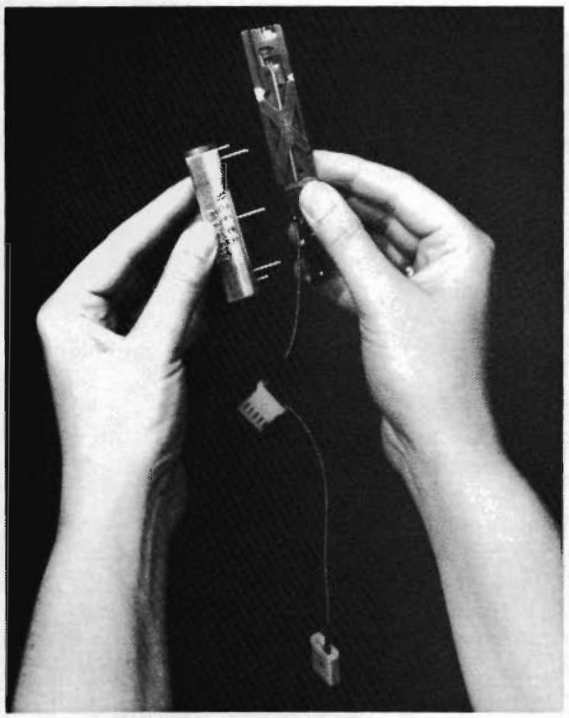
b. Remove the top cover (1, figure 6-1) as outlined in paragraph 5-6.

c. Remove the two screws (38, figure 6-3) and flat washers (39) used to secure the carriage-latch solenoid to the actuator assembly (45).

d. Unsolder the connections made at the carriage-latch solenoid.

e. Remove the carriage-latch solenoid from the actuator assembly.

The carriage-latch solenoid is installed by reversing this procedure. Ensure that the leads removed in step d are properly replaced and soldered. See figure 4-30 for the



VIEW A

VIEW B

VIEW C

VIEW D

7300-29

Figure 5-8. Using the Head Installation Tool

correct wiring color code. Also, ensure that the carriage-latch solenoid is properly adjusted so that the plunger is fully seated in the hole provided in the carriage assembly pivot bearing and clears the hole when the solenoid is energized. If the carriage-latch solenoid requires adjustment, refer to paragraph 3-7.

5-40. ACTUATOR ASSEMBLY

WARNING

The Actuator Assembly, part no. 07905-60030, has a magnetic field which may adversely affect aircraft compasses when air shipped. Each actuator assembly must be packaged individually. Transporting more than one actuator assembly in a single container could exceed aircraft limitations (5.25 milligauss at 4.6 metres/15 feet), thereby creating a potential hazard to personnel during shipping. The actuator must be declared as Restricted Articles: "Magnetic Material" per International Air Transport Association (IATA) Article 1052, Packaging Note 905(c); and/or "Class ORM-C, Magnetized Material", per Code of Federal Regulations (CFR) Title 49, Packaging Note 173.1020.

Call or see your nearest Restricted Article Coordinator or the Restricted Article Coordinator at Hewlett-Packard Disc Memory Division (USA phone 208/376-6000) if you have any questions about how to declare and label a Restricted Article.

The actuator assembly (45, figure 6-3) provides the means to position the heads over a given cylinder. Replacement procedures for each replaceable subassembly are provided in the following paragraphs. The removal procedure for the entire actuator assembly is as follows:

a. Remove the card cage chassis (69) and motherboard PCA-A7 (66) as outlined in paragraphs 5-20 and 5-21, respectively.

b. Remove the prefilter duct (67, figure 6-1) as outlined in paragraph 5-10.

c. Rotate the two 1/4-turn fasteners (112, figure 6-3) used to secure power and motor control PCA-A8 (111) to the bottom cover right bracket (16, figure 6-1) 1/4-turn counterclockwise.

d. Lower power and motor control PCA-A8 into its service position.

CAUTION

Care should be exercised when handling the actuator assembly with the carriage-latch solenoid (37, figure 6-3) removed because carriage assembly movement will no longer be restrained and head damage could result.

e. Remove the two screws (38) and flat washers (39) used to secure the carriage-latch solenoid to the actuator assembly.

f. Set the carriage-latch solenoid to one side of the working area.

g. Unsolder the connections made at the carriage-back detector (47).

h. Disconnect the green and white leads from the coil bands located on the left side of the actuator assembly (as viewed from the front).

i. Remove the four screws (43) and lock washers (44) used to secure the actuator assembly to the main casting (167).

j. Grasp the top of the actuator assembly with both hands and lift it straight up (approximately 3/4-inch) to release the guide pin from the hole in the main casting, then lift it to the rear to remove it from the disc drive.

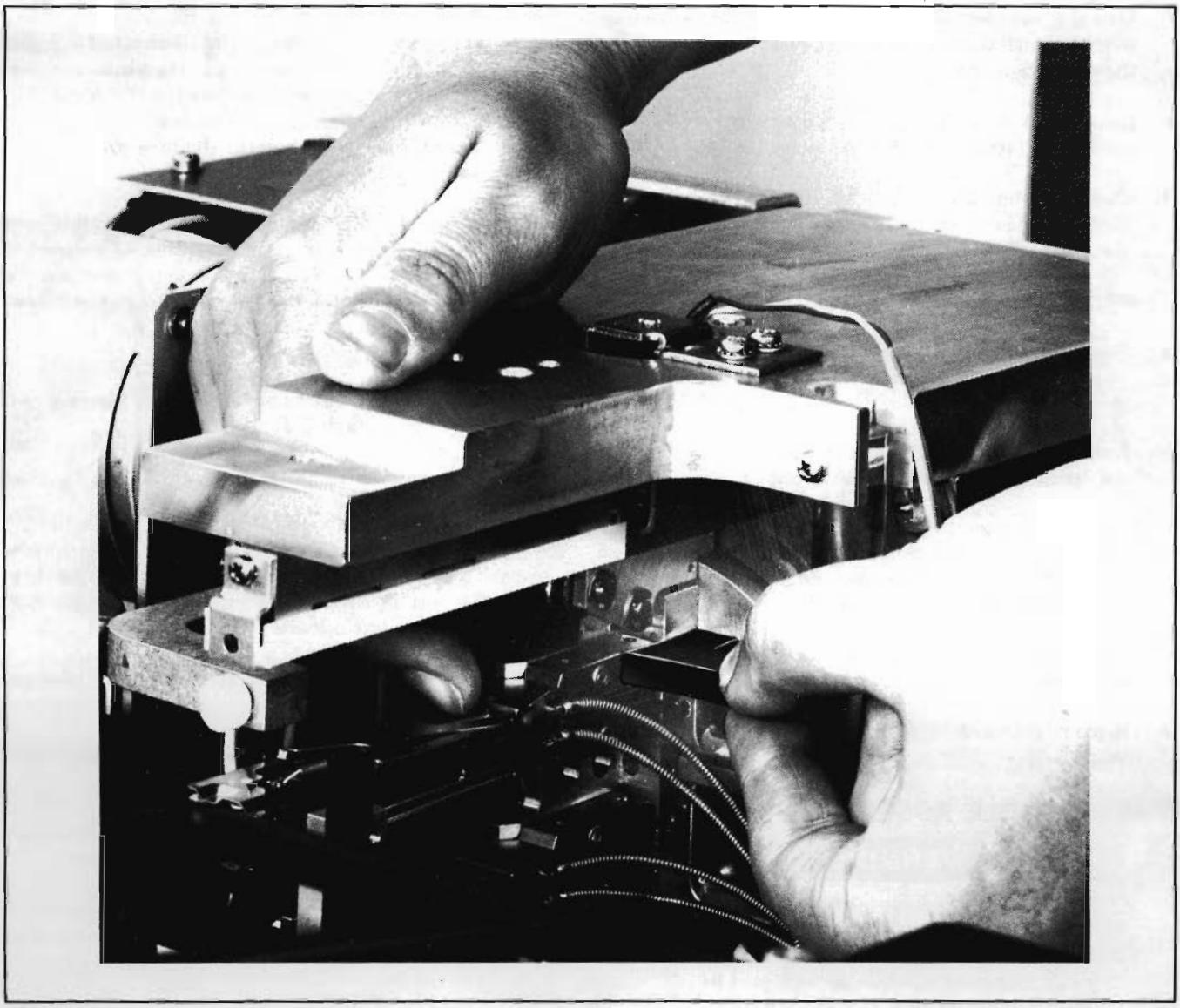
The actuator assembly is installed by reversing this procedure. Before installing it, clean the exposed area of the main casting vacated by the actuator assembly as outlined in paragraph 2-17, steps d through f. Ensure that the guide pin is correctly positioned in the hole in the main casting, that all cable connectors are properly installed and fully seated, and that the leads removed in step g are replaced and soldered. See figure 4-30 for the correct wiring color code. Ensure that the four screws and lockwashers removed in step i are tightened to 80 in.-lbs. Also, ensure that the carriage-latch solenoid is properly adjusted so that the plunger is fully seated in the hole provided in the carriage assembly pivot bearing and clears the hole when the solenoid is energized. If the carriage-latch solenoid requires adjustment, refer to paragraph 3-7.

5-41. CARRIAGE-BACK DETECTOR

The carriage-back detector (47, figure 6-3) is removed from the disc drive as follows:

a. Remove the card cage chassis (69) as outlined in paragraph 5-20.

b. Remove the two screws (46) used to secure the carriage-back detector to the actuator assembly (45).



7300-30

Figure 5-9. Using the Head Initial Position Tool

c. Unsolder the connections made at the carriage-back detector.

d. Remove the carriage-back detector from the disc drive.

The carriage-back detector is installed by reversing this procedure. Ensure that the leads removed in step c are properly replaced and soldered. See figure 4-30 for the correct wiring color code. Also, ensure that the optical flag (50) passes freely through the carriage-back detector. If it does not, loosen the retaining screws, reposition the detector, then retighten the retaining screws.

5-42. VELOCITY TRANSDUCER

The velocity transducer (40, figure 6-3) must be removed from the disc drive together with the velocity transducer shaft as outlined in paragraph 5-43.

5-43. VELOCITY TRANSDUCER SHAFT

The velocity transducer (40, figure 6-3) and velocity transducer shaft (42, figure 6-3) are removed from the disc drive as follows:

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the rear cover (7, figure 6-1) as outlined in paragraph 5-8.

c. Disconnect velocity transducer cable connector A7P2 from motherboard PCA-A7 (66, figure 6-3).

d. Remove the card cage chassis (69) as outlined in paragraph 5-20.

e. Loosen the set screw used to secure the velocity transducer shaft to the carriage assembly.

f. Using a slender tool (such as a 1/32-inch allen wrench), push the velocity transducer shaft free from the carriage assembly.

g. Remove the two screws (41) used to secure the velocity transducer (40) to the actuator assembly (45).

h. Carefully slide the velocity transducer (with the velocity transducer shaft inside it) out from the rear of the actuator assembly.

To install the velocity transducer shaft, proceed as follows:

a. Replace the velocity transducer and secure it in place using the two screws removed in step g of the removal procedure.

b. Insert the rod end of the velocity transducer shaft into the opening at the end of the velocity transducer.

c. Using a slender tool (such as the eraser end of a pencil), push on the magnetized end of the velocity transducer shaft until the rod end protrudes through the hole in the carriage assembly.

d. Tighten the set screw loosened in step e of the removal procedure.

e. Replace the card cage chassis as outlined in paragraph 5-20.

5-44. SPINDLE ASSEMBLY

WARNING

The Spindle Assembly, part no. 07906-60021, has a weak magnetic field which may adversely affect aircraft compasses when air shipped in multiple quantities. If you ship more than the quantities listed in the "Not Restricted" column below, you must declare the shipment as Restricted Articles: "Magnetic Material" per International Air Transport Association (IATA) Article 1052, Packaging Note 905(c); and/or "Class ORM-C, Magnetized Material", per Code of Federal Regulations (CFR) Title 49, Packaging Note 173.1020.

SHIPPING PACKAGE	FIELD STRENGTH (milligauss)		SHIPMENT QUANTITY	
	2.13 m (7 ft)	4.57 m (15 ft)	Not Restricted	Restricted
Corrugated Carton	0.90	0.09	1 max.	2 to 50*
Shielded Metallic Canister	0.59	0.06	1 or 2	3 to 75**

* Quantities of 51 or more, ship by surface only.
** Quantities of 76 or more, ship by surface only.

Call or see your nearest Restricted Article Coordinator or the Restricted Article Coordinator at Hewlett-Packard Disc Memory Division (USA phone 208/376-6000) if you have any questions about how to declare and label a Restricted Article.

The spindle assembly (70, figure 6-2) is used to rotate both the fixed disc (69) and the removable disc at a speed of 3600 revolutions per minute. Replacement procedures for each replaceable subassembly are provided in the following paragraphs. The removal procedure for the entire spindle assembly is as follows:

a. Remove the fixed disc as outlined in the removal procedure in paragraph 5-31.

b. Remove the prefilter duct (67, figure 6-1) as outlined in paragraph 5-10.

c. Rotate the two 1/4-turn fasteners (112, figure 6-3) used to secure power and motor control PCA-A8 (111) to the bottom cover right bracket (16, figure 6-1) 1/4-turn counterclockwise.

d. Lower power and motor control PCA-A8 into its service position.

e. Disconnect spindle motor cable connector A8P4 from power and motor control PCA-A8.

f. Disconnect main harness connector A10P1 from spindle motor encoder PCA-A10 (82, figure 6-2).

g. Remove the four screws (71) and lock washers (72) used to secure the spindle assembly to the main casting (167, figure 6-3).

CAUTION

Never attempt to remove the spindle assembly by pulling on its hub assembly because this may alter its runout and flatness characteristics.

h. Push up on the bottom of the spindle assembly to free it from the main casting. Continue pushing until the housing can be grasped, then remove the spindle assembly from the top of the disc drive.

CAUTION

The spindle assembly is a delicate device. Follow the removal/packaging instructions provided in the shipping package containing the replacement spindle assembly.

The spindle assembly is installed by reversing this procedure. Ensure that it is lowered straight into the hole

provided in the main casting, otherwise the two metal surfaces may bind. Also, ensure that it is correctly oriented so that the flat side of the housing is aligned with the flat side of the main casting. Ensure that the four screws and lockwashers removed in step g are tightened to 80 in.-lbs. Check also that all cable connectors are properly installed and fully seated. Clean the top surface of the spindle assembly as outlined in paragraph 2-16, steps c through f.

5-45. SPINDLE MOTOR ENCODER PCA-A10

Spindle motor encoder PCA-A10 (82, figure 6-2) is removed from the disc drive as follows:

a. Remove the prefilter duct (67, figure 6-1) as outlined in paragraph 5-10.

b. Disconnect the main harness connector A10P1 from PCA-A10.

c. Remove the two screws (80, figure 6-2) and lock washers (81) used to secure PCA-A10 to the spindle assembly housing.

d. Remove PCA-A10 from the disc drive.

Spindle motor encoder PCA-A10 is installed by reversing this procedure.

5-46. SPINDLE GROUND CONTACT

The spindle ground contact (78, figure 6-2) is removed from the disc drive as follows:

a. Remove the prefilter duct (61, figure 6-1) as outlined in paragraph 5-10.

b. Remove the three screws (73, figure 6-2) used to secure the spindle assembly bottom cover (74) to the spindle assembly housing.

c. While holding the spindle motor hub assembly, rotate the brass body of the spindle ground contact counterclockwise.

d. Remove the spindle ground contact from the disc drive.

CAUTION

When replacing the spindle ground contact, ensure that the sector disc (79) is installed with its part number facing toward the spindle assembly bottom cover, otherwise the spindle motor will run backwards.

The spindle ground contact is installed by reversing this procedure.

5-47. SPINDLE GROUND SPRING

The spindle ground spring (75, figure 6-2) is removed from the disc drive as follows:

a. Remove the prefilter duct (67, figure 6-1) as outlined in paragraph 5-10.

b. Remove the three screws (73, figure 6-2) used to secure the spindle assembly bottom cover (74) to the spindle assembly housing.

c. Remove the two screws (76) and lock washers (77) used to secure the spindle ground spring to the spindle assembly bottom cover.

d. Remove the spindle ground spring from the disc drive.

The spindle ground spring is installed by reversing this procedure. Ensure that the insulated side of the spindle ground spring faces toward the spindle assembly bottom cover.

5-48. POWER SUPPLY ASSEMBLY

The power supply assembly (27, figure 6-3) supplies dc voltages to the voltage regulator circuits on power and motor control PCA-A8 (111) and ac voltages to the blower motor (15) and the brush motor (78). The removal procedure is as follows:

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the top cover (1, figure 6-1) and prefilter duct (67) as outlined in paragraphs 5-6 and 5-10, respectively.

c. Rotate the two 1/4-turn fasteners (112, figure 6-3) used to secure power and motor control PCA-A8 to the bottom cover right bracket (16, figure 6-1) 1/4-turn counterclockwise.

d. Lower power and motor control PCA-A8 into its service position.

e. Loosen the nine screws in terminal block A8TB1 and remove all nine power supply assembly leads (see figure 5-1).

f. Remove the two screws (25, figure 6-3) and lock washers (26) used to secure the terminal block cover (24) to the power supply assembly.

g. Loosen terminal screws 1, 3, and 4 and remove the two input line leads, the blue blower motor starting capacitor lead, and the white blower motor lead.

h. Remove the four screws (28) and lock washers (29) used to secure the power supply assembly to the main casting (167).

i. Remove the screw used to secure the green and yellow ground wire to the main casting.

j. Remove the screw, flat washer, and cable clamp used to secure the power harness to the main casting.

k. Carefully lift the power supply assembly up and away from the disc drive.

The power supply assembly is installed by reversing this procedure. Ensure that the power harness is properly routed and anchored and that the leads removed in steps e, g, and i are properly replaced. See figure 4-30 for the correct wiring color code.

Also, ensure that the strapping configuration of TB1 on the power supply assembly corresponds to the primary power source to be used (see figure 4-30). Verify power supply voltages as outlined in paragraph 3-3.

5-49. BLOWER MOTOR ASSEMBLY

The blower motor assembly provides cooling air to the disc drive. Replacement procedures for each replaceable subassembly are provided in the following paragraphs.

5-50. BLOWER MOTOR

The blower motor (15, figure 6-3) is removed from the disc drive as follows:

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the top cover (1, figure 6-1) and prefilter duct (67) as outlined in paragraphs 5-6 and 5-10, respectively.

c. Remove the insulator cover (1, figure 6-3) from the blower motor starting capacitor (6).

d. Remove the red and blue blower motor leads from the blower motor starting capacitor.

e. Remove the two screws (25) and lock washers (26) used to secure the terminal block cover (24) to the power supply assembly (27).

f. Loosen terminal screw 3 on TB1 of the power supply assembly and remove the white blower motor lead.

g. Rotate the two 1/4-turn fasteners (112, figure 6-3) used to secure power and motor control PCA-A8 (111) to the bottom cover right bracket (16, figure 6-1) 1/4-turn counterclockwise.

h. Lower power and motor control PCA-A8 into its service position.

i. Remove the five screws (19) used to secure the bottom cover left bracket (18) to the main casting (167, figure 6-3).

j. Remove the bottom cover left bracket from the disc drive.

k. Remove the screw (8), flat washer (9), and cable clamp (10) used to secure the impeller cover (12) to the main casting.

l. Remove the four screws (11) used to secure the impeller cover to the main casting.

m. Remove the impeller cover.

n. Loosen the set screw used to secure the impeller (13) to the blower motor shaft.

o. Remove the impeller from the disc drive.

p. Remove the four screws (14) used to secure the blower motor to the main casting.

q. Remove the blower motor from the disc drive.

The blower motor is installed by reversing this procedure. Ensure that the leads removed in steps d and f are properly replaced. See figure 4-30 for the correct wiring color code.

Also, ensure that the impeller is positioned to just clear the impeller cover before tightening the impeller set screw against the flat portion of the blower motor shaft.

5-51. BLOWER MOTOR STARTING CAPACITOR

The blower motor starting capacitor (6, figure 6-3) is removed from the disc drive as follows:

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the top cover (1, figure 6-1) as outlined in paragraph 5-6.

c. Remove the insulator cover (1, figure 6-3) from the blower motor starting capacitor.

d. Remove the red and blue blower motor leads and the blue power supply assembly (27) lead.

e. Remove the two screws (2) and flat washers (3) used to secure the blower motor starting capacitor clamp (7) to the main casting (167).

f. Remove the blower motor starting capacitor and clamp from the disc drive.

g. Loosen the screw (4) used to secure the clamp to the blower motor starting capacitor.

The blower motor starting capacitor is installed by reversing this procedure. Ensure that the leads removed in step d are properly replaced. See figure 4-30 for the correct wiring color code.

5-52. COOLING AIR DUCT

The cooling air duct (102, figure 6-3) is removed from the disc drive as follows:

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the prefilter duct (67, figure 6-1) as outlined in paragraph 5-10.

c. Rotate the two 1/4-turn fasteners (112, figure 6-3) used to secure power and motor control PCA-A8 (111) to the bottom cover right bracket (16, figure 6-1) 1/4-turn counterclockwise.

d. Lower power and motor control PCA-A8 into its service position.

e. Loosen the hose clamp retaining screw in the hose clamp (97, figure 6-3) used to secure the hose (98) to the cooling air duct.

f. Remove the hose from the cooling air duct.

g. Remove the two screws (103), flat washers (104), and nuts (105) used to secure the cooling air duct to PCA-A8.

h. Remove the cooling air duct from the disc drive.

The cooling air duct is installed by reversing this procedure.

5-53. OPERATOR CONTROL PANEL ASSEMBLY

The operator control panel assembly, located behind the control panel access cover provides a UNIT SELECT switch, two DISC PROTECT switches, and a FORMAT switch. The assembly is connected into circuit via a cable connector. The four switches on the operator control panel are not replaceable; a defective switch requires replacement of the complete assembly, as described in paragraph 5-54.

The operator control panel assembly on the HP 7906A Disc Drive, in addition to providing the four switches described above, also contains an ac POWER on/off switch and a primary power fuseholder. All of these components are replaceable, as described in paragraphs 5-55 through 5-58.

WARNING

AC line voltage is present in the operator control panel assembly whenever the disc drive ac power cord is connected to an ac power source. To avoid serious electrical shock, do not proceed further in this section until power has been removed from the disc drive, as described in paragraph 5-3, and the disc drive ac power cord has been disconnected.

5-54. OPERATOR CONTROL PANEL

The operator control panel is removed from the disc drive as follows:

a. Remove power from the disc drive as described in paragraph 5-3.

b. Disconnect the ac power cord from the rear frame of the disc drive.

c. Remove the lower front cover as outlined in paragraph 5-9.

d. Remove the two screws (142) used to secure the operator control panel to the standoffs (145).

e. Disconnect the connector from the rear of the power panel assembly and remove the assembly from the disc drive.

The power panel assembly is installed by reversing this procedure.

5-55. UNIT SELECT SWITCH

The HP 7906A UNIT SELECT switch (150, figure 6-3) is removed from the disc drive as follows:

a. Remove power from the disc drive as described in paragraph 5-3.

b. Disconnect the ac power cord from the disc drive.

c. Remove the lower front cover as outlined in paragraph 5-9.

d. Remove the two screws (142) used to secure the operator control panel assembly to the standoffs (145).

e. Remove the three screws (143) used to secure the operator control panel assembly switch cover (144) to the operator control panel assembly bracket (166).

f. Remove the operator control panel assembly switch cover from the operator control panel assembly bracket.

g. Unsolder the connections made at the UNIT SELECT switch.

h. Loosen the setscrew used to secure the knob (146) to the UNIT SELECT switch shaft.

i. Remove the knob.

j. Remove the nut (147) used to secure the UNIT SELECT switch to the operator control panel assembly bracket.

k. Remove the UNIT SELECT switch from the operator control panel assembly bracket.

The UNIT SELECT switch is installed by reversing this procedure. Ensure that the leads removed in step g are properly replaced and soldered. See figure 4-30 for the correct wiring color code. Reconnect the disc drive power cord to the ac power source and restore power as described in paragraph 5-3. Ensure that the position of the knob corresponds with the selected logical unit address displayed by the numerical indicator, then tighten the set screw loosened in step h.

5-56. POWER SWITCH

The HP 7906A POWER switch (154, figure 6-3) is removed from the disc drive as follows:

a. Remove power from the disc drive as described in paragraph 5-3.

b. Disconnect the ac power cord from the disc drive.

c. Remove the lower front cover as outlined in paragraph 5-9.

d. Remove the two screws (142) used to secure the operator control panel assembly to the standoffs (145)

e. Remove the three screws (143) used to secure the operator control panel assembly switch cover (144) to the operator control panel assembly bracket (166).

f. Remove the operator control panel assembly switch cover from the operator control panel assembly bracket.

g. Unsolder the connections made at the POWER switch.

h. Remove the knurled nut (151) used to secure the POWER switch to the operator control panel assembly bracket.

i. Remove the POWER switch from the operator control panel assembly bracket.

The POWER switch is installed by reversing this procedure. Ensure that the leads removed in step g are properly replaced and soldered. See figure 4-30 for the correct wiring color code.

5-57. PRIMARY POWER FUSEHOLDER

The HP 7906A primary power fuseholder is removed from the disc drive as follows:

a. Remove power from the disc drive as described in paragraph 5-3.

b. Disconnect the ac power cord from the disc drive.

c. Remove the lower front cover as outlined in paragraph 5-9.

d. Remove the two screws (142, figure 6-3) used to secure the operator control panel assembly to the standoffs (145).

e. Remove the three screws (143) used to secure the operator control panel assembly switch cover (144) to the operator control panel assembly bracket (166).

f. Remove the operator control panel assembly switch cover from the operator control panel assembly bracket.

g. Unsolder the connections made at the primary power fuseholder.

h. Remove the nut (157) used to secure the fuseholder body (160) to the operator control panel assembly bracket.

i. Remove the fuseholder body from the operator control panel assembly bracket.

The primary power fuseholder is installed by reversing this procedure. Ensure that the leads removed in step g are properly replaced and soldered. See figure 4-30 for the correct wiring color code. Also, ensure that the rating of primary power fuse F1 to be used conforms to the rating specified in figure 4-30.

5-58. DISC PROTECT AND FORMAT SWITCHES

The HP 7906A UPPER DISC PROTECT switch, LOWER DISC PROTECT switch, and FORMAT switch are removed from the disc drive as follows:

a. Remove power from the disc drive as outlined in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the lower front cover as outlined in paragraph 5-9.

c. Remove the two screws (142, figure 6-3) used to secure the operator control panel assembly to the standoffs (145).

d. Remove the three screws (143) used to secure the operator control panel assembly switch cover (144) to the operator control panel assembly bracket (166).

e. Remove the operator control panel assembly switch cover from the operator control panel assembly bracket.

f. Unsolder the connections made at the defective switch.

g. Remove the two screws (162), lock washers (163), and nuts (164) used to secure the defective switch (161) to the operator control panel assembly bracket.

h. Remove the defective switch from the operator control panel assembly bracket.

The UPPER DISC PROTECT switch, LOWER DISC PROTECT switch, and FORMAT switch are installed by reversing this procedure. Ensure that the leads removed in step f are properly replaced and soldered. See figure 4-30 for the correct wiring color code. Restore power to the disc drive as described in paragraph 5-3. Ensure that the PROTECT UPPER DISC indicator lights whenever the UPPER DISC PROTECT switch is set to the protected position (•, up) and the PROTECT LOWER DISC indicator lights whenever the LOWER DISC PROTECT switch is set to the protected position (•, up).

5-59. DOOR LOCK SOLENOID

The door lock solenoid (124, figure 6-3) is removed from the disc drive as follows:

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the top cover (1, figure 6-1) as outlined in paragraph 5-6.

c. Unsolder the connections made at the door lock solenoid.

d. Remove the screw (121, figure 6-3) used to secure the door lock pawl to the standoff (122).

e. Remove the two screws (123) used to secure the door lock solenoid to the right-hand gusset (140).

f. Remove the door lock solenoid from the right-hand gusset.

The door lock solenoid is installed by reversing this procedure. Ensure that the leads removed in step c are properly replaced and soldered. See figure 4-30 for the correct wiring color code. Also, ensure that the door lock solenoid is properly adjusted so that the door lock pawl latches the cartridge access door whenever the door lock solenoid is de-energized and unlatches the cartridge access door whenever the door lock solenoid is energized. If the door lock solenoid requires adjustment, refer to paragraph 3-9.

5-60. DOOR CLOSED SWITCH

The door closed switch (130, figure 6-3) is removed from the disc drive as follows:

a. Remove power from the disc drive as described in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the top cover (1, figure 6-1) as outlined in paragraph 5-6.

c. Remove the two screws (131, figure 6-3), flat washers (132), lock washers (133), and nuts (134) used to secure the door closed switch to the right-hand gusset (140).

d. Unsolder the connections made at the door closed switch.

e. Remove the door closed switch from the right-hand gusset.

The door closed switch is installed by reversing this procedure. Ensure that the leads removed in step d are properly replaced and soldered. See figure 4-30 for the correct wiring color code. Also ensure that the door closed switch is properly adjusted so that a) it "clicks" closed whenever the cartridge access door is latched, and b) it "clicks" open whenever it is not. If the door closed switch requires adjustment, refer to paragraph 3-10.

5-61. DOOR LOCKED SWITCH

The door locked switch (125, figure 6-3) is removed from the disc drive as follows:

a. Remove power from the disc drive as detailed in paragraph 5-3. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the top cover (1, figure 6-1) as outlined in paragraph 5-6.

c. Remove the two screws (126, figure 6-3), flat washers (127), lock washers (128), and nuts (129) used to secure the door locked switch to the right-hand gusset (140).

d. Unsolder the connections made at the door locked switch.

e. Remove the door locked switch from the disc drive.

The door locked switch is installed by reversing this procedure. Ensure that the leads removed in step d are properly replaced and soldered. See figure 4-30 for the correct wiring color code. Also ensure that the door locked switch is properly adjusted so that a) it "clicks" closed whenever the door lock solenoid is energized to unlatch the cartridge access door, and b) it "clicks" open whenever the door lock solenoid is de-energized to latch the cartridge access door. Reconnect the ac power cord and restore power to the disc drive as described in paragraph 5-3. Ensure that the DOOR UNLOCKED indicator lights whenever the door lock solenoid is energized. If the door locked switch requires adjustment, refer to paragraph 3-11.

REPLACEABLE PARTS

SECTION VI

6-1. INTRODUCTION

This section provides listings of all field-replaceable parts and an illustrated parts breakdown for the HP 7906 Disc Drive, as well as replacement part ordering information.

Replaceable parts for the disc drive are listed in disassembly order in tables 6-1 through 6-5 and illustrated in figures 6-1 through 6-5. In each replaceable parts listing, attaching parts are listed immediately after the item they attach. Items in the DESCRIPTION column are indented to indicate their relationship. 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 6-6 for an explanation of those abbreviations used in the DESCRIPTION column.

d. MFR. CODE. The five digit code that denotes a typical manufacturer of a part. Refer to table 6-7 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.

6-2. 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 6-1. HP 7906 Disc Drive, Replaceable Parts Listing

FIG. INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-1-	7906	DISC DRIVE			1
1	07906-00010	*Cover, Top	28480	07906-00010	1
		(Attaching Parts)			
2	2510-0043	*Screw, Machine, ph, pozi, w/ext-tooth, no. 8-32, 0.312 in.	00000	OBD	4
3	3050-0001	*Washer, Flat, no. 8	00000	OBD	4
4	2360-0196	*Screw, Machine, fh, pozi, no. 6-32, 0.375 in.	00000	OBD	2
5		Not Assigned			
		— — — x — — —			
6	0570-0642	*Screw, Shoulder, no. 8-32	28480	0570-0642	4
7	07905-00008	*Cover, Rear	28480	07905-00008	1
		(Attaching Parts)			
8	2510-0045	*Screw, Machine, ph, pozi, w/ext-tooth, no. 8-32, 0.375 in.	00000	OBD	2
9	2510-0045	*Screw, Machine, ph, pozi, w/ext-tooth, no. 8-32, 0.375 in.	00000	OBD	2
10	3050-0001	*Washer, Flat, no. 8	00000	OBD	2
		— — — x — — —			
11	7120-0636	*Label, PVE Maintenance	28480	7120-0636	1
12	07905-00091■	*Insulator, Bottom Cover	28480	07905-00091	1
13	1390-0333■	*Fastener, 1/4-turn stud	94222	82-11-180-16	4
14	1390-0088■	*Retainer, 1/4-turn fastener	28480	1390-0088	4
15	07905-00010■	*Cover, Bottom	28480	07905-00010	1
16	07905-00114●	*Bracket, Bottom Cover, Right	28480	07905-00114	1
	07906-00029▲	*Bracket, Bottom Cover, Right	28480	07906-00029	1
		(Attaching Parts)			
17	2510-0045●	*Screw, Machine, ph, pozi, w/ext-tooth, no. 8-32, 0.375 in.	00000	OBD	4
	2510-0108▲	*Screw, Machine, 100-deg fh, pozi, no. 8-32, 0.625 in.	00000	OBD	5
17A	2190-0048▲	*Washer, Lock, Ext-tooth, no. 8	00000	OBD	5
		— — — x — — —			
18	07905-00113	*Bracket, Bottom Cover, Left	28480	07905-00113	1
		(Attaching Parts)			
19	2510-0108	*Screw, Machine, 100-deg fh, pozi, no. 8-32, 0.625 in.	00000	OBD	5
19A	2190-0048	*Washer, Lock, ext-tooth, no. 8	00000	OBD	5
		— — — x — — —			
20	1390-0091	*Receptacle, 1/4 turn fastener	94222	82-47-104-15	12
21	07905-00075	*Plate, Rack Mount	28480	07905-00075	2
		(Attaching Parts)			
22	2510-0100	*Screw, Machine, 100-deg fh, pozi, no. 8-32, 0.312 in.	00000	OBD	2
		— — — x — — —			
23	07906-60011	*Indicator PCA (A9)	28480	07906-60011	1
		(Attaching Parts)			
24	2200-0143	*Screw, Machine, ph, pozi, no. 4-40, 0.375 in.	00000	OBD	6
24A	0380-1037	*Standoff, Hex, 0.625 in.	02170	9740-SS-0440-7	2
25	2190-0003	*Washer, Lock, Split, no. 4	00000	OBD	6
		— — — x — — —			
26	2140-0209	**Lamp, T 1-3/4, 14V	01236	382	5
27	3130-0103	*Nut, Face, 0.25 in. ID	27191	15-109-6	1
28	2190-0102	*Washer, Lock, int-tooth, 0.472 in. ID	00000	OBD	1
29	2950-0035	*Nut, Hex, no. 15/32-32	00000	OBD	1
30	3101-1051	*Switch, Toggle, SPDT, 1A, 250 Vac	27191	8908K507	1
31	2360-0115	*Screw, Machine, ph, pozi, w/ext-tooth, no. 6-32, 0.312 in.	00000	OBD	4
32	1460-1378	*Spring, Extension, 0.188 in. OD, 0.750 in. long	84830	LE-0318-00-MW	2
33	07905-00061	*Hinge, Screen, Right	28480	07905-00061	1
34	07905-00062	*Hinge, Screen, Left	28480	07905-00062	1
35	0340-0584	*Insulator, Bushing, nylon	02170	2709-205141-N173	1
36	4208-0083	*Foam, Polyurethane, 0.375 in. thick	28480	4208-0083	1
37	07905-00119	*Door, Access, Control, Panel	28480	07905-00119	1
38	2200-0169	*Screw, Machine, 82 deg fh, pozi, no. 4-40, 0.500 in.	00000	OBD	4

NOTES: ■ Provided with rack-mountable drives only.
● Used on 7906A and 7906B disc drives with serial numbers prefixed 2033 and prior.
▲ Used on 7906B disc drives with serial numbes prefixed 2034 and later.

Table 6-1. HP 7906 Disc Drive, Replace Parts Listing (Continued)

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-1-					
39	07905-20086	*Brace	28480	07905-20086	2
40	1390-0552	*Screw, Captive	06540	6236-B-0832	2
41	07905-20084	*Frame Assembly	28480	07905-20084	1
41A	07906-20006	**Indicator Panel	28480	07906-20006	1
42	7120-3040	*Label, Warning	28480	7120-3040	1
	07906-60044★	*Cartridge Access Door Assembly	28480	07906-60044	1
	07905-60085▲	*Cartridge Access Door Assembly	28480	07905-60085	1
	07906-60093♦	*Cartridge Access Door Assembly	28480	07906-60093	1
		(Attaching Parts)			
43	2510-0047	*Screw, Machine, ph, pozi, w/ext-tooth, no. 8-32, 0.438 in.	00000	OBD	4
		— — — x — — —			
44	07905-20085	**Support, Hinge	28480	07905-20085	2
		(Attaching Parts)			
45	2200-0105	**Screw, Machine, ph, pozi, w/ext-tooth, no. 4-40, 0.312 in.	00000	OBD	2
46	Deleted	Deleted			
47	07905-00079	**Plate, Pivot Retaining	28480	07905-00079	2
		— — — x — — —			
48	1480-0018	**Pin, Dowel, 0.125 in. dia, 1 in. long	00000	OBD	2
49	1410-1093	**Bearing, Sleeve	28480	1410-1093	2
50	2200-0105	**Screw, Machine, ph, pozi, w/ext-tooth, no. 4-40, 0.312 in.	00000	OBD	2
51	07905-00094	**Latch, Door	28480	07905-00094	1
	07906-00030♦	**Latch, Door	28480	07906-00030	1
52	2360-0115	**Screw, Machine, pozi, w/ext-tooth, no. 6-32, 0.312 in.	00000	OBD	8
53	3050-0407	**Washer, Flat, no. 6	00000	OBD	8
54	07905-40028	**Window	28480	078	1
55	0403-0340	**Bumper	28480	0403-0340	2
56	07906-20004★	**Frame, Cartridge Access Door	28480	07906-20004	1
	07905-20083▲	**Frame, Cartridge Access Door	28480	07905-20083	REF
57	No Number	*Mainframe Assembly A (See figure 6-2)	28480	NSR	1
		Items 58 through 69 list parts of the prefilter assembly. For further details, refer to the *40019 Prefilter Assembly Installation and Service Manual,* part no. 40019-90901.			
58	40019-00003	*Bracket, Grill, left	28480	40019-00003	1
		(Attaching Parts)			
59	2360-0117	*Screw, Machine, ph, pozi, no. 6-32, 0.375 in.	28480	2360-0117	2
60	3050-0066	*Washer, Flat, no. 6	00000	OBD	2
		— — — x — — —			
61	40019-00001	*Bracket, Grill, right	28480	40019-00001	1
		(Attaching Parts)			
62	2360-0117	*Screw, Machine, ph, pozi, no. 6-32, 0.375 in.	28480	2360-0117	2
63	3050-0066	*Washer, Flat, no. 6	00000	OBD	2
		— — — x — — —			
	40019-60005	*Duct Assembly	28480	40019-60005	1
64	3150-0329	**Filter	28480	3150-0329	1
65	1390-0214	**Fastener, 1/4-turn	28480	13900214	2
66	1390-0088	**Retainer, Ring	28480	1390-0088	2
67	4040-1287	**Duct	28480	4040-1287	1
68	40019-60004	*Duct Bracket Assembly (Standard drive only)	28480	40019-60004	1
69	40019-60006●	*Power Control Assembly (Rack-mountable drive only)	28480	40019-60006	1
	40019-60012■	*Power Control Assembly (Rack-mountable drive only. See *40019 Prefilter Assembly Installation and Service* Manual, part no. 40019-90901, for replaceable parts.)	28480	40019-60012	1
	8120-1575★	*Power Cord, Cabinet	28480	8120-1575	1
	8120-1378★	*Power Cord (Standard)	28480	8120-1378	REF

NOTES: ★ First used on 7906B.
▲ Used on 7906A only.
● Optional on 7906B disc drives with serial numbers prefixed 2016 and prior. For replacement, order part no. 40019-60012.
■ Optional on 7906B disc drives with serial numbers prefixed 2017 and later.
♦ First used on 7906B disc drives with serial numbers prefixed 2107.

Table 6-1. HP 7906 Disc Drive, Replace Parts Listing (Continued)

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-1-					
	8120-1860★	*Power Cord (Option 015)	28480	8120-1860	REF
	8120-1521▲	*Power Cord (Standard)	28480	8120-1521	REF
	8120-2191▲	*Power Cord (Option 015)	28480	8120-2191	REF
	07906-60039★	*Terminator Bracket Assembly	28480	07906-60039	REF
	07905-60012▲	*Terminator Bracket Assembly	28480	07905-60012	REF
	07905-80010	*Cable-To-Cable Adapter	28480	07905-80010	1
	07906-90902	*Manual, Installation, 7906 Disc Drive	28480	07906-90902	1
	07906-90901	*Manual, User's, 7906 Disc Drive	28480	07906-90901	1
	29425-90001	*Manual, Installation and Service, 29425 Cabinet	28480	29425-90001	1

NOTES: ★First used on 7906B.
▲Used on 7906A only.

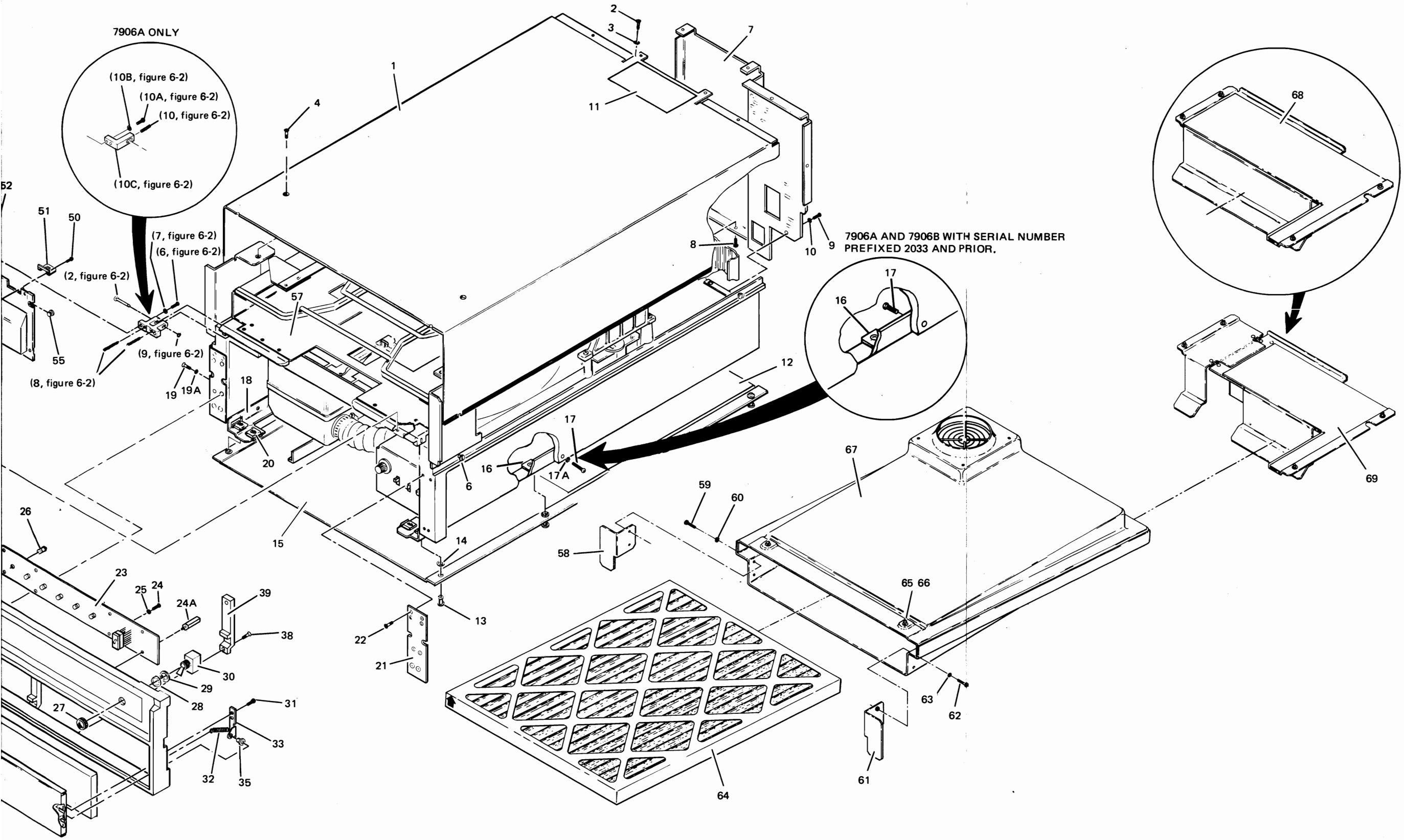
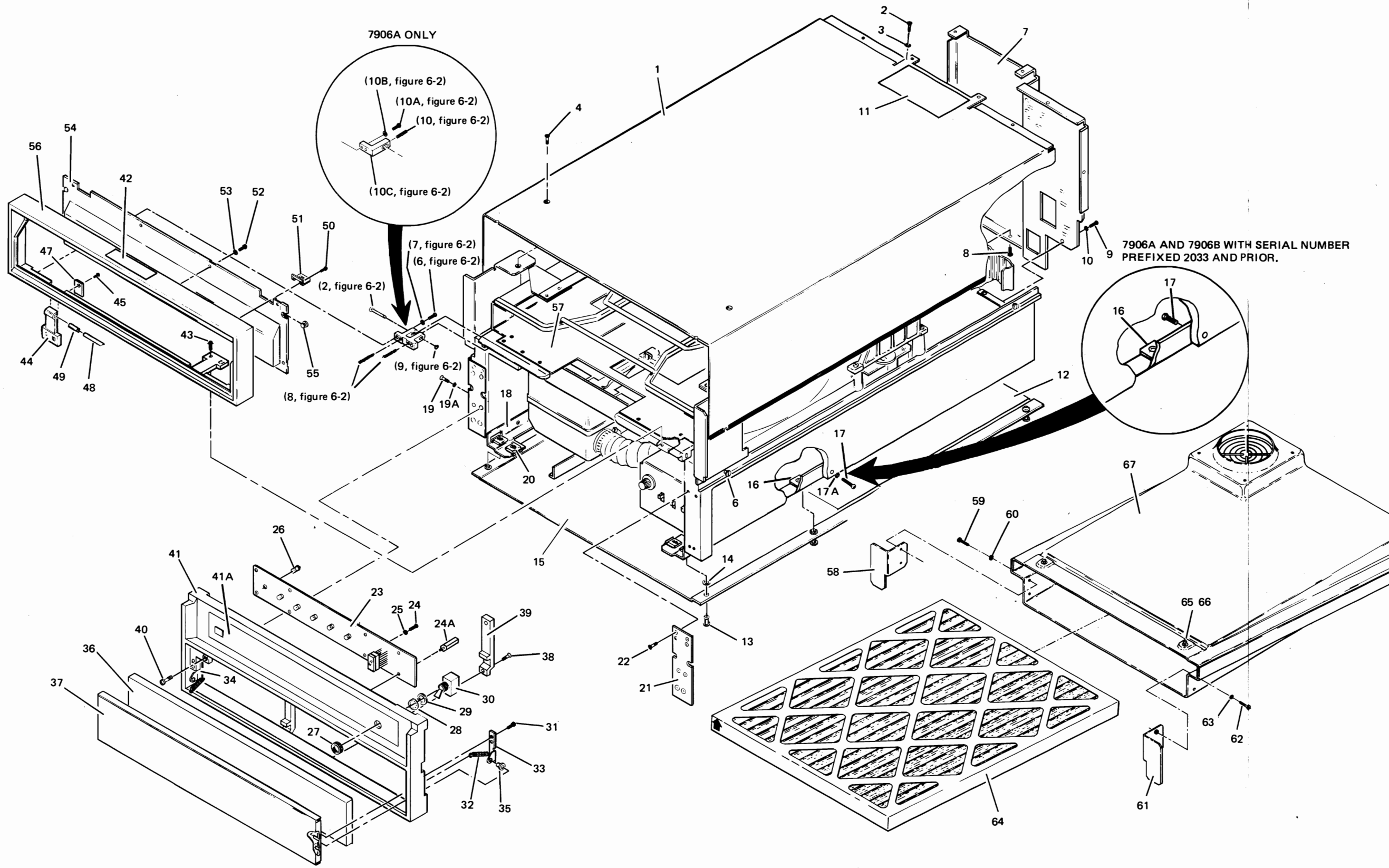


Figure 6-1. HP 7906 Disc Drive, Exploded View


7906A ONLY
(10B, figure 6-2)
(10A, figure 6-2)
(10, figure 6-2)
(10C, figure 6-2)
7906A AND 7906B WITH SERIAL NUMBER PREFIXED 2033 AND PRIOR.
(7, figure 6-2)
(6, figure 6-2)
(2, figure 6-2)
(9, figure 6-2)
(8, figure 6-2)
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REF 7300-31F

Table 6-2. Mainframe Assembly A, Replaceable Parts Listing

FIG. & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-2-	No Number	MAINFRAME ASSEMBLY A (57, figure 6-1)			1
	07906-60028★	*Receiver Assembly	28480	07906-60028	1
	07905-60018▲	*Receiver Assembly	28480	07905-60018	REF
1	0510-1048 ★	**Retainer, Ring	28480	0510-1048	2
2	1480-0498 ★	**Pin	28480	1480-0498	2
3	1460-1705 ★	**Spring, Compression, 0.12 in. OD, 0.69 in. long	28480	1460-1705	2
4	07906-40003★	**Lip, Front, Right	28480	07906-40003	1
		(Attaching Parts)			
5	2360-0196 ★	**Screw, Machine, 100-deg fh, 6-32, 0.375 in. long	00000	OBD	4
		— — — x — — —			
6	2360-0123 ★	**Screw, Machine, ph, pozi, w/ext-tooth, 6-32, 0.625 in. long	00000	OBD	4
7	3050-0228 ★	**Washer, Flat, no. 6	00000	OBD	4
8	1460-1730 ★	**Spring, Compression, 0.12 in. OD, 1.0 in. long	28480	1460-1730	4
9	07906-40001★	**Link, Receiver	28480	07906-40001	2
10	1460-0565 ▲	**Spring, Cprsn-Cyl, 0.18 in. OD, 0.625 in. long	28480	1460-0565	2
10A	2360-0123 ▲	**Screw, Machine, ph, pozi, w/ext-tooth, no. 6-32, 0.625 in.	00000	OBD	4
10B	3050-0228 ▲	**Washer, Flat, no. 6	00000	OBD	4
10C	07905-40027▲	**Link, Receiver	28480	07905-40027	2
10D	07905-20069▲	**Screw, Pivot	28480	07905-20069	2
10E	3050-0100 ▲	**Washer, Flat, no. 6	00000	OBD	2
10F	2420-0001 ▲	**Nut, Hex, no. 6-32, w/ext-tooth	00000	OBD	2
10G	07905-40020▲	**Lip, Front, Right	28480	07905-40020	1
		(Attaching Parts)			
10H	2360-0196 ▲	**Screw, Machine, 100-deg fh, no. 6-32, 0.375 in.	00000	OBD	4
10J	2420-0001 ▲	**Nut, Hex, no. 6-32, w/ext-tooth	00000	OBD	4
		— — — x — — —			
11	07906-40002★	**Lip, Front, Left	28480	07906-40002	1
	07905-40023▲	**Lip, Front, Left	28480	07905-40023	REF
		(Attaching Parts)			
	2360-0196	**Screw, Machine, 100-deg fh, no. 6-32, 0.375 in.	00000	OBD	4
		— — — x — — —			
12	1460-1706 ★	**Spring, Extension, 0.375 in. OD, 2.0 in. long	28480	1460-1706	2
	1460-1181 ▲	**Spring, Extension, 0.375 in. OD, 2.582 in. long	28480	1460-1181	REF
13	07905-00078●	**Spring, Cartridge	28480	07905-00078	2
		(Attaching Parts)			
14	2360-0197 ●	**Screw, Machine, ph, pozi, no. 6-32, 0.375 in.	00000	OBD	2
15	3050-0228 ●	**Washer, Flat, no. 6	00000	OBD	2
16	2190-0851 ●	**Washer, Lock, Split, no. 6	00000	OBD	2
17	2420-0002 ●	**Nut, Hex, no. 6-32	00000	OBD	2
		— — — x — — —			
18	07905-00036●	**Bracket, Spring	28480	07905-00036	2
		(Attaching Parts)			
19	2360-0197 ●	**Screw, Machine, ph, pozi, no. 6-32, 0.375 in.	00000	OBD	3
20	3050-0228 ●	**Washer, Flat, no. 6	00000	OBD	3
21	2190-0851 ●	**Washer, Lock, Split, no. 6	00000	OBD	3
22	2420-0002 ●	**Nut, Hex. no. 6-32	00000	OBD	3
		— — — x — — —			
23	2420-0002	**Nut, Hex, no. 6-32	00000	OBD	4
24	2190-0851	**Washer, Lock, Split, no. 6	00000	OBD	4
25	3050-0228	**Washer, Flat, no. 6	00000	OBD	4
26	2360-0201	**Screw, Machine, ph, pozi, no. 6-32, 0.625 in.	00000	OBD	4
27	1530-1750	**Frame, Wire	28480	1530-1750	1

NOTES: ★ First used on 7906B.
▲ Used on 7906A only.
● Used on 7906A only. For replacement of this assembly, order either Left Spring Assembly, part no. 07906-00019, or Right Spring Assembly, part no. 07906-00020.

Parts Listing (Continued)

	MFR CODE	MFR PART NO.	UNITS PER ASSY
	28480	07906-60009	1
	28480	07906-60021	1
	00000	OBD	4
	00000	OBD	4
	00000	OBD	3
	28480	07905-00031	1
	28480	07905-00032	1
	00000	OBD	2
	28480	07905-60031	1
	28480	07920-00016	1
	00000	OBD	2
	00000	OBD	2
	28480	07920-60009	1
.312 in.	00000	OBD	2
	28480	07905-00074	1
	28480	4320-0002	2
	28480	07905-00058	2
.375 in.	00000	OBD	3
.375 in.	00000	OBD	8
	28480	07905-00022	1
	28480	7120-6129	1
	28480	0570-0642	4
	28480	NSR	1

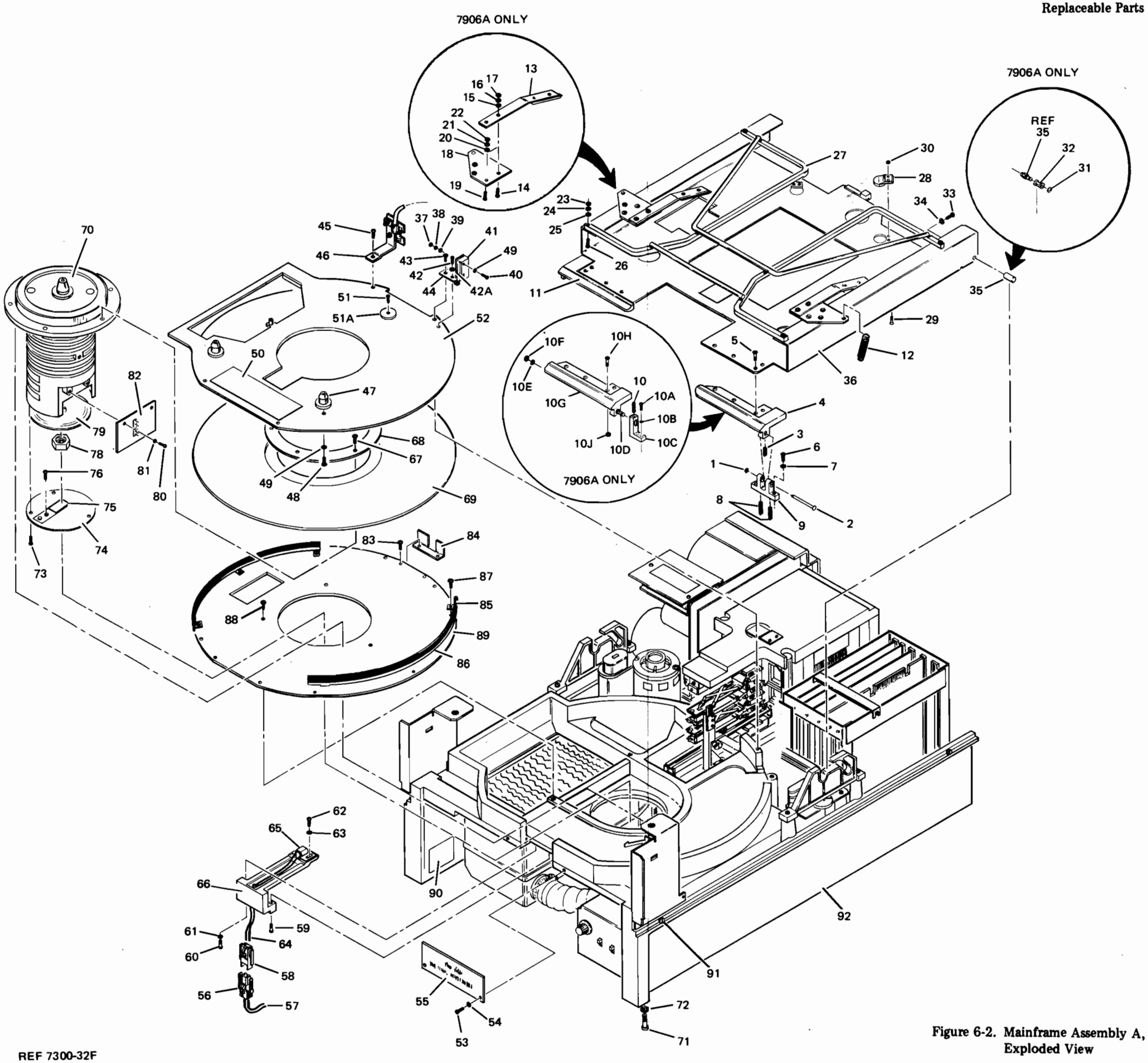


Figure 6-2. Mainframe Assembly A, Exploded View

Table 6-2. Mainframe Assembly A, Replaceable Parts Listing (Continued)

FIG. & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-2					
28	07905-40019●	**Detent, Cartridge (Attaching Parts)	28480	07905-40019	2
29	0520-0162●	**Screw, Machine, 82-deg fh, pozi, no. 2-56, 0.125 in.	00000	OBD	2
30	0610-0011●	**Nut, Hex, no. 2-56 — — — x — — —	00000	OBD	2
31	0510-0045▲	**Retainer, Ring, 0.188 in. dia	97464	1000-18-ST-CD	2
32	1410-0561▲	**Bearing, Oilite	70417	FF-303-4	2
33	2360-0113	**Screw, Machine, ph, pozi, w/ext-tooth, no. 6-32, 0.250 in.	00000	OBD	2
34	3050-0100	**Washer, Flat, no. 6	00000	OBD	2
35	1531-0067★	**Follower, Cam	28480	1531-0067	2
	07905-20050▲	**Shaft, Bearing	28480	07905-20050	2
36	07906-60028★	**Receiver	28480	07906-60028	1
	07905-00067▲	**Receiver	28480	07905-00067	REF
37	0610-0001	*Nut, Hex, no. 2-56	00000	OBD	2
38	2190-0045	*Washer, Lock, Split, no. 2	00000	OBD	2
39	2190-0479	*Washer, Flat, no. 2	00000	OBD	4
40	0520-0133	*Screw, Machine, ph, pozi, no. 2-56, 0.50 in.	00000	OBD	2
41	3102-0009	*Switch, Cartridge-in-Place	82647	20700L10-205	1
42	2200-0105	*Screw, Machine, ph, pozi, w/ext-tooth, no. 4-40, 0.312 in.	00000	OBD	1
42A	3050-0222	*Washer, Flat, no. 4	00000	OBD	1
43	2510-0045	*Screw, Machine, ph, pozi, w/ext-tooth, no. 8-32, 0.375 in.	00000	OBD	1
44	07905-00080	*Bracket, Switch, Cartridge-in-Place	28480	07905-00080	1
45	2510-0045	*Screw, Machine, ph, pozi, w/ext-tooth, no. 8-32, 0.375 in.	00000	OBD	7
46	07906-60080	*Sensor, Temperature	28480	07906-60080	1
47	07905-20067	*Post, Locator (Attaching Parts)	28480	07905-20067	2
48	2510-0045	*Screw, Machine, ph, pozi, w/ext-tooth, no. 8-32, 0.375 in.	00000	OBD	1
49	3050-0001	*Washer, Flat, no. 8 — — — x — — —	00000	OBD	1
50	7120-0695	*Label, Information	28480	7120-0695	1
	07906-60017■	*Disc Top Cover Assembly	28480	07906-60017	1
51	2360-0180■	**Screw, Machine, 82-deg fh, no. 6-32, 0.188 in.	00000	OBD	1
51A	07906-20003■	**Pad, Cartridge	28480	07906-20003	1
52	07906-00008■	**Cover, Top, Disc	28480	07906-00008	1
53	2510-0045	*Screw, Machine, ph, pozi, w/ext-tooth, no. 8-32, 0.375 in.	00000	OBD	2
54	3050-0001	*Washer, Flat, no. 8	00000	OBD	2
55	07905-00083	*Plate, Label	28480	07905-00083	1
56	1251-4128	*Connector, 2-pin	28480	1251-4128	1
57	1251-0612	*Contact, Connector, Male	28480	1251-0612	2
58	1251-4130	*Connector, 2-pin	28480	1251-4130	1
59	3030-0557	*Screw, Shoulder, no. 8-32, 0.5 in.	00000	OBD	1
60	3030-0015	*Screw, Socket Head Cap, no. 8-32, 0.75 in.	00000	OBD	1
61	2190-0017	*Washer, Lock, Split, no. 8	00000	OBD	1
	07905-60045	*Index Transducer Assembly (Attaching Parts) Not Found	28480	07905-60045	1
62	2200-0105	*Screw, Machine, ph, pozi, w/ext-tooth, no. 4-40, 0.312 in.	00000	OBD	2
63	3050-0229	*Washer, Flat, no. 4 — — — x — — —	00000	OBD	2
64	1251-0613	**Contact, Connector, Female	28480	1251-0613	2
65	0960-0407	**Transducer, Index	28480	0960-0407	1
66	07905-20074	*Support, Index Transducer	28480	07905-20074	1
67	2510-0045	*Screw, Machine, ph, pozi, w/ext-tooth, no. 8-32, 0.375 in.	00000	OBD	6
68	1600-0468	*Ring, Clamp	28480	1600-0468	1

NOTES: ●Used on 7906A and 7906B disc drives with serial numbers prefixed 2043 and prior.
▲Used on 7906A only.
★First used on 7906B.
■07906-60017 Assembly first used on 7906A, serial numbers prefixed 1827, and on 7906B. On prior serial number prefixes, Cartridge Pad (07905-20068) and/or Disc Top Cover (07905-00059) may be replaced separately or both may be replaced with 07906-60017 Assembly.

Table 6-2. Mainframe Assembly A, Replaceable Parts Listing (Cont

FIG. & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE
6-2			
69	07906-60009	*Disc, Fixed	28480
70	07906-60021	*Spindle Assembly (Attaching Parts)	28480
71	3020-0006	*Screw, Socket Head Cap, no. 1/4-20, 1.25 in.	00000
72	2190-0032	*Washer, Lock, Split, 1/4 in. — — — x — — —	00000
73	2510-0103	**Screw, Machine, ph, pozi, no. 8-32, 0.375 in.	00000
74	07905-00031	**Cover, Bottom, Spindle	28480
75	07905-00032	**Spring, Ground (Attaching Parts)	28480
76	2360-0113	**Screw, Machine, ph, pozi, no. 6-32, 0.250 in.	00000
77		Not Assigned — — — x — — —	
78	07905-60031	**Spindle Ground Contact	28480
79	07920-00016	**Disc, Sector	28480
80	2510-0045	**Screw, Machine, ph, pozi, no. 8-32, 0.375 in.	00000
81	3050-0001	**Washer, flat, no. 8	00000
82	07920-60009	**Spindle Motor Encoder PCA (A10)	28480
83	2510-0043	*Screw, Machine, ph, pozi, w/ext-tooth, no. 8-32, 0.312 in.	00000
84	07905-00074	*Seal, Head Access	28480
85	4320-0002	*Extrusion, Rubber	28480
86	07905-00058	*Channel, Baffle (Attaching Parts)	28480
87	2510-0045	*Screw, Machine, ph, pozi, w/ext-tooth, no. 8-32, 0.375 in. — — — x — — —	00000
88	2510-0045	*Screw, Machine, ph, pozi, w/ext-tooth, no. 8-32, 0.375 in.	00000
89	07905-00022	*Cover, Lower, Disc	28480
90	7120-6129	*Label, Fault Code	28480
91	0570-0642	*Screw, Special, slotted, no. 8-32, 0.460 in.	28480
92	No Number	*Mainframe Assembly B (see figure 6-3)	28480

Table 6-3. Mainframe Assembly B, Replaceable Parts Listing

FIG. & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-3-	No Number	MAINFRAME ASSEMBLY B, (91, figure 6-2)			1
1	0340-0761	*Insulator Cover, Terminal	90201	OC-1	1
2	2510-0045	*Screw, Machine, ph, pozi, w/ext-tooth, no. 8-32, 0.375 in.	00000	OBD	2
3	3050-0001	*Washer, Flat, no. 8	00000	OBD	2
4	2360-0195	*Screw, Machine, ph, pozi, no. 6-32, 0.312 in.	00000	OBD	1
5	2420-0001	*Nut, Hex, no. 6-32, w/ext-tooth	00000	OBD	1
6	0160-0585	*Blower Motor Starting Capacitor, 5uf, ±10%	56289	500P9032	1
7	1400-0189	*Clamp, Capacitor	01002	128A2244G21	1
8	2510-0051	*Screw, Machine, ph, pozi, w/ext-tooth, no. 8-32, 0.625 in.	00000	OBD	1
9	3050-0001	*Washer, Flat, no. 8	00000	OBD	1
10	1400-0293	*Clamp, Cable	05683	3/8-6B	1
11		Deleted			
12	07906-60016	*Cover, Impeller	28480	07906-60016	1
13	3160-0292	*Impeller, 4.813 in. dia, 1.75 in. thick	28480	3160-0292	1
14	2510-0108	*Screw, Machine, 100-deg fh, pozi, no. 8-32, 0.625 in.	00000	OBD	4
14A	2190-0048	*Washer, Lock, ext-tooth, no. 8	00000	OBD	4
15	3140-0532	*Motor, Blower, 115 Vac, 3300 rpm	28480	3140-0532	1
16	2510-0045	*Screw, Machine, ph, pozi, w/ext-tooth, no. 8-32, 0.375 in.	00000	OBD	2
17	0510-0053	*Ring, Retainer, 0.188 in. dia.	97464	7100-18-CD	1
18	1410-0093	*Bearing, Sleeve, Nylon	96881	NYLINER 3L2-FF	2
19	07905-00102	*Bail, Cartridge	28480	07905-00102	1
20	1460-1551	*Spring, Torsion	28480	1460-1551	1
21	0380-0018	*Spacer, np brs, 0.194 in. ID, 0.25 in. OD, 0.25 in. long	28480	0380-0018	1
22	07905-00068	*Support, Bail	28480	07905-00068	1
23	7120-8040★	*Label, Warning	28480	7120-8040	1
	7120-4567▲	*Label, Warning	28480	7120-4567	REF
24	07920-00100★	*Cover, Terminal Block	28480	07920-00100	1
	07905-00076▲	*Cover, Terminal Block	28480	07905-00076	REF
		(Attaching Parts)			
25	2200-0155★	*Screw, Machine, ph, pozi, no. 4-40, 1.00 in.	00000	OBD	2
	2360-0127▲	*Screw, Machine, ph, pozi, no. 6-32, 0.875 in.	00000	OBD	REF
26	2190-0411★	*Washer, Lock, int-tooth, 0.116 in. ID	00000	OBD	2
	2190-0851▲	*Washer, Lock, Split, no. 6	00000	OBD	REF
26A	3050-0407▲	*Washer, Flat, no. 4	00000	OBD	2
		— — — x — — —			
27	07906-60014★	*Power Supply Assembly (See figure 6-4)	28480	07906-60014	1
	07905-60020▲	*Power Supply Assembly (see figure 6-5)	28480	07905-60020	REF
		(Attaching Parts)			
28	2940-0055	*Screw, Cap, hex, no. 1/4-20, 0.625 in.	00000	OBD	4
29	2190-0032	*Washer, Lock, Split, 1/4 in.	00000	OBD	4
		— — — x — — —			
30	07905-00056	*Retaining Strap, Head Connector	28480	07905-00056	1
		(Attaching Parts)			
31	2360-0121	*Screw, Machine, ph, pozi, w/ext-tooth, no. 6-32, 0.500 in.	00000	OBD	1
32	3050-0228	*Washer, Flat, no. 6	00000	OBD	1
		— — — x — — —			
33	07906-60010	*Read/Write Head Assembly (Up, fixed disc)	28480	07906-60010	1
34	07905-60024	*Read/Write Head Assembly (Up, cartridge)	28480	07905-60024	2
35	07905-60025	*Read/Write Head Assembly (Down, cartridge)	28480	07905-60025	1
36	07905-60026	*Servo Head Assembly	28480	07905-60026	1
37	07906-60088■	*Solenoid Assembly	28480	07906-60088	1
	07905-60051●	*Solenoid, Assembly	28480	07905-60051	1
		(Attaching Parts)			
38	2360-0115	*Screw, Machine, ph, pozi, w/ext-tooth, no. 6-32, 0.312 in.	00000	OBD	2
39	3050-0228	*Washer, Flat, no. 6	00000	OBD	2
		— — — x — — —			

NOTES: ★ Used on 7906B.
▲ Used on 7906A only.
■ Used on 7906B disc drives with serial numbers prefixed 2018 and later.
● Used on 7906A and 7906B disc drives with serial numbers prefixed 2008 and prior.

Table 6-3. Mainframe Assembly B, Replaceable Parts Listing (Continued)

FIG. & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-3-40	07905-60046	*Velocity Transducer (Attaching Parts)	28480	07905-60046	1
41	2200-0165	*Screw, Machine, 82-deg fh, pozi, no. 4-40, 0.250 in. — — — x — — —	00000	OBD	2
42	07905-60049	*Velocity Transducer Shaft	28480	07905-60049	1
43	3020-0006	*Screw, Socket Head Cap, no. 1/4-20, 1.25 in.	00000	OBD	4
44	2190-0032	*Washer, Lock, Split, 1/4 in.	00000	OBD	4
45	07905-60030	*Actuator Assembly	28480	07905-60030	1
45A	1400-1054	**Clip, Cable	28480	1400-1054	1
45B	1400-0514	**Clamp, Cable, flat	28480	1400-0514	1
46	2200-0103	**Screw, Machine, ph, pozi, w/ext-tooth, no. 4-40, 0.250 in.	00000	OBD	2
47	1990-0467	**Detector, Carriage-Back	50522	MCA8	1
48	2200-0103	**Screw, Machine, ph, pozi, w/ext-tooth, no. 4-40, 0.188 in.	00000	OBD	1
49	2190-0416	**Washer, Flat, no. 4	00000	OBD	1
50	07905-00051	**Flag, Optical	28480	07905-00051	1
50A	07906-40008	**Shield, Coil band (Attaching Parts)	28480	07906-40008	1
50B	2360-0117	**Screw, Machine, ph, pozi, w/ext-tooth, no. 6-32, 0.375 in.	00000	OBD	2
50C	3050-0228	**Washer, Flat, no. 6 — — — x — — —	00000	OBD	2
50D	0360-0628	**Terminal (Attaching Parts)	28480	0360-0628	2
50E	2360-0117	**Screw, Machine, ph, pozi, w/ext-tooth, no. 6-32, 0.375 in. — — — x — — —	00000	OBD	4
51	2510-0043	*Screw, Machine, ph, pozi, w/ext-tooth, no. 6-32, 0.375 in.	00000	OBD	1
52	3050-0001	*Washer, Flat, no. 6	00000	OBD	1
53	07906-00007	*PCA Retainer	28480	07906-00007	1
54	07906-60001	*I/O Sector PCA (A2)	28480	07906-60001	1
55	07906-60003	*Servo PCA (A3)	28480	07906-60003	1
56	07906-60102	*Control PCA (A4)	28480	07906-60102	1
57	07906-60004	*Track Follower PCA (A5)	28480	07906-60004	1
58	07906-60006	*Read/Write Preamplifier PCA (A6) (Attaching Parts)	28480	07906-60006	1
59	2360-0219	*Screw, Machine, ph, pozi, no. 6-32, 1.375 in.	00000	OBD	1
60	2190-0851	*Washer, Lock, Split, no. 6	00000	OBD	1
60A	2190-0464	*Washer, Flat, no. 6 — — — x — — —	00000	OBD	1
61	2200-0111	*Screw, Machine, ph, pozi, w/ext-tooth, no. 4-40, 0.500 in.	00000	OBD	1
62	3050-0222	*Washer, Flat, no. 4	00000	OBD	2
63	1251-2518	*Connector, Edge, 48-pin	71785	251-24-30-261	2
64	2360-0119	*Screw, Machine, ph, pozi, no. 6-32, 0.438 in.	00000	OBD	6
65		Deleted			
66	07906-60108	*Motherboard PCA (A7)	28480	07906-60108	1
66A	1390-0075	*Screw, Captive	06540	51-18-606-24	4
67	1901-0496	*Diode, 100V, 12A (Attaching Parts)	04713	SR2080-2	1
67A	2740-0003	*Nut, Hex, no. 10-31, w/ext-tooth — — — x — — —	00000	OBD	1
68	0403-0102	*Guide, PCA, Nylon, 6.5 in. long, 0.312 in. wide	23880	1650F	10
69	07905-00100	*Card Cage Chassis	28480	07905-00100	1
69A	2360-0117	*Screw, Machine, ph, pozi, w/ext-tooth, no. 6-32, 0.375 in.	00000	OBD	1
69B	3050-0227	*Washer, Flat, no. 6	00000	OBD	1
70	2510-0045◆	*Screw, Machine, ph, pozi, w/ext-tooth, no. 8-32, 0.375 in.	00000	OBD	3
71	3050-0001◆	*Washer, Flat, no. 8	00000	OBD	3
72	0610-0001◆	*Nut, Hex, no. 2-56	00000	OBD	2
73	2190-0045◆	*Washer, Lock, Split, no. 2	00000	OBD	2
74	2190-0479◆	*Washer, Flat, no. 2	00000	OBD	2

NOTE: ◆Not used on disc drives with serial numbers prefixed 2040 and later.

Table 6-3. Mainframe Assembly B, Replaceable Parts Listing (Continued)

FIG. & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-3-					
75	0520-0133 ♦	*Screw, Machine, ph, pozi, no. 2-56, 0.438 in.	00000	OBD	2
76	3102-0009 ♦	*Switch, Brushes-back	82647	20700L10-205	1
77	07905-60027 ♦	*Brush Cycle Assembly	28480	07905-60027	1
78	3140-0531 ♦	*Motor, Brush Cycle, 24 Vac, 4 rpm	28480	3140-0531	1
		(Attaching Parts)			
79	2200-0142 ♦	**Screw, Machine, 100-deg fh, pozi, no. 4-40, 0.312 in.	00000	OBD	2
80	2190-0078 ♦	**Washer, Lock, Split, no. 4	00000	OBD	2
81	2260-0002 ♦	**Nut, Hex, no. 4-40	00000	OBD	2
		— — — x — — —			
82	No Number	**Disc Brushes, Pair	28480	NSR	1
83	8120-1575 ★	*Cord, Power, 3-conductor, 30 in. long	28480	8120-1575	1
	8120-2371 ★	*Cord, Power, Standard, 3 conductor	28480	8120-2371	REF
	8120-1860 ★	*Cord, Power, 015, 3 conductor	28480	8120-1860	REF
	8120-1689 ★	*Cord, Power, 3 conductor	28480	8120-1689	REF
	8120-1369 ★	*Cord, Power, 3 conductor	28480	8120-1369	REF
	8120-1351 ★	*Cord, Power, 3 conductor	28480	8120-1351	REF
	8120-1521 ▲	*Cord, Power, Standard, 3 conductor	28480	8120-1521	REF
	8120-2191 ▲	*Cord, 015, 3 conductor	28480	8120-2191	REF
	8120-1692 ▲	*Cord, Power, 3 conductor	28480	8120-1692	REF
	8120-0696 ▲	*Cord, Power, 3 conductor	28480	8120-0696	REF
	8120-1703 ▲	*Cord, Power, 3 conductor	28480	8120-1703	REF
84	2260-0009	*Nut, Hex, no. 4 w/ext-tooth	00000	OBD	2
85	3050-0229	*Washer, Flat, no. 4	00000	OBD	2
86	2200-0147	*Screw, Machine, ph, pozi, no. 4-40, 0.500 in.	00000	OBD	2
87	07925-60057 ★	*Receptacle, Power	28480	07925-60057	1
	1251-2357 ▲	*Receptacle, Power	28480	1251-2357	1
88	9135-0031 ▲	*Line Filter	28480	9135-0031	1
		(Attaching Parts)			
89	2360-0113 ▲	*Screw, Machine, ph, pozi, w/ext-tooth, no. 6-32, 0.250 in.	00000	OBD	2
		— — — x — — —			
90	07905-00093 ▲	*Bracket, Line Filter	28480	07905-00093	1
		(Attaching Parts)			
91	2510-0045 ▲	*Screw, Machine, ph, pozi, w/ext-tooth, no. 8-32, 0.372 in.	00000	OBD	2
92	3050-0001 ▲	*Washer, Flat, no. 8	00000	OBD	2
		— — — x — — —			
93	07906-40004 ★	*Cam, Receiver	28480	07906-40004	2
	07905-40006 ▲	*Cam, Receiver	28480	07905-40006	REF
		(Attaching Parts)			
94	2510-0051	*Screw, Machine, ph, pozi, w/ext-tooth, no. 8-32, 0.625 in.	00000	OBD	2
95	3050-0001	*Washer, Flat, no. 8	00000	OBD	2
		— — — x — — —			
96	1400-0851	*Clamp, Adjustable, 1.75 in. dia, 0.312 in. wide	81646	Micro-Gear 6206	1
97	1400-0851	*Clamp, Adjustable, 1.75 in. dia, 0.312 in. wide	81646	Micro-Gear 6206	1
98	0890-1147	*Hose, Flexible, 1.5 in. ID, 11.5 in. long	28480	0890-1147	1
99	0570-1175	*Screw, Thumb, no. 8-32, 0.375 in. long	73734	33302	2
100	3150-0276	*Filter, Absolute	28480	3150-0276	1
101	07920-00056	*Fin, Air Duct	28480	07920-00056	1
102	07920-20063	*Duct, Air	28480	07920-20063	1
		(Attaching Parts)			
103	2360-0137	*Screw, Machine, ph, pozi, no. 6-32, 1.750 in.	00000	OBD	2
104	3050-0228	*Washer, Flat, no. 6	00000	OBD	2
105	2420-0006	*Nut, Hex, no. 6-32, w/ext-tooth	00000	OBD	2
		— — — x — — —			
106	1251-0334	*Connector, Edge, 18-pin	71785	251-18-30-261	1
		(Attaching Parts)			
107	2200-0111	*Screw, Machine, ph, pozi, w/ext-tooth, no. 4-40, 0.500 in.	00000	OBD	2
108	3050-0222	*Washer, Flat, no. 4	00000	OBD	2
		— — — x — — —			

NOTES: ♦ Not used on disc drives with serial numbers prefixed 2040 and later.
★ First used on 7906B. ▲ Used on 7906A only.

Parts Listing (Continued)

	MFR CODE	MFR PART NO.	UNITS PER ASSY
	28480	3100-3287	1
	04009	8991-3	1
	78189	1922-01	1
	00000	OBD	1
	28480	3101-0646	1
	75915	345002-020	1
	28480	2110-0565	1
d 120	71400	MDA8	1
0 and	28480	2110-0365	1
	00000	OBD	1
	28480	2110-0569	1
	78189	1924-02	1
	00000	OBD	1
	75915	345001-010	1
	28480	2110-0564	1
	79727	GF-126-0000	3
	00000	OBD	2
	00000	OBD	2
	00000	OBD	2
	28480	7120-4368	1
	28480	07906-00005	1
	28480	07905-00016	REF
	28480	NSR	1

acing part no. 2110-0470, order part numbers 2110-0564,
B.

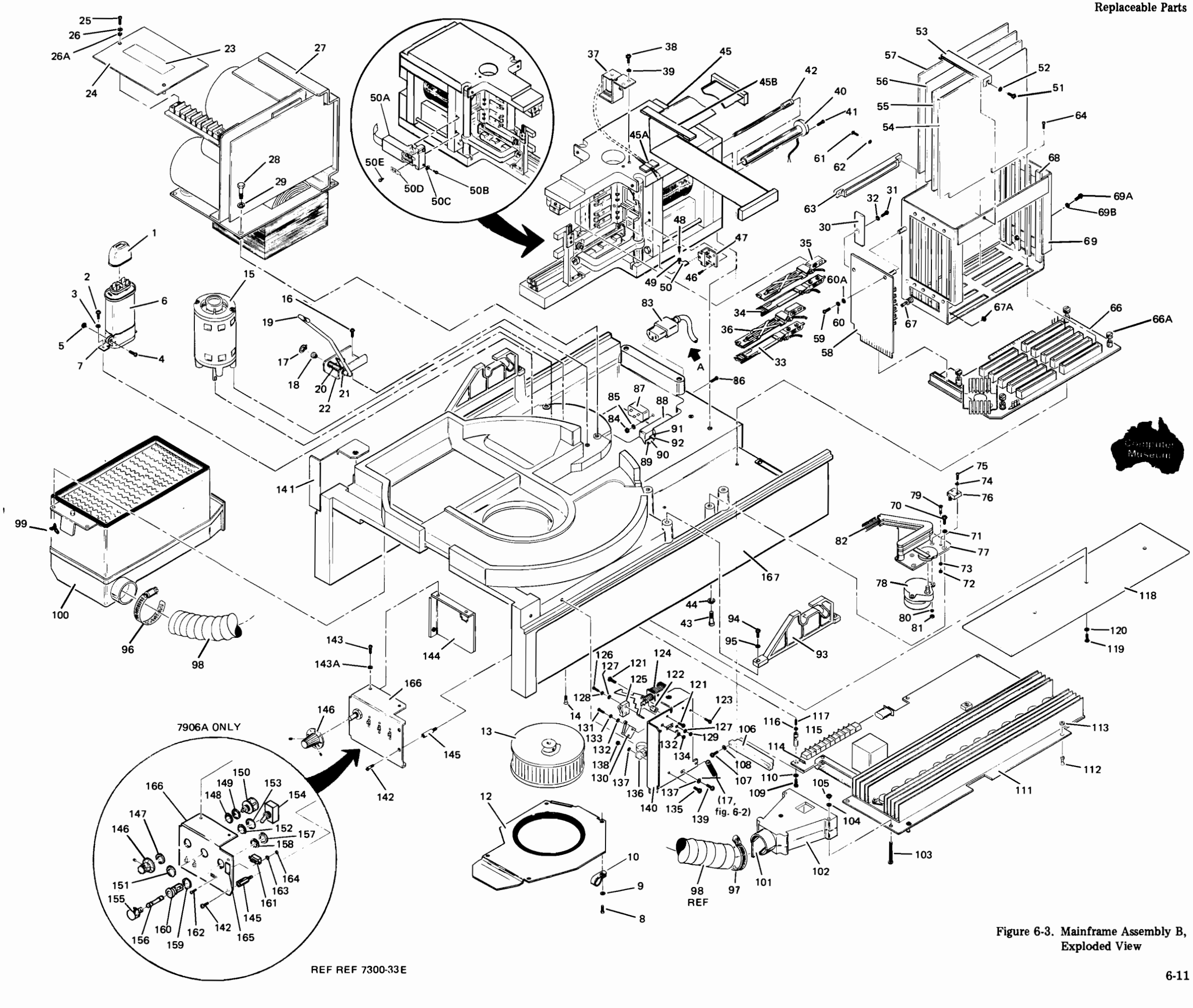


Figure 6-3. Mainframe Assembly B, Exploded View

Table 6-3. Mainframe Assembly B, Replaceable Parts Listing (Continued)

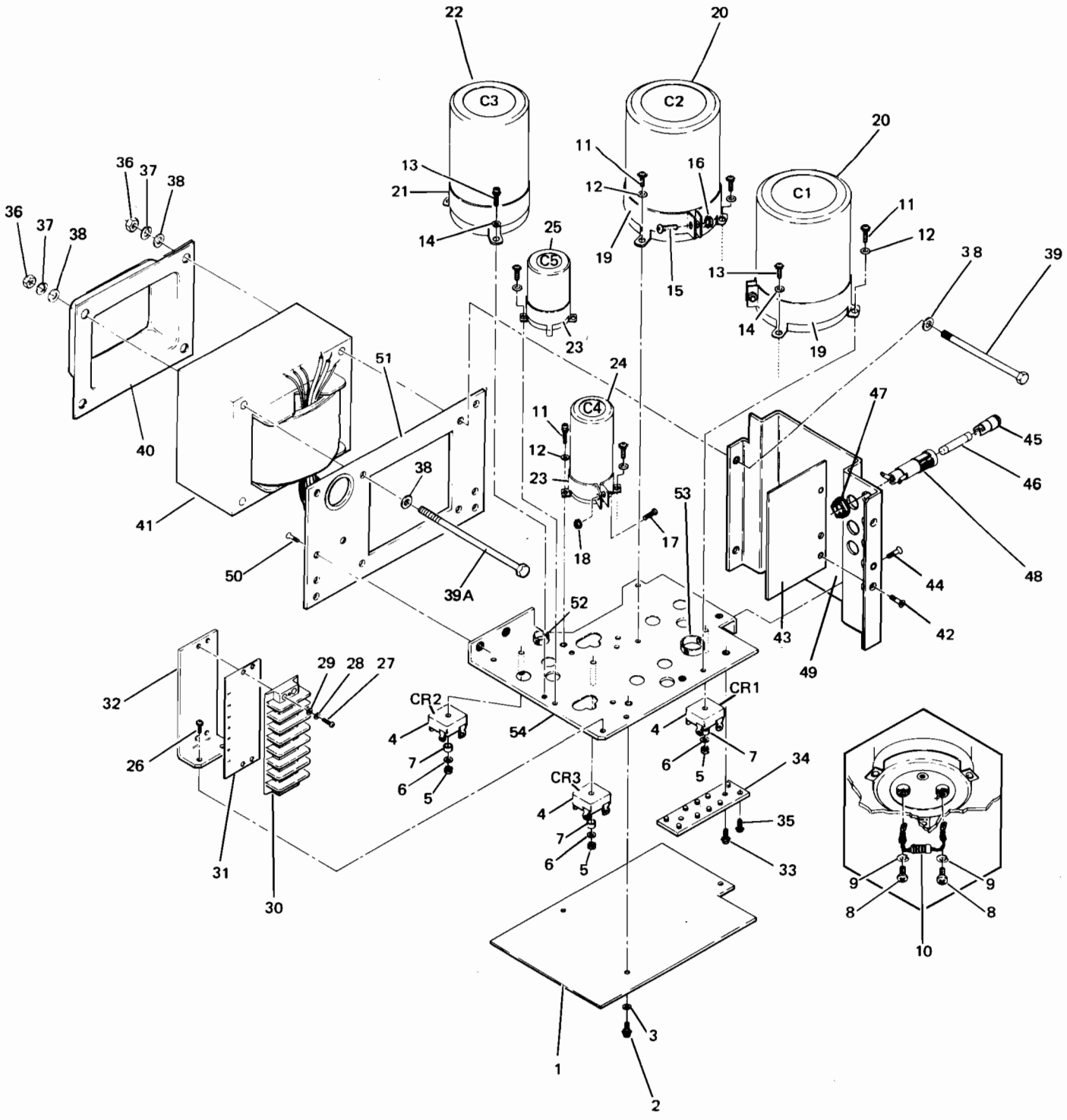
FIG. & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-3-					
109	2510-0043	*Screw, Machine, ph, pozi, w/ext-tooth, no. 8-32, 0.312 in.	00000	OBD	3
110	3050-0001	*Washer, Flat, no. 8	00000	OBD	3
111	07906-60095	*Power and Motor Control PCA (A8)	28480	07906-60095	1
112	1390-0333	**Fastener, 1/4-turn stud	94222	82-11-180-16	2
113	1390-0088	**Retainer, 1/4-turn fastener	28480	1390-0088	2
114	2110-0099	**Fuse, 1A, 125V	28480	2110-0099	1
115	0380-0571	*Standoff, Hinged, 0.75 in. long, 0.25 in. OD, no. 8-32 thread	00000	OBD	3
116	2580-0003	*Nut, Hex, no. 8-32, w/ext-tooth	00000	OBD	3
117	3030-0319	*Setscrew, Hex, no. 8-32, 0.75 in.	00000	OBD	3
118	07905-00084	*Cover, Heat Sink	28480	07905-00084	1
		(Attaching Parts)			
119	2510-0045	*Screw, Machine, ph, pozi, w/ext-tooth, no. 8-32, 0.375 in.	00000	OBD	3
120	3050-0001	*Washer, Flat, no. 8	00000	OBD	3
		— — — x — — —			
121	2360-0113	*Screw, Machine, ph, pozi, w/ext-tooth, no. 6-32, 0.250 in.	00000	OBD	2
122	07905-20045	*Standoff	28480	07905-20045	1
123	2200-0101	*Screw, Machine, ph, pozi, no. 4-40, 0.188 in.	00000	OBD	2
124	07905-60058	*Solenoid, Door Lock	28480	07905-60058	1
125	3102-0009	*Switch, Door Closed	28480	3102-0009	1
		(Attaching Parts)			
126	0520-0133	*Screw, Machine, ph, pozi, no. 2-56, 0.438 in.	00000	OBD	2
127	2190-0479	*Washer, Flat, no. 2	00000	OBD	2
128	2190-0045	*Washer, Lock, Split, no. 2	00000	OBD	2
129	0610-0001	*Nut, Hex, no. 2-56	00000	OBD	2
		— — — x — — —			
130	3102-0009	*Switch, Door Locked	28480	3102-0009	1
		(Attaching Parts)			
131	0520-0133	*Screw, Machine, ph, pozi, no. 2-56, 0.438 in.	00000	OBD	2
132	2190-0479	*Washer, Flat, no. 2	00000	OBD	2
133	2190-0045	*Washer, Lock, Split, no. 2	00000	OBD	2
134	0610-0001	*Nut, Hex, no. 2-56	00000	OBD	2
		— — — x — — —			
135	2360-0201	*Screw, Machine, ph, pozi, no. 6-32, 0.500 in.	00000	OBD	1
136	1400-0440	*Clamp, Cable, 1.75 in. dia, 0.184 in. wide, 7.81 in. long	06383	PLC2S-S10-M	1
137	3050-0228	*Washer, Flat, no. 6	00000	OBD	1
138	2420-0006	*Nut, Hex, no. 6-32, w/ext-tooth	00000	OBD	1
139	2510-0045	*Screw, Machine, ph, pozi, w/ext-tooth, no. 8-32, 0.375 in.	00000	OBD	2
139A	3050-0001	*Washer, Flat, no. 8	00000	OBD	2
140	07906-00012 ★	*Gusset, Right-Hand	28480	07906-00012	1
	07906-00002 ▲	*Gusset, Right-Hand	28480	07906-00002	REF
	07906-00031 ♦	*Gusset, Right-Hand	28480	07906-00031	1
141	07906-00013 ★	*Gusset, Left-Hand	28480	07906-00003	1
	07906-00003 ▲	*Gusset, Left-Hand	28480	07906-00003	REF
142	2360-0181 ★	*Screw, Machine, 82-deg fh, pozi, no. 6-32, 0.250 in.	00000	OBD	2
	2510-0045 ▲	*Screw, Machine, ph, pozi, w/ext-tooth, no. 8-32, 0.375 in.	00000	OBD	REF
143	2360-0115	*Screw, Machine, ph, pozi, w/ext-tooth, no. 6-32, 0.312 in.	00000	OBD	3
143A	2190-0464 ★	*Washer, Flat, no. 6	00000	OBD	3
144	07906-00009 ★	*Cover, Switch, Operator Control Panel Assembly	28480	07906-00009	1
	07905-00095 ▲	*Cover, Switch, Operator Control Panel Assembly	28480	07905-00095	REF
145	0380-1124	*Standoff, Hex, Male/Female, 0.875 in., no. 8-32	28480	0380-1124	2
	07906-60019 ★	*Operator Control Panel Assembly	28480	07906-60019	1
	07905-60028 ▲	*Operator Control Panel Assembly	28480	07905-60028	REF
146	07905-80040	**Knob	28480	07905-80040	1
147	2950-0001 ▲	**Nut, Hex, no. 3/8-32	12697	20/4-13	1
148	2190-0022 ▲	**Washer, Lock, int-tooth, 0.384 in. ID	78189	1920-00	REF
149	2950-0001 ▲	**Nut, Hex, no. 3/8-32	12697	20/4-13	1

NOTES: ★ First used on 7906B.
▲ Used on 7906A only.
♦ First used on 7906B disc drives with serial numbers prefixed 2107.

Table 6-3. Mainframe Assembly B, Replaceable Parts L

FIG. & INDEX NO.	HP PART NO	DESCRIPTION
6-3-		
150	3100-3287 ▲	**Switch, Rotary
151	0590-0012 ▲	**Nut, Knurled, no. 15/32-32
152	2190-0102 ▲	**Washer, Lock, int-.472 in. ID
153	2950-0035 ▲	**Nut, Hex. no. 15/32-32
154	3101-0646 ▲	**Switch, Toggle, DPST
155	2110-0465 ■	**Fuseholder Cap
	2110-0565 ●	**Fuseholder Cap
156	2110-0383 ▲	**Fuse, 8A, 250V, slo-blo (F1) (Used on 100 and 120 Vac models)
	2110-0365 ▲	**Fuse, 4A, 250V, slo-blo (F1) (Used on 200, 220 and 240 Vac models)
157	2950-0054 ■	**Nut, Hex, no. 1/2-28
	2110-0569 ●	**Nut, Hex, 14 mm
158	2190-0068 ■	**Washer, Lock, int-tooth, 0.505 in. ID
159	1400-0090 ▲	**Washer, Rubber, 5/8 in. OD
160	2110-0470 ■	**Fuseholder Body
	2110-0564 ●	**Fuseholder Body
161	3101-0070 ▲	**Switch, Slide, DPDT
		(Attaching Parts)
162	0520-0129 ▲	**Screw, Machine, ph, pozi, no. 2-56, 0.312 in.
163	2190-0045 ▲	**Washer, Lock, Split, no. 2
164	0610-0001 ▲	**Nut, Hex, no. 2-56
		— — — x — — —
165	7120-4368 ▲	**Label, Warning
166	07906-00005 ★	**Bracket, Operator Control Panel Assembly
	07905-00016 ▲	**Bracket, Operator Control Panel Assembly
167	No Number	*Main Casting

NOTES: ▲ Used on 7906A only.
■ Used on 7906A serial numbers prefixed 1810 or earlier. When replacing part n
2110-0565, and 2110-0569.
● First used on 7906A serial numbers prefixed 1823 and on 7906B.
★ First used on 7906B.



7300-150B

Figure 6-4. Power Supply Assembly (7906B), Exploded View

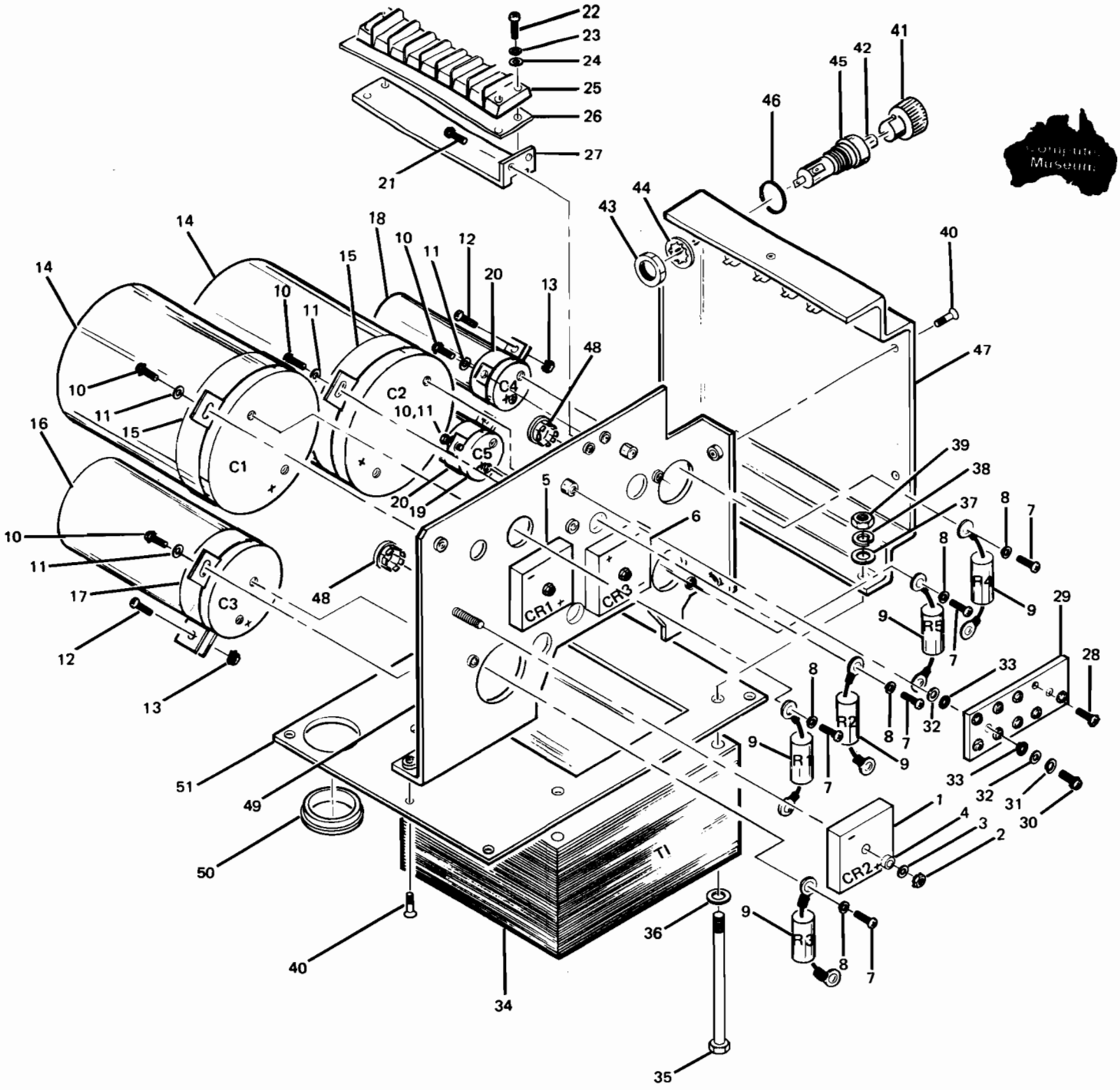
Table 6-4. Power Supply Assembly (7906B), Replaceable Parts Listing (Continued)

FIG. & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-4-					
50	2510-0121	*Screw, Machine, 82-deg fh, pozi, no. 8-32, 0.375 in.	00000	OBD	2
51	07920-00096	*Bracket, Transformer	28480	07920-00096	1
52	0400-0056	*Bushing, Snap-In, for 0.375 in. hole	28480	0400-0056	1
53	0340-0597	*Bushing, Snap-In, for 1.000 in. hole	28480	0340-0597	1
54	No Number	*Bracket, Capacitor	28480	NSR	1

Table 6-5. Power Supply Assembly (7906A), Replaceable Parts Listing

FIG. & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-5-	07905-60020 ▲	POWER SUPPLY ASSEMBLY (27, figure 6-3)	28480	07905-60020	1
1	1906-0205	*Diode (CR2)	28480	1906-0205	1
		(Attaching Parts)			
2	2420-0001	*Nut, Hex, no. 6, w/ext-tooth	00000	OBD	1
3	3050-0228	*Washer, Flat, no. 6	00000	OBD	1
4	0380-0549	*Spacer, 0.18 in. ID, 0.25 in. OD, 0.125 in. long	00000	OBD	1
		— — — x — — —			
5	1906-0205	*Diode (CR1)	28480	1906-0205	1
		(Attaching Parts)			
	2420-0001	*Nut, Hex, no. 6, w/ext-tooth	00000	OBD	1
	3050-0228	*Washer, Flat, no. 6	00000	OBD	1
	0380-0549	*Spacer, 0.18 in. ID, 0.25 in. OD, 0.125 in. long	00000	OBD	1
		— — — x — — —			
6	1906-0205	*Diode (CR3)	28480	1906-0205	1
		(Attaching Parts)			
	2420-0001	*Nut, Hex, no. 6, w/ext-tooth	00000	OBD	1
	3050-0066	*Washer, Flat, no. 6	00000	OBD	1
	0380-0549	*Spacer, 0.18 in. ID, 0.25 in. OD, 0.125 in. long	00000	OBD	1
		— — — x — — —			
7	2680-0099	*Screw, Machine, ph, pozi, no. 10-32, 0.375 in.	00000	OBD	10
8	2190-0034	*Washer, Lock, Split, no. 10	00000	OBD	10
9	0698-3640	*Resistor, 1.8k, 5%, 2 W (R1 thru R5)	28480	0698-3640	5
10	2360-0115	*Screw, Machine, ph, pozi, w/ext-tooth, no. 6-32, 0.312 in.	00000	OBD	13
11	3050-0228	*Washer, Flat, no. 6	00000	OBD	13
12	2510-0107	*Screw, Machine, ph, pozi, no. 8-32, 0.5 in.	00000	OBD	5
13	2580-0003	*Nut, Hex, no. 8-32, w/ext-tooth	00000	OBD	5
14	0180-0539	*Capacitor, 41,000 μF, +75% −10%, 50 Vdc (C1 and C2)	28480	0180-0539	2
15	0180-1958	*Clamp, Capacitor (Used on C1 and C2)	28480	0180-1958	2
16	0180-0541	*Capacitor, 55,000 μF, +75% −10%, 15 Vdc (C3)	28480	0180-0541	1
17	0180-1969	*Clamp, Capacitor (Used on C3)	28480	0180-1969	1
18	0180-0540	*Capacitor, 8400 uF, +75% −10%, 30 Vdc (C4)	28480	0180-0540	1
19	0180-0542	*Capacitor, 4400 uF, +75% −10%, 30 Vdc (C5)	28480	0180-0542	1
20	1210-0013	*Clamp, Capacitor (Used on C4 and C5)	28480	1210-0013	2
21	2360-0115	*Screw, Machine, ph, pozi, w/ext-tooth, no. 6-32, 0.312 in.	00000	OBD	2
22	2200-0149	*Screw, Machine, ph, pozi, no. 4-40, 0.625 in.	00000	OBD	2
23	2190-0078	*Washer, Lock, Split, no. 4	00000	OBD	2
24	2190-0416	*Washer, Flat, no. 4	00000	OBD	2
25	0360-0622	*Block, Barrier, 7-terminal (TB1)	28480	0360-0622	1
26	0360-0625	*Strip, Marker	28480	0360-0625	1
27	07905-00072	*Bracket, Terminal Block	28480	07905-00072	1
28	2360-0115	*Screw, Machine, ph, pozi, w/ext-tooth, no. 6-32, 0.312 in.	00000	OBD	10
29	13215-20001	*Block, Ground	28480	13215-20001	1
		(Attaching Parts)			
30	2360-0203	*Screw, Machine, ph, pozi, no. 6-32, 0.625 in.	00000	OBD	2
31	2190-0851	*Washer, Lock, Split, no. 6	00000	OBD	2
32	3050-0228	*Washer, Flat, no. 6	00000	OBD	4
33	1200-0092	*Washer, Insulator	28480	1200-0092	4
		— — — x — — —			
34	9100-4057	*Transformer, Power (T1)	28480	9100-4057	1
		(Attaching Parts)			
35	0570-1003	*Screw, Cap, 1/4-20 hex, 3.25 in.	00000	OBD	4
36	2190-0784	*Washer, Fiber	28480	2190-0784	4
37	3050-0225	*Washer, Flat, no. 1/4	00000	OBD	4
38	2190-0032	*Washer, Lock, Split, no. 1/4	00000	OBD	4
39	2950-0004	*Nut, Hex, no. 1/4-20	00000	OBD	4
		— — — x — — —			
40	2510-0100	*Screw, Machine, 100-deg fh, no. 8-32, 0.375 in.	00000	OBD	4

NOTE: ▲ Used on 7906A only.



REF 7300-34A

Figure 6-5. Power Supply Assembly (7906A), Exploded View

Table 6-5. Power Supply Assembly (7906A), Replaceable Parts Listing (Continued)

FIG. & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-5-					
41	2110-0465 ■	*Fuseholder Cap	28480	2110-0465	5
	2110-0565 ●	*Fuseholder Cap	28480	2110-0565	5
42	2110-0383	*Fuse, 8A, 250V, slo-blo (F2 and F3)	71400	MDA-8	2
	2110-0342	*Fuse, 8A, 250V (F4)	75915	314-008	1
	2110-0043	*Fuse, 1.5A, 250V (F5 and F6)	71400	AGC 1-1/2	2
43	2950-0054 ■	*Nut, Hex, no. 1/2-28	00000	OBD	5
	2110-0569 ●	*Nut, Hex, 14 mm	28480	2110-0569	5
44	2190-0068 ■	*Washer, Lock, Int-tooth, 0.505 in. ID	78189	1924-02	5
45	2110-0470 ■	*Fuseholder Body	75915	345001-010	5
	2110-0564 ●	*Fuseholder Body	28480	2110-0564	5
46	1400-0090	*Washer, Rubber, 5/8 in. OD	00000	OBD	5
47	07905-00049	*Bracket, AC Power	28480	07905-00049	1
48	0400-0056	*Bushing, Snap-In for 0.500 in. hole	28480	0400-0056	2
49	07905-00012	*Chassis, Power Supply	28480	07905-00012	1
50	0400-0085	*Bushing, Snap-In for 1.093 in. hole	28480	0400-0085	1
51	07905-00013	*Bracket, Transformer	28480	07905-00013	1

NOTES: ■ Used on 7906A serial numbers prefixed 1810 or earlier. When replacing part no. 2110-0470, order part numbers 2110-0564, 2110-0565, and 2110-0569.

● First used on 7906A serial numbers prefixed 1823.

Table 6-6. Reference Designations and Abbreviations

REFERENCE DESIGNATIONS

A = assembly	H = hardware	T = transformer
B = blower, fan, motor, synchro	J = jack, receptacle connector	TB = terminal board
BT = battery	K = relay	TP = test point
C = capacitor	L = inductor	U = integrated circuit, non-repairable assembly
CB = circuit breaker	M = meter	V = electron tube
CR = diode	MP = mechanical part	VR = voltage regulator
DL = delay line	P = plug connector	W = cable assembly (with connectors), wire
DS = indicator lamp	Q = semiconductor device other than diode or integrated circuit	X = socket
E = contact, miscellaneous electrical part	R = resistor	Y = crystal unit
F = fuse	RT = thermistor	Z = network, tuned circuit
FL = filter	S = switch	

ABBREVIATIONS

A = ampere(s)	Hg = mercury	PCA = printed-circuit assembly
ac = alternating current	Hz = Hertz	ph = pan head
Al = aluminum		phh = phillips head
AR = as required	ID = inside diameter	PNP = positive-negative-positive (transistor)
assy = assembly	impreg = impregnated	P/O = part of
	in. = inch, inches	porc = porcelain
Be Cu = beryllium copper	incand = incandescent	posn = position
brs = brass	incl = include(s)	pot = potentiometer
	insul = insulation, insulated	pozi = Pozidriv
c = centi (10^{-2})	int = internal	
C = Celsius, centigrade	I/O = input/output	qty = quantity
Cd pl = cadmium plate		
cer = ceramic	k = kilo (10^{3}), kilohm	rdh = round head
CMOS = complementary metal-oxide transistors	kg = kilogram	rect = rectifier
comp = composition	lb = pound	ref = reference
conn = connector	LED = light-emitting diode	rf = radio frequency
CRT = cathode-ray tube	lh = left hand	rh = right hand
CTL = complementary transistor logic	lin = linear	rms = root-mean-square
		rpm = revolutions per minute
d = deci (10^{-1})	M = mega (10^{6}), megohm	RTL = resistor-transistor logic
dc = direct current	m = milli (10^{-3})	rwv = reverse working voltage
deg = degree(s)	met oxd = metal oxide	
depc = deposited carbon	mfr = manufacturer	sb = slow blow
dia = diameter	mintr = miniature	SCR = semiconductor-controlled rectifier
dpdt = double-pole, double-throw	misc = miscellaneous	Se = selenium
dpst = double-pole, single-throw	mom. = momentary	Si = silicon
DTL = diode transistor logic	mtg = mounting	spcl = special
	My = Mylar	spdt = single-pole, double throw
ECL = emitter-coupled logic		spst = single-pole, single throw
elctlt = electrolytic	n = nano (10^{-9})	sst = stainless steel
encap = encapsulated	n.c. = normally closed	stl = steel
ext = external	Ne = neon	
	no. = number	Ta = tantalum
F = Fahrenheit, farad	n.o. = normally open	Ti = titanium
FET = field-effect transistor	np = nickel plated	tgl = toggle
FF = flip-flop	NPN = negative-positive-negative (transistor)	thd = thread
fig. = figure	NPO = negative-positive zero (zero temperature coefficient)	tol = tolerance
filh = fillister head	NRFR = not recommended for field replacement	TTL = transistor-transistor logic
fh = flat head	NSR = not separately replaceable	U (μ) = micro (10^{-6})
flm = film		
fxd = fixed	OBD = order by description	V = volt(s)
	OD = outside diameter	var = variable
G = giga (10^{9})	ovh = oval head	Vdcw = direct current working volts
GE = germanium	oxd = oxide	
gl = glass		W = watt(s)
	p = pico (10^{-12})	w/ = with
H = henry, henries	PC = printed-circuit	WIV = inverse working volts
hd = head		ww = wire-wound
hdw = hardware		
hex = hexagon, hexagonal		

Table 6-7. Code List of Manufacturers

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

CODE NO.	MANUFACTURER	ADDRESS
01002	General Electric Co.	Hudson Falls, N.Y.
	Industrial and Power Capacitor Products Dept.	
01236	GTE Sylvania	Danvers,Ma
	Lighting Prod. Group	
04009	Arrow-Hart, Inc.	Hartford, Conn.
04713	Motorola, Inc.	Phoenix, Ariz.
	Semiconductor Products Div.	
06383	Panduit Corp.	Tinley Park, Ill.
06540	Amatom Electronic	New Haven, Conn.
	Hardware Division of Mite	
12697	Clarostat Mfg. Co., Inc.	Dover, N.H.
23880	Stanford Applied Engineering, Inc.	Santa Clara, Ca.
27191	Cutler-Hammer, Inc.	Milwaukee, Wis.
	Power Distribution and Control Div.	
28480	Hewlett-Packard Co.	Palo Alto, Ca.
50522	Monsanto Co.	Cupertino, Ca.
	Electronic Special Products	
56289	Sprague Electric Co.	North Adams, Ma.
70417	Chrysler Corp.	Detroit, Mich.
	Amplex Div.	
71400	Bussman Mfg. Div.	St. Louis, Mo
	McGraw Edison Co.	
71785	TRW Electronic Components	Elk Grove Village, Ill.
	Cinch Div.	
73734	Federal Screw Products, Inc.	Chicago, Ill.
75915	Littlefuse, Inc.	Des Plaines, Ill.
78189	Illinois Tool Works, Inc.	Elgin, Ill.
	Shakeproof Div.	
79727	Continental-Wirt Electronics Div.	Warminster, Pa.
81646	Ideal Corp.	New York, N.Y.
82647	Texas Instruments, Inc.	Attleboro, Ma.
	Control Products Div.	
83259	Parker Seal Co.	Culver City, Ca.
	Division of Parker-Hannifin Corp.	
84830	Lee Spring Co., Inc.	Brooklyn, N.Y.
90201	Mallory Capacitor Co.	Indianapolis, Ind.
94222	Southco, Inc.	Lester, Pa.
96881	Thomson Industries, Inc.	Manhasset, N.Y.
97464	Industrial Retaining Ring Co.	Irvington, N.J.

APPENDIX A

HP 7906H
DISC DRIVE SERVICE

PREFACE

This appendix adds service information for the HP 7906H and HR Disc Drives. Unless otherwise specified, the information given for the HP 7906H is fully applicable to the HP 7906HR. In general, the information contained in the main manual is applicable to the HP 7906H, with the following exceptions:

SECTION I — THEORY OF OPERATION

- All paragraphs

SECTION II — MAINTENANCE

- Special Test Equipment (paragraph 2-6)
- Preventive Maintenance Schedule (paragraph 2-7)

SECTION III — ALIGNMENT AND ADJUSTMENT

- DSU Installation (paragraph 3-13)
- On-Line Checkout (paragraph 3-19)

SECTION IV — TROUBLESHOOTING

- Troubleshooting Flowcharts (paragraph 4-2)
- Power Sources (paragraph 4-3)
- Visual Indication of Drive Status (paragraph 4-4)
- System Functional Diagrams (paragraph 4-6)
- Wiring Connections (paragraph 4-8)
- Power Distribution (paragraph 4-9)

SECTION V — REMOVAL AND REPLACEMENT

- Rear Cover (paragraph 5-8)
- Printed Circuit Assemblies (paragraph 5-15)
- Index Transducer (paragraph 5-29)

SECTION VI — REPLACEABLE PARTS

- Introduction (paragraph 6-1)

These exceptions are fully detailed in Parts I through VI of this appendix. In addition, Part IV contains a description of the self-test capabilities of the HP 7906H (not part of the HP 7906) and Part VII provides a description of the HP 7906H recording format and communications protocol.

CONTENTS

ILLUSTRATIONS

TABLES

PART I — THEORY OF OPERATION

A-1. INTRODUCTION

This part contains a brief introduction to the HP 7906H Disc Drive addressing structure, the HP 7906H environment, the functional makeup of the HP 7906H, the format of the disc data surfaces, and a list of mnemonics and abbreviations. Also provided is a detailed discussion of the integrated controller and each of the eight systems which compose the drive function.

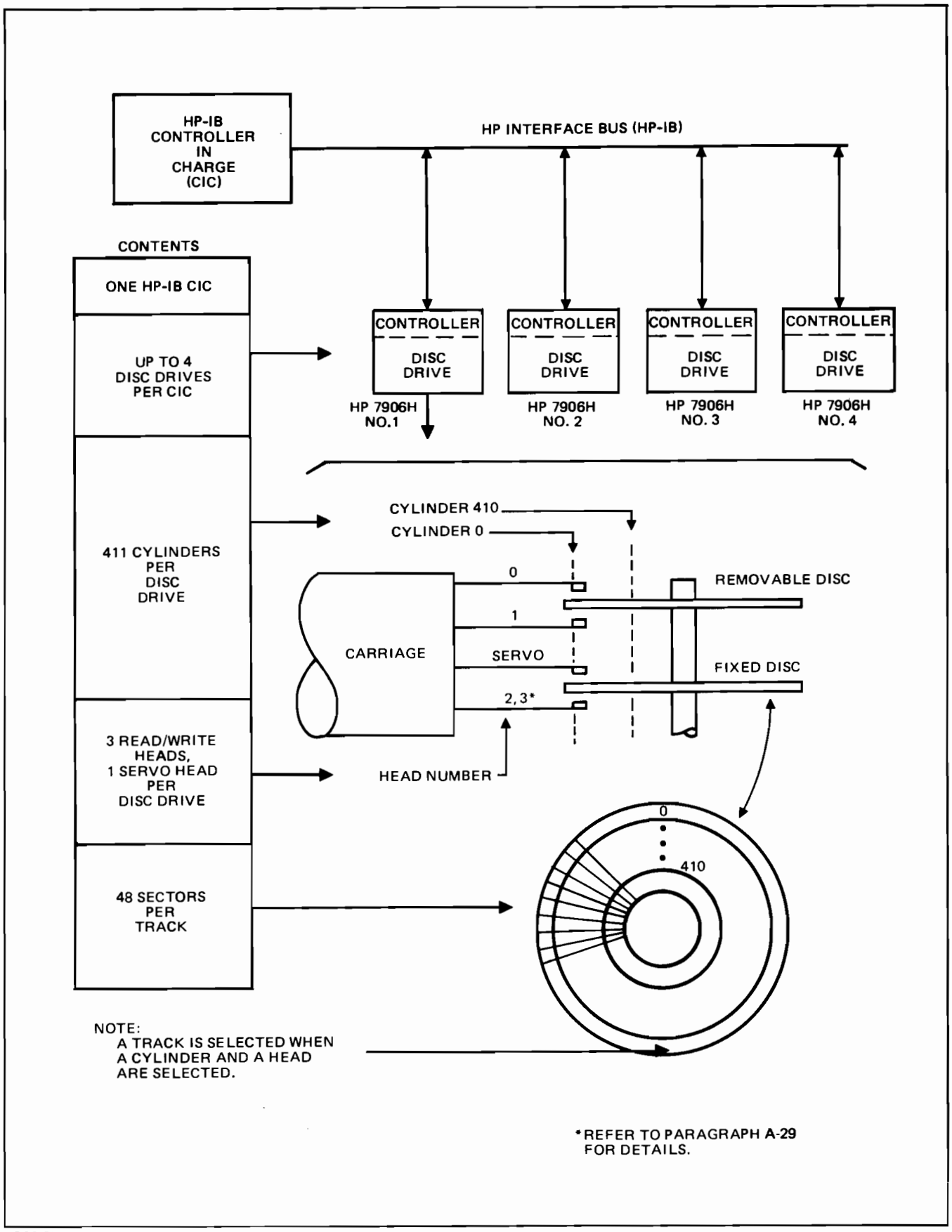
The principal difference between the HP 7906H and the HP 7906 Disc Drive described in the main manual is that the HP 13037 Disc Controller used by the HP 7906 is replaced by disc controller circuitry contained within the HP 7906H. This integrated controller (hereafter referred to as the controller) provides a simple interface between the Hewlett-Packard Interface Bus (HP-IB) and the HP 7906H. (See figure A-1.) The characteristics of the controller permit up to four HP 7906H's to be interfaced to a single HP-IB channel. Upon receipt of command sequences via the HP-IB, the controller decodes and generates all of the necessary timing sequences for the disc drive. In addition, the controller handles all of the input/output communications with the HP-IB controller-in-charge. A self-test function incorporated in the controller provides a go/no-go check of the controller hardware and certain functions of the disc drive.

The HP 7906H contains two discs; one removable and the other fixed. (See figure A-1.) The disc drive accesses the data on three surfaces with three read/write heads. Head-positioning and sector-counting information is derived from the fourth (servo) surface through the servo head on the fixed disc. There are 411 cylinders available for information storage. The cylinder address range is from zero to 410. Each cylinder consists of four tracks, one on each surface of the removable disc and two on the lower surface of the fixed disc. Each track is divided into 48 sectors. Sectors are addressed by specifying a head and sector address within a cylinder. Head addresses range from zero to three and sector addresses range from zero to 47.

As shown in figure A-2, the HP 7906H is composed of a controller and eight systems; a spindle rotating system, a head positioning system, an operation control system, a read/write system, a sector sensing system, a power system, an air circulation system, and a fault detection system. The controller consists of three modules: an HP-IB device interface module, a microprocessor module, and a data path module. In addition, the controller includes a number of operation control registers. The HP-IB device interface module provides a logical interface between the HP-IB and the controller. The microprocessor module handles all of the communications and command interpretations for the controller and in turn generates most of the timing and all of the control signals needed by the controller and the disc drive. The data path module contains the circuitry necessary for the proper transfer of data bidirectionally between the controller and the disc drive. The operation control registers appear to the microprocessor as a bank of I/O registers through which the microprocessor controls and monitors the state of the disc drive operation control and sector sensing systems.The spindle rotating system rotates the discs at a speed of 3600 revolutions per minute. The head positioning system positions the heads in response to controller direction and, under emergency fault conditions, retracts the heads off the discs. Temperature compensation in the head positioning system reduces head positioning offset on the removable disc to a minimum. This offset is caused by the initial temperature difference between the removable disc and the fixed disc, which contains the servo code. The operation control system interfaces between the controller and the disc drive. The read/write system reads and writes data from the read/write data lines to the discs or vice versa. The sector sensing system constantly monitors the identity of the sectors currently under the heads. This information is transmitted to the controller on request. The read/write system also requires this information to know on which sector of the disc to read or write. The power system supplies power to the controller and the disc drive components. The air circulation system supplies cooling air to the circuits and filtered air to the discs. The fault detection system is composed of several subsystems which sense fault conditions and light indicators, retract the heads, or take other appropriate action when a fault occurs.

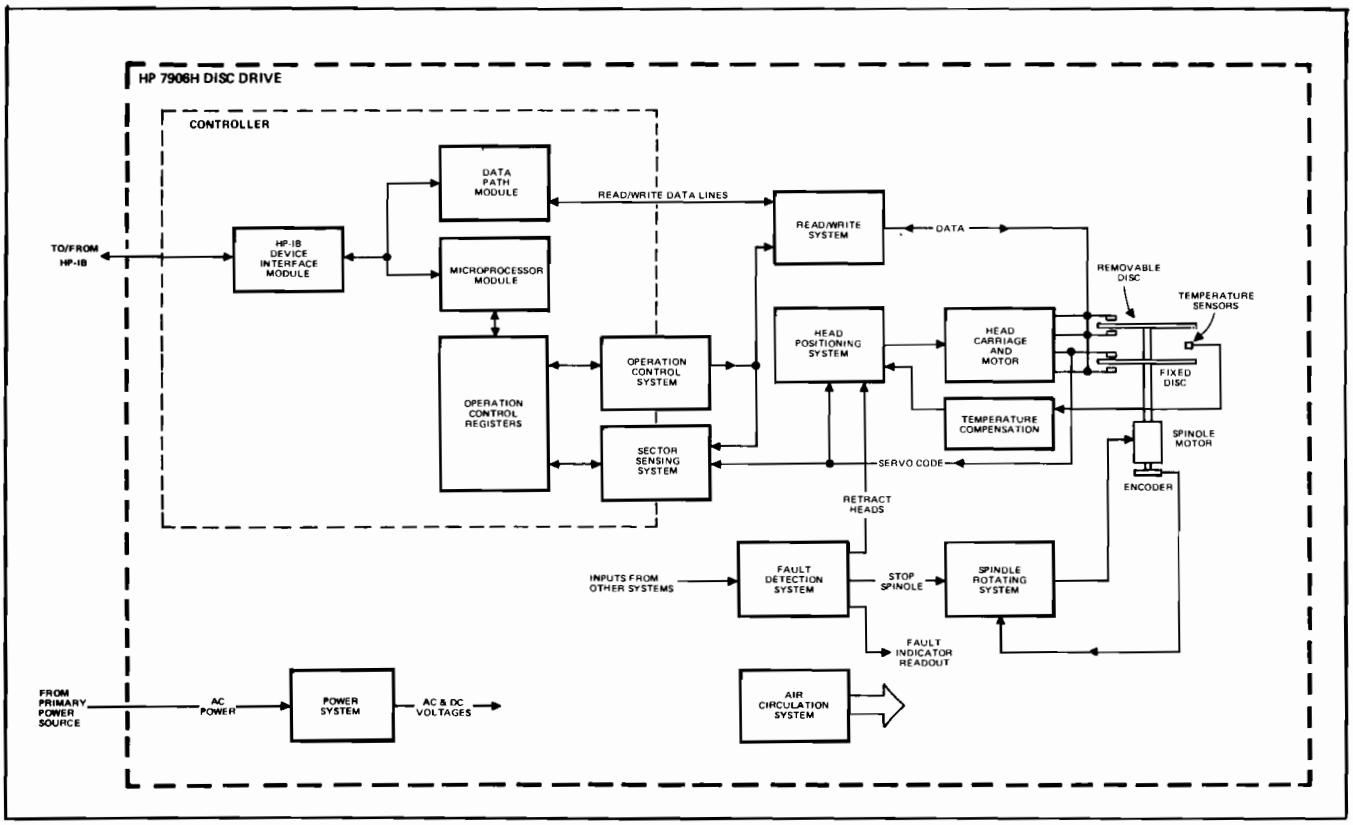
A-2. TRACK FORMAT

Each track is divided into 48 equal data sectors which are derived by counting pulses from the servo track. (See figure A-1.) Each sector has a sector number (sector address). The location of sector 0 is defined by an index mark. On the fixed disc, the index mark is a unique pattern on each servo track which indicates the location of sector 0 on the single recording surface. On the removable disc, the index mark is a small notch in the center hub which is detected by a magnetic transducer. Since the index mark of the removable disc is randomly aligned with that of the fixed disc, two sets of sector counting electronics are provided in the sector sensing system. Each of the counters is incremented once each sector and set to zero each time its index marker is sensed.



7300-87

Figure A-1. Addressing Structure of HP 7906H Disc Drive



7300-88

Figure A-2. HP 7906H Disc Drive Overall Block Diagram

A-3. SECTOR FORMAT

The smallest addressable data storage area on a data surface is a sector. Accessing a sector is accomplished by specifying the address of the cylinder, head, and sector. (See figure A-3.)

Each sector contains a sector address field, a data field, and data checking and error correction fields. The sector address field contains the cylinder, head; and sector addresses of the sector, as well as indicators for spare, defective, and protected tracks. The data field stores 256 bytes of data. Each data byte is defined as 8 bits. Only the data field is transferred to and from the host CPU in most data operations. The preamble and postamble are normally generated and checked in the controller. All fields except the sync field are error-checked by the controller. A more complete description of the sector format is provided in Part VII of this appendix.

A-4. LOGIC SIGNAL NOTATION

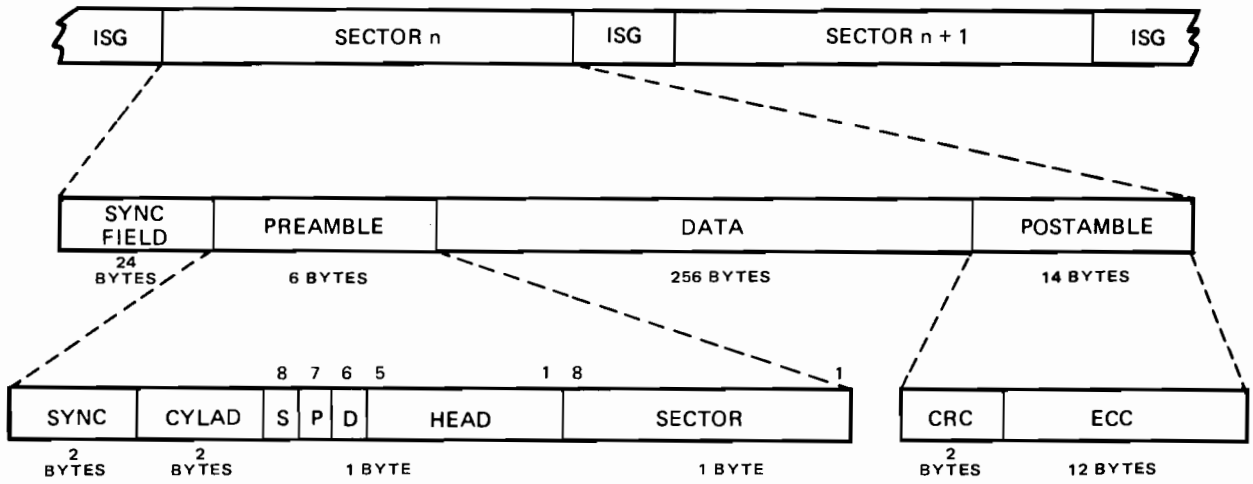
In the controller and disc drive logic circuits, a signal is applied to its destination at all times in one of two states; active or inactive. The signal is active when its voltage level (low or high) is such as to make the action occur for which the signal was designed (this is usually the same action as is referenced in the signal name).

Note: A bar over a signal name should be considered a part of the signal name and is read as a "not" in front of the signal name. For example, $\overline{\text{RETRACT}}$ should be interpreted as "not RETRACT".

Table A-1 uses two example signals (SEN and $\overline{\text{SEN}}$) to present information on logic signal notation. Note that the action which both signals are intended to initiate is enabling of the servo. Each signal is active when the servo is enabled and inactive when the servo is not enabled.

Table A-1. Logic Signal Examples

SIGNAL NAME	CONDITION	VOLTAGE LEVEL	MESSAGE TRANSMITTED
SEN	Active	High	Servo enabled.
SEN	Inactive	Low	Servo not enabled.
$\overline{\text{SEN}}$	Active	Low	Servo enabled.
$\overline{\text{SEN}}$	Inactive	High	Servo not enabled.



ISG : Intersector gap.

SYNC FIELD : 24 bytes (192 bits) of 0's. Used to synchronize read electronics to data stream during read operation.

PREAMBLE : 6 bytes of address information.

DATA : 256 bytes of data.

POSTAMBLE : A 14-byte field containing data checking and error correction information.

SYNC : Sync word – 100376_8 if ECC field is valid; 100377_8 otherwise.

CYLAD : Cylinder address.

S, P, D : S – If 1, spare track in active use.
P – If 1, protected track.
D – If 1, defective track.

HEAD : Head address (octal).

SECTOR : Sector address (octal).

CRC : Two bytes of cyclic redundancy check (CRC) information for detection of errors during readout.

ECC : A 12-byte field reserved for error correcting code (ECC) information. Not written or read by HP 7906H.

7300-101

Figure A-3. HP 7906H Sector Format

A-5. FUNCTIONAL DESCRIPTION

The following paragraphs describe the controller and the eight systems that perform the drive functions. To aid in identifying the circuits that carry out these functions, the events flowcharts accompanying the text are cross-referenced to the functional diagrams contained in Part IV of this appendix. In addition, table A-2 provides a description of the signal mnemonics used in the text and table A-3 defines the functions of the operation control command signals.

A-6. CONTROLLER

The controller provides a simple interface between the HP-IB and a disc drive having a storage capacity of 20 megabytes. Upon receipt of command sequences via the HP-IB, the controller decodes and generates all the necessary timing and control signals for the disc drive. The controller also handles all of the input/output communications with the HP-IB.

The controller is a microprocessor-based design, interfacing to the HP-IB through the Hewlett-Packard Processor-to-HP-IB-Interface (PHI) chip. The HP-IB protocol used in the controller is compatible with the requirement of other HP-IB disc subsystems. The controller command set (the set of legal commands passed as data for the secondary get command) is a proper subset of the HP 12745 (HP 13037 Disc Controller/HP-IB) subsystem command set. A general description of the controller command protocol is contained in Part VII of this appendix. For a detailed description of the controller command structure, refer to the *HP*

Table A-2. Mnemonics and Abbreviations

MNEMONIC	SIGNAL	MNEMONIC	SIGNAL
ACRY	Access Ready	ICA	Illegal Cylinder Address
ACW	AC Write Current	IE	Input Enable
ADBI 0-7	Data Input Bus	IFC	Interface Clear
ADBO 0-7	Data Output Bus	IFIFO	Input from FIFO
ADDR	Address	IL	Interlock
AGC	Automatic Gain Control	ILF	Interlock Fault
AGCF	AGC Fault	INPHI	Input from PHI chip
ALU CLK	ALU Clock	INTCW	Internal Control Word
ALU IMM	ALU Immediate	ISTSW	Initiate Self-Test Switch
ANYER	Any Error	LD	Lock Door
ATN	Attention	LED 0-3	Light Self-Test LED
BB	Brushes Back	LIP	Lower Index Pulse
CARRY	Carry Bit	LSB	Last Significant Bit
CBUSL	Control Bus, Lower Byte	M−1	Match Minus One
CBUSU	Control Bus, Upper Byte	MH	Multiple Heads
CC	Current Command	MHS	Multiple Heads Selected
CIP	Cartridge-In-Place	MSB	Most Significant Bit
CLA	Clear Attention	NDAC	Data Accepted
CLK	Clock	NDPS	Non-Destructive Preset
CLO	Clear Offset	NLD	Negative Level Detector
CLS	Clear Status	NRFD	Ready for Data
CPS	Controller Preset	NTORE	Not Output Register Empty
CRB	Carriage Back	OE	Output Enable
CYL	Cylinder	OFIFO	Output to FIFO
DAV	Data Valid	OPHI	Output to PHI
DCW	DC Write Current	OVRFLO	Overflow
DDB	Differential Data Bus	OVRUN	Overrun
DGC	Data AGC	PHEAD	Physical Head
DIFF	Difference	PHICW	PHI Control Word
DIO 1-8	Data I/O	PON	PON Reset
DL	Door Locked	POR	Power On Reset
DPS	Destructive Preset	POS	Position
DRDY	Drive Ready	PRT	Protect
DRDYL	Drive Ready Lamp	PRTL	Protect Lower Disc
DT	Data Test	PRTU	Protect Upper Disc
DTYPE	Drive Type	PSECT	Physical Sector
DWA	Decrease Write Current (13 ma)	R	Reset
DWB	Decrease Write Current (6.5 ma)	RAR 0-11	ROM Address Register
DWC	Decrease Write Current (3.25 ma)	RC	Read Clock
ECS	Energize Carriage Solenoid	RCL	Recalibrate
ENA	Encoder Phase A	RCP	Read Clock Pulses
ENB	Encoder Phase B	RD	Read Data
EOI	End or Identify	RDA	Read DataA
EOT	End of Transmission	RDB	Read Data B
EOW	End of Word	READ	Read
ERE	External ROM Enable	REF	Reference
EXADBOE	External ALU Output Data Bus Enable	REN	Remote Enable
EXCLR	External Clear	RES	Reset
EXRAREN	External RAR Enable	RET	Retract
FLT	Fault	REV	Reverse
FLTL	Fault Lamp	RH	Restore Home
FWD	Forward	ROM 0-23	ROM Output Memory
HD REG	Head Register	ROR 0-23	ROM Output Register
HLDD	Heads Loaded	RPS	Rotational Position Sensing
HS0	Head 0 Selected	RS	Run Spindle
HS1	Head 1 Selected	S	Set
HS2	Head 2 Selected	SB	Servo Balanced

Table A-2. Mnemonics and Abbreviations (Continued)

MNEMONIC	SIGNAL	MNEMONIC	SIGNAL
SC	Sector Compare	TCD	Track Centered
SCL	Sector Clock	TEMP	Temperature
SCTGR	Sector Register	TGBUS	Tag Bus
SEN	Servo Enable	TNSW 0-3	Test Number Switches
SERSW	Service Switch	TO	Timeout
SK	Seek	TTO	Temperature Timeout
SKC	Seek Complete	UDS	Upper Disc Selected
SKH	Seek Home	UIX	Upper Index
SKI	Seek Inhibit	URG	Unselected Read Gate
SPD	Spindle Speed Down	USS	Upper Surface Selected
SPU	Spindle Speed Up	UWG	Unselected Write Gate
SRQ	Service Request	VRFLG	Verify Flag
STAT 2	Status Two	WC	Write Clock
STINP	Self-Test Input	WD	Write Data
STFAIL	Self-Test Fail	WDA	Write Data A
STOUT	Self-Test Out	WDB	Write Data B
STP	Set Timeout Period	WEN	Write Enable
SW	Switch	WORD 8	Eighth Word
SYNC 1	Sync One	WRITE	Write
TBIT	T-Bit	ZCR	Zero Crossing
TAC	Tachometer	ZERO	Zero Flag

Table A-3. Operation Control Command Signals

MNEMONIC	SIGNAL	ACTION
CLA	Clear Attention	Resets Attention flip-flop.
CLS	Clear First Status	Resets First Status flip-flop.
CPS	Controller Preset	Resets controller, together with Head, Sector, and Fault registers. Also initiates self-test routine.
RED	Read One Sector	Sector addressed by Head and Sector registers is read onto HP-IB.
RCL	Recalibrate	Heads seek to cylinder 0. Cylinder 0 is used as a reference. Correct location is found by counting tracks from cylinder 0.
SK	Seek	Heads seek to target cylinder address, provided it is a legal address (0 – 410).
SOF	Set Offset	Controller supplies, on control bus, amount and direction of head offset in 63 increments of 25 microinches each. Offset is stored in Offset register and heads are offset as required.
WRT	Write One Sector	Data supplied by HP-IB is written into sector addressed by Head and Sector registers.

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The controller consists of two printed-circuit assemblies (PCA's) which reside in the card cage of the disc drive. A functional diagram of the controller is provided in figure A-15 and table A-4 describes the signal mnemonics used in the diagram. Microprocessor PCA-A2 of the controller replaces I/O sector PCA-A2 of the HP 7906 Disc Drive while retaining the necessary sector circuitry. Data PCA-A1 of the controller occupies the previously unused A1 slot in the disc drive card cage. Self-test PCA-A12, mounted on the rear cover of the disc drive and connected by cable to data PCA-A1, contains the controller self-test controls and indicators and the HP-IB input/output connector.

All of the electrical power required by the controller is drawn from the disc drive power supplies.

In the controller, all data transferred during a read or write operation flows through the PHI chip and a 16-byte first-in, first-out memory device (FIFO). Therefore, the maximum number of bytes of data that the controller can buffer is 24. In order to guarantee no loss of data, an HP-IB channel with a transfer rate of greater than 900 kilobytes is required.

A user can request normal or full-sector data transfer. During a normal READ or WRITE, only the actual 256 data bytes within the sector are transferred, whereas in a READ FULL SECTOR or WRITE FULL SECTOR transfer the preamble and postamble information is also transferred. Thus, a full sector consists of 6 bytes of preamble, 256 bytes of data, 2 bytes of Cyclic Redundancy Check (CRC) bits and 12 bytes reserved for Error Correcting Code (ECC) information — a total of 276 bytes. The controller does not support ECC and all error checking is handled by CRC. However, all disc cartridges written by the controller and the HP 13037 Disc Controller are interchangeable. There is also a VERIFY command, in which the controller reads from the disc as in a normal READ, checking the CRC bytes, but not transferring data to the HP-IB. This command is used mainly to check for possible disc data errors.

During a READ or WRITE (normal or FULL SECTOR), a hardware DMA configuration handshakes data between the FIFO and the PHI chip. The microprocessor is used only to switch the data path between the actual data and the CRC bytes. Between each sector of a multi-sector transfer, the microprocessor checks for errors and addresses the next sector to be transferred.

The components comprising the three modules of the controller are described in the following paragraphs.

A-7. MICROPROCESSOR MODULE. The microprocessor module consists of the following components.

A-8. Eight-Bit Microprocessor. The microprocessor is composed of two four-bit slice bipolar microprocessor chips. It executes all of the arithmetic, logical, and I/O operations within the instruction cycle time of 267 nanoseconds. The microprocessor handles all the communications and command interpretations for the controller, and in turn generates most of the timing and all of the control signals needed by the controller and the disc drive. (The DMA hardware generates its own timing signals once it has been enabled by the microprocessor.) The microprocessor also executes the self-test algorithms for self-test diagnostics of the disc drive.

A-9. Read-Only Memory (ROM). The controller utilizes a 24-bit wide microcode format and 3072 words of control store made up of three 2k × 8 and three 1k × 8 ROM chips with 80 nanosecond access time.

A-10. Operation Control Registers. The operation control registers form the interface between the microprocessor and the disc drive electronics. The functions of the registers are as follows:

Output Register	Contents/Functions
Function	Drive command (one bit per drive function)
Control Bus Upper and Control Bus Lower	Cylinder and offset address, front panel LED, self-test bit
Head Address	Current head address, currently selected head
Target Sector	Target sector address
Status	The present status of the disc drive
Drive Type	The drive type, current HP-IB device address, rotational position sensing (RPS) enable.
Physical Sector	Physical sector presently passing under head

The microprocessor module also contains the sector counters and the sector compare logic for the disc drive. These circuits are discussed in the sector sensing system description (paragraphs A-33 through A-38).

A-11. HP-IB INTERFACE MODULE. The HP-IB interface module consists primarily of a PHI chip that provides a logical interface between the controller and the HP-IB. It incorporates all of the acceptor, listener, talker, etc., functions defined in IEEE Standard No. 488-1975, *IEEE Standard Digital Interface for Programmable Instrumentation.* To the microprocessor, the PHI appears as a bank of eight registers, some of which are read-only, write-only, and read/write registers. Four transceiver chips provide a physical interface between the PHI chip logic levels and those of the HP-IB. The HP-IB device address is obtained from the UNIT SELECT switch on the control panel of the disc drive. At power-on, or on completion of self test, the value set on the UNIT SELECT switch is loaded into the HP-IB address register of the PHI chip.

A-12. DATA PATH MODULE. The data path module consists of the following components.

A-13. FIFO and Data Serializer/Deserializer. A 16-level serial/parallel first-in, first-out memory device

Table A-4. Controller Mnemonics

MNEMONIC	SIGNAL	FUNCTION
ADBI 0-7	Data Input Bus	Eight-bit bus providing input data for microprocessor.
ADBO 0-7	Data Output Bus	Eight-bit bus carrying data from microprocessor.
$\overline{\text{ALU CLK}}$	ALU Clock	Clock having a 75-percent duty cycle and 276 nanosecond period that runs ALU chips, Program Status register, and Output Address decoder.
$\overline{\text{ALU IMM}}$	ALU Immediate	Allows data byte from microcode word to be used by ALU or output through ALU.
ANYER	Any Error	Flag indicating that an error has been detected by cyclic redundancy check (CRC) circuit during a read or verify.
ATN	Attention (ground true)	Bidirectional HP-IB control signal.
CARRY	Carry Bit	Flag indicating that a one has been moved left from most significant bit of ALU by a shift or arithmetic operation.
$\overline{\text{CBUSL}}$	Control Bus, Lower Byte	Enables loading output register containing lower byte of cylinder address or offset value.
$\overline{\text{CBUSU}}$	Control Bus, Upper Byte	Enables loading output register containing upper bits of cylinder address or offset or T-bit and select.
DAV	Data Valid (ground true)	Bidirectional HP-IB control line.
DDB, $\overline{\text{DDB}}$	Differential Data Bus	Serial data between formatter/separator and read/write circuitry.
DIO 1-8	Data Input/Output	Eight-bit wide HP-IB bidirectional data bus.
DT	Data Test	Signal from Self-Test output register to formatter/separator enabling data loopback.
$\overline{\text{DTYPE}}$	Drive Type	Enables reading of input register containing drive type, rotational position sensing (RPS) enable, sector compare, and device address.
EOI	End or Identify (ground true)	Bidirectional HP-IB control line.
EOT	End of Transmission	Flag from DMA handshake logic to microprocessor indicating that read or write of a sector is complete.
EOW	End of Word	Flag from data path End-of-Word counter indicating that a byte has been clocked to/from formatter/separator circuitry.
$\overline{\text{ERE}}$	External ROM Enable	Grounding this line turns off internal PROMS, allowing external microcode store to be connected to microprocessor PCA-A2 via connector A2J2.
$\overline{\text{EXADBOE}}$	External ALU Output Data Bus Enable	Grounding this line allows output data bus to be driven from connector J1 of microprocessor PCA-A2.
$\overline{\text{EXCLR}}$	External Clear	Grounding this line on connector J2 of microprocessor PCA-A2 resets microprocessor to zero memory location. Signal action is similar to PON.
$\overline{\text{EXRAREN}}$	External RAR Enable	Grounding this line on connector J2 of microprocessor PCA-A2 allows microcode memory to be addressed via connector J2 of PCA-A2.
$\overline{\text{HDREG}}$	Head Register	Enables loading of Head Register from data output bus.
$\overline{\text{IE}}$	Input Enable	Enables loading of ALU from bidirectional buffer via input data bus.
IFC	Interface Clear	Bidirectional HP-IB control line.
$\overline{\text{IFIFO}}$	Input from FIFO	Enables transfer of data from first-in-first-out memory (FIFO) to ALU.

Table A-4. Controller Mnemonics (Continued)

MNEMONIC	SIGNAL	FUNCTION
IL	Interlock	Completes interlock path on motherboard PCA-A7.
$\overline{\text{INPHI}}$	Input from PHI chip	Enables transfer of data from PHI to ALU.
$\overline{\text{INTCW}}$	Internal Control Word	Enables loading of Internal Control Word output register. This register sets up data path operations.
ISTSW	Initiate Self-Test Switch	Flag from self-test panel to microprocessor which starts self-test sequence.
$\overline{\text{LED 0-3}}$	Light Self-Test LED	Four lines from Self-Test output register to self-test panel.
LSB	Least Significant Byte	Flag indicating that least significant bit of ALU output byte is a one.
MSB	Most Significant Bit	Flag indicating that most significant bit of ALU output byte is a one.
NDAC	Data Accepted (ground true)	Bidirectional HP-IB control line.
NRFD	Ready for Data (ground true)	Bidirectional HP-IB control line.
NTORE	Not Output Register Empty	Flag indicating presence of data in FIFO.
OE	Output Enable	Enables transfer of data from ALU to bidirectional buffer over output data bus.
$\overline{\text{OFIFO}}$	Output to FIFO	Enables data transfer from ALU to FIFO via bidirectional buffer.
$\overline{\text{OPHI}}$	Output to PHI	Enables data transfer from ALU to PHI chip via bidirectional buffer.
OVRFLO	Overflow	Flag indicating an overflow in ALU during an arithmetic operation.
OVRUN	Overrun	Flag indicating either FIFO going empty during a write operation or FIFO overflowing during a read operation. (Indicates failure of HP-IB or CPU to keep up.)
$\overline{\text{PHEAD}}$	Physical Head	Enables head register to pass current head address to ALU via input data bus.
$\overline{\text{PHICW}}$	PHI Control Word	Enables data to pass from ALU to PHI Control Word register, setting up parameters for transfer to or from PHI chip.
PON	Power on Preset	Connects to disc drive NPDS line and resets microcode.
$\overline{\text{PSECT}}$	Physical Sector	Enables number of sector currently under heads to be transmitted from Physical Sector register to ALU.
RAR 0-11	ROM Address Register	Twelve-bit address of next microcode word.
RC	Read Clock	A 7.5-MHz read clock generated by separator circuitry during a read or verify operation.
RCP	Read Clock Pulses	Special read clock for word counter. Not enabled during formatter/separator loopback self test when write clock only is used.
RD	Read Data	Serial data from separator during read to verify operations.
REN	Remote Enable	A bidirectional HP-IB control line.
$\overline{\text{RES}}$	Reset	Signal generated from PON to clear various registers in microprocessor.
ROM 0-23	ROM Output Memory	Output of currently addressed microcode memory location.
ROR 0-23	ROM Output Register	Latched microcode word representing current microprocessor instruction.

Table A-4. Controller Mnemonics (Continued)

MNEMONIC	SIGNAL	FUNCTION
$\overline{\text{SCTRG}}$	Sector Register	Enables target sector address to be transferred from ALU to Target Sector register.
SERSW	Service Switch	Flag representing state of OP/SERVICE switch on self-test panel.
SRQ	Service Request	Bibirectional HP-IB control line.
$\overline{\text{STAT 2}}$	Status Two	Enables transfer of contents of Status register to ALU.
$\overline{\text{STINP}}$	Self-Test Input	Enables transfer of state of self-test TEST NUMBER switches to ALU.
$\overline{\text{STFAIL}}$	Self-Test Fail	Line from Self-Test output register which activates S.T. FAILED LED on self-test panel and SELF TEST FAILED indicator on disc drive control panel.
$\overline{\text{STOUT}}$	Self-Test Out	Enables transfer of data from ALU to Self-Test output register.
SYNC 1	Sync One	Flag indicating that sync word has been detected by data separator during a read or verify operation.
TBIT	T-Bit	Line from control bus, Upper Byte register which clears disc drive Function register and Self-Test output register.
$\overline{\text{TGBUS}}$	Tag Bus	Enables transfer of data to disc drive Function register.
TNSW 0-3	Test Number switches	Four lines connecting self-test TEST NUMBER switches to Self-Test input register.
VRFLG	Verify Flag	Flag from PHI Control Word register which disables PHI chip from transferring data out during a verify operation.
WC	Write Clock	A 7.5-MHz clock from formatter during a write operation which advances word counter and clocks data from FIFO to formatter.
WD	Write Data	Serial data from data path multiplexer to formatter during write.
WORD 8	Eighth Word	Flag for microprocessor indicating eighth word in read, write, or verify data transfer.
ZERO	Zero Flag	A flag indicating presence of all zeros in ALU output.

(FIFO) provides a measure of buffering for the data passing through the controller. The FIFO also converts bytes received from the HP-IB to the bit-serial form required by the data formatter component (writing) and reconstructs bytes from the bit-serial data stream supplied by the data separator (reading).

A-14. Data Formatter. At the start of each sector of a write operation, the data formatter automatically generates and writes a sync field (24 bytes of zeros). At the completion of the sync field, the formatter clocks the data (including the preamble) from the serial output of the FIFO, encodes it to a MFM (delay modulation) form, precompensates for pulse crowding, and sends it to the disc drive read/write system (paragraph A-39).

A-15. Data Separator. During a read operation, the amplified MFM signal received from the disc drive read/write system (paragraph A-39) is decoded into clock and data by the data separator. The sync field is used to synchronize the phase-locked loop (PLL) of the separator. Starting from the first 1-bit of the preamble, bit-serial data is clocked into the FIFO and the CRC checker. Data written and read by the formatter/separator is compatible with data processed by the formatter/separator in the HP 13037 Disc Controller.

A-16. CRC Generator/Checker. During a WRITE or INITIALIZE command, a CRC word is generated from the preamble and data being written and is appended to the end of the data field. During a VERIFY command, and all READ commands except READ FULL SECTOR, the CRC checker looks for a CRC word appropriate to the

preceding data and preamble fields. If a data error is detected, a flag will be set to alert the microprocessor.

A-17. DMA Machine. During data transfers, the PHI chip and the FIFO handshake directly under the control of the DMA machine. This is because the microprocessor cannot process individual bytes at the required 937.5 kilobyte rate. Instead, the microprocessor keeps a count of the bytes transferred and switches the CRC generator/checker into the data path at the proper time. The micropocessor starts up the DMA machine at the beginning of each sector. The machine stops by itself when any one of the following conditions is detected: a) End of Sector (normal stop), b) Data Overrun (the channel plus all controller buffering cannot match the burst transfer rate of the controller), or c) End of Transfer (the EOI bit has been detected during a write data operation).

A-18. OPERATION CONTROL SYSTEM

The operation control system (figure A-16) receives commands and information for drive operations from the controller, and outputs status information to the controller.

A-19. DRIVE IDENTIFICATION. Unless addressed, the disc drive can respond only to a limited number of HP-IB commands all of which are handled completely in the PHI chip, without controller interference. The address to which the drive will respond is set by disc drive UNIT SELECT switch S3, with the selected address appearing at the UNIT SELECT display on the operator panel. The address is read by the controller from the Drive Type register after a self-test operation and as part of the HP-IB command.

A-20. DRIVE OPERATION CONTROL. When the disc drive is addressed by the HP-IB, the controller will respond to commands and perform the appropriate operations. Those operations which require drive functions external to the controller are initiated by control signals entering into the Function register by the controller. These control signals are described in table A-3. If a REQUEST STATUS command is received, the controller will transfer several bytes of data concerning the disc drive and controller to the HP-IB. One byte is an encoded word representing the status of the controller itself. Another byte contains the drive type. The controller reads this value, set by jumpers W362 and W363 on microprocessor PCA-A2, from the Drive Type register. (The location of jumpers W362 and W363 on PCA-A2 is shown in figure A-16.) The HP 7906H is type 0. The third status byte comes from the Status register. This status reflects conditions in the drive external to the controller. The status bits are defined as follows:

A-21. ATTENTION CIRCUITS. The Attention flip-flops each activate the ATTN1 signal under special circumstances. The ATTN (ACRY) and ATTN (RET) flip-flops are both reset whenever the heads leave the cylinder on which they were settled at the start of a seek operation. When the heads settle on the cylinder being sought, the ATTN (ACRY) flip-flop is set, showing that the seek operation is complete. If the RET signal becomes active, deactivating the DRDY signal, the ATTN (RET) flip-flop is set, showing that the heads have retracted.

Bit	Status Condition
1	Access Not Ready
2	Drive Not Ready
3	Seek Check
4	First Status
5	Drive Fault
6	Format Switch
7	Surface Protect
8	Attention

A-22. SPINDLE ROTATING SYSTEM

Included in the spindle rotating system (figure A-17) are the door lock circuits, the brush cycle circuits, and a servo loop which runs the spindle motor.

A-23. DOOR LOCK CIRCUITS. The door lock solenoid is de-energized, holding the door locked, if any one of the following conditions is met: a) RUN/STOP switch is in the RUN position, b) heads or brushes are not retracted, c) spindle is not stopped, d) an interlock fault (ILF signal active) occurs.

A-24. BRUSH CIRCUITS. The disc brushes are no longer required for disc drive operation. All brush circuitry and related hardware have been removed from disc drives with serial numbers prefixed 2040 and later. On earlier drives, the disc brushes (82, figure 6-3) should be removed as outlined in paragraph 5-24. The installation of control PCA-A4, part no. 07906-60102, in an earlier drive will inhibit the operation of the existing brush circuitry. If the disc drive has control PCA-A4, part no. 07906-60002, installed, it is necessary for the brush mechanism to cycle, even though the brushes have been removed. The brushes operate through a brush cycle while the spindle is getting up to normal speed after the RUN/STOP switch has been set to RUN. The brush motor turns a circular cam with a detent on its circumference. The brushes are mechanically linked to the cam so that, as the cam rotates, the brushes are extended across the surface of the disc. The "brushes-back" microwsitch has a spring-loaded roller which runs along the circumference of the cam as it rotates. The switch is held open, deactivating the $\overline{BB}$ signal while the cam is rotating. When the cam has completed a revolution, the switch roller alls into the detent, closing the switch and activating the $\overline{BB}$ signal.

A-25. SPINDLE SERVO LOOP. The spindle servo is controlled by the Run Spindle flip-flop which activates the servo loop, provided the proper conditions exist and the RUN/STOP switch is set to RUN. The spindle servo senses the motor speed through the spindle motor phase encoder, compares the two feedback signals (Phase A and

Phase B) with the output from an oscillator, and adjusts the motor speed as necessary to reduce the difference to zero.

The phase encoder consists of an encoder disc and an encoder assembly. The encoder disc rotates with the spindle and contains three slots of 60-degree length. The three slots are separated by 60 degrees of non-slot area so that, at the radius at which the slots are located, the disc consists of six alternate slot/non-slot segments of 60 degrees each.

The encoder assembly consists of two identical circuits (Phase A and Phase B). Each circuit contains a light-emitting diode (LED), a phototransistor, and a transistor amplifier/inverter. The phototransistor circuits are located 30 degrees apart and are placed so that light from a LED shines through a disc slot to energize the associated phototransistor for three 60-degree segments of a disc revolution. When the light strikes a phototransistor, the output (Phase A or Phase B) is ground. Phase A lags Phase B by 30 degrees so that each signal is active for half of the time the other signal is active.

A-26. HEAD POSITIONING SYSTEM

The head positioning system (figure A-18) positions the heads on any of the 411 cylinders with whatever offset is specified by the controller. It also retracts the heads under emergency conditions. During a head load sequence it automatically positions the heads on cylinder 0. It consists primarily of a head positioning servo loop, which moves the heads to the cylinder address stored in the new cylinder address register in response to a SK command (see figure A-7); slew circuits, which move the heads to the home (cylinder 0) position in response to an RCL command (see figure A-11) or during a power-up sequence; an offset register which stores offset from track center; ACRY circuits, which activate the DRDY signal and light the DRIVE READY lamp when the first seek operation is completed and also activate the ACRY signal when the heads are settled on the addressed cylinder; and an emergency retract circuit which retracts the heads if the head positioning servo is disabled or the ILF signal becomes active.

A-27. OFFSET. The amount of offset from track center on the removable disc is supplied to the offset register on the control bus in the form of a seven-bit binary word. Six bits specify the offset magnitude in 63 increments of 25 microinches each. The seventh bit specifies the direction (+ or −) from track center. The offset is stored in the register by a SOF command (see figure A-8) and must be re-specified after each SK or RCL command.

A-28. SLEW CIRCUITS. The slew circuits move the heads, either forward or reverse, to the home (track 0) position when the RCL command is activated. If the heads are outside the outer guard band (no AGC signal) at the start of a slew operation, the heads slew forward until the heads pass over the outer guard band and the AGC signal becomes active. The active AGC signal clocks the Seek Home flip-flop, deactivating the SKH signal. This disables the slew circuits and the servo loop takes over control of the heads to position them over track 0 (which was stored in the new cylinder address register when it was cleared by the active $\overline{\text{SKH}}$ signal).

If the heads start from a position within the guard bands, the AGC signal is initially active and the heads slew reverse until the AGC signal becomes inactive. Then they slew forward until the AGC signal again becomes active. Activation of the AGC signal deactivates the SKH signal and the servo loop positions the heads over track 0.

A-29. HEAD POSITIONING SERVO LOOP. The servo loop contains circuits which compare the new cylinder address to the present cylinder address and generate a difference signal to the motor. The feedback circuits convert the servo code from the servo head to clock signals which step the present cylinder address counter as the heads cross tracks. The address of the cylinder to which the heads are to seek is stored in the new cylinder address register. The address of the cylinder on which the heads are presently located is stored in the present cylinder address counter. The comparator produces a difference signal from these two addresses. It also indicates, with the +DIFF signal, whether the difference is positive or negative. The differences signal is converted to an analog signal and adjusted to be of relatively lesser magnitude for lesser differences between addresses. This signal (CC) causes the motor to move the heads in the direction which will change the present cylinder address to be closer to the new cylinder address.

The servo code, from the servo head, is converted into the POS signal by the track follower circuits on PCA-A5. The POS signal, when the heads are crossing tracks (see figure A-22), is a sawtooth waveform which crosses the zero line each time a track center is crossed. (It is 0 volts if the heads are stationary.) The cylinder clock generator on PCA-A3 generates a clock pulse to step the present cylinder address counter each time the POS signal crosses the zero line. (The +DIFF signal from the comparator tells the present cylinder address counter whether to count up or down.)

The clock pulse generator exhibits a characteristic such that, under certain conditions, it generates a clock pulse when the heads leave the track on which they were initially positioned at the start of the seek operation. Also, the same characteristic, under certain conditions, inhibits it from generating a clock pulse when the heads reach the track to which they are seeking. A clock pulse is generated

whenever the POS signal behaves in one of the following ways:

a. Goes positive, with respect to ground, from a condition of being equal to, or less than, ground.

b. Becomes equal to, or less than, ground from a condition of being positive with respect to ground.

To block an undesired first clock pulse, the First Clk Inhibit flip-flop is reset by the SK signal and set (enabling subsequent clocks) by the TCD signal. When the MATCH signal is inactive, the TCD signal is active while the heads are within one-quarter track width of a track center. (The MATCH signal is active only when the address in the present cylinder address counter equals the address in the new cylinder address register.) When the heads approach the first track after leaving the track on which they were initially centered, the TCD signal becomes active. This sets the First Clk Inhibit flip-flop and enables clock pulses starting with the one which occurs when the first track is crossed.

Since the cylinder clock generator does not generate the last clock pulse, the track center detector does so when the heads approach within three-quater track width of the cylinder being sought.It is notified, by the active MATCH-1 signal, that the next track approached will be the one sought. (The MATCH-1 signal becomes active when the address in the present cylinder address counter is one less than the address in the new cylinder address register.)

The last clock pulse steps the present cylinder address counter the last count so that it equals the address in the new cylinder address register. When this occurs, the MATCH signal becomes active and remains so as long as the two addresses are equal.

When the MATCH signal becomes active the TCD signal, which (while the heads are crossing tracks) is active as long as the heads are within one-quarter track width of any track center, becomes inactive again and the offset from track center for which it will be active is narrowed from one-quarter track width (approximately 1300 microinches) to 100 microinches. With the MATCH signal active, the FINE POSITION signal becomes active making the POS signal the source of the head positioning signal to the motor. When the servo loop has positioned the heads within 100 microinches of the track center, the TCD signal again becomes active. When this happens, the head offset from track center tolerated by the track center detector is widened to 200 microinches. With the heads centered on track, the FINE POSITION signal remains active, enabling the POS signal to keep the heads on track.

Note: Track center, as interpreted by the servo loop, is track center plus whatever offset amount is stored in the offset register and added to the feedback signal on track follower PCA-A5.

The cylinder width is halved on the lower surface of the fixed disc, thus creating two data tracks per cylinder. The data track center is one-quarter servo track width (1300 microinches) from the cylinder center. The two outermost data tracks have the cylinder address of 0 while the two innermost data tracks have the 410 cylinder address. These tracks are accessed by the same read/write head. The address of this head can be either head 2 or head 3. When the MATCH signal becomes active, the read/write head of the fixed disc is positioned over the desired track of the specific cylinder address by changing the gain of the +P and −P signals through the position amplifier. Consequently, the Position signal will always be zero when the desired track is reached.

When switching is performed between the removable disc heads and the fixed disc heads on the same cylinder, the ACRY signal will always be active. To allow the heads time to settle on track during this operation, the OSD signal is activated for a specific time period. The OSD signal holds off the sector compare signal and keeps the TCD signal active.

A-30. ACCESS READY. When both FINE POSITION and TCD are active the $\overline{SB}$ signal is active. After a 1.3 millisecond delay to ensure that the heads are settled on the track, the HLDD and ACRY signals become active. The HLDD signal becomes active when the heads settle on the first cylinder sought after leaving the retracted position. Once active, it remains so until the RET signal becomes active. The DRIVE READY lamp is on while the DRDY signal is active. The ACRY signal, when active, indicates the heads are settled on a track.

A-31. EMERGENCY RETRACT CIRCUIT. The emergency retract circuit retracts the heads whenever the $\overline{SEN}$ signal becomes inactive or if the ILF signal becomes active. Even if the power fails, the heads will be retracted by the emergency retract circuits using power generated by the still-rotating spindle.

When activated, the emergency retract circuits are disabled by the active CRB signal, once the heads reach the retracted position.

A-32. TEMPERATURE COMPENSATION. When a cartridge is loaded into a warm disc drive, there will be an initial offset between the fixed disc (with the servo code) and the removable disc, caused by the initial temperature difference between the two discs. The temperature compensation circuit moves the read/write heads to reduce this offset.

Two thermistors placed near the edges of the fixed and removable discs sense the temperature difference of the two discs. The thermistors are connected to a bridge amplifier circuit which has the ΔT signal as its output.

When the Spindle Speed Up ($\overline{SPU}$) signal becomes active, a 15-second delay is initiated. If the temperature difference between the two discs is less than 4 degrees Celsius at the end of the 15-second delay, the Temperature Time Out (TTO) signal becomes active. However, if the temperature difference between the two discs is greater than 4 degrees Celsius at the end of the 15-second delay, signal TTO will not become active until the ΔT signal is less than 4 degrees Celsius.

When signal TTO becomes active, the Drive Ready (DRDY) signal becomes active and the ΔT signal is sampled. This sampled signal begins an exponential decay that approximates the exponential nature of the temperature difference between the fixed disc and the removable disc. When head zero or head one is selected, the exponential signal is added to the input of the position amplifier. To compensate for the difference in radial expansion of the higher numbered tracks, the amplitude to the exponential signal is varied using signals DWA and DWB — the two most significant digits of the cylinder address. All of the temperature compensation circuitry, with the exception of the thermistors, is located on track follower PCA-A5.

A-33. SECTOR SENSING SYSTEM

The sector sensing system (figure A-19) generates the physical sector address that allows the controller to monitor the sector over which the heads are located. It also activates the Sector Compare (SC) signal, which tells the controller when the heads are over the target sector and enables the URG or UWG signals to the read/write system so it can begin reading from or writing to the sector. Near the end of the sector the system disables reading or writing by deactivating SC, which disables URG and UWG.

A-34. PRESENT SECTOR IDENTIFICATION. The servo code from the servo head is converted to the SCL pulse train of 53,760 pulses per revolution by the circuits on track follower PCA-A5. The SCL signal is input to two sets of timing generators and decoders on PCA-A2 that form divide-by-1120 counters which produce 48 pulses per revolution. Two sector counters count these pulses, identifying the physical sector, 0 to 47, presently under the heads.

Two sets of counters, one for each disc, are necessary because the removable and fixed disc have no known positional relationship to each other. The counters for the removable disc are reset to zero once per each disc revolution by the Upper Index Transducer (UIX) pulse. The fixed disc counters are reset by the LIP pulse, which is derived from an index code, present on every track of the servo surface.

A-35. SECTOR ADDRESS STORAGE. The address of the target sector for data operations is supplied by the controller as a 6-bit binary word from the controller output data bus, bits 0 to 5. Before it is stored, the controller checks that it is not greater than 47, the maximum for the HP 7906H Disc Drive. A Sector Address is stored by the controller for SEEK or ADDRESS RECORD commands from the HP-IB.

A-36. HEAD ADDRESS STORAGE. The head address to be used for data transfer, derived from bits 0 – 3 of the controller output data bus, is stored in the Head register as a 4-bit binary number. Only two bits are necessary for the four heads of the HP 7906H. A head address is stored by SEEK or ADDRESS RECORD commands from the HP-IB.

A-37. UNIT IDENTITY GENERATION. When the disc drive is turned on, reset, or given certain HP-IB commands, the controller will examine the number set by the UNIT SELECT switch on the control panel. This number is the HP-IB device address for the drive, and selects the drive as the unit activated for data transfers.

When jumper W360 is in place on microprocessor PCA-A2, a sector look-ahead algorithm called Rotational Position Sensing (RPS) is in effect. (The location of jumper W360 on PCA-A2 is shown in figure A-16.) Then, after a SEEK has been completed, the response of the dirve to a PARALLEL POLL command on the HP-IB is enabled only during a period of time (n + 1) milliseconds long on each revolution of the disc, when n is the unit number. This parallel poll response window closes two sectors before the target sector. If the host CPU does not give the parallel poll within this window, it must wait until the next revolution.

If RPS is not enabled, the disc drive will respond to parallel poll immediately upon completing the seek, even though the heads might not be anywhere near the target sector. This could tie up the HP-IB for nearly 16 milliseconds waiting for a data transfer to begin.

A-38. ENABLING READING OR WRITING. When the controller has selected reading or writing and the sector presently under the heads matches the addressed sector, the Sector Compare (SC) signal is activated, enabling the URG and URW signals. This enables reading and writing, respectively. Each sector lasts for 1120 pulses of the SCL signal. If the count 1082 is reached and normal read or write termination has not occurred, SC is deactivated, aborting the read or write operation.

A-39. READ/WRITE SYSTEM

The read/write system (figure A-20) reads data from the addressed sector or writes data into it during a time period established by the sector sensing system. This time period begins when the start of the addressed sector is under the selected head and lasts until nearly the end of the sector. Both read data and write data passes between the controller and the disc drive on the same data lines. Head 0, 1, 2,

or 3 is selected for reading or writing according to the head identity stored in the head register.

Write current is reduced for the higher numbered tracks (those closest to the spindle) as specified by the three most significant digits of the cylinder address ($\overline{DWA}$, $\overline{DWB}$, and $\overline{DWC}$) stored in the new cylinder address register. The $\overline{DWA}$ signal corresponds to the most significant digit and $\overline{DWC}$ corresponds to the third most significant digit. DWC, when active, reduces the write current by 3.25 milliamperes. Write current is reduced by 6.5 milliamperes by $\overline{DWB}$ and 13 milliamperes by $\overline{DWA}$. Current is reduced in steps 64 tracks apart as follows:

TRACK SEGMENT	CURRENT REDUCTION (MA)
0 - 63	0
64 - 127	3.25
128 - 191	6.50
192 - 255	9.75
256 - 319	13.00
320 - 383	16.25
384 - 410	19.50

Four read/write fault conditions are sensed by the fault detection system. When any of the conditions exist, the fault detection system takes further action as detailed in following paragraphs. These conditions are as follows:

a. More than one head selected for reading or writing.

b. Absence of dc write current during write gate.

c. Absence of an ac write signal which is derived from write data.

d. Absence of the ACRY signal during write gate.

The fault system takes notice of the last three conditions only during write mode.

A-40. FAULT DETECTION SYSTEM

The disc drive contains six fault subsystems (figure A-21) for monitoring important drive functions: the interlock fault subsystem, address fault subsystem, read/write fault subsystem, AGC fault subsystem, CRB fault subsystem, and timeout subsystem. Indication of the nine drive faults detected by the subsystem is provided by four light-emitting diodes (LED's) mounted on PCA-A4 and visible through the front door. The faults are indicated by coding the operation of two red LED's, one green LED, and one yellow LED. The coding for these LED's is as follows:

FAULT	LED(s) ILLUMINATED
CB	yellow
T	red
AGC	yellow, red
IL	green
W • AR	yellow, green
R • W	green, red
W • AC	yellow, green, red
MH	red, red
W • DC	red, red, yellow

The action of the readout system is included in the following description of the fault subsystems.

A-41. INTERLOCK FAULT SUBSYSTEM. This subsystem senses the presence of PCA's A1 through A6, A8, and A10, and monitors the −36, −24, −12, +5, +12, and +36 Vdc and 25 Vac power sources and the temperature on the heat sink located on power and motor control PCA-A8. (It also disables the +5 volt power source if the track formatter PCA and I/O sector PCA-A2 are both installed in the disc drive at the same time.) If any PCA is not firmly in place, if any of the monitored power sources fall below a specified value, or the temperature on the PCA-A8 heat sink increases beyond a specified value, the following conditions occur:

a. IL (green) LED lights.

b. FAULT indicator lights.

c. Heads are retracted (if they were loaded).

d. Head positioning servo disabled.

e. Door locked solenoid de-energized (door locked).

f. Spindle stops.

The +5 volt power source is monitored for overvoltage. If the voltage increases over a value of approximately +5.6 volts, the +5 volt power source is shorted to ground by a circuit loaded on motherboard PCA-A7.

A-42. ADDRESS FAULT SUBSYSTEM. The address fault sensing subsystem indicates when an illegal cylinder has been selected or if the heads are not settled on a track (ACRY active) when a SK command (see figure A-7) occurs.

A-43. READ/WRITE FAULT SUBSYSTEM. This subsystem senses five error conditions and classifies them as either a non-destructive write fault (NDWF) or a de-

structive write fault (DWF). Both non-destructive and destructive write faults light the DRIVE FAULT indicator. The heads are retracted and a 1.25-second timeout is initiated only by a destructive write fault. If the heads do not reach the retracted (carriage back) position within 1.25 seconds, the T (red) LED will be lighted.

The two non-destructive write fault conditions are as follows:

a. Heads not settled on a track in write mode (UWG signal active and ACRY signal inactive). The W • AR (yellow, green) LED's are lighted.

b. Read and write modes exist simultaneously (URG and UWG signals both active). The R • W (green, red) LED's are lighted.

A destructive write fault exists under the following conditions:

a. No data is being written in write mode (the ACW signal is inactive and the UWG signal is active). The W • AC (yellow, green, red) LED's are lighted.

b. Two or more heads selected for reading or writing (MHS signal active). The MH (red, red) LED's are lighted.

c. The heads are receiving write current while the drive is not in write mode (DCW signal active and UWG signal inactive). The color-coded readout for this fault is "red, red, yellow".

A-44. AGC FAULT SUBSYSTEM. An AGC fault occurs if the servo AGC signal is lost while the heads are located on or between cylinders 0 and 410 and the HLDD signal is active. The AGC (yellow, red) LED's are lighted and the heads are retracted when such a fault occurs.

A-45. CRB FAULT SUBSYSTEM. A CRB fault occurs when the heads are indicated as being in the retracted position while no RET signal has been registered by the HLDD flip-flop (CRB and HLDD signals simultaneously active). Under these conditions, the CB (yellow) LED is lighted and the heads are retracted.

A-46. TIMEOUT SUBSYSTEM. The timeout subsystem disables the disc drive if certain head positioning functions are not completed within a time set by the timeout subsystem. A 90-millisecond timeout is initiated each time the SK signal becomes active (table A-5). A 1.25-second timeout is initiated each time the RH signal becomes active and each time the RET signal becomes inactive. A timeout is also initiated when the RET signal becomes active, provided it was not caused by a previous timeout or an active ILF signal. The standard used by the timeout subsystem to measure time is the STP signal which is derived from the spindle speed. If the timeout, once initiated, is not cancelled before the time limit, the following events occur:

a. T (red) LED lights.

b. DRIVE FAULT indicator lights.

c. Heads are retracted.

d. Head positioning servo is disabled.

e. Door locked solenoid is de-energized.

f. DRIVE READY indicator goes out.

g. Spindle stops rotating.

A-47. FAULT DETECTION SYSTEM RESET. The AGC fault, CRB fault, read/write fault, and address fault subsystems are reset when the ILF signal is active, when the POWER switch is set to ON, or when the RUN/STOP switch is set to RUN. Also, any timeout condition is cancelled if the ACRY signal is active or if the heads are retracted.

Table A-5. Timeout Conditions

TIMEOUT TYPE	INITIATING CONDITION	CANCELLING CONDITION
90 ms	Seek command (SK signal active).	Heads settle on a track within 90 milliseconds (ACRY signal active).
1.25 sec	Recalibrate command (RH signal active).	Heads settle on track 0 within 1.25 seconds (ACRY signal active).
1.25 sec	RET signal active and not caused by a timeout or an active ILF signal.	Heads reach retracted position within 1.25 seconds (CRB signal active).
1.25 sec	RET signal becomes inactive.	Heads settle on track 0 within 1.25 seconds. (Inactive RET signal activates SKH signal.)

A-48. AIR CIRCULATION AND FILTRATION SYSTEM

The air circulation and filtration system (see figure A-4) includes a blower motor which rotates an impeller to draw cooling air into the disc drive through a prefilter duct assembly mounted on the bottom of the disc drive. Approximately one-third of the developed air flow passes through the lower portion of the absolute filter. This cooling air is directed through a flexible hose to the cooling air duct where it is diverted into two separate paths. These two paths of cooling air flow along the fins of the heat sink on the power and motor control PCA-A8 and exhaust through the vent openings in the lower right-hand corner of the rear cover. A fan mounted on the rear cover directs cooling air to the PCA's housed in the card cage assembly.

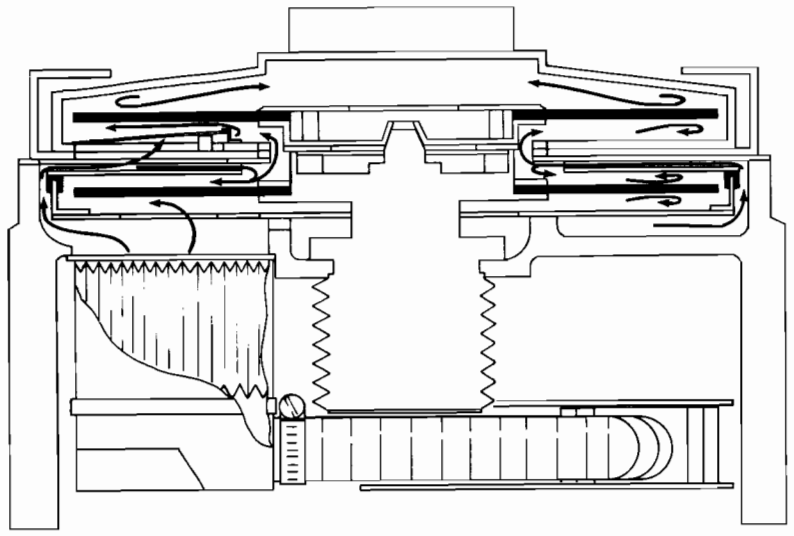
The remaining two-thirds of the air flow developed by the impeller passes through the filtration element in the absolute filter where 99% of all contaminants 0.3 micron or larger are trapped. After the air is thoroughly filtered, it is injected into the fixed disc and removable cartridge cavities. This flow of cool, clean air serves three extremely important functions. First, it tends to purge all critical areas of any airborne contaminants. Secondly, it cools both the fixed disc and the disc in the removable cartridge. Thirdly, it maintains a positive pressure within the disc cavities to prevent any inward flow of airborne contaminants. View A shows a cutaway section of the fixed disc and removable cartridge cavities and the approximate air flow pattern within them.

View B shows the critical elements involved in the read/write process, i.e., the read/write gap, the flying height of the heads, and the thickness of the oxide coating on the disc surfaces. The flying height is an average value due to the surface irregularities of both heads and disc. Also shown in View B are various types of contaminants and their size relationships. A contaminant particle hard enough and of the right size may scratch either the oxide coating or the head surface. Even if not hard enough to scratch, it may be large enough to increase the head disc spacing, thereby causing data errors. Therefore, to prevent potential damage or data loses, it is extremely important to maintain the cleanliness of the air within the disc drive.

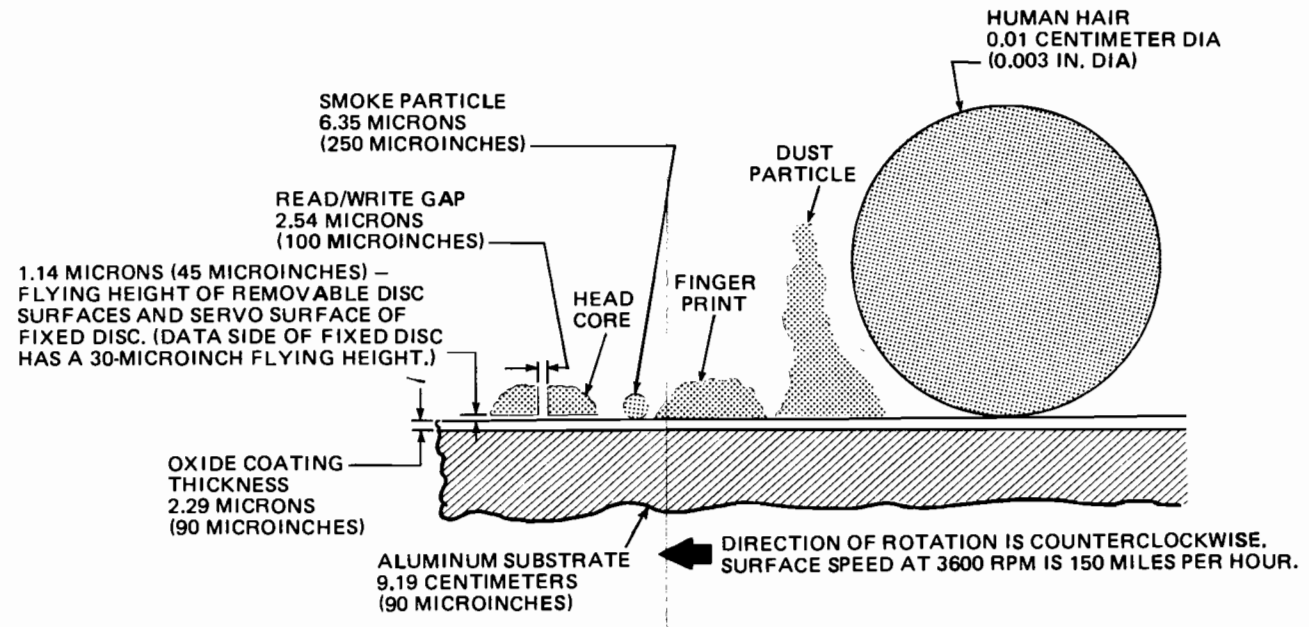
To ensure that clean air will be present, the disc drive must be operated in the specified environment and the air flow through the prefilter and the absolute filter checked on a regularly scheduled basis. When the drive is operated in the specified environment, the preventive maintenance schedule (refer to table 2-3, main manual) requires that a) the prefilter be checked for contamination, and b) the absolute filter output air pressure be measured, every six months. When the disc drive is operated in a severe environment such as one in which unusual amounts of dust, smoke, moisture, oil vapor, and other foreign matter are present, prefilter contamination and absolute filter output air pressure should be checked more frequently. The procedures for making these checks are provided in paragraphs 2-12 and 2-13, respectively, of the main manual. The prefilter should be changed when it becomes contaminated and the absolute filter should be changed when the air flow becomes restricted and the output air pressure drops below the values specified in table 2-4 of the main manual. Replacement procedures for the prefilter and the absolute filter are provided in paragraphs 5-12 and 5-13, respectively, of the main manual.

A-49. POWER DISTRIBUTION SYSTEM

The power distribution system converts ac input power to 25 Vac and +5 Vdc, +12 Vdc, −12 Vdc, and −24 Vdc and distributes these voltages to the brush motor and PCA's. Figure A-24 is a schematic representation of the power distribution system.



VIEW A



VIEW B

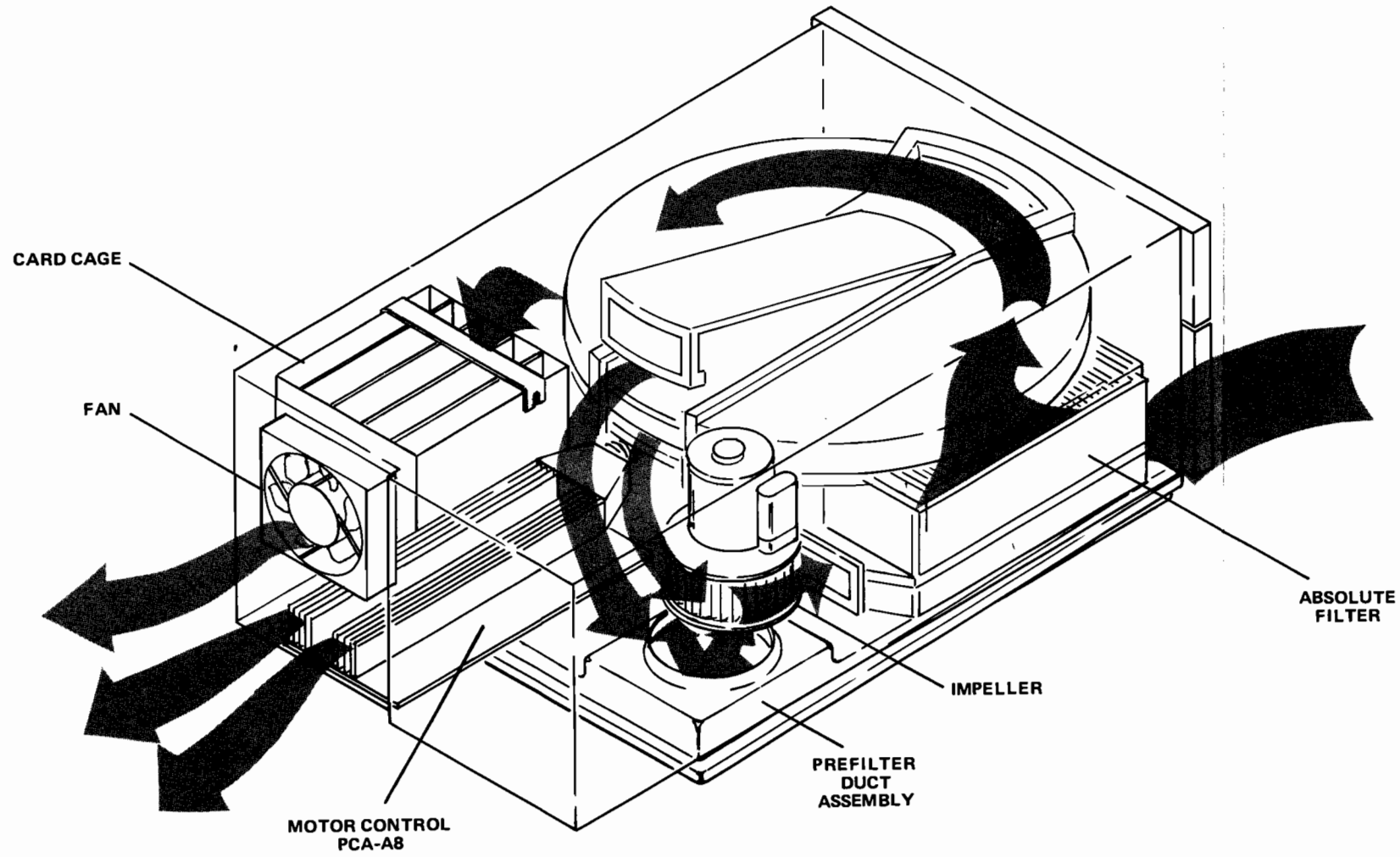
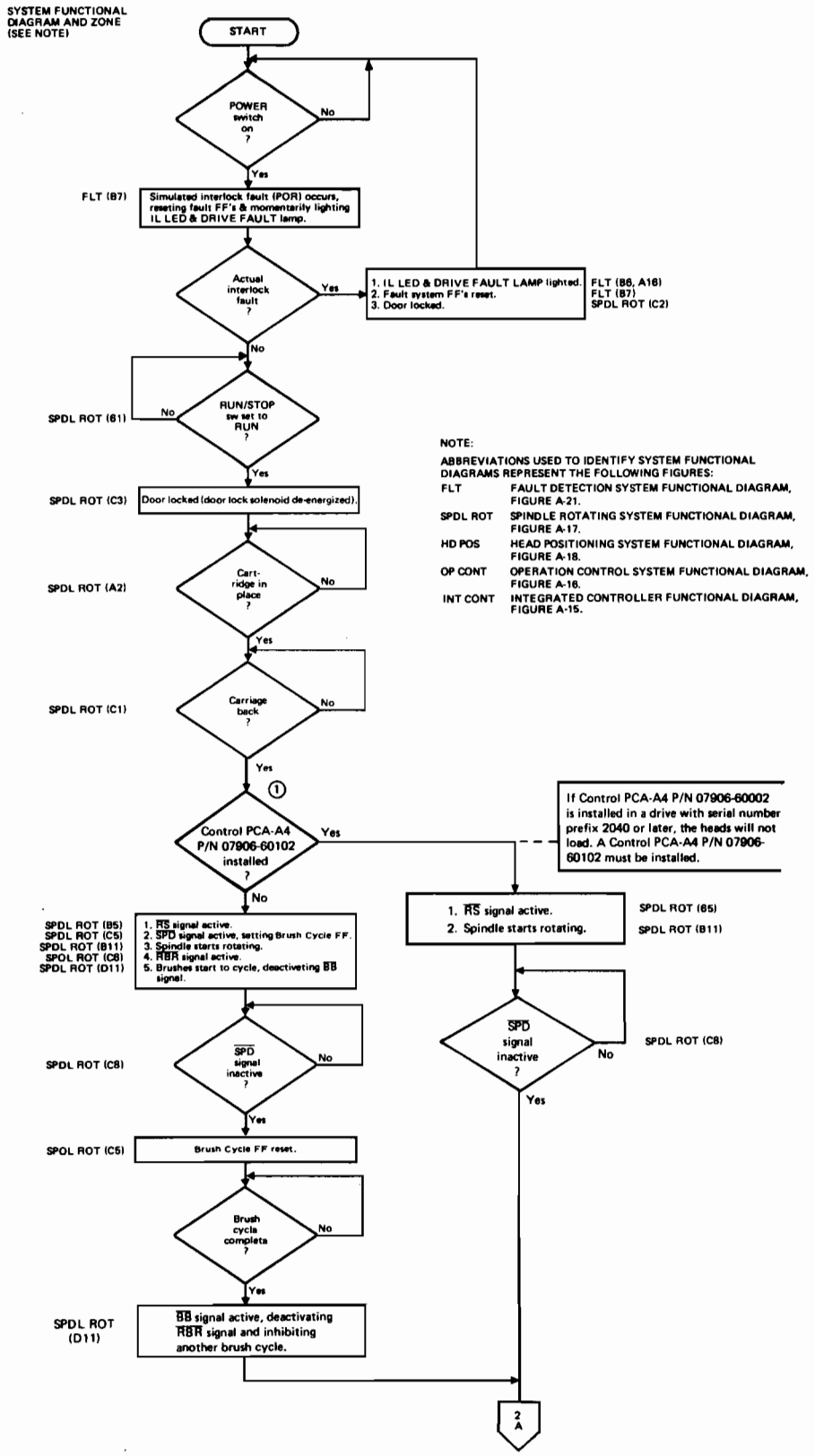
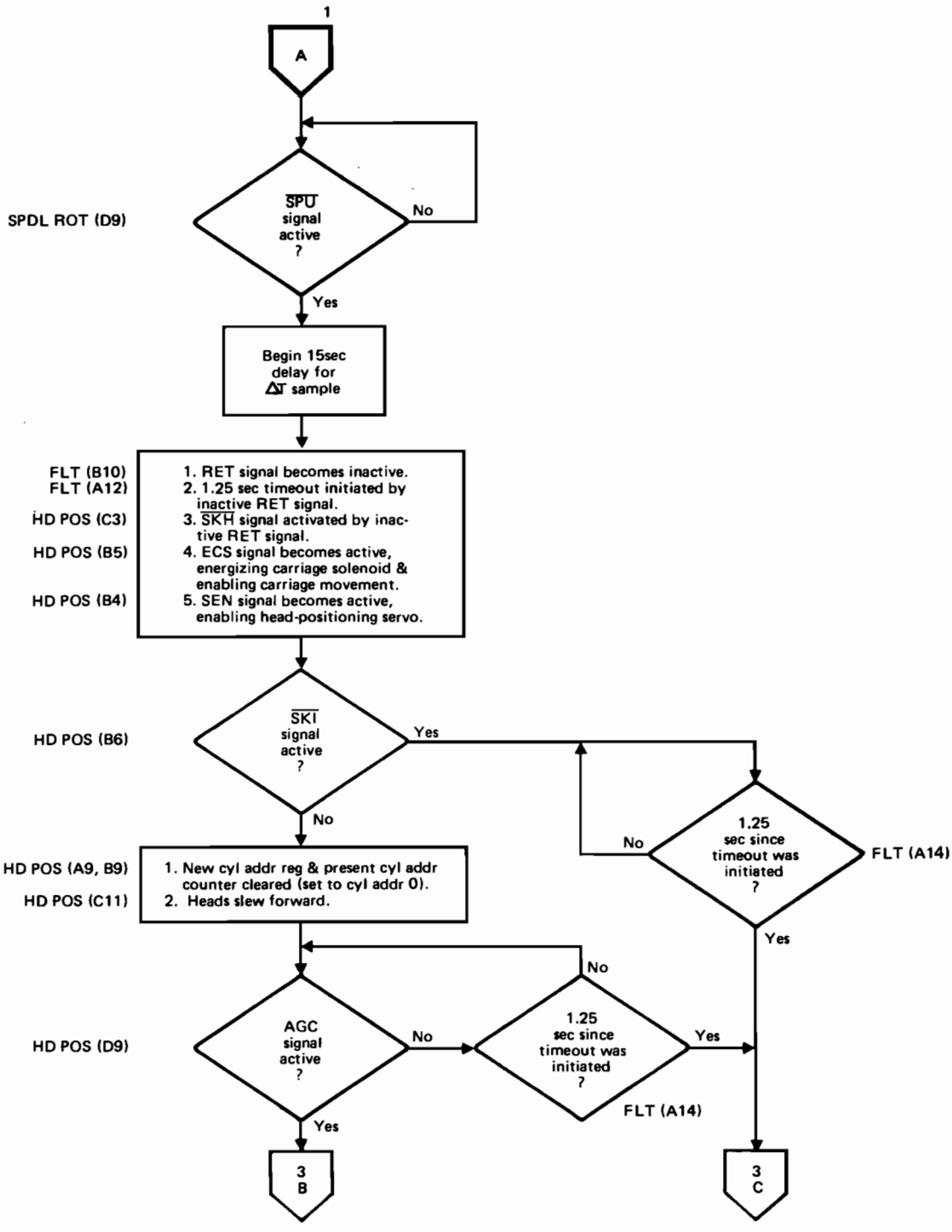


Figure A-4. HP 7906H Air Circulation and Filtration System



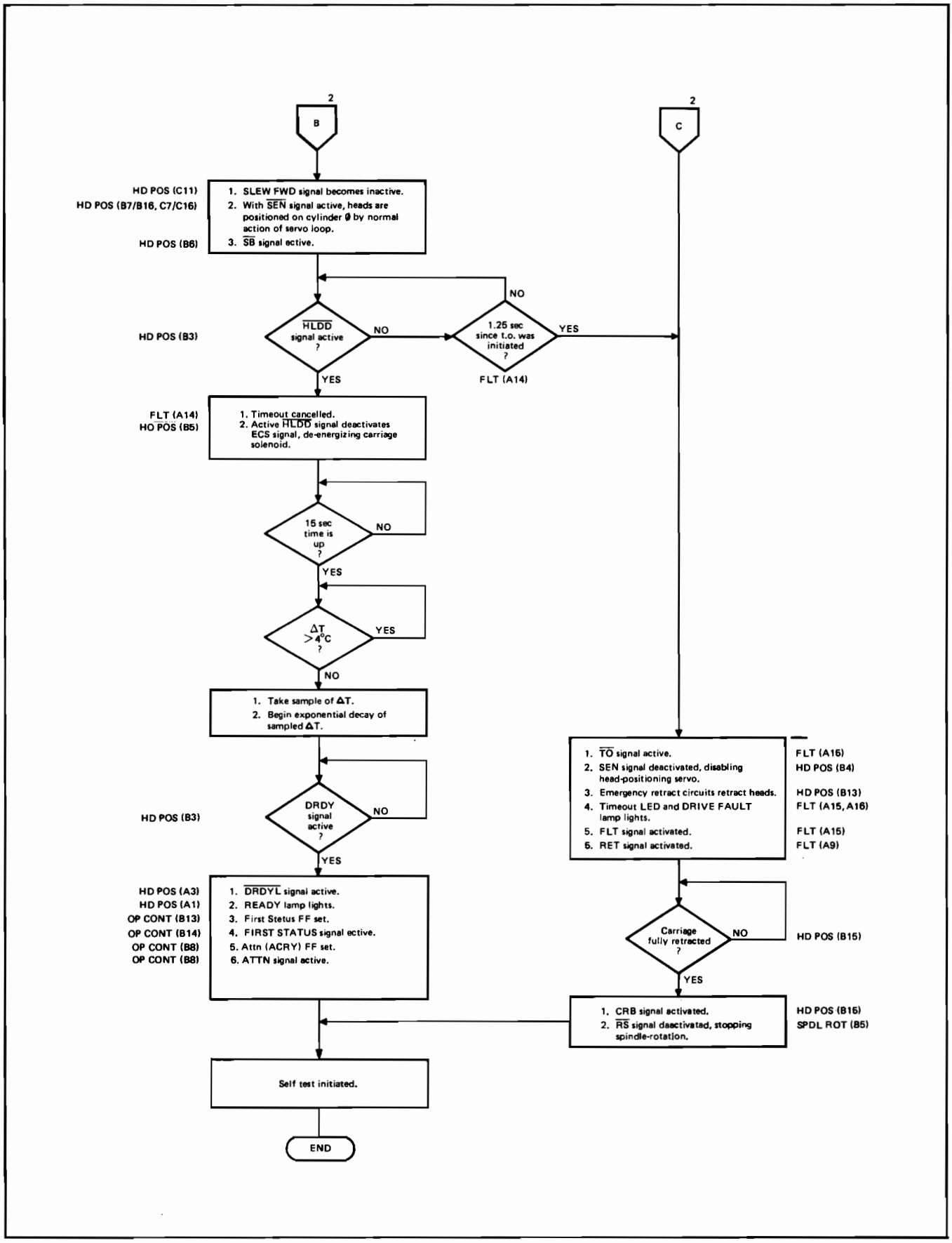
7300-91(1) A

Figure A-5. Power-Up Events Flowchart (Sheet 1 of 3)



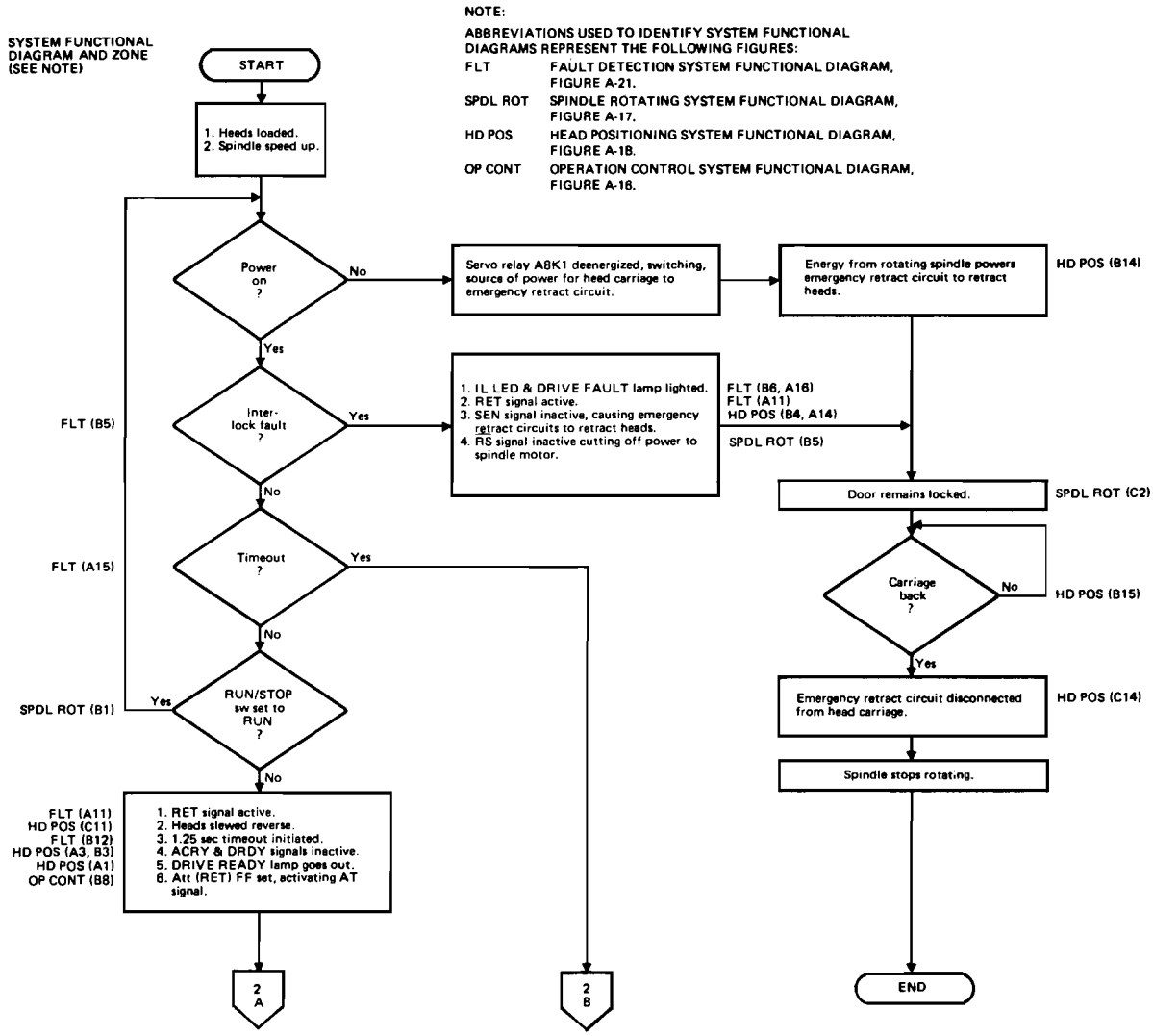
7300-91(2) A

Figure A-5. Power-Up Events Flowchart (Sheet 2 of 3)



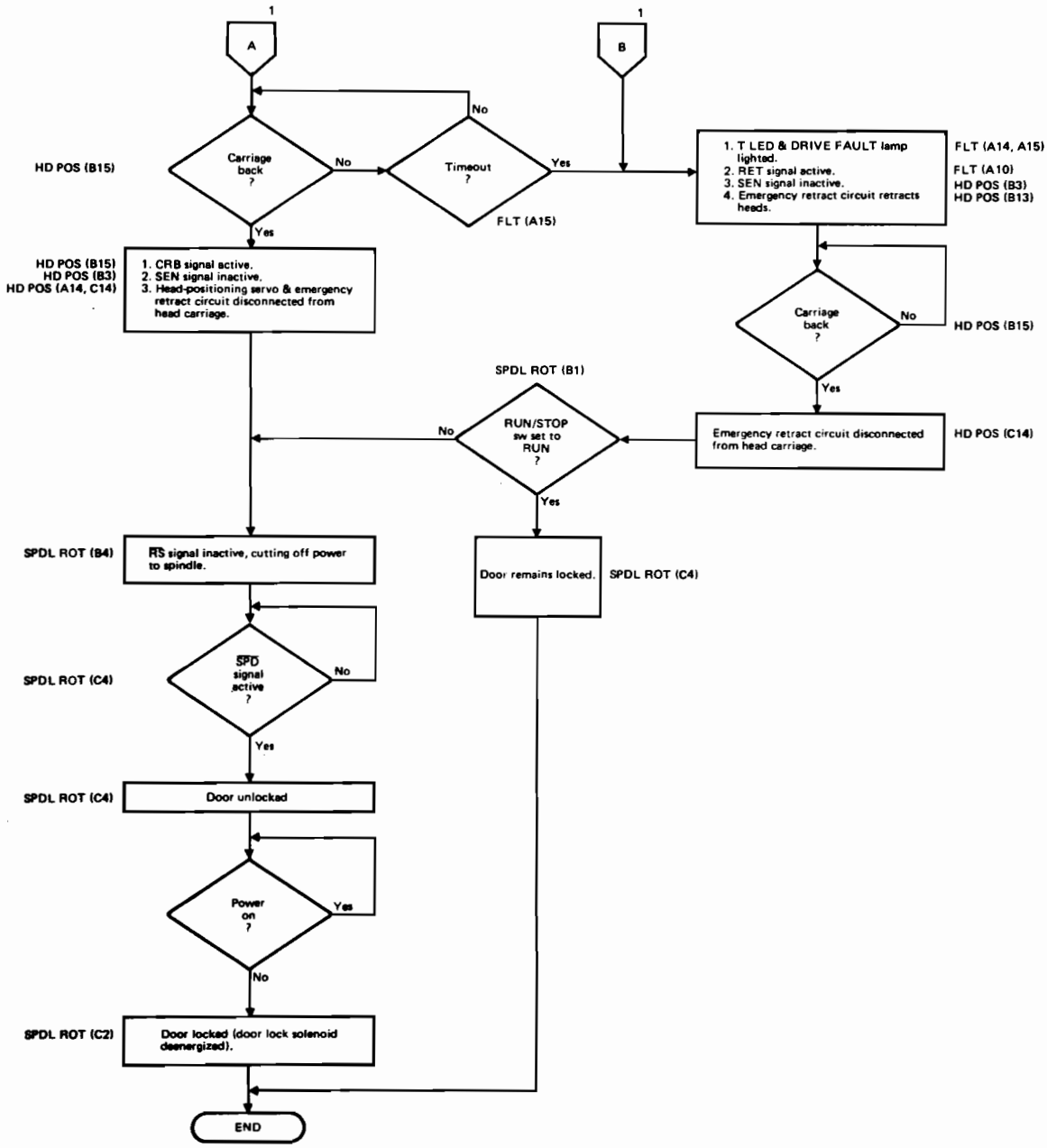
7300-91(3)A

Figure A-5. Power-Up Events Flowchart (Sheet 3 of 3)



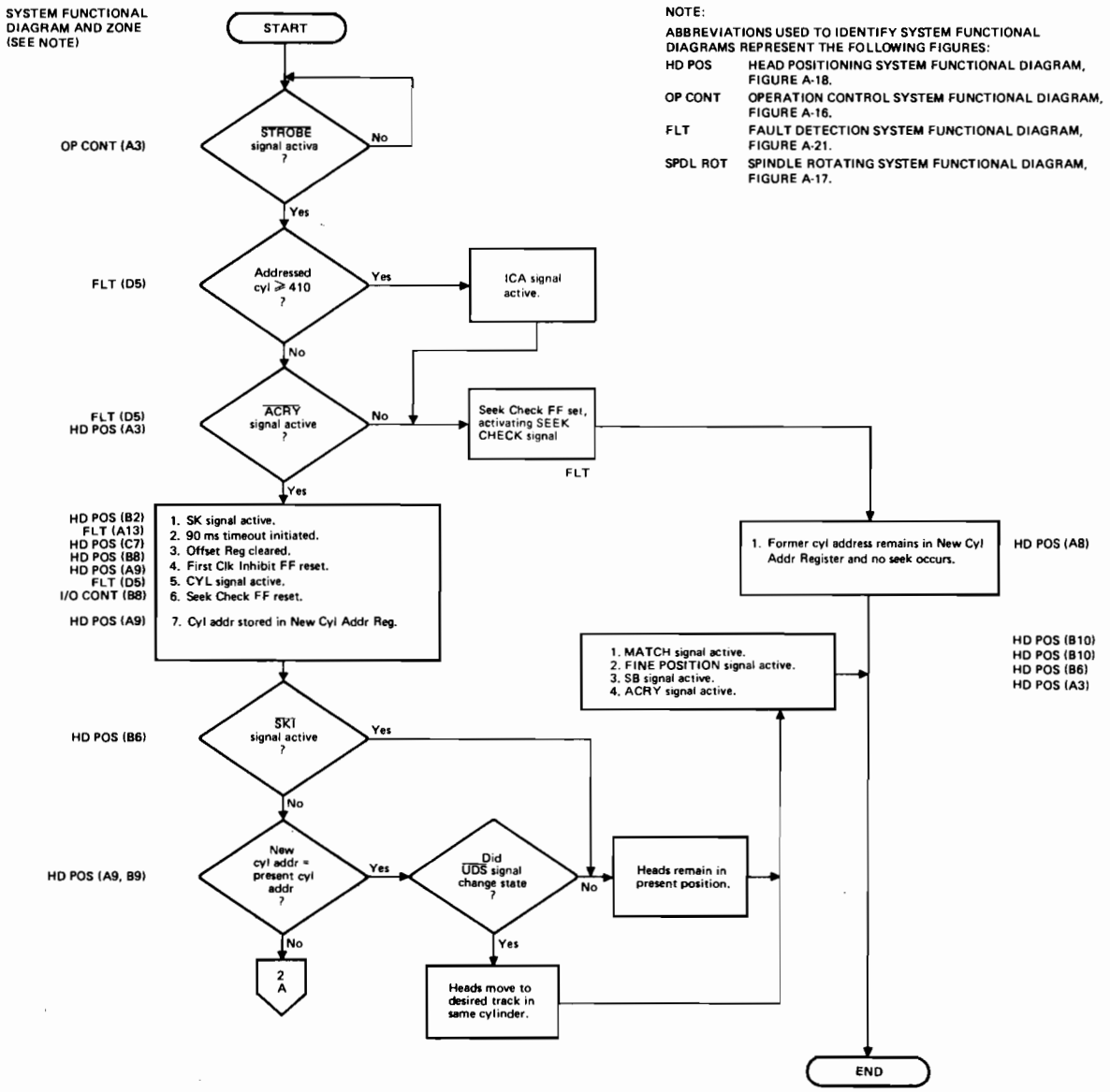
7300-92(1)

Figure A-6. Power-Down Events Flowchart (Sheet 1 of 2)



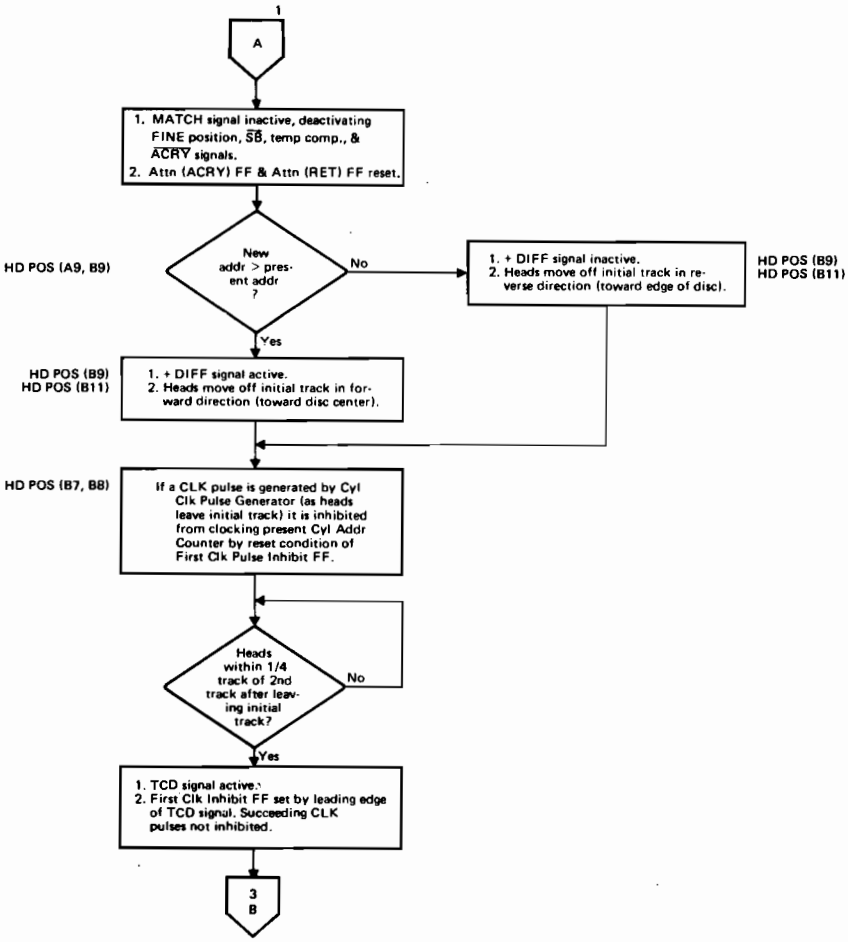
7300-92(2)

Figure A-6. Power-Down Events Flowchart (Sheet 2 of 2)



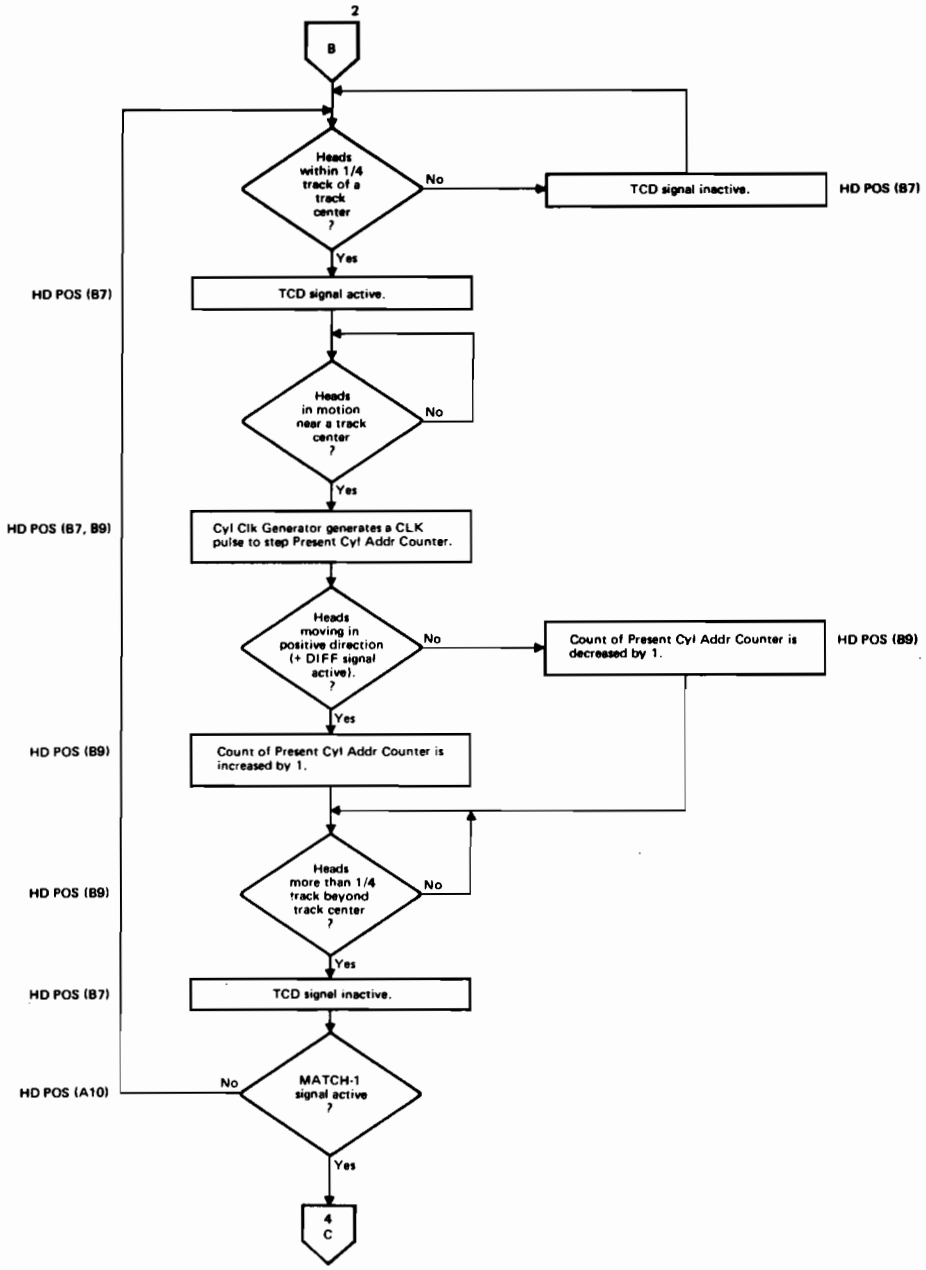
7300-93(1)

Figure A-7. SK Command Events Flowchart (Sheet 1 of 4)



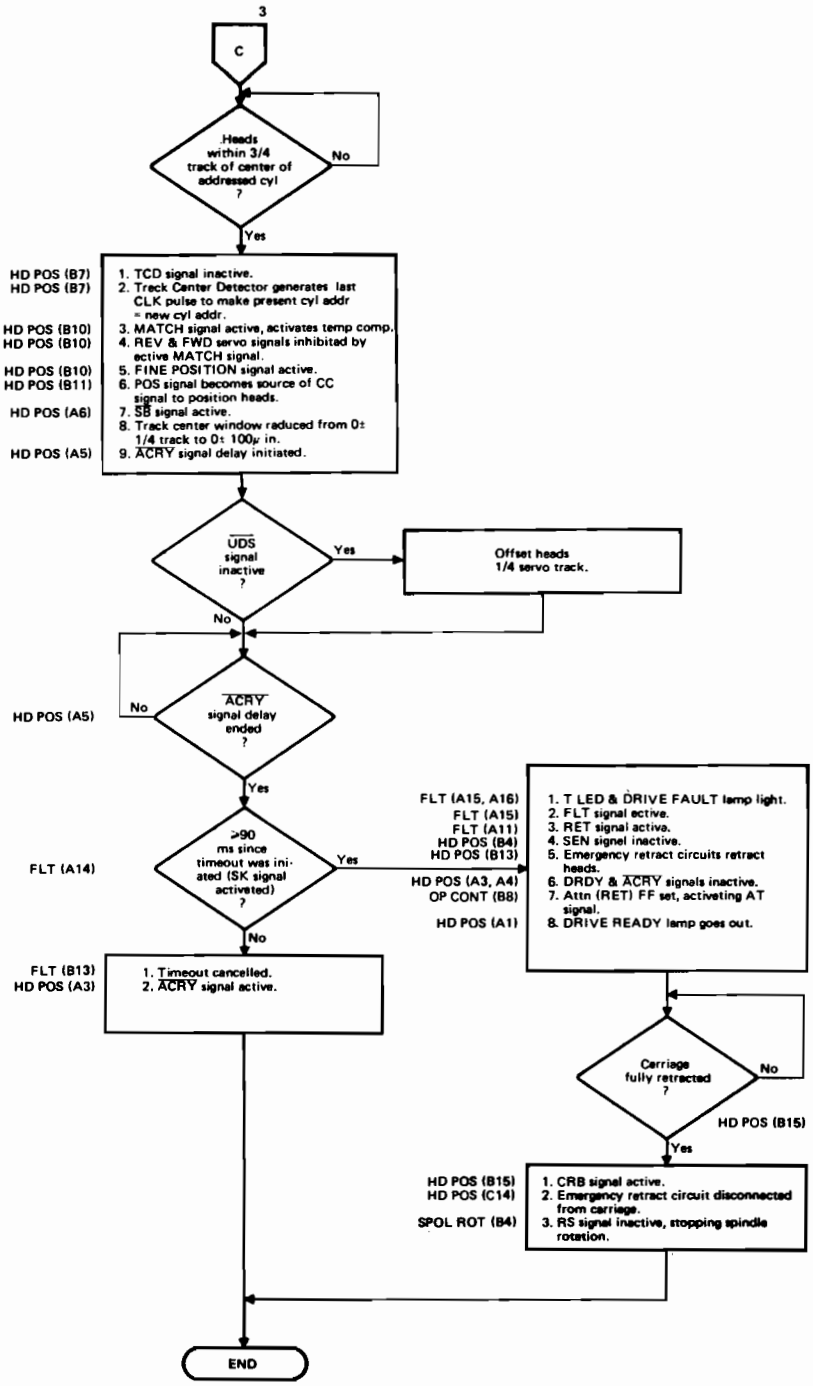
7300-93(2)

Figure A-7. SK Command Events Flowchart (Sheet 2 of 4)



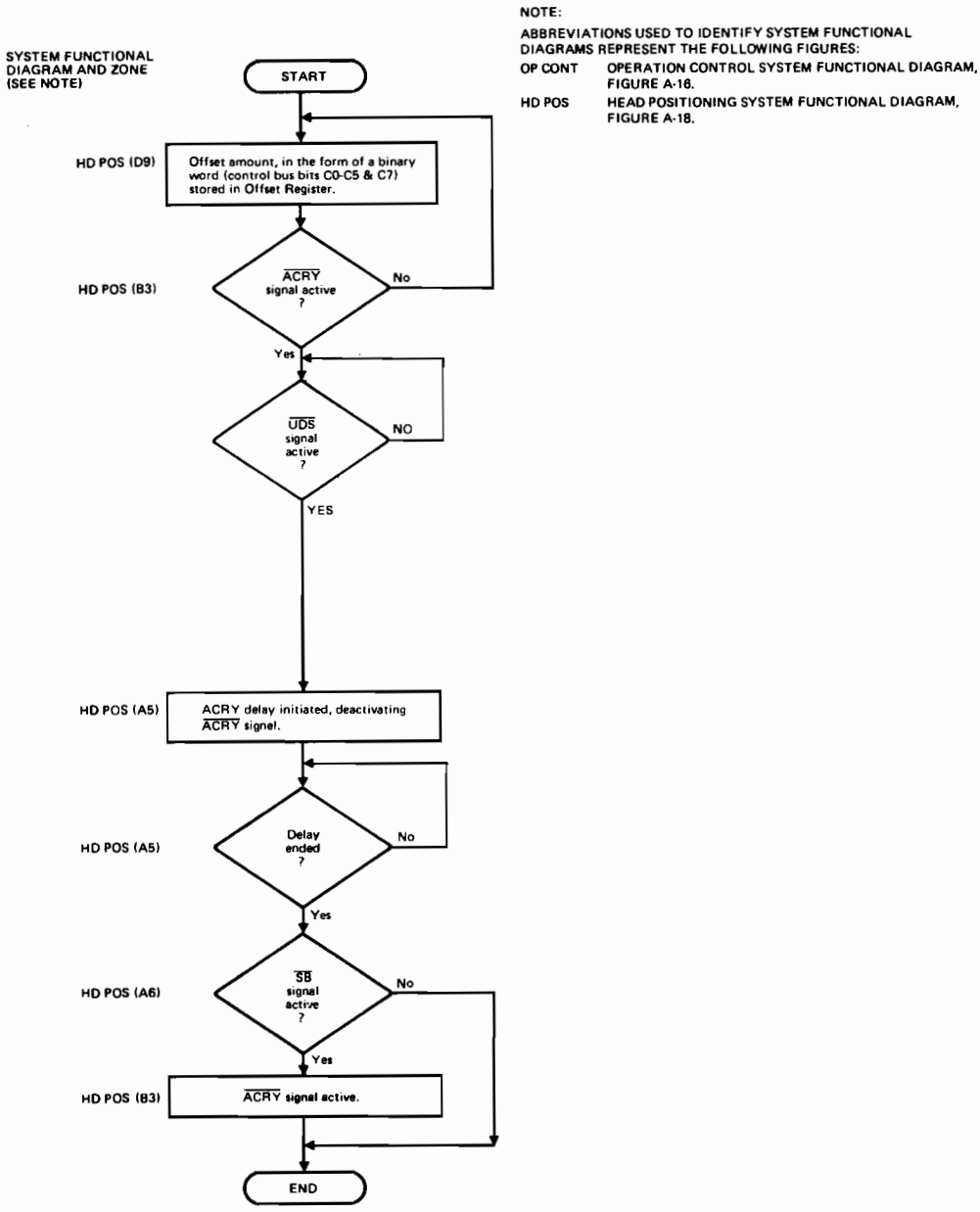
7300-93(3)

Figure A-7. SK Command Events Flowchart (Sheet 3 of 4)



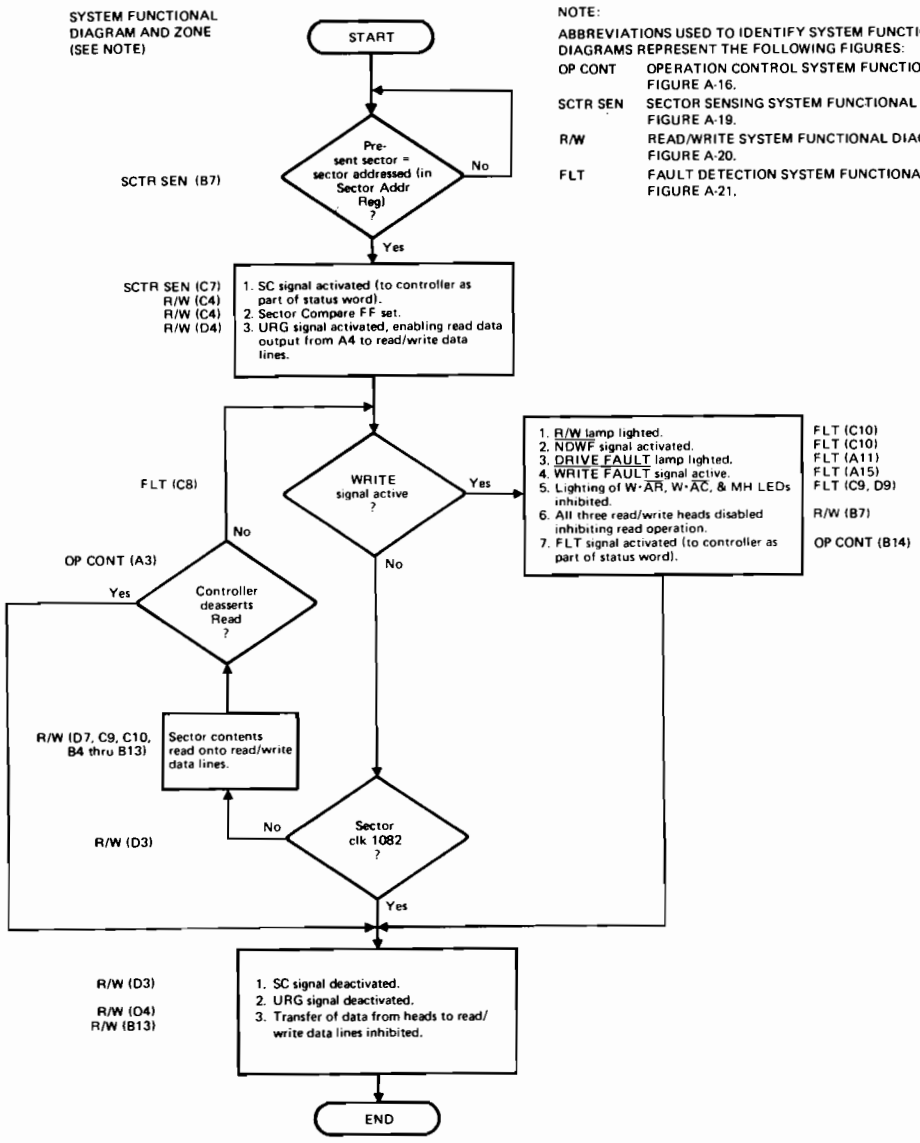
7300-93(4)

Figure A-7. SK Command Events Flowchart (Sheet 4 of 4)



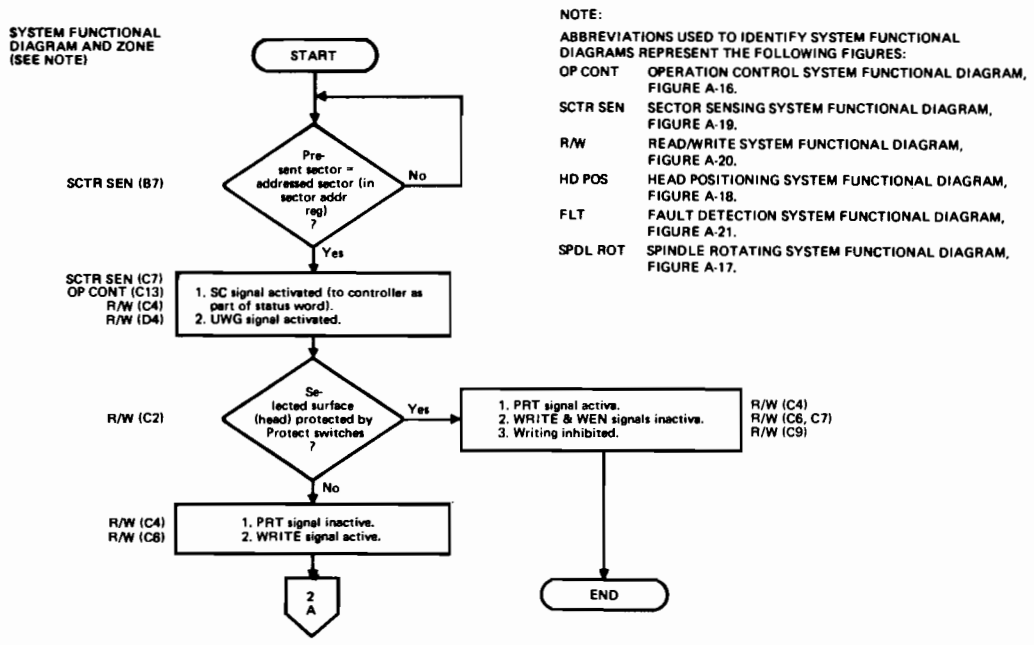
7300-94

Figure A-8. SOF Command Events Flowchart



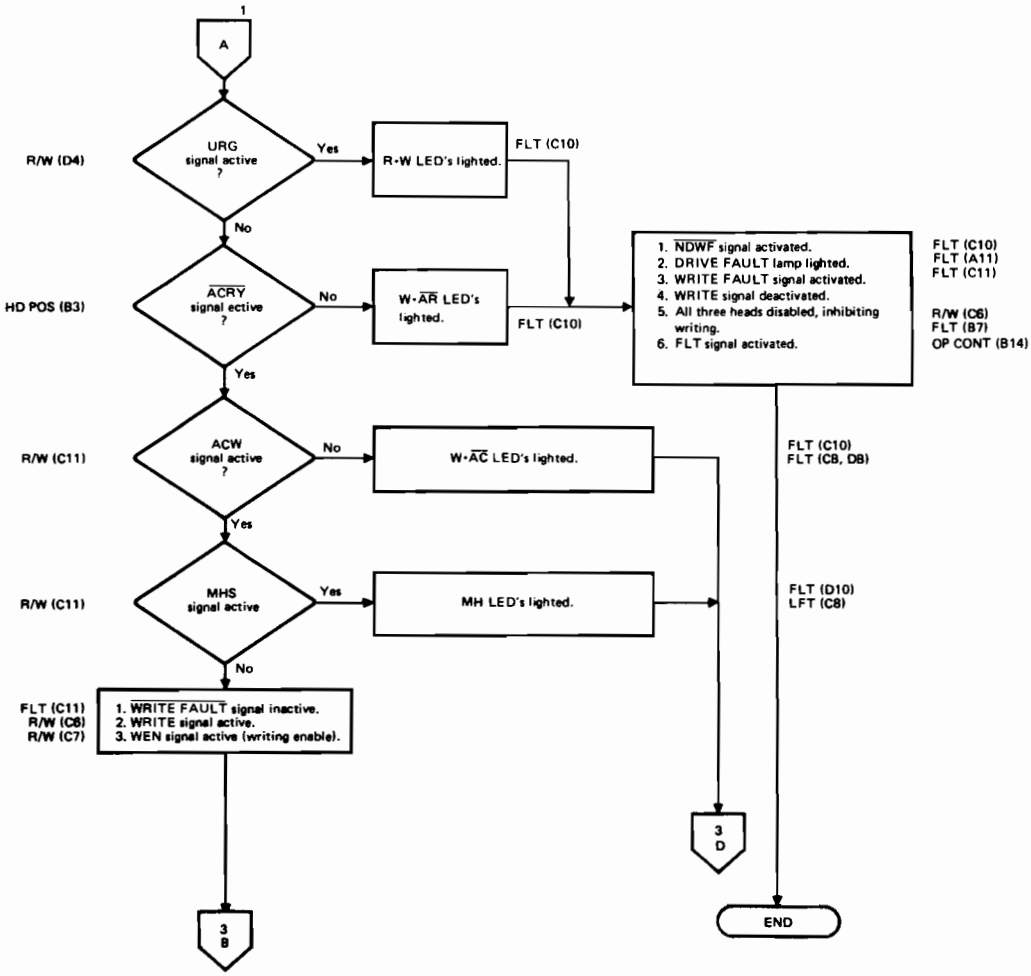
7300-95

Figure A-9. RED Command Events Flowchart



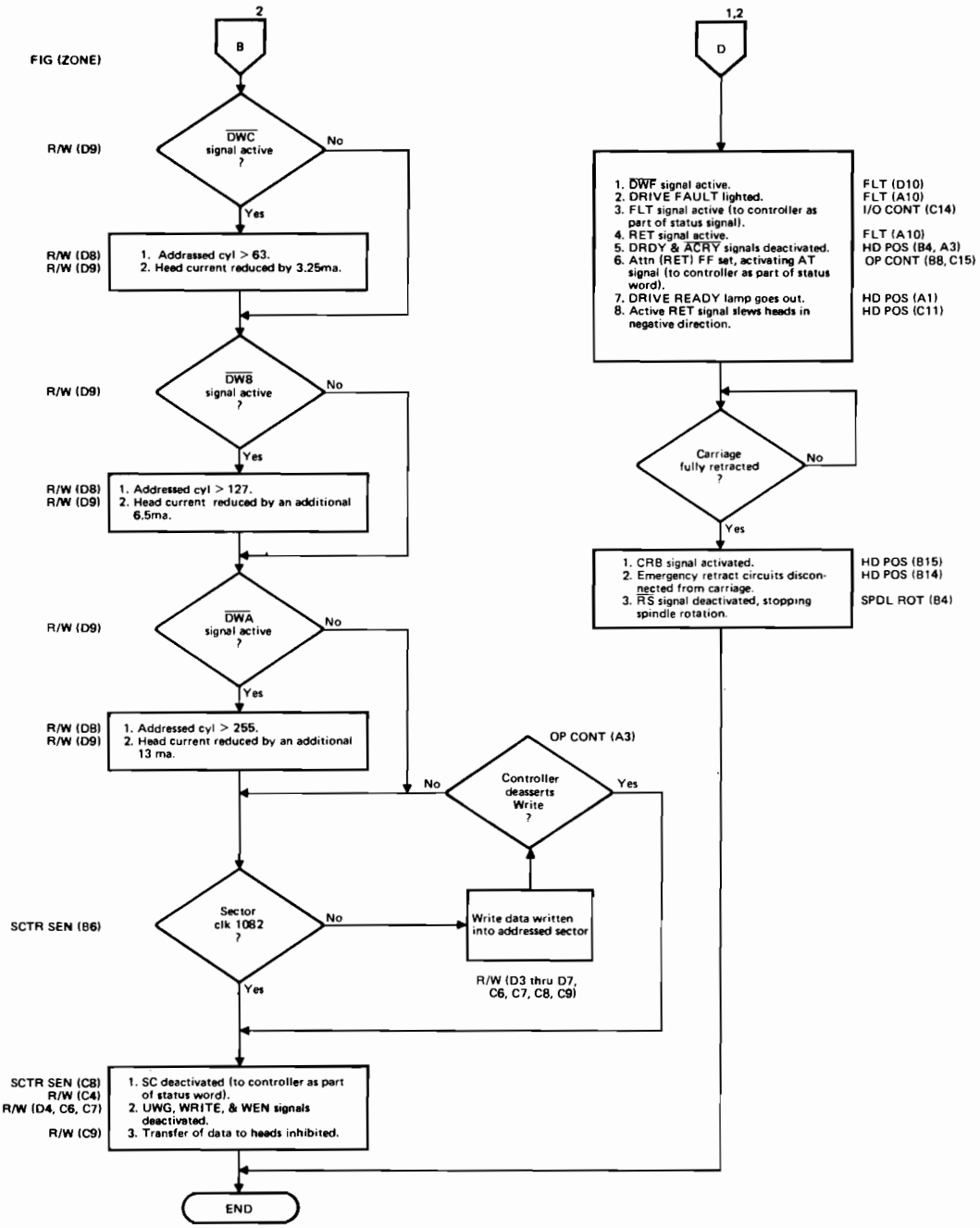
7300-96(1)

Figure A-10. WRT Command Events Flowchart (Sheet 1 of 3)



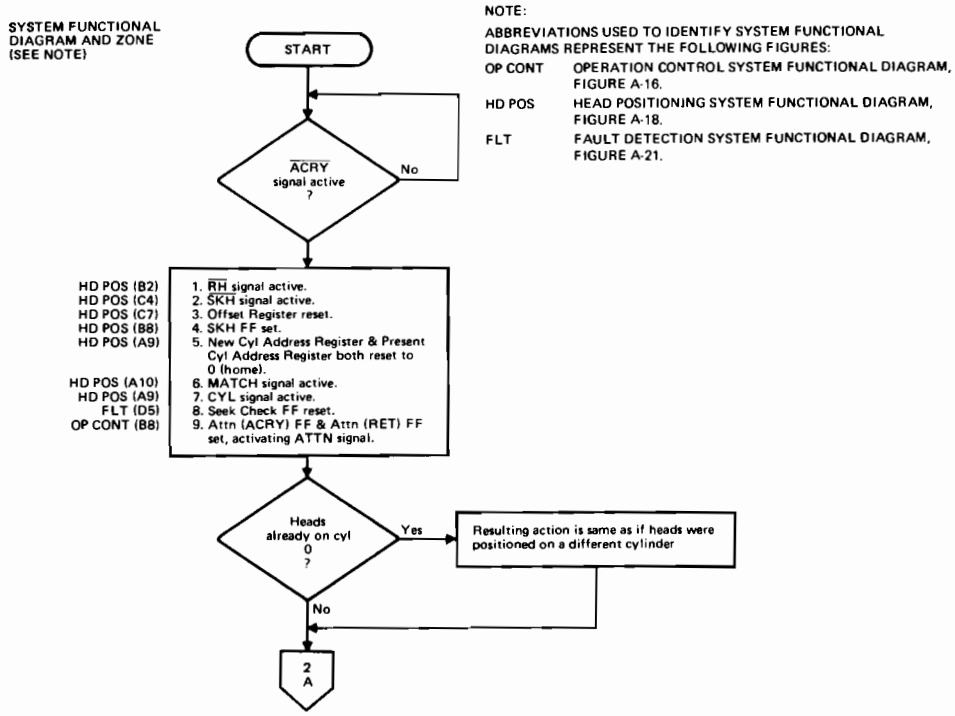
7300-96(2)

Figure A-10. WRT Command Events Flowchart (Sheet 2 of 3)



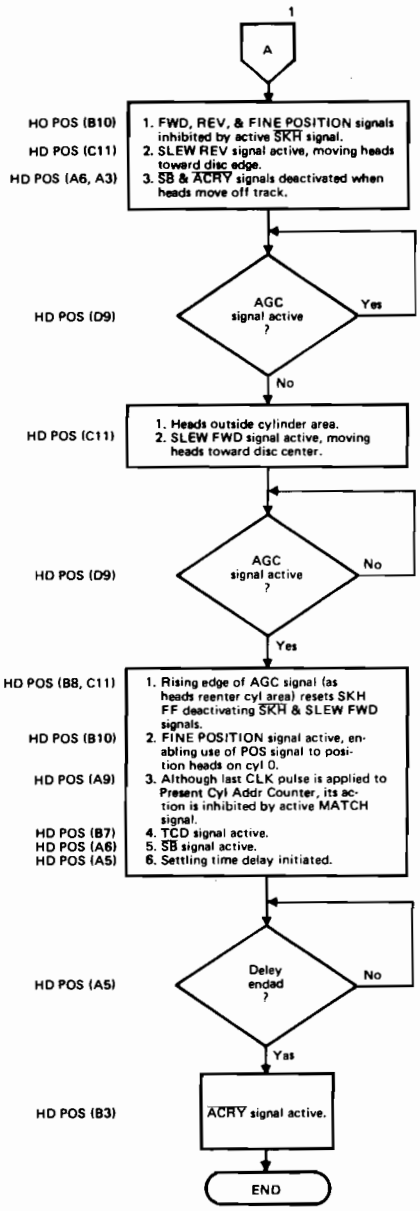
7300-96(3)

Figure A-10. WRT Command Events Flowchart (Sheet 3 of 3)



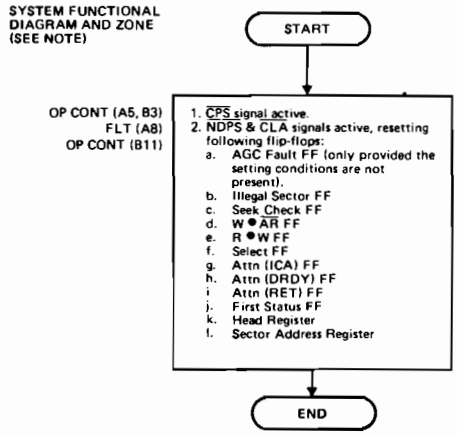
7300-97(1)

Figure A-11. RCL Command Events Flowchart (Sheet 1 of 2)



7300-97(2)

Figure A-11. RCL Command Events Flowchart (Sheet 2 of 2)



NOTE:

ABBREVIATIONS USED TO IDENTIFY SYSTEM FUNCTIONAL DIAGRAMS REPRESENT THE FOLLOWING FIGURES:

OP CONT	OPERATION CONTROL SYSTEM FUNCTIONAL DIAGRAM, FIGURE A-16.
FLT	FAULT DETECTION SYSTEM FUNCTIONAL DIAGRAM, FIGURE A-21.

7300-98

Figure A-12. CPS Command Events Flowchart

PART II — MAINTENANCE

In general, the maintenance information contained in section II of the main manual is applicable to the HP 7906H. The only changes required pertain to the description of the special test equipment (paragraph 2-6) and the preventive maintenance schedule (paragraph 2-7). These changes are described in the following paragraphs.

A-50. SPECIAL TEST EQUIPMENT

The Disc Service Unit (DSU), part no. 13354-60011, described in section II of the main manual is the only item of special test equipment required to service the HP 7906H Disc Drive. However, operation of the DSU with the HP 7906H requires the use of the following additional item of equipment:

- I/O Sector PCA, part no. 07906-60001.

Instructions for installing the DSU in the HP 7906H are provided in Part III of this appendix.

It should be noted that the controller's self-test feature is deactivated when the DSU is installed in the HP 7906H — disc drive faults are identified solely by four light-emitting diodes (LED's) located on disc drive PCA-A4. Interpretation of this readout is described in section IV of the main manual.

A-51. PREVENTIVE MAINTENANCE SCHEDULE

For HP 7906H usage, the following information should be added to table 2-3 in the main manual.

ITEM	ROUTINE
Rear Cover Fan	Inspect for proper operation.

PART III — ALIGNMENT AND ADJUSTMENT

In general, the alignment and adjustment procedures given in section III of the main manual are applicable to the HP 7906H. The only differences pertain to DSU installation (paragraph 3-13) and on-line checkout (paragraph 3-19). These paragraphs should be replaced with the following information.

A-52. DISC SERVICE UNIT INSTALLATION

The Disc Service Unit (DSU) is required to perform the seek time adjustment, actuator assembly radial alignment, index transducer alignment, and head alignment procedures described in section III of the main manual. To install the DSU in the HP 7906H, proceed as follows.

WARNING

The equipment described in these instructions does not contain operator-serviceable parts. To prevent electrical shock, refer the following installation to service-trained personnel.

a. Remove power from the disc drive as outlined in paragraph 5-3 of the main manual. Ensure that the ac power cord is disconnected from the rear frame of the disc drive.

b. Remove the top cover from the disc drive as outlined in paragraph 5-6 of the main manual.

c. Loosen the screw used to secure the PCA retainer to the card cage chassis and remove the retainer.

d. Remove jumper cable, part no. 13365-60006, connected between data PCA-A1 and microprocessor PCA-A2.

e. Disconnect the ribbon cable connector attached to data PCA-A1.

f. Remove data PCA-A1 and microprocessor PCA-A2 from the card cage chassis.

g. Remove read/write preamplifier PCA-A6 from the disc drive as follows:

(1) Remove the PCA retaining screw and lock washer.

(2) Loosen the screw securing the head connector retaining strap to the PCA.

(3) Remove the head connector retaining strap.

(4) Disconnect the three read/write head connectors and servo head connector from the PCA.

CAUTION

Use care when removing the PCA to avoid catching it on the wiring in the surrounding area.

(5) Carefully grasp the upper edge of the PCA and pull it free from the connector on motherboard PCA-A7, then remove the PCA from the disc drive.

h. Install Head Alignment PCA, part no. 12995-60003 or 13354-60010, into the card guides for A1. See figure 3-2 in the main manual. Ensure that the component side of the PCA is facing towards the right-hand side of the card cage chassis, as viewed from the front of the disc drive. Push the PCA into the connectors on motherboard PCA-A7 until the PCA is firmly seated.

i. Insert I/O Sector PCA, part no. 07906-60001, into the card guides for A2. Ensure that the component side of the PCA is facing in the same direction as the component side of the head alignment PCA. Push the PCA firmly into the connectors on motherboard PCA-A7.

j. Hang the DSU Test Module, part no. 12995-60045 or 13354-60005, on the top right-hand edge of the card cage chassis as shown in figure 3-2 of the main manual.

k. Connect 50-pin Jumper Cable, part no. 12995-60011 or 13354-60012, between the 50-pin connector on the DSU test module and J1 on the I/O Sector PCA. (See figure 3-2 in the main manual.)

l. Connect 20-pin Jumper Cable, part no. 12995-60009 or 13354-60013, between the 20-pin connector on the DSU test module and J1 on the head alignment PCA. (See figure 3-2 in the main manual.)

CAUTION

The head alignment preamplifier PCA must be installed whenever a CE head alignment cartridge or CE servo reference cartridge is to be used. This will prevent any accidental damage to the prerecorded surfaces.

m. Insert Head Alignment Preamplifier, part no. 12995-60040, into the A6 connector as shown in figure 3-2 of the main manual. Ensure that the PCA is correctly oriented, then push it firmly into the connector until it is fully seated. The component side of the PCA must face towards the rear of the disc drive. Reconnect the four head connectors disconnected in step g (4).

n. Connect the head cable connector from the head alignment PCA to the head connector on the head alignment preamplifier PCA. This connector is located at the center of the top edge of the PCA. (See figure 3-2 in the main manual.)

A-53. ON-LINE CHECKOUT

A-54. PREPARATION FOR SERVICE

After all of the parameter adjustments described in section III of the main manual have been verified, return the disc drive to a normal operating state as follows:

a. Remove power from the disc drive. Ensure that the ac power cord is disconnected from the rear frame of the disc drive.

b. Remove the DSU from the disc drive. DSU components include the following:

- DSU test module.
- Head alignment preamplifier PCA.
- Head alignment PCA.
- I/O sector PCA.
- 50-pin jumper cable.
- 20-pin jumper cable.

c. Replace the following components in the disc drive by following, in reverse order, the instructions given in steps c through g of paragraph A-52.

- Data PCA-A1
- Microprocessor PCA-A2
- Read/write preamplifier PCA-A6
- Jumper cable, part no. 13365-60006

d. Reconnect the temperature compensation cable connector to track follower PCA-A5.

e. Replace the top cover and restore the disc drive to its normal operating position in its equipment cabinet.

A-55. SELF TEST

The HP 7906H contains a self-test feature that provides a go/no-go check of the controller hardware and also tests certain functions of the disc drive. Self test can be invoked in the following three ways:

- Automatically via a power-on or by setting the disc drive RUN/STOP switch to RUN.
- Using the HP-IB INITIATE SELF-TEST command.
- Manually by activating the START switch on the self-test panel located at the rear of the disc drive, assuming that the controller is in Idle State 2 or 3.

Full details of self-test operation and readout interpretation are provided in Part IV of this appendix.

A-56. DIAGNOSTIC TESTING

If the disc drive is installed in an HP system, run the system diagnostic tests in accordance with the instructions provided in the diagnostic manual. If the disc drive is installed in some other system, an off-line checkout may be performed in accordance with the instructions provided in section IV of the main manual.

PART IV — TROUBLESHOOTING

The troubleshooting information provided in section IV of the main manual requires a number of changes and additions to make it applicable to the HP 7906H. Changes are required for the following:

- Troubleshooting flowcharts (paragraph 4-2)
- Power sources (paragraph 4-3)
- Visual indication of drive status (paragraph 4-4)
- Disc service unit (paragraph 4-5)
- System functional diagrams (paragraph 4-6)
- Wiring connections (paragraph 4-8)
- Power distribution (paragraph 4-9)

Details of the required changes are provided in paragraphs A-57 through A-63.

In addition, the HP 7906H includes a unique self-test feature that provides an additional troubleshooting aid. A full description of self test is contained in paragraphs A-64 through A-69.

WARNING

Troubleshooting instructions are intended for service-trained personnel only. To avoid potentially serious electrical shock, do not proceed further in this part unless qualified to do so.

A-57. TROUBLESHOOTING FLOWCHARTS

The following troubleshooting flowchart is revised for use with the HP 7906H and replaces figure 4-1 in the main manual.

- Figure A-14. HP 7906H Power-Up Troubleshooting Flowchart

The remainder of the troubleshooting flowcharts in the main manual are applicable to the HP 7906H. The revised functional diagrams listed in paragraph A-61 should be used with these flowcharts.

A-58. POWER SOURCES

The following schematic is revised for use with the HP 7906H and replaces figure 4-31 in the main manual.

- Figure A-24. HP 7906H Power Distribution Schematic Diagram

A-59. VISUAL INDICATION OF DRIVE STATUS

The information given in the main manual for visual indication of drive status (table 4-1) is applicable to the HP 7906H, with the exception of the listing of applicable functional diagrams and the data presented for the Unit Select Identification indicator and the IL drive fault indicator. The revised data for these indicators is given in table A-6. All references to figures 4-24, 4-25, 4-28, and 4-29 in the remainder of table 4-1 should be changed to figures A-17, A-18, A-20, and A-21, respectively, in this appendix.

A-60. DISC SERVICE UNIT

The disc service unit (DSU) installation instructions given in section III of the main manual do not apply to the HP 7906H. Refer to Part III of this appendix for DSU installation instructions applicable to the HP 7906H.

A-61. SYSTEM FUNCTIONAL DIAGRAMS

The following diagrams have been revised for use with the HP 7906H and replace figures 4-23 through 4-29 in the main manual.

- Figure A-16. HP 7906H Operation Control System Functional Diagram
- Figure A-17. HP 7906H Spindle Rotating System Functional Diagram
- Figure A-18. HP 7906H Head Positioning System Functional Diagram
- Figure A-19. HP 7906H Sector Sensing System Functional Diagram
- Figure A-20. HP 7906H Read/Write System Functional Diagram
- Figure A-21. HP 7906H Fault Detection System Functional Diagram
- Figure A-22. Servo Surfaces Format and Waveforms

A functional diagram of the integrated controller is provided in figure A-15.

In addition, the following table has been revised for use with the HP 7906H and replaces table 4-3 in the main manual:

- Table A-7. HP 7906H Mnemonic Signal Sources

A-62. WIRING CONNECTIONS

The following wiring diagram is revised for use with the HP 7906H and replaces mainframe assembly wiring diagram (figure 4-30) in the main manual:

- Figure A-23. HP 7906H Mainframe Assembly Wiring Diagram

A-63. POWER DISTRIBUTION

The following schematic is revised for use with the HP 7906H and replaces figure 4-31 in the main manual:

- Figure A-24. HP 7906H Power Distribution Schematic Diagram

A-64. SELF TEST

A-65. INTRODUCTION

In addition to the troubleshooting aids described in the main manual, the HP 7906H Disc Drive also includes a self-test capability that provides a) a go/no-go check of the controller circuitry and b) an additional servicing aid for troubleshooting the disc drive. Self test thoroughly tests controller PCA's A1 and A2 to a functional block level (I/O logic, microprocessor, formatter/separator, etc.) and is intended as an aid to board-level repair of the controller. Certain functions of the disc drive are also tested on a go/no-go basis. The self-test feature includes the following components:

- Test firmware in ROM.
- A test panel with operating controls and indicators, located on the rear cover of the disc drive (see figure A-13).
- A SELF TEST FAILED indicator on the operator panel of the disc drive.

The self-test routine is divided into 13 separate tests with two additional tests reserved for equipment adjustments. Most of the tests are subdivided into sections (up to 15). The tests are executed in a "bottom up" progression, first testing the controller microprocessor, extending to the remainder of the controller logic, and finally testing the functioning of the disc drive (with the exception of write). The tests are executed in reverse order, from test 17 (octal) to test 3. The first test turns on all of the rear panel TEST RESULT LED's (octal 17). If self-test passes, all of the LED's are turned off.

Self test can be invoked in the following three ways:

- Automatically via a power-on or by setting the disc drive RUN/STOP switch to RUN.
- Using the secondary HP-IB INITIATE SELF-TEST command.
- Manually by activating the START switch on the rear self-test panel (assuming that the controller is in Idle State 2 or 3).

Note: The LED in the upper left-hand corner of the disc drive Unit Select Indicator is unlighted when the controller is in Idle State 2, Idle State 3, or when self test is running. When the LED is lighted, the controller will not respond to the test START switch.

A-66. MODES OF OPERATION

The OP/SERVICE switch on the self-test panel (figure A-13) places the controller self-test feature in either an operating mode or a service mode. The switch must be in the OP (operating) position for the disc drive to operate normally. In the SERVICE position, the self-test circuit will loop continuously in self-test until a failure occurs. Details of the two modes of operation are provided in the following paragraphs. Refer to table A-8 for a summary of self-test control operation and to table A-9 for a detailed description of the tests.

A-67. OPERATING MODE. Self test will be started at power turn on and will run through the self-test sequence until a test requiring a "drive ready" state is incurred. A flashing octal 10 will then be seen on the TEST RESULT LED's. When the disc drive RUN/STOP switch is set to RUN, the sequence described above will be repeated. When the spindle comes up to speed, the heads load, and the internal time delays have lapsed, "drive ready" will occur, and the self-test sequence will complete. A similar sequence can be initiated by HP-IB command, or by the START switch on the self-test panel. At the beginning of self test, the TEST RESULT LED's, the S.T. FAILED LED, and the operator panel SELF TEST FAILED indicator will flash briefly, indicating controller activity and testing of the LED's. If a test fails, the test number (octal) is displayed continuously on the TEST RESULT LED's. A test failure summary, including probable failure sources is provided in table A-10. The S.T. FAILED LED and the SELF TEST FAILED indicator are also lit continuously if a test fails. If no failures are detected, all self-test readout remains off.

If an error occurs on tests 17 through 15, the controller "hangs" (HP-IB command sequences are not recognized and the self-test panel switches are inoperative). If an error occurs in tests 14 through 3, or if there are no errors, self test exits to the controller operating firmware where the HP-IB sequences are recognized. The secondary sequence RETURN SELF-TEST RESULT should be executed before any disc drive commands are attempted in order to learn of any self-test failures.

All other disc drive indicators and controls, including the DRIVE FAULT and DRIVE READY indicators, and the RUN/STOP switch are not affected by self test. Drive ready is not inhibited by a self-test failure.

A-68. SERVICE MODE. In the service mode, the controller loops continuously on the test number set on the TEST NUMBER switches until the first error is detected. If the TEST NUMBER switches are set to zero, the controller loops on the entire self-test program.

If the controller is looping on a single test in the service mode and an error is detected, the section number of the failure is continuously displayed on the test panel TEST RESULT LED's. If the controller is looping on all of self test (TEST NUMBER switches set to zero), the test failed number is displayed continuously. Whenever a test is successfully completed when in the service mode, the TEST RESULT LED's flash the appropriate test number to indicate which test the controller is executing. When looping on all of self test, the TEST RESULT LED's continually count down through the test numbers.

A-69. SELF-TEST EXAMPLE

The following example is provided to illustrate the manner in which a circuit malfunction — an intermittent fault in the formatter/separator data path — is isolated by means of self test. First, it should be noted that intermittent faults may not cause a self-test fail at power turn on, especially if the problem is temperature related. Therefore, if a drive fault is suspected, it is recommended that a continuous loop on self test be initiated. This is achieved by a) setting the OP/SERVICE switch to the SERVICE position, b) setting all of the TEST NUMBER switches to zero, and c) activating the START switch. In the event that the system is not in Idle State 2 or 3, Idle State 2 can be entered via the END command. The controller will now loop on self test, with the TEST RESULT LED's counting down the test numbers until an error is detected. The TEST RESULT LED's will then continuously display the errant test number and the self-test failed indicators will be lit. For the sample malfunction, an octal 12 will be displayed, indicating a formatter/separator loopback test failure. Details of this test are given in table A-9. By setting the TEST NUMBER switches to 12 and again activating the START switch, the controller can now be made to loop on the formatter/separator test until a failure again occurs. This time, when a failure is detected, self test will halt with the TEST RESULT LED's indicating the sector number of the failure — in this case an octal 15. From table A-10, it can be determined that the data sent through the formatter/separator is bad and the probable source of the malfunction is data PCA-A1.

It is possible to continuously loop on a section failure by a) selecting the service mode, b) setting the TEST NUMBER switches to the failed section number, and c) holding the START switch in the on position. This allows the failed test to be repeated after it is detected — a useful feature when troubleshooting the circuitry with an oscilloscope.

Table A-6. Visual Indication of Drive Status — Changes for HP 7906H

INDICATOR/ INDICATION	ACTIVE STATE		FUNCTIONAL DIAGRAM
	LOGIC EQUATION	CIRCUIT DESCRIPTION	
IL drive fault indication (green LED)	None	LED is lit when any one of the following conditions is met: a. 25 Vac, +36 Vdc, +12 Vdc, +5 Vdc, −12 Vdc, −24 Vdc, or −36 Vdc power source below tolerance or missing (blown fuse). b. PCA-A1, A2, A3, A4, A5, or A6 improperly seated. c. PCA-A8 or A19 has improper wiring connection. d. Operator Control Panel assembly disconnected. e. Track formatter PCA and PCA-A2 both present in drive.	Fault Detection System, figure A-21
Unit Select Identification Indicator	SL	Indicator is off when any one of the following conditions is met: a. Self test is running. b. Controller is in Idle State 2 or Idle State 3.	Operation Control System, figure A-16

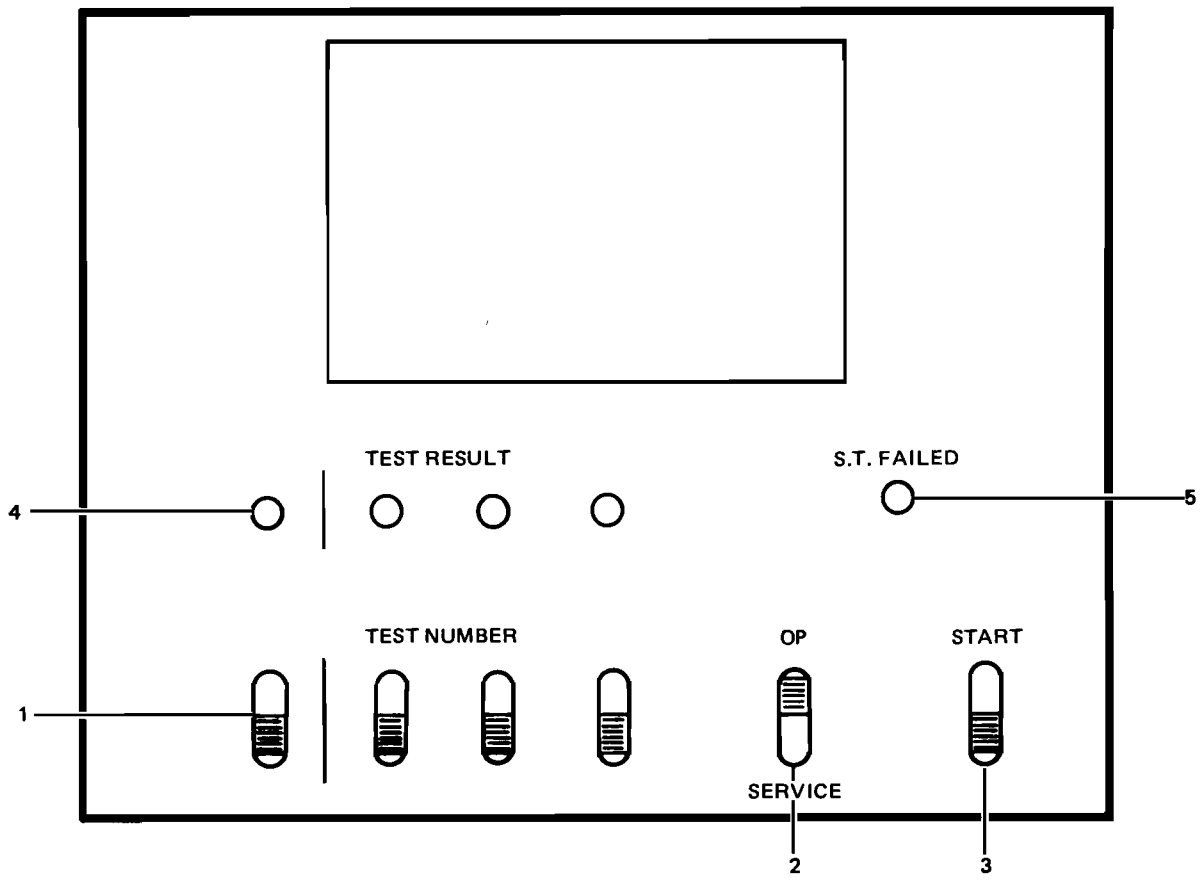
Table A-7. HP 7906H Mnemonic Signal Sources

MNEMONIC	SIGNAL	SOURCE	
		FIG.	ZONE
$\overline{\text{ACRY}}$	Access Ready	A-18	A3
ACW	AC Write Current	A-20	C11
ADBI 0-7	Data Input Bus	A-15	B1
ADBO 0-7	Data Output Bus	A-15	B4
AGC	Automatic Gain Control	A-18	D9
$\overline{\text{AGCF}}$	AGC Fault	A-18	B10
$\overline{\text{ALU CLK}}$	alu clock	A-15	B2
$\overline{\text{ALU IMM}}$	ALU Immediate	A-15	B2
ANYER	Any Error	A-15	C10
ATN	Attention	A-15	B12
ATTN	Attention	A-16	B8
$\overline{\text{BB}}$	Brushes Back	A-17	D10
CARRY	Carry Bit	A-15	C3
$\overline{\text{CBUSL}}$	Control Bus, Lower Byte	A-15	A4
$\overline{\text{CBUSU}}$	Control Bus, Upper Byte	A-15	A4
CC	Current Command	A-18	A12
CIP	Cartridge in Place	A-17	A3
$\overline{\text{CLA}}$	Clear Attention	A-16	B3
CLK	Clock	A-18	B8
$\overline{\text{CLO}}$	Clear Offset	A-18	C8
CPS	Controller Preset	A-16	A5
CRB	Carriage Back	A-18	B15
CYL	Cylinder	A-18	A9
DAV	Data Valid	A-15	B12
DCW	DC Write Current	A-20	C11
DDB	Differential Data Bus	A-20	A5
$\overline{\text{DDB}}$	Differential Data Bus	A-20	A5
DGC	Data AGC	A-20	B12
DIFF	Difference	A-18	B9
DIO 1-8	Data Input/Output	A-15	C12
DL	Door Locked	A-17	A3
$\overline{\text{DPS}}$	Destructive Preset	A-21	B7
DRDY	Drive Ready	A-18	B3
$\overline{\text{DRDYL}}$	Drive Ready Lamp	A-18	A3
$\overline{\text{DTYPE}}$	Drive Type	A-15	B4
DWA	Decrease Write Current (13 mA)	A-20	D9
$\overline{\text{DWA}}$	Decrease Write Current (13 mA)	A-20	D9
DWB	Decrease Write Current (6.5 mA)	A-20	D9
$\overline{\text{DWB}}$	Decrease Write Current (6.5 mA)	A-20	D9
$\overline{\text{DWC}}$	Decrease Write Current (3.25 mA)	A-20	D9
ECS	Energize Carriage Solenoid	A-18	B5
ENA	Encoder Phase A	A-17	C8
ENB	Encoder Phase B	A-17	C7
EOI	End or Identify	A-15	B12
EOT	End of Transmission	A-15	C8
EOW	End of Word	A-15	D9
$\overline{\text{ERE}}$	External ROM Enable	A-15	A5
$\overline{\text{EXADBOE}}$	Ext. ALU Output Data Bus Enable	A-15	A3
$\overline{\text{EX CLR}}$	External Clear	A-15	D2
$\overline{\text{EX RAREN}}$	External RAR Enable	A-15	A5
$\overline{\text{FLT}}$	Fault	A-21	A15
FLTL	Fault Lamp	A-21	A15
FWD	Forward	A-18	B11
$\overline{\text{HD REG}}$	Head Register	A-15	A3
$\overline{\text{HS0}}$	Head 0 Selected	A-20	B7
$\overline{\text{HS1}}$	Head 1 Selected	A-20	B7
$\overline{\text{HS2}}$	Head 2 Selected	A-20	B7
$\overline{\text{HLDD}}$	Heads Loaded	A-18	A4
ICA	Illegal Cylinder	A-18	A8
$\overline{\text{IE}}$	Input Enable	A-15	B2
IFC	Interface Clear	A-15	B12
$\overline{\text{IFIFO}}$	Input from FIFO	A-15	B3
$\overline{\text{ILF}}$	Interlock Fault	A-21	B5
$\overline{\text{INPHI}}$	Input from PHI Chip	A-15	B3
INTCW	Internal Control Word	A-15	A3
ISTSW	Initiate Self Test Switch	A-15	A11
$\overline{\text{LD}}$	Lock Door	A-17	C3
$\overline{\text{LED 0-3}}$	Light Self-Test LED	A-15	A10
LIP	Lower Index Pulse	A-19	B3
LSB	Least Significant Bit	A-18	A9
M−1	Match Minus 1	A-18	A10
MH	Multiple Heads	A-21	D0
MHS	Multiple Heads Selected	A-20	C11
MSB	Most Significant Bit	A-15	C3
NDAC	Data Accepted	A-15	B11
$\overline{\text{NDPS}}$	Non-Destructive Preset	A-21	A8
NLD	Negative Level Detector	A-19	B2
NRFD	Ready for Data	A-15	B11
NTORE	Not Output Register Empty	A-15	C10
OE	Output Enable	A-15	B2
$\overline{\text{OFIFO}}$	Output to FIFO	A-15	A3
$\overline{\text{OPHI}}$	Output to PHI	A-15	A3
O/S	offset	A-18	D9
OVRFLO	Overflow	A-15	C3
OVRUN	Overrun	A-15	D9
$\overline{\text{PHEAD}}$	Physical Head	A-15	B4
PHICW	PHI Control Word	A-15	A3
PON	Power On Preset	A-21	D6
POR	Power On Reset	A-21	B7
POS	position	A-18	C9
PRT	Protect	A-20	C4
PRTL	Protect Lower Disc	A-20	C2
PRTU	Protect Upper Disc	A-20	C2
$\overline{\text{PSECT}}$	Physical Sector	A-15	B3
R	Reset	- - -	- - -
RAR 0-11	ROM Address Register	A-15	C4
$\overline{\text{RBR}}$	Run Brushes	A-17	C6
RC	Read Clock	A-15	D10
RCL	Recalibrate	A-16	A3
RD	Read Data	A-15	D10
RDA	Read Data A	A-20	B11
RDB	Read Data B	A-20	B11
READ	Read	A-16	A3
REF	Reference	A-19	B3
REN	Remote Enable	A-15	B12
$\overline{\text{RES}}$	Reset	A-15	D2
RET	Retract	A-21	A11
REV	Reverse	A-18	B11
$\overline{\text{RH}}$	Restore Home	A18	B2
ROM $\overline{\text{0-23}}$	ROM Output Memory	A-15	A5

Table A-7. HP 7906H Mnemonic Signal Sources (Continued)

MNEMONIC	SIGNAL	SOURCE	
		FIG.	ZONE
ROR 0-23	ROM Output Register	A-15	A2
$\overline{RS}$	Run Spindle	A-17	B5
S	Set	- - -	- - -
$\overline{SB}$	Servo Balanced	A-18	B6
SC	Sector Compare	A-19	C8
SCL	Sector Clock	A-19	B3
$\overline{SCTRG}$	Sector Register	A-15	A3
$\overline{SEN}$	Servo Enable	A-18	B5
SERSW	Service Switch	A-15	A11
SK	Seek	A-16	A3
$\overline{SKC}$	Seek Complete	A-18	A4
$\overline{SKH}$	Seek Home	A-18	C4
$\overline{SKI}$	Seek Inhibit	A-18	C6
SL	This Drive Selected by Controller	A-16	B3
SOF	Set Offset	A-16	A3
$\overline{SPD}$	Spindle Speed Down	A-17	C8
$\overline{SPU}$	Spindle Speed Up	A-17	D9
SRQ	Service Request	A-15	B11
$\overline{STAT\ 2}$	Status Two	A-15	B5
$\overline{STINP}$	Self-Test Input	A-15	B3
$\overline{STFAIL}$	Self-Test Fail	A-15	A10
$\overline{STOUT}$	Self-Test Out	A-15	A3
STP	Set Timeout Period	A-17	A11

MNEMONIC	SIGNAL	SOURCE	
		FIG.	ZONE
SW	Switch	- - -	- - -
SYNC 1	Sync One	A-15	D10
$\overline{TAC}$	Tachometer	A-18	B12
TCD	Track Centered	A-18	B7
TEMP	Temperature	- - -	- - -
$\overline{TGBUS}$	Tag Bus	A-15	A4
TNSW 0-3	Test Number Switches	A-15	A11
TO	Timeout	A-21	A15
TTO	Temperature Timeout	A-18	D12
UDS	Upper Disc Selected	A-20	B4
$\overline{UIX}$	Upper Index	A-19	A2
URG	Unselected Read Gate	A-20	D4
$\overline{USS}$	Upper Surface Selected	A-20	B4
UWG	Unselected Write Gate	A-20	D4
VRFLG	Verify Flag	A-15	B8
WC	Write Clock	A-15	D10
WDA	Write Data A	A-20	C7
WDB	Write Data B	A-20	C7
WEN	Write Enable	A-18	C7
WORD 8	Eighth Word	A-15	D9
WRITE	Write	A-16	A3
ZCR	Zero Crossing	A-18	D11
ZERO	Zero Flag	A-15	C3



1. TEST NUMBER switches	—	Select desired self-test test number in octal when OP/SERVICE switch (2) is in SERVICE position.
2. OP/SERVICE switch	—	Selects self-test mode of operation. When OP position is selected, controller executes self-test routine at power turn-on, on HP-IB command, or when START switch (3) is activated. Switch must be in OP position for disc drive to operate normally. When SERVICE position is selected, controller will loop continuously in self test until a fault is detected.
3. START switch	—	Initiates self-test operation. Switch is spring-loaded in off position.
4. TEST RESULT LED's	—	Provides a readout of self-test operation. At beginning of self-test routine, LED's will flash briefly, indicating controller activity and testing of LED's. If a test fails, the LED's indicate the number of the failed test in octal. If self test passes, the LED's remain unlit.
5. S.T. FAILED LED	—	Indicates a self-test (S.T.) failure. Result is duplicated by SELF TEST FAILED indicator on disc drive operator panel.

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Figure A-13. Self-Test Panel Controls and Indicators

Table A-8. Self-Test Control Operation

SWITCH SETTING	SELF-TEST ACTION	LED DISPLAY
OP/SERVICE switch: OP TEST NUMBER switches: Any setting START switch: Momentary operation	Tries to execute all tests once. If error in test 17, 16, or 15, controller hangs.[1] If error in tests 14 through 1, exits immediately to controller firmware.	All LED's flash momentarily. If there is an error, TEST RESULT LED's display failed test number. S.T. FAILED LED is also lit. If there is no error, all LED's go off.
OP/SERVICE switch: OP TEST NUMBER switches: Any setting START switch: Held in on position[2]	Loops on entire self test until START switch is released. Exits test only when switch is released. Executes tests up to first error and then restarts self test.	All LED's flash momentarily each pass through self test. Error is not displayed until START switch is released.
OP/SERVICE switch: SERVICE[3] TEST NUMBER switches: n > 2 START switch Momentary operation	Loops on test n until first error is detected. Halts (JMP*) on error until START switch is set again (except for error in test 17, where controller hangs).	TEST RESULT LED's flash test n each time that test is completed. On error in test n, LED's continuously display section number of failure. S.T. FAILED LED is also lit.
OP/SERVICE switch: SERVICE[3] TEST NUMBER switches: 2 START switch: Momentary operation	Generates PHI tuning procedure.	Flashes 2 on TEST RESULT LED's.
OP/SERVICE switch: SERVICE[3] TEST NUMBER switches: 1 START switch: Momentary operation	Causes disc drive to do random seeks.	Flashes 1 on TEST RESULT LED's.
OP/SERVICE switch: SERVICE[3] TEST NUMBER switches: 0 START switch: Momentary operation	Loops on entire self test until error is detected. Halts on error until START switch is set again (except for errors in test 17, where controller hangs).	TEST RESULT LED's flash test number each time test is completed. On error in a test, LED's continuously display failed test number. S.T. FAILED LED is also lit.

Notes:

1. An error in test 17, 16, or 15 will cause the controller to hang (i.e., not respond to HP-IB commands). The only way to reset the controller after a test 17 failure is to reset the disc drive, either by cycling the disc drive power switch or the RUN/STOP switch. In tests 16 and 15, activating the START switch also restarts self test.
2. In the service mode, with the START switch held in the on position, the controller will loop on the appropriate test (or entire self test) until the first error is detected, when it will start over again. The START switch inhibits error halts except in test 17.
3. Always return the OP/SERVICE switch to the OP position to use the disc drive. Otherwise, the controller will not respond to HP-IB commands.

Table A-9. Self-Test Function Test Description

TEST NO.	TEST	DESCRIPTION
17	Microprocessor alive	This is the first test executed. It tests the heart of the microprocessor — the sequencers and the branching logic. Some ALU faults are also trapped by test 17. If a fault is detected in test 17, the controller hangs up in a JMP* loop. The only way to exit this loop is to either cycle the POWER switch or the disc drive RUN/STOP switch. This action resets the microprocessor and causes it to start self test over. There are no distinct sections within this test. On error, the TEST RESULT LED's display an octal 17 both in the OP (operating) and SERVICE positions of the OP/SERVICE switch.
16	RALU, Flags	This test checks the 2901 registers and arithmetic/logic units (RALU's), and the program status register flags. Like test 17, if a failure is detected in test 16, the controller hangs. Unlike test 17, the "hang" loop can be exited by activating the START switch. On error, the TEST RESULT LED's display an octal 16 continuously whether in the OP or SERVICE mode (unless the START switch is held in the on position).
15	PHI	This test checks the PHI in its offline mode. The following items are tested: • PHI identity sequence • PHI interrupt flags • Inbound and outbound FIFO data test • Data tag bits (EOI and ATN) On error, test 15 outputs an octal 15 on the TEST RESULT LED's and hangs the controller, whether in the OP or SERVICE mode. The hang condition can be exited by activating the START switch.
14	FIFO's	This test checks the 9403 FIFO's in the controller. The following possible faults are tested: • NTORE stuck at 0 or 1 faults • Data errors within each FIFO At this point, the microprocessor and PHI are assumed good and errors can be reliably reported via the HP-IB. This is the first test that a) reports section numbers, and b) exits to the controller operating firmware after an error is detected. Even if test 14 fails, the controller attempts to execute commands and secondaries. Any operation involving data transfer through the FIFO's will probably fail.
13	PHI/FIFO handshake	This test checks the PHI/FIFO handshake logic, sector word counters, read full/write full flip-flop, and EOT detector. The test transfers data from the FIFO, through the PHI, and back to the FIFO. The PHI is in its offline loopback mode.
12	Formatter/ Separator Loopback Test	This test checks the formatter/separator, serial operation of the FIFO's (both in and out), the overrun detector, and the EOW/8th word counter. The test is divided into three subtests: a. The formatter/separator itself is first tested by passing a known data pattern from the FIFO through the formatter/separator in its loopback mode and back into the FIFO. The received data pattern is then compared with the original. b. The overrun detector is then checked by clearing the FIFO and enabling the formatter/separator. An overrun will result when the formatter/separator tries to pull data from an empty FIFO. c. Finally, the 8th word counter is tested by passing 16 bytes through the formatter/separator, counting EOW's, and seeing that the 8th word flag is set only after the 16th byte (8th word) is transferred.

Table A-9. Self-Test Function Test Description (Continued)

TEST NO.	TEST	DESCRIPTION
11	CRC/Data Path Switch	This test checks the CRC generator/checker (9401) and the data path switch (CRC multiplexer). It checks that the CRC chip generates the proper CRC pattern and properly detects CRC errors. A known pattern is loaded into the FIFO, sent through the CRC chip, and returned through the formatter/separator to the FIFO. The generated CRC pattern is then switched into the data path and loaded into the FIFO, where it is checked against the expected results. The ANYER (CRC error) flag is also checked as data is shifted through the CRC chip.
10	Drive Status	This test looks at the drive status register and reports an error if the disc drive is busy with drive ready set or if the drive is faulted. Self test will loop on Tests 17 through 10 until Drive Ready becomes active, flashing octal 10 every time test 10 is executed. When Drive Ready becomes active, the remaining tests will be executed. If Drive Ready does not become true before 92 seconds have elapsed, the S.T. FAILED LED will light and the TEST RESULT LED's will display octal 10. Note: If the disc drive is powered on and the RUN/STOP switch is not in the RUN position or the disc pack is not in place, the resulting absence of Drive Ready will cause the S.T. FAILED indicator to come on approximately 92 seconds after power on is initiated. If this occurs, proper preparation of the disc drive for operation (disc pack installed and RUN/STOP switch set to RUN) will allow the self-test routine to start again.
7	Head/Sector Logic	This test checks much of the I/O sector logic of the controller. The head register is first tested for stuck-at faults. Disallowing drive types (set via the drive type jumpers) will also be reported as an error. The index counters, sector counters, sector comparators, sector registers, and sector compare flip-flop are also tested here. This section of the test is executed twice, once with head 1 addressed and once with head 2 addressed. This tests both sets of sector counters if the drive type is set to a 7906.
6	Recalibrate Test	This test issues a RECALIBRATE command to the drive, waits for drive attention (with a time limit of 1275 milliseconds), and checks the resulting drive status. If the recalibrate does not complete in time, a timeout error is reported. If an attention is received in time, the drive status is then checked; bad drive status is reported to the TEST RESULT LED's.
5	Seek Test	This test exercises the seek function of the disc drive by issuing a seek to the maximum cylinder address. If the seek completes within 100 milliseconds, the controller issues a seek to the maximum cylinder address + 1, forcing a seek check. If a seek check does in fact occur, the controller then issues a seek to cylinder 0, again with a 100 millisecond timeout. No address verification is done in this test, but if the drive does not end up on cylinder 0, the verify test which follows will fail.
4	Set Offset Test	The purpose of this test is to see if a set offset drive order to the disc drive will complete. The maximum positive offset (+63), maximum negative offset (−63), and zero offset are sent to the disc drive in that order. If attention is not received within 10 milliseconds, a timeout error is reported. This test does not verify that the heads are actually offset the proper direction and magnitude.
3	Verify Cylinder 0	This test attempts to verify cylinder 0 with no head offset. The purpose of this test is to check the read data path from the heads, through the preamp, and to the data separator. This test also verifies that the heads are on cylinder 0 by checking the address field in a sector. The entire cylinder is verified in cylinder mode with track sparing enabled. If a data error is found in any sector, one retry is attempted. If the retry also results in a data error, the test is aborted, and the failure is reported to the test panel LED's. No limit is placed on the number of retries allowed for the entire cylinder. Test 3 can fail due to several non-hardware related problems. Bad media, a track flagged defective but not properly spared, or a spare track in cylinder 0 will cause a test 3 failure. However, the drive can still be used after a test 3 failure.

Table A-9. Self-Test Function Test Description (Continued)

TEST NO.	TEST	DESCRIPTION
2	PHI Tuning Procedure	This test is not a legitimate part of the self-test routine. It is provided for diagnostic and service purposes. When selected, self test loops through the program steps described in the PHI data sheet. The HSE waveform can be measured and the delay stabilization trimmer adjusted.
1	Drive Random Seek Procedure	This test is not a legitimate part of the self-test routine. It is provided for diagnostic and service purposes. When selected, self test will generate seek commands using a pseudo-random number generator.

Table A-10. Test Failure Summary

TEST NO.	SECTION NO.	TEST RESULT LED'S	TEST/SECTION FAILURE	PROBABLE SOURCE
17	—	● ● ● ●	MICROPROCESSOR	PCA-A2*, disc drive
16	—	● ● ● ○	RALU, FLAGS	PCA-A2
15	—	● ● ○ ●	PHI	PCA-A1*, PCA-A2
14		● ● ○ ○	FIFO's	PCA-A1*, PCA-A2
	17	● ● ● ●	NTORE stuck-at-0.	PCA-A1*, PCA-A2
	16	● ● ● ○	NTORE stuck-at-1.	PCA-A1*, PCA-A2
	15	● ● ○ ●	Upper FIFO data error.	PCA-A1
	14	● ● ○ ○	Lower FIFO data error.	PCA-A1
13		● ○ ● ●	PHI/FIFO HANDSHAKE	PCA-A1
	17	● ● ● ●	EOT flag stuck.	PCA-A1
	16	● ● ● ○	Write-to-PHI not complete.	PCA-A1
	15	● ● ○ ●	Sector word counter does not handshake.	PCA-A1
	14	● ● ○ ○	Read full/write full does not override EOS (read from PHI handshake does not complete).	PCA-A1
	13	● ○ ● ●	EOT not detected.	PCA-A1
	12	● ○ ● ○	Lower NYBBLE data bad.	PCA-A1
	11	● ○ ○ ●	Upper NYBBLE data bad.	PCA-A1
12		● ○ ● ○	FORMATTER/SEPARATOR	Data PCA-A1*, PCA-A2
	17	● ● ● ●	EOW stuck true.	PCA-A1
	16	● ● ● ○	No EOW in data test.	PCA-A1
	15	● ● ○ ●	Bad data from formatter/ separator.	PCA-A1
	14	● ● ○ ○	Overrun stuck true.	PCA-A1*, PCA-A2
	13	● ○ ● ●	Undetected overrun.	PCA-A1*, PCA-A2
	12	● ○ ● ○	No EOW in 8th word test.	PCA-A1
	11	● ○ ○ ●	8th word flag stuck true.	PCA-A1*, PCA-A2
	10	● ○ ○ ○	8th word flag stuck false.	PCA-A1*, PCA-A2
11		● ○ ○ ●	CRC/DATA PATH SWITCH	PCA-A1*, PCA-A2
	17	● ● ● ●	No EOW in test.	PCA-A1
	16	● ● ● ○	CRC error stuck false.	PCA-A1*, PCA-A2
	15	● ● ○ ●	CRC error stuck true.	PCA-A1*, PCA-A2
	14	● ● ○ ○	Bad generated CRC pattern.	PCA-A1
10		● ○ ○ ○	DRIVE STATUS	Drive electronics*, PCA-A2
	17	● ● ● ●	Drive fault.	Drive electronics
	16	● ● ● ○	Drive busy while ready.	Drive electronics, PCA-A2
	10	● ○ ○ ○▲	Drive not ready.	Drive electronics

○ = LED "OFF" ● = LED "ON" ▲Display flashing * Most probable source

Table A-10. Test Failure Summary (Continued)

TEST NO.	SECTION NO.	TEST RESULT LED'S	TEST/SECTION FAILURE	PROBABLE SOURCE
7		○ ● ● ●	HEAD/SECTOR LOGIC	PCA-A2*, drive electronics
	17	● ● ● ●	Illegal drive type.	PCA-A2
	16	● ● ● ○	Bad head register.	PCA-A2
	15	● ● ○ ●	Sector count too large (head 1).	PCA-A2
	14	● ● ○ ○	Sector count not incrementing (head 1).	PCA-A2*, drive electronics
	13	● ○ ● ●	Sector count not properly cleared (head 1).	PCA-A2*, drive electronics
	12	● ○ ● ○	Sector compare stuck-at-1 (head 1).	PCA-A2
	11	● ○ ○ ●	Sector compare stuck-at-0 (head 1).	PCA-A2
	10	● ○ ○ ○	Sector compare set more than once per revolution (head 1).	PCA-A2
	7	○ ● ● ●	Sector count too large (head 2).	PCA-A2
	6	○ ● ● ○	Sector count not incrementing (head 2).	PCA-A2
	5	○ ● ○ ●	Sector count not properly cleared head 2).	PCA-A2*, drive electronics
	4	○ ● ○ ○	Sector compare stuck-at-1 (head 2).	PCA-A2
	3	○ ○ ● ●	Sector compare stuck-at-0 (head 2).	PCA-A2
	2	○ ○ ● ○	Sector compare set more than once per revolution (head 2).	PCA-A2
6		○ ● ● ○	RECALIBRATE	Drive electronics*, PCA-A2
	17	● ● ● ●	Recalibrate timeout error.	Drive electronics*, PCA-A2
	16	● ● ● ○	Attention stuck-at-1.	Drive electronics*, PCA-A2
	4	○ ● ○ ○	Drive busy and attention set.	Drive electronics*, PCA-A2
	3	○ ○ ● ●	Drive not ready.	Drive electronics
	2	○ ○ ● ○	Seek check.	Drive electronics*, PCA-A2
	1	○ ○ ○ ●	Drive fault.	Drive electronics
5		○ ● ○ ●	SEEK	Drive electronics*, PCA-A2
	17	● ● ● ●	Seek timeout error.	Disc drive*, PCA-A2
	16	● ● ● ○	Attention stuck-at-1.	Drive electronics
	15	● ● ○ ●	Undetected seek check.	Drive electronics*, PCA-A2
	4	○ ● ○ ○	Drive busy and attention set.	Drive Electronics
	3	○ ○ ● ●	Drive not ready.	Drive electronics
	2	○ ○ ● ○	Seek check.	Drive electronics*, PCA-A2
	1	○ ○ ○ ●	Drive fault.	Drive electronics
4		○ ● ○ ○	SET OFFSET	Drive electronics*, PCA-A2
	17	● ● ● ●	Set offset timeout error.	Drive electronics*, PCA-A2
	16	● ● ● ○	Attention stuck-at-1.	Drive electronics
	4	○ ● ○ ○	Drive busy and attention set.	Drive electronics
	3	○ ○ ● ●	Drive not ready.	Drive electronics
	2	○ ○ ● ○	Seek check.	Drive electronics
	1	○ ○ ○ ●	Drive fault.	Drive electronics

○ = LED "OFF" ● = LED "ON" * Most probable source

Table A-10. Test Failure Summary (Continued)

TEST NO.	SECTION NO.	TEST RESULT LED'S	TEST/SECTION FAILURE	PROBABLE SOURCE
3		○ ○ ● ●	VERIFY CYLINDER ZERO	Drive electronics* disc cartridge, PCA-A1
	17	● ● ● ●	Drive status error.	Drive electronics
	16	● ● ● ○	Address miscompare.	Drive electronics
	15	● ● ○ ●	Defective track error.	Disc cartridge
	14	● ● ○ ○	Direct access to spare track.	Disc cartridge
	13	● ○ ● ●	Head 10 data error.	Disc cartridge*, PCA-A6, PCA-A5
	12	● ○ ● ○	Head 9 data error.	Same as section 13
	11	● ○ ○ ●	Head 8 data error.	Same as section 13
	10	● ○ ○ ○	Head 7 data error.	Same as section 13
	7	○ ● ● ●	Head 6 data error.	Same as section 13
	6	○ ● ● ○	Head 5 data error.	Same as section 13
	5	○ ● ○ ●	Head 4 data error.	Same as section 13
	4	○ ● ○ ○	Head 3 data error.	Same as section 13
	3	○ ○ ● ●	Head 2 data error.	Same as section 13
	2	○ ○ ● ○	Head 1 data error.	Same as section 13
	1	○ ○ ○ ●	Head 0 data error.	PCA-A1*, disc cartridge, PCA-A6, PCA-A5

○ = LED "OFF" ● = LED "ON" * Most probable source

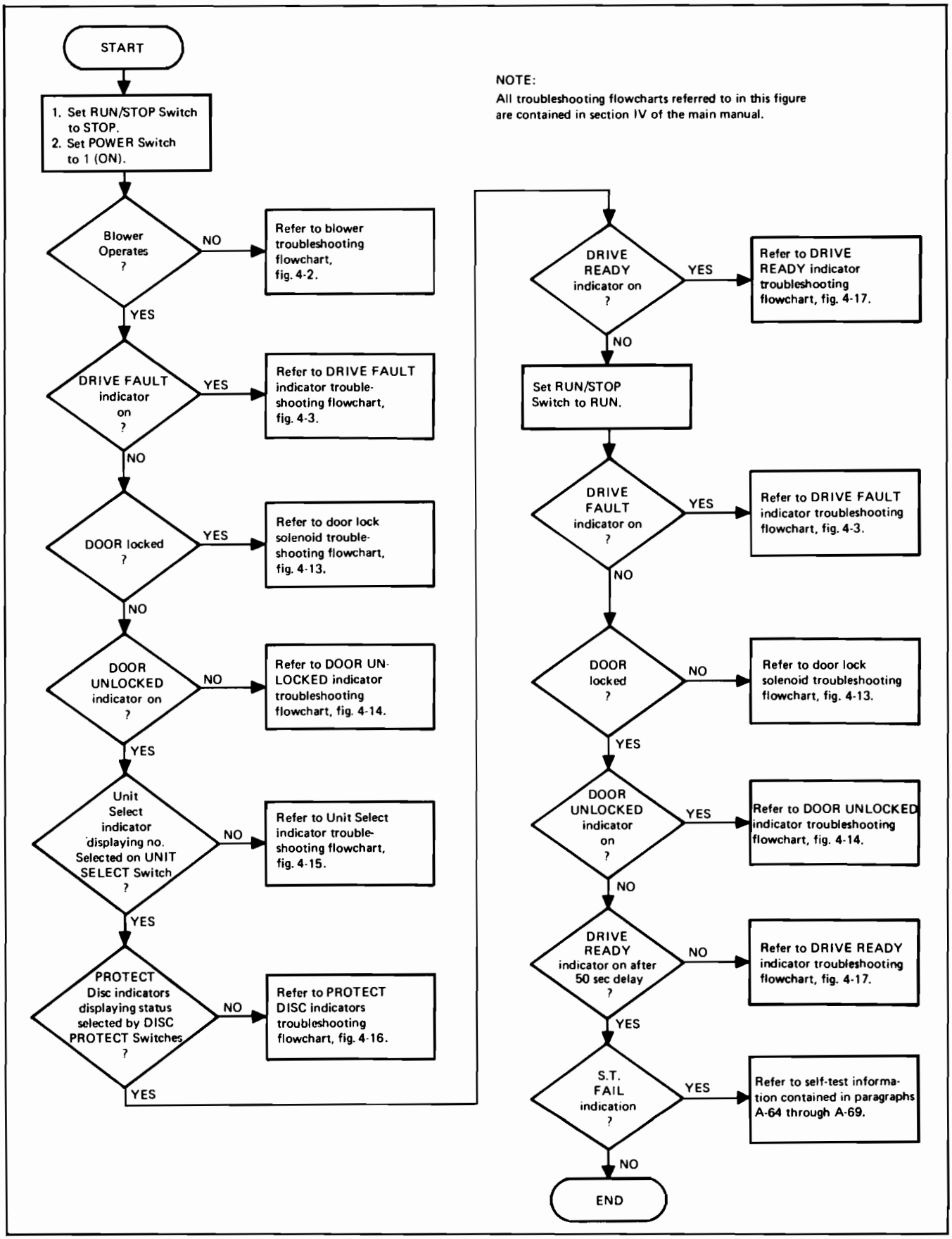

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Figure A-14. Power-Up Troubleshooting Flowchart

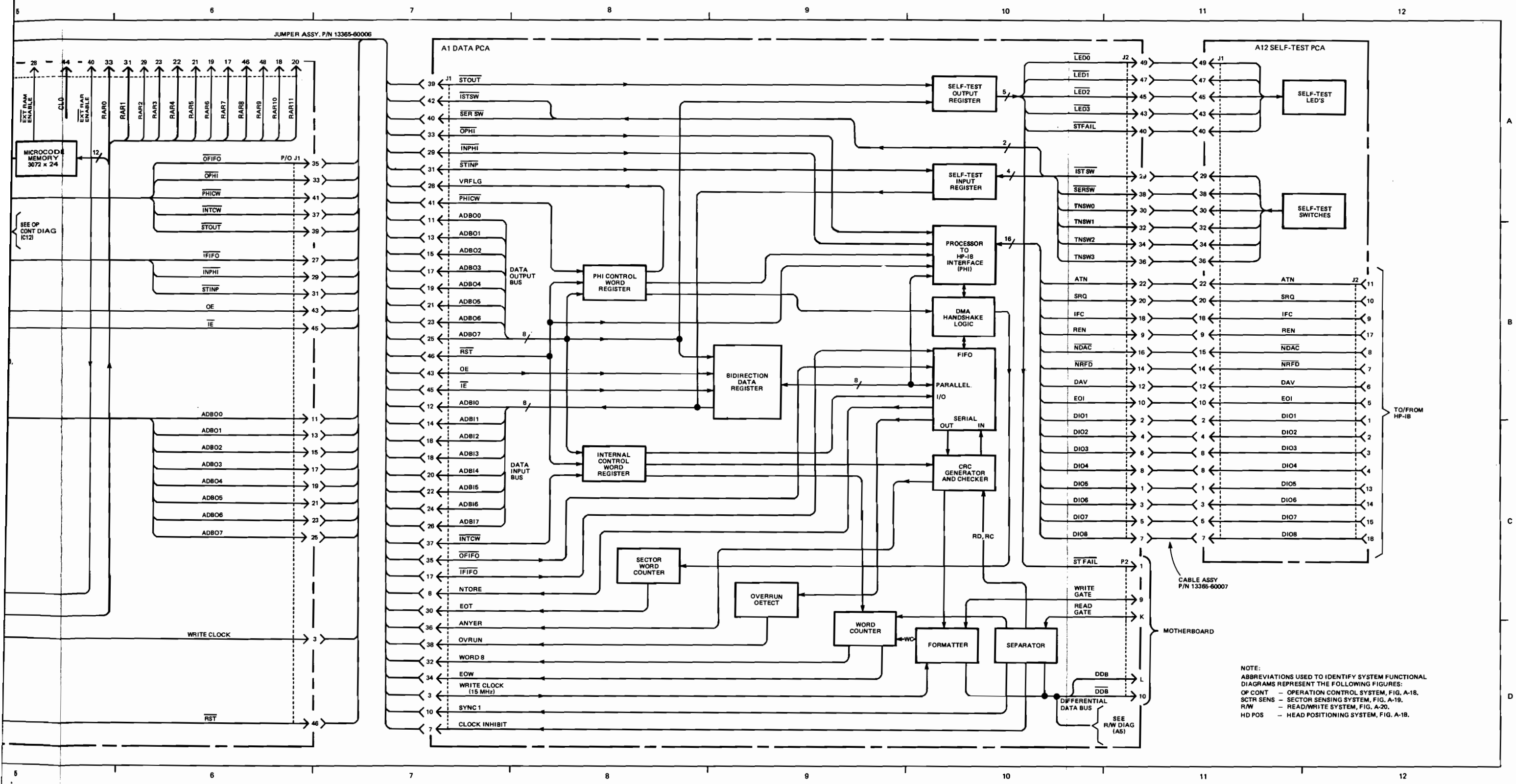
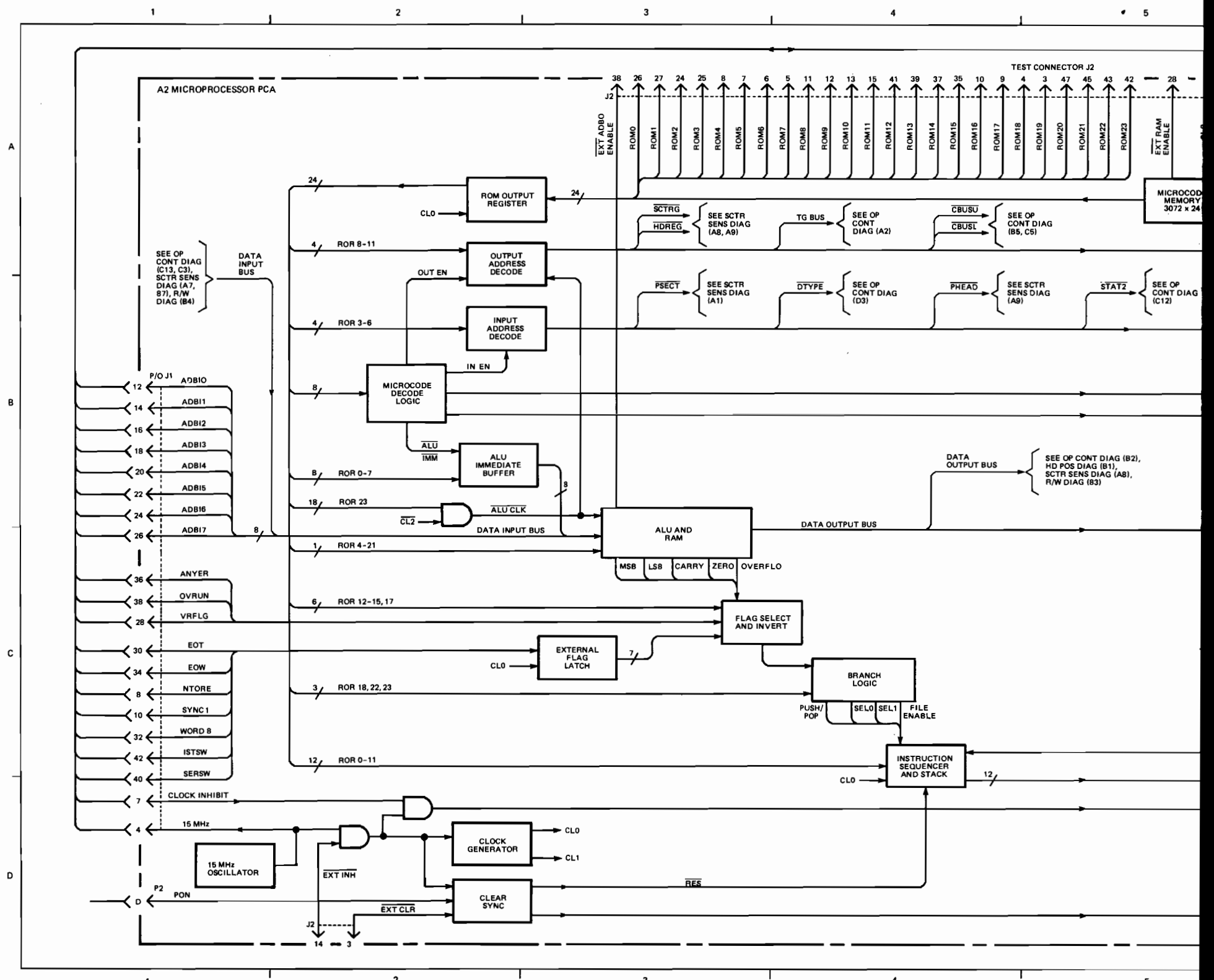


Figure A-15. HP 7906H Integrated Controller Functional Diagram


A2 MICROPROCESSOR PCA
TEST CONNECTOR J2
J2
38 26 27 24 25 8 7 6 5 11 12 13 15 41 39 37 35 10 9 4 3 47 45 43 42 28
EXT ADBO ENABLE
ROM0 ROM1 ROM2 ROM3 ROM4 ROM5 ROM6 ROM7 ROM8 ROM9 ROM10 ROM11 ROM12 ROM13 ROM14 ROM15 ROM16 ROM17 ROM18 ROM19 ROM20 ROM21 ROM22 ROM23
EXT RAM ENABLE
MICROCODE MEMORY 3072 x 24
ROM OUTPUT REGISTER
24
CLO
SCTRG
HDREG
SEE SCTR SENS DIAG (A8, A9)
TG BUS
SEE OP CONT DIAG (A2)
CBUSU
CBUSL
SEE OP CONT DIAG (B5, C5)
SEE OP CONT DIAG (C13, C3), SCTR SENS DIAG (A7, B7), R/W DIAG (B4)
DATA INPUT BUS
4 ROR 8-11
OUTPUT ADDRESS DECODE
OUT EN
PSECT
SEE SCTR SENS DIAG (A1)
DTYPE
SEE OP CONT DIAG (D3)
PHEAD
SEE SCTR SENS DIAG (A9)
STAT2
SEE OP CONT DIAG (C12)
4 ROR 3-6
INPUT ADDRESS DECODE
IN EN
P/O J1
12 ADBI0
14 ADBI1
16 ADBI2
18 ADBI3
20 ADBI4
22 ADBI5
24 ADBI6
26 ADBI7
8
8 ROR 0-7
MICROCODE DECODE LOGIC
ALU IMM
ALU IMMEDIATE BUFFER
8
18 ROR 23
CL2
ALU CLK
DATA INPUT BUS
ALU AND RAM
DATA OUTPUT BUS
DATA OUTPUT BUS
SEE OP CONT DIAG (B2), HD POS DIAG (B1), SCTR SENS DIAG (A8), R/W DIAG (B3)
1 ROR 4-21
MSB LSB CARRY ZERO OVERFLO
36 ANYER
38 OVRUN
28 VRFLG
6 ROR 12-15, 17
FLAG SELECT AND INVERT
30 EOT
34 EOW
8 NTORE
10 SYNC1
32 WORD 8
42 ISTSW
40 SERSW
EXTERNAL FLAG LATCH
CLO
7
3 ROR 18, 22, 23
BRANCH LOGIC
PUSH/ POP
SEL0 SEL1
FILE ENABLE
12 ROR 0-11
INSTRUCTION SEQUENCER AND STACK
CLO
12
7 CLOCK INHIBIT
4 15 MHz
15 MHz OSCILLATOR
EXT INH
CLOCK GENERATOR
CL0
CL1
RES
P2
D PON
EXT CLR
CLEAR SYNC
J2
14 3
A
B
C
D
1
2
3
4
5

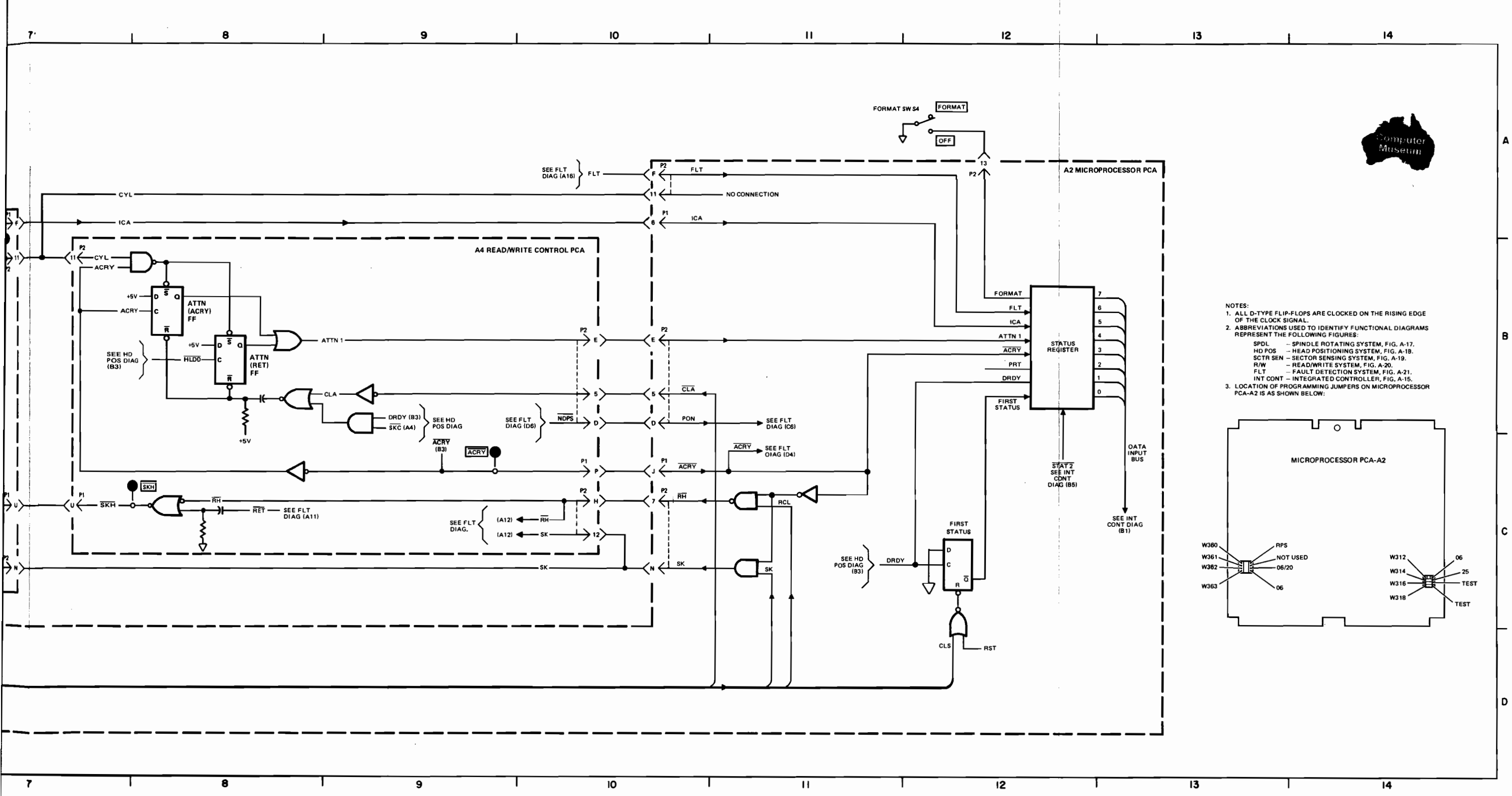
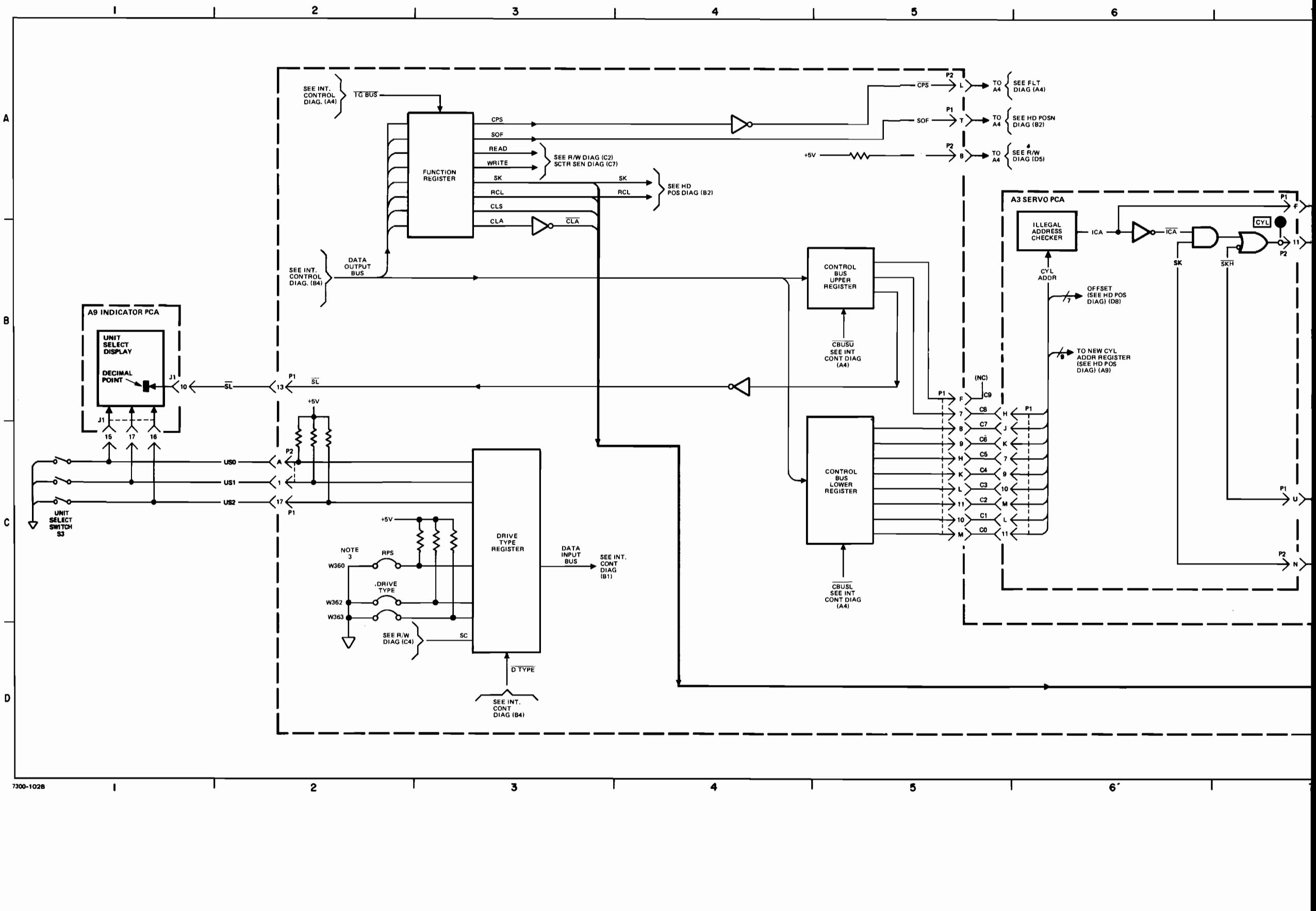


Figure A-16. HP 7906H Operation Control System Functional Diagram


SEE INT. CONTROL DIAG. (A4)
TG BUS
FUNCTION REGISTER
CPS
SOF
READ
WRITE
SEE R/W DIAG (C2) SCTR SEN DIAG (C7)
SK
RCL
SEE HD POS DIAG (B2)
CLS
CLA
CLA
SEE INT. CONTROL DIAG. (B4)
DATA OUTPUT BUS
CONTROL BUS UPPER REGISTER
CBUSU SEE INT CONT DIAG (A4)
CONTROL BUS LOWER REGISTER
CBUSL SEE INT CONT DIAG (A4)
+5V
P2 L
TO A4
SEE FLT DIAG (A4)
P1 T
SEE HD POSN DIAG (B2)
P2 B
SEE R/W DIAG (D5)
A3 SERVO PCA
ILLEGAL ADDRESS CHECKER
ICA
CYL
CYL ADDR
OFFSET (SEE HD POS DIAG) (D8)
TO NEW CYL ADDR REGISTER (SEE HD POS DIAG) (A9)
SK
SKH
P1 F
P2 11
P1 U
P2 N
(NC)
C9
C8
C7
C6
C5
C4
C3
C2
C1
C0
A9 INDICATOR PCA
UNIT SELECT DISPLAY
DECIMAL POINT
J1
10
SL
P1 13
SL
J1 15 17 16
US0
US1
US2
P2 A
1
17
P1
UNIT SELECT SWITCH S3
+5V
NOTE 3
RPS
W360
DRIVE TYPE
W362
W363
SEE R/W DIAG (C4)
SC
DRIVE TYPE REGISTER
DATA INPUT BUS
SEE INT. CONT DIAG (B1)
D TYPE
SEE INT. CONT DIAG (B4)

7300-1028

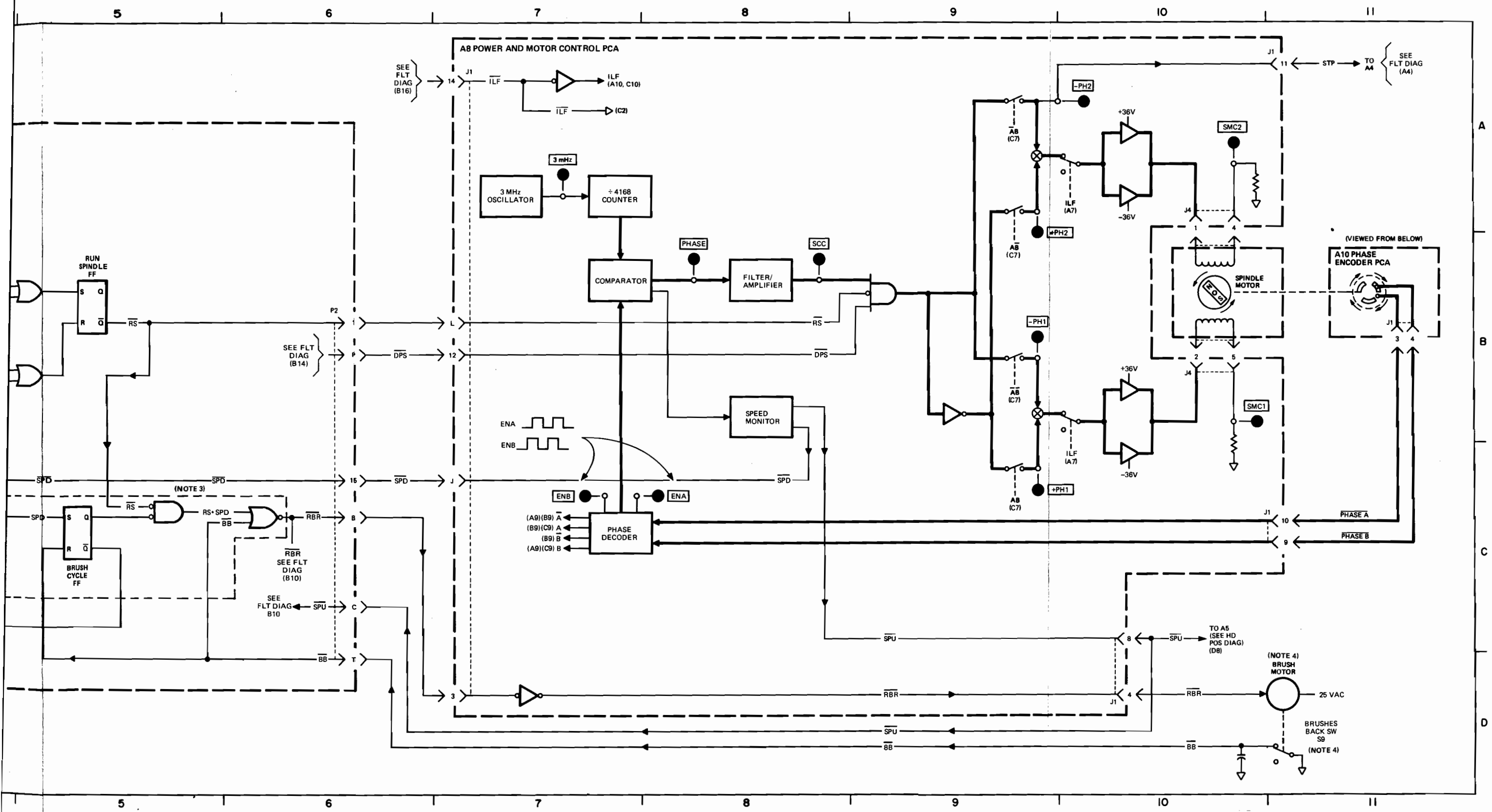
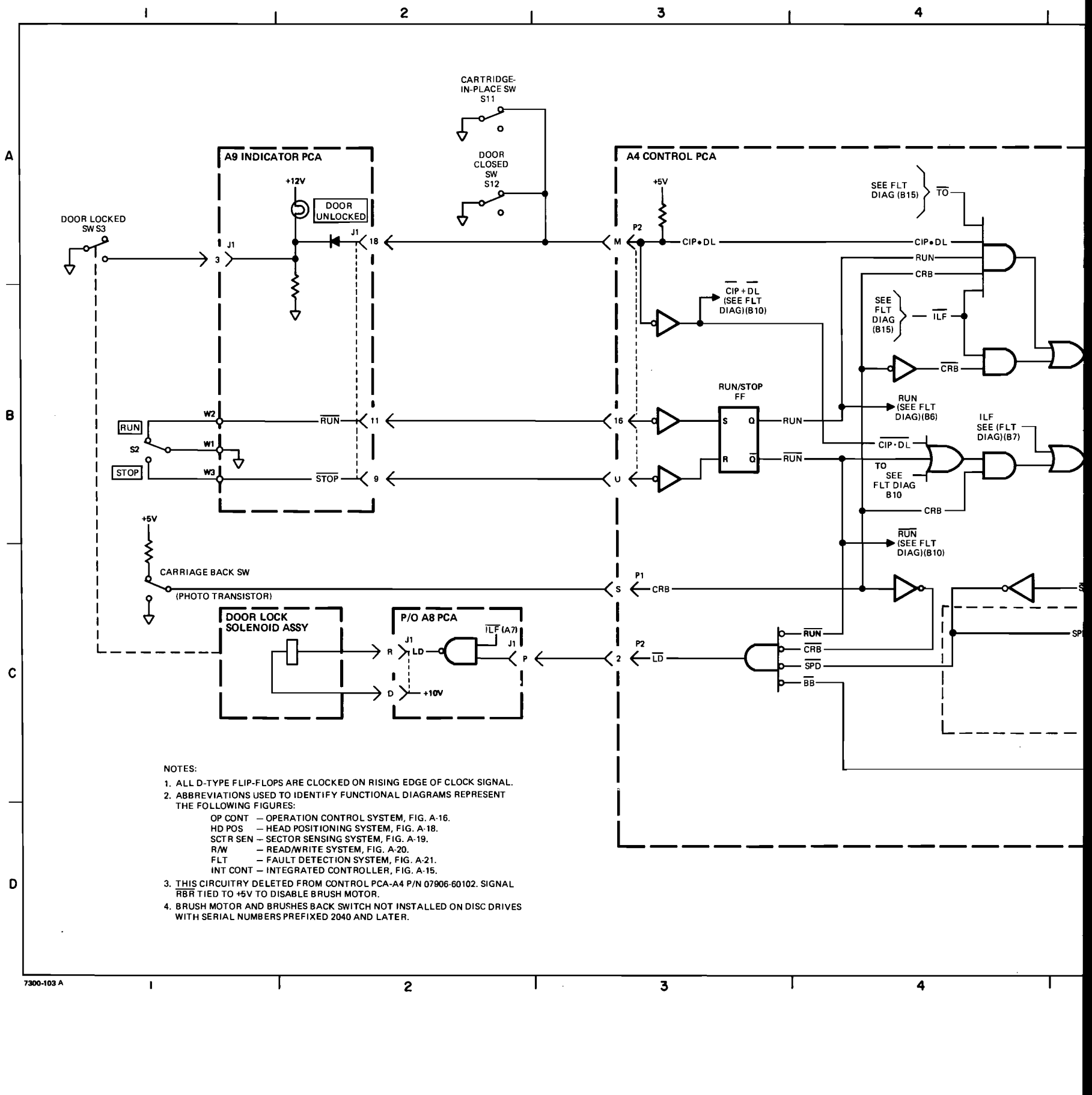


Figure A-17. HP 7906H Spindle Rotating System Functional Diagram



NOTES:

1. ALL D-TYPE FLIP-FLOPS ARE CLOCKED ON RISING EDGE OF CLOCK SIGNAL.
2. ABBREVIATIONS USED TO IDENTIFY FUNCTIONAL DIAGRAMS REPRESENT THE FOLLOWING FIGURES:
   - OP CONT – OPERATION CONTROL SYSTEM, FIG. A-16.
   - HD POS – HEAD POSITIONING SYSTEM, FIG. A-18.
   - SCTR SEN – SECTOR SENSING SYSTEM, FIG. A-19.
   - R/W – READ/WRITE SYSTEM, FIG. A-20.
   - FLT – FAULT DETECTION SYSTEM, FIG. A-21.
   - INT CONT – INTEGRATED CONTROLLER, FIG. A-15.
3. THIS CIRCUITRY DELETED FROM CONTROL PCA-A4 P/N 07906-60102. SIGNAL $\overline{RBR}$ TIED TO +5V TO DISABLE BRUSH MOTOR.
4. BRUSH MOTOR AND BRUSHES BACK SWITCH NOT INSTALLED ON DISC DRIVES WITH SERIAL NUMBERS PREFIXED 2040 AND LATER.

7300-103 A

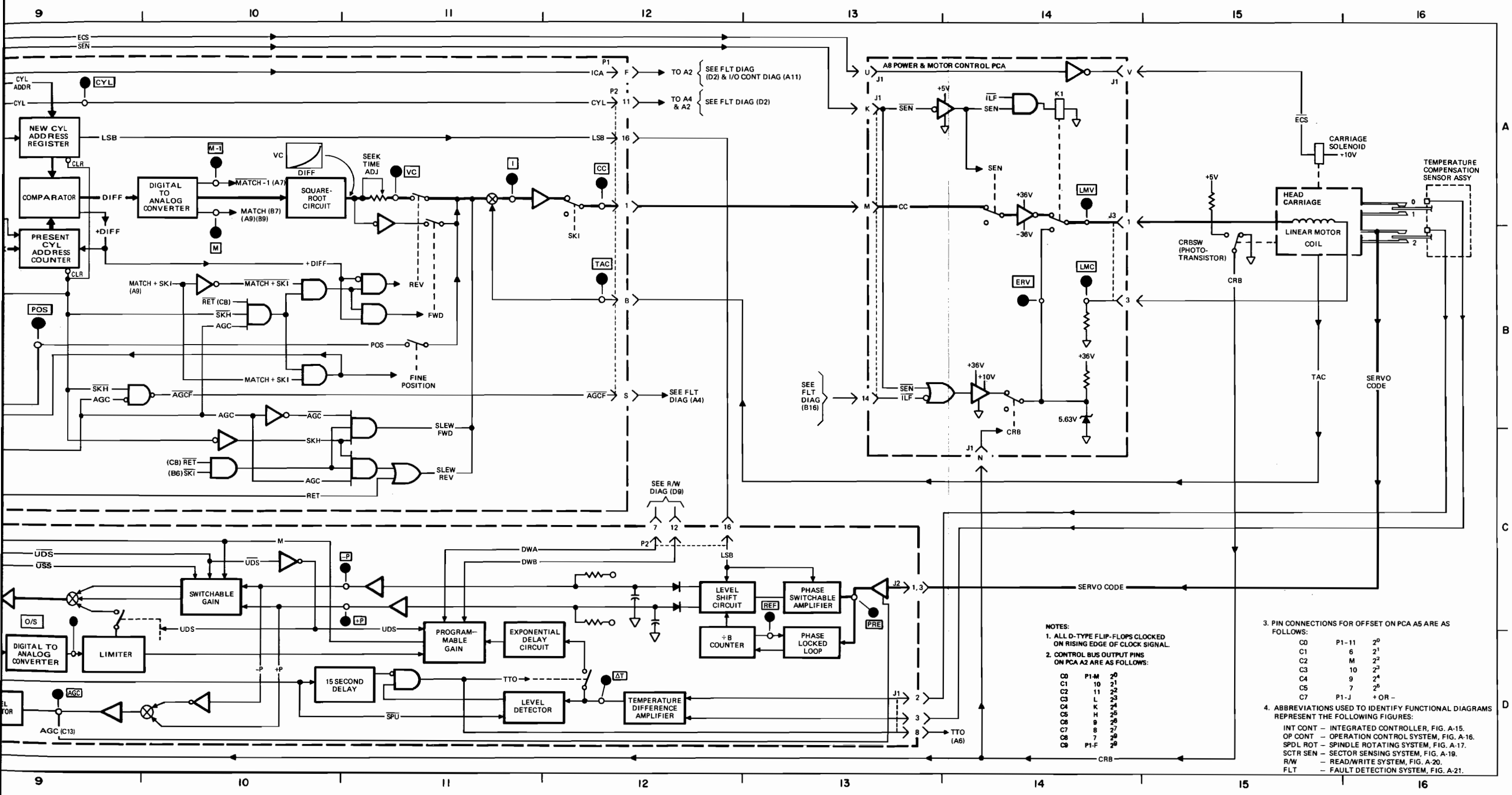
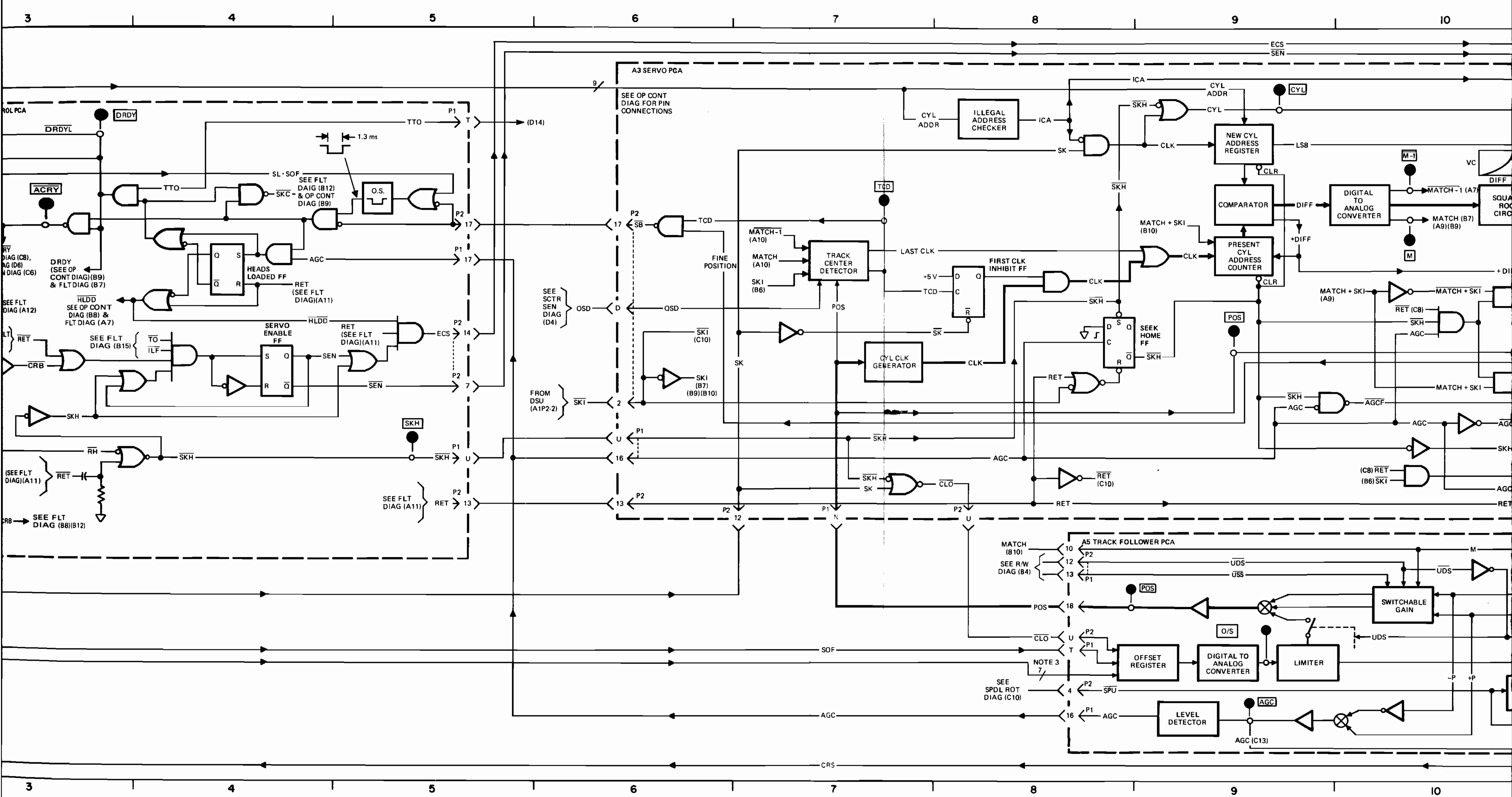
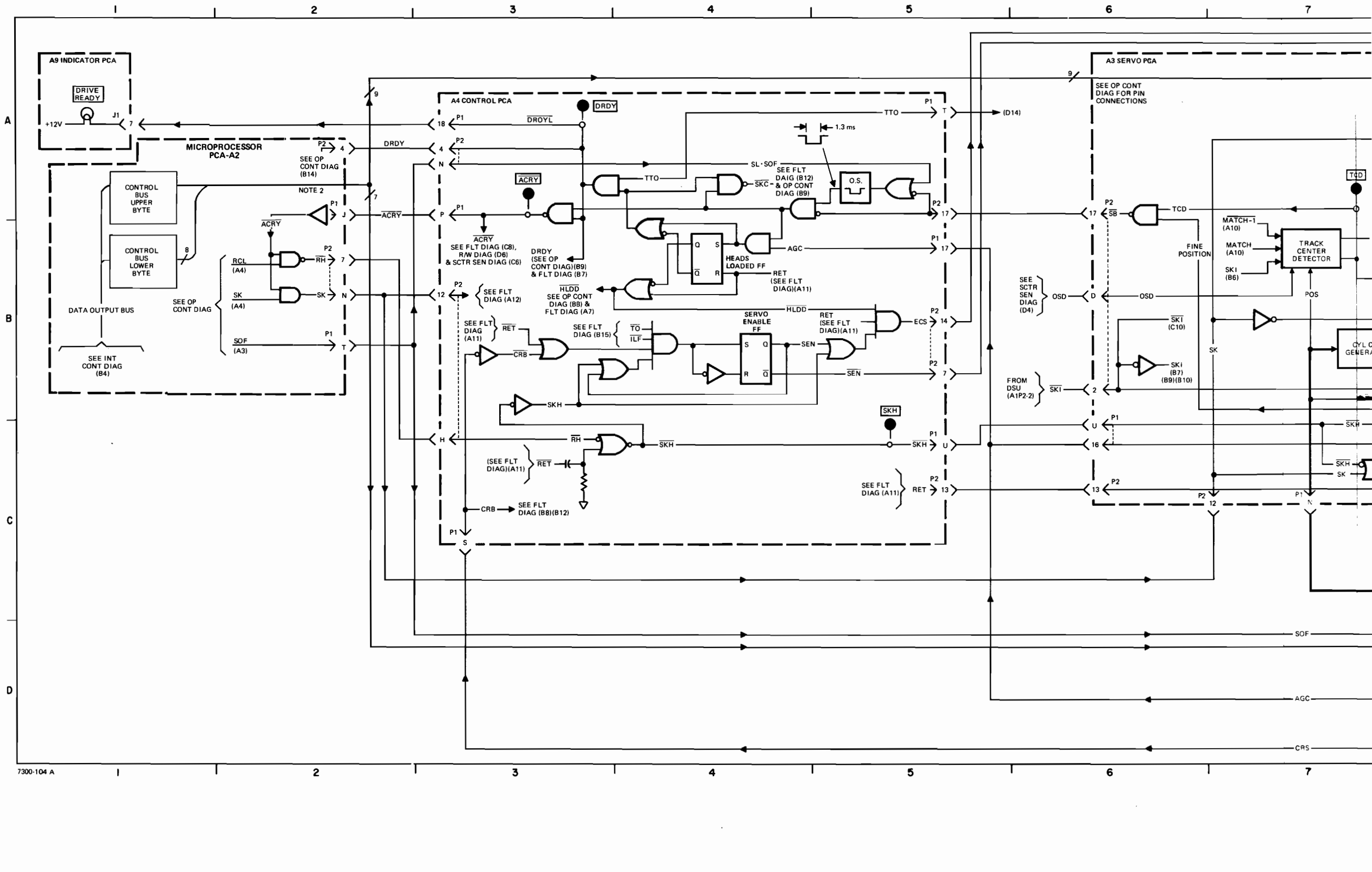


Figure A-18. HP 7906H Head Positioning System Functional Diagram



A3 SERVO PCA
SEE OP CONT DIAG FOR PIN CONNECTIONS
A5 TRACK FOLLOWER PCA
ILLEGAL ADDRESS CHECKER
NEW CYL ADDRESS REGISTER
COMPARATOR
DIGITAL TO ANALOG CONVERTER
PRESENT CYL ADDRESS COUNTER
TRACK CENTER DETECTOR
CYL CLK GENERATOR
FIRST CLK INHIBIT FF
SEEK HOME FF
SERVO ENABLE FF
HEADS LOADED FF
OFFSET REGISTER
DIGITAL TO ANALOG CONVERTER
LIMITER
SWITCHABLE GAIN
LEVEL DETECTOR
FINE POSITION
LAST CLK
NOTE 3


A9 INDICATOR PCA
DRIVE READY
+12V
J1
MICROPROCESSOR PCA-A2
CONTROL BUS UPPER BYTE
CONTROL BUS LOWER BYTE
DATA OUTPUT BUS
SEE INT CONT DIAG (B4)
SEE OP CONT DIAG
SEE OP CONT DIAG (B14)
NOTE 2
RCL (A4)
SK (A4)
SOF (A3)
ACRY
A4 CONTROL PCA
DROYL
DRDY
SEE FLT DIAG (C8), R/W DIAG (D6) & SCTR SEN DIAG (C6)
DRDY (SEE OP CONT DIAG)(B9) & FLT DIAG (B7)
SEE FLT DIAG (A12)
HLDD
SEE OP CONT DIAG (B8) & FLT DIAG (A7)
SEE FLT DIAG (A11)
RET
CRB
SEE FLT DIAG (B15)
TO
ILF
SERVO ENABLE FF
SEN
SKH
(SEE FLT DIAG)(A11)
SEE FLT DIAG (B8)(B12)
TTO
1.3 ms
SL·SOF
SKC
SEE FLT DAIG (B12) & OP CONT DIAG (B9)
O.S.
AGC
HEADS LOADED FF
RET (SEE FLT DIAG)(A11)
ECS
(D14)
A3 SERVO PCA
SEE OP CONT DIAG FOR PIN CONNECTIONS
TCD
MATCH-1 (A10)
MATCH (A10)
SKI (B6)
TRACK CENTER DETECTOR
FINE POSITION
POS
SEE SCTR SEN DIAG (D4)
OSD
SKI (C10)
SKI (B7) (B9)(B10)
FROM DSU (A1P2-2)
SK
SOF
AGC
CRS
7300-104 A

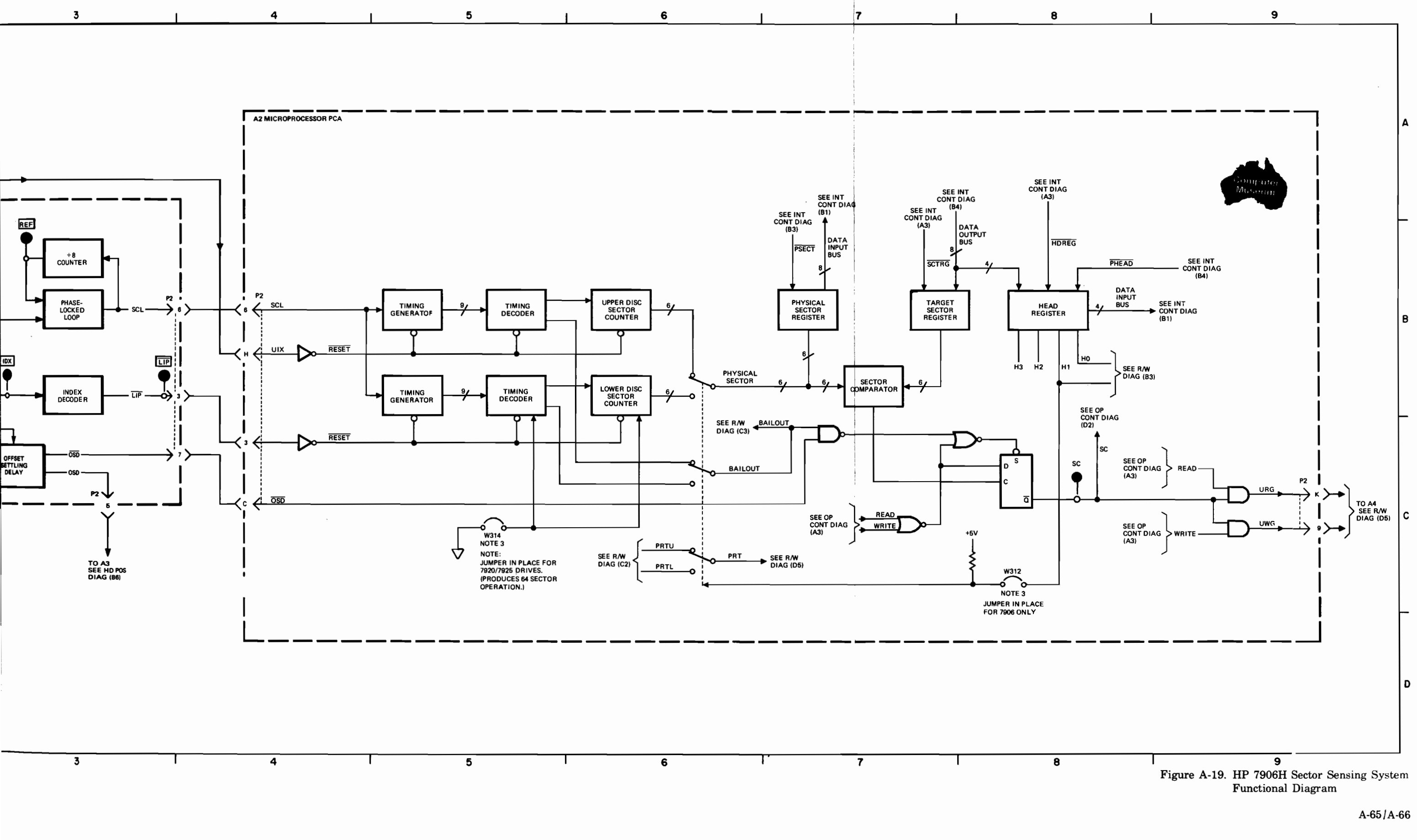
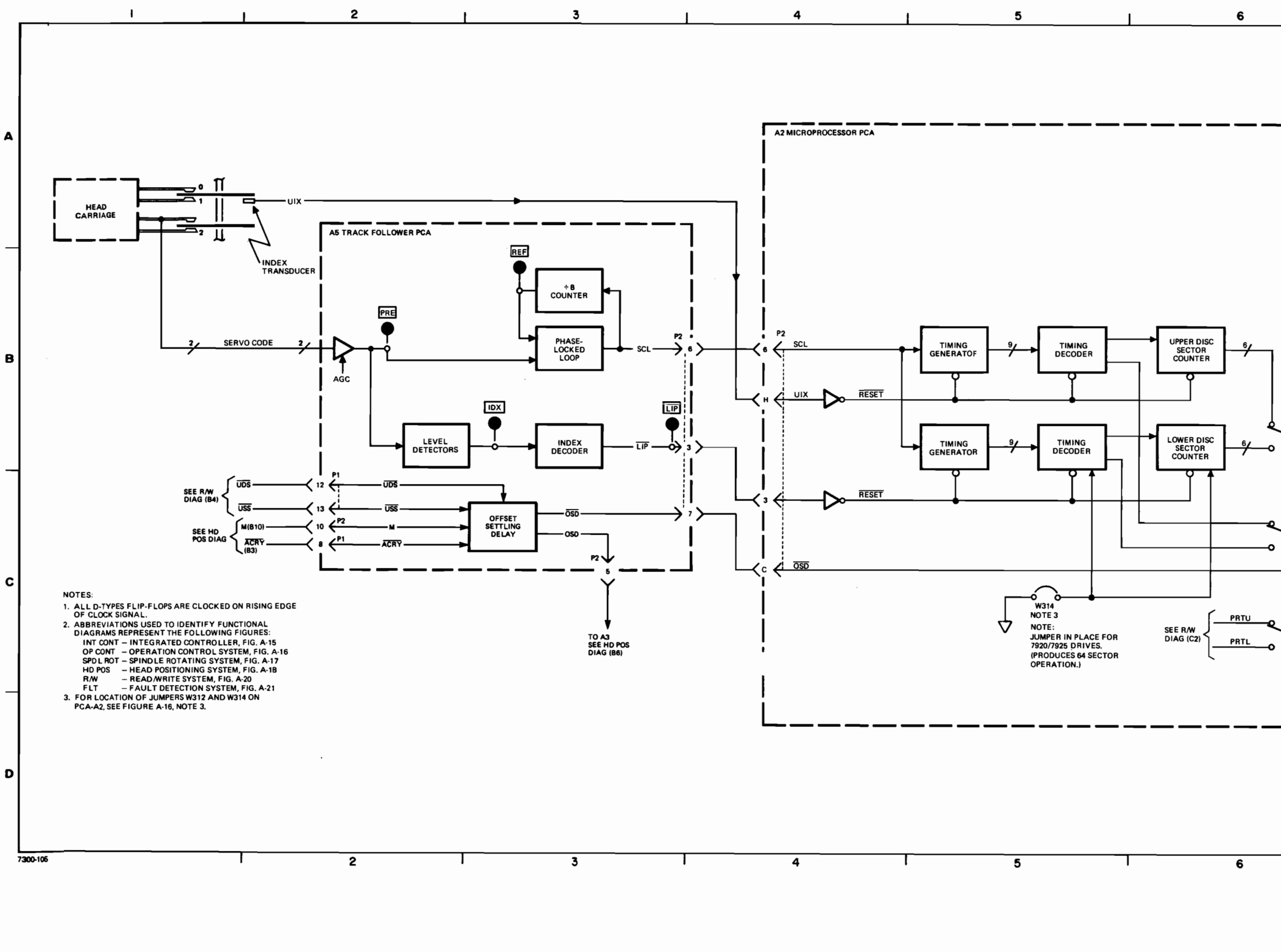


Figure A-19. HP 7906H Sector Sensing System Functional Diagram



NOTES:

1. ALL D-TYPES FLIP-FLOPS ARE CLOCKED ON RISING EDGE OF CLOCK SIGNAL.
2. ABBREVIATIONS USED TO IDENTIFY FUNCTIONAL DIAGRAMS REPRESENT THE FOLLOWING FIGURES:
   - INT CONT – INTEGRATED CONTROLLER, FIG. A-15
   - OP CONT – OPERATION CONTROL SYSTEM, FIG. A-16
   - SPDL ROT – SPINDLE ROTATING SYSTEM, FIG. A-17
   - HD POS – HEAD POSITIONING SYSTEM, FIG. A-18
   - R/W – READ/WRITE SYSTEM, FIG. A-20
   - FLT – FAULT DETECTION SYSTEM, FIG. A-21
3. FOR LOCATION OF JUMPERS W312 AND W314 ON PCA-A2, SEE FIGURE A-16, NOTE 3.

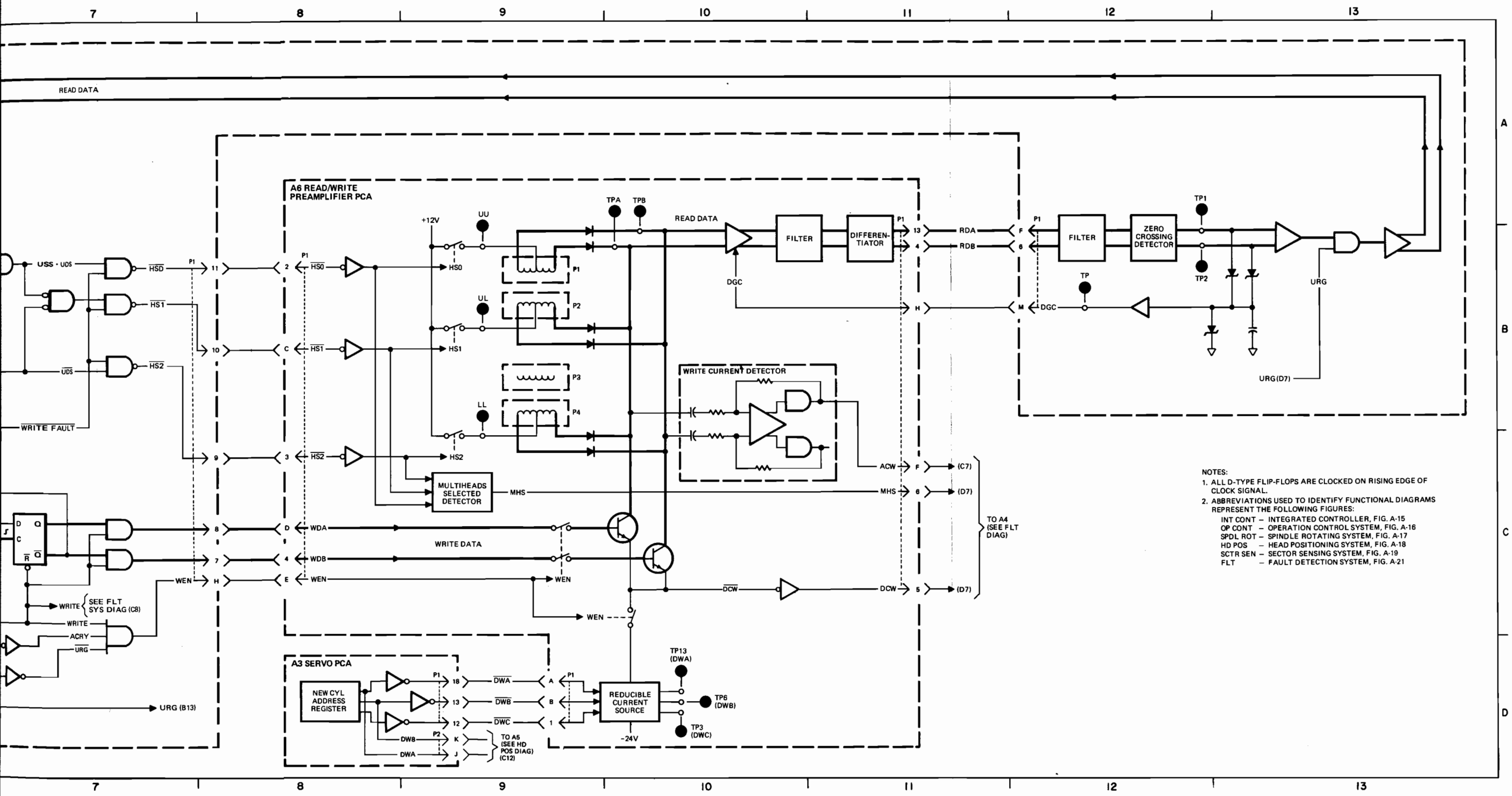
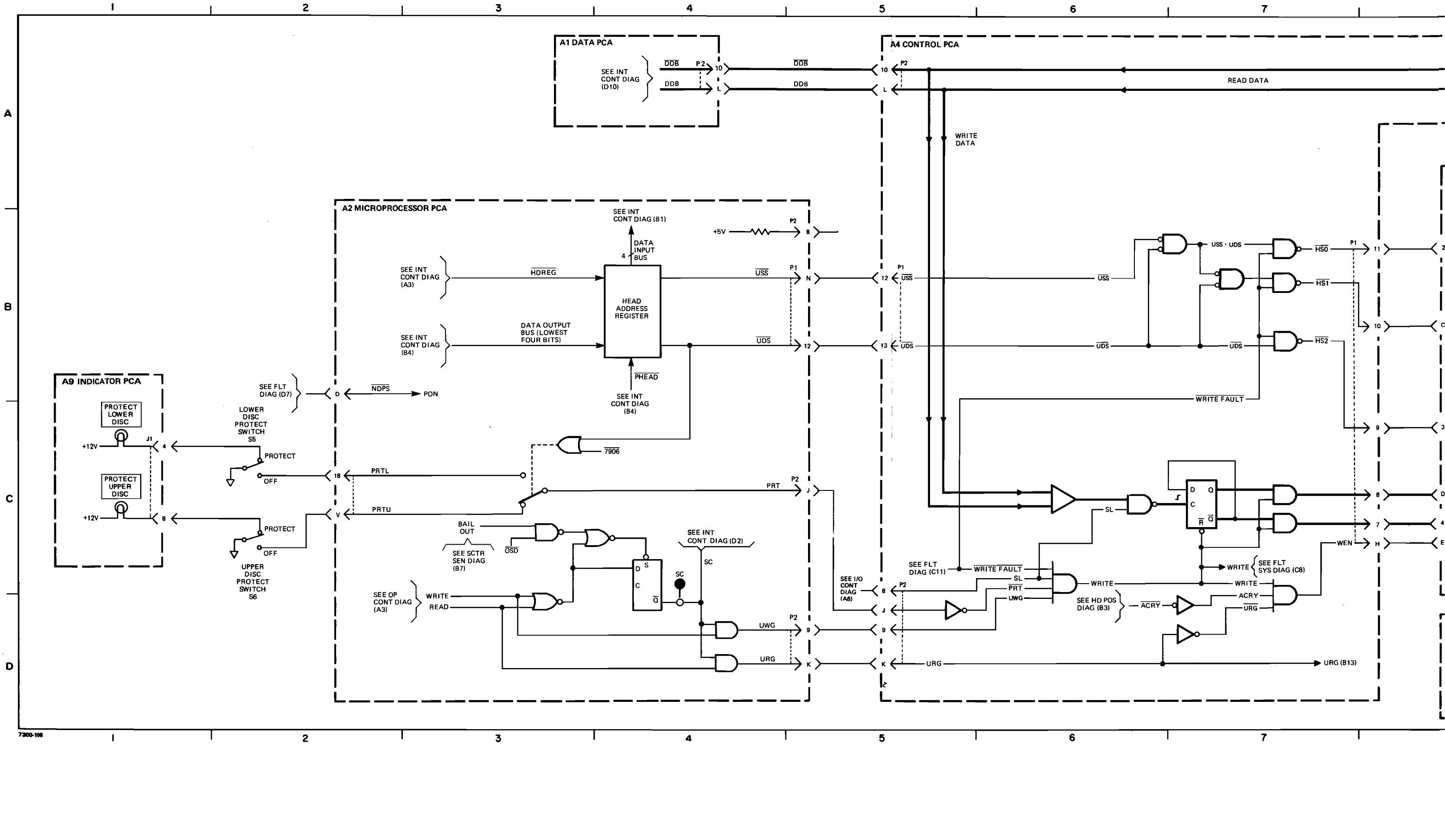
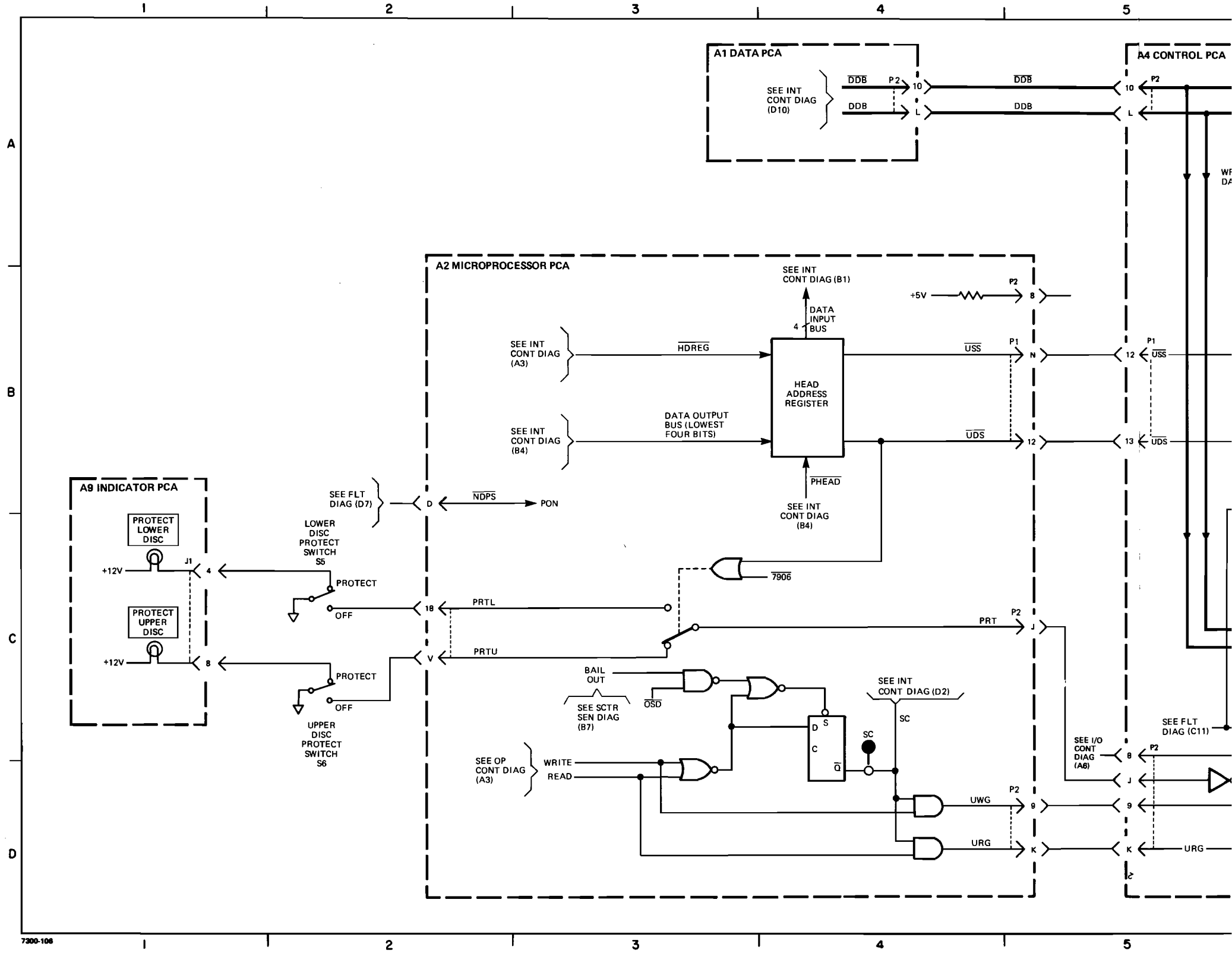
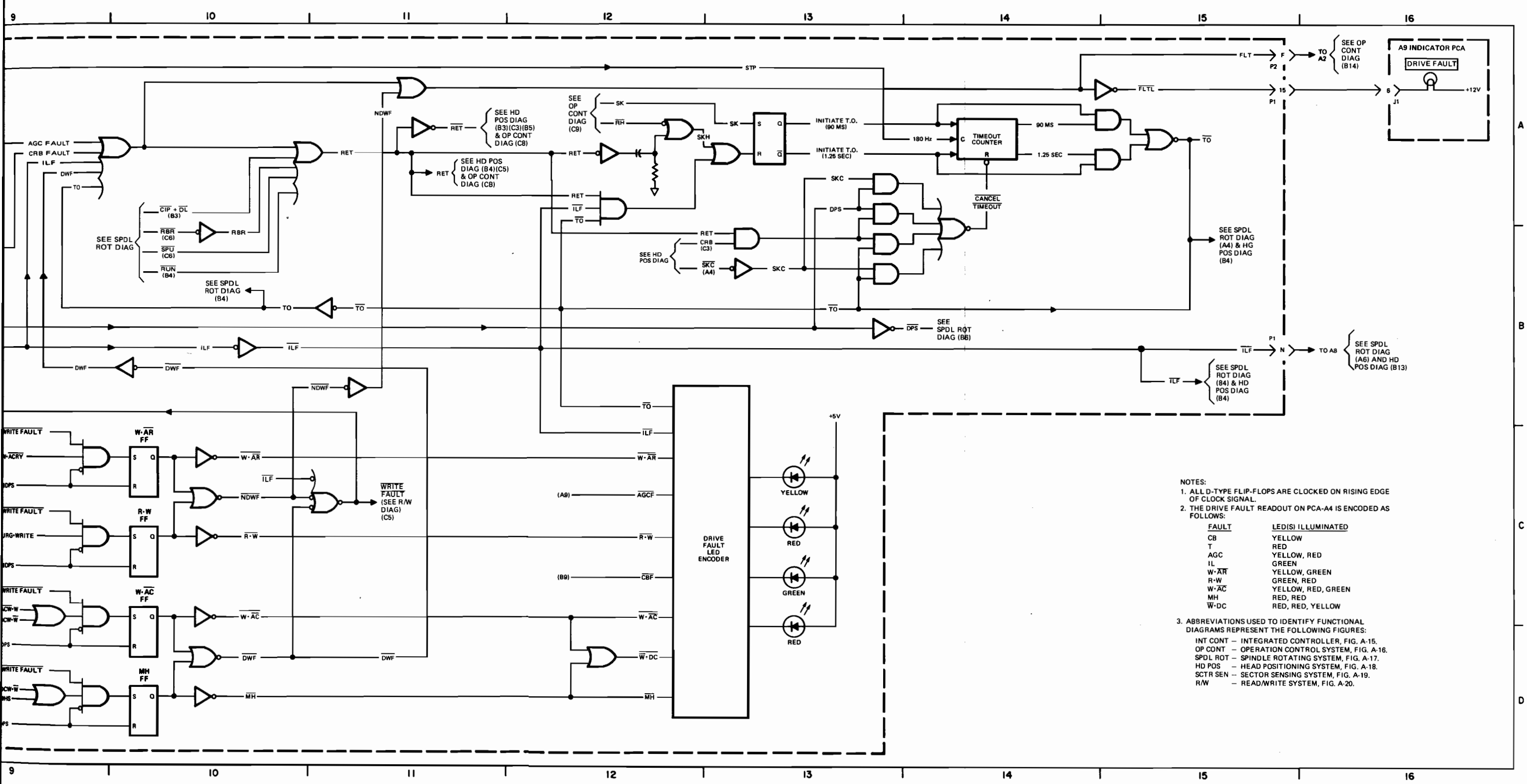


Figure A-20. HP 7906H Read/Write System Functional Diagram


A1 DATA PCA
SEE INT CONT DIAG (D10)
DDB
P2
10
L
A4 CONTROL PCA
READ DATA
WRITE DATA
A2 MICROPROCESSOR PCA
SEE INT CONT DIAG (81)
+5V
DATA INPUT BUS
SEE INT CONT DIAG (A3)
HDREG
HEAD ADDRESS REGISTER
USS
UDS
SEE INT CONT DIAG (84)
DATA OUTPUT BUS (LOWEST FOUR BITS)
PHEAD
SEE INT CONT DIAG (B4)
7906
A9 INDICATOR PCA
PROTECT LOWER DISC
PROTECT UPPER DISC
+12V
J1
LOWER DISC PROTECT SWITCH S5
UPPER DISC PROTECT SWITCH S6
PROTECT
OFF
SEE FLT DIAG (D7)
NDPS
PON
PRTL
PRTU
PRT
BAIL OUT
SEE SCTR SEN DIAG (B7)
OSD
SEE INT CONT DIAG (D2)
SC
SEE OP CONT DIAG (A3)
WRITE
READ
UWG
URG
SEE I/O CONT DIAG (A6)
USS · UDS
HS0
HS1
HS2
WRITE FAULT
SL
SEE FLT DIAG (C11)
SEE HD POS DIAG (B3)
ACRY
WEN
SEE FLT SYS DIAG (C8)
URG (B13)
7300-106


A1 DATA PCA
SEE INT CONT DIAG (D10)
DDB
P2
10
L
A4 CONTROL PCA
A2 MICROPROCESSOR PCA
SEE INT CONT DIAG (B1)
DATA INPUT BUS
4
+5V
SEE INT CONT DIAG (A3)
HDREG
HEAD ADDRESS REGISTER
USS
P1
N
12
SEE INT CONT DIAG (B4)
DATA OUTPUT BUS (LOWEST FOUR BITS)
UDS
13
PHEAD
SEE INT CONT DIAG (B4)
A9 INDICATOR PCA
PROTECT LOWER DISC
PROTECT UPPER DISC
+12V
J1
SEE FLT DIAG (D7)
NDPS
PON
LOWER DISC PROTECT SWITCH S5
PROTECT
OFF
7906
PRTL
18
PRT
PRTU
V
BAIL OUT
SEE SCTR SEN DIAG (B7)
OSD
SEE INT CONT DIAG (D2)
SC
SEE OP CONT DIAG (A3)
WRITE
READ
UWG
URG
SEE I/O CONT DIAG (A6)
SEE FLT DIAG (C11)
UPPER DISC PROTECT SWITCH S6
7300-106



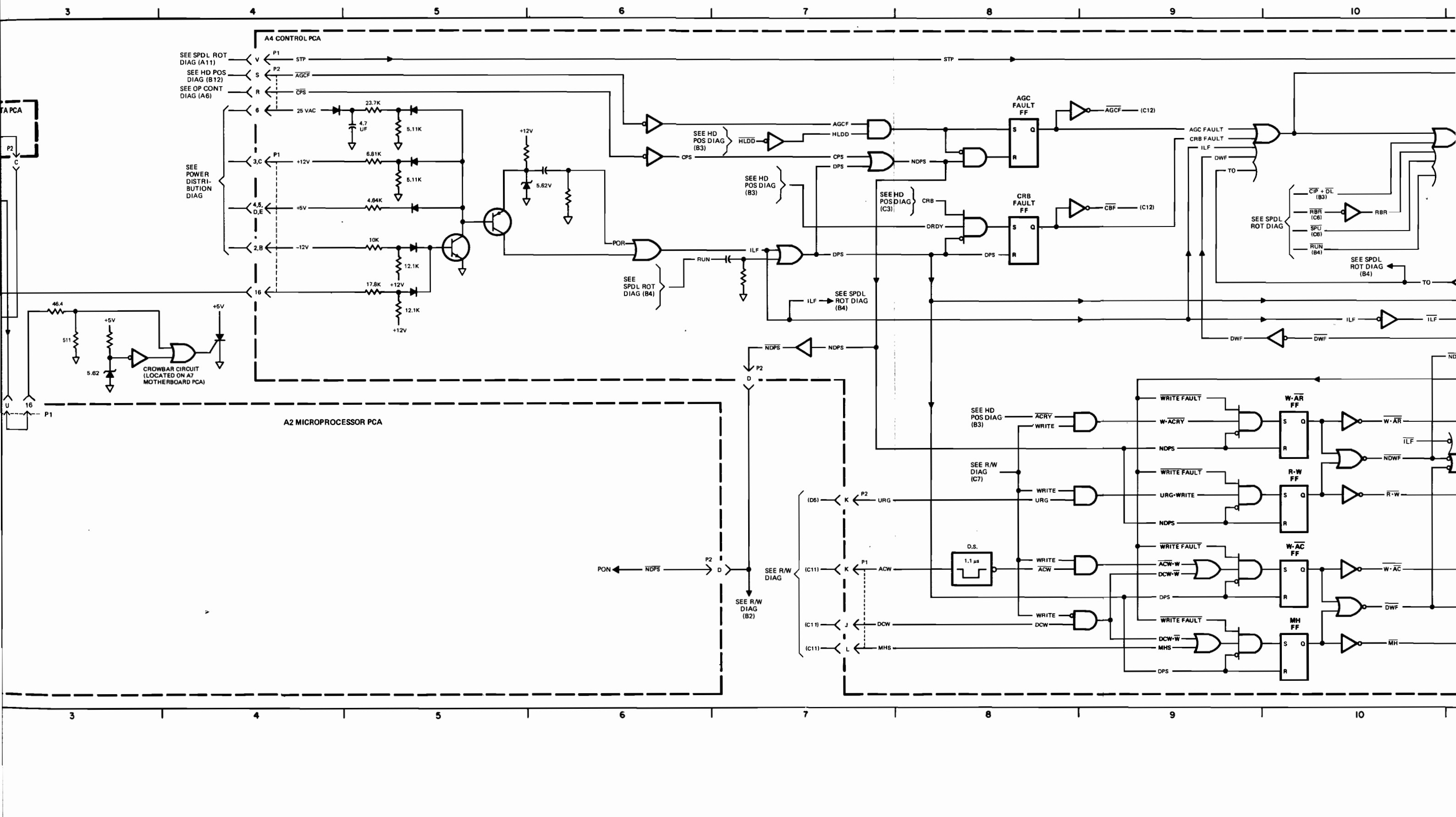
NOTES:

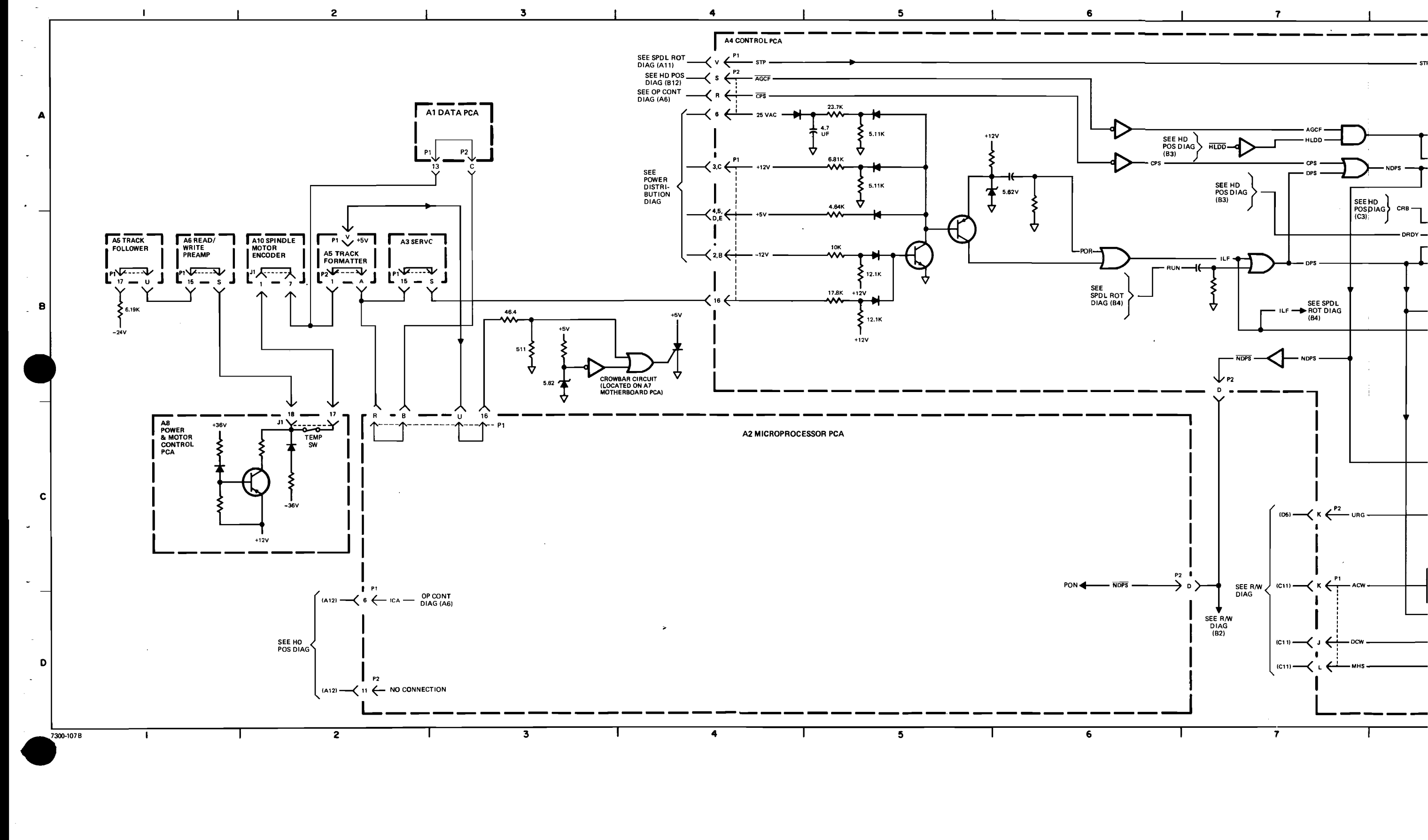
1. ALL D-TYPE FLIP-FLOPS ARE CLOCKED ON RISING EDGE OF CLOCK SIGNAL.
2. THE DRIVE FAULT READOUT ON PCA-A4 IS ENCODED AS FOLLOWS:

FAULT	LED(S) ILLUMINATED
CB	YELLOW
T	RED
AGC	YELLOW, RED
IL	GREEN
W·$\overline{AR}$	YELLOW, GREEN
R·W	GREEN, RED
W·$\overline{AC}$	YELLOW, RED, GREEN
MH	RED, RED
$\overline{W}$·DC	RED, RED, YELLOW

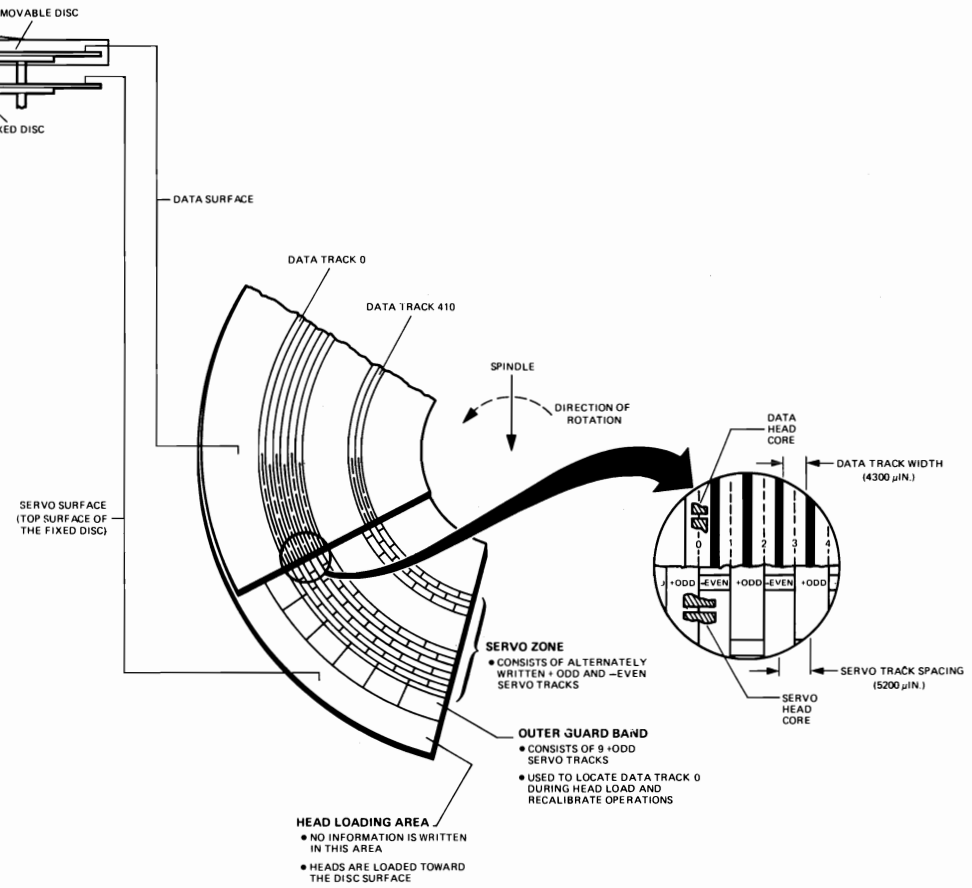
3. ABBREVIATIONS USED TO IDENTIFY FUNCTIONAL DIAGRAMS REPRESENT THE FOLLOWING FIGURES:
   - INT CONT – INTEGRATED CONTROLLER, FIG. A-15.
   - OP CONT – OPERATION CONTROL SYSTEM, FIG. A-16.
   - SPDL ROT – SPINDLE ROTATING SYSTEM, FIG. A-17.
   - HD POS – HEAD POSITIONING SYSTEM, FIG. A-18.
   - SCTR SEN – SECTOR SENSING SYSTEM, FIG. A-19.
   - R/W – READ/WRITE SYSTEM, FIG. A-20.

Figure A-21. HP 7906H Fault Detection System Functional Diagram


3
4
5
6
7
8
9
10
A4 CONTROL PCA
SEE SPDL ROT DIAG (A11)
SEE HD POS DIAG (B12)
SEE OP CONT DIAG (A6)
P1
P2
V
S
R
STP
AGCF
CPS
6
25 VAC
23.7K
4.7 UF
5.11K
SEE POWER DISTRI-BUTION DIAG
3,C
+12V
6.81K
5.11K
4,5, D,E
+5V
4.64K
2,B
-12V
10K
12.1K
16
17.8K
+12V
12.1K
+12V
5.62V
+12V
46.4
+5V
511
5.62
CROWBAR CIRCUIT (LOCATED ON A7 MOTHERBOARD PCA)
+5V
U
16
P1
A2 MICROPROCESSOR PCA
SEE HD POS DIAG (B3)
HLDD
AGCF
HLDD
CPS
DPS
NDPS
SEE HD POS DIAG (B3)
SEE HD POS DIAG (C3)
CRB
DRDY
DPS
AGC FAULT FF
CRB FAULT FF
S
Q
R
AGCF
(C12)
CBF
(C12)
AGC FAULT
CRB FAULT
ILF
DWF
TO
SEE SPDL ROT DIAG
CIP + DL (B3)
RBR (C6)
SPU (C6)
RUN (B4)
RBR
SEE SPDL ROT DIAG (B4)
TO
POR
RUN
ILF
DPS
SEE SPDL ROT DIAG (B4)
ILF
SEE SPDL ROT DIAG (B4)
ILF
DWF
NDPS
NDPS
P2
D
PON
NDPS
P2
D
SEE R/W DIAG (B2)
SEE R/W DIAG
(D5)
K
P2
URG
(C11)
K
P1
ACW
(C11)
J
DCW
(C11)
L
MHS
D.S.
1.1 µs
SEE HD POS DIAG (B3)
ACRY
WRITE
SEE R/W DIAG (C7)
WRITE
URG
WRITE
ACW
WRITE
DCW
WRITE FAULT
W·ACRY
NDPS
W·AR FF
W·AR
ILF
NDWF
WRITE FAULT
URG·WRITE
NDPS
R·W FF
R·W
WRITE FAULT
ACW·W
DCW·W
DPS
W·AC FF
W·AC
DWF
WRITE FAULT
DCW·W
MHS
DPS
MH FF
MH


A4 CONTROL PCA
SEE SPDL ROT DIAG (A11)
SEE HD POS DIAG (B12)
SEE OP CONT DIAG (A6)
SEE POWER DISTRI-BUTION DIAG
25 VAC
+12V
+5V
-12V
23.7K
4.7 UF
5.11K
6.81K
4.64K
10K
12.1K
17.8K
5.62V
STP
AGCF
CPS
HLDD
NDPS
DPS
CRB
DRDY
POR
RUN
ILF
SEE HD POS DIAG (B3)
SEE SPDL ROT DIAG (B4)
A1 DATA PCA
A5 TRACK FOLLOWER
A6 READ/ WRITE PREAMP
A10 SPINDLE MOTOR ENCODER
A5 TRACK FORMATTER
A3 SERVC
6.19K
-24V
46.4
511
5.62
CROWBAR CIRCUIT (LOCATED ON A7 MOTHERBOARD PCA)
A8 POWER & MOTOR CONTROL PCA
+36V
-36V
TEMP SW
A2 MICROPROCESSOR PCA
PON
SEE R/W DIAG
SEE R/W DIAG (B2)
SEE HD POS DIAG
OP CONT DIAG (A6)
NO CONNECTION
URG
ACW
DCW
MHS

7300-107B



NOTE:
WAVEFORM AND TRIGGER TEST POINTS ARE SHOWN ON THE HP 7906H HEAD POSITIONING SYSTEM FUNCTIONAL DIAGRAM, FIGURE A-18, AT THE FOLLOWING LOCATIONS:

A5 'PRE' – (C13)
A5 'REF' – (D13)
A5 'POS' – (C9)
A5 'O/S' – (D9)

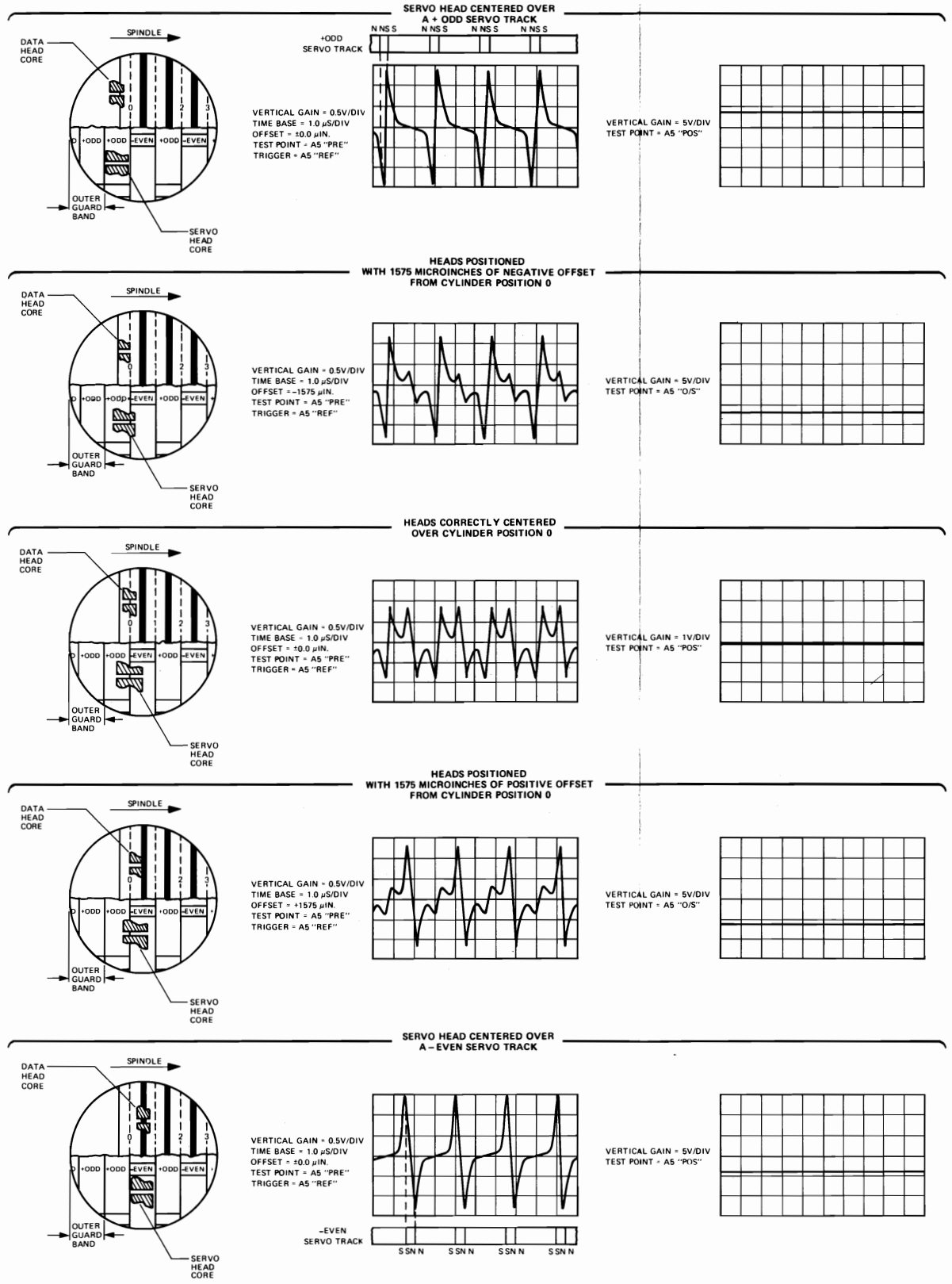


Figure A-22. Servo Surface Format and Waveforms

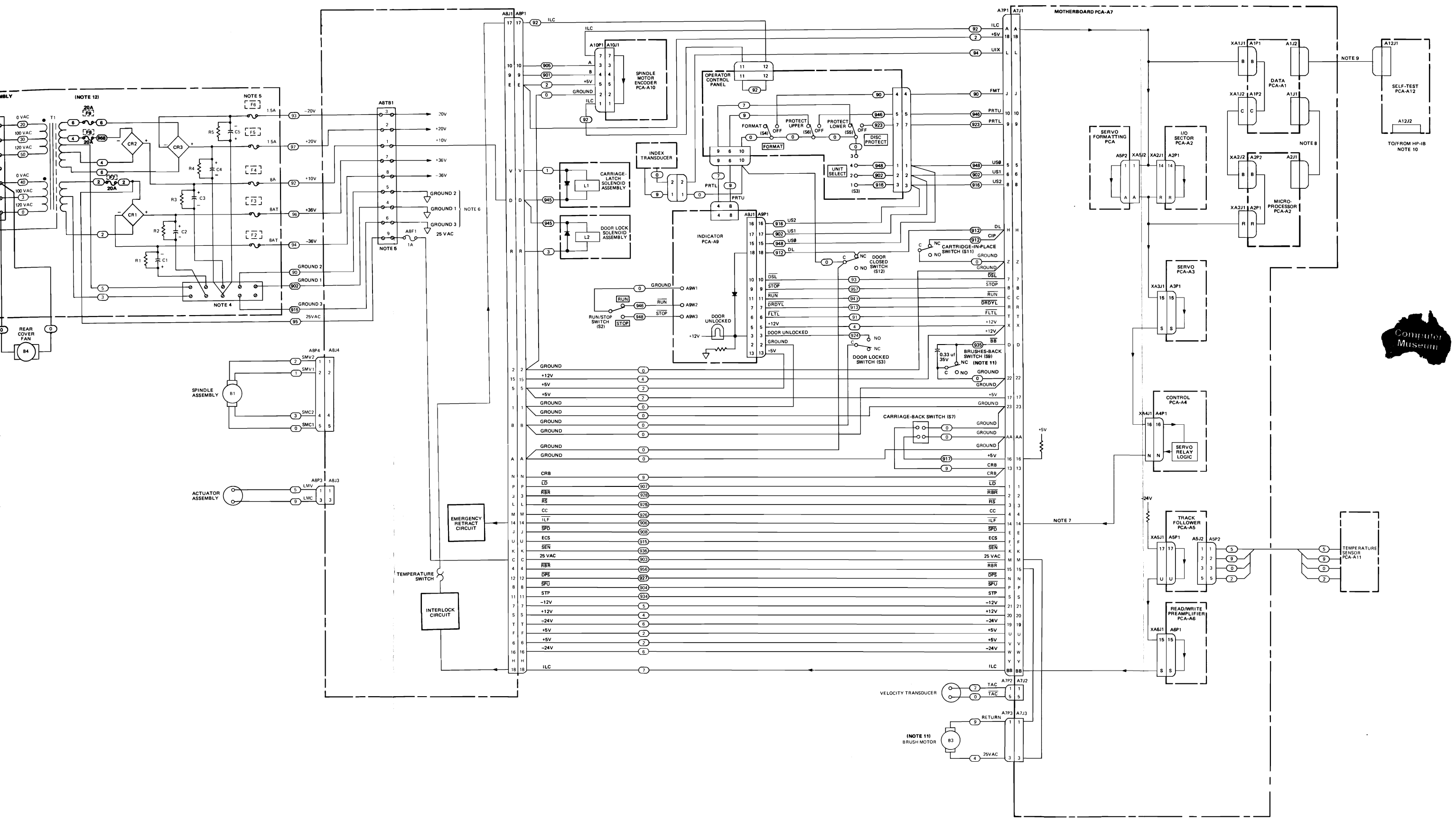


Figure A-23. HP 7906H Mainframe Assembly Wiring Diagram

NOTES:

1. ENCIRCLED NUMBERS INDICATE WIRING COLOR CODE AS FOLLOWS:

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
GRAY	8	8	8
WHITE	9	9	9

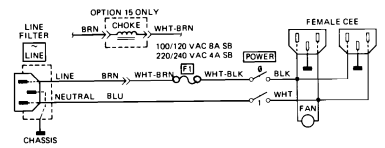
2. AC POWER IS SUPPLIED BY CABLE FROM A POWER PANEL ASSEMBLY (NOT PART OF THE DISC DRIVE) IN THE HP 29425B CABINET (HP 7906M/S DISC DRIVE) OR ON THE PREFILTER DUCT ASSEMBLY (HP 7906MR/SR DISC DRIVE). SCHEMATIC DIAGRAMS FOR THE POWER PANEL ASSEMBLIES ARE SHOWN BELOW. VALUES FOR LINE FUSE F1 ARE:

100 VAC – 8A SB 250V, 2110-0383
120 VAC – 8A SB 250V, 2110-0383
220 VAC – 4A SB 250V, 2110-0365
240 VAC – 4A SB 250V, 2110-0365

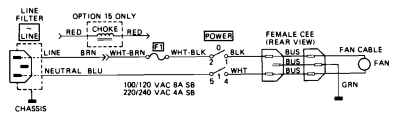
THE CABLE SUPPLYING POWER FROM THE HP 29425B CABINET POWER PANEL IS CABLE ASSEMBLY, PART NO. 8120-0575.

FOR A COMPLETE DESCRIPTION OF THE POWER PANEL ASSEMBLIES, REFER TO THE FOLLOWING PUBLICATIONS:

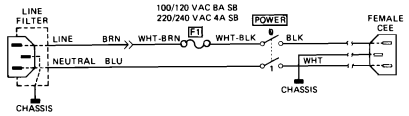
- HP 29425 CABINET INSTALLATION AND SERVICE MANUAL, PART NO. 29425-90001.
- HP 40019 PREFILTER ASSEMBLY INSTALLATION AND SERVICE MANUAL, PART NO. 40019-90901.



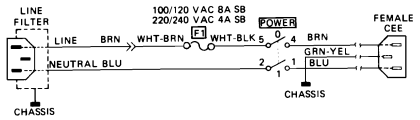
7604-4A
HP 29425B CABINET POWER PANEL ASSEMBLY, P/N 29425-60009 AND 29425-60010
(USED ON 7906B DISC DRIVES WITH SERIAL NUMBERS PREFIXED 2017 AND PRIOR)



7604-8
HP 29425B CABINET POWER PANEL ASSEMBLY, P/N 29425-60014 AND 29425-60015
(USED ON 7906B DISC DRIVES WITH SERIAL NUMBERS PREFIXED 2018 AND LATER)

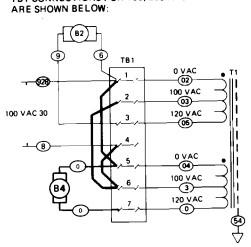


7312-4A
HP 40019B PREFILTER ASSEMBLY, P/N 40019-60006
(OPTIONAL ON 7906B DISC DRIVES WITH SERIAL NUMBERS PREFIXED 2016 AND PRIOR)

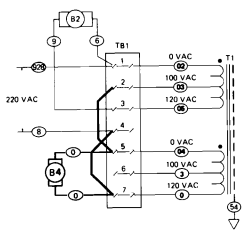


7312-4B
HP 40019B PREFILTER ASSEMBLY, P/N 40019-60012
(OPTIONAL ON 7906B DISC DRIVES WITH SERIAL NUMBERS PREFIXED 2017 AND LATER

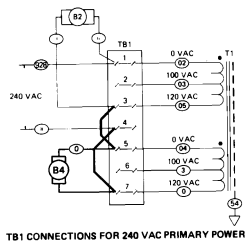
3. TERMINAL BLOCK TB1 IS SHOWN CONFIGURED FOR 120 VAC OPERATION. TB1 CONNECTIONS FOR 100, 220 AND 240 VAC PRIMARY POWER INPUTS ARE SHOWN BELOW:



TB1 CONNECTIONS FOR 100 VAC PRIMARY POWER



TB1 CONNECTIONS FOR 220 VAC PRIMARY POWER



TB1 CONNECTIONS FOR 240 VAC PRIMARY POWER

4. GROUND BLOCK CONNECTIONS MUST BE MADE AS SHOWN.

5. FUSES F2 THROUGH F9 AND A8F1 ARE AS FOLLOWS:

F2	8AT*, 250V, 2110-0383
F3	8AT*, 250V, 2110-0383
F4	8A, 250V, 2110-0342
F5	1.5A, 250V, 2110-0043
F6	1.5A, 250V, 2110-0043
F7	20A, 125V, 2110-0098
F8	20A, 125V, 2110-0098
F9	20A, 125V, 2110-0098
A8F1	1A, 125V, 2110-0099

*THE T INDICATES THAT A TIME DELAY FUSE MUST BE USED.

6. ONLY GROUND 1 LEAVES THE POWER AND MOTOR CONTROL PCA-A8.

7. INTERLOCK LINE IS AT 18V EXCEPT UNDER FAULT CONDITION.

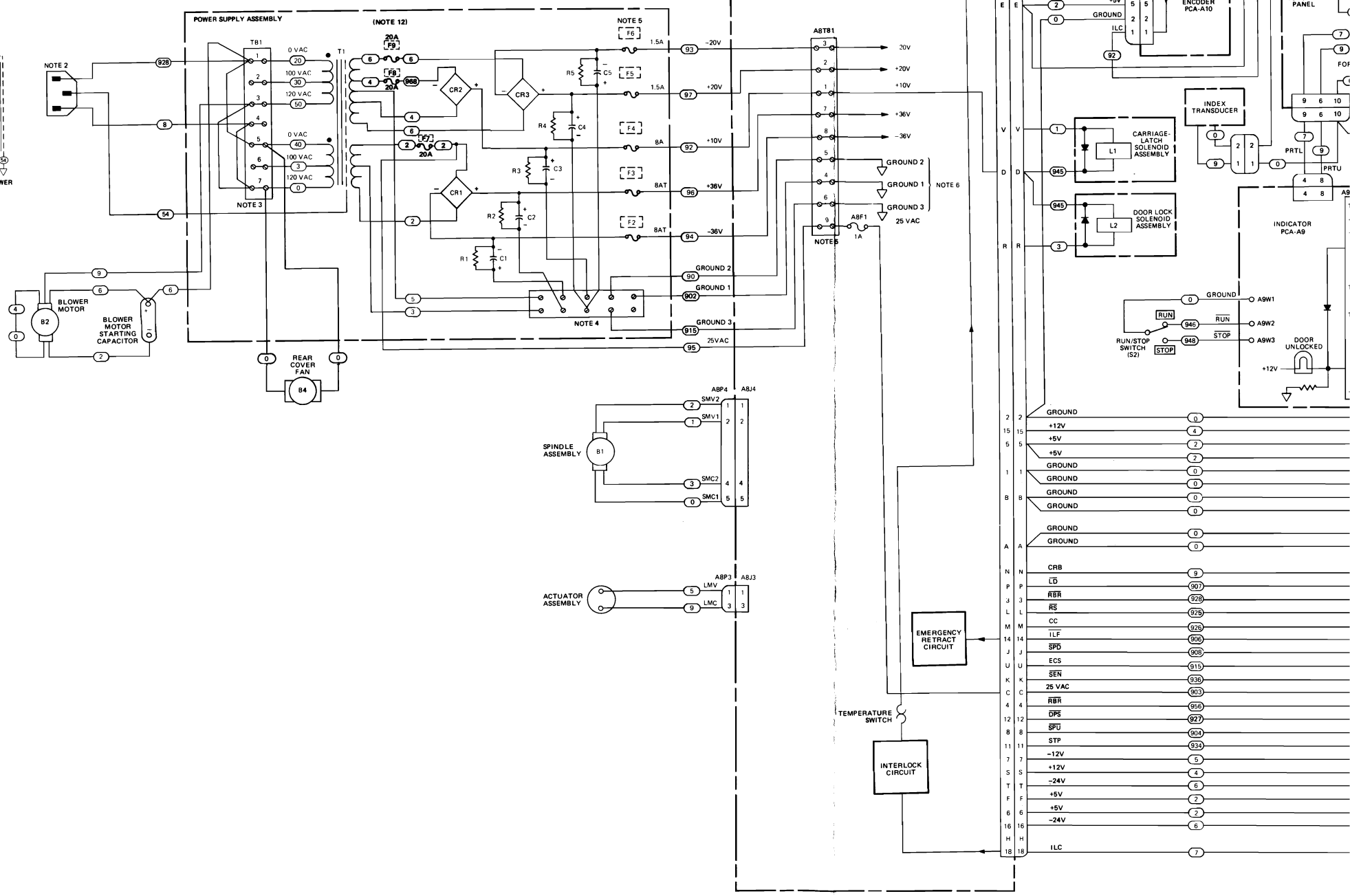
8. CONNECTION BETWEEN A1J1 AND A2J1 IS VIA JUMPER ASSEMBLY, PART NO. 13365-60006. REFER TO FIGURE A-15 FOR PIN ASSIGNMENTS.

9. CONNECTION BETWEEN A1J2 AND A12J1 IS VIA CABLE ASSEMBLY, PART NO. 13365-60007. REFER TO FIGURE A-15 FOR PIN ASSIGNMENTS.

10. CONNECTOR A12J2 IS A STANDARD HP-IB CONNECTOR. REFER TO FIGURE A-15 FOR PIN ASSIGNMENTS.

11. BRUSHES-BACK SWITCH AND BRUSH MOTOR NOT INSTALLED ON DRIVES WITH SERIAL NUMBERS PREFIXED 2040 AND LATER. ALL BRUSH CIRCUITRY IS INOPERATIVE IF DRIVE CONTROL PCA-A4, P/N 07906-60102, IS INSTALLED.

12. POWER SUPPLY PART NUMBERS 07905-60020 AND 07906-60014 DO NOT INCLUDE FUSES F7 THROUGH F9.



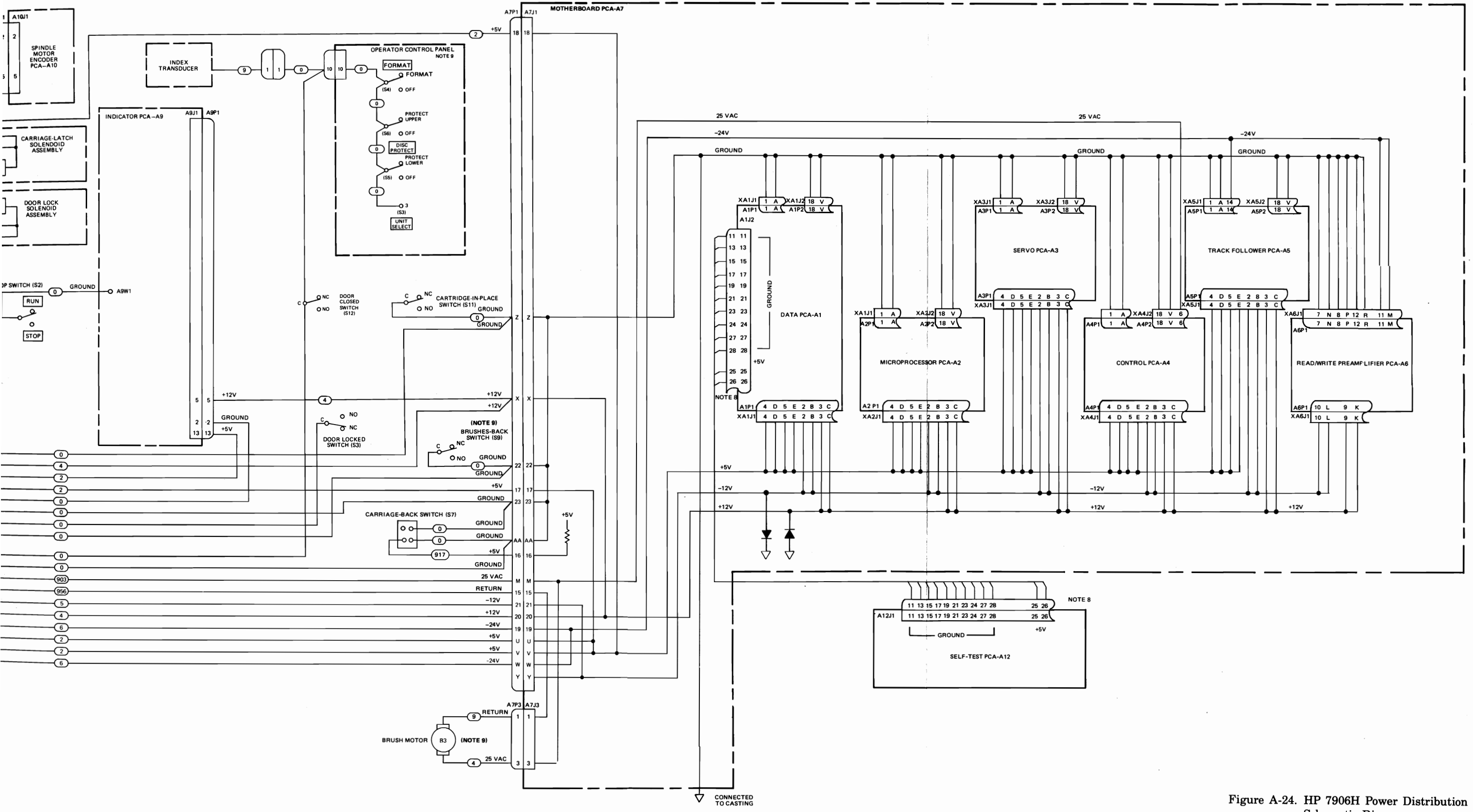
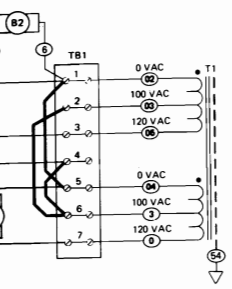
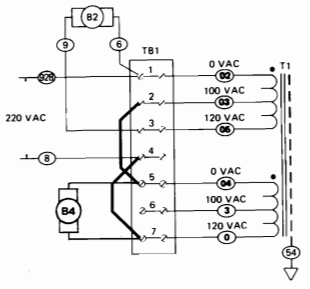


Figure A-24. HP 7906H Power Distribution Schematic Diagram

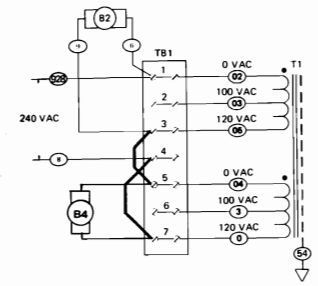
CK TB1 IS SHOWN CONFIGURED FOR 120 VAC OPERA-
NECTIONS FOR 100, 220, AND 240 VAC PRIMARY POWER
OWN BELOW:



CTIONS FOR 100 VAC PRIMARY POWER



TB1 CONNECTIONS FOR 220 VAC PRIMARY POWER



TB1 CONNECTIONS FOR 240 VAC PRIMARY POWER

GROUND BLOCK CONNECTIONS MUST BE MADE AS SHOWN.

FUSES F2 THROUGH F9 AND A8F1 ARE AS FOLLOWS:

F2	8AT*, 250V, 2110-0383
F3	8AT*, 250V, 2110-0383
F4	8A, 250V, 2110-0342
F5	1.5A, 250V, 2110-0043
F6	1.5A, 250V, 2110-0043
F7	20A, 125V, 2110-0098
F8	20A, 125V, 2110-0098
F9	20A, 125V, 2110-0098
A8F1	1A, 125V, 2110-0099

* THE T INDICATES THAT A TIME DELAY FUSE MUST BE USED.

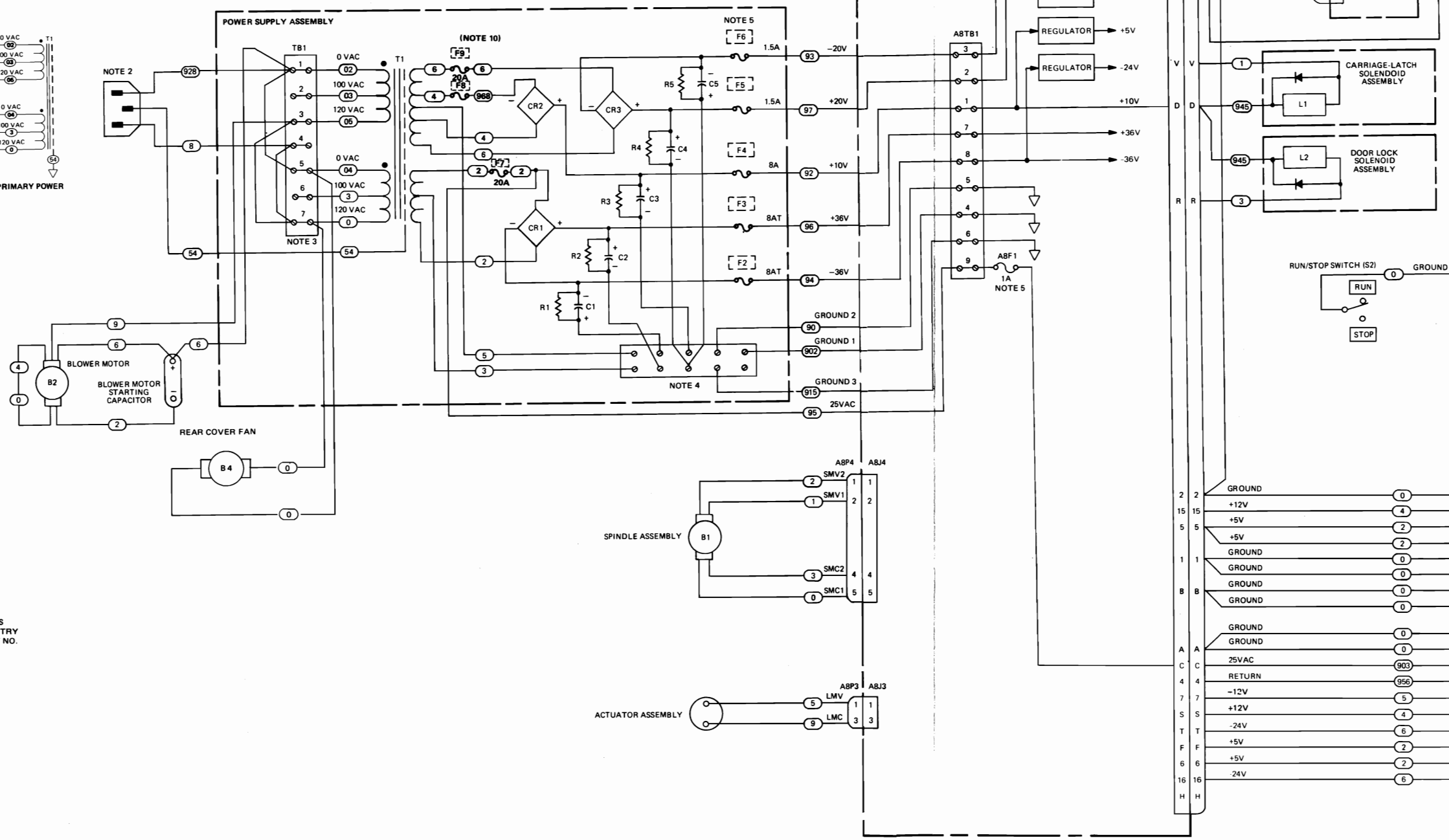
ONLY GROUND 1 LEAVES THE POWER AND MOTOR CONTROL PCA-A8.

NTERLOCK LINE IS AT 18V EXCEPT UNDER FAULT CONDITION.

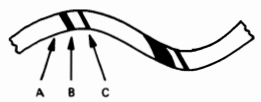
+5V AND GROUND CONNECTIONS BETWEEN A1J2 AND A12J1 ARE VIA CABLE ASSEMBLY, PART NO. 13365-60007.

BRUSHES-BACK SWITCH AND BRUSH MOTOR NOT INSTALLED ON DRIVES WITH SERIAL NUMBERS PREFIXED 2040 AND LATER. ALL BRUSH CIRCUITRY IS INOPERATIVE ON EARLIER DRIVES IF DRIVE CONTROL PCA-A4, PART NO. 07906-60102 IS INSTALLED.

POWER SUPPLY PART NUMBERS 07906-60020 AND 07906-60014 DO NOT INCLUDE FUSES F7 THROUGH F9.



NOTES:
1. ENCIRCLED NUMBERS INDICATE WIRING COLOR CODE AS FOLLOWS:



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
GRAY	8	8	8
WHITE	9	9	9

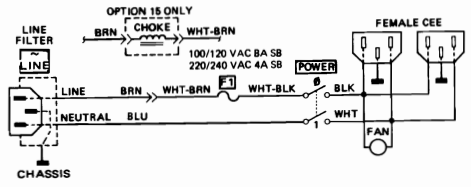
2. AC POWER IS SUPPLIED BY CABLE FROM A POWER PANEL ASSEMBLY (NOT PART OF THE DISC DRIVE) IN THE HP 29425B CABINET (HP 7906M/S DISC DRIVE) OR ON THE PREFILTER DUCT ASSEMBLY (HP 7906MR/SR DISC DRIVE). SCHEMATIC DIAGRAMS FOR THE POWER PANEL ASSEMBLIES ARE SHOWN BELOW. VALUES FOR LINE FUSE F1 ARE:

100 VAC – 8A SB 250V, 2110-0383
120 VAC – 8A SB 250V, 2110-0383
220 VAC – 4A SB 250V, 2110-0365
240 VAC – 4A SB 250V, 2110-0365

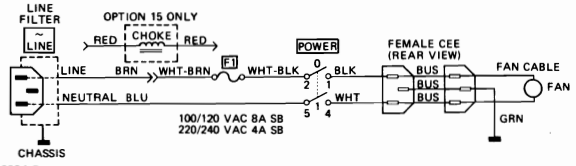
THE CABLE SUPPLYING POWER FROM THE HP 29425B CABINET POWER PANEL IS CABLE ASSEMBLY, PART NO. 8120-0575.

FOR A COMPLETE DESCRIPTION OF THE POWER PANEL ASSEMBLIES, REFER TO THE FOLLOWING PUBLICATIONS:

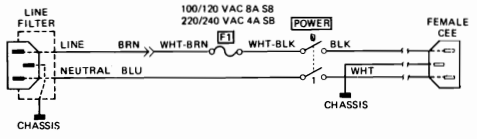
- HP 29425 CABINET INSTALLATION AND SERVICE MANUAL, PART NO. 29425-90001.
- HP 40019 PREFILTER ASSEMBLY INSTALLATION AND SERVICE MANUAL, PART NO. 40019-90901.



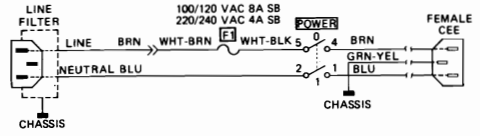
7604-4A
HP 29425B CABINET POWER PANEL ASSEMBLY, P/N 29425-60009 AND 29425-60010
(USED ON 7906B DISC DRIVES WITH SERIAL NUMBERS PREFIXED 2017 AND PRIOR)



7604-8
HP 29425B CABINET POWER PANEL ASSEMBLY, P/N 29425-60014 AND 29425-60015
(USED ON 7906B DISC DRIVES WITH SERIAL NUMBERS PREFIXED 2018 AND LATER)

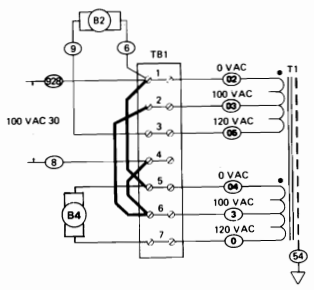


7312-4A
HP 40019B PREFILTER ASSEMBLY, P/N 40019-60006
(OPTIONAL ON 7906B DISC DRIVES WITH SERIAL NUMBERS PREFIXED 2016 AND PRIOR)

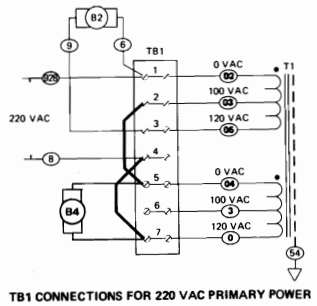


7312-4B
HP 40019B PREFILTER ASSEMBLY, P/N 40019-60012
(OPTIONAL ON 7906B DISC DRIVES WITH SERIAL NUMBERS PREFIXED 2017 AND LATER)

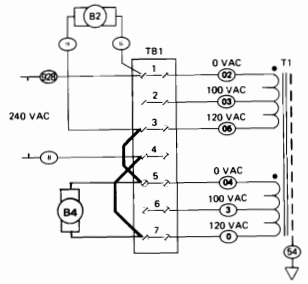
3. TERMINAL BLOCK TB1 IS SHOWN CONFIGURED FOR 120 VAC OPERATION. TB1 CONNECTIONS FOR 100, 220, AND 240 VAC PRIMARY POWER INPUTS ARE SHOWN BELOW:



TB1 CONNECTIONS FOR 100 VAC PRIMARY POWER



TB1 CONNECTIONS FOR 220 VAC PRIMARY POWER



TB1 CONNECTIONS FOR 240 VAC PRIMARY POWER

4. GROUND BLOCK CONNECTIONS MUST BE MADE AS SHOWN.

5. FUSES F2 THROUGH F9 AND A8F1 ARE AS FOLLOWS:

F2	8AT*,	250V, 2110-0383
F3	8AT*,	250V, 2110-0383
F4	8A,	250V, 2110-0342
F5	1.5A,	250V, 2110-0043
F6	1.5A,	250V, 2110-0043
F7	20A,	125V, 2110-0098
F8	20A,	125V, 2110-0098
F9	20A,	125V, 2110-0098
A8F1	1A,	125V, 2110-0099

*THE T INDICATES THAT A TIME DELAY FUSE MUST BE USED.

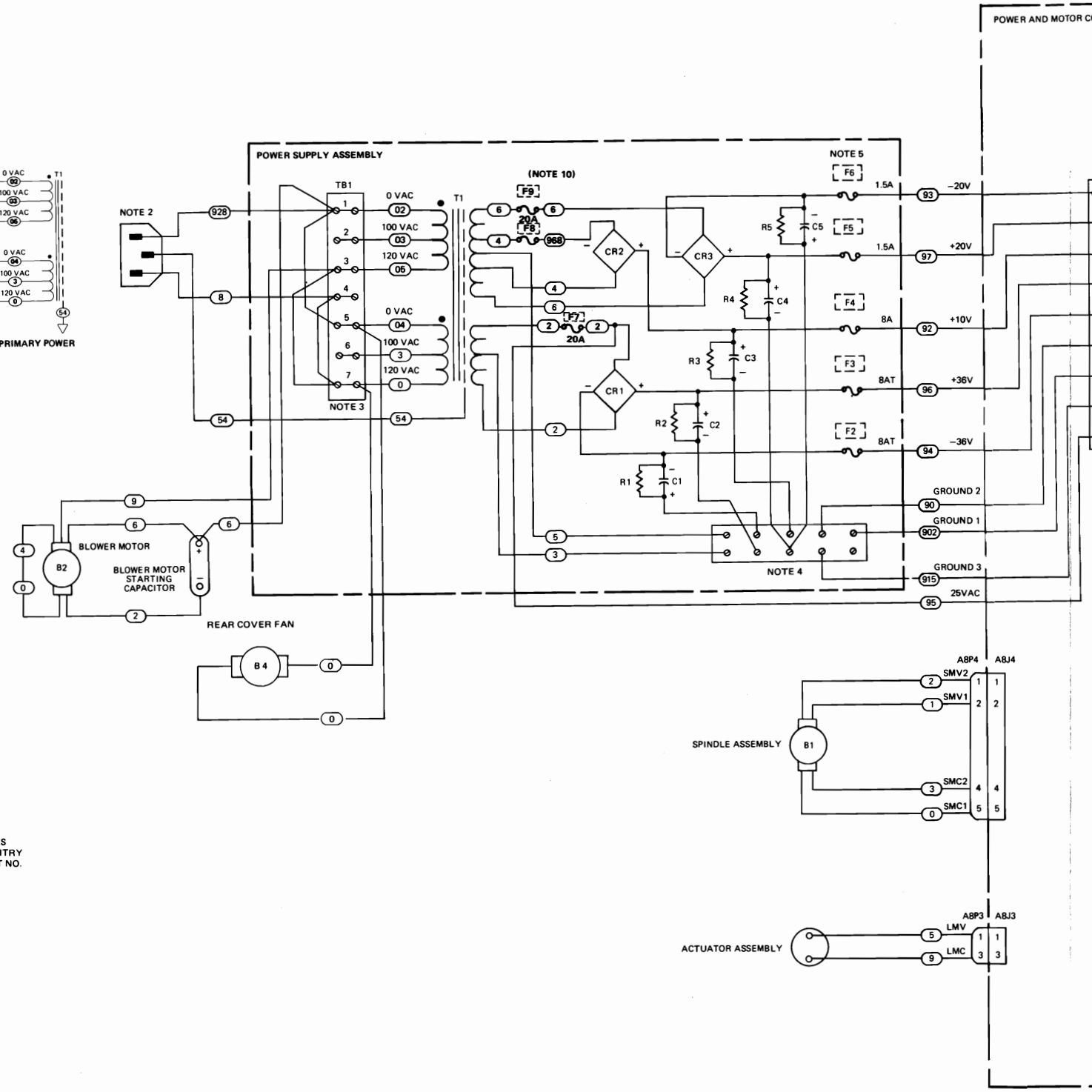
6. ONLY GROUND 1 LEAVES THE POWER AND MOTOR CONTROL PCA-A8.

7. INTERLOCK LINE IS AT 18V EXCEPT UNDER FAULT CONDITION.

8. +5V AND GROUND CONNECTIONS BETWEEN A1J2 AND A12J1 ARE VIA CABLE ASSEMBLY, PART NO. 13365-60007.

9. BRUSHES-BACK SWITCH AND BRUSH MOTOR NOT INSTALLED ON DRIVES WITH SERIAL NUMBERS PREFIXED 2040 AND LATER. ALL BRUSH CIRCUITRY IS INOPERATIVE ON EARLIER DRIVES IF DRIVE CONTROL PCA-A4, PART NO. 07906-60102 IS INSTALLED.

10. POWER SUPPLY PART NUMBERS 07906-60020 AND 07906-60014 DO NOT INCLUDE FUSES F7 THROUGH F9.



PART V — REMOVAL AND REPLACEMENT

The majority of the removal and replacement procedures contained in section V of the main manual are applicable to the HP 7906H. The only differences pertain to removal instructions for a) the rear cover (paragraph 5-8), b) certain of the PCA's (paragraphs 5-15 through 5-19), and c) the fan on the rear cover of the disc drive. The test point for checking the output of the index transducer (paragraph 5-29) is also changed. These changes are described in the following paragraphs.

WARNING

The information given in this part is intended for service-trained personnel. To avoid potentially serious electrical shock, do not proceed further unless qualified to do so.

A-70. REAR COVER

The rear cover is removed from the disc drive as follows.

Note: Unless otherwise specified, references made to index numbers (those numbers in parentheses) in the procedure correspond to the parts listing given in table A-11 of this appendix.

a. Remove power from the disc drive as outlined in paragraph 5-3 of the main manual. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the top cover from the disc drive as outlined in paragraph 5-6 of the main manual.

c. Remove the two screws (2), lock washers (3), and flat washers (4) used to secure the rear panel (1) to the rear cover assembly.

d. Disconnect the 50-pin connector (5) from self-test PCA-A12 (6).

e. Remove the four screws (8, 9, figure 6-1, main manual) and two lock washers (10, figure 6-1) used to secure the rear cover to the disc drive mainframe.

f. Disconnect the connector (13) from the fan (14) on the rear panel.

g. Remove the rear cover from the disc drive.

The rear cover is installed by reversing this procedure. Ensure that the 50-pin connector and fan connector disconnected in steps d and f are pushed firmly on until fully seated.

A-71. PRINTED-CIRCUIT ASSEMBLIES

Eleven different printed-circuit assemblies are used in the HP 7906H. They are mounted in seven different locations. Procedures are provided in the following paragraphs for removing the five PCA's (A1 through A5) housed in the card cage chassis and A12 mounted on the rear cover. Removal procedures for the remainder of the PCA's (A6 through A11) remain as described in the main manual.

A-72. CARD CAGE CHASSIS PCA'S

Each of the five PCA's housed in the card cage chassis is removed as follows:

a. Remove power from the disc drive as outlined in paragraph 5-3 of the main manual.

b. Remove the top cover from the disc drive as outlined in paragraph 5-6 of the main manual.

c. Loosen the screw (51) and flat washer (52) used to secure the PCA retainer (1, table A-12) to the card cage chassis.

d. Remove the PCA retainer.

e. Disconnect all cables connected to the PCA to be removed from the card cage chassis.

f. On PCA's A1 and A2, pull up on the PCA extractor and slide the PCA up and out of the card cage chassis. On PCA's A3 through A5, simultaneously lift up the two PCA extractor levers and slide the PCA up and out of the card cage chassis.

CAUTION

Ensure that the correct replacement PCA is inserted into its corresponding card guides, otherwise damage to the PCA could result.

CAUTION

If track follower PCA-A5 is replaced, ensure that the following procedures described in the main manual are performed before returning the disc drive to service:

- Temperature compensation check (paragraph 3-4)
- All adjustable parameter verification checks (paragraphs 3-15 through 3-18)

CAUTION

If microprocessor PCA-A2 is replaced, ensure that programming jumpers W360 through W363 and W312 through W318 on PCA-A2 are correctly positioned for 7906 operation, as detailed below. (The location of the jumpers is shown in figure A-16.)

W360 — Installed for rotational position sensing (RPS) operation only.
W361 — Spare. A spare jumper can be stored here.
W362 — } Installed
W363 — }
W312 — Installed
W314 — *Not* installed
W316 — } Installed
W318 — }

g. Insert the replacement PCA into the card guides in the card cage chassis assembly. Ensure that the PCA is correctly aligned (the component side of the PCA should face toward the right-hand side of the card cage chassis, as viewed from the front of the disc drive). Push the PCA into the connectors on motherboard PCA-A7 until it is fully seated.

h. Replace the PCA retainer and tighten the screw removed in step c.

i. Reconnect any cables disconnected in step e.

j. Replace the top cover on the disc drive.

A-73. SELF-TEST PCA-A12

Self-test PCA-A12 (6, table A-11) is removed from the disc drive as follows.

Note: Unless otherwise specified, references made to index numbers (those numbers in parentheses) in the procedure correspond to the parts listing given in table A-11 of this appendix.

a. Remove power from the disc drive as outlined in paragraph 5-3 of the main manual. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the two screws (2), lock washers (3), and flat washers (4) used to secure the rear panel (1) to the rear cover assembly.

c. Disconnect the 50-pin connector (5) from self-test PCA-A12 (6).

d. Remove the screw (7), lock washer (8), and flat washer (9) used to secure PCA-A12 to the rear cover.

e. Remove the two screws (10), lock washers (11), and flat washers (12) used to secure PCA-A12 to the rear cover.

f. Remove PCA-A12 from the rear cover.

Self-test PCA-A12 is installed by reversing this procedure. Ensure that the 50-pin connector disconnected in step c is pushed firmly on until fully seated.

A-74. FAN

The fan (14, table A-11) mounted on the rear cover is removed as follows:

a. Remove power from the disc drive as described in paragraph 5-3 of the main manual. Ensure that the ac power cord is disconnected from the disc drive.

b. Remove the rear cover from the disc drive as outlined in paragraph A-70 of this appendix.

c. Remove the three nuts (15), lock washers (16), flat washers (17), spacers (18), and screws (19) securing the fan (14) to the rear cover.

The fan is installed by reversing this procedure. Ensure that the fan is mounted with the airflow arrow pointing toward the exterior of the disc drive.

A-75. INDEX TRANSDUCER TEST POINT

Paragraph 5-29, step s (1) in the main manual states that the output of the index transducer is monitored at pin P2-H of I/O sector PCA-A2. In the HP 7906H, the index transducer output is monitored at pin P2-H of microprocessor PCA-A2.

PART VI — REPLACEABLE PARTS

A-76. INTRODUCTION

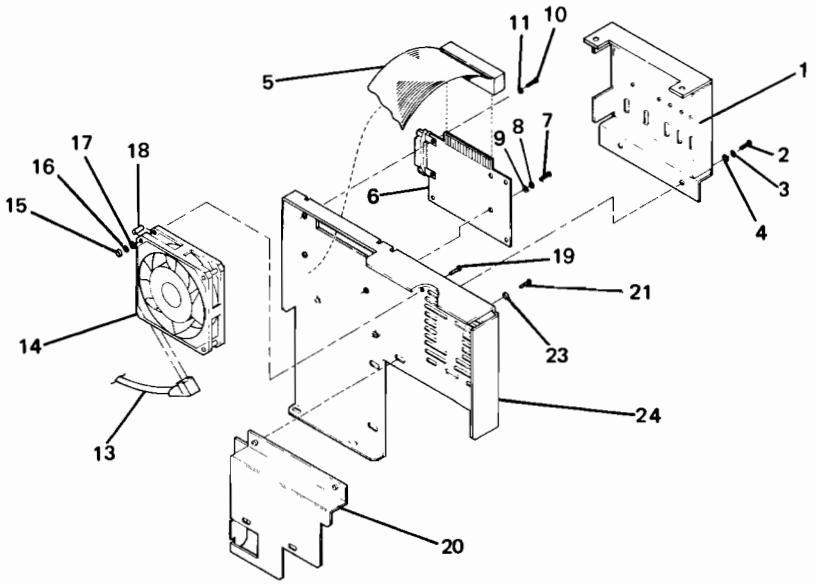
The replaceable parts lists and exploded views contained in section VI of the main manual are applicable to the HP 7906H, with the exception of certain component changes required in the documentation for the HP 7906 Disc Drive (table 6-1, figure 6-1) and mainframe assembly B (table 6-3, figure 6-3). These changes are detailed in tables A-11 and A-12, respectively. In addition, an HP-IB Device Address Label, part no. 7120-8111, is used to identify the 8-position rotary switch on the disc drive control panel bracket (166, figure 6-3).

Table A-11. HP 7906 Disc Drive — Part Changes for HP 7906H

For HP 7906H usage, item 7 (cover, rear) is deleted from table 6-1 and figure 6-1 in the main manual and replaced with the rear cover assembly described below.

INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
	No Number	*Cover, Rear Assembly▲	28480	NSR	1
1	13365-00002	**Panel, Rear	28480	13365-00002	1
		(Attaching Parts)			
2	2510-0101	**Screw, Machine, ph, pozi, 8-32, 0.312 in.	00000	OBD	2
3	2190-0321	**Washer, Lock, int-tooth, no. 8	00000	OBD	2
4	3050-0176	**Washer, Flat, no. 8	00000	OBD	2
		— — — x — — —			
5	13365-60007	**Cable Assembly	28480	13365-60007	REF
6	13365-60003	**Self-Test PCA (A12)	28480	13365-60003	1
		(Attaching Parts)			
7	2360-0201	**Screw, ph, pozi, 6-32, 0.5 in.	00000	OBD	1
8	2190-0468	**Washer, Lock, int-tooth, no. 6	00000	OBD	1
9	3050-0407	**Washer, Flat, no. 6	00000	OBD	1
10	2200-0742	**Screw, Machine, 4-40, 0.5 in., nylon	00000	OBD	2
11	2190-0199	**Washer, Flat, no. 4, nylon	00000	OBD	2
12		Deleted			
		— — — x — — —			
13	13365-60011	**Cord, Fan	28480	13365-60011	1
14	3160-0350	**Fan (B4)	28480	3160-0350	1
		(Attaching Parts)			
15	2260-0001	**Nut, Hex, no. 4-40	00000	OBD	3
16	2190-0469	**Washer, Lock, int-tooth, no. 4	00000	OBD	3
17	3050-0229	**Washer, Flat, no. 4	00000	OBD	3
18	0380-0912	**Spacer	28480	0380-0912	3
19	2200-0123	**Screw, Machine, ph, pozi, 4-40, 1.250 in.	00000	OBD	3
		— — — x — — —			
20	13365-00003	**Panel, Modesty	28480	13365-00003	1
		(Attaching Parts)			
21	2360-0115	**Screw, Machine, ph, pozi, w/ext-tooth, 6-32, 0.312 in.	00000	OBD	4
22		Deleted			
23	3050-0407	**Washer, Flat, no. 6	00000	OBD	4
24	13365-00004	**Cover, Rear	28480	13365-00004	1

▲For attaching parts, see items 8, 9, and 10 of figure 6-1, main manual.

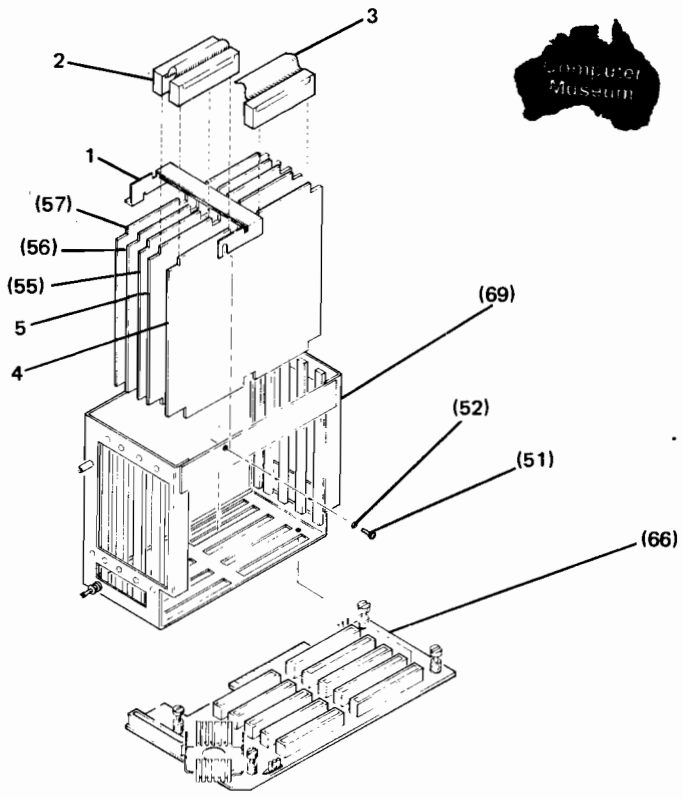


7300-147A

Table A-12. Mainframe Assembly B — Part Changes for HP 7906H

For HP 7906H usage, items 53 (PCA retainer) and 54 (I/O Sector PCA-A2) are deleted from table 6-3 and figure 6-3 in the main manual and replaced with the components detailed below.

INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
1	13365-00006	*Retainer, PCA	28480	13365-00006	1
2	13365-60006	*Cable, Jumper	28480	13365-60006	1
3	13365-60007	*Cable Assembly	28480	13365-60007	REF
4	13365-60001	*Data PCA (A1)	28480	13365-60001	1
5	13365-60202	*Microprocessor PCA (A2)	28480	13365-60202	1



Note: Components identified by index numbers in parentheses are unchanged and are shown for reference only. Refer to table 6-3 in the main manual for a description of these components.

7300-148

PART VII — RECORDING FORMAT AND COMMUNICATION PROTOCOL

A-77. INTRODUCTION

This Part describes the recording format used in the HP 7906H Disc Drive and provides details of the HP 7906H command set. The bit numbering notation shown in figure A-25 is used throughout the section. A 16-bit word is made up of two bytes, namely the left-hand (upper, most significant) byte and the right-hand (lower, least significant) byte. Note that the HP 7906/1000 numbering scheme is the reverse of the HP 300/3000 scheme in that the least significant bit is numbered 0 and the most significant bit is numbered 15.

A-78. RECORDING FORMAT

The HP 7906H track and sector recording format is illustrated in figure A-26. There are 48 sectors on each track and each sector is separated from the next by an intersector gap (ISG) having a nominal duration of 27 microseconds. Each sector contains a number of fields, described as follows.

- **SYNC.** The sync field consists of 24 bytes of all zeros. The field is generated at the beginning of each sector written, and is used to synchronize the read electronics to the data stream during a read operation.

- **PREAMBLE.** The preamble is a 6-byte field that precedes the data field of each sector. The six bytes are defined as follows:

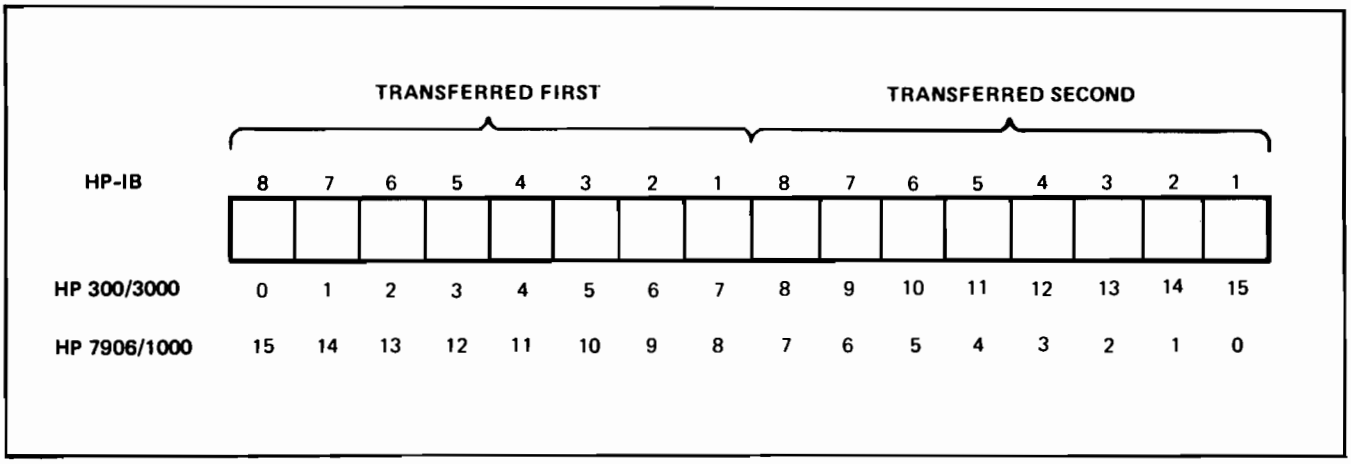
  SYNC — The sync bytes form one word (two bytes) of value 100377 (octal). The leading 1, since it follows the sync field, signifies the start of a valid data stream to the data separator. The least significant 1 (making the bytes 100377 instead of 100376) indicates that there is no valid error-correcting information in the ECC field of the postamble. The controller will not support error correction at present, but will write an arbitrary pattern into the ECC field so that the READ FULL SECTOR and WRITE FULL SECTOR of all compatible disc drive subsystems will function properly.

  CYLAD — Two bytes containing the 16-bit cylinder address of the sector. The address may not be the same as the physical address of the sector if the sector is part of a track which has been flagged with the S (spare) or D (defective) bit.

  S, P, D — Three bits of track status information. The combination used must be the same for all sectors of a particular track (cylinder and head address). The three bits are defined as follows:

  S bit — When set to 1 indicates that the track being accessed is a spare track in active use.

  P bit — When set to 1 indicates that the track being accessed is write protected. Such a track may not be written on unless the READ ONLY switch on the disc drive



7300-110

Figure A-25. Bit Numbering Notation

is not set and the FORMAT switch on the disc drive is set to override the protect feature.

D bit — When set to 1 indicates that the track being accessed has been flagged defective.

The S and D bits are mutually exclusive. The P bit may be set in any combination.

HEAD — Five bits containing the head address of the sector. The address may not be the same as the physical head address of the sector being flagged with the S or D bit. The S, P, D bits and the head address together form one byte of the preamble.

SECTOR — One byte containing the sector (rotational position) address of the sector.

- **DATA.** The data field consisting of 256 bytes of data.

- **POSTAMBLE.** The postamble is a 14-byte field that follows the data field of each sector. The 14 bytes are:

CRC — Two bytes of cyclic redundancy check (CRC) information for detection of errors during readout.

ECC — A 12-byte field reserved for error-correcting information. The present controller will not support error correction. The controller writes an arbitrary pattern on the ECC field. A READ FULL SECTOR command will return the pattern after the other fields have been transmitted.

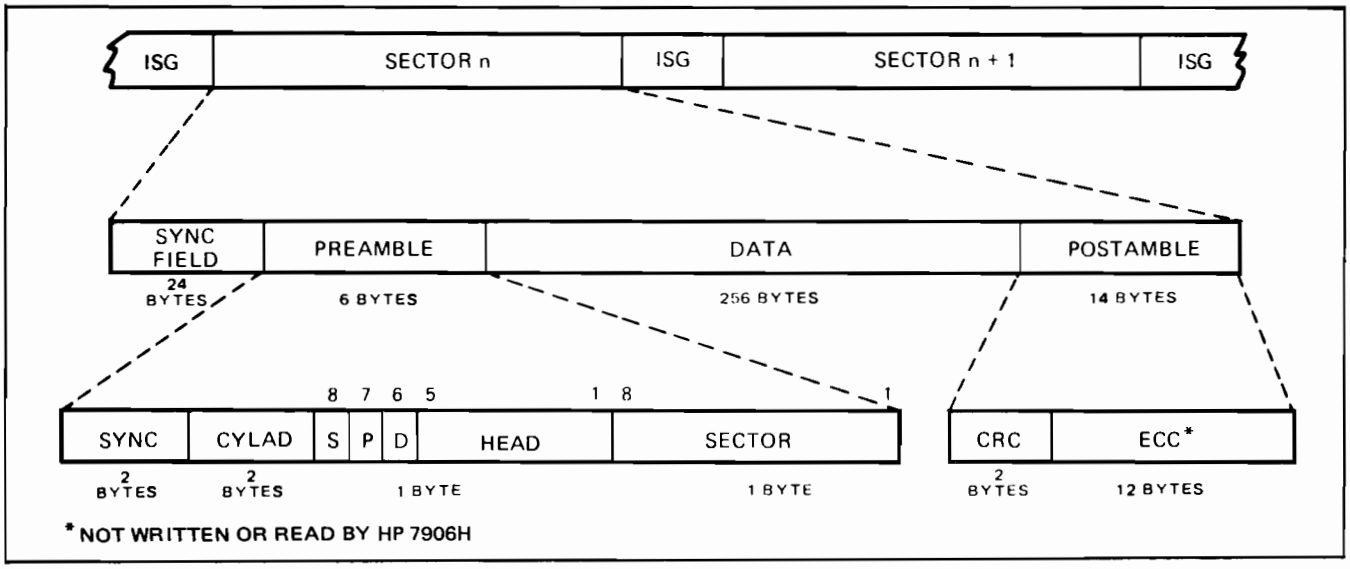
A-79. CHANNEL COMMUNICATIONS

The controller presents a bus-controlled device interface on the HP-IB. In this mode of operation, the controller-in-charge of the bus (for example, an HP 300 System I/O channel) explicitly addresses devices (for example, the HP 7906H) to communicate over the HP-IB. This is accomplished by using the primary and secondary commands defined in IEEE Standard 488-1975, *IEEE Standard Digital Interface for Programmable Instrumentation.* Communications between the controller and HP-IB (except for the SECONDARY (HARD) CLEAR and IDENTIFY sequences) observe the general sequence protocol shown in figure A-27.

An HP-IB primary or secondary is distinguished from data by the assertion of the Attention (ATN) line on the HP-IB. Only the HP-IB controller-in-charge (CIC) can assert ATN. Primary and secondary, as used in this Part, are subsets of the total class of primaries and secondaries available under HP-IB protocol. In particular, the primaries recognized by the controller are primary address to talk/listen (Primary 1) and primary untalk/unlisten (Primary 2). Refer to *IEEE Standard Digital Interface for Programmable Instrumentation* for additional details.

In general, four different types of information flow between the controller and the HP-IB channel. These types are:

- Control commands (Op codes) and associated parameters.
- Controller status on completed commands.
- Read data passed from the disc to the I/O channel.
- Write data passed from the I/O channel to the disc.



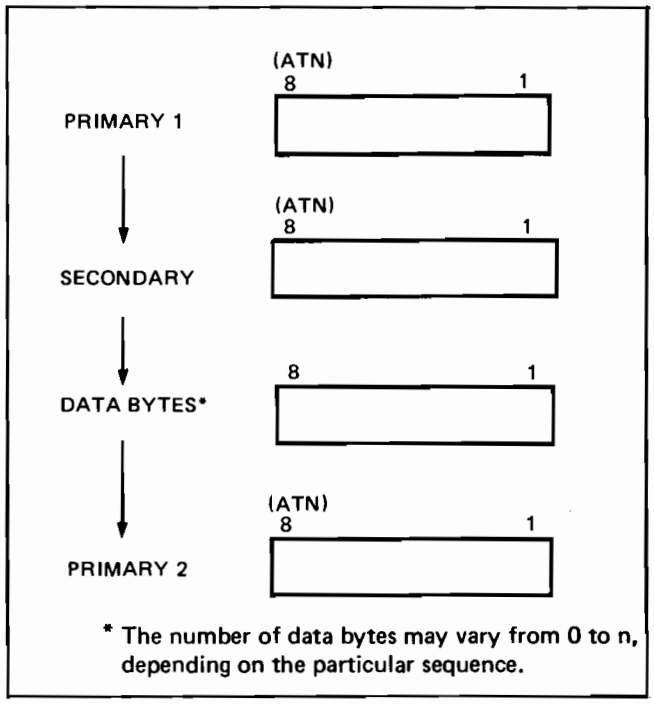
7300-111

Figure A-26. Track and Sector Format

An HP-IB secondary command is associated with each of the above types. Upon receipt of such a secondary, the controller examines the modifier field (see table A-13) in order to distinguish which of the four operation types to perform.

In addition to the four types of information listed above, there are seven other types of control information with secondaries that the controller is capable of interpreting. These are listed below and described in following paragraphs.

- DSJ (DEVICE SPECIFIED JUMP). Informs the I/O channel whether or not an operation was completed successfully (a go/no go indication).
- PARALLEL POLL. The I/O channel conducts a parallel poll on the HP-IB and each device on the bus is allowed to request attention or service by asserting the HP-IB Data I/O (DIO) line corresponding to the HP-IB address.
- SECONDARY (HARD) CLEAR. The controller is commanded to place itself in a known reset state.



7300-112 Figure A-27. Sequence Protocol

Table A-13. Controller Secondaries Coding Summary

PRIMARY COMMAND	SECONDARY TYPE	SECONDARY COMMAND								FUNCTION
					D/C	MODIFIER FIELD				
		8	7	6	5	4	3	2	1	
Listen	D (DATA)	P	1	1	0	1	0	0	0	Receive Disc Command (Secondary Get Command)
Talk	D	P	1	1	0	1	0	0	0	Send Disc Status (Secondary Send Status)
Listen	D	P	1	1	0	0	0	0	0	Receive Write Data (Secondary Write Data)
Talk	D	P	1	1	0	0	0	0	0	Send Read Data (Secondary Read Data)
Listen	D	P	1	1	0	1	0	0	1	Cyclic Redundancy Check (CRC)*
Talk	D	P	1	1	0	1	0	0	1	Cyclic Redundancy Check (CRC)*
Listen	C (CONTROL)	P	1	1	1	0	0	0	0	Secondary (Hard) Clear
Talk	C	P	1	1	1	0	0	0	0	Return Device-Specified Jump (DSJ) byte
Listen	C	P	1	1	1	1	1	1	1	Initiate Self-Test
Talk	C	P	1	1	1	1	1	1	1	Return Self-Test Result
Listen	C	P	1	1	1	1	1	1	0	Write Loopback Record
Talk	C	P	1	1	1	1	1	1	0	Read Loopback Record
Untalk	—	P	1	1	A	D	D	R	S	Identify

* Not implemented on current versions of the controller.

- SELF-TEST. The I/O channel commands the controller to execute a self-diagnostic procedure. The channel can then request the result of the diagnostic.
- LOOPBACK. A test of the channel and the controller. The channel writes data to the controller, then reads it back and compares it with the original data.
- IDENTIFY. Invoked by the operating system to determine what kind of devices are present on the I/O channel. The controller returns two bytes of preassigned identification code whenever the identify is performed (usually at system power-up) to aid the channel in the process of auto-configuration.
- CRC. A dummy cyclic redundancy check which is contained in the controller vocabulary to provide upward compatibility with future versions of the PHI chip capable of checking for errors in the data.

A-80. IDLE STATES

The controller has three idle states, where it is waiting to perform an operation (command or secondary). Idle State 1 (analogous to the Command Wait Loop in the HP 13037 Disc Controller) is entered at the normal or error completion of all secondaries except the END command and the RETURN DSJ BYTE secondary. In Idle State 1, the controller will respond to any parallel poll conducted on the HP-IB but will not report the disc drive being unloaded nor allow self-test to be invoked via the self-test START switch located at the rear of the disc drive. These conditions are reversed in Idle State 2 (analogous to the HP 13037 Disc Controller Poll Loop). That is, the controller will not respond to a parallel poll except when a disc drive is unloaded, but it will respond to the self-test START switch. Idle State 3, entered after a self-test or SECONDARY (HARD) CLEAR is performed, is similar to Idle State 2 except that the controller also generates a parallel poll response (PPR). Since a self-test is automatically performed at power-on or whenever the disc drive is loaded, Idle State 3 will be entered at these times also.

A-81. CONTROLLER SECONDARIES

The controller can interpret the thirteen secondaries listed in table A-13. (For a detailed description of these secondaries, refer to the *HP 13365 Integrated Controller Programming Guide*, part no. 13365-90901.) The two CRC secondaries listed in table A-13 are not implemented in current versions of the controller and are included for reference only.

The general form of the secondary, as transmitted over the HP-IB, is as shown in figure A-28. P is an odd parity bit in bit 8 of all controller-in-charge primaries and secondaries. The PHI chip may or may not freeze the bus when parity is not odd. This is a programmable feature set by bit 1 on in the data byte of a System 300 CLEAR command. D/C is used to distinguish between "data-type" and "control-type" secondaries (D/C = 0/1), and XXXX is a modifier field which defines the particular operation to be performed. Note in table A-13 that the same secondary can be used to perform different operations, depending on whether the associated primary is an address to talk or an address to listen.

The PHI chip, when processing a secondary, changes the 1 sent in bit 6 to a listen/talk = 0/1, depending on the sense of the associated primary. Thus, the controller can determine the proper interpretation of the secondary.

The controller expects the last data byte sent to it during any listen sequence to be tagged with the EOI bit. When the controller is addressed to talk, any data byte tagged with EOI usually indicates an error condition in the controller. The only exceptions are the READ LOOPBACK RECORD secondary and the CRC secondary.

Any secondary other than those described will generate an I/O program error status and set the device-specified jump (DSJ) byte to 1 (error). I/O program error status and DSJ byte = 1 also result if any byte tagged with ATN is received with incorrect (even) parity and the parity freeze option of the PHI is not enabled.

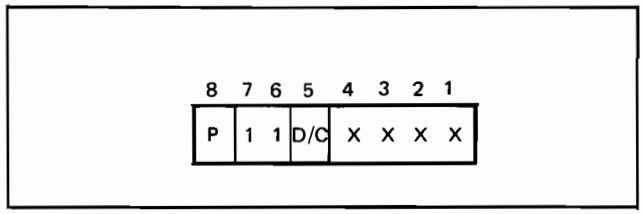


Figure A-28. General Form of Secondary

HEWLETT PACKARD

7906
DISC DRIVE
SERVICE MANUAL

UPDATING SUPPLEMENT

21 DEC 1983

MANUAL IDENTIFICATION

Manual Part No.: 07906-90903

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Manual Printed: JUL 1983

SUPPLEMENT DESCRIPTION

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

CHANGE HISTORY

Changes 1 through 16, dated 21 December 1983.

CHANGE	DESCRIPTION
1	Page 2-7, figure 2-3. Change the paragraph references listed under the third occurrence of "**REMEDY:**" as follows: change "PARAGRAPH 5-34" to "PARAGRAPH 5-38"; and change "PARAGRAPHS 5-29 AND 5-30" to "PARAGRAPHS 5-33 AND 5-34".
2	Page 2-7, figure 2-3. Change the paragraph reference listed under the fourth occurrence of "**REMEDY:**" as follows: change "PARAGRAPH 5-34" to "PARAGRAPH 5-38".
3	Page 3-1, paragraph 3-3, step f. In the fourth sentence, change "potentiometer A8R54" to "potentiometer A8R48".
4	Page 6-2, table 6-1, index no. 7. Change the HP PART NO. and the MFR PART NO. from "07905-00008" to "07906-60120".
5	Page 6-2, table 6-1, index no. 15. Change the HP PART NO. and the MFR PART NO. from "07905-00010" to "07906-60121".
6	Page 6-3, table 6-1, last entry. Change the HP PART NO. and the MFR PART NO. from "8120-1378" to "8120-2371".
7	Page 6-7, table 6-2, index no. 67. Change the HP PART NO. and the DESCRIPTION to read: "2510-0315; *Screw, machine, ph, pozi, w/square cone washer, no. 8-32, 0.375 in.".
8	Page 6-7, table 6-2, index no. 74. Change the HP PART NO. and the MFR PART NO. from "07925-60113" to "07925-60114".

CHANGE	DESCRIPTION
9	Page 6-7, table 6-2, index no. 86. Change the HP PART NO. and the MFR PART NO. from "07905-00058" to "07906-60125".
10	Page 6-7, table 6-2, index no. 87. Change the HP PART NO. and the DESCRIPTION to read: "2510-0315; *Screw, machine, ph, pozi, w/square cone washer, no. 8-32, 0.375 in.".
11	Page 6-7, table 6-2, index no. 88. Change the HP PART NO. and the DESCRIPTION to read: "2510-0315; *Screw, machine, ph, pozi, w/square cone washer, no. 8-32, 0.375 in.".
12	Page 6-8, table 6-3, first entry. Change the DESCRIPTION to read: "MAINFRAME ASSEMBLY B, (92, figure 6-2)".
13	Page 6-8, table 6-3. Insert the following entry after index no. 13: "13A; 3030-0939; *Setscrew, hex, locking, 1/4-20, 0.375 in.; 28480; 3030-0939; 1".
14	Page 6-9, table 6-3, index no. 42. Change the HP PART NO. and the MFR PART NO. from "07930-60202" to "07930-60226".
15	Page 6-10, table 6-3, index no. 106. Change the DESCRIPTION to read: "*Connector, edge, 36-pin".
16	Page 6-11, figure 6-3. Cut the following illustrations from this page and tape them over the corresponding assemblies in the upper left and lower center portions of the figure.