For HeathKit Floppy Disk

MEMOREX

550 Flexible Disc Drive
Technical Manual

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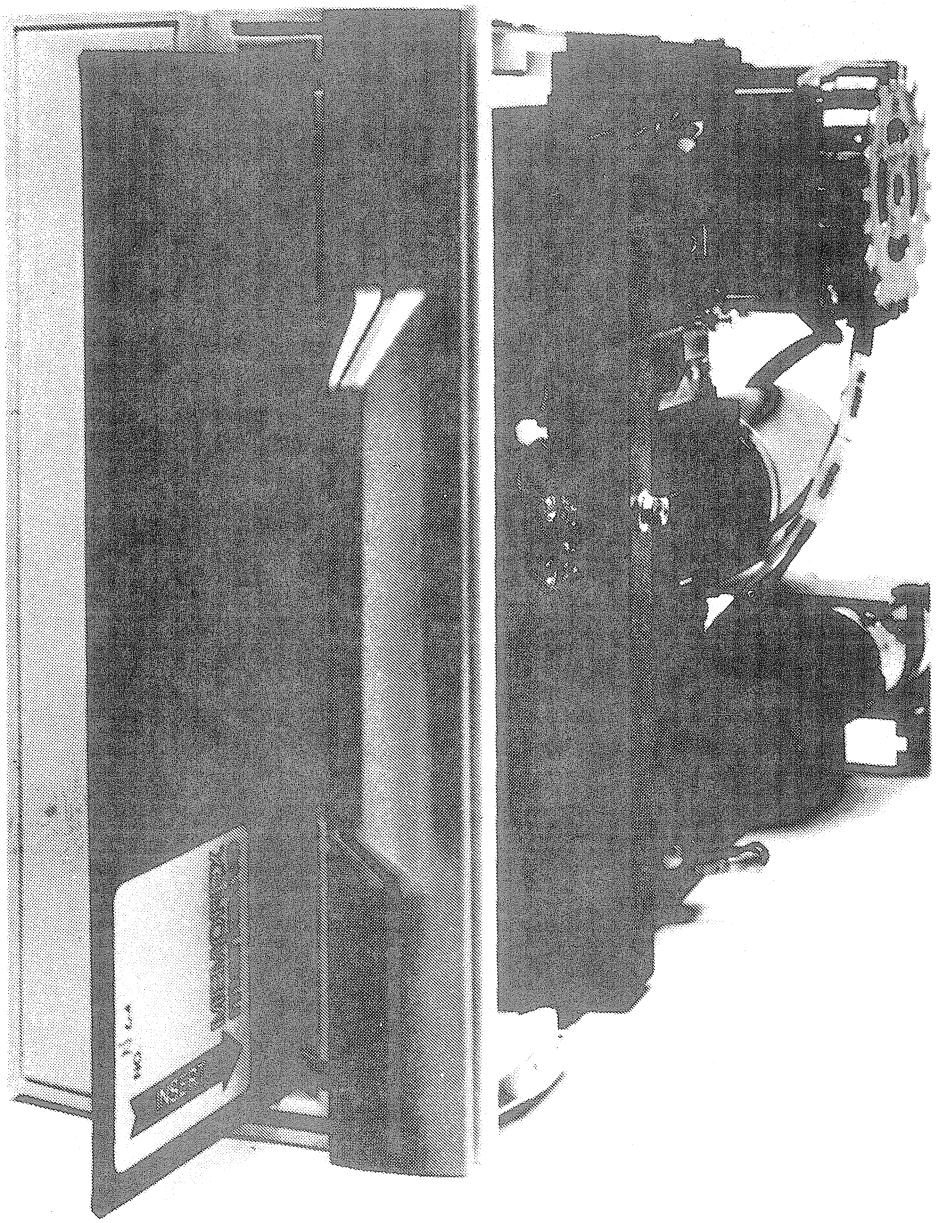


MEMOREX 550 FLEXIBLE DISC DRIVE

SECTION 1
INTRODUCTION

1.1 GENERAL DESCRIPTION

The Memorex 550 Flexible Disc Drive is a convenient, low-cost, magnetic recording and playback device designed to read and write data on a Memorex Markette, IBM Diskette, or competitive equivalent in response to specific commands from a host system. Recording is in the Frequency Modulation (FM) mode at a bit transfer rate of 250,000 bits per second. IBM compatible and non-IBM compatible modes, single- and double-density modes, are possible on the 550.

The storage medium is a small inexpensive flexible disc cartridge capable of storing up to 3.2 million bits in single-density mode and up to 6.4 million bits in double-density recording mode. The disc is rotated on a spindle at 360 rpm. A cartridge recorded on one 550 drive may be read on any other 550 drive or existing IBM compatible drive. The 550 produces recorded discs that meet the requirements depicted in the *IBM Diskette Original Equipment Manufacturer's Information Manual* and the ANSI standard now under development.

Solid state sensors are used to detect Index, Sector, Track 00, Track 43, and Write Protect conditions. A mechanical switch detects a door closed condition. The control, read, and write logic constitute the interface electronics between the user's host system and the 550 Flexible Disc Drive. The drive contains unique head loading and disc clamping mechanisms. An interlocking latch system insures proper positioning of the disc cartridge and prevents the operator from closing the door on an improperly inserted disc cartridge. When the door is reopened the cartridge is partially ejected for easy removal.

The drive contains a ceramic read/write head, mounted in a carriage capable of stepping forward or reverse to any of seventy-seven (77) discrete positions (tracks). The carriage is positioned by a three-phase stepper motor with an integral lead screw. The stepper motor rotates the lead screw clockwise or counterclockwise to obtain forward or reverse motion.

The drive base is compression molded, fiberglass-reinforced thermosetting polyester for long-lasting, maintenance-free life. The door and front panel are made of a molded, glass-filled thermoplastic. The carriage is made of molded glass- and teflon-filled polycarbonate. The 550 is available in two configurations; drive mechanism only or drive mechanism and associated electronics. Drive electronics are mounted in the drive mechanism chassis on a single PCB. The 550 Flexible Disc Drive is compact enough to fit into standard EIA 19-inch racks in pairs, if mounted horizontally, or in fours, if mounted vertically.

Memorex designed the 550 Flexible Disc Drive specifically as a low-cost, high-capacity, compact OEM product. The 550 is suitable for handling a variety of applications, such as program loads, file saves, dumps and restores.

1.2 FEATURES

- High disc cartridge storage capacity
- Single- or double-density recording
- 250,000 bit per second transfer rate (single-density)
- 500,000 bit per second transfer rate (double-density)
- Cartridges recorded are fully interchangeable on other drives
- IBM compatibility
- All drive electronics on one PCB
- 77 tracks per diskette; 41,667 bit capacity per track (single-density) or 83,333 bit capacity per track (double-density)
- Convenient easy-to-load cartridge
- Reliability (9,000 hrs MTBF; 0.5 hrs MTTR)

1.3 OPTIONS

- Write protect
- Hard sector detection
- Expansion from 4- to 8-drive multiplexing mode (customer installed option)
- Program-controlled door lock
- Two-sided operation
- File Busy indicator
- Separated data/clock feature
- Negative power supply

1.4 SPECIFICATIONS

Table 1-1 contains a summary of 550 Flexible Disc Drive Specifications (nominal values).

TABLE 1-1. SPECIFICATIONS SUMMARY

OPERATIONAL	
Media	IBM Diskette, Memorex Markette, or equivalent.
Recording Method	Frequency Modulation (FM) or (MFM) or (M^2FM)
Rotation Speed	360 rpm
Access Time	16 milliseconds track-to-track
Latency Time (avg.)	83.33 milliseconds at nominal rotation speed
Start-Up Time	0.5 seconds after door is closed. 2.0 seconds after power on with cartridge already inserted
Data Transfer Rate	250,000 bits per second (single-density) 500,000 bits per second (double-density)
Disc Capacity:	
Single-Density	3.2 million bits
Double-Density	6.4 million bits
Number of Tracks	77
Recording Density:	
Single-Density	722.8 bits per cm (1836 bits per inch) on outside track (Track 00) to 1286.6 bits per cm (3268 bits per inch) on inside track (Track 76).
Double-Density	1445.6 bits per cm (3672 bits per inch) on outside track (Track 00) to 2573.2 bits per cm (6536 bits per inch) on inside track (Track 76).
Data Error Rate, Soft	One error per every 10^9 bits transferred (maximum)
Data Error Rate, Hard	One error per every 10^{12} bits transferred (maximum)
Seek Error Rate	One error per every 10^6 positioning movements
Mean Time to Repair (MTTR)	0.5 hours per incident
Mean Time Between Failures (MTBF)	9000 hours
Media Life	5×10^6 passes per track
Preventive Maintenance (PM)	¼ hour every year (normal environment)

TABLE 1-1. SPECIFICATIONS SUMMARY (Continued)

PHYSICAL	
Drive:	
Size	22.23 × 11.13 × 35.56 cm (8.75 × 4.38 × 14.0 inches)
Weight	4.73 kg (10.7 lbs.)
Flexible Disc Cartridge	
Size	20.32 × 20.32 × .159 cm (8 × 8 × 1/16 inches)
POWER	
AC Power	115/230 VAC, (+10%), 60/50 Hz (±0.5%), 40 watts, single phase
DC Power	+5V (±0.25V) -5V (±0.25V) +24V (±1.2V)
ENVIRONMENTAL	
Temperature:	
*Operating	10°C to 38°C (50°F to 100°F)
Storage	-34°C to +66°C (-30°F to +150°F)
Relative Humidity:	
*Operating	20% to 80%
Storage	5% to 95% (No condensation)
Wet Bulb Temperature	26°C (78°F), maximum
Shock and Vibration	Drive can withstand normal shock and vibration levels encountered in commercial air and surface transportation
Altitude	30.5 metres (100 feet) below sea level to 3048 metres (10,000 feet) above sea level

*After storage outside the operating range, stabilization for four (4) hours within the operating range is required for proper operation of the 550 drive.

SECTION 2
OPERATIONAL DESCRIPTION

The 550 Flexible Disc Drive consists of electronic, mechanical, and transducer elements that perform the following functions:

- Receive and generate control signals
- Generate status signals
- Access the appropriate track
- Write or read data
- Clamp and rotate the disc

These functions are implemented by the assemblies and logic signals shown in the block diagram of Figure 2-1. This section depicts each block and signal shown on the block diagram.

2.1 GENERAL OPERATION

The 550 employs the contact method of recording; the read/write head is in direct contact with the disc. The head is mounted on a carriage positioning device, consisting of a stepper motor operating in conjunction with a lead screw. The carriage is moved by the lead screw, positioning the read/write head. The stepper motor rotates the lead screw clockwise or counterclockwise in 15 degree increments, causing the head to move, forward or reverse, one track position each increment. The host system increments the head to the desired track. The carriage can be positioned to any of 77 tracks. The carriage is guided by the O.D. of the lead screw and a parallel cylindrical rod. The screw follower acts radially along the screw, reducing the offtrack effect of wear.

The Head Assembly contains a single head which performs the functions of read, write, and erase. Head loading is achieved by using a Head Load Solenoid (refer to Figure 2-2). With the solenoid energized, the bail is disengaged from the load arm, permitting the load arm spring to force the pressure pad against the disc and urge it gently against the head. Deenergizing the solenoid causes the retracting bail to lift the load pad from the disc, thereby unloading the head.

A synchronous drive motor provides power to rotate the disc on the spindle at 360 rpm through a belt and pulley system. The drive motor is provided with an axial-flow fan for cooling. The disc is correctly positioned on the spindle by a disc clamping mechanism actuated by the closing of the door. A pressure pad is used to register the cartridge against a platen, for proper head penetration. The clamp and pressure pad are located on the carrier. Figure 2-3 depicts the clamp and registration hub assemblies.

The Index Light Emitting Diode (LED) and Detector generate disc index pulses which may be used by the host system to format data written on the disc. The pulses are generated by light passing through the index hole as the disc rotates. The Index LED and Detector (photo transistor) are placed on opposite sides of the disc. As the disc revolves, the index hold passes between the LED and Detector illuminating the Detector and turning it on. The detector output is shaped by a Threshold Detector and an output pulse is obtained. The output is normally at +5 volts with a transition to 0 volts for the pulse.

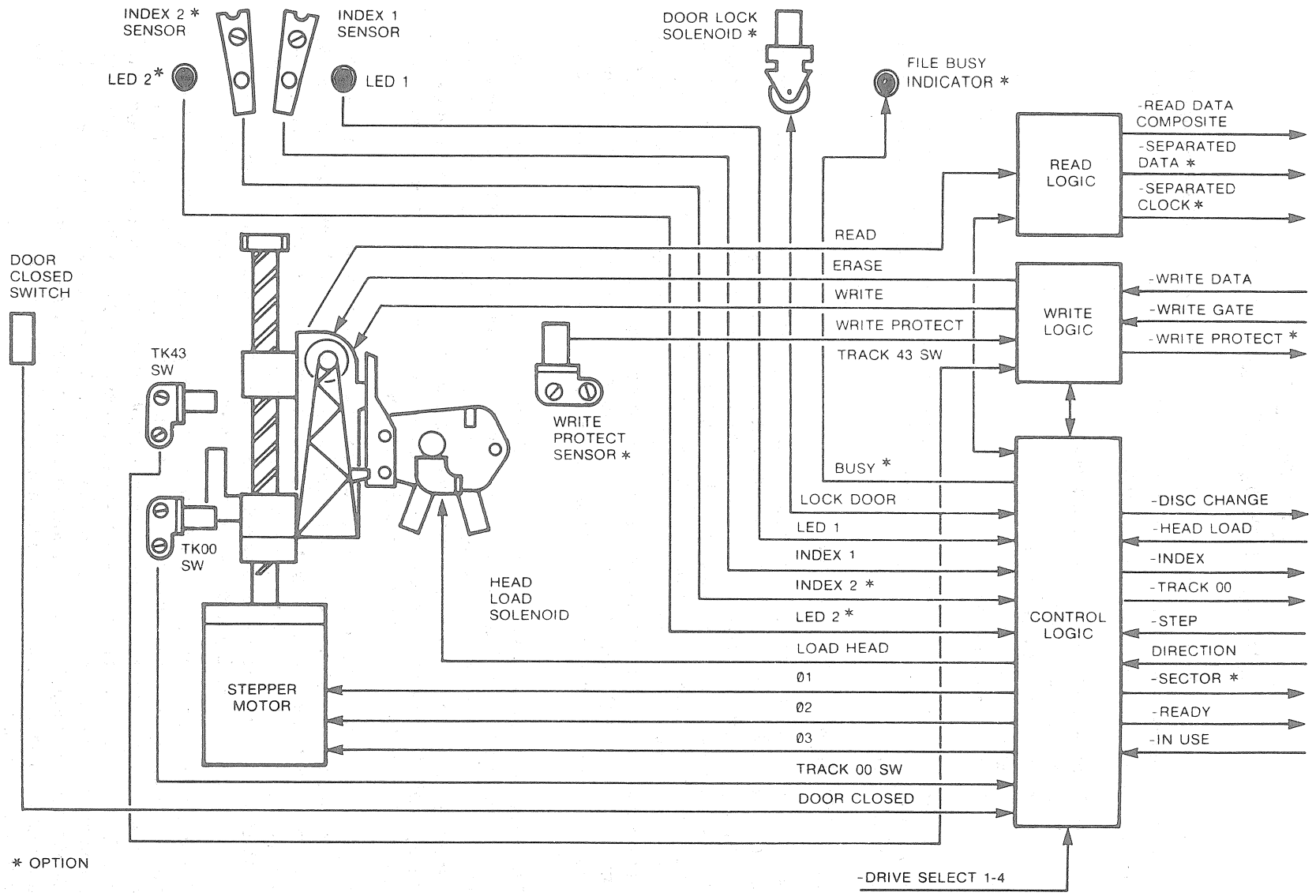


FIGURE 2-1. 550 FUNCTIONAL DIAGRAM

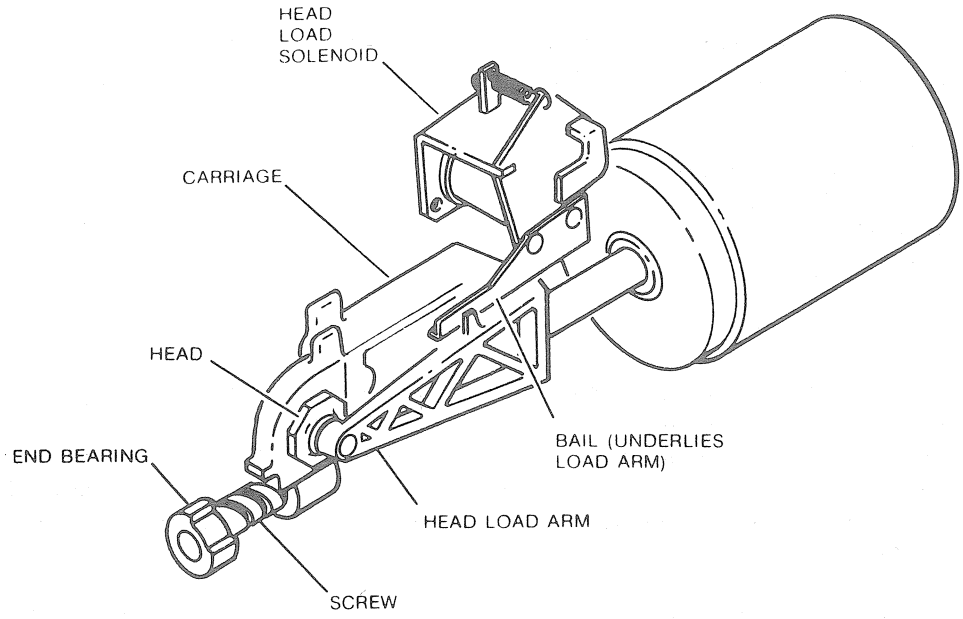
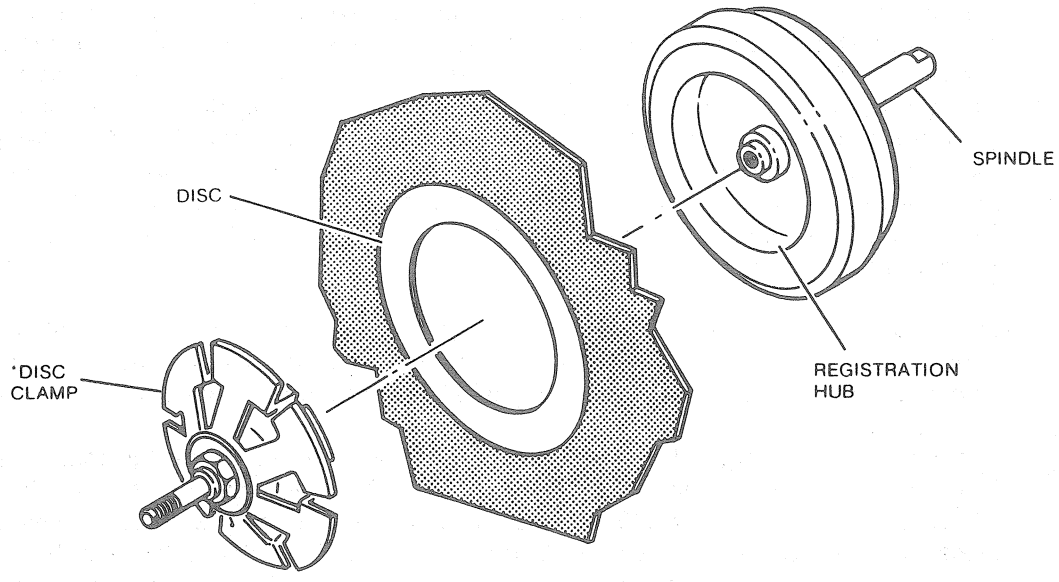


FIGURE 2-2. HEAD LOADING ASSEMBLY



*DISC CLAMP AND PRESSURE PAD ARE CONNECTED TO UNDERSIDE OF CARRIER.

FIGURE 2-3. DISC CLAMPING AND REGISTRATION

A second LED and Detector are optionally available to permit alternate side operation. With a second Index assembly, the user may read/record either side of the Flexible Disc.

The Control, Read and Write Logic constitute the interface electronics between the user system and the 550. These electronics are packaged on one printed circuit board (PCB) along with:

- Sensor detector circuits
- Head load circuit
- Write protect circuit
- Motor drive circuit
- Current switching circuit
- Interlock circuit

The PCB is connected to the user's system via a 50-pin 3M type edge connector and cable. Separate connectors are provided for power, head, and internal circuits connections. The PCB contains logic that enables multiple drives to be connected in serial fashion. Configurations of up to four (4) serial drives may ordinarily be connected. The PCB has provisions for an installed customer supplied option for eight (8) serially connected drives.

Solid state sensors are provided to detect Track 00, Track 43, and Write Protect in addition to the index/sector sensor(s). A "Door Closed" status is detected by a mechanical switch. This switch is the only mechanical switch on the 550 drive. Its principal function is to deenergize the head load solenoid.

The disc cartridge, shown in Figure 2-4, is composed of a Flexible Disc which rotates inside a plastic envelope. The envelope has three openings in it that allow the disc to interface with the drive. An oval opening for the read/write head to access the disc during recording/reading, a circular opening for the rotating driving hub (spindle) to engage the disc, and a circular opening for the index function. The disc clamp also uses the hub opening for contact with the disc. The envelope measures 20.3 centimetres (8 inches) square by 0.16 centimetres (0.062 inches) thick. It is made of flexible material sealed around the edges and lined with a self-cleaning wiper to clean the disc as it rotates.

The Flexible Disc itself measures 7.88 inches in diameter, and rotates at 360 rpm during operation. It is punched with one hole near the center which is used for indexing. Up to 77 tracks of data (Tracks 00 through 76) can be written on the disc.

The 550 drive is designed to operate with any Flexible Disc cartridge that meets the requirements depicted in the *IBM Diskette Original Equipment Manufacturer's Information Manual* GA21-9190-2 and the ANSI standard now under development. Discs that meet these requirements but also contain 32 sector holes punched on the same radious as the index hole may be used in the 550. When these non-IBM-compatible "hard sector" discs are used, the 550 separates the 32 sector pulses from the one index pulse and transmits this index and sector information to the controller over separate lines. The 550 provides full interchangeability between drives for any diskette recorded or read on a 550 drive or a compatible drive with comparable features.

The disc may be write-protected by means of a notch cut in the cartridge, as shown in Figure 2-4. When the cartridge is inserted in the 550, an invisible beam of infrared light generated by a LED is passed through the notch and is sensed by a photo transistor detector. The detector is situated on the other side of the disc cartridge, opposite the LED. The detector generates a WRITE PROTECT signal which inhibits WRITE ENABLE, thus preventing the drive from writing on the disc.

The data transfer rate of the 550 is 250 kilobits per second, in single-density mode, and 500 kilobits per second, in double-density mode.

In single-density mode, the maximum capacity of a track is 41,667 bits (5,208 bytes). A disc has a total capacity of 3,208,333 bits (401,042 bytes). In double-density mode, the maximum capacity of a track is 83,333 bits (10,416 bytes) with a total disc capacity of 6,416,667 bits (802,083 bytes). The capacities given are maximums and are based on the number of bits recorded on a track in an unsectored format. Actual capacities will depend on the user's chosen format.

Positioning time required to move the head between any pair of adjacent tracks is 16 milliseconds including settling time. Multiple track moves, moving of the head in multiple steps through adjacent tracks, is 6 milliseconds per step except the first two steps and last two steps, which are 10 ms each, plus 6 ms for settling time. In a completely random mode, the average positioning time required to move the head to the desired track and allow the head to settle is 174 milliseconds. The maximum positioning time, the time required to move the head from Track 00 to Track 76, is 478 milliseconds including settling time.

The average time required to rotate to a desired record location on a designated track is 83.33 milliseconds, at a rotation speed of 360 rpm. The maximum time required at this speed is 166.67 milliseconds.

The 550 Flexible Disc Drive is ready for operation 0.5 seconds after its door is closed, or within 2 seconds after the power is first turned on, if the disc cartridge is already inserted.

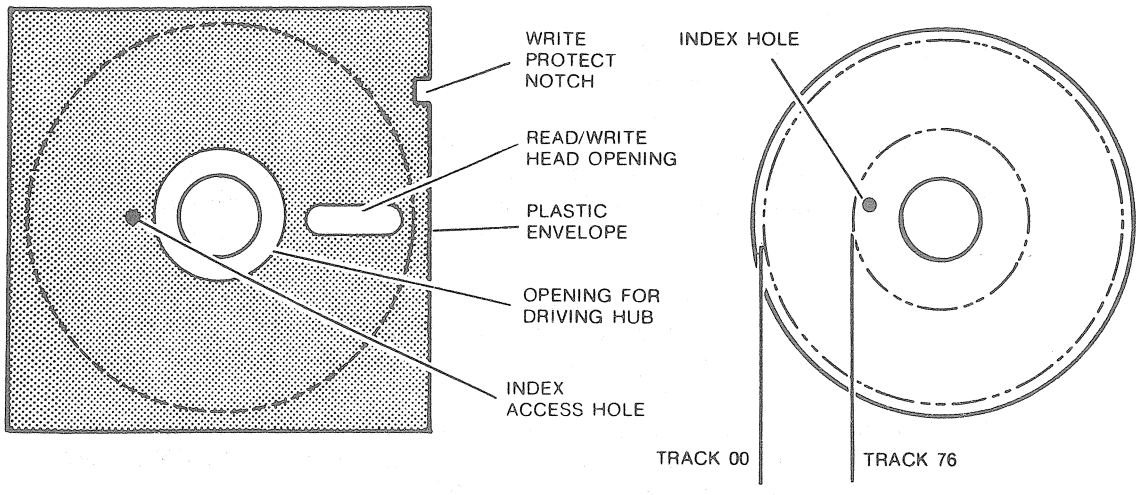


FIGURE 2-4. DISC CARTRIDGE AND DISC CONFIGURATION

2.2 LOGIC

The logic and signals shown in Figure 2-1 are described below. All input interface signals are generated by the user; all output interface signals by the 550.

2.2.1 Control Logic

The functions of the Control Logic are to place the read/write head on the proper track, hold the disc against the head for read or write operations, and indicate disc rotational position.

User interface signals are:

HEAD LOAD Command from the host controller to initiate the drive for use. Control Logic outputs a LOAD HEAD signal to the Head Load Solenoid in response to this command.

INDEX This line informs the controller a disc revolution has occurred. The controller may use this line as a fixed starting point from which to determine disc position.

TRACK 00 Output to the host controller to provide head position information. Says read/write head is positioned on Track 00, (outermost track on disc) and stepper motor is on phase 1.

STEP This line, when active, enables the carriage to move the head one track forward or reverse for each STEP pulse.

DIRECTION This line works in conjunction with the STEP line to cause the stepper motor to move the carriage one step in either forward or reverse direction. With this line low (-), steps are toward the center of the disc; when this line is high (+), steps are toward the outside of the disc.

SECTOR* Each time a sector hole on a "hard sectored" disc is detected, a status line informs the controller.

READY This interface line to the host controller indicates that the drive is selected and either two revolutions or two sector holes have been sensed and that the door is closed and latched. The signal remains true until the door is opened or DC power is dropped.

IN USE The IN USE interface line from the host controller may be used to control the optional busy indicator. It also may be used to control the optional door lock solenoid.

DISC CHANGE This signal informs the controller that a previously deselected drive has gone from being READY to NOT READY to READY again when it is next selected.

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*Denotes optional device

Transducer signals between the 550 Control Logic and electromechanical assemblies are as follows:

This section identifies the interface lines available if Memorex control logic is not provided.

BUSY* The BUSY signal is output to a BUSY INDICATOR on the front panel when the 550 drive is in use.

LOCK DOOR* Output pulse to the Door Lock Solenoid to inhibit the door latch from operating, thus preventing the door from being opened.

INDEX 1 This line provides a signal to the Control Logic once each disc revolution.

INDEX 2* (ALTERNATE SIDE INDEX) The ALTERNATE SIDE INDEX pulse functions the same as the INDEX pulse when operating on the opposite side of the disc. This second pulse is required due to the changed position of the index access hole when the disc is reverse side operated.

LOAD HEAD This output line from the Control Logic loads or unloads the disc from the read/write head. The LOAD HEAD signal is sent to the Head Load Solenoid to initiate a Load Head operation.

PHASE 01, 02, 03 These three output pulses to the Stepper Motor provide direction data; phases determine clockwise or counterclockwise movement which translates into forward or reverse carriage steps. These three phase signals are a function of the DIRECTION and STEP commands from the host controller.

TRACK 00 This input from the Track 00 sensor indicates when the read/write head carriage is positioned at Track 00.

TRACK 43 This input from the Track 43 sensor indicates when the read/write head is positioned at any track greater than Track 42. This signal is normally used to reduce write current.

DOOR CLOSED This input signal is provided to the Control Logic from the mechanical door closed switch.

LED 1 Provides power to the Light Emitting Diode associated with Index 1.

LED 2 Provides power to the Light Emitting Diode associated with Index 2.

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*Denotes optional device

2.2.2 Write Logic

The Write Logic converts digital data received from the user into analog form for recording on the disc. The drive receiving the data, in response to the WRITE command from the controller, is previously and that the disc is not write protected. User interface signals are:

WRITE DATA A user-generated composite signal consisting of alternating write clocks and data.

WRITE GATE This user generated signal enables the write electronics in the 550. Without this WRITE GATE line from the controller, writing is inhibited.

WRITE PROTECT* This interface signal to the host controller indicates the presence of a write protected disc cartridge. All write circuitry is disabled with this signal active.

550 internal signals to/from the Write Logic are:

HEAD When writing, this signal is output to the Head performing a WRITE operation. If WRITE PROTECT is active, the WRITE operation is inhibited.

WRITE PROTECT This is the input line from the Write Protect sensor indicating to the Write Logic that the disc cartridge in use is Write Protected. All writing is inhibited.

TRACK 43 This input comes from the Control Logic to initiate a low current WRITE. The Track 43 signal is used to write on Tracks 43 through 76 (the inner tracks) with a lower amplitude write signal than that used on Tracks 00 through 42 (outer tracks).

---

*Denotes optional device

2.2.3 Read Logic

The Read Logic receives pulses from the disc and converts these pulses into a composite pulse train of clock and data pulses. The data is transferred from the selected drive to the user's interface. Data and clock pulses are output from the Read Logic block when the disc is loaded onto the head and WRITE ENABLE is inactive. User interface signals are:

READ DATA COMPOSITE — Serial pulse train of digital data and clock bits read from the disc; data and clock bits are output to the host controller.

SEPARATED DATA — Serial pulse train of digital data bits read from the disc; data bits are separated from clock bits and output to the host controller.

SEPARATED CLOCK — Serial pulse train of digital clock bits read from the disc to clock the read operation.

550 internal signals to/from the Read Logic are:

HEAD — When reading, the HEAD line contains data and clocks from the Head in analog form. The information is amplified, differentiated, limited, and then shaped and output to the host controller as digital data via the Read Logic block.

2.2.4 Power Signal Description

The following are the power inputs required by the 550 drive. The inputs are supplied by the host system.

+24 VOLTS DC — Power required to drive the Stepper Motor, Head Load Solenoid, and optional Programmed Controlled Door Lock.

+5 VOLTS DC — Power required to drive the PCB Logic components, the emitter/sensor devices, the optional busy indicator light, and the stepper motor during power saver operation.

-5 VOLTS DC — Power required to drive the Read/Write Circuitry.

AC POWER — 115 or 230 volts, 50 or 60 Hertz, AC is required to drive the disc drive motor. Voltage choice is a user option.

NOTE

A selected AC voltage requires a selected motor and capacitor. A selected AC frequency requires a selected drive pulley.

2.3 TIMING SEQUENCES

The timing sequences of the 550 can be divided into the following modes of operation:

- Initiate
- Track Access
- Read/Write

The Initiate mode is used when the power is turned on. During normal operation, the desired track is loaded with Track Access, and either Write or Read is performed. All signals shown on the following timing diagrams are to or from the host system.

2.3.1 Initiate Mode of Operation

Timing for the Initiate Mode of Operation is shown in Figure 2-5. The user applies AC and DC power to the 550. After a 2 second delay from POWER ON, the controller generates STEP pulses until the read/write head is positioned at Track 00. This operation is performed to ensure that the head is properly oriented before a Read or Write operation begins.

When the head is positioned at Track 00, the Track 00 interface signal becomes true (low). The stepping pulses are needed in addition to the Track 00 internal signal to ensure that the read/write head is actually at Track 00.

The HEAD LOAD signal can be applied any time after the power has been turned on. When the HEAD LOAD line is false, the read/write head is unloaded from the disc. The HEAD LOAD signal must be true for a minimum of 35 milliseconds before a Write or Read operation can begin. The head should always be unloaded if a read, write or head positioning command is not executed within four revolutions of the disc, or if the disc is not rotating.

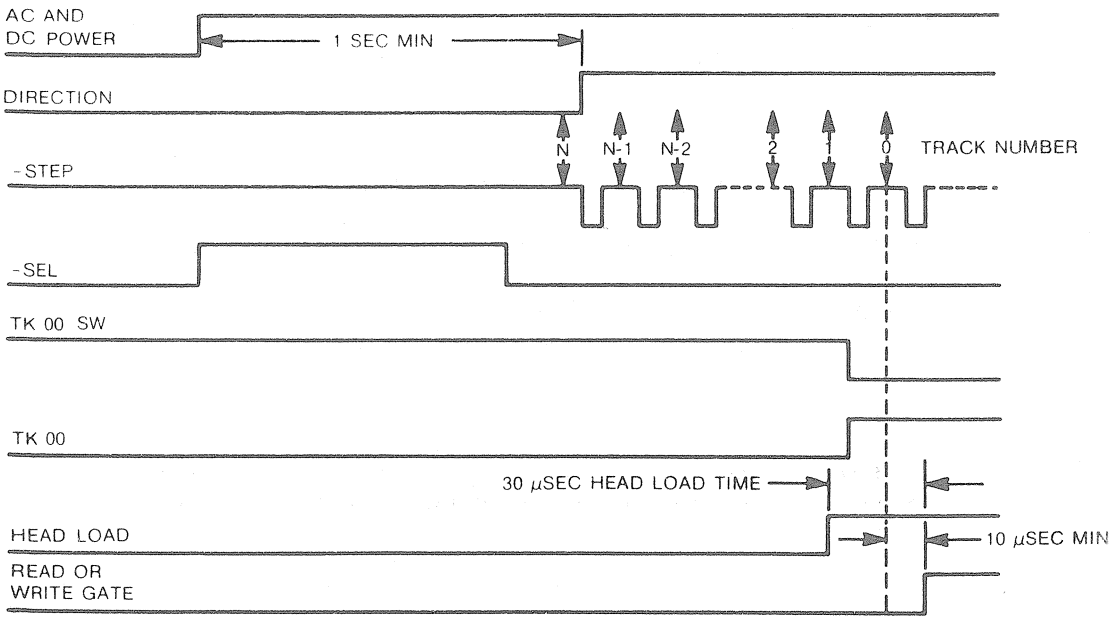


FIGURE 2-5. INITIATE MODE OF OPERATION

2.3.2 Track Access Mode of Operation

The DIRECTION and STEP signals are used for positioning the read/write head to the desired track. STEP pulses must be a minimum of 6 milliseconds apart to ensure every step will be valid. After the last step, 10 milliseconds head/carriage settle time must be allowed before any read or write operation commences. The Track Access Timing Sequence is shown in Figure 2-6.

2.3.3 Write or Read Mode of Operation

The Write and Read Timing sequences are basically the same. They are shown separately in Figures 2-7 and 2-8 for clarity. The read/write head must be loaded by means of the HEAD LOAD signal from the host controller before a Write or Read operation can begin.

The user applies AC and DC power to the 550. After a specified delay from power ON, the host controller-generated STEP pulses are applied to the selected drive until the read/write head is positioned at the desired track. The WRITE GATE signal is active (low) for a WRITE DATA operation and inactive (high) for a READ DATA operation. Read or Write data is activated 80 milliseconds after an initial DC power ON or 1.5 seconds after AC power ON.

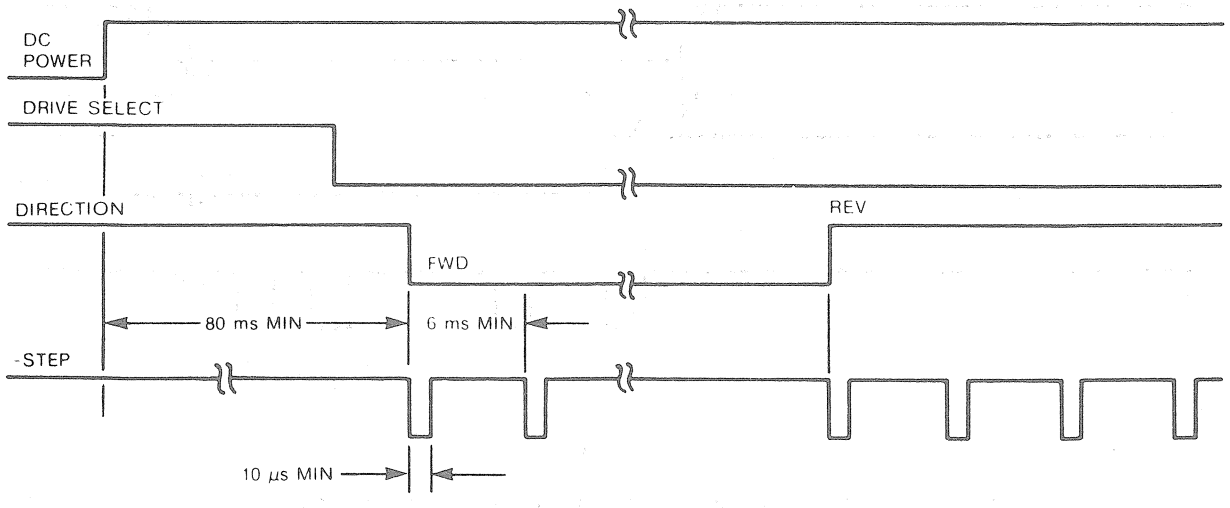
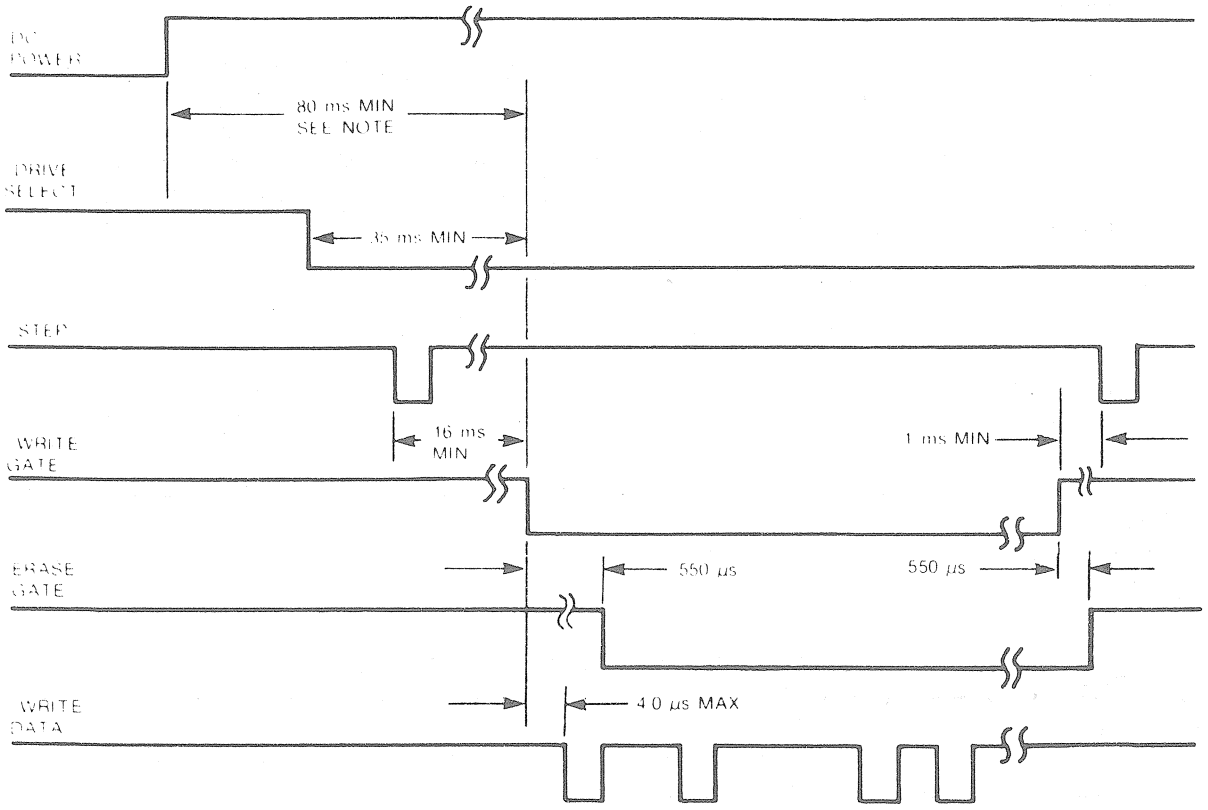


FIGURE 2-6. TRACK ACCESS TIMING

2.3.3.1 Write

The WRITE GATE signal can be made true (low) 16 milliseconds after the leading edge of the last STEP pulse required to step to the desired track. This 18 millisecond delay is made up of two parts. 6 milliseconds of motion time, during which the head moves to the final track, and 10 milliseconds of settle time to allow the head to stabilize at the correct center-of-track position. Four (4) microseconds after the WRITE GATE goes low, the WRITE DATA pulses may be transmitted for writing on the disc.



NOTE: 1 5 SECONDS IF AC AND DC POWER ARE APPLIED AT THE SAME TIME

FIGURE 2-7. TIMING REQUIRED TO INITIATE A WRITE OPERATION

The WRITE DATA signal is formed in the host controller by a combination of separate clock and data pulses. These pulses are combined into a composite WRITE DATA signal, coded as determined by user encoding scheme, and transmitted to the 550 drive electronics for writing onto the disc. Figures 2-9, 2-10, and 2-11 show WRITE DATA Timing for three types of user encoding. (Frequency Modulation, Modified Frequency Modulation and Modified, Modified Frequency Modulation, respectively.)

2.3.3.2 Read

Data read off the disc and sent to the host controller during a read operation is in the form of alternating discrete clock and data pulses if the IBM compatible mode of operation is being used; otherwise, the data to the controller may be sent over two lines, SEPARATED DATA and SEPARATED CLOCK. The READ DATA timing pulses are active 16 milliseconds after the leading edge of the last STEP pulse for head positioning.

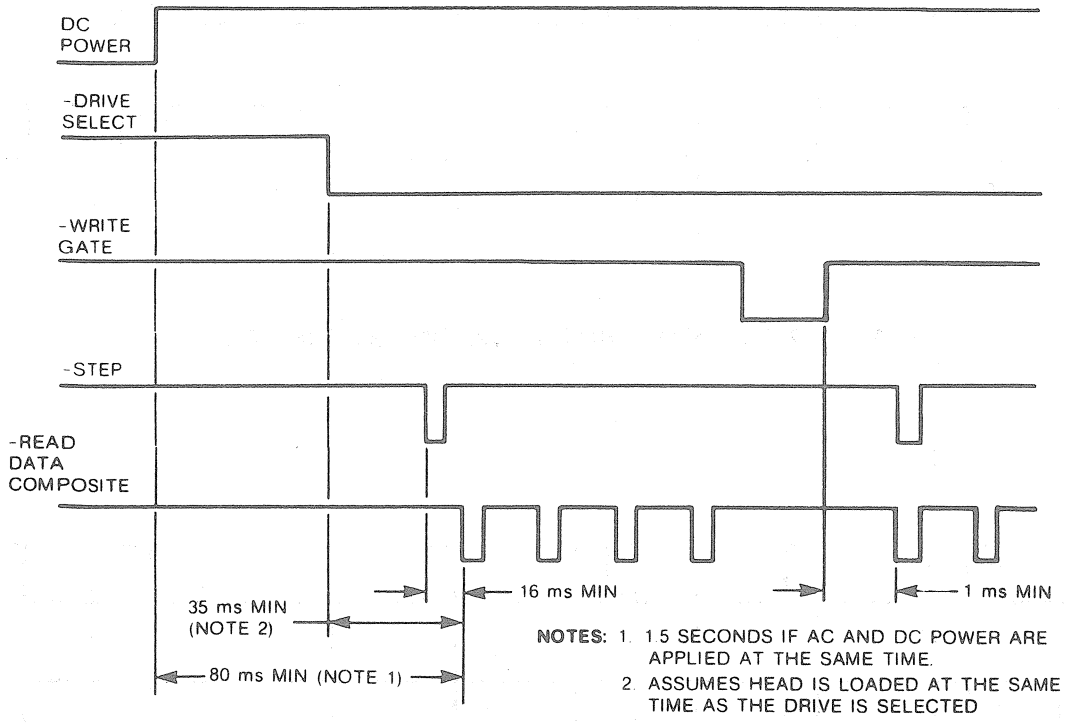


FIGURE 2-8. TIMING REQUIRED TO INITIATE A READ OPERATION

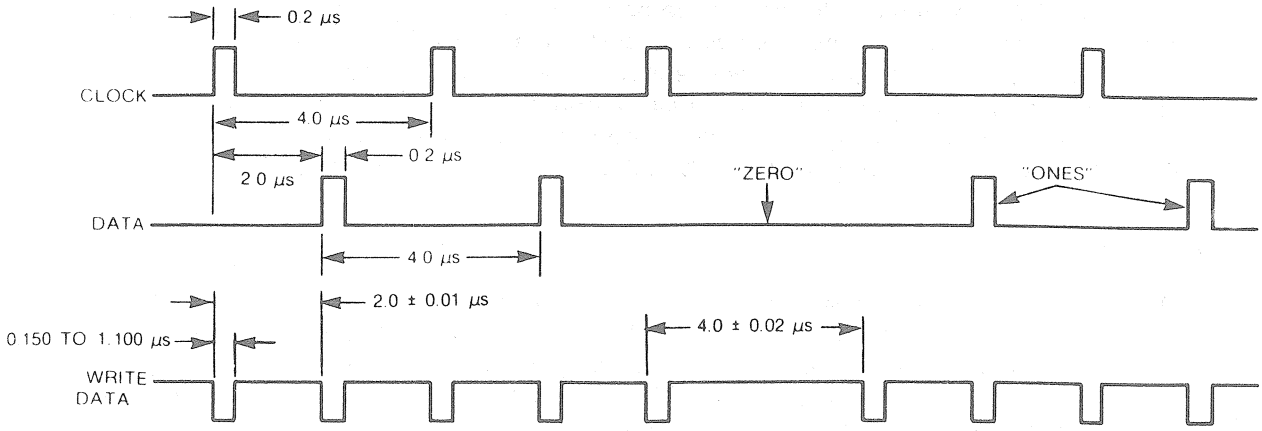


FIGURE 2-9. FM WRITE DATA TIMING FUNCTION

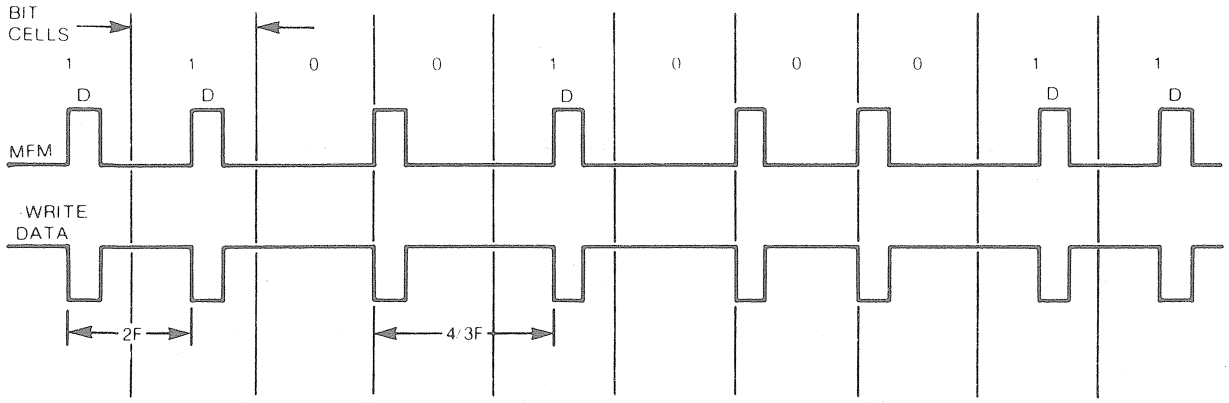


FIGURE 2-10. MFM WRITE DATA TIMING FUNCTION

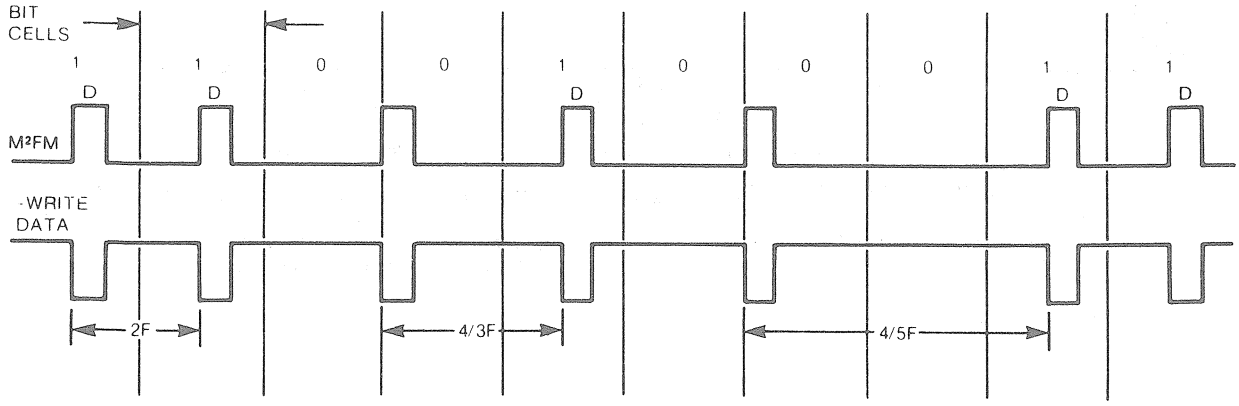


FIGURE 2-11. M²FM WRITE DATA TIMING FUNCTION

2.4 DATA FORMATS

The format of the data recorded on the disc is a function of the host system, and should be designed around the user's application to take advantage of the total available bits that can be written on any one track. All data is written on the disc in the form of alternating clock and data pulses in FM recording. In MFM or M²FM there are no CLKS.

One method of recording data is by use of the Index format. Using this format, one record is recorded per track using the INDEX signal as a start-of-track reference. The Index format is shown in Figure 2-12. At the beginning of each record, 128 clock bits are required for tolerances and synchronization. Following the clock bits, a "data identifier" byte (specified by the user) is required to recognize the start of data. For ease of searching and record verification, each data identifier block may be followed re data integrity is critical, the address bytes should be read to verify track and sector location before attempting a Write operation. A read back check is recommended after the Write operation.

Data may also be recorded using the IBM 3740 compatible track format. This format allows recording up to 26 records per track, where each record can contain up to 128 bytes. Figure 2-13 shows the IBM track format.

The beginning of the track is recorded with a 79-byte synchronization field. The field starts following the INDEX HOLE and consists of 46 bytes of clock pulses, followed by a one-byte Index Mark (IM), and 32 more bytes of clock pulses. Following the synchronization field is a 7-byte ID field that defines the start of Sector 01. The field is broken down as follows:

- Address Mark (AM) byte
- Two track Address bytes
- Two sector Address bytes
- Two Cyclic Redundancy Check (CRC) bytes

A block of 17-bytes of clock pulses is recorded after the ID field, followed by the sector 01 data field. The data field is 131 bytes long, and it is broken down as follows:

- One Data Mark (DM) byte
- 128 bytes of data
- Two CRC bytes

Following the data field is a 33-byte separator field. This completes the sector format in the IBM compatible mode. The remaining sectors (Sectors 02 through 26) are formatted in the same manner. The balance of the track is filled with clock pulses (241-bytes). Additional information about IBM track formatting and initializing the disc is found in the *IBM Diskette Original Equipment Manufacturer's Information Manual*, GA21-9190-2.

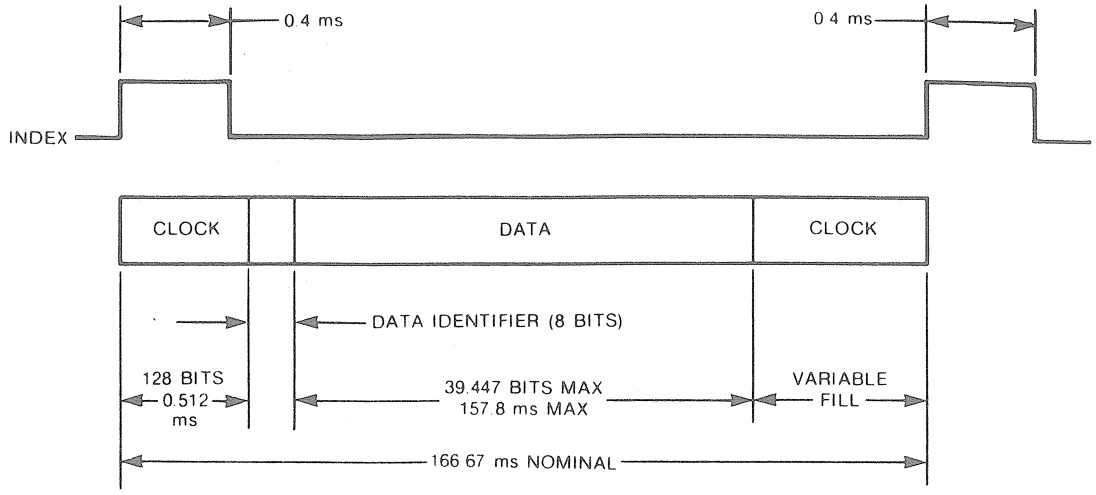


FIGURE 2-12. INDEX RECORDING FORMAT (NON-IBM COMPATIBLE)

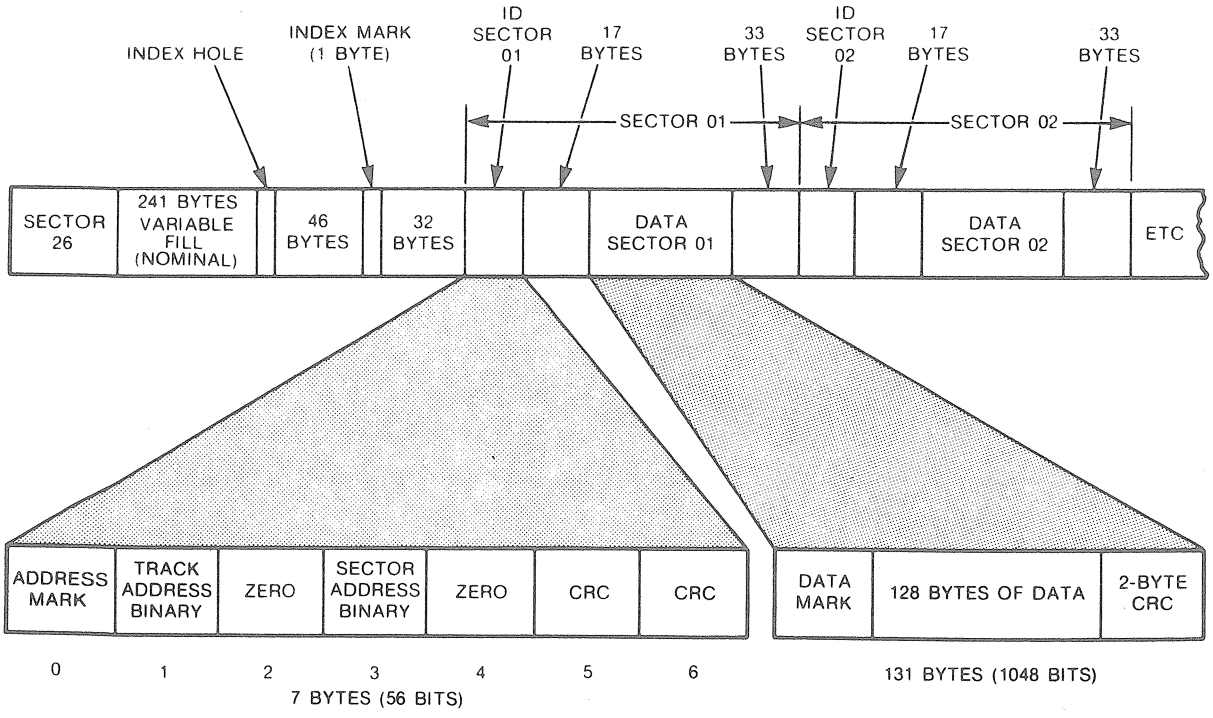


FIGURE 2-13. IBM TRACK FORMAT

2.4.1 Recording Modes

The 550 Flexible Disc Drive is capable of recording in single-density or double-density mode. Currently, the most prevalent mode is the single-density, double-frequency FM, self-clocking, serial by bit type recording mode. It is the IBM compatible mode. Track density is 18.9 tracks per centimetre (48 tracks per inch); bit density varies from 722.8 bits per centimetre (1836 bits per inch) on the outer track (Track 00) to 1286.6 bits per centimetre (3268 bits per inch) on the inner track (Track 76).

The user may choose to use the double-density mode of recording. The two most frequently used recording methods in this mode are:

- Modified Frequency Modulation (MFM)
- Modified Modified Frequency Modulation (M^2FM)

In the MFM mode, every "1" bit transition occurs at the center of the bit cell time; a "0" bit preceded by a "1" bit has no transition. A "0" bit preceded by a "0" bit causes a transition to occur at the beginning of the bit cell time.

In the M^2FM mode, every "1" bit transition occurs at the center of the cell time. Odd "0" bits cause no transition; even "0" bits cause transitions at the beginning of the bit cell time.

Figure 2-14 is a comparison chart of the FM, MFM, and M^2FM recording modes.

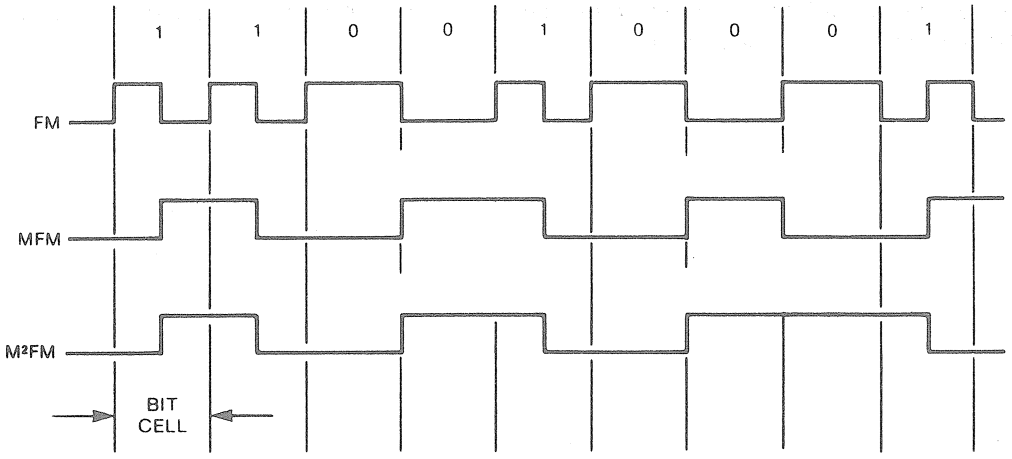


FIGURE 2-14. COMPARISON OF FM, MFM, AND M^2FM RECORDING MODE

2.5 OPTIONS

The following are brief descriptions of the options available with the 550 Flexible Disc Drive.

2.5.1 File Indicator

This is a red LED, located on the front panel, that is lighted anytime the drive is busy, i.e., reading or recording. The light warns the operator that interrupting the operation in progress may adversely affect data integrity.

2.5.2 Program-Controlled Door Lock

This option consists of an internal solenoid-operated latch that prohibits the opening of the drive door, when the solenoid is energized. Without this option, if the drive door is opened during disc operation, the READY signal goes false, causing operations to halt. This programmed lock is installed as a safety device to prevent the loss of data.

2.5.3 Write Protect

The Write Protect option consists of a solid-state sensor that is used to determine the presence or absence of the standard ANSI Write-Protect notch on the disc cartridge. With the Write Protect circuit active, all writing is inhibited on the cartridge.

2.5.4 Alternate Side Operation

The Alternate Side Operation hardware permits the disc to be read/recorded on both sides. To use the second or reverse side of a disc, another Index transducer (sensor) is provided for sensing the index pulses on the disc's second side. This additional Index sensor is required because the first sensor (the one used for normal side operations) is offset from the disc centerline.

SECTION 3
INSTALLATION AND INTERFACING

This section describes the 550 Installation and Interfacing requirements which must be met by the user in an OEM environment.

3.1 INSTALLATION OF THE 550 FLEXIBLE DISC DRIVE

The physical and environmental specifications of the 550 drive are depicted in Table 1-1 (SPECIFICATIONS) of this manual. Discs exposed to a condition outside of the drive operating limits should be acclimated in the machine environment for a minimum of 30 minutes before use. The disc should be removed from its envelope during this acclimation time. Exposure of the disc to magnetic fields should be avoided as a magnetic field of 50 oersteds or more may cause loss of data.

Performance of the 550 can be seriously degraded by improper environment. Dust and other airborne contaminants are a major threat to the operating life of the recording components and the Stepper motor. Environmental protection similar to that used for magnetic tape and removable disc pack installations should be observed.

The 550 is a UL (Underwriters Laboratories) recognized device. Recognition by UL means that a user must comply with the conditions of acceptability for any application within another piece of equipment if that second piece of equipment seeks UL recognition.

3.1.1 Cables and Connectors

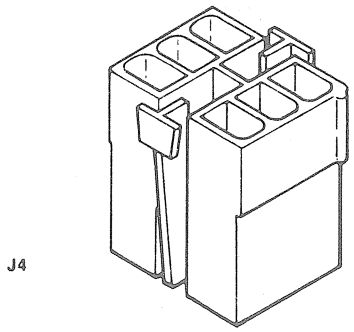
All internal cables are factory installed prior to shipment. Recommended interface connectors which must be supplied by the user are shown in Table 3-1.

The host controller plugs into the PCB Connector (J1). This I/O connection and the DC power connection to Connector (J4) are the only interfaces required between the host system and the 550 drive. (Refer to Section 4.3.1 for PCB connector locations.)

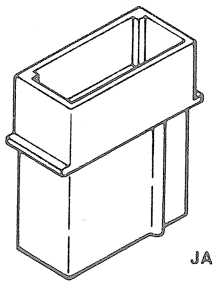
TABLE 3-1. INTERFACE CABLES AND CONNECTORS (J1)

Type of Cable	Manufacturer	Connector P/N	Contact P/N
Twisted pair #26 (crimp or solder)	AMP	1-583717-1	583616-5 (crimp) 583854-3 (solder)
Twisted Pair #26 (solder term.)	Viking	3VH25/1JN-5	NA
Flat Cable	3M "Scotchflex"	3415-0001	NA

Connectors J4 (Power) and JA (AC) are shown below:



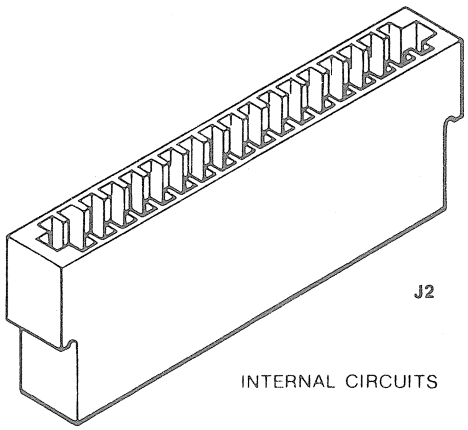
DC POWER



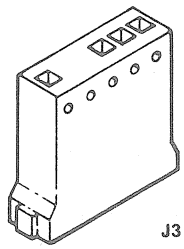
AC POWER

J4 is a 6-pin AMP Mate-N-Lok connector, P/N 1-480270-0, using AMP contacts P/N 60619-1. It mates with connector P4, AMP P/N 1-380999-0, mounted in the Device Control PC Board. JA is the 3-pin AC power connector, using AMP housing P/N 1-480303-0 or 1-480304-0, using contacts P/N 60619-1. It mates with PA, AMP housing P/N 480305-0, mounted in the capacitor bracket, using contacts P/N 60620-1.

Connectors J2 (internal circuits connector) and J3 (head connector) are shown below:



INTERNAL CIRCUITS



HEAD

J2 is a 18-pin dual AMP connector, P/N 583717-7. It is a 0.062 in. PCB edge connector.

J3 is a 5-pin AMP connector P/N 86035-3. It mates with 0.025 square header pins.

Figure 3-1 shows pertinent interface connector data.

3.1.2 Mounting Dimensions and Instructions

The mounting dimensions for the 550 are shown in Figure 3-2. Memorex recommends that drives be installed vertically, when possible, in order to prevent dust particles from settling on the disc surface. However, the 550 is designed to operate either vertically or horizontally.

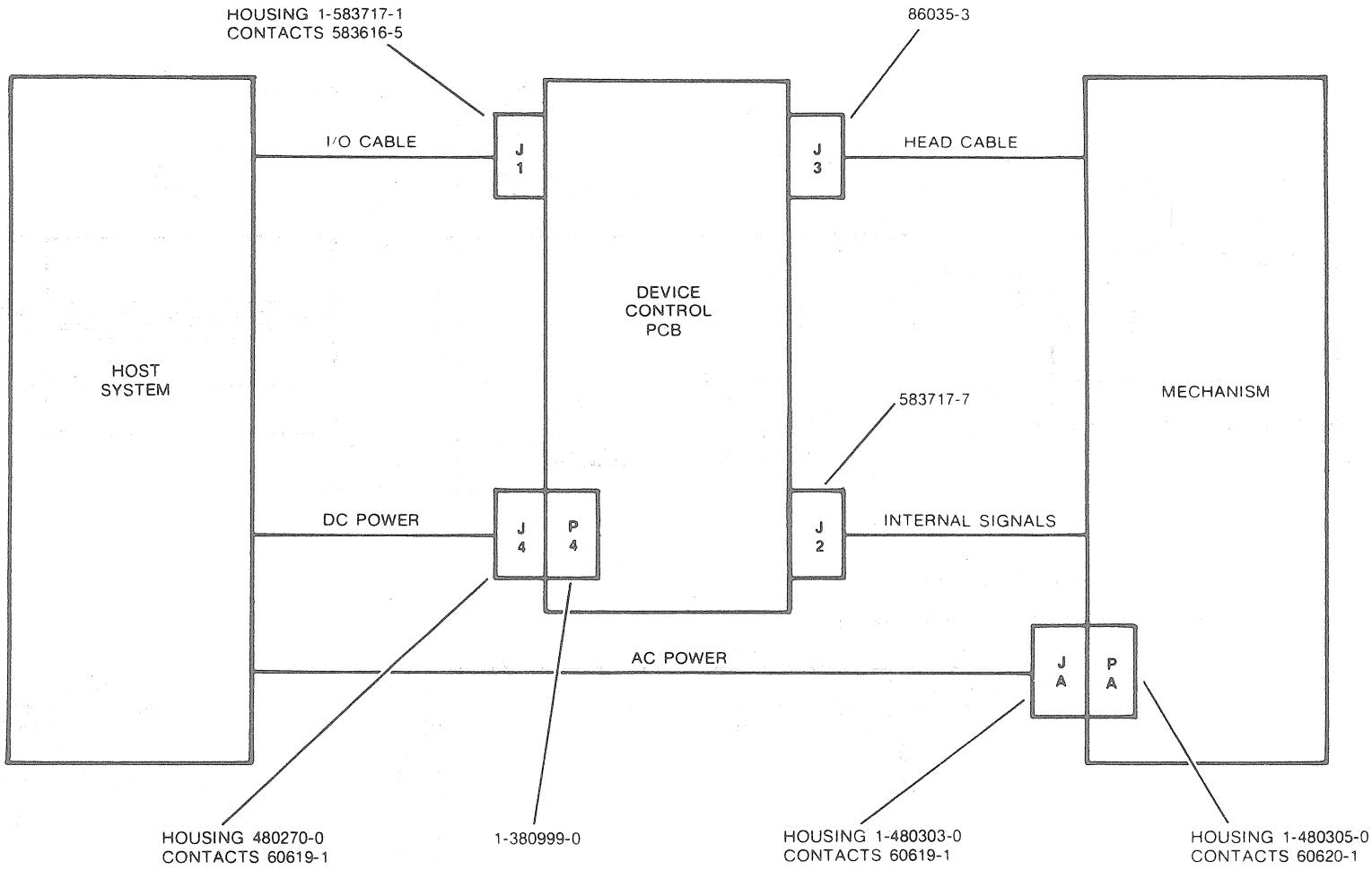


FIGURE 3-1. CONNECTOR IDENTIFICATION (AMP NUMBERS ONLY)

MOUNTING ATTITUDE NOTES:

1. Preferred mounting is with disc vertical.
2. Mounting with disc horizontal, drive motor up, is acceptable.
3. Inverted disc horizontal mounting requires special order information.

NOTES:

1. All dimensions are in millimetres with equivalent inches given in parentheses.
2. Tolerance
   0.XXX=±0.127 (0.005)
   0.XX =±0.51 (0.02)

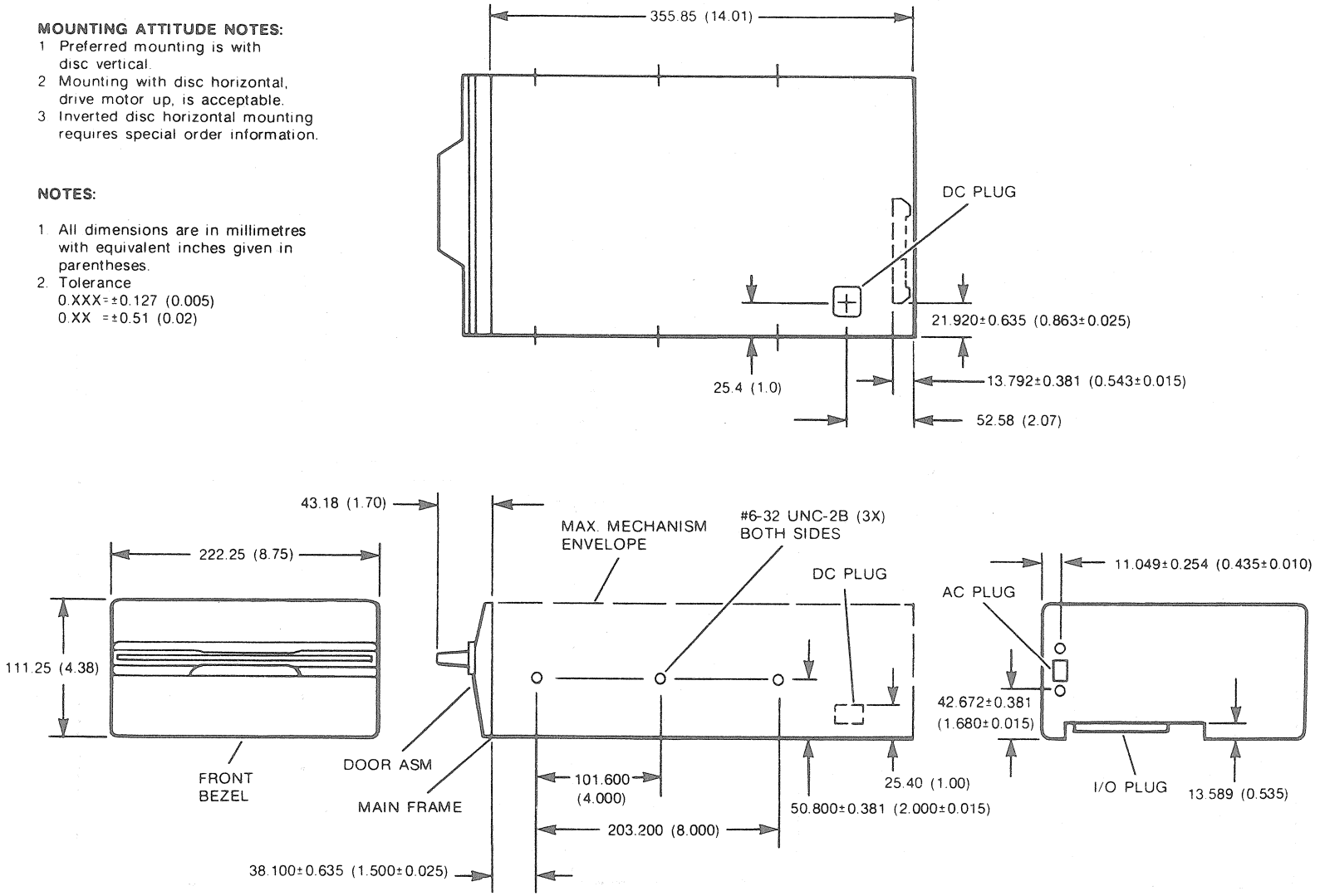


FIGURE 3-2. MOUNTING DIMENSIONS OF THE 550 DRIVE

3.2 INTERFACE INFORMATION

An interface wiring diagram illustrating the signal line transmission system used in the 550 is shown in Figure 3-4. Signal names, signal direction (input or output), polarities, interface connector designations, and pin numbers are included. All signal lines are terminated at the receiver with a 150-ohm impedance. A 3M, 50-pin conductor-ribbon cable is used to transmit signals (no limitation on length). A 6-pin cable is used for the DC power interface line. Maximum line length is 7.6 metres (25 feet). Power signal characteristics are listed in Table 3-3. Connector pin assignments are listed in Tables 3-2 and 3-3. A terminator, consisting of a DIP resistor module that plugs into a socket, is used in the last unit in a serial configuration. Logic on the interface is as follows: True = "0"; False = "1." All interface circuitry must be of the transistor-to-transistor logic type.

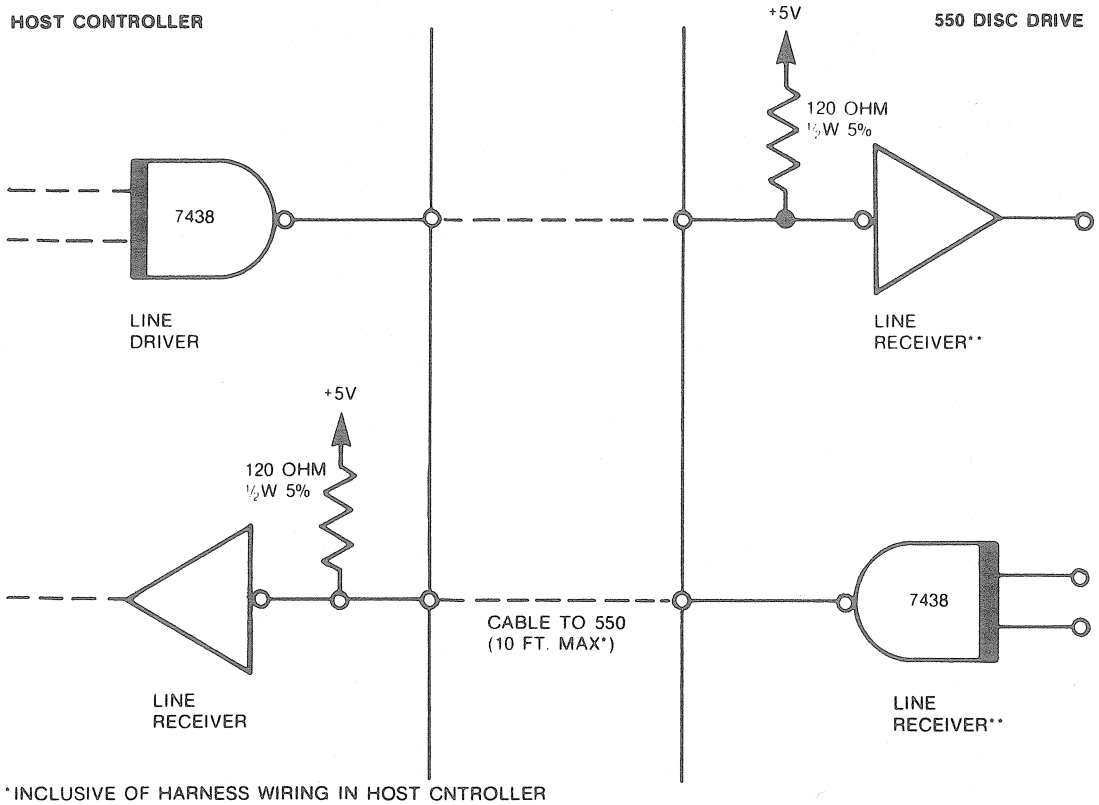
All transmitted signals to the 550 should originate from open collector drivers capable of sinking 48 milliamperes of current (e.g., a 7438 element). Conversely, the receiver in the host controller should be a TTL buffer gate with a 150-ohm pull-up to +5 VDC. Recommended circuits for line drive and line receiver circuits in the host controller are shown in Figure 3-3. The line receiver receives signals from the 550 and the line driver transmits signals to the 550. The line receiver should detect a true signal of no higher than +1.5 volts and a false signal no lower than +2.5 volts. The line receiver and line driver shown are applicable to both control and data signals.

TABLE 3-2. CONNECTOR PIN ASSIGNMENTS

Signal J1 Pin No.	Gnd Pin No.	Line Function
2	1	Not Used
4	3	Not Used
6	5	Not Used
8	7	Not Used
10	9	Not Used
12	11	-Disc Change
14	13	Not Used
16	15	-In Use
18	17	-Head Load
20	19	-Index (Radial)
22	21	-Ready (Radial)
24	23	-Sector (Radial)
26	25	-Drive Select 1
28	27	-Drive Select 2
30	29	-Drive Select 3
32	31	-Drive Select 4
34	33	Direction
36	35	-Step
38	37	-Write Data
40	39	-Write Gate
42	41	-Track 00
44	43	-Write Protect
46	45	-Read Data Composite
48	47	-Separated Data
50	49	-Separated Clock

TABLE 3-3. DC POWER CHARACTERISTICS AND CONNECTOR PIN ASSIGNMENTS

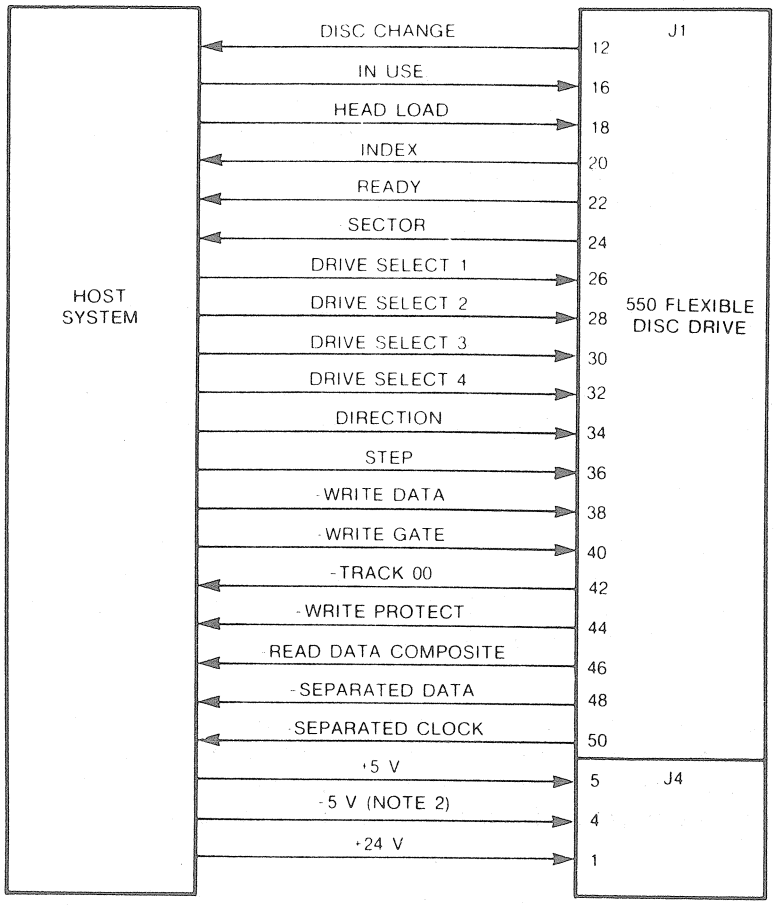
J-4 Pin No.	Voltage	Notes
1	+24.0 ±1.5 VDC	1.5 A max.
2	+24.0V Return	100 mV ripple max p-p.
3	-5.0V Return	0.100 A max.
4	-5.0 +0.5 VDC -0.0 VDC	50 mV ripple max p-p
5	+5.0 ±0.2 VDC	1.25 A max.
6	+5.0V Return	50 mV ripple max p-p



*INCLUSIVE OF HARNESS WIRING IN HOST CNTROLLER

**PROVIDED BY 550

FIGURE 3-3. RECOMMENDED DRIVER/RECEIVER CIRCUITS



NOTES:

1 ALL SIGNAL RETURNS (NOT SHOWN) ARE ON THE NEXT LOWER, ODD NUMBER PINS.
2 OPTIONAL POWER SUPPLY IS -7 TO -16 VDC.
3 THE ALTERNATE I/O CONNECTIONS ARE NOT SHOWN. ALTERNATE I/O LINES ARE ON PINS 2, 4, 6, 8, 10, AND 14.

FIGURE 3-4. INTERFACE WIRING DIAGRAM

3.2.1 Interface Signal Descriptions

The signals on connector J1 are described below:

- **Drive Select 1 - 4**—These four input lines are used to select the unit to be accessed by the host system controller. These lines remain true during drive operations.

- **Head Load**—When true, this input line from the controller causes the Head Load solenoid to be energized. The signal should be initiated at least 35 milliseconds before a Read or Write operation in order to allow for head settling time. The Head Load Solenoid should be deenergizing when a Read or Write Operation is not occurring. The head load solenoid is automaticaly deenergized when the door is opened.

- **Write Gate**—When true, this input line enables the Write Driver in the 550.

- **Write Data**—Input line from the host system with composite clock and data information. Timing required to initiate a Write Operation is shown in Figure 2-7.

- **Step**—When this input line is active (true) for at least 10 microseconds, the head is moved one step (i.e., carriage positions head one track forward or reverse of present location). Timing for this positioning operation is shown in Figure 2-6 (Track Access Timing).

- **Direction**—This input line from the controller works in conjunction with the Step line to determine the direction of the head movement. Steps will be toward the center of the disc (forward) when this line is true; steps will be toward the outside of the disc when this line is false.

- **In Use**—This input line will turn on the optional BUSY light mounted on the front panel. Instead of the normal indication that the head is loaded, the light may be used to alert an operator to special operating conditions such as:

  1. Drive has a special configuration
  2. Drive requires a disc change
  3. Disc inserted is Write Protected

Although this option is shipped with the -HEAD LOAD signal activating the BUSY indicator, the user may jumper the "a" trace to activate the In Use signal on the interface at Pin 16 (refer to Figure 3-5).

- **Index**—This output line provides the host controller with a 0.4 millisecond true pulse every time the Index hole is sensed.

- **Sector**—This optional output line provides the controller with a 0.4 millisecond true pulse each time a Sector hole is sensed. This line is active only with 33-hole discs. The user may select 8 or 16 sectors per revolution of the disc. Drives with this option are shipped with a 32-sector output set.

- **Ready**—This output line informs the controller that the selected drive is ready for operation. READY is a status signal indicating a disc cartridge is inserted properly, the drive's door is latched, and that two disc revolutions have been sensed since +5V power was applied or that two index holes have been sensed.

- **Track 00**—This output line to the controller is true when the head is positioned at Track 00 and phase 1 of the stepper motor is energized.

- **Separated Data**—This optional output line contains separated data bits when in the non-IBM compatible FM mode.

- **Separated Clock**—This optional output line contains separated clock bits when in the non-IBM compatible FM mode.

- **Read Data Composite**—This output line contains both the clock and data bits as read by the head (refer to Figure 2-8.). In MFM and M²FM Modes, this line contains all data bits.

- **Write Protect**—This is an optional output line used to inform the controller that a Write Protect notch in the inserted disc cartridge has been detected. The internal logic of the 550 will inhibit the Write and Erase circuitry.

- **Disc Change**—This output line informs the controller that a disc drive condition has changed from READY to NOT READY and back to READY while the drive was deselected. The signal is activated when the affected drive is reselected. The signal is reset on a logical zero to logical one transition of the Drive Select signal, if the drive is again in the READY state. Figure 3-6 shows the Disc Change Timing sequence.

3.2.2 Internal Circuits Connector (J2)

The user may optionally choose to connect host system lines to the internal circuits of the 550 instead of using the internal 550 PCB. A P2 plug is provided for this interfacing requirement. Figure 3-7 shows the internal circuits wiring to the Internal Circuits Connector Plug (P2).

The P2 connector is a dual 18-pin connector. It contains 36-pins total (18 pairs, one on each side). Each pair of pins is numbered, with each pin of a pair identified as either the L (left) or R (right) pin. This L and R pin configuration is depicted in Figure 3-7.

The electrical requirements for the circuits shown in Figure 3-7 are listed in Table 3-4.

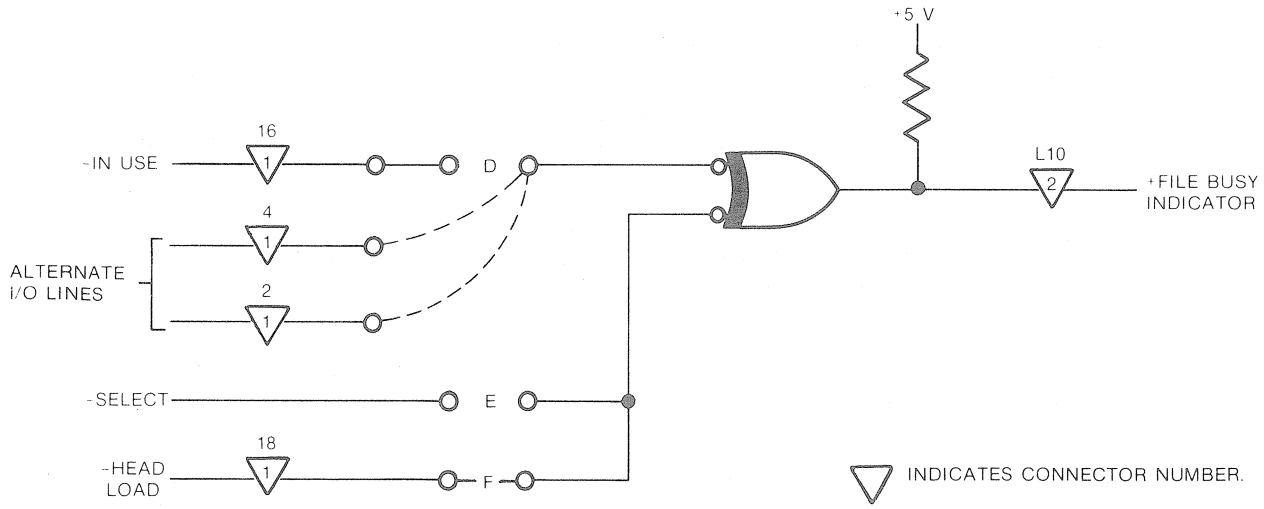


FIGURE 3-5. IN USE SIGNAL CIRCUITRY

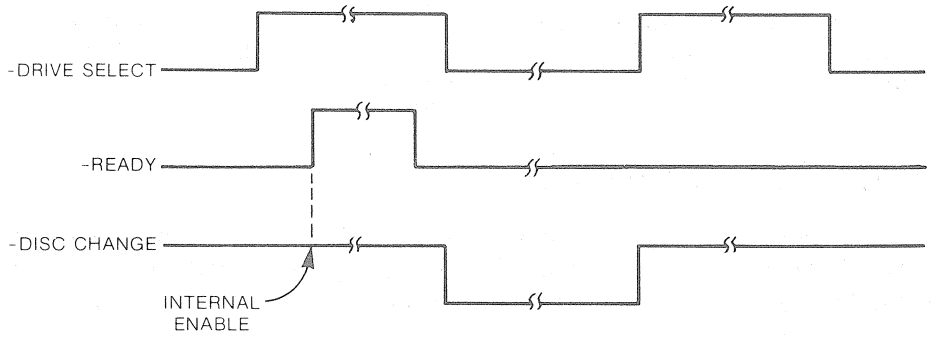
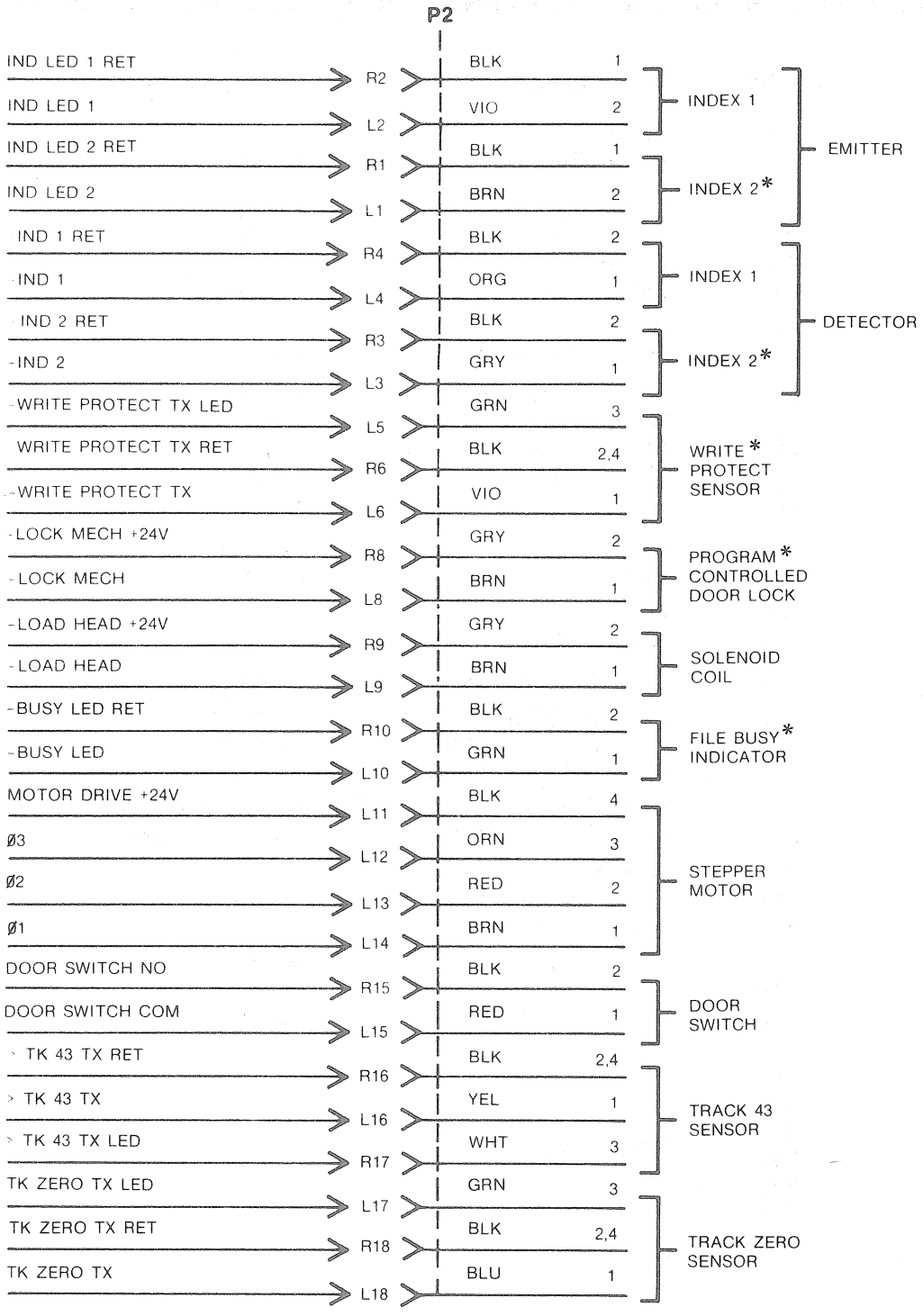


FIGURE 3-6. DISC CHANGE TIMING



*OPTIONAL FEATURE

FIGURE 3-7. INTERNAL CIRCUITS CONNECTOR

TABLE 3-4. INTERNAL CIRCUITS CONNECTOR (P2) ELECTRICAL SPECIFICATIONS

Pin No.	Signal Ident.	Current or Voltage
R1	Return	
L1	Index LED 2	40 mA
R2	Return	
L2	Index LED 1	40 mA
R3	Return	
L3	Index Detector 2	100 μA
R4	Return	
L4	Index Detector 1	100 μA
L5	Write Protect LED	40 mA
R6	Return	
L6	Write Protect Detector	100 μA
R8	Door Lock	24 volts
L8	Door Lock	200 mA
R9	Load Head	24 volts
L9	Load Head	200 mA
R10	Return	
L10	Busy LED	20 mA
*L11	Stepper Motor Drive	24 volts
L12	Stepper Motor Phase 3	1.3 amps
L13	Stepper Motor Phase 2	1.3 amps
L14	Stepper Motor Phase 1	1.3 amps
R15	Door Switch (NO)	Mechanical Switch
L15	Door Switch (Common)	Mechanical Switch
R16	Return	
L16	Track 43 Sensor	100 μA
R17	Track 43 LED	40 mA
L17	Track 00 LED	40 mA
R18	Return	
L18	Track 00 Sensor	100 μA
L7		
R5		
R7		
R11	NOT USED	
R12		
R13		
R14		

* The 550 FD Stepper Motor +24 volts will be reduced to a +5 volt level approximately 15 milliseconds after the last step command. This provides minimum power drain and prevents over-heating.

3.2.3 Drive Select

The standard feature PCB provides the user with the choice of selecting the unit drive from one of four input signal lines. The choice of input line is implemented as follows:

> Install a jumper between DS 1, DS 2, DS 3, or DS 4 and the center row. Figure 3-8 illustrates selection of DS 1 in a one-to-four drive configuration.

Optionally, selection from one of eight drives can be implemented by using the following procedure with the parts listed below.

Parts Required

Name	MRX Part Number	Manufacturer's Part Number	Quantity
Comparator		74L85	1
Shorting Plug	159301	Berg 65474-004	7
Terminal Pins	159163	Berg 75491-004	13

Implementation Procedure

1. Remove all shorting plugs installed at DS 1 through DS 4.
2. Remove shorting plug at terminal T2.
3. Install a jumper at trace DDS (refer to Figure 3-9).
4. Install the 74L85 four-bit comparator in position 7C (Figure 3-9).
5. Install terminal pins in the four DSM locations (Figure 3-9).
6. Install terminal pins in the nine PCB locations for the matrix D4, D2, D1, 0, 1 (Figure 3-9).
7. Install four shorting plugs between the four DSM terminals and the four center row terminals as shown in Figure 3-10.

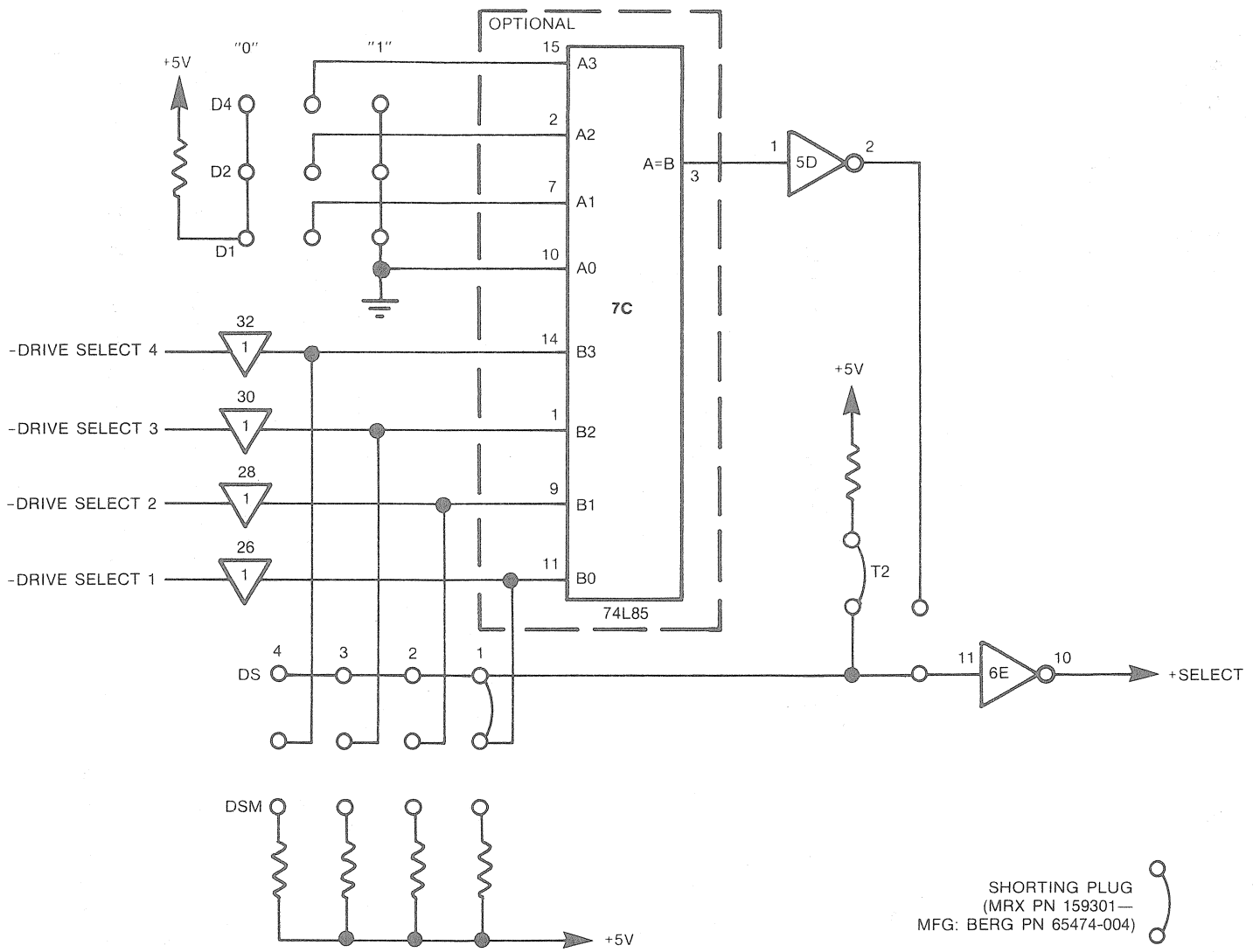


FIGURE 3-8. DRIVE SELECTION FOR ONE-TO-FOUR DRIVE CONFIGURATION

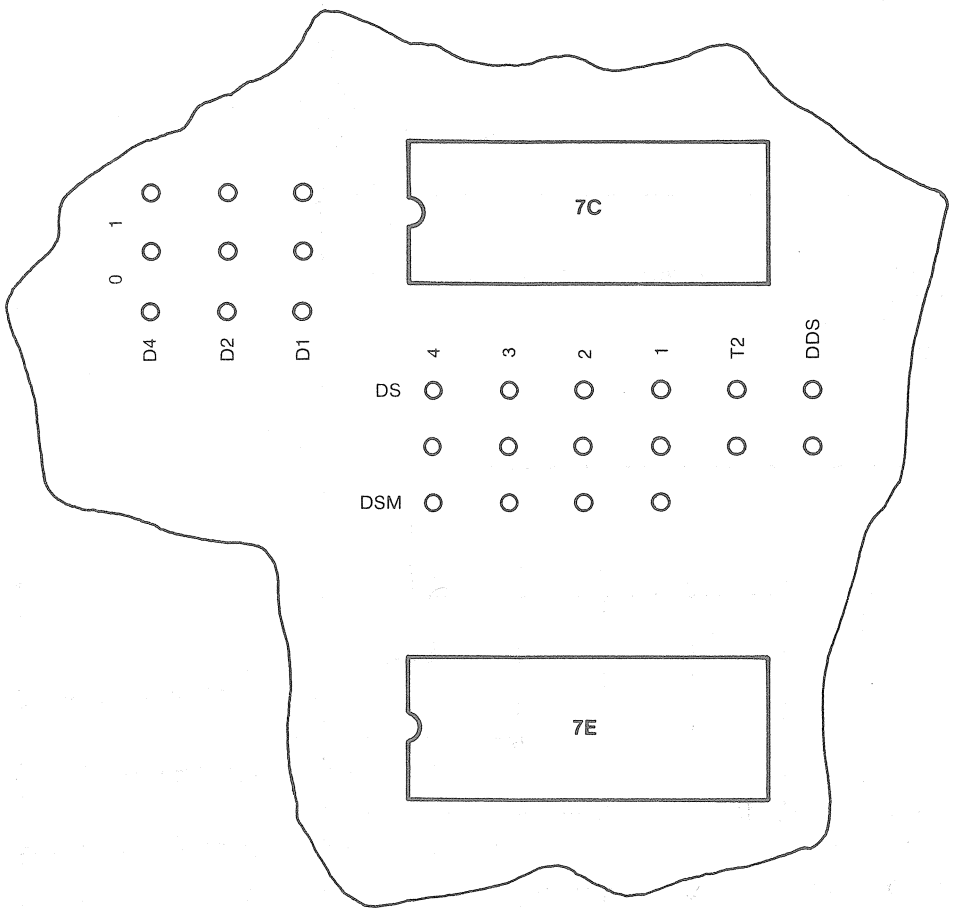


FIGURE 3-9. SECTION OF COMPONENT SIDE OF PCB FOR DRIVE SELECTION OPTION

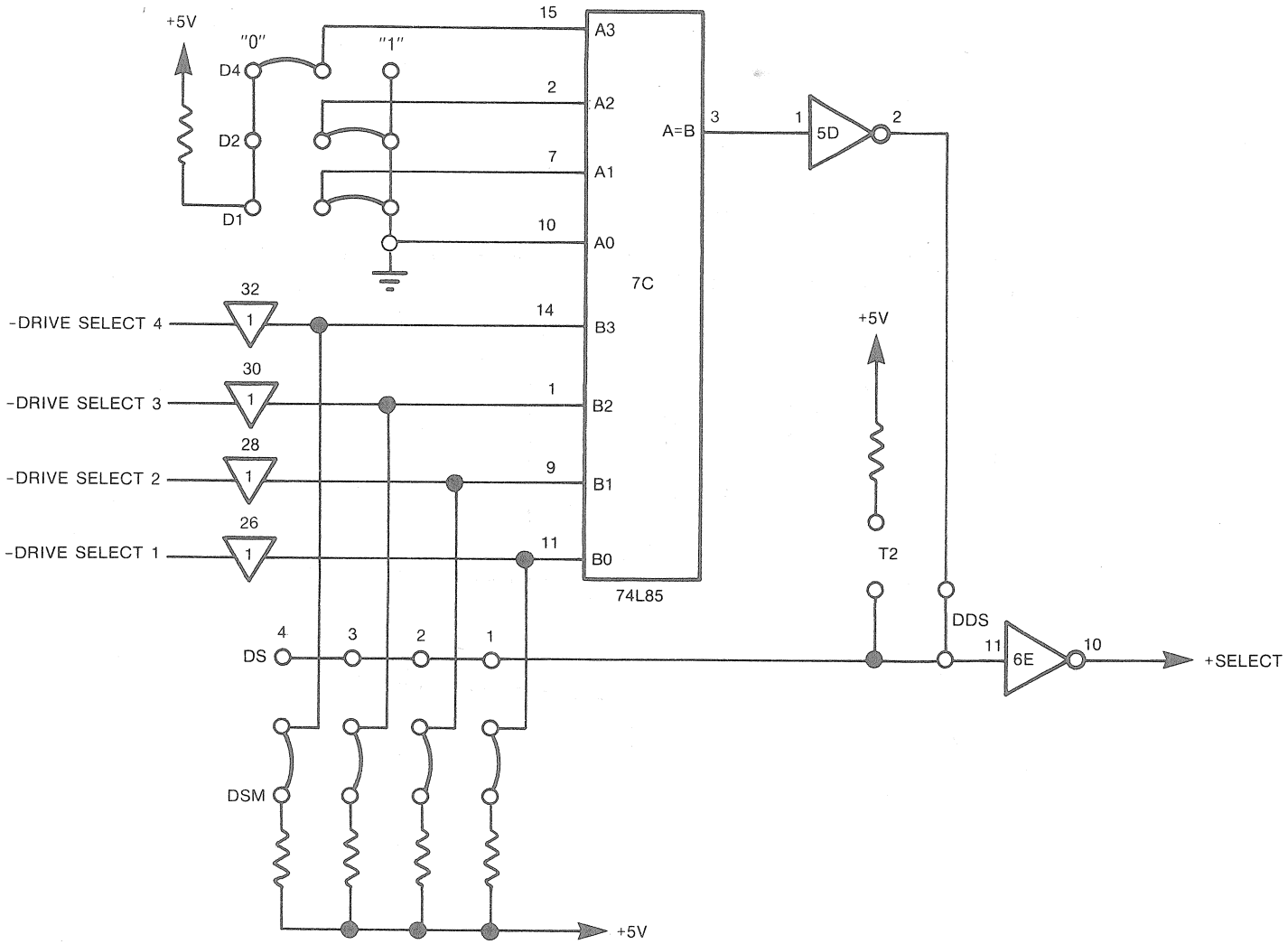


FIGURE 3-10. EXAMPLE OF DRIVE SELECTION FOR ONE-TO-EIGHT DRIVE CONFIGURATION (DRIVE DECIMAL ADDRESS 2 SHOWN SELECTED)

8. Jumper the desired decimal address of the drive to be selected. To do this, use Figure 3-11 to determine the D4, D2, D1, 0, 1 combination of jumpers that is required. Figure 3-11 uses negative logic notation since the input drive select lines are negative-equals-true signals. For example, a decimal drive address of 2 requires jumpers installed in the following locations, as shown in Figure 3-10.

D4 = 0
D2 = 1
D1 = 1

DECIMAL ADDRESS	74L85: -DRIVE SELECT:	BINARY ADDRESS (NEGATIVE LOGIC) B0 1	B1 2	B2 3	B3 4	74L85: D:	A0 0	A1 1	A2 2	A3 4
1		1	1	1	1		1	1	1	1
2		1	1	1	0		1	1	1	0
3		1	1	0	1		1	1	0	1
4		1	1	0	0		1	1	0	0
5		1	0	1	1		1	0	1	1
6		1	0	1	0		1	0	1	0
7		1	0	0	1		1	0	0	1
8		1	0	0	0		1	0	0	0

FIGURE 3-11. DRIVE SELECT ADDRESSING

3.3 OPTIONAL I/O (INPUT/OUTPUT)

This section describes suggested optional I/O line usage on the 550 Flexible Disc Drive.

3.3.1 Head Load Option

The head load option allows the drive's read/write head to be loaded when the drive is selected; that is, when the -SELECT input signal line becomes active. (As shown in Figure 3-12, the standard PCB in the drive provides a separate input line to load the read/write head.) To implement the head load option, refer to Figure 3-12 and proceed as follows.

1. Remove the PCB from the drive and, on the circuit side, cut the trace going to 3B, Pin 1.

2. On the circuit side, add a jumper wire between 3B, Pin 1 and 3B, Pin 2.

3.3.2 Hard Sector Option

This option permits converting the soft sector feature in the standard drive PCB to a hard sector option. A choice between 32-, 16-, or 8-sector pulses per revolution can be selected. The sector timing comparisons for the choices are shown in Figure 3-13. The procedure for converting from soft sector to hard sector is as follows.

1. Cut the trace as shown in Figure 3-14.

2. Connect a shorting plug on the terminals at "501" (see Figure 3-15).

3. Connect a shorting plug on the desired sector terminals—32, 16, or 8. An example of the hard sector option with 16 sectors per revolution is shown in Figure 3-15.

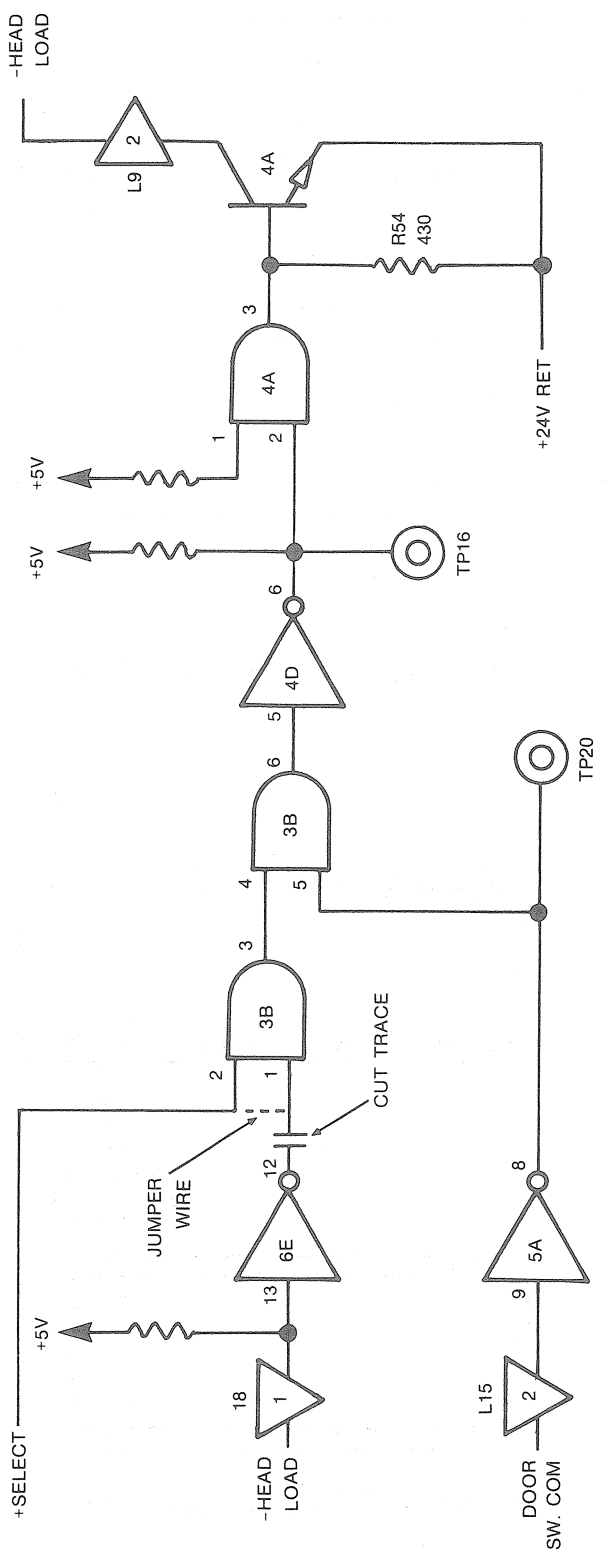


FIGURE 3-12. HEAD LOAD ON THE STANDARD PCB

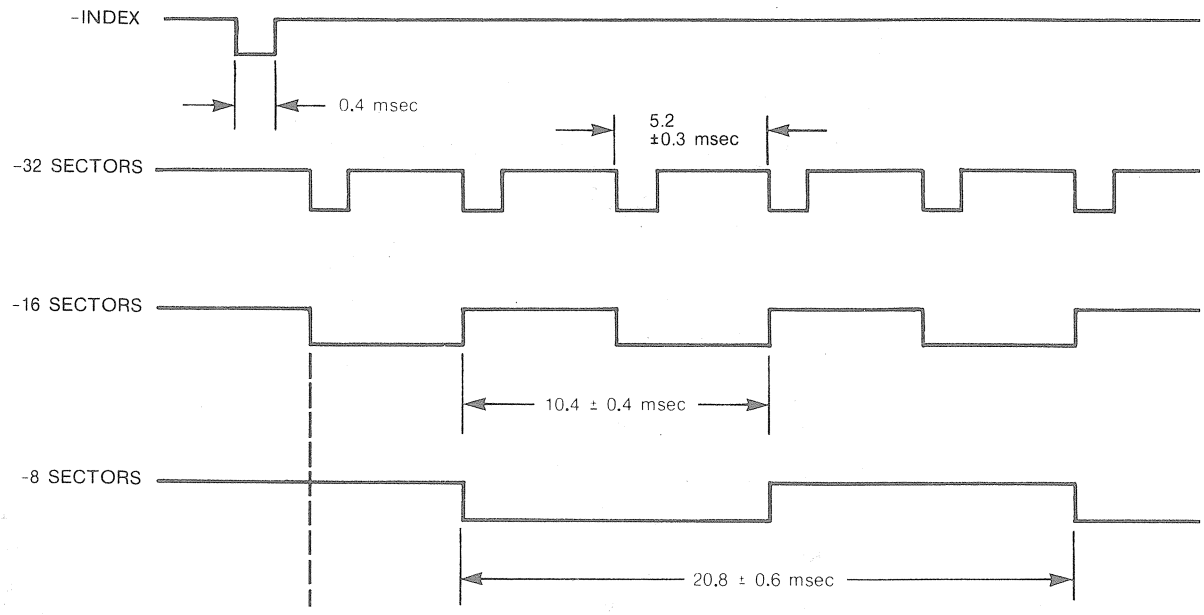


FIGURE 3-13. INDEX-SECTOR TIMING

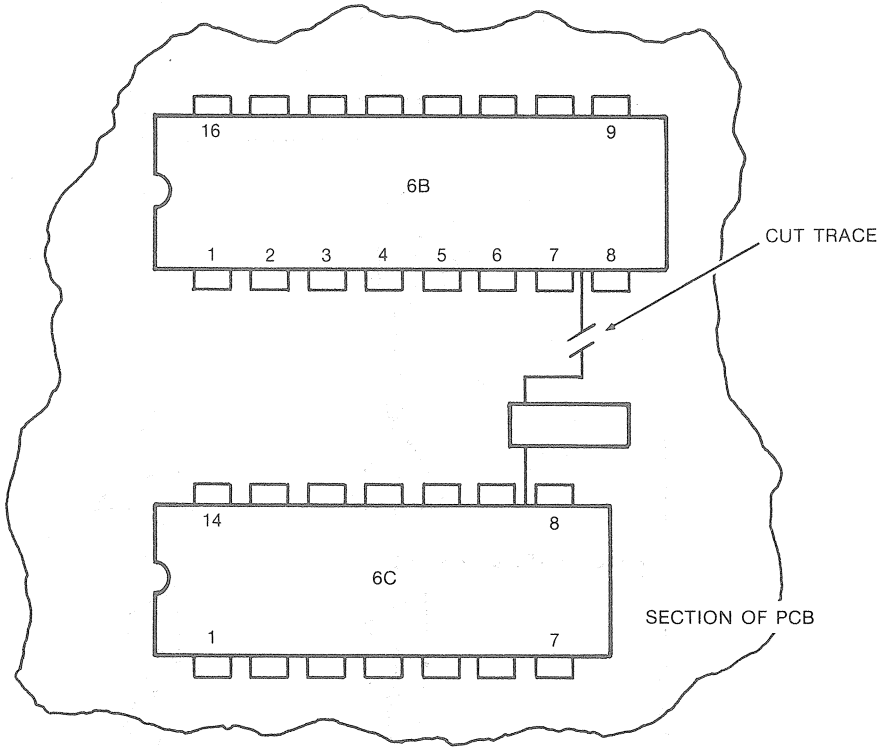


FIGURE 3-14. TRACE CUT FOR CONVERSION TO HARD SECTOR

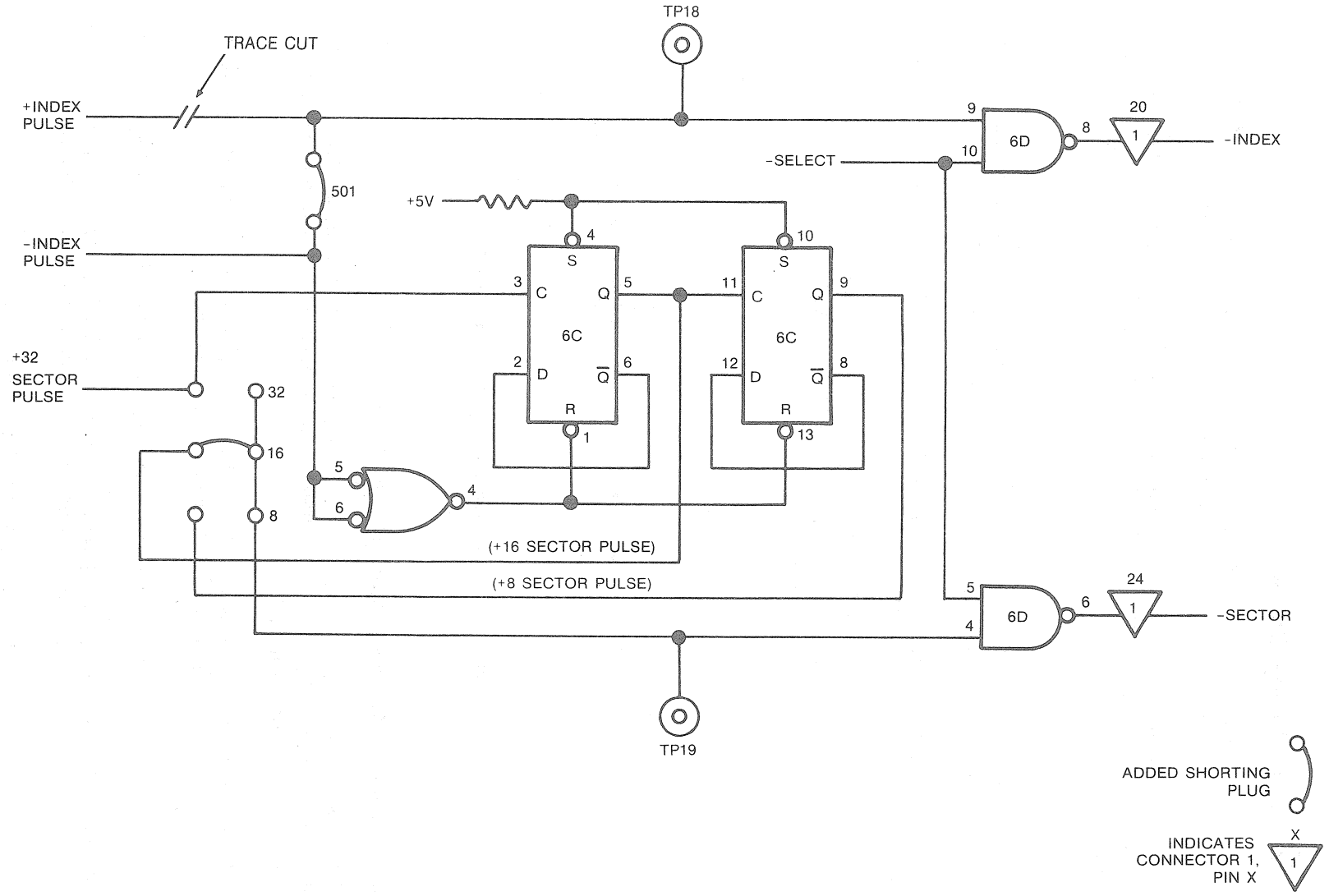


FIGURE 3-15. EXAMPLE OF HARD SECTOR WITH 16 SECTORS PER REVOLUTION

3.3.3 Radial Ready Option

This option permits the -READY signal line to be valid even though the drive is not selected. To implement this option, cut trace "RR" (refer to Figure 3-16).

If the drive is one of a multiple drive configuration and the READY lines must be kept separate, spare pins can be used for the -READY signal. This is accomplished as follows.

1. Cut trace "RR."
2. Cut trace "R." (This trace is identified on the PCB component side but the actual trace to be cut is on the other side of the PCB.)
3. Add a jumper wire from pad "R" to the pad of the selected spare I/O pin.

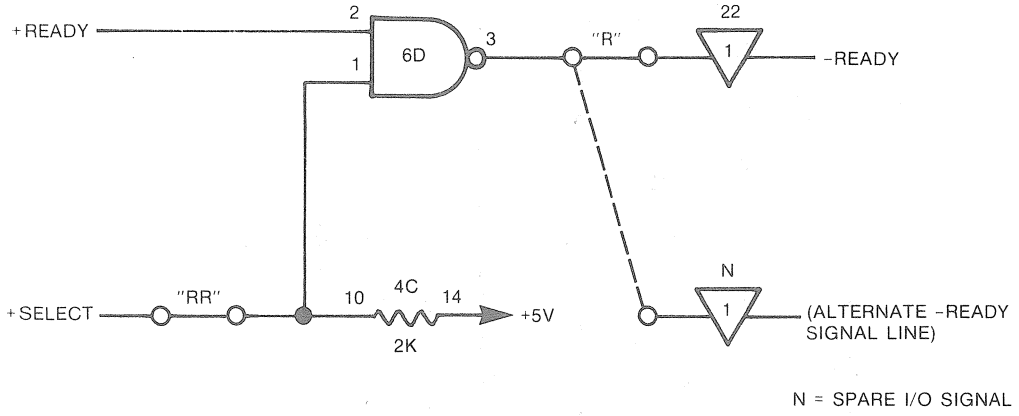


FIGURE 3-16. RADIAL READY OPTION

3.3.4 Busy LED Lamp Optional Features

With the standard PCB installed, the BUSY lamp lights when the drive's door is closed, the drive is selected, and the head is loaded (see Figure 3-17). There are two optional choices that are user-selectable.

Optional Choice 1: This option allows the -IN USE input signal line to be used to light the BUSY lamp programmably.

To enable this option, install a jumper at "D" (see Figure 3-17).

Optional Choice 2: This option permits lighting the BUSY lamp only when the drive is selected. To enable this option, proceed as follows:

1. Cut trace "F" (see Figure 3-17)
2. Install a jumper on the terminal at "E."

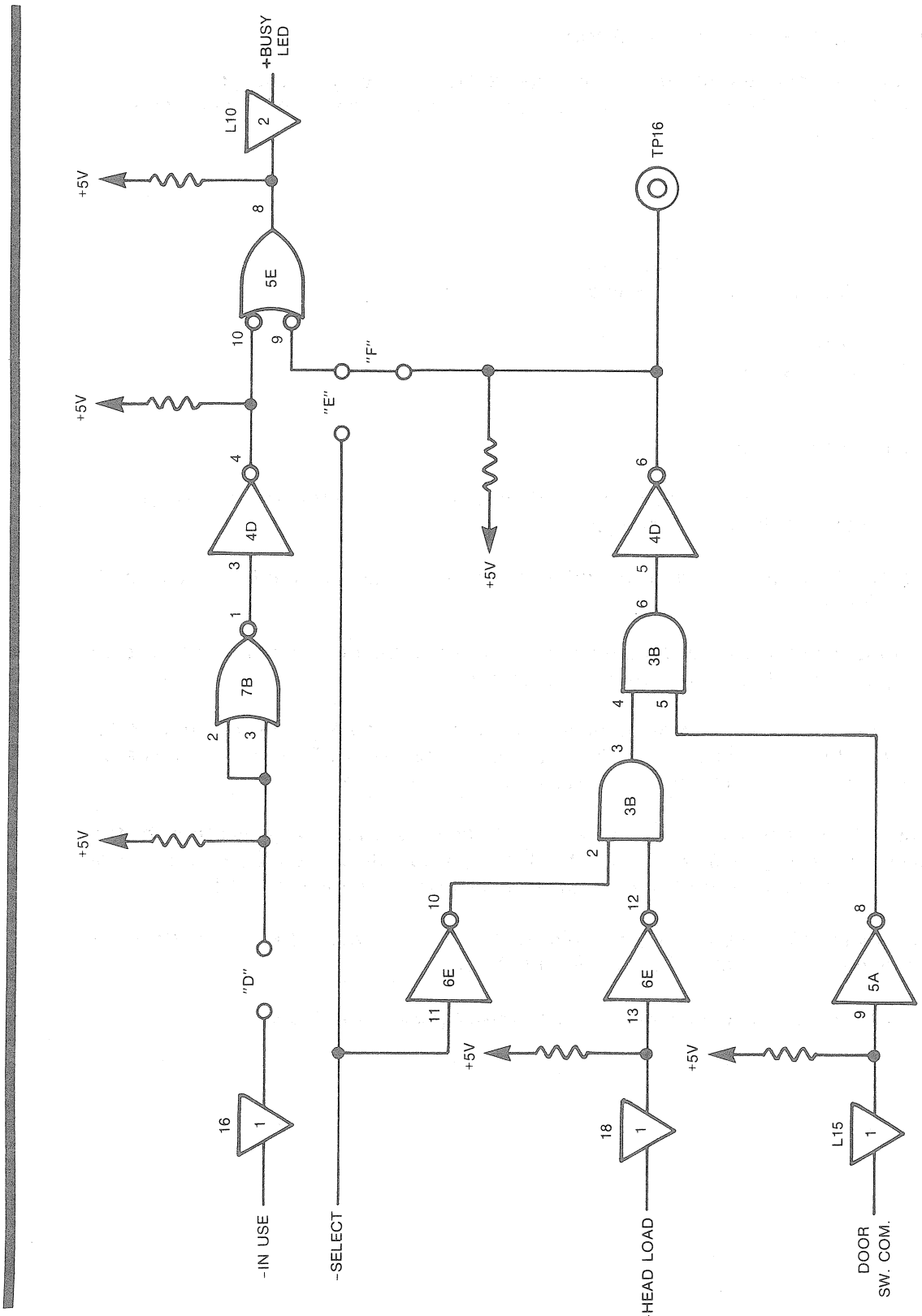


FIGURE 3-17. BUSY LED LAMP OPTION

3.3.5 Negative DC Power Option

This option permits the standard -5V negative DC voltage to be changed to a value from -7V to -16V. To implement this change, use the following procedure with the parts listed below.

Parts Required

Description	Memorex Part Number
-5V Regulator	157779
2.2 μF Capacitor	151120

Implementation Procedure

1. Remove both AC and DC power to the drive and disconnect the power plugs J4 and J5. Disconnect the J1 I/O connector.

2. Remove the PCB from the drive and then remove the jumper wire from location J5 (see Figure 3-18).

3. a. If the 2.2 μF capacitor on the component side of the PCB is mounted as shown by the dotted lines in Figure 3-18, remove it.

   b. If the 2.2 μF capacitor is mounted as shown by the solid lines in Figure 3-18, leave it in place. Ensure that the negative side of the 2.2 μF capacitor is soldered to the output of the negative regulator pin (see Figure 3-18).

4. If step 3a was necessary, use the new 2.2 μF capacitor and install it as shown by the solid lines in Figure 3-18. Ensure that the negative side of the 2.2 μF capacitor is soldered to the output of the negative regulator pin (see Figure 3-18).

5. Install the -5V negative voltage regulator so that its flat surface is against the component side of the PCB (see Figure 3-18).

6. Reinstall PCB in the drive and connect power plugs J4 and J5.

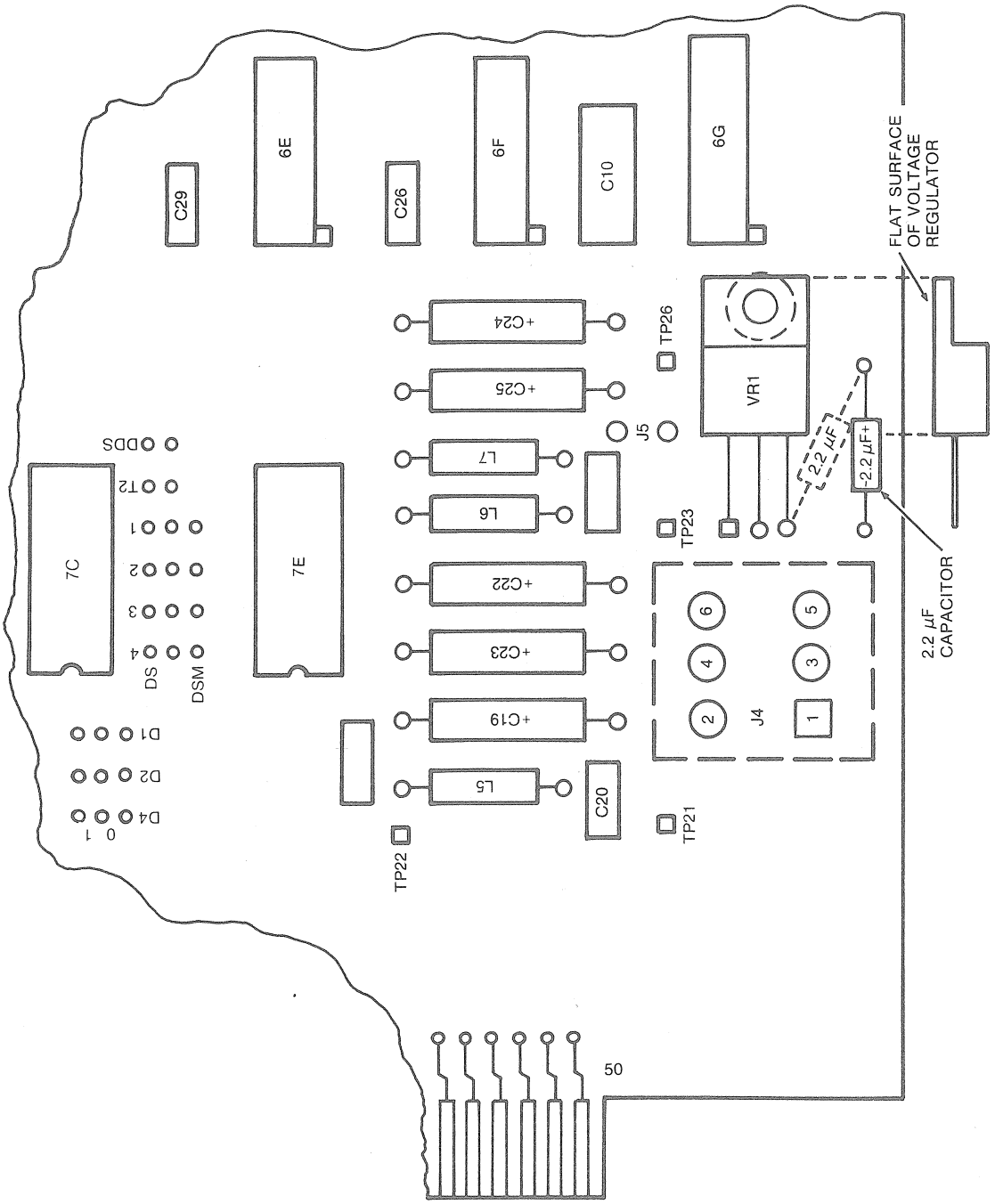


FIGURE 3-18. SECTION OF PCB (COMPONENT SIDE) FOR IMPLEMENTATION OF NEGATIVE DC POWER OPTION

SECTION 4
MAINTENANCE PROCEDURES

This section provides complete, step-by-step instructions for 550 drive removal/replacement and alignment/adjustment techniques.

Before performing any of the following maintenance procedures, the operator or field service technician should check the following when answering a maintenance call.

Check to ensure that the operator is attempting an operation that is valid and the proper procedure is being employed. It is always a good idea to contact the person placing the call and attempt to have him identify the problem, whenever possible.

Check for obvious problems, i.e., input power fluctuations, loose cables to the PCB dirty head, loose drive belt, cartridge inserted upside down or backwards, etc.

CAUTION

Power should be removed from the 550 Disc Drive before attempting any maintenance procedures which do not require power to be on.

A few minutes spent checking the basics may save hours of maintenance and troubleshooting time.

4.1 TOOLS REQUIRED

The tools required in order to properly perform the various maintenance procedures listed in Section 4.3 and Section 4.4 are listed:

TOOL	REQUIRED FOR
Screwdriver (0.19 × 0.04 blade)	Most maintenance procedures
1/4" open end wrenches (2 required)	Clamp adjustment
Small nose pliers	Spindle spring removal
#1/16 AF allen wrench	Drive pulley
#5/64 AF allen wrench	Carriage end stop
Feeler gauge set	Various adjustments and clearances
Oscilloscope	Most alignments and adjustments
9/16" 0 punch	Spindle bearing removal
550 alignment disc (P/N 312218)	Head and track alignment
Gram gauge	To check load on head load arm

4.2 PREVENTIVE MAINTENANCE (PM)

The 550 Flexible Disc Drive is designed to operate with a minimum of preventive maintenance. The annual cleaning and inspection listed below is the only PM required. The PM procedure can be performed by an operator in a few minutes time.

4.2.1 Materials Required For PM

1. Isopropyl alcohol.
2. Cotton swabs.

4.2.2 Cleaning The 550 Drive

The following cleaning procedure is recommended by Memorex. It should be performed at least once each year.

1. Clean the head assembly using a cotton swab moistened in isopropyl alcohol (95% type is recommended). Wipe the head carefully to remove all accumulated dirt and oxide.

2. With the drive belt removed, clean the belt switches on the drive and driven pulley using a cotton swab moistened in isopropyl alcohol. Remove all accumulated dirt.

4.2.3 Inspecting the 550 Drive

The following inspection is recommended by Memorex. It should be performed at least once each year.

1. Inspect the drive belt for frayed edges or loose (stretched) belt. Change belt if required.

2. Inspect the Head Load Pad for worn or dirty pad. Change the pad using the following procedure, if required.

4.2.3.1 Head Load Pad Replacement

1. Locate pop-out pad assembly, refer to Figure 4-1. This assembly fits into the tip of the head load arm.

2. Remove worn pad assembly by squeezing retaining lugs and pushing the pad assembly out, as shown below.

3. Install new pad assembly.

NOTE

Some early production models will not have this pop-out pad, in which case the worn pad must be removed from the load arm, residual adhesive and foreign matter must be removed from the cavity and a new pad must be installed.

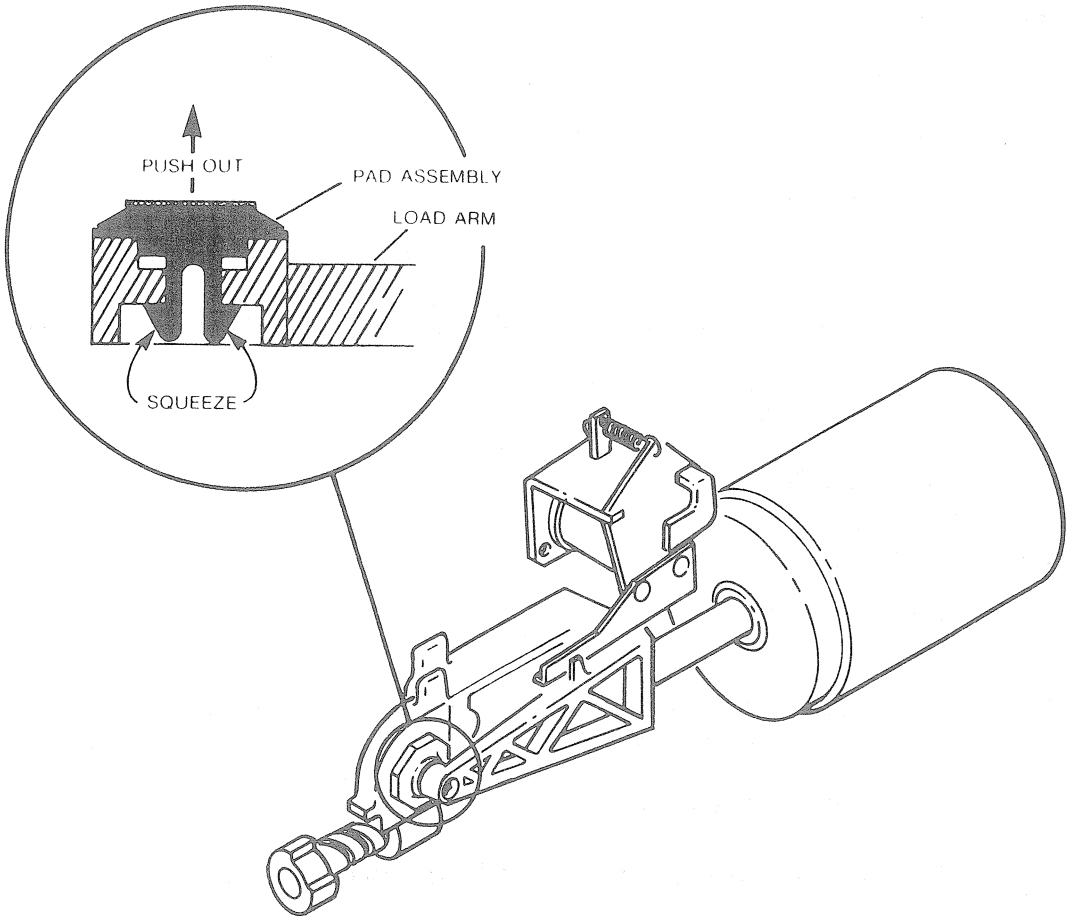


FIGURE 4-1. POP-OUT LOAD PAD REMOVAL

4.3 MECHANICAL REMOVAL AND REPLACEMENT

4.3.1 Printed Circuit Board (PCB)

On units equipped with a PCB, all drive electronics are mounted on a single printed circuit board. The PCB (shown in Figure 4-2) is mounted on the 550 drive with the component side out. The PCB is connected to the 550's base by two screws and four latch type standoffs. Four cable plugs are connected to the PCB, I/O, DC power, and internal circuits (see Figure 3-1).

4.3.1.1 Removal

Prerequisite: None

1. Disconnect connectors J1, J3, and J4.
2. Remove two corner screws [A]
3. Do not remove screw [B] and standoff [C]
4. Disengage four latch type standoffs [D] by squeezing latches and sliding board off.
5. Disconnect connector J2.
6. Remove PCB.

4.3.1.2 Replacement

1. Reconnect J2.

CAUTION

Ensure cabling to internal circuits connector (J2) is free and does not cause warping of the PCB.

2. Reconnect connectors J1, J3, and J4.
3. Position PCB, and engage four latch type standoffs [D]
4. Install two corner screws [A]

4.3.2 Drive Belt

A drive belt is installed on the 550 drive, under the PCB. The belt provides spindle rotation by connecting the driven pulley, installed on the spindle, to a drive pulley, installed on the drive motor shaft. The drive belt [E] is shown in Figure 4-2

4.3.2.1 Removal

Prerequisite: PCB removal

Remove the belt [E] by sliding it off the driven pulley [F] .

4.3.2.2 Replacement

1. Install the belt [E] over the drive pulley [G] and then over the driven pulley [F] .

2. Apply AC power to motor to ensure belt is tracking properly before reinstalling PCB.

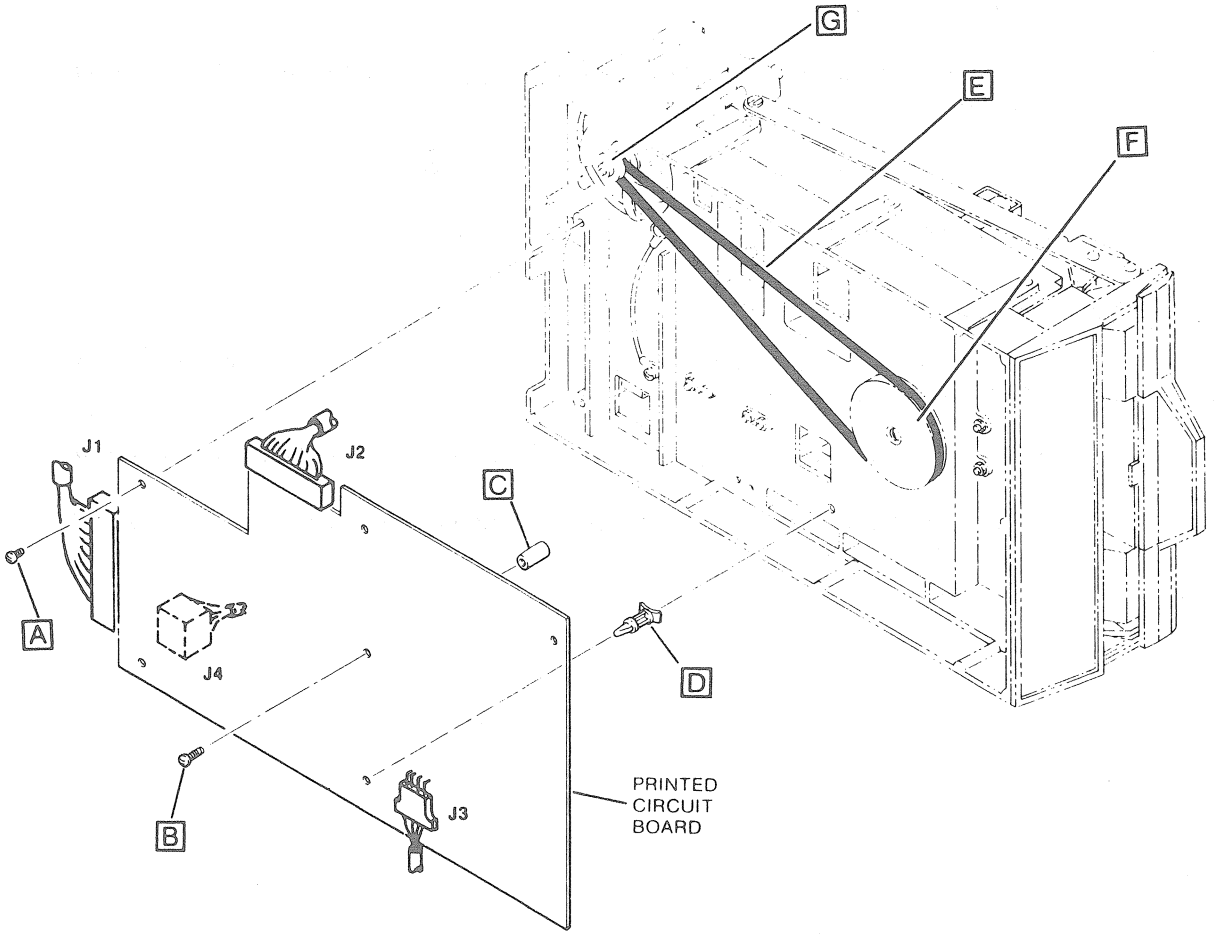


FIGURE 4-2. PRINTED CIRCUIT BOARD (PCB) AND DRIVE BELT REMOVAL AND REPLACEMENT

4.3.3 Head Load Solenoid Assembly

The Head Load Actuator Assembly consists of a solenoid assembly with an armature extension that operates a bail. The purpose of the assembly is to control the action of the load arm, which is spring-loaded to press the disc in the cartridge against the head mounted on the carriage assembly. When the solenoid is deenergized, armature spring action moves the bail away from the disc. The bail contacts the load arm tab, and bail travel moves the load arm pressure pad out of contact with the disc. The solenoid is energized by the -LOAD HEAD signal. When the solenoid is energized the armature moves the bail toward the disc, and disengages the bail from the load arm tab. The load arm spring moves the released load arm toward the disc, and the load arm pressure pad presses the disc against the head.

The Head Load Solenoid Assembly is mounted on the 550 drive as shown in Figure 4-3. The Solenoid Assembly is attached to the drive base by two screws on the bottom of the assembly.

4.3.3.1 Removal

Prerequisites:

1. Disconnect the solenoid leads and wires [A] . All connections are of the slip-on type.
2. Remove the two solenoid attaching screws [B] .
3. Remove head load solenoid assembly [C] .

4.3.3.2 Replacement

1. Position the head load solenoid assembly [C] in place and install two attaching screws [B] .
2. Connect the slip-on leads and wires [A] removed in the disassembly process.
3. Perform Bail Clearance Verification to complete replacement procedure (refer to section 4.4.9).

4.3.4 Sensor Assemblies

There are three separate Sensor Assemblies to provide track 00, track 43, and write protect (optional) information to the PCB. These Sensor Assemblies (shown in Figure 4-3) are mounted on the base by two holding screws each.

The track 00 sensor indicates, to the electronics, that the head is positioned at track 00 on the flexible disc.

The track 43 sensor indicates, to the electronics, that the head is positioned at track 43 or above on the flexible disc. This information is used by the electronics to switch to low write current. The signal to the electronics remains active for all tracks above 42.

The Write Protect Sensor indicates, to the electronics, that a disc cartridge with a Write Protect notch is presently inserted in the 550 drive. The electronics will inhibit the write and erase circuitry as long as this disc is used. The Write Protect Sensor is an option on the 550 drive.

4.3.4.1 Removal

Prerequisite: PCB removal (see paragraph 4.3.1)

1. Disconnect slip-on wires on the sensor assembly.
2. Remove two screws [D] holding the sensor assembly to the base. (Retain or retrieve socketed nuts [E] on opposite side of base.)
3. Remove sensor(s).

4.3.4.2 Replacement

1. Position sensor(s) in place.
2. Install two holding screws in each sensor.
3. Reconnect wires previously removed.
4. Follow adjustment procedure detailed in Sections 4.4.4, 4.4.6, 4.4.12 (Track 00, Track 43, Write Protect Adjustment, respectively) of this manual.

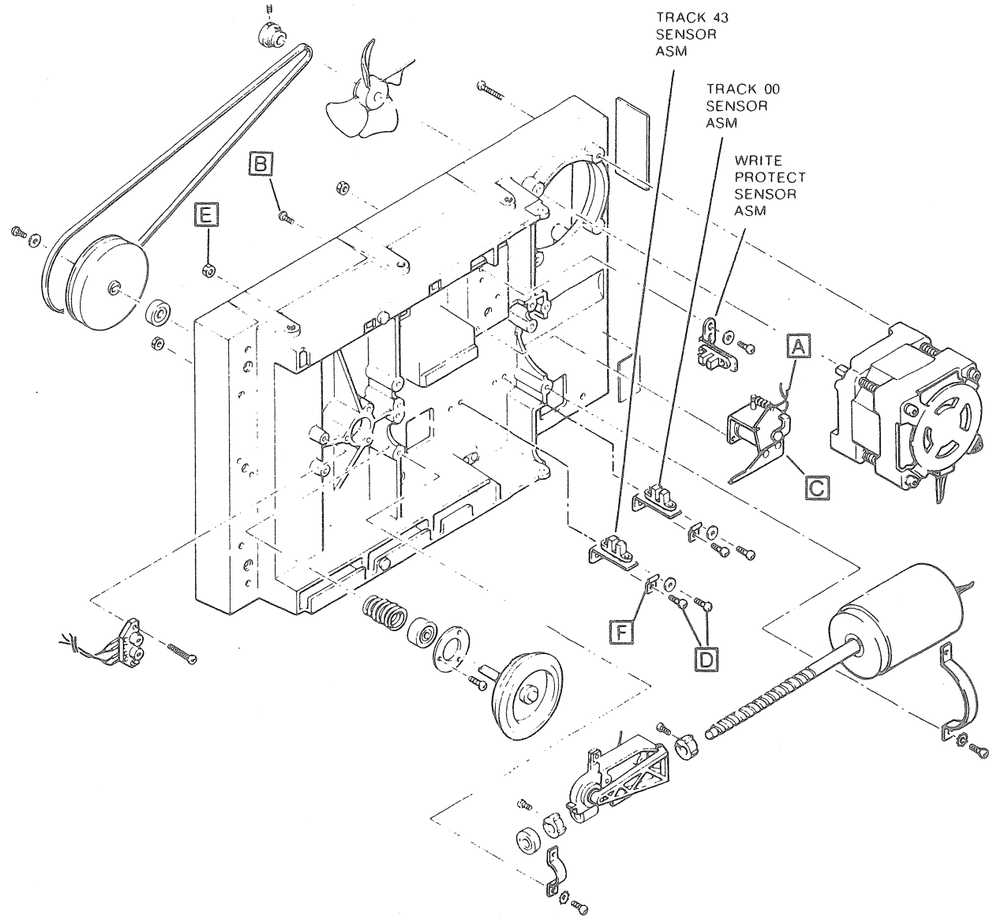


FIGURE 4-3. HEAD LOAD SOLENOID AND SENSOR ASSEMBLIES REMOVAL AND REPLACEMENT

4.3.5 Door Closed Switch

The Door Closed Switch is located on the carrier assembly (shown in Figure 4-4) and secured to the assembly by two screws. The switch prevents the 550 from becoming READY unless the door is properly latched. The head cannot be loaded unless the switch is made.

4.3.5.1 Removal

Prerequisite: None

1. Remove the two small screws [A] that hold the door switch [B] to the carrier assembly [C] .
2. Remove two wires (slip-off type) from switch [D] .
3. Remove the switch.

4.3.5.2 Replacement

1. Install the two screws [A] after positioning the door switch [B] over its mounting holes.
2. Reconnect wires [D] .
3. Close door; as door latches (carrier assembly closes), verify that the switch makes and breaks. If the switch does not operate properly, refer to the carrier adjustment section of this manual. If the switch does operate properly, replacement is completed.

4.3.6 Index/Sector Detector Assembly

The Index/Sector Detector is mounted on the carrier assembly as shown in Figure 4-4. The detector is used to detect the presence of the index hole on the flexible disc. When using hard sectored discs, the index detector is used to detect both index and sector holes as the disc revolves. The relative position of the detector on the carrier assembly mounting slot determines the timing alignment. Light from the light emitting diode, falls on the detector when a disc index, or disc sector, hole passes between the two, turns on the detector, and a threshold detector circuit generates the timing pulse.

With optional two-sided operation, i.e., both sides of the flexible disc may be read/recorded, a second Index/Sector Detector Assembly is mounted next to the first assembly. The second assembly operates exactly the same as the first assembly. It permits the index pulse to occur at the proper time when the reverse side of the flexible disc is in contact with the head.

4.3.6.1 Removal

Prerequisite: None

1. Remove two wires [E] connected to the detector assembly [F] .
2. Remove one holding screw [G] .
3. Remove the detector assembly [F] .

4.3.6.2 Replacement

1. Position the detector over the proper mounting holes.
2. Install the holding screw [G] .
3. Reconnect the two wires previously removed [E] .
4. Refer to Section 4.4.5 of this manual for the Index Sector Alignment Procedure.

4.3.7 Door Assembly

The Door Assembly is mounted to the carrier assembly via two brackets as shown in Figure 4-4. Two interlock actuators are also attached to these brackets. The door is made of a molded, glass-filled thermoplastic. 550 operations are inhibited unless the door is properly closed and latched. The door is attached to the carrier which contains the disc clamping mechanism. Closing the door clamps the disc to the spindle, and holds the cartridge against the platen.

4.3.7.1 Removal

Prerequisite: None

1. Remove two interlock actuators [H] (one on each door bracket) by removing two screws [J] in each actuator.
2. Disconnect Door Assembly [K] from carrier [C] by removing four screws [L] (two on each side).
3. Pull Door Assembly out through bezel.

4.3.7.2 Replacement

1. Push Door Assembly [K] into position through bezel [M] .
2. Reconnect Door Assembly to carrier assembly [C] by installing four screws [L] . (Two on each side.)
3. Reconnect two interlock actuators (one on each side of door) by installing two screws in each actuator.
4. Refer to Sections 4.4.11 and 4.4.13 of this manual for proper adjustments to be performed after replacement.

4.3.8 Bezel and Interlocking Latch

The Bezel is the front panel of the 550 flexible disc drive. An optional bezel with a red file busy indicator may be installed to inform the operator when the unit is reading or recording. It warns the operator that interrupting the operation in progress may affect data integrity.

The two interlocking latches are attached to the Bezel via an interlock shaft. The latches lock the flexible disc cartridge in place after proper insertion. Operating in conjunction with the interlock actuators, the latches prevent the door from closing if a disc is improperly seated. The Bezel and interlocking latches are shown in Figure 4-4.

4.3.8.1 Removal

Prerequisite: Removal of PCB (paragraph 4.3.1) and door assembly (paragraph 4.3.7) for Bezel removal only. No prerequisites are required for the removal of the interlocking latches.

1. Loosen Bezel's four mounting screws [N] .

NOTE

On some early production models the Bezel screws must be removed.

2. Remove Bezel [M] by sliding it out of the drive frame.
3. Remove two screws [P] one at each end, on the interlock shaft [R] .
4. Remove latch stops [S] .
5. Slide interlocking latches [T] off ends of shaft.
6. Remove bushings [U] .
7. Remove latch springs [V] .
8. Remove interlock shaft [R] .

4.3.8.2 Replacement

1. Insert interlock shaft [R] into Bezel [M] .
2. Install latch springs [V] .
3. Install bushings [U] .

4. Install interlocking latches [T] on ends of interlock shaft.

CAUTION

Ensure that latches are fully engaged with flats on shaft before starting screws. Ensure that latches are properly installed under springs.

5. Install one screw [P] at each end of shaft to the interlocking latch with latch stops S under screw heads.

6. Install Bezel [M] by sliding it on to the drive base as far as it will go.

7. Tighten Bezel's four mounting screws N making sure Bezel is centrally positioned and tight against base for full length.

NOTE

On early production models the Bezel screws must be reinstalled.

8. Refer to Section 4.4.11 for appropriate adjustment procedure.

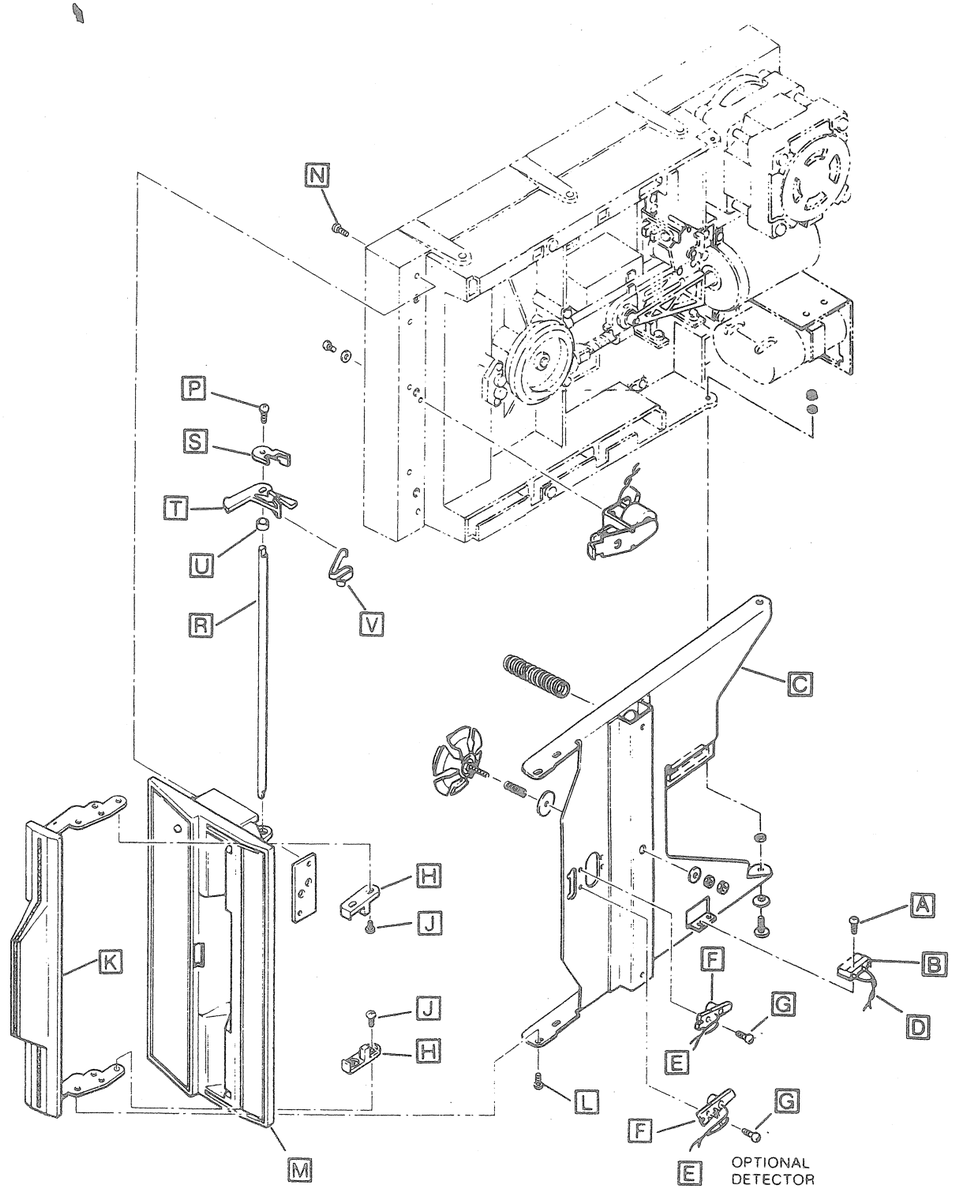


FIGURE 4-4. DOOR CLOSED SWITCH, INDEX SECTOR DETECTOR, DOOR, BEZEL AND INTERLOCKING LATCH ASSEMBLIES REMOVAL AND REPLACEMENT

4.3.9 Program Controlled Door Lock Assembly

The Program-Controlled Door Lock is an optional solenoid-operated device to prevent the opening of the drive door. When the solenoid is energized, the locking ear blocks the door latch, thus protecting the drive from being interrupted. The lock is mounted internally, on the base; Figure 4-5 shows the location of the door lock assembly.

4.3.9.1 Removal

Prerequisite: Bezel removal (paragraph 4.3.8).

1. Disconnect cable [A] .
2. Remove two mounting screws and washers [B] .
3. Remove lock assembly [C] .

4.3.9.2 Replacement

1. Position lock assembly [C] in place.
2. Install two mounting screws [B] .
3. Reconnect cable [A] .

CAUTION

When reinstalling Bezel ensure that locking ear lies on top of stop on Bezel.

4.3.10 Clamp Assembly

The Clamp is used to center the disc on the spindle and clamp the disc to the spindle. It is mounted on the carrier and performs its function when the door is closed and latched. The Clamp contains an adjustable nut and locknut for vertical positioning. The Clamp Assembly is shown in Figure 4-5.

4.3.10.1 Removal

Prerequisite: Door assembly removal (paragraph 4.3.7).

1. Remove lock nut, nut, and washer [D] that hold clamp to carrier [E] .
2. Swing open carrier assembly and remove carrier springs [F] .

CAUTION

Open carrier carefully. Do not force past stops. Do not allow carrier to slam shut.

3. Remove clamp [G] (with screw), spring [H] , and washer [J] from carrier.

4.3.10.2 Replacement

1. Assemble spring [H] and washer [J] on clamp [G] .
2. Place clamp and screw in spindle cavity.
3. Close carrier carefully, allowing screw to protrude through hole.
4. Install washer, nut, and lock nut [D] on outer side of carrier to secure clamp.

CAUTION

Ensure carrier springs are reinstalled before replacing door assembly.

4.3.11 Carrier Assembly

The main function of the Carrier Assembly is to hold and actuate the disc clamp. It also provides mounting means for the door closed switch, index detectors, and cartridge pressure pad. The Carrier is mounted to the base by two pivot screws. The Carrier is shown in Figure 4-5.

4.3.11.1 Removal

Prerequisite: Door assembly removal (paragraph 4.3.7).

1. Disconnect two wires to door switch assembly.
2. Disconnect wires to index detector(s) assembly.
3. Remove cables.
4. Remove two Carrier pivot screws [K] .
5. Retain four washers [L] , one spring washer [M] , and two kep nuts [N] .
6. Remove Carrier [E] ; retain two Carrier springs [F] .

4.3.11.2 Replacement

1. Position carrier [E] in place; with two Carrier springs [F] not yet inserted.
2. Place keps nuts [N] , spring washer [M] , and washers [L] on pivot screws [K] .
3. Install pivot screws [K] ensuring that spring washer [M] is directly under head of pivot screw closest to drive motor.
4. Install the two Carrier springs [F] .
5. Install cables.
6. Reconnect wires to index detector(s) assembly.
7. Reconnect two wires to door switch assembly.
8. Perform the adjustments listed in Sections 4.4.5 (Index Alignment) and 4.4.11 (Carrier Adjustment) to complete the replacement procedure.

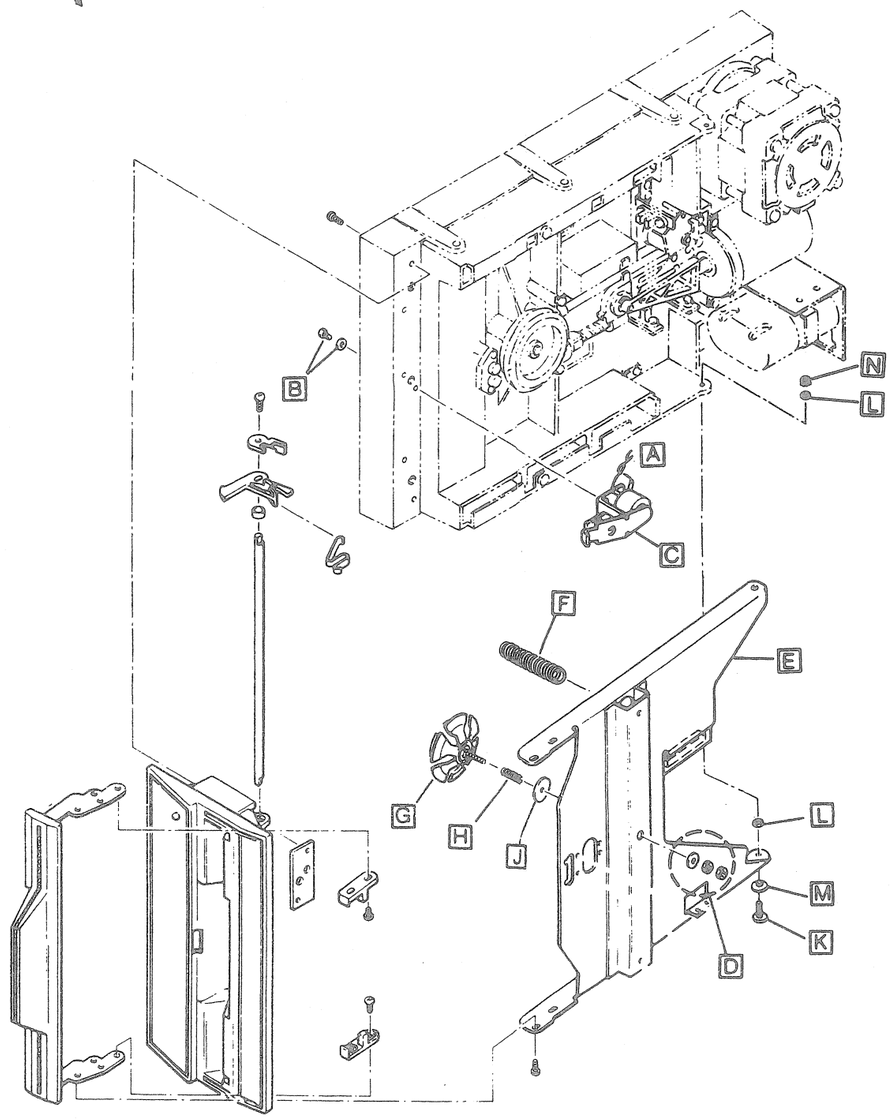


FIGURE 4-5. PROGRAM CONTROLLED DOOR LOCK, CLAMP, AND CARRIER ASSEMBLIES REMOVAL AND REPLACEMENT

4.3.12 Spindle, Bearings, and Driven Pulley

The Spindle Assembly consisting of the spindle and press fitted hub is mounted in bearings on the base as shown in Figure 4-6. The Driven Pulley is mounted on the spindle on the opposite end of the hub. The pulley is driven by the drive motor and belt to provide disc rotation.

4.3.12.1 Removal

Prerequisite: PCB (paragraph 4.3.1), belt (paragraph 4.3.2), and Carrier Assembly (paragraph 4.3.11) removals.

1. Remove pulley mounting screw and washer [A] .
2. Remove driven pulley [B] .
3. Remove lower spindle bearing (bearing under driven pulley) [C] .
4. Turn unit over.
5. Remove spindle assembly [D] .
6. Remove three mounting screws [E] and keeper plate [F] .
7. Invert unit again; press-out upper spindle bearing [G] and bearing load spring [H] . (This requires a $\frac{9}{16}$ inch diameter punch.)

4.3.12.2 Replacement

1. Insert bearing load spring [H] and carefully press upper spindle bearing [G] in hole until seated.

NOTE

Shielded end of bearings should be out.

2. Install keeper plate [F] with three mounting screws [E] .
3. Insert spindle assembly [D] .
4. Invert unit.
5. Install lower spindle bearing [C] .
6. Install driven pulley [B] .

CAUTION

On reassembly be extremely careful when putting driven pulley on shaft. Use moderate hand pressure to hold pulley in keyed position while tightening screw. Bearing load spring will push pulley out of key if proper pressure is not applied. It may be necessary to hold the hub during this operation.

7. Install screw and washer [A] on bottom side of spindle.

4.3.13 Index/Sector Emitter (LED) Assembly

Emitter Assembly is mounted on the base in front of the spindle assembly; it is secured by two mounting screws. The assembly normally includes one LED (Light Emitting Diode) which emits invisible infrared light whenever DC power is applied to the 550 drive. The assembly can include a second LED for alternate side operation. The Index/Sector Emitter Assembly is shown in Figure 4-6.

4.3.13.1 Removal

Prerequisites: PCB (paragraph 4.3.1) and door assembly removal (paragraph 4.3.7).

1. Swing open carrier.
2. Disconnect the cable(s) [J] to the Emitter Assembly [K] .
3. Remove two screws [L] and nuts [M] holding Emitter Assembly to base.
4. Remove Emitter Assembly [K] .

4.3.13.2 Replacement

1. Position Emitter Assembly [K] over its mounting holes on base.
2. Install two screws [L] and nuts [M] to secure emitter assembly to base.
3. Reconnect the cable(s) [J] previously removed.
4. Refer to Section 4.4.5 for the Index alignment procedure.

4.3.14 Stepper and Carriage Assembly

The Stepper motor is used to position the carriage at the track address determined by the drive electronics. The Stepper and Carriage Assembly is shown in Figure 4-6.

The recording head is mounted on a carriage that travels parallel to a radius of the disc. The carriage is driven toward or away from the disc center by a rotating screw on which the carriage is mounted. The screw is rotated in either direction by the Stepper motor. The Stepper motor rotates the screw in 15-degree increments. The linear head travel resulting from one rotational increment is equal to the center-to-center distance between two adjacent tracks on the disc 0.053 centimetre (approximately 0.021 inch). accessing depends upon the initial alignment of the carriage on the screw so that the head is radially positioned over a track centerline. Carriage stops are mounted on both ends of the screw to prevent inadvertent carriage overtravel. The stops must be correctly positioned after the head radial alignment is complete.

4.3.14.1 Removal

Prerequisite: PCB removal (paragraph 4.3.1). If Stepper removal is being performed, start with step A; if Carriage is being removed, start with step B.

A. Remove cable ties and disconnect wires from positions L11, L12, L13, and L14 of (P2). (See Figure 4-2 and 3-7.)

B. Loosen screw in outboard carriage end stop.

1. Remove cable clamp ([F] see Figure 4-3) from track 43 switch assembly.
2. Remove two Stepper clamp screws [N] and remove clamp [P] .
3. Ensure that track sensor flag is free of sensors.
4. Withdraw Stepper motor until end of shaft is free from bearing [R] .
5. Remove Stepper motor [S] and Carriage assembly by swinging carriage clear of way shaft [X] and lifting off of base.
6. Remove outboard carriage end stop [T] .
7. Unscrew Carriage assembly [U] from Stepper motor shaft.
8. Carriage is now free.

4.3.14.2 Replacement

1. Screw the Carriage assembly [U] on to the Stepper motor [S] shaft.
2. Install outboard carriage end stop [T] .
3. Install Stepper motor and Carriage assembly on base by sliding Stepper motor shaft into bearing [R] , and allow stepper motor to seat in its saddle with the motor axially indexed against the frame.

CAUTION

Ensure ear on load arm overlays the bail on head load solenoid. Ensure that carriage guide properly engages the way shaft and that the sensor flag clears the sensors.

4. Install Stepper clamp [P] using two Stepper clamp screws [N] .
5. Install cable clamp and screw on base of track 43 switch assembly.
6. Tighten screw in outboard carriage end stop [T] .
7. Reconnect wires from L11 and L12 positions (P2) (if required).
8. Install cable ties (if required).
9. Refer to the following adjustments in this manual to complete replacement procedure.

ADJUSTMENT	SECTION
Radial	4.4.2
Track 00	4.4.4
Track 43	4.4.6
End stops	4.4.7
Bearing/shoulder clearance	4.4.8
Bail Clearance Verification	4.4.9
Carrier/door/ disc clamp	4.4.10

4.3.15 Way Shaft Assembly

The Way Shaft is used to guide and stabilize the carriage. The Way Shaft is shown in Figure 4-6.

4.3.15.1 Removal

Prerequisite: Door assembly removal (paragraph 4.3.7).

1. Swing open carrier.
2. Loosen two screws [V] on clamp [W] closest to spindle.
3. Remove other clamp by removing two screws.
4. Slide out Way Shaft [X] .

4.3.15.2 Replacement

1. Slide Way Shaft [X] into place.
2. Install clamp previously removed.
3. Tighten two screws [V] on clamp closest to spindle [W] .
4. Close carrier assembly.

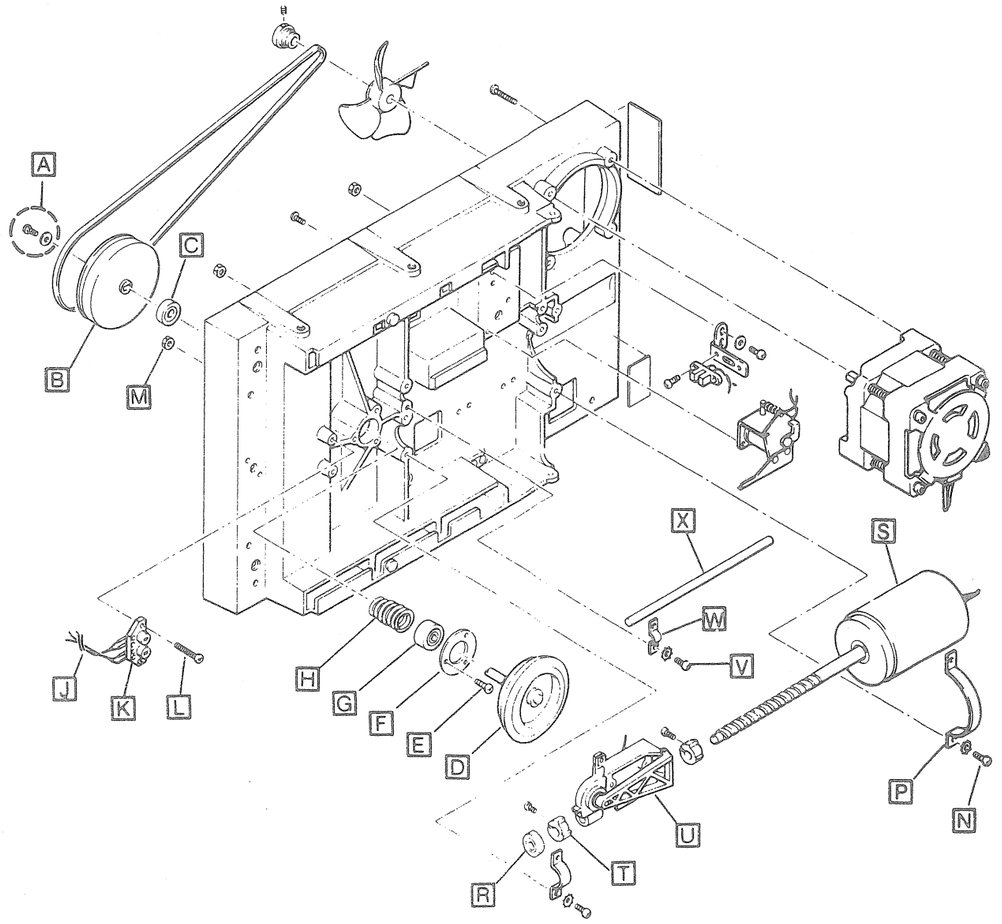


FIGURE 4-6. SPINDLE, BEARINGS, DRIVEN PULLEY, INDEX/SECTOR EMITTER, STEPPER AND CARRIAGE ASSEMBLIES REMOVAL AND REPLACEMENT

4.3.16 Drive Motor and Capacitor Assembly

The Drive Motor and Capacitor Assembly provide power to rotate the disc spindle. Speed is reduced from synchronous speed to 360 rpm by means of a belt and pulley system. The Motor is provided with an axial-flow fan for cooling. The Motor is mounted on the top side of the base. The Capacitor is also mounted on the top side of the base at the adjacent corner. Mounting is shown in Figure 4-8.

4.3.16.1 Removal

Prerequisite: PCB and drive belt removals (paragraph 4.3.1 and 4.3.2).

1. Remove the grounding wire [A] on the PCB side of the Drive. One motor mounting screw [B] and one screw [C] on capacitor mounting bracket hold the ground wire to the base.

2. Remove the remaining Capacitor bracket screw.

3. Remove the remaining three Motor mounting screws and lock washers.

4. Remove Motor [D] and Capacitor [E] assembly from base.

4.3.16.2 Replacement

1. Install Motor [D] and Capacitor [E] assembly over respective positioning holes on the base.

2. On the PCB side, install three Motor mounting screws [B] and washers [F] leaving the hole closest to the Capacitor bracket empty.

3. Install Capacitor bracket screw in the far end (hole closest to outer edge of unit); align with other hole in base and tighten screw.

4. Reconnect the ground wire [A] using the two remaining screws and lock washers in the remaining holes on the Motor and Capacitor mounting bracket.

4.3.17 Driving Pulley

The Driving Pulley is mounted on the end of the drive motor shaft located on the PCB side of the drive. The Drive Pulley drives the driven pulley on the spindle via a linking drive belt. Figure 4-8 shows the Driving Pulley location.

4.3.17.1 Removal

Prerequisite: PCB and drive belt removal (paragraph 4.3.1 and 4.3.2).

1. Loosen set screw [G] in drive pulley [H] .
2. Remove pulley.

4.3.17.2 Replacement

1. Install new pulley and tighten set screw.

CAUTION

Ensure set screw is installed on flat side of shaft.

2. Adjust installation of pulley to conform to the specifications shown in Figure 4-7.

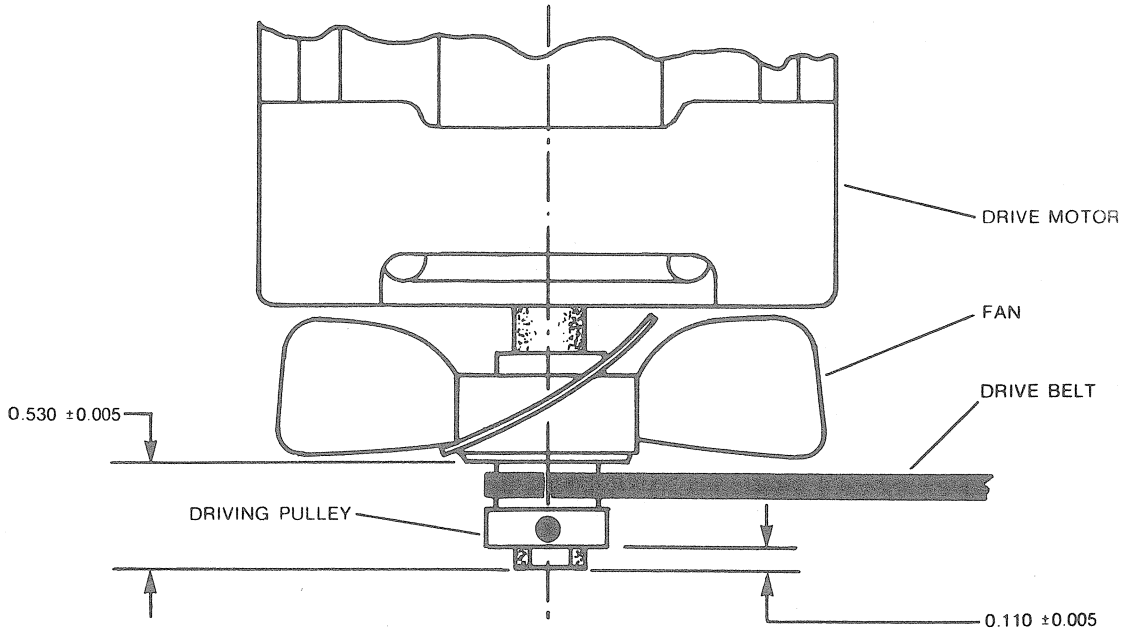


FIGURE 4-7. DRIVE PULLEY AND FAN INSTALLATION SPECIFICATIONS

4.3.18 Fan Assembly

The Fan Assembly is part of the drive motor assembly, used for cooling the motor. Mounting location is shown in Figure 4-8.

4.3.18.1 Removal

Prerequisite: Drive motor and capacitor assembly removals (paragraph 4.3.16).

1. Remove the pulley [H] .
2. Carefully pry fan [J] up and off of motor shaft, working against inner hub. Avoid forcing outer hub or fan blades.

4.3.18.2 Replacement

Press fan onto drive motor shaft per specifications shown in Figure 4-7. Apply force at inner hub only.

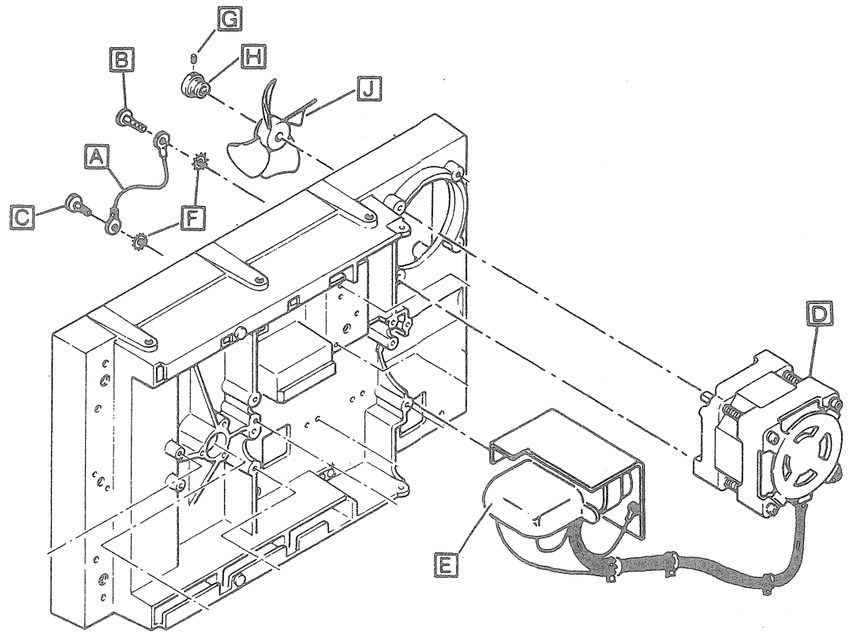


FIGURE 4-8. DRIVE MOTOR CAPACITOR, DRIVING PULLEY AND FAN ASSEMBLIES REMOVAL AND REPLACEMENT

4.3.19 Eject Springs

The Eject Springs are responsible for pushing the cartridge partially out of the drive for easy removal. This action occurs when the interlocking latches release the cartridge. The Eject Springs are mounted under the carrier, one on each side. Figure 4-9 shows the Eject Springs and mounting positions.

4.3.19.1 Removal

Prerequisite: PCB removal (paragraph 4.3.1).

1. From the PCB side remove two screws [A] and washers [B] attaching each spring [C] to the base.

2. Remove springs, retain socketed nuts [D] .

4.3.19.2 Replacement

1. Install springs.

CAUTION

Ensure that ends of springs are resting against end of cartridge guide ears on base.

2. Install two securing screws.

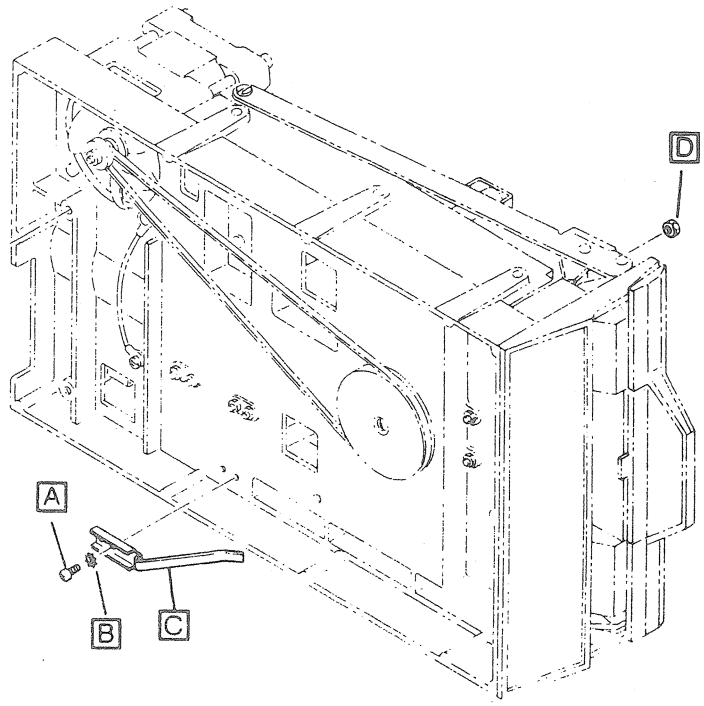


FIGURE 4-9. EJECT SPRINGS REMOVAL AND REPLACEMENT

4.4 ELECTRICAL REPLACEMENT, ALIGNMENT AND ADJUSTMENT

4.4.1 PCB

The PCB (Printed Circuit Board) assembly contains the necessary electronic circuitry for the 550 drive. All operations internal to the 550 (i.e., reading, recording, status, and controlling) are controlled by a single PCB. The block diagram in Figure 4-10 shows the major functional sections of the PCB. For detailed logic drawings, refer to the 550 Logic Manual.

The PCB assembly is a replaceable unit. Once it is determined that a PCB problem exists, the board should be removed and replaced per the instructions in paragraph 4.3.1.

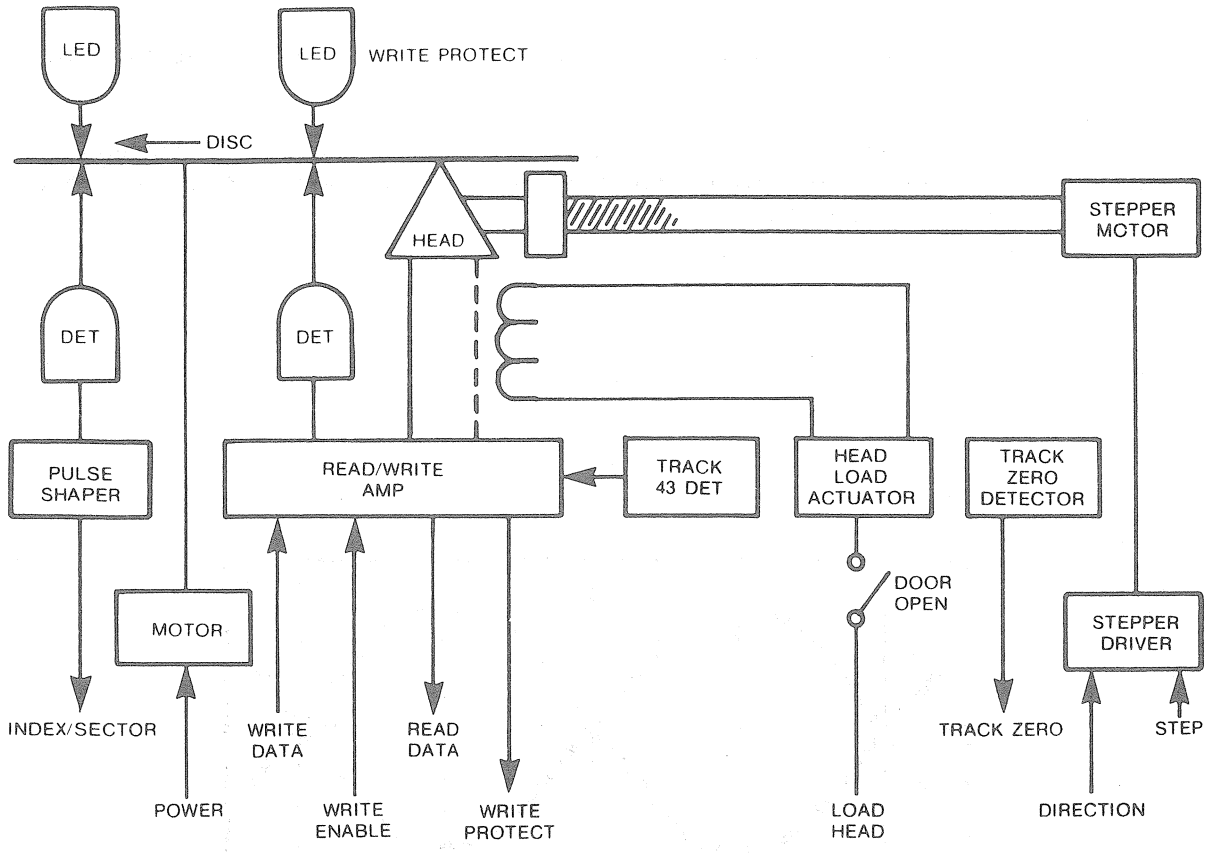


FIGURE 4-10. PCB FUNCTIONAL BLOCK DIAGRAM

4.4.2 Radial Head Check

Prerequisite: Warm-up period of ½ hour.

1. Insert field service alignment cartridge into drive.

2. Access track 38.

3. Check phase 03 to ensure that it is energized. (Collector Q5 should be low for phase 03).

4. Set-up oscilloscope as follows:

Vertical	0.2V per cm
Horizontal	20 msec per division
Input	Add differentially
Sync	Index (TP18)

   Place test probes on PCB TP 1 and TP 2 (head signal test points).

5. Observe waveform. Lobes should be within 20% of each other (refer to Figure 4-11).

6. If waveform is within specification, Radial Head check is completed. If waveform is not within specification, refer to Radial Head Alignment Procedure, Section 4.4.3.

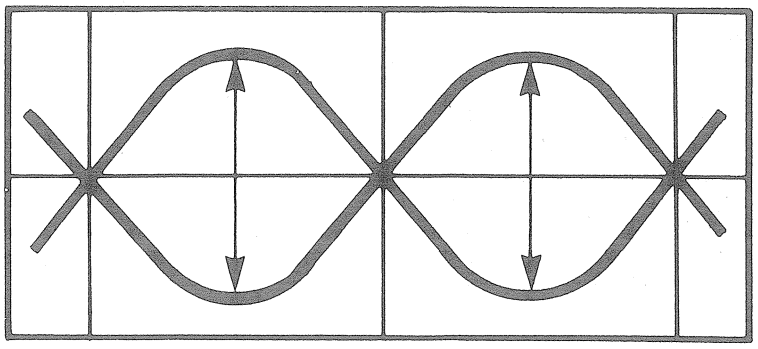


FIGURE 4-11. RADIAL HEAD CHECK

4.4.3 Radial Head Alignment Procedure

Prerequisite: Warm-up period of ½ hour is required for temperature stability before doing any alignment in this section.

1. Insert field service alignment cartridge into 550 drive.
2. At interfacing equipment, access track 38.
3. Phase 03 must be energized at this point. With phase 03 energized (collector on Q5 is low), the screw and motor turn together.
4. Connect oscilloscope to TP1 and TP2; set scope as follows:

Vertical	0.2V per cm
Horizontal	20 msec per division
Input	Add differentially
Sync	On index (TP18)

5. Load head.
6. Ground test point TP38.
7. Loosen two screws on stepper motor clamp to permit stepper rotation (Figure 4-6).
8. Observe waveform; it should be distinct lobe patterns; refer to Figure 4-11.
9. Adjust (rotate) stepper housing with front of housing indexed against base until both adjacent lobes are equal in amplitude (±10%). (See Figure 13.)
10. Tighten clamp screws without disturbing alignment.

TO CHECK ADJUSTMENT PROCEED AS FOLLOWS:

1. Observe waveform after adjustment has been secured. It should be the same as in step (9), above.
2. Access tracks forward and reverse five steps; this will cause the stepper to operate.
3. Return to track 38 (adjustment track).
4. Compare amplitudes of two adjacent lobes. They must be equal within 15%. If lobes are not equal, repeat steps (7) through (10), then, repeat adjustment check procedure.
5. Remove ground from TP38.
6. Remove test probes.

4.4.4 Track 00 Alignment Procedure

Prerequisite: Perform Radial Head alignment check (paragraph 4.4.2).

1. Insert field service alignment cartridge in 550 drive. (If it is not already in drive from a previous adjustment.)

2. Connect oscilloscope test probe to TP12; set scope as follows:

Vertical	1V per division
Horizontal	1 msec per division
Sync	auto

3. Access head to track 38 and observe lobes defined in Radial Head Alignment Procedure (section 4.4.3).

4. From track 38, step reverse 37 steps. Head should be on track 01.

5. Loosen two screws on track 00 transducer (track 00 sensor is shown in Figure 4-3).

6. Move track 00 transducer until it just switches to high signal (greater than +4 volts).

7. Retighten screws.

NOTE

Phase 02 must be energized at this point. 02 may be observed with the oscilloscope test probe on Q4; this test point should be low. If Q4 is not low, i.e., phase 02 is not energized, the Radial Head Alignment must be performed.

8. Step reverse one track; head should be at track 00.

9. Move test probe to J1, pin 42. There should be a low (on) signal present.

10. Access one track forward; track 01 position.

11. Signal at J1, pin 42 should switch to high (off).

ADJUSTMENT COMPLETED. REMAIN ON TRACK 01 FOR THE FOLLOWING ADJUSTMENT.

4.4.5 Index Alignment Procedure

Prerequisite: Perform stepper alignment check (paragraph 4.4.3).

1. Insert field service alignment cartridge in 550 drive.
2. At interfacing equipment, load head, and access track 01.
3. Track 01 on alignment diskette has a pulse on it to be used for index transducer alignment. Set up oscilloscope as follows:

Vertical	0.5V per division
Horizontal	50 μsec per division
Sync	TP18 (Index)

   Test probes on TP1 and TP2.

Input	Add differentially

4. Observe waveform; it should look like waveform in Figure 4-12.

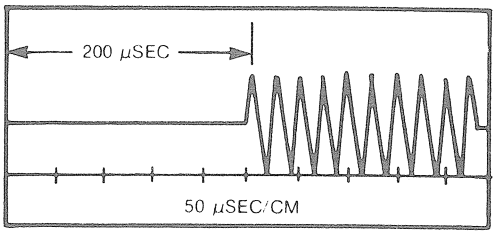


FIGURE 4-12. INDEX SENSING ALIGNMENT WAVEFORM

5. Loosen index sensor (transducer) screw. Move index sensor until a 200 μsec (±50 μsec) delay is obtained.
6. Move a test probe to TP29. Signal pulse width should be 1 to 1.9 msec.
7. If signal observed is within specifications, go to step 11. If signal observed is not within specifications, go to next step.
8. Loosen two screws on base of emitter; refer to Figure 4-6.
9. Move emitter toward right (as you look at drive from the front) to obtain more delay time; move emitter toward left to obtain less delay time.
10. When pulse width at TP29 is within specifications, tighten emitter assembly securing screws.
11. Access track 76.
12. With the oscilloscope and test probes on the same sync (TP18) and test points (TP1 and TP2) the observed waveform should not change by more than 50 μsec from the waveform observed on track 01.

4.4.6 Track 43 Alignment Procedure

Prerequisite: Head Radial alignment and track 00 alignment performed.

1. Access track 00; then, move forward 43 tracks.
2. Check that phase 02 is active at this point. (Test point Q4, low).
3. Place test probe on J2, L16.
4. Loosen two screws which hold track 43 sensor (refer to Figure 4-3).

NOTE

One sensor screw also holds cable clamp.

5. Adjust sensor position until observed waveform goes high (greater than +4V).
6. Tighten two securing screws being careful not to disturb adjustment.

4.4.7 End Stops Adjustment Procedure

Prerequisite: Head Radial alignment.

1. Access track 00; move forward 77 steps to track 77.

2. Position end stop so that the inside end stop contacts the carriage lug with 0.25 ±0.12mm (.010 ±0.005 in.) between edge of the stop and the carriage frame.

3. Move the head reverse 78 steps; this positions head on track -01.

4. position outside end stop so that it contacts carriage lug with 0.25 ±0.12 mm (0.010 ±0.005 in.) between the edge of the stop and carriage frame.

4.4.8 Bearing/Shoulder Clearance (Verification Only)

This check is performed after a Stepper motor is reinstalled or replaced.

With shoulder of the Stepper motor in contact with the forward edge of the shallow Stepper motor relief in the base, verify a clearance of 0.50 ±0.25 mm (0.020 ±0.010 in.) between shoulder on shaft and edge of outboard bearing. (Refer to Figure 4-13.)

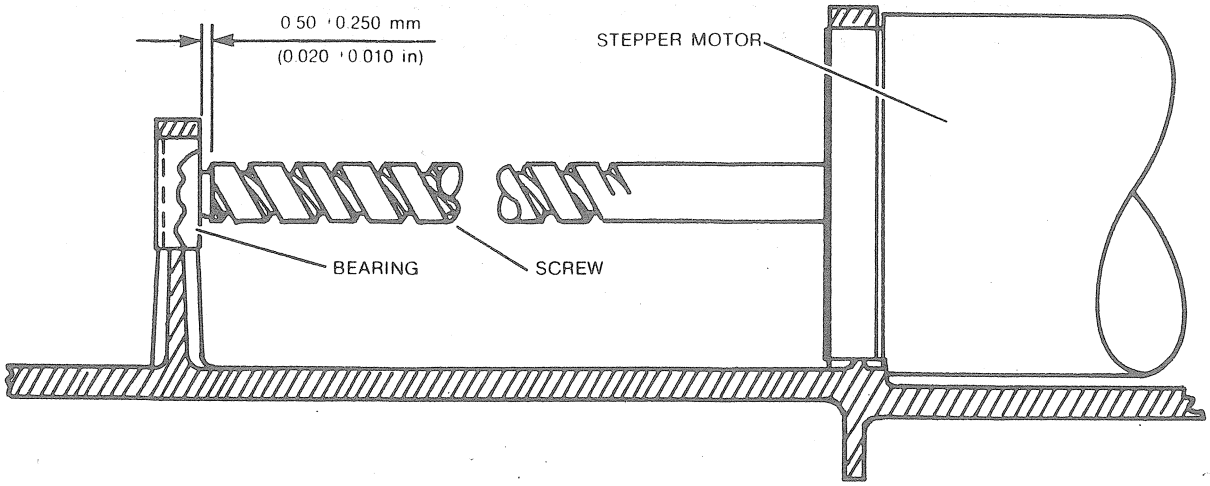


FIGURE 4-13. BEARING/SHOULDER CLEARANCE

4.4.9 Bail Clearance Verification

This check is performed after a Stepper motor, Carriage, or Head Load Solenoid assembly is reinstalled or replaced.

Verify that there is a minimum clearance of 0.25 mm (0.010 in.) between the armature bail and load arm ear for all positions of the carriage. (Refer to Figure 4-14.)

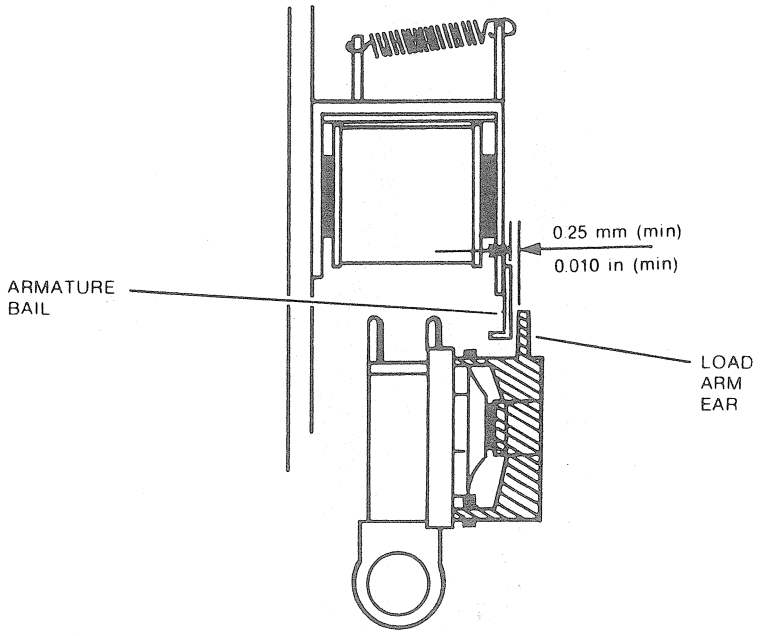


FIGURE 4-14. BAIL AND LOAD ARM CLEARANCE

4.4.10 Load Pad Clearance Verification

This check is performed after a head load solenoid replacement.

With the load arm solenoid deenergized, verify a 4.8 ±0.75 mm (0.19 ±0.03 in.) clearance exists between the read/write and the load pad. (Refer to Figure 4-15.)

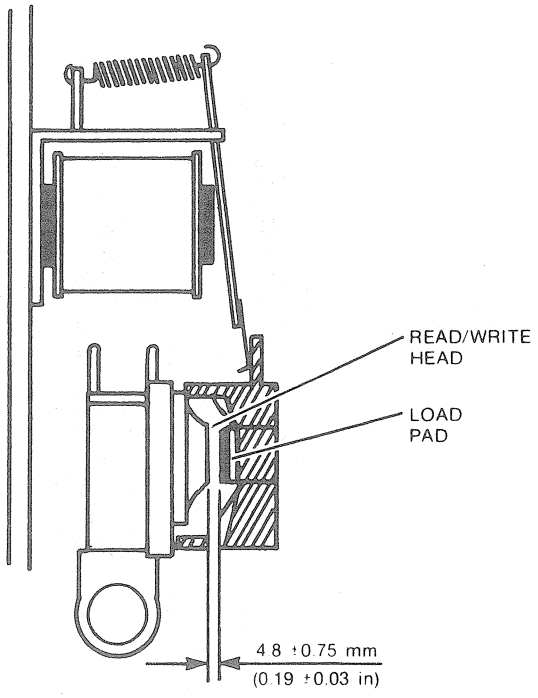


FIGURE 4-15. READ/WRITE HEAD AND LOAD PAD CLEARANCE

4.4.11 Carrier/Door/Disc Clamp (or Spider) Adjustment Procedure

This adjustment is performed after a Carrier/Door/ or bezel replacement.

1. With the door latch seated on the Bezel latch surface, the door shall be fastened to the clamp carrier per the specifications shown in Figure 4-16.

2. With the door latched closed, the disc clamp nut and lock nut shall be adjusted and locked per the specifications shown in Figure 4-16.

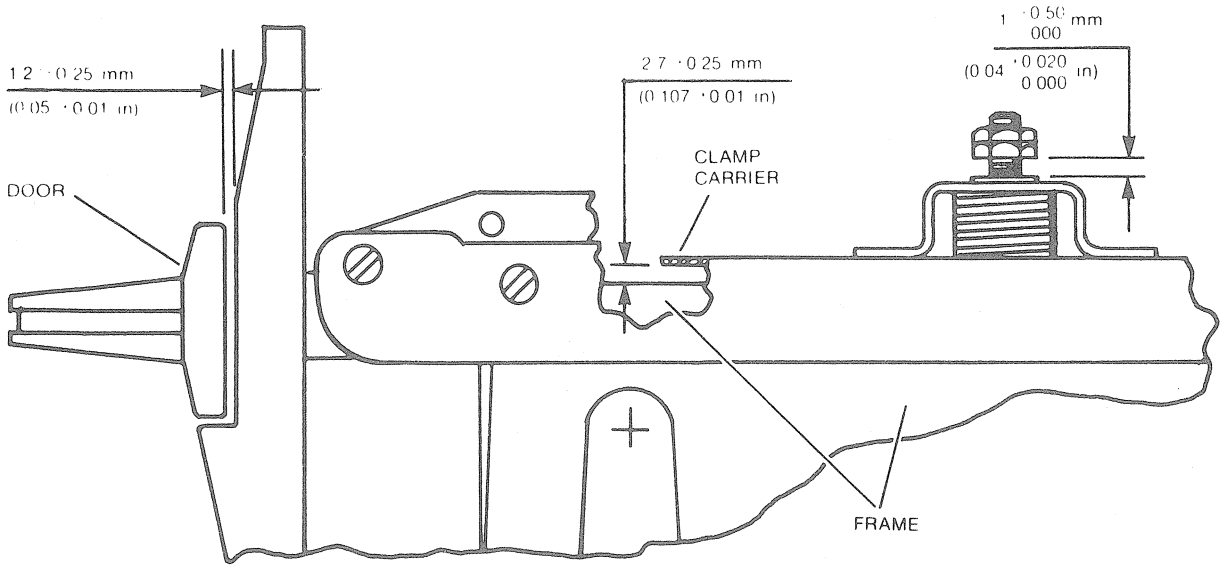


FIGURE 4-16. DOOR AND DISC CLAMP POSITIONS

4.4.12 Write Protect Adjustment Procedure

Adjust the Write Protect Sensor so that a cartridge with a Write Protect notch, meeting ANSI standards, activates it, and a cartridge without the notch does not activate it.

1. Loosen two screws in Write Protect Sensor; refer to Figure 4-3.

2. Move sensor until the above result is obtained. Using an oscilloscope, look at TP15; write protect activated = low, not activated = high.

3. Tighten screws.

4.4.13 LOCKING LATCH ACTUATORS ADJUSTMENT PROCEDURE

The Interlocking Latch Actuators are adjusted per Figure 4-17. This is the nominal position, which may have to be varied for proper function as follows:

1. With a disc cartridge absent or fully inserted to a latched position, there must be no positive restriction to door closure from its fully open to fully closed (latched) position, including overstroke beyond the latched position.

2. During door opening, the interlocking latches must release the cartridge after the door latch has cleared the path of the cartridge.

3. With a disc cartridge partially inserted, the interlocking latches must effectively block door closure at both actuators.

4. Attempted reclosure following release as in (2.) above, before the door has fully opened, must be prevented by the secondary blocking surfaces on the interlocking latches.

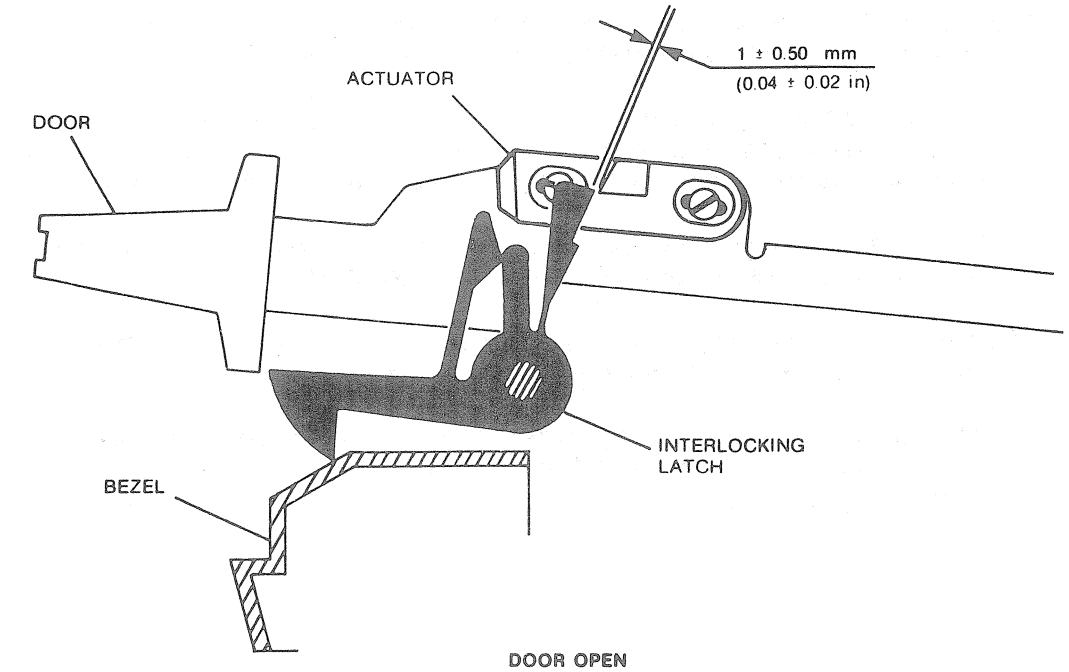


FIGURE 4-17. INTERLOCKING LATCH AND ACTUATOR

4.5 TROUBLESHOOTING FLOWCHARTS

The flow charts listed in this section are provided to help the service technician in locating a faulty assembly within the 550 drive.

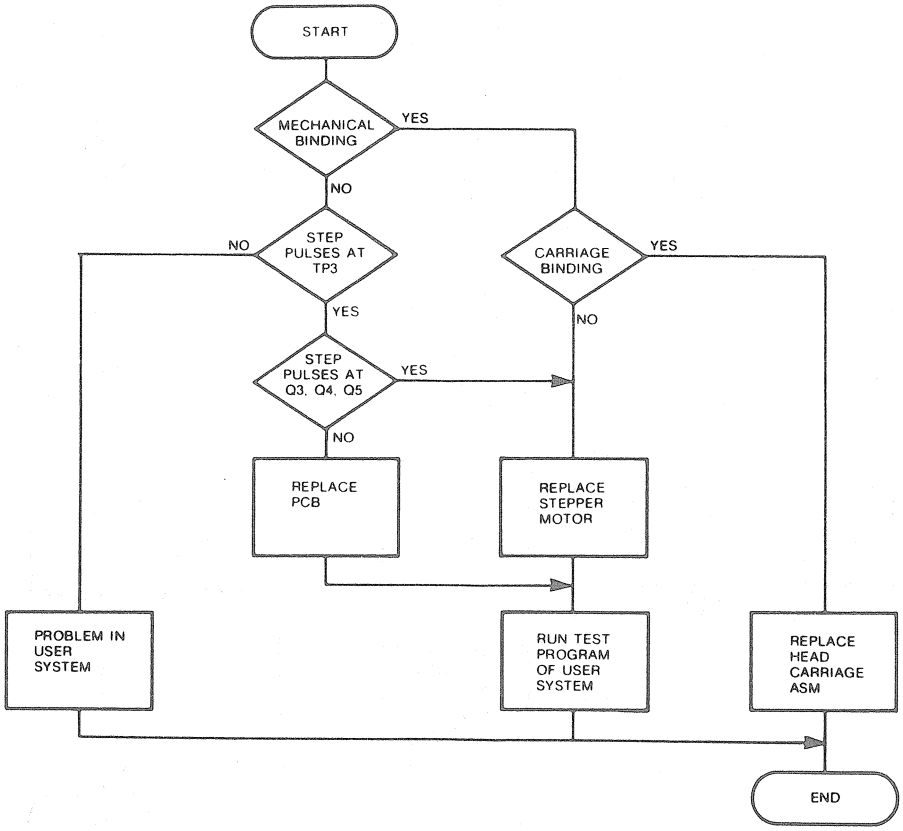


FIGURE 4-18. HEAD POSITION ACTUATOR DIAGNOSTIC FLOWCHART

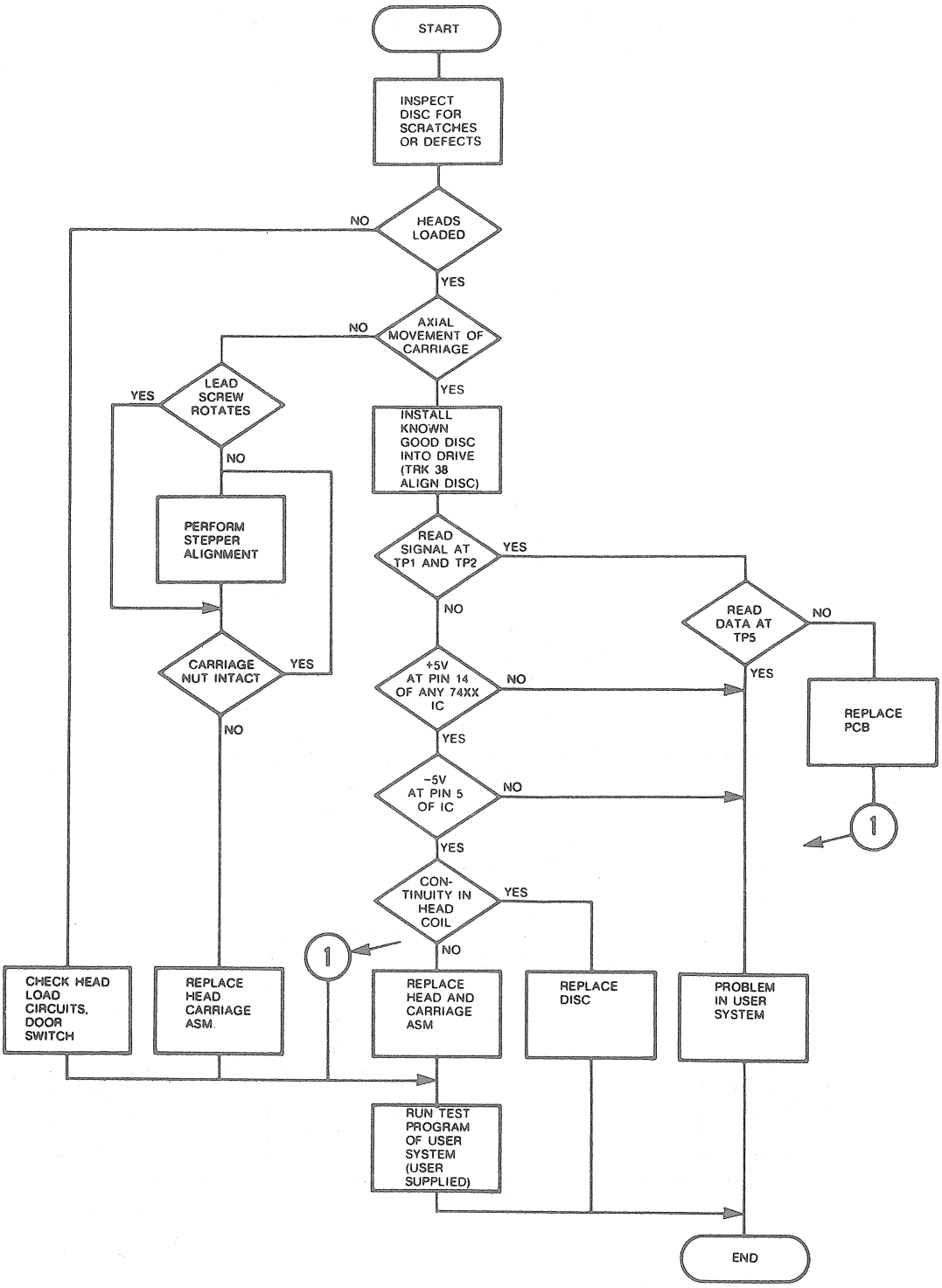


FIGURE 4-19. READ CIRCUIT DIAGNOSTIC FLOWCHART

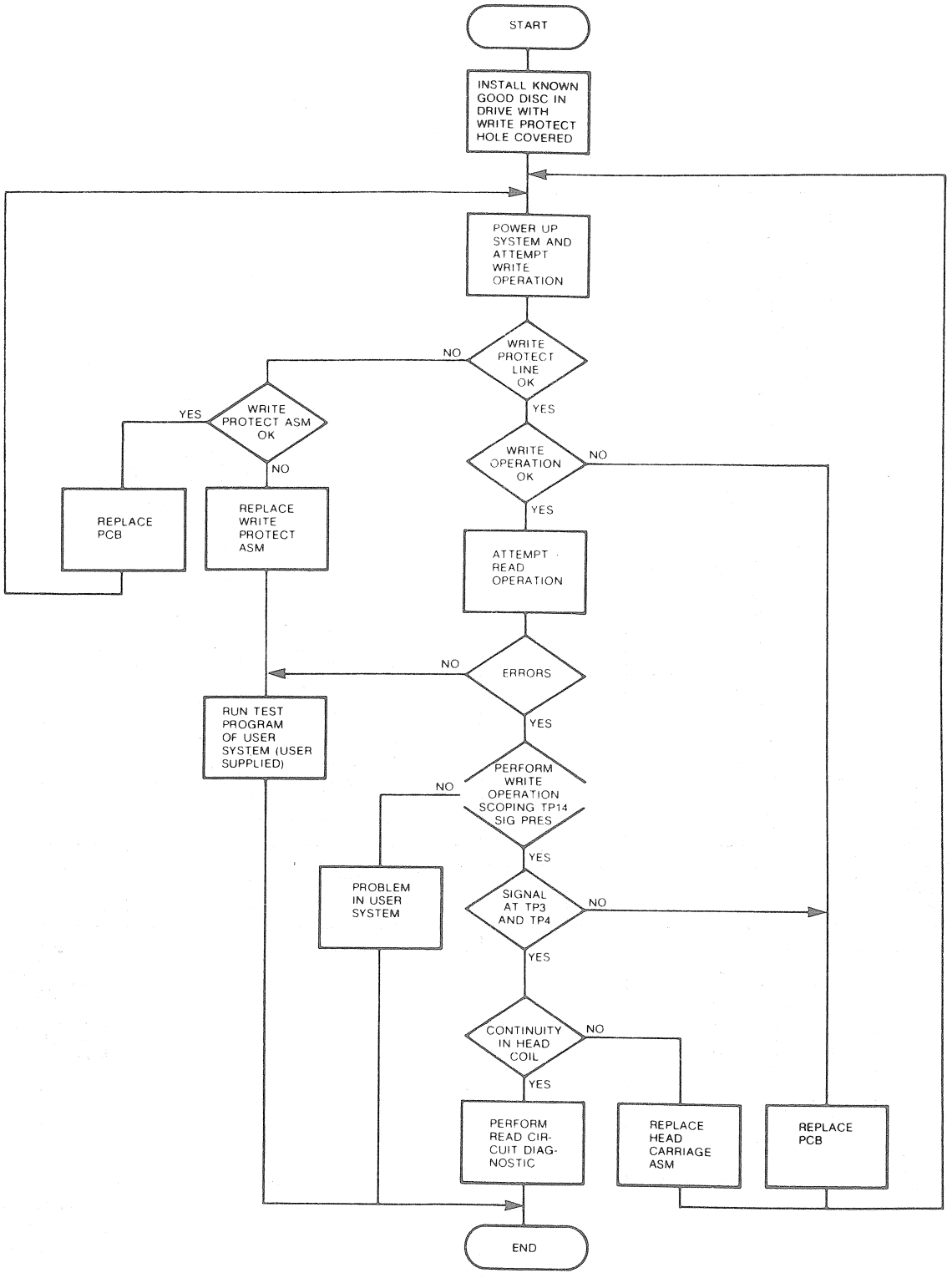


FIGURE 4-20. WRITE CIRCUIT DIAGNOSTIC FLOWCHART

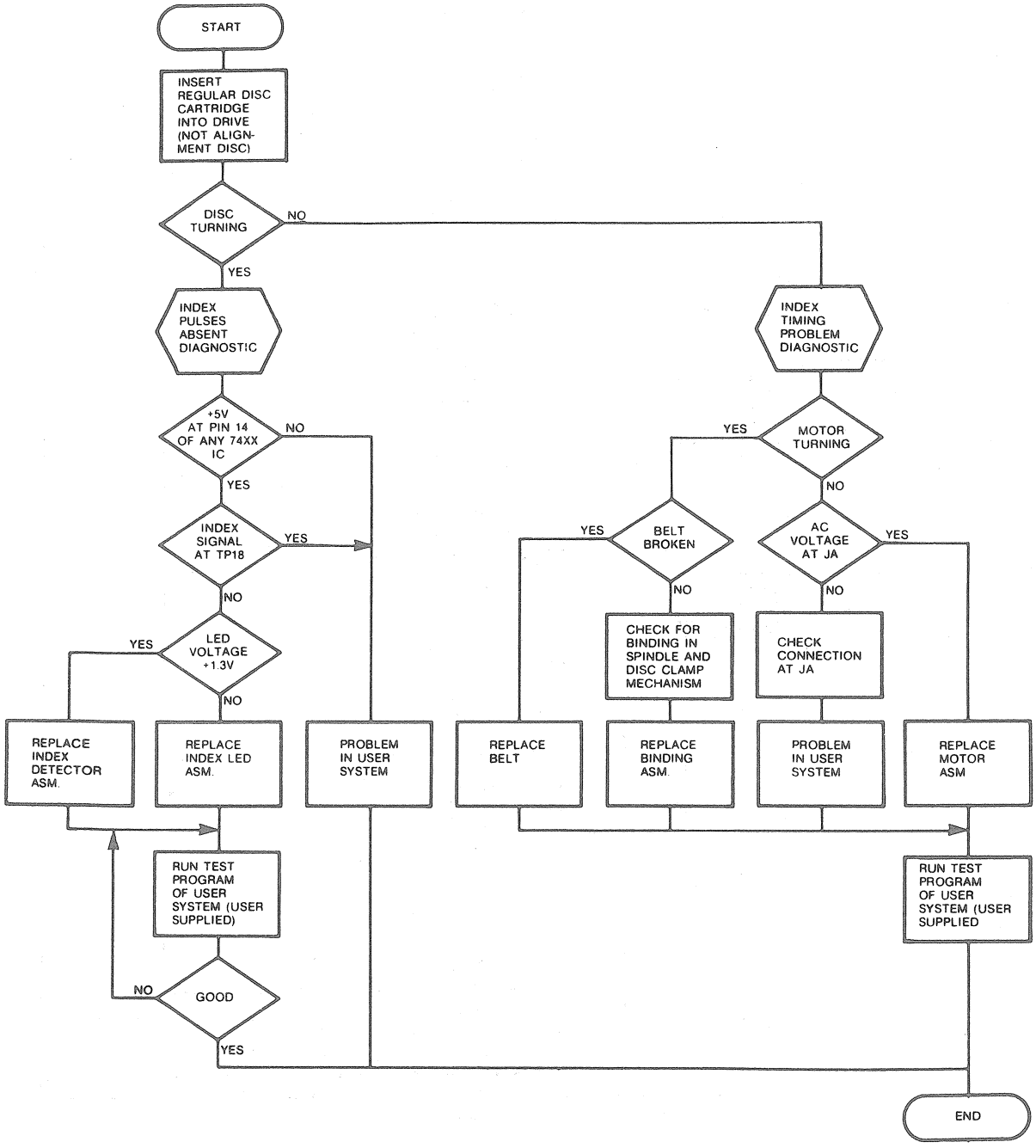


FIGURE 4-21. INDEX PULSES ABSENT AND INDEX TIMING PROBLEM DIAGNOSTIC FLOWCHART

SECTION 5
ILLUSTRATED PARTS CATALOG

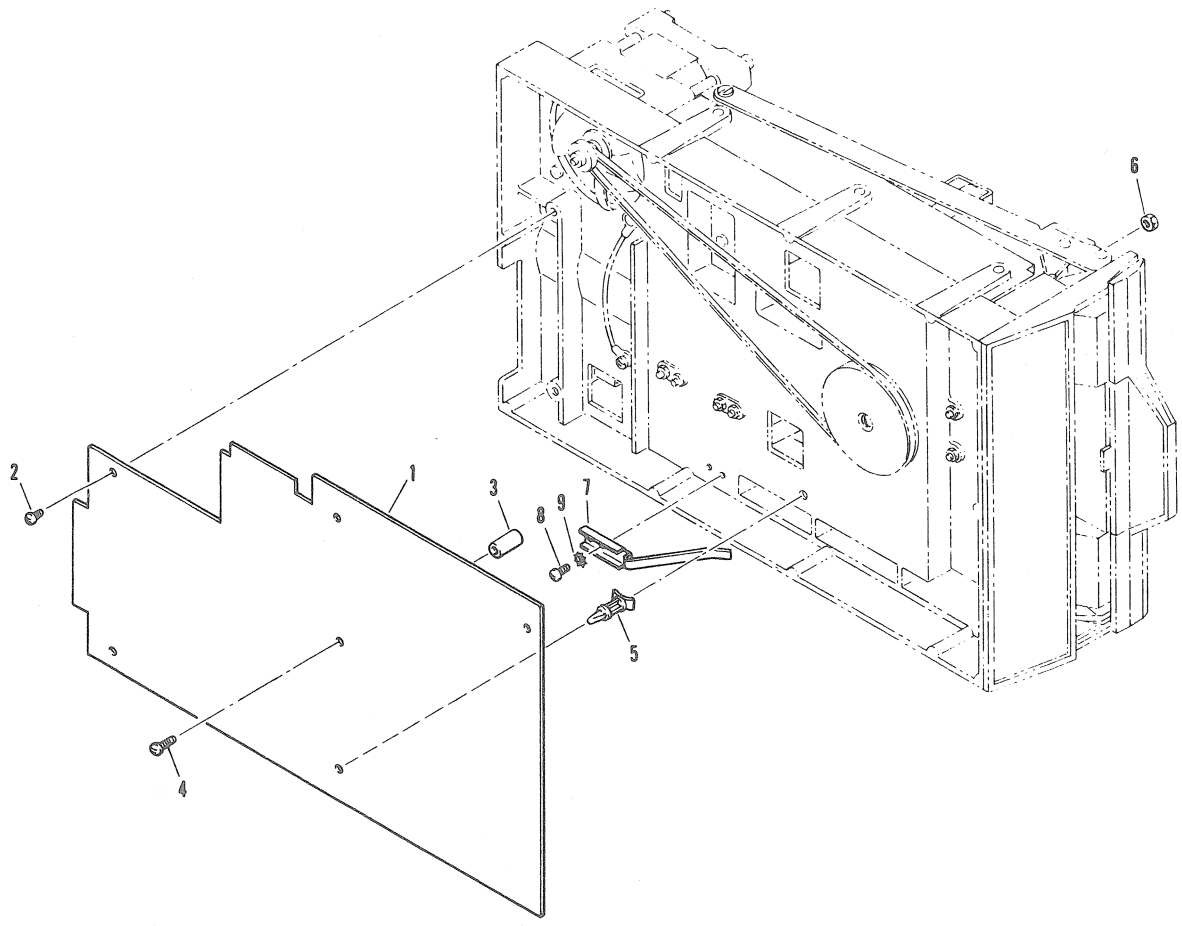


FIGURE 1. FEATURES AND BASIC ASM (Sheet 1 of 4)

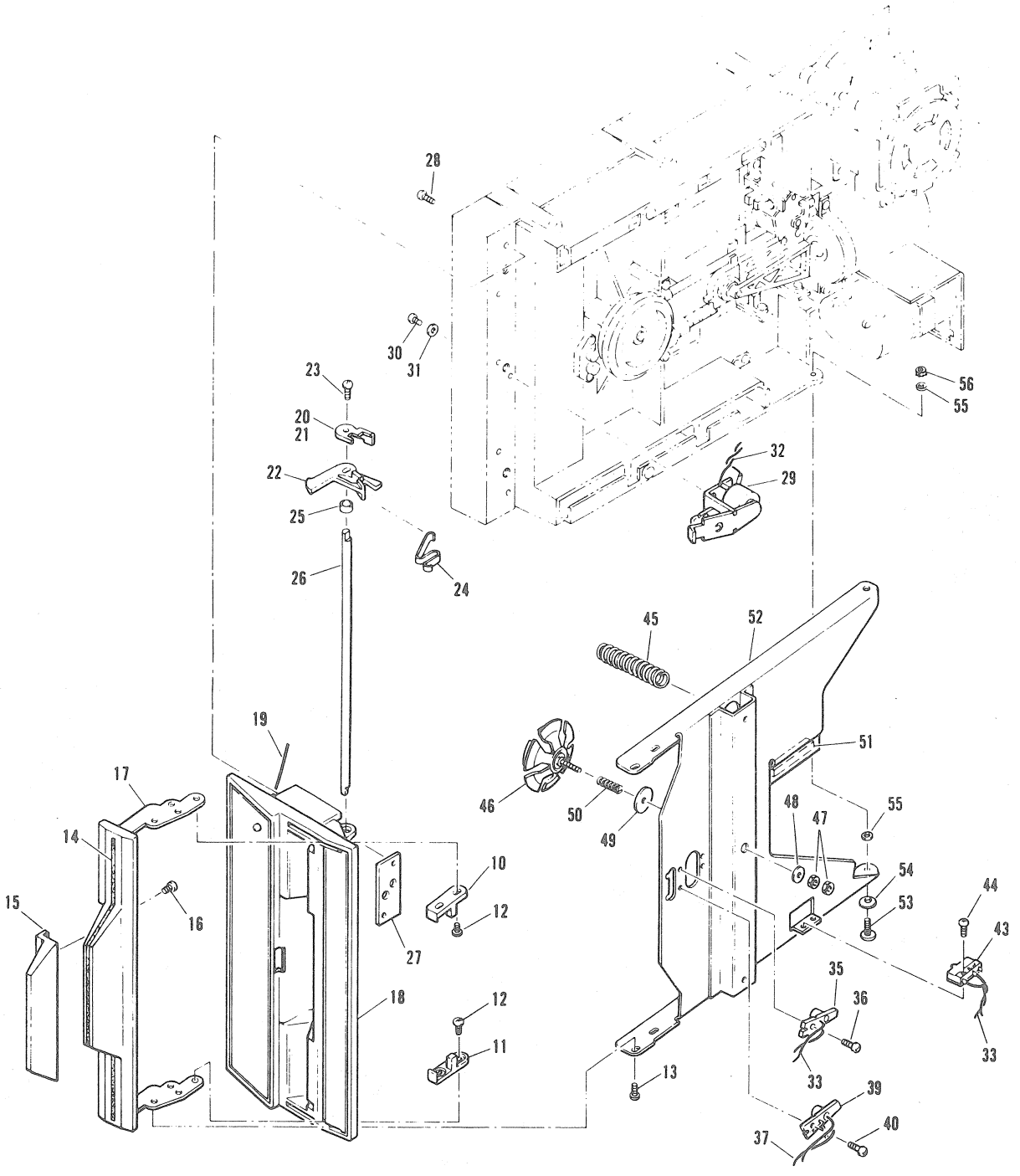


FIGURE 1. FEATURES AND BASIC ASM (Sheet 2 of 4)

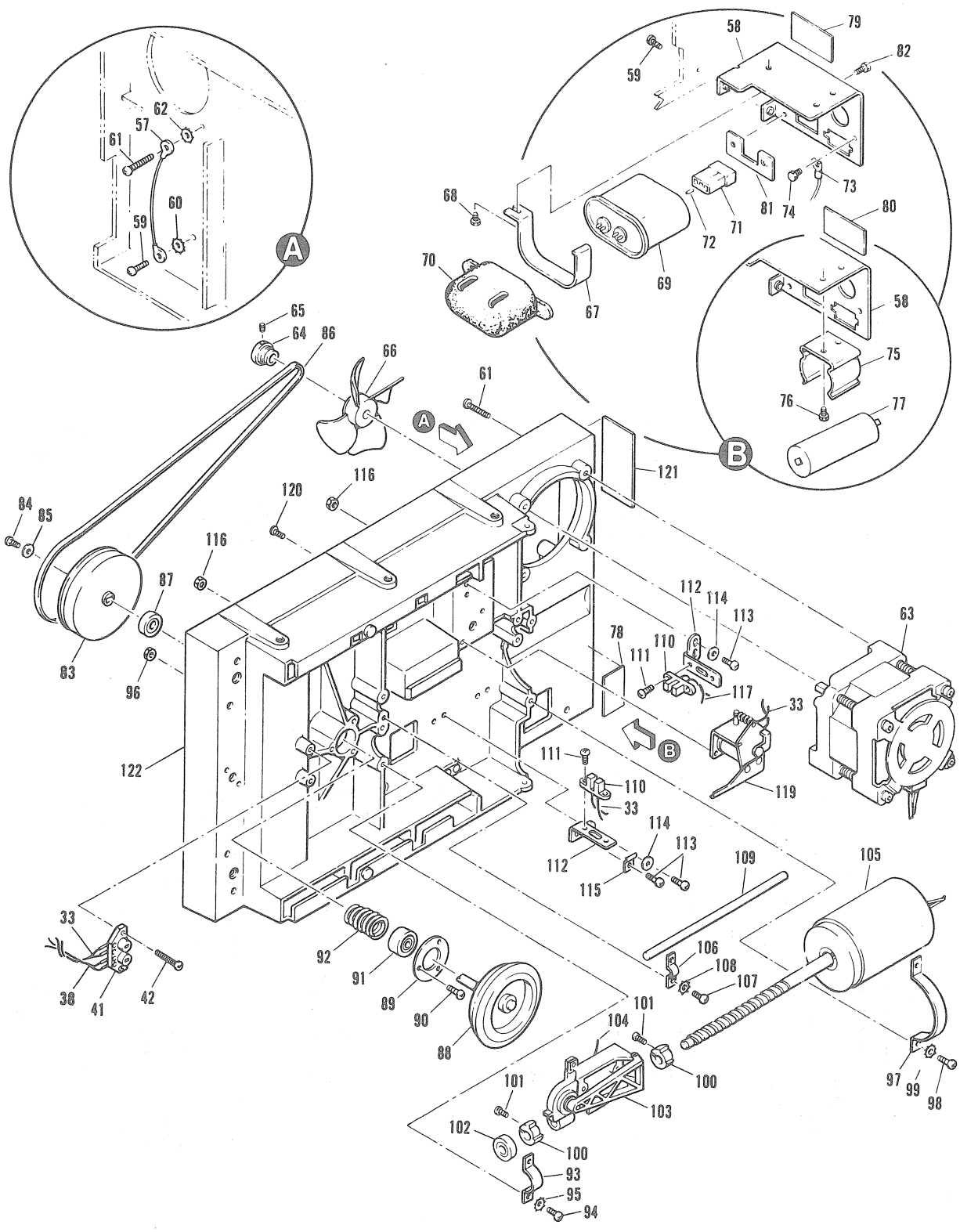


FIGURE 1. FEATURES AND BASIC ASM (Sheet 3 of 4)

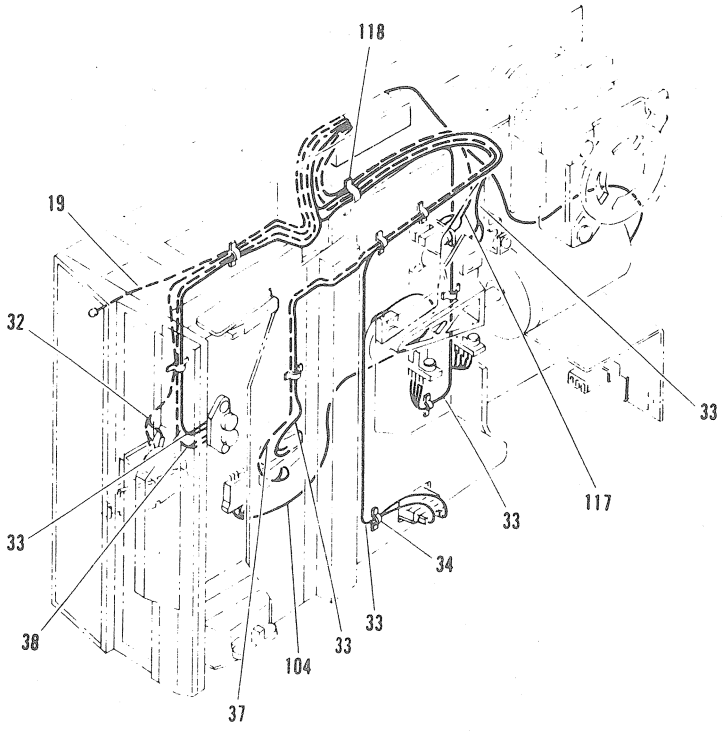


FIGURE 1. FEATURES AND BASIC ASM (Sheet 4 of 4)

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4	QTY PER ASSY	USABLE ON CODE
1-				
		CODE A - USED ON 312149 ONLY CODE B - USED ON 312150 ONLY CODE C - USED ON 312151 ONLY CODE D - USED ON 312152 ONLY CODE 1 - USED ON FEATURES ONLY		
	NO NO.	FEATURES AND BASIC ASM	REF	
-	809103	. MACHINE FEATURE INDEX	REF	1
-1	013921	. . PCB ASM, BASIC, STANDARD POWER ONLY	1	1
-1	013941	. . PCB ASM, BASIC WITH NEGATIVE VOLTAGE	1	1
-1	013926	. . PCB ASM, BASIC WITH DATA/CLOCK SEPARATOR	1	1
-1	013946	. . PCB ASM, BASIC WITH DATA/CLOCK SEPARATOR AND NEGATIVE VOLTAGE	1	1
-1	013951	. . PCB ASM, BASIC WITH DATA/CLOCK SEPARATOR AND HARD SECTOR SEPARATE	1	1
-1	013906	. . PCB ASM, BASIC WITH DATA/CLOCK SEPARATOR, HARD SECTOR SEPARATE AND NEGATIVE VOLTAGE	1	1

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4	QTY PER ASSY	USABLE ON CODE
1-	312000	. . BASIC ASM, 550 FLEXIBLE DISC FILE	REF	
-2*	111530	. . . SCREW, PAN HD, 6-32 × 0.25	2	
-3	312221	. . . SPACER	1	1
-4*	111532	. . . SCREW, 6-32 × 0.375	1	
-5	112881	. . . SUPPORT	4	
-6*	110573	. . . NUT, HEX, 4-40	4	
-7	312043	. . . SPRING, EJECT	2	
-8*	111516	. . . SCREW, PAN HD, 4-40 × 0.25	4	
-9*	110379	. . . WASHER, LOCK, EXTERNAL TOOTH, NO.4	4	
-10	312036	. . . INTERLOCK ACTUATOR, LH	1	
-11	312035	. . . INTERLOCK ACTUATOR, RH	1	
-12*	111515	. . . SCREW, PAN HD, 4-40 × 0.188	4	
		ATTACHING PARTS FOR ITEMS 10 AND 11		
-13*	111514	. . . SCREW, PAN HD, 4-40 × 0.125	4	
-14	312193	. . . STRIP, ORANGE	1	
	312067	. . . DOOR ASM	1	
-16*	112895	. . . . SCREW	2	
-17	312022	. . . . MOLDED DOOR	1	
	NO NO.	. . FILE BUSY INDICATOR LIGHT	REF	1
-18	312197	. . . BEZEL, FRONT	1	1
	NO NO.	. . NON-INDICATOR BEZEL	REF	1
-18	312209	. . . BEZEL, FRONT	1	1
-19	312186	. . . CABLE ASM	1	1
		(SEE FIGURE 2-1, 6, 8, AND 13 FOR DETAILS)		
-20	312220	. . . LATCH STOP, LH	1	
-21	312219	. . . LATCH STOP, RH	1	
-22	312054	. . . LATCH, INTERLOCK	2	
-23	111515	. . . SCREW, PAN HD, 4-40 × 0.188	2	
-24	312180	. . . SPRING, INTERLOCK LATCH	2	
-25	312130	. . . SLEEVE, INTERLOCK	2	
-26	312108	. . . SHAFT, INTERLOCK	1	
-27	312136	. . . NUT PLATE, BEZEL	2	
-28*	111532	. . . SCREW, PAN HD, 6-32 × 0.375	4	
	NO NO.	. . PROGRAM CONTROLLED DOOR LOCK	REF	1
-29	312226	. . . DOOR LOCK SOLENOID ASM	1	1
-30*	111516	. . . SCREW, PAN HD, 4-40 × 0.25	2	1
-31*	110385	. . . WASHER, LOCK, INTERNAL TOOTH	2	1
-32	312185	. . . CABLE ASM, DOOR LOCK SOLENOID	1	1
		(SEE FIGURE 2-1, 6, 8 AND 12 FOR DETAILS)		
-33	312110	. . . HARNESS ASM, MAIN CABLE	1	
		(SEE FIGURE 2-1, 6, 8, 9, 10, 11, 12 AND 13 FOR DETAILS)		
-34	112901	. . . CLAMP, CABLE	8	
-35	312178	. . . DETECTOR ASM, INDEX I	1	
-36*	111516	. . . SCREW, PAN HD, 4-40 × 0.25	1	
	NO NO.	. . ALTERNATE SIDE FEATURE	REF	1
-37	312168	. . . CABLE ASM, ALTERNATE SIDE DETECTOR, INDEX II	1	1
		(SEE FIGURE 2-1, 6, 8 AND 11 FOR DETAILS)		
-38	312194	. . . CABLE ASM, ALTERNATE SIDE EMITTER, INDEX II	1	1
		(SEE FIGURE 2-1, 6, 8 AND 11 FOR DETAILS)		
-39	312178	. . . DETECTOR ASM, INDEX II	1	1
-40	111516	. . . SCREW, PAN HD, 4-40 × 0.25	1	1
-41	312177	. . . EMITTER ASM	1	
-42*	111523	. . . SCREW, PAN HD, 4-40 × 0.750	2	
-43	159234	. . . SWITCH	1	
-44*	111504	. . . SCREW, PAN HD, 2-56 × 0.375	2	
-45	312046	. . . . SPRING, CARRIER SUPPORT	2	

GE 82-3571 (103)
Health Part # 969-62 @ 6.70
Parts Department

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4	QTY PER ASSY	USABLE ON CODE
1-46	312073	. . . SPIDER, DISC ASM	1	
-47*	111483	. . . NUT, HEX, 8-32	2	
-48*	112884	. . . WASHER, CLAMP SPACING	1	
-49	312011	. . . WASHER, DISC CLAMPING	1	
-50	112921	. . . SPRING, COMP	1	
-51	204081	. . . PAD, WIPE	1	
-52	312005	. . . CARRIER, DISC CLAMP	1	
-53*	312045	. . . SCREW, CARRIER PIVOT	2	
-54*	112882	. . . WASHER, SPRING	2	
-55*	312087	. . . WASHER, CARRIER PIVOT	4	
-56*	110849	. . . NUT, HEX, KEPS, 6-32	2	
-57*	312196	. . . GROUND WIRE ASM (SEE FIGURE 2-2 AND 3 FOR DETAILS)	1	
-58	312062	. . . BRACKET, CAPACITOR MOUNTING	1	
-59*	111532	. . . SCREW, PAN HD, 6-32 × 0.375	2	
-60*	110380	. . . WASHER, LOCK, EXTERNAL TOOTH, NO. 6	1	
-61*	111550	. . . SCREW, PAN HD, 8-32 × 0.750	4	
-62*	110381	. . . WASHER, LOCK, EXTERNAL TOOTH, NO. 8	1	
	NO NO.	. . PRIMARY POWER FREQUENCY	REF	1
-63	312149	. . . DRIVE MOTOR ASM, 60 HZ-110V ONLY	1	A,1
-63	312150	. . . DRIVE MOTOR ASM, 50 HZ-110V ONLY	1	B,1
-63	312151	. . . DRIVE MOTOR ASM, 60 HZ-220V ONLY	1	C,1
-63	312152	. . . DRIVE MOTOR ASM, 50 HZ-220V ONLY	1	D,1
-63	312223	. . . . CABLE ASM, DRIVE MOTOR, 110V (SEE FIGURE 2-4, 5, 6 AND 15 FOR DETAILS)	1	A,B,1
-63	312224	. . . . CABLE ASM, DRIVE MOTOR, 220V (SEE FIGURE 4, 5, 6 AND 14 FOR DETAILS)	1	C,D,1
-64	312027	. . . . PULLEY	1	A,C,1
-64	312141	. . . . PULLEY	1	B,D,1
-65*	110522	. . . . SET SCREW, 6-32 × 0.188	1	1
-66	159926	. . . . BLADE	1	1
-67	312170	. . . . STRAP	1	A,B,1
-68*	111528	. . . . SCREW, PAN HD, 6-32 × 0.125	1	A,B,1
-69	158926	. . . . CAPACITOR	1	A,B,1
-70	005029	. . . . COVER	1	A,B,1
-71	150250	. . . . HOUSING	1	1
-72	150202	. . . . CONTACT	1	1
-73	150120	. . . . TERMINAL	1	1
-74*	111528	. . . . SCREW, PAN HD, 6-32 × 0.125	1	1
-75	112902	. . . . CLIP	1	C,D,1
-76*	111528	. . . . SCREW, PAN HD, 6-32× 0.125	3	C,D,1
-77	159279	. . . . CAPACITOR	1	C,D,1
-78	158311	. . . . LABEL, CANADIAN STANDARD ASSOCIATION	1	A,C,1
-79	301193	. . . . LABEL, WARNING, 115V	1	A,B,1
-80	301387	. . . . LABEL, WARNING, 230V	1	C,D,1
-81	204069	. . . PLATE, CONNECTOR ANCHOR	1	
-82*	700559	. . . SCREW, THREADFORMING, 6-32 × 0.38	2	
-83	312026	. . . PULLEY, DRIVEN	1	
-84*	111530*	. . . SCREW, PAN HD, 6-32 × 0.250	1	
-85*	110362*	. . . WASHER, FLAT, NO. 6	1	
-86	112887	. . . BELT DRIVE	1	
-87	112876	. . . BEARING, BALL	1	
-88	312037	. . . SPINDLE ASM	1	
-89	312016	. . . RETAINER, BEARING	1	
-90*	111515	. . . SCREW, PAN HD, 4-40 × 0.188	3	
-91	112877	. . . BEARING, BALL	1	
-92	312020	. . . SPRING, RETAINER	1	
-93	312040	. . . CLAMP, STEPPER BEARING	1	

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4	QTY PER ASSY	USABLE ON CODE
1-94*	111530	. . . SCREW, PAN HD, 6-32 × 0.250	2	
-95*	110380	. . . WASHER, LOCK, EXTERNAL TOOTH, NO. 6	2	
-96*	110573	. . . NUT, HEX, 4-40	8	
-97	312029	. . . CLAMP, STEPPER MOTOR	1	
-98*	111530	. . . SCREW, PAN HD, 6-32 × 0.250	2	
-99*	110380*	. . . WASHER, LOCK, EXTERNAL TOOTH, NO. 6	2	
-100	312103	. . . STOP, CARRIAGE END	2	
-101*	112885	. . . SCREW, 2-56 × 0.250	2	
-102	112876	. . . BEARING, BALL	1	
-103	312071	. . . CARRIAGE ASM	1	
-104	312111	. . . CABLE ASM, HEAD SIGNAL (SEE FIGURE 2-6 AND 7 FOR DETAILS)	1	
-105	312070	. . . STEPPER MOTOR ASM	1	
-106	312028	. . . CLAMP, CARRIAGE WAY	2	
-107*	111530	. . . SCREW, PAN HD, 6-32 × 0.250	4	
-108*	110380	. . . WASHER, LOCK, EXTERNAL TOOTH, NO. 6	4	
-109	312044	. . . SHAFT, CARRIAGE WAY	1	
	NO NO.	. . WRITE PROTECT SENSOR	REF	1
-110	159223	. . . SENSOR	2	
-110	159223	. . . SENSOR	1	1
-111*	111515	. . . SCREW, PAN HD, 4-40 × 0.188	4	
-111*	111515	. . . SCREW, PAN HD, 4-40 × 0.188	2	1
-112	312012	. . . BRACKET, SENSOR	2	
-112	312012	. . . BRACKET, SENSOR	1	1
-113*	111518	. . . SCREW, PAN HD, 4-40 × 0.375	4	
-113*	111518	. . . SCREW, PAN HD, 4-40 × 0.375	2	1
-114*	110919	. . . WASHER, FLAT, NO. 4	3	
-114*	110919	. . . WASHER, FLAT, NO. 4	2	1
-115	312122	. . . CLAMP, CABLE	1	
-116*	110573	. . . NUT, HEX, 4-40	4	
-116*	110573	. . . NUT, HEX, 4-40	2	1
-117	312167	. . . CABLE ASM, WRITE PROTECT (SEE FIGURE 2-1, 6, 8 AND 13 FOR DETAILS)	1	1
-118	112900	. . . CLAMP, CABLE	1	
-119	312078	. . . LOAD ARM, SOLENOID ASM	1	
-120*	111515	. . . SCREW, PAN HD, 4-40 × 0.188	2	
-121	312166	. . . LABEL, RATING	1	
-122	312003	. . . MAIN FRAME	1	

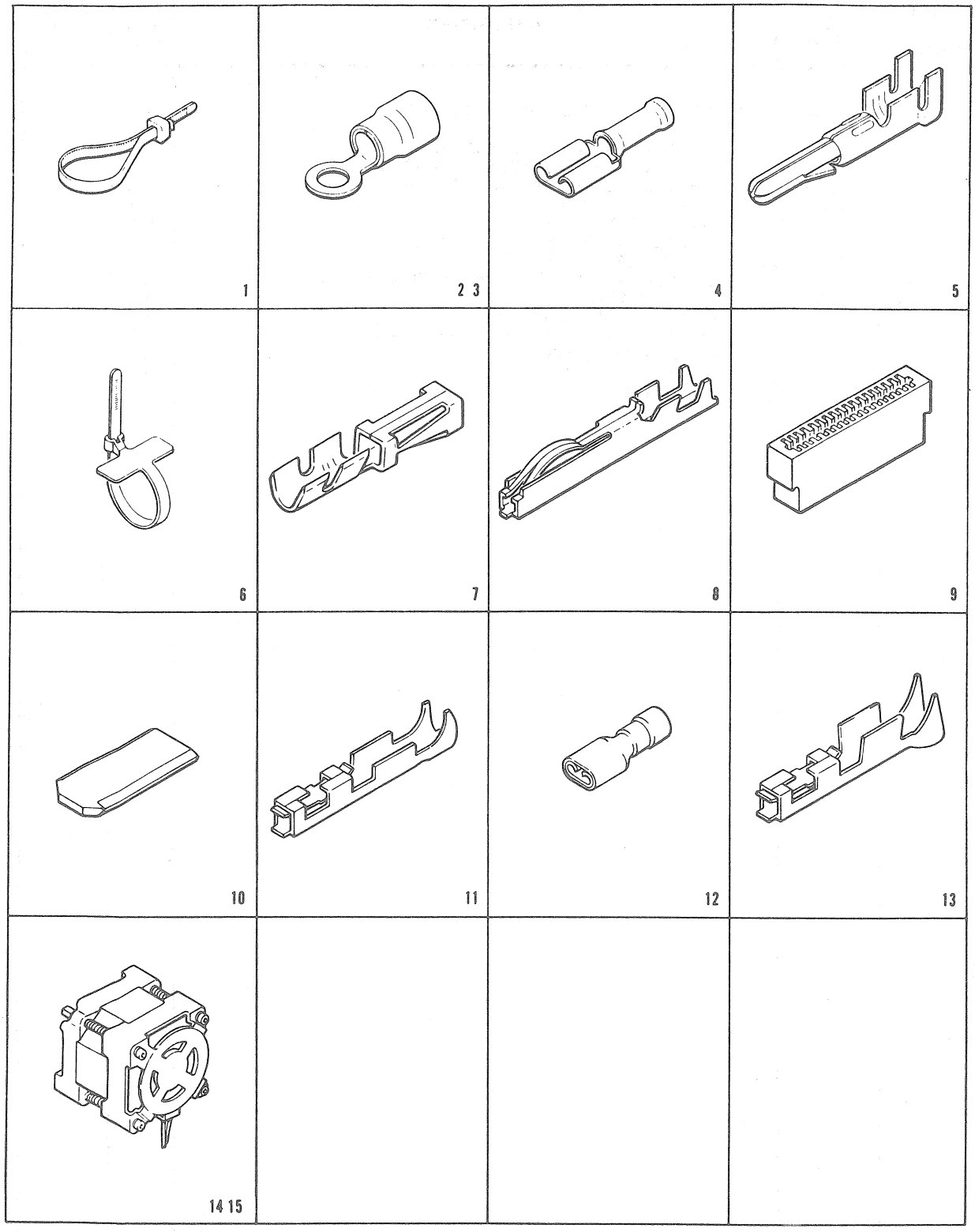


FIGURE 2. HARNESS AND CABLE COMPONENT ASM

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4	QTY PER ASSY	USABLE ON CODE
2-	NO NO.	HARNESS AND CABLE COMPONENT ASM	REF	
-1	005046	. TIE, CABLE	A/R	
-2	150102	. TERMINAL, LUG, RING TONGUE, 22-16, NO. 6	A/R	
-3	150103	. TERMINAL, LUG, RING TONGUE, 22-16, NO. 8	A/R	
-4	150128	. TERMINAL, QUICK DISCONNECT, 22-18	A/R	
-5	105202	. CONTACT, PIN, 20-14	A/R	
-6	154319	. MARKER, CABLE	A/R	
-7	158291	. CONTACT, MINIATURE	A/R	
-8	158645	. CONTACT LEAF, 28 AWG TO 24 AWG	A/R	
-9	158946	. HOUSING, CONNECTOR, 0.100 CENTERS, PC BOARD	A/R	
-10	158966	. KEY, POLARIZING	A/R	
-11	158988	. CONTACT, CRIMP, SNAP-IN	A/R	
-12	159317	. TERMINAL, FULLY INSULATED, 0.110 TAB	A/R	
-13	159792	. CONTACT, RECEPTACLE	A/R	
-14	312153	. MOTOR, 220V	A/R	
-15	312154	. MOTOR, 110V	A/R	

PART NUMBER	FIGURE & INDEX NUMBER
005029	1-70
005046	2-1
013906	1-1
013921	1-1
013926	1-1
013941	1-1
013946	1-1
013951	1-1
110362	1-85
110379	1-9
110380	1-108
110380	1-60
110380	1-95
110380	1-99
110381	1-62
110385	1-31
110522	1-65
110573	1-116
110573	1-96
110573	1-6
110849	1-56
110919	1-114
111483	1-47
111504	1-44
111514	1-13
111515	1-111
111515	1-120
111515	1-12
111515	1-23
111515	1-90
111516	1-30
111516	1-36
111516	1-40
111516	1-8
111518	1-113
111523	1-42
111528	1-68
111528	1-74
111528	1-76
111530	1-107
111530	1-84
111530	1-94
111530	1-98
111530	1-2
111532	1-28
111532	1-59
111532	1-4
111550	1-61
112876	1-102
112876	1-87
112877	1-91
112881	1-5
112882	1-54
112884	1-48
112885	1-101
112887	1-86
112895	1-16
112900	1-118
112901	1-34
112902	1-75
112921	1-50
150102	2-2
150103	2-3
150120	1-73
150128	2-4
150202	1-72
150202	2-5
150250	1-71
154319	2-6
158291	2-7
158311	1-78
158645	2-8
158926	1-69
158946	2-9
158966	2-10
158988	2-11
159223	1-110
159234	1-43
159279	1-77
159317	2-12
159792	2-13
159926	1-66
204069	1-81
204081	1-51
301193	1-79
301387	1-80
312000	1-REF
312003	1-122
312005	1-52
312011	1-49
312012	1-112
312016	1-89
312020	1-92
312022	1-17
312026	1-83
312027	1-64
312028	1-106
312029	1-97
312035	1-11
312036	1-10
312037	1-88
312040	1-93
312043	1-7
312044	1-109
312045	1-53
312046	1-45
312054	1-22
312062	1-58
312067	1-17
312070	1-105
312071	1-103
312073	1-46
312078	1-119
312087	1-55
312103	1-100
312108	1-26
312110	1-33
312111	1-104
312122	1-115
312130	1-25
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312141	1-64
312149	1-63
312150	1-63
312151	1-63
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312154	2-15
312166	1-121
312167	1-117
312168	1-37
312170	1-67
312177	1-41
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312178	1-39
312180	1-24
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312186	1-19
312193	1-14
312194	1-38
312196	1-57
312197	1-18
312209	1-18
312219	1-21
312220	1-20
312221	1-3
312223	1-63
312224	1-63
312226	1-29
700559	1-82
809103	1-REF

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Publications Bulletin

550.60-0001
12/77

Update Package for:

550 Flexible Disc Drive
Technical Manual
550.60-00

This Bulletin advises of changes which have occurred to the above manual since the May 1977 edition was issued. New and replacement pages are provided where required.

Pages	Action
iii, iv	Replace
vii, viii	Replace
3-9 through 3-25	Replace 3-9 through 3-23

Please file this Bulletin with the publication to retain a record of changes.

COMMENTS FORM

550 FLEXIBLE DISC DRIVE TECHNICAL MANUAL—550.60-00

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