MODEL FD200 FLEXIBLE DISK DRIVE
OPERATING AND SERVICE MANUAL NO. 600470

FOREWORD

This manual provides operating and service instructions for the FD200 Flexible Disk Drive, manufactured by the Pertec Division of Pertec Computer Corporation, Chatsworth, California.

PROPRIETARY NOTICE

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SECTION I
GENERAL DESCRIPTION AND SPECIFICATIONS

1.1 INTRODUCTION

This section provides a physical description, functional description, and specifications for the FD200 Flexible Disk Drives, manufactured by the PERTEC DIVISION of PERTEC COMPUTER CORPORATION.

In addition to the unique features described, the following features are included in all models.

- Write Protect Sensors. Used to disable the disk drive write electronics, thus preventing overwriting the protected diskettes.
- Trim erase timing circuits internal to the disk drive.

1.2 PURPOSE OF EQUIPMENT

The FD200 disk drive is a compact disk memory device designed for random access data storage, data entry, and data output applications. These applications typically are intelligent terminal controllers, micro-computers, word processing systems, data communications systems, error logging and micro-program logging, and point of sale terminals.

The FD200 has the capability of recording and reading digital data using a double frequency technique.

1.3 PHYSICAL DESCRIPTION OF EQUIPMENT

The FD200 flexible disk drive is shown in Figure 1-1. The drives can be mounted in any vertical or horizontal plane; however, when mounted horizontally, the non-recording surface of the diskette must be uppermost.

The mechanical components of the drive consist of a belt-driven spindle which is driven by a dc motor, and a stepper motor/cam combination. This combination is used for positioning the magnetic head assembly.

The read/write erase head assembly is a glass-bonded ferrite/ceramic structure which has a life in excess of 20,000 hours.

Operator access for diskette loading is provided a slot located at the front of the unit.

The electronic components of the drive are mounted on a single PCBA which is located beneath the chassis. Power and interface signals are routed through connectors which plug directly into the PCBA.

NOTE

Information regarding format and control of PERTEC flexible disk drives is contained in a series of Application Notes, PERTEC document numbers 75605, 75607, and 76601, and may offer guidelines to the user.
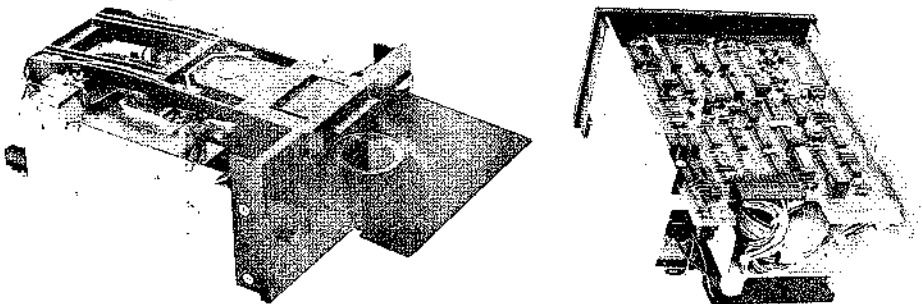

Figure 1-1. FD200 Disk Drive

1.4 FUNCTIONAL DESCRIPTION

The flexible disk drive is fully self contained and requires no operator intervention during normal operation. The drive consists of a spindle drive system, head load and positioning system, and read/write and erase system.

When the front door is opened, access is provided for the insertion of a diskette. The diskette is positioned in a lateral and up/down direction by cartridge guides. In/out location is provided by ensuring that the diskette is inserted until a back stop is encountered.

Closing the front door activates the cone/clamp system resulting in (first) centering of the recording medium and (second) clamping of the diskette to the drive hub. The drive hub is driven at a constant speed of 300 rpm by a dc motor.

In operation, the magnetic head is loaded into contact with the recording medium by the head load system. For reliable operation, it is important that the head/medium relationship is controlled. This is accomplished by:

   (1) Referencing the diskette to a platen surface.

   (2) Referencing the head crown to the same platen surface as the diskette.

   (3) Providing a pressure pad which is loaded on the opposite side of the recording medium from the head with a force of 12 to 15 grams.

The magnetic head is positioned over the desired track by means of a 4-phase stepper motor/cam assembly and its associated electronics. This positioner employs a 2-step movement to cause a 1-track linear movement.

When a write protected diskette is inserted into the the drive, the write protect sensors disable the write electronics of the drive.

A double frequency recording system is typically employed in the FD200 flexible disk drive.

When performing a write operation, an 0.33 mm (0.013-inch) (nominal) data track is recorded. This track is then tunnel erased to 0.30 mm (0.012 inch) (nominal).

Data recovery electronics include a low-level read amplifier, differentiator, zero-crossing detector, and digitizing circuits. No data decoding facilities are provided in the basic drive.

Although the drive is primarily intended for operation in a double frequency recording mode, the basic electronics design does not preclude the use of other recording code systems.

The drive is also supplied with the following sensor systems.

   (1) A Track 0 switch which senses when the Head/Carriage assembly is positioned at Track 0.

   (2) Index sensors, which consist of LED light sources and phototransistors, are positioned such that when an index hole is detected, a digital signal is generated. The dual set of sensors allow *flip-side* recording.

   (3) In the case when a hard sectored (multi-hole) diskette is used, the index sensors used are high resolution devices which can distinguish holes placed close together, i.e., Index-Sector holes.

1.5 DISKETTES

The standard 133.4 mm (5.25 inch) diskette is designed for use with a format in which sector mark information may be prerecorded on the diskette. In this case, a single index hole is provided for reference purposes. Detection of this hole is accomplished by an index Transistor/LED combination.

Other diskettes available are designed with multiple holes, which themselves provide sector mark information via the same circuitry that is used in the single hole configuration.

Figure 1-2 is a simplified drawing of the diskette used with the flexible disk drive. It can be seen that this recording medium is a flexible magnetic disk enclosed in a protective jacket. The protected disk, free to rotate within the jacket, is continuously cleaned by the soft fabric inner lining of the jacket during normal operation.

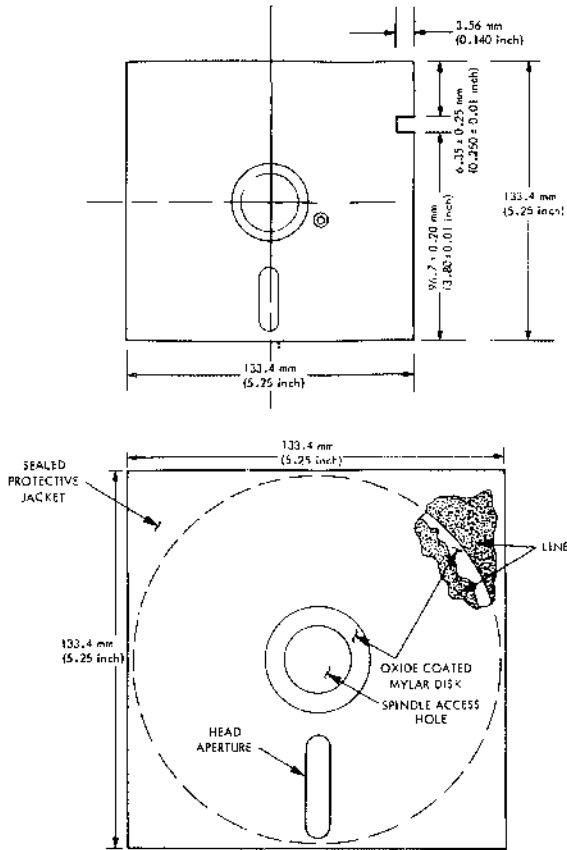Figure 1-2. Recording Medium

1.6 MECHANICAL AND ELECTRICAL SPECIFICATIONS

The mechanical and electrical specifications for the flexible disk drive family are given in Table 1-1.

1.7 INTERFACE SPECIFICATIONS

Levels: True = +0.2v (±0.2v) (approximately)

False = +3.0v (approximately)

Pulses: Levels as above.

The interface circuits are designed so that a disconnected wire results in a false signal.

Table 1-1
Mechanical and Electrical Specifications

Media	Industry-compatible 5¼-inch diskette
Tracks per Inch	48
Number of Tracks	40
Read/Write Track Width	0.305 mm (0.012 inch)
Dimensions	
Height	82.55 mm (3.25 inches)
Width	146.05 mm (5.75 inches)
Depth	203.2 mm (8.0 inches)
Weight	1.45 kg (3.2 pounds)
Temperature	
Operating	10°C to 42°C (50°F to 107.6°F)
Non-operating	−40°C to 71°C (−40°F to 160°F)
Relative Humidity	
Operating	20% to 80%
Non-operating	5% to 95% (non-condensing)
Vibration	6-600 Hz 0.5g peak
Seek Time	25 msec track to track
Head Settling Time	10 msec (last track addressed)
Head Loading Time	35 msec (maximum)
Error Rate	1 per 10^9 recoverable (maximum)
	1 per 10^{12} non-recoverable (maximum)
Head Life	20,000 hours (normal use)
Media Life	3 million passes on a single track
Disk Speed	300 rpm ± 1.5%
Instantaneous Speed Variation	± 1.0%
Start/Stop Time	1 second (maximum)
Transfer Rate	125/250K bits/sec
Recording Density (inside track)	2768/5536 bpi
Bits per Side per Disk (unformatted)	1 million/2 million (maximum)
Bits per Track	25,000/50,000 (maximum)
Recording Mode	FM single/MFM double density
Power	+ 12v dc ± 0.6v, 2 amps maximum
	5v dc ± 0.25v, 0.8 amps maximum

1.8 UNCRATING THE DISK DRIVE

The disk drive is shipped in a protective container which, when bulk packaged, meets the National Safe Transit Specification (Project 1A, Category 1). The container is designed to minimize the possibility of damage during shipment. The following procedure describes the recommended method for uncrating the disk drive.

    (1) Place the shipping container on a flat work surface. Ensure that the carton is positioned as indicated on the carton.

    (2) Remove the outer cardboard sleeve from around the inner container.

    (3) Remove the upper half of the inner container.

    (4) Remove the disk drive from the lower half of the inner container.

    (5) Check the contents of the shipping container against the packing slip. Investigate the contents for possible damage; notify the carrier immediately if any damage is noted.

1.9 PHYSICAL CHECKOUT

Before applying power to the unit and before Integrating it Into a system, the following inspection should be performed.

    (1) Diskette Loading Door. Check that the front access door opens and closes. Note that when the door is opened, the head-load arm raises.

    (2) Ensure that the bezel is secure.

    (3) Manually rotate the drive hub. The hub should rotate freely.

    (4) Manually rotate the stepper motor cam. The cam should rotate without hindrance and should cause the head carriage to advance and retract as the cam is rotated alternately clockwise and counterclockwise.

    (5) Check that the PCBA is secure. Access to the PCBA Is from the bottom of the drive. Check that the connectors are firmly seated.

CAUTION

OPERATION OF THE DISK DRIVE WITH THE UNIT SITTING HORIZONTALLY ON A FLAT SURFACE WITH NO PROVISION FOR AIR FLOW BENEATH THE UNIT MAY CAUSE OVER-HEATING. DO NOT OPERATE THE DRIVE IN THIS CONFIGURATION FOR AN EXTENDED PERIOD.

1.10 INTERFACE CONNECTIONS

Signal connections for the FD200 are made via a user-supplied 34-pin flat ribbon connector (3M Part No. 3463-0001, or equivalent). This connector mates directly with the PCBA connector at the rear of the drive. Power connections are divided for dc requirements. The dc connector is a four pin connector (Amp Mate-N-Lok, Part No. 1-480424-0) which mates with the PCBA connector at the rear of the drive. The interface description of the connectors, and the location of each, is contained in Section III.

The signal connector harness should be of the flat ribbon type with the following characteristics.

    (1) Maximum length of 9.14 m (30 feet).

    (2) 22—24 gauge conductor compatible with connector to be used.

Power connections should be made with 18 AWG cable (minimum). In addition, the PCBA mounted dc power connector is keyed.

1.11 CHASSIS GROUND

To ensure proper operation of the drive, the chassis should be connected to earth ground. The circuit board hold down screw, located at the rear of the chassis, is provided to facilitate this connection.

1.12 MOUNTING THE DISK DRIVE

The drive has been designed such that It can be mounted in any plane, i.e., upright, horizontal, or vertical. The only mounting restriction is that when mounted horizontally, the non-recording side of the diskette must be the uppermost side. Tapped holes are provided in various locations for the attachment of user-supplied hardware. Figure 1-3 shows the location of the recommended mounting holes.

The user should comply with the guidelines contained in the following paragraphs when designing an enclosure for the flexible disk drive. Outline dimensions are shown in Figure 1-3.

1.12.1 HARDWARE

The flexible disk drive is a precision device In which certain critical internal alignments must be maintained. Therefore, in keeping with rigid disk requirements, it is important that the mounting hardware does not introduce significant stress on the drive.

Any mounting scheme in which the drive is part of the structural integrity of the enclosure is not permitted.

Since the disk drive cannot be subjected to significant stress when it is slide mounted, this type of mounting generally satisfies the foregoing requirements.

Mounting schemes should allow for adjustable brackets or incorporate resilient members to accommodate tolerances.

Mounting schemes involving more than two hard mounting points and a third point should be avoided.

1.12.2 DUST COVER

Since the flexible disk drive is not provided with a dust cover, the design of an enclosure should incorporate a means to prevent direct ingress of loose items, e.g., dust, paper punch waste, etc.
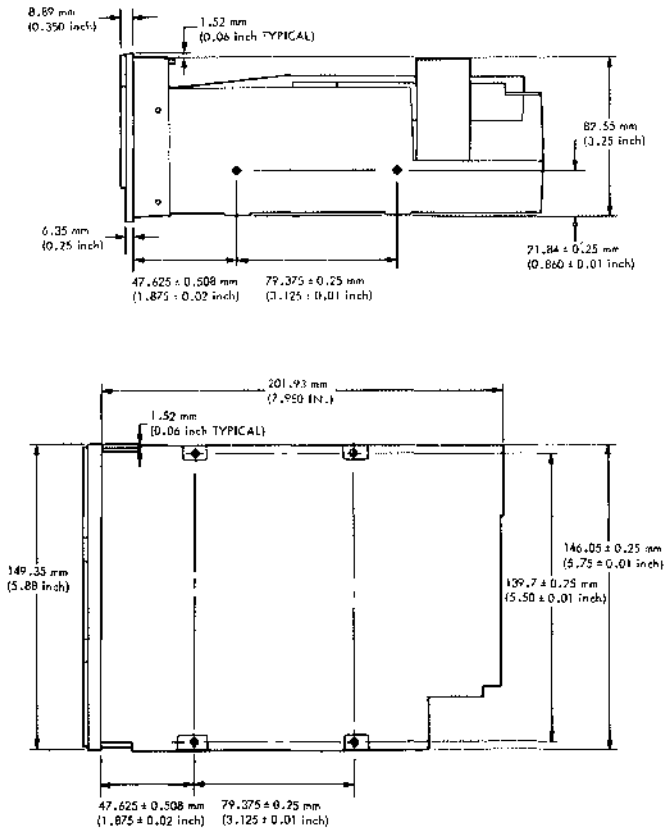
Figure 1-3. Physical Dimensions

1.12.3 COOLING

Heat dissipation from a single disk drive is normally 12 watts (40 Btu/Hr) and a maximum of 22 watts (74 Btu/Hr) under high line conditions. When the drive is mounted so that the components have access to the free flow of air, normal convection cooling allows operation over the specified temperature range.

When the drive is mounted in a confined environment, air flow may have to be provided to maintain specified air temperatures in the vicinity of the motors, PCBA, and diskette.

1.12.4 DRIVE SEPARATION

In addition to the cooling requirements specified in Paragraph 1.12.3, a minimum separation of 25.4 mm (1 inch) between drives is recommended. This is required to avoid electrical interference between the motors of one drive and the magnetic head of another drive. Closer mounting is allowable if a grounded sheet of steel at least 1.52 mm (0.060-inch) thick is interposed between units. However, use of this steel sheet may increase the cooling requirements.

1.13 DISKETTE HANDLING AND STORAGE

It is important that the diskette be handled and stored properly so that the integrity of the recorded data is maintained. A damaged or contaminated diskette can impair or prevent recovery of data and can result in damage to the read/write head.

Figure 1-2 illustrates the physical configuration of the diskette. The diskette is an oxide coated, flexible mylar disk, 130.2 mm (5.125 inches) in diameter, and is enclosed in a 133.4 mm x 133.4 mm (5.25 x 5.25-inch) protective jacket. Read/write erase head access is made through an aperature in the jacket. Openings for the driving hub and diskette index hole are also provided.

Figure 1-4 provides some helpful hints on the care and handling of the disk drive and diskettes. Additionally, to assure trouble-free operation and enhance the service life of the diskette, the following procedures for handling should be observed.

- Return the diskette to the protective jacket when not in use.
- Store the diskette vertically; do not stack.
- Avoid exposing the diskette to any magnetizing force in excess of 50 oersted.

NOTE

The 50 oersted level of magnetizing force is reached at a distance of approximately 76 mm (3 inches) from a typical source, e.g., motors, generators, transformers.

- Do not store the diskette in direct sunlight; warping could result.
- Do not use a lead pencil or ballpoint pen to write on the label; use a felt tip pen and mark lightly on the label

1.14 LOADING THE DISKETTE

Diskette loading is accomplished by inserting the properly oriented diskette into the *mail box* type slot provided. Access to the diskette loading slot is obtained by opening the front loading door.

The diskette should be carefully inserted until the jacket is solidly against the stops.

CAUTION

DAMAGE TO THE DRIVE HUB HOLE IN THE DISKETTE MAY RESULT IF THE DOOR IS CLOSED WHEN THE DISKETTE IS NOT PROPERLY INSERTED.

1.15 WRITE PROTECT

The flexible disk drive is equipped with a write protect sensor assembly. This sensor operates in conjunction with a diskette having a slot cut in the protective jacket. The location of the slot is shown in Figure 1-5.

When the slot is covered, the diskette is write protected. The slot must be uncovered to write on the diskette. Figure 1-5 illustrates how to install a tab to cover the slot. (A write protect tab may be fabricated from an adhesive-backed label such as Avery #DGF-K1-D12.)

1.16 DC POWER REQUIREMENTS

+ 12 ± 0.6v dc: 2.0 amp (maximum)

+ 5 ± 0.25v dc: 0.8 amp (maximum), 100 mv ripple

NOTE

If the unit is intended to be used in a system listed by Underwriters Laboratories, Inc. and/or Canadian Standards Association (UL/CSA approved), the dc supplies must be current limited (i.e., fused) to 5 amperes maximum.

DO NOT TOUCH PRECISION SURFACE WITH YOUR FINGERS.

TO AVOID DAMAGE TO THE DISKETTE AND TO YOUR DRIVE, INSERT DISKETTE CAREFULLY.

KEEP DISKETTE AWAY FROM MAGNETIC FIELDS.

RETURN THE DISKETTE TO ITS JACKET WHEN NOT IN USE.

HANDLE WITH CARE BENDING AND FOLDING MAY DAMAGE DISKETTE.

DISKETTES SHOULD BE STORED AT: 10° TO 52°C, 50° TO 125° F.
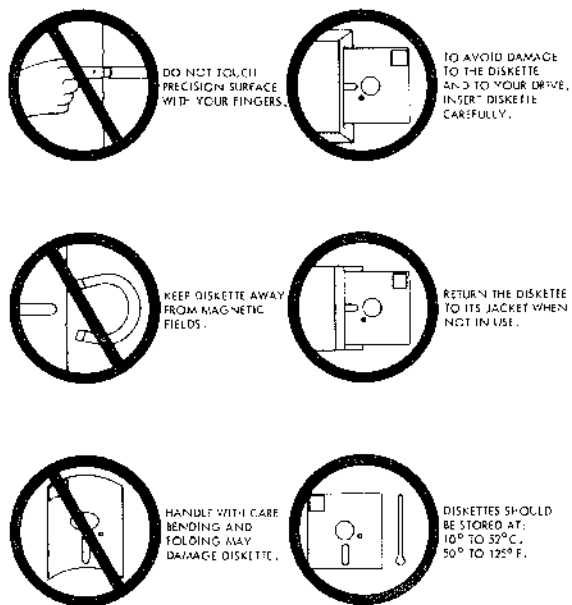
Figure 1-4. Diskette Care and Handling

WRITE PROTECT TAB

FOLD OVER BACK OF DISKETTE

WRITE PROTECT TAB

3.556 mm (0.14 inch)

6.390 mm (0.25 inch)

96.723 mm (3.808 inch)

INDEX ACCESS HOLE
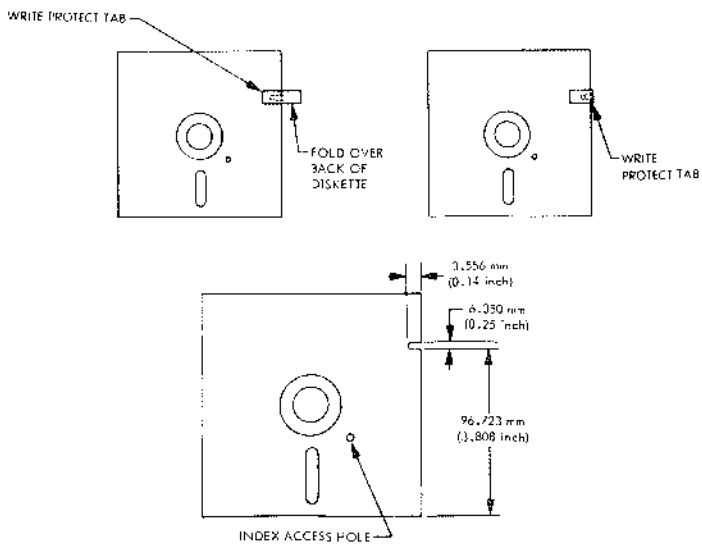
Figure 1-5 Write Protect Tab

2.1 INTRODUCTION

This section provides a basic description of the operation of the PERTEC FD200 disk drive.

The flexible disk drive consists of the mechanical and electrical components necessary to record and read digital data on a diskette. User provided dc power at +12v, +5v is required for operation.

2.2 ORGANIZATION OF THE DISK DRIVE

All electrical subassemblies in the disk drive, except the magnetic head, are constructed with leads which terminate in AMP push-in pins. These leads are merged and inserted in the 30-pin PCB connector body which interfaces with the single electronics PCBA in the drive. Thus, the individual assemblies can be removed without providing individual connectors with their associated space requirements on the PCBA.

The magnetic head is connected to the PCBA via cable terminated in a 5-pin female connector and its associated male socket which is located in close proximity to the data electronics.

Interface signals and power are provided via connector(s) at the rear of the drive. Detailed description of these signals are presented in Section III of this document.

2.3 FUNCTIONAL BLOCK DIAGRAM DESCRIPTION

Figure 2-1 is a functional block diagram of the FD200 disk drive and should be referred to in conjunction with the following discussion.

NOTE

The identification of the elements in this discussion and the associated figures although related to the actual schematic are not exact. Total correspondence is not possible since the schematic contains functions which are only represented in simplified form in this section.

The flexible disk drive consists of the following functional groups.

(1) Head Load Driver

(2) Index Pulse Shaper

(3) Write Protect Sensor

(4) Track 0 Sensor

(5) Spindle Drive Control

(6) Positioner Control

(7) Write/Erase Control

(8) Read Amplifier and Digitizer

2.4 HEAD LOAD DRIVER

The head load consists of a Head Load Solenoid Driver and a Head Load Solenoid. The logic may be configured to cause the head to load via the DRIVE MOTOR ENABLE interface line or the UNIT SELECT interface lines. A true level on the appropriate interface line causes the Head Load Solenoid to energize. This action loads the load arm/pressure pad against the surface of the disk causing the recording surface to conform to the Write/Read Head. The load arm/pressure pad is lifted from the media when the access door is opened

2.5 INDEX

An index pulse is provided to the user system via the INDEX PULSE interface line. The index circuitry consists of a pair of Index LEDs, a pair of Index Photo Transistors, and a Pulse Shaping Network. As the index hole in the disk passes the appropriate Index LED/Photo Transistor combination, light from the LED strikes the Index Photo Transistor causing it to conduct. The signal from the Index Photo Transistor is passed to the Pulse Shaping Network which produces a pulse for each hole detected This pulse is presented to the user on the INDEX PULSE interface line.

2.6 WRITE PROTECT

A Write Protect signal is provided to the user system via the WRITE PROTECT interface line. The write protect circuitry consists of a pair of Write Protect Sensors wired in series and circuitry to route the signal produced.

When a write protected diskette is inserted in the drive, both sensors are closed and the logic disables the write electronics and supplies the status signal to the interface.
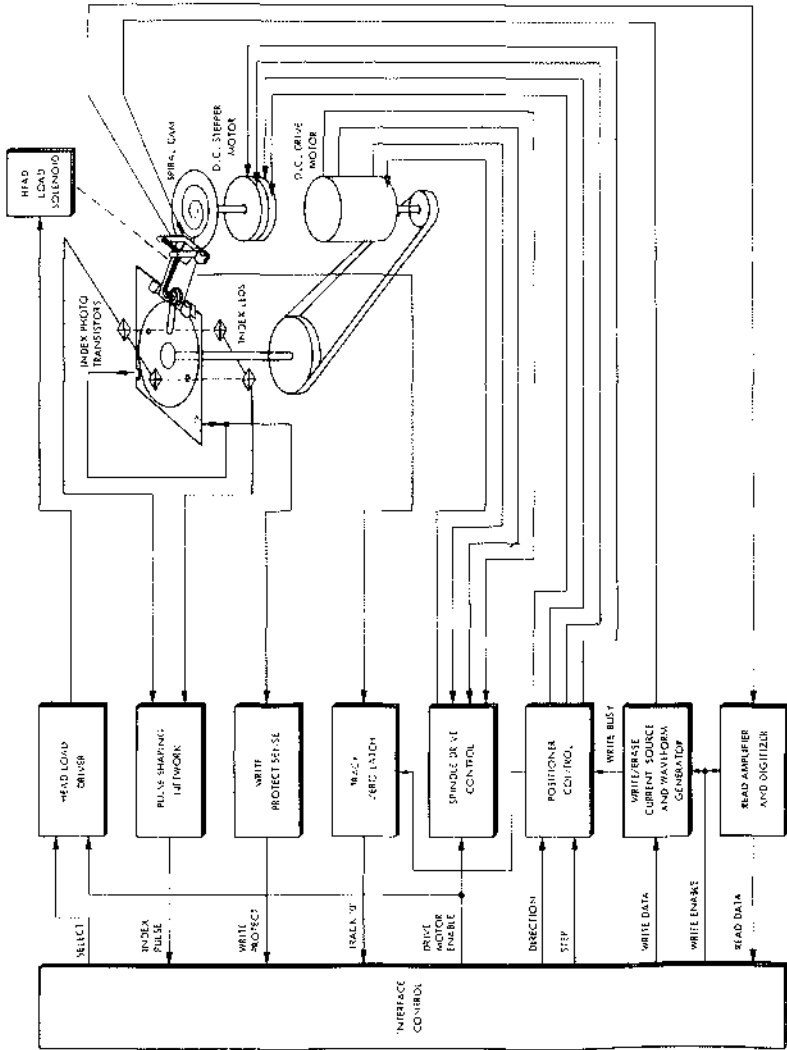
Figure 1. FD200 Functional Block Diagram

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2.7 TRACK 0 SWITCH

The level on the TRACK 0 interface line is a function of the magnetic head assembly. When the head is positioned at Track 0 and the stepper motor is on the home position, a true level is generated and sent to the user system. The Track 0 latch is activated by the Track 0 switch and inhibits response to any step out commands issued by the user.

2.8 SPINDLE DRIVE

The Spindle Drive system consists of a spindle assembly driven by a dc motor-tachometer combination through a drive belt.

Associated with the spindle drive motor are the electronics required for control. Speed regulation is accomplished by a circuit which takes timing information from the tachometer, compares it to a reference time and generates a driving voltage proportional to the time difference

The control circuitry also includes a current limiter and an interface control line. When the DRIVE MOTOR ENABLE interface line is true, the drive motor is allowed to come up to speed. When the current through the drive motor exceeds one ampere, the current limit circuitry disables the motor drive.

2.9 POSITIONER CONTROL

The Head Positioning system utilizes a four phase stepper motor driven through two phases for each track advancement of the Read/Write carriage. The control circuitry provides *home phase* pulses and *transient* pulses to generate the correct sequences of pulses for required stepper motor rotation. In addition to the steering logic necessary for motion control, a latch is provided as a memory element for inhibiting positioner motion during a write operation, then operating motion control signals after the write operation has been performed and only if a step command has been issued during the write operation.

2.10 DATA ELECTRONICS

Information is normally recorded on the diskette in a double frequency code. Figure 2-2 illustrates the magnetization profiles in each bit cell for the number sequence shown.

The erase gaps serve to trim the recorded track from 0.330 to 0.305 mm (0.013 to 0.012-inch) and also provide an erased guard band on either side of the recorded track. This provides for tolerances in track positioning.

All signals required to control the data electronics are provided by the user system and are shown in the block diagram, Figure 2-1. These control signals are:

- SELECT
- WRITE ENABLE
- WRITE DATA

The READ DATA composite signal is sent to the user system via the interface.

2.10.1 DATA RECORDING

Referring to Figure 2-1, it can be seen that the Write Electronics consists of a Write/Erase Current Source and Write Waveform Generator, Erase Current Source, and Trim Erase Control Logic.
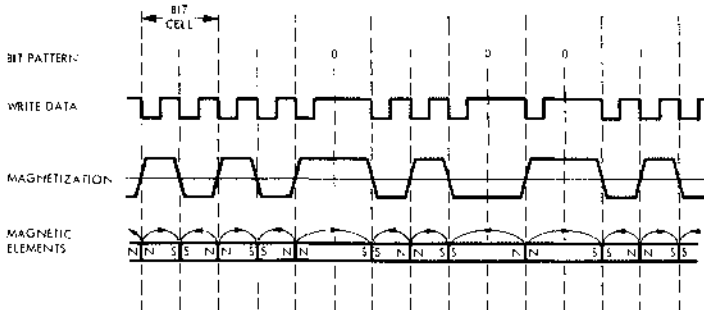

Figure 2-2. Double Frequency Recording

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The write/read winding on the magnetic head is center-tapped. During a write operation, current from the Write Current Source flows in alternate halves of the winding under control of the Write Waveform Generator.

Before recording can begin, certain conditions must be satisfied. The condtions required for recording (i.e., unit ready) must be established by the user system as follows.

(1) Drive speed stabilization. This condition will exist 1 second after starting the drive motor.

(2) Subsequent to any step operation, the positioner must be allowed to *settle*. This requires 10 msec after the last step pulse is initiated, i.e., 25 msec for the step motion and 10 msec for settling.

(3) Subsequent to a Head Load operation, 35 msec is required for the head-media relationship to stabilize.

NOTE

All of the foregoing operations can be overlapped, if required.

Figure 2-3 shows the relevant timing diagram for a write operation. At t = 0 when the unit is ready, the WRITE ENABLE interface line goes true (Plot 1); this enables the Write Current Source.

Since the trim erase gaps are behind the read/write gap, the TRIM ERASE control goes true (Plot 2) 430 μsec after the WRITE ENABLE interface line. It should be noted that this value is optimized between the requirements at Track 0 and Track 39 so that the encroachment by the trim erase gaps on previous information is minimized.

Plot 4 shows the information on the WRITE DATA interface line; Plot 5 shows the output of the Write Waveform Generator which toggles on the leading edge of every WRITE DATA pulse.

Note that Plot 4 indicates a minimum of 4 μsec and a maximum of 8 μsec between WRITE ENABLE going true and the first WRITE DATA pulse. This period is only required if faithful reproduction of the first WRITE DATA transition is significant.

At the end of recording, at least one additional pulse on the WRITE DATA line must be inserted after the last significant WRITE DATA to avoid excessive peak shift effects.

The TRIM ERASE signal (Plot 2) must remain true for 840 μsec after the termination of WRITE ENABLE to ensure that all recorded data are trim erased. This value is again optimized between the requirements at Tracks 0 and 39.
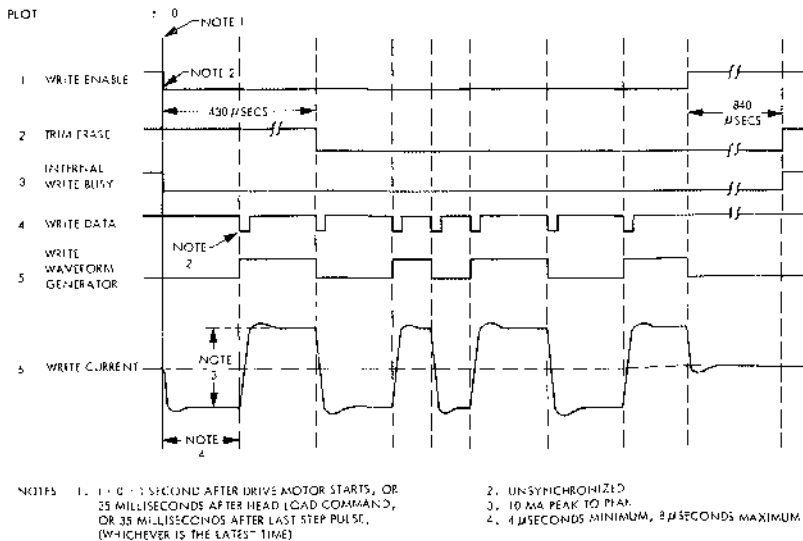

Figure 2-3. Write Timing Diagram

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The duration of a write operation is from the true-going edge of WRITE ENABLE to the false-going edge of TRIM ERASE. This is indicated by the internal WRITE BUSY waveform shown in Plot 3.

NOTE

Further information regarding format and control of the flexible disk is contained in a series of Application Notes, PERTEC document numbers 75605, 75607, and 76601.

2.10.2 DATA REPRODUCTION

The Read Electronics consist of the following.

- Read Switch
- Read Amplifier
- Filter
- Differentiator
- Comparator and Digitizer

The Read Switch is used to isolate the Read Amplifier from the voltage excursions across the magnetic head during a write operation. The switch is operated by the WRITE ENABLE signal.

Before reading can begin, the drive must be in a ready condition. As with the data recording operation, this ready condition must be established by the user system. In addition to the requirements established in Paragraph 2.10.1, a 100 µsec delay must exist from the trailing edge of the TRIM ERASE signal to allow the Read Amplifier to settle after the transient caused by the Read Switch returning to the Read mode.

Referring to Figure 2-4, the output signal from the read/write head is amplified by a *balanced-in/balanced-out* read amplifier and filtered to remove noise by a linear phase Filter. The linear output from the Filter (Plot 1) is passed to the Differentiator which generates a waveform (Plot 2) whose zero crossovers correspond to the peaks of the read signal (Plot 1). This signal is then fed to the Comparator and Digitizer circuit.

The Comparator and Digitizer circuitry generates a 1 µsec READ DATA pulse (Plot 3) corresponding to each peak of the read signal.

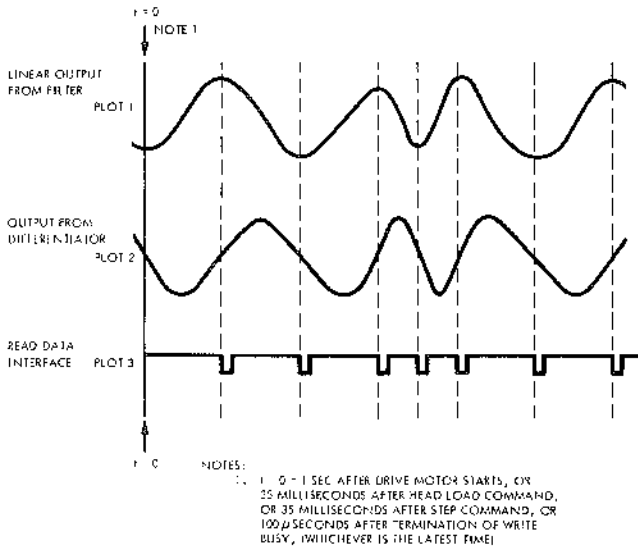This Composite Read Data signal is then sent to the user system via the READ DATA interface line.

Figure 2-4. Read Timing Diagram

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OPERATION

3.1 INTRODUCTION

This section contains the interface description and the mechanical/electrical adjustments necessary for the FD200 Diskette Drive. Also presented is a schematic diagram of the PCBA installed in the disk drive.

3.2 PHYSICAL DESCRIPTION, PCBA NO. 600411

The PCBA is approximately 193 mm (7.6 inches) long by 130 mm (5.1 inches) wide. Figure 3-1 illustrates the placement of test points and connectors.

There are four connectors on the PCBA. J1 is the interface connector and is slotted to mate with a key in the mating plug; J2 is a 30 pin right angle connector into which the subassembly connector plugs; J3 is mounted on the reverse side to allow for dc power connections; J4, also mounted on the reverse side, is the connector into which the read/write head plugs.

3.3 INTERFACE ELECTRONICS SPECIFICATIONS

All interface signals are TTL compatible. Logic true (low) is at +0.4v (maximum), logic false (high) is +2.4v (minimum). Figure 3-2 illustrates the interface configuration.

It is recommended that the interface cable be twisted pairs, each with a characteristic impedance of 100 ohms (or equivalent) flat ribbon cable. Maximum interface cable length of 9.14 m (30 feet).

Interface connector pin assignments and power connector pin assignments are given in Tables 3-1 and 3-2, respectively.

3.3.1 INPUT CONTROL LINES

3.3.1.1 SELECT Lines (ISLT0—ISLT3)

The SELECT lines provide a means of selecting and deselecting a disk drive. These four lines (ISLT0—ISLT2 standard; ISLT3 optional) select one of the four disk drives attached to the controller. When the signal logic level is true (low), the disk drive electronics are activated, the head is loaded, and the drive is conditioned to respond to step or read/write commands. When the logic level is false (high), the input control lines and output status lines are disabled.

A SELECT line must remain stable in the true (low) state until the execution of a step or read/write command is completed.

The disk drive address is determined by a Select Switch on the PCBA. SELECT lines 0—3 provide a mean. daisy-chaining a maximum of four disk drives to a controller. Only one line can be true (low) at a time. An undefined operation might result if two or more units are assigned the same address or if two or more SELECT lines are in the true (low) state simultaneously.

3.3.1.2 DRIVE MOTOR ENABLE (IDEN)

When this signal line logic level goes true (low), the drive motor accelerates to its nominal speed of 300 rpm and stabilizes in less than 1 second. When the logic level goes false (high), the disk drive decelerates to a stop in less than 1 second.

3.3.1.3 DIRECTION and STEP Lines (2 Lines) (IDIR) (ISTP)

When the disk drive is selected, a true (low) pulse with a time duration greater than 200 nsec, but less than 2 msec, on the STEP line initiates the access motion. The direction of motion is determined by the logic state of the DIRECTION line when a STEP pulse is issued. The motion is towards the center of the disk if the DIRECTION line is in the true (low) state when a STEP pulse is issued. The direction of motion is away from the center of the disk if the DIRECTION line is in the false (high) state when a STEP pulse is issued. To ensure proper positioning, the DIRECTION line should be stable 0.1 μsec (minimum) before the trailing edge of the corresponding STEP pulse and remain stable until the trailing edge of the STEP pulse. The access motion is initiated on the trailing edge of the STEP pulse.

3.3.1.4 WRITE DATA (IWDA)

When the disk drive is selected, this interface line provides the bit-serial WRITE DATA pulses that control the switching of the write current in the head. The write electronics must be conditioned for writing by the WRITE ENABLE line (see Paragraph 3.3.1.5).

For each high-to-low transition on the WRITE DATA line, a flux change is produced at the write head gap. This causes a flux change to be stored on the medium.
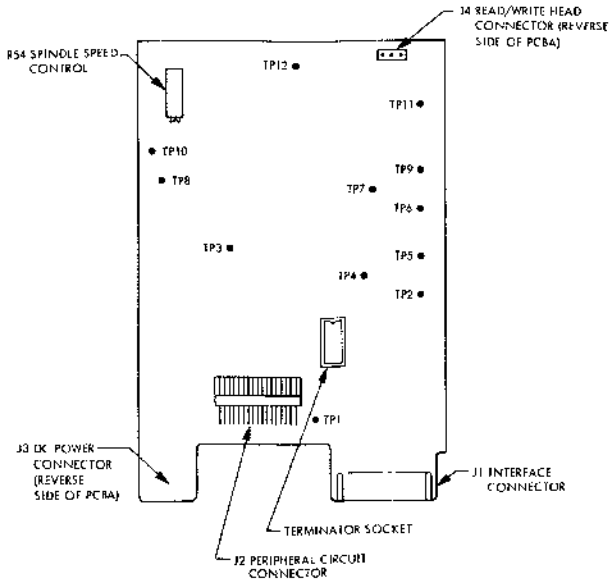
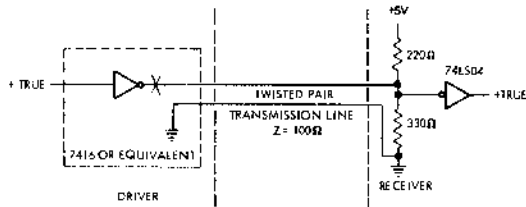Figure 3-1. FD200 PCBA No. 600411, Test Point and Connector Placement

Figure 3-2. Interface Configuration

Table 3-1
Interface Connector Pin Assignments, J1 / P1

Controller-to-Disk Drive		
Ground	Signal	Description (Mnemonic)
1	2	(Spare)
3	4	(Spare)
5	6	(Spare) (ISLT3)(Optional)
9	10	SELECT 0 (ISLT0)
11	12	SELECT 1 (ISLT1)
13	14	SELECT 2 (ISLT2)
15	16	DRIVE-MOTOR ENABLE (IDEN)
17	18	DIRECTION (IDIR)
19	20	STEP (ISTP)
21	22	WRITE DATA (IWDA)
23	24	WRITE ENABLE (IWEN)
Disk Drive-to-Controller		
7	8	INDEX (IINXP)
25	26	TRACK 0 (ITRK0)
27	28	WRITE PROTECT (IWPT)
29	30	READ DATA (IRDA)
31	32	(Spare)
33	34	(Spare)

Table 3-2
Power Connector Pin Assignment, J3 / P3

Pin	Supply Voltage
1	+ 12v dc
2	Return (+ 12v dc)
3	Return (+ 5v dc)
4	+ 5v dc

The double-frequency type encoding technique is used in which data and clock form the combined Write Data signal. It is generally recommended that the repetition of the high-to-low transitions, when writing all zeros, be equal to the nominal data rate, ±0.1 percent. The repetition rate of the high-to-low transitions, when writing all ones, should be equal to twice the nominal data rate, ±0.1 percent.

3.3.1.5 WRITE ENABLE (IWEN)

When this signal is true (low), the write electronics are prepared for writing data (read electronics disabled). This signal turns on write current in the read/write head. Data is written under control of the WRITE DATA input line. It is generally recommended that changes of state on the WRITE ENABLE line occur before the first WRITE DATA pulse. However, the separation between the leading edge of WRITE ENABLE and the first significant WRITE DATA pulse should not be less than 4 μsec and not greater than 8 μsec. The same restrictions exist on the relationship between the least significant WRITE DATA pulse and the termination of the WRITE ENABLE signal. When the WRITE ENABLE line is false (high), all write electronics are disabled.

When a write-protected diskette is installed in a FD200 Disk Drive, the write electronics are disabled irrespective of the state of the WRITE ENABLE line.

3.3.2 OUTPUT STATUS LINES

3.3.2.1 INDEX (IINXP)

The INDEX signal is provided once each revolution (200 msec, nominal) to indicate to the controller the beginning of a track. The INDEX line remains in the true (low) state for the duration of the INDEX pulse. The duration of an INDEX pulse is nominally 4.0 ±1.0 msec.

The leading edge of an INDEX pulse must always be used to ensure diskette interchangeability between PERTEC FD200 Disk Drives.

3.2.2.2 TRACK 0 (ITRK0)

When the disk drive is selected, the TRACK 0 interface signal indicates to the controller that the read/write head is positioned at Track 0. The TRACK 0 signal remains true (low) until the head is moved away from Track 0.

3.3.2.3 WRITE PROTECT (IWPT)

When the disk drive is selected, this signal line logic level goes true (low) when the diskette is write protected. The write electronics are internally disabled when the diskette is write protected.

When the level on this line is false (high), the write electronics are enabled and the write operation can be performed. It is generally recommended that the controller not issue a write command when the WRITE PROTECT signal is true (low).

3.2.4 READ DATA (IRDA)

This interface line transmits the readback data to the controller when the drive is selected. It provides a pulse for each flux transition recorded on the medium. The READ DATA output line goes true (low) for a duration of 1 = 0.1 μsec for each flux change recorded.

The leading edge of the READ DATA output pulse represents the true positions of the flux transitions on the diskette surface.

3.4 CIRCUIT BOARD TEST POINTS

The following test points description assumes that the PCBA is installed in a FD200 Flexible Disk Drive and that the drive is in an operational mode with a diskette installed.

3.4.1 LOGIC GROUND (TP1, TP10)

Digital logic ground reference points are provided at particular locations on the PCBA: TP1 near the I/O Connector; TP10 near the Speed Adjust Potentiometer.

3.4.2 DIFFERENTIATED READ SIGNAL (TP2, TP5)

Unit is in the operational mode with diskette installed, head loaded and positioned at Track 0. The differential amplitude of this signal when reading an all ones (2F) pattern should be 3v peak-to-peak (nominal value, ±1v).

3.4.3 READ DATA SINGLE SHOT (TP3)

The output of the single shot used in the read section is nominally 1.0 ±0.1 μsec for each flux transition detected.

3.4.4 INDEX PULSE (TP4)

With a standard diskette installed, the signal is a high-going pulse nominally 4.0 msec in duration every 200 msec.

3.4.5 AMPLIFIED READ SIGNAL (TP6, TP9)

These test points are provided to observe the differential output of the first stage of read signal amplification.

3.4.6 WRITE ENABLE (TP7)

This signal is the gated Write Enable interface line.

3.4.7 DC MOTOR TACHOMETER (TP8)

This signal is the *squared* output of the tachometer signal of the DC Motor.

3.4.8 ANALOG GROUND (TP11)

Analog ground reference point is provided when measuring read/write waveforms.

3.4.9 TRIM ERASE DRIVER (TP12)

Output of the trim erase driver transistor.

3.5 OPTION SELECT

This section describes each jumper, etch cut, switch position and the related option.

3.5.1 HEAD LOAD WITH DRIVE MOTOR ENABLE (W1)

The head may be loaded with the DRIVE MOTOR ENABLE interface line when W1 is installed and W2 is omitted.

3.5.2 HEAD LOAD WITH SELECT (W2)

The standard configuration allows the head to be loaded with the SELECT line when W2 is installed and W1 is omitted.

3.5.3 SELECT SWITCH, S1

This Select Switch Array provides address selection for unit position. The switch positions should be exclusive, i.e.,. only one position active at a time. The following list specifies unit select via switch position. Etch D.C. on the component side of the PCBA must be cut to enable operation of the Select Switch.

S1-1	Select 0
S1-2	Select 1
S1-3	Select 2
S1-4	Select 3

3.6 MAINTENANCE PHILOSOPHY

To ensure that the disk drive operates at its optimum design potential, the only scheduled preventive maintenance required is periodic cleaning of the magnetic recording head and inspection of the load pad.

Mechanical and electrical adjustment details are provided for the case where further service is required as a result of disassembly or repair.

3.6.1 CLEANING THE HEAD

To clean the magnetic head, use a lint-free cloth or cotton swab moistened with 91% isopropyl alcohol. Wipe the head carefully to remove all accumulated oxide and dirt. Dry the head using a lint-free cloth.

NOTE

The magnetic head must be cleaned after head load pad replacement.

CAUTION

ROUGH OR ABRASIVE CLOTH SHOULD NOT BE USED TO CLEAN THE MAGNETIC RECORDING HEAD. USE ONLY 91% ISOPROPYL ALCOHOL. USE OF OTHER CLEANING SOLVENTS, SUCH AS CARBON TETRA-CHLORIDE, MAY DAMAGE THE HEAD LAMINATION ADHESIVE.

Inspect the load pad for discoloration or excessive oxide build-up.

3.7 ADJUSTMENT

3.7.1 CE ALIGNMENT

The CE alignment procedure locates the magnetic read/write head at the proper radial distance from the hub centerline, thus assuring accurate track location. This adjustment is necessary only after service, or for suspected diskette interchange problems.

3.7.1.1 Disk Drive Preparation

(1) Manually rotate the stepper motor cam until the carriage is positioned at Track 0.

(2) Apply the necessary power and control to turn on the disk drive.

(3) Insert a CE Alignment Diskette (PERTEC Part No. 600402-01) into the drive and close the loading door.

(4) Attach oscilloscope signal probes to test points TP6 and TP9; place ground clips of signal probes to TP11. Adjust the oscilloscope to read differentially (A + B with B inverted). Sync the oscilloscope on the leading edge of the Index pulse at TP4 with sync probe ground clip at TP1.

3.7.1.2 Radial Track Alignment

(1) Load Magnetic Head.

(2) Perform 16 Step-In commands. The carriage will move to Track 16 (approximately).

(3) Loosen the two stepper motor retaining screws on bottom of chassis.

(4) Manually rotate stepper motor until the cats-eye pattern shown in Figure 3-3 is observed. Carefully rotate stepper motor until the cats-eye pattern has equal amplitudes (one lobe being 80 percent of the other).

(5) Secure the stepper motor by tightening the retaining screws. Torque the two screws 9 to 11 In-lb.

(6) After securing the stepper motor screws, verify Step (4). Repeat as required.

3.7.1.3 Index Sensor Alignment

(1) Position Index sensors (located on Clamp Support Beam) to center of travel; lightly tighten retaining screws.

(2) Load magnetic head.

(3) Perform CE alignment as required to locate the cats-eye pattern at Track 16 (refer to Paragraph 3.7.1.2).

(4) Perform 15 repetitive Step-Out commands to position the carriage at Track 01.

(5) Set oscilloscope horizontal time base to 20 µsec per division.

(6) Referring to Figure 3-4, adjust photo-transistor mounting block until the first transition of the 2 msec burst recorded at Track 01 occurs 200 ±50 µsec after the leading edge of the Index pulse. Adjustment may be made with the use of a flat-bladed screwdriver placed between the photo-transistor mounting block and Clamp Support Beam cavity as required.

NOTE

Care should be taken to avoid breakage of the web of the Clamp Support Beam forward of the photo-transistor mounting block during adjustment.

(7) Secure retaining screws on the photo-transistor mounting blocks and verify burst location; readjust as necessary.

(8) Verify the cats-eye pattern at Track 16.

3.7.2 TRACK 0 SWITCH

(1) Apply the necessary power and control to turn on the drive.

(2) Insert CE Alignment Diskette (PERTEC Part No. 600402-01) into the drive and close the loading door.

(3) Load magnetic head.

(4) Position the carriage to Track 16. Confirm the Track 16 position by observing the cats-eye pattern. Position the carriage to Track 0.

(5) Loosen the two retaining screws of the Track 0 bracket.

(6) Adjust the Track 0 switch bracket so that the switch is closed when the carriage is positioned at Track 0 and open at Track 1. Secure the two retaining screws.

3.7.3 WRITE PROTECT SWITCHES

(1) Insert diskette to within 1.016 mm (0.040 inch) of diskette stop.

(2) Ensure that both switches are actuated.

(3) Insert diskette fully against diskette stop and close the loading door.

(4) Adjust switch by loosening retaining screws and setting sense arm in center of notch.

(5) Remove the diskette, turn the diskette over (180°) and adjust the other switch.

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3.7.4 DRIVE MOTOR SPEED

(1) Apply necessary power and control to turn on the drive.

(2) Insert soft-sectored diskette.

(3) Ensure that Drive Motor Enable line is active.

(4) With counter-timer connected to Index Pulse (TP4), measure the duration of Index to Index pulse.
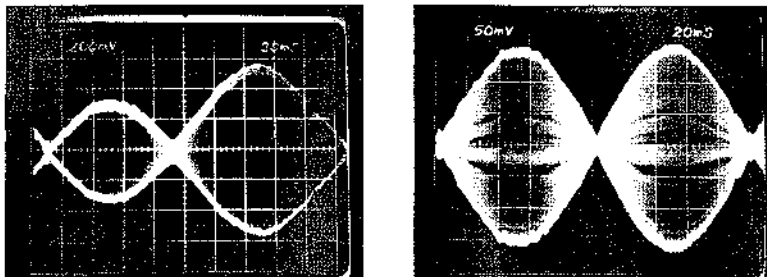
(5) Adjust Speed Control potentiometer R54 until Index duration is 200 msec ±3 msec.
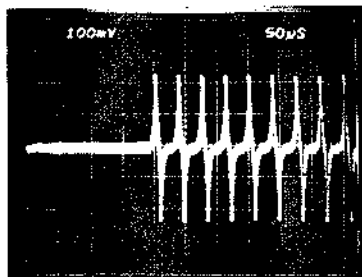

Figure 3-3. Cats Eye Pattern

Figure 3-4. Index to Data Burst
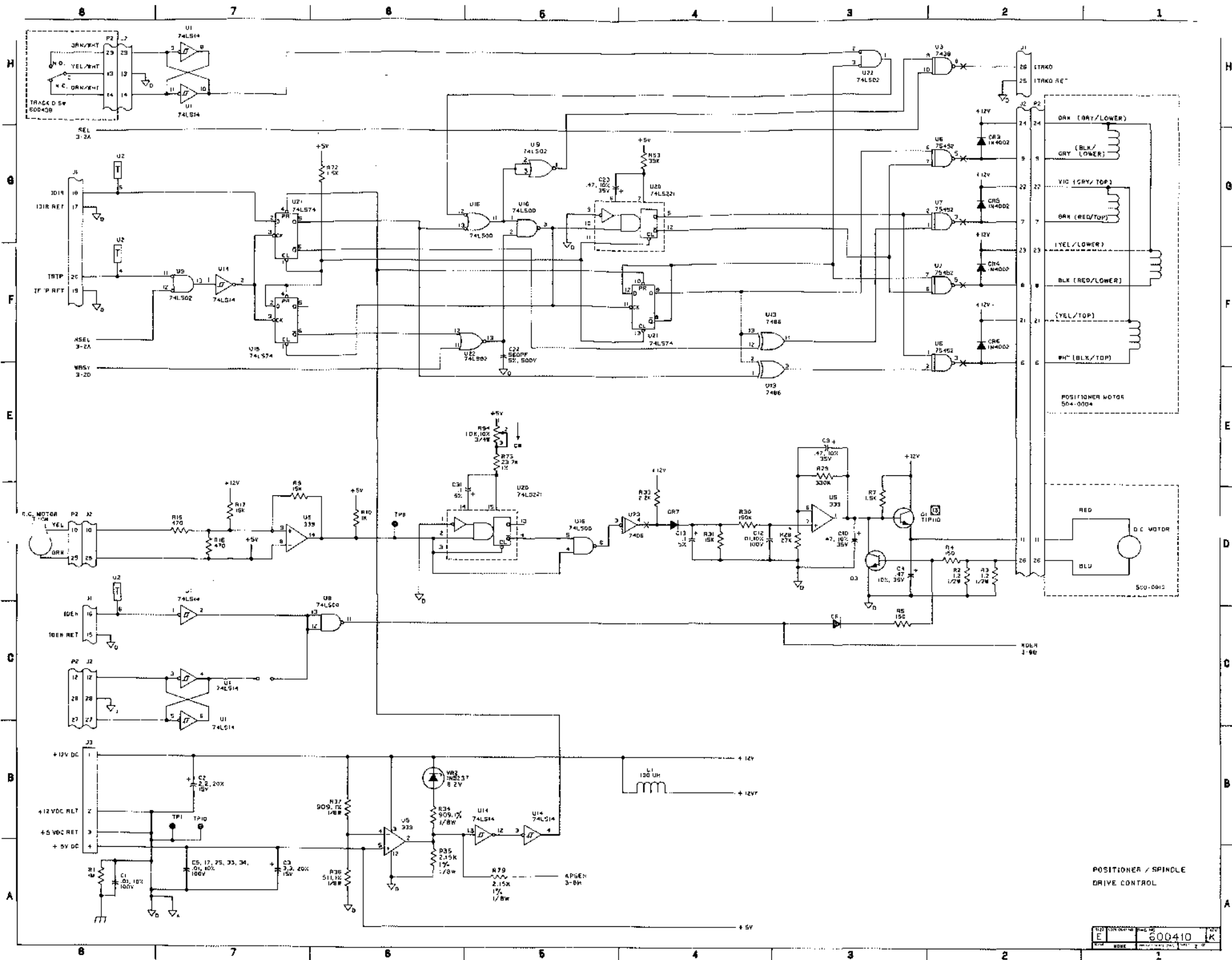
POSITIONER / SPINDLE

DRIVE CONTROL

| E | 600410 | K |

READ/WRITE & CONTROL LOGIC

E 600410 K

DENOTES PIN NO. 1

J4
(FARSIDE)

550-0002
600-0405
604-0401
612-0016

PIN NO. 4
REF

J3

XU2
509-7544
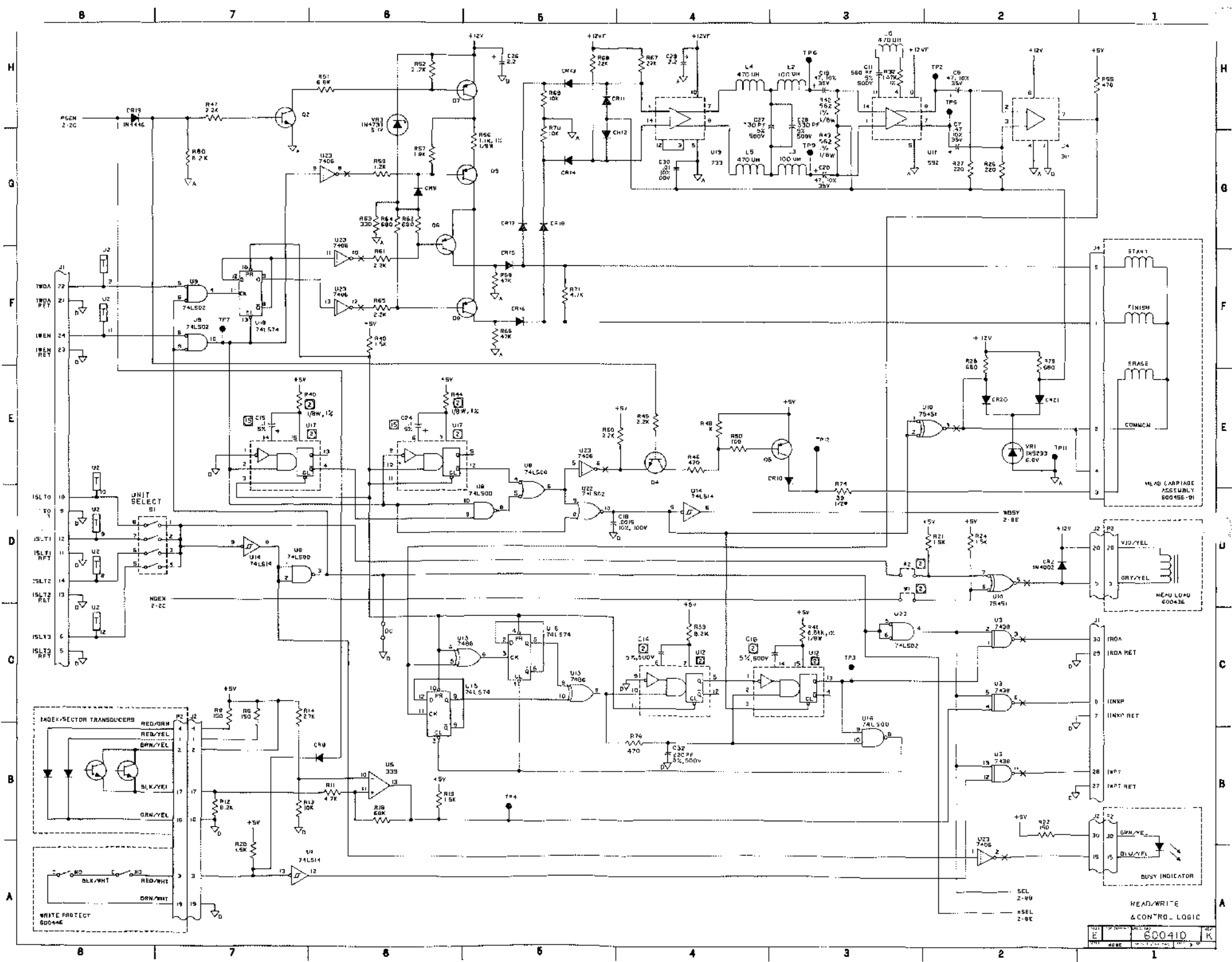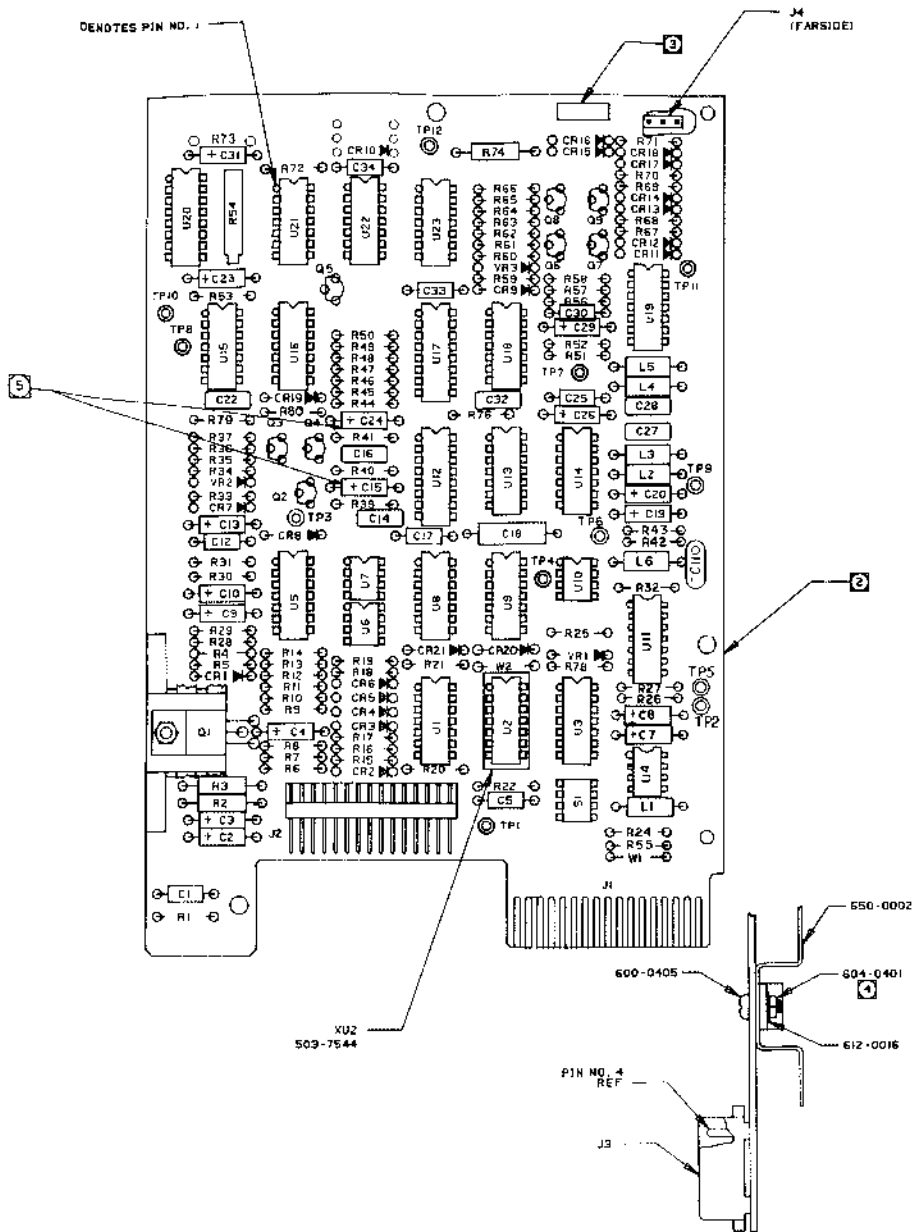
5. COMPONENT POLARITIES FOR C15 AND C24 ARE REVERSED FOR -02 VERSION.
   REMOVE POLARITY SYMBOLS FROM SILKSCREEN FOR C15 AND C24.

4. TORQUE TO 11 INCH LBS.

3. MARK VERSION NUMBER AND VERSION
   ISSUE LETTER IN AREA SHOWN.

2. THIS ASSEMBLY SHALL BE MADE FROM PROCESS
   BOARD 600412-01 REV J AND SUBSEQUENT.

1. ASSEMBLE PER STANDARD MANUFACTURING METHODS.

NOTES: UNLESS OTHERWISE SPECIFIED

PERTEC
a division of Pertec Computer Corporation

TITLE
PCBA
F D CONTROL E

SIZE	CODE IDENT NO	DWG NO.	REV
	32097	600411	M