INTELLEC® DISKETTE OPERATING SYSTEMS MODELS 710/711/712, MODELS 720/721/722, AND MODELS 730/731/732 SERVICE INFORMATION

Manual Order Number: 9800880-01

intel®

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Intel Corporation, 3065 Bowers Avenue, Santa Clara, California 95051

Additional copies of this manual or other Intel literature may be obtained from:

Literature Department
Intel Corporation
3065 Bowers Avenue
Santa Clara, CA 95051

PREFACE

This publication provides service information for the Intellec DISKETTE Subsystems Models 710/711/712, Models 720/721/722, and Models 730/731/732.

This service information is organized to facilitate repair of the subsystem by identification and replacement of faulty modules. For assistance from Intel Customer Engineers, refer to the "Repair and Service Assistance" section.

Other publications required for service of the Intellec Diskette Subsystem are:

ISIS-II User's Guide
(Intel Order No. 9800306)

Intel Series II Installation Manual
((Intel Order No. 9800559)

Diskette Operating System Microcomputer Development System MDS-DOS Hardware Reference Manual
(Intel Order No. 9800212A)

Intellec Microcomputer Development System Diskette Diagnostic User's Guide
(Intel Order No. 9800457A)

Intellec Microcomputer Development System Diagnostic Confidence Test Operator's Manual
(Intel Order No. 9800386B)

Intellec Series II Installation & Service Manual
(Intel Order No. 9800878-01)

Intellec 800 Microcomputer Development System Operator's Manual
(Intel Order No. 9800129A)

Intellec Double Density Diskette Operating System Hardware Reference Manual
(Intel Order No. 9800422A)

More detailed information on the LSI IC's used in the Diskette Subsystem may be found in:

Intel Series 3000 Microprogramming Manual
(Intel Order No. 9800210A)

Intel Series 3000 Reference Manual
(Intel Order No. 9800221A)

Intel 1978 Component Data Catalog
(Intel Order No. 110400)

Intel 1978 System Data Catalog
(Intel order No. 610200)

MCS-80™ User's Manual
(Intel Order No. 9800153)

Peripheral Design Handbook
(Intel Order No. 9800676)

Other publications providing useful information are:

Intel Multibus Specification
(Intel Order No. 9800683)

Intel memory Design Handbook
(Intel Order No. 111100)

A Guide to Microcomputer Development Systems
(Intel Order No. 9800558)

CONTENTS

INTRODUCTION

The Intellec® Diskette subsystem consists of a low profile disk drive unit, the disk drive controller, and associated cables. The Intel low-profile disk drive unit is a randomly accessible, sequential mass-storage device used for file storage by the host computing system. It consists of two flexible disk drives with an integral power supply, all mounted within a single chassis. Each disk drive is individually accessed and controlled by the controller which consists of two printed circuit boards. These two boards (Channel and Interface) are mounted within either the Intellec® Series II or the 800 host Microcomputer development system and may be configured as either a single or double density controller.

The controller is a dedicated microprocessor that interprets channel commands from the host system and generates the necessary signals to the disk drive unit to initiate:

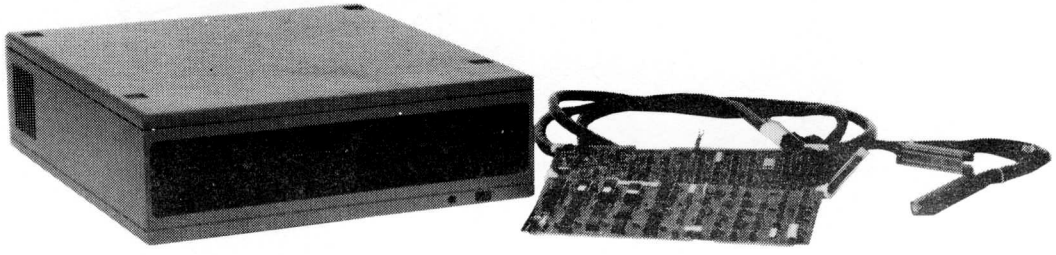
- drive selection
- selected drive status
- read/write head movement to a specified track, and
- either serializes and formats parallel write data from the host computing system to be subsequently stored in the specified sector of that track, or
- deserializes serial read data from the track and issues parallel data back to the host computing system.

The basic differences in configurations are single- or double-density capability, power requirements, and color of the chassis, as described below.

CONTROLLER

MODEL	110V, 60 Hz DRIVE	220V, 50 Hz DRIVE	DENSITY	CHANNEL P/N	INTERFACE P/N	CONTROLLER CABLE P/N	PERIPHERAL CABLE P/N	CABINET COLOR
710	4500963-01		SINGLE	1000467-03	1000603	4001979 (4000522)	4001990 (4000521)	BLUE
711		4500963-02	SINGLE	1000467-03	1000603	4001979 (4000522)	4001990 (4000521)	BLUE
712		4500963-02	SINGLE	1000467-03	1000603	4001979 (4000522)	4001990 (4000521)	GRAY
720	4502534-01		DOUBLE	1000467-04	1001036	4002175 (4000516)	4002176	BLUE
721		4502534-02	DOUBLE	1000467-04	1001036	4002175	4002176	BLUE
722		4502534-02	DOUBLE	1000467-04	1001036	4002175	4002176	GRAY
730	4502534-01		DOUBLE	N/A	N/A	N/A	4002176	BLUE
731		4502534-02	DOUBLE	N/A	N/A	N/A	4002176	BLUE
732		4502534-02	DOUBLE	N/A	N/A	N/A	4002176	GRAY

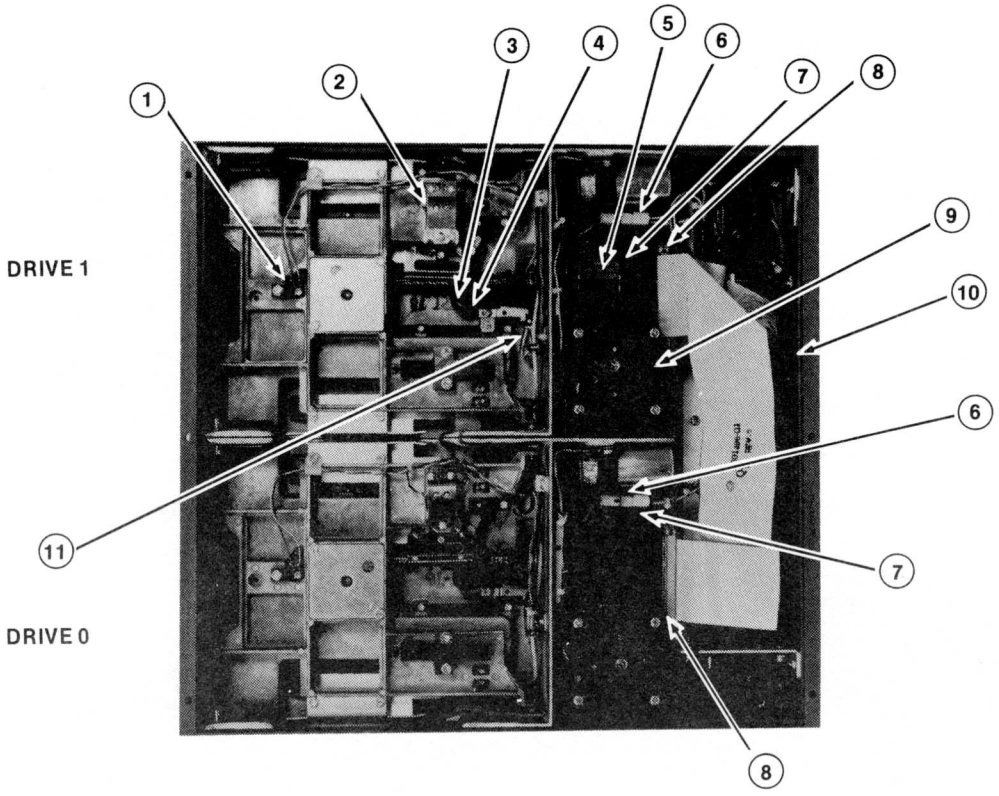
NOTE: Number inside parens ( ) is the MDS-800 earlier cable part number used in earlier versions.



COMPONENT LOCATIONS

The major components of the disk drive are indicated in the figure and identified in the following list.

1. The **Index/sector transducer** consists of a phototransistor and LED. A small diameter hole is located in the diskette such that when the disk is rotated, invisible light emitting from the LED passes through the hole and strikes the phototransistor generating the INDEX signal. This signal is generated once per disk revolution to indicate the beginning of a track.
2. The **head load solenoid** is energized to position the head load pad against the diskette.
3. The **head load pad**, when energized by the head load solenoid, places the diskette against the read/write head.
4. The **read/write head** is a center-tapped coil with a gap and an erase element encased within ceramic. It is mounted to the moveable carriage assembly which is positioned by the stepper motor lead screw.
5. The **stepper motor** is a three-phase motor with its stator windings wired in a manner that causes the lead screw to be rotated at 15 degree increments moving the attached read/write head one track per increment.
6. **P3 and P4 connectors** route AC power from the power supply to drive 0 and drive 1 respectively.
7. **P1 and P2 connectors** route DC power from the power supply to drive 0 and drive 1 respectively.
8. **P10 and P11 connectors** route the interface signals to and from the Interface board to both drives.
9. The **drive motor** rotates the spindle 360 rpm via a drive belt. The spindle in turn rotates the affixed diskette.
10. The **power supply** supplies the necessary operating voltages throughout the drive.
11. The **track 00 detector** consists of a phototransistor and LED. When the carriage assembly is positioned to the outer most track of the diskette, it interrupts invisible light emitting from the LED. This absence of light causes the generation of the TRACK 00 signal.



DRIVE SPECIFICATIONS

STORAGE CAPACITY		
Unformatted	SINGLE DENSITY	DOUBLE DENSITY
Per Disk	3.2 Megabits	6.4 Megabits
Per Track	41.7 Kilobits	83.4 Kilobits
RECORDING DENSITY (Inside Track)	3200 bpi	6400 bpi
DATA TRANSFER RATE	250K bits/s	500K bits/s
LATENCY (average)	83 ms	83 ms
Track density	48 tpi	
Rotational Speed	360 rpm ± 2.5%	
Tracks	77	
Access time		
Track to track	8 ms	
Average	260 ms	
Head Settling Time	14 ms	
Head Load Time	35 ms	

Format — Compatible to IBM 3740 Soft Sector

ERROR RATES	
Soft Read Errors	1 per 10^9 bits read
Hard Read Errors	1 per 10^{10} bits read
Seek Errors	1 per 10^6 seeks

ENVIRONMENTAL SPECIFICATIONS

Temperature 40°F (4.9°C) to 115°F (46.1°C)
Relative Humidity 20% to 80% Maximum Wet Bulb 78°F (25°C)

POWER SPECIFICATIONS

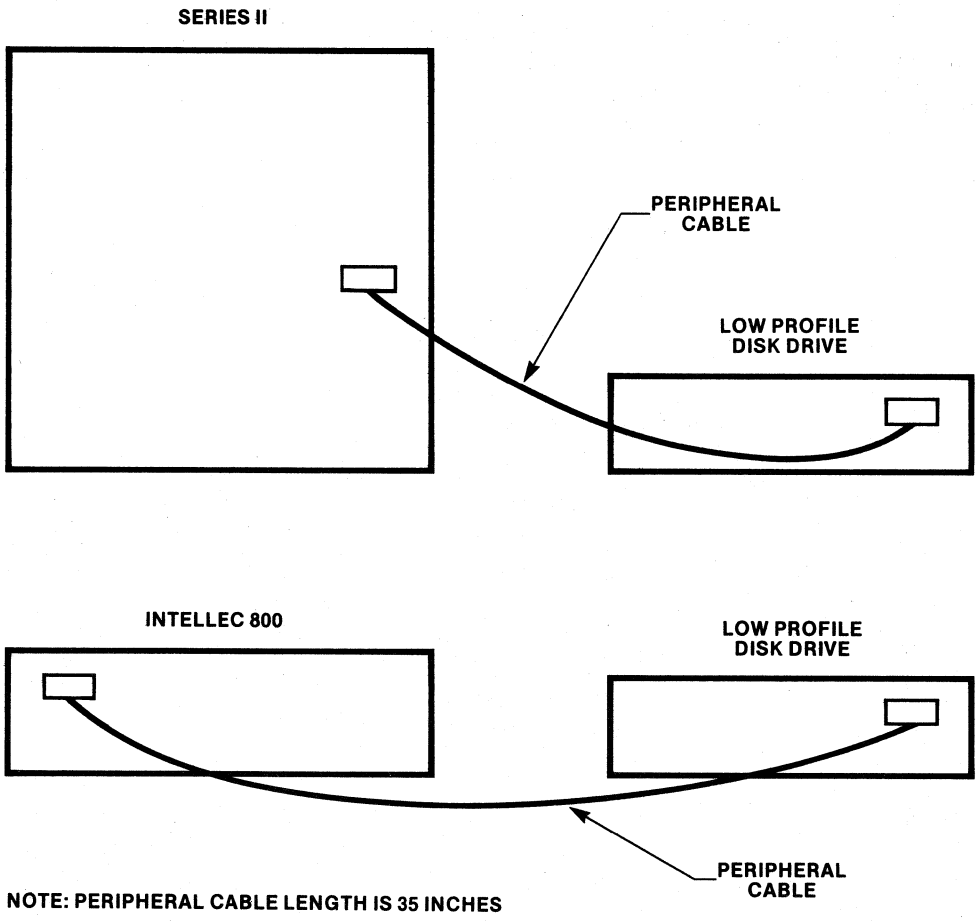
+24.0 ± 1.2V DC @ 1.7A maximum
−5.0 ± 0.25V DC @ 0.07A maximum
+5.0 ± 0.25V DC @ 1.0A maximum

INSTALLATION PLANNING

Intel's Series 71X, 72X, and 73X low profile disk drives may be located adjacent to any other electronic data processing equipment provided the temperature, humidity, and other environment characteristics are within the limits specified.

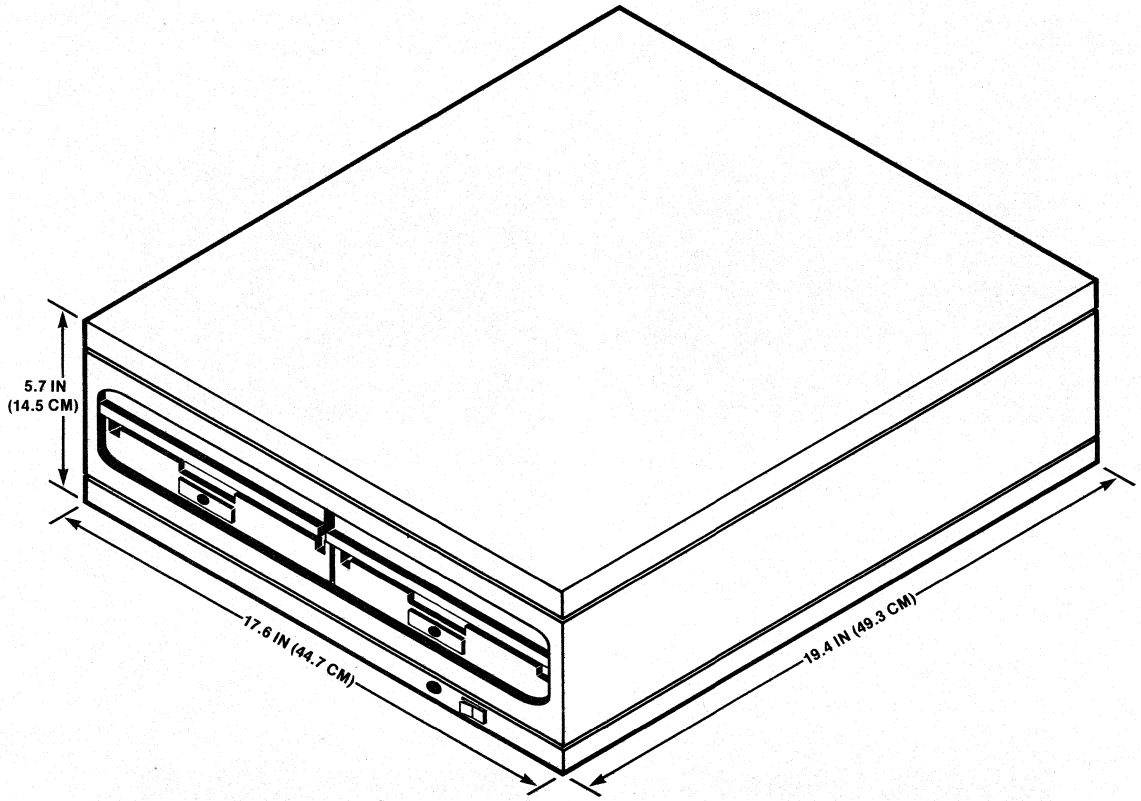
To obtain optimum performance from the equipment, the ambient temperature fluctuations should be kept as small as possible and a reasonable clear and dust free environment should be provided. It is also important that a free flow of clean air be allowed around the equipment.

The low profile disk drive subsystem is designed to interconnect with either the Intellec® Model 800 or the Series II. Note that for the 71X and 72X drives, the Controller cable must be connected from the Interface Board to the rear panel prior to connecting the Peripheral cable. The mounting hardware is located in the accessory kit. With the 73X drives, the Controller cable will already be installed. Interconnection between units is accomplished with the Peripheral Cable at the rear of both units. The cable length is 35 inches.



LOW PROFILE DISK DRIVES
PHYSICAL CHARACTERISTICS

Mounting:	Table Top
Height:	5.7 in. (14.5 cm)
Width:	17.6 in. (44.7 cm)
Depth:	19.4 in. (49.3 cm)
Weight:	43.0 lb. (19.5 kg)



DISK DRIVE EXTERIOR INSPECTION

After receiving your Intel product, inspect the shipping carton immediately upon receipt for evidence of mishandling during transit. If the shipping carton is severely damaged or waterstained, request that the carrier's agent be present when the carton is opened. If the carrier's agent is not present when the carton is opened and the contents of the carton are damaged, keep the carton and packing material for the agent's inspection.

After removing the unit from the shipping carton inspect the exterior of the chassis, then remove the top cover to visually inspect the inside of the chassis for loose connections.

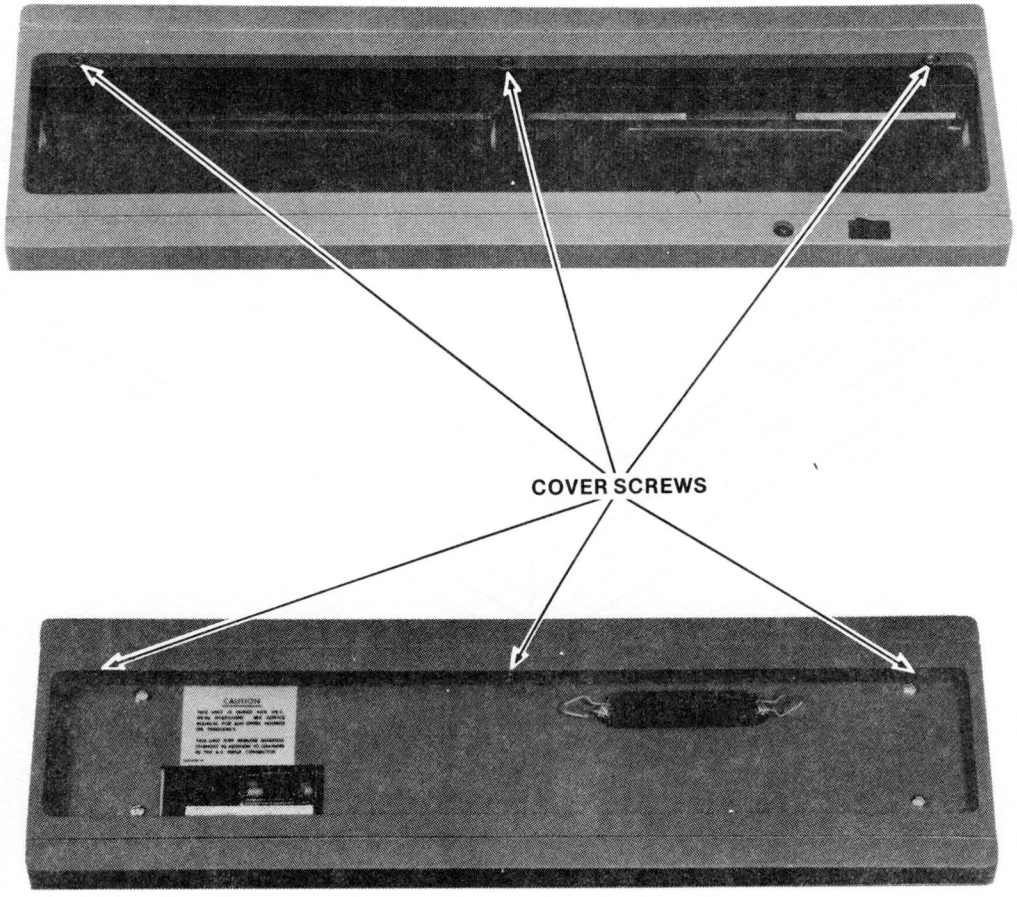
For repairs to a product damaged in shipment, contact the Intel Office in your area, or contact the Intel Service Center. (Refer to the Service and Repair Assistance section of this publication for details.)

NOTE

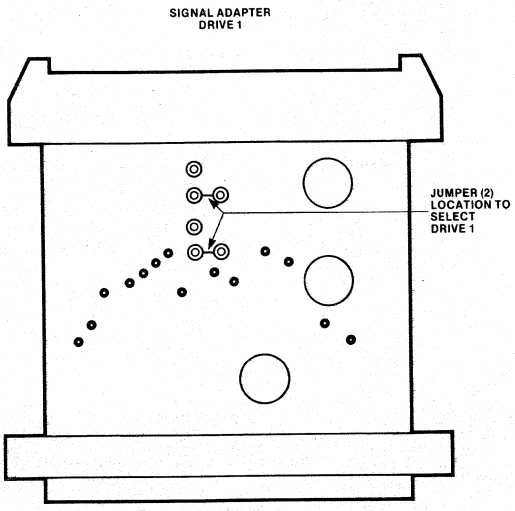
Perform interior inspection only if drive fails the Confidence test.

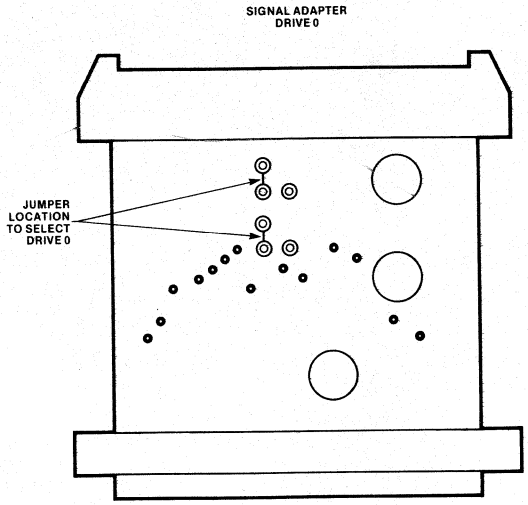
DISK DRIVE INTERIOR INSPECTION

1. Remove six socket head cap screws (three in front and three in the back) securing the top cover to the chassis.



2. Remove top cover and visually check the interior of the drive for evidence of:
   a. Loose connections
   b. Broken or bent parts
   c. Improperly seated connectors
   d. Correct drive select jumpers on the signal adapter.



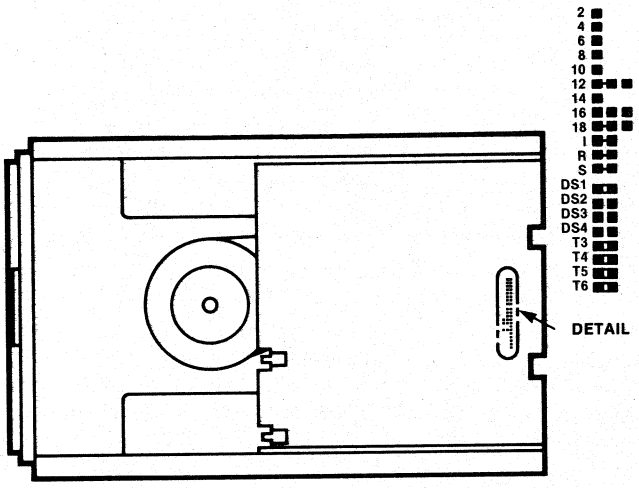


3. Remove drives (one at a time) from the chassis and visually inspect for evidence of:
   a. Drive belt wear
   b. Correct line termination. Always terminate drive 0 with jumper shorting plug installed at DS1. When warranted by additional drives, terminate drive 2 with jumper shorting plug installed at DS2.
   c. Proper drive selection jumper options on the drive board.

DRIVE ADDRESS

Ensure that the jumpers are properly installed corresponding to their drive number assignment.

Drive 0		Drive 1	
JUMPER	CUT TRACE EXISTS	JUMPER	CUT TRACE EXISTS
DS1	RR	DS1	RR
DS2		DS2	
T3			
T4			
T5			
T6			
X		X	
T2		T2	
HL		HL	
Z		Z	
A		A	
B		B	



DRIVE BOTTOM VIEW

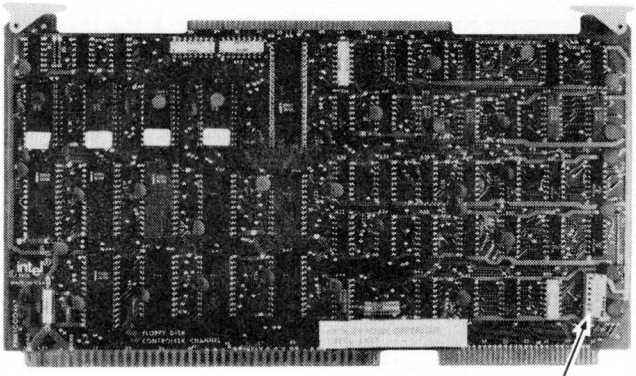
CHANNEL BOARD INSPECTION

Visually inspect the Channel Board for evidence of:

1. Improperly seated PROMs
2. Improperly seated 3001
3. Incorrect setting of the dip switch for channel addressing.

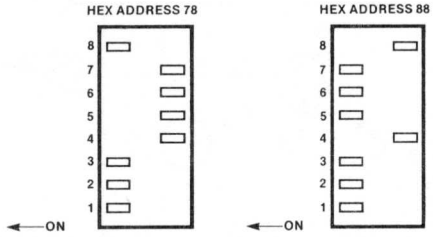
CHANNEL ADDRESS

The I/O base address selection is accomplished by setting the dip switches on the Channel Board. When a switch position is closed (ON) tied to ground, it represents a logical 0 address bit. When the switch is off, +5V, it represents a logical 1. The channel address for the controller is 78_H. In a configuration where both single and double density drives are used, the channel associated with the double density drive is assigned as address 78_H and is placed in the lowest card slot. While the single density channel is assigned an address of 88_H and is placed into the next higher priority slot.



CHANNEL BOARD

ADDRESS SELECTION SWITCHES



INTERFACE BOARD INSPECTION

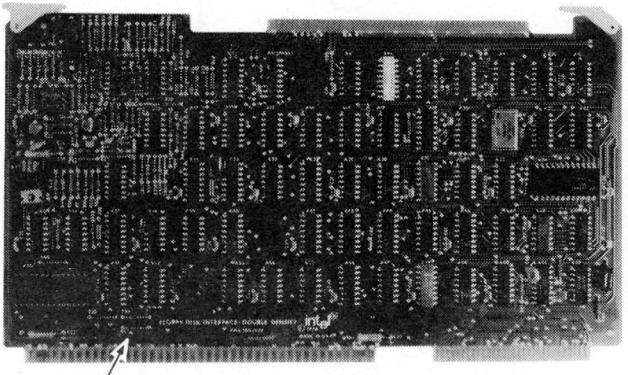
Visually inspect the Interface Board for proper interrupt switch setting.

INTERRUPT PRIORITY

The disk drive controller interrupt priority selection is done by positioning the seven position rotary switch located on the Interface Board to position 3 or Interrupt 2. The user may wish to assign a different priority to the drive controller but remember that the highest priority should be assigned to the drive controller. The IPB board is the lowest priority.

CABLE INSPECTION

Visually inspect cables for broken or bent pins, broken or frayed wire, and bent or broken lugs.

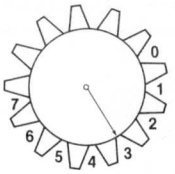


INTERRUPT SELECTION SWITCH

INTERFACE BOARD

SWITCH POSITION	INTERRUPT PRIORITY LINE	RELATIVE PRIORITY (INTELLEC MDS SYSTEM)
1	INT0/	HIGHEST
2	INT1/	
3	INT2/	
4	INT3/	
5	INT4/	
6	INT5/	
7	INT6/	
8	INT7/	LOWEST

THE FOLLOWING CLOCK SHOWS THE SWITCH SETTING 3 CORRESPONDING TO PRIORITY LINE INT2/.



INSTALLATION OF INDIVIDUALLY SHIPPED DRIVE UNITS INTO CHASSIS

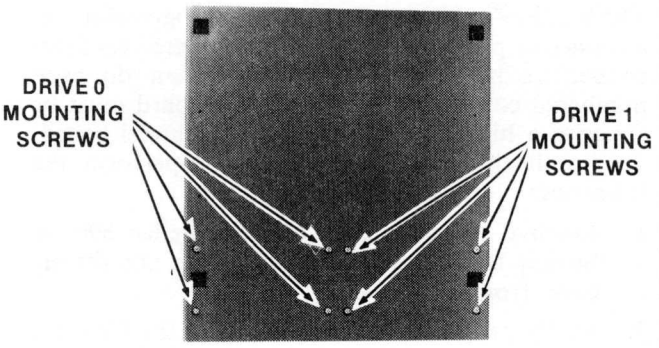
After ensuring that the proper drive selection jumpers have been installed on the drive board and the signal adapter, perform the following steps:

1. Install individual drive with its signal adapter in place into the vacated location within the chassis.
2. Connect connector P1 (drive 0) or P2 (drive 1).
3. Connect connector P3 (drive 0) or P4 (drive 1).
4. Connect connector P10 (drive 0) or P11 (drive 1) to the top of the signal adapter.

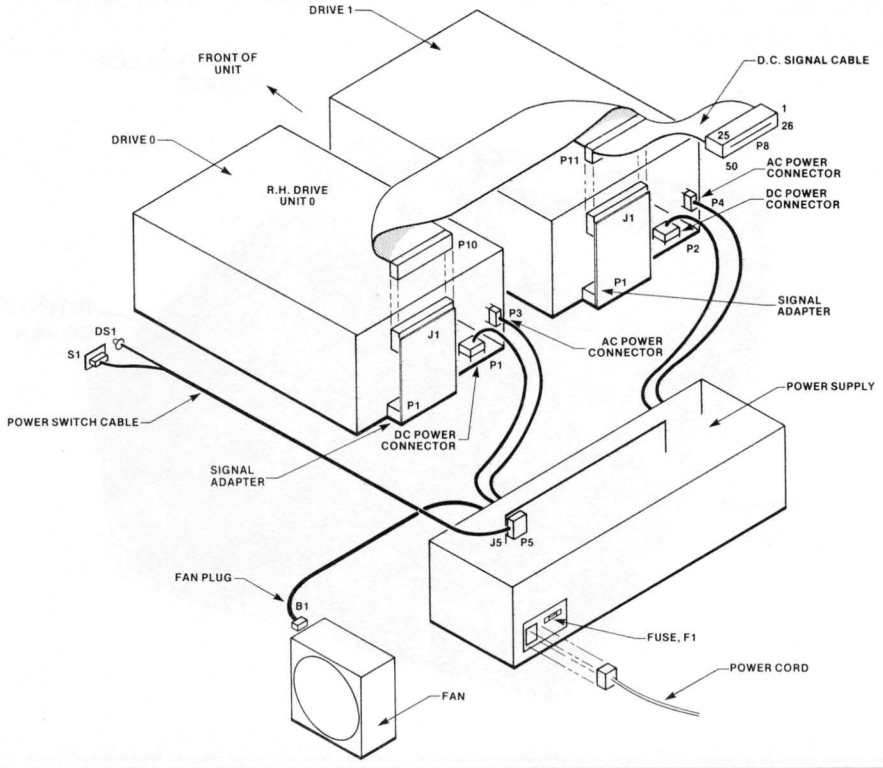
CAUTION

Do not place drive unit too far over the table edge as a tip hazard would result causing equipment damage.

5. Place drive chassis over table edge to gain access to the bottom four screws, install the four screws and secure the drive unit to the chassis. Move chassis back into place on the table.



6. Place top cover in place and secure the six socket head cap screws holding the top cover to the chassis.
7. Connect the Peripheral cable between the rear connector of the drive chassis and either J8 (drive 0 and 1) or J9 (drive 2 and 3) of either the Intellec® Series II or the 800.
8. Slide the plastic shield on the drive chassis to the right and connect the AC power cord.



INSTALLING DISK DRIVE CONTROLLER INTO INTELLEC® 800

The addition or replacement of the subsystem's disk drive controller involves the installation of two printed circuit boards, a dual auxiliary connector, and the controller cable.

The Intellec® 800 Multibus™ bus configuration has a connector priority scheme. Odd numbered card slot connectors have a higher priority than do even numbered connectors. The Interface board must be assigned a higher priority than the Channel board. To install the disk drive controller, perform the following:

1. Remove the top cover of the Intellec 800 by turning four screws one-quarter turn and lift the cover from the chassis.
2. Verify proper Channel address on the Channel board. (Refer to Channel Board inspection.)
3. Verify proper interrupt address on the Interface board. (Refer to Interface Board inspection.)
4. Install or verify the Controller cable connector(s) on the back panel.

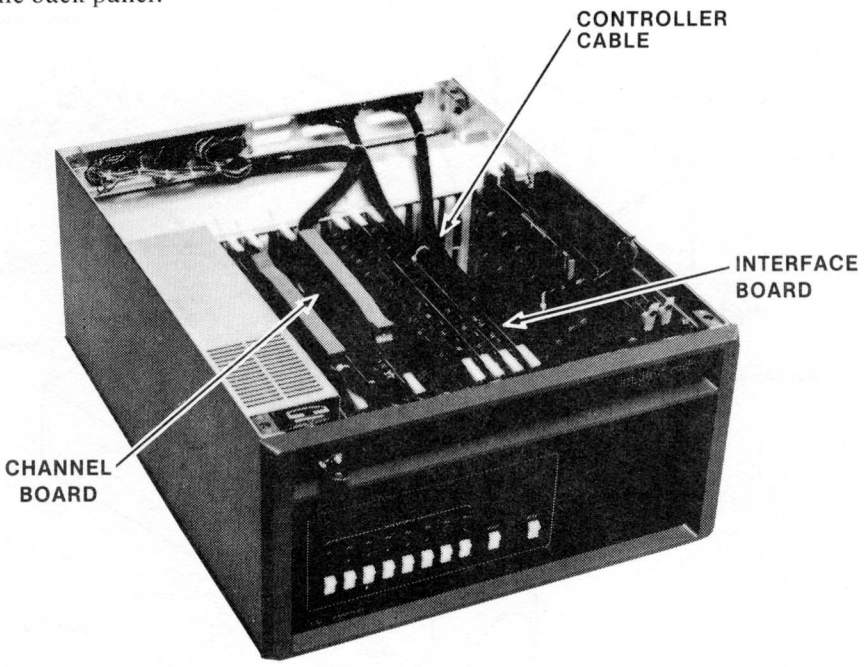
NOTE

The double density Interface cable has two connectors which are to be mounted on the back panel; the single density Interface cable has one connector to be mounted on the back panel.

5. Install the Channel board edge connector P2 into the left most connector of the auxiliary connector and the Interface board edge connector P2 into the right connector. (This interconnects the two boards and provides the correct spacing to fit into the Intellec 800 card slot connectors.)
6. Install the Channel board and Interface board into their appropriate card slot connectors in the Intellec 800. (For example, place the Channel board into card slot connector number 14 and the Interface board into slot 15.
7. Connect the Controller cable to the Interface board connector.
8. Connect the Peripheral cable to connector J8 or J9 on the rear panel.

CAUTION

Incorrect connection of the Controller Cable will damage the Interface Board. There are two types of cables available with the Intellec MDS 800. The routing for the blue connector cable must be with the cabling coming from the back as shown. An earlier version (the black connector) must be routed with the cabling going toward the front and looping back to the rear panel.



1. Slide plastic shield to the right and connect AC power cord.

   CAUTION

   Ensure that connection is made to the proper power source as designated on the label.

2. Connect the peripheral cable between connector J8 on either the Intellec® Series II or the 800 and the rear connector of the drive chassis (drives 0 and 1).

   When an additional drive unit is installed, connect the peripheral cable between connector J9 and the rear connector of the drive chassis (drives 2 and 3).

   NOTE

   When the Intellec ® Series 220 system is being updated by the addition of a 72X drive unit:

   1. the integral drive automatically reverts to drive 4 (even though there are no drives 2 and 3),

   2. the Series II built-in diagnostics test the integral drive, but not the external ones.

INSTALLING DISK DRIVE CONTROLLER INTO AN INTELLEC® SERIES II

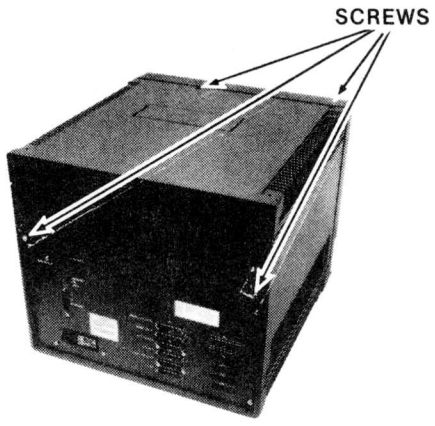
The addition or replacement of the subsystem's disk drive controller involves the installation of two printed circuit boards, a dual auxiliary connector, and a Controller cable.

The Series II Multibus™ bus configuration has a connector priority scheme. The lowest card has the highest priority. The Interface board must be inserted into a lower card slot than the Channel board.

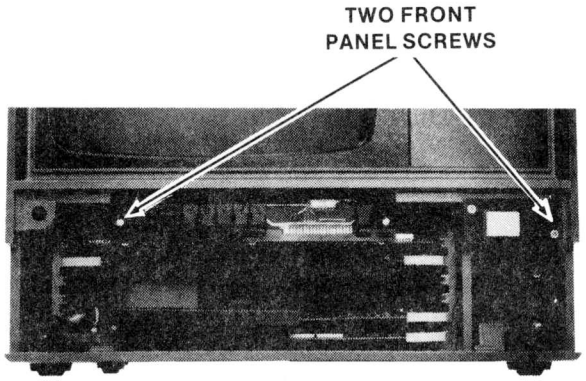
The two boards (Channel and Interface) are interconnected via the dual auxiliary connector. Note, for those who have both an Intellec 800 and a Series II, that the dual auxiliary connector for the Series II is physically smaller than that of the 800.

To install the disk drive controller in the Series II, perform the following:

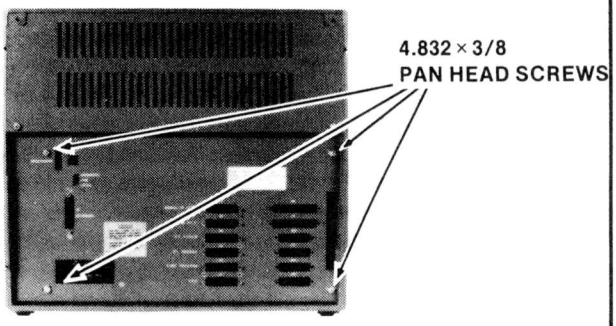
1. Remove the top cover by removing two screws located at the top front and two screws in the back, then, lift cover from chassis.



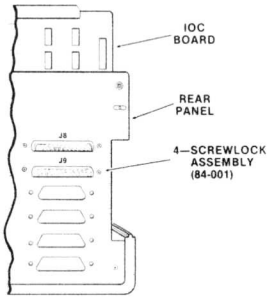
2. Remove front panel by turning two screws one-quarter turn and pulling out on panel.



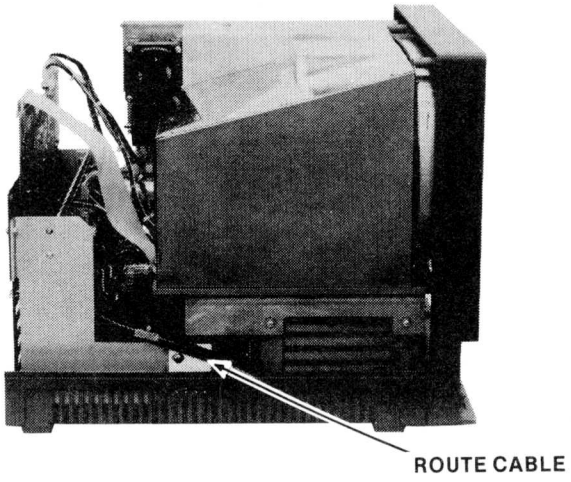
3. Remove rear panel by removing four screws.



4. Install interface connector(s) into the cut out(s) on the rear panel.



5. Route the interface cable up and outside the power supply chassis, alongside the card cage and through the front.



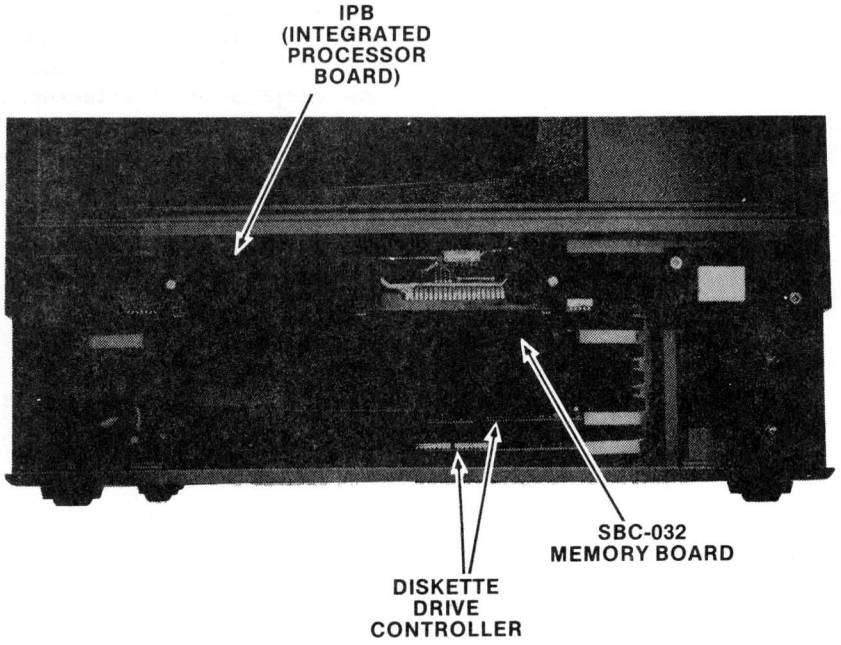
6. Connect the Interface board into the lower connector of the dual auxiliary connector.
7. Connect the Channel Board into the upper connector of the dual auxiliary connector.

INSTALLING DISK DRIVE CONTROLLER INTO AN INTELLEC® SERIES II (Continued)

8. Place both boards into the lower card slots of the Series II and press into place.
9. Connect the Controller cable connector onto the Interface Board.
10. Install the rear panel into place using four screws.
11. Install the top cover into place using four screws: two on the top front and two at the back of the top cover.
12. Connect the disk drive unit.

NOTE

For additional information concerning Series II installation consult the Series II Installation and Service manual.



SERVICE AND REPAIR ASSISTANCE

The best service for your Intel product will be provided by an Intel Customer Engineer. These trained professionals will provide prompt, efficient on-site installation, preventive maintenance, or corrective maintenance services that will keep your equipment in the best possible operating condition.

Your Intel Customer Engineer can provide the service you need through a prepaid service contract or an hourly-charge basis. For further information, contact your local Intel office.

When it is impossible for you to use the services of an Intel Customer Engineer or when Intel service is not available in your local area, you may contact the Intel Service Center directly, at one of the following numbers:

Telephone:
From Alaska or Hawaii call—
(408) 987-8080
From locations within California call toll free—
(800) 672-3507
From all other U.S. locations call toll free—
(800) 538-8014
TWX: 910-338-0026
TELEX: 34-6372

Never return equipment to Intel for service or repair before you contact an Intel Customer Engineer or the Intel Service Center.

If return of your equipment is necessary, you will be given a Repair Authorization Number, shipping instructions, and other important information that will help Intel provide you with fast, efficient service. If the product is being returned because of damage sustained during shipment, or if the product is out of warranty, a purchase order is necessary in order for the Intel Service Center to make the repair.

When preparing the product for shipment to the Service Center, use the original factory packaging material, if available. If the original packaging is not available, wrap the product in a cushioning material such as Air Cap TH-240, manufactured by the Sealed Air Corporation, Hawthorne, N.J. (or equivalent) and enclose in a heavy-duty corrugated shipping carton. Seal the carton securely, mark it "FRAGILE" to ensure careful handling, and ship it to the address specified by the Intel Service Center.

NOTE

Customers outside of the United States should contact their sales source (Intel Sales Office or Authorized Intel Distributor) for directions on obtaining service or repair assistance.

U.S. AND CANADIAN OFFICES

ALABAMA
Intel Corp.
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TWX: 910-595-1114

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Bldg. 1, Suite 260
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TWX: 910-931-2289

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Orlando 32804
Tel: (305) 628-2393
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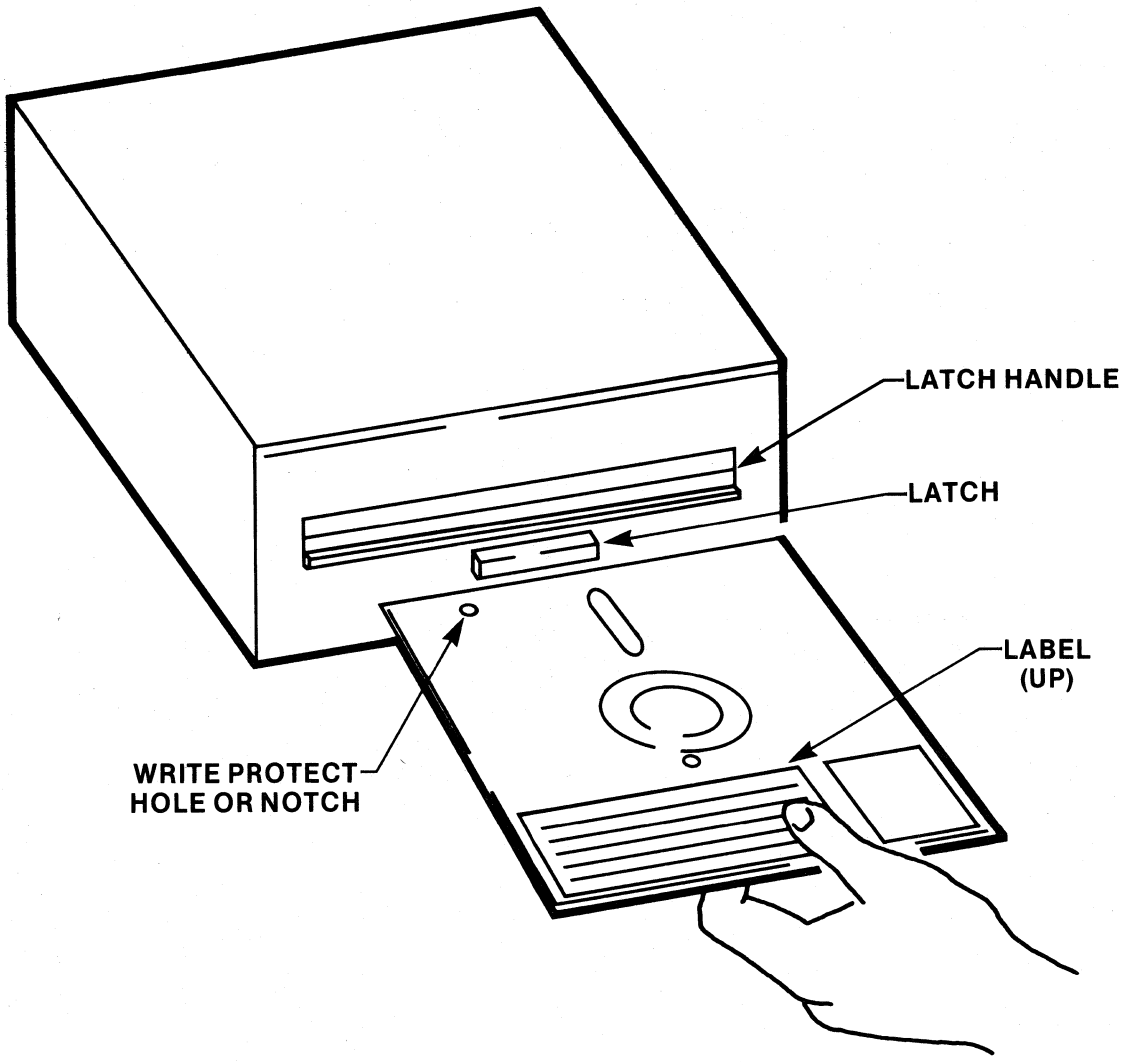
INSTALLING A DISKETTE INTO A DRIVE ASSEMBLY

To load a diskette, perform the following:

1. Press power on switch to the on position.
2. Remove diskette from protective cover.
3. Press latch.
4. Insert diskette with label facing up.
5. Move latch handle down.

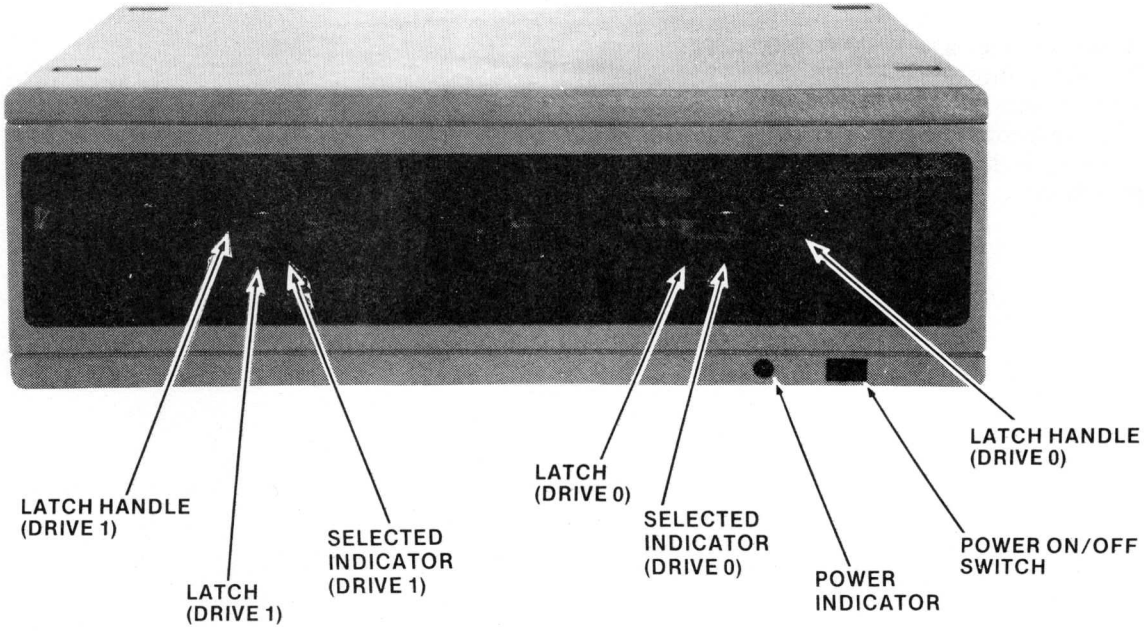
NOTE

When writing to the diskette is to be done, place a metallic tab over the hole or notch. If writing to the diskette is to be inhibited, remove metallic tab.



DISK DRIVE UNIT CONTROLS AND INDICATORS

CONTROL/INDICATOR	FUNCTION
POWER ON/OFF SWITCH	Controls AC power to the power supply.
Power indicator	Lights when DC power is applied.
Selected indicator	Lights when drive is selected.
Latch	Depressing the latch opens the diskette receiver cavity permitting the insertion or removal of a diskette.
Latch handle	Pulling the latch handle down causes the spindle hub to engage clamping the diskette to the spindle.



DISK DRIVE SUBSYSTEM CHECKOUT PROCEDURE

Checkout of the disk drive subsystem requires usage of an operational Intellec® system and a formatted diskette containing ISIS and a diskette diagnostic test. This procedure assumes that the Intellec system is functioning properly. Refer to the appropriate Intellec Installation and Service Manual for information concerning checkout procedures for a given system.

To checkout the disk drive subsystem, perform the following:

1. Press the power on switch on the disk drive front panel.
2. Turn system power on.
3. Insert the diskette containing ISIS.
4. Load ISIS into memory as follows:

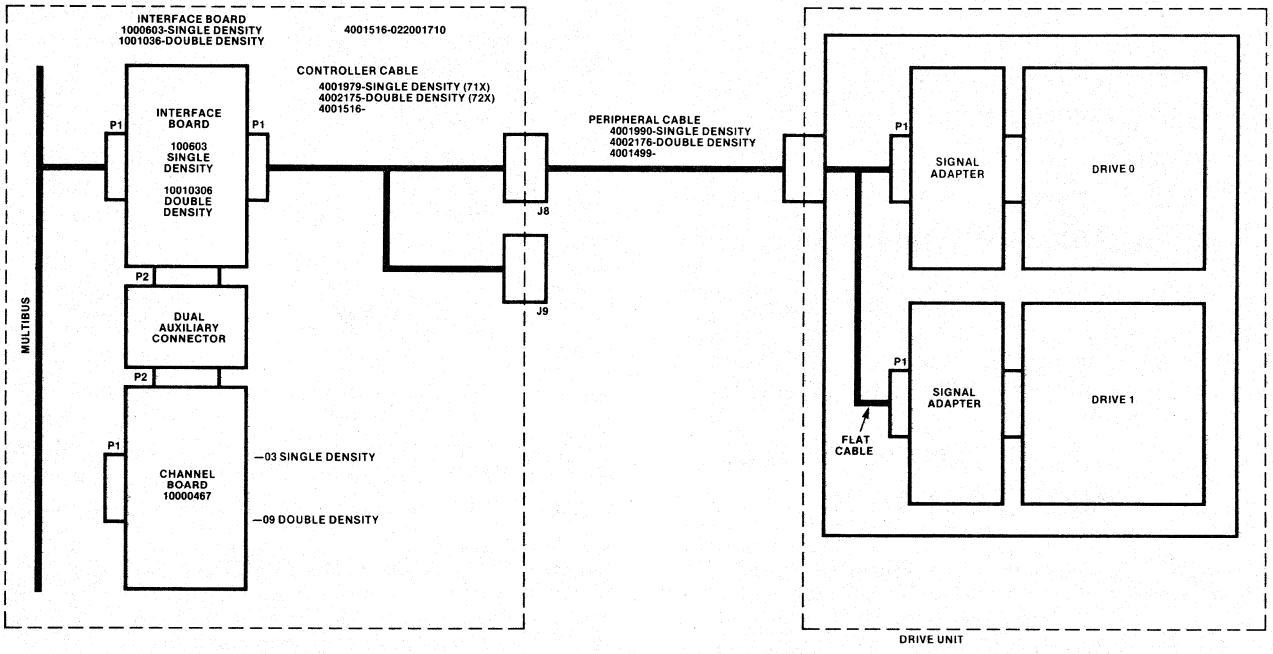
   For a Series II, this is accomplished by pressing the RESET switch.

   For an 800, this is accomplished by

   a. Turn power on.
   b. Press top half of the BOOT switch.
   c. Press top half of the RESET switch.
   d. Press the space bar on the control console.
   e. Press the bottom half of the BOOT switch.

A sign-on message is displayed indicating that the disk drive subsystem is functioning properly. If the sign-on message is not displayed, refer to the Troubleshooting Flow Chart. If more extensive checking is desired, refer to Diskette diagnostics call procedure.

All interfacing between the low profile disk drive unit and the controller Interface board is accomplished with two cables; Peripheral and Controller. The Peripheral cable interconnects the drive unit and either the Intellec® Series II or the 800. The Controller cable routes the signals from the rear panel of the host computing system to the Interface board.



CHANNEL BOARD FUNCTIONAL DESCRIPTION

The Diskette controller consists of a Channel Board and an Interface Board.

The Channel Board receives, decodes, and responds to channel commands from the host processor of the Intellec® MultibusTM Bus system. It accesses system memory to determine the specific diskette operation to be performed and fetches the required parameters. Results of the completed operation including error conditions are monitored and retained by the Channel Board and transferred to the host processor upon command (i.e., Read result byte).

The Channel Board is divided into six functional logic groups:

- Channel Command logic
- Micro Control logic
- Microprogram Memory logic
- Central Processing Element
- Data/Clock Shift Register logic
- Data Flow Control logic

CHANNEL COMMAND

The Channel Command logic decodes one of six possible channel commands issued from the CPU upon recognition of its channel address. It transfers three decoded bits (ADR0 through ADR2) to the Micro Control Unit.

MICRO CONTROL

The Micro Control logic decodes these three bits which specify either a channel command (read or write) or the three least significant data outputs from the Central processing element. These two groups of three bits determine the microprogram routine to be executed. The Micro Control generates a nine-bit address to the Microprogram Memory logic in order to fetch the appropriate microprogram routine. The Microprogram Memory logic returns two flag control signals and seven address control signals which determines the address of the next microinstruction to be fetched and executed.

MICROPROGRAM MEMORY

The Microprogram Memory logic stores 512 x 32-bit microinstructions. Nine bits of the microinstruction word are issued back to the MCU. Seven bits (F0 through F6) are issued to the CPE logic to specify the function to be performed. The other sixteen bits of the microinstruction word performs a variety of control functions.

CENTRAL PROCESSING ELEMENT

The Central Processing Element logic is an 8-bit processor. It receives data from the Data Flow Control logic and the Data/Clock Shift Register and receives status information from the Interface Board. It manipulates three various data types as determined by both the function and mask control bits generated from the Microprogram Memory logic. The results of the data manipulation are routed either as the eight most significant system address signals ADR8 through ADRF) or the eight CPE data lines (D0 through D7). D0 through D7 signals are available to the MCU, the shift register, and the Data Flow Control logic.

DATA/CLOCK SHIFT REGISTER

The Data/Clock Shift Register accepts serial data from the serial data synchronization logic on the Interface Board and parallel loads the data into the CPE during read operations for subsequent transfer to the CPU.

During write operations, the parallel input (clock or data) from the CPE via the D0 through D7 lines are serially shifted out to the Interface Board via the SR DATA OUT and SR CLK OUT lines.

DATA FLOW CONTROL

The Data Flow Control logic routes data from the CPE via D0 through D7 lines to either the eight least significant address lines (ADR0 through ADR7) or to either the lower (DATA 0 through DATA 7) or the upper (DATA8 through DATA F) lines of the data bus. It also routes data from both halves of the data bus via the eight memory data input lines (MD0 through MD7).

INTERFACE BOARD FUNCTIONAL DESCRIPTION

The Interface Board receives a series of instructions from the Channel Board to 1) establish a communications path with the CPU, 2) generate a drive selection signal, 3) generate signals to the selected drive for controlling head movement, 4) generate the required timing signals for modified frequency modulation (M^2FM), and 5) transfer data either to or from the disk drive.

The Interface Board is divided into five functional logic groups.

- Bus Control
- Disk Drive Control
- Write Clock Generator
- Serial Data/Clock Synchronization Logic
- Cyclic Redundancy Check (CRC) Generator/Checker

BUS CONTROL LOGIC

The Bus Control logic establishes and maintains master control of the Intellec® Multibus™ Bus. It acknowledges receipt of CPU issued read and write commands, sets the Busy flag, and, in turn, generates the appropriate read or write command that permits access to system memory. These write and read commands determine the direction of data flow. During write operations, data is transferred to the selected drive with bit 0 of each byte transferred first and bit 7 transferred last. During read operations, data is transferred from the selected drive with bit 0 transferred first.

DISK DRIVE CONTROL LOGIC

The Disk Drive Control logic decodes the Decoded output and Mask bits from the Channel and generates those signals to the disk drive that result in drive selection, head loading/unloading, and the head motion signals (direction and step). It also monitors the drive status signals such as ready, index, and track 00.

WRITE CLOCK GENERATOR

The Write Clock Generator generates the modified frequency modulation timing signals for clock and data bit cell periods. It includes a precompensation circuit which compensates for the undesirable tendency of magnetic dipoles (recorded data) to shift their positions in time, from positions of higher density to those of lower densities.

SERIAL DATA/CLOCK SYNCHRONIZATION LOGIC

The Serial Data/Clock Synchronization logic receives read data from the selected disk drive. This read data is used to synchronize a phase lock oscillator output to the rotational speed of the diskette to permit valid separation of data and clock. The Synchronization logic examines the data looking for specific bit patterns which identify address marks. These address marks precede address and data fields in accordance with the track format standard. This logic also includes a counter that determines when a data byte has been routed to or from the selected drive. Once a data byte is received from the drive, the separated clock and data pulses are serially shifted into a register on the Channel Board for subsequent parallel loading back to the CPU. For additional information, refer to the *Diskette Operating System Hardware Reference Manual.*

CYCLIC REDUNDANCY CHECK (CRC) GENERATOR/CHECKER

The CRC Generator generates two bytes (16 bits) resulting from the write data bits shifted through the generator. These two CRC bytes are appended to the end of each address and data field during format and write operations. During a read operation, the read data is shifted through the generator along with the two CRC bytes to verify the validity of the written data. A recorded data error during a write operation or the inability to detect a bit during a read operation, results in a CRC error. A CRC error condition is made available to the CPU after a read operation has been performed.

DRIVE FUNCTIONAL DESCRIPTION

The Disk Drive rotates a diskette at 360 rpm via a belt-drive scheme, detects rotational speed of the diskette, and responds to control signals from the Interface Board.

The Disk Drive is divided into three functional logic groups:

- Control logic
- Write logic
- Read logic

CONTROL LOGIC

The Control logic determines the rotational speed of the diskette and the beginning of each track by detecting the index mark on the rotating diskette. When the diskette has reached rotational speed and the Interface Board activates a unique drive select line, the drive responds with its Ready signal back to the Interface Board. The activation of the Drive Select signals enables power to the head positioning actuator, enables the input lines, and activates the output lines. Upon command from the Interface Board, the Control logic positions the read/write head one track at a time in a direction determined by the logic level of the DIRECTION signal. A positive logic level on the DIRECTION line causes the read/write head to be positioned one track for each pulse of the STEP signal in a direction away from the center of the diskette. The LOAD head signal from the Interface Board causes the diskette to come in contact with the read/write head.

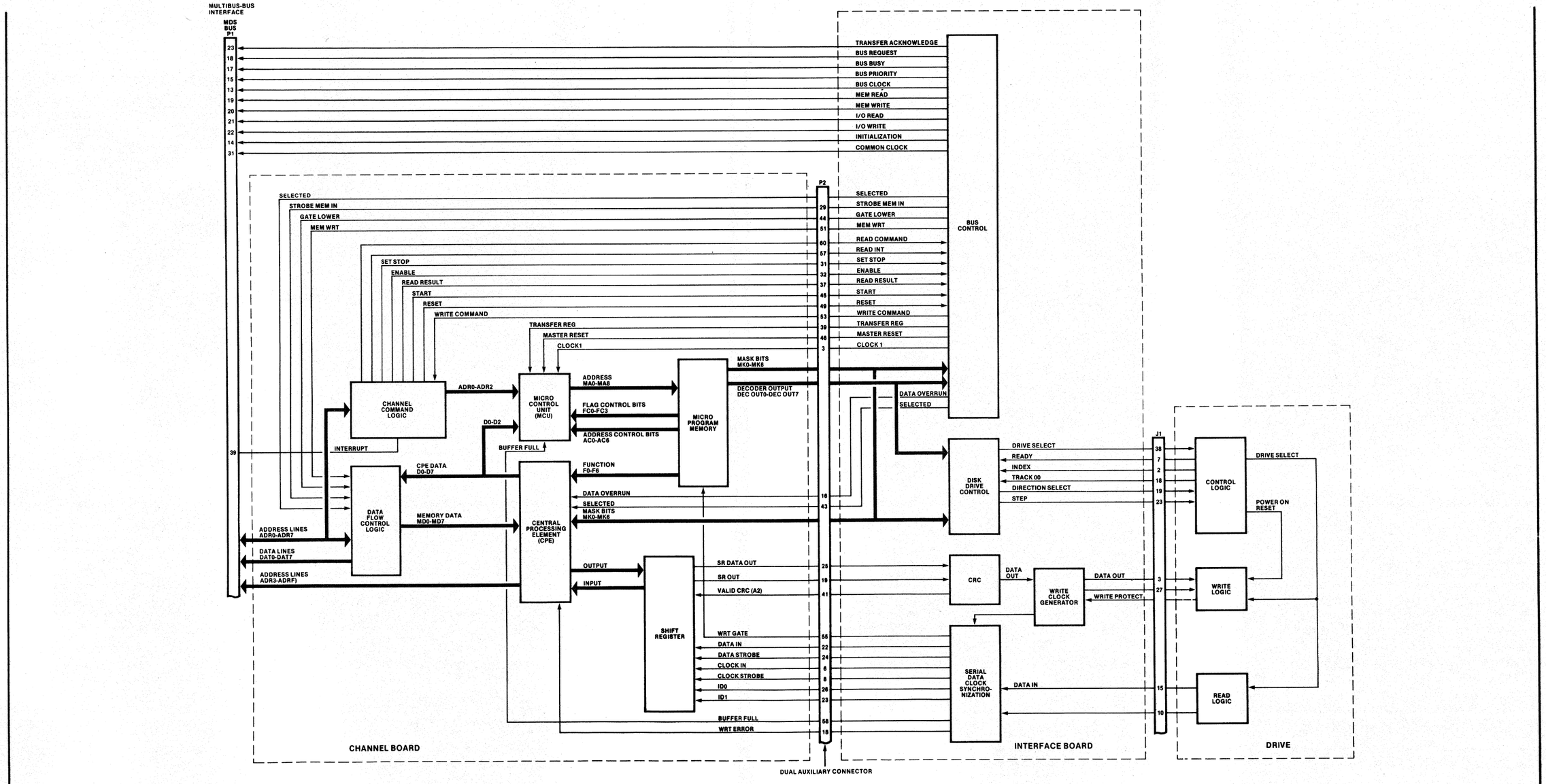
WRITE LOGIC

Once the head has been positioned and the head is loaded, a write operation may commence (if the diskette is not write protected) by activating WRITE GATE. Writing on a write protected diskette results in an error condition. When a diskette is not write protected and WRITE GATE signal has been activated, the Write logic responds to the WRITE DATA by causing current to flow through the read/write head first in one direction and then the other in accordance with the write data pulses from the Interface Board.

READ LOGIC

Whenever the head is loaded and the drive is not writing, it is reading. The Read logic detects the flux transitions from the diskette and amplifies the induced current to a detectable voltage level. This level is routed back to the Interface Board as READ DATA.

DISKETTE SUBSYSTEM FUNCTIONAL BLOCK DIAGRAM



Successful preventive maintenance requires the implementation of a systematic inspection and maintenance program performed at regularly scheduled intervals. The recommended preventive maintenance schedule is at 12 month intervals.

UNIT	FREQ. MONTHS	CLEAN	OBSERVE
Read/Write Head	12	Clean Read/Write Head ONLY IF NECESSARY	Oxide build up
R/W Head Load Button	12*	Replace	
Stepper Motor and Lead Screw	12 12	Clean off all oil, dust, and dirt	Inspect for nicks and burrs
Belt	12		Frayed or weakened areas
Base	12	Clean base	Inspect for loose screws, connectors, and switches
Read/Write Head	12		Check for proper alignment

*Assumes normal usage

PREVENTIVE MAINTENANCE PROCEDURE

To perform preventive maintenance, proceed as follows:

1. Turn power off (system and drive).
2. Remove six socket head cap screws and remove top cover.
3. Inspect heads for evidence of oxide build-up. If oxide is present, clean heads using cotton swab dampened with 91% isopropyl alcohol.
4. Inspect for evidence of worn (glazing) or defective head load pad. Replace worn or defective head load pad.
5. Inspect head lead screw for dirt or oil. Clean head lead screw using clean lint-free cloth.
6. Inspect for evidence of broken or loose connections. Repair or correctly install connectors.
7. Inspect drive belt for evidence of wear. Replace frayed belt.

NOTE

Lubrication of the drive is not recommended. Lubricants allow dirt to accumulate.

Corrective Maintenance is the systematic isolation of a malfunction to a specific cause and consists of troubleshooting, alignment, and assembly replacement. In digital data processing equipment, a failure can very often be isolated to a particular area by means of deductive reasoning about the symptoms of a malfunction. This approach can be substituted successfully in place of extensive signal tracing, at a considerable saving of time. The basic approach to corrective maintenance is to run a diagnostic test program or subroutine of that program repeatedly to determine all of the malfunctioning conditions. After the Diskette subsystem has been isolated as the cause of the malfunction, problems can be further isolated by following the troubleshooting flow chart. Perform the indicated operation, and then, either perform the recommended alignment procedure listed for the error encountered or replace the defective component listed as the probable failing assembly. Prior to performing the response indicated in the troubleshooting flowchart, perform the power supply voltage check. Out of tolerance voltage will cause apparent drive malfunctions.

POWER SUPPLY VOLTAGE CHECK

Using a VTVM, check the power supply outputs on either J1 or J2.

Pin 1 - +24±1.2V DC

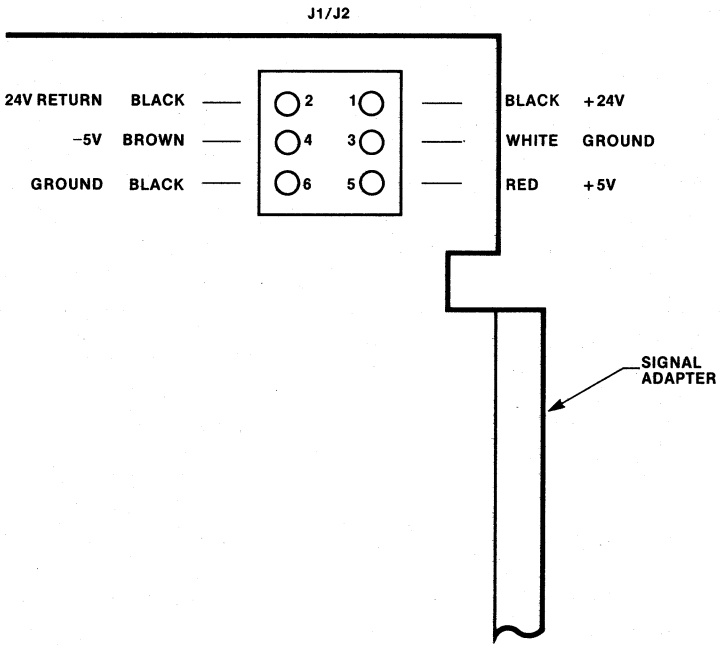
2 - 24V return

3 - Common

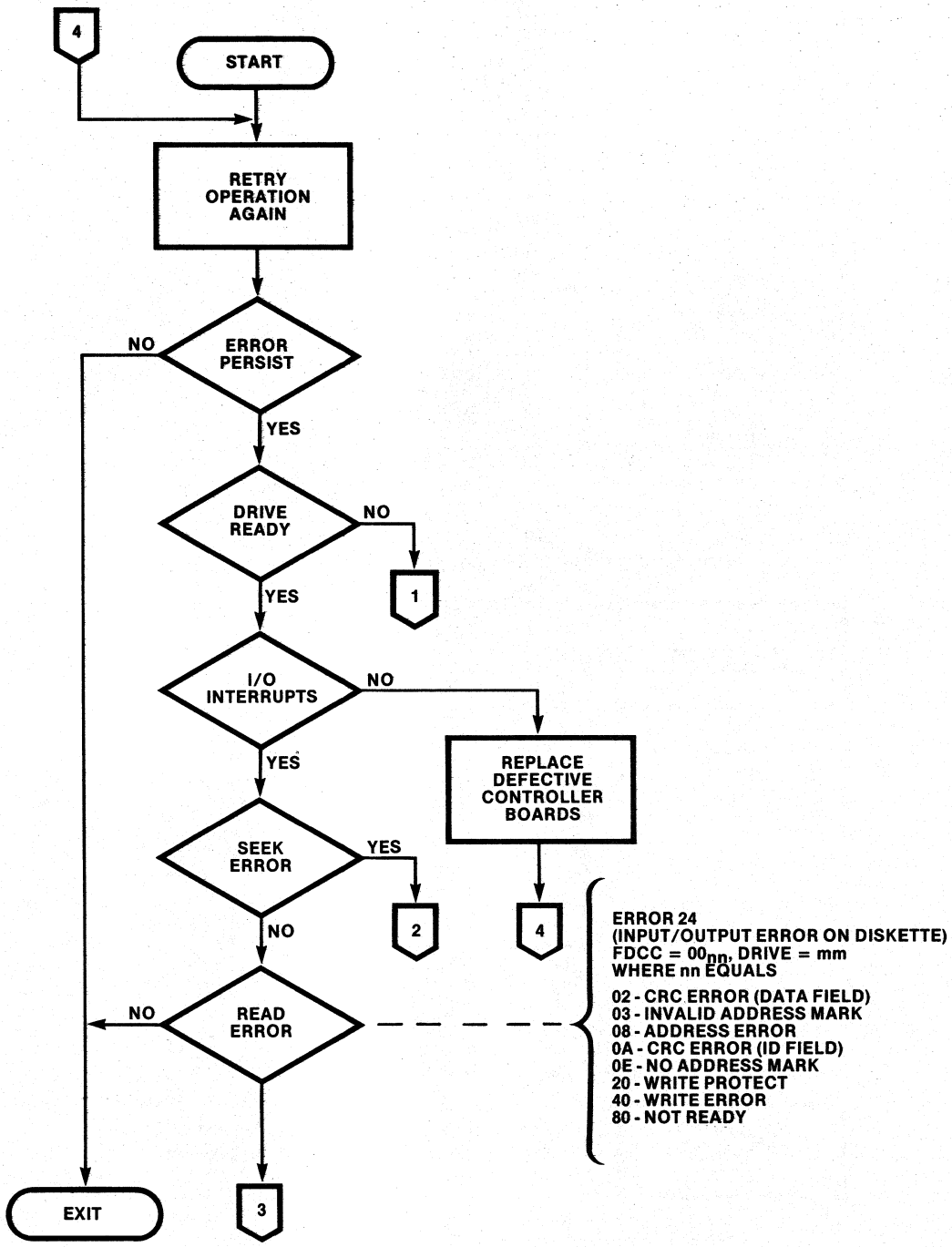
4 - −5±0.25V DC

5 - +5±0.25 V DC

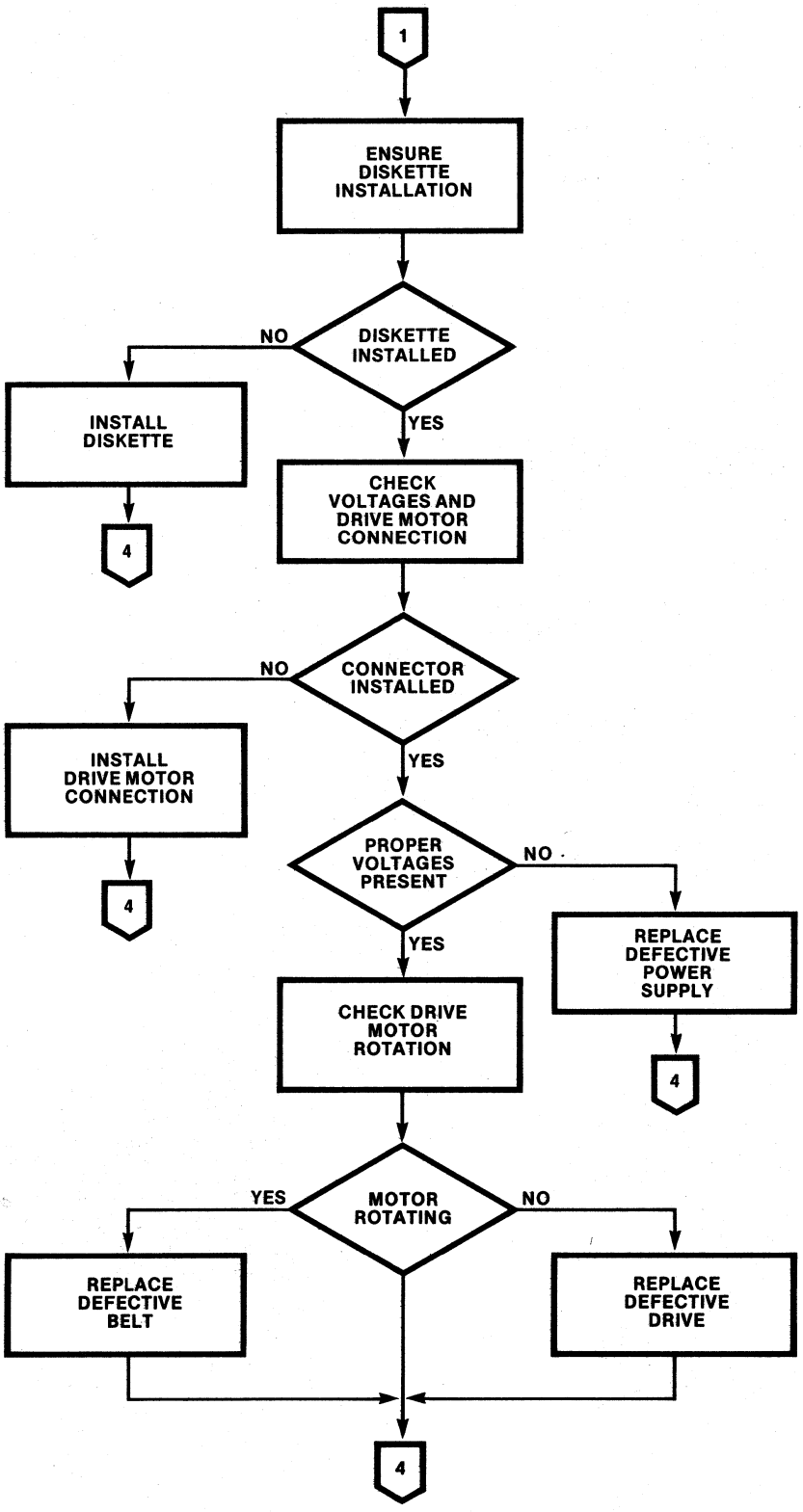
6 - Common



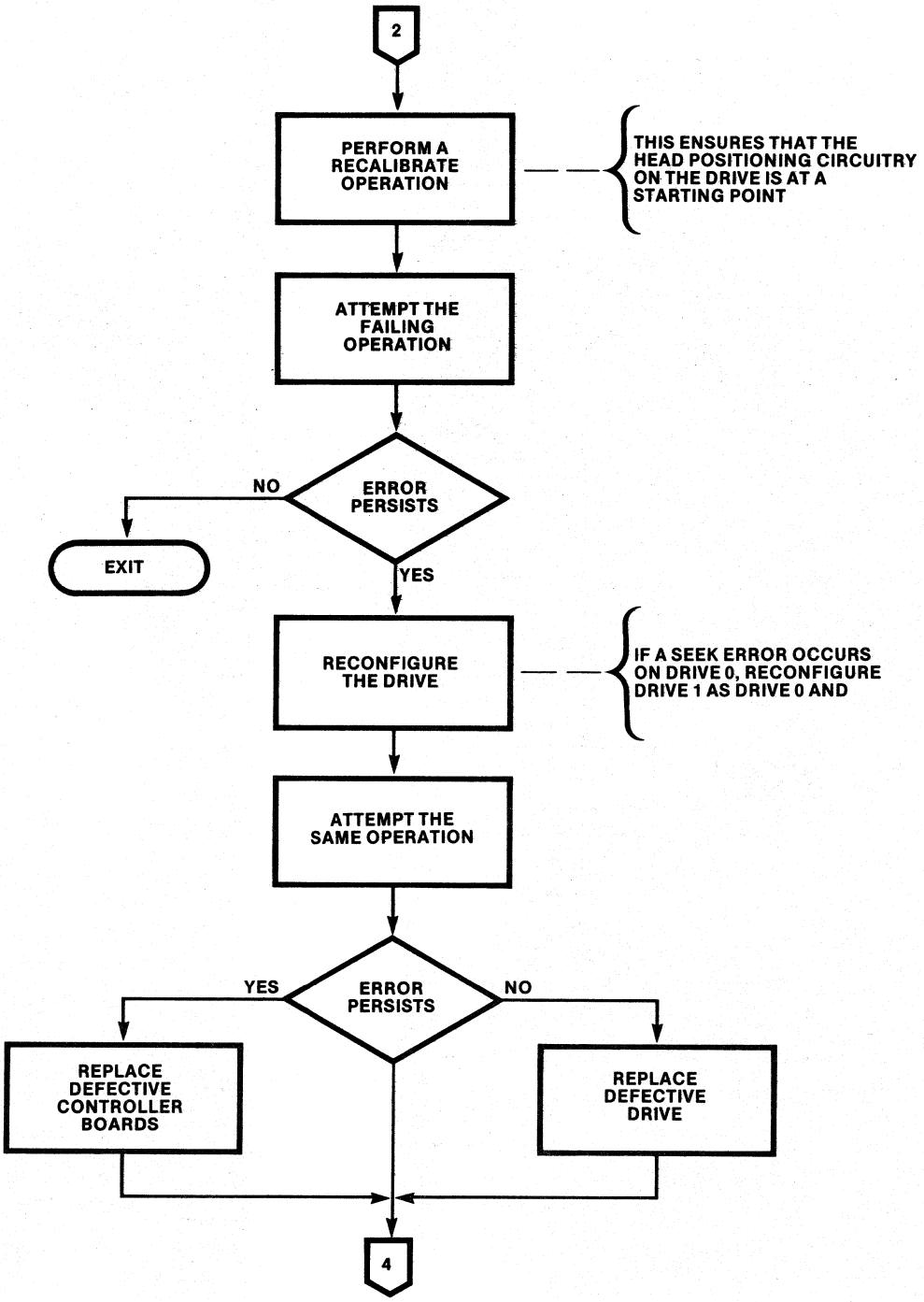
TROUBLESHOOTING FLOW CHART



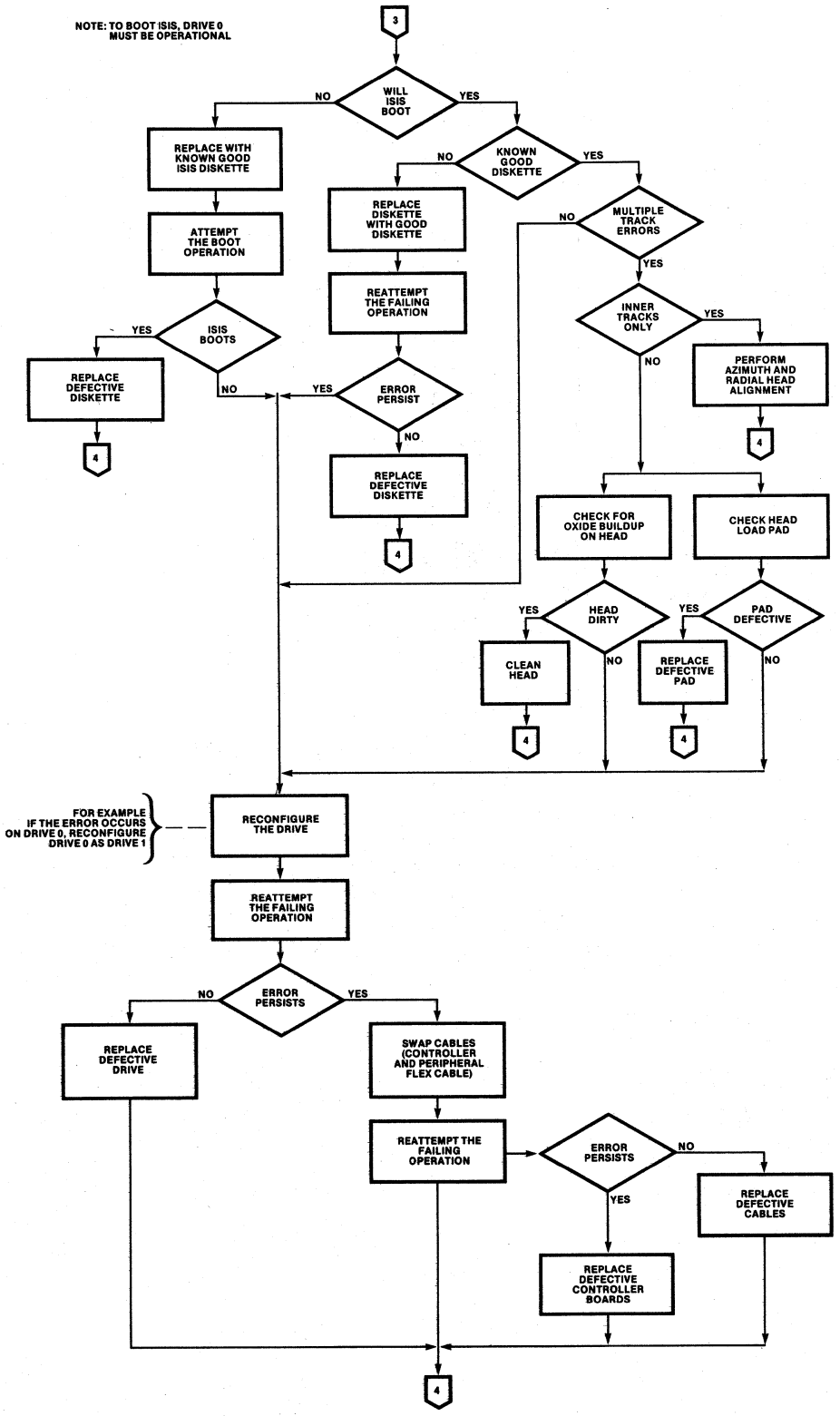
TROUBLESHOOTING FLOW CHART (Continued)



TROUBLESHOOTING FLOW CHART (Continued)



TROUBLESHOOTING FLOW CHART (Continued)



ALIGNMENT PROCEDURES

The alignment procedures for the disk drive consist of:

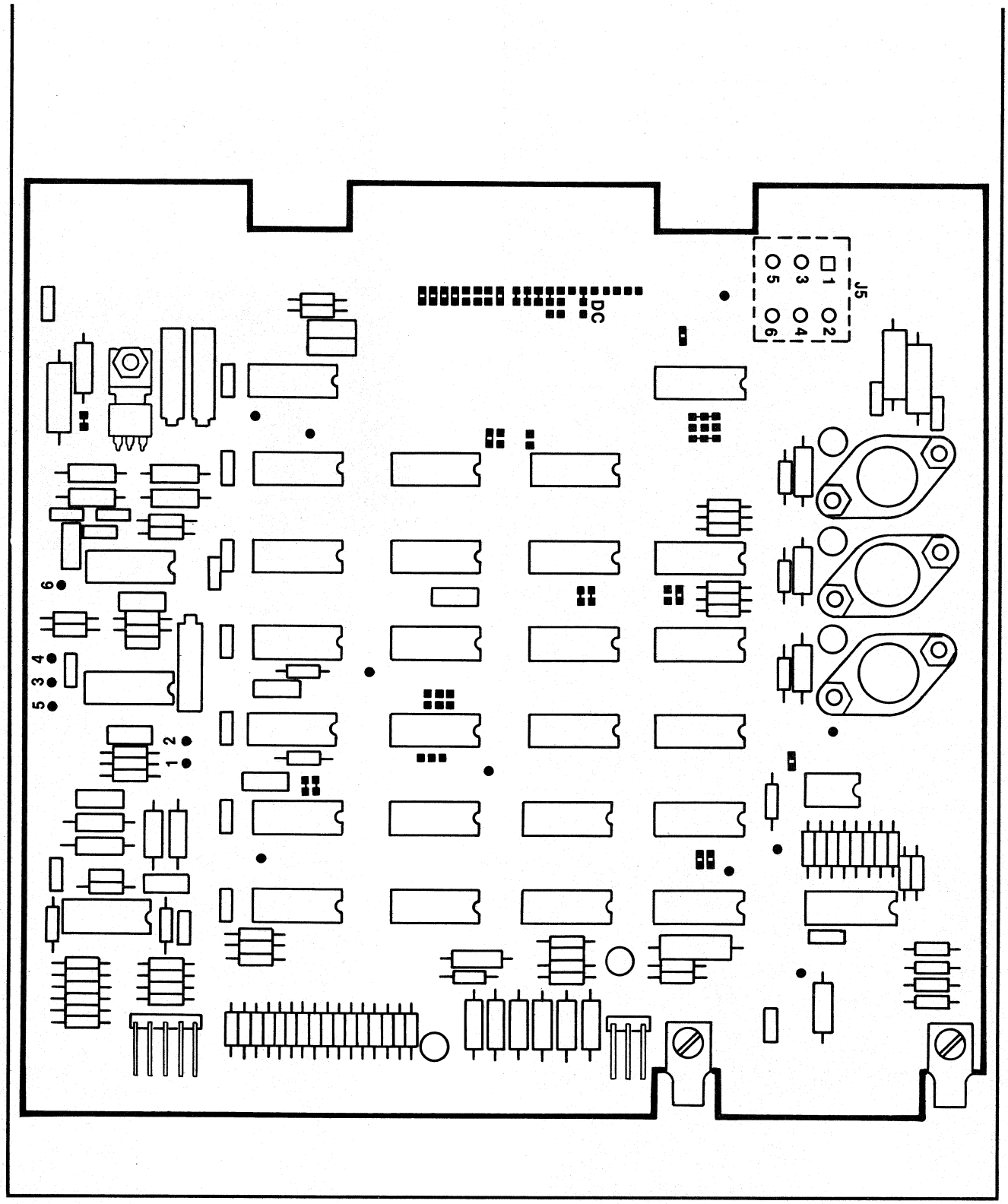
These procedures are to be used

1. during preventive maintenance inspection,
2. when indicated as a remedy for a specific troubleshooting symptom and
3. after replacement of a drive component which requires alignment.

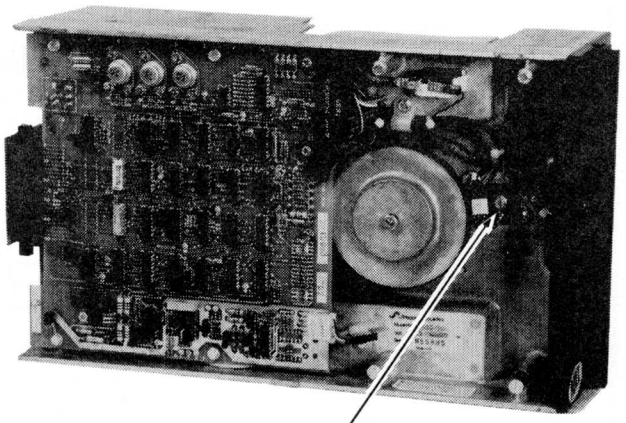
DISKETTE DIAGNOSTIC PROCEDURE

PROCEDURE	REMARKS
1. Remove diskette, remove power and extend drive chassis over table edge to gain access to screws in bottom of chassis.	a. Press door release b. Press power on switch c. Remove AC power cord. **CAUTION** Exercise care to prevent equipment from falling off of the table.
2. Remove four screws located on bottom of chassis.	
3. Remove six socket head cap screws securing the top cover to the chassis and remove the top cover.	
4. Close door latch and lift drive from chassis. Then carefully rotate the drive assembly positioning it such that the test points on the PC board are accessible.	
NOTE Adapter cable P/N 4002621 should be installed in series with AC and DC power for improved access.	**NOTE** If drive 0 is being removed, disconnect the connector to the fan. This connector does not have to be removed if drive 1 is being removed.
5. Apply power to system.	a. Press power on switch on drive chassis. b. Press power on switch on Series II (turn key to on for Model 800)
6. Install a formatted diskette with ISIS program. Call ISIS.	For Model 800 Press upper BOOT switch Press RESET switch Enter via keyboard: space bar Press lower BOOT switch For Series II Model 220 and 230 press RESET. For Series II Model 210 press Space bar. Display monitor displays SERIES II MONITOR Vx.y where; x = version y = release
7. Call diskette program	Call directory to ascertain diskette filename. Enter via keyboard; DIR I c/r monitor displays all files contained on the diskette. Enter via the keyboard the diskette filename. (HELP will define available commands and their format.)
8. After the ready prompt (*) appears, select the drive to be accessed.	Enter via keyboard; S0 for drive 0, S1 for drive 1, S2 for drive 2, etc.
9. Step to track 4C HEX and perform a continuous read operation. After asterisk (*) appears, open door, remove formatted diskette.	Enter via keyboard: RK 4C,1 c/r.

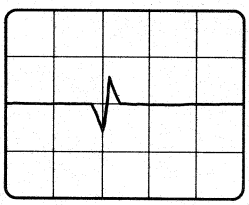
TEST POINT LOCATION DIAGRAM



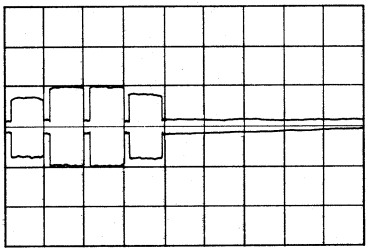
INDEX PULSE ALIGNMENT PROCEDURE

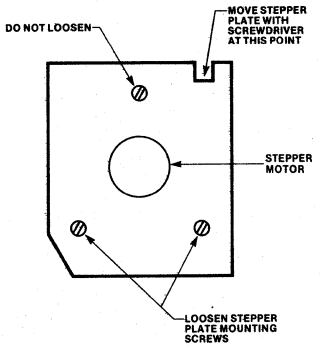
PROCEDURE	REMARKS
10. Insert alignment diskette.	
11. Connect probe between CH A and TP12 on drive board.	
12. Set oscilloscope controls to observe waveform.	a. CH A NORM - DC- vertical-2V/DIV b. TIME BASE - 5ms/DIV c. SYNC -INTERNAL d. LEVEL - pull out for neg. (−).
13. Verify negative going pulse with a pulse width of 1.7±.5ms	
14. If pulse width is not within tolerance, adjust potentiometer located on the Index/sector phototransistor until it is within tolerance.	 SECTOR/INDEX PHOTOTRANSISTOR POTENTIOMETER
15. Remove alignment diskette and perform burst to index alignment procedure.	

BURST TO INDEX ALIGNMENT PROCEDURE

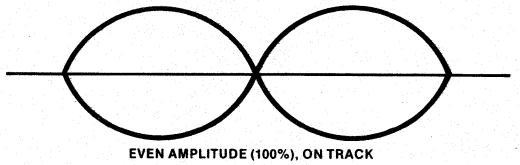
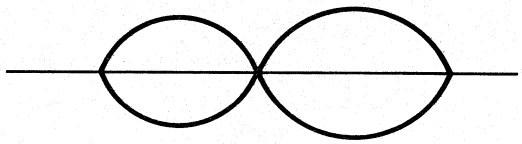
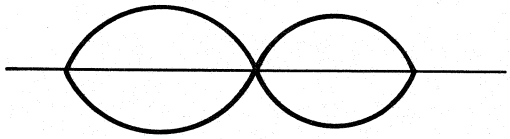
PROCEDURE	REMARKS
1. Connect probe between CH A and TP1 on drive board.	
2. Connect probe between CH B and TP2 on drive boad.	
3. Connect probe between SYNC and TP12 on drive board.	
4. Set up oscilloscope controls to observe waveform	a. CH A NORM-AC-VERT-500mV/DIV b. CH B INVERT -AC- VERT - 500mV/DIV c. TIME BASE - 50 us/DIV d. ADD
5. Insert formatted diskette.	
6. Step to track 1.	Enter via keyboard; RK1,1 c/R
7. Remove formatted diskette	
8. Install alignment diskette.	
9. Verify that the elapse time between the start of the sweep and the first data pulse is 200 ±100 us.	
10. If not, loosen the screw holding the Index LED until it is just able to move and position the LED assembly to obtain the correct elapse time.	Insure that the LED assembly is against the registration surface on the base casting.
11. Tighten the mounting screw while monitoring the waveform.	If timing changes repeat adjustment
12. Remove alignment diskette.	
13. Insert formatted diskette.	
14. Step to track 4C HEX.	Enter via keyboard; RK4C,1 c/r.
15. Remove formatted diskette.	
16. Install alignment diskette.	
17. Recheck timing. If timing is not within tolerance, repeat steps 5 through 17.	

R/W HEAD AZIMUTH ALIGNMENT PROCEDURE

PROCEDURE	REMARKS
1. Connect probe between CH A and TP1 on drive board.	
2. Connect probe between CH B and TP2 on drive boad.	
3. Connect probe between SYNC and TP12 on drive board.	
4. Set up oscilloscope controls to monitor waveform	a. CH A NORM - vertical -⅛100mV/DIV b. CH B INVERT - vertical - 100mV/DIV c. TIME BASE - 20ms/DIV d. SYNC - EXT e. LEVEL - pull out for neg. (−). f. Adjust trigger level
5. Insert formatted diskette.	
6. Step to track 4C HEX.	Enter via keyboard; RK4C,1 c/r
7. Remove formatted diskette and insert alignment diskette.	
8. Verify that the two middle amplitudes appear equal and that the two outside amplitudes are less than the ones in the middle.	
9. If not, slightly loosen the two stepper plate mounting screws.	
10. Using a medium screwdriver, pry on the stepper plate until the two outside amplitudes are less than the middle two.	
11. Tighten the two stepper plate mounting screws.	
12. If either of the two outside amplitudes increase to greater than the two middle ones, repeat steps 9 through 12.	
13. Remove alignment diskette and insert formatted diskette.	
14. Step to track 0.	Enter via keyboard; RK0, 1 c/r
15. Remove formatted diskette and insert alignment diskette.	
16. Recheck amplitudes. If amplitudes are not within tolerance, repeat steps 8 through 12.	
17. Remove alignment diskette and perform the Index/sector alignment.	



R/W HEAD RADIAL ALIGNMENT PROCEDURE

PROCEDURE	REMARKS
1. Connect probe between CH A and TP1 on drive board.	
2. Connect probe between CHB and TP2 on drive boad.	
3. Connect probe between SYNC and TP12 on drive board.	
4. Set up oscilloscope controls to observe read data.	a. CH A NORM- vertical- 100mV/DIV b. CH B INVERT- vertical -100mV/DIV c. Time base- 20MS/DIV d. SYNC- EXT e. LEVEL pull out for neg. (−). f. Adjust trigger level.
5. Insert formatted diskette.	
6. Step to track 26.	Enter via keyboard; RK26, 1 c¾r
7. Remove formatted diskette and insert alignment diskette.	
8. Observe waveform. If the amplitude difference between the two lobes is less than 80% proceed to step 9. If the amplitude difference is equal or within 80%, proceed with Burst to Index alignment.	 EVEN AMPLITUDE (100%), ON TRACK  LEFT 60% OF RIGHT, + 2 MIL OFF TRACK TOWARD TK 0  RIGHT 60% OF LEFT, - 2 MIL OFF TRACK TOWARD 76
9. Loosen two mounting screws holding the motor clamp to the mounting plate.	
10. Slowly rotate the stepper motor until both lobes are within tolerance, then tighten the mounting screws.	
11. Repeat steps 5 through 8 approaching track 26 from both 0 and 4C.	

REMOVAL AND REPLACEMENT PROCEDURES

Component replacement procedures for the flexible disk subsystem involves the removal of the disk drive assembly from the chassis and the removal of the Interface and Channel Boards.

DISK DRIVE ASSEMBLY REMOVAL PROCEDURE

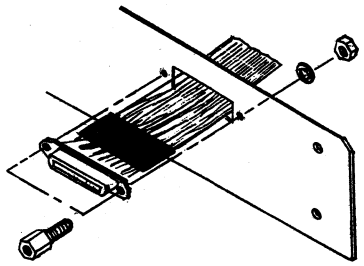
To remove the disk drive assembly, proceed as follows:

1. Remove diskette.
2. Turn drive power switch off.
3. Disconnect AC power cord.
4. Disconnect peripheral cable from disk drive unit.
5. Extend disk drive chassis over the table edge to gain access to screws on the bottom of the chassis.
6. Remove four screws securing drive assembly to chassis and reposition the drive unit back onto the table.
7. Remove six socket head cap screws (three in front and three in back) securing the top cover to the chassis and remove top cover.
8. To remove drive 0, disconnect connectors P1, P3, P10, and the fan connector.
9. To remove drive 1, disconnect connectors P2, P4, and P11.
10. Close the door latch and carefully lift the drive assembly from the chassis.

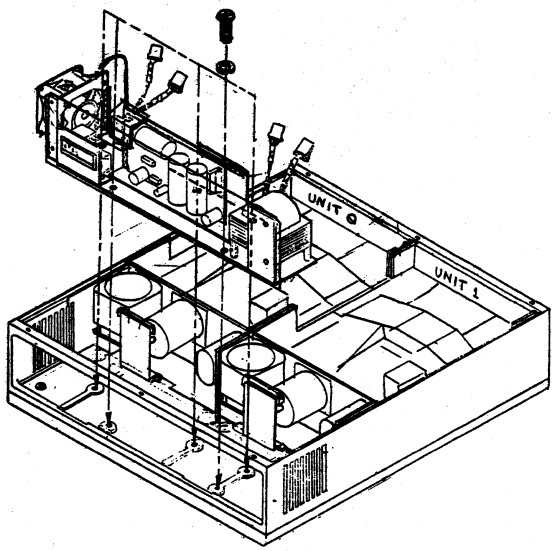
POWER SUPPLY REMOVAL PROCEDURE

To remove the power supply from the disk drive chassis, proceed as follows:

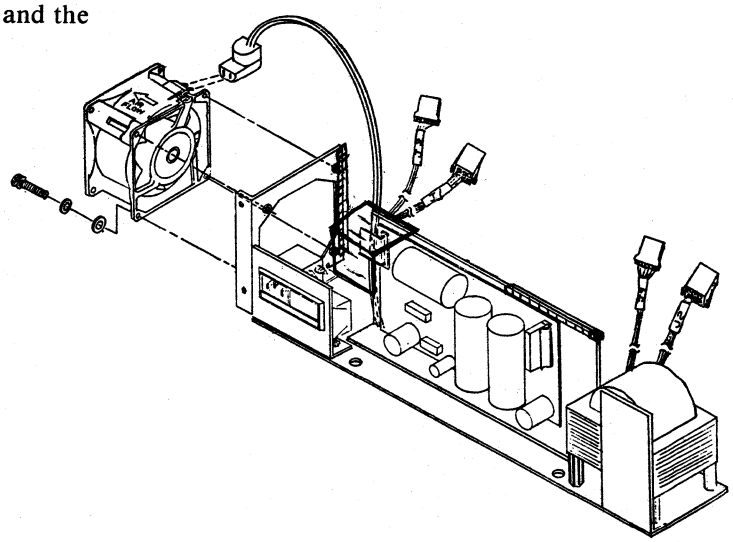
1. Turn power off (system and drive)
2. Disconnect AC power cord.
3. Disconnect Peripheral cable from drive chassis.
4. Remove four-632 x 3/8 pan head screws located on the rear panel.
5. Remove two- stand-off screws securing the flex cable connector to the rear panel and remove connector.



6. Disconnect connectors P1, P2, P3, P4, P5, and the fan connector.
7. Remove five-832 x 3/8 pan head screws securing power supply to the chassis.



8. Lift power supply from drive chassis.
9. Remove four-632 x 5/8 socket head cap screws securing the fan to the power supply.



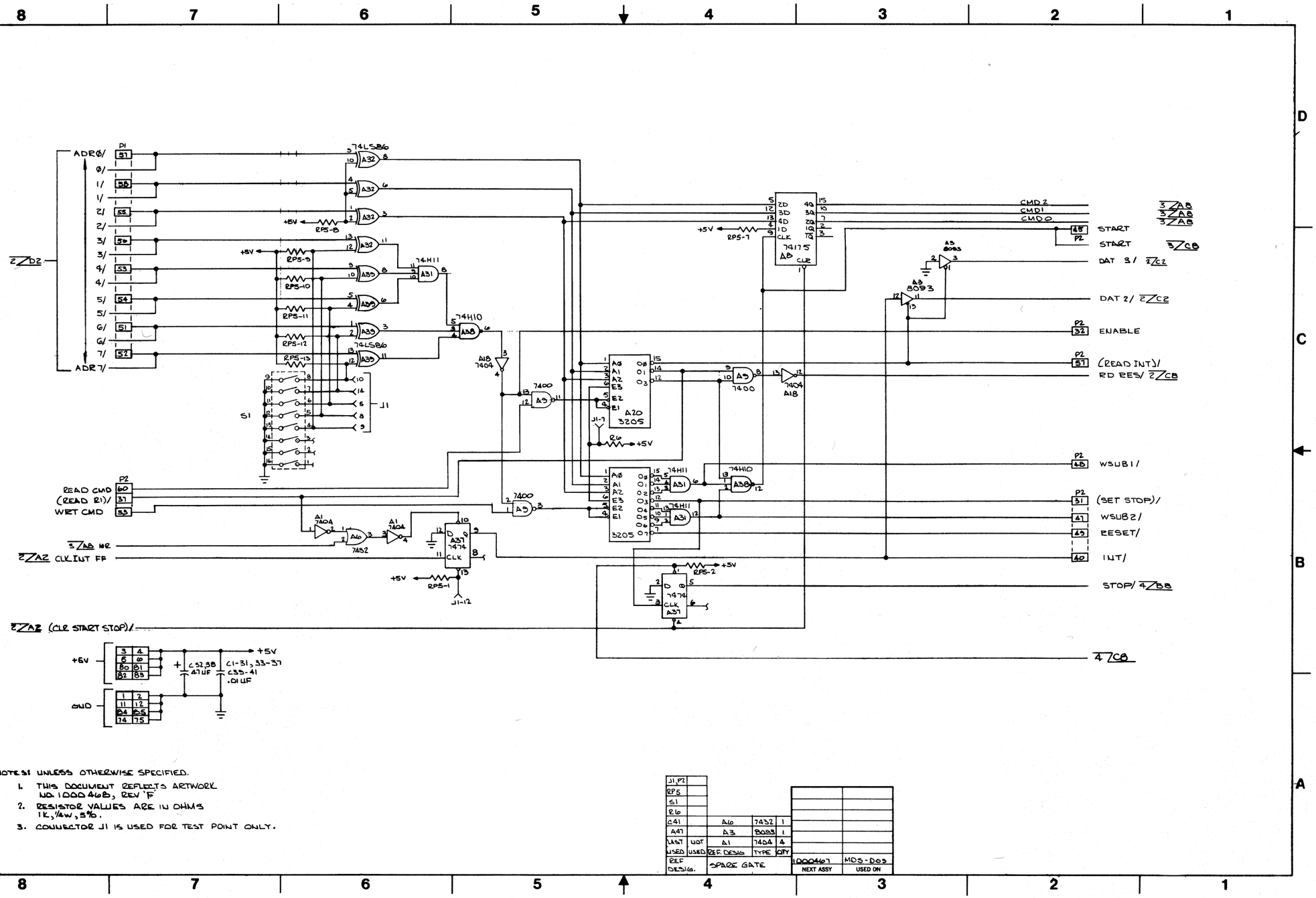
CONTROLLER BOARDS REMOVAL PROCEDURE

To remove the Disk drive subassembly Controller boards from the Intellec® 800, proceed as follows:

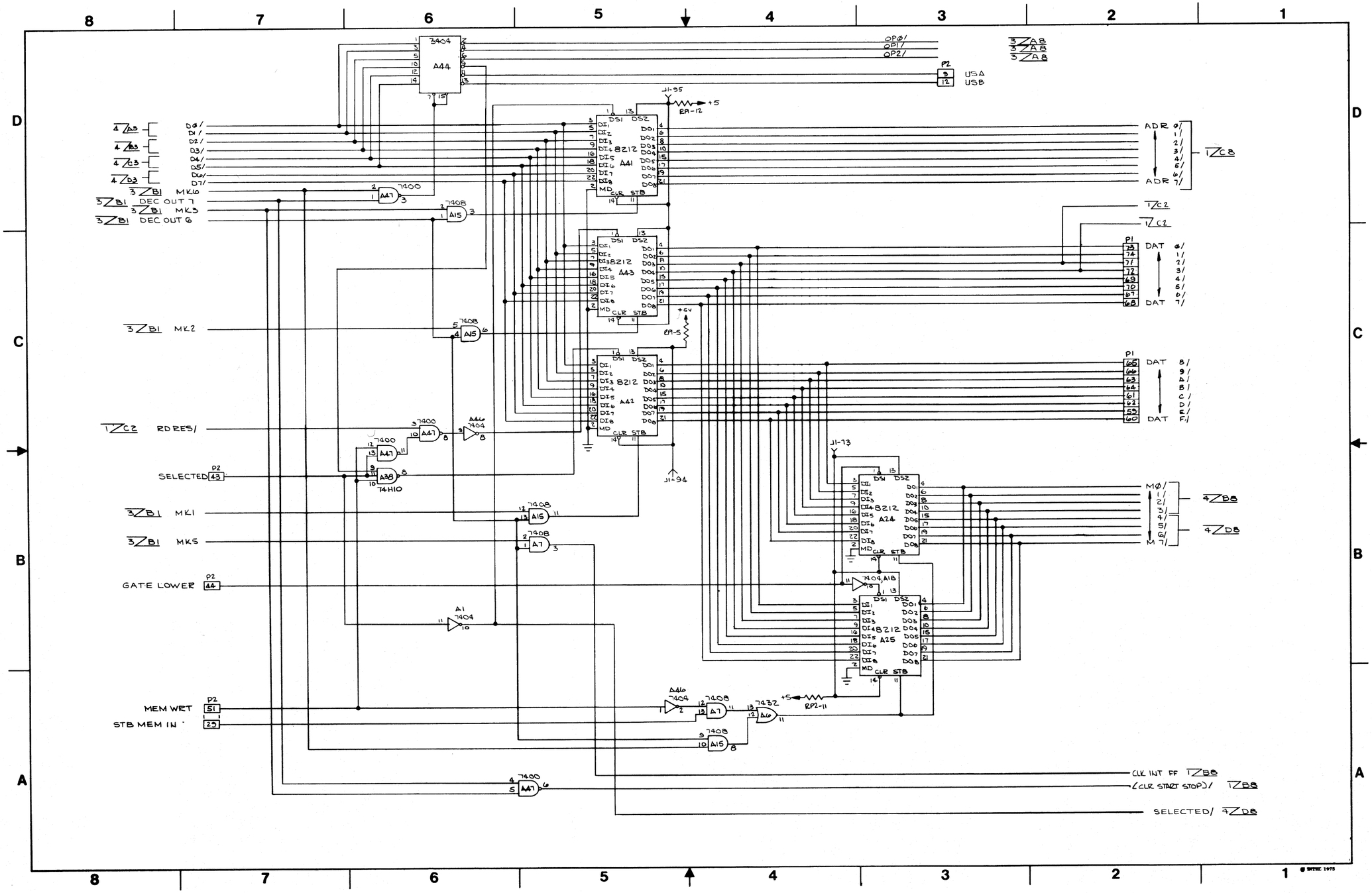
1. Remove top cover of the Intellec® 800 by turning four screws one-quarter turn and lift cover from chassis.
2. Using the ejectors, pull out on the Controller Boards.
3. Disconnect the dual auxiliary connector from both boards.

To remove the Disk drive Controller boards from the Intellec® Series II, proceed as follows:

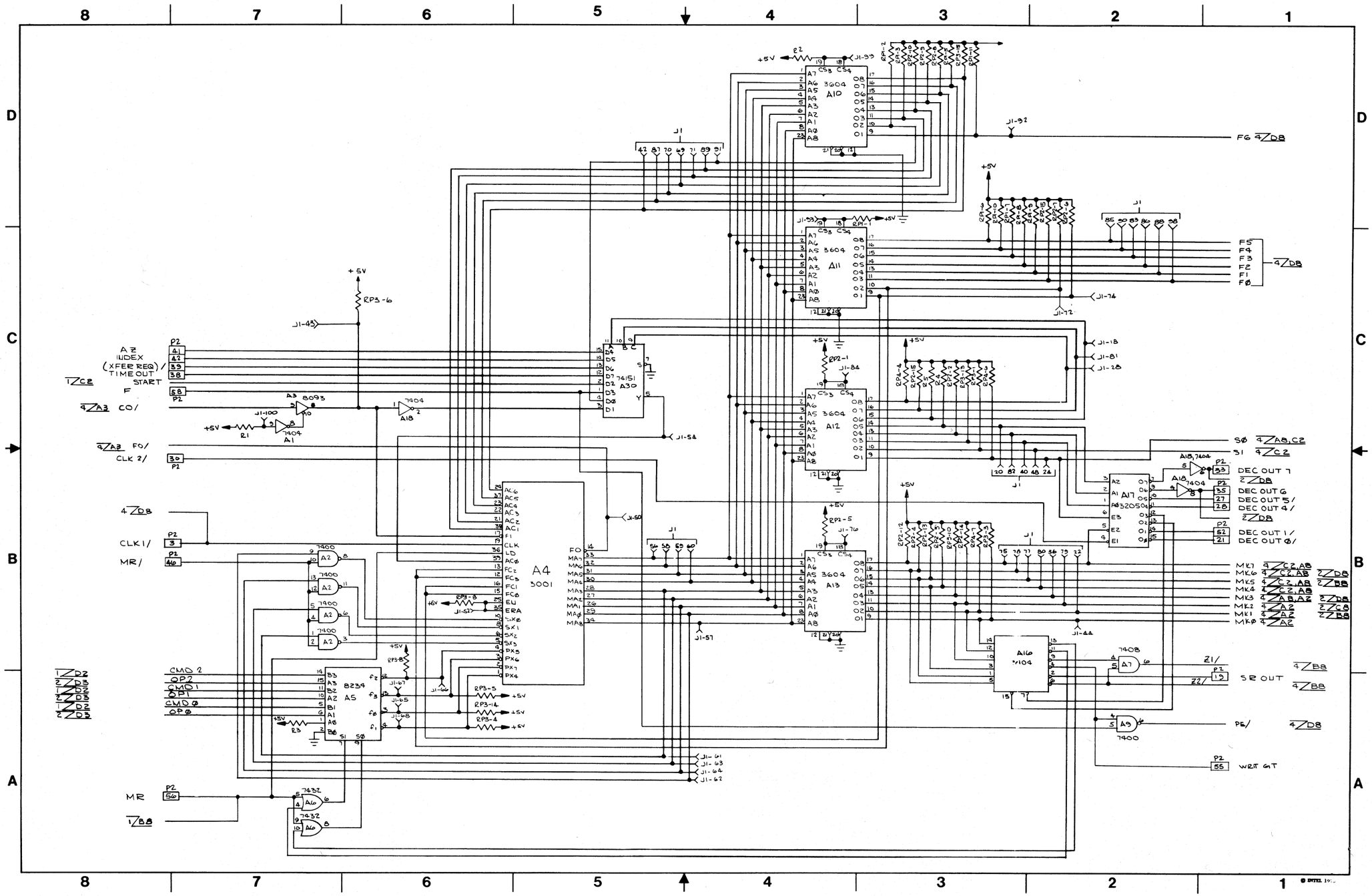
1. Remove front cover of the Intellec® Series II by turning two screws one-quarter turn and pull out from chassis.
2. Using the ejectors, pull out on Controller boards.
3. Disconnect the dual auxiliary connector from both boards.



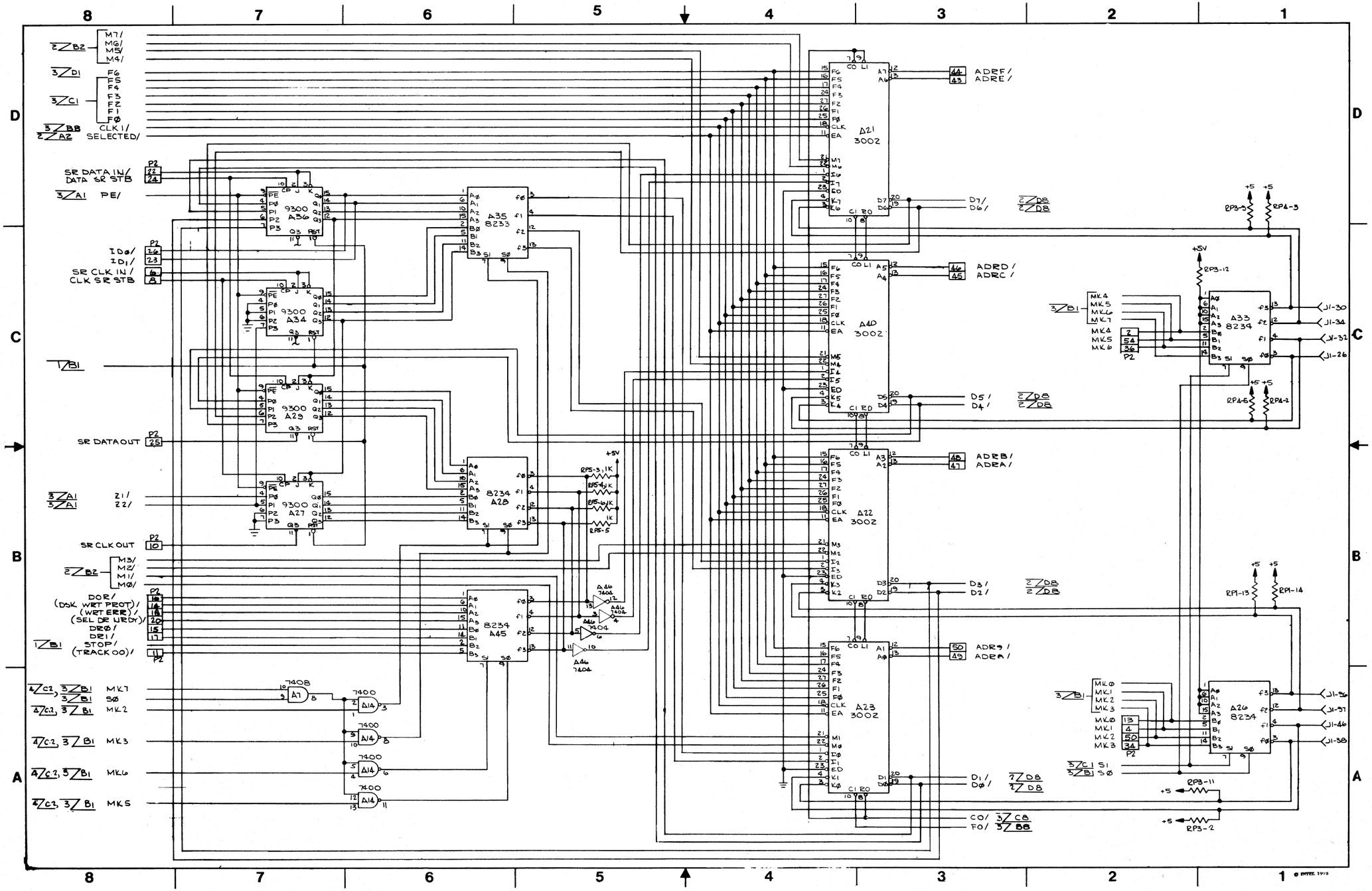
Floppy Disk Controller Channel Schematic (Sheet 1 of 4)



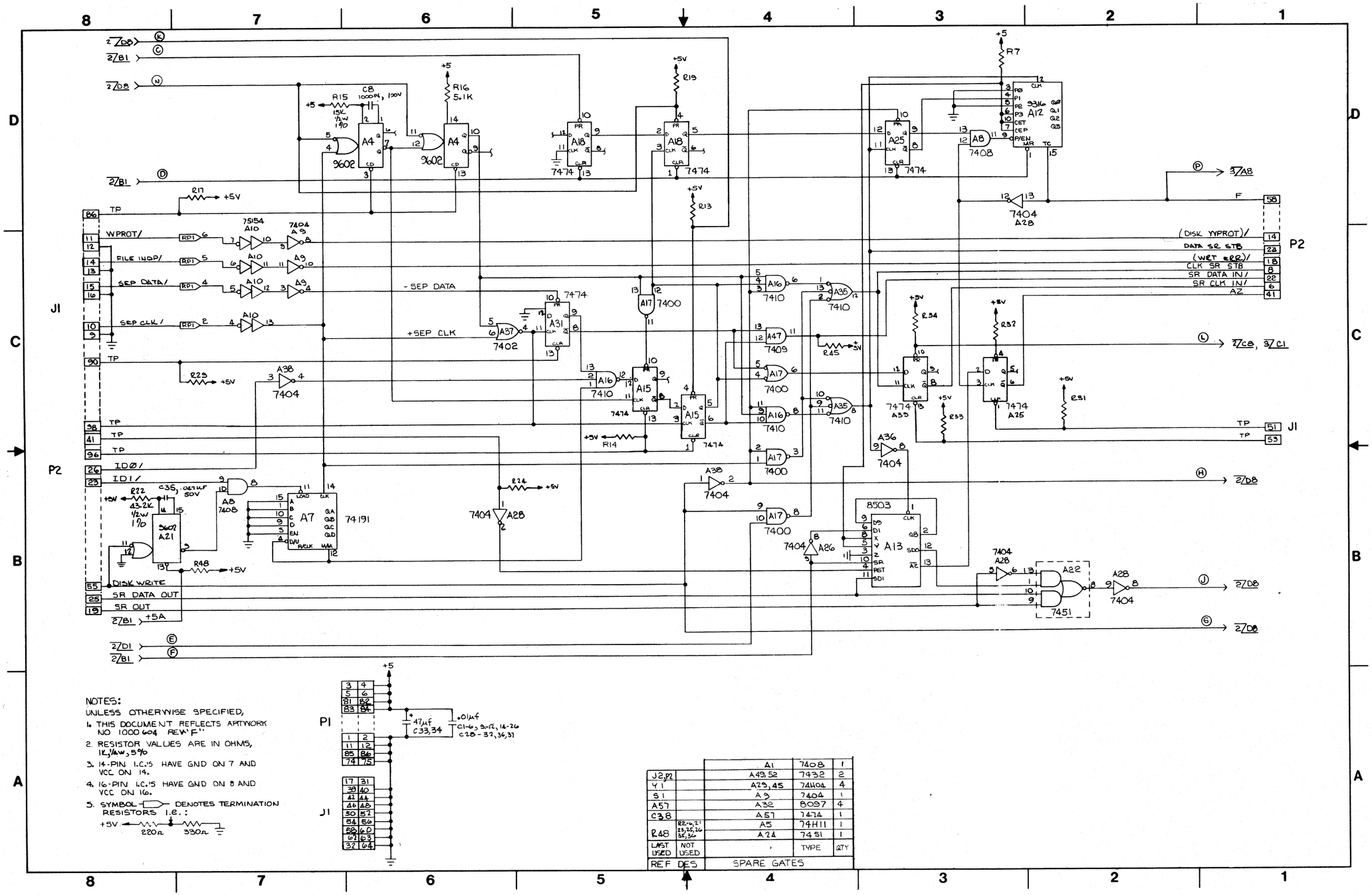
Floppy Disk Controller Channel Schematic (Sheet 2 of 4)



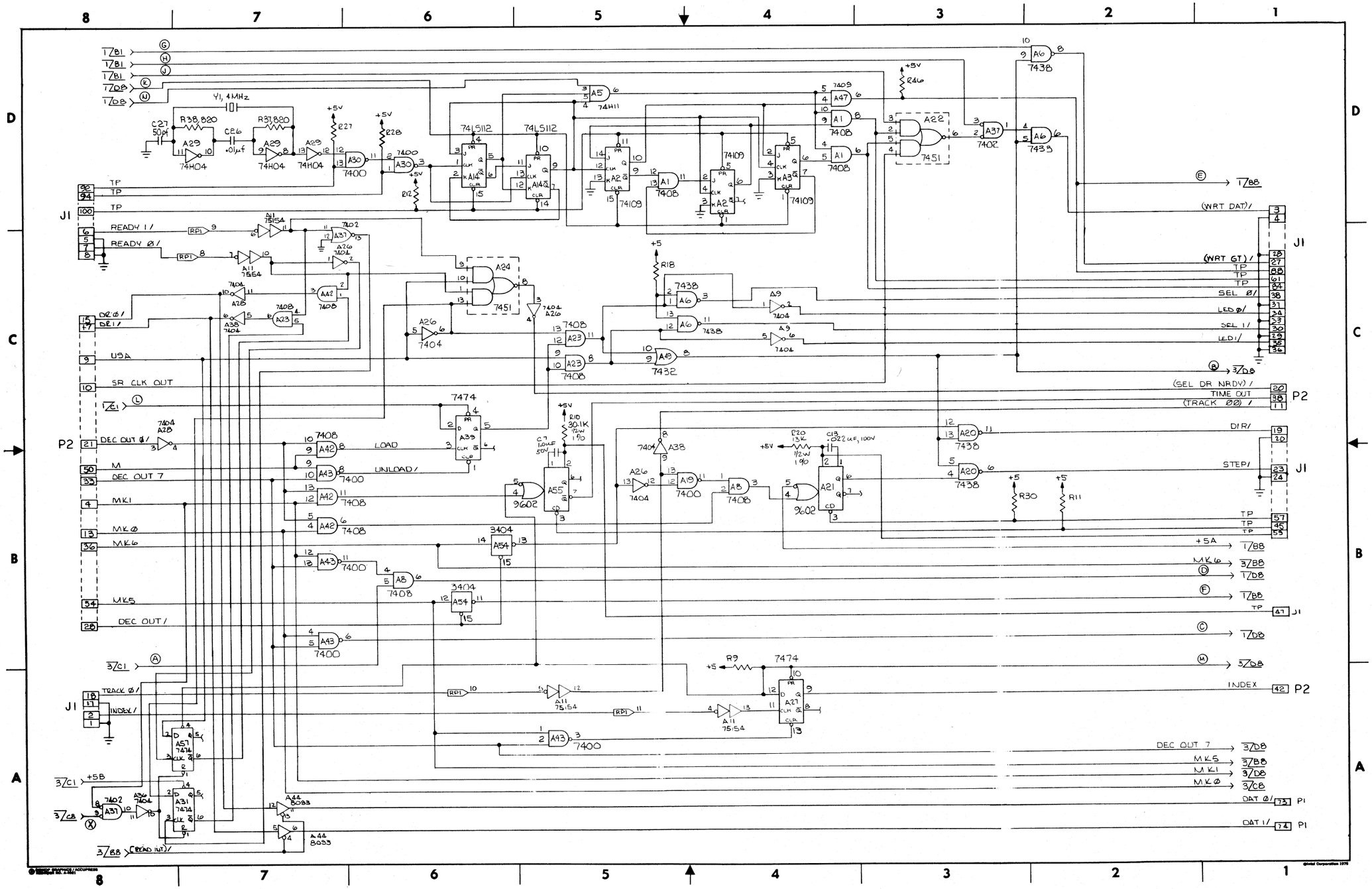
Floppy Disk Controller Channel Schematic (Sheet 3 of 4)



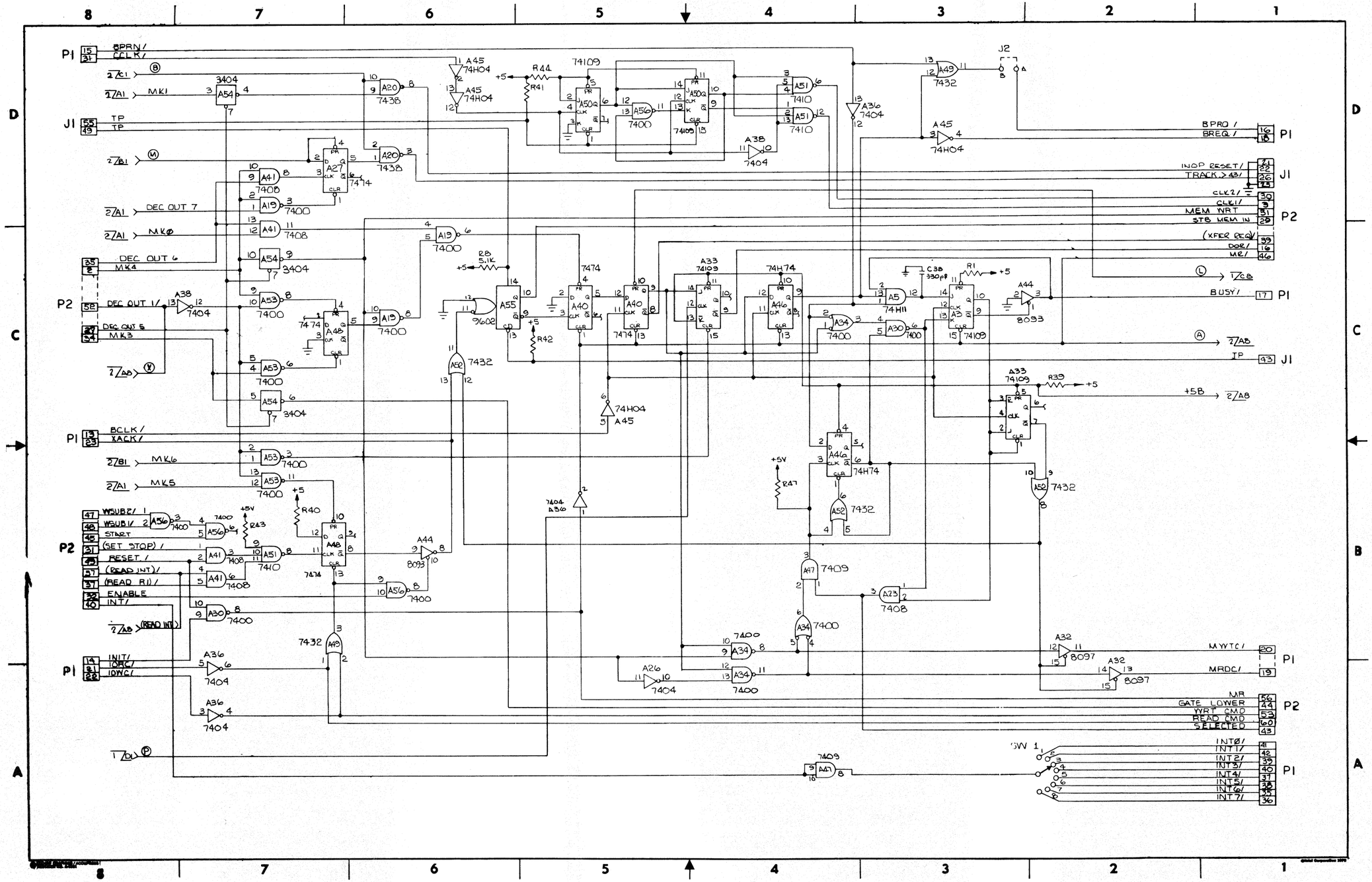
Floppy Disk Controller Channel Schematic (Sheet 4 of 4)



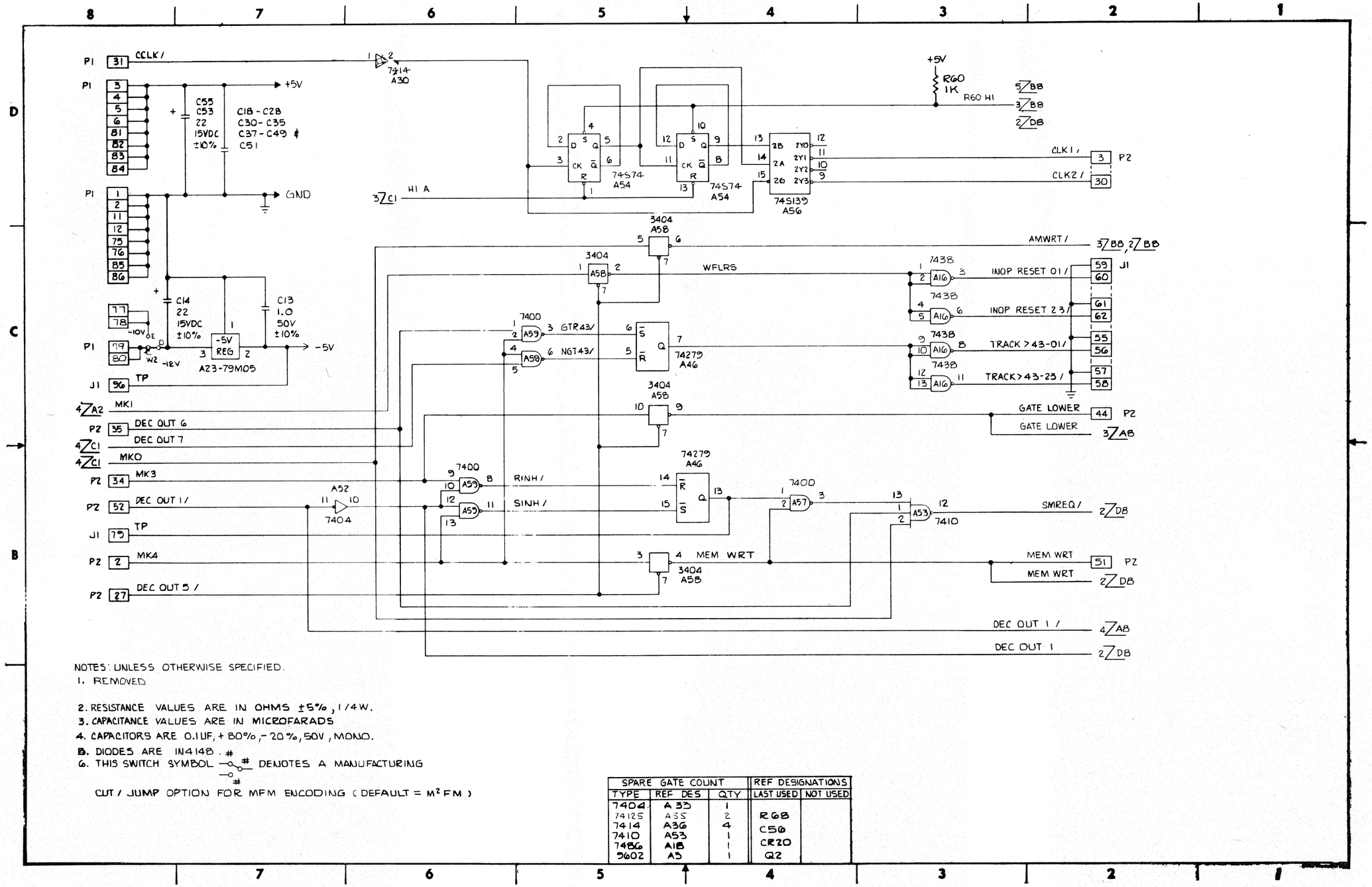
Floppy Disk Controller Interface (CDC) Schematic (Sheet 1 of 3)



Floppy Disk Controller Interface (CDC) Schematic (Sheet 2 of 3)



Floppy Disk Controller Interface (CDC) Schematic (Sheet 3 of 3)

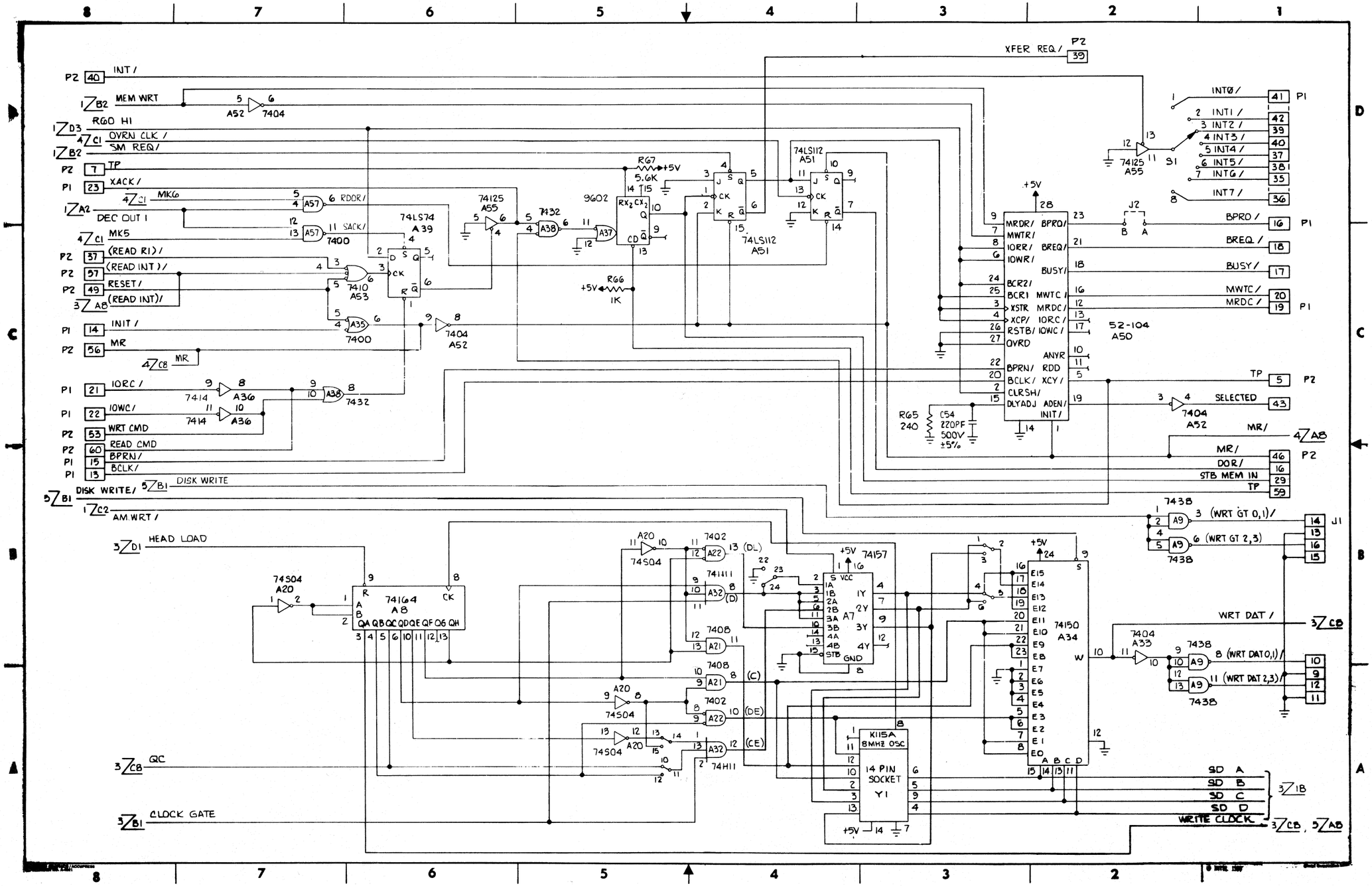


NOTES: UNLESS OTHERWISE SPECIFIED.

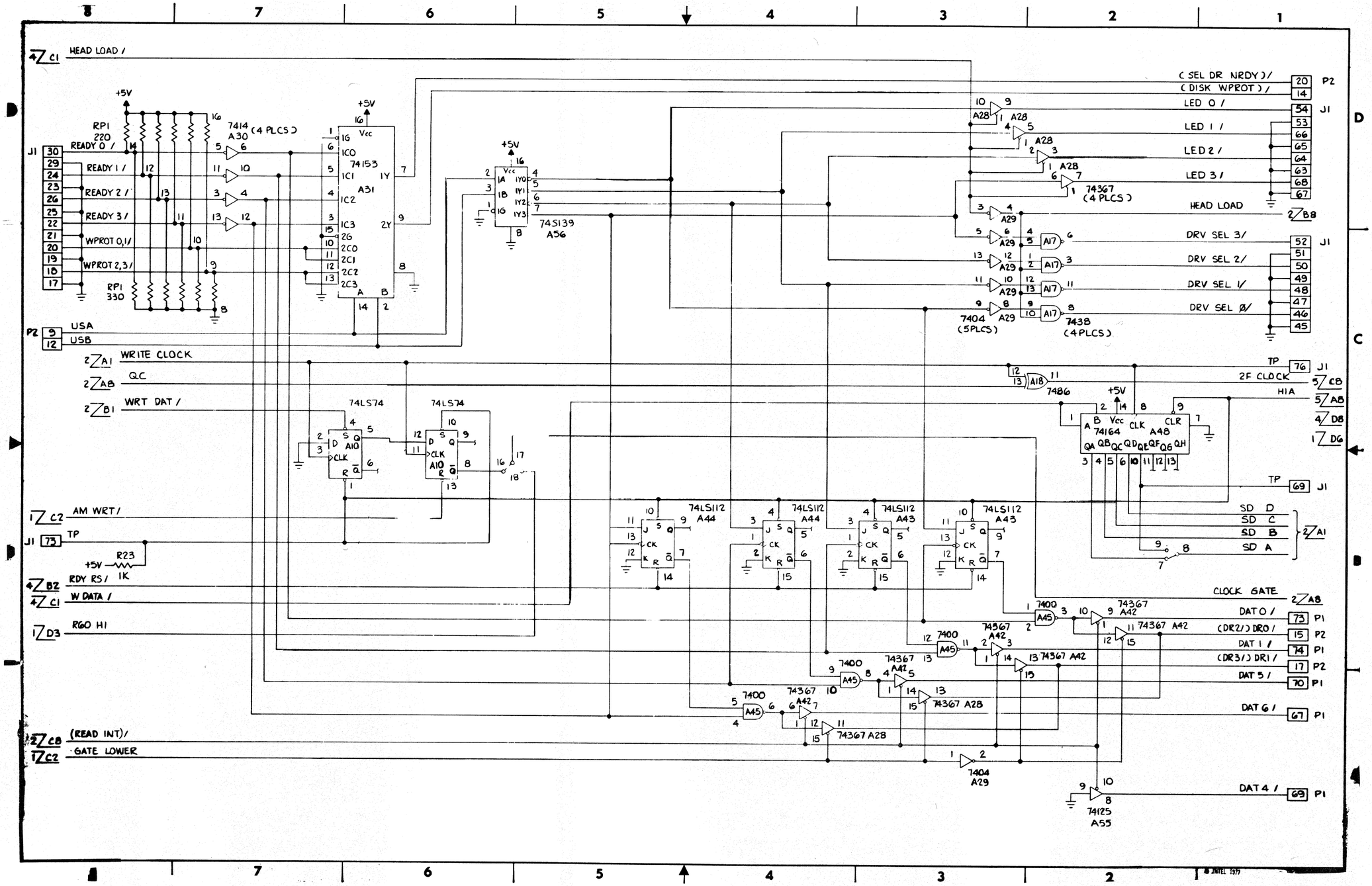
1. REMOVED
2. RESISTANCE VALUES ARE IN OHMS ±5%, 1/4W.
3. CAPACITANCE VALUES ARE IN MICROFARADS
4. CAPACITORS ARE 0.1 UF, +80%, -20%, 50V, MONO.
5. DIODES ARE IN4148.
6. THIS SWITCH SYMBOL —o #/o— DENOTES A MANUFACTURING CUT / JUMP OPTION FOR MFM ENCODING (DEFAULT = M²FM)

SPARE GATE COUNT			REF DESIGNATIONS	
TYPE	REF DES	QTY	LAST USED	NOT USED
7404	A33	1		
74125	A55	2	R68	
7414	A36	4	C58	
7410	A53	1	CR20	
7486	A18	1	Q2	
3602	A3	1		

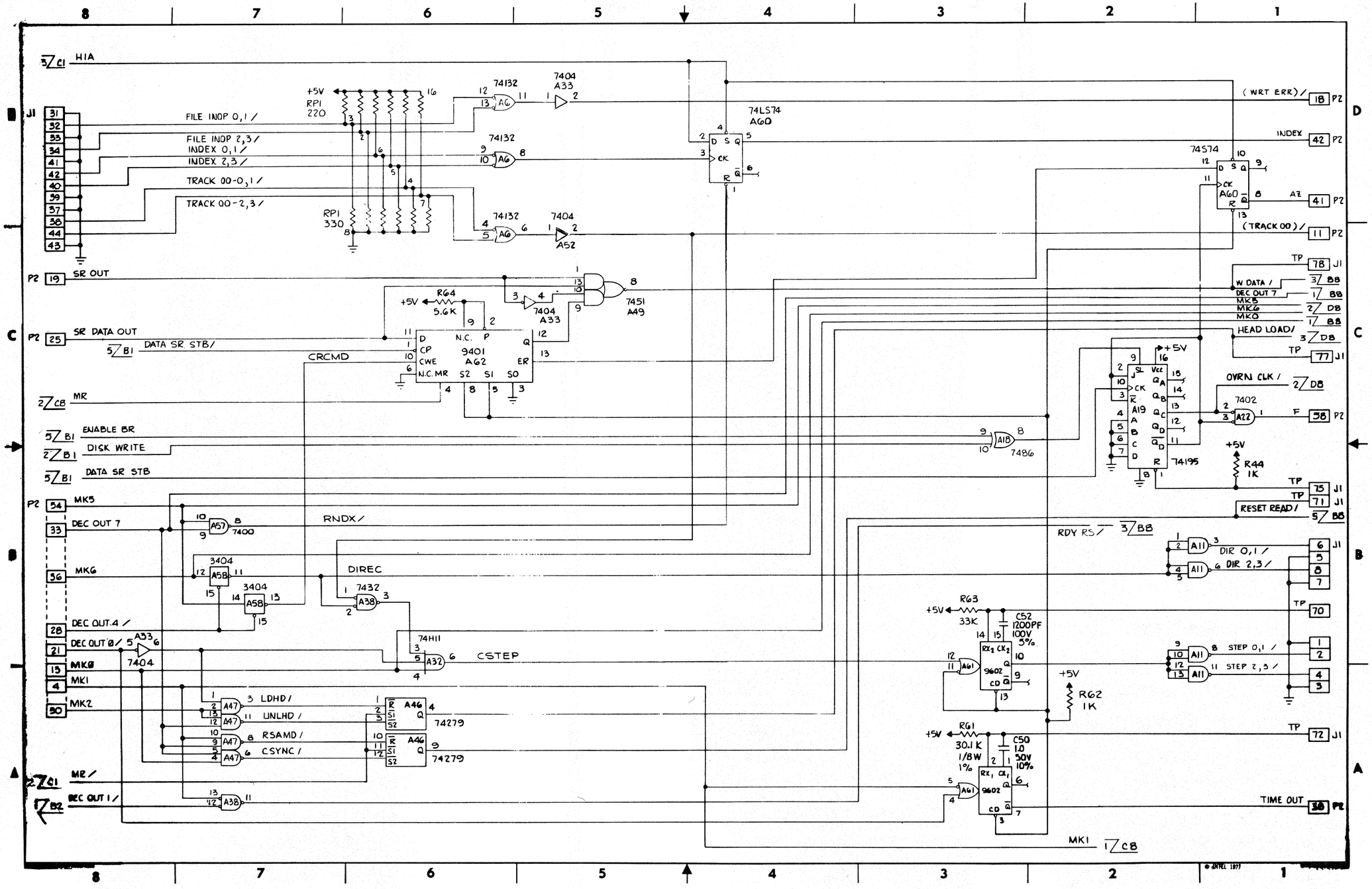
FDC Interface Double Density Schematic (Sheet 1 of 6)



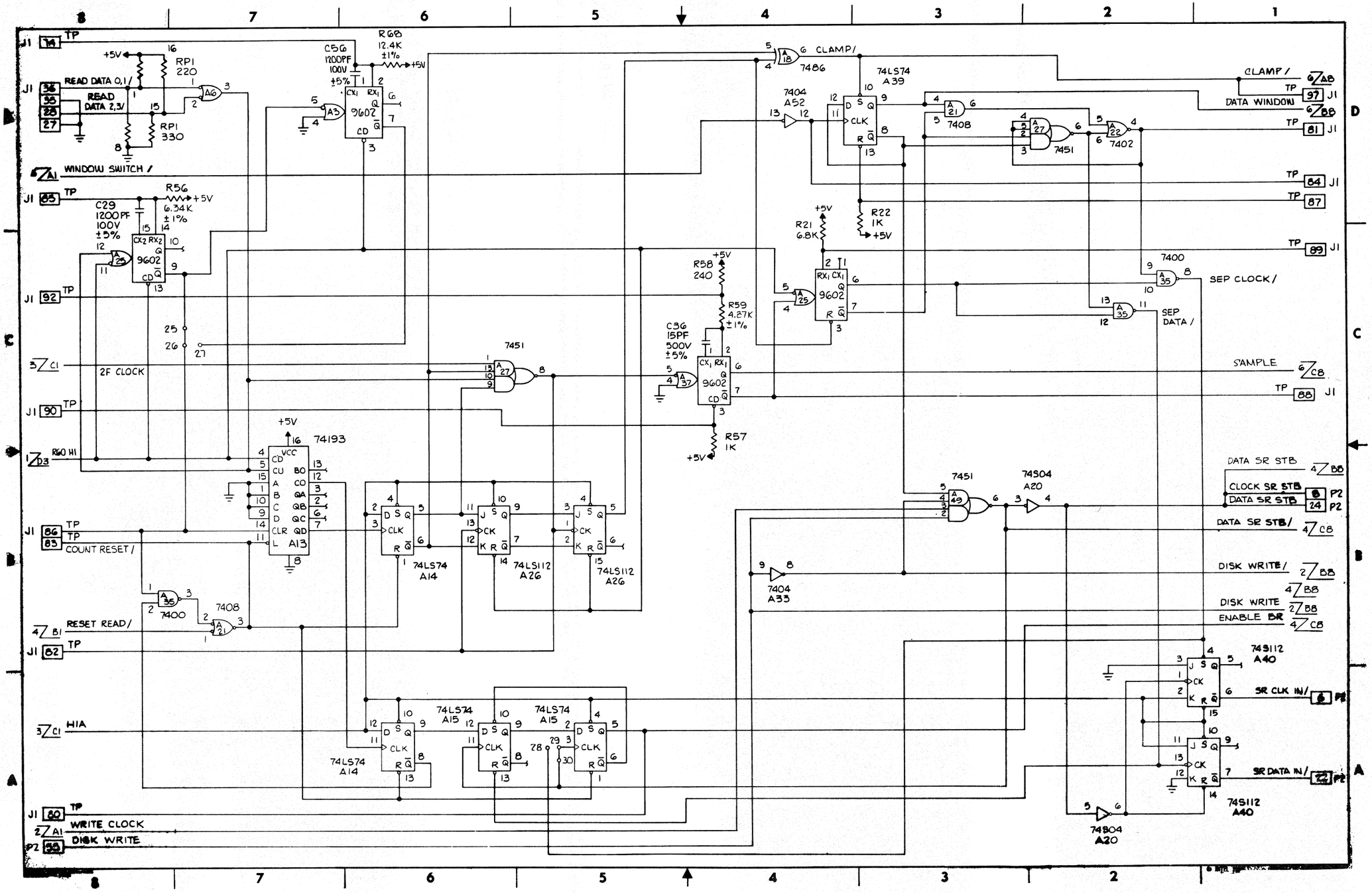
FDC Interface Double Density Schematic (Sheet 2 of 6)



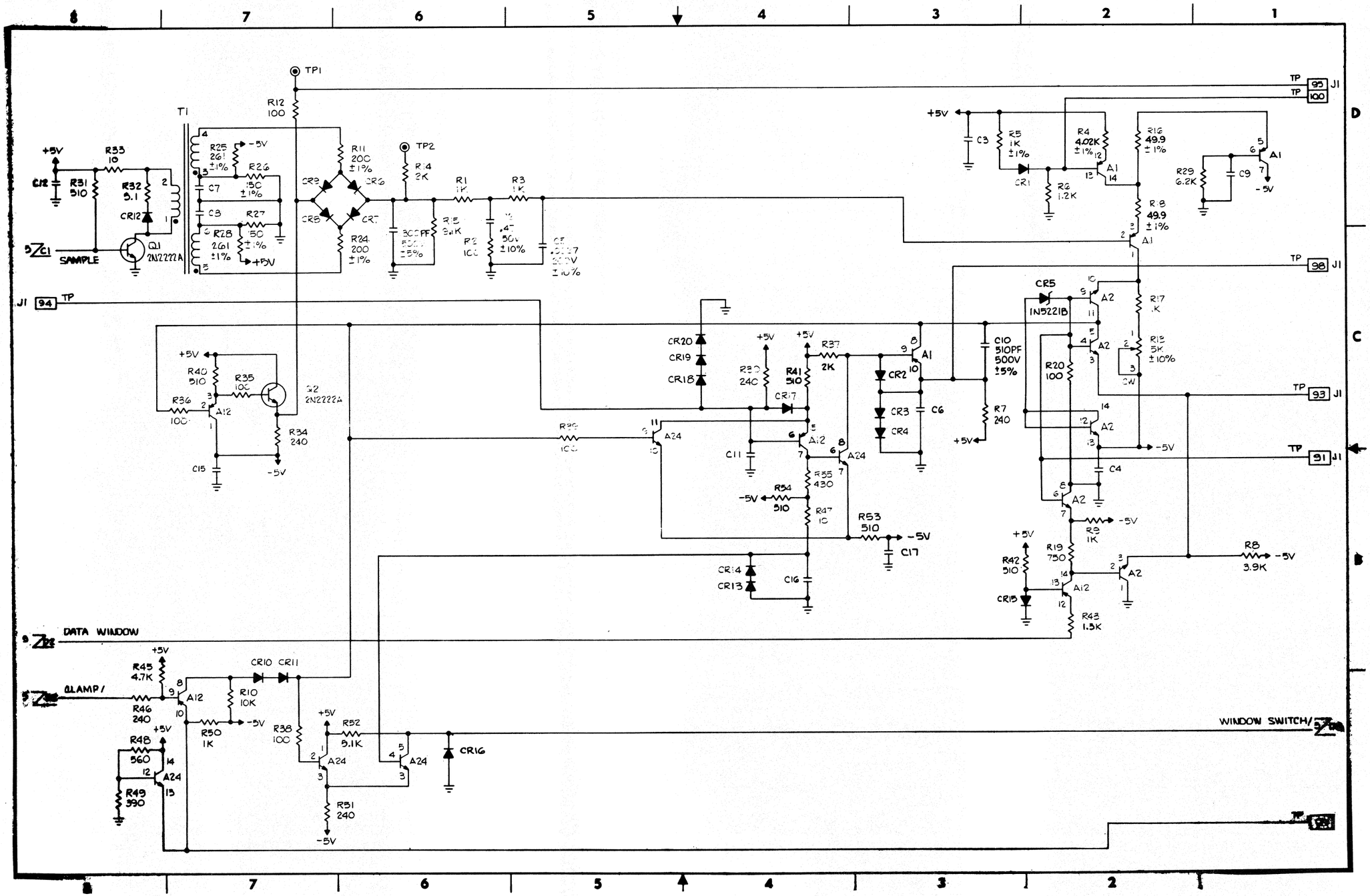
FDC Interface Double Density Schematic (Sheet 3 of 6)



FDC Interface Double Density Schematic (Sheet 4 of 6)



FDC Interface Double Density Schematic (Sheet 5 of 6)



FDC Interface Double Density Schematic (Sheet 6 of 6)

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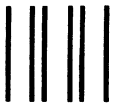

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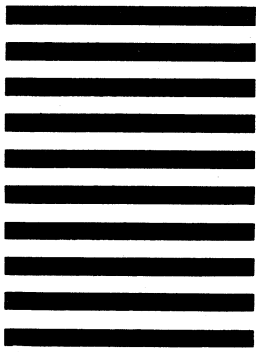

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