CONTROL DATA®
MULTIPLE DISK DRIVE

BM1A5

GENERAL DESCRIPTION
OPERATION
INSTALLATION &
CHECKOUT
MAINTENANCE

CONTROL DATA

CUSTOMER ENGINEERING MANUAL

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CUSTOMER ENGINEERING MANUAL

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PREFACE

All available customer engineering installation, operation, and maintenance information for the CONTROL DATA® BM1A5 Multiple Disk Drive is in three manuals:

Publication No. 70602400	General Description, Operation, Installation and Checkout, Maintenance
Publication No. 70602500	Theory of Operation, Diagrams, Maintenance Aids, Wire List
Publication No. 70601900	Illustrated Parts List

CONTENTS

FIGURES

TABLES

SECTION 1

GENERAL DESCRIPTION

GENERAL DESCRIPTION

The CONTROL DATA Multiple Disk Drive (consisting of equipment number BM1A5 is a random access data storage device that interfaces with a central processor via a control unit.

The electromechanical multiple disk drive (MDD) positions its read/write heads to discrete positions or tracks over spinning disk surfaces. Data, in the form of magnetized bits or spots, is written on or read from the disk surfaces by the read/write heads.

The MDD consists of independent and individually addressable decks. Each deck uses a spindle-mounted disk pack assembly as its recording medium. The disk pack assemblies used by the decks are mechanically interchangeable and magnetically compatible with any similar Control Data Corporation MDD. Typically, all of the decks are on-line, except for one which is available for use if servicing or maintenance becomes necessary on any of the on-line units.

Decks for the MDD are mounted in cabinets. The BM1A5 cabinet contains two decks and is referred to as a two-by (2X). Each deck consists of a deck assembly, supporting logic and power components, and frame-mounted accessory equipment.

The deck assembly contains the hydraulic access mechanism, the speed and location sensing devices necessary to position the read/write heads, and four Silicon Peripheral Logic (SPL) cards involved in read/write operations. This assembly also includes the mounting and operational facilities required by the disk pack: spindle assembly, spindle drive motor, and shroud. The shroud surrounds the disk pack and thereby minimizes damage to the read/write heads and disk surfaces caused by the ingestion of dust. A hinge-mounted logic chassis assembly is the mounting point for the main complement of the SPL cards used by the deck(s): four cards are mounted on each deck assembly. SPL cards for the cabinet are mounted in two rows (A and B). This assembly also contains a maintenance panel, an I/O connector panel, and three fans to cool the SPL cards. The maintenance panel provides jacks to monitor logic voltages, for each deck in the cabinet, and a switch/lamp combination to analyze the occurrence of an error, and an ON LINE/OFF LINE switch.

A solid-state power supply assembly provides +6, ±20, and +40 vdc outputs. The power supply in a 2X cabinet is shared by the decks of that cabinet. Power to each deck of the 2X cabinet is controlled separately at the power supply control panel (accessible when logic chassis is swung out).

A frame assembly provides the required mounting structure for the previously mentioned assemblies. In addition to the structural elements, this assembly contains the operator controls for the deck(s), a blower assembly, and facilities for input power distribution. Each cabinet contains a circuit breaker that controls the application of input power to the power supply of that cabinet. The output of the blower assembly is ducted to the deck assembly(ies) to provide positive pressurization of the disk and shroud area.

The equipment specifications for the MDD are as follows:

ACCESSING TIME

Maximum Access Time	135 ms
Maximum One-Track Access Time	24.5 ms

RECORDING

Mode	Double frequency
Density (nominal)	1530 bpi (outer track) 2220 bpi (inner track)
Bit Rate (nominal)	2.50 MHz
Data Transfer Rate	416,000 characters/second/deck

DATA ORGANIZATION

Bits/Character	6
Characters/Track	10,085
Tracks/Cylinder	20
Cylinders/Deck	200 + 3 spares
Decks/MDD (8X)	8

DATA CAPACITY - SECTOR ORGANIZATION

Bits/Track	63,250
Bits/Cylinder	1,265,000
Bits/Deck	253,000,000

DISK PACK

Disks/Disk Pack	11
Useable Recording Surfaces/ Disk Pack	20
Disk Surface Diameter	14 inches
Recording Diameters	Track 202 (Inner) 9.068 inch nominal Track 0 (Outer) 13.152 inch nominal
Disk Surface Coating	Magnetic oxide
Disk Pack Velocity	2400 (+36, -96) rpm

READ/WRITE HEADS

Heads/Deck	20
Heads/MDD	180 maximum
Read/Write Track Width	0.0065 inch
Erase Track Width	0.013 inch
Track Spacing	0.010 inch

PHYSICAL - Each Cabinet	
Height	67 inches (170.18 cm)
Width	32 inches (81.28 cm)
Depth	40 inches (101.6 cm)
Weight - 2X cabinet	1100 pounds (498.96 kg)
ELECTRICAL	
Power Source	380-volt (±10%), 50 (+0.6, -1.2) hertz, 3-phase, 4-wire wye
Operating Current(2X cabinet)	4 amps/phase
Standby Current(2X cabinet)	1.7 amps/phase
INPUT/OUTPUT CONNECTIONS	Three connectors per cabinet located below Logic Chassis Maintenance panel. Pin assignments according to Table 3-1. Connections according to Figure 3-3.

SECTION 2

OPERATION

OPERATION

This section provides instructions and information related to operating the MDD.

CONTROLS AND INDICATORS

The MDD contains a number of panels and indicators. Figure 2-1 locates the panels and the indicator on a typical cabinet of the MDD. Table 2-1 provides panel and indicator complements in terms of the 2X cabinet and the MDD. A functional description of the controls and indicators is given in Table 2-2.

TABLE 2-1. MDD PANELS AND INDICATORS

PANEL OR INDICATOR	NO. PER 2X	TOTAL PER 9X
Operator Panel	2	8
Filter Box Panel	1	4
Logic Chassis Maintenance Panel	1	4
Track Number Indicator	2	8
Power Supply Panel	1	4

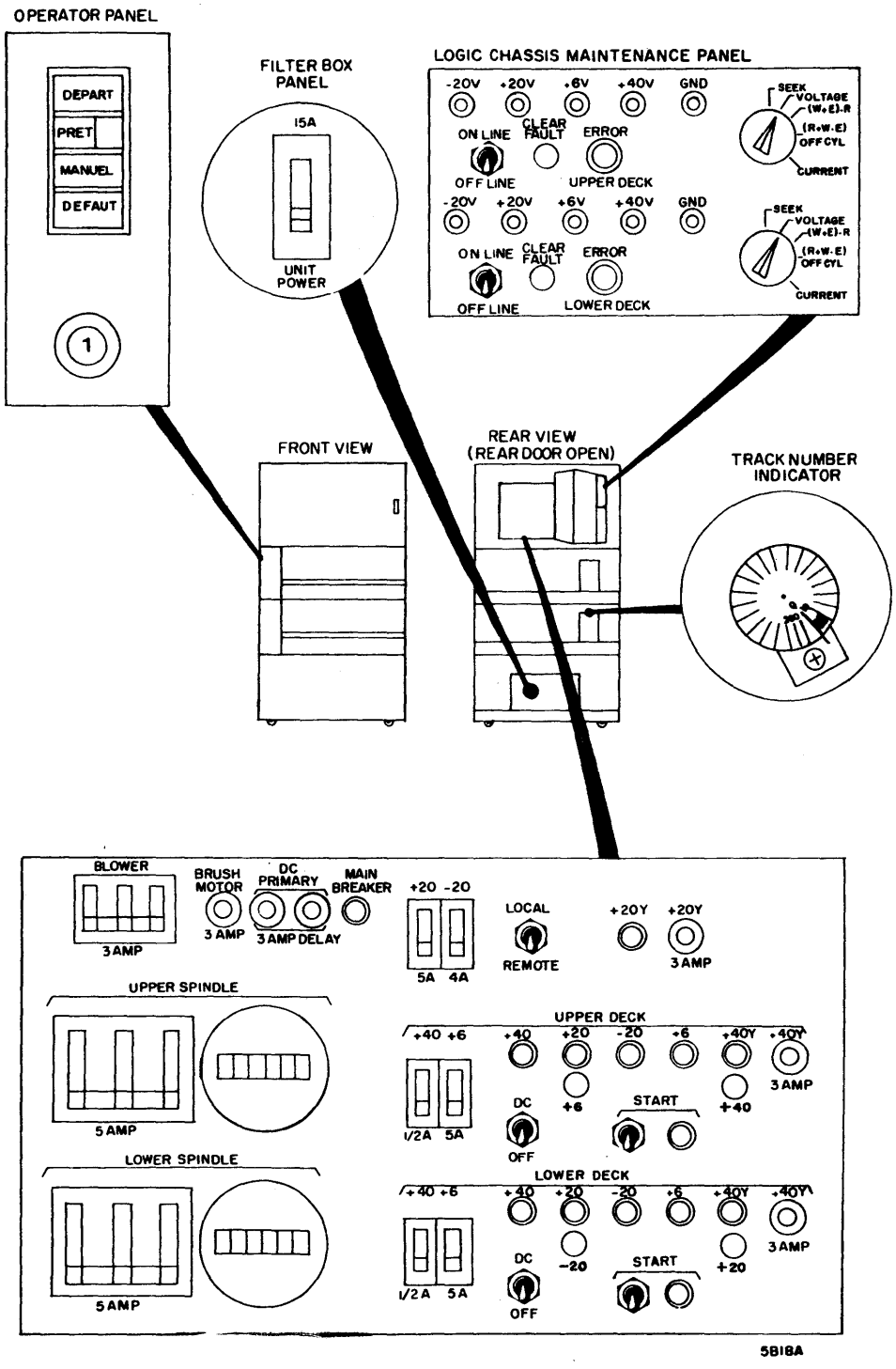


Figure 2-1. Controls and Indicators

TABLE 2-2. CONTROLS AND INDICATORS

CONTROL OR INDICATOR	FUNCTION
Operator Panel	
DEPART switch/indicator	Switch energizes (when pressed to light) drive motor and begins the First Seek sequence provided the following conditions are met: 1. Disk pack is in place. 2. Deck assembly drawer is closed (closes sector block in place switch. Can be overridden, Figure 2-2). 3. Proper circuit breakers are on. 4. Sequence power available either from control unit (if power supply LOCAL/REMOTE switch is set to REMOTE) or from power supply (if power supply LOCAL/REMOTE is set to LOCAL. Lights when switch is on even if one or more of the above conditions is not met. This allows operator to know which units will sequence on when control unit sequence power becomes available. Switch causes a power off sequence when pressed with the indicator lighted.

NOTE

Certain malfunctions can occur in head load mechanism that cause PRET indicator to give a false indication of heads being loaded. If this occurs, the on-line deck is unable to return a Ready signal to controller and hence is unable to respond to controller commands.

TABLE 2-2. CONTROLS AND INDICATORS (Cont'd)

CONTROL OR INDICATOR	FUNCTION
PRET/Unit number indicator	PRET segment lights when logic chassis maintenance panel ON LINE/OFF LINE switch is set to the ON LINE position and the read/write heads are loaded. Unit number/segment of the indicator lights when the disk pack velocity exceeds 50 rpm. Significance of Unit Number (0 thru 7) is limited to indicating physical location of a spindle within the MDD.
MANUEL indicator	Lights when related module is not on-line as a result of one of the following conditions: 1. LOCAL/REMOTE switch on power supply set to LOCAL. 2. DC/OFF switch on power supply set to OFF. 3. ON LINE/OFF LINE switch on logic chassis maintenance panel set to OFF LINE.
Defaut switch/indicator	Lights when one or more of the following unwanted conditions occur: 1. More than one head is selected. 2. Read and Write Selects exist at the same time. 3. Read and Erase Selects exist at the same time. 4. Erase is selected with no write driver.

TABLE 2-2. CONTROLS AND INDICATORS (Cont'd)

CONTROL OR INDICATOR	FUNCTION
DEFAUT switch/indicator (cont'd)	5. Erase is selected with both write drivers. 6. Either one or both write drivers are on with no erase. 7. Read, write, or erase is selected without an On Cylinder signal. 8. Low voltage condition sensed. Pressing the DEFAUT switch clears the Fault FF on the logic chassis and extinguishes the indicator.
Logic Number plug/indicator	Lights when related deck is selected. Each deck contains a plug that responds to a specific binary code from control unit. Lens of plug reflects number that plug recognizes. A deck in which a plug labeled SPARE is installed, is not available to the control unit. Plugs are removable and interchangeable.

TABLE 2-2. CONTROLS AND INDICATORS (Cont'd)

CONTROL OR INDICATOR	FUNCTION
Filter Box Panel	
UNIT POWER circuit breaker	Controls distribution of main input power to the cabinet power supply.
Logic Chassis Maintenance Panel	
NOTE This panel contains two identical sets of controls: one for each deck assembly in the cabinet.	
-20V, +20V, +6V, +40V, and GND test jacks	Afford a point at which dc voltages in the logic chassis can be measured.
ON LINE/OFF LINE switch	ON LINE position places unit under control of control unit. Setting switch to OFF LINE position causes following: 1. Prevents control unit from initiating seek or read/write operations. 2. Unit Number and Logic Number indicators extinguish. 3. Maintenance indicator lights. 4. Inhibits Unit Ready and Unit Selected signals to controller. 5. Deselects all heads. 6. Inhibits Seek Complete or Seek Error interrupt to controller.

TABLE 2-2. CONTROLS AND INDICATORS (Cont'd)

CONTROL OR INDICATOR	FUNCTION
Error Select switch and ERROR indicator	A 5-position rotary switch that samples each of the 5-bits of the Error register. Causes the ERROR indicator to light when the bit being sampled is set. Normally, the indicator will light briefly between each position of the switch.
CLEAR FAULT switch	Clears FAULT FF and all bits of the Error register when pressed.
Power Supply Panel	
BLOWER circuit breaker	Controls application of three-phase 208 vac to blower motor. Disables dc power when set to OFF.
BRUSH MOTOR/3 AMP fuse	Protects the 115 vac line to the brush motors and logic chassis and power supply cooling fans.
DC PRIMARY/3 AMP DELAY fuses (2)	Protect the 208 vac lines to the primary winding of the dc supply transformer.
MAIN BREAKER indicator	Provides remote indication of the position of the UNIT POWER circuit breaker located on the cabinet filter box panel.
±20 circuit breaker	Control the application of the ±20 vdc to the logic chassis.
LOCAL/REMOTE switch	Allows the power on sequence to be controlled by either a signal from the controller (when set to REMOTE) or by +20Y

TABLE 2-2. CONTROLS AND INDICATORS (Cont'd)

CONTROL OR INDICATOR	FUNCTION
LOCAL/REMOTE Switch (cont'd)	vdc from the power supply (when set to LOCAL). MANUEL indicator on operator panel lights when switch is set to LOCAL.
+20Y indicator	Indicates status of +20Y vdc (used to power lamps, relays, etc).
+20Y/3 AMP fuse	Protects the +20Y vdc circuit.
NOTE The following controls and indicators are duplicated on the power supply panel: one set each for the upper and lower units.	
SPINDLE circuit breaker	Controls application of three-phase 208 vac to the spindle drive motor.
SPINDLE elapsed time meter	Indicates cumulative hours of spindle motor operation (pack rotating).
+40 Circuit Breaker	Controls application of +40 vdc to logic chassis.
+6 circuit breaker	Controls application of +6 vdc to logic chassis.
+40 indicator	Provides visual status of +40 circuit breaker.
±20 indicators	Provides visual status of the ±20 circuit breakers.

TABLE 2-2. CONTROLS AND INDICATORS (Cont'd)

CONTROL OR INDICATOR	FUNCTION
+6 indicator	Provides visual status of the +6 circuit breaker.
+40Y indicator	Indicates status of +40Y vdc (used to power deck solenoids and head latch). Lights when disk pack rpm is about 2000 rpm.
+40Y/3 AMP fuse	Protects the +40Y vdc circuit.
CAUTION Before applying dc power to or removing dc power from either deck in a 2X cabinet, the START switch on the remaining deck must be turned to the off (related indicator goes out) position. After dc power is switched, normal operation may be continued on remaining deck.	
DC/OFF switch	Set to the DC position during normal operation. When set to OFF, removes all dc power to deck and logic cards and causes operator panel MANUEL indicator to light.
START switch and indicator	Switch/indicator combination wired in parallel with same items on operator panel. Provide start/stop control from rear of MDD during a maintenance situation.
Deck Assembly	
Track Number Indicator	Calibrated dial read at adjacent index mark. Readout is the current track or cylinder location of the read/write heads. Located on top of carriage immediately above read/write heads.

OPERATING INSTRUCTIONS

MDD POWER APPLICATION

The following procedure prepares the MDD to go on line. The procedure is valid only if the unit was shut down according to the MDD Power Removal paragraph. If power is to be applied to a single deck or spindle and a part of the MDD is already operating on line, refer to Deck or Spindle Power Application paragraph following.

1. Set the Filter Box panel UNIT POWER circuit breaker to ON in each MDD cabinet.
2. Observe each operator panel. Only the spindles to be powered up should have their DEPART indicator lighted. Press any indicators on or off as required.
3. Apply sequence power at the control unit. When a spindle completes its power up sequence, the related PRET indicator will light.
4. When the required PRET indicators are lighted, the MDD is on line.

NOTE

Maximum operational stability is achieved only after the unit has reached thermal stability. The warmup time (spindle rotating) is approximately 45 minutes if the ac power has been removed for longer than 4 hours. It is recommended that this warmup period be allowed prior to a Read or Write operation.

5. The unit is now ready to receive a Read, a Write, or a Seek command.

DECK OR SPINDLE POWER APPLICATION

The following procedure applies power to a deck or spindle so that it can join other on line units of an MDD.

1. Open the rear panel of the cabinet housing the spindle to go on line.
2. Set the Logic Chassis Maintenance panel ON LINE/OFF LINE switch (for applicable deck) to OFF LINE.
3. If one spindle in this cabinet is already on line, go to step 4; otherwise go

to step 7.

4. Position the Power Supply panel switches, related to the spindle to receive power, as follows:

   SPINDLE circuit breaker to ON
   +40 circuit breaker to ON
   +6 circuit breaker to ON
   DC/OFF switch to DC
   START switch to toggle down

5. The following Power Supply panel indicators will light:

   +20
   -20
   +6

6. Proceed to step 9.

7. Position the Power Supply panel switches as follows:

   BLOWER circuit breaker to ON
   +20 circuit breaker to ON
   -20 circuit breaker to ON
   LOCAL/REMOTE switch to REMOTE
   SPINDLE (as applicable) circuit breaker to ON
   +40 (as applicable) circuit breaker to ON
   +6 (as applicable) circuit breaker to ON
   DC/OFF (as applicable) switch to DC
   START (as applicable) switch to toggle down

8. Set the Filter Box panel UNIT POWER circuit breaker to ON. If power supply panel START indicator lights, set related START switch toggle up. The blower motor, the logic chassis fans, and the power supply fans will begin to operate. The following Power Supply panel indicators light:

   MAIN POWER
   +20 Y
   +20
   -20
   +6

   } for the spindle to receive power

9. Set related ON LINE/OFF LINE switch to ON LINE (for applicable deck).
10. Swing the logic chassis into the cabinet and close the cabinet rear panel.

11. Install a disk pack (refer to disk pack installation paragraph following).

12. Press the operator panel DEPART switch/indicator. The switch/indicator lights.

13. When the control unit sequence power becomes available, the First Seek operation begins as indicated by the following operator panel events:

    UNIT Number indicator lights (pack speed is greater than 50 rpm)
    PRET indicator lights (heads have been loaded)

    NOTE

    Maximum operational stability is achieved only after the unit has reached thermal stability. The warmup time (spindle rotating) is approximately 45 minutes if the ac power has been removed for longer than 4 hours. It is recommended that this warmup period be allowed prior to a Read or Write operation.

14. The First Seek operation is complete when the heads are returned to track 00. The unit is now ready to receive a Read, a Write, or a seek command from the control unit.

MDD POWER REMOVAL

The following procedure removes power to the entire MDD.

1. Follow the reverse of the preceding MDD Power Application procedure.
2. Remove sequence power at the control unit.

DISK PACK INSTALLATION

Make certain that the disk pack to be installed has been cleaned and maintained according to the Preventive Maintenance instructions. Do not open spindle drawer if operator panel SPIN indicator is lighted.

1. Release the front latch (Figure 2-2) on the desired spindle drawer and pull the drawer out to the stop.

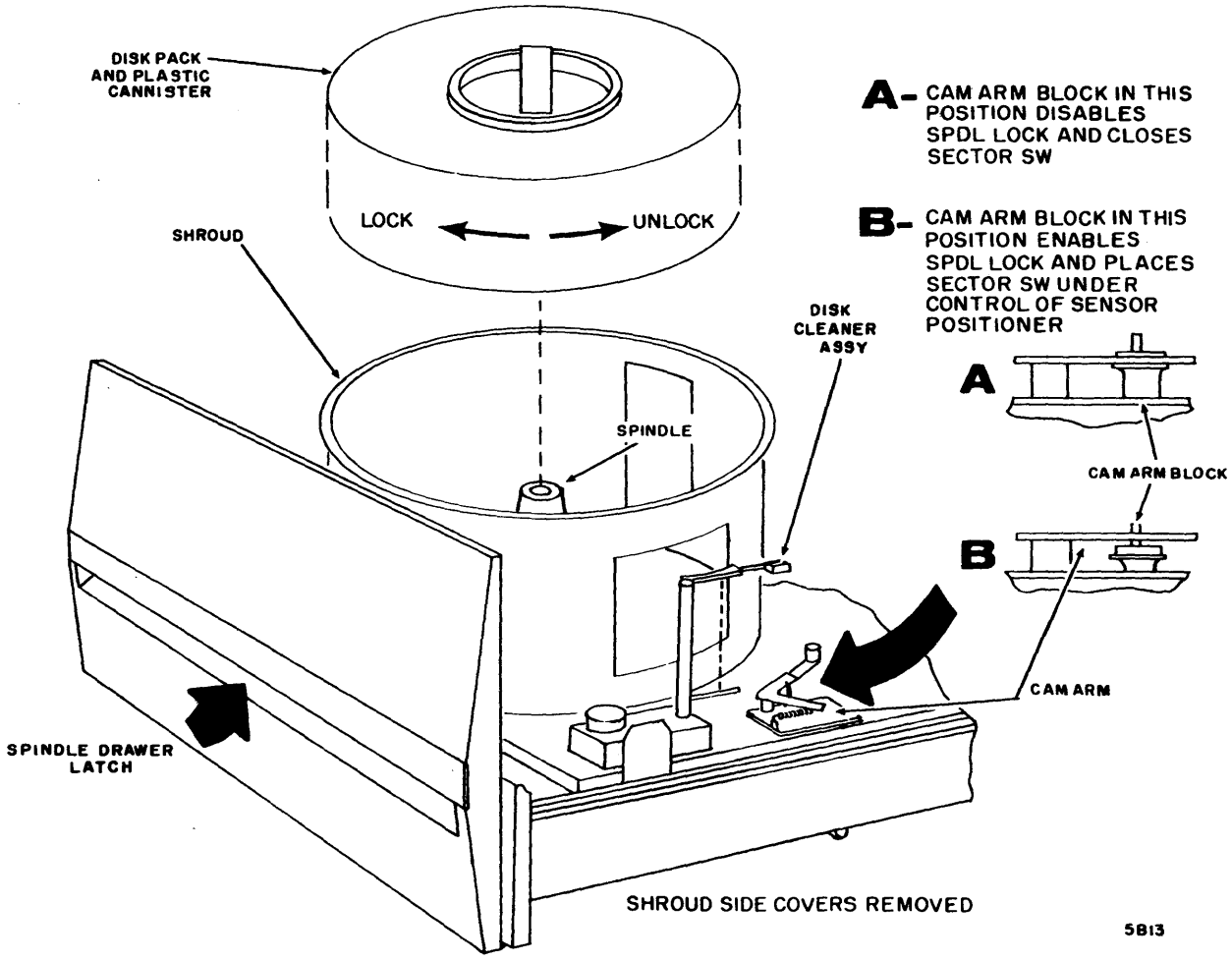


Figure 2-2. Disk Pack Load/Unload Machanics

NOTE

A spindle lock mechanism is actuated when the spindle drawer is opened. The mechanism holds the spindle stationary until the pack loading force exceeds the torque of the slipping clutch.

2. Lift the disk pack by the plastic canister handle.

3. Unscrew the bottom dust cover from the disk pack using the knob in the center of the cover. Set the cover aside. Remove protective cover from spindle and set aside.

CAUTION

Avoid abusive contact between the disk pack and the spindle. During maintenance procedures the read/write heads are sometimes manually positioned. Make certain that the heads are fully retracted.

4. Place the disk pack onto the spindle.

CAUTION

Air blowing into the shroud area could lift away the canister before the disk pack is locked in place.

5. Twist the canister handle clockwise to lock the disk pack in place.

6. Lift the canister clear of the disk pack and set it aside.

NOTE

If a maintenance situation requires the spindle drawer to be open (in either direction) while the spindle rotates, refer to Figure 2-2 and position the cam arm block to disable the spindle lock.

7. Close the spindle drawer.

DISK PACK REMOVAL

1. Press (to extinguish) the operator panel START switch.

CAUTION

A spindle lock mechanism is actuated when the spindle drawer is opened. A loud ratcheting noise occurs when the drawer of a spinning disk pack is opened. While this action is not recommended, it will not damage the unit.

2. Check that the Operator panel Unit Number indicator is not lighted.
3. Release the front latch (Figure 2-2) on the desired spindle drawer and pull the drawer out to the stop.

CAUTION

During maintenance procedures the read/write heads are sometimes manually positioned. Make certain that the heads are fully retracted.

4. Place the plastic canister over the mounted disk pack so that the post protruding from the center of the disk pack is received into the canister handle.
5. Twist the canister handle counterclockwise until the disk pack is free of the spindle.

CAUTION

Avoid abusive contact between the disk pack and the spindle assembly.

6. Lift the canister and the disk pack clear of the spindle.
7. Install protective cover on spindle cone and close the spindle drawer.
8. Place the bottom dust cover in position on the disk pack and tighten it.

SECTION 3

INSTALLATION AND CHECKOUT

INSTALLATION AND CHECKOUT

This section provides the information and procedures necessary to put an MDD into operation.

UNCRATING

During uncrating, care must be used so that any tools being used do not inflict damage to an assembly. As a cabinet is uncrated, inspect it for possible shipping damage. All claims for this type of damage should be filed promptly with the transporter involved. If a claim is filed for damages, save the original crating materials. Most crating materials will be reuseable if reasonable care is used uncrating. Uncrate MDD cabinet as follows:

1. Applicable to air-shipped units only: Cut two vertical steel straps securing unit to skid.
2. Cut two horizontal steel straps securing exterior container.
3. Remove corrugated-paper caps from front and rear of cabinet.
4. Remove corrugated-paper panels covering top and sides of unit.
5. Raise plastic dust cover clear of cabinet.
6. Applicable to air-shipped units only: Using Roll-A-Lifts (placed at cabinet sides) carefully remove cabinet from skid.
7. Open cabinet rear door.
8. Remove two non-metallic straps and wooden block securing logic chassis.
9. Remove cushioning material from top of filter box.
10. Remove tape securing power cable (if present) in bottom of cabinet.
11. Remove tape securing top front door latch and open door. Untape air filter and cushioning material from top of power supply chassis. Separate filter from cushioning material.
12. Remove wedge from between bottom of lower deck drawer and top edge of bottom front door.
13. Open bottom front door. Slide primary filter (unpacket in step 11) into place in base of cabinet (Figure 6-2).

14. Remove cabinet side panels (if installed).

15. Release two non-metallic straps securing both ends of each deck slide to cabinet horizontal frame member above the deck (total of eight straps per 2X cabinet).

16. Release latch in center of drawer front panel and open upper deck drawer.

17. Release non-metallic strap from lower edge of slide on both sides of deck.

18. Remove two wood blocks from between front edge of deck casting and inner surface of drawer front panel.

CAUTION

Do not position read/write heads manually without first referring to Manually Positioning Carriage paragraph, Section 6.

19. Remove nylon cord and CAUTION tag from carriage.

20. Close deck drawer.

21. Repeat steps 16 through 20 for lower deck.

SPACE ALLOCATION

One MDD 2X cabinet requires a floor area of approximately 2.7 x 3.3 feet. In addition, a three foot service access area to the front and a four foot area to the rear of the unit should be provided.

LEVELING AND ALIGNING

Position the MDD cabinets to their operational location and level as follows:

1. Lower jack screws in base of cabinet until casters no longer contact floor.

2. Place a spirit level on main deck so ends of level point toward front and rear of deck.

3. Spirit level should indicate that surface is horizontal to within 3 angular degrees. Adjust jack screws until requirement is met.

4. Place spirit level on main deck so ends of level point toward sides of deck. Repeat step 3.

5. Cabinet is level when spirit level (oriented in both directions) indicates main deck horizontal to within 3 angular degrees and each cabinet caster is clear of floor.

6. Position next cabinet to be leveled alongside previous unit. Repeat steps 1 through 5. In addition to the requirements for being level (step 5), the front frame members and the top surfaces of cabinets must be flush with each other to within ± 1/32 inch.

7. Repeat step 6 for remaining cabinets.

CAUTION

To perform step 8, some cabinet panels must be removed. Make certain that the panels are returned to the same cabinet. Misalignment and/or binding could result from switching panels.

8. Refer to Figure 3-1 and secure each cabinet frame to the adjacent cabinet frame at four places. Tighten each nut to a torque of 175 ± 25 inch-pounds.

9. Do not install cabinet panels removed in step 8.

CABLING AND CONNECTIONS

CABINET INTRACABLING

Inspect the cabling in each cabinet for agreement with Figure 3-2.

INPUT/OUTPUT CABLES

CAUTION

Jackscrews on the logic chassis connecting cables must be alternately tightened or damage could occur.

Refer to Figures 3-3 and 3-4 and install system input/output cables. Table 3-1 provides information relative to the connector pin/signal assignments for these cables.

POWER CABLES

The power cable for each cabinet originates in the cabinet filter box located at the lower rear of the cabinet. Each power cable should exit the respective cabinet under the rear door of the cabinet.

GROUND BOND

To minimize the effect of system generated noise, a ground bond (either a tinned copper braid of 7500 circular mils minimum or a copper strap of 5900 square mils minimum) must be connected between each MDD and controller.

The ground bond is connected to any unused terminal on terminal board TB05 (located on the power supply side panel) and the controller system ground.

The ground bonding scheme may be daisy chained or individually connected between each MDD and controller.

CABINET ACCESSORIES

1. Install operator panel Unit Number lenses as follows:
   a. Remove blank lens by squeezing top and bottom edges together and displacing lens up or down.
   b. Snap appropriate numbered lens into place.
2. Carefully insert appropriate Logic Number plug into hole below operator panel switches and push plug into receptacle.
3. Install cabinet trim as follows:

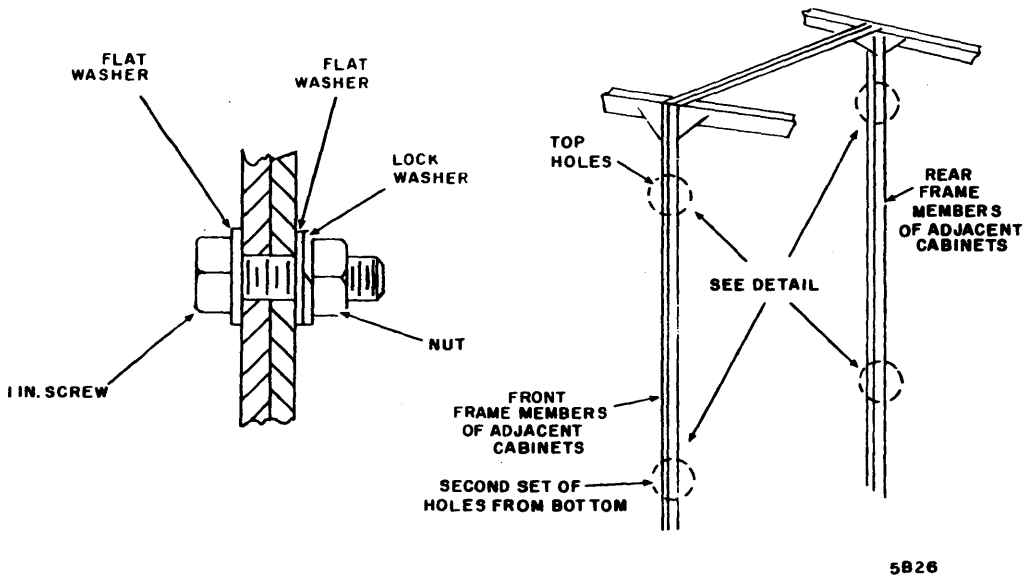


Figure 3-1. Joining Cabinets

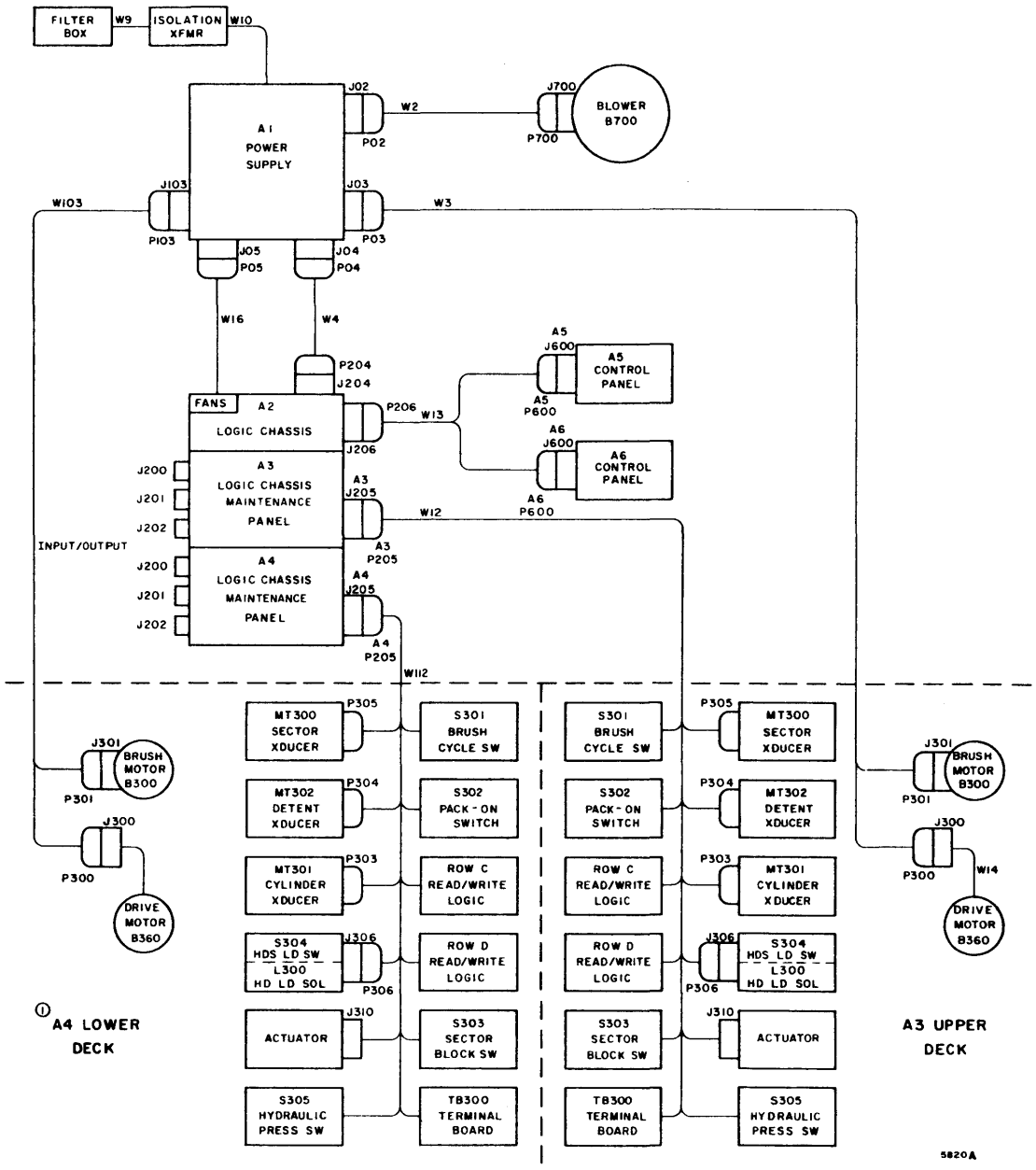


Figure 3-2. Cabinet Intracabling Diagram

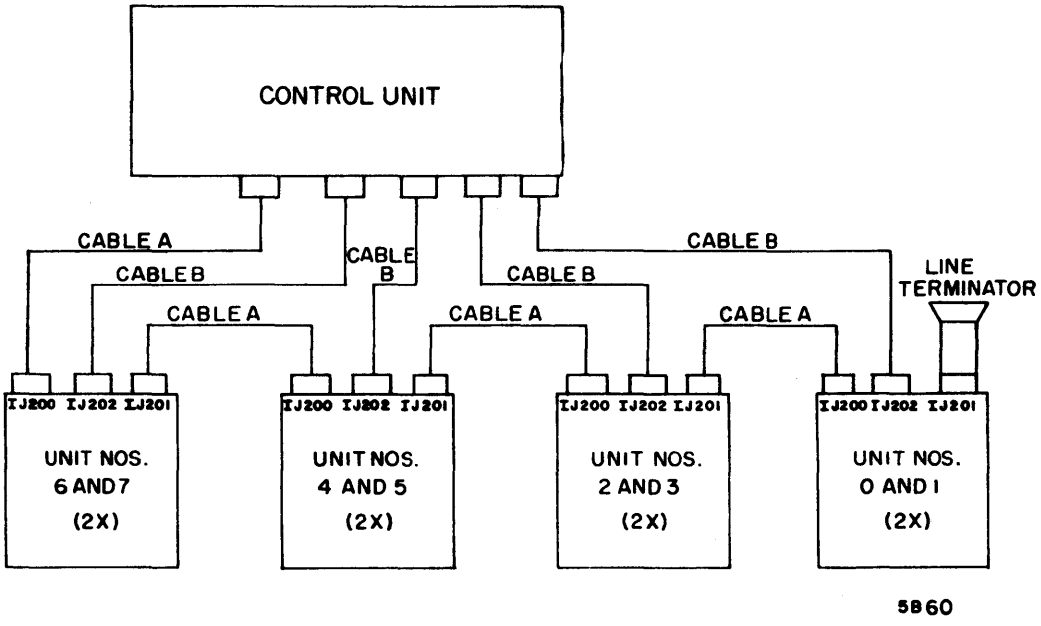


Figure 3-3. System Intercabling

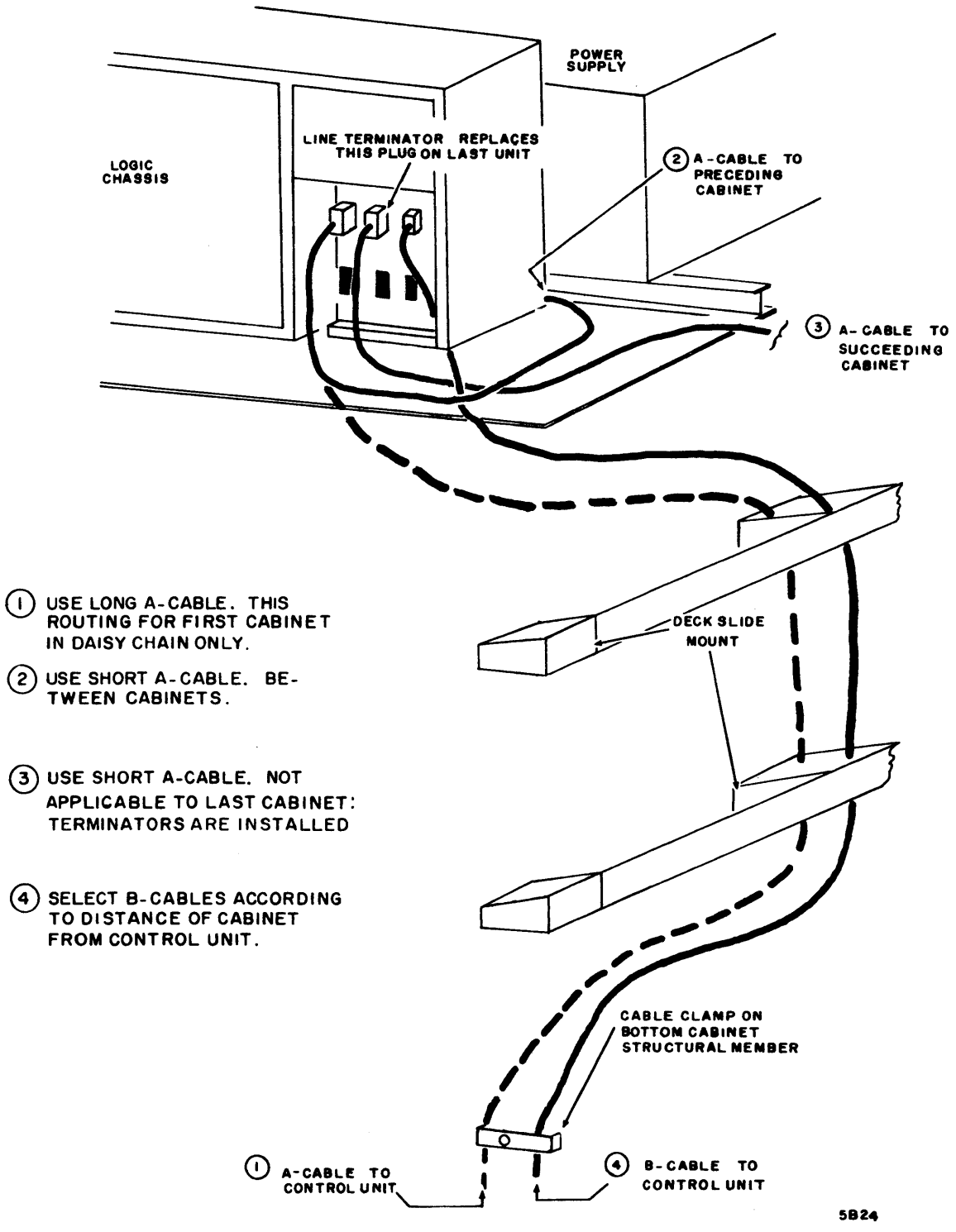


Figure 3-4. Intercabling Routing

TABLE 3-1. INPUT/OUTPUT CONNECTOR PIN ASSIGNEMENTS

CABLE A (J200 AND J201)		CABLE B (J202)	
PINS	FUNCTION	PINS	FUNCTION
1-4	Bidirectional Bus Line 0	A-C	Spare
2-5	Bidirectional Bus Line 1	AA-CC	Spare
3-7	Bidirectional Bus Line 2	B-D	Unit Selected (Upper)
8-12	Bidirectional Bus Line 3	BB-DD	Unit Selected (Lower)
10-13	Bidirectional Bus Line 4	E-H	Seek Complete or Seek Error (Upper)
11-14	Bidirectional Bus Line 5	EE-HH	Seek Complete or Seek Error (Lower)
15-18	Bidirectional Bus Line 6	L	Spare
16-20	Bidirectional Bus Line 7	N	Termination Power Shield
17-21	Cylinder Select	P	Spare
22-25	Head Select	R	Termination Power Ground**
23-26	Difference Select	S	Spare
24-27	Control Select	T	Sequence Lines Shield
28-31	Read Cylinder Select	U	Sequence Line
29-32	Spare	V	Sequence Line
30-33	Spare	W	Sequence Line
34-37	Pack Unsafe	X	Sequence Line
35-38	Seek Error	Y	Sequence Line
36-39	Pin wired but not used by MDD	Z	Sequence Line
40-43	Logic No. 1 (Bit 0)	F-J	Read Data (Upper)
41-44	Logic No. 2 (Bit 1)	FF-JJ	Read Data (Lower)
42-45	Logic No. 3 (Bit 2)	K-M	Write Data (Upper)
46-49	Logic No. 4 (Bit 3)	KK-MM	Write Data (Lower)
47-50	Unit Select	LL-NN	Spare
48-51	Pin wired but not used by MDD		
52-55	Pin wired but not used by MDD		
53-56	Spare		
54-57	Spare		
58-62	On Cylinder		
59-63	Unit Ready		
60-64	Index		
65-70	Release		

TABLE 3-1. INPUT/OUTPUT CONNECTOR PIN ASSIGNMENTS (Cont'd)

CABLE A (J200 AND J201)		CABLE B (J202)	
PINS	FUNCTION	PINS	FUNCTION
66-71	Spare		
67-72	Clear		
73-76	Spare		
74-77	Spare		
75-78	Spare		
79	Spare		
80	Termination Power Ground*		
82	Spare		

* Provides a return path for terminators and does not connect to the lines in cable.

** From control unit

3. Install cabinet trim as follows:

CAUTION

Following procedure removes cabinet panels. Make certain that the panels are returned to the same cabinet. Misalignment and/or binding could result from switching panels.

a. Open all deck drawers to the front. Open front cabinet doors. Remove lower front cabinet panels.

b. Refer to Figure 3-5 and position front trim strip flat against front frame members and behind operator panel. Locate top end of trim strip as shown. Secure strip to frame placing moulding clips as near to top and bottom of strip as possible. Space six remaining clips equally between top and bottom pairs.

c. Refer to Figure 3-5 and secure trim spacer to side trim with five equally spaced moulding clips. Locate top end of side trim as shown. Secure side trim to frame using five moulding clips spaced as in step b.

4. Remove all top panels. Position dust shield over top frame members as shown in Figure 3-5. Install top panels.

5. Install side panels as follows:

a. Refer to Figure 3-6 and assemble side panel hanger and slides and bracket/stud assemblies to cabinet. Do not completely tighten attaching screws at this time.

b. Adjust side panel hanger on lower frame member to dimension shown on Figure 3-6. Tighten screws securing hanger. Tighten screws securing side panel slides to hanger.

c. Put side panel in place on cabinet and secure with quarter-turn fasteners in bracket/stud assemblies.

d. Loosen upper brackets on side panel, establish the 1/2 ± 1/32 inch dimension along top edge (Figure 3-6), and tighten upper brackets on side panel.

CAUTION

Adjustments made in following steps are not complete until seal strip on side panel is compressed along its entire length. Improper adjustment will allow the entry of dust into the cabinet and could cause damage to the unit.

e. Loosen lower brackets on side panel. Move side panel until it is flush with side trim to within ± 1/32 inch (Figure 3-6) and hold it there. Now press side panel toward frame until seal strip along top edge of side panel is compressed at all points. Tighten screws in bracket/stud assemblies.

f. Inspect gap (in which seal strip is compressed) around perimeter of side panel. Seal strip must be compressed at all points and gap must be uniform to within ± 1/16 inch. Make required adjustments by loosening and repositioning side panel hanger or bracket/stud assemblies.

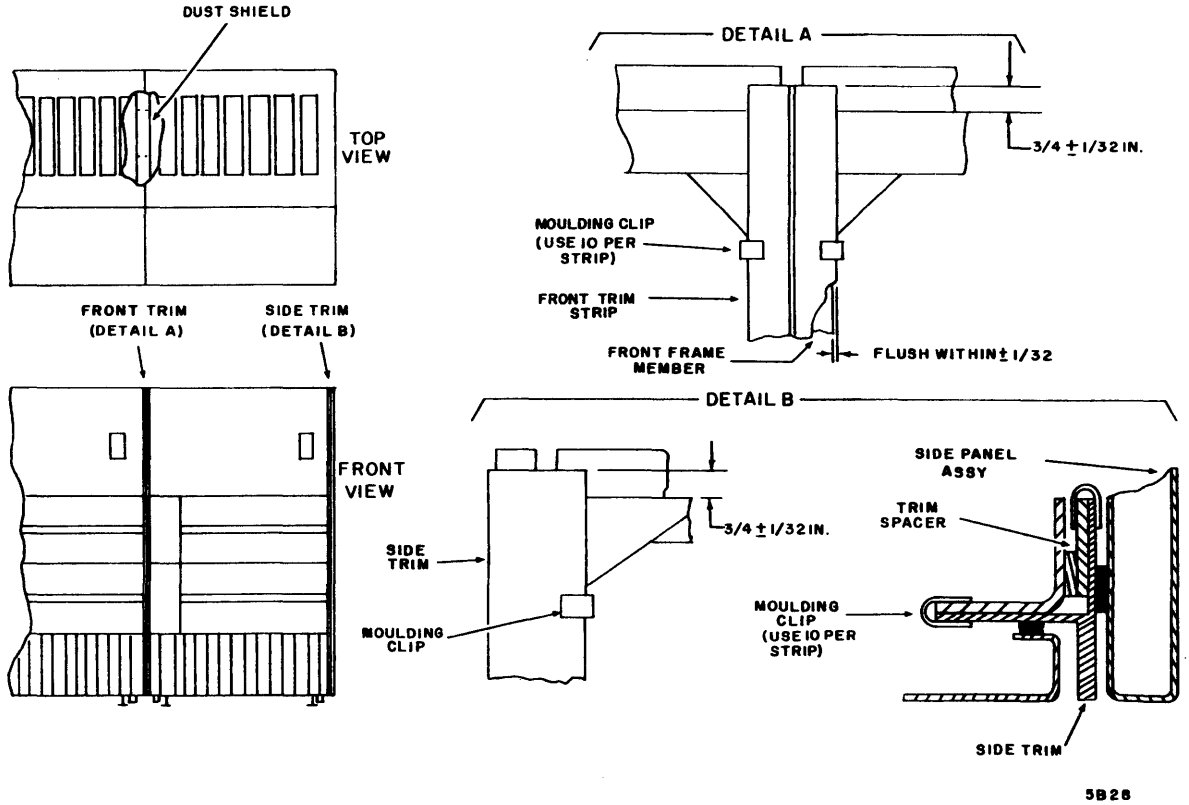


Figure 3-5. Trim and Dust Shield Installation

g. Tighten lower brackets on side panel. Make certain that side panel slides are positioned laterally on side panel hanger so as to maintain side panel alignment.

INPUT POWER REQUIREMENTS

The MDD requires an input power source capable of supplying 380 volt ± 10%, 50 Hz (+1%, -2%) 3-phase, four-wire wye.

The maximum current consumption with this input voltage is as follows:

Operating current (disk packs turning, steady-state)	4 amps/phase/2X cabinet

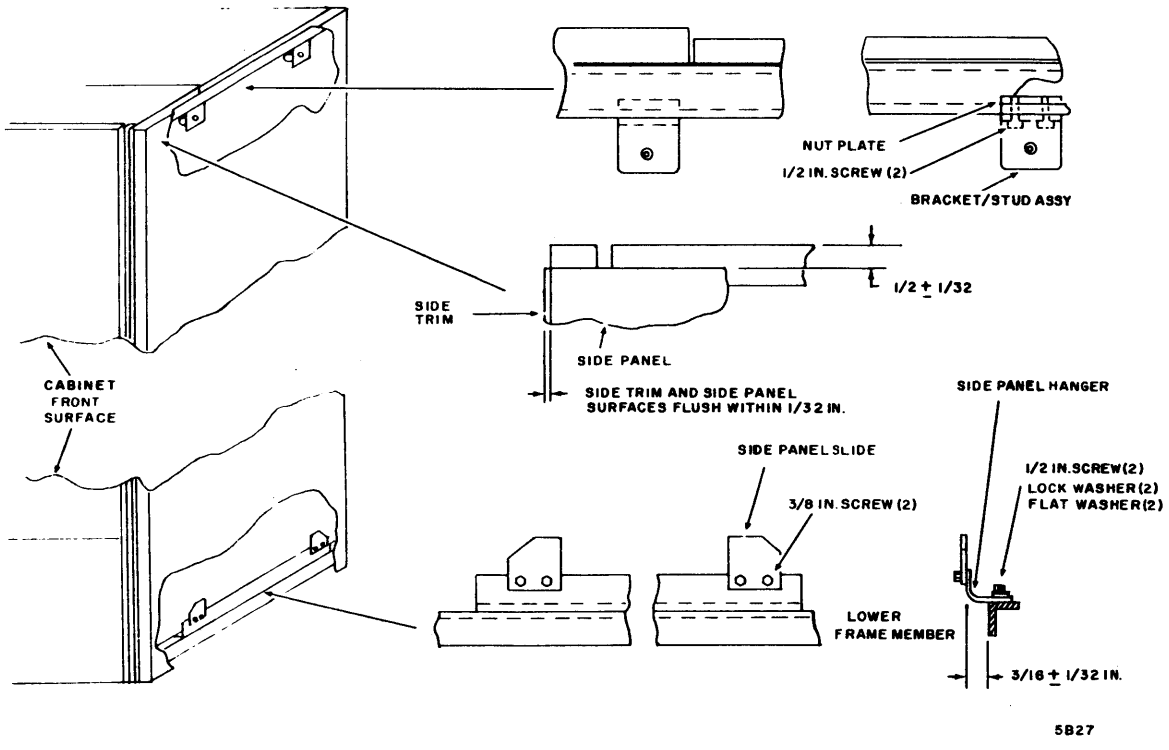


Figure 3-6. Side Panel Installation and Adjustment

Standby current	1.7 amps/phase/2X cabinet
Surge current	15 amps/phase drawn by each spindle motor during start. (Decreases to operational level as motor approaches operating speed. Spindle motors sequenced on, one at a time, during power application)

ENVIRONMENT

Operating and storage environments of the MDD are as follows:

Operating status	60 to 90° F (12° F/hr maximum fluctuation)
	10 to 80% relative humidity (providing there is no condensation)
Non-Operating status	-30 to +150° F
	5 to 95% relative humidity (providing there is no condensation)

INITIAL CHECKOUT AND STARTUP PROCEDURE

This procedure should be used to make the first power application to the MDD. The procedure assumes that the preceding procedures and requirements of this section have been performed and satisfied. Instructions are given for one deck of one cabinet, repeat as required for additional decks and cabinets.

1. Open cabinet rear door. Check that all logic chassis cards are firmly seated in their connectors.
2. Extend deck drawer to rear. Check that the four logic cards adjacent to shroud are seated securely in their connectors.
3. Remove plastic spindle cover.

NOTE

To avoid contamination of spindle assembly, install plastic cover on spindle whenever disk pack is not installed.

4. Grasp and attempt to turn spindle. Spindle should not rotate.
5. Disable spindle lock mechanism (Figure 2-2). Grasp and turn spindle. Spindle should rotate with little resistance.

CAUTION

Bearing damage may occur if alcohol runs into spindle.

6. Wipe spindle surface clean with alcohol-dampened gauze.

CAUTION

Never load read/write heads manually.

7. Unlatch head load cam (see Manually Positioning Carriage, Section 6) and extend read/write heads into shroud area.
8. Inspect and clean read/write heads (see Preventive Maintenance Index, Section 6).
9. Disengage detent pawl and retract carriage to stop.
10. Enable spindle lock mechanism (Figure 2-2).
11. Make certain that sector sensor and pack cleaning brushes are rotated back from shroud openings.
12. Install a disk pack (see Section 2).
13. Inspect and clean disk pack (see Preventive Maintenance Index, Section 6).
14. Remove disk pack from spindle (see Section 2).
15. Use a vacuum cleaner to remove any dust or dirt from interior of shroud and cabinet.

16. Set Filter Box panel UNIT POWER circuit breaker to OFF.

17. Make certain that cabinet power cable is connected to correct external ac power source. (Nominal voltage and frequency requirements are specified on identification plate located on top horizontal structural member at rear of cabinet.)

18. If external ac power to MDD is protected by circuit breaker, set circuit breaker to ON.

19. Set Logic Chassis Maintenance panel ON LINE/OFF LINE switch to OFF LINE.

20. Set Power Supply panel switches as follows:

    BLOWER circuit breaker to OFF
    +20 Circuit breaker to OFF
    -20 circuit breaker to OFF
    LOCAL/REMOTE switch to LOCAL
    SPINDLE (as applicable) circuit breaker to OFF
    +40 (as applicable) circuit breaker to OFF
    +6 (as applicable) circuit breaker to OFF
    DC/OFF (as applicable) switch to DC
    START (as applicable) switch to toggle down

21. Set Filter box panel UNIT POWER circuit breaker to ON. Power supply MAIN BREAKER and +20Y indicators light. Logic chassis and power supply fans begin to operate.

22. Set power supply BLOWER circuit breaker to ON. Cabinet blower begins to operate.

23. Extend deck drawer to rear. Place hand over air baffle surrounding spindle in bottom of shroud. Blower should be exhausting air into shroud. If blower is drawing air from shroud, reverse the connection of any two phase leadwires of the unit input power.

24. Install disk pack. Close deck drawer. If power supply START and Operator panel DEPART indicators light, set power supply START (as applicable) switch to toggle up.

25. Set power supply +20 and -20 circuit breakers to ON.

26. Set power supply +40 and +6 (as applicable) circuit breakers to ON.

27. Set power supply SPINDLE (as applicable) circuit breaker to ON and set related ON LINE/OFF LINE switch to ON LINE.

28. Set power supply START switch to toggle down.

29. Set power supply LOCAL/REMOTE switch to REMOTE.

30. Press Operator panel DEPART switch/indicator. Operator panel DEPART and power supply START indicators light.

31. Make sequence power available from controller.

NOTE

When more than one deck is being powered up, power is sequenced to the next deck in line when the spindle of the preceding deck reaches the correct speed. Following events do not occur simultaneously in each deck to be powered up.

32. Power supply +6, +20, and -20 indicators light and SPINDLE (as applicable) time meter starts. On the deck the spindle drive motor and disk cleaner (brush motor) start. Operator panel SPIN indicator lights indicating a disk pack rpm of more than 50.

33. When disk pack has achieved operational speed, power supply +40 and +40Y indicators light and actuator moves to hydraulic home position. At this point sequence power is passed to next deck (if any) to be powered up.

NOTE

Further activity ceases until brush motor finishes driving the cleaning brushes over disk pack surfaces.

34. When brushes are returned to a position clear of disk pack, the hydraulic actuator drives carriage forward to load read/write heads.

35. When heads are loaded, Operator panel PRET indicator lights and hydraulic actuator returns read/write heads to track zero.

36. Perform Head/Arm Adjustment procedure (see Preventive Maintenance Index).

37. Perform Index to Burst Check and Adjustment (see Corrective Maintenance).

38. To stop spindle motor, press Operator panel DEPART switch/indicator (indicator will extinguish). To remove power to unit, set ON LINE/OFF LINE switch to OFF LINE (for each spindle) and set Filter Box panel UNIT POWER circuit breaker to OFF.

CAUTION

Unit Number indicator goes out immediately if UNIT POWER circuit breaker is set to OFF.

39. Allow Unit Number indicator to go out before opening deck drawer.

Information for these sections is included in
BM1A5 Multiple Disk Drive
Pub. No. 70602500

SECTION 4

THEORY OF OPERATION

SECTION 5

DIAGRAMS

THEORY OF OPERATION

Theory of operation for the MDD is divided into three parts. The first part considers the MDD in terms of the functions it performs and the signals exchanged with the controller. The second part relates the major assemblies of the MDD to the previously discussed functions. The last part deals with the disk pack which is physically not a part of the MDD, but figures functionally in all MDD operations.

FUNCTIONS

Overall capabilities of the MDD are best described by examining the functional blocks of activity performed by a deck of the MDD. The functions are as follows:

First Seek

Direct (Forward or Reverse) Seek

Return to Zero Seek (RTZS)

Read/Write/Erase

Each of these functions is further described by flow charts and timing diagrams in Section 5 of this manual.

The above functions are performed by each deck of the MDD. Normal operation is such that a controller will generally be directing the functional activities of more than one deck. Figure 4-1 shows the method of selecting and gating input/output data to a particular deck. Figure 4-2 details the sequence of events that establishes the link and gating. The signals that are then exchanged are described in Table 4-1 and are shown relative to a point of origin on Figure 4-3.

FIRST SEEK

This function involves the activities that a deck must perform before it can effectively respond to a read, a write, or a seek command from the controller.. This function consists mainly of power supply relay sequencing and status checking by the deck logic.

As a result, no actual selection of the deck is required and very little MDD/controller signal exchange occurs. Successful progression of the function assumes that power supply circuit breakers for the deck are on, power supply DC/OFF switch for the deck is set to DC, power supply fuses are operational, related filter box panel UNIT POWER circuit breaker is on, START indicators for deck are lighted, disk pack is installed on spindle of deck, and the sector sensor is engaging the disk pack sector disk.

Initiation of the function occurs when the controller makes sequence power available to the power supply for the deck. Sequence power causes the power supply relay K01 (K101 for lower deck) to energize and the power supply performs a Power-On sequence (refer to Power Supply under Assemblies in this section for a detailed description).

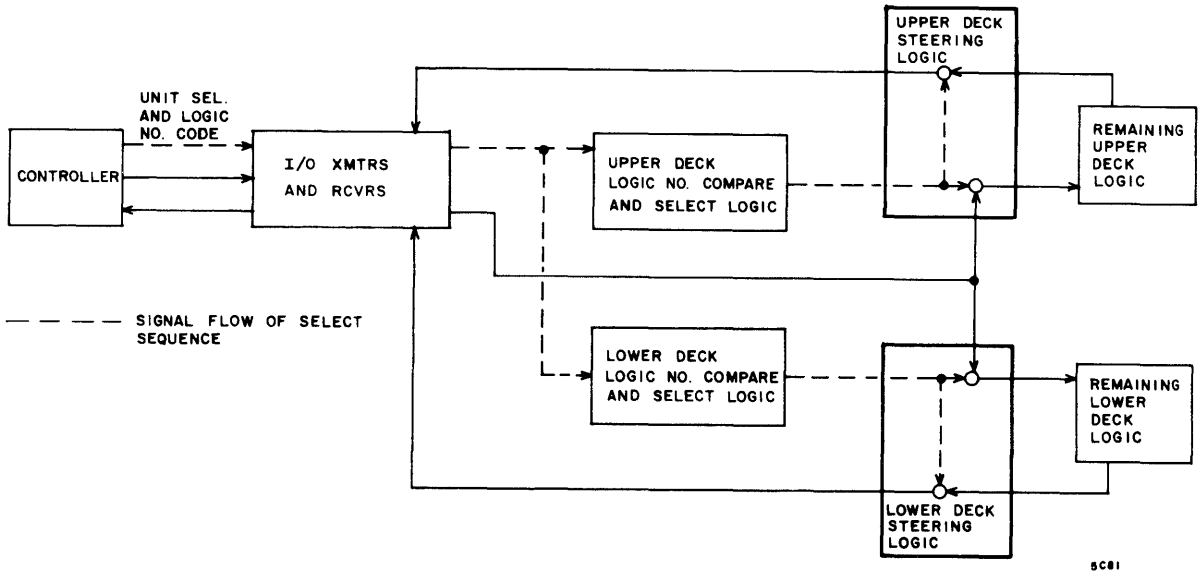


Figure 4-1. Input/Output Signal Gating - 2X Cabinet

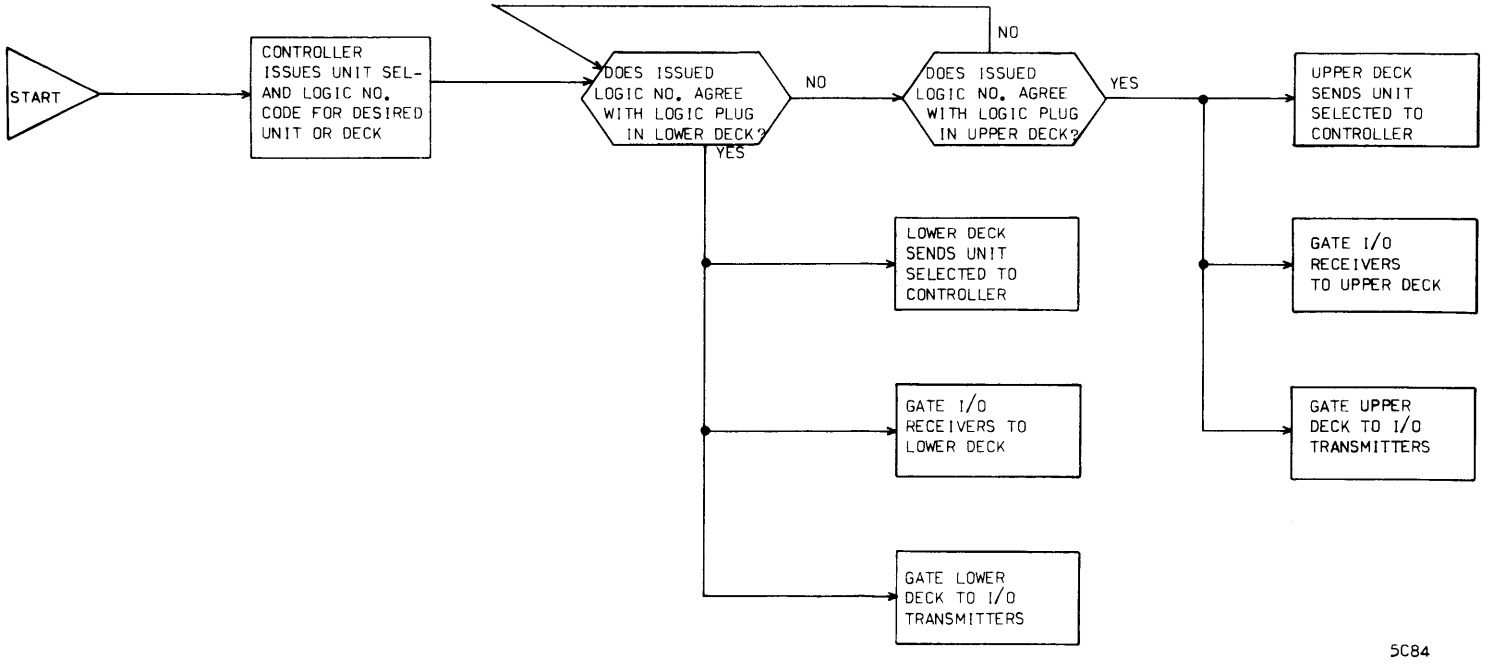


Figure 4-2. Select and Reserve Sequence

TABLE 4-1. INPUT/OUTPUT LINES

SIGNAL	FUNCTION
Bidirectional Lines Address and Control	Information carried by the bidirectional lines is coupled by five select (tag) signals. The influencing tag signal must be known before information on a bidirectional line can be interpreted. The five tag signals are defined below under Input Lines. The information coupled by each tag signal is as follows:

Address/ Control bus	Read Cylinder Select, Difference Select, or Cylinder Select	Head Select	Control Select
Bit 0	1	1	Write Gate - A "1" input on this line enables the write drivers.
Bit 1	2	2	Read Gate - A "1" input on this line enables the digital read data line.
Bit 2	4	4	Seek Forward - A "1" input on this line initiates forward carriage movement.
Bit 3	8	8	Not Used
Bit 4	16	16	Erase Gate - A "1" input on this line initiates reverse carriage movement.
Bit 5	32	Not Used	Seek Reverse - A "1" input on this line initiates reverse carriage movement.
Bit 6	64	Not Used	Return to Zero - A "1" input on this line initiates carriage movement to cylinder 00.
Bit 7	128	Not Used	Not Used

TABLE 4-1. INPUT/OUTPUT LINES (Cont'd)

SIGNAL	FUNCTION
Input Lines	
Read Cylinder Select	A "1" input on this line enables the address and control lines transmitter of the selected deck. Information transmitted to the control unit through these lines is the current cylinder address.
Difference Select	A "1" input on this line indicates that the address and control lines contain the difference address from the control unit. This address is the difference between the control unit's current cylinder request and the selected deck's present cylinder location.
Cylinder Select	A "1" input on this line indicates that the address and control lines contain the control unit's current cylinder request.
Head Select	A "1" input on this line indicates that the address and control lines contain the head select information.
Control Select	A "1" input on this line indicates that the address and control lines contain control information.
*Unit Select	This signal is preceded by a Logic Number transmission. A "1" input on this line initiates the select sequence (assuming the unit is ready) in the unit whose logic number corresponds to the number currently on the four Logic Number lines. If the unit is ready, it returns a Unit Ready and a Unit Selected signal. If not ready, the unit returns a "0" on the Unit Ready line.

TABLE 4-1. INPUT/OUTPUT LINES (Cont'd)

SIGNAL	FUNCTION
*Logic Number lines (4)	A transmission on these lines is accompanied by a Unit Select signal. The unit with the logic number corresponding to the digital number transmitted on these four lines initiates a select sequence (assuming the unit is ready and available) when a Unit Select signal is transmitted. If the unit is ready and available, it returns a Unit Ready and a Unit Selected signal. If not ready and/or available, the unit returns a "0" on the Unit Ready line.
*Clear	This line enables an unrestricted reset of the unit select condition.
Release	A "1" input on this line clears the Reserve and Compare Enable flip-flops in the selected unit.
Write Data	Carries information to be written from the control unit to the selected deck.
Output Lines	
Read Data	Carries digital information read from a disk to the control unit.
On Cylinder	Indicates that the positioning mechanism of the selected deck has stopped and the read/write heads have reached the addressed cylinder.
Seek Error	A "1" output indicates that the selected deck was unable to complete a seek operation to the point of an On Cylinder signal to the control unit. A Return to Zero command sent to the unit indicating a seek error clears the Seek Error condition, returns the heads to cylinder 00, and enables an On Cylinder signal to be sent to the control unit.

TABLE 4-1. INPUT/OUTPUT LINES (Cont'd)

SIGNAL	FUNCTION
Unit Selected	This signal is a response to the receipt of a Unit Select and a Logic Number signal combination. A "1" output indicates that the unit is available. A "0" signal indicates that the unit is not ready (see Unit Ready signal). The control unit checks that a Unit Selected signal is not received from more than one unit at a time.
Index	Provides a track reference mark from the selected deck to the control unit. This mark occurs once for each revolution of the disk pack.
Pack Unsafe	A "1" output indicates that the selected deck has one or more fault conditions. Write and erase currents are inhibited by the presence of any of the conditions. The conditions include: 1. More than one head selected. 2. Read and write gates up at the same time. 3. Read and erase gates up at the same time. 4. Erase and no write driver on. 5. Erase and both write drivers on. 6. One or both write drivers on and no erase driver on. 7. Read, write, or erase gate on and not On Cylinder. 8. Low voltage situation that could cause a loss in control of write and erase currents.

TABLE 4-1. INPUT/OUTPUT LINES (Cont'd)

SIGNAL	FUNCTION
*Unit Ready	This signal is a response to the receipt of a Unit Select and a Logic Number signal combination. A "1" output is present if both of the following conditions are satisfied: 1. Disk pack installed, spindle motor up to speed, and heads loaded. 2. Related Logic Chassis Maintenance panel ON LINE/OFF LINE switch set to ON LINE.
*Seek Complete or Seek Error	Indicates that the unit has completed (Seek Complete) or is unable to complete (Seek Error) the previously addressed seek. This is an interrupt line transmitted with or without the unit being selected. The signal is a 1 μsec "1" pulse which is initiated by an On Cylinder condition (Seek Complete) or or if the unit is unable to complete a seek (Seek Error).

*This signal is not gated by the Unit Selected signal.

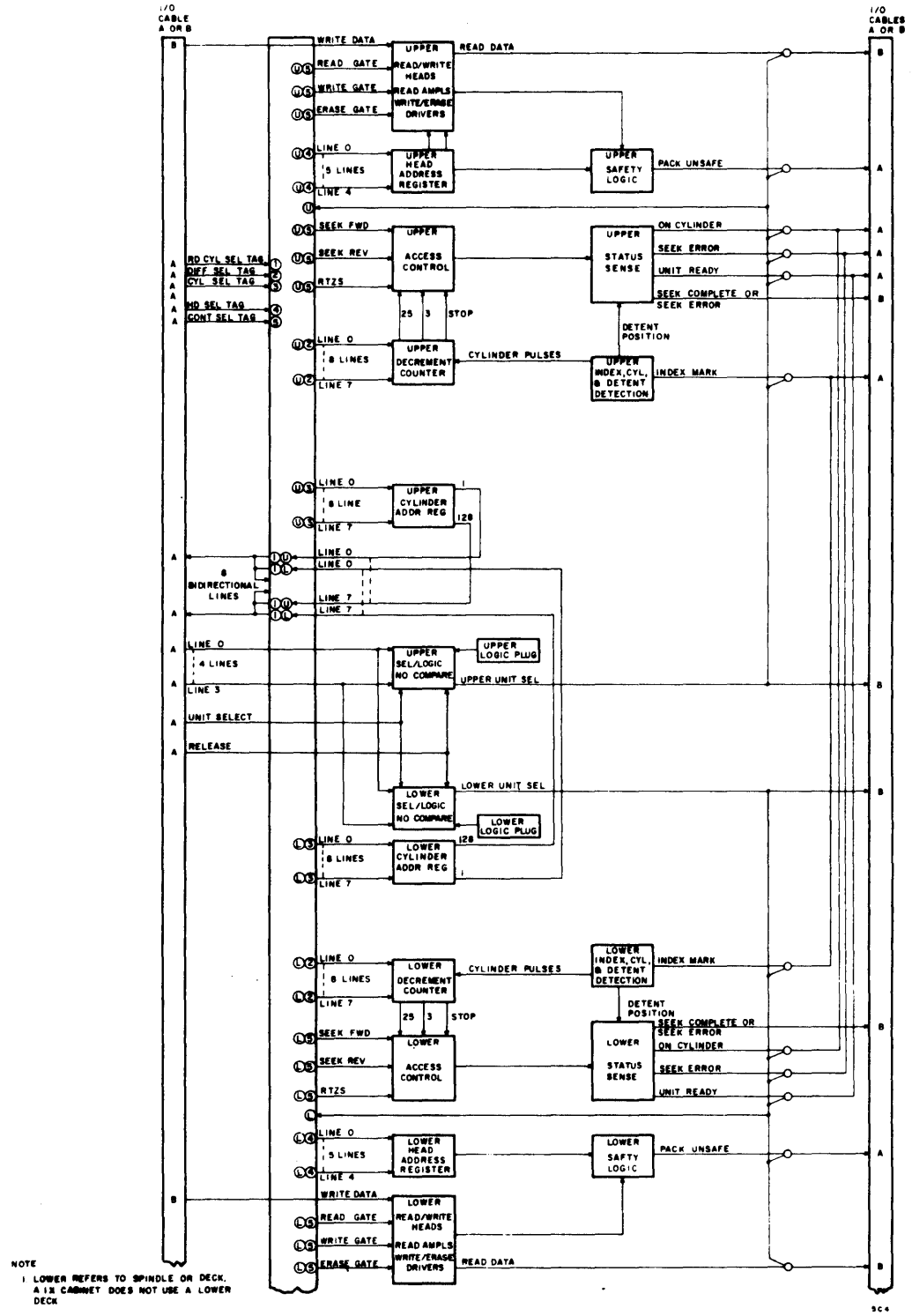


Figure 4-3. Block Diagram - 2X Cabinet

Power is applied to the brush and spindle drive motors during the Power-On sequence. Application of power to the brush motor starts a 60-second (approximately) disk cleaning cycle. When the disk pack speed reaches 2000 rpm, the power supply relay K05 (K105 for lower deck) energizes to provide sequence power to the next deck. Actuator solenoid power also becomes available, causing the detent pawl to disengage and the actuator to access forward at 2 ips to the hydraulic home position.

Transfer of the brush switch contacts at the end of the brush cycle sets the Forward Latch (FF). This causes the actuator to perform a forward fast access that mechanically loads and latches the read/write heads. The transferring contacts of the heads loaded switch sets the RTZS FF which clears the Forward Latch. The actuator responds by performing a reverse fast access to the hydraulic home position. A 300-ms delay (started when the RTZS FF was set) circuit clears the RTZS FF which in turn sets the Forward Latch, Intermediate, and Slow FF's. This causes the actuator to access forward at 2 ips until the logic senses the leading edge of the first track (track 00) pulse. The track pulse sets the Detent FF and releases the detent pawl. The output of the detent transducer is now observed and 5 ms after the pawl engages the detent gear, the deck sends an On Cylinder signal to the controller. (A seek Error signal would have been sent instead if a 600-ms delay, starting when the heads loaded switch transferred, had timed out.) The deck is now ready to perform a Read, a Write, or a seek (Direct or RTZS) operation. Such an operation must be preceded by the selecting sequence covered previously (Figures 4-1 and 4-2).

DIRECT (FORWARD/REVERSE) SEEK

The Direct Seek function involves those operations that must be performed to move the read/write heads from their current track or cylinder location to the one specified by the controller. This function must be preceded by the selecting sequence (Figure 4-1 and 4-2) unless the deck is already selected. Assume that the desired deck just completed a First Seek and is awaiting further instruction at track 00. Assume further that the controller wishes to do a Read or a Write operation at track 88. When the controller determines that the deck is selected and ready, it issues a Cylinder Select signal. This signal gates the content of the deck Cylinder Address register (00) to the controller via the bidirectional lines (content of the register always preset to 00 during

a First Seek or RTZS). The controller then calculates the difference between the decks current and desired location and sends a Difference select that gates the seek length (88 tracks) into the decrement counter of the deck (again via the bidirectional lines). The controller now uses a Cylinder Select and the bidirectional lines to gate the address of the desired cylinder (88) into the deck Cylinder Address register. This is followed by a Sector Select that enters the sector address into the deck Sector Address register. Next the controller sends a Head Select signal that gates the number corresponding to the desired read/write head into the Head register. The last address and control exchange involves the Control Select signal that gates a "1" to the deck on bit 2 (Seek Forward) of the bidirectional lines.

The Seek Forward pulse causes an Any Seek pulse. (A Seek Reverse pulse would also cause the Any Seek, but in addition would have cleared the Forward Latch.) Any Seek transfers the content of rank I of the decrement counter (88) to rank II and clears the Detent FF. The hydraulic actuator responds by applying pressure to the detent pawl. As soon as the detent pawl clears the detent gear, forward motion begins. As each track is crossed, the cylinder transducer generates a track pulse. The trailing edge of each of these pulses decreases the content of the decrement counter by one. Motion velocity is controlled according to the content of the decrement counter, and since this content is in excess of 26, the actuator performs a forward fast access. Fast access (26 ips) continues until the decrement counter content equals 25 tracks remaining. At this time the counter output decoding logic sets the Intermediate FF, and the hydraulic actuator continues the access in the forward intermediate mode (7 ips). When the decrement counter content indicates three tracks to go, the Slow FF sets. This causes the actuator to reduce speed to 2 ips and continue the access at a forward slow rate. When the tracks remaining have been reduced to one, the output of the cylinder transducer detection logic is gated such that the leading edge of the next track pulse sets the Detent FF. This causes the hydraulic actuator to release the spring-loaded pawl. (If this were a Reverse Seek, the Forward Latch would set as a result of the Detent FF setting. Setting the Forward Latch would cause carriage motion to change direction and allow the detent pawl to engage the gear in the same manner as for a Forward Seek.)

Five ms after the detent transducer indicates that the detent pawl has engaged the detent gear, the deck sends an On Cylinder signal to the controller. (If the period during which the pawl was disengaged from the detent gear had exceeded 600 ms, a

Seek Error signal would have replaced the On Cylinder signal.) The deck is now ready to perform a Read, a Write, or a Seek (Direct or RTZS) operation.

RETURN TO ZERO SEEK (RTZS)

The RTZS functions allow a controller to return the read/write heads to track 00 when a Seek Error signal occurs. This function must be preceded by the selecting sequence (Figures 4-1 and 4-2) unless the deck is already selected. The controller responds to a Seek Error signal from a deck by sending a Control Select tag that gates a "1" on bit 6 (RTZS pulse) of the bidirectional lines to the afflicted deck.

The RTZS pulse sets the RTZS FF and causes an Any Seek pulse. The Any Seek pulse clears the Detent FF causing the hydraulic actuator to apply hydraulic pressure to the detent actuator. The pressure overrides the force of the pawl spring and the carriage is free to be moved. The set output of the RTZS FF causes the following events:

Clears decrement counter

Clears Cylinder Address register

Clears Forward Latch

Initiates a 300-ms delay circuit

Establishes a tracks-to-go greater than 26 signal (T>26)

With the Forward Latch cleared and a T>26 situation, the actuator enters into a fast reverse access toward the rear stop (cushioned hydraulically). When the 300-ms delay times out, the RTZS FF clears and the T>26 signal drops. The clear output of the RTZS FF sets the Forward Latch, Intermediate, and Slow FF's. The hydraulic actuator responds to this activity with a slow forward (2 ips) access. As soon as the leading edge of the first track pulse occurs, the Detent FF sets and the actuator removes pressure to the spring-loaded detent pawl. Five ms after the detent transducer indicates that the detent pawl has engaged the detent gear, the deck sends an On Cylinder signal to the controller. (If the period during which the pawl was disengaged from the detent gear had exceeded 600 ms, a Seek Error signal would have replaced the On Cylinder signal.) The deck is now ready to perform a Read, a Write, or a Seek (Direct or RTZS) operation.

READ/WRITE/ERASE

An On Cylinder signal indicates to the controller that the selected MDD deck has completed a seek operation and is awaiting further instruction. If, however, the controller initiated a seek operation in one deck and then in the interim selected another deck, the first deck would make its status known via the On Sector interrupt signal. In the latter case, the controller would be required to precede a Read or a Write operation with the selecting sequence (Figures 4-1 and 4-2). The following paragraphs cover the sequence of events involved in a Read or a Write operation.

A Write operation actually begins before the hydraulic actuator positions the heads to the desired track: the Head Select tag gates the identifying number of the head to be used into the Head Address register. When the seek is completed or a seek error is discovered, the deck sends a Seek Complete or Seek Error interrupt signal. If the controller has selected another deck in the mean time, this deck will standby until it is reselected by the controller. In any case the controller will examine the Seek Error and On Cylinder lines. If a Seek Error exists, a RTZS pulse will clear it. If an On Cylinder exists, the controller responds with a Control Select tag that gates the Read Gate signal (bit 1 of the bidirectional lines) to the deck. Read Gate enables the read circuit logic to function with the previously selected head. As each record of data on the disk pack is reached, the address is read from the Read Data line and compared by the controller with the address of the desired record. (Refer to Section 5 of this manual for detailed information relative to the read/write format.) When the controller is satisfied that the desired record is being read, it drops the Read Gate and gates in the Write Gate and Erase Gate (bits 0 and 4 of the bidirectional lines) with the Control Select tag. This disables the read circuit and enables the write circuit, and data from the controller is written via the Write Data line onto the disk pack record. The Erase Gate signal enables erase current to the erase coil during the Write operation to ensure a clear writing surface.

A Read operation is performed in much the same manner as the Write operation. The difference is that the Write Gate and Erase Gate signals are never enabled (Read Gate stays on throughout the entire record).

ASSEMBLIES

POWER SUPPLY

Each MDD cabinet has a self-contained power supply accessible via the rear door and located behind the swingout logic chassis. The power supply provides a fixed output voltage of +40Y volts for use by the solenoids on the deck assemblies. It also provides adjustable output voltages of +40 vdc (to read/write logic), ±20 vdc (to logic), and +6 vdc (to logic). Each voltage is duplicated within the power supply, so that the voltage can be distributed separately to the upper deck and the lower deck or to row A and row B of the logic chassis.

Basic on/off power control and monitoring is provided at the front panel of the assembly. The front panel is hinged so that access can be gained to adjust or perform maintenance. The assembly is cooled by fans located on the top surface of the chassis.

AD/DC Distribution (Figure 4-4)

Input power is applied through the closed contacts of the MAIN POWER circuit breaker (on filter box panel) to the primary of transformer T01. The presence of the primary input power at the power supply is indicated by the power supply MAIN BREAKER indicator.

The input power is applied directly to the cooling fans in the power supply and the logic chassis. Input power will also be applied to the blower in the lower part of the cabinet, but only when the power supply BLOWER circuit breaker is set to ON. All other distribution of ac power is delayed until during the power-on sequence (described in a later paragraph).

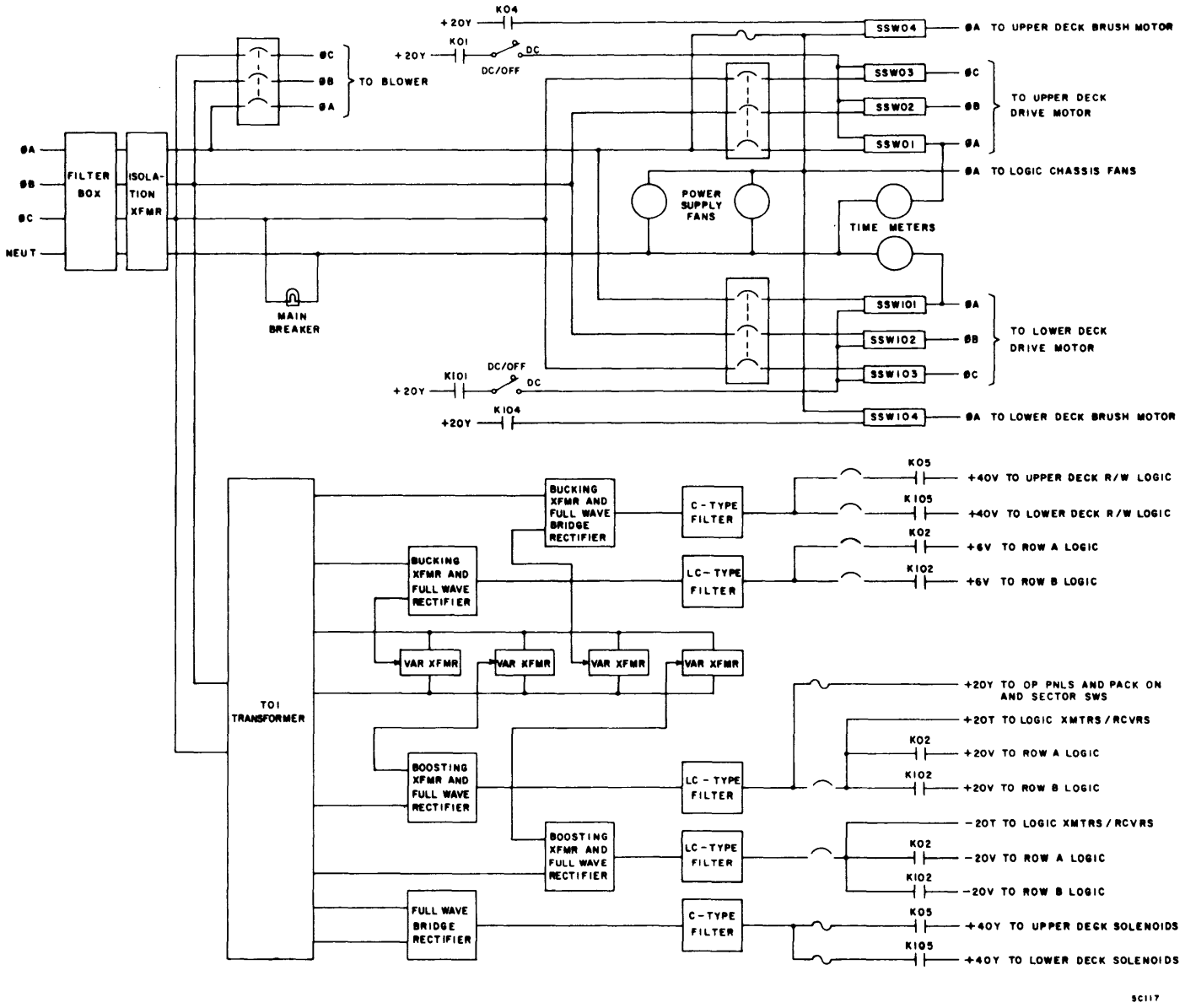


Figure 4-4. Power Supply - AC/DC Distribution

The dc power distribution begins with the application of main input power to the primary of T01. Voltages developed across the secondary windings are applied to five rectifier/filter circuits. Each of these circuits develops a separate dc voltage. Through the use of variable transformers, four of the five voltages are adjustable (+40Y solenoid power is not adjustable). The +20Y voltage is immediately available when T01 is energized. This voltage is distributed to the operator panels and the pack on and sector in-place switches. The voltage is required to determine the status of these elements during a power on sequence. Distribution of the other dc voltages is controlled by circuit breakers and/or relay contacts.

Power-On Sequence

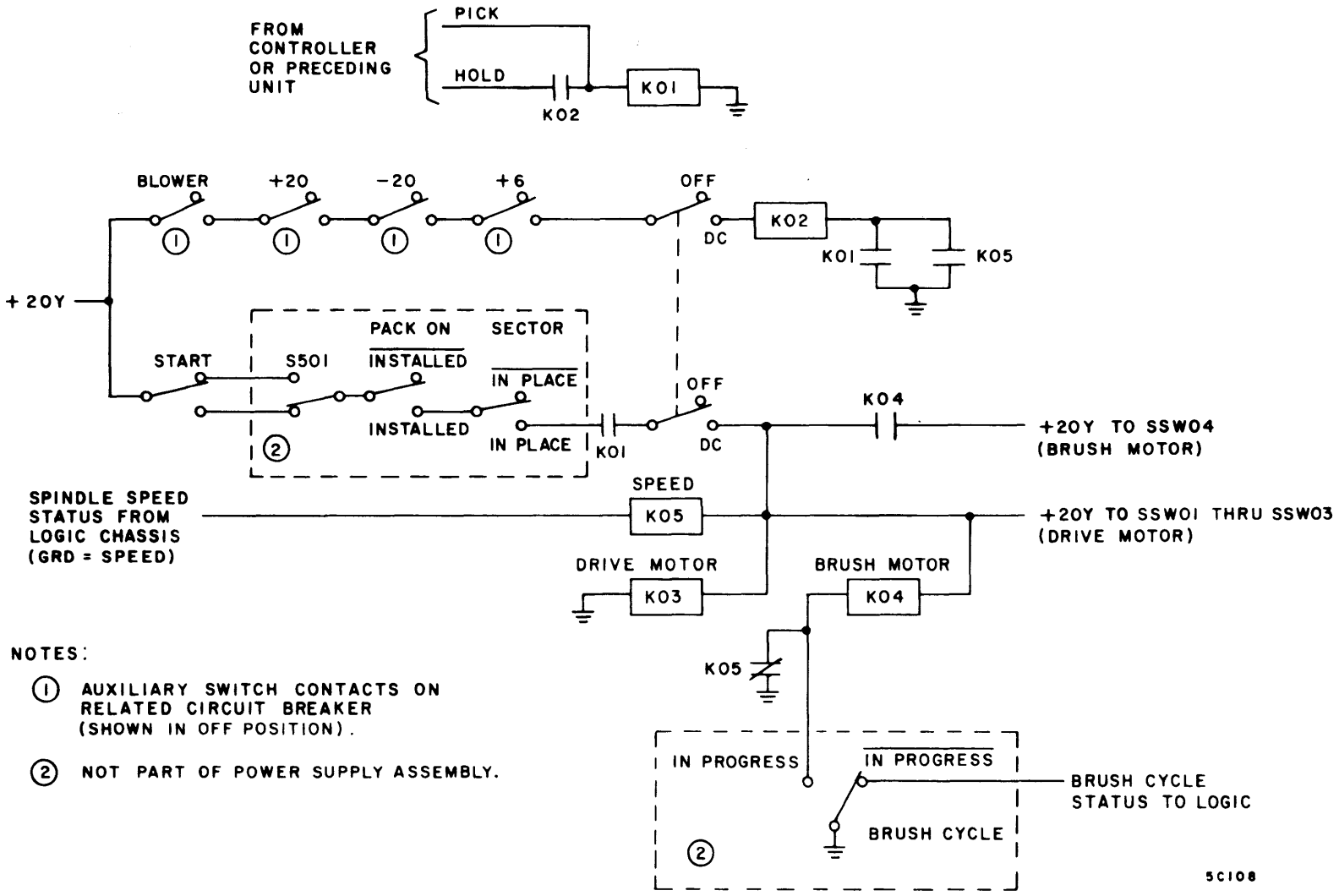
Power application to a deck is sequenced up by relays in the power supply (Figure 4-5). Sequencing is required to prevent damage to read/write heads and/or disk packs.

A normal on line, power-on sequence begins when switch S501 on the operator panel is pressed (actuating power supply panel START switch will also start the sequence). The progression of the sequence assumes that all power supply circuit breakers are on, that all power supply fuses are operational, that the power supply DC/OFF switch is set to DC, that a disk pack is installed, that the deck drawer is closed, and that sequence voltage to relay K01 is available.

NOTE

Although steps 1 through 3 occur prior to actuating S501, they should be considered a part of the power on sequence.

1. When filter box MAIN POWER circuit breaker was set to ON, +20Y voltage became available (Figure 4-4).
2. When controller issued sequence voltage, K01 energized via pick line (Figure 4-5). The +20Y voltage was applied to solid-state switches SSW01, SSW02, and SSW03 (Figure 4-4). This enabled the solid-state switches to conduct their respective phase of ac power. The upper deck drive motor and time meter started.



NOTES:

(1) AUXILIARY SWITCH CONTACTS ON RELATED CIRCUIT BREAKER (SHOWN IN OFF POSITION).

(2) NOT PART OF POWER SUPPLY ASSEMBLY.

Figure 4-5. Power Supply - Sequencing (Upper Deck Only)

3. With circuit breakers on and DC/OFF switch set to DC, the closing contacts of K02 caused the following:

   a. Distributed +6, +20, and -20 vdc to the A row of the logic chassis.

   b. Applied holding current to armature of relay K01.

4. Press operator panel switch S501 (or actuate power supply START switch).

5. The +20Y voltage energizes K03 (K05 does not energize because spindle speed is zero).

6. The +20Y voltage also energizes relay K04. Closing contacts of K04 cause +20Y voltage to be applied to SSW04. The solid-state switch conducts ac power and the brush motor starts. Brush cycle switch transfers to the in-progress position.

7. When the logic chassis detection circuit determines that the spindle speed is adequate, K05 energizes. The contacts of K05 cause the following:

   a. The +40 voltage is distributed to the read/write logic on the upper deck (Figure 4-4).

   b. The +40Y voltage is distributed to the solenoids on the upper deck (Figure 4-4).

   c. One of the grounds to K04 is removed, but K04 does not de-energize since the brush cycle is still in progress.

8. As the disk pack cleaning brushes return from sweeping the disk surfaces, the brush cycle switch is mechanically transferred and de-energizes K04. This removes the enabling +20Y voltage to SSW04, and ac power to the brush motor is dropped.

9. Completion of the brush cycle allows the start of the First Seek (load heads) function. Upon completion of the First Seek operation the deck is ready to respond to commands from the controller.

Power-Off Sequence

A power-off sequence begins when the operator panel switch S501 is pressed (Figure 4-5). The sequence is as follows:

1. Press S501 (actuating power supply panel START switch will also initiate the sequence).

2. Relays K03, K04, and K05 de-energize. Contacts cause the following:

   a. K05 contacts disable +40 volts to read/write logic.

   b. K05 contacts disable +40Y voltage to hydraulic actuator solenoids and head latch solenoid. Read/write heads unload and the reverse biased (hydraulically) carriage moves in reverse to retracted stop at 2 ips (see Hydraulic Operations, Section 4 of this manual).

   c. K05 contacts also provide a path to ground for relay K04 in preparation for next power-on sequence.

   d. The application of the +20, -20, and +6 voltages to logic chassis will continue until the occurrence of one of the following: K01 drops because sequence voltage was removed at controller, or K02 drops because of either the actuation of a power supply switch or breaker (DC/OFF, +20, -20, +6, BLOWER) or removal of cabinet input power.

LOGIC CHASSIS

The logic chassis assembly consists of a logic card section, a maintenance panel, and an input/output connector panel. The assembly is accessible through the rear door and is located at the top of the cabinet. The assembly is mounted on hinges to allow access to the power supply assembly. Three fans are mounted along the lower surface of the assembly. These fans are energized whenever the filter box circuit breaker is on, and they provide cooling air to the logic card section. The back cover of the entire assembly can be removed (four half-turn fasteners) to gain access to components and wiring.

The logic card section contains the bulk of the SPL logic cards used in the cabinet (four cards are located on each deck assembly). The vertically mounted cards are installed in two rows (A top row and B bottom row) at numerically identified locations. Refer to Section 5 of this manual for a description of the logical functions performed by the cards. Section 9 contains a tabulation of the wiring connections in the chassis.

The maintenance panel contains a set of test point jacks, switches, and an indicator for each deck in the cabinet. These components function primarily to isolate the occurrence of a fault on the related deck. Specific information on each control or indicator of this panel is provided in the Operation section for this equipment (see Preface of this manual for publication number).

Connectors located on the input/output connector panel are involved only with signals exchanged between a deck and the controller. Refer to Table 4-1 for a description of these signals. The Installation and Checkout section for this equipment covers cabling and I/O connector pin assignments (see Preface of this manual for publication number).

DECK ASSEMBLY

The deck assemblies (Figure 4-6) are responsible for the dynamic operations of an MDD: driving the disk packs, and loading and positioning the read/write heads. The deck assembly consists of a deck plate on which are mounted a drive motor assembly, a spindle assembly, a hydraulic pump, a carriage and carriage mount, three transducers, a disk cleaner assembly, and a hydraulic actuator.

The deck assembly mounts in the MDD cabinet on a drawer mechanism. The drawer may be extended out the front of the cabinet to load a disk pack, or extended out the rear of the cabinet for maintenance purposes.

Drive Motor Assembly

The drive motor drives the spindle assembly and the hydraulic pump. The motor is an induction type, 3/4-hp unit. The motor is secured to a mounting plate which bolts to the underside of the deck plate. Power is transferred via a flat, smooth-surfaced belt that threads over the pulleys of the spindle, hydraulic pump, and drive motor. A spring-loaded idler pulley maintains a constant tension on the belt.

The temperature of the motor is monitored by a thermal protection switch. To restore operation after an over-temperature condition, the red, 1/4-inch button on the top end of the motor must be manually reset (pressed).

Spindle Assembly

The spindle assembly is the physical interface between an MDD deck and a disk pack. The conical surface of the spindle cone (Figure 4-7) mates directly with the cone-shaped opening in the center of the disk pack.

Starting in the spindle cone and running through the center of the spindle assembly is the vertically free-floating lockshaft. The upper end of the lockshaft contains internal threads that engage the external threads of a stud projecting from the disk pack. When the disk pack cannister cover handle is rotated clockwise, the spring-loaded lockshaft is pulled upward and the disk pack is pulled down. As a result, the conical surfaces of the disk pack and the spindle cone are engaged by a force of approximately 200 pounds. When the disk pack is fully engaged, a release mechanism in the cannister handle frees the cannister from the disk pack.

A notched lock wheel secures to the bottom surface of the drive pulley. The notches of the wheel are engaged by the tip of the spindle lock pawl (Figure 4-6) when the deck drawer is open. This locks the spindle, making it easier to install or remove a disk pack. Opening the drawer of an operating deck will cause a loud ratcheting noise (such action, while not recommended, will not cause damage). The spindle lock mechanism can be overridden if deck operation is required with the drawer open

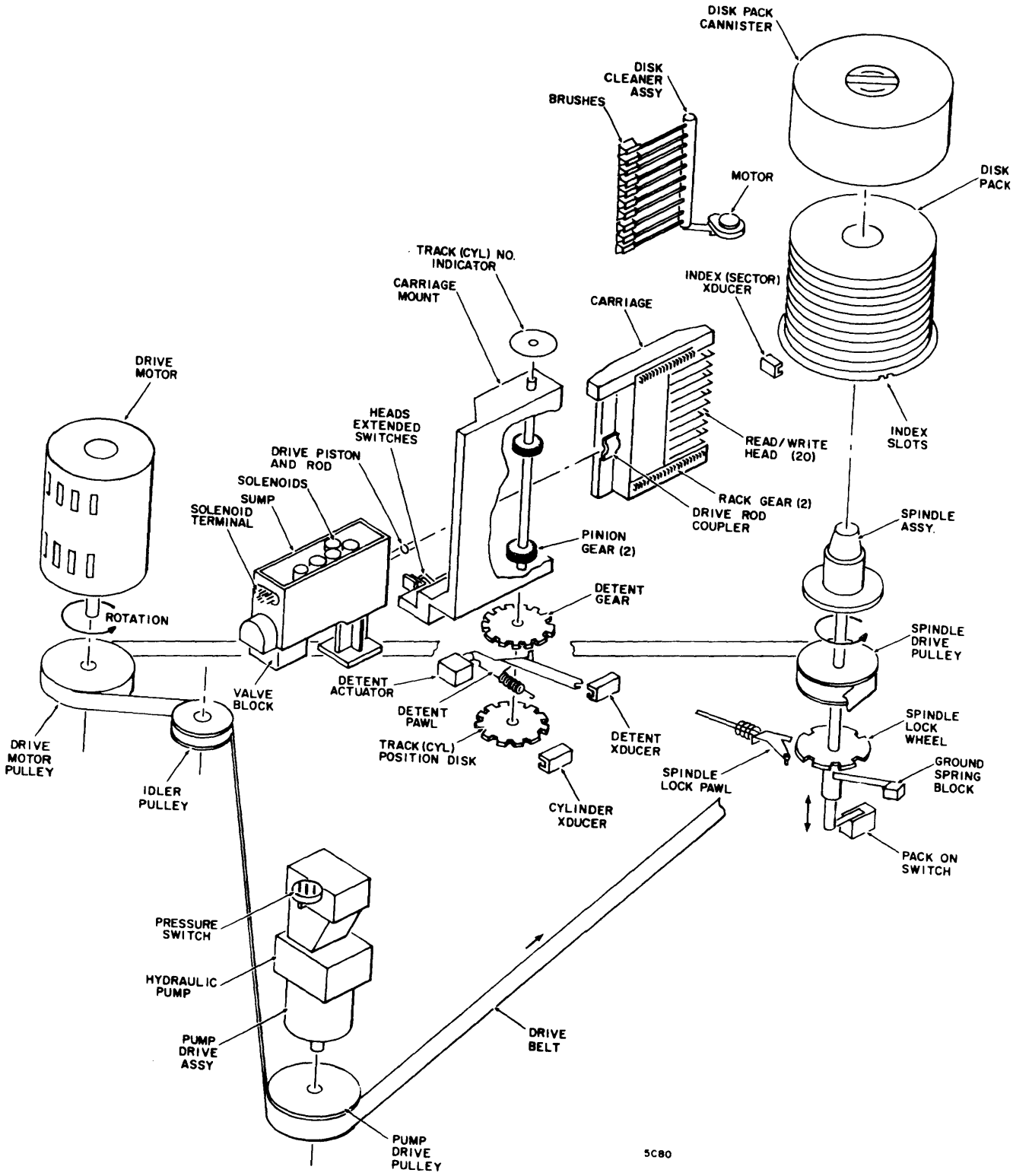


Figure 4-6. Deck Assembly

(refer to Figure 2-2). Closing the drawer will cancel the override. The spindle drive pulley is driven by a flat belt linking it to the drive motor pulley.

The Pack-On switch and ground spring are mounted at the lower end of the spindle assembly. The ground spring block is mounted so that it is always in contact with the ground sleeve. The Pack-On switch contacts transfer in response to the vertical movement of the lockshaft. When the shaft is up (disk pack mounted), the contacts are closed. When a pack is not installed, the shaft moves downward to deflect the switch actuator and transfer the contacts.

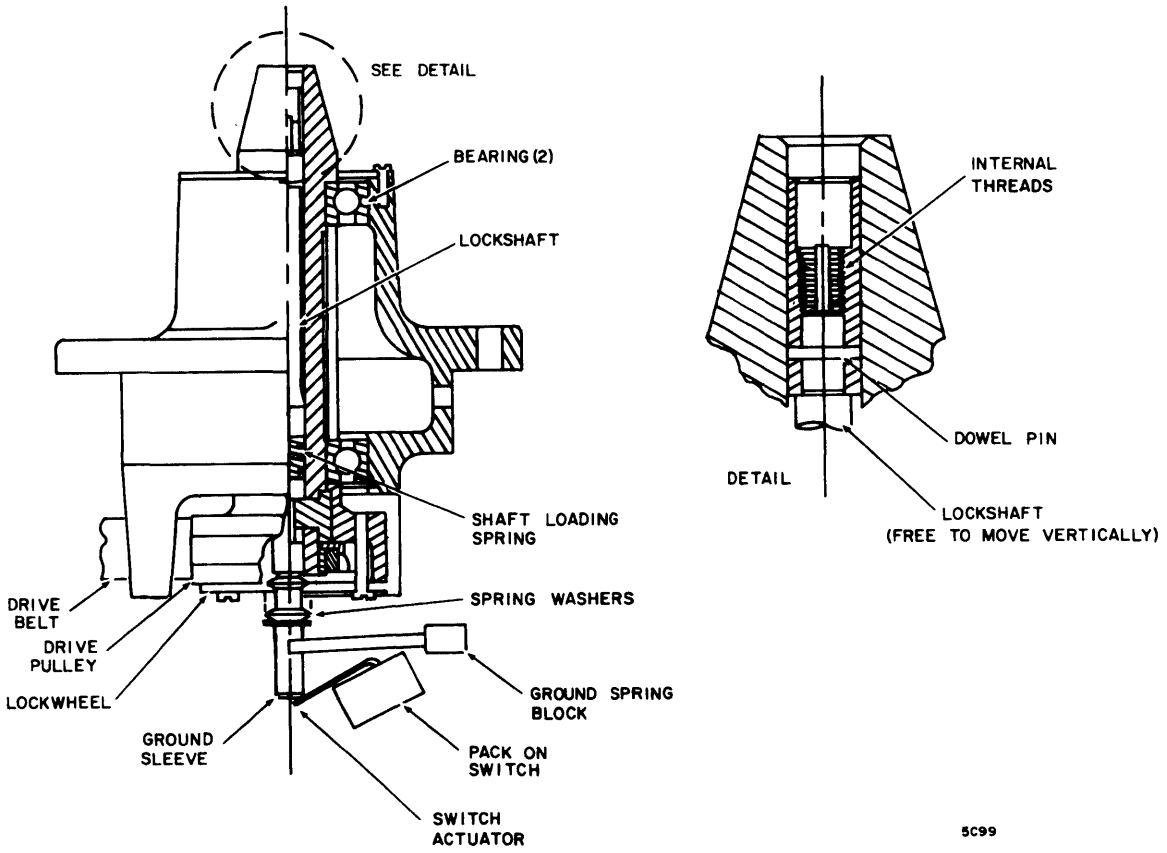


Figure 4-7. Spindle Assembly

Hydraulic Pump

The hydraulic pump is a positive-displacement type device capable of delivering 0.67 gpm at a nominal pressure of 200 psi.

The pump is located on the top of and at the rear of the deck assembly. The pump is seated on the pump drive assembly which functions to extend and couple the pump shaft through the deck to the pump drive pulley. A flat belt driven by the drive motor turns the pump.

The input and output hydraulic connections at the pump both originate at the hydraulic actuator. The hydraulic fluid pump and all pressure control valves are located in the hydraulic actuator.

A pressure sensing switch is installed on the pump output line. The switch transfers at a nominal output of 10 psi (approximately 50 rpm) and is used in conjunction with an operator panel indicator (see Section 2).

Carriage and Carriage Mount

The carriage and carriage mount (Figure 4-8) combine to form the vehicle that supports the read/write heads. Movement of the carriage, within the carriage mount, is controlled by the hydraulic actuator.

The carriage consists of an upper rail and a lower rail, separated by the receiver and the coupler plate. The rails contain bearing surfaces that interface with the various bearings and rollers of the carriage mount. Each rail has a rack gear that meshes with a pinion gear on the detent gear shaft (mounted vertically in carriage mount). The detent gear and the track position disk are mounted on the lower end of this same shaft. The ball tip of the hydraulic actuator drive rod is connected to the carriage by the drive rod coupler. When the hydraulic actuator extends or retracts the carriage, the detent gear shaft (and detent gear and track position disk) rotates.

The cylinder transducer senses the passing of the slots and lands of the rotating track position disk. From the center of one slot to the center of an adjacent land is recognized as a movement of one track. The transducer output causes the difference (decrement) counter content to decrease by one each time a track is crossed. When the logic determines that the next track to be crossed is the addressed track, it signals the detent solenoid to release the detent pawl. The spring-loaded pawl is drawn into the teeth of the detent gear and locks the carriage at the desired track. The detent transducer senses the pawl and gear engagement and signals the logic.

A track indicator (top of detent gear shaft) provides a visual indication of the current track location of the read/write heads.

A head loading mechanism mounts between the receiver and the coupler plate. Operation of this mechanism and the heads loaded switches is covered in the following paragraph.

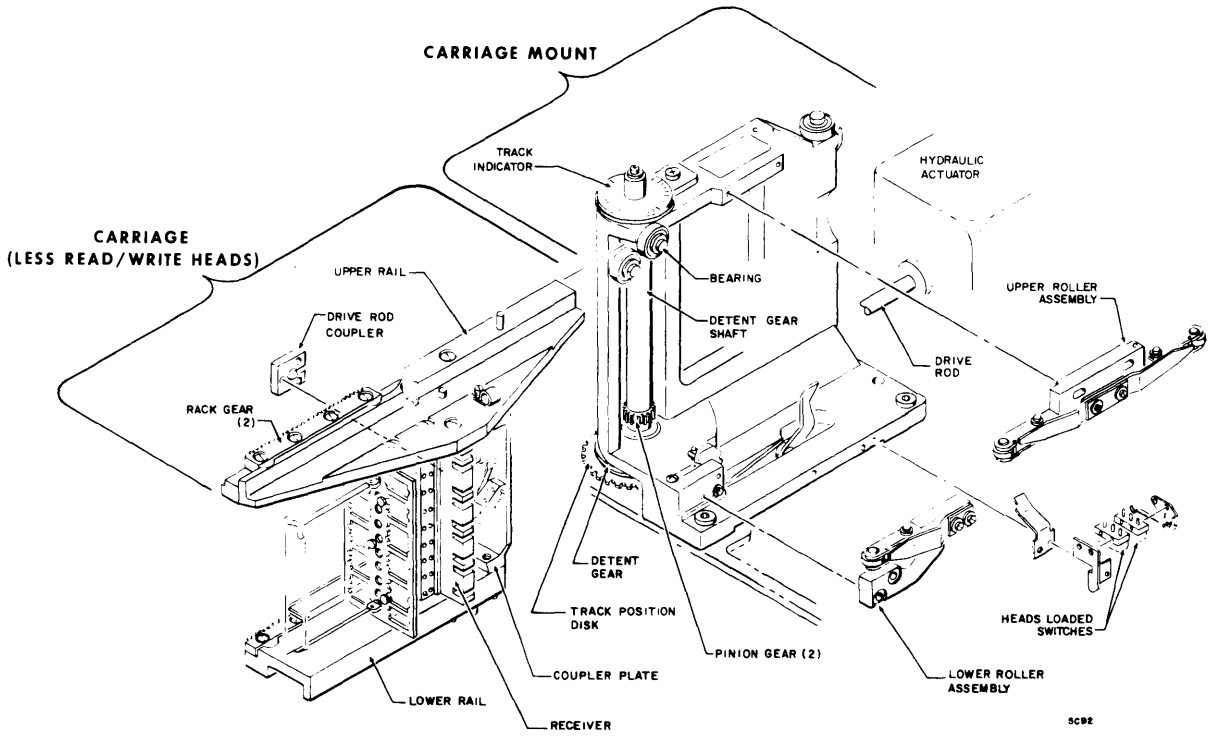


Figure 4-8. Carriage/Carriage Mount

Head Loading

The read/write heads must be loaded to the disk surfaces before exchanging data with the controller. The heads must be released from this position (unloaded) and driven clear of the disk pack when power is removed to the deck or the disk pack velocity falls below a predetermined rpm. The carriage components involved in these operations are identified in Figure 4-9.

Head loading amounts to applying spring pressure to the back of the read/write head so the aerodynamically shaped head face approaches the related disk surface. When the cushion of air that exists on the surface of the spinning disk is encountered, it resists the further approach by the head. Spring pressure is designed to just equal the opposing cushion pressure (function of disk pack rpm) at the required height. As a result, the head flies. However, if the spring pressure exceeds the cushion pressure (as would happen if the disk pack lost enough speed), the head will stop flying and contact the disk surface. This could cause damage to the head as well as the disk surface.

To prevent damage to the heads and/or the disk pack during automatic operation, loading occurs only after the disk pack is up to speed and the heads are over the disk surfaces. For the same reason, the heads unload automatically and are retracted if the disk pack rpm drops out of tolerance. During manual operations, heads should never be loaded on a disk pack that is not rotating, nor should heads be loaded without a disk pack being installed on the spindle. (The Maintenance section for this equipment provides instructions on how to disable the head loading mechanism.) Head loading is a part of the First Seek function. As power to the deck is sequenced up, the drive motor starts. This causes disk pack rotation, hydraulic pump operation, and a brush cycle (approximately 60 seconds). When the disk pack rpm reaches 2000, the extend solenoid (and head latch magnet) energizes and the carriage moves from the retracted position to the hydraulic home position. Upon completion of the brush cycle (brushes clear of disk pack), the hydraulic actuator forward solenoid energizes and the carriage moves forward toward the spindle and the forward mechanical stop. Head loading occurs during this forward motion.

The cam follower (part of carriage) moves along the head loading cam (part of carriage mount). When the follower encounters the up-ramp of the cam, the linkage rod assembly moves upward (Figure 4-9, part C). This causes each of the ten torsion rods to rotate which forces the 20 read/write heads toward the proper disk surface. The spring force of the torsion rod is opposed by the air layer on the disk surface and an equilibrium is attained with the heads flying over the disks.

As the carriage nears the spindle, the head load pawl enters the notch in the linkage and transfers the heads extended switch. The head latch magnet holds the pawl in the latched position until power (to magnet) is removed. Forward carriage motion continues until the cam follower contacts the head load cam latch. This contact frees the

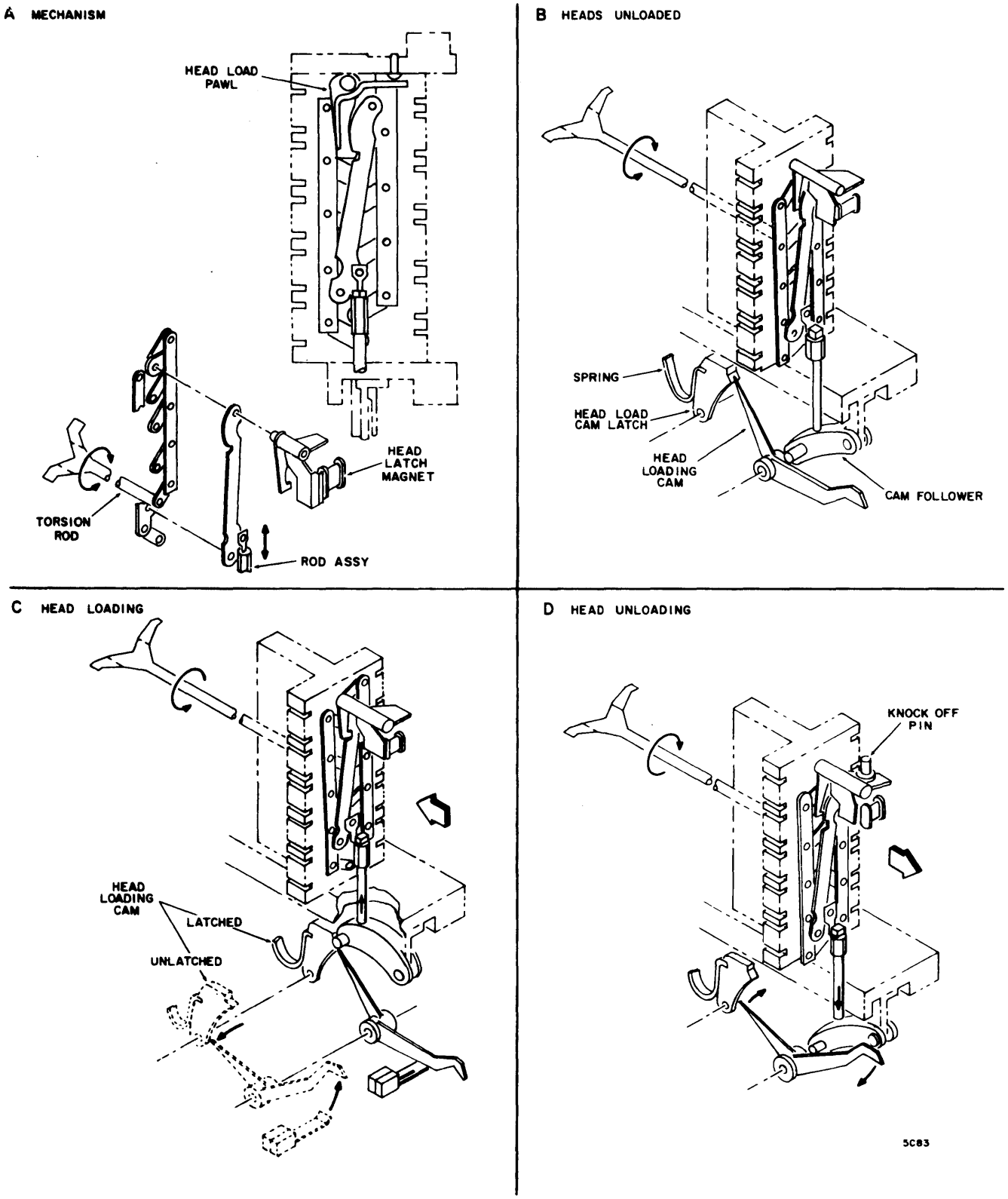


Figure 4-9. Head Loading Mechanism

end of the cam and it rotates downward to transfer the heads loaded switches. This transfer signals the logic that loading is complete and causes the carriage to be retracted and positioned to track 00. The heads remain loaded and latched until power is removed, the index (sector) transducer is displaced from sector disk of disk pack, or disk pack rpm drops below tolerance.

Head unloading (Figure 4-9, part D), occurs when solenoid power is removed to the head latch magnet. The head load pawl pulls out of the linkage notch, the torsion rods rotate to relieve the pressure to the back of the read/write heads, and the heads unload or move away from their respective disk surfaces. With solenoid power absent, the reverse biased (hydraulically) actuator moves the carriage toward the retracted mechanical stop. As the carriage moves in reverse, the linkage rod assembly pressing down on the cam follower pivots the head loading cam so that the tip (of cam) engages the head load cam latch. This relatching occurs as the carriage moves from hydraulic home to the retracted stop.

If the linkage malfunctions and fails to unload the heads, the upper roller assembly (Figure 4-8) contacts the knock off pin (Figure 4-9, part D). This contact forces the knock off pin downward to forcibly rotate the head load pawl clear of the head latch magnet pole face, the thereby unload the heads. The knock off pin is contacted by the roller somewhere between tracks -7 and -12.

Head/Arm Assemblies

Twenty head/arm assemblies are mounted on the carriage of each deck. A head/arm assembly consists of a read/write and erase coil package (head assembly) mounted at the end of a supporting arm structure.

The head assembly (Figure 4-10), which includes a cable and plug, is mounted on a gimbal ring which in turn is mounted on a floating arm. This method of mounting allows the head assembly to move (independent of the arm) tangentially and radially relative to a data track on the disk surface. Such motion is required to compensate for irregularities in the disk surface.

The arm structure consists of a floating arm secured to a heavier fixed arm. The end of the fixed arm opposite the head installs in the carriage receiver. The floating arm is the mounting point for the head and is necessarily flexible so that it can respond to

the force applied (on load button) by the torsion rod/spring during head loading. Each tip of the Y-shaped torsion spring loads a head, moving one head up and one head down.

The freedom and mobility of the head are necessary elements to being able to function with interchangeable disk packs. During head loading the 10 torsion rods rotate in unison to flex the 20 heads toward the air cushion of the spinning disk surfaces. The force applied by the torsion spring causes the heads to fly or float on the air cushion. Vertical motion by a disk surface (due to warpage or imperfection) is countered by a move in the opposite direction by the gimballed head and/or the floating arm. As a result, flight height remains nearly constant.

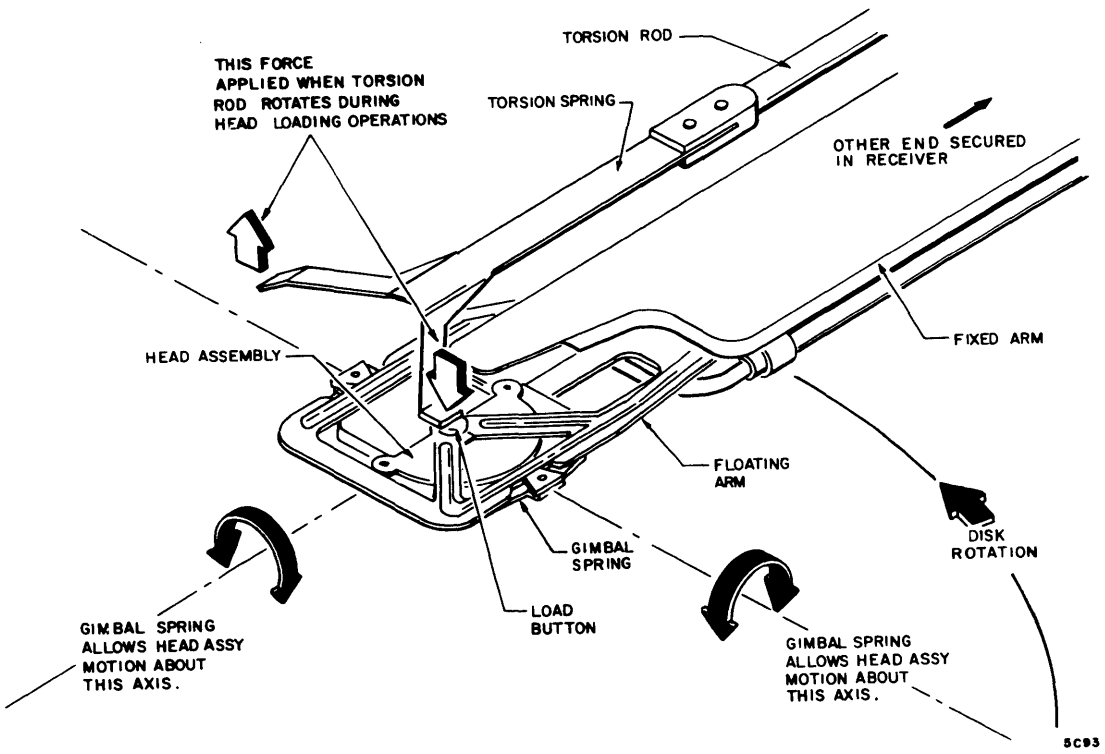


Figure 4-10. Head/Arm Assembly Motion

Transducers

Three transducers are used on each MDD deck: detent transducer, cylinder transducer, and index (sector) transducer. A transducer is a potted assembly consisting

of a primary coil and two secondary coils (Figure 4-11). The secondary and primary coils are separated by a notched and movable metal plate. The primary of the transducer is excited by a 187-kHz oscillator. When a notch (air gap) is between the secondary and primary windings, the output of the transducer secondary is maximum. The secondary output is minimum when the metal plate is between the windings. The secondary outputs drive a preamplifier card.

The related preamplifier card plugs into the transducer. The preamplifier output is processed in the logic chassis. The only adjustment required of this assembly amounts to repositioning the transducer relative to the slotted metal plate.

Detent Transducer

The detent transducer senses the location of the slot in the detent flag. When the detent pawl engages the gear, the slot is nearer to the bottom secondary coil (Figure 4-12). This causes the amplifier output to go negative. The preamplifier card filtering removes part of the 187-kHz signal. The detection circuit converts the negative signal to a "0".

If the detent pawl is disengaged from the gear, the flag slot moves nearer to the upper coil. This causes a positive amplifier output which is detected as a "1".

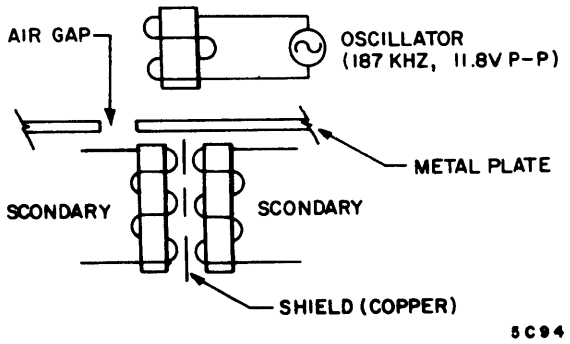


Figure 4-11. Transducer

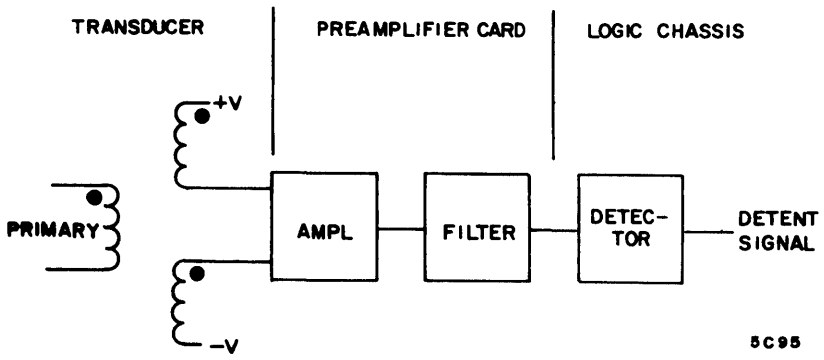


Figure 4-12. Detent Detection

Cylinder Transducer

The cylinder transducer senses slots in the edge of the rotating track position disk. The cylinder detection circuit (Figure 4-13) converts the analog output of the transducer to "1's" and "0's".

The slotted edge of the track position disk separates the primary of the transducer from the secondaries. As the disk rotates, the notches allow varying levels of coupling between the primary and the secondaries. Figure 4-14 shows rotational positions of the track position disk and the resulting cylinder detection. As the notch passes over secondary A, maximum coupling of the primary is possible and the output of secondary A is maximum. Since secondary B is covered by a land, coupling to the primary is minimum as is the output.

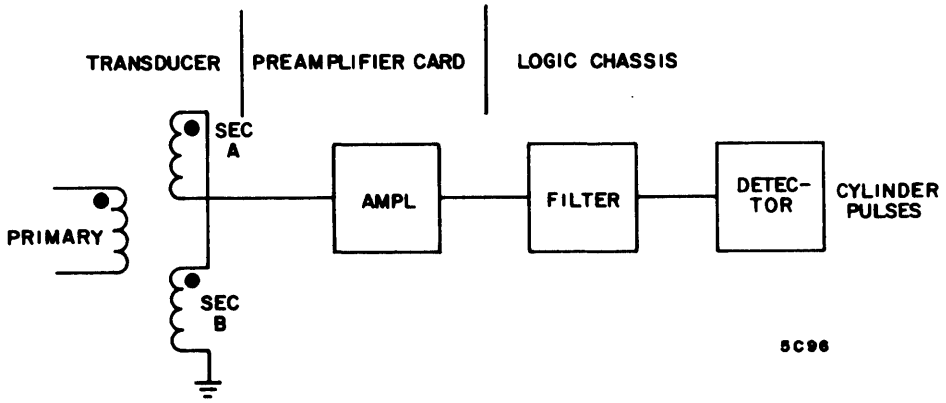


Figure 4-13. Cylinder Detection

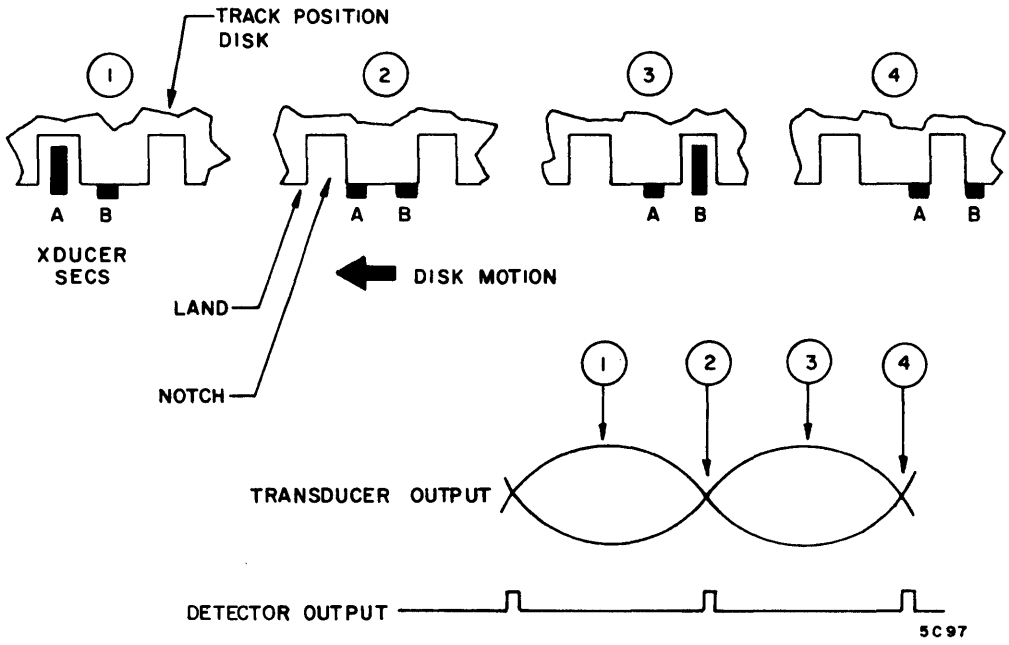


Figure 4-14. Cylinder Position Detection

As the disk rotates, both secondaries become covered by a land. Since the outputs are equal, the transducer output is a null.

Further rotation of the disk uncovers secondary B allowing maximum coupling and raising output B to the maximum. Since secondary A is now covered by a land, output A is a minimum.

Disk rotation continues until both secondaries are centered on a notch, but covered by a land. The outputs are again equal, so a null occurs in the output.

Each notch and each land nulls the transducer output. The detection circuit generates a pulse for each null in the transducer output.

Index (Sector) Transducer

This transducer senses notches in the edge of the sector disk (large disk at bottom of each disk pack).

Each notch on the sector disk causes a differential input to the preamplifier card amplifier (Figure 4-15). The detector generates a 55-μsec "1" pulse in response to each notch. These pulses are further processed by the MDD logic to determine if the disk pack speed is sufficient for continued operation.

All disk packs have two closely spaced notches called index. These notches indicate the beginning of a revolution of the disk pack. Some disk packs have, in addition to index, other notches equally spaced about the circumference of the sector disk. These notches are related to data organization on the disk pack.

Disk Cleaner Assembly

The disk cleaner assembly sweeps the disk pack recording surfaces free of any foreign materials. The sweep cycle occurs just before the read/write heads are loaded during the First Seek sequence.

The assembly consists of a motor, 10-comb-mounted brushes, a reset switch, motor to comb linkage, and a mounting base. The base mounts on the deck assembly and the brushes are pivot mounted on the base. Pivoting of the brushes is controlled by the motor, the linkage, and the switch. The motor is energized during the power on sequence and starts a 60-second (approximately) cycle. As the cycle proceeds, the brushes sweep toward the spindle until the linkage causes a reversal in direction. As the brushes return to the original position (clear of disk pack) the reset switch is encountered and transfers. This de-energized the Brush Motor relay and disables the motor.

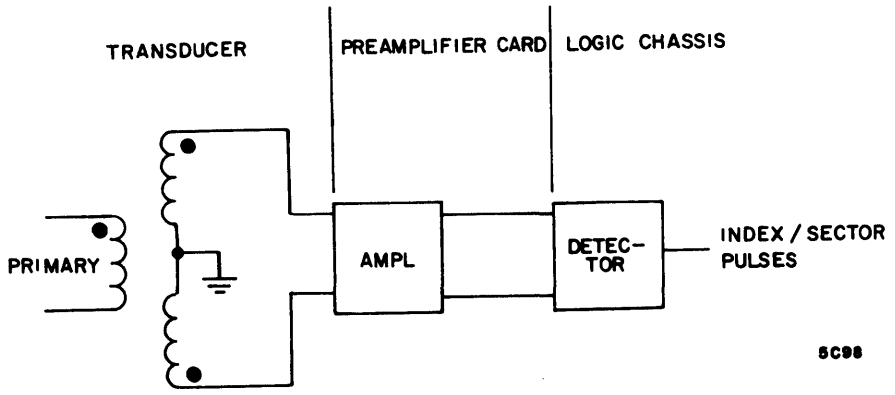


Figure 4-15. Index/Sector Detection

The brushes are mounted using a ball-slot detent mechanism. If power is dropped or lost during the brush cycle, the operator can override the detent and rotate the brushes clear of the disk pack so that the disk pack can be removed from the spindle. The brush cycle during the next Power-on sequence will be an incomplete cycle as the brushes automatically reset themselves. Subsequent cycles will be normal.

Hydraulic Actuator

The hydraulic actuator drives and locks the carriage mounted read/write heads to any one of 203 discrete positions or cylinders of data. Activity of the hydraulic actuator is regulated by five solenoid-controlled valves that direct the routing of hydraulic fluid. The solenoids are controlled from the MDD logic chassis. Hydraulic fluid at a pressure of approximately 200 psi is provided by the hydraulic pump.

The hydraulic actuator (Figure 4-16) consists of a piston and sump block in or on which are mounted a valve block, two hydraulic fluid filters, an extend piston, a drive piston, and five solenoid and valve combinations.

Valve Block

The valve block contains all valves and most of the related fluid passages of the unit. The block mounts directly under the sump chamber of the piston and sump block.

Filters

The two fluid filters are located in the sump portion of the piston and sump block. The primary filter is a large-particle screen in the pump suction outlet. The secondary filter removes smaller particles from a bypass flow originating when the slow solenoid is energized.

A third filter removes smaller particles and is located in the pump output pipe between the pump and the hydraulic actuator.

Extend Piston

The extend piston is located in the rear cylinder of two concentrically bored cylinders of the piston and sump block. This piston is hydraulically positioned to either the extend or the retracted position by the status of the extend solenoid. Whenever power

is applied to the deck, the extend solenoid is energized and the related valve is closed. Hydraulic pressure on the larger rear face of the piston drives it forward to a positive stop. This is the extended position, and the piston remains in this position until power to the deck is dropped. In the extended position the forward face of the extend piston functions as a hydraulically cushioned stop for the drive piston and also establishes the hydraulic home position for the carriage. When deck power is removed, the extend solenoid de-energizes, the spring-loaded valve opens, and the piston moves to the retracted position. As a result, the effective operating chamber for the drive piston is extended to the rear of the carriage and the carriage is retracted to a position where the heads are clear of the disk pack surfaces.

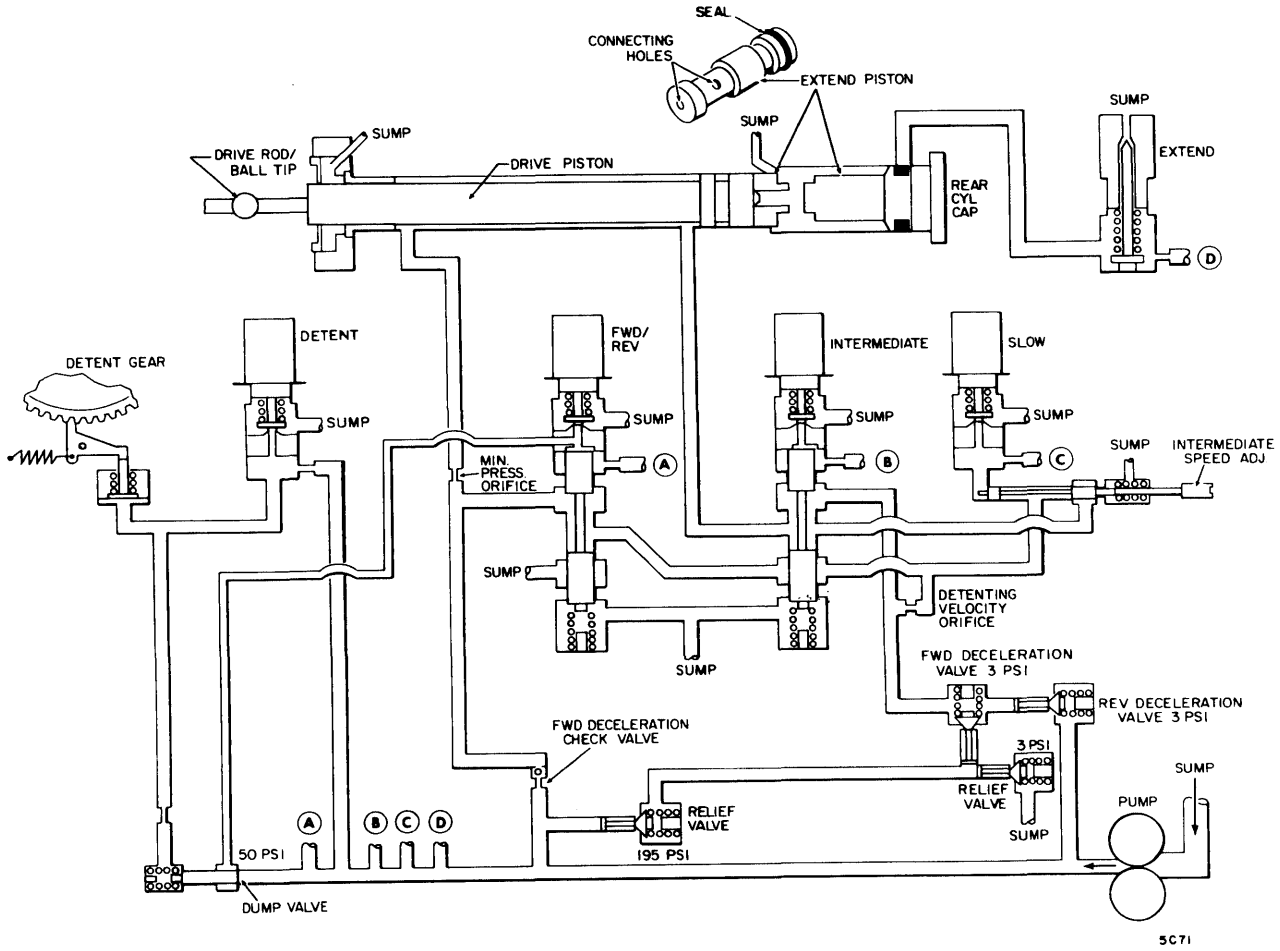


Figure 4-16. Hydraulic Actuator - Power Off

Drive Piston

The drive piston operates in the smaller forward cylinder of the piston and sump block. This piston connects, via the ball tip, to the movable carriage (mounting point of the read/write heads). The drive piston is constantly biased in the reverse direction by hydraulic pressure applied via the forward deceleration check valve and the minimum pressure orifice. Piston direction and rate of motion are controlled by three solenoids and valves.

Solenoids and Valves

The hydraulic actuator uses five solenoid and valve combinations. The function of the extend solenoid and valve was discussed previously.

The detent solenoid and valve controls the routing of hydraulic pressure to the detent actuator (not physically a part of the hydraulic actuator). When hydraulic pressure is available and the detent solenoid is de-energized, the pressure is applied to the detent actuator to pivot the detent pawl out of the detent gear. When the detent solenoid is energized, the related valve opens to vent pressure to the sump, and the detent pawl spring pulls the pawl into the gear.

Three solenoids and valves direct the routing of hydraulic fluid to the drive piston. All solenoid activity is controlled by signals originating in the logic chassis. The solenoids are located in the sump chamber of the hydraulic actuator and the control valves are located in the valve block. Electrical connections are via a solenoid terminal at the rear of the actuator. Each solenoid operates with at least one related valve. This valve is open when the solenoid is energized, and closed (spring-loaded) when the solenoid is de-energized. The forward/reverse, intermediate, and slow solenoids each control an additional spring-loaded spool. When the related solenoid is de-energized, system pressure from the hydraulic pump overrides the spring force and repositions the spool toward the spring.

Hydraulic Operations

The following paragraphs describe the configuration of the hydraulic actuator during the various operational phases.

Power Off (Figure 4-16)

No power, electrical or hydraulic, is available to the deck during this phase. As a result, all spring-loaded valves or devices are positioned according to spring loading. The extend and drive pistons are in the retracted position. This positioning occurs during removal of power to the extend solenoid during the preceding power shut down. When the extend solenoid de-energizes, pressure to the rear of the extend solenoid is vented to the sump. Pressure still exists in actuator, even though the pump rpm is decreasing. The reverse biased drive piston under the influence of this pressure moves in reverse, pushing the extend piston ahead of it, to the retracted position.

Hydraulic Home (Figure 4-17)

Hydraulic home is the physical location established when the extend piston moves to the extend position. The actuator moves to hydraulic home at the beginning of each First Seek operation. It is the starting point for the forward motion required to load and latch the read/write heads. The sequence of events for this phase is as follows:

1. Hydraulic pump delivers pressure increasing toward 200 psi.
2. Increasing pressure and de-energized solenoids cause forward/reverse and intermediate spools to move downward and slow spool to move to right.
3. De-energized extend solenoid vents pressure to sump. Extend piston stays in retracted position (Figure 4-16).
4. When pump pressure reaches approximately 200 psi, detent actuator pivots pawl out of detent gear and relief valves begin controlling pressure.
5. When disk pack exceeds required speed, power is applied to extend solenoid. Vent to sump is blocked, pressure moves extend piston (and drive piston) to left, and heads move into disk pack to hydraulic home position.

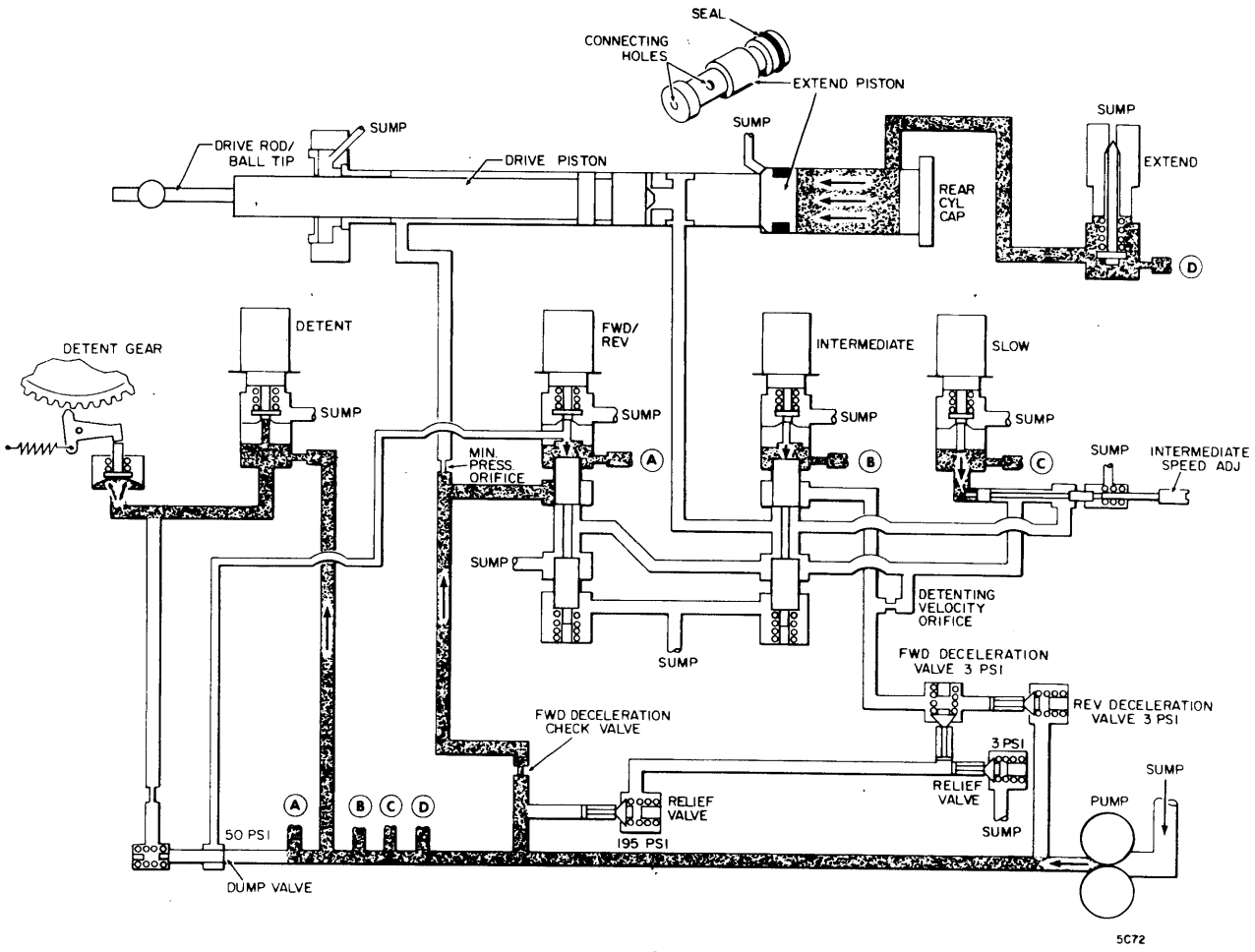


Figure 4-17. Hydraulic Actuator - Hydraulic Home

Detent (Figure 4-18)

The detent phase occurs at the end of each seek operation. The operation consists of removing pressure to the detent actuator so that the detent pawl spring pivots the pawl to engage the detent gear and lock the carriage to a track. The sequence of events for this phase is as follows:

1. During a First Seek or a RTZS operation, the detent solenoid energizes when the leading edge of the first track pulse is sensed as the carriage moves forward from hydraulic home (after the heads have loaded during First Seek). During a forward Direct Seek operation, the detent solenoid energizes when the leading edge of the first track pulse is sensed after the decrement counter indicates less than 2 tracks to go to the desired track. The forward/reverse solenoid remains energized.

   During a reverse Direct Seek operation, the detent solenoid energizes when the leading edge of the first track pulse is sensed after the decrement counter indicates less than 2 tracks to go to the desired track. This causes the forward/reverse solenoid to energize. Changing the direction of carriage motion at this point allows the detent pawl to engage the gear in the same manner as for a forward seek.

2. Energized detent solenoid vents pressure to sump. Loss of pressure in detent actuator causes spring to pivot detent pawl into detent gear.

3. The 50 psi dump valve opens to vent system pressure to sump (via forward/reverse solenoid valve). This causes system pressure to drop to 50 psi and thereby prevents excessive heating of hydraulic fluid.

4. Slow solenoid remains energized.

Forward Operations

The length of the seek determines the forward operations to be used. If the seek is in excess of 26 tracks when the forward/reverse solenoid is energized, the read/write heads move toward the center of the disk pack in the forward fast mode (26 ips). This rate of access continues until the logic determines that there are less than 26 tracks to go to reach the desired track. When this determination is made, the logic energizes the intermediate solenoid which causes the access to continue in the forward intermediate mode (7 ips). When the heads are less than four tracks from the desired track, the logic energizes the slow solenoid. This reduces the access rate to 2 ips (forward slow mode), which continues until the detent pawl engages the detent gear and stops the heads at the desired track. If the desired track is less than 26 tracks but more than 3 tracks from the current location, the intermediate solenoid is energized immediately. In this case the seek would consist of a forward intermediate mode, followed by a forward slow mode, and detent.

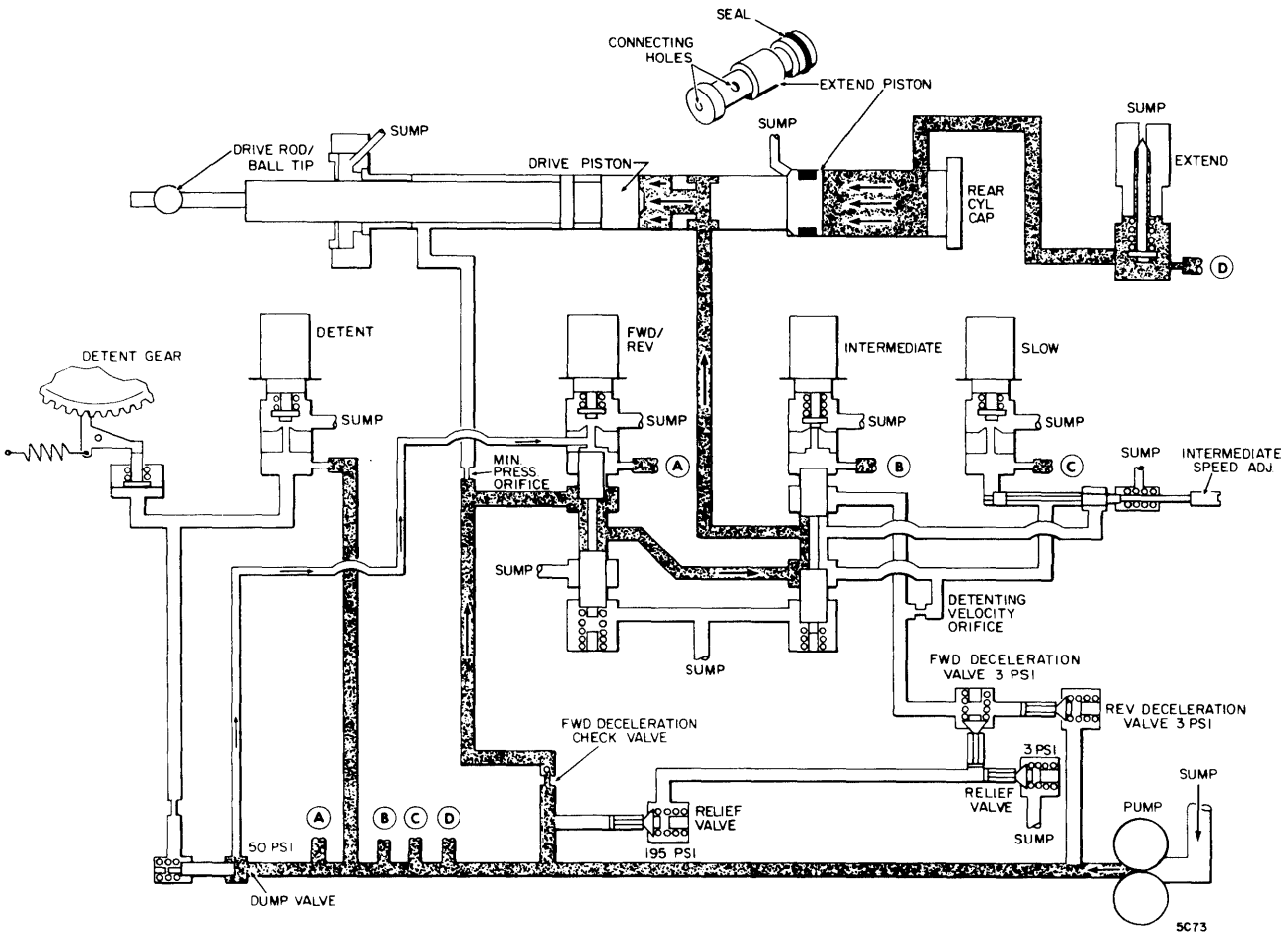


Figure 4-18. Hydraulic Actuator - Detent

For a seek of three tracks or less, both the slow and intermediate solenoids would energize immediately. The seek would consist of a forward slow mode followed by detent.

Forward motion is stopped by detenting, but there is a back-up method in the form of a mechanical stop.

Forward Fast Mode (Figure 4-19): The sequence of events for this mode is as follows:

1. With extend solenoid energized and detent solenoid de-energized, the forward/reverse solenoid energizes.

2. Open forward/reverse valve vents pressure to sump. Resulting pressure drop causes upward movement of spring-loaded forward/reverse spool.

NOTE

Pressures at left and right faces of drive piston are equal. Drive piston moves to left because area of face is greater

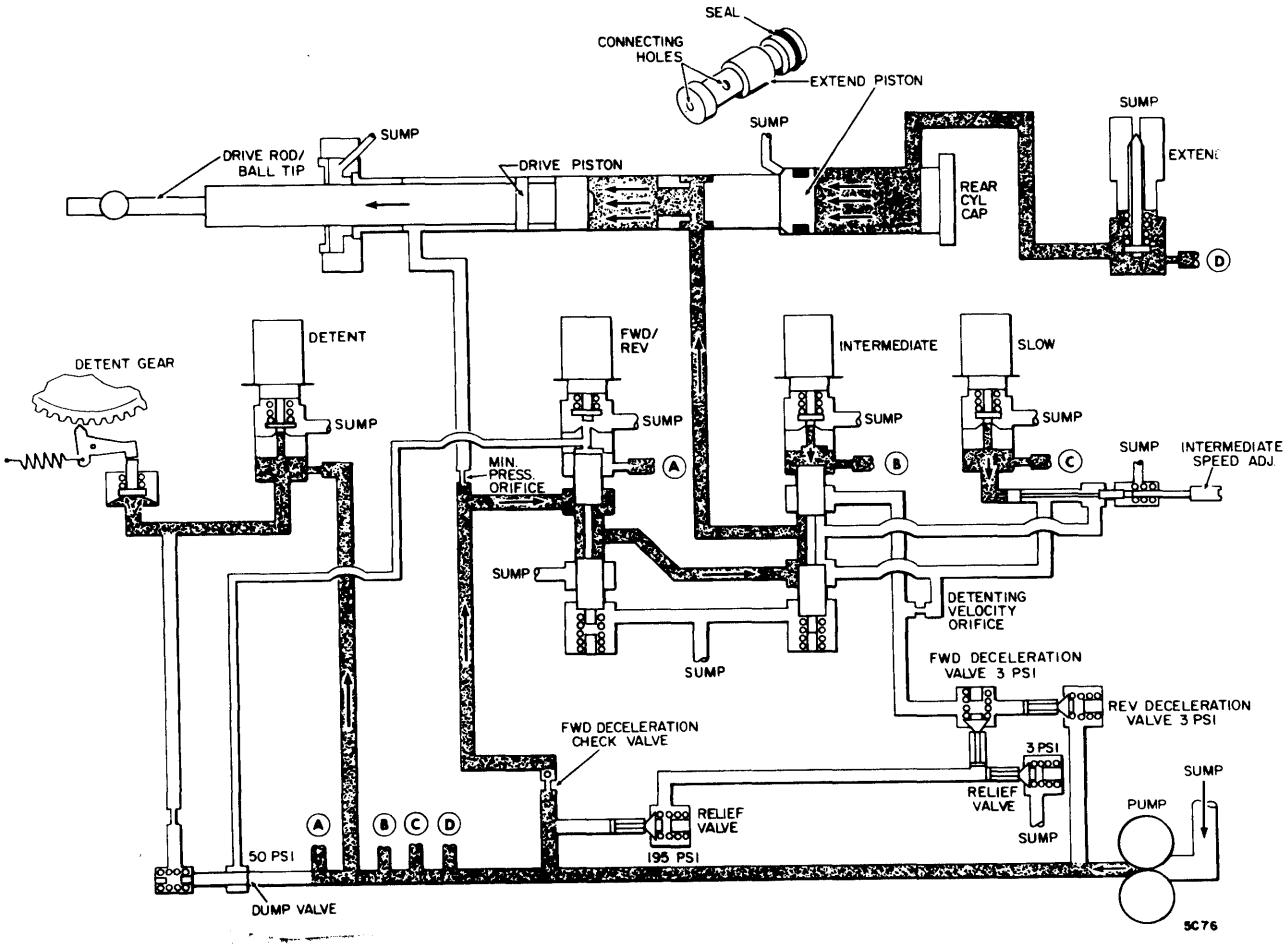


Figure 4-19. Hydraulic Actuator - Forward Fast

3. Hydraulic fluid flows through hole in extend piston causing drive piston to move left (forward) at 26 ips.

Forward Intermediate Mode (Figure 4-20): The sequence of events for this mode is as follows:

1. With extend solenoid energized and detent solenoid de-energized, forward/reverse and intermediate solenoids energize.
2. Open forward/reverse and intermediate valves vent pressure to sump. Resulting pressure drop causes upward movement of spring-loaded forward/reverse and intermediate spools.
3. Hydraulic fluid flows past forward/reverse spool and around intermediate spool. It then branches into parallel paths through detenting velocity orifice and slow spool, rejoining at and passing the intermediate spool. From here it passes through hole in extend piston causing the drive piston to move left at 7 ips.

Forward Slow Mode (Figure 4-21): The sequence of events for this mode is as follows:

1. With extend solenoid energized and detent solenoid de-energized, forward/reverse, intermediate, and slow solenoids energize.
2. Open forward/reverse, intermediate, and slow valves vent pressure to sump. Resulting pressure drop causes upward movement of spring-loaded forward/reverse and intermediate spools and slow spool moves to left.
3. Hydraulic fluid flows past forward/reverse spool and around intermediate spool. It then flows through detenting velocity orifice, past intermediate spool and out forward face of extend piston to rear of drive piston.
4. Drive piston moves left at 2 ips.

Reverse Operations

As with forward operations, the length of the seek determines the mode(s) required to complete the seek.

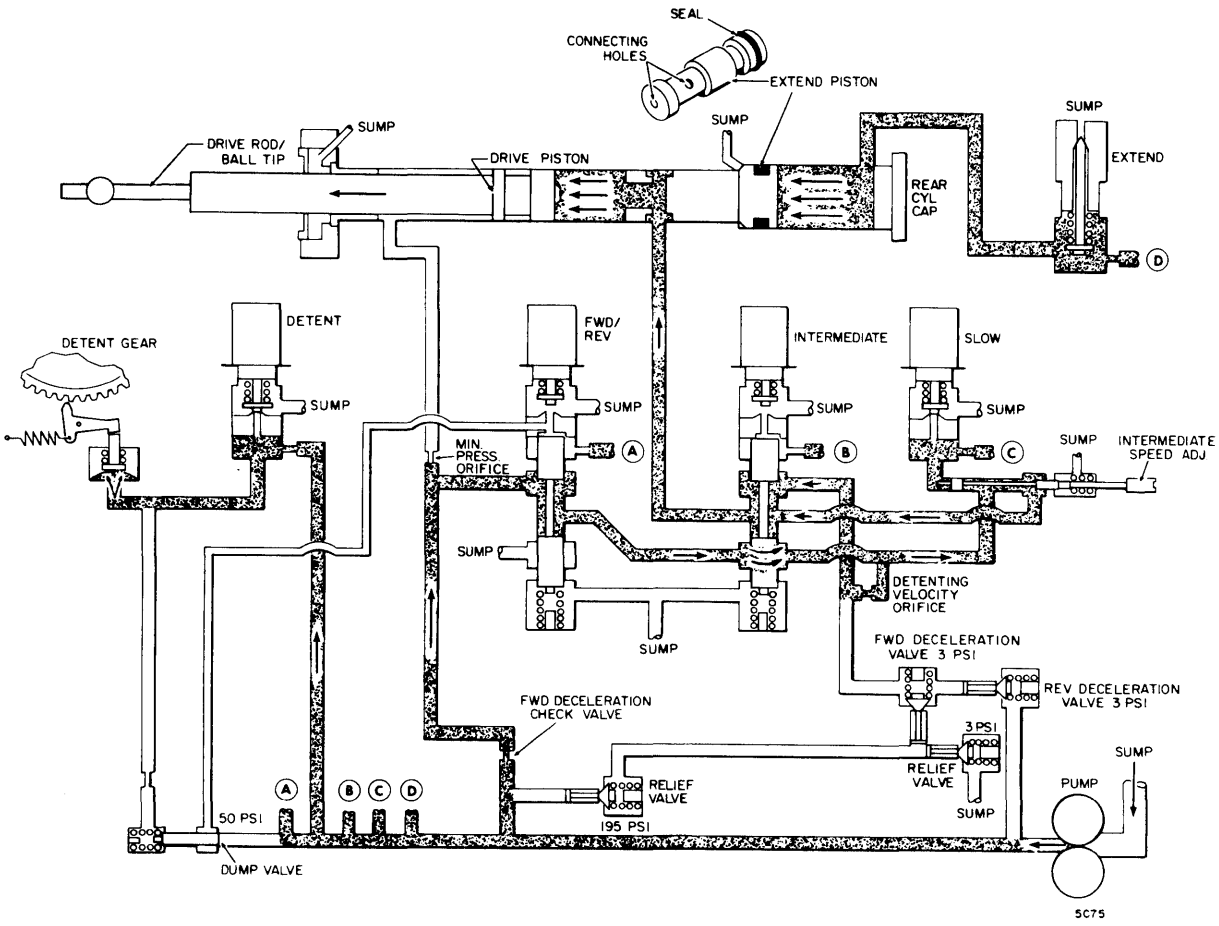


Figure 4-20. Hydraulic Actuator - Forward Intermediate

Reverse motion is stopped by switching to forward motion and then detenting or by the drive piston encountering the hydraulic cushion on the front face of the extend piston.

Reverse Fast Mode (Figure 4-22): The sequence of events for this mode is as follows:

1. With extend solenoid energized and detent solenoid de-energized, forward/reverse solenoid de-energizes.
2. Closed forward/reverse and intermediate valves cause line pressure to move related spools downward.

3. Hydraulic fluid at rear face (right end) of drive piston flows past intermediate spool and returns to sump at lower end of forward/reverse spool.

4. Hydraulic fluid flows through minimum pressure orifice to left face of drive piston and piston moves right at 26 ips.

Reverse Intermediate Mode (Figure 4-23): The sequence of events for this mode is as follows:

1. With extend solenoid energized and detent solenoid de-energized, forward/reverse solenoid de-energizes and intermediate solenoid energizes.

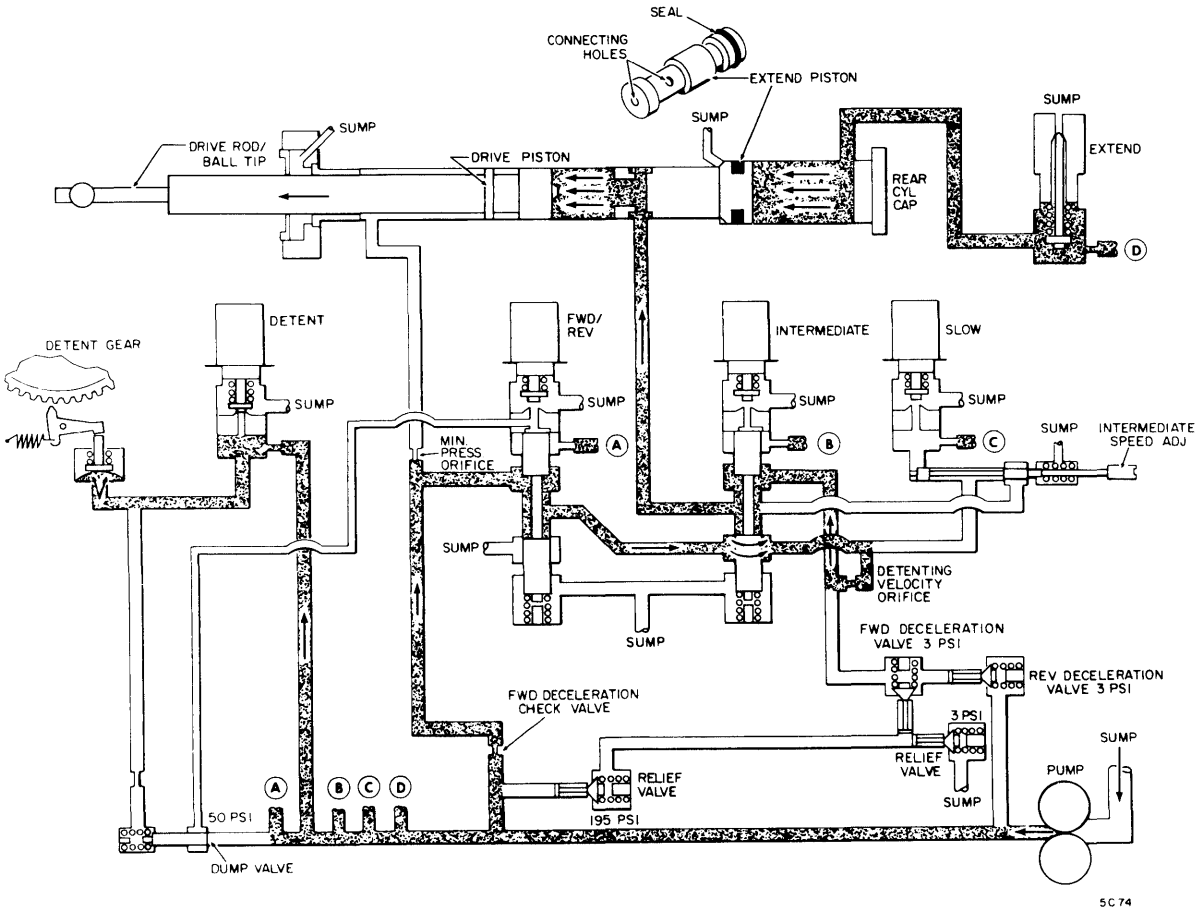


Figure 4-21. Hydraulic Actuator - Forward Slow

2. Closed forward/reverse valve causes line pressure to move related spool downward. Intermediate spool rises.

3. Hydraulic fluid at rear face of drive piston flows past intermediate spool and branches into two parallel paths past slow spool and through detenting velocity orifice. The paths rejoin to pass around the intermediate spool and vent to sump at forward/reverse spool.

4. Hydraulic fluid flows through minimum pressure orifice to left face of drive piston and piston moves right at 7 ips.

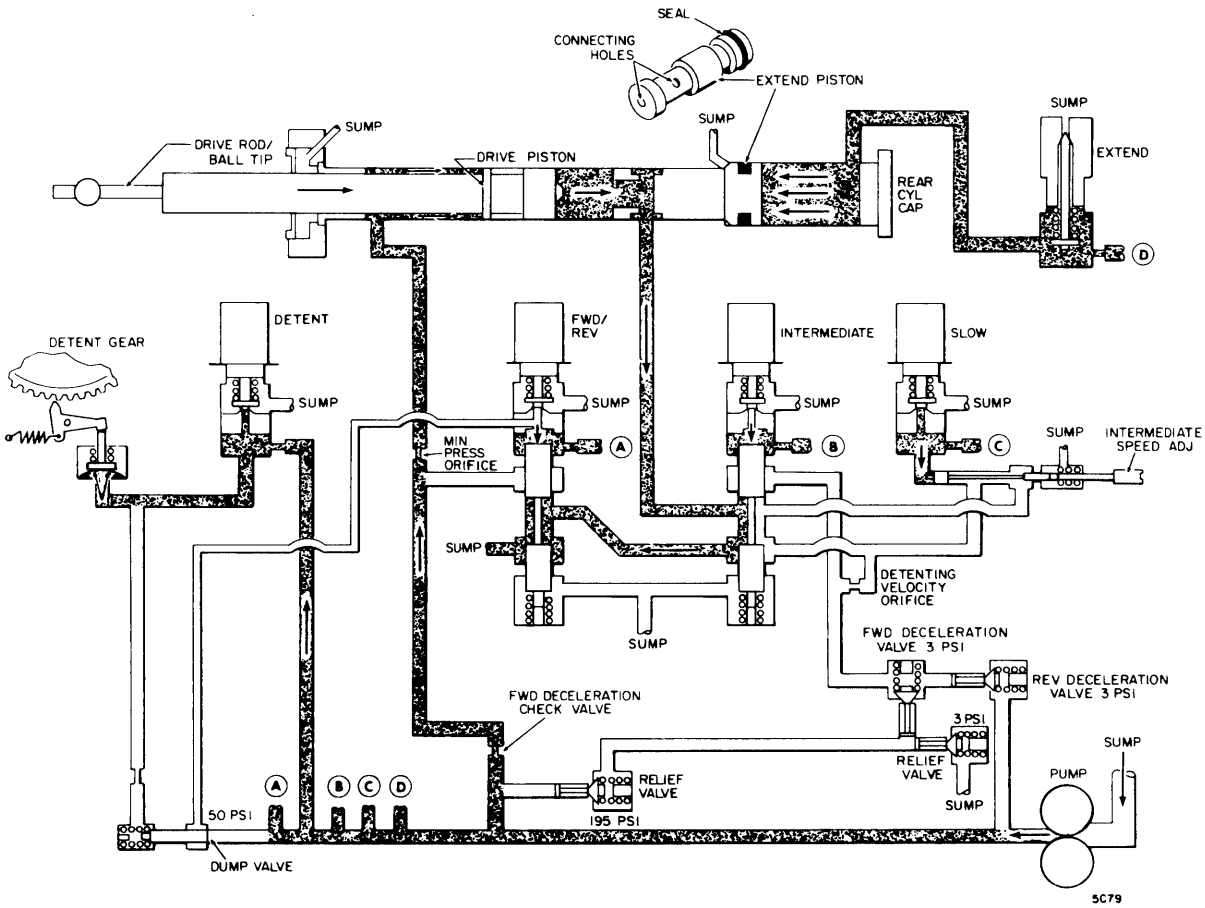


Figure 4-22. Hydraulic Actuator - Reverse Fast

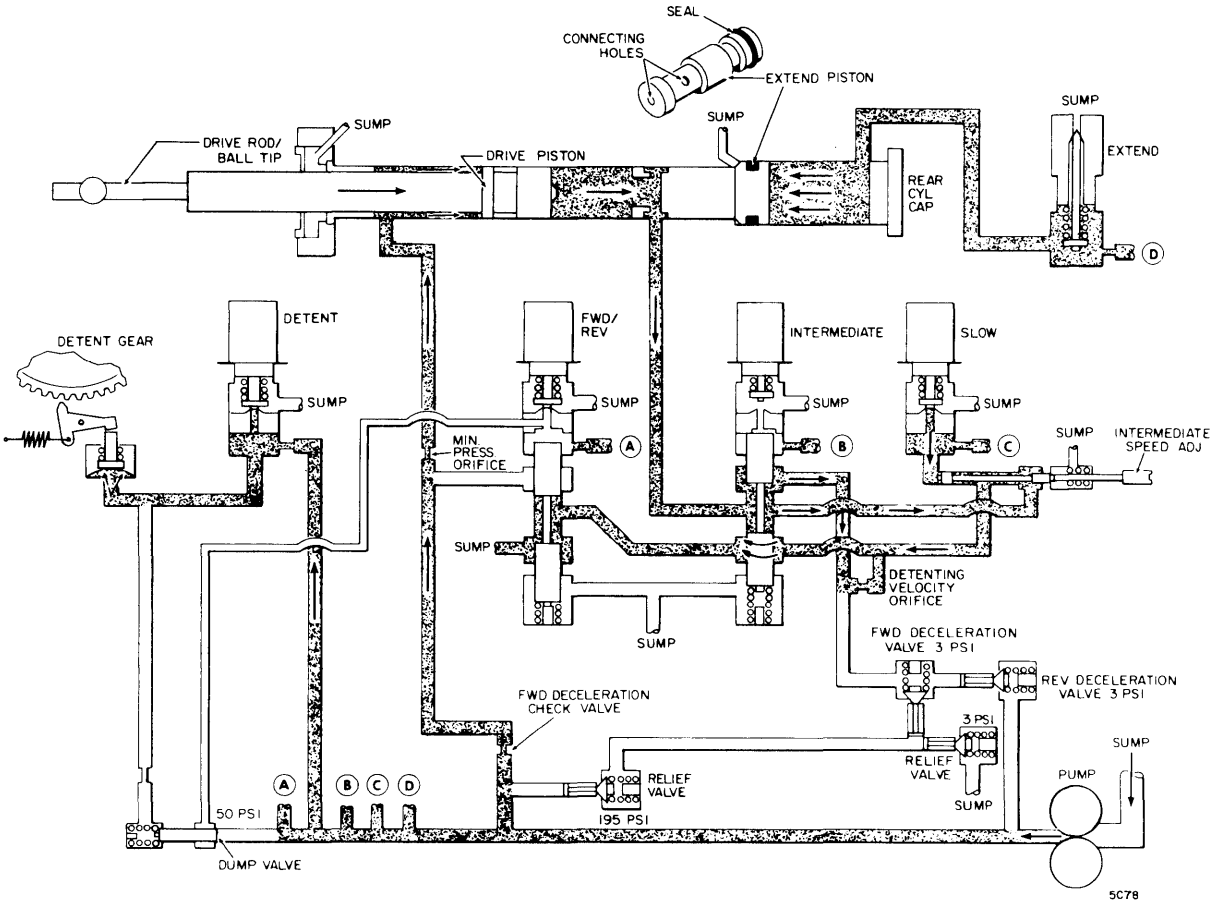


Figure 4-23. Hydraulic Actuator - Reverse Intermediate

Reverse Slow Mode (Figure 4-24): The sequence of events for this mode is as follows:

1. With extend solenoid energized and detent solenoid de-energized, forward/ reverse solenoid de-energizes and slow and intermediate solenoids energize.

2. Closed forward/reverse valve causes line pressure to move related spool downward. Open intermediate valve causes related spool to rise. Open slow valve causes slow spool to move to left.

3. Hydraulic fluid at rear face of drive piston flows past intermediate spool, through detenting velocity orifice, over intermediate spool, and vents to sump past forward/reverse spool.

4. Hydraulic fluid flows through minimum pressure orifice to left face of drive piston and piston moves right at 2 ips.

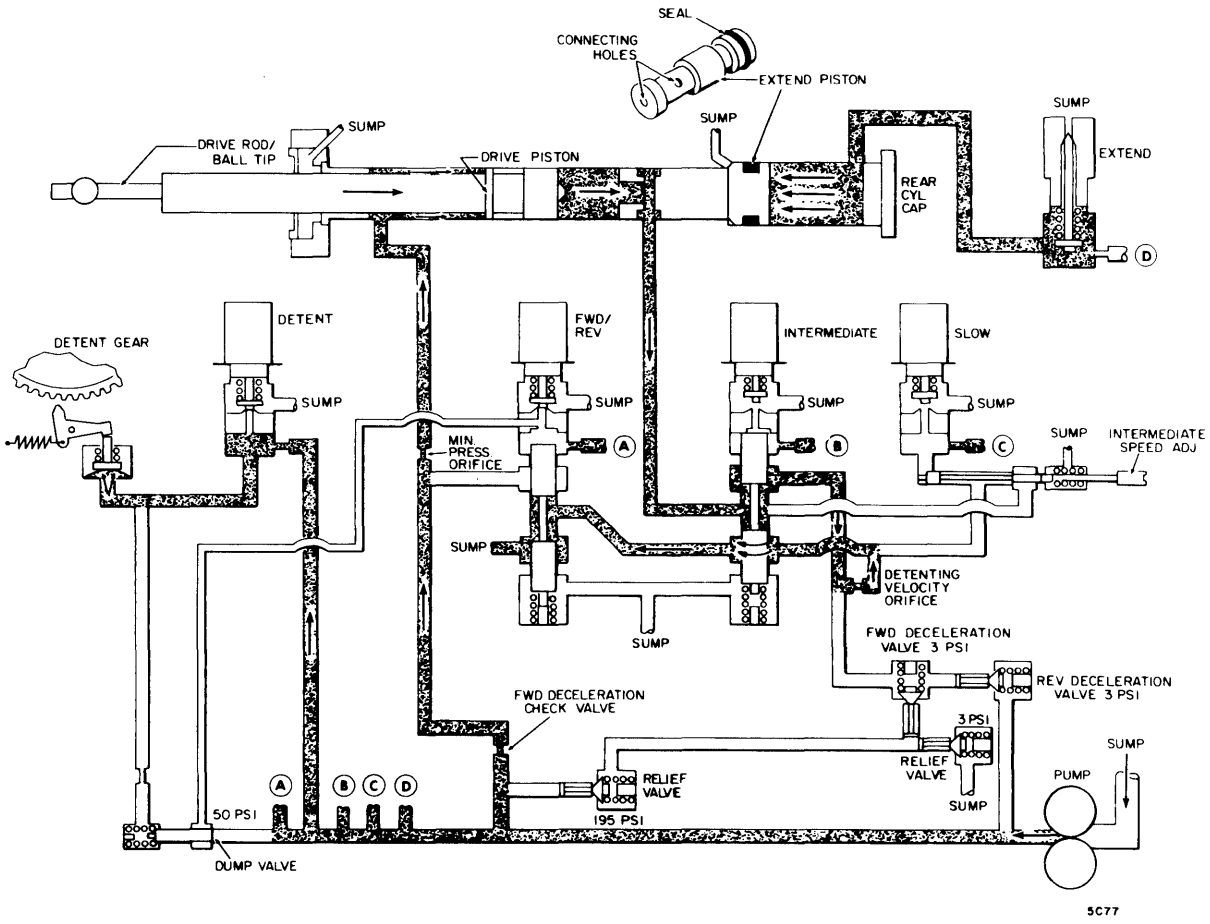


Figure 4-24. Hydraulic Actuator - Reverse Slow

FRAME

The frame assembly consists generally of the structural members, drawer mechanisms, and panels of the cabinet. Two additional subassemblies are, by virtue of their location, considered a part of the frame: blower system and filter box.

Blower System

The blower system (Figure 4-25) provides positive pressure at the center of a disk pack mounted on the spindle of a deck assembly. The presence of this elevated pressure at the center of the disk surfaces results in an outward dispersion of air over each disk surface. This air flow greatly reduces possible contamination and damage of the disks and the read/write heads.

The system consists of a motor driven impeller that forces air through an absolute filter (glass and asbestos) and related ducts upward to the spindles present in the cabinet. Much of the ducting is extendable to allow the deck drawers to be extended out the front and rear of the cabinet. Power to the blower drive motor is controlled by the power supply BLOWER circuit breaker.

Filter Box

The filter box controls power to the cabinet in which it is located. The box is located in the bottom of the cabinet and is accessible by opening the cabinet rear door. It contains a circuit breaker (UNIT POWER) that controls application of main input power to the cabinet power supply. The power supply MAIN POWER indicator monitors the status of the circuit breaker. Frequency filters for the input power lines are mounted inside the box.

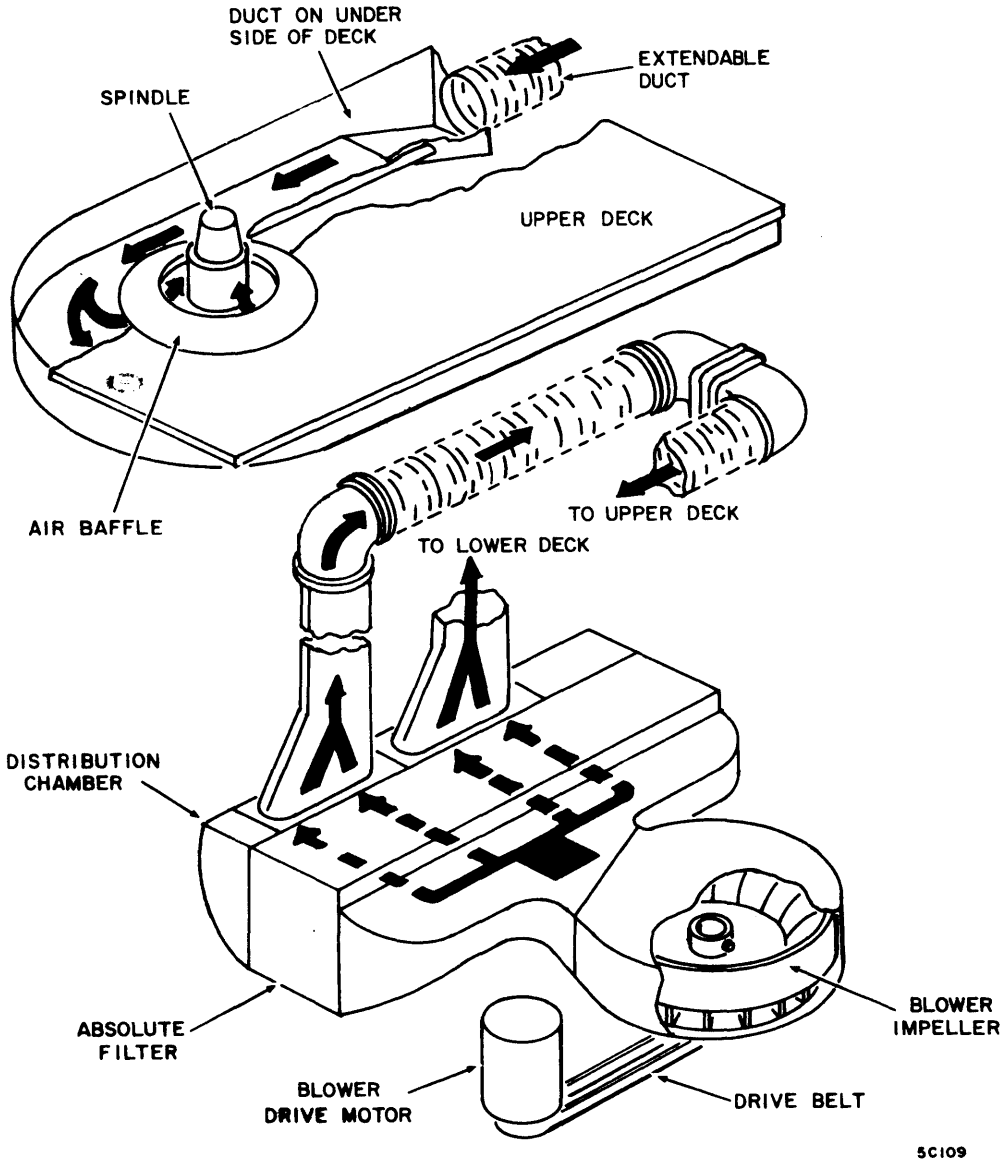


Figure 4-25. Blower System

DISK PACK

The disk pack is the recording medium for the MDD. The disk pack consists of eleven 14-inch, magnetic oxide coated disks center-mounted on a hub. The recording surface of each disk is coated with a layer (0.0002 inch) of magnetic iron oxide and related binders and adhesives.

The 203 recording tracks are located in a 2-inch band near the outer edge of the disk. Track 202 has a diameter of approximately 9 inches, while the diameter of track 00 is about 13 inches. The tracks are spaced 0.010 inch apart.

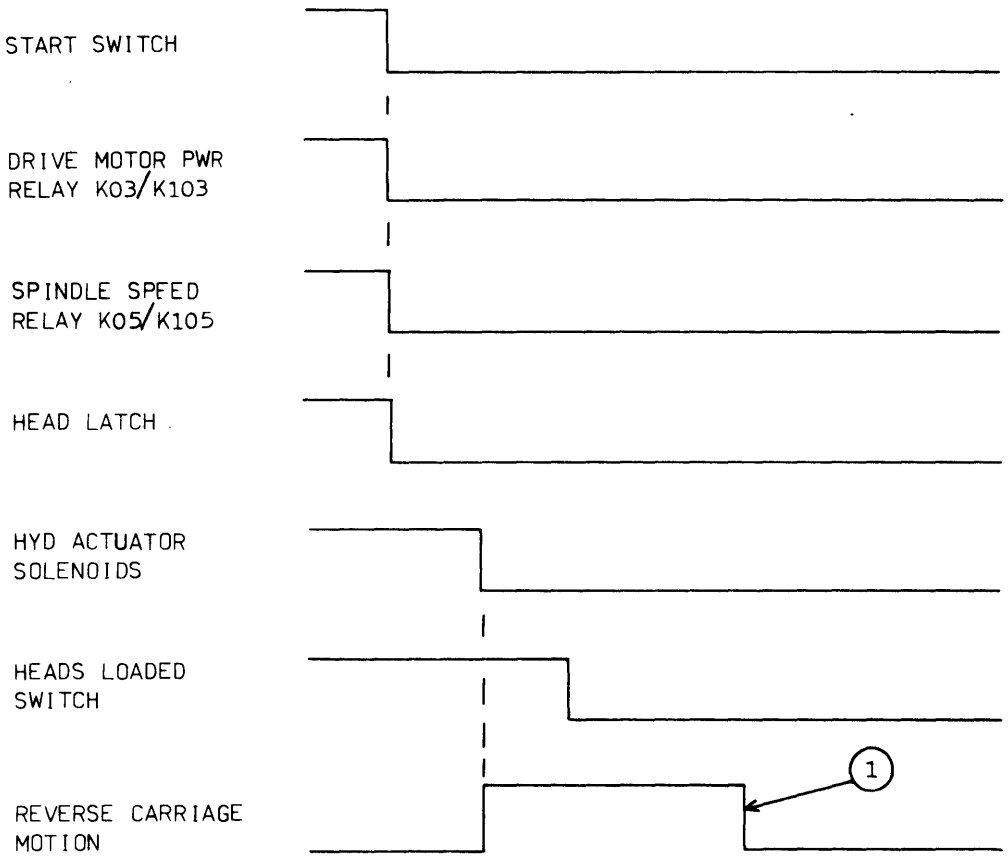
The top and bottom disk surfaces are covered by protective non-recording disks. The bottom protective disk is called the sector disk. This disk contains notches that are sensed by the index transducer. The pulse outputs of the transducer are used to determine disk pack rpm and to detect organizational segments of the disk pack.

The lower hub of the disk pack contains a replaceable filter. This filter removes particles from the air supplied by the blower. Keeping positive air pressure at the center of the disks reduces the possibility of dust caused damage.

The disk pack has a two-piece container assembly. The bottom cover can be removed simply by grasping and rotating the center hub. The top cover is designed so that it can be removed only by installing the disk pack on the deck spindle assembly. The disk pack can be removed from the spindle only by using the top cover (see Section 2). This design protects the disk pack from physical damage and greatly reduces the possibility of contamination of the disk pack recording surfaces.

SECTION 5

DIAGRAMS



NOTE:

(1) CARRIAGE ENCOUNTERS REVERSE POSITIVE STOP. RESIDUAL HYDRAULIC PRESSURE HOLDS CARRIAGE IN THIS POSITION. DETENT PAWL SPRING OVERRIDES FADING PRESSURE TO PULL PAWL INTO DETENT GEAR.

5C60

Figure 5-4. Power Off Timing

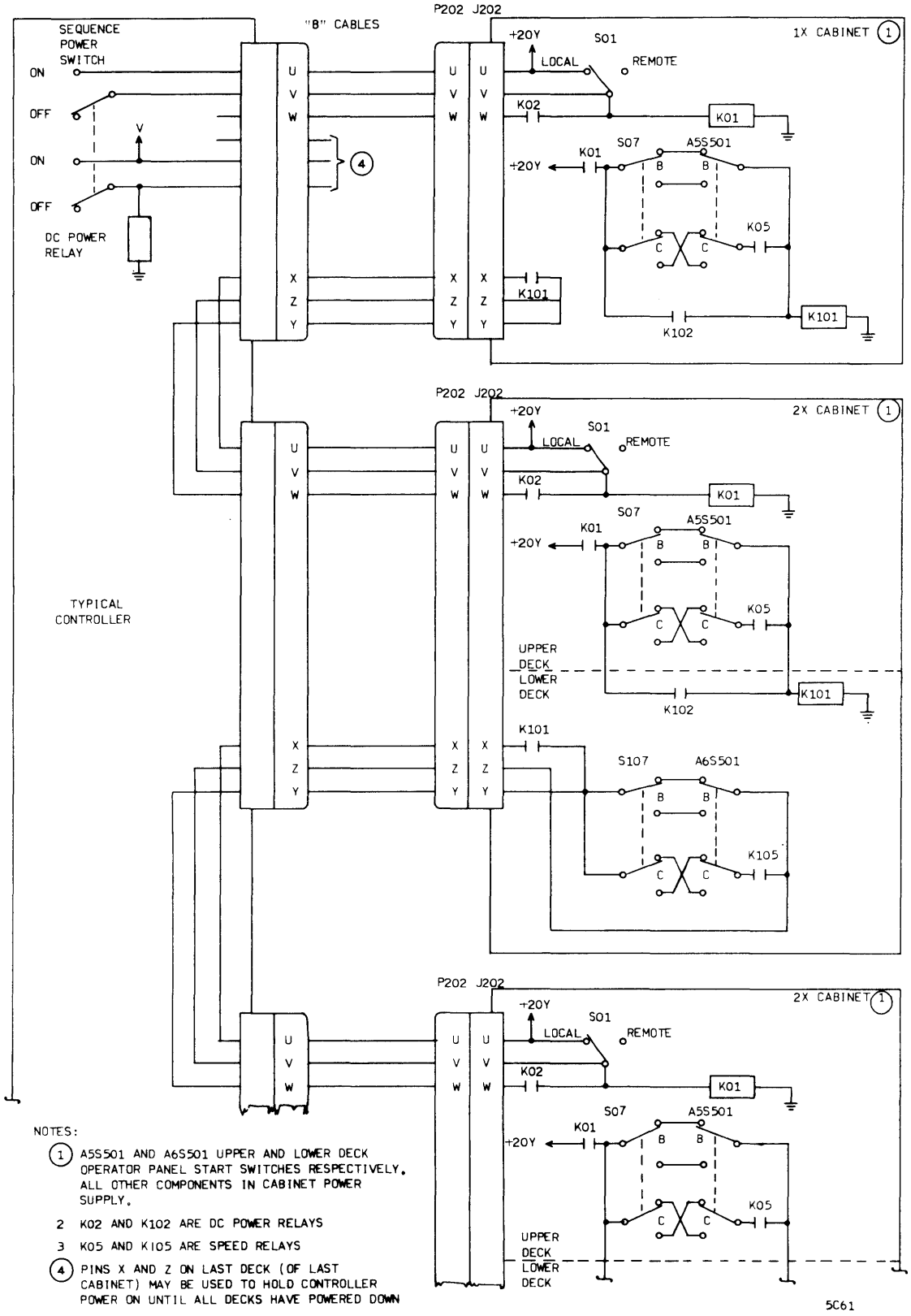


Figure 5-5. System Power Sequence Lines

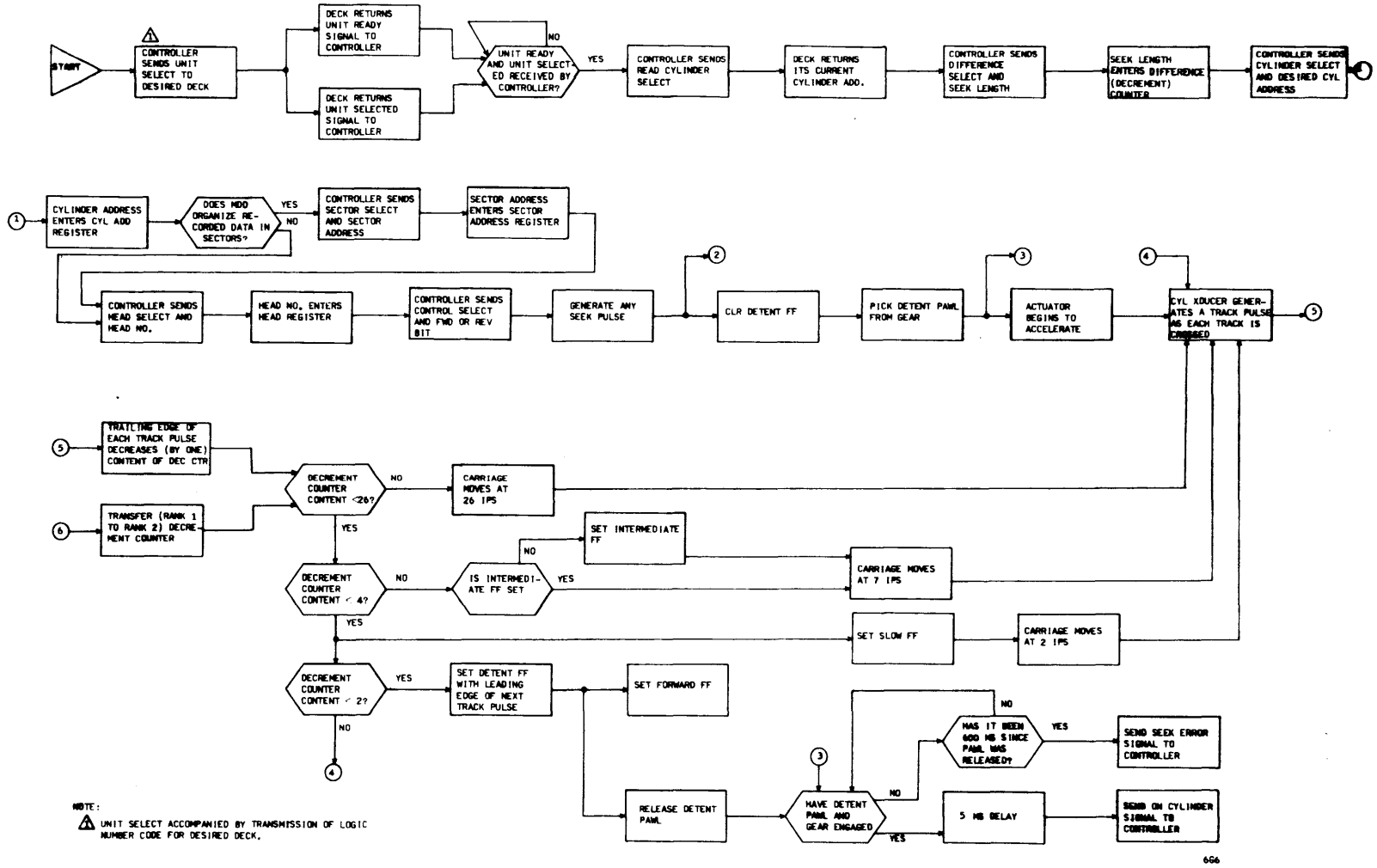


Figure 5-6. Direct Seek Sequence

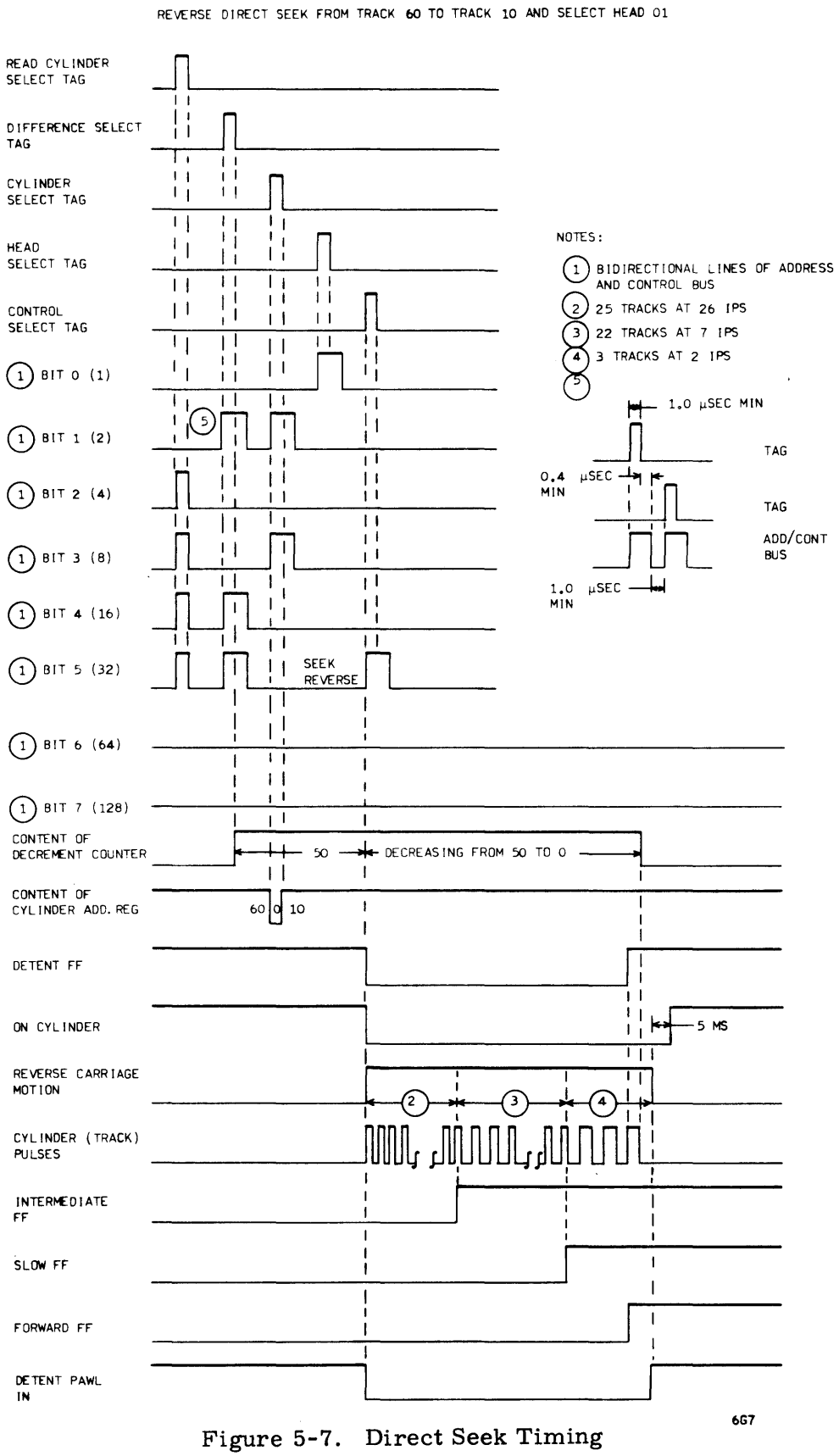


Figure 5-7. Direct Seek Timing

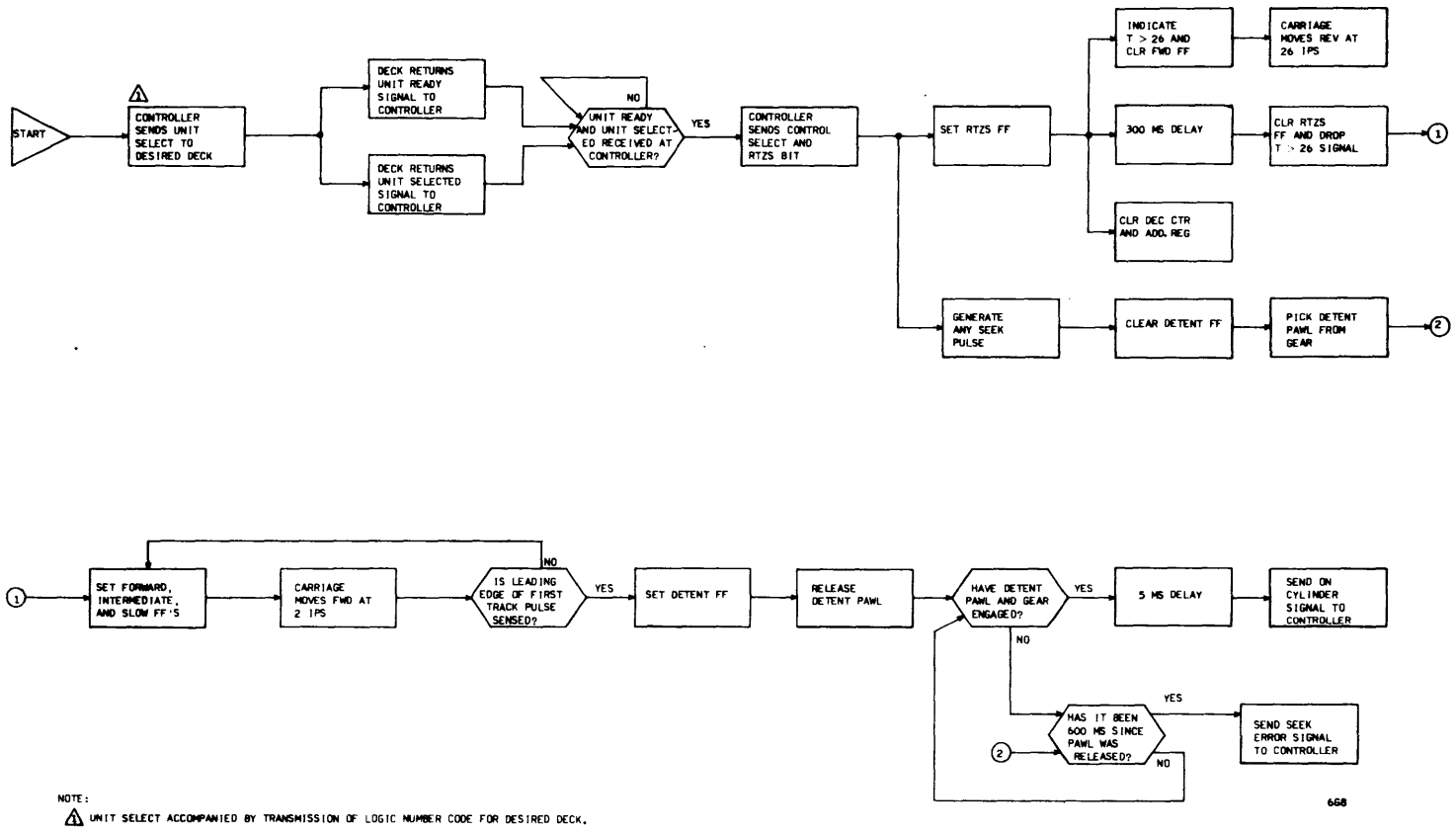


Figure 5-8. Return to Zero Seek Sequence

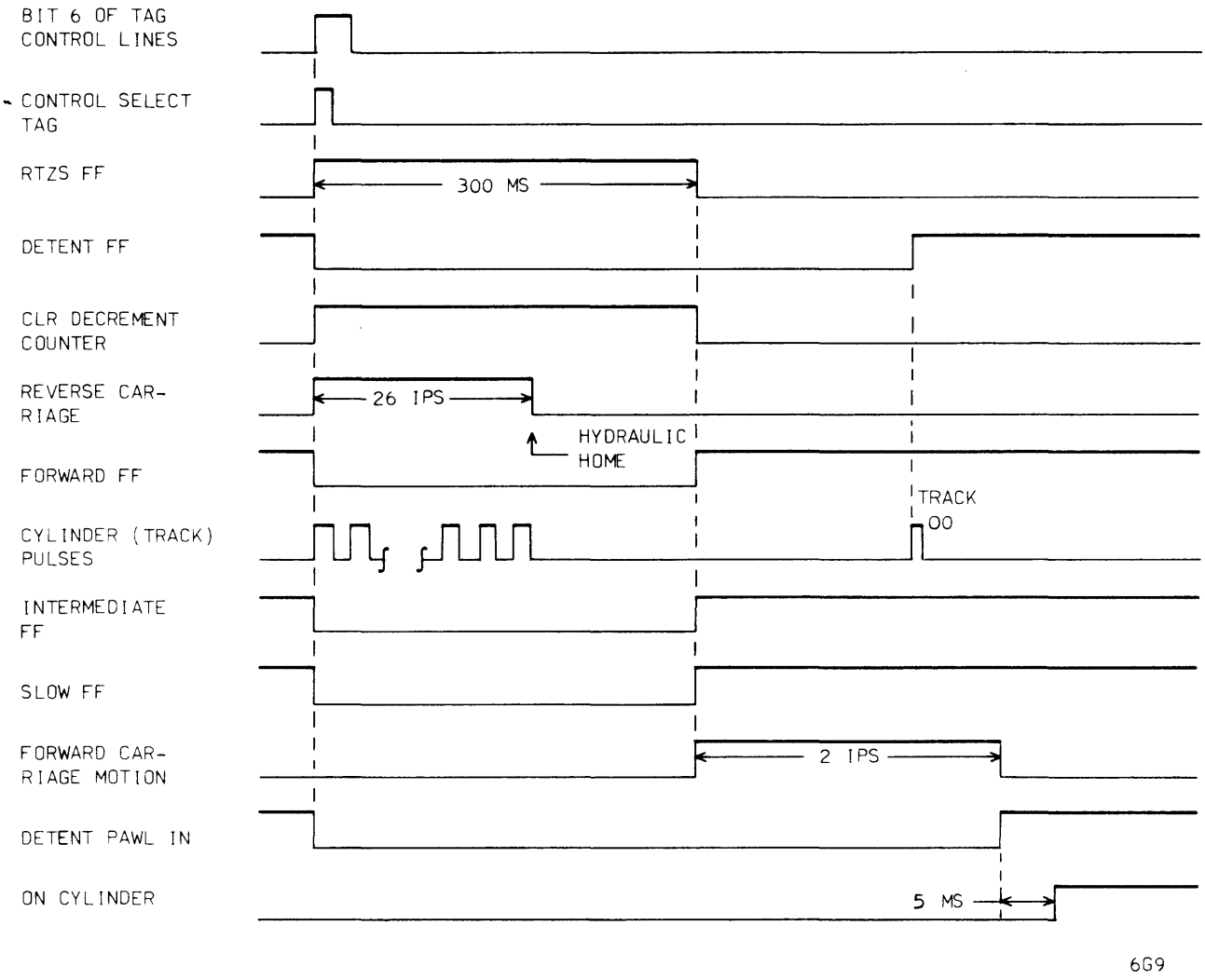
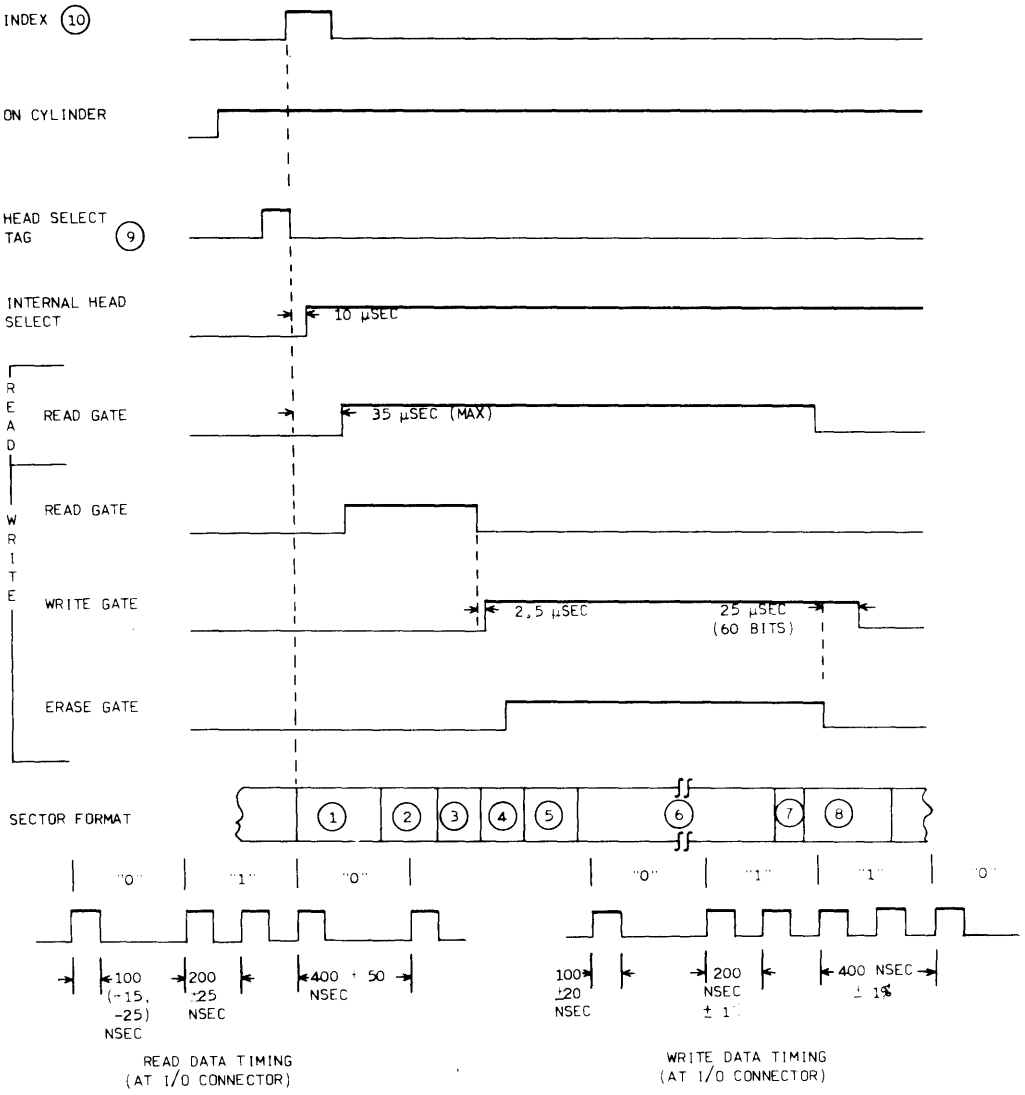


Figure 5-9. Return to Zero Seek Timing



NOTES:

(1) TOLERANCE GAP 1 - 120 BITS - ACCOMODATES PHYSICAL READ/WRITE TO ERASE GAP DISTANCE AND ALLOWS HEAD SWITCHING AND READ AMPLIFIER STABILIZATION TIME.

(2) SYNC PATTERN 1 - 112 BITS - INDICATES BEGINNING OF ADDRESS AREA. CONTROLLER MUST INITIATE SYNC BYTE (OR BIT) SEARCH MIDWAY THROUGH THIS PATTERN (REQUIRED TO INSURE THAT HEAD IS READING A KNOWN PATTERN EVEN UNDER WORST-CASE CONDITIONS OF HEAD SKEW, RPM, AND INDEX TOLERANCES DUE TO DISK PACK INTERCHANGE).

(3) ADDRESS - 36 BITS (TYPICAL) - TWELVE-BIT UPPER ADDRESS, 12-BIT LOWER ADDRESS, AND 12-BIT CHECKWORD.

(4) HEAD GAP - 120-BITS-ACCOMODATES PHYSICAL READ/WRITE TO ERASE GAP DISTANCE.

(5) SYNC PATTERN 2 - 112 BITS (MINIMUM) - INDICATES BEGINNING OF DATA FIELD.

(6) DATA FIELD - LENGTH DEPENDS UPON DATA RECORD FORMAT.

(7) POST AMBLE - 1 BIT - A PAD TO ENSURE THAT LAST BIT OF DATA IS NOT DESTROYED OR DISTORTED.

(8) TOLERANCE GAP 2 - LENGTH DEPENDS UPON FORMAT (SHOULD EQUAL APPROXIMATELY 2.5% OF SECTOR BIT CAPACITY). COMPENSATES FOR WORST-CASE CONDITIONS OF SPINDLE SPEED AND OSCILLATOR TOLERANCES.

(9) HEAD SELECT TAG LINE SHOWN OCCURRING AT LATEST ACCEPTABLE TIME RELATIVE TO INDEX: NOT TO BE CONSIDERED A TYPICAL RELATIONSHIP.

(10) INDEX PULSE AVAILABLE TO CONTROLLER TO INDICATE BEGINNING OF TRACK OR CYLINDER.

5C69

Figure 5-10. Typical Sector Format Read/Write Timing

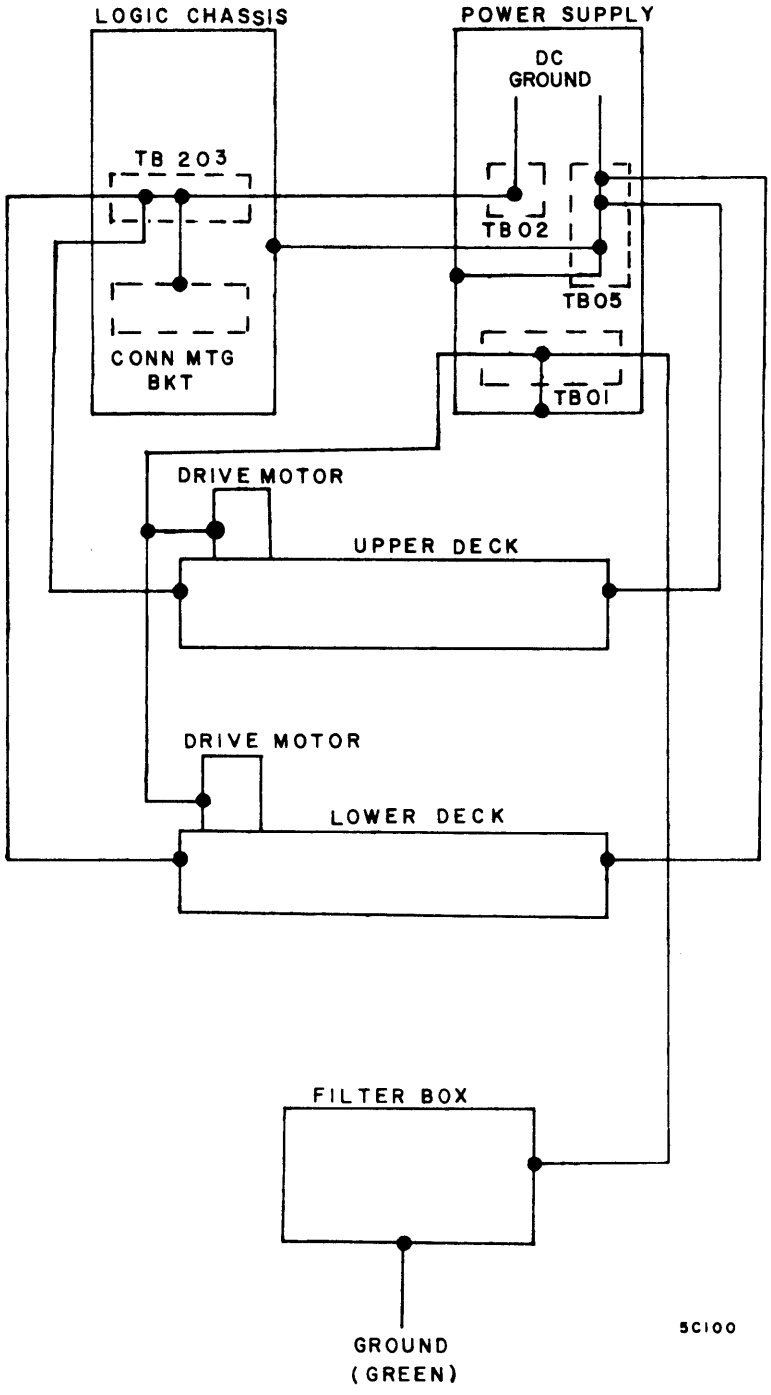
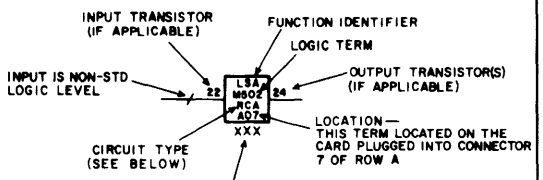


Figure 5-11. Ground Scheme

DISCRETE COMPONENT

DISCRETE COMPONENT CIRCUIT INFORMATION EXAMPLE



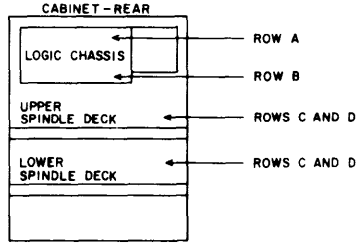
DISCRETE COMPONENT CIRCUIT TYPES:

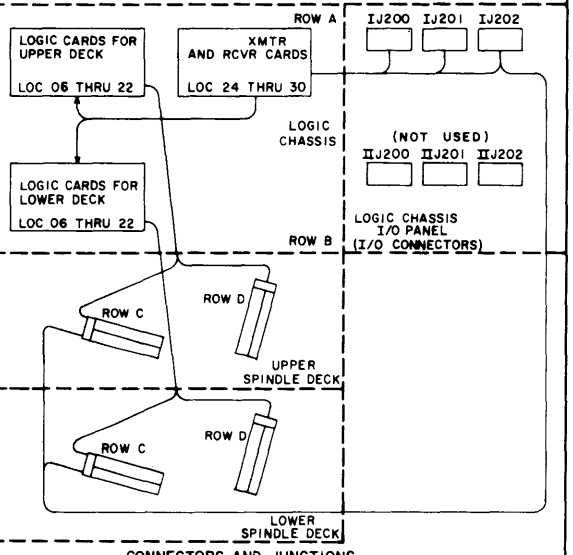
FAB	LO LEVEL AMPL
GJA	ANALOG GATE
HA-	HI LEVEL AMPL
HJA	ANALOG LINE DRIVER
IAA, IBA, ICA	LAMP DRIVER
IDA	SOLENOID DRIVER
JAB	WRITE DRIVER
JBB	ERASE DRIVER
LAA	LINE XMTR
MAA	OSCILLATOR
MBA	WAVEFORM GENERATOR
QAA, QBA, QCA, QF-	QUANTIZING DETECTOR
QDA	SPEED DETECTOR
QEA	VOLTAGE "OR"
RAA, RBA	LINE RCVR
RCA, RDA	SWITCH RCVR
RFA	TERMINATED RCVR
U--	DELAY
VAA, VAC	"AND"
VAB, VJ-	SPECIAL AND/OR
WB-	FLIP-FLOP
XA-	PULSE SHAPER

GENERAL

EXCEPT FOR SHEET 2, THESE SHEETS SHOW THE LOGIC REQUIRED TO SUPPORT A SINGLE SPINDLE (DRAWN FOR AN UPPER SPINDLE). SHEET 2 SHOWS I/O LOGIC FOR BOTH SPINDLES.

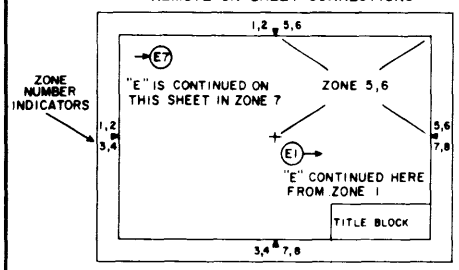
LOGIC CARD LOCATIONS / RELATIONS





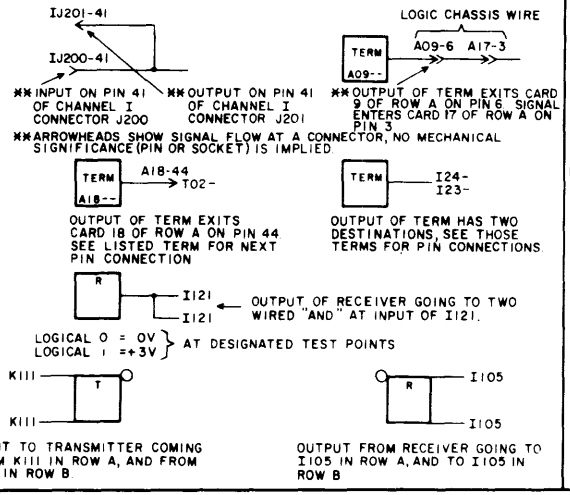
GENERAL SYMBOLOGY

REMOTE ON-SHEET CONNECTIONS



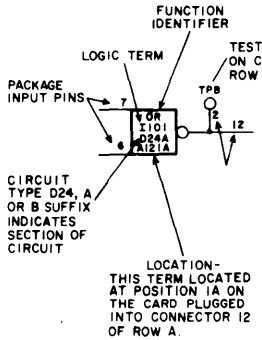
ODD NUMBERS USED TO DESIGNATE ZONES DURING FIRST PASS THRU ALPHABET. EVEN NUMBERS USED ONLY IF CONNECTIONS EXCEED 24 (I AND O NOT USED).

CONNECTORS AND JUNCTIONS

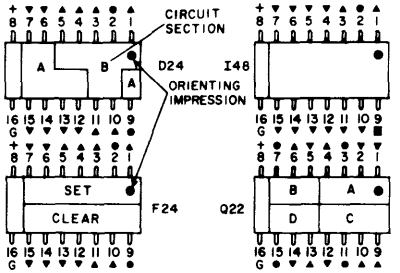


INTEBRID

INTEBRID CIRCUIT INFORMATION EXAMPLE



INTEBRID CIRCUIT PACKAGE IDENTIFICATION (TOP VIEW)

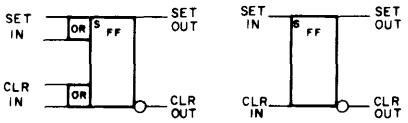


KEY:

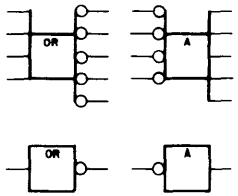
- ▼ 7 INPUT PIN (7)
- ▲ 15 OUTPUT PIN (15)
- ■ UNUSED
- ● COLLECTOR (TEST POINT)
- \+ +6V APPLICATION PIN
- G GROUND

INTEBRID SYMBOLS

FLIP-FLOP (TYPE F24)

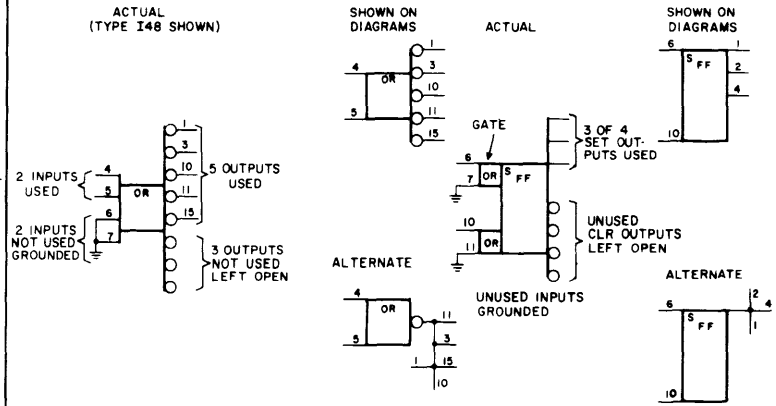


INVERTER (TYPE D24, I48, OR Q22)

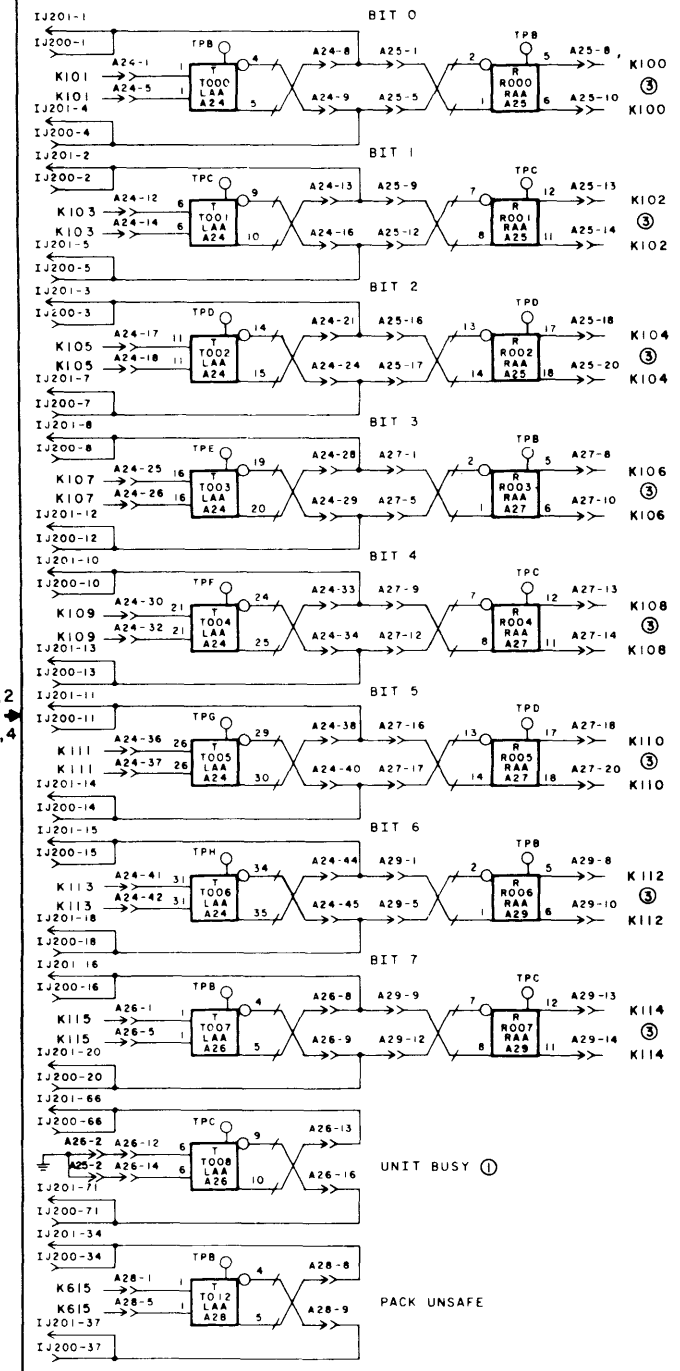


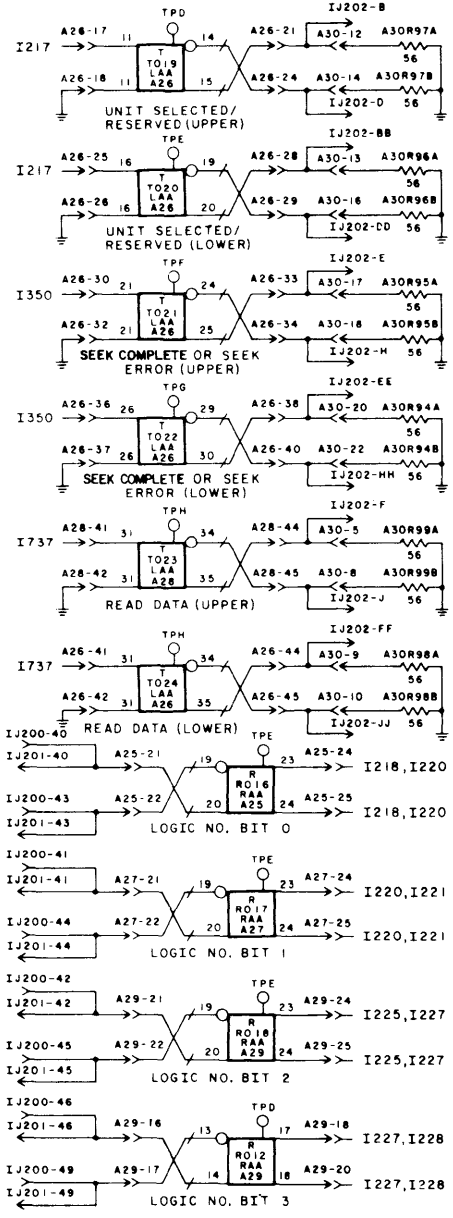
UNUSED INTEBRID CIRCUIT INPUTS AND OUTPUTS ARE NOT SHOWN ON THE LOGIC DIAGRAMS. IF A GATE HAS ONLY ONE INPUT, THE GATE HAS NO LOGICAL SIGNIFICANCE AND IS NOT SHOWN.

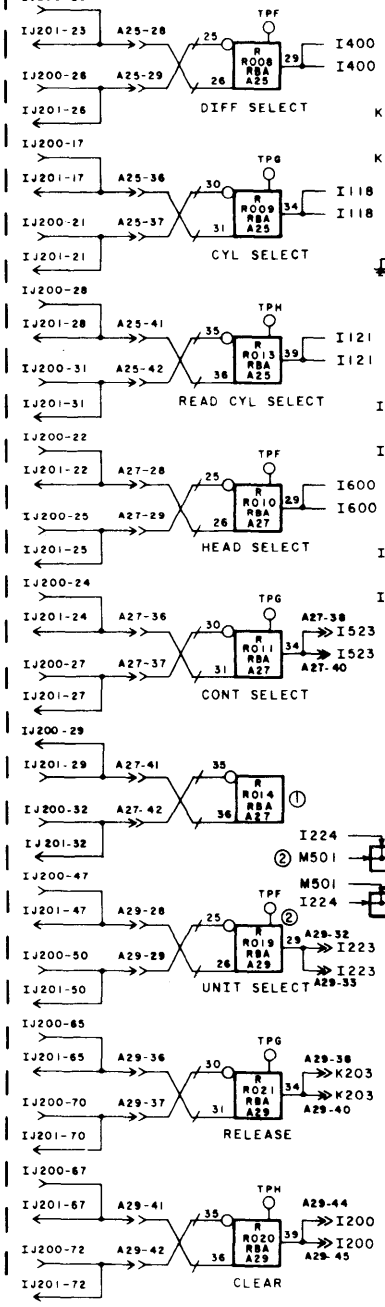
EXAMPLES

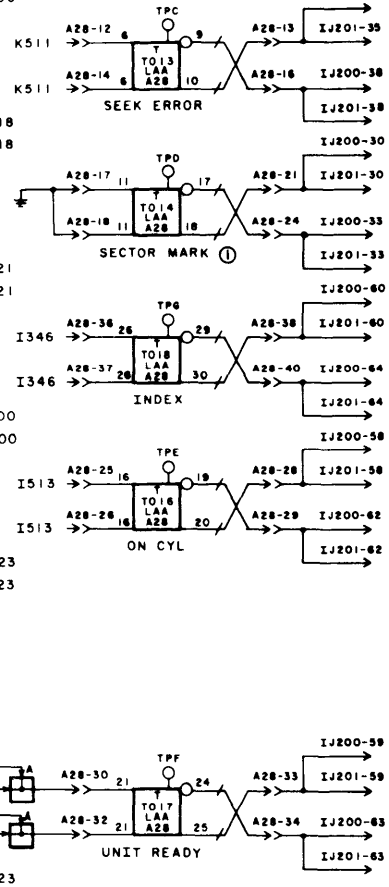


CONTROL DATA	TITLE: KEY TO LOGIC SYMBOLS	EQUIPMENT: BMIA5	
DEVELOPMENT DIVISION		SIZE: C	DRAWING NO: 70954900 REV: A
		SHEET: 1	PAGE









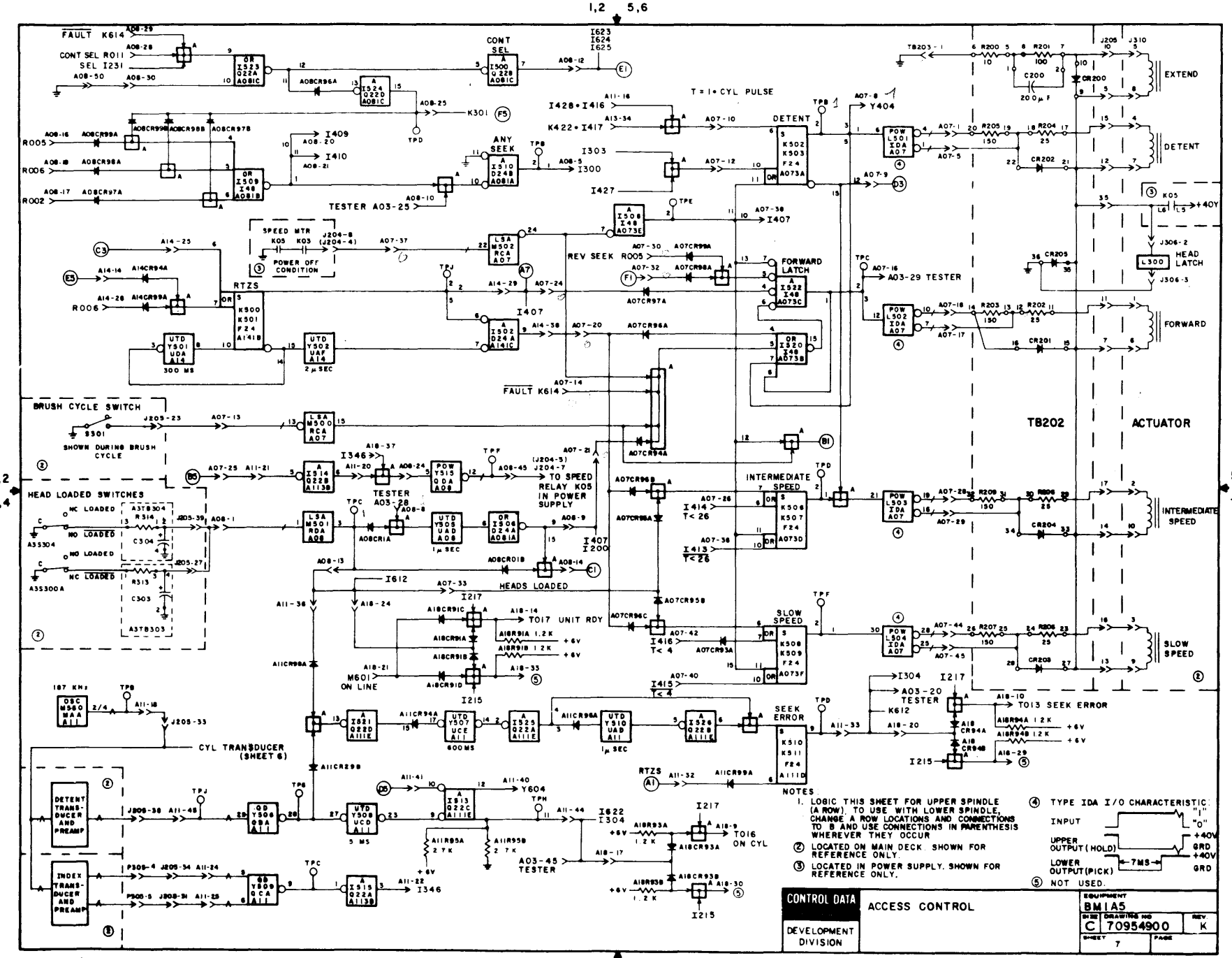
ADDR/ CONT BUS	RD CYL SEL, DIFF SEL, OR CYL SEL		HEAD SEL	CONT SEL
BIT 0	1		1	WRITE GATE
BIT 1	2		2	READ GATE
BIT 2	4		4	SEEK FWD
BIT 3	8		8	①
BIT 4	16		16	ERASE GATE
BIT 5	32		①	SEEK REV
BIT 6	64		①	RETURN 000
BIT 7	128		①	①

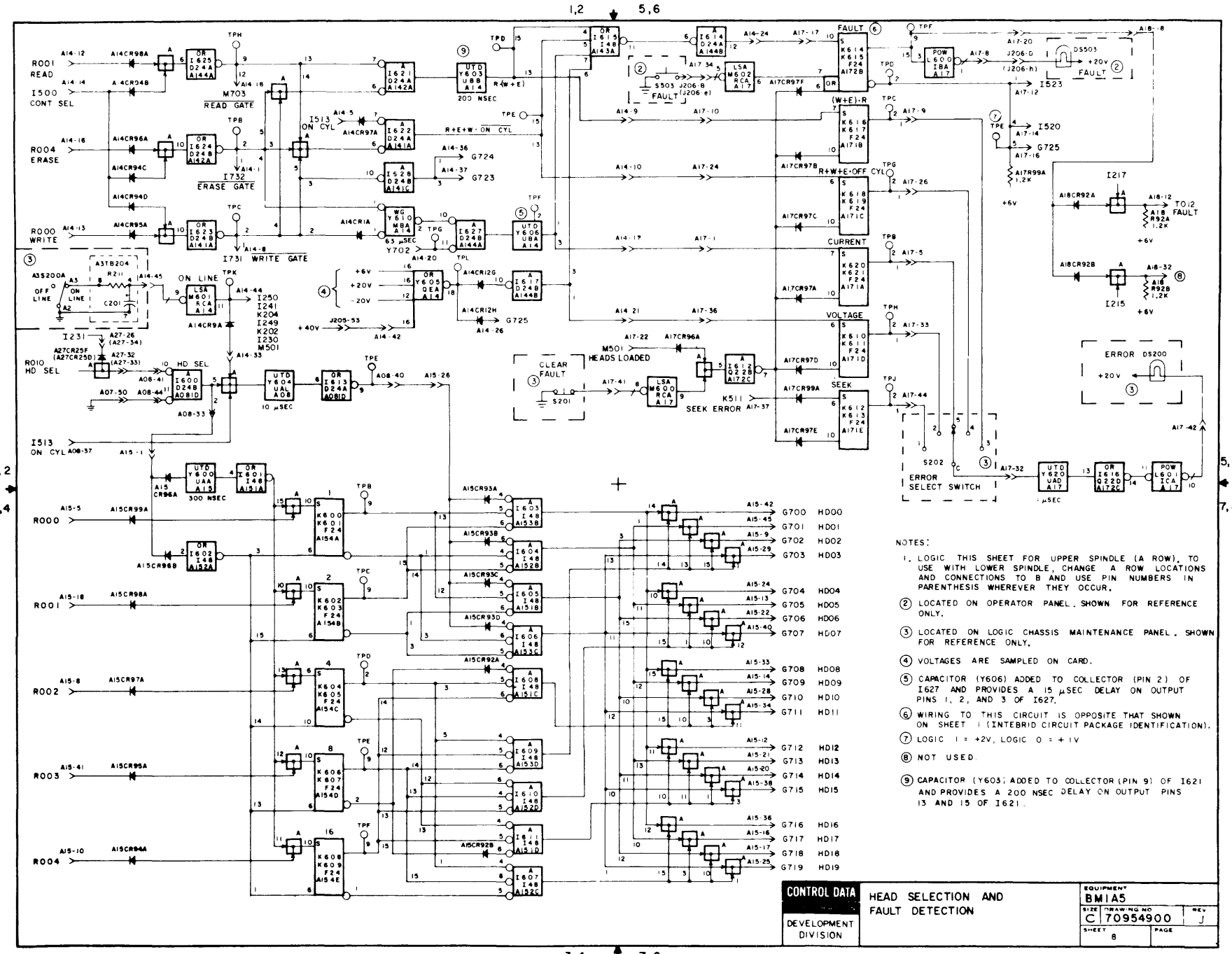
NOTES:
① NOT USED.

② PARTIAL INPUT SIGNAL SHOWN. SEE SHEET 7 FOR COMPLETE GATING INFORMATION.

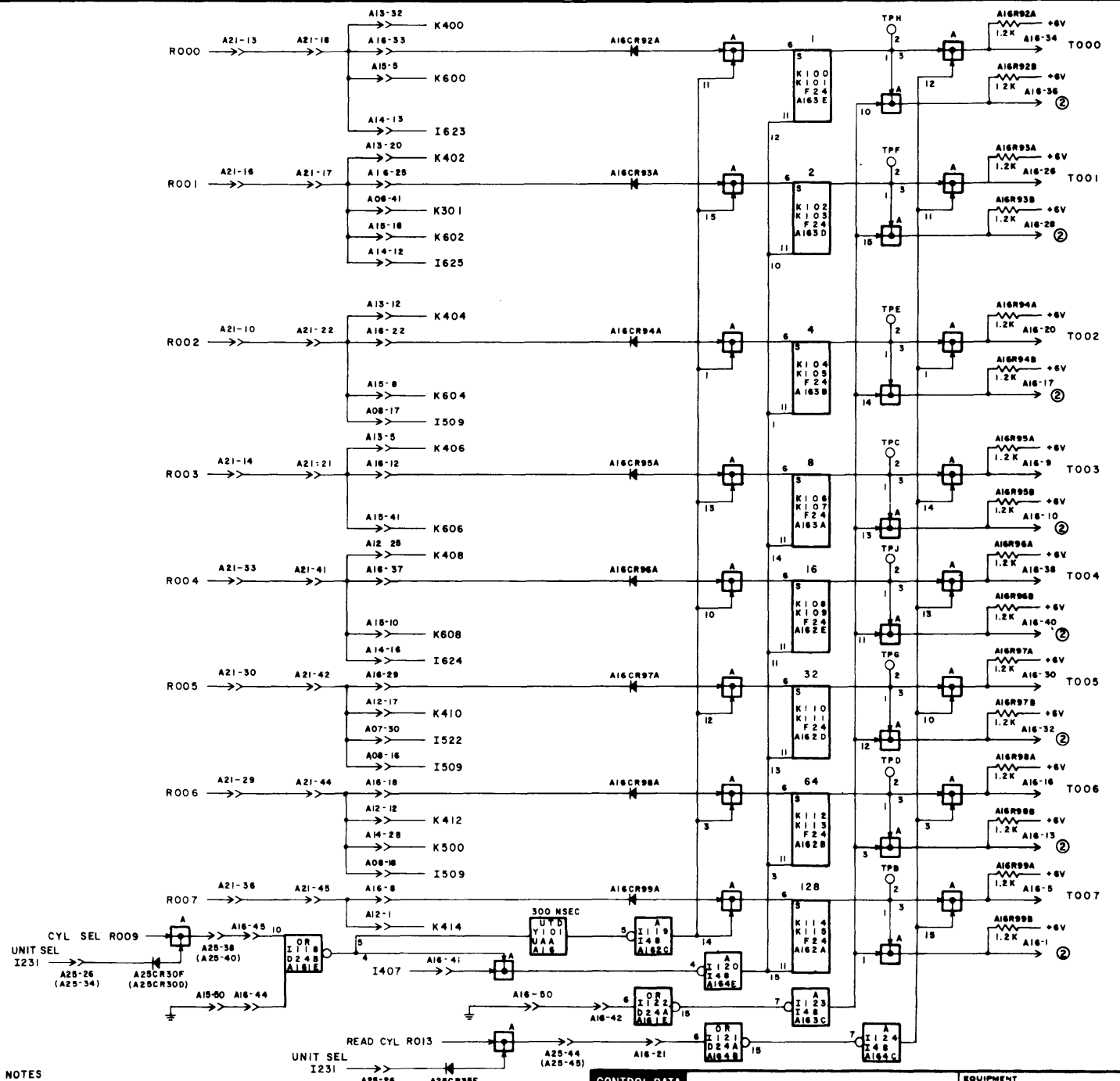
③ ADDITIONAL OUTPUTS SHOWN ON SHEET 3.

CONTROL DATA	INPUT/OUTPUT TRANSMITTERS AND RECEIVERS	EQUIPMENT BMIA5	
DEVELOPMENT DIVISION		SIZE C	DRAWING NO 70954900 REV A
		SHEET 2	PAGE


1,2 5,6
FAULT K614
CONT SEL R011
SEL I231
CONT SEL
I623
I624
I625
T = 1 • CYL PULSE
I428 • I416
K422 • I417
DETENT
Y404
EXTEND
DETENT
ANY SEEK
TESTER A03-25
I409
I410
I303
I427
I300
I407
SPEED MTR K05 K03 (J204-4)
POWER OFF CONDITION
RTZS
REV SEEK R005
FORWARD LATCH
A03-29 TESTER
HEAD LATCH
FORWARD
300 MS
2 μ SEC
FAULT K614
BRUSH CYCLE SWITCH
S301
SHOWN DURING BRUSH CYCLE
TO SPEED RELAY K05 IN POWER SUPPLY
INTERMEDIATE SPEED
HEAD LOADED SWITCHES
TESTER A03-28
I346
I414 T< 26
I413 T< 26
I407 I200
I612
HEADS LOADED
I217
SLOW SPEED
TO17 UNIT RDY
M601 ON LINE
I416 T< 4
I415 T< 4
187 KHz
CYL TRANSDUCER (SHEET 6)
SEEK ERROR
I304
A03-20 TESTER
TO13 SEEK ERROR
DETENT TRANSDUCER AND PREAMP
INDEX TRANSDUCER AND PREAMP
600 MS
5 MS
Y604
I622 I304
A03-45 TESTER
TO16 ON CYL
I215
T8202
ACTUATOR
1,2
3,4
5,6
7,8
NOTES
1. LOGIC THIS SHEET FOR UPPER SPINDLE (A ROW). TO USE WITH LOWER SPINDLE, CHANGE A ROW LOCATIONS AND CONNECTIONS TO B AND USE CONNECTIONS IN PARENTHESIS WHEREVER THEY OCCUR
2 LOCATED ON MAIN DECK. SHOWN FOR REFERENCE ONLY.
3 LOCATED IN POWER SUPPLY. SHOWN FOR REFERENCE ONLY.
4 TYPE IDA I/O CHARACTERISTIC:
INPUT "1" "0"
UPPER OUTPUT (HOLD) +40V GRD
LOWER OUTPUT (PICK) +40V GRD
7MS
5 NOT USED.
CONTROL DATA
DEVELOPMENT DIVISION
ACCESS CONTROL
EQUIPMENT BM1A5
SIZE C
DRAWING NO 70954900
REV K
SHEET 7
PAGE


R001 READ
I500 CONT SEL
R004 ERASE
R000 WRITE
M703 READ GATE
I732 ERASE GATE
I731 WRITE GATE
ON LINE
OFF LINE
R010 HD SEL
I513 ON CYL
M501 HEADS LOADED
CLEAR FAULT
S201
K511 SEEK ERROR
FAULT
(W+E)-R
R+W+E-OFF CYL
CURRENT
VOLTAGE
SEEK
ERROR DS200
S202 ERROR SELECT SWITCH
TO12 FAULT
R000
R001
R002
R003
R004
HD00
HD01
HD02
HD03
HD04
HD05
HD06
HD07
HD08
HD09
HD10
HD11
HD12
HD13
HD14
HD15
HD16
HD17
HD18
HD19
NOTES:
1. LOGIC THIS SHEET FOR UPPER SPINDLE (A ROW). TO USE WITH LOWER SPINDLE, CHANGE A ROW LOCATIONS AND CONNECTIONS TO B AND USE PIN NUMBERS IN PARENTHESIS WHEREVER THEY OCCUR.
2. LOCATED ON OPERATOR PANEL. SHOWN FOR REFERENCE ONLY.
3. LOCATED ON LOGIC CHASSIS MAINTENANCE PANEL. SHOWN FOR REFERENCE ONLY.
4. VOLTAGES ARE SAMPLED ON CARD.
5. CAPACITOR (Y606) ADDED TO COLLECTOR (PIN 2) OF I627 AND PROVIDES A 15 μSEC DELAY ON OUTPUT PINS 1, 2, AND 3 OF I627.
6. WIRING TO THIS CIRCUIT IS OPPOSITE THAT SHOWN ON SHEET 1 (INTEBRID CIRCUIT PACKAGE IDENTIFICATION).
7. LOGIC 1 = +2V, LOGIC 0 = +1V
8. NOT USED.
9. CAPACITOR (Y603) ADDED TO COLLECTOR (PIN 9) OF I621 AND PROVIDES A 200 NSEC DELAY ON OUTPUT PINS 13 AND 15 OF I621.
CONTROL DATA
DEVELOPMENT DIVISION
HEAD SELECTION AND FAULT DETECTION
EQUIPMENT BMIA5
SIZE C
DRAWING NO 70954900
REV J
SHEET 8
PAGE

1,2 ↓ 5,6

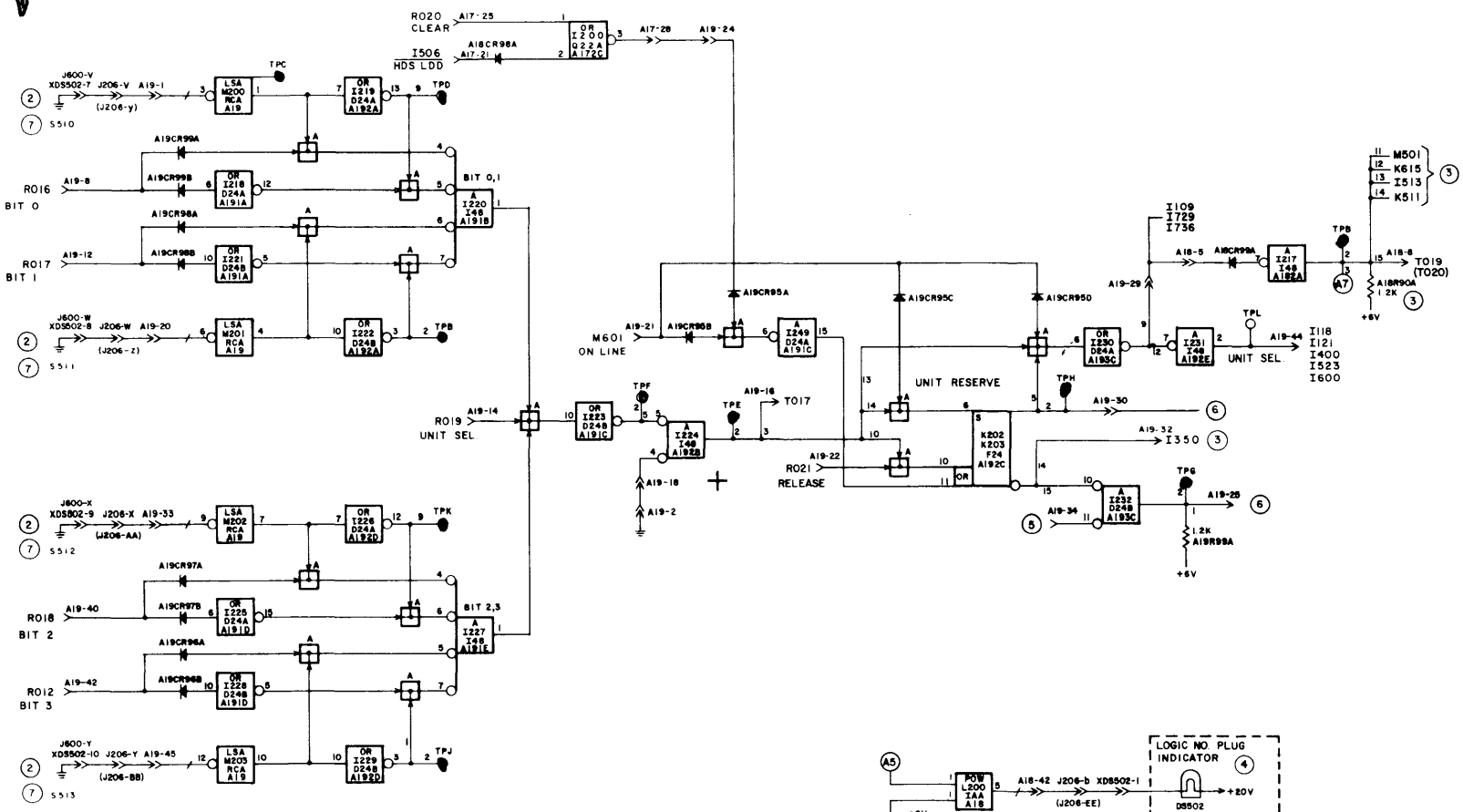


NOTES

1. LOGIC THIS SHEET FOR UPPER SPINDLE (A ROW). TO USE WITH LOWER SPINDLE, CHANGE A ROW LOCATIONS AND CONNECTIONS TO B AND USE CONNECTIONS IN PARENTHESIS WHENEVER THEY OCCUR.

② NOT USED.

CONTROL DATA DEVELOPMENT DIVISION	ADDRESS REGISTER AND CONTROL BUS STEERING	EQUIPMENT BM1A5	
		SIZE C	DRAWING NO 70954900 REV A
		SHEET 3	PAGE



NOTES

1. LOGIC THIS SHEET FOR UPPER SPINDLE (A ROW). TO USE WITH LOWER SPINDLE, CHANGE A ROW LOCATIONS AND CONNECTIONS TO B AND USE TERM NUMBERS AND CONNECTIONS IN PARENTHESIS WHEREVER THEY OCCUR
2. ELECTRICAL PLUG GROUNDS ARE ENABLE BY THE INSERTION OF THE ELECTRICAL LOGIC NO. PLUG. LOGIC NO. OF PLUG DETERMINES GROUNDS ACCORDING TO SHORTED PINS SHOWN IN ADJACENT TABLE. THIS UNIT SHOWN WITH LOGIC NO. "0" PLUG INSTALLED AT OPR CONTROL PANEL.
3. THIS SIGNAL FORMS WIRED AND GATE WITH THE OUTPUT OF LISTED TERM(S) GATE(S) IS SHOWN ON SAME SHEET AS LISTED TERM.
4. LOCATED ON OPERATOR PANEL. SHOWN FOR REFERENCE ONLY.
5. CIRCUIT OPEN
6. NOT USED
7. MECHANICAL PLUG GROUNDS ARE ENABLE BY THE INSERTION OF THE MECHANICAL LOGIC PLUG. THE NO. OF THE LOGIC PLUG DETERMINES GROUNDS ACCORDING TO CLOSED SWITCHES SHOWN IN ADJACENT TABLE, THIS UNIT SHOWN WITH LOGIC NO. "0" PLUG INSTALLED AT OPR CONTROL PANEL.

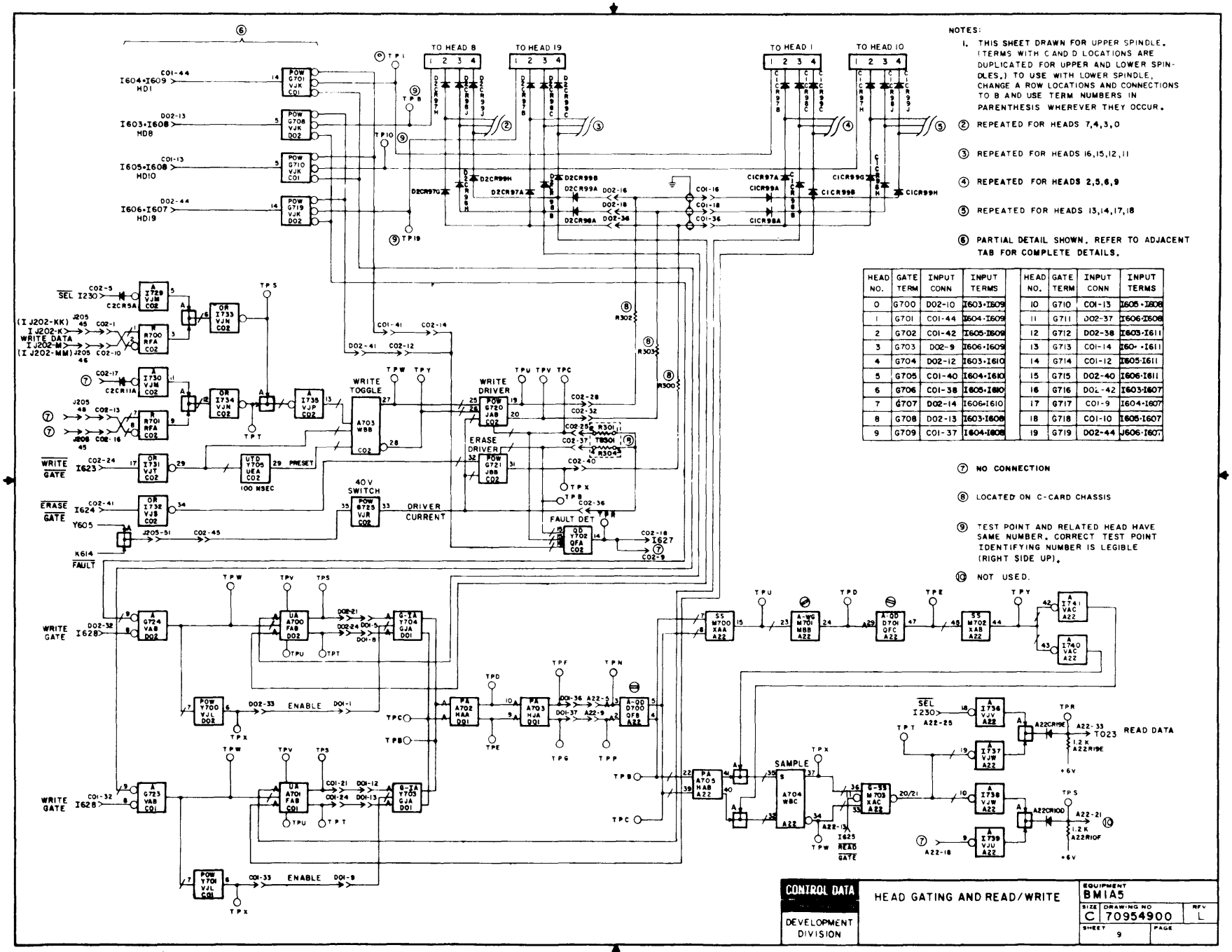
(2)

LOGIC NO.	SHORTED PINS
0	7,8,9,10
1	8,9,10
2	7, 9,10
3	9,10
4	7,8, 10
5	8, 10
6	7, 10
7	10
8	7,8,9

(7)

LOGIC NO.	OPEN = O CLOSED = C			
	S513	S512	S511	S510
0	C	C	C	C
1	C	C	C	O
2	C	C	O	C
3	C	C	O	O
4	C	O	C	C
5	C	O	C	O
6	C	O	O	C
7	C	O	O	O
8	O	C	C	C

CONTROL DATA DEVELOPMENT DIVISION	SELECT AND RESERVE	EQUIPMENT BMIA5	
		SIZE C	DRAWING NO 70954900 REV J
		SHEET 4	PAGE



HEAD NO.	GATE TERM	INPUT CONN	INPUT TERMS	HEAD NO.	GATE TERM	INPUT CONN	INPUT TERMS
0	G700	D02-10	I603·I609	10	G710	C01-13	I605·I608
1	G701	C01-44	I604·I609	11	G711	D02-37	I606·I608
2	G702	C01-42	I605·I609	12	G712	D02-38	I603·I611
3	G703	D02-9	I606·I609	13	G713	C01-14	I604·I611
4	G704	D02-12	I603·I610	14	G714	C01-12	I605·I611
5	G705	C01-40	I604·I610	15	G715	D02-40	I606·I611
6	G706	C01-38	I605·I610	16	G716	D02-42	I603·I607
7	G707	D02-14	I606·I610	17	G717	C01-9	I604·I607
8	G708	D02-13	I603·I608	18	G718	C01-10	I605·I607
9	G709	C01-37	I604·I608	19	G719	D02-44	I606·I607

LOGIC CHASSIS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
A			TESTER ④			SINGLE SECTOR	SOLENOID CONTROL	SPEED DETECTOR AND MISC			UPPER DIFFERENCE COUNTER	LOWER DIFFERENCE COUNTER	RTZS AND FAULT DETECTION	HEAD SELECTION	ADDRESS REGISTER	FAULT STATUS	CHAN I SELECT AND RESERVE ③			READ RECOVERY		XMTR	RCVR	XMTR	RCVR	XMTR	RCVR	TERMINATOR		A
			8FFN			AFJN	8AQN	AFEN			9APN ②	8AJN	8AWN	8ASN	8AHN	8AKN	BFGN	8ANN	8FBN			AAUN		8ATN	8ARN	8ATN	8ARN	8ATN	8ARN	8AZN		
B			TESTER ④			SINGLE SECTOR	SOLENOID CONTROL	SPEED DETECTOR AND MISC			UPPER DIFFERENCE COUNTER	LOWER DIFFERENCE COUNTER	RTZS AND FAULT DETECTION	HEAD SELECTION	ADDRESS REGISTER	FAULT STATUS	CHAN I SELECT AND RESERVE ③			READ RECOVERY										B
			8FFN			AFJN	8AQN	AFEN			9APN ②	8AJN	8AWN	8ASN	8AHN	8AKN	BFGN	8ANN	8FBN			AAUN									

UPPER DECK

LOWER DECK

D

2	1
8AFN	8FAN

HEAD SELECT PREAMP

ANALOG GATE AND AMPLIFIER

C

2	1
9AYN	8AFN

WRITE ERASE CIRCUITS

HEAD SELECT PREAMP

NOTES:

② ANY SEEK, SEEK ERROR, ON CYL, AND SPEED DETECTION

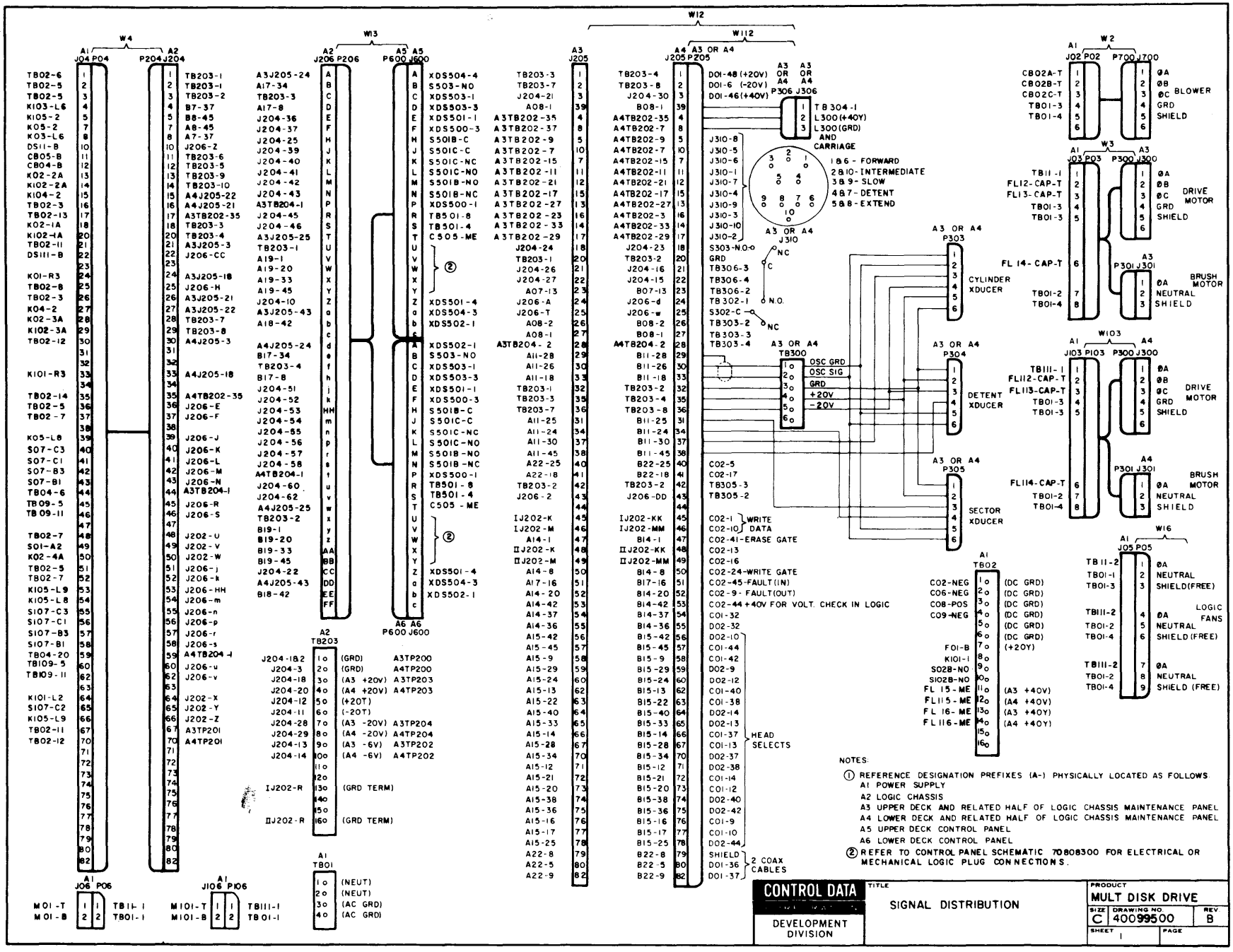
③ STEERING UNIT LOGIC

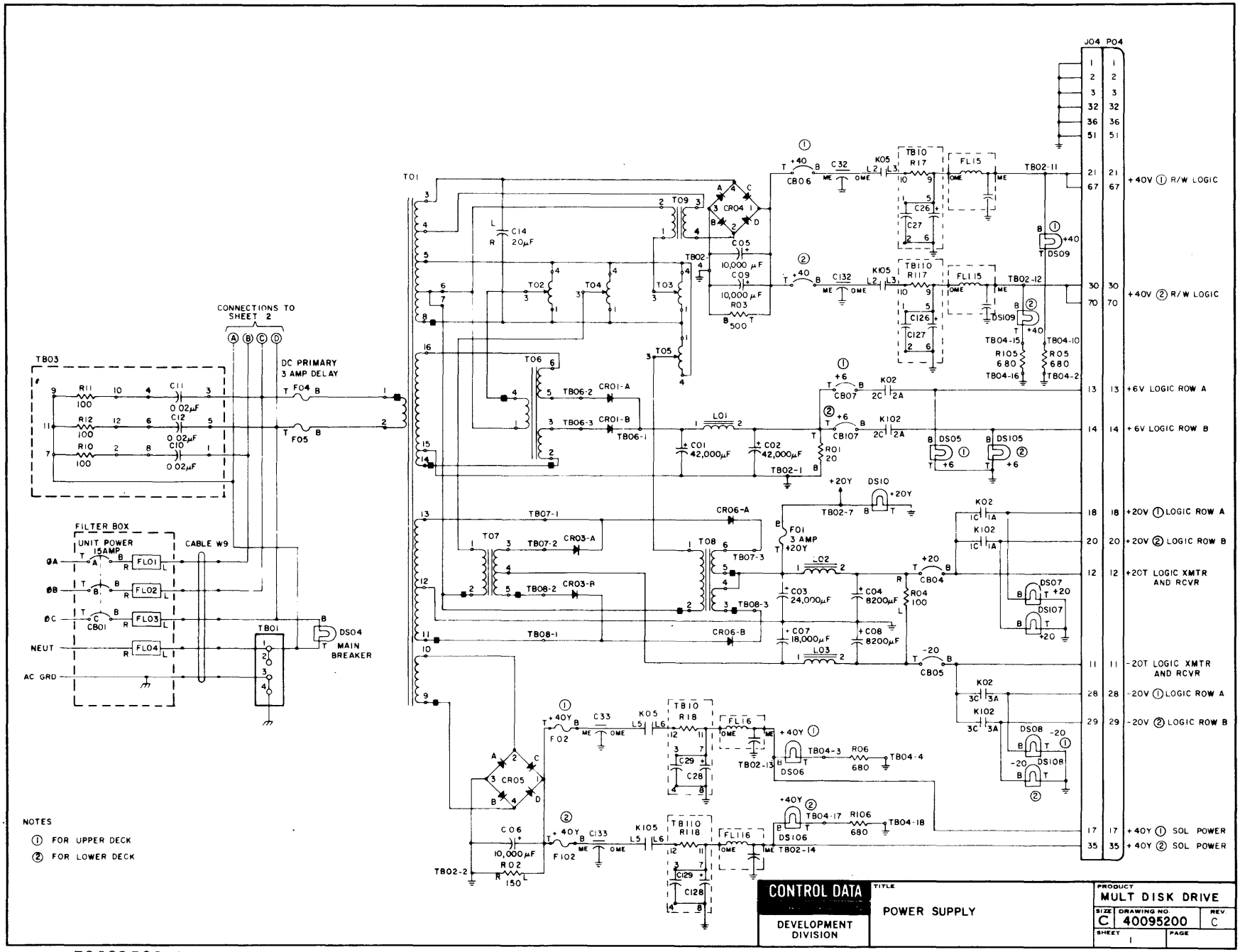
④ OPTIONAL CARD SHOWN FOR REFERENCE ONLY. WHEN TESTER (CDC P/N 40072100) IS USED DURING MAINTENANCE SITUATION INSTALL IT AT A03 FOR UPPER SPINDLE OR B03 FOR LOWER SPINDLE. LOGIC SHEETS SHOW INTERFACE WITH TESTER. TESTER CARD SCHEMATIC SHOWN WITH CARD SCHEMATICS.

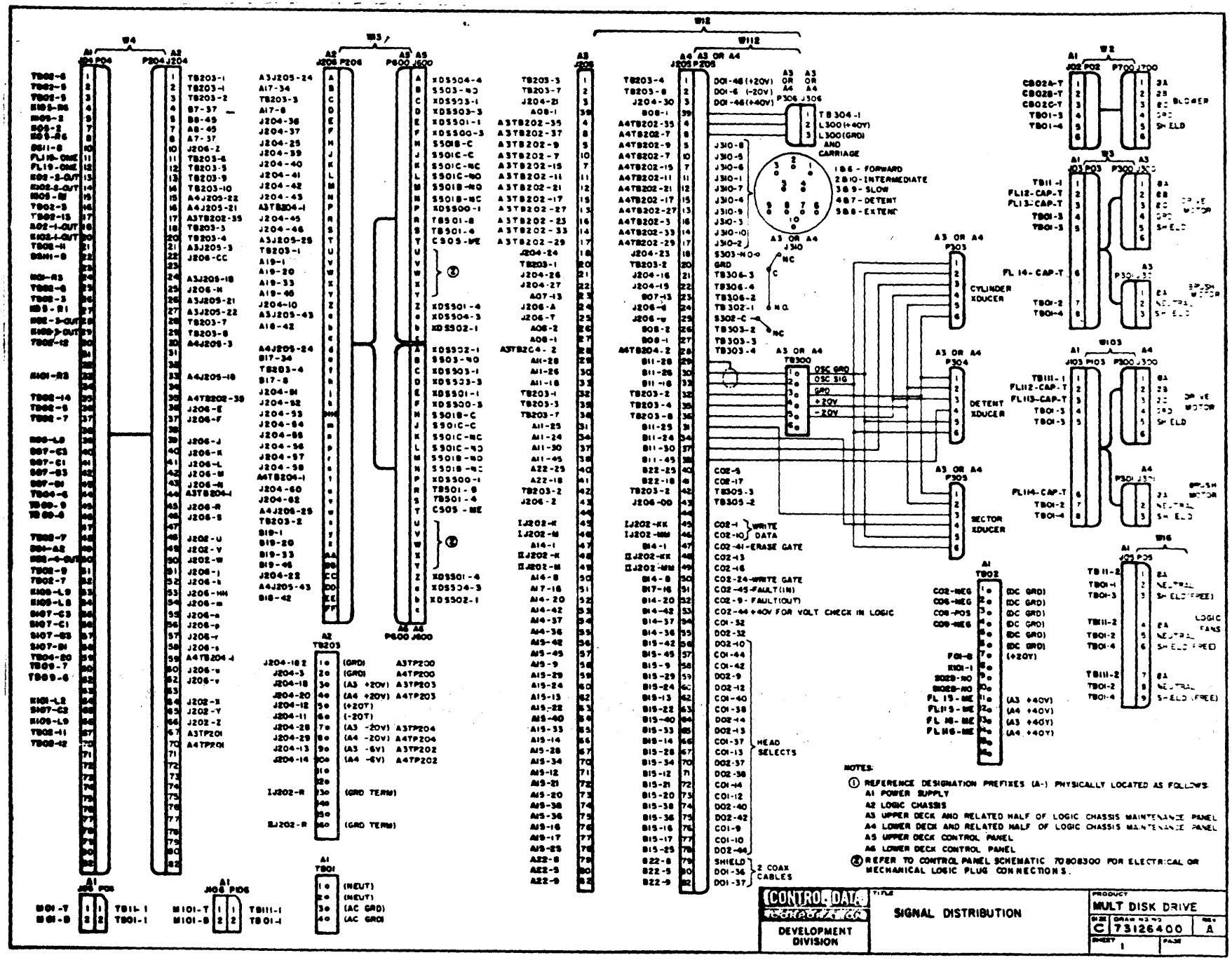
CONTROL DATA
DEVELOPMENT DIVISION

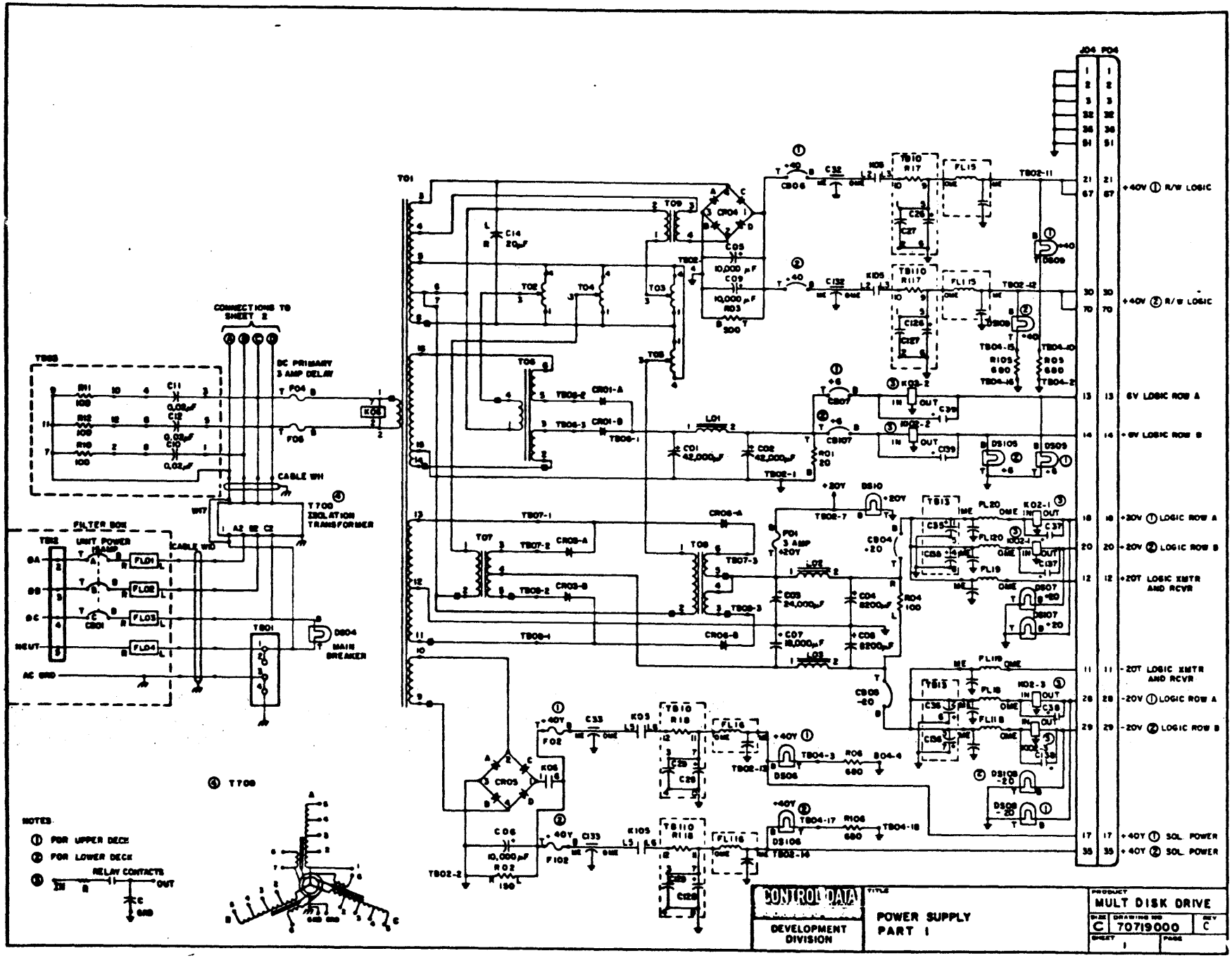
CHASSIS MAP

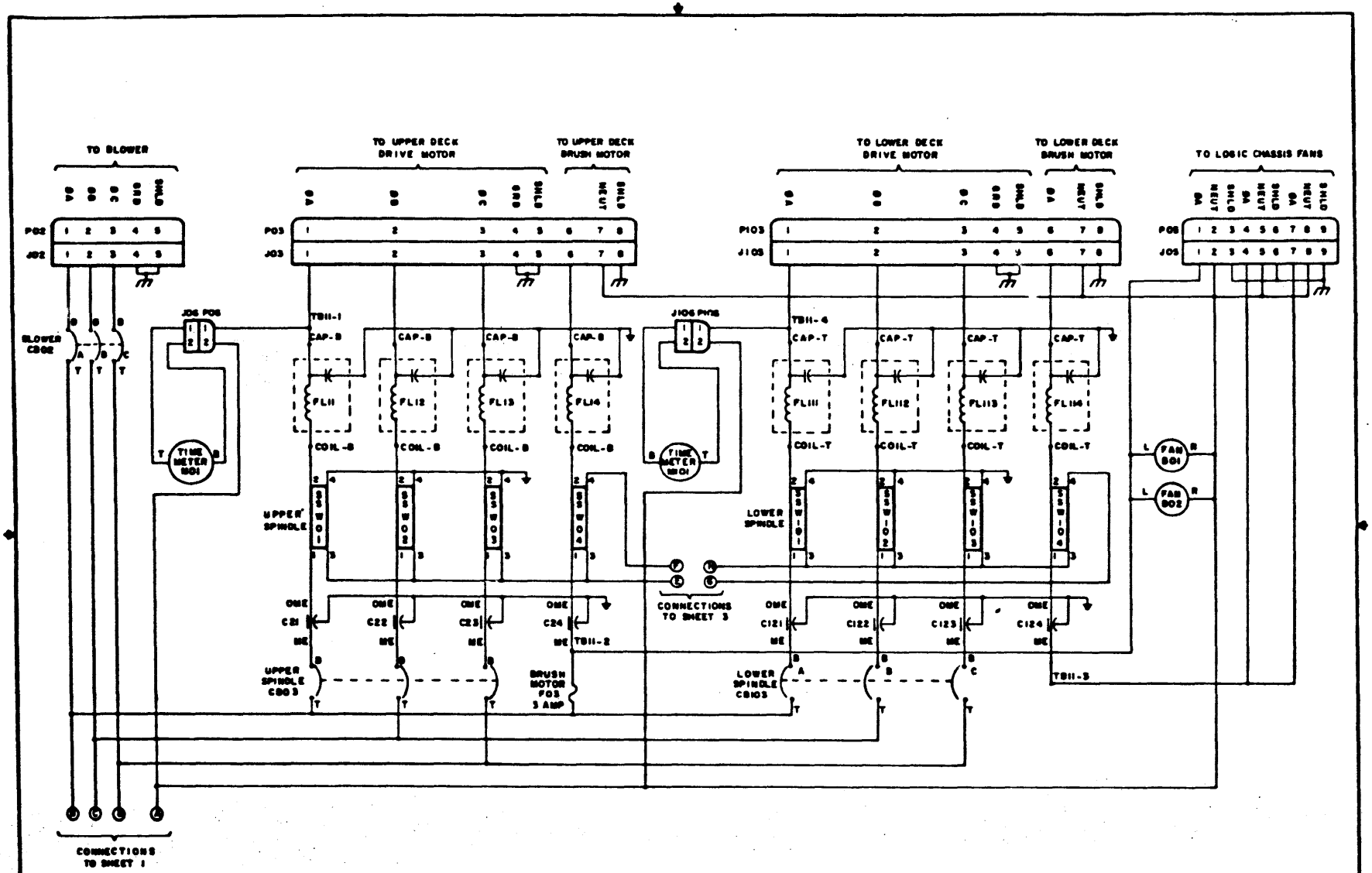
EQUIPMENT BM1A5
SIZE C | DRAW NO 70954900 | REV K
SHEET 10 | PAGE

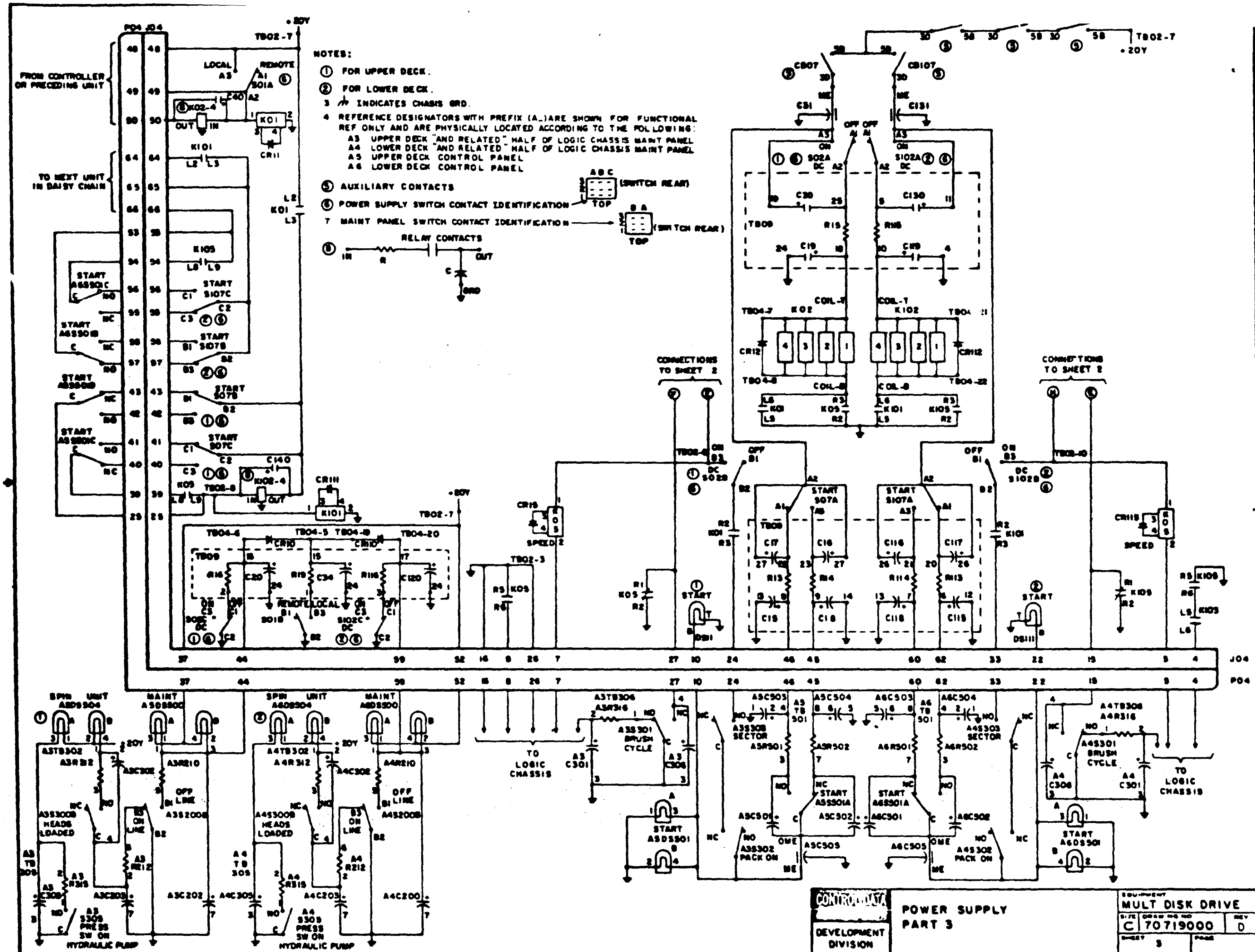

W4
W13
W12
W112
W2
W3
W103
W16
A1 J04 P04
P204 J204
A2 J206 P206
A5 P600 J600
A3 J205
A4 A3 OR A4 J205 P205
A1 J02 P02
P700 J700
A1 J03 P03
P300 J300
A3 P301 J301
A1 JI03 PI03
A4 P301 J301
A1 J05 P05
A1 J06 P06
A1 JI06 PI06
A2 TB203
A1 TB01
A1 TB02
A3 OR A4 P306 J306
A3 OR A4 J310
A3 OR A4 TB300
A3 OR A4 P303
A3 OR A4 P304
A3 OR A4 P305
TB02-6 TB02-5 TB02-5 K103-L6 K105-2 K05-2 K03-L6 DSII-B CB05-B CB04-B K02-2A K102-2A K104-2 TB02-3 TB02-13 K02-1A K102-1A TB02-11 DSIII-B K01-R3 TB02-8 TB02-3 K04-2 K02-3A K102-3A TB02-12 K101-R3 TB02-14 TB02-5 TB02-7 K05-L8 S07-C3 S07-C1 S07-B3 S07-B1 TB04-6 TB09-5 TB09-11 TB02-7 S01-A2 K02-4A TB02-5 TB02-7 K105-L9 K105-L8 S107-C3 S107-C1 S107-B3 S107-B1 TB04-20 TBI09-5 TBI09-11 K101-L2 S107-C2 K105-L9 TB02-11 TB02-12
TB203-1 TB203-1 TB203-2 B7-37 B8-45 A8-45 A7-37 J206-Z TB203-6 TB203-5 TB203-9 TB203-10 A4J205-22 A4J205-21 A3TB202-35 TB203-3 TB203-4 A3J205-3 J206-CC A3J205-18 J206-H A3J205-21 A3J205-22 TB203-7 TB203-8 A4J205-3 A4J205-18 A4TB202-35 J206-E J206-F J206-J J206-K J206-L J206-M J206-N A3TB204-1 J206-R J206-S J202-U J202-V J202-W J206-j J206-k J206-HH J206-m J206-n J206-p J206-r J206-s A4TB204-1 J206-u J206-v J202-X J202-Y J202-Z A3TP201 A4TP201
A3J205-24 A17-34 TB203-3 A17-8 J204-36 J204-37 J204-25 J204-39 J204-40 J204-41 J204-42 J204-43 A3TB204-1 J204-45 J204-46 A3J205-25 TB203-1 A19-1 A19-20 A19-33 A19-45 J204-10 A3J205-43 A18-42 A4J205-24 B17-34 TB203-4 B17-8 J204-51 J204-52 J204-53 J204-54 J204-55 J204-56 J204-57 J204-58 A4TB204-1 J204-60 J204-62 A4J205-25 TB203-2 B19-1 B19-20 B19-33 B19-45 J204-22 A4J205-43 B18-42
XDS504-4 S503-NO XDS503-1 XDS503-3 XDS501-1 XDS500-3 S501B-C S501C-C S501C-NC S501C-NO S501B-NO S501B-NC XDS500-1 TB501-8 TB501-4 C505-ME ② XDS501-4 XDS504-3 XDS502-1 XDS502-1 S503-NO XDS503-1 XDS503-3 XDS501-1 XDS500-3 S501B-C S501C-C S501C-NC S501C-NO S501B-NO S501B-NC XDS500-1 TB501-8 TB501-4 C505-ME ② XDS501-4 XDS504-3 XDS502-1
TB203-3 TB203-7 J204-21 A08-1 A3TB202-35 A3TB202-37 A3TB202-9 A3TB202-7 A3TB202-15 A3TB202-11 A3TB202-21 A3TB202-17 A3TB202-27 A3TB202-23 A3TB202-33 A3TB202-29 J204-24 TB203-1 J204-26 J204-27 A07-13 J206-A J206-T A08-2 A08-1 A3TB204-2 A11-28 A11-26 A11-18 TB203-1 TB203-3 TB203-7 A11-25 A11-24 A11-30 A11-45 A22-25 A22-18 TB203-2 J206-2 IJ202-K IJ202-M A14-1 IIJ202-K IIJ202-M A14-8 A17-16 A14-20 A14-42 A14-37 A14-36 A15-42 A15-45 A15-9 A15-29 A15-24 A15-13 A15-22 A15-40 A15-33 A15-14 A15-28 A15-34 A15-12 A15-21 A15-20 A15-38 A15-36 A15-16 A15-17 A15-25 A22-8 A22-5 A22-9
TB203-4 TB203-8 J204-30 B08-1 A4TB202-35 A4TB202-7 A4TB202-9 A4TB202-7 A4TB202-15 A4TB202-11 A4TB202-21 A4TB202-17 A4TB202-27 A4TB202-3 A4TB202-33 A4TB202-29 J204-23 TB203-2 J204-16 J204-15 B07-13 J206-d J206-w B08-2 B08-1 A4TB204-2 B11-28 B11-26 B11-18 TB203-2 TB203-4 TB203-8 B11-25 B11-24 B11-30 B11-45 B22-25 B22-18 TB203-2 J206-DD IJ202-KK IJ202-MM B14-1 IIJ202-KK IIJ202-MM B14-8 B17-16 B14-20 B14-42 B14-37 B14-36 B15-42 B15-45 B15-9 B15-29 B15-24 B15-13 B15-22 B15-40 B15-33 B15-14 B15-28 B15-34 B15-12 B15-21 B15-20 B15-38 B15-36 B15-16 B15-17 B15-25 B22-8 B22-5 B22-9
DOI-48 (+20V) DOI-6 (-20V) DOI-46(+40V) J310-8 J310-5 J310-6 J310-1 J310-7 J310-4 J310-9 J310-3 J310-10 J310-2 S303-NO S303-C S302-C S302-NO TB303-3 TB303-4 C02-5 C02-17 TB305-3 TB305-2 C02-1 C02-10 C02-41-ERASE GATE C02-13 C02-16 C02-24-WRITE GATE C02-45-FAULT(IN) C02-9-FAULT(OUT) C02-44 +40V FOR VOLT. CHECK IN LOGIC C01-32 D02-32 D02-10 C01-44 C01-42 D02-9 D02-12 C01-40 C01-38 D02-14 D02-13 C01-37 C01-13 D02-37 D02-38 C01-14 C01-12 D02-40 D02-42 C01-9 C01-10 D02-44 SHIELD DOI-36 DOI-37
TB 304-1 L300(+40Y) L300(GRD) AND CARRIAGE
1 & 6 - FORWARD 2 & 10 - INTERMEDIATE 3 & 9 - SLOW 4 & 7 - DETENT 5 & 8 - EXTEND
NC C N.O. NC
OSC GRD OSC SIG GRD +20V -20V
WRITE DATA
HEAD SELECTS
2 COAX CABLES
CYLINDER XDUCER
DETENT XDUCER
SECTOR XDUCER
CB02A-T CB02B-T CB02C-T TB01-3 TB01-4
ØA ØB ØC BLOWER GRD SHIELD
TB11-1 FLI2-CAP-T FLI3-CAP-T TB01-3 TB01-3
ØA ØB ØC DRIVE MOTOR GRD SHIELD
FL 14-CAP-T TB01-2 TB01-4
ØA BRUSH MOTOR NEUTRAL SHIELD
TBIII-1 FLII2-CAP-T FLII3-CAP-T TBI-3 TBI-3
FLII4-CAP-T TBI-2 TBI-4
M01-T M01-B TBIII-1 TB01-1
M101-T M101-B TBIII-1 TB01-1
J204-182 J204-3 J204-18 J204-20 J204-12 J204-11 J204-28 J204-29 J204-13 J204-14 IJ202-R IIJ202-R (GRD) (GRD) (A3 +20V) (A4 +20V) (+20T) (-20T) (A3 -20V) (A4 -20V) (A3 -6V) (A4 -6V) (GRD TERM) (GRD TERM) A3TP200 A4TP200 A3TP203 A4TP203 A3TP204 A4TP204 A3TP202 A4TP202
(NEUT) (NEUT) (AC GRD) (AC GRD)
C02-NEG C06-NEG C08-POS C09-NEG FOI-B K101-1 S028-NO S102B-NO FL 15-ME FLII5-ME FL 16-ME FLII6-ME (DC GRD) (DC GRD) (DC GRD) (DC GRD) (DC GRD) (DC GRD) (+20Y) (A3 +40V) (A4 +40V) (A3 +40Y) (A4 +40Y)
TB11-2 TBI-1 TBI-3 TBIII-2 TBI-2 TBI-4 TBIII-2 TBI-2 TBI-4
ØA NEUTRAL SHIELD(FREE) LOGIC FANS ØA NEUTRAL SHIELD (FREE) ØA NEUTRAL SHIELD (FREE)
NOTES:
① REFERENCE DESIGNATION PREFIXES (A-) PHYSICALLY LOCATED AS FOLLOWS.
A1 POWER SUPPLY
A2 LOGIC CHASSIS
A3 UPPER DECK AND RELATED HALF OF LOGIC CHASSIS MAINTENANCE PANEL
A4 LOWER DECK AND RELATED HALF OF LOGIC CHASSIS MAINTENANCE PANEL
A5 UPPER DECK CONTROL PANEL
A6 LOWER DECK CONTROL PANEL
② REFER TO CONTROL PANEL SCHEMATIC 70808300 FOR ELECTRICAL OR MECHANICAL LOGIC PLUG CONNECTIONS.
CONTROL DATA
DEVELOPMENT DIVISION
TITLE
SIGNAL DISTRIBUTION
PRODUCT
MULT DISK DRIVE
SIZE C
DRAWING NO. 40099500
REV B
SHEET 1
PAGE

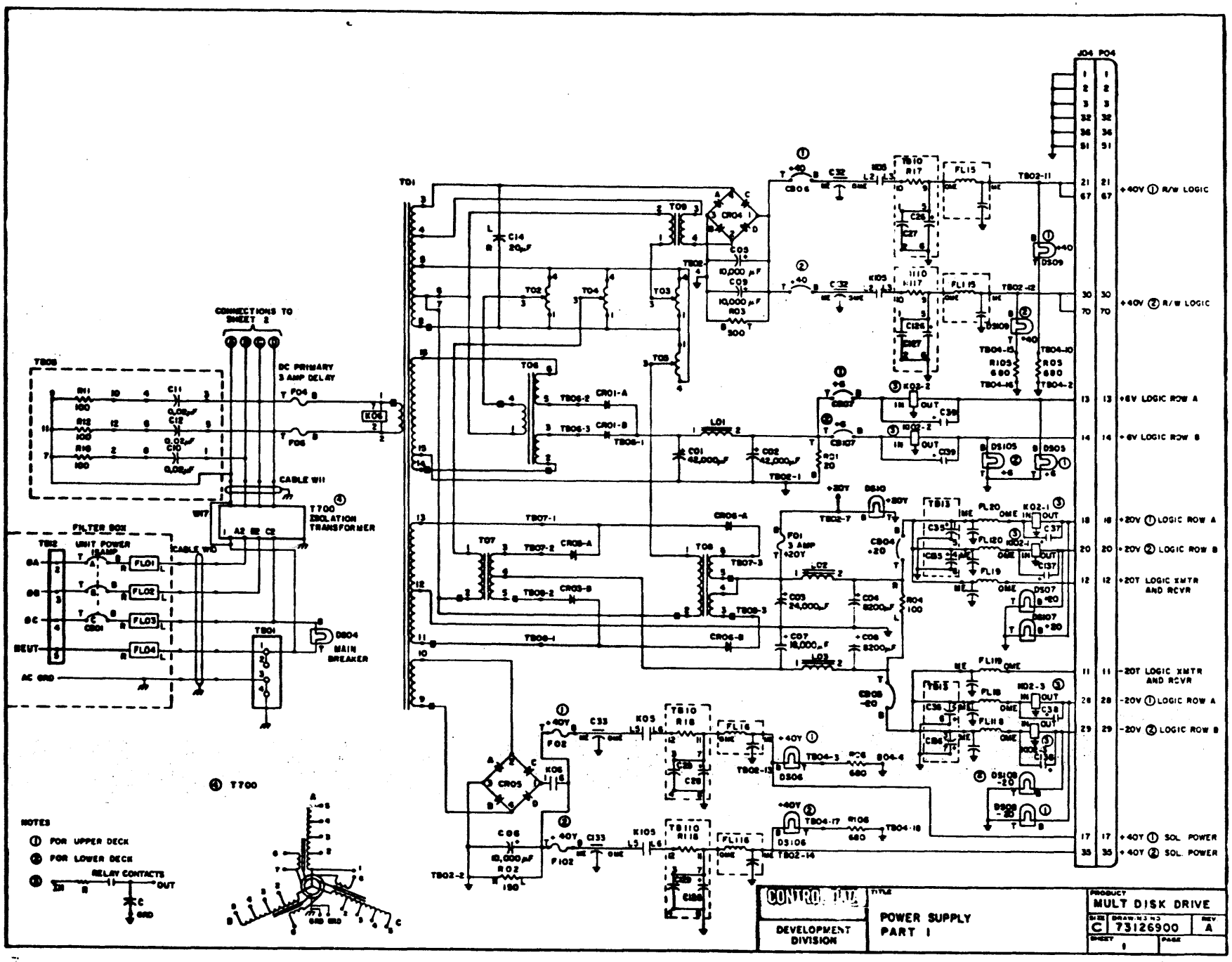

CONNECTIONS TO SHEET 2
TB03
DC PRIMARY 3 AMP DELAY
FILTER BOX
UNIT POWER 15AMP
CABLE W9
MAIN BREAKER
TO1
TB01
TB02
TB04
TB10
TB110
J04 P04
+40V ① R/W LOGIC
+40V ② R/W LOGIC
+6V LOGIC ROW A
+6V LOGIC ROW B
+20V ① LOGIC ROW A
+20V ② LOGIC ROW B
+20T LOGIC XMTR AND RCVR
-20T LOGIC XMTR AND RCVR
-20V ① LOGIC ROW A
-20V ② LOGIC ROW B
+40Y ① SOL POWER
+40Y ② SOL POWER
NOTES
① FOR UPPER DECK
② FOR LOWER DECK
CONTROL DATA
DEVELOPMENT DIVISION
TITLE
POWER SUPPLY
PRODUCT
MULT DISK DRIVE
SIZE C
DRAWING NO. 40095200
REV C
SHEET 1
PAGE


NOTES:
① REFERENCE DESIGNATION PREFIXES (A-) PHYSICALLY LOCATED AS FOLLOWS:
A1 POWER SUPPLY
A2 LOGIC CHASSIS
A3 UPPER DECK AND RELATED HALF OF LOGIC CHASSIS MAINTENANCE PANEL
A4 LOWER DECK AND RELATED HALF OF LOGIC CHASSIS MAINTENANCE PANEL
A5 UPPER DECK CONTROL PANEL
A6 LOWER DECK CONTROL PANEL
② REFER TO CONTROL PANEL SCHEMATIC 70808300 FOR ELECTRICAL OR MECHANICAL LOGIC PLUG CONNECTIONS.
CONTROL DATA
DEVELOPMENT DIVISION
SIGNAL DISTRIBUTION
MULT DISK DRIVE
C
73126400
A
SHEET 1

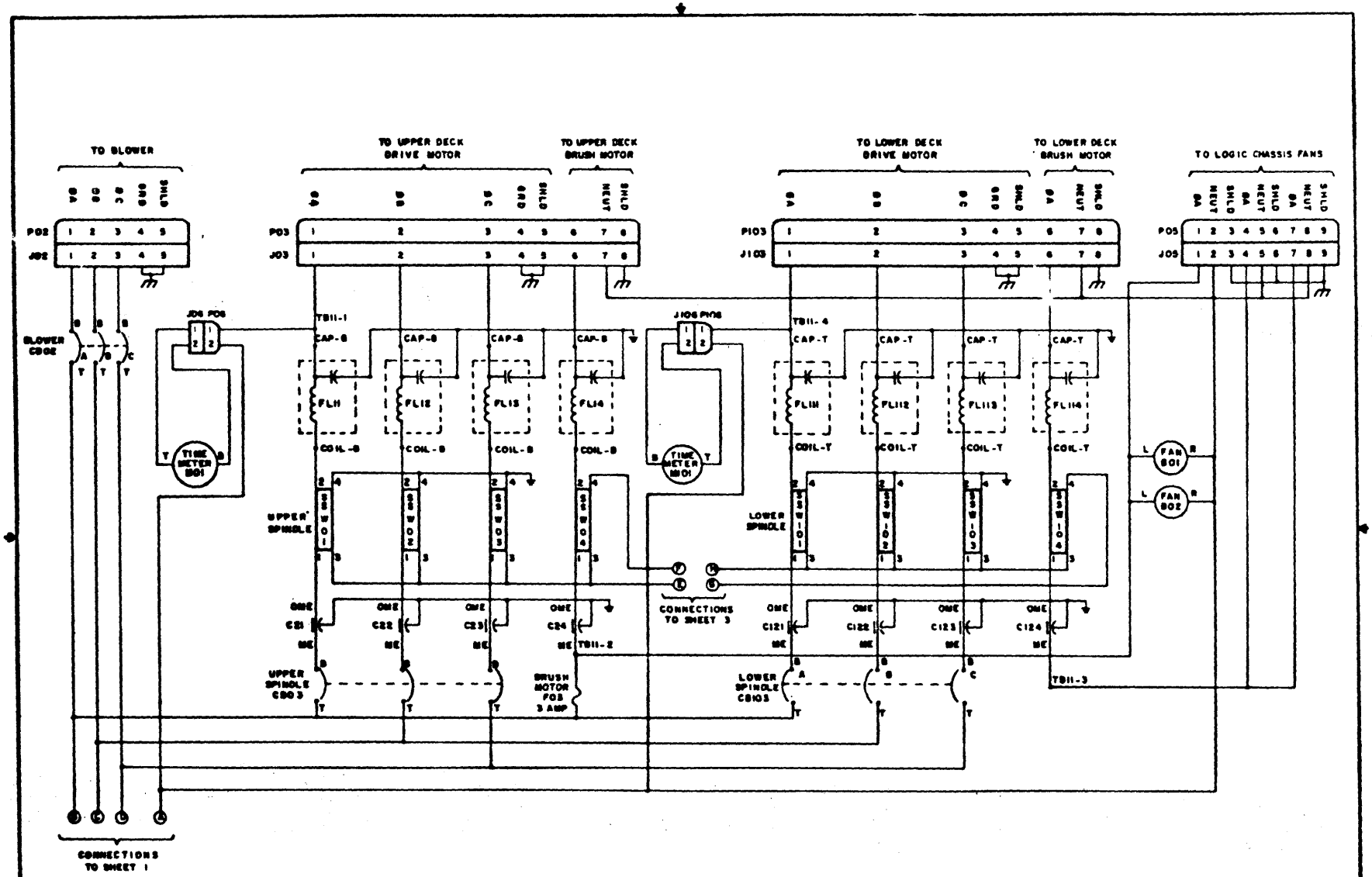

CONNECTIONS TO SHEET 2
DC PRIMARY 3 AMP DELAY
CABLE WH
T708 ISOLATION TRANSFORMER
FILTER BOX
UNIT POWER (RAMP)
MAIN BREAKER
NOTES:
① FOR UPPER DECK
② FOR LOWER DECK
③ RELAY CONTACTS
④ T708
+40V ① R/W LOGIC
+40V ② R/W LOGIC
6V LOGIC ROW A
+6V LOGIC ROW B
+20V ① LOGIC ROW A
+20V ② LOGIC ROW B
+20T LOGIC XMTR AND RCVR
-20T LOGIC XMTR AND RCVR
-20V ① LOGIC ROW A
-20V ② LOGIC ROW B
+40Y ① SOL POWER
+40Y ② SOL POWER
CONTROL DATA
DEVELOPMENT DIVISION
POWER SUPPLY PART 1
MULT DISK DRIVE
C 70719000 C


TO BLOWER
TO UPPER DECK DRIVE MOTOR
TO UPPER DECK BRUSH MOTOR
TO LOWER DECK DRIVE MOTOR
TO LOWER DECK BRUSH MOTOR
TO LOGIC CHASSIS FANS
BLOWER CB02
UPPER SPINDLE CB03
LOWER SPINDLE CB103
BRUSH MOTOR POS 3 AMP
CONNECTIONS TO SHEET 1
CONNECTIONS TO SHEET 3
TIME METER M01
FAN B01
FAN B02
CONTROL DATA
DEVELOPMENT DIVISION
POWER SUPPLY
PART 2
EQUIPMENT
MULT DISK DRIVE
SIZE C
DRAWING NO 70719000
REV D
SHEET 2
PAGE

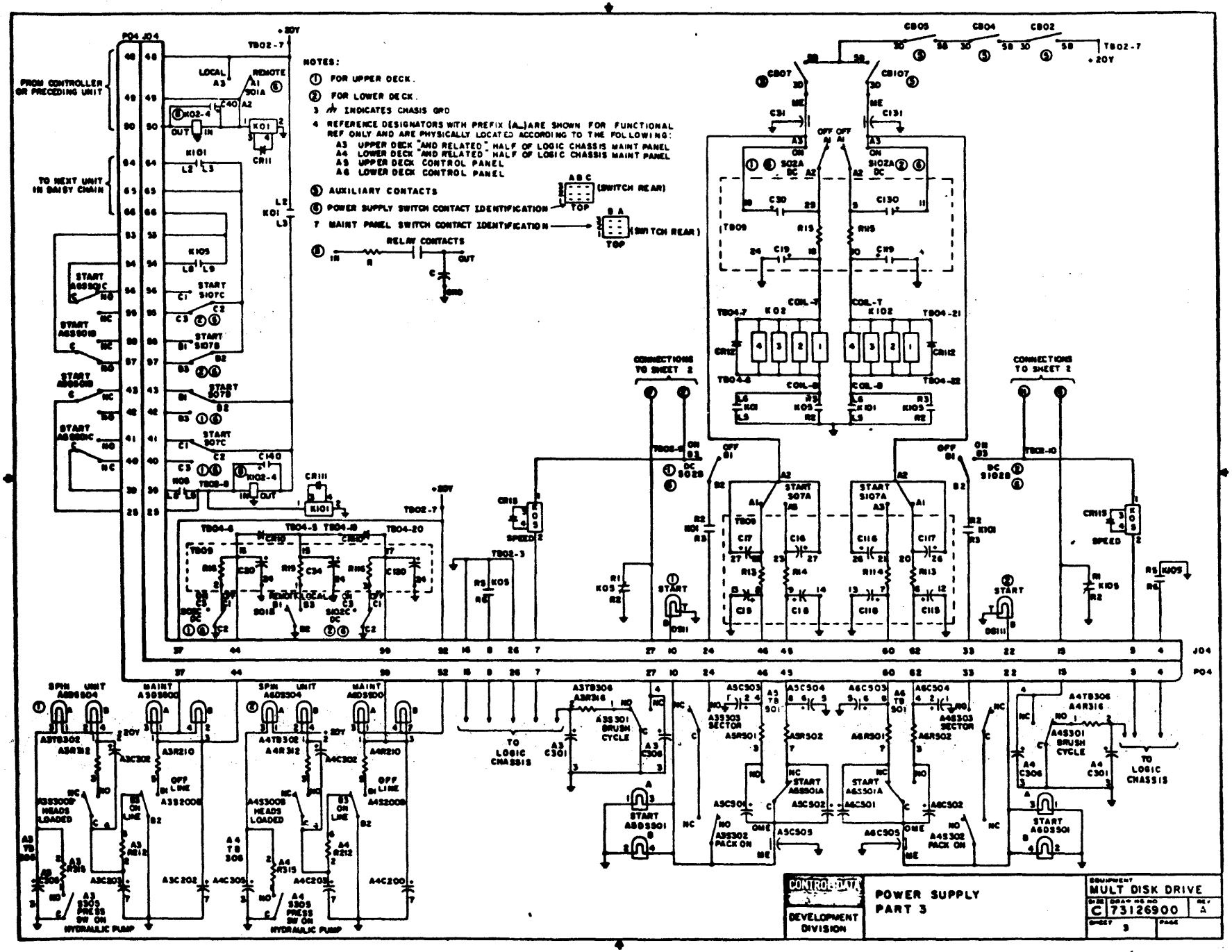

NOTES:
① FOR UPPER DECK.
② FOR LOWER DECK.
3 INDICATES CHASIS GRD.
4 REFERENCE DESIGNATORS WITH PREFIX (A_)ARE SHOWN FOR FUNCTIONAL REF ONLY AND ARE PHYSICALLY LOCATED ACCORDING TO THE FOLLOWING:
A3 UPPER DECK "AND RELATED" HALF OF LOGIC CHASSIS MAINT PANEL
A4 LOWER DECK "AND RELATED" HALF OF LOGIC CHASSIS MAINT PANEL
A5 UPPER DECK CONTROL PANEL
A6 LOWER DECK CONTROL PANEL
⑤ AUXILIARY CONTACTS
⑥ POWER SUPPLY SWITCH CONTACT IDENTIFICATION
7 MAINT PANEL SWITCH CONTACT IDENTIFICATION
⑧ RELAY CONTACTS
(SWITCH REAR)
TOP
FROM CONTROLLER OR PRECEDING UNIT
TO NEXT UNIT IN DAISY CHAIN
P04 J04
CONNECTIONS TO SHEET 2
TO LOGIC CHASSIS
SPIN UNIT A5DS304
MAINT A5DS300
SPIN UNIT A6DS304
MAINT A6DS300
A3S300B HEADS LOADED
A4S300B HEADS LOADED
A3 S305 PRESS SW ON HYDRAULIC PUMP
A4 S305 PRESS SW ON HYDRAULIC PUMP
A3S301 BRUSH CYCLE
A4S301 BRUSH CYCLE
A3S303 SECTOR
A4S303 SECTOR
A3S302 PACK ON
A4S302 PACK ON
START A5DS501
START A6DS501
CONTROL DATA
DEVELOPMENT DIVISION
POWER SUPPLY
PART 3
EQUIPMENT
MULT DISK DRIVE
SIZE C
DRAWING NO 70719000
REV D
SHEET 3
PAGE

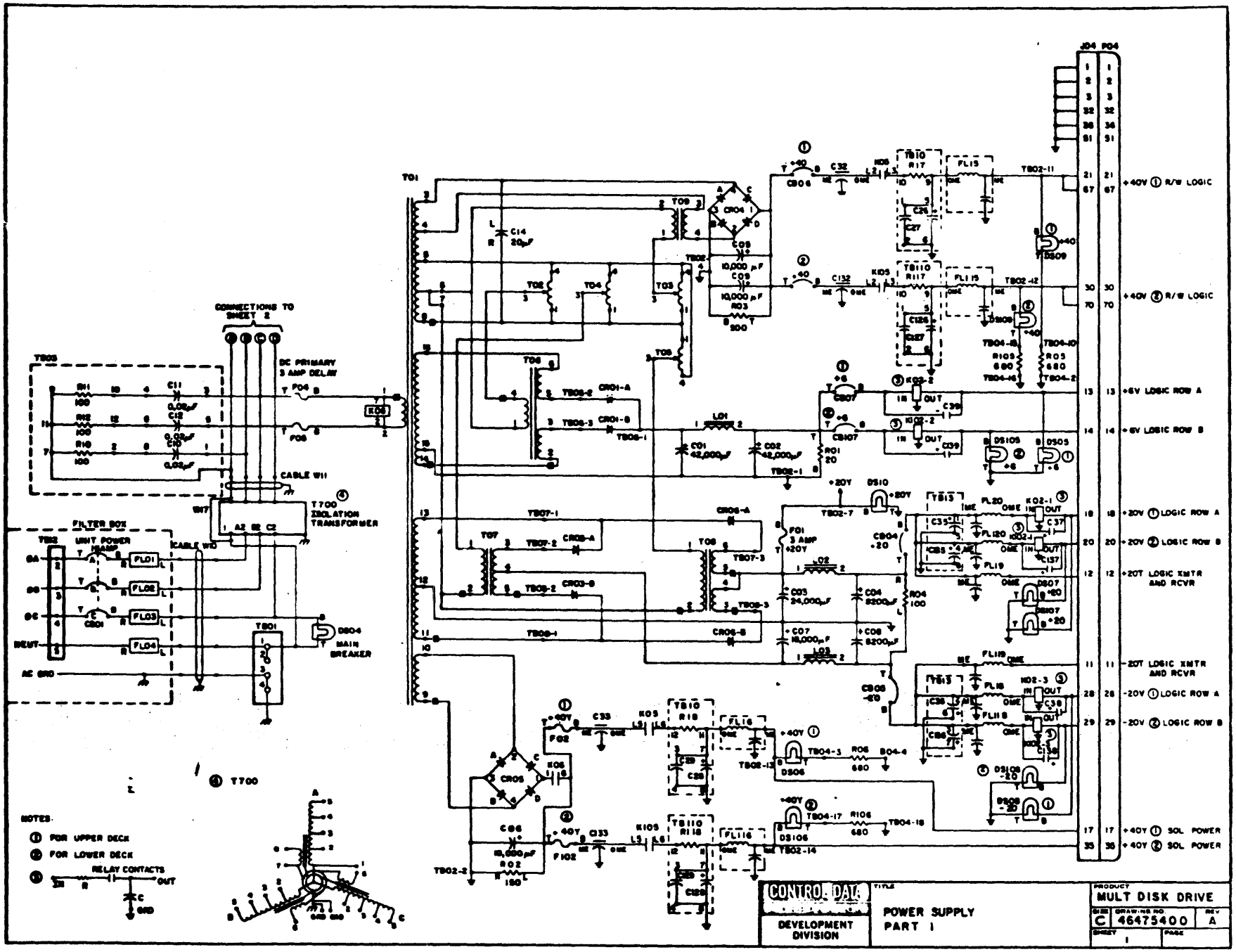

CONNECTIONS TO SHEET 2
DC PRIMARY 3 AMP DELAY
CABLE W11
T700 ISOLATION TRANSFORMER
FILTER BOX
UNIT POWER (RAMP)
CABLE W10
MAIN BREAKER
AC GND
T700
NOTES
① FOR UPPER DECK
② FOR LOWER DECK
③ RELAY CONTACTS
+40V ① R/W LOGIC
+40V ② R/W LOGIC
+6V LOGIC ROW A
+6V LOGIC ROW B
+20V ① LOGIC ROW A
+20V ② LOGIC ROW B
+20T LOGIC XMTR AND RCVR
-20T LOGIC XMTR AND RCVR
-20V ① LOGIC ROW A
-20V ② LOGIC ROW B
+40T ① SOL. POWER
+40T ② SOL. POWER
CONTROL DATA
DEVELOPMENT DIVISION
TITLE
POWER SUPPLY PART 1
PRODUCT
MULT DISK DRIVE
SIZE C
DRAWING NO 73126900
REV A
SHEET 1
PAGE

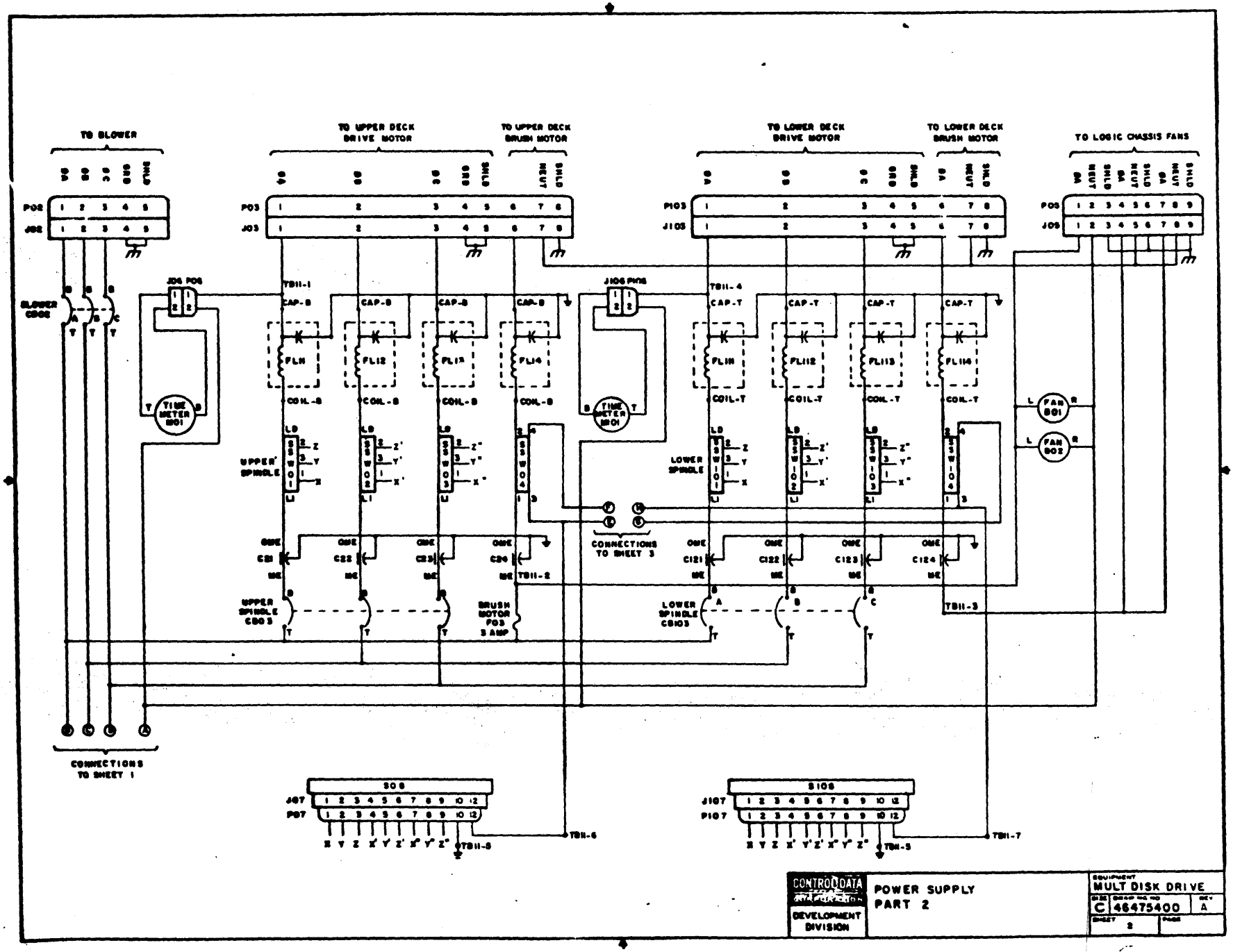
70602500 E

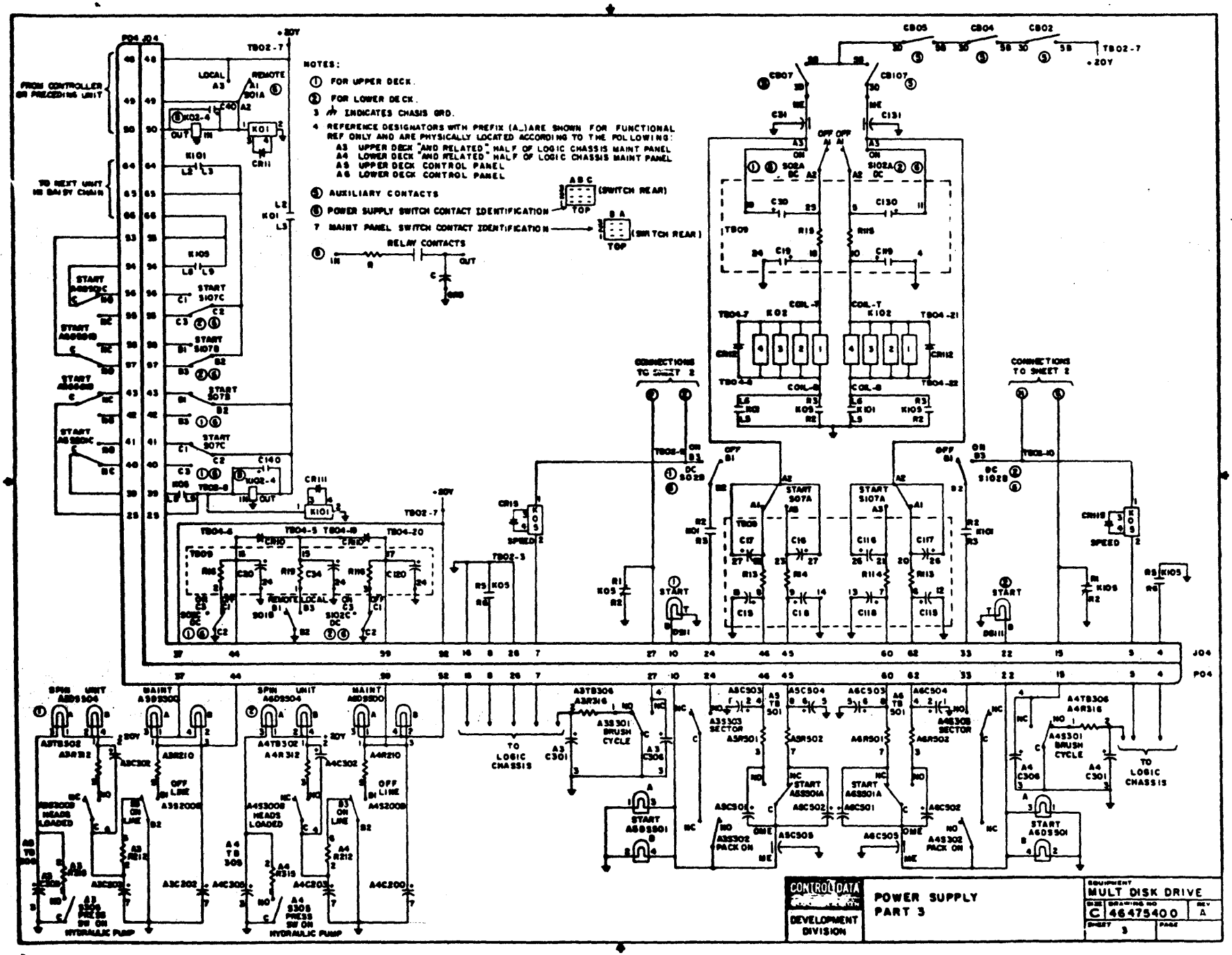


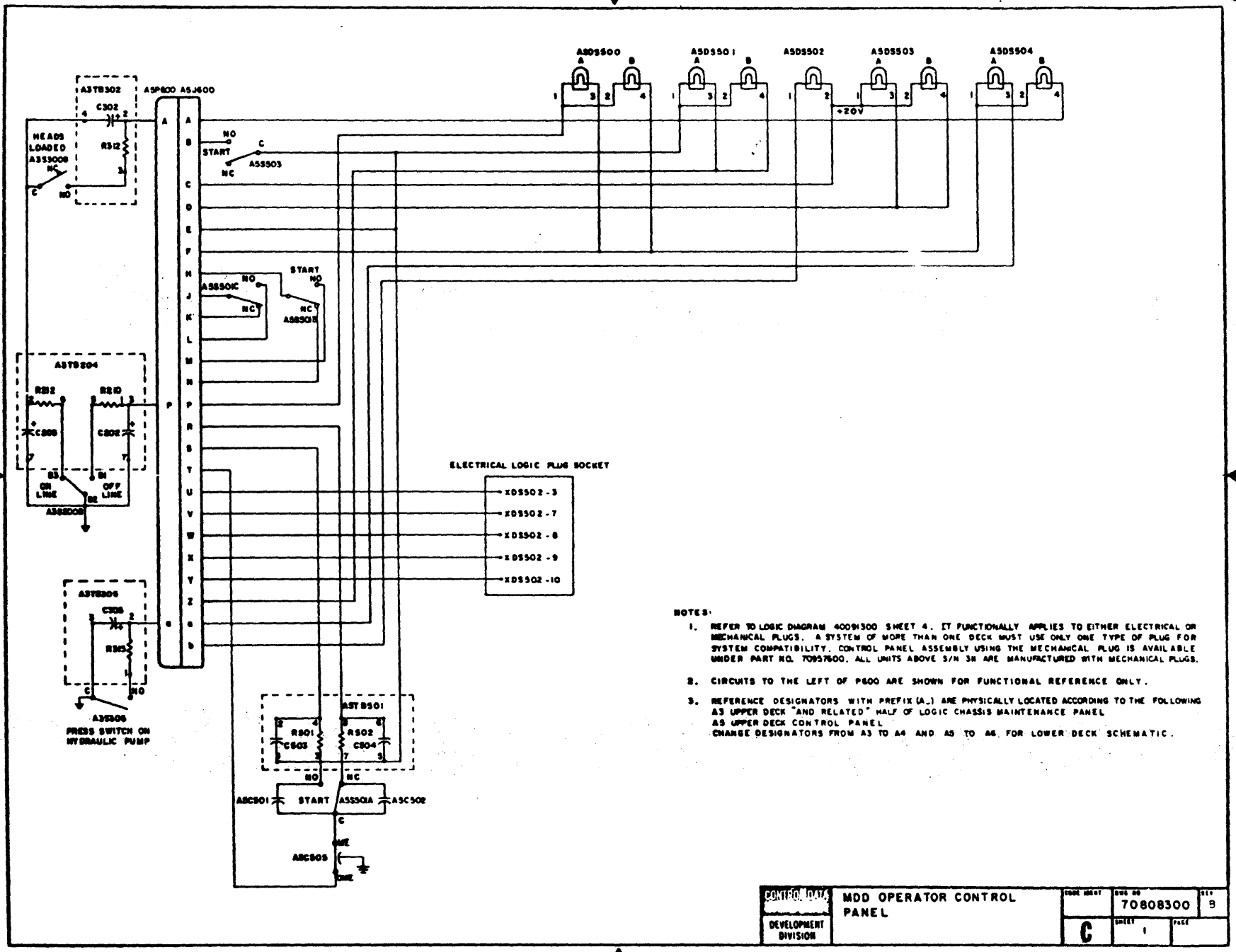
CONTROL DATA DEVELOPMENT DIVISION	POWER SUPPLY PART 2	EQUIPMENT MULT DISK DRIVE SIZE C DRAWING NO 73126900 REV A SHEET 2 OF 5


NOTES:
1 FOR UPPER DECK.
2 FOR LOWER DECK.
3 INDICATES CHASSIS GRD
4 REFERENCE DESIGNATORS WITH PREFIX (A_) ARE SHOWN FOR FUNCTIONAL REF ONLY AND ARE PHYSICALLY LOCATED ACCORDING TO THE FOLLOWING:
A3 UPPER DECK "AND RELATED" HALF OF LOGIC CHASSIS MAINT PANEL
A4 LOWER DECK "AND RELATED" HALF OF LOGIC CHASSIS MAINT PANEL
A5 UPPER DECK CONTROL PANEL
A6 LOWER DECK CONTROL PANEL
5 AUXILIARY CONTACTS
6 POWER SUPPLY SWITCH CONTACT IDENTIFICATION
7 MAINT PANEL SWITCH CONTACT IDENTIFICATION
8 RELAY CONTACTS
FROM CONTROLLER OR PRECEDING UNIT
TO NEXT UNIT IN DAISY CHAIN
LOCAL
REMOTE
START
TO LOGIC CHASSIS
HYDRAULIC PUMP
CONNECTIONS TO SHEET 2
SPEED
CONTROL DATA
DEVELOPMENT DIVISION
POWER SUPPLY
PART 3
MULT DISK DRIVE
C 73126900
A


CONTROL DATA
DEVELOPMENT DIVISION
TITLE
POWER SUPPLY
PART 1
PRODUCT
MULT DISK DRIVE
SIZE C
DRAWING NO. 46475400
REV A
SHEET 1
PAGE
J04 P04
+40V ① R/W LOGIC
+40V ② R/W LOGIC
+6V LOGIC ROW A
+6V LOGIC ROW B
+20V ① LOGIC ROW A
+20V ② LOGIC ROW B
+20T LOGIC XMTR AND RCVR
-20T LOGIC XMTR AND RCVR
-20V ① LOGIC ROW A
-20V ② LOGIC ROW B
+40V ① SOL POWER
+40V ② SOL POWER
CONNECTIONS TO SHEET 2
DC PRIMARY 3 AMP DELAY
CABLE W11
T700 ISOLATION TRANSFORMER
FILTER BOX
CABLE W10
UNIT POWER TRANSF
MAIN BREAKER
NOTES:
① FOR UPPER DECK
② FOR LOWER DECK
③ RELAY CONTACTS
④ T700


TO BLOWER
TO UPPER DECK DRIVE MOTOR
TO UPPER DECK BRUSH MOTOR
TO LOWER DECK DRIVE MOTOR
TO LOWER DECK BRUSH MOTOR
TO LOGIC CHASSIS FANS
P02
J02
P03
J03
P103
J103
P05
J05
BLOWER CB02
TIME METER B01
FAN B01
FAN B02
UPPER SPINDLE
LOWER SPINDLE
UPPER SPINDLE CB03
LOWER SPINDLE CB103
BRUSH MOTOR P03 3 AMP
CONNECTIONS TO SHEET 1
CONNECTIONS TO SHEET 3
S08
S108
P07
J07
P107
J107
TB11-1
TB11-2
TB11-3
TB11-4
TB11-5
TB11-6
TB11-7
TB11-8
CONTROL DATA
DEVELOPMENT DIVISION
POWER SUPPLY
PART 2
MULT DISK DRIVE
C
46475400
A
2

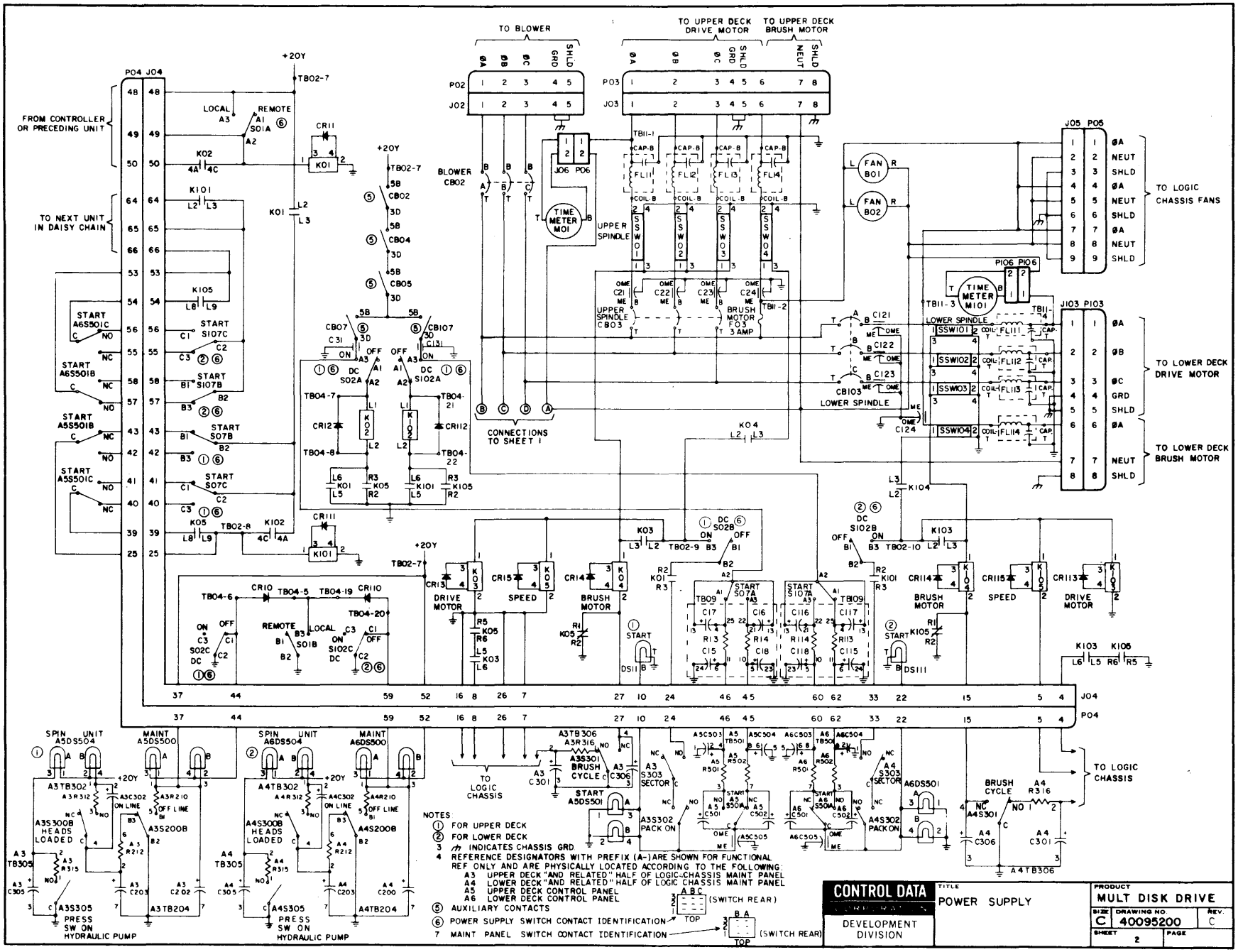

NOTES:
1 FOR UPPER DECK.
2 FOR LOWER DECK.
3 INDICATES CHASSIS GRD.
4 REFERENCE DESIGNATORS WITH PREFIX (A_) ARE SHOWN FOR FUNCTIONAL REF ONLY AND ARE PHYSICALLY LOCATED ACCORDING TO THE FOLLOWING:
A3 UPPER DECK "AND RELATED" HALF OF LOGIC CHASSIS MAINT PANEL
A4 LOWER DECK "AND RELATED" HALF OF LOGIC CHASSIS MAINT PANEL
A5 UPPER DECK CONTROL PANEL
A6 LOWER DECK CONTROL PANEL
5 AUXILIARY CONTACTS
6 POWER SUPPLY SWITCH CONTACT IDENTIFICATION
7 MAINT PANEL SWITCH CONTACT IDENTIFICATION
8 RELAY CONTACTS
FROM CONTROLLER OR PRECEDING UNIT
TO NEXT UNIT IN DAISY CHAIN
+20V
TB02-7
LOCAL
REMOTE
CONNECTIONS TO SHEET 2
TO LOGIC CHASSIS
HYDRAULIC PUMP
CONTROL DATA
DEVELOPMENT DIVISION
POWER SUPPLY
PART 3
EQUIPMENT
MULT DISK DRIVE
SIZE C
DRAWING NO 46475400
REV A
SHEET 3



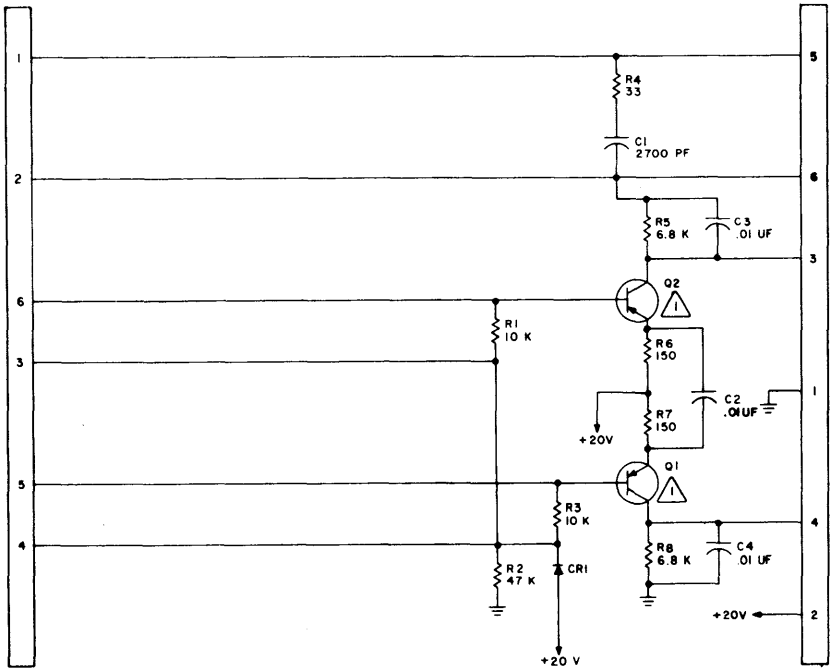
NOTES:

1. REFER TO LOGIC DIAGRAM 40091300 SHEET 4. IT FUNCTIONALLY APPLIES TO EITHER ELECTRICAL OR MECHANICAL PLUGS. A SYSTEM OF MORE THAN ONE DECK MUST USE ONLY ONE TYPE OF PLUG FOR SYSTEM COMPATIBILITY. CONTROL PANEL ASSEMBLY USING THE MECHANICAL PLUG IS AVAILABLE UNDER PART NO. 70957600. ALL UNITS ABOVE S/N 38 ARE MANUFACTURED WITH MECHANICAL PLUGS.
2. CIRCUITS TO THE LEFT OF P600 ARE SHOWN FOR FUNCTIONAL REFERENCE ONLY.
3. REFERENCE DESIGNATORS WITH PREFIX (A_) ARE PHYSICALLY LOCATED ACCORDING TO THE FOLLOWING
   A3 UPPER DECK "AND RELATED" HALF OF LOGIC CHASSIS MAINTENANCE PANEL
   A5 UPPER DECK CONTROL PANEL
   CHANGE DESIGNATORS FROM A3 TO A4 AND A5 TO A6 FOR LOWER DECK SCHEMATIC.

CONTROL DATA DEVELOPMENT DIVISION	MDD OPERATOR CONTROL PANEL	CODE IDENT C	DWG NO 70808300	REV B
			SHEET 1	PAGE


TO BLOWER
TO UPPER DECK DRIVE MOTOR
TO UPPER DECK BRUSH MOTOR
FROM CONTROLLER OR PRECEDING UNIT
TO NEXT UNIT IN DAISY CHAIN
TO LOGIC CHASSIS FANS
TO LOWER DECK DRIVE MOTOR
TO LOWER DECK BRUSH MOTOR
TO LOGIC CHASSIS
CONNECTIONS TO SHEET 1
NOTES
1 FOR UPPER DECK
2 FOR LOWER DECK
3 INDICATES CHASSIS GRD
4 REFERENCE DESIGNATORS WITH PREFIX (A-) ARE SHOWN FOR FUNCTIONAL REF ONLY AND ARE PHYSICALLY LOCATED ACCORDING TO THE FOLLOWING:
A3 UPPER DECK "AND RELATED" HALF OF LOGIC-CHASSIS MAINT PANEL
A4 LOWER DECK "AND RELATED" HALF OF LOGIC CHASSIS MAINT PANEL
A5 UPPER DECK CONTROL PANEL
A6 LOWER DECK CONTROL PANEL
5 AUXILIARY CONTACTS
6 POWER SUPPLY SWITCH CONTACT IDENTIFICATION
7 MAINT PANEL SWITCH CONTACT IDENTIFICATION
CONTROL DATA
DEVELOPMENT DIVISION
TITLE
POWER SUPPLY
PRODUCT
MULT DISK DRIVE
SIZE C
DRAWING NO. 40095200
REV. C
SHEET 2
PAGE

REVISIONS					
SYM	E.C.O	ZONE	DESCRIPTION	DATE	APPROVAL
A			RELEASED		



TRANSDUCER CONNECTOR

PRINTED CIRCUIT CONTACTS

NOTES:

1. TRANSISTOR, MATCHED PAIR, 2N3638, 50210602.
2. DIODE SILICON, 92115023.
3. COMPONENT ASSY 40021200.
4. FOR TRANSDUCER PIN CONNECTIONS SEE 40058600.

40021300 A

LIST OF MATERIAL			APPLICATION	QTY. REQD.
UNLESS OTHERWISE SPECIFIED				
COMPONENTS	Tolerance	Value	Size	
RESISTORS	±5%	OHMS	1/4 W	
CAPACITORS	±10%			
DIODES				

	BY	DATE
DRAWN	Ja. Jamoral	2-29-68
CHECKED	[illegible]	3-22-68
ENGR	[illegible]	12-5-68
PROD ENGR	[illegible]	12-16-68
QC	[illegible]	[illegible]
PROJECT		

TITLE: SCHEMATIC DIAGRAM PREAMP SECTOR DETECTION

CONTROL DATA CORPORATION
PERIPHERAL EQUIPMENT DIVISION
7801 COMPUTER AVENUE
MINNEAPOLIS 24 MINNESOTA

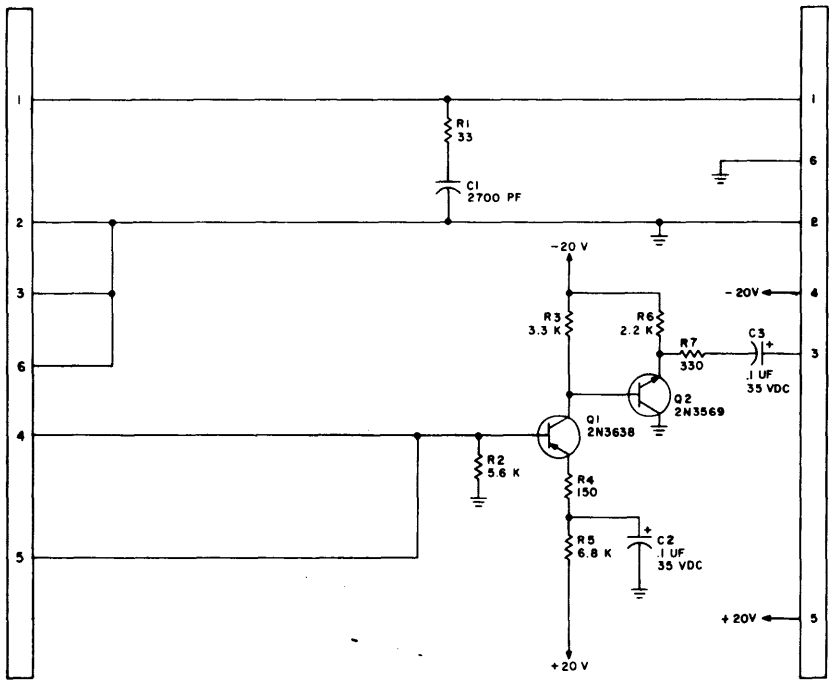
REFERENCE DRAWINGS	
PRINTED CIRCUIT	40021101
COMPONENT LAYOUT	40021200

DWG SIZE: C

DWG. NO. 40021300

SHEET 1 OF 1

REVISIONS					
SYM	E.C.O	ZONE	DESCRIPTION	DATE	APPROVAL
A			RELEASED	12-5-68	MM



NOTES:

1. ALL TRANSISTORS ARE SILICON
2. COMPONENT ASSY 40021500.
3. FOR TRANSDUCER PIN CONNECTIONS SEE 40058700.

40021600
A

LIST OF MATERIAL			APPLICATION	QTY. REQD.
UNLESS OTHERWISE SPECIFIED				
COMPONENTS	Tolerance	Value	Size	
RESISTORS	±5%	OHMS	1/4 W	
CAPACITORS	±10%			
DIODES				

	BY	DATE
DRAWN	Jo. JAMORAL	2-29-68
CHECKED	[illegible]	3-27-68
ENGR	[illegible]	10-24-68
PROD ENGR	[illegible]	12-4-68
QC	[illegible]	12-4-68
PROJECT		

TITLE: SCHEMATIC DIAGRAM PREAMP CYLINDER DETECTOR

CONTROL DATA CORPORATION
PERIPHERAL EQUIPMENT DIVISION
7801 COMPUTER AVENUE
MINNEAPOLIS 24 MINNESOTA

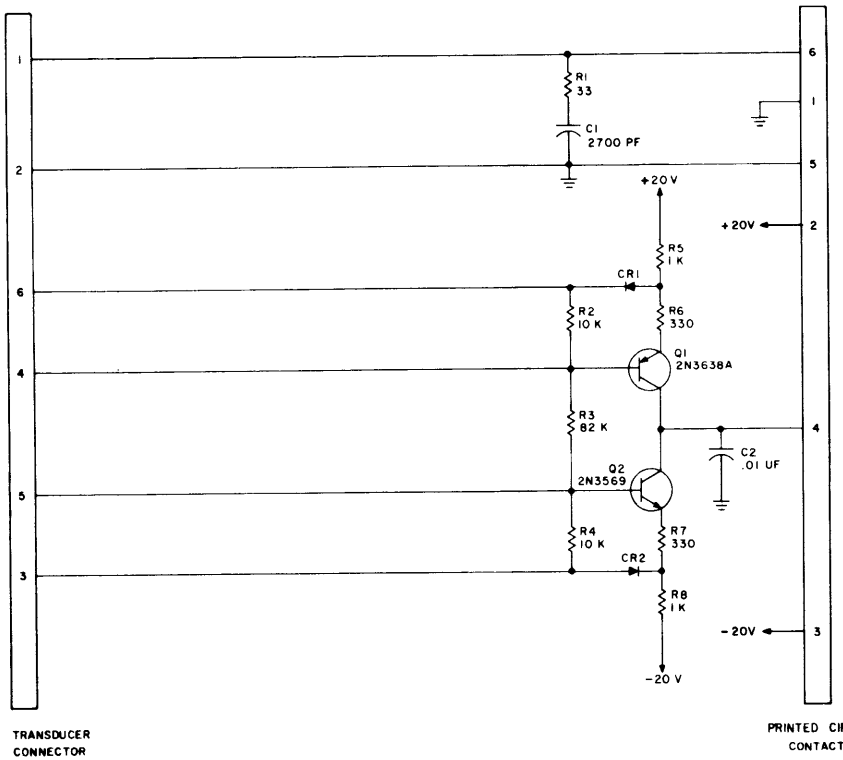
REFERENCE DRAWINGS	
PRINTED CIRCUIT	40021400
COMPONENT LAYOUT	40021500

DWG SIZE: C

DWG. NO. 40021600

SHEET 1 OF 1

REVISIONS					
SYM	ECO	ZONE	DESCRIPTION	DATE	APPROVAL
A			RELEASED		



NOTES:

1. ALL TRANSISTORS ARE SILICON.
2. ALL DIODES ARE SILICON 92115023.
3. COMPONENT ASSY 40021800.
4. FOR TRANSDUCER PIN CONNECTIONS SEE 40058701.

40021900 A

LIST OF MATERIAL

UNLESS OTHERWISE SPECIFIED			
COMPONENTS	Tolerance	Value	Size
RESISTORS	±5%	OHMS	1/4 W
CAPACITORS	±10%		
DIODES			

	BY	DATE
DRAWN	Jg. JAMORAL	2-29-68
CHECKED		
ENGR		
PROD ENGR		
QC		
PROJECT		

APPLICATION | QTY. REQD.

TITLE: SCHEMATIC DIAGRAM PREAMP DETENT SENSING

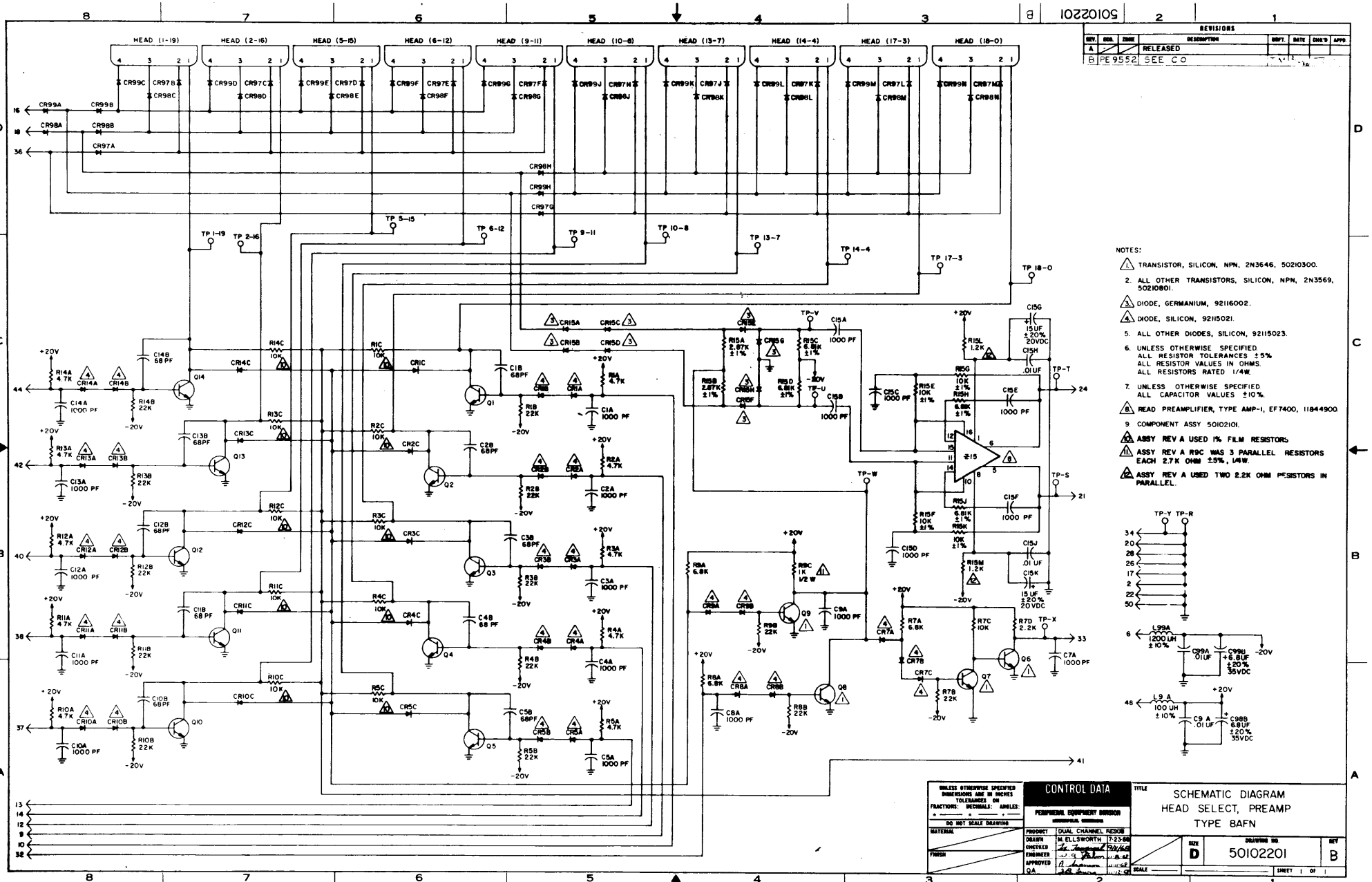
CONTROL DATA CORPORATION
PERIPHERAL EQUIPMENT DIVISION
7801 COMPUTER AVENUE
MINNEAPOLIS 24 MINNESOTA

REFERENCE DRAWINGS	
PRINTED CIRCUIT	40021700
COMPONENT LAYOUT	40021800

DWG SIZE: C

DWG NO 40021900

SHEET 1 OF 1



NOTES:

1. TRANSISTOR, SILICON, NPN, 2N3646, 50210300.
2. ALL OTHER TRANSISTORS, SILICON, NPN, 2N3569, 50210801.
3. DIODE, GERMANIUM, 92116002.
4. DIODE, SILICON, 92115021.
5. ALL OTHER DIODES, SILICON, 92115023.
6. UNLESS OTHERWISE SPECIFIED
   ALL RESISTOR TOLERANCES ±5%
   ALL RESISTOR VALUES IN OHMS.
   ALL RESISTORS RATED 1/4W.
7. UNLESS OTHERWISE SPECIFIED
   ALL CAPACITOR VALUES ±10%.
8. READ PREAMPLIFIER, TYPE AMP-1, EF7400, 11844900.
9. COMPONENT ASSY 50102101.
10. ASSY REV A USED 1% FILM RESISTORS
11. ASSY REV A R9C WAS 3 PARALLEL RESISTORS EACH 2.7K OHM ±5%, 1/4W.
12. ASSY REV A USED TWO 2.2K OHM RESISTORS IN PARALLEL.

REVISIONS							
REV.	ECO.	ZONE	DESCRIPTION	DRFT.	DATE	CHK'D	APPR.
A			RELEASED				
B	PE 9552		SEE CO				

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS: DECIMALS: ANGLES:
DO NOT SCALE DRAWING
MATERIAL
FINISH

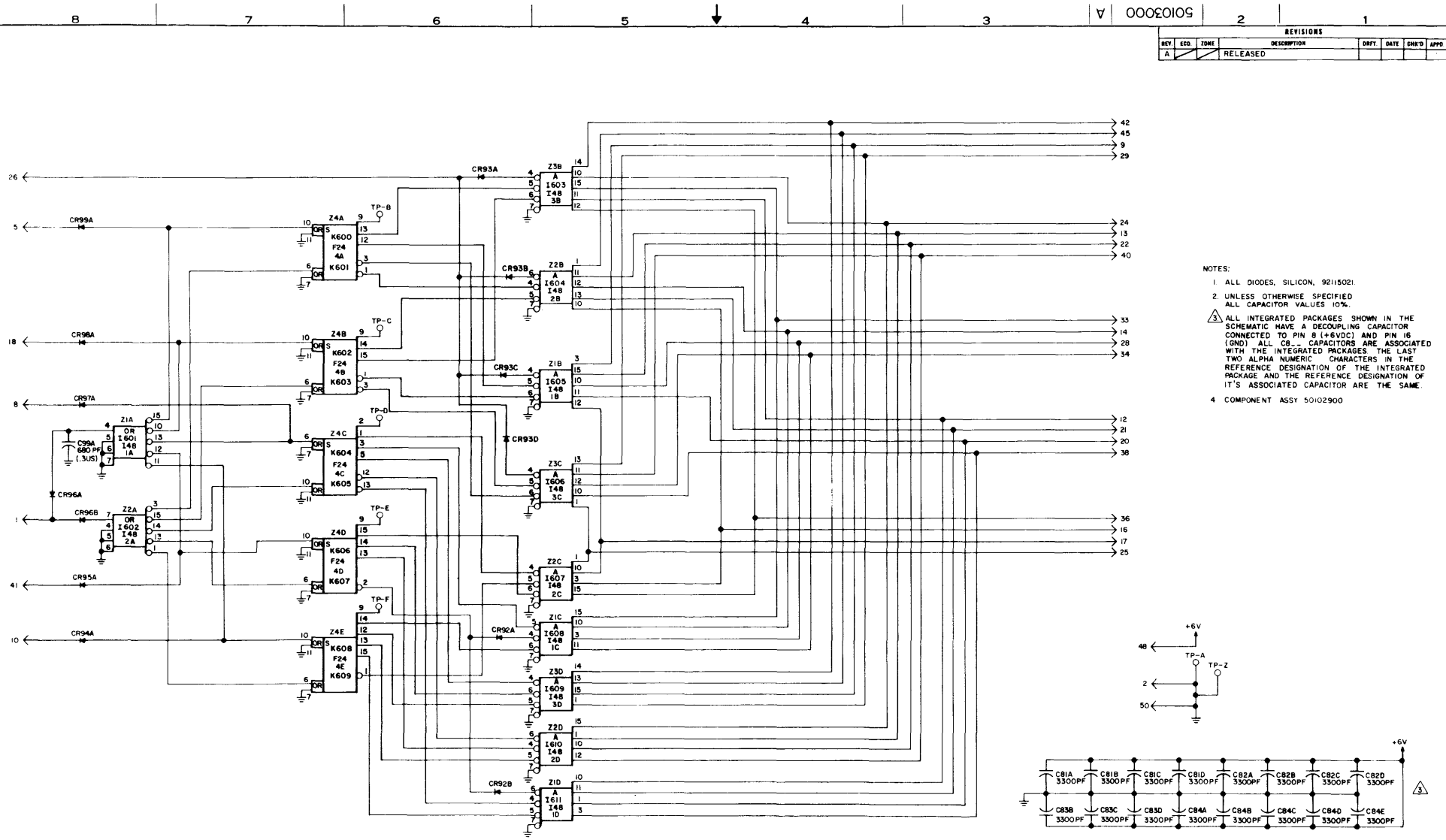
CONTROL DATA
PERIPHERAL EQUIPMENT DIVISION

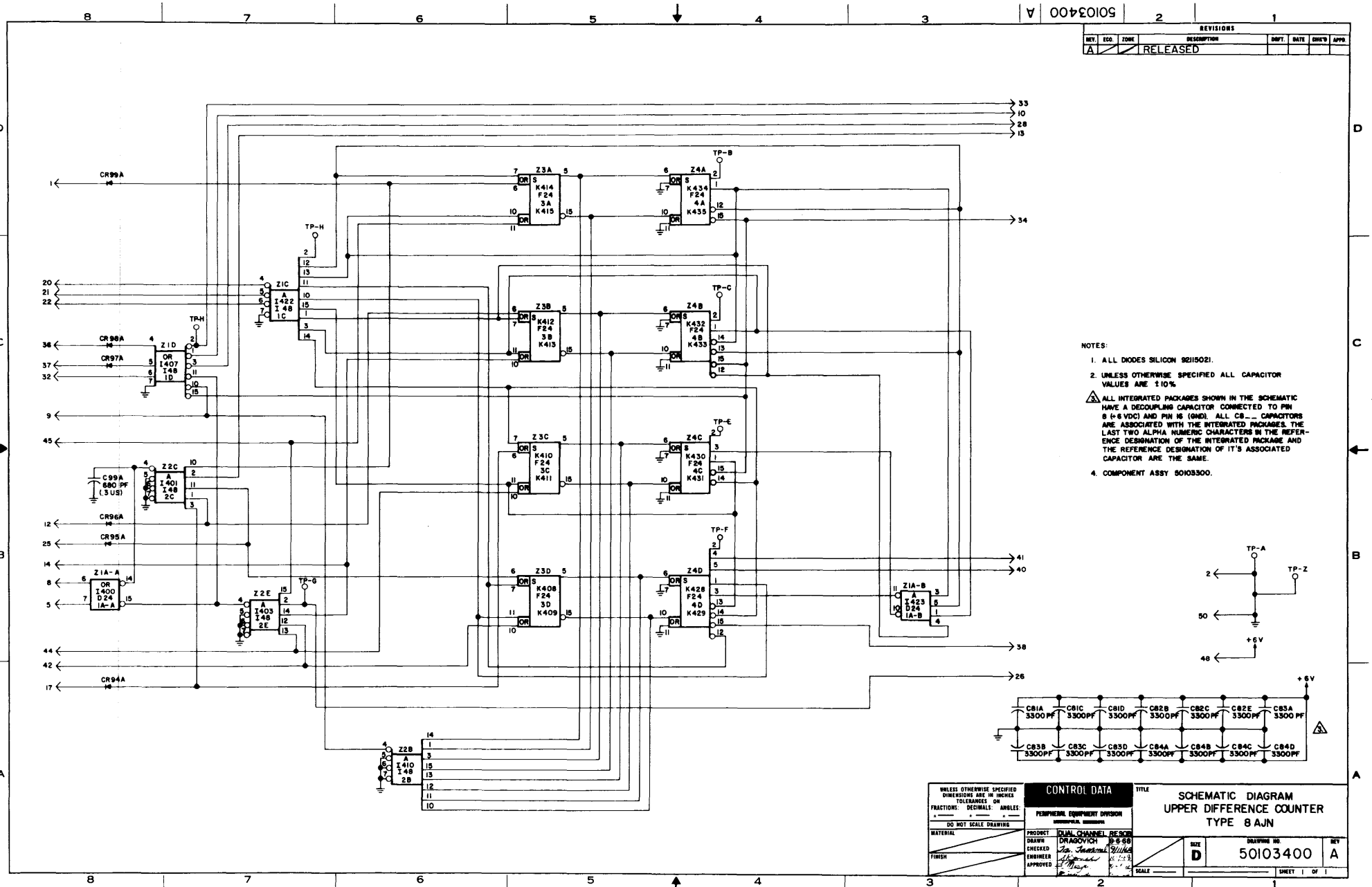
PRODUCT	DUAL CHANNEL RESCR
DRAWN	M. ELLSWORTH 7-23-68
CHECKED	
ENGINEER	
APPROVED	
QA	

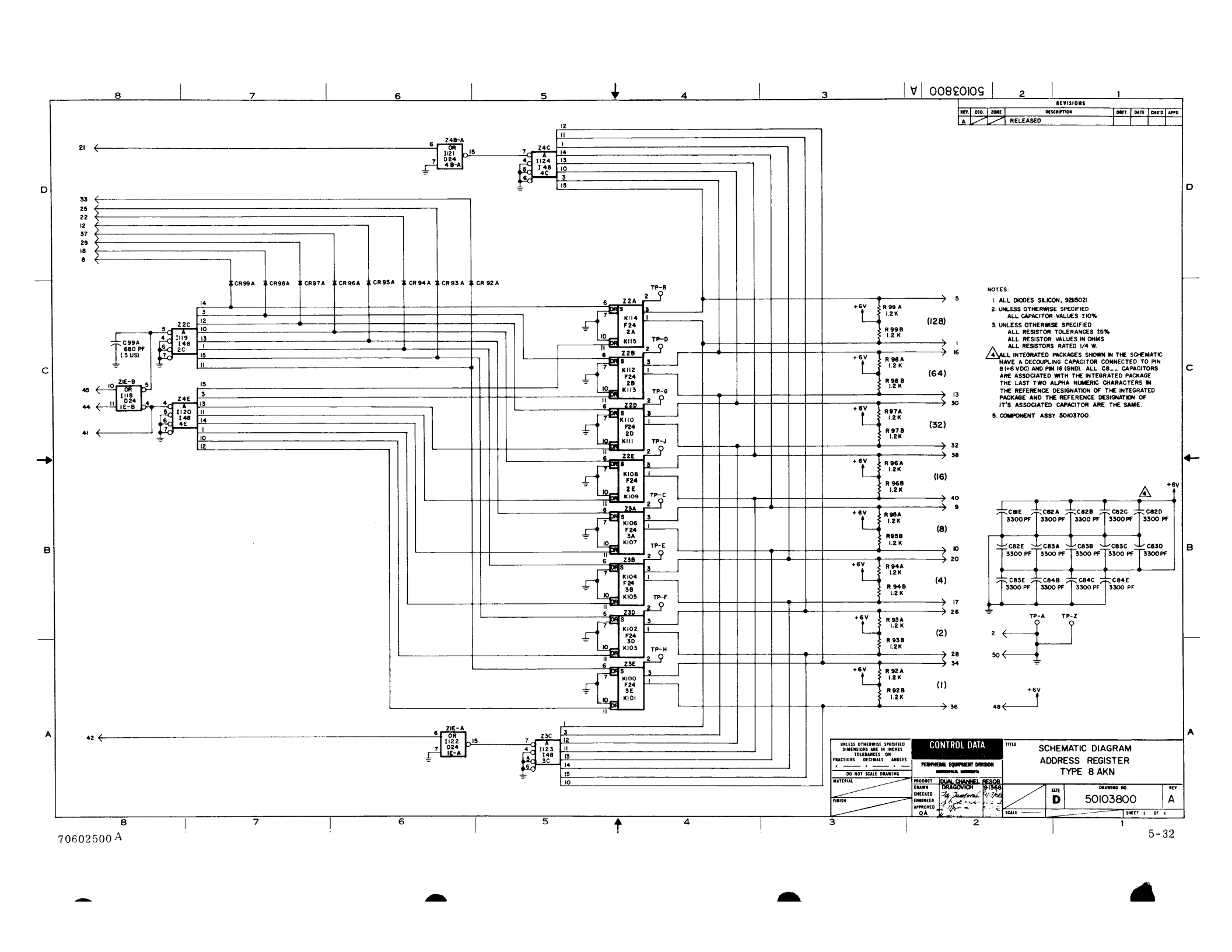
TITLE
SCHEMATIC DIAGRAM
HEAD SELECT, PREAMP
TYPE 8AFN

SIZE D | DRAWING NO. 50102201 | REV B
SCALE | SHEET 1 OF 1

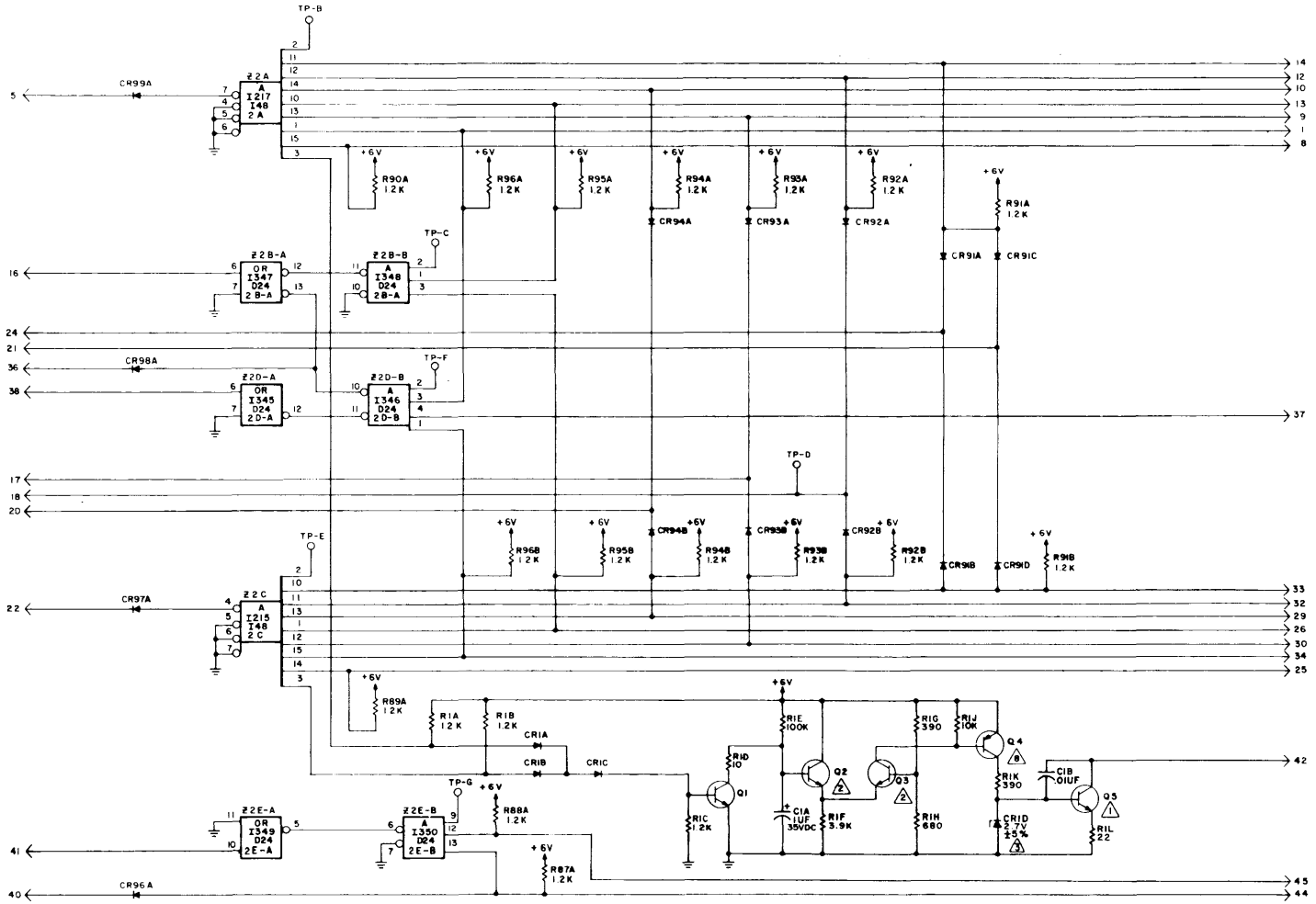
70602500 A


REVISIONS
REV. ECO. ZONE DESCRIPTION DRFT. DATE CHK'D APPD
A RELEASED
50103000 A
NOTES:
1. ALL DIODES, SILICON, 92115021.
2. UNLESS OTHERWISE SPECIFIED ALL CAPACITOR VALUES 10%.
3 ALL INTEGRATED PACKAGES SHOWN IN THE SCHEMATIC HAVE A DECOUPLING CAPACITOR CONNECTED TO PIN 8 (+6VDC) AND PIN 16 (GND) ALL C8_ _ CAPACITORS ARE ASSOCIATED WITH THE INTEGRATED PACKAGES THE LAST TWO ALPHA NUMERIC CHARACTERS IN THE REFERENCE DESIGNATION OF THE INTEGRATED PACKAGE AND THE REFERENCE DESIGNATION OF IT'S ASSOCIATED CAPACITOR ARE THE SAME.
4 COMPONENT ASSY 50102900
CONTROL DATA
PERIPHERAL EQUIPMENT DIVISION
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES
DO NOT SCALE DRAWING
MATERIAL
FINISH
PRODUCT DUAL CHANNEL RS08
DRAWN M.ELLSWORTH 9 4 68
CHECKED
ENGINEER
APPROVED
QA
TITLE
SCHEMATIC DIAGRAM
HEAD SELECTION
TYPE 8AHN
SIZE D
DRAWING NO. 50103000
REV A
SCALE
SHEET 1 OF 1
70602500 A
5-30


REVISIONS
REV. ECO. ZONE DESCRIPTION DEPT. DATE CHK'D APPD.
A RELEASED
NOTES:
1. ALL DIODES SILICON 92115021.
2. UNLESS OTHERWISE SPECIFIED ALL CAPACITOR VALUES ARE ±10%
3. ALL INTEGRATED PACKAGES SHOWN IN THE SCHEMATIC HAVE A DECOUPLING CAPACITOR CONNECTED TO PIN 8 (+6 VDC) AND PIN 16 (GND). ALL C8_ _ CAPACITORS ARE ASSOCIATED WITH THE INTEGRATED PACKAGES. THE LAST TWO ALPHA NUMERIC CHARACTERS IN THE REFERENCE DESIGNATION OF THE INTEGRATED PACKAGE AND THE REFERENCE DESIGNATION OF IT'S ASSOCIATED CAPACITOR ARE THE SAME.
4. COMPONENT ASSY 50103300.
CONTROL DATA
PERIPHERAL EQUIPMENT DIVISION
SCHEMATIC DIAGRAM
UPPER DIFFERENCE COUNTER
TYPE 8 AJN
DRAWING NO. 50103400
REV A
SIZE D
SHEET 1 OF 1
50103400 A


REVISIONS
REV. ECO. ZONE DESCRIPTION DRFT. DATE CHK'D APPD.
A RELEASED
50103800 A
NOTES:
1. ALL DIODES SILICON, 9215021.
2. UNLESS OTHERWISE SPECIFIED ALL CAPACITOR VALUES ±10%
3. UNLESS OTHERWISE SPECIFIED ALL RESISTOR TOLERANCES ±5% ALL RESISTOR VALUES IN OHMS ALL RESISTORS RATED 1/4 W.
4. ALL INTEGRATED PACKAGES SHOWN IN THE SCHEMATIC HAVE A DECOUPLING CAPACITOR CONNECTED TO PIN 8 (+6 VDC) AND PIN 16 (GND). ALL C8__ CAPACITORS ARE ASSOCIATED WITH THE INTEGRATED PACKAGE THE LAST TWO ALPHA NUMERIC CHARACTERS IN THE REFERENCE DESIGNATION OF THE INTEGRATED PACKAGE AND THE REFERENCE DESIGNATION OF IT'S ASSOCIATED CAPACITOR ARE THE SAME.
5. COMPONENT ASSY 50103700.
CR99A CR98A CR97A CR96A CR95A CR94A CR93A CR92A
Z4B-A OR I121 D24 4B-A
Z4C I124 148 4C
Z1E-B OR I118 D24 1E-B
Z1E-A OR I122 D24 1E-A
Z2C I119 148 2C
Z4E I120 148 4E
Z3C I123 148 3C
C99A 680 PF (3 US)
Z2A K114 F24 2A K115
Z2B K112 F24 2B K113
Z2D K110 F24 2D K111
Z2E K108 F24 2E K109
Z3A K106 F24 3A K107
Z3B K104 F24 3B K105
Z3D K102 F24 3D K103
Z3E K100 F24 3E K101
TP-B TP-D TP-G TP-J TP-C TP-E TP-F TP-H
+6V
R 99A 1.2K R 99B 1.2K (128)
R 98A 1.2K R 98B 1.2K (64)
R 97A 1.2K R 97B 1.2K (32)
R 96A 1.2K R 96B 1.2K (16)
R 95A 1.2K R 95B 1.2K (8)
R 94A 1.2K R 94B 1.2K (4)
R 93A 1.2K R 93B 1.2K (2)
R 92A 1.2K R 92B 1.2K (1)
C81E C82A C82B C82C C82D 3300 PF
C82E C83A C83B C83C C83D 3300 PF
C83E C84B C84C C84E 3300 PF
TP-A TP-Z
CONTROL DATA
PERIPHERAL EQUIPMENT DIVISION
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES DO NOT SCALE DRAWING
MATERIAL FINISH
PRODUCT DUAL CHANNEL RESOB
DRAWN DRAGOVICH 9-1368
CHECKED ENGINEER APPROVED QA
TITLE SCHEMATIC DIAGRAM ADDRESS REGISTER TYPE 8 AKN
SIZE D DRAWING NO. 50103800 REV A
SCALE SHEET 1 OF 1

REVISIONS							
REV.	ECO.	ZONE	DESCRIPTION	DRFT.	DATE	CHK'D	APPD
A			RELEASED				



NOTES

1. TRANSISTOR, SILICON, NPN, 2N3569, 50210801
2. TRANSISTOR, SILICON, NPN, 2N3565, 50210700.
3. DIODE, SILICON, ZENER, 50240146.
4. ALL OTHER DIODES, SILICON, 92115021.
5. UNLESS OTHERWISE SPECIFIED ALL CAPACITOR VALUES ±10%
6. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTOR TOLERANCE ±5%
   ALL RESISTOR VALUES IN OHMS,
   ALL RESISTORS RATED 1/4 W.
7. ALL INTEGRATED PACKAGES SHOWN IN THE SCHEMATIC HAVE A DECOUPLING CAPACITOR CONNECTED TO PIN 8(+6VDC) AND PIN 16(GND). ALL C82__ CAPACITORS ARE ASSOCIATED WITH INTEGRATED PACKAGES THE LAST TWO ALPHA NUMERIC CHARACTERS IN THE REFERENCE DESIGNATION OF THE INTEGRATED PACKAGE AND THE REFERENCE DESIGNATION OF IT'S ASSOCIATED CAPACITOR ARE THE SAME.
8. TRANSISTOR, SILICON, PNP, 2N3640, 50210400.
9. ALL OTHER TRANSISTORS, SILICON, NPN, 2N3646, 50210300.
10. COMPONENT ASSY 50104902.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON FRACTIONS: DECIMALS: ANGLES:
DO NOT SCALE DRAWING
MATERIAL
FINISH

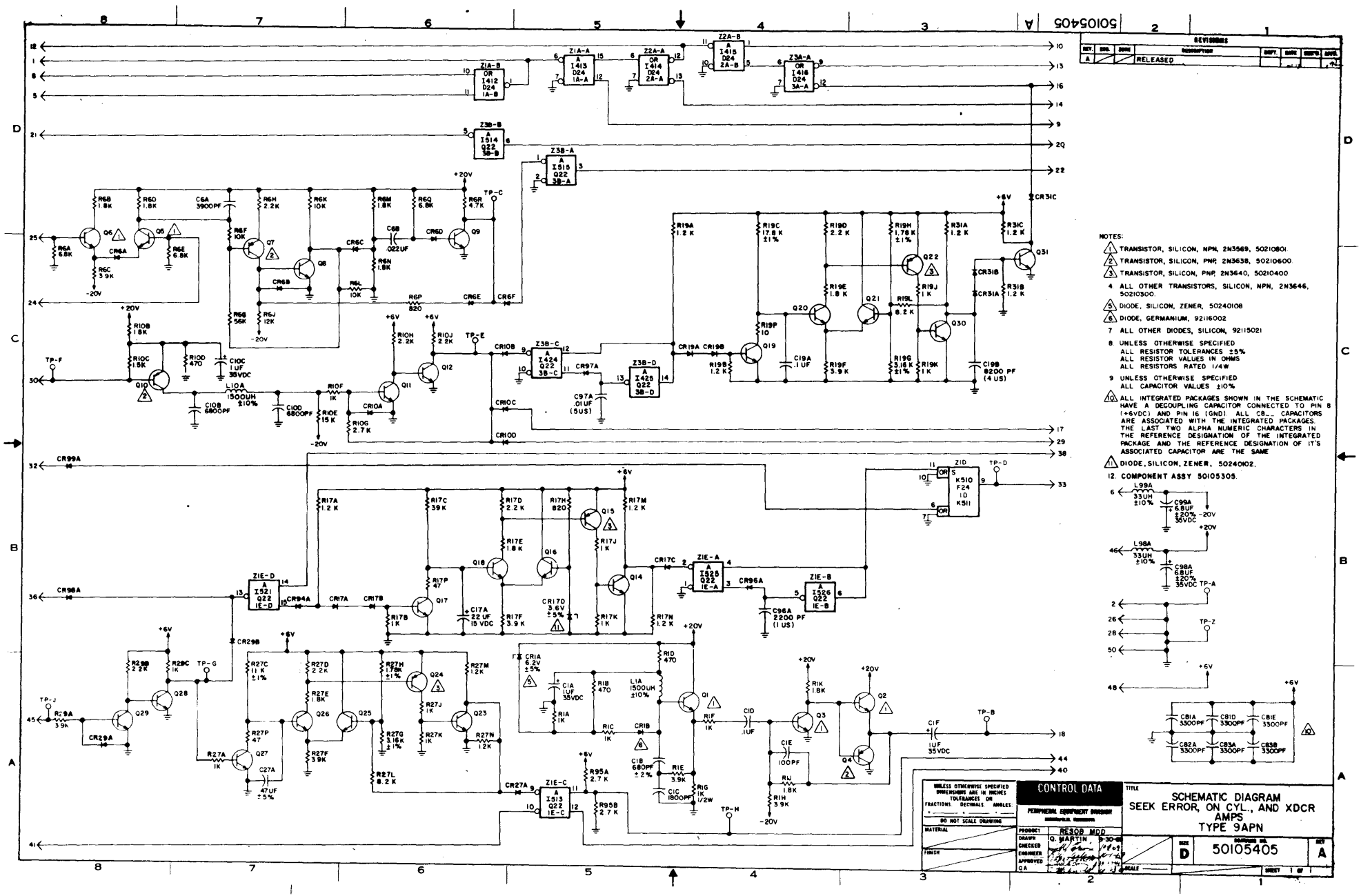
CONTROL DATA
PERIPHERAL EQUIPMENT DIVISION

PRODUCT	MDD	
DRAWN	D. TUTTLE	5-6-69
CHECKED		5-26-69
ENGINEER		6-25-69
APPROVED		6-25-69
QA		7-2-69

TITLE
SCHEMATIC DIAGRAM
STEERING UNIT LOGIC
TYPE BANN

SIZE D | DRAWING NO. 50105002 | REV A

SCALE | SHEET 1 OF 1


50105405
REVISIONS
RELEASED
NOTES:
1. TRANSISTOR, SILICON, NPN, 2N3569, 50210801
2. TRANSISTOR, SILICON, PNP, 2N3638, 50210600
3. TRANSISTOR, SILICON, PNP, 2N3640, 50210400
4. ALL OTHER TRANSISTORS, SILICON, NPN, 2N3646, 50210300.
5. DIODE, SILICON, ZENER, 50240108
6. DIODE, GERMANIUM, 92116002
7. ALL OTHER DIODES, SILICON, 92115021
8. UNLESS OTHERWISE SPECIFIED
ALL RESISTOR TOLERANCES ±5%
ALL RESISTOR VALUES IN OHMS
ALL RESISTORS RATED 1/4W
9. UNLESS OTHERWISE SPECIFIED
ALL CAPACITOR VALUES ±10%
10. ALL INTEGRATED PACKAGES SHOWN IN THE SCHEMATIC HAVE A DECOUPLING CAPACITOR CONNECTED TO PIN 8 (+6VDC) AND PIN 16 (GND). ALL C8__ CAPACITORS ARE ASSOCIATED WITH THE INTEGRATED PACKAGES. THE LAST TWO ALPHA NUMERIC CHARACTERS IN THE REFERENCE DESIGNATION OF THE INTEGRATED PACKAGE AND THE REFERENCE DESIGNATION OF IT'S ASSOCIATED CAPACITOR ARE THE SAME
11. DIODE, SILICON, ZENER, 50240102.
12. COMPONENT ASSY 50105305.
CONTROL DATA
PERIPHERAL EQUIPMENT DIVISION
TITLE
SCHEMATIC DIAGRAM
SEEK ERROR, ON CYL., AND XDCR
AMPS
TYPE 9APN
RESOB MDD
Q. MARTIN
SIZE D
50105405
REV A
SCALE
SHEET 1 OF 1

70602500 A

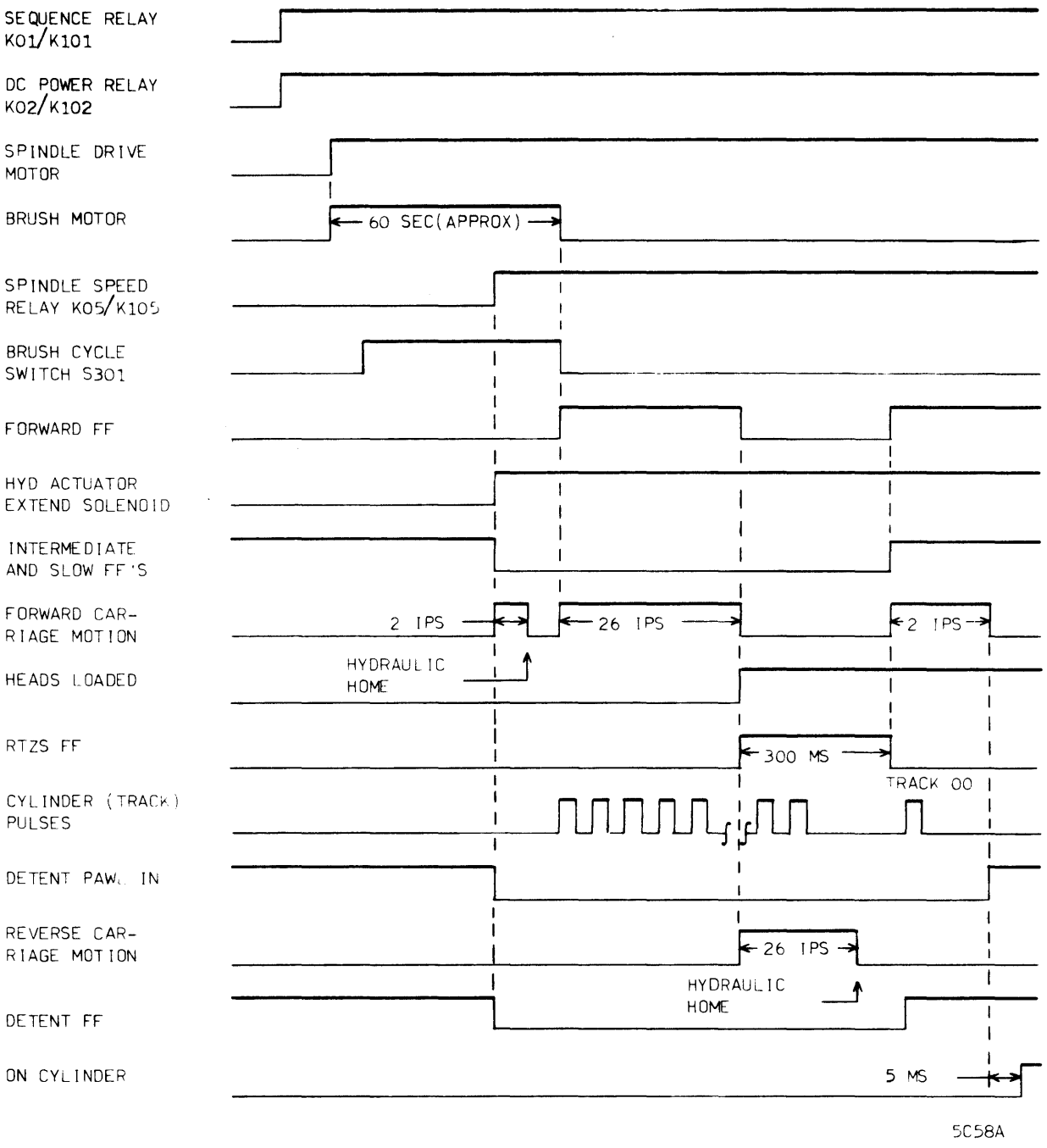


Figure 5-2. Power On/First Seek Timing

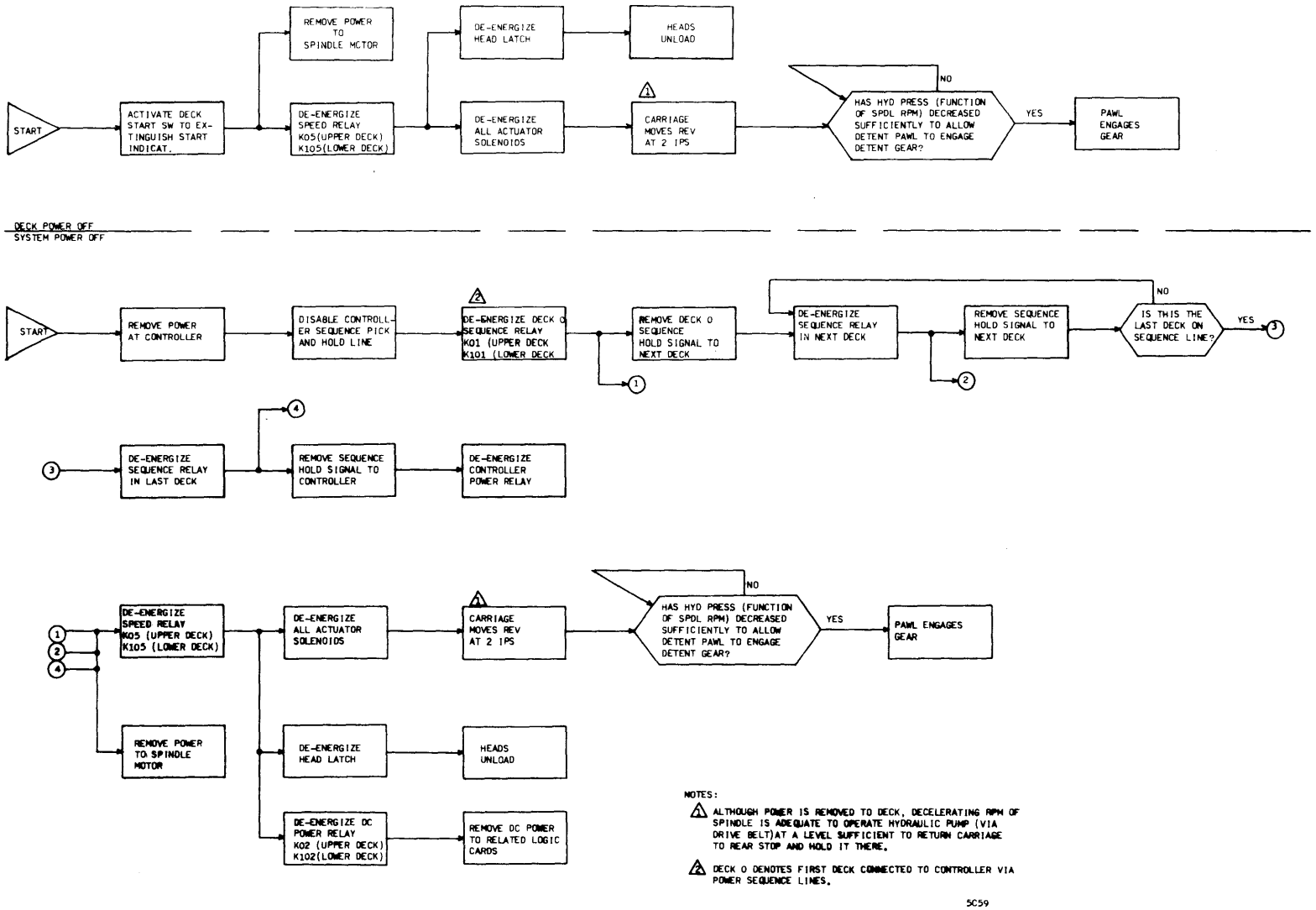
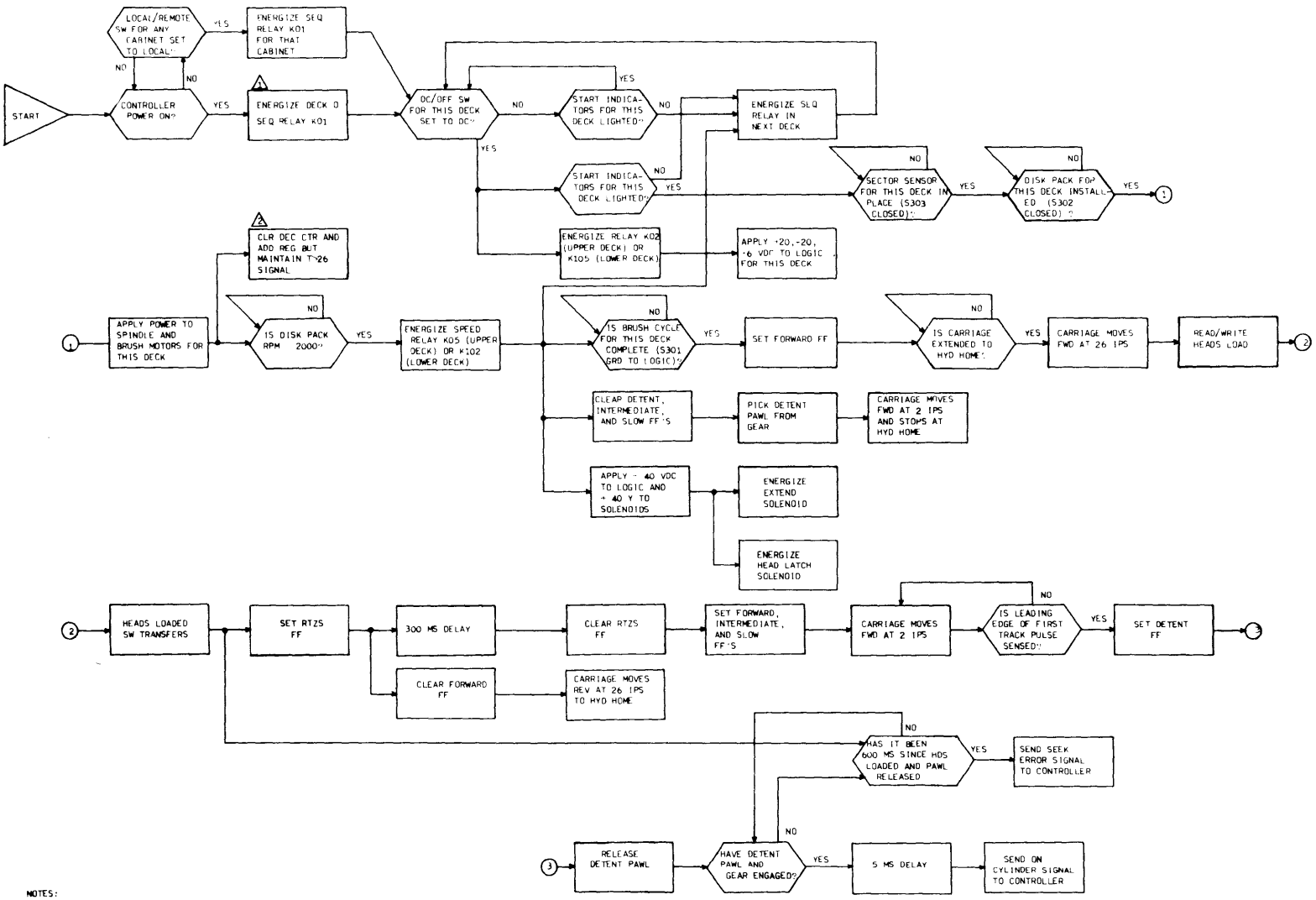


Figure 5-3. Deck or System Power Off Sequence

DIAGRAMS

INTRODUCTION

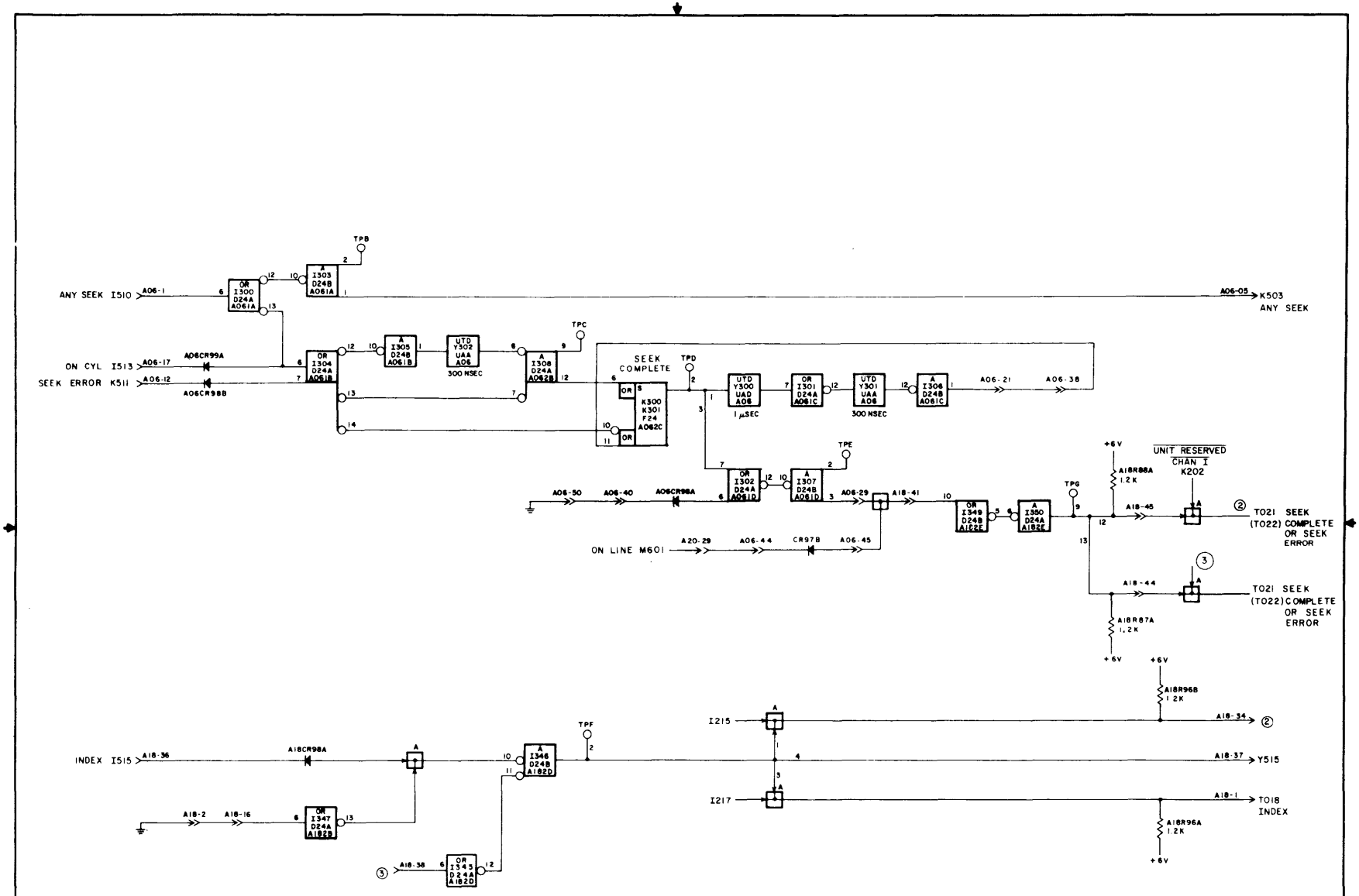
This section contains diagrams that logically describe the MDD in terms of the functions which the unit performs. Figures 5-1 through 5-10 are flow charts, simplified circuits, and timing diagrams that describe the First Seek function, the Power Off sequence, the Direct Seek (forward and reverse) function, the Return to Zero function, and the Read/Write operations. Figure 5-11 shows the ground scheme for a cabinet. The logic diagrams for the unit are provided on pages 5-13 through 5-22. The MDD signal distribution drawing is located on page 5-23, and the unit power supply schematic is found on pages 5-24 through 5-25. Schematic diagrams for the transducer preamplifier cards and the SPL cards are found at the end of the section.

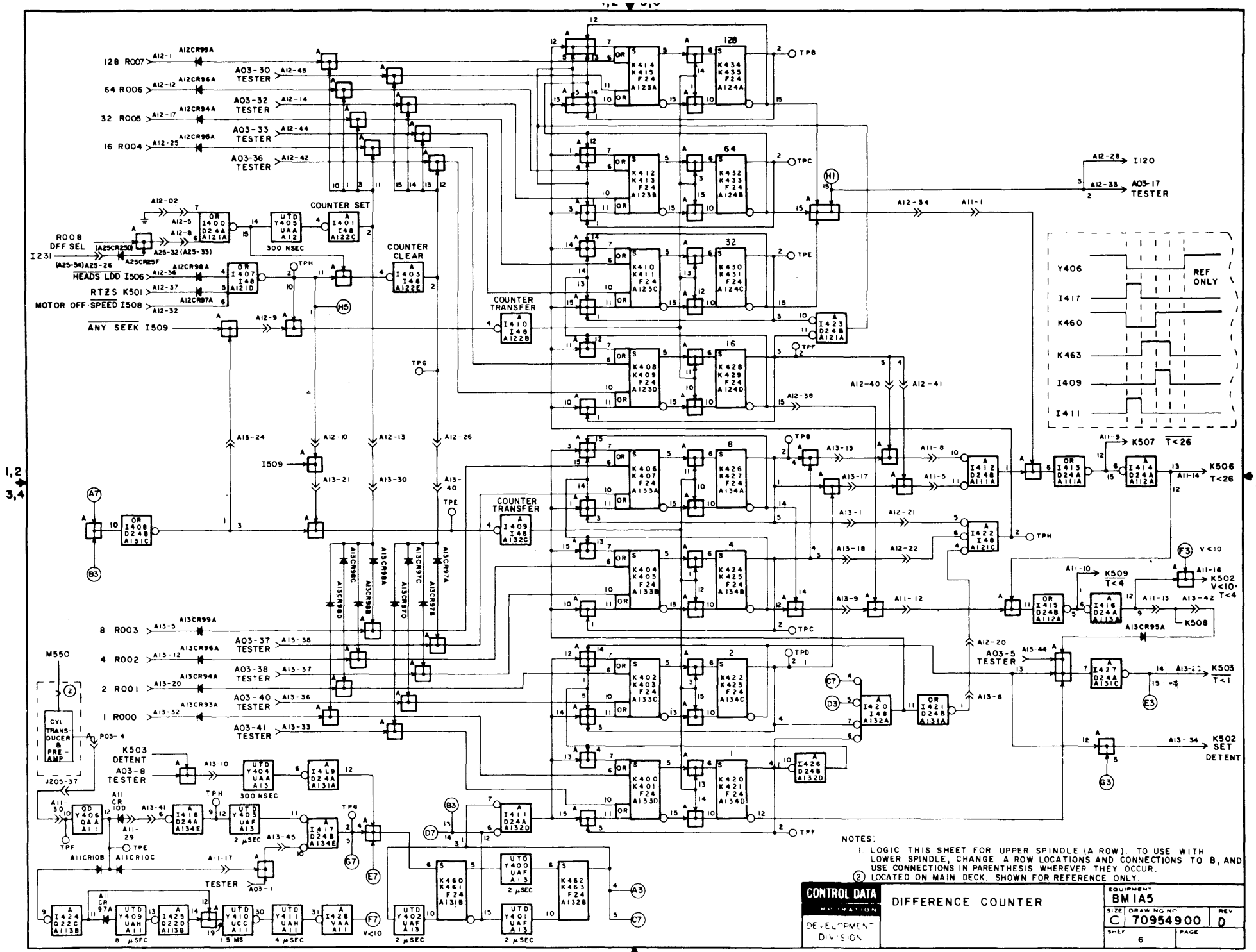


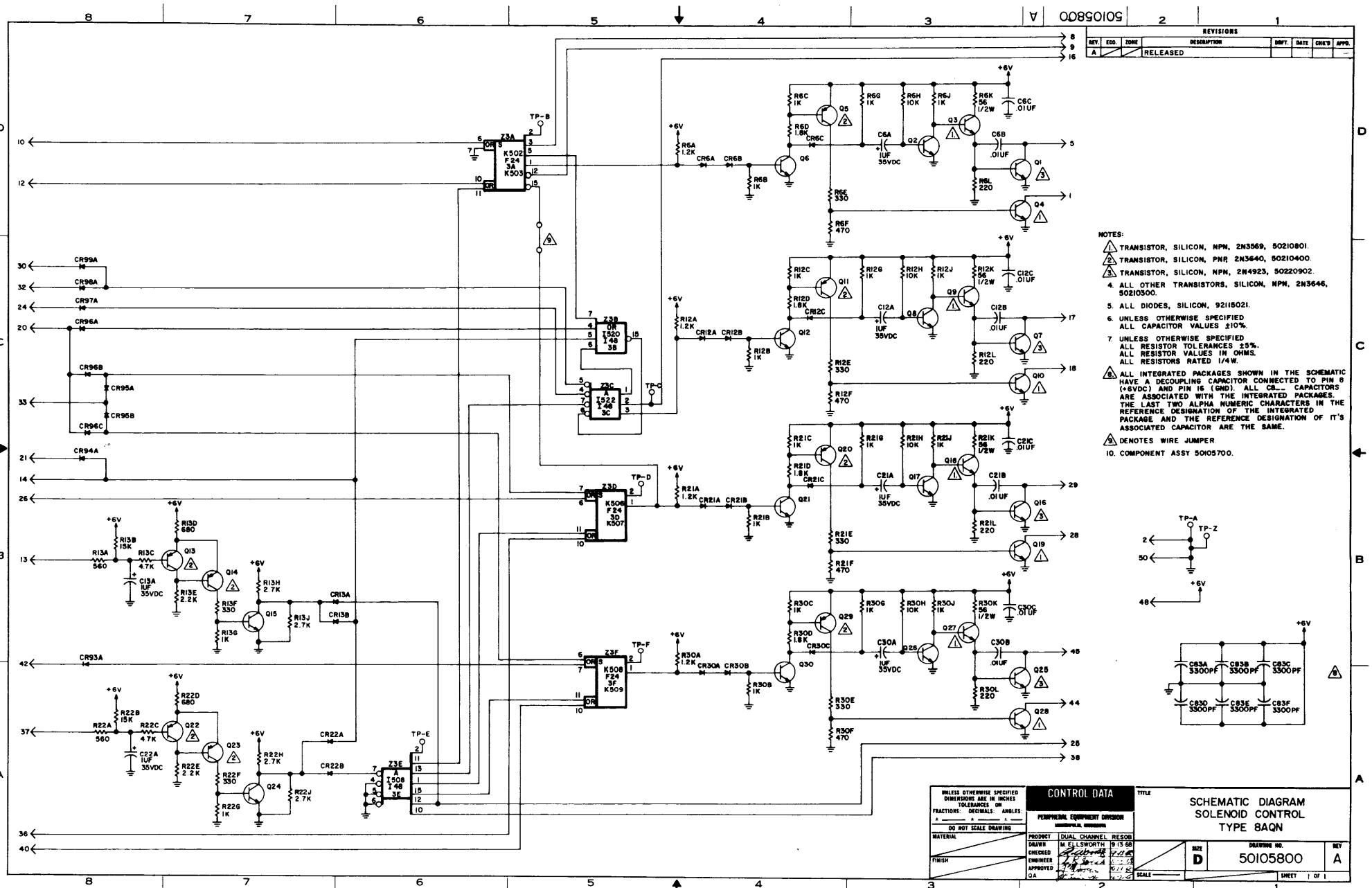
NOTES:

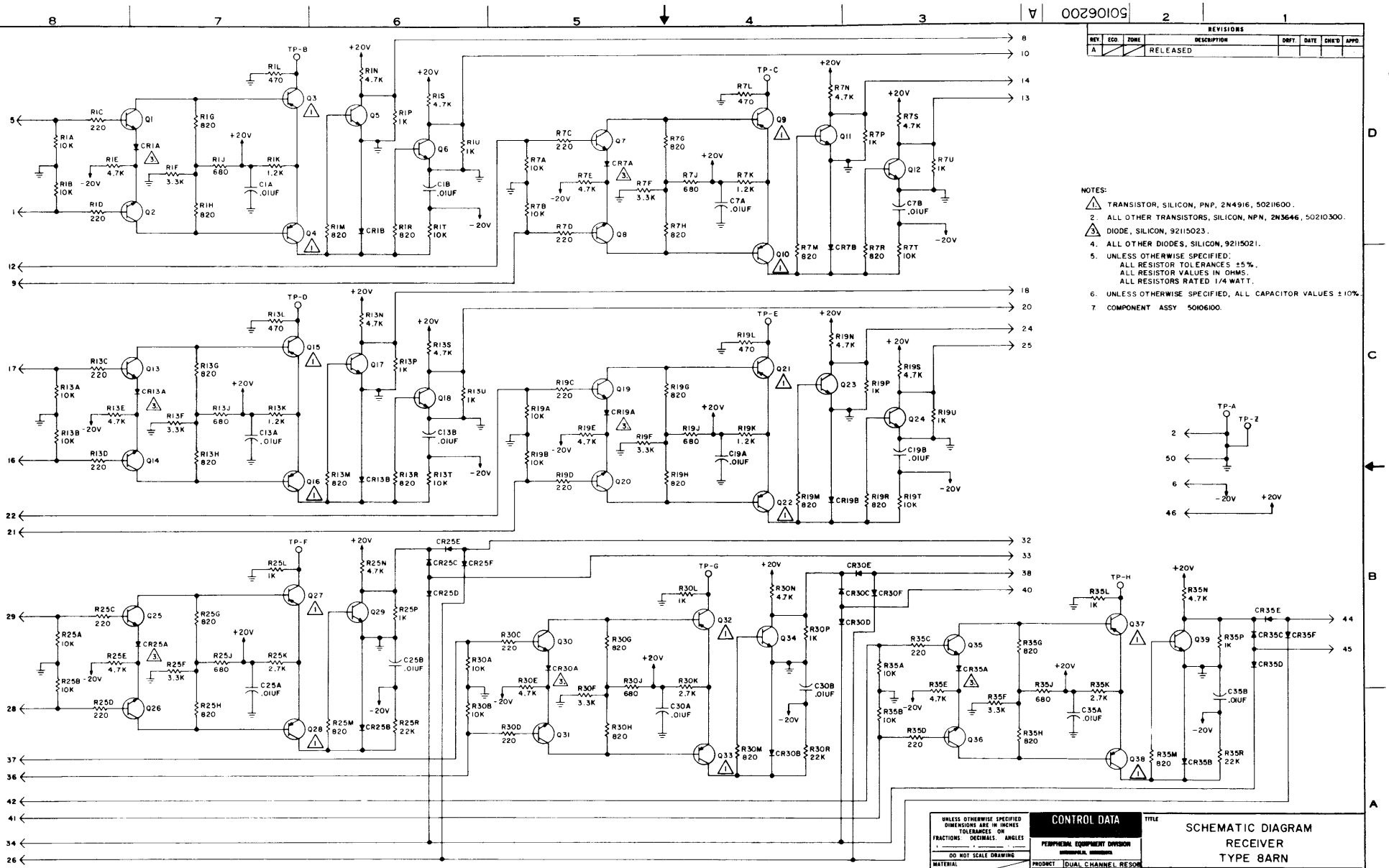
1. DECK 0 DENOTES FIRST DECK CONNECTED TO CONTROLLER VIA POWER SEQUENCE LINES.
2. THIS CONDITION MAINTAINED BY MTR OFF OR HDS UNLD OR SPEED OR RTZS SIGNALS.

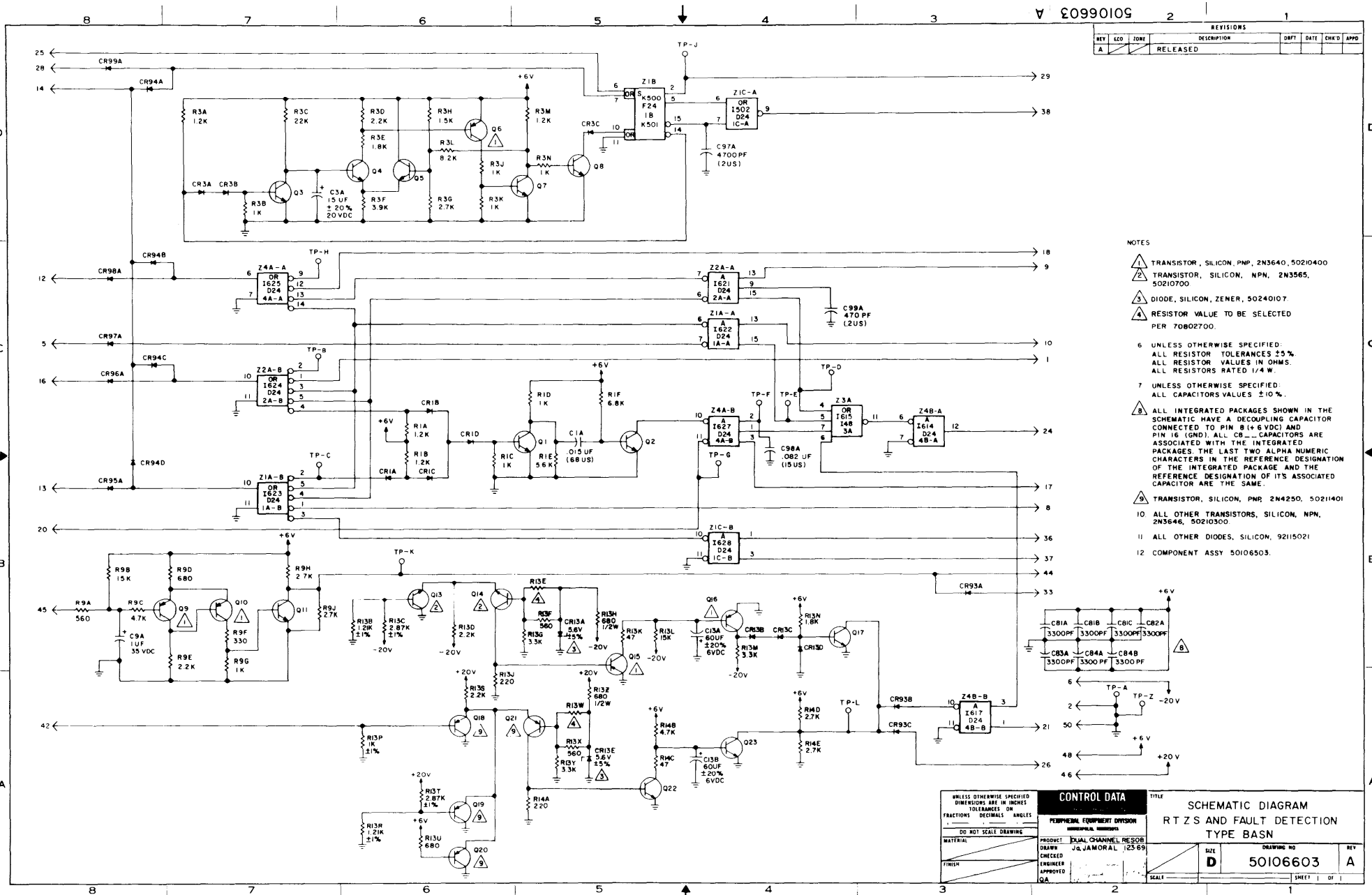
Figure 5-1. Power On/First Seek Sequence

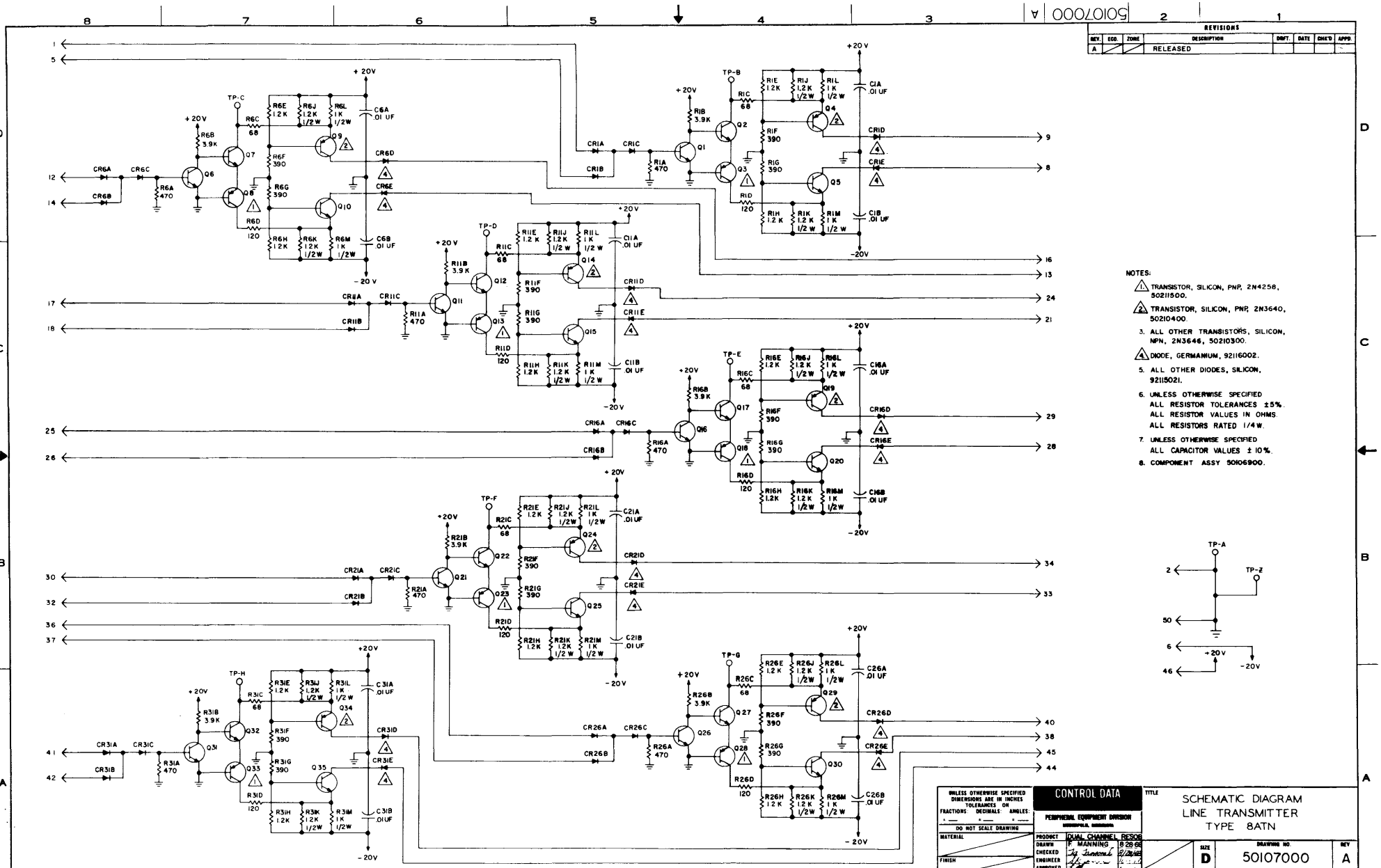

ANY SEEK I510
ON CYL I513
SEEK ERROR K511
A06CR99A
A06CR98B
SEEK COMPLETE
K503 ANY SEEK
ON LINE M601
UNIT RESERVED CHAN I K202
TO21 SEEK (TO22) COMPLETE OR SEEK ERROR
TO21 SEEK (TO22) COMPLETE OR SEEK ERROR
INDEX I515
A18CR98A
I215
I217
Y515
TO18 INDEX
A18R88A 1.2K
A18R87A 1.2K
A18R96B 1.2K
A18R96A 1.2K
+6V
1 μSEC
300 NSEC
NOTES
1 LOGIC ON THIS SHEET FOR UPPER SPINDLE (A ROW) TO USE WITH LOWER SPINDLE, CHANGE A ROW LOCATIONS AND CONNECTIONS TO B AND USE TERMS IN PARENTHESIS WHERE THEY OCCUR
(2) NOT USED.
(3) OPEN.
CONTROL DATA
DEVELOPMENT DIVISION
SEEK COMPLETE AND INDEX
EQUIPMENT BM1A5
SIZE C DRAWING NO 70954900 REV G
SHEET 5 PAGE


128 R007
64 R006
32 R005
16 R004
A03-30 TESTER
A03-32 TESTER
A03-33 TESTER
A03-36 TESTER
COUNTER SET
COUNTER CLEAR
COUNTER TRANSFER
ROOB DFF SEL
I231
HEADS LDD I506
RTZS K501
MOTOR OFF-SPEED I508
ANY SEEK I509
8 R003
4 R002
2 R001
1 R000
A03-37 TESTER
A03-38 TESTER
A03-40 TESTER
A03-41 TESTER
M550
CYL TRANS-DUCER & PRE-AMP
K503 DETENT
A03-8 TESTER
A03-5 TESTER
A03-17 TESTER
I120
K507 T<26
K506 T<26
K509 T<4
K502 V<10 T<4
K508
K503 T<1
K502 SET DETENT
REF ONLY
Y406
I417
K460
K463
I409
I411
NOTES:
1. LOGIC THIS SHEET FOR UPPER SPINDLE (A ROW). TO USE WITH LOWER SPINDLE, CHANGE A ROW LOCATIONS AND CONNECTIONS TO B, AND USE CONNECTIONS IN PARENTHESIS WHEREVER THEY OCCUR.
2. LOCATED ON MAIN DECK. SHOWN FOR REFERENCE ONLY.
CONTROL DATA
DEVELOPMENT DIVISION
DIFFERENCE COUNTER
EQUIPMENT BM1A5
SIZE C
DRAWING NO 70954900
REV D
SHEET 6
PAGE


REVISIONS
REV. ECO. ZONE DESCRIPTION DRFT. DATE CHK'D APPD.
A RELEASED
NOTES:
1. TRANSISTOR, SILICON, NPN, 2N3569, 50210801.
2. TRANSISTOR, SILICON, PNP, 2N3640, 50210400.
3. TRANSISTOR, SILICON, NPN, 2N4923, 50220902.
4. ALL OTHER TRANSISTORS, SILICON, NPN, 2N3646, 50210300.
5. ALL DIODES, SILICON, 92115021.
6. UNLESS OTHERWISE SPECIFIED ALL CAPACITOR VALUES ±10%.
7. UNLESS OTHERWISE SPECIFIED ALL RESISTOR TOLERANCES ±5%. ALL RESISTOR VALUES IN OHMS. ALL RESISTORS RATED 1/4W.
8. ALL INTEGRATED PACKAGES SHOWN IN THE SCHEMATIC HAVE A DECOUPLING CAPACITOR CONNECTED TO PIN 8 (+6VDC) AND PIN 16 (GND). ALL C8___ CAPACITORS ARE ASSOCIATED WITH THE INTEGRATED PACKAGES. THE LAST TWO ALPHA NUMERIC CHARACTERS IN THE REFERENCE DESIGNATION OF THE INTEGRATED PACKAGE AND THE REFERENCE DESIGNATION OF IT'S ASSOCIATED CAPACITOR ARE THE SAME.
9. DENOTES WIRE JUMPER.
10. COMPONENT ASSY 50105700.
CONTROL DATA
PERIPHERAL EQUIPMENT DIVISION
DO NOT SCALE DRAWING
PRODUCT DUAL CHANNEL RESOB
DRAWN M. ELLSWORTH 9 13 68
CHECKED
ENGINEER
APPROVED
QA
TITLE
SCHEMATIC DIAGRAM
SOLENOID CONTROL
TYPE 8AQN
SIZE D
DRAWING NO. 50105800
REV A
SCALE
SHEET 1 OF 1


REVISIONS
REV. ECO. ZONE DESCRIPTION DRFT. DATE CHK'D APPD.
A RELEASED
NOTES:
1. TRANSISTOR, SILICON, PNP, 2N4916, 50211600.
2. ALL OTHER TRANSISTORS, SILICON, NPN, 2N3646, 50210300.
3. DIODE, SILICON, 92115023.
4. ALL OTHER DIODES, SILICON, 92115021.
5. UNLESS OTHERWISE SPECIFIED:
ALL RESISTOR TOLERANCES ±5%.
ALL RESISTOR VALUES IN OHMS.
ALL RESISTORS RATED 1/4 WATT.
6. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ±10%.
7. COMPONENT ASSY 50106100.
TP-A
TP-B
TP-C
TP-D
TP-E
TP-F
TP-G
TP-H
+20V
-20V
CONTROL DATA
PERIPHERAL EQUIPMENT DIVISION
TITLE
SCHEMATIC DIAGRAM
RECEIVER
TYPE 8ARN
PRODUCT DUAL CHANNEL RESOR
DRAWN F. MANNING 7-21-68
CHECKED
ENGINEER
APPROVED
QA
SIZE D
DRAWING NO 50106200
REV A
SCALE
SHEET 1 OF 1
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON FRACTIONS DECIMALS. ANGLES
DO NOT SCALE DRAWING
MATERIAL
FINISH


50106603 A
REVISIONS
REV | ECO | ZONE | DESCRIPTION | DRFT | DATE | CHK'D | APPD
A | RELEASED
NOTES
1 TRANSISTOR, SILICON, PNP, 2N3640, 50210400
2 TRANSISTOR, SILICON, NPN, 2N3565, 50210700
3 DIODE, SILICON, ZENER, 50240107
4 RESISTOR VALUE TO BE SELECTED PER 70802700.
6 UNLESS OTHERWISE SPECIFIED: ALL RESISTOR TOLERANCES ±5 %. ALL RESISTOR VALUES IN OHMS. ALL RESISTORS RATED 1/4 W.
7 UNLESS OTHERWISE SPECIFIED: ALL CAPACITORS VALUES ±10 %.
8 ALL INTEGRATED PACKAGES SHOWN IN THE SCHEMATIC HAVE A DECOUPLING CAPACITOR CONNECTED TO PIN 8 (+6 VDC) AND PIN 16 (GND). ALL C8__ CAPACITORS ARE ASSOCIATED WITH THE INTEGRATED PACKAGES. THE LAST TWO ALPHA NUMERIC CHARACTERS IN THE REFERENCE DESIGNATION OF THE INTEGRATED PACKAGE AND THE REFERENCE DESIGNATION OF IT'S ASSOCIATED CAPACITOR ARE THE SAME.
9 TRANSISTOR, SILICON, PNP, 2N4250, 50211401
10 ALL OTHER TRANSISTORS, SILICON, NPN, 2N3646, 50210300.
11 ALL OTHER DIODES, SILICON, 92115021
12 COMPONENT ASSY 50106503.
CONTROL DATA
PERIPHERAL EQUIPMENT DIVISION
PRODUCT DUAL CHANNEL RESOB
DRAWN J.G. JAMORAL 23-69
CHECKED
ENGINEER
APPROVED
QA
TITLE
SCHEMATIC DIAGRAM
RTZS AND FAULT DETECTION
TYPE BASN
SIZE D
DRAWING NO 50106603
REV A
SCALE
SHEET 1 OF 1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REV. | ECO. | ZONE | DESCRIPTION | DRFT. | DATE | CHK'D | APPD.
A | RELEASED
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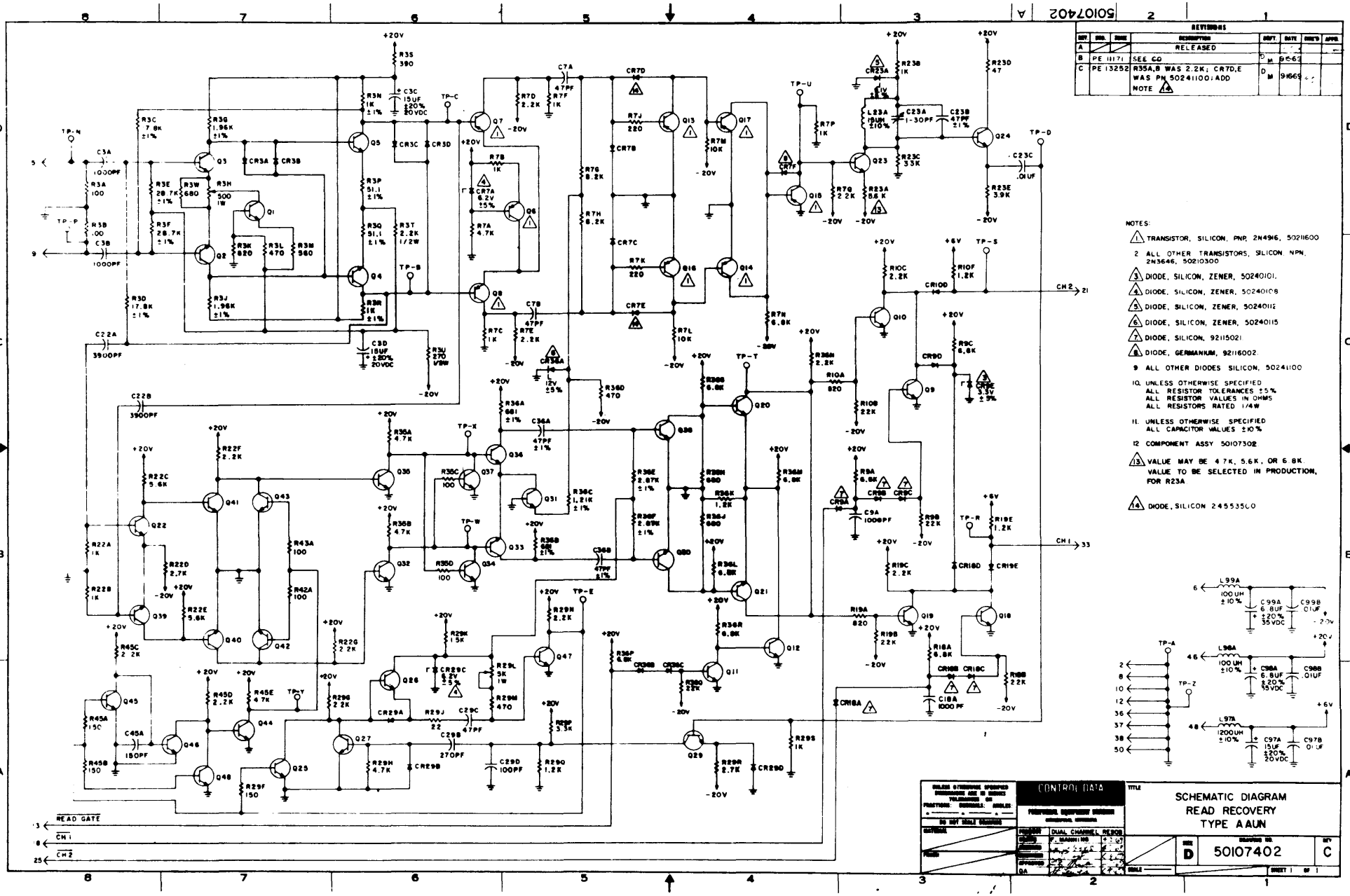
1. TRANSISTOR, SILICON, PNP, 2N4258, 50211500.
2. TRANSISTOR, SILICON, PNP, 2N3640, 50210400.
3. ALL OTHER TRANSISTORS, SILICON, NPN, 2N3646, 50210300.
4. DIODE, GERMANIUM, 92116002.
5. ALL OTHER DIODES, SILICON, 92115021.
6. UNLESS OTHERWISE SPECIFIED ALL RESISTOR TOLERANCES ±5%. ALL RESISTOR VALUES IN OHMS. ALL RESISTORS RATED 1/4 W.
7. UNLESS OTHERWISE SPECIFIED ALL CAPACITOR VALUES ± 10%.
8. COMPONENT ASSY 50105900.
TP-A
TP-Z
2
50
6
46
+20V
-20V
CONTROL DATA
PERIPHERAL EQUIPMENT DIVISION
TITLE
SCHEMATIC DIAGRAM
LINE TRANSMITTER
TYPE 8ATN
DRAWN F MANNING 8-28-68
SIZE D
DRAWING NO. 50107000
REV A
SHEET 1 OF 1


50107402
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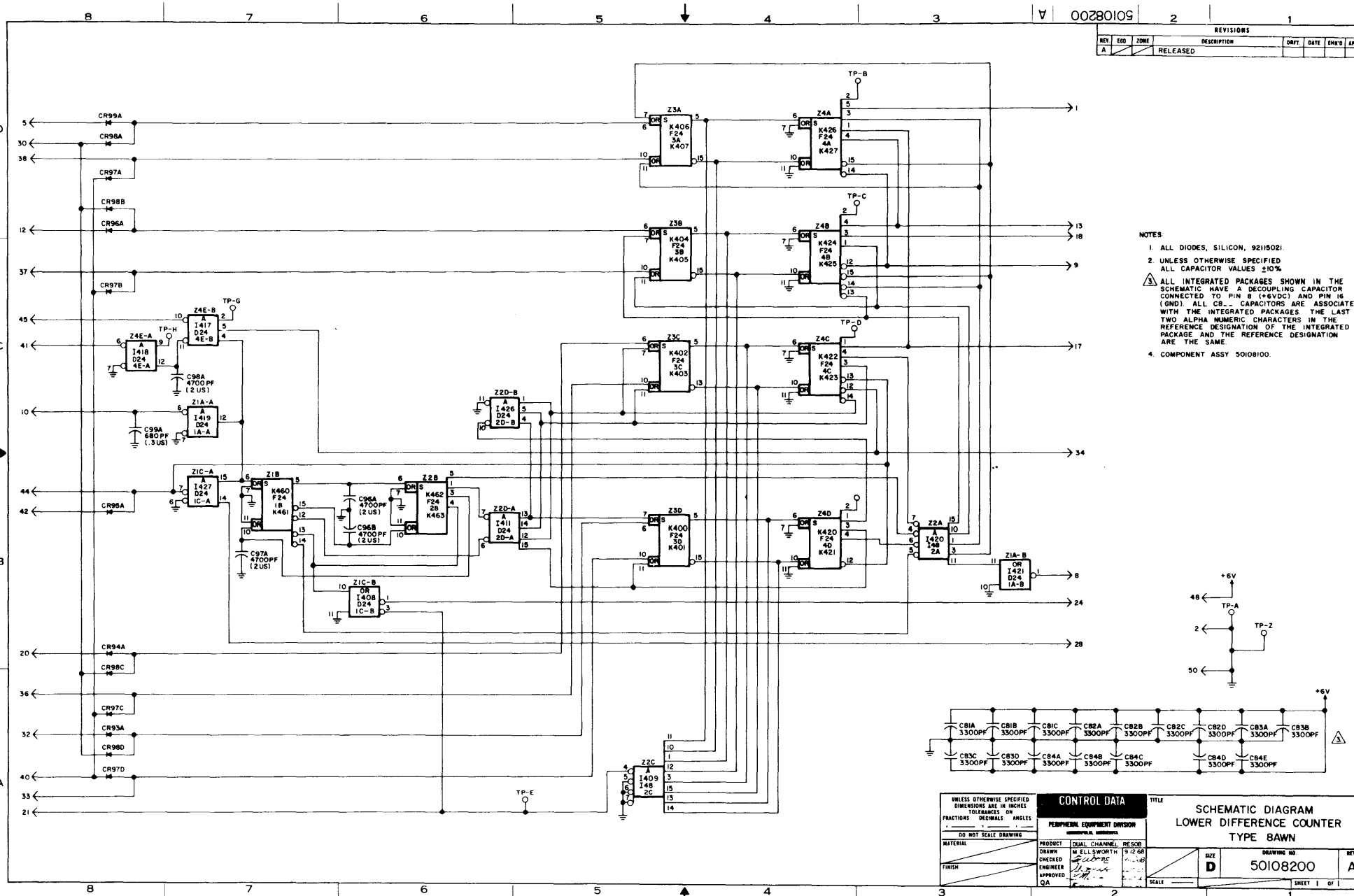
B PE 11171 SEE CO
C PE 13252 R35A,B WAS 2.2K; CR7D,E WAS PN 50241100; ADD NOTE 14
NOTES:
1 TRANSISTOR, SILICON, PNP, 2N4916, 50211600
2 ALL OTHER TRANSISTORS, SILICON, NPN, 2N3646, 50210300
3 DIODE, SILICON, ZENER, 50240101
4 DIODE, SILICON, ZENER, 50240108
5 DIODE, SILICON, ZENER, 50240112
6 DIODE, SILICON, ZENER, 50240115
7 DIODE, SILICON, 92115021
8 DIODE, GERMANIUM, 92116002
9 ALL OTHER DIODES SILICON, 50241100
10 UNLESS OTHERWISE SPECIFIED ALL RESISTOR TOLERANCES ±5% ALL RESISTOR VALUES IN OHMS ALL RESISTORS RATED 1/4W
11 UNLESS OTHERWISE SPECIFIED ALL CAPACITOR VALUES ±10%
12 COMPONENT ASSY 50107302
13 VALUE MAY BE 4.7K, 5.6K, OR 6.8K. VALUE TO BE SELECTED IN PRODUCTION, FOR R23A
14 DIODE, SILICON 2455350
CONTROL DATA
SCHEMATIC DIAGRAM
READ RECOVERY
TYPE AAUN
50107402
D
C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REVISIONS
REV. ECO ZONE DESCRIPTION DRFT. DATE CHK'D APPD
A RELEASED
NOTES:
1. ALL DIODES, SILICON, 92115021.
2. UNLESS OTHERWISE SPECIFIED ALL CAPACITOR VALUES ±10%
3. ALL INTEGRATED PACKAGES SHOWN IN THE SCHEMATIC HAVE A DECOUPLING CAPACITOR CONNECTED TO PIN 8 (+6VDC) AND PIN 16 (GND). ALL C8__ CAPACITORS ARE ASSOCIATED WITH THE INTEGRATED PACKAGES. THE LAST TWO ALPHA NUMERIC CHARACTERS IN THE REFERENCE DESIGNATION OF THE INTEGRATED PACKAGE AND THE REFERENCE DESIGNATION ARE THE SAME.
4. COMPONENT ASSY 50108100.
CONTROL DATA
PERIPHERAL EQUIPMENT DIVISION
TITLE
SCHEMATIC DIAGRAM
LOWER DIFFERENCE COUNTER
TYPE 8AWN
SIZE D
DRAWING NO 50108200
REV A
SHEET 1 OF 1
70602500 A
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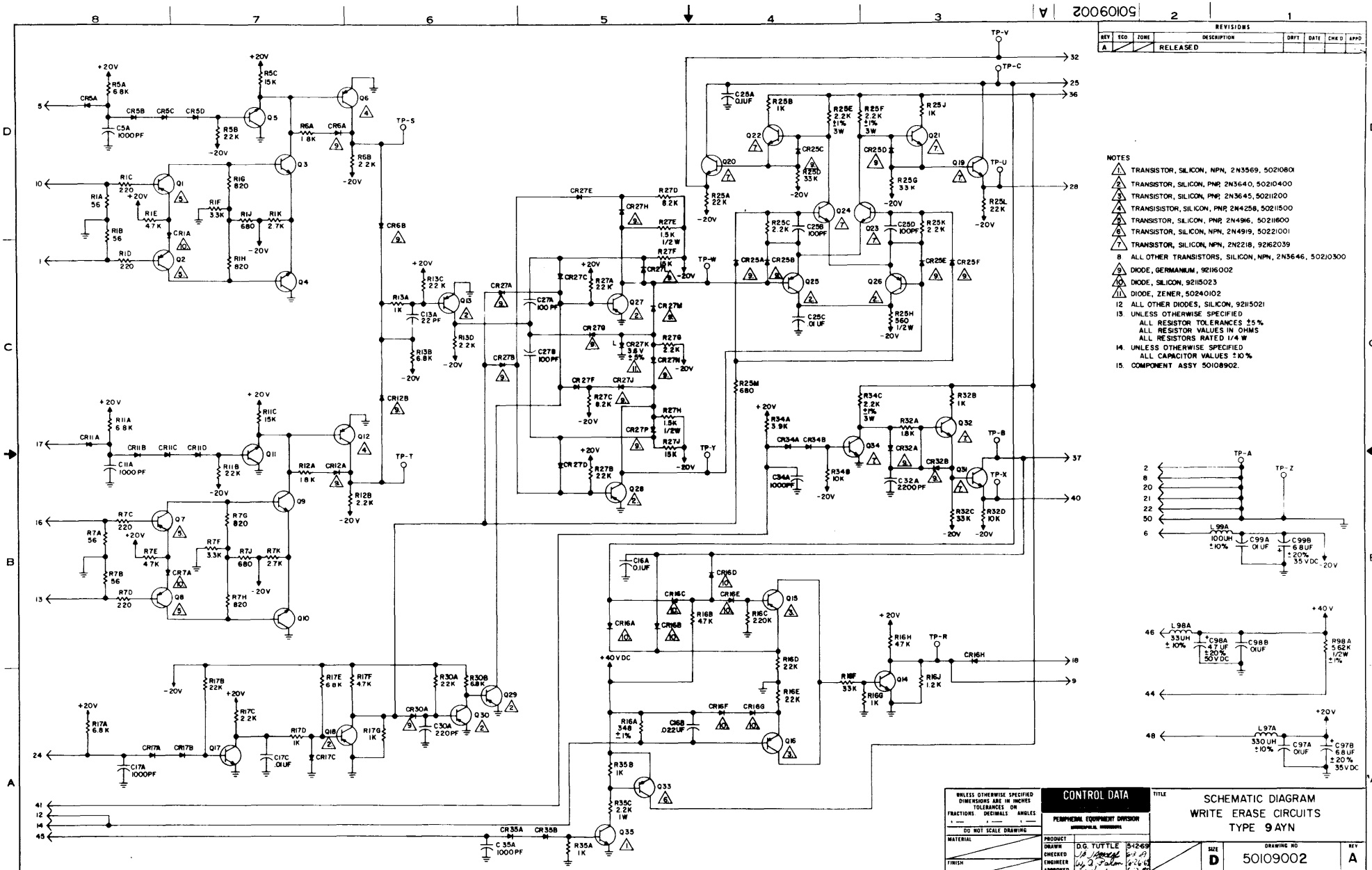
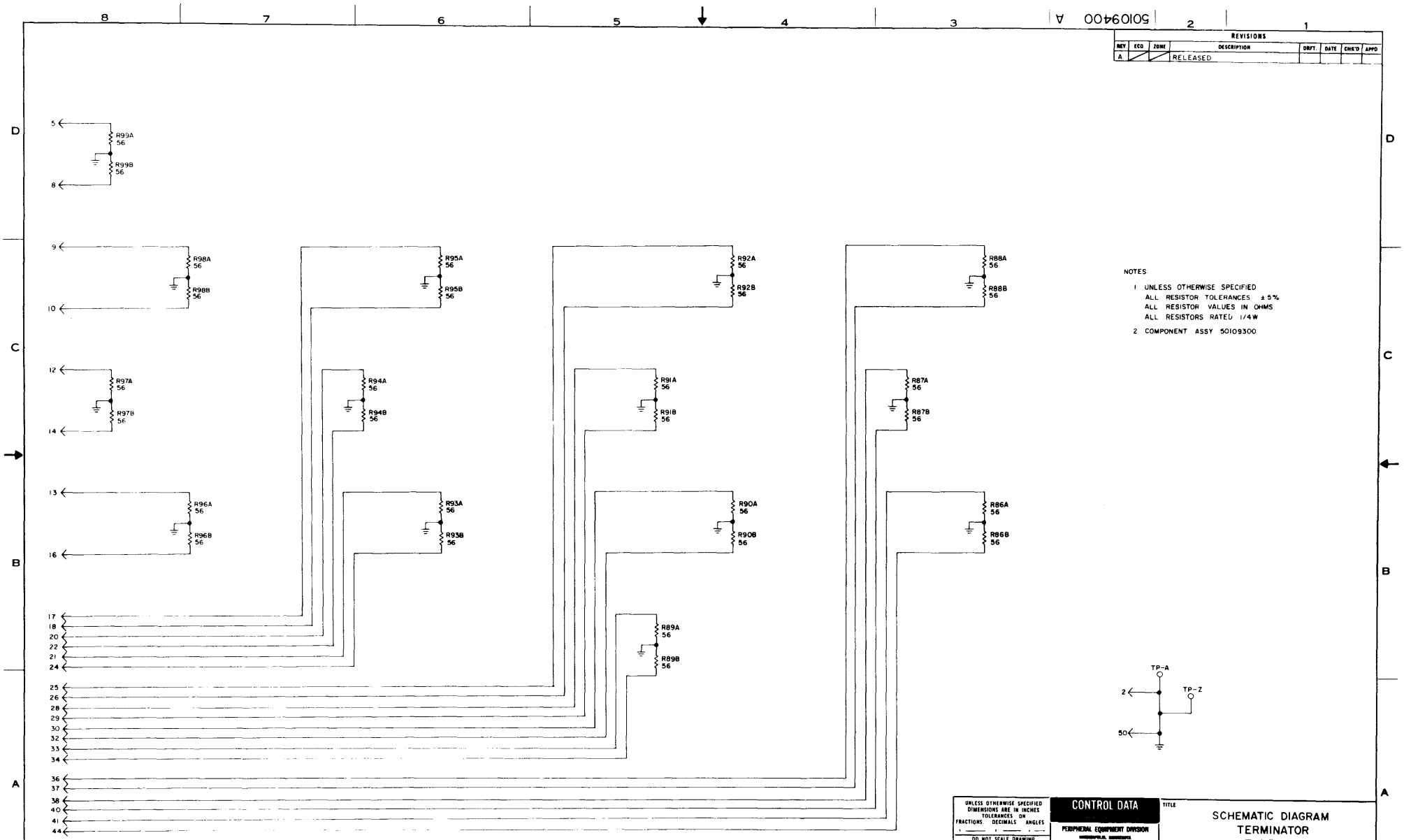

50109002
REVISIONS
REV | ECO | ZONE | DESCRIPTION | DRFT | DATE | CHK'D | APP'D
A | RELEASED
NOTES
1. TRANSISTOR, SILICON, NPN, 2N3569, 50210801
2. TRANSISTOR, SILICON, PNP, 2N3640, 50210400
3. TRANSISTOR, SILICON, PNP, 2N3645, 50211200
4. TRANSISISTOR, SILICON, PNP, 2N4258, 50211500
5. TRANSISTOR, SILICON, PNP, 2N4916, 50211600
6. TRANSISTOR, SILICON, NPN, 2N4919, 50221001
7. TRANSISTOR, SILICON, NPN, 2N2218, 92162039
8. ALL OTHER TRANSISTORS, SILICON, NPN, 2N3646, 50210300
9. DIODE, GERMANIUM, 92116002
10. DIODE, SILICON, 92115023
11. DIODE, ZENER, 50240102
12. ALL OTHER DIODES, SILICON, 92115021
13. UNLESS OTHERWISE SPECIFIED
ALL RESISTOR TOLERANCES ±5%
ALL RESISTOR VALUES IN OHMS
ALL RESISTORS RATED 1/4 W
14. UNLESS OTHERWISE SPECIFIED
ALL CAPACITOR VALUES ±10%
15. COMPONENT ASSY 50108902.
CONTROL DATA
PERIPHERAL EQUIPMENT DIVISION
TITLE
SCHEMATIC DIAGRAM
WRITE ERASE CIRCUITS
TYPE 9 AYN
DRAWN D.G. TUTTLE 5-12-69
SIZE D
DRAWING NO 50109002
REV A
SHEET 1 OF 1
70602500 A
5-41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REVISIONS
REV | ECO | ZONE | DESCRIPTION | DRFT. | DATE | CHK'D | APPD
A | RELEASED
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R99B 56
R98A 56
R98B 56
R95A 56
R95B 56
R92A 56
R92B 56
R88A 56
R88B 56
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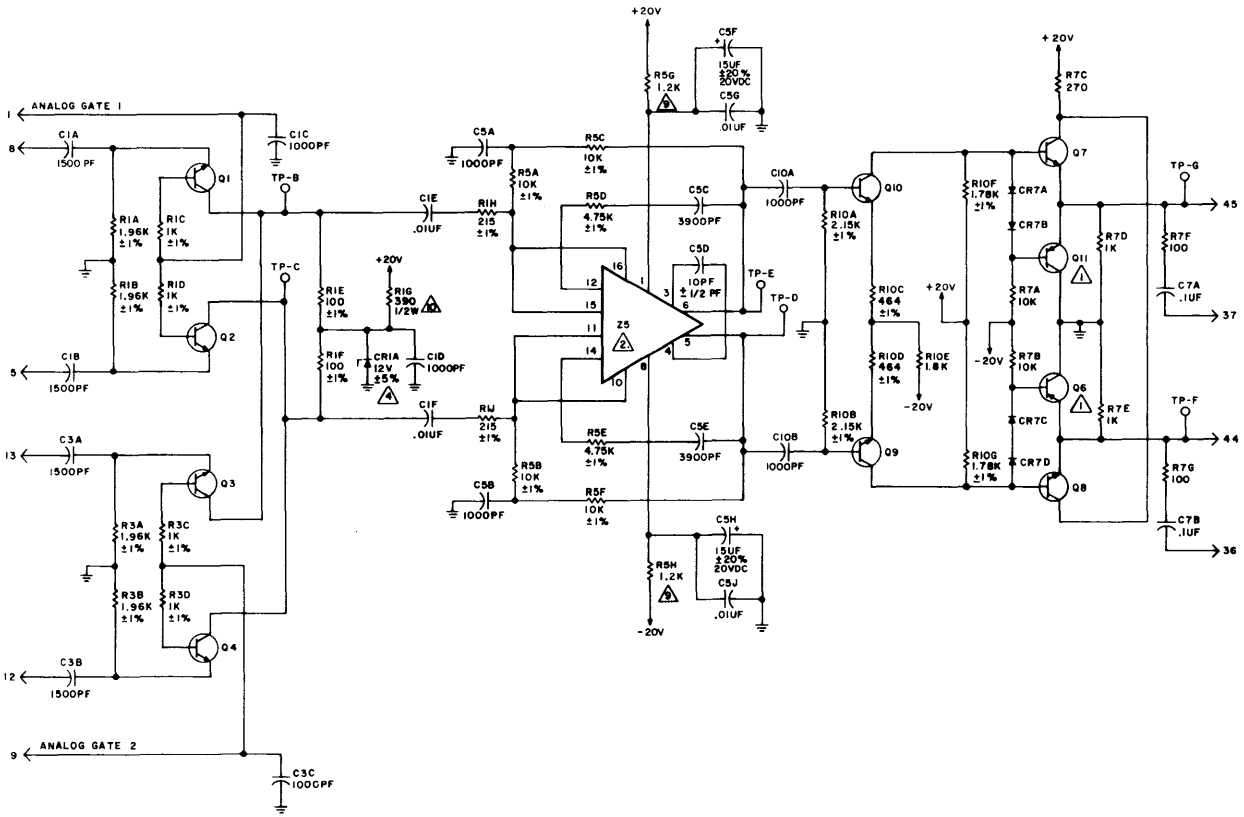
R97B 56
R94A 56
R94B 56
R91A 56
R91B 56
R87A 56
R87B 56
R96A 56
R96B 56
R93A 56
R93B 56
R90A 56
R90B 56
R86A 56
R86B 56
R89A 56
R89B 56
TP-A
TP-Z
NOTES:
1. UNLESS OTHERWISE SPECIFIED
ALL RESISTOR TOLERANCES ±5%
ALL RESISTOR VALUES IN OHMS
ALL RESISTORS RATED 1/4W
2. COMPONENT ASSY 50109300
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES
DO NOT SCALE DRAWING
MATERIAL
FINISH
CONTROL DATA
PERIPHERAL EQUIPMENT DIVISION
PRODUCT DUAL CHANNEL RESOB
DRAWN M ELLSWORTH 8 30 68
CHECKED
ENGINEER
APPROVED
QA
TITLE
SCHEMATIC DIAGRAM
TERMINATOR
TYPE 8AZN
SIZE D
DRAWING NO 50109400
REV A
SCALE
SHEET 1 OF 1

REVISIONS						
REV.	ECO.	ZONE	DESCRIPTION	DRFT.	DATE	CHK'D	APPD.
A			RELEASED				
B	PE 9552		SEE C5				



NOTES:

1. TRANSISTOR, SILICON, PNP, 2N4258, 50211500.
2. READ PREAMPLIFIER, TYPE AMP-1, EF 7400, 11844900.
3. ALL OTHER TRANSISTORS, SILICON, NPN, 2N3646, 50210300.
4. DIODE, SILICON ZENER, 50240115.
5. ALL OTHER DIODES, SILICON, 50241100.
6. UNLESS OTHERWISE SPECIFIED
   ALL RESISTOR TOLERANCES ±5%
   ALL RESISTOR VALUES IN OHMS.
   ALL RESISTORS RATED 1/4 W.
7. UNLESS OTHERWISE SPECIFIED
   ALL CAPACITOR VALUES ±10%
8. COMPONENT ASSY 50180100.
9. ASSY REV A USED TWO 2.2K OHM RESISTORS IN PARALLEL.
10. ASSY REV A USED TWO 680 OHM, 1/4W RESISTORS IN PARALLEL.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS: DECIMALS: ANGLES:
DO NOT SCALE DRAWING
MATERIAL
FINISH

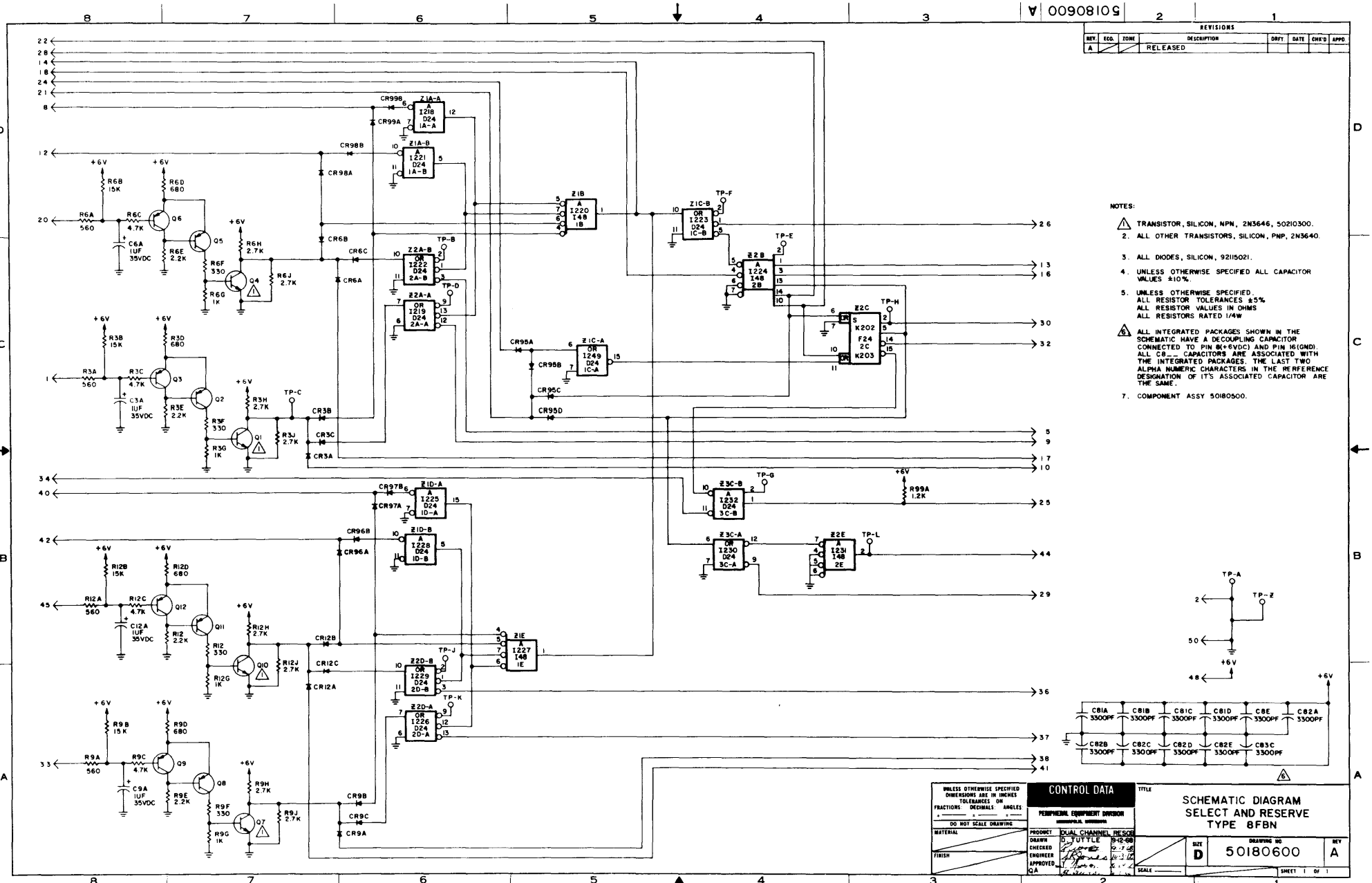
CONTROL DATA
PERIPHERAL EQUIPMENT DIVISION
COMMERCIAL ENGINEERING

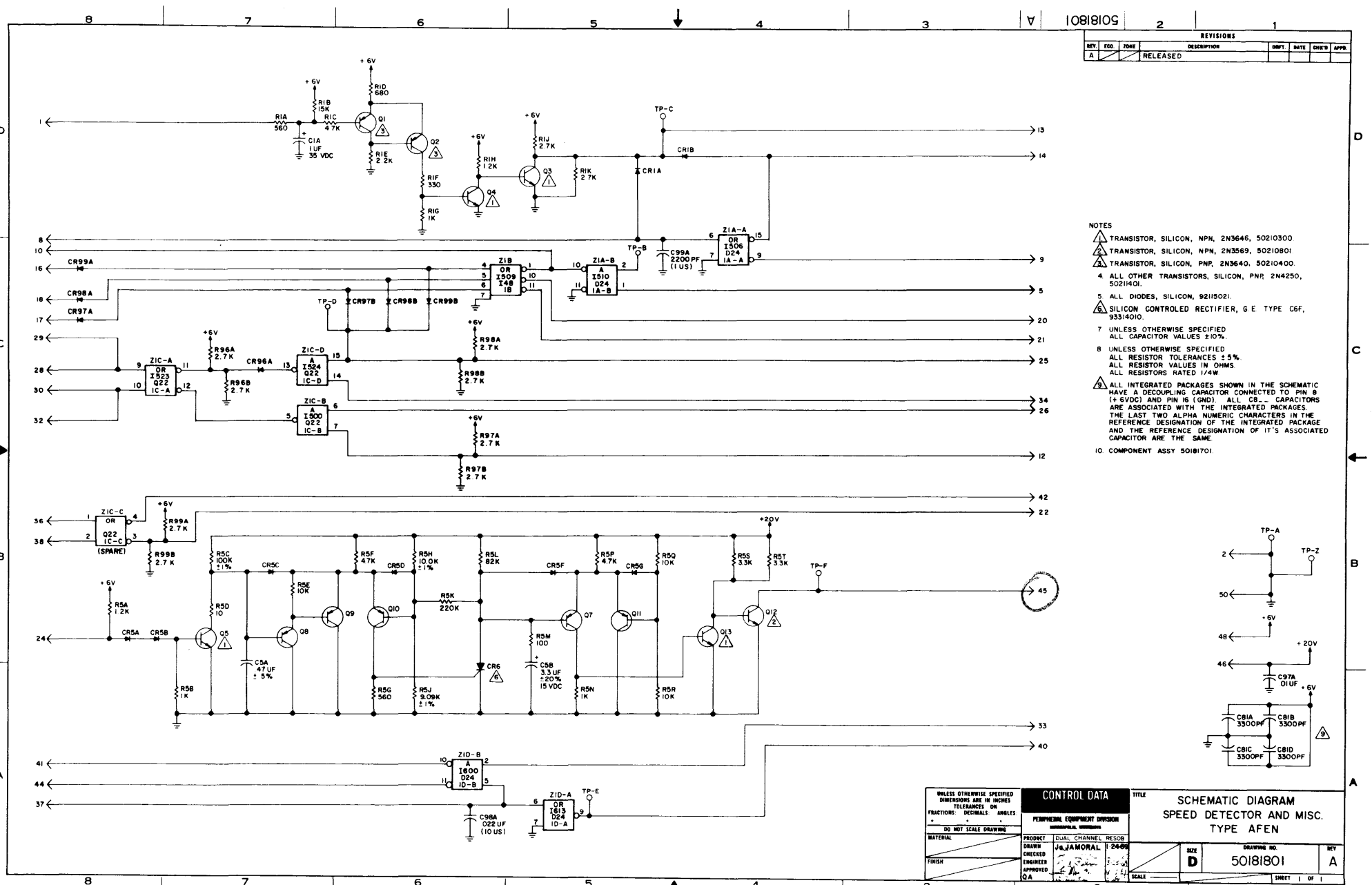
PRODUCT	DUAL CHANNEL RESOR	
DRAWN	J. MANNING	7-21-69
CHECKED		
ENGINEER		
APPROVED		
QA		

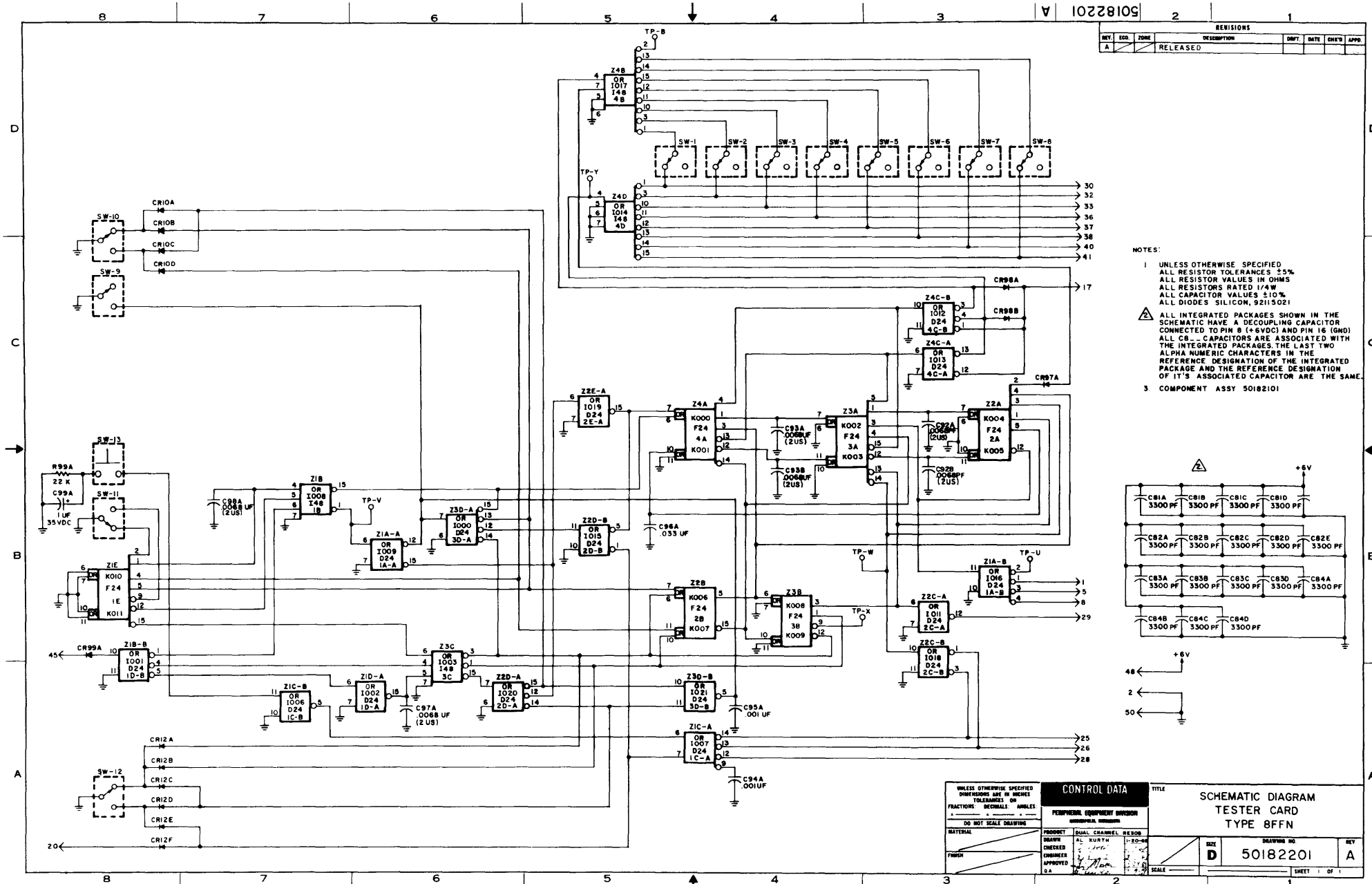
TITLE
SCHEMATIC DIAGRAM
ANALOG GATE AND AMPLIFIER
TYPE 8FAN

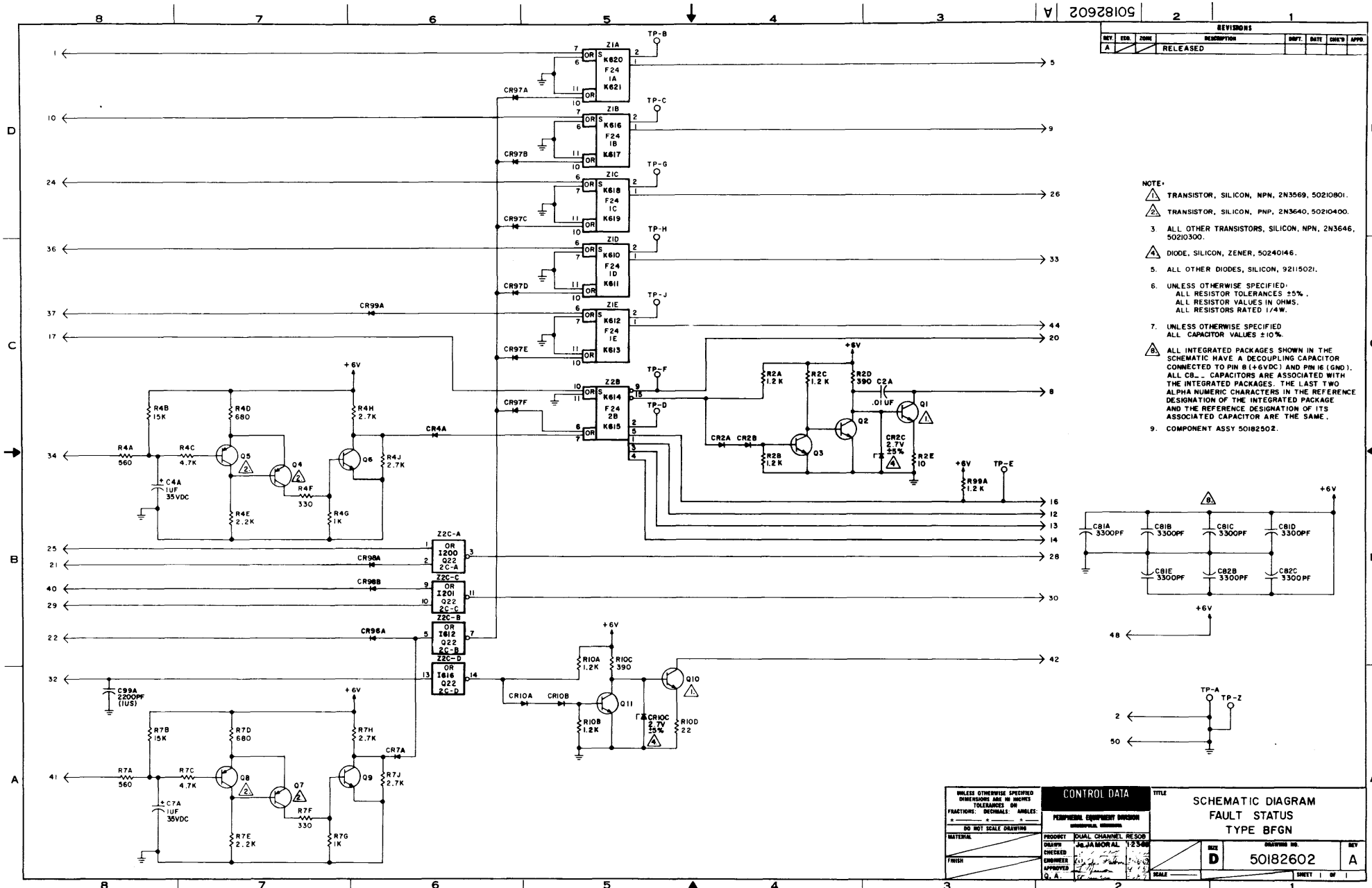
SIZE	DRAWING NO.	REV
D	50180200	B

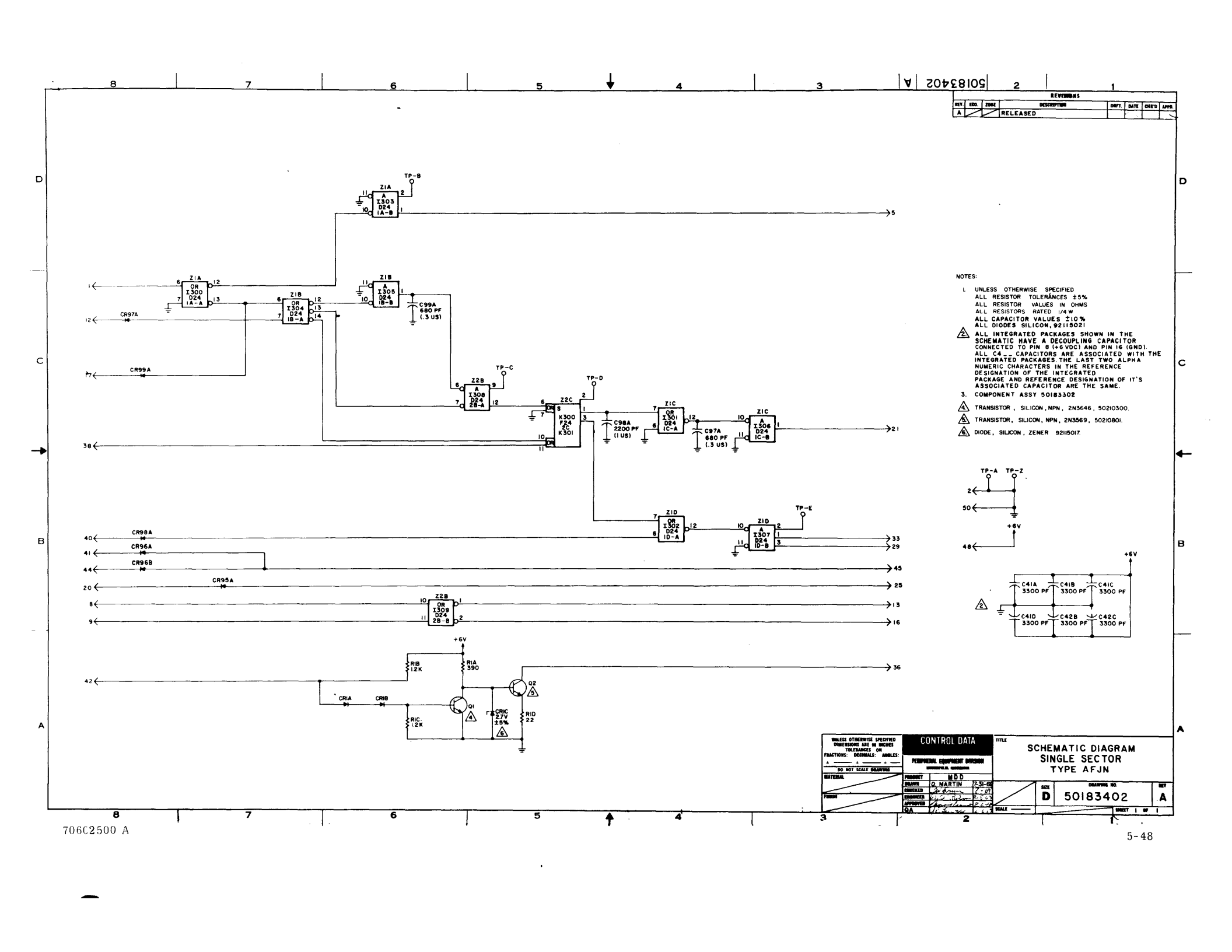
SCALE | SHEET 1 OF 1


REVISIONS
REV | ECO | ZONE | DESCRIPTION | DRFT | DATE | CHK'D | APPD
A | | | RELEASED
NOTES:
1. TRANSISTOR, SILICON, NPN, 2N3646, 50210300.
2. ALL OTHER TRANSISTORS, SILICON, PNP, 2N3640.
3. ALL DIODES, SILICON, 92115021.
4. UNLESS OTHERWISE SPECIFIED ALL CAPACITOR VALUES ±10%.
5. UNLESS OTHERWISE SPECIFIED.
ALL RESISTOR TOLERANCES ±5%
ALL RESISTOR VALUES IN OHMS
ALL RESISTORS RATED 1/4W
6. ALL INTEGRATED PACKAGES SHOWN IN THE SCHEMATIC HAVE A DECOUPLING CAPACITOR CONNECTED TO PIN 8(+6VDC) AND PIN 16(GND). ALL C8__ CAPACITORS ARE ASSOCIATED WITH THE INTEGRATED PACKAGES. THE LAST TWO ALPHA NUMERIC CHARACTERS IN THE REFFERENCE DESIGNATION OF IT'S ASSOCIATED CAPACITOR ARE THE SAME.
7. COMPONENT ASSY 50180500.
CONTROL DATA
PERIPHERAL EQUIPMENT DIVISION
PRODUCT: DUAL CHANNEL RESOR
DRAWN: D. TUTTLE 9-12-68
CHECKED
ENGINEER
APPROVED
QA
TITLE
SCHEMATIC DIAGRAM
SELECT AND RESERVE
TYPE 8FBN
SIZE D
DRAWING NO 50180600
REV A
SCALE
SHEET 1 OF 1
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS: DECIMALS: ANGLES:
DO NOT SCALE DRAWING
MATERIAL
FINISH
50180600 A


50181801
REVISIONS
REV. ECO. ZONE DESCRIPTION DRFT. DATE CHK'D APPD.
A RELEASED
+6V
+20V
RIA 560
RIB 15K
RIC 4.7K
RID 680
RIE 2.2K
RIF 330
RIG 1K
RIH 1.2K
RIJ 2.7K
RIK 2.7K
CIA 1 UF 35 VDC
Q1 Q2 Q3 Q4
CR1A CR1B
TP-C TP-B TP-D TP-E TP-F
C99A 2200 PF (1 US)
C98A .022 UF (10 US)
CR99A CR98A CR97A
CR97B CR98B CR99B
ZIA-A OR I506 D24 1A-A
ZIA-B A I510 D24 1A-B
ZIB OR I509 I48 1B
ZIC-A OR I523 Q22 1C-A
ZIC-B A I500 Q22 1C-B
ZIC-C OR Q22 1C-C (SPARE)
ZIC-D A I524 Q22 1C-D
ZID-A OR I613 D24 1D-A
ZID-B A I600 D24 1D-B
R96A 2.7K
R96B 2.7K
R98A 2.7K
R98B 2.7K
R97A 2.7K
R97B 2.7K
R99A 2.7K
R99B 2.7K
R5A 1.2K
R5B 1K
R5C 100K ±1%
R5D 10
R5E 10K
R5F 47K
R5G 560
R5H 10.0K ±1%
R5J 9.09K ±1%
R5K 220K
R5L 82K
R5M 100
R5N 1K
R5P 4.7K
R5Q 10K
R5R 10K
R5S 3.3K
R5T 3.3K
C5A .47 UF ±5%
C5B 3.3 UF ±20% 15 VDC
CR5A CR5B CR5C CR5D CR5F CR5G
CR6
Q5 Q7 Q8 Q9 Q10 Q11 Q12 Q13
1 2 5 6 7 8 9 10 11 12 13 14 15 16 17 18 20 21 22 24 25 26 28 29 30 32 33 34 36 37 38 40 41 42 44 45
TP-A TP-Z
2 50 48 46
C97A .01UF
C81A 3300PF C81B 3300PF C81C 3300PF C81D 3300PF
NOTES
1. TRANSISTOR, SILICON, NPN, 2N3646, 50210300.
2. TRANSISTOR, SILICON, NPN, 2N3569, 50210801.
3. TRANSISTOR, SILICON, PNP, 2N3640, 50210400.
4. ALL OTHER TRANSISTORS, SILICON, PNP, 2N4250, 50211401.
5. ALL DIODES, SILICON, 9211502I.
6. SILICON CONTROLED RECTIFIER, G.E. TYPE C6F, 93314010.
7. UNLESS OTHERWISE SPECIFIED ALL CAPACITOR VALUES ±10%.
8. UNLESS OTHERWISE SPECIFIED ALL RESISTOR TOLERANCES ±5%. ALL RESISTOR VALUES IN OHMS. ALL RESISTORS RATED 1/4W
9. ALL INTEGRATED PACKAGES SHOWN IN THE SCHEMATIC HAVE A DECOUPLING CAPACITOR CONNECTED TO PIN 8 (+6VDC) AND PIN 16 (GND). ALL C8_ _ CAPACITORS ARE ASSOCIATED WITH THE INTEGRATED PACKAGES. THE LAST TWO ALPHA NUMERIC CHARACTERS IN THE REFERENCE DESIGNATION OF THE INTEGRATED PACKAGE AND THE REFERENCE DESIGNATION OF IT'S ASSOCIATED CAPACITOR ARE THE SAME.
10. COMPONENT ASSY 50181701.
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS: DECIMALS: ANGLES:
DO NOT SCALE DRAWING
MATERIAL
FINISH
CONTROL DATA
PERIPHERAL EQUIPMENT DIVISION
PRODUCT DUAL CHANNEL RESOR
DRAWN J.R. JAMORAL 1-24-69
CHECKED
ENGINEER
APPROVED
QA
TITLE
SCHEMATIC DIAGRAM
SPEED DETECTOR AND MISC.
TYPE AFEN
SIZE D
DRAWING NO. 50181801
REV A
SCALE
SHEET 1 OF 1


50182201 A
REVISIONS
REV. ECO. ZONE DESCRIPTION DRFT. DATE CHK'D APPD.
A RELEASED
NOTES:
1. UNLESS OTHERWISE SPECIFIED
ALL RESISTOR TOLERANCES ±5%
ALL RESISTOR VALUES IN OHMS
ALL RESISTORS RATED 1/4W
ALL CAPACITOR VALUES ±10%
ALL DIODES SILICON, 9211-5021
2. ALL INTEGRATED PACKAGES SHOWN IN THE SCHEMATIC HAVE A DECOUPLING CAPACITOR CONNECTED TO PIN 8 (+6VDC) AND PIN 16 (GND) ALL C8__ CAPACITORS ARE ASSOCIATED WITH THE INTEGRATED PACKAGES. THE LAST TWO ALPHA NUMERIC CHARACTERS IN THE REFERENCE DESIGNATION OF THE INTEGRATED PACKAGE AND THE REFERENCE DESIGNATION OF IT'S ASSOCIATED CAPACITOR ARE THE SAME.
3. COMPONENT ASSY 50182101
TP-B
TP-Y
TP-V
TP-W
TP-X
TP-U
SW-1 SW-2 SW-3 SW-4 SW-5 SW-6 SW-7 SW-8
SW-9 SW-10 SW-11 SW-12 SW-13
Z4B OR 1017 14B 4B
Z4D OR 1014 14B 4D
Z4C-B OR 1012 D24 4C-B
Z4C-A OR 1013 D24 4C-A
Z4A K000 F24 4A K001
Z3A K002 F24 3A K003
Z2A K004 F24 2A K005
Z2B K006 F24 2B K007
Z3B K008 F24 3B K009
Z1E K010 F24 1E K011
Z1B OR 1008 14B 1B
Z1A-A OR 1009 D24 1A-A
Z3D-A OR 1000 D24 3D-A
Z2E-A OR 1019 D24 2E-A
Z2D-B OR 1015 D24 2D-B
Z1A-B OR 1016 D24 1A-B
Z2C-A OR 1011 D24 2C-A
Z2C-B OR 1018 D24 2C-B
Z1B-B OR 1001 D24 1B-B
Z1C-B OR 1006 D24 1C-B
Z1D-A OR 1002 D24 1D-A
Z3C OR 1003 14B 3C
Z2D-A OR 1020 D24 2D-A
Z3D-B OR 1021 D24 3D-B
Z1C-A OR 1007 D24 1C-A
CR10A CR10B CR10C CR10D
CR12A CR12B CR12C CR12D CR12E CR12F
CR97A CR98A CR98B CR99A
R99A 22 K
C99A .1UF 35VDC
C98A .0068 UF (2 US)
C97A .0068 UF (2 US)
C96A .033 UF
C95A .001 UF
C94A .001UF
C93A .0068UF (2US)
C93B .0068UF (2US)
C92A .0068UF (2US)
C92B .0068PF (2US)
C81A 3300 PF
C81B 3300 PF
C81C 3300 PF
C81D 3300 PF
C82A 3300 PF
C82B 3300 PF
C82C 3300 PF
C82D 3300 PF
C82E 3300 PF
C83A 3300 PF
C83B 3300 PF
C83C 3300 PF
C83D 3300 PF
C84A 3300 PF
C84B 3300 PF
C84C 3300 PF
C84D 3300 PF
+6V
CONTROL DATA
PERIPHERAL EQUIPMENT DIVISION
DO NOT SCALE DRAWING
MATERIAL
FINISH
PRODUCT DUAL CHANNEL RESOR
DRAWN AL KURTH 1-20-66
CHECKED
ENGINEER
APPROVED
QA
TITLE
SCHEMATIC DIAGRAM
TESTER CARD
TYPE 8FFN
SIZE D
DRAWING NO 50182201
REV A
SCALE
SHEET 1 OF 1


50182602 A
REVISIONS
REV. ECO. ZONE DESCRIPTION DRFT. DATE CHK'D APPD
A RELEASED
Z1A K620 F24 1A K621
Z1B K616 F24 1B K617
Z1C K618 F24 1C K619
Z1D K610 F24 1D K611
Z1E K612 F24 1E K613
Z2B K614 F24 2B K615
Z2C-A OR 1200 Q22 2C-A
Z2C-C OR I201 Q22 2C-C
Z2C-B OR I612 Q22 2C-B
Z2C-D OR I616 Q22 2C-D
CR97A CR97B CR97C CR97D CR97E CR97F CR99A CR98A CR98B CR96A CR4A CR7A CR10A CR10B CR10C
TP-B TP-C TP-G TP-H TP-J TP-F TP-D TP-E TP-A TP-Z
+6V
R4A 560 R4B 15K R4C 4.7K R4D 680 R4E 2.2K R4F 330 R4G 1K R4H 2.7K R4J 2.7K
C4A 1UF 35VDC
Q4 Q5 Q6
R7A 560 R7B 15K R7C 4.7K R7D 680 R7E 2.2K R7F 330 R7G 1K R7H 2.7K R7J 2.7K
C7A 1UF 35VDC
Q7 Q8 Q9
R2A 1.2K R2B 1.2K R2C 1.2K R2D 390 R2E 10
C2A .01 UF
CR2A CR2B CR2C 2.7V ±5%
Q1 Q2 Q3
R99A 1.2K
R10A 1.2K R10B 1.2K R10C 390 R10D 22
Q10 Q11
C99A 2200PF (1US)
C81A 3300PF C81B 3300PF C81C 3300PF C81D 3300PF C81E 3300PF C82B 3300PF C82C 3300PF
NOTE:
1. TRANSISTOR, SILICON, NPN, 2N3569, 50210801.
2. TRANSISTOR, SILICON, PNP, 2N3640, 50210400.
3. ALL OTHER TRANSISTORS, SILICON, NPN, 2N3646, 50210300.
4. DIODE, SILICON, ZENER, 50240146.
5. ALL OTHER DIODES, SILICON, 9211502I.
6. UNLESS OTHERWISE SPECIFIED: ALL RESISTOR TOLERANCES ±5%. ALL RESISTOR VALUES IN OHMS. ALL RESISTORS RATED 1/4W.
7. UNLESS OTHERWISE SPECIFIED ALL CAPACITOR VALUES ±10%.
8. ALL INTEGRATED PACKAGES SHOWN IN THE SCHEMATIC HAVE A DECOUPLING CAPACITOR CONNECTED TO PIN 8 (+6VDC) AND PIN 16 (GND). ALL C8_ _ CAPACITORS ARE ASSOCIATED WITH THE INTEGRATED PACKAGES. THE LAST TWO ALPHA NUMERIC CHARACTERS IN THE REFERENCE DESIGNATION OF THE INTEGRATED PACKAGE AND THE REFERENCE DESIGNATION OF ITS ASSOCIATED CAPACITOR ARE THE SAME.
9. COMPONENT ASSY 50182502.
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS: DECIMALS: ANGLES: DO NOT SCALE DRAWING
MATERIAL FINISH
CONTROL DATA PERIPHERAL EQUIPMENT DIVISION
PRODUCT DUAL CHANNEL RESOB
DRAWN Ja.JA MORAL 12348
CHECKED ENGINEER APPROVED Q. A.
TITLE SCHEMATIC DIAGRAM FAULT STATUS TYPE BFGN
SIZE D DRAWING NO. 50182602 REV A
SCALE SHEET 1 OF 1


50183402 A
REVISIONS
REV. ECO. ZONE DESCRIPTION DRFT. DATE CHK'D APPD.
A RELEASED
Z1A OR I300 D24 1A-A
Z1A A I303 D24 1A-B
Z1B OR I304 D24 1B-A
Z1B A I305 D24 1B-B
Z2B OR I308 D24 2B-A
Z2C S K300 F24 2C K301
Z1C OR I301 D24 1C-A
Z1C A I306 D24 1C-B
Z1D OR I302 D24 1D-A
Z1D A I307 D24 1D-B
Z2B OR I309 D24 2B-B
TP-A
TP-B
TP-C
TP-D
TP-E
TP-Z
CR97A
CR99A
CR98A
CR96A
CR96B
CR95A
C99A 680 PF (.3 US)
C98A 2200 PF (1 US)
C97A 680 PF (.3 US)
C41A 3300 PF
C41B 3300 PF
C41C 3300 PF
C41D 3300 PF
C42B 3300 PF
C42C 3300 PF
+6V
R1B 1.2K
R1A 390
R1C 1.2K
R1D 22
CR1A
CR1B
CR1C 2.7V ±5%
Q1
Q2
NOTES:
1. UNLESS OTHERWISE SPECIFIED
ALL RESISTOR TOLERANCES ±5%
ALL RESISTOR VALUES IN OHMS
ALL RESISTORS RATED 1/4 W
ALL CAPACITOR VALUES ±10%
ALL DIODES SILICON, 92115021
2. ALL INTEGRATED PACKAGES SHOWN IN THE SCHEMATIC HAVE A DECOUPLING CAPACITOR CONNECTED TO PIN 8 (+6 VDC) AND PIN 16 (GND). ALL C4__ CAPACITORS ARE ASSOCIATED WITH THE INTEGRATED PACKAGES. THE LAST TWO ALPHA NUMERIC CHARACTERS IN THE REFERENCE DESIGNATION OF THE INTEGRATED PACKAGE AND REFERENCE DESIGNATION OF IT'S ASSOCIATED CAPACITOR ARE THE SAME.
3. COMPONENT ASSY 50183302
4 TRANSISTOR, SILICON, NPN, 2N3646, 50210300.
5 TRANSISTOR, SILICON, NPN, 2N3569, 50210801.
6 DIODE, SILICON, ZENER 92115017.
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS: DECIMALS: ANGLES:
DO NOT SCALE DRAWING
MATERIAL
FINISH
CONTROL DATA
PERIPHERAL EQUIPMENT DIVISION
PRODUCT MDD
DRAWN Q. MARTIN 2-21-68
CHECKED
ENGINEER
APPROVED
QA
TITLE
SCHEMATIC DIAGRAM
SINGLE SECTOR
TYPE AFJN
SIZE D
DRAWING NO. 50183402
REV A
SCALE
SHEET 1 OF 1