
**CONTROL DATA®
DISK STORAGE UNIT
BR3C2**

**INSTALLATION AND CHECKOUT
PREVENTIVE MAINTENANCE
DIAGRAMS
WIRE LISTS**

Volume 1 of 2

HARDWARE MAINTENANCE MANUAL

LIST OF EFFECTIVE PAGES

Sheet 1 of 2

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PREFACE

This manual has been prepared for customer engineers and other technical personnel directly involved with maintaining the disk storage unit (drive).

Maintenance information is provided by five sections in this manual. Section numbers and a brief description of their contents are listed below.

Section 1 - Installation and Checkout. Provides information on preparing the drive for initial use: unpacking, power/signal cabling, and initial checkout.

Section 2 - Preventive Maintenance. Provides detailed procedures on maintaining the equipment.

Section 3 - Corrective Maintenance. Provides check/adjustment and replacement information for various components and assemblies in the device.

Section 4 - Diagrams. Contains logic diagrams and assembly schematics.

Section 5 - Wire Lists. Provides documentation on wiring for logic and mechanical assemblies.

Manuals applicable to the BR3C2 Disk Storage Unit are as follows:

<u>Publication No.</u>	<u>Title</u>
83306800	Reference
83306700	Maintenance
83306900	Parts Data
70629100	Logic Cards

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SECTION 1
INSTALLATION AND CHECKOUT

UNCRATING

CAUTION

As a cabinet is uncrated, use tools carefully to prevent damage to any 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 material may be re-used if reasonable care is used while uncrating.

Uncrate the drive as follows:

WARNING

Use care while cutting steel straps as they may whip when cut.

1. On air-shipped units, cut two vertical straps securing unit to skid.
2. Remove external packing material.
3. Remove polyethylene dust cover.
4. Remove cushioning material from pack cover glass.
5. Remove logic chassis-to-frame bolts and clamps.
6. Open logic chassis.
7. Remove front panel, then side panels (disconnect ground wire for each panel).
8. Remove drive motor stabilizers (two metal straps fastened to the drive motor with a hose clamp, and to the frame with bolts).
9. Remove leveling pads. They may be inside cable box (separate parcel) or inside bag taped to top of AC power supply. The pads will be installed later.
10. If unit is air shipped, use Rol-a-Lifts (or equivalent) to remove unit from skid.
11. Install leveling pads as follows:
 - a. Remove floor panel and roll cabinet so that one corner hangs over opening in floor.
 - b. Working from opening, install leveling pad in bottom of unit and screw it in until pad clears floor.
 - c. Repeat steps a and b for remaining pads.
12. Remove tape holding pack cover latch.

NOTE

The pack cover is locked by a manually operated latch. Open pack cover (with power removed from drive) by grasping and pulling latch up until latch clears catch, raise cover and release latch.

13. Release front cover latch (figure 1-1).
14. Open top cover from rear. Deck is held stationary (for shipping purposes only) by two bolts and washers at rear of deck and one bolt at front of deck. These bolts are identified by plastic plugs and caution labels. Remove plugs. Remove and discard bolts and washers. Replace plugs.
15. Remove tape and lacing securing following items:
 - a. Read/Write logic cards on deck.
 - b. Actuator (cord holds it retracted).
16. Thoroughly vacuum-clean unit.

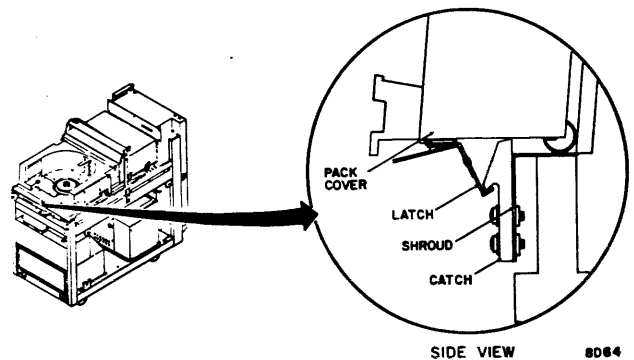


Figure 1-1. Pack Cover Latch

17. Remove logic chassis back panel cover.
Inspect cable plugs on wire wrap pins that they are securely seated on pins.
18. Replace skins and reconnect their ground straps.

INSTALLATION REQUIREMENTS

Site space and environmental requirements are listed in table 1-1.

TABLE 1-1. INSTALLATION SPECIFICATIONS

PHYSICAL (Approximate)				
<u>Size</u>	<u>Uncrated</u>	<u>Crated (Van)</u>		<u>Crated (Air)</u>
Height	39.5 in.	42 in.		46 in.
Width	22 in.	27 in.		27 in.
Depth	44.5 in.	48 in.		48 in.
Volume	---	31.5 ft ³		34.5 ft ³
Weight	660 lb.	700 lb.		740 lb.
ENVIRONMENT: Refer to BR3C2A/B Disk Storage Unit Pub. No. 83306800				
POWER				
<u>Consumption</u>	<u>Standby</u>		<u>Accessing</u>	
	50 Hz	60 Hz	50 Hz	60 Hz
Amps/Phase	2.5	2.0	9.5	8.0
True Power (KW)	0.5	0.4	1.3	1.2
Power Factor	0.9	0.9	0.6	0.7
BTU/Hour	1,750	1,400	4,500	4,200
Starting Current (Approximate and Non-Linear)				
<u>Time</u>	<u>180V</u>	<u>208V</u>	<u>225V</u>	<u>245V</u>
0-6 sec.	30	38	40	43
6-8 sec.	30	38	25	29
8-10 sec.	30	24	18	10
10-12 sec.	30	18	10	
12-14 sec.	22	11	8	
14-16 sec.	12	11		
Power Connector				
<u>Description</u>	<u>Connector</u>		<u>Mating Receptacle</u>	
60 Hz, 5 wire, 20 amp	CDC 24515100		CDC 24515200	
208 vac, 3-phase	Hubble 2521		Hubble 3523	
50 Hz, 5 pole, 30 amp	CDC 17634301*		CDC 17810701*	
	CDC 17634303**		CDC 17810703**	
380 vac, 3-phase	Hubble 45115		Hubble 45135	
NOTES: * S/C 11 & Below ** S/C 12 & Above				

Figure 1-2 illustrates recommended clearances required for maintenance.

LEVELING AND ALIGNING

1. Roll cabinet to designated location. Position it so that I/O panel (Figure 1-2) is over floor cutout.
2. Turn down leveling pads until casters are completely off of floor.
3. Place spirit level on main deck so ends of level point to front and rear of deck.
4. Adjust leveling pads until surface is horizontal within three angular degrees.
5. Place spirit level on main deck so ends of level point toward sides.
6. Adjust leveling pads until surface is horizontal within three angular degrees.
7. Repeat procedure until main deck is horizontal within three angular degrees regardless of spirit level orientation.

POWER WIRING

SITE ELECTRICAL REQUIREMENTS

General Requirements

Drive power requirements are listed in the Publication Number 83306800.

Power System Grounding Requirements

The site ac power system must have provisions for correct equipment safety grounding. All of the following conditions must be met:

1. The branch circuit supplying ac power to the drive must have safety ground provisions. Therefore, this circuit must include an insulated grounding conductor that is identical to the grounded and ungrounded branch circuit conductors. The insulated grounding conductor shall show either a green color or green with a yellow strip.
2. The grounding conductor specified in step 1 is to be grounded at the service equipment.
3. All power receptacles (including convenience outlets for oscilloscopes and other test equipment) must be at a common ground potential to prevent shock hazards if two equipments are touched simultaneously. Therefore, all attachment-plug receptacles in the vicinity of the drive are to be of the grounding type; furthermore, the grounding conductors serving these receptacles are to be connected to the same grounding conductor that serves the drive.

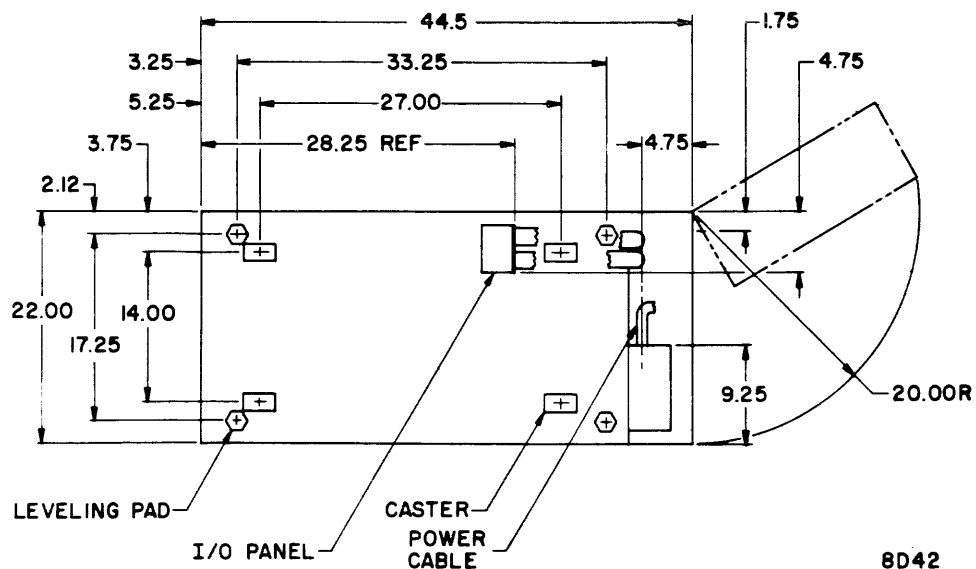


Figure 1-2. Space Requirements

SYSTEM GROUNDING

The controller and its attached drives must be connected to earth ground. The permissible grounding schemes, listed in preferred order, are:

1. Controller and drives connected to qualified site floor ground. A qualified ground would be a floor grid where the horizontal and vertical members of the grid are mechanically secure and have ground straps or their equivalent joining them to assure a constant ground potential. In turn, the grid must be connected to earth ground. An alternate qualified floor ground is a grounding grid or grounding bus system provided under the false floor.
2. Controller and drives connected to otherwise qualified floor grid, except that floor grid is isolated from earth ground. In this case, controller is then connected to earth ground to ground the system.
3. No site floor grid available: controller and drives connected to each other in a daisy chain configuration. Controller connected to earth ground.

Floor Grid Available

If a floor grid is available (schemes 1 or 2), each drive is to be individually connected to the floor grid. Ground each drive as follows:

1. Open logic chassis.
2. Grounding block is mounted at the bottom end of unit, next to I/O panel. Route braided strap with free end into floor cut-out.
3. Drill 11/32-inch hole in grid.
4. Secure strap lug to grid using screw (P/N 17901524) and lock washer (P/N 10126403). Lock washer goes under terminal lug.

Floor Grid Not Available

If a floor grid is not available, all of the drives must be connected to the controller in a daisy chain grounding configuration. In turn, the controller must be connected to earth ground.

The ground connections are via flat braided shielding (P/N 24534811). Cut this shielding to the lengths required to go from drive to drive, drive to controller, and controller to earth ground. Crimp and solder a terminal lug (P/N 40125601) to the end of each strap.

Earth ground at the site may be available at the main power distribution panel (if it is connected to building ground), at the steel plate in contact with the masonry below the panel (if the panel is not connected to earth ground), or to an earth ground bus. Connect one end of a prepared ground strap to the available ground.

Connect remainder of grounds as follows:

1. Open logic chassis.
2. Grounding block is mounted at the bottom end of unit, next to I/O panel. Loosen grounding block screw that secures 3-foot length of ground strap (other end of this strap is not connected). Remove ground strap.
3. Attach two ground straps to this screw. One strap will go to each of the two closest drives. Tighten screws.
4. Repeat step 3 for remaining drives. Drive closest to controller is to be connected to controller ground.
5. Connect controller to earth ground.

AC POWER CONNECTIONS

Each drive receives its ac power via a 6-foot cable. This cable originates from terminal board A1TB1 in the UNIT POWER circuit breaker box located in the rear of the cabinet and below the logic chassis.

Although each drive receives three-phase input power at A1TB1, only one phase is used per drive. All motors are single-phase, connected phase-to-phase.

In order to balance the power line load, phases are rotated from drive-to-drive. The first drive is connected between phase A and B, the second between phase B and C with the third between phase C and A. Therefore, each group of three drives presents a balanced load while operating.

The input power is available at terminal board A1TB1. This terminal board is located next to the UNIT POWER circuit breaker; it is accessible by removing the screws securing the power distribution box cover. Phasing is controlled by connecting wires between A1TB1 and the UNIT POWER circuit breaker. Phase assignments are as follows:

<u>Phase</u>	<u>A1TB1</u>
A (or X)	1
B (or Z)	2
C (or Y)	3
Neutral (or W)	4

The green wire is safety ground. It is not to be used as neutral as it is a non-current-carrying ground. This wire connects to a lug inside the drive. Make sure that this is a secure connection.

Connect power as follows:



Make certain that plug is not connected to ac power. Power at A1TB1 and at UNIT POWER circuit breaker is unswitched.

1. Remove power distribution box cover.
2. Verify color of wires entering A1TB1 are as follows:

<u>Color</u>	<u>A1TB1</u>
Black	1
Red	2
Orange	3
White	4

3. Observe two yellow wires leading from terminals A1 and B1 of UNIT POWER circuit breaker. These wires are normally connected to A1TB1-1 and -2 when the unit is shipped. These wires will be repositioned, as necessary, to rotate phases.

4. On 60-Hz units, connect one yellow lead to A1TB1-1. Connect other yellow lead as follows (repeat for each group of three drives):

<u>Drive</u>	<u>A1TB1 Terminals</u>
First	1
Second	2
Third	3

SIGNAL CABLING

I/O CABLES

Each drive communicates with a controller by means of two interconnecting cables. The cables are illustrated in Figure 1-3. Signal functions are listed in Table 1-2. Cable accessories are listed in Table 1-3.

The I/O connectors are located on a panel under the logic chassis. There are two I/O plugs provided: one for each cable.

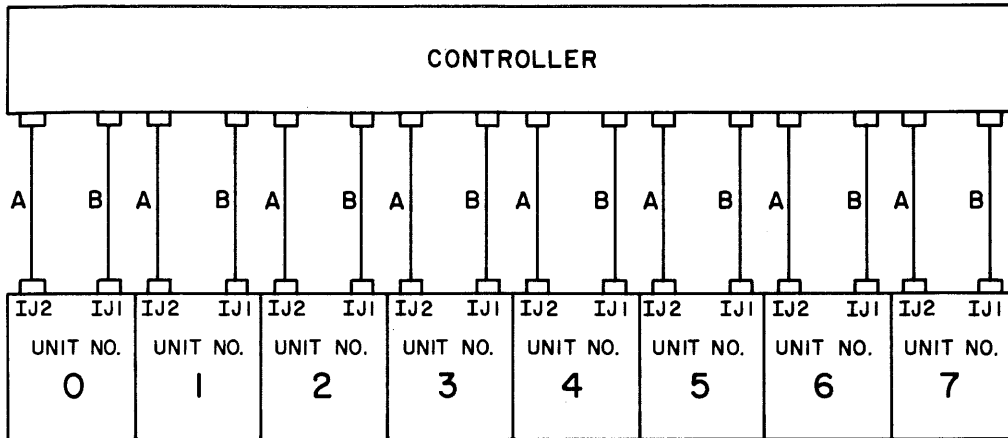
Cabinet Intercabling

Inspect the cabling in the cabinet for agreement with Figure 1-4.

INITIAL CHECKOUT AND STARTUP

This procedure assumes that all of the preceding procedures have been completed. Before performing this procedure, become familiar with the safety precautions and maintenance preliminary conditions specified in Section 3. Proceed as follows:

1. Inspect read/write heads and track servo head as specified in Preventive Maintenance portion of Section 2.



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Figure 1-3. System Cabling

TABLE 1-2. INPUT/OUTPUT CONNECTOR PIN ASSIGNMENT

Cable A (IJ2, IJ2)		Cable A (IJ2, IJ2)	
<u>Pins</u>	<u>Function</u>	<u>Pins</u>	<u>Function</u>
1-4	Output Bus Line Status Bit 0	41-44	Open Cable Detector ✓
2-5	Output Bus Line Status Bit 1	42-45	Spare
3-7	Output Bus Line Status Bit 2	46-49	Cylinder Select ✓
8-12	Output Bus Line Status Bit 3	47-50 Sector Select	
10-13	Output Bus Line Status Bit 4	48-51	Head Select ✓
11-14	Output Bus Line Status Bit 5	52-55	Control Select ✓
15-18	Output Bus Line Status Bit 6	53-56	Read Cylinder Status
16-20	Output Bus Line Status Bit 7	54-57	Spare
17-21	Output Bus Line Status Bit 8	58-62	Spare
22-25	Fault	59-63	Read Sector
23-26	Input Bus Line Bit 0	60-64	Spare
24-27	Input Bus Line Bit 1	65-70	Spare
28-31	Input Bus Line Bit 2	66-71	Spare
29-32	Input Bus Line Bit 3	67-72	Read Fault Status
30-33	Input Bus Line Bit 4	73-76	Read Control Status
34-37	Input Bus Line Bit 5	74-77	Head Advance
35-38	Input Bus Line Bit 6	75-78	Seek Error
36-39	Input Bus Line Bit 7		
40-43	Input Bus Line Bit 8		

TABLE 1-2. INPUT/OUTPUT CONNECTOR PIN ASSIGNMENT (Cont'd)

Cable B (J1)		Cable B (J1)	
Pins	Function	Pins	Function
A-C	Unit Ready ✓	d-f	Clear Fault ✓
B-D	Unit Busy ✓	h	Power Sequence 0 (Seq Pwr Out) ✓
E-H	Unit Selected and Reserved ✓	j	Power Sequence 1 (Pick In) ✓
F-J	On Line ✓	k	Power Sequence 2 (Hold In) ✓
K	Read Data (Coaxial) ✓	m	Power Sequence 3 (Hold Out) ✓
L	Read Clock (Coaxial) ✓	n	Power Sequence 4 (Pick Out) ✓
M	Servo Clock (Coaxial) ✓	p	Power Sequence 5 (Seq Pwr In) ✓
N	Write Data (Coaxial) ✓	r	Shield (Seq Lines)
P-S	Logic Plug (Bit 0)	t-v	Open Cable Detector
R-T	Logic Plug (Bit 1)	u-w	Sector Pulses
U-W	Logic Plug (Bit 2)	x-y	Spare
V-X	Logic Plug (Bit 3)	z-AA	Address Mark
Y-a	Unit Select	BB-DD	On Cylinder
Z-b	Release	CC-EE	Spare
c-e	Clear		

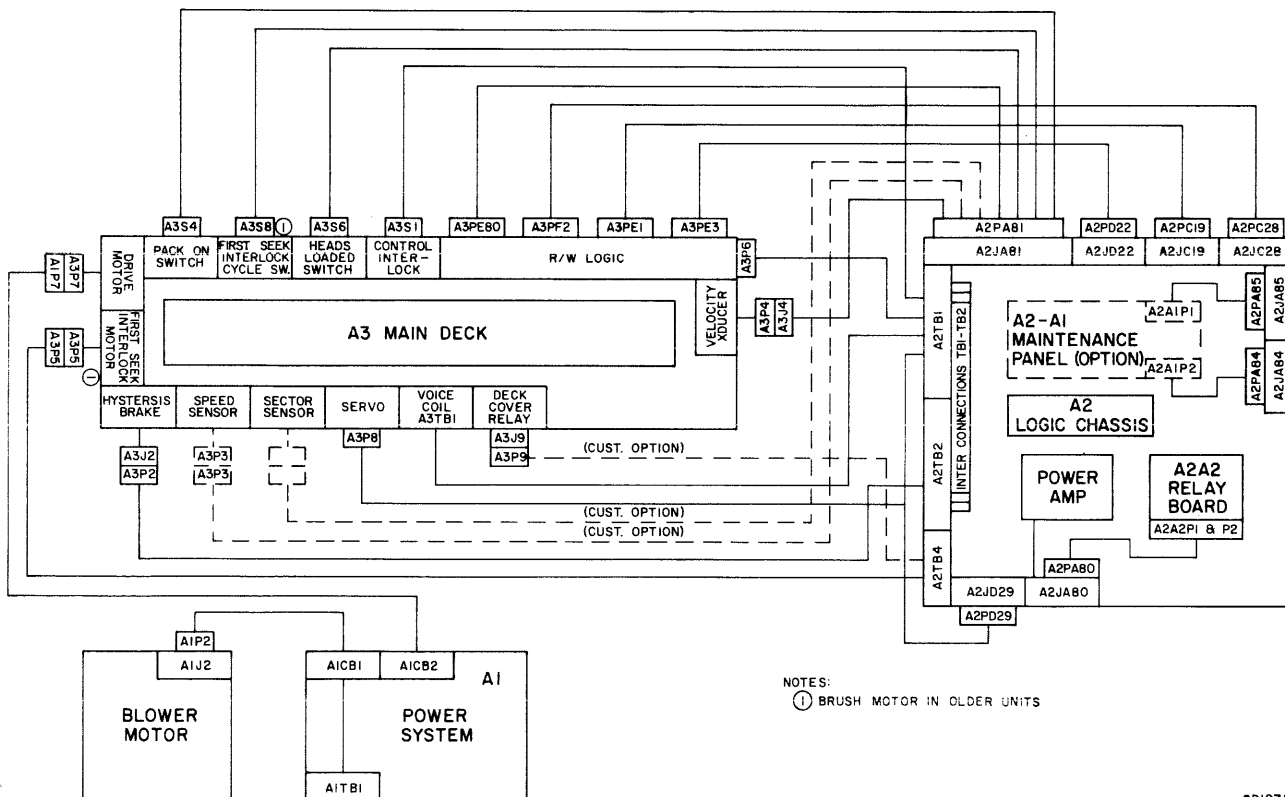
Handwritten notes: A circle is drawn around pins P-S, R-T, U-W, and V-X. Another circle is drawn around pins h, j, k, m, n, and p. An arrow points from the right side of the table towards the circled pins, with the text "NEXT DRIVE" written next to it.

TABLE 1-3. ACCESSORIES

Part	Description	Part Number	
<u>"A" Cable</u>	15 ft	40020507	
	20	40020508	
	25	40020501	
	30	40020509	
	40	40020510	
	50	40020502	
	60	40020511	
	70	40020512	
	<u>"B" Cable</u>	15 ft	73589400
		20	73589401
		25	73589402
		30	73589403
35		73589404	
40		73589405	
50		73589407	

TABLE 1-3. ACCESSORIES (Cont'd)

Part	Description	Part Number
"B" Cable (Cont'd)	55 ft	73589408
	60	73589409
	65	73589410
	70	73589411
Lettered Lens	0	93562055
	1	93562056
	2	93562057
	3	93562058
	4	93562059
	5	93562060
	6	93562061
	7	93562137



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Figure 1-4. Cabinet Intracabling

CAUTION

Bearing damage can occur if alcohol runs into spindle.

2. Wipe spindle clean with media cleaning solution dampened gauze.
3. Using vacuum cleaner, remove dust or dirt from interior of shroud and cabinet.
4. Check that logic cards next to actuator assembly are firmly seated.
5. Open cabinet rear door. Verify that all logic chassis cards are firmly seated in their connectors.
6. Set UNIT POWER circuit breaker to OFF.
7. Turn off all power supply circuit breakers.
8. Verify that drive is connected to external power source and that external circuit breaker (if any) is on.
9. Set DRIVE MOTOR and BLOWER MOTOR circuit breakers to ON.
10. Turn on UNIT POWER circuit breaker. Blower motor shall start.
11. Set LOCAL/REMOTE switch on power supply to LOCAL. If START switch indicator is lighted, press switch to extinguish indicator.
12. Position maintenance panel switches as follows:

ON LINE/OFF LINE/WRITE DISABLE switch to OFF LINE

CARRIAGE OFFSET switch to NORMAL

DATA WINDOW switch to NORMAL
13. Turn on all remaining power supply circuit breakers. Verify that all control panel lights are off, except MAINT is on.
14. Install clear scratch pack as directed in section 2.
15. Open top cover from rear.
16. Remove one of the voice coil wires. This will prevent the heads from loading.
17. Press the START switch. Observe the following:
 - a. Start indicator lights.
 - b. Spindle motor lights.
 - c. Brushes sweep disk surface and stop (approximately 5 seconds).

Purge unit in this mode for one minute.
18. Stop unit and replace voice coil wire.
19. Press START switch. Observe the following:
 - a. START indicator lights.
 - b. Spindle motor starts.
 - c. In older unit containing the brush motor assembly, brushes sweep disk surface (approximately 5 seconds); brush motor continues to operate. In later units containing the first seek interlock assembly, the first delay begins.
20. In older units containing the brush motor assembly, when brush cycle is complete (approximately 20 seconds), heads will load to cylinder 000. In later units containing the first seek interlock assembly when the first seek delay times out (approximately) 15 seconds, head will load to cylinder 000. Verify that the Unit Number indicator on control panel lights.
21. Perform Head/Arm Alignment, per section 3 of this manual. If necessary perform Head/Arm Adjustment.

NOTE

Sequence power is now available to all drives with higher Unit Number indicator designations. For example, if unit 2 is set to LOCAL, any of the units 3 through 7 with pack installed and START switch on will also power up.

22. Set ON LINE/OFF LINE/WRITE DISABLE switch to ON LINE.
23. Perform required controller/system checks.

tion the brake belt tension must be readjusted. Record the hour meter reading (the reading at time of installation) and the fact that the tension readjustment is necessary, in the machine/site log.

BRAKE BELT (V-BELT) TENSION ADJUSTMENT S/C II & BELOW

Approximately 150 hours after drive installa-

SECTION 2

PREVENTIVE MAINTENANCE

PREVENTIVE MAINTENANCE

INTRODUCTION

Performance of the drive is dependent on the proper and timely execution of a preventive maintenance routine. Such a routine is provided by the Preventive Maintenance Index (table 2-1).

The index consists of five levels based on a calendar period or hours of operation (whichever comes first). The power supply elapsed time meter keeps a cumulative record of hours of operation. Perform preventive maintenance in accordance with the indication of this meter. The Procedure column (table 2-1) lists the title of the paragraph containing the required instructions.

The following levels of scheduled preventive maintenance are required:

- Level 1 - Weekly or 150 hours (no preventive maintenance scheduled)
- Level 2 - Monthly or 500 hours (no preventive maintenance scheduled)
- Level 3 - Quarterly or 1,500 hours
- Level 4 - Semiannually or 3,000 hours

Level 5 - Annually or 6,000 hours (no preventive maintenance scheduled)

Level 6 - Biennially or 9,000 hours

MAINTENANCE MATERIALS

The materials used in the procedures of this section are listed below:

Material	Source
Filter Coat	CDC®*12210958
Gauze, Lint-Free	CDC 12209713
Lubricant Paste	CDC 95016101
Media Cleaning Solution	CDC 95033502
Plastic Spatulas (or wooden tongue depressor)	Commercially available
Tape, Adhesive	Commercially available

*CDC® is a registered trademark of Control Data Corporation.

LEVEL 3 MAINTENANCE PROCEDURES

Inspect Actuator Assembly

1. Raise cabinet top cover.
2. Remove deck cover.
3. Inspect entire actuator for presence

TABLE 2-1. PREVENTIVE MAINTENANCE INDEX

Level	Estimated Time (Minutes)	Preventive Maintenance
3	2	Inspect actuator assembly
3	1	Clean pack cover glass
3	5	Clean primary filter*
3	2	Check power supply outputs
3	10	Inspect servo & read/write heads
4	1	Clean shroud and spindle
4	2	Clean and lubricate lockshaft
4	5	Clean carriage rails and bearings
4	5	Clean pack on switch contacts
6	20	Replace absolute filter*

*Intervals are maximum times. Preventive maintenance may be required more frequently depending on dust contamination level of operating area.

of dust and other foreign materials. Pay particular attention to following areas:

- a. Circular cutout in face of magnet assembly (receives voice coil).
 - b. Rail surfaces (particularly horizontal surfaces) of carriage track on which carriage and bearing assembly travels.
4. Use lint-free gauze dampened with media cleaning solution (not soaked) to remove deposits or attracted particles. Refer to Clean Carriage Rails and Bearings procedure.

Clean Front Cover Glass

Use a lint-free gauze dampened (not soaked) with media cleaning solution to remove smudges and deposits from the glass in the pack cover.

Clean Primary Filter

1. Remove air filter from bottom of blower

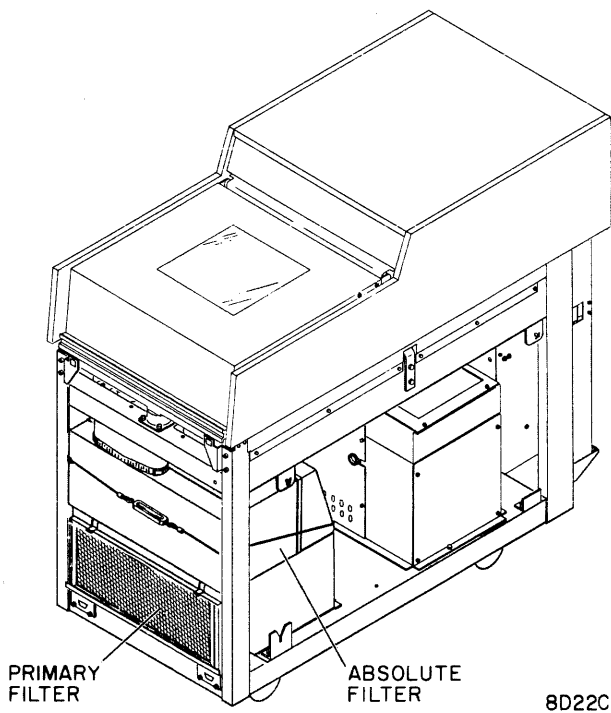


Figure 2-1. Cabinet Filters

assembly at front of cabinet (figure 2-1) by pushing bottom of filter inward and lifting upward to that bottom edge clears retaining trough. Pull bottom of filter towards you and out of top trough.

2. Agitate filter in mild detergent solution. Rinse in reverse direction with a low-pressure nozzle.
3. Shake any excess water from filters and allow filters to dry before proceeding.
4. Spray filters thoroughly with Filter Coat and install in unit.

Check Power Supply Outputs

1. Open cabinet rear door.
2. Start spindle motor and allow read/write heads to load.
3. Command a 32-track repeat seek (32 tracks forward and 32 tracks reverse continuously) starting at track 0.
4. Use an AC/DC volt/ohmmeter to measure output voltages at corresponding test jacks on logic chassis test point panel.

NOTE

5 volt regulators are equipped with an over-voltage crowbar protection SCR. This circuit trips the circuit breaker if more than 7 volts is applied to the logic. (Refer to Over Voltage Protection Check in Corrective Maintenance.)

- a. Measure +5v. Does meter read +5.00 (± 0.05) volts?
 - no 1. Release inner surface of read door. Adjust potentiometer shaft on edge of +5v regulator card.
 - yes
 - b. Measure -5v. Does meter read -5.00 (± 0.05) volts?
 - no 1. Adjust potentiometer shaft on edge of -5v regulator card.
 - yes
- Procedure completed.

LEVEL 4 MAINTENANCE PROCEDURES

Clean Shroud And Spindle

1. Stop spindle motor.
2. Open pack cover.

CAUTION

Keep any disk pack at least three inches away from any part of the magnet assembly.

3. Remove disk pack.
4. Clean shroud with a lint-free gauze that is slightly dampened with media cleaning solution. Wipe shroud to remove all dirt and smudges. Thoroughly wipe spindle surface.
5. After cleaning shroud, use a wad of adhesive type tape and pick up any particles that were not picked up with gauze. Make certain that all particles are removed from interior of shroud.

Clean And Lubricate Lockshaft

1. Stop spindle motor.
2. Open pack cover.
3. Remove disk pack.

4. Use lint-free gauze and a brush or sharp instrument to clean lockshaft threads on top end of spindle.
5. Apply a thin coat of Lubricant paste to threads.

Clean Carriage Rails And Bearings

1. Turn off UNIT POWER circuit breaker.
2. Remove disk pack.
3. Open top cover and remove deck cover.
4. Clean rails and bearing surfaces (Figure 2-2) with lint-free gauze that is slightly dampened with media cleaning solution. It is necessary to manually move carriage to gain access to all surfaces. Install head cam tool per Head Cam Tool Installation procedure.
5. Wipe rails and bearing surfaces with dry gauze.
6. Check for cleanliness by manually moving carriage through operating range. If any slight resistance to free rolling is encountered, repeat steps 4 and 5.

Clean Pack On Switch Contacts

1. Stop spindle motor.
2. Remove disk pack.
3. Open cabinet front door and set **UNIT POWER** circuit breaker to **OFF**.
4. Remove cabinet front panel.
5. Clean pack on switch contacts with a lint-free gauze that is slightly dampened with media cleaning solution.

LEVEL 6 MAINTENANCE PROCEDURES

Replace Absolute Filter

1. Stop spindle motor.
2. Remove disk pack.
3. Set **UNIT POWER** circuit breaker to **OFF**.
4. Remove cabinet front panel.
5. Refer to **Clean Blower Assembly Primary Filter** procedure and remove and clean primary filter (do not install primary filter until instructed to).
6. Open air supply as follows:
 - a. If unit has metal air supply, remove four nuts from four tie bolts holding air plenum and absolute filter together. Remove tie bolts.
 - b. If unit has plastic air supply, loosen turnbuckle and lower cable holding air plenum and absolute filter together.
7. Swing air plenum up and **remove absolute filter**.
8. Install replacement **absolute filter and air plenum**.

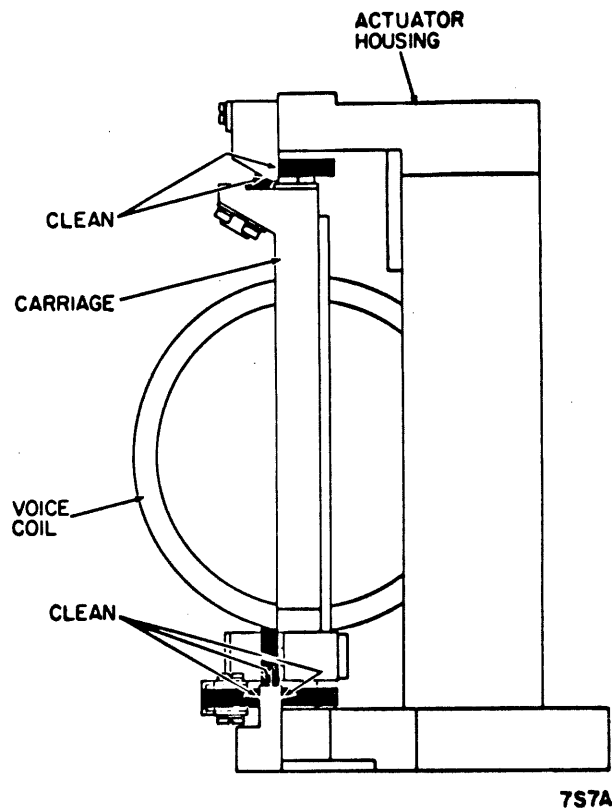


Figure 2-2. Carriage Rails and Bearings

9. Secure filter and plenum as follows:
 - a. If unit has metal air supply, secure with four nuts and four tie bolts.
 - b. If unit has plastic air supply, place cable around air plenum and tighten turnbuckle.
10. Install primary filter.
11. Install cabinet front panel.
12. Set **UNIT POWER** circuit breaker to **ON**. Allow blower to purge unit for two minutes. Set **UNIT POWER** circuit breaker to **OFF**.

SECTION 3

CORRECTIVE MAINTENANCE

SCOPE

This section contains the instructions for drive maintenance. The information is provided in the form of Electrical Checks and Adjustments, and Mechanical Corrective Maintenance.

SAFETY PRECAUTIONS

Observe the following safety precautions at all times. Failure to do so may cause equipment damage and/or personal injury.

1. Use care while working with power system. Line ac voltages are present at A1TB1 (below UNIT POWER circuit breaker) and inside power supply.
2. Keep hands away from positioner during seek operations or when reconnecting leads to voice coil. (Under certain conditions, emergency retract voltage may be present, causing sudden reverse motion and head unloading.)
3. Use caution while working near heads. If heads are touched, fingerprints can damage them. Clean heads immediately if they are touched.
4. Keep front cover closed unless it must be open for maintenance. This prevents entrance of dust into pack area.
5. Keep all watches, disk packs, meters, and other test equipment at least two feet away from an unshielded voice coil magnet.
6. Do not use customer disk pack. Otherwise, customer data may be destroyed.
7. Do not use CE alignment disk pack unless specifically directed. These packs contain prerecorded alignment data that can be destroyed if the procedure requires the drive to write. These alignment tracks cannot be generated in the field.

8. Do not initiate brush cycle while disk pack is rotating. Doing so will melt pack cleaning brushes, contaminating pack and heads. If unit is powered down, wait until pack rotation completely stops before restarting.

MAINTENANCE PRELIMINARY CONDITIONS

INTERLOCKS

Three safety interlock switches are connected in series to inhibit the Start switch (Figure 3-1). This prevents the DSU from doing a First Seek before all conditions are met. These interlock switches are:

1. Pack-On switch. This switch closes when a disk pack is in place and tightened on the drive spindle.
2. Pack Access Cover switch. This switch closes when the pack access door is closed.

If any of the above interlock switches are opened while the drive is running, the heads will unload and retract. And the spindle drive motor will stop.

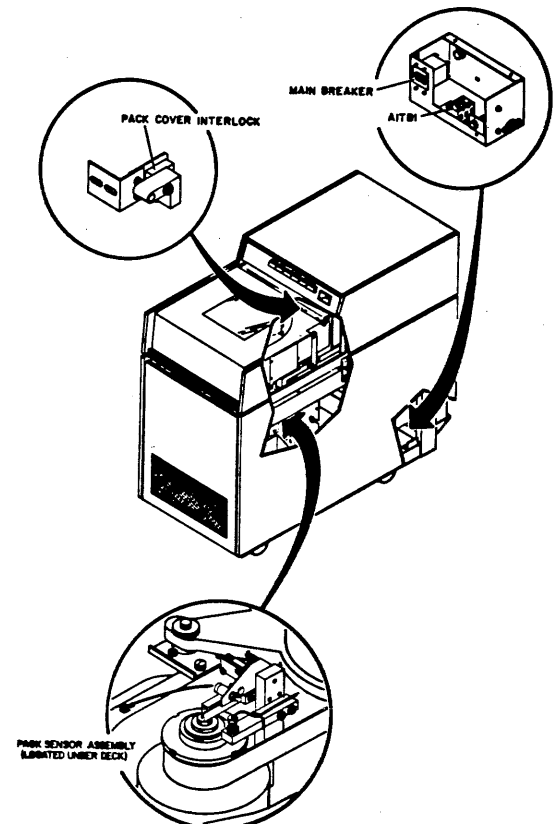


Figure 3-1. Drive Interlocks

OFFLINE OPERATIONS

Certain procedures require execution of operational commands (seek, read, etc.). These commands may be derived by means of an OFF LINE tester (refer to Publication Number 70629500 for OFF LINE Tester functions).

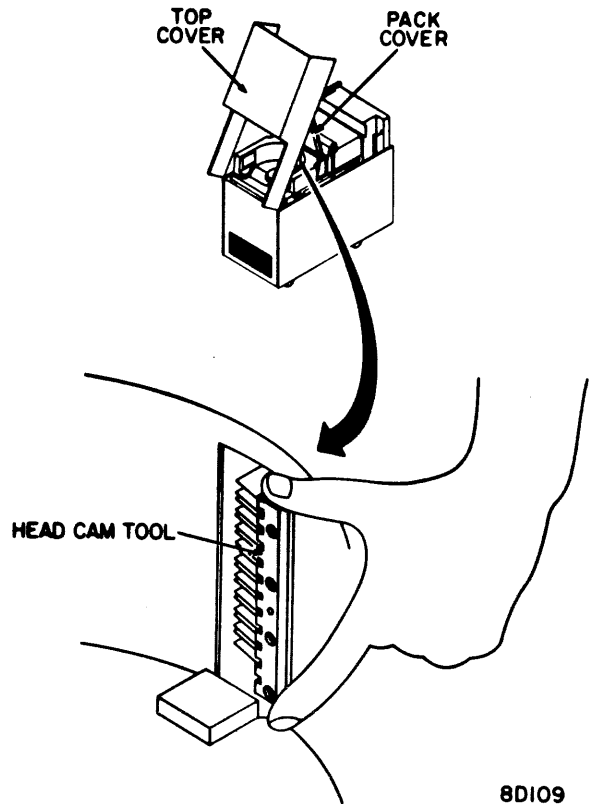
Manual operation of the positioner is possible if the yellow lead is disconnected from the voice coil. Observe the following safety precautions during manual operation:

1. Before moving carriage to load heads (with disk pack removed from spindle) install head cam tool per Head Cam Tool Installation procedure.
2. Before turning off power, or if power to spindle motor is lost, immediately retract carriage. Otherwise heads will crash when disk speed is insufficient to permit heads to fly.
3. Before reconnecting yellow lead, make sure fingers are clear of positioner. Rapid positioner movement will occur if difference counter contains a value other than 511 or if an emergency retract condition exists.

MANUALLY POSITIONING CARRIAGE

Manually positioning the carriage (with power off and disk pack removed) requires installation of the head cam tool.

1. Open pack cover and remove disk pack.
2. Close pack cover.
3. Open top cover and remove deck cover.
4. Open pack cover.
5. Remove voice coil yellow leadwire.
6. Position head cam tool against head cam mounted on actuator (Figure 3-2) using one hand.



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Figure 3-2. Head Cam Tool Installation

7. With other hand, move carriage forward until head/arm assemblies enter and begin to grasp tips of head cam tool, while moving tool along with forward movement of head/arm assemblies. When head/arm assembly securely holds head cam tool, release tool. Carriage is now free to move without damaging R/W heads.
8. To remove head cam tool, grasp head cam tool and retract carriage until head/arm assemblies release tool. Remove tool.
9. Connect voice coil yellow leadwire.
10. Install deck cover.
11. Close pack and top covers.

MAINTENANCE TOOLS AND MATERIALS

The tools, test equipment, and materials recommended for drive maintenance are listed in Table 3-1.

TABLE 3-1. MAINTENANCE TOOLS AND MATERIALS

Description	Part Number
Actuator Stop Adjustment Tool X	CDC TM 87008000*
Adapter (3/16 Hex to 1/4 Sq) ?	CDC 12262582
Ball Ended Hex Driver (3/16 Hex) X	CDC 12263201
Belt Tension Gauge X	CDC 87390400
Card Extender (Half-Size) } 20 20	CDC 54099700
Card Extender (Full-Size) }	CDC 54109700
Card Extraction Tool X	CDC 87399200
Carriage Alignment Arm } MFG	CDC 87007900
Carriage Alignment Ring } REG'D	CDC 87389800
CE Disk Pack <i>DIS.</i>	CDC 89280400
Chip Extender-Chip Cliplog ✓	CDC 12212196
Grease Dielectric ✓	CDC 95533600
Head Adjustment Tool ✓	CDC 75009100
Head Alignment Card (BSFV) ✓ <i>DIS.</i>	CDC 54226502
Head Cam Tool X	CDC 75081800
Head Installation and Removal Tool X	CDC 73678500
Hex Key, 1/8 in. (Disk Cleaner Removal Tool)	CDC 73228100
Lever Force Gage, 5-15 grams X	CDC 94363200
Lever Force Gage, 20-100 grams X	CDC 94363201
Loctite, Grade C ✓	Loctite Corporation
Loctite, Primer, Grade N ✓	Loctite Corporation
Media Cleaning Solution ✓	CDC 95033502
Mini-Voltmeter (Null Meter) ✓	CDC 73576400
Nutdriver, Hollow Stem ✓	Excelite #6
Off Line Tester ✓	CDC 72841001
Oscilloscope, Dual Trace ✓	Tektronix 454 or equivalent
Oscilloscope Hood	Tektronix 016-0083-00
Pin Straightener X	CDC 87369400
Pulley Alignment Tool X	CDC 87083900
Push-Pull Gage X	CDC 12210836
Removal Tool, 20-30 GA X	CDC 12259183
Scope Probe Tip (Hatchet Type) ✓	CDC 12212885
Shim Assortment (used for Carriage Stop Adjustment when replacing actuator) ✓	CDC 75039400
Spindle Adjustment Tool — <i>2+4 MILL</i>	CDC 87051900
Torque Screwdriver X	CDC 12218425
Torque Screwdriver Bit X	CDC 87016701
Torque Wrench, 1/4 inch X	CDC 12263205
Volt/ohmmeter ✓	Ballantine 345 or equivalent digital voltmeter
Wire Wrap Bit, 30 GA	CDC 12218402
Wire Wrap Gun, Electric	CDC 12259111
Wire Wrap Sleeve, 30 GA	CDC 12218403

*CDCTM is a registered trademark of Control Data Corporation.

ELECTRICAL CHECKS AND ADJUSTMENTS

CAUTION

INTRODUCTION

The electrical adjustments should be performed prior to replacing any parts. This ensures that apparent malfunctions are not caused simply by misadjustments. Also, these procedures should be performed whenever logic cards or other electrical components are repaired or replaced.

These adjustments are divided into four parts:

- Power System -- power supply voltages and power sequencing.
- Servo System -- the parts involved in moving the positioner to the selected cylinder.
- Read/Write System -- the logic used to select the read/write heads and to read or write these heads.
- Miscellaneous Logic -- the remaining logic in the drive not directly applicable to the two systems listed above.

Before performing any of these procedures, be thoroughly familiar with the safety precautions and preliminary conditions specified earlier in this section.

POWER SYSTEM CHECKS

Introduction

The power system test procedure has been subdivided into subchecks to permit trouble analysis and checkout of specific system functions. The first test, Sequencing Functional Check, provides a quick check of power supply sequencing. It does not, however, check all capabilities. For a complete power supply checkout, perform all tests.

Figure 3-3 is a troubleshooting guide that will assist in isolating malfunctions. Locations of parts within the AC power supply are illustrated in Figure 3-4. Locations of parts within the DC power supply are illustrated in Figure 3-5.

Unless otherwise specified, sequence power from the controller should be off when performing any of these tests.

Sequencing Functional Check

This procedure provides a quick check of the power supply sequencing. For a complete check of all power supply capabilities, including data protection, perform all of the remaining power supply tests. Proceed as follows:

1. Load disk pack and close cover.
2. Turn off all power supply circuit breakers.
3. Set LOCAL/REMOTE switch to REMOTE.
4. Open top cover from rear.
5. Disconnect yellow lead from voice coil.
6. Set ON LINE/OFF LINE/WRITE DISABLE switch to OFF LINE.
7. Verify that UNIT POWER circuit breaker is on.
8. Check if blower motor is operating. If not, check:
 - a. Site ac power available at A1TB1.
 - b. UNIT POWER circuit breaker.
 - c. Line terminals of A1P2.
9. Check that +20Y indicator on DC panel lights. If not, check for +22v at A2TB1-1 (terminal board on back of logic chassis). If present, bulb is defective. If absent, check +20Y fuses. If fuses are good, check dc power panel A1CR7-10+.
10. Turn on +5 and -5 circuit breakers.
11. Set LOCAL/REMOTE switch to LOCAL. Check that MAINT indicator on operator panel lights. If not:
 - a. Measure from +5 test point on maintenance panel to ground. If +5v present, proceed directly to step f; if absent, proceed to step b.

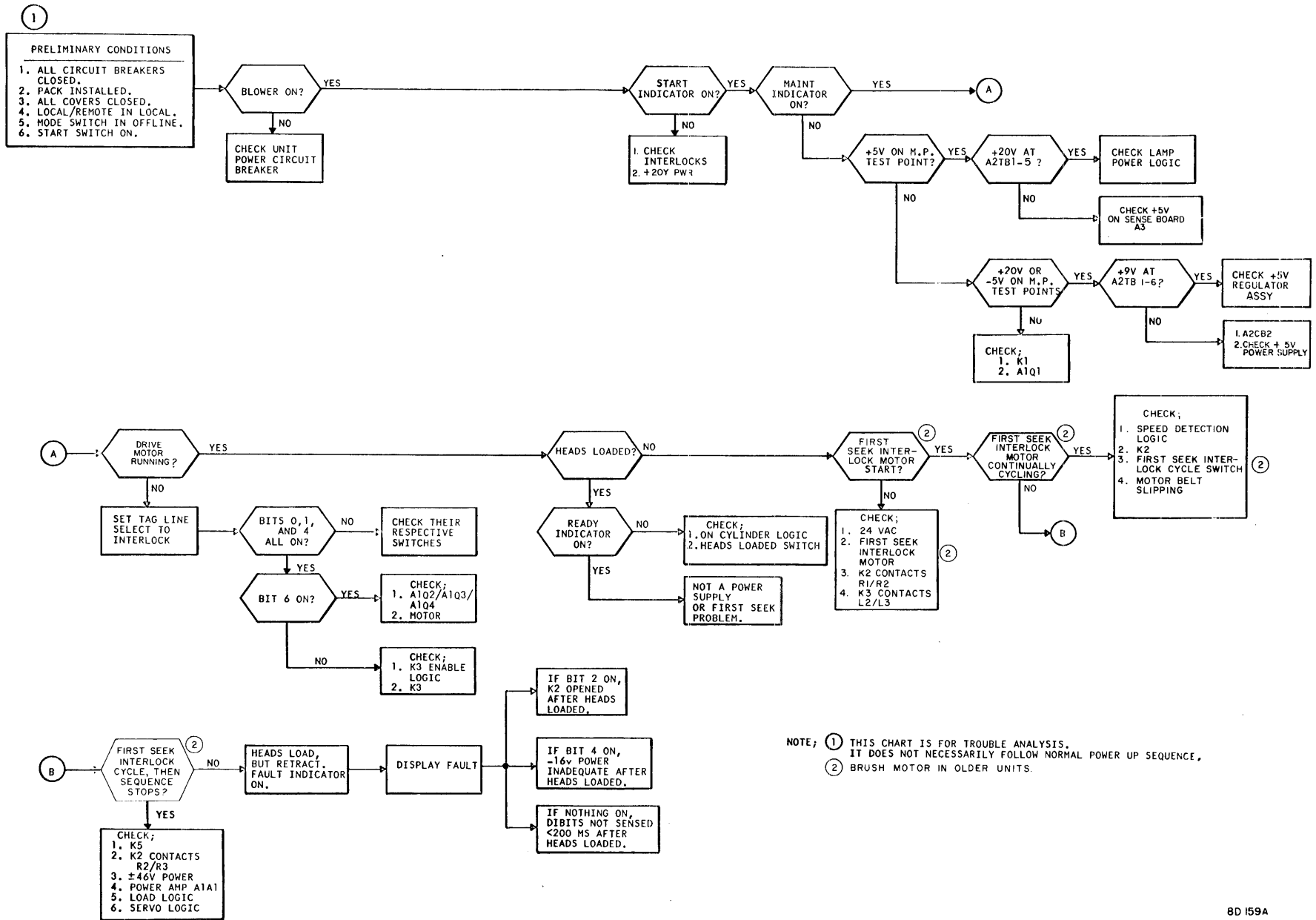


Figure 3-3. Power Sequencing Trouble Analysis Chart

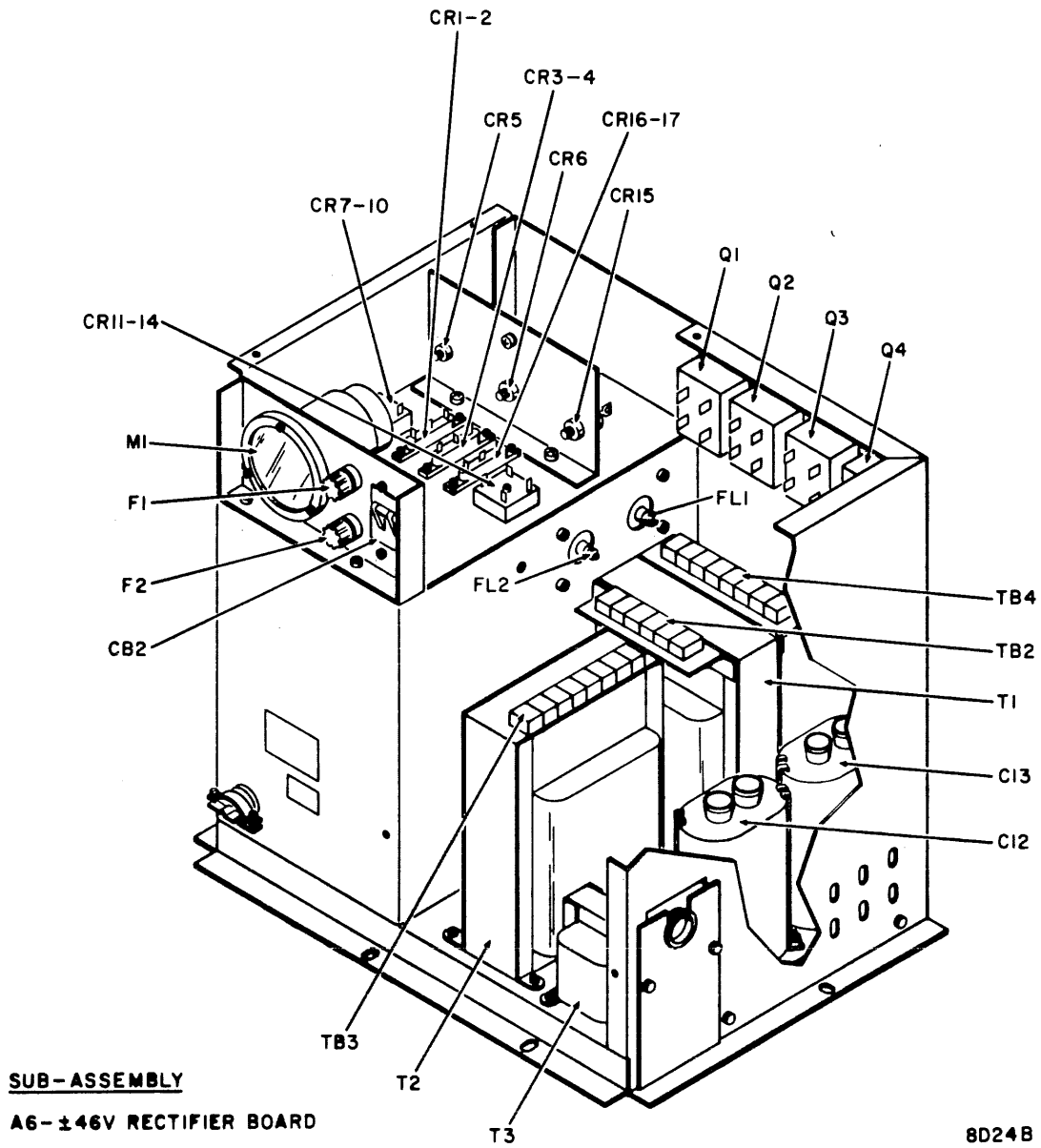


Figure 3-4. AC Power Supply Locator
 (A1 Power System)

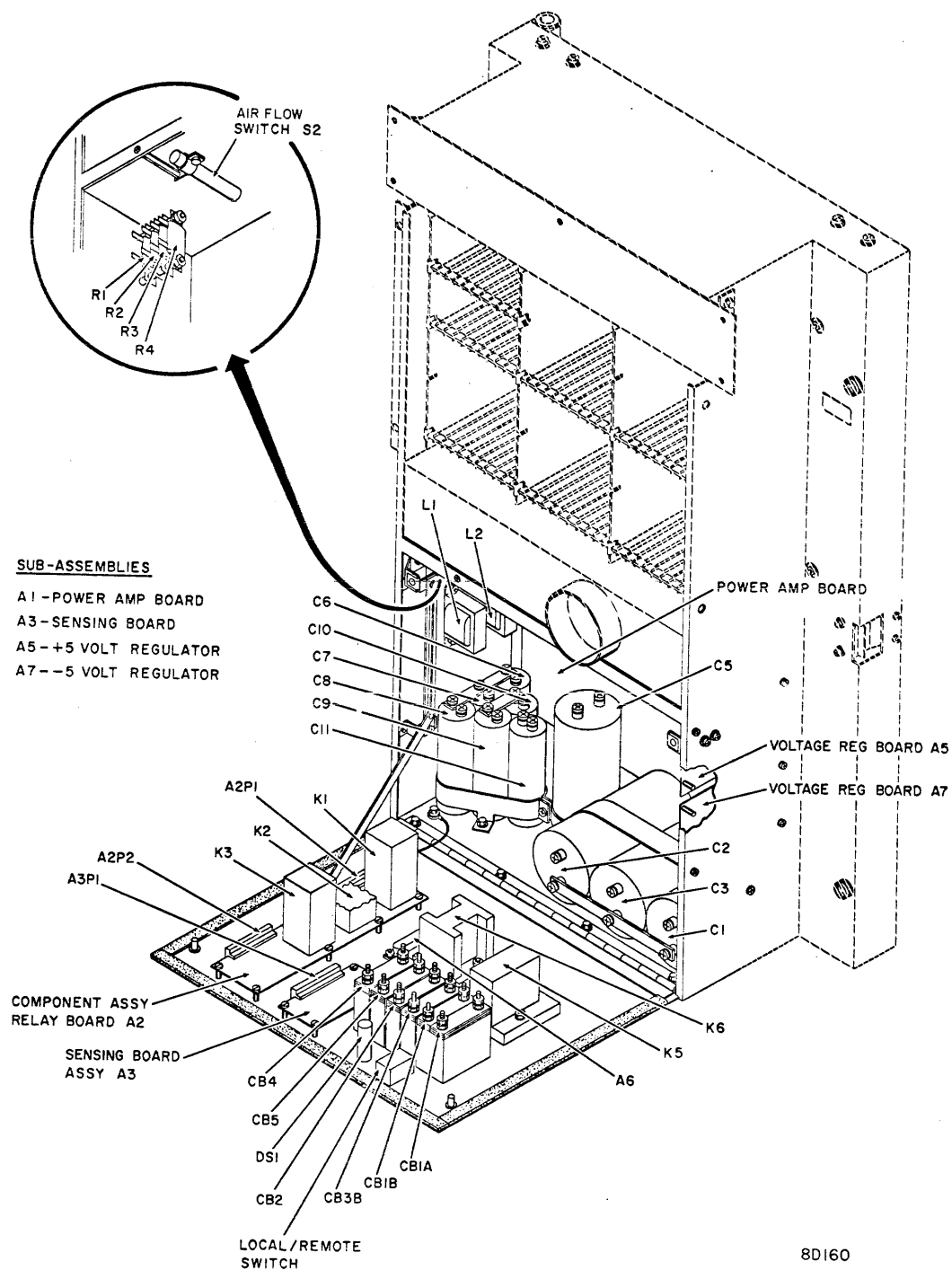


Figure 3-5. DC Power Supply Locator
(A2 Power Supply)

- b. Turn on ± 20 circuit breakers on power supply. Measure these voltages from their respective test points on maintenance panel to ground. If +20v, -20v, and -5v are all absent, ac power panel A1 and related rectifiers are not supplying dc voltages. Proceed to step c.
- c. If any voltages are present, proceed to step g.
- c. Measure from A1Q1 terminal 3 to ground. If not +20v, relay K1 is not energized, (it should be). Proceed to step d if voltage is present.
- d. Measure resistance from A1Q1-4 to ground. If not zero ohms, interlock wiring from ± 5 circuit breakers is open or circuit breaker auxiliary contacts are defective. Proceed to step e.
- e. Measure voltage across pins 1 and 2 of A1Q1. If not less than about 2vac, A1Q1 is faulty (it should be acting as a closed switch). Otherwise, check A1T2 and its associated components.
- f. This step applies if +5v is present in step a. Problem is caused by lack of operator panel lamp power. Measure from A2TB1-5 to ground. If +20v, check lamp driver logic. If not +20v, sensing board A2A3 (+5v sense) is not supplying power to lamps on operator panel; perform Data Protection Sensing Check.
- g. This step applies if voltage other than +5v could be measured in step b. Problem is lack of +5v. Measure from A2TB1-3 to ground. If voltage is not +9v, check A1TB2-8 for +9v; if absent, CR5, CR6 OR T2 may be suspected. If +9v is present at A2TB1-3, regulator A2A3 is faulty.

- 12. Turn on remaining circuit breakers.

NOTE

If any of the following conditions are not met, refer to Sequencing Safety Checks for troubleshooting information.

- 13. Press START switch. If it does not light, check interlocks. Observe that the following occur:
 - a. Spindle motor starts.
 - b. Brush motor starts.
- 14. After about 15 seconds, brush motor shall complete one revolution and stop.
- 15. Manually move actuator forward until heads loaded switch transfers.
- 16. Fully load heads on pack, then position them near ramp.
- 17. Reconnect yellow lead to voice coil. Coil should not retract. If it does, perform Data Protection Sensing Check. (Retract relay K5 is de-energized, causing emergency retract condition.)
- 18. Turn off UNIT POWER circuit breaker. Carriage shall immediately retract (simulated emergency retract condition). If not, immediately retract heads manually to prevent them from crashing as spindle motor slows. Check retract relay K5 for sticking and check actuator for open coil or broken straps.

Output Voltages Check

Perform the following check with the drive performing continuous 32-track seeks. The $\pm 5v$ power is adjusted in the Preventive Maintenance procedure. The $\pm 20v$, $\pm 20Y$, and ± 46 voltages are not adjustable. With the exception of the $\pm 46v$ and $\pm 20Y$ power, all measurements should be made by connecting a voltmeter between the applicable test point and ground on the test point panel.

1. +20 (+2.4, -0.2) vdc.
2. -20 (-2.4, +0.2) vdc.
3. +5 (± 0.05) vdc.
4. -5 (± 0.05) vdc.
5. Measure +20Y by connecting positive lead to A2TB1 -11 to ground. It should be +22 (± 2.0) vdc. This terminal board is on the wire wrap side of the logic chassis.
6. Measure ± 46 vdc at TB1 on the back of power amplifier assembly A1. Ground is available on A2A1TB1-6.
 - a. +46 (± 2) vdc at A2A1TB1-2.
 - b. -46 (± 2) vdc at A2A1TB1-10.

Interlock Switches Check

This procedure verifies that the power interlock is functioning. The pack need not be installed. Proceed as follows:

1. Set LOCAL/REMOTE switch on power supply to REMOTE.
2. Turn on all circuit breakers.
3. Close all covers.

NOTE

Interlocks may be checked by three test points on terminal board (A2TB1) of wire wrap side of the logic chassis. These test points will be at ground potential if the following conditions are met:

- a. A2TB2-15 if circuit breakers auxiliary contacts are closed.
- b. A2TB1-10 if condition a is met and if pack cover is closed.
- c. A2TB1-14 if condition b is met and START switch is on.

4. Press START switch. Indicator should light; if not, check interlock test points specified in preceding note. If they are all at ground, remove lens and lamp; check socket for +20v and ground.
5. Open pack cover. START indicator shall go out; if not, pack cover interlock may be defective.
6. Close cover and note that START indicator lights again.

Sequencing Safety Checks

This procedure verifies that the power sequencing interlocks and logic are functioning correctly. Start this procedure without a pack installed. Proceed as follows:

1. Open top cover from rear.
2. Remove deck cover.
3. Disconnect yellow lead from voice coil.
4. Turn on all circuit breakers.
5. Press (to light indicator) START switch.
6. Set LOCAL/REMOTE switch on power supply to LOCAL, drive motor should not start. If it does, switch is misadjusted or defective.
7. Press (to extinguish) START.
8. Install pack and close cover.
9. Press (to light) START switch. Observe effects specified in steps 10 and 11.
10. Spindle motor shall start. If not:
 - a. Check for ground at logic pin B12-9A. If at +20v, logic is faulty. If at ground wiring or +5v sense of sensing board A1A3 is faulty. (The +5v sense is required to pull relays K2 and K3.)
 - b. Check if relay K3 is energized. If motor is humming (trying to start), measure voltage across pins 1 and 2 of A1Q4. It should be low (about 1v); if high (about 100 vac), A1Q4 is defective or motor start capacitor is faulty.

If motor is not trying to start check pins 1 and 2 or AlQ2 and AlQ3; they should also have Low voltage drop. If all voltages are correct, motor may be faulty.

11. Steps 12 and 13 applicable to units with brush motor installed. Steps 14 and 15 applicable to units with First Seek Interlock assembly installed (no brushes).
12. Brush motor shall start (cleaning takes about 5 seconds with 15 seconds required for full motor cycle). If not:
 - a. Check A2TB4-8 for 24 vac to ground.
 - b. Check contacts of K2, K3, and brush cycle switch.
13. After brush motor completes one cycle (15 seconds), it shall stop. If ok, go to step 16. If not:
 - a. Speed detection logic may be faulty.

NOTE

If loss of speed has existed for an undetermined length of time or for more than one hour, inspect pack for deposited nylon and clean pack if required.

- b. Relay K2 or brush switch may be faulty.

If two or more cycles are required, malfunctions could be caused by drive belt slippage or low line voltage. Also, AlQ4 could be shorted, not allowing motor to attain full speed. Motor will eventually become overheated, tripping DRIVE MOTOR circuit breaker. Normally, speed is attained before completion of brush cycle. This energizes K2 which, in turn, energizes Retract relay K5. If not up to speed before completion of brush cycle, speed enable is disabled by Speed Enable FF. K2 remains de-energized and another brush cycle starts. Heads cannot load during brush cycle.

14. First Seek Interlock motor must start (with 15 seconds required for full motor cycle). If ok, go to step 15. If not:
 - a. Check A2TB4-8 for 24 vac to ground.
 - b. Check contacts of K2, K3, and interlock switch.

- c. While performing previous check motor may have rotated partially through its cycle. It may first complete this partial cycle before beginning full cycle. If two cycles are required, the motor drive belt may be slipping (interlock motor cycles continue until speed enables relay K2).

15. After First Seek Interlock motor completes one cycle (15 seconds), must stop. If ok, go to step 16. If not:
 - a. Speed detection logic may be faulty.
 - b. Relay K2 or interlock switch may be faulty.
 - c. If two or more cycles are required, malfunctions could be caused by drive belt slippage or low line voltage. Also, AlQ4 could be shorted, not allowing motor to attain full speed. Motor will eventually become overheated, tripping DRIVE MOTOR circuit breaker. Normally, speed is attained before completion of First Seek Interlock cycle delay. This energizes K2 which, in turn, energizes Retract relay K5. If not up to speed before completion of First Seek Interlock cycle, speed detection enable is disabled by Speed Enable FF. K2 remains de-energized and another First Seek Interlock delay starts. Heads cannot load during First Seek Interlock delay.
16. When up to speed, manually move actuator forward until heads loaded switch transfers. Relay K6 must be energized. If not, switch is faulty or misadjusted.
17. Press (to extinguish) START switch. Motor must not stop because heads are still loaded. If it does, immediately retract heads to prevent head crashing and check logic.
18. Move actuator to reverse stop. Observe that pack stops.
19. Reconnect yellow lead to voice coil.

Data Protection Sensing Check

This procedure verifies that the sensing function of board ALA3 is functioning to prevent writing

capability during an emergency retract. It also checks the voltage and current fault detection. An emergency retract condition is also generated. With a pack installed, proceed as follows:

1. Open top cover.
2. Remove deck cover.
3. Disconnect yellow lead from voice coil.
4. Set ON LINE/OFF LINE/WRITE DISABLE switch to ON LINE.
5. Turn on all circuit breakers.
6. If necessary, press (to extinguish) START switch.

NOTE

While performing steps 8 and 9, observe operator panel indicators.

7. Set LOCAL/REMOTE switch to LOCAL. No indicators shall blink except for Unit Number indicator. Drive motor shall not jerk.
8. Set LOCAL/REMOTE switch back to REMOTE. No indicator shall blink nor shall drive motor jerk. If conditions of steps 6 and 7 are not met:
 - a. Check transistors Q4, Q5, and Q7 (along with their associated circuitry) on board A2A3. This is +5v sense function. Lamp drivers and K3 also receive power from +5 volt sense circuit.
 - b. If +9.7 volt power drops, this circuit should drop K3 power, to prevent write power during emergency retracts, before remainder of dc power decays.
9. Set TAG LINE SELECT switch to FAULT.
10. Observe that bit 4 (-volt) indicator is on. If not:
 - a. -Volt fault is sensed by A2A3-Q1 because heads are loaded and -16 volt emergency retract voltage is inadequate when switch first closes.

b. Observe that both FAULT indicators are on. It should be caused by -volt faults.

11. Turn off UNIT POWER circuit breaker. Observe that carriage immediately retracts. This is emergency retract function provided by A2C2 and normally-closed contacts of Retract relay K5.

Normal Retract Check

This procedure verifies that the sensing function of board A2A3 is functioning to allow the actuator to retract at the normal controlled velocity when system sequence power is dropped. A pack need not be installed. Proceed as follows:

1. Open top cover.
2. Set LOCAL/REMOTE switch to REMOTE.
3. Remove deck cover.
4. Make sure voice coil yellow lead is connected to its proper terminal.

CAUTION

While performing following step 6, move heads forward far enough to cause heads loaded switch to transfer, but not far enough so that heads contact each other. Otherwise, heads will be damaged.

5. Move actuator forward until Heads Loaded switch transfer. An immediate hold back force shall be encountered. If not:
 - a. Check for +5v at logic chassis maintenance panel. If absent, proceed to step b; if present, proceed to step c.
 - b. Check Q3 and its associated components on sensing board A2A3. This transistor holds 5v power on during a normal retract until the heads unload.
 - c. Fault is caused by K6 malfunctioning. When heads loaded switch transfers, K6 relay should charge retract capacitor A2C2 to -16v.

Speed Backup Check

This procedure verifies that the heads cannot load until speed is attained. This function is normally under logic control; however, if the primary speed detection logic fails, the speed backup should also prevent the heads from loading onto a slow pack.

Proceed as follows:

1. Set LOCAL/REMOTE switch on power supply to REMOTE.
2. Verify that +20Y indicator is on.
3. Open dc power supply front panel.
4. Remove protective cover from speed relay K2.

CAUTION

Perform step 5 gently to prevent damage to relay contacts.

5. Press K2 clapper. Verify that retract relay K5 does not energize. If it does:
 - a. Check A2A3P1-13 (drive motor interlock to sensing board A2A3). If not ground, motor centrifugal switch is malfunctioning. This switch should remain closed (providing ground) until motor speed exceeds about 2,000 rpm.
 - b. If test point in step a is ground, check Q6 and Q2 and their associated circuitry on board A2A3.
6. Replace relay K2 relay cover.
7. Close dc power supply.

SERVO SYSTEM CHECKS

Figure 3-6 is a simplified diagram of the servo subsystem. This illustration indicates the primary test points used for checking and aligning the servo loop along with a brief explanation of the various signals, their test points, and the applicable check-out procedure. Servo test point waveforms for various seek lengths are shown in Figure 3-7.

General Checkout Criteria

Of the procedures listed in Figure 3-6, only the procedures listed below are adjustments, the remainder are checks to verify proper operation:

- Velocity Gain Adjustment
- DC Offset Adjustment
- Fine Position Gain Adjustment
- Integrator Gain Adjustment

Because the subsystem is a closed loop servo, all of the signals are interacting. Therefore, misadjustments may cause seek difficulties that appear to be hardware malfunctions. Check all adjustments before initiating detailed trouble analysis procedures. All adjustments should be checked if any servo loop cards have been replaced.

The key procedure is Velocity Gain Adjustment. Perform this procedure first. Overall loop operation may be assumed to be normal if this procedure may be successfully completed. Repeat the procedure prior to returning the drive to the customer.

Velocity Gain Adjustment

This procedure adjusts the gain of the velocity signal applied to the summing amplifier. This signal controls seek time. The concept of this procedure is to adjust seek time to be fast enough to meet specifications, yet not so fast as to cause an overshoot past the desired cylinder. Repeat the procedure as necessary for optimum seek time. Optimum seek time for a 410-track seek is about 50 to 53 ms (from start of seek to On Cylinder Enable). Proceed as follows:

1. Command continuous 410-track repeat seeks.
2. Sync positive on A28, TP-L (Forward A1200).
3. Connect oscilloscope vertical input to A29, TP-K (On Cylinder Enable, I1310).

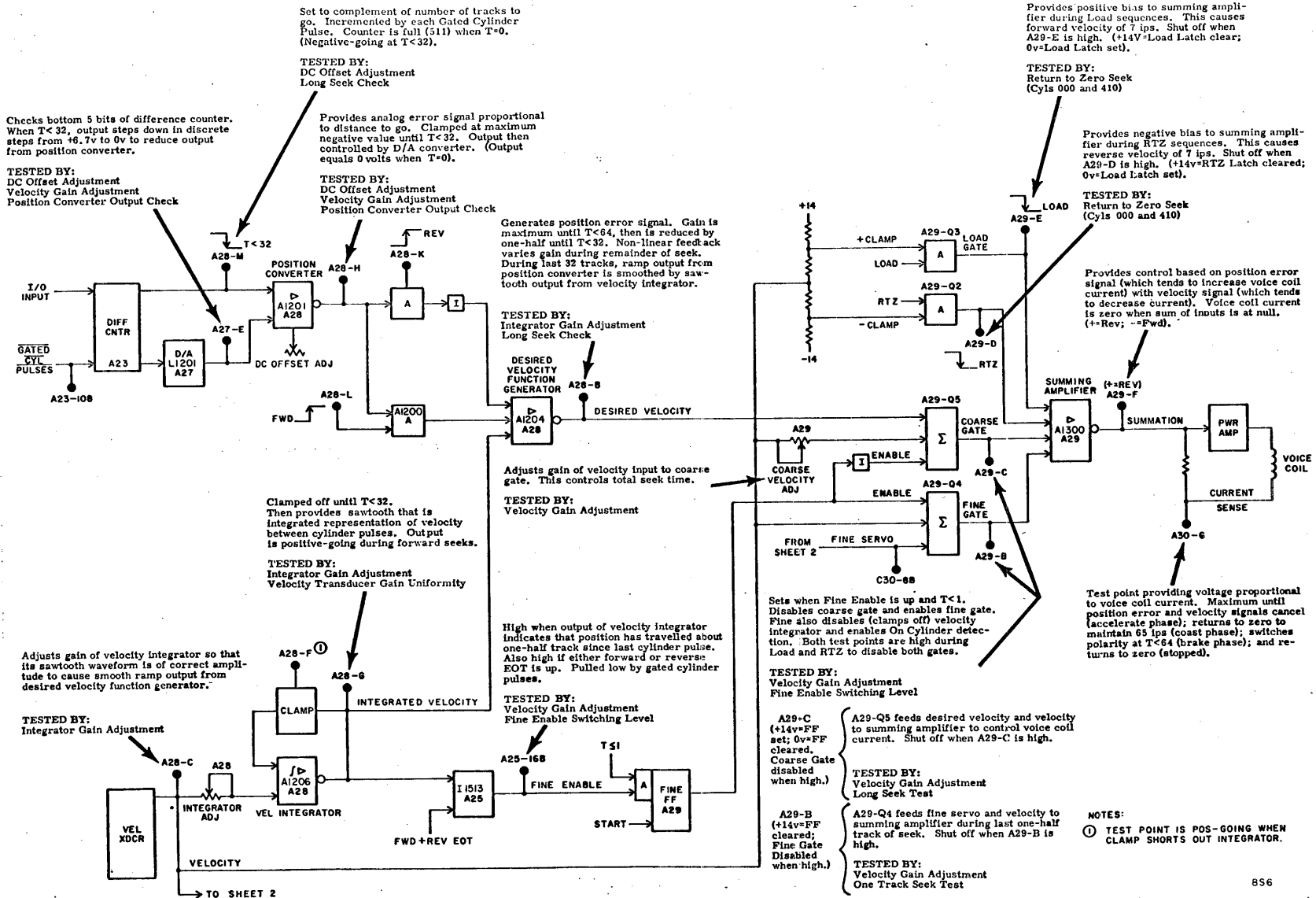


Figure 3-6. Servo System Test Points (Sheet 1 of 3)

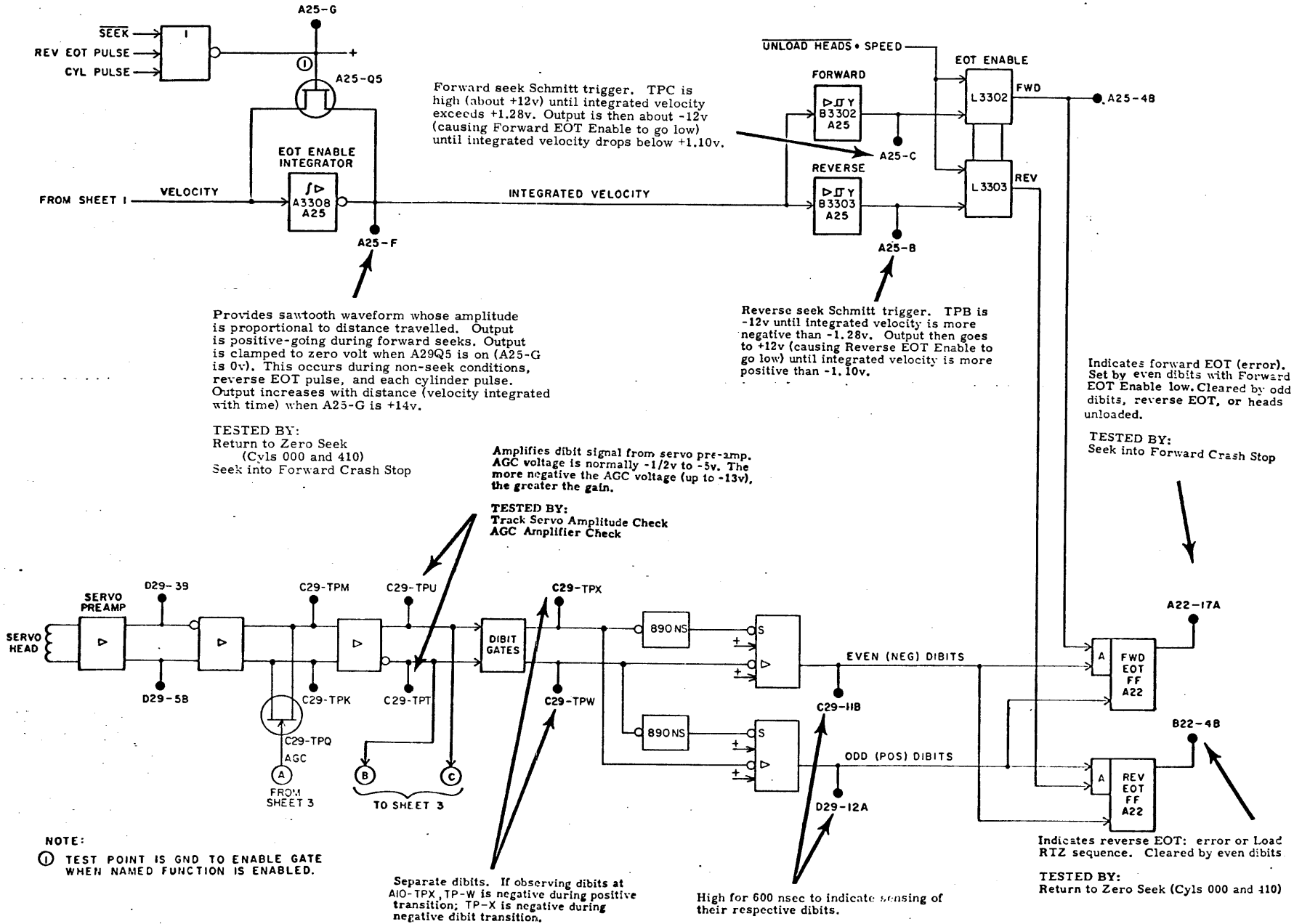


Figure 3-6. Servo System Test Points (Sheet 2 of 3)

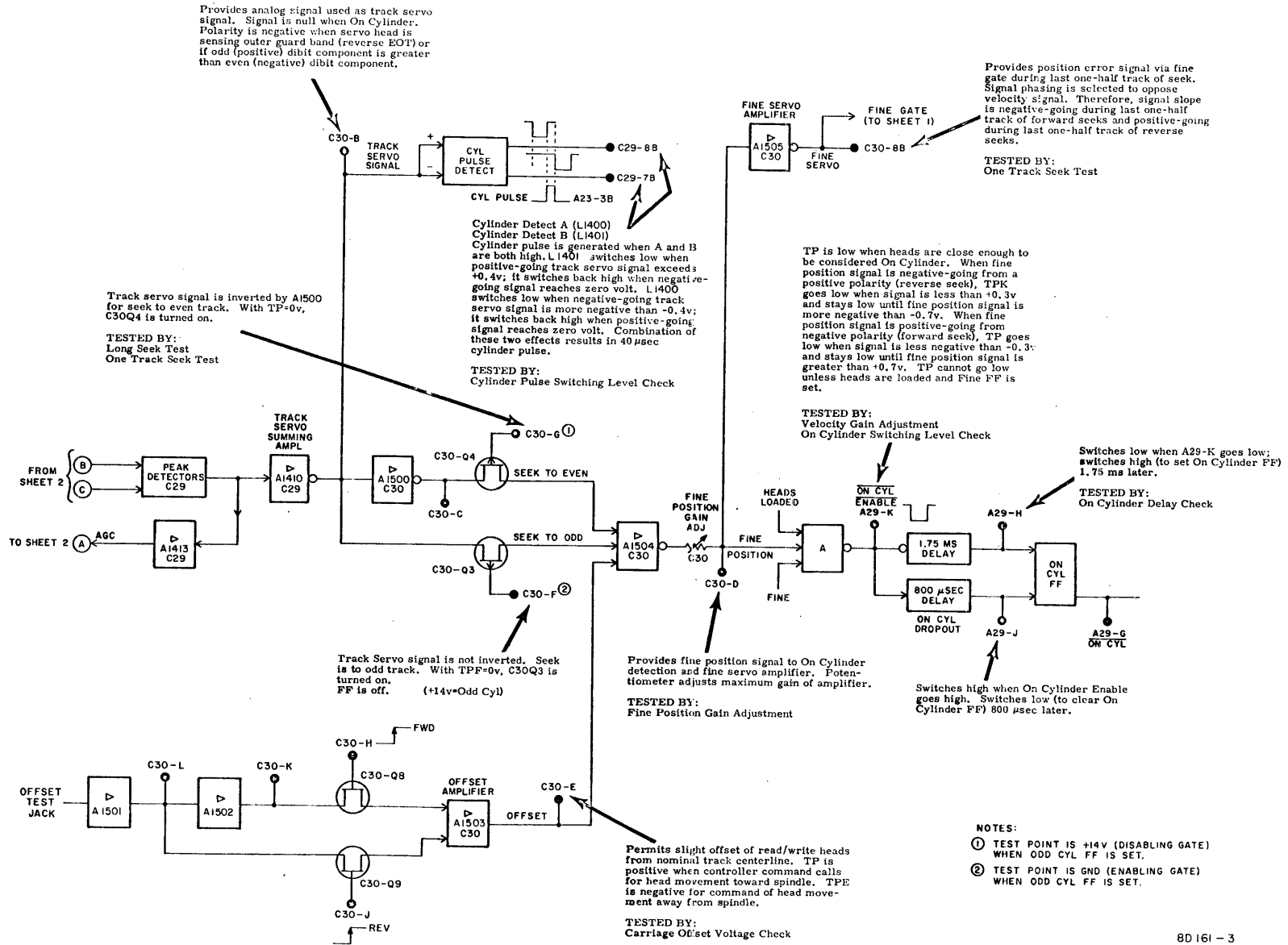
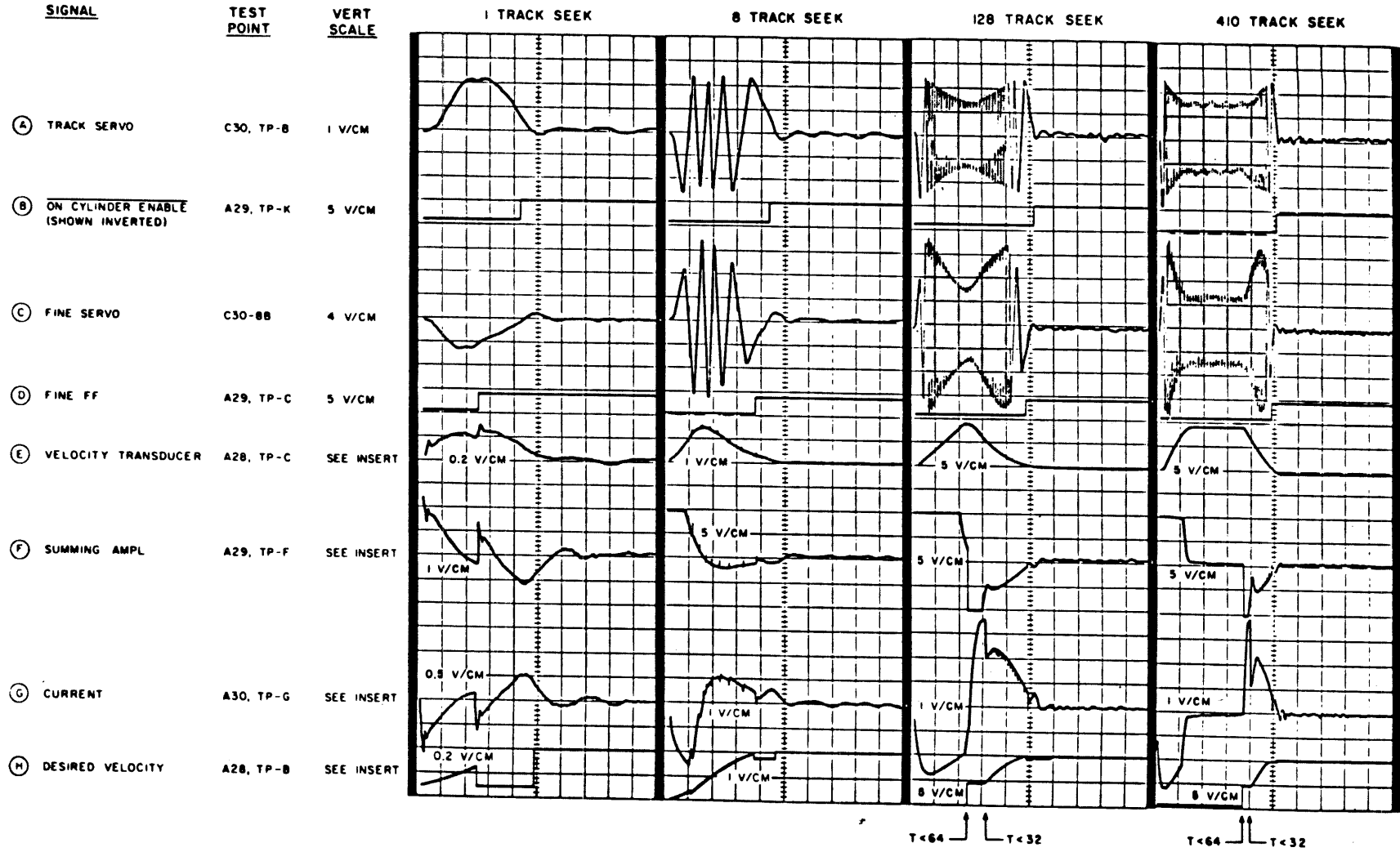


Figure 3-6. Servo System Test Points (Sheet 3 of 3)



NOTES
 1 SYNC (+) ON REVERSE SEEK (A28, TP-K)
 2 HORIZONTAL SWEEP IS 5 MS/CM

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Figure 3-7. Reverse Seek Waveforms

NOTE

On Cylinder Enable is used as test point because it is easier to observe than On Cylinder itself. Elapsed times specified in this procedure assume that On Cylinder delay is exactly 1.75 ms. Perform On Cylinder Delay Check after completing this procedure. If delay exceeds 1.75 ms, it may be necessary to reperform this procedure. Total seek time from seek initiation to On Cylinder shall not exceed 55 ms.

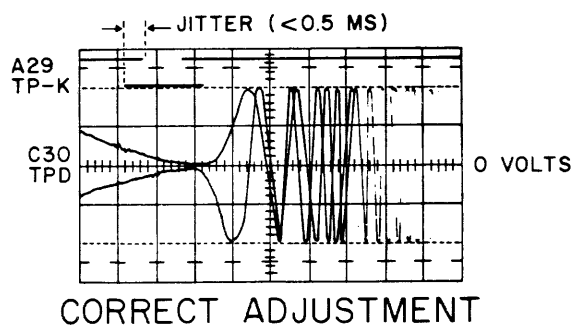
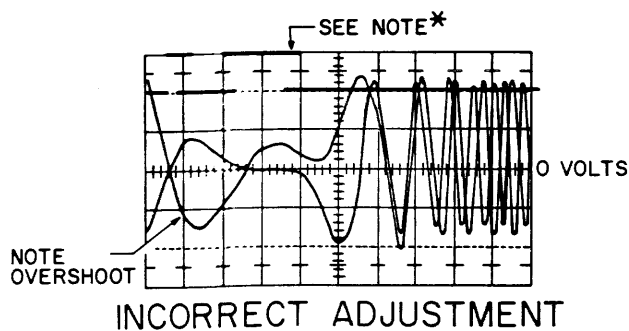
4. Time from trigger until On Cylinder Enable switches from "1" to "0" shall not exceed 53 ms. If it does, adjust pot on A29 (coarse velocity adjust), to increase velocity.
5. Sync position on A28, TP-K (Reverse, A1203).
6. Check that reverse seek time does not exceed 53 ms.

NOTE

Remainder of procedure optimizes seek time.

7. Sync positive on A29, TP-B (Fine, I1306).

8. Connect channel A to A29, TP-K (On Cylinder Enable, I1310).
9. Connect channel B to C30, TP-B (Fine Position, A1504).
10. Observe waveform similar to Figure 3-8. Adjust scope triggering controls to display these signals during both forward and reverse seeks. Note the following:
 - a. Fine position should be smoothly decreasing toward zero volt. This signal is a function of velocity: if velocity is too great, the carriage must stop and reverse direction (as shown in right waveform) to return to the destination cylinder. On the other hand, insufficient velocity will cause slow accessing.
 - b. The negative-going On Cylinder Enable signal should occur at the same time for both forward and reverse seeks.



NOTE: EXCESSIVE OVERSHOOT CAUSES LOSS OF ON CYLINDER ENABLE, CAUSING DOUBLE PULSE. A29-K IS SHOWN INVERTED.

7J151

Figure 3-8. Velocity Gain Waveforms

Unequal time will cause jitter of this waveform. Jitter less than 0.5 ms is optimum, although jitter of up to 1.0 ms is acceptable.

- c. Adjust pot on A29 for minimum seek time (not to exceed 53 ms) while meeting conditions of steps a and b.

The waveform display from C30, TP-D provides additional loop operation information. Note that the upper waveform (horizontal sweep rate is 1 ms/cm) is smooth and reaches zero volt in about 3 ms. If the slope differs from the illustrated waveform, perform the Fine Position Gain Adjustment procedure. At the same time, the slopes of this waveform for forward and reverse seeks should be almost identical. If they are not, perform the Velocity Transducer Gain Uniformity check.

On Cylinder Delay Check

1. Command continuous one-track seeks.
2. Sync negative on A29, TP-K (On Cylinder Enable, I1310).
3. Connect vertical input to A29, TP-H (On Cylinder Delay, X1301).
4. Trigger waveform goes negative at On Cylinder Enable. Signal on TP-H should then go negative. Elapsed time from time that TP-H goes negative until it goes positive again shall be 1.75 (± 0.35) ms. If not, X1301 on A29 is faulty.

DC Offset Adjustment

This procedure adjusts the position converter offset voltage to a null.

1. Load heads.
2. Connect oscilloscope to A28, TP-H (position converter output, A1200).
3. Calibrate oscilloscope to ground. Check that voltage is 0 (± 20) mv. Proceed to step 4 only if this requirement is not met.

4. Check that A27, TP-E is "0"; if not, proceed to step 5. If it is, extend A28 and adjust pot on bottom of card for 0 (± 20) mv on A28, TP-II. Procedure is completed.

5. This step applies only if A27, TP-E, L1201 is not at ground. A logic fault condition exists.

- a. Check test points A27-D, G, H, J, and K. They should all be "0". If they are "0", A27, TP-F should be "0"; if not, L1202 on A27 is faulty.
- b. If one or more test points listed above are "1", display difference counter. All bits should be on (count=511). If not difference counter and/or its gating logic may be faulty. If all bits are set, wiring or gates of A27 are faulty.

Fine Position Gain Adjustment

This procedure adjusts the gain of the fine position analog signal. This signal is used during the last 1/2-track portion of the seek to provide an error voltage proportional to the positional error. It is also used to enable the On Cylinder logic.

1. Load heads.
2. Command one-track continuous seeks.
3. Sync positive on A28, TP-L (Forward, A1200).
4. Connect oscilloscope vertical input to C30, TP-D (Fine Position signal, A1504).

NOTE

Figure 3-9 is an idealized waveform. Theoretically, the waveform should settle out at zero volts; however, an overshoot knee is likely. Adjust for proper voltage without regard to amount of overshoot. Problems could occur if the overshoot exceeds 400 millivolts.

5. Observe waveform similar to Figure 3-9. Adjust for peak-to-peak signal of 5 (± 0.2) volts. If not, adjust pot on C30 for proper amplitude
6. Perform Fine Position Test.

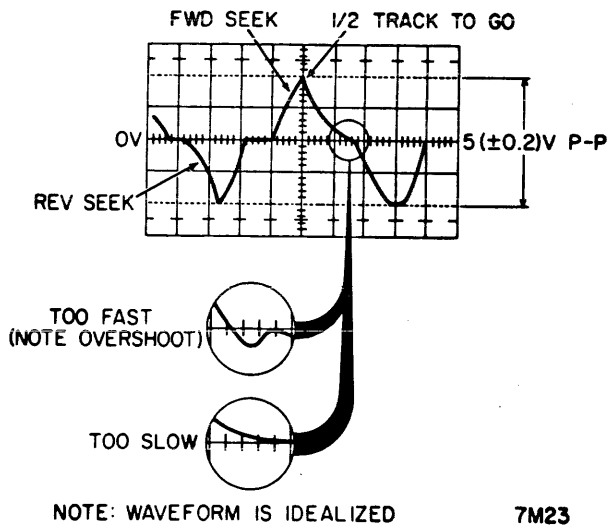


Figure 3-9. Fine Position Gain Waveform

Fine Position Test

NOTE

Runout is the degree to which a rotating object rotates off center. Too much runout causes the object to wobble or vibrate.

This test checks the track following capability of the drive and runout of the spindle. Runout of the pack and spindle are additive, therefore a pack with known characteristics must be used (preferably a CE pack).

1. Load heads.
2. Sync positive on Index B11-12B (X3401).
3. Connect oscilloscope to A26-TPD (Fine Position Signal). Set sweep rate to 2 ms/div.
4. Perform direct seek to cylinder 200.

NOTE

The signal measured in step 4 is the 60 Hz component of the displayed waveform. The waveform in Figure 3-9.1 is typical and may vary from drive to drive.

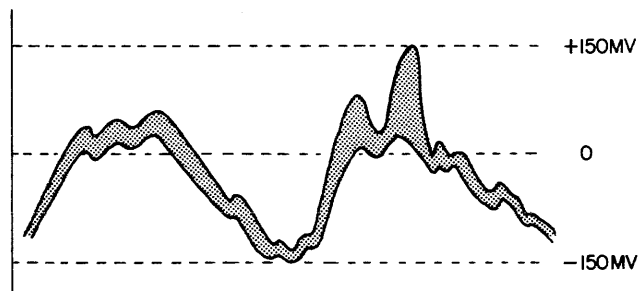
5. Observe waveform on scope. The average peak-to-peak value of the observed waveform should not exceed the requirements of Figure 3-9.1. If value exceeds requirements, go to step 8. If value is within requirements, go to step 6.

6. Remove pack, rotate pack 90 degrees and install pack.
7. Observe waveform on scope. The average peak-to-peak value should not exceed requirements of Figure 3-9.1. If value exceeds requirements, go to step 11. If within requirements, go to step 8.
8. Observe waveform on scope to determine where Fine Position signal synchronizes with Index.
9. Remove pack, rotate pack 90 degrees and install pack.

NOTE

The point at which Index and the Fine Position signal synchronizes may be different from pack to pack. However, the sync point must be the same for the pack under test, no matter how many times the pack is removed, rotated, and installed on the spindle.

10. Observe waveform on scope to determine where Fine Position signal synchronizes with Index. If sync point coincides with sync point determined in step 8, go to step 11. If not, go to step 12.
11. Check waveform amplitude requirements of Figure 3-9.1. If observed waveform exceeds limits, the problem is too much pack runout. Replace pack with a known good pack and repeat this procedure. If waveform is now within limits, test is complete.
12. If unable to get waveform to synchronize on Index at same position of waveform by rotating pack, problem is a defective spindle or servo head. Replace servo head or spindle and retest.



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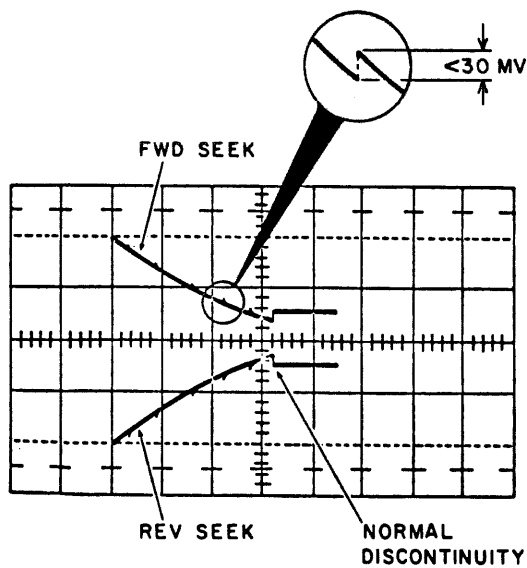
Figure 3-9.1. Fine Position Gain Waveform

Integrator Gain Adjustment

4

This procedure adjusts the gain of the velocity signal applied to the velocity integrator. The integrator output smooths out the stepped output from the position converter during the last 32 tracks.

1. Load heads.
2. Command continuous seeks from cylinder 000 to 064.
3. Sync negative on A28, TP-M (T<32, L1200).
4. Connect oscilloscope vertical input to A28, TP-B (Desired Velocity, A1204).
5. Adjust oscilloscope controls to display two sloped curves (Figure 3-10). Typical settings are 2 ms/cm sweep and .1v/cm vertical sensitivity.
6. Observe waveform. Track slopes must be smooth and contain no discontinuities. Transient spikes are normal, but none shall exceed 30 mv. (The last discontinuity, just before the waveform settles out to about 0.7 volt, is normal. This is the point that integrator gain increases when the Fine FF sets.)



NOTE: WAVEFORM IS IDEALIZED

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Figure 3-10. Velocity Integrator Waveform

Seek Timing Checks

The seek timing checks verify correct overall loop operations. These tests are not necessarily requirements: if the Velocity Gain Adjustment conditions can be met, servo operation may be assumed to meet specifications. Failure to pass any of these tests, however, indicates potential degraded performance that may cause difficulties at a later time.

Long Seek Test

1. Connect oscilloscope to A29, TP-G ($\overline{\text{On}}$ Cylinder, K1301).
2. Sync positive internal.
3. Command continuous 128-track seeks.
4. Waveform shall be "1" for 30 (± 3) ms.

One Track Seek Test

1. Connect oscilloscope to A29, TP-G ($\overline{\text{On}}$ Cylinder, K1301).
2. Sync positive internal.
3. Command continuous one-track seeks.
4. Observe waveform through at least 80 tracks of seeks. Waveform from start of seek (starting at "1") until it goes to "0" shall not exceed 8 ms.

Return to Zero Seek from Cylinder 000

1. Connect oscilloscope to A29, TP-G ($\overline{\text{On}}$ Cylinder, K1301).
2. Sync positive internal.
3. Command direct seek to cylinder 000.
4. Command RTZ. Waveform shall be "1" for 20 (± 5) ms.

Return to Zero Seek from Cylinder 410

1. Connect oscilloscope to A29, TP-G ($\overline{\text{On}}$ Cylinder, K1301).
2. Sync positive internal.
3. Command direct seek to cylinder 410.
4. Command RTZ. Waveform shall be "1" for 275-400 ms.

Seek Into Forward Crash Stop

1. Connect oscilloscope to A29, TP-G ($\overline{\text{On}}$ Cylinder, K1301).
2. Sync positive internal.
3. Command direct seek to cylinder 410.
4. Command one-track forward seek.
5. Waveform shall be "1" for 20 (± 5) ms.
6. Command RTZS to clear error.

Track Servo Logic Checks

These tests check the logic associated with the track servo. The tests are applicable only if the adjustments could not be made or if troubleshooting a malfunctioning drive.

Track Servo Amplitude Check

This test checks the amplitude of the track servo signal output of the servo preamp.

1. Disconnect voice coil yellow lead.
2. Manually load heads with pack up to speed.
3. Connect oscilloscope channel A vertical input to D29-3B; channel B to D29-5B. (Track Servo preamp output.)
4. Invert channel A and add algebraically. Sync internal.
5. Peak-to-peak amplitude of waveform shall be 1.2 (± 1.0) volts (throughout carriage motion).

AGC Amplifier Check

This test verifies that AGC (A1403) amplifier and the AGC voltage are working correctly.

1. Disconnect voice coil yellow lead wire.
2. Manually load heads with pack up to speed.
3. Extend C29.
4. Connect oscilloscope channel A vertical input to C29, TP-T; channel B to C29, TP-U.
5. Invert channel A and add algebraically. Sync internal.
6. Observe waveform similar to Figure 3-11. Move carriage to position near cylinder 000

so that horns (one set positive, other set negative) are of equal amplitude. Carriage is now on cylinder. Peak-to-peak voltage shall be 1.0 (± 0.2) volts.

Cylinder Pulse Switching Level Check

It is not necessary to perform the remainder of the procedure if the requirements of steps 1 through 4 are met.

1. Sync positive on A28, TP-L (Forward, A1200).
2. Connect oscilloscope vertical input to A23-3B (Cylinder Pulses, I1110).
3. Command continuous 4-track seeks. Check for series of positive-going 40 μ sec cylinder pulses. (Depending on system alignment, last pulse may be 1.2 μ sec.)
4. Command continuous seeks of varying lengths. Verify that pulses are consistently generated during long seek lengths. (Track servo signal amplitude decreases with increasing velocity.) Proceed to step 5 if requirements of steps 3 or 4 are not met.
5. Connect oscilloscope vertical input to C30, TP-B (Track Servo, A1410).
6. Sync negative on C29-8B (Cylinder Detect A, L1400).

NOTE

The following steps may be accomplished by moving positioner manually with voice coil yellow lead disconnected or by commanding 3-track continuous seeks.

7. Check that servo signal is +0.4 (± 0.1) volt at beginning of sweep.

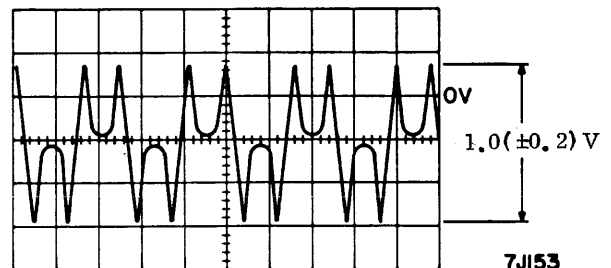


Figure 3-11. Track Servo Amplitude

8. Sync positive. Check that servo signal is 0 (± 0.1) volt at beginning of sweep.
9. Sync positive on C29-7B (Cylinder Detect B, L1402). Check that servo signal is 0v (± 0.1) at beginning of sweep.
10. Sync negative. Check that servo signal is -0.4 (± 0.1) volt at beginning of sweep.
11. If requirement of steps 7 through 10 are met, extend A23 and check delays X1101 and X1102.

Carriage Offset Voltage Check

The drive must be in Off Line mode to perform this test.

1. Load heads and seek to cylinder 000.
2. Connect oscilloscope to C30, TP-E (Offset Amplifier, A1503).
3. Connect VOM to C30, TP-B (Track Servo, A1410). Record voltage.
4. Set CARRIAGE OFFSET switch to FWD. TP-B must go more positive.
5. Check that TP-E is +1.6 (± 0.1) volts.
6. Set CARRIAGE OFFSET switch to REV. TP-E shall be -1.6 (± 0.1) volts.
7. Connect ground probe between CARRIAGE OFFSET and GND test points on maintenance panel.
8. With CARRIAGE OFFSET switch still in REV, check that TP-E is now -3.2 (± 0.2)v.
9. Set CARRIAGE OFFSET switch to FWD. Check that TP-E is now +3.2 (± 0.2) volts.
10. Set CARRIAGE OFFSET switch to NORMAL.
11. Remove ground jumper wire.

On Cylinder Switching Level Check

This procedure verifies that On Cylinder is enabled when the fine position signal approaches null with

1. Disconnect yellow lead from voice coil.

2. Manually load heads with pack up to speed.
3. Set TAG LINE SELECT switch to CONTROL.
4. Verify that bit 3 (On Cylinder) may be switched on and off near cylinder 000.
5. Connect oscilloscope to C30, TP-D (Fine Position, A1504).
6. Sync negative on A29, TP-K (On Cylinder Enable, I1310).
7. Calibrate scope track to ground.
8. Slowly move carriage manually. Two erratic horizontal waveforms will be displayed. Check that waveforms at beginning of track are +0.70 (± 0.05) volt and -0.70 (± 0.05) volt.
9. Sync positive and recalibrate trace to ground.
10. Slowly move carriage manually. Check that horizontal waveforms at beginning of sweep are +0.30 (± 0.05) and -0.30 (± 0.05) volt.

Velocity Logic Checks

These tests check the logic associated with the desired velocity logic. The tests are applicable only if the adjustments could not be made or if troubleshooting a malfunctioning drive.

Position Converter Output Check

Position Converter output should be clamped at negative saturation until $T < 32$. During the remaining tracks of the seek, the converter output is under control of the D/A converter.

1. Command continuous 40-track seeks.
2. Connect channel B to A27, TP-E (D/A Converter output, L1201).
3. Connect channel A to A28, TP-H (Position Converter output, A1200).
4. Sync positive on A28, TP-L (Forward, A1201). Set sweep time to 1 ms/cm.
5. Observe waveforms similar to Figure 3-12. Following events are occurring:

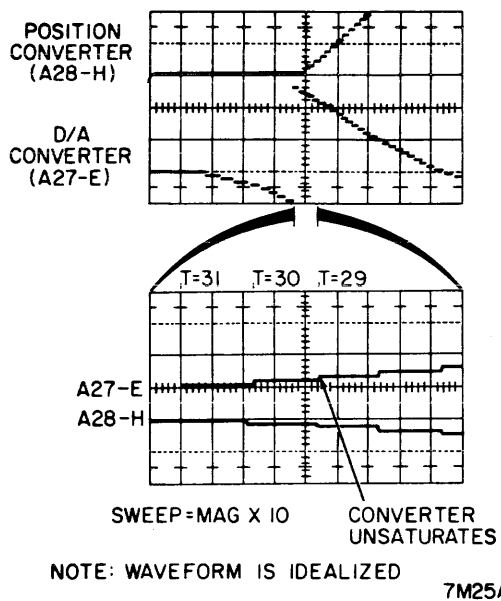
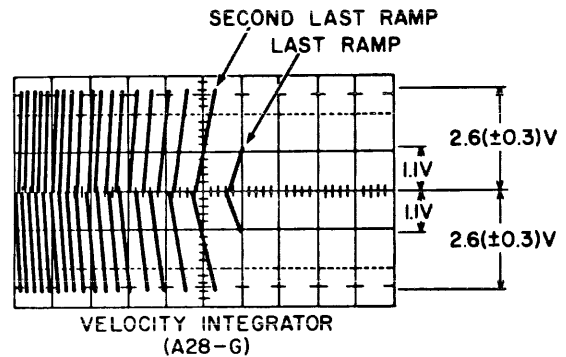


Figure 3-12. Position Converter Output Waveforms

- a. From T=40 through T=33, D/A is stepping down, but has no effect. Converter output is saturated negatively.
 - b. At T=32, D/A output is ground.
 - c. At T=31, D/A output switches back to +6.7v. It then steps down with each track to control converter output.
6. Set oscilloscope controls to magnify horizontal sweep X10.
 7. Check that converter comes out of negative saturation within four steps from time that D/A switches to +6.7 volts. If not, perform DC Offset Adjustment.

Velocity Transducer Gain Uniformity

1. Command 410-track continuous seeks.
2. Sync negative on A28, TP-M (T<32, L1200).
3. Connect oscilloscope vertical input to A28, TP-G (Integrated Velocity, A1206).
4. Observe waveform similar to Figure 3-13. Adjust triggering controls to observe both



NOTE: WAVEFORM IS IDEALIZED 7M26A

Figure 3-13. Velocity Transducer Gain Uniformity Waveform

negative and positive ramps. Ramps represent integrated velocity sawtooth during last 32 tracks of seek. Positive ramps are forward seek; negative ramps are reverse seek.

5. Check voltages of next to last positive and negative ramps. There amplitudes shall be 2.6 (±0.3) volts. Also, these voltages shall be equal (the difference of their absolute values) within 0.2 volt. If not:
 - a. Perform Integrator Gain Adjustment.
 - b. Repeat this procedure. If it still fails, replace transducer rod assembly.

Fine Enable Switching Level

This procedure verifies that fine enable switches in at the proper level. This signal, along with T<1, should set the Fine FF.

1. Load heads and command continuous one-track seeks.
2. Sync positive on A28, TP-L (Forward, A1200).
3. Connect channel A to A29, TP-C (Fine FF, I1303).
4. Connect channel B to A28, TP-G (Integrated Velocity, A1206).

5. Check that Fine switches to "1" when velocity signal is 1.28 (± 0.10) volts. See Figure 3-14.
6. Sync positive on A28, TP-K (Reverse, A1203) and repeat procedure.

READ/WRITE SYSTEM CHECKS

Field-level tests of the read/write system require that signals with fast rise times be accurately measured. Make sure that the scope probe ground adapter is connected to ground (TA-A or TP-Z) of the card being tested. Connect secure ground lead between scope ground and GND jack on maintenance panel.

Head Amplitude Test

The procedure verifies that the read signal has sufficient amplitude to be reliably processed by the read logic. Since amplitude decreases as the recording frequency increases, the minimum amplitude in MFM recording is obtained when an all "0's" or all "1's" pattern is being read. The minimum amplitude is tested first. Minimum recording frequency, therefore, the greatest amplitude, is obtained by a pattern of alternate "1010..." pattern. This amplitude is also tested.

Since read data is tested by the same heads that write the data pattern, head alignment is not verified by this test. If this test fails on only one head, replace that head. If it fails on all heads, replace card E00 (on main deck) and repeat test.

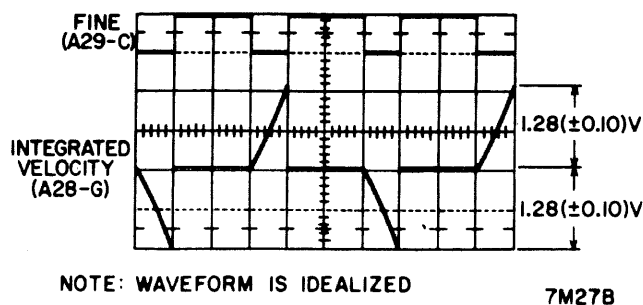


Figure 3-14. Fine Enable Switching Level Waveform

Perform this test on all heads as follows:

1. Seek to cylinder 409.
2. Connect oscilloscope vertical inputs to E00, TP-X and TP-Y. Measure signal differentially by placing in Add mode and inverting channel B.

CAUTION

Use scratch pack. Writing data pattern with Off Line tester completely destroys all CPU-generated data for the entire track from Index to Index.

3. Sync negative on D26-10B (Index, X1701).
4. Write data pattern on all "1's".

NOTE

Off Line Tester writes by syncing on negative-going edge of Index, then writing 150 μ sec of "0's", sync bit, and cylinder address before writing data pattern. Measurements made in this procedure refer to data pattern only without regard to preamble.

5. Measure and record peak-to-peak amplitude of read signal. It shall be at least 74 millivolts.
6. Seek to cylinder 000.
7. Write data pattern of 101010...
8. Measure and record peak-to-peak amplitude of read signal. It shall not exceed 680 millivolts.

Read Recovery Timing Adjustment

The phase lock oscillator card at C24 and the data separator card at C25 require exacting delay timing. These cards are aligned at the factory and must be considered as a matched set; if either card is replaced, both must be replaced.

Because of head variations, final data strobe timing cannot be determined until the cards are installed in the unit. This procedure determines the final setting. Cards must not be on extenders while performing this procedure.

When a matched set of read recovery cards is installed in a unit, a verification test of the factory settings of the read recovery timing adjustment will be required. In most cases, the unit will perform to spec with the factory setting and will only require soldering the delay line tap permanently into place.

In some units, the normal verification of read/write head parameters will require a readjustment of the factory alignment. The Read Recovery Timing Adjustment procedure should be performed only if the verification of factory alignment test was not passed.

Verification of Read Recovery Alignment

1. Set jumper wires on C1 and B3 of data separator card at C25 per settings indicated on tag or label on the card. See Figure 3-15.
2. Install phase lock oscillator card in C24 and data separator card in C25.
3. Install scratch pack and power up drive.
4. Write the following repetitive data pattern on all heads at cylinder 410: 101010.

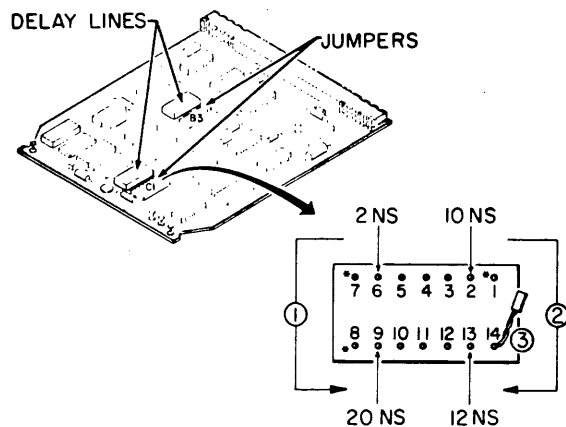
5. Read all heads sequentially at track 410 for three minutes. Verify no read errors have occurred.
6. Command an Advance Read Clock (ART) and read all heads sequentially at track 410 for three minutes. Verify no read errors have occurred.
7. Command a Retard Read Clock (RRC) and read all heads sequentially for three minutes. Verify no read errors have occurred.
8. If no read errors occurred in steps 5, 6, or 7, no further testing is necessary. Remove the data separator card from C25. Remove and discard the plug-in jumpers from delay lines B3 and C1.
9. Solder the factory designated setting terminals together using #20 bare wire. Install card in C25.
10. If read errors occurred during steps 5, 6, or 7, perform the Read Recovery Timing Adjustment procedure.

Read Recovery Timing Adjustment

The purpose of the adjustment is to center the strobe in the data window to achieve the optimum nominal setting.

The procedure consists of three parts. First, the strobe is advanced in discrete steps by adjusting taps on a delay line until errors occur. Second, the strobe is retarded in discrete steps until read errors occur. In the third step, the strobe is permanently set to a position half-way between the limits for advanced and retarded strobe obtained during steps 1 and 2.

1. Command Advanced Read Clock (ARC).
2. Read in sequential head mode for one minute.
 - a. If errors occur, perform Shifting Read Clock Retarded procedure until no errors occur. Make note of tap settings. Proceed to step 3.



NOTES:

- ① CCW MOVEMENT OF TAP ON C1 ADJUSTS STROBE EARLY BY 2 NS/TAP CW ON C1 ② DELAYS STROBE.
- ② CW MOVEMENT OF TAP ON B3 REQUIRED FOR CCW ① MOVEMENT ON C1.
- ③ ONE END OF JUMPER WIRE IS ALWAYS CONNECTED TO PIN 14.
- 4 *PINS 1, 7 AND 8 OF JUMPER ARE UNUSED.

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Figure 3-15. Data Separator Card Delay Wiring

- b. If errors do not occur, perform Shifting Read Clock Advanced procedure until errors occur. Make note of tap settings. Proceed to step 3.
3. Command Retard Read Clock (RRC).
4. Read in sequential head mode for one minute.
 - a. If errors occur, perform Shifting Read Clock Advanced procedure until no errors occur. Make note of tap settings. Proceed to step 5.
 - b. If errors do not occur, perform Shifting Read Clock Retarded procedure until errors occur. Make note of tap settings. Proceed to step 5.
5. Calculate the new delay tap settings by subtracting the shortest delay (determined from steps 2 and 4) from the longest delay. Divide the result by two and add this to the shortest delay, the result is the new delay setting.
6. Remove the data separator card from C25. Remove and discard the plug-in jumpers.
7. Using #20 bare wire, solder jumper from B3 pin 14 to terminal determined in step 5. It is necessary to maintain the timing relationship between C1 and B3. For example, if final setting requires that C1 tap must be repositioned counterclockwise by two terminals from factory-recorded terminal, B3 tap must be repositioned clockwise by two terminals from factory-recorded terminal.
8. Solder a jumper from C1 pin 14 to the terminal determined from step 6.
9. Reinstall the data separator card in C25.
10. Set READ CLOCK switch to NORMAL.
11. Read continuously for three minutes to verify that no read errors occur.

Shifting Read Clock Advanced

Adjust the data strobe for a more advanced setting by moving the jumper on selector plug C1 counterclockwise (shorter delay time) by one 2 nsec-tap and moving the jumper on selector plug B3 clockwise (longer delay time) by one 2 nsec-tap. These jumpers must both be moved to maintain the correct timing relationship between the two delay lines.

Shifting Read Clock Retarded

Adjust the data strobe for a more retarded setting by moving the jumper on selector plug C1 clockwise (longer delay time) by one 2 nsec-tap and moving the jumper on selector plug B3 counterclockwise (shorter delay time) by one 2 nsec-tap. These jumpers must both be moved to maintain the correct timing relationship between the two delay lines.

MISCELLANEOUS LOGIC CHECKOUT

Motor Safety Interlock

This procedure verifies that the logic safety interlock will prevent the spindle motor from starting if the actuator is not completely retracted. Proceed as follows with a pack installed and START switch off:

1. Disconnect voice coil yellow lead.
2. Set LOCAL/REMOTE switch to LOCAL.
3. Turn on all circuit breakers.

CAUTION

While performing following steps, move heads forward far enough to cause heads loaded switch to transfer, but not far enough to contact pack. Otherwise, heads and/or pack may be damaged.

4. Manually push actuator forward until Heads Loaded switch transfer. FAULT indicator may light: this is normal, since emergency retract capacitor was discharged.
5. Press START switch. Observe the following:
 - a. START indicator shall light. If not, check switch and its associated interlock.
 - b. Spindle motor shall not start. If not, check Pull Motor Relay logic at A18 and A03.
6. Press (to extinguish) START.
7. Retract actuator.
8. Reconnect yellow lead to voice coil.

Clock/Index Timing

This procedure verifies correct operation of the 806 kHz clock and the Index timing. Proceed as follows with a pack installed:

1. Load heads.
2. Connect oscilloscope channel A to C29-10B (Odd + Even Dibits).
3. Connect oscilloscope channel B to B20-9B (806 kHz Clock).
4. Observe that waveforms are identical. (Dibits are not present during Index detection portion of disk.) If not, check clock circuit at D20.
5. Connect oscilloscope to D26-10B (Index). Observe that signal is "1" for 2 μ sec (± 0.5). If not, check Index detection circuit at D26.

Start/Stop Time

These procedures verify correct operation of the spindle drive motor and hysteresis brake. Use a stopwatch or wristwatch with sweep second hand. With a pack installed and all covers closed, proceed as follows:

1. Press (to light) START switch and start timer. Heads shall load when brush cycle is completed in 25 (± 7) seconds.
2. Press (to extinguish) START switch. Pack shall come to complete stop in less than 25 seconds.

Speed Sensing

This procedure verifies correct operation of the speed detection function. Proceed as follows with a pack installed:

1. Load heads.
2. Connect oscilloscope to back panel A08-7B (Speed Transducer Output). Sync positive internal. Calibrate scope trace to ground.

NOTE

Signal must go positive before negative. If not, reverse wiring contacts in speed transducer connector.

3. Observe waveform on oscilloscope. Signal should be 4 to 7 volts peak-to-peak. If not, check sensor gap as directed in Speed Sensor Assembly Check and Adjustment procedure in corrective maintenance portion of this manual.
4. Connect oscilloscope to A08-3B (Speed pulses). Sync positive internal.
5. Observe that signal is a "1" for 55 (± 14) μ sec. If not, check X2600 on card at A08.

Power Up Blanking

This procedure verifies that the internal Master Clear is operational during startup conditions. A pack need not be installed.

1. Turn off UNIT POWER circuit breaker.
2. Connect oscilloscope channel A to +5 test point on logic chassis maintenance panel. Sync positive internal.
3. Connect oscilloscope channel B to back panel pin B11-10B (Power Up Blanking).
4. Turn on UNIT POWER circuit breaker while observing oscilloscope.
 - a. Channel A ($\pm 5v$) should reach +4.5v within 100 ms. If not, check power supply and regulator A2A5.
 - b. Channel B pulse width ("1") should be 150 (± 50) ms. If not, check delay D100 on card at B11.

MECHANICAL CORRECTIVE MAINTENANCE

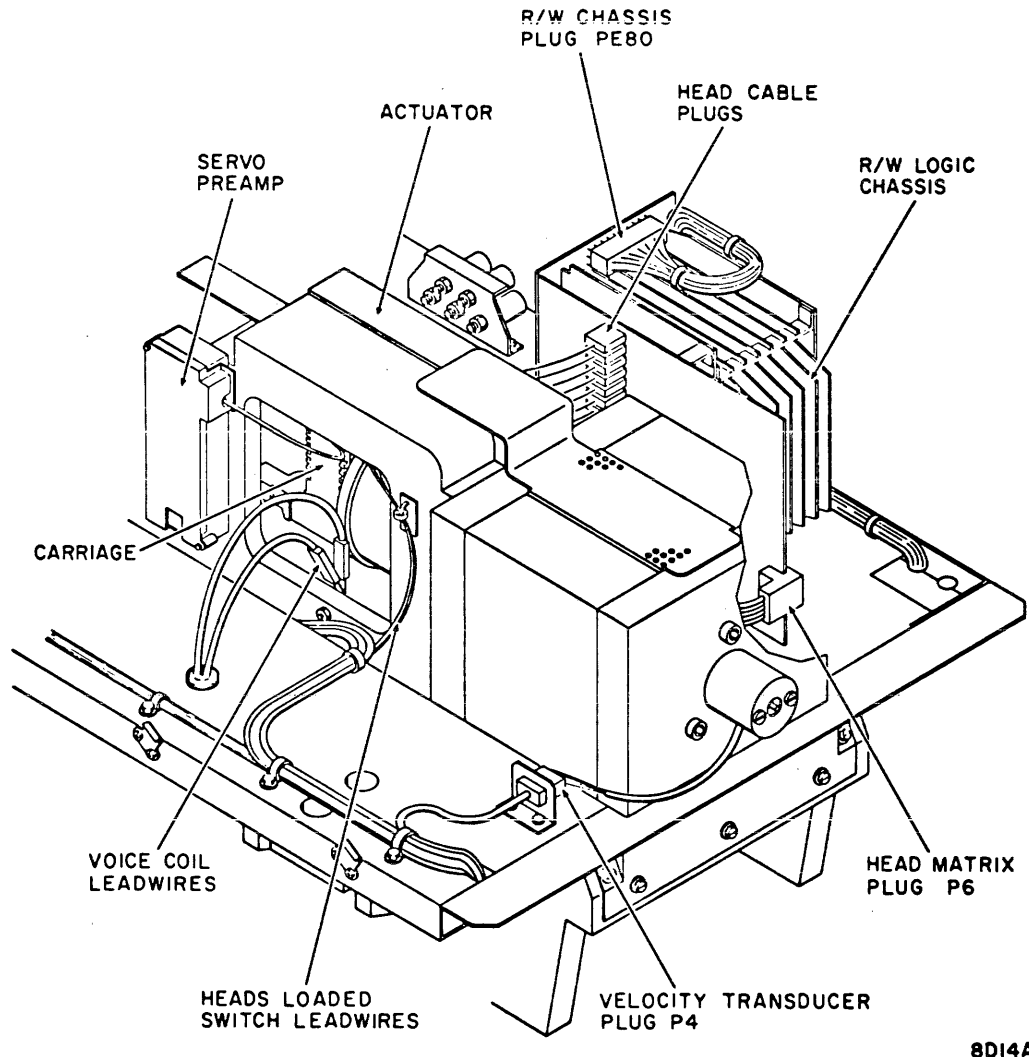
ACTUATOR REPLACEMENT

CAUTION

The magnetic field generated by the magnet assembly is very strong. Remove watch, rings, or jewelry you are wearing. Permanent watch damage will occur if brought near magnet.

1. Set UNIT POWER circuit breaker to OFF.
2. Remove disk pack.
3. Refer to Side Panel Removal/Installation procedure and remove right (viewed facing drive front) side panel.
4. Open cabinet top cover.
5. Remove deck top cover.
6. Make note of voice coil leadwire connection scheme and disconnect leadwires.
7. Remove velocity transducer plug P4.

8. Leadwires to heads loaded switch are fastened to actuator side with a cable tie. Cut cable tie to free leadwires.
9. Make note of heads loaded switch leadwire connection scheme. Disconnect leadwires.
10. Remove two screws securing servo preamp housing cover (Figure 3-17). Remove and set cover aside.
11. Disconnect servo head plug and servo output plug P8 from servo preamp circuit board. Write "SERVO" on servo head plug.
12. Remove plug P6 on logic card E0 (Figure 3-17).
13. Install head cam tool (refer to Manually Positioning Carriage procedure).
14. Refer to Velocity Transducer Replacement procedure and remove velocity transducer.
15. Remove two screws securing forward stop plate to stop mount (Figure 3-18).
16. Remove screw securing actuator to magnet assembly.
17. Remove three screws (under deck) securing magnet assembly to deck (screw above motor mounting plate can not be completely removed, allow screw to rest on motor mounting plate).
18. Fully extend carriage (with head cam tool installed).



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Figure 3-17. Main Deck Topside

CAUTION

When removing magnet assembly, use care not to damage voice coil. Do not place magnet on or near any metal because it will be almost impossible to separate the two. Preferably place magnet on a wooden table, free of any metal filings or other metallic objects.

19. Remove magnet assembly from deck by sliding assembly straight back from voice coil.
20. Using a 1/4 inch ratchet torque wrench, with adapter, and a 3/16 inch ball ended hex driver, remove three screws and washers securing actuator to deck.

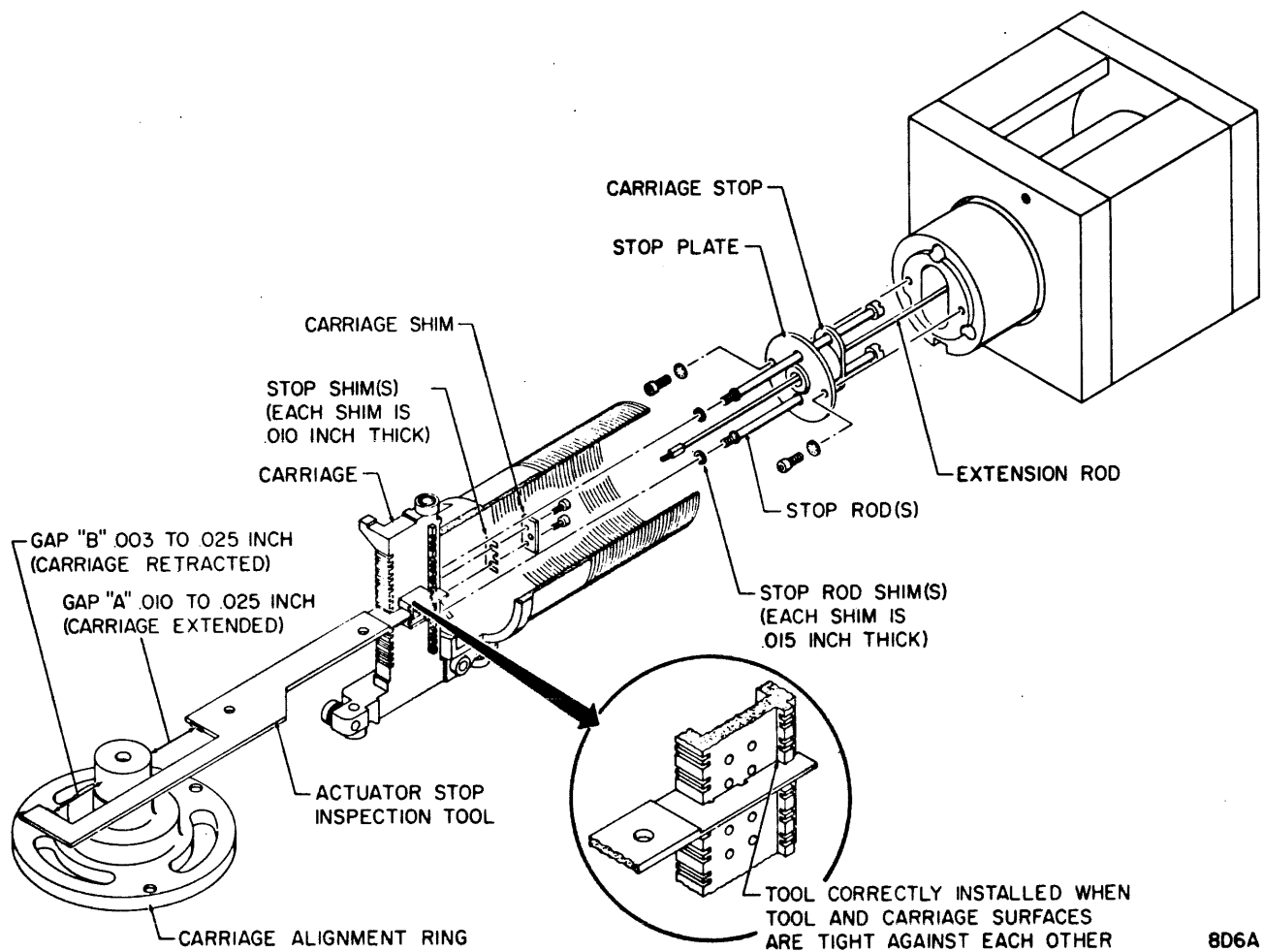


Figure 3-18. Carriage Stop Adjustment

21. Remove screw and washer securing head cable clamp bracket to deck (applicable to units with in-line heads only).
22. Retract carriage and remove head cam tool.

NOTE

The actuator is mounted on a dowel pin. Lift actuator off dowel pin, and pull back to remove.

CAUTION

The actuator and logic card E0 are removed at the same time, use care not to damage card or head cables.

23. Remove actuator assembly and logic card E0 to a clean work area.
24. Remove two screws securing servo preamp housing assembly to actuator. Remove and install servo preamp housing on replacement actuator.

NOTE

Before removing head cable plugs from card E0, mark each plug in the sequence they are removed (from top plug "0" to last plug "17", servo head plug was marked "SERVO" in step 11, do not re-mark servo plug).

25. Remove head cable plugs from logic card E0.
26. Starting from top of carriage remove each head/arm assembly and install it in the same location on replacement actuator (refer to Head/Arm Replacement procedure for proper method of head removal/installation).
27. Refer to figure 3-18 and inspect replacement actuator for presence of stop rod shims. If not shims were installed, proceed to step 28. If shims are installed, proceed to step 31.
28. Remove stop rods and install two stop rod shims (from shim assortment, see table 3-1) on each stop rod.
29. Apply one drop of Loctite, Grade C, to threads of each stop rod. Secure stop rods to carriage assembly.
30. Install head cable plugs on logic card E0, starting with head cable plug marked 17 (bottom plug).
31. Connect servo head plug to servo preamp circuit board.
32. Install replacement actuator and logic card E0 on deck. Use three screws to loosely secure actuator to deck. Connect plug P6 to logic card E0.
33. Install head cam tool and extend carriage.
34. Install magnet assembly on deck. Loosely secure magnet to deck using three screws.
35. Loosely install screw through top of actuator into magnet assembly. Move voice coil in and out of magnet making sure voice coil is not contacting magnet assembly while tightening screw.
36. Retract carriage and remove head cam tool.
37. Install head cable clamp bracket using one screw and washer (units with inline heads only).
38. Connect heads loaded switch leadwires. Secure leadwires to actuator side using cable tie through metal plate.
39. Perform Carriage Alignment procedure.
40. Perform Heads Loaded Switch Adjustment procedure.
41. Install velocity transducer per Velocity Transducer Replacement procedure.
42. Connect velocity transducer cable plug P4 (figure 3-17).
43. Connect voice coil leadwires.
44. Connect servo output plug P8 to servo preamp circuit board.
45. Install servo preamp housing cover using two screws.
46. Perform Head/Arm Adjustment procedure.
47. Install deck top cover.
48. Close cabinet top cover.

BRAKE BELT (V-BELT) S/C 11 & BELOW

Brake belt maintenance is limited to replacement of a worn or defective belt. As part of the replacement procedure the belt tension

is adjusted. After approximately 150 hours of drive operation - after belt replacement - the tension must be readjusted to compensate for initial wear-in. No other brake belt maintenance is required.

Replacement

1. Press START switch to stop drive motor.
2. Prepare drive for brake belt replacement.
 - a. Open cabinet rear door and swing out logic chassis.
 - b. Set UNIT POWER circuit breaker to OFF.
 - c. Raise top cover assembly.
 - d. Remove front panel assembly.
3. Remove two idler springs (drive belt tension springs): This allows drive motor and brake assembly to move forward to facilitate drive belt removal. Refer to figure 3-19. On older drives, the second tension spring is located towards the top of the frame, on the right side, in the middle of the drive.
4. Remove drive belt from drive motor pulley: Reach in from front of drive and remove drive belt from spindle pulley. Lift drive belt over drive motor pulley and slide drive belt toward front of drive. Leave drive belt hanging under spindle assembly.
5. Loosen two rear brake plate mounting screws: From rear of drive, using an Allen wrench, loosen (do not remove) two rear brake plate mounting screws by turning counterclockwise.
6. Remove pulley cover: Remove screw securing right side of pulley cover. Remove screw, lock washer, ground strap, and second lock washer securing left side of pulley cover. Set pulley cover and associated hardware aside. Leave ground strap hanging.
7. Loosen belt adjustment screw: Turn brake belt adjustment screw counterclockwise until there is enough movement in the brake mounting plate to allow brake belt removal.
8. Remove brake belt: Push forward on brake mounting plate and remove brake belt from V-belt pulley and lift it up and off drive motor pulley.
9. Install new brake belt:
 - a. Lift new brake belt over top of drive motor pulley and seat belt in brake belt groove on lower side of drive motor pulley.
 - b. Check brake belt installation on drive motor pulley by applying slight backward force on brake belt while rotating belt back and forth. If belt is properly installed, drive motor pulley rotates freely. If binding is encountered, brake belt is wedged between drive motor, and step 9 must be repeated.
 - c. Seat new brake belt in V-belt pulley by pushing brake mounting plate forward and lifting brake belt into pulley groove.
 - d. Pull brake mounting plate towards rear of machine to hold new belt in position.
10. Tighten brake belt adjustment screw: Using a mirror, observe the position of the compression spring sleeve. Turn brake belt adjustment screw clockwise until sleeve is flush with motor mounting bracket. This step is the initial brake belt adjustment.
11. Reposition drive belt: From front of drive, reach in and place drive belt over and onto drive motor pulley. Slip drive belt onto spindle pulley. Push drive motor toward rear of drive to hold drive belt in place. Patience

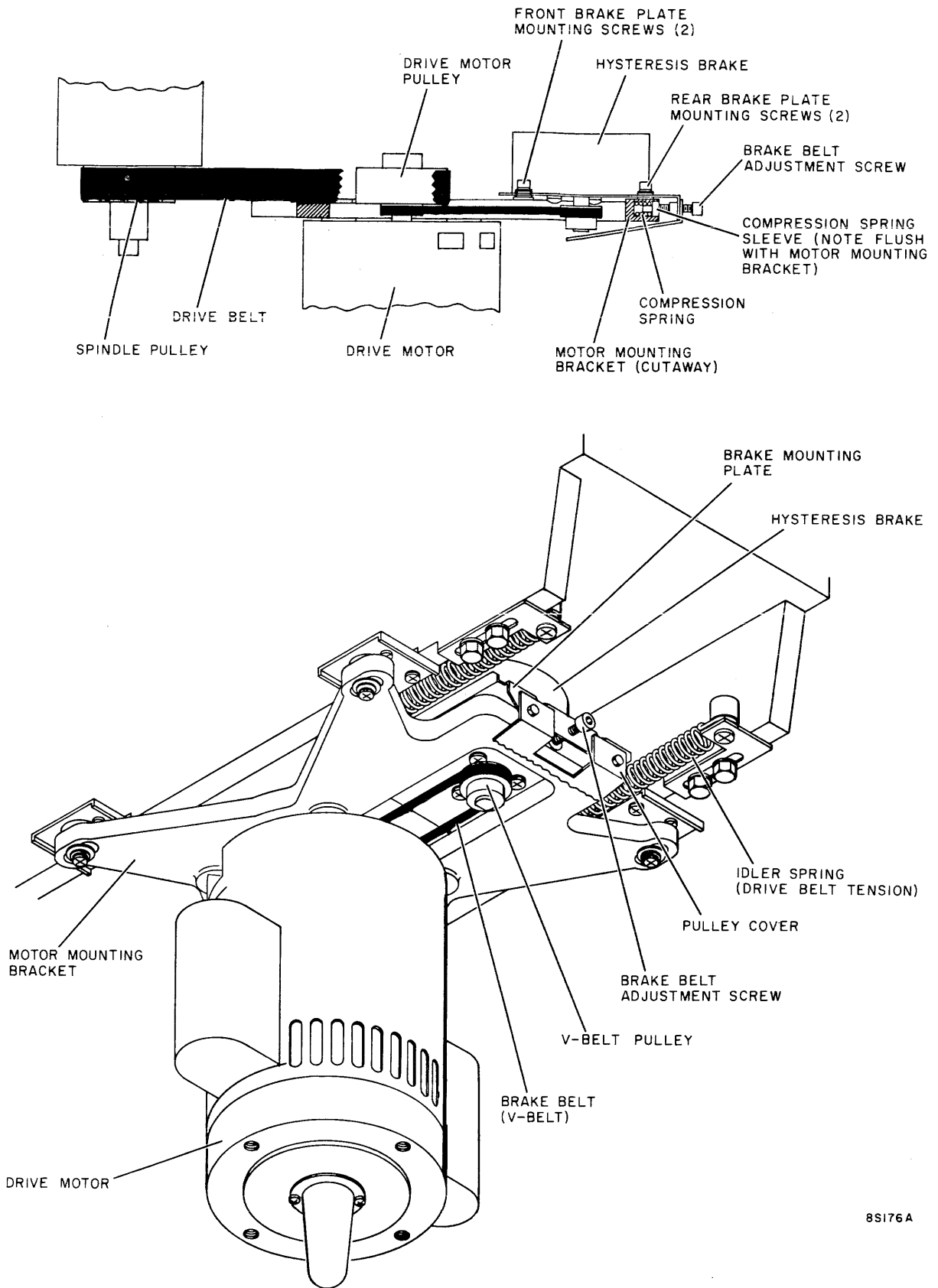


Figure 3-19. Brake Belt Adjustment

and resourcefulness are helpful in completing this step.

12. Reposition idler springs (drive belt tension springs) removed in step 3.
13. Start and stop drive motor: Set UNIT POWER circuit breaker to ON. Press START switch to start drive motor and allow heads to load. Press START switch to stop drive motor and allow drive motor to stop. Set UNIT POWER circuit breaker to OFF.
14. Recheck brake belt adjustment: Using a mirror, check position of spring compression sleeve in relation to motor mounting bracket. If sleeve is not flush adjust brake belt adjustment screw as necessary.
15. Tighten two rear brake plate mounting screws.

NOTE

When pulley cover is in place, it should not contact V-belt pulley.

16. Replace pulley cover: Secure pulley cover to brake mounting plate using hardware removed in step 6.
17. Prepare drive for normal operation:
 - a. Replace front panel assembly.
 - b. Lower top cover assembly.
 - c. Set UNIT POWER circuit breaker to ON.
 - d. Close cabinet rear door.
 - e. Press START switch to load heads.
18. Log brake belt replacement and hour meter reading into machine/site log.

Brake Belt Tension Readjustment

This procedure is to be performed after approximately 150 hours of drive operation after a new drive belt has been installed.

1. Press START switch to stop drive motor.
2. Prepare drive for brake belt readjustment.
 - a. Open cabinet rear door and swing out logic chassis.
 - b. Set UNIT POWER circuit breaker to OFF.
 - c. Raise top cover assembly.
3. Loosen two rear brake plate mounting screws (refer to figure 3-19): From rear of drive, using an Allen wrench, loosen (do not remove) two rear brake plate mounting screws by turning counterclockwise.
4. Push forward on, and then release brake mounting plate to insure freedom of movement.
5. Tighten two rear brake plate mounting screws.
6. Prepare drive for normal operation:
 - a. Lower top cover assembly.
 - b. Set UNIT POWER circuit breaker to ON.
 - c. Close cabinet rear door.
7. Log brake belt tension readjustment and hour meter reading into machine/site log.

BRAKE PAWL ASSEMBLY

Check & Adjustment (S/N 3151 & Below)

1. Turn off main breaker.
2. Lift pack access cover.
3. Remove disk pack.
4. Rotate spindle to a position where the brake tooth is not under a notch in the pack mounting plate (Figure 3-20).
5. Check distance between brake tooth and pack mounting plate with a feeler gauge. Distance should be .010 (\pm .002) inch. If necessary, adjust as follows:
6. Remove brake access cover.
7. Adjust back stop screw. (Clockwise to increase distance, or counterclockwise to decrease distance.)

NOTE

Brake access cover acts as a limit stop for the brake pawl assembly.

8. Replace brake access cover and recheck distance between brake tooth and pack mounting plate.

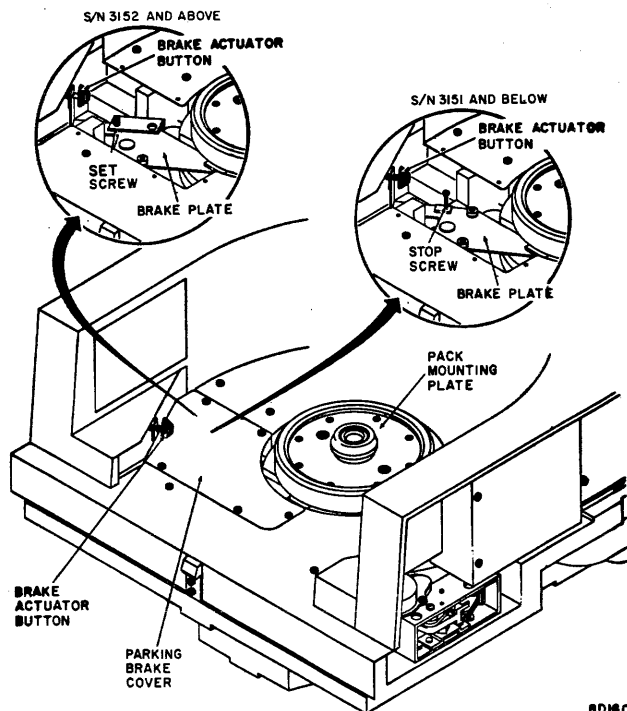


Figure 3-20. Brake Plate Replacement

9. Repeat steps 6,7,and 8 until distance between brake tooth and pack mounting plate is .010 (\pm .002) inch.
10. Install disk pack.
11. Check distance between actuator button and bottom protective disk with a feeler gauge. Distance should be 0.010 ($+0.005,-0.0$) inch. If necessary, adjust as follows:
12. Remove disk pack.
13. Insert Allen wrench through hole in actuator button and turn clockwise (to increase distance between actuator button and bottom protective disk) or counterclockwise (to decrease distance).
14. Install disk pack.
15. Repeat steps 11 through 14 until distance between actuator button and bottom protective disk is 0.010 ($+0.005, -0.0$) inch.

Check & Adjustment (S/N 3152 & Above)

1. Turn off main breaker.
2. Lift pack access cover.
3. Remove disk pack.
4. Rotate spindle to a position where the brake tooth is not under a notch in the pack mounting plate (Figure 3-20).
5. Check distance between brake tooth and pack mounting plate with a feeler gauge. Distance should be .010 (\pm .002) inch. If necessary, adjust as follows:
6. Remove brake access cover.
7. Adjust setscrew. (Clockwise to increase distance,or counterclockwise to decrease distance.)
8. Install disk pack.
9. Check distance between actuator button and bottom protective disk with a feeler gauge.

Distance should be 0.010 (+0.005, -0.0) inch. If necessary, adjust as follows:

10. Remove disk pack.
11. Insert Allen wrench through hole in actuator button and turn clockwise (to increase distance between actuator button and bottom protective disk) or counterclockwise (to decrease distance).
12. Install disk pack.
13. Repeat steps 9 through 12 until distance between actuator button and bottom protective disk is 0.010 (+0.005, -0.0) inch.

Replacement

1. Stop drive motor.
2. Remove disk pack. Leave pack cover open.
3. Remove five screws securing parking brake cover to shroud.
4. Remove two screws securing brake plate assembly and springs to deck casting.
5. Install replacement brake plate assembly to deck casting with two screws and springs (Figure 3-20).
6. Install parking brake cover on shroud.
7. Secure cover with five screws.
8. Close pack cover.

CARRIAGE ASSEMBLY

Carriage/Spindle Alignment

The carriage assembly is properly aligned when carriage motion is along a radial line to the axis of rotation of the spindle assembly. The following adjustment is required whenever the five screws securing the actuator housing to the deck casting are loosened, or the spindle assembly is loosened from the deck casting.

1. Set UNIT POWER circuit breaker to OFF.
2. Refer to Head/Arm Replacement procedure and remove head number 10.
3. Install carriage alignment arm on carriage at head 10 position.
4. Torque head/arm clamp screw, clamp plate, washers, and alignment arm to 4 inch-pounds.
5. Install head cam tool.
6. Install carriage alignment ring on spindle.
7. Slowly extend carriage until carriage alignment arm and ring are approximately aligned as shown in Figure 3-21.

CAUTION

The carriage is aligned by moving the spindle. The five bolts securing the actuator to the deck are not to be loosened.

8. Check that clearance between ring and arm tools is as specified in Figure 3-21.
9. Loosen three screws securing the spindle assembly to deck.

NOTE

On units having cutouts in shroud (see Figure 3-21) proceed to step 10. On units not having cutouts proceed to step 11.

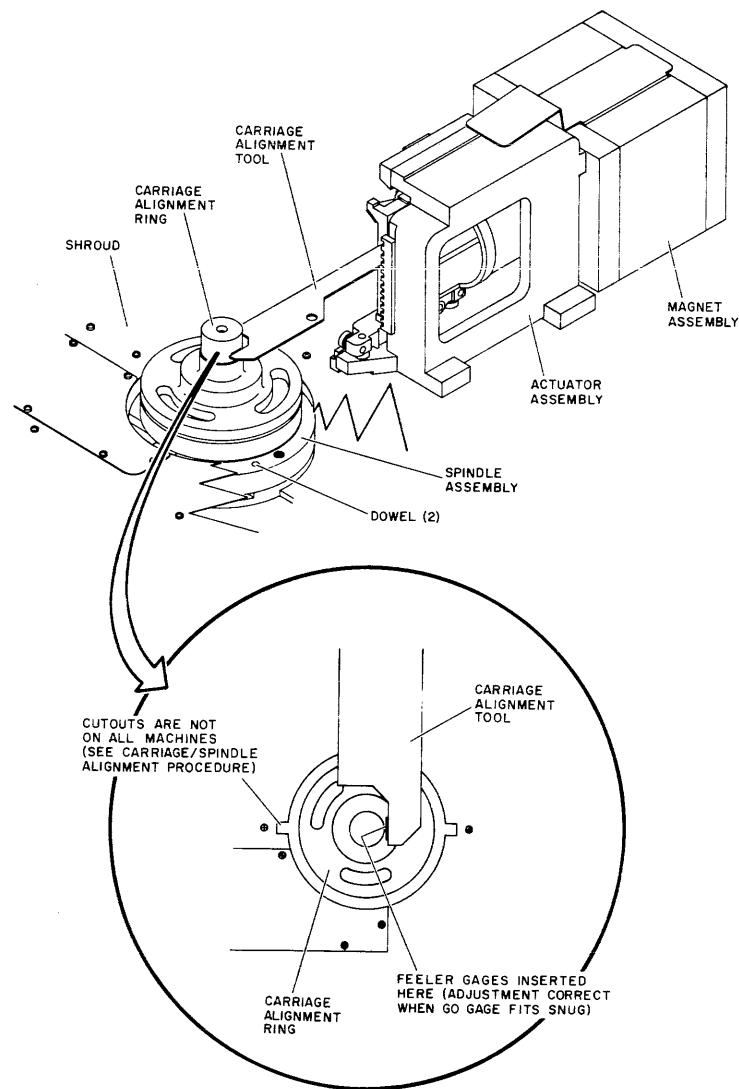
10. Using spindle adjustment tool, move the spindle to obtain the clearance specified in Figure 3-21. If this clearance is obtained proceed to step 12. However, if it is too far out of adjustment to be corrected in this manner proceed to step 13.
11. Using a plastic face hammer, lightly tap spindle housing (beneath deck) to move spindle assembly. If requirements of Figure 3-21 are met proceed to step 12. However, if it is too far out of adjustment proceed to step 13.

12. Tighten the three spindle screws and recheck clearance. If incorrect repeat steps 10 or 11 (as applicable). When the clearance is correct proceed to step 20.
13. Move the spindle until the dowel pins (Figure 3-21) are centered in the spindle slots.
14. Loosen the three screws securing the actuator housing to the deck.
15. Loosen the three screws securing the magnet to the deck.

NOTE

The actuator housing pivots on a pin located in its base and just forward of the magnet assembly. Pivoting motion is tangential to spindle.

16. Rotate the actuator to obtain the clearance specified in Figure 3-21.
17. Torque (using 55 to 60 in-lbs.) the three screws securing the actuator housing.
18. Tighten the three screws securing the magnet.



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Figure 3-21. Carriage Alignment

19. Recheck the clearance and fine adjust as instructed in step 10 or 11 (as applicable).
20. Retract carriage, remove head cam tool and carriage alignment arm.
21. Remove carriage alignment ring.
22. Refer to Head/Arm Replacement procedure and install head removed in step 2.
23. Perform Head/Arm Adjustment procedure.
24. Inspect read/write heads according to procedures in Preventive Maintenance section, clean heads if necessary.
12. Using a plastic feeler gage, measure gap "B" shown in Figure 3-18. If requirements are not met, perform Retracted Carriage Stop Adjustment procedure.
13. Remove carriage alignment tool from spindle.
14. Remove head cam tool.
15. Remove actuator stop inspection tool.
16. Refer to Head/Arm Installation procedure and install head removed in step 6.
17. Perform Head/Arm Alignment procedure on head removed and heads above and below it.

Carriage Extend Stop Adjustment

Stop Check

1. Stop drive motor.
2. Remove disk pack.
3. Open cabinet top and pack cover.
4. Remove deck top cover.
5. Refer to Head/Arm Replacement procedure and remove head 7.
6. Install carriage alignment tool on spindle assembly.

NOTE

When installing actuator stop inspection tool, hold tool tight against back carriage stop until secured in place (Figure 3-18).

7. Install actuator forward inspection tool on carriage in head position 7. Secure tool with head clamping hardware.
8. Install head cam tool (refer to Manually Positioning Carriage procedure).
9. Fully extend carriage and hold securely in place.
10. Using plastic feeler gage, measure gap "A" shown in Figure 3-18. If requirements are not met, perform Extended Carriage Stop Adjustment procedure.
11. Fully retract carriage and hold securely in place.

1. Perform steps 1 through 8 of Carriage Stop Check procedure.
2. Refer to Actuator Replacement procedure and remove magnet assembly.

NOTE

Each stop rod shim is .015 inch thick. Determine the quantity of shims to be added or removed before removing stop rods.

3. Using a screwdriver, remove each stop rod (Figure 3-18).

NOTE

Remove or replace an equal number of shims on each stop rod.

4. Add or remove stop rod shims as required for each stop rod.
5. Apply one drop of Loctite, Grade C, to the threads on each stop rod.
6. Install stop rods and tighten in place.
7. Refer to Actuator Replacement procedure and install magnet assembly.
8. Perform Carriage Alignment procedure.
9. Perform Carriage Stop Check procedure.

Carriage Retracted Stop Adjustment

1. Perform steps 1 through 8 of Carriage Stop Check procedure.

NOTE

Each stop shim is .010 inch thick. Determine the quantity of shims to be added or removed before removing screws that secure carriage shim.

2. Remove two screws securing carriage shim (Figure 3-18).
3. Add or remove stop shims as required.
4. Apply one drop of Loctite, Grade C, to the threads of each screw used to secure carriage shim.
5. Install two screws through carriage shim and stop shims into carriage. Tighten screws.
6. Perform Carriage Stop Check procedure.

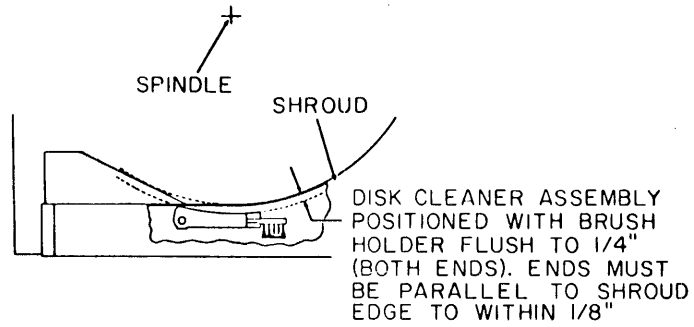
DISK CLEANER ASSEMBLY S/C 09 WITHOUT PE35634C & BELOW

The disk cleaner cam attached to the brush motor and the brush cycle switch are the only adjustable parts of the disk cleaner assembly. Cam adjustment is performed during brush motor replacement and should not require further adjustment. Adjust the brush cycle switch as required. If trouble with the disk cleaner assembly is not related to the brush motor or brush cycle switch, replace disk cleaner assembly.

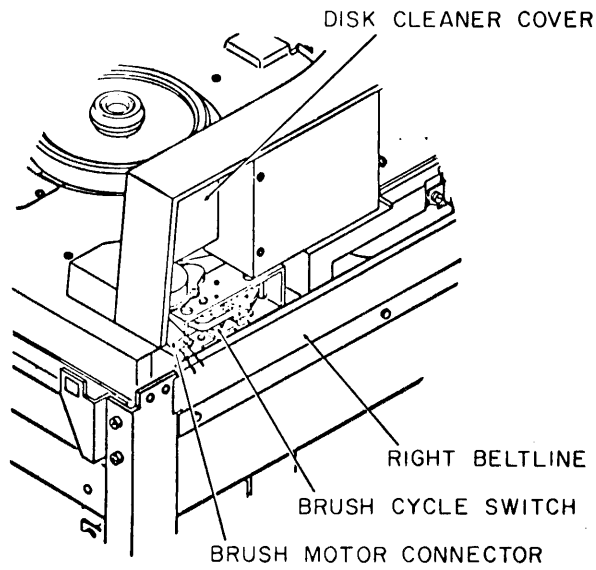
Assembly Replacement

1. Set UNIT POWER circuit breaker to OFF.
2. Open pack cover.
3. Remove disk pack.
4. Open top cover.
5. Remove five screws securing disk cleaner cover to shroud (Figure 3-22). Remove cover.

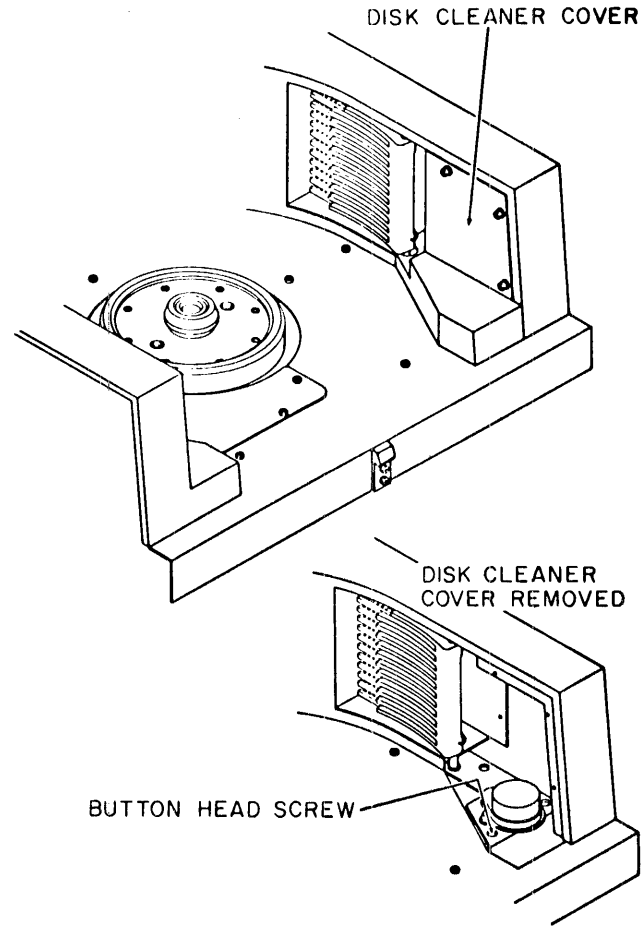
6. Disconnect motor cable plug and brush cycle switch leadwires.
7. Using a 1/8 inch hex key, loosen button head screw securing disk cleaner assembly to deck (Figure 3-22).
8. Remove two screws and washers (cable tie is under one screw) securing disk cleaner assembly to deck.
9. Slide assembly away from spindle to clear button head screw. Pull assembly upwards and through opening in shroud. Remove disk cleaner from drive.
10. Remove brushes from faulty disk cleaner assembly (Refer to Brush Replacement procedure in Preventive Maintenance section).
11. Check brushes for wear (Figure 3-23) and replace if necessary.
12. Install brushes on replacement disk cleaner assembly.
13. Connect brush cycle switch leadwires.
14. Connect brush motor cable plug.
15. Install replacement disk cleaner assembly. Make sure that slot in base of disk cleaner engages button head screw.
16. Loosely install two screws, washers, and cable tie through base of assembly.
17. Position disk cleaner to dimensions shown in Figure 3-22 and tighten three screws securing assembly to deck (use hex key to tighten button head screw).
18. Install a disk pack.
19. Visually check horizontal alignment of brushes and brush holder arms with disk spaces (manually rotate brush holder to pack edge if necessary).



BRUSH HOLDER LATCHED (RETRACTED) TOP VIEW



DISK CLEANER ASSEMBLY TOP VIEW



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Figure 3-22. Disk Cleaner Assembly Replacement

20. Manually move brush holder to latched (retracted) position under shroud.
21. Remove disk pack.
22. Position disk cleaner cover and shroud and secure cover with five screws.
23. Close cabinet top cover.
24. Close pack cover.

Motor Replacement

1. Remove disk cleaner assembly from unit (refer to Disk Cleaner Assembly Replacement procedure).
2. Manually rotate disk cleaner cam clockwise (from below) until cam timing mark is opposite the pivot pin in cam follower arm (Figure 3-23).
3. Remove two screws and washers securing brush motor to disk cleaner base. Remove noise filter.
4. Remove two screws in hub of disk cleaner cam.
5. Hold disk cleaner cam against underside of disk cleaner base and pull motor shaft out of cam. Set motor aside.

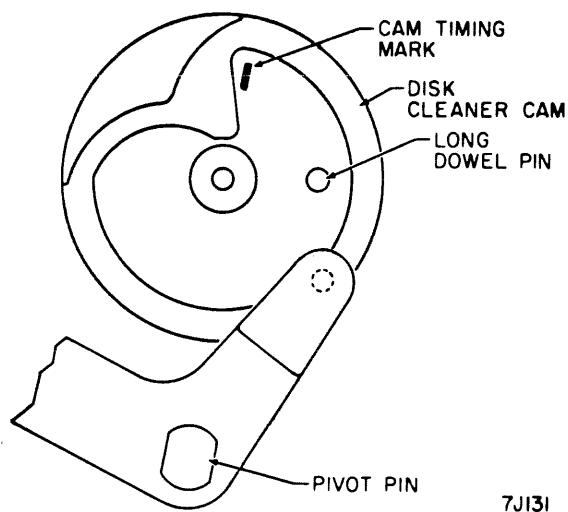


Figure 3-23. Cam Position For Removing Brush Motor Assembly

6. With disk cleaner cam held against underside of disk cleaner base, insert replacement motor shaft through disk cleaner base and cam hub.
7. Replace noise filter and secure motor to disk cleaner base with two screws and lockwashers.

NOTE

Before installing the two setscrews in cam hub, apply Loctite, Grade C, to the first two or three threads of the setscrews.

8. Position disk cleaner cam on brush motor shaft to achieve the clearance between cam and large dowel pin as indicated in Figure 3-24. Tighten two screws in cam hub.

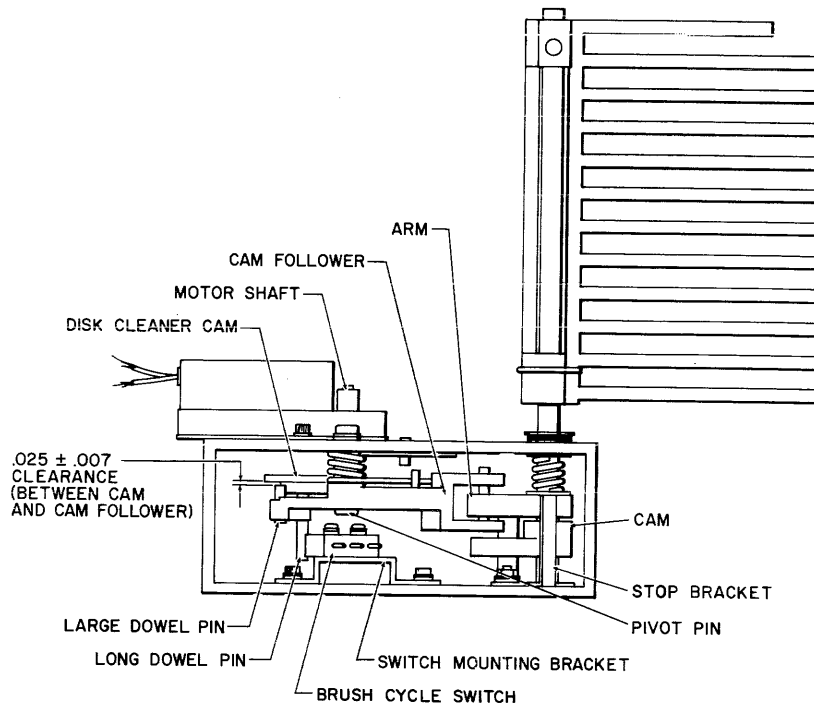
NOTE

When the cam timing mark and cam follower are aligned, switch actuation should have just occurred.

9. Manually rotate disk cleaner cam counterclockwise (from below) and align cam follower pin and cam timing mark (Figure 3-25).
10. Check that brush cycle switch actuation has occurred. Perform Brush Cycle Switch Adjustment procedure.
11. Install disk cleaner assembly (refer to Disk Cleaner Assembly Replacement procedure).

Switch Check And Adjustment

1. Set UNIT POWER circuit breaker to OFF.
2. Remove disk pack.
3. Open top cover.
4. Identify and mark leadwires to brush cycle switch. Disconnect leadwires at switch.
5. Manually rotate disk cleaner cam clockwise (from below) to align cam follower pin and cam timing mark (black line, Figure 3-25).
6. Loosen two screws securing switch bracket to disk cleaner assembly.



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Figure 3-24. Disk Cleaner Assembly

7. Connect the probes of a multimeter (set to Rx1) across switch terminals marked C and NC.
8. Rotate switch away from long dowel pin (Figure 3-25) until switch transfers (meter reading goes from 0 ohms to infinity). Disconnect probes.
9. Connect multimeter probes to switch terminals marked C and NO.
10. Rotate switch in towards the long dowel pin until switch actuates (meter reading goes from 0 ohms to infinity). Tighten switch bracket screws.
11. Check adjustment by manually rotating cam 20 degrees counterclockwise then clockwise until timing mark lines up with cam follower (Figure 3-25). Switch should transfer, if not, repeat steps 8, 9, and 10.
12. Disconnect meter probes.
13. Replace switch if requirements of steps 7, 8, 9, and 10 are not met.
14. Close top cover.

Switch Replacement

1. Set UNIT POWER circuit breaker to OFF.
2. Remove disk pack.
3. Open top cover.
4. Identify and mark leadwires to brush cycle switch. Disconnect leadwires at switch.
5. Remove two screws and washers securing switch bracket to disk cleaner base. Remove switch and bracket from unit.

NOTE

Before removing switch from switch bracket, note switch position on bracket.

6. Remove two screws and washers securing switch to switch bracket.
7. Position replacement switch on switch bracket and secure switch with two screws and washers.
8. Loosely attach switch bracket to disk cleaner assembly with two screws and washers.
9. Perform Brush Switch Check and Adjustment procedure.

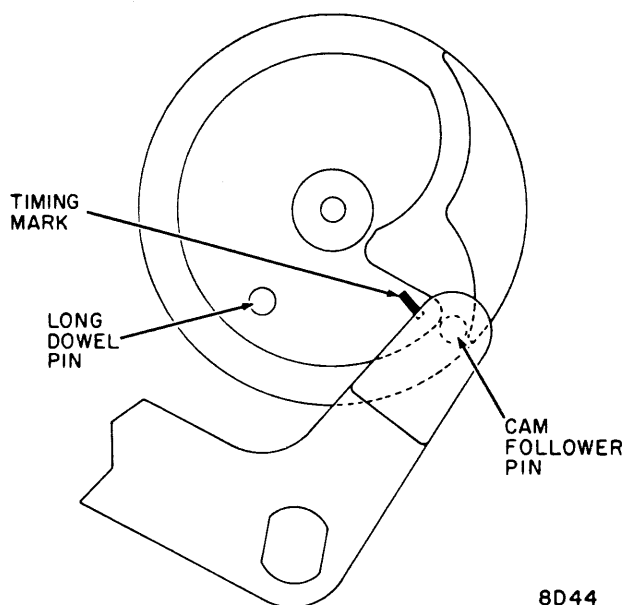


Figure 3-25. Cam Position for Adjusting Brush Cycle Switch

FIRST SEEK INTERLOCK ASSEMBLY S/C 09 WITH PE35634C & ABOVE

The timing motor cam and the interlock switch are the only adjustable part of the first seek interlock assembly. Cam adjustment is performed during motor replacement and should not require further adjustment. Adjust the interlock switch as required.

Check

This procedure verifies correct operation of the first seek interlock assembly. Use a stopwatch or wristwatch with sweep second hand. With a pack installed and all covers closed, proceed as follows:

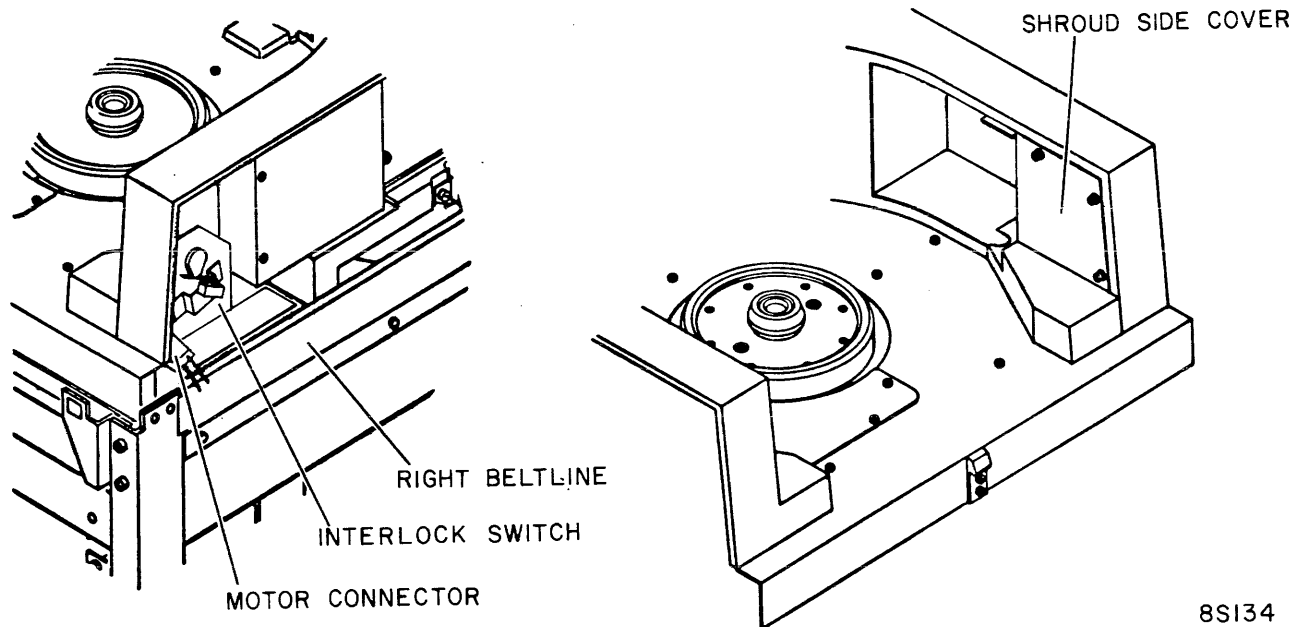
1. Set the LOCAL/REMOTE switch to LOCAL.
2. Set UNIT POWER circuit breaker to ON.
3. While observing physical unit identification indicators, press START switch and start timer. Indicator should light after about 15 seconds. If longer than about 17 seconds, check the following:
 - Timing motor cam adjustment
 - Interlock switch adjustment
 - Logic card at location A12.

Assembly Replacement

1. Set UNIT POWER circuit breaker to OFF.
2. Open pack cover.
3. Remove disk pack.
4. Open top cover.
5. Disconnect timing motor cable plug (Figure 3-26).
6. Identify and disconnect interlock switch leadwires.
7. Remove two screws and washers securing interlock assembly to deck (Figure 3-26).
8. Slide assembly away from spindle while pulley assembly upwards through opening in shroud. Remove assembly from drive.
9. Connect timing motor cable plug to replacement interlock assembly.
10. Connect interlock switch leadwires.
11. Install replacement interlock assembly on deck. Secure assembly to deck using two screws and washers.
12. Perform First Seek Interlock Check procedure.

Motor Replacement

1. Perform steps 1 through 8 of First Seek Interlock Assembly procedure then go to next step.
2. Loosen 2 setscrews securing cam to motor shaft.
3. Remove 2 screws, washers, and nuts securing the timing motor (and 4-lug terminal strip) to the mounting bracket (Figure 3-26.1). Remove motor and terminal strip.
4. Install replacement timing motor and terminal strip on mounting bracket as shown in Figure 3.26.1. Secure motor and terminal strip using 2 screws, washers and nuts.
5. Install cam on motor shaft as shown in Figure 3.26.1. Adjust cam on shaft to get maximum contact with switch actuator arm. Tighten setscrews in cam.



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Figure 3-26. First Seek Interlock Assembly

NOTE

Bend capacitor leads midway between solder joint and where lead goes into capacitor body.

6. Using a needlenose pliers, bend capacitor leads on terminal strip as shown in Figure 3-26.1.
7. Perform steps 9 through 12 of First Seek Interlock Assembly Replacement procedure.

Interlock Switch Adjustment

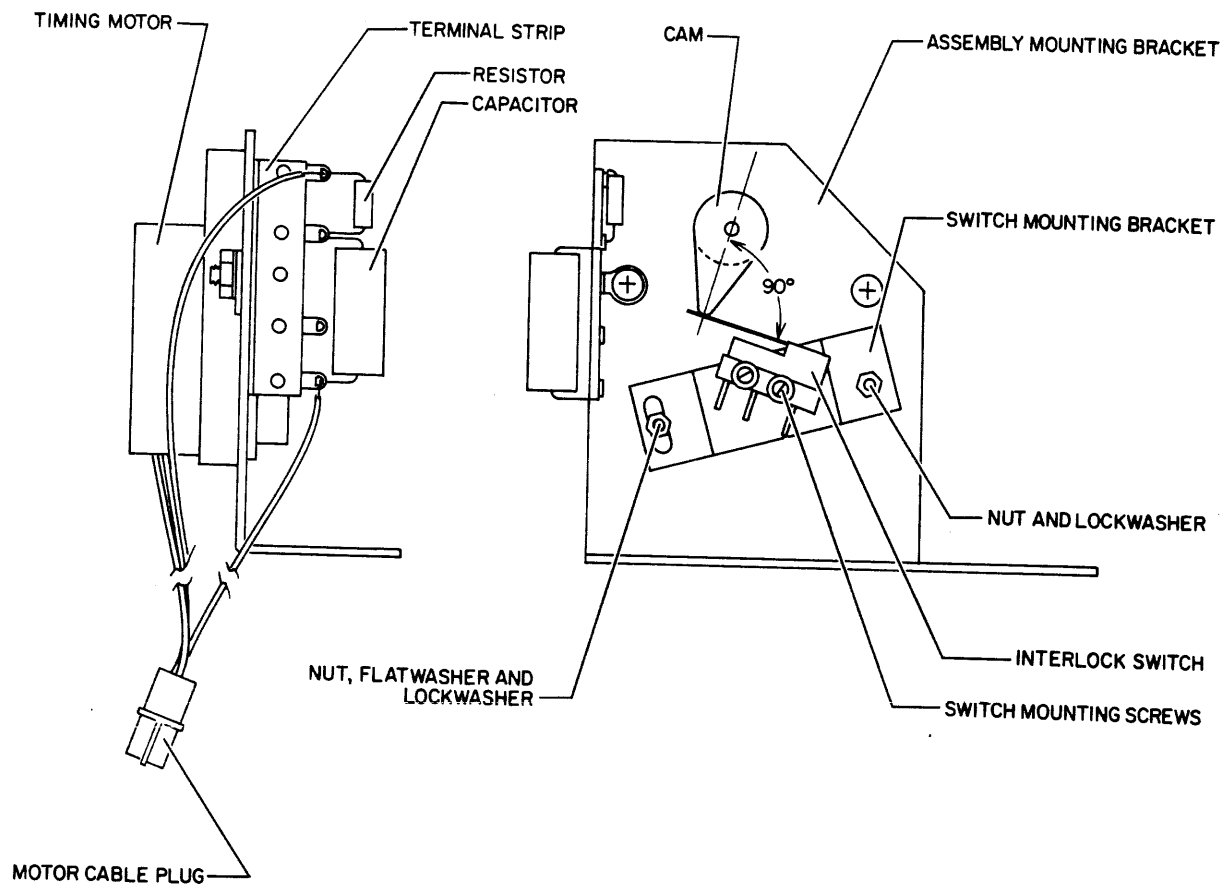
1. Set UNIT POWER circuit breaker to OFF.
2. Open cabinet top cover.
3. Using a number 4 nutdriver, loosen the 2 nuts securing switch mounting bracket (Figure 3-26.1) to assembly bracket.
4. Adjust switch mounting bracket so the switch activates when the timing motor cam is tangent with the switch actuator arm (Figure 26.1). Tighten the left nut

(nut that is on adjustment slot in bracket) first, then tighten right nut.

5. Perform Interlock Switch Check procedure.

Replacement

1. Set UNIT POWER circuit breaker to OFF.
2. Open top cover.
3. Identify and mark leadwires to interlock switch. Disconnect leadwire at switch terminals.
4. Remove two screws and washers securing switch to switch mounting bracket. Remove switch.
5. Position replacement switch on switch mounting bracket as shown in Figure 26.1. Secure switch using two screws and washers.
6. Perform Switch Adjustment procedure.



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Figure 3-26. 1. Timing Motor/Switch Replacement

DRIVE BELT

Adjustment

1. Set UNIT POWER circuit breaker to OFF.
2. Open cabinet front panel.

NOTE

While inspecting drive belt, also inspect brake belt. If required, replace brake belt per Brake Belt Replacement procedure.

3. Inspect drive belt for cracks or worn spots. If required, replace belt per Drive Belt Replacement procedure.
4. Open cabinet rear door.

NOTE

Units having two idler springs repeat steps 6, 7, and 8.

5. Locate drive belt tension idler spring

(Figure 3-27).

6. Length of idler spring between spring end loops must be 5.42 (\pm .12) inch. If adjustment is required, proceed to step 7, if not, proceed to step 9.
7. Loosen two screws securing idler spring adjustment bracket to deck.
8. Reposition idler spring bracket and spring until requirements are met. Tighten screws and recheck requirements.
9. Close cabinet rear door.
10. Close cabinet front panel.

Replacement

1. Set UNIT POWER circuit breaker to OFF.
2. Remove disk pack.

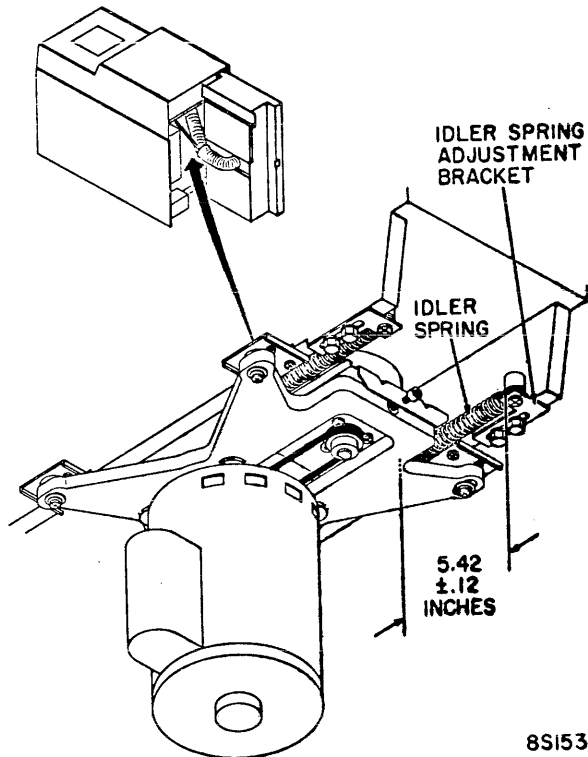


Figure 3-27. Drive Belt Adjustment

3. Refer to Side Panel Removal/Installation procedure and remove right (viewed facing drive front) side panel.
4. Remove static ground spring leadwire.
5. Make note of pack on switch leadwire connection scheme and disconnect leadwires at switch.

NOTE

Use care when removing drive belt not to damage pack on switch or static ground spring.

6. Move drive motor toward spindle assembly and remove drive belt from drive motor pulley, then from spindle pulley. Remove belt from unit.
7. Install replacement belt around spindle pulley.
8. Move drive motor toward spindle assembly and slip drive belt around drive motor pulley. Release drive motor.
9. Reconnect pack on switch leadwires and static ground spring leadwires.

10. Perform Drive Belt Adjustment procedure.
11. Install side panel per Side Panel Removal/Installation procedure.

DRIVE MOTOR REPLACEMENT S/C 11 & BELOW

1. Stop drive motor.
2. Remove disk pack.
3. Set UNIT POWER circuit breaker to OFF.
4. Refer to Side Panel Removal/Installation procedure and remove both side panels.

NOTE

Units having two idler springs repeat step 5.

5. Loosen two screws securing idler spring adjustment bracket to deck (figure 3-27). Remove idler spring.
6. Move drive motor towards spindle assembly and slip drive belt off drive motor pulley.
7. Disconnect drive motor cable plug P7.
8. Disconnect hysteresis brake cable plug P2.
9. Support drive motor from below and remove four screws (note how washers and bushing comes off each screw) and washers securing motor mount casting to shock mounts. Remove drive motor and motor mount casting from drive.
10. Turn hysteresis brake adjustment screw counterclockwise to relieve tension on brake belt. Slip brake belt off hysteresis brake pulley and then off drive motor pulley.
11. Remove four screws securing drive motor to motor mount casting.
12. Loosen setscrew in drive motor pulley. Remove pulley.
13. Position pulley adjustment tool on motor as shown on figure 3-25. Slide drive motor pulley on replacement drive motor shaft until it contacts pulley adjustment tool. Tighten both set screws.
14. Install replacement drive motor on motor mount casting (orient air exhaust openings towards hysteresis brake). Secure drive motor to motor mount casting with four screws.

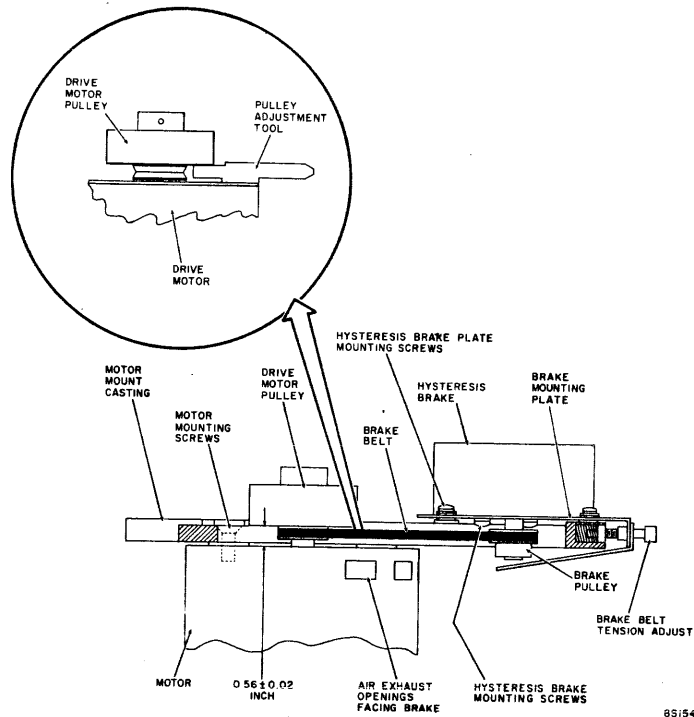


Figure 3-28. Motor and Brake Assembly

15. Slip brake belt around drive motor pulley (make sure belt is seated properly on pulley). Slip other end of belt around hysteresis brake pulley.
 16. Turn hysteresis brake belt adjustment screw clockwise until adjustment nut is flush with motor mount casting.
 17. Assemble four screws, washers, and bushings. Lay screws at bottom of drive cabinet so they will be close at hand when installing drive motor casting.
 18. Support drive motor from below and position motor mount casting below deck on shock mounts (Figure 3-29). Secure motor mounting casting to shock mounts with four screws, washers, and bushings prepared in step 17.
- NOTE
- Units having two idler springs, repeat steps 19 and 21.
19. Slip one end of idler spring around spring post on idler spring adjustment bracket (Figure 3-27). Move drive motor away from spindle assembly while slipping other end of idler spring around spring post on motor mount casting.
 20. Position drive belt around spindle pulley. Slip other end of belt around drive motor pulley.
 21. Position idler spring adjustment bracket until length of spring is as shown in Figure 3-27. Tighten two screws securing bracket to deck casting.
 22. Connect drive motor cable plug P7.
 23. Connect hysteresis brake cable plug P2.
 24. Set UNIT POWER circuit breaker to ON.
 25. Install a scratch pack.
 26. Start spindle motor. Observe drive motor for proper operation.
 27. Stop drive motor.
 28. Remove disk pack.
 29. Install side panels per Side Panel Removal/Installation procedure.

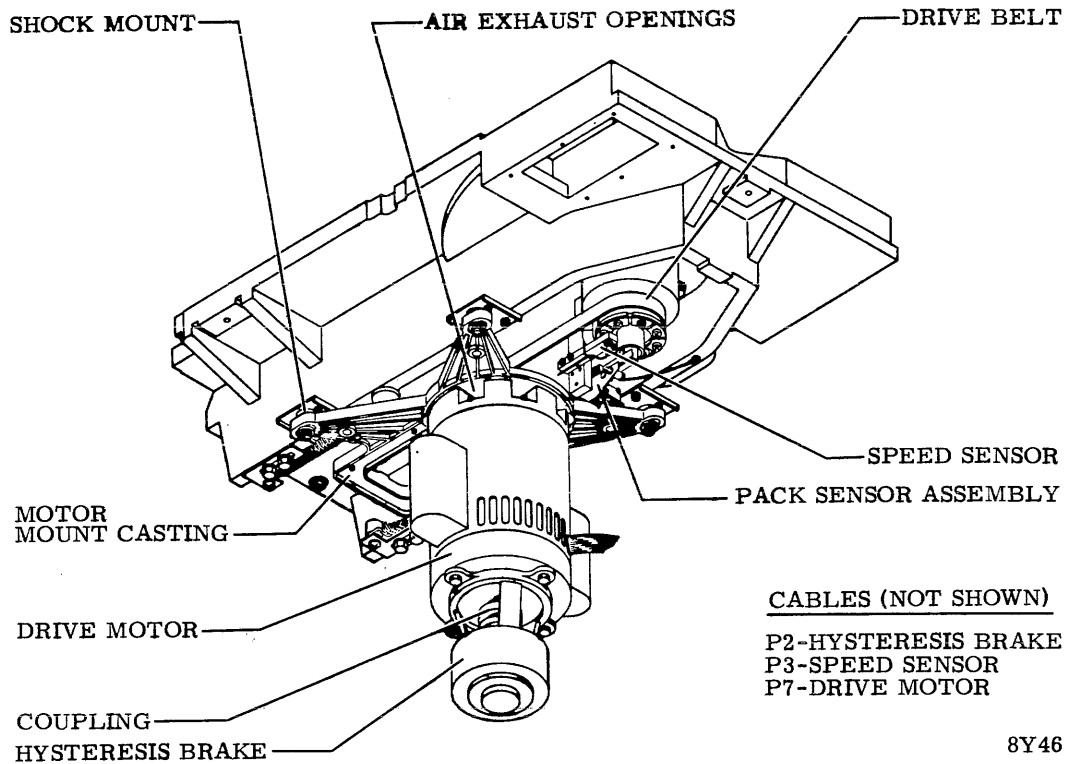


Figure 3-28.1. Drive Motor Replacement
S/C 12 & Above

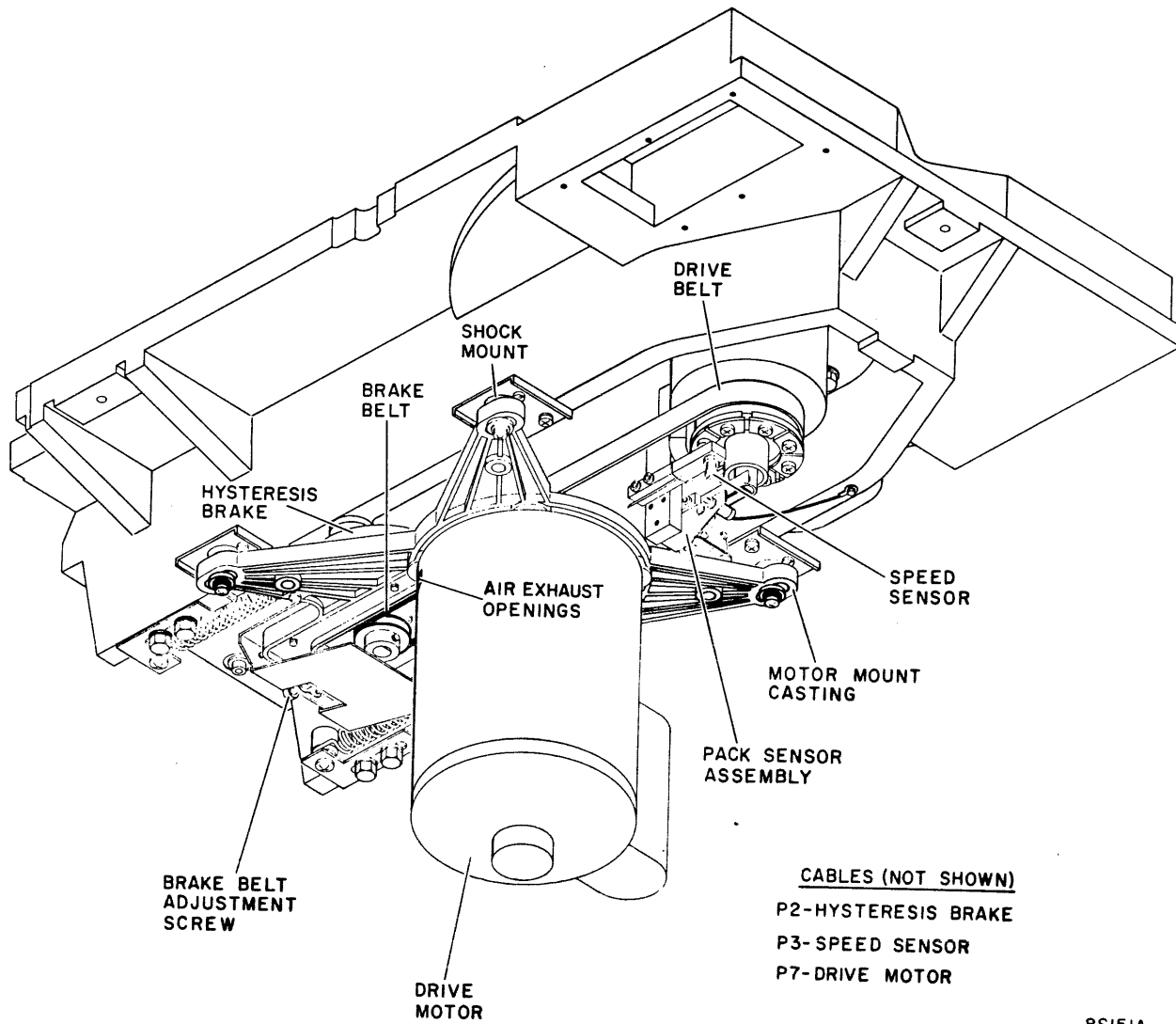
DRIVE MOTOR REPLACEMENT S/C 12 & ABOVE

1. Stop spindle motor.
2. Remove disk pack.
3. Set UNIT POWER circuit breaker to OFF.
4. Remove idler springs.
5. Move drive motor towards spindle assembly and slip drive belt off drive motor pulley.
6. Disconnect drive motor cable plug P7.
7. Disconnect hysteresis brake cable plug P2, speed sensor plug P3, and pack on switch connector.

CAUTION

- Do not support motor and brake assembly on hysteresis brake cup.
8. Support drive motor and brake assembly from below and remove four screws holding drive motor to motor mount. Note that there are two long and two short screws. (Refer to figure 3-28.1.)

9. Loosen both setscrews in drive motor pulley. Remove pulley.
10. Remove hysteresis brake assembly as described in Hysteresis Brake Replacement procedure.
11. Install hysteresis brake assembly on replacement drive motor as described in Hysteresis Brake Replacement procedure.
12. Slide drive motor pulley on replacement drive motor shaft until it is 0.56 (± 0.02) inch from drive motor end bell. Tighten both set screws.
13. Support replacement drive motor from below and install on motor mount casting (orient air exhaust openings towards air supply). Secure drive motor to motor mount casting using two long and two short screws in their respective locations.
14. Position drive belt around spindle



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Figure 3-29. Deck Assembly Bottom Side

- pulley, and slip other end of belt around drive motor pulley. Visually confirm that drive motor pulley is aligned with spindle pulley.
15. Replace idler springs.
 16. Connect drive motor cable plug P7.
 17. Connect hysteresis brake cable plug P2.
 18. Set UNIT POWER circuit breaker to ON.
 19. Install a scratch pack.
 20. Start spindle motor. Observe drive motor for proper operation.
 21. Stop drive motor.
 22. Remove disk pack.

HEAD/ARM ASSEMBLIES

Head Inspection And Cleaning

The drive has a positive pressure filtration

system that eliminates the need for periodic inspection and cleaning of heads, except where extreme environmental conditions exist. The heads should be inspected for the following reasons only:

- A problem is associated with a specific head or heads; for example, excessive data errors.
- Head to disk contact is suspected.
- Contamination of pack is suspected (possibly due to improper storage of the pack).
- Concentric scratches are observed on pack surface.

CAUTION

Do not smoke when inspecting or cleaning heads. Use extreme care not to damage head. If gimbal spring (holds head on end of arm) is permanently bent, entire head/arm assembly must be replaced. Do not touch head pad or gimbal with fingers or tools. If heads must be laid down, do not allow pad or gimbal to touch anything.

Head Inspection

Prior to removing head for inspection, use a bright directional light to inspect pack while it is mounted on drive spindle. If pack shows signs of concentric scratches or any surface damage in data zone, reject pack. (Small tick marks in the head loading zone are not cause for pack rejection.)

1. Remove suspected head per Read/Write or Servo Head/Arm Replacement procedure.
2. Inspect head for reddish-brown oxide deposits.
3. If oxide deposits exist, clean head per Head Cleaning procedure.
4. If head appears scratched or damaged, refer to Head/Arm Replacement Criteria.

Head Cleaning

If cleaning of head is required, refer to figure 3-29.1 and perform the following procedure. Use care not to damage the precision head pad, gimbal, and arm.

1. Clean a smooth, flat working surface (for example, glass or formica) with a soft tissue. Then wipe surface with palm of hand to remove all traces of dust or lint.

CAUTION

Do not use shiny or coated paper because they contain fine clay dust and other polishing fillers that could be deposited on head flying surface.

2. Place a sheet of clean bond paper on the flat surface in manner that allows head/arm to be held parallel to paper surface.

CAUTION

Do not use isopropyl alcohol, acetone or other solvents. Use CDC media cleaning solution only. Refer to table 3-1.

3. Moisten a small area of the paper with media cleaning solution.

CAUTION

In the following step, move the head/arm in a direction away from curved edge of head pad.

4. Gently place head pad flying surface on moistened area and lightly move head along paper in a zig-zag buffing motion (as shown in figure 3-29.1) from the moistened area to the dry area.
5. Inspect head to determine that oxide deposits were removed. If deposits remain but show signs of being removed, repeat step 4 until deposits are removed. If oxide deposits cannot be removed, replace head with a new one.

6. If oxide deposits were removed and head passes inspection criteria (refer to Head/Arm Replacement Criteria), re-install head.
7. Follow Read/Write or Servo Head/Arm Replacement procedure to install cleaned head or a replacement head as required.

Head/Arm Replacement Criteria

A head/arm requires replacement if any of the following conditions exist:

1. Consistent oxide buildup on head in-

- dicating repeated head/disk impact.
2. Appreciable oxide buildup located primarily on edge of ferrite insert.
3. Wear or scratches over 1/2 of head face surface.
4. Audible ping while operating with heads over disk area, indicating that head is hitting disk surface.
5. Oxide deposits cannot be cleaned from head.
6. Head or head/arm is damaged.

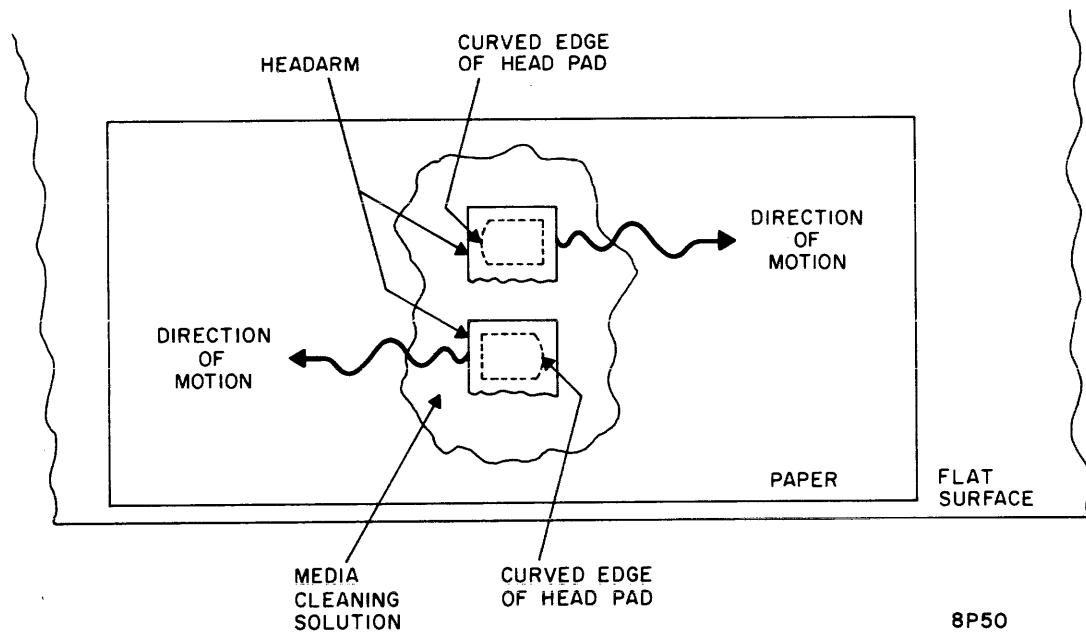


Figure 3-29.1. Head Cleaning Motion

Head/Arm Replacement

1. Set UNIT POWER circuit breaker to OFF.
2. Remove disk pack.
3. Open cabinet top cover.
4. Remove deck top cover.
5. Remove head cable plate (Figure 3-30).
6. Refer to Figure 3-31 and determine location of faulty head/arm assembly.

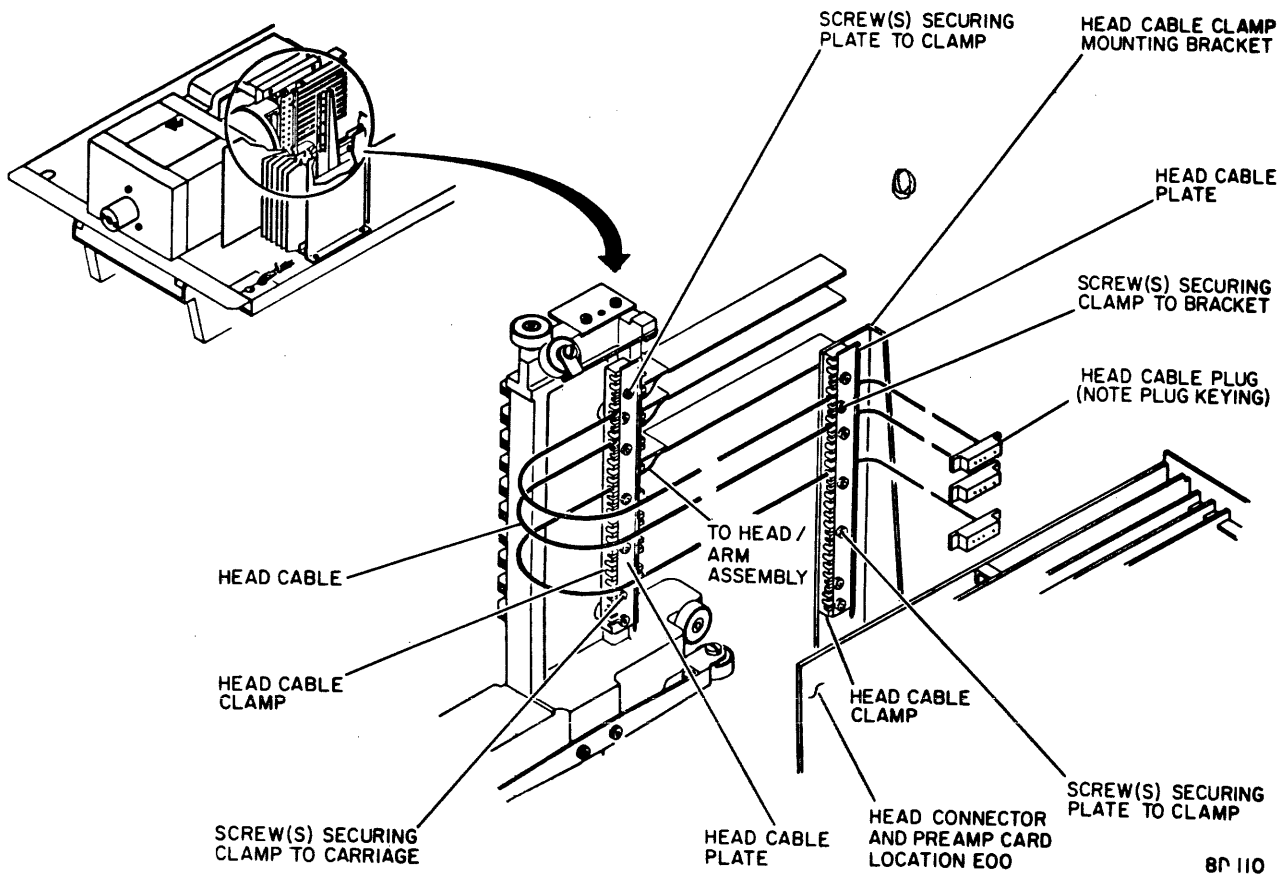


Figure 3-30. Head Cable Clamping/Connecting

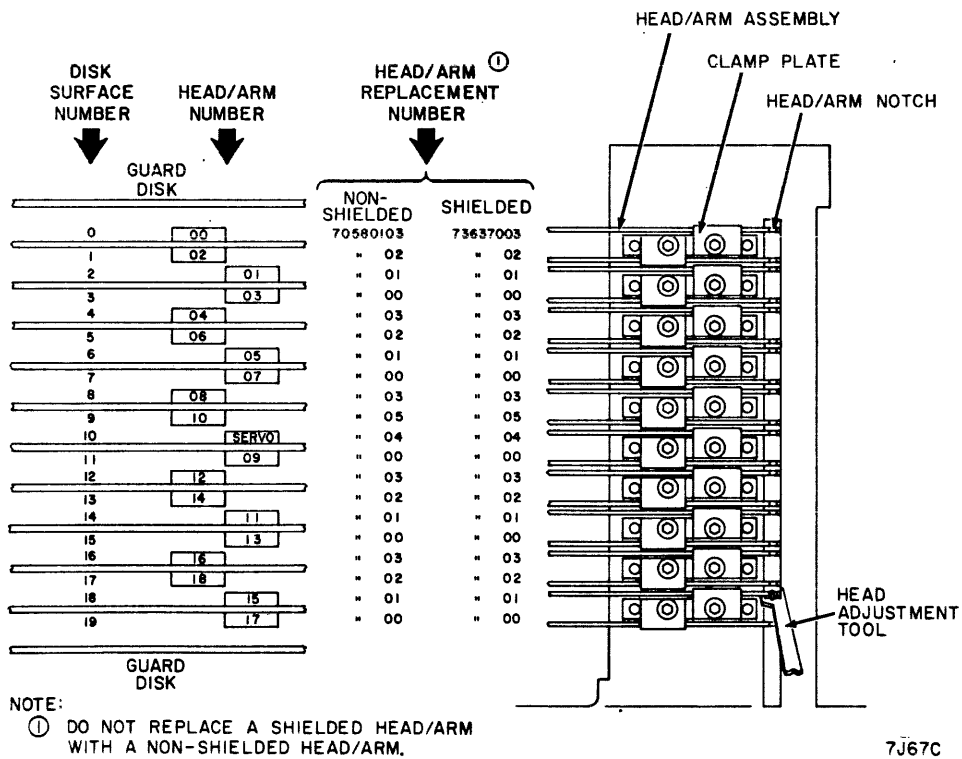


Figure 3-31. Head/Arm Assembly Identification

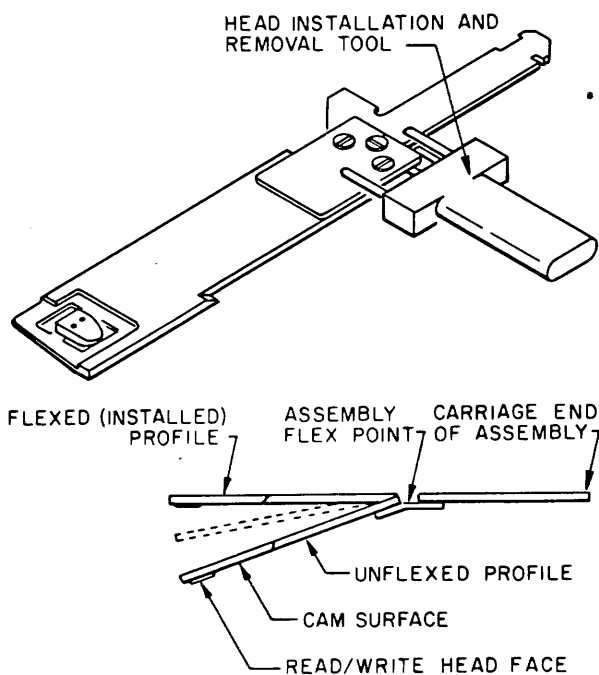
7. Carefully remove head cable for faulty head from head cable clamp (Figure 3-30) and disconnect related head cable plug at card E00.
8. Refer to Figure 3-32 and slide head installation and removal tool on outer edge of faulty head/arm assembly.
9. Remove clamp plate securing faulty head/arm assembly to carriage (Figure 3-31).

CAUTION

Observe the following precautions during remainder of procedure:

- a. Do not touch head face. Damage to gimbal springs may result.
 - b. Use minimum force when overriding assemblies tendency to unflex. Unnecessary force can damage assembly.
 - c. Use care when installing or removing an assembly. If assembly is allowed to unflex, damage to itself or to an adjacent assembly may result.
 - d. Keep all contact with adjacent head/arms to a minimum. This will save alignment time later.
10. Grasp carriage end of head/arm assembly (Figure 3-32) between thumb and forefinger.

11. Grasp other end of assembly (avoid head face) between thumb and forefinger of other hand. Carefully remove assembly from carriage and head cam.
12. Slip installation and removal tool off faulty head/arm and set head/arm aside.
13. Carefully flex replacement head/arm (see Figure 3-31 for head/arm assembly part numbers) until straight and slip head installation tool on head/arm as shown in Figure 3-32.
14. Guide head and tool through head cam and toward carriage. Engage carriage end of assembly and receiving slot in carriage.
15. Visually align free end of assembly with adjacent assemblies.
16. Carefully slip head installation tool free of head/arm assembly.
17. Install head/arm clamp plate. Torque clamp plate screws to 4 inch-pounds.
18. Install head cable in cable clamp (Figure 3-31). Make sure cable is oriented similarly to adjacent cables.
19. Install head cable plates.
20. Connect head cable plug to logic card E00.
21. Perform Head/Arm Alignment procedure on replaced head and on heads immediately above and below it.



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Figure 3-32. Head/Arm Installation and Removal

Head/Arm Alignment Check

NOTE

The CE disk pack used in the following procedure must be temperature stabilized. Pack and drive must be in the same temperature environment for the 60 minute period immediately preceding performance of this procedure.

1. Stop spindle motor and remove disk pack.
2. Open rear door and set ON LINE/OFF LINE/WRITE PROTECT switch to WRITE PROTECT.
3. Set UNIT POWER circuit breaker to OFF.

CAUTION

The CE disk pack contains specially recorded tracks of data. Extreme care must be taken so that this data is not modified or destroyed.

4. Open pack cover and install CE disk pack.
5. Close pack cover.
6. Open rear door.
7. Install head alignment card in location A21.
8. Connect OFFLINE TESTER to location C230.
9. Set UNIT POWER circuit breaker to ON.
10. Start spindle motor and allow heads to load. Allow 30 minutes of operation in this configuration before proceeding to next step.
11. Set READ-WRITE/SERVO switch (S2) on head alignment card to SERVO position.
12. Connect null meter (mini-voltmeter) to alignment card test points X and Y.

NOTE

If the readings obtained in the following three steps are incorrect, the problem must be diagnosed and corrected before this procedure can be completed. Refer to Servo System Checks procedure.

13. Set CARRIAGE OFFSET switch on Maintenance panel to NORMAL position.
14. Set P-N switch (S1) on head alignment card first to P position (note null meter reading) then to N position (note null meter reading). Algebraically subtract N from P and record reading. P-N reading should be 0 ± 50 mv.
15. Set CARRIAGE OFFSET switch to IN.

NOTE

Polarity of reading may be +400 or -400 in steps 19 or 21, disregard polarity.

16. Perform step 17 and record reading, except P-N reading should be $400 (\pm 50)$ mv.

17. Set CARRIAGE OFFSET switch to OUT.
18. Set READ-WRITE/SERVO switch (S2) on head alignment card to READ-WRITE position. Check that mode light is out.
19. Command continuous repeat seek between tracks 240 and 245 for 30 seconds minimum.
20. Select head being tested.
21. Record null meter reading with head alignment tester switch S1 first in P position, then to N position. Algebraically subtract P from N and record result. P-N should be less than ± 150 mv.
22. If P-N exceeds ± 150 mv, perform Head/Arm Adjustment procedure.
23. Repeat procedure for all heads.

Head/Arm Adjustment

Perform this procedure only if the head clamping screws were loosened, after installation of a replacement head/arm, or if head fails the Head/Arm Alignment Check procedure.

1. Perform steps 1 through 12 of the Head/Arm Alignment Check procedure.
2. Load heads. Command a continuous repeat seek between tracks 240 and 245 for 30 seconds minimum.
3. Command seek to track 245.

CAUTION

If power is lost with heads loaded damage to heads and/or disk pack will occur if heads are not retracted before pack rotation stops.

4. Connect oscilloscope channel A to TPZ.
5. Select head to be adjusted. Check that MODE indicator on head alignment card is ON.
6. Loosen clamp screw of selected head and then torque screw to 4 inch-pounds.

7. Refer to Figure 3-31 and position head adjustment tool so that tips of tool straddle carriage ridge and tool pin engages head/arm notch.
8. Adjust head to obtain a balanced dibit pattern (Figure 3-33) on the oscilloscope. (Point A amplitude equals point B, point C amplitude equals point C.)
9. Set switch S1 on head alignment card to position P.
10. Position head (using head alignment tool and null meter set to ± 50 mv scale) until the meter reading is 25 mv or less. Record reading.
11. Set switch S1 on head alignment card to position N.
12. Record null meter reading.
13. Algebraically subtract recorded reading N from P.
14. If P-N result exceeds ± 50 mv, repeat steps 8 through 13 until result is ± 50 mv or less.
15. Repeat steps 5 through 14 for all heads requiring alignment adjustment.
16. Unload heads by stopping spindle. Reload and check alignment.
17. Perform continuous seeks between tracks 240 and 245 for 30 seconds minimum.
18. Repeat steps 9 (do not reposition head) through 13.
19. If P-N result is ± 75 mv or greater for any head, repeat steps 9 through 18 for that head.
20. Stop spindle motor.
21. Install deck cover and close top cover.
22. Remove disk pack.
23. Set UNIT POWER circuit breaker to OFF.
24. Disconnect null meter, oscilloscope and offline tester.
25. Remove head alignment card.
26. Set UNIT POWER circuit breaker to ON and return unit on ON LINE configuration.

HEADS LOADED SWITCH

Adjustment

1. Set UNIT POWER circuit breaker to OFF.
2. Remove disk pack.
3. Open cabinet top cover and remove deck cover.
4. Make note of switch leadwire connection scheme and disconnect leadwires.
5. Connect a multimeter (set to Rx1) across switch leadwire terminals.

CAUTION

- Do not move carriage so far as to cause heads to load. Switch transfer will occur before head loading.
6. Carefully move carriage about one-half inch forward from retracted stop.
 7. Slowly retract carriage. Stop carriage at point where switch transfer occurs.
 8. Using a steel scale, measure distance that carriage travels before contacting retracted stop. Switch transfer must occur when carriage is between 0.100 and 0.180 inch of encountering retracted stop.

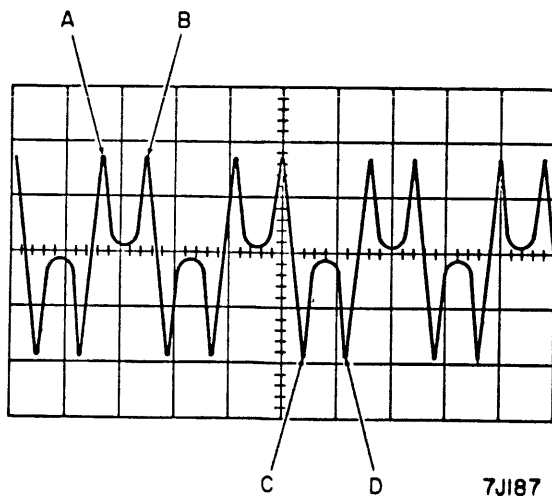


Figure 3-33. Balanced Dibit Pattern

9. If requirement is not met, loosen two screws securing switch mounting bracket to actuator housing. Reposition switch and bracket until requirement is met and tighten screws.
10. Remove multimeter and connect pack on switch leadwires.
11. Install deck top cover.
12. Close cabinet top cover.

Replacement

No special instructions are required for removal and replacement except, when replacing switch, use one drop of Loctite, Grade C, on threads of each screw securing switch to mounting bracket. Perform Heads Loaded Switch Adjustment procedure following switch replacement.

HYSTERESIS BRAKE REPLACEMENT S/C 11 & BELOW

NOTE

The drive motor mount casting may have to be loosened in order to remove brake.

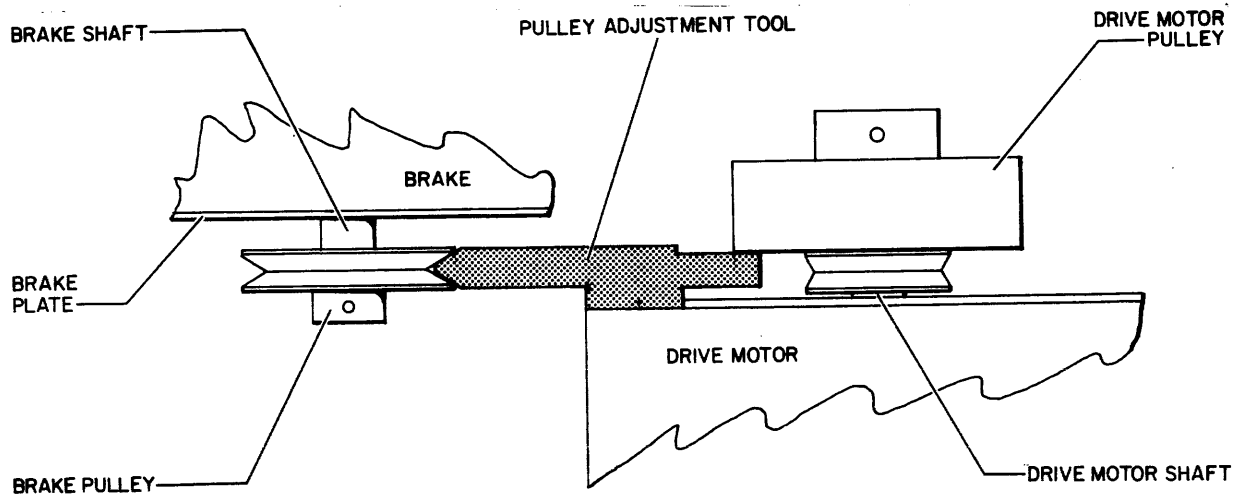
1. Set UNIT POWER circuit breaker to OFF.
2. Open cabinet rear door.

3. Loosen the two brake plate rear mounting screws.
4. Disconnect hysteresis brake cable P2.
5. Turn brake belt adjustment screw counterclockwise to relieve tension on brake belt (figure 3-19).
6. Slip brake belt off brake and drive pulleys.
7. Loosen setscrew securing brake pulley to brake shaft. Remove pulley and check condition of groove.
8. Remove faulty hysteresis brake.
9. Install replacement hysteresis brake to brake mounting plate with 3 screws and washers.
10. Apply one drop of Loctite, Grade N to pulley setscrew threads.

NOTE

It may be necessary to loosen (turn counterclockwise) the brake belt adjustment screw to allow pulling brake back far enough to perform steps 11 through 13.

11. Pull brake back and slide pulley on brakeshaft but do not tighten setscrews.



8S155

Figure 3-34. Brake Pulley Adjustment

12. Hold pulley adjustment block in position shown in figure 3-34. Push brake forward and adjust pulley on brake-shaft until adjustment tool seats in groove of pulley.
13. When they are mated as shown in figure 3-34 they pulley is aligned. Tighten setscrew and remove pulley alignment tool.

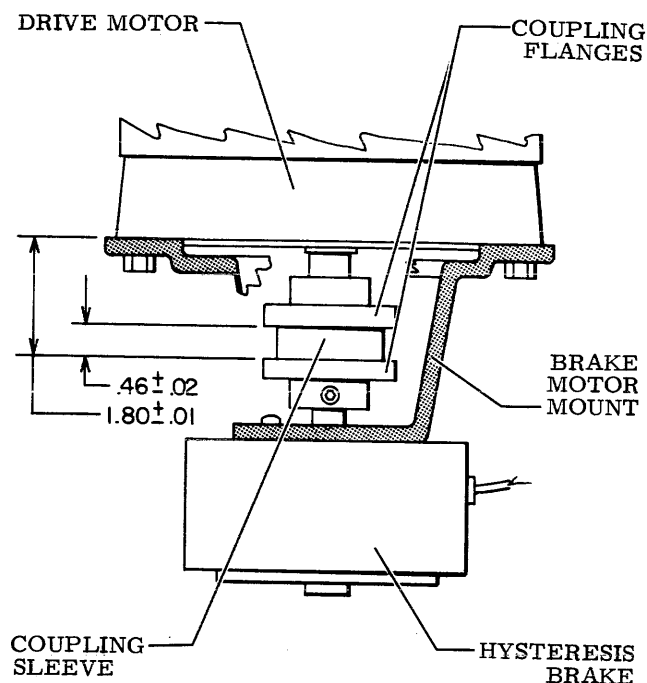
NOTE

In step 14 always use new belt and ensure that brake is far enough forward that belt can be replaced without riding it onto pulley.

14. Replace brake belt on drive pulley ensuring that it is seated properly. Slip other end of belt over brake pulley.
15. Position drive belt around spindle pulley and slip other end of belt around drive motor pulley.
16. Replace idler springs.
17. Connect hysteresis brake cable plug P2.
18. Perform Brake Belt Adjustment procedure.

HYSTERESIS BRAKE REPLACEMENT S/C 12 & ABOVE

1. Stop spindle motor.
2. Set UNIT POWER circuit breaker to OFF.
3. Remove side panel of drive, or if drive is in line, remove front panel and air supply.
4. Disconnect hysteresis brake cable P2.
5. Remove four screws attaching hysteresis brake assembly to drive motor.
6. Remove hysteresis brake assembly, observing orientation of brake power cable.
7. Remove rubber coupling sleeve. Refer to figure 3-34.1.



8Y52

Figure 3-34.1. Hysteresis Brake Replacement S/C 12 & Above

8. Loosen two set screws securing coupling flange to hysteresis brake shaft. Remove flange.
9. Remove three screws attaching hysteresis brake to brake motor mount and remove brake.
10. If necessary to remove flange from drive motor shaft, loosen two set screws and slide off.
11. Install replacement hysteresis brake on brake motor mount with three screws.
12. Install coupling flange on hysteresis brake shaft to meet the requirements of figure 3-34.1. Tighten two set screws.
13. Loosely install coupling flange on motor shaft.
14. Install rubber coupling sleeve.
15. Install hysteresis brake assembly on drive motor using four screws. (Orient

brake power cable to connect to P2.)

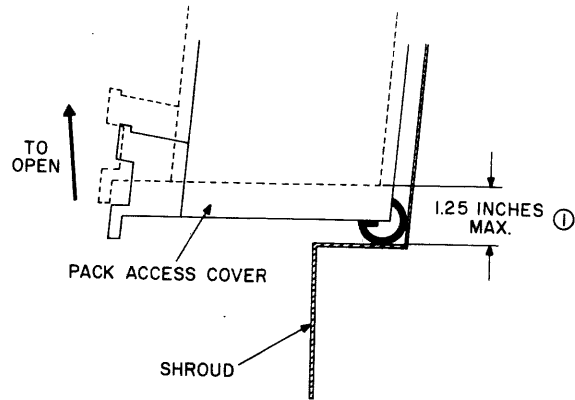
16. Tighten set screws in coupling flange on motor shaft so that flange position meets the requirements of figure 3-34.1.
17. Connect hysteresis brake cable P2.
18. Install air supply and front panel.
19. Perform Power Down check.

PACK ACCESS COVER SWITCH

To check pack access cover switch, unit must be running and heads loaded. Lift pack access cover per figure 3-34.2. Spindle should stop and Start indicator should go off. If necessary, adjust switch.

Adjustment

1. Power down unit.
2. Remove deck top cover.
3. Loosen screws securing switch mount to switch adjustment bracket with an offset Phillips screwdriver.
4. Adjust switch mount so that switch contacts open when pack access cover is raised as shown in figure 3-34.2. (Up, increase distance; down, decrease distance.)
5. Tighten screws loosened in step 3.
6. Recheck distance pack access cover has to be lifted to open switch contacts.



① DISTANCE MEASURED FROM RIGHT SIDE PACK ACCESS COVER.

8DI14

Figure 3-34.2. Pack Access Cover Switch Adjustment

7. Replace deck top cover.

Replacement

1. Turn off main breaker.
2. Remove deck top cover.
3. Disconnect wires attached mini switch.
4. Remove two screws and associated lock washers and nuts securing mini switch to switch mount.
5. Remove mini switch.
6. Install new mini switch.
7. Connect wires disconnected in step 3.
8. Perform Pack Access Cover Switch Adjustment.
9. Replace deck top cover.

PACK SENSOR SWITCH

Check

1. Stop spindle motor.
2. Remove disk pack.
3. Set UNIT POWER circuit breaker to OFF.
4. Remove cabinet front panel.
5. Identify pack sensor switch leadwires (figure 3-35). Disconnect leadwires at switch.
6. Connect a multimeter (set to Rx1) across switch terminals.
7. Install a disk pack. Multimeter should indicate 0 ohms.
8. Remove disk pack. Multimeter should indicate infinity.
9. If requirements of steps 7 and 8 are not met, perform Pack Sensor Switch Adjustment procedure. If requirements are met, go to step 10.

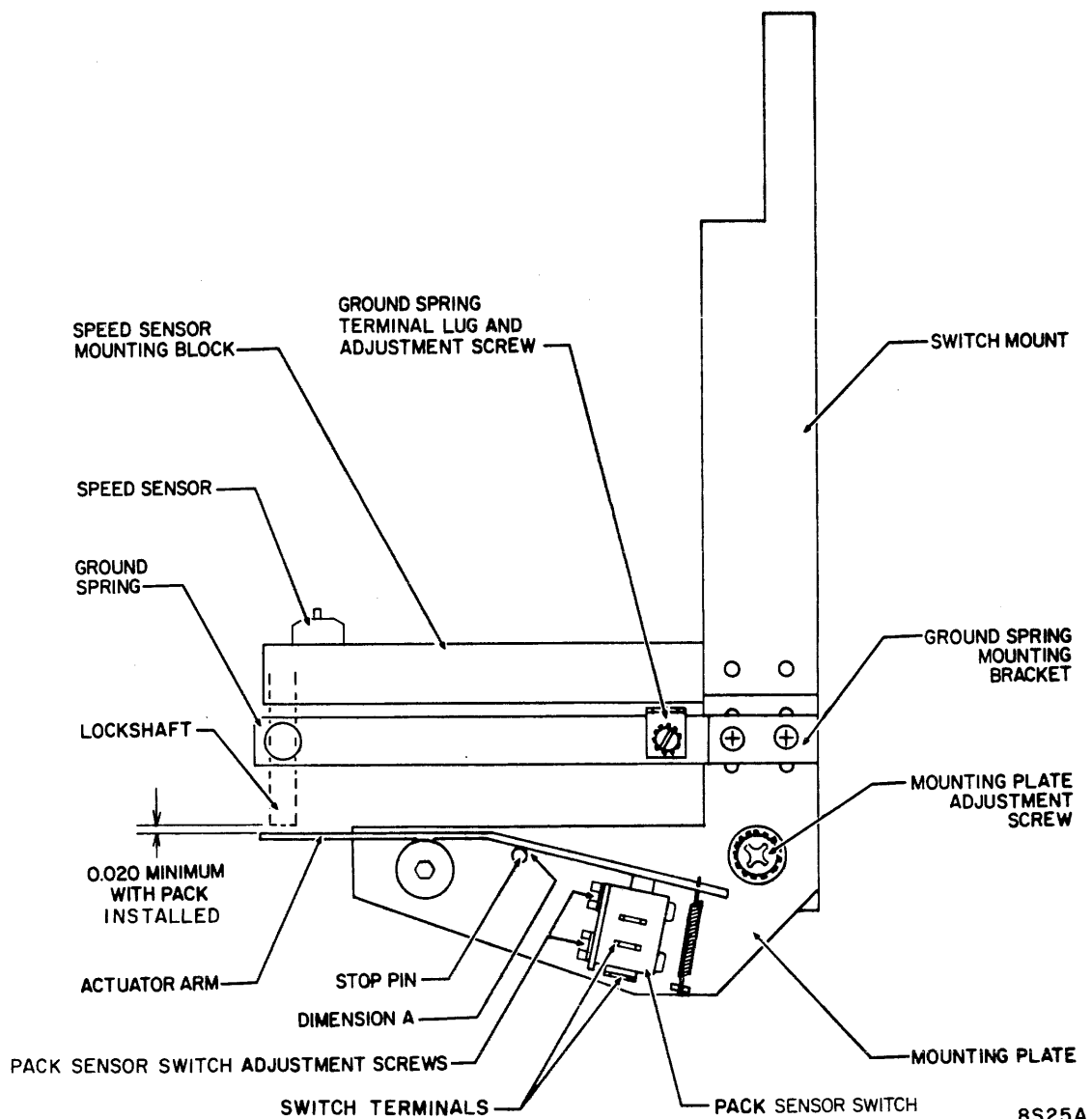


Figure 3-35. Pack Sensor Assembly

10. Disconnect multimeter leadwires.
11. Connect pack sensor switch leadwires to pack sensor switch terminals.
12. Install cabinet front panel.

Adjustment

1. Press (to extinguish light) START switch.
2. Install a disk pack.
3. Set UNIT POWER circuit breaker to OFF.
4. Refer to Side Panel Removal/Installation procedure and remove right (viewed from front) side panel.
5. Identify pack sensor switch leadwires (figure 3-35). Disconnect wires at switch terminals.
6. Dimension between actuator arm and lockshaft must be as specified in figure 3-35. If dimension is as specified, go to step 10. If adjustment is required, go to step 7.
7. Loosen mounting plate adjustment screw (figure 3-35).
8. Loosen two screws securing ground spring mounting bracket to switch mount.
9. Position mounting plate until dimension between actuator arm and lockshaft is as specified in figure 3-35. Tighten screws.
10. Connect a multimeter (set to Rx1) to pack sensor switch terminals (figure 3-35). Meter must indicate 0 ohms. If correct go to step 12, if not go to step 11.
11. Loosen pack sensor switch adjustment screws and position switch until multimeter just indicates 0 ohms. Tighten screws.
12. Insert an .011 inch thick feeler gage between actuator arm and stop pin (dimension A of figure 3-35).

13. Multimeter must indicate infinity. If not, go to step 14. If correct, remove feeler gage and go to step 17.
14. Loosen pack sensor switch adjustment screws and position switch until multimeter just indicates infinity. Tighten screws.
15. Remove feeler gage. Multimeter must indicate 0 ohms. If correct, go to step 16. If not, repeat procedure starting at step 11.
16. If pack sensor switch was repositioned, perform step 5 and if further adjustments are required repeat entire adjustment procedure. If requirements of step 5 are met, go to step 17.
17. Disconnect multimeter from switch terminals.
18. Connect pack sensor switch leadwires to switch terminals.
19. Perform Ground Spring Adjustment procedure if mounting plate screws were loosened.
20. Install side panel.

Replacement

1. Stop spindle motor.
2. Remove disk pack.
3. Set UNIT POWER circuit breaker to OFF.
4. Refer to Side Panel Removal/Installation procedure and remove right (viewed from front) side panel.
5. Identify pack sensor switch leadwires. Disconnect wires at switch (figure 3-35).
6. Remove two screws, washers and nuts securing switch to mounting plate bracket. Remove faulty switch.
7. Install replacement switch to mounting plate bracket using two screws, washers, and nuts. Do not tighten screws.

8. Perform Pack Sensor Switch Adjustment procedure.

SERVO PREAMP PC BOARD REPLACEMENT

1. Stop drive motor.
2. Remove disk pack.
3. Open top cover and remove deck cover.
4. Remove four screws securing right shroud side cover.
5. Remove two screws securing servo preamp cover (figure 3-17). Remove cover.
6. Disconnect servo head cable plug and output plug P8 from servo preamp board.
7. Remove two socket head screws inside preamp housing. Remove preamp housing from unit.
8. Remove two screws securing faulty preamp circuit board to preamp housing.
9. Install replacement preamp circuit board to preamp housing, with two pan head screws. Tighten screws.
10. Install preamp housing on acuator using two socket head screws. Tighten screws.
11. Connect servo head cable plug and output plug P8 to preamp circuit board.
12. Using two screws, secure preamp housing cover to preamp housing. Tighten screws.
13. Install right shroud side cover using four screws. Tighten screws.
14. Install deck cover and close top cover.

SIDE PANEL REMOVAL/INSTALLATION

1. Set UNIT POWER circuit breaker to OFF.
2. Remove disk pack.
3. Release two turnlock fasteners securing cabinet front panel. Remove and set panel aside.
4. Lower two leveling jackscrews in front base of cabinet until casters contact floor.

5. Open cabinet rear door.
6. Lower two leveling jackscrews in rear base of cabinet until casters contact floor. Close cabinet rear door.

CAUTION

Use care when wheeling drive cabinet out of line so that input/output cables and connectors are not damaged.

7. Roll drive clear of adjacent units.
8. Open cabinet rear door.
9. Release two quarter-turn fasteners securing panel side cover. Disconnect side panel ground wire. Remove and set panel aside.
10. Install side panel and return unit to normal operating position by reversing steps 1 through 9.

SPEED SENSOR ASSEMBLY

Adjustment

1. Set UNIT POWER circuit breaker to OFF.
2. Remove disk pack.
3. Use feeler gage to check that gap between sensor tip and pin is 0.003 to 0.007 inch.
4. If requirement of step 3 is not met, adjust speed sensor as follows:
 - a. Loosen jam nut on speed sensor assembly, figure 3-36.
 - b. Adjust sensor assembly (clockwise rotation closes gap, counterclockwise rotation widens gap) as required.

NOTE

Tightening jam nut more than 10 inch-pounds can cause damage to speed sensor assembly.

- c. Torque jam nut to 5 (\pm 1) in.-lbs.
 - d. Recheck dimension of gap.
5. Perform Speed Sensing procedure of Miscellaneous Logic Checkout.

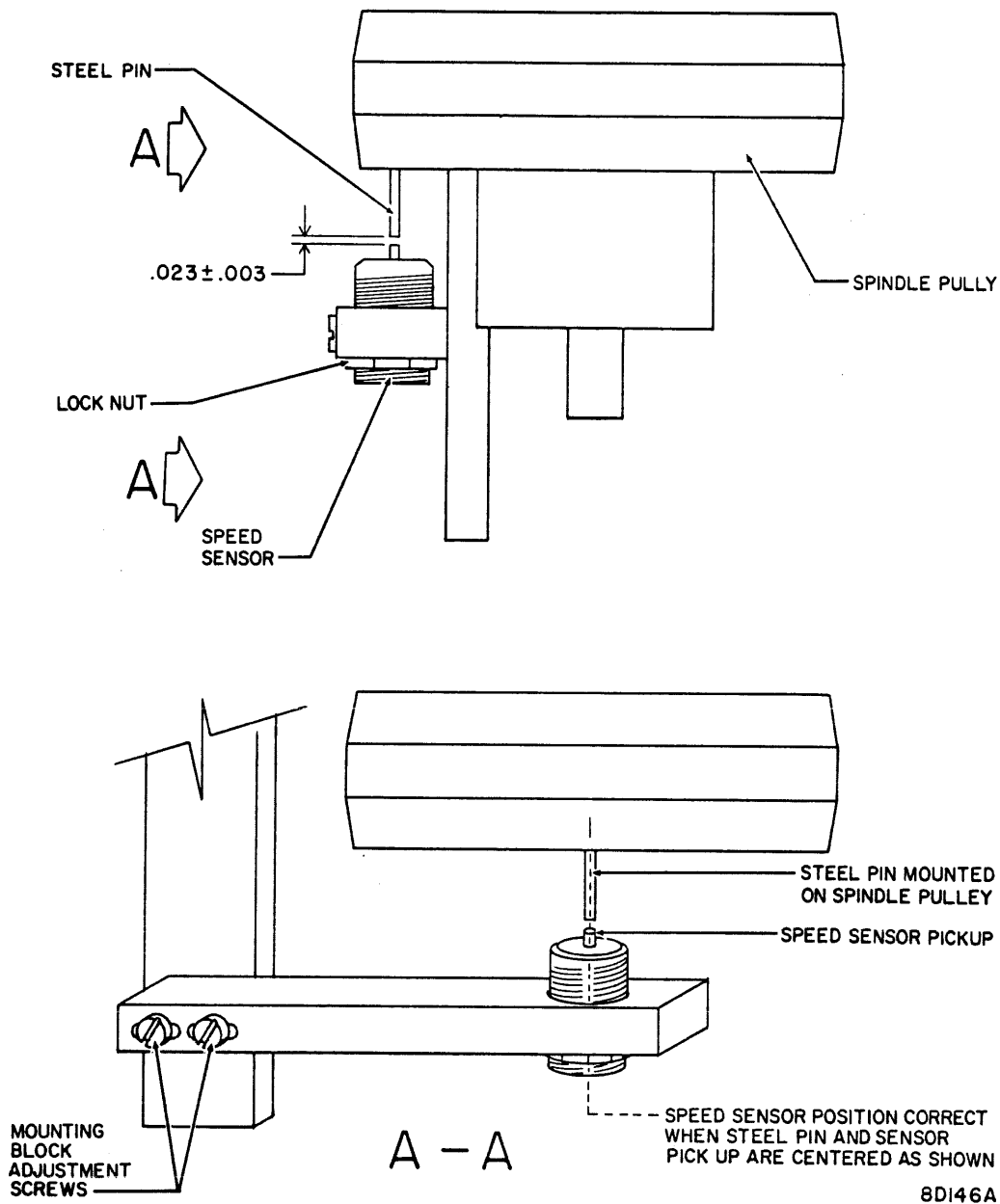


Figure 3-36. Speed Sensor Adjustment

Replacement

NOTE

1. Set UNIT POWER circuit breaker to OFF.
2. Disconnect speed sensor cable plug P3.
3. Cut two cable ties securing speed sensor leadwires to speed sensor mounting bracket.
4. Loosen jam nut on faulty speed sensor assembly. Remove assembly from unit.
5. Install replacement speed sensor on speed sensor mounting bracket.
6. Adjust speed sensor assembly until gap between sensor tip and pin is 0.003 to 0.007 inch.

7. Torque jam nut to 5 (± 1) in. -lb. Recheck gap.
8. Connect speed sensor cable plug P3.
9. Secure speed sensor leadwires to mounting bracket with two cable ties.
10. Perform Speed Sensing procedure of Miscellaneous Logic Checkout.

Tightening jam nut more than 10 inch-pounds can cause damage to speed sensor assembly.

SPINDLE AND LOCKSHAFT ASSEMBLY

Field repair of this assembly is limited to replacing the lockshaft. If replacing lockshaft does not correct the problem, replace entire spindle assembly. Return faulty assembly to factory.

Lockshaft Replacement

1. Stop spindle motor.
2. Remove disk pack.
3. Set UNIT POWER circuit breaker to OFF.
4. Refer to Side Panel Removal/Installation procedure and remove either side panel.
5. Disconnect ground spring leadwire.
6. Identify leadwires to pack on switch. Disconnect leadwires.
7. Remove two screws securing ground spring mounting block to switch mounting block.
8. Remove mounting plate adjustment screw (Figure 3-35). Remove mounting plate.

NOTE

In following step do not remove retaining ring securing springs in spindle assembly (this is retaining ring located behind flat washer removed in next step).

9. Remove retaining ring and flat washer from lower end of lockshaft.
10. Carefully raise faulty lockshaft out of top of spindle assembly.
11. Lower replacement lockshaft into top of spindle assembly.

CAUTION

Before proceeding, make certain that lockshaft is free to move downward against internal spring force. Lockshaft must be free and not bind.

12. Install flat washer and retaining ring on lower end of lockshaft.

13. Position mounting plate on switch mount as shown in Figure 3-35 and loosely secure secure plate to mount with mounting plate adjustment screw.

NOTE

Position ground spring mounting bracket so that contact on end of spring is contacting lockshaft.

14. Position ground spring mounting block on switch mounting block (Figure 3-35) and loosely secure block with two screws.
15. Perform Pack On Switch Adjustment procedure.
16. Perform Ground Spring Adjustment procedure.

Spindle And Lockshaft Replacement

1. Stop spindle motor.
2. Remove disk pack.
3. Set UNIT POWER circuit breaker to OFF.
4. Refer to Side Panel Removal/Installation procedure and remove either side panel.
5. Identify leadwires to pack on switch and ground spring. Disconnect leadwires.
6. Disconnect speed sensor cable plug P3.
7. Move motor mounting plate towards spindle to relieve drive belt tension. Remove belt from drive motor pulley. Release motor mounting plate.
8. Remove drive belt from spindle pulley.
9. Open cabinet pack access cover.
10. Remove five screws securing brake cover to shroud (Figure 3-20). Remove brake cover.

NOTE

While removing assembly in next step observe mounting technique used to secure brake plate assembly to deck.

11. Remove two screws securing brake plate assembly to deck casting (Figure 3-20). Remove and set assembly aside.

NOTE

Tighten spindle down evenly over pins, keeping spindle bottom surface parallel to deck surface.

12. Remove three screws (under deck) securing spindle assembly to deck.
13. Grasp spindle drive pulley and alternately push and pull on assembly while applying upward force to free spindle assembly from two round pins driven through spindle flange and into deck.
14. Lift spindle assembly up away from deck being careful not to damage shroud.
15. Place replacement spindle assembly on deck (orient flat surface on side of spindle assembly towards drive motor). Position spindle assembly on pins protruding from deck and press down on spindle so that pins begin entering spindle.

NOTE

Tighten spindle down evenly over pins, keeping spindle bottom surface parallel to deck surface.

16. Install three screws and washers to secure spindle to deck. Tighten screws so that lateral movement of the spindle is possible.
17. Perform Spindle Alignment procedure then go to step 18.
18. Install drive belt on spindle pulley.
19. Move drive motor mounting plate towards spindle assembly and slip drive belt around drive motor pulley.
20. Position pack sensor assembly on spindle assembly as shown in Figure 3-29.

NOTE

Before tightening screws in next step, position pack sensor assembly as close as possible to the dimensions shown in Figures 3-35 and 3-36. Doing this will minimize adjustment required after assembly is secured to the spindle.

21. Secure pack sensor assembly to spindle assembly with two screws. Tighten screws.

22. Secure brake plate assembly to deck using two screws and related brake plate hardware.
23. Install brake plate cover to shroud using five screws. Tighten screws.
24. Connect ground spring and pack on switch leadwires.
25. Connect speed sensor cable plug P3.
26. Perform the following procedures:
 - a. Pack On Switch Adjustment.
 - b. Grounding Spring Adjustment.
 - c. Speed Sensor Adjustment.
 - d. Head/Arm Alignment Check

STATIC GROUND SPRING

Adjustment

1. Set UNIT POWER circuit breaker to OFF.
2. Remove disk pack.
3. Refer to Side Panel Removal/Installation procedure and remove right (viewed facing drive front) side panel.
4. Visually check that ground spring is approximately centered on lockshaft (Figure 3-35).
5. If required, loosen screw securing ground spring to mounting bracket and center spring as required. Tighten screw.
6. Place a .002 - .005 inch non-metallic feeler gage between ground spring and lockshaft.
7. Hook a push-pull gage to outer end of ground spring.
8. Force (applied perpendicular to spring) required to allow feeler gage to fall free should be 125 (± 25) grams.
9. If required, carefully bend spring to adjust spring tension.
10. Install side panel per Side Panel Removal/Installation procedure.

Replacement

1. Set UNIT POWER circuit breaker to OFF.
2. Remove disk pack.
3. Refer to Side Panel Removal/Installation procedure and remove right (viewed facing drive front) side panel.
4. Remove static ground spring leadwire.
5. Remove screw, nut, three washers, terminal lug and ground spring from contact mounting bracket (Figure 3-35).
6. Install replacement ground spring on contact mounting bracket using one screw, one nut, three washers, and terminal lug.
7. Perform Static Ground Spring Adjustment procedure.
8. Connect ground spring leadwire.
9. Install side panel per Side Panel Removal/Installation procedure.

VELOCITY TRANSDUCER REPLACEMENT

1. Set UNIT POWER circuit breaker to OFF.
2. Remove disk pack.
3. Open cabinet top cover.
4. Remove deck top cover.
5. Disconnect velocity transducer cable plug P4 (Figure 3-37).
6. Remove two screws and washers securing velocity transducer end cap to magnet assembly. Retain cap, screws, and spring (located inside cap).

CAUTION

Use care in the following steps so that extension rod is not damaged.

7. Unthread extension rod at point where it enters rear of head/arm receiver.
8. Carefully pull transducer magnet and extension rod out of cap end of transducer coil/housing.

NOTE

Omit steps 9 and 14 if only the magnet is being replaced.

9. Remove transducer coil/housing from magnet assembly.

CAUTION

Replacement velocity transducer magnet can be rendered unuseable if it comes in contact with a ferro magnetic object. Assembly must be moved out of magnet at least 18 inches before changing direction. New assembly must not approach the magnet closer than 18 inches except from center rear. Do not place transducer magnet on any metal surface.

10. Carefully remove replacement transducer magnet from shipping container.
11. Place replacement magnet alongside old magnet to determine correct polarity (like poles repel). Note which end should connect to extension rod and return magnet to shipping container.
12. Carefully unthread extension rod from old transducer magnet. Moderate force may be required since Loctite is on rod threads.
13. Apply one drop of Loctite, Grade C, to extension rod threads that mate with transducer magnet. Observing polarity that was determined in step 11, thread rod into end of new transducer magnet.
14. Slide replacement transducer coil/housing into magnet assembly.
15. Insert free end of extension rod into bore of coil/housing. Slide assembly into coil/housing until threads of extension rod are visible behind head/arm receiver.
16. Apply one drop of Loctite, Grade C, to extension rod threads. Using a pliers and only moderate force, install extension rod in head/arm receiver.
17. Install head cam tool and fully extend carriage.

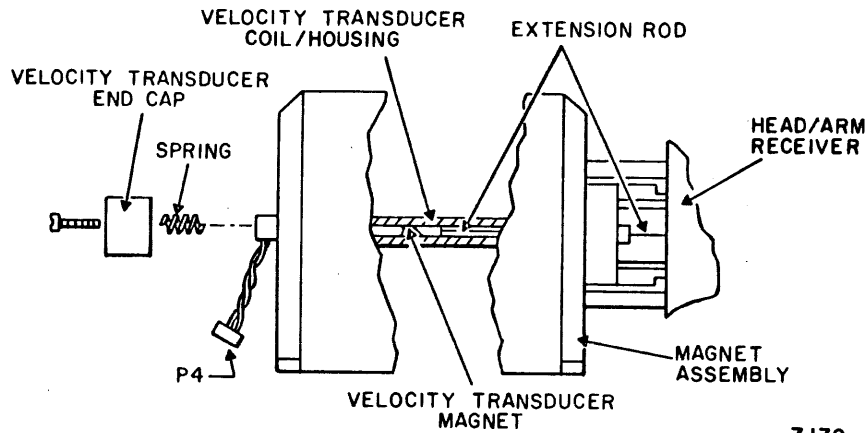


Figure 3-37. Velocity Transducer Replacement

- | | |
|--|--|
| <p>18. Assemble spring and transducer end cap to magnet assembly using two screws and washers.</p> <p>19. Connect velocity transducer plug P4.</p> | <p>20. Remove head cam tool.</p> <p>21. Perform Integrator Gain Adjustment procedure.</p> <p>22. Perform Velocity Transducer Gain Uniformity procedure.</p> <p>23. Perform Velocity Gain Adjustment procedure.</p> |
|--|--|

NOTE

Transducer polarity is correct when A28, TP-C swings in negative direction while actuator is manually moved in forward direction.

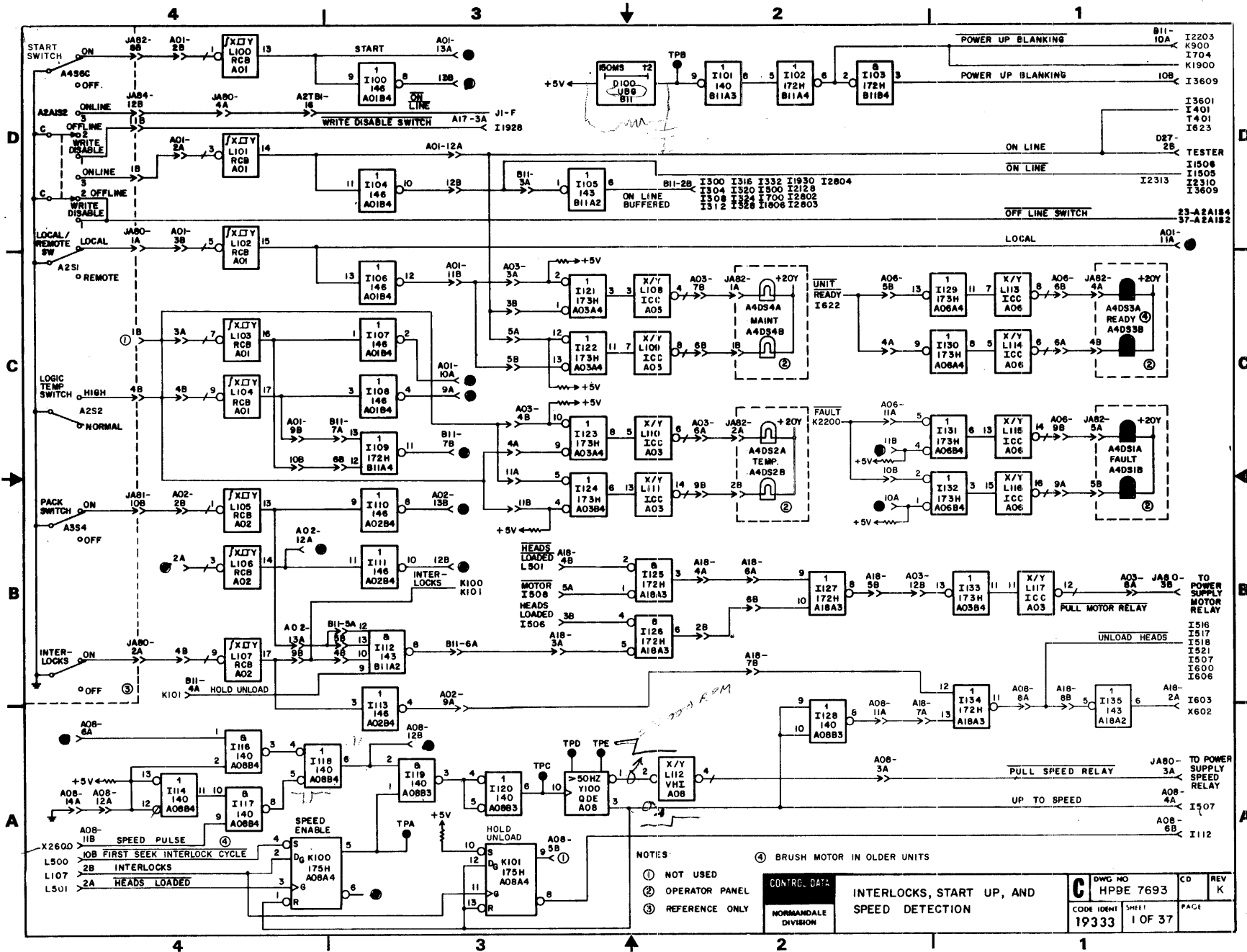
SECTION 4

DIAGRAMS

INTRODUCTION

This section contains diagrams that logically describe the drive in terms of the functions which the unit performs. Schematic diagrams for the logic cards are located in the Logic Cards Manual (refer to Preface). Descriptive material for discrete component circuits is located in the same manual.

Flow charts, simplified circuits, and timing diagrams that describe unit functions are located in the Theory of Operation section (refer to Publication Number 70630400).



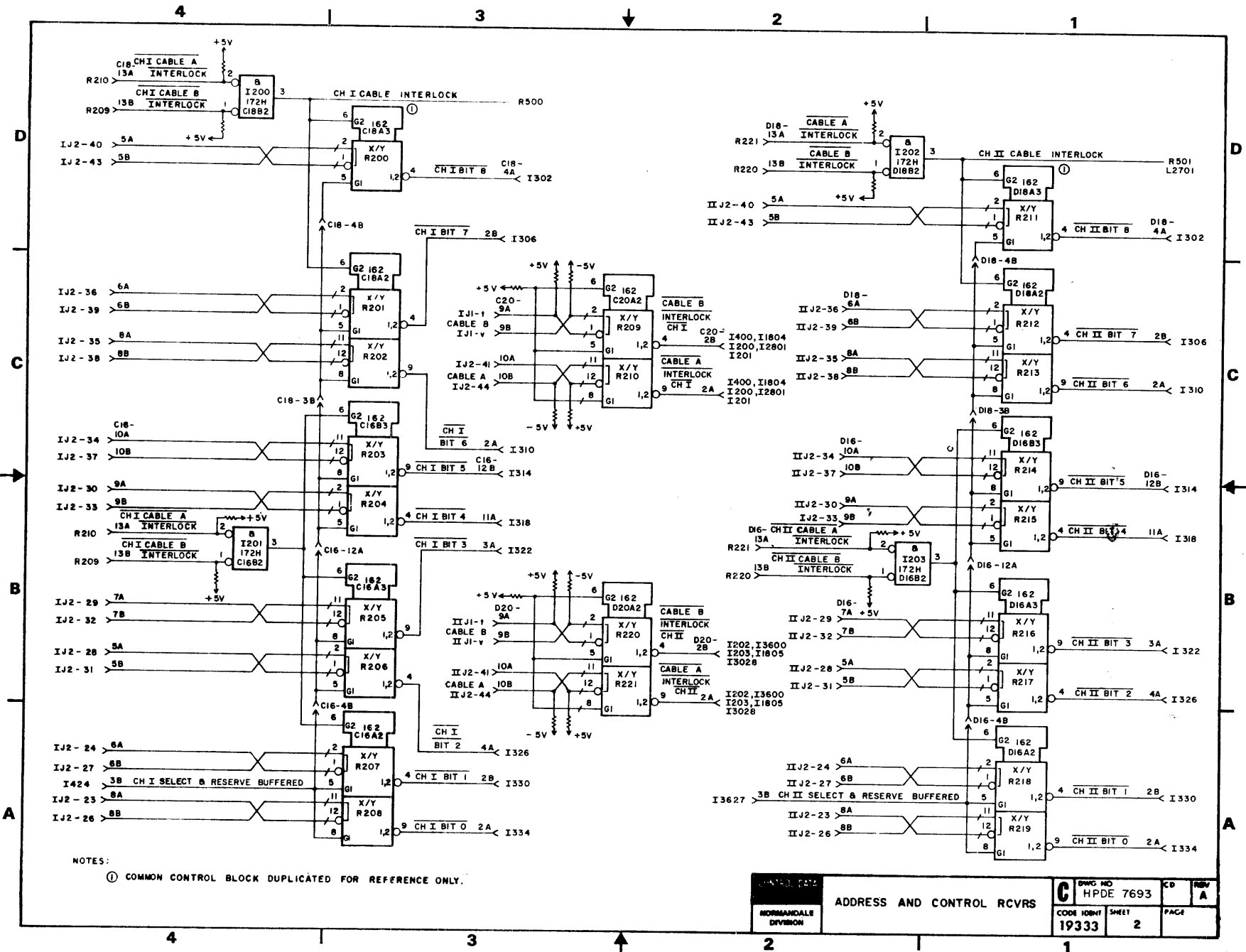
NOTES:
 (1) NOT USED
 (2) OPERATOR PANEL
 (3) REFERENCE ONLY
 (4) BRUSH MOTOR IN OLDER UNITS

CON'G. DATA
 NORMANDELE
 DIVISION

INTERLOCKS, START UP, AND
 SPEED DETECTION

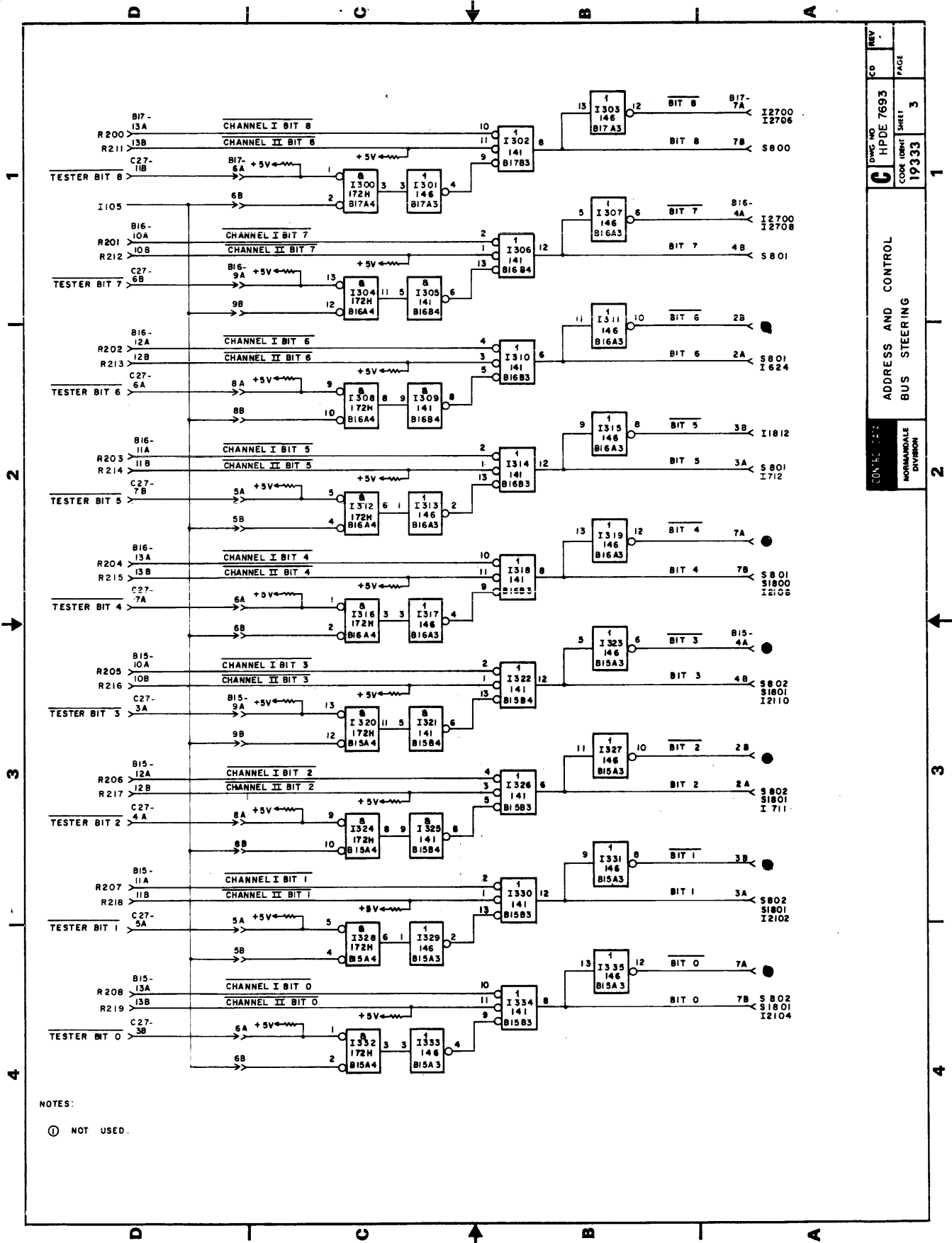
DWG NO
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CD REV
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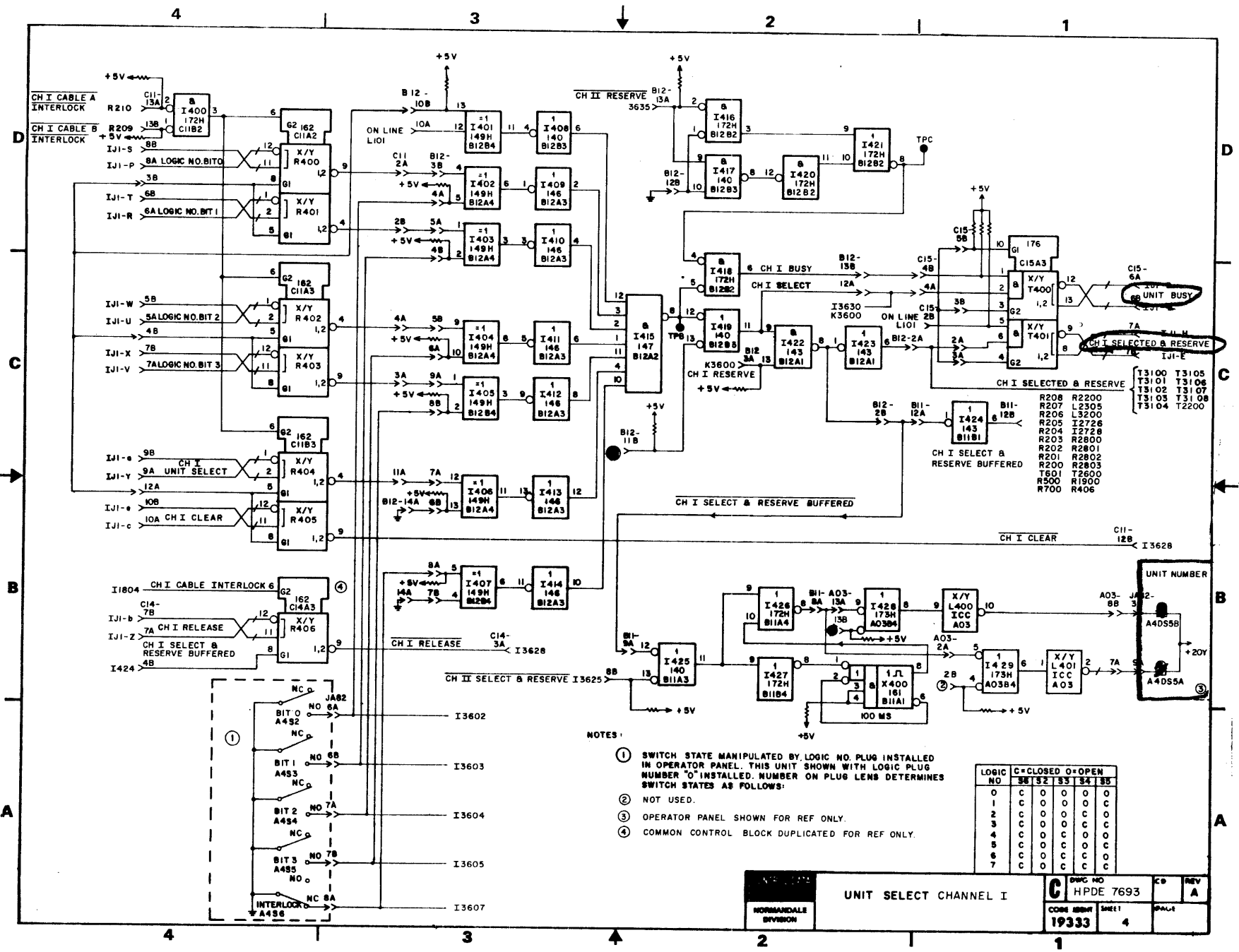
NOTES:
 ① COMMON CONTROL BLOCK DUPLICATED FOR REFERENCE ONLY.

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	CODE IDENT 19333	SHEET 2		



NOTES:
 ⓪ NOT USED.

REV.	CO	PAGE
	3	
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	CODE (DIRT) SHEET	
19333		
ADDRESS AND CONTROL BUS STEERING		
NORMANVILLE DIVISION		

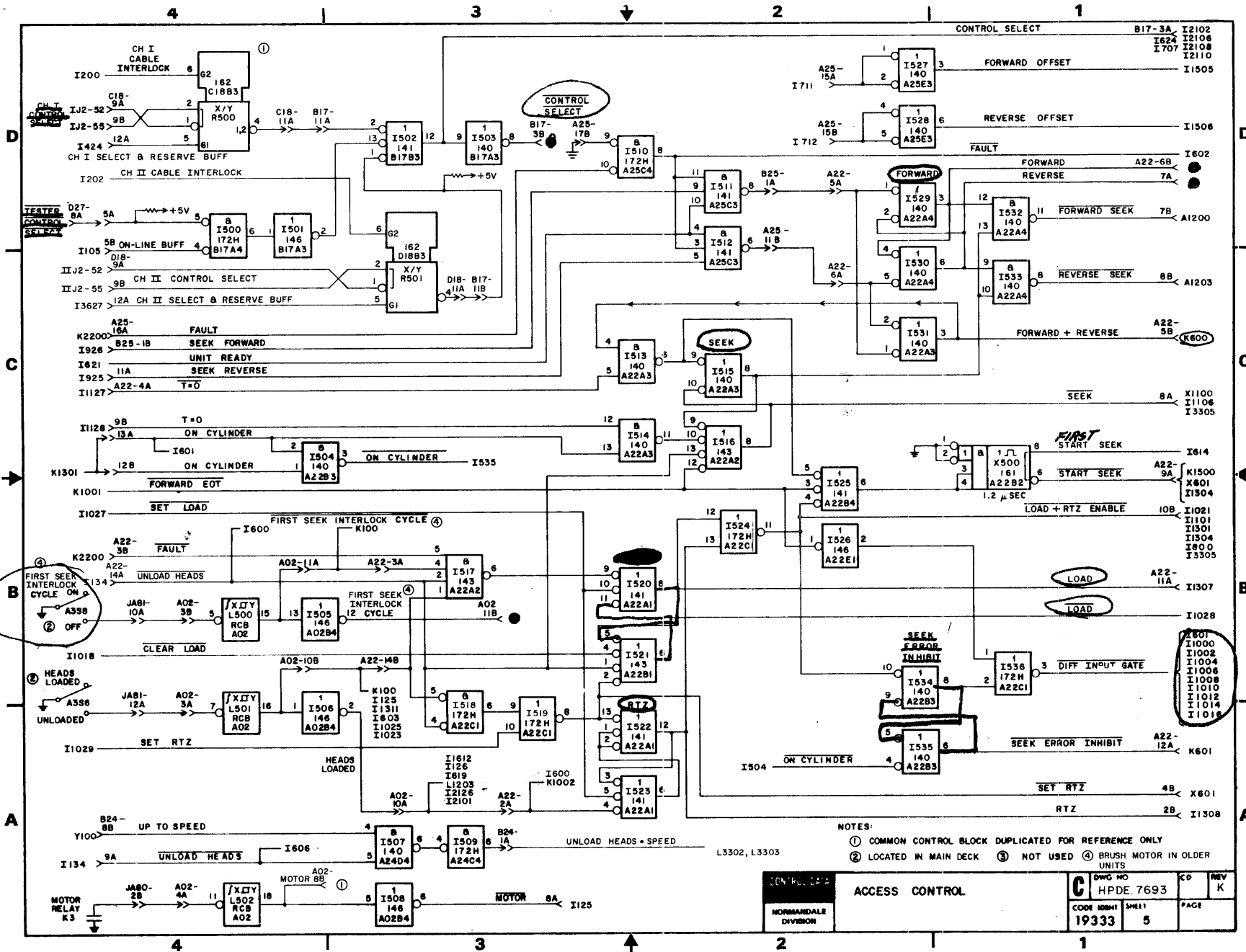


- NOTES:
- ① SWITCH STATE MANIPULATED BY LOGIC NO. PLUG INSTALLED IN OPERATOR PANEL. THIS UNIT SHOWN WITH LOGIC PLUG NUMBER "0" INSTALLED. NUMBER ON PLUG LENS DETERMINES SWITCH STATES AS FOLLOWS:
 - ② NOT USED.
 - ③ OPERATOR PANEL SHOWN FOR REF ONLY.
 - ④ COMMON CONTROL BLOCK DUPLICATED FOR REF ONLY.

LOGIC NO	C=CLOSED O=OPEN				
	35	32	33	34	35
0	C	O	O	O	O
1	C	O	O	O	C
2	C	O	O	C	C
3	C	O	C	C	C
4	C	C	C	C	C
5	C	C	C	C	C
6	C	C	C	C	C
7	C	C	C	C	C

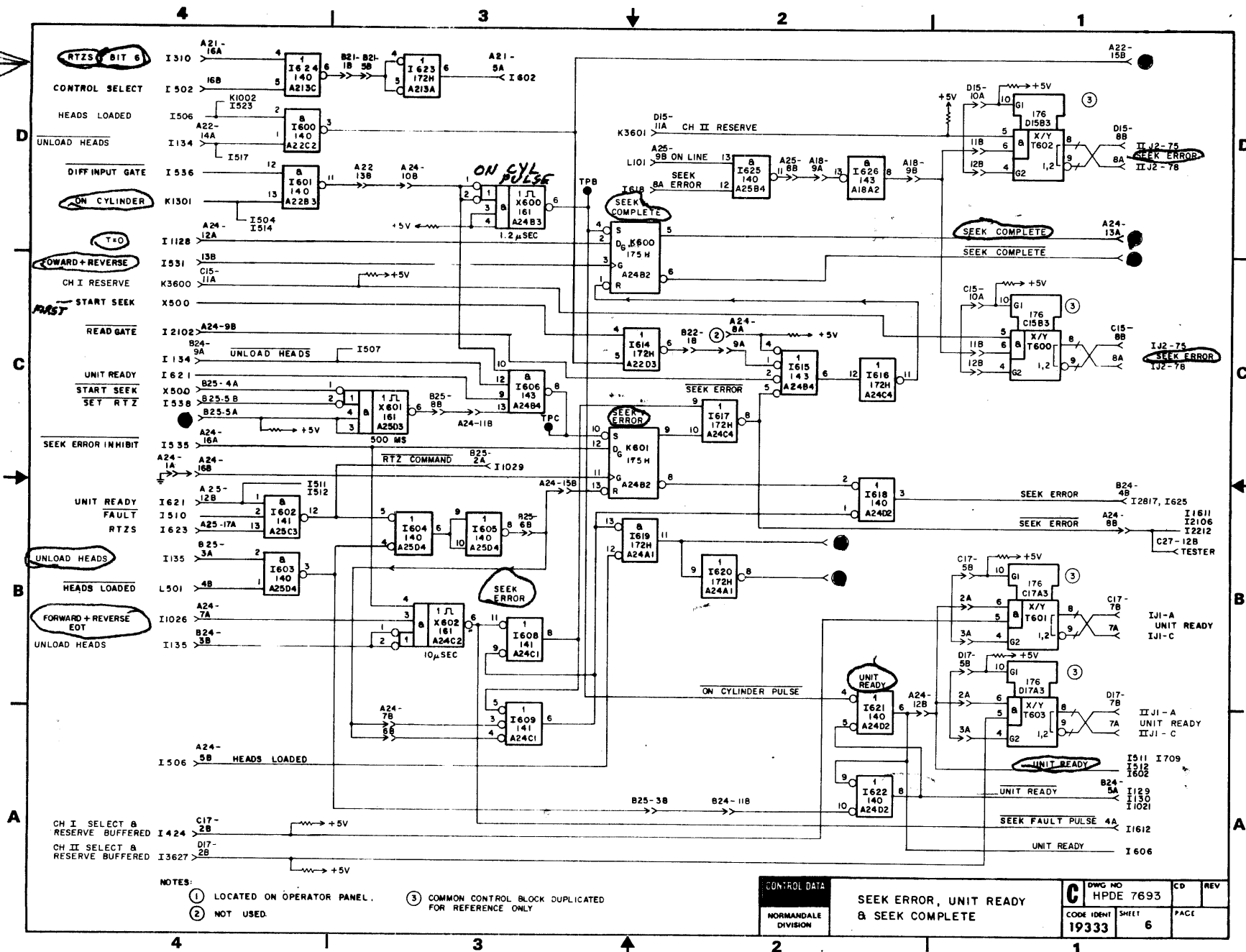
UNIT SELECT CHANNEL I

NORMANVILLE DIVISION	C	DWG NO HPDE 7693	C/D	REV A
	19333	SHEET 4	DATE	REV



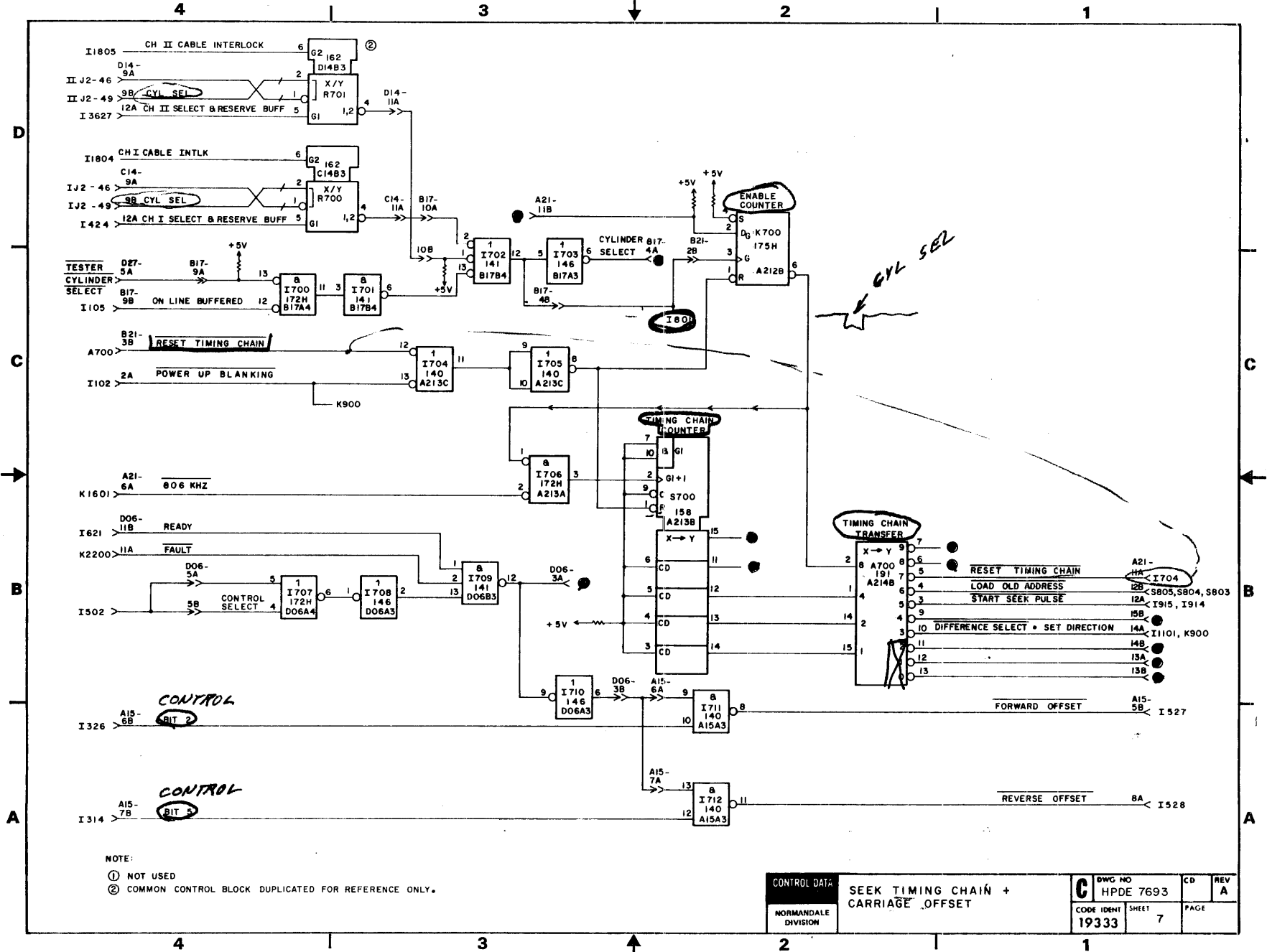
NOTES:
 ① COMMON CONTROL BLOCK DUPLICATED FOR REFERENCE ONLY
 ② LOCATED IN MAIN DECK ③ NOT USED ④ BRUSH MOTOR IN OLDER UNITS

CONTROL CASE		ACCESS CONTROL		C		DWG NO		CD		REV	
NORMANDEALE DIVISION				19333		HPDE 7693		5		K	



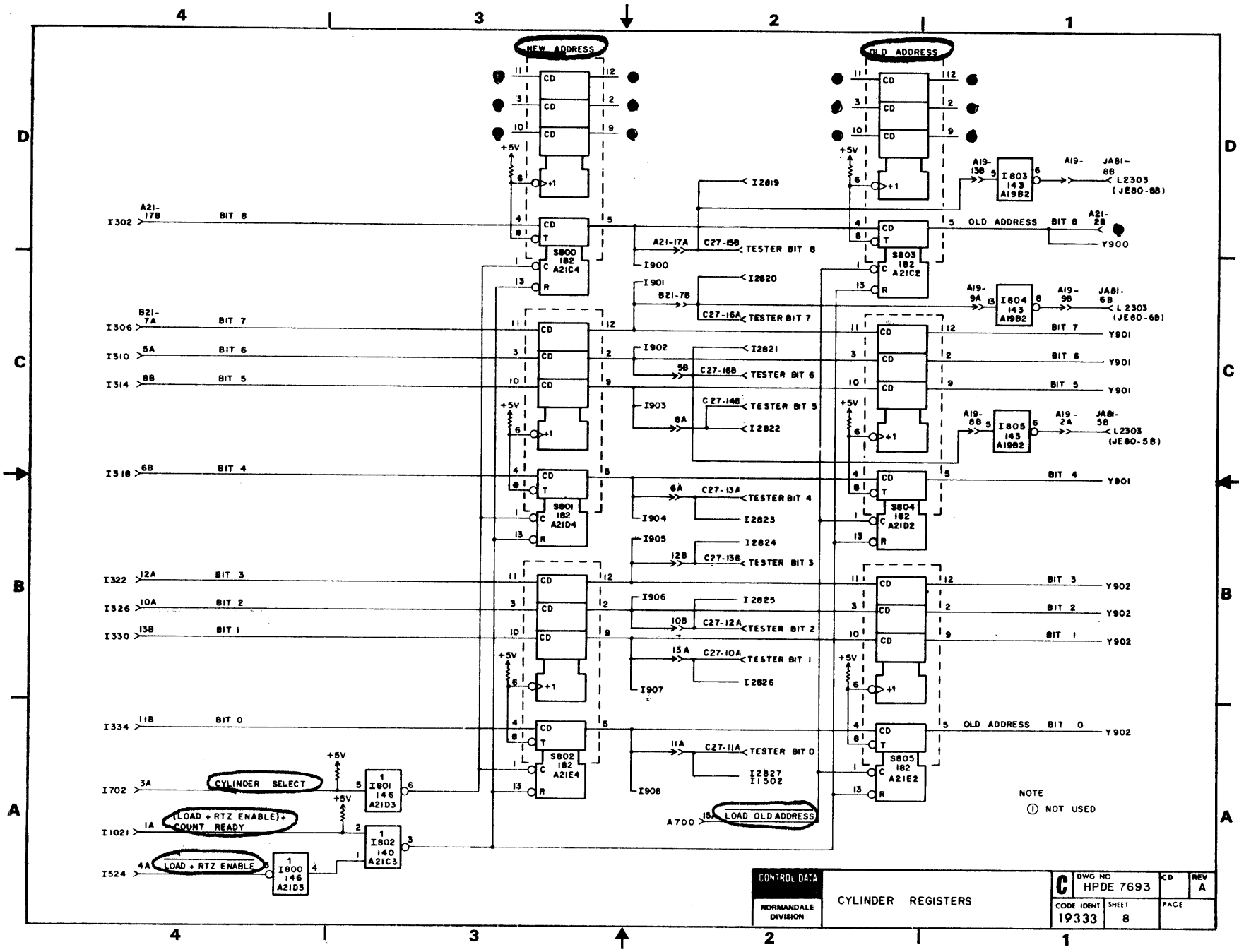
NOTES:
 ① LOCATED ON OPERATOR PANEL.
 ② NOT USED.
 ③ COMMON CONTROL BLOCK DUPLICATED FOR REFERENCE ONLY

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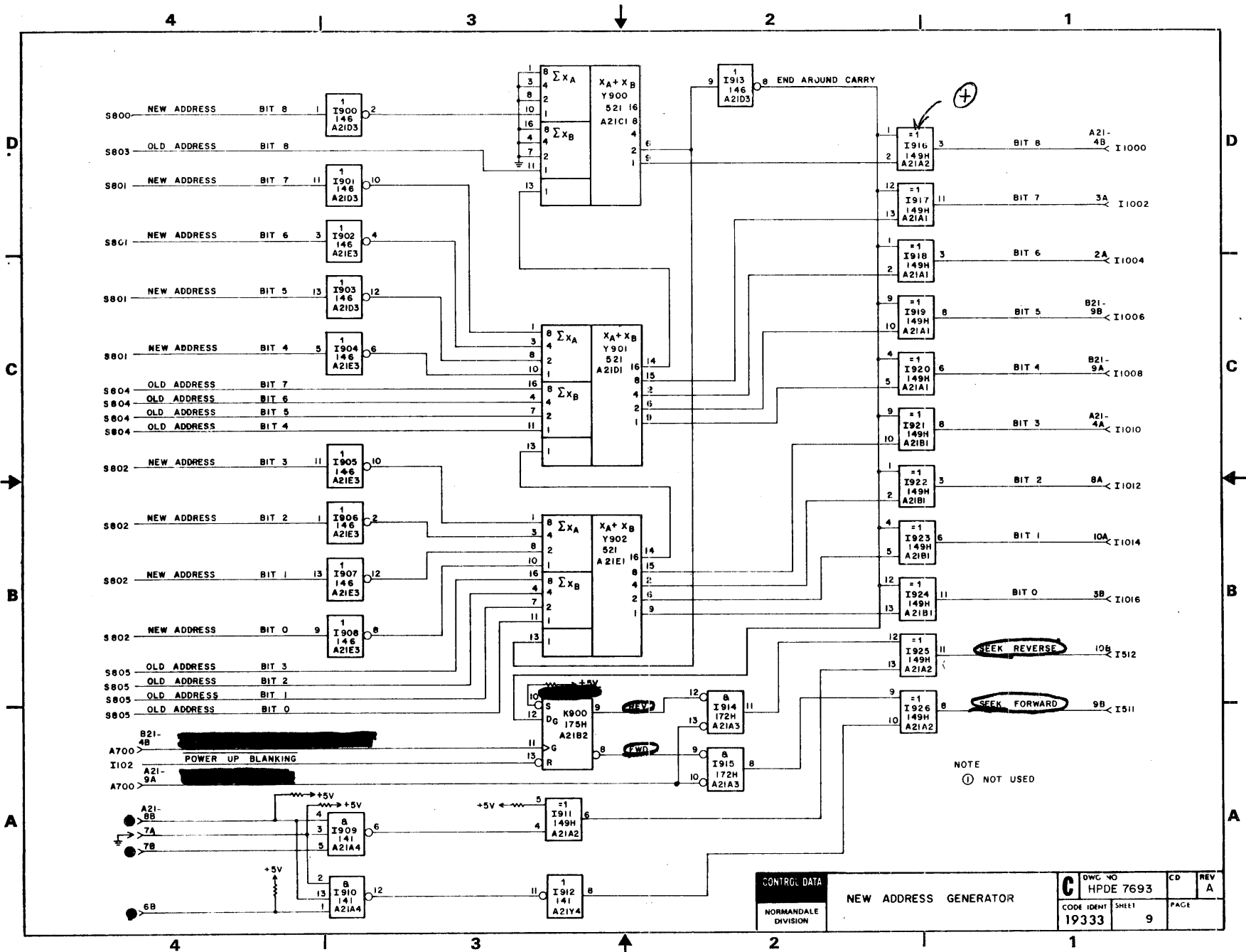
NOTE:
 ① NOT USED
 ② COMMON CONTROL BLOCK DUPLICATED FOR REFERENCE ONLY.

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NORMANDEALE DIVISION		CODE IDENT SHEET 19333		PAGE 7			



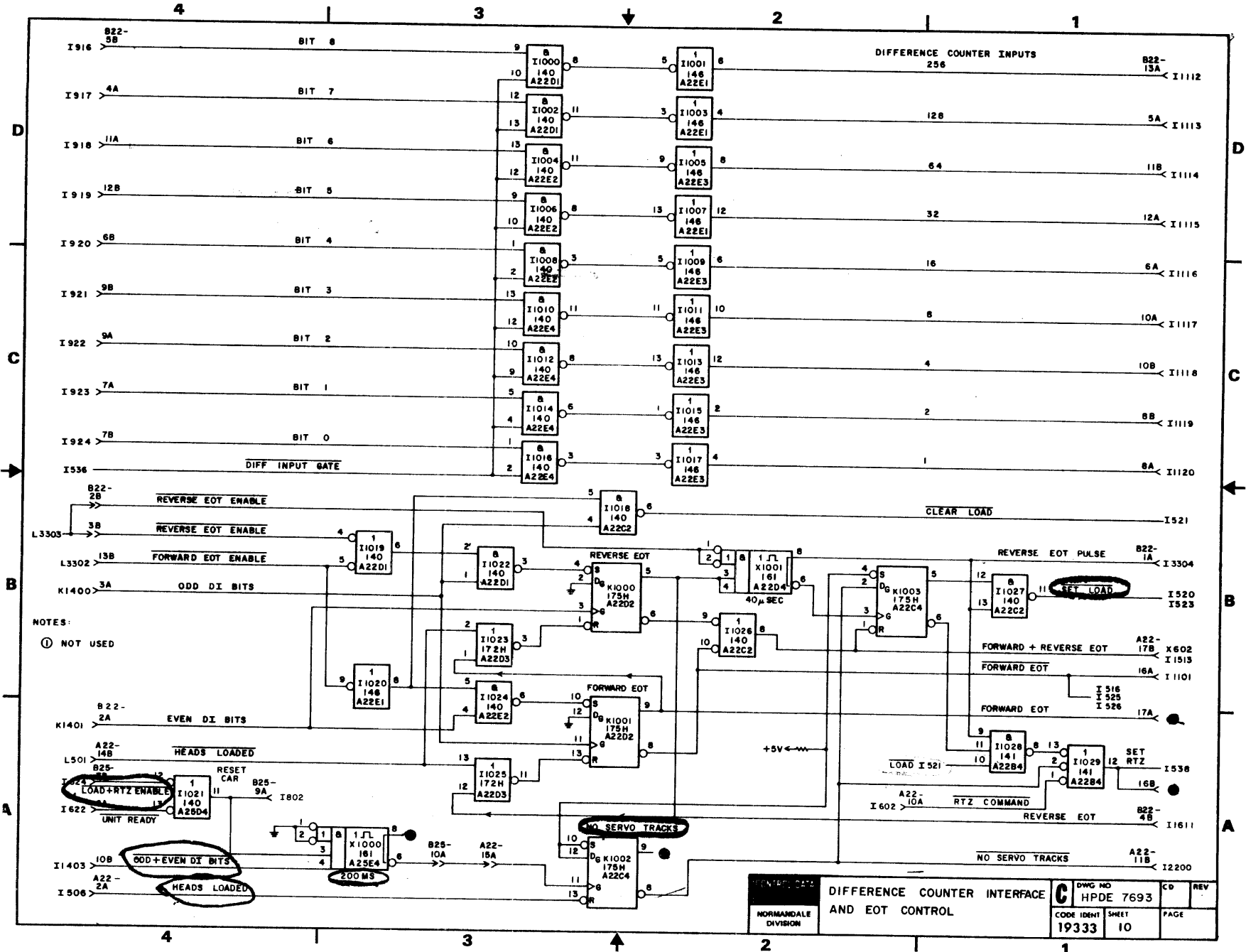
NOTE
① NOT USED

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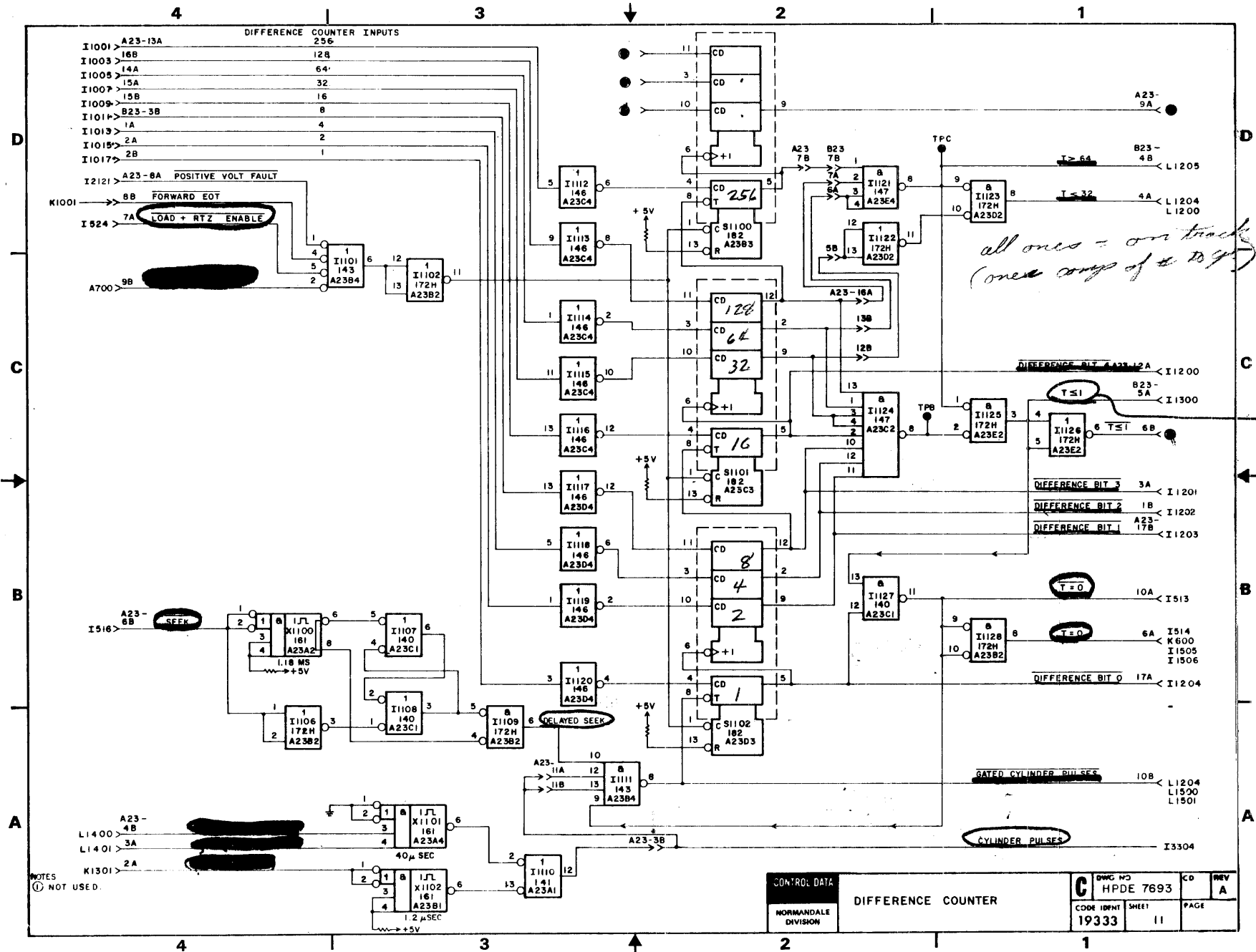
CONTRL. DATA
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NEW ADDRESS GENERATOR

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NOTES:
 ① NOT USED

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			19333	10		



all ones = on track
(once comp of # 10 9)

T=0

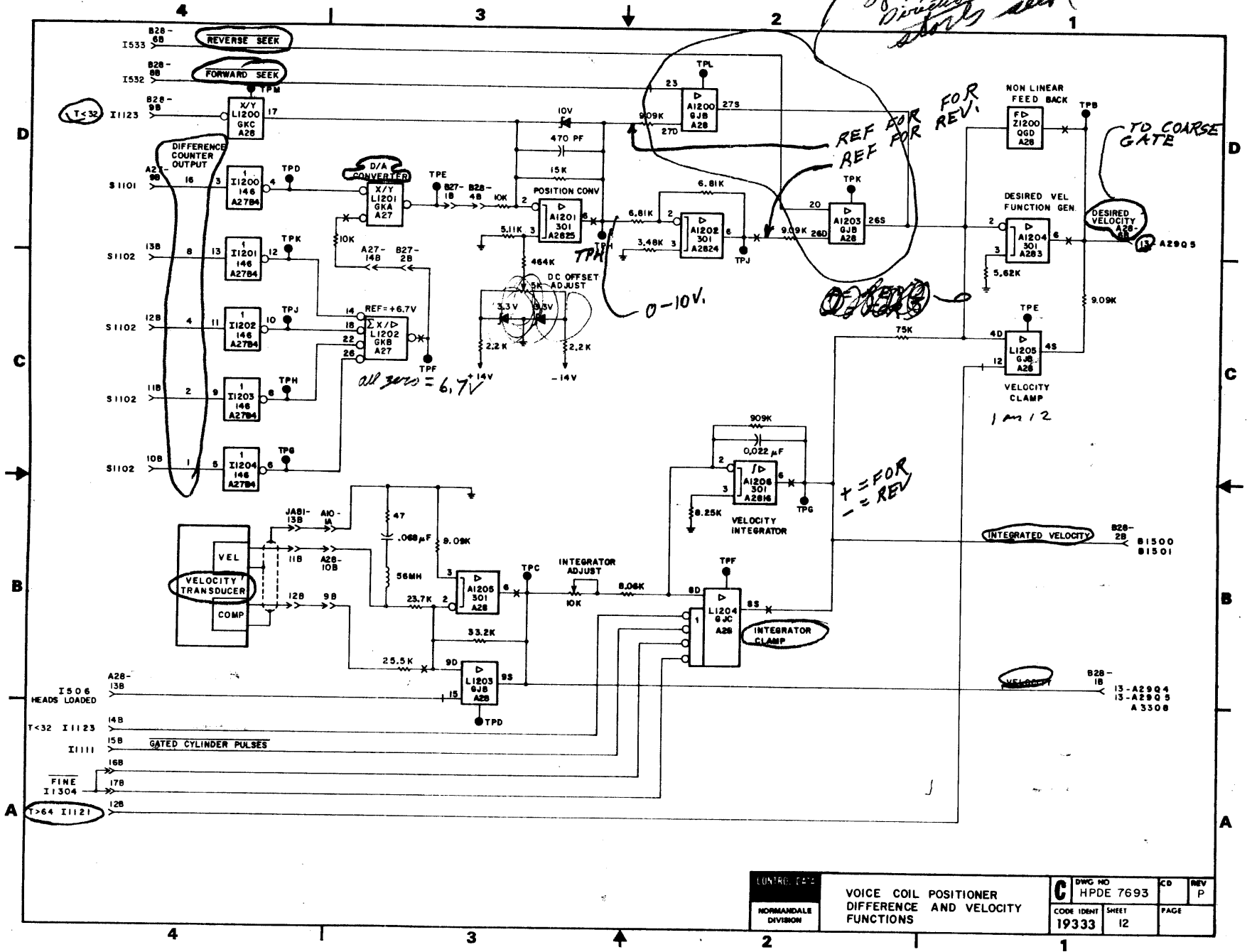
T=0

GATED CYLINDER PULSES

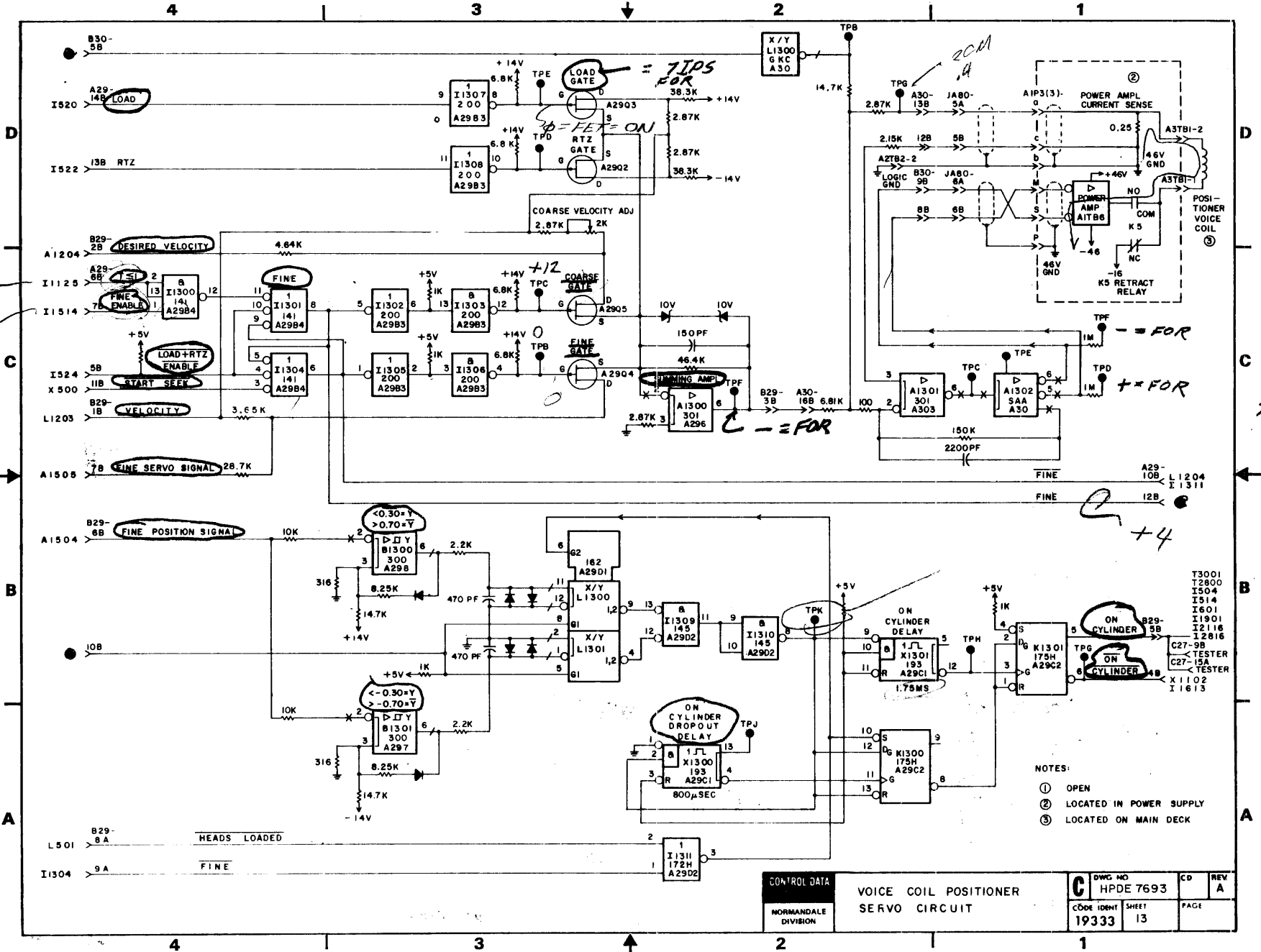
CYLINDER PULSES

NOTES
① NOT USED.

Changes Polarity of D/A to correct direction also check



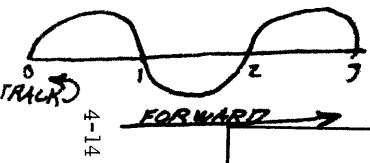
NORMANDALE DIVISION	VOICE COIL POSITIONER DIFFERENCE AND VELOCITY FUNCTIONS		C	DWG NO	CD	REV P
	19333	12		HPDE 7693		



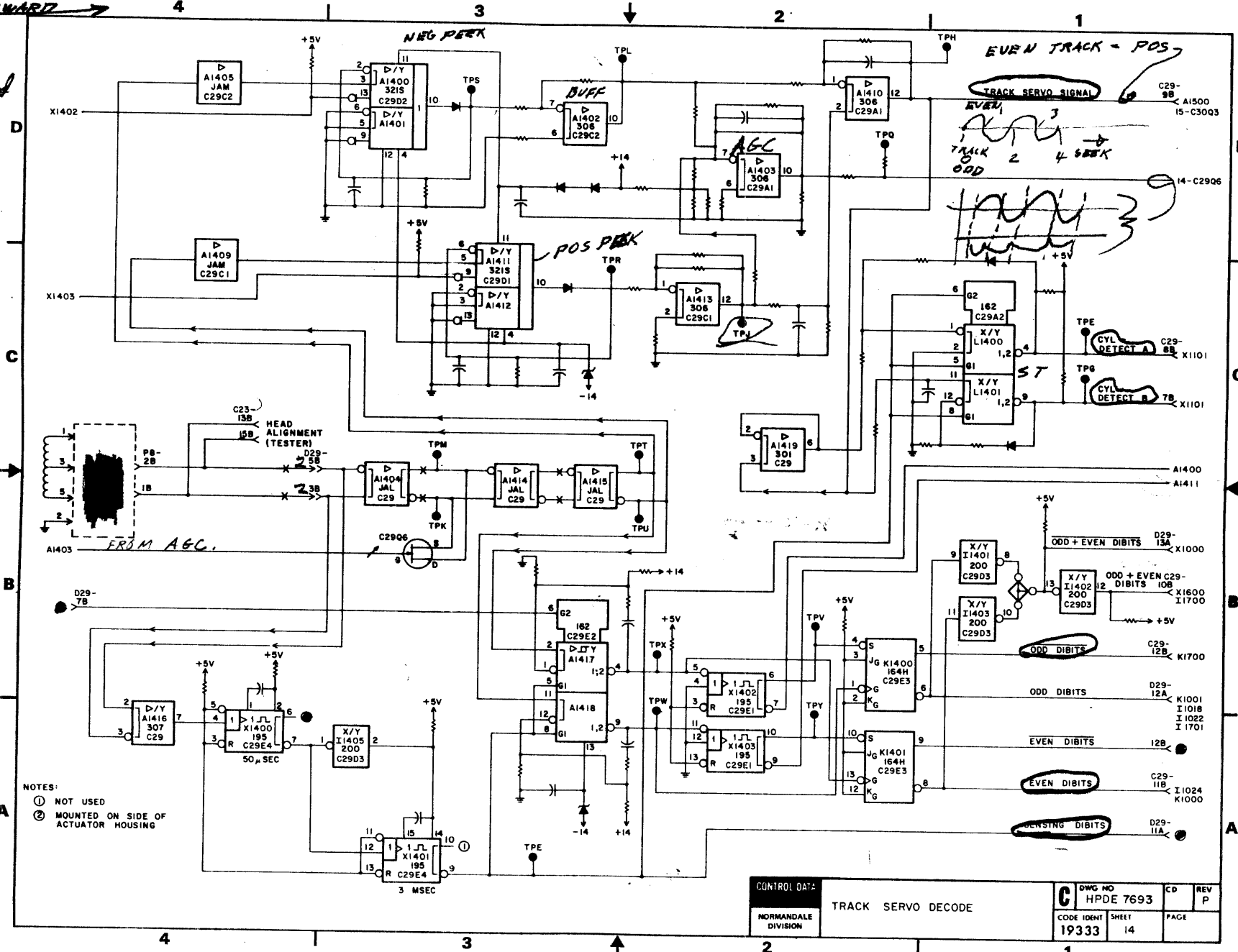
- NOTES:
- ① OPEN
 - ② LOCATED IN POWER SUPPLY
 - ③ LOCATED ON MAIN DECK

CONTROL DATA NORMANDEALE DIVISION	VOICE COIL POSITIONER SERVO CIRCUIT		C DWG NO HPDE 7693	CD REV A
	CODE IDENT 19333	SHEET 13		

000 = \bar{V}_1 = -LEVEL @ TPH TRACK SERVO SIG.



FORWARD

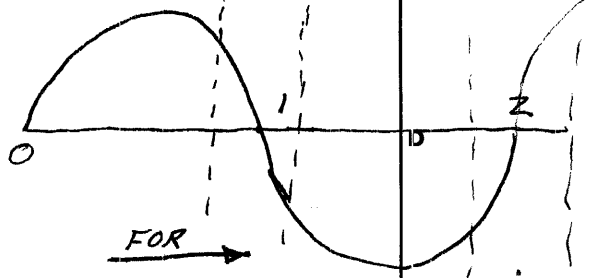


NOTES:
① NOT USED
② MOUNTED ON SIDE OF ACTUATOR HOUSING

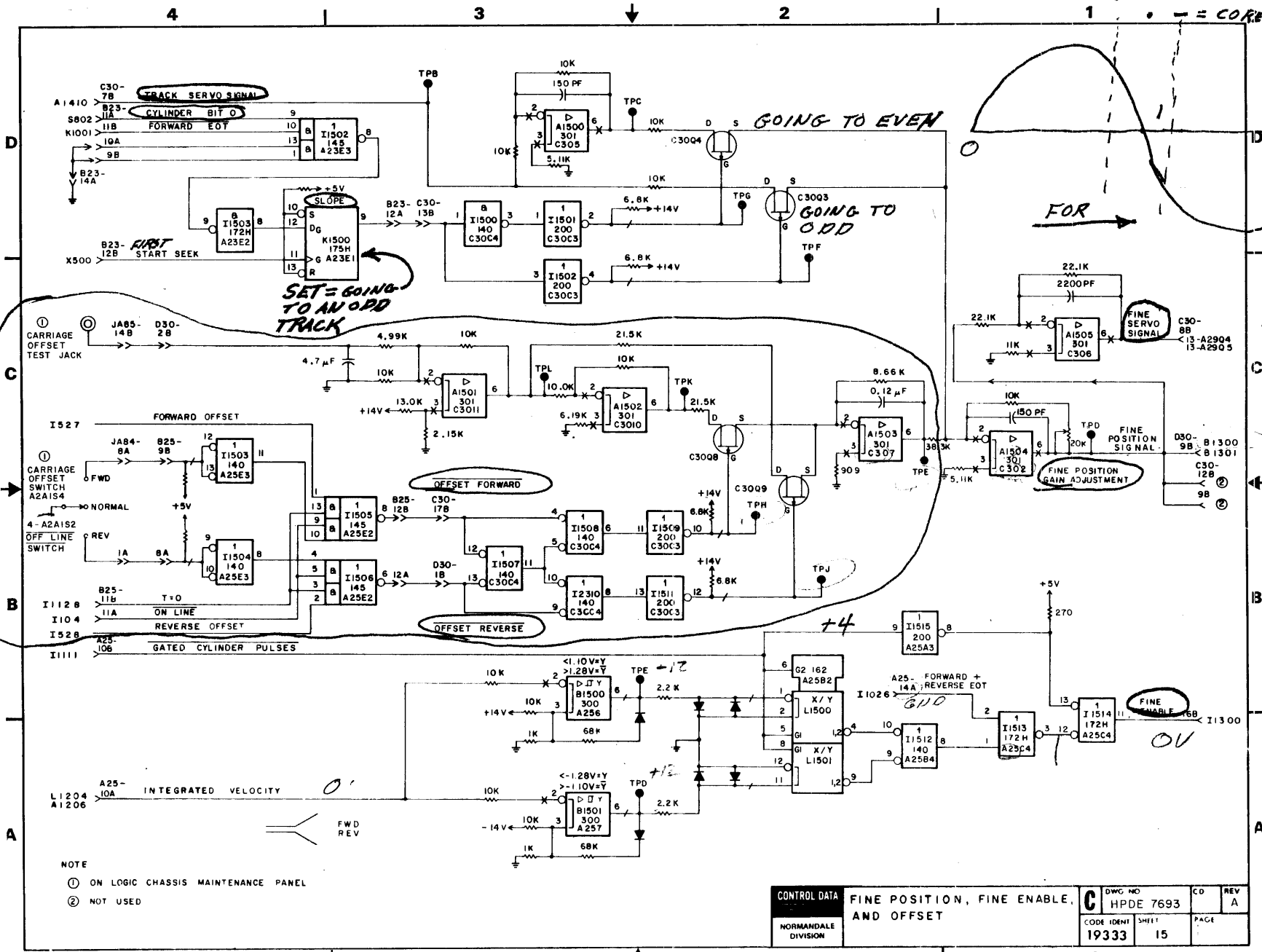
CONTROL DATA:		C	OWG NO	CD	REV
NORMANDALE DIVISION			HPDE 7693		P
		TRACK SERVO DECODE			
CODE IDENT	SHEET	PAGE			
19333	14				

83306700 E

+ = CORRECT WITH FOR
• - = CORRECT WITH REV

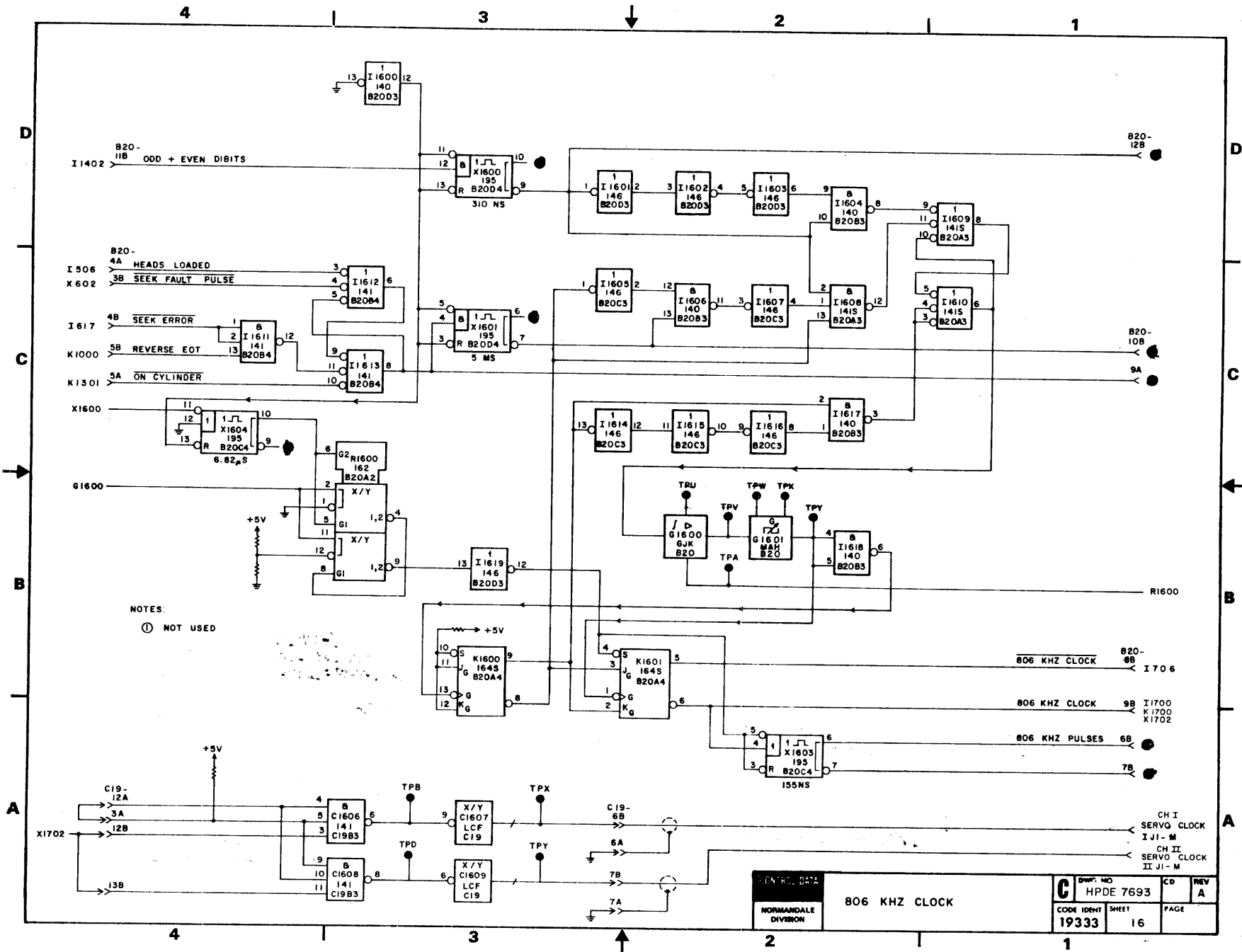


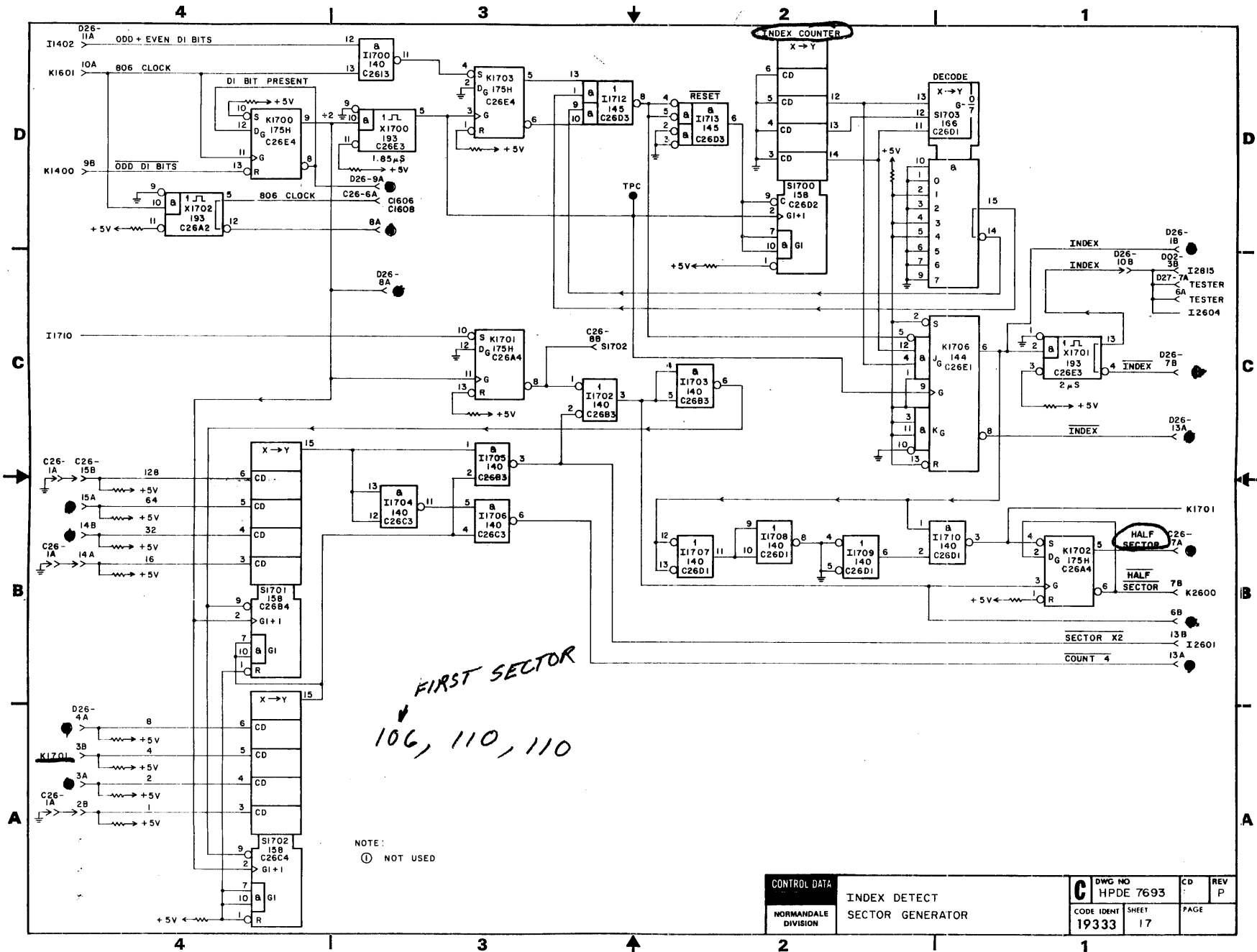
+ = CORRECT WITH FOR
+ = CORRECT WITH REV



NOTE
① ON LOGIC CHASSIS MAINTENANCE PANEL
② NOT USED

CONTROL DATA NORMANDE DIVISION	FINE POSITION, FINE ENABLE, AND OFFSET	C	DWG NO HPDE 7693	CD	REV A
			CODE IDENT 19333	SHEET 15	PAGE

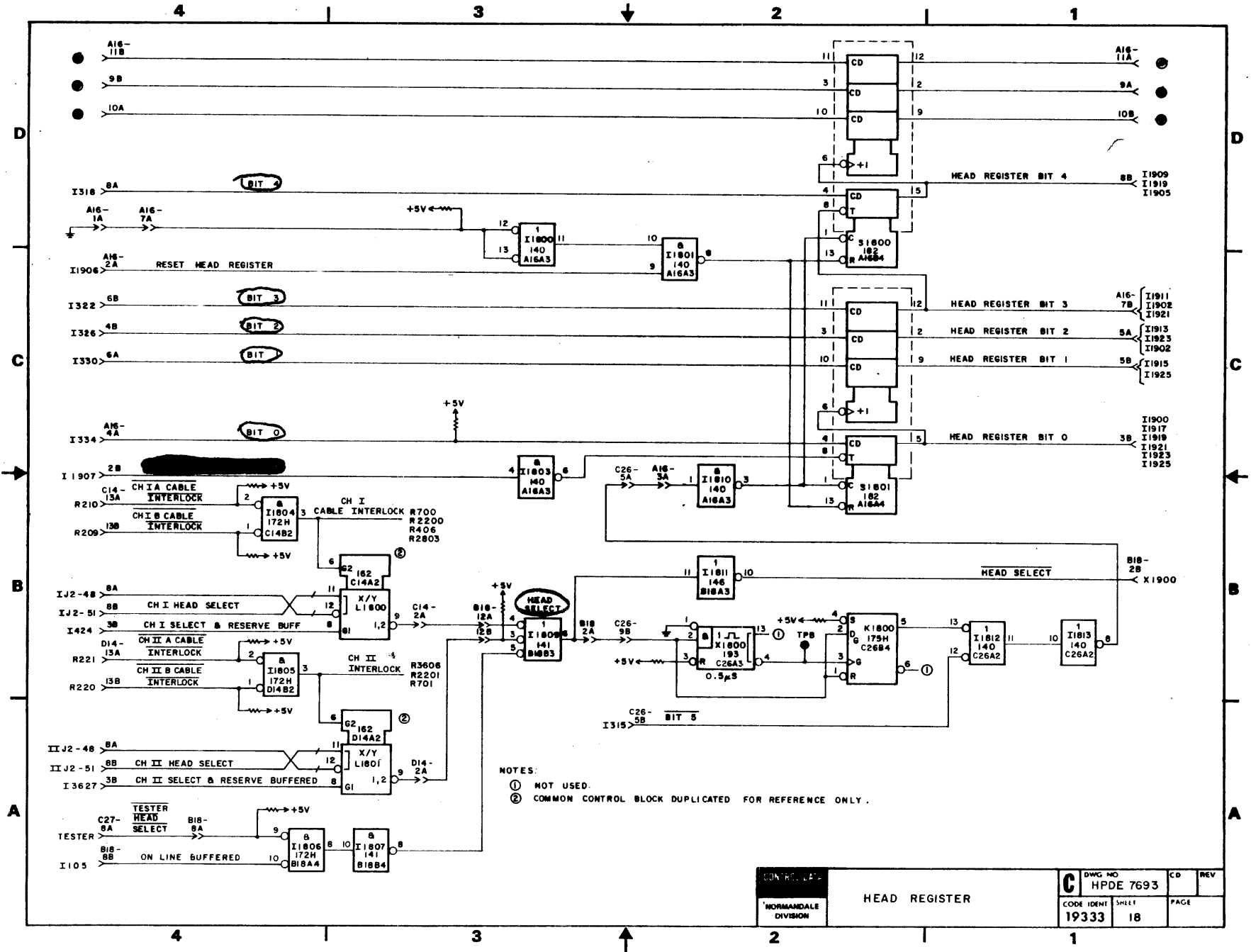




FIRST SECTOR
 ↓
 106, 110, 110

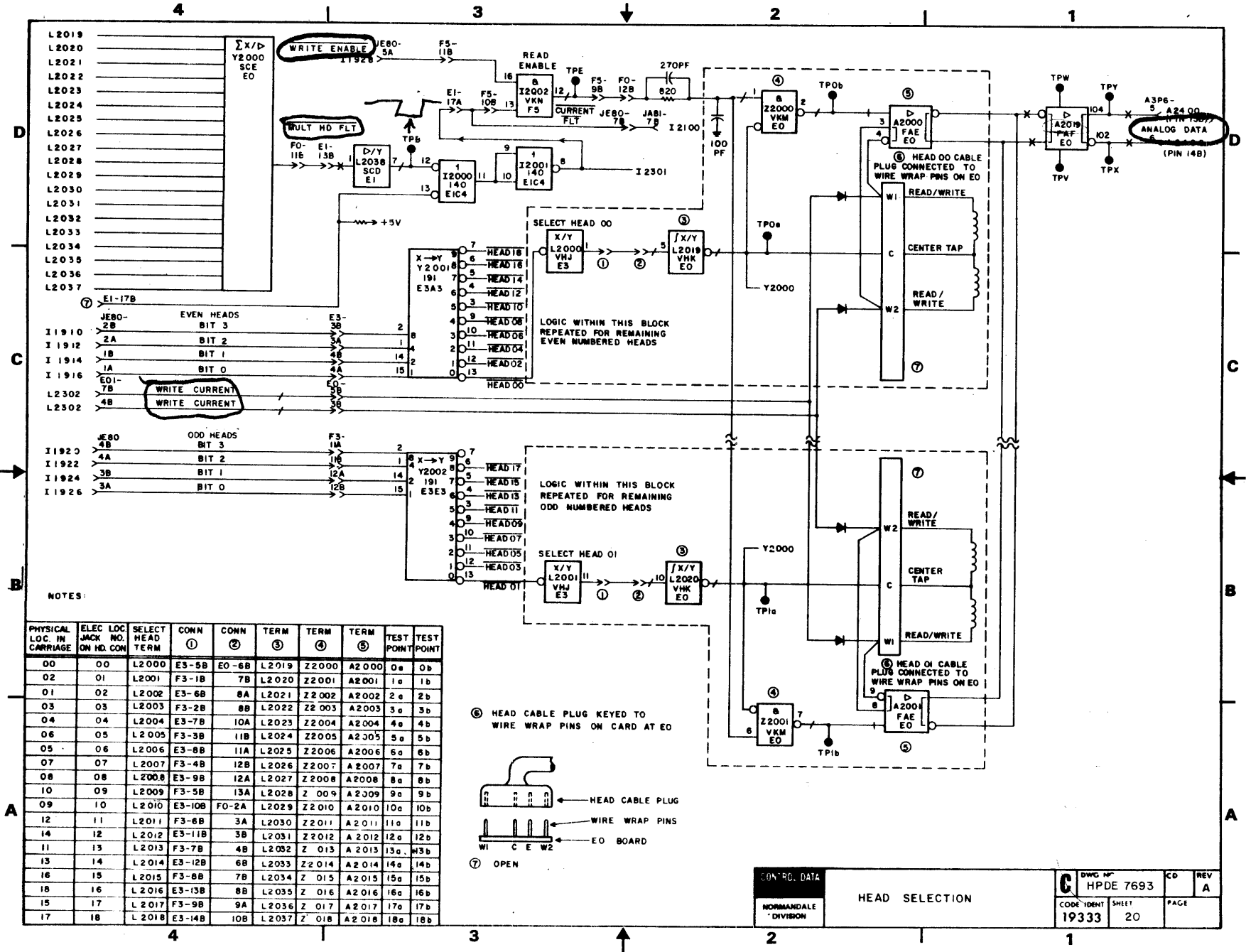
NOTE:
 (1) NOT USED

CONTROL DATA		DWG NO HPDE 7693		CD	REV
NORMANDEALE DIVISION		INDEX DETECT SECTOR GENERATOR		P	P
		CODE IDENT 19333	SHEET 17	PAGE	



NOTES:
 ① NOT USED.
 ② COMMON CONTROL BLOCK DUPLICATED FOR REFERENCE ONLY.

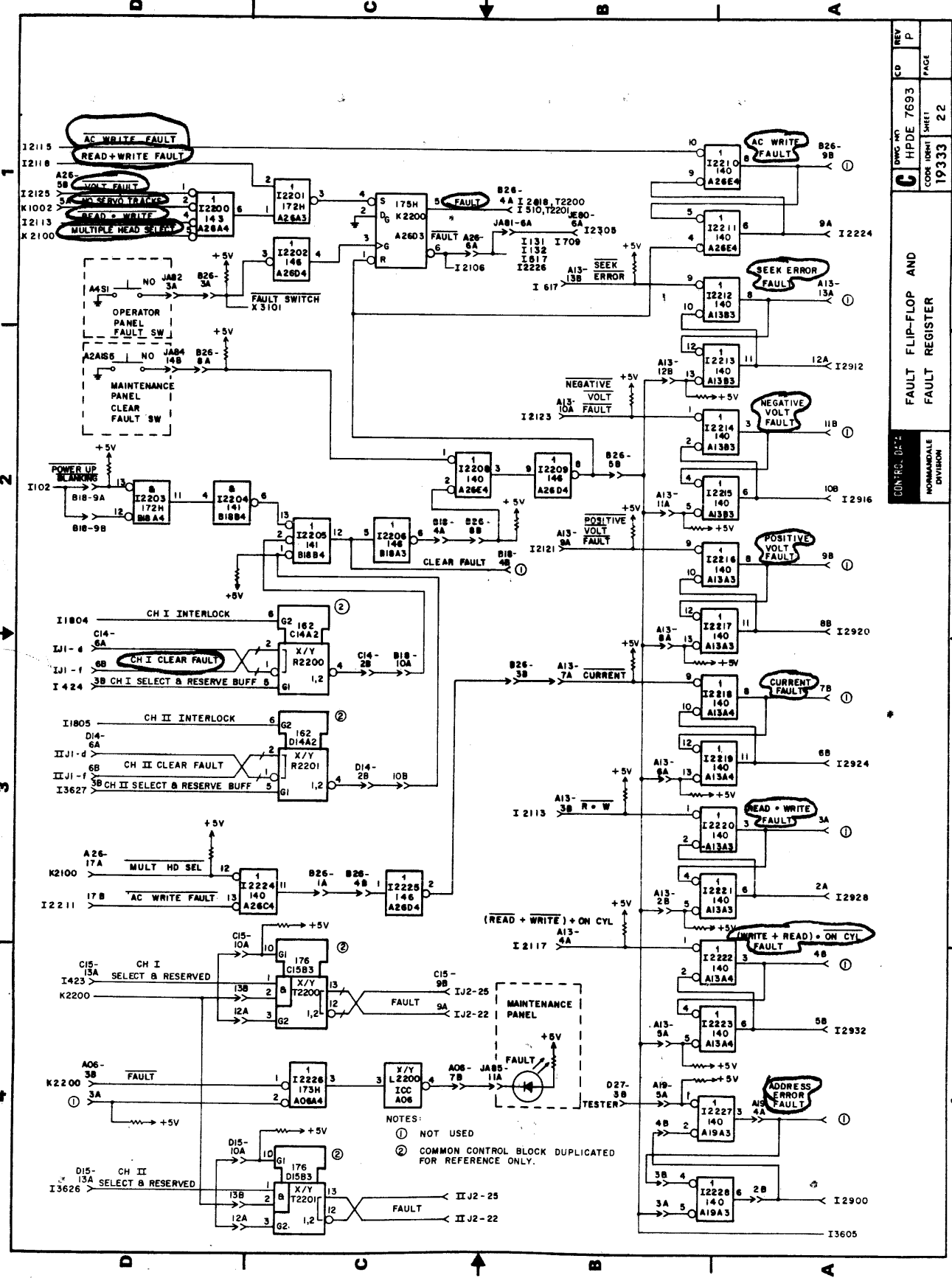
NORMANDEALE DIVISION	HEAD REGISTER		DWG NO HPDE 7693	CD	REV
	CODE IDENT 19333	SHEET 18	PAGE		



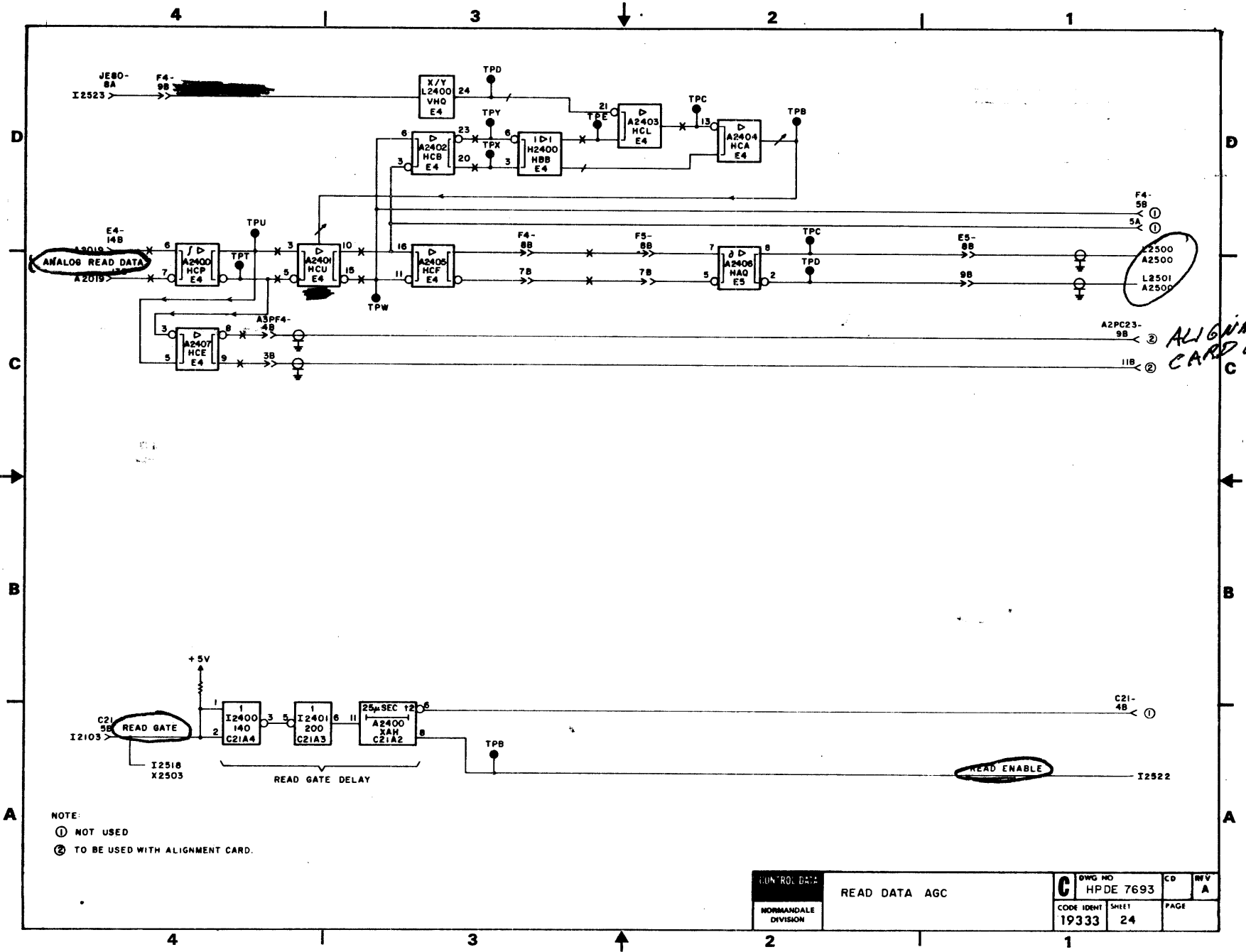
NOTES:

PHYSICAL LOC. IN CARRIAGE	ELEC JACK NO. ON HD. CON	LOC. NO. ON HD. CON	SELECT HEAD TERM	CONN ①	CONN ②	TERM ③	TERM ④	TERM ⑤	TEST POINT	TEST POINT
00	00	L2000	E3-5B	EO-6B	L2019	Z2000	A2000	0a	0b	
02	01	L2001	F3-1B	7B	L2020	Z2001	A2001	1a	1b	
01	02	L2002	E3-6B	8A	L2021	Z2002	A2002	2a	2b	
03	03	L2003	F3-2B	8B	L2022	Z2003	A2003	3a	3b	
04	04	L2004	E3-7B	10A	L2023	Z2004	A2004	4a	4b	
06	05	L2005	F3-3B	11B	L2024	Z2005	A2005	5a	5b	
05	06	L2006	E3-8B	11A	L2025	Z2006	A2006	6a	6b	
07	07	L2007	F3-4B	12B	L2026	Z2007	A2007	7a	7b	
08	08	L2008	E3-9B	12A	L2027	Z2008	A2008	8a	8b	
10	09	L2009	F3-5B	13A	L2028	Z2009	A2009	9a	9b	
09	10	L2010	E3-10B	FO-2A	L2029	Z2010	A2010	10a	10b	
12	11	L2011	F3-6B	3A	L2030	Z2011	A2011	11a	11b	
14	12	L2012	E3-11B	3B	L2031	Z2012	A2012	12a	12b	
11	13	L2013	F3-7B	4B	L2032	Z2013	A2013	13a	13b	
13	14	L2014	E3-12B	6B	L2033	Z2014	A2014	14a	14b	
16	15	L2015	F3-8B	7B	L2034	Z2015	A2015	15a	15b	
18	16	L2016	E3-13B	8B	L2035	Z2016	A2016	16a	16b	
15	17	L2017	F3-9B	9A	L2036	Z2017	A2017	17a	17b	
17	18	L2018	E3-14B	10B	L2037	Z2018	A2018	18a	18b	

CD	REV	P
DWG NO	HPDE 7693	PAGE
CODE IDENT SHEET	19333	22
FAULT FLIP-FLOP AND FAULT REGISTER		
CONFIG. 04-2 NORMALDALE DIVISION		



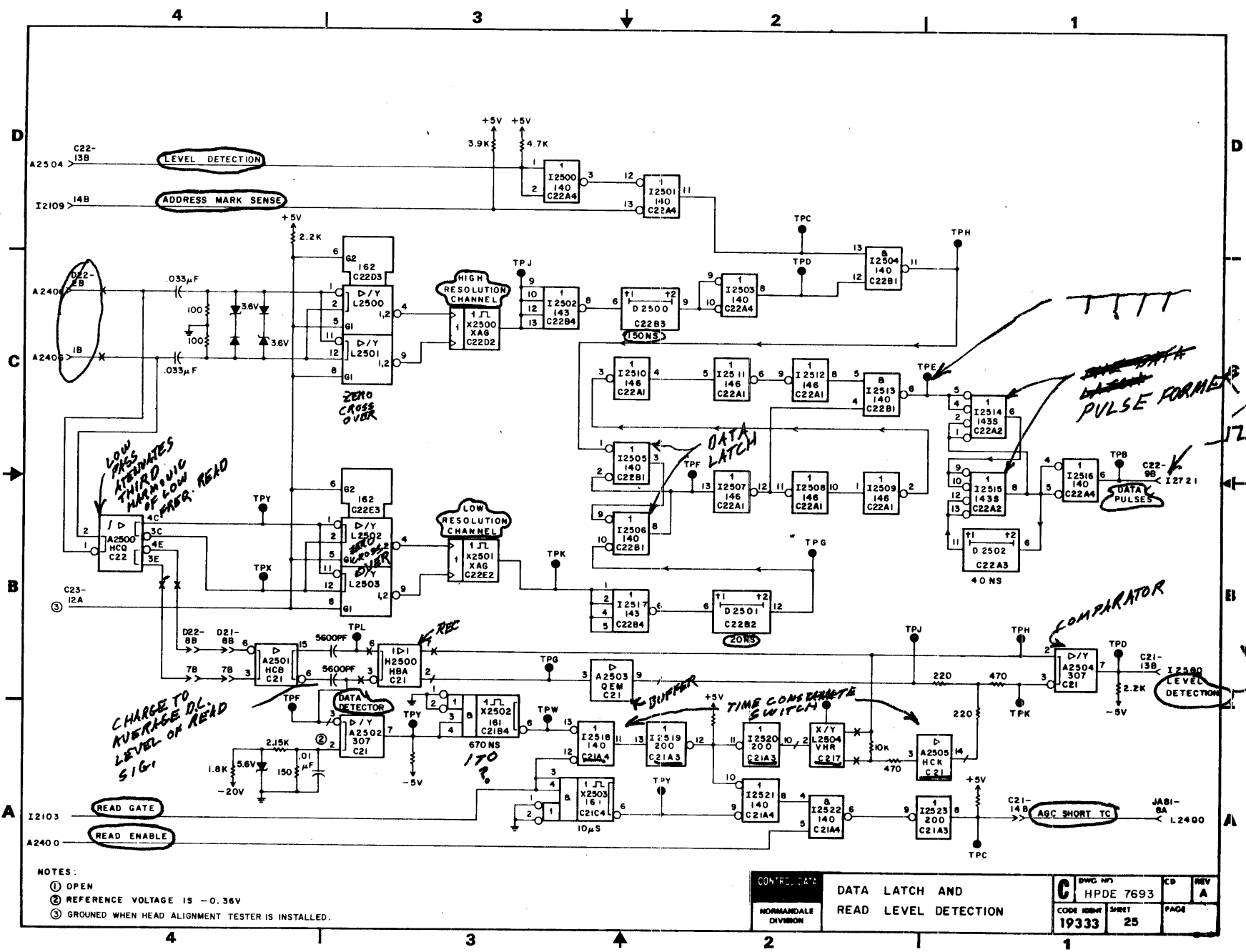
NOTES:
 ① NOT USED
 ② COMMON CONTROL BLOCK DUPLICATED FOR REFERENCE ONLY.



ALIGNMENT CARD ONLY

83306700

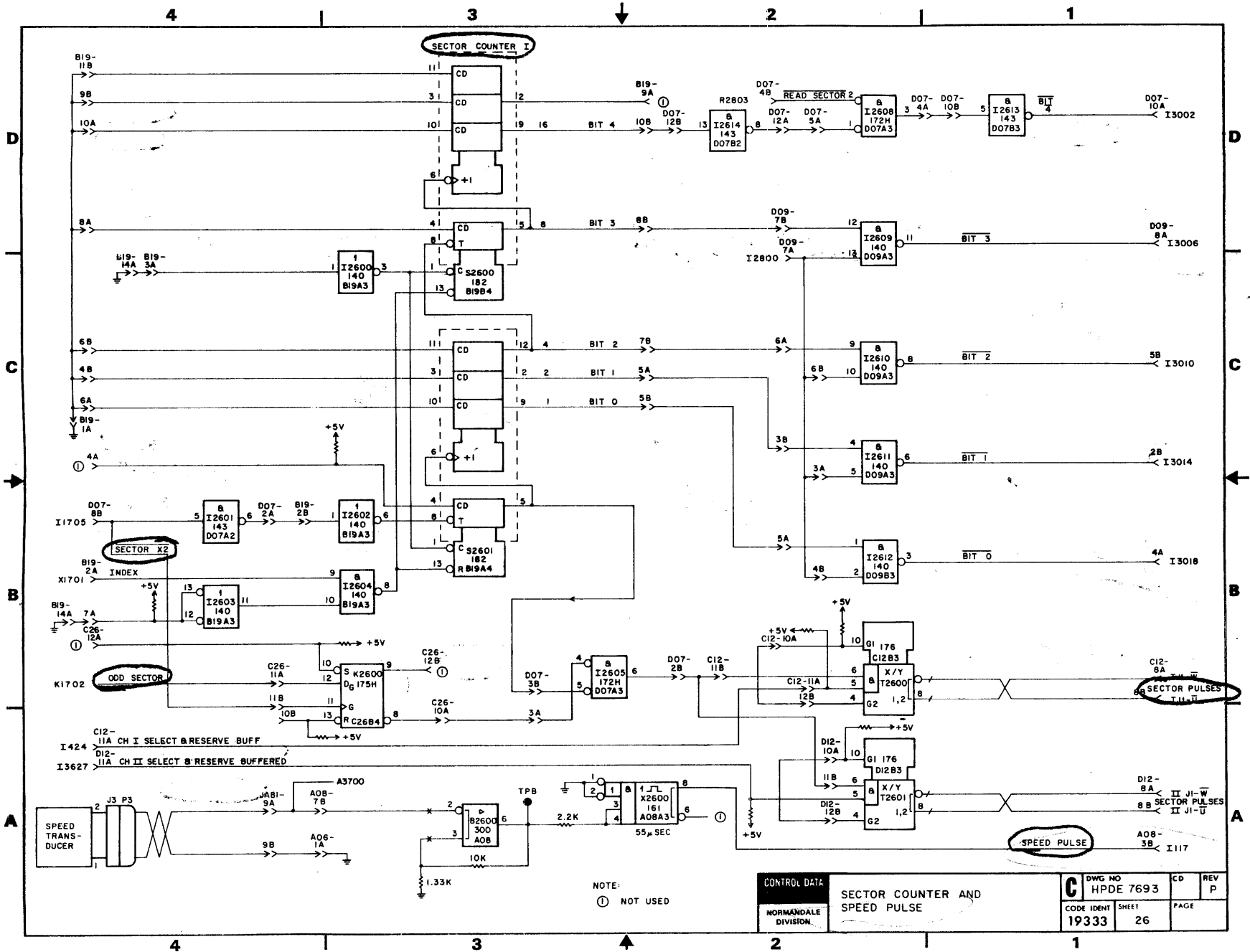
2.4 + 2.5
motional
act.



NOTES:
 ① OPEN
 ② REFERENCE VOLTAGE IS -0.36V
 ③ GROUNDED WHEN HEAD ALIGNMENT TESTER IS INSTALLED.

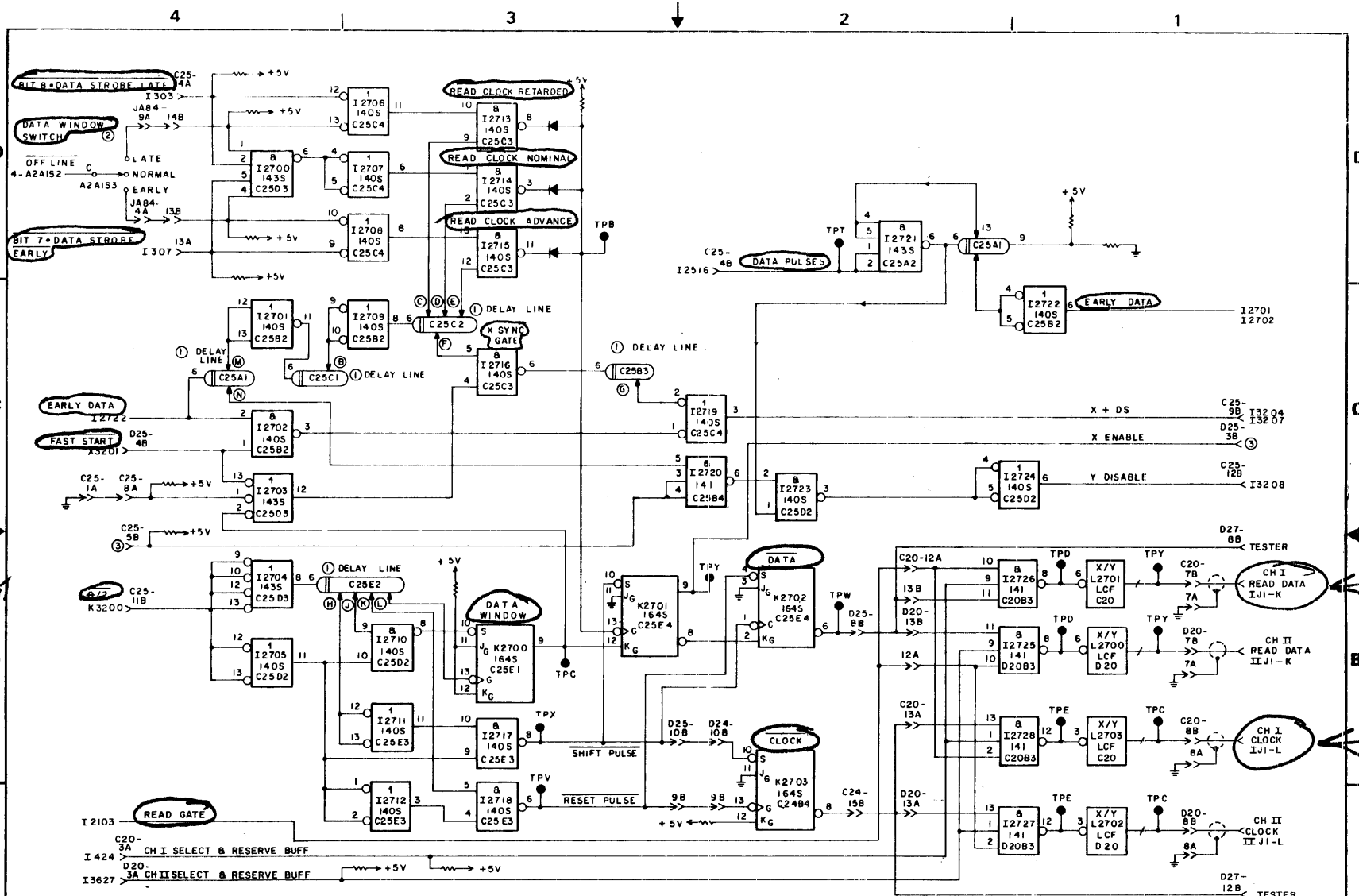
CONTROL DATE	DATA LATCH AND READ LEVEL DETECTION	DWG NO C HPDE 7693	CD A	REV A
NORMANDEALE DIVISION		CODE IDENT 19333	SHEET 25	PAGE A

4-25



NOTE:
 ⓪ NOT USED

CONTROL DATA		SECTOR COUNTER AND SPEED PULSE	
NORMANDALE DIVISION		DWG NO HPDE 7693	CD REV P
CODE IDENT 19333	SHEET 26	PAGE	



WRITE TIME OUT
IS CAUSED BY
ISS OF SECTOR B

Randomly
Selected
FAULT

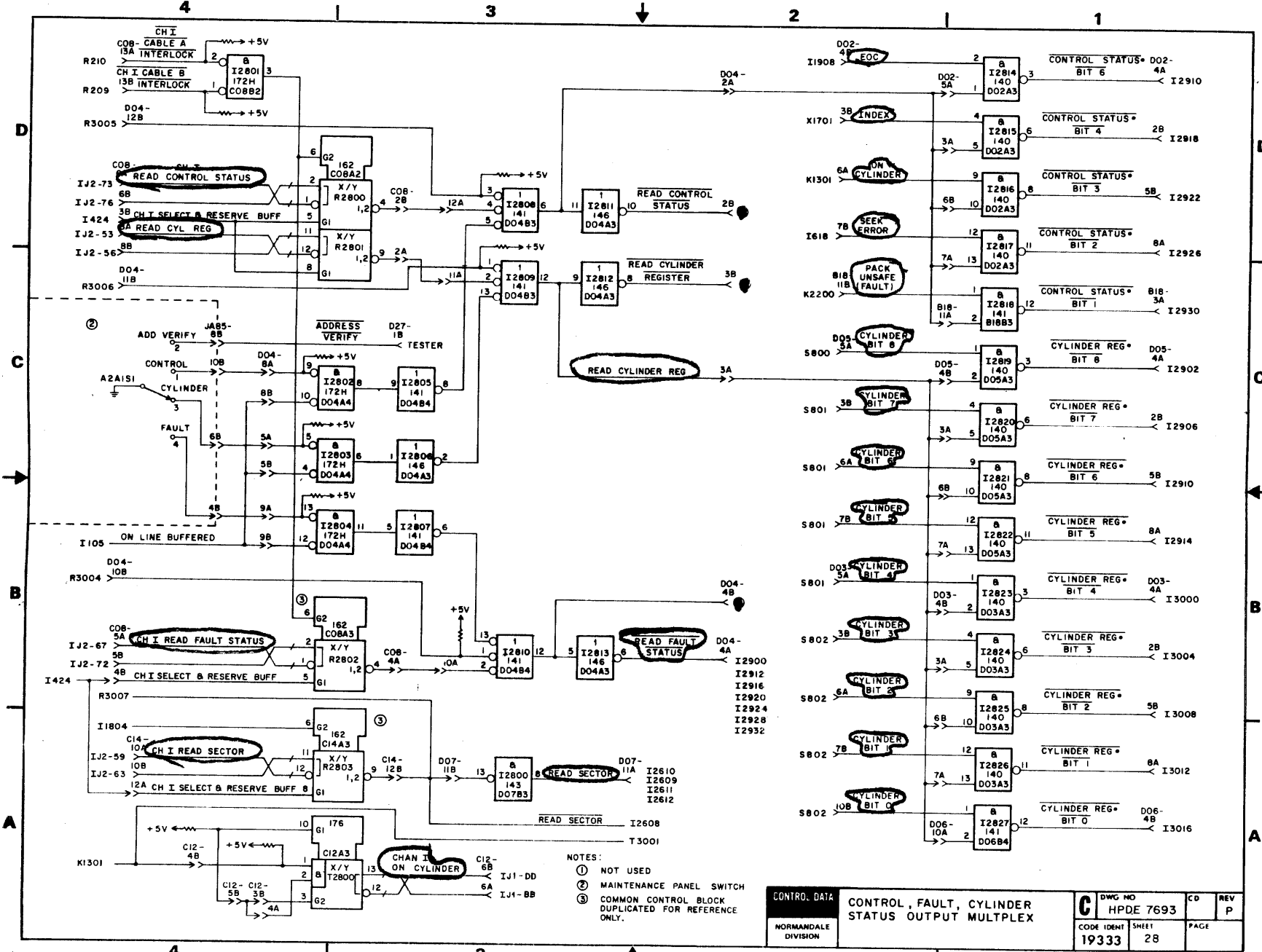
NOTES:

① DELAY LINE CONNECTED TO AN ADJACENT JUMPER BLOCK VIA CARD PATHS. DELAY SELECTED DURING MANUFACTURING BY JUMPERING PINS OF THE BLOCK. DELAYS CAN BE MEASURED AT JUMPER BLOCK PIN AS FOLLOWS:

DELAY	JUMPER BLK LOC/PIN	DELAY PERIOD, TYP	DELAY	JUMPER BLK LOC/PIN	DELAY PERIOD, TYP	DELAY	JUMPER BLK LOC/PIN	DELAY PERIOD, TYP
A	XA1-14	20 NS	G	XB3-14	10 NS	N	XB1-1	40 NS
B	XC1-14	12 NS	H	XE2-14	16 NS			
C	XC2-7	18 NS	J	XE2-7	16 NS			
D	XC2-1	10 NS	K	XE2-1	20 NS			
E	XC2-8	2 NS	L	XE2-8	16 NS			
F	XC2-14	2 NS	M	XB1-14	30 NS			

- ② ON LOGIC CHASSIS MAINTENANCE PANEL.
③ NOT USED.

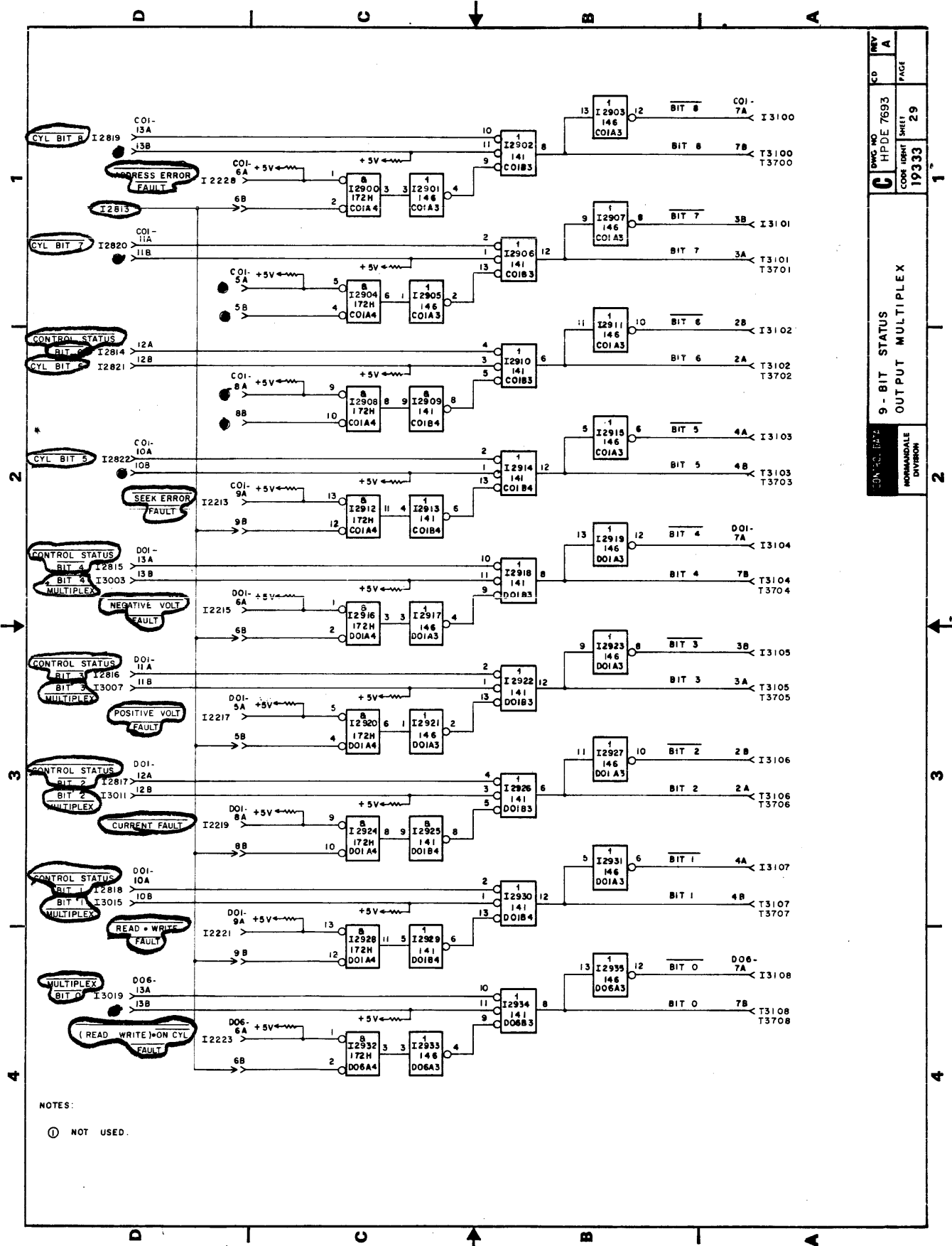
CONTROL DATA NORMANDALE DIVISION	DATA SEPARATOR		DWG NO HPDE 7693	CD	REV A
	CODE IDENT 19333	SHEET 27	PAGE		



- NOTES:
- ① NOT USED
 - ② MAINTENANCE PANEL SWITCH
 - ③ COMMON CONTROL BLOCK DUPLICATED FOR REFERENCE ONLY.

CONTROL DATA		CONTROL, FAULT, CYLINDER STATUS OUTPUT MULTIPLEX		DWG NO HPDE 7693		CD	REV
NORMANDALE DIVISION				CODE IDENT 19333	SHEET 28	PAGE	P

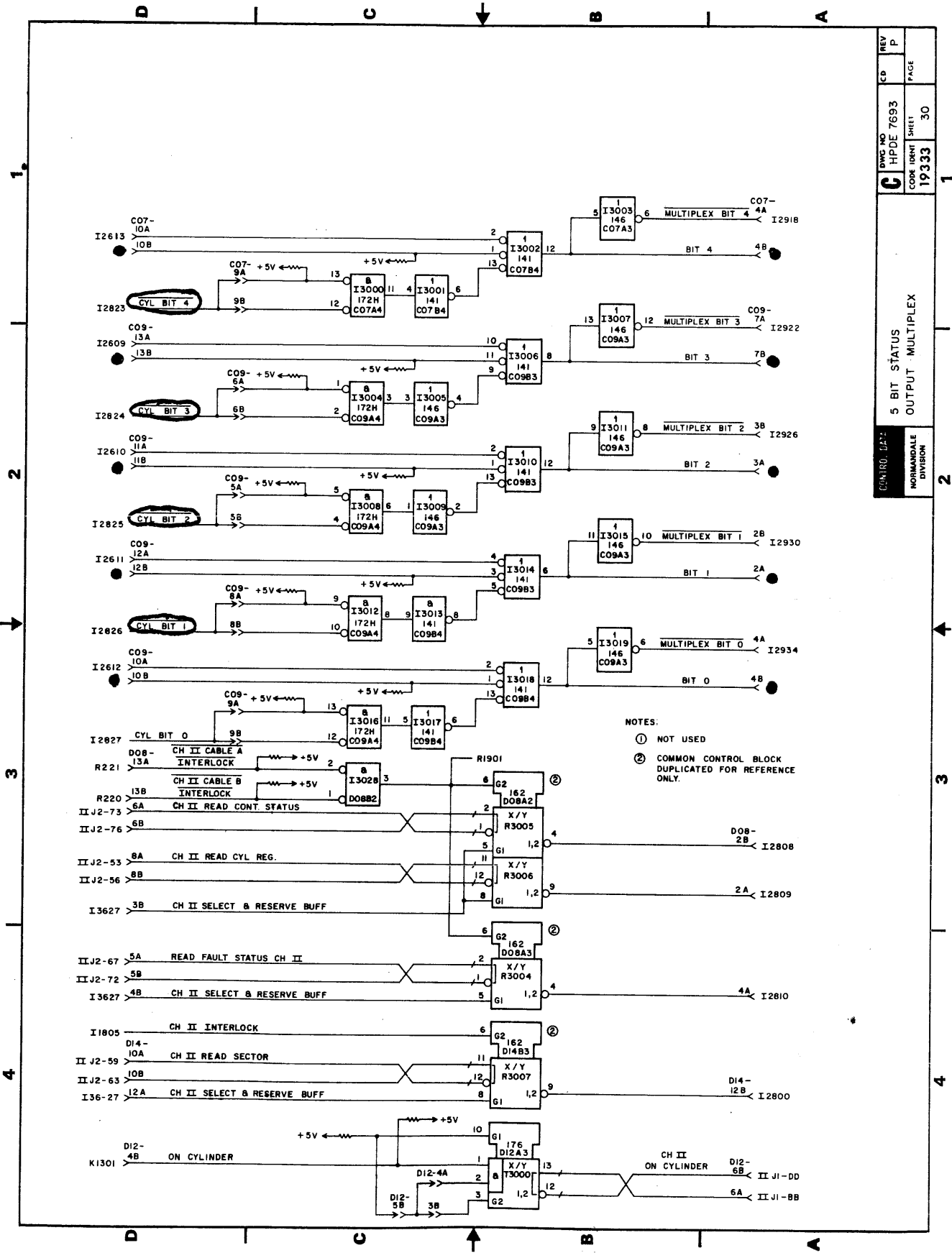
120 ~~mm~~ inch
28-35 mm inch



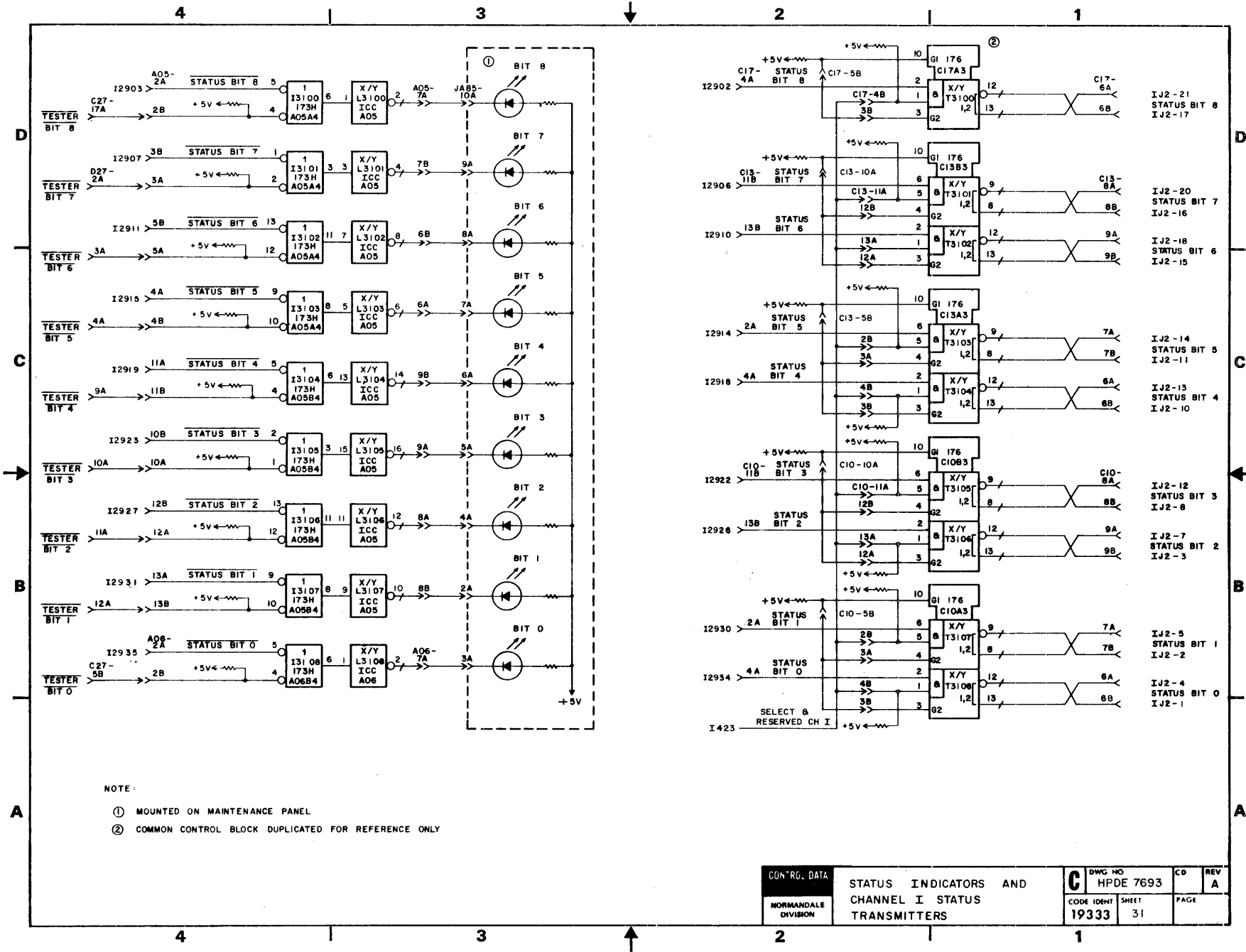
REV	A
CD	
HPDE	7693
FORM NO	
FORM IDENT	29
19333	
9 - BIT STATUS OUTPUT MULTIPLEX	
NORMANDEALE DIVISION	

NOTES:
① NOT USED.

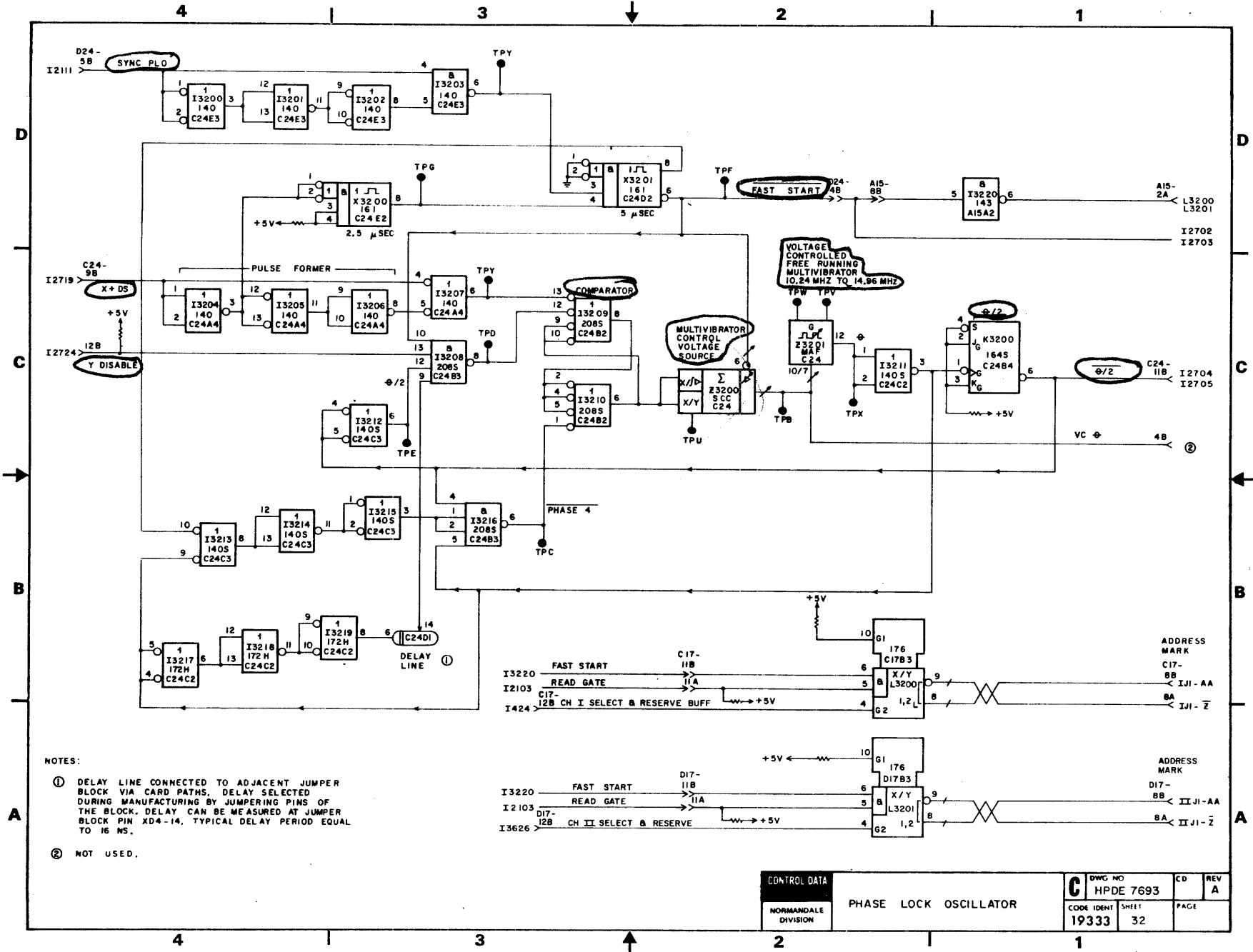
C	DWG NO	HPDE 7693	REV	P
	COOR	19333	SHEET	30
5 BIT STATUS OUTPUT MULTIPLEX				
CONTR. 02: NORMANDALE DIVISION				



NOTES:
 ① NOT USED
 ② COMMON CONTROL BLOCK DUPLICATED FOR REFERENCE ONLY.



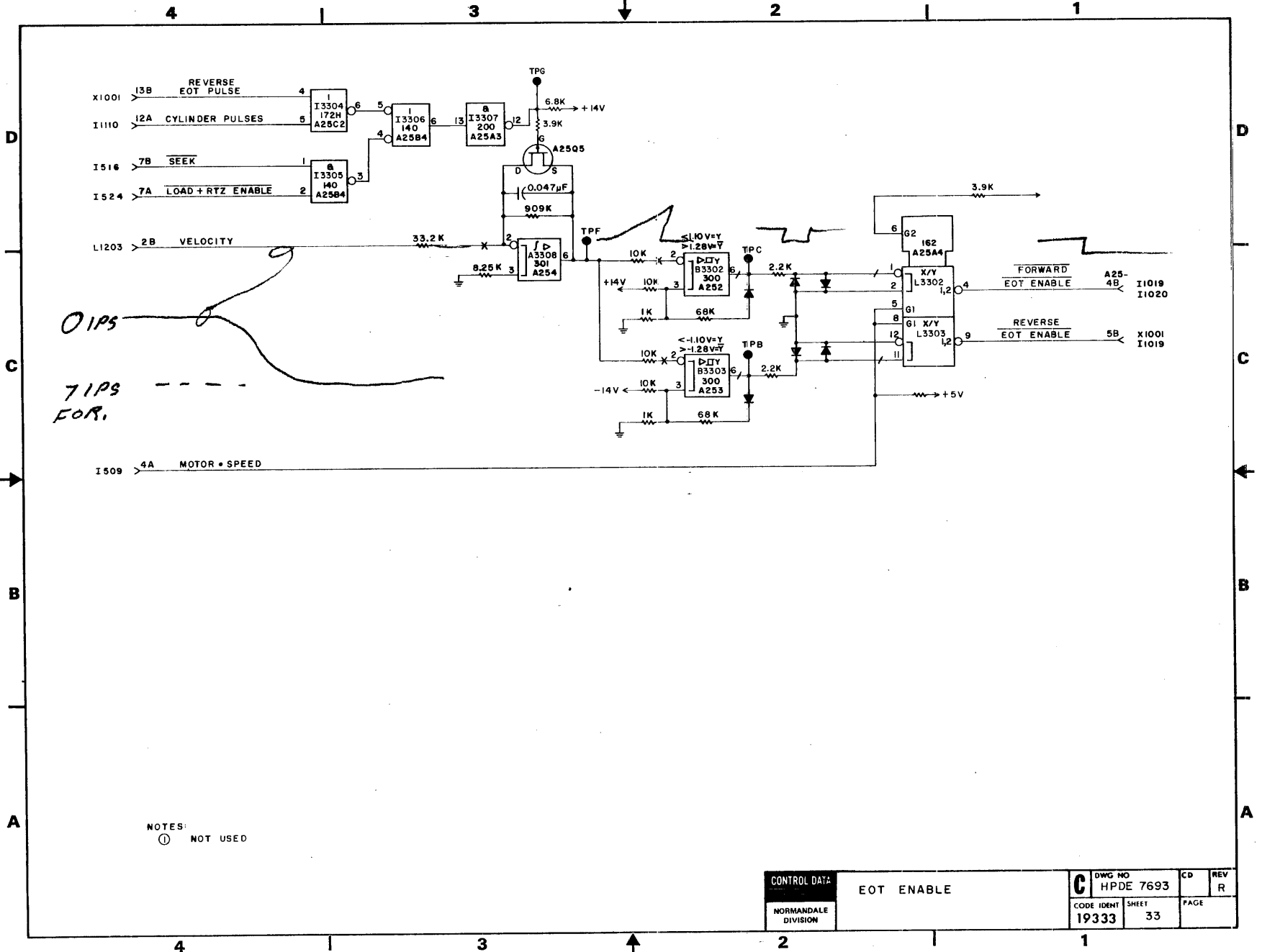
CON'RG. DATA	STATUS INDICATORS AND		CD	REV
	CHANNEL I STATUS			
NORMANDALE DIVISION	TRANSMITTERS		DWG NO	A
			HPDE 7693	
		CODE IDENT	SHEET	
		19333	31	



NOTES:

- ① DELAY LINE CONNECTED TO ADJACENT JUMPER BLOCK VIA CARD PATHS. DELAY SELECTED DURING MANUFACTURING BY JUMPING PINS OF THE BLOCK. DELAY CAN BE MEASURED AT JUMPER BLOCK PIN XD4-14. TYPICAL DELAY PERIOD EQUAL TO 16 NS.
- ② NOT USED.

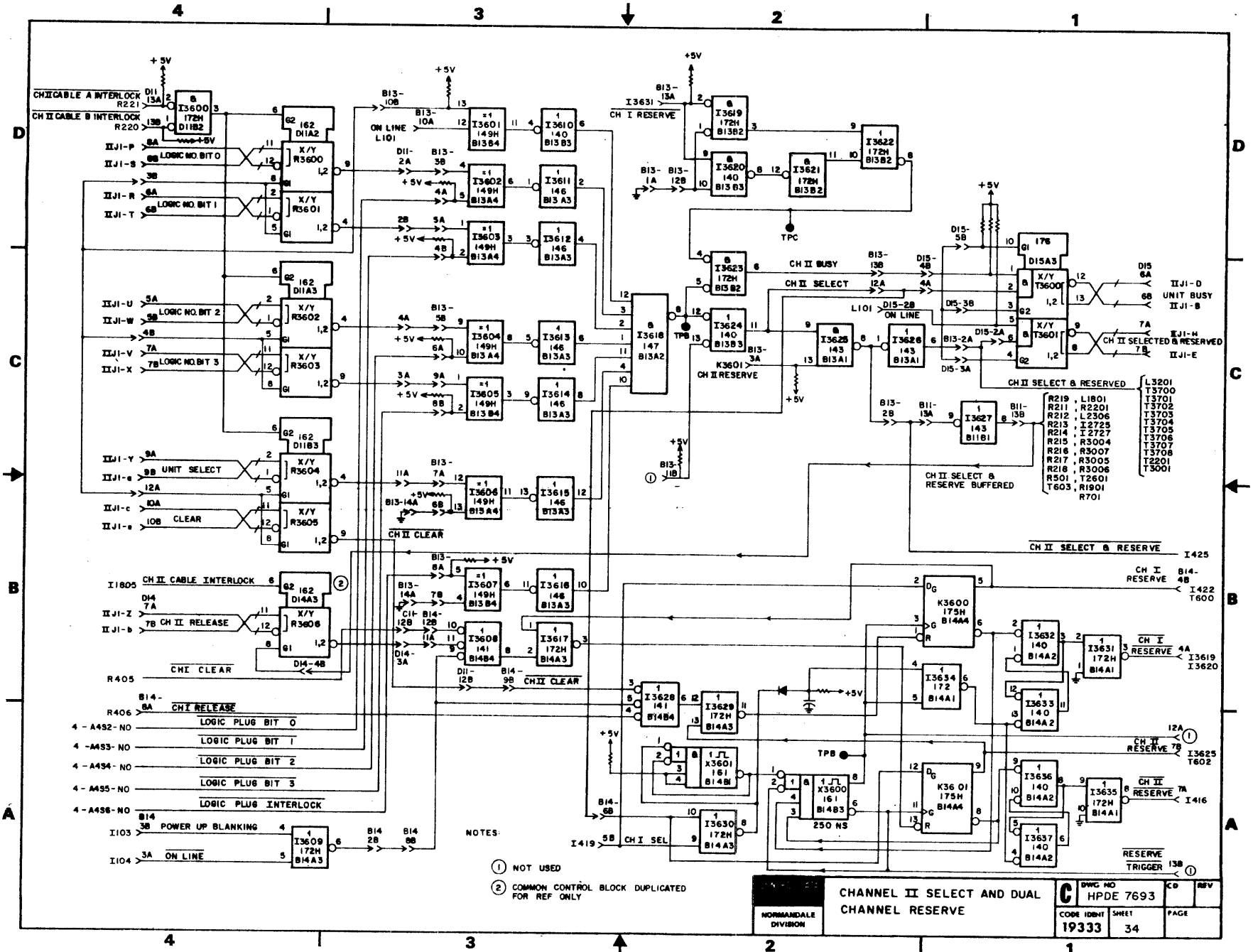
CONTROL DATA NORMANDE DIVISION	PHASE LOCK OSCILLATOR		C	DWG NO	CD	REV
				HPDE 7693		A
	CODE IDENT	SHEET	PAGE			
	19333	32				



0 IPS
 7 IPS
 FOR.

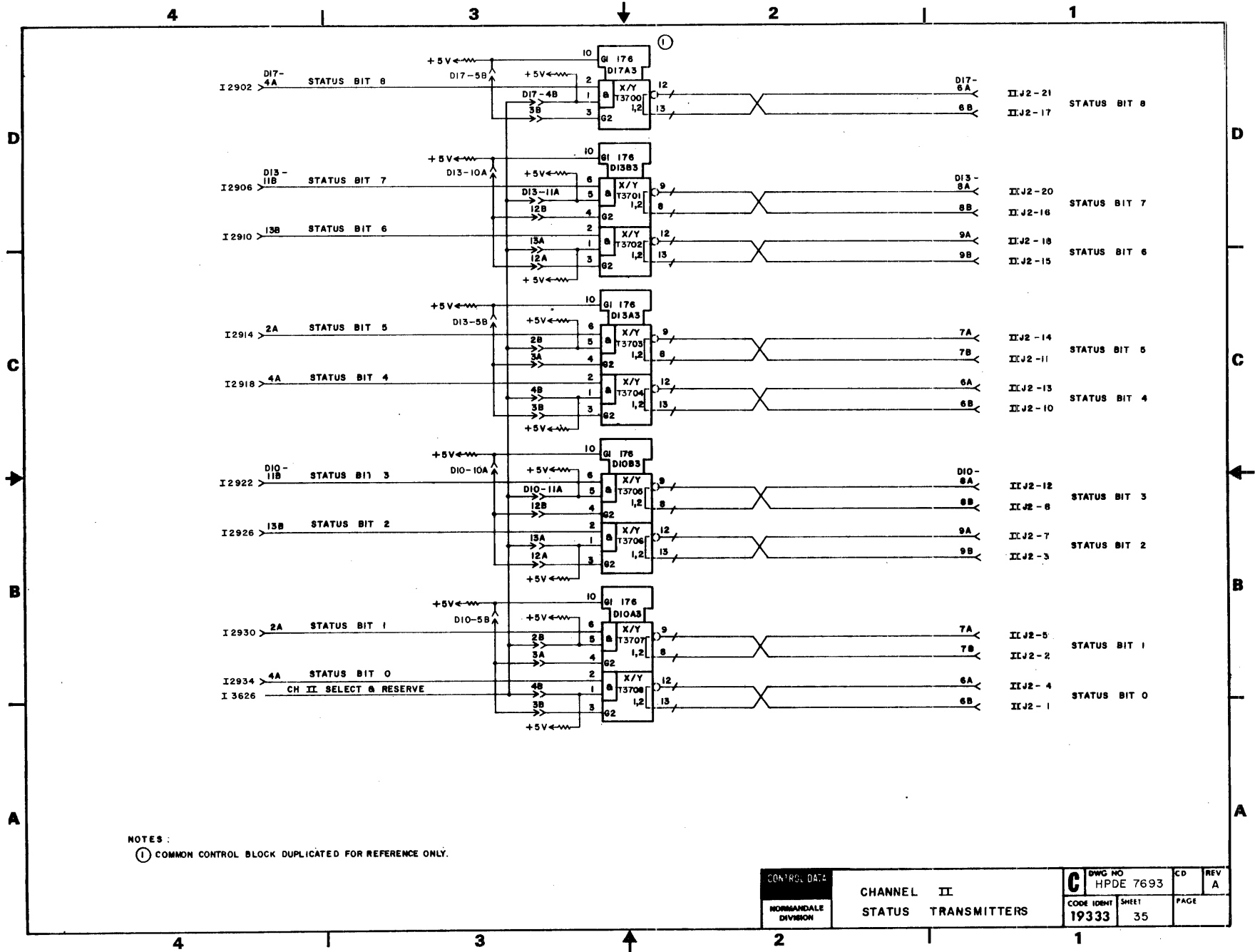
NOTES:
 ① NOT USED

CONTROL DATA:		EOT ENABLE		C		DWG NO HPDE 7693		CD	REV
NORMANDALE DIVISION				CODE IDENT 19333		SHEET 33		PAGE	



NOTES:
 ① NOT USED
 ② COMMON CONTROL BLOCK DUPLICATED FOR REF ONLY

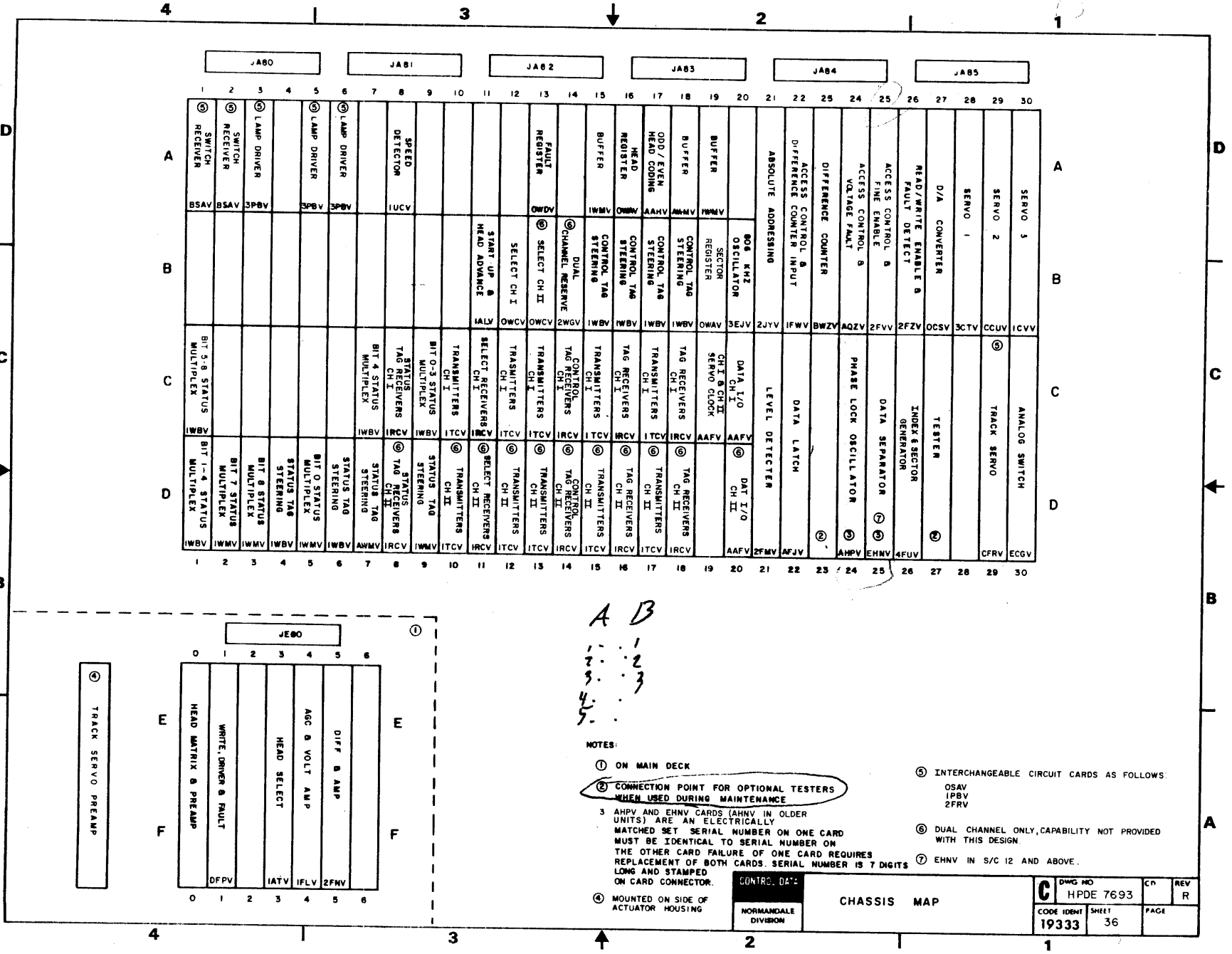
NORMAN DALE DIVISION	CHANNEL II SELECT AND DUAL CHANNEL RESERVE		C	DWG NO	HPDE 7693	CD	REV
	CODE IDENT	SHEET		34	PAGE		
	19333	34					



NOTES:
 ① COMMON CONTROL BLOCK DUPLICATED FOR REFERENCE ONLY.

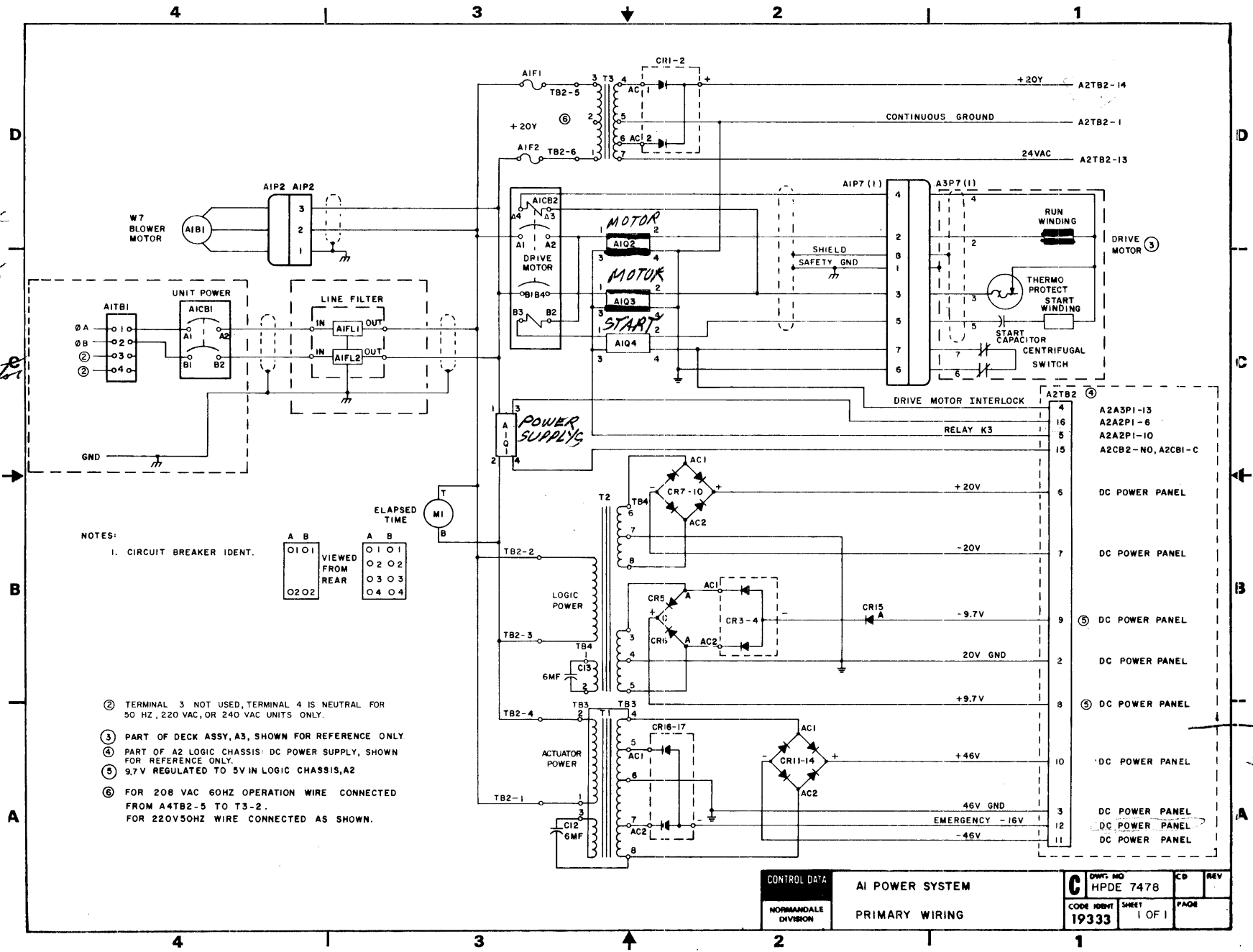
CONTR. DATA		C DWG NO HPDE 7693	CD	REV A
NORMANDEALE DIVISION			CODE IDENT 19333	SHEET 35

CHANNEL II
 STATUS TRANSMITTERS



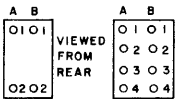
83306700 C

41 P/L
2 LOGIC
3 DECK
4 OPS
5 I/O Computer



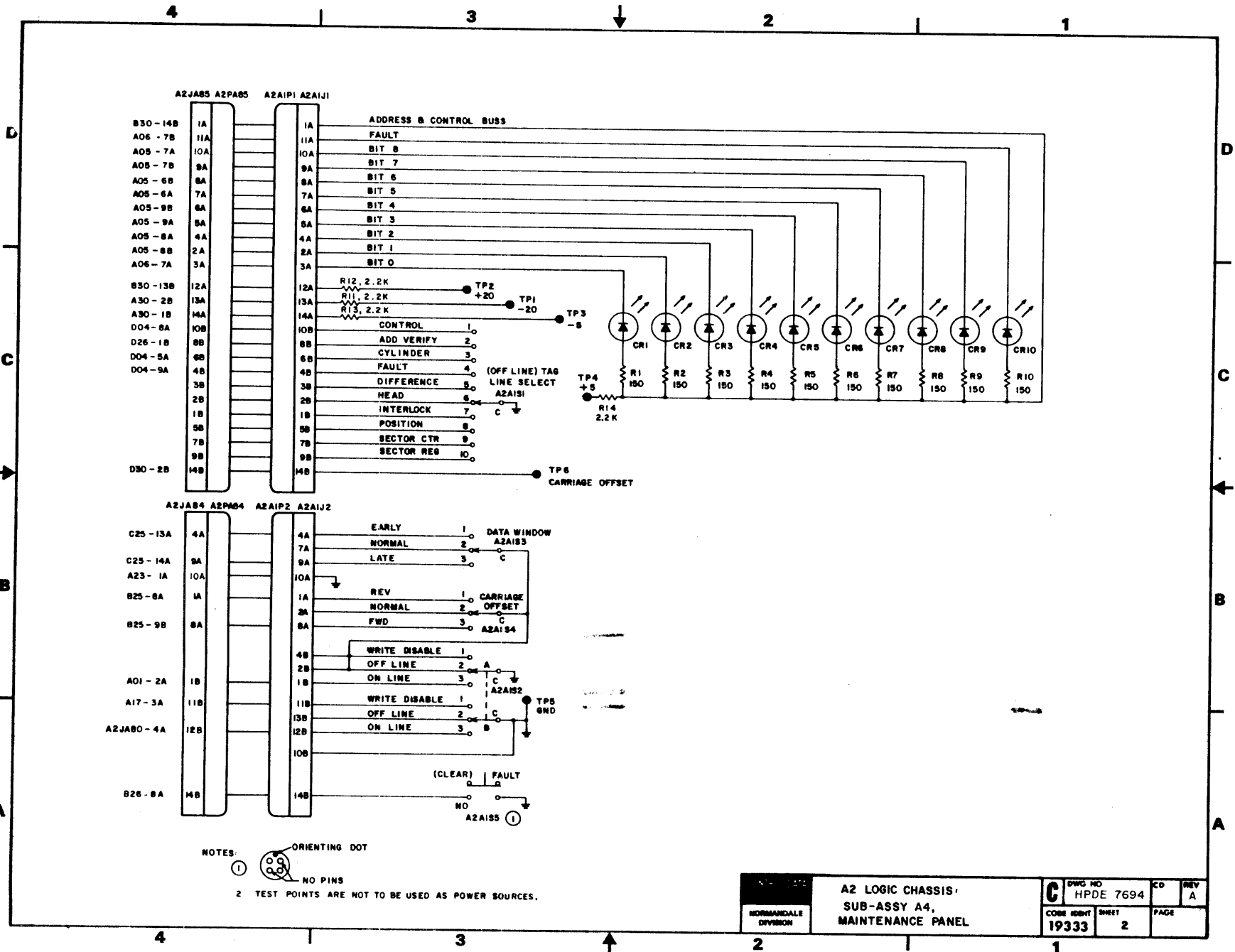
NOTES:

- 1. CIRCUIT BREAKER IDENT.
- 2. TERMINAL 3 NOT USED, TERMINAL 4 IS NEUTRAL FOR 50 HZ, 220 VAC, OR 240 VAC UNITS ONLY.
- 3. PART OF DECK ASSY, A3, SHOWN FOR REFERENCE ONLY
- 4. PART OF A2 LOGIC CHASSIS: DC POWER SUPPLY, SHOWN FOR REFERENCE ONLY.
- 5. 9.7V REGULATED TO 5V IN LOGIC CHASSIS, A2
- 6. FOR 208 VAC 60HZ OPERATION WIRE CONNECTED FROM A4TB2-5 TO T3-2. FOR 220V50HZ WIRE CONNECTED AS SHOWN.



CONTROL DATA		AI POWER SYSTEM		C DWG. NO. HPDE 7478		CD	REV
NORMANDEALE DIVISION		PRIMARY WIRING		19333		SHEET	PAGE
				1 OF 1			

SEE SHEET 6



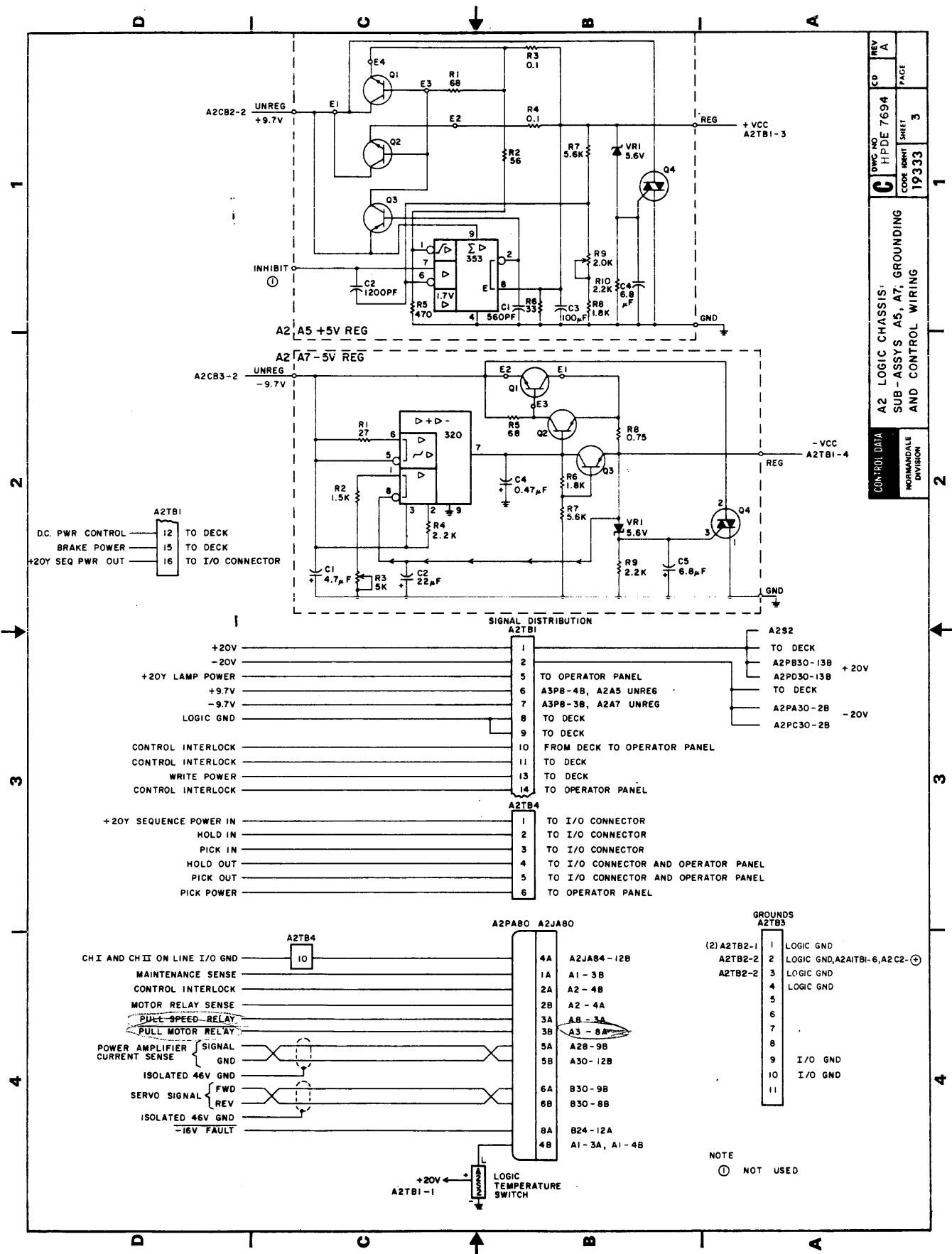
NOTES:

1 ORIENTING DOT

2 NO PINS

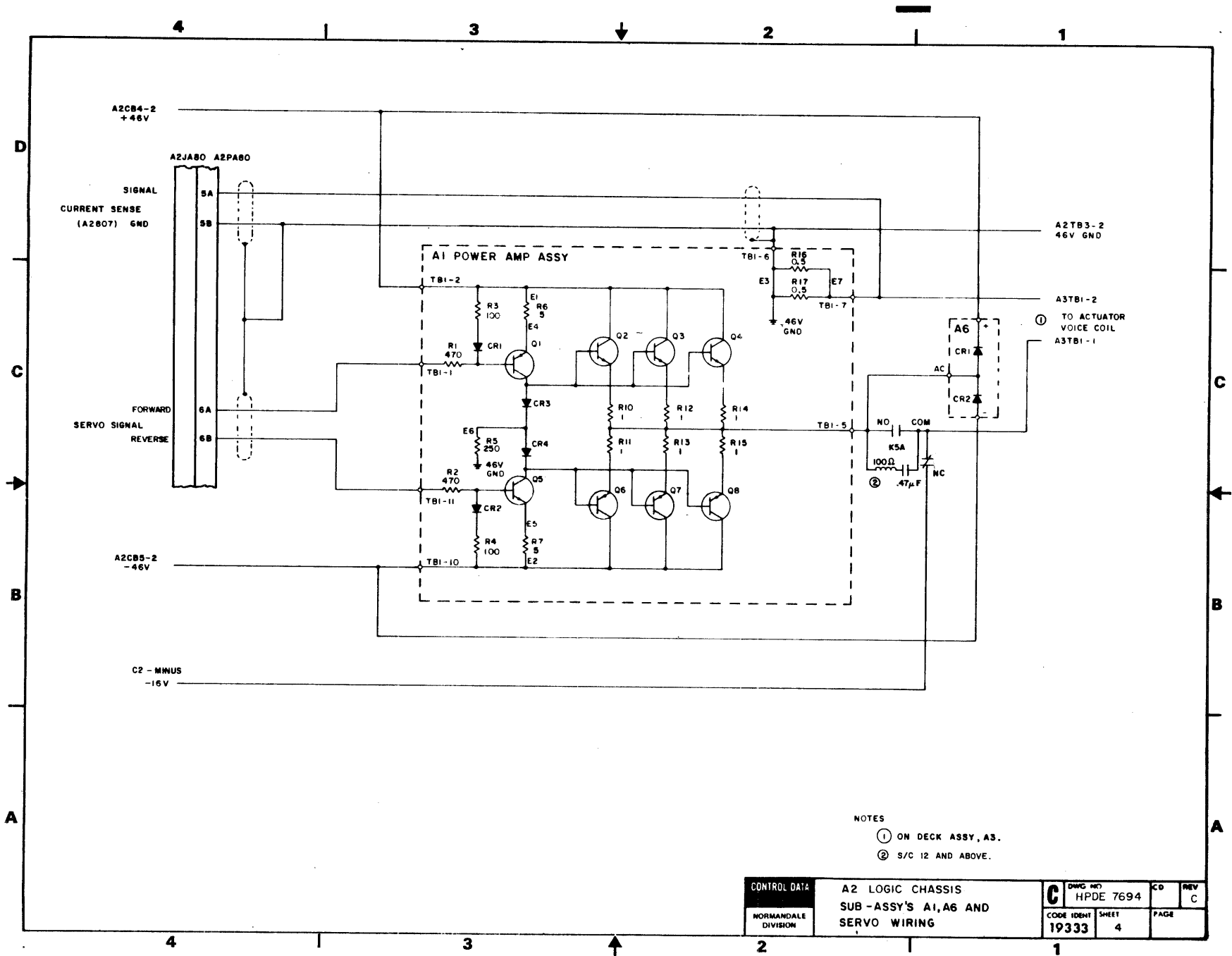
2 TEST POINTS ARE NOT TO BE USED AS POWER SOURCES.

NORMANDEALE DIVISION	A2 LOGIC CHASSIS SUB-ASSY A4, MAINTENANCE PANEL	DRWG NO HPDE 7694	CD A	REV A
		CODE IDENT 19333	SHEET 2	PAGE



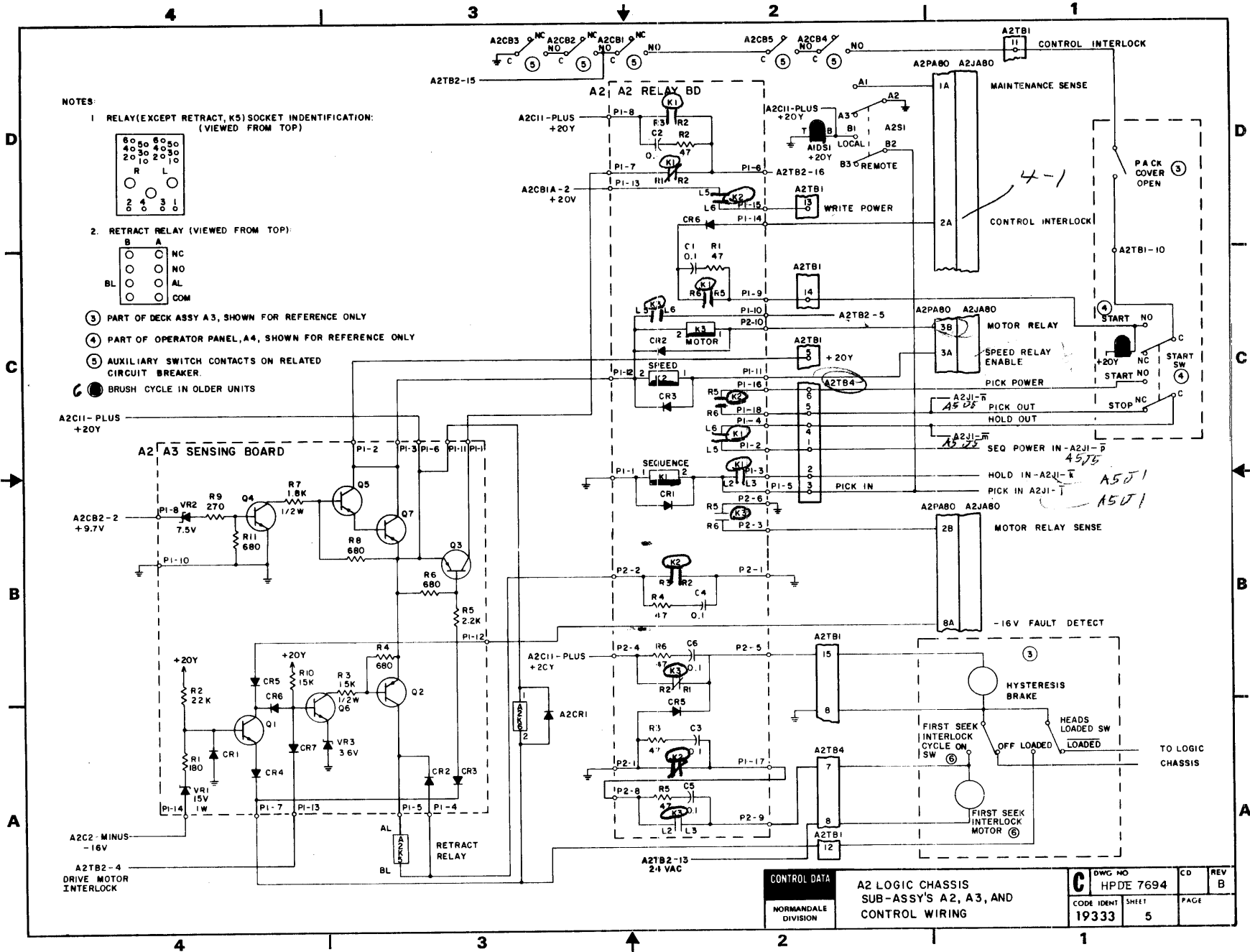
REV	A
CD	3
DWG. NO.	HIPDE 769A
COOR. IDENT.	19333
SHEET	3
PAGE	3

CONTROL DATA
 NORMANVILLE DIVISION



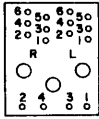
- NOTES
- ① ON DECK ASSY, A3.
 - ② S/C 12 AND ABOVE.

CONTROL DATA NORMANDEALE DIVISION	A2 LOGIC CHASSIS SUB-ASSY'S A1, A6 AND SERVO WIRING	① DWG. NO. HPDE 7694	CD	REV
	19333		4	C
		CODE IDENT	SHEET	PAGE
		19333	4	

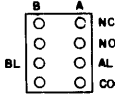


NOTES:

1 RELAY (EXCEPT RETRACT, K5) SOCKET IDENTIFICATION: (VIEWED FROM TOP)

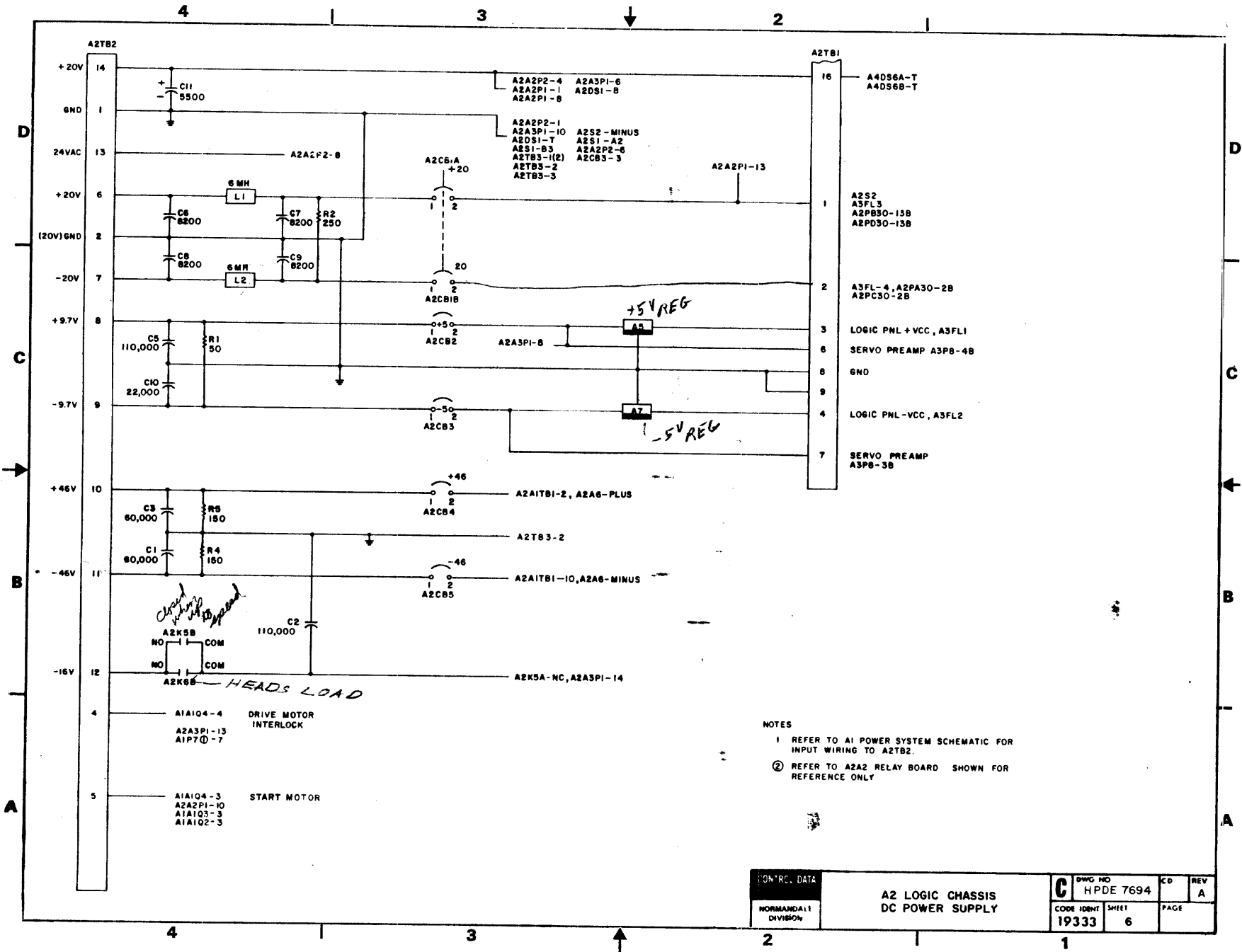


2. RETRACT RELAY (VIEWED FROM TOP):

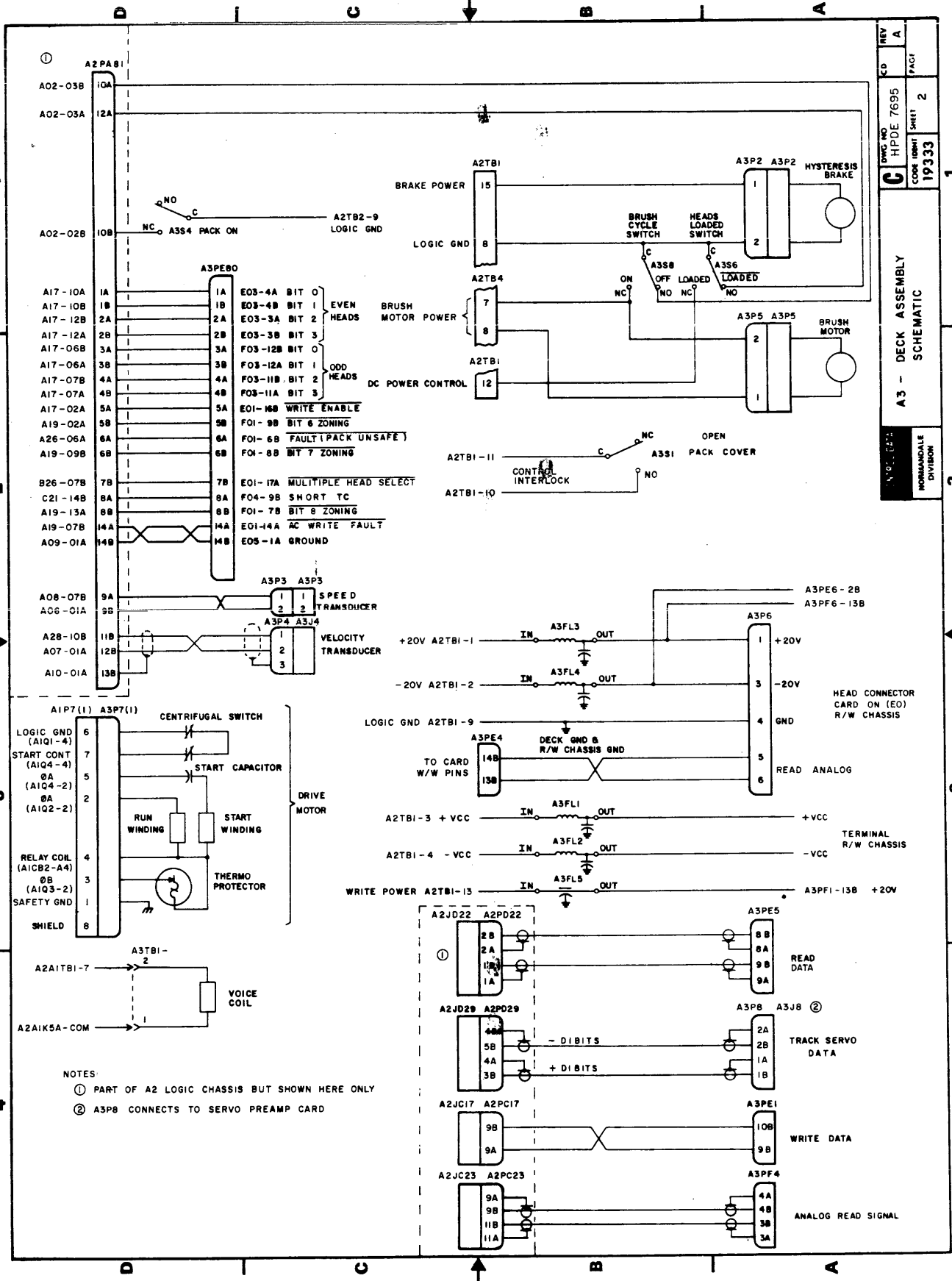


- ③ PART OF DECK ASSY A3, SHOWN FOR REFERENCE ONLY
- ④ PART OF OPERATOR PANEL, A4, SHOWN FOR REFERENCE ONLY
- ⑤ AUXILIARY SWITCH CONTACTS ON RELATED CIRCUIT BREAKER.
- ⑥ BRUSH CYCLE IN OLDER UNITS

CONTROL DATA NORMANDALE DIVISION	A2 LOGIC CHASSIS SUB-ASSY'S A2, A3, AND CONTROL WIRING		DWG NO HPDE 7694	CD	REV B
	C	19333	SHEET 5	PAGE	

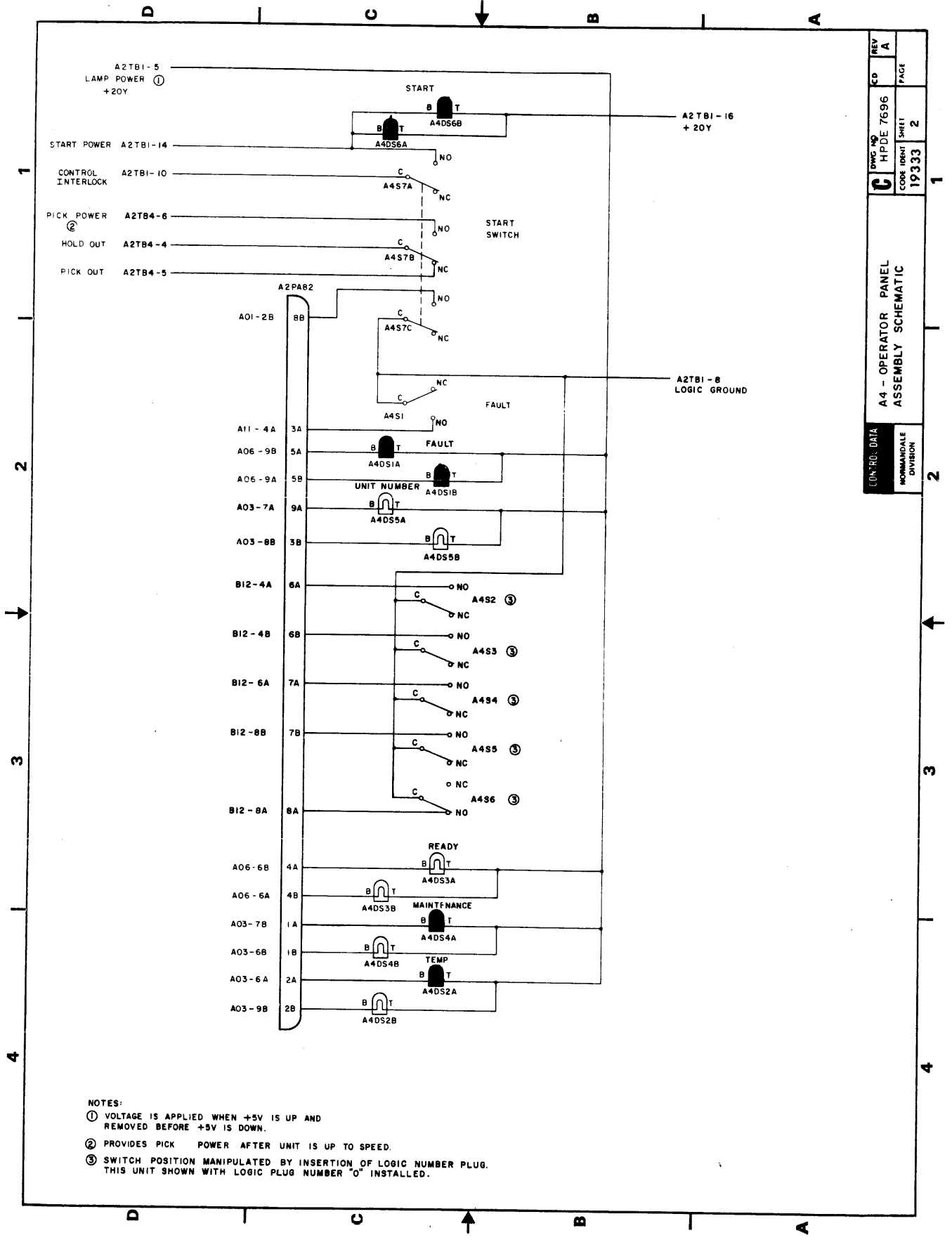


CONTR. DATA		A2 LOGIC CHASSIS DC POWER SUPPLY		C		DWG NO HPDE 7694		CD	REV
NORMANDAL1 DIVISION				CODE IDENT 19333		SHEET 6		PAGE	



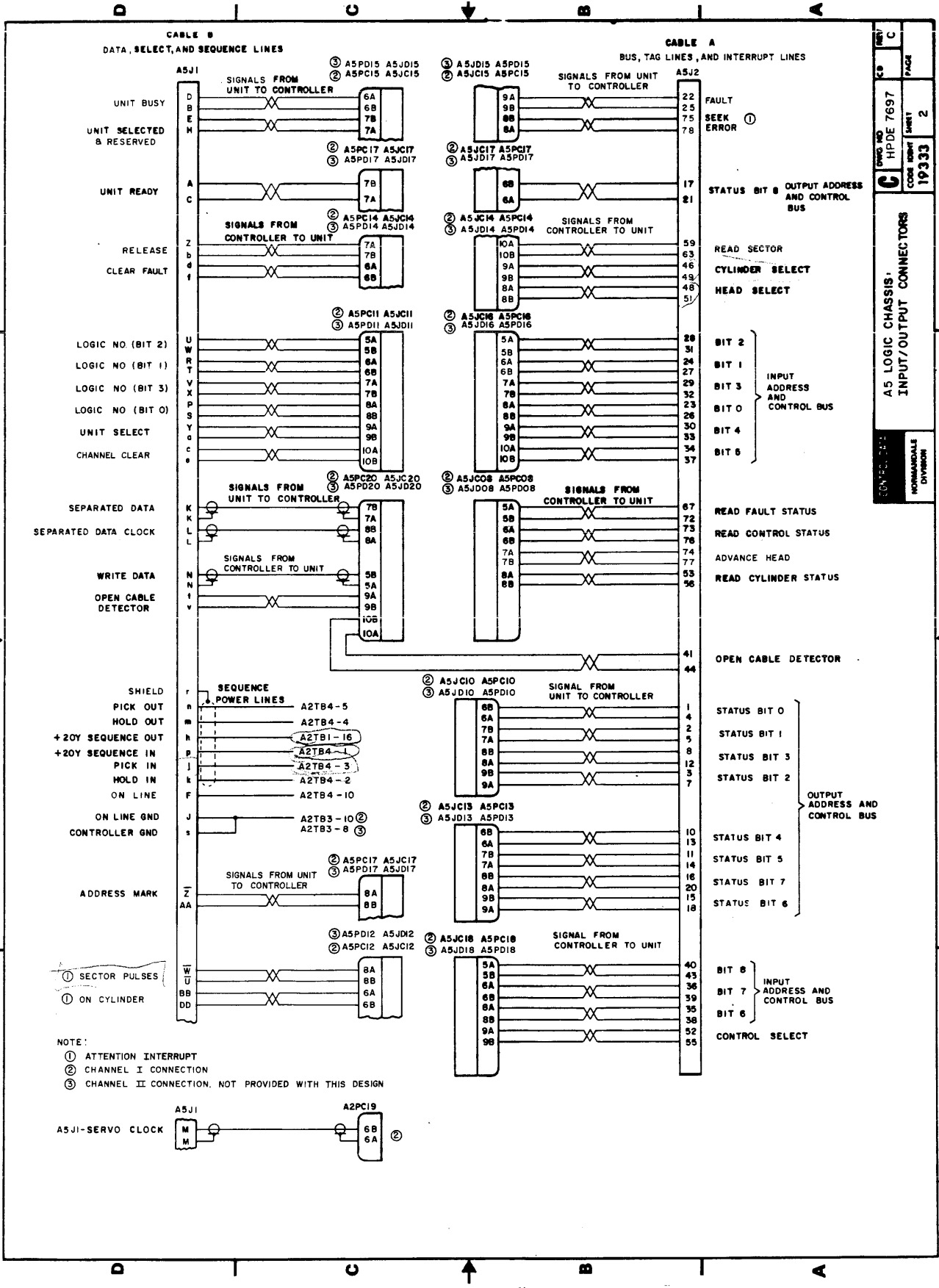
REV A
 CD
 DWG NO HPDE 7695
 CORE UNIT SHEET 2
 19333
 A3 - DECK ASSEMBLY SCHEMATIC
 MORANDALE DIVISION

- NOTES
 ① PART OF A2 LOGIC CHASSIS BUT SHOWN HERE ONLY
 ② A3P8 CONNECTS TO SERVO PREAMP CARD



REV	A
CD	A
DWG NO	HPDE 7696
LOOK UP	SHEET 2
19333	
A4 - OPERATOR PANEL ASSEMBLY SCHEMATIC	
CONTR. DATA	
NORMAN DALE DIVISION	

- NOTES:
- ① VOLTAGE IS APPLIED WHEN +5V IS UP AND REMOVED BEFORE +9V IS DOWN.
 - ② PROVIDES PICK POWER AFTER UNIT IS UP TO SPEED.
 - ③ SWITCH POSITION MANIPULATED BY INSERTION OF LOGIC NUMBER PLUG. THIS UNIT SHOWN WITH LOGIC PLUG NUMBER "0" INSTALLED.



SECTION 5

WIRE LISTS

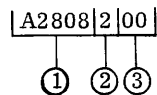
INTRODUCTION

Wire lists are divided into two basic categories; wire wrap wire lists and non-logic wire lists.

WIRE WRAP WIRE LISTS

Wire wrap wire lists provide wire origin/destination information for the logic back panel and the R/W pin and guide assembly.

Wires are referenced by logic term origin. Logic terms are arranged in alpha/numerical order under Signal Name. The signal name is decoded as follows:



- ① A2808; is the logic term of the inverter, multiplexer, op-amp, etc., found in the logic diagrams.
- ② 2; denotes the various outputs of the same logic term.
- ③ 00; indicates daisy chain order of wires that go to various destinations from a single logic term.

Signal names that begin with a numeral, are miscellaneous wires. These wires generally originate at some point other than a logic term (switch, bus, test point, etc.).

Z level denotes the vertical position of a wire on a pin relative to the wire wrap board. Two vertical positions are possible. A numeral 1 in this column indicates the wire is closest to the wire wrap board. A numeral 2 indicates the wire is farthest from the wire wrap board. Both ends of a wire are always at the same Z level.

NON-LOGIC WIRE LISTS

Non-Logic wire lists provide wire origin/destination information for harness assemblies and various panels.

The number identification is used to sequence the wire list and provide engineering reference for change order activity.

Wire color coding is as follows:

0 - Black	5 - Green
1 - Brown	6 - Blue
2 - Red	7 - Violet
3 - Orange	8 - Gray
4 - Yellow	9 - White

In multi-digit color codes, the first digit denotes base color and the remaining digits denote tracer colors.

14 Rows
Page 1-4

TITLE		WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP (Ref: 76027905)			HPDE 7022	Sheet 1 of 23	F
LINE NO.	SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL
1	A12040 00	A2806B	B2902B		1
2	A12060 A13000 00	B2802B B3016B	A2510A B2903B		1 1
3	A13020 00	B3008B	JA8006B		1
4	A13020 00	B3009B	JA8006A		1
5	A14100 00	C2909B	C3007B		1
6	A15040 00	B2906B	D3009B		1
7	A15050	B2907B	C3008B		1
8	A25000 00	D2107B	D2207B		1
9	A25000 00	D2108B	D2208B		1
10	A25040 00	C2113B	C2213B		1
11	A70000	A2109A	A2112A		1
12	A70000	A2111A	B2103B		1
13	A70000	A2112B	A2115A		1
14	A70000	A2114A	B2104B		2
15	A70000	A2114A	A2309B		1
16	C16050	A2106A	B2008B		1
17	I01030	B1110B	B1403B		1
18	I04180 I04190 00	B1213B B1212A	C1504B B1405B		1 1
19	I04190 01	B1405B	C1504A		2
20	I06230 I10010 00	A2105A A2313A	A2517A B2213A		1 1
21	I10030 00	A2316B	B2205A		1
22	I10050 00	A2314A	B2211B		1
23	I10070 00	A2315A	B2212A		1
24	I10090 00	A2315B	B2206A		1
25	I10110 00	B2210A	B2303B		1
26	I10130 00	B2210B	B2301A		1
27	I10150 00	B2208B	B2302A		1
28	I10170 00	B2208A	B2302B		1
29	I10200	B1809B	B2102A		2
30	I10200 01	B1110A	B1809A		2
31	I10200 02	B1809A	B1809B		1
32	I10210 I10260 00	B2101A A2217B	B2509A A2407A		1 2
33	I10260 01 I10340 00	A2407A A1808A	A2514A A1808B		1 1
34	I10340 01 I10340 02	A2214A A1808B	B2409A A2214A		1 2

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TITLE			WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP				HPDF 7022	2	
LINE NO.	SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	
1	I10400 00	A0112B	B1103A		1	
2	I10400 01	B1403A	B2511A		1	
3	I10400 02	C2011A	D2011A		1	
4	I10400 03	B1103A	B1403A		2	
5	I10400 04	B2511A	C2011A		2	
6	I10500	B1708B	B1808B		2	
7	I10500	B1806B	D0409B		2	
8	I10500	D0408B	D0409B		1	
9	I10500	D0405B	D0408B		2	
10	I10500 00	B1102B	B1508B		2	
11	I10500 00	B1709B	B1808B		1	
12	I10500 01	B1706B	B1709B		2	
13	I10500 01	B1508B	B1509B		1	
14	I10500 02	B1705B	B1706B		1	
15	I10500 03	B1609B	B1705B		2	
16	I10500 04	B1608B	B1609B		1	
17	I10500 05	B1605B	B1608B		2	
18	I10500 06	B1605B	B1606B		1	
19	I10500 07	B1506B	B1606B		2	
20	I10500 08	B1505B	B1506B		1	
21	I10500 09	B1505B	B1509B		2	
22	I10500 06	B1708B	D0405B		1	
23	I10600 00	A0111B	A0303A		1	
24	I10600 01	A0303A	A0305B		2	
25	I10700 00 I11100 00	A0912B A2303B	A0312B A2311B		2 1	
26	I11100 01	A2311A	A2311B		2	
27	I11100 02	A2311A	A2512A		1	
28	I11110 00	A2310B	A2510B		1	
29	I11110 01	A2510B	A2815B		2	
30	I11130 00	A0209A	A1807B		1	
31	I11200 00	A1803A	B1106A		1	
32	I11210 00	A2812B	B2304B		1	
33	I11230 00 I11230 01	B2304A A2814B	A2814B B2809B		2 1	
34	I11250 00	A2906B	B2305A		1	

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TITLE				WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP					HPDE 7022	3	D
LINE NO.	SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL		
1	I11269 99	A2204A	A2410A		1		
2	I11280 00	A2306A	A2412A		2		
3	I11280 01	A2209B	A2306A		1		
4	I11280 02	A2412A	B2511B		1		
5	I12500 00	A1804A	A1806A		1		
6	I12600 00	A1802B	A1806B		1		
7	I12700 00	A0312B	A1805B		1		
8	I12800 00	A0811A	A1807A		1		
9	I13040 00	A2817B	A2910B		2		
10	I13040 01	A2816B	A2817B		1		
11	I13040 02	A2910B	B2909A		1		
12	I13400 00	A1808A	B2409A		1		
13	I13400 01	A1808A	A2214A		2		
14	I13500 00	A1802A	B2503A		1		
15	I13500 01	B2503A	B2403		2		
16							
17	I14020	B2011B	C2910B		2		
18	I14020	C2910B	D2611A		1		
19	I14030 00	B2510B	D2913A		1		
20	I15050 00	B2512B	C3017B		1		
21	I15060 00	B2512A	D3001B		1		
22	I15140 00	A2516B	A2907B		1		
23	I17050	C2611B	C2613B		2		
24	I17050	C2613B	D0708B		1		
25							
26							
27	I18090 00 I18110 00	B1802A A1709B	C2609B B1802B		2 1		
28	I18130	A1603A	C2605A		1		
29	I19050 00	A1705A	D2704B		1		
30							
31	I19060 00	A1602A	B1111B		1		
32	I19070 00	A1602B	B1111A		1		
33	I19080	A1704B	D0204B		1		
34	I19100 00	A1712A	JA8102B		1		

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TITLE			WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP				HPDE 7022	4	
LINE NO.	SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	
1	I19120 00	A1712B	JA8102A		1	
2	I19140 I19160 00	A1710B A1710A	JA8101B JA8101A		1 1	
3	I19200 00	A1707A	JA8104B		1	
4	I19220 00	A1707B	JA8104A		1	
5	I19240 00	A1706A	JA8103B		1	
6	I19260 00	A1706B	JA8103A		1	
7	I19280 00	A1702A	JA8105A		1	
8	I19310 00 I19310 01	B1807B B1103B	B1103B B1102A		1 2	
9	I21000 00 I21010 00	B2607A A2614B	B2610B B2611B		1 1	
10	I21020 00	A2409B	A2608A		1	
11	I21020 01	A2409B	B1708A		2	
12	I21030 00	A2611B	C2105B		1	
13	I21030 01	C1711A	D1711A		1	
14	I21030 02	C2012A	D2012A		1	
15	I21030 03	C1711A	C2105B		2	
16	I21030 04	C2012A	D1711A		2	
17	I21050 00	A1702B	A2610B		1	
18	I21080 00	A2613B	A2616B		1	
19	I21090 I21100	A2614A B1806A	C2214B B2602B		1 1	
20	I21100	B1712A	B1806A		2	
21	I21110 I21130 00	B1702A A1303B	D2405B A2604B		1 1	
22	I21170 00	A1304A	A2612A		1	
23	I21210 00	A1309A	B2406B		1	
24	I21210 00	A2308A	B2406B		2	
25	I21210 01	A2308B	B2311B		2	
26	I21230 00	A1310A	B2410B		1	
27	I21250 00	A2605B	B2405B		1	
28	I21260	A1908A	A1910B		1	
29	I21270	A1910A	A2615A		1	
30	I22060 00	B1804A	B2608B		1	
31	I22090 00	A1305A	B2605B		1	
32	I22090 01	A1311A	A1312B		1	
33	I22090 02	A1308A	A1311A		2	
34	I22090 03	A1306A	A1308A		1	

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TITLE			WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP				HPDE 7022	5	F
LINE NO.	SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	
1	I22090 04	A1305A	A1306A		2	
2	I22090 05	A1302B	A1312B		2	
3	I22090 06	A1302B	A1903A		1	
4	I22110 00	A2617B	B2609A		1	
5	I22130	A1312A	C0109A		1	
6	I22150	A1310B	D0106A		1	
7	I22170	A1308B	D0105A		1	
8	I22190	A1306B	D0108A		1	
9	I22210	A1302A	D0109A		1	
10	I22230	A1305B	D0606A		1	
11	I22240 I22250 00	B2601A A1307A	B2604B B2603B		1 1	
12	I22270 I22280	A1904A A1902B	A1903B C0106A		1 2	
13	I22280 00	A1902B	A1904B		1	
14	I23110 00	C1713B	C2004A		1	
15	I25160 00	C2209B	C2504B		1	
16	I25230 00	C2114B	JA8108A		1	
17	I26000	B1903A	B1914A		1	
18	I26000 I26010 00	C1212B B1902B	C1210A D0702A		2 1	
19	I26030	B1907A	B1914A		2	
20	I26050	D0702B	D1211B		2	
21	I26050	C1211B	D0702B		1	
22	I26080	D0710B	D0710B		1	
23	I26090	C0913A	D0908A		1	
24	I26100	C0911A	D0905B		1	
25	I26110	C0912A	D0902B		1	
26	I26120	C0910A	D0904A		1	
27	I26130	C0710A	D0710A		1	
28	I26140	D0705A	D0712A		1	
29	I26200 00	A1502A	C1711B		1	
30	I27170 00	D2410B	D2510B		1	
31	I27180 00	D2409B	D2509B		1	
32	I27190 00	C2409B	C2509B		1	
33	I27240 00	C2412B	C2512B		1	
34	I28000 I28000 01	C1205B D0906B	C1204A D0907A		2 2	

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TITLE			WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP				HPDE 7022	6	F
LINE NO.	SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	
1	I28000 02	D0903A	D0906B		1	
2	I28000 03	D0903A	D0904B		2	
3	I28000 04 I28080 01	D0711A D0205A	D0907A D0402A		1 1	
4	I28080 02	D0203A	D0205A		2	
5	I28080 03	D0203A	D0206B		1	
6	I28080 04	D0206B	D0207A		2	
7	I28080 05	B1811A	D0207A		1	
8	I28090	D0506B	D0507A		2	
9	I28090	D0503A	D0506B		1	
10	I28090 01	D0503A	D0504B		2	
11	I28090 04	D0304B	D0507A		1	
12	I28090 05	D0303A	D0304B		2	
13	I28090 06	D0303A	D0306B		1	
14	I28090 07	D0306B	D0307A		2	
15	I28090 08	D0307A	D0610A		1	
16	I28090 09 I28130 01	D0403A C0106B	D0610A D0404A		2 1	
17	I28130 02	C0106B	C0109B		2	
18	I28130 03	C0109B	D0106B		1	
19	I28130 04	D0105B	D0106B		2	
20	I28130 05	D0108B	D0109B		2	
21	I28130 05	D0105B	D0108B		1	
22	I28130 06	D0109B	D0606B		1	
23	I28140 00	C0112A	D0204A		1	
24	I28150 00	D0113A	D0202B		1	
25	I28160 00	D0111A	D0205B		1	
26	I28170 00	D0112A	D0208A		1	
27	I28190 00	C0113A	D0504A		1	
28	I28200 00	C0111A	D0502B		1	
29	I28210 00	C0112B	D0505B		1	
30	I28220 I28230 00	D0508A C0709A	C0110A C0709B		1 1	
31	I28230 01	C0709A	D0304A		2	
32	I28240 00	C0906A	D0302B		1	
33	I28240	C0906A	C0906B		2	
34	I28250 00	C0905A	D0305B		1	

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TITLE LOGIC WIRE WRAP			WL	DOCUMENT NO. HPDE 7022	SHEET NO. 7	REV. F
LINE NO.	SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	
1						
2	I28250 01	C0905A	C0905B		2	
3	I28260 00	C0908A	D0308A		1	
4	I28260	C0908A	C0908B		2	
5	I28270 00	C0909A	D0604B		1	
6						
7	I28270 01	C0909A	C0909B		2	
8	I29020	C0107B	D1704A		2	
9	I29020 I29030 00	D1704A A0502A	C1704A C0107A		1 1	
10	I29060	C0103A	D1311B		2	
11	I29060 00	C0103A	C1311B		1	
12	I29070 00	A0503B	C0103B		1	
13	I29100	C0102A	D1313B		2	
14	I29100 00	C0102A	C1313B		1	
15	I29110 00	A0505B	C0102B		1	
16	I29140 I29140 00	D1302A C0104B	C1302A C1302A		2 1	
17	I29150 00	A0504A	C0104A		1	
18	I29180 I29180 00	C1304A C1304A	D1304A D0107B		2 1	
19	I29190 I29220	D0107A D0103A	A0511A D1011B		1 2	
20	I29220 00	C1011B	D0103A		1	
21	I29230 00	A0510B	D0103B		1	
22	I29260	D0102A	D1013B		2	
23	I29260 00	C1013B	D0102A		1	
24	I29270 00	A0512B	D0102B		1	
25	I29300	D0104B	D1002A		2	
26	I29300 00	C1002A	D0104B		1	
27	I29310 I29340	D0104A D0607B	A0513A D1004A		1 2	
28	I29340 00	C1004A	D0607B		1	
29	I29350 00	A0602A	D0607A		1	
30	I30030	C0704A	D0113B		2	
31	I30070	C0907A	D0111B		1	
32	I30110	C0903B	D0112B		1	
33	I30150	C0902B	D0110B		1	
34	I30190	C0904A	D0613A		1	

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TITLE			WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP				HPDE 7022	8	C
LINE NO.	SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	
1	I30200	A2117B	B1707B		1	
2	I30300 00	B1707A	C2514A		1	
3	I30600	B1604B	B2107A		1	
4	I30700 00	B1604A	C2513A		1	
5	I31000	B1602A	B2105A		2	
6	I31000	A2116A	B2105A		1	
7	I31400	B1603A	B2108B		2	
8						
9	I31400	B2108B	A1507B		1	
10	I31500	B1603B	C2605B		1	
11	I31800	B1607B	B2106B		2	
12	I31800 01	A1608A	A2616A		2	
13	I31800 02	A2616A	B1607B		1	
14	I32200	B2112A	B2601B		2	
15	I32200	B1504B	B2112A		1	
16	I32200	C1711B	D1711B		2	
17	I32200 00	A1606B	B1504B		2	
18	I32600	B1502A	B2110A		1	
19	I32600 01	A1604B	B1502A		2	
20	I33000	A2608B	B2113B		2	
21	I33000	B1503A	B2113B		1	
22	I33000 03	A1606A	B1503A		2	
23	I33400	A2609B	B2111B		2	
24	I33400	B1507B	B2111B		1	
25	I33400 03	A1604A	B1507B		2	
26						
27						
28	I36060 00GND I36060 01GND	B1306B B1306B	B1314A B1307B		2 1	
29	I36080 01	A0912A	A0907A		2	
30	I36090	B1402B	B1408B		1	
31	I3623 I3624 00 I3624 01	B1313B B1312A B1406B	D1504B D1504A D1504A		1 1 2	
32	I36250 00	B1302B	B1108B		1	
33	I36250 01 I36260 00	B1108B B1302A	B1113A D1502A		2 1	
34	I36260 01 I36260 02	D1503A D1311A	D1712B D1704B		1 1	

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TITLE LOGIC WIRE WRAP			WL	DOCUMENT NO. HPDE 7022	SHEET NO. 9	REV. F
LINE NO.	SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	
1	I36260 03	D1304B	D1313A		1	
2	I36260 04	D1011A	D1304B		2	
3	I36260 05	D1004B	D1013A		1	
4	I36260 06	D1002B	D1302B		1	
5	I36260 07	D1502A	D1503A		2	
6	I36260 08	D1704B	D1712B		2	
7	I36260 09	D1311A	D1313A		2	
8	I36260 10	D1013A	B1302A		2	
9						
10	I36260 12	D1002B	D1004B		2	
11	I36270 00	B1113B	D0804B		1	
12	I36270 01	D0803B	D1211A		1	
13	I36270 02	D1403B	D1412A		1	
14	I36270 03	D1603B	D1612A		1	
15	I36270 04	D1404B	D1604B		1	
16	I36270 05	D1702B	D1803B		1	
17	I36270 06	D1804B	D1812A		1	
18	I36270 07	D0803B	D0804B		2	
19	I36270 08	D1211A	D1403B		2	
20	I36270 09	D1412A	D1603B		2	
21	I36270 10	D1604B	D1612A		2	
22	I36270 11	D1404B	D1702B		2	
23	I36270 12	D1803B	D1812A		2	
24	I36270 13	D1804B	D2003A		2	
25	I36310	B1313A	B1404A		1	
26	I36350	B1213A	B1407A		1	
27	I42200 00	B1109A	B1202B		2	
28	I42200 01	B1109A	B1112A		1	
29	I42300	B1202A	C1513A		2	
30	I42300 00	B1202A	C1002B		1	
31	I42300 01	C1002B	C1004B		2	
32	I42300 02	C1004B	C1011A		1	
33	I42300 03	C1011A	C1013A		2	
34	I42300 04	C1013A	C1313A		1	

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TITLE				WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP					HPDE 70 22	10	F
LINE NO.	SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL		
1	I42300 05	C1311A	C1313A		2		
2	I42300 06	C1304B	C1311A		1		
3	I42300 07	C1302B	C1304B		2		
4	I42300 08	C1302B	C1502A		1		
5	I42300 09	C1502A	C1704B		2		
6	I42400 00	B1112B	C0804B		1		
7	I42400 01	C0803B	C1211A		1		
8	I42400 02	C1211A	C1404B		2		
9	I42400 03	C1404B	C1412A		1		
10	I42400 04	C1603B	C1604B		1		
11	I42400 05	C1612A	C1712B		1		
12	I42400 06	C1702B	C1804B		1		
13	I42400 07	C1803B	C1812A		1		
14	I42400 08	C0803B	C0804B		2		
15							
16	I42400 10	C1403B	B1112B		2		
17	I42400 11	C1412A	C1604B		2		
18	I42400 12	C1603B	C1612A		2		
19	I42400 13	C1702B	C1712B		2		
20	I42400 14	C1803B	C1804B		2		
21	I42400 15	C1812A	C2003A		2		
22	I42600 00	A0313A	B1108A		1		
23	I42600 01	A0302A	B1108A		2		
24	I50200	A2116B	D0605A		2		
25	I50200	A2116B	B2602A		1		
26	I50200 00	A2607A	B1703A		1		
27	I50200 01	A2607A	A2609A		2		
28	I50200 02	A2609A	A2615B		1		
29	I50200 03	A2615B	B2602A		2		
30	I50600	A0210A	A2202A		2		
31	I50600	B2004A	A0210A		1		
	I50600 00	A1803B	A2813B		1		
32	I50600 02	A2202A	A2405B		1		
33	I50600 03	A2405B	A2813B		2		
34	I50600 05	A1907A	B2004A		2		

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TITLE			WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP				HPDE 7022	11	C
LINE NO.	SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	
1	I50600 06	A1907A	B2610A		1	
2	I50800 00	A0208A	A1805A		1	
3	I50900 00	A2504A	B2401A		1	
4						
5	I51100 01 I51200 01	A2205A A2206A	B2501A A2511B		1 1	
6	I51600 00	A2208A	A2306B		1	
7	I51600 01	A2306B	A2507B		2	
8	I52000 00	A2211A	A2914B		1	
9	I52200 00	A2202B	A2913B		1	
10	I52400	A2210B	B2104A		1	
11	I52400 01	A2307A	A2507A		1	
12	I52400 02	A2507A	B2507B		2	
13	I52400 03	A2905B	B2507B		1	
14	I52400 05 I53100 00	A2307A A2205B	A2210B A2413B		2 1	
15	I53200 00	A2207B	B2808B		1	
16	I53300 00	A2208B	B2806B		1	
17	I53500 00	A2212A	A2416A		1	
18						
19	I53800 00	A2204B	B2505B		1	
20	I60100 00 I60200 00	A2213B A2210A	A2410B B2502A		1 1	
21	I60300 00	B2411B	B2503B		1	
22	I60500 00	A2415B	B2506B		1	
23	I60500 01	A2407B	A2415B		2	
24	I60500 02 I61400 00	A2406B A2409A	B2506B B2201B		2 1	
25	I61700 00	A2408B	A2606B		2	
26	I61700 01	A2606B	C2712B		1	
27	I61700 03	B2004B	C2712B		2	
28	I61700 04 I61800 00	A1313B A2508A	B2004B D0207B		1 1	
29	I61800 01 I62100	A2508A A2512B	B2404B D1702A		2 2	
30	I62100	C1702A	D0611B		1	
31	I62100 02	A2412B	C1702A		2	
32	I62200 00	A0605B	B2405A		2	
33	I62200 01	A0604A	A0605B		1	
34	I62200 02	B2405A	B2506A		1	

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TITLE			WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP				HPDF 7022	12	C
LINE NO.	SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	
1	I62300	A2105B	B2101B		1	
2	I62600 00 I62500	L1511B A2508B	D1511B A1809A		1 1	
3	I62600 02 I70200	A1809B B2102B	C1511B B2103A		2 2	
4	I70200	B1704B	B2103A		1	
5	I71000	A1506A	D0603B		1	
6	I71000 01 I71100	A1507A A1505B	A1506A A2515A		2 1	
7	I71200	A1508A	A2515B		1	
8	I80300 00	A1913A	JA8108B		1	
9	I80400 00	A1909B	JA8106B		1	
10	I80500 00	A1902A	JA8105B		1	
11	I91600 00	A2104B	B2205B		1	
12	I91700 00	A2103A	B2204A		1	
13	I91800 00	A2102A	B2211A		1	
14	I91900 00	B2109B	B2212B		1	
15	I92000	B2109A	B2206B		1	
16	I92100 00	A2104A	B2209B		1	
17	I92200 00	A2108A	B2209A		1	
18	I92300 00	A2110A	B2207A		1	
19	I92400 00	A2103B	B2207B		1	
20	I92500 00	A2110B	A2511A		1	
21	I92600 00	A2109B	B2501B		1	
22	K10000 00	B2005B	B2204B		1	
23	K10010 00	A2216A	A2308B		1	
24	K10020 00	A2211B	A2605A		1	
25	K10102 00	A0806B	B1104A		1	
26	K13010 00	B2005A	B2904B		1	
27	K13010 00	A2607B	B2905B		1	
28	K13010 01	A2302A	B2005A		2	
29	K13010 01	C2709B	C2715A		1	
30	K13010 02	D0206A	D1204B		1	
31	K13010 03	A2213A	C1204B		1	
32	K13010 04	A1703B	A2212B		1	
33	K13010 05	A2607B	C2715A		2	
34	K13010 06	C2709B	D1204B		2	

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TITLE		WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP			HPDE 7022	13	C
LINE NO.	SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL
1	K13010 07	C1204B	D0206A		2
2	K13010 08 K14000 00	A2213A C2912B	A2212B D2609B		2 1
3	K14001 00	B2203A	D2912A		1
4	K14010 00	B2202A	C2911B		1
5	K15000 00	B2312A	C3013B		1
6	K16010 K17010 K17020	B2009B C2608B C2607B	D2610A D2603B C2611A		2 1 1
7	K21000 00	A2602A	A2617A		1
8	K22000	A2606A	D0611A		2
9	K22000	C1513B	D1513B		1
10	K22000	A2516A	B1811B		2
11	K22000 00	A2203B	A2606A		1
12	K22000 00	A2516A	B2604A		1
13	K22000 01	A0603B	A2203B		2
14	K22000 02	A0610B	JA8106A		1
15	K22000 03	A0610B	A0611A		2
16	K22000 04 K22000 04	B2604A A0603B	C1513B A0611A		2 1
17	K22020 01 K26000	D2013B C2610A	D2708B D0703A		2 1
18					
19	K27020 00	C2013B	D2508B		2
20	K27020 01 K27020 02	D2013B D2508B	D2722B D2708B		2 1
21	K27030 00	C2415B	D2712B		1
22	K27030 01	C2013A	C2415B		2
23	K27030 02	D2013A	D2712B		2
24	K33000	C2411B	C2511B		1
25	K36000 00 K36000 01	B1404B B1203A	B1203A C1511A		1 2
26	K36010 00 K36010 01	B1407B B1303A	D1511A B1407B		1 2
27	L01010 00 L01010 01	A2509B C1502B	B1210A D2702B		1 1
28	L01010 02	A0303B	A0305A		1
29	L01010 03	A0112A	B1310A		1
30	L01010 04	A2509B	C1502B		2
31	L01010 05	A0303B	D2702B		2
32	L01010 06	A0112A	A0305A		2
33	L01010 08	D1502B	B1210A		2
34	L10300 00	A011B	B1106B		1

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TITLE			WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP				HPDE 7022	14	C
LINE NO.	SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	
1	L10400 00	A0109B	B1107A		1	
2	L10500 00	A0213A	B1105B		2	
3	L10500 01	B1105A	B1105B		1	
4	L10700 00	A0209B	B1104B		1	
5	L10700 01	A0802B	B1104B		2	
6	L10800 00	A0307B	JA8201A		1	
7	L10900 00	A0306B	JA8201B		1	
8	L11000 00	A0306A	JA8202A		1	
9	L11100 00	A0309B	JA8003A		1	
10	L11200 00	A0803A	JA8003A		1	
11	L11300 00	A0606B	JA8204A		1	
12	L11400 00	A0606A	JA8204B		1	
13	L11500 00	A0609B	JA8205A		1	
14	L11600 00	A0609A	JA8205B		1	
15	L11700 00	A0308A	JA8003B		1	
16	L12010 00	B2701B	B2804B		1	
17	L12020 L12030 00	A2714B B2801B	B2702B B2901B		1 2	
18	L12030 01	B2502B	B2801B		1	
19	L13000 01	A3013B	JA8005A		1	
20	L14000 00	A2304B	C2908B		1	
21	L14010 00	A2303A	C2908B		1	
22	L18000 L18010	C1402A B1812B	B1812A D1402A		1 1	
23	L22000 00	A0607B	JA8511A		1	
24	L23060	C2011B	D2003B		1	
25	L30010 00	A0507B	JA8509A		1	
26	L30020 00	A0506B	JA8508A		1	
27	L30030 00	A0506A	JA8507A		1	
28	L30050 00	A0509A	JA8505A		1	
29	L30060 00	A0508A	JA8504A		1	
30	L30070 00	A0508B	JA8502A		1	
31	L30080 00 L31000	A0607A A0507A	JA8503A JA8510A		1 1	
32	L31040 L33020 00	A0509B A2504B	JA8506A B2213B		1 1	
33	L33030 00	A2505B	B2202B		1	
34	L33030 01	B2202B	B2203B		2	

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TITLE LOGIC WIRE WRAP			WL	DOCUMENT NO. HPDE 7022	SHEET NO. 15	REV.
LINE NO.	SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	
1	L40000 L40100 00	A0308B A0307A	JA8203B JA8209A		1 1	
2	L50000 00	A0211A	A0810B		1	
3	L50000 00 L50000 01	A0905B A0810B	A0211A A2203A		2 2	
4	L50100 00	A0210B	A0802A		1	
5	L50100 01	A1804B	B2504B		2	
6	L50100 02	A0802A	A2214B		2	
7	L50100 04 L50100 05	A1804B A2214B	B2908A B2504B		1 1	
8	L50200 00 R02110	A0910A B1713B	A0208B D1804A		1 1	
9	R02120	B1610B	D1802B		1	
10	R02130	B1612B	D1802A		1	
11	R02140	B1611B	D1612B		1	
12	R02150	B1613B	D1611A		1	
13	R02160 R02170	D1603A B1512B	B1510B D1604A		1 1	
14	R02180	B1511B	D1602B		1	
15	R02190 R02200 00	D1602A D0813B	B1513B D1113B		1 1	
16	R02200 01	D1413B	D1613B		1	
17	R02200 02	D1813B	D2002B		1	
18	R02200 03	D1113B	D1413B		2	
19	R02200 04	D1613B	D1813B		2	
20	R02210 00	D0813A	D1113A		1	
21	R02210 01	D1413A	D1613A		1	
22	R02210 02	D1813A	D2002A		1	
23	R02210 03	D1113A	D1413A		2	
24	R02210 04	D1613A	D1813A		2	
25	R0405	C1112B	B1412B		1	
26	R04060 R05010	C1403A B1711B	B1408A D1811A		1 1	
27	R19000	B1813B	C0803A		1	
28	R19010	B1813A	D0803A		1	
29	R20000 00	B1713A	C1804A		1	
30	R20100 00	B1610A	C1802B		1	
31	R20200 00	B1612A	C1802A		1	
32	R20300 00	B1611A	C1612B		1	
33	R20400 00	B1613A	C1611A		1	
34	R20500 00	B1510A	C1603A		1	

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TITLE			WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP				HPDE 7022	16	
LINE NO.	SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	
1	R20600 00	B1512A	C1604A		1	
2	R20700 00	B1511A	C1602B		1	
3	R20800 00	B1513A	C1602A		1	
4	R20900 00	C0813B	C1113B		1	
5	R20900 01	C1413B	C1613B		1	
6	R20900 02	C1813B	C2002B		1	
7	R20900 03	C1113B	C1413B		2	
8	R20900 04	C1613B	C1813B		2	
9	R21000 00	C0813A	C1113A		1	
10	R21000 01	C1413A	C1613A		1	
11	R21000 02	C1813A	C2002A		1	
12	R21000 03	C1113A	C1413A		2	
13	R21000 04	C1613A	C1813A		2	
14	R22000 00	B1810A	C1402B		1	
15	R22010 R28000 00	D1402B C0802B	B1810B D0412A		1	
16	R28010 00	C0802A	D0411A		1	
17	R28020 00	C0804A	D0410A		1	
18	R28030	D0704B	D0711B		2	
19	R28030	C1412B	D0711B		1	
20	R28030 R2805	D1412B D0412B	C1412B D0802B		2 1	
21	R2806	D0411B	D0802A		1	
22	R3004 R36000	D0804A B1303B	D0410B D1102A		1 1	
23	R36000 00	D1103B	D1104B		1	
24	R36000 01	D1104B	D1112A		2	
25	R36000 02 R36010	B1310B D1102B	D1112A B1305A		1 1	
26	R36020 R36030	D1104A B1309A	B1305B D1103A		1 1	
27	R36040	B1307A	D1111A		1	
28	R36050	D1112B	B1409B		1	
29	R36060 R40000 00	D1403A B1203B	B1411A C1102A		1 1	
30	R40100 00	B1205A	C1102B		1	
31	R40200 00	B1205B	C1104A		1	
32	R40300 00	B1209A	C1103A		1	
33	R40400 00	B1207A	C1111A		1	
34	R50000 00	B1711A	C1811A		1	

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TITLE		WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP			HPDE 7022	17	
LINE NO.	SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL
1	R70000 00	B1710A	C1411A		1
2	R70100	B1710B	D1411A		1
3	S11000 00	A2307B	B2307B		1
4	S11010 00	A2312A	A2709B		1
5	S11010 00	A2312B	B2305B		1
6	S11010 00	A2313B	B2306A		1
7	S11010 00	A2316A	B2307A		1
8	S11020 00	A2712B	B2301B		1
9	S11020 00	A2317A	A2710B		1
10	S11020 00	A2713B	B2303A		1
11	S11020 00	A2317B	A2711B		1
12	S17010	C2601A	C2615B		2
13	S17010	C2614A	C2615B		1
14	S17010 02	D2602B	C2614A		2
15					
16	S18000 00	A1608B	A1713B		1
17	S18010	A1607B	A1711A		1
18	S18010 00	A1605B	A1711B		1
19	S18010 00	A1603B	A1713A		1
20	S18010 00	A1605A	A1709A		1
21	S19010	A1909A	B2107B		2
22	S26000	B1907B	D0906A		1
23	S26000	B1905B	D0905A		2
24	S26000	B1905A	D0903B		1
25	S26000	B1908B	D0907B		1
26	S26000 00	B1909B	B1911B		1
27	S26000 01	B1909B	B1910A		2
28	S26000 02	B1908A	B1910A		1
29	S26000 03	B1906B	B1908A		2
30	S26000 04	B1910B	D0712B		1
	S26010	B1903B	D0703B		1
31	S26010 04	B1904B	B1906B		1
32	S26010 05	B1904B	B1906A		2
33	S26010 06	B1901A	B1906A		1
34	S80000	A1913B	A2117A		2

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TITLE LOGIC WIRE WRAP			WL	DOCUMENT NO. HPDE 7022	SHEET NO. 18	REV. F
LINE NO.	SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	
1	S80000	A2117A	C2715B		1	
2	S80000	A1913B	D0505A		1	
3	S80100	B2105B	C2716B		1	
4	S80100	B2106A	C2713A		1	
5	S80100	A1908B	B2105B		2	
6	S80100	A1908B	D0506A		1	
7	S80100	B2107B	C2716A		1	
8	S80100	B2106A	D0305A		2	
9	S80100	B2108A	D0507B		2	
10	S80100	B2108A	C2714B		1	
11	S80100	A1909A	D0503B		1	
12	S80200	B2113A	D0307B		2	
13	S80200	B2111A	D0610B		1	
14	S80200	B2110B	C2712A		1	
15	S80200	B2112B	D0303B		2	
16	S80200	B2112B	C2713B		1	
17	S80200	B2110B	D0306A		2	
18	S80200	B2111A	B2311A		2	
19	S80200	B2113A	C2710A		1	
20	S80200 02	B2311A	C2711A		1	
21	TESTER CONT	B1705A	D2708A		1	
22	T06000	C1510A	C1502B		1	
23	T22010 00	D1510A	D1512A		1	
24	T26000	C1212A	D1212B		1	
25	T26010	D1212A	D1212B		1	
26	T26010	D1210A	D1212B		2	
27	T28000	C1203B	C1205B		1	
28	T28010	D1203B	D1205B		1	
29	T30000 T36000 00	D1205B D1503B	D1204A D1505B		2 1	
30	T36000 01	D1503A	D1503B		2	
31	T37000	D1703B	D1705B		1	
32	T37010 00 T37010 01	D1310A D1312B	D1312B D1312A		1 2	
33	T37030 00 T37030 01	D1303A D1303A	D1305B D1303B		1 2	
34	T37050 00 T37050 01	D1010A D1012A	D1012B D1012B		1 2	

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TITLE LOGIC WIRE WRAP			WL	DOCUMENT NO. HPDE 7022	SHEET NO. 19	REV. C
LINE NO.	SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	
1	T37070 00	D1003A	D1005B		1	
2	T37070 01	D1003A	D1003B		2	
3	T60200	D1510A	D1512B		2	
4	X10000 00	A2215A	B2510A		1	
5	X10010 00	A2513B	B2201A		1	
6	X17000 00	D2706A	D2707A		1	
7	X17010 00	D0203B	D2610B		1	
8	X17010 01	D0203B	D2707A		2	
9	X17010 02	B1902A	D2706A		2	
10	X17020 00	C1912B	C2606A		1	
11	X17020 01	C1912B	C1913B		2	
12	X23000 00	A1907B	JA8114A		1	
13	X26000	A0803B	A0811B		1	
14	X33010	A1508B	D2404B		2	
15	X33010	D2404B	D2504B		1	
16	X50000 00	A2209A	B2504A		1	
17	X50000 01	B2312B	B2504A		2	
18	X50000 02	A2911B	B2312B		1	
19	X60100 00	A2411B	B2508B		1	
20	X60200 00	B2003B	B2404A		1	
21	Y10000 00	A0804A	B2408B		1	
22	100001	A1012B	JA8208B		1	
23	100002	A1703A	JA8411B		1	
24	100003	JA8004A	JA8412B		1	
25	100004	A1012A	JA8401B		1	
26	100005	A0103B	JA8001A		1	
27	100006	A0103A	JA8001B		1	
28	100006 02	A0304B	JA8001B		2	
29	100006 03	A0103A	A0104B		2	
30	100007	A0104B	JA8004B		1	
31	100007 01	A0304A	A0311B		1	
32	100007 02	A0311B	JA8004B		2	
33	100007 04 100008	A0311A A0202B	A0304A JA8110B		2 1	
34	100009	A0204B	JA8002A		1	

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TITLE			WL	DOCUMENT NO.	SHEET NO	REV.
LOGIC WIRE WRAP				HPDE 7022	20	D
LINE NO.	SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	
1	100010 00GND	A0812A	A0814A		2	
2	100012 00	C1104B	C1103B		2	
	100012 01	C1104B	C1112A		1	
3	100012 01	C1103B	B1210B		1	
	100013	B1109B	A1708A		1	
4	100014	B1204A	JA8206A		2	
	100014	B1204A	B1304A		1	
5	100015	B1204B	JA8206B		2	
6	100015	B1204B	B1304B		1	
7	100016	B1206A	JA8207A		2	
8	100016	B1206A	B1306A		1	
9	100017	B1208B	JA8207B		2	
10	100017 00	B1208B	B1308B		1	
	100018 0GND	B1206B	B1207B		1	
11	100018	B1212B	B1206B		2	
	100019	B1208A	JA8208A		2	
12	100019	B1208A	B1308A		1	
13	100020 0GND	B1207B	B1214A		2	
14	100022	C1503B	C1505B		2	
15	100023	C1503A	C1503B		1	
16	100032 0GND	A1601A	A1607A		1	
17	100033 00	B1808A	C2708A		1	
18	100035	B2412A	JA8008A		1	
19	100036	B2607B	JA8107B		1	
20	100037	B2603A	JA8203A		1	
21	100038	B2608A	JA8414B		1	
22	100039	A1905A	D2703B		1	
23	100040	C1710A	C1712A		1	
24	100041	C2514B	JA8409A		1	
25	100042	C2513B	JA8404A		1	
26	100044	D2701B	JA8508B		1	
27	100045	D0408A	JA8510B		1	
28	100046	D0409A	JA8504B		1	
29	100047	D0405A	JA8506B		1	
30	100055	A0502B	C2717A		1	
31	100056	A0503A	D2702A		1	
32	100057	A0505A	D2703A		1	
33	100058	A0504B	D2704A		1	
34	100059 0GND	B2310A	B2310B		1	

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TITLE			WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP				HPDE 7022	21	
LINE NO.	SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	
1	100060 0GND	B2309A	B2309B		1	
2	100061 0GND	B2309B	B2310A		2	
3	100062 0GND	B2309A	B2314A		2	
4	100063	B1709A	D2705A		1	
5	100064	A2809B	JA8112B		1	
6	100065	A1001A	JA8113B		1	
7	100067	A2810B	JA8111B		1	
8	100068 00 100070	A0908B A3012B	A0914A JA8005B		1 1	
9	100071	D3002B	JA8514B		1	
10	100072	B2509B	JA8408A		1	
11	100073	B2508A	JA8401A		1	
12	100076 00 100085	JA8014B A0807B	A0202A JA8109A		1 1	
13	100085 01 100086	A0807B A0601A	A0903B JA8109B		2 1	
14	100095	B1706A	C2711B		1	
15	100096	B1609A	C2706B		1	
16	100097	B1608A	C2706A		1	
17	100098	B1605A	C2707B		1	
18	100099	B1606A	C2707A		1	
19	100100	B1509A	C2703A		1	
20	100101	B1508A	C2704A		1	
21	100102	B1505A	C2705A		1	
22	100103	B1506A	C2703B		1	
23	100105	A0203B	JA8110A		1	
24	100106	A0203A	JA8112A		1	
25	100107	A0204A	JA8002B		1	
26	100109 0GND	A2401A	A2416B		1	
27	100112	C1512A	C1512B		2	
28	100114	C1703A	C1703B		1	
29	100117	A0511B	D2709A		1	
30	100118	A0510A	D2710A		1	
31	100119	A0512A	D2711A		1	
32	100120	A0513B	D2712A		1	
33	100121	A0602B	C2705B		1	
34	100122	C1703B	C1705B		2	

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TITLE		WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP			HPDE 7022	22	C
LINE NO.	SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL
1	100123	C1310A	C1312B		1
2	100124	C1312A	C1312B		2
3	100125	C1303A	C1305B		2
4	100126	C1303A	C1303B		1
5	100127	C1010A	C1012B		1
6	100128	C1012A	C1012B		2
7	100129	C1003A	C1005B		2
8	100130	C1003A	C1003B		1
9	100154	A0809A	A0814A		1
10	100155	C2004B	D2710B		1
11	100156	A3001B	JA8514A		1
12	100157	B3014B	JA8501A		1
13	100158	A3002B	JA8513A		1
14	100159	B3013B	JA8512A		1
15	100172 00	C1903A	C1912A		1
16	100173 000	A2301A	JA8410A		1
17	100180 00	C1913A	C1914A		1
18	100181 00	C2012B	C2014A		1
19	100183 00	C2501A	C2508A		1
20	100184	A2501A	A2517B		1
21	100186 GND	A2101A	A2107A		1
22	100189 100191	C2215B B1312B	C2312A B1301A		1 1
23	100192	JA8114B	A0901A		1
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					

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TITLE READ/WRITE WIRE WRAP				WL	SHEET NO. 1	DOCUMENT NO. HPDE 7246	REV.
WIRE IDENTIFICATION	COMMENT	ORIGIN	DESTINATION	Z LEVEL	REMARKS		
A24050 00		F0408B	F0508B	1			
A24050 00		F0407B	F0507B	1			
I19100 00		E0303B	JE8002B	1			
I19120 00		E0303A	JE8002A	1			
I19140 00		E0304B	JE8001B	1			
I19160 00		E0304A	JE8001A	1			
I19200 00		F0311A	JE8004B	1			
I19220 00		F0311B	JE8004A	1			
I19240 00		F0312A	JE8003B	1			
I19260 00		F0312B	JE8003A	1			
I19280 00		E0116B	JE8005A	1			
I19280 01		F0511B	JE8005A	2			
I20010 00		E0117A	F0510B	1			
I20010 00		E0117A	JE8007B	2			
I20020 00		F0012B	F0509B	1			
I23080 00		E0114B	JE8007A	1			
I25230 00		F0409B	JE8008A	1			
I80300 00		F0107B	JE8008B	1			
I80400 00		F0108B	JE8006B	1			
I80500 00		F0109B	JE8005B	1			
K22000 00		F0106B	JE8006A	1			
L20000 00		E0006B	E0305B	1			
L20010 00		E0007B	F0301B	1			
L20020 00		E0008A	E0306B	1			
L20030 00		E0008B	F0302B	1			
L20040 00		E0307B	F0010A	1			
L20050 00		E0011B	F0303B	1			
L20060 00		E0011A	E0308B	1			
L20070 00		E0012B	F0304B	1			
L20080 00		E0012A	E0309B	1			
L20090 00		E0013A	F0305B	1			
L20100 00		E0310B	F0002A	1			
L20110 00		F0003A	F0306B	1			
L20120 00		E0311B	F0003B	1			
L20130 00		F0004B	F0307B	1			
L20140 00		E0312B	F0006B	1			
L20150 00		F0007B	F0308B	1			
L20160 00		E0313B	F0008B	1			
L20170 00		F0009A	F0309B	1			
L20180 00		E0314B	F0010B	1			

KOR 0513

TITLE					WL	SHEET NO.	DOCUMENT NO.	REV.
LOGIC HARNESS						1	HPDE 7928	
IDENTIFIER	WIRE SIZE	COLOR CODE	WIRE LENGTH	ORIGIN		DESTINATION		REMARKS
				LOCATION	PIN NO.	LOCATION	PIN NO.	
1	16	2		A2TB2	14	A2C11	+	
2	16	0		A2TB2	1	A2C11	-	
3	20	2		A2CB2	2	A2TB1	6	
4								
5	20	4		A2A2P2	18	A2TB4	7	
6	20	2		A2TB2	5	A2A2P2	11	
7	20	4		A2TB2	13	A2A2P2	8	
8	20	2		A2TB2	6	A2C6	+	
9	20	4		A2TB2	4	A2A2P2	12	
10	12	0		A2TB2	2	A2C6	-	
11	12	0	10	A2TB2	2	A2TB3	2	
12	12	0		A2TB2	1	A2TB3	1	
13	20	6		A2TB2	7	A2C8	-	
14	24	0		A2PA80-1B		DEAD END		
15	12	2		A2TB2	8	A2C5	+	
16	20	2		A2C5	+	A2R1	T	
17	12	2		A2C5	+	A2CB2	1	
18	16	6		A2TB2	9	A2C10	-	
19	20	6		A2C10	-	A2R1	B	
20	16	6		A2C10	-	A2CB3	1	
21	16	2		A2TB2	10	A2C3	+	
22	20	2		A2C3	+	A2R5	T	
23	16	2		A2C3	+	A2CB4	1	
24	16	0		A2TB3	2	A2C3	-	
25								
26	20	0		A2C3	-	A2R5	B	
27	20	0		A2C1	+	A2R4	T	
28								
29	16	0		A2C2	+	A2A1TB1	6	
30	16	6		A2TB2	11	A2C1	-	
31	20	6		A2C1	-	A2R4	B	
32	16	6		A2C1	-	A2CB5	1	
33	20	6		A2TB2	12	A2K5B	NO	
34	20	6		A2TB2	12	A2K6	NO	
35	20	0		A2TB1	8	A2A2P2	16	
36								
37	24	2		A2TB2	5	A2A2P1	10	
38	24	2		A2TB2	16	A2A2P1	6	
39	20	2		A2L1	2	A2C7	+	
40	20	2		A2R2	T	A2L1	2	

KOR 0512

TITLE								SHEET NO.	DOCUMENT NO.	REV.	
LOGIC HARNESS								WL	2	HPDE 7928	
IDENTIFIER	WIRE SIZE	COLOR CODE	WIRE LENGTH	ORIGIN		DESTINATION		REMARKS			
				LOCATION	PIN NO.	LOCATION	PIN NO.				
41	20	2		A2CB1A	1	A2C7	+				
42	12	0	10	A2TB2	3	A2TB3	1				
43	24	2		A2CB1A	2	A2A2P1	13				
44	20	2		A2CB1A	2	A2TB1	1				
45	20	2		A2TB1	1	A2PB30	13B				
46	20	2		A2TB1	1	A2PD30	13B				
47	20	6		A2L2	2	A2C9	-				
48	20	6		A2R2	B	A2L2	2				
49	20	6		A2CB1B	1	A2C9	-				
50	20	6		A2CB1B	2	A2TB1	2				
51	20	6		A2TB1	2	A2PA30	2B				
52	20	6		A2TB1	2	A2PC30	2B				
53	12	2		A2CB2	2	A2A5	UN-REG				
54	24	2		A2CB2	2	A2A3P1	8				
55	16	6		A2CB3	2	A2A7	UN-REG				
56	20	6		A2CB3	2	A2TB1	7				
57	12	0	10	A2TB2	2	A2TB3	3				
58	20	4		A2TB2	4	A2A3P1	13				
59	16	2		A2CB4	2	A2A1TB1	2				
60	16	2		A2CB4	2	A2A6	+				
61	16	6		A2CB5	2	A2A1TB1	10				
62	16	6		A2CB5	2	A2A6	-				
63	20	6		A2K6	C	A2C2	-				
64	20	6		A2K5B	C	A2C2	-				
65	20	6		A2C2	-	A2K5A	NC				
66	20	6		A2C2	-	A2A3P1	14				
67	12	2		A2A5	REG	A2TB1	3				
68	16	2		A2TB1	3	LOGIC Vcc+	TOP				
69	16	6		A2A7	REG	A2TB1	4				
70	16	6		A2TB1	4	LOGIC Vcc-	TOP				
71	16	6		A2TB1	4	LOGIC Vcc-	BOT				
72	16	2		A2TB1	3	LOGIC Vcc+	BOT				
73											
74	24	2		A2A2P2	4	A2C11	+				
75	24	2		DEAD END		A2C11	+				
76	24	2		A2A2P1	8	A2C11	+				
77	24	2		A2A3P1	6	A2C11	+				
78	20	2		A2DS1	B	A2C11	+				
79	20	2		A2C11	+	A2TB1-16					
80	24	2		A2DS1	B	A2S1	B1				

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TITLE					WL	SHEET NO.	DOCUMENT NO.	REV.
LOGIC HARNESS						3	HPDE 7928	
IDENTIFIER	WIRE SIZE	COLOR CODE	WIRE LENGTH	ORIGIN		DESTINATION		REMARKS
				LOCATION	PIN NO.	LOCATION	PIN NO.	
81	12	0		A2C11	-	A2C8	+	
82								
83	24	0		A2TB1	8	A2A2P2	6	
84	20	0		A2TB1	8	A2S2	-	
85	24	0		A2TB1	8	A2A3P1	10	
86	24	0		A2TB1	8	A2A2P2	1	
87	24	0		A2TB1	9	A2CB3	3	
88	20	0		A2TB1	9	A2S1	A2	
89	24	0		A2TB1	9	A2DS1	T	
90	20	0		A2TB1	9	DEAD END		
91	20	2		A2C6	+	A2L1	1	
92	20	0		DEAD END		DEAD END		
93	20	0		DEAD END		DEAD END		
94	12	0		A2C7	-	A2C9	+	
95	12	0		A2C9	+	A2C5	-	
96								
97	16	0		A2TB2	1	A2A5	GND	
98	16	0		A2TB2	1	A2A7	GND	
99	20	6		A2C8	-	A2L2	1	
100								
101								
102	12	0		A2C8	+	A2TB1	9	
103	20	0		A2A3P1	7	A2TB1	12	
104	20	0		A2K6	2	A2TB1	12	
105	20	0		A2A2P1	1	A2TB1	8	
106	20	2		A2A3P1	5	A2K5	AL	
107	20	0		A2K5	BL	A2A3P1	4	
108	20	0		A2K5	BL	A2A2P2	2	
109	20	2		A2A3P1	2	A2TB1	5	
110	24	2		A2A3P1	3	A2A2P1	12	
111	20	2		A2A3P1	11	A2K6	1	
112								
113	20	2		A2A3P1	1	A2A2P1	7	
114	20	6		A2A3P1	12	A2PA80	8A	
115	20	4		A2A2P2	9	A2TB4	8	
116								
117	20	4		A2A2P2	5	A2TB1	15	
118	24	0		A2A2P2	3	A2PA80	2B	
119	20	0		A2A2P1	5	A2TB4	3	
120	20	0		A2TB4	3	A2S1	B2	

KOR 0512

TITLE						SHEET NO.		DOCUMENT NO.		REV.
LOGIC HARNESS						WL	4	HPDE 7928		
IDENTIFIER	WIRE SIZE	COLOR CODE	WIRE LENGTH	ORIGIN		DESTINATION		REMARKS		
				LOCATION	PIN NO.	LOCATION	PIN NO.			
121	20	0		A2A2P1	3	A2TB4	2			
122	20	2		A2A2P1	4	A2TB4	4			
123	20	2		A2TB4	4	DEAD END				
124	20	0		A2A2P1	2	A2TB4	1			
125	20	2		A2A2P1	18	A2TB4	5			
126	20	2		A2A2P1	16	A2TB4	6			
127	24	0		A2A2P1	11	A2PA80	3A			
128	24	0		A2A2P2	10	A2PA80	3B			
129	20	0		A2A2P1	9	A2TB1	14			
130	20	4		A2A2P1	14	A2PA80	2A			
131	20	2		A2A2P1	15	A2TB1	13			
132										
133	20	0		A2CB1		A2TB2	15			
134	20	4		A2S1	A1	A2PA80	1A			
135	24	0		DEAD END		A2PA80	7B			
136	24	0		A2CB3	4	A2CB2	4			
137	24	0		A2CB3	4	A2PA80	7A			
138	24	0		A2CB3	5	A2CB2	3			
139	24	0		A2CB2	5	A2CB1	3			
140	24	0		A2CB1	5	A2CB5	3			
141	24	0		A2CB5	5	A2CB4	3			
142	20	0		A2CB4	5	A2TB1	11			
143	20	4		A2S2	L	A2PA80	4B			
144	20	2		A2S2	+	A2TB1	1			
145	20									
145A		9		A2PA80	5A	A2A1TB1	7			
145B		0		A2PA80	5B	A2A1TB1	6			
145C		SHLD				A2A1TB1	6			
146	20									
146A		SHLD				A2A1TB1	6			
146B		9		A2PA80	6A	A2A1TB1	1			
146C		0		A2PA80	6B	A2A1TB1	11			
147	20	0		A2TB4	9	DEAD END				
148	14	4		A2A6	AC	A2A1TB1	5			
149	14	4		A2A1TB1	5	A2K5A	NO			
150	12	0		A2TB3	1	LOGIC	GND			
151	12	0		A2TB3	2	LOGIC	GND			
152	12	0		A2TB3	3	LOGIC	GND			
153	12	0		A2TB3	4	LOGIC	GND			
154	20	0		A2TB4	10	A2PA80	4A			

KOR 0512

TITLE DECK HARNESS (REFER 77383500)						WL	SHEET NO. 1	DOCUMENT NO. HPDE 7338	REV. D
IDENTIFIER	WIRE SIZE	COLOR CODE	WIRE LENGTH	ORIGIN		DESTINATION		REMARKS	
				LOCATION	PIN NO.	LOCATION	PIN NO.		
1	24	4		A3P2	1	A2TB1	15		
2	24	0		A3S8	C	A3S6	C		
3	24	0		A3S6	C	A3P2	2		
4	24	0		A3P2	2	A2TB1	8		
5	24	4		A3S8	NC	A3P5	2		
6	24	4		A3P5	2	A2TB4	7		
7	24	4		A3P5	1	A2TB4	8		
8	24	4		A3S6	NC	A2TB1	12		
9	24	0		A3S8	NO	A2PA81	10A		
10	24	4		A3S6	NO	A2PA81	12A		
11	24	0		A3S4	C	A2TB1	9		
12	24	0		A3S4	NC	A2PA81	10B		
13	24	0		A3S1	C	A2TB1	11		
14	24	0		A3S1	NO	A2TB1	10		
15									
16									
17									
18	24	6		-VCC LGC PANEL	BOT- TOM	DEAD END			
19	24	4		DEAD END		DEAD END			
20	24	4		DEAD END		DEAD END			
21	↑	↑		A3PE80	1A	A2PA81	1A		
22				↑	1B	↑	1B		
23					2A		2A		
24					2B		2B		
25					3A		3A		
26					3B		3B		
27					4A		4A		
28					4B		4B		
29					5A		5A		
30					5B		5B		
31					6A		6A		
32					6B		6B		
33					7A		7A		
34					7B		7B		
35					8A		8A		
36	↓	↓		↓	8B	↓	8B		
37	24	4		A3PE80	9A	A2PA81	11A		
38	24								
38A		4		A3PE80	14A	A2PA81	14A		
38B		0		A3PE80	14B	A2PA81	14B		

KOR 0512

TITLE						SHEET NO.		DOCUMENT NO.		REV.
DECK HARNESS						WL 2		HPDE 7338		
IDENTIFIER	WIRE SIZE	COLOR CODE	WIRE LENGTH	ORIGIN		DESTINATION		REMARKS		
				LOCATION	PIN NO.	LOCATION	PIN NO.			
39	24									
39A		0		A3P3	1	A2PA81	9B			
39B		4		A3P3	2	A2PA81	9A			
40	20									
40A		9		A3J4	1	A2PA81	12B			
40B		0		A3J4	2	A2PA81	11B			
40C		SHLD		A3J4	3	A2PA81	13B			
41	14	4		A3TB1	1	A2K5A	C			
42	14	1		A3TB1	2	A2A1TB1	7			
43	20									
43A		9		A3P8	4B	A2TB1	6			
43B		0		A3P8	3B	A2TB1	7			
43C		SHLD		A3P8	3A	A2TB1	8			
44	24									
44A		CNTR		A3P8	1B	A2PD29	3B			
44B		SHLD		A3P8	1A	A2PD29	4A			
45	24									
45A		CNTR		A3P8	2B	A2PD29	5B			
45B		SHLD		A3P8	2A	A2PD29	4B			
46	24									
46A		0		A3PE1	9B	A2PC17	9B			
46B		4		A3PE1	10B	A2PC17	9A			
47	20	2		A3P6	1	A3FL3	OUT			
48	24	2		A3PF6	13B	A3FL3	OUT			
49	20	6		A3P6	3	A3FL4	OUT			
50	24	6		A3PE6	2B	A3FL4	OUT			
51	20	0		A3P6	4	A2TB1	9			
52	24									
52A		4		A3P6	5	A3PE2	13B			
52B		0		A3P6	6	A3PE2	14B			
53	16	2		R/W CHASSIS	+Vcc	A3FL1	OUT			
54	16	6		R/W CHASSIS	-Vcc	A3FL2	OUT			
55	20	2		A3PF1	13B	A3FL5	OUT			
56										
57	20	2		A3FL1	IN	A2TB1	3			
58	20	6		A3FL2	IN	A2TB1	4			
59	20	2		A3FL3	IN	A2TB1	1			
60	20	6		A3FL4	IN	A2TB1	2			
61	20	2		A3FL5	IN	A2TB1	13			

KOR 0512

TITLE								W/L	SHEET NO.	DOCUMENT NO.	REV.
CONTROL PANEL									1	HPDE 7861	
IDENTIFIER	WIRE SIZE	COLOR CODE	WIRE LENGTH	ORIGIN		DESTINATION		REMARKS			
				LOCATION	PIN NO.	LOCATION	PIN NO.				
1	24	2		A2TB1	5	A4DS5A	T				
2	↑	2		A4DS5B	T	A4DS5A	T				
3		2		A4DS5B	T	A4DS4A	T				
4		2		A4DS4B	T	A4DS4A	T				
5		2		A4DS4B	T	A4DS2A	T				
6		2		A4DS2B	T	A4DS2A	T				
7		2		A4DS2B	T	A4DS1A	T				
8		2		A4DS1B	T	A4DS1A	T				
9		2		A4DS1B	T	A4DS3A	T				
10		2		A4DS3B	T	A4DS3A	T				
11		2		A2TB1	16	A4DS6B	T				
12		2		A4DS6A	T	A4DS6B	T				
13		0		A4DS6A	B	A4DS6B	B				
14		0		A2TB1	14	A4DS6B	B				
15		0		A4DS6A	B	A4S7A	NO				
16		0		A2TB1	10	A4S7A	C				
17		2		A2TB4	6	A4S7B	NO				
18		2		A2TB4	4	A4S7B	C				
19		2		A2TB4	5	A4S7B	NC				
20		0		A2PA82	8B	A4S7C	NO				
21		0		A2PA82	3A	A4S1	NO				
22		4		A2PA82	5A	A4DS1A	B				
23		4		A2PA82	5B	A4DS1B	B				
24		4		A2PA82	9A	A4DS5A	B				
25		4		A2PA82	3B	A4DS5B	B				
26		4		A2PA82	4A	A4DS3A	B				
27		4		A2PA82	4B	A4DS3B	B				
28		4		A2PA82	1A	A4DS4A	B				
29		4		A2PA82	1B	A4DS4B	B				
30		4		A2PA82	2A	A4DS2A	B				
31		4		A2PA82	2B	A4DS2B	B				
32		0		A2TB1	8	A4S7C	C				
33		0		A4S1	C	A4S7C	C				
34		0		A4S1	C	A4S2	C				
35		0		A3S3	C	A4S2	C				
36		0		A3S3	C	A4S4	C				
37		0		A4S5	C	A4S4	C				
38		0		A4S5	C	A4S6	C				
39	↓	4		A4S2	NO	A2PA82	6A				
40	24	4		A4S3	NO	A2PA82	6B				

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TITLE					SHEET NO.		DOCUMENT NO.		REV.	
I/O PANEL (REF: 77472200)					WL		1		HPDE 7970	A
IDENTIFIER	WIRE SIZE	COLOR CODE	WIRE LENGTH	ORIGIN		DESTINATION		REMARKS		
				LOCATION	PIN NO.	LOCATION	PIN NO.			
1	24	2	59	A2TB4	5	I A5J1	N			
2	24	2	59	A2TB4	4	I A5J1	M			
3	24	2	59	A2TB1	16	I A5J1	H			
4	24	2	59	A2TB4	1	I A5J1	P			
5	24	2	59	A2TB4	3	I A5J1	J			
6	24	2	59	A2TB4	2	I A5J1	K			
7	16	0	53	A2TB3	10	I A5J1	S			
8	24	0	59	A2TB3	10	I A5J1	J			
9	24	0	59	A2TB4	10	I A5J1	F			
10	24		50							
10A		0		A2PC10	6B	I A5J2	1			
10B		4		A2PC10	6A	I A5J2	4			
11	24		50							
11A		0		A2PC10	7B	I A5J2	2			
11B		4		A2PC10	7A	I A5J2	5			
12	24		50							
12A		0		A2PC10	8B	I A5J2	8			
12B		4		A2PC10	8A	I A5J2	12			
13	24		50							
13A		0		A2PC10	9B	I A5J2	3			
13B		4		A2PC10	9A	I A5J2	7			
14	24		50							
14A		0		A2PC13	6B	I A5J2	10			
14B		4		A2PC13	6A	I A5J2	13			
15	24		50							
15A		0		A2PC13	7B	I A5J2	11			
15B		4		A2PC13	7A	I A5J2	14			
16	24		50							
16A		0		A2PC13	8B	I A5J2	16			
16B		4		A2PC13	8A	I A5J2	20			
17	24		50							
17A		0		A2PC13	9B	I A5J2	15			
17B		4		A2PC13	9A	I A5J2	18			
18	24		50							
18A		0		A2PC17	6B	I A5J2	17			
18B		4		A2PC17	6A	I A5J2	21			
19	24		50							
19A		0		A2PC12	8B	IA5J1	u			
19B		4		A2PC12	8A	IA5J1	w			
20	24		50							

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TITLE				I/O PANEL				WL	SHEET NO.	DOCUMENT NO.	REV.
									2	HPDE 7970	A
IDENTIFIER	WIRE SIZE	COLOR CODE	WIRE LENGTH	ORIGIN		DESTINATION		REMARKS			
				LOCATION	PIN NO.	LOCATION	PIN NO.				
20A		0		A2PC15	8B	I A5J2	75				
20B		4		A2PC15	8A	I A5J2	78				
21	24		50								
21A		0		A2PC8	5A	I A5J2	67				
21B		4		A2PC8	5B	I A5J2	72				
22	24		50								
22A		0		A2PC8	6A	I A5J2	73				
22B		4		A2PC8	6B	I A5J2	76				
23	24		50								
23A		0		A2PC8	7A	IA5J2	74				
23B		4		A2PC8	7B	IA5J2	77				
24	24		50								
24A		0		A2PC15	9B	IA5J2	25				
24B		4		A2PC15	9A	IA5J2	22				
25	24		50								
25A		0		A2PC8	8A	I A5J2	53				
25B		4		A2PC8	8B	I A5J2	56				
26	24		50								
26A		0		A2PC15	6B	IA5J1	B				
26B		4		A2PC15	6A	IA5J1	D				
27	24		56								
27A		0		A5PC20	10A	IA5J2	41				
27B		4		A5PC20	10B	IA5J2	44				
28	24		50								
28A		0		A2PC14	9A	I A5J2	46				
28B		4		A2PC14	9B	I A5J2	49				
29	24		50								
29A		0		A2PC14	8A	I A5J2	48				
29B		4		A2PC14	8B	I A5J2	51				
30	24		50								
30A		0		A2PC14	10A	IA5J2	59				
30B		4		A2PC14	10B	IA5J2	63				
31											
31A											
31B											
32											
32A											
32B											
33	24		50								
33A		0		A2PC16	5A	I A5J2	28				

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TITLE								WL	SHEET NO.	DOCUMENT NO.	REV.
I/O PANEL									3	HPDE 7970	A
IDENTIFIER	WIRE SIZE	COLOR CODE	WIRE LENGTH	ORIGIN		DESTINATION		REMARKS			
				LOCATION	PIN NO.	LOCATION	PIN NO.				
33B		4		A2PC16	5B	I A5J2	31				
34	24		50								
34A		0		A2PC16	6A	I A5J2	24				
34B		4		A2PC16	6B	I A5J2	27				
35	24		50								
35A		0		A2PC16	7A	I A5J2	29				
35B		4		A2PC16	7B	I A5J2	32				
36	24		50								
36A		0		A2PC16	8A	I A5J2	23				
36B		4		A2PC16	8B	I A5J2	26				
37	24		50								
37A		0		A2PC16	9A	I A5J2	30				
37A		4		A2PC16	9B	I A5J2	33				
38	24		50								
38A		0		A2PC16	10A	I A5J2	34				
38B		4		A2PC16	10B	I A5J2	37				
39	24		50								
39A		0		A2PC18	5A	I A5J2	40				
39B		4		A2PC18	5B	I A5J2	43				
40	24		50								
40A		0		A2PC18	6A	I A5J2	36				
40B		4		A2PC18	6B	I A5J2	39				
41	24		50								
41A		0		A2PC18	8A	I A5J2	35				
41B		4		A2PC18	8B	I A5J2	38				
42	24		50								
42A		0		A2PC18	9A	I A5J2	52				
42B		4		A2PC18	9B	I A5J2	55				
43	24		50								
43A		0		A2PC17	8B	I A5J1	AA				
43B		4		A2PC17	8A	I A5J1	Z				
44	24		50								
44A		0		A2PC17	7B	I A5J1	A				
44B		4		A2PC17	7A	I A5J1	C				
45	24		50								
45A		0		A2PC15	7B	I A5J1	E				
45B		4		A2PC15	7A	I A5J1	H				
46	24	0	56	A2PC11	10A	IA5J1	C				
46A		4		A2PC11	10B	IA5J1	E				
46B	24		50								
47		0		A2PC14	6A	IA5J1	D				
47A		4		A2PC14	6B	I A5J1	F				
47B											

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TITLE					W/L	SHEET NO.	DOCUMENT NO.	REV.
I/O PANEL						4	HPDE 7970	A
IDENTIFIER	WIRE SIZE	COLOR CODE	WIRE LENGTH	ORIGIN		DESTINATION		REMARKS
				LOCATION	PIN NO.	LOCATION	PIN NO.	
48	24		50					
48A		0		A2PC12	6B	IA5J1	DD	
48B		4		A2PC12	6A	IA5J1	BB	
49	24		50					
49A		0		A2PC14	7A	IA5J1	z	
49B		4		A2PC14	7B	IA5J1	b	
50	24		50					
50A		0		A2PC11	9A	I A5J1	Y	
50B		4		A2PC11	9B	I A5J1	A	
51	24		50					
51A		0		A2PC11	8A	I A5J1	P	
51B		4		A2PC11	8B	I A5J1	S	
52	24		50					
52A		0		A2PC11	7A	I A5J1	V	
52B		4		A2PC11	7B	I A5J1	X	
53	24		50					
53A		0		A2PC11	6A	I A5J1	R	
53B		4		A2PC11	6B	I A5J1	T	
54	24		50					
54A		0		A2PC11	5A	I A5J1	U	
54B		4		A2PC11	5B	I A5J1	W	
55			56					
55A	CC			A2PC20	7B	I A5J1	K	
55B	SHLD			A2PC20	7A	I A5J1	CC	
56			56					
56A	CC			A2PC20	8B	I A5J1	L	
56B	SHLD			A2PC20	8A	I A5J1	FF	
57								
57A	CC			A2PC19	6B	IA5J1	M	
57B	SHLD			A2PC19	6A	IA5J1	HH	
58			56					
58A	CC			A2PC20	5B	I A5J1	N	
58B	SHLD			A2PC20	5A	I A5J1	EE	
59	24		56					
59A		0		A2PC20	9A	I A5J1	T	
59B		4		A2PC20	9B	I A5J1	V	
60								
60								
60								

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TITLE						SHEET NO.		DOCUMENT NO.		REV.	
A. C. HARNESS (REF: 76474707)						WL 1		HPDE 7924		A	
IDENTIFIER	WIRE SIZE	COLOR CODE	WIRE LENGTH	ORIGIN		DESTINATION		REMARKS			
				LOCATION	PIN NO.	LOCATION	PIN NO.				
1	14	1	9	N/A		A1FL2	IN				
2	14	1	9	N/A		A1FL1	IN				
3											
4											
5											
6											
7											
8											
9											
10	16	1		A1FL1	OUT	A1CB2	A1				
11	16	1		A1CB2	A1	A1M1	T				
12	16	1		A1CB2	A1	A1XF1	IN				
13	16	1		A1CB2	A1	A1TB2	2				
14	16	1		A1CB2	1	A1TB3	1				
15	16	1		A1CB2	B1	A1XF2	IN				
16	16	1		A1CB2	B1	A1Q1	1				
17	16	1		A1FL2	OUT	A1CB2	B1				
18											
19	16	1		A1XF1	OUT	A1TB2	5				
20	16	1		A1XF2	OUT	A1TB2	6				
21	16	1		A1CB2	A2	A1Q2	1				
22	16	1		A1CB2	B3	A1Q4	1				
23	16	1		A1Q1	2	A1TB2	3				
24	16	1		A1M1	B	A1TB2	4				
25	16	1		A1TB3	2	A1TB2	4				
26	16	1		A1CB2	B3	A1Q3	1				
27	16	1		A1CB2	A3	A1Q3	2				
28											
29											
30											
31	16	1		A1CB2	A4	A1P7 (1)	4				
32	16	1		A1CB2	A3	A1P7 (1)	3				
33	16	1		A1Q2	2	A1P7 (1)	2				
34	16	1		A1Q4	2	A1P7 (1)	5				
35	16	54		SAFETY	GND	A1P7 (1)	1				
36	16	54		SAFETY	GND	A1P7 (1)	8	S/C 07 & BELOW			
36	16	5		SAFETY	GND	A1P7 (1)	8	S/C 08 & ABOVE			
37											
38											
39											
40	16	1		A1TB2	5	A1T3	2				

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TITLE						SHEET NO.		DOCUMENT NO.		REV.
A.C. HARNESS						WL 2		HPDE 7924		
IDENTIFIER	WIRE SIZE	COLOR CODE	WIRE LENGTH	ORIGIN		DESTINATION		REMARKS		
				LOCATION	PIN NO.	LOCATION	PIN NO.			
41	16	1		A1TB2	6	A1T3	1			
42										
43										
44	20									
44A		1		A1FL1	OUT	A1P2	2			
44B		1		A1FL2	OUT	A1P2	3			
44C		SHLD		A1P2	1	A1FL1	GND			
45										
46										
47										
48										
49										
50	16	54		SAFETY A1 GND		SAFETY A2 GND				
51	16	4		A1Q4	4	A2TB2	4			
52	16	2		A1Q2	3	A2TB2	5			
53	16	2		A1Q3	3	A1Q2	3			
54	16	2		A1Q4	3	A1Q3	3			
55	16	2		A1Q1	3	A2TB2	16			
56	16	0		A1Q1	4	A2TB2	15			
57	16	2		A1CR7-10	+	A2TB2	6			
58	16	0		A1TB4	7	A1TB4	4			
59	12	0		A1TB4	4	A2TB2	2			
60	16	6		A1CR7-10	-	A2TB2	7			
61	12	2		A1CR5-6	C	A2TB2	8			
62	16	6		A1CR15	A	A2TB2	9			
63	16	2		A1CR11-14	+	A2TB2	10			
64	16	0		A1TB3	6	A2TB2	3			
65	16	6		A1CR11-14	-	A2TB2	11			
66	16	6		A1CR16-17	-	A2TB2	12			
67	16	4		A1Q4	4	A1P7 (1)	7			
68	16	0		A1Q3	4	A1P7 (1)	6			
69	16	4		A1TB3	5	A1CR16-17	AC1			
70	16	4		A1TB3	7	A1CR16-17	AC2			
71	16	4		A1T3	4	A1CR1-2	AC1			
72	16	4		A1T3	6	A1CR1-2	AC2			
73	16	4		A1TB3	3	A1C12	T			
74	16	4		A1TB3	8	A1C12	B			
75	16	4		A1C12	B	A1CR11-14	AC2			
76	14	4		A1TB4	3	A1CR5	A			
77	16	4		A1TB3	4	A1CR11-14	AC1			

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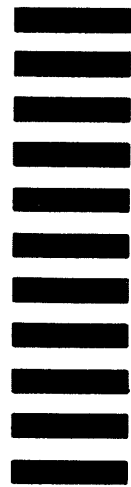
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