83308100B

CONTROL DATA CORPORATION

CONTROL DATA®
DISK STORAGE UNIT
BR308

PREVENTIVE MAINTENANCE
CORRECTIVE MAINTENANCE
DIAGRAMS
WIRE LISTS

Volume 1 of 2

HARDWARE MAINTENANCE MANUAL

REVISION RECORD

REVISION	DESCRIPTION
A	Manual released by Engineering Change Order PE39149. Engineering Change Orders
8-1-75	PE35816, PE35827, PE39243, PE39280C, PE39324, PE39327, PE39338, PE39356, and PE39359
	are incorporated in this manual.
B	Add Corrective maintenance section.
9-15-75	

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LIST OF EFFECTIVE PAGES

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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 BR308 Disk Storage Unit are as follows:

Publication No.	Title
83308100	Maintenance
83308200	Reference
83308300	Parts Data

CONTENTS

FIGURES

TABLES

SECTION 1

INSTALLATION AND CHECKOUT

INTRODUCTION

This section contains the steps involved in unpacking each unit. For air shipment, each unit is covered with a plastic dust shield, enclosed within an outer corrugated fiberboard carton, and then strapped to a wooden pallet. For domestic surface shipment, each unit is packaged in the same manner as for air shipment but is not placed on a wooden pallet. This permits each unit to be moved about on its own casters.

INSPECTION

When uncrating the units,inspect each carton for possible shipping damage. All claims for this type of damage should be filed with the carrier involved. Most crating materials may be reused if reasonable care is taken while uncrating. When uncrating is complete, check off all parts listed in the Shipping Bill accompanying the equipment. Discrepancies, missing items, damaged equipment, etc., should be reported to the CDC Account Sales Representative responsible for the equipment.

UNCRATING

1. Remove external packing material.

WARNING

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

2. Remove polypropylene straps securing unit to skid and remove dust shield.

WARNING

The DSU weighs approximately 750 lbs when crated. To prevent injury to personnel or damage to unit, use Rol-a-Lifts or equivalent to remove unit from pallet.

3. Remove unit from skid.

4. Remove filler tubes from top of pack cover glass. Remove material (if any) contained inside tubes.

NOTE

The pack cover is locked in place by a manually operated latch. Open cover by pulling upward on latch until clear of catch (see Figure 1-1).

5. Lift pack cover.

6. Remove logic chassis-to-frame retainer.

7. Swing logic chassis out.

8. Remove all material shipped inside unit.

9. Remove deck cover (see Figure 1-2).

10. Remove front panel.

11. Remove side skins (if installed).

12. Remove front deck hold-down bolts - two places (see Figure 1-3).

13. Remove shipping hardware holding spindle motor plate (see Figure 1-4).

14. Remove rear deck hold-down bolts - two places. These bolts are identified by plastic plugs. Replace plugs after removing hold-down bolts.

15. Remove actuator tie-bolt cord.

16. Remove logic chassis access cover and check all cards for proper seating. Replace access cover.

17. Replace deck cover.

18. Thoroughly vacuum-clean unit.

19. Replace front panel.

20. Replace side skins.

21. Reposition pack cover.

22. Swing logic chassis to closed position.

INSTALLATION REQUIREMENTS

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

Figure 1-5 illustrates recommended clearances required for maintenance.

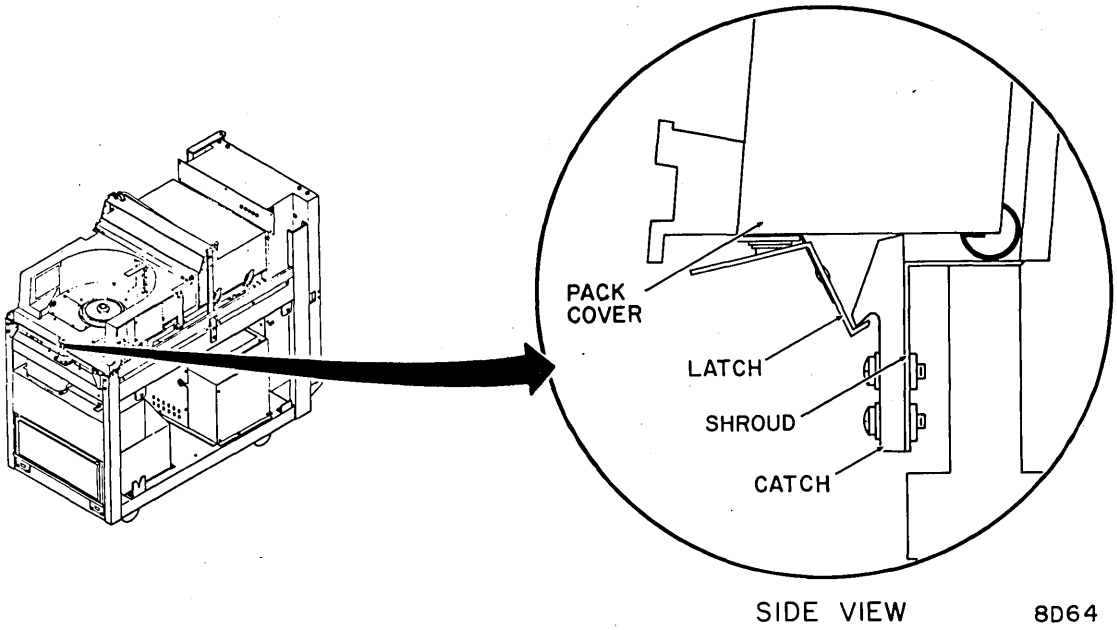


Figure 1-1. Pack Cover Latch

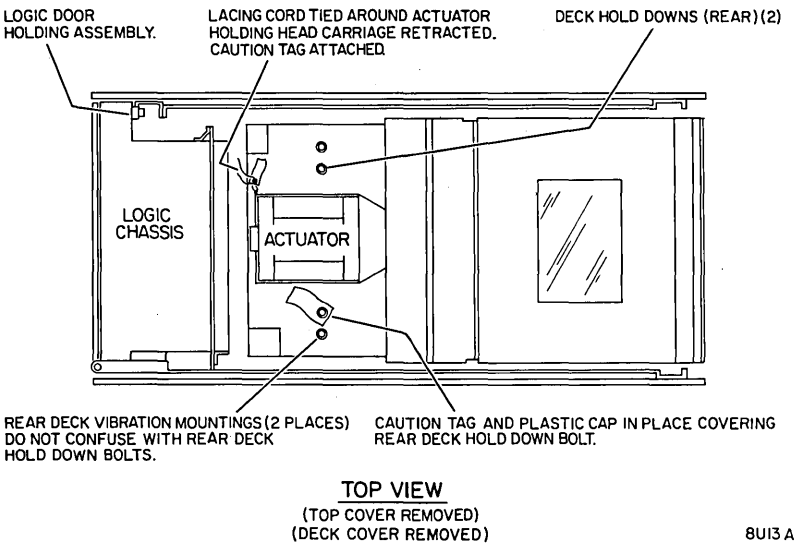


Figure 1-2. Drive Top View

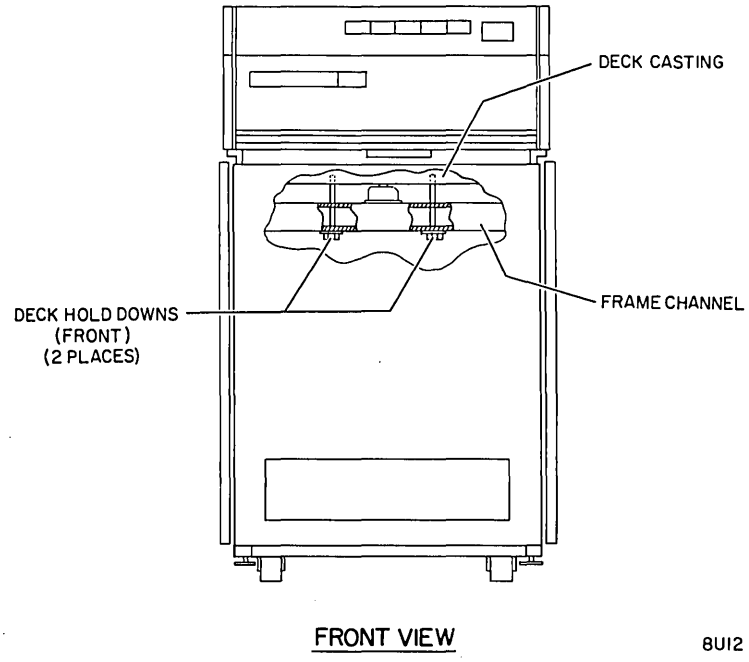


Figure 1-3. Drive Front View

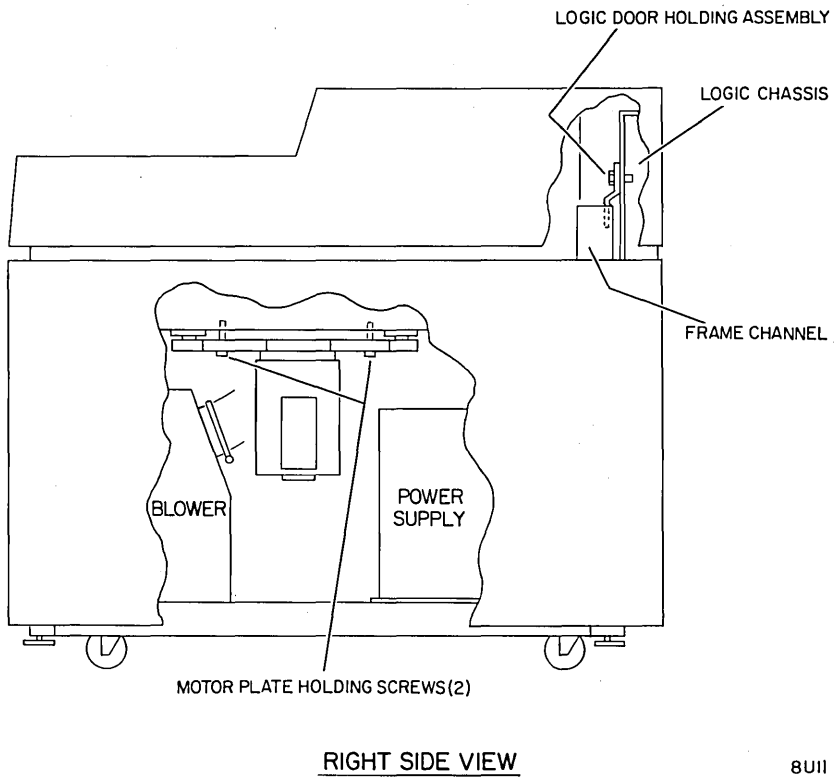


Figure 1-4. Drive Right Side View

TABLE 1-1. INSTALLATION SPECIFICATIONS

PHYSICAL (Approximate)

Size	Uncrated
Height	39.5 in.
Width	22 in.
Depth	44.5 in.
Weight	700 lbs.

ENVIRONMENT

Characteristic	Condition	Specification
Temperature	Operating	60°F (15.6°C) to 90°F (32.2°C)
	Gradient	12°F (6.6°C) per hour
	Non-Operating	-30°F (-34°C) to +150°F (66°C)
Relative Humidity (no condensation)	Operating	20% to 80%
	Non-Operating	5% to 95%
Altitude	Operating	-1000 ft (-305 m) to +10,000 ft (3.05 km)
	Non-Operating	-1000 ft to +34,000 ft (10.7 km)

POWER

Consumption	Standby			Accessing		
	60 Hz	50 Hz	400 Hz	60 Hz	50 Hz	400 Hz
Amps/Phase	0.8	0.9	1.0	4.4	5.0	2.4
True Power (KW)	0.15	0.18	0.3	0.8	0.8	0.7
Power Factor	0.9	0.9	0.8	0.8	0.8	0.8
BTU/Hour	510	610	1020	2730	2730	2380

Starting Current (Approximate and Non-Linear)

Time	208V	220V
0-6 seconds	38	40
6-8 seconds	38	25
8-10 seconds	20	12
10-12 seconds	12	8
12-14 seconds	8	-

POWER CONNECTOR

Unit	Description	Connector	Mating Receptacle
60 Hz	2-pole, 3-wire, with ground, 20 amp, 250v, ac or dc	CDC 94368003 Hubble 2321	CDC 94368004 Hubble 2323
50 Hz	2-pole, 3-wire, with ground, 20 amp, 277v, ac or dc	CDC 94368800 Hubble 2331	CDC 94368801 Hubble 2333

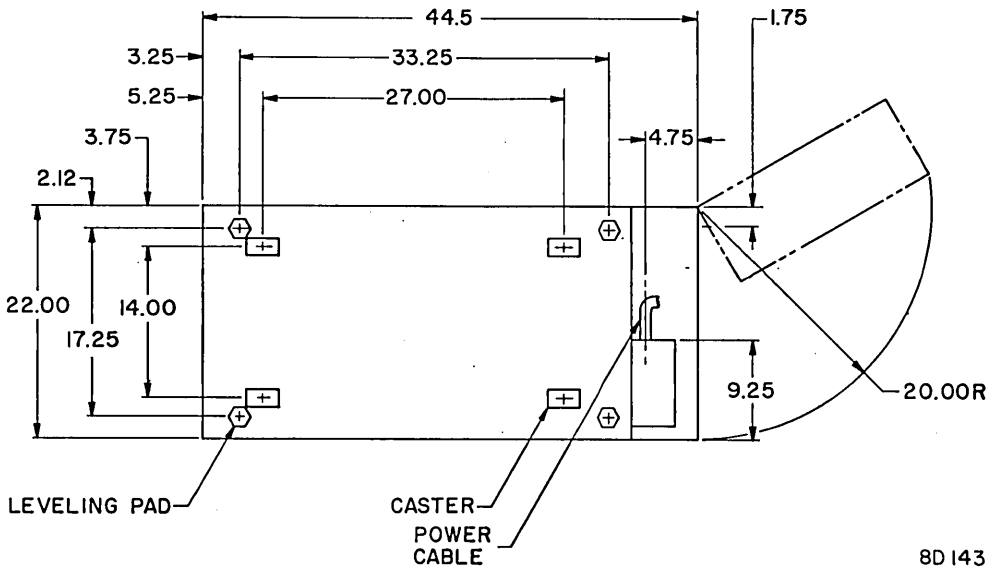


Figure 1-5. Space Requirements

LEVELING PAD INSTALLATION

Install leveling pads on each unit as follows:

1. Remove floor panel and roll cabinet so that one corner hangs over opening in floor.
2. Working from opening, install leveling pad in bottom of unit and screw in until pad clears floor.
3. Repeat steps 1 and 2 for remaining pads.

LEVELING AND ALIGNING CABINET

1. Turn down leveling pads until casters are completely off of floor.
2. Place spirit level on main deck so ends of level point to front and rear of deck.
3. Adjust leveling pads until surface is horizontal within three angular degrees.
4. Place spirit level on main deck so ends of level point toward sides.
5. Adjust leveling pads until surface is horizontal within three angular degrees.
6. 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 Table 1-1.

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.

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 the ac circuit breaker box. Route braided strap with free end into floor cutout.

3. Drill 11/32-inch hole in grid.

4. Secure strap lug to grid using screw (P/N 17901524) and lockwasher (P/N 10126403). Lockwasher 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 93267009). 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 the ac circuit breaker box. 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. Drive farthest from controller has only one ground strap connected to it.

5. Connect controller to earth ground.

AC POWER CONNECTIONS

Each drive receives its 50 or 60 Hz power via an eight foot cable having a three-pole connector. This cable originates from the UNIT POWER circuit breaker located in the ac power supply at the rear of the drive. The 400 Hz cabling for each drive must be provided at the site. The 400 Hz cable is connected to terminal board A1TB1 located in the ac circuit breaker box.

All motors in the drive are single phase (connected phase-to-phase for 60 Hz and phase-to-neutral for 50 Hz). Although each drive uses single phase power, three phase power should be available at the site. External phase connections to the drives should be rotated from drive to drive so that each

group of three drives presents a balanced load to a three-phase system.

Phasing is controlled prior to the connector on the drive's cable. Phase assignments of the connector are:

60 Hz

X - Phase A (Brown)

Y - Phase B (Blue)

G - Ground (Green)

50 Hz

X - Phase A (Brown)

W - Neutral (Blue)

G - Ground (Green)

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

SIGNAL CABLING

Each drive communicates with a controller by means of two interconnecting cables. System cables are illustrated in Figure 1-6. Signal functions are listed in Tables 1-2 and 1-3.

CAUTION

When installing I/O cables, use care so that signal pins are not damaged.

The I/O connectors are located on the frame below the logic chassis. There are four I/O connectors provided: two for each channel. Connectors IJ1 and IJ2 are for channel I; IIJ1 and IIJ2 are for channel II.

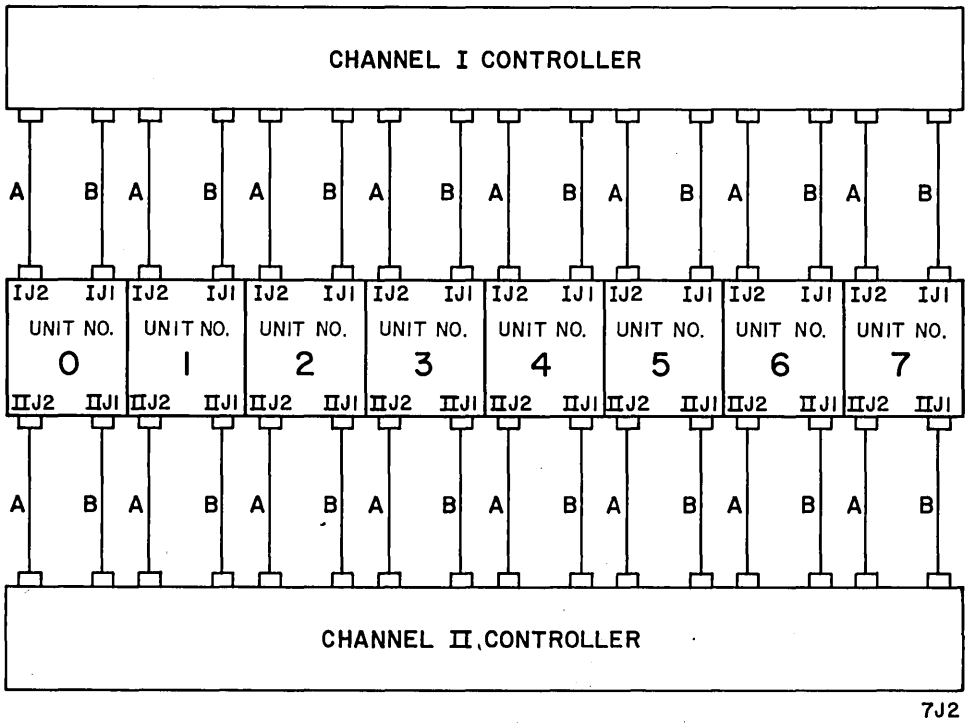


Figure 1-6. System Cabling

TABLE 1-2. "A" CABLE I/O CONNECTOR PIN ASSIGNMENT (J2)

Pin No.	Signal Name
Signals From Unit To Controller	
	Status Bit
1-4	0
2-5	1
3-7	2
8-12	3
10-13	4
11-14	5
15-18	6
16-20	7
17-21	8
22-25	9
74-77	On Sector
75-78	Seek Error
Signals From Controller To Unit	
	Address and Control Bus Bit
23-26	0
24-27	1
28-31	2
29-32	3
30-33	4
34-37	5
35-38	6
36-39	7
40-43	8
41-44	Open Cable Detector
42-45	Difference Select
46-49	Cylinder Select
47-50	Sector Select
48-51	Head Select
52-55	Control Select
53-56	Read Cylinder Status
54-57	Read Difference Status
58-62	Read Head Status
59-63	Read Sector Counter Status
60-64	Read Sector Register Status
65-70	Read Interlock Status
66-71	Read Positioner Status
67-72	Read Fault Status
73-76	Read Control Status

TABLE 1-3. "B" CABLE I/O CONNECTOR PIN ASSIGNMENT (J1)

Pin No.	Signal Name
Signals From Unit To Controller	
x-y	Double Density (Both Grounded To Unit)
A-C	Unit Ready
B-D	Unit Busy
E-H	Unit Selected
F-J	On Line - F = On Line J = gnd
K	Read Data "1" (Coax)
L	Read Clock (Coax)
M	Write Clock (Coax)
Signals From Controller To Unit	
Y-a	Unit Select
Z-b	Release
c-e	Clear All Other Channel Reserves
d-f	Clear Fault
BB-DD	Write Data
$\overline{t}$-$\overline{v}$	Open Cable Detector
P-S	Bit 9 (Address and Control Bus)
CC-EE	Write Strobe
Sequence Power Lines	
h	Power Sequence 0
j	Power Sequence 1
k	Power Sequence 2
m	Power Sequence 3
n	Power Sequence 4
P	Power Sequence 5
r	Shield (Not Grounded To Unit)
Miscellaneous	
$\overline{s}$	Ground

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. Turn off both UNIT POWER circuit breakers.

2. Turn off all dc power supply circuit breakers.

CAUTION

Bearing damage can occur if media cleaning solution runs into spindle.

3. Wipe spindle clean with lint-free gauze that is slightly dampened (not soaked) with media cleaning solution.

4. Using vacuum cleaner, remove dust or dirt from interior of shroud and cabinet.

5. Open cabinet rear door. Verify that all logic chassis cards are firmly seated in their connectors. Check all miscellaneous connectors to see that they are properly seated.

6. Open top cover and remove deck cover.

7. Check that logic cards next to actuator assembly are firmly seated. Check that head connectors are properly seated.

8. Replace deck cover and close top cover.

9. Verify that drive is connected to external power source and that source circuit breaker is on.

10. Turn on UNIT POWER circuit breakers. Determine that blower motor and elapsed time meter begin to operate.

11. If START switch indicator is lighted, press switch to turn off indicator.

12. Set LOCAL/REMOTE switch on power supply to LOCAL.

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 turned on will power up in sequence.

13. 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
- TAG LINE SELECT switch to INTERLOCK

14. Turn on all dc power supply circuit breakers. Verify the following:

a. All output voltages are at nominal values.

b. All control panel lights off, except MAINTENANCE is on.

c. ADDRESS & CONTROL BUS indicators are as follows:

Bit	State	Function
0	on	Pack On
1	on	Interlocks Closed
2	off	Heads Loaded
3	off	Load Heads
4	off	START switch
5	on	LOCAL
6	off	Motor On
7	on	Cooling Air OK
8	on	Logic Temp OK

15. Install clean scratch pack as directed in Section 2.

16. Open top cover from rear and remove deck cover.

17. Remove one of the voice coil wires. This will prevent the heads from loading.

NOTE

Only one drive should be accelerating the pack at a time. The second drive may be started after the first drive reaches operating speed (approximately 15 seconds).

18. Press the START switch. Observe the following:

a. START indicator lights.

b. Spindle motor starts.

Purge unit in this mode for one minute.

19. Stop unit and replace voice coil wire.

20. Press START switch. Observe the following:

a. START indicator lights.

b. Spindle motor starts.

c. Bits 3, 4, and 6 of ADDRESS & CONTROL BUS light.

21. When first seek interlock delay is complete (approximately 15 seconds), heads will load to cylinder 000. Verify the following:

a. Unit Number indicator on operator control panel lights.

b. ADDRESS & CONTROL BUS indicator bit 2 turns on; bit 3 goes out.

22. Set ON LINE/OFF LINE/WRITE DISABLE switch to ON LINE.

23. Check head/arm alignment. If necessary, perform Head/Arm Alignment procedure in Corrective Maintenance section.

24. Perform required controller/system checks.

If unit fails to power down, refer to Normal Power Off Sequence in Theory of Operation section of Reference manual.

CAUTION

If unit fails to power down when START switch is pressed, disconnect yellow leadwire to voice coil and manually unload heads to clear disk pack before troubleshooting malfunction. Refer to Corrective Maintenance section of this manual.

25. To stop spindle motor, press operator START switch. To remove power to drive, turn off both UNIT POWER circuit breakers.

SECTION 2

PREVENTIVE MAINTENANCE

SCOPE

Maintenance procedures listed within this section are written so that a person familiar with the procedure need only read up to the colon in each step of the procedure. Information listed after the colon is a detailed account of how to perform that step. It is recommended that before performing any maintenance procedure that the entire procedure be read.

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 six 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 Preventive Maintenance column (Table 2-1) lists the title of the paragraph containing the required instructions.

TABLE 2-1. PREVENTIVE MAINTENANCE INDEX

Level*	Est.Time (Minutes)	Procedure
3	10	Inspect actuator assembly
3	1	Clean pack access cover glass
3	10	Clean primary air filter
3	2	Check power supply outputs
4	1	Clean shroud and spindle
4	2	Clean and lubricate lockshaft
4	5	Clean carriage rails and bearings
4	120	Check head/arm alignment
6	20	Replace absolute air filter

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

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 - Anually or 6,000 hours (no preventive maintenance scheduled)

Level 6 - Biennially or 9,000 hours

PREVENTIVE MAINTENANCE MATERIALS

The materials used in the procedures of this section are listed in Table 2-2.

TABLE 2-2. PREVENTIVE MAINTENANCE MATERIALS

Material	Source
Detergent	Commercially available
Filter Coat	CDC* 12210958
Lint-Free Gauze	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. Remove disk pack: Press START switch to stop spindle motor. Open pack access cover,remove disk pack and close access pack cover.

2. Open cabinet rear door and set UNIT POWER circuit breakers to OFF.

3. Remove voice coil yellow leadwire: Open cabinet top cover and remove deck cover. Remove voice coil yellow leadwire.

4. Inspect entire actuator for presence of dust and other foreign materials. Pay particular attention to the following areas:

   a. Circular cutout in face of magnet assembly (receives voice coil).

   b. Rail surfaces (particularly horizontal surfaces) or carriage track on which carriage and bearing assembly travels.

5. Clean actuator area: Use lint free gauze dampened with media cleaning solution (not soaked) to remove deposits or attracted particles.

6. Clean rails and bearings: Refer to Manually Positioning Carriage With Power Off (located in Section 3 of this manual) and install head cam tool. Refer to Clean Carriage Rails and Bearings procedure (located in this Section) for method of cleaning rails and bearings.

7. Remove head cam tool.

8. Check that heads are fully retracted. Install voice coil yellow leadwires.

9. Install deck cover and close cabinet top cover.

10. Set UNIT POWER circuit breakers to ON and close cabinet rear door.

CLEAN PACK ACCESS COVER GLASS

1. Remove disk pack: Press START switch to stop spindle motor. Open pack access cover and remove disk pack (leave cover open).

2. Clean pack access cover glass (both sides): Use a lint-free gauze dampened (not soaked) with media cleaning solution to remove smudges and deposits from the glass (both sides) in the pack access cover. Close pack access cover.

CLEAN PRIMARY AIR FILTER

1. Remove disk pack: Press START switch to stop spindle motor. Open pack access cover, remove disk pack and close pack access cover.

2. Open cabinet rear door and set UNIT POWER circuit breakers to OFF.

3. Remove primary air filter: Remove cabinet front panel and set panel aside. Remove primary air filter from bottom of air supply assembly at front of cabinet (Figure 2-1) by pressing upward on clips while pulling filter out. Remove filter from air supply.

4. Clean primary air filter: Agitate filter in a mild detergent solution. Thoroughly flush filter with water from a low pressure nozzle. Shake any excess water from filter and allow filter to dry.

5. Spray primary air filter with filter coat: When filter is completely dry, thoroughly coat both sides of the filter with Filter Coat spray.

6. Install primary air filter: Position primary air filter in bottom trough of air supply. While pressing upward on retaining clips, push filter against air supply and release retaining clips. Check that filter is properly seated in air supply. Install cabinet front panel.

7. Set UNIT POWER circuit breakers to ON and close cabinet rear door.

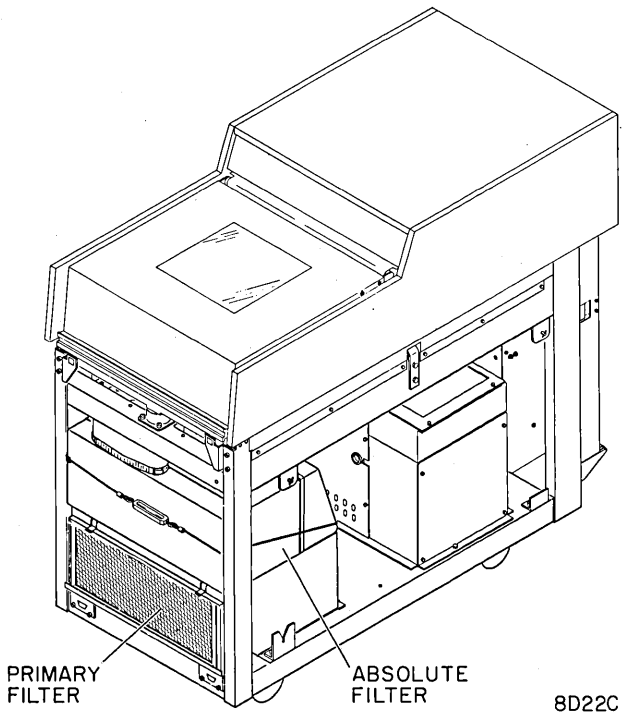


Figure 2-1. Cabinet Air Filters

CHECK POWER SUPPLY OUTPUTS

1. Install a scratch pack: Press START switch to stop spindle motor. Open pack access cover, remove customer disk pack. Install scratch disk pack and close pack access cover.

2. Connect Off Line Tester to drive: Open cabinet rear door. Set UNIT POWER circuit breakers to OFF. Remove logic chassis card cover. Install Off Line Tester as directed in Reference manual. After tester is installed set the UNIT POWER circuit breakers to ON. Leave cabinet rear door open.

3. Load Heads: Press START switch to start spindle motor and to load heads.

4. Using Off Line Tester command repeat seeks between cylinder 0 and 32. (See Reference manual for tester operating procedures.)

5. Measure output voltages at corresponding test jacks on logic chassis maintenance panel: Using an ac/dc volt/ohmmeter measure the following test points on the logic chassis maintenance panel (located on inside, and at top of cabinet rear door):

   a. Measure +5v. Meter shall read +4.95 to +5.05 volts dc. If voltage is not within limits, adjust potentiometer shaft on edge of +5v regulator board (refer to Section 3 of this manual).

   b. Measure -5v. Meter shall read -4.95 to -5.05 volts dc. If voltage is not within limits, adjust potentiometer shaft on edge of -5v regulator board (refer to Section 3 of this manual.)

6. Remove disk pack: Press START switch to stop spindle drive motor. Open pack access cover, remove disk pack and close pack access cover.

7. Disconnect Off Line Tester: Set UNIT POWER circuit breakers to OFF. Disconnect tester from drive. Install logic chassis card cover. Set UNIT POWER circuit breakers to ON and close cabinet rear door.

LEVEL 4 MAINTENANCE PROCEDURES

CLEAN SHROUD AND SPINDLE

1. Remove disk pack: Press START switch to stop spindle motor. Open Pack access cover and remove disk pack (leave pack access cover open).

2. Clean shroud: Using lint-free gauze that is slightly dampened (not soaked) with media cleaning solution, wipe shroud to remove all dirt and smudges.

CAUTION

Do not allow media cleaning solution to run into spindle or bearing damage could occur.

3. Clean spindle: Using lint-free gauze that is slightly dampened (not soaked) with media cleaning solution, wipe spindle top surface to remove all dirt and smudges.

4. Remove any remaining particles: Use a wad of adhesive-type tape and pick up any particles that were not picked up with gauze.

5. Close pack access cover.

CLEAN AND LUBRICATE LOCKSHAFT

1. Remove disk pack: Press START switch to stop spindle drive motor. Open pack access cover and remove disk pack (leave pack access cover open).

2. Clean top of spindle: Use (dry) lint-free gauze and a brush or sharp instrument to clean lockshaft threads on top end of spindle.

3. Lubricate lockshaft: Apply a thin coat of lubricant paste to the lockshaft threads.

4. Check lockshaft movement: Check for free movement of lockshaft by depressing lockshaft and checking that it freely returns to its original position. If lockshaft does not depress or stays depressed, replace lockshaft.

5. Close pack access cover.

CLEAN CARRIAGE RAILS AND BEARINGS

1. Remove disk pack: Press START switch to stop spindle motor. Open pack access cover and remove disk pack (leave pack access cover open).

2. Open cabinet rear door and set UNIT POWER circuit breakers to OFF.

3. Install head cam tool: Install head cam tool per Manual Carriage Positioning With Power Off procedure (located in Section 3 of this manual).

4. Open cabinet top cover and remove deck cover. Clean rails and bearings per following steps:

   a. Using lint-free gauze that is slightly dampened (not soaked) with media cleaning solution, wipe rails and bearing surfaces (Figure 2-2).

   b. Check rail and bearing cleanliness by manually moving carriage through operating range. If any resistance to free rolling is encountered,clean rails and bearings again. If problem still exists, have a qualified CE inspect actuator.

5. Remove head cam tool: Fully retract carriage and remove head cam tool.

6. Install voice coil yellow leadwire.

7. Set UNIT POWER circuit breakers to ON and close cabinet rear door.

8. Install deck cover. Close cabinet top cover and pack access cover.

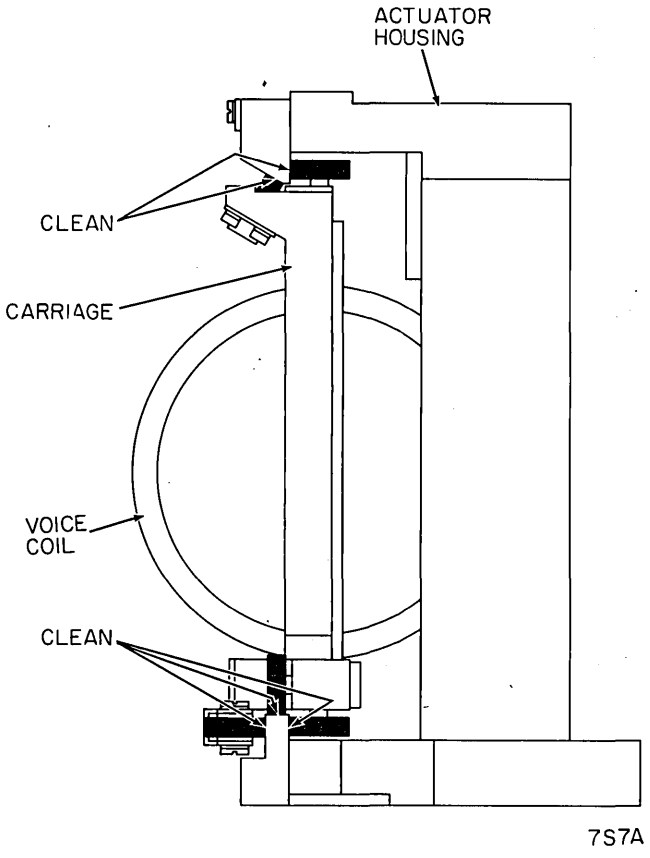


Figure 2-2. Carriage Rails and Bearings

LEVEL 6 MAINTENANCE PROCEDURES

REPLACE ABSOLUTE AIR FILTER

1. Remove disk pack: Press START switch to stop spindle motor. Open pack access cover, remove disk pack and close pack access cover.

2. Open cabinet rear door and set UNIT POWER circuit breakers to OFF.

3. Remove cabinet front panel.

4. Remove and clean primary air filter per the Clean Primary Air Filter procedure listed under Level 3 Maintenance Procedures in this section. (Do not install primary air filter until instructed to do so.)

5. Remove absolute filter:

   a. Loosen turnbuckle securing plenum and air filter. Allow wire and turnbuckle to fall free.

   b. Swing air plenum up and remove absolute filter.

6. Install replacement absolute filter:

   a. Position replacement absolute filter in air plenum.

   b. Position wire and turnbuckle over air filter and plenum. Tighten turnbuckle until plenum is secure.

7. Install primary filter: Position primary filter in bottom trough of air supply. While pressing upward on retaining clips, push filter against air supply and release retaining clips.

8. Install cabinet front panel.

CAUTION

In the next step the blower is run for several minutes to purge dust or dirt particles from unit. Do not install a disk pack until after purging unit.

9. Set UNIT POWER circuit breakers to ON (ensure the blower starts). Allow blower to purge unit for two minutes before installing disk pack.

SECTION 3

CORRECTIVE MAINTENANCE

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.

Maintenance procedures listed within this section are written so that a person familiar with the procedure need only read up to the colon in each step of the procedure. Information listed after the colon is a detailed account of how to perform that step. It is recommended that the entire step be read before performing any action.

SAFETY PRECAUTIONS

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

- Use care while working with power supply. Line voltages are present inside the ac power assembly.
- Keep hands away from actuator during seek operations and when reconnecting leads to voice coil. (Under certain conditions, emergency retract voltage may be present, causing sudden reverse motion and head unloading.)
- Use caution while working near heads. If heads are touched, fingerprints can damage them. Clean heads immediately if they are touched.
- Keep pack access cover closed unless it must be open for maintenance. This prevents entrance of dust into pack area.
- Keep all watches, disk packs, meters, and other test equipment at least two feet away from voice coil magnet when deck cover is off.
- Do not use customer disk pack; otherwise, customer data may be destroyed.
- Do not use CE alignment disk pack unless specifically directed to do so. These packs contain prerecorded alignment data that can be destroyed if test procedure requires drive to write. This alignment data cannot be generated in the field.
- If drive fails to power down when START switch is pressed (to turn off indicator) disconnect yellow leadwire to voice coil and manually retract heads before troubleshooting malfunction.
- Before manually moving carriage to load heads (disk pack not in place), install head cam tool per Manual Carriage Positioning procedure.
- Make certain that heads are unloaded before turning off power.
- If power to spindle motor is lost while heads are loaded and voice coil leadwire is disconnected, immediately retract carriage. Otherwise heads will crash when disk speed is insufficient to permit heads to fly.

MAINTENANCE PRELIMINARY CONDITIONS

OFF-LINE OPERATIONS

Certain procedures require execution of operational commands (seek, read, etc.). These commands can be generated by the Off-Line Tester. Refer to Reference Manual for instructions on installing and operating Off-Line Tester.

MANUAL POSITIONING OF HEADS WITH POWER OFF

Manually positioning of heads (with power off and/or disk pack removed) requires installation of the head cam tool. Install head cam tool as follows:

1. Remove disk pack: Press START switch to stop spindle drive motor. Open pack access cover and remove disk pack (leave pack access cover open).
2. Open cabinet rear door and set UNIT POWER circuit breakers to OFF.
3. Open cabinet top cover and remove deck cover.
4. Disconnect voice coil yellow leadwire.
5. Install head cam tool as follows:
   a. With one hand, position head cam tool flush against head cam such that it is aligned with similar contour of head cam. Refer to Figure 3-1.
   b. With other hand, move carriage forward until head/arm assemblies completely slide into head cam tool but do not protrude out of it.
   c. Move head cam tool along with forward movement of head/arm assemblies until head/arm assembly cam surfaces pass free of the head cam.

d. Release hold on head cam tool. Carriage is now free to move without damaging heads.

6. Position carriage as required for maintenance procedure.

7. Remove head cam tool as follows:

   a. Retract carriage until head/arm cam surfaces begin to contact head cam.

   b. Grasp head cam tool using one hand.

   c. With other hand, retract carriage until head/arm assemblies release hold on head cam tool. Remove tool.

8. Install voice coil yellow leadwire.

9. Install deck cover, close cabinet top cover and pack access cover.

10. Set UNIT POWER circuit breakers to ON and close cabinet rear door.

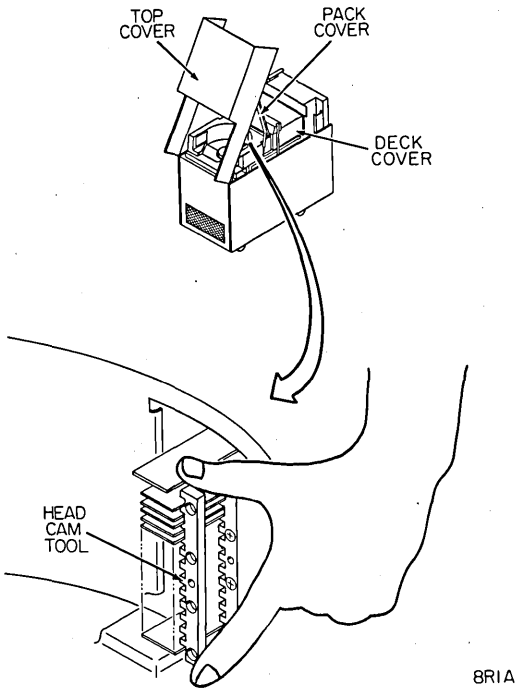


Figure 3-1. Head Cam Tool Installation

MANUAL POSITIONING OF HEADS WITH POWER ON

CAUTION

Manual loading and unloading of heads is not recommended unless required by the maintenance procedure.

Manually positioning of heads (with power on and disk pack up to speed) is possible if the voice coil yellow leadwire is removed. Manually position carriage as follows:

1. Observe following safety precaution during manual carriage operation.

   - Make certain that heads are unloaded before turning power off.

   - If power to spindle motor is lost while heads are loaded and voice coil leadwire is disconnected, immediately retract carriage. Otherwise heads will crash when disk speed is insufficient to permit heads to fly.

   - When positioning heads, do not use excessive downward force on coil.

   - Before reconnecting yellow leadwire, make sure fingers and tools are clear of coil and actuator. Rapid positioner movement will occur if difference counter contains a value other than 1023 or if an emergency retract condition exists.

NOTE

Do not use a CE disk pack unless specifically directed to do so. Use only the type of pack called for in the maintenance procedure.

2. Install disk pack: Press START switch to stop spindle drive motor. Open pack access cover, install disk pack and close pack access cover.

3. Press START switch and allow a normal power-up first seek.

4. Open cabinet top cover and remove deck cover.

5. Disconnect voice coil yellow leadwire.

6. Position carriage by grasping flange of coil assembly cap with fingers and moving forward or backward.

7. Perform desired maintenance procedure(s).

CAUTION

Keep hands away from actuator.

8. Install voice coil yellow leadwire.

9. Install deck cover and close cabinet top cover.

MAINTENANCE TOOLS AND MATERIALS

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

ELECTRICAL CHECKS AND ADJUSTMENTS

INTRODUCTION

The electrical checks and 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 checks and adjustments are divided into four sections:

- Power Supply Checks - Checks power supply voltages, power sequencing, and data protection sensing.
- Servo Circuit Checks and Adjustments- Checks and adjusts circuitry involved in moving actuator to selected cylinder.
- Read/Write Circuit Checks and Adjustments - Checks read signal amplitude and checks/adjusts read recovery timing.
- Miscellaneous Logic Checks - Checks logic and circuits not included above, such as power up blanking, start/stop time, sector sensing, etc.

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

POWER SUPPLY CHECKS

Introduction

The first power supply check, 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 3-2 is a troubleshooting guide that will assist in isolating malfunctions. Locations of parts within the circuit breaker box are illustrated in Figure 3-3; locations of parts within the ac power supply are illustrated in Figure 3-4, and locations of parts within the dc power supply are illustrated in Figure 3-5.

CAUTION

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

Sequencing Function Checks

This procedure provides a quick check of the power supply sequencing. Proceed as follows:

1. Install a scratch disk pack: Press START switch to stop spindle drive motor. Open pack access cover, remove customer disk pack, install scratch disk pack and close pack access cover.
2. Open cabinet rear door and set all power supply circuit breakers to OFF.
3. Set LOCAL/REMOTE switch to REMOTE.
4. Open top cover from rear. Remove deck cover.
5. Disconnect yellow leadwire from voice coil.
6. Set ON LINE/OFF LINE/WRITE DISABLE switch to OFF LINE.
7. Set TAG LINE SELECT switch to INTERLOCK.
8. Set UNIT POWER circuit breakers to ON.
9. Check if blower motor is operating. If not, check:
   a. Site ac power available at terminal board A1CB1.
   b. UNIT POWER circuit breakers.
   c. Relay A1K4.
   d. +20Y supply as described below.
10. Check that +20Y indicator on dc power supply panel lights. If not, check for +22v at A2TB1-16 (terminal board on back of logic chassis). If present, bulb is defective. If absent, check +20Y fuses. If fuses are good, check dc power supply rectifier A1CR1-2+ and transformer A1T3.
11. Set +10v and -10v circuit breakers to ON.
12. Set LOCAL/REMOTE switch to LOCAL. Check that MAINTENANCE indicator on operator panel lights. If not:

TABLE 3-1. CORRECTIVE MAINTENANCE TOOLS AND MATERIALS

Description	Part Number	Description	Part Number
Actuator Stop Adjustment Tool	CDC* 87008000	None-Mettalic Feeler Gage, 0.005 inch	CDC 12205600
Adapter (3/16 Hex to 1/4 Sq)	CDC 12262582	Oscilloscope, Dual Trace	Tektronix 454 or equivalent
Ball End Hex Driver (3/16 Hex)	CDC 12263201	Oscilloscope Hood	Tektronix 016-0083-00
Card Extender (Half-Size)	CDC 54099700	Pin Straightener	CDC 87369400
Card Extender (Full-Size)	CDC 54109700	Pulley Gage	CDC 87098800
Card Extraction Tool	CDC 87399200	Push-Pull Gage	CDC 12210797
Carriage Alignment Arm	CDC 87007900	Rail Adjustment Tool	CDC 87053600
Carriage Alignment Ring	CDC 87389800	Removal Tool, 20-30 Gage	CDC 12259183
CE Disk Pack	CDC 70430003	Scope Probe Tip (Hatchet Type)	CDC 12212885
Chip Extender-Chip Cliplog	CDC 12212196	Shim Assortment (used for carriage stop adjustment when replacing actuator)	CDC 75039400
Disk Pack (9883-61)	CDC 70430501		
Offline Tester	CDC 86073405	Spindle Adjustment Tool	CDC 87059900
Grease, Slicone	CDC 95109000	Torque Screwdriver	CDC 12218425
Head Adjustment Tool	CDC 75009100	Torque Screwdriver Bit	CDC 87016701
Head Alignment Card	CDC 54226505	Torque Wrench, 1/4 inch	CDC 12263205
Head Cam Tool	CDC 72842700	Volt/ohmmeter	Ballantine 345 or equivalent digital voltmeter
Head Installation and Removal Tool	CDC 73678500		
Loctite, Grade C	Loctite Corp.	Wire Wrap Bit, 30 Gage	CDC 12218402
Loctite Primer, Grade N	Loctite Corp.	Wire Wrap Gun, Electric	CDC 12259111
Media Cleaning Solution	CDC 95033502	Wire Wrap Sleeve, 30 Gage	CDC 12218403

*CDC is a registered trademark of Control Data Corporation.

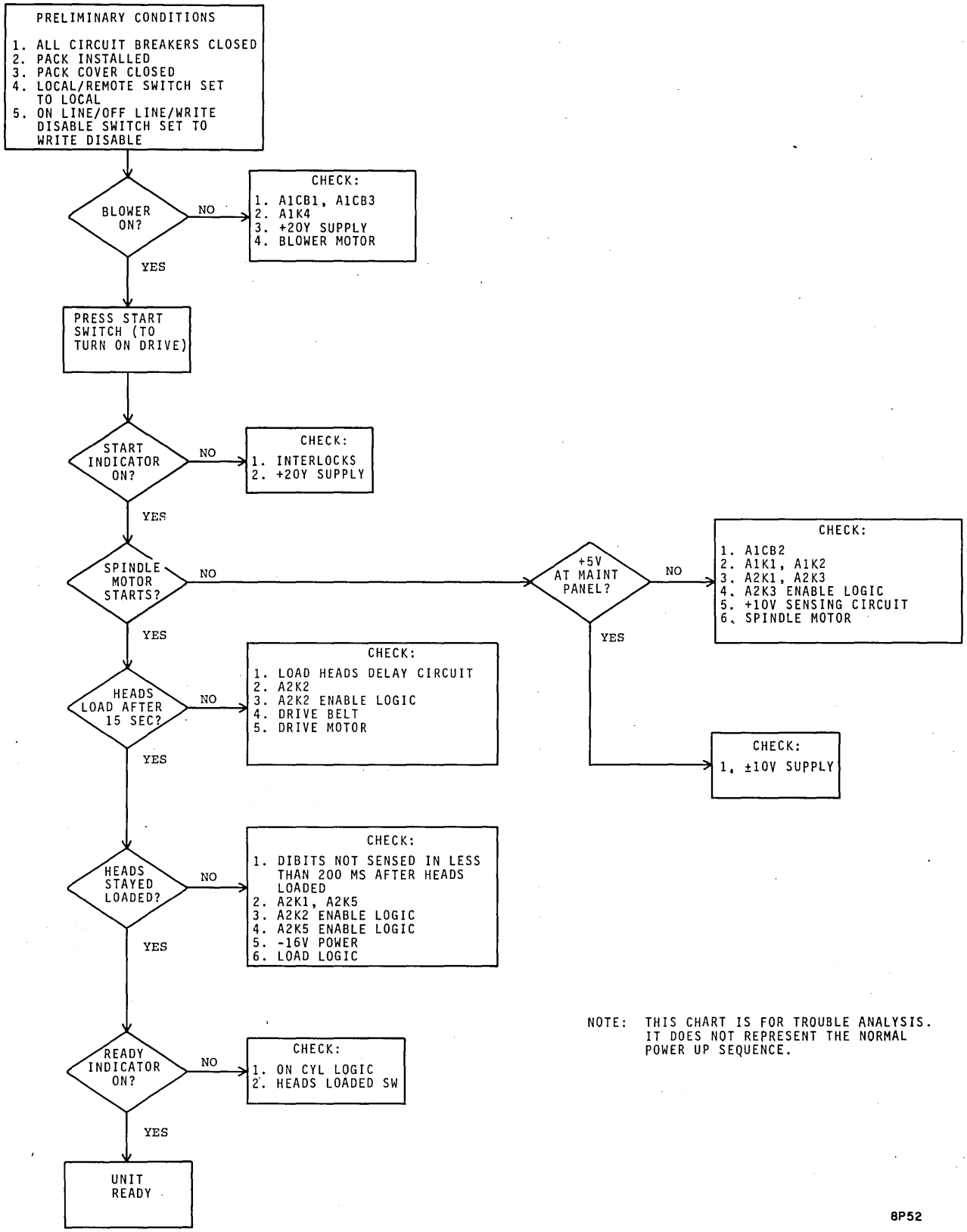


Figure 3-2. Power Sequencing Trouble Analysis Chart

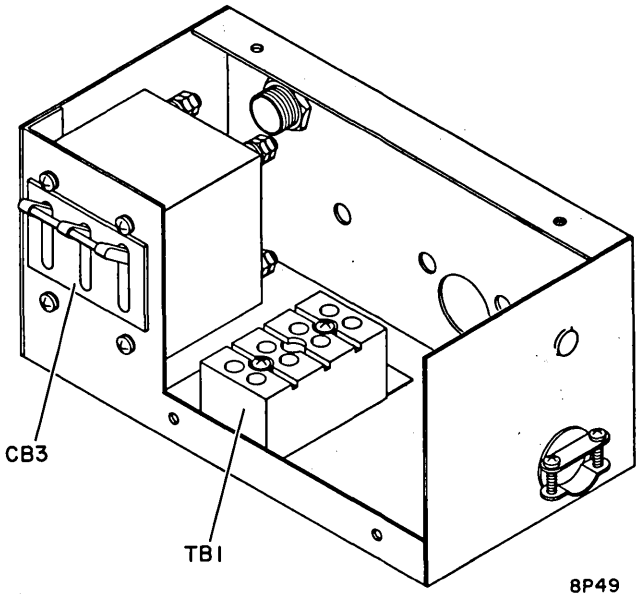


Figure 3-3. Circuit Breaker Box Locator

a. Measure from +5v test point on maintenance panel to ground. If +5v present, proceed directly to step c; if absent, proceed to step b.

b. Set +20v and -20v circuit breakers to ON. 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.

c. This step applies if +5v is present in step a. Problem is caused by lack of operator panel lamp power or faulty logic. Measure from terminal A2TB1-5 to ground. If +20v, check lamp driver logic. If not +20v, sensing board A2A3 (+10v sense) is not supplying power to lamps on operator panel; perform Data Protection Sensing Check.

d. This step applies if voltage other than +5v could be measured in step b. Problem is lack of +5v. Measure from terminal A2TB1-3 to ground. If +10v is not present at terminal A2TB1-3, check voltage at circuit breaker A2CB2-2. If voltage at circuit breaker A2CB2-2 is 10v, regulator A2A3 is faulty. If 10v is not present, check circuit breaker A2CB2, rectifier CR5-6+, and terminal A1T2.

13. Set remaining circuit breakers to ON.

NOTE

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

14. Press START switch to start spindle drive motor. If START indicator does not light, check interlocks. Observe that spindle motor starts.

15. Wait 15 seconds (for load heads delay to time-out), then manually move actuator forward until heads loaded switch transfers. Bit 2 on maintenance panel lights when TAG LINE SELECT switch is set to INTERLOCK.

16. Check following ADDRESS & CONTROL BUS indicators on maintenance panel.

Bit	Correct State	Function	If wrong, check
0	on	Pack On	Switch (motor will not start)
1	on	Control Interlocks	Switch (motor will not start)
2	~~off~~ on	Heads Loaded	Switch
3	off	Not Load Heads	Switch
4	on	START	Switch (lamp will not light)
5	on	LOCAL	Switch (dc voltages disabled)
6	on	Spindle Motor	Relay A2K3 and logic
7	on*	Logic Cooling Air	Switch/dirty filter
8	on*	Logic Temp	Switch/dirty filter

*When on, indicate that temperature is normal.

17. Continue to move actuator forward until heads are fully loaded on pack, then retract actuator until head/arm cam surfaces begin to touch head cam. Stop retract motion at this position.

18. Reconnect yellow leadwire to voice coil. It should not retract. If it does perform Data Protection Sensing Check. (Retract relay A2K5 is de-energized, causing emergency retract condition.)

MAY GET FAULT

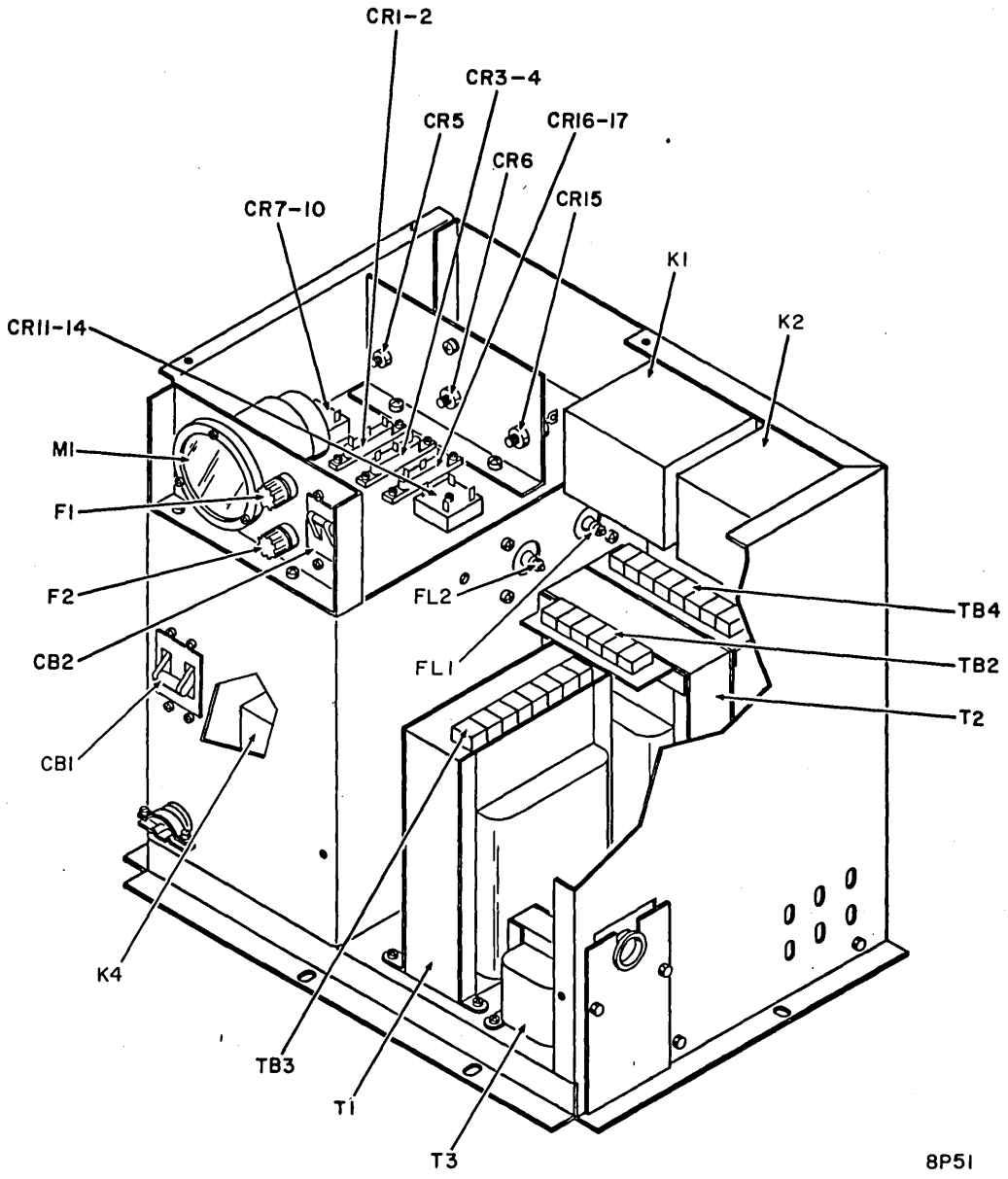


Figure 3-4. AC Power Supply Locator

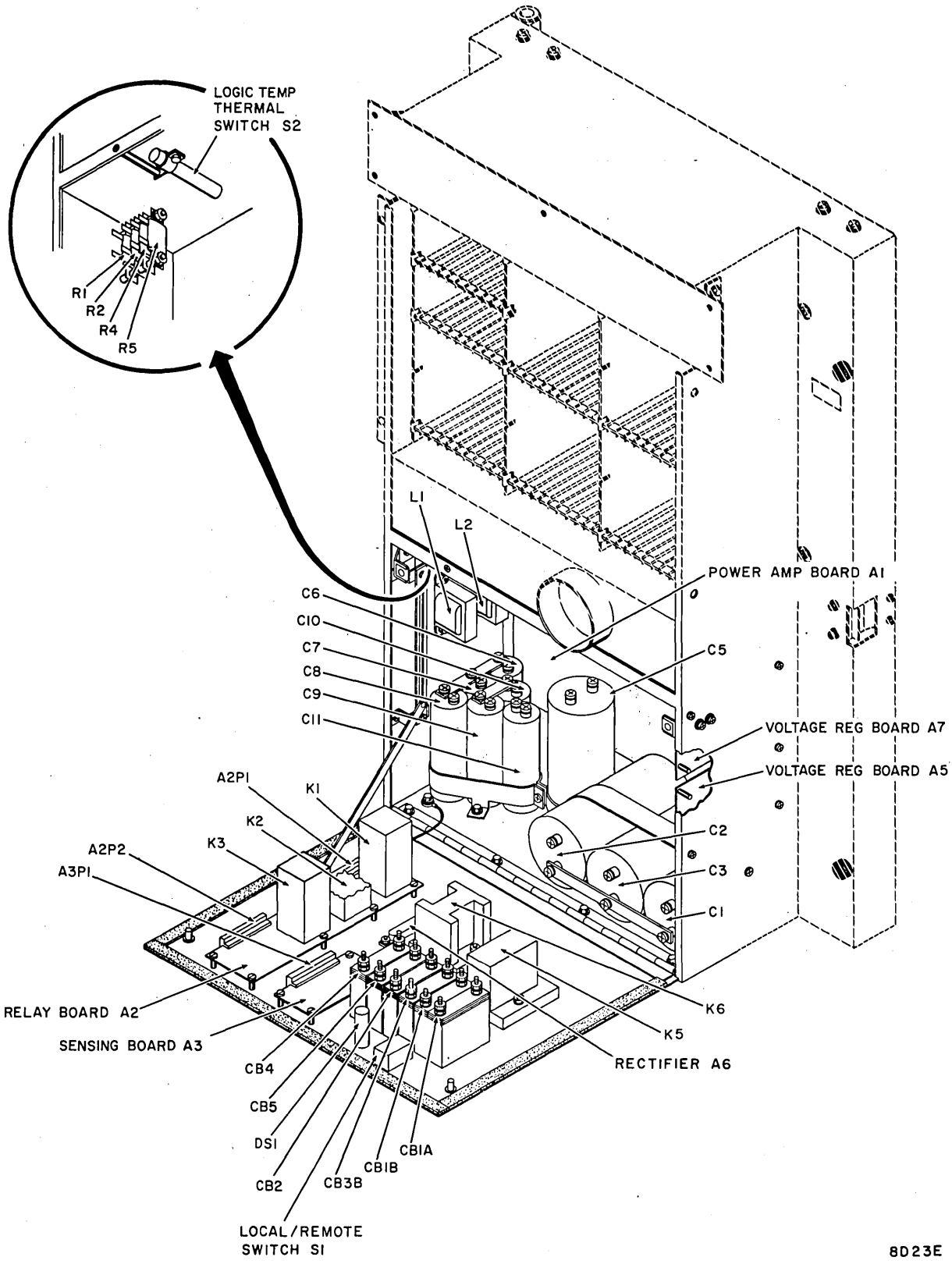


Figure 3-5. DC Power Supply Locator

19. Set UNIT POWER circuit breaker (~~15A~~ 9A) to OFF. Carriage must immediately retract (simulated emergency retract condition). If not, immediately retract heads manually to prevent them from crashing as spindle motor slows. Check retract relay A2K5 for sticking and check actuator for open coil or broken straps.

Output Voltages Check

Perform the following check with the drive performing continuous 256-track seeks. The +5v and -5v adjustment procedures are located in Check Power Supply Outputs of Section 2 in this manual. The other voltages are not adjustable. With the exception of the +46v, -46v, and +20Y power, all measurements should be made by connecting a voltmeter between the applicable test point and ground on the maintenance panel. The following voltages shall be present:

1. +20 (+2.4, -0.2) vdc.
2. -20 (-2.4, +0.2) vdc.
3. +5.10 (±0.05) vdc.
4. -5.10 (±0.05) vdc.
5. Measure +20Y by connecting positive lead of meter to terminal A2TB1-~~13~~ 13 and negative lead to ground. It must be +22 (±2.5) vdc. This terminal board is on the wire wrap side of the logic chassis.
6. Measure +46v and -46v at terminal board A2TB2 on the back of the logic chassis. Ground is available on terminal A2TB2-3.
   a. +46 (±2) vdc at terminal A2TB2-10.
   b. -46 (±2) vdc at terminal A2TB2-11.

Interlock Switches Check

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

1. Open cabinet rear door and set LOCAL/REMOTE switch on power supply to REMOTE.
2. Set all circuit breakers to ON.
3. Close all covers.
4. Press START switch (to light indicator). Indicator must light; if not, check interlock test points specified in following step. If they are all at ground, remove lens and lamp; check socket for +20v and ground.
5. Check interlock circuit at three test points on terminal boards on wire wrap side of the logic chassis. The following test points will be at ground potential if the specified conditions are met:
   a. Terminal A2TB2-15 is at ground if +10v and -10v circuit breakers auxiliary contacts are closed.
   b. Terminal A2TB1-11 is at ground if condition a is met and if +46v, -46v and ±20v circuit breakers auxiliary contacts are closed.
   c. Terminal A2TB1-10 is at ground if conditions a and b are met and if pack cover is closed.
   d. Terminal A2TB1-14 is at ground if conditions a, b, and c are met and START switch is on.
6. Open pack access cover. START indicator must go out; if not, pack cover interlock may be defective.
7. Close pack access cover and note that START indicator lights again.
8. Press START switch (to turn off indicator) and turn off all circuit breakers.

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. Remove disk pack: Press START switch to stop spindle drive motor. Open pack access cover, remove disk pack and close pack access cover.
2. Open top cover from rear and remove deck cover.
3. Disconnect voice coil yellow leadwire.
4. Open cabinet rear door and set all circuit breakers to ON.
5. Press (to light indicator) START switch.
6. Set LOCAL/REMOTE switch on power supply to LOCAL. Observe the following:
   a. Drive motor does not start. If it does, check that bit 0 (Pack On) indicator of ADDRESS AND CONTROL BUS indicators is off. If it is on, pack on switch is misadjusted or defective, proceed to step b.

b. Check that bit 6 (Spindle Motor) is off. If on, motor relay A2K3 is energized; logic is defective. (Motor should not start with pack off. Also, if motor does start, speed relay A2K2 should not pick: without pack installed, lack of sector pulses should inhibit speed enable.)

c. Bit 1 indicator (Control Interlocks) should be on.

7. Press (to turn off indicator) START switch.

8. Install a scratch disk pack: Open pack access cover, install scratch disk pack and close pack access cover. Verify that bit 0 lights.

9. Press (to light) START switch. Observe effects specified in steps 10 and 11.

10. Spindle motor must start. If not:

a. Check for ground at logic pin B12-8A. If at +20v, logic is faulty. If at ground, wiring or +10v sense of sensing board A2A3 is faulty. (The +10v sense is required to pull speed relay A2K2 and motor relay A2K3.

b. Check if motor relay A2K3 is energized. If it is energized, check motor relays A1K1 and A1K2. If they are energized, check motor.

Normally, speed is attained before completion of load heads delay (15 sec). This energizes speed relay A2K2 which, in turn, energizes retract relay A2K5. If spindle motor is not up to speed before completion of load heads delay, speed detection enable circuit is disabled by Speed Enable FF and speed relay A2K2 remains de-energized. Heads cannot load during load heads delay.

11. When up to speed, and with TAG LINE SELECT switch set to INTERLOCK, manually move actuator forward until heads loaded switch transfers. Bit 2 on maintenance panel lights when TAG LINE SELECT switch is set to INTERLOCK. Holdback relay A2K6 must be energized. If not, heads loaded switch is faulty or misadjusted.

12. Press (to extinguish) START switch. Motor must not start to slow because heads are still loaded. If it does, immediately retract heads to prevent head crashing and check logic.

13. Move actuator to reverse stop. Observe that pack stops rotating.

14. Reconnect voice coil yellow leadwire.

15. Install deck cover and close cabinet top cover.

16. Remove scratch disk pack: Open pack access cover, remove scratch disk pack and close pack access cover.

17. Close cabinet rear door.

Data Protection Sensing Check

This procedure verifies that the sensing function of board A2A3 will prevent writing during an emergency retract. This procedure also checks voltage fault detection and generates an emergency retract condition.

1. Install a scratch disk pack: Open pack access cover, install a scratch disk pack and close pack access cover.

2. Open cabinet top cover and remove deck cover.

3. Disconnect voice coil yellow leadwire.

4. Set ON LINE/OFF LINE/WRITE DISABLE switch to ON LINE.

5. Set TAG LINE SELECT switch on maintenance panel to INTERLOCK.

6. Set all circuit breakers to ON.

7. If necessary, press (to turn off indicator START switch.

NOTE

While performing steps 8 and 9 observe operator panel indicators.

8. Set LOCAL/REMOTE switch to LOCAL. Indicators must not blink except for unit number indicator. Drive motor must not jerk.

9. Set LOCAL/REMOTE switch back to REMOTE. Indicators must not blink and drive motor must not jerk. If conditions of steps 8 and 9 are not met:

a. Check transistors A2A3Q4, Q5 and Q7 (along with their associated circuitry) on sensing board A2A3. This is +10v sense function. Lamp drivers and relays A2K2 and A2K3 also receive power from +10v sense circuit.

b. If +10v power drops, this sensing circuit should drop speed relay A2K2 to prevent write power during emergency retracts, before remainder of dc power decays.

10. Set LOCAL/REMOTE switch to LOCAL.

11. Set ON LINE/OFF LINE/WRITE DISABLE switch to OFF LINE.

12. Discharge emergency retract capacitor by temporarily touching voice coil yellow leadwire to voice coil terminal. Then make sure yellow leadwire is disconnected.

CAUTION

When performing step 13 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.

13. Move actuator forward until bit 2 (Heads Loaded) indicator lights.

14. Fully retract heads.

15. Set TAG LINE SELECT switch to FAULT. Observe that FAULT bit 2 (Current), and bit 4 (-Volt) indicators are on. If not:

    a. Current fault is result of write driver circuitry sensing that heads loaded switch has transferred and that +20v write voltage is off because speed relay A2K2 is de-energized.

    b. -Volt fault is sensed by transistor A2A3-Q1 because heads are loaded and -16v volt emergency retract voltage is inadequate when switch first closes.

16. Reconnect yellow leadwire to voice coil.

17. Press FAULT switch to clear error.

18. Install a scratch disk pack: Open pack access cover, install a scratch disk pack and close pack access cover.

19. Press START switch (to turn on indicator).

20. After heads load, set UNIT POWER circuit breakers to OFF. Observe that carriage immediately retracts. This is emergency retract function provided by capacitor A2C2 and normally closed contacts of retract relay A2K5.

21. Remove scratch disk pack: Open pack access cover, remove disk pack and close pack access cover.

22. Install deck cover and close cabinet top cover.

23. Set UNIT POWER circuit breakers to ON and close cabinet rear door.

Normal Retract Check

This procedure verifies that the sensing function of board A2A3 allows 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 cabinet rear door.

2. Set LOCAL/REMOTE switch to REMOTE.

3. Open cabinet top cover and remove deck cover.

4. Make sure voice coil yellow leadwire is connected to its proper terminal.

5. Set TAG LINE SELECT switch on maintenance panel to INTERLOCK.

CAUTION

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

6. Move actuator forward until bit 2 (Heads Loaded) indicator lights. An immediate hold back force should be encountered. If not:

    a. Check for +5v at maintenance panel. If absent, proceed to step b; if present, proceed to step c.

    b. Check transistor A2A3Q3 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 relay A2K6 malfunctioning. When heads loaded switch transfers, relay A2K6 should be energized to connect 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 circuitry should also prevent the heads from loading onto a slow pack. Proceed as follows:

1. Open cabinet rear door and 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 A2K2.

CAUTION

Perform step 5 gently to prevent damage to relay contacts.

5. Press relay A2K2 clapper. Verify that retract relay A2K5 does not energize. If it does:

   a. Check pin 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 transistors A2A3Q6 and Q2 and their associated circuitry on board A2A3.

6. Replace relay A2K2 relay cover.

7. Close dc power supply.

8. Set LOCAL/REMOTE switch to LOCAL and close cabinet rear door.

SERVO CIRCUIT CHECKS

Figure 3-6 is a simplified diagram of the servo circuit. This illustration indicates the primary test points used for checking and adjusting the servo loop along with a brief explanation of the various signals, their test points, and the applicable checkout procedure. Servo test point waveforms for various forward 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
- Coarse Position Gain Adjustment
- Integrator Gain Adjustment
- Fine Position Offset Adjustment

Because the servo circuit is closed loop, 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. All adjustments must be made on a thermally stable unit with the deck cover installed. For thermal stabilization, perform 256-track repeated seeks for 15 minutes.

Velocity Gain Adjustment

This procedure adjusts the gain of the velocity signal applied to the summing amplifier. The purpose of this procedure is to adjust the track following capability.

1. Install a scratch disk pack: Press START switch to stop spindle drive motor. Open pack access cover, remove customer disk pack (if installed). Install a scratch disk pack and close pack access cover.

2. Connect Off Line Tester to drive: Open cabinet rear door and set UNIT POWER circuit breakers to OFF. Remove logic chassis card cover. Connect Off Line Tester to drive per installation instructions in the Reference manual.

3. Set oscilloscope control settings as follows:

   - CH 1 VOLTS/DIV: 100 mv
   - A TIME/DIV: 5 ms
   - A TRIGGERING: Positive/Internal
   - MODE TRIGGER: CHOP

4. Connect oscilloscope to drive as follows:

   - CH1 to test point D on card C30 (Fine Position Signal, A2405).
   - A Triggering to test point Y on card C30 (square wave generator, X2502).

5. Perform 15 minutes of 256-cylinder repeat seeks for thermal stabilization and stop heads at cylinder 000: Set UNIT POWER circuit breakers to ON. Press START switch to start spindle drive motor and to load heads. Using Off Line Tester, command drive to perform 256-cylinder repeat seeks for 15 minutes. Stop heads at cylinder 000.

NOTE

Perform test at cylinder 000 and then retest at cylinder 822.

6. Enable square wave generator: Remove back panel from cabinet rear door. Connect a wire from C30-01A to C30-16B.

7. Adjust vertical position control on scope to move trace up until area "A" in Figure 3-8 is centered on the middle graduation of scope.

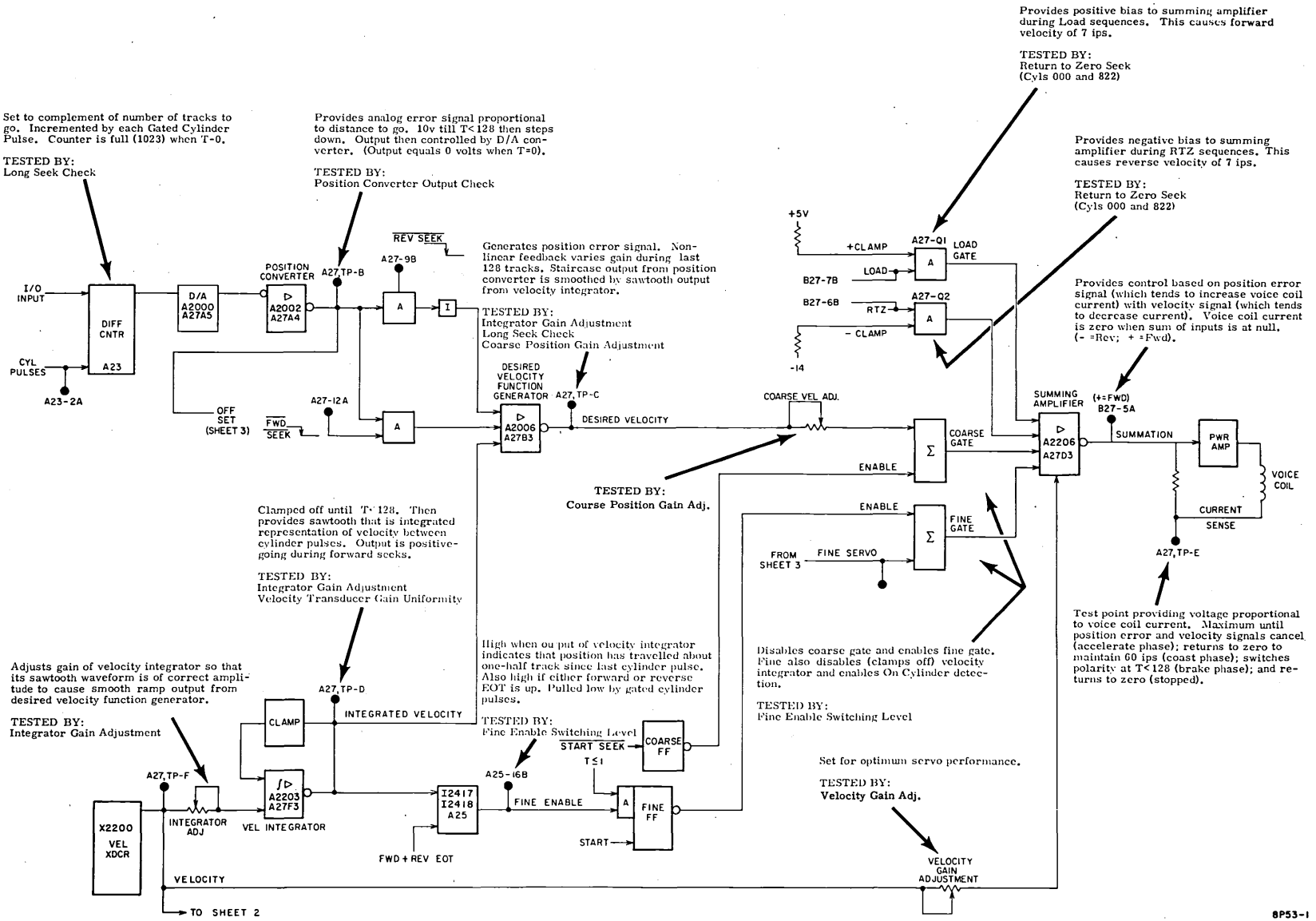


Figure 3-6. Servo System Test Points (Sheet 1 of 3)

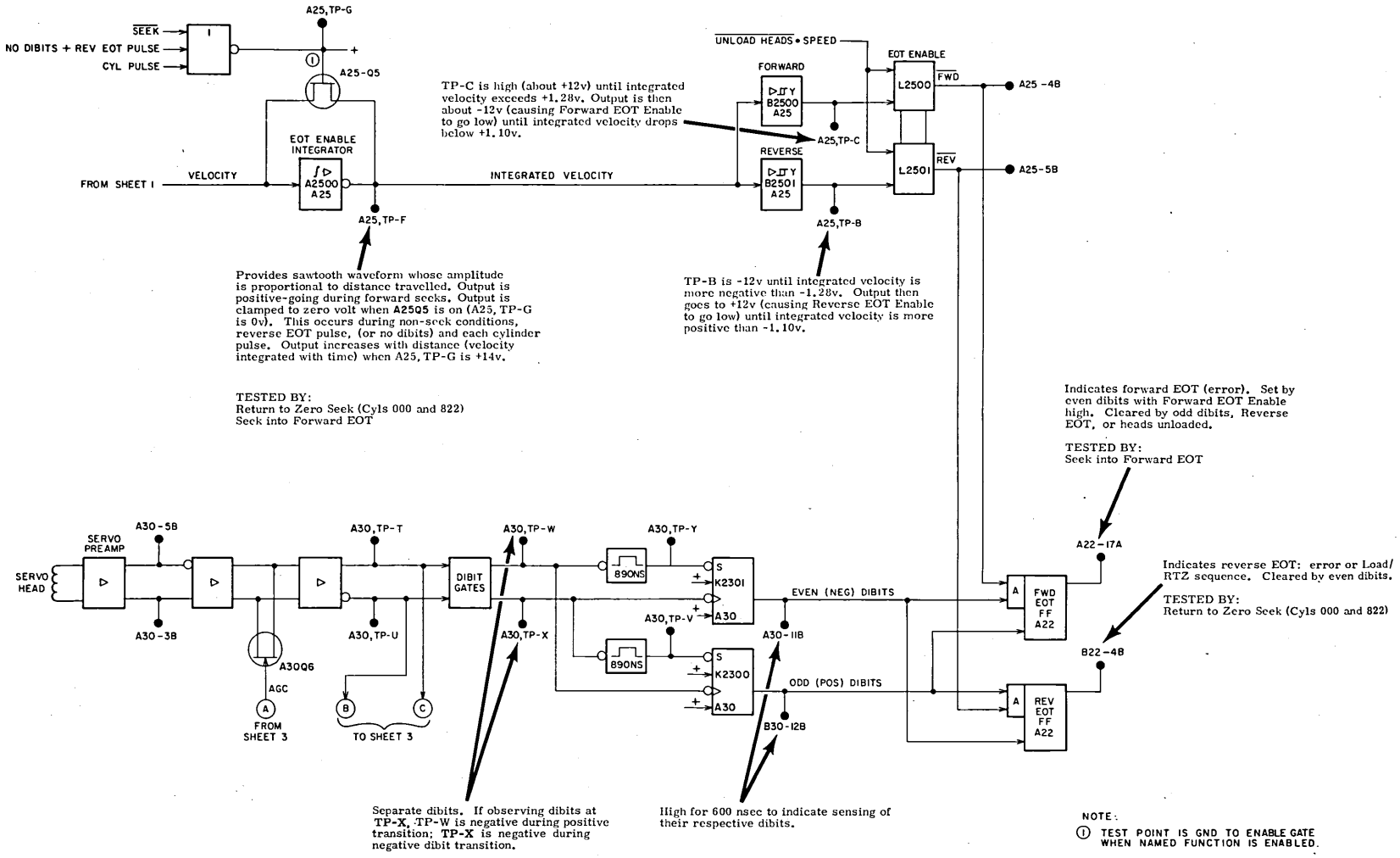


Figure 3-6. Servo System Test Points (Sheet 2 of 3)

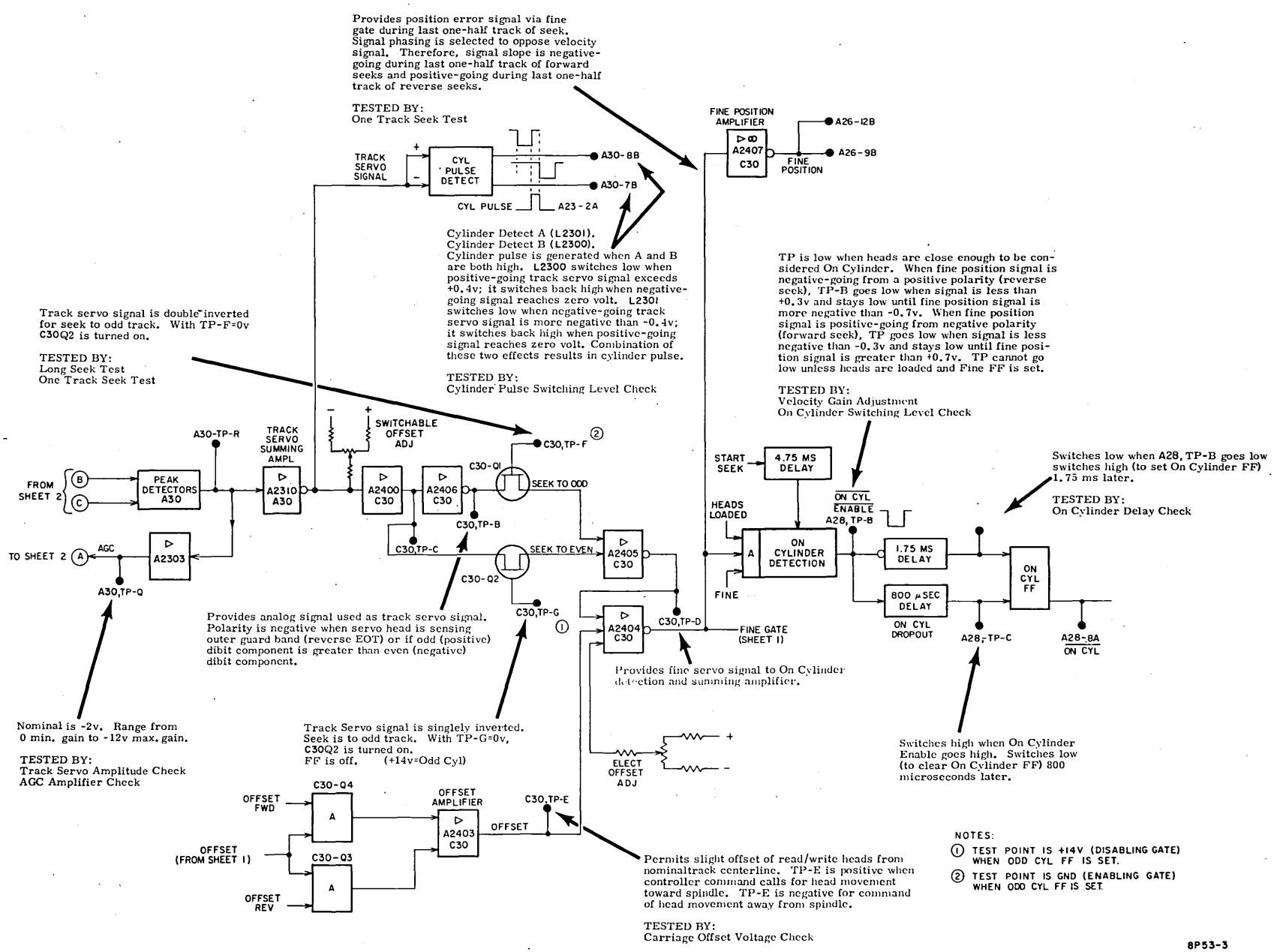
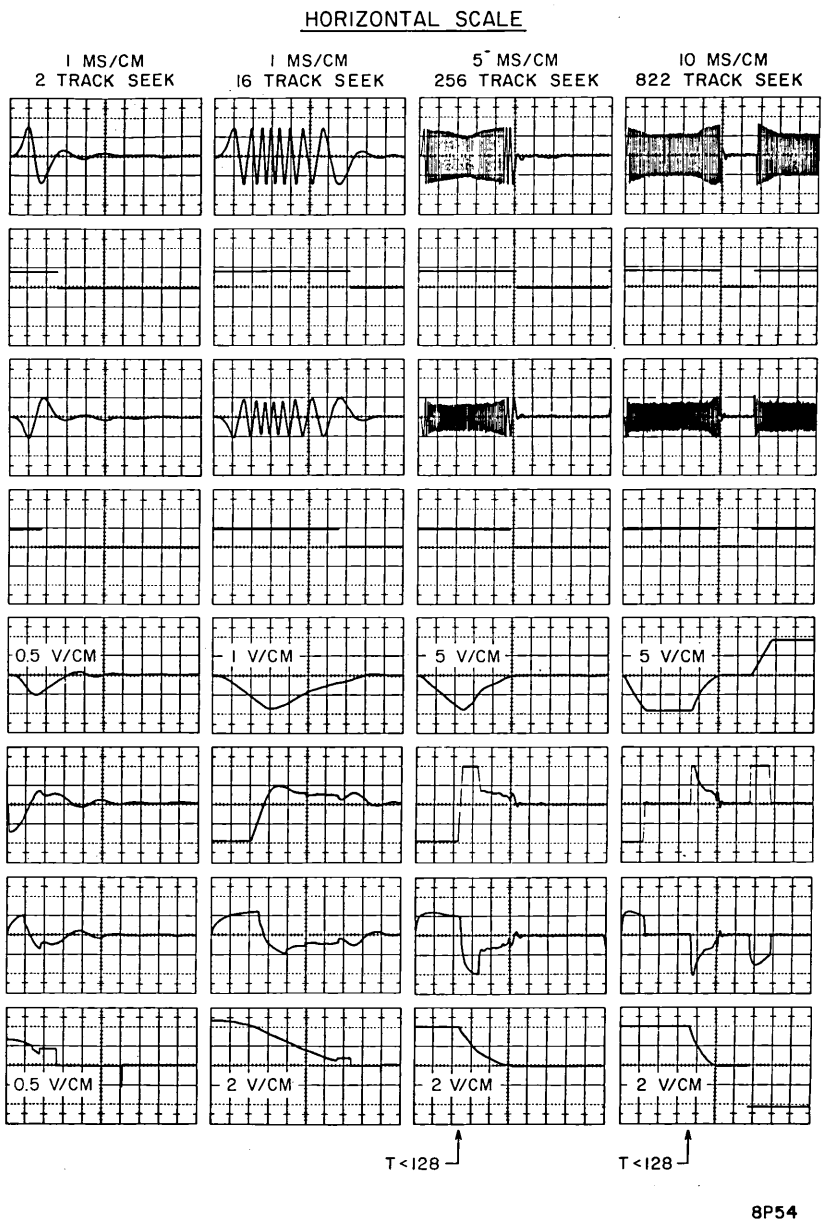


Figure 3-6. Servo System Test Points (Sheet 3 of 3)

	SIGNAL	TEST POINT	VERT SCALE
Ⓐ	TRACK SERVO	C30-7B	1 V/CM
Ⓑ	$\overline{\text{ON CYLINDER ENABLE}}$	A28-TPB	5 V/CM
Ⓒ	FINE SERVO	C30-8B	1 V/CM
Ⓓ	$\overline{\text{FINE GATE}}$	A27-10A	5 V/CM
Ⓔ	VELOCITY TRANSDUCER	A27-TPF	SEE INSERT
Ⓕ	SUMMING AMPL	B27-5A	5 V/CM
Ⓖ	CURRENT	A27-TPE	2 V/CM
Ⓗ	DESIRED VELOCITY	A27-TPC	SEE INSERT



NOTE:
1. SYNC (-) ON FORWARD SEEK (A27-12A)

Figure 3-7. Forward Seek Waveforms

8. Adjust velocity gain pot (middle pot) on A27 until first overshoot (point "B" on Figure 3-8) is between 200 to 300 mv (2 to 3 divisions) below center graduation of scope.

9. Adjust vertical position knob on scope to move trace until area "C" (of Figure 3-9) is centered on middle graduation of scope. The first overshoot (point "D" of Figure 3-9) must be between 200 to 300 mv (2 to 3 divisions) above the center graduation on scope. If overshoot is too high or too low, readjust velocity gain pot so that both positive (point "D", Figure 3-9) and negative (point "B", Figure 3-8) overshoots have at least an 80% occurrence within 200 to 300 mv.

10. When adjustment is complete, remove wire used to enable square wave generator.

11. Perform Coarse Position Gain Adjustment immediately.

Coarse Position Gain Adjustment

This procedure must be done in conjunction with the Velocity Gain Adjustment and the Integrator Gain Check and Adjustment procedures. These procedures interact with each other and must be repeated to verify that both procedures meet their requirements.

NOTE

The Course Position Gain Adjustment must be made when thermal stabilization exists. It is not an indication of malfunction if the requirements of this adjustment are not met during extreme limits of operation, such as prior to warmup or after several hours of continuous seeking.

1. Install a scratch disk pack: Press START switch to stop spindle drive motor. Open pack access cover and remove customer disk pack if installed. Install scratch disk pack and close pack access cover.

2. Connect Off Line Tester to drive: Open cabinet rear door. Set UNIT POWER circuit breakers to OFF. Remove logic chassis card cover and cabinet rear door panel. Connect Off Line Tester to drive per installation instructions in Reference manual.

3. Set oscilloscope control settings as follows:

   - CH 1 VOLTS/DIV: 0.5
   - CH 2 VOLTS/DIV: 1
   - A and B TIME/DIV: 10 ms
   - A TRIGGERING: Negative/External

4. Connect oscilloscope to drive as follows:

   - CH 1 to test point D on card C30 (Fine Position Signal, A2405).
   - CH 2 to test point E on card A27 (Summing Amp Output, A2206).
   - A TRIGGERING to wirewrap pin A27-12A (Forward Seek, A2001).

5. Command drive to perform 256-cylinder repeat seeks with either a Read or Write operation after each seek: Set UNIT POWER circuit breakers to ON. Press START switch to start spindle drive motor and to load heads. Using Off Line Tester, command a 256-cylinder repeat seeks with a Read or Write operation after each seek.

6. Adjust coarse position gain (top pot) on A27 so that point A (Figure 3-10) lies between the 14th and 15th negative pulses. Allow the drive to access at this adjustment for 1 minute to allow temperature stabilization. Readjust if necessary.

7. Proceed to Integrator Gain Adjustment and then return to step 6 of this procedure. Repeat until both adjustments meet their respective limits.

8. If the requirements of steps 6 and 7 are met go to step 9. If requirements of steps 6 and 7 cannot be met, troubleshoot drive servo logic (refer to Servo Margin Test procedure).

9. Remove scratch disk pack: Press START switch to stop spindle drive motor. Open pack access cover, remove disk pack and close pack access cover.

10. Disconnect Off Line Tester: Set UNIT POWER circuit breakers to OFF. Disconnect Off Line Tester from drive. Install logic chassis card cover and cabinet rear door panel. Set UNIT POWER circuit breakers to ON and close cabinet rear door.

Integrator Gain Check and Adjustment

This procedure must be done in conjunction with the Coarse Position Gain Adjustment

OSCILLOSCOPE SETTINGS

LOGIC GND TO SCOPE GND

VOLTS / DIV
CH 1 – 100 MV/DIV
CH 2 – NOT USED

TIME / DIV
A – 5 MS/DIV
B – NOT USED

TRIGGERING
A– POS/EXT ON C30–TPY
B– NOT USED

PROBE CONNECTIONS
CH 1 TO C30–TPD
CH 2 NOT USED

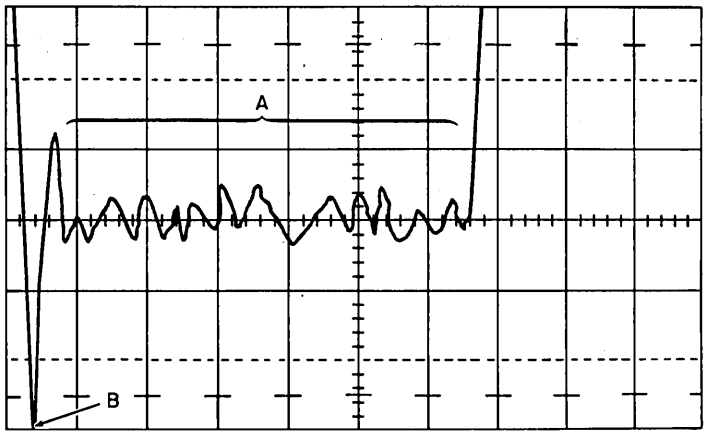


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Figure 3-8. Velocity Gain Waveform (Preliminary)

OSCILLOSCOPE SETTINGS

LOGIC GND TO SCOPE GND

VOLTS / DIV
CH 1 – 100 MV/DIV
CH 2 – NOT USED

TIME / DIV
A – 5MS/DIV
B – NOT USED

TRIGGERING
A– POS/EXT ON C30–TPY
B– NOT USED

PROBE CONNECTIONS
CH 1 TO C30–TPD
CH 2 NOT USED

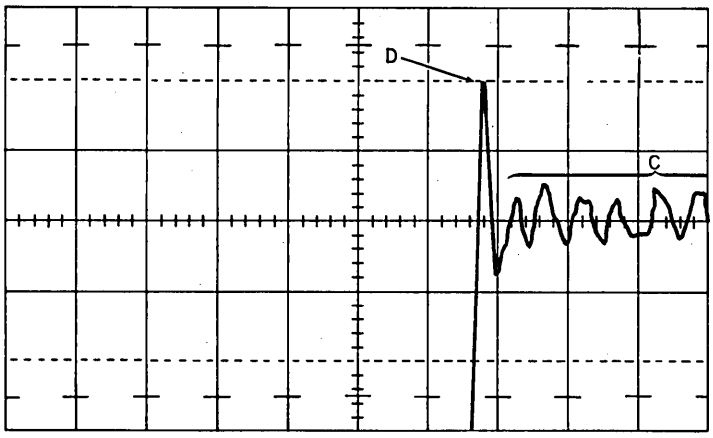

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Figure 3-9. Velocity Gain Waveform (Final)

OSCILLOSCOPE SETTINGS

LOGIC GND TO SCOPE GND

VOLTS / DIV
CH 1 - 0.5V/DIV
CH 2 - 1V/DIV

TIME / DIV (MAGNIFY BY 10)
A - 10 MS / DIV
B - 10 MS / DIV

TRIGGERING
A - NEG/EXT ON A27-12A
B - NOT USED

PROBE CONNECTIONS
CH 1 TO C30-TPD
CH 2 TO A27-TPE

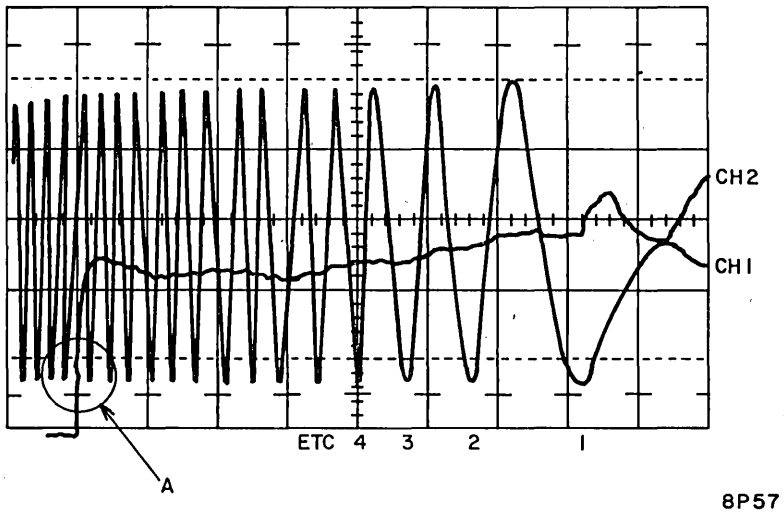


Figure 3-10. Coarse Position Gain Waveform

procedure. The adjustments in these procedures interact with each other and must be repeated until both procedures meet their requirements.

1. Install a scratch disk pack: Press START switch to stop spindle drive motor. Open pack access cover and remove customer disk pack (if installed). Install a scratch disk pack and close pack access cover.

2. Connect Off Line Tester to drive: Open cabinet rear door and set UNIT POWER circuit breakers to OFF. Remove logic chassis card cover and rear door panel. Connect Off Line Tester to drive per installation instructions in Reference manual.

3. Set oscilloscope control settings as follows:

   - CH 1 VOLTS/DIV: 0.2
   - A TIME/DIV: 2 ms
   - A TRIGGERING: Negative/External
   - HORIZ DISPLAY MAG: X10

4. Connect oscilloscope to drive as follows:

   - CH 1 to test point C on card A27 (Desired Velocity, A2705)
   - A TRIGGERING TO wirewrap pin A27-11A (Coarse, K2201)

5. Command a continuous repeated seek between cylinders 000 and 032: Set UNIT POWER circuit breakers to ON. Press START switch to start spindle drive motor. Using Off Line Tester, command drive to continuously seek between cylinders 000 and 032.

6. Adjust scope controls to display waveform shown in Figure 3-11.

7. Observe waveform on scope. Forward and reverse seek waveforms should have smooth slopes and contain no discontinuities other than 100 to 500 mv transient spikes (The last discontinuity, just before the waveform settles out to about 0.7 volt, is normal. This is the point that the integrator gain increases when the Fine FF sets).

8. Observe last transient spike (refer to Figure 3-11); it should be ≤30 mv. Ideally, there should be no step, only a transient spike (refer to ideal insert in Figure 3-11). If not within limits, go to step 9. If within limits go to step 10.

9. If required, adjust A BOTTOM potentiometer on A27 to bring the step at the last transient spike to ≤30 mv.

10. Return to step 6 of Coarse Position Gain Adjustment. When the requirements of this procedure (Integrator Gain Check and Adjustment) and the Coarse

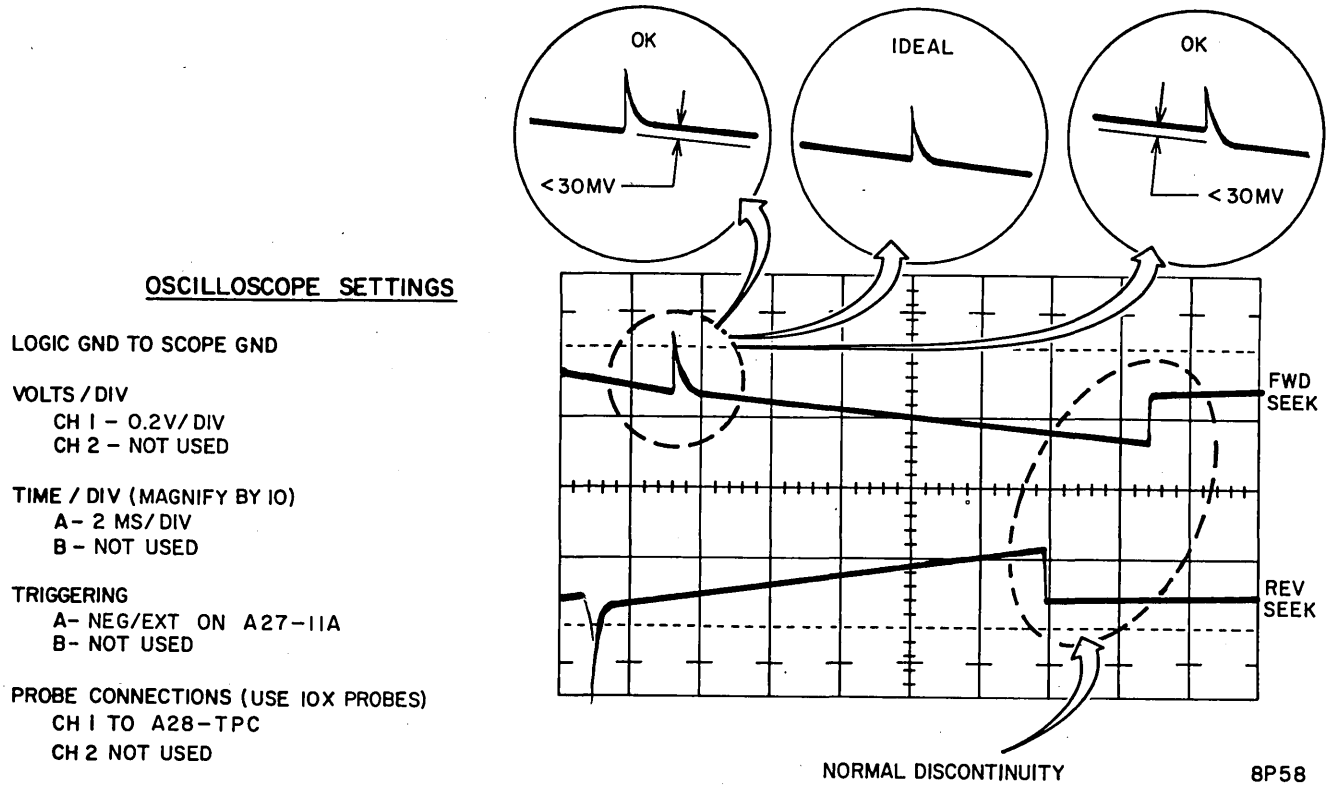


Figure 3-11. Velocity Integrator Waveform

Position Gain Adjustment are met, proceed to step 11.

11. Remove scratch disk pack: Press START switch to stop spindle drive motor. Open pack access cover, remove disk pack and close pack access cover.

12. Disconnect Field Test Unit from drive: Set UNIT POWER circuit breakers to OFF. Disconnect Off Line Tester from drive. Install logic chassis card cover and cabinet rear door panel. Set UNIT POWER circuit breakers to ON and close cabinet rear door.

Servo Margin Test:

This procedure is intended to be a troubleshooting aid and not an adjustment procedure. Perform this test after adjusting the velocity gain, coarse position gain, and integrator gain.

1. Perform steps 1 through 5 of the Coarse Position Gain Adjustment procedure and then return to step 2 of this procedure.

2. Adjust coarse position gain (top pot on card A27) so that point A of Figure 3-10, lies on the 7th negative pulse.

3. Perform five minutes of random access seeks (no read/write functions). No access errors should occur.

4. Access errors indicate:

   a. Velocity gain misadjusted.

   b. Velocity tranducer defective. Excessive velocity drift causes point A shown on Figure 3-10 to move towards first pulse.

   c. Defective servo cards or servo head.

5. Readjust coarse position gain (top pot on card A30) so that point A (Figure 3-10) lies between 14th and 15th negative pulses.

6. Remove scratch disk pack: Press START switch to stop spindle drive motor. Open pack access cover, remove disk pack and close pack access cover.

7. Disconnect Off Line Tester: Set UNIT POWER circuit breakers to OFF. Disconnect Off Line Tester from drive. Install logic chassis card cover and cabinet rear door panel. Set UNIT POWER circuit breakers to ON and close cabinet rear door.

On Cylinder Delay Check

This procedure is intended as a useful troubleshooting aid and is not an adjustment.

1. Install a scratch disk pack: Press START switch to stop spindle motor. Open pack access cover and remove customer disk pack (if installed). Install scratch disk pack and close pack access cover.

2. Connect Off Line Tester to drive: Open cabinet rear door and set the UNIT POWER circuit breakers to OFF. Remove logic chassis card cover and cabinet rear door panel Connect Off Line Tester to drive per installation instructions in the Reference manual.

3. Set oscilloscope controls as follows:

   - CH 1 VOLTS/DIV: 1
   - CH 2 VOLTS/DIV: 1
   - A and B TIME/DIV: 2 ms NEG/EXT
   - A TRIGGERING: ~~Positive/External~~
   - MODE TRIGGER: CHOP

4. Connect oscilloscope to drive as follows:

   - CH 1 to test point B on card A28 (On Cylinder Detection, I2101)
   - CH 2 to wirewrap pin A28-08B (On Cylinder I2104)
   - A TRIGGERING to test point B on card A28

5. Command drive to perform one-cylinder repeated seeks: Set UNIT POWER circuit breakers to ON. Press START switch to start spindle motor and to load heads. Off Line Tester, command drive to perform one-cylinder repeated seeks.

6. Observe scope and determine time channel 1 is a logical 1. It shall be a logical 1 for 4.75 (±0.5) ms.

7. Observe scope and determine time channel 2 is a logical 0. It shall be a logical 0 for 7.0 (±1.0) ms.

8. If requirements of steps 6 and 7 are not within limits, check card A28. If requirements are met, go to step 9.

9. Disconnect Off Line Tester and scope: Press START switch to stop spindle motor. Set UNIT POWER circuit breakers to OFF. Disconnect Off Line Tester and scope connections. Install cabinet rear door panel and logic card cover. Close cabinet rear door.

10. Remove scratch disk pack: Open pack access cover, remove scratch disk pack and close pack access cover.

Fine Position Offset Check and Adjustment (Servo Offset Null/DC Offset Adjustment)

The intent of this procedure is to check (and if required, to adjust) the odd-to-even servo track signals for a null and to check/adjust the track servo a signal null.

1. Install a scratch disk pack: Press START switch to stop spindle drive motor. Open pack access cover and remove customer disk pack (if installed). Install a scratch disk pack and close pack access cover.

2. Install test equipment: Open cabinet rear door and set UNIT POWER circuit breakers to OFF. Remove logic chassis card cover. Install test equipment as follows:

   a. Connect Off Line Tester to drive per installation instructions in the Reference manual.

   b. Insert head alignment card in card location C23.

   c. Connect null meter to test points X and Z of head alignment card.

3. Set ON LINE/OFF LINE/WRITE DISABLE switch on maintenance panel to WRITE DISABLE.

4. Set switches on head alignment card as follows:

   - R/W-SERVO switch to SERVO
   - X1/X.1 switch to X1
   - N/P switch to P

NOTE

Perform 15 minutes of 256-cylinder repeat seeks (access seeks only) for thermal stabilization.

5. Command a direct seek (access only) to cylinder 490.

6. Steps 7, 8, and 9 adjust the odd-to-even servo track signals to a null (servo electrical offset null adjustment). If unable to perform any of these adjustments, refer to Servo Fine Position Maintenance Criteria.

7. Note null meter reading at cylinder 490.

8. Command a direct seek to cylinder 491 and note meter reading.

9. If the meter reading at cylinder 491 is not equal to the meter reading at cylinder 490, adjust the bottom potentiometer on card C30 so the reading at cylinder 491 moves toward the reading at cylinder 490. Switch between cylinders 490 and 491 while adjusting potentiometer until readings are equal.

10. Steps 11 to 14 adjust the track servo signal to null. This is the switchable offset (dc offset) adjustment to signal derived from track servo preamp. If unable to perform adjustment, refer to Servo Fine Position Maintenance Criteria.

11. Command a seek to cylinder 490 and note meter reading.

12. Toggle the N/P switch on the head alignment card and adjust the top potentiometer on card at C30 so that the positive and negative readings move towards each other. Repeat procedure until readings are equal to within 2 mv.

13. Command a seek to cylinder 491 and verify track servo signal null (using N/P switch). If meter reading is not nulled, repeat procedure starting at step 5. If reading is nulled, go to step 14.

14. Make note of N/P meter readings at cylinders 8 and 800. Do not readjust potentiometers. If P-N differences are greater than 20 mv at cylinders 8 and 800, refer to servo Fine Position Maintenance Criteria. If less than 20 mv go to step 15.

15. Disconnect test equipment: Press START switch to stop spindle motor. Set UNIT POWER circuit breakers to OFF. Disconnect Off Line Tester, head alignment card, and null meter. Install logic card cover.

SCRATCH

16. Remove CE disk pack: Open pack access cover, remove CE disk pack and close pack access cover.

17. Set UNIT POWER circuit breakers to ON and close cabinet rear door.

Fine Position Test

NOTE

The requirements of the Fine Position Offset Check and Adjustment must be met before performing this test.

This test checks the track following capability of the drive and runout of the spindle. Runout is the degree to which a rotating object rotates off center. Too much runout causes the object to wobble or vibrate. Runout of the pack and spindle are additive, therefore a pack with known characterisitcs must be used (preferably a CE pack).

1. Install a disk pack: Press START switch to stop spindle motor. Open pack access cover and remove customer disk pack (if installed). Install CE disk pack and close pack access cover.

2. Connect Off Line Tester to drive: Open cabinet rear door and set UNIT POWER circuit breakers to OFF. Remove logic chassis card cover and cabinet rear door pack panel. Connect Off Line Tester to drive per installation instructions in Reference manual.

3. Set oscilloscope controls as follows:

   - CH 1 VOLTS/DIV: 10 mv
   - A TIME/DIV: 2 ms
   - A TRIGGERING: Positive/External
   - HORIZ DISPLAY MAG: X10

4. Connect oscilloscope to drive as follows:

   - CH 1 to wirewrap pin C30-09B (Fine Position Signal, A2407)
   - A TRIGGERING to wirewrap pin B21-10B (Index, X2701)

5. Command direct seek to cylinder 400: Set UNIT POWER circuit breakers to ON. Press START switch to start spindle drive motor and to load heads. Using Off Line Tester, command a direct seek to cylinder 400.

NOTE

The signal measured in step 6 is the 60 Hz component of the displayed waveform. The waveform in Figure 3-12 is typical and may vary from drive to drive.

6. Observe waveform on scope. The average peak-to-peak value of the observed waveform should not exceed +150 or -150 mv. If value is within requirements, go to step 7. If value exceeds requirements, go to step 9.

7. Rotate pack 90 degrees: Press START switch to stop spindle drive motor. Open pack access cover. Remove disk pack, rotate disk pack 90 degrees and install disk pack. Close pack access cover. Press START switch to start spindle drive motor and to load heads. Command direct seek to cylinder 400.

8. Observe waveform on scope. The average peak-to-peak value should not exceed requirements of Figure 3-12. If value exceeds requirements, go to step 11. If within requirements, go to step 9.

9. Observe waveform on scope to determine where Fine Position signal synchronizes with Index (Figure 3-12).

10. Rotate pack 90 degrees: Perform step 7 of this procedure and then go to step 11.

NOTE

The point at which Index and the Fine Position Signal synchronizes may be different from pack to pack. However, the sync point (Index) will be the same for the pack under test, no matter how many times the disk pack is removed, rotated, and installed on the spindle because Index is derived from a pre-recorded code that was written on the disk pack servo track surface.

11. Observe waveform on scope to determine where Fine Position Signal synchronizes with respect to Index.

    a. If the waveform coincides with the sync point as observed in step 9, the probelm is disk pack runout. Replace pack with a known good pack and repeat procedure starting at step 5.

    b. If the waveform does not coincide with the sync point as observed in step 9, the problem is a defective spindle or servo head. Replace spindle or servo head and repeat the procedure.

OSCILLOSCOPE SETTINGS

LOGIC GND TO SCOPE GND

VOLTS / DIV
- CH 1 - 10 MV/DIV
- CH 2 - NOT USED

TIME / DIV
- A - 2 MS/DIV
- B - NOT USED

TRIGGERING
- A- POS/EXT ON B21-10B
- B- NOT USED

PROBE CONNECTIONS
- CH 1 TO C30-09B
- CH 2 NOT USED

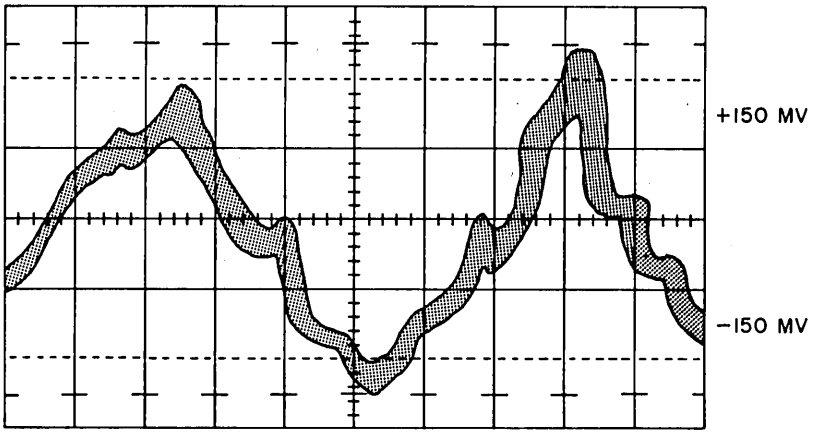


Figure 3-12. Fine Position Signal Modulation Waveform

Positioner Offset Check

1. Install CE disk pack: Press START switch to stop spindle drive motor. Open pack access cover and remove customer disk pack (if installed). Install CE disk pack and close pack access cover.

2. Connect Off Line Tester to drive: Open cabinet rear door and set UNIT POWER circuit breakers to OFF. Remove logic chassis card cover. Connect Off Line Tester to drive per installation instructions in Reference manual.

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.

3. Open rear door and set ON LINE/OFF LINE/ WRITE DISABLE switch to OFF LINE.

4. Set UNIT POWER circuit breakers to ON.

5. Load Heads: Press START switch to start spindle drive motor and to load heads.

6. Connect meter to test point E on card C30.

7. Set CARRIAGE OFFSET switch to FWD.

8. Measure the voltage test point E on card C30. It shall be -1.370 ±0.14 volts (200 microinch forward offset).

9. Set CARRIAGE OFFSET switch to REV.

10. Measure the voltage test point E card C30. It shall be +1.370 ±0.14 volts (200 microinch reverse offset).

11. Remove CE disk pack. Press START switch to stop spindle drive motor. Open pack access cover, remove disk pack and close pack access cover.

Servo Fine Position Maintenance Criteria

Servo loop and servo data offset effects may be so large that the switchable offset (servo offset null) and electrical offset (dc offset) adjustments will not reduce error to acceptable limits. If unable to complete these adjustments, replace card at C30 or A27 for servo offset null, or replace card at A30 or servo head/arm assembly for the dc offset adjustments.

Dirty rails may affect null adjustments. If this seems to be a problem, seek to cylinders (460-461 instead of 490-491) and perform servo electrical offset null and dc offset adjustment procedures. If requirements can be met at cylinders 460-461, clean rails and repeat adjustment procedure at cylinders 490-491.

P-N readings may deviate up to 20 mv at extreme cylinder positions (such as 8 and 800). This effect is normally due to variations in the disk pack air currents and head cable stresses at extreme positions. However, if mechanical parts have been changed (heads, carriage, head cable bracket, etc.), mechanical stresses may have developed which cause excessive deviation (P-N readings) at extreme cylinder positions. If P-N readings do not meet requirements at cylinders 8 and 800, check the following:

1. Check head cables for binding, kinking, twisting, or oil canning.

2. Check that head cables are properly clamped in clamping block, that cables have equal stress, and that none of the shields protrude from the rear of the clamping block.

3. Check clamping block to see if it is twisted or bent.

4. Check for blockage that could affect air flow in pack area (clogged air filter, obstructions, etc.).

Seek Timing Checks

Introduction

The seek timing checks verify correct overall servo loop operations. These tests are not necessarily requirements. Failure to pass any of these tests, however, indicates potential degraded performance that may cause difficulties at a later time. Steps 1, 2, and 3 immediately following prepare the drive for the seek timing checks. Steps 4 and 5 return drive to system operation.

1. Install a scratch disk pack: Press START switch to stop spindle drive motor. Open pack access cover and remove customer disk pack (if installed). Install scratch disk pack and close pack access cover.

2. Install Off Line Tester: Open cabinet rear door and set UNIT POWER circuit breakers to OFF. Remove logic chassis card cover. Remove rear door panel. Connect Off Line Tester to drive per installation instructions in the Reference manual.

3. Perform all Seek Timing Checks; when complete go to step 4.

NOTE

If any problems exist, trouble-shoot drive before proceeding. If drive meets all requirements of the Seek Timing Checks, perform the following steps:

4. Remove disk pack: Press START switch to stop spindle drive motor. Open pack access cover, remove disk pack and close pack access cover.

5. Disconnect Off Line Tester and oscilloscope: Set UNIT POWER circuit breakers to OFF. Disconnect Off Line Tester and scope from drive. Install logic chassis card cover and cabinet rear door panel. Set UNIT POWER circuit breakers to ON and close cabinet rear door.

256-Cylinder Seek

1. Set oscilloscope controls as follows:
   - CH 1 VOLTS/DIV: 1
   - A TIME/DIV: 10 ms
   - A TRIGGERING: Positive/Internal
2. Connect oscilloscope to drive as follows:
   - CH 1 to wirewrap pin A28-08A (On Cylinder, I2103)
3. Command repeated seeks between cylinders 000 and 256: Press START switch to start spindle drive motor and to load heads. Using Off Line Tester, command repeated seeks between cylinders 000 and 256.
4. Observe scope waveform. Signal must be a logical 1 for 27 (+3,-2) ms. If not within requirement, perfrom Servo Margin Test procedure. If within limits, go to One-Cylinder Seek test. Do not change scope settings or connections until instructed to do so.

One-Cylinder Seek

1. Scope settings and connections same as for 256-Cylinder Seek test.
2. Command one-cylinder sequential seeks.
3. Observe waveform through at least 80 cylinders of seeks. Signal must be a logical 1 for 7 ±1 ms. If not within requirements, perform Servo Margin Test Procedure. If within limits, go to Return-to-Zero Seek From Cylinder 000 test. Do not change scope settings or connections until instructed to do so.

Return-To-Zero Seek From Cylinder 000

1. Scope settings and connections same as for 256-Cylinder Seek Test.
2. Command direct seek to cylinder 000.
3. Command an RTZ.
4. Observe scope waveform. Signal must be a logical 1 for 15 ±5 ms. If not within requirements, perform Servo Margin Test procedure. If within limits, go to Return-to-Zero Seek from Cylinder 822 test. Do not change scope settings or connections unless instructed to do so.

Return-To-Zero Seek From Cylinder 822

1. Scope settings and connections same as for 256-Cylinder Seek test execpt set the A TIME/DIV to 100 MS/DIV.
2. Command a single direct seek to cylinder 822.
3. Command an RTZ.
4. Observe scope waveform. Signal must be a logical 1 for 300 ±50 ms.
5. If not within requirements perform Servo Margin Test procedure. If within limits go to Seek Into Forward EOT test. Do not change scope settings or connections until instructed to do so.

Seek Into Forward EOT

1. Scope settings and connections same as 256-Cylinder Seek test except set the A TIME/DIV to 5 MS/DIV.
2. Command a direct seek to cylinder 822.
3. Command a one-cylinder forward seek while observing scope.
4. Observe scope waveform. Signal must be a logical 1 for 20 ±5 ms. Command an RTZ to clear Seek Error status in drive logic.
5. If not within requirements perform Servo Margin Test procedure. If within limits, go to Velocity Transducer Linearity Test procedure.

Velocity Transducer Linearity

1. Set oscilloscope controls as follows:
   - CH 1 VOLTS/DIV: 10 mv
   - CH 1 VOLTS/DIV: 10
   - A and B TIME/DIV: 2 ms
   - A TRIGGERING: Positive/External
   - MODE TRIGGER: ALT
2. Connect scope to drive as follows:
   - CH 1 to test point F on card A27 (Velocity Feedback, A2203)
   - CH 2 to wirewrap pin A27-10A (Fine Gate, K2200)
   - A TRIGGERING to wirewrap pin A22-07B (Forward Seek, I1532)
3. Command one-cylinder repeated seeks between cylinders 000 and 001.
4. Adjust scope controls to obtain waveform shown in Figure 3-13.
5. Observe waveform on scope. Signal on channel 1 (Velocity Feedback) should be 600 mv p-p and exhibits a double hump when channel 2 (Fine Gate) switches from a logical 1 to a logical 0.
6. Command one-cylinder repeated seeks between cylinders 821 and 822.
7. Observe waveform on scope. This waveform should be the same as the wavefrom observed when seeking between cylinder 000 and 001 (step 5).
8. Perform an RTZ. Perform steps 4 and 5 listed in the introduction to Seek Timing Checks.

Track Servo Logic Checks

Introduction

These tests check the logic associated with the track servo. The tests are applicable only if servo adjustments could not be made or if troubleshooting a malfunctioning drive. Steps 1 and 2 immediately following prepare the drive for the Track Servo Logic Checks. Steps 4 and 5 return the drive to system operation. Perform whatever tests are deemed necessary at step 3.

1. Install a scratch disk pack: Press START switch to stop spindle motor. Open pack access cover and remove customer disk pack (if installed). Install a scratch disk pack and close pack access cover.
2. Connect Off Line Tester to drive: Open cabinet rear door and set UNIT POWER circuit breakers to OFF. Remove logic chassis card cover and cabinet rear door panel. Connect Off Line Tester to drive per installation instructions in Reference manual. Set UNIT POWER circuit breakers to ON.

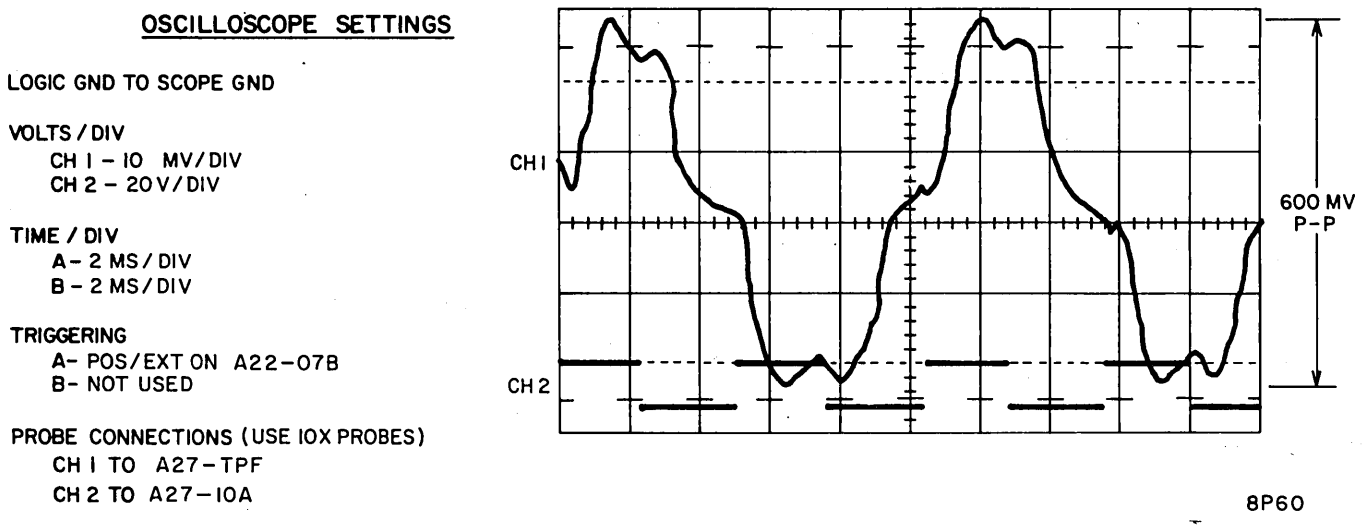


Figure 3-13. Velocity Linearity Waveform

3. Perform any of the track servo logic checks as required.

4. Remove scratch disk pack: Press START switch to stop spindle drive motor. Open pack access cover, remove scratch disk pack and close pack access cover.

5. Disconnect Off Line Tester from drive: Set UNIT POWER circuit breakers to OFF. Disconnect Off Line Tester from drive. Install logic card cover and cabinet rear door panel. Set UNIT POWER circuit breakers to ON and close cabinet rear door.

Track Servo Amplitude

This test checks the amplitude of the track servo signal output of the servo preamplifier. Perform steps 1 and 2 listed in the introduction to the Track Servo Logic Checks.

1. Set oscilloscope controls as follows:

   - CH 1 VOLTS/DIV: 0.5
   - CH 2 VOLTS/DIV: 0.5
   - A and B TIME/DIV: ~~20~~ ms 1 usec
   - A TRIGGERING: Positive/Internal
   - MODE TRIGGER: ADD

2. Connect oscilloscope to drive as follows:

   - CH 1 to wirewrap pin B30-03B (track servo preamp output)
   - CH 2 to wirewrap pin B30-05B (track servo preamp output)

3. Perform first six steps described in Manual Carriage Positioning With Power On.

4. Manually move heads while observing scope. Monitor the maximum signal points (between cylinders) at cylinders 000 and 823.

5. The peak-to-peak amplitude of the observed signal must be between 0.36 and 2.1 volts. If not, check preamp card and servo head.

6. Perform steps 8 and 9 of Manual Carriage Positioning With Power On.

7. If drive maintenance or checkout is complete, perform steps 4 and 5 listed in the introduction of the Track Servo Logic Checks.

AGC Amplifier

This test verifies that the agc amplifier and the agc voltage are working correctly. Perform steps 1 and 2 listed in the introduction to the Track Servo Logic Checks.

1. Remove logic card at location A30, install card on card extender and install extender and card in location A30.

2. Set oscilloscope controls as follows:

   - CH 1 VOLTS/DIV: 50 mv
   - CH 2 VOLTS/DIV: 50 mv
   - A and B TIME/DIV: ~~20 ms~~ 1 μS
   - A TRIGGERING: Positive/Internal
   - MODE TRIGGER: ADD

3. Connect oscilloscope to drive as follows:

   - CH 1 to test point T on card A30 (Servo preamp output, A2508)
   - CH 1 to test point U on card A30 (Servo preamp output, A2508)

4. Perform first six steps described in Manual Carriage Positioning With Power On.

5. Observe scope while manually moving heads near cylinder 000 so that horns of dibit waveform (one set positive, other set negative) are of equal amplitude (refer to Figure 3-14). Heads are now on cylinder.

6. The peak-to-peak amplitude of the observed signal must be 1 ±0.25 volt.

7. Perform steps 8 and 9 of Manual Carriage Positioning With Power On.

8. If drive maintenance or check out is complete, perform steps 4 and 5 listed in the introduction of the Track Servo Logic Checks.

Cylinder Pulse Switching Level

This test checks that the cylinder pulses are of uniform pulse width and amplitude over short and long seek lengths. Perform steps 1 and 2 listed in the introduction to the Track Servo Logic Checks.

1. Set oscilloscope controls as follows:

OSCILLOSCOPE SETTINGS

LOGIC GND TO SCOPE GND

VOLTS / DIV
CH 1 - 50 MV/DIV
CH 2 - 50 MV/DIV

TIME / DIV
A- ~~20 MS~~/DIV 1 usec
B- ~~20 MS~~/DIV 1 usec

TRIGGERING
A- POS/INT
B- POS/INT

PROBE CONNECTIONS
CH 1 TO A30-TPT
CH 2 TO A30-TPU

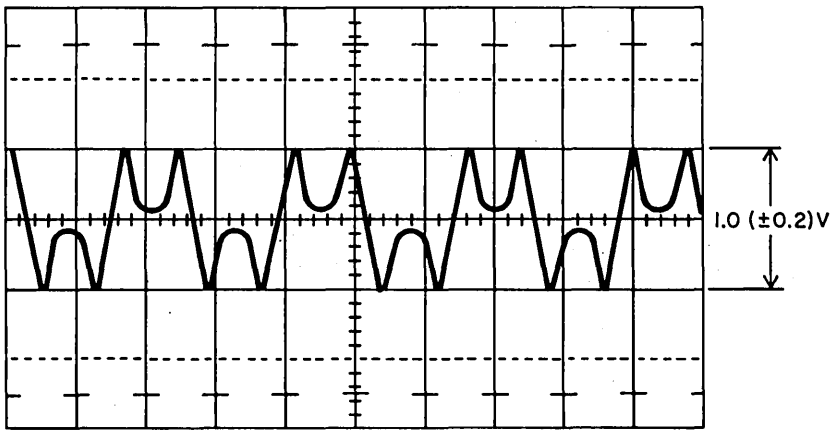


Figure 3-14. AGC'ed Track Servo Amplitude

- CH 1 VOLTS/DIV: 0.1
- A TIME/DIV: 0.2 ms
- A TRIGGERING: Negative/External
- MODE TRIGGER: CH 1

2. Connect oscilloscope to drive as follows:
   - CH 1 to wirewrap pin A23-02A (Cylinder Pulses, I1810)
   - A TRIGGERING probe to wirewrap pin A22-07B (Forward Seek, I1532)
3. Command repeated 4-cylinder seeks: Press START switch to start spindle drive motor and to load heads. Using Off Line Tester, command repeated 4-cylinder seeks.
4. Observe waveform on scope. Check for a series of positive-going 10 µsec pulses (cylinder pulses). Depending on system alignment the last pulse may be 1.2 µsec wide.
5. Command repeated seeks of varying lengths. Verify that cylinder pulses are consistently generated during long seek lengths. Press START switch to stop spindle drive motor. Go to step 6 if requirements are not met. Go to step 15 if within limits.
6. Connect oscilloscope to drive as follows:
   - CH 1 to wirewrap pin A30-09B (Track Servo signal)
   - A TRIGGERING to wirewrap pin A30-07B (Cylinder Detect A L2301)

NOTE

In the following steps the 3-cylinder seeks may be accomplished by manually positioning carriage or by using the Off Line Tester.

7. Command repeated 3-cylinder seeks: Press START switch to start spindle drive motor and to load heads. Using Off Line Tester, command repeated 3-cylinder seeks.
8. Observe waveform on scope. Check that servo signal is +0.4 ±0.1 volt at beginning of the sweep.
9. Set oscilloscope A TRIGGERING to positive.
10. Observe waveform on scope. Check that servo signal is 0 ±0.1 volt at beginning of sweep.
11. Change sync point to wirewrap pin A30-08B (Cylinder Detect B, L3200): Move A TRIGGERING probe to backpanel pin A30-08B (triggering is Positive/External).

12. Observe waveform on scope. Check that servo signal is 0 ±0.1 volt at beginning of sweep.

13. Set oscilloscope A TRIGGERING to negative.

14. Observe waveform on scope: Check that servo signal at beginning of sweep is 0.4 ±0.2 volt.

15. If drive maintenance or check out is complete, perform steps 4 and 5 listed in introduction to the Track Servo Logic Checks.

Velocity Logic Checks

Introduction

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

Steps 1 and 2 immediately following prepare the drive for the Velocity Logic Checks. Steps 4 and 5 return the drive to system operation. Perform whatever tests are deemed necessary.

1. Install a scratch disk pack: Press START switch to stop spindle motor. Open pack access cover and remove customer disk pack (if installed). Install a scratch disk pack and close pack access cover.

2. Connect Off Line Tester to drive: Open cabinet rear door and set UNIT POWER circuit breakers to OFF. Remove logic chassis card cover and cabinet rear door panel. Connect Off Line Tester to drive per installation instructions in Reference manual. Set UNIT POWER circuit breakers to ON.

3. Perform any of the velocity logic checks as required.

4. Remove scratch disk pack: Press START switch to stop spindle drive motor. Open pack access cover, remove scratch disk pack and close pack access cover.

5. Disconnect Off Line Tester and oscilloscope from drive: Set UNIT POWER circuit breakers to OFF. Disconnect Off Line Tester from drive. Disconnect scope probes from drive. Install logic card cover and cabinet rear door panel. Set UNIT POWER circuit breakers to ON and close cabinet rear door.

Fine Enable Switching Level

This procedure verifies that On Cylinder is enabled when the Fine Position Signal approaches null with the Fine FF set.

1. Perform steps 1 and 2 listed in the introduction to the Velocity Logic Checks.

2. Set oscilloscope controls as follows:

   - CH 1 VOLTS/DIV: 5
   - CH 2 VOLTS/DIV: 0.5
   - A and B TIME/DIV: 1 ms
   - A TRIGGERING: Positive/External
   - MODE TRIGGER: ALT

3. Connect oscilloscope to drive as follows:

   - CH 1 to wirewrap pin A27-10A (Fine, K2200)
   - CH 2 to test point D on card A27 (Integrated Velocity, A2203)
   - A TRIGGERING to wirewrap pin A27-12A (Forward Seek, I1532)

4. Command continuous repeated seeks between cylinders 000 and 001: Press START switch to start spindle drive motor and to load heads. Using Off Line Tester, command repeated seeks between cylinders 000 and 001.

5. Adjust scope controls to display waveform shown in Figure 3-15.

6. Scope waveform must be the same as waveform of Figure 3-15: Check that Fine signal switches to 0 volt when velocity signal is 0.90 ±0.10 volts (+0.90 for forward seeks and -0.90 for reverse seeks, see Figure 3-15).

7. Perform steps 4 and 5 listed in the introduction to the Velocity Logic Checks.

Velocity Transducer Gain Uniformity

This procedure checks the output voltage and waveshape characteristics of the velocity transducer.

1. Perform steps 1 and 2 listed in the introduction to the Velocity Logic Checks.

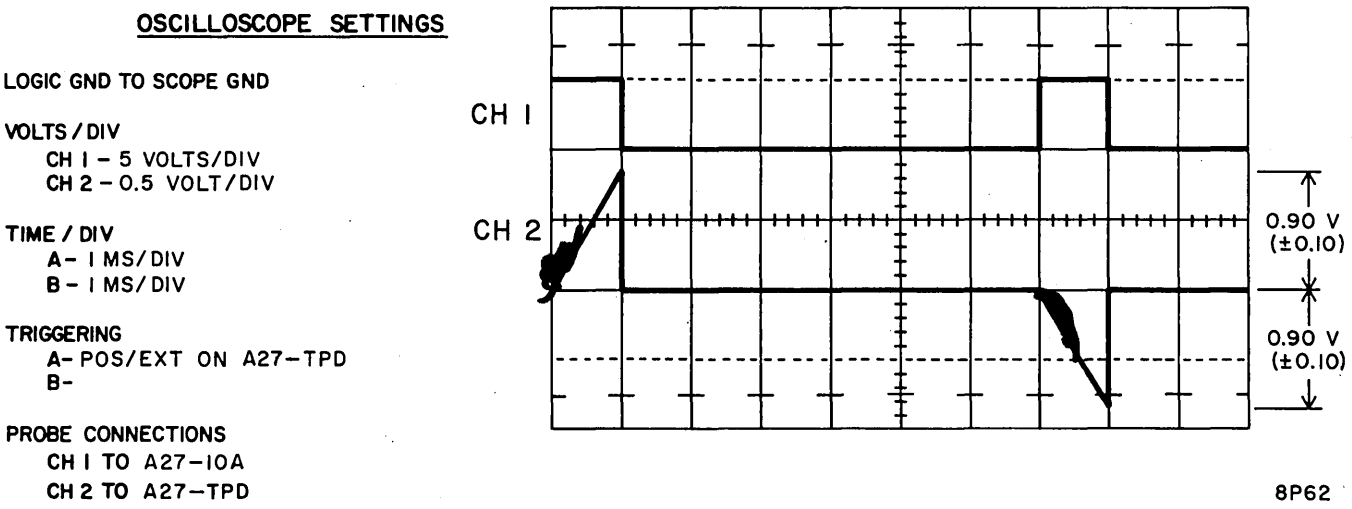


Figure 3-15. Fine Enable Switching Load

2. Set oscilloscope controls as follows:

   - CH 1 VOLTS/DIV: 1
   - A TIME/DIV: 2 ms
   - A TRIGGERING: Positive/External

3. Connect oscilloscope to drive as follows:

   - CH 1 to test point D on card A27 (Integrated Velocity, A2203)
   - A TRIGGERING probe to wirewrap pin B23-05B (T≤128, I1823)

4. Command continuous repeated seeks between cylinders 000 and 822: Press START switch to start spindle drive motor and to load heads. Using Off Line Tester, command continuous repeated seeks between cylinders 000 and 822.

5. Adjust scope controls to display waveform shown in Figure 3-16.

6. Scope waveform must be the same as waveform of Figure 3-16. Ramps represent Integrated Velocity sawtooth waveform during last 127 cylinders of seek. Positive ramps are forward seek and negative ramps are reverse seek.

7. Voltage amplitude of next to last positive and last negative ramps shall be 2.0 ±0.2 volts (positive ramp is +2.0 volt and negative ramp is -2.0 volt). Also, these voltages shall be equal (the difference of the absolute values) within 0.3 volt. If not:

   a. Perform Integrator Gain Adjustment.

   b. Repeat this procedure. If it still fails, replace transducer rod assembly.

8. Perform steps 4 and 5 listed in the introduction of the Velocity Logic Checks.

Position Converter Output

The position converter output should be clamped at negative saturation until T<128. During the remaining cylinders of the seek, the converter output is under control of the D/A converter.

1. Perform steps 1 and 2 listed in the introduction to the Velocity Logic Checks.

2. Set oscilloscope controls as follows:

   - CH 1 VOLTS/DIV: 2

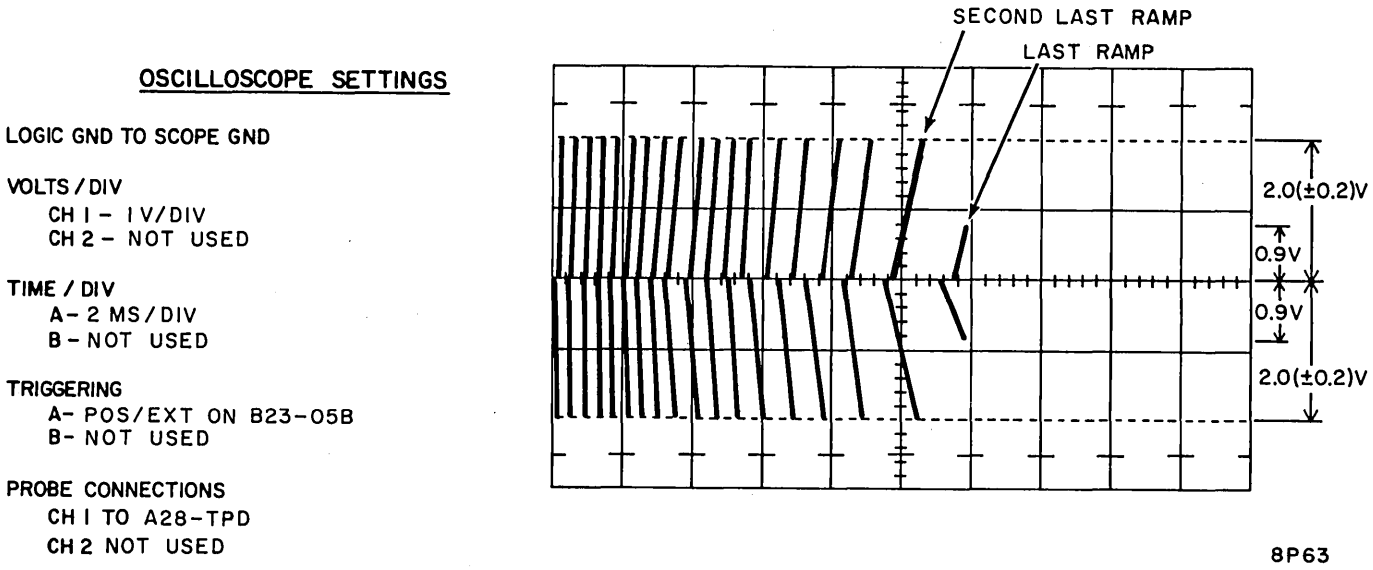


Figure 3-16. Velocity Transducer Gain Uniformity

- A TIME/DIV: 2 ms
- A TRIGGERING: Positive/External

3. Connect oscilloscope to drive as follows:
   - CH 1 to test point B of card A27 (D/A Converter Output, A2002)
   - A TRIGGERING to wirewrap pin A27-12A (Forward Seek, I1532)
4. Command continuous repeated seeks between cylinders 000 and 130: Press START switch to start spindle drive motor and to load heads. Using Off Line Tester command repeated seeks between cylinders 000 and 130.
5. Adjust scope controls to display waveform shown in Figure 3-17.
6. Observe waveform on scope. The following events are occurring:
   a. From cylinder 192 through cylinder 128, D/A converter output is 10 volts.
   b. At cylinder 127, D/A converter output steps down (and continues to step down when each cylinder is crossed) to control position converter output.
   c. If requirements of step a and b are not met, check D/A converter circuitry on card at location A27.
7. Perform steps 4 and 5 listed in the introduction to the Velocity Logic Checks.

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 (TPA or TPZ) of the card being tested. Connect secure ground lead between scope ground and GND jack on maintenance panel.

Read Recovery Timing

The phase lock oscillator card at C24 and the data separator card at C25 require delay timing adjustments. 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.

OSCILLOSCOPE SETTINGS

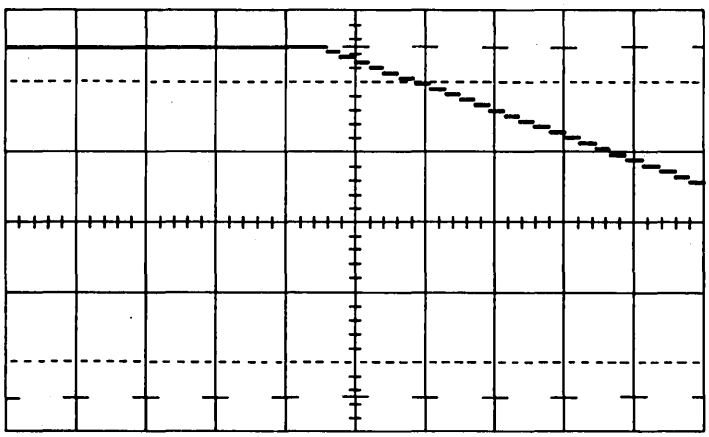
LOGIC GND TO SCOPE GND

VOLTS / DIV
CH 1 - 2 VOLTS/DIV
CH 2 - NOT USED

TIME / DIV
A - 2 MS/DIV
B - NOT USED

TRIGGERING
A - NEG/EXT ON A27-12A
B - NOT USED

PROBE CONNECTIONS
CH 1 TO A27-TPB
CH 2 NOT USED



8P64

Figure 3-17. Position Converter Output

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 is required. In most cases, the unit will perform to specification with the factory setting and only requires wire wraping the delay line tap permanently into place.

In some units, the normal verification of read/write head parameters requires a readjustment of the factory alignment. The Read Recovery Timing Adjustment procedure should be performed only if unit did not meet Verification of Read Recovery Alignment Procedure.

Verification of Read Recovery Alignment

1. Install a scratch disk pack: Press START switch to stop spindle drive motor. Open pack access cover and remove customer disk pack (if installed). Install a scratch disk pack and close pack access cover.

2. Install Off Line Tester: Open cabinet rear door and set the UNIT POWER circuit breakers to OFF. Remove logic chassis card cover. Connect Off Line Tester to drive per installation instructions in the Reference manual.

3. Set jumper wires on delay lines C1 and B3 of the replacement data separator card (card that goes into location C25) per settings indicated on tag or label that came with card. Refer to Figure 3-18 for delay line locations on data separator card.

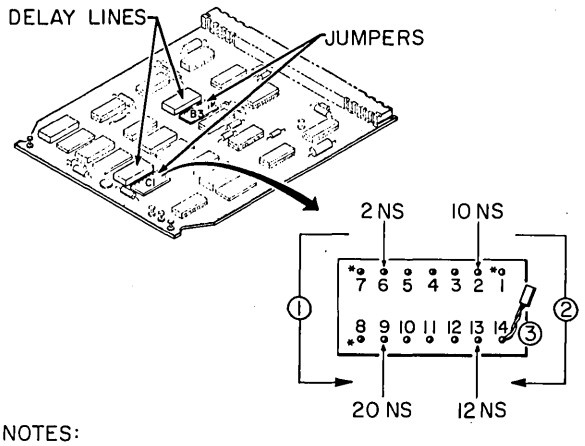
4. Remove old data separator card from logic card location C25 and install replacement card.

5. Seek to cylinder ~~822~~ 821 and write an alternate data pattern (101010...) with all heads: Press START switch to start spindle drive motor and to load heads. Using Off Line Tester, command a direct seek to cylinder ~~822~~ 821 and write an alternate data pattern (101010...) with all heads.

6. Read all heads sequentially at cylinder 822 for three minutes. Verify that no data errors have occurred.

7. Using Off Line Tester, set DATA WINDOW switch on maintenance panel to EARLY and perform a strobe early and read all heads sequentially at cylinder 822 for three minutes. Verify no read errors have occurred.

8. Using Off Line Tester, set DATA WINDOW switch on maintenance panel to LATE and perform a strobe late and read all heads sequentially at cylinder 822 for three minutes. Verify no read errors have occurred.



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.

7J152A

Figure 3-18. Data Separator Card Delay Wiring

9. If no read errors occurred in steps 6, 7, or 8, no further testing is necessary, go to step 10. If read errors occurred in steps 6, 7, or 8, perform the Read Recovery Timing Adjustment procedure.

10. Remove data separator card from location C25: Press START switch to stop spindle drive motor and set UNIT POWER circuit breakers to OFF. Remove logic card from location C25.

11. Remove and discard the plug-in jumpers from delay lines B3 and C1 on the data separator card.

12. Wirewrap the factory designated settings, or to the settings determined in test, on the delay line terminals.

13. Install data separator card in location C25.

14. Remove scratch disk pack and Off Line Tester: Open pack access cover, remove disk pack and close pack access cover. Set UNIT POWER circuit breakers to OFF. Disconnect Off Line Tester from drive. Install logic chassis card cover. Set UNIT POWER circuit breakers to ON and close cabinet rear door.

Read Recovery Timing Adjustment

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

The procedure consists of three parts. First, the strobe is advanced in discrete steps by adjusting taps on a delay line until read 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.

Perform this procedure only after first performing the Verification of Read Recovery Alignment procedure and then only if read errors occurred in that procedure.

1. Using Off Line Tester perform a strobe early read on all heads sequentially at cylinder 82[illegible] for one minute.

   a. If errors occur, perform the Retard Read Clock procedure and proceed to step 2.

   b. If errors do not occur, perform the Advance Read Clock procedure and proceed to step 3.

2. Using Off Line Tester, perform a strobe early read on all heads sequentially at cylinder 82[illegible] for one minute.

   a. If errors occur, perform the Retard Read Clock procedure and repeat step 2.

   b. If errors do not occur, make note of delay time in nsec for Jumper C1 and B3. (See Figure 3-17). Proceed to step 4.

3. Using Off Line Tester, perform a strobe early read on all heads sequentially at cylinder 82[illegible] for one minute.

   a. If errors do not occur, perform the Advance Read Clock procedure and repeat step 3.

   b. If errors do occur, proceed to step 2a.

4. Using Off Line Tester, perform a strobe late read on all heads sequentially at cylinder 82[illegible] for one minute.

   a. If errors occur, perform the Advance Read Clock procedure and proceed to step 5.

   b. If errors do not occur, perform the Retard Read Clock procedure and proceed to step 6.

5. Using Off Line Tester, perform a strobe late read on all heads sequentially at cylinder 822 for one minute.

   a. If errors occur, perform the Advance Read Clock procedure and repeat step 5.

   b. If errors do not occur, make note of delay time in nsec for Jumper C1 and B3. (See Figure 3-17) Proceed to step 7.

6. Using Off Line Tester, perform a strobe late read on all heads sequentially at cylinder 822 for one minute.

   a. If errors do not occur, perform the Retard Read Clock procedure and repeat step 6.

   b. If errors occur, proceed to step 5a,

7. Calculate the new delay tap settings for C1 and B3 by subtracting the shortest delay time from the longest delay time for C1 and B3 respectively. (The delay times were determined in step 2b and 5b). Divide each result by two and add this to each respective shortest delay; the result is the new delay setting in nsec.

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.

NOTE

If final delay time is odd, subtract 1 nsec from one delay time and add 1 nsec to the other delay time.

8. Remove data separator card from location C25: Press START switch to stop spindle drive motor and set UNIT POWER circuit breakers to OFF. Remove logic card from location C25.

9. Remove and discard plug-in jumpers from delay lines B3 and C1 on the data separator card.

10. Wirewrap pin 14 of delay line C1 to the delay top setting determined in step 7.

11. Wirewrap pin 14 of delay line B3 to the delay top setting determined in step 7.

12. Install data separator card in location C25.

13. Perform Verification of Read Recovery Alignment procedure to make sure delay lines B3 and C1 are properly set.

Advance Read Clock

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.

Retard Read Clock

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.

Head Amplitude Test

This procedure verifies that the read signal has sufficient amplitude to be reliably processed by the read logic. Readback amplitude decreases as the recording frequency increases, thus the minimum amplitude in MFM recording is obtained when reading an all "0's" or all "1's" pattern. Maximum readback amplitude is obtained when reading a pattern of alternate "1010...".

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 all heads, replace card E00 (on main deck) and repeat test.

Perform this test on all heads as follows:

1. Install a scratch disk pack: Press START switch to stop spindle drive motor. Open pack access cover and remove customer disk pack (if installed). Install scratch disk pack and close pack access cover.

2. Connect Off Line Tester to drive: Open cabinet rear door and remove logic chassis card cover. Set UNIT POWER circuit breakers to OFF. Connect Off Line Tester to drive per installation

instructions in Reference manual. Open cabinet top cover and remove deck cover. Remove cabinet rear door panel.

3. Set oscilloscope control settings as follows:
   - CH 1 VOLTS/DIV: 100 mv
   - CH 2 VOLTS/DIV: 100 mv
   - A and B TIME/DIV: 1 ms
   - A TRIGGERING: Positive/External
   - MODE TRIGGER: ADD
4. Connect oscilloscope to drive as follows:

   NOTE

   Card E00 is located in R/W chassis on deck.

   - CH 1 to test point X on card E00 (Analog Read Data, A3219)
   - CH 2 to test point Y on card E00 (Analog Read Data, A3219)
   - A TRIGGERING to wirewrap pin B21-10B (Index, X2701)
5. Command a direct seek to cylinder 808: Set UNIT POWER circuit breakers to ON. Press START switch to start spindle drive motor and to load heads. Using Off Line Tester, command a direct seek to cylinder 808.
6. Select head to be tested and write a data pattern of all "1's".

   NOTE

   The Off Line Tester syncs at Index and writes the following pattern in each sector until next index.

   a. Delay of 130 µsec after leading edge of sector mark.

   b. 350 µsec of bit pattern that was loaded into PATTERN display.
7. Read with head selected in step 6.
8. Observe waveform on scope and measure peak-to-peak amplitude of read signal. It shall be at least 74 mv, go to step 9.
9. Command a direct seek to cylinder 000.
10. Write an alternate data pattern (101010...) on head selected in step 6.
11. Read head selected in step 10.
12. Observe waveform on oscilloscope and measure peak-to-peak amplitude of read signal. It shall not exceed 800 mv, go to step 13.
13. If head is not within requirements of steps 8 and 12, replace only that head. If all heads were tested and all heads failed, replace logic card E00 (on deck) and repeat test. If heads are within limits, go to step 14.
14. Remove scratch disk pack: Press START switch to stop spindle drive motor. Disconnect oscilloscope probes. Install deck cover and close cabinet top cover. Open pack access cover, remove disk pack and close pack access cover.
15. Disconnect Off Line Tester: Set UNIT POWER circuit breakers to OFF. Disconnect Off Line Tester from drive. Install logic chassis card cover and rear door panel. Set UNIT POWER circuit breakers to ON and close cabinet rear door.

MISCELLANEOUS LOGIC CHECKS

Clock Index Timing

This procedure verifies correct operation of the 806 kHz Clock and Index timing. Proceed as follows:

1. Install a scratch disk pack: Press START switch to stop spindle drive motor. Open pack access cover and remove customer disk pack (if installed). Install a scratch disk pack and close pack access cover.
2. Set oscilloscope controls as follows:
   - CH 1 VOLTS/DIV: 2
   - CH 1 VOLTS/DIV: 2
   - A and B TIME/DIV: 0.5 µsec
   - A TRIGGERING: Positive/Internal
   - MODE TRIGGER: ALT
3. Connect oscilloscope to drive as follows: Open cabinet rear door, remove logic chassis card cover and remove cabinet rear door panel. Set UNIT POWER circuit breakers to OFF. Connect oscilloscope probes to drive per steps listed below.

- CH 1 to wirewrap pin B21-11A (Odd and Even Dibits, I2700)
- CH 2 to wirewrap pin B21-10A (806 kHz Pulses, I2700)

4. Load heads: Set UNIT POWER circuit breakers to ON. Press START switch to start spindle drive motor and to load heads.
5. Observe that oscilloscope waveforms are synchronous. If not check clock circuit on logic card at location B20.
6. Disconnect CH 1 and connect it to wirewrap pin B21-10B (Index, X2701).
7. Observe that oscilloscope channel 1 waveform is a logical 1 for 2 ±0.5 µsec. If not, check index detection circuit on logic card at location A21.
8. Remove scratch disk pack: Press START switch to stop spindle motor. Open pack access cover, remove disk pack and close pack access cover.
9. Disconnect oscilloscope: Remove oscilloscope probes from drive. Install logic chassis card cover and cabinet rear door panel. Close cabinet rear door.

Start/Stop Time

This procedure verifies correct operations of the spindle drive motor and hysteresis brake. Use a stopwatch or wristwatch with sweep second hand.

1. Install a scratch disk pack: Press START switch to stop spindle drive motor. Open pack access cover and remove customer disk pack (if installed). Install scratch disk pack and close pack access cover.
2. Set oscilloscope controls as follows:
   - CH 1 VOLTS/DIV: 1
   - A TIME/DIV: 2 sec
3. Connect oscilloscope to backpanel pin A08-04A (Up to Speed, Y1000): Open cabinet rear door and remove logic chassis card cover. Remove rear door panel. Connect oscilloscope to backpanel pin A08-04A.
4. Press START switch and start timer. Observe the following:
   a. Oscilloscope waveform should switch from a logical 0 to a logical 1 in 10 ±5 seconds.
   b. Heads should load in 15 ±2 seconds.
5. Press START switch. Pack should come to complete stop in less than 20 seconds.
6. If requirements of steps 4 and 5 are not met, check drive belt and hysteresis brake. If requirements are within limits, go to step 7.
7. Remove scratch disk pack: Open pack access cover, remove disk pack and close pack access cover.
8. Disconnect oscilloscope probe from drive and install cabinet rear door panel.

Speed Sensing

This procedure verifies correct operation of speed sensor and the speed detection circuitry.

1. Install a scratch disk pack: Press START switch to stop spindle drive motor. Open pack access cover and remove customer disk pack (if installed). Install a scratch disk pack and close pack access cover.
2. Set oscilloscope controls as follows:
   - CH 1 VOLTS/DIV: 1
   - A TIME/DIV: 5 ms
   - A TRIGGERING: Negative/Internal
3. Connect oscilloscope to wirewrap A08-07B (Speed Transducer Output): Open cabinet rear door and remove logic chassis card cover. Remove rear door panel. Connect oscilloscope CH 1 to backpanel pin A08-07B.
4. Load Heads: Press START switch to start spindle drive motor and to load heads.
5. Calibrate scope to ground. Observe waveform on oscilloscope. Signal should be 4 to 7 volts, peak-to-peak. If not, check speed sensor gap as directed in Speed Sensor Assembly Adjustment procedure. If within limits go to step 6.
6. Disconnect CH 1 and connect it to wirewrap pin A08-3B (Speed Pulses, X2800).
7. Observe that signal is a logical 1 for 55 ±14 µsec and that time between positive leading edges (period between pulses) is approximately 16.6 µsec: Switch oscilloscope A TIME/DIV control

first to 10 µsec/DIV for first reading and then to 2 µsec/DIV for second reading (period reading).

8. If requirements of step 7 are not met, troubleshoot speed logic circuitry on card A08. If within limits, go to step 9.

9. Remove scratch pack: Press START switch to stop spindle drive motor. Open pack access cover, remove disk pack and close pack access cover.

10. Disconnect oscilloscope: Disconnect oscilloscope probe from drive. Install logic chassis card cover and cabinet rear door panel. Close cabinet rear door.

Power Up Clear

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

1. Open cabinet rear door and set the UNIT POWER circuit breakers to OFF.

2. Set oscilloscope controls as follows:

   - CH 1 VOLTS/DIV: 1
   - A TIME/DIV: 50 ms
   - A TRIGGERING: Positive/Internal
   - MODE TRIGGER: CHOP

3. Connect oscilloscope to drive as follows: Remove logic chassis card cover and remove rear door panel.

   - CH 1 to +5 test point jack on logic chassis maintenance panel.
   - CH 2 to wirewrap in B11-10B (Power Up Blanking, I1003)

4. Observe oscilloscope while turning 3A UNIT POWER circuit breaker to ON. 400 Hz

   a. Channel 1 (+5v) should reach +4.5 volts within 100 ms. If not, check +5 volt regulator and ac power supply.

   b. Channel 2 should be a logical 1 for 200 ±100 ms. If not, check UBG delay B11 (D1000) and associated logic circuitry.

MECHANICAL CORRECTIVE MAINTENANCE

ACTUATOR REPLACEMENT

NOTE

Replacement of the actuator is to be performed only by trained service personnel.

1. Remove disk pack: Press START switch to stop spindle drive motor. Open pack access cover, remove disk pack and close pack access cover.

2. Open cabinet rear door and set UNIT POWER circuit breakers to OFF.

3. Refer to Side Panel Removal/Installation procedure and remove right (viewed facing drive front) side panel.

CAUTION

The magnetic field generated by the magnet assembly is very strong. Permanent watch damage will occur if brought near magnet.

4. Disconnect voice coil leadwire: Open cabinet top cover and remove deck cover. Make note of voice coil leadwire connect scheme and disconnect leadwires.

5. Disconnect velocity transducer plug P4 (refer to Figure 3-19).

6. Leadwires to heads loaded switch are fastened to actuator side with a cable tie. Cut cable tie to free leadwires.

7. Loosen two screws attaching heads loaded switch and remove switch.

8. Open pack access cover.

9. Remove two screws holding lower mounting bracket of gas cylinder to deck (one bracket on each side of pack access cover).

10. Remove five screws securing parking brake cover to shroud and remove cover.

11. Remove two screws attaching access cover interlock switch to shroud. Take switch out of shroud area and let hang by its leadwires.

12. Remove five screws securing shroud side panels to shroud and deck (one panel on each side of shroud).

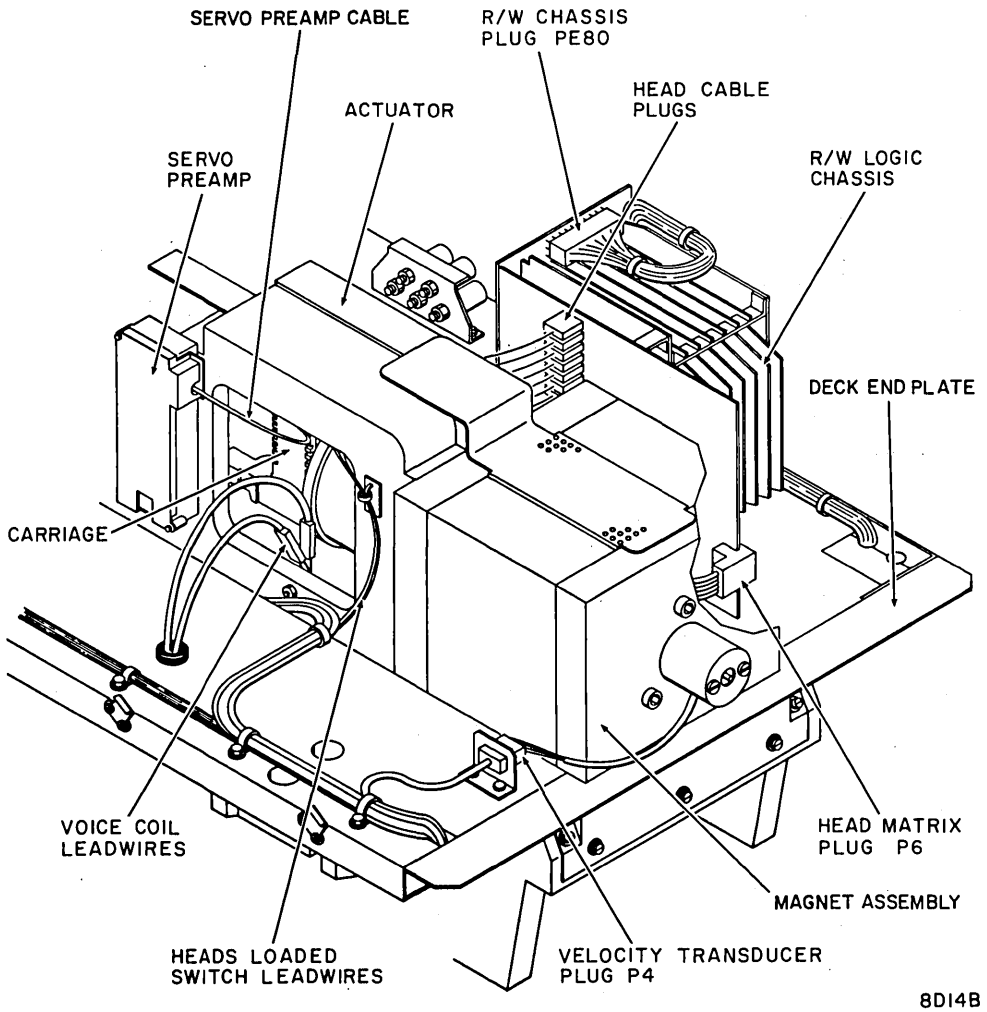


Figure 3-19. Main Deck Top View

13. Remove ground cable between shroud and operator control panel.

14. Remove 12 screws attaching shroud to deck.

15. Close pack access cover. Lift up on front of shroud/access cover to enable rear to clear operator panel and pull shroud forward to remove it.

16. Remove two screws securing servo preamp housing cover (Figure 3-19). Remove and set cover aside.

17. Disconnect servo head plug and servo output plug P8 from servo preamp circuit board. Write "SERVO" on servo head plug.

18. Remove head cable plugs from card E0 (mark each plug in sequence removed from top plug "0" to last plug "18").

CAUTION

Remove one head/arm assembly at a time.

19. Remove head/arm assemblies starting at top of carriage (refer to Head/Arm Replacement procedure).

20. Remove logic card E0.

21. Loosen four screws securing read/write chassis to deck, slide chassis toward the rear, lift off deck and lay it aside.

22. Remove screw attaching head cable bracket to deck. Remove bracket.

23. Refer to Velocity Transducer Replacement procedure and remove velocity transducer.

24. Remove two screws securing forward stop plate to stop mount (Figure 3-20).

25. Remove 10 screws holding rear deck seal to deck. Remove rear deck seal.

26. Remove screw securing actuator to magnet assembly.

27. Remove three screws (under deck) securing magnet assembly to deck (screw above motor mounting plate cannot be completely removed, allow screw to rest on motor mounting plate).

28. Fully extend carriage.

CAUTION

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

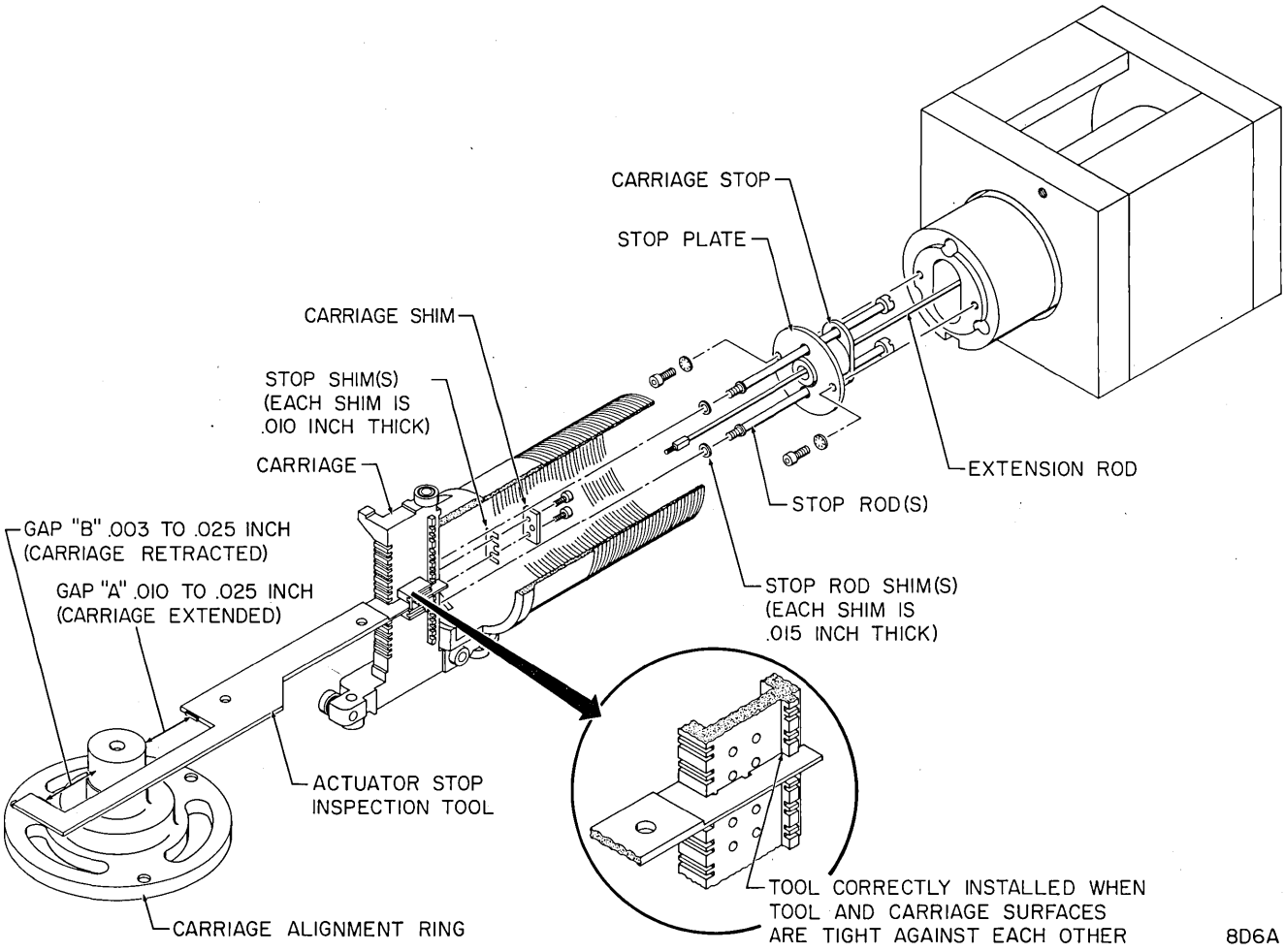


Figure 3-20. Carriage Stop Adjustment

29. Remove magnet assembly from deck by sliding assembly straight back from voice coil.

30. Remove two screws securing servo preamp housing assembly to actuator. Remove servo preamp housing.

31. Remove nut, screw, and clip holding flexible conductor to actuator housing. Back carriage out of actuator housing.

32. Using a 3/16 inch ball ended hex driver remove five screws and washers securing actuator to deck.

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

34. Remove actuator assembly to a clean work area.

35. Prepare to install replacement actuator by removing screw, clip and nut securing flexible conductor to replacement actuator housing. Then back carriage out of housing.

36. Install replacement actuator housing on deck. Use five screws to loosely secure actuator to deck. Visually center front screw in its hole by rotating housing on its dowel pin.

37. Remove air supply according to Air Supply Removal Installation procedure to allow access to spindle mount screws.

38. Loosen spindle mounting screws. Use spindle adjusting tool (refer to Figure 3-24) to adjust spindle so the two locating pins are centered in the spindle flange slots. Then tighten spindle mounting screws until they are snug.

39. Slide carriage into actuator housing.

40. Install carriage alignment arm on carriage at head 9 position (Figure 3-24), torque head/arm clamp screw to 4 inch-pounds.

41. Install carriage alignment ring on spindle.

42. Slowly extend carriage until carriage alignment arm and ring are approximately as shown in Figure 3-20.

NOTE

Initial alignment of carriage to spindle is performed by moving actuator housing with reference to spindle.

43. Rotate the actuator housing on its dowel pin to obtain correct clearance between alignment ring and arm as specified in Figure 3-20.

44. Carefully remove carriage alignment arm and carriage.

45. Torque five screws securing the actuator assembly to deck to 60 inch-pounds.

CAUTION

Do not loosen any of the socket head screws securing rails to actuator housing. Rails are adjusted forcibly by turning the eccentric screws without loosening the securing socket head screws.

46. Clean feet of rail adjustment tool and pads of deck. Place rail adjustment tool on deck (Figure 3-21)and measure flatness of top of lower rail as follows:

    a. Move indicator from 0.38 inch in front of front screw back to front eccentric (Figure 3-22). Total deviation must not exceed three small divisions (0.000060 inch).

    b. Move indicator from 1.25 inch in front of rear eccentric to 1.0 inch in back of rear eccentric. Total deviation must not exceed three small divisions (0.000060 inch). If requirements are met, proceed to step 48. If not, proceed to step 47.

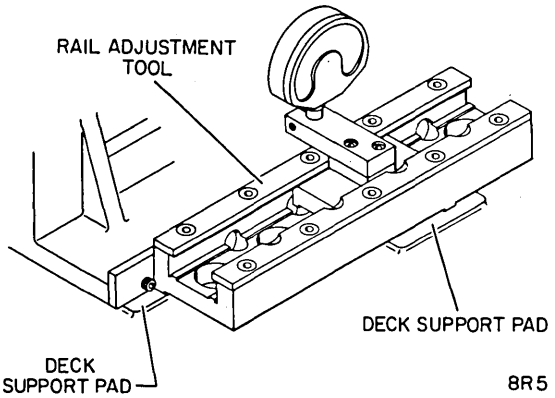


Figure 3-21. Rail Adjustment Tool

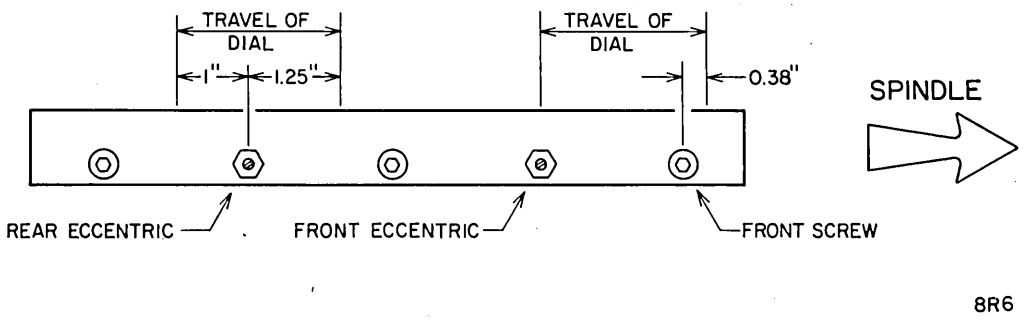


Figure 3-22. Lower Rail Adjustment Eccentrics

47. If either or both requirements are not met adjust as follows:

    a. Remove rail adjustment tool and loosen lock nut on eccentric screw that requires adjustment (both if necessary).

    b. Replace rail adjustment tool and turn eccentric screw with a screwdriver to adjust flatness. Repeat for other eccentric screw if required.

    c. When rail is adjusted to meet requirements of step 46, remove rail adjustment tool and tighten lock nut to 28 inch-pounds. Recheck flatness (repeat step 45a and 45b).

48. Clean actuator rails and carriage bearings per Section 2.

49. Install carriage into actuator housing from rear and attach flexible conductor to housing with insulated screw, clip, and nut (nut on outside of housing).

50. Install three carriage stop shims and tighten.

51. Insert a 1/16 inch allen wrench through hole in stop rod and use wrench as lever to unscrew stop rod.

52. Install two stop rod shims on each stop rod and lightly tighten stop rods.

53. Extend carriage forward, slide magnet assembly into position, and loosely secure magnet to deck using three screws.

54. Install two screws to secure stop plate. to magnet assembly and tighten securely.

55. Move carriage back and forth to assure that stop rods do not rub on stop plate.

56. 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, then tighten screw to 60 ±3 inch-pounds. Insert 0.005 inch non-metallic feeler gage between coil and magnet to ensure 0.005 inch gap around coil. Then tighten three screws securing magnet to deck to 30 ±1 inch-pounds. Recheck 0.005 inch gap around coil.

57. Install actuator stop inspection tool in head position 9, hold tight against back carriage reference surface, and secure with head clamping hardware.

58. Fully extend carriage and hold firmly in place.

59. Using plastic feeler gage, measure gap "A" shown in Figure 3-20.

    NOTE

    Each stop rod shim is 0.015 inch thick. Refer to Table 3-2 and determine quantity of shims to be added or removed before removing stop rods. Add or remove an equal number of shims on each stop rod.

60. Unscrew stop rod using a 1/16 inch allen wrench through hole in stop rod.

61. Add or remove stop rod shims as required for each stop rod.

62. Apply one drop of Loctite, Grade C, to threads of each stop rod.

63. Install stop rods and tighten rods firmly.

64. Fully retract carriage and hold carriage firmly in place.

TABLE 3-2. SHIMS FOR FORWARD ADJUSTMENT

Measurement at Gap "A"	Shims Added per Stop Rod
0.010 - 0.025	0
0.026 - 0.039	1
0.040 - 0.055	2
0.056 - 0.069	3

65. Using plastic feeler gage, measure gap "B" shown in Figure 3-20.

66. If the requirements are met, apply one drop of Loctite, Grade C, to the threads of each carriage shim screw and re-tighten. If the requirements are not met, add or remove carriage stop shims as required (each carriage stop shim is 0.010 inch thick). Refer to Table 3-3.

67. Remove actuator stop inspection tool and install carriage alignment arm in head 9 position. Secure with head clamping hardware and torque head/arm clamp screw to 4 inch-pounds.

68. Using spindle adjustment tool, adjust spindle to obtain clearance specified in Figure 3-24.

69. Tighten three spindle mounting screws and recheck clearance.

70. Remove carriage alignment arm and carriage alignment ring.

71. Attach rear deck seal to deck.

72. Replace air supply.

73. Replace heads loaded switch.

74. Secure heads loaded switch leadwires to actuator side with cable tie.

75. Perform Heads Loaded Switch Adjustment procedure.

76. Install velocity transducer per Velocity Transducer Replacement procedure.

77. Connect velocity transducer cable plug P4.

78. Attach cable post to deck.

79. Slip read/write chassis into position under four screws and tighten screws.

80. Install logic card E0.

81. Install all heads per Head/Arm Replacement procedure.

82. Attach head cable plugs to card E0 in reverse of sequence removed.

83. Connect servo head plug and servo output plug P8 to servo preamp circuit board.

84. Install servo preamp housing cover.

85. Connect voice coil leadwires.

86. Install shroud and attach to deck.

87. Replace ground cable between shroud and operator control panel.

88. Replace both shroud side panels.

89. Replace access cover interlock switch and attach with two screws.

90. Replace parking brake access cover.

91. Attach both lower mounting brackets of gas cylinders to deck.

92. Perform Servo System Checks and Adjustments.

93. Perform Head/Arm Adjustment procedure.

94. Replace deck cover.

95. Close cabinet top cover.

96. Replace right side panel.

97. Close cabinet rear door.

AIR SUPPLY REMOVAL / INSTALLATION

1. Remove disk pack: Press START switch to stop spindle drive motor. Open pack access cover, remove disk pack and close pack access cover.

2. Open cabinet rear door and set UNIT POWER circuit breakers to OFF.

TABLE 3-3. SHIMS FOR REVERSE ADJUSTMENT

Measurement at Gap "B"	Stop Shims Required
0.003 - 0.025	0
0.026 - 0.035	1
0.036 - 0.045	2
0.046 - 0.055	3

3. Release two turnlock fasteners securing front panel to drive, reach behind front panel to disconnect ground lead, then remove panel.

4. Loosen hose clamp securing rubber boot to top outlet of air supply. Remove rubber boot.

5. Remove air supply primary filter by pressing clips away from primary filter frame (refer to Figure 1-1).

6. Remove two screws (located behind primary filter) that attach air supply to frame.

7. Reach behind air supply and pull the two inch hose from air supply with a twisting motion.

8. Loosen hose clamp holding three inch hose to upper rear of air supply. Remove hose.

9. Pull air supply forward sufficiently to disconnect power cable connector P2 from lower rear of air supply. Then pull out air supply.

10. After performing desired maintenance, install air supply by reversing the above procedure.

BRAKE PLATE ASSEMBLY

Replacement

1. Remove disk pack: Press START switch to stop spindle drive motor. Open pack access cover, remove disk pack (leave cover open).

2. Open cabinet rear door and set UNIT POWER circuit breakers to OFF.

3. Remove parking brake cover: Remove five screws securing parking brake cover to shroud. (Figure 3-23). Remove parking brake cover from shroud.

4. Remove defective brake plate assembly: Remove two screws securing brake plate assembly and springs to deck casting. Remove brake plate from deck observing how screws, springs and plate are assembled.

5. Install replacement brake plate assembly: Assemble two screws, two springs and replacement brake plate assembly. Position assembly on deck and tighten the two screws.

6. Perform Brake Plate Check and Adjustment procedure.

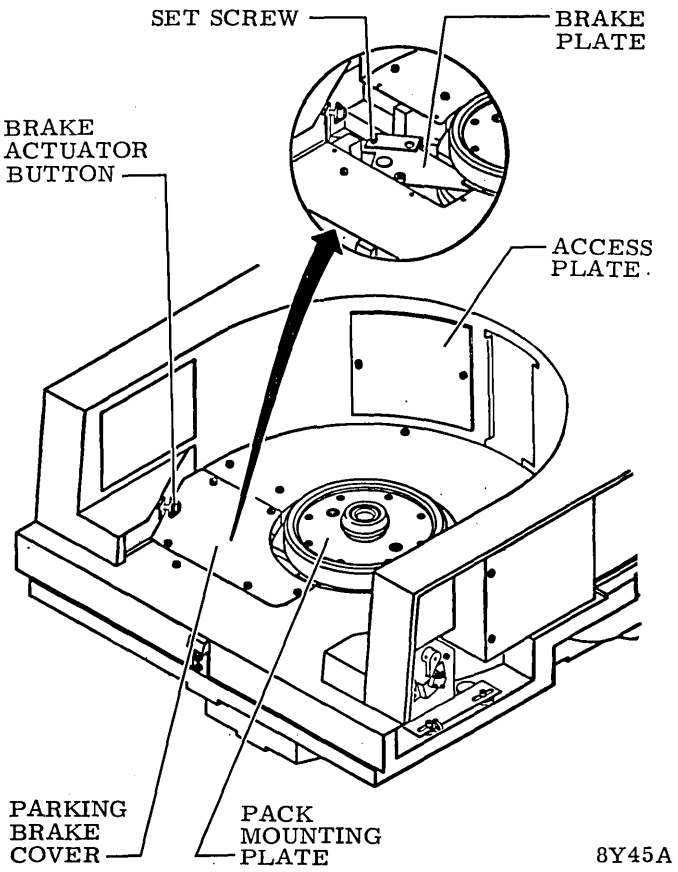


Figure 3-23. Brake Plate Replacement

Check And Adjustment

1. Remove disk pack: Press START switch to stop spindle drive motor. Open pack access cover and remove disk pack (leave pack access cover open).

2. Open cabinet rear door and set UNIT POWER circuit breakers to OFF.

3. Measured clearance between brake tooth and pack mounting plate should be 0.015 ±0.005 inch: With parking brake cover in place (Figure 3-23), use feeler gauge to check that clearance between brake tooth and flat surface on underside of pack mounting plate is 0.015 ±0.005 inch (measured distance is where tooth is not engaged or under a notch in pack mounting plate).

4. If requirement of step 3 is within limits, go to step 5. If not within limits, adjust as follows:

a. Remove disk pack.

b. Remove parking brake cover: Remove five screws securing parking brake to shroud. Remove parking brake cover from shroud.

c. Rotate spindle to a position where the brake tooth is not under a notch in the pack mounting plate.

d. Adjust setscrew (Figure 3-23) until distance between brake tooth and pack mounting plate is 0.015 ±0.005 inch. Turning setscrew clockwise decreases distance and turning setscrew counterclockwise increases distance.

e. Install parking brake cover: Position parking brake cover on shroud. Secure parking brake cover to shroud using five screws.

5. Close pack access cover. Set UNIT POWER circuit breakers to ON and close cabinet rear door.

CARRIAGE/SPINDLE ALIGNMENT

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

1. Remove disk pack: Press START switch to stop spindle drive motor. Open pack access cover and remove disk pack (leave cover open).

2. Open cabinet rear door and set UNIT POWER circuit breakers to OFF.

3. Remove head number 10: Refer to Head/Arm Replacement procedure and remove head number 10.

4. Install carriage alignment arm on carriage at head 10 position. Torque head/arm clamp screw, clamp plate, washers, and alignment arm to 4 inch-pounds.

5. Install carriage alignment ring on spindle.

6. Install head cam tool: Refer to Manual Carriage Positioning With Power Off and install head cam tool at head number 10 position.

7. Slowly extend carriage until carriage alignment arm and ring are approximately aligned as shown in Figure 3-24.

CAUTION

The carriage is aligned by moving the spindle. The six bolts securing the actuator and magnet to the deck are not to be loosened unless alignment cannot be attained by moving the spindle.

8. Check that clearance between ring and arm tools is a specified in Figure 3-24. If correct proceed to step 19.

9. If clearance is incorrect, loosen three screws securing the spindle assembly to deck.

NOTE

On units having cutouts in shroud (see Figure 3-23) 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 3-24. If this clearance is obtained proceed to step 11. However, if it is too far out of adjustment to be corrected in this manner proceed to step 12.

11. Tighten the three spindle screws and recheck clearance. If incorrect, repeat step 10. When the clearance is correct proceed to step 19.

12. Move the spindle until the dowel pins (Figure 3-24) are centered in the spindle slots. Tighten the three spindle screws.

13. Loosen the three screws securing the actuator housing to the deck.

NOTE

The servo preamp housing must be removed to gain access to one of the actuator mounting screws.

14. 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.

15. Rotate the actuator and magnet as one assembly to obtain the clearance specified in Figure 3-24.

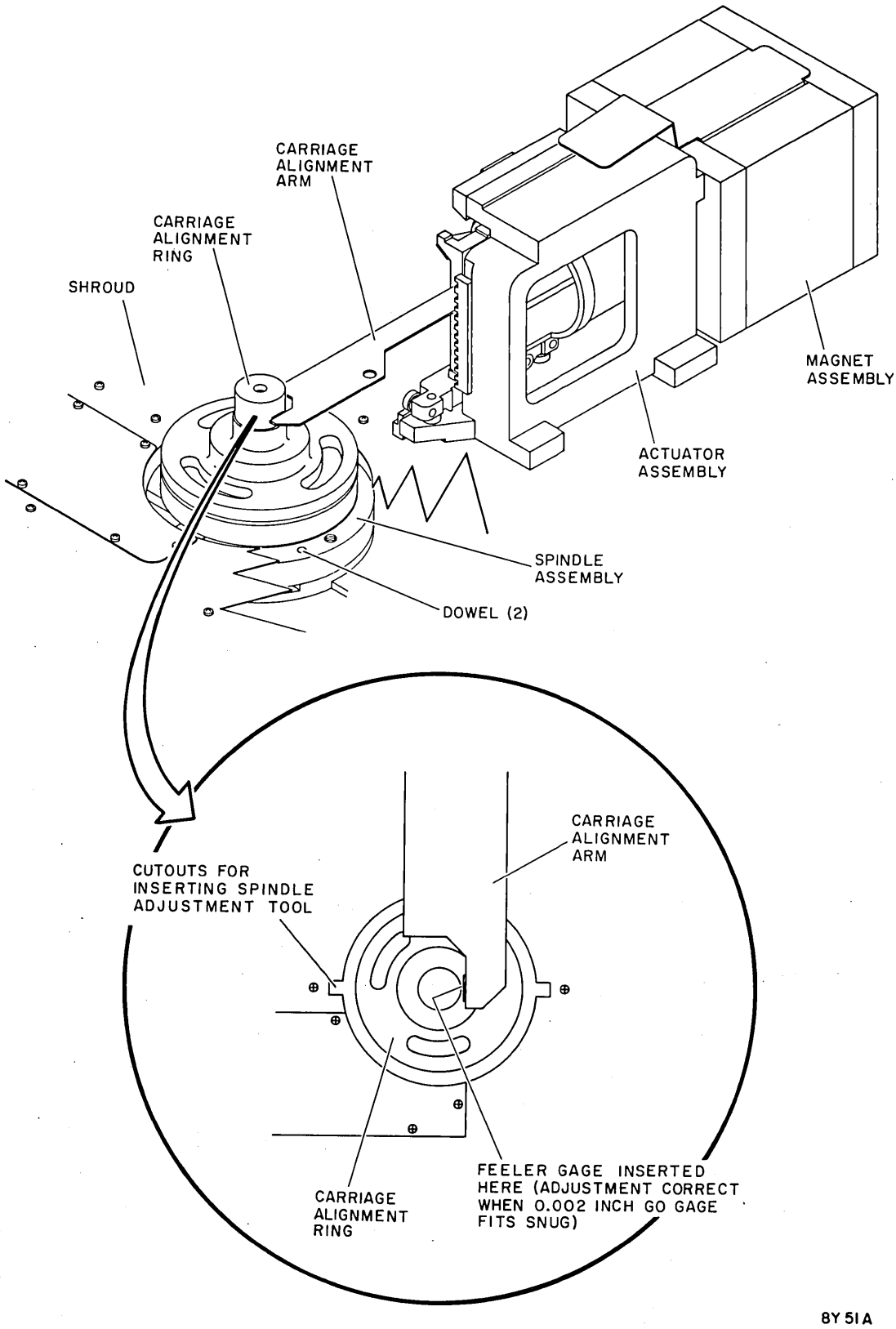


Figure 3-24. Carriage/Spindle Alignment

16. Torque (using 55 to 60 in-lbs.) the three screws securing the actuator housing.

17. Tighten the three screws securing the magnet.

18. Recheck the clearance. If incorrect proceed to step 9 to fine adjust the alignment.

19. Retract carriage, remove head cam tool and carriage alignment arm.

20. Remove carriage alignment ring.

21. Install head removed in step 2: Refer to Head/Arm Replacement procedure and install head removed in step 2.

22. Inspect read/write heads per the Head/Arm Replacement Criteria in this section.

23. Perform the Head/Arm Alignment procedure on all heads.

DRIVE BELT

Adjustment

1. Remove disk pack: Press START switch to stop spindle drive motor. Open pack access cover, remove disk pack and close pack access cover.

2. Open cabinet rear door and set UNIT POWER circuit breakers to OFF.

3. Remove cabinet front panel: Release two turnlock fasteners securing front panel to drive, reach behind front panel to disconnect ground lead, then remove panel.

4. Push motor forward to insure free lateral movement of motor mounting plate.

5. Inspect drive belt for cracks or worn spots. If required, replace belt per Drive Belt Replacement procedure.

NOTE

Units having two idler springs, repeat steps 7, 8 and 9 for each idler spring.

6. Locate drive belt tension idler springs (Figure 3-25). Check for correct adjustment as explained in step 7.

7. Length between idler spring posts must be 5.42 ±.12 inch. If adjustment is required, proceed to step 8, if not, proceed to step 10.

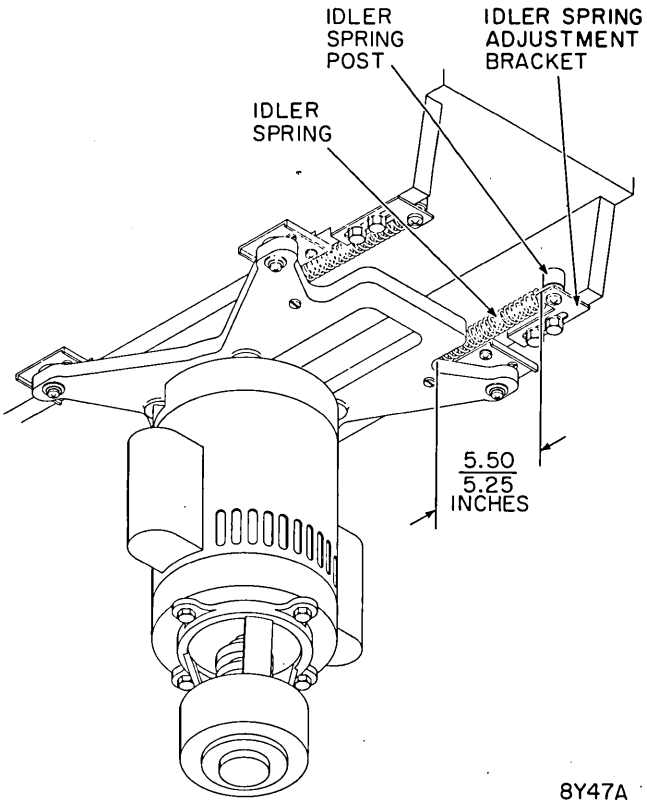


Figure 3-25. Drive Belt Adjustment

8. Loosen two screws securing idler spring adjustment bracket to deck.

9. Reposition idler spring bracket and spring until requirements are met. Tighten screws and recheck requirements.

10. Install cabinet front panel.

11. Set UNIT POWER circuit breakers to ON and close cabinet rear door.

Replacement

1. Remove disk pack: Press START switch to stop spindle drive motor. Open pack access cover, remove disk pack and close pack access cover.

2. Open cabinet rear door and set UNIT POWER circuit breakers to OFF.

3. Remove cabinet front panel: Release two turnlock fasteners securing front panel to drive, reach behind front panel to disconnect ground lead, then remove panel.

4. Remove static ground spring leadwire from deck casting.

5. Disconnect speed sensor plug P3.

6. Disconnect pack on switch leadwires: Make note of pack sensor switch leadwire connection scheme and disconnect leadwires at switch.

CAUTION

Use care when removing drive belt to prevent damage to the pack sensor switch and static ground spring.

7. Remove drive belt from unit as follows:

   a. Remove idler springs (Figure 3-25).

CAUTION

Use care when removing drive belt to prevent damage to the pack sensor switch and static ground spring.

   b. Move drive motor toward spindle assembly and remove drive belt from drive motor pulley and from spindle pulley. Remove belt from unit.

8. Install replacement drive belt: Install replacement drive belt as follows:

   a. Position replacement drive belt around drive motor pulley.

   b. Move drive motor toward spindle assembly and slip drive belt around spindle pulley.

   c. Install idler springs (Figure 3-25).

   d. Push drive motor to rear of cabinet to insure motor is properly seated.

   e. Manually rotate spindle to align drive belt on pulleys.

9. Connect speed sensor plug P3 and static ground spring leadwire.

10. Perform Drive Belt Adjustment procedure, steps 6 through 10.

DRIVE MOTOR REPLACEMENT

1. Remove disk pack: Press START switch to stop spindle drive motor. Open pack access cover, remove disk pack and close pack access cover.

2. Open cabinet rear door and set UNIT POWER circuit breakers to OFF.

3. Remove cabinet front panel: Release two turnlock fasteners securing front panel to drive, reach behind front panel to disconnect ground lead, then remove panel.

4. Disconnect the following plugs and leadwires:

   a. Drive motor cable plug P7.

   b. Hysteresis brake cable plug P2.

   c. Speed sensor cable plug P3.

   d. Pack sensor switch leadwires (make note of leadwire connection scheme before disconnecting leadwires); disconnect wires at switch.

5. Refer to Drive Belt Replacement procedure, step 7, and remove drive belt.

CAUTION

Do not support motor and brake assembly on hysteresis brake cup.

6. 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 3-26).

7. Loosen both setscrews in drive motor pulley. Remove pulley.

8. Remove hysteresis brake assembly as described in Hysteresis Brake Replacement procedure.

9. Install hysteresis brake assembly on replacement drive motor as described in Hysteresis Brake Replacement procedure.

10. Slide drive motor pulley on replacement drive motor shaft until it is 0.56 ±0.02 inch from drive motor end bell. Tighten both setscrews.

11. 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.

12. Position drive belt around spindle pulley, and slip other end of belt around drive motor pulley. Visually confirm that drive motor pulley is aligned with spindle pulley.

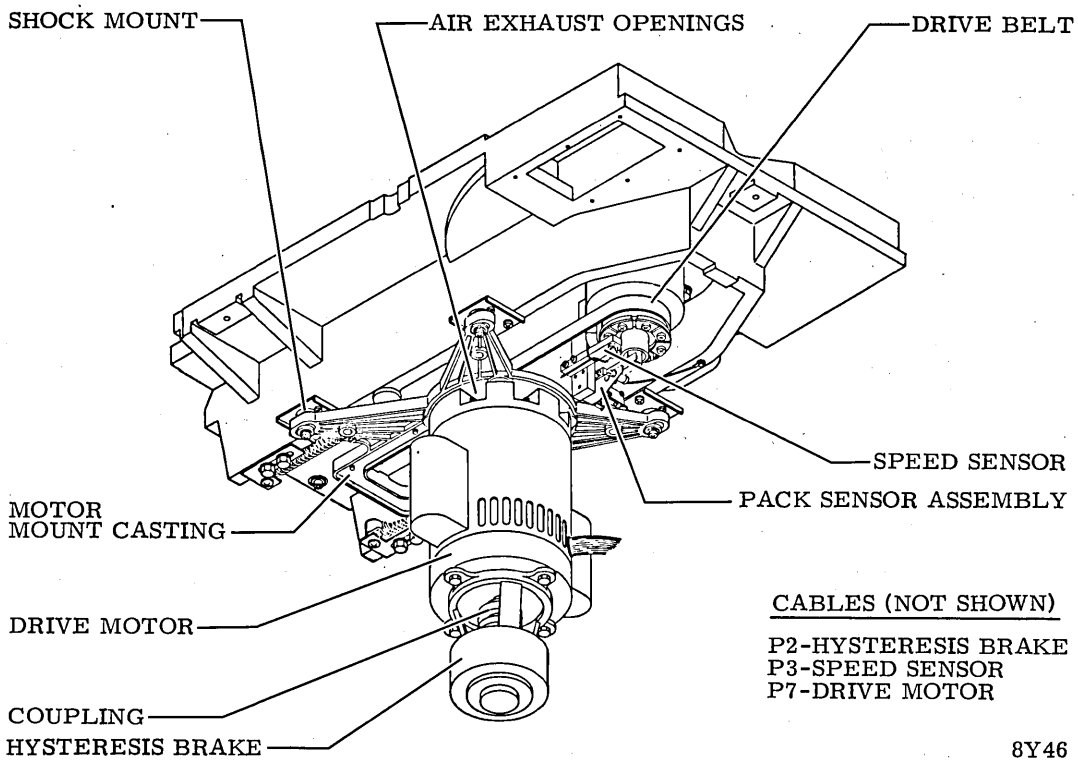


Figure 3-26. Deck Assembly Bottom View

13. Install drive belt: Refer to Drive Belt Replacement procedure, step 8, and install drive belt.

14. Connect the following plugs and leadwires:

    a. Drive motor cable plug P7.

    b. Hysteresis brake cable plug P2.

    c. Speed sensor cable plug P3.

    d. Pack sensor switch leadwires.

15. Install a scratch disk pack: Open pack access cover, install a scratch disk pack and close pack access cover.

16. Start spindle drive motor, observe drive motor for proper operation: Set UNIT POWER circuit breakers to ON. Press START switch to start spindle drive motor. Observe drive motor for proper operation.

17. Press START switch to stop spindle drive motor.

18. Close cabinet rear door and install cabinet front panel.

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 3-27 and perform the following procedure. Use care not to damage the 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.

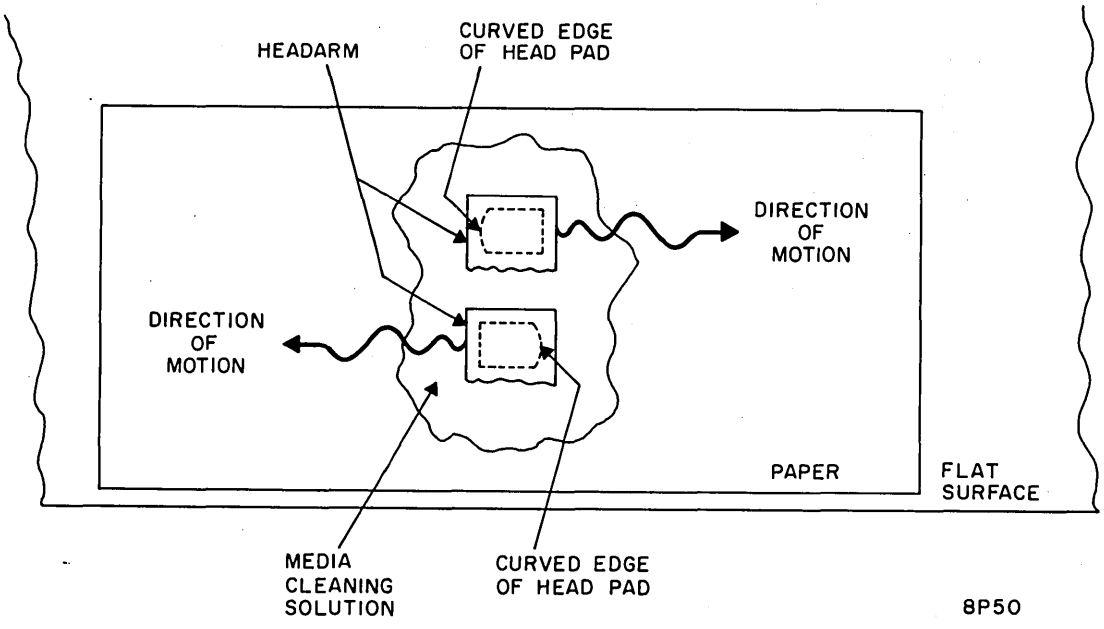


Figure 3-27. Head Cleaning Motion

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 3-27) 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 indicating repeated head/disk impact.

2. Appreciable oxide buildup located primarily on edge of ferrite insert.

3. Scratches over 1/2 of head face surface.

4. Imbedded particles in head.

5. Audible ping while operating with heads over disk area, indicating that head is hitting disk surface.

6. Oxide deposits cannot be cleaned from head.

7. Head or head/arm is damaged.

Read-Write Head/Arm Replacement

1. Remove disk pack: Press START switch to stop spindle drive motor. Open pack access cover, remove disk pack and close pack access cover.

2. Open cabinet rear door and set UNIT POWER circuit breakers to OFF.

3. Open cabinet top cover and remove deck cover.

4. Remove five screws securing left (as viewed from front) shroud side panel. Remove shroud side panel by sliding forward and swinging out.

5. Open pack access cover.

6. Using a 3/32 inch hex driver through opening created by removing left shroud side panel, remove four of the five screws securing head cable plate (top two screws and bottom two screws). Refer to Figure 3-27.

7. Loosen (but do not remove) center screw securing head cable plate, Remove head cable plate by pulling forward and unhooking from loosened screw.

NOTE

To facilitate replacement of the bottom heads, the voice coil leads may be removed.

8. To determine location of faulty head, refer to either the head identification label on the actuator assembly or to Figure 3-29.

9. Remove clamp plate securing faulty head/arm to carriage (Figure 3-28) and set aside.

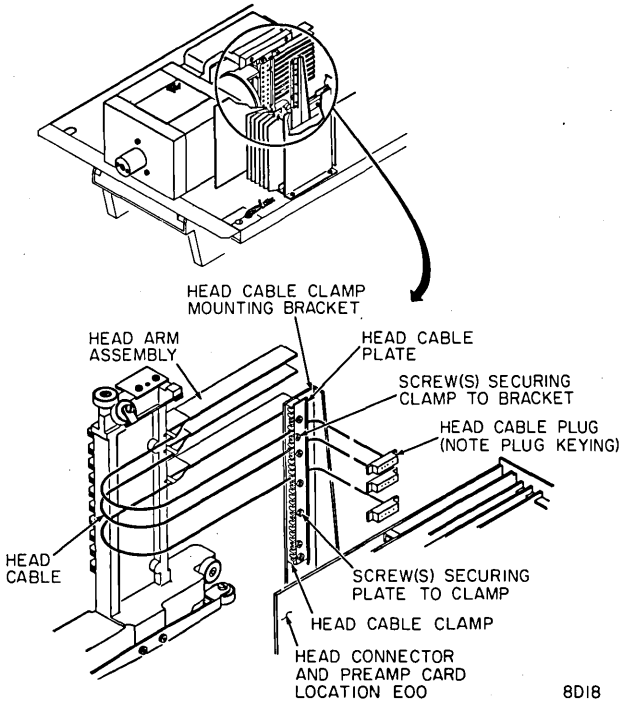


Figure 3-28. Head Cable Clamping/Connecting

CAUTION

Observe the following precautions during remainder of procedure:

a. Do not touch head pad. Damage to the gimbal spring may result. Also, finger prints on flying surface of head will cause head crashes.

b. Use care when installing or removing a head/arm assembly. If assembly is allowed to unflex and contact the adjacent head, damage to itself and/or to an adjacent assembly may result.

10. With the left hand reaching into the shroud area, grasp front of head/arm firmly between index finger and thumb (avoiding head pad) and force head/arm in one of the following directions (Figure 3-30):

    a. Down - if head pad is facing up.

    b. Up - if head pad is facing down.

    This prevents head pad from contacting adjacent head/arm.

11. Move front of head/arm towards left side of drive (refer to Figure 3-31). Head/arm pivots to free rear notch of head/arm from slot in carriage rib.

12. While holding front of head/arm with left hand, grasp rear with right hand and wiggle head/arm back and forth (in a sideways motion) constantly pulling forward to disengage head from front slot of carriage.

13. Lay head/arm in shroud area and disconnect head cable from logic card E0.

14. Remove cable spring from head cable clamp. Remove head/arm from drive taking care not to snag head cable connector.

15. Plug replacement head/arm cable connector onto proper pins of logic card E0.

16. Slide head/arm between existing head/arm cables at approximate place. Tip head/arm on its side and slide into shroud.

CAUTION

Head/arm must be kept straight (see Figure 3-30) while inserting until it is completely in place to avoid damage to itself and adjacent head/arms.

17. Manually straighten head/arm as shown in Figure 3-30 and guide it into proper front slot of carriage (Figure 3-31).

18. Wiggle head/arm back and forth (in a sideways motion) constantly pushing toward the rear until the head/arm is firmly seated in the front slot of the carriage.

19. Push rear notch of head/arm tight against the carriage rib while guiding front of arm over cam surface. Visually check lateral alignment of head/arm with other head/arms as viewed from front of drive to determine that it is properly seated. Reseat if necessary.

20. Install clamp plate removed in step 9 and torque to 4 inch-pounds.

21. Press end of head cable spring into proper slot of head cable clamp.

NOTE

Before installing head cable plate make sure all head cables are properly placed. Also ensure that washer of screw loosened in step 7 is toward head of screw.

22. Place head cable plate into position. While pushing head cable plate toward rear of drive, tighten screw loosened in step 7.

23. Install remaining screws attaching head cable plate to head cable bracket.

24. Close pack access cover.

25. Install left shroud side panel.

26. Perform Head/Arm Alignment procedure on replaced head/arm.

Servo Head, Arm Replacement

1. Remove disk pack: Press START switch to stop spindle drive motor. Open pack access cover, remove disk pack and close pack access cover.

2. Open cabinet rear door and set UNIT POWER circuit breakers to OFF.

3. Open cabinet top cover and remove deck cover.

4. Remove five screws securing right (as viewed from front) shroud side panel. Remove shroud side panel by sliding forward and swinging out.

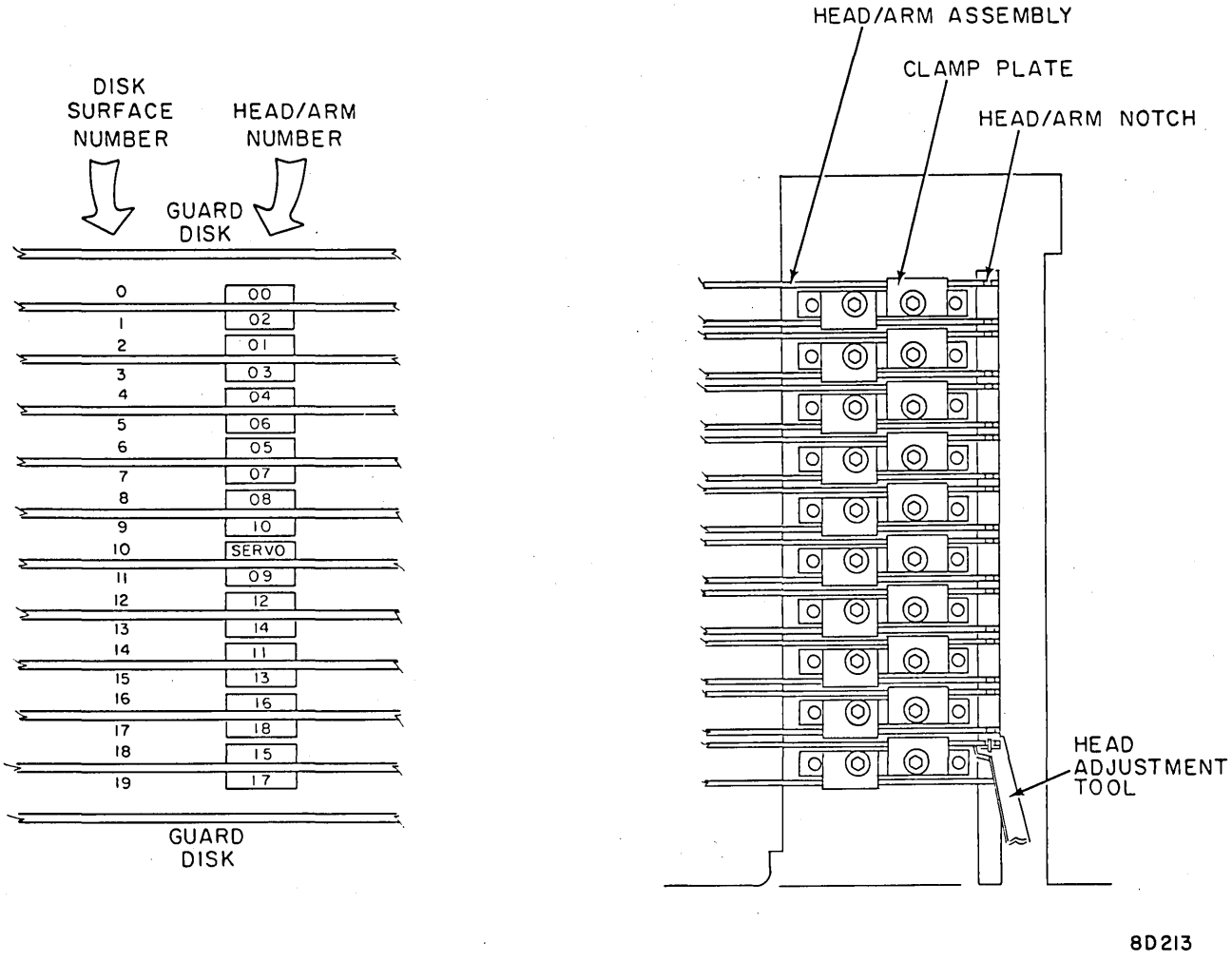


Figure 3-29. Head/Arm Assembly Identification

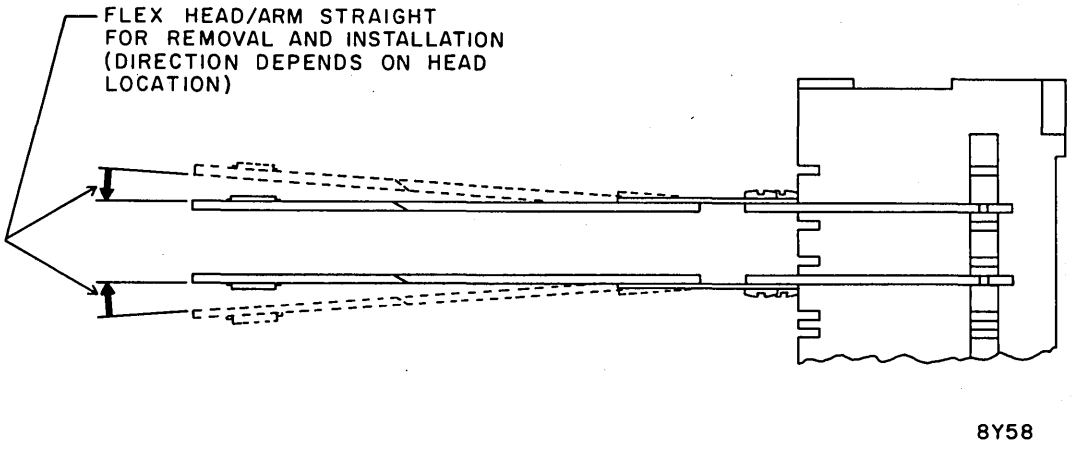


Figure 3-30. Head/Arm Installation and Removal Profile

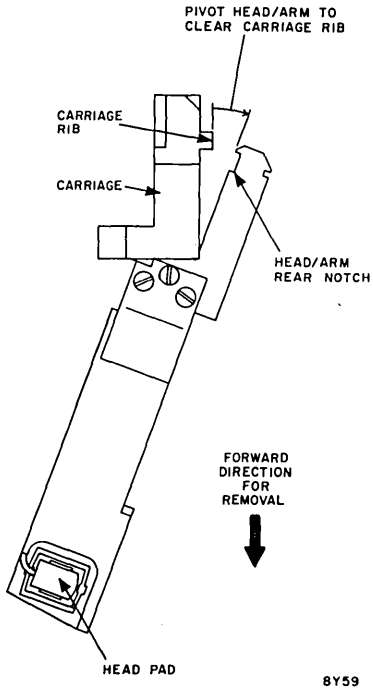


Figure 3-31. Head/Arm Installation and Removal Position

5. Open pack access cover.

6. Using a 1/4 inch nut driver through the opening created by removing right shroud side panel, remove two screws securing servo preamp housing cover.

7. Remove servo preamp housing cover.

NOTE

To facilitate replacement of servo head, the voice coil leads may be removed.

8. To determine location of servo head, refer to either the head identification label on the actuator assembly or to Figure 3-29.

CAUTION

Observe the following precautions during remainder of procedure:

a. Do not touch head pad. Damage to the gimbal spring may result. Also, finger prints on flying surface of head will cause head crashes.

b. Use care when installing or removing a head/arm assembly. If assembly is allowed to unflex and contact the adjacent head, damage to itself and/or to an adjacent assembly may result.

9. Remove clamp plate securing servo head/arm to carriage (Figure 3-29) and set aside.

10. Disconnect servo head/arm cable connector from servo preamp.

11. With the left hand reaching into the shroud area, grasp front of head/arm firmly between index finger and thumb (avoiding head pad) and force head/arm in an upward direction. This prevents head pad from contacting adjacent head/arm.

12. Move front of head/arm towards left side of drive (refer to Figure 3-31). Head/arm pivots to force rear notch of head/arm from slot in carriage rib.

13. While holding front of head/arm with left hand, grasp rear with right hand and wiggle head/arm back and forth (in a sideways motion) constantly pulling forward to disengage head/arm from front slot of carriage.

14. Move freed head/arm into shroud area. Guide head/arm cable and connector carefully into shroud area and remove head/arm from drive.

CAUTION

Head/arm must be kept straight (see Figure 3-30) while inserting until it is completely in place to avoid damage to itself and adjacent head/arms.

15. Guide head/arm cable and connector between existing head/arms.

16. Manually straighten head/arm as shown in Figure 3-30 and guide it into proper front slot of the carriage (Figure 3-31).

17. Wiggle head/arm back and forth (in a sideways motion) constantly pushing toward the rear until the head/arm is firmly seated in the front slot of the carriage.

18. Push rear notch of head/arm tight against the carriage rib while guiding front of arm over cam surface. Visually check lateral alignment of head/arm with other head/arms as viewed from front of drive to determine that it is properly seated. Reseat if necessary.

19. Install clamp plate removed in step 9 and torque to 4 inch-pounds.

20. Connect servo head/arm cable connector to servo preamp.

21. Replace servo preamp housing cover.

22. Close pack access cover.

23. Install right shroud side panel.

24. Perform Head/Arm Alignment procedure on all head/arms.

Head/Arm Alignment Check

Head/arm alignment check is performed by using the Off Line Tester or by using microprogram diagnostic routines and a controller. The following procedure uses the Off Line Tester for alignment operation. Refer to the Reference manual for installation and familiarization of tester operation.

Refer to Controller manual for head alignment procedure using microprogram diagnostics.

The CE disk pack and Off Line Tester must be temperature stabilized before the following procedure is performed. Pack, drive, and Off Line Tester must be in the same temperature environment for a minimum 60 minute period immediately preceding head alignment. In addition, the CE pack must be purged on the drive a minimum of 30 minutes and the Off Line Tester must be plugged into the drive a mimimum of 10 minutes before performing head alignment procedure.

NOTE

If head alignment is being performed on more than one drive, the CE pack needs only a 15 minute purge per drive after head alignment has been performed on the preceding drive.

1. Install CE disk pack: Press START switch to stop spindle drive motor. Open pack access cover and remove customer disk pack. Install CE disk pack and close pack access cover.

2. Connect Off Line Tester and head alignment card to drive: Open cabinet rear door and set UNIT POWER circuit breakers to OFF. Remove logic chassis card cover. Connect Off Line Tester to drive per installation instructions in Reference manual. Install head alignment card in location C23.

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.

3. Open rear door and set ON LINE/OFF LINE/ WRITE DISABLE switch to WRITE DISABLE.

4. Set UNIT POWER circuit breakers to ON.

5. Load Heads: Press START switch to start spindle drive motor and allow heads to load.

6. Connect null meter to test points X and Z of head alignment card.

7. Set R/W - SERVO switch S2 on head alignment card to SERVO position.

8. Check that CARRIAGE OFFSET switch on Maintenance panel is set to NORMAL position.

9. Command a seek to cylinder 491.

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.

10. Set N/P 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 ±15 mv. If requirements are met proceed to step 11, if not, perform Servo Fine Position Offset Check/Adjustments.

11. Set R/W - SERVO switch S2 on head alignment card to R/W position. Check that MODE light on card is off.

12. Select head to be checked per instructions in Reference manual.

13. Record null meter reading with head alignment card switch S1 first in P position; then to N position. Algebraically subtract P minus N and record result. P-N should be less than ±200 mv.

14. If P-N exceeds ±200 mv, perform Head/ Arm Adjustment procedure.

15. Repeat steps 13, 14, and 15 for all heads to be checked.

16. If all requirements are met, disconnect test equipment: Set UNIT POWER circuit breakers to OFF. Disconnect Off Line Tester and head alignment card from drive. Install logic chassis card cover and rear door panel. Set UNIT POWER circuit breakers to ON and close cabinet rear door.

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 13 of the Head/Arm Alignment Check procedure.
2. Raise drive top cover.
3. Remove deck cover.
4. Command a continuous repeat seek between cylinders 486 and 491 for 30 seconds minimum.
5. Command a seek to cylinder 491.
6. Install Carriage Blocking tool.

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.

7. Connect oscilloscope channel A to TPY of head alignment card. Set controls as follows:
   - CH 1: 2V/DIV
   - A TIME DIV: 1 μSEC/DIV
   - A TRIGGERING: Positive/Internal
8. Check that R/W - SERVO switch S2 on head alignment card is set to R/W position and that MODE light on card is off.
9. Loosen clamp screw of selected head and torque screw to 4 inch-pounds.
10. Refer to Figure 3-29 and position head adjustment tool so that tips of tool straddle carriage ridge and tool pin engages head/arm notch.
11. Adjust head to obtain a dibit pattern as shown in Figure 3-32 on the oscilloscope.
12. Set switch S1 on head alignment card to position P.
13. Position head (using head alignment tool) until the meter reading is 20 mv or less.
14. Re-torque the head clamp screw to 4 inch-pounds.
15. Record P reading.
16. Set switch S1 on head alignment card to position N.
17. Record null meter reading of N.
18. Algebraically subtract recorded reading N from P.
19. If P-N result exceeds ±20 mv, repeat steps 12 through 18 until result is ±20 mv or less.
20. Repeat steps 9 through 19 for all heads requiring alignment adjustment.
21. Remove Carriage Blocking tool.
22. Unload heads a minimum of two times by stopping spindle.
23. Perform continuous seeks between tracks 486 and 491 for 30 seconds minimum.
24. Repeat steps 12,16,17,18,19. Record P-N readings at track 491.
25. If P-N result is ±150 mv or greater for any head, repeat steps 12 through 19 for that head.
26. Stop spindle motor.
27. Install deck cover and close top cover.
28. Remove disk pack.
29. Disconnect test equipment: Set UNIT POWER MAIN POWER circuit breakers to OFF. Disconnect null meter, oscilloscope and Off Line Tester.
30. Set UNIT MAIN POWER circuit breakers to ON and close cabinet rear door.

HEADS LOADED SWITCH

Adjustment

1. Remove disk pack: Press START switch to stop spindle drive motor. Open pack access cover, remove disk pack and close pack access cover.

OSCILLOSCOPE SETTINGS

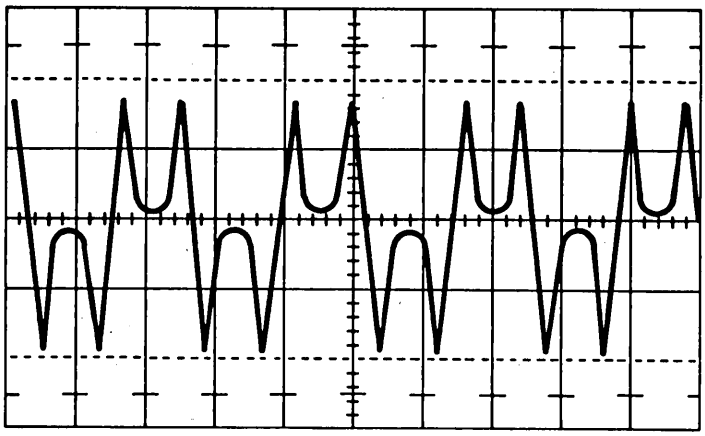
LOGIC GND TO SCOPE GND

VOLTS / DIV
CH 1 - 2V/DIV
CH 2 - NOT USED

TIME / DIV
A - 20 MS/DIV
B - NOT USED

TRIGGERING
A- POS/INT
B- NOT USED

PROBE CONNECTIONS (USE X10 PROBE)
CH 1 TO C23-TPY
CH 2 NOT USED



8P65

Figure 3-32. Balanced Dibit Pattern

2. Open cabinet rear door and set UNIT POWER circuit breakers to OFF.

3. Open cabinet top cover and remove deck cover.

4. Make note of heads loaded 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.

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 heads loaded switch leadwires.

11. Install deck cover.

12. Close cabinet top cover.

13. Set UNIT POWER circuit breakers to ON and close cabinet rear door.

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

1. Remove disk pack: Press START switch to stop spindle drive motor. Open pack access cover, remove disk pack and close pack access cover.

2. Open cabinet rear door and set UNIT POWER circuit breakers to OFF.

3. Remove side panel, or if drive is in line, remove front panel and air supply.

4. Disconnect hysteresis brake cable P2.

5. Remove four screws attaching brake motor mount (and 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 3-33.

8. Loosen two setscrews securing coupling flange to hysteresis brake shaft. Remove flange.

9. Remove three screws attaching hysteresis brake to brake motor mount and remove brake.

10. Install replacement hysteresis brake on brake motor mount with three screws. Torque each screw to 28 to 32 inch-pounds.

11. Install coupling flange on hysteresis brake shaft so that one setscrew is on flat of brake shaft. Do not tighten setscrews, only loosely secure coupling flange to brake shaft.

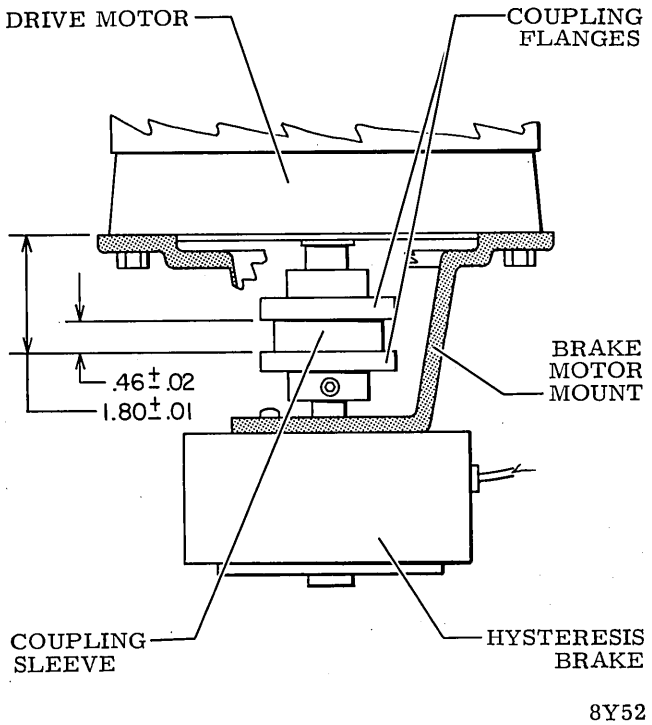


Figure 3-33. Hysteresis Brake Assembly

12. Install rubber coupling sleeve on brake coupling flange.

13. Position brake motor mount (and replacement hysteresis brake) on bottom of drive motor. Make sure rubber coupling sleeve engages the motor coupling flange. Orient brake power cable to connect to P2.

14. Secure brake motor mount to the drive motor using four screws and washers. Torque each screw to 110 to 135 inch-pounds.

15. Position coupling flange on hysteresis brake shaft to meet the requirements of Figure 3-33. Torque each setscrew in coupling flange to 20-25 inch-pounds.

16. Connect hysteresis brake cable to P2.

17. Install side panel or air supply and front panel, as required.

18. Perform Start/Stop time procedure.

PACK SENSOR SWITCH

Check

1. Remove disk pack: Press START switch to stop spindle drive motor. Open pack access cover and remove disk pack.

2. Open cabinet rear door and set UNIT POWER circuit breakers to OFF.

3. Disconnect pack sensor switch leadwires: Remove cabinet front panel. Identify and make note of pack sensor switch (Figure 3-34) leadwires. Disconnect leadwires at switch terminals.

4. Connect multimeter across pack sensor switch terminals: Connect a multimeter (set to Rxl) across pack sensor switch terminals as follows:

Meter Terminal	Pack Sensor Switch
BLK (GND)	C
RED (POS)	NC

5. Observe meter scale: Meter should indicate infinity. Go to step 6.

6. Install a scratch disk pack.

7. Observe meter scale. Meter should indicate 0 ohms. Go to step 8.

8. If requirements of steps 5 and 7 are met go to step 9. If not within requirements, perform Pack Sensor Switch Adjustment procedure.

9. Reconnect pack sensor leadwires: Remove multimeter probes from switch terminals. Connect pack sensor switch leadwires to switch terminals.

10. Remove scratch disk pack and close pack access cover.

11. Install cabinet front panel.

12. Set UNIT POWER circuit breakers to ON and close cabinet rear door.

Adjustment

1. Perform steps 1 through 4 of Pack Sensor Switch Check procedure.

2. Install a scratch disk pack.

3. Dimension between actuator arm and lockshaft must be as specified in Figure 3-34. If dimension is as specified go to step 10. If adjustment is required go to step 7.

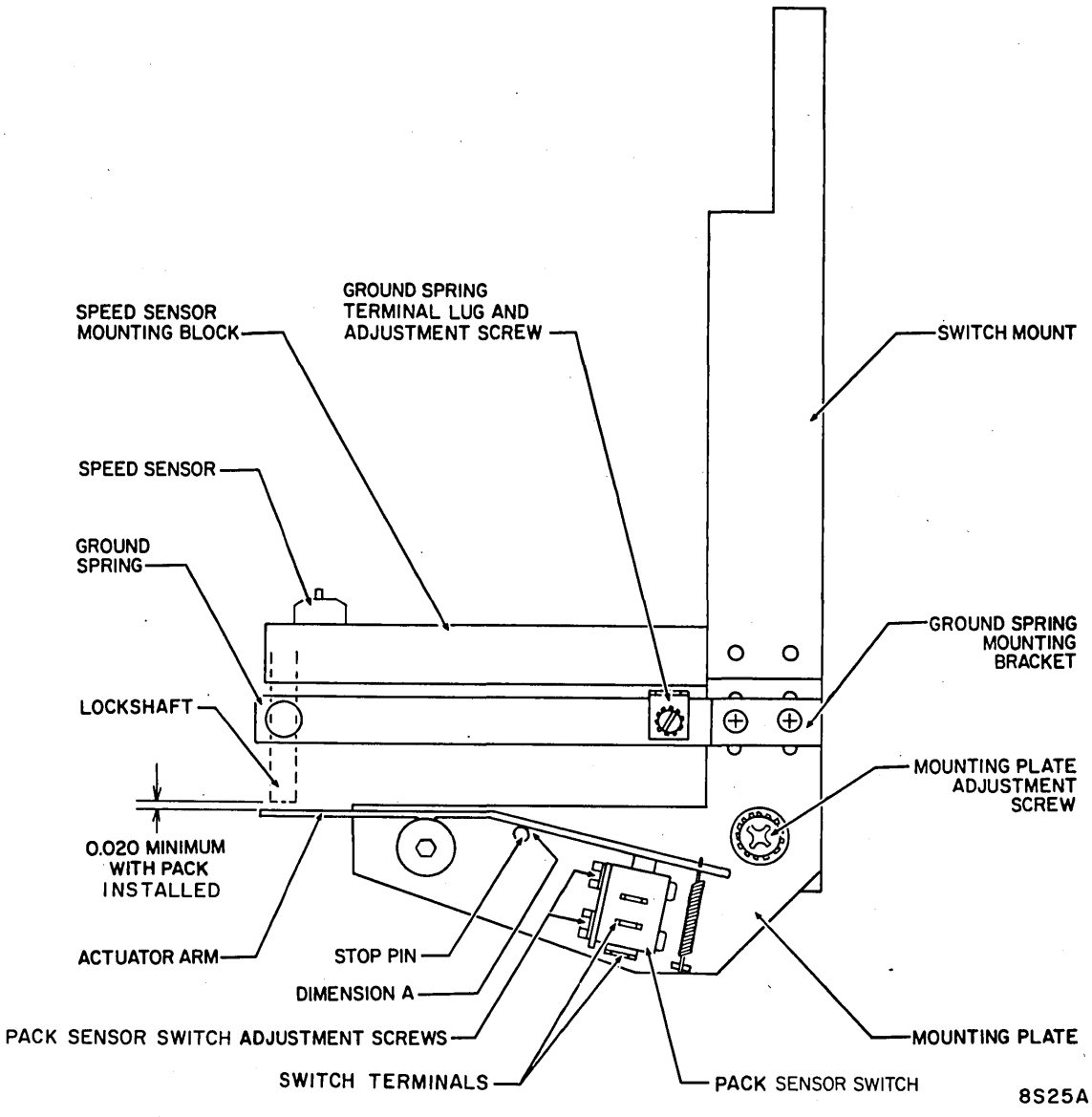


Figure 3-34. Pack Sensor Assembly

4. Loosen mounting plate adjustment screw (Figure 3-34).

5. Loosen two screws securing ground spring mounting bracket to switch mount.

6. Position mounting plate until dimension between actuator arm and lockshaft is as specified in Figure 3-34. Tighten screws.

7. Connect a multimeter (set to Rx1) to pack on switch terminals (refer to step 4 of Pack Sensor Switch Check procedure). Meter must indicate 0 ohms. If correct go to step 19, if not go to step 8.

8. Loosen pack sensor switch adjustment screws and position switch until multimeter just indicates 0 ohms. Tighten screws.

9. Insert an 0.011 inch feeler gage between actuator arm and stop pin (dimension A of Figure 3-34).

10. Multimeter must indicate infinity. If not, go to step 11. If correct, remove feeler gage and go to step 13.

11. Loosen pack sensor switch adjustment screws and position switch until multimeter just indicates infinity. Tighten screws.

12. Remove feeler gage. Multimeter must indicate 0 ohms. If correct, go to step 13. If not, repeat procedure starting at step 8.

13. If pack sensor switch was repositioned, perform step 3 and if further adjustments are required repeat entire adjustment procedure. If requirements of step 3 are met, go to step 14.

14. Reconnect pack sensor leadwires: Remove multimeter probes from switch terminals. Connect pack sensor switch leadwires to switch terminals.

15. Remove scratch disk pack and close pack access cover.

16. Perform Ground Spring Adjustment procedure if mounting plate screws were loosened. If not, go to step 17.

17. Install cabinet front panel.

18. Set UNIT POWER circuit breakers to ON and close cabinet rear door.

Replacement

1. Perform steps 1, 2 and 3 of the Pack Sensor Switch Check procedure.

2. Remove two screws, washers and nuts securing pack sensor switch to the pack sensor mounting plate bracket (Figure 3-34). Remove faulty switch.

3. Install replacement switch to mounting plate bracket using two screws, washers, and nuts. Do not tighten screws.

4. Perform Pack Sensor Switch Adjustment procedure starting at step 2.

SERVO PREAMP PC BOARD REPLACEMENT

1. Remove disk pack: Press START switch to stop spindle drive motor. Open pack access cover, remove disk pack and close pack access cover.

2. Open cabinet rear door and set UNIT POWER circuit breakers to OFF.

3. Open cabinet top cover and remove deck cover.

4. Remove two screws securing servo preamp cover (Figure 3-19). Remove cover.

5. Disconnect servo head cable plug and output plug P8 from servo preamp board.

6. Remove two socket head screws inside preamp housing. Remove preamp housing from unit.

7. Remove two screws securing faulty preamp circuit board to preamp housing and remove circuit board.

8. Install replacement preamp circuit board to preamp housing, with two pan head screws. Tighten screws.

9. Install preamp housing on actuator using two socket head screws. Tighten screws.

10. Connect servo head cable plug and output plug P8 to preamp circuit board.

11. Using two screws, secure preamp housing cover to preamp housing. Tighten screws.

12. Install deck cover and close top cover.

13. Set UNIT POWER circuit breakers to ON and close cabinet rear door.

SIDE PANEL REMOVAL/REPLACEMENT

1. Remove disk pack: Press START switch to stop spindle drive motor. Open pack access cover, remove disk pack and close pack access cover.

2. Open cabinet rear door and set UNIT POWER circuit breakers to OFF.

3. Turn two leveling jackscrews in rear base of cabinet until casters contact floor. Close cabinet rear door.

4. Release two turnlock fasteners securing cabinet front panel. Remove and set panel aside.

5. Turn two leveling jackscrews in front base of cabinet until casters contact floor.

CAUTION

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

6. Roll drive clear of adjacent units.

7. Open cabinet rear door.

8. Release two quarter-turn fasteners securing panel side cover. Disconnect side panel ground wire. Remove and set panel aside.

9. Install side panel and return unit to normal operating position by reversing steps 1 through 8.

10. Level unit per Installation procedures.

SPEED SENSOR ASSEMBLY

Adjustment

1. Remove disk pack: Press START switch to stop spindle drive motor. Open pack access cover, remove disk pack and close pack access cover.

2. Open cabinet rear door and set UNIT POWER circuit breakers to OFF.

3. Remove cabinet front panel: Release two turnlock fasteners securing front panel to drive, reach behind front panel to disconnect ground lead, then remove panel.

4. Use feeler gage to check that gap between sensor tip and pin is 0.023 ±0.002 inch (Figure 3-35).

5. If requirements of step 4 is not met, adjust speed sensor as follows:

   a. Check speed sensor lateral alignment per requirements of Figure 3-35. If required, loosen mounting block adjustment screws and position assembly. Tighten screws.

   b. Loosen jam nut on speed sensor assembly.

   c. Adjust sensor assembly (clockwise rotation closes gap, counterclockwise rotation widens gap) as required.

NOTE

Tightening jam nut more than 15 inch-pounds can cause damage to speed sensor assembly.

   d. Torque jam nut to 5 ±1 inch-pounds.

   e. Recheck dimension of gap.

6. Perform Speed Sensing procedure of Miscellaneous Logic Checkout.

7. Replace cabinet front panel by reversing step 3.

Replacement

1. Remove disk pack: Press START switch to stop spindle drive motor. Open pack access cover, remove disk pack and close pack access cover.

2. Open cabinet rear door and set UNIT POWER circuit breakers to OFF.

3. Remove cabinet front panel: Release two turnlock fasteners securing front panel to drive, reach behind front panel to disconnect ground lead, then remove panel.

4. Disconnect speed sensor cable plug P3.

5. Cut cable tie securing speed sensor leadwires to speed sensor mounting bracket.

6. Loosen locknut on faulty speed sensor assembly (Figure 3-34). Remove assembly from unit.

NOTE

Tightening jam nut more than 15 inch-pounds can cause damage to speed sensor assembly.

7. Install replacement speed sensor on speed sensor mounting bracket. Torque jam nut to 5 ±1 inch-pounds.

8. Perform Speed Sensor Adjustment procedure.

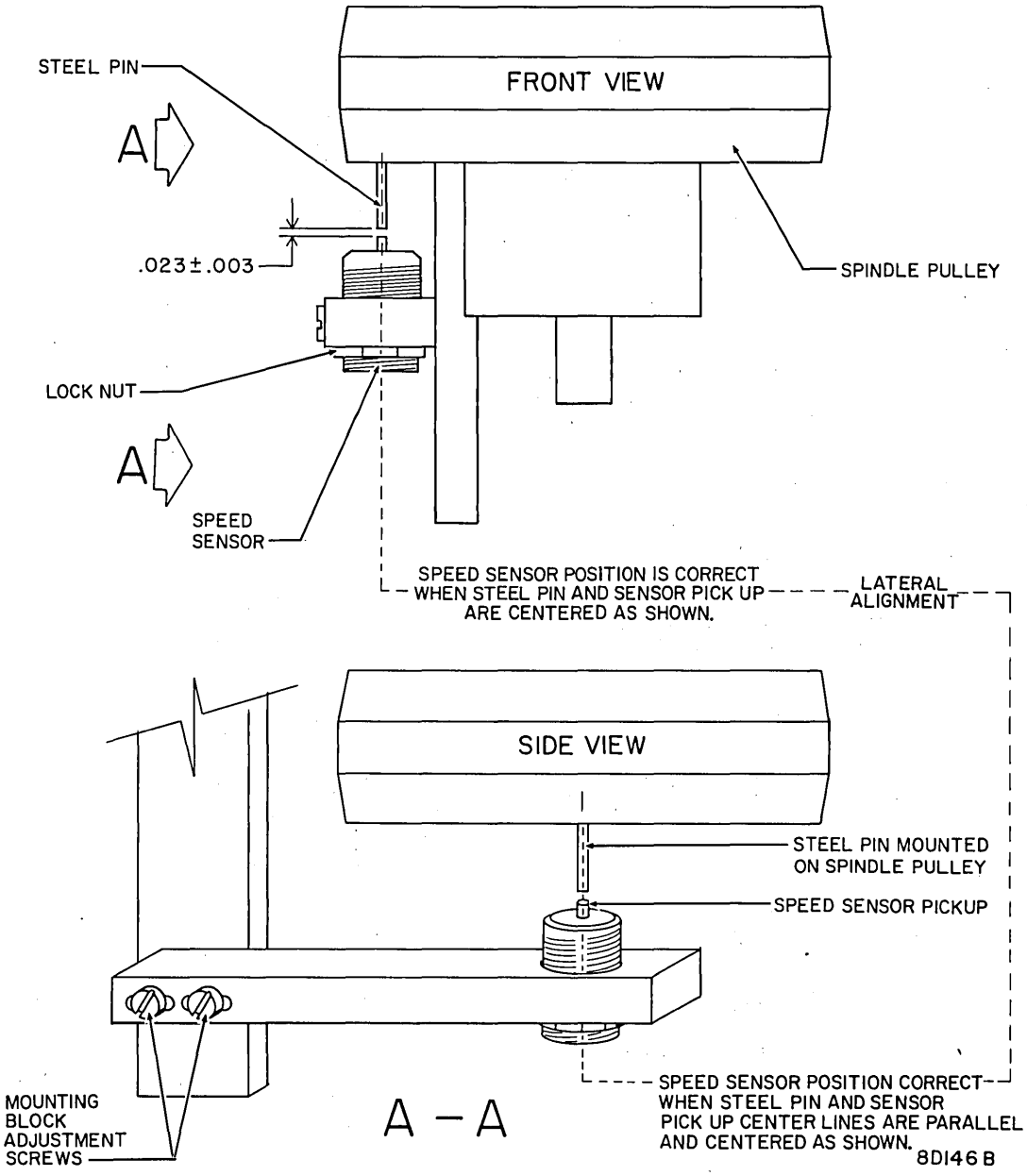


Figure 3-35. Speed Sensor Adjustment

SPINDLE AND LOCKSHAFT ASSEMBLY

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

Lockshaft Replacement

1. Remove disk pack: Press START switch to stop spindle drive motor. Open pack access cover and remove disk pack.
2. Open cabinet rear door and set UNIT POWER circuit breakers to OFF.
3. Remove cabinet front panel: Release two turnlock fasteners securing front panel to drive, reach behind front panel to disconnect ground lead, then remove panel.
4. Remove absolute air filter and air plenum: Refer to Replace Absolute Filter procedure (Section 2) and remove absolute air filter and air plenum.
5. Remove two screws securing ground spring mounting block to switch mounting block.

NOTE

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

6. Remove retaining ring and flat washer from lower end of lockshaft.
7. Carefully raise faulty lockshaft out of top of spindle assembly.
8. 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.

9. Push lockshaft down 1/8 inch below top of spindle and install flat washer and retaining ring on lower end of lockshaft.

NOTE

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

10. Position ground spring mounting block on switch mounting block (Figure 3-34) and loosely secure block with two screws.
11. Perform Pack On Switch Adjustment procedure.
12. Perform Ground Spring Adjustment procedure.
13. Replace absolute air filter and plenum: Refer to Replace Absolute Filter procedure (Section 2) and replace absolute air filter and air plenum.
14. Replace cabinet front panel by reversing step 3.

NOTE

Allow blower to purge unit for two minutes before installing a disk pack.

15. Set UNIT POWER circuit breakers to ON and close cabinet rear door.

Spindle And Lockshaft Replacement

1. Remove disk pack: Press START switch to stop spindle drive motor. Open pack access cover and remove disk pack.
2. Open cabinet rear door and set UNIT POWER circuit breakers to OFF.
3. Remove cabinet front panel: Release two turnlock fasteners securing front panel to drive, reach behind front panel to disconnect ground lead, then remove panel.
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. Remove idler springs (Figure 3-25) and move motor mounting plate towards spindle to relieve drive belt tension. Remove belt from drive motor pulley and spindle pulley.

8. Remove pack sensor assembly from rear of spindle by removing two 3/16 allen screws.

9. Open pack access cover.

10. Remove five screws securing parking brake cover to shroud (Figure 3-23). 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 3-23). Remove and set assembly aside.

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.

NOTE

Spindle base may have to be rotated to clear shroud because of irregularities in casting.

14. Lift spindle assembly up away from deck being careful not to damage shroud.

NOTE

Insure mating surfaces of spindle and deck are clean.

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 for spindle alignment.

17. Position pack sensor assembly on spindle assembly as shown in Figure 3-34.

NOTE

Before tightening screws in next step, position pack sensor assembly as close as possible to the dimensions shown in Figure 3-34. Doing this will minimize adjustment required after assembly is secured to the spindle.

18. Secure pack sensor assembly to spindle assembly with two 3/16 allen screws. Tighten screws.

19. Install drive belt on motor pulley.

20. Move drive motor mounting plate towards spindle assembly and slip drive belt around spindle pulley. Install idler springs, manually rotate spindle and push motor forward to seat belt.

21. Secure brake plate assembly to deck using two screws and related brake plate hardware. Perform Brake Plate Assembly Check and Adjustment.

22. Install brake plate cover to shroud using five screws. Tighten screws.

23. Connect ground spring and pack sensor switch leadwires.

24. Connect speed sensor cable plug P3.

25. Perform the following procedures:

    a. Pack Sensor Switch Adjustment

    b. Static Ground Spring Adjustment

    c. Speed Sensor Adjustment

    d. Carriage/Spindle Alignment

    e. Head/Arm Alignment Check

STATIC GROUND SPRING

Adjustment

1. Remove disk pack: Press START switch to stop spindle drive motor. Open pack access cover, remove disk pack and close pack access cover.

2. Open cabinet rear door and set UNIT POWER circuit breakers to OFF.

3. Remove cabinet front panel: Release two turnlock fasteners securing front panel to drive, reach behind front panel to disconnect ground lead, then remove panel.

4. Visually check that ground spring is approximately centered vertically and horizontally on lockshaft (Figure 3-34).

5. If required, loosen screw securing ground spring to mounting bracket and center spring as required. Tighten screw.

6. Place a 0.002-0.005 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 cabinet front panel.

11. Set UNIT POWER circuit breakers to ON and close cabinet rear door.

Replacement

1. Remove disk pack: Press START switch to stop spindle drive motor. Open pack access cover, remove disk pack and close pack access cover.

2. Open cabinet rear door and set UNIT POWER circuit breakers to OFF.

3. Remove cabinet front panel: Release two turnlock fasteners securing front panel to drive, reach behind front panel to disconnect ground lead, then remove panel.

4. Remove static ground spring leadwire.

5. Remove screw, nut, three washers, terminal lug and ground spring from contact mounting bracket (Figure 3-34).

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 cabinet front panel by reversing step 3.

10. Set UNIT POWER circuit breakers to ON and close cabinet rear door.

VELOCITY TRANSDUCER REPLACEMENT

1. Remove disk pack: Press START switch to stop spindle drive motor. Open pack access cover, remove disk pack and close pack access cover.

2. Open cabinet rear door and set UNIT POWER circuit breakers to OFF.

3. Open cabinet top cover and remove deck cover.

4. Disconnect velocity transducer cable plug P4 (Figure 3-36).

5. 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.

6. Extend carriage 1/2 inch and unthread extension rod at point where it enters rear of head/arm receiver.

7. Carefully pull transducer magnet and extension rod out of cap end of transducer coil/housing.

CAUTION

Replacement velocity transducer magnet can be rendered unuseable if it comes in contact with a ferro magnetic object.

8. Carefully remove replacement transducer magnet from shipping container.

9. Determine polarity of replacement transducer magnet by placing near magnet just removed. Like poles repel.

10. Carefully unthread extension rod from transducer magnet. Moderate force may be required since Loctite is on rod threads.

NOTE

Extension rod must be grasped at end nearest magnet while removing and replacing magnet.

11. Apply one drop of Loctite, Grade C, to extension rod threads that mate with transducer magnet. Thread rod into end of transducer magnet with same polarity as old transducer magnet.

12. Remove old transducer coil/housing from magnet assembly and slide replacement transducer coil/housing into magnet assembly

13. Install head cam tool and fully extend carriage.

14. Insert free end of extension rod into bore of coil/housing. Slide assembly

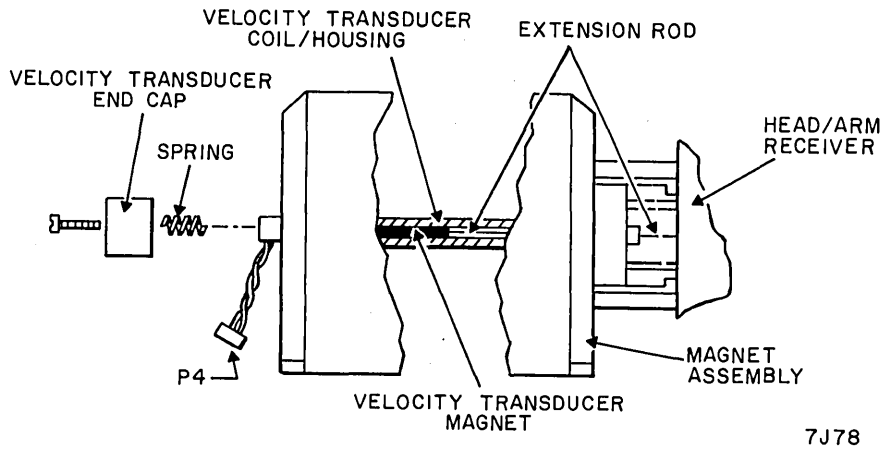


Figure 3-36. Velocity Transducer Replacement

into coil/housing until threads of extension rod are visible behind head/arm receiver.

15. 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.

16. Assemble spring and transducer end cap to magnet assembly using two screws and washers. Remove voice coil yellow leadwire.

17. Connect velocity transducer plug P4. Set UNIT POWER circuit breakers to ON. Verify that card test point A28-TPC swings in negative direction while actuator is manually moved in forward direction.

NOTE

If A28-TPC swings in the wrong direction, magnet is installed backwards.

18. Retract carriage and remove head cam too.

19. Perform Velocity Gain Adjustment procedure.

20. Perform Velocity Transducer Gain Uniformity procedure.

21. Perform Integtator Gain Adjustment procedure.

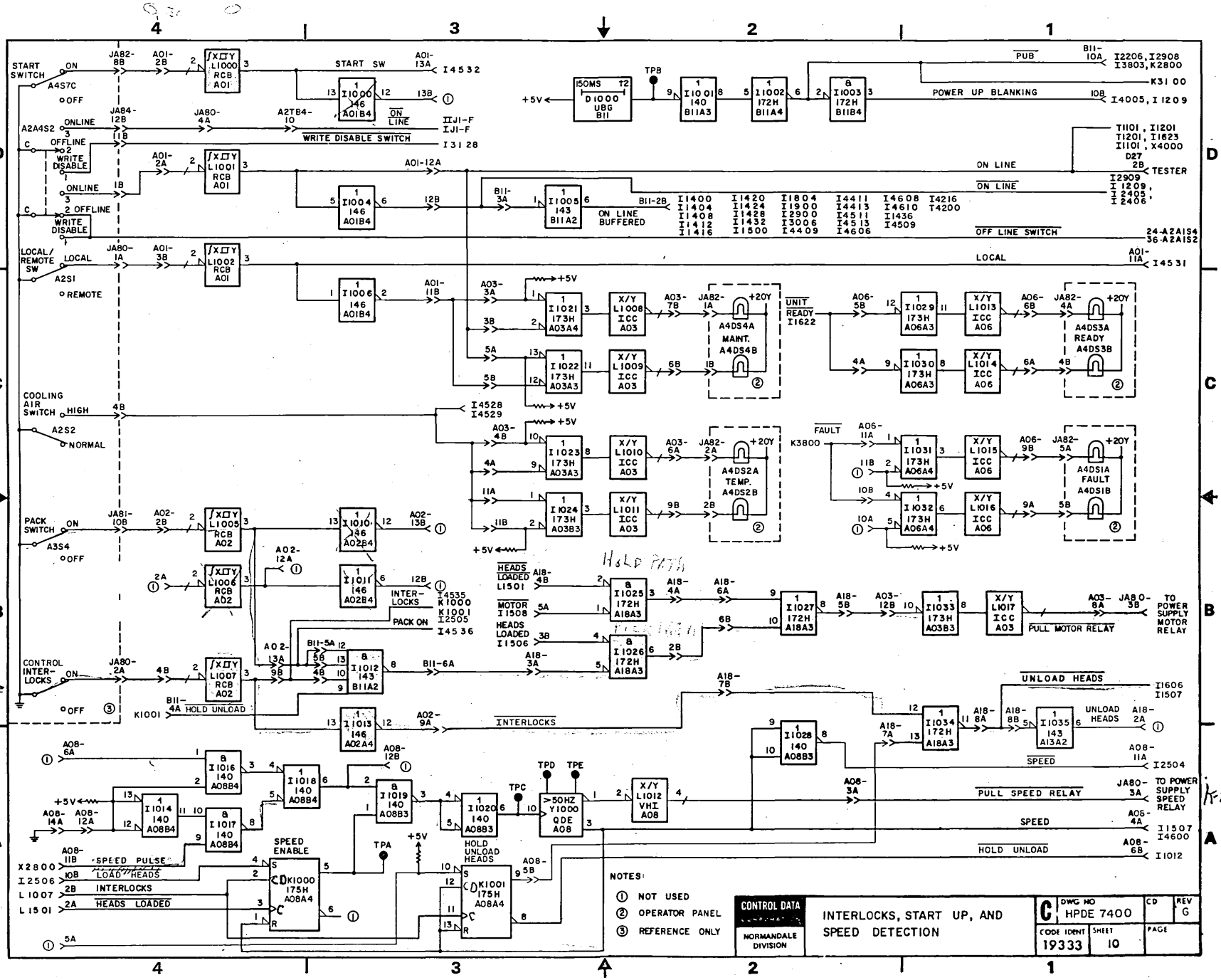
SECTION 4

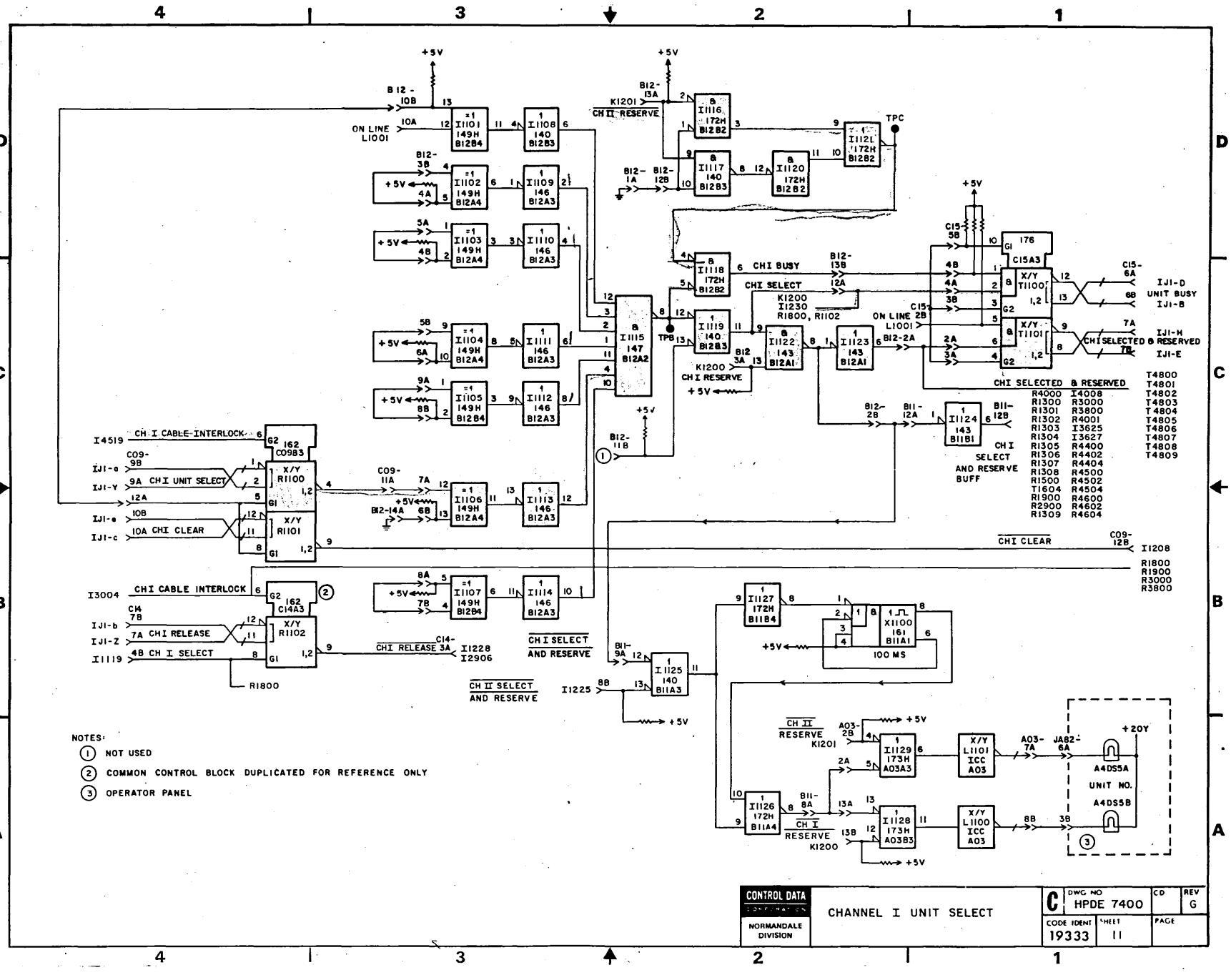
DIAGRAMS

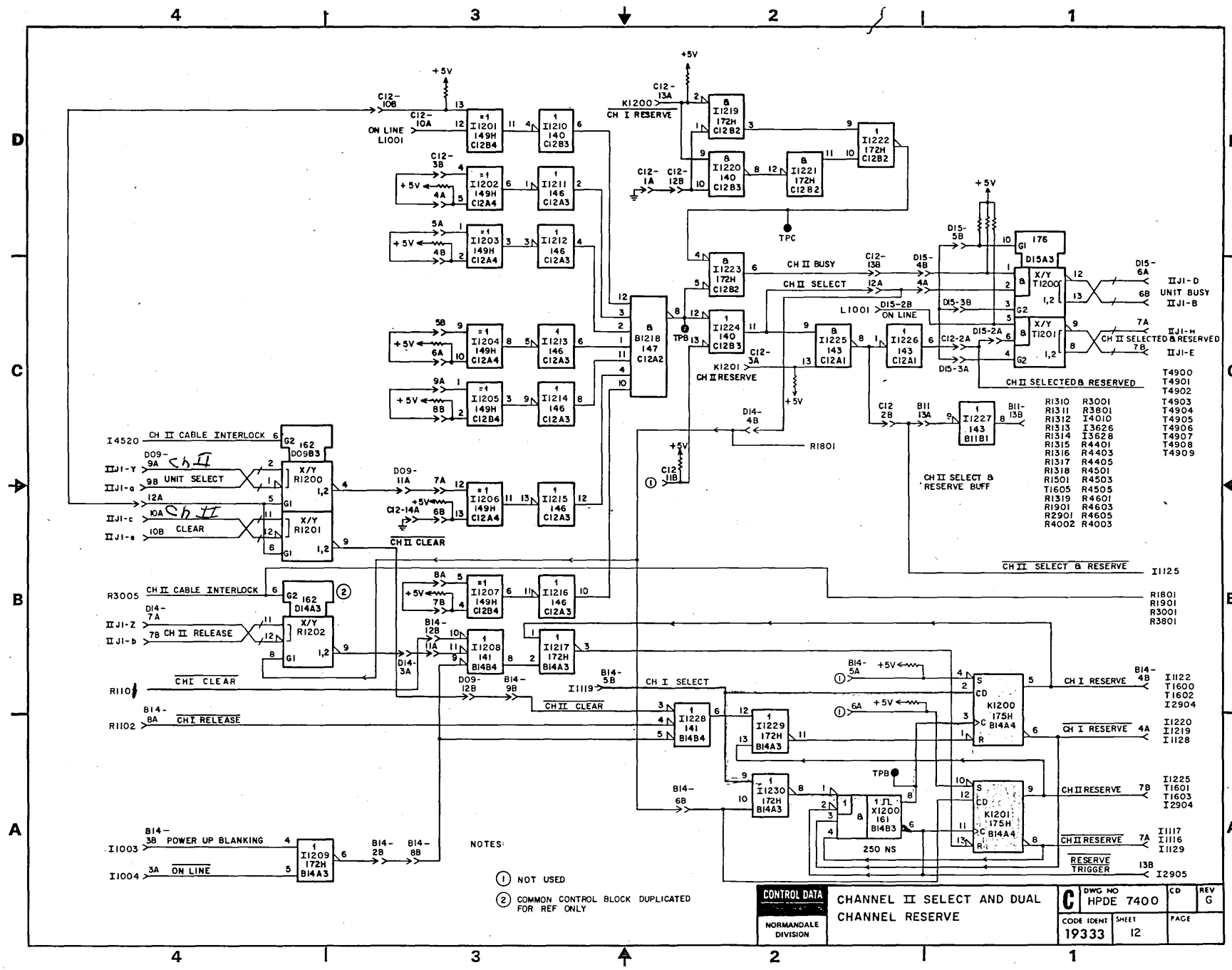
INTRODUCTION

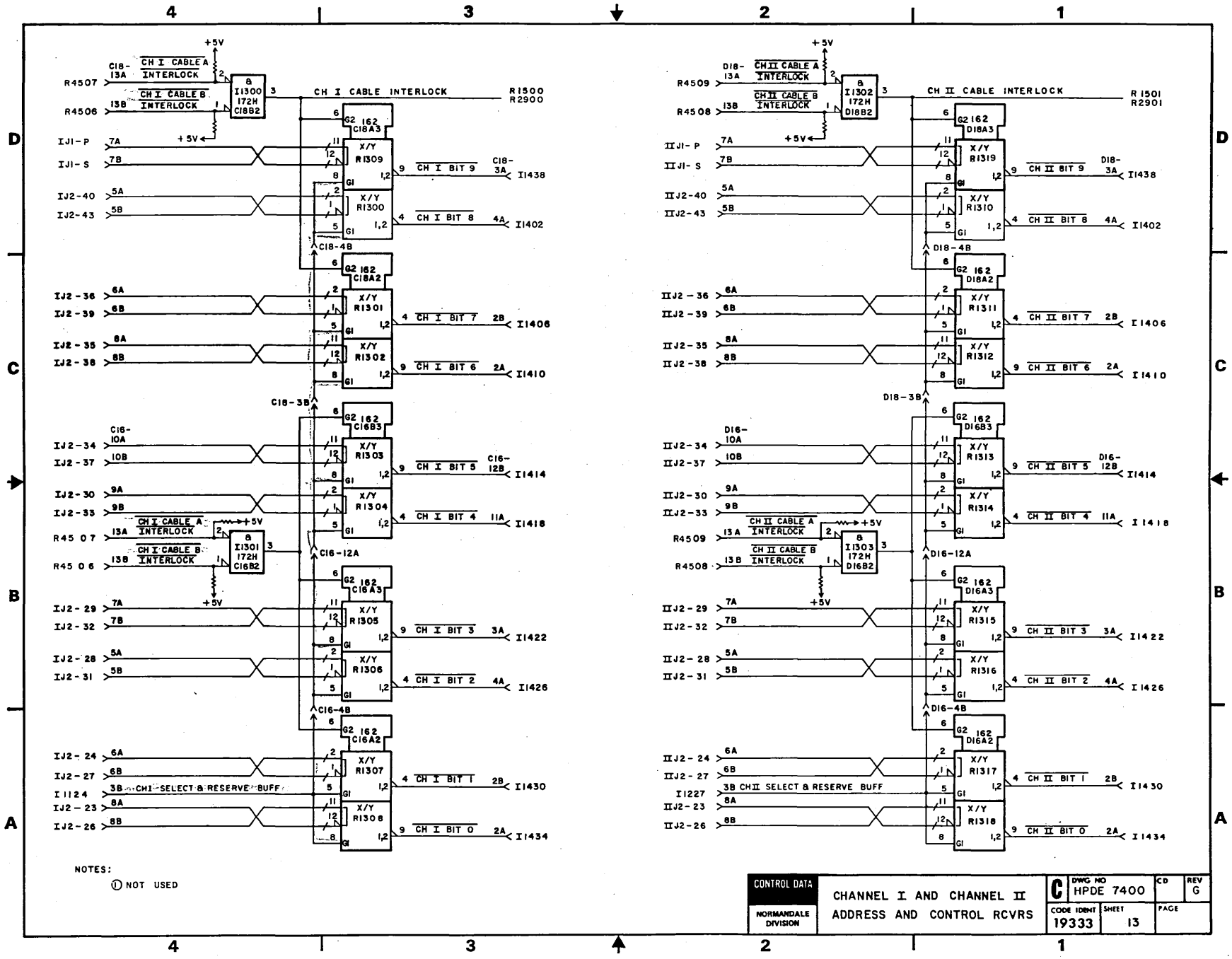
This section contains diagrams that logically describe the drive in terms of the functions which the unit performs and schematics that show the wiring of the various assemblies. Descriptive material for integrated and discrete component circuits is located in Sections 4, 5, and 6 of the Reference manual (Publication No. 83308200). Flow charts, simplified circuits, and timing diagrams are located in the same manual.

Logic sheets 1 through 9 and sheet 1 of all assembly schematics (located at end of section) are not included in this manual. They are for factory use only.


START SWITCH
ON
OFF
A4S7C
START SW
WRITE DISABLE SWITCH
ON LINE
OFF LINE SWITCH
LOCAL/ REMOTE SW
LOCAL
REMOTE
A2S1
COOLING AIR SWITCH
HIGH
NORMAL
A2S2
PACK SWITCH
A3S4
CONTROL INTER- LOCKS
POWER UP BLANKING
PUB
TESTER
ON LINE BUFFERED
UNIT READY I1622
A4DS4A MAINT. A4DS4B
A4DS3A READY A4DS3B
FAULT
K3800
A4DS2A TEMP. A4DS2B
A4DS1A FAULT A4DS1B
HEADS LOADED L1501
MOTOR I1508
HEADS LOADED I1506
PACK ON
INTER- LOCKS
PULL MOTOR RELAY
TO POWER SUPPLY MOTOR RELAY
HOLD UNLOAD
UNLOAD HEADS
SPEED
PULL SPEED RELAY
TO POWER SUPPLY SPEED RELAY
HOLD UNLOAD
SPEED ENABLE
HOLD UNLOAD HEADS
SPEED PULSE
LOAD HEADS
INTERLOCKS
HEADS LOADED
NOTES:
① NOT USED
② OPERATOR PANEL
③ REFERENCE ONLY
CONTROL DATA
NORMANDALE DIVISION
INTERLOCKS, START UP, AND SPEED DETECTION
DWG NO HPDE 7400
REV G
CODE IDENT 19333
SHEET 10

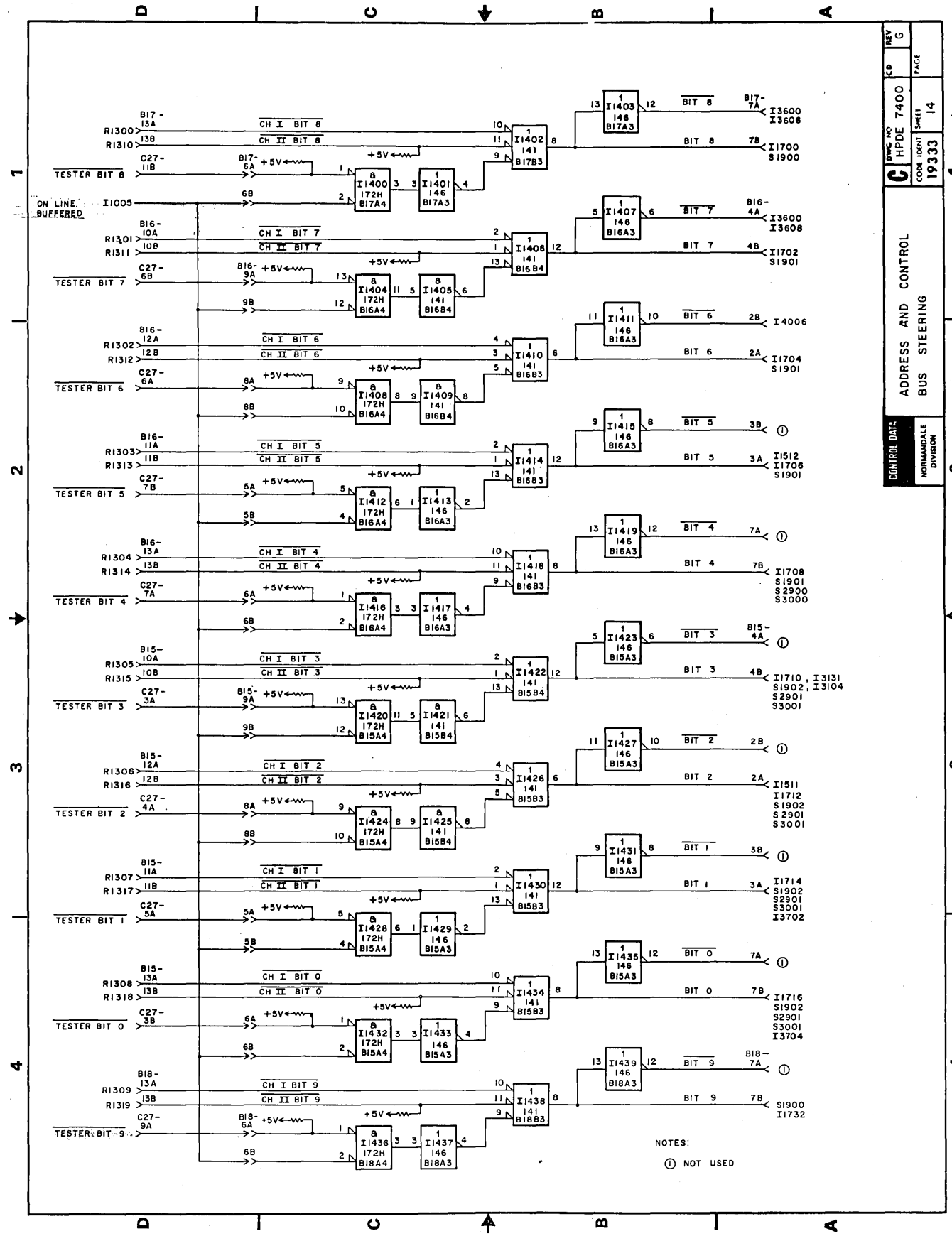

4
3
2
1
D
C
B
A
+5V
ON LINE L1001
CH II RESERVE
K1201
TPC
TPB
CH I BUSY
CH I SELECT
K1200 I1230 R1800, R1102
K1200 CH I RESERVE
ON LINE 2B L1001
CH I SELECTED & RESERVED
IJI-D UNIT BUSY IJI-B
IJI-H CH I SELECTED & RESERVED IJI-E
CH I SELECTED & RESERVED
R4000 I4008 T4800
R1300 R3000 T4801
R1301 R3800 T4802
R1302 R4001 T4803
R1303 I3625 T4804
R1304 I3627 T4805
R1305 R4400 T4806
R1306 R4402 T4807
R1307 R4404 T4808
R1308 R4500 T4809
R1500 R4502
T1604 R4504
R1900 R4600
R2900 R4602
R1309 R4604
CH I SELECT AND RESERVE BUFF
CH I CABLE INTERLOCK
I4519
CH I UNIT SELECT
CH I CLEAR
CH CABLE INTERLOCK
I3004
CH I RELEASE
CH I SELECT
R1800
CH I RELEASE 3A
I1228 I2906
CH I SELECT AND RESERVE
CH II SELECT AND RESERVE
I1225
CH CLEAR
I1208
R1800 R1900 R3000 R3800
100 MS
CH II RESERVE
CH I RESERVE
A4DS5A UNIT NO. A4DS5B
+20Y
NOTES:
1 NOT USED
2 COMMON CONTROL BLOCK DUPLICATED FOR REFERENCE ONLY
3 OPERATOR PANEL
CONTROL DATA CORPORATION
NORMANDALE DIVISION
CHANNEL I UNIT SELECT
C
DWG NO HPDE 7400
CD
REV G
CODE IDENT 19333
SHEET 11
PAGE

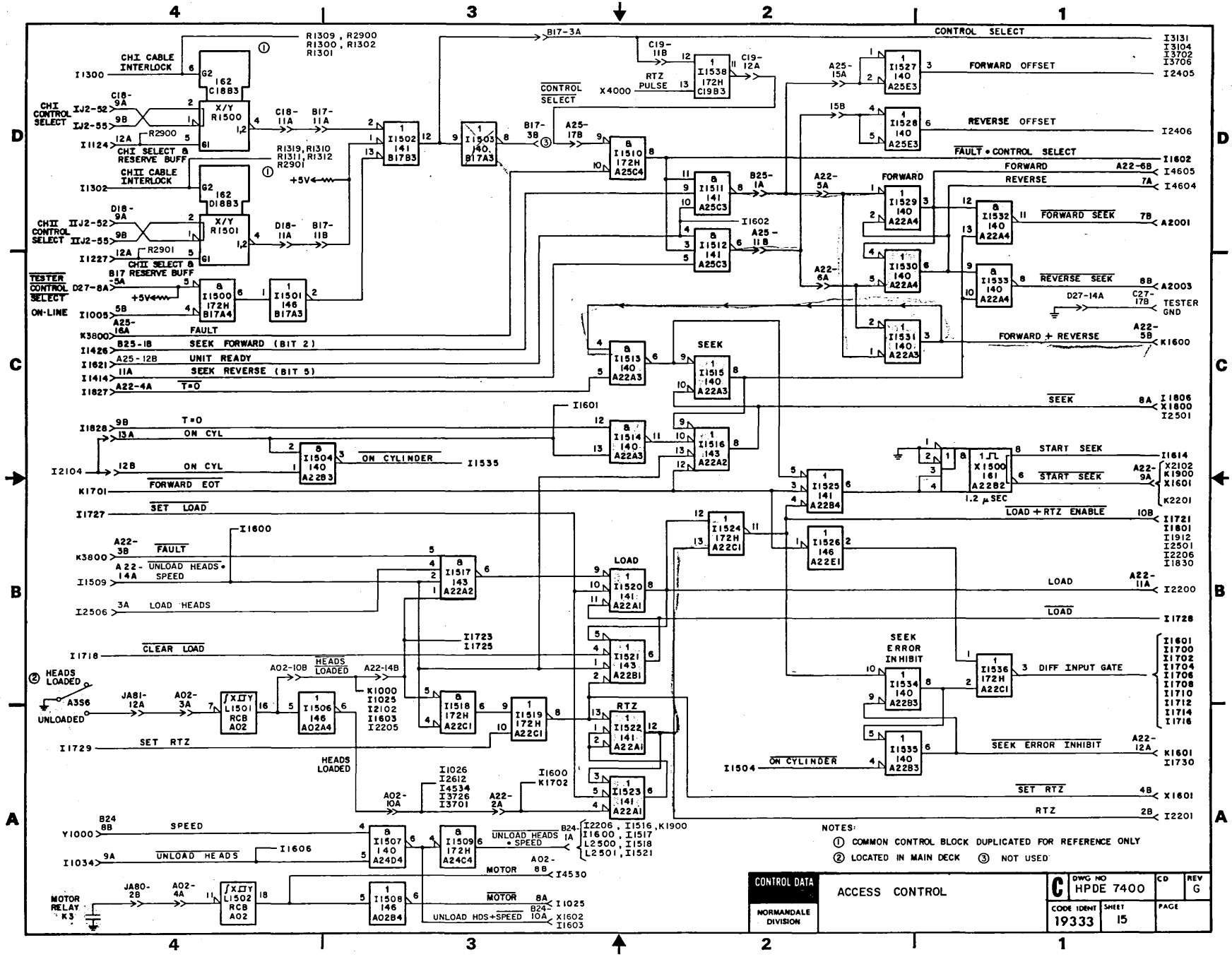

CHANNEL II SELECT AND DUAL CHANNEL RESERVE
CONTROL DATA
NORMANDALE DIVISION
DWG NO HPDE 7400
CD
REV G
CODE IDENT 19333
SHEET 12
PAGE
NOTES:
① NOT USED
② COMMON CONTROL BLOCK DUPLICATED FOR REF ONLY
CH II BUSY
CH II SELECT
CH II RESERVE
CH II CLEAR
CH II SELECT & RESERVE
CH II SELECTED & RESERVED
CH II RELEASE
CH I SELECT
CH I RESERVE
CH I CLEAR
CH I RELEASE
ON LINE
UNIT SELECT
CLEAR
POWER UP BLANKING
250 NS
RESERVE TRIGGER
CH II CABLE INTERLOCK
TPB
TPC

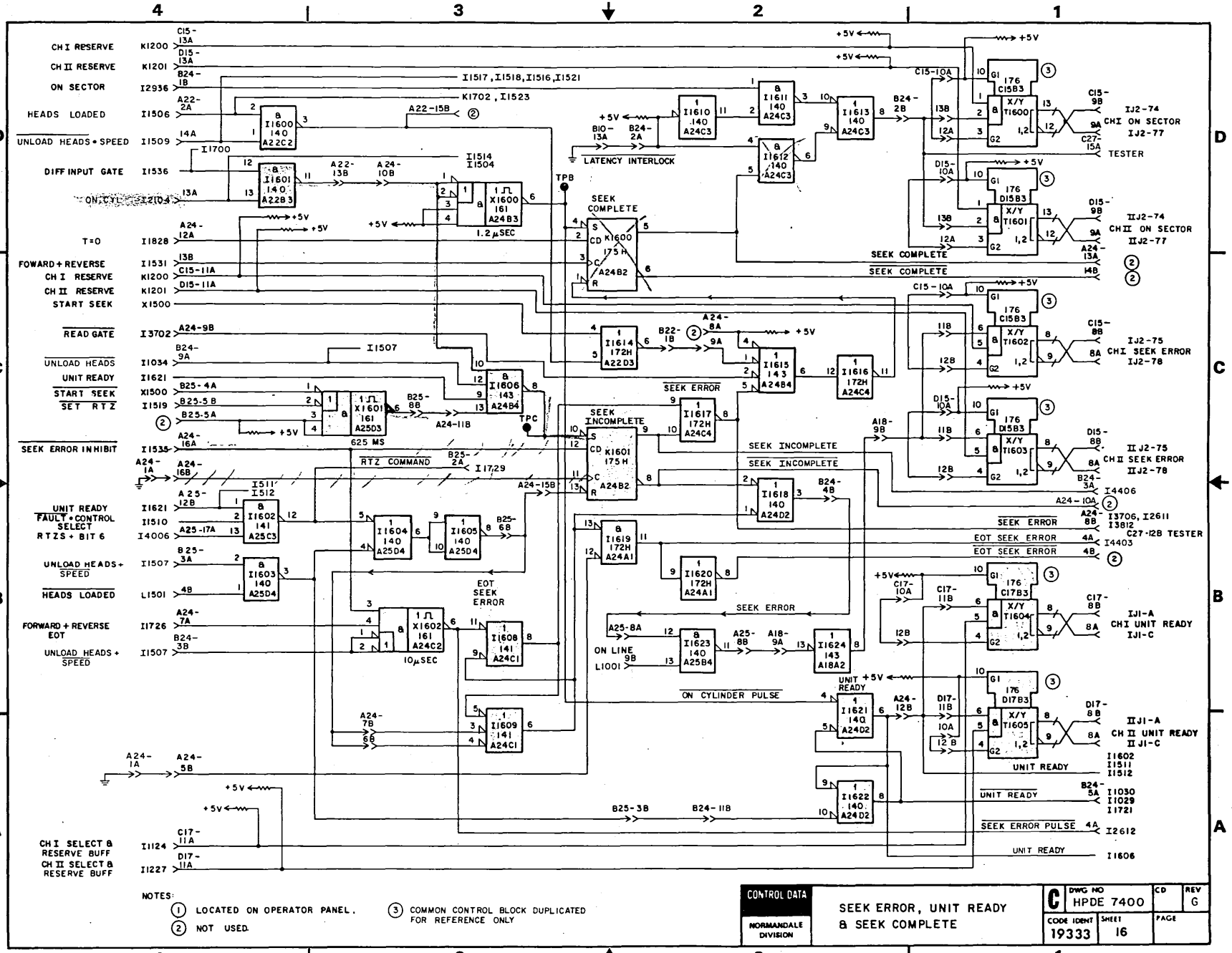


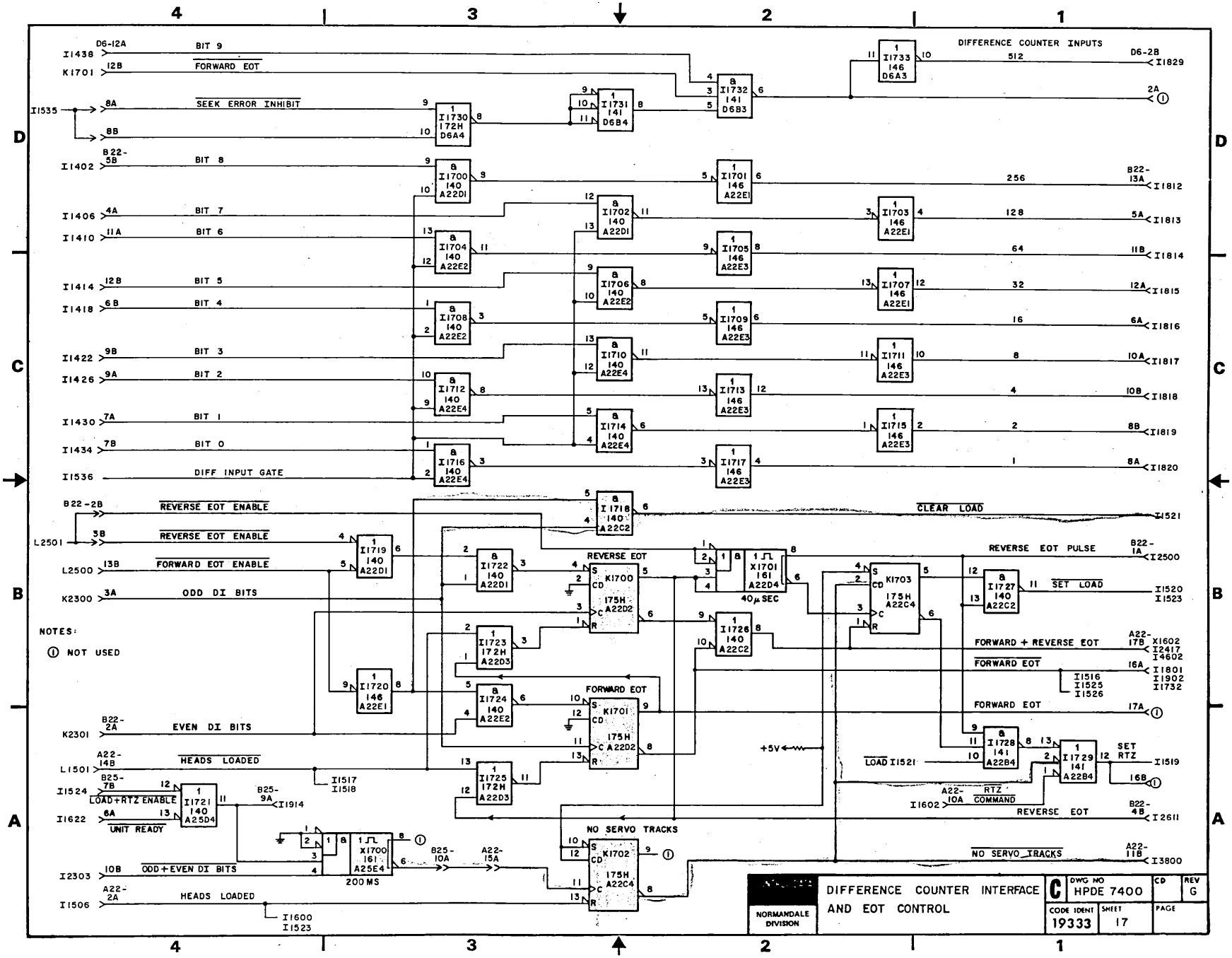
NOTES:
① NOT USED

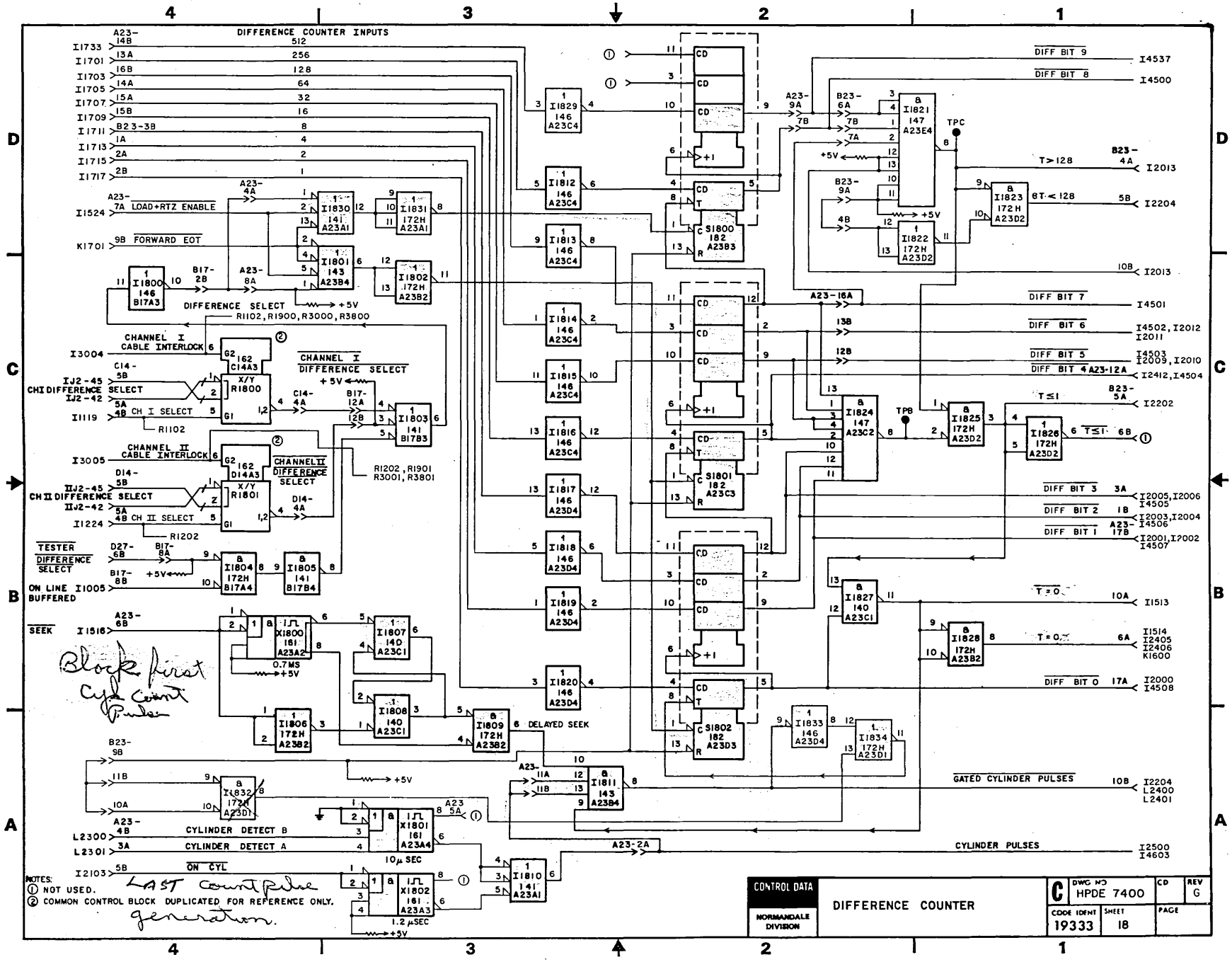
CONTROL DATA NORMANDALE DIVISION	CHANNEL I AND CHANNEL II ADDRESS AND CONTROL RCVRS	C DWG NO HPDE 7400	CD REV G
		CODE IDENT 19333	SHEET 13 PAGE

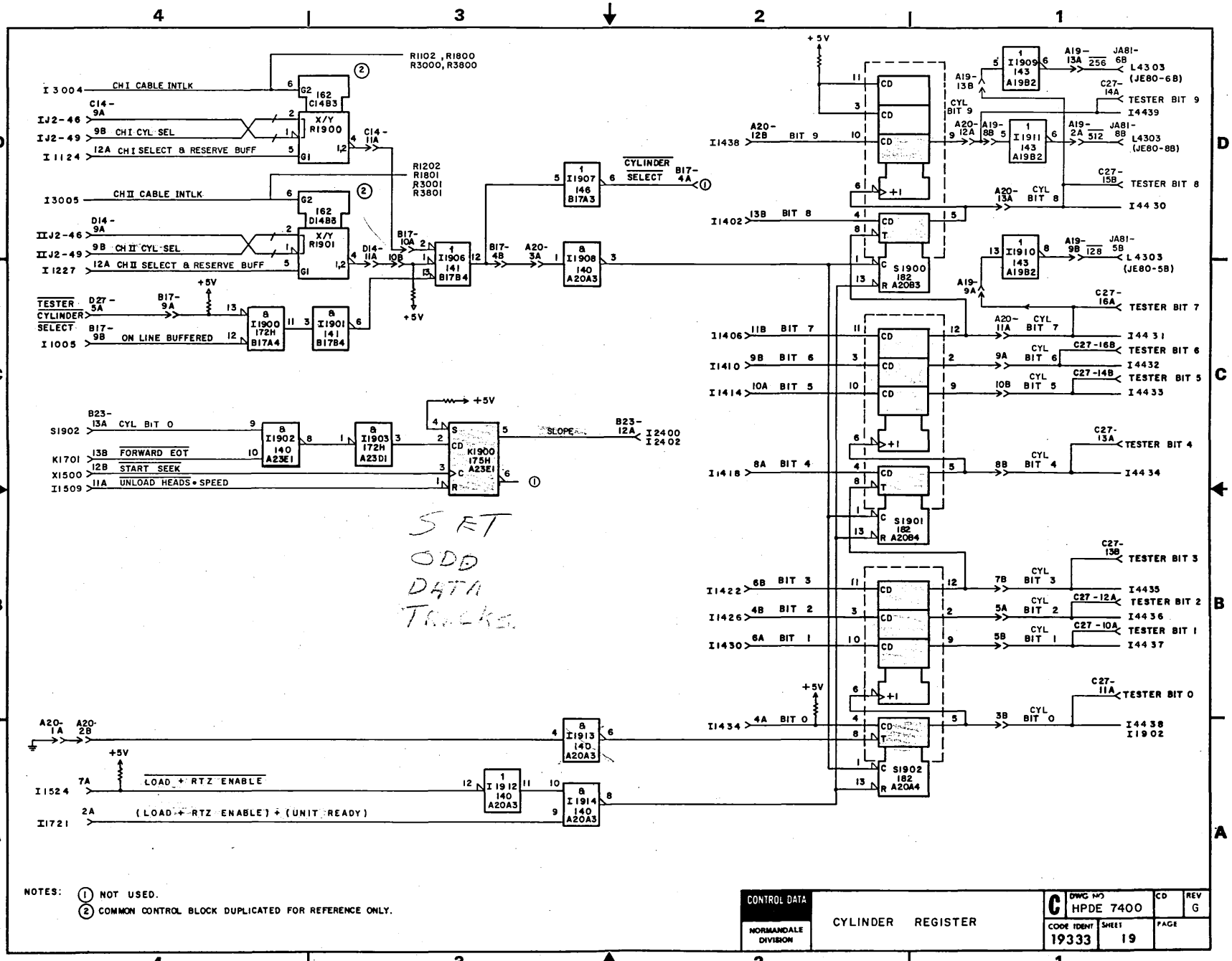

ADDRESS AND CONTROL BUS STEERING
CONTROL DATA
NORMANDALE DIVISION
DWG NO HPDE 7400
REV G
SHEET 14
CODE IDENT 19333
ON LINE BUFFERED
TESTER BIT 8
TESTER BIT 7
TESTER BIT 6
TESTER BIT 5
TESTER BIT 4
TESTER BIT 3
TESTER BIT 2
TESTER BIT 1
TESTER BIT 0
TESTER BIT 9
CH I BIT 8
CH II BIT 8
CH I BIT 7
CH II BIT 7
CH I BIT 6
CH II BIT 6
CH I BIT 5
CH II BIT 5
CH I BIT 4
CH II BIT 4
CH I BIT 3
CH II BIT 3
CH I BIT 2
CH II BIT 2
CH I BIT 1
CH II BIT 1
CH I BIT 0
CH II BIT 0
CH I BIT 9
CH II BIT 9
BIT 8
BIT 7
BIT 6
BIT 5
BIT 4
BIT 3
BIT 2
BIT 1
BIT 0
BIT 9
+5V
I1005
I1400 I1401 I1402 I1403
I1404 I1405 I1406 I1407
I1408 I1409 I1410 I1411
I1412 I1413 I1414 I1415
I1416 I1417 I1418 I1419
I1420 I1421 I1422 I1423
I1424 I1425 I1426 I1427
I1428 I1429 I1430 I1431
I1432 I1433 I1434 I1435
I1436 I1437 I1438 I1439
I3600 I3606
I1700 S1900
I3600 I3608
I1702 S1901
I4006
I1704 S1901
I1512 I1706 S1901
I1708 S1901 S2900 S3000
I1710, I3131 S1902, I3104 S2901 S3001
I1511 I1712 S1902 S2901 S3001
I1714 S1902 S2901 S3001 I3702
I1716 S1902 S2901 S3001 I3704
S1900 I1732
NOTES:
① NOT USED

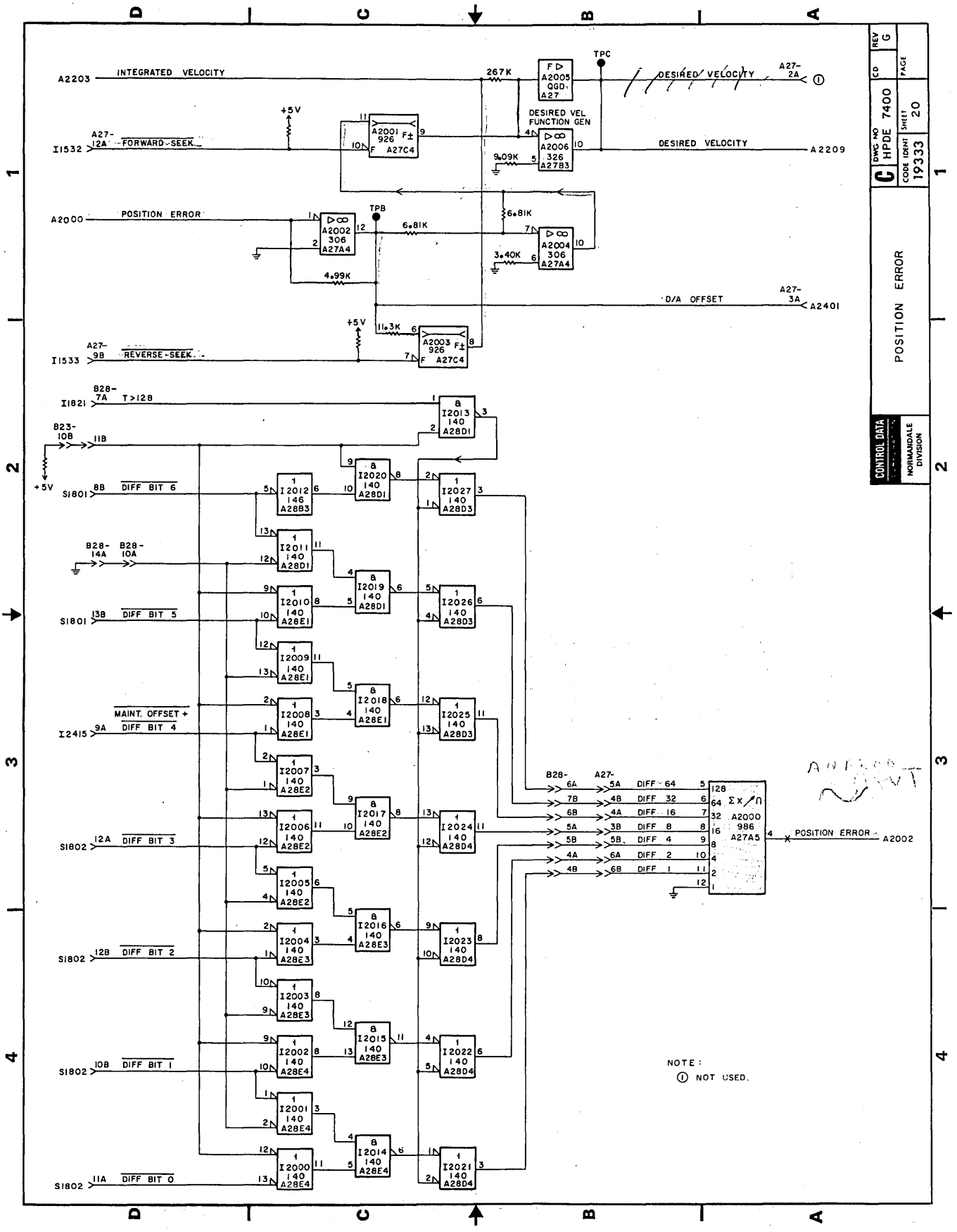

CHI CABLE INTERLOCK
CHI CONTROL SELECT
CHI SELECT & RESERVE BUFF
CHII CABLE INTERLOCK
CHII CONTROL SELECT
CHII SELECT & RESERVE BUFF
TESTER CONTROL SELECT
ON-LINE
FAULT
SEEK FORWARD (BIT 2)
UNIT READY
SEEK REVERSE (BIT 5)
T=0
ON CYL
ON CYLINDER
FORWARD EOT
SET LOAD
UNLOAD HEADS • SPEED
LOAD HEADS
CLEAR LOAD
HEADS LOADED
UNLOADED
SET RTZ
SPEED
UNLOAD HEADS
MOTOR RELAY K3
CONTROL SELECT
FORWARD OFFSET
REVERSE OFFSET
FAULT • CONTROL SELECT
FORWARD
REVERSE
FORWARD SEEK
REVERSE SEEK
FORWARD + REVERSE
SEEK
START SEEK
1.2 μSEC
LOAD + RTZ ENABLE
LOAD
SEEK ERROR INHIBIT
DIFF INPUT GATE
RTZ
NOTES:
① COMMON CONTROL BLOCK DUPLICATED FOR REFERENCE ONLY
② LOCATED IN MAIN DECK
③ NOT USED
CONTROL DATA
NORMANDALE DIVISION
ACCESS CONTROL
C
DWG NO HPDE 7400
REV G
CODE IDENT 19333
SHEET 15
PAGE

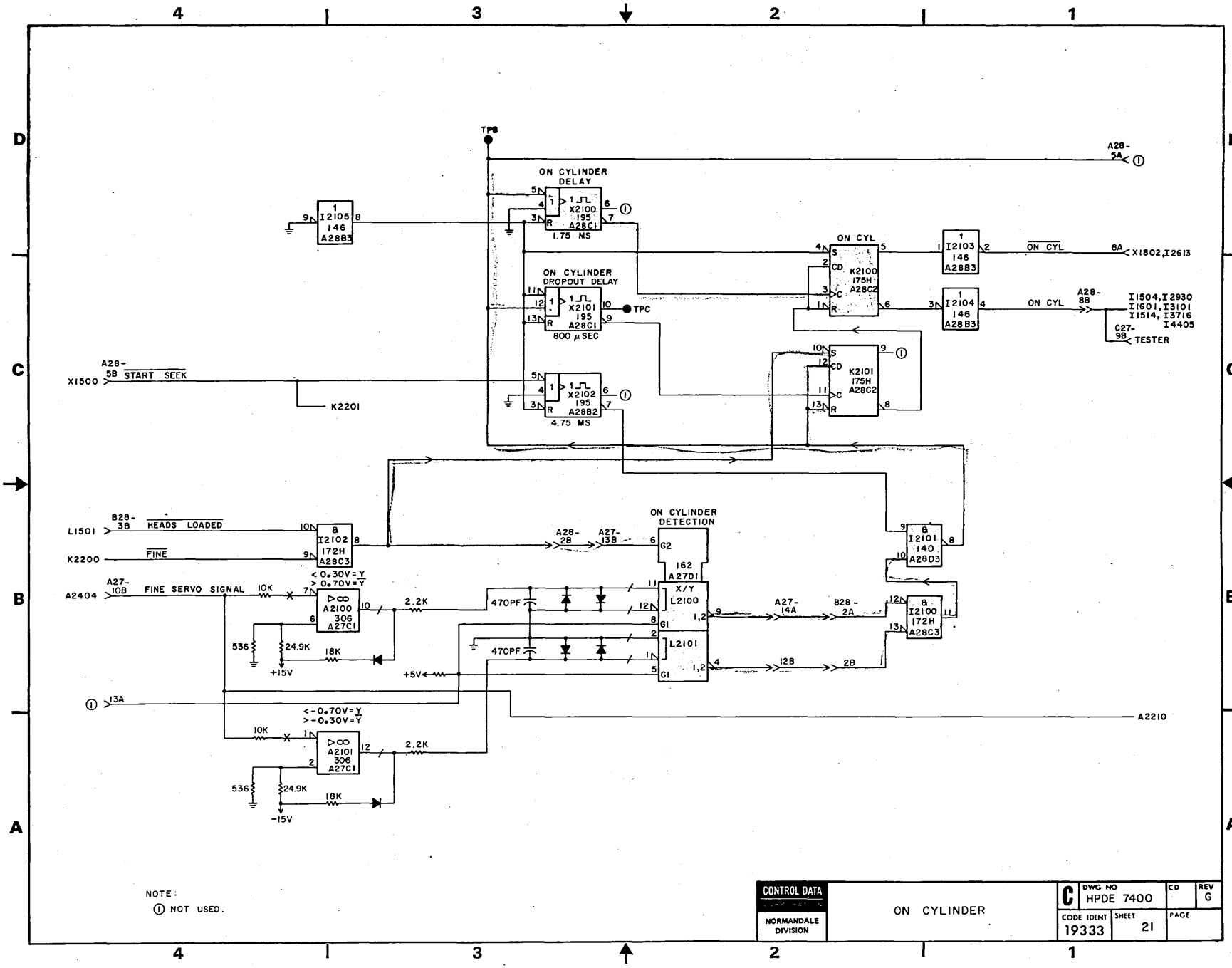

CH I RESERVE
CH II RESERVE
ON SECTOR
HEADS LOADED
UNLOAD HEADS • SPEED
DIFF INPUT GATE
ON CYL
T=0
FOWARD + REVERSE
START SEEK
READ GATE
UNLOAD HEADS
UNIT READY
SET RTZ
SEEK ERROR INHIBIT
FAULT • CONTROL SELECT
RTZS + BIT 6
FORWARD + REVERSE EOT
CH I SELECT & RESERVE BUFF
CH II SELECT & RESERVE BUFF
SEEK COMPLETE
SEEK INCOMPLETE
SEEK ERROR
EOT SEEK ERROR
LATENCY INTERLOCK
RTZ COMMAND
ON CYLINDER PULSE
ON LINE
TPB
TPC
1.2 μSEC
625 MS
10 μSEC
TESTER
UNIT READY
SEEK ERROR PULSE
NOTES:
(1) LOCATED ON OPERATOR PANEL.
(2) NOT USED.
(3) COMMON CONTROL BLOCK DUPLICATED FOR REFERENCE ONLY
CONTROL DATA
NORMANDALE DIVISION
SEEK ERROR, UNIT READY & SEEK COMPLETE
C
DWG NO HPDE 7400
CD
REV G
CODE IDENT 19333
SHEET 16
PAGE


DIFFERENCE COUNTER INPUTS
BIT 9
FORWARD EOT
SEEK ERROR INHIBIT
BIT 8
BIT 7
BIT 6
BIT 5
BIT 4
BIT 3
BIT 2
BIT 1
BIT 0
DIFF INPUT GATE
REVERSE EOT ENABLE
REVERSE EOT ENABLE
FORWARD EOT ENABLE
ODD DI BITS
EVEN DI BITS
HEADS LOADED
LOAD+RTZ ENABLE
UNIT READY
ODD+EVEN DI BITS
HEADS LOADED
512
256
128
64
32
16
8
4
2
1
CLEAR LOAD
REVERSE EOT
FORWARD EOT
NO SERVO TRACKS
40μ SEC
200 MS
+5V
REVERSE EOT PULSE
SET LOAD
FORWARD + REVERSE EOT
FORWARD EOT
FORWARD EOT
SET RTZ
RTZ COMMAND
REVERSE EOT
NO SERVO TRACKS
NOTES:
① NOT USED
DIFFERENCE COUNTER INTERFACE AND EOT CONTROL
NORMANDALE DIVISION
DWG NO HPDE 7400
CODE IDENT 19333
SHEET 17
REV G


DIFFERENCE COUNTER INPUTS
512
256
128
64
32
16
8
4
2
1
LOAD+RTZ ENABLE
FORWARD EOT
DIFFERENCE SELECT
R1102, R1900, R3000, R3800
CHANNEL I CABLE INTERLOCK
CHANNEL I DIFFERENCE SELECT
CH I DIFFERENCE SELECT
CH I SELECT
R1102
CHANNEL II CABLE INTERLOCK
CHANNEL II DIFFERENCE SELECT
CH II DIFFERENCE SELECT
CH II SELECT
R1202
R1202, R1901 R3001, R3801
TESTER DIFFERENCE SELECT
ON LINE BUFFERED
SEEK
Block first Cycle Count Pulse
0.7MS
DELAYED SEEK
CYLINDER DETECT B
CYLINDER DETECT A
ON CYL
LAST Count Pulse generation.
10μ SEC
1.2 μSEC
GATED CYLINDER PULSES
CYLINDER PULSES
DIFF BIT 9
DIFF BIT 8
DIFF BIT 7
DIFF BIT 6
DIFF BIT 5
DIFF BIT 4
DIFF BIT 3
DIFF BIT 2
DIFF BIT 1
DIFF BIT 0
T>128
T≤128
T=0
TPC
TP8
S1800 182 A23B3
S1801 182 A23C3
S1802 182 A23D3
NOTES:
① NOT USED.
② COMMON CONTROL BLOCK DUPLICATED FOR REFERENCE ONLY.
CONTROL DATA
NORMANDALE DIVISION
DIFFERENCE COUNTER
DWG NO HPDE 7400
CODE IDENT 19333
SHEET 18
REV G

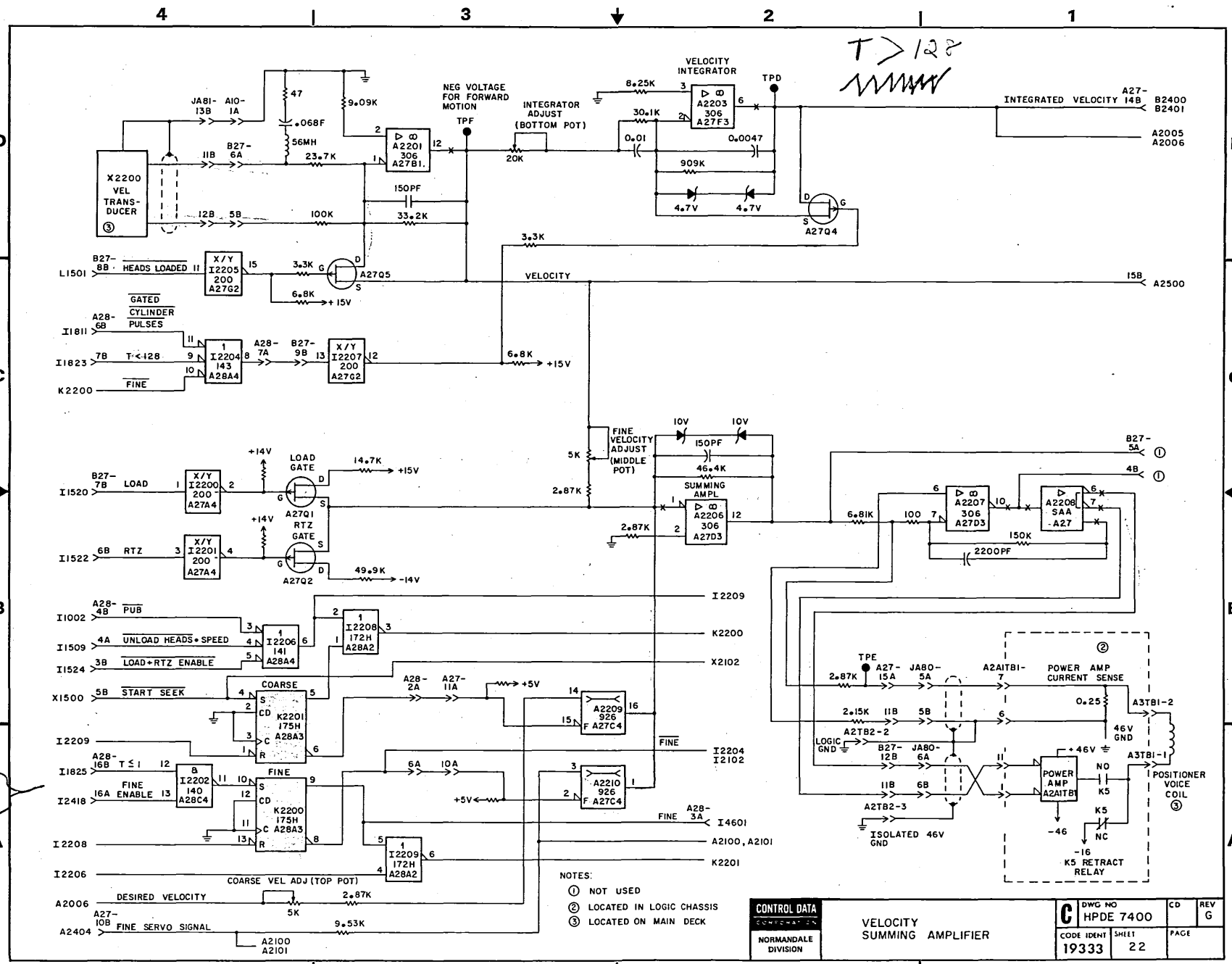

I3004 CHI CABLE INTLK
IJ2-46 C14-9A
IJ2-49 9B CHI CYL SEL
I1124 12A CHI SELECT & RESERVE BUFF
R1102, R1800 R3000, R3800
I3005 CHII CABLE INTLK
IIJ2-46 D14-9A
IIJ2-49 9B CHII CYL SEL
I1227 12A CHII SELECT & RESERVE BUFF
R1202 R1801 R3001 R3801
TESTER CYLINDER SELECT I1005
B17-9B ON LINE BUFFERED
CYLINDER SELECT B17-4A
S1902 B23-13A CYL BIT 0
K1701 13B FORWARD EOT
X1500 12B START SEEK
I1509 11A UNLOAD HEADS • SPEED
SLOPE B23-12A I2400 I2402
A20-1A A20-2B
I1524 7A LOAD + RTZ ENABLE
I1721 2A (LOAD + RTZ ENABLE) • (UNIT READY)
I1438 A20-12B BIT 9
I1402 13B BIT 8
I1406 11B BIT 7
I1410 9B BIT 6
I1414 10A BIT 5
I1418 8A BIT 4
I1422 6B BIT 3
I1426 4B BIT 2
I1430 6A BIT 1
I1434 4A BIT 0
CYL BIT 9 I4439
CYL BIT 8 I4430
CYL BIT 7 I4431
CYL BIT 6 I4432
CYL BIT 5 I4433
CYL BIT 4 I4434
CYL BIT 3 I4435
CYL BIT 2 I4436
CYL BIT 1 I4437
CYL BIT 0 I4438 I1902
TESTER BIT 9
TESTER BIT 8
TESTER BIT 7
TESTER BIT 6
TESTER BIT 5
TESTER BIT 4
TESTER BIT 3
TESTER BIT 2
TESTER BIT 1
TESTER BIT 0
L4303 (JE80-6B)
L4303 (JE80-8B)
L4303 (JE80-5B)
S1900 182 R A2083
S1901 182 R A2084
S1902 182 R A20A4
SET ODD DATA TRACKS
NOTES: (1) NOT USED.
(2) COMMON CONTROL BLOCK DUPLICATED FOR REFERENCE ONLY.
CONTROL DATA
NORMANDALE DIVISION
CYLINDER REGISTER
C HPDE 7400
CD
REV G
CODE IDENT 19333
SHEET 19
PAGE


A2203 INTEGRATED VELOCITY
267K
TPC
DESIRED VELOCITY
A27-2A
DESIRED VEL FUNCTION GEN
+5V
A27-12A FORWARD-SEEK I1532
A2001 926 F±
A27C4
A2006 326 A27B3
9.09K
DESIRED VELOCITY A2209
A2000 POSITION ERROR
TPB
A2002 306 A27A4
6.81K
A2004 306 A27A4
3.40K
4.99K
D/A OFFSET
A27-3A A2401
11.3K
A2003 926 F± A27C4
A27-9B REVERSE-SEEK I1533
B28-7A T>128 I1821
B23-10B 11B
I2013 140 A28D1
I2020 140 A28D1
I2027 140 A28D3
S1801 8B DIFF BIT 6
I2012 146 A28B3
I2011 140 A28D1
B28-14A B28-10A
I2019 140 A28D1
I2026 140 A28D3
S1801 13B DIFF BIT 5
I2010 140 A28E1
I2009 140 A28E1
I2018 140 A28E1
I2025 140 A28D3
MAINT. OFFSET +
I2415 9A DIFF BIT 4
I2008 140 A28E1
I2007 140 A28E2
I2017 140 A28E2
I2024 140 A28D4
S1802 12A DIFF BIT 3
I2006 140 A28E2
I2005 140 A28E2
I2016 140 A28E3
I2023 140 A28D4
S1802 12B DIFF BIT 2
I2004 140 A28E3
I2003 140 A28E3
I2015 140 A28E3
I2022 140 A28D4
S1802 10B DIFF BIT 1
I2002 140 A28E4
I2001 140 A28E4
I2014 140 A28E4
I2021 140 A28D4
S1802 11A DIFF BIT 0
I2000 140 A28E4
B28- A27-
6A 5A DIFF 64
7B 4B DIFF 32
6B 4A DIFF 16
5A 3B DIFF 8
5B 5B DIFF 4
4A 6A DIFF 2
4B 6B DIFF 1
A2000 986 A27A5
POSITION ERROR A2002
NOTE:
① NOT USED.
CONTROL DATA NORMANDALE DIVISION
DWG NO HPDE 7400
REV G
SHEET 20
CODE IDENT 19333
POSITION ERROR

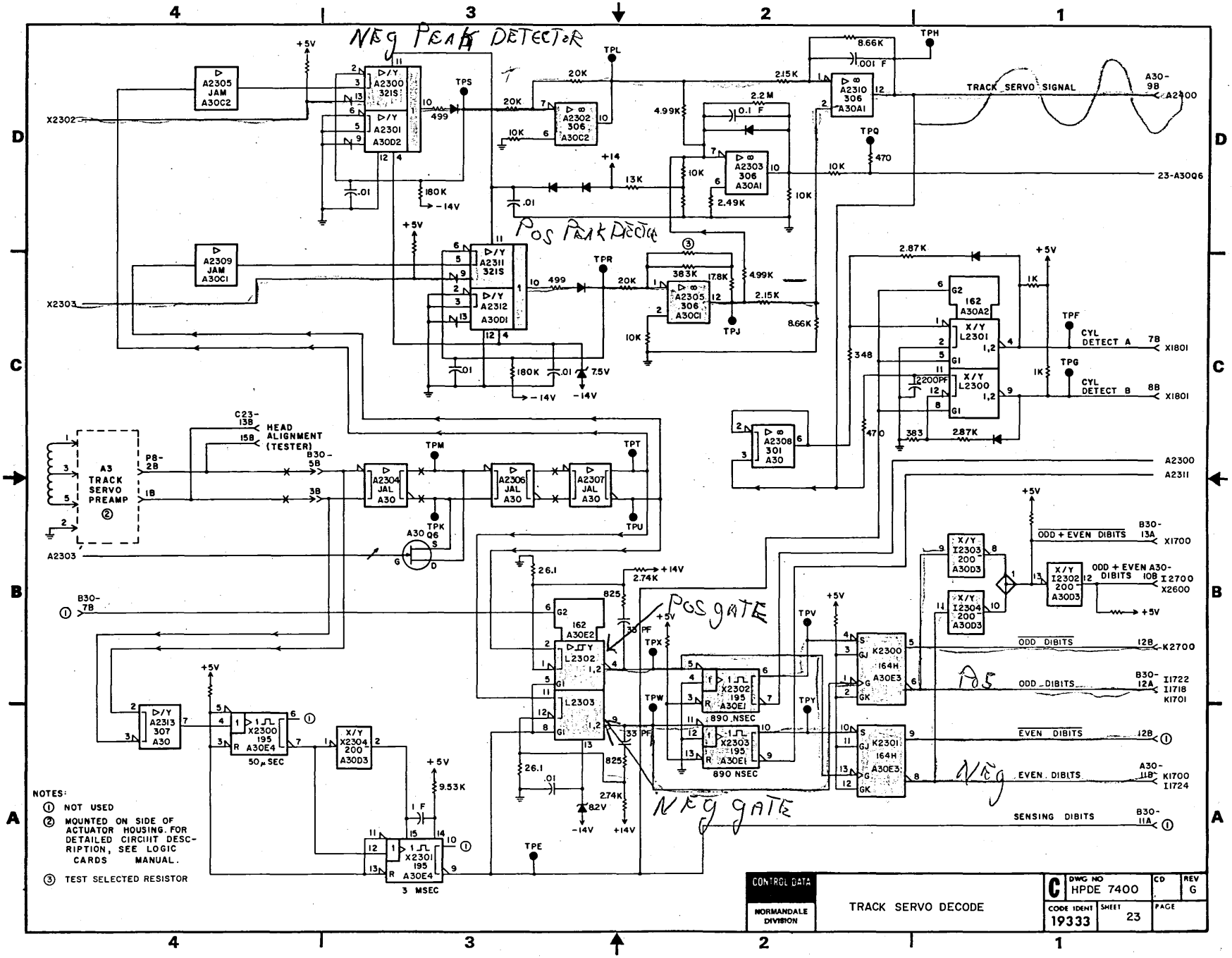


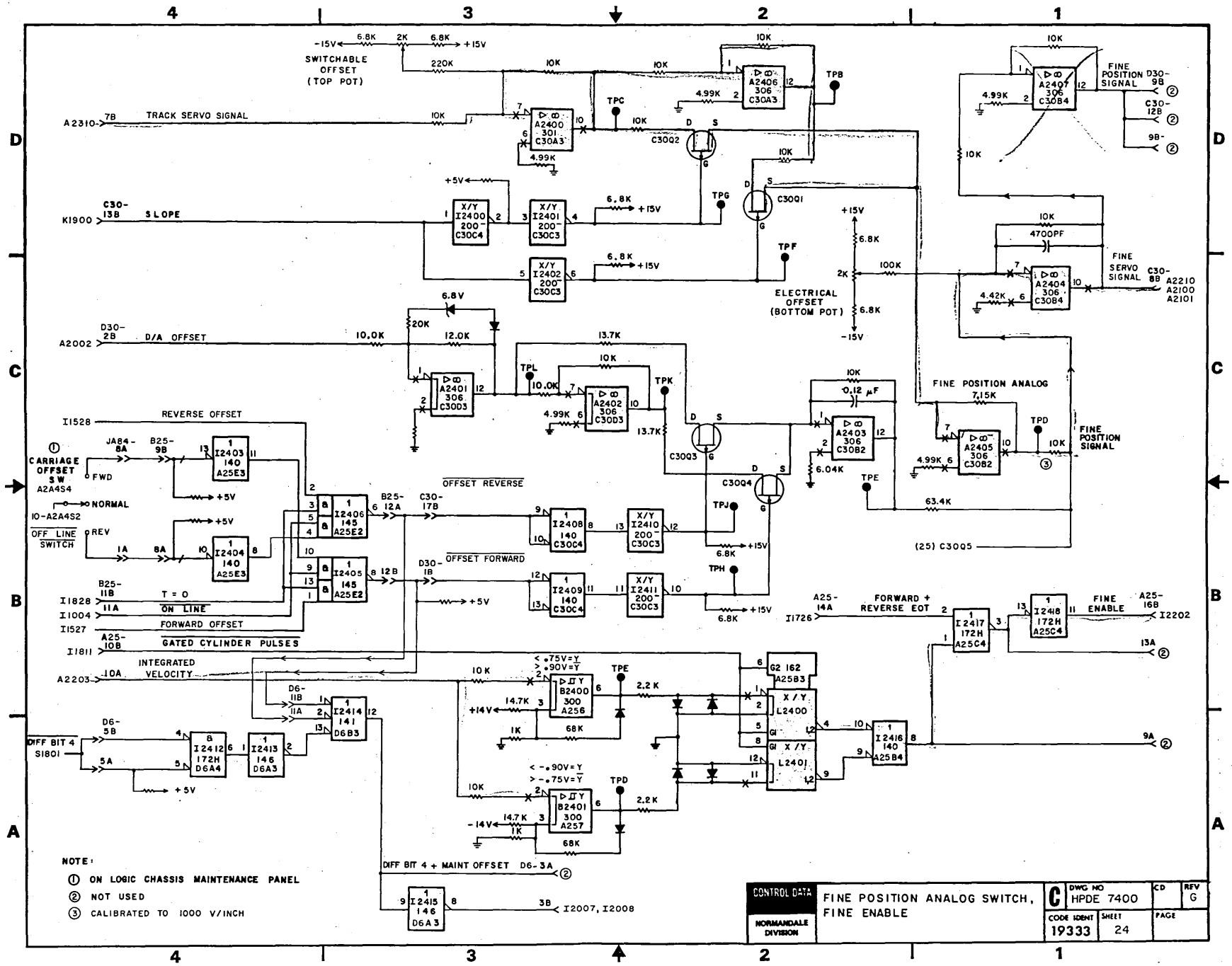
NOTE:
① NOT USED.

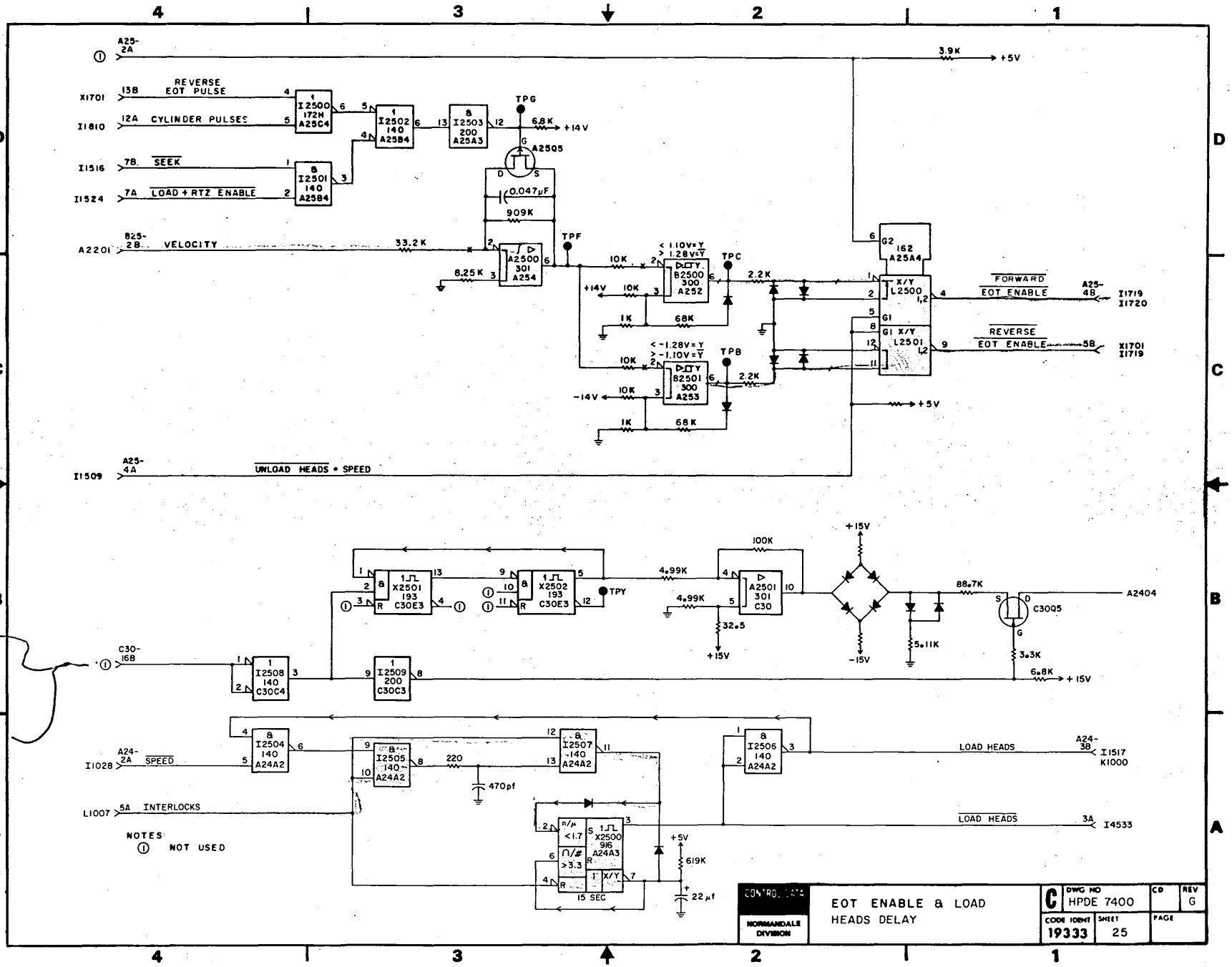
CONTROL DATA		C	DWG NO HPDE 7400	CD	REV G
NORMANDALE DIVISION	ON CYLINDER		CODE IDENT 19333	SHEET 21	PAGE



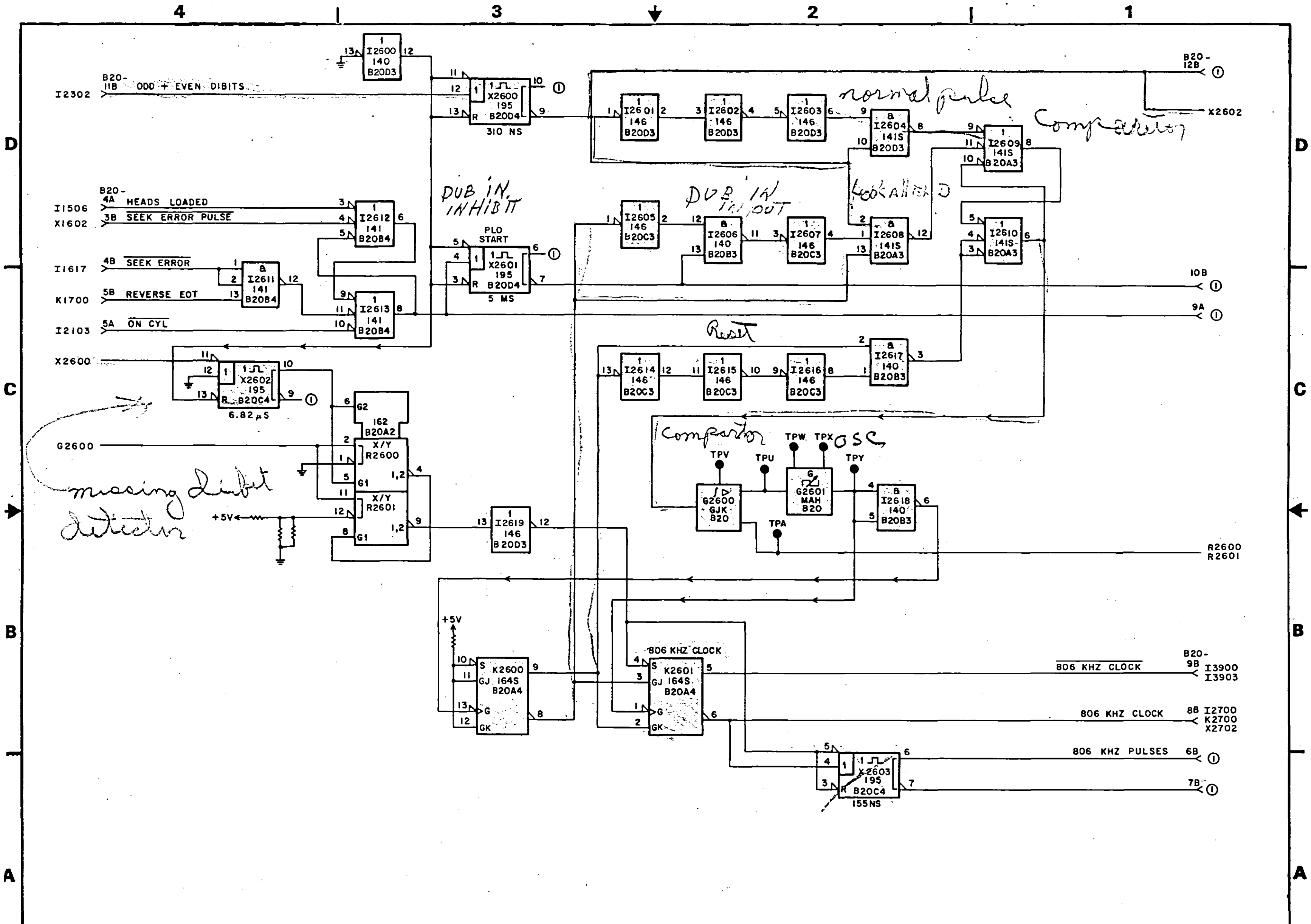
CONTROL DATA CORPORATION NORMANDALE DIVISION	VELOCITY SUMMING AMPLIFIER	C HPDE 7400	CD / REV G
		CODE IDENT 19333 / SHEET 22	PAGE


NEG PEAK DETECTOR
POS PEAK DETECT
POS GATE
NEG GATE
TRACK SERVO SIGNAL
A30-98 A2300
23-A30Q6
A3 TRACK SERVO PREAMP ②
HEAD ALIGNMENT (TESTER)
CYL DETECT A 7B X1801
CYL DETECT B 8B X1801
ODD + EVEN DIBITS B30-13A X1700
ODD + EVEN DIBITS A30-10B I2700 X2600
ODD DIBITS 12B K2700
ODD DIBITS B30-12A I1722 I1718 K1701
EVEN DIBITS 12B ①
EVEN DIBITS A30-11B K1700 I1724
SENSING DIBITS B30-11A ①
50 μ SEC
3 MSEC
890 NSEC
890 NSEC
NOTES:
① NOT USED
② MOUNTED ON SIDE OF ACTUATOR HOUSING. FOR DETAILED CIRCUIT DESCRIPTION, SEE LOGIC CARDS MANUAL.
③ TEST SELECTED RESISTOR
CONTROL DATA
NORMANDALE DIVISION
TRACK SERVO DECODE
C
DWG NO HPDE 7400
CD
REV G
CODE IDENT 19333
SHEET 23
PAGE


SWITCHABLE OFFSET (TOP POT)
TRACK SERVO SIGNAL
SLOPE
D/A OFFSET
REVERSE OFFSET
CARRIAGE OFFSET SW A2A4S4
FWD
NORMAL
OFF LINE SWITCH
REV
T = 0
ON LINE
FORWARD OFFSET
GATED CYLINDER PULSES
INTEGRATED VELOCITY
OFFSET REVERSE
OFFSET FORWARD
ELECTRICAL OFFSET (BOTTOM POT)
FINE POSITION ANALOG
FINE POSITION SIGNAL
FINE SERVO SIGNAL
FINE POSITION D30-9B
FORWARD + REVERSE EOT
FINE ENABLE
DIFF BIT 4 S1801
DIFF BIT 4 + MAINT OFFSET D6-3A
NOTE:
① ON LOGIC CHASSIS MAINTENANCE PANEL
② NOT USED
③ CALIBRATED TO 1000 V/INCH
CONTROL DATA
NORMANDALE DIVISION
FINE POSITION ANALOG SWITCH, FINE ENABLE
DWG NO HPDE 7400
CD
REV G
CODE IDENT 19333
SHEET 24
PAGE


A25-2A
3.9K
+5V
REVERSE EOT PULSE
I1701 13B
I1810 12A CYLINDER PULSES
I1516 7B SEEK
I1524 7A LOAD + RTZ ENABLE
I2500 172H A25C4
I2502 140 A25B4
I2503 200 A25A3
TPG
6.8K
+14V
A25Q5
0.047μF
909K
A2201 B25-2B VELOCITY
33.2K
8.25K
A2500 301 A254
TPF
10K
1K
68K
+14V
-14V
B2500 300 A252
B2501 300 A253
TPC
TPB
2.2K
G2 162 A25A4
X/Y L2500
G1 X/Y L2501
FORWARD EOT ENABLE
A25-4B
I1719
I1720
REVERSE EOT ENABLE
5B
I1701
I1719
I1509 A25-4A UNLOAD HEADS • SPEED
X2501 193 C30E3
X2502 193 C30E3
TPY
4.99K
100K
A2501 301 C30
32.5
88.7K
C30Q5
A2404
5.11K
3.3K
6.8K
+15V
-15V
C30-16B
I2508 140 C30C4
I2509 200 C30C3
ground for velocity gain adjustment
A24-2A SPEED
I1028
I2504 140 A24A2
I2505 140 A24A2
I2507 140 A24A2
I2506 140 A24A2
220
470pf
LOAD HEADS
A24-3B
I1517
K1000
L1007 5A INTERLOCKS
X2500 916 A24A3
15 SEC
619K
22μf
LOAD HEADS
3A
I4533
NOTES:
① NOT USED
CONTROL DATA
NORMANDALE DIVISION
EOT ENABLE & LOAD HEADS DELAY
C
DWG NO HPDE 7400
CD
REV G
CODE IDENT 19333
SHEET 25
PAGE

83308100 A

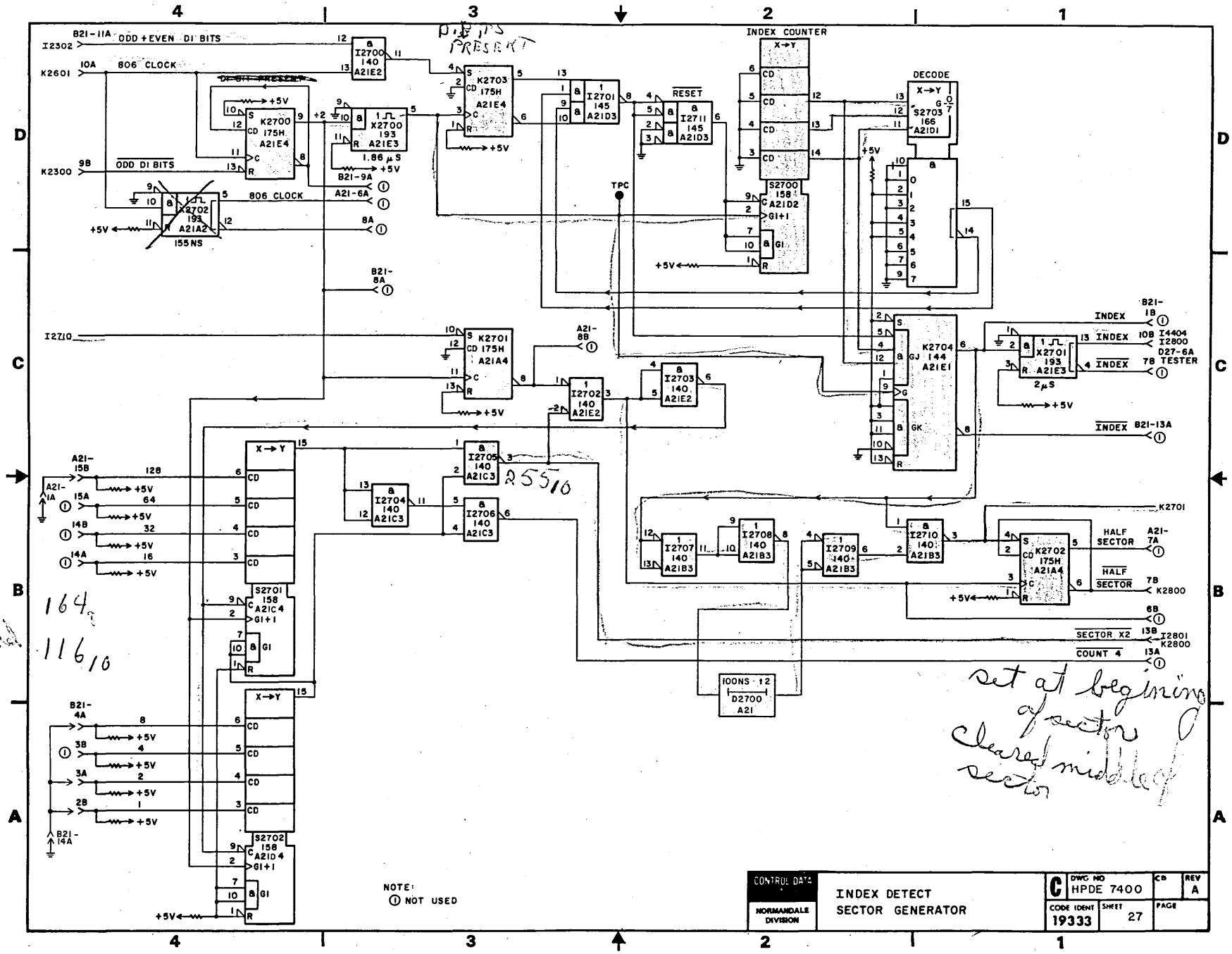


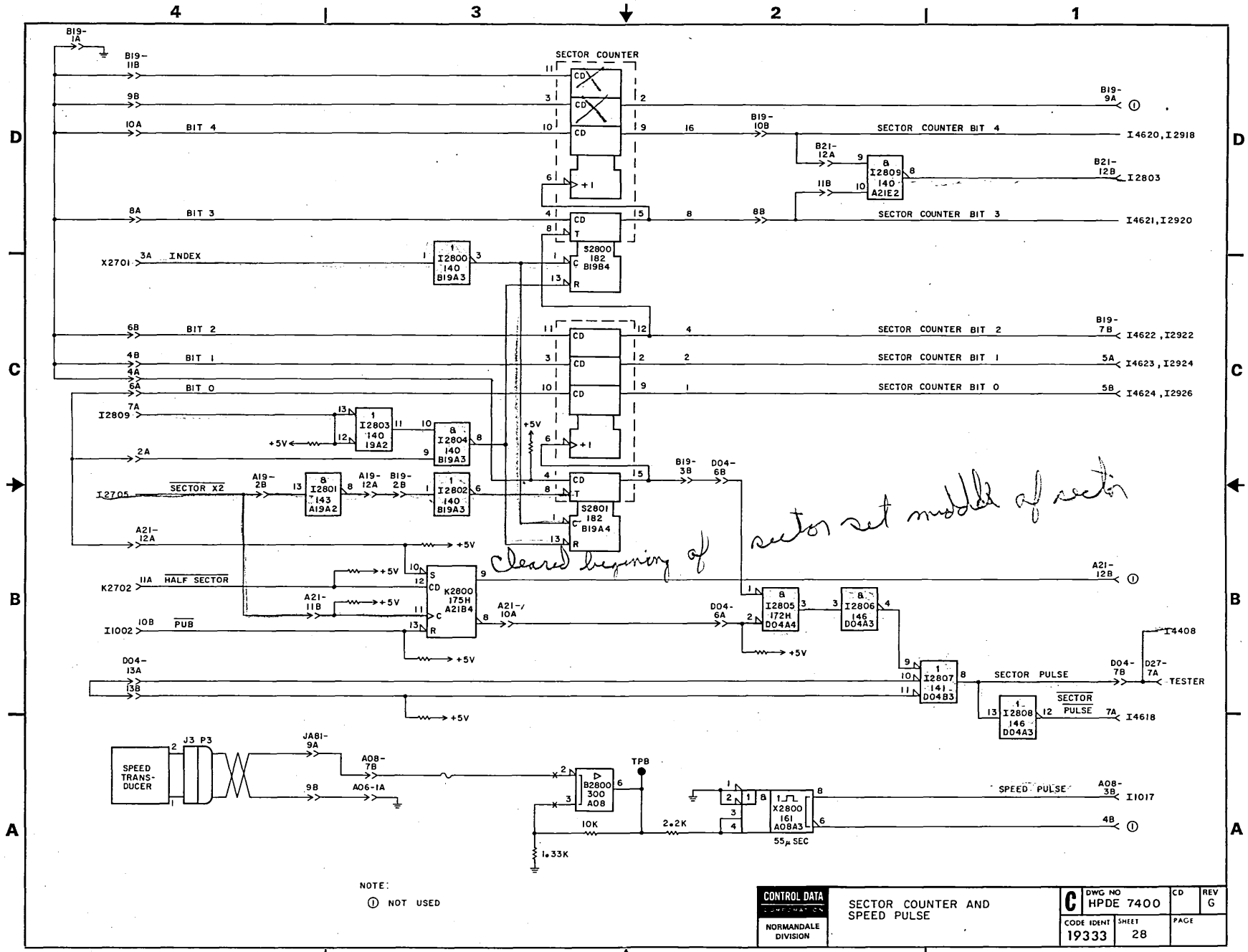
CONTROL DATA

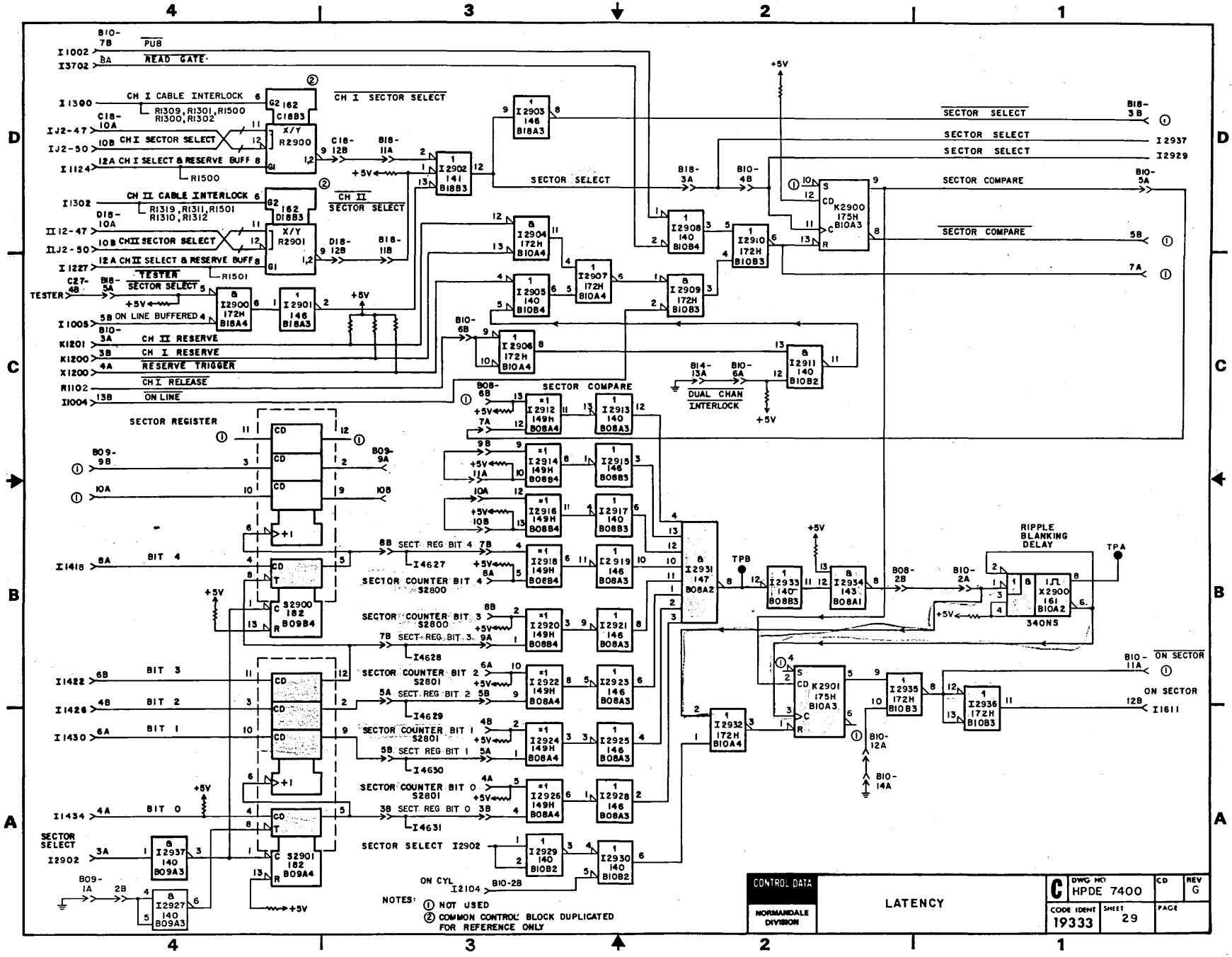
NORMANDALE DIVISION

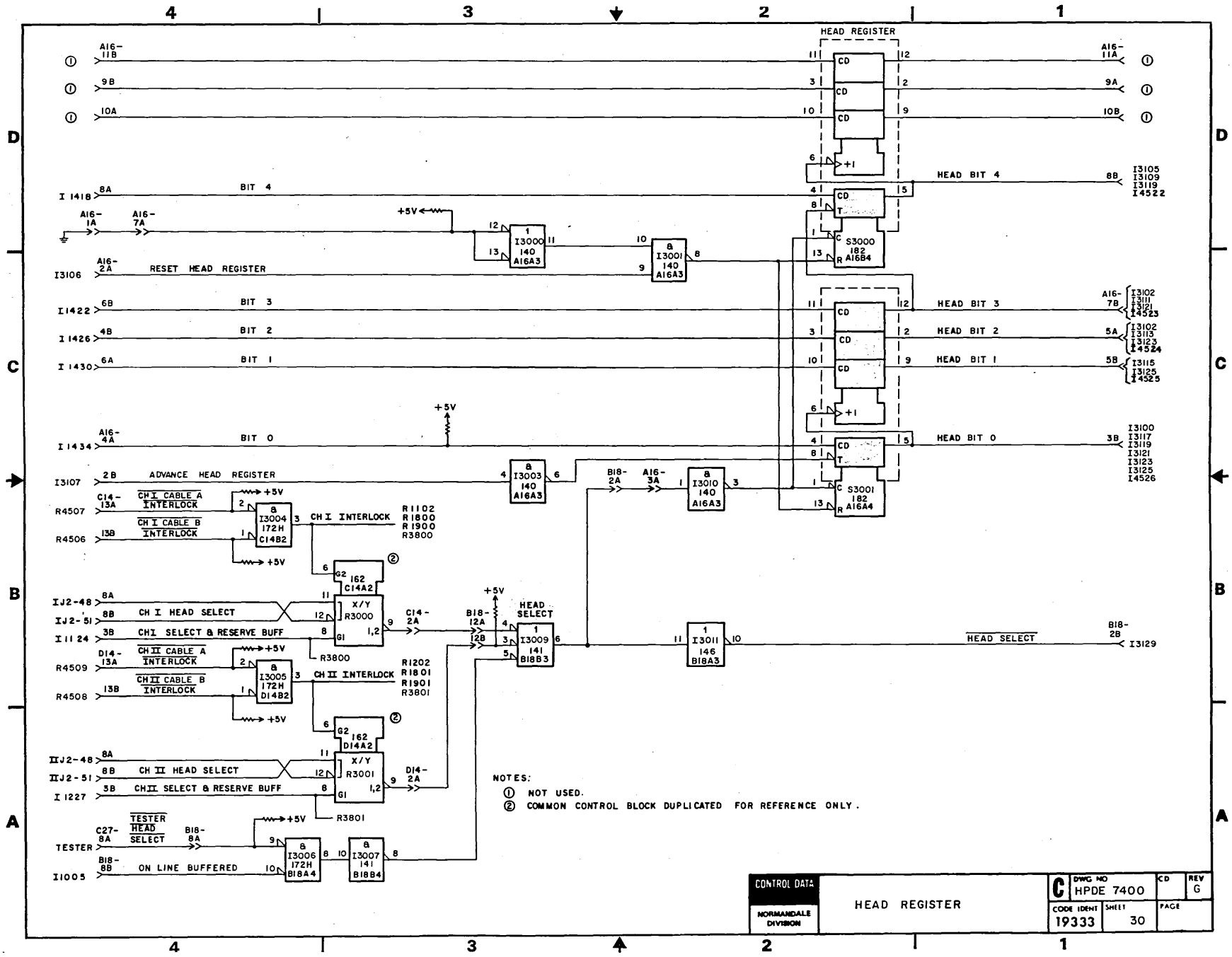
806 KHZ CLOCK

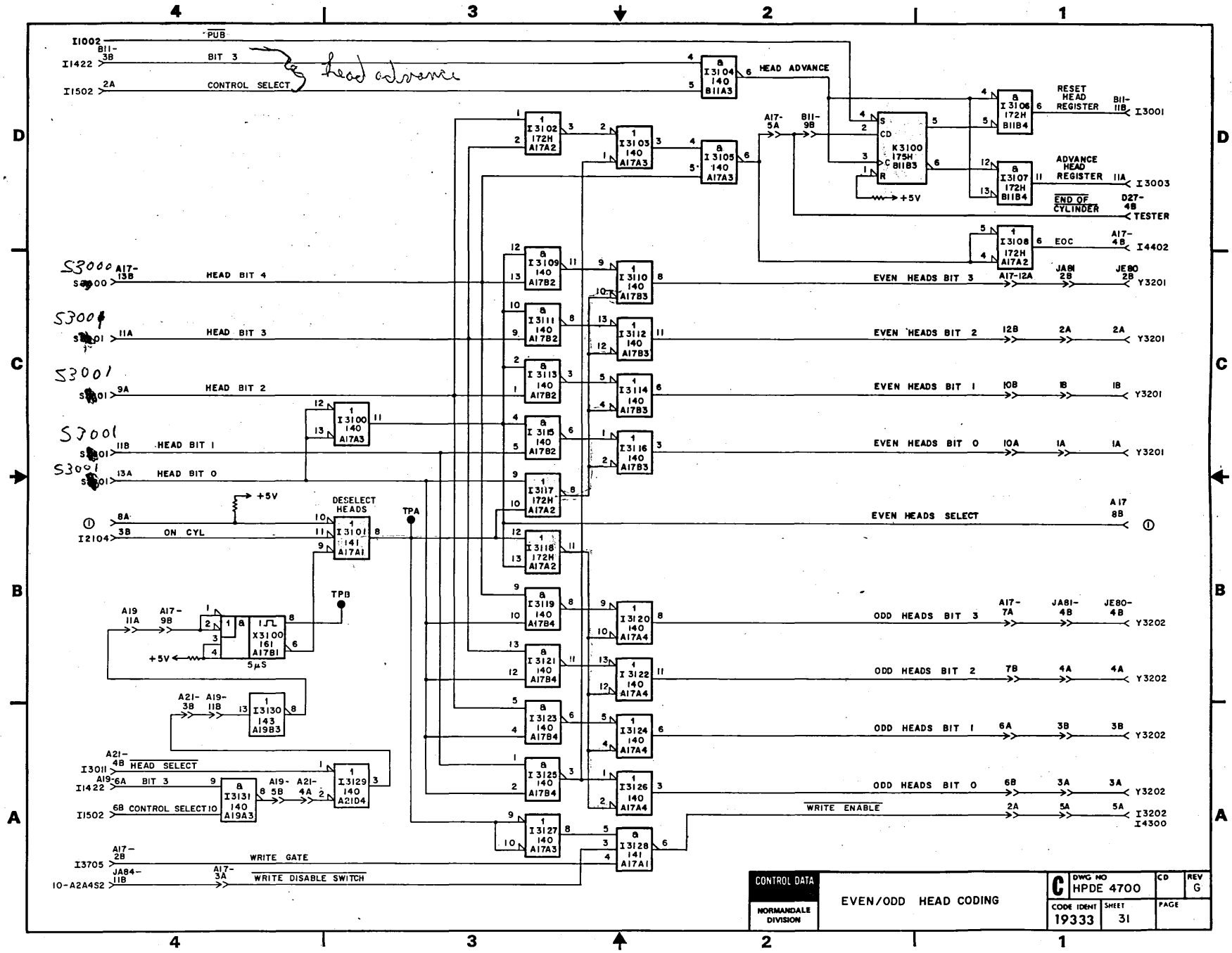
C	DWG NO	CD	REV
	HPDE 7400		G
CODE IDENT	SHEET	PAGE	
19333	26		

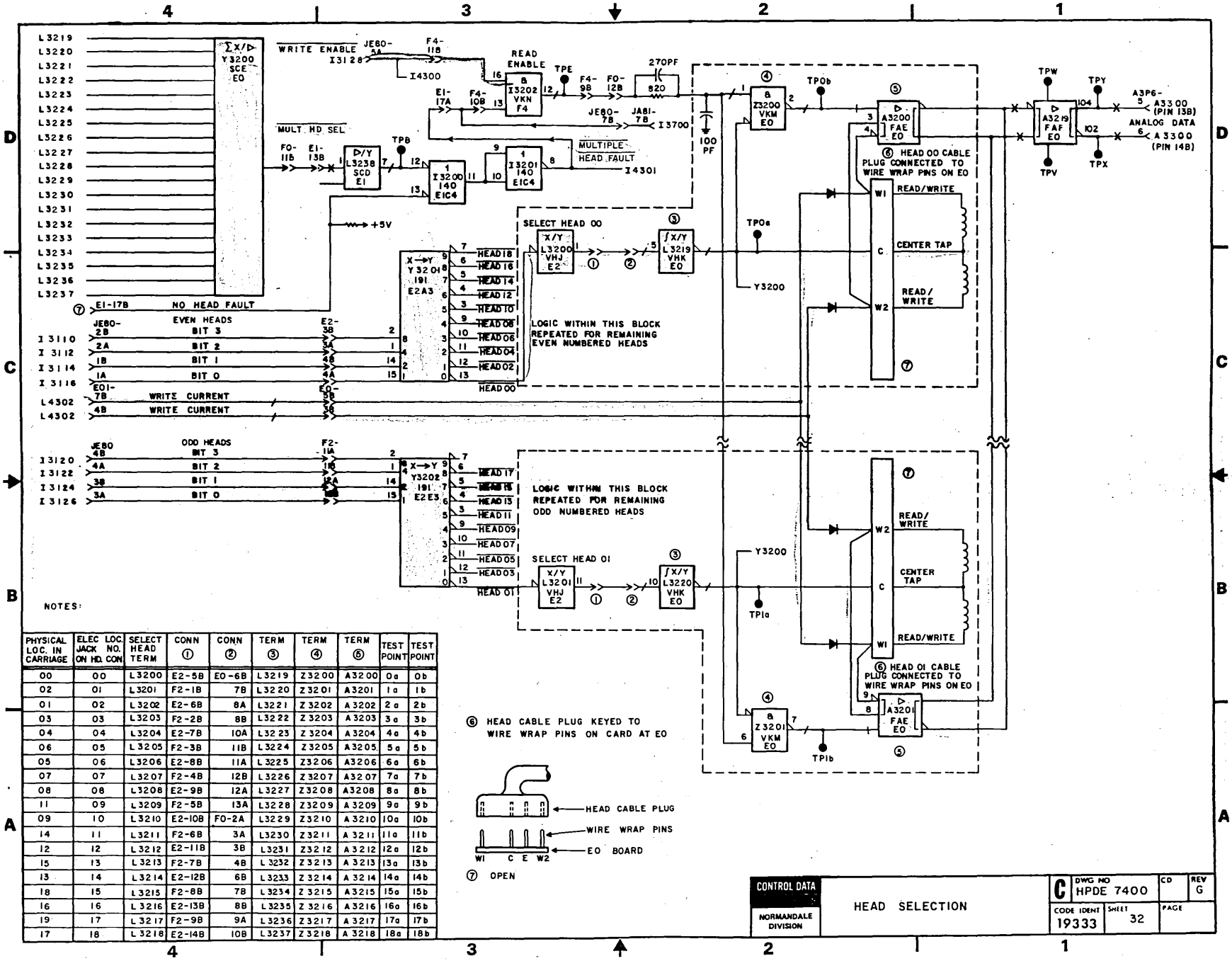

B21-11A ODD + EVEN DI BITS
I2302
K2601 10A 806 CLOCK
K2300 98 ODD DI BITS
I2700 140 A2IE2
K2703 175H A2IE4
X2700 193 A2IE3
1.86 μS
B21-9A
A21-6A
8A
X2702 193 A2IA2
155 NS
B21-8A
I2701 145 A2ID3
RESET
I2711 145 A2ID3
INDEX COUNTER
S2700 158 A2ID2
DECODE
S2703 166 A2ID1
TPC
I2710
K2701 175H A2IA4
A21-8B
I2702 140 A2IE2
I2703 140 A2IE2
K2704 144 A2IE1
X2701 193 A2IE3
2 μS
INDEX B21-18
INDEX 10B I4404 I2800 D27-6A TESTER
INDEX 7B TESTER
INDEX B21-13A
A21-15B 128
A21-1A
15A 64
14B 32
14A 16
I2705 140 A2IC3
I2706 140 A2IC3
I2704 140 A2IC3
25510
S2701 158 A2IC4
I2707 140 A2IB3
I2708 140 A2IB3
I2709 140 A2IB3
I2710 140 A2IB3
K2702 175H A2IA4
HALF SECTOR A21-7A
HALF SECTOR 7B K2800
6B
SECTOR X2 13B I2801 K2800
COUNT 4 13A
100NS · 12 D2700 A21
B21-4A 8
3B 4
3A 2
2B 1
B21-14A
S2702 158 A2ID4
NOTE:
① NOT USED
CONTROL DATA NORMANDALE DIVISION
INDEX DETECT SECTOR GENERATOR
C DWG NO HPDE 7400 CD REV A
CODE IDENT 19333 SHEET 27 PAGE


SECTOR COUNTER
BIT 4
BIT 3
BIT 2
BIT 1
BIT 0
INDEX
SECTOR X2
HALF SECTOR
PUB
SECTOR COUNTER BIT 4
SECTOR COUNTER BIT 3
SECTOR COUNTER BIT 2
SECTOR COUNTER BIT 1
SECTOR COUNTER BIT 0
SECTOR PULSE
SPEED PULSE
SPEED TRANS-DUCER
55μ SEC
Cleared beginning of sector set middle of sector
NOTE:
① NOT USED
CONTROL DATA
NORMANDALE DIVISION
SECTOR COUNTER AND SPEED PULSE
DWG NO HPDE 7400
REV G
CODE IDENT 19333
SHEET 28


PUB
READ GATE
CH I CABLE INTERLOCK
CH I SECTOR SELECT
CH I SECTOR SELECT
CH II CABLE INTERLOCK
CH II SECTOR SELECT
CH II SECTOR SELECT
TESTER SECTOR SELECT
ON LINE BUFFERED
CH II RESERVE
CH I RESERVE
RESERVE TRIGGER
CH I RELEASE
ON LINE
SECTOR SELECT
SECTOR SELECT
SECTOR SELECT
SECTOR COMPARE
SECTOR COMPARE
SECTOR COMPARE
DUAL CHAN INTERLOCK
SECTOR REGISTER
BIT 4
BIT 3
BIT 2
BIT 1
BIT 0
SECT REG BIT 4
SECT REG BIT 3
SECT REG BIT 2
SECT REG BIT 1
SECT REG BIT 0
SECTOR COUNTER BIT 4 S2800
SECTOR COUNTER BIT 3 S2800
SECTOR COUNTER BIT 2 S2801
SECTOR COUNTER BIT 1 S2801
SECTOR COUNTER BIT 0 S2801
SECTOR SELECT I2902
ON CYL I2104
RIPPLE BLANKING DELAY
340NS
ON SECTOR
ON SECTOR I1611
NOTES: ① NOT USED
② COMMON CONTROL BLOCK DUPLICATED FOR REFERENCE ONLY
CONTROL DATA
NORMANDALE DIVISION
LATENCY
DWG NO HPDE 7400
CODE IDENT 19333
SHEET 29
REV G


HEAD REGISTER
A16-11B
9B
10A
A16-11A
9A
10B
CD
+1
HEAD BIT 4
I1418 8A BIT 4
A16-1A
A16-7A
+5V
I3000 140 A16A3
I3001 140 A16A3
S3000 182 A16B4
I3106 A16-2A RESET HEAD REGISTER
I3105 I3109 I3119 I4522
I1422 6B BIT 3
HEAD BIT 3
I1426 4B BIT 2
HEAD BIT 2
I1430 6A BIT 1
HEAD BIT 1
I3102 I3111 I3121 I4523
I3102 I3113 I3123 I4524
I3115 I3125 I4525
I1434 A16-4A BIT 0
HEAD BIT 0
I3100 I3117 I3119 I3121 I3123 I3125 I4526
I3107 2B ADVANCE HEAD REGISTER
I3003 140 A16A3
B18-2A
A16-3A
I3010 140 A16A3
S3001 182 A16A4
C14-13A
CH I CABLE A INTERLOCK
R4507
CH I CABLE B INTERLOCK
R4506 13B
I3004 172H C14B2
CH I INTERLOCK
R1102 R1800 R1900 R3800
G2 162 C14A2
IJ2-48 8A
IJ2-51 8B
CH I HEAD SELECT
I1124 3B CHI SELECT & RESERVE BUFF
X/Y R3000
C14-2A
R3800
D14-13A
CH II CABLE A INTERLOCK
R4509
CH II CABLE B INTERLOCK
R4508 13B
I3005 172H D14B2
CH II INTERLOCK
R1202 R1801 R1901 R3801
G2 162 D14A2
IIJ2-48 8A
IIJ2-51 8B
CH II HEAD SELECT
I1227 3B CHII SELECT & RESERVE BUFF
X/Y R3001
D14-2A
R3801
HEAD SELECT
I3009 141 B18B3
B18-12A
I3011 146 B18A3
B18-2B
I3129
C27-8A TESTER
TESTER HEAD SELECT
B18-8A
I3006 172H B18A4
I3007 141 B18B4
B18-8B I1005 ON LINE BUFFERED
NOTES:
① NOT USED.
② COMMON CONTROL BLOCK DUPLICATED FOR REFERENCE ONLY.
CONTROL DATA
NORMANDALE DIVISION
HEAD REGISTER
C
DWG NO HPDE 7400
CD
REV G
CODE IDENT 19333
SHEET 30
PAGE

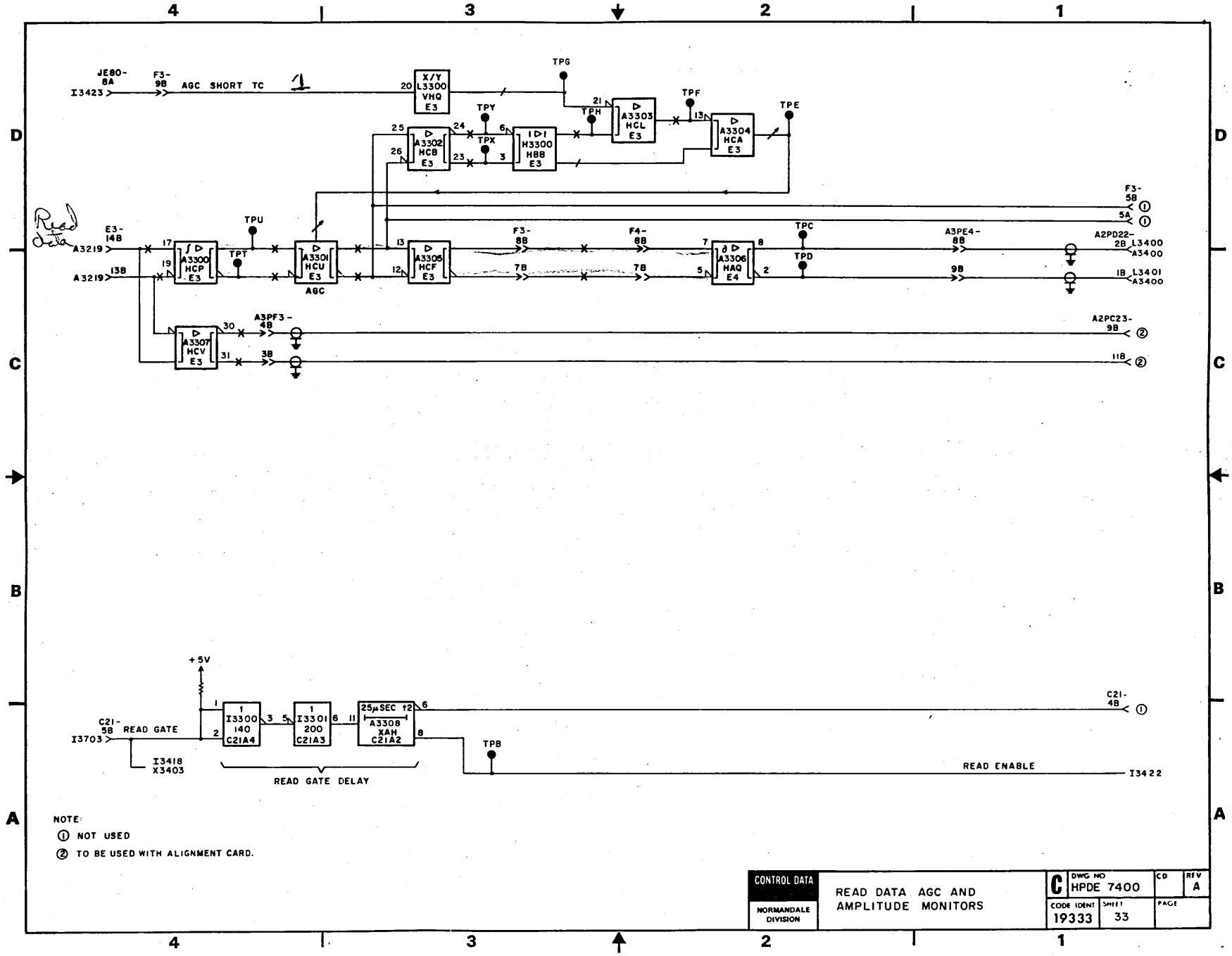

I1002 BII-3B PUB
I1422 BIT 3
I1502 2A CONTROL SELECT
head advance
HEAD ADVANCE
RESET HEAD REGISTER BII-11B I3001
ADVANCE HEAD REGISTER 11A I3003
END OF CYLINDER D27-4B TESTER
EOC A17-4B I4402
S3000 A17-13B HEAD BIT 4
S3001 11A HEAD BIT 3
S3001 9A HEAD BIT 2
S3001 11B HEAD BIT 1
S3001 13A HEAD BIT 0
I2104 8A 3B ON CYL
DESELECT HEADS
TPA
TPB
X3100 161 A17B1
5μS
A21-3B A19-11B HEAD SELECT
I3011
I1422 A19-6A BIT 3
I1502 6B CONTROL SELECT
WRITE GATE
I3705 A17-2B
WRITE DISABLE SWITCH
10-A2A4S2 JA84-11B A17-3A
EVEN HEADS BIT 3 A17-12A JA81 2B JE80 2B Y3201
EVEN HEADS BIT 2 12B 2A 2A Y3201
EVEN HEADS BIT 1 10B 1B 1B Y3201
EVEN HEADS BIT 0 10A 1A 1A Y3201
EVEN HEADS SELECT A17 8B
ODD HEADS BIT 3 A17-7A JA81-4B JE80-4B Y3202
ODD HEADS BIT 2 7B 4A 4A Y3202
ODD HEADS BIT 1 6A 3B 3B Y3202
ODD HEADS BIT 0 6B 3A 3A Y3202
WRITE ENABLE 2A 5A 5A I3202 I4300
CONTROL DATA NORMANDALE DIVISION
EVEN/ODD HEAD CODING
C DWG NO HPDE 4700 CD REV G
CODE IDENT 19333 SHEET 31 PAGE



NOTES:

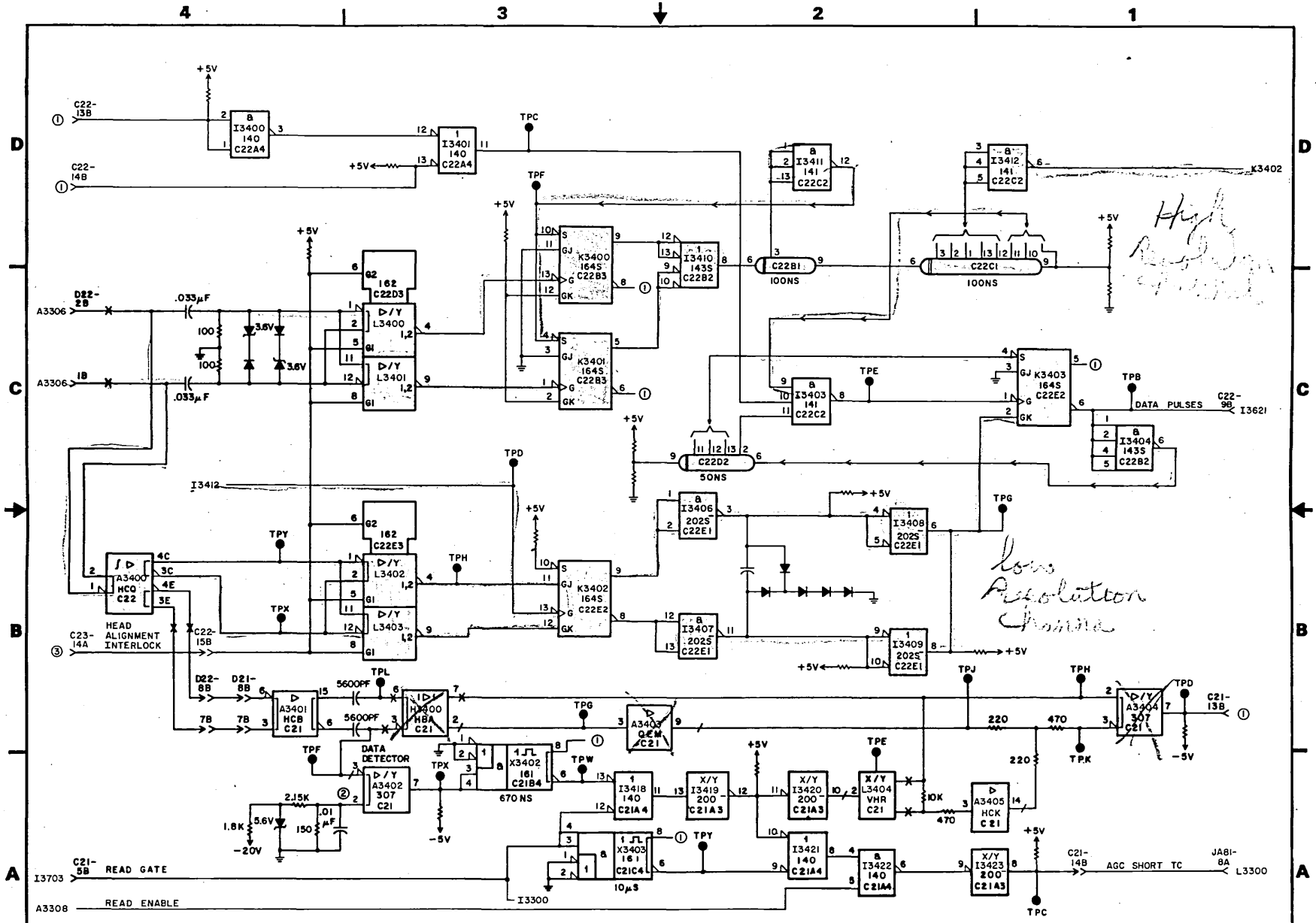
PHYSICAL LOC. IN CARRIAGE	ELEC LOC. JACK NO. ON HD. CON	SELECT HEAD TERM	CONN ①	CONN ②	TERM ③	TERM ④	TERM ⑤	TEST POINT	TEST POINT
00	00	L3200	E2-5B	E0-6B	L3219	Z3200	A3200	0a	0b
02	01	L3201	F2-1B	7B	L3220	Z3201	A3201	1a	1b
01	02	L3202	E2-6B	8A	L3221	Z3202	A3202	2a	2b
03	03	L3203	F2-2B	8B	L3222	Z3203	A3203	3a	3b
04	04	L3204	E2-7B	10A	L3223	Z3204	A3204	4a	4b
06	05	L3205	F2-3B	11B	L3224	Z3205	A3205	5a	5b
05	06	L3206	E2-8B	11A	L3225	Z3206	A3206	6a	6b
07	07	L3207	F2-4B	12B	L3226	Z3207	A3207	7a	7b
08	08	L3208	E2-9B	12A	L3227	Z3208	A3208	8a	8b
11	09	L3209	F2-5B	13A	L3228	Z3209	A3209	9a	9b
09	10	L3210	E2-10B	F0-2A	L3229	Z3210	A3210	10a	10b
14	11	L3211	F2-6B	3A	L3230	Z3211	A3211	11a	11b
12	12	L3212	E2-11B	3B	L3231	Z3212	A3212	12a	12b
15	13	L3213	F2-7B	4B	L3232	Z3213	A3213	13a	13b
13	14	L3214	E2-12B	6B	L3233	Z3214	A3214	14a	14b
18	15	L3215	F2-8B	7B	L3234	Z3215	A3215	15a	15b
16	16	L3216	E2-13B	8B	L3235	Z3216	A3216	16a	16b
19	17	L3217	F2-9B	9A	L3236	Z3217	A3217	17a	17b
17	18	L3218	E2-14B	10B	L3237	Z3218	A3218	18a	18b

CONTROL DATA	HEAD SELECTION	DWG NO HPDE 7400	CD	REV G
NORMANDALE DIVISION		CODE IDENT 19333	SHEET 32	PAGE



NOTE:
① NOT USED
② TO BE USED WITH ALIGNMENT CARD.

CONTROL DATA NORMANDALE DIVISION	READ DATA AGC AND AMPLITUDE MONITORS	C	DWG NO HPDE 7400	CD	REV A
			CODE IDENT 19333	SHEET 33	PAGE

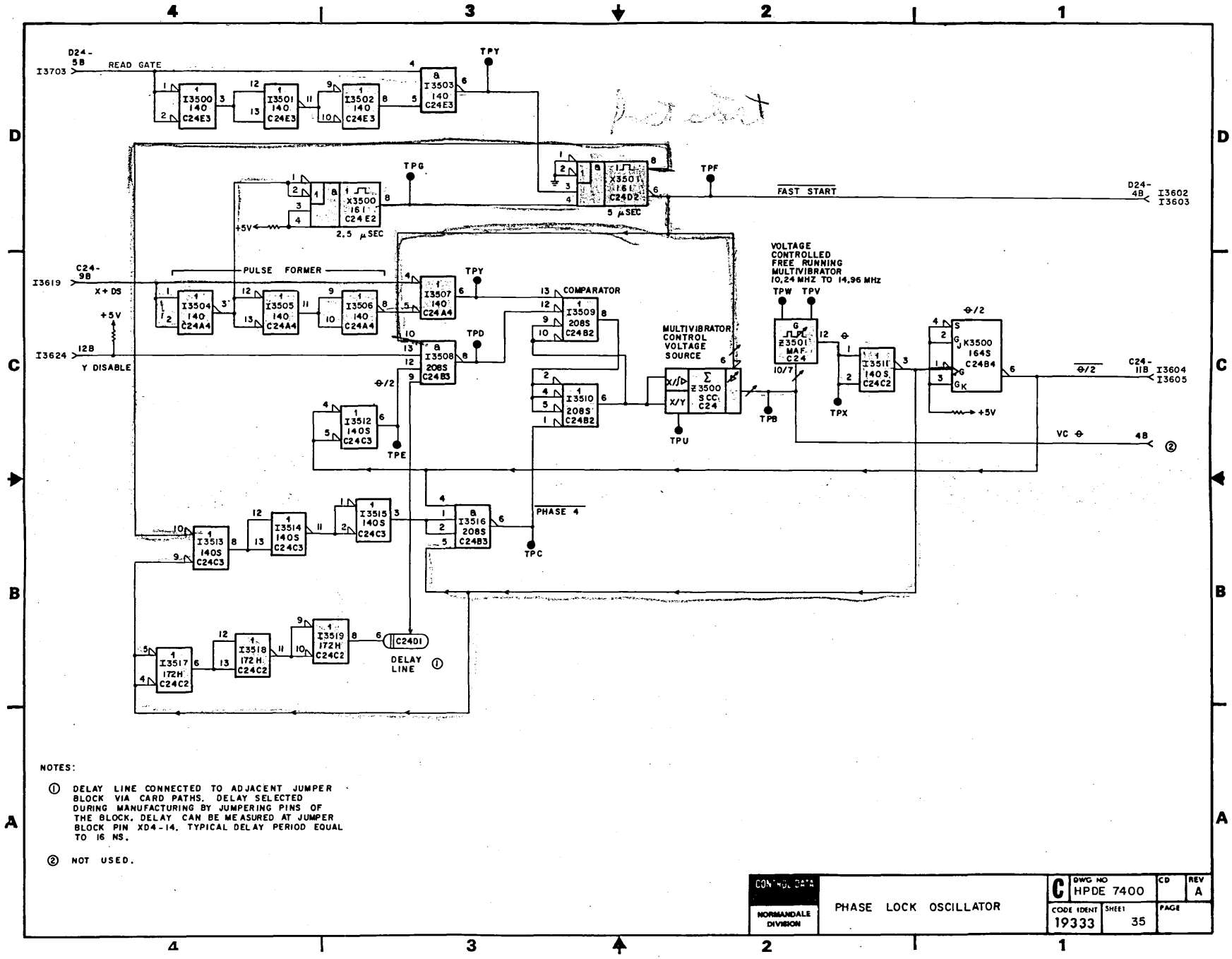


NOTES:
1. OPEN.
2. REFERENCE VOLTAGE IS −0.36V
3. GROUNDED WHEN HEAD ALIGNMENT TESTER INSTALLED

CONTROL DATA NORMANDALE DIVISION

DATA LATCH AND READ LEVEL DETECTION

DWG NO	CD	REV
HPDE 7400		A
CODE IDENT 19333	SHEET 34	PAGE

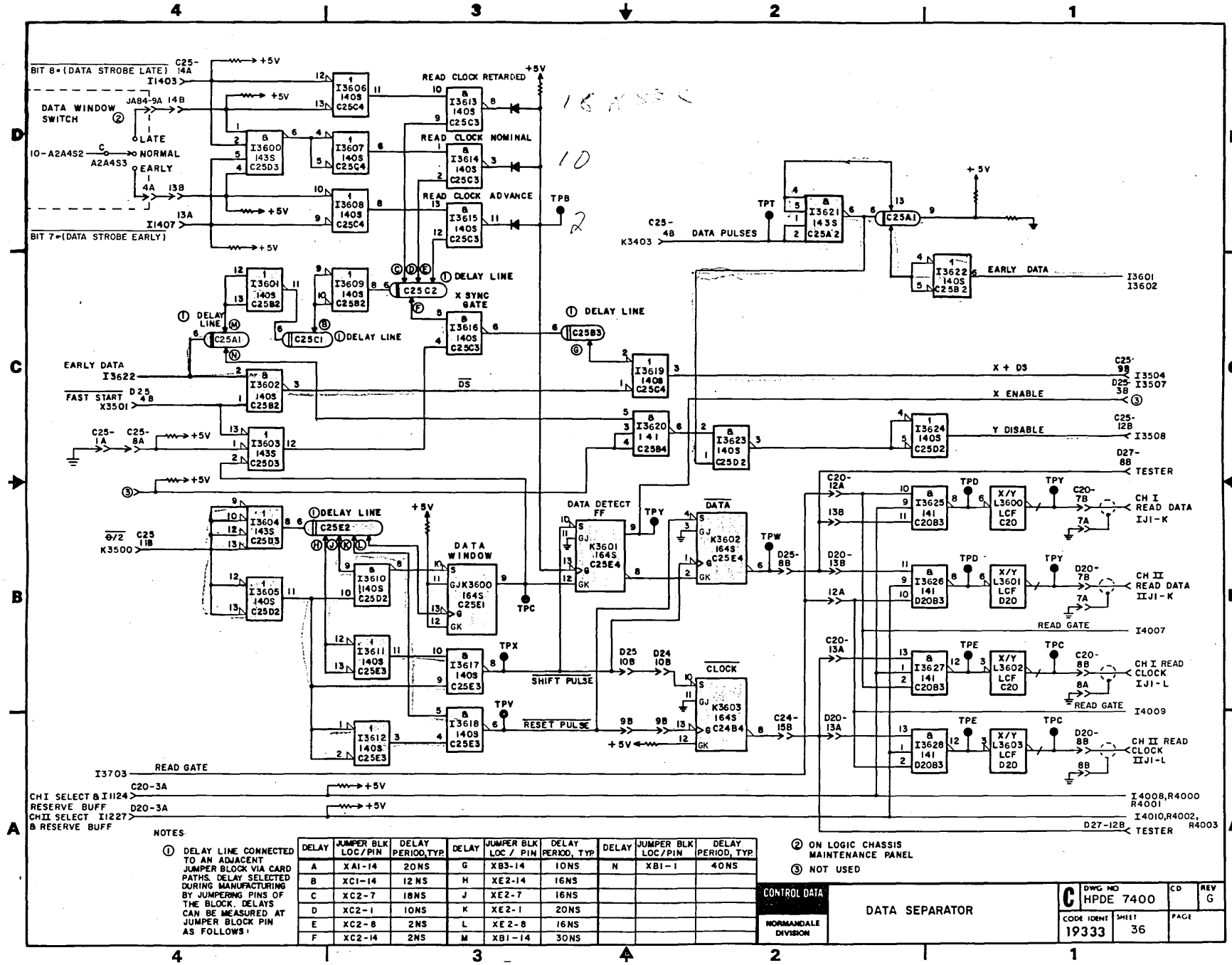


NOTES:

① DELAY LINE CONNECTED TO ADJACENT JUMPER BLOCK VIA CARD PATHS. DELAY SELECTED DURING MANUFACTURING BY JUMPERING PINS OF THE BLOCK. DELAY CAN BE MEASURED AT JUMPER BLOCK PIN XD4-14. TYPICAL DELAY PERIOD EQUAL TO 16 NS.

② NOT USED.

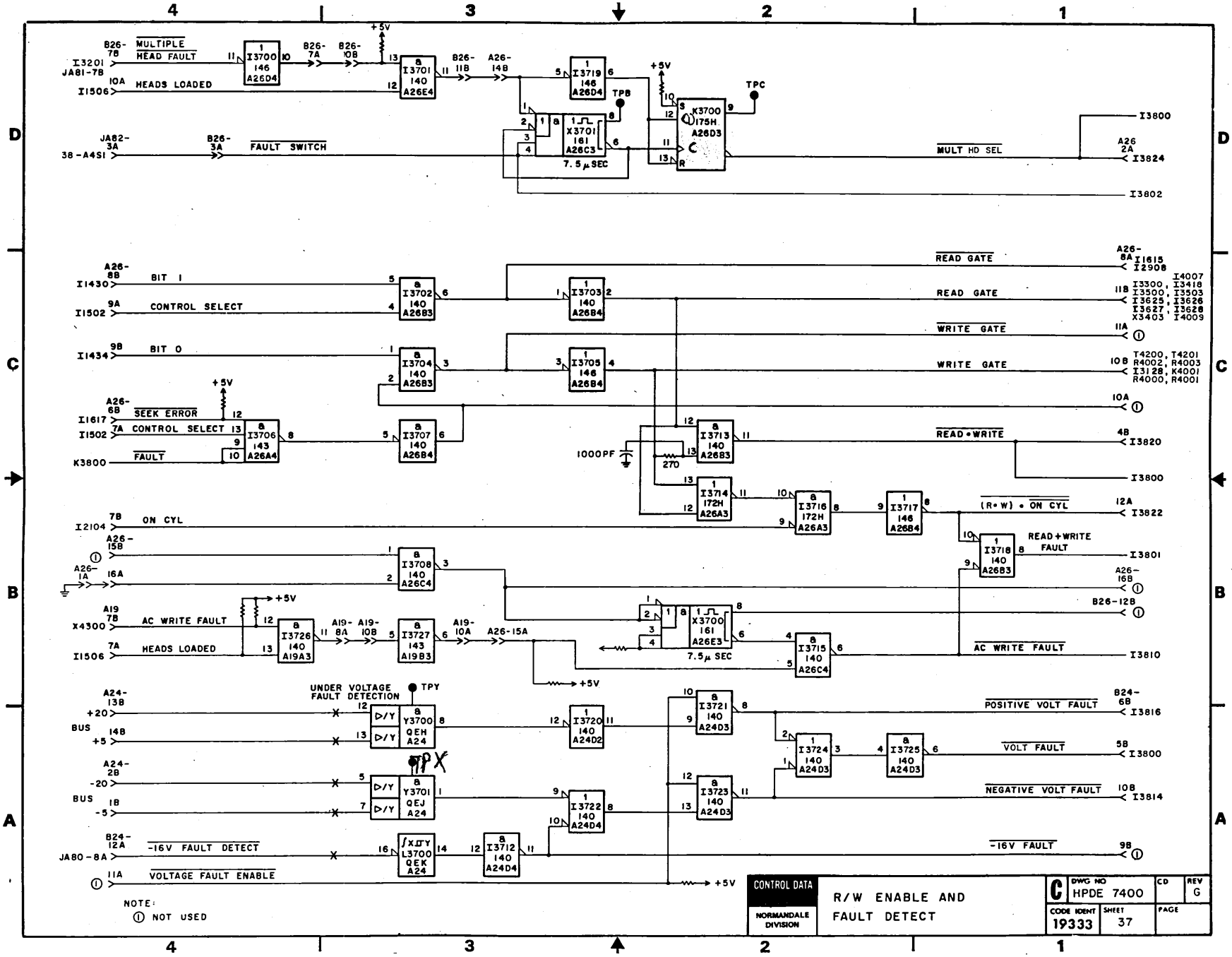
CONTROL DATA NORMANDALE DIVISION	PHASE LOCK OSCILLATOR	C DWG NO HPDE 7400	CD	REV A
		CODE IDENT 19333	SHEET 35	PAGE

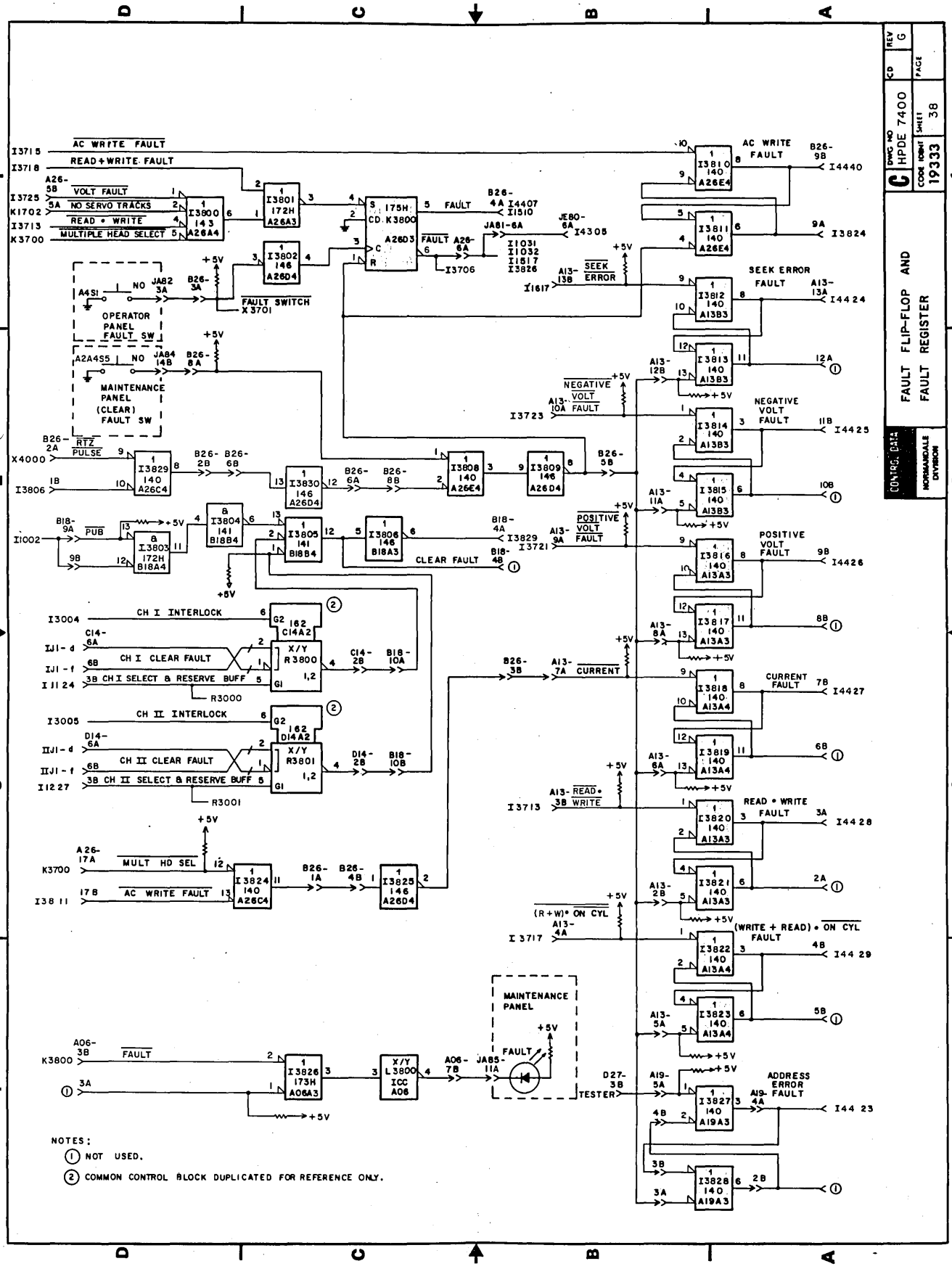


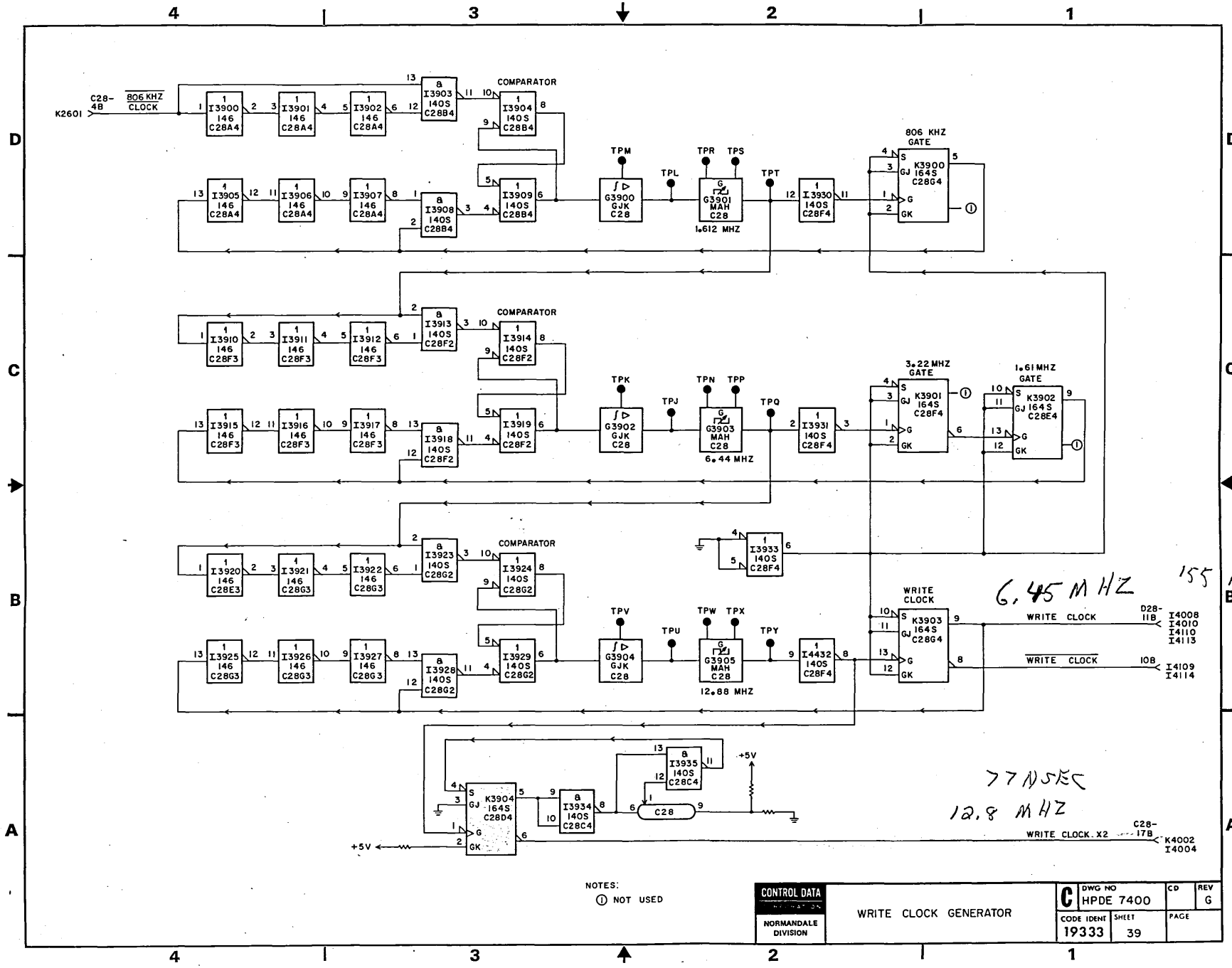
NOTES:

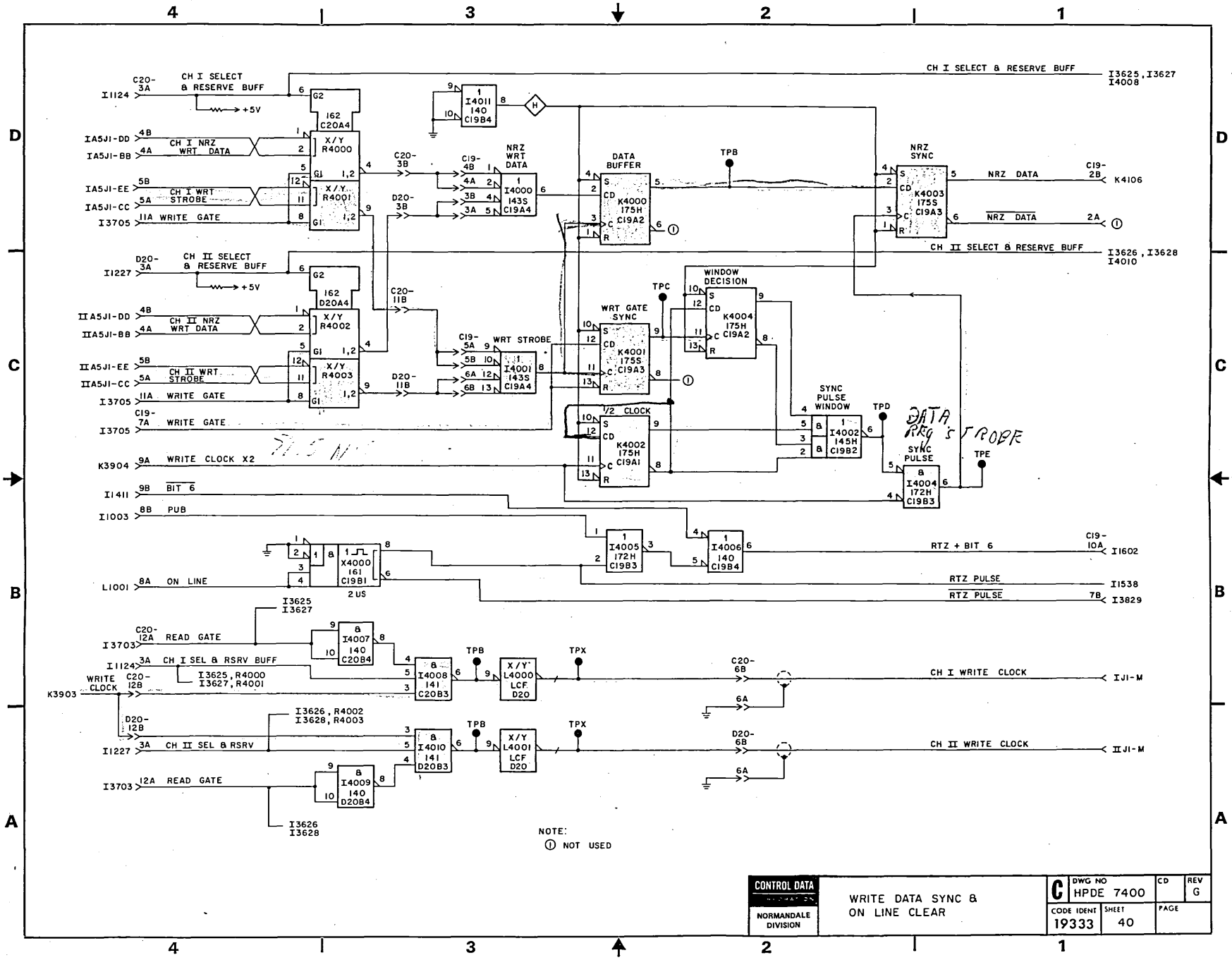
① DELAY LINE CONNECTED TO AN ADJACENT JUMPER BLOCK VIA CARD PATHS. DELAY SELECTED DURING MANUFACTURING BY JUMPERING PINS OF THE BLOCK. DELAYS CAN BE MEASURED AT JUMPER BLOCK PIN AS FOLLOWS:

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	20NS	G	XB3-14	10NS	N	XB1-1	40NS
B	XC1-14	12 NS	H	XE2-14	16NS			
C	XC2-7	18NS	J	XE2-7	16NS			
D	XC2-1	10NS	K	XE2-1	20NS			
E	XC2-8	2NS	L	XE2-8	16NS			
F	XC2-14	2NS	M	XB1-14	30NS			

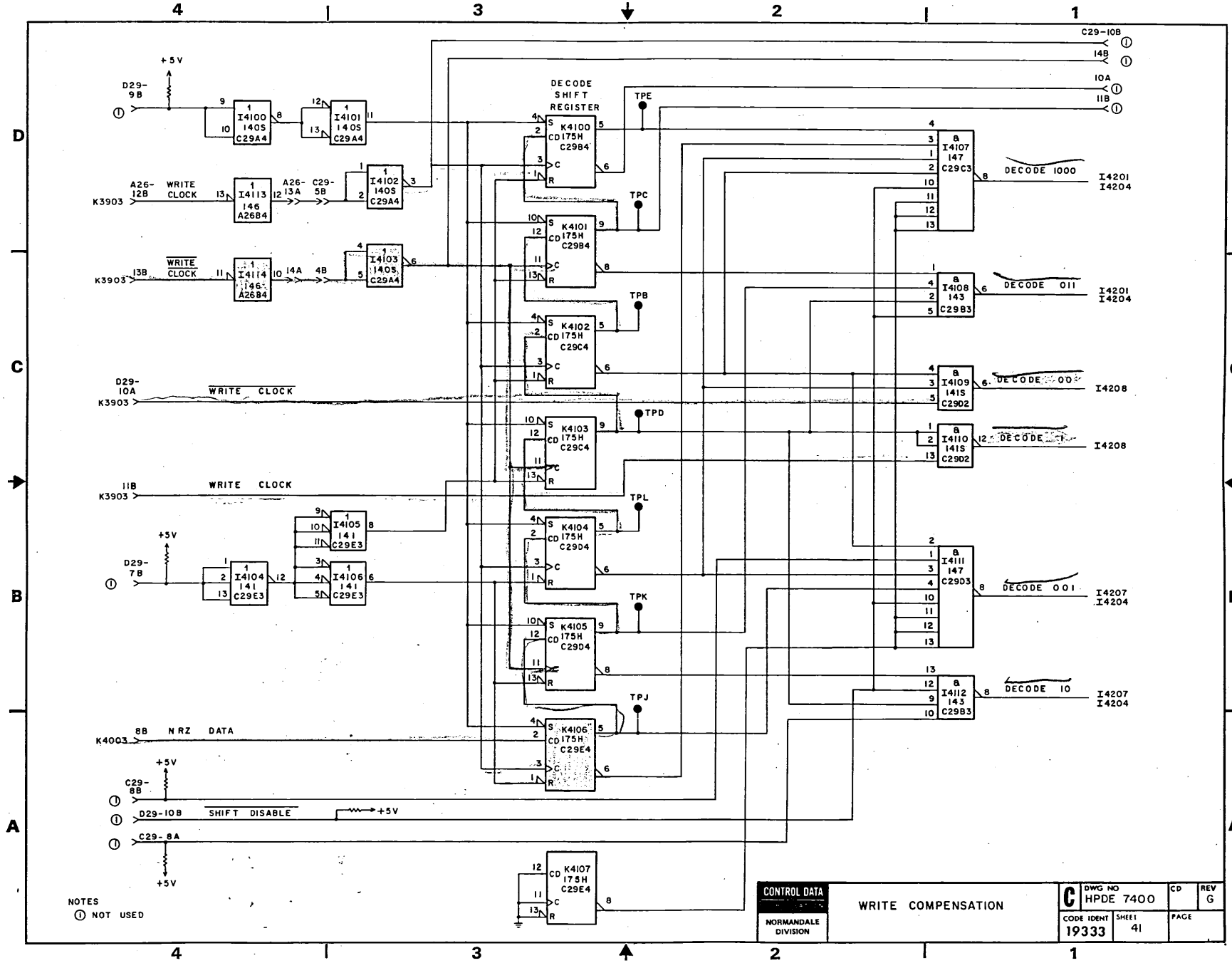

MULTIPLE HEAD FAULT
HEADS LOADED
FAULT SWITCH
MULT HD SEL
BIT 1
CONTROL SELECT
BIT 0
SEEK ERROR
FAULT
READ GATE
WRITE GATE
READ+WRITE
ON CYL
(R+W) • ON CYL
READ+WRITE FAULT
AC WRITE FAULT
UNDER VOLTAGE FAULT DETECTION
POSITIVE VOLT FAULT
VOLT FAULT
NEGATIVE VOLT FAULT
-16V FAULT DETECT
VOLTAGE FAULT ENABLE
-16V FAULT
7.5μ SEC
NOTE:
① NOT USED
CONTROL DATA
NORMANDALE DIVISION
R/W ENABLE AND FAULT DETECT
DWG NO HPDE 7400
CD
REV G
CODE IDENT 19333
SHEET 37
PAGE

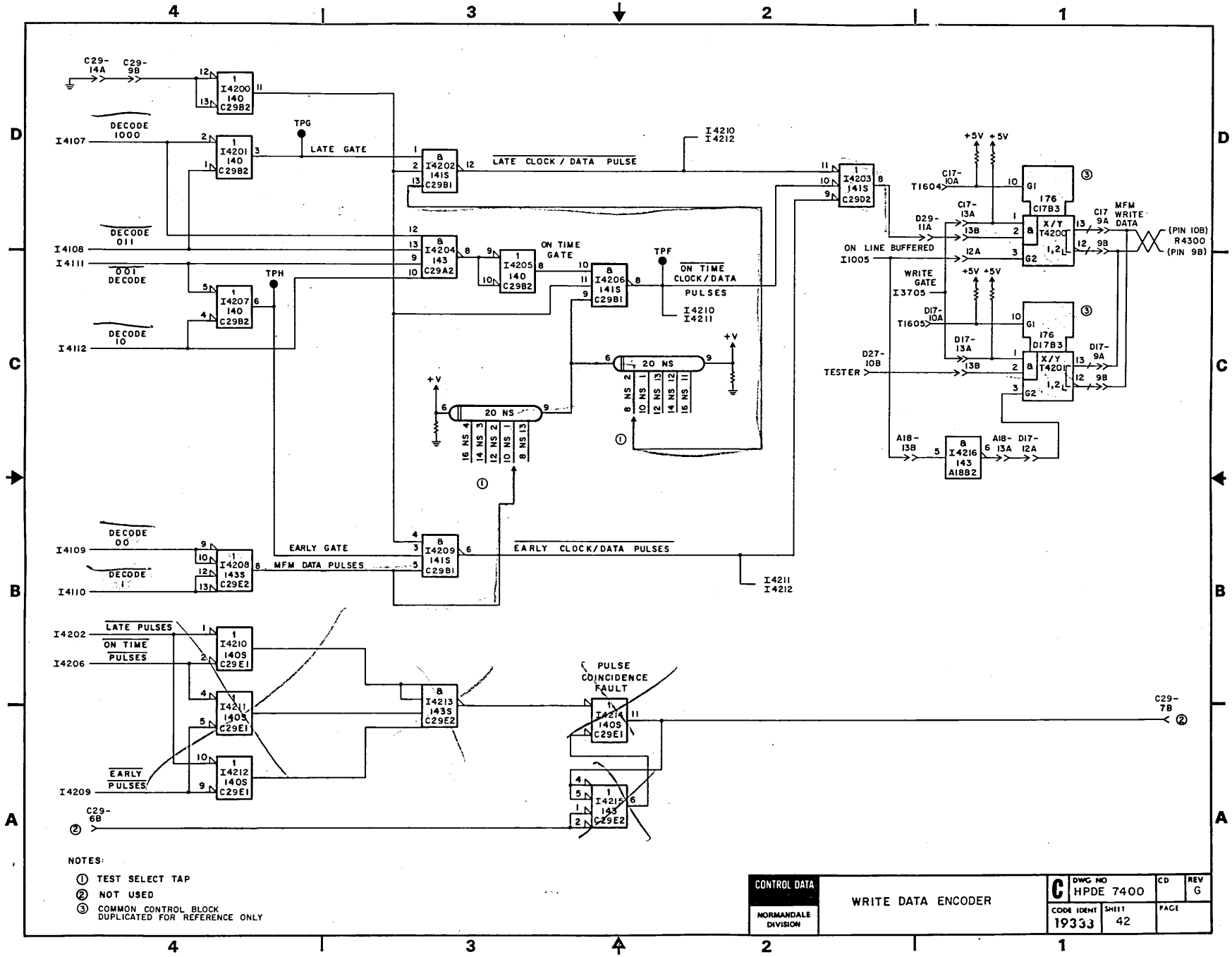

FAULT FLIP-FLOP AND FAULT REGISTER
CONTROL DATA
NORMANDALE DIVISION
DWG NO HPDE 7400
REV G
SHEET 38
CODE IDENT 19333
AC WRITE FAULT
READ+WRITE FAULT
VOLT FAULT
NO SERVO TRACKS
READ • WRITE
MULTIPLE HEAD SELECT
FAULT
SEEK ERROR
OPERATOR PANEL FAULT SW
MAINTENANCE PANEL (CLEAR) FAULT SW
FAULT SWITCH X3701
RTZ PULSE
PUB
CLEAR FAULT
NEGATIVE VOLT FAULT
POSITIVE VOLT FAULT
CURRENT FAULT
READ • WRITE FAULT
(R+W)• ON CYL
(WRITE + READ) • ON CYL FAULT
ADDRESS ERROR FAULT
CH I INTERLOCK
CH I CLEAR FAULT
CH I SELECT & RESERVE BUFF
CH II INTERLOCK
CH II CLEAR FAULT
CH II SELECT & RESERVE BUFF
MULT HD SEL
MAINTENANCE PANEL
TESTER
NOTES:
(1) NOT USED.
(2) COMMON CONTROL BLOCK DUPLICATED FOR REFERENCE ONLY.


C28-
48
K2601
806 KHZ
CLOCK
COMPARATOR
806 KHZ
GATE
TPM
TPL
TPR
TPS
TPT
1.612 MHZ
3.22 MHZ
GATE
1.61 MHZ
GATE
TPK
TPJ
TPN
TPP
TPQ
6.44 MHZ
6.45 MHZ
155 N.S.E.C
WRITE
CLOCK
TPV
TPU
TPW
TPX
TPY
12.88 MHZ
77 N.S.E.C
12.8 MHZ
WRITE CLOCK
WRITE CLOCK
WRITE CLOCK. X2
+5V
NOTES:
① NOT USED
CONTROL DATA
NORMANDALE DIVISION
WRITE CLOCK GENERATOR
DWG NO HPDE 7400
CD
REV G
CODE IDENT 19333
SHEET 39
PAGE



CONTROL DATA NORMANDALE DIVISION	WRITE DATA SYNC & ON LINE CLEAR	C HPDE 7400	CD / REV G
		CODE IDENT 19333 / SHEET 40	PAGE

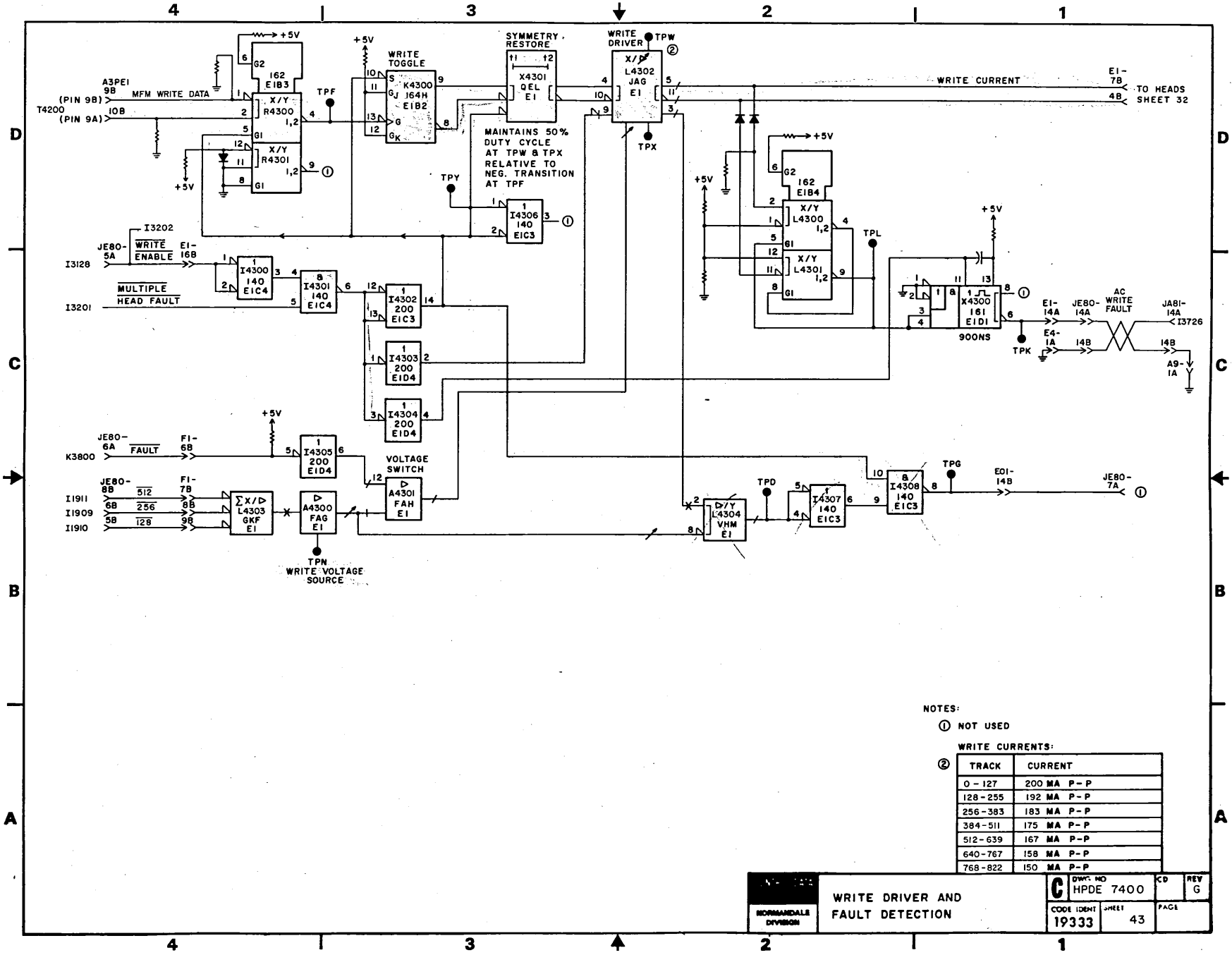

DECODE SHIFT REGISTER
WRITE COMPENSATION
CONTROL DATA
NORMANDALE DIVISION
DWG NO HPDE 7400
CODE IDENT 19333
SHEET 41
CD G
PAGE
NOTES
① NOT USED
WRITE CLOCK
SHIFT DISABLE
8B NRZ DATA
DECODE 1000
DECODE 011
DECODE 00
DECODE 1
DECODE 001
DECODE 10
I4201 I4204
I4208
I4207 I4204

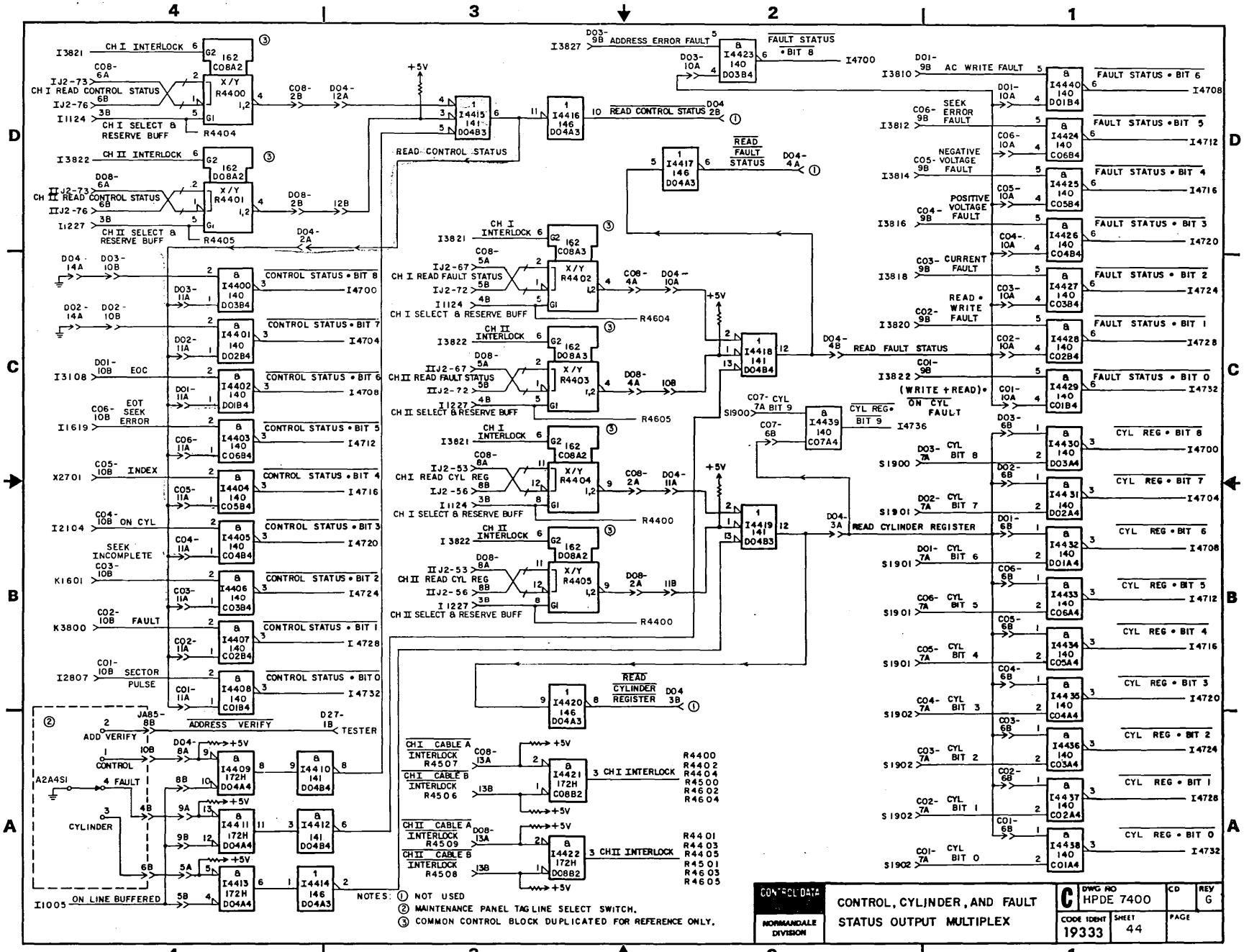


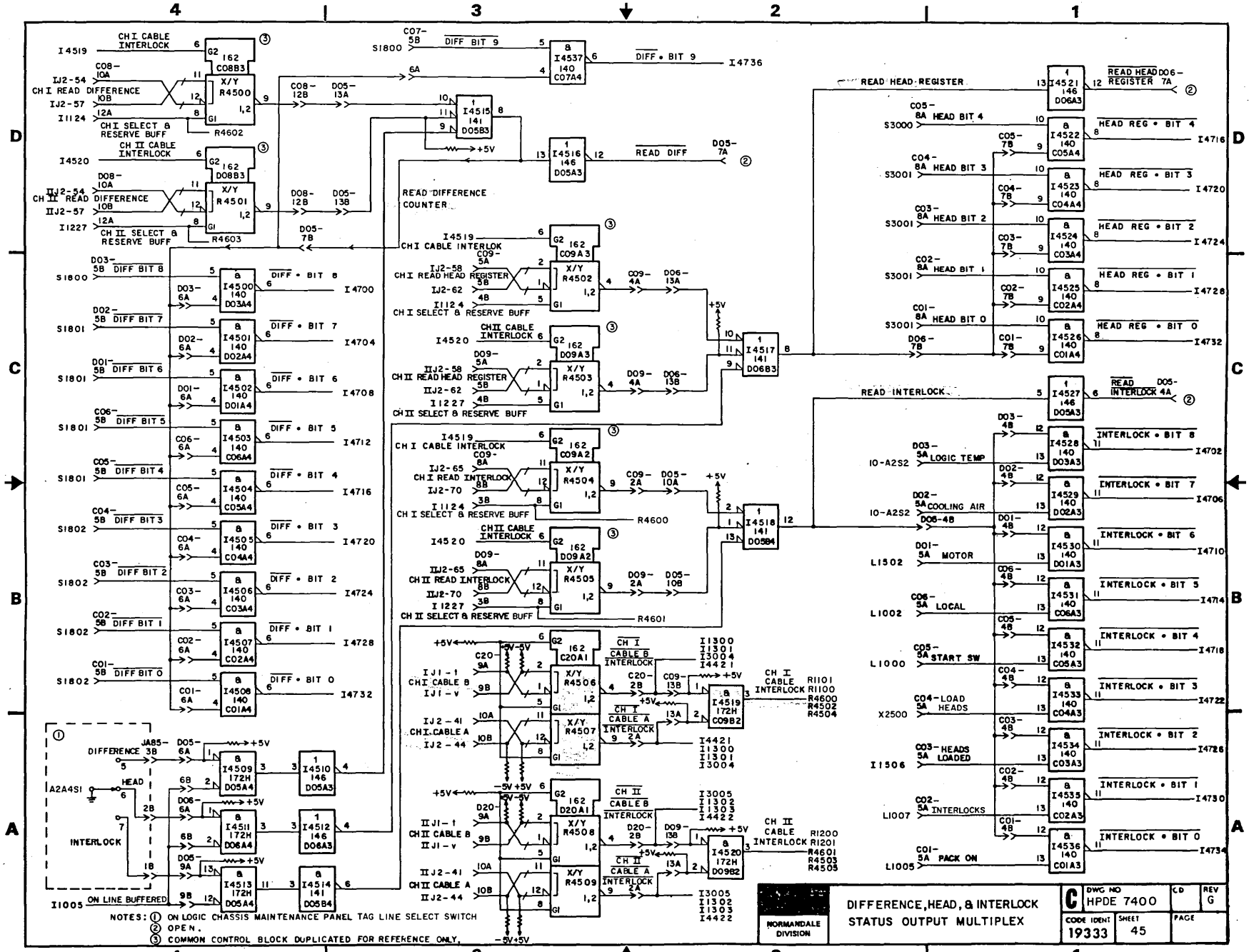
NOTES:

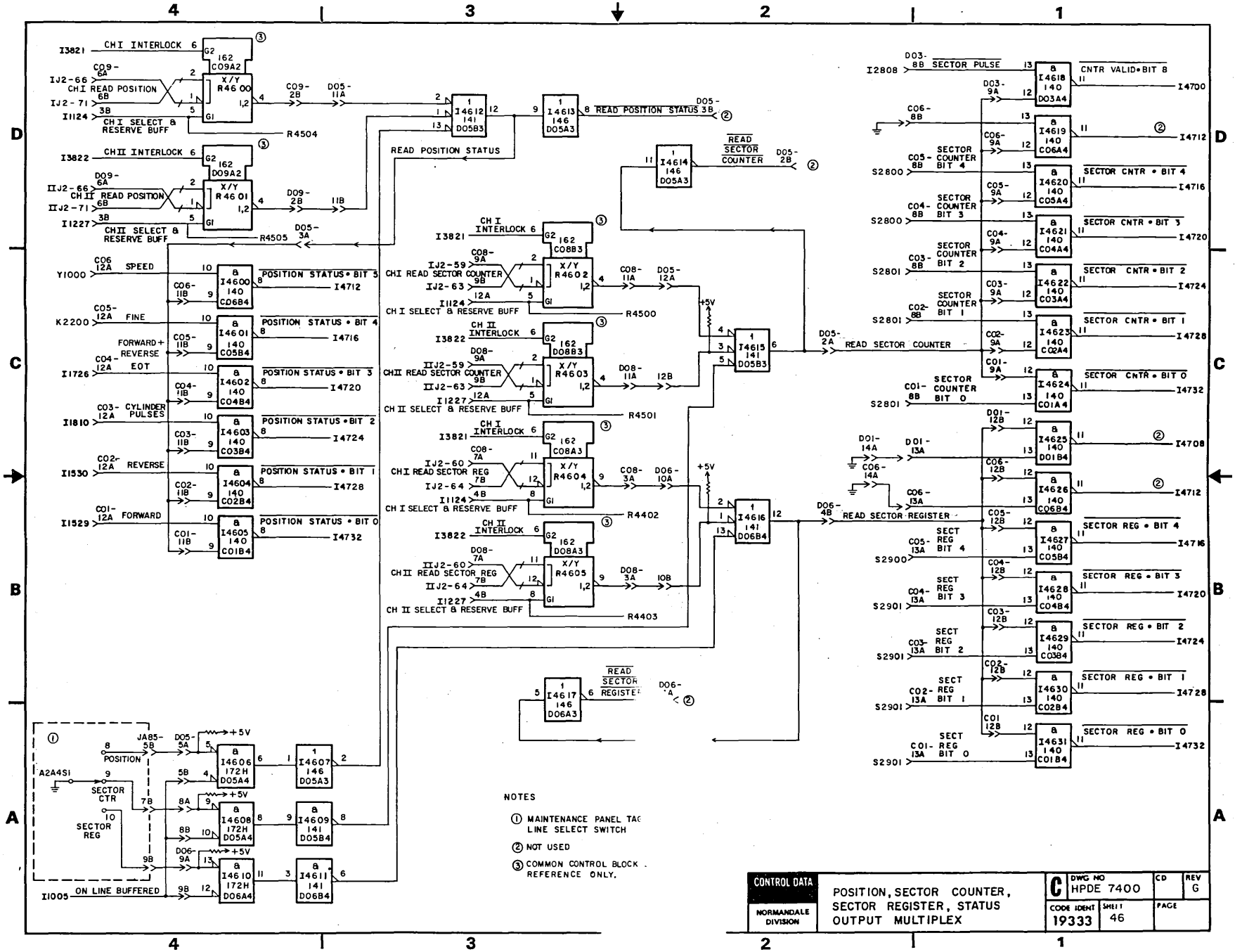
① TEST SELECT TAP
② NOT USED
③ COMMON CONTROL BLOCK DUPLICATED FOR REFERENCE ONLY

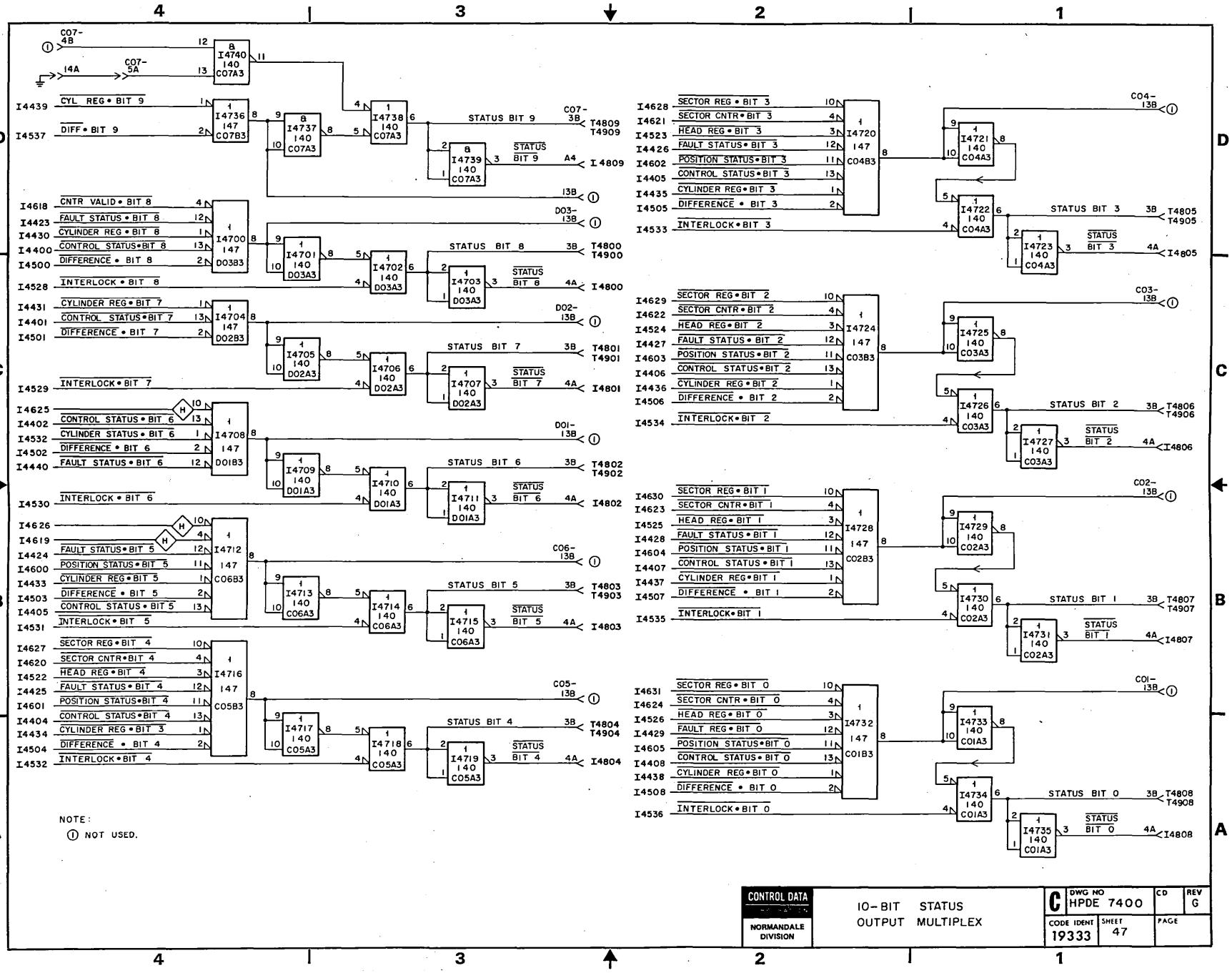
CONTROL DATA	WRITE DATA ENCODER	C	DWG NO HPDE 7400	CD	REV G
NORMANDALE DIVISION			CODE IDENT 19333	SHEET 42	PAGE

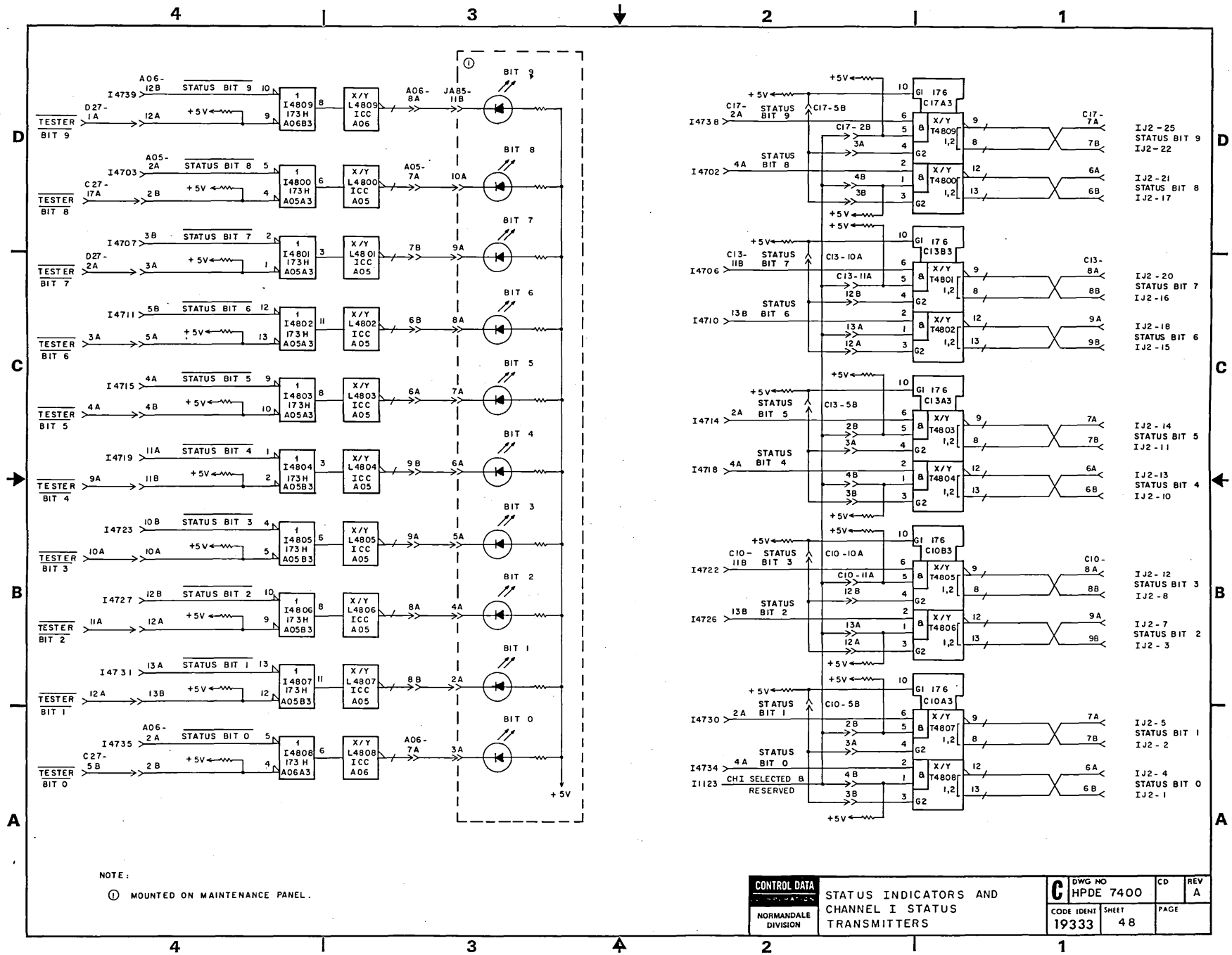

WRITE DRIVER AND FAULT DETECTION
NORMANDALE DIVISION
DWG NO HPDE 7400
CODE IDENT 19333
SHEET 43
CD
REV G
PAGE
WRITE CURRENT
TO HEADS SHEET 32
MAINTAINS 50% DUTY CYCLE AT TPW & TPX RELATIVE TO NEG. TRANSITION AT TPF
MFM WRITE DATA
WRITE ENABLE
MULTIPLE HEAD FAULT
FAULT
VOLTAGE SWITCH
TPN WRITE VOLTAGE SOURCE
AC WRITE FAULT
900NS
NOTES:
① NOT USED
② WRITE CURRENTS:
TRACK | CURRENT
0 - 127 | 200 MA P-P
128 - 255 | 192 MA P-P
256 - 383 | 183 MA P-P
384 - 511 | 175 MA P-P
512 - 639 | 167 MA P-P
640 - 767 | 158 MA P-P
768 - 822 | 150 MA P-P


CH I INTERLOCK
CH I READ CONTROL STATUS
CH I SELECT & RESERVE BUFF
CH II INTERLOCK
CH II READ CONTROL STATUS
CH II SELECT & RESERVE BUFF
READ CONTROL STATUS
I3827 DO3-9B ADDRESS ERROR FAULT
FAULT STATUS • BIT 8 I4700
I3810 DO1-9B AC WRITE FAULT
FAULT STATUS • BIT 6 I4708
I3812 C06-9B SEEK ERROR FAULT
FAULT STATUS • BIT 5 I4712
I3814 C05-9B NEGATIVE VOLTAGE FAULT
FAULT STATUS • BIT 4 I4716
I3816 C04-9B POSITIVE VOLTAGE FAULT
FAULT STATUS • BIT 3 I4720
I3818 C03-9B CURRENT FAULT
FAULT STATUS • BIT 2 I4724
I3820 C02-9B READ • WRITE FAULT
FAULT STATUS • BIT 1 I4728
I3822 C01-9B (WRITE + READ) • ON CYL FAULT
FAULT STATUS • BIT 0 I4732
READ FAULT STATUS
READ CYLINDER REGISTER
CYL REG • BIT 8 I4700
CYL REG • BIT 7 I4704
CYL REG • BIT 6 I4708
CYL REG • BIT 5 I4712
CYL REG • BIT 4 I4716
CYL REG • BIT 3 I4720
CYL REG • BIT 2 I4724
CYL REG • BIT 1 I4728
CYL REG • BIT 0 I4732
I1124 CH I SELECT & RESERVE BUFF R4404
I1227 CH II SELECT & RESERVE BUFF R4405
R4604
R4605
R4400
R4400
I1005 ON LINE BUFFERED
ADDRESS VERIFY
ADD VERIFY
CONTROL
FAULT
CYLINDER
TESTER
CH I CABLE A INTERLOCK R4507
CH I CABLE B INTERLOCK R4506
3 CH I INTERLOCK
R4400 R4402 R4404 R4500 R4602 R4604
CH II CABLE A INTERLOCK R4509
CH II CABLE B INTERLOCK R4508
3 CH II INTERLOCK
R4401 R4403 R4405 R4501 R4603 R4605
NOTES: ① NOT USED
② MAINTENANCE PANEL TAG LINE SELECT SWITCH.
③ COMMON CONTROL BLOCK DUPLICATED FOR REFERENCE ONLY.
CONTROL DATA NORMANDALE DIVISION
CONTROL, CYLINDER, AND FAULT STATUS OUTPUT MULTIPLEX
C HPDE 7400
CODE IDENT 19333
SHEET 44
CD
REV G
PAGE


DIFFERENCE, HEAD, & INTERLOCK STATUS OUTPUT MULTIPLEX
NORMANDALE DIVISION
DWG NO HPDE 7400
CODE IDENT 19333
SHEET 45
REV G
NOTES: ① ON LOGIC CHASSIS MAINTENANCE PANEL TAG LINE SELECT SWITCH
② OPEN.
③ COMMON CONTROL BLOCK DUPLICATED FOR REFERENCE ONLY.
CH I CABLE INTERLOCK
CH II CABLE INTERLOCK
CH I READ DIFFERENCE
CH II READ DIFFERENCE
CH I SELECT & RESERVE BUFF
CH II SELECT & RESERVE BUFF
READ DIFFERENCE COUNTER
READ HEAD REGISTER
READ INTERLOCK
DIFF BIT 9
DIFF BIT 8
DIFF BIT 7
DIFF BIT 6
DIFF BIT 5
DIFF BIT 4
DIFF BIT 3
DIFF BIT 2
DIFF BIT 1
DIFF BIT 0
HEAD BIT 4
HEAD BIT 3
HEAD BIT 2
HEAD BIT 1
HEAD BIT 0
INTERLOCK BIT 8
INTERLOCK BIT 7
INTERLOCK BIT 6
INTERLOCK BIT 5
INTERLOCK BIT 4
INTERLOCK BIT 3
INTERLOCK BIT 2
INTERLOCK BIT 1
INTERLOCK BIT 0
LOGIC TEMP
COOLING AIR
MOTOR
LOCAL
START SW
LOAD HEADS
HEADS LOADED
INTERLOCKS
PACK ON
ON LINE BUFFERED
DIFFERENCE
HEAD
INTERLOCK


CHI INTERLOCK
CHI READ POSITION
CHI SELECT & RESERVE BUFF
CHII INTERLOCK
CHII READ POSITION
CHII SELECT & RESERVE BUFF
READ POSITION STATUS
READ POSITION STATUS 3B
READ SECTOR COUNTER
READ SECTOR REGISTER
SPEED
FINE
FORWARD+ REVERSE
EOT
CYLINDER PULSES
REVERSE
FORWARD
POSITION STATUS • BIT 5
POSITION STATUS • BIT 4
POSITION STATUS • BIT 3
POSITION STATUS • BIT 2
POSITION STATUS • BIT 1
POSITION STATUS • BIT 0
CHI READ SECTOR COUNTER
CHII READ SECTOR COUNTER
CHI READ SECTOR REG
CHII READ SECTOR REG
SECTOR PULSE
SECTOR COUNTER BIT 4
SECTOR COUNTER BIT 3
SECTOR COUNTER BIT 2
SECTOR COUNTER BIT 1
SECTOR COUNTER BIT 0
SECT REG BIT 4
SECT REG BIT 3
SECT REG BIT 2
SECT REG BIT 1
SECT REG BIT 0
CNTR VALID • BIT 8
SECTOR CNTR • BIT 4
SECTOR CNTR • BIT 3
SECTOR CNTR • BIT 2
SECTOR CNTR • BIT 1
SECTOR CNTR • BIT 0
SECTOR REG • BIT 4
SECTOR REG • BIT 3
SECTOR REG • BIT 2
SECTOR REG • BIT 1
SECTOR REG • BIT 0
POSITION
SECTOR CTR
SECTOR REG
ON LINE BUFFERED
NOTES
① MAINTENANCE PANEL TAG LINE SELECT SWITCH
② NOT USED
③ COMMON CONTROL BLOCK REFERENCE ONLY.
CONTROL DATA
NORMANDALE DIVISION
POSITION, SECTOR COUNTER, SECTOR REGISTER, STATUS OUTPUT MULTIPLEX
DWG NO HPDE 7400
CD
REV G
CODE IDENT 19333
SHEET 46
PAGE

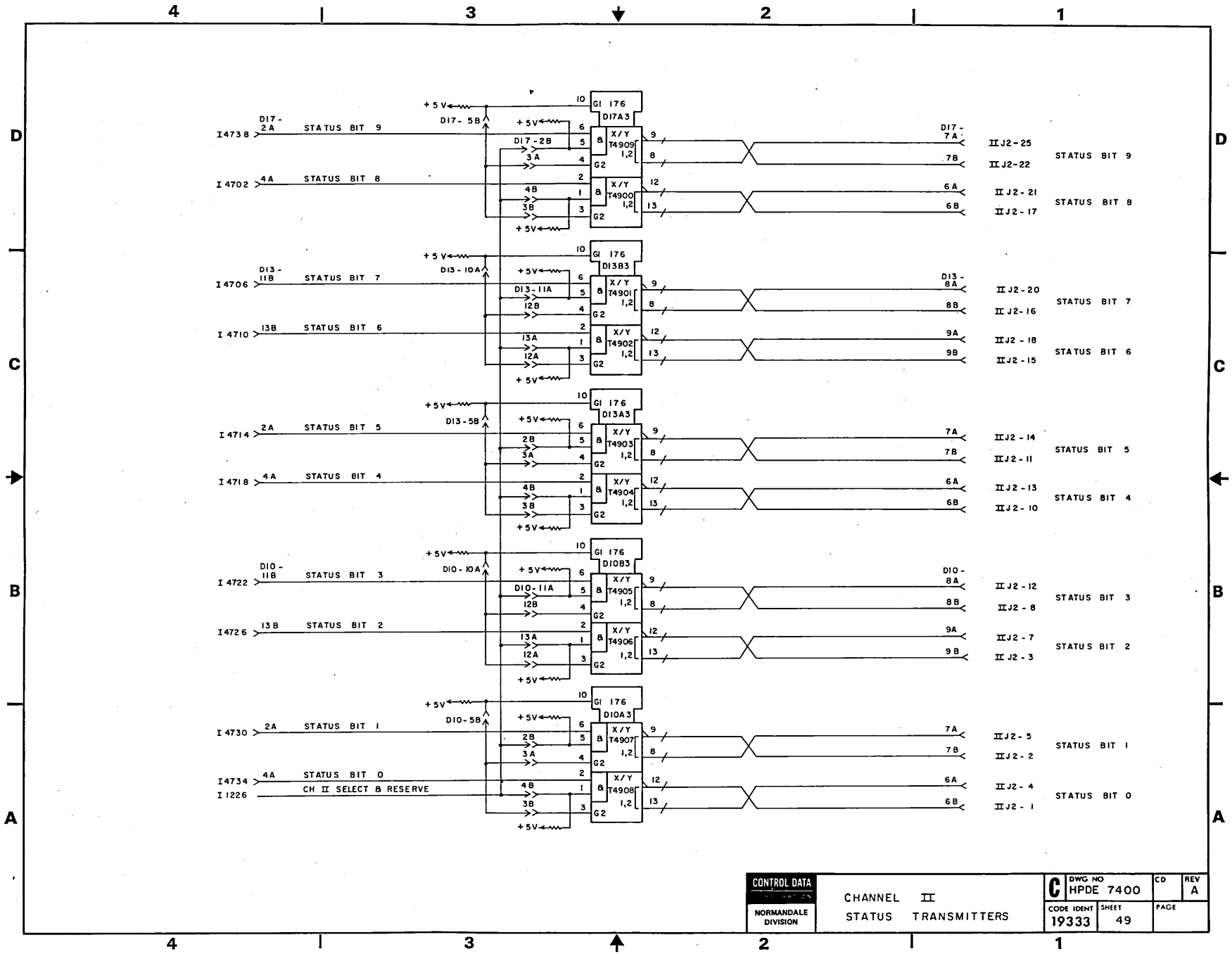

4 3 2 1
D C B A
C07-4B
14A
C07-5A
I4740 140 C07A3
I4439 CYL REG • BIT 9
I4537 DIFF • BIT 9
I4736 147 C07B3
I4737 140 C07A3
I4738 140 C07A3
STATUS BIT 9
C07-3B
T4809 T4909
I4739 140 C07A3
STATUS BIT 9
A4
I4809
13B
I4618 CNTR VALID • BIT 8
I4423 FAULT STATUS • BIT 8
I4430 CYLINDER REG • BIT 8
I4400 CONTROL STATUS • BIT 8
I4500 DIFFERENCE • BIT 8
I4700 147 D03B3
D03-13B
I4701 140 D03A3
I4702 140 D03A3
STATUS BIT 8
3B T4800 T4900
I4703 140 D03A3
STATUS BIT 8
4A I4800
I4528 INTERLOCK • BIT 8
I4431 CYLINDER REG • BIT 7
I4401 CONTROL STATUS • BIT 7
I4501 DIFFERENCE • BIT 7
I4704 147 D02B3
D02-13B
I4705 140 D02A3
I4706 140 D02A3
STATUS BIT 7
3B T4801 T4901
I4707 140 D02A3
STATUS BIT 7
4A I4801
I4529 INTERLOCK • BIT 7
I4625 H
I4402 CONTROL STATUS • BIT 6
I4532 CYLINDER STATUS • BIT 6
I4502 DIFFERENCE • BIT 6
I4440 FAULT STATUS • BIT 6
I4708 147 D01B3
D01-13B
I4709 140 D01A3
I4710 140 D01A3
STATUS BIT 6
3B T4802 T4902
I4711 140 D01A3
STATUS BIT 6
4A I4802
I4530 INTERLOCK • BIT 6
I4626 H
I4619 H
I4424 FAULT STATUS • BIT 5
I4600 POSITION STATUS • BIT 5
I4433 CYLINDER REG • BIT 5
I4503 DIFFERENCE • BIT 5
I4405 CONTROL STATUS • BIT 5
I4531 INTERLOCK • BIT 5
I4712 147 C06B3
C06-13B
I4713 140 C06A3
I4714 140 C06A3
STATUS BIT 5
3B T4803 T4903
I4715 140 C06A3
STATUS BIT 5
4A I4803
I4627 SECTOR REG • BIT 4
I4620 SECTOR CNTR • BIT 4
I4522 HEAD REG • BIT 4
I4425 FAULT STATUS • BIT 4
I4601 POSITION STATUS • BIT 4
I4404 CONTROL STATUS • BIT 4
I4434 CYLINDER REG • BIT 3
I4504 DIFFERENCE • BIT 4
I4532 INTERLOCK • BIT 4
I4716 147 C05B3
C05-13B
I4717 140 C05A3
I4718 140 C05A3
STATUS BIT 4
3B T4804 T4904
I4719 140 C05A3
STATUS BIT 4
4A I4804
NOTE:
① NOT USED.
I4628 SECTOR REG • BIT 3
I4621 SECTOR CNTR • BIT 3
I4523 HEAD REG • BIT 3
I4426 FAULT STATUS • BIT 3
I4602 POSITION STATUS • BIT 3
I4405 CONTROL STATUS • BIT 3
I4435 CYLINDER REG • BIT 3
I4505 DIFFERENCE • BIT 3
I4533 INTERLOCK • BIT 3
I4720 147 C04B3
C04-13B
I4721 140 C04A3
I4722 140 C04A3
STATUS BIT 3
3B I4805 T4905
I4723 140 C04A3
STATUS BIT 3
4A I4805
I4629 SECTOR REG • BIT 2
I4622 SECTOR CNTR • BIT 2
I4524 HEAD REG • BIT 2
I4427 FAULT STATUS • BIT 2
I4603 POSITION STATUS • BIT 2
I4406 CONTROL STATUS • BIT 2
I4436 CYLINDER REG • BIT 2
I4506 DIFFERENCE • BIT 2
I4534 INTERLOCK • BIT 2
I4724 147 C03B3
C03-13B
I4725 140 C03A3
I4726 140 C03A3
STATUS BIT 2
3B T4806 T4906
I4727 140 C03A3
STATUS BIT 2
4A I4806
I4630 SECTOR REG • BIT 1
I4623 SECTOR CNTR • BIT 1
I4525 HEAD REG • BIT 1
I4428 FAULT STATUS • BIT 1
I4604 POSITION STATUS • BIT 1
I4407 CONTROL STATUS • BIT 1
I4437 CYLINDER REG • BIT 1
I4507 DIFFERENCE • BIT 1
I4535 INTERLOCK • BIT 1
I4728 147 C02B3
C02-13B
I4729 140 C02A3
I4730 140 C02A3
STATUS BIT 1
3B T4807 T4907
I4731 140 C02A3
STATUS BIT 1
4A I4807
I4631 SECTOR REG • BIT 0
I4624 SECTOR CNTR • BIT 0
I4526 HEAD REG • BIT 0
I4429 FAULT REG • BIT 0
I4605 POSITION STATUS • BIT 0
I4408 CONTROL STATUS • BIT 0
I4438 CYLINDER REG • BIT 0
I4508 DIFFERENCE • BIT 0
I4536 INTERLOCK • BIT 0
I4732 147 C01B3
C01-13B
I4733 140 C01A3
I4734 140 C01A3
STATUS BIT 0
3B T4808 T4908
I4735 140 C01A3
STATUS BIT 0
4A I4808
CONTROL DATA NORMANDALE DIVISION
10-BIT STATUS OUTPUT MULTIPLEX
C DWG NO HPDE 7400
CD
REV G
CODE IDENT 19333
SHEET 47
PAGE



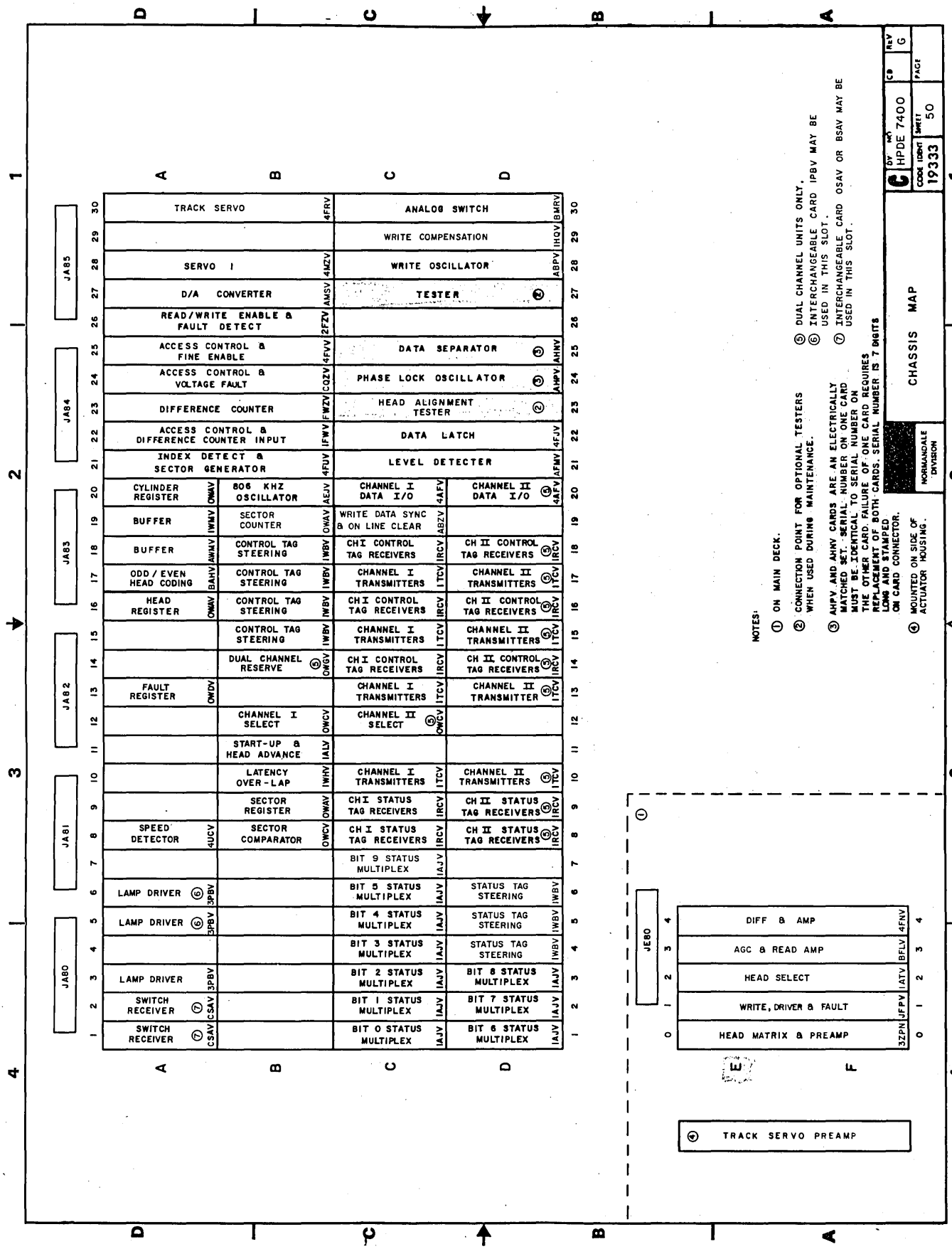
NOTE:

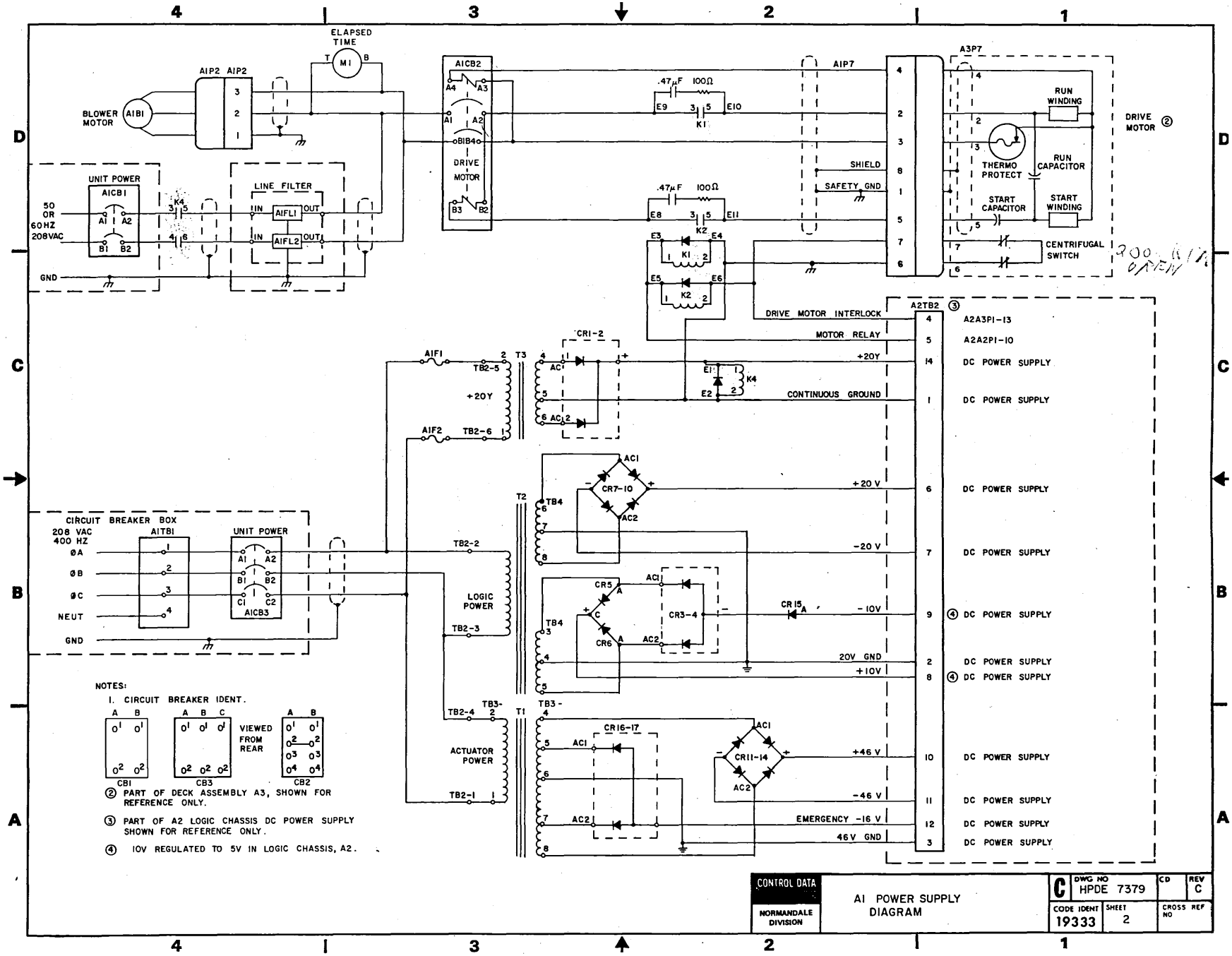
① MOUNTED ON MAINTENANCE PANEL.

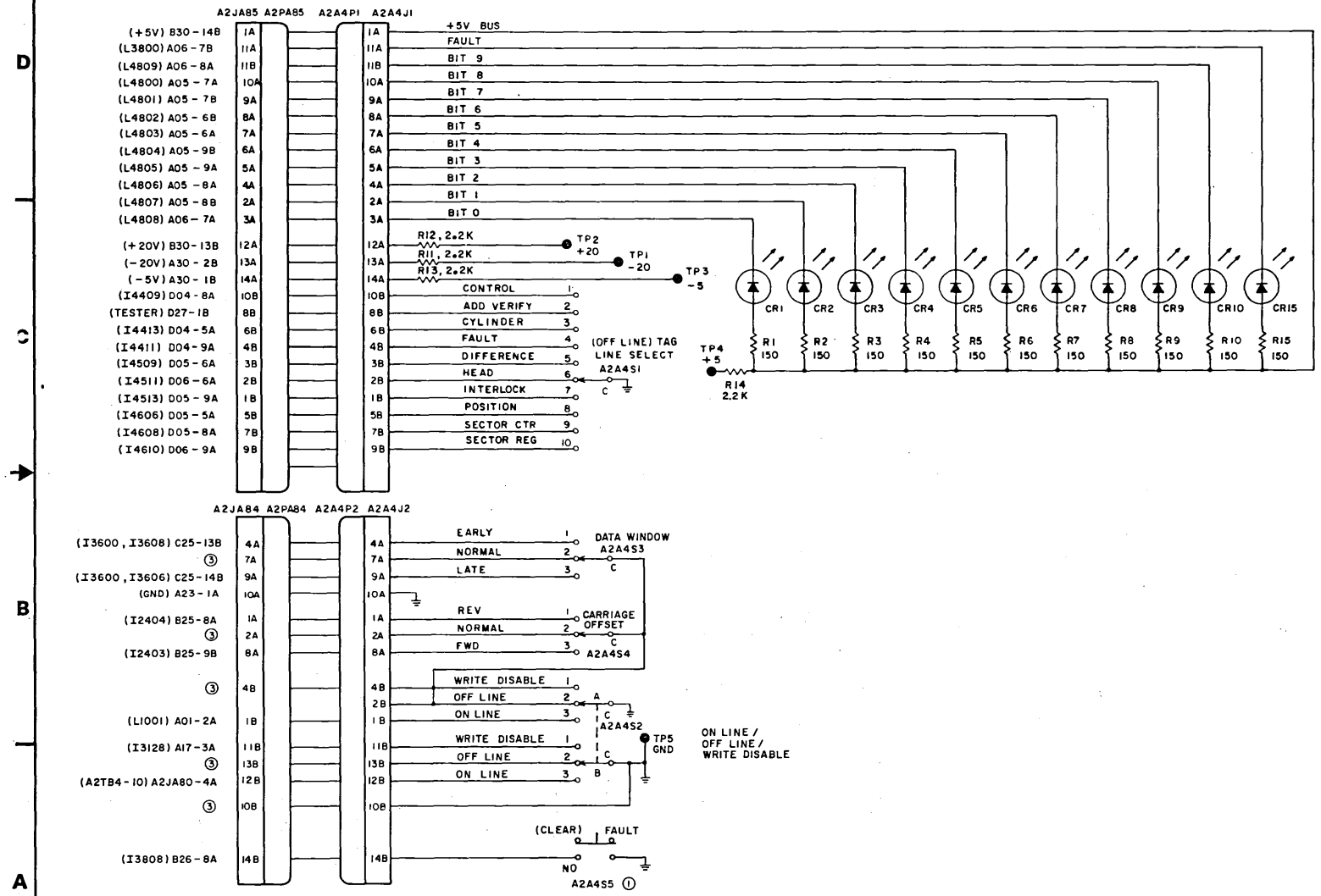
CONTROL DATA NORMANDALE DIVISION	STATUS INDICATORS AND CHANNEL I STATUS TRANSMITTERS	C	DWG NO HPDE 7400	CD / REV A
		CODE IDENT 19333	SHEET 48	PAGE



CONTROL DATA NORMANDALE DIVISION	CHANNEL II STATUS TRANSMITTERS	C	DWG NO HPDE 7400	CD / REV A
		CODE IDENT 19333	SHEET 49	PAGE


JA85
JA84
JA83
JA82
JA81
JA80
TRACK SERVO
SERVO I
D/A CONVERTER
READ/WRITE ENABLE & FAULT DETECT
ACCESS CONTROL & FINE ENABLE
ACCESS CONTROL & VOLTAGE FAULT
DIFFERENCE COUNTER
ACCESS CONTROL & DIFFERENCE COUNTER INPUT
INDEX DETECT & SECTOR GENERATOR
CYLINDER REGISTER
BUFFER
BUFFER
ODD / EVEN HEAD CODING
HEAD REGISTER
FAULT REGISTER
SPEED DETECTOR
LAMP DRIVER
LAMP DRIVER
LAMP DRIVER
SWITCH RECEIVER
SWITCH RECEIVER
806 KHZ OSCILLATOR
SECTOR COUNTER
CONTROL TAG STEERING
CONTROL TAG STEERING
CONTROL TAG STEERING
CONTROL TAG STEERING
DUAL CHANNEL RESERVE
CHANNEL I SELECT
START-UP & HEAD ADVANCE
LATENCY OVER-LAP
SECTOR REGISTER
SECTOR COMPARATOR
ANALOG SWITCH
WRITE COMPENSATION
WRITE OSCILLATOR
TESTER
DATA SEPARATOR
PHASE LOCK OSCILLATOR
HEAD ALIGNMENT TESTER
DATA LATCH
LEVEL DETECTER
CHANNEL I DATA I/O
WRITE DATA SYNC & ON LINE CLEAR
CHI CONTROL TAG RECEIVERS
CHANNEL I TRANSMITTERS
CHI CONTROL TAG RECEIVERS
CHI CONTROL TAG RECEIVERS
CHANNEL I TRANSMITTERS
CHANNEL I TRANSMITTERS
CHANNEL I SELECT
CHI STATUS TAG RECEIVERS
CHI STATUS TAG RECEIVERS
BIT 9 STATUS MULTIPLEX
BIT 5 STATUS MULTIPLEX
BIT 4 STATUS MULTIPLEX
BIT 3 STATUS MULTIPLEX
BIT 2 STATUS MULTIPLEX
BIT 1 STATUS MULTIPLEX
BIT 0 STATUS MULTIPLEX
CHANNEL II DATA I/O
CH II CONTROL TAG RECEIVERS
CHANNEL II TRANSMITTERS
CH II CONTROL TAG RECEIVERS
CHANNEL II TRANSMITTERS
CHANNEL II TRANSMITTER
CHANNEL II SELECT
CHANNEL II TRANSMITTERS
CH II STATUS TAG RECEIVERS
CH II STATUS TAG RECEIVERS
STATUS TAG STEERING
STATUS TAG STEERING
STATUS TAG STEERING
BIT 8 STATUS MULTIPLEX
BIT 7 STATUS MULTIPLEX
BIT 6 STATUS MULTIPLEX
NOTES:
① ON MAIN DECK.
② CONNECTION POINT FOR OPTIONAL TESTERS WHEN USED DURING MAINTENANCE.
③ AHPV AND AHNV CARDS ARE AN ELECTRICALLY MATCHED SET. SERIAL NUMBER ON ONE CARD MUST BE IDENTICAL TO SERIAL NUMBER ON THE OTHER CARD. FAILURE OF ONE CARD REQUIRES REPLACEMENT OF BOTH CARDS. SERIAL NUMBER IS 7 DIGITS LONG AND STAMPED ON CARD CONNECTOR.
④ MOUNTED ON SIDE OF ACTUATOR HOUSING.
⑤ DUAL CHANNEL UNITS ONLY.
⑥ INTERCHANGEABLE CARD IPBV MAY BE USED IN THIS SLOT.
⑦ INTERCHANGEABLE CARD OSAV OR BSAV MAY BE USED IN THIS SLOT.
NORMANDALE DIVISION
CHASSIS MAP
DV MFG HPDE 7400
CODE IDENT 19333
SHEET 50
REV G
JE80
DIFF & AMP
AGC & READ AMP
HEAD SELECT
WRITE, DRIVER & FAULT
HEAD MATRIX & PREAMP
TRACK SERVO PREAMP


ELAPSED TIME
BLOWER MOTOR
A1B1
A1P2 A2P2
UNIT POWER
A1CB1
50 OR 60HZ 208VAC
GND
LINE FILTER
A1FL1
A1FL2
A1CB2
DRIVE MOTOR
.47μF 100Ω
K1
K2
K4
A1P7
A2P7
SHIELD
SAFETY GND
RUN WINDING
RUN CAPACITOR
THERMO PROTECT
START CAPACITOR
START WINDING
CENTRIFUGAL SWITCH
DRIVE MOTOR ②
DRIVE MOTOR INTERLOCK
MOTOR RELAY
A2TB2 ③
A2A3P1-13
A2A2P1-10
+20Y
CONTINUOUS GROUND
DC POWER SUPPLY
CR1-2
A1F1
A1F2
TB2-5
TB2-6
T3
+20Y
CR7-10
+20 V
-20 V
CR5
CR6
CR3-4
CR15
-10V
20V GND
+10V
CIRCUIT BREAKER BOX
208 VAC 400 HZ
ØA
ØB
ØC
NEUT
GND
A1TB1
UNIT POWER
A1CB3
TB2-2
TB2-3
LOGIC POWER
T2
TB4
TB2-4
TB2-1
ACTUATOR POWER
T1
TB3
CR16-17
CR11-14
+46 V
-46 V
EMERGENCY -16 V
46V GND
NOTES:
1. CIRCUIT BREAKER IDENT.
CB1
CB3
CB2
VIEWED FROM REAR
② PART OF DECK ASSEMBLY A3, SHOWN FOR REFERENCE ONLY.
③ PART OF A2 LOGIC CHASSIS DC POWER SUPPLY SHOWN FOR REFERENCE ONLY.
④ 10V REGULATED TO 5V IN LOGIC CHASSIS, A2.
CONTROL DATA
NORMANDALE DIVISION
A1 POWER SUPPLY DIAGRAM
C
DWG NO HPDE 7379
REV C
CODE IDENT 19333
SHEET 2
CROSS REF NO



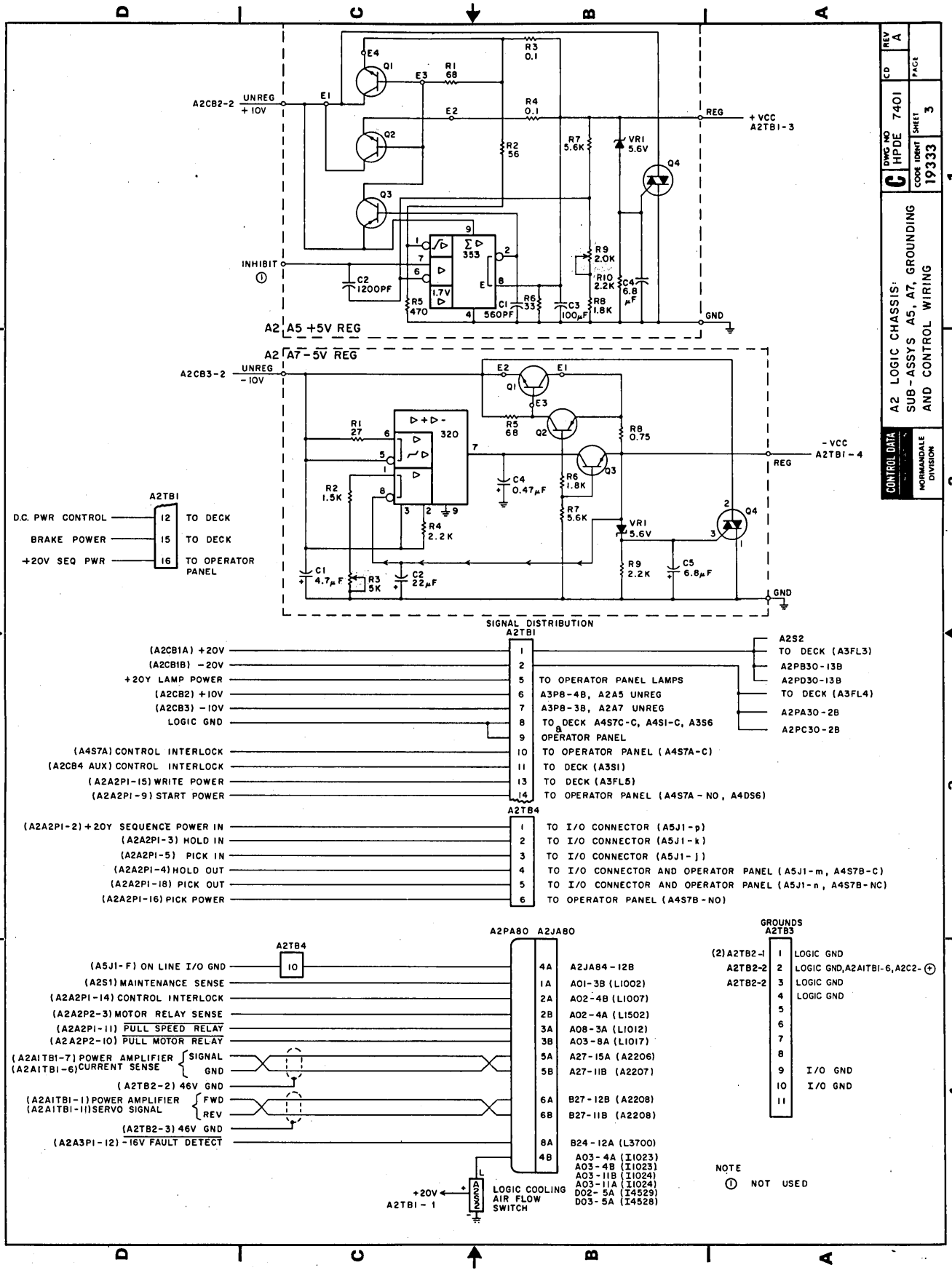
NOTES

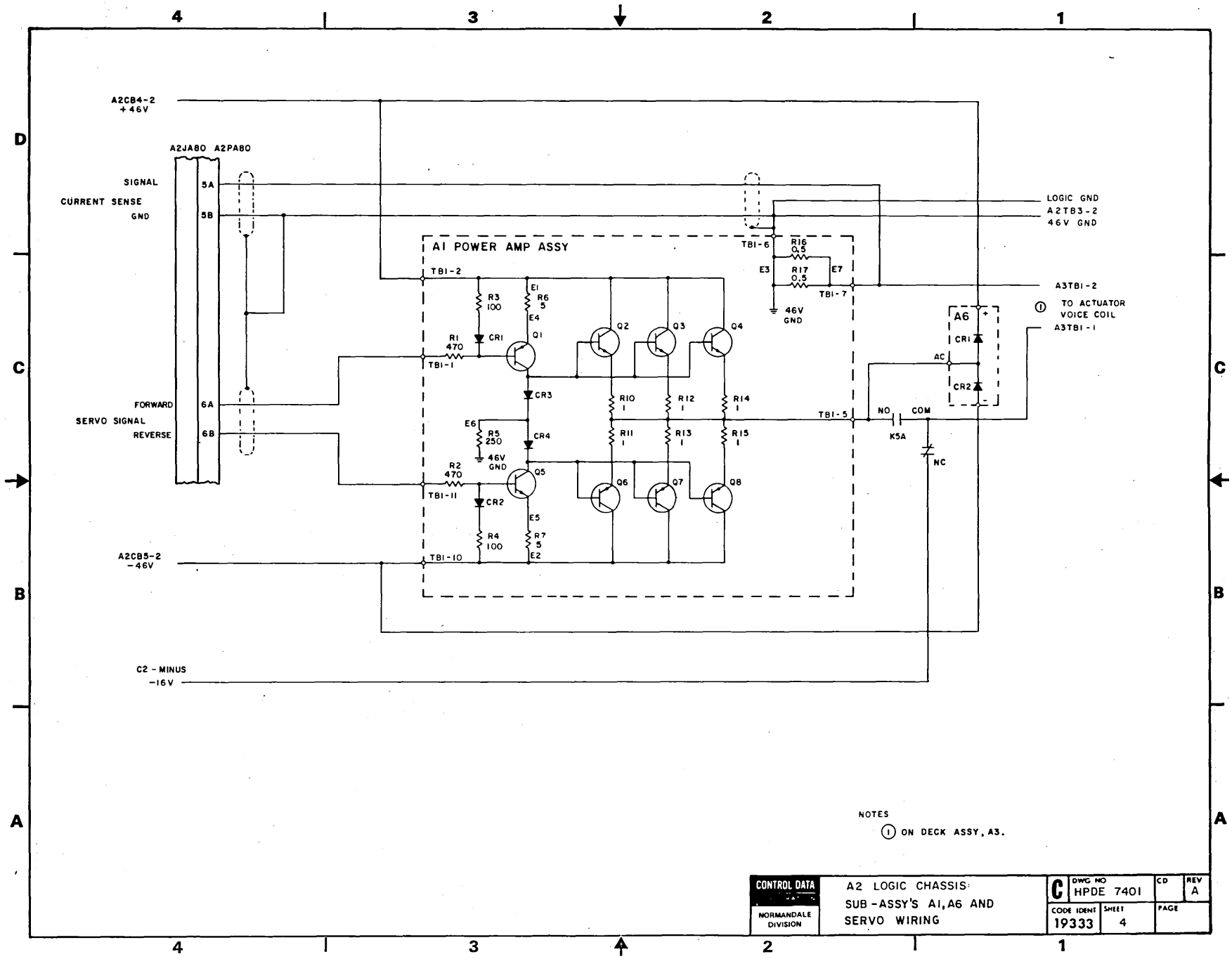
① ORIENTING DOT, NO PINS

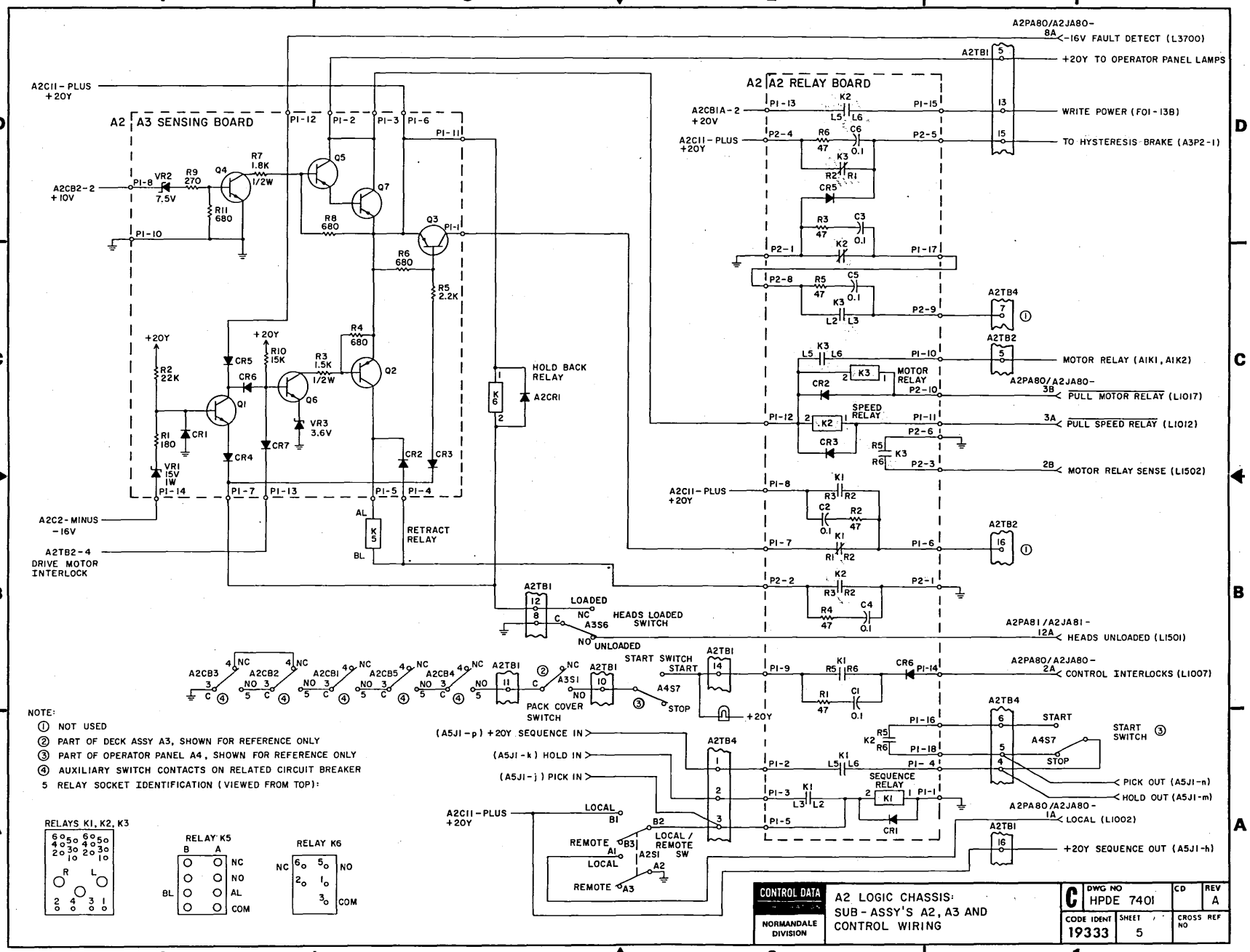
2 TEST POINTS ARE NOT TO BE USED AS POWER

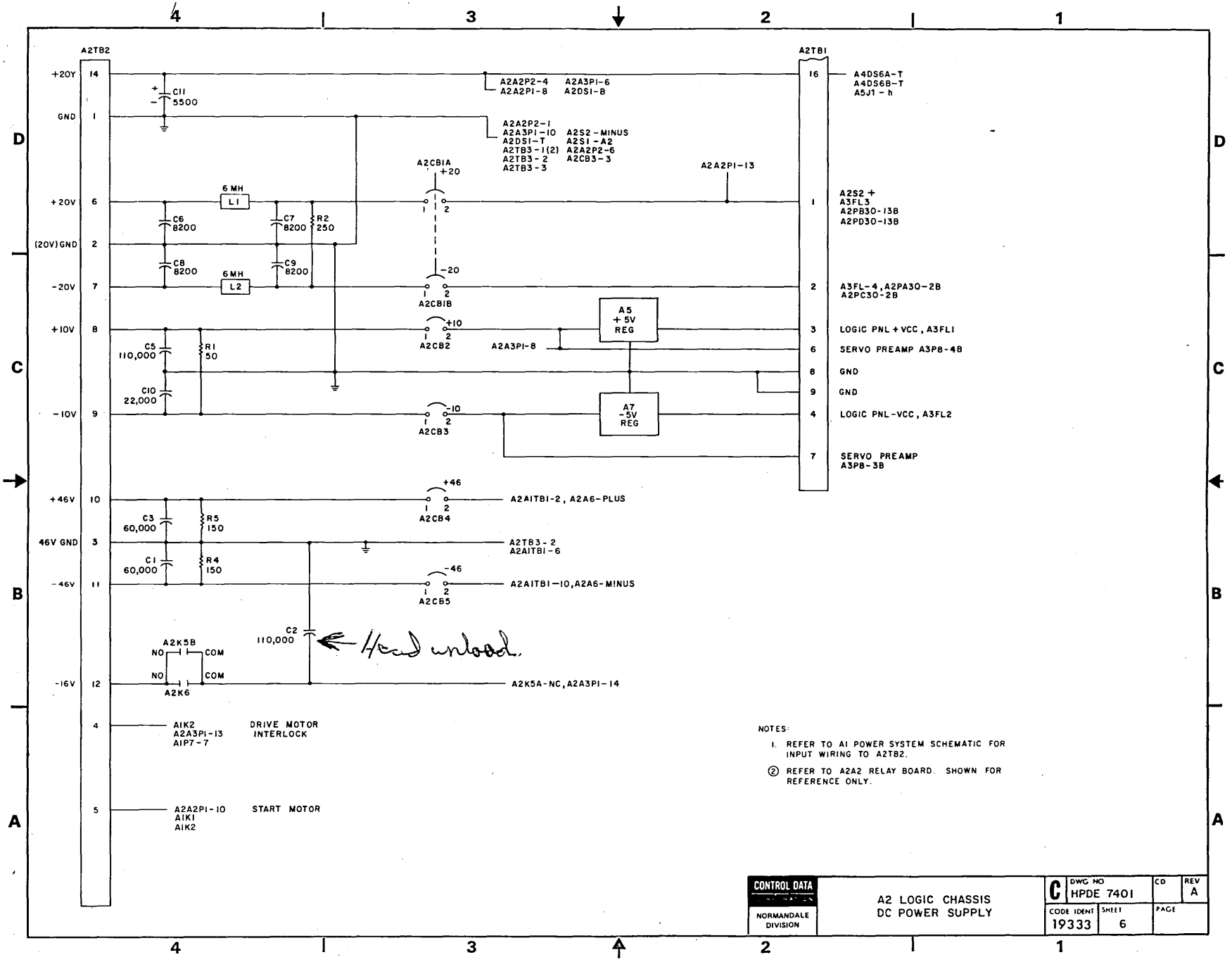
③ NOT USED

CONTROL DATA NORMANDALE DIVISION	A2 LOGIC CHASSIS SUB-ASSY A4, MAINTENANCE PANEL	C	DWG NO HPDE 7401	CD / REV A
		CODE IDENT 19333	SHEET 2	PAGE


A2 LOGIC CHASSIS
SUB-ASSYS A5, A7, GROUNDING AND CONTROL WIRING
CONTROL DATA
NORMANDALE DIVISION
DWG NO HPDE 7401
CODE IDENT 19333
SHEET 3
REV A
A2 A5 +5V REG
A2 A7 -5V REG
A2CB2-2 UNREG +10V
A2CB3-2 UNREG -10V
+VCC A2TB1-3
-VCC A2TB1-4
INHIBIT
REG
GND
A2TB1
D.C. PWR CONTROL 12 TO DECK
BRAKE POWER 15 TO DECK
+20V SEQ PWR 16 TO OPERATOR PANEL
SIGNAL DISTRIBUTION
A2TB1
(A2CB1A) +20V 1
(A2CB1B) -20V 2
+20Y LAMP POWER 5 TO OPERATOR PANEL LAMPS
(A2CB2) +10V 6 A3P8-4B, A2A5 UNREG
(A2CB3) -10V 7 A3P8-3B, A2A7 UNREG
LOGIC GND 8 TO DECK A4S7C-C, A4S1-C, A3S6
9 OPERATOR PANEL
(A4S7A) CONTROL INTERLOCK 10 TO OPERATOR PANEL (A4S7A-C)
(A2CB4 AUX) CONTROL INTERLOCK 11 TO DECK (A3S1)
(A2A2P1-15) WRITE POWER 13 TO DECK (A3FL5)
(A2A2P1-9) START POWER 14 TO OPERATOR PANEL (A4S7A-NO, A4DS6)
A2S2 TO DECK (A3FL3)
A2PB30-13B
A2PD30-13B TO DECK (A3FL4)
A2PA30-2B
A2PC30-2B
A2TB4
(A2A2P1-2) +20Y SEQUENCE POWER IN 1 TO I/O CONNECTOR (A5J1-p)
(A2A2P1-3) HOLD IN 2 TO I/O CONNECTOR (A5J1-k)
(A2A2P1-5) PICK IN 3 TO I/O CONNECTOR (A5J1-j)
(A2A2P1-4) HOLD OUT 4 TO I/O CONNECTOR AND OPERATOR PANEL (A5J1-m, A4S7B-C)
(A2A2P1-18) PICK OUT 5 TO I/O CONNECTOR AND OPERATOR PANEL (A5J1-n, A4S7B-NC)
(A2A2P1-16) PICK POWER 6 TO OPERATOR PANEL (A4S7B-NO)
A2PA80 A2JA80
A2TB4
(A5J1-F) ON LINE I/O GND 10 4A A2JA84-12B
(A2S1) MAINTENANCE SENSE 1A A01-3B (L1002)
(A2A2P1-14) CONTROL INTERLOCK 2A A02-4B (L1007)
(A2A2P2-3) MOTOR RELAY SENSE 2B A02-4A (L1502)
(A2A2P1-11) PULL SPEED RELAY 3A A08-3A (L1012)
(A2A2P2-10) PULL MOTOR RELAY 3B A03-8A (L1017)
(A2AITB1-7) POWER AMPLIFIER SIGNAL 5A A27-15A (A2206)
(A2AITB1-6) CURRENT SENSE GND 5B A27-11B (A2207)
(A2TB2-2) 46V GND
(A2AITB1-1) POWER AMPLIFIER FWD 6A B27-12B (A2208)
(A2AITB1-11) SERVO SIGNAL REV 6B B27-11B (A2208)
(A2TB2-3) 46V GND
(A2A3P1-12) -16V FAULT DETECT 8A B24-12A (L3700)
4B A03-4A (I1023)
A03-4B (I1023)
A03-11B (I1024)
A03-11A (I1024)
D02-5A (I4529)
D03-5A (I4528)
+20V A2TB1-1
LOGIC COOLING AIR FLOW SWITCH
GROUNDS A2TB3
(2) A2TB2-1 1 LOGIC GND
A2TB2-2 2 LOGIC GND, A2AITB1-6, A2C2-⊕
A2TB2-2 3 LOGIC GND
4 LOGIC GND
9 I/O GND
10 I/O GND
NOTE
① NOT USED


A2CB4-2
+46V
A2JA80 A2PA80
SIGNAL
CURRENT SENSE
GND
5A
5B
FORWARD
SERVO SIGNAL
REVERSE
6A
6B
A2CB5-2
-46V
A1 POWER AMP ASSY
TBI-2
TBI-1
TBI-11
TBI-10
TBI-6
TBI-7
TBI-5
R1 470
R2 470
R3 100
R4 100
R5 250
R6 5
R7 5
R10
R11
R12
R13
R14
R15
R16 0.5
R17 0.5
CR1
CR2
CR3
CR4
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
E1
E2
E3
E4
E5
E6
E7
46V GND
LOGIC GND
A2TB3-2
46V GND
A3TBI-2
TO ACTUATOR VOICE COIL
A3TBI-1
A6
AC
NO
COM
NC
K5A
C2 - MINUS
-16V
NOTES
1 ON DECK ASSY, A3.
CONTROL DATA
NORMANDALE DIVISION
A2 LOGIC CHASSIS
SUB-ASSY'S A1, A6 AND
SERVO WIRING
DWG NO HPDE 7401
CD
REV A
CODE IDENT 19333
SHEET 4
PAGE

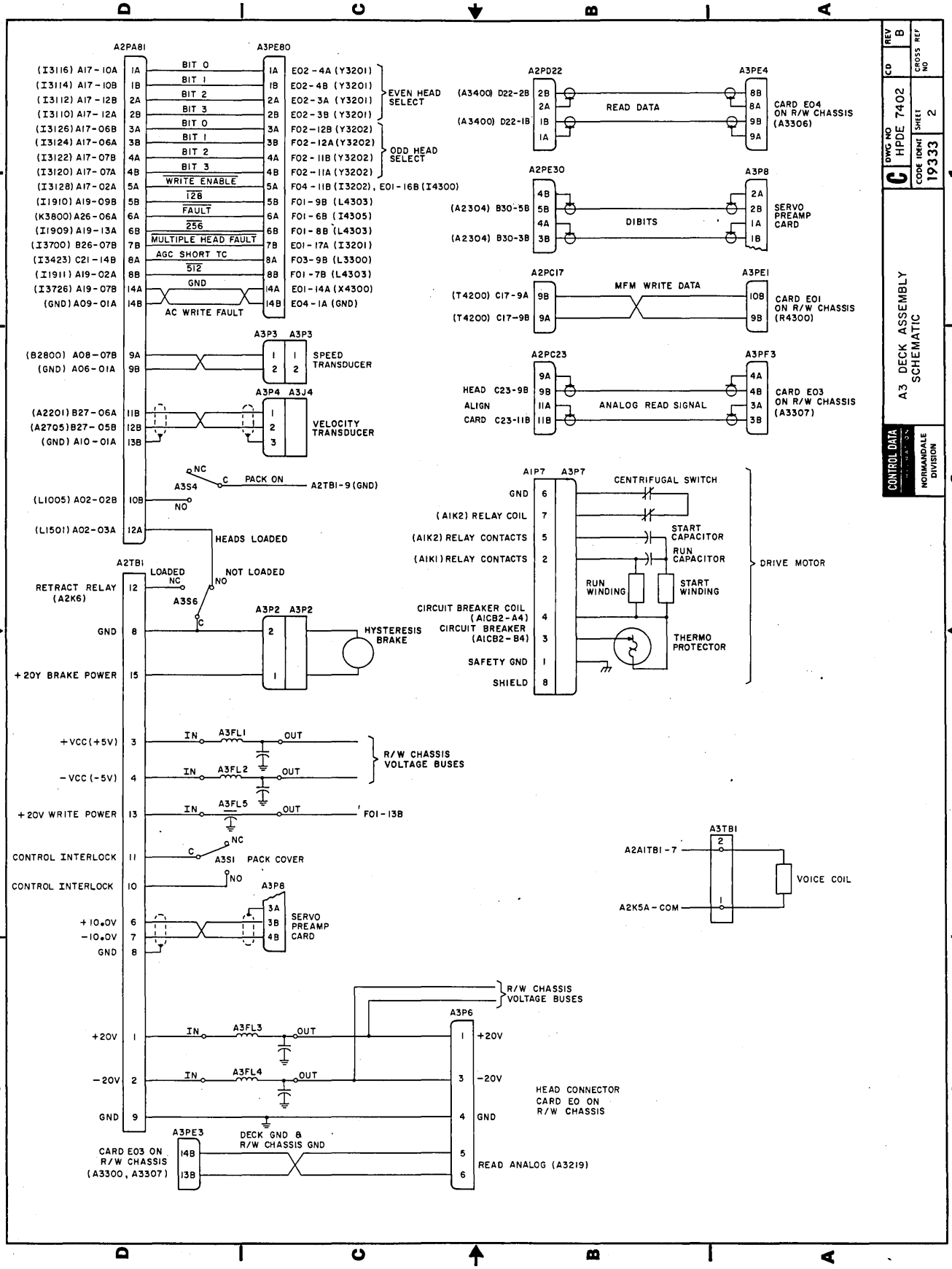

A2 A3 SENSING BOARD
A2 A2 RELAY BOARD
A2C11-PLUS +20Y
A2CB2-2 +10V
A2C2-MINUS -16V
A2TB2-4 DRIVE MOTOR INTERLOCK
A2CB1A-2 +20Y
A2PA80/A2JA80-8A -16V FAULT DETECT (L3700)
+20Y TO OPERATOR PANEL LAMPS
WRITE POWER (FOI-13B)
TO HYSTERESIS BRAKE (A3P2-1)
MOTOR RELAY (AIKI, AIK2)
PULL MOTOR RELAY (LI017)
PULL SPEED RELAY (LI012)
MOTOR RELAY SENSE (LI502)
HOLD BACK RELAY
A2CRI
RETRACT RELAY
LOADED
HEADS LOADED SWITCH
A3S6
UNLOADED
HEADS UNLOADED (LI501)
START SWITCH
A4S7
STOP
PACK COVER SWITCH
A3S1
CONTROL INTERLOCKS (LI007)
(A5JI-p) +20Y SEQUENCE IN
(A5JI-k) HOLD IN
(A5JI-j) PICK IN
PICK OUT (A5JI-n)
HOLD OUT (A5JI-m)
LOCAL (LI002)
+20Y SEQUENCE OUT (A5JI-h)
LOCAL / REMOTE SW
A2S1
SEQUENCE RELAY
MOTOR RELAY
SPEED RELAY
RETRACT RELAY
RELAYS K1, K2, K3
RELAY K5
RELAY K6
NOTE:
① NOT USED
② PART OF DECK ASSY A3, SHOWN FOR REFERENCE ONLY
③ PART OF OPERATOR PANEL A4, SHOWN FOR REFERENCE ONLY
④ AUXILIARY SWITCH CONTACTS ON RELATED CIRCUIT BREAKER
5 RELAY SOCKET IDENTIFICATION (VIEWED FROM TOP):
CONTROL DATA
NORMANDALE DIVISION
A2 LOGIC CHASSIS: SUB-ASSY'S A2, A3 AND CONTROL WIRING
DWG NO HPDE 7401
CD
REV A
CODE IDENT 19333
SHEET 5
CROSS REF NO

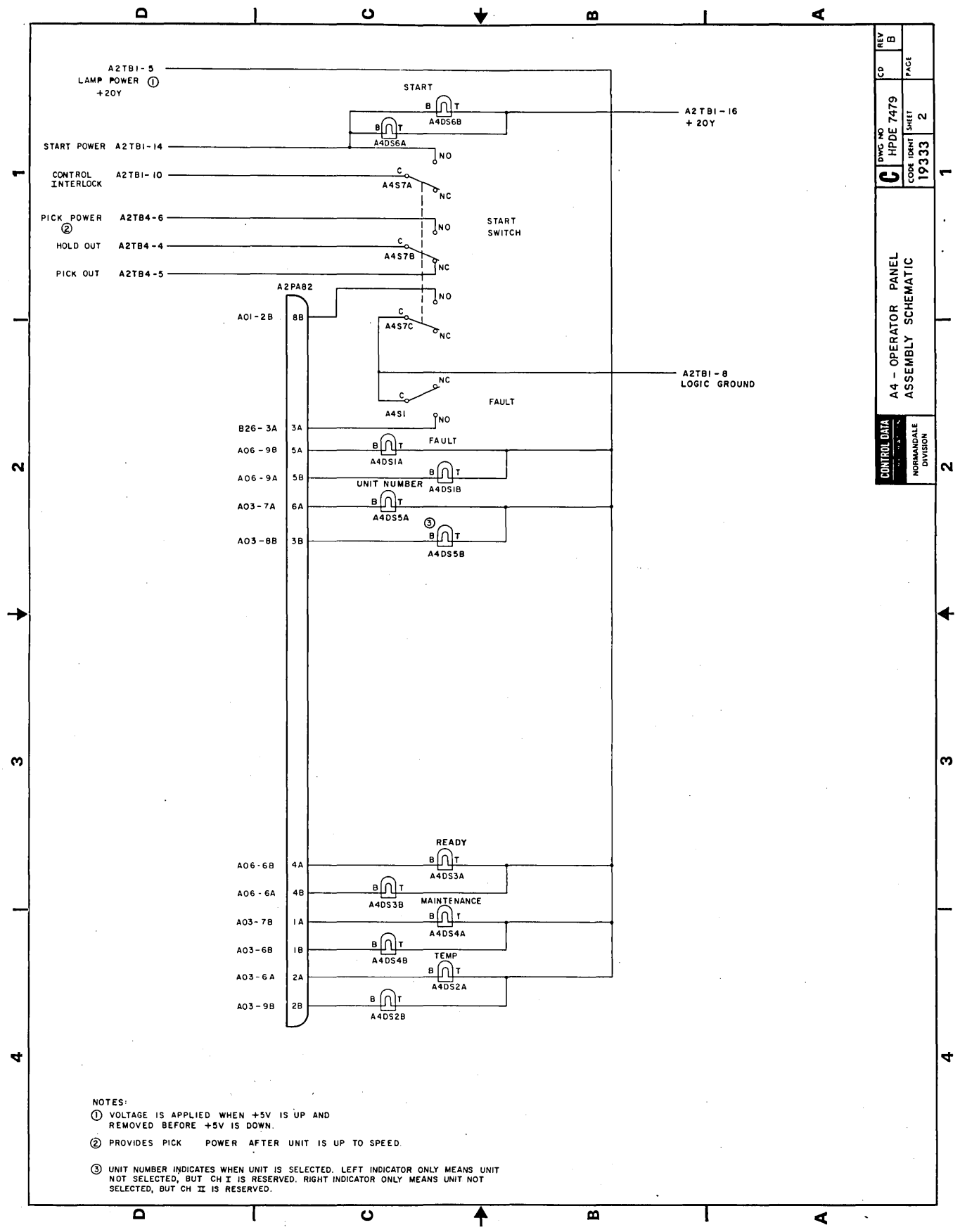


NOTES:

1. REFER TO A1 POWER SYSTEM SCHEMATIC FOR INPUT WIRING TO A2TB2.
2. REFER TO A2A2 RELAY BOARD. SHOWN FOR REFERENCE ONLY.

CONTROL DATA NORMANDALE DIVISION	A2 LOGIC CHASSIS DC POWER SUPPLY	C	DWG NO HPDE 7401	CD / REV A
		CODE IDENT 19333	SHEET 6	PAGE


A2PA81
A3PE80
(I3116) A17-10A 1A BIT 0 1A E02-4A (Y3201)
(I3114) A17-10B 1B BIT 1 1B E02-4B (Y3201)
(I3112) A17-12B 2A BIT 2 2A E02-3A (Y3201)
(I3110) A17-12A 2B BIT 3 2B E02-3B (Y3201)
EVEN HEAD SELECT
(I3126) A17-06B 3A BIT 0 3A F02-12B (Y3202)
(I3124) A17-06A 3B BIT 1 3B F02-12A (Y3202)
(I3122) A17-07B 4A BIT 2 4A F02-11B (Y3202)
(I3120) A17-07A 4B BIT 3 4B F02-11A (Y3202)
ODD HEAD SELECT
(I3128) A17-02A 5A WRITE ENABLE 5A F04-11B (I3202), E01-16B (I4300)
(I1910) A19-09B 5B 128 5B F01-9B (L4303)
(K3800) A26-06A 6A FAULT 6A F01-6B (I4305)
(I1909) A19-13A 6B 256 6B F01-8B (L4303)
(I3700) B26-07B 7B MULTIPLE HEAD FAULT 7B E01-17A (I3201)
(I3423) C21-14B 8A AGC SHORT TC 8A F03-9B (L3300)
(I1911) A19-02A 8B 512 8B F01-7B (L4303)
(I3726) A19-07B 14A GND 14A E01-14A (X4300)
(GND) A09-01A 14B AC WRITE FAULT 14B E04-1A (GND)
A2PD22
A3PE4
(A3400) D22-2B 2B
(A3400) D22-1B 1B
READ DATA
8B 8A 9B 9A
CARD E04 ON R/W CHASSIS (A3306)
A2PE30
A3P8
(A2304) B30-5B 5B
(A2304) B30-3B 3B
DIBITS
4B 4A 2A 2B 1A 1B
SERVO PREAMP CARD
A2PC17
A3PE1
(T4200) C17-9A 9B
(T4200) C17-9B 9A
MFM WRITE DATA
10B 9B
CARD E01 ON R/W CHASSIS (R4300)
A2PC23
A3PF3
HEAD ALIGN CARD C23-9B 9B
C23-11B 11B
ANALOG READ SIGNAL
9A 11A
4A 4B 3A 3B
CARD E03 ON R/W CHASSIS (A3307)
A3P3 A3P3
(B2800) A08-07B 9A 1 1
(GND) A06-01A 9B 2 2
SPEED TRANSDUCER
A3P4 A3J4
(A2201) B27-06A 11B 1
(A2705) B27-05B 12B 2
(GND) A10-01A 13B 3
VELOCITY TRANSDUCER
NC C PACK ON A3S4 A2TB1-9 (GND) NO
(L1005) A02-02B 10B
(L1501) A02-03A 12A HEADS LOADED
A2TB1
LOADED NC NOT LOADED NO
RETRACT RELAY (A2K6)
A3S6
12
GND 8
+20V BRAKE POWER 15
A3P2 A3P2
2 1
HYSTERESIS BRAKE
A1P7 A3P7
GND 6
(A1K2) RELAY COIL 7
(A1K2) RELAY CONTACTS 5
(A1K1) RELAY CONTACTS 2
CIRCUIT BREAKER COIL (A1CB2-A4) 4
CIRCUIT BREAKER (A1CB2-B4) 3
SAFETY GND 1
SHIELD 8
CENTRIFUGAL SWITCH
START CAPACITOR
RUN CAPACITOR
RUN WINDING
START WINDING
THERMO PROTECTOR
DRIVE MOTOR
+VCC (+5V) 3
-VCC (-5V) 4
IN A3FL1 OUT
IN A3FL2 OUT
R/W CHASSIS VOLTAGE BUSES
+20V WRITE POWER 13
IN A3FL5 OUT
F01-13B
CONTROL INTERLOCK 11
C NC A3S1 PACK COVER NO
CONTROL INTERLOCK 10
A3P8
+10.0V 6
-10.0V 7
GND 8
3A 3B 4B
SERVO PREAMP CARD
A3TB1
2
A2A1TB1-7
A2K5A-COM
1
VOICE COIL
R/W CHASSIS VOLTAGE BUSES
A3P6
+20V 1
IN A3FL3 OUT
-20V 2
IN A3FL4 OUT
GND 9
1 +20V
3 -20V
4 GND
HEAD CONNECTOR CARD E0 ON R/W CHASSIS
A3PE3
CARD E03 ON R/W CHASSIS (A3300, A3307)
14B
13B
DECK GND & R/W CHASSIS GND
5
6
READ ANALOG (A3219)
REV B
CO
CROSS REF NO
DWG NO HPDE 7402
SHEET 2
C
CODE IDENT 19333
A3 DECK ASSEMBLY SCHEMATIC
CONTROL DATA
NORMANDALE DIVISION

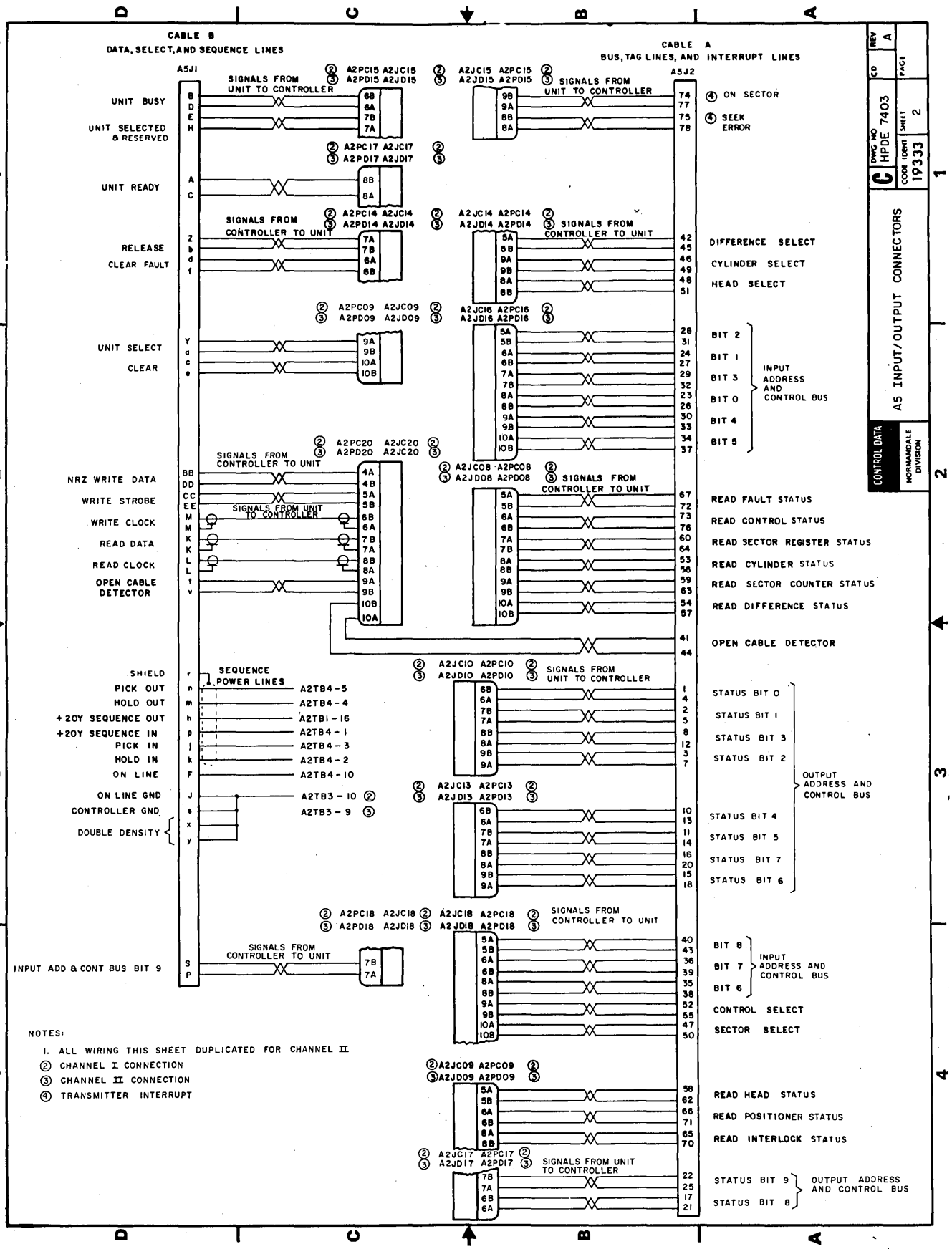


NOTES:

① VOLTAGE IS APPLIED WHEN +5V IS UP AND REMOVED BEFORE +5V IS DOWN.

② PROVIDES PICK POWER AFTER UNIT IS UP TO SPEED.

③ UNIT NUMBER INDICATES WHEN UNIT IS SELECTED. LEFT INDICATOR ONLY MEANS UNIT NOT SELECTED, BUT CH I IS RESERVED. RIGHT INDICATOR ONLY MEANS UNIT NOT SELECTED, BUT CH II IS RESERVED.


CABLE B
DATA, SELECT, AND SEQUENCE LINES
CABLE A
BUS, TAG LINES, AND INTERRUPT LINES
A5J1
A5J2
SIGNALS FROM UNIT TO CONTROLLER
SIGNALS FROM CONTROLLER TO UNIT
SIGNALS FROM UNIT TO CONTROLLER
UNIT BUSY
UNIT SELECTED & RESERVED
UNIT READY
RELEASE
CLEAR FAULT
UNIT SELECT
CLEAR
NRZ WRITE DATA
WRITE STROBE
WRITE CLOCK
READ DATA
READ CLOCK
OPEN CABLE DETECTOR
SHIELD
PICK OUT
HOLD OUT
+20V SEQUENCE OUT
+20V SEQUENCE IN
PICK IN
HOLD IN
ON LINE
ON LINE GND
CONTROLLER GND
DOUBLE DENSITY
SEQUENCE POWER LINES
A2TB4-5
A2TB4-4
A2TB1-16
A2TB4-1
A2TB4-3
A2TB4-2
A2TB4-10
A2TB3-10
A2TB3-9
INPUT ADD & CONT BUS BIT 9
ON SECTOR
SEEK ERROR
DIFFERENCE SELECT
CYLINDER SELECT
HEAD SELECT
BIT 2
BIT 1
BIT 3
BIT 0
BIT 4
BIT 5
INPUT ADDRESS AND CONTROL BUS
READ FAULT STATUS
READ CONTROL STATUS
READ SECTOR REGISTER STATUS
READ CYLINDER STATUS
READ SECTOR COUNTER STATUS
READ DIFFERENCE STATUS
OPEN CABLE DETECTOR
STATUS BIT 0
STATUS BIT 1
STATUS BIT 3
STATUS BIT 2
STATUS BIT 4
STATUS BIT 5
STATUS BIT 7
STATUS BIT 6
OUTPUT ADDRESS AND CONTROL BUS
BIT 8
BIT 7
BIT 6
CONTROL SELECT
SECTOR SELECT
READ HEAD STATUS
READ POSITIONER STATUS
READ INTERLOCK STATUS
STATUS BIT 9
STATUS BIT 8
NOTES:
1. ALL WIRING THIS SHEET DUPLICATED FOR CHANNEL II
② CHANNEL I CONNECTION
③ CHANNEL II CONNECTION
④ TRANSMITTER INTERRUPT
CONTROL DATA
NORMANDALE DIVISION
A5 INPUT/OUTPUT CONNECTORS
DWG NO HPDE 7403
REV A
SHEET 2
CODE IDENT 19333

SECTION 5

WIRE LISTS

WIRE LISTS

INTRODUCTION

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

WIRE WRAP WIRE LIST

The wire wrap wire list provides signal name or number, wire origin, wire destination, and location of the wire on the pin.

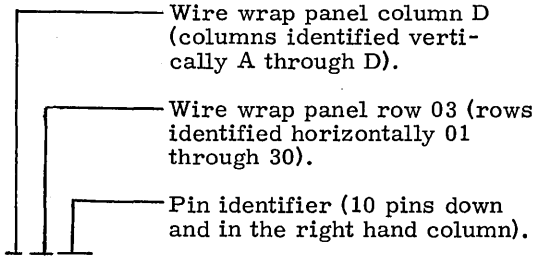
SIGNAL NAME OR NUMBER COLUMN

If the entry begins with a letter, the signal on the wire originates at the listed logic term. A multiple output is indicated when a term is repeated on successive line entries.

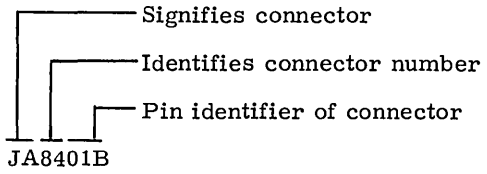
If the entry begins with a number, the signal on the wire generally originates at some point other than a logic term, such as a bus, test point, connector, etc.

ORIGIN/DESTINATION COLUMNS

The origin and destination columns in the wire wrap wire list locate the pins on the logic chassis as shown below:



If the origin or destination column is preceded by the letter J, the wire attaches to one of the connectors as shown below:



Z LEVEL COLUMN

The Z level denotes the vertical separation which an installed wire has relative to the surface of the wire wrap board. This vertical separation is maintained at both ends of the installed wire when it is wrapped on the pins. Two vertical separation distances are possible. A numeral 1 in this column indicates the smallest separation. A 2 in the column indicates the largest separation.

NON-LOGIC WIRE LIST

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.

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP (Ref: 77384302)		7843	1	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
100004	A0102A	JA8401B		1	
100001	A0102B	JA8208B		1	
100005	A0103B	JA8001A		1	
L1002000	A0111A	C0605A		1	
I1006000	A0111B	A0303A		1	
L1001000	A0112A	A0303B		1	
L1001002	A0112A	B1210A		2	
I1004000	A0112B	B1103A		2	
I1004003	A0112B	B1013B		1	
L1000000	A0113A	C0505A		1	
100008	A0202B	JA8110B		1	
100106	A0203A	JA8112A		1	
100105	A0203B	JA8110A		1	
100107	A0204A	JA8002B		1	
100009	A0204B	JA8002A		1	
I1508000	A0208A	A1805A		1	
L1502000	A0208B	D0105A		1	
I1013000	A0209A	A1807B		1	
L1007000	A0209B	C0205A		1	
L1007001	A0209B	A0802B		2	
I1506000	A0210A	C0305A		2	
I1506001	A0210A	A1803B		1	
L1501000	A0210B	A0802A		1	
L1005000	A0213A	B1105B		2	
L1005002	A0213A	C0105A		1	
I1126001	A0302A	A0313A		2	
K1201001	A0302B	B1213A		2	
I1006000	A0303A	A0111B		1	
I1006001	A0303A	A0305B		2	
L1001000	A0303B	A0112A		1	
L1001001	A0303B	A0305A		2	
10000601	A0304A	A0311B		1	
10000602	A0304A	A0304B		2	
10000602	A0304B	A0304A		2	
10000603	A0304B	A0311A		1	
L1001001	A0305A	A0303B		2	
I1006001	A0305B	A0303A		2	
L1010000	A0306A	JA8202A		1	
L1009000	A0306B	JA8201B		1	
L1101000	A0307A	JA8206A		1	
L1008000	A0307B	JA8201A		1	
L1017000	A0308A	JA8003B		1	
L1100000	A0308B	JA8203B		1	
L1011000	A0309B	JA8202B		1	
10000603	A0311A	A0304B		1	
10000604	A0311A	D0305A		2	
10000600	A0311B	JA8004B		2	
10000601	A0311B	A0304A		1	
I1027000	A0312B	A1805B		1	
I1126000	A0313A	B1108A		1	
I1126001	A0313A	A0302A		2	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP		7843	2	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
K1200001	A0313B	C1213A		2	
I4703000	A0502A	D0304A		1	
100055	A0502B	C2717A		1	
100056	A0503A	D2702A		1	
I4707000	A0503B	D0204A		1	
I4715000	A0504A	C0604A		1	
100058	A0504B	D2704A		1	
100057	A0505A	D2703A		1	
I4711000	A0505B	D0104A		1	
L4803000	A0506A	JA8507A		1	
L4802000	A0506B	JA8508A		1	
L4800000	A0507A	JA8510A		1	
L4801000	A0507B	JA8509A		1	
L4806000	A0508A	JA8504A		1	
L4807000	A0508B	JA8502A		1	
L4805000	A0509A	JA8505A		1	
L4804000	A0509B	JA8506A		1	
100118	A0510A	D2710A		1	
I4723000	A0510B	C0404A		1	
I4719000	A0511A	C0504A		1	
100117	A0511B	D2709A		1	
100119	A0512A	D2711A		1	
I4727000	A0512B	C0304A		1	
I4731000	A0513A	C0204A		1	
100120	A0513B	D2712A		1	
100086	A0601A	JA8109B		1	
I4735000	A0602A	C0104A		1	
100121	A0602B	C2705B		1	
K3800001	A0603B	A2203B		2	
K3800002	A0603B	A0611A		1	
I1622001	A0604A	A0605B		1	
I1622000	A0605B	B2405A		2	
I1622001	A0605B	A0604A		1	
L1014000	A0606A	JA8204B		1	
L1013000	A0606B	JA8204A		1	
L4808000	A0607A	JA8503A		1	
L3800000	A0607B	JA8511A		1	
L4809000	A0608A	JA8511B		1	
L1016000	A0609A	JA8205B		1	
L1015000	A0609B	JA8205A		1	
K3800003	A0610B	A0611A		2	
K3800004	A0610B	JA8106A		1	
K3800002	A0611A	A0603B		1	
K3800003	A0611A	A0610B		2	
10016300	A0612A	D2701A		1	
I4739000	A0612B	C0704A		1	
L1501000	A0802A	A0210B		1	
L1501001	A0802A	A1804B		2	
L1007001	A0802B	A0209B		2	
L1007002	A0802B	B1104B		1	
L1012000	A0803A	JA8003A		1	
X2800100	A0803B	A0811B		1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP		7843	3	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
Y1000000	A0804A	B2408B		1	
Y1000000	A0804A	C0612A		2	
K1001000	A0805B	A1807A		1	
K1001100	A0806B	B1104A		1	
100085	A0807B	JA8109A		1	
100154	A0809A	A0814A		1	
I2506001	A0810B	A2203A		2	
I1028000	A0811A	A2402A		1	
X2800100	A0811B	A0803B		1	
10001000GND	A0812A	A0814A		2	
100154	A0814A	A0809A		1	
10001000GND	A0814A	A0812A		2	
10018400	A0901A	JA8114B		1	
100065	A1001A	JA8113B		1	
I3809001	A1302B	A1903A		2	
I3809002	A1302B	A1305A		1	
I3820000	A1303A	C0209B		1	
I3713000	A1303B	A2604B		1	
I3717000	A1304A	A2612A		1	
I3822000	A1304B	C0109B		1	
I3809002	A1305A	A1302B		1	
I3809003	A1305A	A1306A		2	
I3809003	A1306A	A1305A		2	
I3809004	A1306A	A1308A		1	
I3825000	A1307A	B2603B		1	
I3818000	A1307B	C0309B		1	
I3809004	A1308A	A1306A		1	
I3809005	A1308A	A1311A		2	
I3721000	A1309A	B2406B		1	
I3816000	A1309B	C0409B		1	
I3723000	A1310A	B2410B		1	
I3809005	A1311A	A1308A		2	
I3809006	A1311A	A1312B		1	
I3814000	A1311B	C0509B		1	
I3809006	A1312B	A1311A		1	
I3812000	A1313A	C0609B		1	
I1617002	A1313B	A2408B		1	
I1617003	A1313B	B2004B		2	
1000320GND	A1601A	A1607A		1	
I3106000	A1602A	B1111B		1	
I3107000	A1602B	B1111A		1	
I3009000	A1603A	B1802A		1	
S3001000	A1603B	A1713A		1	
S3001001	A1603B	C0108A		2	
I1434003	A1604A	B1507B		2	
I1434004	A1604A	B0904A		1	
I1426000	A1604B	B0904B		1	
I1426001	A1604B	B1502A		2	
S3001200	A1605A	A1709A		1	
S3001201	A1605A	C0308A		2	
S3001100	A1605B	A1711B		1	
S3001101	A1605B	C0208A		2	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP		7843	4	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
I1430003	A1606A	B1503A		2	
I1430004	A1606A	B0906A		1	
I1422002	A1606B	B1504B		2	
I1422003	A1606B	A1906A		1	
1000320GND	A1607A	A1601A		1	
S3001300	A1607B	A1711A		1	
S3001301	A1607B	C0408A		2	
I1418002	A1608A	B1607B		2	
I1418003	A1608A	B0908A		1	
S3000000	A1608B	A1713B		1	
S3000001	A1608B	C0508A		2	
I3128000	A1702A	JA8105A		1	
I3705001	A1702B	A2610B		2	
100002	A1703A	JA8411B		1	
I2104004	A1703B	A2213A		1	
I2104005	A1703B	B1002B		2	
I3108000	A1704B	D0110B		1	
I3105000	A1705A	D2704B		2	
I3105001	A1705A	B1109B		1	
I3124000	A1706A	JA8103B		1	
I3126000	A1706B	JA8103A		1	
I3120000	A1707A	JA8104B		1	
I3122000	A1707B	JA8104A		1	
S3001200	A1709A	A1605A		1	
I3130000	A1709B	A1911A		1	
I3116000	A1710A	JA8101A		1	
I3114000	A1710B	JA8101B		1	
S3001300	A1711A	A1607B		1	
S3001100	A1711B	A1605B		1	
I3110000	A1712A	JA8102B		1	
I3112000	A1712B	JA8102A		1	
S3001000	A1713A	A1603B		1	
S3000000	A1713B	A1608B		1	
I1026000	A1802B	A1806B		1	
I1012000	A1803A	B1106A		1	
I1506001	A1803B	A0210A		1	
I1506002	A1803B	A1907A		2	
I1025000	A1804A	A1806A		1	
L1501001	A1804B	A0802A		2	
L1501002	A1804B	A2214B		1	
I1508000	A1805A	A0208A		1	
I1027000	A1805B	A0312B		1	
I1025000	A1806A	A1804A		1	
I1026000	A1806B	A1802B		1	
K1001000	A1807A	A0805B		1	
I1013000	A1807B	A0209A		1	
I1034000	A1808A	A1808B		1	
I1034000	A1808B	A1808A		1	
I1034001	A1808B	B2409A		2	
I1623000	A1809A	A2508B		1	
I1624000	A1809B	C1511B		1	
I4216000	A1813A	D1712A		1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP		7843	5	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
I1005024	A1813B	B1806B		1	
I1005025	A1813B	C1712A		2	
I1911000	A1902A	JA8108B		1	
I3828000	A1902B	A1904B		1	
I3809000	A1903A	B2605B		1	
I3809001	A1903A	A1302B		2	
I3827000	A1903B	A1904A		1	
I3827000	A1904A	A1903B		1	
I3827001	A1904A	D0309B		2	
I3828000	A1904B	A1902B		1	
100039	A1905A	D2703B		1	
I3131000	A1905B	A2104A		1	
I1422003	A1906A	A1606B		1	
I1422004	A1906A	A2006B		2	
I1502002	A1906B	B1703A		2	
I1502003	A1906B	B1102A		1	
I1506002	A1907A	A1803B		2	
I1506003	A1907A	B2004A		1	
X4300000	A1907B	JA8114A		1	
I3726000	A1908A	A1910B		1	
S1900100	A1908B	A2012A		1	
S1900101	A1908B	C0707A		2	
S1901300	A1909A	A2011A		1	
S1901301	A1909A	D0207A		2	
I1910000	A1909B	JA8105B		1	
I3727000	A1910A	A2615A		1	
I3726000	A1910B	A1908A		1	
I3130000	A1911A	A1709B		1	
I3129000	A1911B	A2103B		1	
I2801000	A1912A	B1902B		1	
I2705001	A1912B	A2113B		2	
I1909000	A1913A	JA8106B		1	
S1900000	A1913B	A2013A		1	
S1900001	A1913B	D0307A		2	
1000640GND	A2001A	A2002B		1	
I1721000	A2002A	B2509A		1	
1000640GND	A2002B	A2001A		1	
I1906000	A2003A	B1704B		1	
S1902000	A2003B	C0107A		1	
S1902001	A2003B	B2313A		2	
I1434000	A2004A	B1507B		1	
I1434001	A2004A	B2207B		2	
I1426002	A2004B	B1502A		1	
I1426003	A2004B	B2209A		2	
S1902200	A2005A	C0307A		1	
S1902201	A2005A	C2712A		2	
S1902100	A2005B	C0207A		1	
S1902101	A2005B	C2710A		2	
I1430000	A2006A	B1503A		1	
I1430001	A2006A	B2207A		2	
I1422004	A2006B	A1906A		2	
I1422005	A2006B	B2209B		1	

TITLE		DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP	WL	7843	6	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
I1524004	A2007A	A2210B		1	
S1902300	A2007B	C0407A		1	
S1902301	A2007B	C2713B		2	
I1418000	A2008A	B1607B		1	
I1418001	A2008A	B2206B		2	
S1901000	A2008B	C0507A		1	
S1901001	A2008B	C2713A		2	
S1901200	A2009A	D0107A		1	
S1901201	A2009A	C2716B		2	
I1410000	A2009B	B1602A		1	
I1410001	A2009B	B2211A		2	
I1414000	A2010A	B1603A		1	
I1414001	A2010A	B2212B		2	
S1901100	A2010B	C0607A		1	
S1901101	A2010B	C2714B		2	
S1901300	A2011A	A1909A		1	
S1901302	A2011A	C2716A		2	
I1406000	A2011B	B2204A		2	
I1406001	A2011B	B1604B		1	
S1900100	A2012A	A1908B		1	
S1900102	A2012A	C2714A		2	
I1438000	A2012B	B1807B		1	
S1900000	A2013A	A1913B		1	
S1900002	A2013A	C2715B		2	
I1402000	A2013B	B2205B		2	
I1402001	A2013B	B1707B		1	
10007400GND	A2101A	A2115B		1	
I3129000	A2103B	A1911B		1	
I3131000	A2104A	A1905B		1	
I3011000	A2104B	B1802B		1	
K2702000	A2107B	A2111A		1	
K2800000	A2110A	D0406A		1	
I1002003	A2110B	B1809B		2	
I1002004	A2110B	A2804B		1	
K2702000	A2111A	A2107B		1	
I2705000	A2111B	A2113B		1	
20003000BIAS	A2112A	B1906A		1	
I2705000	A2113B	A2111B		1	
I2705001	A2113B	A1912B		2	
10007400GND	A2115B	A2101A		1	
I1506004	A2202A	B2004A		2	
I1506005	A2202A	B2610A		1	
I1522000	A2202B	B2706B		1	
I2506000	A2203A	A2403B		1	
I2506001	A2203A	A0810B		2	
K3800000	A2203B	A2606A		1	
K3800001	A2203B	A0603B		2	
I1827000	A2204A	A2310A		1	
I1519000	A2204B	B2505B		1	
I1511000	A2205A	B2501A		1	
I1531000	A2205B	A2413B		1	
I1512000	A2206A	A2511B		1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP		7843	7	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
I1529000	A2206B	C0112A		1	
I1530000	A2207A	C0212A		1	
I1532000	A2207B	A2712A		1	
I1516000	A2208A	A2306B		1	
I1533000	A2208B	A2709B		1	
X1500000	A2209A	B2312B		1	
I1828001	A2209B	A2306A		1	
I1602000	A2210A	B2502A		1	
I1524000	A2210B	A2307A		2	
I1524004	A2210B	A2007A		1	
I1520000	A2211A	B2707B		1	
K1702000	A2211B	A2605A		1	
I1535000	A2212A	A2416A		1	
I1535001	A2212A	D0608B		2	
I2104002	A2212B	A2607B		1	
I2104003	A2212B	A2213A		2	
I2104003	A2213A	A2212B		2	
I2104004	A2213A	A1703B		1	
I1601000	A2213B	A2410B		1	
I1509001	A2214A	B2311A		2	
L1501002	A2214B	A1804B		1	
L1501003	A2214B	B2504B		2	
X1700000	A2215A	B2510A		1	
K1701000	A2216A	A2309B		1	
I1726000	A2217B	A2407A		2	
I1726002	A2217B	C0412A		1	
100173000	A2301A	JA8410A		1	
I1810000	A2302A	A2311B		1	
L2301000	A2303A	A3007B		1	
I1800001	A2304A	A2308A		2	
L2300000	A2304B	A3008B		1	
I2103000	A2305B	A2808A		1	
I2103001	A2305B	B2005A		2	
I1828000	A2306A	A2412A		2	
I1828001	A2306A	A2209B		1	
I1516000	A2306B	A2208A		1	
I1516001	A2306B	A2507B		2	
I1524000	A2307A	A2210B		2	
I1524001	A2307A	A2507A		1	
S1800000	A2307B	B2307B		1	
I1800000	A2308A	B1702B		1	
I1800001	A2308A	A2304A		2	
S1800100	A2309A	B2306A		1	
K1701000	A2309B	A2216A		1	
K1701001	A2309B	B2313B		2	
I1827000	A2310A	A2204A		1	
I1811000	A2310B	A2510B		1	
I1810001	A2311A	A2311B		2	
I1810002	A2311A	A2512A		1	
I1810000	A2311B	A2302A		1	
I1810001	A2311B	A2311A		2	
S1801000	A2312A	C0505B		1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP		7843	8	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
S1801100	A2312B	C0605B		1	
S1801101	A2312B	B2813B		2	
I1701000	A2313A	B2213A		1	
S1801200	A2313B	B2808B		1	
S1801201	A2313B	D0105B		2	
I1705000	A2314A	B2211B		1	
I1733000	A2314B	D0602B		1	
I1707000	A2315A	B2212A		1	
I1709000	A2315B	B2206A		1	
S1801300	A2316A	B2307A		1	
I1703000	A2316B	B2205A		1	
S1802000	A2317A	B2811A		1	
S1802001	A2317A	C0105B		2	
S1802100	A2317B	B2810B		1	
S1802101	A2317B	C0205B		2	
1001090GND	A2401A	A2416B		1	
10010901 GND	A2401A	A2405B		2	
I1028000	A2402A	A0811A		1	
X2500000	A2403A	C0405A		1	
I2506000	A2403B	A2203A		1	
I1619000	A2404A	C0610B		1	
L1007003	A2405A	B1104B		2	
10010901 GND	A2405B	A2401A		2	
I1605002	A2406B	A2407B		1	
I1726000	A2407A	A2217B		2	
I1726001	A2407A	A2514A		1	
I1605001	A2407B	A2415B		2	
I1605002	A2407B	A2406B		1	
I1617000	A2408B	A2606B		2	
I1617002	A2408B	A1313B		1	
I1614000	A2409A	B2201B		1	
I3702000	A2409B	A2608A		1	
I3702001	A2409B	B1008A		2	
I1601000	A2410B	A2213B		1	
X1601000	A2411B	B2508B		1	
I1828000	A2412A	A2306A		2	
I1828002	A2412A	B2511B		1	
I1621000	A2412B	A2512B		1	
I1621001	A2412B	C1711B		2	
I1531000	A2413B	A2205B		1	
I1605000	A2415B	B2506B		1	
I1605001	A2415B	A2407B		2	
I1535000	A2416A	A2212A		1	
1001090GND	A2416B	A2401A		1	
I1509002	A2504A	B2401A		2	
I1509003	A2504A	A2804A		1	
L2500000	A2504B	B2213B		1	
L2501000	A2505B	B2202B		1	
I1524001	A2507A	A2307A		1	
I1524002	A2507A	B2507B		2	
I1516001	A2507B	A2306B		2	
I1618000	A2508A	B2404B		1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP		7843	9	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
I1623000	A2508B	A1809A		1	
L1001007	A2509B	C1908A		1	
L1001008	A2509B	D2702B		2	
A2203000	A2510A	A2714B		1	
I1811000	A2510B	A2310B		1	
I1811001	A2510B	A2806B		2	
I1414002	A2511A	B2212B		1	
I1512000	A2511B	A2206A		1	
I1512001	A2511B	A2515B		2	
I1810002	A2512A	A2311A		1	
I1810003	A2512A	C0312A		2	
I1621000	A2512B	A2412B		1	
X1701100	A2513B	B2201A		1	
I1726001	A2514A	A2407A		1	
I1511001	A2515A	B2501A		2	
I1512001	A2515B	A2511B		2	
K3800100	A2516A	B2604A		1	
K3800101	A2516A	C0210B		2	
I2418000	A2516B	A2816A		1	
I4006000	A2517A	C1910A		1	
I1538000	A2517B	C1912A		1	
10014000 GND	A2601A	A2616A		1	
K3700000	A2602A	A2617A		1	
I3713000	A2604B	A1303B		1	
K1702000	A2605A	A2211B		1	
I3725000	A2605B	B2405B		1	
K3800000	A2606A	A2203B		1	
I1617000	A2606B	A2408B		2	
I1617001	A2606B	C2712B		1	
I1502000	A2607A	B1703A		1	
I1502001	A2607A	A2609A		2	
I2104001	A2607B	C2709B		2	
I2104002	A2607B	A2212B		1	
I3702000	A2608A	A2409B		1	
I1430002	A2608B	B2207A		1	
I1502001	A2609A	A2607A		2	
I1434002	A2609B	B2207B		1	
I3705000	A2610B	C1907A		1	
I3705001	A2610B	A1702B		2	
I3703000	A2611B	C2105B		1	
I3717000	A2612A	A1304A		1	
K3903003	A2612B	C2012B		2	
I4113000	A2613A	C2905B		1	
K3903101	A2613B	D2810B		2	
I4114000	A2614A	C2904B		1	
I3701000	A2614B	B2611B		1	
I3727000	A2615A	A1910A		1	
10014000 GND	A2616A	A2601A		1	
K3700000	A2617A	A2602A		1	
I3811000	A2617B	B2609A		1	
A2002000	A2703A	D3002B		1	
I2024000	A2703B	B2805A		1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP		7843	10	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
I2025000	A2704A	B2806B		1	
I2026000	A2704B	B2807B		1	
I2027000	A2705A	B2806A		1	
I2023000	A2705B	B2805B		1	
I2022000	A2706A	B2804A		1	
I2021000	A2706B	B2804B		1	
I1533000	A2709B	A2208B		1	
K2200000	A2710A	A2806A		1	
A2404000	A2710B	C3008B		1	
K2201000	A2711A	A2802A		1	
10000701	A2711B	JA8005B		1	
I1532000	A2712A	A2207B		1	
L2101000	A2712B	B2802B		1	
I2102000	A2713B	A2802B		1	
L2100000	A2714A	B2802A		1	
A2203000	A2714B	A2510A		1	
10000700	A2715A	JA8005A		1	
A2201000	A2715B	B2502B		1	
K2201000	A2802A	A2711A		1	
I2102000	A2802B	A2713B		1	
K2200100	A2803A	C0512A		1	
I1524003	A2803B	B2507B		1	
I1509003	A2804A	A2504A		1	
I1002004	A2804B	A2110B		1	
X1500002	A2805B	B2504A		1	
K2200000	A2806A	A2710A		1	
I1811001	A2806B	A2510B		2	
I2204000	A2807A	B2709B		1	
I1823000	A2807B	B2305B		1	
I2103000	A2808A	A2305B		1	
I2104000	A2808B	C2709B		1	
I2418000	A2816A	A2516B		1	
I1825000	A2816B	B2305A		1	
20023000 -5V	A3001B	JA8514A		1	
20021000-20V	A3002B	JA8513A		1	
L2301000	A3007B	A2303A		1	
L2300000	A3008B	A2304B		1	
A2310000	A3009B	C3007B		1	
I2302000	A3010B	B2111A		2	
K2301000	A3011B	B2202A		1	
K2300100	A3012B	B2109B		1	
I2934000	B0802B	B1002A		1	
S2901000	B0803B	B0903B		1	
S2901001	B0803B	C0113A		2	
S2801100	B0804A	B1905B		1	
S2801101	B0804A	C0108B		2	
S2801200	B0804B	B1905A		1	
S2801201	B0804B	C0208B		2	
S2901100	B0805A	B0905B		1	
S2901101	B0805A	C0213A		2	
S2901200	B0805B	B0905A		1	
S2901201	B0805B	C0313A		2	

TITLE		DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP	WL	7843	11	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
S2801300	B0806A	B1907B		1	
S2801301	B0806A	C0308B		2	
K2900000	B0807A	B1005A		1	
S2900000	B0807B	B0908B		1	
S2900001	B0807B	C0513A		2	
S2800100	B0808A	B1910B		1	
S2800101	B0808A	C0508B		2	
S2800000	B0808B	B1908B		1	
S2800001	B0808B	C0408B		2	
S2901300	B0809A	B0907B		1	
S2901301	B0809A	C0413A		2	
20005000BIAS	B0809B	B0811A		1	
20006000BIAS	B0810A	B0810B		1	
20006000BIAS	B0810B	B0810A		1	
20005000BIAS	B0811A	B0809B		1	
10016000 GND	B0901A	B0902B		1	
10016000 GND	B0902B	B0901A		1	
I2902001	B0903A	B1004B		1	
S2901000	B0903B	B0803B		1	
I1434004	B0904A	A1604A		1	
I1426000	B0904B	A1604B		1	
S2901200	B0905A	B0805B		1	
S2901100	B0905B	B0805A		1	
I1430004	B0906A	A1606A		1	
I1422001	B0906B	B1103B		2	
S2901300	B0907B	B0809A		1	
I1418003	B0908A	A1608A		1	
S2900000	B0908B	B0807B		1	
I2934000	B1002A	B0802B		1	
I2104005	B1002B	A1703B		2	
I2104006	B1002B	C0410B		1	
K1201101	B1003A	C1203A		1	
K1200101	B1003B	B1203A		1	
X1200000	B1004A	B1413B		1	
I2902000	B1004B	B1803A		2	
I2902001	B1004B	B0903A		1	
K2900000	B1005A	B0807A		1	
1000300GND	B1006A	B1413A		1	
R1102001	B1006B	B1408A		1	
I1002000	B1007B	B1110A		1	
I3702001	B1008A	A2409B		2	
1000310GND	B1012A	B1014A		1	
I2936000	B1012B	B2401B		1	
1001080GND	B1013A	B2402A		1	
I1004003	B1013B	A0112B		1	
1000310GND	B1014A	B1012A		1	
I1502003	B1102A	A1906B		1	
I1502004	B1102A	C1911B		2	
I1005000	B1102B	B1508B		2	
I1005014	B1102B	D0609B		1	
I1004000	B1103A	A0112B		2	
I1004001	B1103A	B1403A		1	

TITLE		DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP	WL	7843	12	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
I1422000	B1103B	B1504B		1	
I1422001	B1103B	B0906B		2	
K1001100	B1104A	A0806B		1	
L1007002	B1104B	A0802B		1	
L1007003	B1104B	A2405A		2	
L1005001	B1105A	B1105B		1	
L1005000	B1105B	A0213A		2	
L1005001	B1105B	B1105A		1	
I1012000	B1106A	A1803A		1	
I1126000	B1108A	A0313A		1	
I1225000	B1108B	C1202B		2	
I1225001	B1108B	B1113A		1	
I1122000	B1109A	B1202B		2	
I1122001	B1109A	B1112A		1	
I3105001	B1109B	A1705A		1	
I1002000	B1110A	B1007B		1	
I1002001	B1110A	B1809A		2	
I1003000	B1110B	B1403B		1	
I3107000	B1111A	A1602B		1	
I3106000	B1111B	A1602A		1	
I1122001	B1112A	B1109A		1	
I1124000	B1112B	C0812A		1	
I1124006	B1112B	C1412A		2	
I1225001	B1113A	B1108B		1	
I1227000	B1113B	D0803B		1	
I1227006	B1113B	D1412A		2	
1000210GND	B1201A	B1212B		1	
I1123000	B1202A	C1002B		1	
I1123004	B1202A	C1313A		2	
I1122000	B1202B	B1109A		2	
K1200100	B1203A	B1404B		2	
K1200101	B1203A	B1003B		1	
20008000B1AS	B1203B	B1204A		1	
20008000B1AS	B1204A	B1203B		1	
20009000B1AS	B1204B	B1205A		1	
20009000B1AS	B1205A	B1204B		1	
20010000B1AS	B1205B	B1206A		1	
20010000B1AS	B1206A	B1205B		1	
10001800GND	B1206B	B1214A		1	
R1100000	B1207A	C0911A		1	
20012000B1AS	B1207B	B1208A		1	
20012000B1AS	B1208A	B1207B		1	
20011000B1AS	B1208B	B1209A		1	
20011000B1AS	B1209A	B1208B		1	
20013000B1AS	B1209B	B1211A		1	
L1001002	B1210A	A0112A		2	
L1001003	B1210A	C1210A		1	
20019000BIAS	B1210B	C0912A		1	
20013000B1AS	B1211A	B1209B		1	
I1119000	B1212A	B1405B		1	
1000210GND	B1212B	B1201A		1	
K1201000	B1213A	B1407A		1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP		7843	13	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
K1201001	B1213A	A0302B		2	
I1118000	B1213B	C1504B		1	
10001800GND	B1214A	B1206B		1	
I1209000	B1402B	B1408B		1	
I1004001	B1403A	B1103A		1	
I1004002	B1403A	B2511A		2	
I1003000	B1403B	B1110B		1	
I1003001	B1403B	C1908B		2	
K1200000	B1404A	C1213A		1	
K1200100	B1404B	B1203A		2	
K1200102	B1404B	C1511A		1	
I1119000	B1405B	B1212A		1	
I1119001	B1405B	C1504A		2	
I1224000	B1406B	C1212A		1	
K1201000	B1407A	B1213A		1	
K1201100	B1407B	C1203A		2	
K1201102	B1407B	D1513A		1	
R1102000	B1408A	C1403A		2	
R1102001	B1408A	B1006B		1	
I1209000	B1408B	B1402B		1	
R1201000	B1409B	D0912B		1	
R1202000	B1411A	D1403A		1	
R1101000	B1412B	C0912B		1	
1000300GND	B1413A	B1006A		1	
X1200000	B1413B	B1004A		1	
I1426001	B1502A	A1604B		2	
I1426002	B1502A	A2004B		1	
I1430000	B1503A	A2006A		1	
I1430003	B1503A	A1606A		2	
I1422000	B1504B	B1103B		1	
I1422002	B1504B	A1606B		2	
100102	B1505A	C2705A		1	
I1005002	B1505B	B1509B		2	
I1005003	B1505B	B1506B		1	
100103	B1506A	C2703B		1	
I1005003	B1506B	B1505B		1	
I1005004	B1506B	B1606B		2	
I1434000	B1507B	A2004A		1	
I1434003	B1507B	A1604A		2	
100101	B1508A	C2704A		1	
I1005000	B1508B	B1102B		2	
I1005001	B1508B	B1509B		1	
100100	B1509A	C2703A		1	
I1005001	B1509B	B1508B		1	
I1005002	B1509B	B1505B		2	
R1305000	B1510A	C1603A		1	
R1315000	B1510B	D1603A		1	
R1307000	B1511A	C1602B		1	
R1317000	B1511B	D1602B		1	
R1306000	B1512A	C1604A		1	
R1316000	B1512B	D1604A		1	
R1308000	B1513A	C1602A		1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP		7843	14	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
R1318000	B1513B	D1602A		1	
I1410000	B1602A	A2009B		1	
I1411000	B1602B	C1909B		1	
I1414000	B1603A	A2010A		1	
I1407000	B1604A	C2513A		1	
I1406001	B1604B	A2011B		1	
100098	B1605A	C2707B		1	
I1005005	B1605B	B1606B		1	
I1005006	B1605B	B1608B		2	
100099	B1606A	C2707A		1	
I1005004	B1606B	B1506B		2	
I1005005	B1606B	B1605B		1	
I1418000	B1607B	A2008A		1	
I1418002	B1607B	A1608A		2	
100097	B1608A	C2706A		1	
I1005006	B1608B	B1605B		2	
I1005007	B1608B	B1609B		1	
100096	B1609A	C2706B		1	
I1005007	B1609B	B1608B		1	
I1005008	B1609B	B1705B		2	
R1301000	B1610A	C1802B		1	
R1311000	B1610B	D1802B		1	
R1303000	B1611A	C1612B		1	
R1313000	B1611B	D1612B		1	
R1302000	B1612A	C1802A		1	
R1312000	B1612B	D1802A		1	
R1304000	B1613A	C1611A		1	
R1314000	B1613B	D1611A		1	
I1800000	B1702B	A2308A		1	
I1502000	B1703A	A2607A		1	
I1502002	B1703A	A1906B		2	
I1906000	B1704B	A2003A		1	
100104	B1705A	D2708A		1	
I1005008	B1705B	B1609B		2	
I1005009	B1705B	B1706B		1	
100095	B1706A	C2711B		1	
I1005010	B1706B	B1708B		2	
I1005009	B1706B	B1705B		1	
I1403000	B1707A	C2514A		1	
I1402001	B1707B	A2013B		1	
100116	B1708A	D2706B		1	
I1005010	B1708B	B1706B		2	
I1005011	B1708B	B1709B		1	
100063	B1709A	D2705A		1	
I1005011	B1709B	B1708B		1	
I1005012	B1709B	B1805B		2	
R1900000	B1710A	C1411A		1	
R1901000	B1710B	D1411A		1	
R1500000	B1711A	C1811A		1	
R1501000	B1711B	D1811A		1	
R1800000	B1712A	C1404A		1	
R1801000	B1712B	D1404A		1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP		7843	15	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
R1300000	B1713A	C1804A		1	
R1310000	B1713B	D1804A		1	
I3009000	B1802A	A1603A		1	
I3011000	B1802B	A2104B		1	
I2902000	B1803A	B1004B		2	
I3806000	B1804A	B2601B		1	
100087	B1805A	C2704B		1	
I1005012	B1805B	B1709B		2	
I1005013	B1805B	B1808B		1	
10003400	B1806A	C2709A		1	
I1005023	B1806B	B1808B		2	
I1005024	B1806B	A1813B		1	
I1438000	B1807B	A2012B		1	
I1438001	B1807B	D0612A		2	
10003300	B1808A	C2708A		1	
I1005023	B1808B	B1806B		2	
I1005013	B1808B	B1805B		1	
I1002001	B1809A	B1110A		2	
I1002002	B1809A	B1809B		1	
I1002002	B1809B	B1809A		1	
I1002003	B1809B	A2110B		2	
R3800000	B1810A	C1402B		1	
R3801000	B1810B	D1402B		1	
R2900000	B1811A	C1812B		1	
R2901000	B1811B	D1812B		1	
R3000000	B1812A	C1402A		1	
R3001000	B1812B	D1402A		1	
R1309000	B1813A	C1803A		1	
R1319000	B1813B	D1803A		1	
10006806	B1901A	B1904A		1	
20003001BIAS	B1902A	B1906A		2	
I2801000	B1902B	A1912A		1	
X2701101	B1903A	B2110B		2	
X2701102	B1903A	C0510B		1	
S2801000	B1903B	D0406B		1	
10006805	B1904A	B1904B		2	
10006806	B1904A	B1901A		1	
10006804	B1904B	B1906B		1	
10006805	B1904B	B1904A		2	
S2801200	B1905A	B0804B		1	
S2801100	B1905B	B0804A		1	
20003000BIAS	B1906A	A2112A		1	
20003001BIAS	B1906A	B1902A		2	
10006803 GND	B1906B	B1908A		2	
10006804	B1906B	B1904B		1	
I2809000	B1907A	B2112B		1	
S2801300	B1907B	B0806A		1	
10006802 GND	B1908A	B1910A		1	
10006803 GND	B1908A	B1906B		2	
S2800000	B1908B	B0808B		1	
S2800002	B1908B	B2111B		2	
10006800 GND	B1909B	B1911B		1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP		7843	16	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
10006801 GND	B1909B	B1910A		2	
10006801 GND	B1910A	B1909B		2	
10006802 GND	B1910A	B1908A		1	
S2800100	B1910B	B0808A		1	
S2800102	B1910B	B2112A		2	
10006800 GND	B1911B	B1909B		1	
X1602000	B2003B	B2404A		1	
I1506003	B2004A	A1907A		1	
I1506004	B2004A	A2202A		2	
I1617003	B2004B	A1313B		2	
I2103001	B2005A	A2305B		2	
K1700000	B2005B	B2204B		1	
K2601100	B2008B	B2110A		1	
K2601000	B2009B	C2804B		1	
I2302001	B2011B	B2111A		1	
10007600GND	B2102B	B2103A		2	
10007601GND	B2102B	B2114A		1	
10007600GND	B2103A	B2102B		2	
10007602GND	B2103A	B2104A		1	
10007602GND	B2104A	B2103A		1	
K2300100	B2109B	A3012B		1	
K2601100	B2110A	B2008B		1	
X2701100	B2110B	D2706A		1	
X2701101	B2110B	B1903A		2	
I2302000	B2111A	A3010B		2	
I2302001	B2111A	B2011B		1	
S2800002	B2111B	B1908B		2	
S2800102	B2112A	B1910B		2	
I2809000	B2112B	B1907A		1	
10007601GND	B2114A	B2102B		1	
X1701100	B2201A	A2513B		1	
I1614000	B2201B	A2409A		1	
K2301000	B2202A	A3011B		1	
L2501000	B2202B	A2505B		1	
L2501001	B2202B	B2203B		2	
K2300000	B2203A	B3012A		1	
L2501001	B2203B	B2202B		2	
I1406000	B2204A	A2011B		2	
K1700000	B2204B	B2005B		1	
I1703000	B2205A	A2316B		1	
I1402000	B2205B	A2013B		2	
I1709000	B2206A	A2315B		1	
I1418001	B2206B	A2008A		2	
I1430001	B2207A	A2006A		2	
I1430002	B2207A	A2608B		1	
I1434001	B2207B	A2004A		2	
I1434002	B2207B	A2609B		1	
I1717000	B2208A	B2302B		1	
I1715000	B2208B	B2302A		1	
I1426003	B2209A	A2004B		2	
I1426004	B2209A	B2501B		1	
I1422005	B2209B	A2006B		1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP		7843	17	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
I1711000	B2210A	B2303B		1	
I1713000	B2210B	B2301A		1	
I1410001	B2211A	A2009B		2	
I1705000	B2211B	A2314A		1	
I1707000	B2212A	A2315A		1	
I1414001	B2212B	A2010A		2	
I1414002	B2212B	A2511A		1	
I1701000	B2213A	A2313A		1	
L2500000	B2213B	A2504B		1	
I1713000	B2301A	B2210B		1	
S1802200	B2301B	B2812B		1	
S1802201	B2301B	C0305B		2	
I1715000	B2302A	B2208B		1	
I1717000	B2302B	B2208A		1	
S1802300	B2303A	B2812A		1	
S1802301	B2303A	C0405B		2	
I1711000	B2303B	B2210A		1	
I1821000	B2304A	B2807A		1	
20000000BIAS	B2304B	B2309A		1	
I1825000	B2305A	A2816B		1	
I1823000	B2305B	A2807B		1	
S1800100	B2306A	A2309A		1	
S1800101	B2306A	C0705B		2	
S1801300	B2307A	A2316A		1	
S1801301	B2307A	D0205B		2	
S1800000	B2307B	A2307B		1	
S1800001	B2307B	D0305B		2	
20000000BIAS	B2309A	B2304B		1	
20002000BIAS	B2309B	B2311B		1	
20002001BIAS	B2310A	B2311B		2	
20001000BIAS	B2310B	B2811B		1	
I1509000	B2311A	B2401A		1	
I1509001	B2311A	A2214A		2	
20002000BIAS	B2311B	B2309B		1	
20002001BIAS	B2311B	B2310A		2	
K1900000	B2312A	C3013B		1	
X1500000	B2312B	A2209A		1	
X1500001	B2312B	B2504A		2	
S1902001	B2313A	A2003B		2	
S1902002	B2313A	C2711A		1	
K1701001	B2313B	A2309B		2	
K1701002	B2313B	D0612B		1	
I1509000	B2401A	B2311A		1	
I1509002	B2401A	A2504A		2	
I2936000	B2401B	B1012B		1	
1001080GND	B2402A	B1013A		1	
I1613000	B2402B	C1513B		2	
I1613002	B2402B	C2715A		1	
K1601000	B2403A	C0310B		1	
I1507000	B2403B	B2503A		2	
I1507001	B2403B	B2410A		1	
X1602000	B2404A	B2003B		1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP		7843	18	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
I1618000	B2404B	A2508A		1	
I1622000	B2405A	A0605B		2	
I1622002	B2405A	B2506A		1	
I3725000	B2405B	A2605B		1	
I3721000	B2406B	A1309A		1	
Y1000000	B2408B	A0804A		1	
I1034001	B2409A	A1808B		2	
I1507001	B2410A	B2403B		1	
I3723000	B2410B	A1310A		1	
I1603000	B2411B	B2503B		1	
100035	B2412A	JA8008A		1	
I1511000	B2501A	A2205A		1	
I1511001	B2501A	A2515A		2	
I1426004	B2501B	B2209A		1	
I1602000	B2502A	A2210A		1	
A2201000	B2502B	A2715B		1	
I1507000	B2503A	B2403B		2	
I1603000	B2503B	B2411B		1	
X1500001	B2504A	B2312B		2	
X1500002	B2504A	A2805B		1	
L1501003	B2504B	A2214B		2	
L1501004	B2504B	B2708B		1	
I1519000	B2505B	A2204B		1	
I1622002	B2506A	B2405A		1	
I1605000	B2506B	A2415B		1	
I1524002	B2507B	A2507A		2	
I1524003	B2507B	A2803B		1	
100073	B2508A	JA8401A		1	
X1601000	B2508B	A2411B		1	
I1721000	B2509A	A2002A		1	
100072	B2509B	JA8408A		1	
X1700000	B2510A	A2215A		1	
I2303000	B2510B	B3013A		1	
I1004002	B2511A	B1403A		2	
I1828002	B2511B	A2412A		1	
I2406000	B2512A	D0611A		1	
I2406001	B2512A	C3017B		2	
I2405000	B2512B	D0611B		1	
I2405001	B2512B	D3001B		2	
I3824000	B2601A	B2604B		1	
I3806000	B2601B	B1804A		1	
X4000000	B2602A	C1907B		1	
I3829000	B2602B	B2606B		1	
100037	B2603A	JA8203A		1	
I3825000	B2603B	A1307A		1	
K3800100	B2604A	A2516A		1	
I3824000	B2604B	B2601A		1	
I3809000	B2605B	A1903A		1	
I3830000	B2606A	B2608B		1	
I3829000	B2606B	B2602B		1	
I3700000	B2607A	B2610B		1	
I3201000	B2607B	JA8107B		1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP		7843	19	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
100038	B2608A	JA8414B		1	
I3830000	B2608B	B2606A		1	
I3811000	B2609A	A2617B		1	
I3810000	B2609B	D0109B		1	
I1506005	B2610A	A2202A		1	
I3700000	B2610B	B2607A		1	
I3701000	B2611B	A2614B		1	
X2200100	B2705B	JA8112B		1	
X2200200	B2706A	JA8111B		1	
I1522000	B2706B	A2202B		1	
I1520000	B2707B	A2211A		1	
L1501004	B2708B	B2504B		1	
L1501005	B2708B	B2803B		2	
I2204000	B2709B	A2807A		1	
A2208200	B2711B	JA8006B		1	
A2208100	B2712B	JA8006A		1	
L2100000	B2802A	A2714A		1	
L2101000	B2802B	A2712B		1	
L1501005	B2803B	B2708B		2	
I2022000	B2804A	A2706A		1	
I2021000	B2804B	A2706B		1	
I2024000	B2805A	A2703B		1	
I2023000	B2805B	A2705B		1	
I2027000	B2806A	A2705A		1	
I2025000	B2806B	A2704A		1	
I1821000	B2807A	B2304A		1	
I2026000	B2807B	A2704B		1	
S1801200	B2808B	A2313B		1	
I2415000	B2809A	D0603B		1	
1000620GND	B2810A	B2814A		1	
S1802100	B2810B	A2317B		1	
S1802000	B2811A	A2317A		1	
20001000BIAS	B2811B	B2310B		1	
S1802300	B2812A	B2303A		1	
S1802200	B2812B	B2301B		1	
S1801101	B2813B	A2312B		2	
1000620GND	B2814A	B2810A		1	
T2300	B3003B	C2313B		1	
T2301	B3005B	C2315B		1	
K2300000	B3012A	B2203A		1	
I2303000	B3013A	B2510B		1	
20020000+20V	B3013B	JA8512A		1	
20022000 +5V	B3014B	JA8501A		1	
I4734000	C0103B	C1004A		1	
I4735000	C0104A	A0602A		1	
I4518008	C0104B	C0204B		1	
L1005002	C0105A	A0213A		1	
S1802001	C0105B	A2317A		2	
I4515003	C0106A	D0106A		2	
I4515004	C0106A	C0206A		1	
I4419003	C0106B	D0106B		2	
I4419004	C0106B	C0206B		1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP		7843	20	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
S1902000	C0107A	A2003B		1	
I4517004	C0107B	C0207B		1	
S3001001	C0108A	A1603B		2	
S2801101	C0108B	B0804A		2	
I4615004	C0109A	C0209A		2	
I4615005	C0109A	C0609A		1	
I3822000	C0109B	A1304B		1	
I4418002	C0110A	D0110A		2	
I4418003	C0110A	C0210A		1	
I2807001	C0110B	D0407B		2	
I4415003	C0111A	D0111A		2	
I4415004	C0111A	C0211A		1	
I4612000	C0111B	D0503A		2	
I4612001	C0111B	C0211B		1	
I1529000	C0112A	A2206B		1	
I4616006	C0112B	C0212B		1	
S2901001	C0113A	B0803B		2	
I4730000	C0203B	C1002A		1	
I4731000	C0204A	A0513A		1	
I4518007	C0204B	C0304B		2	
I4518008	C0204B	C0104B		1	
L1007000	C0205A	A0209B		1	
S1802101	C0205B	A2317B		2	
I4515004	C0206A	C0106A		1	
I4515005	C0206A	C0306A		2	
I4419004	C0206B	C0106B		1	
I4419005	C0206B	C0306B		2	
S1902100	C0207A	A2005B		1	
I4517003	C0207B	C0307B		2	
I4517004	C0207B	C0107B		1	
S3001101	C0208A	A1605B		2	
S2801201	C0208B	B0804B		2	
I4615003	C0209A	C0309A		1	
I4615004	C0209A	C0109A		2	
I3820000	C0209B	A1303A		1	
I4418003	C0210A	C0110A		1	
I4418004	C0210A	C0310A		2	
K3800101	C0210B	A2516A		2	
I4415004	C0211A	C0111A		1	
I4415005	C0211A	C0311A		2	
I4612001	C0211B	C0111B		1	
I4612002	C0211B	C0311B		2	
I1530000	C0212A	A2207A		1	
I4616005	C0212B	C0312B		2	
I4616006	C0212B	C0112B		1	
S2901101	C0213A	B0805A		2	
I4726000	C0303B	C1013B		1	
I4727000	C0304A	A0512B		1	
I4518006	C0304B	C0404B		1	
I4518007	C0304B	C0204B		2	
I1506000	C0305A	A0210A		2	
S1802201	C0305B	B2301B		2	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP		7843	21	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
I4515005	C0306A	C0206A		2	
I4515006	C0306A	C0406A		1	
I4419005	C0306B	C0206B		2	
I4419006	C0306B	C0406B		1	
S1902200	C0307A	A2005A		1	
I4517002	C0307B	C0407B		1	
I4517003	C0307B	C0207B		2	
S3001201	C0308A	A1605A		2	
S2801301	C0308B	B0806A		2	
I4615002	C0309A	C0409A		2	
I4615003	C0309A	C0209A		1	
I3818000	C0309B	A1307B		1	
I4418004	C0310A	C0210A		2	
I4418005	C0310A	C0410A		1	
K1601000	C0310B	B2403A		1	
I4415005	C0311A	C0211A		2	
I4415006	C0311A	C0411A		1	
I4612002	C0311B	C0211B		2	
I4612003	C0311B	C0411B		1	
I1810003	C0312A	A2512A		2	
I4616004	C0312B	C0412B		1	
I4616005	C0312B	C0212B		2	
S2901201	C0313A	B0805B		2	
I4722000	C0403B	C1011B		1	
I4723000	C0404A	A0510B		1	
I4518005	C0404B	C0504B		2	
I4518006	C0404B	C0304B		1	
X2500000	C0405A	A2403A		1	
S1802301	C0405B	B2303A		2	
I4515006	C0406A	C0306A		1	
I4515007	C0406A	C0506A		2	
I4419006	C0406B	C0306B		1	
I4419007	C0406B	C0506B		2	
S1902300	C0407A	A2007B		1	
I4517001	C0407B	C0507B		2	
I4517002	C0407B	C0307B		1	
S3001301	C0408A	A1607B		2	
S2800001	C0408B	B0808B		2	
I4615001	C0409A	C0509A		1	
I4615002	C0409A	C0309A		2	
I3816000	C0409B	A1309B		1	
I4418005	C0410A	C0310A		1	
I4418006	C0410A	C0510A		2	
I2104006	C0410B	B1002B		1	
I4415006	C0411A	C0311A		1	
I4415007	C0411A	C0511A		2	
I4612003	C0411B	C0311B		1	
I4612004	C0411B	C0511B		2	
I1726002	C0412A	A2217B		1	
I4616003	C0412B	C0512B		2	
I4616004	C0412B	C0312B		1	
S2901301	C0413A	B0809A		2	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP		7843	22	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
I4718000	C0503B	C1304A		1	
I4719000	C0504A	A0511A		1	
I4518004	C0504B	C0604B		1	
I4518005	C0504B	C0404B		2	
L1000000	C0505A	A0113A		1	
S1801000	C0505B	A2312A		1	
S1801001	C0505B	D0605A		2	
I4515007	C0506A	C0406A		2	
I4515008	C0506A	C0606A		1	
I4419007	C0506B	C0406B		2	
I4419008	C0506B	C0606B		1	
S1901000	C0507A	A2008B		1	
I4517000	C0507B	D0607B		1	
I4517001	C0507B	C0407B		2	
S3000001	C0508A	A1608B		2	
S2800101	C0508B	B0808A		2	
I4615000	C0509A	D0502A		2	
I4615001	C0509A	C0409A		1	
I3814000	C0509B	A1311B		1	
I4418006	C0510A	C0410A		2	
I4418007	C0510A	C0610A		1	
X2701102	C0510B	B1903A		1	
I4415007	C0511A	C0411A		2	
I4415008	C0511A	C0611A		1	
I4612004	C0511B	C0411B		2	
I4612005	C0511B	C0611B		1	
K2200100	C0512A	A2803A		1	
I4616002	C0512B	D0604B		1	
I4616003	C0512B	C0412B		2	
S2900001	C0513A	B0807B		2	
I4714000	C0603B	C1302A		1	
I4715000	C0604A	A0504A		1	
I4518003	C0604B	D0504B		2	
I4518004	C0604B	C0504B		1	
L1002000	C0605A	A0111A		1	
S1801100	C0605B	A2312B		1	
I4515008	C0606A	C0506A		1	
I4515009	C0606A	C0706A		2	
I4419008	C0606B	C0506B		1	
I4419009	C0606B	C0706B		2	
S1901100	C0607A	A2010B		1	
10014101 GND	C0607B	C0614A		1	
10014101 GND	C0607B	C0608B		2	
10014101 GND	C0608B	C0607B		2	
10014102 GND	C0608B	C0613A		1	
I4615005	C0609A	C0109A		1	
I3812000	C0609B	A1313A		1	
I4418007	C0610A	C0510A		1	
I1619000	C0610B	A2404A		1	
I4415008	C0611A	C0511A		1	
I4612005	C0611B	C0511B		1	
Y1000000	C0612A	A0804A		2	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP		7843	23	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
I4616000	C0612B	D0604B		2	
I4616001	C0612B	D0112B		1	
10014102 GND	C0613A	C0608B		1	
1001410GND	C0614A	C0607B		1	
I4738000	C0703B	C1702A		2	
I4739000	C0704A	A0612B		1	
10016206	C0705A	C0708A		1	
S1800101	C0705B	B2306A		2	
I4515009	C0706A	C0606A		2	
I4419009	C0706B	C0606B		2	
S1900101	C0707A	A1908B		2	
10016205 GND	C0708A	C0708B		2	
10016206	C0708A	C0705A		1	
10016204 GND	C0708B	C0709B		1	
10016205 GND	C0708B	C0708A		2	
10016203 GND	C0709B	C0710B		2	
10016204 GND	C0709B	C0708B		1	
10016202 GND	C0710B	C0712A		1	
10016203 GND	C0710B	C0709B		2	
10016201 GND	C0712A	C0713A		2	
10016202 GND	C0712A	C0710B		1	
10016200 GND	C0713A	C0714A		1	
10016201 GND	C0713A	C0712A		2	
10016200 GND	C0714A	C0713A		1	
R4404000	C0802A	D0411A		1	
R4400000	C0802B	D0412A		1	
R4604000	C0803A	D0610A		1	
I1124002	C0803B	C0804B		1	
I1124003	C0803B	C0903B		2	
R4402000	C0804A	D0410A		1	
I1124001	C0804B	C0812A		2	
I1124002	C0804B	C0803B		1	
R4602000	C0811A	D0512A		1	
I1124000	C0812A	B1112B		1	
I1124001	C0812A	C0804B		2	
R4500000	C0812B	D0513A		1	
R4507004	C0813A	C0913A		2	
R4506004	C0813B	C0913B		2	
R4504000	C0902A	D0510A		1	
R4600000	C0902B	D0511A		1	
I1124003	C0903B	C0803B		2	
I1124004	C0903B	C0904B		1	
R4502000	C0904A	D0613A		1	
I1124004	C0904B	C0903B		1	
I1124005	C0904B	C1403B		2	
R1100000	C0911A	B1207A		1	
20019000BIAS	C0912A	B1210B		1	
R1101000	C0912B	B1412B		1	
R4507003	C0913A	C1413A		1	
R4507004	C0913A	C0813A		2	
R4506003	C0913B	C1413B		1	
R4506004	C0913B	C0813B		2	

TITLE		DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP	WL	7843	24	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
I4730000	C1002A	C0203B		1	
I4730001	C1002A	D1002A		2	
I1123000	C1002B	B1202A		1	
I1123001	C1002B	C1004B		2	
100129	C1003A	C1005B		2	
100130	C1003A	C1003B		1	
100130	C1003B	C1003A		1	
I4734000	C1004A	C0103B		1	
I4734001	C1004A	D1004A		2	
I1123001	C1004B	C1002B		2	
I1123002	C1004B	C1011A		1	
100129	C1005B	C1003A		2	
100127	C1010A	C1012B		1	
I1123002	C1011A	C1004B		1	
I1123003	C1011A	C1013A		2	
I4722000	C1011B	C0403B		1	
I4722001	C1011B	D1011B		2	
100128	C1012A	C1012B		2	
100128	C1012B	C1012A		2	
100127	C1012B	C1010A		1	
I1123003	C1013A	C1011A		2	
I4726000	C1013B	C0303B		1	
I4726001	C1013B	D1013B		2	
100092	C1201A	C1212B		1	
I1226000	C1202A	D1304B		1	
I1226007	C1202A	D1004B		2	
I1225000	C1202B	B1108B		2	
K1201100	C1203A	B1407B		2	
K1201101	C1203A	B1003A		1	
20014000B1AS	C1203B	C1204A		1	
20014000B1AS	C1204A	C1203B		1	
20015000B1AS	C1204B	C1205A		1	
20015000B1AS	C1205A	C1204B		1	
20015000B1AS	C1205B	C1206A		1	
20015000B1AS	C1206A	C1205B		1	
10009000GND	C1206B	C1214A		1	
R1200000	C1207A	D0911A		1	
20017000B1AS	C1207B	C1208A		1	
20017000B1AS	C1208A	C1207B		1	
20016000B1AS	C1208B	C1209A		1	
20016000B1AS	C1209A	C1208B		1	
20018000B1AS	C1209B	C1211A		1	
L1001003	C1210A	B1210A		1	
L1001004	C1210A	C1502B		2	
10002400	C1210B	D0912A		1	
20018000B1AS	C1211A	C1209B		1	
I1224000	C1212A	B1406B		1	
I1224001	C1212A	D1504A		2	
100092	C1212B	C1201A		1	
K1200000	C1213A	B1404A		1	
K1200001	C1213A	A0313B		2	
I1223000	C1213B	D1504B		1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP		7843	25	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
10009000GND	C1214A	C1206B		1	
I4714000	C1302A	C0603B		1	
I4714001	C1302A	D1302A		2	
I1123007	C1302B	C1304B		1	
I1123008	C1302B	C1502A		2	
100126	C1303A	C1303B		1	
100125	C1303A	C1305B		2	
100126	C1303B	C1303A		1	
I4718000	C1304A	C0503B		1	
I4718001	C1304A	D1304A		2	
I1123006	C1304B	C1311A		2	
I1123007	C1304B	C1302B		1	
100125	C1305B	C1303A		2	
100123	C1310A	C1312B		1	
I1123005	C1311A	C1313A		1	
I1123006	C1311A	C1304B		2	
I4706001	C1311B	D1311B		1	
100124	C1312A	C1312B		2	
100123	C1312B	C1310A		1	
100124	C1312B	C1312A		2	
I1123004	C1313A	B1202A		2	
I1123005	C1313A	C1311A		1	
I4710001	C1313B	D1313B		1	
R3000000	C1402A	B1812A		1	
R3800000	C1402B	B1810A		1	
R1102000	C1403A	B1408A		2	
I1124005	C1403B	C0904B		2	
R1800000	C1404A	B1712A		1	
I1119002	C1404B	C1504A		1	
R1900000	C1411A	B1710A		1	
I1124006	C1412A	B1112B		2	
I1124007	C1412A	C1612A		1	
R4507002	C1413A	C1613A		2	
R4507003	C1413A	C0913A		1	
R4506002	C1413B	C1613B		2	
R4506003	C1413B	C0913B		1	
I1123008	C1502A	C1302B		2	
I1123009	C1502A	C1704B		1	
L1001004	C1502B	C1210A		2	
L1001005	C1502B	D1502B		1	
100023	C1503A	C1503B		1	
100023	C1503B	C1503A		1	
100022	C1503B	C1505B		2	
I1119001	C1504A	B1405B		2	
I1119002	C1504A	C1404B		1	
I1118000	C1504B	B1213B		1	
100022	C1505B	C1503B		2	
10011000	C1510A	C1512A		1	
K1200102	C1511A	B1404B		1	
K1200103	C1511A	C1513A		2	
I1624000	C1511B	A1809B		1	
I1624001	C1511B	D1511B		2	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP		7843	26	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
100112	C1512A	C1512B		2	
10011000	C1512A	C1510A		1	
100112	C1512B	C1512A		2	
K1200103	C1513A	C1511A		2	
I1613000	C1513B	B2402B		2	
I1613001	C1513B	D1513B		1	
R1308000	C1602A	B1513A		1	
R1307000	C1602B	B1511A		1	
R1305000	C1603A	B1510A		1	
I1124010	C1603B	C1711A		2	
I1124009	C1603B	C1604B		1	
R1306000	C1604A	B1512A		1	
I1124008	C1604B	C1612A		2	
I1124009	C1604B	C1603B		1	
R1304000	C1611A	B1613A		1	
I1124007	C1612A	C1412A		1	
I1124008	C1612A	C1604B		2	
R1303000	C1612B	B1611A		1	
R4507001	C1613A	C1813A		1	
R4507002	C1613A	C1413A		2	
R4506001	C1613B	C1813B		1	
R4506002	C1613B	C1413B		2	
I4738000	C1702A	C0703B		2	
I4738001	C1702A	D1702A		1	
I1123010	C1702B	C1704B		2	
100114	C1703A	C1703B		1	
100122	C1703B	C1705B		2	
100114	C1703B	C1703A		1	
I4702001	C1704A	D1704A		1	
I1123010	C1704B	C1702B		2	
I1123009	C1704B	C1502A		1	
100122	C1705B	C1703B		2	
T4201100	C1709A	D1709B		1	
T4201200	C1709B	D1709A		1	
10004000BIAS	C1710A	C1712B		1	
I1124010	C1711A	C1603B		2	
I1124011	C1711A	C1803B		1	
I1621001	C1711B	A2412B		2	
I1621003	C1711B	D1711B		1	
I1005025	C1712A	A1813B		2	
10004000BIAS	C1712B	C1710A		1	
I3705005	C1713A	D1713A		1	
I4203100	C1713B	D2911A		1	
R1302000	C1802A	B1612A		1	
R1301000	C1802B	B1610A		1	
R1309000	C1803A	B1813A		1	
I1124011	C1803B	C1711A		1	
I1124012	C1803B	C1804B		2	
R1300000	C1804A	B1713A		1	
I1124012	C1804B	C1803B		2	
I1124013	C1804B	C1812A		1	
R1500000	C1811A	B1711A		1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP		7843	27	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
I1124013	C1812A	C1804B		1	
I1124014	C1812A	C2003A		2	
R2900000	C1812B	B1811A		1	
R4507000	C1813A	C2002A		2	
R4507001	C1813A	C1613A		1	
R4506000	C1813B	C2002B		2	
R4506001	C1813B	C1613B		1	
K4003000	C1902B	D2908B		1	
R4002001	C1903A	C1903B		2	
R4002000	C1903B	D2003B		1	
R4002001	C1903B	C1903A		2	
R4000001	C1904A	C1904B		2	
R4000000	C1904B	C2003B		1	
R4000001	C1904B	C1904A		2	
R4001000	C1905A	C2011B		1	
R4001001	C1905A	C1905B		2	
R4001001	C1905B	C1905A		2	
R4003000	C1906A	D2011B		1	
R4003001	C1906A	C1906B		2	
R4003001	C1906B	C1906A		2	
I3705000	C1907A	A2610B		1	
I3705002	C1907A	C2011A		2	
X4000000	C1907B	B2602A		1	
L1001006	C1908A	D1502B		2	
L1001007	C1908A	A2509B		1	
I1003001	C1908B	B1403B		2	
K3904000	C1909A	C2817B		1	
I1411000	C1909B	B1602B		1	
I4006000	C1910A	A2517A		1	
I1502004	C1911B	B1102A		2	
I1538000	C1912A	A2517B		1	
R4507000	C2002A	C1813A		2	
R4506000	C2002B	C1813B		2	
I1124014	C2003A	C1812A		2	
R4000000	C2003B	C1904B		1	
I3705002	C2011A	C1907A		2	
I3705003	C2011A	D2011A		1	
R4001000	C2011B	C1905A		1	
I3703001	C2012A	C2105B		2	
I3703002	C2012A	D2012A		1	
K3903002	C2012B	D2012B		1	
K3903003	C2012B	A2612B		2	
K3603001	C2013A	C2415B		2	
K3603002	C2013A	D2013A		1	
K3602002	C2013B	D2013B		1	
I3703000	C2105B	A2611B		1	
I3703001	C2105B	C2012A		2	
I3423000	C2114B	JA8108A		1	
K3403100	C2209B	C2504B		1	
10001100	C2215B	C2314A		1	
T2300	C2313B	B3003B		1	
10001100	C2314A	C2215B		1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP		7843	28	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
T2301	C2315B	B3005B		1	
I3619000	C2409B	C2509B		1	
K3500000	C2411B	C2511B		1	
I3624000	C2412B	C2512B		1	
K3603000	C2415B	D2712B		1	
K3603001	C2415B	C2013A		2	
10018300	C2501A	C2508A		1	
K3403100	C2504B	C2209B		1	
10018300	C2508A	C2501A		1	
I3619000	C2509B	C2409B		1	
K3500000	C2511B	C2411B		1	
I3624000	C2512B	C2412B		1	
I1407000	C2513A	B1604A		1	
100042	C2513B	JA8404A		1	
I1403000	C2514A	B1707A		1	
100041	C2514B	JA8409A		1	
100100	C2703A	B1509A		1	
100103	C2703B	B1506A		1	
100101	C2704A	B1508A		1	
100087	C2704B	B1805A		1	
100102	C2705A	B1505A		1	
100121	C2705B	A0602B		1	
100097	C2706A	B1608A		1	
100096	C2706B	B1609A		1	
100099	C2707A	B1606A		1	
100098	C2707B	B1605A		1	
10003300	C2708A	B1808A		1	
10003400	C2709A	B1806A		1	
I2104000	C2709B	A2808B		1	
I2104001	C2709B	A2607B		2	
S1902101	C2710A	A2005B		2	
S1902002	C2711A	B2313A		1	
100095	C2711B	B1706A		1	
S1902201	C2712A	A2005A		2	
I1617001	C2712B	A2606B		1	
S1901001	C2713A	A2008B		2	
S1902301	C2713B	A2007B		2	
S1900102	C2714A	A2012A		2	
S1901101	C2714B	A2010B		2	
I1613002	C2715A	B2402B		1	
S1900002	C2715B	A2013A		2	
S1901302	C2716A	A2011A		2	
S1901201	C2716B	A2009A		2	
100055	C2717A	A0502B		1	
10000000 GND	C2717B	D2714A		1	
K2601000	C2804B	B2009B		1	
K3904000	C2817B	C1909A		1	
10016100	C2901A	C2909B		1	
I4114000	C2904B	A2614A		1	
I4113000	C2905B	A2613A		1	
10016100	C2909B	C2901A		1	
A2310000	C3007B	A3009B		1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP		7843	29	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
A2404000	C3008B	A2710B		1	
K1900000	C3013B	B2312A		1	
I2406001	C3017B	B2512A		2	
I4710000	D0103B	D1313B		2	
I4711000	D0104A	A0505B		1	
I4518002	D0104B	D0204B		1	
L1502000	D0105A	A0208B		1	
S1801201	D0105B	A2313B		2	
I4515002	D0106A	D0206A		1	
I4515003	D0106A	C0106A		2	
I4419002	D0106B	D0206B		1	
I4419003	D0106B	C0106B		2	
S1901200	D0107A	A2009A		1	
10014202 GND	D0108A	D0112A		2	
10014203 GND	D0108A	D0108B		1	
10014203 GND	D0108B	D0108A		1	
I3810000	D0109B	B2609B		1	
I4418001	D0110A	D0310A		1	
I4418002	D0110A	C0110A		2	
I3108000	D0110B	A1704B		1	
I4415002	D0111A	D0211A		1	
I4415003	D0111A	C0111A		2	
10014201 GND	D0112A	D0113A		1	
10014202 GND	D0112A	D0108A		2	
I4616001	D0112B	C0612B		1	
10014200 GND	D0113A	D0114A		2	
10014201 GND	D0113A	D0112A		1	
10014200 GND	D0114A	D0113A		2	
I4706000	D0203B	D1311B		2	
I4707000	D0204A	A0503B		1	
I4518001	D0204B	D0304B		2	
I4518002	D0204B	D0104B		1	
10000605	D0205A	D0305A		1	
S1801301	D0205B	B2307A		2	
I4515001	D0206A	D0306A		2	
I4515002	D0206A	D0106A		1	
I4419001	D0206B	D0306B		2	
I4419002	D0206B	D0106B		1	
S1901301	D0207A	A1909A		2	
1001480GND	D0207B	D0209A		1	
1001480GND	D0209A	D0207B		1	
1001470GND	D0209A	D0210A		2	
100145	D0210A	D0211B		1	
1001470GND	D0210A	D0209A		2	
10018900	D0210B	D0214A		2	
I4415001	D0211A	D0311A		2	
I4415002	D0211A	D0111A		1	
100145	D0211B	D0210A		1	
1001460GND	D0211B	D0212B		2	
100149	D0212B	D0214A		1	
1001460GND	D0212B	D0211B		2	
100149	D0214A	D0212B		1	

TITLE		DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP	WL	7843	30	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
10018900	D0214A	D0210B		2	
I4702000	D0303B	D1704A		2	
I4703000	D0304A	A0502A		1	
I4518000	D0304B	D0504B		1	
I4518001	D0304B	D0204B		2	
10000604	D0305A	A0311A		2	
10000605	D0305A	D0205A		1	
S1800001	D0305B	B2307B		2	
I4515000	D0306A	D0507B		1	
I4515001	D0306A	D0206A		2	
I4419000	D0306B	D0403A		1	
I4419001	D0306B	D0206B		2	
S1900001	D0307A	A1913B		2	
100152	D0307B	D0311B		2	
I2808000	D0308B	D0407A		1	
I4615006	D0309A	D0502A		1	
I3827001	D0309B	A1904A		2	
I4418000	D0310A	D0404B		2	
I4418001	D0310A	D0110A		1	
10018800	D0310B	D0414A		1	
I4415000	D0311A	D0402A		1	
I4415001	D0311A	D0211A		2	
100150	D0311B	D0312B		1	
100152	D0311B	D0307B		2	
100153	D0312B	D0314A		2	
100150	D0312B	D0311B		1	
100153	D0314A	D0312B		2	
I4415000	D0402A	D0311A		1	
I4419000	D0403A	D0306B		1	
I4418000	D0404B	D0310A		2	
100047	D0405A	JA8506B		1	
I1005022	D0405B	D0408B		1	
K2800000	D0406A	A2110A		1	
S2801000	D0406B	B1903B		1	
I2808000	D0407A	D0308B		1	
I2807000	D0407B	D2707A		1	
I2807001	D0407B	C0110B		2	
100045	D0408A	JA8510B		1	
I1005021	D0408B	D0409B		2	
I1005022	D0408B	D0405B		1	
100046	D0409A	JA8504B		1	
I1005020	D0409B	D0506B		1	
I1005021	D0409B	D0408B		2	
R4402000	D0410A	C0804A		1	
R4403000	D0410B	D0804A		1	
R4404000	D0411A	C0802A		1	
R4405000	D0411B	D0802A		1	
R4400000	D0412A	C0802B		1	
R4401000	D0412B	D0802B		1	
20004000BIAS	D0413A	D0413B		1	
20004000BIAS	D0413B	D0413A		1	
10018800	D0414A	D0310B		1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP		7843	31	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
I4615000	D0502A	C0509A		2	
I4615006	D0502A	D0309A		1	
I4612000	D0503A	C0111B		2	
I4518000	D0504B	D0304B		1	
I4518003	D0504B	C0604B		2	
100052	D0505A	JA8505B		1	
I1005018	D0505B	D0509B		1	
I1005019	D0505B	D0506B		2	
100048	D0506A	JA8503B		1	
I1005020	D0506B	D0409B		1	
I1005019	D0506B	D0505B		2	
I4515000	D0507B	D0306A		1	
100053	D0508A	JA8507B		1	
I1005016	D0508B	D0606B		1	
I1005017	D0508B	D0509B		2	
100050	D0509A	JA8501B		1	
I1005017	D0509B	D0508B		2	
I1005018	D0509B	D0505B		1	
R4504000	D0510A	C0902A		1	
R4505000	D0510B	D0902A		1	
R4600000	D0511A	C0902B		1	
R4601000	D0511B	D0902B		1	
R4602000	D0512A	C0811A		1	
R4603000	D0512B	D0811A		1	
R4500000	D0513A	C0812B		1	
R4501000	D0513B	D0812B		1	
I1733000	D0602B	A2314B		1	
I2415000	D0603B	B2809A		1	
I4616000	D0604B	C0612B		2	
I4616002	D0604B	C0512B		1	
S1801001	D0605A	C0505B		2	
S1801002	D0605A	D0605B		1	
S1801002	D0605B	D0605A		1	
100049	D0606A	JA8502B		1	
I1005015	D0606B	D0609B		2	
I1005016	D0606B	D0508B		1	
I4517000	D0607B	C0507B		1	
I1535002	D0608A	D0608B		1	
I1535001	D0608B	A2212A		2	
I1535002	D0608B	D0608A		1	
100054	D0609A	JA8509B		1	
I1005014	D0609B	B1102B		1	
I1005015	D0609B	D0606B		2	
R4604000	D0610A	C0803A		1	
R4605000	D0610B	D0803A		1	
I2406000	D0611A	B2512A		1	
I2405000	D0611B	B2512B		1	
I1438001	D0612A	B1807B		2	
K1701002	D0612B	B2313B		1	
R4502000	D0613A	C0904A		1	
R4503000	D0613B	D0904A		1	
R4405000	D0802A	D0411B		1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP		7843	32	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
R4401000	D0802B	D0412B		1	
R4605000	D0803A	D0610B		1	
I1227000	D0803B	B1113B		1	
I1227001	D0803B	D0804B		2	
R4403000	D0804A	D0410B		1	
I1227001	D0804B	D0803B		2	
I1227002	D0804B	D0812A		1	
R4603000	D0811A	D0512B		1	
I1227002	D0812A	D0804B		1	
I1227003	D0812A	D0903B		2	
R4501000	D0812B	D0513B		1	
R4509004	D0813A	D0913A		2	
R4508004	D0813B	D0913B		2	
R4505000	D0902A	D0510B		1	
R4601000	D0902B	D0511B		1	
I1227003	D0903B	D0812A		2	
I1227004	D0903B	D0904B		1	
R4503000	D0904A	D0613B		1	
I1227004	D0904B	D0903B		1	
I1227005	D0904B	D1403B		2	
R1200000	D0911A	C1207A		1	
10002400	D0912A	C1210B		1	
R1201000	D0912B	B1409B		1	
R4509003	D0913A	D1413A		1	
R4509004	D0913A	D0813A		2	
R4508003	D0913B	D1413B		1	
R4508004	D0913B	D0813B		2	
I4730001	D1002A	C1002A		2	
I1226008	D1002B	D1004B		1	
I1226009	D1002B	D1011A		2	
10013901	D1003A	D1003B		1	
10013800	D1003B	D1005B		2	
10013901	D1003B	D1003A		1	
I4734001	D1004A	C1004A		2	
I1226007	D1004B	C1202A		2	
I1226008	D1004B	D1002B		1	
10013800	D1005B	D1003B		2	
10013600	D1010A	D1012A		1	
I1226010	D1011A	D1013A		1	
I1226009	D1011A	D1002B		2	
I4722001	D1011B	C1011B		2	
10013600	D1012A	D1010A		1	
10013701	D1012A	D1012B		2	
10013701	D1012B	D1012A		2	
I1226010	D1013A	D1011A		1	
I4726001	D1013B	C1013B		2	
I4714001	D1302A	C1302A		2	
I1226001	D1302B	D1304B		2	
I1226002	D1302B	D1313A		1	
10013501	D1303A	D1303B		1	
10013400	D1303B	D1305B		2	
10013501	D1303B	D1303A		1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP		7843	33	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
I4718001	D1304A	C1304A		2	
I1226000	D1304B	C1202A		1	
I1226001	D1304B	D1302B		2	
10013400	D1305B	D1303B		2	
10013200	D1310A	D1312A		1	
I1226003	D1311A	D1313A		2	
I1226004	D1311A	D1502A		1	
I4706000	D1311B	D0203B		2	
I4706001	D1311B	C1311B		1	
10013200	D1312A	D1310A		1	
10013301	D1312A	D1312B		2	
10013301	D1312B	D1312A		2	
R1202000	D1403A	B1411A		1	
I1227005	D1403B	D0904B		2	
R1801000	D1404A	B1712B		1	
I1224002	D1404B	D1504A		1	
R1901000	D1411A	B1710B		1	
I1227006	D1412A	B1113B		2	
I1227007	D1412A	D1612A		1	
R4509002	D1413A	D1613A		2	
R4508002	D1413B	D1613B		2	
L1001006	D1502B	C1908A		2	
10009401	D1503A	D1503B		1	
10009300	D1503B	D1505B		2	
10009401	D1503B	D1503A		1	
I1224001	D1504A	C1212A		2	
I1224002	D1504A	D1404B		1	
I1223000	D1504B	C1213B		1	
10009300	D1505B	D1503B		2	
100111	D1510A	D1512A		1	
K1201103	D1511A	D1513A		2	
I1624001	D1511B	C1511B		2	
100113	D1512A	D1512B		2	
100111	D1512A	D1510A		1	
100113	D1512B	D1512A		2	
K1201102	D1513A	B1407B		1	
K1201103	D1513A	D1511A		2	
I1613001	D1513B	C1513B		1	
R1318000	D1602A	B1513B		1	
R1317000	D1602B	B1511B		1	
R1315000	D1603A	B1510B		1	

TITLE		WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP			7843	34	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
I1227010	D1603B	D1711A		2	
I1227009	D1603B	D1604B		1	
R1316000	D1604A	B1512B		1	
I1227008	D1604B	D1612A		2	
I1227009	D1604B	D1603B		1	
R1314000	D1611A	B1613B		1	
I1227007	D1612A	D1412A		1	
I1227008	D1612A	D1604B		2	
R1313000	D1612B	B1611B		1	
R4509001	D1613A	D1813A		1	
R4509002	D1613A	D1413A		2	
R4508001	D1613B	D1813B		1	
R4508002	D1613B	D1413B		2	
I4738001	D1702A	C1702A		1	
I1226006	D1702B	D1704B		1	
100115	D1703A	D1703B		1	
100115	D1703B	D1703A		1	
10013100	D1703B	D1705B		2	
I4702000	D1704A	D0303B		2	
I4702001	D1704A	C1704A		1	
I1226005	D1704B	D1502A		2	
I1226006	D1704B	D1702B		1	
10013100	D1705B	D1703B		2	
T4201200	D1709A	C1709B		1	
T4201100	D1709B	C1709A		1	
10016400BIAS	D1710A	D1712B		1	
I1227010	D1711A	D1603B		2	
I1227011	D1711A	D1803B		1	
I1621003	D1711B	C1711B		1	
I4216000	D1712A	A1813A		1	
10016400BIAS	D1712B	D1710A		1	
I3705004	D1713A	D2011A		2	
I3705005	D1713A	C1713A		1	
10015500	D1713B	D2710B		1	
R1312000	D1802A	B1612B		1	
R1311000	D1802B	B1610B		1	
R1319000	D1803A	B1813B		1	
I1227011	D1803B	D1711A		1	
I1227012	D1803B	D1804B		2	
R1310000	D1804A	B1713B		1	
I1227012	D1804B	D1803B		2	
I1227013	D1804B	D1812A		1	
R1501000	D1811A	B1711B		1	
I1227013	D1812A	D1804B		1	
I1227014	D1812A	D2003A		2	
R2901000	D1812B	B1811B		1	
R4509000	D1813A	D2002A		2	
R4509001	D1813A	D1613A		1	
R4508000	D1813B	D2002B		2	
R4508001	D1813B	D1613B		1	
R4509000	D2002A	D1813A		2	
R4508000	D2002B	D1813B		2	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP		7843	35	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
I1227014	D2003A	D1812A		2	
R4002000	D2003B	C1903B		1	
I3705003	D2011A	C2011A		1	
I3705004	D2011A	D1713A		2	
R4003000	D2011B	C1906A		1	
I3703002	D2012A	C2012A		1	
I3703003	D2012A	D2405B		2	
K3903001	D2012B	D2811B		2	
K3903002	D2012B	C2012B		1	
K3603002	D2013A	C2013A		1	
K3602001	D2013B	D2508B		2	
K3602002	D2013B	C2013B		1	
A3400100	D2107B	D2207B		1	
A3400000	D2108B	D2208B		1	
A3400100	D2207B	D2107B		1	
A3400000	D2208B	D2108B		1	
X3501000	D2404B	D2504B		1	
I3703003	D2405B	D2012A		2	
I3618000	D2409B	D2509B		1	
I3617000	D2410B	D2510B		1	
X3501000	D2504B	D2404B		1	
K3602000	D2508B	D2708B		1	
K3602001	D2508B	D2013B		2	
I3618000	D2509B	D2409B		1	
I3617000	D2510B	D2410B		1	
10016300	D2701A	A0612A		1	
100044	D2701B	JA8508B		1	
100056	D2702A	A0503A		1	
L1001008	D2702B	A2509B		2	
100057	D2703A	A0505A		1	
100039	D2703B	A1905A		1	
100058	D2704A	A0504B		1	
I3105000	D2704B	A1705A		2	
100063	D2705A	B1709A		1	
X2701100	D2706A	B2110B		1	
100116	D2706B	B1708A		1	
I2807000	D2707A	D0407B		1	
100104	D2708A	B1705A		1	
K3602000	D2708B	D2508B		1	
100117	D2709A	A0511B		1	
100118	D2710A	A0510A		1	
10015500	D2710B	D1713B		1	
100119	D2711A	A0512A		1	
100120	D2712A	A0513B		1	
K3603000	D2712B	C2415B		1	
10000000 GND	D2714A	C2717B		1	
K3903100	D2810B	D2910A		1	
K3903101	D2810B	A2613B		2	
K3903000	D2811B	D2911B		1	
K3903001	D2811B	D2012B		2	
K4003000	D2908B	C1902B		1	
K3903100	D2910A	D2810B		1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP		7843	36	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
I4203100	D2911A	C1713B		1	
K3903000	D2911B	D2811B		1	
I2405001	D3001B	B2512B		2	
A2002000	D3002B	A2703A		1	
100005	JA8001A	A0103B		1	
100009	JA8002A	A0204B		1	
100107	JA8002B	A0204A		1	
L1012000	JA8003A	A0803A		1	
L1017000	JA8003B	A0308A		1	
100003	JA8004A	JA8412B		1	
10000600	JA8004B	A0311B		2	
10000700	JA8005A	A2715A		1	
10000701	JA8005B	A2711B		1	
A2208100	JA8006A	B2712B		1	
A2208200	JA8006B	B2711B		1	
100035	JA8008A	B2412A		1	
I3116000	JA8101A	A1710A		1	
I3114000	JA8101B	A1710B		1	
I3112000	JA8102A	A1712B		1	
I3110000	JA8102B	A1712A		1	
I3126000	JA8103A	A1706B		1	
I3124000	JA8103B	A1706A		1	
I3122000	JA8104A	A1707B		1	
I3120000	JA8104B	A1707A		1	
I3128000	JA8105A	A1702A		1	
I1910000	JA8105B	A1909B		1	
K3800004	JA8106A	A0610B		1	
I1909000	JA8106B	A1913A		1	
I3201000	JA8107B	B2607B		1	
I3423000	JA8108A	C2114B		1	
I1911000	JA8108B	A1902A		1	
100085	JA8109A	A0807B		1	
100086	JA8109B	A0601A		1	
100105	JA8110A	A0203B		1	
100008	JA8110B	A0202B		1	
X2200200	JA8111B	B2706A		1	
100106	JA8112A	A0203A		1	
X2200100	JA8112B	B2705B		1	
100065	JA8113B	A1001A		1	
X4300000	JA8114A	A1907B		1	
10018400	JA8114B	A0901A		1	
L1008000	JA8201A	A0307B		1	
L1009000	JA8201B	A0306B		1	
L1010000	JA8202A	A0306A		1	
L1011000	JA8202B	A0309B		1	
100037	JA8203A	B2603A		1	
L1100000	JA8203B	A0308B		1	
L1013000	JA8204A	A0606B		1	
L1014000	JA8204B	A0606A		1	
L1015000	JA8205A	A0609B		1	
L1016000	JA8205B	A0609A		1	
L1101000	JA8206A	A0307A		1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIRE WRAP		7843	37	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
100001	JA8208B	A0102B		1	
100073	JA8401A	B2508A		1	
100004	JA8401B	A0102A		1	
100042	JA8404A	C2513B		1	
100072	JA8408A	B2509B		1	
100041	JA8409A	C2514B		1	
100173000	JA8410A	A2301A		1	
100002	JA8411B	A1703A		1	
100003	JA8412B	JA8004A		1	
100038	JA8414B	B2608A		1	
20022000 +5V	JA8501A	B3014B		1	
100050	JA8501B	D0509A		1	
L4807000	JA8502A	A0508B		1	
100049	JA8502B	D0606A		1	
L4808000	JA8503A	A0607A		1	
100048	JA8503B	D0506A		1	
L4806000	JA8504A	A0508A		1	
100046	JA8504B	D0409A		1	
L4805000	JA8505A	A0509A		1	
100052	JA8505B	D0505A		1	
L4804000	JA8506A	A0509B		1	
100047	JA8506B	D0405A		1	
L4803000	JA8507A	A0506A		1	
100053	JA8507B	D0508A		1	
L4802000	JA8508A	A0506B		1	
100044	JA8508B	D2701B		1	
L4801000	JA8509A	A0507B		1	
100054	JA8509B	D0609A		1	
L4800000	JA8510A	A0507A		1	
100045	JA8510B	D0408A		1	
L3800000	JA8511A	A0607B		1	
L4809000	JA8511B	A0608A		1	
20020000+20V	JA8512A	B3013B		1	
20021000-20V	JA8513A	A3002B		1	
20023000 -5V	JA8514A	A3001B		1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
READ/WRITE WIRE WRAP (Ref: 76509500)		7095	1 OF 2	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
A33051	F0308B	F0408B		1	
A33052	F0307B	F0407B		1	
Current Sense	E0310B	JE8009A		1	
I19090	F0108B	JE8006B		1	
I19100	F0109B	JE8005B		1	
I19110	F0107B	JE8008B		1	
I31100	E0203B	JE8002B		1	
I31120	E0203A	JE8002A		1	
I31140	E0204B	JE8001B		1	
I31160	E0204A	JE8001A		1	
I31200	F0211A	JE8004B		1	
I31220	F0211B	JE8004A		1	
I31240	F0212A	JE8003B		1	
I31260	F0212B	JE8003A		1	
I31280	E0016B	JE8005A		1	
I31280	F0411B	JE8005A		2	
I32010	E0117A	F0410B		1	
I32010	E0117A	JE8007B		2	
I32020	F0012B	F0409B		1	
I34230	F0309B	JE8008A		1	
I43080	E0114B	JE8007A		1	
K38002	F0106B	JE8006A		1	
L32000	E0006B	E0205B		1	
L32010	E0007B	F0201B		1	
L32020	E0008A	E0206B		1	
L32030	E0008B	F0202B		1	
L32040	E0010A	E0207B		1	
L32050	E0011B	F0203B		1	
L32060	E0011A	E0208B		1	
L32070	E0012B	F0204B		1	
L32080	E0012A	E0209B		1	
L32090	E0013A	F0205B		1	
L32100	E0210B	F0002A		1	
L32110	F0003A	F0206B		1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
READ/WRITE WIRE WRAP		7095	2 OF 2	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
L32120	E0211B	F0003B		1	
L32130	F0004B	F0207B		1	
L32140	E0212B	F0006B		1	
L32150	F0007B	F0208B		1	
L32160	E0213B	F0008B		1	
L32170	F0009A	F0209B		1	
L32180	E0214B	F0010B		1	
L43021	E0005B	E0107B		1	
L43022	E0003B	E0104B		1	
Write +20V	F0113B	JE8100A		1	
X43002	E0114A	JE8014A		1	
Y32000	E0113B	F0011B		1	
430000	E0401A	JE8014B		1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC HARNESS (Ref: 76505600)		7056	1 OF 5	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
1	A2TB2 14	A2C11 +	2		
2	A2TB2 1	A2C11 -	0		
3	A2CB2 2	A2TB1 6	2		
4	A2A2P1 17	A2A2P2 8	4		
5	A2A2P2 9	A2TB4 7	4		
6					
7	A2TB2 13	A2TB4 8	4		
8	A2TB2 6	A2C6 +	2		
9					
10	A2TB2 2	A2C6 -	0		
11	A2TB2 2	A2TB3 2	0		
12	A2TB2 1	A2TB3 1	0		
13	A2TB2 7	A2C8 -	6		
14	A2PA80 1B	Dead End	0		
15	A2TB2 8	A2C5 +	2		
16	A2C5 +	A2R1 T	2		
17	A2C5 +	A2CB2 1	2		
18	A2TB2 9	A2C10 -	6		
19	A2C10 -	A2R1 3	6		
20	A2C10 -	A2CB3 1	6		
21	A2TB2 10	A2C3 +	2		
22	A2C3 +	A2R5 T	2		
23	A2C3 +	A2CB4 1	2		
24	A2TB3 2	A2C3 -	0		
25					
26	A2C3 +	A2R5 B	0		
27	A2C1 +	A2R4 T	0		
28					
29	A2C2 +	A2A1TB16	0		
30	A2TB2 11	A2C1 -	6		
31	A2C1 -	A2R4 B	6		
32	A2C1 -	A2CB5 1	6		
33	A2TB2 12	A2K5B NO	6		
34	A2TB2 12	A2K6 NO	6		

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC HARNESS		7056	2	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
35	A2TB1 8	A2A2P2 16	0		
36					
37	A2TB2 5	A2A2P1 10	2		
38	A2TB2 16	A2A2P1 6	2		
39	A2L1 2	A2C7 +	2		
40	A2R2 T	A2L1 2	2		
41	A2CB1A 1	A2C7 +	2		
42	A2TB2 3	A2TB3 1	0		
43	A2CB1A 2	A2A2P1 13	2		
44	A2CB1A 2	A2TB1 1	2		
45	A2TB1 1	A2PB30 13B	2		
46	A2TB1 1	A2PD30 13B	2		
47	A2L2 2	A2C9 -	6		
48	A2R2 B	A2L2 2	6		
49	A2CB1B 1	A2C9 -	6		
50	A2CB1B 2	A2TB1 2	6		
51	A2TB1 2	A2PA30 2B	6		
52	A2TB1 2	A2PC30 2B	6		
53	A2CB2 2	A2A5 Un-Reg	2		
54	A2CB2 2	A2A3P1 8	2		
55	A2CB3 2	A2A7 Un-Reg	6		
56	A2CB3 2	A2TB1 7	6		
57	A2TB2 2	A2TB3 3	0		
58	A2TB2 4	A2A3P1 13	4		
59	A2CB4 2	A2A1TB1 2	2		
60	A2CB4 2	A2A6 +	2		
61	A2CB5 2	A2A1TB1 10	6		
62	A2CB5 2	A2A6 -	6		
63	A2K6 C	A2C2 -	6		
64	A2K5B C	A2C2 -	6		
65	A2C2 -	A2K5A NC	6		
66	A2C2 -	A2A3P1 14	6		
67	A2A5 Reg	A2TB1 3	2		
68	A2TB1 3	Logic Vcc+ Top	2		

TITLE		WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC HARNESS			7056	3	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
69	A2A7 Reg	A2TB1 4	6		
70	A2TB1 4	Logic Vcc- Top	6		
71	A2TB1 4	Logic Vcc- Bot	6		
72	A2TB1 3	Logic Vcc+ Bot	2		
73					
74	A2A2P2 4	A2C11 +	2		
75	Dead End	A2C11 +	2		
76	A2A2P1 8	A2C11 +	2		
77	A2A3P1 6	A2C11 +	2		
78	A2DS1 B	A2C11 +	2		
79	A2C11 +	A2TB1 16	2		
80	A2DS1 B	A2S1-B1	2		
81	A2C11 -	A2C8 +	0		
82					
83	A2TB1 8	A2A2P2 6	0		
84	A2TB1 8	A2S2 -	0		
85	A2TB1 8	A2A3P1 10	0		
86	A2TB1 8	A2A2P2 1	0		
87	A2TB1 9	A2CB3 3	0		
88	A2TB1 9	A2S1 A2	0		
89	A2TB1 9	A2DS1 T	0		
90	A2TB1 9	Dead End	0		
91	A2C6 +	A2L1 1	2		
92	Dead End	A2TB4 9	2		
93	Dead End	A2TB4 1	2		
94	A2C7 -	A2C9 +	0		
95	A2C9 +	A2C5 -	0		
96					
97	A2TB2 1	A2A5 Gnd	0		
98	A2TB2 1	A2A7 Gnd	0		
99	A2C8 -	A2L2 1	6		
100					
101					
102	A2C8 +	A2TB1 9	0		

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC HARNESS		7056	4	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
103	A2A3P1 7	A2TB1 12	0		
104	A2K6 2	A2TB1 12	0		
105	A2A2P1 1	A2TB1 8	0		
106	A2A3P1 5	A2K5 AL	2		
107	A2K5 BL	A2A3P1 4	0		
108	A2K5 BL	A2A2P2 2	0		
109	A2A3P1 2	A2TB1 5	2		
110	A2A3P1 3	A2A2P1 12	2		
111	A2A3P1 11	A2K6 1	2		
112	A2TB1 5	A2PA80 8B	2		
113	A2A3P1 1	A2A2P1 7	2		
114	A2A3P1 12	A2PA80 8A	6		
115					
116					
117	A2A2P2 5	A2TB1 15	4		
118	A2A2P2 3	A2PA80 2B	0		
119	A2A2P1 5	A2TB4 3	0		
120	A2TB4 3	A2S1 B2	0		
121	A2A2P1 3	A2TB4 2	0		
122	A2A2P1 4	A2TB4 4	2		
123	A2TB4 4	Dead End	2		
124	SS	A2TB4 1	0		
125	A2A2P1 18	A2TB4 5	2		
126	A2A2P1 16	A2TB4 6	2		
127	A2A2P1 11	A2PA80 3A	0		
128	A2A2P2 10	A2PA80 3B	0		
129	A2A2P1 9	A2TB1 14	0		
130	A2A2P1 14	A2PA80 2A	4		
131	A2A2P1 15	A2TB1 13	2		
132					
133	A2CB1 3	A2TB2 15	0		
134	A2S1 A1	A2PA80 1A	4		
135	Dead End	A2PA80 7B	0		
136	A2CB3 4	A2CB2 4	0		

TITLE		WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC HARNESS			7056	5	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
137	A2CB3 4	A2PA80 7A	0		
138	A2CB3 5	A2CB2 3	0		
139	A2CB2 5	A2CB1 3	0		
140	A2CB1 5	A2CB5 3	0		
141	A2CB5 5	A2CB4 3	0		
142	A2CB4 5	A2TB1 11	0		
143	A2S2 L	A2PA80 4B	4		
144	A2S2 +	A2TB1 1	2		
145					
145A	A2PA80 5A	A2A1TB17	9		
145B	A2PA80 5B	A2A1TB16	0		
145C		A2A1TB16	Shld		
146					
146A		A2A1TB16	Shld		
146B	A2PA80 6A	A2A1TB11	9		
146C	A2PA80 6B	A2A1TB111	0		
147	A2TB4 9	Dead End	0		
148	A2A6 AC	A2A1TB15	4		
149	A2A1TB15	A2K5A No	4		
150	A2TB3 1	Logic Gnd	0		
151	A2TB3 2	Logic Gnd	0		
152	A2TB3 3	Logic Gnd	0		
153	A2TB3 4	Logic Gnd	0		
154	A2TB4 10	A2PA80 4A	0		
155	A2A1TB1 6	Logic Gnd	0		

TITLE		WL	DOCUMENT NO.	SHEET NO.	REV.
DECK HARNESS (Ref: 77382807)			7828	1 OF 3	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
1	A3P2 1	A2TB1 15	4		
2	Dead End C	A3S6 C	0		
3	A3S6 C	A3P2 2	0		
4	A3P2 2	A2TB1 8	0		
5	Dead End NC	Dead End 2	4		
6	Dead End 2	A2TB4 7	4		
7	Dead End 1	A2TB4 8	4		
8	A3S6 NC	A2TB1 12	4		
9	Dead End NO	A2PA81 10A	0		
10	A3S6 NO	A2PA81 12A	4		
11	A3S4 C	A2TB1 9	0		
12	A3S4 NO	A2PA81 10B	0		
13	A3S1 C	A2TB1 11	0		
14	A3S1 NO	A2TB1 10	0		
15	A3PE80 9B	A2PA80 13B	4		
16					
17					
18					
19	Dead End	A2TB4	4		
20	Dead End	A2TB4	4		
21	A3PE80 1A	A2PA81 1A	4		
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	A3PE80 7B	A2PA81 7B	4		

TITLE		WL	DOCUMENT NO.	SHEET NO.	REV.
DECK HARNESS			7828	2	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
35	A3PE808A	A2PA81 8A	4		
36	A3PE80 8B	A2PA81 8B	4		
37	A3PE80 9A	A2PA8111A	4		
38					
38A	A3PE8014A	A2PA81 14A	4		
38B	A3PE8014B	A2PA8114B	0		
39					
39A	A3P3-1 1	A2PA81 9B	0		
39B	A3P3-2 2	A2PA81 9A	4		
40					
40A	A3J4 1	A2PA8112B	9		
40B	A3J4 2	A2PA8111B	0		
40C	A3J4 3	A2PA8113B	Shld		
41	A3TB1 1	A2K5A C	4		
42	A3TB1 2	A2A1TB17	1		
43					
43A	A3P8 4B	A2TB1 6	9		
43B	A3P8 3B	A2TB1 7	0		
43C	A3P8 3A	A2TB1 8	Shld		
44					
44A	A3P8 1B	A2PB30 3B	Center		
44B	A3P8 1A	A2PB30 4A	Shld		
45					
45A	A3P8 2B	A2PB30 5B	Center		
45B	A3P8 2A	A2PB30 4B	Shld		
46					
46A	A3PE1 9B	A2PC17 9B	0		
46B	A3PE1 10B	A2PB17 9A	4		
47	A3P6 1	A3FL3 Out	2		
48					
49	A3P6 3	A3FL4 Out	6		
50					
51	A3P6 4	A2TB1 9	0		
52					

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
DECK HARNESS		7828	3	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
52A	A3P6 5	A3PE3 13B	4		
52B	A3P6 6	A3PE3 14B	0		
53					
54					
55					
56	A3PE8010A	A2PA8013A	4		
57	A3FL1 In	A2TB1 3	2		
58	A3FL2 In	A2TB1 4	6		
59	A3FL3 In	A2TB1 1	2		
60	A3FL4 In	A2TB1 2	6		
61	A3FL5 In	A2TB1 13	2		
62					
62A	A3PE4 9B	A2PD22 1B	Cond		
62B	A3PE4 9A	A2PD22 1A	Shld		
63					
63A	A3PE4 8B	A2PD22 2B	Cond		
63B	A3PE4 8A	A2PD22 2A	Shld		
64					
64A	A3PF3 4A	A2PC23 9A	Shld		
64B	A3PF3 4B	A2PC23 9B	Cond		
65					
65A	A3PF3 3A	A2PC2311A	Shld		
65B	A3PF3 3B	A2PC2311B	Cond		
66					
67	R/W Panel Gnd	Deck Gnd	38, 40		
68					
68A	A2TB4 9	Dead End 1	0		
68B	A2TB1 5	Dead End 2	4		
69					
69A	A2PA8014A		0		
69B	A2PA8014B		4		

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
I/O PANEL (Ref: 77470800)		7708	1 OF 10	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
1	A2TB4 5	IA5J1 $\overline{N}$	2		
2	A3TB4 4	$\overline{M}$	2		
3	A2TB1 16	$\overline{H}$	2		
4	A2TB4 1	$\overline{P}$	2		
5	A2TB4 3	$\overline{J}$	2		
6	A2TB4 2	$\overline{K}$	2		
7	A2TB3 10	$\overline{S}$	0		
8	A2TB3 10	$\overline{J}$	0		
9	A2TB4 10	IA5J1 F	0		
10					
10A	A2PC10 6B	IA5J2 1	0		
10B	A2PC10 6A	IA5J2 4	4		
11					
11A	A2PC10 7B	IA5J2 2	0		
11B	A2PC10 7A	IA5J2 5	4		
12					
12A	A2PC10 8B	IA5J2 8	0		
12B	A2PC10 8A	IA5J2 12	4		
13					
13A	A2PC10 9B	IA5J2 3	0		
13B	A2PC10 9A	IA5J2 7	4		
14					
14A	A2PC13 6B	IA5J2 10	0		
14B	A2PC13 6A	IA5J2 13	4		
15					
15A	A2PC13 7B	IA5J2 11	0		
15B	A2PC13 7A	IA5J2 14	4		
16					
16A	A2PC13 8B	IA5J2 16	0		
16B	A2PC13 8A	IA5J2 20	4		
17					
17A	A2PC13 9B	IA5J2 15	0		
17B	A2PC13 9A	IA5J2 18	4		
18					

TITLE		WL	DOCUMENT NO.	SHEET NO.	REV.
I/O PANEL			7708	2	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
18A	A2PC17 6B	I A5J2 17	0		
18B	A2PC17 6A	I A5J2 21	4		
19					
19A	A2PC15 9B	I A5J2 74	0		
19B	A2PC15 9A	I A5J2 77	4		
20					
20A	A2PC15 8B	I A5J2 75	0		
20B	A2PC15 8A	I A5J2 78	4		
21					
21A	A2PC8 5A	I A5J2 67	0		
21B	A2PC8 5B	I A5J2 72	4		
22					
22A	A2PC8 6A	I A5J2 73	0		
22B	A2PC8 6B	I A5J2 76	4		
23					
23A	A2PC8 9A	I A5J2 59	0		
23B	A2PC8 9B	I A5J2 63	4		
24					
24A	A2PC8 7A	I A5J2 60	0		
24B	A2PC8 7B	I A5J2 64	4		
25					
25A	A2PC8 8A	I A5J2 53	0		
25B	A2PC8 8B	I A5J2 56	4		
26					
26A	A2PC8 10A	I A5J2 54	0		
26B	A2PC8 10B	I A5J2 57	4		
27					
27A	A2PC14 5A	I A5J2 42	0		
27B	A2PC14 5B	I A5J2 45	4		
28					
28A	A2PC14 9A	I A5J2 46	0		
28B	A2PC14 9B	I A5J2 49	4		
29					
29A	A2PC14 8A	I A5J2 48	0		

TITLE		WL	DOCUMENT NO.	SHEET NO.	REV.
I/O PANEL			7708	3	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
29B	A2PC14 8B	I A5J2 51	4		
30					
30A	A2PC9 5A	I A5J2 58	0		
30B	A2PC9 5B	I A5J2 62	4		
31					
31A	A2PC9 6A	I A5J2 66	0		
31B	A2PC9 6B	I A5J2 71	4		
32					
32A	A2PC9 8A	I A5J2 65	0		
32B	A2PC9 8B	I A5J2 70	4		
33					
33A	A2PC16 5A	I A5J2 28	0		
33B	A2PC16 5B	I A5J2 31	4		
34					
34A	A2PC16 6A	I A5J2 24	0		
34B	A2PC16 6B	I A5J2 27	4		
35					
35A	A2PC16 7A	I A5J2 29	0		
35B	A2PC16 7B	I A5J2 32	4		
36					
36A	A2PC16 8A	I A5J2 23	0		
36B	A2PC16 8B	I A5J2 26	4		
37					
37A	A2PC16 9A	I A5J2 30	0		
37B	A2PC16 9B	I A5J2 33	4		
38					
38A	A2PC1610A	I A5J2 34	0		
38B	A2PC1610B	I A5J2 37	4		
39					
39A	A2PC18 5A	I A5J2 40	0		
39B	A2PC18 5B	I A5J2 43	4		
40					
40A	A2PC18 6A	I A5J2 36	0		
40B	A2PC18 6B	I A5J2 39	4		

TITLE		WL	DOCUMENT NO.	SHEET NO.	REV.
I/O PANEL			7708	4	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
41					
41A	A2PC18 8A	I A5J2 35	0		
41B	A2PC18 8B	I A5J2 38	4		
42					
42A	A2PC18 9A	I A5J2 52	0		
42B	A2PC18 9B	I A5J2 55	4		
43					
43A	A2PC1810A	I A5J2 47	0		
43B	A2PC1810B	I A5J2 50	4		
44					
44A	A2PC17 7B	I A5J2 22	0		
44B	A2PC17 7A	I A5J2 25	4		
45					
45A	A2PC15 7B	I A5J1 E	0		
45B	A2PC15 7A	I A5J1 H	4		
46					
46A	A2PC15	I A5J1 B	0		
46B	A2PC15	I A5J1 D	4		
47					
47A	A2PC14 6A	I A5J1 $\overline{D}$	0		
47B	A2PC14 6B	I A5J1 $\overline{F}$	4		
48					
48A	A2PC14 7A	I A5J1 Z	0		
48B	A2PC14 7B	I A5J1 $\overline{B}$	4		
49					
49A	A2PC9 10A	I A5J1 $\overline{C}$	0		
49B	A2PC9 10B	I A5J1 $\overline{E}$	4		
50					
50A	A2PC9 9A	I A5J1 Y	0		
50B	A2PC9 9B	I A5J1 $\overline{A}$	4		
51					
51A	A2PC17 8B	I A5J1 A	0		
51B	A2PC17 8A	I A5J1 C	4		
52					

TITLE		WL	DOCUMENT NO.	SHEET NO.	REV.
I/O PANEL			7708	5	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
52A	A2PC18 7A	I A5J1 P	0		
52B	A2PC18 7B	I A5J1 S	4		
53					
53A					
53B					
54					
54A	A2PC20 4A	I A5J1 BB	0		
54B	A2PC20 4B	I A5J1 DD	4		
55					
55A	A2PC20 7B	I A5J1 K			
55B	A2PC20 7A	I A5J1 K			
56					
56A	A2PC20 8B	I A5J1 L			
56B	A2PC20 8A	I A5J1 L			
57					
57A	A2PC20 6B	I A5J1 M			
57B	A2PC20 6A	I A5J1 M			
58					
58A	A2PC20 5B	I A5J1 EE	4		
58B	A2PC20 5A	I A5J1 CC	0		
59					
59A	A2PC20 9A	I A5J1 $\overline{T}$	0		
59B	A2PC20 9B	I A5J1 $\overline{V}$	4		
60					
60A	A2PC2010A	I A5J2 41	0		
60B	A2PC2010B	I A5J2 44	4		
61					
61A					
61B					
62	A2TB3 10	I A5J1 $\overline{Y}$	0		
62A					
62B					
62C					
63	A2TB3 10	I A5J1 $\overline{X}$	0		

TITLE		WL	DOCUMENT NO.	SHEET NO.	REV.
I/O PANEL			7708	6	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
64	A2TB3 9	II A5J1 $\overline{Y}$	0		
65	A2TB3 9	II A5J1 $\overline{X}$	0		
66	A2TB4 5	II A5J1 $\overline{N}$	2		
67	A2TB4 4	II A5J1 $\overline{M}$	2		
68	A2TB1 16	II A5J1 $\overline{H}$	2		
69	A2TB4 1	II A5J1 $\overline{P}$	2		
70	A2TB4 3	II A5J1 $\overline{J}$	2		
71	A2TB4 2	II A5J1 $\overline{K}$	2		
72	A2TB3 9	II A5J1 $\overline{S}$	0		
73	A2TB3 9	II A5J1 J	0		
74	A2TB4 10	II A5J1 5	0		
75					
75A	A2PD10 6B	II A5J2 1	0		
75B	A2PD10 6A	II A5J2 4	4		
76					
76A	A2PD10 7B	II A5J2 2	0		
76B	A2PD10 7A	II A5J2 5	4		
77					
77A	A2PD10 8B	II A5J2 8	0		
77B	A2PD10 8A	II A5J2 12	4		
78					
78A	A2PD10 9B	II A5J2 3	0		
78B	A2PD10 9A	II A5J2 7	4		
79					
79A	A2PD13 6B	II A5J2 10	0		
79B	A2PD13 6A	II A5J2 13	4		
80					
80A	A2PD13 7B	II A5J2 11	0		
80B	A2PD13 7A	II A5J2 14	4		
81					
81A	A2PD13 8B	II A5J2 16	0		
81B	A2PD13 8A	II A5J2 20	4		
82					
82A	A2PD13 9B	II A5J2 15	0		

TITLE		WL	DOCUMENT NO.	SHEET NO.	REV.
I/O PANEL			7708	7	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
82B	A2PD13 9A	II A5J2 18	4		
83					
83A	A2PD17 6B	II A5J2 17	0		
83B	A2PD17 6A	II A5J2 21	4		
84					
84A	A2PD15 9B	II A5J2 74	0		
84B	A2PD15 9A	II A5J2 77	4		
85					
85A	A2PD15 8B	II A5J2 75	0		
85B	A2PD15 8A	II A5J2 78	4		
86					
86A	A2PD8 5A	II A5J2 67	0		
86B	A2PD8 5B	II A5J2 72	4		
87					
87A	A2PD8 6A	II A5J2 73	0		
87B	A2PD8 6B	II A5J2 76	4		
88					
88A	A2PD8 9A	II A5J2 59	0		
88B	A2PD8 9B	II A5J2 63	4		
89					
89A	A2PD8 7A	II A5J2 60	0		
89B	A2PD8 7B	II A5J2 64	4		
90					
90A	A2PD8 8A	II A5J2 53	0		
90B	A2PD8 8B	II A5J2 56	4		
91					
91A	A2PD8 10A	II A5J2 54	0		
91B	A2PD8 10B	II A5J2 57	4		
92					
92A	A2PD14 5A	II A5J2 42	0		
92B	A2PD14 5B	II A5J2 45	4		
93					
93A	A2PD14 9A	II A5J2 46	0		
93B	A2PD14 9B	II A5J2 49	4		

TITLE		WL	DOCUMENT NO.	SHEET NO.	REV.
I/O PANEL			7708	8	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
94					
94A	A2PD14 8A	II A5J2 48	0		
94B	A2PD14 8B	II A5J2 51	4		
95					
95A	A2PD9 5A	II A5J2 58	0		
95B	A2PD9 5B	II A5J2 62	4		
96					
96A	A2PD9 6A	II A5J2 66	0		
96B	A2PD9 6B	II A5J2 71	4		
97					
97A	A2PD9 8A	II A5J2 65	0		
97B	A2PD9 8B	II A5J2 70	4		
98					
98A	A2PD16 5A	II A5J2 28	0		
98B	A2PD16 5B	II A5J2 31	4		
99					
99A	A2PD16 6A	II A5J2 24	0		
99B	A2PD16 6B	II A5J2 27	4		
100					
100A	A2PD16 7A	II A5J2 29	0		
100B	A2PD16 7B	II A5J2 32	4		
101					
101 A	A2PD16 8A	II A5J2 23	0		
101 B	A2PD16 8B	II A5J2 26	4		
102					
102A	A2PD16 9A	II A5J2 30	0		
102B	A2PD16 9B	II A5J2 33	4		
103					
103A	A2PD1610A	II A5J2 34	0		
103B	A2PD1610B	II A5J2 37	4		
104					
104A	A2PD18 5A	II A5J2 40	0		
104B	A2PD18 5B	II A5J2 43	4		
105					

TITLE		WL	DOCUMENT NO.	SHEET NO.	REV.
I/O PANEL			7708	9	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
105A	A2PD18 6A	II A5J2 36	0		
105B	A2PD18 6B	II A5J2 39	4		
106					
106A	A2PD18 8A	II A5J2 35	0		
106B	A2PD18 8B	II A5J2 38	4		
107					
107A	A2PD18 9A	II A5J2 52	0		
107B	A2PD18 9B	II A5J2 55	4		
108					
108A	A2PD1810A	II A5J2 47	0		
108B	A2PD1810B	II A5J2 50	4		
109					
109A	A2PD17 7B	II A5J2 22	0		
109B	A2PD17 7A	II A5J2 25	4		
110					
110A	A2PD15 7B	II A5J1 E	0		
110B	A2PD15 7A	II A5J1 H	4		
111					
111A	A2PD15 6B	II A5J1 B	0		
111B	A2PD15 6A	II A5J1 D	4		
112					
112A	A2PD14 6A	II A5J1 $\overline{D}$	0		
112B	A2PD14 6B	II A5J1 $\overline{F}$	4		
113					
113A	A2PD14 7A	II A5J1 Z	0		
113B	A2PD14 7B	II A5J1 $\overline{B}$	4		
114					
114A	A2PD9 10A	II A5J1 $\overline{C}$	0		
114B	A2PD9 10B	II A5J1 $\overline{E}$	4		
115					
115A	A2PD9 9A	II A5J1 Y	0		
115B	A2PD9 9B	II A5J1 $\overline{A}$	4		
116					
116A	A2PD17 8B	II A5J1 A	0		

TITLE		WL	DOCUMENT NO.	SHEET NO.	REV.
I/O PANEL			7708	10	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
116B	A2PD17 8A	II A5J1 C	4		
117					
117A	A2PD18 7A	II A5J1 P	0		
117B	A2PD18 7B	II A5J1 S	4		
118					
118A					
118B					
119					
119A	A2PD20 4A	II A5J1 BB	0		
119B	A2PD20 4B	II A5J1 DD	4		
120					
120A	A2PD20 7B	II A5J1 K			
120B	A2PD20 7A	II A5J1 K			
121					
121A	A2PD20 8B	II A5J1 L			
121B	A2PD20 8A	II A5J1 L			
122					
122A	A2PD20 6B	II A5J1 M			
122B	A2PD20 6A	II A5J1 M			
123					
123A	A2PD20 5B	II A5J1 EE	4		
123B	A2PD20 5A	II A5J1 CC	0		
124					
124A	A2PD20 9A	II A5J1 $\overline{T}$	0		
124B	A2PD20 9B	II A5J1 $\overline{V}$	4		
125					
125A	A2PD2010A	II A5J2 41	0		
125B	A2PD2010B	II A5J2 44	4		
126					
126A					
126B					
126C					
127					
127A 127B					

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
CONTROL PANEL (W-8) (Ref: 75042900)		7429	1 OF 1	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
1	A2TB1 5	A4DS1A T	2		
2	A4DS1B T	A4DS1A T	2		
3	A4DS1B T	A4DS5A T	2		
4	A4DS5B T	A4DS5A T	2		
5	A4DS5B T	A4DS3A T	2		
6	A4DS3B T	A4DS3A T	2		
7	A4DS3B T	A4DS4A T	2		
8	A4DS4B T	A4DS4A T	2		
9	A4DS4B T	A4DS2A T	2		
10	A4DS2B T	A4DS2A T	2		
11	A2TB1 16	A4DS6B T	2		
12	A4DS6A T	A4DS6B T	2		
13	A4DS6A B	A4DS6B B	0		
14	A2TB1 14	A4DS6B B	0		
15	A4DS6A B	A4S7A NO	0		
16	A2TB1 10	A4S7A C	0		
17	A2TB4 6	A4S7B NO	2		
18	A2TB4 4	A4S7B C	2		
19	A2TB4 5	A4S7B NC	2		
20	A2PA82 8B	A4S7C NO	0		
21	A2PA82 3A	A4S1 NO	0		
22	A2PA82 5A	A4DS1A B	4		
23	A2PA82 5B	A4DS1B B	4		
24	A2PA82 6A	A4DS5A B	4		
25	A2PA82 3B	A4DS5B B	4		
26	A2PA82 4A	A4DS3A B	4		
27	A2PA82 4B	A4DS3B B	4		
28	A2PA82 1A	A4DS4A B	4		
29	A2PA82 1B	A4DS4B B	4		
30	A2PA82 2A	A4DS2A B	4		
31	A2PA82 2B	A4DS2B B	4		
32	A2TB1 8	A4S7C C	0		
33	A4S1 C	A4S7C C	0		

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
MAINTENANCE PANEL (Ref: 76462300)		7623	1 OF 2	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
1	A2A1P1 1A	A2PA85 1A	8		
1A	2	2			
1B	3	3			
1C	4	4			
1D	5	5			
1E	6	6			
1F	7	7			
1G	8	8			
1H	9	9			
1J	10	10			
1K	11	11			
1L	12	12			
1M	13	13			
1N	A2A1P1 14A	A2PA85 14A			
1P	A2A1P1 1B	A2PA85 1B			
1R	2	2			
1S	3	3			
1T	4	4			
1U	5	5			
1V	6	6			
1W	7	7			
1X	8	8			
1Y	9	9			
1AA	10	10			
1BB	11	11			
1CC	12	12			
1DD	13	13			
1EE	A2A1P1 14B	A2PA8514B			
2	A2A1P2 1A	A2PA84 1A			
2A	4A	4A			
2B	8A	8A			
2C	9A	9A			
2D	10A	10A			
2E	A2A1P2 1B	A2PA84 1B	8		

TITLE		WL	DOCUMENT NO.	SHEET NO.	REV.
MAINTENANCE PANEL			7623	2	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
2F	A2A1P2 11B	A2PA84 11B	8		
2G	A2A1P2 12B	A2PA84 12B	8		
2H	A2A1P2 14B	A2PA84 14B	8		

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
AC HARNESS (50 or 60 Hz) (Ref: 77462300)		7623	1 OF 3	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
1	A1CB1 A2	A1K4 3	4		
2	A1CB1 B2	A1K4 4	4		
3	A1K4 5	A1FL1 In	4		
4	A1K4 6	A1FL2 In	4		
5	A1FL1 Out	A1CB2 A1	1		
6	A1CB2 A1	A1M1 T	1		
7	A1CB2 B1	A1FL2 Out	1		
8	A1CB2 B1	A1M1 B	1		
9					
9A	A1FL1 Out	A1P2 2	1		
9B	A1FL2 Out	A1P2 3	1		
9C	A1P2 1	A1FL1 Gnd	Shld		
9D	A1P2 1	A1FL1 Gnd	54		
10	Safety Gnd Gnd	A1P7(1) 1	54		
11	A1K1 5	A1P7(1) 2	1		
12	A1K1 5	A1A1 E10	1		
13	A1CB2 A3	A1P7(1) 3	1		
14	A1CB2 A3	A1CB2 B4	1		
15	A1CB2 A4	A1P7(1) 4	1		
16	A1K2 5	A1P7(1) 5	1		
17	A1K2 5	A1A1 E11	1		
18	Safety Gnd Gnd	A1P7(1) 8	5		
19	A1CB2 A2	A1K1 3	1		
20	A1K1 3	A1A1 E9	1		
21	A1CB2 B3	A1K2 3	1		
22	A1K2 3	A1A1 E8	1		
23					
24					
25	A1TB2 2	A1XF1 In	1		
26	A1TB2 1	A1XF2 In	1		
27	A1TB2 4	A1TB3 2	1		
28	A1TB2 1	A1TB3 1	1		
29	A1XF1 Out	A1TB2 5	1		
30	A1XF2 Out	A1TB2 6	1		

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
AC HARNESS (50 or 60 Hz)		7623	2	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
31	A1TB2 5	A1T3 2	1		
32	A1TB2 6	A1T3 1	1		
33	A1 Safety Gnd	A2 Safety Gnd	54		
34	A1CR7-10+	A2TB2 6	2		
35	A1TB4 7	A1TB4 4	0		
36	A1TB4 4	A2TB2 2	0		
37	A1CR7-10-	A2TB2 7	6		
38	A1CR5-6 C	A2TB2 8	2		
39	A1CR15 A	A2TB2 9	6		
40	A1CR11-14+	A2TB2 10	2		
41	A1TB3 6	A2TB2 3	0		
42	A1CR11-14-	A2TB2 11	6		
43	A1CR16-17-	A2TB2 12	6		
44	A1K2 2	A1P7(1) 7	4		
45	A1K2 2	A1A1 E6	4		
46	A1K4 2	A1P7(1) 6	0		
47	A1K4 2	A1K1 2	0		
48	A1TB3 5	A1CR16 -17 AC1	4		
49	A1TB3 7	A1CR16 -17 AC2	4		
50	A1T3 4	A1CR1 -2 AC1	4		
51	A1T3 6	A1CR1 -2 AC2	4		
52	A1TB3 8	A1CR11 -14 AC2	4		
53	A1TB4 3	A1CR5 A	4		
54	A1TB3 4	A1CR11 -14 AC1	4		
55	A1TB4 5	A1CR6 A	4		
56	A1TB4 6	A1CR7 -10 AC1	4		
57	A1CR6 A	A1CR3 -4 AC2	4		
58	A1CR5 A	A1CR3 -4 AC1	4		
59	A1TB4 8	A1CR7 -10 AC2	4		
60	A1CR3-4 -	A1CR15 C	6		
61	A1CR1-2 +	A2TB2 14	2		
62	A1CR1-2 +	A1K4 1	2		
63	A1K4 1	A1A1 E1	2		
64	A1T3 5	A2TB2 1	0		

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
AC HARNESS (50 or 60 Hz)		7623	3	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
65	A1T3 5	A1A1 E2	0		
66	A1A1 E2	A1A1 E4	0		
67					
68	A1K1 2	A1A1 E4	0		
60	A2TB2 4	A1A1 E6	4		
70					
71	A2TB2 5	A1A1 E5	2		
72	A1A1 E5	A1K2 1	2		
73	A1K2 1	A1K1 1	2		
74	A1K1 1	A1A1 E3	2		

TITLE		DOCUMENT NO.	SHEET NO.	REV.
POWER CABLE (W-2) (Ref: 77463900)	WL	7639	1 OF 1	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
1					
1A	P1 X	A1CB1 A1	1		
1B	P1 Y	A1CB1 B1	6		
1C	P1 Gnd	Frame Gnd	5		

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
AC HARNESS (400 Hz) (Ref: 77464800)		7648	1 OF 1	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
1					
2	Main Frame Safety Gnd	A1 Safety Gnd	54		
3	Shld	Shld			
4	A1CB3A 2	A1TB2 2	4		
5	A1CB3B 2	A1TB2 3	4		
6	A1CB3C 2	A1TB2 1	4		

TITLE		DOCUMENT NO.	SHEET NO.	REV.
CIRCUIT BREAKER BOX (Ref: 77464300)	WL	7643	1 OF 1	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
1	A1CB3A 1	A1TB1 1	4		
2	A1CB3B 1	A1TB1 2	4		
3	A1CB3C 1	A1TB1 3	4		

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