83322450

CONTROL DATA CORPORATION

CDC® STORAGE MODULE DRIVE

BJ4M1

BJ4M2

BJ402

INSTALLATION AND CHECKOUT
MAINTENANCE
DIAGRAMS
WIRE LISTS
PARTS DATA

HARDWARE MAINTENANCE MANUAL

REVISION RECORD

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Control Data Corporation
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Minneapolis, Mn. 55435

or use Comment Sheet in the back of this manual.

MANUAL TO EQUIPMENT LEVEL CORRELATION

This manual reflects the equipment configurations listed below.

EXPLANATION: Locate the equipment type and series number, as shown on the equipment FCO log, in the list below. Immediately to the right of the series number is an FCO number. If that number and all of the numbers underneath it match all of the numbers on the equipment FCO log, then this manual accurately reflects the equipment.

This correlation sheet also applies to the following related manuals:

Publication No._____ Rev._____ Publication No._____ Rev._____

Publication No._____ Rev._____ Publication No._____ Rev._____

EQUIPMENT TYPE	SERIES	WITH FCO'S	COMMENTS
BJ4M1/BJ4M2	03	NONE	
	04	NONE	
	05	NONE	
	06	22882	
	07	NONE	
	08	NONE	
	09	NONE	
BJ402A/B	10	NONE	
	11 to 16	NONE	
	17	57130 57143	
	18	57142	

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iii	P
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v	S
vi	S
vii	G
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ix	F
x	P
xi	H
xii	A
xiii	D
xiv	P
xv	J
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PREFACE

This manual contains maintenance information applicable to Control Data® BJ4M1 and BJ4M2 Storage Module Drives (SMD's). The specific types of BJ4M1/BJ4M2, BJ402A/B drives and their configurations are listed in the configuration chart (refer to Table of Contents).

Most of the information in this manual is applicable to all types of BJ4M1 and BJ4M2 drives. However, where information is applicable only to specific types, this is noted in the text.

Maintenance information is divided into five sections. These sections and a brief description of their contents are as follows:

- Section 1 - Installation and checkout. Provides information on installing the drive and preparing it for initial use.
- Section 2 - Maintenance. Provides information for performing preventive and corrective maintenance on the drive.
- Section 3 - Diagrams. Contains logic and wiring diagrams for the drive.
- Section 4 - Wire Lists. Provides wire lists for the logic, power supply and interassembly wiring.
- Section 5 - Parts Data. Contains parts lists and illustrations showing all field replaceable parts.

Manuals applicable to the BJ4M1 and BJ4M2 Storage Module Drives are as follows:

Publication Number	Title
83322450	Hardware Maintenance Manual
83322460	Hardware Reference Manual
83322440	Normandale Circuits Manual

CONTENTS

FIGURES

TABLES

APPENDIX

CONFIGURATION CHART

EQUIPMENT	POWER REQUIREMENTS ***		STANDARD OPTIONS **		TLA * NUMBER	COLOR CODE
	Voltage (Volts)	Frequency (Hz)	RD PLO/ Data Separator	Pack Access Cover Solenoid		
BJ4M1A	208	60	No	No	77445204	A
BJ4M1B	220	50	No	No	77445205	A
BJ4M1D	220	50	No	No	77445206	B
BJ4M2A	208	60	No	No	77445016	A
BJ4M2B	220	50	No	No	77445017	A
BJ4M2C	208	60	No	No	77445028	B
BJ4M2D	220	50	No	No	77445018	B
BJ402A	208	60	No	No	77445021	C
BJ402B	220	50	No	No	77445022	C

* For factory use only

** Defined in General Description of hardware reference manual

*** 208 Volt, 60 Hz drives can be rewired for 230 Volt, 60 Hz, and 220 Volt, 50 Hz drives can be rewired for 240 Volt, 50 Hz. See Installation Section for Instructions.

SECTION 1

INSTALLATION

INTRODUCTION

This section contains information concerning the initial installation and checkout of the drive. The person performing the installation and checkout should be familiar with operation of the drive and with all information in the discussion on General Maintenance (section 2A of this manual).

This section is divided into the following areas:

- Packaging - Describes removal and installation of the packaging used to protect the drive during shipping.
- Site Preparation - Describes requirements that must be met in preparing a site for installation of the drive.
- Drive Installation Procedure - Contains instructions and procedures describing installation of the drive.
- Initial Checkout and Startup - Explains checks that must be made prior to putting the drive into normal online operation.

PACKAGING

The drive must be properly packaged whenever it is shipped from one location to another.

The drive leaves the factory packaged to ensure it is not damaged during shipment to the installation site. This packaging must be removed prior to installing the drive.

The first step in unpacking is to remove the outer package consisting of a corrugated cardboard cover, wood frame, and plastic dust cover. The remainder of the packaging is removed by following the instructions on the unpackaging instruction sheet contained within the pack shroud area. All packaging materials should be retained for use in the event it is necessary to reship the drive.

If it is necessary to reship the drive, obtain packaging instructions from:

Packaging Engineer, Material Services Dept.
Normandale Division, MPI
7801 Computer Ave.
Minneapolis, MN. 55435
Telephone Number 612/830-5462

When ordering packaging instructions, specify the exact equipment number and series code of the drive as shown on the equipment identification plate.

SITE PREPARATION

GENERAL

Site preparation information is provided to enable a user to layout an installation site. Consideration is given to:

- Space and Clearances
- Environment
- Power (ac)
- Grounding
- I/O Cabling

The installation instructions provided later in this section are based on the assumption that all site preparation requirements have been met.

SPACE AND CLEARANCES

The drive can be located either by itself or in line with other drives. In either case there must be enough clearance around the unit to permit access for maintenance. Space requirements are determined by referring to figure 1-1.

ENVIRONMENT

The site location must present the proper environmental conditions for the drive. Environmental requirements are determined by referring to table 1-1.

POWER REQUIREMENTS

An ac power connection must be provided for each drive in the system. The drives connect to the power source via 6-foot (1828 mm) long power cords.

All 60 Hz units arrive from the factory with a power connector installed (refer to Parts Data section). However, a connector is not furnished with 50 Hz units and therefore it

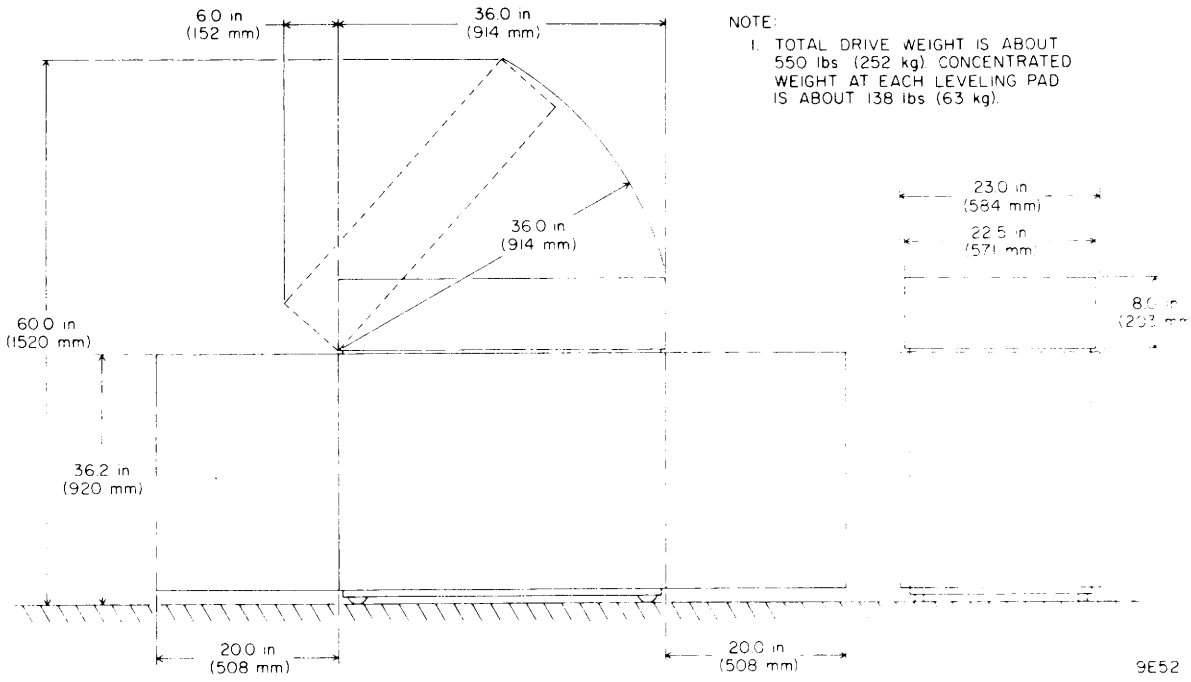


Figure 1-1. Space Requirements

TABLE 1-1. ENVIRONMENTAL REQUIREMENTS

Specification	Value
Temperature	
Operating	59°F (15.0°C) to 90°F (32°C)
Gradient	12°F (6.7°C) per hour
Transit (packed)	-40°F (-40.4°C) to +158°F (70°C)
Relative Humidity	
Operating	20% to 80% (no condensation)
Transit (packed)	5% to 95%
Altitude	
Operating	-1000 ft (-305 m) to +6500 ft (2000 m)
Transit (packed)	-1000 ft (-305 m) to +1500 ft (4572 m)

is necessary to obtain one that meets the requirements of the site power source connection.

Tables 1-2 and 1-3 list the drive input voltage and power consumption requirements. Figure 1-2 shows drive startup current for each of the possible input voltages.

It is important to note that drives come from the factory wired to accept either 208 Volt, 60 Hz or 220 Volt, 50 Hz input power. To change a 60 Hz drive to 230 Volts or a 50 Hz drive to 240 Volts requires rewiring as described in the Wiring and Power Cable routing procedures. Also a 60 Hz drive cannot be converted to 50 Hz or a 50 Hz to 60 Hz without making additional changes (such as transformers etc..).

TABLE 1-2. DRIVE INPUT VOLTAGE REQUIREMENTS

Drive* Type	Input Voltage/Tolerance (ac volts)	Input Frequency/Tolerance (Hz)
BJ4M1 A BJ4M2 A BJ402 A	** 208 (+14.6, -29) 230 (+16.0, -32)	60 (+.6, -1.0) 60 (+.6, -1.0)
BJ4M1 B BJ4M2 B BJ4M1 D BJ4M2 D BJ402 B	** 220 (+15.0, -25) 240 (+17.0, -27)	50 (+.5, -1.0) 50 (+.5, -1.0)

* Type determined by referring to name plate located on frame at rear of drive (refer to General Description section of reference manual for more information).

** Drive comes from factory wired for this voltage.

TABLE 1-3. DRIVE POWER CONSUMPTION REQUIREMENTS

Input Voltage	Unit Status	Line * Current	Consumption * KW	BTU/HR	Power Factor
208 V, 60 Hz	Disks and Carriage In Motion	8.0	1.20	4200	.70
230 V, 60 Hz		7.2	1.20	4200	.70
220 V, 50 Hz		9.5	1.30	4200	.70
240 V, 50 Hz		8.7	1.30	4200	.70
208 V, 60 Hz	Disks Not In Motion	2.0	.40	1400	.90
230 V, 60 Hz		1.8	.40	1400	.90
220 V, 50 Hz		2.5	.50	1750	.90
240 V, 50 Hz		2.3	.50	1750	.90

* These are maximum values.

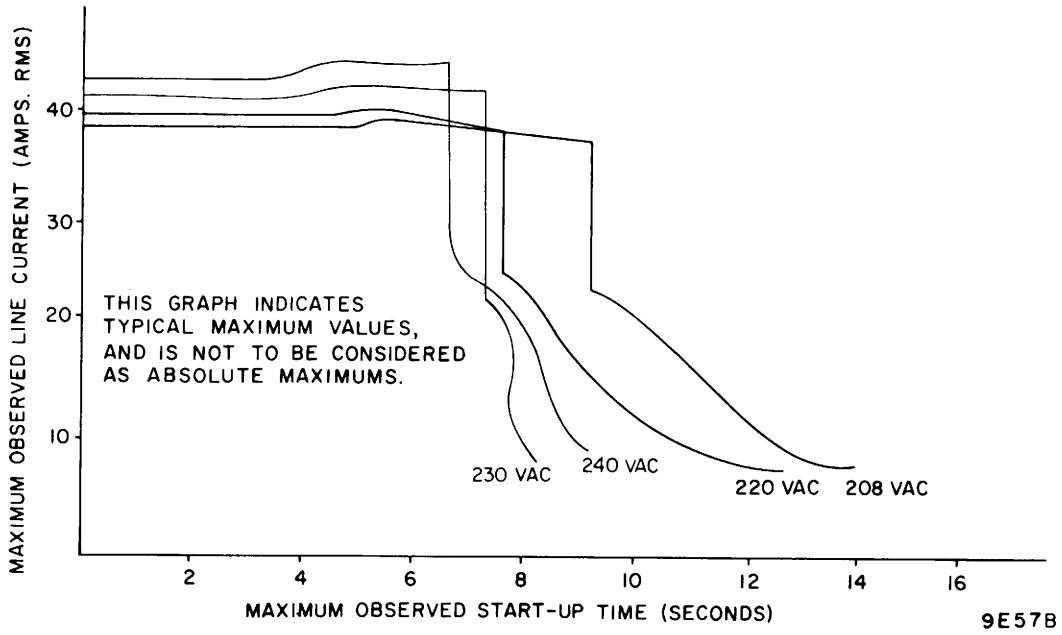


Figure 1-2. Startup Current

GROUNDING

General

Each drive must be properly grounded to ensure safe and satisfactory operation. To be properly grounded, the drive must have two ground connections: (1) Site ac power system safety ground and (2) a system ground. Both of these are explained in the following discussions.

Site Power System Safety Ground

The site ac power system ground is provided by the green (or green with yellow stripes) wire in the ac power cord. This wire connects to the drive frame and goes through the ac power cord to earth ground, via the ac branch circuit supplying the drive. Also, all power receptacles in the vicinity of the drive must be at the same ground potential as the drive.

System Ground

The power system safety ground does not necessarily satisfy all system grounding requirements. Therefore, additional connections to earth ground are required to ensure proper drive and system operation. This is referred to as the system ground. The system ground can connect to earth using any of the following methods:

- Floor grid (grounded) - Drives and controller are connected to a floor grid consisting of horizontal and vertical members which are mechanically secured and have ground straps or their equivalent joining them. The ground straps ensure a constant ground potential at all points on the grid. This grid is located under a false floor and connects directly to earth ground.

- Floor Grid (not grounded) - Drives and controller are connected to a floor grid that is isolated from earth ground. In this case, the controller is connected to earth ground to ground the grid.

  NOTE

  The daisy chain method of grounding the system is not recommended in systems containing more than ten separate equipments.

- Daisy Chain - Drives ground terminals are connected in a daisy chain to one another and then to the controller which connects to earth ground.

I/O CABLES

In laying out the site, consideration must be given to the routing of I/O cables. The drive connects to the controller via two I/O

cables which are designated as the A cable and the B cable.

The I/O cables connect to the controller in either a star or daisy chain configuration depending on the requirements of the specific installation. Both configurations are shown in figure 1-3.

The star system requires that the A and B cables go directly from each drive to the controller. It also requires an A cable terminator assembly at each drive.

The daisy chain configuration also requires that the B cable go directly from each drive to the controller. However, only the first drive in the chain requires an A cable directly to the controller. The others are connected via the daisy chain. In the daisy chain configuration, only the last drive in the chain has an A cable terminator assembly

Both the I/O cables and terminators are considered accessories and must be obtained separately from the drive. The part numbers of the terminators and the various available lengths of I/O cables are listed in table 1-4. The pin assignments for the I/O connectors are listed in table 1-5

TABLE 1-4. I/O CABLE INSTALLATION ACCESSORIES

Cable Length	* Cable Type and Part Number			
	A Cable (non shielded)	A Cable (shielded)	B Cable (non shielded)	B Cable (shielded)
9 in (228.6 mm)	-	-	-	Part Numbers not available at time of printing will be supplied in a later revision
5 ft (1.53 m)	-	-	75241300	
6 ft (1.83 m)	40020500	77569700	-	
8 ft (2 44 m)	40020504	77569704	-	
10 ft (3.05 m)	40020505	77569705	75241301	
15 ft (4.58 m)	40020507	77569707	75241302	
20 ft (6.10 m)	40020508	77569708	75241303	
25 ft (7.63 m)	40020501	77569701	75241313	
30 ft (9.16 m)	40020509	77569709	75241304	
35 ft (10.7 m)	-	-	75241314	
40 ft (12.2 m)	40020510	77569710	75241305	
45 ft (13.8 m)	-	-	75241315	
50 ft (15.3 m)	40020502	77569702	75241306	
55 ft (16.8 m)	-	-	75241316	
60 ft (1.83 m)	40020511	77569711	75241307	
65 ft (19.9 m)	-	-	75241317	
70 ft (21.4 m)	40020512	77569712	75241308	
75 ft (22.9 m)	-	-	75241309	
80 ft (24.5 m)	40020513	77569713	75241310	
90 ft (27.5 m)	40020514	77569714	75241311	
100 ft (30.5 m)	40020515	77569715	75241312	

* I/O Plug Terminator Part Number is 40067209

TABLE 1-5 I/O CONNECTOR PIN ASSIGNMENTS

Pins*	A Cable J3, J4 Function
22,25	Drive Select Hold
1 , 4	Tag Gate Out
46,49	Tag 2^0
48,51	Tag 2^1
52,55	Tag 2^2
23,26	Bus Out Bit 0
24,27	Bus Out Bit 1
28,31	Bus Out Bit 2
29,32	Bus Out Bit 3
30,33	Bus Out Bit 4
34,37	Bus Out Bit 5
35,38	Bus Out Bit 6
36,39	Bus Out Bit 7
74,77	Sector
10,13	Index
2 , 5	Tag Gate In
42,45	Bus In Bit 0
3 , 7	Bus In Bit 1
15,18	Bus In Bit 2
17,21	Bus In Bit 3
8 ,12	Bus In Bit 4
16,20	Bus In Bit 5
75,78	Bus In Bit 6
11,14	Bus In Bit 7
73	Sequence Power
76	Sequence Power
40,43	Spare
41,44	Spare
47,50	Spare
53,56	Spare
54,57	Spare
58,62	Spare

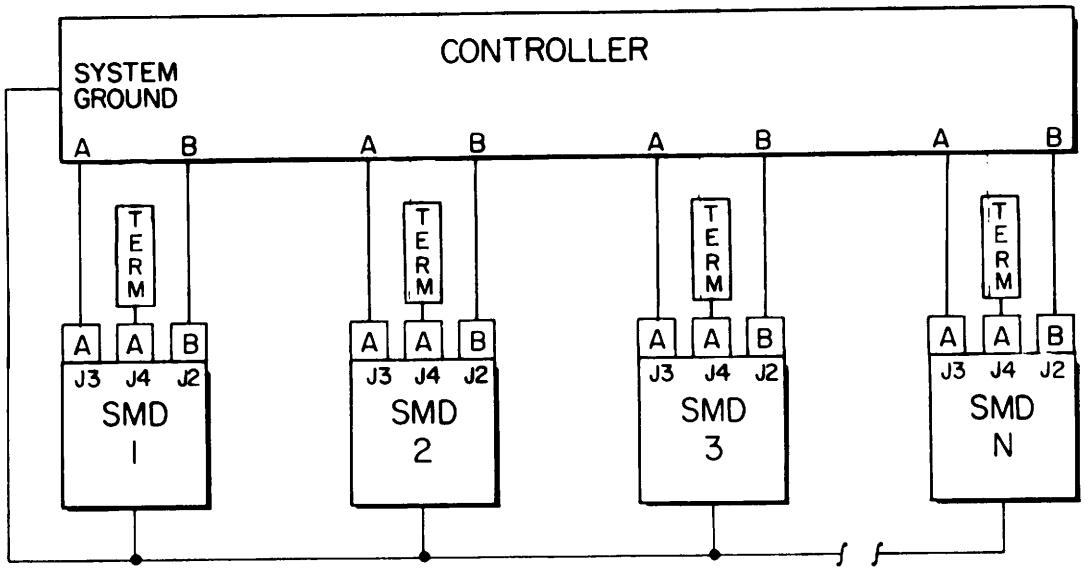
Pins*	A Cable J3, J4 Function
59,63	Spare
60,64	Spare
65,70	Spare
66,71	Spare
67,72	Spare
80	GND**

Pins*	B Cable J2 Functions
A,B	Read/Write Data
D	Read/Write Data Shield
H,J	Write Clock
E	Write Clock Shield
M,N	Servs Clock
K	Servs Clock Shield
W,X	Read Clock***
Y	Read Clock Shield***
AA,CC	Seek End
BB,DD	Module Address
EE,HH	Interrupt
U,V	Spare
T	Spare
FF,JJ	Spare
MM	-5V for Tester**

* I/O Connector pins without corresponding wires in cable are not listed(Exceptions are noted).

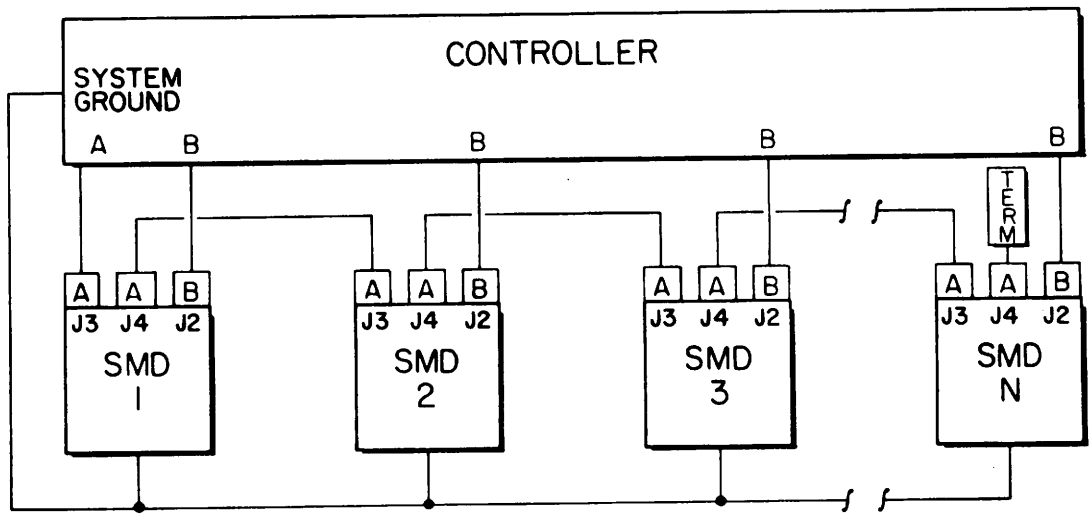
** Available at I/O Connector but does not have corresponding wire in cable.

*** Applicable only to drives with RD PLO/ DATA SEPARATOR Option.



STAR-CABLED SYSTEM

MAXIMUM INDIVIDUAL A AND B CABLE LENGTHS = 100 FT.



DAISY CHAIN-CABLED SYSTEM

MAXIMUM CUMULATIVE A CABLE LENGTH = 100 FT. *
MAXIMUM INDIVIDUAL B CABLE LENGTH = 100 FT.

* EXCLUDES INTERNAL DRIVE CABLE.

9D34A

Figure 1-3. System Cabling

INSTALLATION PROCEDURES

GENERAL

The procedures in this discussion describe the actual installation of the drive. These procedures assume that the requirements discussed under Site Preparation have been met.

All the procedures are listed below and generally speaking should be considered in the order they are presented. However, this order may have to be varied somewhat to meet requirements of specific installations.

- Preinstallation Inspection
- Grounding
- AC Power Wiring
- Power Cable Routing
- I/O Cable Installation
- Setting Sector Switches
- Cabinet Leveling

NOTE

Make sure temperature gradients are not exceeded during installation. Refer to the general description section in the hardware reference manual.

PREINSTALLATION INSPECTION

Perform the following inspection prior to installing the drive.

1. Inspect drive for possible shipping damage. Any claim for this type of damage should be filed promptly with the transporter involved. If a claim is filed, save the original shipping materials.
2. Verify that all logic cards are firmly seated in logic chassis and power supply.
3. Verify that all connectors are firmly seated, and check for loose hardware.
4. Verify that the control panel is firmly seated in shroud.
5. Verify that all cabling is intact and that there are no broken or damaged wires.
6. Check entire drive for presence of foreign material which could cause an electrical short.
7. Check actuator and pack area for presence of material which could obstruct movement of carriage and heads.
8. Check Pack Access Cover for tight seal per adjustment procedure of Pack Access Cover.

GROUNDING

The following procedures describe the previously discussed methods of grounding the drive.

Drive To Floor Grid Grounding

If a floor grid is available (either grounded or ungrounded), each drive is individually connected to the floor grid (refer to figure 1-4). The following describes this procedure (refer to table 1-6 for grounding accessories).

1. Crimp and solder a terminal lug to one end of a length of flat braided shielding.
2. Connect terminal lug to ac terminal of grounding block (refer to figure 1-5).
3. Route free end of braid strap through I/O cable guide and into cutout in floor.
4. Cut strap to proper length and attach terminal lug to free end as done in step 2.
5. Drill 11/32 inch hole in floor grid.
6. Secure terminal lug to grid using 10x32x1/2 screw and #10 external tooth lockwasher.
7. If grid is not connected directly to earth ground, connect it to earth ground via the controller.

NOTE

The system ground must connect both the drive dc (logic) and ac (frame) ground to earth. In most installations the drives ac and dc grounds are tied together by a jumper wire (refer to figure 1-5), and only one system ground connection is required. However, some installations may require the ac and dc grounds to isolated. In these cases, the jumper must be removed and both ac and dc grounds must connect to earth via separate system ground connections. Perform steps 8 and 9 only if the drive is to have isolated ac and dc grounds.

8. Remove jumper wire between ac and dc portions of grounding block (refer to figure 1-5).
9. Perform steps 1 through 6 except when performing step connect ground strap to dc terminal of grounding block instead of ac terminal.

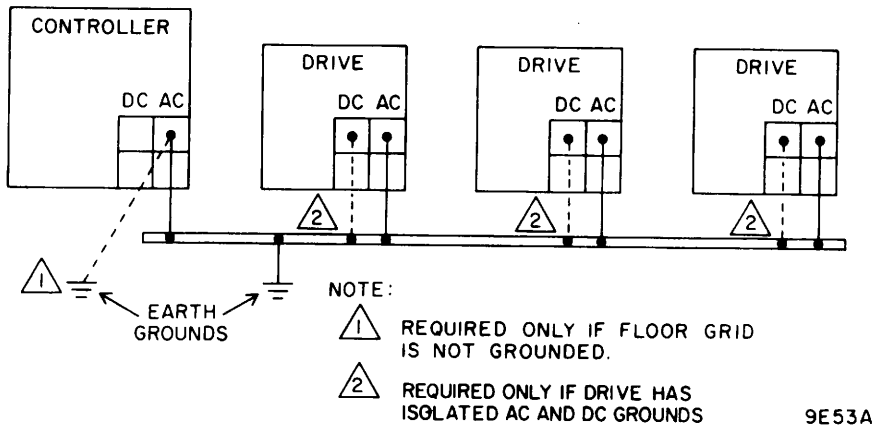


Figure 1-4. Floor Grid System Grounding

TABLE 1-6. GROUNDING ACCESSORIES

Part	CDC Part Number
Flat Braided Shielding	93267009 (50 ft)
Terminal Lug	40125601
Lockwasher, external tooth, #10	10126403
Screw, Cross Recessed, Pan Head, 10x32x1/2	17901524

Daisy Chain Grounding

If a floor grid is not available, all drives must be connected to the controller in a daisy chain grounding configuration (refer to figure 1-6). The controller must then be connected to earth ground. When connected in this configuration, the drive must have a common ac and dc ground. Therefore, the jumper on the grounding block must be connected (refer to figure 1-5). The following describes this procedure (refer to table 1-2 for grounding accessories).

1. Cut lengths of flat braided shielding to lengths required to go from drive to drive, last drive in chain to controller and controller to earth ground.
2. Crimp and solder a terminal lug to ends of each strap.
3. Connect two straps to ac terminal of grounding block, route straps through I/O cable guide and connect to each of the two closest drives.
4. Ensure that the following conditions exist:
   - All drives and controller are connected in daisy chain.
   - Drive closest to controller is connected to controller.
   - Controller is connected to earth ground.

AC POWER WIRING

Depending on its type (refer to table 1-3), the drive comes from the factory wired to accept either 208 volts, 60 Hz or 220 volt, 50 Hz input power. It is possible to rewire the 60 Hz units to accept 230 volts and the 50 Hz units to accept 240 volts by moving wires on transformers A1T1, A1T2, and A1T3 (refer to figure 1-7). The required transformer wiring for each input voltage is shown on cross reference number 803 in the Diagrams section of this manual. It should be noted that a 60 Hz drive cannot be converted to 50 Hz or a 50 Hz drive to 60 Hz without making additional changes (such as transformers, etc.).

The connector furnished with the drive is for 60 Hz operation. If 50 Hz operation is desired, the connector must be replaced with a 50 Hz connector that meets the requirements of the specific installation site. This connector is wired as follows:

- Green or Green/Yellow wire to safety ground terminal.
- Brown to Phase One.
- Blue to Neutral or Phase Two.

POWER CABLE ROUTING

The drives power cable is routed and connected as follows (refer to figure 1-7).

1. Remove two screws securing cable guide to frame and remove cable guide.

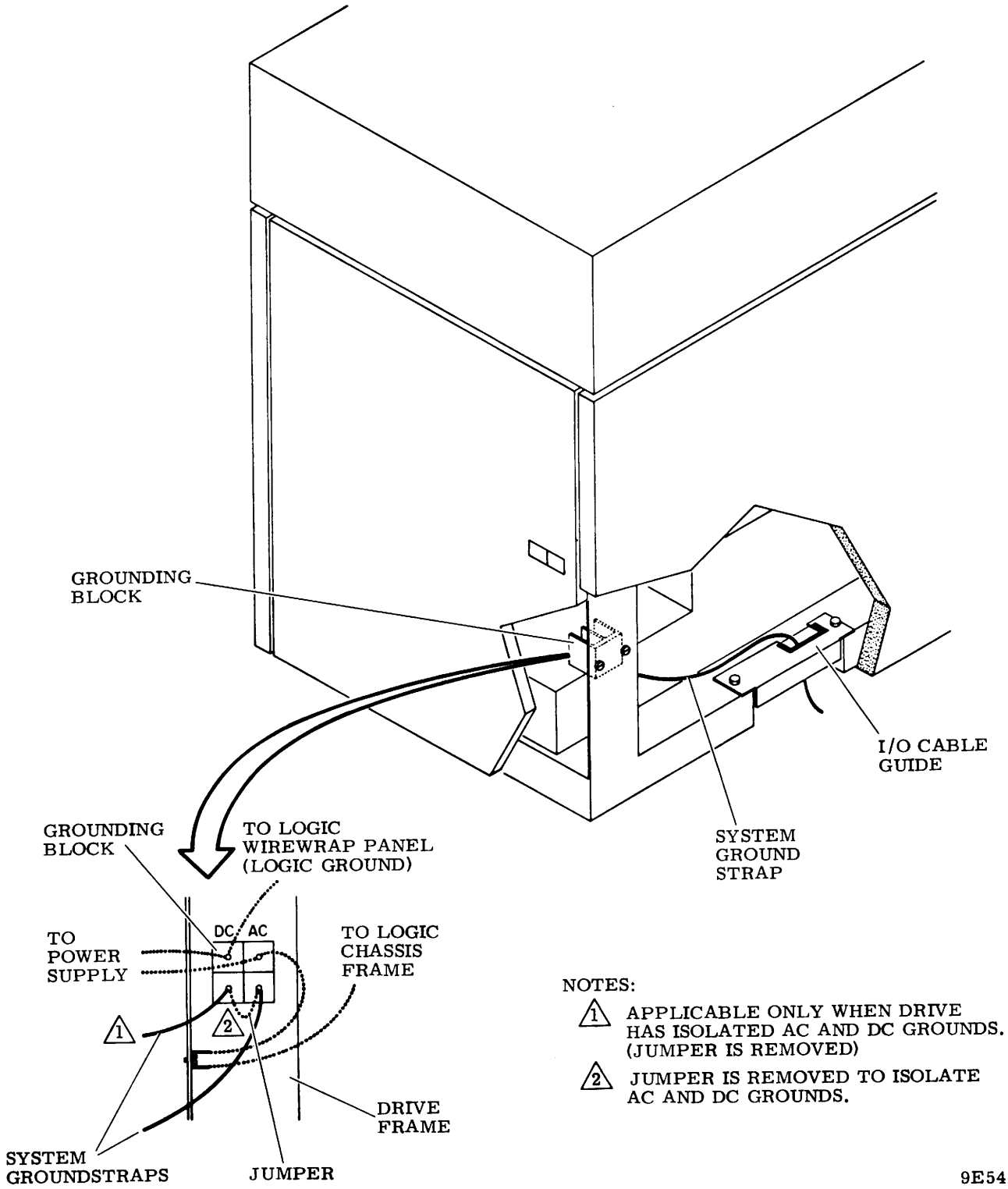


Figure 1-5. Drive Grounding Block

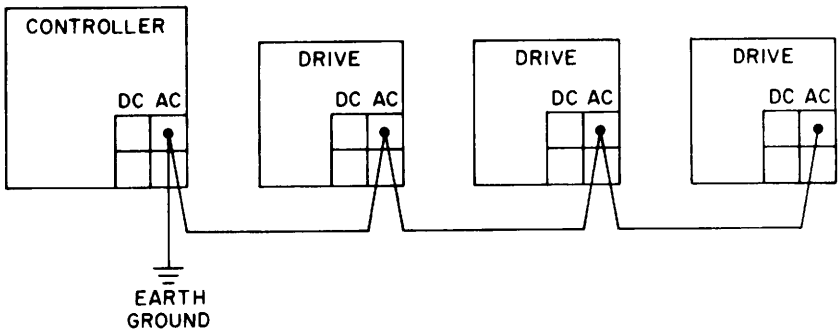


Figure 1-6. Daisy Chain System Grounding

WARNING

Ensure MAIN AC circuit breaker is set to off when connecting power cable.

2. Route power cable through cable guide and connect to power receptacle.

3. Position cable guide on frame and secure with two screws.

4. Connect support spring to power cable.

WARNING

Ensure AC power wiring procedure has been properly performed before connecting power-cord connector to site power source.

5. Connect power cord connector to site power source connection.

I/O CABLE INSTALLATION

This procedure describes the installation of drive I/O cables and terminators. It assumes that the person performing the installation is familiar with the information under I/O cabling presented earlier in this section.

1. Remove power from drive by setting MAIN AC circuit breaker to off.

2. Remove left side panel.

3. Remove two screws securing I/O cable guide (refer to figure 1-8) and remove guide.

NOTE

All cables installed in the following steps are routed through the I/O cable cutout (opening left by removal of cable guide). Also some systems may require that specific connectors on the controller relate to specific physical drives. Consult controller manual for information relating to I/O connections.

4. Connect B cable between controller and drive connector J2.

NOTE

Steps 5 and 6 apply only to systems using star I/O cable configuration.

5. Connect A cable from controller to drive connector J3.

6. Install terminator on J4.

NOTE

Steps 7 through 13 apply only to systems using daisy chain I/O cabling configuration.

7. Connect A cable from controller or connector J4 on upstream drive (drive which is closer to controller on daisy chain) to drive connector J3.

NOTE

If drive is not last in daisy chain perform step 10. If drive is last in daisy chain, perform step 11.

10. Connect another A cable from drive connector J4 to down stream drive connector J3. Proceed to step 12.

11. Install terminator on J4.

12. Replace I/O cable guide, ensuring that cables are routed as shown on figure 1-8.

13. Replace left side panel.

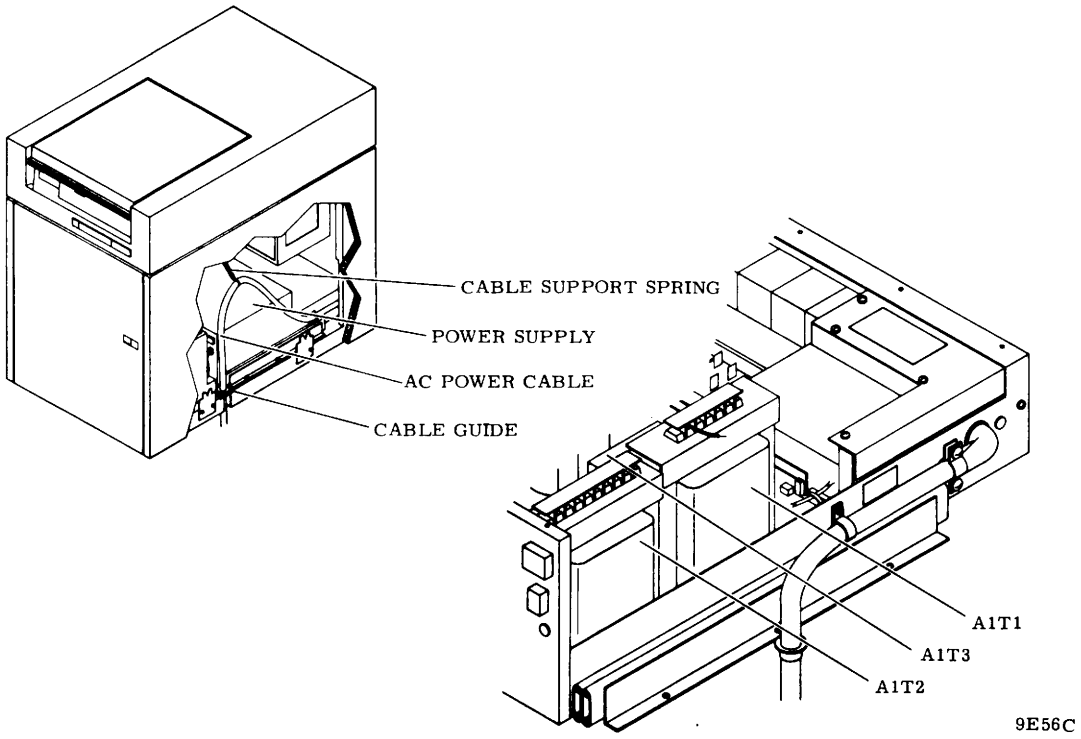
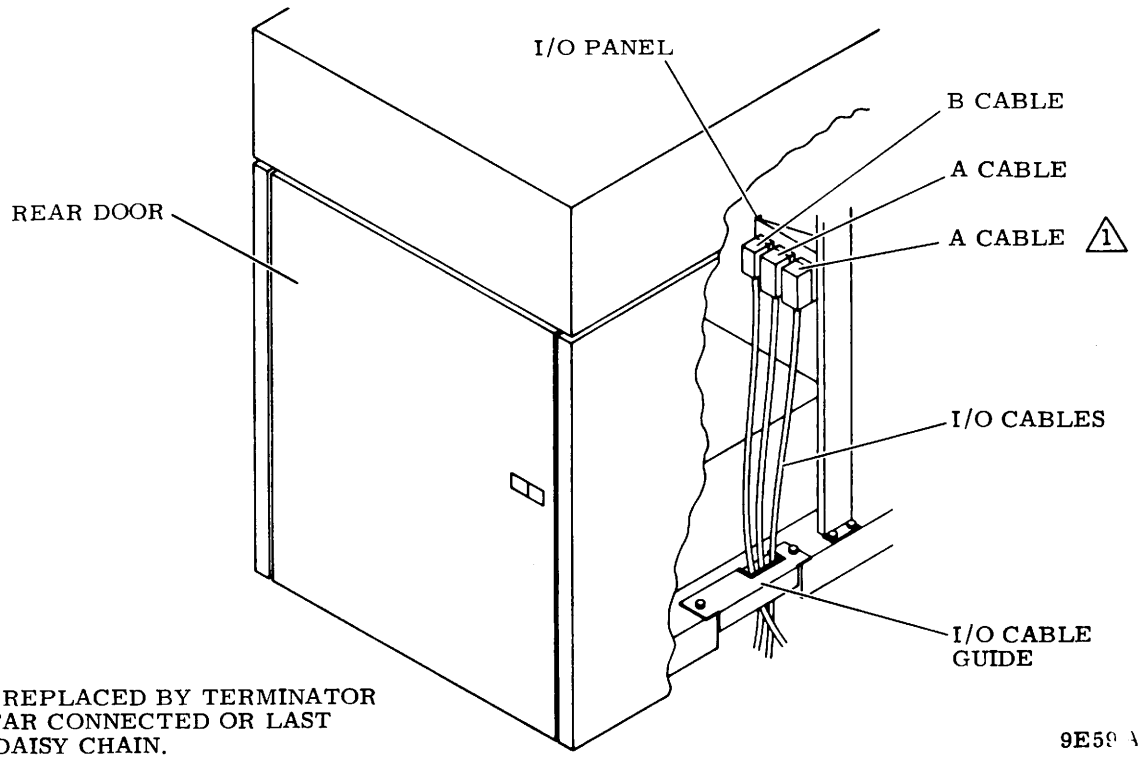


Figure 1-7. Power Cable Routing



NOTES:

1 J4 CABLE REPLACED BY TERMINATOR IF IT IS STAR CONNECTED OR LAST DRIVE IN DAISY CHAIN.

Figure 1-8. I/O Signal Cable Routing

SECTOR PLUG WIRING

The number of sector pulses generated by the drive during each revolution of the disk pack depends on the configuration of its sector plug. This plug is installed on the logic chassis backpanel at location A06 and furnishes preset inputs to the drive sector counter. The sector counter must be preset to the proper value in order to obtain the number of sectors desired. Figure 1-9 shows the sector plug and table 1-7 shows the binary value of each sector plug terminal.

The drive comes from the factory with its sector plug wired for 64 sectors. If a different number of sectors is desired, it is necessary to rewire the plug. Prior to rewiring the plug, the correct preset value for the counter must be determined. This is done using the following formula (refer to the hardware reference manual for more information):

4096 - Length of Sector = Preset Value

Where: Length of Sector equals

$$13440 \frac{\text{(total dibits per revolution)}}{\text{Number of Desired Sectors}}$$

4096 indicates the sector counter is a divide by 4096 counter.

Preset Value equals value that must be initially loaded into the counter in order to obtain the correct number of sector pulses.

Depending on the number of sectors desired, the sector length computation may or may not come out evenly (without a remainder). If it comes out evenly, the disk will be divided into the desired number of sectors all of equal length. If it comes out with a remainder, the drive divides the disk into the desired number of equal length sectors and accounts for the remainder with a short sector just preceding Index. A short sector, resulting from a remainder, is ignored and not counted as part of the total number of sectors. Both cases are explained in the following examples.

Terminal	Wired To
2B (2^{11})	5A
2A (2^{10})	5A
3B (2^{9})	5A
3A (2^{8})	5A
8B (2^{7})	1A
8A (2^{6})	1A
9B (2^{5})	5A
9A (2^{4})	1A
13A (2^{3})	5A
14B (2^{2})	5A
14A (2^{1})	5A
15B (2^{0})	1A

Example 1: In this example 64 sectors are desired.

1. Determine sector length as follows:
   Sector length = $\frac{13440}{64}$ = 210 (no remainder)

   This means there will be 64 sectors each 210 dibits in length.

2. Determine preset value as follows:

   Preset Value = 4096 - Sector Length = 4096 - 210 = 3886

   The sector plug must be wired to preset the counter to 3886.

3. Wire the sector plug as follows (refer to figure 1-9 and table 1-7):

TABLE 1-7. Sector Plug Wiring

Plug Terminal	2B	2A	3B	3A	8B	8A	9B	9A	13A	14B	14A	15B
Binary Value	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
Decimal Value	2048	1024	512	256	128	64	32	16	8	4	2	1

NOTE: Those terminals to be set to a logical one should be connected to terminal 5A (+5 V).
Those terminals to be set to a logical zero should be connected to plug terminal 1A (gnd).

Example 2: In this example 71 sectors are desired.

1. Determine sector length as follows:

   Sector Length = $\frac{13440}{71}$ = 189 with a remainder of 21.

   This means that there will be 71 sectors each 189 dibits in length and one sector (the last before Index) 21 dibits in length. Ignore the 21 dibit sector.

2. Determine preset value as follows (note that remainder is not used in computing preset value):

   Preset Value = 4096 - Sector Length = 4096 - 189 = 3907

   The sector plug must be wired to preset the counter to 3907.

3. Wire the sector plug as follows: (refer to figure 1-9 and table 1-7):

The procedure for wiring the sector plug is as follows (refer to figure 1-9 and table 1-7):

1. Remove the existing jumper wires from the plug.

2. Compute the desired sector length and preset value then determine the proper wiring by referring to table 1-7.

Terminal	Wired To
2B (2^{11})	5A
2A (2^{10})	5A
3B (2^{9})	5A
3A (2^{8})	5A
8B (2^{7})	1A
8A (2^{6})	5A
9B (2^{5})	1A
9A (2^{4})	1A
13A (2^{3})	1A
14V (2^{2})	1A
14A (2^{1})	5A
15B (2^{0})	5A

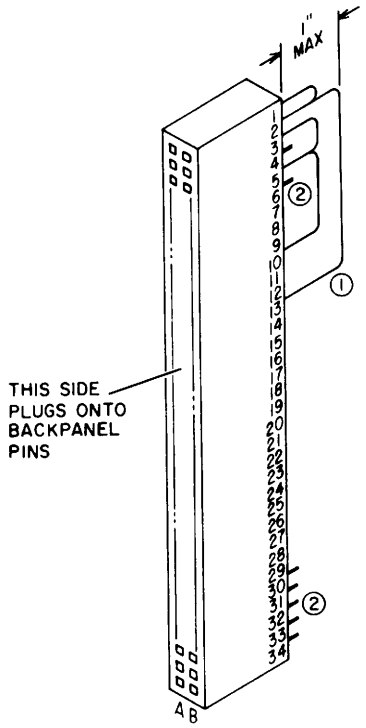
NOTE

In steps 3 and 4, use 24 AWG wire of the correct length with a contact crimped to each end. Refer to figure 1-9 for details.

3. Daisy chain together all the terminals that are to be a logical one and connect the daisy chain to terminal 5A (+5 V).

4. Daisy chain together alll the terminals that are to be a logical zero and connect the daisy chain to terminal 1A (ground).

5. Insert a wire and contact pin into all unused terminals in rows 1 through 6 and rows 30 through 34 (refer to figure 1-7).



NOTES:

① JUMPER WIRE IS 24 AWG (PN 24548305) AND HAS A CONTACT (PN 94245607) CRIMPED ONTO EACH END.

② INSERT WIRE AND CONTACT (CRIMPED TOGETHER) INTO UNUSED TERMINALS IN ROWS 1-6 AND 30-34.

3. TERMINAL 5A CONNECTS TO +5V ON BACKPANEL AND TERMINAL 1A CONNECTS TO GND ON BACKPANEL.

9E226

Figure 1-9. Sector Plug Wiring

CABINET LEVELING

Cabinet leveling should not be performed until drive is in final location and there is no further necessity to move it.

Cabinet leveling consists of installing leveling pads, placing drive in final location, screwing down leveling pads until drive is aligned with other equipments, and ensuring weight is off casters.

1. Install jam nut on each leveling pad and install a leveling pad at each corner of cabinet frame (see figure 1-11) by raising corner of cabinet and threading leveler into weldnut on frame.
2. Locate drive in final position.
3. Turn leveling pads down until they support drives' weight.
4. Adjust leveling pass until drive is aligned with adjacent equipment.
5. Place spirit level on drive top cover and adjust leveling pads until drive is level within three angular degrees both front to back and side to side.
6. When drive is level in both directions, tighten jam nut against bottom of frame.

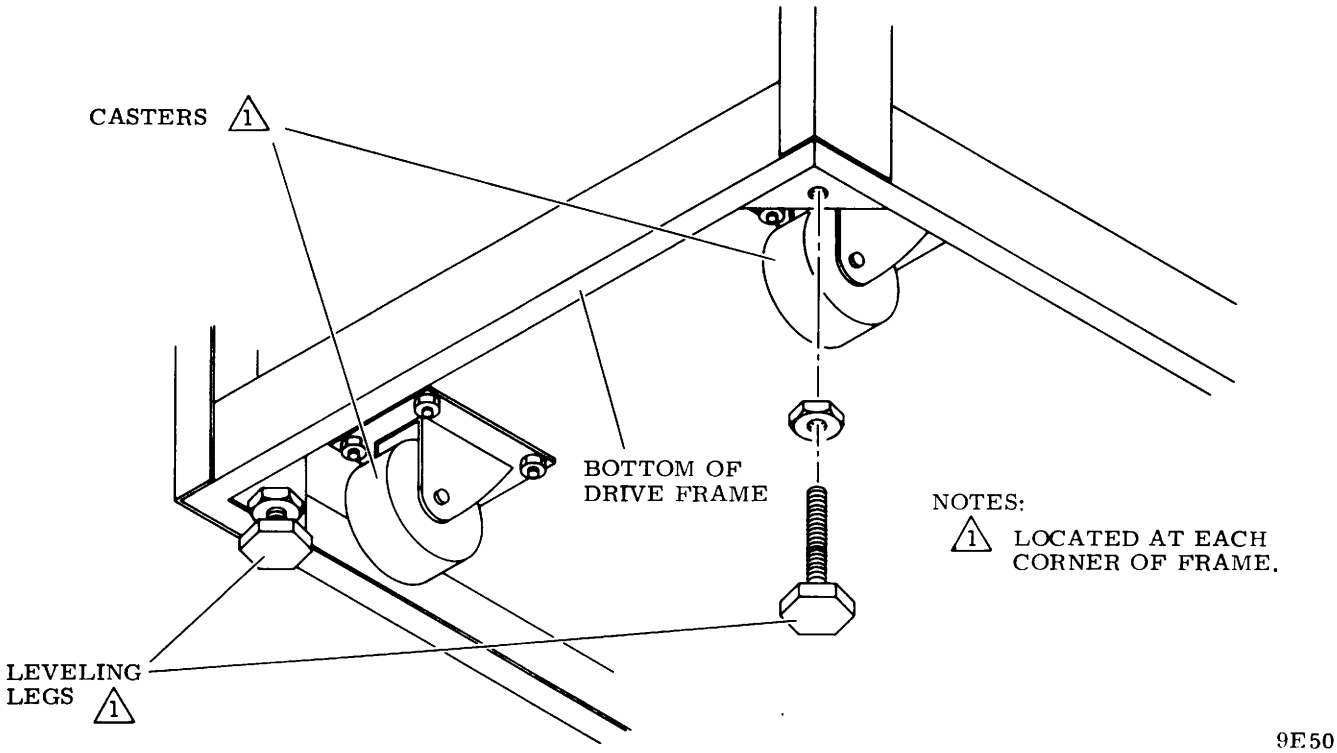


Figure 1-10. Leveling Legs

INITIAL CHECKOUT AND STARTUP

This procedure describes checks that should be performed on the drive prior to putting it online. This procedure assumes that the drive has been unpacked, installed in its normal operating position, all grounding power, and I/O connections have been made, sector switches have been set, and logic plug installed.

1. Set all circuit breakers to off.
2. Perform Clean Shroud and Spindle procedure.
3. Open cabinet rear door, release logic chassis catch and swing logic chassis open.
4. Remove logic chassis card cover and verify that all cards are firmly seated in their connectors.
5. Verify that all connectors are firmly seated on the backpanel pins, and check for loose or broken wires.
6. Open top cover and remove deck cover.
7. Verify that all cards in the read/write chassis are fimrly seated in their connectors.
8. Set all circuit breakers to on, verify that blower starts and allow it to operate for at least 10 minutes before proceeding to step 9.
9. Install scratch disk pack.
10. Press START switch and verify the following occurs:
    a. START indicator lights.
    b. Drive motor starts and pack comes up to speed in approximately 30 seconds.
    c. Heads load when pack comes up to speed.
11. Perform following procedures:
    a. Servo System Test and Adjustment.
    b. Head Alignment.

SECTION 2

MAINTENANCE

INTRODUCTION

This section contains drive preventive and corrective maintenance information. The maintenance discussed in this section is limited to that which may be performed in the field. The information is divided into the following major areas:

- General Maintenance Information - Contains general information that a person should be familiar with prior to performing maintenance on the drive.
- Preventive Maintenance - Describes preventive maintenance that must be performed to maintain proper drive operation.
- Tests and Adjustments - Contains procedures describing the electrical adjustments that may be performed on the drive in the field.
- Trouble Analysis - Describes tests that may be performed to isolate problems with the drive.
- Repair and Replacement - Describes replacement and adjustment of those drive assemblies that may be replaced or adjusted in the field.

SECTION 2A

GENERAL MAINTENANCE INFORMATION

GENERAL

This section contains general information relating to maintenance of the drive. A person performing maintenance on the drive should be familiar with this information in addition to the operating principles and procedures described in the hardware reference manual.

The information in this section is divided into the following areas:

- Safety Precautions - Lists safety precautions that must be observed when working on the drive.
- Maintenance Tools and Materials - Lists the tools and materials required to perform maintenance on the drive. This includes discussions on the types of disk packs used during maintenance procedures, the head alignment kit card which is used during head alignment, and the use of test software or field test unit for performing drive test and adjustments.
- Accessing Drive for Maintenance - Describes the features of the drive which allow convenient access to its assemblies for maintenance.
- Maintenance Controls and Test Points - Locates and describes the controls, indicators and test points used during maintenance.
- Manually Position Carriage - Describes how the heads may be loaded and positioned manually.
- Special Maintenance procedures - Describes certain procedures and practices that are important to proper maintenance of the drive.

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.
- Make certain that heads are unloaded before turning off power.
- If power to drive 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 enable heads to fly.
- Observe safety precautions described in discussion on Handling Electrostatic Devices when working on -YFN card in power supply or this card may be damaged.

MAINTENANCE TOOLS AND MATERIALS

GENERAL

When performing preventive and corrective maintenance on the drive, certain special tools, test equipment and materials are required. These are listed in table 2-1 along with their CDC part numbers.

Most of these items require no special instructions for their use and where special instructions are necessary, they are included in the maintenance procedures. However, several of the items in table 2-1 do require more explanation than is included in the maintenance procedures. These are the disk pack, head alignment kit, and field test unit

TABLE 2-1. MAINTENANCE TOOLS AND MATERIALS

Description	CDC Part Number
Adapter (3/16 Hex to 1/4 Sq)	CDC* 12262582
Ball End Hex Driver (3/16 Hex)	CDC 12263201
Card Extender (Full Size)	CDC 54109701
Card Extraction Tool	CDC 87399200
Carriage Alignment Arm	CDC 75018400
Chip Extender (Chipclip)	CDC 12212196
Cloth Lint Free	CDC 94211400
Computer Card No. 50848***	None
Disk Pack, CE (883-51)	CDC 70430003
Disk Pack, Regular (883-91)	CDC 70430505
Dust Remover***	CDC 95047800
Epoxy (Fast Cure)	To be supplied
Field Test Unit TB303D (with Head Alignment)	CDC 75255006
Field Test Unit TB303# (without Head Alignment)	CDC 75255007
Filter Coat	CDC 12210958
Gauze, Lint Free	CDC 12209713
Grease, Silicone	CDC 95109000
Head Adjustment Tool	CDC 75018800
Head Alignment Kit	CDC 77440503
Hose Assembly	CDC 82346500
High Itensity Light	CDC 12212038
I/O Pin Removal	CDC 12212759
Loctite, Grade C	Loctite Corp.
Loctite Primer, Grade N	Loctite Corp.
Lubricant Paste	CDC 95016101
Media Cleaning Solution	CDC 82365800
Mirror	Commerially available
Non-Metallic Feeler Gage, 0.005 inch	CDC 12205633
Oscilloscope, Dual Trace	Tektronix 454 or equivalent
Oscilloscope Hood	Tektronix 016-0083-00
Pin Straightener	CDC 87369400
Pressure Gauge Kit, Differential (optional)	CDC 73040100
Push-Pull Gage	CDC 12210797
Wirewrap Removal Tool, 20-30 Gage	CDC 12259183
Scope Probe Tip (Hatchet Type)	CDC 12212885
Spindle Adjustment Tool	CDC 87059900
Torque Screwdriver**	CDC 12218425
Torque Screwdriver Bit**	CDC 87016701
Torque Wrench, 1/4 inch	CDC 12263205
Volt/ohmmeter	Ballantine 345 or equivalent digital voltmeter
Wire Wrap Bit, 30 Gage	CDC 12218402
Wire Wrap Gun, Electric	CDC 12259111
Wire Wrap Sleeve, 30 Gage	CDC 12218403

* CDC is a registered trademark of Control Data Corporation.
** Torque screwdriver and bit are used for torqueing head clamping hardware.
*** Used for head cleaning.

which are described in the following discussions (note that these discussions also describe the use of test software which may be used in lieu of the field test unit).

DISK PACK

The maintenance procedures refer to three types of disk packs: (1) customer (2) scratch and (3) CE. All three are physically identical, but are used for different purposes.

A customer disk pack refers to a pack used by the customer for data storage during normal online operations.

The CE pack contains special prerecorded information used during maintenance and care must be taken that this data is not descroyed or altered.

A scratch pack is simply a disk pack that does not contain customer or other information that must not be destroyed. Therefore, a scratch pack can be used in maintenance procedures where a danger exists that the pack could be damaged or its information altered or destroyed.

Information regarding disk pack installation, removal, and maintenance is found in the hardware reference manual.

HEAD ALIGNMENT KIT

The head alignment kit is used whenever the heads are aligned by the use of test software.

The kit consists of a null meter which gives a visual indication of head alignment, a card which processes alignment information from the heads so it can be used in the meter, and a cable which carries raw alignment information from the heads to the card. Each of these are shown on figure 2-1 and explained in the following paragraphs.

The head alignment card develops an output voltage which is derived from the output of the servo and read/write preamplifiers. When a CE disk pack is installed on the drive, this output voltage will be proportional to the distance a selected head is offset from the track centerline. The head alignment card plugs into card location A16 in the drives logic chassis.

The head alignment card included in the kit is either the HFSV card or the AZPV card. The only difference between the cards is that the AZPV card does not have the four indicators found on the HFSV card (see figure 2-1).

The following toggle switches control the cards operation (refer to figure 2-1).

S1 - Changes the polarity of the alignment signal and is used in aligning both servo and read/write heads. This is done as follows:

a. Note null meter reading when switch is in P position.

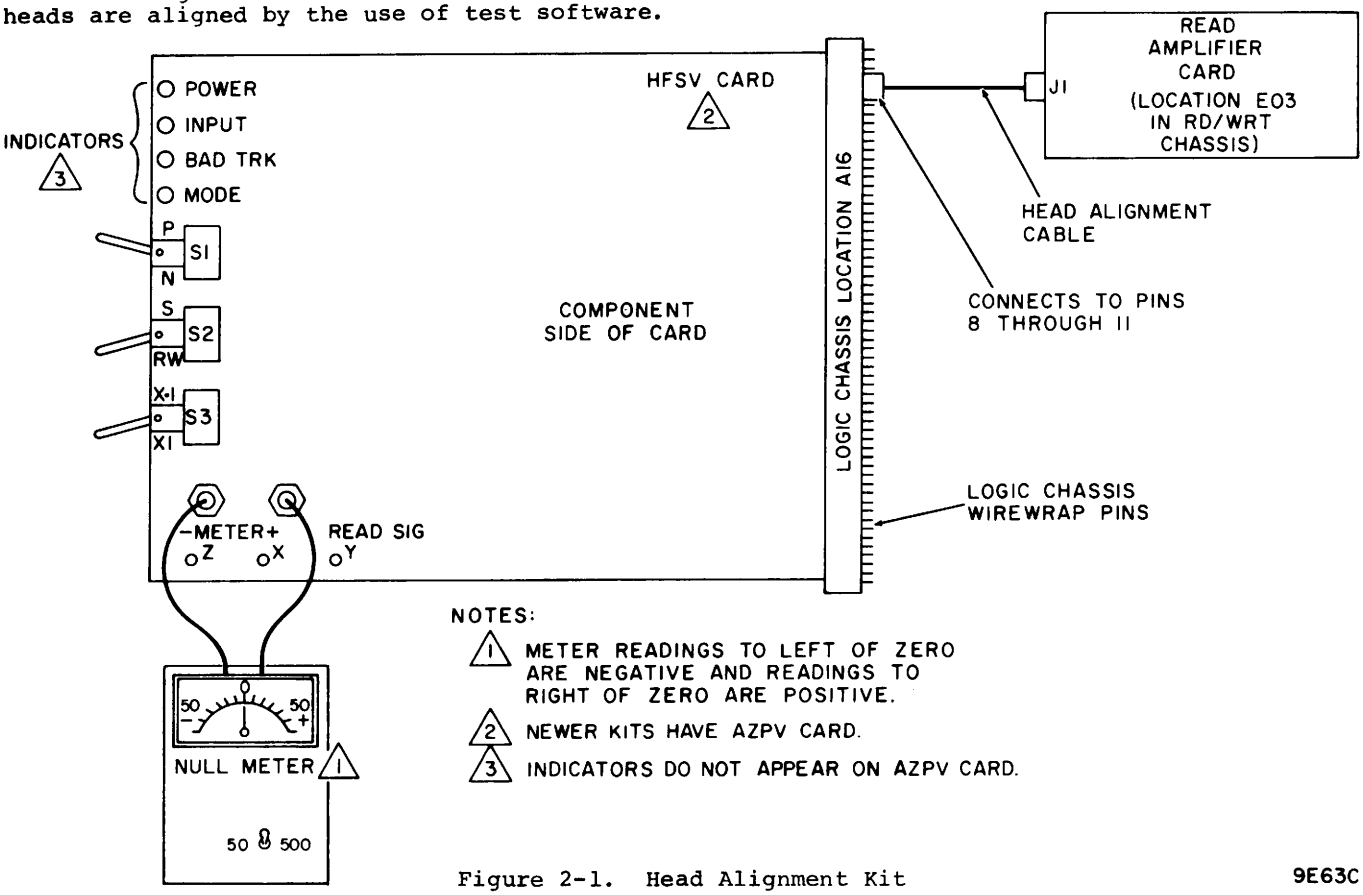


Figure 2-1. Head Alignment Kit 9E63C

b. Note null meter reading when switch is in N position.

c. Subtract N reading from P reading to determine alignment error. For example: If P = +30mV and N = -40mV then P - N = (+30) - (-40) = +70mV.

S2 - When switch is in S position, the card selects the servo head as an input to the card. When switch is in R/W position it selects a data head input to the card.

S3 - Changes sensitivity of card. When in X.1 position, the cards sensitivity is reduced by a factor of 10. When in X1 position, the cards sensitivity is not reduced. This switch should be in X1 position when making measurements for use in calculating head alignment error.

Four indicators are provided on the HFSV card (but not on the AZPV card) as monitors to ensure the card is operating properly and is receiving the proper data. These indicators are as follows:

Power - When lighted it indicates power is applied to card.

Input - When lighted, it indicates the input signals are too low for the alignment card circuits to operate.

Bad Track - When lighted, it indicates a short duration loss of input. A one shot maintains the lighted condition for at least four seconds. Note that this indicator lights when the S1 operated.

Mode - When lighted, it indicates that either S2 is in the S (servo) position or S3 is in the X.1 position. When either of these conditions exists, read/write head alignment error cannot be measured.

The card receives its inputs via the head alignment cable which is a part of the head alignment kit. This cable connects between A16 pins 8 through 11 and J1 on the read amplifier board in read/write chassis location E03.

The cards output voltage is measured by a null meter (refer to figure 2-1) which connects via test leads to test points X and Z on the card. This meter is either part of the FTU or is a separate unit if the head alignment kit is being used.

The switch on the meters front panel changes the sensitivity of the meter. When the switch is in the 50 position, the meter reads up to ±50mV. When the switch is in the 500 position, the meter reads up to ±500mV. This switch should be in the 50 position when making measurements for use in calculating head alignment error.

TESTING DRIVE WITH FTU OR SOFTWARE

General

A Field test exerciser (FTU) or test software is required to perform most of the electrical tests and adjustments described in this manual. The FTU or test software provide various functions (such as seeking) which are necessary to perform the test. The following discussion describes the use of both FTU and software in testing the drive.

Testing With FTU

The FTU is an offline tester. This means the drive cannot be selected or used by the controller while tests are performed with the FTU.

It connects to the drive by disconnecting the system I/O cables from the drive and connecting the FTU I/O cables; in their place.

This connection is described in the Preparation of Drive for Testing procedure. Refer to the manual applicable to the FTU for more information concerning its operation, installation, and use.

Testing With Software

The drive can also be tested by use of microdiagnostic test routines (test software). This requires use of the controller and the appropriate software. In this type of testing, the drive communicates with the controller as during normal online operations and no special I/O connections are necessary.

The procedure for preparing the drive is the same as when using the FTU, except for the I/O connections and is described in the Preparation of Drive for Testing procedure.

Refer to manuals or other documentation applicable to the specific system or subsystem for information concerning the test software routines.

Preparation Of Drive For Testing

The following prepares the drive for testing with either the FTU or software.

1. Press START switch to stop drive motor and unload heads.

NOTE

Disable I/O by deselecting drive at controller before performing step 2. Also set drives Maintenance Unit Disable switch(refer to discussion on Maintenance Controls and Indicators) to disable position.

2. Open rear door and set MAIN AC circuit breaker to off.

NOTE

All procedures other than head alignment require installation of a scratch pack; however, head alignment requires a CE pack.

3. Raise pack access cover, remove customer disk pack and replace with either scratch pack or CE pack.

4. Close pack access cover.

5. Release logic chassis latch and swing chassis open.

NOTE

If test software is to be used, proceed to step 7. If FTU is used, proceed to Step 6.

6. Connect FTU standard I/O cables to drive as follows (refer to figure 2-2):

   a. Disconnect I/O cables from J2, J3, and J4 on drive I/O panel.

   b. Terminate J4.

   c. Install tester A cable to J3 and B cable to J2.

   d. If drive is in system that is daisy chained, make necessary connections to ensure other drives remain under system control.

7. Loosen Turn Lock Fastener securing card cage cover to logic chassis and remove cover.

8. Install card extender if test or adjustment procedure being performed requires it (this will be noted in that procedure).

9. If head alignment is being performed, proceed as follows:

   a. Install head alignment card (HFSV) in location A16.

   b. Connect head alignment cable from logic backpanel location A16 pins 8 through 11, to J1 oncard E03 in read/write chassis (refer to discussion on head alignment for more information).

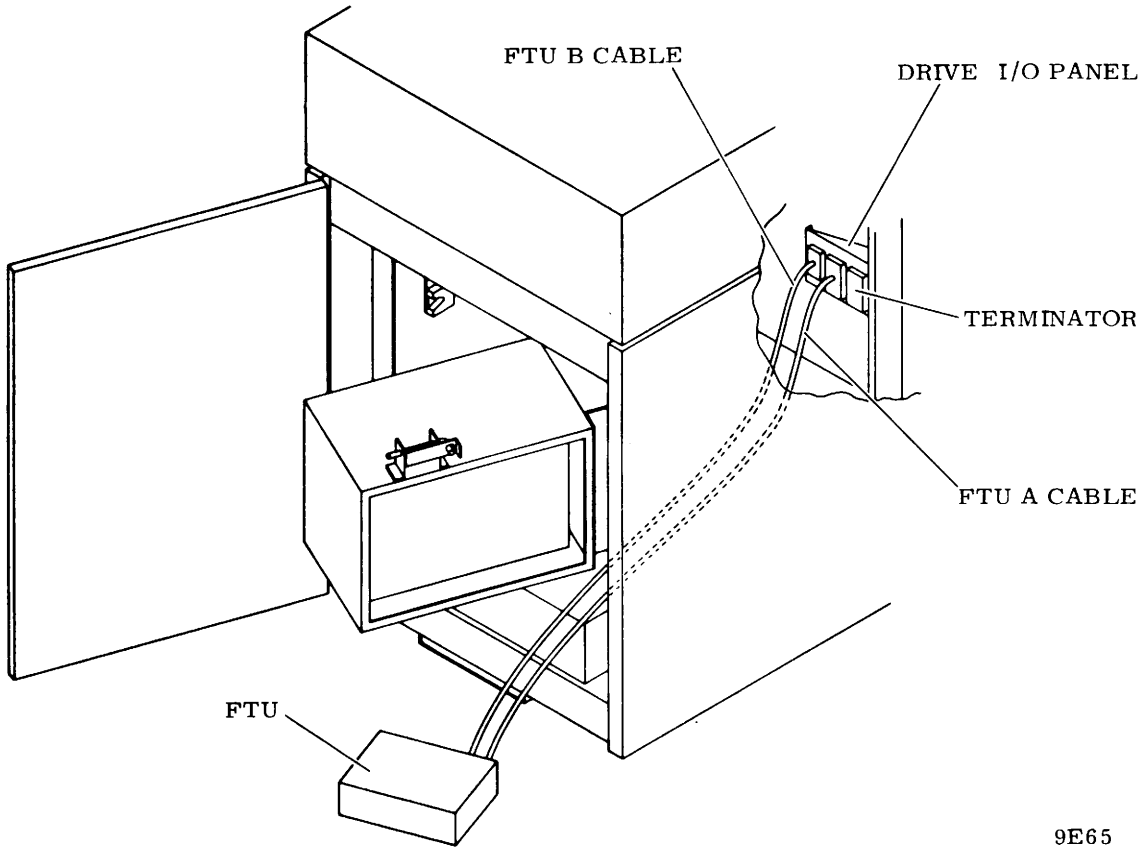


Figure 2-2. FTU to Drive I/O Connection

10. Set MAIN AC circuit breaker to on.

11. Press START switch to start drive motor and load heads.

12. Select drive (when drive is selected it is ready for tests and/or adjustments).

Preparation Of Drive For Return Online After Testing

The following prepares the drive for return to normal online operation after completing tests with either FTU or software.

1. Remove power from drive as follows:

   a. Press START switch to stop drive motor and unload heads.

   b. Set MAIN AC circuit breaker to off.

NOTE

If test software was used, proceed to step 5. If FTU was used, proceed to step 2.

2. Disconnect FTU standard I/O cables from J2 and J3 on drive I/O panel.

3. Disconnect terminator from J4 on drive I/O panel, if it was installed during installation of FTU and is not required for normal online operation.

4. Reconnect system I/O cables to drive in same configuration as they were prior to installation of FTU.

5. If any cards were installed on card extender, remove card extender and replace card in logic chassis.

6. If head alignment was performed, remove head alignment card from location A16. Also remove head alignment cable which is connected from E03 on read/write chassis to A16 on drive backpanel.

7. Replace cover on card cage and secure with turnlock fastener.

8. Close logic chassis and rear door.

9. Close cabinet top cover, (if it has been open).

10. Remove scratch pack or CE pack (whichever was used).

ACCESSING DRIVE FOR MAINTENANCE

GENERAL

The drive has certain features such as doors and covers which provide easy access to its major assemblies. These features are useful when performing maintenance on the drive. Figure 2-3 shows all of these features and they are further described in the following discussions.

CABINET DOORS

The drive has doors on both the front and rear of the cabinet (refer to figure 2-3). The front door provides access to the blower assembly. If the blower assembly is removed, the lower part of the spindle and its associated parts may also be accessed. The rear door allows access to the logic chassis, power supply and drive motor.

The doors are opened by pushing the latch and swinging them outward as shown on figure 2-3. The doors are removed by first removing the groundstrap, then lifting out the pin securing the door to the lower hinge and slipping the door off the upper hinge. The doors are replaced by reversing the removal procedure.

CABINET TOP COVER

General

The top cover must be raised to access the deck assemblies. It must be removed prior to removing the shroud cover, shroud or pack access cover.

The top cover has no latch and is raised by lifting it from the rear and raising it until the support locks into place (refer to figure 2-4).

The following describes removal and replacement of the top cover. Note that if the drive is installed in line with other drives it must be removed from the in-line position before the cover can be removed or replaced.

Top Cover Removal

1. Raise top cover until support locks it in upright position.
2. Remove nuts from screws holding each side of top cover but do not remove screws. Cover should remain in raised position, supported by screws and support brackets.
3. Remove C clip securing support bracket to top cover, then lower support bracket and top cover to closed position.
4. Remove screws from top cover hinges and lift top cover off drive.

Top Cover Replacement

1. Set top cover on drive.
2. Insert screws through hinges and drive frame.

NOTE

Cover should be supported by screws when it is raised in step 3.

3. Lift top cover to raised position and secure support bracket to top cover with C clip.
4. Install nuts on screws securing hinges to frame.

DECK COVER

The deck cover (refer to figure 2-4) must be removed to access the rear half of the deck. This includes the actuator and magnet assemblies. The purpose of this cover is to provide an electromagnetic interference shield for the drive. The cover is lined with acoustical foam to reduce machine noise.

The cover is removed by releasing the four latches and lifting it off the deck.

LOGIC CHASSIS

The logic chassis is located at the rear of the drive and is accessed by opening the rear door. Releasing the catch on the logic chassis allows it to swing outward thus permitting access to the card cage (refer to figure 2-5). The card cage cover must be removed in order to reach the logic cards, use care when opening and closing the logic chassis not to damage the cables or air hose.

PACK ACCESS COVER

General

This cover provides access to the disk pack and shroud area and must be closed to start the drive motor. The pack access cover is opened by releasing the latch on the front of the cover; however, it can be fully raised only when the top cover is closed. Once opened it is supported by a gas spring attached between it and the deck (refer to figure 2-6).

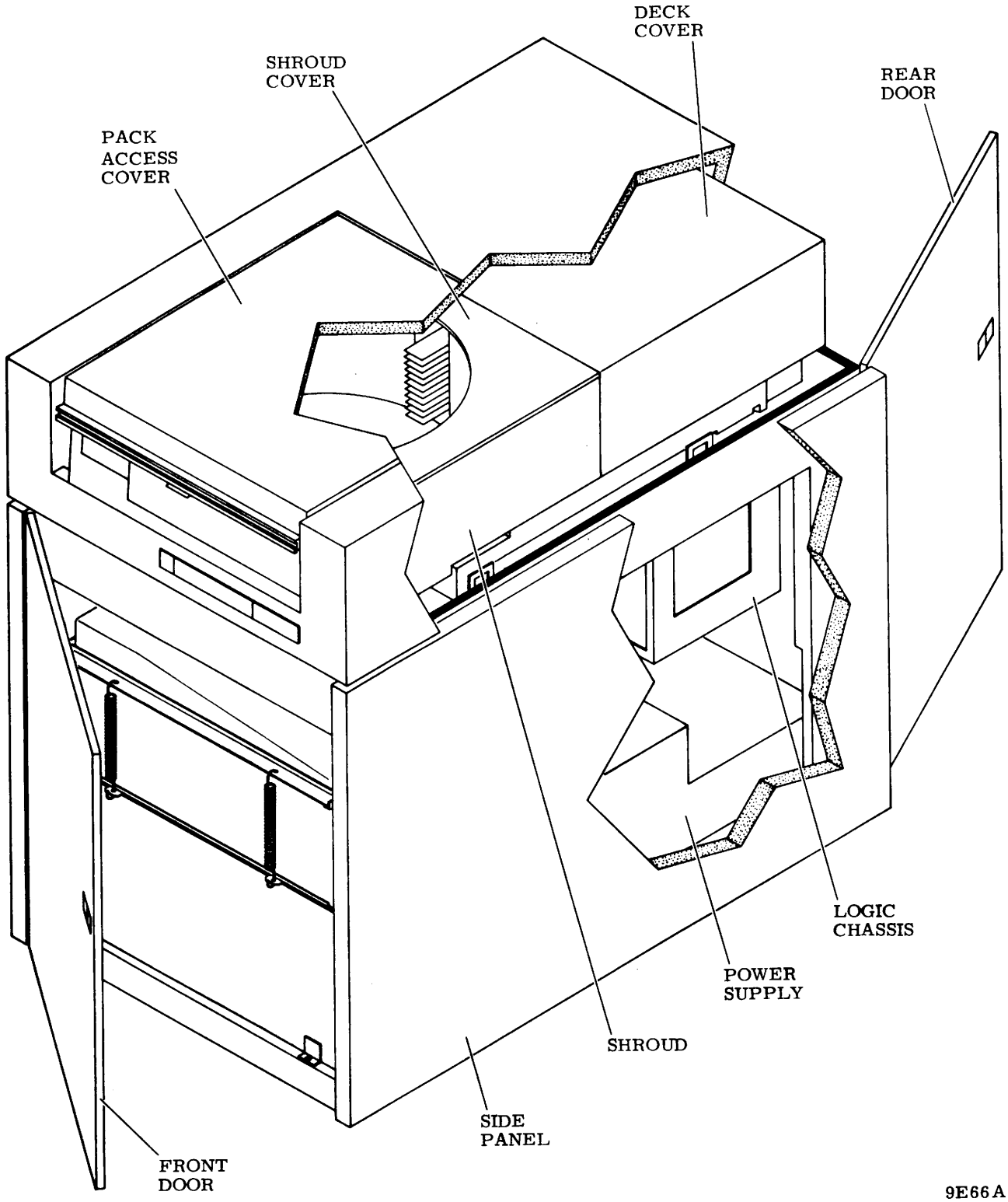


Figure 2-3. Access For Maintenance Features

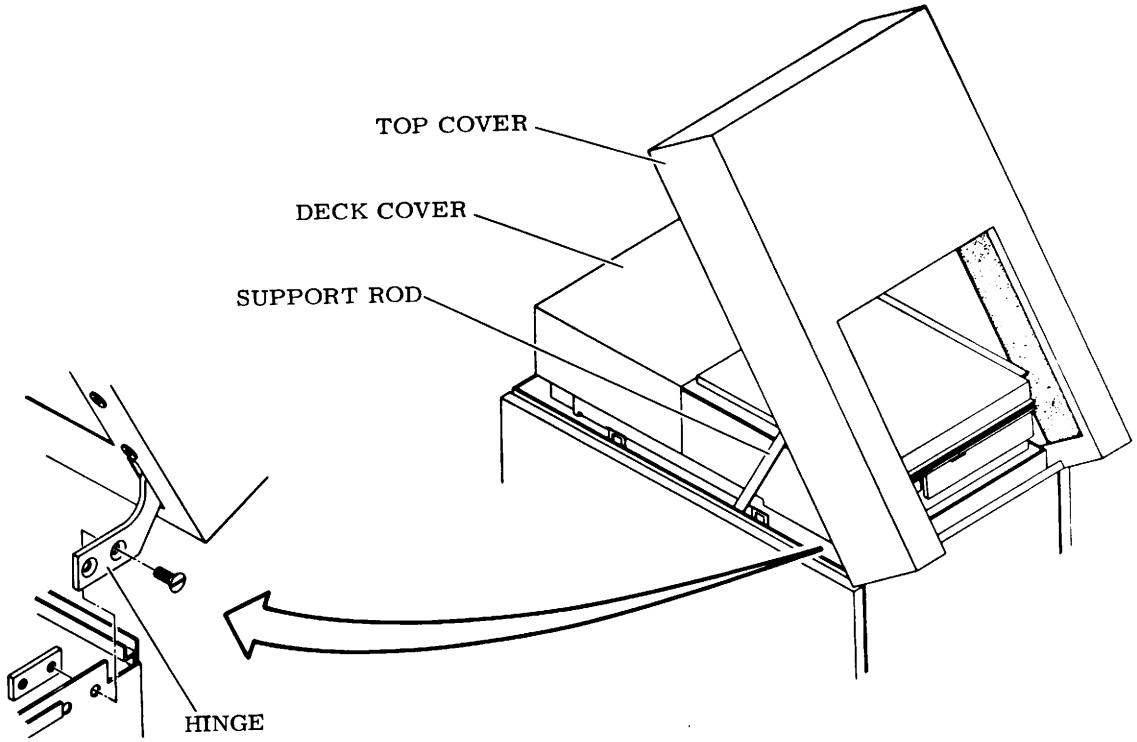


Figure 2-4. Top and Deck Cover

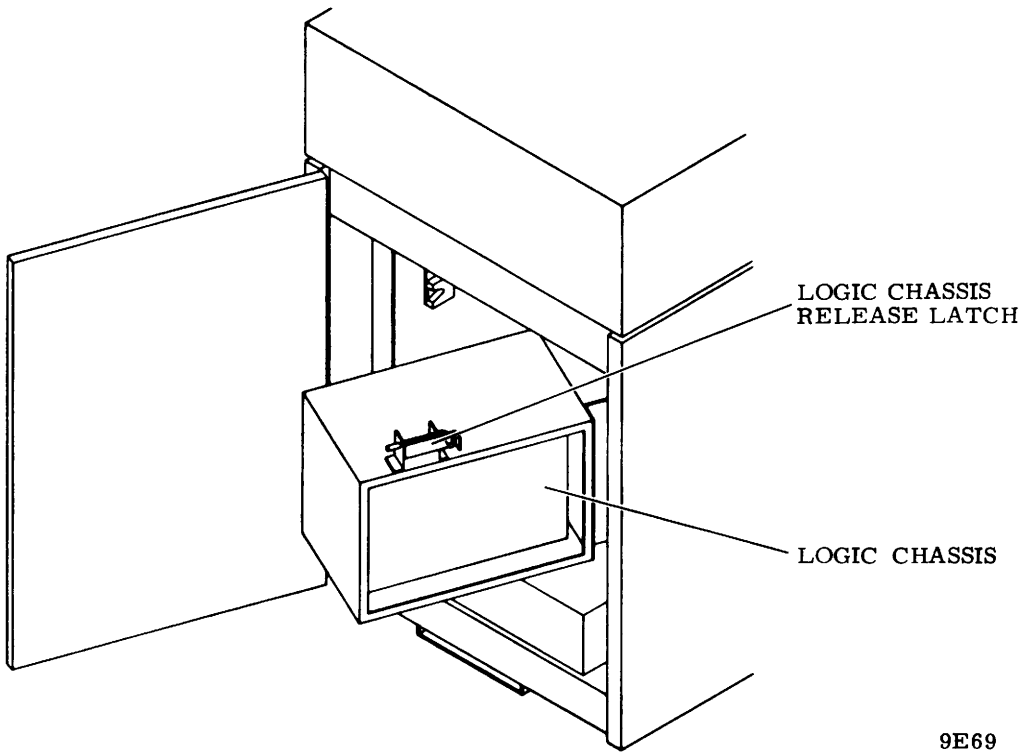


Figure 2-5. Logic Chassis

On some drives a pack access cover solenoid is installed on the front of the shroud cover. This solenoid locks the pack access cover shut whenever the pack is spinning.

The pack access cover is removed and replaced as described in the following procedures.

Pack Access Cover Removal

1. Remove cabinet top cover.
2. Remove C clip securing gas spring to pack access cover.
3. Disconnect ground lead from pack access cover.
4. Remove screws and nuts securing pack access cover hinges to shroud cover and remove pack access cover.

Pack Access Cover Replacement

1. Install pack access cover on shroud cover by securing hinges with nuts and screws. Before tightening screws ensure cover is approximately centered on shroud.

   Also ensure that clearance on front of shroud is such that the pack access cover solenoid (if installed) will engage.

2. Secure gas spring to pack access cover using pin, nylon spacers and C clip (refer to figure 2-6).
3. Connect ground lead to pack access cover.

   NOTE

   The solenoid will also have to be adjusted if it is installed and the catch on shroud cover is moved to ensure a proper air seal.

4. Check to ensure that a tight air seal exists between pack access cover and shroud cover. This can be checked visually and also by noting the drag on a sheet of paper as it is pulled out from between closed pack access cover and shroud cover. Adjust if necesary by moving catch on shroud cover up or down until pack access cover latches tight enough to provide an air seal.

POWER SUPPLY

The power supply is mounted on slides at the bottom rear of the drive cabinet. The slides allow the power supply to be slid out to a position convenient for maintenance. Put the power supply in the maintenance position as follows:

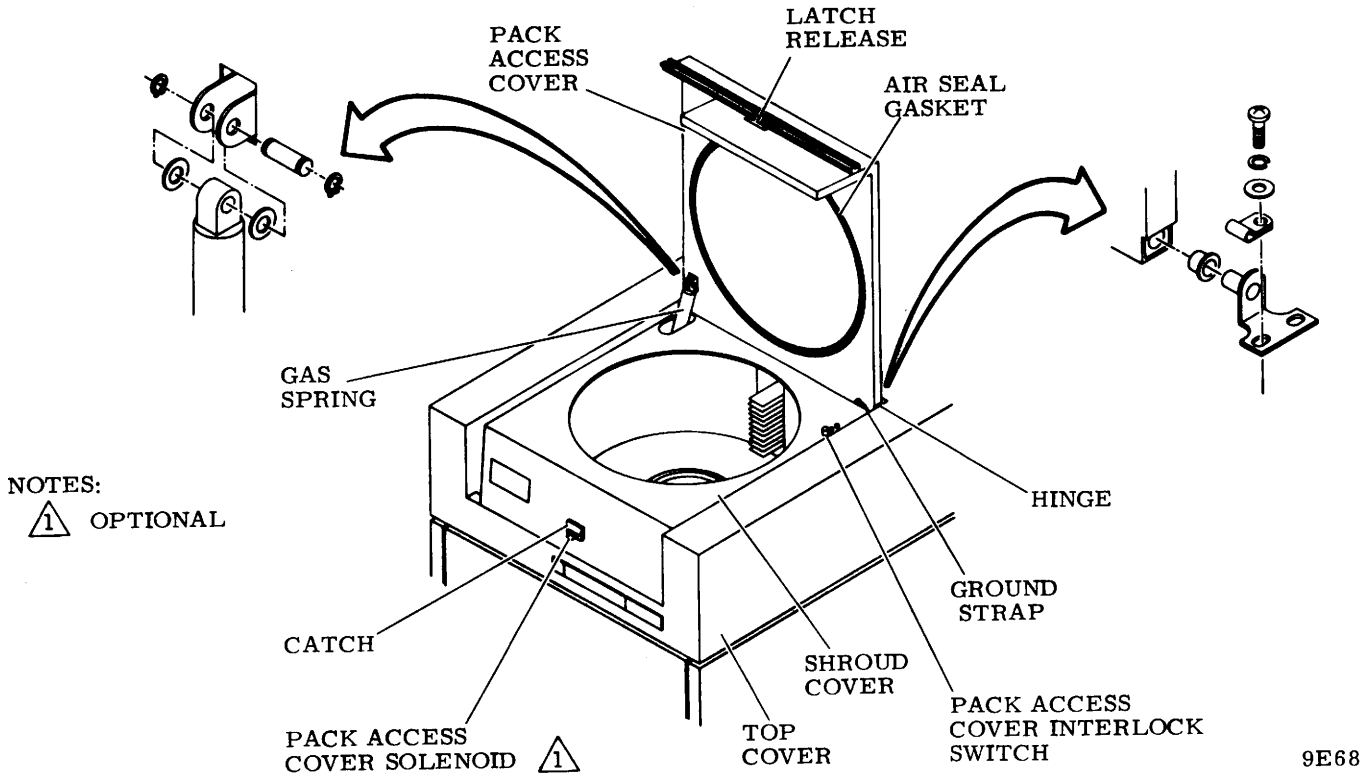


Figure 2-6. Pack Access Cover

1. Swing logic chassis outward far enough so it is not damaged when power supply is slid out.

2. Lift power supply release latch (see figure 2-8) and pull power supply out to maintenance position.

When the power supply is in the maintenance position, the top cover can be removed to provide access to the inside of the supply. The top cover is removed by first removing the four screws at the rear of the cover (refer to figure 2-8) then loosening the four screws at the front of the cover and slipping the cover off.

The power supply control panel is hinged on its bottom edge so the panel may be opened to allow access to components on the back of the panel. To open the control panel, first remove the top cover, then remove the screws on each side of the panel and pull it open.

SIDE PANELS

The drive has both left and right side panels. The panels are removed by pulling up on the release lateches, swinging the panels outward far enough to disconnect the round straps, and then removing the panels from the drive (refer to figure 2-7). The panels are replaced by reversing the removal procedure. Note that if the drive is installed in line with other drives, it must be moved out of line to remove or replace the side panels.

SHROUD AND SHROUD COVER

General

The shroud and shroud cover enclose the pack area and the front portion of the deck. They must be removed to perform certain maintenance procedures and their removal and replacement is described in the following (refer to figure 2-9).

Shroud and Shroud Cover Removal

1. Remove cabinet top cover.

2. Remove pack access cover.

3. Remove pack access cover switch by removing two screws securing it to shroud cover and letting it hang by leadwires.

4. Snap operator control panel out of its position in shroud cover, disconnect control panel cable plug from control panel and then snap control panel back into place.

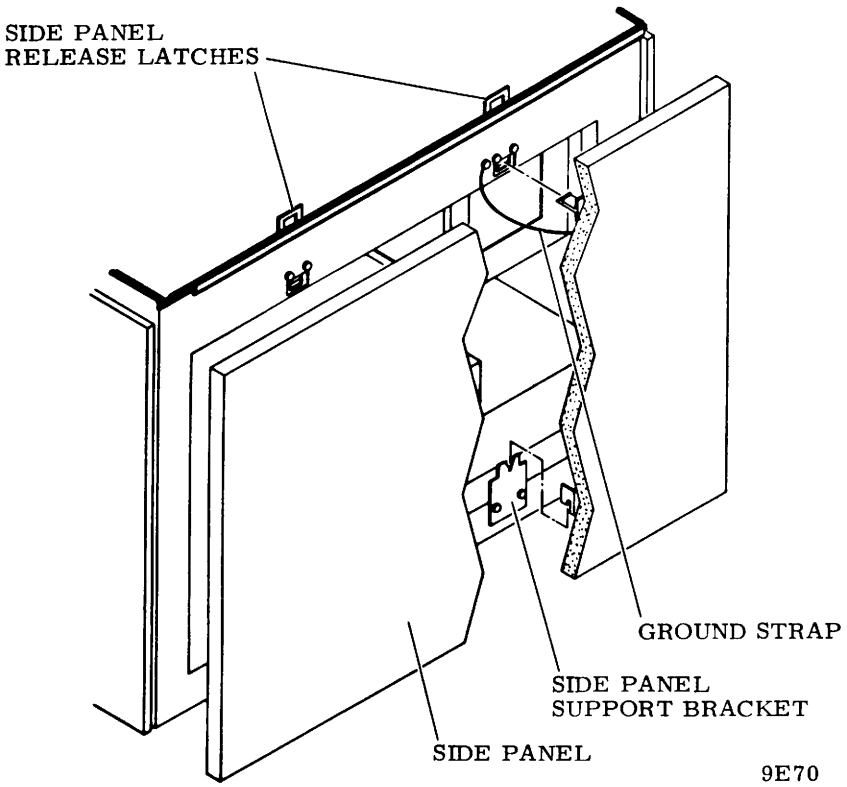


Figure 2-7. Side Panel

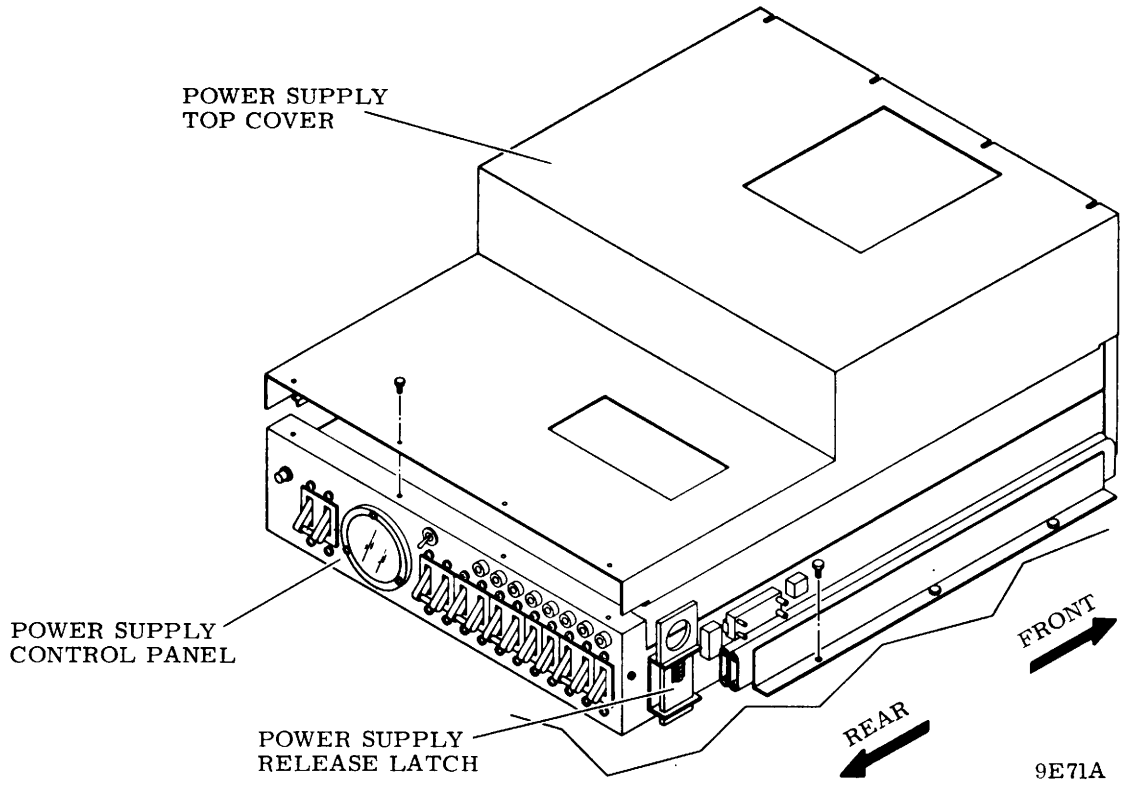


Figure 2-8. Power Supply

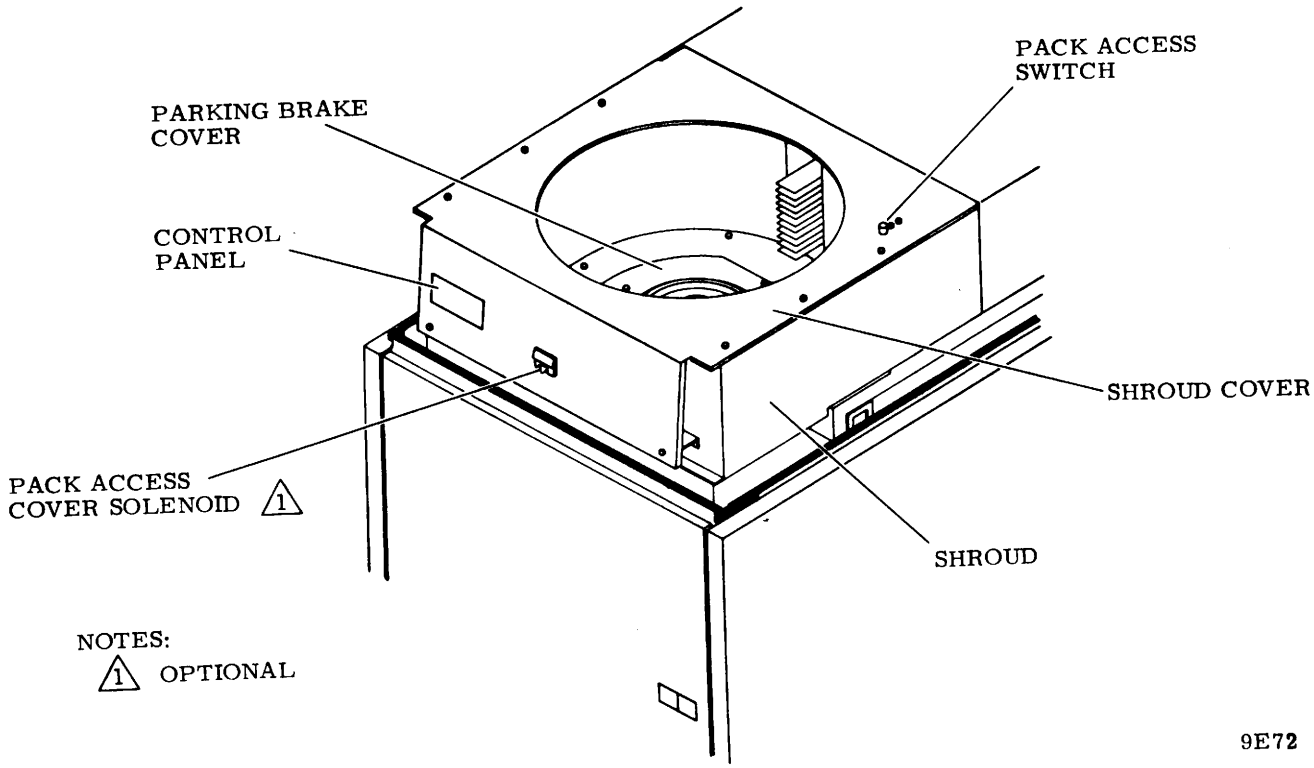


Figure 2-9 . Shroud and Shroud Cover

NOTE

If pack access cover solenoid is installed it is necessary to move shroud cover far enough forward to disconnect solenoid leadwires before removing shroud cover in step 5.

5. Remove twelve screws securing shroud cover to shroud and remove shroud cover.

6. Remove six screws and washers securing packing brake cover to shroud cover and remove parking brake cover.

7. Remove nine screws and washers securing shroud to deck and remove shroud.

Shroud and Shroud Cover Replacement

1. Position shroud on deck and secure with nine screws and washers.

NOTE

If pack access cover solenoid is installed, it is necessary to reconnect solenoid leadwires before securing shroud cover to shroud.

2. Position shroud cover on shroud and secure with twelve screws.

3. Secure parking brake cover to shroud with six screws and washers.

4. Snap operator control panel out of its position in shroud cover, connect control panel cable plug to operator control panel, and snap control panel into its position in shroud cover.

5. Position pack access cover switch under shroud cover and secure with two screws.

6. Replace pack access cover.

7. Replace top cover.

MAINTENANCE CONTROLS AND TEST POINTS

GENERAL

Throughout this manual, references are made to switches, indicators, and test points. These are located and described in the following discussions.

MAINTENANCE CONTROLS

In addition to the operator panel and power supply Control panel switches and indicators described in the Operation section of the hardware reference manual, the drive has a number of controls and indicators used primarily for maintenance. All of these are located on the edge of the Fault card in location A17 of the logic chassis. Figure 2-10 shows these controls and indicators and Table 2-2 defines their functions.

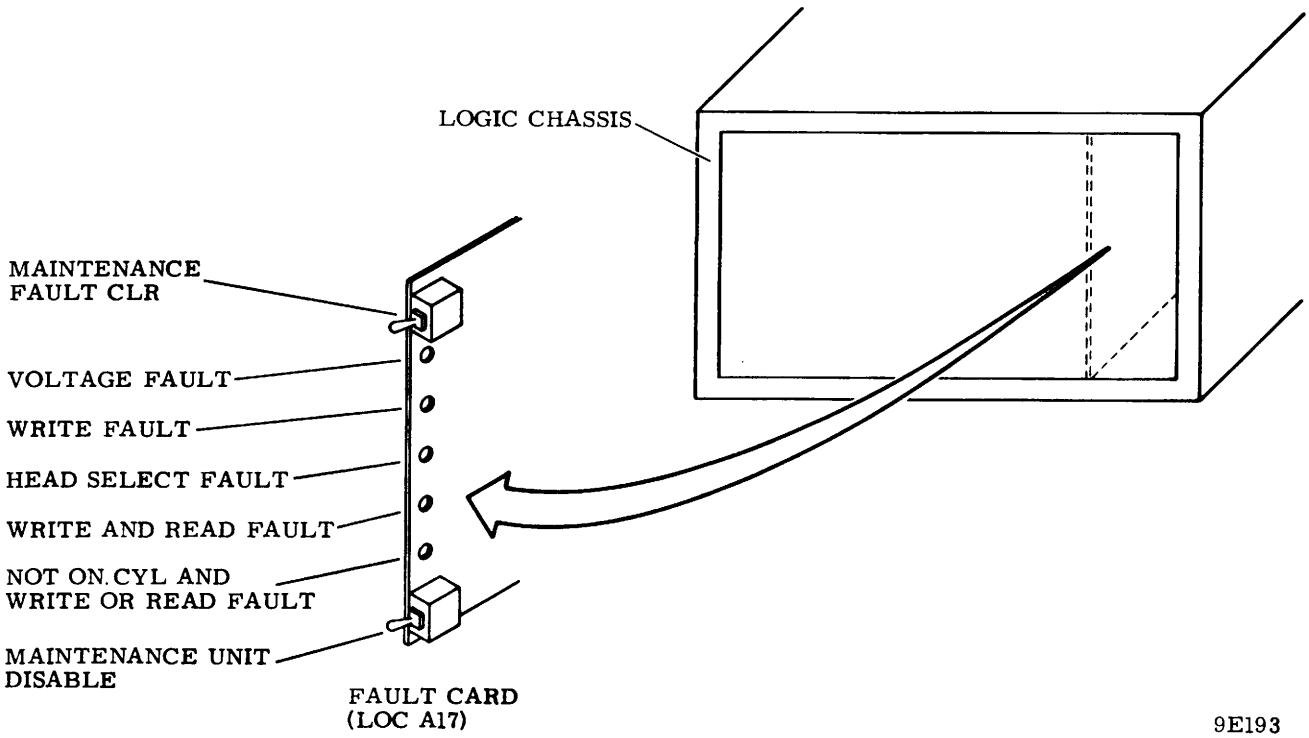


Figure 2-10 Maintenance Controls and Indicators

Table 2-2 MAINTENANCE CONTROLS AND INDICATORS

Control or Indicator	Function
Maintenance Fault Clear Switch	Clear position (up) clears out Fault Latch and five Fault Status Latches. When switch is actuated fault indicators on edge of Fault card go out and remain out unless condition causing fault still exists. Norm position (down) is normal operating position for switch and position to which it returns when released (spring loaded).
Maintenance Unit Disable Switch	Norm position (down) is used during normal on Line operations. Disable position (up) prevents drive from decoding commands and also disables transmitters for all signals except Seek End, Read Clock, Interrupt, and Servo Clock. This position is used during maintenance.
Voltage Fault Indicator	Lightes to indicate a below normal voltage existed.
Write Fault Indicator	Lightes to indicate a write fault existed.
Multiple Head Select Fault Indicator	Lightes to indicate a multiple head select occurred.
Write and Read Fault Indicator	Lightes to indicate that both write and read were commanded simultaneously.
Write or Read and Off Cyl Indicator	Lightes to indicate that a write or read was selected during a seek operation (not on cylinder.)

TEST POINTS

General

When performing the electrical checks and adjustments described in this manual, it is necessary to monitor signals at various points in the drives logic or other circuitry. These test points are in three categories:(1) Pins on logic chassis wirewrap panel (2) Test points located on a card in the logic or read write chassis, (3) test points on the power supply control panel.

Wirewrap Pins

The procedures reference wirewrap pins (refer to figure 2-11) by card location and pin number. For example, A08-05A refers to pin 05A at wirewrap panel location A08. The location and orientation of pins on the logic chassis wirewrap panel is explained in the Key to Diagrams in section 3 of this manual.

Card Test Points

The card test points (refer to figure 2-12) are located on logic cards located in either the logic or read write chassis. These test points are located on the component side of the cards and consist of studs to which an oscilloscope can be attached.

The test points can be located anywhere on the component side of a card and are lettered alphabetically (omitting letters I and O). When viewed from the component side with the connector at the right, the test points appear as follows (refer to figure 2-12):

- The test point in the lower left hand corner is always ground and labelled Z.
- The upper test point (on the left) is also ground and labelled A.
- Other test points on the card edge are labelled B, C, D, etc.

- All other test points are assigned in reverse order from the end of the alphabet (Y, X, W, etc). Y is nearest the bottom right of the card and the letters progress (in reverse order) from right to left in successive rows from bottom to top (refer to figure 2-12).

The maintenance procedures reference test points by card location and test point letter. This means that test point A on card A02 in the logic chassis would be referenced as A02-TPA. It should be noted that only the test points located on the outer edge of the cards can be accessed without putting the card on an extender, and only those test points are called out in the procedures.

Power Supply Test Points

The power supply control panel (refer to figure 2-13) contains test points to measure certain voltage outputs from the power supply These consist of jacks into which a meter probe can be inserted to make the measurement.

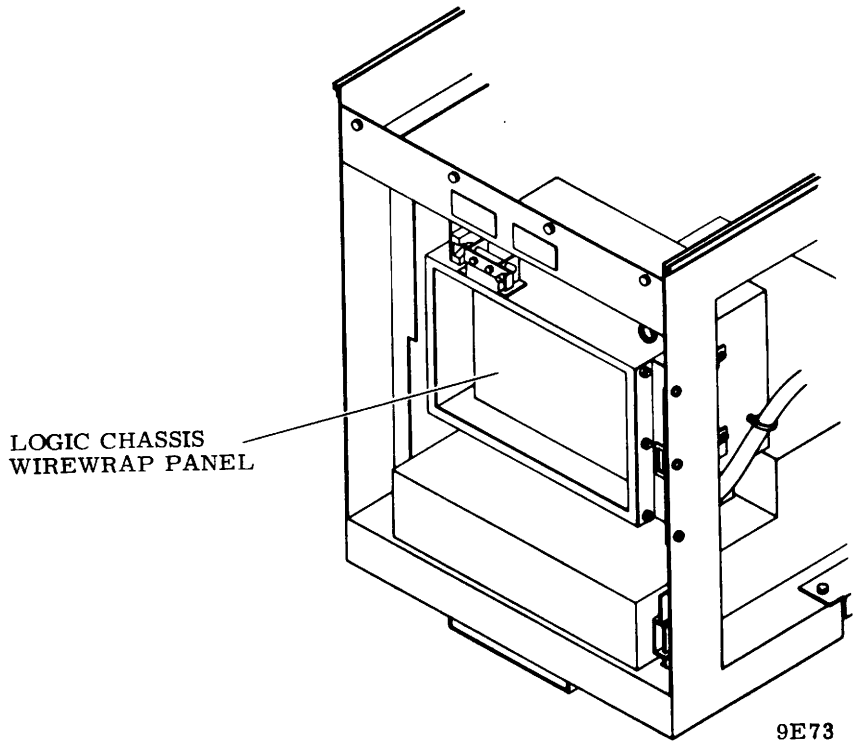


Figure 2-11. Wirewrap Panel

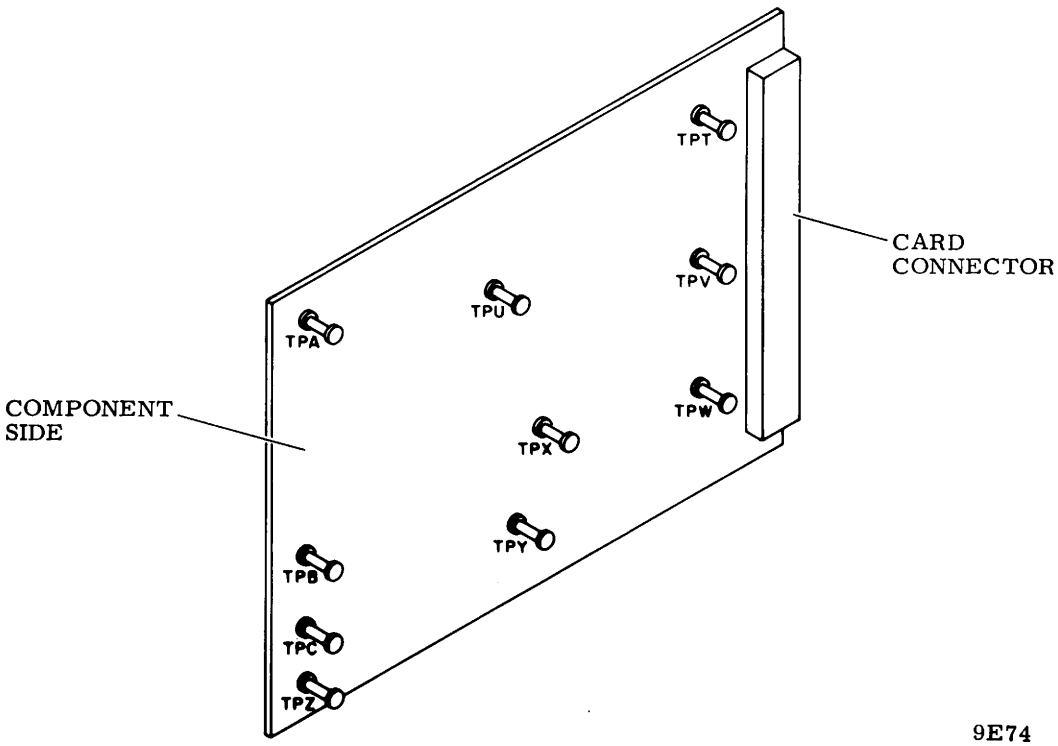


Figure 2-12. Card Test Points

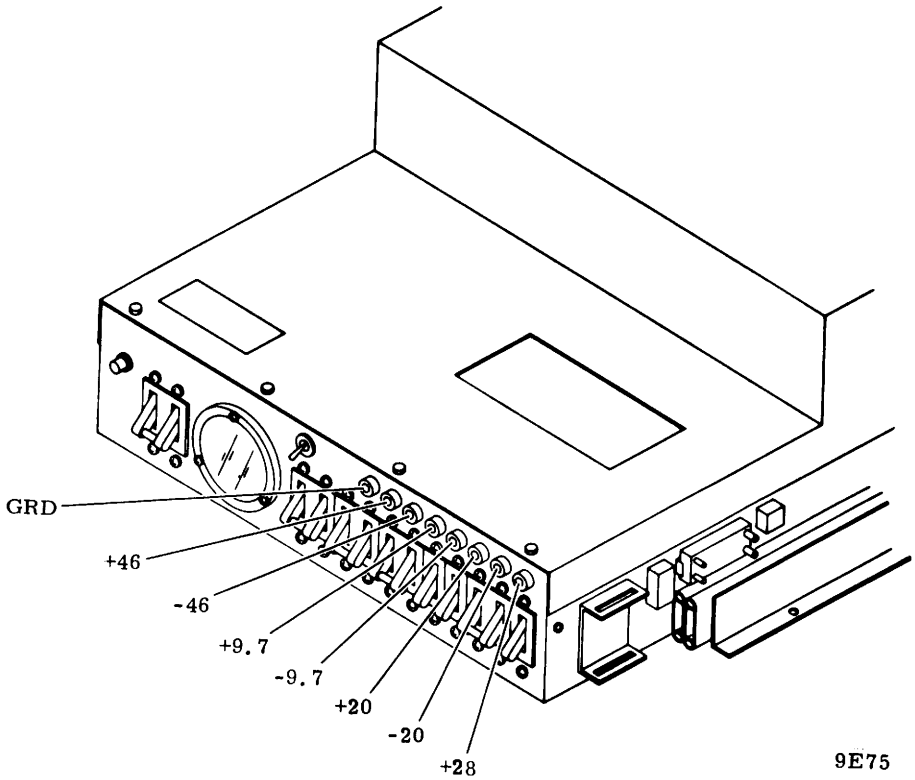


Figure 2-13. Power Supply Control Panel Test Points

SPECIAL MAINTENANCE PROCEDURES AND PRACTICES

GENERAL

The following describes some procedures and practices which are both useful and important when performing maintenance on the drive.

MANUALLY POSITION CARRIAGE PROCEDURE

Certain tests require manual operation of the positioner. This procedure should be performed only if the drive will not respond or the desired results cannot be obtained with the servo under logic control. It should be noted that improper positioning of the heads (for example, loading too slow, carriage hitting forward stop, or positioning heads in loading zone) will cause a servo fault condition. This could cause inaccurate results from any test that was being performed. If a servo fault occurs, unload the heads, clear the fault, and repeat the operation being performed.

1. Press START switch to stop drive motor and unload heads.
2. Remove yellow leadwire from voice coil.
3. Press START switch to start drive motor.
4. Remove plastic shield to expose voice coil.

CAUTION

Wait for 30 seconds for drive motor to come up to speed then load heads as fast as possible to avoid having the heads in a partially loaded position.

5. Carefully grasp voice coil and load heads.

CAUTION

Move coil at approximately the same speed as it moves under logic control and while moving coil do not apply a downward force. If spindle power is lost, immediately retract heads.

6. Move positioner as described by applying a lateral (parallel to coil movement) pressure to coil.

CAUTION

Unload heads as fast as possible to avoid having the heads in a partially loaded position.

7. When tests are completed, manually unload heads to fully retracted position.
8. Press START switch to stop drive motor.

WARNING

Before reconnecting yellow leadwire, make sure fingers are clear of positioner.

9. Reconnect yellow leadwire to voice coil.
10. Press START switch to start drive motor and load heads.

HANDLING ELECTROSTATIC DEVICES

The -YFN card in the power supply uses metal oxide semiconductor (MOS) integrated circuits. These circuits are extremely sensitive and may be damaged by static electricity. For this reason, a defective -YFN card should be replaced rather than repaired. The following special precausions must be observed whenever handling or working with a -YFN card.

- Turn off power before removing and installing the logic card.
- Ensure that anything coming in contact with the card is electrically connected to ground. This includes tools, the body, clothing, containers, etc.
- Touch the logic chassis to bleed off any accumulated static charge before removing or installing the card, and continue to touch the chassis while removing or installing the card.
- Handle the card only by a non-circuit portion. Connector pins and circuit connection points must not be touched.
- Place the card in a conductive container immediately following its removal from the unit. The card (and container) must be in contact with logic chassis ground before and during the time that the card is inserted in or removed from the container. The container should have a warning label indicating that it contains an electrostatic sensitive device.
- The logic card must remain in the container whenever it is not installed in the logic chassis or at a properly prepared work station.

SECTION 2B

PREVENTIVE MAINTENANCE

GENERAL

This section describes the preventive maintenance that must be performed on the drive to keep it operating properly. This maintenance is performed regularly on a schedule determined by the preventive maintenance index. The preventive maintenance index is shown in table 2-3.

The preventive maintenance index gives the required procedure for performing the maintenance, the estimated time to perform it, and the level which refers to the how often it should be performed.

The levels of preventive maintenance are based on a calendar period or hours of operation (whichever comes first). Table 2-4 lists the levels of preventive maintenance.

The person performing the maintenance should be thoroughly familiar with operation of the drive and with all information in the General Maintenance section of this manual.

TABLE 2-3. PREVENTIVE MAINTENANCE INDEX

Level*	Est Time (Minutes)	Procedure
2	20	**Head Dusting****
3	10	Clean Primary Air Filter
3	2	Check +5 Volt and -5 Volt Outputs
4	1	Clean Shroud and Spindle
4	2	Clean and Lubricate Lockshaft
4	5	Clean Carriage Rails and Bearings
6	20	Absolute Air Filter Replacement

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

**The head dusting level 2 interval is recommended for the average site. However, the interval may be shorter or longer or the procedure eliminated depending upon site conditions.

TABLE 2-4. PREVENTIVE MAINTENANCE LEVELS

Level	Time Schedule
Level 1	Weekly or 150 hours (no preventive maintenance scheduled)
Level 2	Bimonthly or 1000 hours (no preventive maintenance scheduled)
Level 3	Quarterly or 1,500 hours
Level 4	Semiannually or 3,000 hours
Level 5	Annually or 6,000 hours (no preventive maintenance scheduled)
Level 6	Biennially or 9,000 hours

LEVEL 2 MAINTENANCE PROCEDURES

HEAD DUSTING

NOTE

Head dusting is a dry process. Do not use any type of cleaning solution.

1. Turn off drive motor.
2. Before removing the disk pack, use a lint-free cloth moistened with head and media cleaning solution to wipe off the top of the drive and around and behind the pack cover.
3. Remove disk pack.
4. Set Main AC Power circuit breaker to Off.
5. Place index finger on top surface of the top head arm assembly, as shown in figure 2-14. Avoid touching rear surface of head pad. Push down and pull the head arm assemblies toward the spindle to the point just before the head arms slide off the head cam. If the head arm assemblies are extended beyond this point, follow the directions in step 10 to move them to the retracted position; then repeat this step.

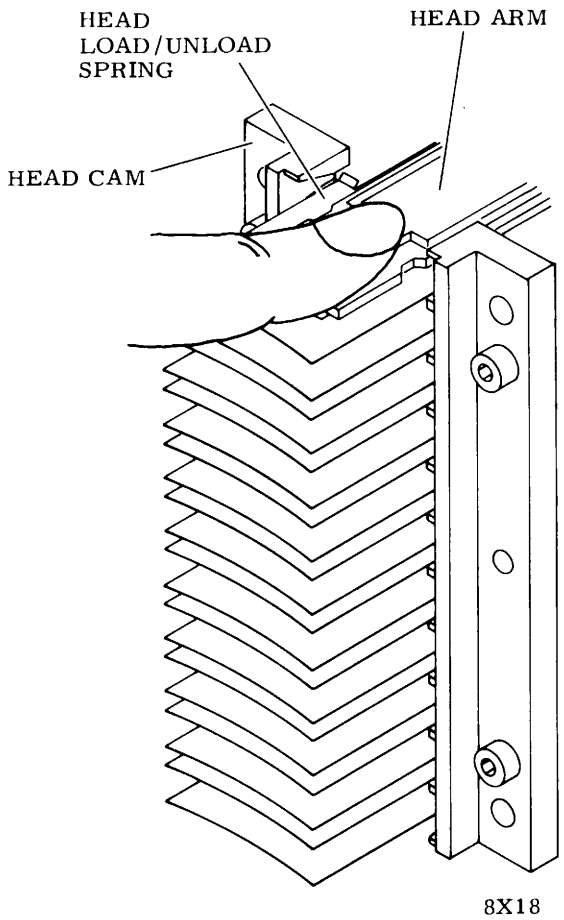


Figure 2-14. Positioning Head Arm Assemblies

6. Use the following procedure to blow off the loose oxide dust particles from the flying surface, spoiler holes, and leading edge of each head. (See figure 2-15.)

WARNING

Aim nozzle of can of dust remover away from face to prevent personal injury in case hose snaps off nozzle.

NOTE

Keep can of dust remover in an upright position to prevent liquid propellant from spraying on heads.

a. Connect plastic hose to nozzle of super dry dust remover can. (See figure 2-15.1.)

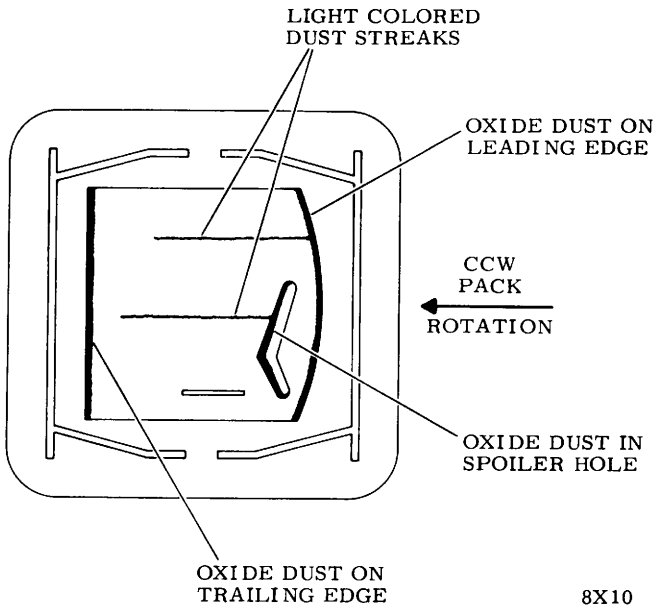


Figure 2-15. Typical Formation of Oxide Particles on Head Pad

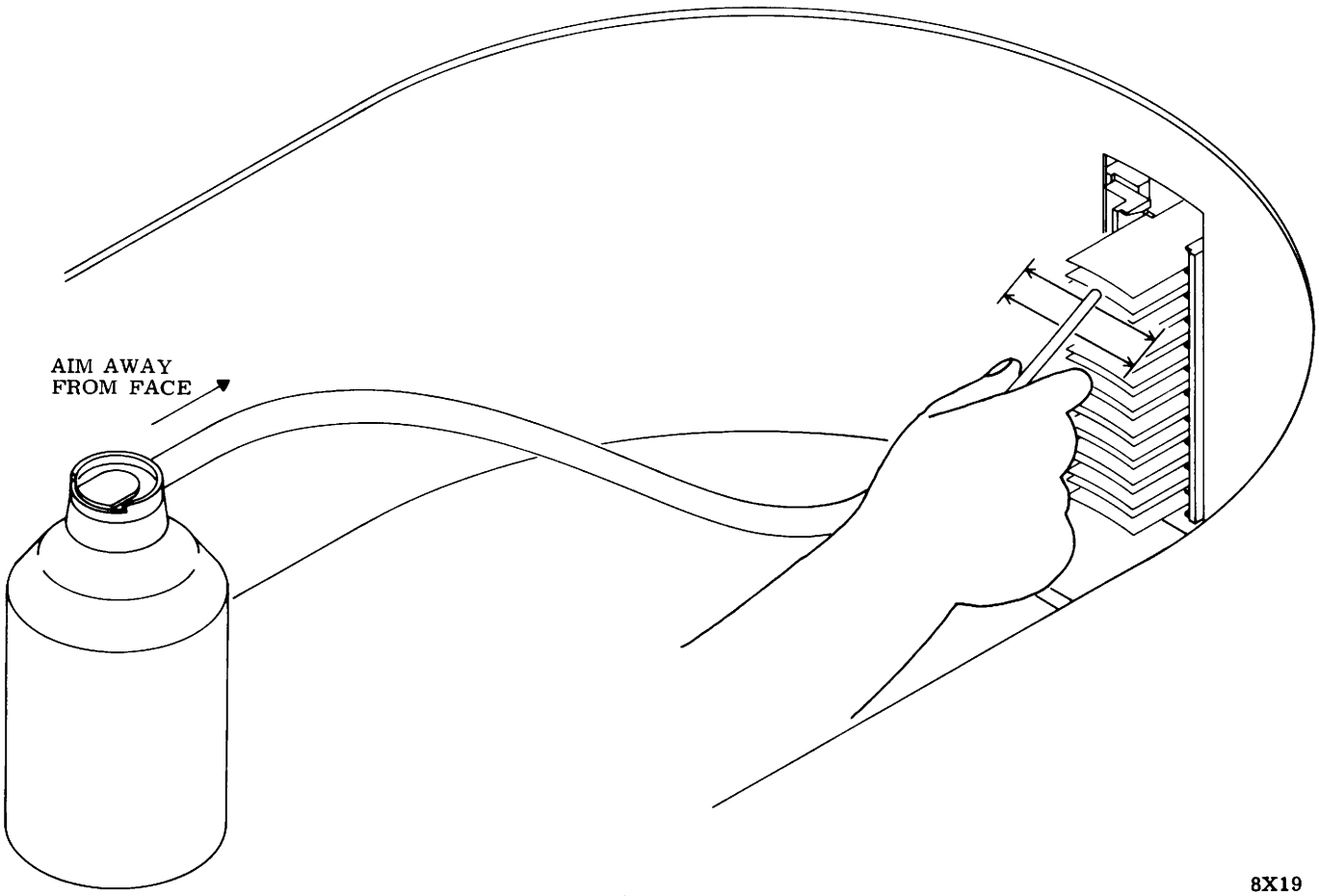


Figure 2-15.1. Using Super Dry Dust Remover

b. Set the can of dust remover on a flat surface inside the shroud.

NOTE

Always start with the top head and proceed to the next lower head, doing the bottom head last.

c. Hold end of plastic hose one-fourth inch from head to be cleaned. Aim it upward for downward-facing heads or downward for upward-facing heads.

d. While spraying, move hose back and forth six to eight times.

7. Buff the flying surface of each head as follows. (See figure 2-15.2.)

a. Hold an eight-inch strip of lint-free gauze between the thumb and forefinger of both hands. Hold gauze tightly, not slack.

b. Place the gauze over a head and move the gauze back and forth eight to ten times on each head while applying light pressure.

c. Buff each head using the same piece of gauze.

d. Repeat a through c using a new piece of gauze each time until there is no longer any evidence of oxide on the gauze.

If, after buffing heads three times, the gauze still shows evidence of oxide, the heads will have to be removed from the drive and cleaned as described in the head cleaning procedure in this manual.

8. Blow off heads again using the super dry dust remover, as in step 6. Be sure all lint and dust are removed.

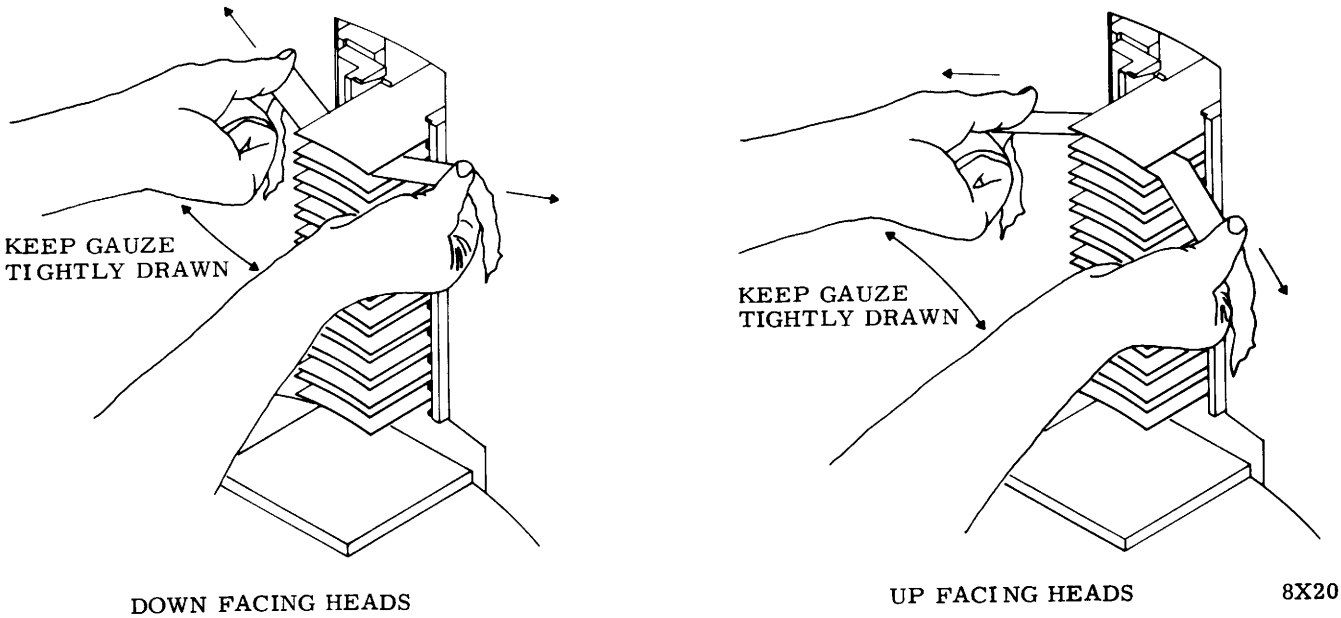


Figure 2-15.2. Wiping Head Pads

9. Inspect heads with a high intensity light to see if any loose oxide dust particles remain. Use a two-inch minimum square mirror to view heads facing downward.

   If after inspection, any head still shows evidence of oxide on flying surface, remove the head and clean or replace it as described in this manual.

10. When finished dusting heads, place the end of a pen or screwdriver on the surface of the carriage indicated by the arrow in figure 2-15.3. Push the head arm assemblies back to the retracted position. Avoid touching the head load/unload springs.

11. Set Main AC Power circuit breaker to On.

12. With the air blower on, wipe the inside of the shroud using a lint-free cloth moistened with head and media cleaning solution.

NOTE

If available, use scratch pack in steps 13 and 14. Replace scratch pack with customer pack after allowing drive to run on scratch pack for one minute.

13. Place disk pack in drive and close pack access cover. Allow the air flow to purge the system for one minute.

14. Start up drive and observe that drive functions properly.

15. Return drive to computer operator.

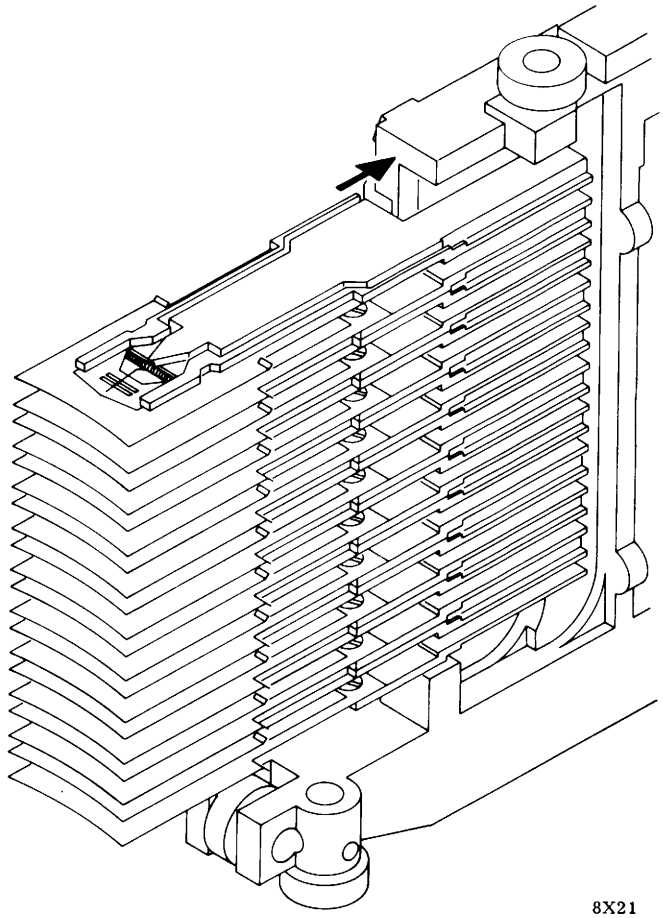


Figure 2-15.3. Returning Head Arm Assemblies to Retracted Position

The following materials are required for head dusting (see the list of Maintenance Tools and Materials for the applicable CDC part numbers):

Description

1. Super Dry Dust Remover
2. Hose Assembly
3. High Intensity Light
4. Lint-free Tube Gauze
5. Two Inch Minimum Square Front Surface Mirror

The following material is used only for moistening the lint-free cloth to wipe off the top of the pack access cover and inside the shroud:

Description

6. Head and Media Cleaning Solution
7. Lint-free cloth

LEVEL 3 MAINTENANCE PROCEDURES

CLEAN PRIMARY AIR FILTER

This procedure describes cleaning the primary air filter. This filter is located in a bracket located at the bottom rear of the drive (refer to figure 2-14).

1. Remove power from the drive as follows:

   a. Press START switch to stop drive motor and unload heads.

   b. Set MAIN AC circuit breaker to off.

2. Remove disk pack.

3. Remove air filter by pulling it out of its bracket (refer to figure 2-14).

4. Clean filter by agitating in mild detergent solution. Rinse by thoroughly flushing filter with water from a low pressure nozzle.

5. Shake excess water from filter and allow to dry before proceeding.

6. Spray filter thoroughly with filter coat and install in drive.

7. Set circuit breakers to on and allow blowers to purge unit for at least 2 minutes, then set MAIN AC circuit breaker to off.

Check +5 Volt and -5 Volt Outputs

These outputs are checked by performing the +5 Volt and -5 Volt Test and Adjustment procedure.

LEVEL 4 MAINTENANCE PROCEDURES

CLEAN SHROUD AND SPINDLE

This procedure describes cleaning of the inside shroud area and the top of the spindle upon which to pack rests.

1. Remove power to drive as follows:

   a. Press START switch to stop drive motor and unload heads.

   b. Set MAIN AC circuit breaker to off.

2. Open pack access cover, then remove disk pack and leave pack access cover open.

CAUTION

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

3. Remove all dirt and smudges from shroud and top surface of spindle by using lint free gauze that is slightly dampened (not soaked) with media cleaning solution.

4. Inspect shroud and spindle for any particles that were not picked up with

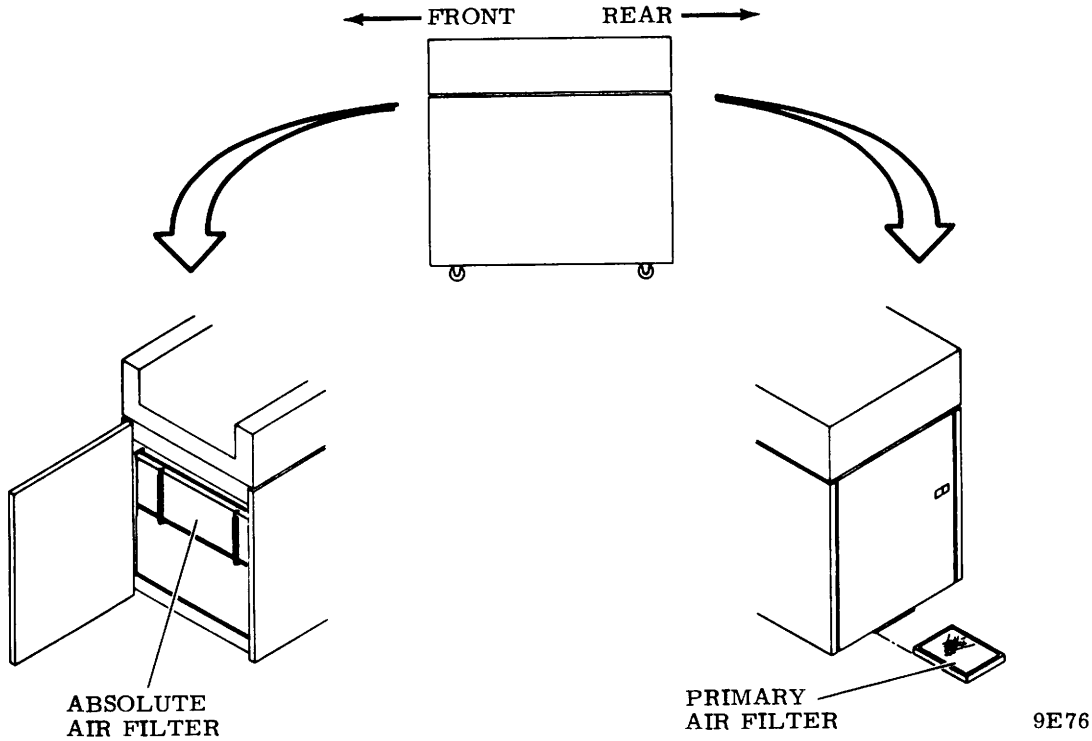


Figure 2-15.4. Air Filters

gauze in step 3. Pick up these particles using a wad of adhesive type tape.

5. Close pack access cover.

CLEAN AND LUBRICATE LOCKSHAFT

This procedure describes cleaning and lubrication of the threads on the top of the spindle lockshaft.

1. Remove power from drive as follows:

   a. Press START switch to stop drive motor and unload heads.

   b. Set MAIN AC circuit breaker to off.

2. Open pack access cover, remove disk pack and leave pack access cover open.

3. Use dry lint free gauze and a brush or sharp instrument to clean lockshaft threads.

4. Apply a thin coat of lubricant paste to lockshaft threads.

5. Check for free movement of lockshaft by depressing it and verifying that it returns to its original position. If lockshaft does not depress or stays depressed, replace lockshaft (refer to Spindle Lockshaft Replacement procedure). If lockshaft works satisfactorily, close pack access cover.

CLEAN CARRIAGE RAILS AND BEARINGS

This procedure describes cleaning of the rails and bearings on which the carriage rides (refer to figure 2-15).

1. Remove power to drive as follows:

   a. Press START switch to stop drive motor and unload heads.

   b. Set MAIN AC circuit breaker to off.

2. Remove disk pack.

3. Open cabinet top cover and remove deck cover.

4. Remove magnet cover by grasping edge of cover and snapping it out of place.

5. Grasp coil through opening in top of magnet assembly. Carefully and slowly push coil forward to extend heads.

6. Once head arms have cleared cams, gently slide carriage and coil assembly back and forth along full length of rails. While moving coil be aware of any possible irregularity (bumps or jerks) in movement. A sudden irregularity indicates dirt on rails or bearings. Do not confuse pressure of flex leads and and head leads with a sudden irregularity in motion. Pressure from leads is a smooth change.

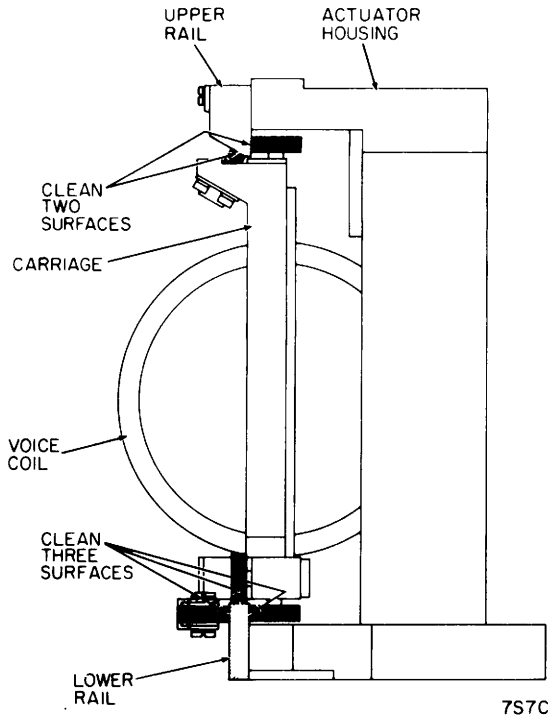


Figure 2-15.5. Clean Carriage Rails and Bearings

7. If a sudden irregularity in motion was noted in previous step proceed to next step. If no sudden irregularity in motion was noted, cleaning is not required. Terminate procedure by returning carriage to heads unloaded position (fully retracted) and replace magnet cover.

8. Using a cotton swab dampened (not soaked) in media cleaning solution, clean rail and bearing surfaces. Access front portion of lower rail from interior of pack area. Access rear portion of lower rail and all of top rail from sides of actuator. Raise logic chassis as required to gain access from left side of actuator. Move carriage back and forth while cleaning in order to ensure all surfaces are reached.

9. When rail and bearing cleaning is completed, repeat step 6 to ensure that carriage moves freely without sudden irregularities in its motion. If carriage now moves smoothly throughout its travel, proceed to step 10. If sudden irregularities persist, visually inspect rails and bearings using a strong light.

9. Look for deterioration of rail or bearing surfaces. Surface deterioration requires replacement of defective parts. Since neither carriage nor rails are field replaceable, contact factory maintenance representative.

10. Return carriage to heads unloaded position (fully retracted) and replace magnet cover.

11. Replace deck cover and close cabinet top cover.

LEVEL 6 MAINTENANCE PROCEDURES

ABSOLUTE AIR FILTER REPLACEMENT

An adequate supply of clean air to the pack area is essential to proper operation of the drive. The absolute filter traps particles too small to be stopped by the primary filter. Eventually the filter becomes too clogged to yield a sufficient airflow, and it must be replaced. Its useful life depends on the drives operating environment.

The user has two options: (1) replace the absolute filter at fixed intervals dependent on site environment (2) obtain a pressure gauge (see table 2-1) and replace the absolute filter when it fails the testing procedure given below.

With the first option, replacement of the absolute filter is required once every two years when the drive is operated in a computer room environment. If the drive is operated in something other than a computer room environment, absolute filter replacement is required more often. In a non-computer room environment, it is suggested that the absolute filter be replaced every year or whenever there is doubt about the ability of the filter to pass air into the shroud area.

With the second option, maintenance personnel can periodically check the airflow through the absolute filter to determine the proper time for filter replacement. Regardless of a planned testing schedule, testing should be performed whenever there is doubt about the ability of the filter to pass air into the shroud area.

Figure 2-15.6 is a flow chart showing the procedure included in this section and the options available to maintenance personnel. Use the flow chart to determine which of the following procedures are applicable.

Filter Replacement

1. Remove power from drive as follows:

   a. Press START switch to stop drive motor and unload heads.

   b. Set MAIN AC circuit breaker to off.

2. Remove disk pack.

3. Open cabinet front door.

4. Remove blower assembly from drive as follows:

   a. Loosen clamp on large hose located on top of blower enclosure, then slide clamp up on hose and remove hose from blower enclosure.

   b. Remove two screws securing bottom front of blower enclosure to deck.

   c. Slide blower enclosure out of front drive and set on floor.

5. Detach four springs (or four posts in older drives) securing exhaust plenum and absolute filter.

6. Lift plenum and remove filter from blower assembly.

7. Set new filter in opening of blower mount with arrows pointing up.

8. Set exhaust plenum on top of absolute filter.

9. Replace four springs (or four posts in older drives) securing exhaust plenum and absolute filter to blower mount.

CAUTION

Following reassembly of blower assembly, the blower should be allowed to purge system for at least two minutes before installing a disk pack.

10. Replace blower assembly in drive as follows:

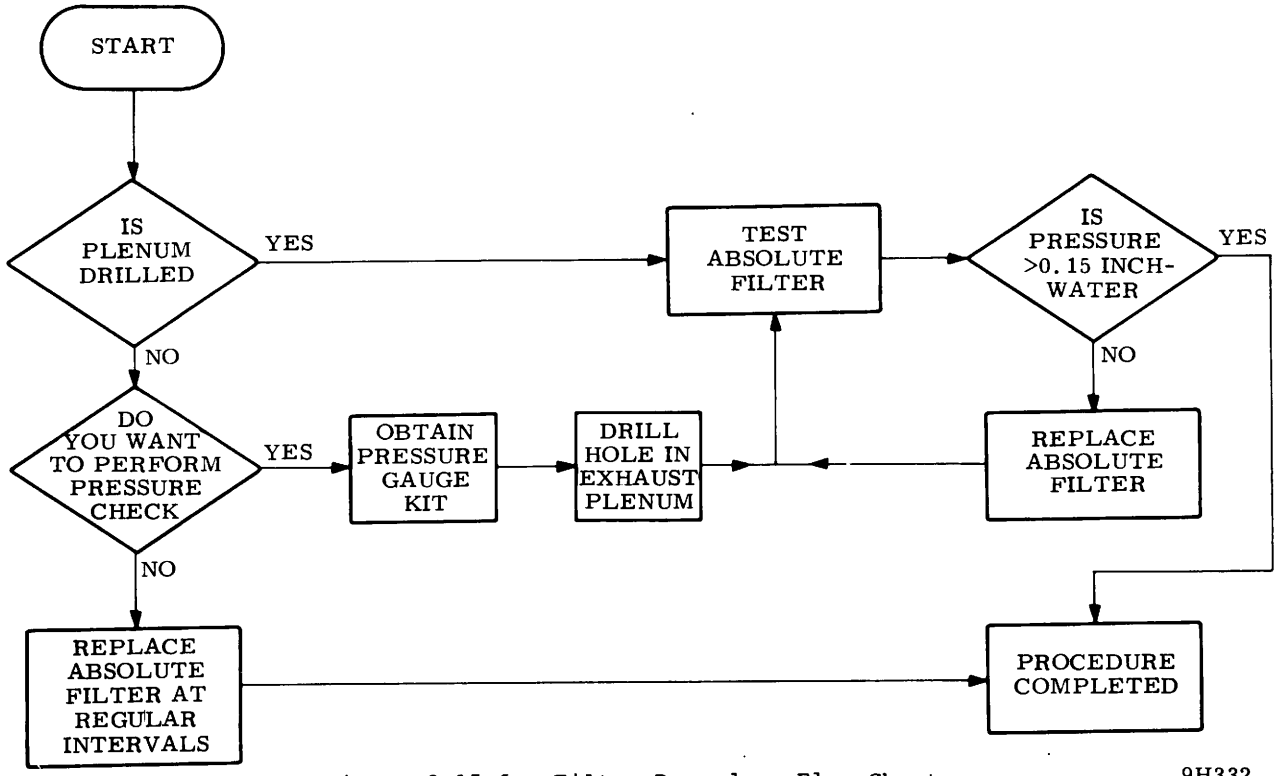


Figure 2-15.6. Filter Procedure Flow Chart 9H332

CAUTION

Ensure that air hoses or blower motor cable are not pinched.

a. Slide blower assembly into drive until flange on rear lower edge of blower enclosure slips into channel on cabinet frame.

b. Secure front of blower enclosure to cabinet using two screws.

c. Slip large air hose over output on top of blower enclosure and secure with clamp.

11. Close cabinet front door.

Drilling Hole in Exhaust Plenum

1. Perform steps 1 through 5 of Filter replacement procedure.

2. Remove exhaust plenum from drive.

3. Drill a 6.35 mm (0.25 in) hole in exhaust plenum in location shown in figure 2-15.7.

4. Insert plastic plug in hole in exhaust plenum. (Spare plastic plugs are included in the gauge test kit).

5. Set exhaust plenum on top of absolute filter.

6. Perform steps 9 through 11 of Filter Replacement procedure.

Testing Filter

1. Remove plastic plug and insert tubing attached to differential pressure gauge (refer to list of Maintenance Tools and Materials).

2. Apply power to drive as follows:

   a. Set MAIN AC circuit breaker to on.

   b. Press START switch to start drive motor and load heads.

3. If pressure is 0.15 inch-water or less, filter should be replaced. If pressure is above 0.15 inch-water, filter need not be replaced at this time.

4. Remove power from drive as follows:

   a. Press START switch to stop drive motor and unload heads.

   b. Set MAIN AC circuit breaker to off.

5. Remove tubing and insert plastic plug. The plastic plug must be inserted at all times except when making pressure measurements.

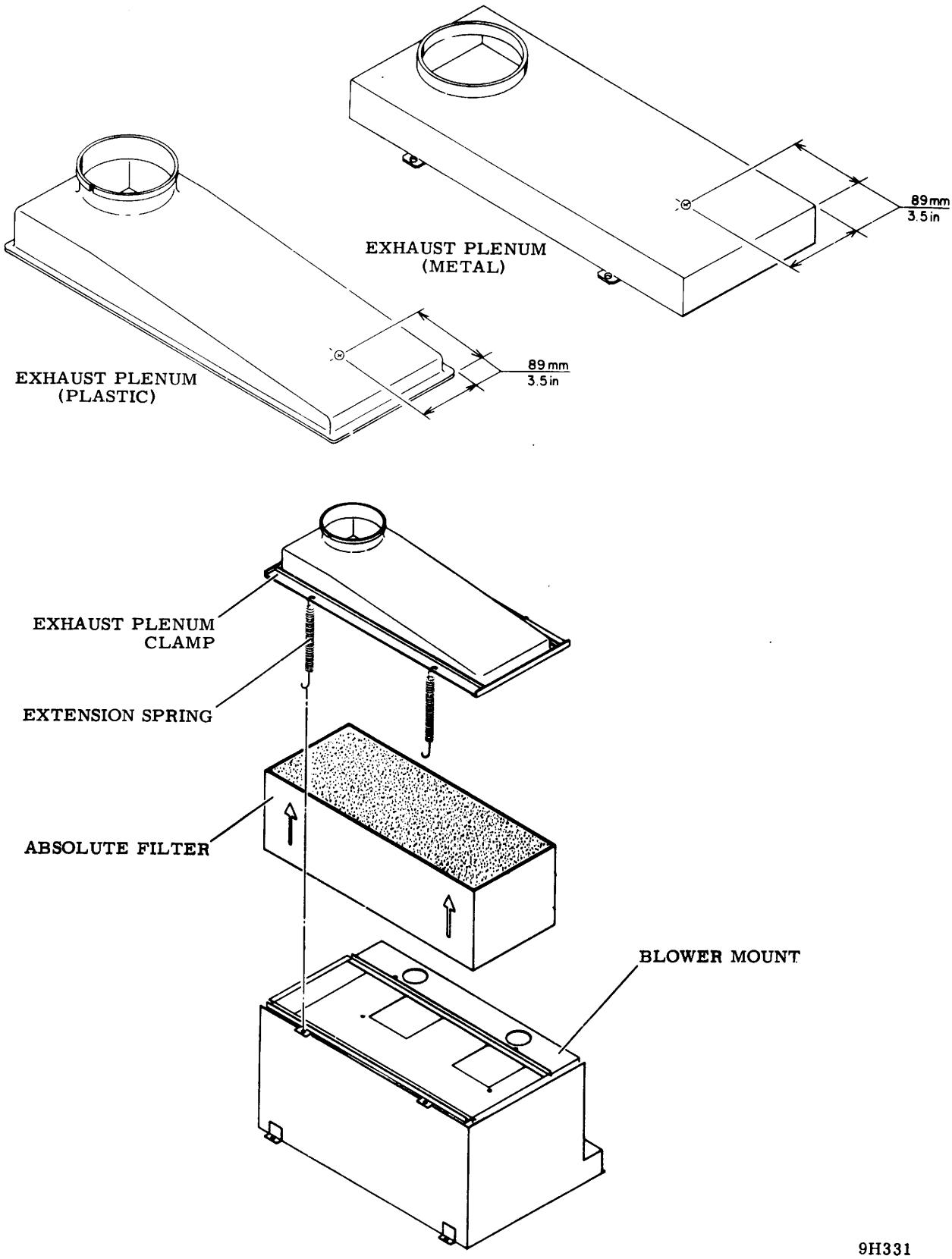


Figure 2-15.7. Plenum Removal and Drilling

SECTION 2C

TESTS AND ADJUSTMENTS

GENERAL

This section contains procedures describing all drive electrical adjustments that may be performed in the field. Each of these procedures described both the tests and adjustment of a particular aspect of drive performance.

It should be noted that some of the following procedures differ slightly, depending on whether they are performed on a 150 MB (BJ4M1) or 300 MB (BJ4M2, BJ402) drive.

These differences are limited to seek length. In these cases, the 150 MB value is shown in parenthesis as in the following example.

Example: Command drive to perform a direct seek to Cylinder 491(245).

Applicable to 150 MB Units (BJ4M1).

Applicable to 300 MB Units (BJ4M2, BJ402).

Where no parenthesis appear, the value shown applies to both types of drives.

The person performing these procedures should be thoroughly familiar with operation of the drive and with all information in the General Maintenance section of this manual.

+5 VOLT AND -5 VOLT TEST AND ADJUSTMENT

This procedure describes test and adjustment of the +5 and -5 volt outputs from the regulator board (refer tofigure 2-16).

1. Prepare drive for use with test software or FTU.
2. Command continuous seeks between cylinders 000 and 128(64).
3. Check and adjust +5 volts as follows:
   a. Connect positive meter lead to A2JD94-04A on logic backpanel.
   b. Connect negative meter lead to terminal marked ground on front edge of regulator card.
   c. Measured voltage should be +5.1 (±.05) Vdc. If this requirement is not met, adjust bottom pot on regulator card until voltage is within specified limits.
4. Check and adjust -5 volts as follows:
   a. Connect positive meter lead to terminal marked gnd on front edge of regulator board.
   b. Connect negative meter lead to wire wrap pin A2JD94-01A on logic backpanel.
   c. Measured voltage should be -5.1 (±.05) Vdc. If this adjustment is not met, adjust top pot on regulator board until voltage is within specific limits.
5. Prepare drive for return to online operation.

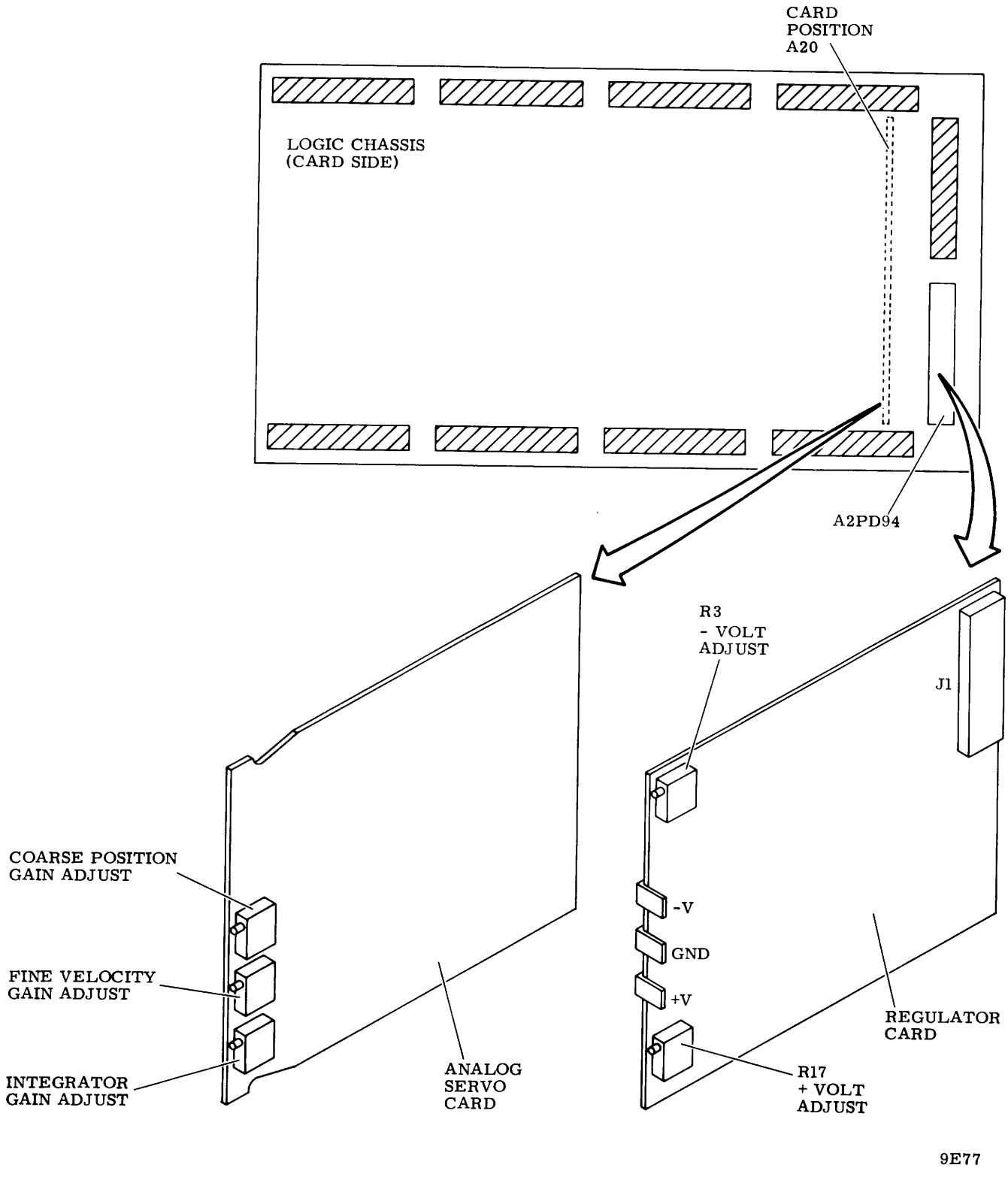


Figure 2-16. Voltage Regulator and Servo Adjustments

HEAD ALIGNMENT

GENERAL

Alignment of the heads is checked under the following conditions:

- During initial installation of the drive.
- After replacing one or more head arm assemblies.
- When misalignment of one or more heads is suspected. (For example, inability to read a pack written on another drive.)

If it is determined that a head is misaligned, the head arm is adjusted to bring the alignment of the head within specifications. Figure 2-17 is a flowchart summarizing the basic functions of the head alignment check and adjustment procedure.

Head alignment is performed by using a Field Test Unit (FTU) or by using the controller, microprogram diagnostics, head alignment card and meter. This procedure applies only to the method using an FTU. Refer to the FTU maintenance manual for switch settings and functions called for in this procedure.

When performing head alignment, give special consideration to the following:

Thermal Stabilization - In order to ensure accuracy during head alignment, it is important that the drive, CE pack, and FTU be at their normal operating temperature. This requires that all three be connected and allowed to operate (pack turning and heads loaded to cylinder zero) for a minimum of 60 minutes. If head alignment is being performed on more than one drive, and provided that the pack was taken immediately from a previous drive, and provided that the drive under test has been operating with heads loaded for a minimum of 60 minutes preceding tests; then the CE pack only requires a 15-minute stabilization time.

Alignment Tool - Use only the head alignment tool specified in the maintenance tools and materials table. Use of a different tool may cause damage to head arm or carriage. Always inspect the adjustment end of tool prior to use. Tool must be free of nicks and scratches and must have a polished surface where it enters the carriage alignment hole. If any aluminum deposits are present, polish tool surface with crocus cloth. Any other polishing medium will damage the tool. Do not use a defective tool; repair or replace tool if damage exists. When using tool, position it so that pin in end of tool engages alignment slot in head arm. The tool should slip easily through the alignment slot in the head arm. If anything more than a small amount of force is required to adjust the head, the tool is probably binding in the hole of the carriage. Ensure that alignment tool is kept perpendicular to hole in carriage at all times.

Carriage Locking - During the alignment procedure (when the heads are over the alignment track) the carriage locking pin and ring assembly must be installed in the ALIGN TRACK LOCK hole in the rail bracket assembly. This locks the carriage in one head alignment position. Failure to install the pin and ring assembly would allow the carriage to retract if any emergency retract signal were generated. Since your hands are in the actuator during the head alignment procedure, the retract could be dangerous.

CAUTION

Should an emergency retract condition be generated when the locking pin is in the ALIGN TRACK LOCK hole, the following results may occur:

- Blown fuses,
- Tripped dc circuit breaker
- Blown power amplifier transis transistors, and
- Unretracted heads on a stationary CE pack.

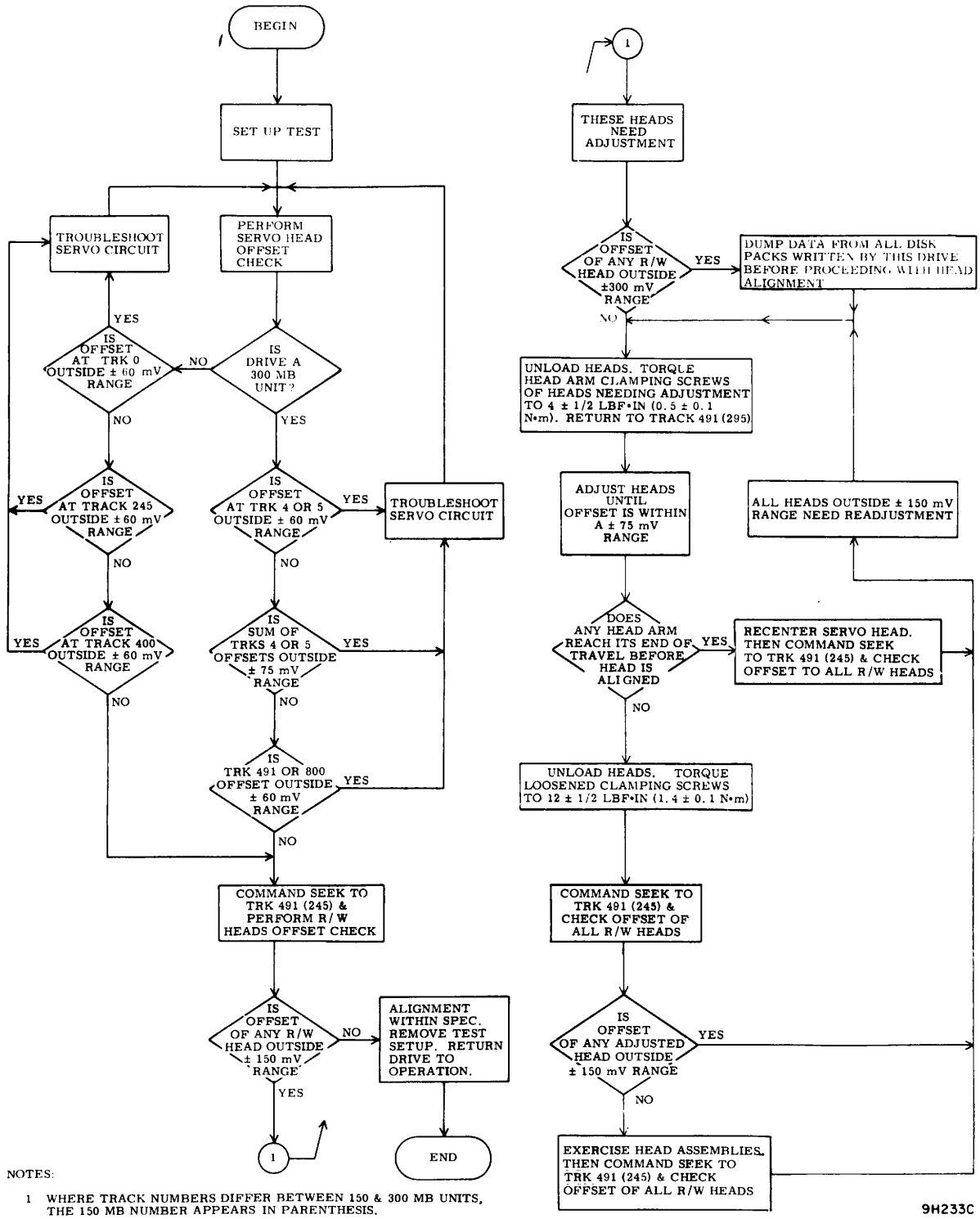
Carefully observe the instructions regarding the installation and removal of the carriage locking pin and ring assembly.

Cylinder Notation - In steps of this procedure that apply to both the 300 MB and 150 MB drives, a cylinder number for the 300 MB unit will be followed by a cylinder number in parentheses for the 150 MB unit.

Example: Command a direct seek to track 491 (245). If a 300 MB unit is being checked, this step requires a seek to track 491. However, with a 150 MB unit, a seek to track 245 is required.

INITIAL SETUP

1. Prepare drive for use with FTU (refer to Preparation of Drive For Testing procedure).
2. Ensure that CE pack is thermally stabilized.
3. Connect oscilloscope to test points Z (ground) and Y (dibits) on head alignment card.
4. Connect test leads between head alignment card and FTU null meter.



NOTES:

1 WHERE TRACK NUMBERS DIFFER BETWEEN 150 & 300 MB UNITS, THE 150 MB NUMBER APPEARS IN PARENTHESIS.

Figure 2-17. Basic Head Alignment Check and Adjustment Procedure

SERVO HEAD OFFSET CHECK

1. Set head alignment card S/RW switch to S and X.|/X| switch to X.|.

2. Command continuous seeks between cylinders 240 and 245 for a minimum of 30 seconds.

3. Command direct seek to cylinder 004 (000).

4. Observe dibit pattern on oscilloscope. It should be similar to that shown on figure 2-18.

5. Toggle P/N switch to both P and N positions and record null meter readin readings. If both P and N readings are less than 50 mV, the X.|/X| switch can be set to X| position for more accurate readings.

6. Calculate head offset by using the following formula:

   (P) - (N) = OFFSET

   Where P is meter reading with P/N switch in P position and N is meter reading with switch in N position. Meter readings to right of zero are positive and meter readings to left of zero are negative.

   EXAMPLE 1: P = +20 N = +15
   (P) - (N) = (+20) - (+15) = +5

   EXAMPLE 2: P = +20 N = -15
   (P) - (N) = (+20) - (-15) = +35

   EXAMPLE 3: P = -20 N = +15
   (P) - (N) = (-20) -(+15) = -35

7. Record offset calculated in step 6.

8. Evaluate servo head offset as follows:

   - If offset ranges between +60 mV and -60 mV, it is acceptable so proceed with head alignment.

   - If offset is outside ± 60 mV range, it is unacceptable. In this case, trouble shoot servo system before proceeding with head alignment.

   NOTE

   If performing head alignment on a 150 MB drive, skip steps 9 and 10.

9. Command direct seek to cylinder 005 and repeat steps 4 through 8.

10. Add offset readings from cylinders 004 and 005. This sum should range between +75 mV and -75 mV. If it does not, troubleshoot servo system.

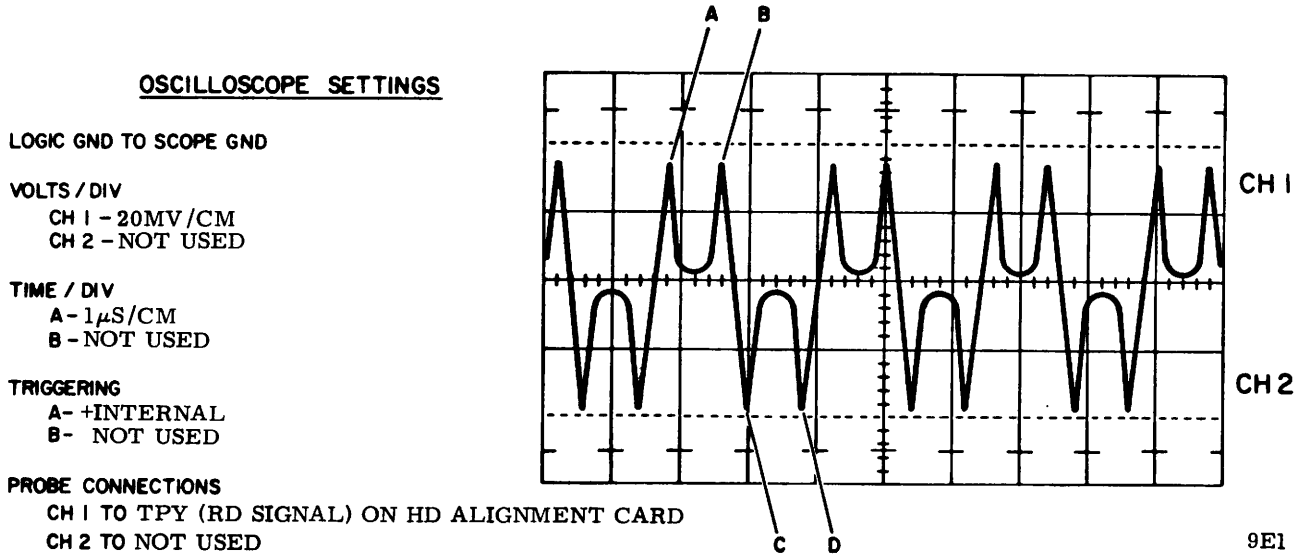


Figure 2-18. Head Alignment Waveform

11. EXAMPLE 1: $P_4 = -25$ $N_4 = -15$

(P) - (N) = (-25) - (-15) = -10 mV

$P_5 = +10$ $N_5 = -10$

(P) - (N) = (+10) - (-10) = +20 mV

(-10) + (+20) = +10 mV

Sum is within ±75 mV range and is therefore acceptable.

EXAMPLE 2: $P_4 = +30$ $N_4 = -10$

(P) - (N) = (+30) - (-10) = +40 mV

$P_5 = +15$ $N_5 = -30$

(P) - (N) = (+15) - (-30) = +45 mV

(+40) + (+45) = +85 mV

Sum is outside ±75 mV range and is therefore unacceptable. Servo system troubleshooting is required.

11. Command direct seek to cylinder 800 (400) and repeat steps 4 through 8.

12. Command direct seek to cylinder 491 (245).

13. Install carriage locking pin into alignment hole (refer to figure 2-19) and repeat steps 4 through 8.

READ/WRITE HEADS CHECK AND ADJUSTMENT

1. Set R/RW switch to RW. Observe that dibit pattern is similar to that shown on figure 2-18.

2. Calculate offset of all read/write heads by using same method given in steps 5 and 6 of Servo Head Check.

3. Remove carriage locking pin.

4. Evaluate read/write head offset as follows:

   - If all offsets range between +150 mV and -150 mV, head alignment is within specifications. Therefore proceed to step 15 and restore drive to online operation.

   - If any offsets are outside of the ±150 mV range, these heads are misaligned so proceed to step 5. However, before proceeding, ensure that no offset exceeds a ± 300 mV range. If any offsets exceed this range, excessive misalignment exists, so transfer data from all packs written with these heads, to other storage, before proceeding with alignment.

5. Press START switch to stop drive motor and unload heads.

NOTE

If heads 16, 17, or 18 require adjustment, move servo preamp housing before proceeding. See Servo Preamp Board Replacement procedure for instructions.

6. Loosen head-arm mounting screws securing heads requiring alignment and torque these screws to 4 ±1/2 lbf.in (0.5 +0.1 N·m).

7. Press START switch to start drive motor and load heads.

8. Command direct seek to cylinder 491 (245).

NOTE

When performing alignment on a 300 MB drive, the force exerted during adjustment can move the heads from the alignment cylinder to an adjacent cylinder. This will result in an improper alignment. Prevent this by connecting a jumper from A07-11A (Seek Error) to ground. However, be sure to remove the jumper before commanding the drive to perform another seek.

9. Align as follows:

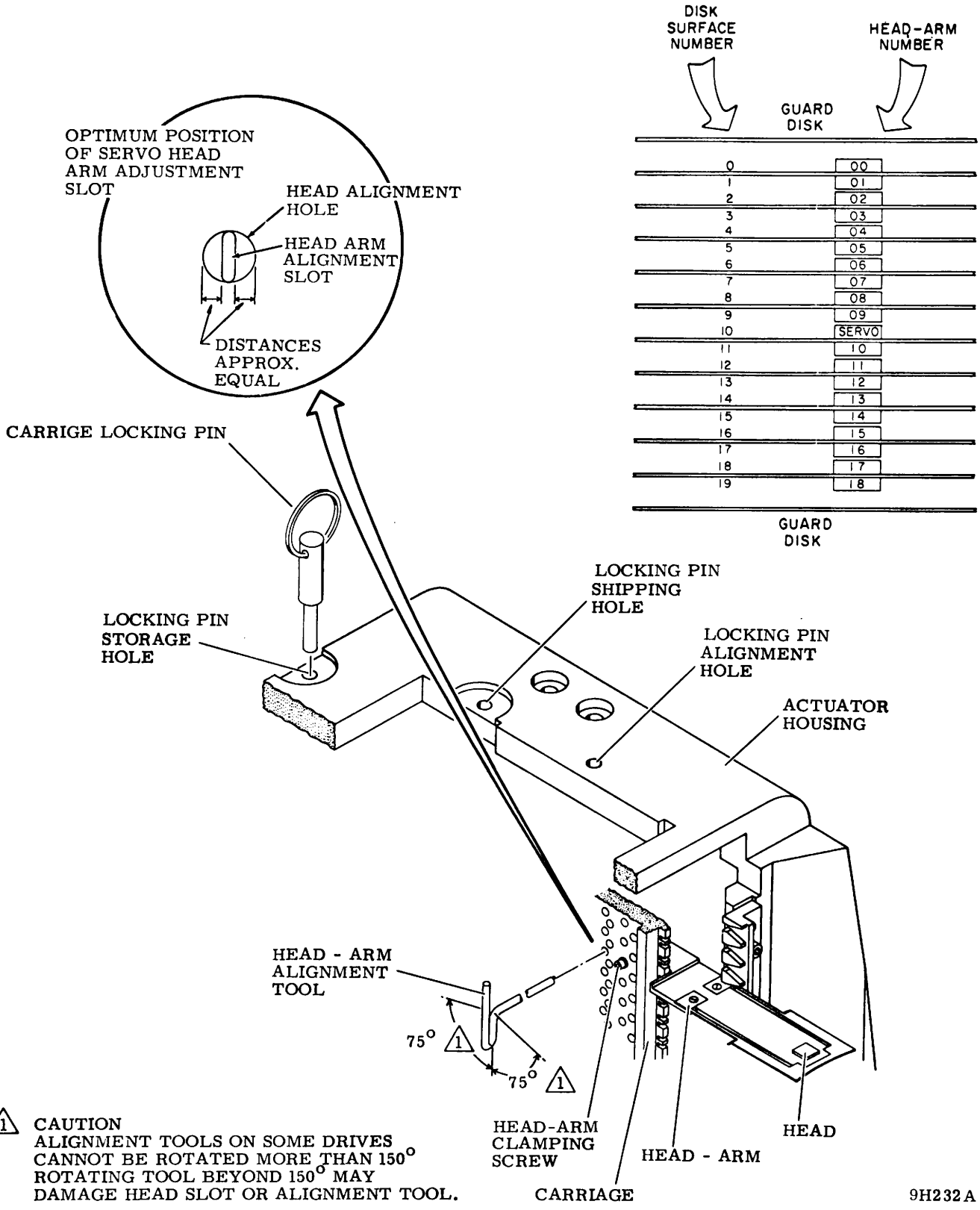
   a. Select head to be aligned.

WARNING

To prevent personal injury in case of an emergency retract, install carriage locking pin in head alignment hole prior to positioning head alignment tool. Be sure to remove pin before next seek is performed.

   b. Install head alignment tool so that tool pin engages head-arm alignment slot (refer to figure 2-19).

   c. Observe oscilloscope and adjust head to obtain balanced dibit pattern. Pattern is balanced when point A amplitude equals point B and point C equals point D (see figure 2-18).



1 CAUTION
ALIGNMENT TOOLS ON SOME DRIVES CANNOT BE ROTATED MORE THAN 150° ROTATING TOOL BEYOND 150° MAY DAMAGE HEAD SLOT OR ALIGNMENT TOOL.

Figure 2-19. Head Arm Alignment

d. Observe null meter and adjust head until offset ranges between +75 mV and -75 mV. Calculate offset as described in steps 5 and 6 of Servo Head Check. Occasionally, a head cannot be aligned because its adjustment slot is at its end of travel. If this occurs, check position of servo head-arm adjustment slot and, if necessary, recenter it. However, it should be noted that any slight adjustment of the servo head requires realignment of all read/write heads. Torque servo head to 12 ±1/2 (lbf·in (1.4 ±0.1 N·m).

e. Repeat steps a through d for all heads to be aligned.

10. Remove carriage locking pin and also remove jumper from A07-11A (if it was installed).

11. Press START switch to stop drive motor and unload heads.

12. Torque head-arm clamp screws of each head adjusted to 12 ±1/2 lbf·in (1.4 ± 0.1 N·m). While torqueing screws, use only straight arm allen wrench and keep it as perfectly aligned as possible with screws. If care is not taken during this operation, head may be pushed out of alignment.

13. Check each head adjusted to see if torqueing screws affected alignment. If any heads are outside ±150 mV range, readjust them as directed in steps 6 through 12.

14. Perform the following to ensure that heads will remain aligned under normal operating conditions.

    a. Command continuous seeks between cylinders 240 and 245 for a minimum of 30 seconds.

    b. Unload and load heads at least twice.

    c. Command direct seek to cylinder 291 (245).

    d. Check alignment of each head adjusted. If any heads are outside ±150 mV range, repeat this procedure starting with step 9.

15. Prepare drive for return to online operation.

SERVO SYSTEM TEST AND ADJUSTMENT

The procedure tests and adjusts the drives servo system. The servo system adjustments and their basic functions are as follows:

- Coarse Position Gain - Adjusts the gain of the velocity signal applied to the summing amplifier when the servo system is in coarse mode (cylinders to go equals more than one half). This adjustment causes seek time to be fast enough to meet the required specifications without causing excessive overshoot past the desired cylinder.

- Integrator Gain - Adjusts the gain of the velocity signal applied to the integrator. The integrator output is summed with the output from the D/A converter during the last 128(64) cylinders of a seek.

- Fine Velocity Gain - Adjusts the gain of the velocity signal applied to the summing amplifier when the servo system is in fine mode (cylinders to go equals less than one half). This adjustment optimizes servo system response by minimizing overshoot without overdamping the system.

These adjustments are interactive and therefore must be made in the proper sequence. The proper sequence is shown on figure 2-20. The following describes test and adjustment of the servo system.

1. Prepare drive for use with test software or FTU.

2. Test and adjust coarse position gain as follows:

   a. Command continuous seeks between cylinder 000 and 822(410).

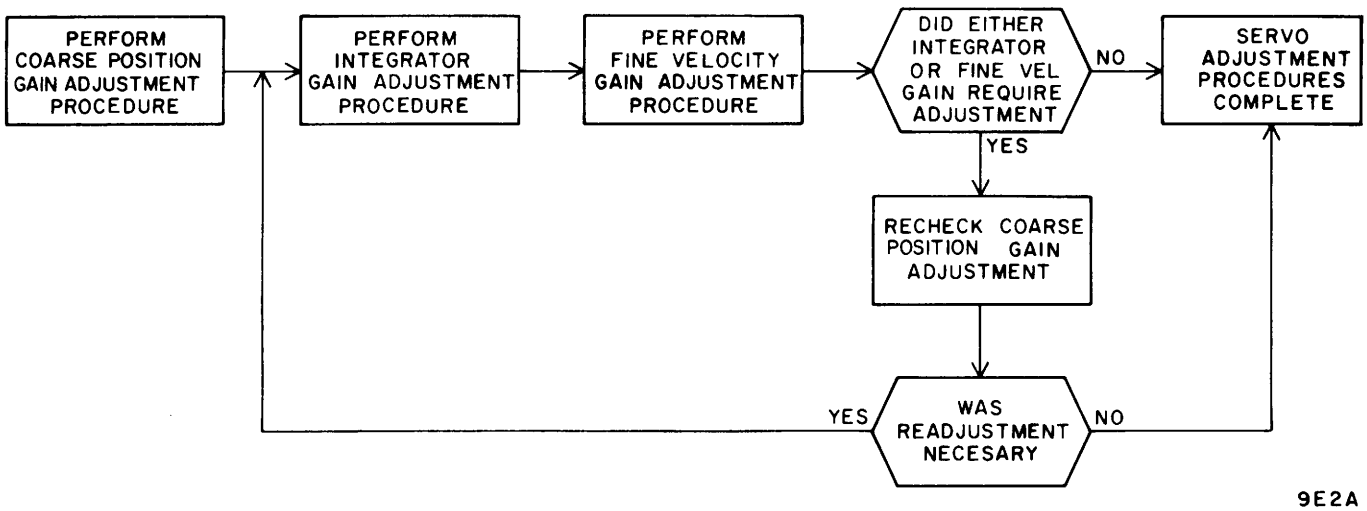


FIGURE 2-20. SERVO SYSTEM ADJUSTMENTS FLOW CHART

b. Connect oscilloscope channel 1 to A07-03A (+ On Cylinder).

c. Trigger oscilloscope negative external on A07-07A (- Forward Seek).

d. Set other oscilloscope controls as necessary to make measurements required in step e.

e. Observe display. If distance between on cylinder pulses is not within 50 to 54 msec, adjust top potentiometer on card A20 until this requirement is met.

3. Test and adjust integrator gain as follows:

a. Command continuous seeks between cylinders 000 and 128(64).

b. Setup oscilloscope as indicated on figure 2-21 and adjust it until the two sloped curves shown on figure 2-21 are displayed.

NOTE

VOLT/CM and TIME/CM settings have to be changed to make measurement required in step c.

c. Observe the second to last discontinuity (indicated on figure 2-21) and that it has a difference of 0±.03V (ignore the spike). If it exceeds this value adjust bottom pot on A20 so that it meets these requirements.

NOTE

In step 4 the read operation is performed between seeks. This causes enough delay between seeks to provide the proper display.

4. Adjust fine velocity gain as follows:

a. Command read operation to be performed in conjunction with continuous seeks between cylinders 000 and 001.

b. Connect and setup oscilloscope as indicated in figure 2-22.

c. Referring to figure 2-22, note that the displayed signal settles out with maximum overshoot of less than 0.5 V. If overshoot exceeds this value adjust middle pot on card in A20. When adjustment is complete, the display should resemble the ideal waveform on figure 2-22.

d. Command sequential forward seek from cylinder 000 through 822(410) to be performed in conjunction with a read.

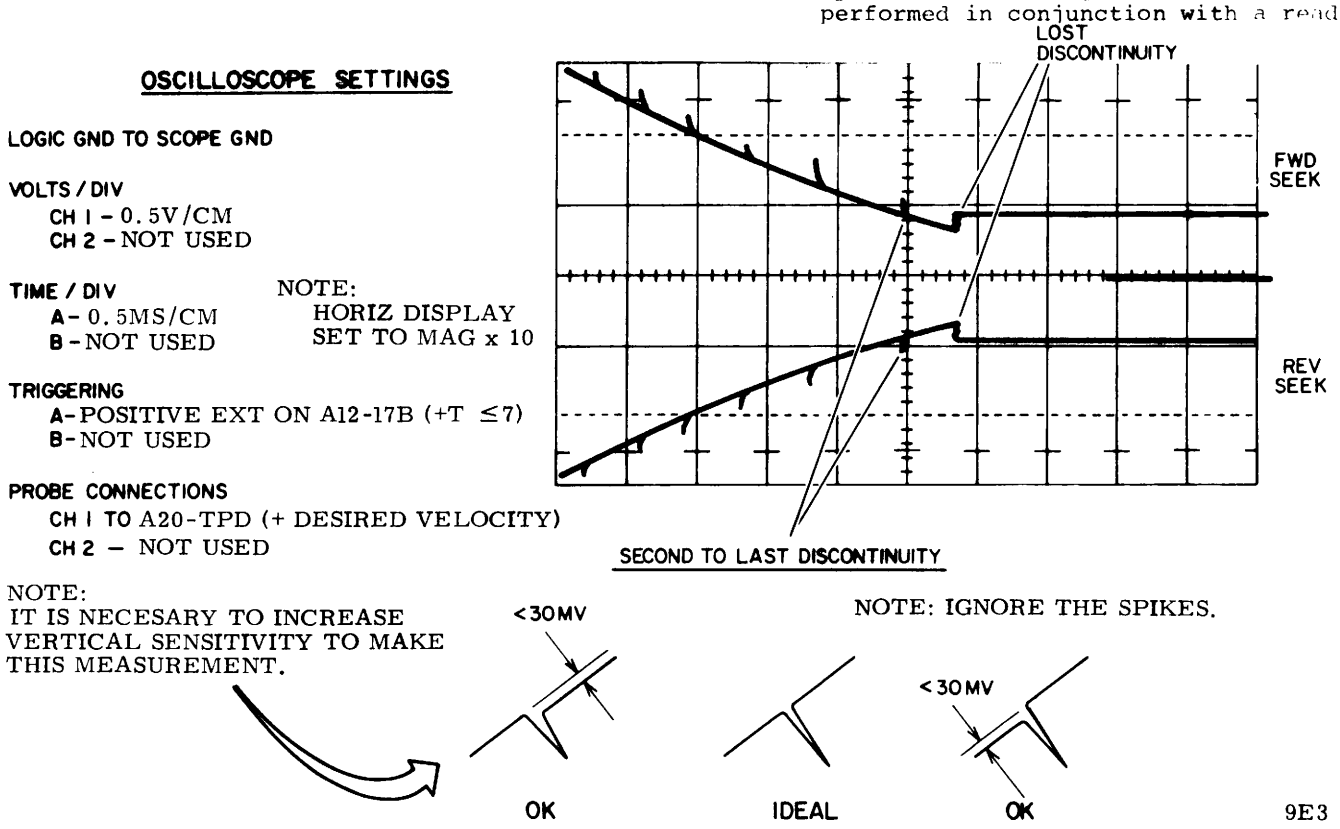
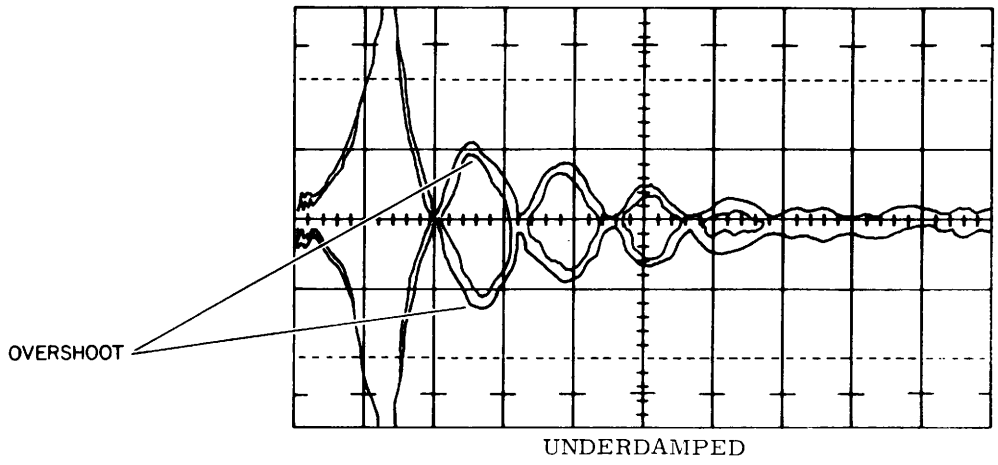


Figure 2-21. Integrator Gain Waveform



OSCILLOSCOPE SETTINGS

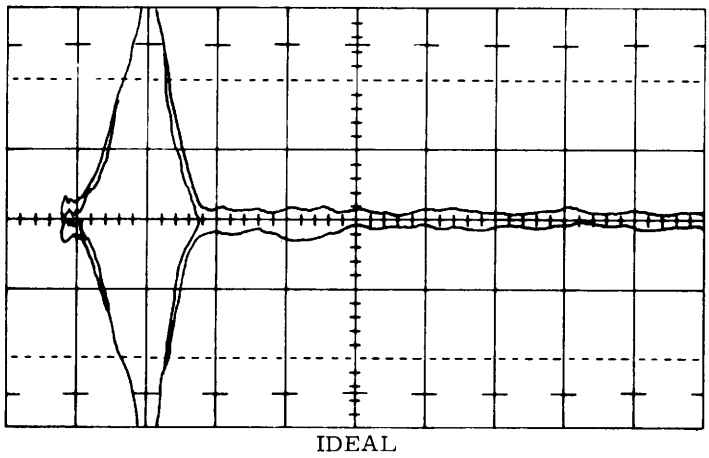
LOGIC GND TO SCOPE GND

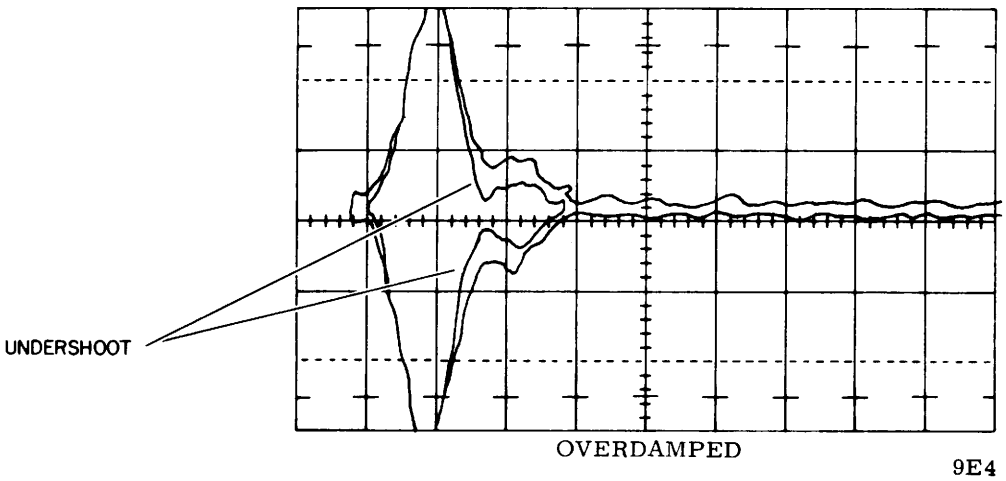
VOLTS / DIV
CH 1 - 0.5V/CM
CH 2 - NOT USED

TIME / DIV
A - 1MS/CM
B - NOT USED

TRIGGERING
A - NEGATIVE ON A07-30A (-SEEK)
B - NOT USED

PROBE CONNECTIONS
CH 1 TO A19-TPC (+FINE POSITION ANALOG)
CH 2 — NOT USED





9E4

Figure 2-22. Fine Velocity Initial Check Waveform

e. Note that displayed signal is as shown on figure 2-23 at each cylinder. If overshoot exceeds .5v at any cylinder adjust middle pot on card in A20 until this requirement is met.

5. Prepare drive for return to online operations.

OSCILLOSCOPE SETTINGS

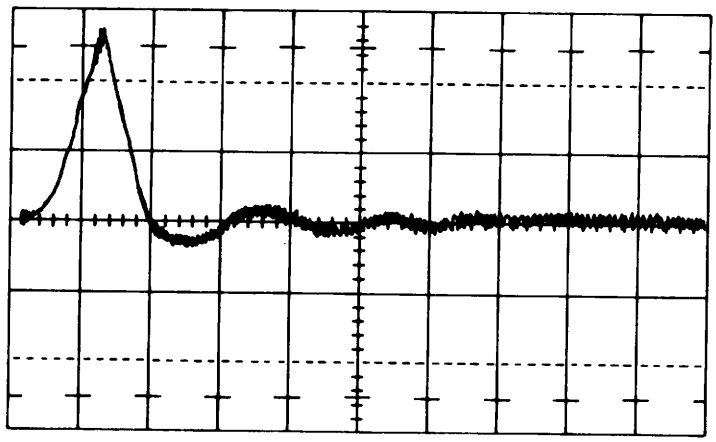
LOGIC GND TO SCOPE GND

VOLTS / DIV
- **CH 1** - 0.5V/CM
- **CH 2** -NOT USED

TIME / DIV
- **A** - 0.1MS/CM
- **B** - NOT USED

TRIGGERING
- **A** - -EXT, A07-30A (-SEEK)
- **B** - NOT USED

PROBE CONNECTIONS
- **CH 1** TO A19-TPC (+FINE POSITION ANALOG)
- **CH 2** - NOT USED



9E5

Figure 2-23. Fine Velocity Gain Final Check Waveform

SECTION 2D

TROUBLE ANALYSIS

GENERAL

This section describes procedures for checking various portions of drive circuitry which are critical to proper drive operation.

The purpose of the procedures is to assist maintenance personnel in isolating problems causing improper drive operation. However, if the drive appears to be operating properly, failure to meet a specification given in this section does not in itself indicate improper drive operation.

The procedure are divided into the following major areas:

- Power Supply DC Voltage Output Checks
- Servo System Checks
- Read/Write System Checks
- Miscellaneous Logic Checks

It should be noted that some of the following procedures differ slightly depending on whether they are performed on a 150 MB (BJ4M1) or 300 MB (BJ4M2, BJ402) drive.

These differences are limited to seek length. In these cases, the 150 MB value is shown in parenthesis as in the following example.

EXAMPLE: Command drive to perform direct seek to cylinder 822(410)

Applicable to 300 MB (BJ4M2, BJ402) units.

Applicable to 150 MB (BJ4M1) units.

Where no parenthesis appear, the value shown applies to both types of drives.

The person performing the maintenance procedures in this section should be thoroughly familiar with operation of the drive and with all information in the General Maintenance section of this manual.

POWER SUPPLY DC VOLTAGE OUTPUT CHECK

This procedure checks the dc power supply output voltages. This includes all voltages except +5 volts and -5 volts which are checked in the +5 Volt and -5 Volt Test and Adjustment procedure.

1. Prepare drive for use with test software or FTU.
2. Command continuous seeks between cylinders 000 and 128(64).
3. Connect voltmeter ground lead to ground test jack on power supply panel.
4. Measure between ground jack and appropriate test jacks on power supply control panel to check following voltages.
   a. +46 (-2+5) Vdc
   b. -46 (+2-5) Vdc
   c. +9.7 (±1) Vdc
   d. -9.7 (±1) Vdc
   e. +20 (±2) Vdc
   f. -20 (±2) Vdc
   g. +28 (±2) Vdc
5. Disconnect voltmeter, then setup and connect oscilloscipe as appropriate to make measurements in step 6.
6. Measure between ground jack and appropriate test jack on power supply control panel and ensure that peak to peak voltage ripple at the following test jacks is within the following limits.

Test Jack	Ripple
a. +46	4.5 V
b. -46	4.5 V
c. +20	1.0 V
d. -20	1.0 V
e. +28	1.0 V

SERVO SYSTEM CHECKS

GENERAL

The servo system checks consist of procedures that test various points in the drives servo logic. These procedures are divided into two

categories: (1) logic controlled checks and (2) manual controlled checks.

The logic controlled checks use the FTU or test software to command the carriage movement required for testing the servo system.

The manual controlled checks provide various tests that can be performed by manually positioning the carriage. These tests may be necessary if problems exist such that satisfactory results cannot be made through the use of the FTU or test software.

LOGIC CONTROLLED SERVO CHECKS

General

The following procedures describe various tests that can be performed by using the FTU or test software.

D/A Converter Output Check

This procedure checks the output of the D/A Converter. The D/A converter produces an output that begins at some maximum value and steps down as each track is crossed until the drive is on cylinder. When on cylinder the D/A output should be zero.

1. Prepare drive for use with test software or FTU.
2. Connect and setup oscilloscope as shown on figure 2-24.
3. Command continuous seeks between cylinders 000 and 128(64).
4. Check that the observe waveforms are as shown on figure 2-24. Note that by further expanding this waveform it is possible to see the individual steps produced as each track is crossed. The steps should be approximately equal and about .07V in amplitude (refer to figure 2-25).
5. Prepare drive for return to online operation.

Cylinder Pulse Blanking Delay Check

This procedure checks the delay preventing a cylinder pulse from being generated as the drive moves off cylinder.

1. Prepare drive for use with test software or FTU.
2. Command continuous seeks between cylinders 000 and 003.
3. Connect and setup oscilloscope as follows:
   a. Connect channel 1 to A07-30B (+ Cylinder Pulse Blanking).
   b. Trigger positive internal.
   c. Set other controls as appropriate to make measurements required in step 4.
4. Observe that the Cylinder Pulse Blanking delay is one for 950 (±50) µs.
5. Prepare drive for return to online operation.

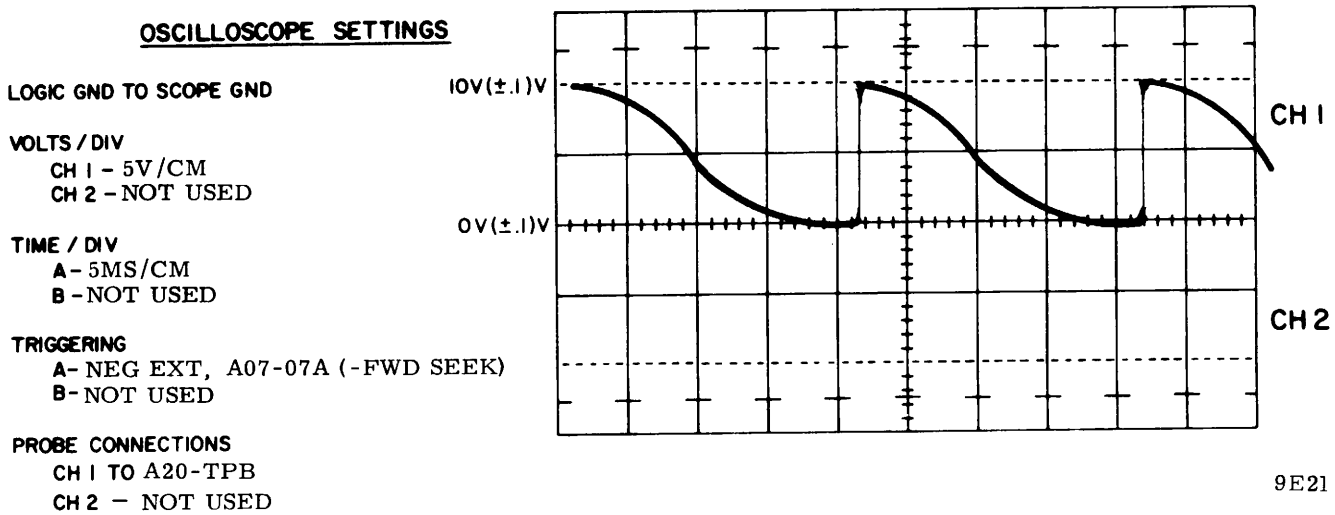


Figure 2-24. D/A Converter Output Waveform

OSCILLOSCOPE SETTINGS

LOGIC GND TO SCOPE GND

VOLTS / DIV
CH 1 - 0.1V/CM
CH 2 - NOT USED

TIME / DIV
A - 5MS/CM
B - NOT USED

TRIGGERING
A - NEG EXT, A07-07A (-FWD SEEK)
B - NOT USED

PROBE CONNECTIONS
CH 1 TO A20-TPB
CH 2 — NOT USED

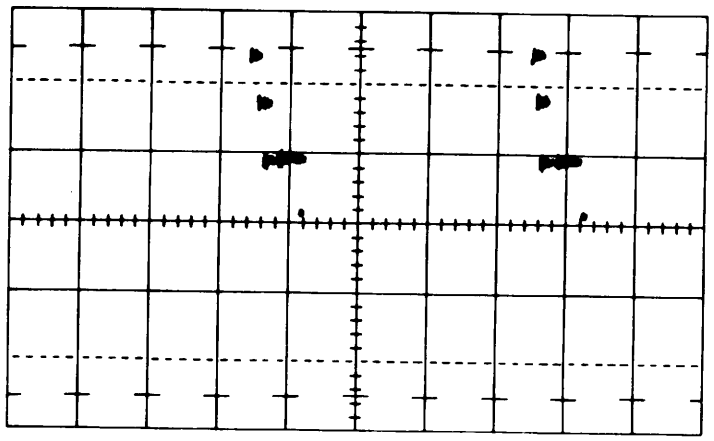


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Figure 2-25. D/A Converter Output Waveform Expanded

Cylinder Pulse One Shot Check

This procedure checks the duration of the cylinder pulses.

1. Prepare drive for use with test software or FTU.
2. Command continuous seeks between cylinders 000 and 003.
3. Connect and setup oscilloscope as follows:
   a. Connect channel 1 to A07-22A (+ Cylinder Pulses).
   b. Trigger positive internal.
   c. Set other controls as appropriate to make measurements required in step 4.
4. Observe that Cylinder Pulse one shot is one for 10 (±2.5) µs.
5. Prepare drive for return to online operation.

Cylinder Pulse Switching Level Check

This test checks the levels at which the track crossing detectors switch to cause generation of a cylinder pulse.

1. Prepare drive for use with either test software or FTU.
2. Command 1 cylinder sequential forward seeks between cylinders 000 and 822 (410).
3. Connect and setup oscilloscope as indicated on figure 2-26. Note that this figure actually shows four different checks each having a separate resulting waveform.
4. Evaluate results as shown on figure 2-26.
5. Prepare drive for return to online operation.

Fine Enable Switching Level Check

This procedure verifies that the fine enable signal switches in at the proper time. The fine enable signal is turned on when tracks to go are less than one and integrated velocity reaches a certain point.

1. Prepare drive for use with test software or FTU.
2. Connect and setup oscilloscope as indicated on figure 2-27.
3. Command continuous seeks between cylinders 000 and 001.
4. Observe that the waveforms are as indicated on figure 2-27. Note that fine enable switches to a zero level when integrated velocity is between +.82 and +.98V for forward seeks and -.82 and -.98V for reverse seeks.
5. Prepare drive for return to online operation.

OSCILLOSCOPE SETTINGS

LOGIC GND TO SCOPE GND

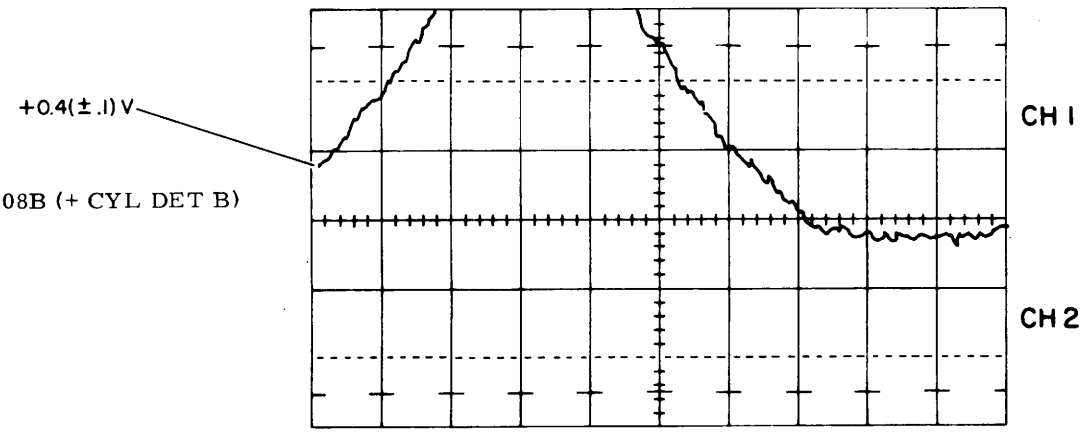
TIME / DIV
A - .2 MS/CM
B - NOT USED

PROBE CONNECTIONS
CH 1 TO A18-09 B (+ TRACK SERVO SIGNAL)
CH 2 - NOT USED

NOTE:
TIME/DIV AND PROBE CONNECTIONS ARE COMMON TO ALL THE FOLLOWING WAVEFORMS.

VOLTS / DIV
CH 1 - .5V/CM
CH 2 - NOT USED

TRIGGERING
A- NEG EXT. A18-08B (+ CYL DET B)
B- NOT USED



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

TRIGGERING
A- POS EXT. A18-08B (+CYL DET B)
B- NOT USED

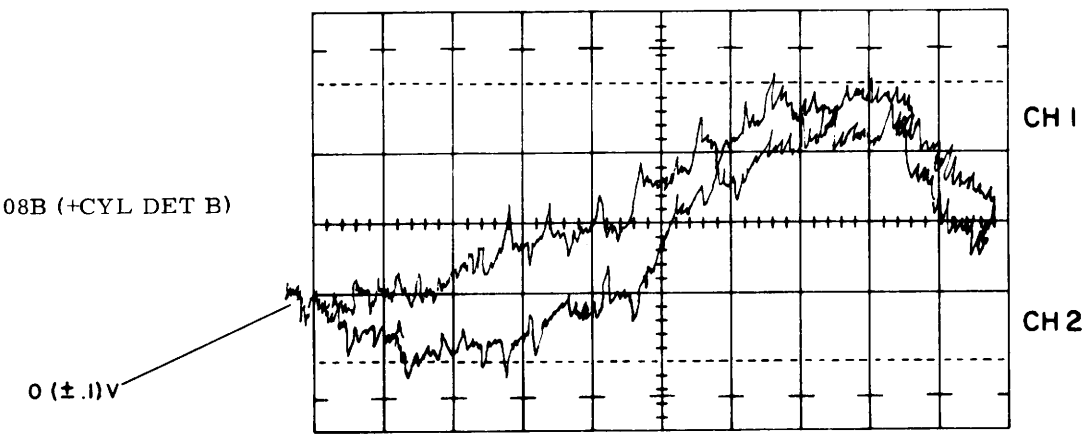


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Figure 2-26. Cylinder Pulse Switching Level Waveform
(Sheet 1 of 2)

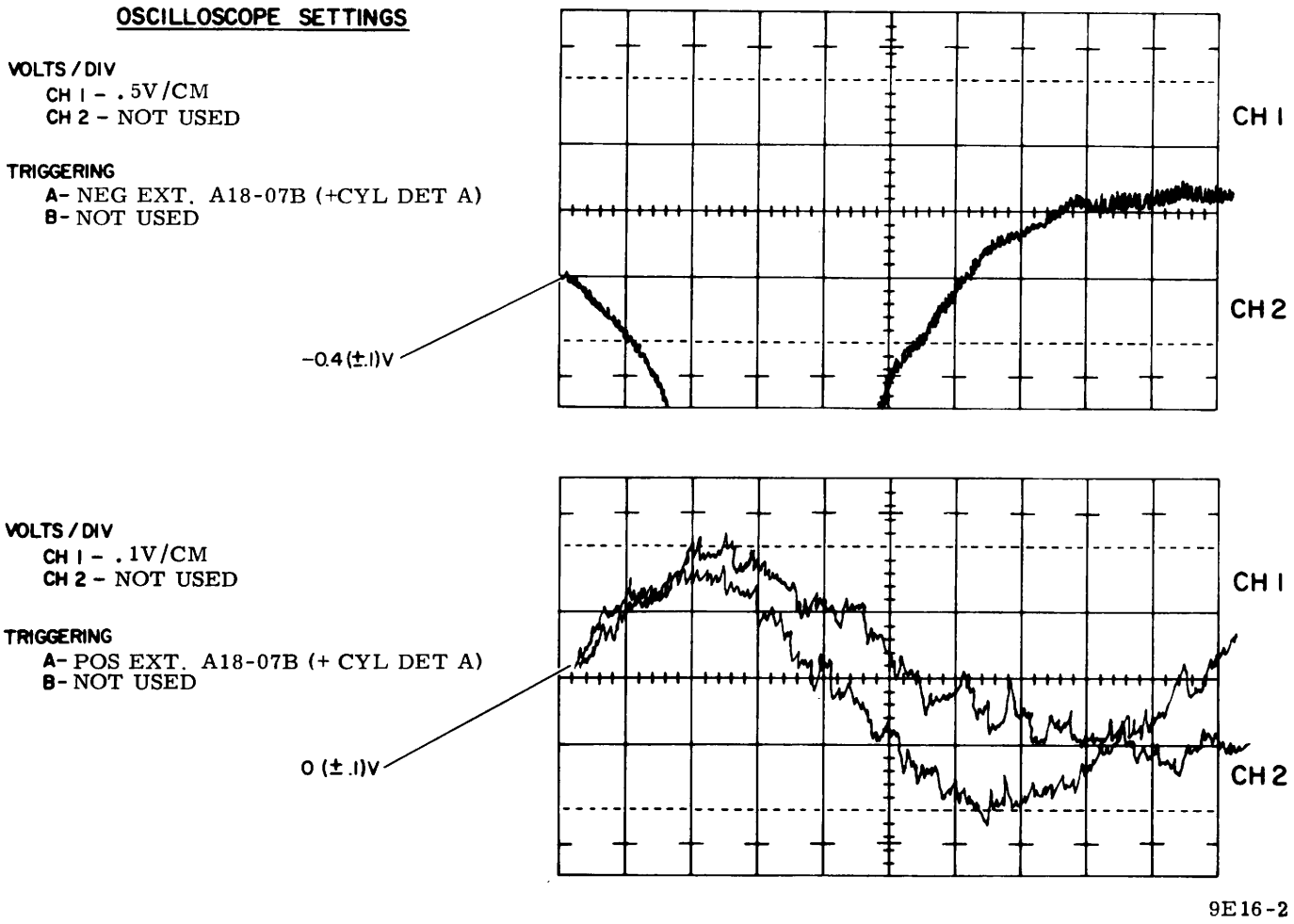


Figure 2-26. Cylinder Pulse Switching Level Waveform
(Sheet 2 of 2)

On Cylinder Delay Check

This procedure checks the delay between the time the drive is on cylinder and the On Cylinder pulse is generated.

1. Prepare drive for use with test software or FTU.
2. Command continuous seeks between cylinder 000 and 003.
3. Connect and setup oscilloscope as follows:
   a. Connect channel 1 to A07-03B (- On Cylinder).
   b. Trigger positive on A07-15A (+ On Cylinder Sense).
   c. Set other controls as appropriate to make measurement required in step 4.
4. Observe that not On Cylinder is a logic one for 1.75 (±.35) ms.
5. Prepare drive for return to online operation.

On Cylinder Dropout Delay Check

This procedure checks the delay between the time the drive goes off cylinder and when the On Cylinder signal drops.

OSCILLOSCOPE SETTINGS

LOGIC GND TO SCOPE GND

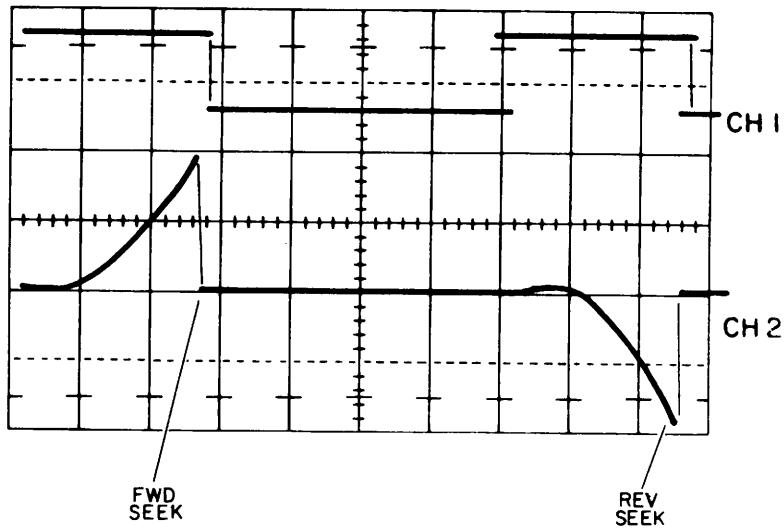
VOLTS / DIV
CH 1 - 5V/CM
CH 2 - 0.5V/CM

TIME / DIV
A - 0.5MS/CM
B - NOT USED

TRIGGERING
A - EXT NEG, A20-12A (-FWD SEEK)
B - NOT USED

PROBE CONNECTIONS
CH 1 TO A20-10A (-FINE ENABLE)
CH 2 TO A20-TPG (+INTEGRATED VEL)

NOTE: SET DISPLAY MODE TO CHOP.



9E19

Figure 2-27. Fine Enable Switching Level Waveform

NOTE

Place card A07 on card extender during drive preparation procedure. Also place chip clip on IC in position A3.

1. Prepare drive for use with test software or FTU.
2. Command continuous seeks between cylinders 000 and 003.
3. Connect and setup oscilloscope as follows:
   a. Connect channel 1 to pin 3 of chip in position A3.
   b. Trigger negative internal.
   c. Set other controls as appropriate to make measurement required in step 4 of this procedure.
4. Observe that On Cylinder Dropout delay is zero for 800 (±300) µs.
5. Prepare drive for return to online operation.

On Cylinder Pulse Check

This procedure measures duration of On Cylinder pulse.

1. Prepare drive for use with test software or FTU.
2. Command continuous seeks between cylinders 000 and 001.
3. Connect and setup oscilloscope as follows:
   a. Connect channel 1 to A07-22A (+ Cylinder Pulses).
   b. Trigger positive internal.
   c. Set other controls as appropriate to make measurement required in step 4.
4. Observe that On Cylinder pulse is one for 0.3 (±.05) µs.
5. Prepare drive for return to online operation.

On Cylinder Switching Level Check

This procedure checks the level at which the On Cylinder Sense signals goes true. This should occur at each zero (track) crossing.

1. Prepare drive for use with either test software or FTU.

2. Setup and connect oscilloscope as shown on figure 2-28.

3. Command continuous 2 track seeks between cylinder 000 to 002(001).

4. Check that resulting waveforms agree with those shown on figure 2-28.

5. Setup and conect oscilloscope as shown on figure 2-29.

CAUTION

While performing step 6, refer to manually positioning carriage procedure and perform that entire procedure before proceeding to step 7.

6. Observe display while manually moving carriage in forward and reverse directions. Check that resulting waveforms agree with those on figure 2-29.

7. Prepare drive for return to online operation.

One Track Seek Time Check

This procedure checks the time it takes for the positioner to move from one track to another.

1. Prepare drive for use with test software or FTU.

2. Command drive to perform one cylinder sequential forward seeks, starting at cylinder 000 and ending at 822(410). Perform a read operation between each seek.

3. Connect and setup oscilloscope as follows:

   a. Connect channel 1 to A07-03A (+ On Cylinder).

   b. Trigger negative internal on A07-07A (- Forward Seek).

   c. Set other oscilloscope controls as appropriate for making measurements required in step 4.

4. Observe that signal is low for 6 ms or less.

5. Prepare drive for return to online operation.

Positioner Offset Voltage Check

This checks the offset level produced by a servo offset command. The measurement is made on the Track Servo signal which normally has an average dc level of zero when the drive is on cylinder.

1. Prepare drive for use with either test software or FTU.

2. Command direct seek to cylinder 400 (200).

3. Connect and setup oscilloscope as follows:

   a. Connect channel 1 to A18-09B (+ Track Servo Signal)

   b. Set A sweep trigger mode to AUTO.

   c. Set other controls as appropriate to make measurement required in step 4.

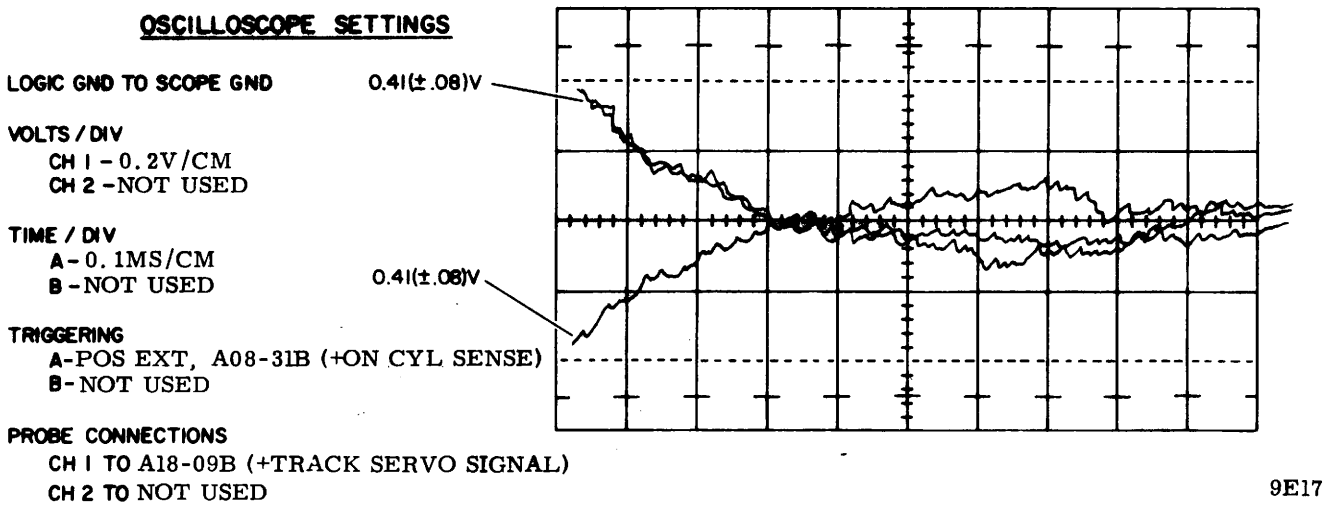


Figure 2-28. On Cylinder Switching Level - Waveform I

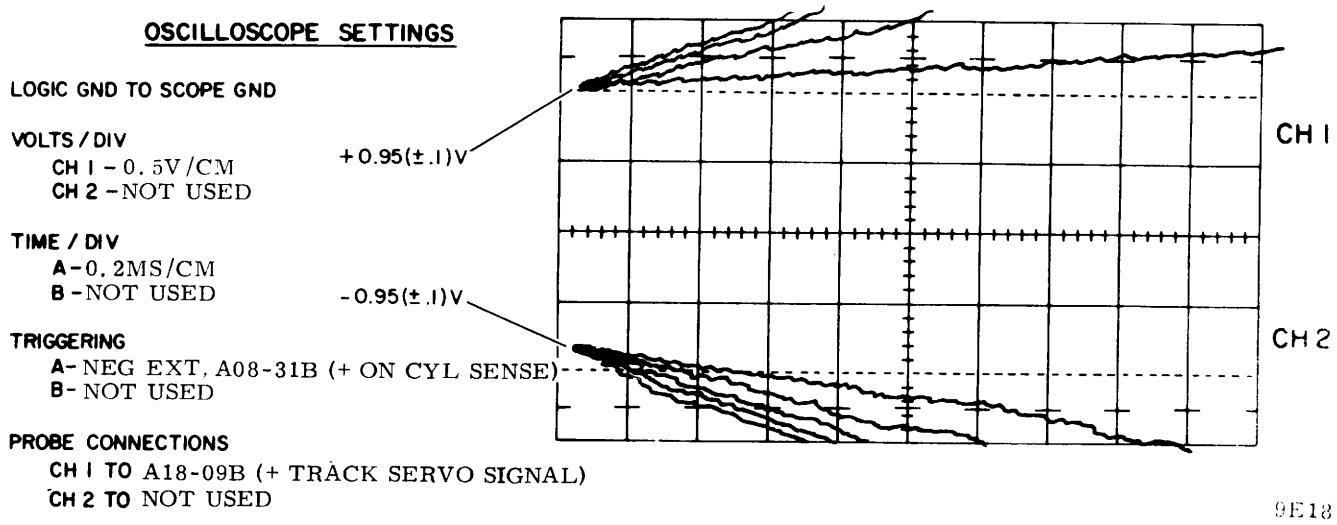


Figure 2-29. On Cylinder Switching Level - Waveform II

Note

Measure average dc level in steps 4 and 5.

4. Command carriage offset plus (forward offset) and observe that the scope indicates +.6±.1 V.

5. Command carriage offset minus (reverse offset) and observe that the scope indicates -.6±.1 V.

6. Prepare drive for return to online operation.

Track Following Check

This procedure checks the ability of the heads to accurately follow the track. Inability to stay on track may be caused by excessive runout of the disk pack or spindle assembly. Runout is the degree to which a rotating object wobbles off its center of rotation.

Inability to stay on track is also caused by the servo logic being unable to respond to allowable runout.

If the heads do not accurately follow the track, read errors may occur and the drive may also intermittently drop on cylinder.

1. Prepare drive for use with test software or FTU.

2. Command direct seek to cylinder 400 (200).

3. Connect and setup oscilloscope as follows:

   a. Connect channel 1 to A19-TPC (Fine Position Analog).

   b. Trigger positive external on A06-TPC (Index).

   c. Set other controls as appropriate to make observations required in remainder of this procedure.

4. Observe display and refer to figure 2-30. As runout increases, waveform sinusoidal amplitude increases.

5. Interpret display as follows:

   a. If amplitude of 60 Hz sinusoidal component of waveform exceeds 400 mV peak to peak, it is excessive and a problem exists with either drive or disk pack. In this case note point at which waveform syncs with Index and proceed to step 6.

   b. If waveform sinusiodal amplitude does not exceed 400 mV the drive or disk pack does not have excessive runout. In this case proceed to step 11.

6. Press START switch to stop drive motor and unload heads.

7. Note position of disk pack on spindle, remove disk pack, rotate in 90 degrees (1/4 turn) in either direction and reinstall it on the spindle.

8. Press START switch to start drive motor and load heads.

9. Command direct seek to cylinder 400 (200).

OSCILLOSCOPE SETTINGS

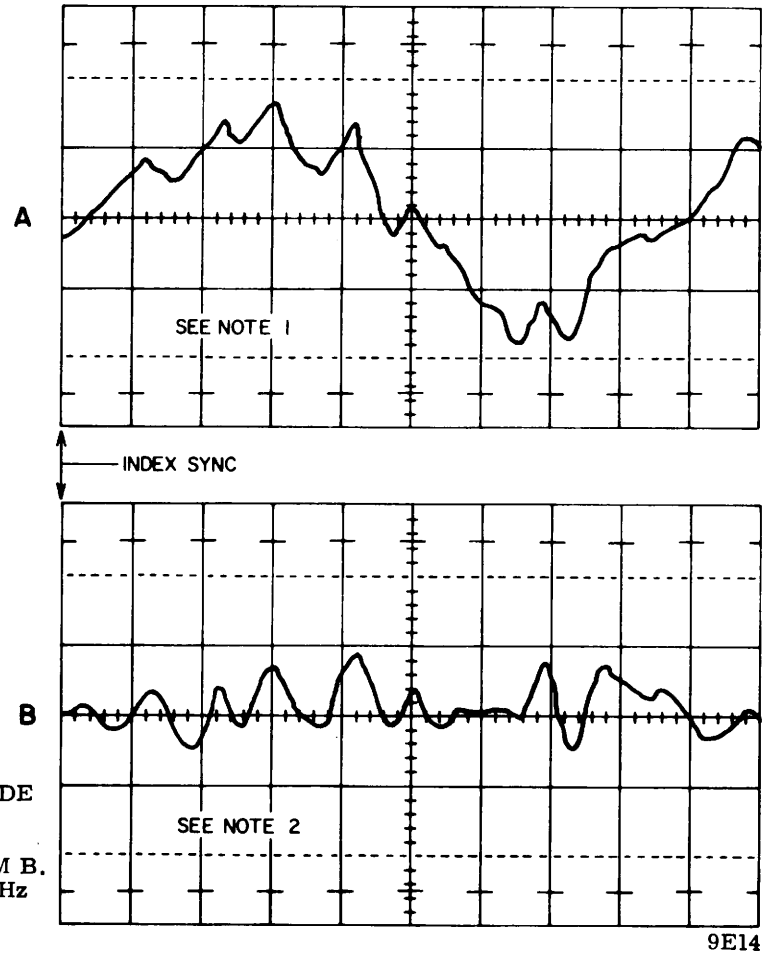
LOGIC GND TO SCOPE GND

VOLTS / DIV
CH 1 - 0.1V/CM (READ SCALE AS 100MV)
CH 2 - NOT USED

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

TRIGGERING (POSITIVE /EXTERNAL)
A - INDEX
B - NOT USED

PROBE CONNECTIONS
CH 1 TO A19-TPC (FINE POS ANALOG)
CH 2 - NOT USED



NOTES:

1 MORE THAN NORMAL RUNOUT RESULTS IN THE WAVEFORM HAVING A 60Hz SINUSOIDAL COMPONENT AS SHOWN ON WAVEFORM A. AS AMOUNT OF RUNOUT INCREASES, THE PEAK TO PEAK AMPLITUDE OF THE 60Hz COMPONENT INCREASES.

2 NORMAL RUNOUT IS SHOWN ON WAVEFORM B. IN THIS CASE, THE AMPLITUDE OF THE 60Hz SINUSOIDAL COMPONENT IS LESS THAN 400MV PEAK TO PEAK.

Figure 2-30. Track Following Check Waveform

NOTE

Because Index and Fine Position signals are both derived from servo dibit tracks on disk pack, there should be no phase shift between these signals when disk pack is rotated with respect to spindle if there is no spindle runout.

10. Compare phase position of waveform displayed with phase position of waveform observed in step 5. Interpret results as follows:

    a. If phase relationship of both waveforms coincide, disk pack or servo system is cause of excessive runout.

    b. If phase relationship of both waveforms do not coincide, spindle or servo system is causing excessive runout.

11. Prepare drive for return to online operation.

Track Servo Amplitude Check

This procedure checks the amplitude of the track servo dibits signal that is input to the track servo circuit.

1. Prepare the drive for use with test software or FTU.

2. Connect and setup oscilloscope as indicated on figure 2-31.

3. Command direct seek to cylinder 000 and observe peak to peak amplitude of waveform.

4. Command direct seek to cylinder 822(410) and observe peak to peak amplitude of waveform.

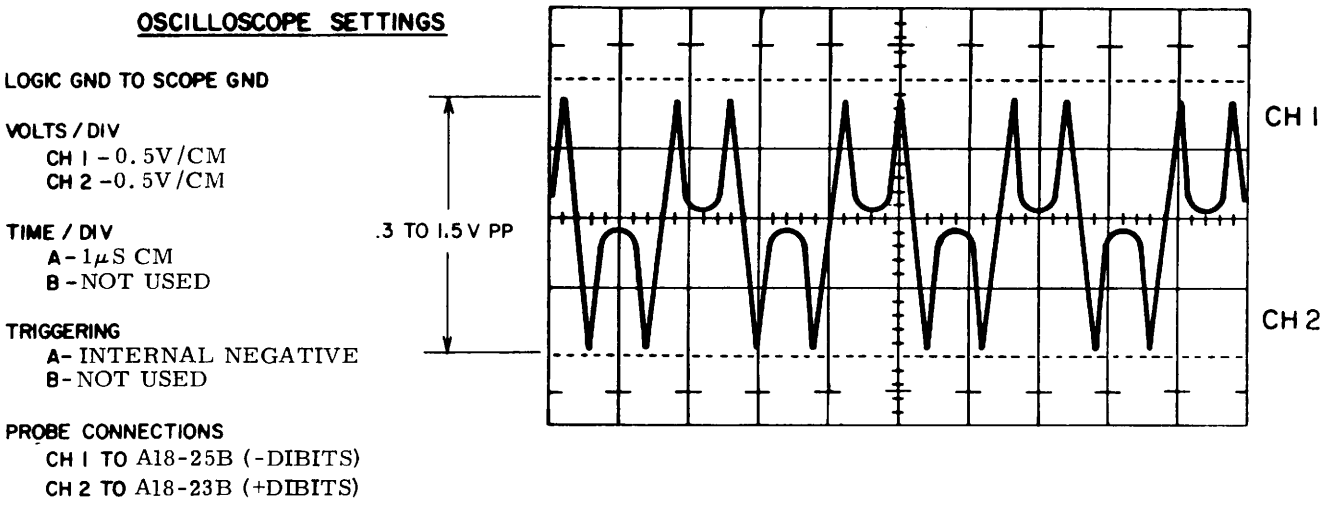


Figure 2-31. Track Servo Amplitude Waveform

5. Check that waveforms observed in steps 3 and 4 is between .3 and 1.5 V peak to peak. Also note that waveform of step 3 has the largest amplitude.

6. Prepare drive for return to online operation.

Velocity Transducer Gain Uniformity Check

This checks the output of the velocity transducer by monitoring the sawtooth output of the velocity integrator. Note that the positive sawtooth waveforms are produced during forward seeks and the negative waveforms during reverse seeks.

1. Prepare drive for use with test software or FTU.

2. Connect and setup oscilloscope as indicated on figure 2-32.

3. Command continuous seeks between cylinders 000 and 822(410).

4. Observe waveforms as shown on figure 2-32, check that the amplitude of the second to last positive and negative ramps are each 1.8V to 2.2V and the difference between the two is .3V maximum. Note that the positive ramps are produced during first seeks and negative during reverse seeks.

MANUAL CONTROLLED SERVO CHECKS

This procedure describes testing the servo system while manually positioning the carriage.

1. Prepare drive as follows:

   a. Press START switch to stop drive motor.

   b. Set MAIN AC circuit breaker to off.

   c. Raise top cover.

   d. Put logic chassis in maintenance position.

   e. Remove logic control of voice coil by disconnecting yellow lead wire at voice coil.

CAUTION

Make sure carriage is fully retracted (refer to procedure for manually positioning carriage).

2. Check that output of summing amplifier at 0 volts before drive motor is energized, by performing the following procedure.

   a. Set oscilloscope vertical sensitivity control to 5V/CM.

   b. Set oscilloscope horizontal sweep control to .1 MS/CM.

   c. Set oscilloscope trigger control to auto (free running).

   d. Connect oscilloscope channel A to A20-25A (+ Summing Amp Output).

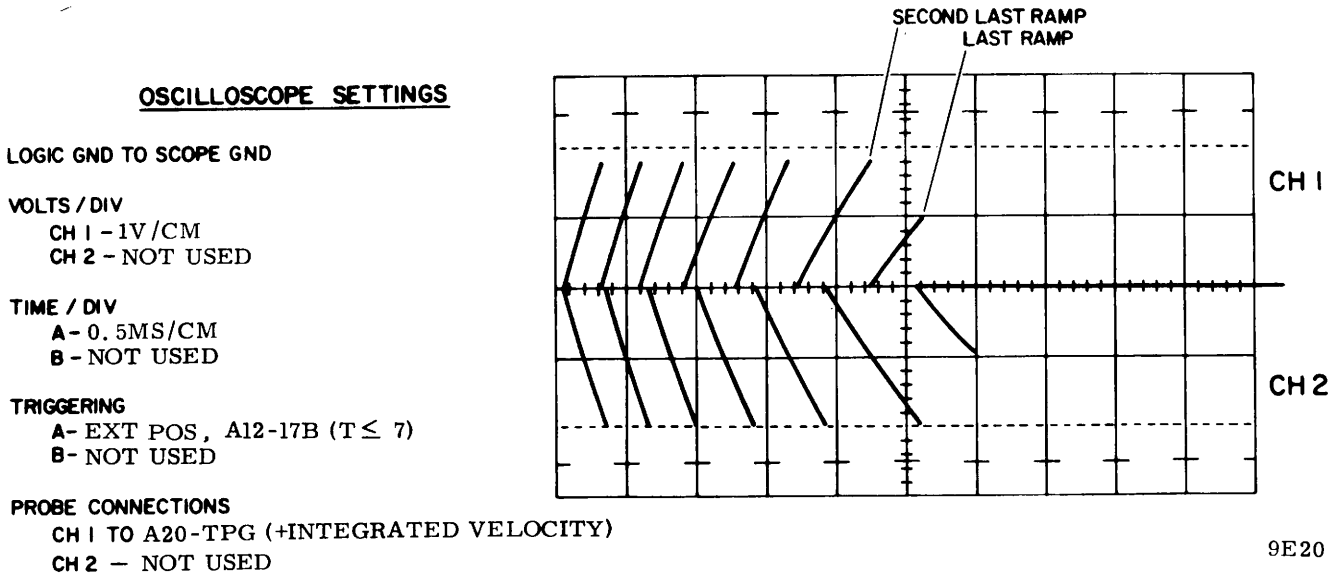


Figure 2-32. Velocity Gain Uniformity Waveform

e. Set main AC circuit breaker to ON and observe that voltage remains at 0 volts.

3. Check that output of summing amplifier goes to -10V when drive motor gets up to speed by performing the following procedure.

   a. Connect and setup oscilloscope as in step 2.

   b. Press START switch to start drive motor and observe that summing amplifier output drops to -10 volts when drive motor gets up to speed (approximately 30 seconds).

CAUTION

Refer to discussion on manually positioning carriage before loading and positioning heads as described in the following steps.

4. Manually load heads (refer to discussion on manually positioning carriage).

5. Check velocity transducer and amplifier as described in the following. If signals observed are as specified.

   a. Setup oscilloscope as follows:

   - Vertical sensitivity to .5V/M
   - Horizontal sweep to 10MS/CM.
   - Trigger control to AUTO (free running).
   - Connect channel A to A20-TPE (+ Velocity).

   b. Manually move carriage toward cylinder 822(410) (forward direction). Signal should go negative and amplitude should increase as speed of carriage increases.

   c. Manually move carriage toward cylinder 000 (reverse direction). Signal should go positive and amplitude should increase as speed of carriage increases.

6. Check Fine Position Analog signal. If signals observed as specified in the following, it indicates that track servo and servo head are functioning properly.

   a. Setup and connect oscilloscope as follows:

   - Set Vertical sensitivity control to 1V/CM.
   - Set Horizontal sweep control to 10MS/CM.
   - Set trigger control to AUTO (free running).
   - Connect channel A to A19 TPC (Fine Position Analog).

   b. Observe an approximately 3.8 volts peak to peak signal when moving carriage in either forward or reverse direction. When signal is at 0 volts drive is on cylinder.

7. Check prolarity of Fine Position Analog signal. If observed signals are as specified it ensures that the Fine Position Analog signal has the proper polarity when it is applied to the fine gate.

a. Oscilloscope settings and connections are same as in previous step.

b. Move carriage back until heads contact head cams (do not unload heads).

c. Observe that Fine Position Analog signal is at zero volts.

d. Manually move carriage slowly forward and observe that signal first goes positive (as it crosses reverse end of travel area) then alternately positive and negative as servo head starts crossing tracks.

8. Check summing amplifier output. If signals observed in the following are as specified, it indicates that proper signal is being gated to summing amplifier, fine mode is enabled, and Velocity and Fine Position Analog signals are properly summed together.

   a. Connect and setup oscilloscope as follows:

      - Set Vertical sensitivity control to 5V/CM.
      - Set Horizontal sweep control to 20MS/CM.
      - Set Trigger control to AUTO (free running).
      - Connect channel A to A20-25A (+ Summing Amp Output).

   b. Move carriage in forward then reverse direction. Signal should be that of step 6 superimposed on signal of step 5 and signal should clamp at approximately ±10 Volts, depending on direction of travel.

9. Check Power Amplifier output. If signal observed are as specified in following, power amplifier is functioning properly.

   a. Connect and setup oscilloscope as follows:

      - Set Vertical sensitivity control to 2V/CM (use 10X probe)
      - Set Horizontal sweep control to 10MS/CM.
      - Set trigger control to AUTO (free running).
      - Connect channel A to yellow leadwire which was disconnected from voice coil.

   b. Move carriage in forward then reverse direction and observe signal switching from +46 to -46 volts.

CAUTION

Refer to discussion on manually positioning carriage before manually unloading heads.

10. Manually unload heads.

11. Press START switch to stop drive motor.

12. Set MAIN AC circuit breaker to off.

13. Reconnect yellow lead wire to voice coil.

14. Prepare drive to online operation.

READ/WRITE SYSTEM CHECKS

GENERAL

The read/write system checks consist of procedures checking the basic read/write capability of the drive.

WRITE CIRCUIT CHECKS

This procedure checks three points in the write circuits (refer to figure 2-33). If the signals at these points are correct, it indicates the circuits are performing their basic function.

1. Prepare the drive for use with test software or FTU.

2. Command drive to write a 1010 bit pattern on the disk.

3. Check inputs to NRZ to MFM converter and write compensation circuits. Timing relationships between these signals (NRZ data and 9.67 MHZ Enable signals) must be correct before proper NRZ to MFM conversion and write compensation can be performed.

   a. Connect and setup oscilloscope as shown in figure 2-34.

   b. Observe that signals have timing relationships as shown in figure 2-34.

4. Check input to write drives circuits. This checks compensated MFM data input to Write Toggle FF.

   a. Move oscilloscope channel 2 probe to E02-TPU.

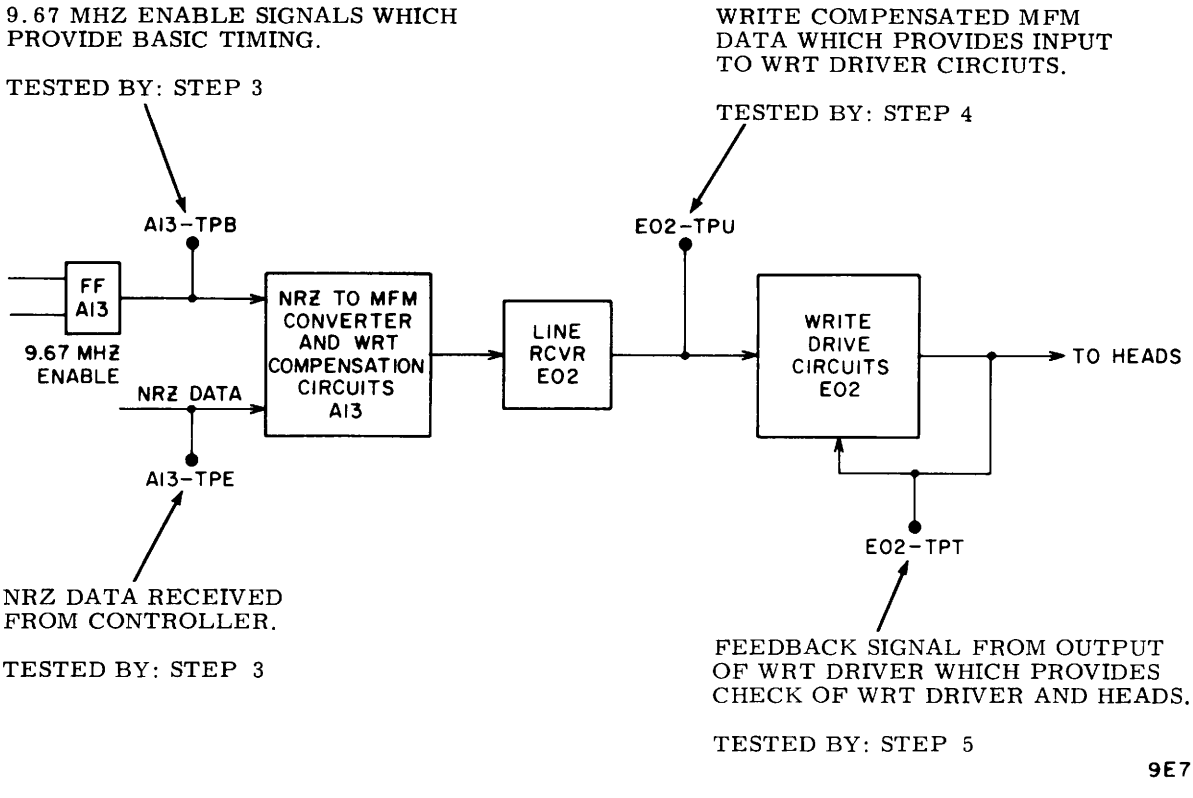


Figure 2-33. Write Circuits Test Points

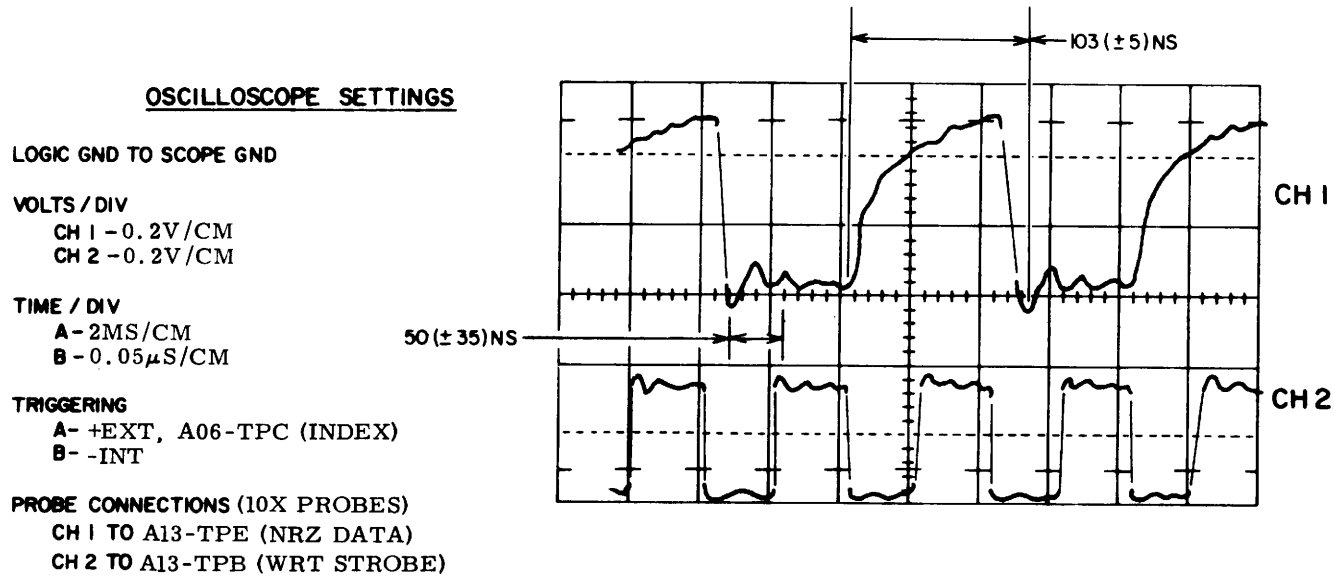


Figure 2-34. NRZ Write Data Input Waveform

b. Observe that signals have approximately the relationship shown in figure 2-35 and that channel 2 signal has proper polarity.

5. Check output of write driver circuits. This ensures that write driver is sending data and that head is functioning.

   a. Move oscilloscope channel 2 probe to E02-TPT.

   b. Observe that signals are approximately as shown on figure 2-36

6. Prepare drive for return to online operation.

READ CIRCUIT CHECKS

This procedure checks the basic operation of the read circuits (refer to figure 2-37). If the observed signals are correct it indicates these circuits are performing their basic functions.

1. Prepare drive for use with test software or FTU.

2. Command drive to write 1010 bit pattern on disk.

3. Command drive to read 1010 bit pattern.

4. Check Analog Data input to the analog to digital converter circuits. If signals are correct it indicates the analog data detection circuits are functioning.

   a. Connect and setup oscilloscope as indicated on figure 2-38.

   b. Observe that signal is approximately as shown on figure 2-38 with approximately 200 ns between zero crossings.

5. Check output of Data latch FF. If observed signals are correct it indicates high and low resolution channels and Data latch FF are functioning.

   a. Connect and setup oscilloscope as shown on figure 2-39.

   b. Observe that signal is approximately as shown on figure 2-39.

6. Check frequency of Read Reference Clock signals.

   a. Connect and setup oscilloscope as shown on figure 2-38 except move Channel 1 probe to A15-24B (+ Read Reference Clock) and Channel 2 probe to A15-23B (- Read Reference Clock).

   b. Observe that the displayed signal has a frequency of approximately 4.84 Mhz.

7. Check the Read data to Read clock timing relationship. If signals are correct, it indicates read circuits are generating the proper Read data and Read clock signals.

   a. Connect and setup oscilloscope as shown in figure 2-40.

   b. Observe that displayed signals have timing relationships as shown on figure 2-40.

8. Prepare drive for return to online operation.

HEAD AMPLITUDE CHECK

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

1. Prepare the drive for use with test software or FTU.

2. Command direct seek to cylinder 822 (410) and write an all ones pattern.

3. Connect and setup oscilloscope as follows:

   a. Trigger negative external on A06-TPC (Index).

   b. Connect channel 1 to E03-TPB.

   c. Connect channel 2 to E03-TPC.

   d. Set DISPLAY MODE to ADD and invert one channel.

   e. Set VOLTS/CM and TIME/CM controls to values appropriate for making measurements required in remainder of this procedure.

4. Command drive to read, select each head in turn and measure amplitude of read signal for each head. This amplitude should be a minimum of 130 mV peak to peak.

5. Command direct seek to cylinder 001 and write a 101010.... pattern with all heads.

OSCILLOSCOPE SETTINGS

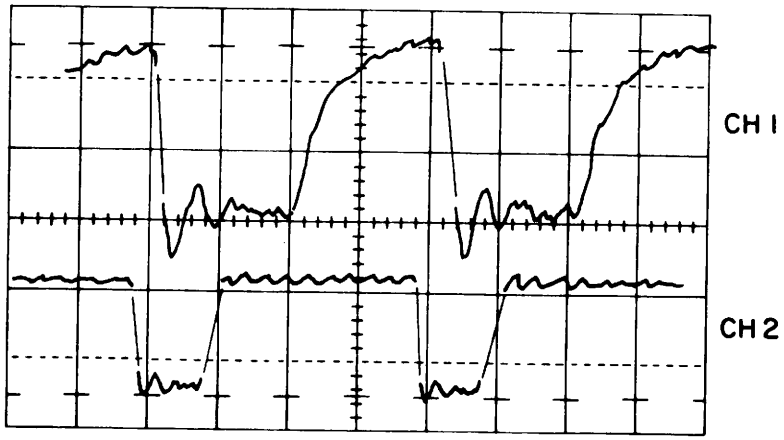
LOGIC GND TO SCOPE GND

VOLTS / DIV
CH 1 - 0.2V/CM
CH 2 - 0.2V/CM

TIME / DIV
A - 2MS/CM
B - 0.05 μS/CM

TRIGGERING
A - +EXT, A06-TPC (+ INDEX)
B - -INT

PROBE CONNECTIONS (10X PROBES)
CH 1 TO A13-TPE (NRZ DATA)
CH 2 TO EO2-TPU



NOTE: SET DISPLAY MODE TO ALT AND TRIGGER MODE TO CH 1 ONLY.
ALSO SET HORIZONTAL DISPLAY TO B (DELAYED SWEEP)

9E12

Figure 2-35. Write Driver Input Waveform

OSCILLOSCOPE SETTINGS

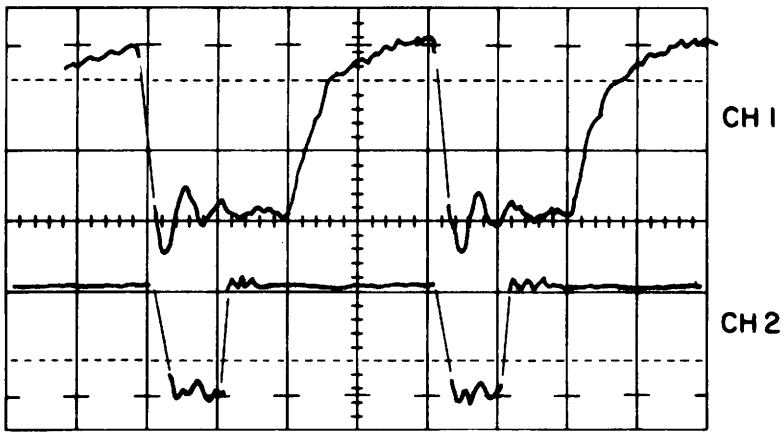
LOGIC GND TO SCOPE GND

VOLTS / DIV
CH 1 - 0.2V/CM
CH 2 - 0.2V/CM

TIME / DIV
A - 2MS/CM
B - 0.05 μS/CM

TRIGGERING
A - +EXT, A06-TPC (+ INDEX)
B - - INT

PROBE CONNECTIONS (10X PROBES)
CH 1 TO A13-TPE (NRZ DATA)
CH 2 TO EO2-TPT



NOTE: SET DISPLAY MODE TO ALT AND TRIGGER MODE TO CH 1 ONLY
ALSO SET HORIZONTAL DISPLAY TO B (DELAYED SWEEP)

9E13

Figure 2-36. Write Driver Output Waveform

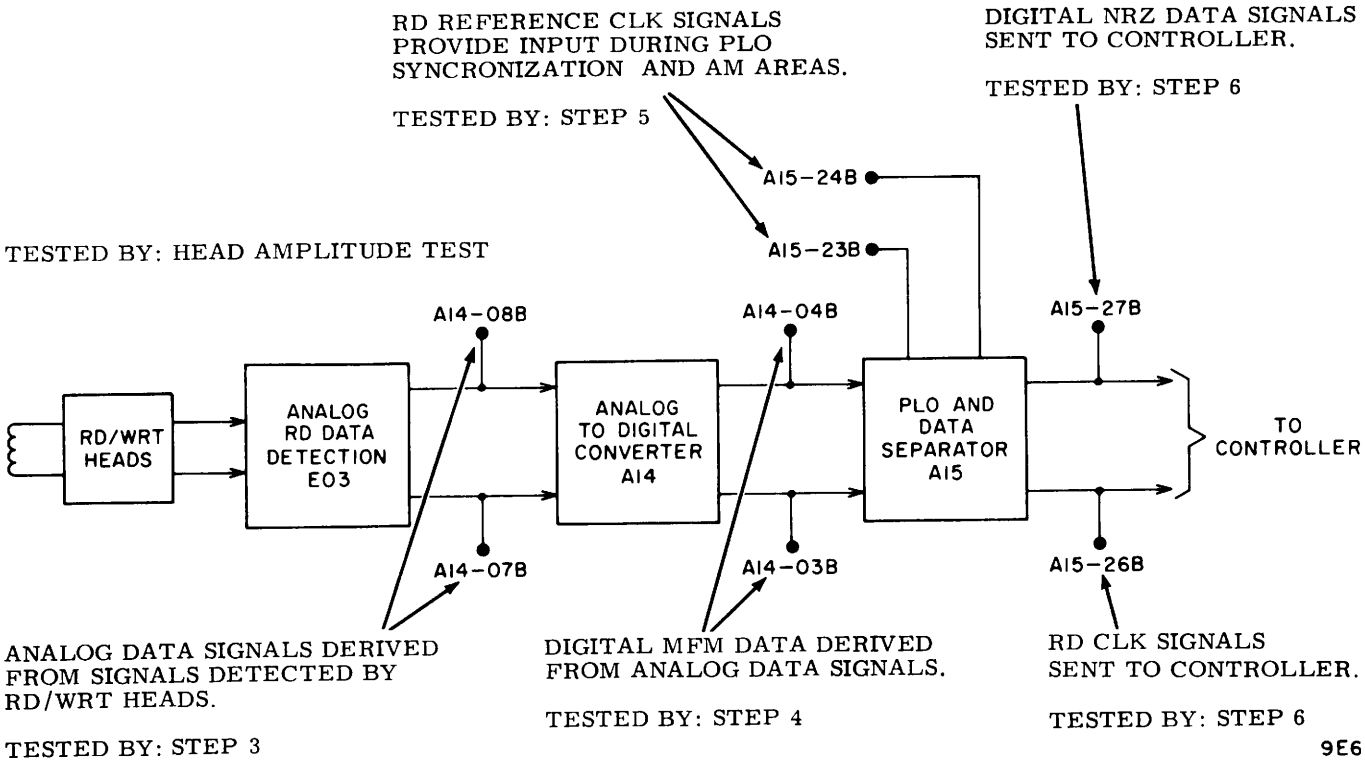


Figure 2-37. Read Circuits Test Points

OSCILLOSCOPE SETTINGS

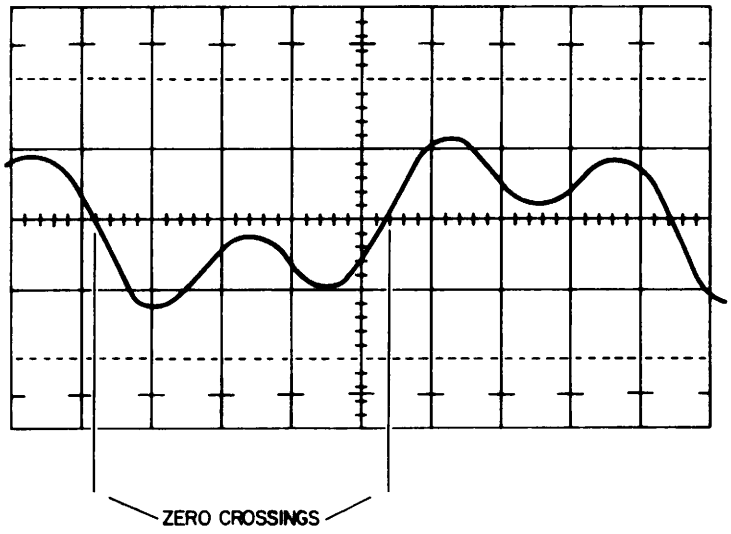
LOGIC GND TO SCOPE GND

VOLTS / DIV
CH 1 - 0.1V/CM
CH 2 - 0.1V/CM

TIME / DIV
A - 2MS/CM
B - 0.05μS/CM

TRIGGERING
A - +EXT, A06-TPC (+INDEX)
B - -INT

PROBE CONNECTIONS (10x PROBES)
CH 1 TO A14-08B (-ANALOG DATA)
CH 2 TO A14-07B (+ANALOG DATA)



NOTE: SET DISPLAY MODE TO ADD AND INVERT ONE CHANNEL. ALSO SET HORIZONTAL DISPLAY TO B (DELAYED SWEEP)

9E8

Figure 2-38. Analog Read Data Waveform

OSCILLOSCOPE SETTINGS

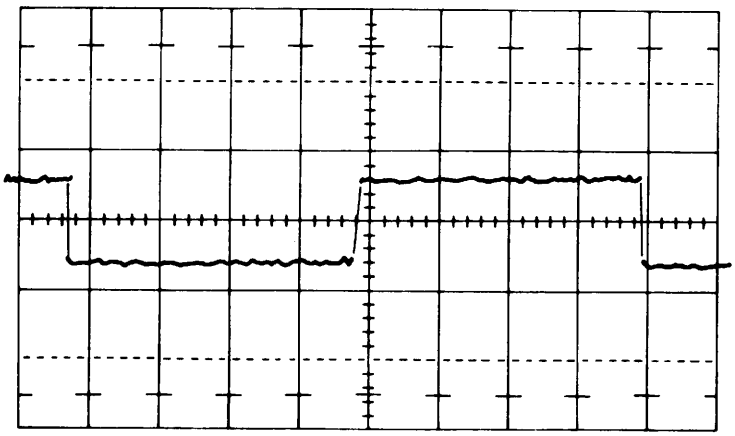
LOGIC GND TO SCOPE GND

VOLTS / DIV
CH 1 - 0.1V/CM
CH 2 - 0.1V/CM

TIME / DIV
A - 2MS/CM
B - 0.05 S/CM

TRIGGERING
A - +EXT, A06-TPC (+INDEX)
B - -INT

PROBE CONNECTIONS (10x PROBES)
CH 1 TO A14-03B (+RD DATA)
CH 2 TO A14-04B (-RD DATA)



9E9

NOTE: SET DISPLAY MODE TO ADD AND INVERT ONE CHANNEL.
ALSO SET HORIZONTAL DISPLAY TO B (DELAYED SWEEP)

Figure 2-39. Data Latch Output Waveform

OSCILLOSCOPE SETTINGS

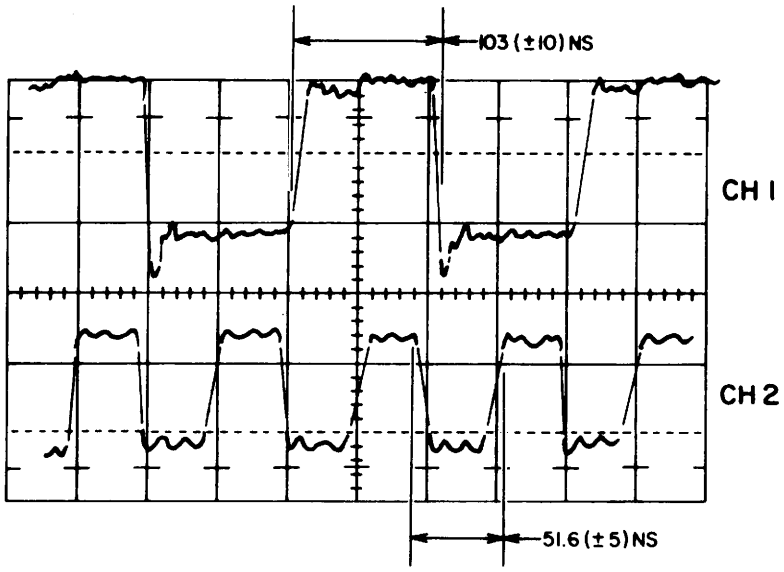
LOGIC GND TO SCOPE GND

VOLTS / DIV
CH 1 - 0.2V/CM
CH 2 - 0.2V/CM

TIME / DIV
A - 2MS/CM
B - 0.05 μS/CM

TRIGGERING
A - -EXT, A15-12B (-READ GATE)
B - -INT

PROBE CONNECTIONS (X10 PROBES)
CH 1 TO A15-27B
CH 2 TO A15-26B



9E10

NOTE: SET DISPLAY MODE TO ALT AND TRIGGER MODE TO CH 1 ONLY.
ALSO SET HORIZONTAL DISPLAY TO B (DELAYED SWEEP)

Figure 2-40. Read Data to Read Clock Timing

6. Command drive to read, select each head in turn and measure amplitude of read signal for each head. This amplitude should be a maximum of 1100 mV peak to peak.

7. Prepare drive for return to online operation.

MISCELLANEOUS LOGIC CHECKS

INDEX TIMING CHECK

This procedure ensures that Index is present and has the proper pulse width. It also checks the time between successive Index pulses which is an indication of disk pack rotational speed.

1. Prepare drive for use with test software or FTU.

2. Connect and setup oscilloscope as follows:

   a. Connect channel 1 to A06-TPC (+ Index).

   b. Trigger internal positive.

   c. Set other controls as appropriate to make measurements required in steps 3 and 4.

3. Observe that Index is a logic one for 2.5 (±.3) μs.

4. Observe that time between Indexes is approximately 16.7 ms.

5. Prepare drive for return to online operation.

SPEED SENSOR OUTPUT CHECK

This procedure checks the output of the speed sensor to ensure that it has the proper polarity and is of sufficient amplitude.

1. Prepare drive for use with test software or FTU.

2. Connect and setup oscilloscope as follows:

   a. Connect channel 1 to A17-17A (speed sensor output).

   b. Trigger positive internal.

   c. Set other controls as necessary to make measurement in step 3.

3. Check oscilloscope waveform for the following:

   a. Scope trace should first go positive and then negative with respect to ground.

      If not, wiring to speed sensor is reversed. Correct wiring to speed sensor and recheck polarity of signal. If waveform is correct, go to step 3b.

   b. Observe amplitude of waveform on oscilloscope. Signal should have positive and negative amplitudes of at least .6 volts. If not, recheck speed sensor gap.

4. Prepare drive for return to online operation.

SECTION 2E

REPAIR AND REPLACEMENT

GENERAL

This section contains information concerning the mechanical replacement and adjustment of the driver field replacement parts. It describes the replacement of all major field replaceable assemblies and those components having critical or complex replacement procedures. It also includes associated mechanical adjustments which are critical to proper operation of the drive and may be performed in the field.

The section is divided into procedures each describing either the replacement or adjustment of a particular assembly or component. These procedures are arranged alphabetically according to the assembly or component associated with the procedure.

It should be noted that all the procedures in this section assume the drive is installed in line with other drives and can be accessed only from front and rear.

If it is not installed in this position, certain procedures may be more easily performed by removing side panels and accessing the drive from the side.

Figure 2-41 locates the assemblies and components having a replacement and/or adjustment procedure. The theory concerning the operation of these parts is given in the hardware reference manual. Additional parts information, including illustrations and part numbers, is included in the Parts Data section of this manual.

The person performing the maintenance should be thoroughly familiar with operation of the drive and with all information in the General Maintenance section of this manual.

ACTUATOR ASSEMBLY REPLACEMENT

The actuator is located on the deck assembly (refer to figure 2-41).

The following describes the entire procedure for replacing the actuator assembly. Figure 2-42 is an exploded view of the deck assemblies involved in actuator replacement.

1. Remove power from drive as follows:

   a. Press START switch to stop drive motor and unload heads.

   b. Set MAIN AC circuit breaker to off.

2. Remove disk pack.

   NOTE

   If drive is installed in line with other driver it may be necessary to move drive out of line to remove the top cover.

3. Remove cabinet top cover.

4. Remove deck cover.

5. Remove pack access cover.

6. Remove shroud and shroud cover.

   CAUTION

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

7. Make note of voice coil leadwire connections and disconnect leadwires.

8. Disconnect velocity transducer cable plug P4.

9. Cut cable ties securing voice coil and heads loaded switch leadwires to side of actuator housing.

10. Remove two screws and washers securing heads loaded switch to actuator housing then remove switch and set it aside leaving leadwires connected.

11. Move servo preamp housing as follows:

    a. Remove two screws securing cover to preamp housing and remove cover.

    b. Disconnect servo head cable plug from servo preamp board.

    c. Remove two screws securing servo preamp housing to deck.

    d. Move housing to one side leaving leadwires connected.

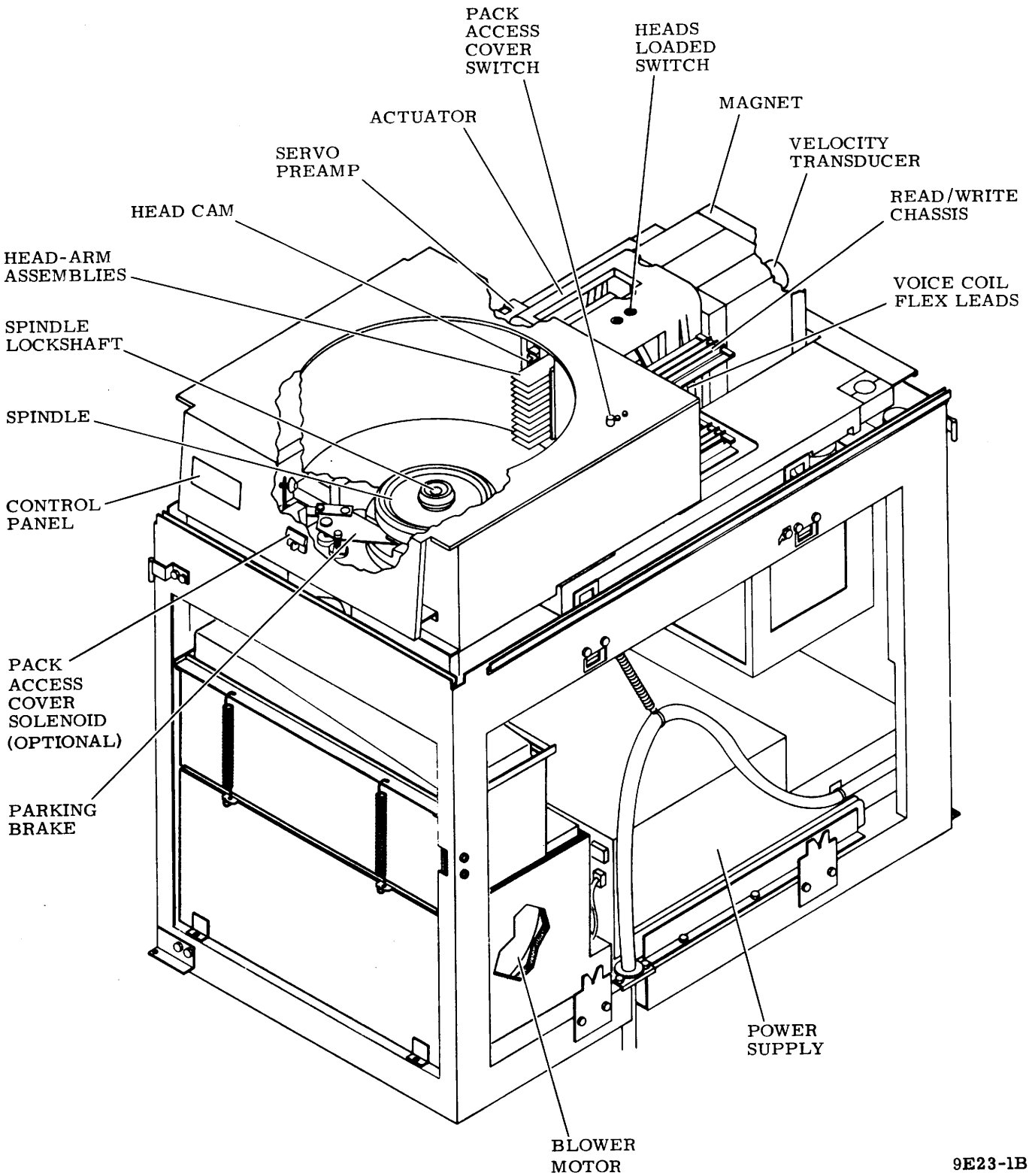
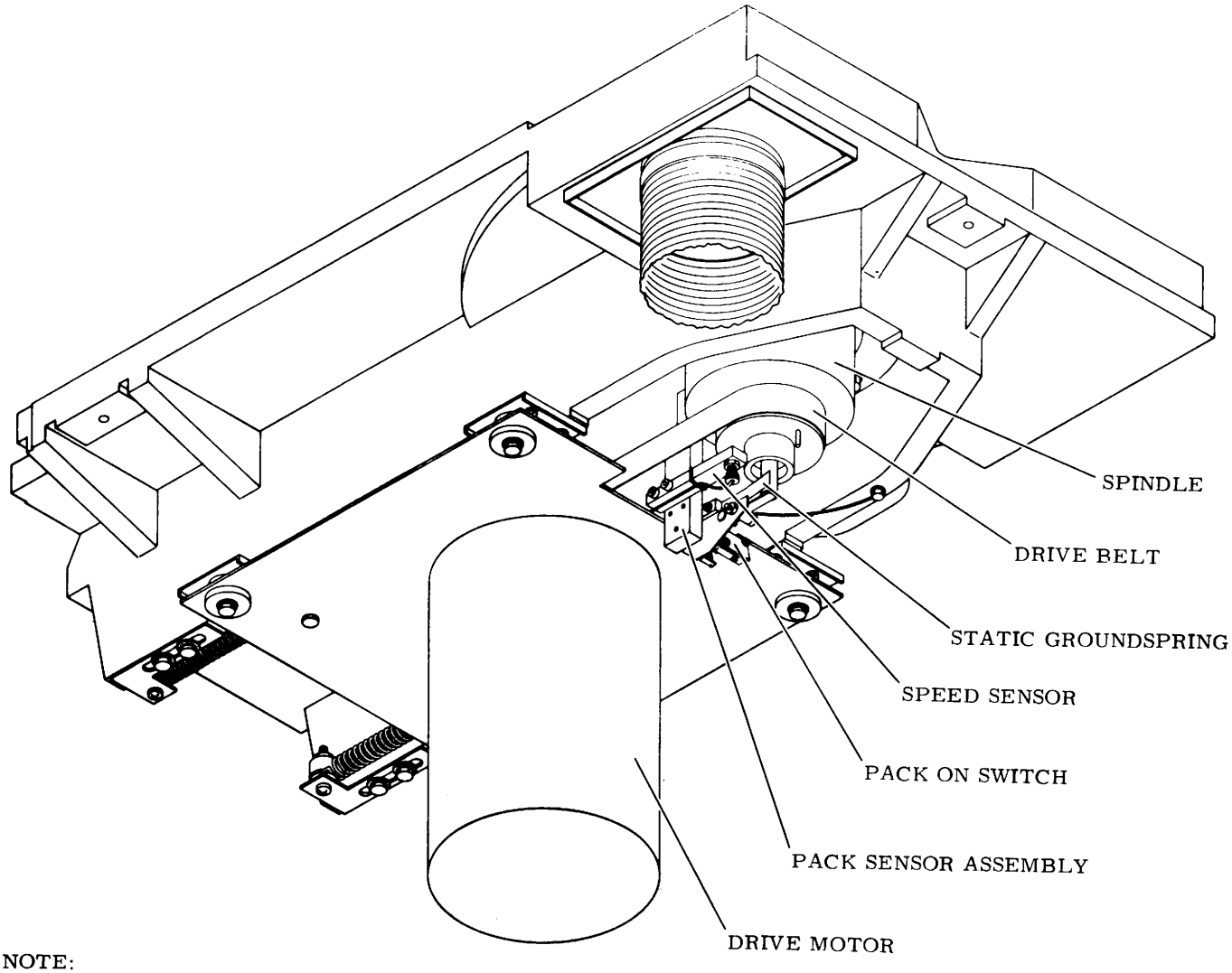


Figure 2-41. Assembly Locator (Sheet 1 of 2)



NOTE:

1. ILLUSTRATION SHOWS UNDERSIDE OF DECK VIEWED FROM LOWER LEFT. IRREVALENT PARTS ARE NOT SHOWN.

9E23-2A

Figure 2-41. Assembly Locator (Sheet 2 of 2)

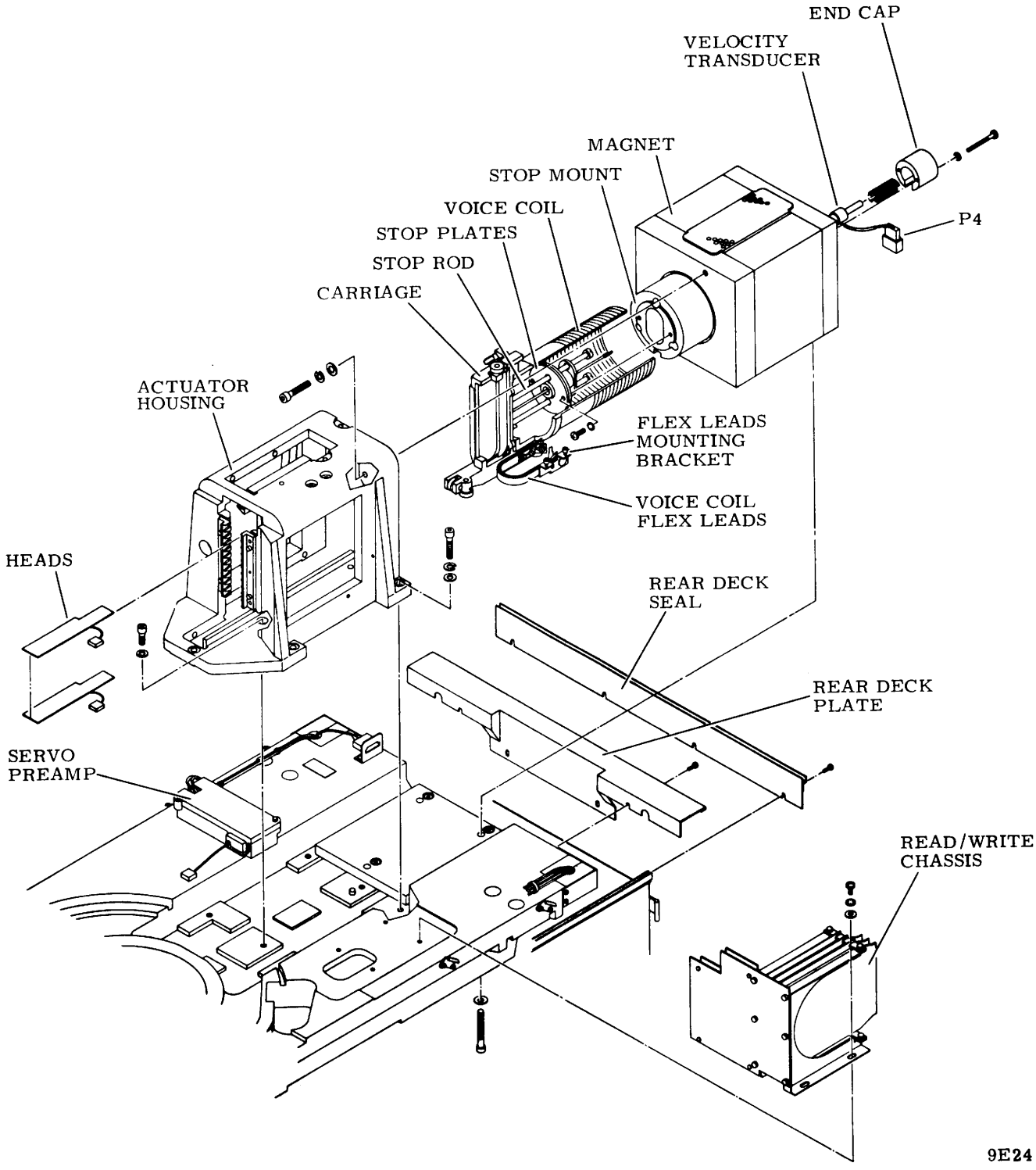


Figure 2-42. Actuator Replacement

CAUTION

Remove only one head-arm assembly at a time. As each head-arm assembly is moved, observe order in which it is removed and lay out in order of removal. Lay each head (face up) on a clean surface. Each head-arm assembly must be installed in the same slot it was removed from.

12. Remove head-arm assemblies starting with head 00. Refer to Head-Arm Assembly Replacement procedure step 8.

13. Remove read/write logic chassis as follows:

    a. Remove connectors from cards.

    b. Remove four screws and washers securing read/write logic chassis to deck and remove chassis.

14. Refer to Velocity Transducer Replacement procedure step 5, and remove velocity transducer from magnet assembly.

15. Remove magnet assembly as follows (refer to figure 2-42):

    a. Loosen four screws securing rear deck seal to frame and remove rear deak seal.

    b. Loosen four screws securing deck rear plate to deck and remove rear deck plate.

    c. Remove plastic magnet cover by prying cover from magnet assembly.

CAUTION

The screw removed in next step goes through the actuator housing and threads into the magnet assembly. The magnet will have a strong pull on the wrench used to remove this screw so use care not to damage actuator components.

    d. Remove screw securing actuator housing to magnet assembly. This screw is located at top inside surface of actuator housing next to magnet.

    e. Move carriage as far forward as possible.

    f. Remove two screws securing stop rod plate to stop mount on magnet.

    g. Remove three screws and washers (under deck) securing magnet assembly to deck.

CAUTION

When removing magnet assembly use card not to damage voice coil. Also use care to place magnet away from metal filings or other metallic objects.

    h. Remove magnet from deck by sliding straight back from voice coil.

16. Remove carriage and voice coil from actuator housing as follows (refer to figure 2-42):

    a. Remove nut and screw securing flex lead mounting bracket and voice coil flex leads to actuator housing.

    b. Back carriage out of actuator housing using care not to damage voice coil flex leads.

17. Remove seven screws and washers securing actuator housing to deck then lift actuator housing straight up off pin and deck.

NOTE

The defective actuator assembly has now been completely removed. The following steps describe installation of the replacement actuator assembly.

18. Prepare replacement actuator for installation as follows:

    a. Remove nut and screw securing voice coil flex lead adjustment bracket to actuator housing. This frees the flex leads and bracket from the housing.

    b. Back carriage out of actuator housing, using care not to damage voice coil flex leads.

    c. Check to see that there are no burrs or foreign particles on mounting surfaces of deck or actuator housing. If necessary clean these surfaces.

NOTE

When installing actuator housing leave screws loose enough to perform carriage to spindle alignment.

19. Install actuator housing on deck using seven screws and washers.

20. Slide carriage into actuator housing taking care not to damage voice coil flex leads.

21. Align carriage to spindle as follows:

    a. Install and position carriage alignment arm as instructed in step 5 (a, b and c) of Carriage to Spindle Alignment procedure.

    b. Check to see that clearance between carriage alignment arm and spindle post is between .002 and .004 inches (refer to figure 2-69).

    c. If requirements of step c are not met, gently tap actuator on one side or the other to move it in the proper direction.

NOTE

Do not disturb actuator position when removing carriage alignment arm and carriage.

    d. Remove carriage alignment arm from carriage.

    e. Remove carraige from actuator housing.

NOTE

Start with center screws when securing actuator housing to deck and use care not to disturb actuator position.

    f. Torque seven screws securing actuator housing to deck to 60(±5) inch-pounds.

    g. Slide carriage into actuator housing.

    h. Check to ensure alignment was not disturbed during torquing of actuator housing screws, by repeating steps a and b. If requirements of step b are not met proceed to step i, otherwise proceed to step m.

    i. Remove carriage alignment arm.

    j. Back carriage out of actuator housing.

    k. Loosen seven screws securing actuator housing, sufficiently to permit carriage to spindle alignment.

    l. Realign as instructed in steps a through h.

    m. Remove carriage alignment arm.

22. Apply Loctite, Grade C to threads of screw and attach voice coil flex lead mounting bracket to actuator housing.

23. Move carriage and check to see that voice coil flex leads do not bind and ride approximately parallel to deck. If necessary adjust flex lead mounting bracket until this is the case.

CAUTION

While performing next step use care not to damage voice coil windings.

24. Install magnet assembly as follows:

    a. Move carriage forward as far as possible without unloading bearings from rails.

    b. Carefully slide magnet into position and loosely secure it to deck using three screws and washers.

CAUTION

While performing following step use caution not to damage voice coil.

25. Align magnet and voice coil as follows:

    a. Loosely install screw and washer through top of actuator into magnet assembly.

    b. Slowly move voice coil in and out of magnet assembly while moving magnet assembly as necessary to ensure voice coil is not making contact with it.

    c. While moving coil in and out of magnet insert a .005 inch non metallic feeler gage between coil and magnet to ensure a 0.005 inch gap exists all around coil.

    d. Torque screw through top of actuator, to 60(±2) inch-pounds.

    e. Recheck gap (step c) and if required, loosen screw, and repeat step b through d until proper gap is obtained.

    f. Torque three screws securing magnet to deck to 30(±1) inch-pounds.

    g. Recheck gap (step c) and if required, loosen all magnet screws and repeat steps b through f until proper gap is obtained.

26. Secure stop rod plates to magnet assembly with two screws and washers. Ensure that stop rods do not rub on stop plates during carriage movement.

27. Replace plastic magnet shield.

28. Replace velocity transducer assembly (refer to figure 2-70) as follows:

a. Insert coil housing, containing transducer core and extension rod, into rear of magnet.

b. Position end cap and spring on magnet, then secure with two screws and washers.

c. Apply one drop of Loctite, Grade C to extension rod threads, then thread extension rod into carriage and tighten.

d. Connect velocity transducer cable plug P4.

29. Replace heads loaded switch on actuator housing, using two screws and washers.

30. Perform Heads Loaded Switch Adjustment procedure steps 6 through 15.

31. Position read/write chassis on deck and secure using four screws and washers.

32. Replace cable connectors on read/write chassis cards.

NOTE

Inspect heads before installing them and clean if necessary (refer to head inspection and cleaning procedure).

33. Replace head-arm assemblies (starting at bottom) as follows:

CAUTION

Ensure that head cable and plug do not contact head pad on adjacent heads or these heads may be damaged.

a. Install head-arm, plug and cable carefully between existing heads until head-arm is in proper position.

b. Install head-arm clamp screw and torque to 4 inch-pounds.

c. If installing read/write head-arm, connect head cable plug to XGN card in read/write chassis location E05. If installing servo head, connect servo cable jumper plug to connector card on actuator housing.

d. Repeat steps a through c for all heads to be installed.

34. Replace voice coil leadwire.

35. Secure heads loaded switch and voice coil lead wires to side of actuator housing with cable ties.

36. Replace servo preamp assembly as follows:

a. Position servo preamp housing on deck and secure using two screws.

b. Connect servo head plug to servo preamp board.

c. Secure cover to servo preamp housing using two screws and washers.

37. Position deck rear plate on deck and securely tightening four screws (refer to figure 2-42.

38. Position rear deck seal on frame and secure by tightening four screws (refer to figure 2-42).

39. Replace shroud and shroud cover.

40. Replace pack access cover.

NOTE

If it had been necessary to move drive from inline position to remove top cover, reinstall drive inline after replacing top cover.

41. Replace cabinet top cover.

CAUTION

Before installing a disk pack, allow blower to operate for at least two minutes. This is necessary to purge shroud area of foreign particles that may have accumulated during actuator replacement.

42. Perform following procedures:

a. Head Alignment

b. Servo System Adjustment

BLOWER MOTOR REPLACEMENT

The blower motor is located within the blower assembly as shown in figure 2-43. Replacing the motor requires removing the entire blower assembly from the drive. The following describes removal and replacement of the blower motor.

1. Remove power from drive as follows:

a. Press START switch to stop drive motor and unload heads.

b. Set main AC circuit breaker to off.

2. Remove disk pack.

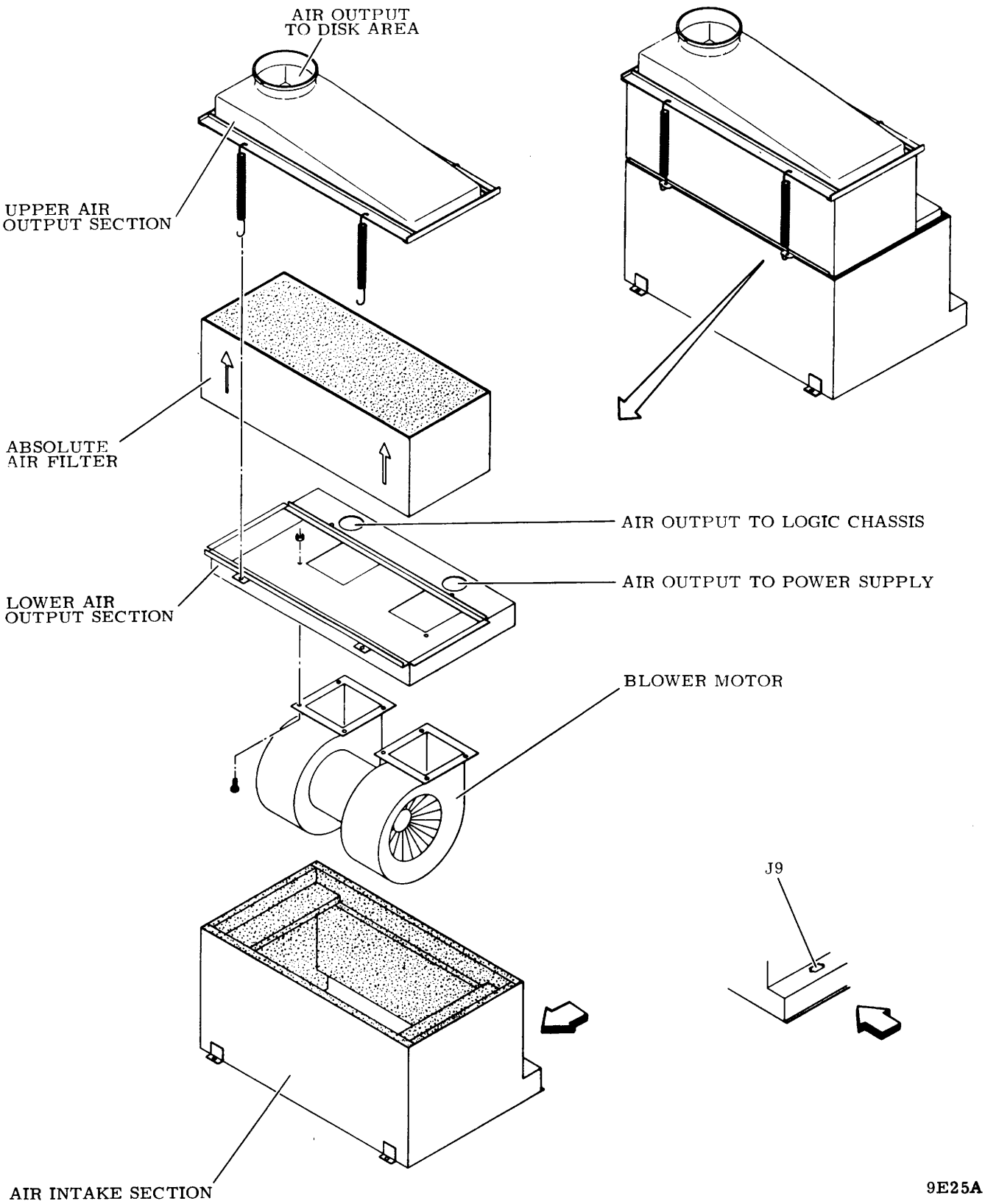


Figure 2-43. Blower Motor Replacement

3. Open cabinet front door.

4. Remove blower assembly (containing blower motor) from drive as follows:

   a. Loosen clamp on large hose located on top of blower enclosure, then slide clamp up on hose and remove hose from blower enclosure.

   b. Remove two screws securing bottom front of blower enclosure to deck.

   c. Slide blower enclosure out of front of drive and set on floor.

CAUTION

Hoses actually unscrew from their position in blower enclosure but use care not to exert too much upward force or hoses will tear.

   d. Remove two smaller hoses from blower enclosure by turning in a clockwise direction until they come free.

   e. Disconnect blower motor cable plug P9 from its connector on blower enclosure.

5. Snap J9 out of its position on air intake section of blower enclosure and allow it to hang from its leadwire.

6. Disconnect ground strap from terminal on air intake section of blower enclosure.

7. Remove four posts securing upper air output section and absolute air filter and set aside.

8. Lift lower air output section, containing blower motor, off the air intake section.

9. Remove six screws and nuts securing blower motor to lower air input section and remove motor.

10. Position replacement blower motor on lower air input section and secure with six screws and nuts.

11. Set lower air output section (with motor mounted) on air intake section.

12. Reconnect ground strap and install J9 in its position on air intake section.

13. Observing arrows indicating air flow, set absolute air filter on lower air output section.

14. Secure upper air output section with four posts.

CAUTION

Following replacement of blower assembly, the blower should be allowed to purge system for at least two minutes before installing a disk pack.

15. Replace blower enclosure in drive as follows:

   a. Connect blower motor cable plug P9 to J9 on rear of air intake section.

   b. Connect small air hoses to rear of lower air output section by screwing them clockwise into holes. (Refer to figure 2-43 for proper orientation.)

CAUTION

Ensure that air hoses or blower motor cable are not pinched.

   c. Slide blower into drive until flange on rear lower edge of blower enclosure slips into channel on cabinet frame.

   d. Secure front of blower enclosure to cabinet using two screws.

   e. Slip large air hose over output hole on top of blower enclosure and secure with clamp.

16. Close cabinet front door.

DRIVE BELT REPLACEMENT

The drive belt (refer to figure 2-41) transfers drive motor power to the spindle. It is removed by first removing the two idler springs, which keep tension on the belt, then slipping it off the pulleys. When the belt is replaced the drive belt tension may need adjustment; however, this adjustment is covered in the Drive Belt Adjustment procedure. The following describes removal and replacement of the drive belt.

CAUTION

A drive belt should only be removed by first removing the two tension springs as directed in the replacement procedure. Never remove a drive belt by rolling the belt off the pulleys or damage to the drive motor shaft or belt will result.

1. Remove power to drive as follows:

   a. Press START switch to stop drive motor and unload heads.

b. Set MAIN AC circuit breaker to off.

2. Remove disk pack.

3. Open cabinet rear door and swing logic chassis open.

4. Remove blower enclosure from drive cabinet (refer to Blower Motor Replacement procedure steps 3 and 4).

5. Remove static groundspring leadwire from static ground spring.

6. Disconnect speed sensor cable plug A3P3.

7. Note lead wire connections and disconnect pack on leadwires at pack on switch.

CAUTION

Use care not to damage the pack sensor assembly when removing drive belt.

8. Remove drive belt as follows (refer to figure 2-44):

   a. Remove two idler springs.

   b. Push drive motor toward spindle assembly to relieve tension on drive belt then slip belt off pulleys and set aside.

NOTE

Smooth surface of belt goes against pulleys.

9. Install replacement belt as follows:

   a. Position belt around drive motor pulley.

   b. Push drive motor toward spindle and slip belt around spindle pulley.

   c. Install idler springs.

   d. Move drive motor and mounting plate back and forth several times to ensure the mounting plate is properly seated.

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

10. Connect speed sensor plug A3P3 and static ground spring leadwire.

11. Connect pack on switch leadwires to switch terminals.

12. Replace blower assembly (refer to Blower Motor Replacement procedure step 15).

13. Close cabinet front door.

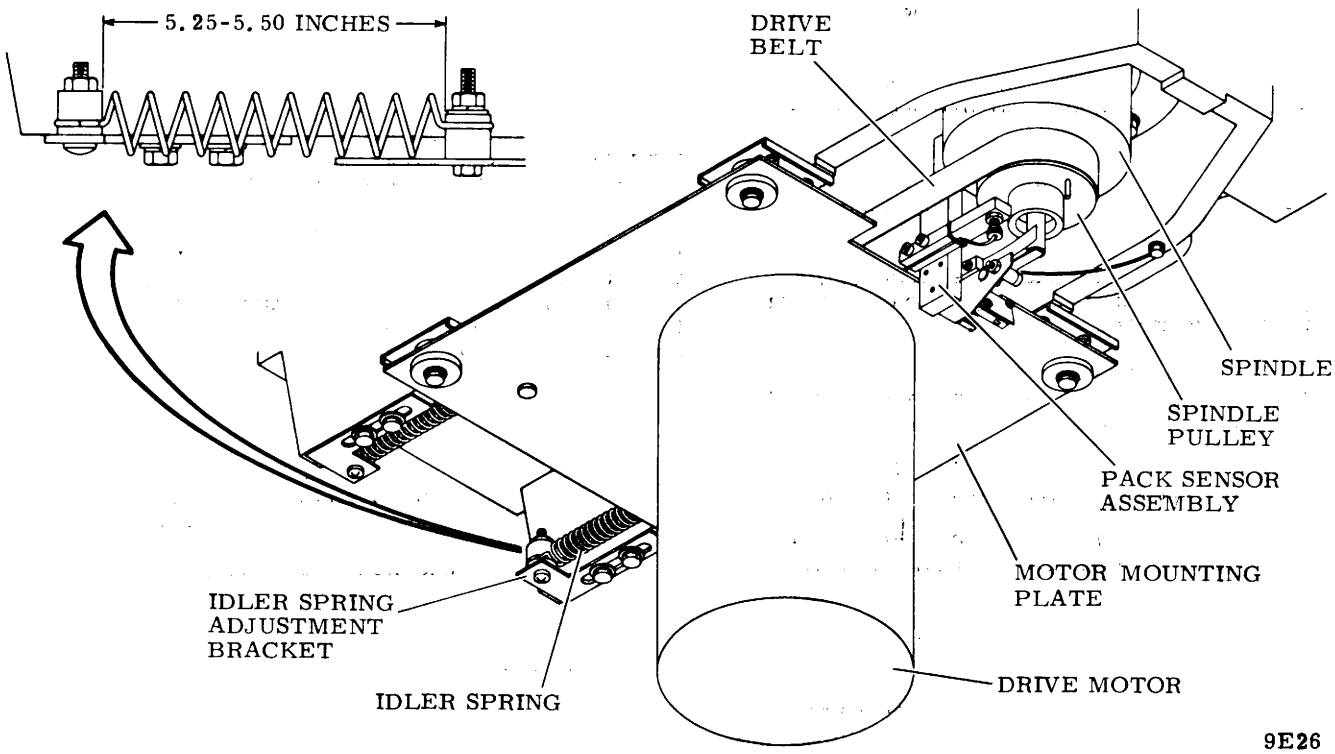


Figure 2-44. Drive Belt Replacement/Adjustment

14. Perform Drive Belt Adjustment procedure starting with step 4.

DRIVE BELT ADJUSTMENT

The drive belt adjustment consists of changing the belt tension which is maintained by the two idler springs. These springs are mounted between posts mounted on adjustable brackets on the deck casting and fixed posts mounted on the motor mounting plate (refer to figure 2-44). The drive motor mounting plate is moved by the springs to exert tension on the belt. The springs are adjusted by removing them from the brackets, repositioning the adjustable brackets and then replacing the springs.

1. Remove power to drive as follows:

   a. Press START switch to stop drive motor and unload heads.

   b. Set MAIN AC circuit breaker to off.

2. Remove disk pack.

3. Open rear door of cabinet and swing logic chassis open.

4. Inspect drive belt for cracks or worn spots. If required, replace belt by performing Drive Belt Replacement procedure starting with step 4.

5. Check drive belt adjustment by measuring distance between idler spring posts (refer to figure 2-44).

   This distance should be from 5.25 to 5.50 inches. If distance is not within these limits, adjustment is required, so go to step 6. If distance is within these limits, no adjustment is required, go to step 7.

6. Adjust idler spring tension (and therefore drive belt tension) as follows:

   a. Remove idler spring from idler spring post connected to adjustment bracket.

   b. Loosen two screws securing adjustment bracket and reposition bracket to bring distance checked in step 6 within specified limits.

   c. Tighten screws securing adjustment bracket.

   d. Replace idler spring on idler spring posts.

   NOTE

   Tension between idler springs is interacting; therefore, when adjusting one spring always recheck both springs.

   e. Recheck spring distance requirements by repeating procedure starting with step 5.

7. Close logic chassis and rear door of cabinet.

DRIVE MOTOR REPLACEMENT

The replacement motor assembly includes the motor, pulley, and cable with attached plug. Replacing the drive motor assembly involves removing the motor mounting plate with motor attached. The old motor is then removed from the mounting plate and the replacement motor mounted in its place. This assembly is then replaced in the drive cabinet.

1. Remove power from the drive as follows:

   a. Press START switch to stop drive motor and unload heads.

   b. Set MAIN AC circuit breaker to off.

   NOTE

   If drive is installed in line with other drives, it must be taken out of line to remove side panels.

2. Remove cabinet side panels.

3. Open cabinet rear door and swing logic chassis open.

CAUTION

Use care not to damage pack sensor assembly when removing drive belt.

4. Remove drive belt by performing Drive Belt Replacement procedure, steps 5 through 8.

5. Remove drive motor and motor mounting plate as follows: (refer to figure 2-45)

   a. Disconnect drive motor cable plug AIP7 from rear of power supply.

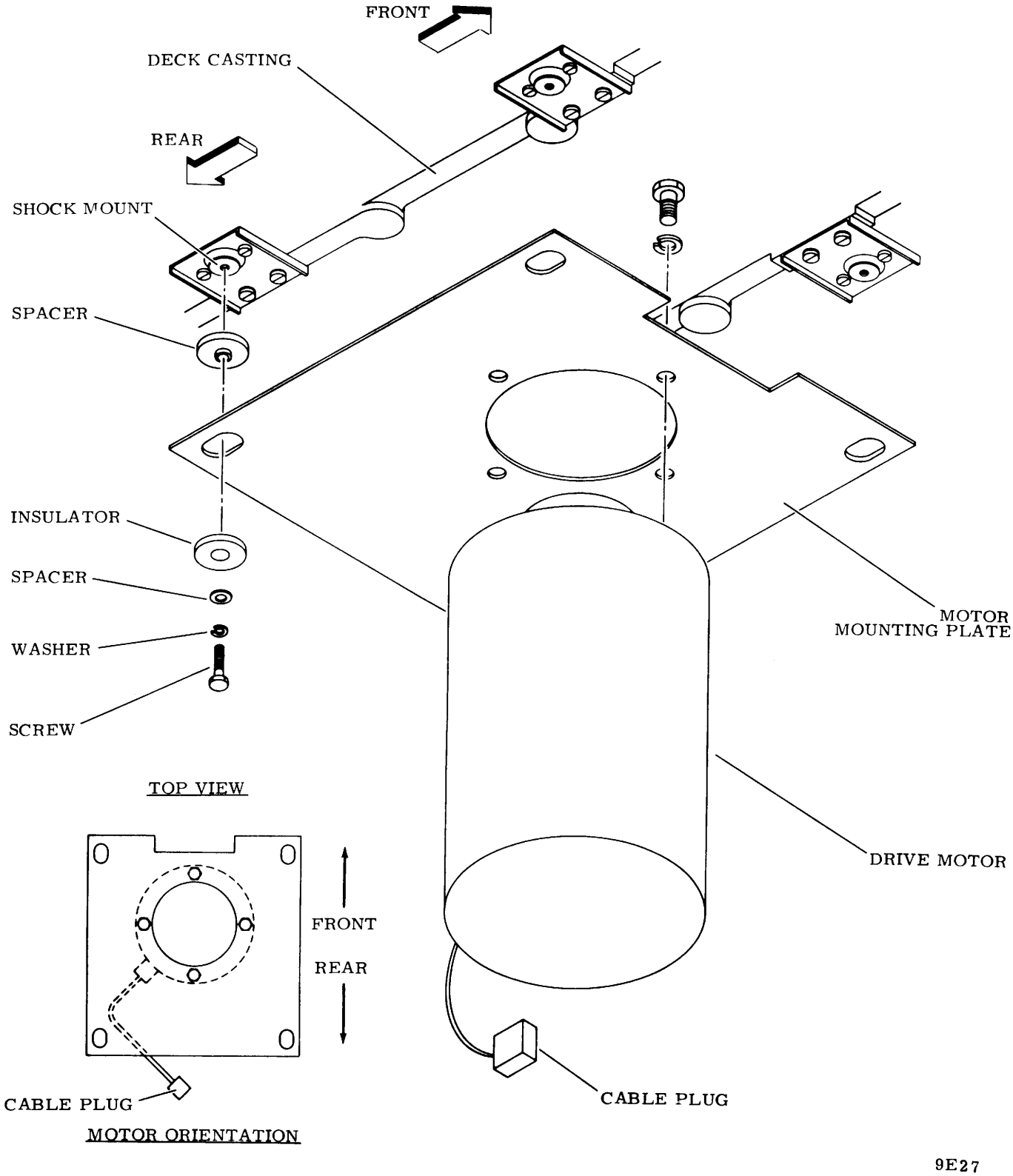


Figure 2-45. Drive Motor Replacement

CAUTION

Drive motor is heavy and difficult to handle. Therefore, it is advisable to have some sort of support beneath drive motor when the securing hardware is removed to prevent it from being dropped to the floor of the drive cabinet.

b. Remove hardware securing motor mounting plate to deck casting and remove drive motor and motor mounting plate from drive cabinet.

6. Remove four screws securing drive motor to motor mounting plate, remove drive motor and pulley from plate and set aside.

7. Replace drive motor and motor mounting plate as follows:

   a. Orient replacement drive motor and pulley on mounting plate as shown on figure 2-45 and secure it with four screws.

CAUTION

Drive motor and mounting plate require support from beneath (such as block of wood on floor of cabinet) to prevent them from being dropped during installation.

NOTE

Apply one drop of Loctite, Grade C, to threads of each screw installed in step b. Also, do not overtighten screws or motor mounting plate will not be free to move between spacers.

   b. Position motor mounting plate and drive motor as shown on figure 2-45 and secure with hardware remove in step 5.

   c. Check that motor mounting plate is free to move forward and backwards between motor mount spacers. If not, loosen four screws and retighten so that mounting plate is free to move.

8. Replace drive belt as follows:

   a. Push drive motor toward spindle and slip drive belt around drive motor pulley.

   b. Install idler springs.

   c. Move drive motor and mounting plate back and forth several times to ensure the mounting plate is properly seated.

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

   e. Connect speed sensor plug A3P3 and static ground spring leadwire.

   f. Connect pack on switch leadwires to switch terminals.

9. Connect drive motor cable plug A1P7 to J7 on rear of power supply.

10. Close logic chassis then close cabinet rear door.

NOTE

If drive was moved from in line position prior to removing side panels, reinstall drive in line after replacing side panels.

11. Replace side panels.

HEAD ARM ASSEMBLIES

GENERAL

The drive has a positive pressure filtration system that eliminates the need for periodic inspection and cleaning of heads. The heads should be inspected for the following reasons only:

1. A problem is traced to a specific head or heads; for example, excessive data errors.
2. Head to disk contact is suspected. This may be indicated by an audible ping, scratching noise, or a burning odor when the heads are over the disk area.
3. Concentric scratches are observed on the disk surfaces.
4. Contamination of pack is suspected (possibly due to improper storage of the pack).
5. The pack has been physically damaged (possibly due to dropping or bumping).

CAUTION

Do not attempt to operate the media on another drive until full assurance is made that no damage or contamination has occurred to the media.

Do not attempt to operate the drive with another media until full assurance is made that no damage or contamination has occurred to the drive heads or to the shroud area.

HEAD INSPECTION

CAUTION

Do not smoke when inspecting or cleaning heads. Use extreme care not to damage the head.

Do not touch the head pad or gimbal spring with fingers or tools.

If head must be laid down, do not allow the head pad or gimbal spring to touch anything.

Remove suspected head as described in the read write or servo head arm replacement procedure. Refer to figure 3- , observe the head arm assembly, and perform the suggested remedy as follows:

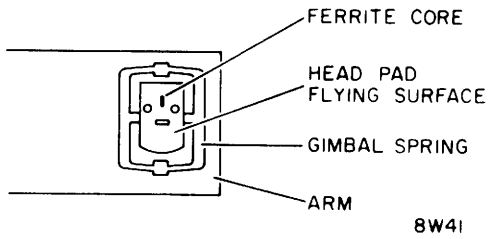


Figure 3-46. Typical Head Arm Components

1. If reddish-brown oxide deposits exist on the head, replace or clean the head arm assembly.
2. If head appears scratched, replace or clean the head arm assembly.
3. If head appears damaged, replace the head arm assembly.
4. If the gimbal spring (it holds the head pad to the arm) is bent or damaged, replace the head arm assembly.

HEAD CLEANING

CAUTION

Head cleaning is a delicate procedure which is not recommended. It should not be undertaken unless it is absolutely necessary and then it should be performed by properly trained personnel only.

Refer to figure 3- if head cleaning is required and perform the following procedure. Use care not to damage any part of the head arm assembly.

CAUTION

In the following step, hold the can of dust remover upright (vertical). If the can is not held upright, liquid propellant will be sprayed on the head.

1. Use super dry dust remover (see list of Maintenance Tools and Materials) to blow off all loose particles from the head pad (flying surface), from the edge of the head pad, and from the holes in the head pad. Hold the nossle one-fourth to one-half inch (6 to 12 mm) from the head pad. Spray with a back and forth motion across the head pad, making certain to hold the can only in a vertical position.

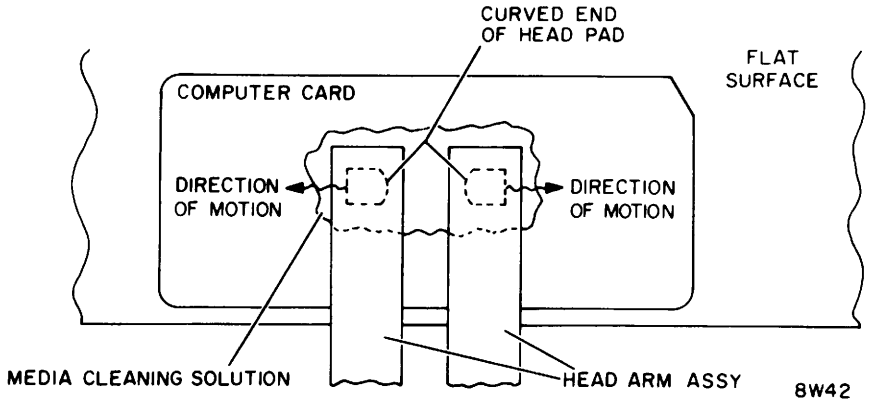


Figure 3-47. Head Cleaning Motion

2. Clean a smooth, flat working surface, for example, a glass or formica table top.

3. Place a new, unpunched, clean computer card with the back side up (printing down) on the clean flat working surface as shown in figure 3- .

CAUTION

Care should be taken to avoid excess cleaning solution. Excess solution on the head cable may remove the plasticizer and make the cable stiff. A stiff cable reduces the flexibility of the head pad and could cause broken wires.

4. Moisten a small area in the center of the card with media cleaning solution. (Refer to the list of Maintenance Tools and Materials.)

CAUTION

Inspect the media cleaning solution for contamination, rust, dirt, etc. Do not use contaminated solution.

5. Very carefully place the head pad flying surface on moistened area and move head pad from moistened area to dry area in a zig-zag motion as shown in figure 3- . Move head in a direction away from curved end of head pad. If it is moved in the opposite direction the sharp edge of the curved end will cut into the computer card and prevent movement and proper cleaning.

6. Blow off the head again using the Super Dry Dust Remover as for step 1.

NOTE

Discoloration of media cleaning solution and computer card indicate that oxide particles are being removed from head pad flying surface.

7. Repeat steps 3, 4, 5, and 6, using a clean computer card and clean media cleaning solution each time until no discoloration on card is present.

8. After discoloration has ceased, inspect head to determine that oxide deposits were removed. If deposits remain but show signs of being removed, repeat cleaning procedure until deposits are removed.

9. If oxide deposits cannot be removed, replace head arm assembly.

10. If oxide deposits were removed and head passes inspection according to the Head Arm Replacement Criteria, reinstall head.

11. 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 assembly requires replacement if any of the following conditions exist:

1. Consistent oxide buildup on the same head, indicating repeated head to disk contact.

2. Appreciable oxide buildup which cannot be removed.

3. Scratches on the head flying surface.

4. Imbedded particles in the head pad flying surface.

5. Bent or damaged gimbal spring.

6. Any apparent physical damage to head arm assembly.

HEAD-ARM ASSEMBLY REPLACEMENT

The following describes replacement of read/write and/or the servo head-arm assemblies. Head alignment must be performed on any head-arm assembly replaced. Replacing the servo head-arm assembly requires alignment of all heads. Head alignment is covered in a separate procedure.

1. Remove power from drive as follows:

   a. Press START switch to stop drive motor and unload heads.

   b. Set MAIN AC circuit breaker to off.

2. Open pack access cover, remove disk pack then close pack access cover.

3. Open cabinet top cover and remove deck cover.

4. Open pack access cover as far as possible.

   NOTE

   Perform step 5 if any of the following apply:

   - If removing all heads
   - If removing any of the heads in surface positions 15 through 19.
   - If removing the servo head. In this case perform only a and b under step 5.

   If none of these apply, proceed to step 6.

5. Move servo preamp housing as follows:

   a. Remove two screws securing cover to housing and remove cover.

   b. Disconnect servo head cable plug from servo preamp board.

   c. Remove two screws securing preamp housing to deck, then move preamp housing as required to provide access to head clamp screws for head surface positions 15 through 19.

6. Determine surface location of head (or heads to be replaced by referring to head identification label on actuator housing or to figure 2-48.

7. Lock carriage in place by inserting carriage locking pin into shipping hole.

8. Remove heads as follows:

   NOTE

   If more than one head is to be removed, disconnect head cables one at a time as the heads are removed.

   a. If removing read/write head, remove head clamp assembly (refer to figure 2-60). Disconnect head cable plug from -XGN card in read/write chassis location E05.

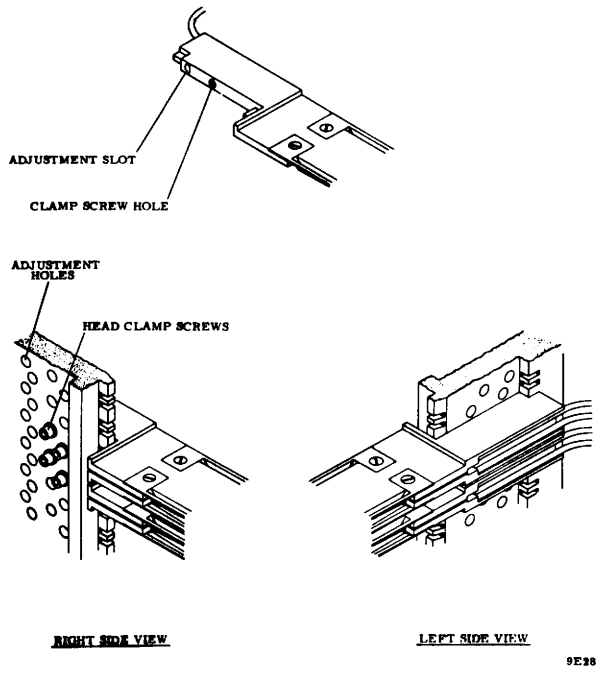


Figure 2-48. Head-Arm Assembly Replacement

If removing servo head, disconnect servo cable jumper plug from connector card on actuator housing.

CAUTION

When head-arm clamping screw is removed, use care not to dislodge head from its position in carriage. This may allow head to contact an adjacent head thus causing damage to itself or that head. Also, if more than one head is to be removed, remove clamping screws one at a time as heads are removed.

b. Remove clamping screw securing head-arm to be removed.

c. Slide head-arm assembly forward from its position in carriage until it can be grasped from front, then carefully remove head arm, cable and plug from carriage assembly.

d. Repeat steps a through c for all heads to be removed.

NOTE

Inspect heads before installing them and clean if necessary (refer to Head Inspection and Cleaning procedure).

9. Install heads as follows:

CAUTION

Ensure that head plug and cable do not contact head pad on adjacent heads or these heads may be damaged.

a. Slide head-arm, plug and cable carefully between existing heads until head-arm is in proper position.

b. Install head-arm clamp screw and torque to 4 inch-pounds.

c. If installing read/write head, connect head cable plug to -XGN card in read/write chassis location E05. Secure head clamp assembly to -XGN card (refer to figure 2-60). If installing servo head, connect servo cable jumper plug to connector card on actuator housing.

d. Repeat steps a through c for all heads to be installed.

10. Remove carriage locking pin from shipping hole.

NOTE

Step 11 is applicable only if step 5 was performed.

11. Reinstall servo preamp housing as follows:

a. Place it in its proper position on deck, and secure with two screws.

b. Reconnect servo head cable plug to preamp board.

c. Replace servo preamp housing cover using two screws.

NOTE

Do not adjust servo head arm if it was not replaced because all read/write heads must be realigned whenever this adjustment is disturbed.

12. If servo head-arm was replaced, adjust it as follows, otherwise proceed to step 14.

a. Using head-arm adjustment tool, center servo head-arm adjustment slot in the head adjustment hole (refer to figure 2-17).

b. Torque head-arm clamp screw to 12(±1/2) inch-pounds.

13. Check alignment of all heads and adjust as necessary (refer to Head Alignment procedure).

HEAD CAM REPLACEMENT

This procedure describes removal and replacement of the head cams. The top cover, pack access cover, shroud, and shroud cover must be removed to gain access to the heads cams. The cams fit onto pins in the actuator housing and require no adjustment after installation.

1. Remove power from drive as follows:

a. Press START switch to stop drive motor and unload heads.

b. Set MAIN AC circuit breaker to off.

2. Remove disk pack.

NOTE

If drive is installed in line with other drives, it may be necessary to move the drive out of line to remove the top cover.

3. Remove cabinet top cover.

4. Remove pack access cover.

5. Remove shroud and shroud cover.

6. Manually load heads.

7. Remove two screws securing each head cam to actuator housing then remove cams by pulling straight off from pins on actuator housing. (Refer to figure 2-49.)

CAUTION

Before replacing head cams ensure that mating surfaces of actuator housing and cams are clean.

8. Install replacement head cams as follows: (refer to figure 2-49)

   a. Fit replacement head cams over dowel pins on actuator housing so they are flush against housing.

   b. Install screws and torque to 4(±.5) inch-pounds.

9. Manually unload heads.

10. Replace shroud and shroud cover with nine screws and washers.

11. Replace pack access cover.

NOTE

If it had been necessary to move drive from in line position to remove top cover, reinstall drive in line after replacing top cover.

12. Replace cabinet top cover.

HEADS LOADED SWITCH REPLACEMENT

This switch is mounted on the actuator housing (refer to figure 2-50) and indicates to the drive logic whether or not the heads are loaded. The following describes the removal

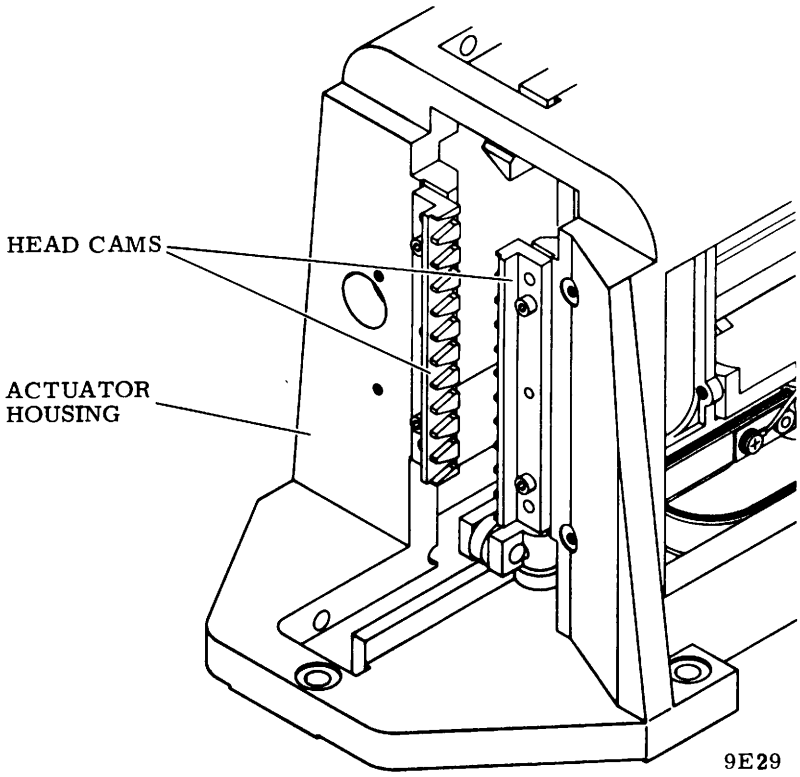


Figure 2-49. Head Cams

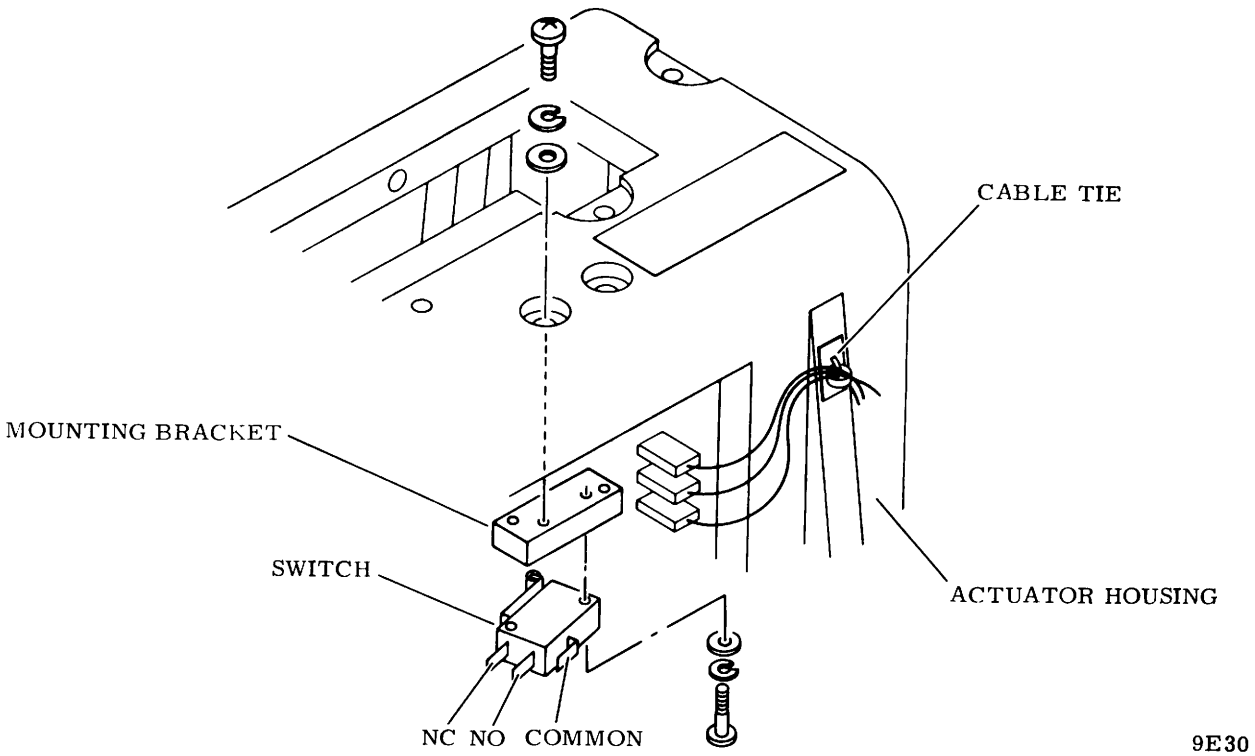


Figure 2-50. Heads Loaded Switch Replacement

and replacement of this switch. This switch also requires adjustment which is explained in the Heads Loaded Switch Adjustment procedure.

1. Remove power to drive as follows:
   a. Press START switch to stop drive motor and unload heads.
   b. Set MAIN AC circuit breaker to off.
2. Remove disk pack.
3. Open cabinet top cover and remove deck cover.
4. Move carriage back to retracted stop.
5. Remove heads loaded switch from actuator housing as follows (refer to figure 2-49):
   a. Cut cable tie securing heads loaded switch leadwires to actuator housing.
   b. Remove two screws and washers securing heads loaded switch mounting block to actuator housing, then remove mounting block and switch from actuator housing.
   c. Note leadwire connections and remove leadwire from switch.
   d. Remove two screws and washers securing switch to block and remove switch.
6. Install replacement switch on mounting block.
7. Install replacement switch and mounting block on actuator housing leaving screws loose enough to perform adjustments in step 8.
8. Secure leadwires to side of actuator housing with cable tie.
9. Perform Heads Loaded Switch Adjustments procedure starting with step 6.

HEADS LOADED SWITCH ADJUSTMENT

The following describes adjusting the heads loaded switch so it actuates when the carriage is forward far enough so that the heads are loaded.

1. Remove power from drive as follows:

a. Press START switch to stop drive motor and unload heads.

b. Set MAIN AC circuit breaker to off.

2. Remove disk pack.

3. Open cabinet top cover and remove deck cover.

4. Move carriage back to retracted stop.

5. Note heads loaded switch leadwire connection and disconnect leadwires.

6. Connect an ohmeter (set to Rx1 scale) across common and normally closed (NC) terminals of the switch (refer to figure 2-50).

7. Check heads loaded switch operation as follows:

   a. With carriage at retracted stop, meter should read zero. If it does not, proceed to step 8. If it does, proceed to b.

   b. Move carriage forward until switch transfers (meter indicates infinity) and measures distance traveled. If distance is between .1 and .2 inches proceed to step 17. If distance is not between these limits, proceed to step 8.

8. Loosen screws securing switch mounting block to actuator housing then move block and switch as far back as possible toward magnet. Meter should now indicate infinity.

9. Disconnect one of meter leads at meter.

NOTE

In next step, a suitable shim is constructed by taping a number of feeler gages together until their combined thickness is from .1 to .18 inches. Check their thickness with a steel rule.

10. Insert .15(.05) inch shim between stop on magnet and shock stop on carriage assembly (refer to figure 2-51).

11. Reconnect meter lead and note that meter still indicates infinity when carriage is moved back against shim.

12. Hold carriage against shim then move heads loaded switch towards spindle until switch transfer occurs (meter indicates zero). Tighten screws securing switch and mounting block to actuator housing taking care not to disturb their position.

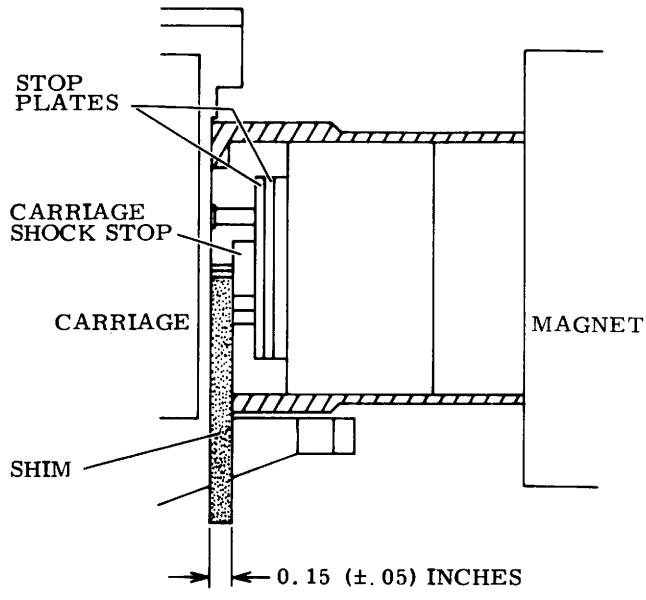


Figure 2-51. Heads Loaded Switch Adjustment

13. Remove shim and move carriage back to retracted stop.

14. Move carriage forward and check with shim or steel rule to ensure switch transfer occurs between .1 and .2 inches of retracted stop

15. If requirements of step 14 are not met, repeat steps 7 through 14 until the adjustment is correct and then proceed to step 16.

16. Disconnect meter from switch terminals and reconnect heads loaded switch leadwires.

17. Replace deck cover and close top cover.

LOGIC CHASSIS BACKPANEL REPAIR

GENERAL

Backpanel repair is limited to replacing damaged wires and bent or broken pins. Both procedures are described in the following.

WIREWRAP PIN REPLACEMENT

This procedure describes removing a damaged pin from the backpanel and replacing it with a new one.

1. Remove power from drive as follows:

   a. Press START switch to stop drive motor and unload heads.

   b. Set MAIN AC circuit breaker to off.

   NOTE

   Use care not to damage wires when removing them from pin. Also note level of wires so they are replaced in the same position as they were removed.

2. Open cabinet rear door and remove cover from logic chassis card cage.

3. Remove all wires from pin (refer to wirewrap replacement procedure step 3.

4. Remove card associated with pin to be replaced.

5. Slide post removal tool over pin and apply pressure toward backpanel until bond breaks between pin and collar (refer to figure 2-52).

6. Grasp shank of pin (with long nose pliers or similar tool) and pull it out of backpanel. If collar comes out with pin, proceed to step 7. If collar remains secure in backpanel, proceed to step 8.

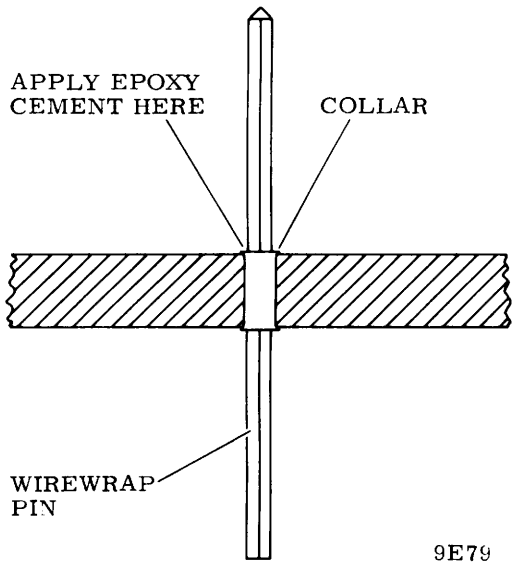


Figure 2-52. Wirewrap Pin Replacement

7. Coat collar of replacement pin (not hole) with epoxy and insert it into backpanel from wirewrap side. Proceed to step 9.

8. Insert replacement pin with collar removed from wirewrap side of backpanel. Push it into collar in backpanel hole until it is same length as adjacent pins.

CAUTION

Any cement on shaft of pin will prevent an electrical connection.

9. Apply fast cure epoxy cement around pin on wirewrap side of backpanel to ensure tightness of pin (refer to figure 2-52).

10. Replace wires removed in step 3 (refer to wirewrap replacement procedure steps 5 through 9.

11. Replace cover on logic chassis card cage and close cabinet rear door.

WIREWRAP REPLACEMENT

This procedure describes removal and replacement of backpanel wirewrap connections.

1. Remove power from drive as follows:

   a. Press START switch to stop drive motor and unload heads.

   b. Set MAIN AC circuit breaker to off.

2. Open cabinet rear door.

NOTE

If pin has two wires and wire to be replaced is closest to backpanel it is necessary to remove the other wire. In this case use care not to damage the other wire.

3. Unwrap each end of wire as follows. Using end of wirewrap tool with notch opposing direction of wrap, slide tool over pin and carefully turn tool to unwrap wire.

4. Cut replacement wire to proper length and strip approximately 1 1/8 inch of insulation from each end of wire.

5. Insert one end of wire into wirewrap tool until insulation rests against stop.

6. Slide tool over backpanel pin, leaving a small gap between bottom of post or lower wrap level and new wire.

7. Hold wire securely (allow small amount of slack to assure one turn of insulation) and twist tool to wrap wire around pin. As tool is twisted, wire wrapping around pin forces tool up and off wire.

8. When wire is completely wrapped, remove tool and proceed to wrap other end of wire to its pin.

9. Ensure that each connection has one turn of insulation and six to seven turns of bare wire around pin.

10. Close cabinet rear door.

OPERATOR CONTROL PANEL REPLACEMENT

The operator control panel is replaced by snapping it out of the shroud cover, removing it from the connector and replacing it with a new control panel assembly.

1. Remove power from drive as follows:

   a. Press START switch to stop drive motor and unload heads.

   b. Set MAIN AC circuit breaker to off.

2. Open pack access cover and remove disk pack.

3. Open cabinet top cover.

4. Remove plastic plug from access hole in shroud cover (refer to figure 2-53).

5. Snap operator control panel out of its position in shroud cover (refer to figure 2-53).

6. Remove control panel cable plug P201 from control assembly card and set assembly aside.

7. Install control panel connector plug P201 on replacement operator control panel then snap replacement control panel into its position in shroud cover.

8. Close pack access cover.

PACK ACCESS COVER SOLENOID REPLACEMENT

This solenoid is mounted on the front of the shroud cover (refer to figure 2-54) and prevents the pack access cover from being opened while the spindle is turning. The following describes replacement, adjustment is covered in the Pack Access Cover Solenoid Adjustment procedure.

1. Remove power from drive as follows:

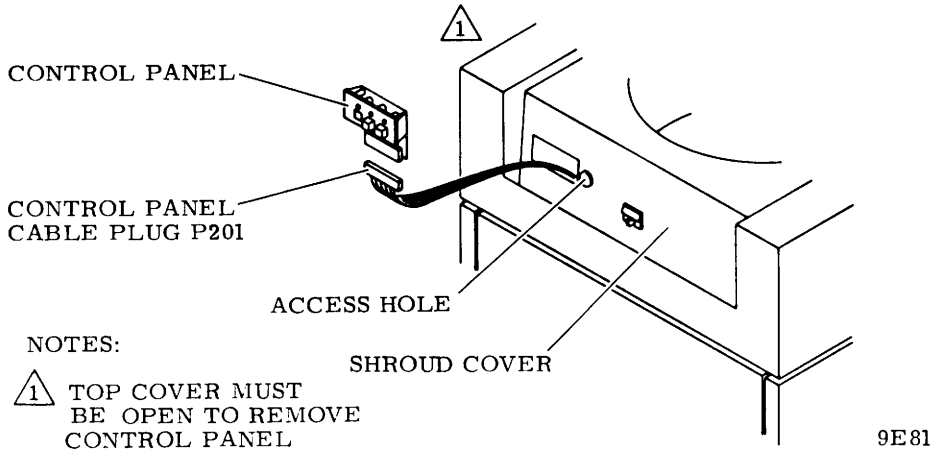


Figure 2-53. Operator Control Panel Replacement

a. Press START switch to stop drive motor and unload heads.

b. Set MAIN AC circuit breaker to off.

2. Remove disk pack.

NOTE

If drive is installed in line with other drives, it will be necessary to pull drive out of line to remove top cover.

3. Remove cabinet top cover.

4. Remove pack access cover.

5. Snap operator control panel out of its position in shroud cover and let it hang by control panel cable wires.

6. Remove 12 screws securing shroud cover to shroud and move shroud cover forward far enough to allow access to pack access cover solenoid assembly.

7. Remove two screws and washers securing solenoid assembly and slip it out from beneatn shroud cover.

8. Note solenoid leadwire connections, disconnect leadwires and set solenoid aside.

9. Install replacement solenoid to shroud cover using two screws and washers.

10. Connect leadwires to solenoid.

11. Move shroud cover back into position and secure using 12 screws.

12. Replace pack access cover.

13. Replace operator control panel in shroud cover.

NOTE

If it was necessary to move drive from in line position to remove top cover, reinstall drive in line after replacing top cover.

14. Replace cabinet top cover.

15. Perform Pack Access Cover Solenoid Adjustment procedure.

PACK ACCESS COVER SOLENOID ADJUSTMENT

This adjustment consists of moving the solenoid assembly (installed on tne shroud cover) up or down until the clearance between it and the cover catch is correct. When this is is accomplished, the solenoid should prevent the cover from opening when the spindle is turning.

1. Remove power from drive as follows:

a. Press START switch to stop drive motor and unload heads.

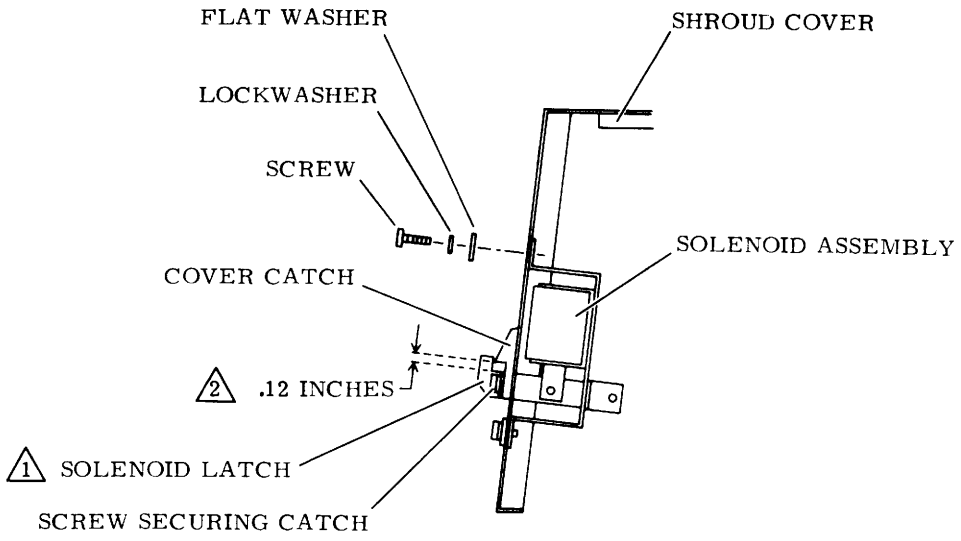
b. Set MAIN AC circuit breaker to off.

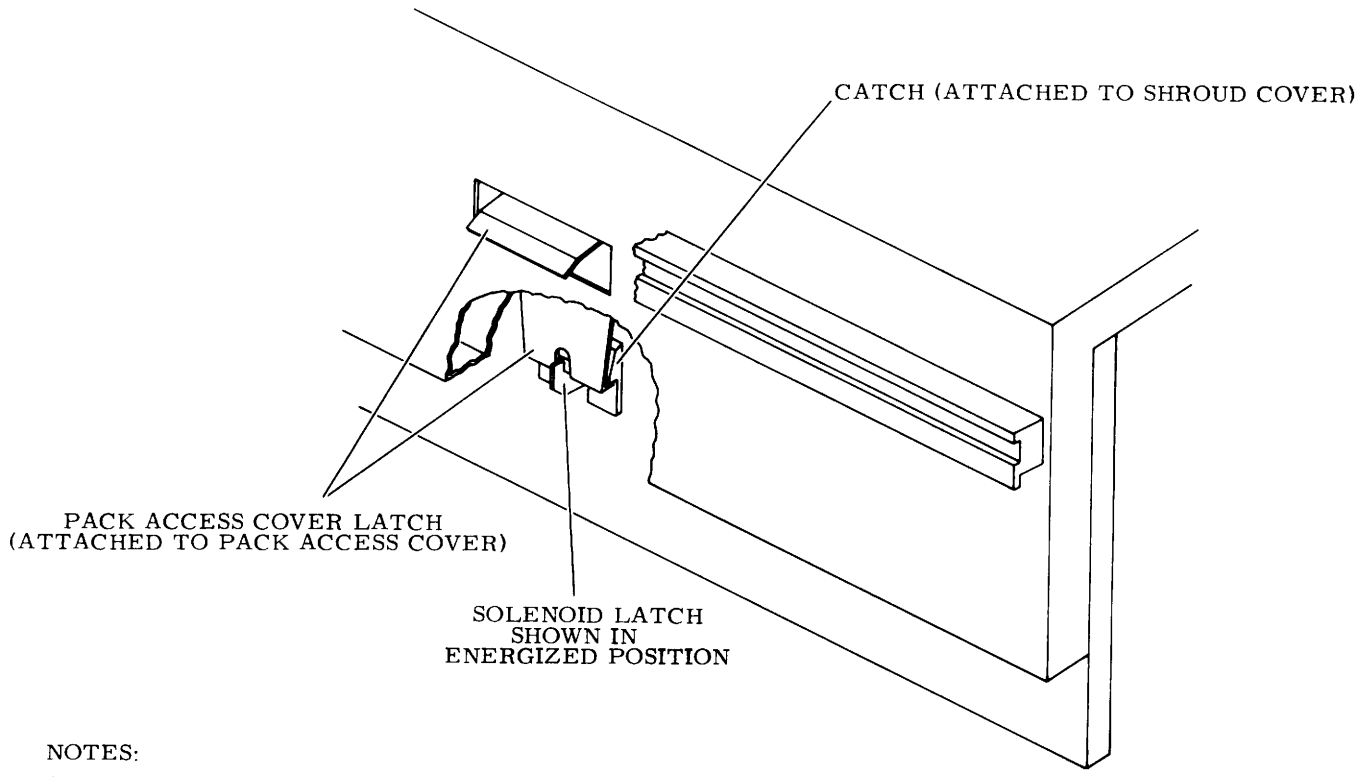
2. Remove disk pack.

3. Raise cabinet top cover.

4. Raise pack access cover as far as possible.

5. Check adjustment by pushing solenoid latch up to simulate energized condition,





NOTES:

1 SHOWN IN ENERGIZED POSITION

2 NOT CRITICAL HOWEVER DISTANCE MUST ENSURE PACK ACCESS COVER WILL BE LOCKED SHUT BY SOLENOID LATCH

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Figure 2-54. Pack Access Cover Solenoid Replacement/Adjustment

then measuring distance between it and catch on shroud cover (refer to figure 2-54).

6. If distance measured in step 5 is as indicated on figure 2-54 proceed to step 7 otherwise adjust as follows:

   a. Loosen screws securing solenoid assembly to shroud cover.

   b. Hold solenoid latch in energized position and adjust solenoid assembly until proper clearance is obtained.

   c. Tighten screws securing solenoid assembly to shroud cover.

7. Perform final check as follows:

   a. Close top cover allowing pack access cover to fully open.

   b. Install scratch disk pack and close pack access cover.

   c. Set MAIN AC circuit breaker to on.

   d. Press START switch to start drive motor and load heads.

   e. Solenoid should energize and prevent pack access cover from being opened. If it operates properly proceed to step 8. However, if cover can be opened repeat steps 1 through 6 and also check catch, latch and solenoid for proper operation.

8. Remove disk pack.

9. Press START switch to stop drive motor and unload heads.

10. Set MAIN AC circuit breaker to off.

11. Close pack access cover.

PACK ACCESS COVER SWITCH REPLACEMENT

This switch prevents the drive motor from starting when the pack access cover is open. It is located under the shroud cover as shown in figure 2-55. The following describes its removal and replacement. This switch requires no adjustments.

1. Remove power from drive as follows:

   a. Press START switch to stop drive motor and unload heads.

   b. Set MAIN AC circuit breaker to off.

2. Remove disk pack.

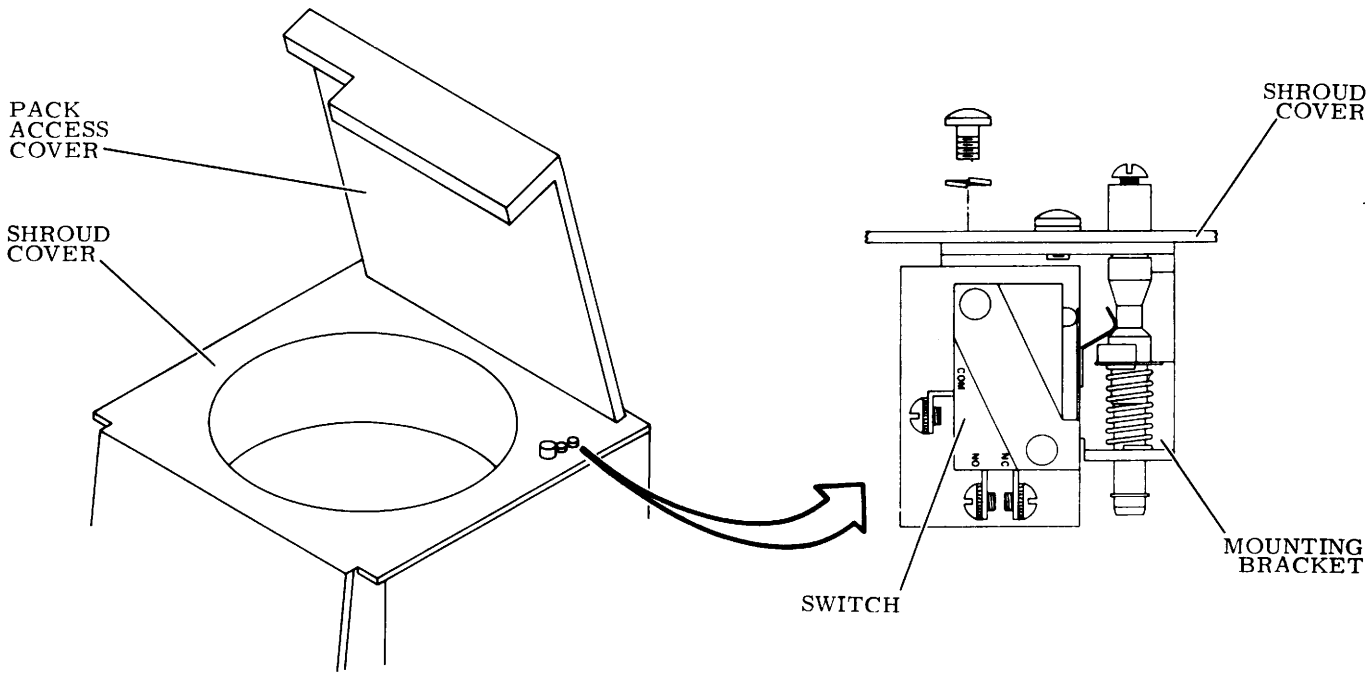


Figure 2-55. Pack Access Cover Switch Replacement

3. Open cabinet top cover and remove deck cover.

4. Open pack access cover as far as possible.

5. Open pack access cover switch assembly as follows (refer to figure 2-55):

   a. Remove two screws and washers securing pack access cover switch assembly to shroud cover and remove switch assembly from beneath shroud cover.

   b. Note leadwire connections and remove leadwires from switch.

   c. Remove two screws and washers securing switch to its mounting bracket, then remove switch from bracket and set aside.

6. Replace pack access cover switch assembly as follows:

   a. Position replacement switch on mounting bracket and secure using two screws and washers.

   b. Connect leadwires to switch terminals.

   c. Position switch under shroud cover and secure with two screws and washers.

7. Close pack access cover.

8. Replace deck cover and close cabinet top cover.

PACK ON SWITCH REPLACEMENT

This switch is located on the pack sensor assembly. The following describes replacement of the pack on switch. The switch must be adjusted following replacement and this is covered in the Pack On Switch Adjustment procedure.

REPLACEMENT (S/C 08 & Below)

1. Remove power from drive as follows:

   a. Press START switch to stop drive motor and unload heads.

   b. Set MAIN AC circuit breakers to off.

2. Remove disk pack.

3. Remove blower assembly (refer to Blower Motor Replacement procedure steps 3 and 4).

4. Note leadwire connections and disconnect leadwires at pack on switch terminals (refer to figure 2-56).

5. Remove small spring located behind pack on switch.

6. Remove two nuts, washers and screws securing switch to mounting bracket then remove switch.

7. Install replacement switch on mounting bracket, then replace small spring.

8. Perform Pack On Switch Adjustment procedure starting with step 4.

REPLACEMENT (S/C 09 & Above)

1. Stop spindle motor.

2. Remove disk pack.

3. Set UNIT POWER circuit breaker to OFF.

4. Refer to Side Panel Removal/Installation procedure and remove right (viewed from front) side panel.

5. Identify pack sensor switch leadwires. Disconnect wires at switch (figure 2-56.1).

6. Remove two screws, washer, and nut securing switch to switch base bracket. Remove faulty switch.

7. Install replacement switch to switch base bracket using two screws, washer, and nut. Do not tighten screws.

8. Perform Pack Sensor Switch Adjustment procedure.

PACK ON SWITCH ADJUSTMENT

This procedure describes adjustment of the pack on switch so it opens and closes at the proper points. The switch should close when a pack is installed and open when the pack is removed.

ADJUSTMENT (S/C 08 & Below)

1. Remove power from drive as follows:

   a. Press START switch to stop drive motor and unload heads.

   b. Set MAIN AC circuit breaker to off.

2. Remove customer disk pack and install a scratch pack.

3. Remove blower assembly (refer to Blower Motor Replacement procedure steps 3 and 4).

4. Note leadwire connection, then remove leadwire from pack on switch.

5. Check that gap between actuator arm and lockshaft is as specified in figure 2-56. If gap is not as specified, proceed to step 6. If it is as specified, proceed to step 7.

6. Adjust mounting plate as follows to obtain clearance specified in step 5.

   a. Loosen two screws securing static groundspring mounting bracket to mounting plate.

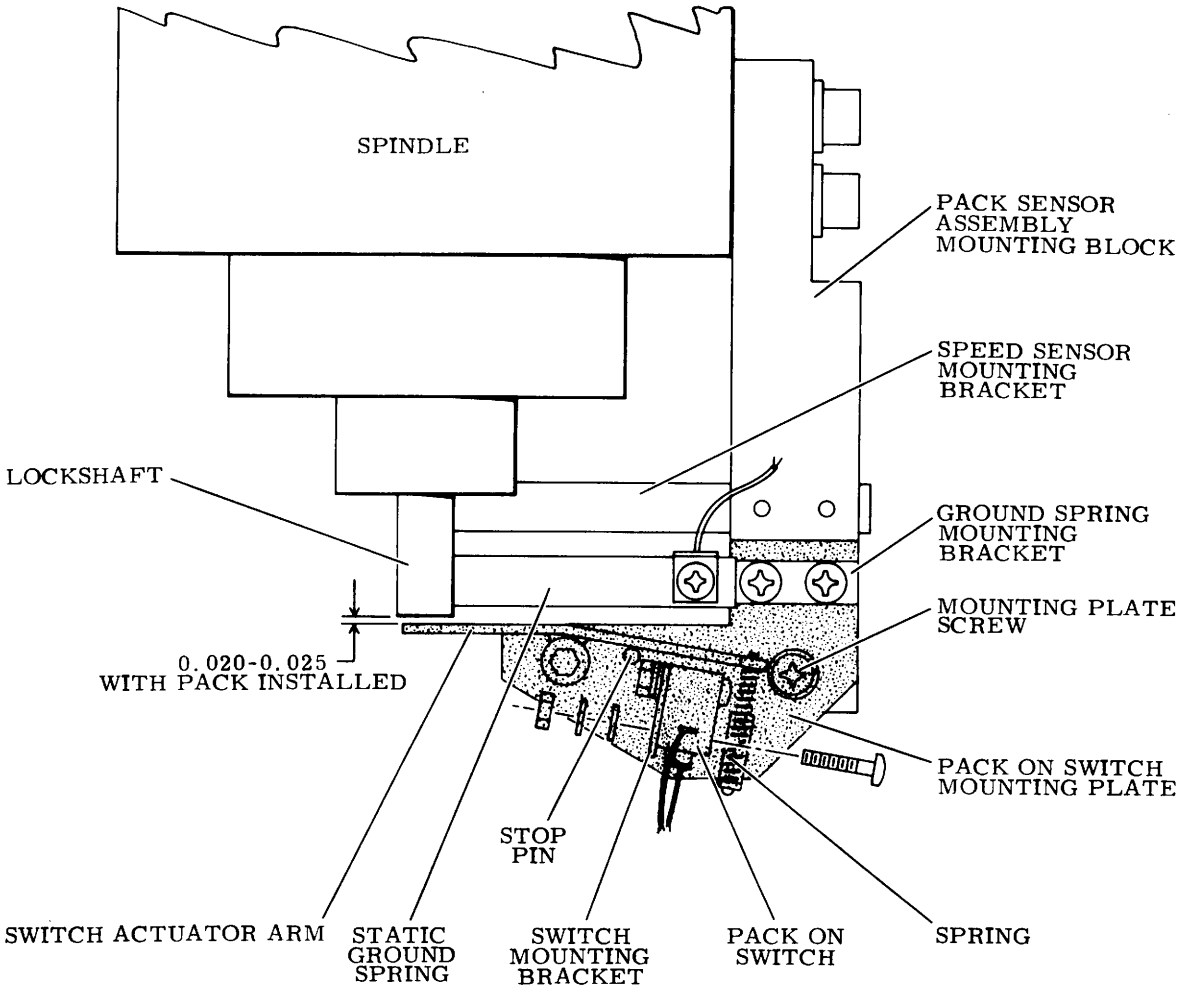
   b. Loosen mounting plate adjustment screw.

   c. Position switch mounting plate until gap between actuator arm and lockshaft is as specified in figure 2-55.

   d. Tighten mounting adjustment screw and two screws securing static ground spring mounting bracket to mounting plate.

   e. Recheck gap and readjust if necessary.

7. Check as follows to ensure that pack on switch is closed.



NOTES:

1 SHADED AREAS INDICATE PARTS RELEVANT TO PACK ON SWITCH ADJUSTMENT AND REPLACEMENT

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Figure 2-56. Pack On Switch Replacement/Adjustment (S/C 08 & Below)

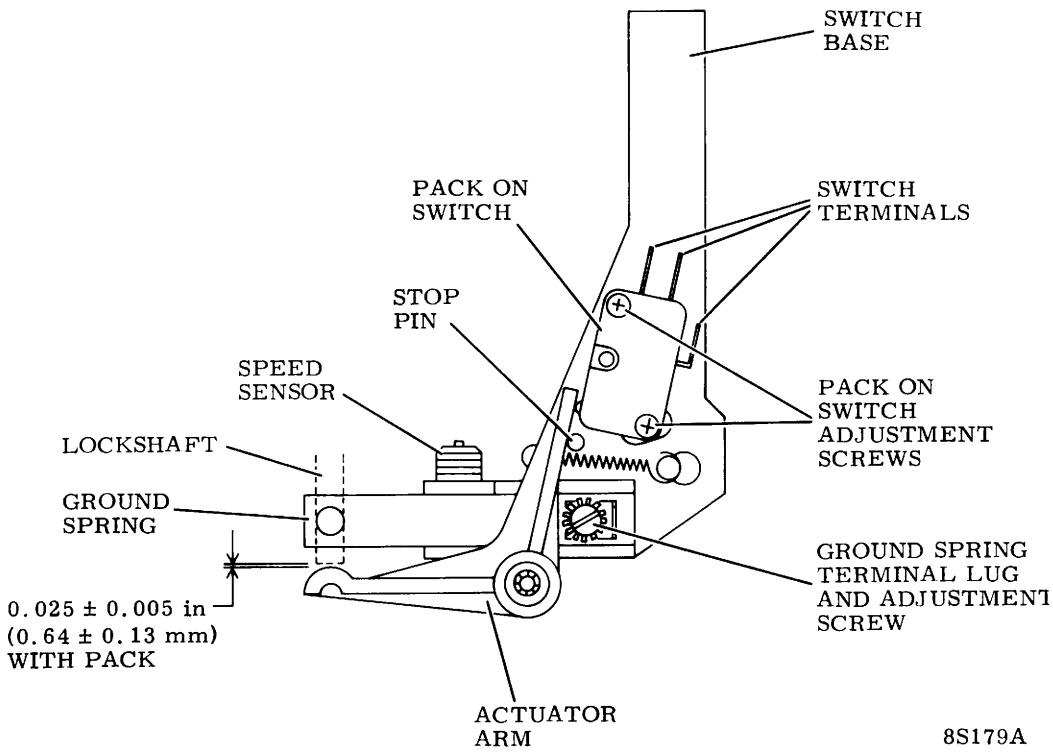


Figure 2-56.1. Pack On Switch Replacement/Adjustment (S/C 09 & Above)

a. Connect multimeter (set to Rx1) across pack sensor terminals as follows:

- Black (ground) lead to pack on switch terminal C.
- Red (positive) lead to pack on switch terminal NO.

b. Observe that meter indicates zero ohms. If it does go to step 9. If it does not go to step 8.

8. Adjust pack on switch to close at proper point as follows:

a. Loosen screws securing switch to mounting bracket.

b. Position switch until meter just indicates zero ohms.

c. Tighten screws securing switch to mounting bracket.

9. Check as follows to see that switch opens at the proper point:

a. Insert 0.011 inch feeler gage between actuator arm and stop pin (refer to figure 2-56).

b. Meter should indicate infinity. If not, go to step 10 if correct remove feeler gage and go to step 11.

10. Adjust pack on switch to open at proper point as follows:

a. Loosen screws securing pack on switch to mounting bracket.

b. Position switch until meter just indicates infinity.

c. Tighten screws.

d. Remove feeler gage and note that meter goes to zero. If meter does not go to zero, repeat procedure starting with step 9. If meter does go to zero proceed to step 11.

11. Remove multimeter probes from pack on switch terminals.

12. Reconnect pack on switch leadwires to switch terminals.

13. If mounting plate was adjusted (step 6) perform Static Groundspring Adjustment procedure steps 4 and 5.

14. Remove scratch disk pack.

15. Install blower assembly (refer to Blower Motor Replacement procedure step 15).

16. Close cabinet front door.

ADJUSTMENT (S/C 09 & Above)

NOTE

The following adjustment procedure applies to units with S/C 09 serial numbers 23 and above. The new pack sensor assembly is interchangeable; but the adjustment varies.

1. Stop spindle motor.

2. Install a disk pack.

3. Set UNIT POWER circuit breaker to OFF.

4. Refer to Side Panel Removal/Installation procedure and remove right (viewed from front) side panel.

5. Identify pack sensor switch leadwires (figure 2-56.1). Disconnect wires at switch terminals.

6. Dimension between actuator arm and lockshaft must be as specified in figure 2-56.1. If dimension is as specified, go to step 9. If adjustment is required, go to step 7.

7. Loosen two screws on switch base bracket (figure 2-56.1).

8. Position switch base bracket until dimension between actuator arm and lockshaft is as specified in figure 3-31. Tighten screws.

9. Connect a multimeter (set to Rxl) to pack sensor switch terminals (figure 2-56.1). Meter must indicate 0 ohms. If correct go to step 11, if not go to step 10.

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

11. Insert 0.011 inch thick feeler gage between actuator arm and stop pin (dimension A of figure 2-56.1).

12. Multimeter must indicate infinity. If not, go to step 13. If correct, remove feeler gage and go to step 16.

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

14. Remove feeler gage. Multimeter must indicate 0 ohms. If correct, go to step 15. If not, repeat procedure starting at step 10.

15. If requirements of step 14 are met, go to step 16. If not, and further adjustments are required, repeat the entire adjustment procedure.

16. Disconnect multimeter from switch terminals.

17. Connect pack sensor switch leadwires to switch terminals.

18. Perform Ground Spring Adjustment procedure if mounting plate screws were loosened.

19. Install side panel.

PACK SENSOR ASSEMBLY REPLACEMENT

This assembly is mounted beneath the deck on the rear of the spindle (refer to figure 2-57). The two main elements of the pack sensor assembly are the static ground spring and pack on switch. The procedure for individually replacing each of these are contained elsewhere in this section. The following describes replacement of the entire pack sensor assembly.

REPLACEMENT (S/C 08 & Below)

1. Remove power from drive as follows:

   a. Press START to stop drive motor and unload heads.

   b. Set MAIN AC circuit breaker to off.

2. Remove disk pack.

3. Remove blower assembly (refer to Blower Motor Replacement procedure steps 3 and 4).

4. Remove pack sensor assembly as follows:

   a. Disconnect static groundspring leadwire from terminal on ground spring.

   b. Note leadwire connections and disconnect leadwire from pack on switch.

   c. Disconnect speed sensor cable plug.

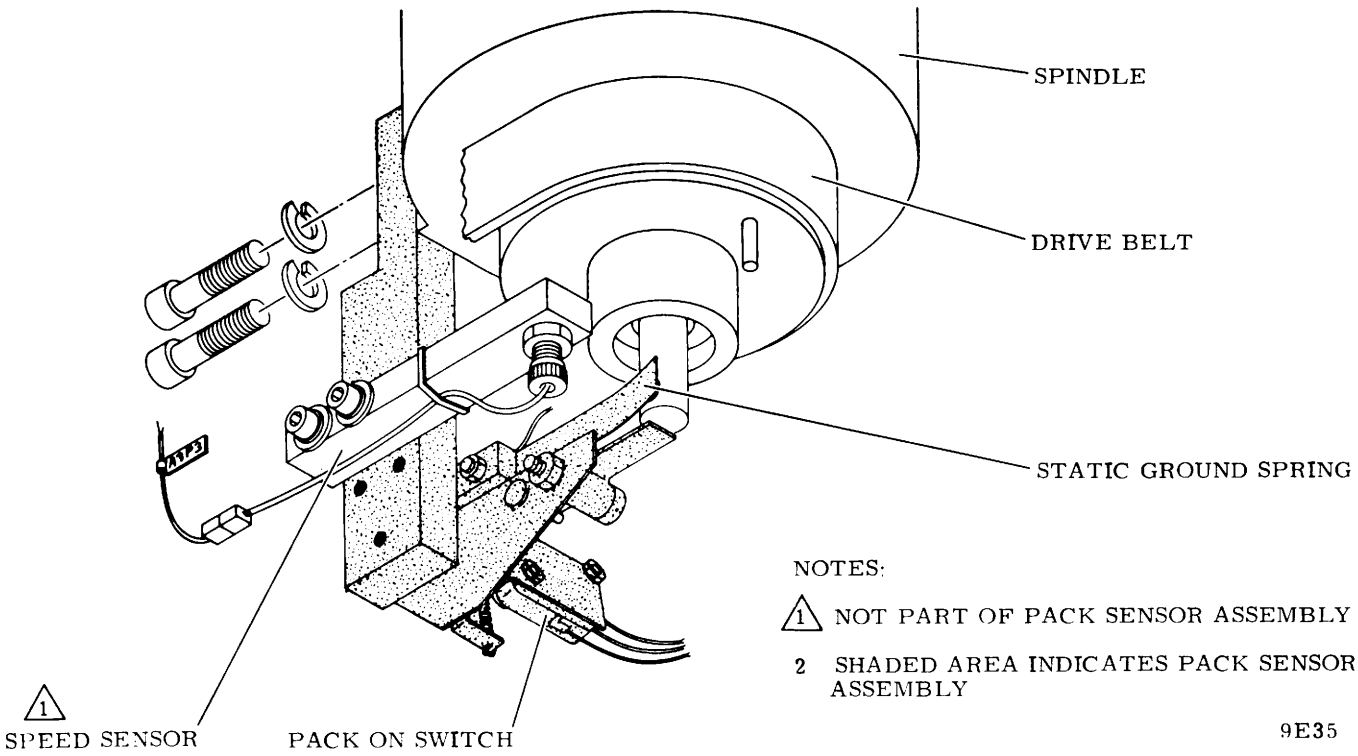


Figure 2-57. Pack Sensor Assembly Replacement (S/C 08 and Below)

d. Remove two screws and washers securing pack sensor assembly to spindle assembly then remove pack sensor assembly and set aside.

5. Remove speed sensor assembly from old pack sensor assembly by removing two screws and washers. Install speed sensor assembly on replacement pack sensor assembly.

6. Install replacement pack sensor assembly as follows:

   a. Position replacement pack sensor assembly on rear of spindle assembly and secure with two screws and washers.

   b. Connect speed sensor cable plug A3P3.

   c. Connect leadwire to pack on switch and static groundspring.

7. Perform the following procedures:

   a. Pack On Switch Adjustment steps 4 through 14.

   b. Static Groundspring Adjustment steps 4 and 5.

   c. Speed Sensor Adjustment Steps 4 through 7.

8. Install blower assembly (refer to Blower Motor Replacement procedure step 15).

9. Perform Speed Sensor Output Check procedure.

ADJUSTMENT (S/C 09 & Above)

1. Remove power from drive as follows:

   a. Press START to stop drive motor and unload heads.

   b. Set MAIN AC circuit breaker to off.

2. Remove disk pack.

3. Remove blower assembly (refer to Blower Motor Replacement procedure steps 3 and 4).

4. Remove pack sensor assembly as follows:

   a. Disconnect static groundspring leadwire from terminal on groundspring.

   b. Cut tie wrap on leadwires.

   c. Note leadwire connections and disconnect leadwires from pack on switch.

   d. Disconnect speed sensor cable plug.

e. Remove drive belt (refer to Drive Belt).

f. Remove two screws and washers securing pack sensor assembly to spindle assembly then remove pack sensor assembly and set aside.

5. Install replacement pack sensor assembly as follows:

   a. Position replacement pack sensor assembly on rear of spindle assembly and secure with two screws and washers.

      Replace drive belt (refer to 2-44 drive belt replacement).

   b. Connect speed sensor cable plug A3P3.

   c. Connect leadwires to pack on switch and static groundspring leadwire.

6. Perform the following procedures:

   a. Pack On Switch Adjustment.

   b. Static Groundspring Adjustment.

   c. Speed Sensor Adjustment.

7. Install blower assembly (refer to Blower Motor Replacement procedure step 15).

8. Perform Speed Sensor Output Check procedure.

PARKING BRAKE REPLACEMENT

The parking brake is located on the deck near the spindle (refer to figure 2-58). It is necessary to remove only the brake cover plate to access the parking brake for removal and replacement and this is covered in the Parking Brake Adjustment procedure.

1. Remove power from drive as follows:

   a. Press START switch to stop drive motor and unload heads.

   b. Set MAIN AC circuit breaker to off.

2. Open pack access cover and remove disk pack.

3. Remove six screws and washers securing brake plate cover to deck then remove cover.

4. Remove two screws securing parking brake assembly to deck (refer to figure 2-58) then remove assembly and set aside.

   NOTE

   Apply Loctite Primer Grade N and Loctite Grade C to screws used in step 5.

5. Install parking brake assembly to deck using two screws.

6. Perform Parking Brake Adjustment procedure starting with step 4.

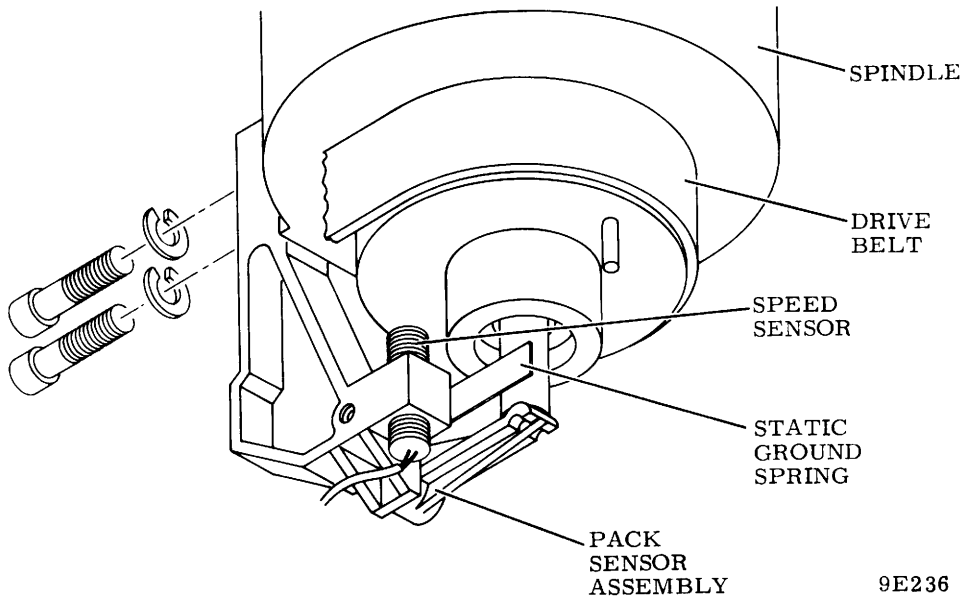


Figure 2-57.1. Pack Sensor Assembly Replacement (S/C 09 and Above)

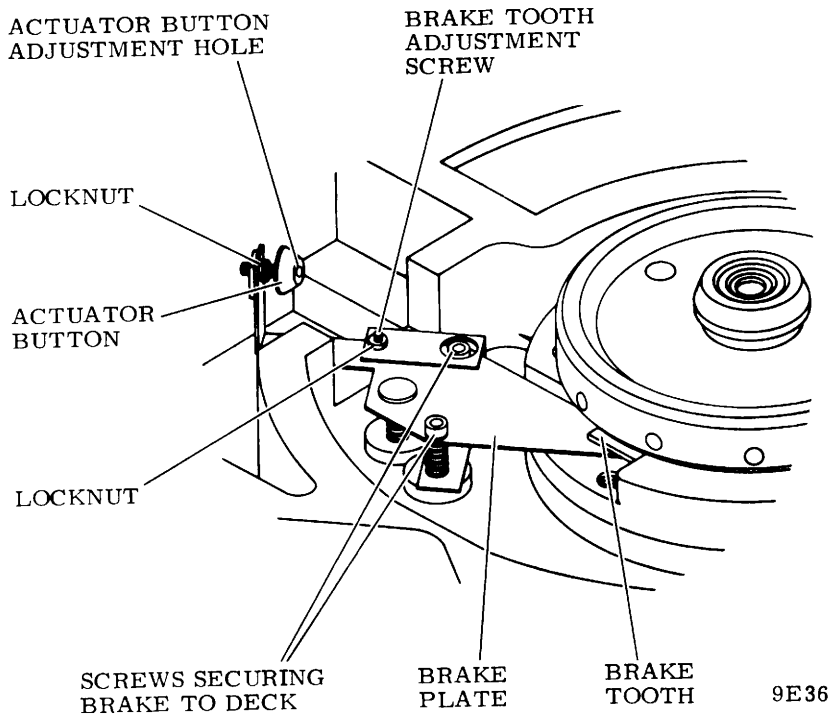


Figure 2-58. Parking Brake Replacement/Adjustment

PARKING BRAKE ADJUSTMENT

The Parking Brake has two adjustments (refer to figure 2-58). These are the actuator button to pack clearance and the brake tooth to bottom of spindle clearance.

The distance between the actuator button and the disk pack bottom disk surface is adjusted by turning the actuator button in or out. The brake tooth to bottom of spindle clearance is adjusted by the brake tooth adjustment screw.

Adjustment of brake tooth to bottom of spindle clearance requires only removing the brake cover plate; however the entire shroud must also be removed to adjust brake button to disk pack clearance.

1. Remove power to drive as follows:

   a. Press START switch to stop drive motor and unload heads.

   b. Set MAIN AC circuit breaker to off.

2. Open pack access cover and remove disk pack.

3. Remove six screws and washers securing brake cover plate.

4. Check clearance between brake tooth and underside of spindle as follows:

   a. Rotate spindle until brake tooth is not engaged or under a notch in spindle.

   b. Check to see if clearance between tooth and underside of spindle is between .005 and .020 inches. If this requirement is not met proceed to step 5. If it is met proceed to step 6.

5. Adjust brake tooth to underside of spindle clearance as follows:

   a. Loosen locknut brake tooth adjustment screw.

   b. Adjust screw until clearance between tooth and underside of spindle is from .005 to .020 inch. Turning setscrew clockwise narrows gap and counterclockwise widens gap.

   c. When gap is correct tighten setscrew.

6. Install a scratch disk pack.

NOTE

In step 7 it is impossible to check the clearance with a conventional feeler gage. However a suitable tool can be constructed by taping the proper feeler gage to the end of a long object such as a screw driver.

7. Check that clearance between actuator button and bottom disk surface on disk pack is between .01 and .02 inches. If the requirement is not met, remove disk pack and proceed to step 8, if it is met remove disk pack and proceed to step 19.

8. Remove disk pack.

NOTE

If drive is installed in line with other drives, it may be necessary to move the drive out of line to remove the top cover.

9. Remove cabinet top cover.

10. Remove deck cover.

11. Remove pack access cover.

12. Remove shroud and shroud cover.

13. Adjust actuator button to disk pack clearance as follows:

    a. Install scratch disk pack.

    b. Loosen locknut on actuator button adjustment screw.

    c. Turn actuator button until clearance between button is between 0.10 and 0.020 inches. Turning button clockwise increases clearance and turning it counterclockwise decreases clearance.

    d. When gap is correct, tighten locknut.

CAUTION

Remove and install disk pack then rotate spindle to ensure there is no interference between brake tooth and spindle.

    e. Remove scratch disk pack.

14. Replace shroud and shroud cover.

15. Install pack access cover.

16. Replace deck cover.

NOTE

If drive was moved from in line position to remove top cover, reinstall drive in line after replacing top cover.

17. Install cabinet top cover.

18. Open pack access cover and clean shroud.

19. Close pack access cover.

POWER SUPPLY ASSEMBLY REPLACEMENT AND MAINTENANCE

The power supply is located on the floor of the cabinet at the rear of the drive (refer to figure 2-59). It contains three replaceable cards and they are: (1) -ZCN (power amplifier) (2) -YEN (capacitor board) and (3) -YFN (relay board). The following procedures describe replacement of the entire power supply as well as each of the cards. It also describes triac and power transistor replacement.

POWER SUPPLY ASSEMBLY REPLACEMENT

The following procedure describes removal and replacement of the entire power supply assembly.

1. Remove power from drive as follows:

    a. Press START switch to stop drive motor and unload heads.

    b. Set MAIN AC circuit breaker to off.

    c. Disconnect power cable from site power receptacle.

NOTE

If drive is installed in line with other drives it will have to be pulled out of line to remove side panels.

2. Remove cabinet side panels.

3. Remove two screws securing cable guide to frame and remove cable guide.

4. Disconnect support spring from power cable.

5. Disconnect five plug connectors to power supply.

6. Open cabinet rear door and swing logic chassis open.

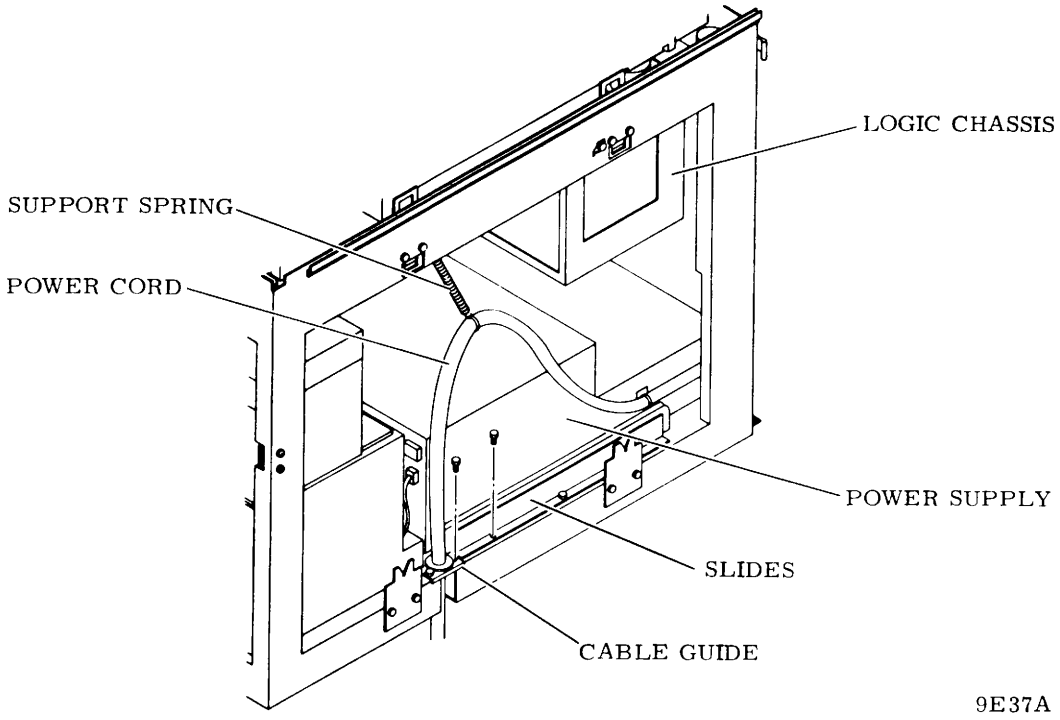


Figure 2-59. Power Supply Assembly Replacement

7. Remove power supply top cover.

8. Disconnect ac and dc ground straps (refer to figure 2-60) and remove them from power supply. Replace top cover on power supply.

9. Remove six screws securing power supply slides to floor of drive cabinet and slide supply out rear of cabinet.

10. Slide replacement power supply into cabinet and secure slides to floor of cabinet with six screws.

11. Remove top cover from replacement power supply and connect ground straps (removed in step 8) as shown in figure 2-60.

12. Connect power wiring as described in AC Power Wiring discussion in the Installation and Checkout section of this manual.

13. Replace top cover on power supply.

14. Reconnect five plugs to power supply.

15. Position power cable in cable guide and secure cable guide to floor of cabinet.

16. Replace cabinet side panels.

17. Connect power cord to site power receptacle.

18. If drive was moved out of line to perform step 2, reinstall it in line.

19. Perform following procedures:

    a. +5 volt and -5 volt Test and Adjustment.

    b. DC Voltage Output Check.

-ZCN (POWER AMPLIEFER) CARD REPLACEMENT

The following procedure describes removal and replacement of only the -ZCN card (refer to figure 2-60).

1. Remove power from drive as follows:

    a. Press START switch to stop drive motor and unload heads.

    b. Set MAIN AC circuit breaker to off.

    c. Disconnect power cable from site main power receptacle.

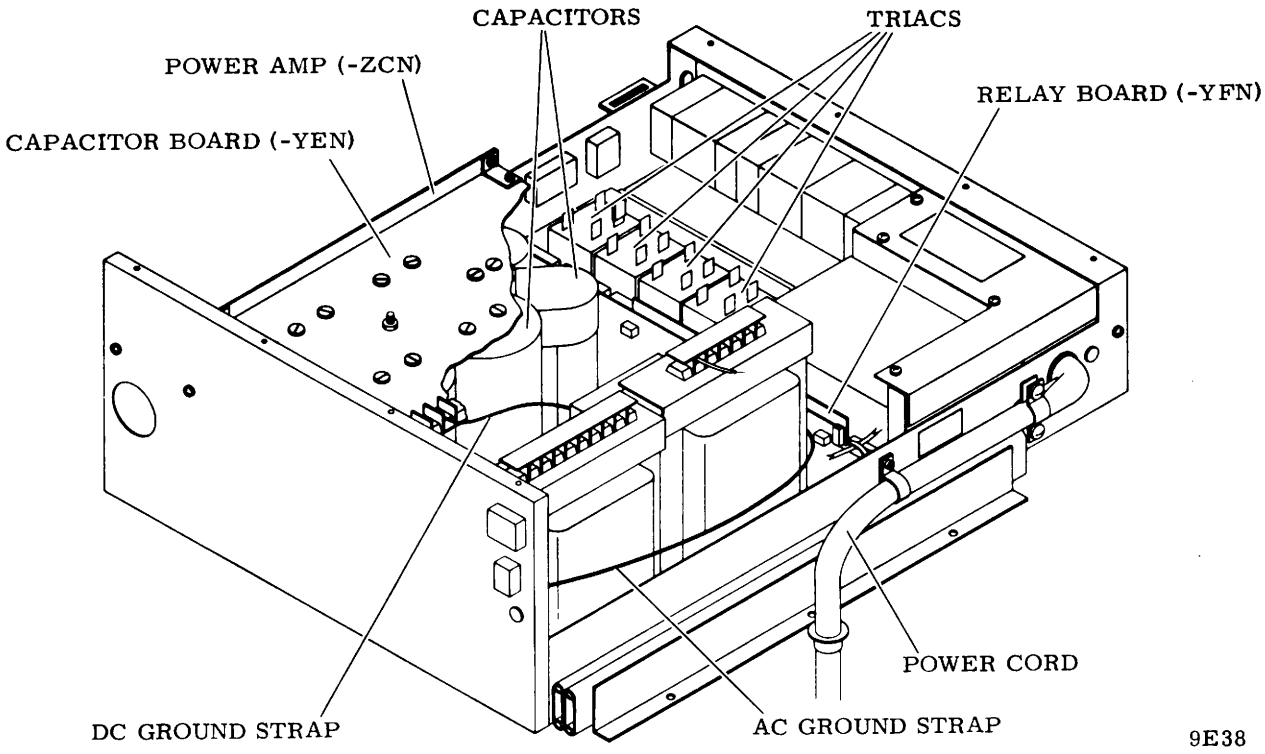


Figure 2-60. Power Supply Card Replacement

2. Slide power supply out and remove power supply top cover.

3. Note connections then disconnect all wires from -ZCN card.

4. Remove two screws and washers securing card in power supply, remove insulated spring clip, then remove card.

5. Position replacement card in power supply, attach insulated spring clip removed from old card (step 4), and secure with two screws and washers.

6. Connect wires to replacement -ZCN card.

7. Replace top cover on power supply and perform steps 1, 4 and 9 of Manual Controlled Servo Checks procedure.

-YEN (CAPACITOR BOARD) REPLACEMENT

The following procedure describes removal and replacement of the -YEN card (refer to figure 2-60).

1. Remove power from drive as follows:

   a. Press START switch to stop drive motor and unload heads.

   b. Set MAIN AC circuit breaker to off.

   c. Disconnect power cable from site main power receptacle.

2. Slide power supply out and remove power supply top cover.

3. Remove two screws and washers securing -ZCN card, remove insulated spring clip, then move -ZCN card away from -YEN.

4. Note connections, then disconnect all wires from -YEN card.

5. Remove ten screws securing card to capacitors.

6. Remove nut and washers from stud securing card to power supply, then remove card.

7. Ensure that all lockwashers are positioned on capacitors, then position -YEN card on capacitors and install ten screws.

8. Install nut and washers on stud and tighten nut.

9. Reposition -ZCN card and secure with two screws and washers. Replace insulated spring clip.

10. Replace top cover on power supply and perform following procedures:

    a. -5 Volt and -5 Volt Test and Adjustment.

    b. Power Supply DC Output Voltage Check.

CAUTION

Observe precautions described in discussion on Handling Electrostatic Devices when working with -YFN card.

-YFN (RELAY BOARD) REPLACEMENT

The following procedure describes removal and replacement of the -YFN card (refer to figure 2-60).

1. Remove power from drive as follows:

    a. Press START switch to stop drive motor and unload heads.

    b. Set MAIN AC circuit breaker to off.

    c. Disconnect power cable from site main power receptacle.

2. Slide power supply out and remove power supply top cover.

3. Remove two connectors from -YFN card.

4. Carefully pry card off three fasteners and remove from power supply.

5. Install replacement -YFN card in power supply by pushing it carefully onto fasteners.

6. Install two connectors on replacement card.

7. Replace top cover on power supply and perform following procedures:

    a. Set MAIN AC circuit breaker to on and set LOCAL/REMOTE switch to LOCAL.

    b. Press START switch and observe that drive motor starts and heads load.

    c. Press START switch and observe that heads unload and pack stops rotating in approximately 30 seconds.

    d. Set LOCAL/REMOTE switch to REMOTE (ensure sequence power is available).

    e. Press START switch and observe that drive motor starts and heads load.

    f. Press START switch and observe that heads unload and pack stops rotating in approximately 30 seconds.

    g. Set MAIN AC circuit breaker to off.

TRIAC AND POWER TRANSISTOR REPLACEMENT

When replacing triacs or power transistors, the following procedure should be performed.

1. Remove power from drive as follows:

    a. Press START switch to stop drive motor and unload heads.

    b. Set MAIN AC circuit breaker to off.

    c. Disconnect power cable from site power receptacle.

2. Swing logic chassis open, slide power supply out, and remove power supply top cover.

3. Remove defective triac or power transistor.

4. Apply a coating of silicone grease to mating surfaces of replacement triac or power transistor and power supply (or heat sink in case of power transistor).

5. Install replacement triac or power transistor.

6. Replace cover on power supply and slide power supply into normal position.

7. Close logic chassis and cabinet rear door.

READ/WRITE CHASSIS -XGN CARD REPLACEMENT

The -XGN card is located in read/write chassis location E05. It is mounted on the -XFN card in location E04 (the -XFN card is also referred to as the mother board). Replacing the XGN card involves removing the read/write chassis from the deck and then removing the -XGN card from its position on the mother board (refer to figure 2-61).

1. Remove power from drive as follows:

    a. Press START switch to stop drive motor and unload heads.

    b. Set MAIN AC circuit breaker to off.

2. Remove disk pack.

3. Open cabinet top cover and remove deck cover.

4. Remove read/write chassis from deck as follows (refer to figure 2-61):

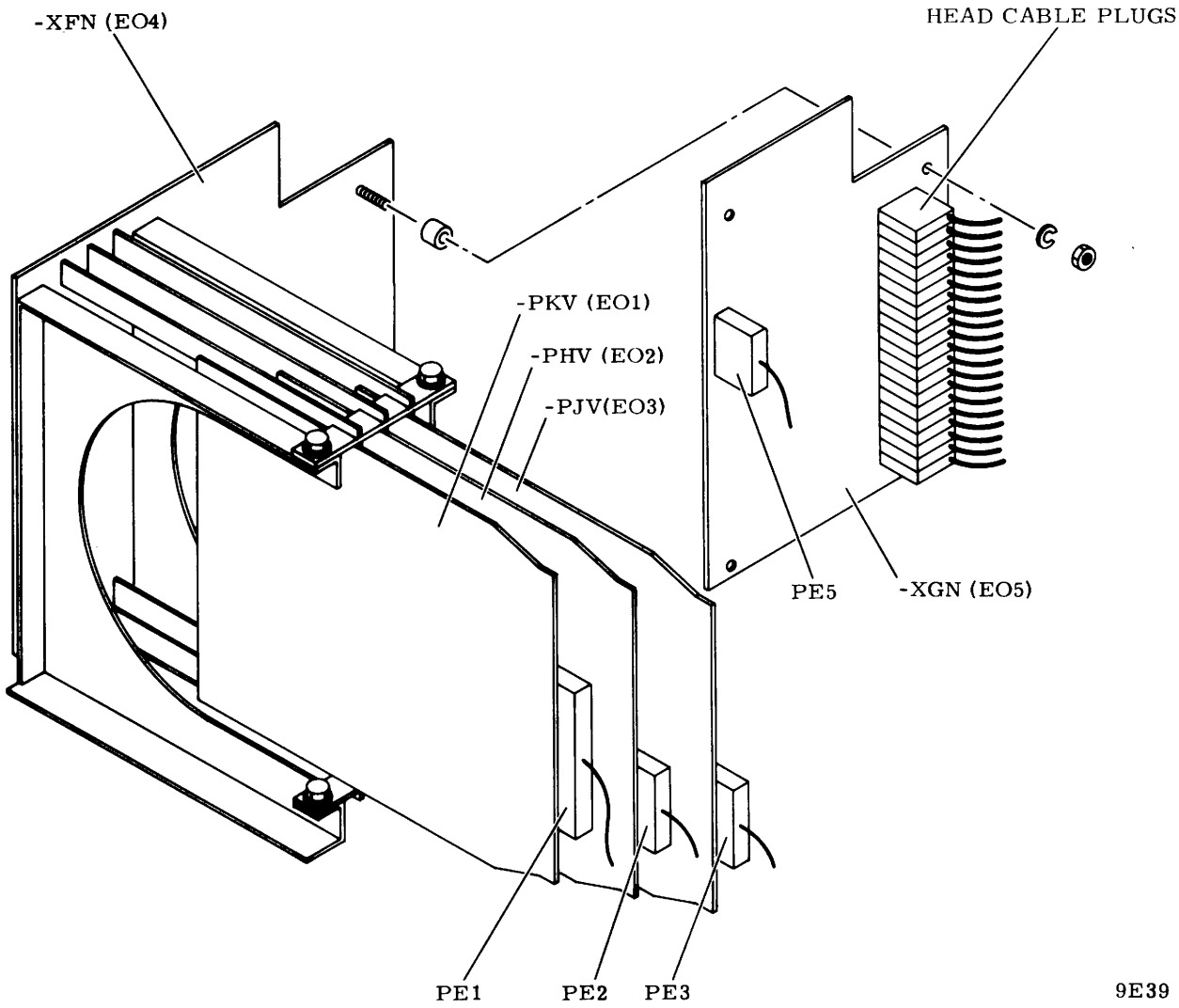


Figure 2-61. Read/Write Chassis Card Replacement

a. Note connections and remove cable plugs from PE1, PE2, PE3 and PE5 from read/write cards.

b. Remove cards E01, E02 and E03 from read/write chassis.

c. Remove screws and lock washers securing head clamp assembly to -XGN card.

d. Note connections and remove head cable plugs from -XGN card starting with top plug.

e. Remove four screws and washers securing read/write chassis to deck and remove chassis from deck.

5. Remove -XGN card from mother board as follows (refer to figure 2-61):

   a. Remove four nuts and washers securing -XGN card to mother board.

CAUTION

Use care not to damage pins.

   b. Pry -XGN card from mother board.

6. Install replacement -XGN card to mother board as follows:

CAUTION

Ensure that all pins go through the proper holes and all pins are straight.

   a. Position -XGN card over pins on mother board then press cards together.

   b. Secure -XGN card to mother board using four lockwashers and nuts.

7. Install read/write chassis on deck as follows:

   a. Position read/write chassis on deck ensuring that mother board engages the clip on actuator housing.

   b. Secure read/write chassis to deck using four screws and washers.

NOTE

Head cable connectors are keyed and plug to mother board only one way. Ensure that cable between head-arm and plug is not twisted or kinked.

   c. Connect head cable plugs, starting with top plug (0).

   d. Secure head clamp assembly to -XGN card using screws and lock washers.

   e. Replace cards E01, E02 and E03 in read/write chassis.

   f. Connect cable plugs PE1, PE2, PE3 and PE5.

8. Install deck cover and close cabinet top cover.

READ/WRITE CHASSIS -XFN (MOTHER BOARD) REPLACEMENT

The -XFN card is also referred to as the mother board. All the other cards in the read/write chassis plug onto pins on the mother board. Replacing the mother board involves removing the read/write chassis from the deck, disconnecting the other cards from the mother board, then removing the mother board from the read/write chassis.

1. Remove read/write chassis from deck and -XGN card from mother board by performing steps 1 through 5 of Read/Write Chassis -XGN Card Replacement procedure.

2. Separate mother board from read/write chassis by removing six screws and washers (refer to figure 2-61) then set mother board aside.

3. Position replacement mother board on read/write chassis and secure with six screws and washers.

4. Replace -XGN card on replacement mother board as instructed in step 6 of Read/Write Chassis -XGN Card Replacement procedure. Note that although step 6 refers to a replacement -XGN card, in this case the old card is reinstalled.

5. Perform steps 7 and 8 of Read/Write Chassis -XGN Card Replacement procedure.

SERVO PREAMP BOARD REPLACEMENT

This board is located in the servo preamp housing which is mounted on the deck (refer to figure 2-62). Replacing the board involves removing the board from the preamp housing.

1. Remove power to drive as follows:

   a. Press START switch to stop drive motor and unload heads.

   b. Set MAIN AC circuit breaker to off.

2. Remove disk pack.

3. Open cabinet top cover and remove deck cover.

4. Remove Servo Preamp board as follows:

   a. Remove two hex head screws securing servo preamp cover and remove cover.

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

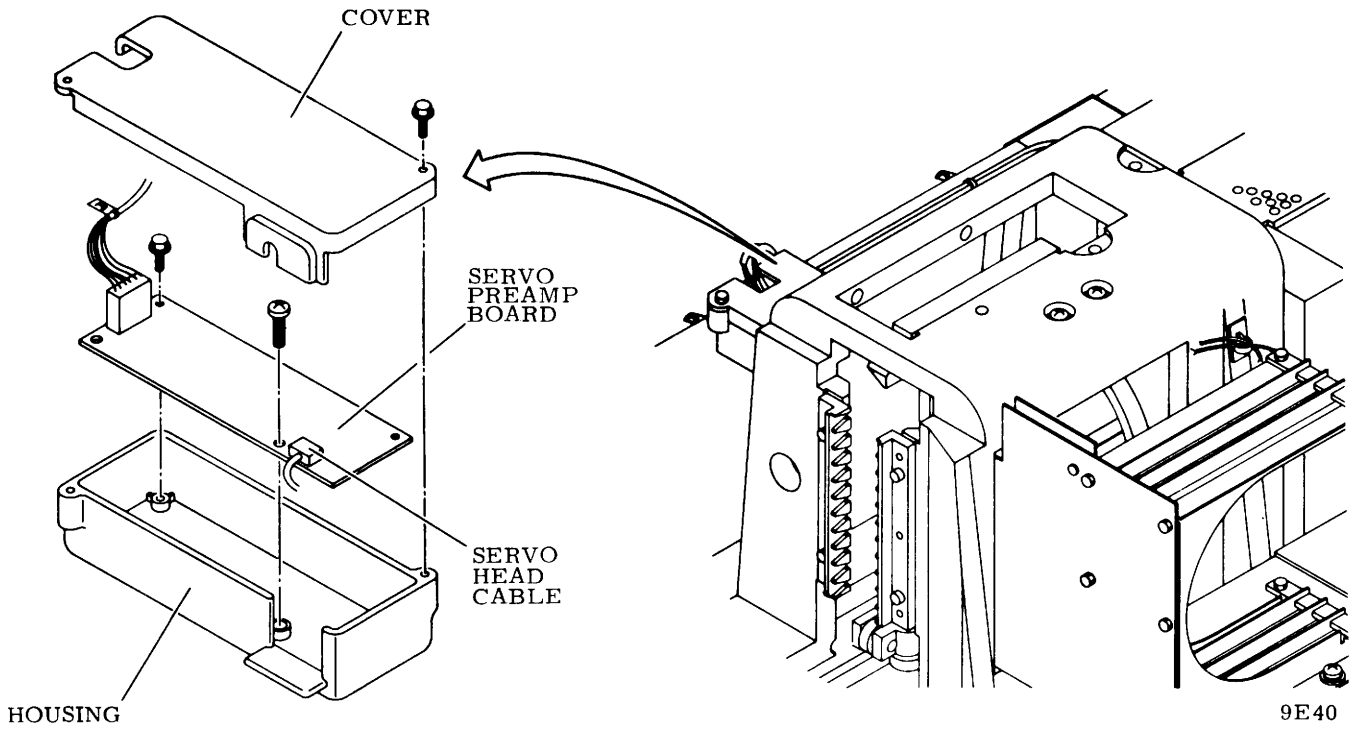


Figure 2-62. Servo Preamp Board Replacement

c. Remove two pan head screws inside preamp housing that secure housing to deck.

d. Remove two hex head screws securing preamp circuit board to housing then remove circuit board and set aside.

5. Install replacement servo preamp board as follows:

a. Secure preamp circuit board to housing with two hex head screws.

b. Secure housing to deck with two pan head screws.

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

d. Secure housing cover to housing using two hex head screws.

6. Install deck cover and close cabinet top cover.

SPEED SENSOR ASSEMBLY REPLACEMENT

The speed sensor assembly consists of the speed sensor and its mounting bracket and is located on the pack sensor assembly. The following procedure describes speed sensor assembly replacement. Speed sensor adjustment is covered in the Speed Sensor Adjustment procedure.

REPLACEMENT (S/C 08 & Below)

1. Remove power to the drive as follows:

a. Press START switch to stop drive motor and unload heads.

b. Set MAIN AC circuit breaker to off.

2. Remove disk pack.

3. Open cabinet front door.

4. Remove blower assembly (refer to Blower Motor Replacement procedure steps 3 and 4).

5. Refer to figure 2-63 and remove speed sensor assembly as follows:

a. Disconnect speed sensor cable plug A3P3.

b. Remove two screws and washers securing speed sensor mounting bracket to pack sensor assembly and remove speed sensor assembly.

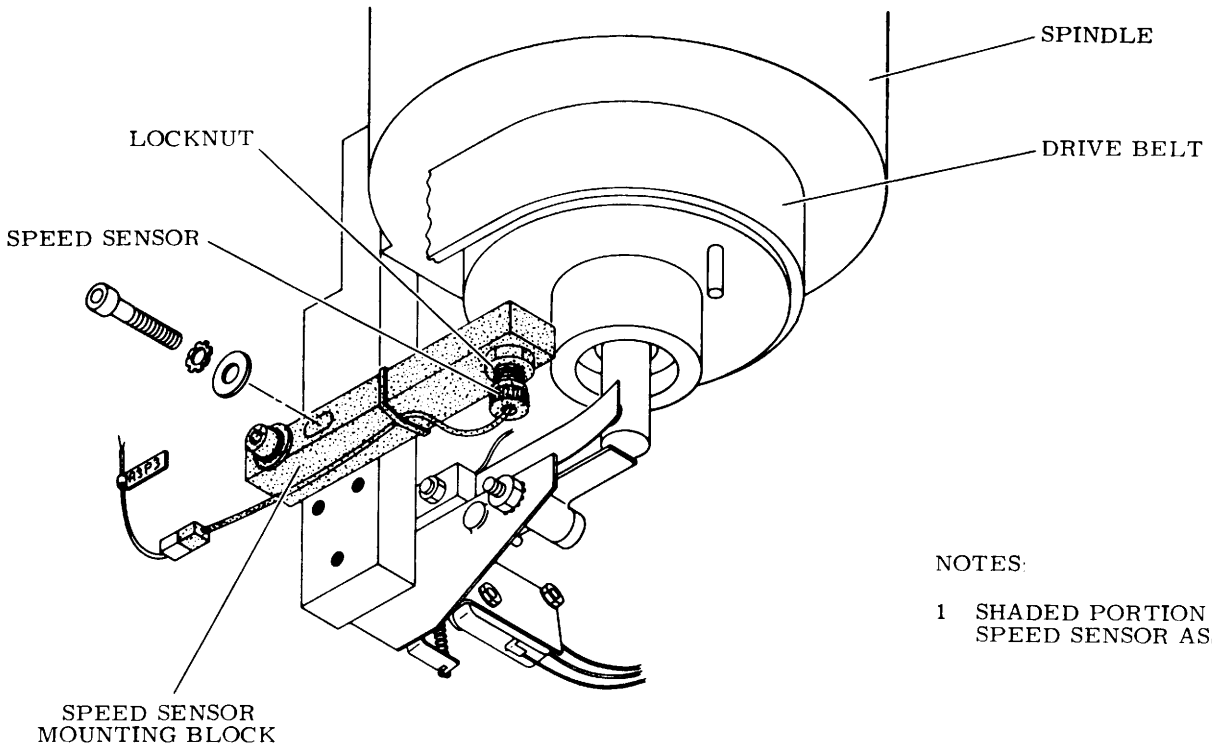


Figure 2-63. Speed Sensor Assembly Replacement (S/C 08 and Below)

6. Install replacement speed sensor assembly as follows:

   a. Secure replacement speed sensor assembly to pack sensor assembly using two screws and washers.

   b. Connect speed sensor cable plug A3P3.

   c. Secure speed sensor leadwire to speed sensor assembly mounting bracket with two cable ties.

7. Perform Speed Sensor Assembly Adjustment procedure starting with step 4.

REPLACEMENT (S/C 09 & Above)

1. Remove power to the drive as follows:

   a. Press START switch to stop drive motor and unload heads.

   b. Set MAIN AC circuit breaker to off.

2. Remove disk pack.

3. Open cabinet front door.

4. Remove blower assembly (refer to Blower Motor Replacement procedure steps 3 and 4).

5. Remove speed sensor assembly as follows:

   a. Disconnect speed sensor cable plug A3P3, and cut tie wrap from speed sensor lead.

   b. Remove locknut from speed sensor.

   c. Remove speed sensor from switch base.

6. Replace speed sensor assembly as follows:

   a. Install new speed sensor in switch base.

   b. Reinstall locknut on speed sensor, torque to 5 in-lb maximum (15 in-lb maximum on the steel sensors).

   c. Connect speed sensor cable plug A3P3.

   d. Secure speed sensor leadwire to speed sensor switch base with a tie wrap.

   e. Perform speed sensor adjustment.

SPEED SENSOR ASSEMBLY ADJUSTMENT

The speed sensor assembly must be adjusted whenever the spindle assembly, pack sensor

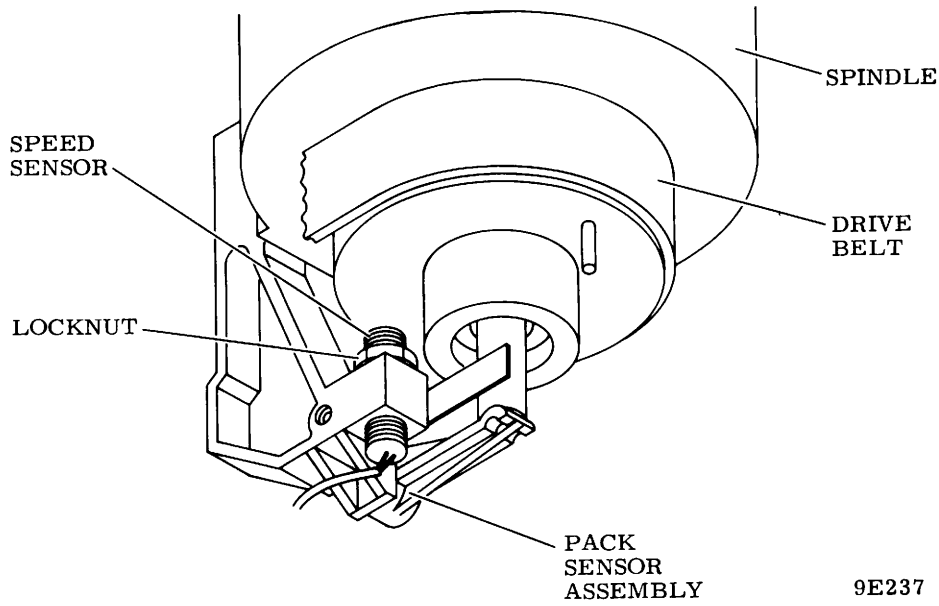


Figure 2-63.1. Speed Sensor Assembly Replacement (S/C 09 and Above)

assembly or speed sensor assembly are replaced. The speed sensor assembly has a lateral and a gap adjustment.

The lateral adjustment is accomplished by moving the speed sensor mounting bracket sideways until the sensor tip is in line with the steel pin on the spindle pulley.

The gap adjustment is accomplished by turning the speed sensor to achieve a specific distance between the sensor tip and the steel pin in the spindle pulley.

ADJUSTMENT (S/C 08 & Below)

1. Remove power from the drive as follows:

   a. Press START switch to stop drive motor and unload heads.

   b. Set MAIN AC circuit breaker to off.

2. Remove disk pack.

3. Remove blower assembly (refer to Blower Motor Replacement procedure steps 3 and 4).

CAUTION

Ensure that steel pin in pulley does not contact speed sensor. This could happen if speed sensor was significantly out of adjustment as for example following replacement.

4. Check lateral alignment of sensor tip and steel pin in spindle pulley as follows:

   a. Rotate spindle until speed pin in bottom of pulley is as close as possible to being centered over sensor tip.

   b. If steel pin will not center over sensor tip (refer to figure 2-63) proceed to step 5. If it is centered as in figure 2-64 proceed to step 6.

5. Adjust lateral alignment as follows (refer to figure 2-64):

   a. Loosen two screws securing sensor mounting bracket to pack sensor assembly.

   b. Moves sensor mounting bracket either forward or backward until steel pin can be centered over sensor tip.

   c. Tighten screws in sensor mounting bracket.

   d. Recheck alignment and readjust if necessary.

6. Check gap between steel pin and sensor tip as follows (refer to figure 2-64):

   a. Rotate spindle pulley until steel pin is centered over sensor tip.

b. Using a non metallic feeler gauge, check that gap between steel pin and sensor tip is between .016 and .022 inches.

c. If gap is not within limits specified go to step 7. If it is within limits proceed to step 8.

7. Adjust gap between steel pin and sensor tip as follows:

a. Loosen locknut on speed sensor by turning counterclockwise.

CAUTION

Do not allow sensor tip to contact steel pin in pulley or damage to sensor tip or steel pin will result.

b. Turn sensor clockwise (looking from below) to narrow gap or counterclockwise to widen gap until gap specified in step 6 is obtained.

CAUTION

Do not overtighten speed sensor locknut or damage to speed sensor will result.

c. After adjusting speed sensor for correct gap, hold sensor stationary and tighten locknut.

d. Recheck gap as instructed in step 6.

8. Replace blower assembly (refer to Blower Motor Replacement procedure step 15).

9. Close cabinet front door.

10. Perform Speed Sensor Output Check procedure.

ADJUSTMENT (S/C 09 & Above)

1. Stop spindle motor.

2. Remove disk pack.

3. Set UNIT POWER circuit breaker to OFF.

4. Use feeler gage to check that gap between sensor tip and pin is 0.019 (0.003) inch (figure 2-64.1).

CAUTION

Ensure that steel pin in pulley does not contact speed sensor. This could happen if speed sensor was significantly out of adjustment as for example following replacement.

5. If requirement of step 4 is not met adjust speed sensor as follows:

a. Loosen locknut on speed sensor assembly.

b. Adjust sensor assembly (clockwise rotation closes gap, counterclockwise rotation widens gap) to meet the requirements of step 3.

CAUTION

To avoid damage to the plastic threads do not over tighten locknut in next step.

c. Torque locknut to 5($\pm$1) inch-pounds.

d. Recheck dimension of gap.

6. Perform Speed Sensing procedure of Miscellaneous Logic Checkout.

SPINDLE LOCKSHAFT REPLACEMENT

The lockshaft is located within the spindle assembly (refer to figure 2-65); however, the lockshaft is removed without removing the spindle. There is no adjustment for the lockshaft replacement.

REPLACEMENT (S/C 08 & Below)

1. Remove power from drive as follows:

a. Press START switch to stop drive motor and unload heads.

b. Set MAIN AC circuit breaker to off.

2. Open pack access cover, remove disk pack; leave pack access cover open.

3. Open cabinet front door.

4. Remove blower assembly (refer to Blower Motor Replacement procedure steps 4).

5. Remove leadwire to static groundspring.

6. Remove two screws securing groundspring mounting bracket to pack sensor assembly mounting block (refer to figure 2-68), then remove ground spring and mounting block.

7. Loosen pack on switch mounting plate adjustment screw (refer to figure 2-66) and swing mounting plate down so it will not interfere with lockshaft removal.

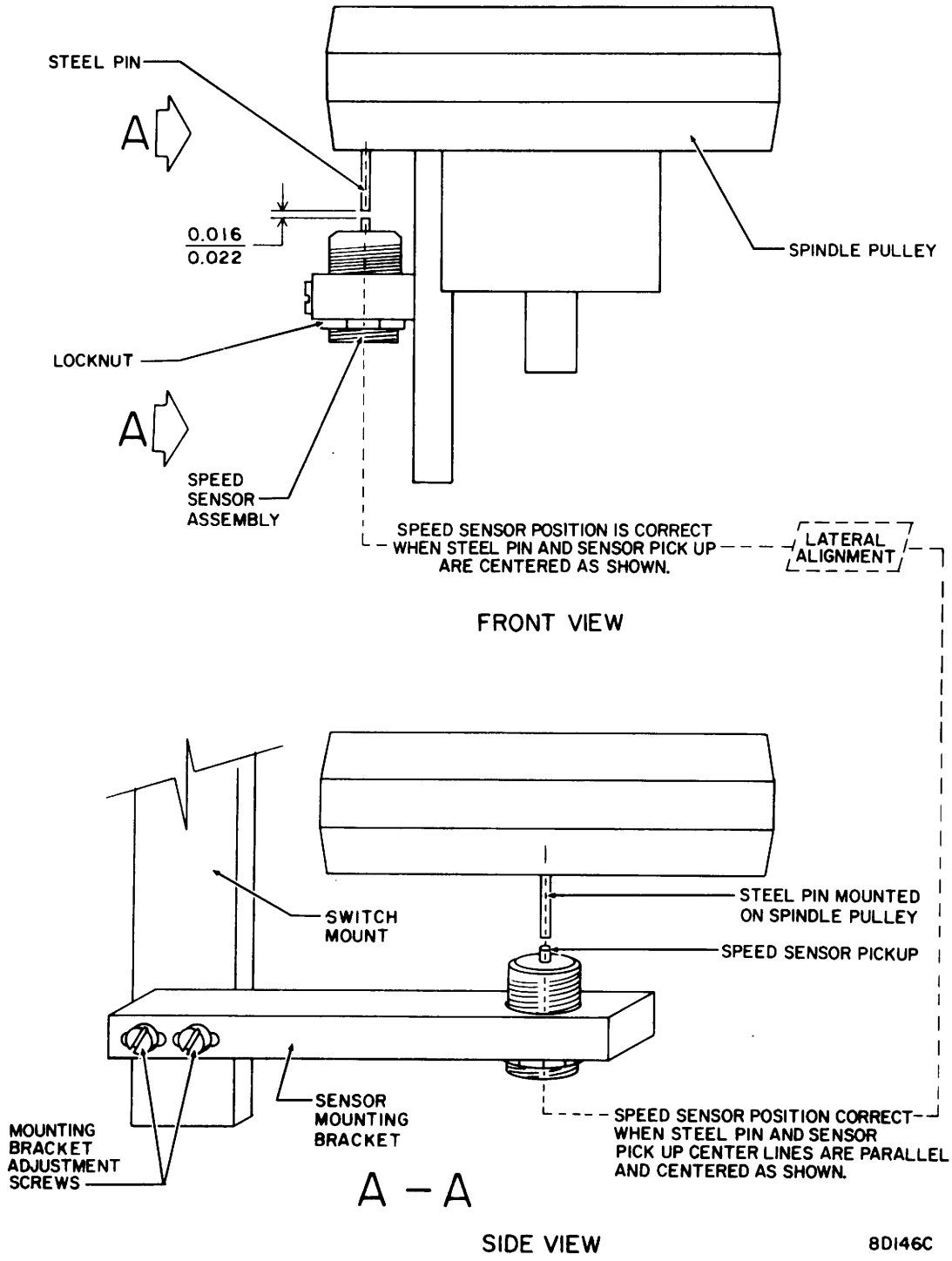


Figure 2-64. Speed Sensor Assembly Adjustment
(S/C 08 and Below)

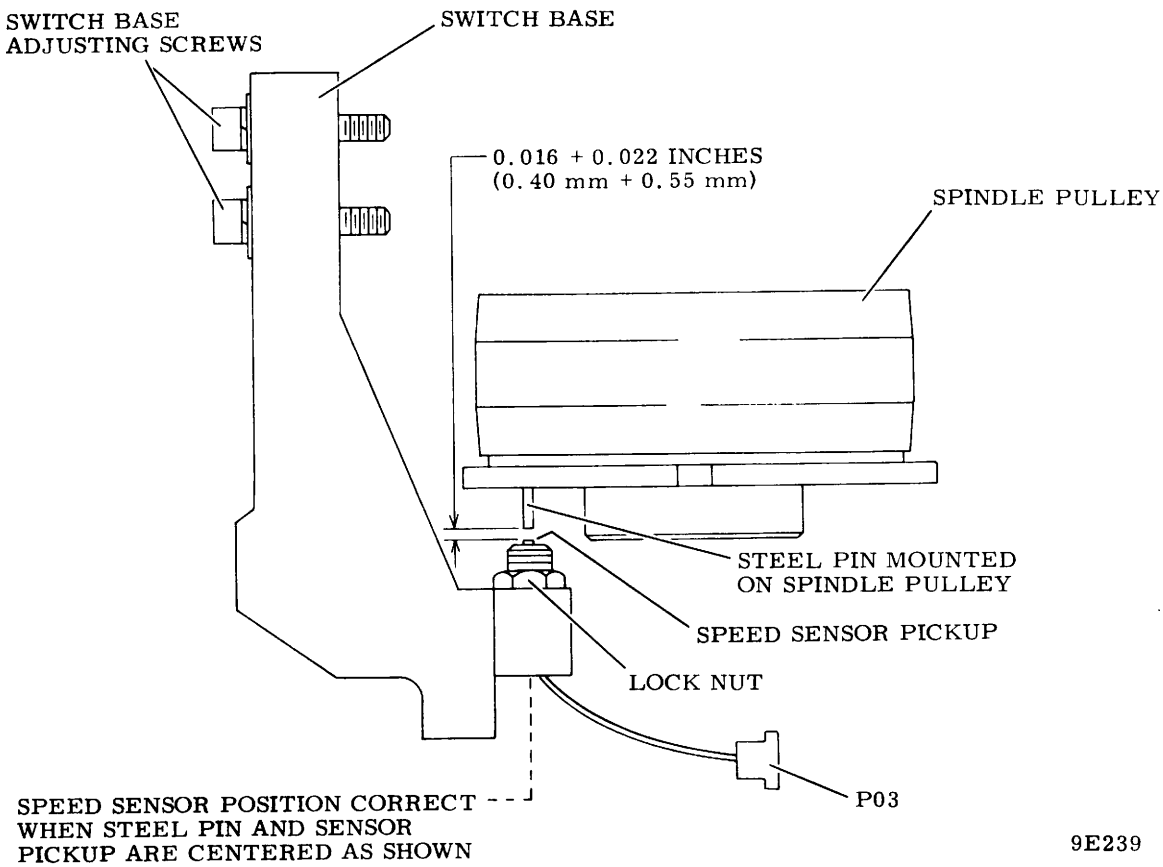


Figure 2-64.1. Speed Sensor Assembly Adjustment (S/C 09 and Above)

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).

8. Remove retaining ring and flat washer from lower end of lockshaft (refer to figure 2-65).

9. Carefully raise lockshaft out of top of spindle assembly.

10. Lower replacement lockshaft into spindle then push lockshaft down until washer and retaining ring can be snapped into place, thus securing lockshaft in spindle assembly.

CAUTION

Push downward on lockshaft making certain that it is free to move downward against internal spring force. Lockshaft must be free and not bind.

11. Position pack on switch mounting plate so that it is approximately in its normal position and tighten adjustment screw (refer to figure 2-66).

12. Position ground spring mounting bracket on pack sensor assembly, mounting block so that contact on end of spring is contacting lockshaft, then loosely secure block with two screws (refer to figure 2-68).

13. Perform pack on switch adjustment procedure steps 4 through 14.

14. Reconnect leadwire to static groundspring.

15. Perform Static Groundspring Adjustment procedure steps 4 and 5.

16. Reinstall blower assembly (refer to Blower Motor Replacement procedure step 15).

17. Close cabinet front door.

CAUTION: When spindle assembly is removed from drive or shipping container, do not allow it to rest on pulley end of assembly. When it must be set down, lay it on its side or on spindle face plate. Improper handling of spindle assembly may cause damage to spindle bearings which could result in premature failure of spindle or even damage to disks and heads.

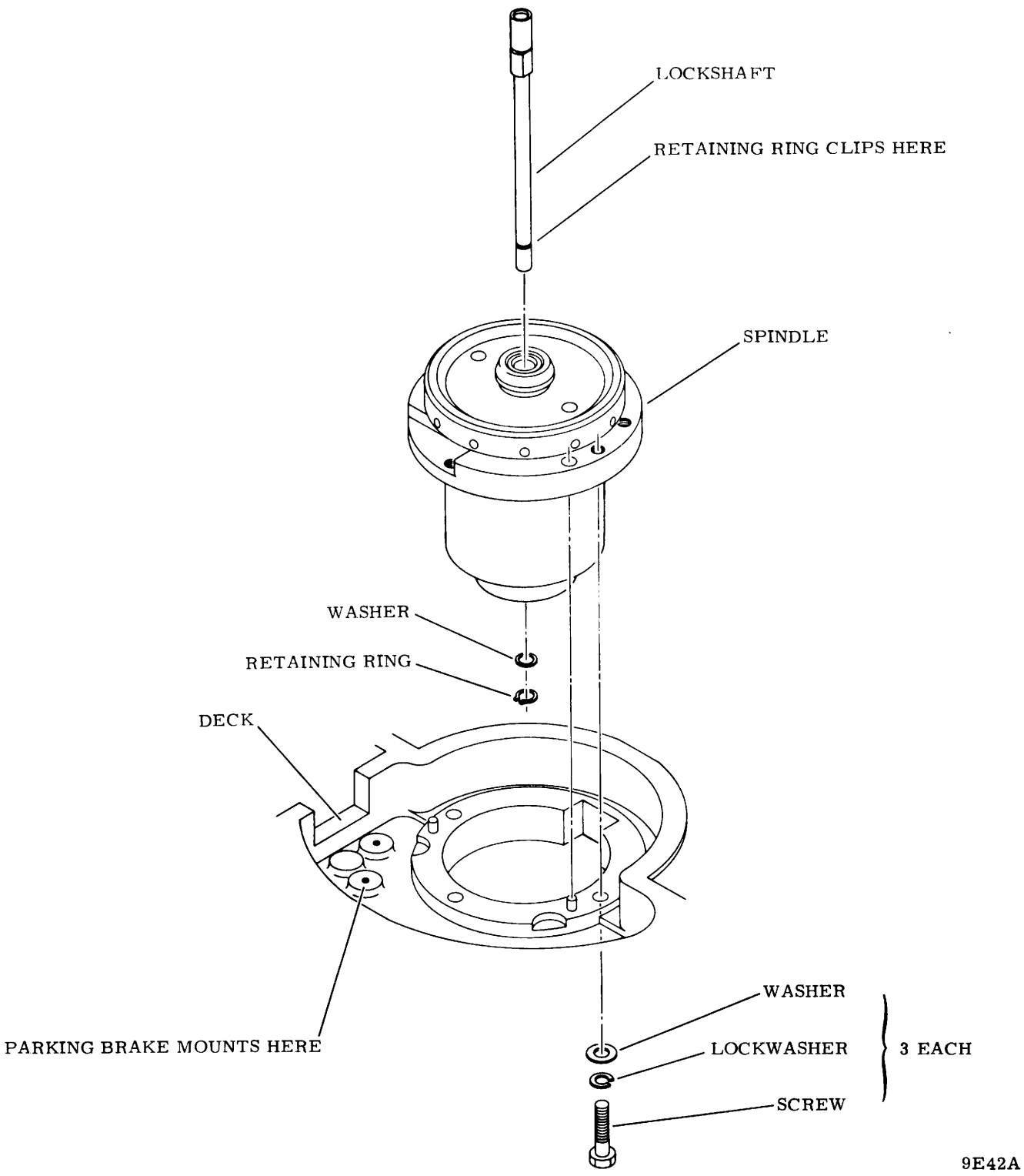


Figure 2-65. Spindle and Lockshaft Replacement

REPLACEMENT (S/C 09 & Above)

1. Remove power from drive as follows:

   a. Press START switch to stop drive motor and unload heads.

   b. Set MAIN AC circuit breaker to off.

2. Open pack access cover, remove disk pack; leave pack access cover open.

3. Open cabinet front door.

4. Remove blower assembly (refer to Blower Motor Replacement procedure step 4).

5. Refer to the following procedures for the removal of the speed sensor assembly.

   a. For S/C 08 and below, remove two screws securing groundspring mounting bracket to pack sensor assembly mounting block (refer to figure 2-67), then remove groundspring and mounting bracket. Loosen the pack-on switch mounting plate adjustment screw (refer to figure 2-65) and swing mounting plate down so it will not interfere with lockshaft removal.

   b. For S/C 09 and above, remove pack sensor assembly (refer to figure 2-57 pack sensor assembly replacement).

NOTE

In the following step, do not remove retaining ring securing spring on 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 (refer to figure 2-65).

7. Carefully raise lockshaft out of top of spindle assembly.

8. Lower replacement lockshaft into spindle then push lockshaft down until washer and retaining ring can be snapped into place, thus securing lockshaft in spindle assembly.

CAUTION

Push downward on lockshaft making certain that it is free to move downward against internal spring force. Lockshaft must be free and not binding.

9. The following procedure is for the reinstalling the speed sensor assembly.

   a. For S/C 08 and below, position pack on switch mounting plate so it is approximately in its original position and tighten the adjustment screw (refer to figure 2-65). Replace groundspring and mounting bracket.

   b. For S/C 09 and above, reinstall pack sensor assembly (refer to pack sensor assembly replacement).

10. Perform pack on switch adjustment procedure steps 4 through 14.

11. Reconnect leadwire to static groundspring.

12. Perform Static Groundspring Adjustment procedure steps 4 and 5.

13. Reinstall blower assembly (refer to Blower Motor Replacement procedure step 15).

14. Close cabinet front door.

CAUTION

When spindle assembly is removed from drive or shipping container, do not allow it to rest on pulley end of assembly. When it must be set down, lay it on its side or on spindle face plate. Improper handling of spindle assembly may cause damage to spindle bearings which could result in premature failure of spindle or even damage to disks and heads.

SPINDLE ASSEMBLY REPLACEMENT

The spindle assembly (refer to figure 2-65) includes the spindle, and lockshaft. It is removed from the top of the deck with the pack sensor assembly still attached. The pack sensor assembly is then transferred to the replacement spindle and they are both replaced in the drive. The spindle must be realigned to the carriage following a spindle replacement and this is covered in the Spindle to Carriage Alignment procedure.

1. Remove power from drive as follows:

   a. Press START switch to stop drive motor and unload heads.

   b. Set MAIN AC circuit breaker to off.

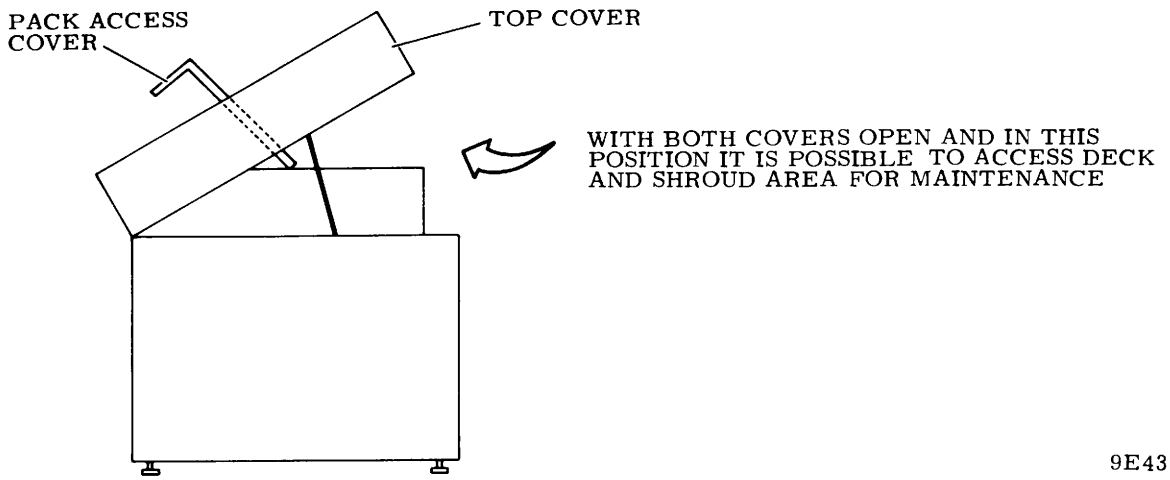


Figure 2-66. Cabinet With Pack Access and Top Covers Open

2. Remove disk pack.

3. Open drive cabinet front door.

4. Remove blower assembly (refer to Blower Motor Replacement procedure step 4).

5. Identify leadwires to pack on switch and static groundspring then disconnect leadwires.

6. Disconnect speed sensor plug A3P3.

7. Open cabinet rear door.

8. Remove drive belt as follows (refer to figure 2-44).

   a. Remove idler springs.

   b. Move motor mounting plate towards spindle to relieve tension from drive belt off pulleys and set aside.

9. Remove parking brake assembly as follows (refer to figure 2-58):

   a. Open pack access cover.

   b. Remove six screws and washers securing brake cover to shroud then remove cover and set aside.

c. Remove two screws securing parking brake assembly to deck casting then remove and set assembly aside.

10. Remove spindle assembly as follows (refer to figure 2-65):

    a. Remove three screws and washers (located under deck(securing spindle assembly to deck.

CAUTION

When removing spindle, use care not to damage pack sensor assembly.

    b. Lift spindle assembly straight up and off from dowel pins and remove from drive.

NOTE

In step c position pack sensor assembly so pack on switch is as close as possible to dimensions shown on figure 2-56. This minimizes final adjustment when spindle is replaced in drive.

    c. Remove pack sensor assembly from old spindle assembly and install on replacement spindle assembly.

NOTE

Ensure mating surfaces of spindle and deck are clean.

11. Lower replacement spindle into position on deck orienting pack sensor assembly toward drive motor and fitting spindle over pins in deck.

NOTE

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

12. Secure spindle assembly to deck using three screws and washers. Leave screws loose enough to allow lateral movement of spindle to carriage alignment.

13. Perform Spindle to Carriage Alignment procedure steps 4 through 22.

NOTE

Apply Loctite Primer, Grade N, and Loctite Grade C to screws used in step 14.

14. Secure parking brake to deck using two screws.

15. Perform Parking Brake Adjustment procedure steps 4 through 14.

16. Replace drive belt as follows:

    a. Position drive belt on drive motor pulley then move drive motor mounting plate towards spindle and slip drive belt around spindle pulley.

    b. Install idler springs.

    c. Manually rotate spindle to seat drive belt.

    d. Close rear door.

17. Perform Pack On Switch Adjustment procedure steps 4 through 14.

18. Replace ground lead on static ground-spring and perform Static Ground Spring Adjustment procedure steps 4 and 5.

19. Reconnect speed sensor cable plug P3.

20. Perform Speed Sensor Adjustment procedure steps 4 through 7.

21. Reinstall blower assembly (refer to Blower Motor Replacement procedure step 15).

22. Close cabinet front door.

23. Perform Speed Sensor Output Check procedure.

SPINDLE TO CARRIAGE ALIGNMENT

This adjustment is required whenever the spindle is loosened from the deck casting. A similar adjustment must be made when the actuator is loosened from the deck; however, this is described in the Actuator Replacement procedure.

The spindle and carriage are properly aligned when carriage motion is along a radial line from the axis of rotation of the spindle assembly. The following describes spindle to carriage alignment.

1. Remove power from drive as follows:

    a. Press START switch to stop drive motor and unload heads.

    b. Set MAIN AC circuit breaker to off.

2. Remove disk pack.

3. Raise top cover, then open pack access cover as far as possible (refer to figure 2-66).

4. Remove heads from surface position 17 and 18 as instructed in Head-Arm Replacement procedure steps 5, 6 and 7.

5. Install and position carriage alignment arm as follows (refer to figure 2-67):

   a. Install carriage alignment arm in surface position 18 and at an angle approximately parallel to the deck. Torque clamp screw to 4(±1/2) inch-pounds.

   b. Slowly extend carriage until heads load, then forward until carriage alignment arm clears edge of spindle and is positioned approximately over spindle hub.

   c. Loosen head-arm clamp screw, and tilt carriage alignment arm downward until it aligns with spindle hub as shown in figure 2-67, then torque clamp screw to 4(±1/2) inch-pounds.

   d. Close top cover thus allowing pack access cover to fully open.

6. Check to see if clearance between carriage alignment arm and spindle post is as specified in figure 2-67. If clearance is not as specified, proceed to step 7. If clearance is as specified, proceed to step 20.

7. Raise top cover so that covers are as shown in figure 2-66.

8. Unload heads and remove carriage alignment arm.

9. Close top cover allowing pack access cover to fully open.

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

11. Raise top cover so that covers are as shown in figure 2-66.

12. Install and position carriage alignment arm as instructed in step 5.

13. Close top cover allowing pack access cover to fully open.

14. Loosen three screws securing spindle to deck thus allowing lateral movement of spindle assembly.

NOTE

If specified clearance is obtained in step 15, proceed to step 17. However, if it is too far out of alignment to be adjusted in this manner, it will be necessary to move the actuator housing to obtain the proper clearance. In this case proceed to step 16.

15. Using spindle adjustment tool, move spindle to obtain clearance specified in figure 2-67.

16. Align spindle to carriage by moving actuator housing as follows:

   a. Move spindle until dowel pins (refer to 2-67) are centered in spindle slots, then tighten three screws securing spindle to deck.

   b. Raise top cover so that covers are as shown in figure 2-66.

   c. Unload heads and remove carriage alignment arm.

   d. Close pack access and top covers.

NOTE

Upon completion of step e, spindle to carriage alignment will have been performed. Therefore, do not complete steps 17 through 24 of this procedure.

   e. Perform Actuator Assembly Replacement procedure except that instead of replacing the actuator housing in steps 17, 18 and 19 only loosen the screws securing it to the deck.

17. Secure spindle by tightening three spindle screws.

18. Recheck clearance and if it is incorrect, repeat steps 14 and 15 until proper clearance is obtained.

19. Raise top cover so that covers are as shown in figure 2-66.

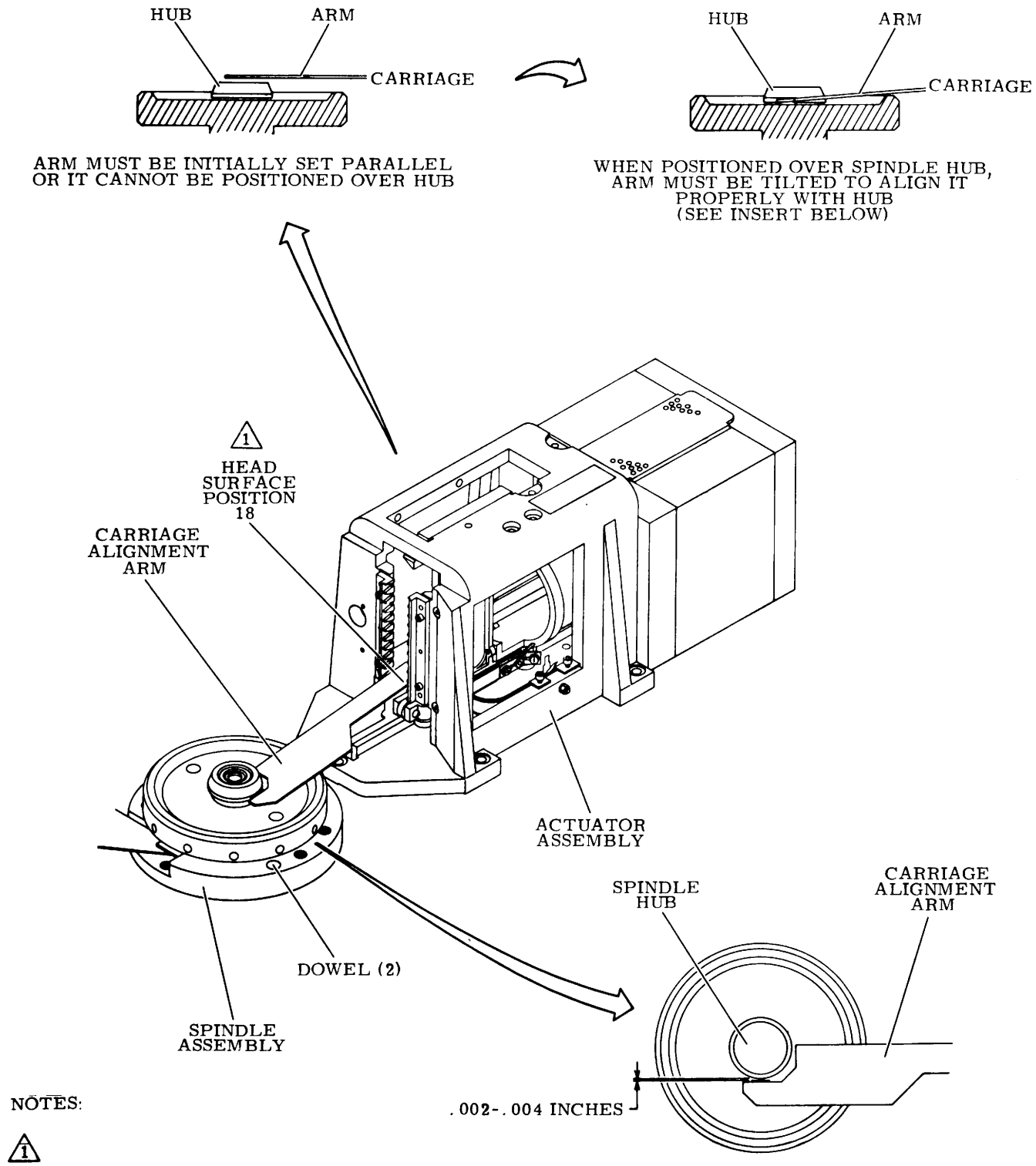
20. Unload heads and remove carriage alignment arm.

21. Replace heads (removed in step 4) as instructed in Head-Arm Assembly Replacement procedure step 9.

22. Close top cover allowing pack access cover to fully open.

23. Replace parking brake cover using six screws and washers.

24. Perform Head Alignment procedure for heads in surface positions 17 and 18.



NOTES:

1. HEADS 17 AND 18 ARE REMOVED. ALL OTHER HEADS WILL REMAIN IN POSITION ALTHOUGH NOT SHOWN IN THIS ILLUSTRATION

9E44

Figure 2-67. Spindle to Carriage Alignment

STATIC GROUNDSPRING REPLACEMENT

The static groundspring is mounted on the staticgroundspring mounting bracket which in turn is mounted on the pack sensor assembly.

This procedure describes removal and replacement of the groundspring from its mounting bracket. Adjustment is required following replacement and this is described in the Static Groundspring Adjustment procedure.

REPLACEMENT (S/C 08 & Below)

1. Remove power from drive as follows:
   a. Press START switch to stop drive motor and unload heads.
   b. Set MAIN AC circuit breaker to off.
2. Remove disk pack.
3. Remove blower assembly. (Refer to Blower Motor Replacement procedure steps 3 and 4).
4. Refer to figure 2-68 and remove static groundspring leadwire from terminal on groundspring.
5. Remove static groundspring from its mounting block and set aside.
6. Install replacement groundspring on static groundspring mounting block.
7. Replace static groundspring leadwire to groundspring terminal.
8. Perform Static Groundspring Adjustment procedure starting at step 4.

REPLACEMENT (S/C 09 & Above)

1. Stop spindle motor.
2. Remove disk pack.
3. Set UNIT POWER circuit breaker to OFF.
4. Refer to Side Panel Removal/Installation procedure and remove left (viewed from front) side panel.
5. Refer to figure 2-68.1 and remove static groundspring leadwire.
6. Remove self threaded screw, lockwasher, terminal lug, and groundspring from switch base bracket.

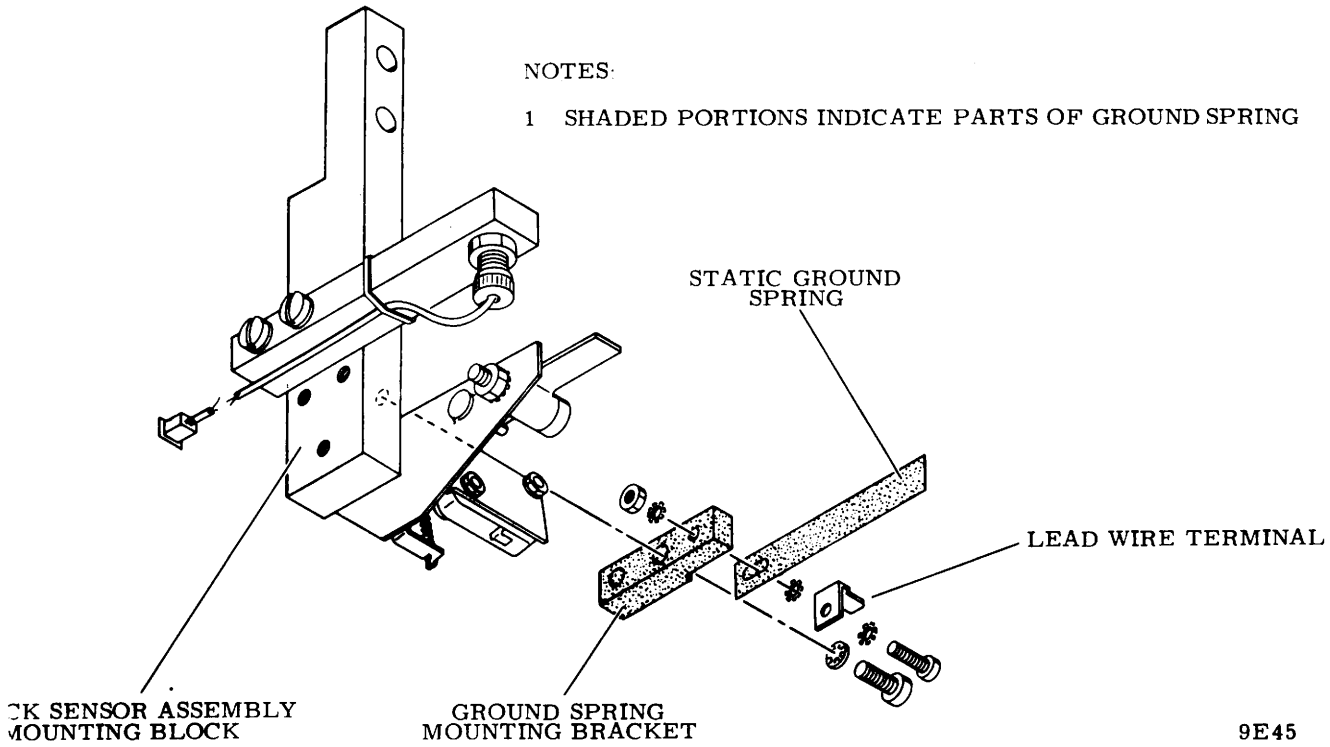


Figure 2-68. Static Groundspring Replacement (S/C 08 and Below)

7. Install replacement groundspring on switch base bracket using screw, lockwasher, and terminal lug.

8. Perform Static Groundspring Adjustment procedure.

9. Connect groundspring leadwire.

10. Install side panel per Side Panel Removal/Installation procedure.

STATIC GROUNDSPRING ADJUSTMENT

This adjustment properly positions the static groundspring in relation to the lockshaft. A check is also made to ensure the groundspring has the correct tension.

ADJUSTMENT (S/C 08 & Below)

1. Remove power from drive as follows:

   a. Press START switch to stop drive motor and unload heads.

   b. Set MAIN AC circuit breaker to off.

2. Remove disk pack.

3. Remove blower assembly (refer to Blower Motor Replacement procedure steps 3 and 4).

4. Refer to figure 2-68 and check that static groundspring is approximately centered vertically and on lockshaft (refer to figure 2-69). If spring is not centered, loosen screw securing spring to its mounting bracket, center spring as required then tighten screw.

5. Check static groundspring tension as follows:

   a. Place 0.002 - 0.005 inch non metallic feeler gage between groundspring and lockshaft.

   b. Hook push pull gage to outer end of groundspring and note force required to allow feeler gage to fall free. Force should be from 100 to 150 grams.

   c. If requirements of step b are not met, carefully bend groundspring to adjust tension.

6. Replace blower assembly (refer to Blower Motor Replacement procedure step 15).

7. Close cabinet front door.

ADJUSTMENT (S/C 09 & Above)

1. Stop spindle motor.

2. Remove disk pack.

3. Set UNIT POWER circuit breaker to OFF.

4. Refer to Side Panel Removal/Installation procedure and remove left (viewed from front) side panel.

5. Refer to figure 2-68.1 and visually check that groundspring is approximately centered on lockshaft.

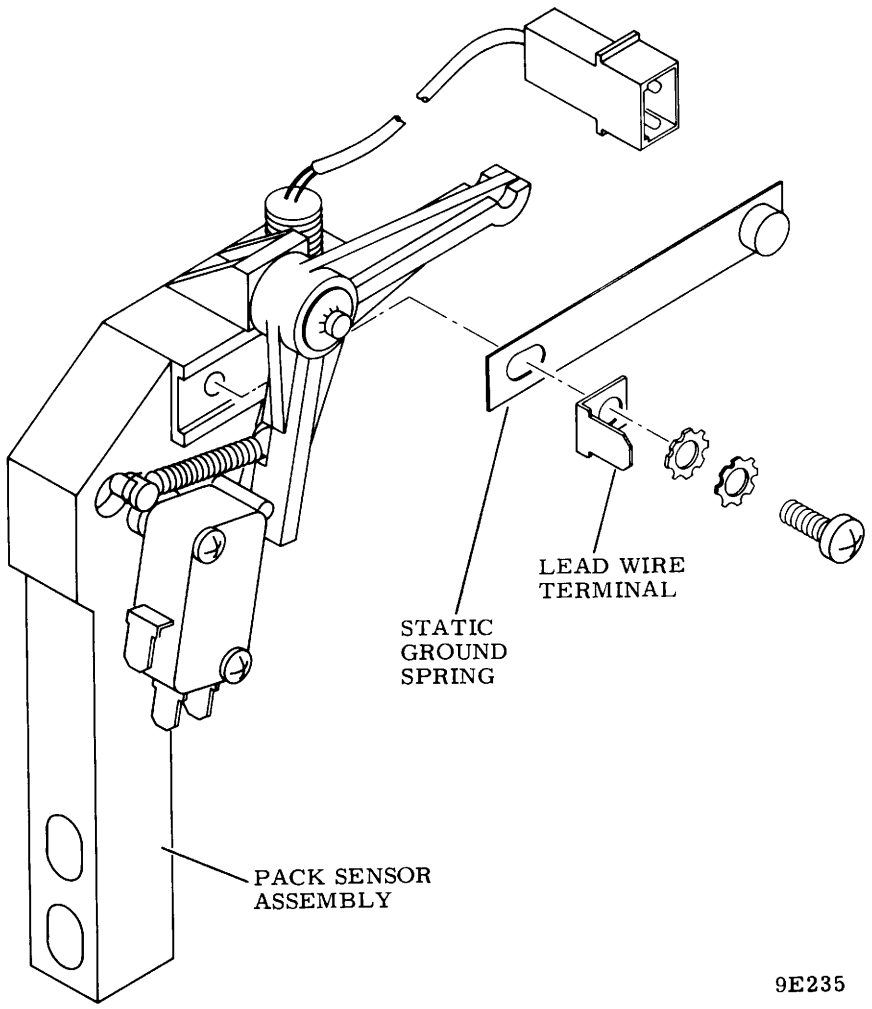


Figure 2-68.1. Static Groundspring Replacement (S/C 09 and Above)

6. If required, loosen screw securing groundspring to mounting bracket and center spring as required. Tighten screw.

7. Place a 0.019 +0.003 inch non-metallic feeler gage between groundspring and lockshaft.

8. Hook a push-pull gage to outer end of groundspring.

9. Force (applied perpendicular to spring) required to allow feeler gage to fall free should be 125 (±25) grams.

10. If required adjust set screw in switch base bracket for proper spring tension.

11. Install side panel per Side Panel Removal/Installation procedure.

VELOCITY TRANSDUCER ASSEMBLY REPLACEMENT

The velocity transducer assembly consists of the coil housing, transducer core and the extension rod (refer to figure 2-70).

The coil housing is secured to the magnet assembly while the transducer core (located inside the coil housing) is connected to the carriage by the extension rod. As the carriage is moved to position the head-arm assemblies, the transducer core and extension rod move with it. The following describes replacement of the transducer coil housing and core.

1. Remove power from drive as follows:

   a. Press START switch to stop drive motor and unload heads.

   b. Set MAIN AC circuit breaker to off.

2. Remove disk pack.

3. Open cabinet top cover and remove deck cover.

4. Disconnect yellow voice coil leadwire.

5. Remove transducer coil and core assembly as follows:

   a. Manually move carriage forward until end of extension rod can be unthreaded from carriage (refer to figure 2-70). However, do not remove transducer core and rod until instructed to do so.

   b. Remove Velocity transducer cable plug P4.

   c. Remove two screws and washers securing Velocity transducer end cap to magnet and remove end cap.

   d. Carefully remove coil housing and transducer core (connected to extension rod) from magnet and set aside.

CAUTION

Transducer core can be rendered unusable if it comes in contact with a ferro magnetic object.

6. Carefully remove replacement coil and core from shipping container and set on a non-ferrous surface.

7. Determine which end of replacement transducer core that is to be connected to extension rod as follows:

NOTE

Replacement transducer core should have a red dot or stripe at one end indicating that end is the north pole of the core. Therefore, the unmarked end is the core's south pole. The unmarked end (south pole) always connects to the extension rod. Whether or not core has a marked end, always check replacement core to determine polarity.

   a. Place end of replacement transducer core (end without red marking if it is marked) next to end of defective transducer core which is connected to extension rod. If cores repel each other, this is the end of replacement transducer core that connects to extension rod. If cores attract each other, opposite end connects to extension rod.

   b. After determining which end of replacement transducer core to connect to extension rod, place replacement transducer core on a non ferrous surface.

CAUTION

Extension rod must be grasped at end nearest transducer core when separating or connecting the two.

8. Carefully unthread extension rod from defective transducer core assembly and set defective transducer core aside.

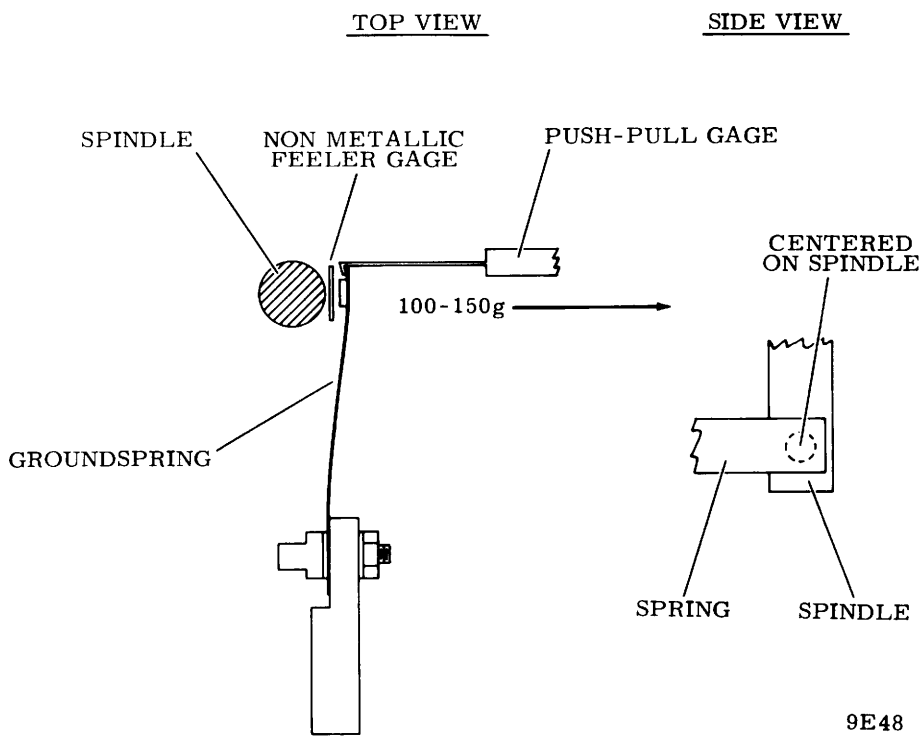


Figure 2-69. Static Groundspring Adjustment

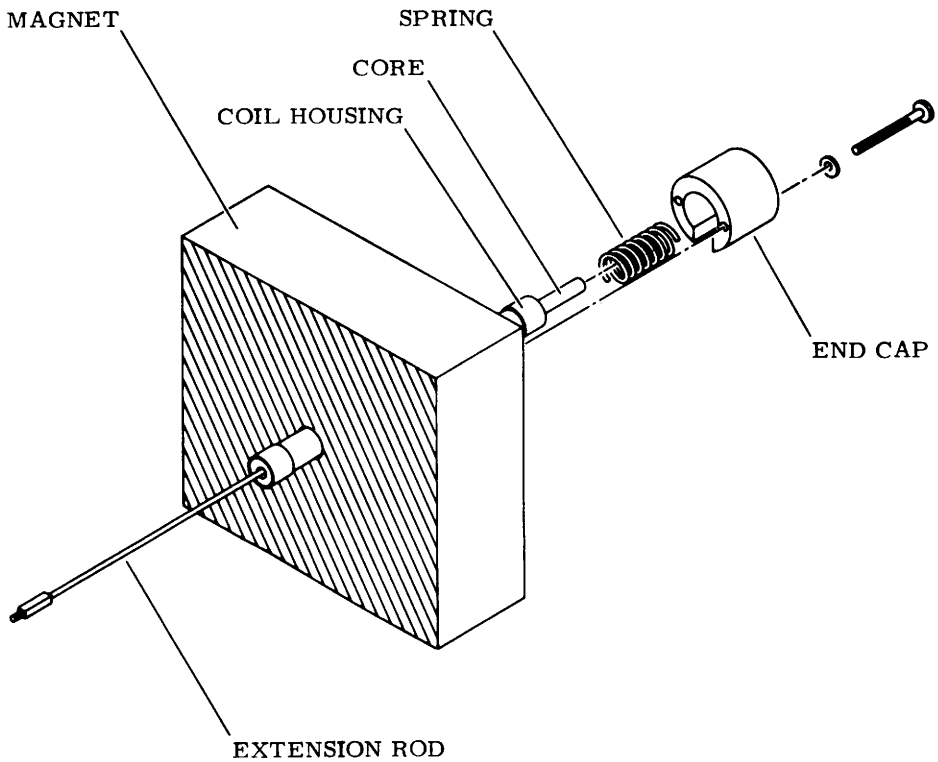


Figure 2-70. Velocity Transducer Replacement

NOTE

Apply one drop of Loctite, Grade C, to end of extension rod connecting to transducer core.

9. Thread extension rod into end of transducer core observing that polarity of replacement core is same as old transducer core. Wipe off excess Loctite.

10. Insert replacement transducer core and extension rod into replacement coil housing unit core is completely contained in housing.

11. Install replacement transducer core and coil housing in magent as follows:

    a. Insert replacement coil housing, containing transducer core and extension rod, into magnet.

    b. Position velocity transducer end cap and spring on magnet, then secure end cap to magnet with two screws and washers.

    c. Apply one drop of Loctite, Grade C, to extension rod threads, then thread extension rod into carriage.

    d. Connect velocity transducer cable plug P4.

12. Manually move carriage back to retracted stop.

13. Install scratch disk pack.

14. Set MAIN AC circuit breaker to on.

15. Ensure velocity transducer output has proper polarity by performing following check:

    a. Open cabinet rear door.

    b. Open logic chassis and remove card cover.

    c. Connect oscilloscope channel 1 (using 10X probe) to A20 - TPE.

    d. Trigger oscilloscope positive internal.

    e. Press START switch to start drive motor.

CAUTION

Refer to Manually Positioning carriage procedure in General Maintenance section (steps 4 and 5) when performing steps f and g.

    f. Manually load heads.

    g. Manually move carriage in a forward direction and observe that oscilloscope waveform goes in a negative direction. If signal goes positive, transducer core is in backwards. In this case, remove core, turn it end for end and repeat this check.

    h. Manually retract heads as instructed in step 7 of Manually Positioning Carriage procedure in general maintenance section.

    i. Press START switch to stop drive motor and unload heads.

16. Set MAIN AC circuit breaker to off.

17. Reconnect yellow leadwire to voice coil.

18. Replace deck cover and close top cover.

19. Perform following procedures:

    a. Servo System Adjustments.

    b. Velocity Transducer Gain Uniformity Check.

VOICE COIL FLEX LEAD REPLACEMENT

The voice coil flex leads are attached between the carriage and actuator housing. They consist of flexible copper strips separated by flexible insulators. The following describes replacement and adjustment of the flex leads. Adjustment is required so they do not bind, kink or restrict carriage travel.

1. Remove power from drive as follows:

    a. Press START switch to stop drive motor and unload heads.

    b. Set MAIN AC circuit breaker to off.

2. Remove disk pack.

3. Open drive top cover and remove deck cover.

4. Remove connectors from cards E01, E02, and E03 in read/write chassis, then remove these cards and set aside.

5. Disconnect voice coil leadwire plug from voice coil connector (refer to figure 2-71).

6. Remove voice coil flex lead as follows:

    a. Remove nut, insulated screw and washers securing voice coil leads and flex lead mounting bracket to actuator housing.

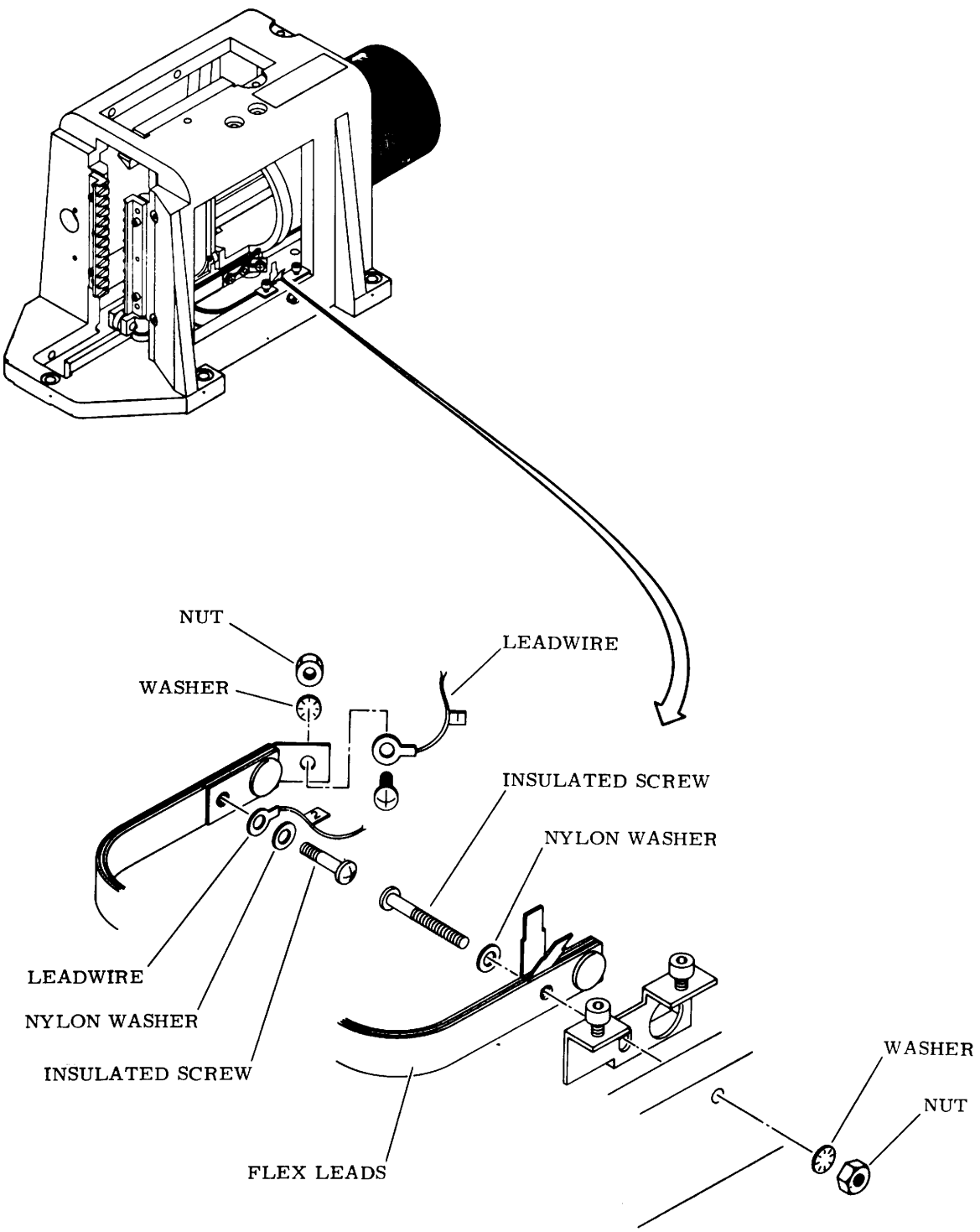


Figure 2-71. Voice Coil Flex Lead Replacement

b. Separate flex leads from mounting bracket and attaching hardware then set bracket and attaching hardware aside.

c. Position free end of flex leads out of actuator housing.

d. Manually extend carriage until end of flex leads attached to carriage is easily accessed.

e. Disconnect number one leadwire by removing screw nut and washer securing it to flex lead.

f. Remove insulated screw and nylon washer securing number two leadwire, flex leads and backing plate to carriage.

g. Remove voice coil flex heads and backing plate from actuator housing and set aside.

CAUTION

Handle replacement flex leads carefully, do not bend or twist them. Also ensure that flex lead copper strips are parallel when installation is complete.

7. Install replacement voice coil flex leads as follows:

a. Position flex leads inside actuator housing as shown in figure 2-70, only with mounting bracket not in place.

NOTE

Apply one drop of Loctite, Grade C, to screws used in steps b, c and d.

b. Secure number 2 leadwire, flex lead and backing plate to carriage using insulated screw and nylon washer.

c. Secure number two leadwire to flex conductor using screw, nut and lockwasher.

d. Secure flex lead mounting bracket and flex leads to actuator housing as shown on figure 2-71.

8. Inspect and adjust voice coil flex leads as follows:

a. Ensure that number one flex lead does not touch carriage casting. If necessary, carefully bend lead until this requirement is met.

b. Ensure that copper strips are parallel. If necessary, loosen all screws and adjust copper strips until they are parallel.

c. Check that flex leads travel freely, without linking or interfering with carriage movement, through entire range of travel. If necessary, adjust mounting bracket or flex lead connections as necessary until this is the case.

9. Perform steps 5 and 6 of Clean Carriage Rails and Bearings procedure in Preventive Maintenance section.

10. Reconnect voice coil leadwires.

11. Replace cards E01, E02 and E03 in read/write chassis and reconnect connectors to them.

12. Manually move heads back to fully retracted position.

13. Replace plastic magnet shield on magnet.

14. Replace deck cover and close top cover.

SECTION 3

DIAGRAMS

DIAGRAMS

INTRODUCTION

This section contains diagrams describing all electrical circuitry and wiring contained in the drive. It also contains information concerning the interpretation of the electrical circuit and wiring diagrams. This results in the diagrams set actually containing three different types of diagrams: (1) Key to Logic (2) card, cabling, and harnessing schematics and (3) card interchangeability charts.

The diagrams set begins with the key to diagrams. These sheets contain information concerning interpretation of the actual circuit diagrams. Additional information concerning their interpretation is found in the Key to Logic section of the hardware reference manual.

The card, cabling and harnessing diagrams follow the key to diagrams and these make-up the major portion of the diagrams set. The card diagrams are schematics of the circuit cards used in the drive. The cabling and harnessing diagrams show the wiring that interconnects the cards and other circuitry contained in the drive.

Additional information concerning applicability may also be contained on the schematics themselves in the form of notes. This makes it necessary to check carefully for notes (particularly on the cover sheet of the schematics) when using the diagrams to ensure that they are interpreted correctly.

Each sheet in the diagrams has a title block containing the information shown on figure 3-1. This information is explained as follows:

- Title - Descriptive of the information contained on that sheet.
- Publication Number - Indicates the publication number is in lieu of the number usually found at the bottom of each page.
- Manual Revision Letter - Indicates the revision level of this sheet and should correspond to that indicated on the revision sheet in the front matter of this manual.
- Diagrams Revision Letter - Indicates revision level of this diagram and changes each time the diagrams changes due to engineering change order, etc.
- Card Type - Indicates the type of card containing the circuitry shown on this diagram. This is included only on the first sheet of each card type not at all on diagrams showing key to logic, card interchangeability, cabling or harnessing information.
- Card Location - Applicable only to cards located in the logic or read/write chassis, this number indicates the location of the card within the chassis.
- Cross Reference Number - Each sheet (except those in key to logic or card interchangeability charts) has a unique 3 digit cross reference number. The first two digits of this number pertain to the physical location of that circuitry within the drive. The last digit pertains to the number of sheets required to show this circuitry.
- Sheet Number - Pertains to the number of sheets required to show this circuitry and should match the last digit of the cross reference number.
- Page Number - Indicates the page number of this sheet within the manual. This number is in lieu of the number usually found at the bottom of each sheet.

Table 3-1 lists the contents of the diagrams set and includes the cross reference number, location and title of each sheet in the set. However, each title and cross reference number is listed only once. This is important to note where several sheets have the same title and cross reference number but contain different information because they apply to different units.

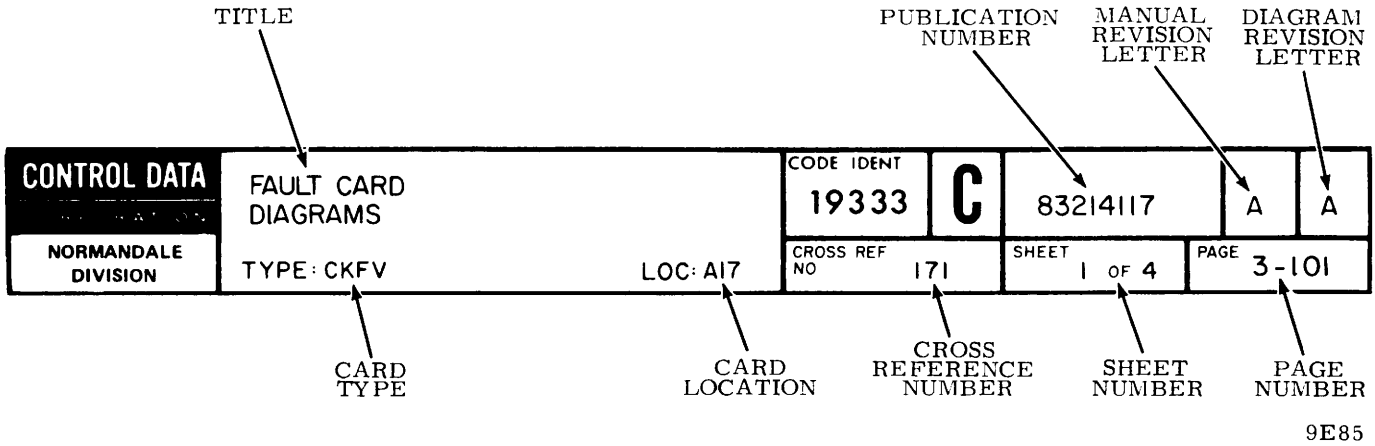


Figure 3-1. Diagram Title Block

TABLE 3-1. CONTENTS OF DIAGRAM

Cross Reference Number	Module* Location	Diagram Title
		Key to Diagrams - Chassis Map
		Key to Diagrams - Configuration Drawing
		Key to Diagrams - Intersheet Referencing
		Key to Diagrams - Logic Chassis Wirewrap Panel
		Key to Diagrams - Miscellaneous
011	A2A01	Transmitters Diagrams
012	A2A01	Transmitters II
013	A2A01	Transmitters II
021	A2A02	Receivers Diagrams
022	A2A02	Receivers I
023	A2A02	Receivers II
024	A2A02	Receivers III
025	A2A02	Receivers IV
031	A2A03	Bus In and RPS Steering Diagram
032	A2A03	Target Resister
033	A2A03	RPS Steering and Interrupt Part I
034	A2A03	RPS Steering and Interrupt Part II
041	A2A04	Bus In Multiplexers Diagrams
042	A2A04	Bus In Multiplexers I
043	A2A04	Bus In Multiplexers II
044	A2A04	Bus In Multiplexers III
061	A2A06	Access Control and Index/Sector Decode Diagrams
062	A2A06	Sector/Index Decode
063	A2A06	Reverse EOT Pulse
064	A2A06	Max Address Fault
071	A2A07	Access Control NO1 Diagrams
072	A2A07	Direction Control, Fine Latch, On Cyl and Cyl Pulses
073	A2A07	Seek FF and Seek Error Detection
074	A2A07	Servo Fault, Load FF and RTZ FF
081	A2A08	Diff Bits, Speed Enable, Mod Addressed Diagrams

Table continued on next page

TABLE 3-1. CONTENTS OF DIAGRAM (contd)

Cross Reference Number	Module* Location	Diagram Title
082	A2A08	Difference Bits
101	A2A10	Write Clock, 806 Khz to 9.67 Mhz Diagrams
102	A2A10	Power Input Pins and Unused Logic Elements
103	A2A10	Sector, Index, Ref and Write PLO Clocks
104	A2A10	Servo and Read Clocks
121	A2A12	Difference Generation and Control Diagrams
122	A2A12	Cylinder Address Register
123	A2A12	Difference Counter Generation
124	A2A12	Difference Counter Output
131	A2A13	NRZ to Compensated MFM Diagrams
132	A2A13	NRZ Data to MFM Data Part I
133	A2A13	NRZ Data to MFM Data Part II
141	A2A14	Data Latch Diagrams
142	A2A14	Analog Data to Read Data
143	A2A14	Lock to Data and Address Mark Detect
151	A2A15	Read PLO Diagrams
152	A2A15	Data Strobe Delay and Rd Data Output
153	A2A15	VCO Output
154	A2A15	Clock and Data Output
155	A2A15	Read PLO Timing Diagram
171	A2A17	Fault Card Diagrams
172	A2A17	Fault Latch and Fault Clear
173	A2A17	Pwr Up Master Clr, Maint Master Clr and Voltage Fault Detect
174	A2A17	Unit Sel, Lap Speed Xdcr, Unit Rdy Latch
181	A2A18	Fine Servo Decoder Diagrams
182	A2A18	Sensing Dibits and AGC'ed Servo Signal
183	A2A18	Track Servo Signal and Cyl Detect A and B
184	A2A18	Track Servo Signal and Cyl Detect A and B
191	A2A19	Access Control NO2 Diagrams
192	A2A19	EOT Detection

Table continued on next page

TABLE 3-1. CONTENTS OF DIAGRAM (contd)

Cross Reference Number	Module* Location	Diagram Title
193	A2A19	Fine Enable, Slope Gate, Command Offset
194	A2A19	Fwd/Rev Offset, Fine Position Signal
201	A2A20	Analog Servo Diagrams
202	A2A20	Cyl Detect, Vel and Vel Gain Adjust
203	A2A20	D/A Convertor and Desired Vel Gen
204	A2A20	Summing Amp Output and Onvecurrent Voice Coil Pwr Amp
611	A3E01	R/W Control Cabling and Diagrams
612	A3E01	Input Power Wiring and Card Voltage Control
613	A3E01	Read/Write Control
621	A3E02	Card Edge Connector and Cabling Diagrams
622	A3E02	Write Driver and Write Fault Detect
631	A3E03	Read Amp and Address Mark Detection
632	A3E03	Input Voltage Pins and Voltage Regulator
633	A3E03	Rd Amp and Adrs Mark Detection
641	A3E04	Diode Matrix and Mother Board Layout Diagrams
642	A3E04	Diode Matrix and Mother Board Schematic
651	A3E05	Hd Sel Board, Hd Plug Connectors, Cabling and Card Layout Diagrams
652	A3E05	Unused Logic Elements, Voltage Input Pins Cabling Information
653	A3E05	Hd Sel Decode, Hd Bit Enable
654	A3E05	Hd Enable and Multi Hd Sel
761	A3	Track Servo Preamp Diagrams
762	A3	Track Servo Preamp Cabling/Plug Connections
763	A3	Track Servo Preamp Schematic
771	A4	A4- Operator Control Panel Diagrams
772	A4	Fault Clr, Lap Switches, Ready Indicators
773	A4	Start Switch/Start Indicator, Start Interlock Reference Schematic
781	A3	A3- I/O Cabling

Table continued on next page

TABLE 3-1. CONTENTS OF DIAGRAM (contd)

Cross Reference Number	Module* Location	Diagram Title
782	A3	I/O Harness Wiring
783	A3	Tag Bus Decode
791	A3	A3- Misc Deck Wiring
792	A3	Vel Xdcr, Speed Sensor, S1, S4, S6, L1 and Voice Coil
801	A1	A1- Power Supply Diagrams
802	A1	Power Supply External Cabling
803	A1	AC Power, DC Circuit Breakers, Relays K6, K7, K8
804	A1	Drive Motor, Start Triacs, Local/Remote Switch
811	A1	Relay Board Power Wiring, Component Layout and Cabling
812	A1	Relay Board Schematic Part I
813	A1	Relay Board Schematic Part II
821	A1	Rectifier and Capacitor Board Component Layout
822	A1	Rectifier and Capacitor Board
831	A1	Voice Coil Power Amp Component Layout
832	A1	Voice Coil Power Amp Schematic
841	A2	A2 - 5 Volt Regulator Diagrams
842	A2	±5 Volt Regulator PC Board and A1P3
843	A2	-5 Volt Regulator Schematic
844	A2	+5 Volt Regulator Schematic

* Location Code is as follows: A1 - Power Supply, A2 - Logic Chassis, A3 - Deck, A4 - Control Panel (refer to Diagrams - Key to Diagrams for configuration drawing).

REVISION STATUS OF SHEETS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A	A	A														
B	A	B	B	A	B														
C	A	B	C	A	B														

REVISIONS

REV.	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	Released	GR		
B		EDITORIAL	SB	5-3-77	
C	PE55259	LOGIC DIAG. IMPROVEMENT	A.A.O	8-4-78	

DRAWN		
CHECKED		
ENGINEER		
APPROVED		

CONTROL DATA

NORMANDALE DIVISION

STORAGE MODULE DRIVE
KEY TO LOGIC
DIAGRAM

CODE IDENT 19333 C 83322450 J C

CROSS REF NO

SHEET 1 OF 6

PAGE 3-7

REF 83214900

1. CHASSIS MAP

KEY

FUNCTIONAL NAME / CROSS REF NO	MODULE TYPE IDENTIFIER

LOGIC CHASSIS

A01	XMTRS 011-013	_THV
A02	RCVRS 021-024	_RSV
A03	BUS IN AND RPS STEERING 031-034	_SLV
A04	BUS IN MULTIPLEXERS 041-044	_SNV
A05	NOT USED	
A06	ACCESS CNTL, INDEX/SECTOR DECODE 061-064	_LTV
A07	ACCESS CNTL NO. 1 071-074	_LVV
A08	DIFF BITS, HD REG, SPEED, UNIT SEL 081-084	_QPV
A09	NOT USED	
A10	WRT CLK 101-104	_LSV
A11	NOT USED	
A12	DIFF GEN AND CNTL 121-124	_LWV
A13	NRZ TO MFM 131-133	_LXV
A14	DATA LATCH 141-143	_LRV
A15	READ PLO 151-155 (5)	_LZV
A16	NOT USED (4)	
A17	FAULT CARD 171-174	_KFV

LOGIC CHASSIS

A18	FINE SERVO DECODE 181-184	_FRV
A19	ACCESS CONTROL NO. 2 191-194	_KGV
A20	ANALOG SERVO 201-204	_MSV

(1) READ/WRT CHASSIS

E01	RD/WRT CNTL 611-613	_PKV
E02	WRT DRVR 621-622	_PJV
E03	RD AMPLIFIER 631-633	_PHV
E04	DIODE MATRIX AND MOTHER BOARD 641-642	_XFN
E05	HD SEL 651-654	_XGN

(1)	TRACK SERVO PREAMP 761-763	_ZQN
(1)	OPERATOR PANEL 771-773	_ZYN

POWER SUPPLY

RELAY BOARD 811-813	_YFN
CAPACITOR BOARD 821-822	_YEN
POWER AMP 831-832	_ZCN

LOGIC CHASSIS

(2)	±5 VOLT REGULATOR 841-844

NOTES:

(1) LOCATED ON DECK

(2) PLUGS INTO A2PD94 FROM CARD SIDE OF LOGIC CHASSIS

3. FOR SPECIFIC CARD TYPE REFER TO CARD INTERCHANGEABILITY CHART AT BACK OF DIAGRAM SET

(4) USED FOR HEAD ALIGNMENT CARD DURING MAINTENANCE

(5) INSTALLED ONLY WITH PLO OPTION

CONTROL DATA NORMANDALE DIVISION	CHASSIS MAP	CODE IDENT 19333	C	83322450	A A
		CROSS REF NO	SHEET 2	PAGE 3-8	

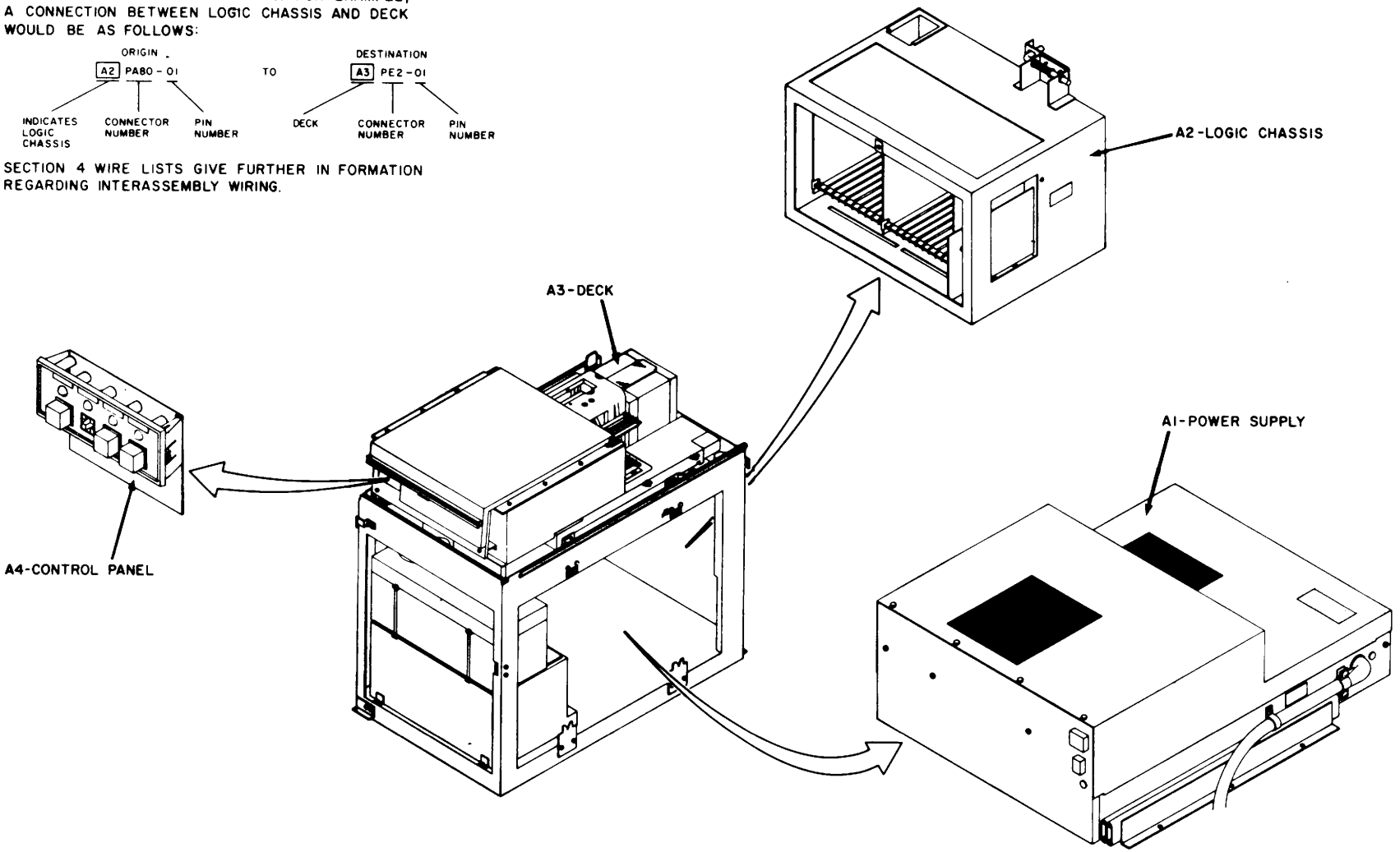
2. CONFIGURATION

DRIVE HAS FOUR MAJOR ASSEMBLIES

- A1 - POWER SUPPLY
- A2 - LOGIC CHASSIS
- A3 - DECK
- A4 - CONTROL PANEL

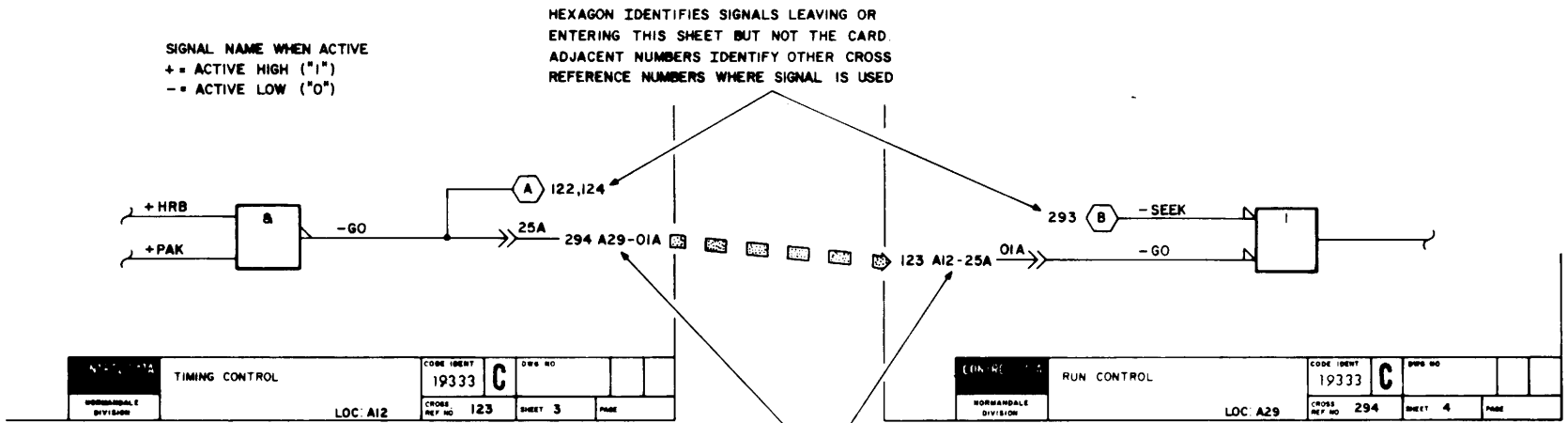
INTERASSEMBLY WIRING IS DESIGNATED ACCORDING TO THE ASSEMBLIES IT CONNECTS. FOR EXAMPLE, A CONNECTION BETWEEN LOGIC CHASSIS AND DECK WOULD BE AS FOLLOWS:

SECTION 4 WIRE LISTS GIVE FURTHER IN FORMATION REGARDING INTERASSEMBLY WIRING.

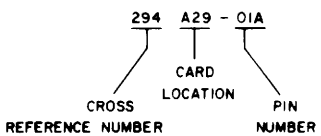


3. INTERSHEET REFERENCING

THE FOLLOWING EXPLAINS THE BASIC METHOD OF INTER-SHEET REFERENCING.

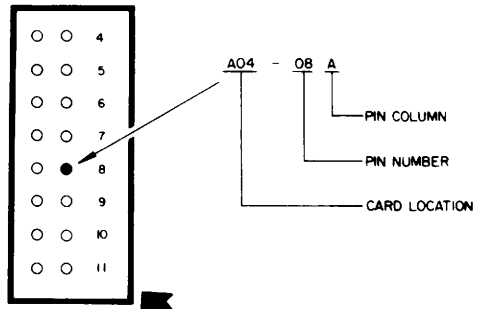


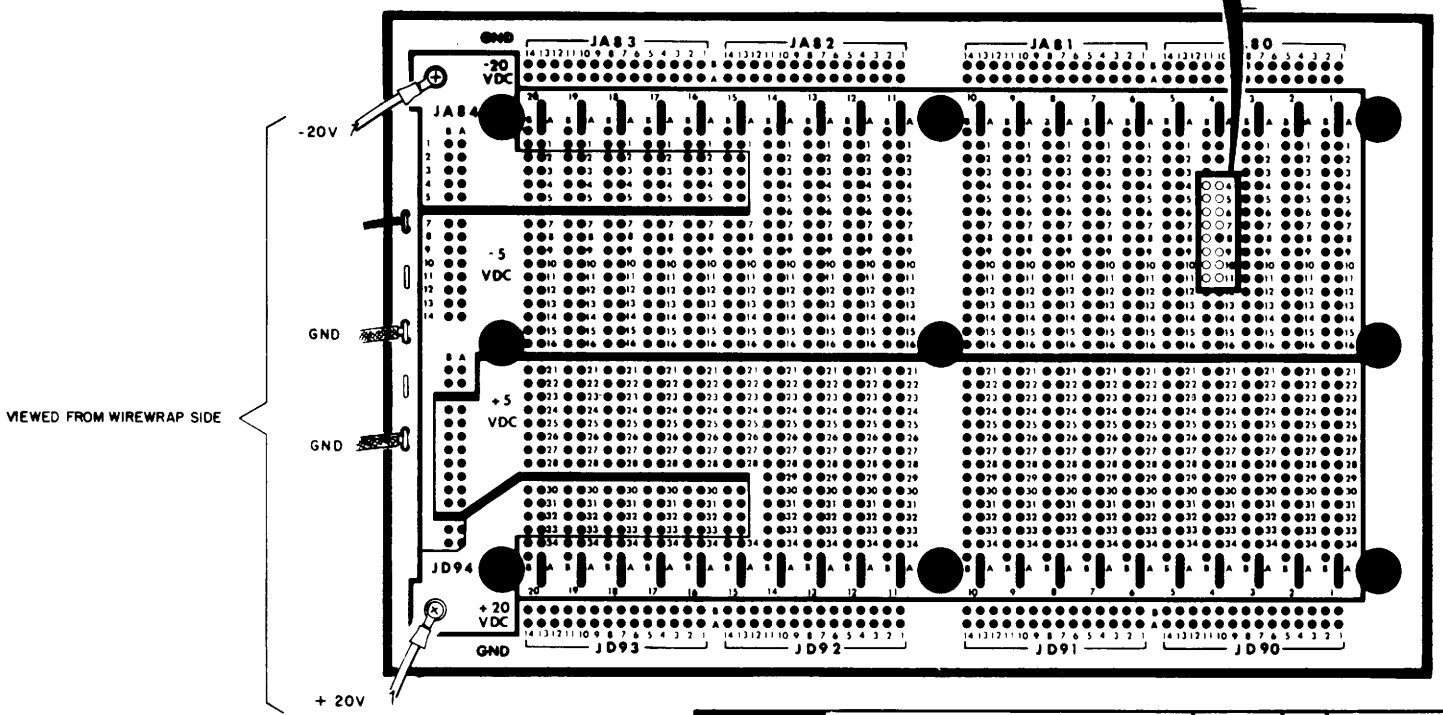
DESTINATIONS SHOW ALL LOCATIONS WHERE OUTPUT SIGNALS GO WITHOUT REGARD TO ACTUAL BACKPANEL WIRE ROUTING, IN THE EXAMPLE SHOWN IT IS AS FOLLOWS:



4. LOGIC CHASSIS WIREWRAP PANEL

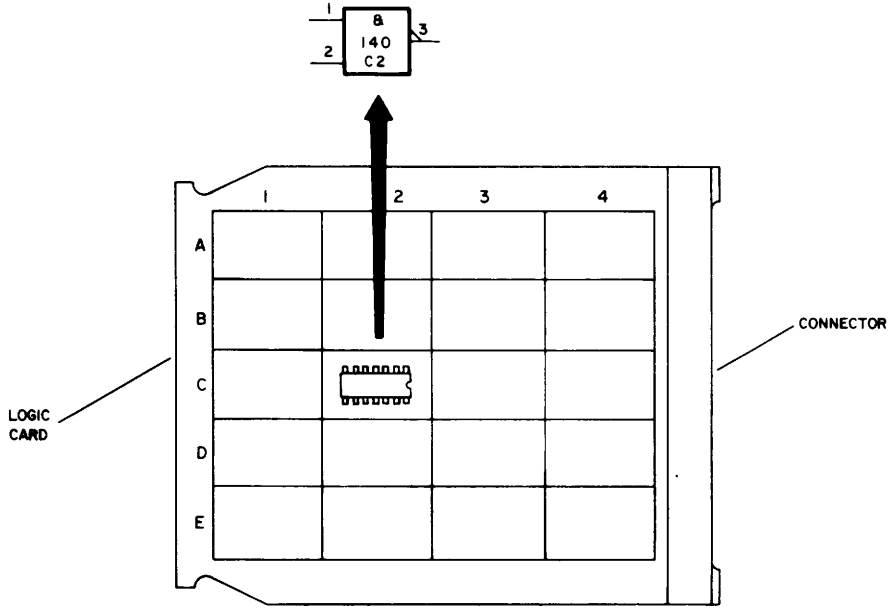
1. VOLTAGE DISTRIBUTED AS FOLLOWS:
   - +20V TO PIN 33B AT LOCATIONS A15 THROUGH A20
   - −20V TO PIN 02B AT LOCATIONS A15 THROUGH A20
   - +5V TO PIN 34B AT ALL LOCATIONS
   - −5V TO PIN 01B AT ALL LOCATIONS
2. GROUND DISTRIBUTED TO PINS 01A AND 34A AT ALL LOCATIONS
3. JA80 THROUGH JA84 AND JD90 THROUGH JD94 ARE AUXILIARY CONNECTORS USED TO CONNECT WIRE WRAP PANEL TO OTHER ASSEMBLIES.





CONTROL DATA NORMANDALE DIVISION	WIREWRAP PANEL	CODE IDENT 19333	C	83322450	A A
		CROSS REF NO		SHEET 5	PAGE 3-11

5. CARD COORDINATES



6. POWER SUPPLY CONNECTIONS

1. POWER CONNECTIONS FOR ALL INTEGRATED CIRCUITS ARE FOUND IN THE NORMANDALE CIRCUITS MANUAL.

2. POWER CONNECTIONS TO EACH LOGIC CARD ARE SHOWN ON THE COVER SHEET FOR THAT CARD

3. INTERASSEMBLY POWER CONNECTIONS ARE FOUND IN THE WIRE LISTS SECTION OF THIS MANUAL

7. GROUND CONNECTIONS

1. GROUND CONNECTIONS TO EACH LOGIC CARD ARE SHOWN ON THE COVER SHEET FOR THAT CARD

2. INTERASSEMBLY GROUND CONNECTIONS ARE FOUND IN THE WIRE LISTS SECTION OF THIS MANUAL

8. LOGIC LEVELS

TTL "1" = +3.6 (±1.6)V
"0" = +0.4 (±0.4)V

ECL "1" = +0.79 (±0.18)V
"0" = +1.95 (±0.43)V

9. SPECIAL NOMENCLATURE

ALL ABBREVIATIONS ARE DEFINED IN THE LIST OF ABBREVIATIONS WHICH IS FOUND IN THE FRONT MATTER OF THE HARDWARE REFERENCE MANUAL

10. CIRCUIT DESCRIPTIONS

DESCRIPTIONS OF DISCRETE CIRCUITS ARE FOUND IN THE HARDWARE REFERENCE MANUAL. DESCRIPTIONS OF INTEGRATED CIRCUITS ARE FOUND IN THE NORMANDALE CIRCUITS MANUAL.

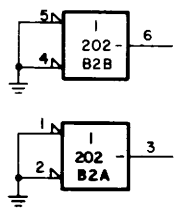
REVISION STATUS OF SHEETS

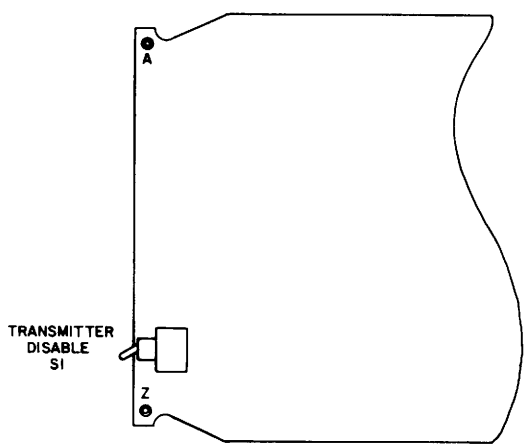
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A																	
B	A	B																	

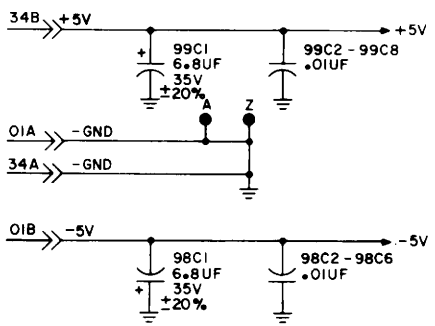
REVISIONS

REV.	ECO.	DESCRIPTION	DRFT.	DATE	CHK'D
A	PE23000	RELEASED			
B	PE22926	ERROR CORRECTION			

UNUSED LOGIC ELEMENTS

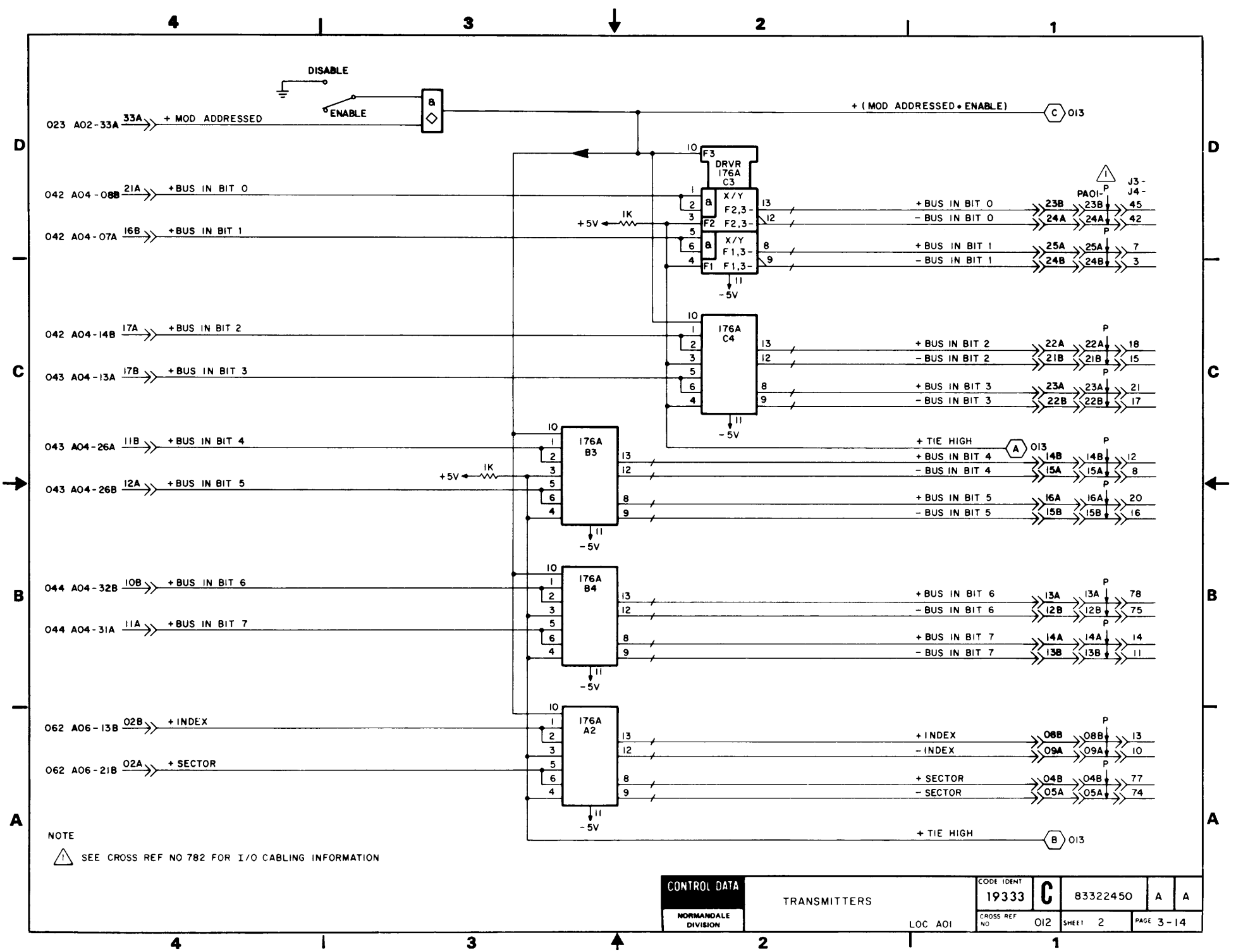




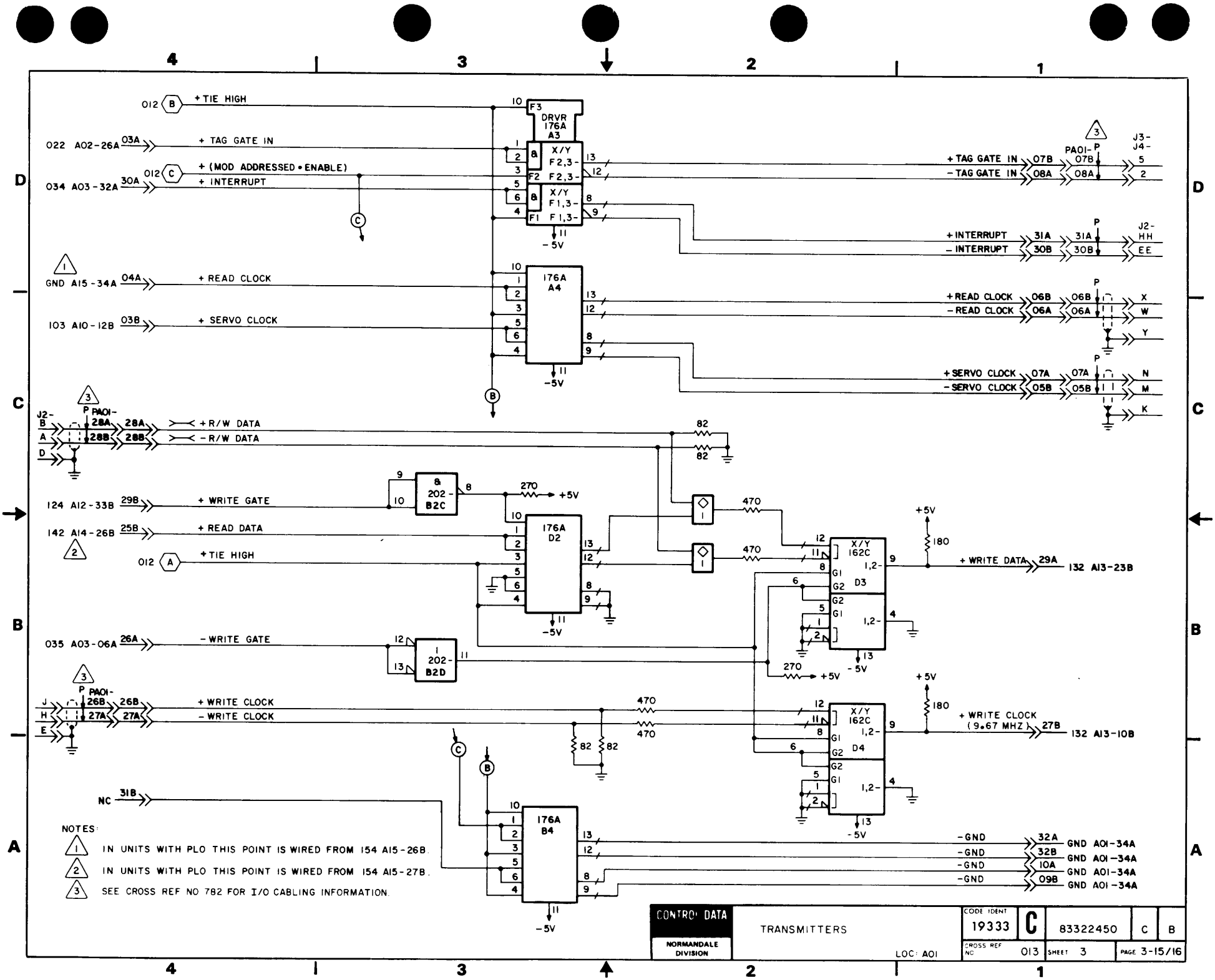


DRAWN	G RABINE	8-12-76	CONTROL DATA	TRANSMITTERS DIAGRAMS	CODE IDENT 19333	C	83322450 C B
CHECKED							
ENGINEER		8/15/76	NORMANDALE DIVISION	TYPE: BTHV LOC A01	CROSS REF NO 011	SHEET 1 OF 3	PAGE 3-13
APPROVED							

REF 83214901



CONTROL DATA NORMANDALE DIVISION	TRANSMITTERS LOC A01	CODE IDENT 19333	C	83322450	A	A
		CROSS REF NO 012		SHEET 2	PAGE 3-14	


012 B +TIE HIGH
022 A02-26A 03A + TAG GATE IN
012 C + (MOD ADDRESSED • ENABLE)
034 A03-32A 30A + INTERRUPT
DRVR 176A A3
X/Y F2,3-
X/Y F1,3-
-5V
+TAG GATE IN 07B 07B P AOI- J3- J4- 5
-TAG GATE IN 08A 08A 2
+INTERRUPT 31A 31A P J2- HH
-INTERRUPT 30B 30B EE
GND A15-34A 04A + READ CLOCK
103 A10-12B 03B + SERVO CLOCK
176A A4
+READ CLOCK 06B 06B P X
-READ CLOCK 06A 06A W
Y
+SERVO CLOCK 07A 07A P N
-SERVO CLOCK 05B 05B M
K
J2- B A D P AOI- 28A 28B +R/W DATA
-R/W DATA
82
82
124 A12-33B 29B + WRITE GATE
142 A14-26B 25B + READ DATA
012 A +TIE HIGH
202- B2C
270 +5V
176A D2
470
X/Y 162C D3
1,2-
G1
G2
+5V
180
+WRITE DATA 29A 132 A13-23B
035 A03-06A 26A -WRITE GATE
202- B2D
270 +5V
J H E P AOI- 26B 27A +WRITE CLOCK -WRITE CLOCK
82 82
X/Y 162C D4
+WRITE CLOCK (9.67 MHZ) 27B 132 A13-10B
NC 31B
176A B4
-GND 32A GND AOI-34A
-GND 32B GND AOI-34A
-GND 10A GND AOI-34A
-GND 09B GND AOI-34A
NOTES:
1 IN UNITS WITH PLO THIS POINT IS WIRED FROM 154 A15-26B.
2 IN UNITS WITH PLO THIS POINT IS WIRED FROM 154 A15-27B.
3 SEE CROSS REF NO 782 FOR I/O CABLING INFORMATION.
CONTROL DATA
NORMANDALE DIVISION
TRANSMITTERS
LOC: AOI
CODE IDENT 19333
C
83322450
C
B
CROSS REF NO 013
SHEET 3
PAGE 3-15/16

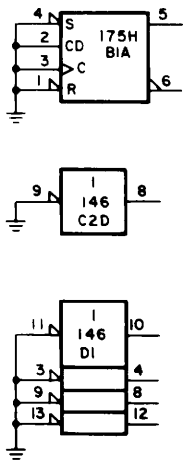
REVISION STATUS OF SHEETS

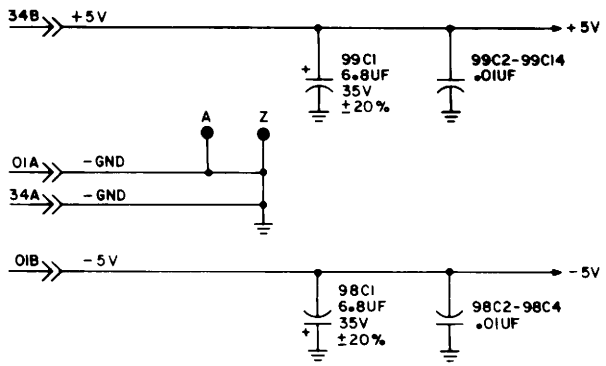
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																
B	B	B	B																

REVISIONS

REV.	ECO.	DESCRIPTION	DRFT.	DATE	CHK'D
A	PE23000	RELEASED	MA		
B	PE55259	LOGIC DIAG. IMPROVEMENT	A.A.O	8 4 78	

UNUSED LOGIC ELEMENTS

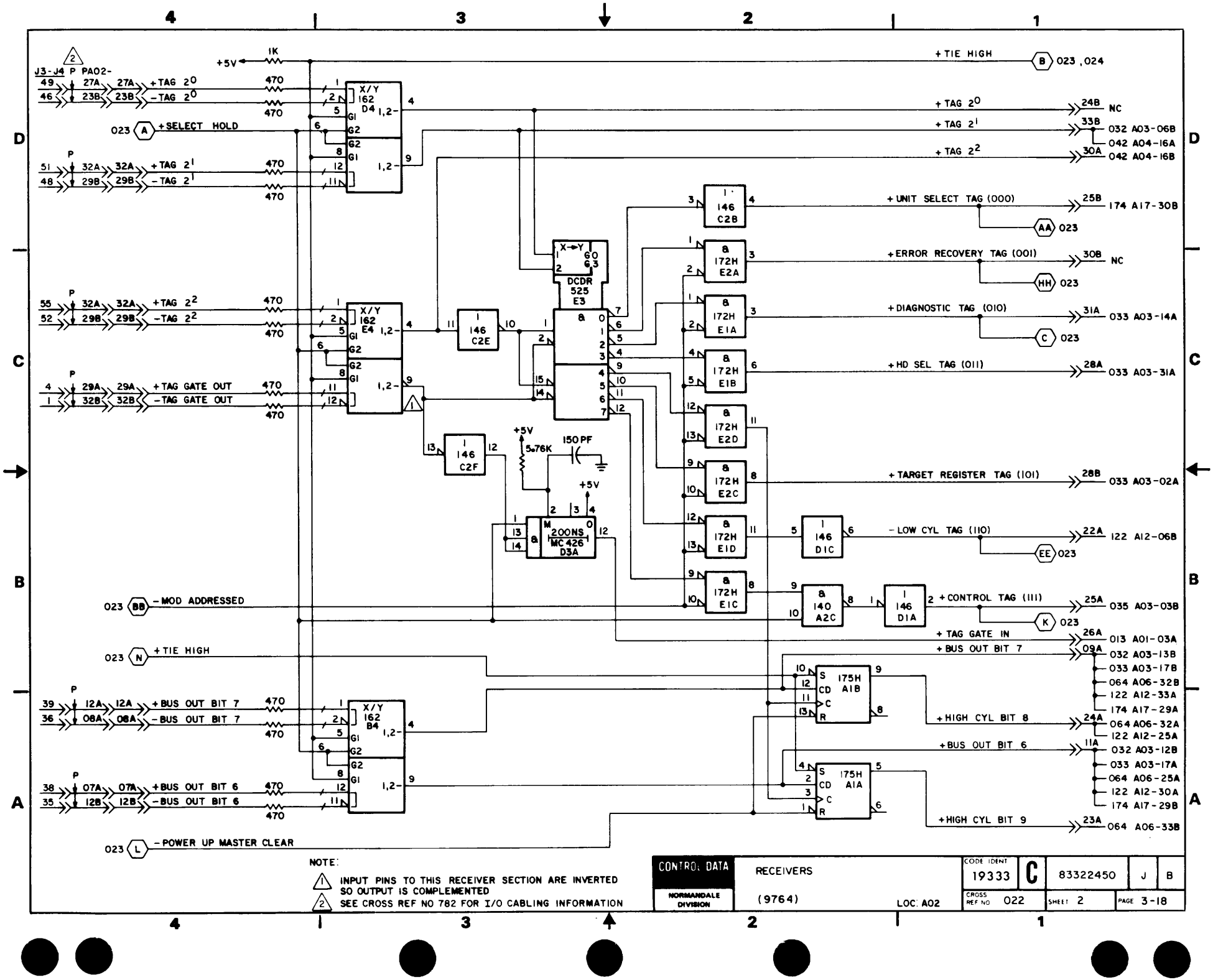




APPLICABLE ONLY TO BJ4M1 = 9764 - 1

DRAWN	S. BENTLER	11-10-76	CONTROL DATA	RECEIVERS DIAGRAMS	CODE IDENT 19333	C	83322450	J	B
CHECKED									
ENGINEER			NORMANDALE DIVISION	TYPE: ARSV LOC: A02	CROSS REF NO. 021		SHEET 1 OF 4	PAGE 3-17	
APPROVED									

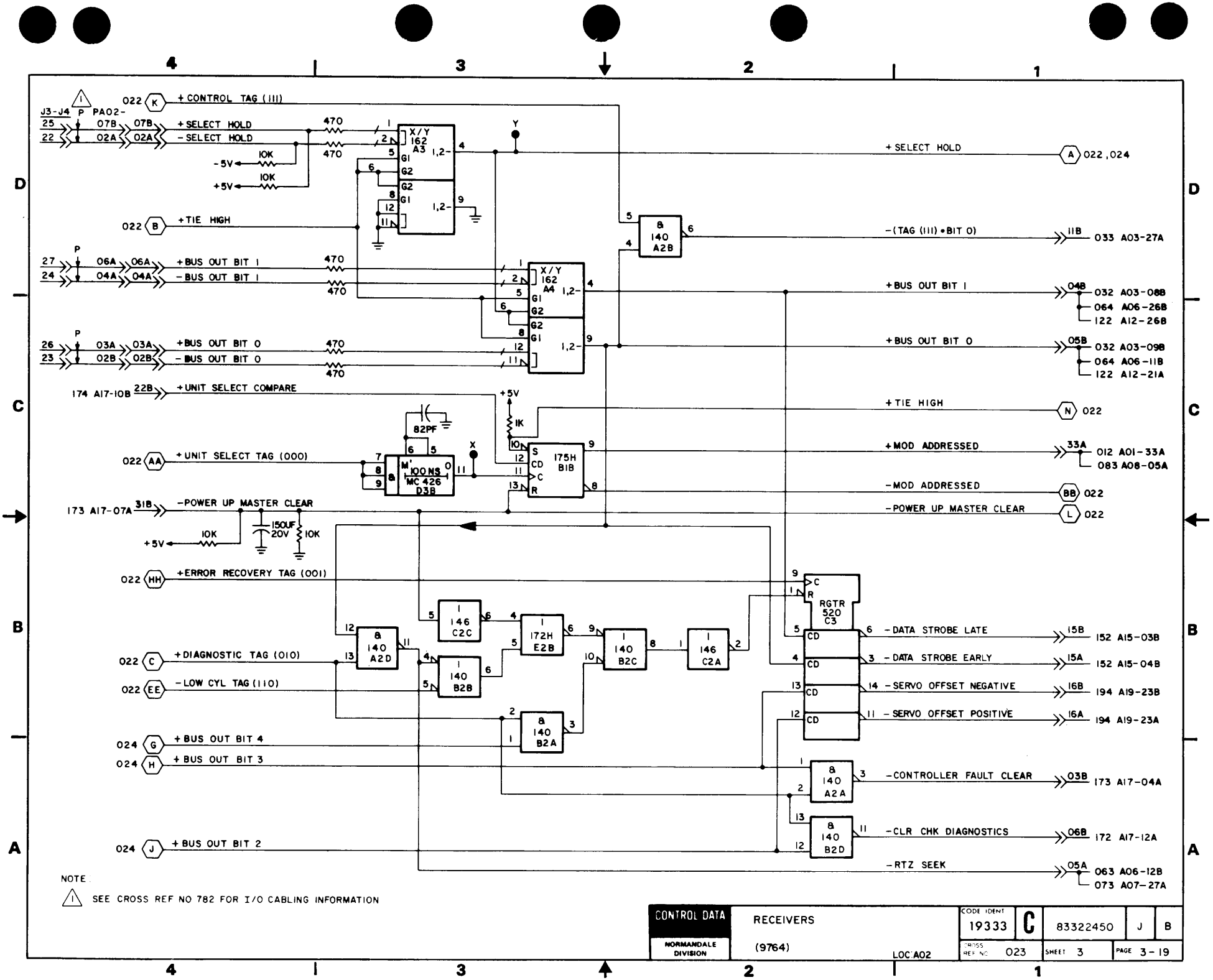
REF 83215001

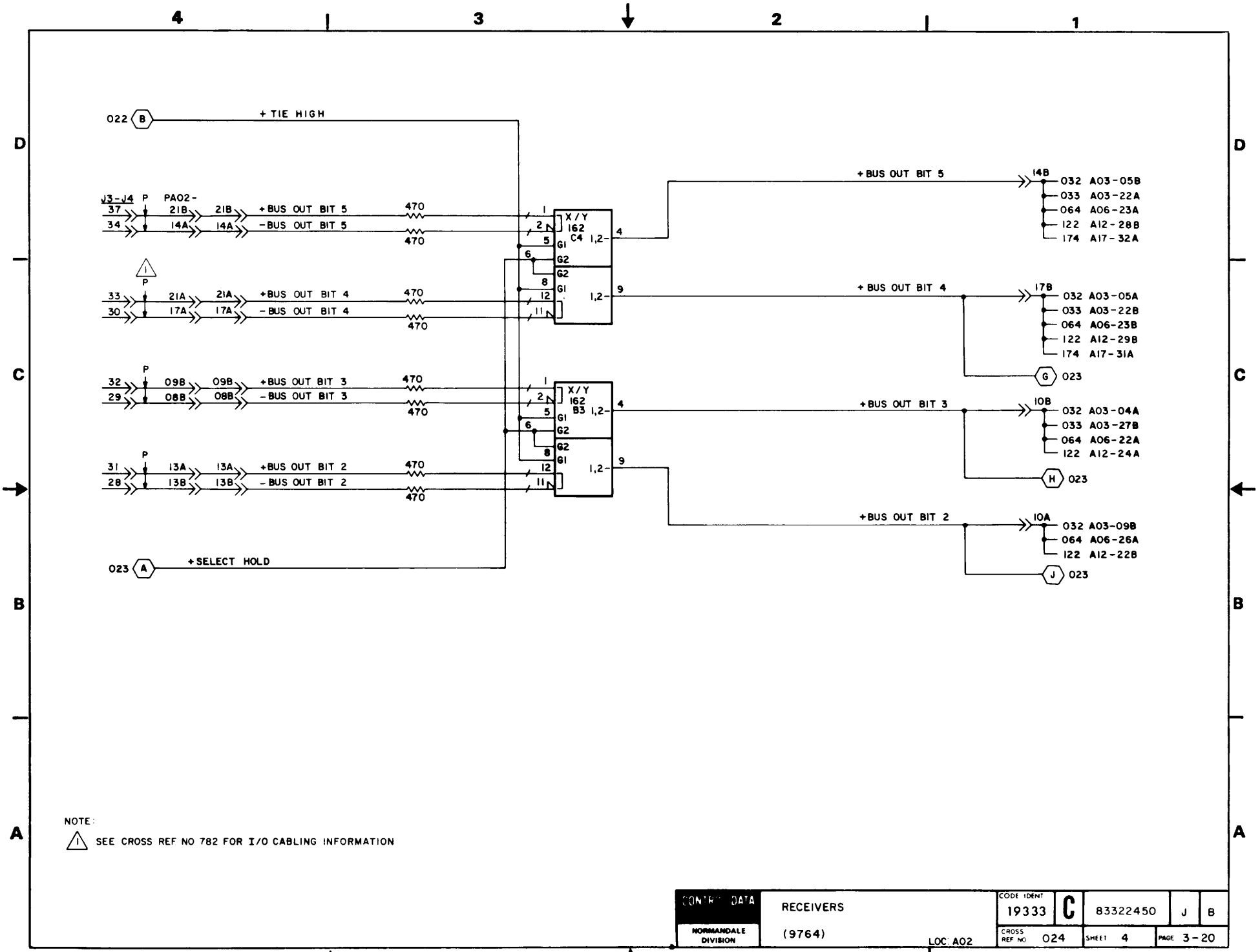


NOTE:

1. INPUT PINS TO THIS RECEIVER SECTION ARE INVERTED SO OUTPUT IS COMPLEMENTED
2. SEE CROSS REF NO 782 FOR I/O CABLING INFORMATION

CONTROL DATA NORMANDALE DIVISION	RECEIVERS (9764)	LOC: A02	CODE IDENT 19333	C	83322450	J	B
			CROSS REF NO 022		SHEET 2	PAGE 3-18	


J3-J4 P PA02-
+CONTROL TAG (111)
+SELECT HOLD
-SELECT HOLD
+TIE HIGH
+BUS OUT BIT 1
-BUS OUT BIT 1
+BUS OUT BIT 0
-BUS OUT BIT 0
+UNIT SELECT COMPARE
+UNIT SELECT TAG (000)
-POWER UP MASTER CLEAR
+ERROR RECOVERY TAG (001)
+DIAGNOSTIC TAG (010)
-LOW CYL TAG (110)
+BUS OUT BIT 4
+BUS OUT BIT 3
+BUS OUT BIT 2
-(TAG (111) • BIT 0)
+MOD ADDRESSED
-MOD ADDRESSED
-DATA STROBE LATE
-DATA STROBE EARLY
-SERVO OFFSET NEGATIVE
-SERVO OFFSET POSITIVE
-CONTROLLER FAULT CLEAR
-CLR CHK DIAGNOSTICS
-RTZ SEEK
X/Y 162 A3 1,2-
X/Y 162 A4 1,2-
8 140 A2B
8 140 A2D
1 146 C2C
1 172H E2B
1 140 B2C
1 146 C2A
1 140 B2B
8 140 B2A
8 140 A2A
8 140 B2D
S CD C R 175H B1B
M' 100 NS MC 426 D3B
RGTR 520 C3
NOTE
SEE CROSS REF NO 782 FOR I/O CABLING INFORMATION
CONTROL DATA
NORMANDALE DIVISION
RECEIVERS
(9764)
LOC:A02
CODE IDENT 19333
C
83322450
J
B
CROSS REF NO 023
SHEET 3
PAGE 3-19



NOTE:

1. SEE CROSS REF NO 782 FOR I/O CABLING INFORMATION

CONTROL DATA NORMANDALE DIVISION	RECEIVERS (9764)	LOC: A02	CODE IDENT 19333	C	83322450	J B
			CROSS REF NO 024		SHEET 4	PAGE 3-20

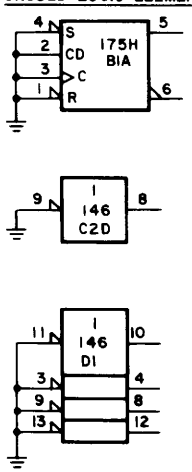
REVISION STATUS OF SHEETS

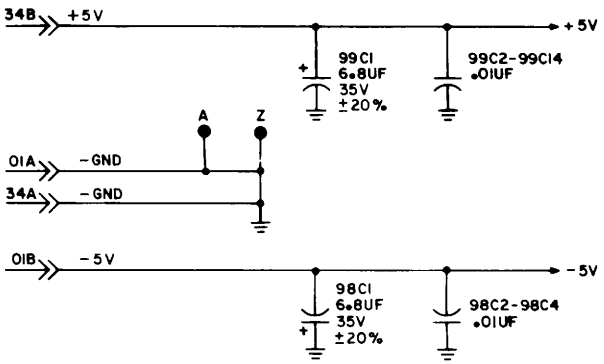
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																
B	A	A	A																
C	C	C	C																

REVISIONS

REV.	ECO.	DESCRIPTION	DRFT.	DATE	CHK'D
A	PE23000	RELEASED	MA	9-15-76	
B		EDITORIAL	DM	2-14-78	
C	PE55259	LOGIC DIAG IMPROVEMENTS	A A O	8-4-78	

UNUSED LOGIC ELEMENTS

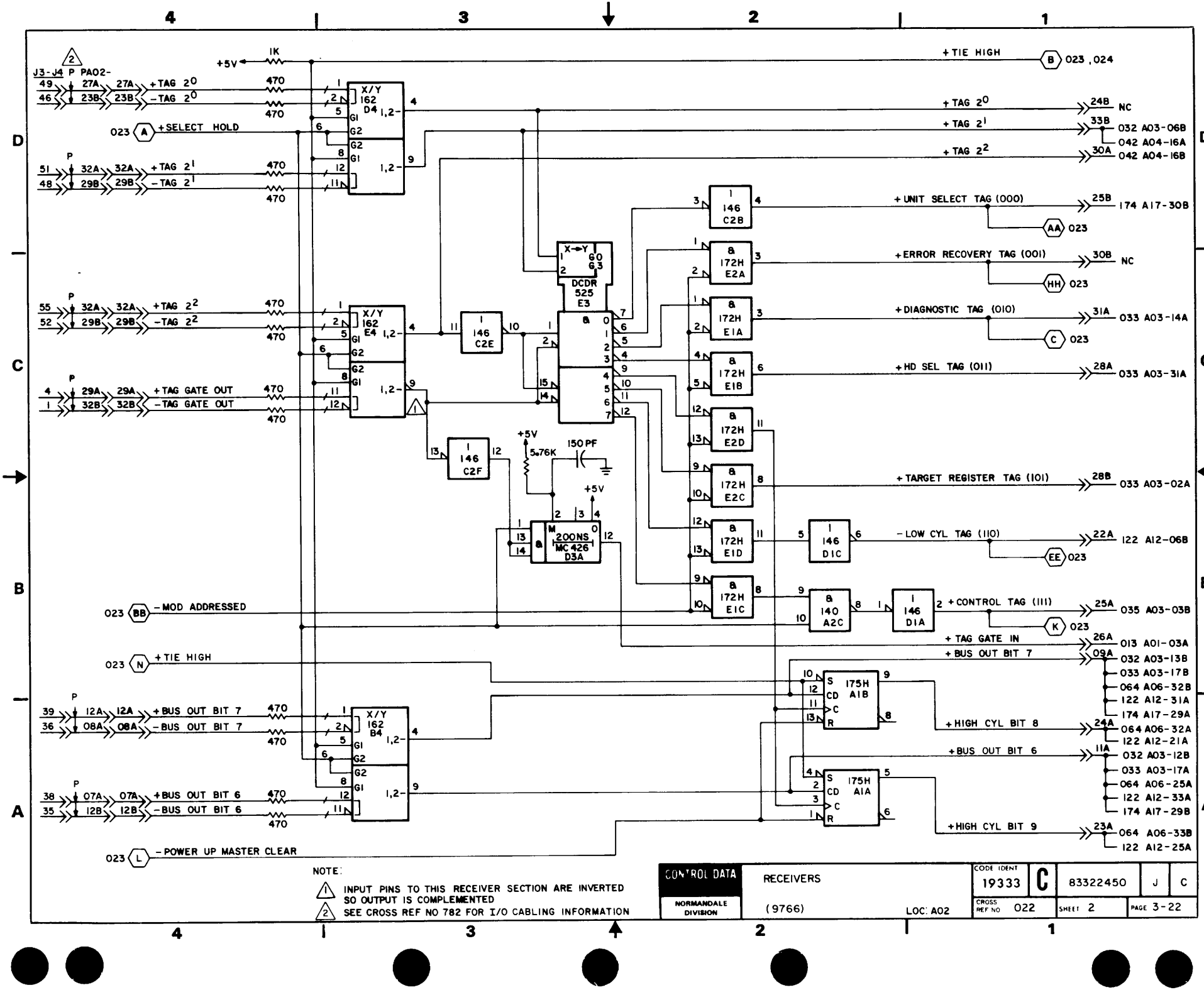


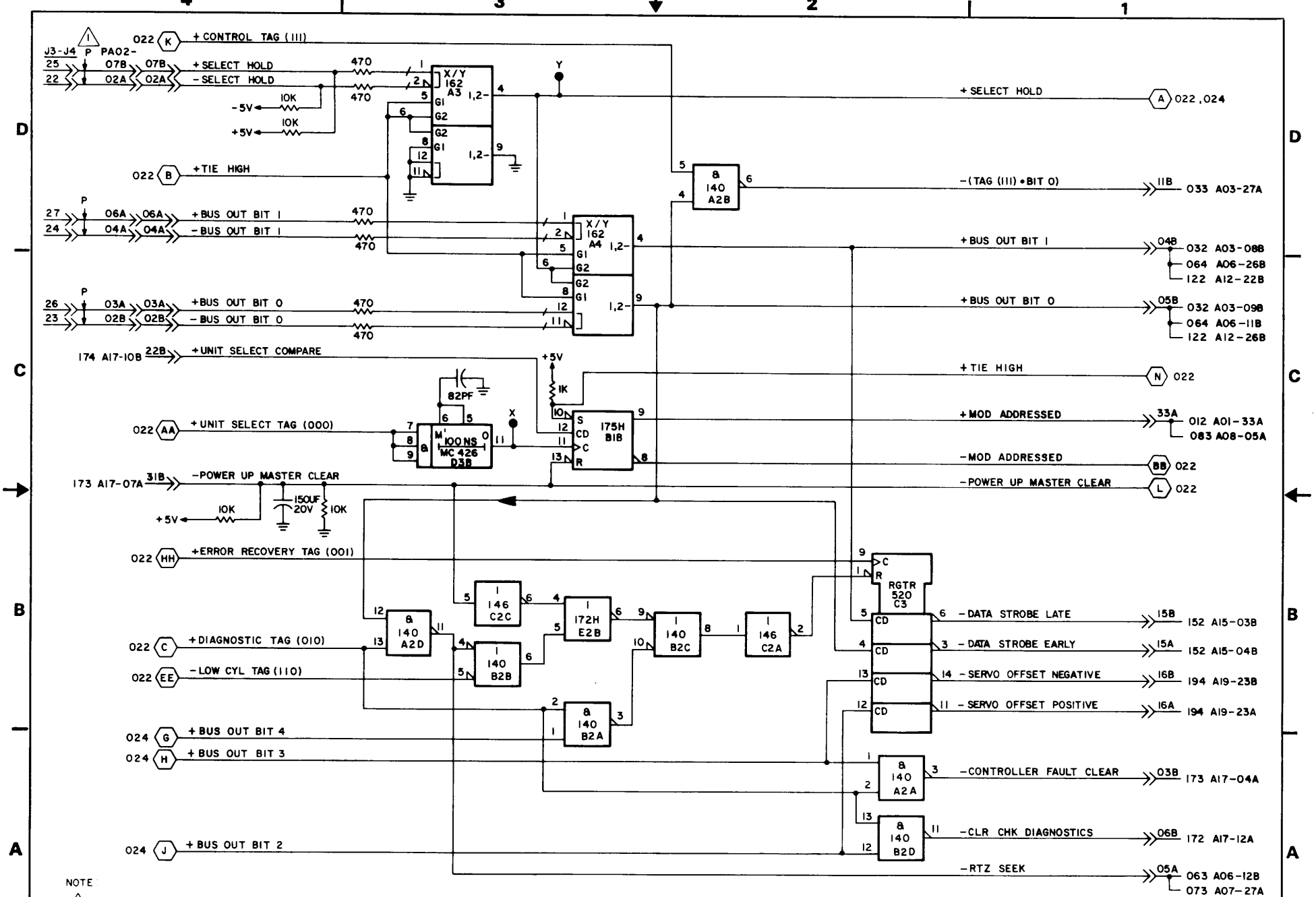


APPLICABLE ONLY TO BJ4M2, BJ402*9766-1

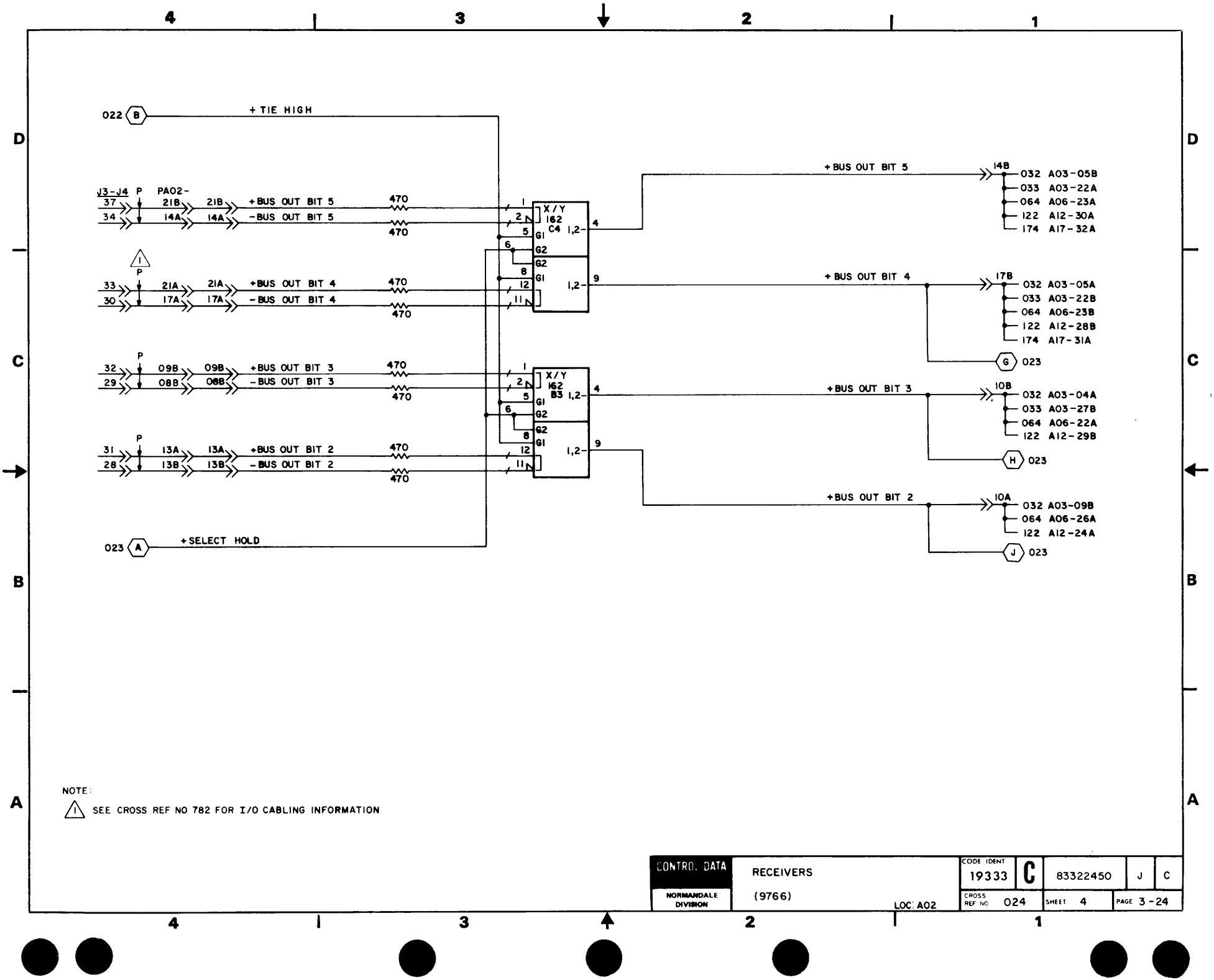
DRAWN		CONTROL DATA	RECEIVERS DIAGRAMS	CODE IDENT 19333	C	83322450	J C
CHECKED							
ENGINEER		NORMANDALE DIVISION	TYPE ARSV LOC A02	CROSS REF NO 021		SHEET 1 OF 4	PAGE 3-21
APPROVED							

REF 83214902


J3-J4 P PA02-
+5V
1K
+TIE HIGH
B 023 , 024
+TAG 2^0
+TAG 2^1
+TAG 2^2
+SELECT HOLD
+TAG GATE OUT
-TAG GATE OUT
-MOD ADDRESSED
+TIE HIGH
+BUS OUT BIT 7
-BUS OUT BIT 7
+BUS OUT BIT 6
-BUS OUT BIT 6
-POWER UP MASTER CLEAR
X/Y 162 D4
X/Y 162 E4
X/Y 162 B4
DCDR 525 E3
M 200NS MC 426 D3A
+5V
5.76K
150 PF
+UNIT SELECT TAG (000)
+ERROR RECOVERY TAG (001)
+DIAGNOSTIC TAG (010)
+HD SEL TAG (011)
+TARGET REGISTER TAG (101)
-LOW CYL TAG (110)
+CONTROL TAG (111)
+TAG GATE IN
+BUS OUT BIT 7
+HIGH CYL BIT 8
+BUS OUT BIT 6
+HIGH CYL BIT 9
NC
032 A03-06B
042 A04-16A
042 A04-16B
033 A03-14A
033 A03-31A
033 A03-02A
122 A12-06B
035 A03-03B
013 A01-03A
032 A03-13B
033 A03-17B
064 A06-32B
122 A12-31A
174 A17-29A
064 A06-32A
122 A12-21A
032 A03-12B
033 A03-17A
064 A06-25A
122 A12-33A
174 A17-29B
064 A06-33B
122 A12-25A
174 A17-30B
032 A03-06B
NOTE:
1 INPUT PINS TO THIS RECEIVER SECTION ARE INVERTED SO OUTPUT IS COMPLEMENTED
2 SEE CROSS REF NO 782 FOR I/O CABLING INFORMATION
CONTROL DATA
NORMANDALE DIVISION
RECEIVERS
(9766)
LOC: A02
CODE IDENT 19333
C
83322450
J
C
CROSS REF NO 022
SHEET 2
PAGE 3-22



CONTROL DATA NORMANDALE DIVISION	RECEIVERS (9766)	LOC:A02	CODE IDENT 19333	C	83322450 J C
			CROSS REF NO. 023	SHEET 3	PAGE 3-23



NOTE:

⚠1 SEE CROSS REF NO 782 FOR I/O CABLING INFORMATION

CONTROL DATA NORMANDALE DIVISION	RECEIVERS (9766) LOC: A02	CODE IDENT 19333	C	83322450	J	C	
		CROSS REF NO 024		SHEET 4	PAGE 3-24		

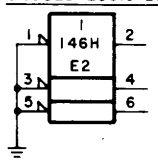
REVISION STATUS OF SHEETS

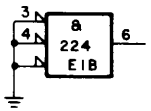
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																
B	B	A	A																
C	C	A	A																
D	C	D	A																

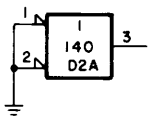
REVISIONS

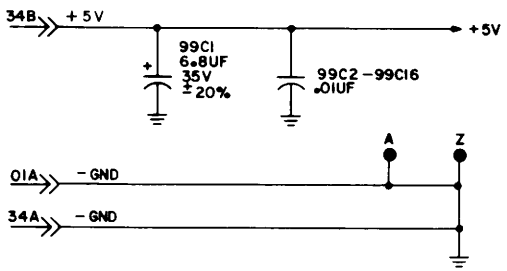
REV.	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA	8-13-76	
B	PE22926	ERROR CORRECTION	DM	7-8-77	
C	PE48782	CORRECT DIAGRAMS	MA	9-13-77	
D	PE57011	CORRECT DIAGRAMS	MA	11-29-78	

UNUSED LOGIC ELEMENTS



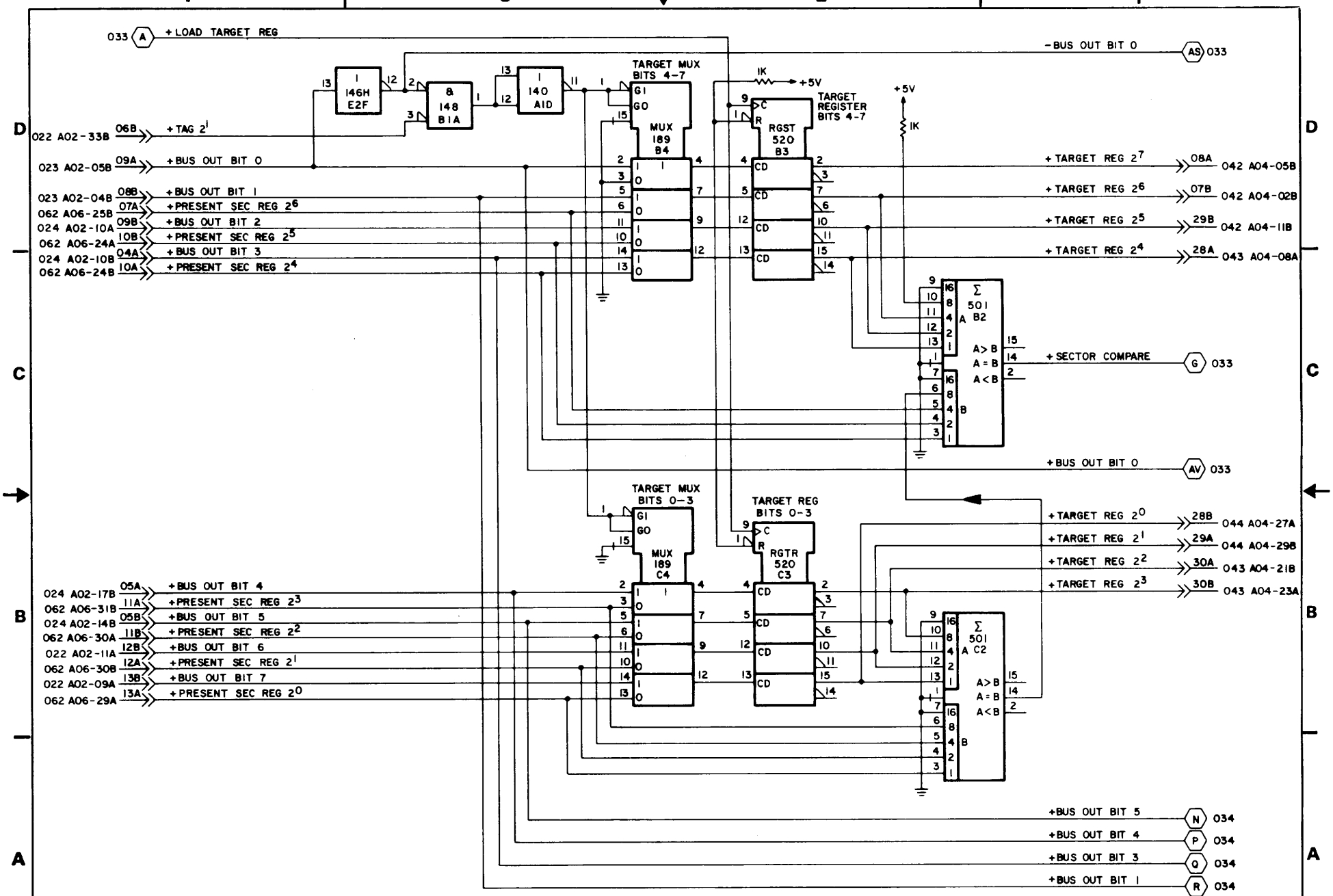


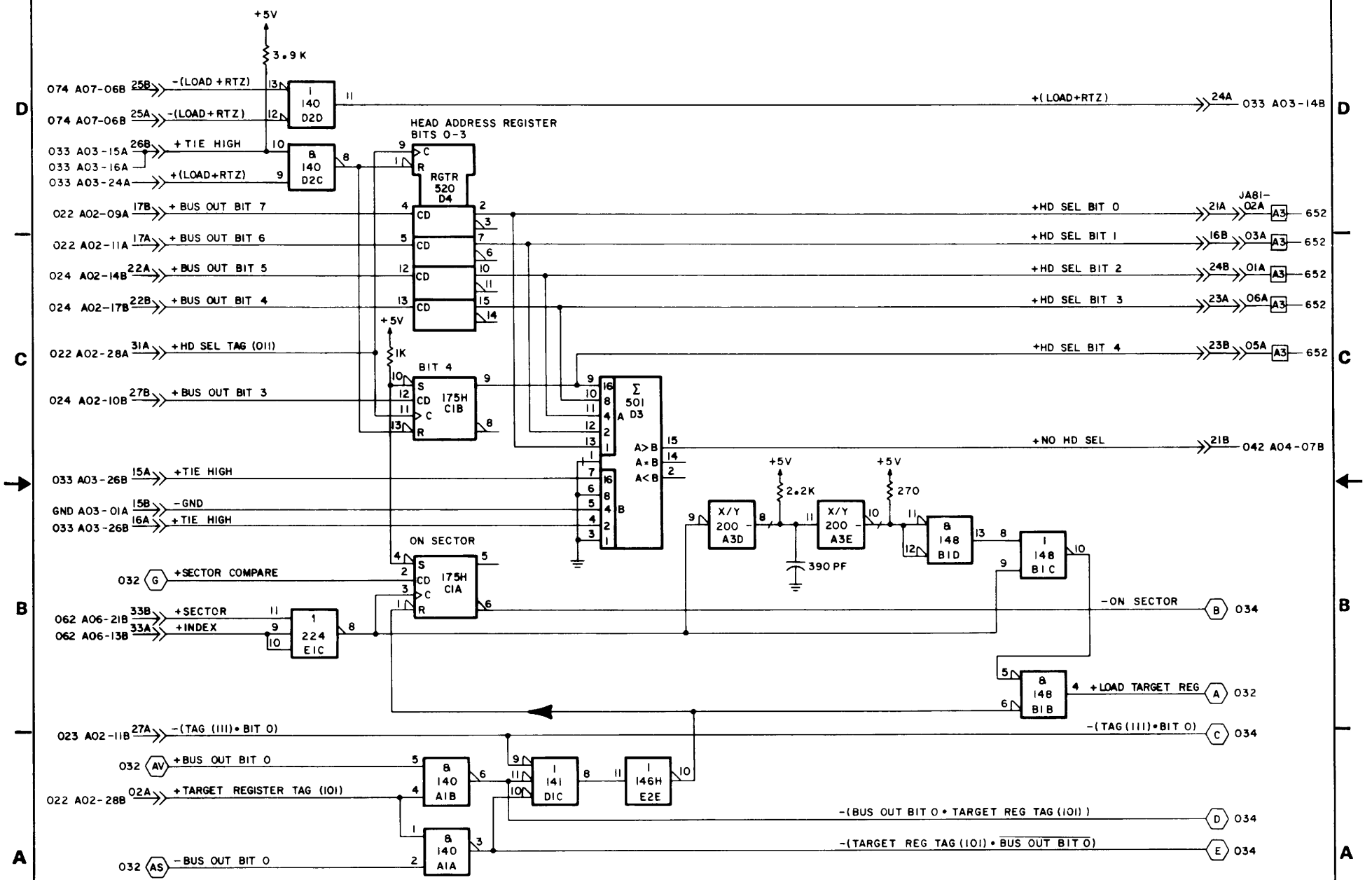


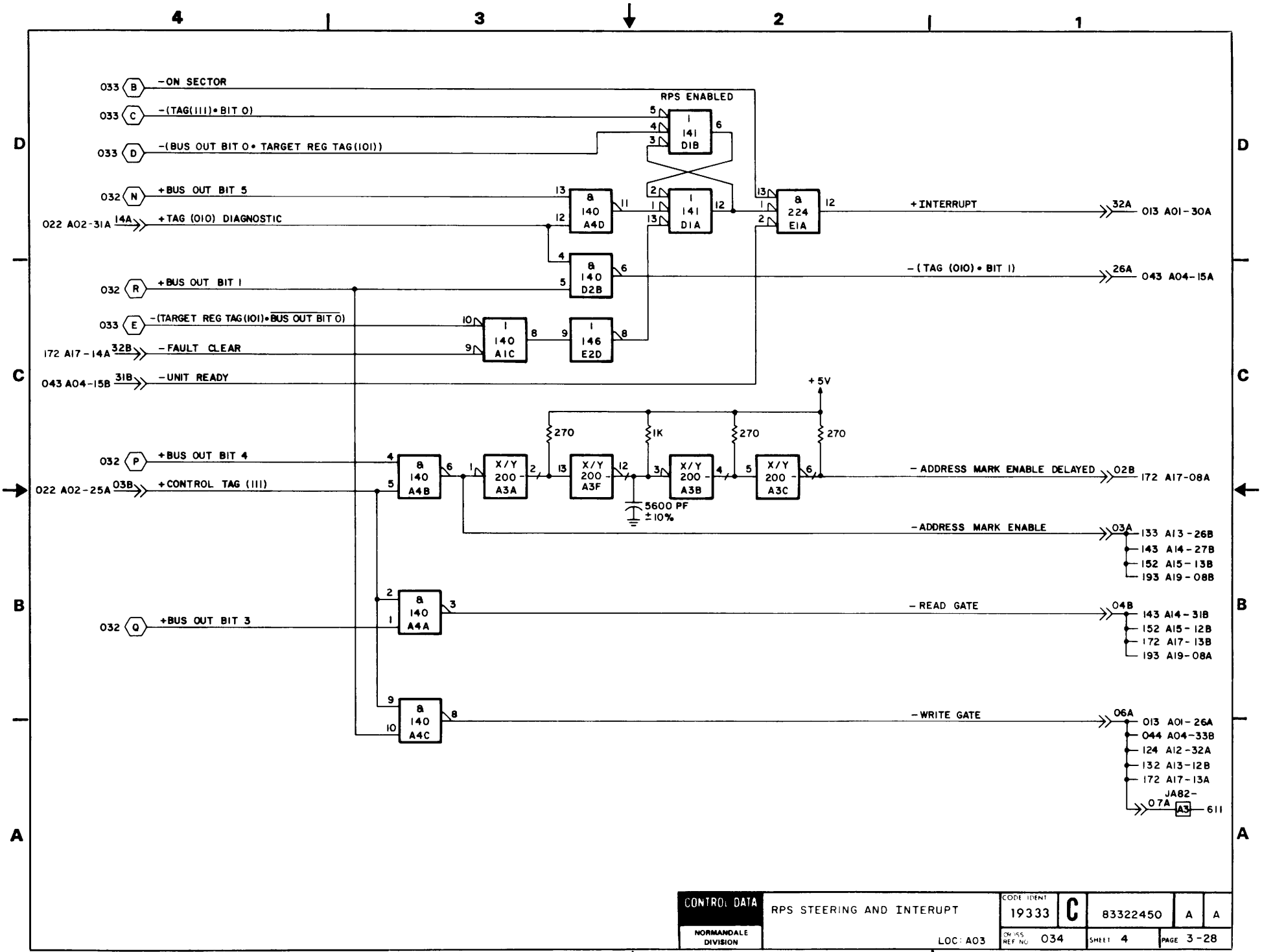


DRAWN		CONTROL DATA	BUS IN AND RPS STEERING DIAGRAMS	CODE IDENT 19333	C	83322450	K D
CHECKED							
ENGINEER		NORMANDALE DIVISION	TYPE: 6SLV LOC: A03	CROSS REF NO 031		SHEET 1 OF 4	PAGE 3-25
APPROVED							

REF 83214903


033 A +LOAD TARGET REG
-BUS OUT BIT 0 AS 033
1 146H E2F
8 148 B1A
1 140 A1D
TARGET MUX BITS 4-7
MUX 189 B4
1K +5V
TARGET REGISTER BITS 4-7
RGST 520 B3
+5V
1K
022 A02-33B 06B +TAG 2^1
023 A02-05B 09A +BUS OUT BIT 0
023 A02-04B 08B +BUS OUT BIT 1
062 A06-25B 07A +PRESENT SEC REG 2^6
024 A02-10A 09B +BUS OUT BIT 2
062 A06-24A 10B +PRESENT SEC REG 2^5
024 A02-10B 04A +BUS OUT BIT 3
062 A06-24B 10A +PRESENT SEC REG 2^4
+TARGET REG 2^7 08A 042 A04-05B
+TARGET REG 2^6 07B 042 A04-02B
+TARGET REG 2^5 29B 042 A04-11B
+TARGET REG 2^4 28A 043 A04-08A
Σ 501 B2
A>B A=B A<B
+SECTOR COMPARE G 033
+BUS OUT BIT 0 AV 033
TARGET MUX BITS 0-3
MUX 189 C4
TARGET REG BITS 0-3
RGTR 520 C3
024 A02-17B 05A +BUS OUT BIT 4
062 A06-31B 11A +PRESENT SEC REG 2^3
024 A02-14B 05B +BUS OUT BIT 5
062 A06-30A 11B +PRESENT SEC REG 2^2
022 A02-11A 12B +BUS OUT BIT 6
062 A06-30B 12A +PRESENT SEC REG 2^1
022 A02-09A 13B +BUS OUT BIT 7
062 A06-29A 13A +PRESENT SEC REG 2^0
+TARGET REG 2^0 28B 044 A04-27A
+TARGET REG 2^1 29A 044 A04-29B
+TARGET REG 2^2 30A 043 A04-21B
+TARGET REG 2^3 30B 043 A04-23A
Σ 501 A C2
+BUS OUT BIT 5 N 034
+BUS OUT BIT 4 P 034
+BUS OUT BIT 3 Q 034
+BUS OUT BIT 1 R 034
CONTROL DATA
NORMANDALE DIVISION
TARGET REGISTER
LOC: A03
CODE IDENT 19333
C
83322450
D
C
CROSS REF 032
SHEET 2
PAGE 3-26


+5V
3.9K
074 A07-06B 25B -(LOAD+RTZ)
074 A07-06B 25A -(LOAD+RTZ)
1 140 D2D
+(LOAD+RTZ) 24A 033 A03-14B
033 A03-15A 26B +TIE HIGH
033 A03-16A
033 A03-24A +(LOAD+RTZ)
8 140 D2C
HEAD ADDRESS REGISTER BITS 0-3
RGTR 520 D4
022 A02-09A 17B +BUS OUT BIT 7
022 A02-11A 17A +BUS OUT BIT 6
024 A02-14B 22A +BUS OUT BIT 5
024 A02-17B 22B +BUS OUT BIT 4
+HD SEL BIT 0 21A JA81-02A A3 652
+HD SEL BIT 1 16B 03A A3 652
+HD SEL BIT 2 24B 01A A3 652
+HD SEL BIT 3 23A 06A A3 652
+HD SEL BIT 4 23B 05A A3 652
022 A02-28A 31A +HD SEL TAG (011)
1K
BIT 4
024 A02-10B 27B +BUS OUT BIT 3
175H C1B
Σ 501 D3
A>B A=B A<B
+NO HD SEL 21B 042 A04-07B
033 A03-26B 15A +TIE HIGH
GND A03-01A 15B -GND
033 A03-26B 16A +TIE HIGH
+5V 2.2K
+5V 270
X/Y 200 A3D
X/Y 200 A3E
390 PF
8 148 B1D
1 148 B1C
ON SECTOR
032 G +SECTOR COMPARE
175H C1A
-ON SECTOR B 034
062 A06-21B 33B +SECTOR
062 A06-13B 33A +INDEX
1 224 E1C
8 148 B1B
+LOAD TARGET REG A 032
023 A02-11B 27A -(TAG (111)•BIT 0)
-(TAG (111)•BIT 0) C 034
032 AV +BUS OUT BIT 0
022 A02-28B 02A +TARGET REGISTER TAG (101)
8 140 A1B
1 141 D1C
1 146H E2E
-(BUS OUT BIT 0 • TARGET REG TAG (101)) D 034
-(TARGET REG TAG (101) • BUS OUT BIT 0) E 034
032 AS -BUS OUT BIT 0
8 140 A1A
CONTROL DATA
NORMANDALE DIVISION
RPS-STEERING & INTERRUPT
LOC: A03
CODE IDENT 19333
C
83322450
K
D
REF 033
SHEET 3
PAGE 3-27



CONTROL DATA NORMANDALE DIVISION	RPS STEERING AND INTERUPT LOC: A03	CODE IDENT 19333	C	83322450	A A
		CROSS REF NO 034		SHEET 4	PAGE 3-28

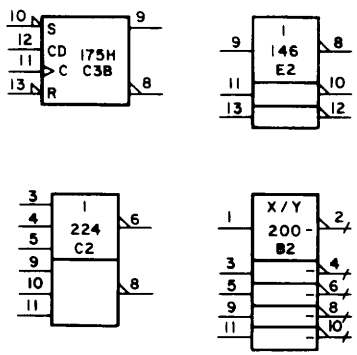
REVISION STATUS OF SHEETS

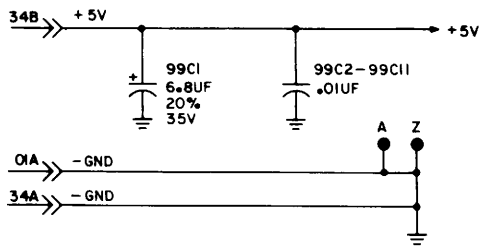
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																
B	B	B	B																
C	B	B	C																

REVISIONS

REV.	ECO.	DESCRIPTION	DRFT.	DATE	CHK'D
A	PE 23000	RELEASED			
B	PE55295	LOGIC DIAG. IMPROVEMENTS	A.A.O	8-4-76	
C	PE57112	STATUS PROTECT			

UNUSED LOGIC ELEMENTS





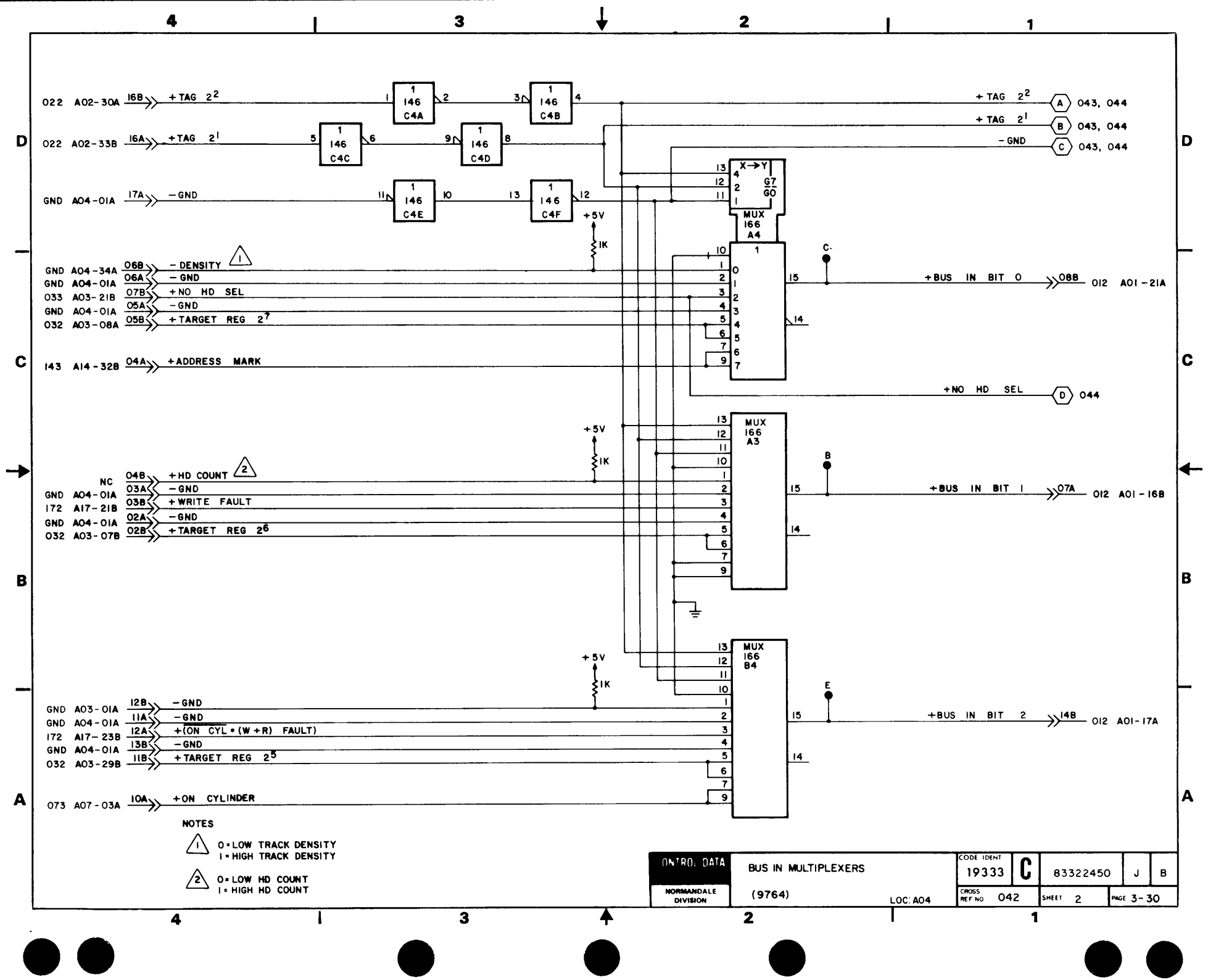
NOTE:

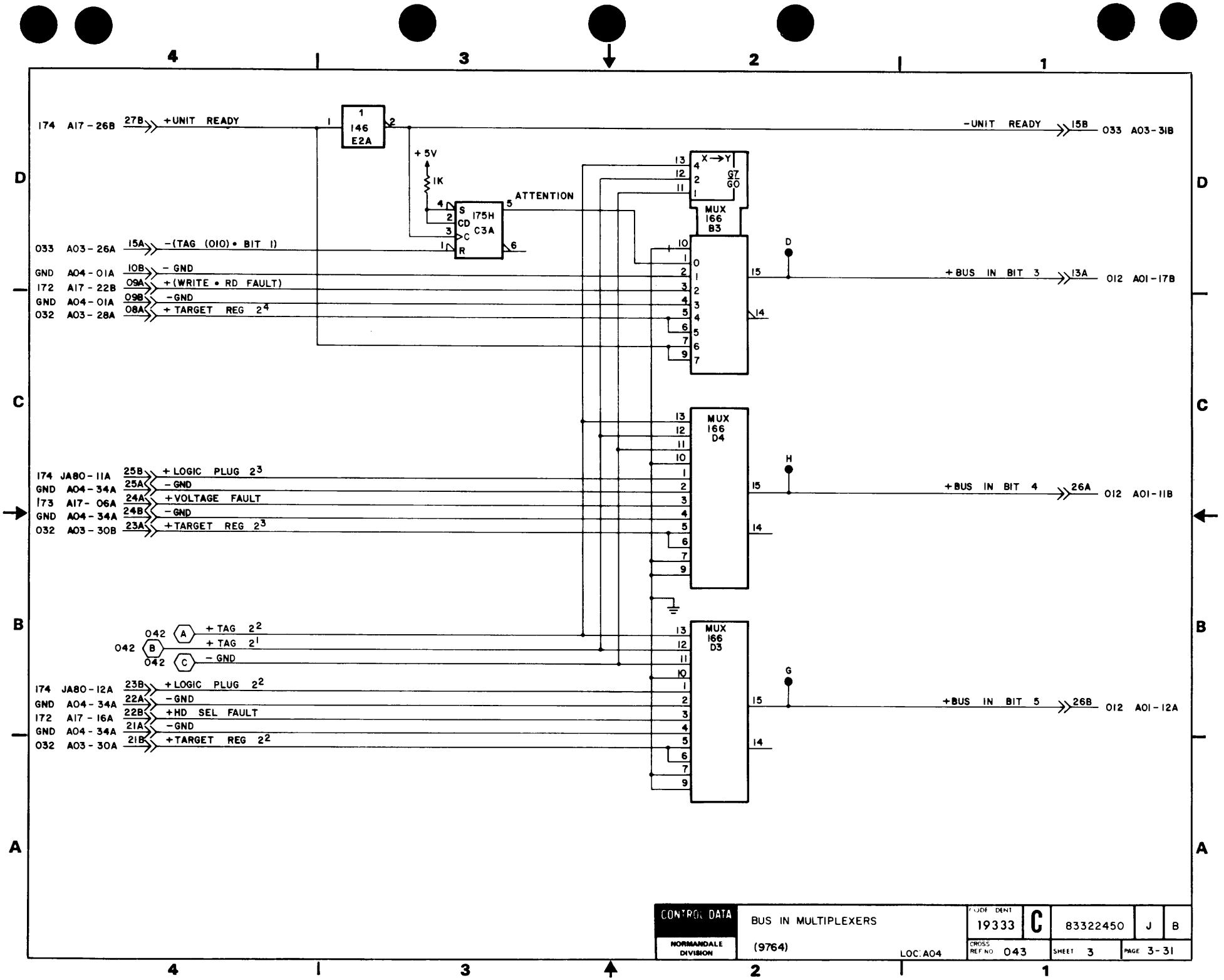
1. REFER TO CROSS REF NO 783 FOR TAG/BUS DECODES CHART.

APPLICABLE ONLY TO BJ4MI = 9764 - 1

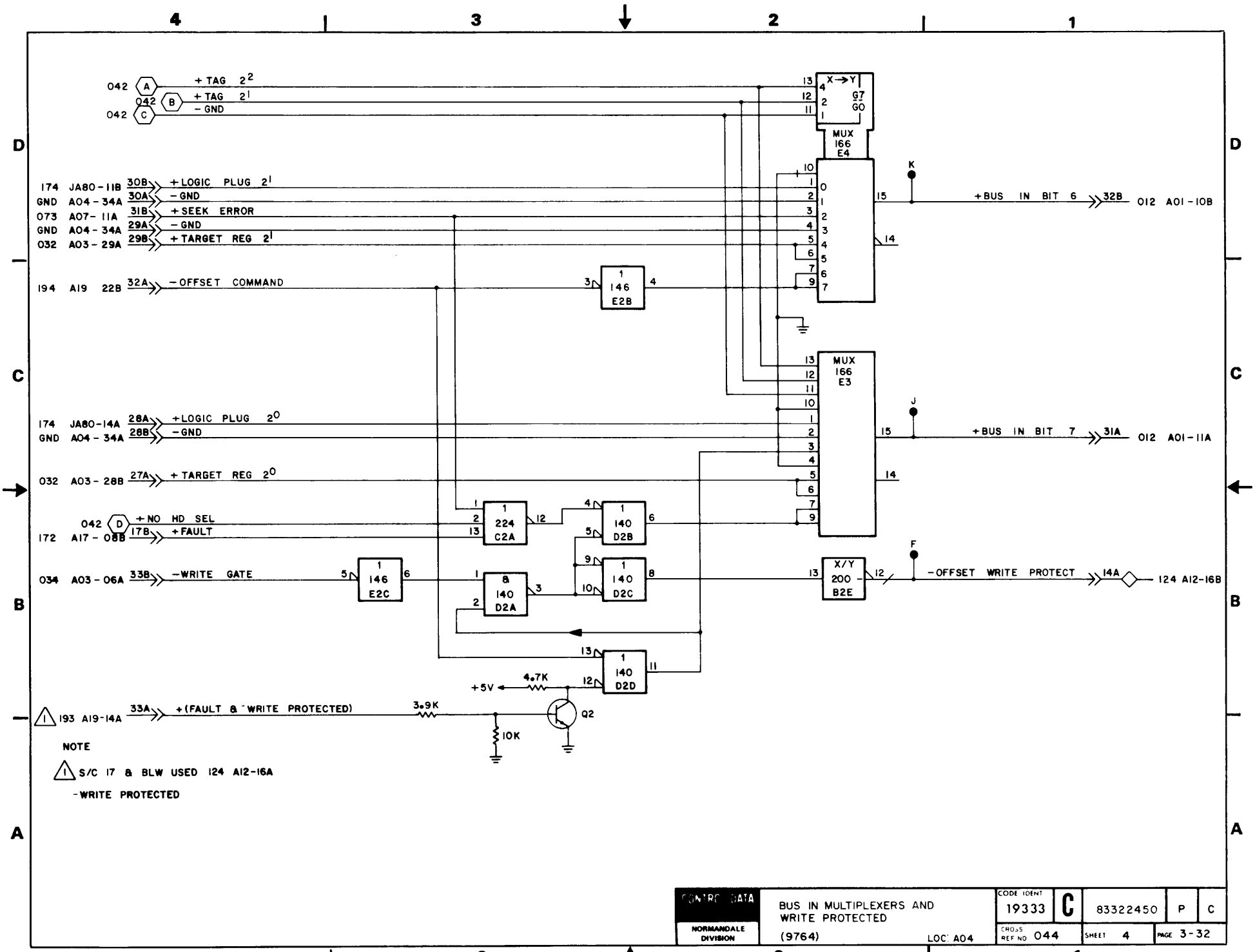
DRAWN	M. ANDERSON	11-11-76	CONTROL DATA	BUS IN MULTIPLEXERS DIAGRAMS	3DE IDENT 19333	C	83322450	P	C
CHECKED									
ENGINEER			NORMANDALE DIVISION	TYPE 6SNV LOC: A04	CROSS REF NO 041	SHEET 1 OF 4	PAGE 3-29		
APPROVED									

REF 83215002


022 A02-30A 16B +TAG 2^2
022 A02-33B 16A +TAG 2^1
GND A04-01A 17A -GND
1 146 C4A
1 146 C4B
1 146 C4C
1 146 C4D
1 146 C4E
1 146 C4F
+5V
1K
MUX 166 A4
MUX 166 A3
MUX 166 B4
X→Y G7 G0
GND A04-34A 06B -DENSITY
GND A04-01A 06A -GND
033 A03-21B 07B +NO HD SEL
GND A04-01A 05A -GND
032 A03-08A 05B +TARGET REG 2^7
143 A14-32B 04A +ADDRESS MARK
NC 04B +HD COUNT
GND A04-01A 03A -GND
172 A17-21B 03B +WRITE FAULT
GND A04-01A 02A -GND
032 A03-07B 02B +TARGET REG 2^6
GND A03-01A 12B -GND
GND A04-01A 11A -GND
172 A17-23B 12A +(ON CYL • (W+R) FAULT)
GND A04-01A 13B -GND
032 A03-29B 11B +TARGET REG 2^5
073 A07-03A 10A +ON CYLINDER
+TAG 2^2 A 043, 044
+TAG 2^1 B 043, 044
-GND C 043, 044
+NO HD SEL D 044
+BUS IN BIT 0 08B 012 A01-21A
+BUS IN BIT 1 07A 012 A01-16B
+BUS IN BIT 2 14B 012 A01-17A
NOTES
1 0=LOW TRACK DENSITY 1=HIGH TRACK DENSITY
2 0=LOW HD COUNT 1=HIGH HD COUNT
CONTROL DATA NORMANDALE DIVISION
BUS IN MULTIPLEXERS (9764) LOC: A04
CODE IDENT 19333 C 83322450 J B
CROSS REF NO 042 SHEET 2 PAGE 3-30



CONTROL DATA NORMANDALE DIVISION	BUS IN MULTIPLEXERS (9764) LOC: A04	CODE IDENT 19333	C	83322450	J	B
		CROSS REF NO 043		SHEET 3	PAGE 3-31	



CONTROL DATA
NORMANDALE DIVISION

BUS IN MULTIPLEXERS AND WRITE PROTECTED
(9764) LOC: A04

CODE IDENT				
19333	C	83322450	P	C
CROSS REF NO 044	SHEET 4	PAGE 3-32		

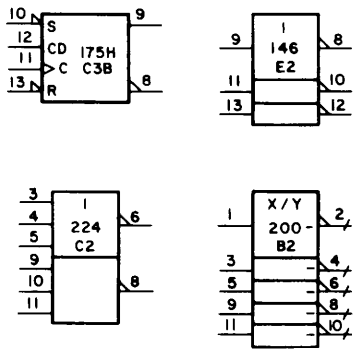
REVISION STATUS OF SHEETS

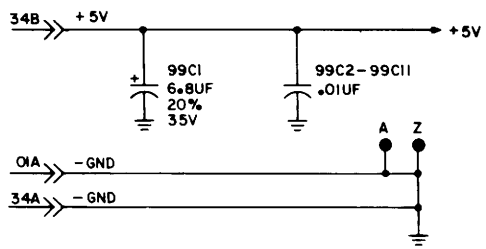
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																
B	A	A	B																
C	A	A	B																
D	D	D	D																
E	D	D	E																

REVISIONS

REV.	ECO.	DESCRIPTION	DRFT.	DATE	CHK'D
A	PE 23000	RELEASED			
B	PE48782	CORRECT DIAGRAMS	MA	9-13-77	
C		EDITORIAL	DM	2-14-78	
D	PE55259	LOGIC DIAG. IMPROVEMENT	A AO	8-4-78	
E	PE57112	STATUS PROTECT			

UNUSED LOGIC ELEMENTS





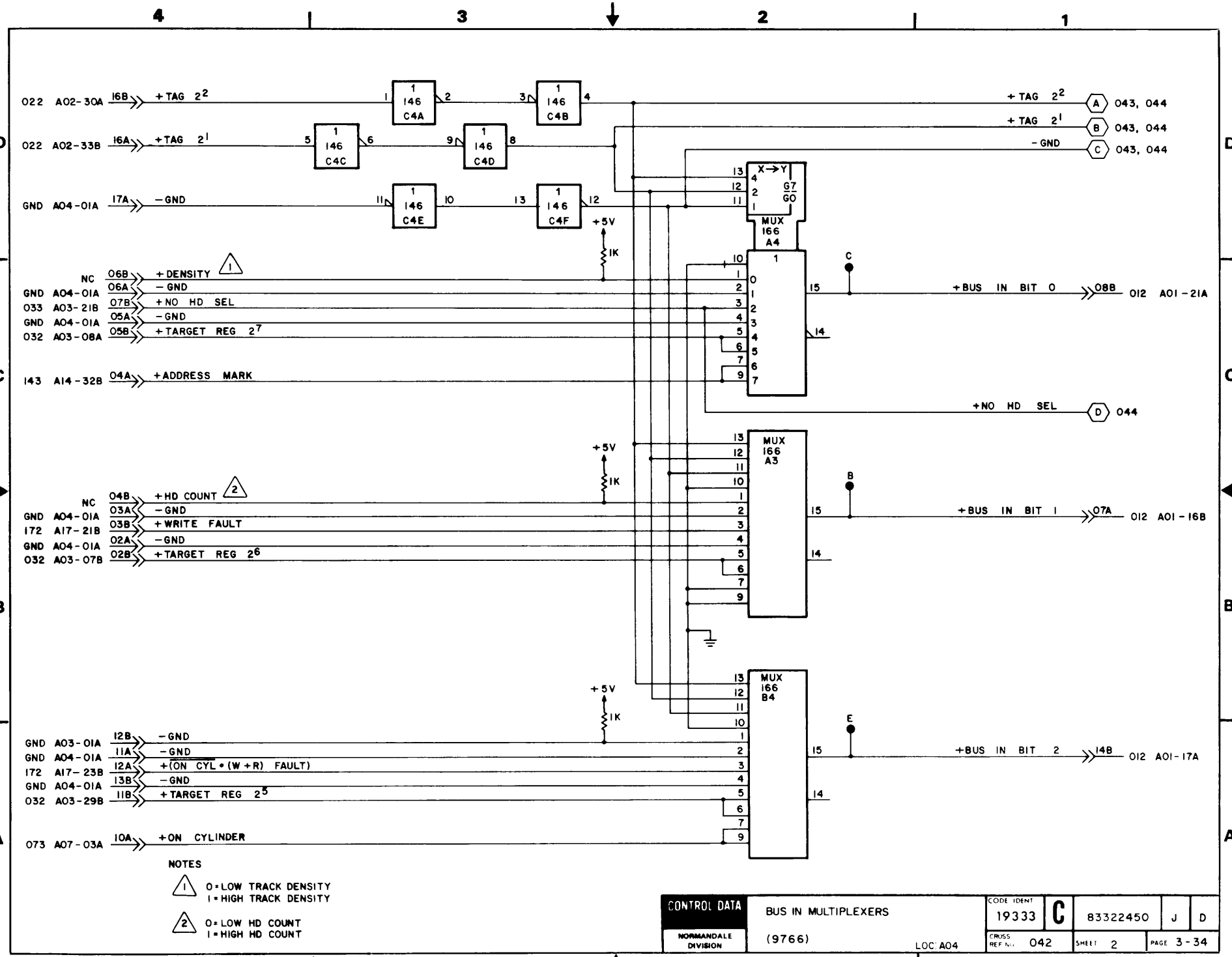
NOTE:

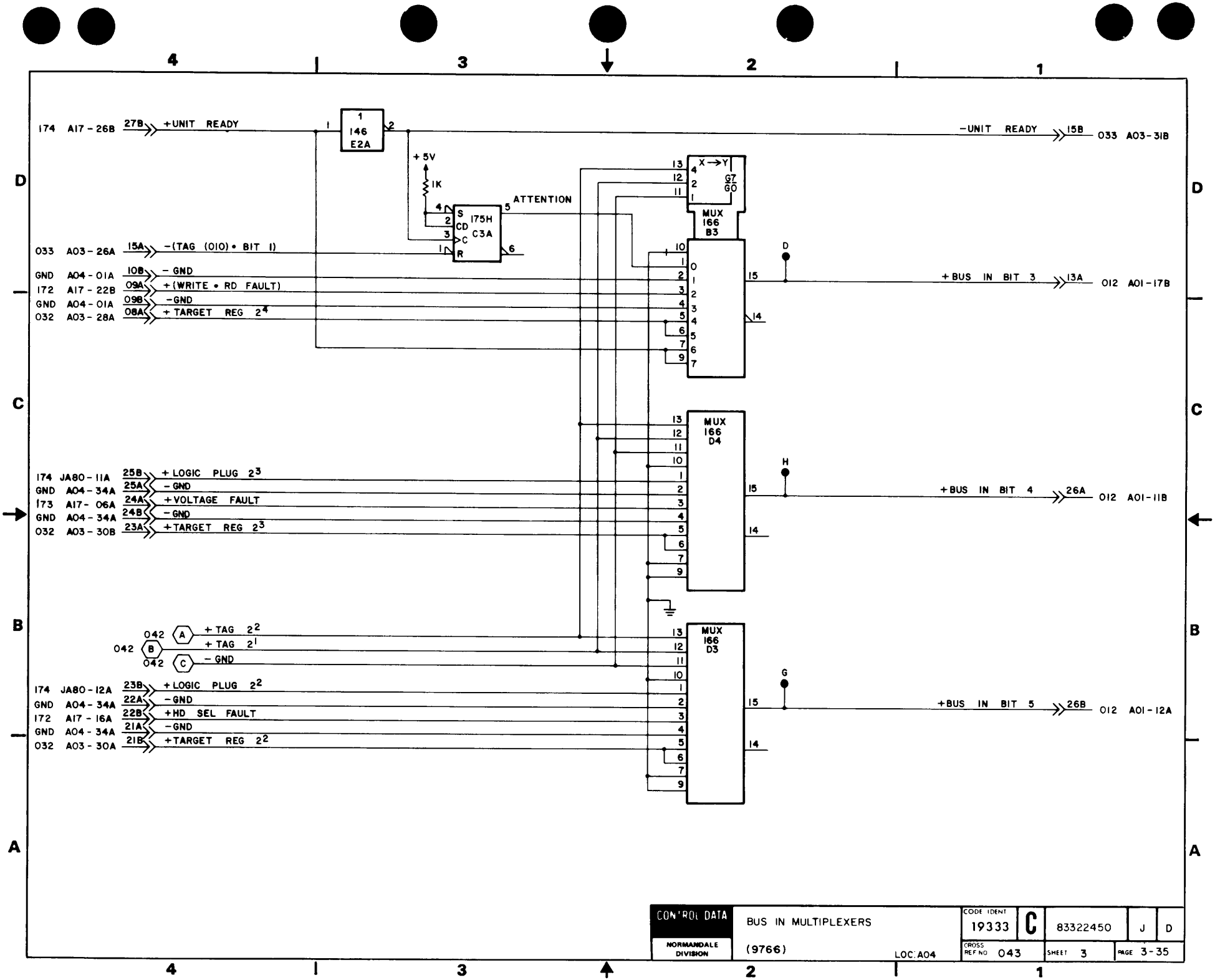
1. REFER TO CROSS REF NO 783 FOR TAG/BUS DECODES CHART.

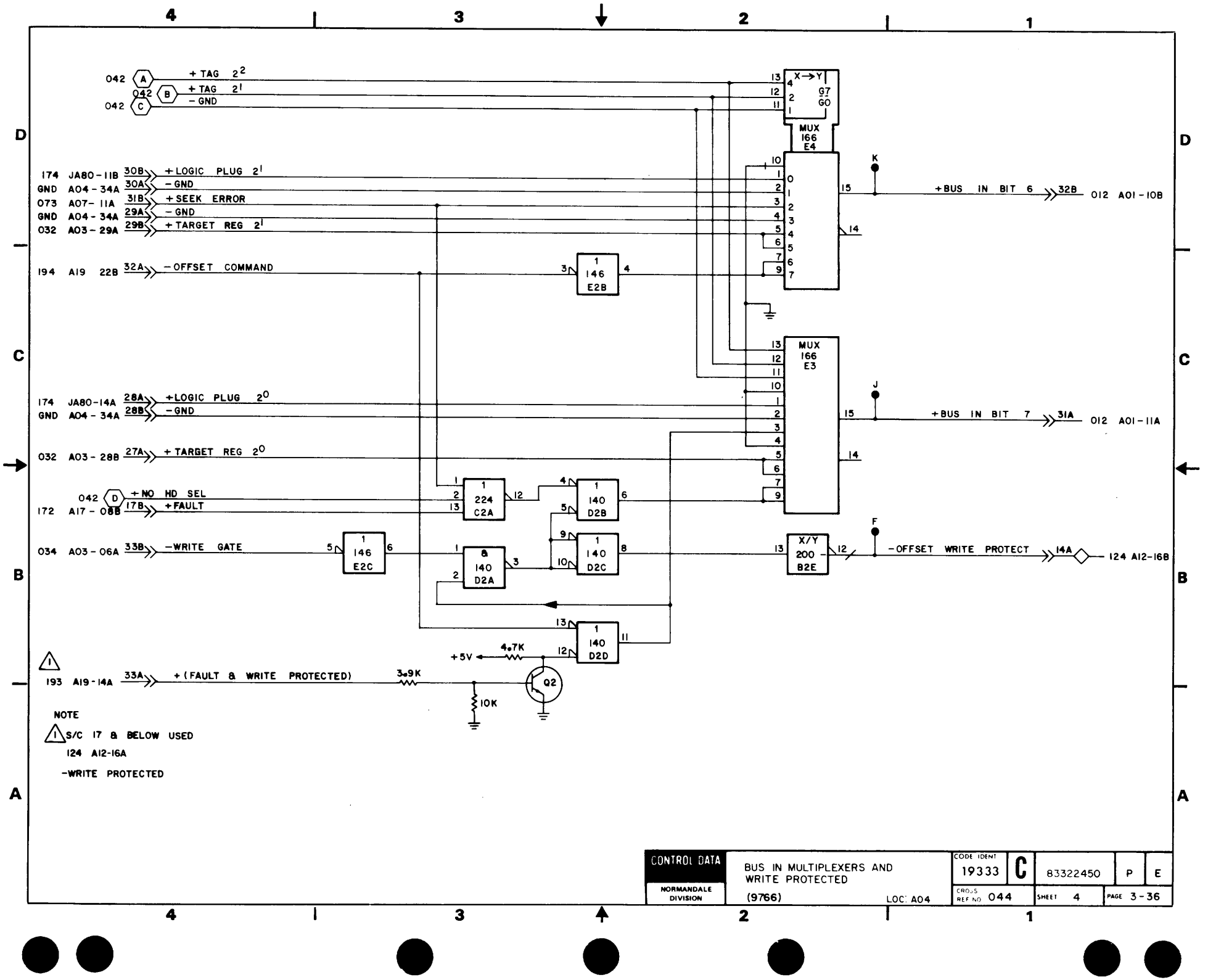
APPLICABLE ONLY TO BJ4M2, BJ402 = 9766-1

DRAWN	M. ANDERSON	CONTROL DATA	BUS IN MULTIPLEXERS DIAGRAMS	CODE IDENT 19333	C	83322450	P E
CHECKED							
ENGINEER		NORMANDALE DIVISION					
APPROVED			TYPE 6SNV LOC A04	CROSS REF NO 041	SHEET 1 OF 4	PAGE 3-33	

REF 83214904


022 A02-30A 16B +TAG 2^2
022 A02-33B 16A +TAG 2^1
GND A04-01A 17A -GND
1 146 C4A
1 146 C4B
1 146 C4C
1 146 C4D
1 146 C4E
1 146 C4F
+5V
1K
NC 06B +DENSITY
GND A04-01A 06A -GND
033 A03-21B 07B +NO HD SEL
GND A04-01A 05A -GND
032 A03-08A 05B +TARGET REG 2^7
143 A14-32B 04A +ADDRESS MARK
NC 04B +HD COUNT
GND A04-01A 03A -GND
172 A17-21B 03B +WRITE FAULT
GND A04-01A 02A -GND
032 A03-07B 02B +TARGET REG 2^6
GND A03-01A 12B -GND
GND A04-01A 11A -GND
172 A17-23B 12A +(ON CYL • (W+R) FAULT)
GND A04-01A 13B -GND
032 A03-29B 11B +TARGET REG 2^5
073 A07-03A 10A +ON CYLINDER
X→Y
G7
GO
MUX 166 A4
MUX 166 A3
MUX 166 B4
+TAG 2^2 A 043, 044
+TAG 2^1 B 043, 044
-GND C 043, 044
+BUS IN BIT 0 08B 012 A01-21A
+NO HD SEL D 044
+BUS IN BIT 1 07A 012 A01-16B
+BUS IN BIT 2 14B 012 A01-17A
NOTES
1 0=LOW TRACK DENSITY 1=HIGH TRACK DENSITY
2 0=LOW HD COUNT 1=HIGH HD COUNT
CONTROL DATA
NORMANDALE DIVISION
BUS IN MULTIPLEXERS
(9766)
LOC: A04
CODE IDENT 19333
C
83322450
J
D
CROSS REF NO. 042
SHEET 2
PAGE 3-34


174 A17 - 26B
27B
+UNIT READY
1
146
E2A
2
-UNIT READY
15B
033 A03-31B
+5V
1K
4
S
2
CD
3
C
1
R
175H
C3A
5
ATTENTION
6
X→Y
G7
G0
MUX
166
B3
033 A03 - 26A
15A
-(TAG (010) • BIT 1)
GND A04 - 01A
10B
- GND
172 A17 - 22B
09A
+(WRITE • RD FAULT)
GND A04 - 01A
09B
-GND
032 A03 - 28A
08A
+ TARGET REG 2⁴
D
15
+BUS IN BIT 3
13A
012 A01-17B
14
MUX
166
D4
174 JA80 - 11A
25B
+ LOGIC PLUG 2³
GND A04 - 34A
25A
- GND
173 A17 - 06A
24A
+VOLTAGE FAULT
GND A04 - 34A
24B
- GND
032 A03 - 30B
23A
+TARGET REG 2³
H
+BUS IN BIT 4
26A
012 A01-11B
042 A
+ TAG 2²
042 B
+ TAG 2¹
042 C
- GND
MUX
166
D3
174 JA80 - 12A
23B
+ LOGIC PLUG 2²
GND A04 - 34A
22A
- GND
172 A17 - 16A
22B
+HD SEL FAULT
GND A04 - 34A
21A
-GND
032 A03 - 30A
21B
+TARGET REG 2²
G
+BUS IN BIT 5
26B
012 A01-12A
CONTROL DATA
NORMANDALE DIVISION
BUS IN MULTIPLEXERS
(9766)
LOC: A04
CODE IDENT 19333
C
83322450
J
D
CROSS REF NO 043
SHEET 3
PAGE 3-35



CONTROL DATA NORMANDALE DIVISION	BUS IN MULTIPLEXERS AND WRITE PROTECTED (9766) LOC: A04	CODE IDENT 19333	C	83322450	P E
		CROSS REF NO 044		SHEET 4	PAGE 3-36

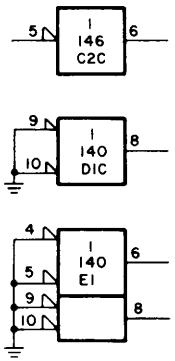
REVISION STATUS OF SHEETS

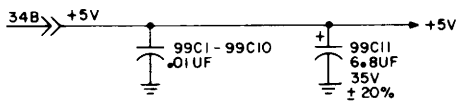
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																
B	B	B	B																
C	C	B	B																

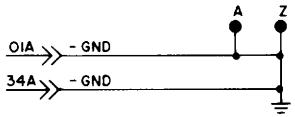
REVISIONS

REV.	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	GR		
B	PE55259	LOGIC DIAG. IMPROVEMENT	A.A.O	8 7 78	
C	PE57011	CORRECT DIAGRAMS	MA	11-29-78	

UNUSED LOGIC ELEMENTS



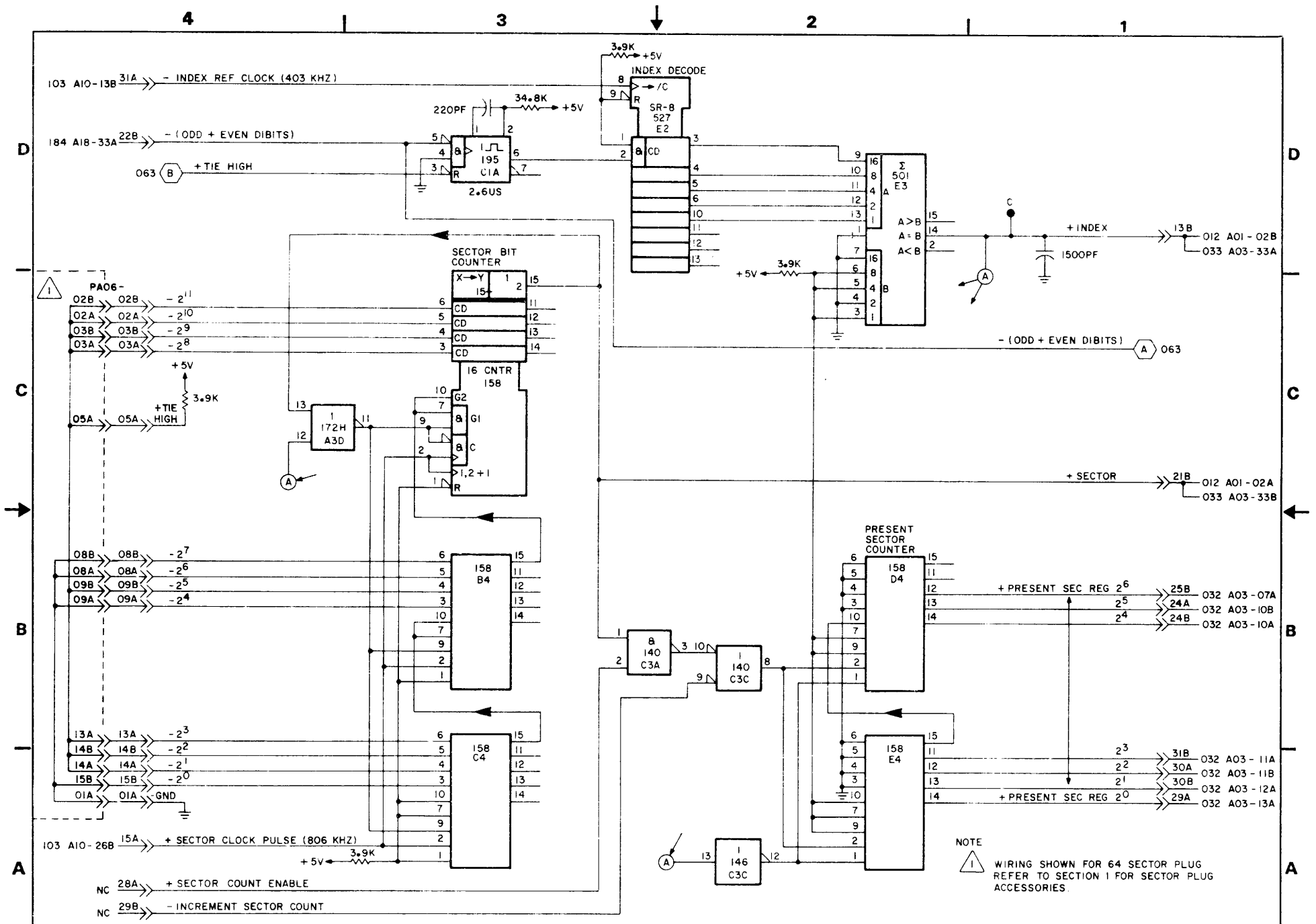




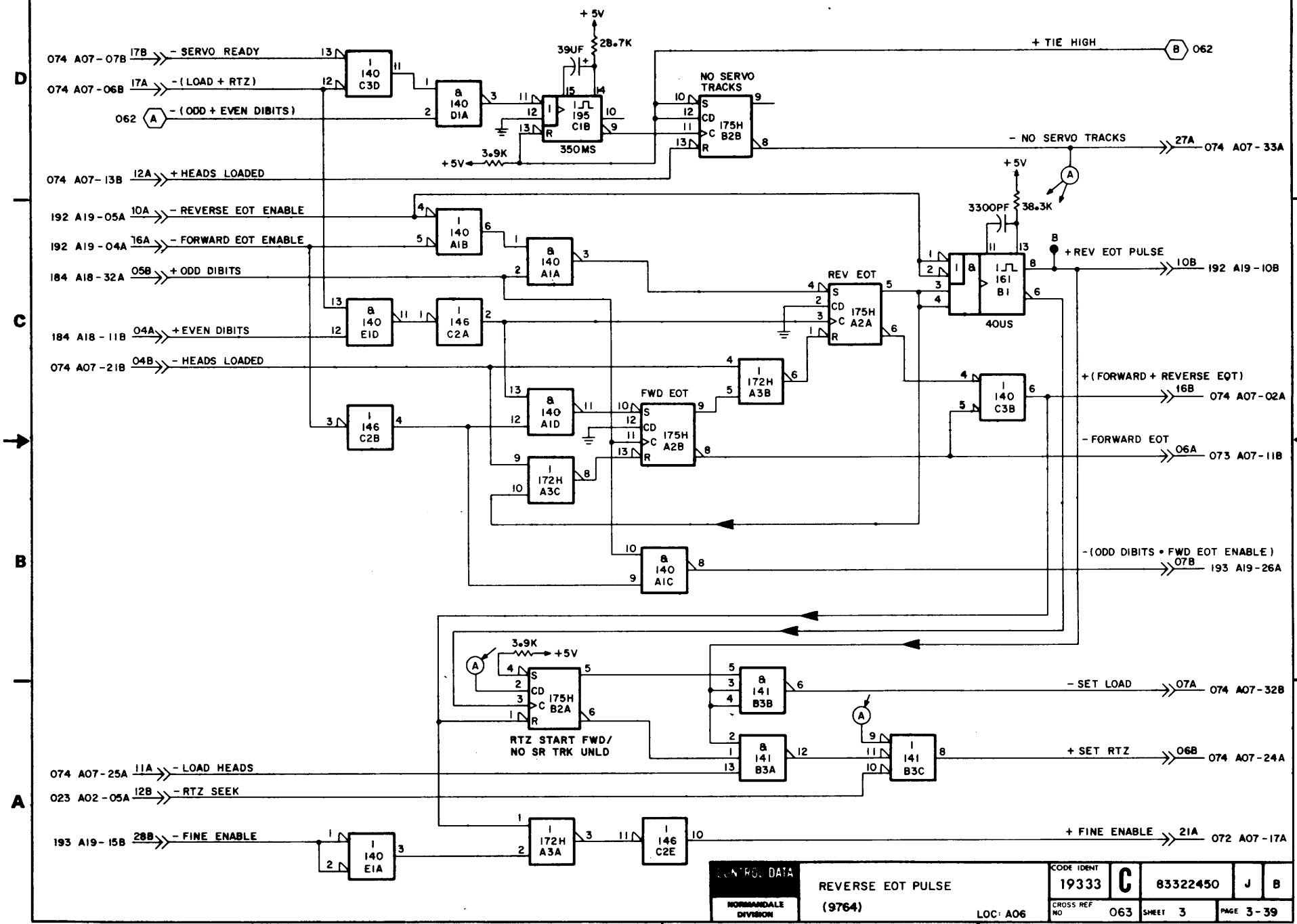
APPLICABLE ONLY TO BJ4M1 = 9764 - 1

DRAWN	S. BENTLER	11-10-76	CONTROL DATA	ACCESS CONTROL AND INDEX/SECTOR DECODE DIAGRAMS	CODE IDENT 19333	C	83322450	K C
CHECKED								
ENGINEER		4/15/76	NORMANDALE DIVISION	TYPE DLTV LOC A06	CROSS REF NO 061	SHEET 1 OF 4	PAGE 3-37	
APPROVED								

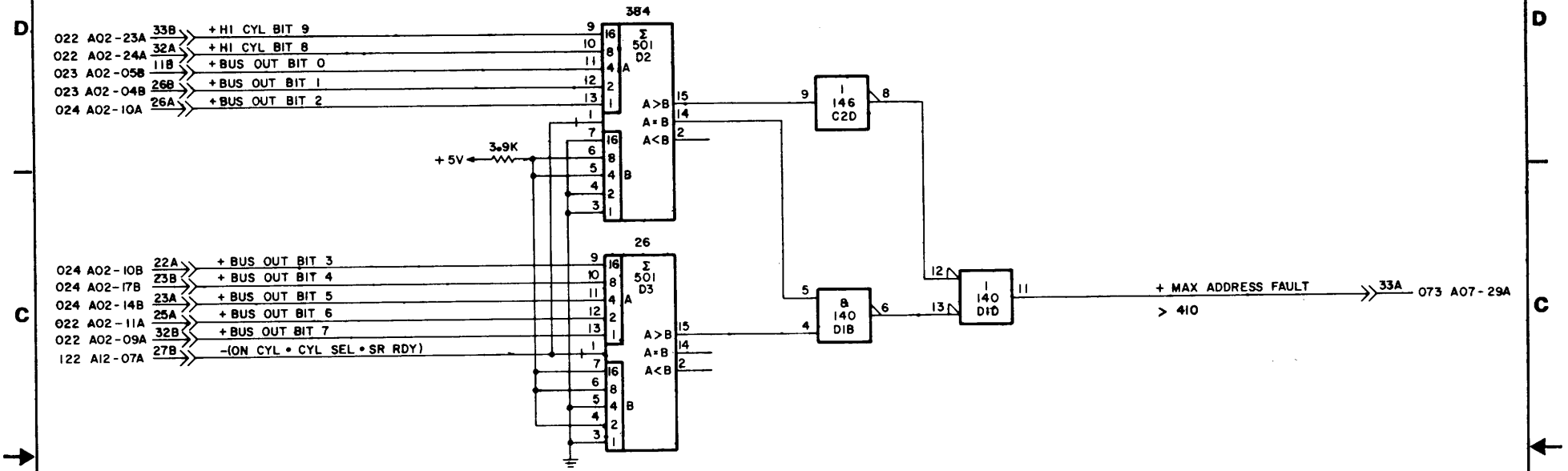
REF 83215033



CONTROL DATA NORMANDALE DIVISION	INDEX / SECTOR DECODE (9764) LOC A06	CODE IDENT 19333	C	83322450	K C
		CROSS REF NO 062	SHEET 2	PAGE 3-38	



CONTROL DATA NORMANDALE DIVISION	REVERSE EOT PULSE (9764)	LOC: A06	CODE IDENT 19333	C	83322450	J	B
			CROSS REF NO 063		SHEET 3	PAGE 3-39	



CONTROL DATA NORMANDALE DIVISION	MAX ADDRESS FAULT (9764) LOC: A06	CODE IDENT 19333	C	83322450	J B
		CROSS REF NO 064		SHEET 4	PAGE 3-40

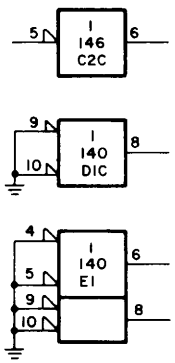
REVISION STATUS OF SHEETS

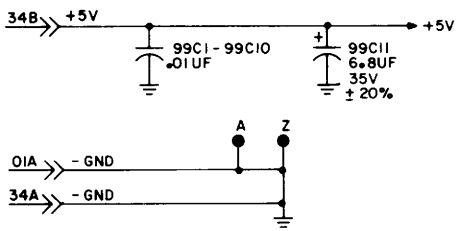
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																
B	B	B	B																
C	C	B	B																

REVISIONS

REV.	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	GR	[illegible]	
B	PE55259	LOGIC DIAG IMPROVEMENT	A A O	8-7-78	
C	PE57011	CORRECT DIAGRAMS	MA	11-29-78	

UNUSED LOGIC ELEMENTS

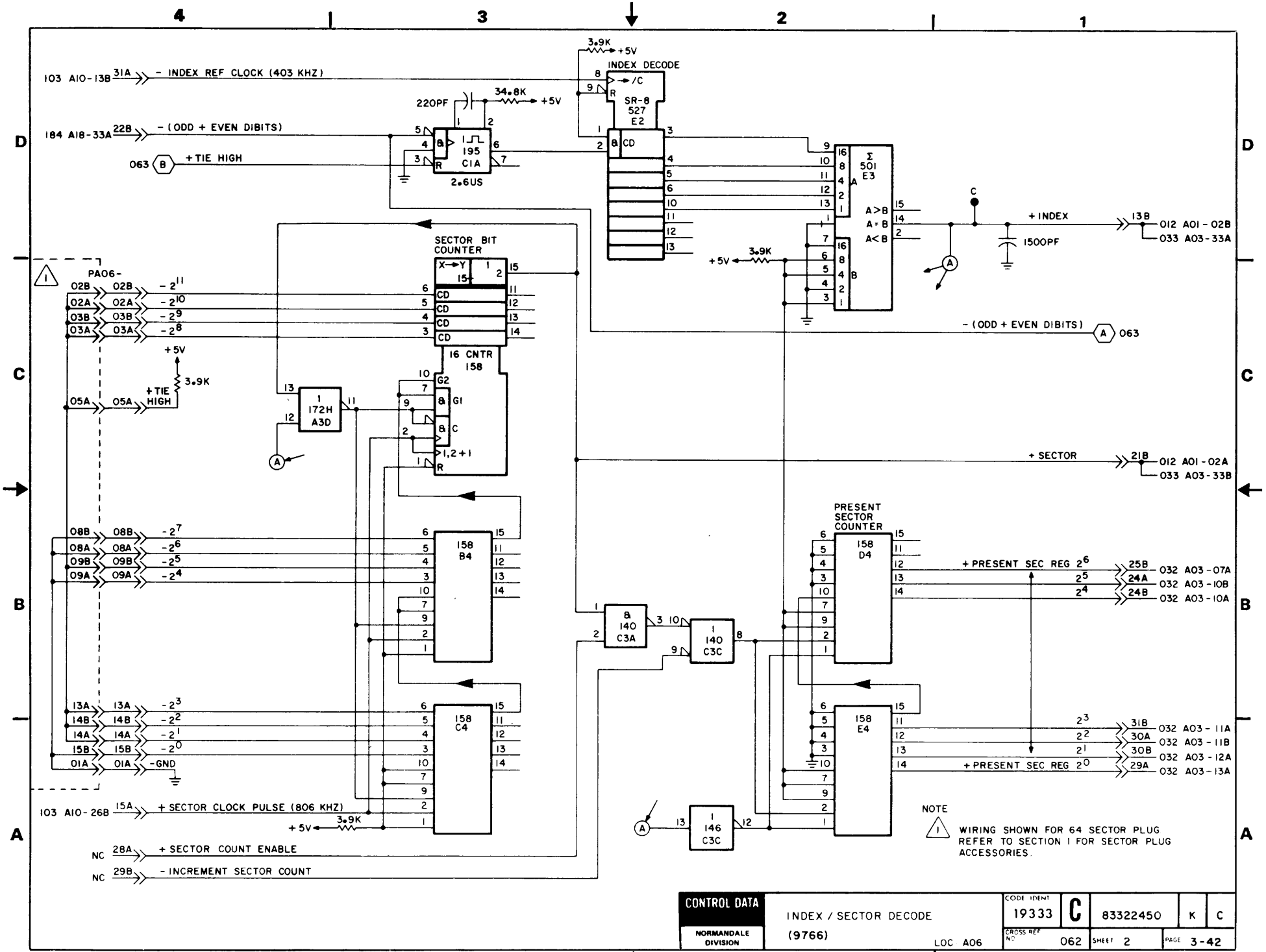




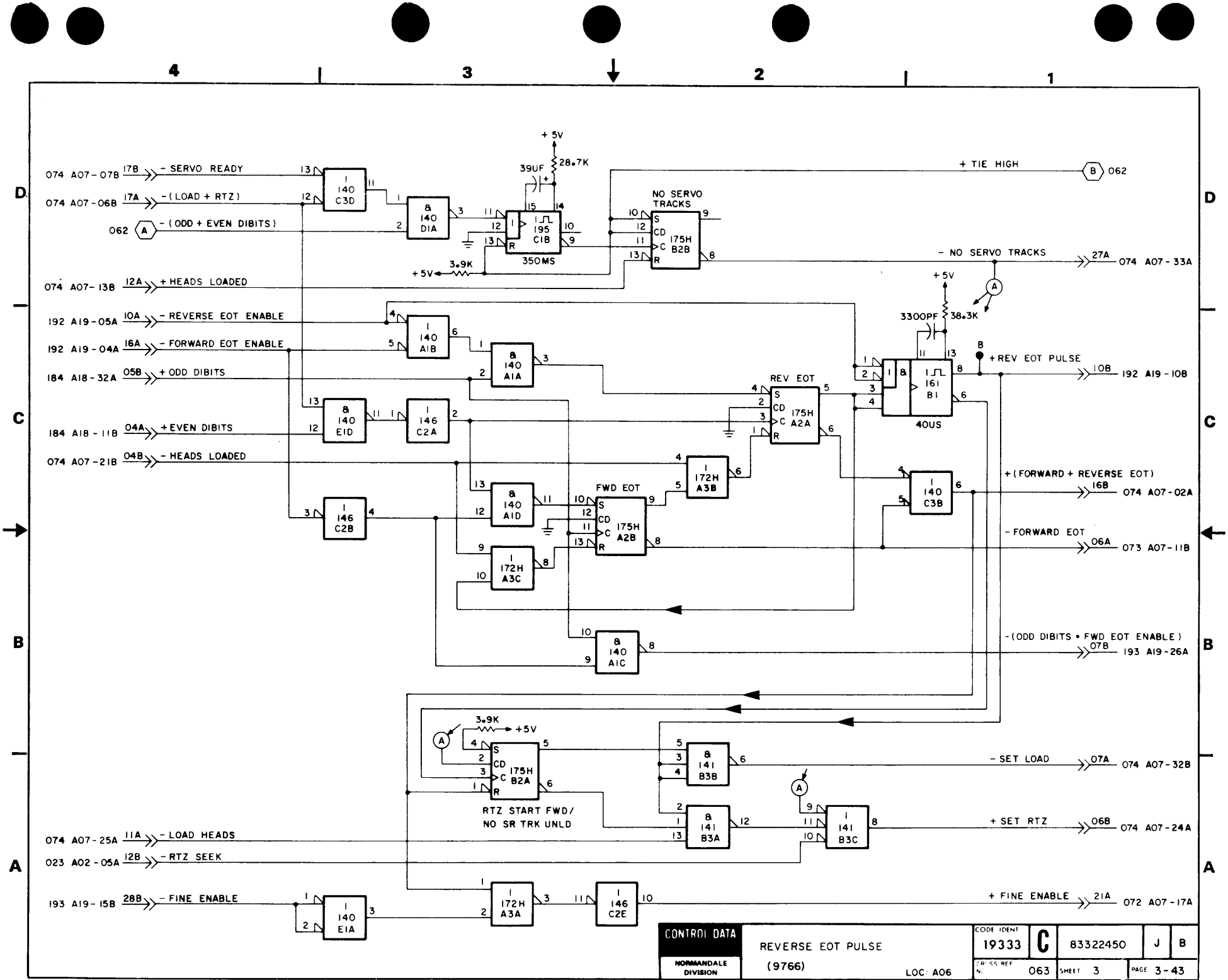
APPLICABLE ONLY TO BJ4M2, BJ402 = 9766-1

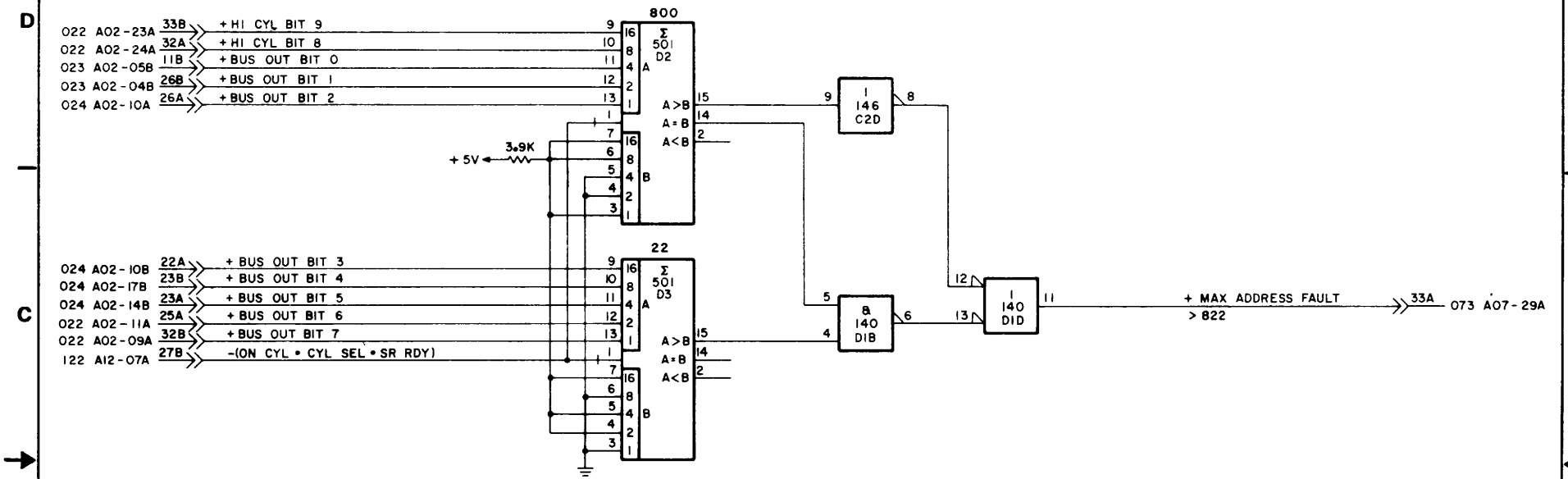
DRAWN	G. RABINE	4/13/76	CONTROL DATA	ACCESS CONTROL AND INDEX/SECTOR DECODE DIAGRAMS	CODE IDENT 19333	C	83322450	K C
CHECKED								
ENGINEER	[illegible]	12/15/76	NORMANDALE DIVISION	TYPE: ELTV LOC A06	CROSS REF NO 061		SHEET 1 OF 4	PAGE 3-41
APPROVED								

REF 83214906



CONTROL DATA NORMANDALE DIVISION	INDEX / SECTOR DECODE (9766) LOC A06	CODE IDENT 19333	C	83322450	K	C
		CROSS REF NO 062		SHEET 2	PAGE 3-42	


074 A07-07B 17B - SERVO READY
074 A07-06B 17A -(LOAD + RTZ)
062 A -(ODD + EVEN DIBITS)
074 A07-13B 12A + HEADS LOADED
192 A19-05A 10A - REVERSE EOT ENABLE
192 A19-04A 16A - FORWARD EOT ENABLE
184 A18-32A 05B + ODD DIBITS
184 A18-11B 04A + EVEN DIBITS
074 A07-21B 04B - HEADS LOADED
193 A19-15B 28B - FINE ENABLE
074 A07-25A 11A - LOAD HEADS
023 A02-05A 12B - RTZ SEEK
+5V
39UF
28.7K
3.9K
350MS
NO SERVO TRACKS
+ TIE HIGH
B 062
- NO SERVO TRACKS
27A 074 A07-33A
3300PF
38.3K
40US
+REV EOT PULSE
10B 192 A19-10B
REV EOT
FWD EOT
+(FORWARD + REVERSE EOT)
16B 074 A07-02A
- FORWARD EOT
06A 073 A07-11B
-(ODD DIBITS • FWD EOT ENABLE)
07B 193 A19-26A
RTZ START FWD/
NO SR TRK UNLD
- SET LOAD
07A 074 A07-32B
+ SET RTZ
06B 074 A07-24A
+ FINE ENABLE
21A 072 A07-17A
CONTROL DATA
NORMANDALE DIVISION
REVERSE EOT PULSE
(9766)
LOC: A06
CODE IDENT 19333
C
83322450
J
B
CROSS REF NO. 063
SHEET 3
PAGE 3-43



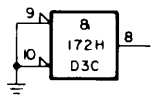
CONTROL DATA NORMANDALE DIVISION	MAX ADDRESS FAULT (9766) LOC A06	CODE IDENT 19333	C	83322450	J	B
		CROSS REF NO 064	SHEET 4	PAGE 3-44		

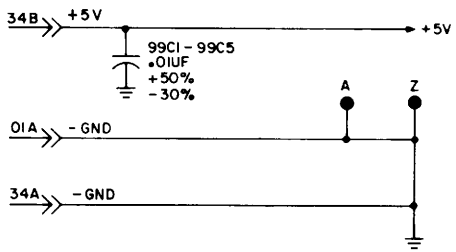
REVISION STATUS OF SHEETS																			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																
B	B	A	A																
C	C	C	C																

REVISIONS

REV.	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA	1-19-77	
B	PE22908	CHANGE DELAY	MLA	9-13-77	
C	PE55259	LOGIC DIAG IMPROVEMENT	A.A.O	8.7.78	

UNUSED LOGIC ELEMENT

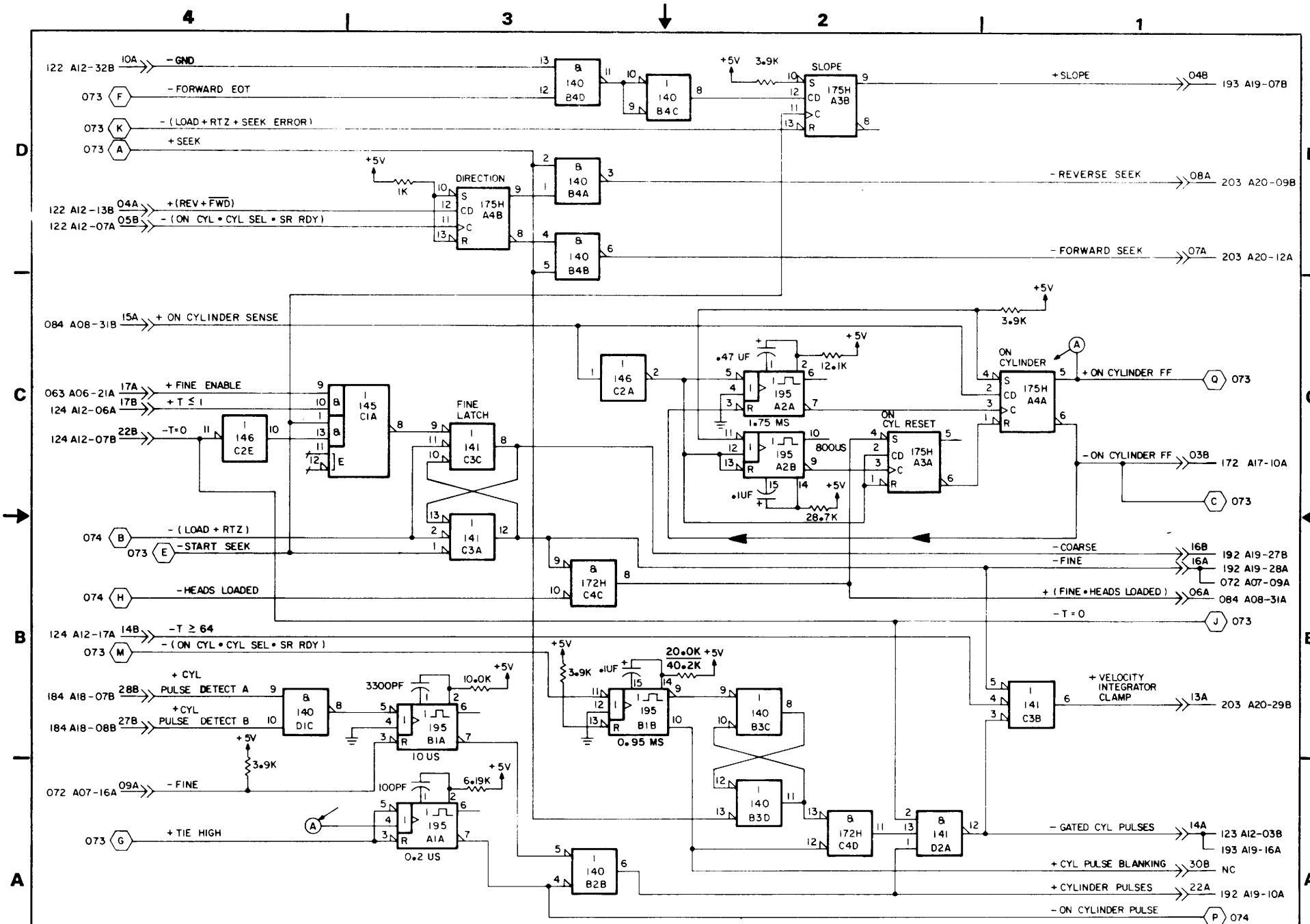




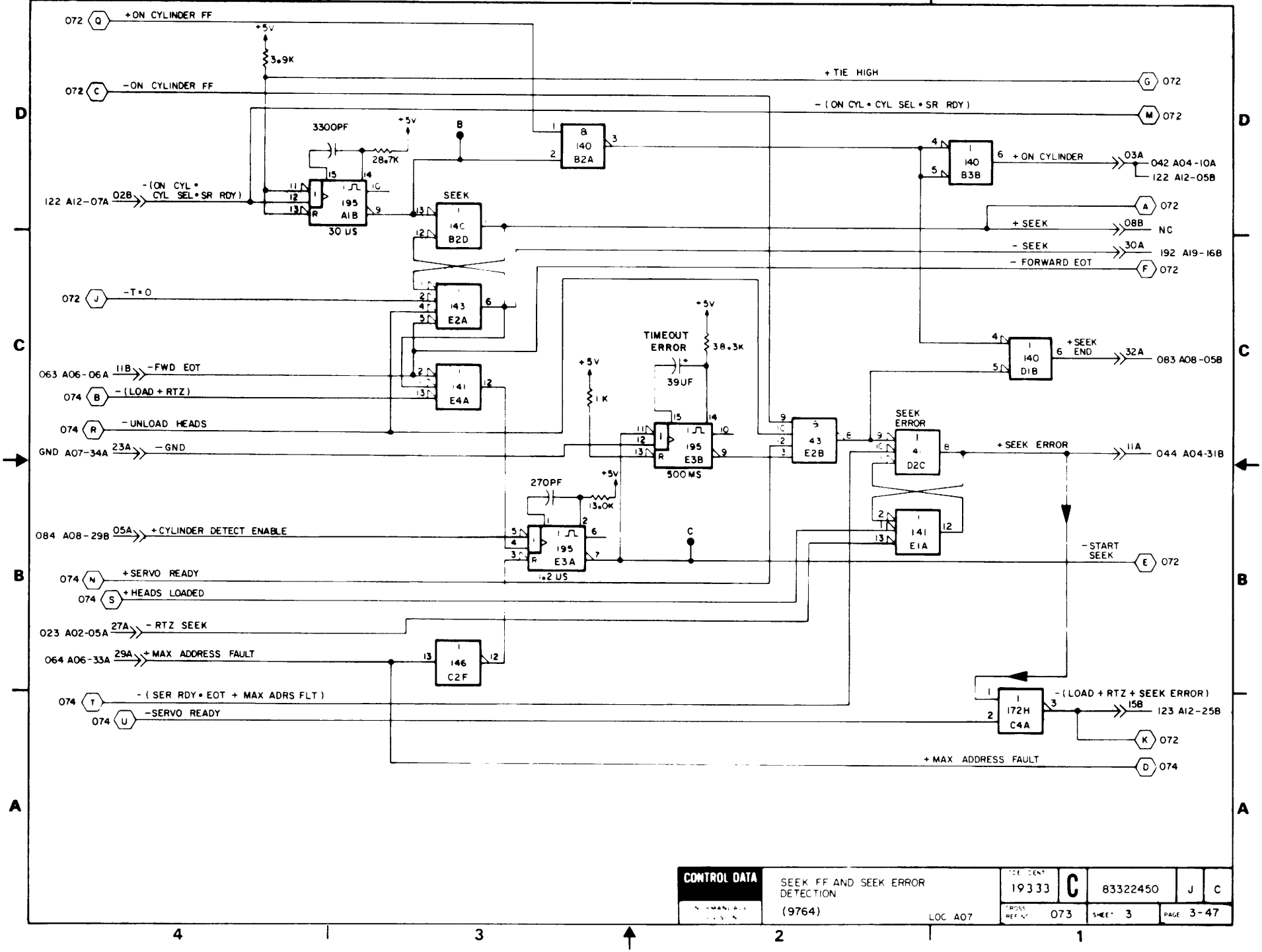
APPLICABLE ONLY TO BJ4M1 = 9764-1

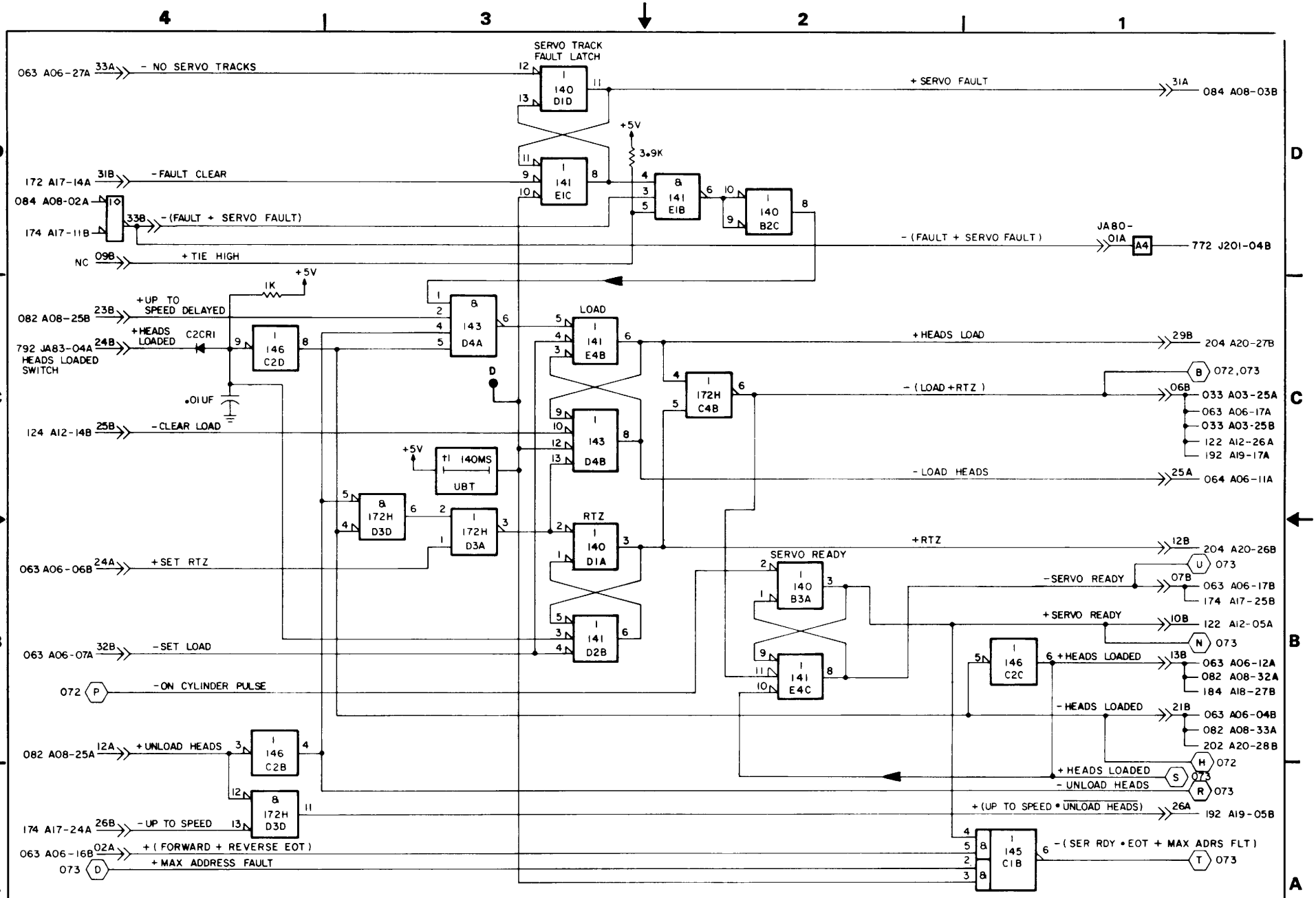
DRAWN	W.BERGSTROM	11-3-76	CONTROL DATA	ACCESS CONTROL NO. 1 DIAGRAMS	CODE IDENT 19333	C	83322450	J C
CHECKED			NORMANDALE DIVISION	TYPE: MLVV LOC A07	CROSS REF NO 071	SHEET 1 OF 4	PAGE 3-45	
ENGINEER								
APPROVED								

REF 83215004



CONTROL DATA NORMANDALE DIVISION	DIRECTION CONTROL, FINE LATCH, ON CYL AND CYL PULSES (9764) LOC A07	CODE IDENT 19333	C	83322450	J C
		CROSS REF NO 072		SHEET 2	PAGE 3-46


072 Q +ON CYLINDER FF
+5V
3.9K
072 C -ON CYLINDER FF
+ TIE HIGH
G 072
- (ON CYL • CYL SEL • SR RDY)
M 072
3300PF
28.7K
B
8 140 B2A
1 140 B3B
6 +ON CYLINDER
03A
042 A04-10A
122 A12-05B
122 A12-07A 02B -(ON CYL • CYL SEL • SR RDY)
195 A1B
30 US
SEEK
14C B2D
A 072
+SEEK
08B NC
-SEEK
30A
192 A19-16B
-FORWARD EOT
F 072
072 J -T=0
143 E2A
TIMEOUT ERROR
38.3K
39UF
+5V
1K
1 140 D1B
6 +SEEK END
32A
083 A08-05B
063 A06-06A 11B -FWD EOT
074 B -(LOAD + RTZ)
141 E4A
074 R -UNLOAD HEADS
GND A07-34A 23A -GND
195 E3B
500MS
5 43 E2B
SEEK ERROR
4 D2C
+SEEK ERROR
11A
044 A04-31B
270PF
13.0K
084 A08-29B 05A +CYLINDER DETECT ENABLE
195 E3A
1.2 US
C
141 E1A
-START SEEK
E 072
074 N +SERVO READY
074 S +HEADS LOADED
023 A02-05A 27A -RTZ SEEK
064 A06-33A 29A +MAX ADDRESS FAULT
146 C2F
074 T -(SER RDY • EOT + MAX ADRS FLT)
074 U -SERVO READY
172H C4A
-(LOAD + RTZ + SEEK ERROR)
15B
123 A12-25B
K 072
+MAX ADDRESS FAULT
D 074
CONTROL DATA
SEEK FF AND SEEK ERROR DETECTION
(9764)
LOC A07
19333
C
83322450
J
C
073
SHEET 3
PAGE 3-47



CONTROL DATA NORMANDALE DIVISION	SERVO FAULT, LOAD FF AND RTZ FF (9764) LOC A07	CODE IDENT 19333	C	83322450	J	C
		CROSS REF NO 074	SHEET 4	PAGE 3-48		

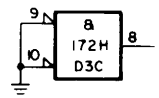
REVISION STATUS OF SHEETS

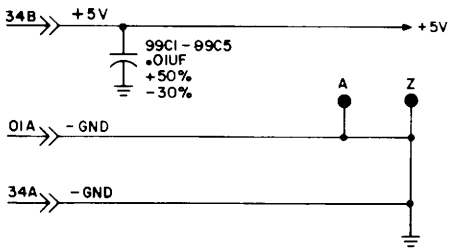
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																
B	B	A	A																
C	B	A	A																
D	D	D	D																

REVISIONS

REV.	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA	1-19-76	
B	PE22908	CHANGE DELAY	MLA	9-13-77	
C		EDITORIAL	DM	2-14-78	
D	PE55259	LOGIC DIAG IMPROVEMENT	A A O	8-7-78	

UNUSED LOGIC ELEMENT

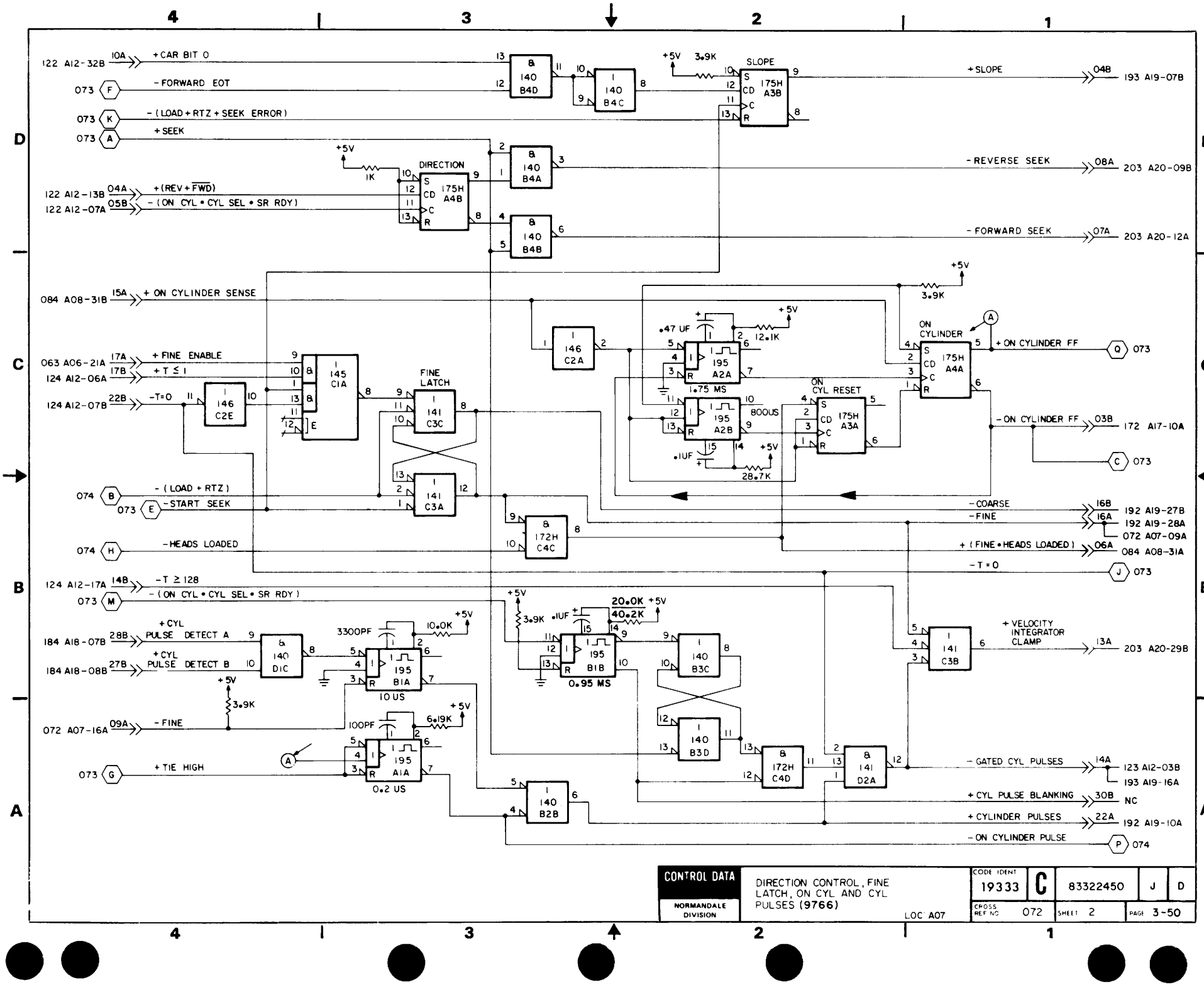




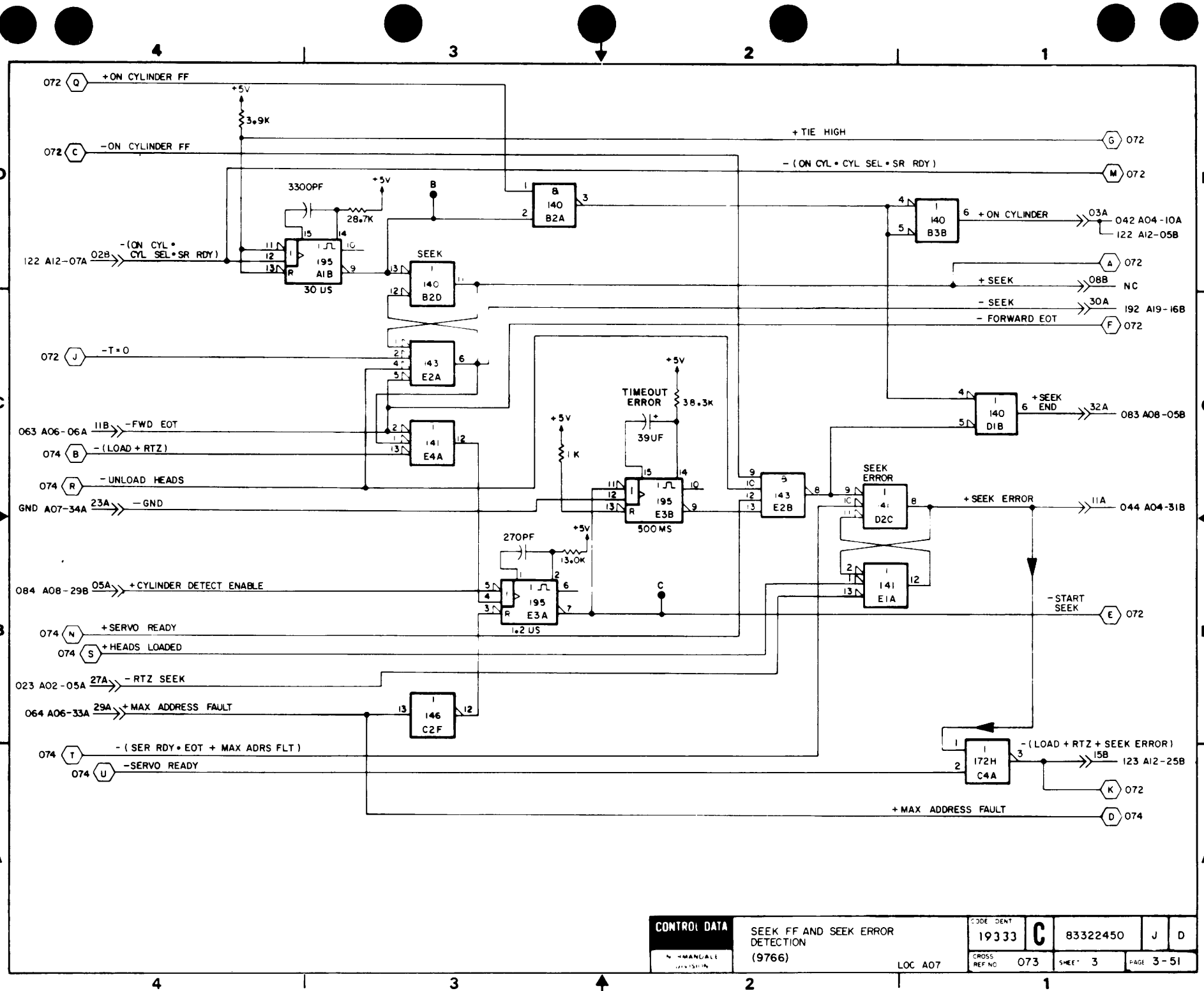
APPLICABLE ONLY TO BJ4M2, BJ402 = 9766-1

DRAWN	M.ANDERSON		CONTROL DATA	ACCESS CONTROL NO. 1 DIAGRAMS	CODE IDENT 19333	C	83322450 J D
CHECKED							
ENGINEER			NORMANDALE DIVISION	TYPE: MLVV LOC A07	CROSS REF NO 071	SHEET 1 OF 4	PAGE 3-49
APPROVED							

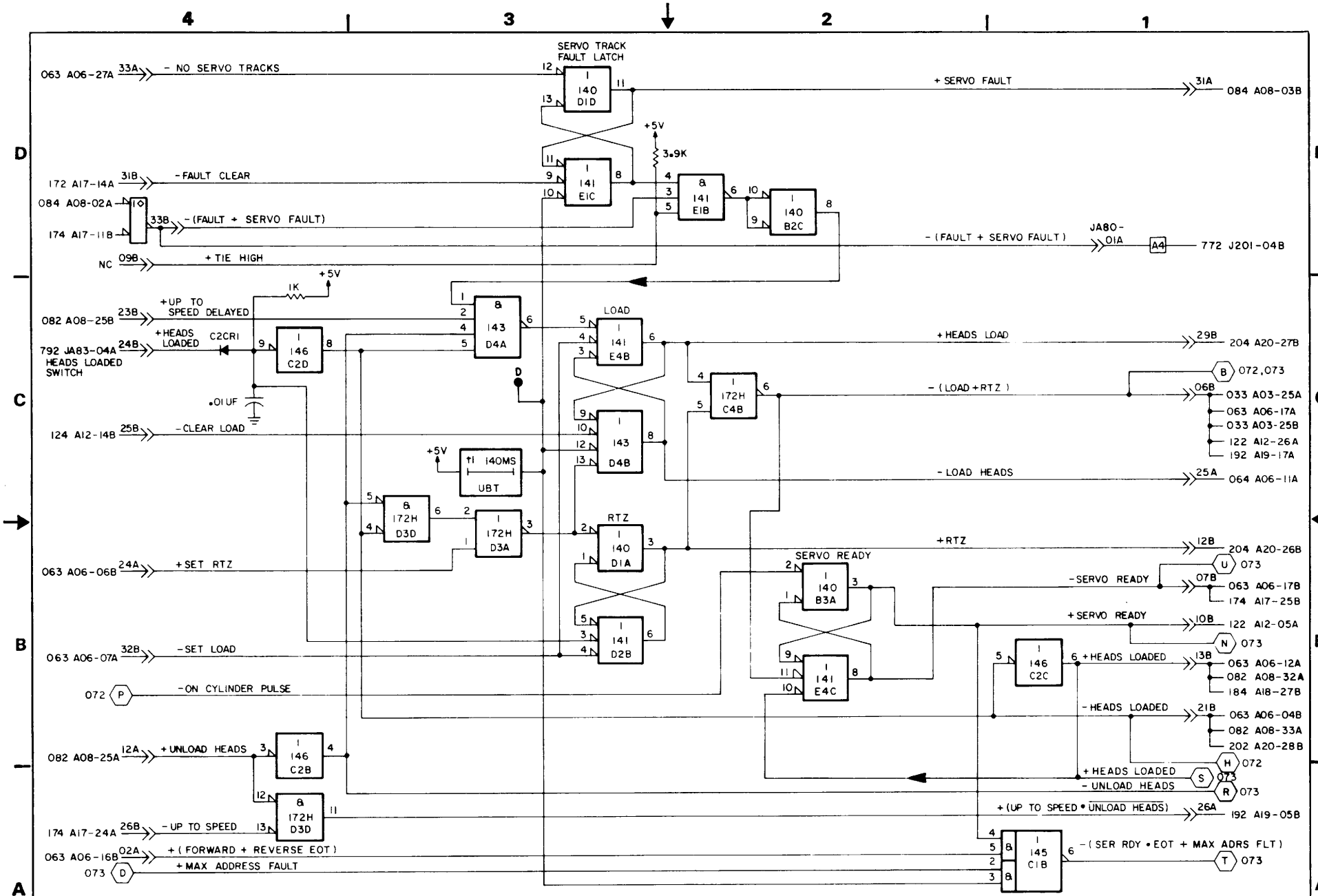
REF 83214907



CONTROL DATA NORMANDALE DIVISION	DIRECTION CONTROL, FINE LATCH, ON CYL AND CYL PULSES (9766) LOC A07	CODE IDENT 19333	C	83322450	J D
		CROSS REF NO 072	SHEET 2	PAGE 3-50	



CONTROL DATA	SEEK FF AND SEEK ERROR DETECTION (9766) LOC A07	CODE IDENT 19333	C	83322450	J D
		CROSS REF NO 073		SHEET 3	PAGE 3-51

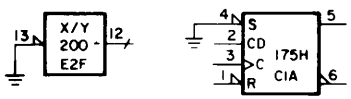


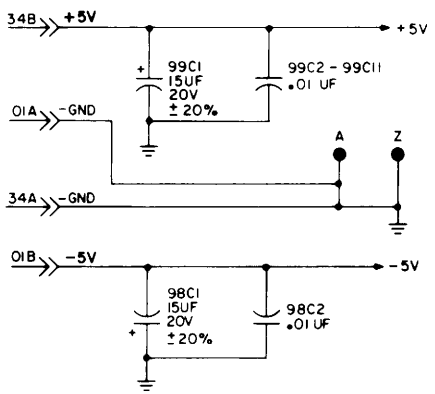
CONTROL DATA NORMANDALE DIVISION	SERVO FAULT, LOAD FF AND RTZ FF (9766) LOC A07	CODE IDENT 19333	C	83322450	J	D
		CROSS REF NO. 074		SHEET 4	PAGE 3-52	

REVISION STATUS OF SHEETS																			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																
B	B	B	B																

REVISIONS					
REV.	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	M.L.A	[illegible]	
B	PE35259	LOGIC DIAG IMPROVEMENT	A.A.O	8-7-78	

UNUSED LOGIC ELEMENTS

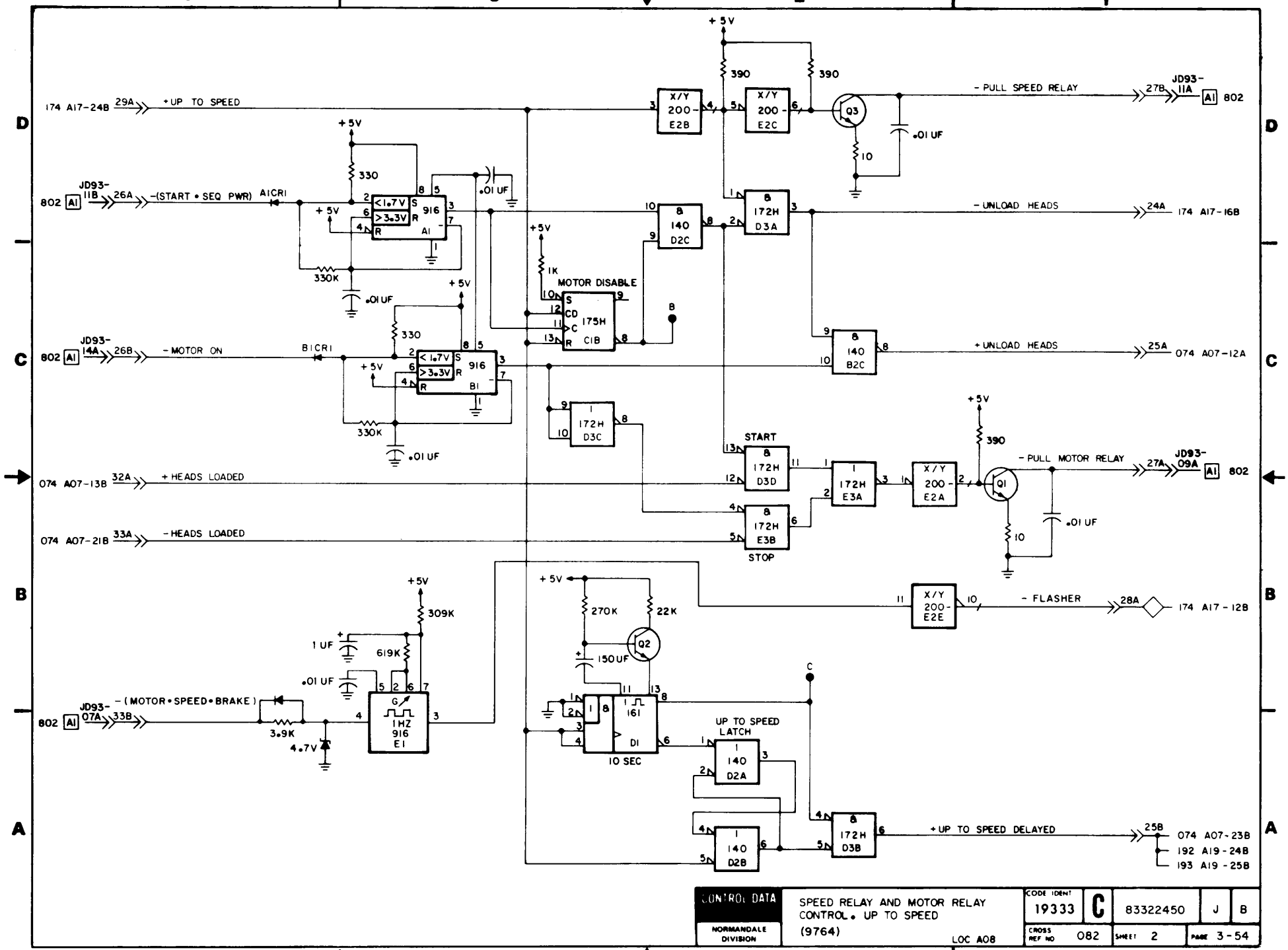


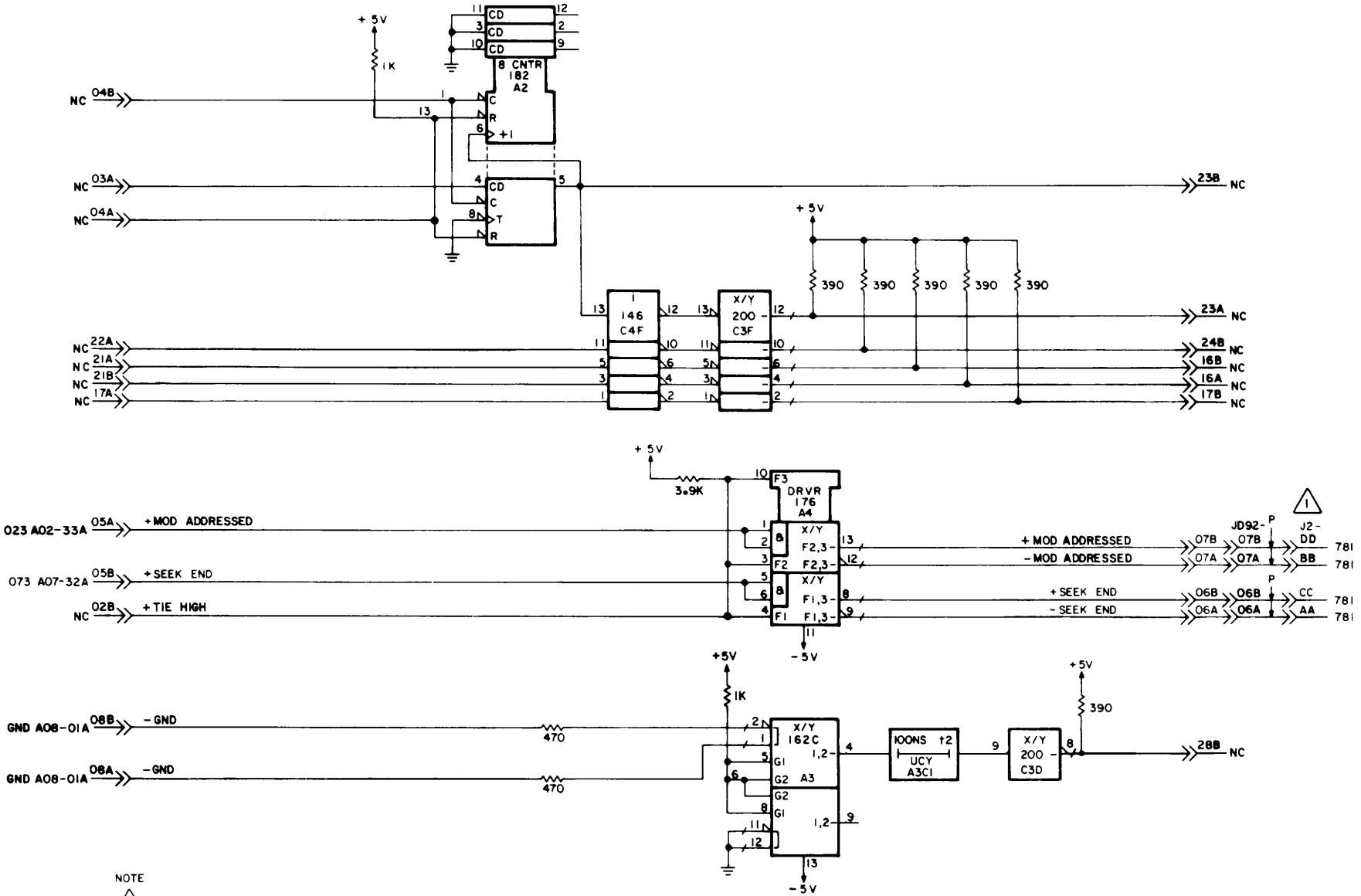


APPLICABLE ONLY TO BJ4MI = 9764 - 1

DRAWN	MANDERSON 11-10-76	CONTROL DATA	DIFF BITS, SPEED ENABLE MOD ADDRESSED DIAGRAMS	CODE IDENT 19333	C	83322450	J B
CHECKED							
ENGINEER							
APPROVED		NORMANDALE DIVISION	TYPE CQPV LOC A08	CROSS REF NO 081	SHEET 1 OF 4		REV 3-53

REF 83215005

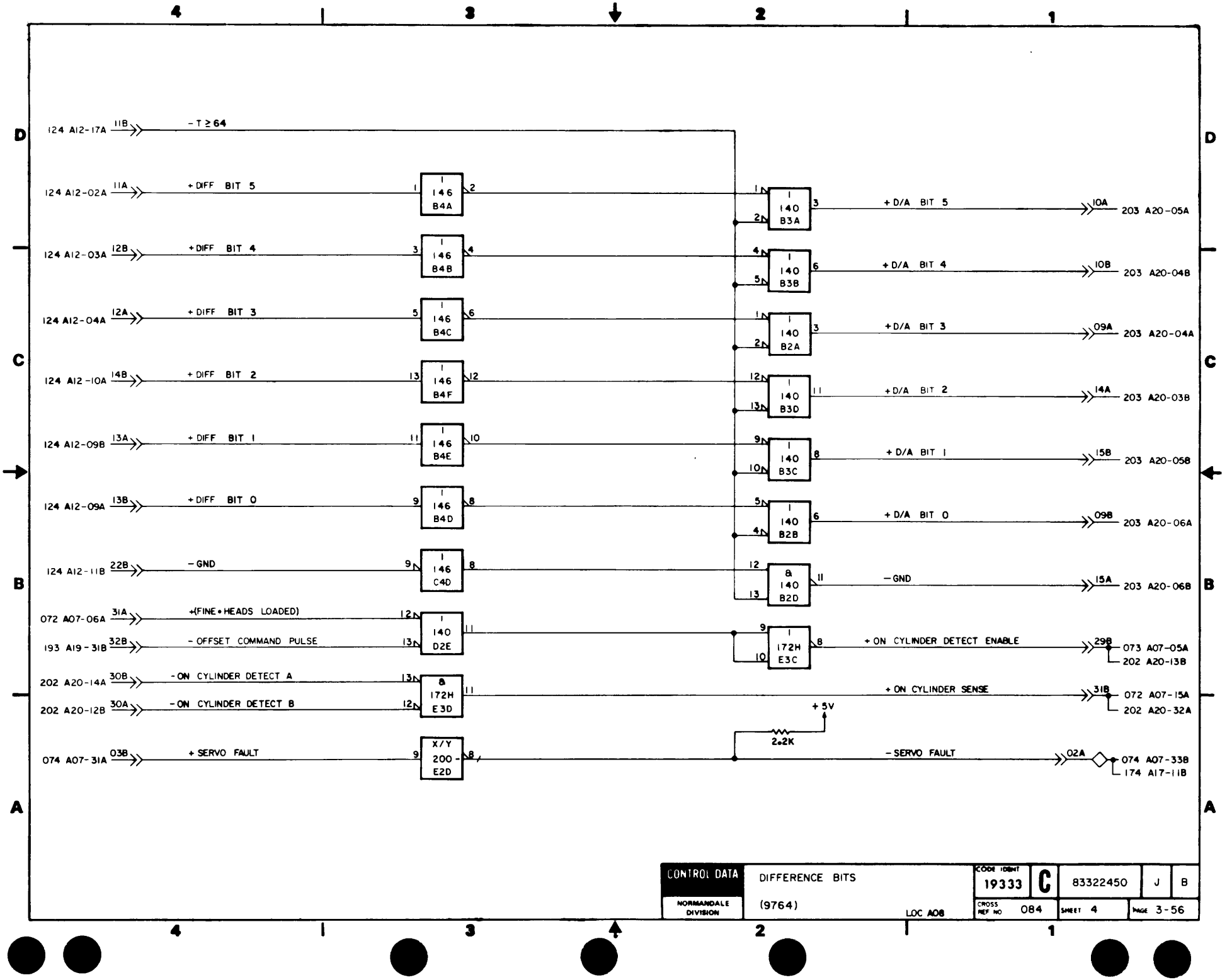

+UP TO SPEED
174 A17-24B
29A
X/Y 200-E2B
X/Y 200-E2C
390
390
+5V
Q3
10
.01 UF
- PULL SPEED RELAY
27B
JD93-11A
A1
802
330
JD93-11B
802 A1
26A
-(START • SEQ PWR)
A1CR1
<1.7V
>3.3V
916 A1
330K
.01 UF
8 140 D2C
8 172H D3A
- UNLOAD HEADS
24A
174 A17-16B
1K
MOTOR DISABLE
175H C1B
B
JD93-14A
802 A1
26B
- MOTOR ON
B1CR1
916 B1
8 140 B2C
+ UNLOAD HEADS
25A
074 A07-12A
1 172H D3C
START
8 172H D3D
8 172H E3B
STOP
1 172H E3A
X/Y 200-E2A
Q1
- PULL MOTOR RELAY
27A
JD93-09A
074 A07-13B
32A
+ HEADS LOADED
074 A07-21B
33A
- HEADS LOADED
X/Y 200-E2E
- FLASHER
28A
174 A17-12B
309K
1 UF
619K
.01 UF
270K
22K
Q2
150UF
JD93-07A
802 A1
33B
-(MOTOR • SPEED • BRAKE)
3.9K
4.7V
1HZ 916 E1
161 D1
10 SEC
C
UP TO SPEED LATCH
1 140 D2A
1 140 D2B
8 172H D3B
+UP TO SPEED DELAYED
25B
074 A07-23B
192 A19-24B
193 A19-25B
CONTROL DATA
NORMANDALE DIVISION
SPEED RELAY AND MOTOR RELAY CONTROL • UP TO SPEED
(9764)
LOC A08
CODE IDENT 19333
C
83322450
J
B
CROSS REF NO 082
SHEET 2
PAGE 3-54



NOTE

(1) SEE CROSS REF NO 782 FOR I/O CABLING INFORMATION.

CONTROL DATA NORMANDALE DIVISION	MOD ADDRESSED XMTR SEEK END XMTR (9764) LOC A08	CODE IDENT 19333	C	83322450	J B
		CROSS REF NO 083		SHEET 3	PAGE 3-55



CONTROL DATA NORMANDALE DIVISION	DIFFERENCE BITS (9764) LOC A08	CODE IDENT 19333	C	83322450	J	B
		CROSS REF NO 084		SHEET 4	PAGE 3-56	

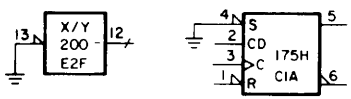
REVISION STATUS OF SHEETS

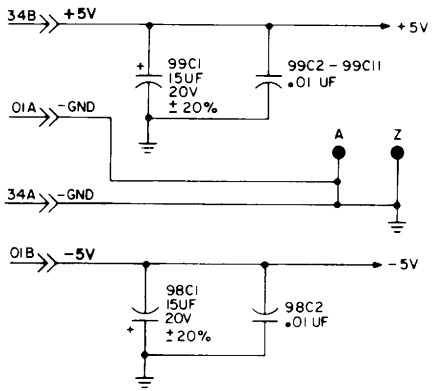
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																
B	B	A	A																
C	B	A	A																
D	D	D	D																

REVISIONS

REV.	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	M.A	30-76	
B	PE48403	ADD PULL UP TO CQPV	MA	3-21-77	
C		EDITORIAL	DM	2-14-78	
D	PE55259	LOGIC DIAG. IMPROVEMENT	A.A.O	8-7-78	

UNUSED LOGIC ELEMENTS

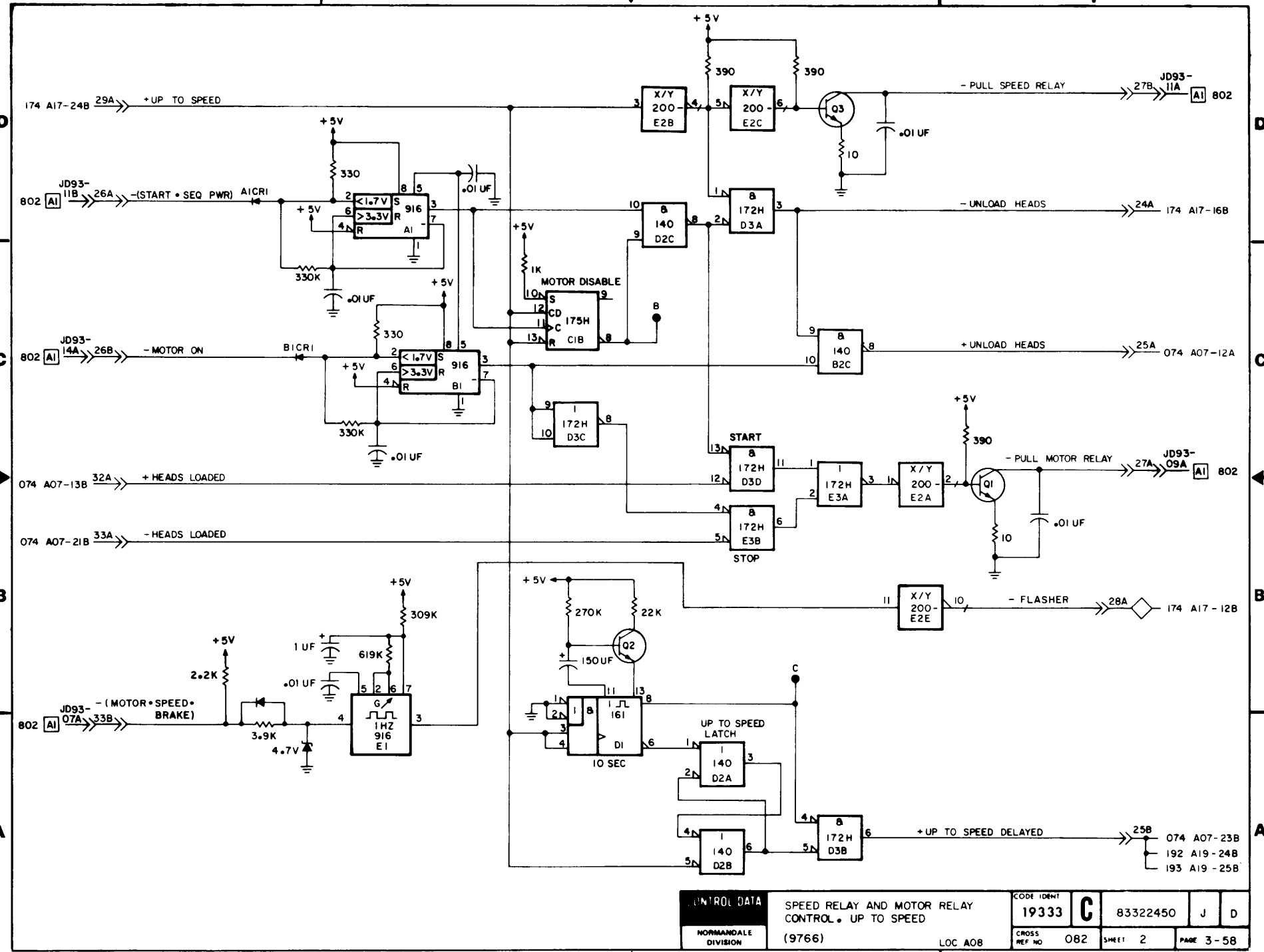




APPLICABLE ONLY TO BJ4M2, BJ402 = 9766-1

DRAWN	MANDERSON	12-30-76	CONTROL DATA	DIFF BITS, SPEED ENABLE, MOD ADDRESSED DIAGRAMS	CODE IDENT 19333	C	83322450 J D
CHECKED							
ENGINEER			NORMANDALE DIVISION	TYPE: CQPV LOC A08	CROSS REF NO. 081	SHEET 1 OF 4	PAGE 3-57
APPROVED							

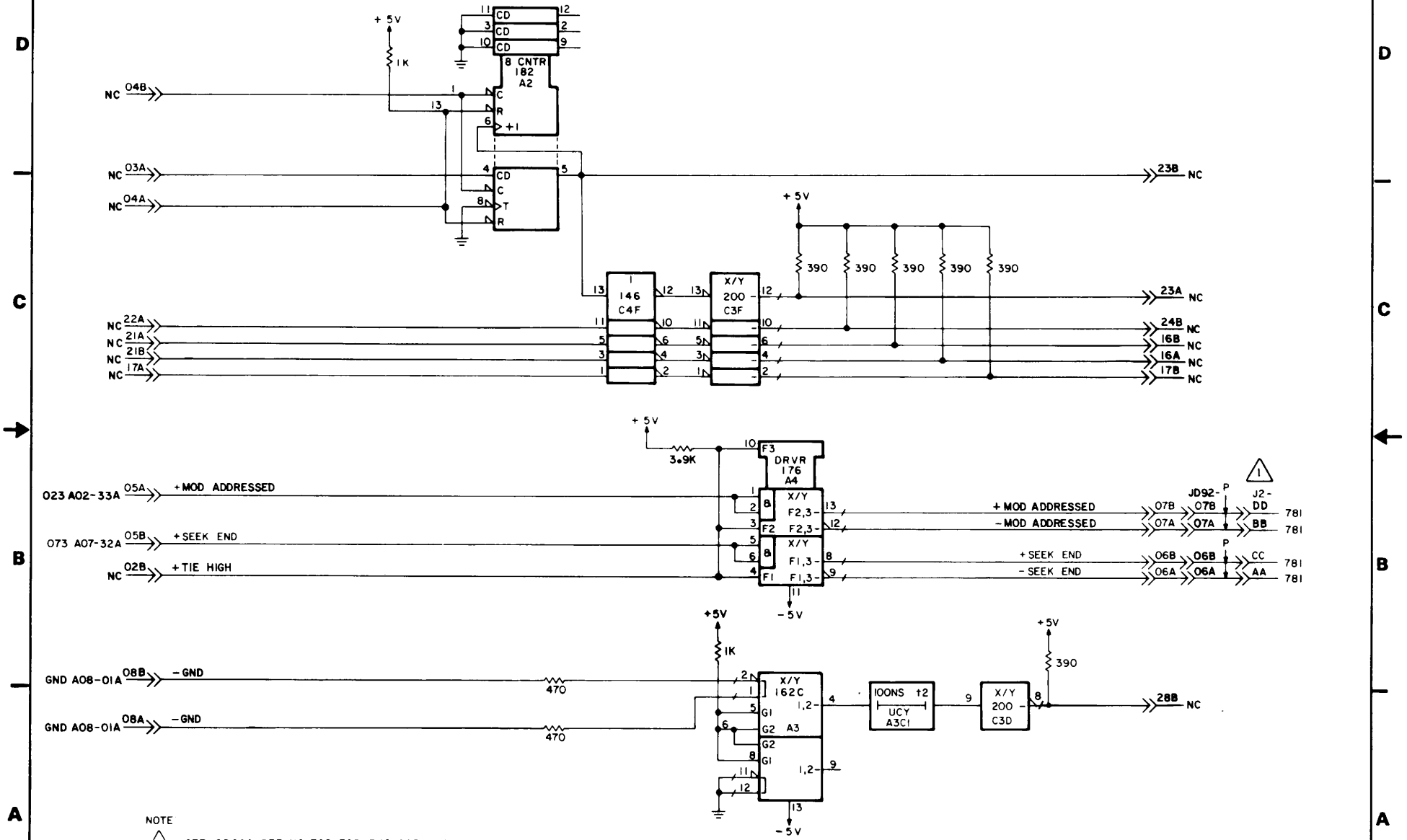
REF 83214908



CONTROL DATA
NORMANDALE DIVISION

SPEED RELAY AND MOTOR RELAY CONTROL • UP TO SPEED
(9766) LOC A08

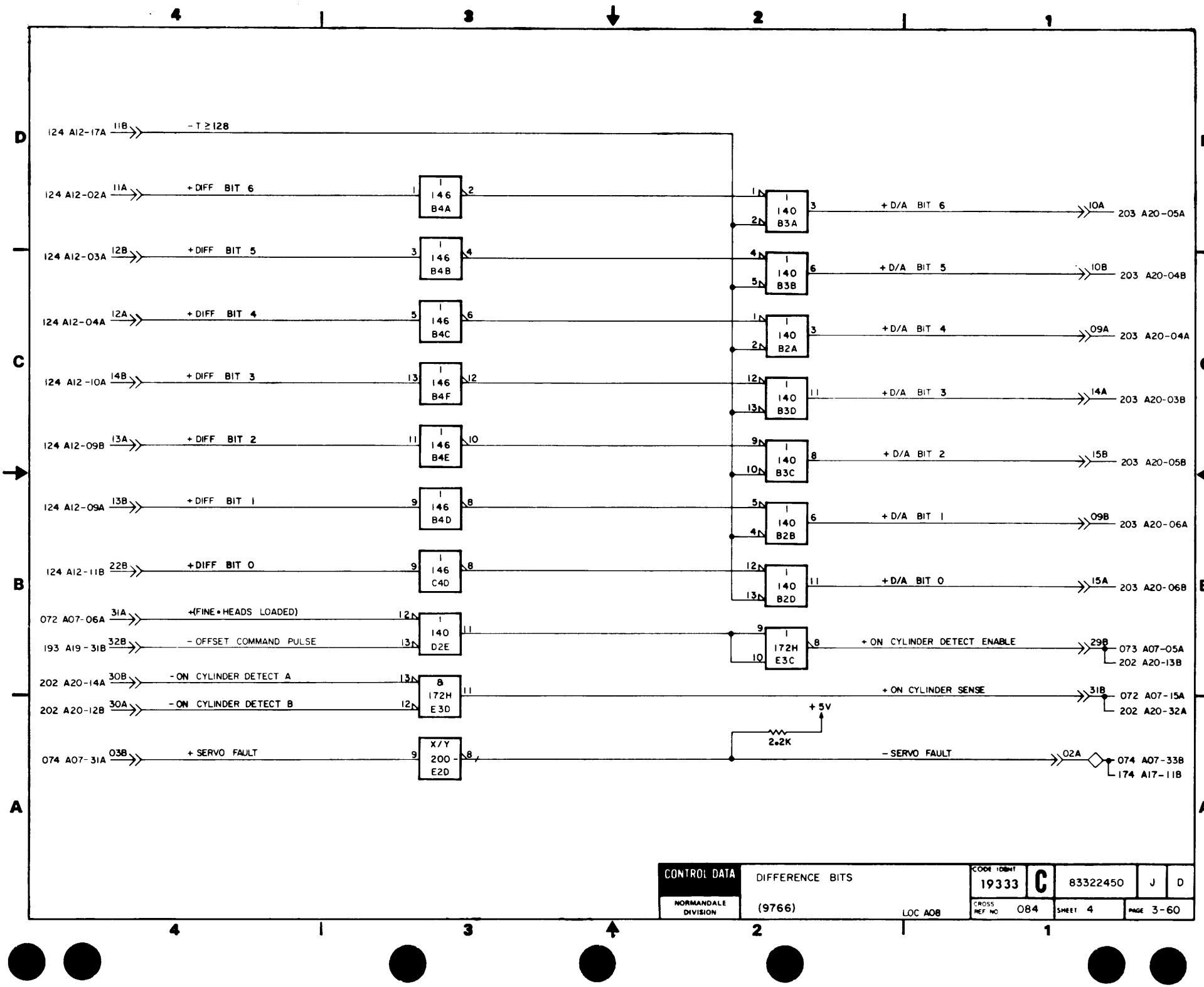
CODE IDENT				
19333	C	83322450	J	D
CROSS REF NO 082	SHEET 2	PAGE 3-58		



NOTE

⚠1 SEE CROSS REF NO 782 FOR I/O CABLING INFORMATION.

CONTROL DATA NORMANDALE DIVISION	MOD ADDRESSED XMTR SEEK END XMTR (9766) LOC A08	CODE IDENT 19333	C	83322450	J	D
		CROSS REF NO 083		SHEET 3	PAGE 3-59	



CONTROL DATA NORMANDALE DIVISION	DIFFERENCE BITS (9766) LOC A08	CODE IDENT 19333	C	83322450	J D
		CROSS REF NO 084		SHEET 4	PAGE 3-60

REVISION STATUS OF SHEETS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																
B	A	B	A																
C	A	B	C																
D	D	D	D																
E	D	E	D																
F	D	F	D																

REVISIONS

REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	M.A	11-16-76	
B	PE48555	REPLACE CLSV REV B WITH REV C	SB	5-2-77	
C	PE22926	ERROR CORRECTION	DM	7-8-77	
D	PE48650	CLSV CARD CHANGE	DM	12-9-77	
E	PE55185	CHANGE DELAY CLSV	A.A.O	7-19-78	
F	PE55259	LOGIC DIAG IMPROVEMENT	MA	9-14-78	

DRAWN	W.BERGSTROM	10-22-76
CHECKED		
ENGINEER		
APPROVED		

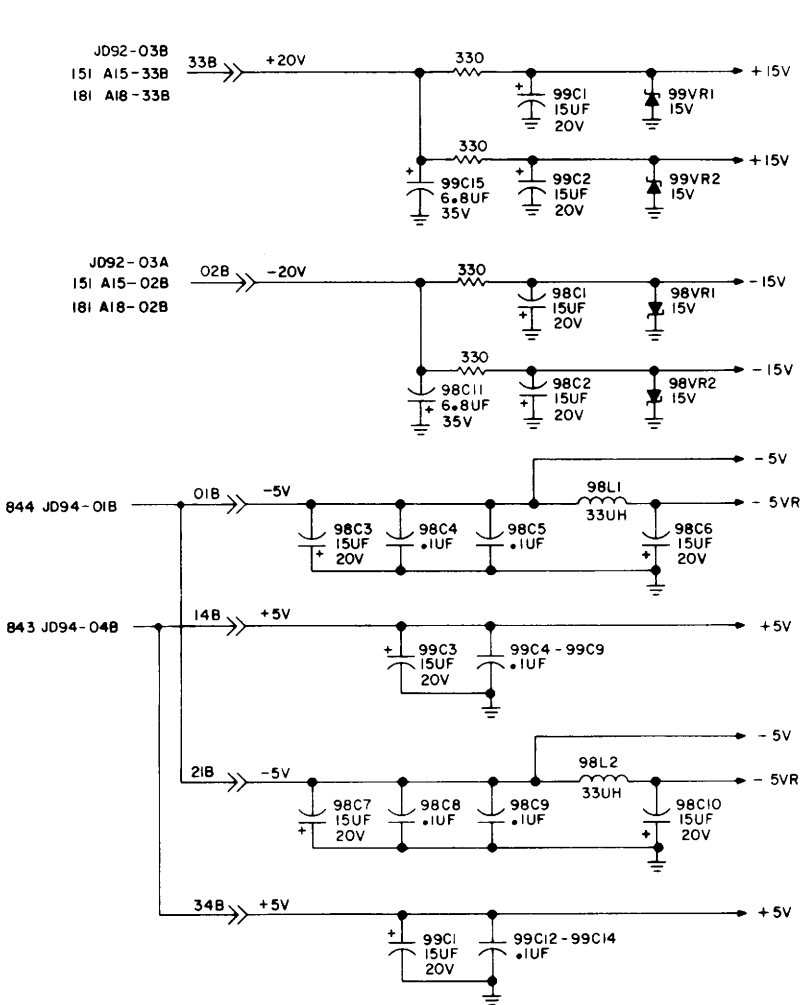
CONTROL DATA
NORMANDALE DIVISION

WRITE CLOCK 806 KHZ
TO 9.67 MHZ DIAGRAMS

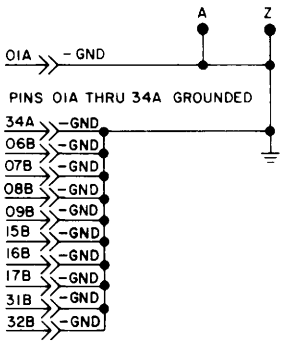
TYPE: CLSV LOC: A10

CODE IDENT				
19333	C	83322450	J	F
CROSS REF NO 101	SHEET 1 OF 4	PAGE 3-61		

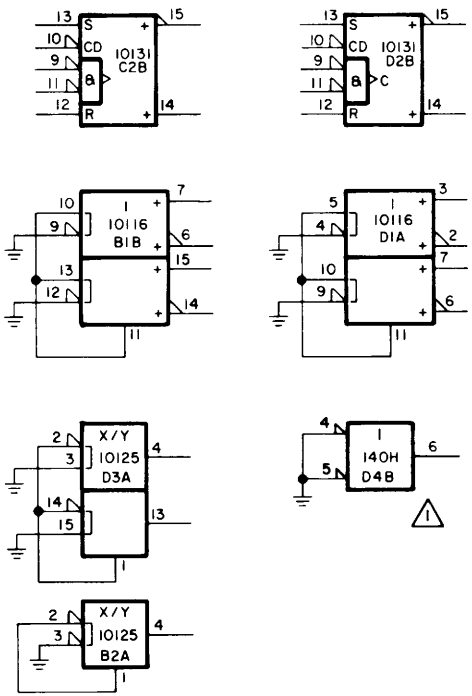
REF 83214910



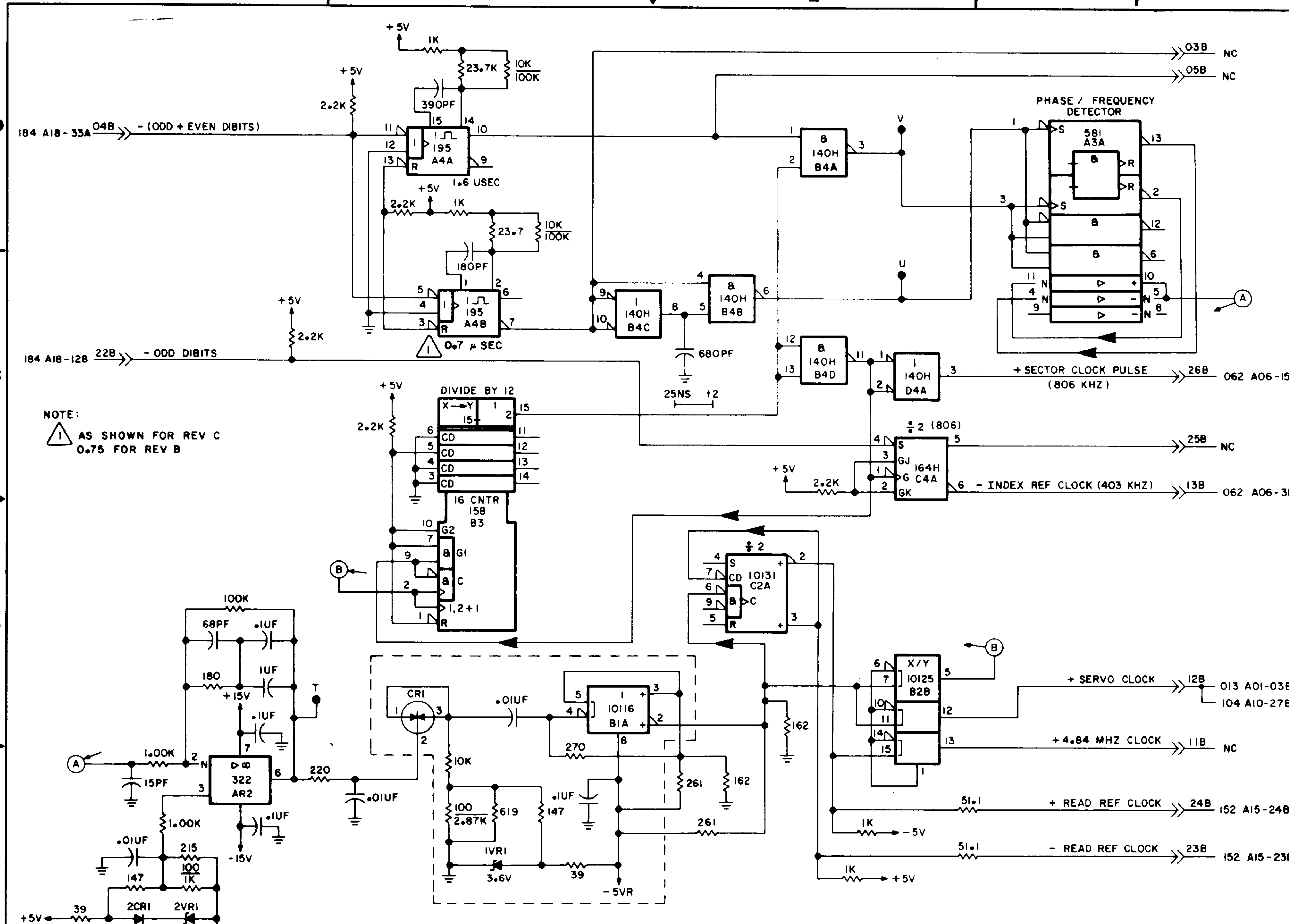
⚠1 APPLICABLE TO REV C & BLW ONLY



UNUSED LOGIC ELEMENTS



CONTROL DATA NORMANDALE DIVISION	POWER INPUT PINS AND UNUSED LOGIC ELEMENTS LOC A10	CODE IDENT 19333	C	83322450	E	D
		CROSS REF NO 102	SHEET 2	PAGE 3-62		

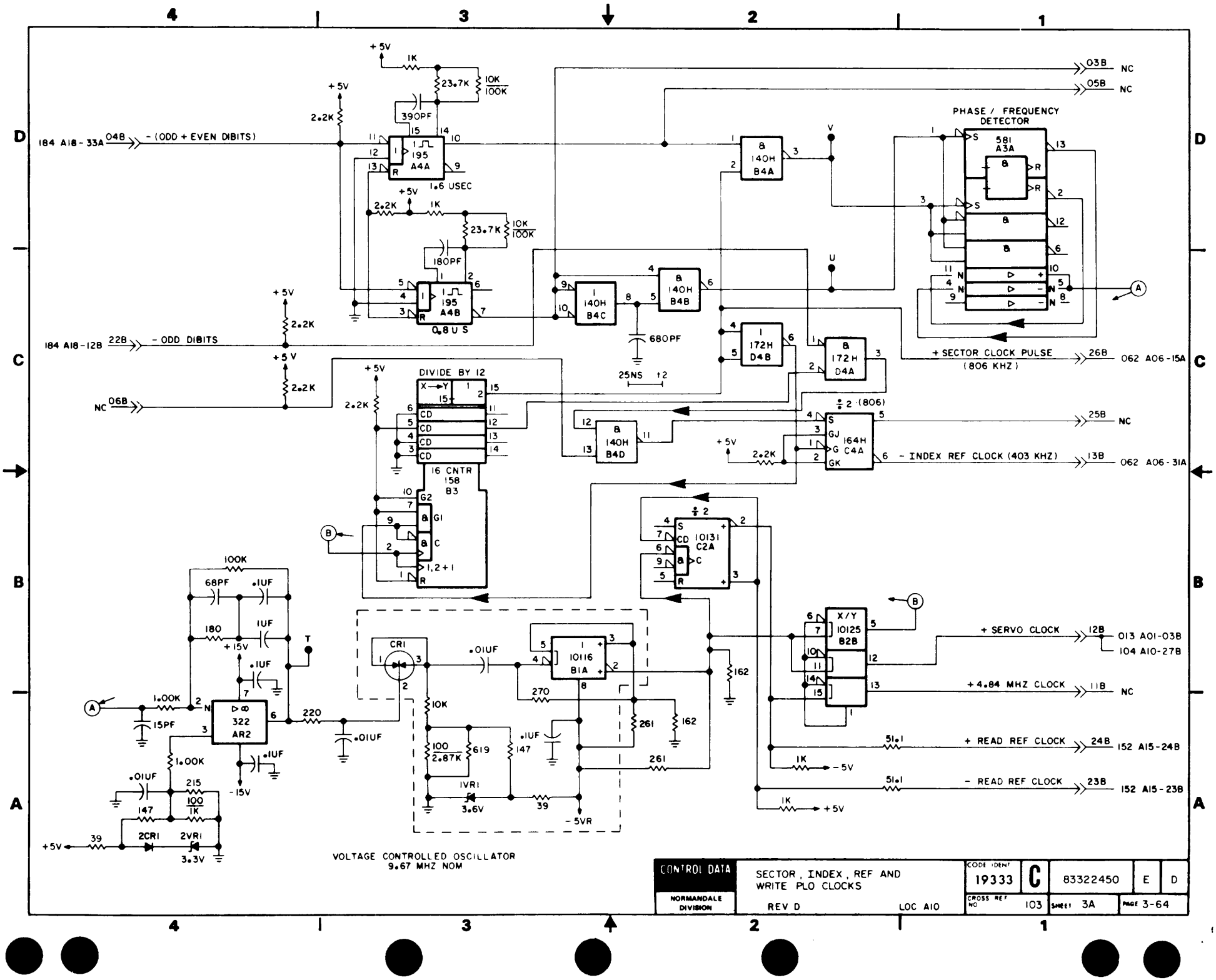


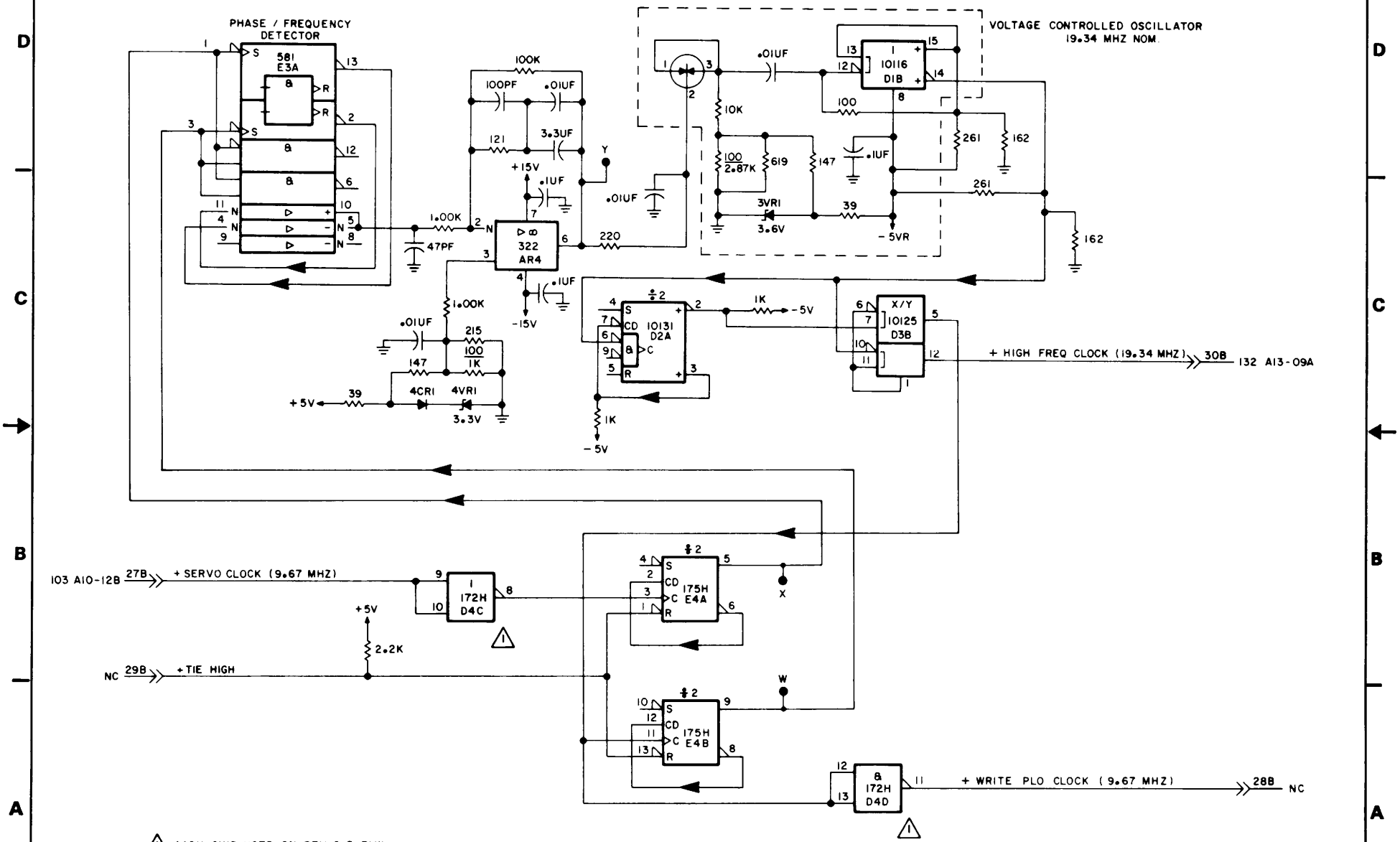
CONTROL DATA NORMANDALE DIVISION

SECTOR, INDEX, REF AND WRITE PLO CLOCKS

REV C & BLW LOC A10

CODE IDENT				
19333	C	83322450	H	E
CROSS REF NO 103	SHEET 3	PAGE 3-63		


PHASE / FREQUENCY DETECTOR
581 A3A
DIVIDE BY 12
16 CNTR 158 B3
140H B4A
140H B4B
140H B4C
140H B4D
172H D4A
172H D4B
164H C4A
10131 C2A
10116 B1A
10125 B2B
322 AR2
195 A4A
195 A4B
1.6 USEC
0.8 U S
680PF
25NS ±2
÷2 (806)
+ SECTOR CLOCK PULSE (806 KHZ)
- INDEX REF CLOCK (403 KHZ)
+ SERVO CLOCK
+4.84 MHZ CLOCK
+ READ REF CLOCK
- READ REF CLOCK
184 A18-33A 04B - (ODD + EVEN DIBITS)
184 A18-12B 22B - ODD DIBITS
NC 06B
03B NC
05B NC
25B NC
26B 062 A06-15A
13B 062 A06-31A
12B 013 A01-03B
104 A10-27B
11B NC
24B 152 A15-24B
23B 152 A15-23B
VOLTAGE CONTROLLED OSCILLATOR
9.67 MHZ NOM
CONTROL DATA
NORMANDALE DIVISION
SECTOR, INDEX, REF AND WRITE PLO CLOCKS
REV D
LOC A10
CODE IDENT 19333
C
83322450
E
D
CROSS REF NO 103
SHEET 3A
PAGE 3-64



CONTROL DATA NORMANDALE DIVISION	SERVO AND READ CLOCKS LOC A10	CODE IDENT 19333	C	83322450	J F
		CROSS REF NO 104		SHEET 4	3-64.1/3-64.2

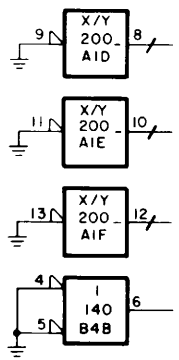
REVISION STATUS OF SHEETS

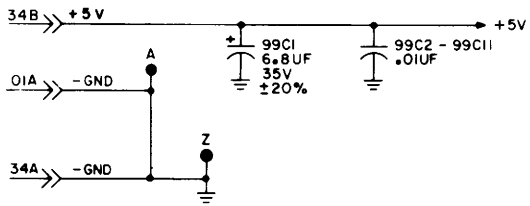
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																
B	B	B	B																
C	B	B	C																
D	B	B	D																

REVISIONS

REV	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA		
B	PE55259	LOGIC DIAG. IMPROVEMENT	A.A.O	8.7.78	
C	PE57112	STATUS PROTECT			
D	PE57185	WIRE WRAP CHANGE	TH	9-14-79	

UNUSED LOGIC ELEMENTS

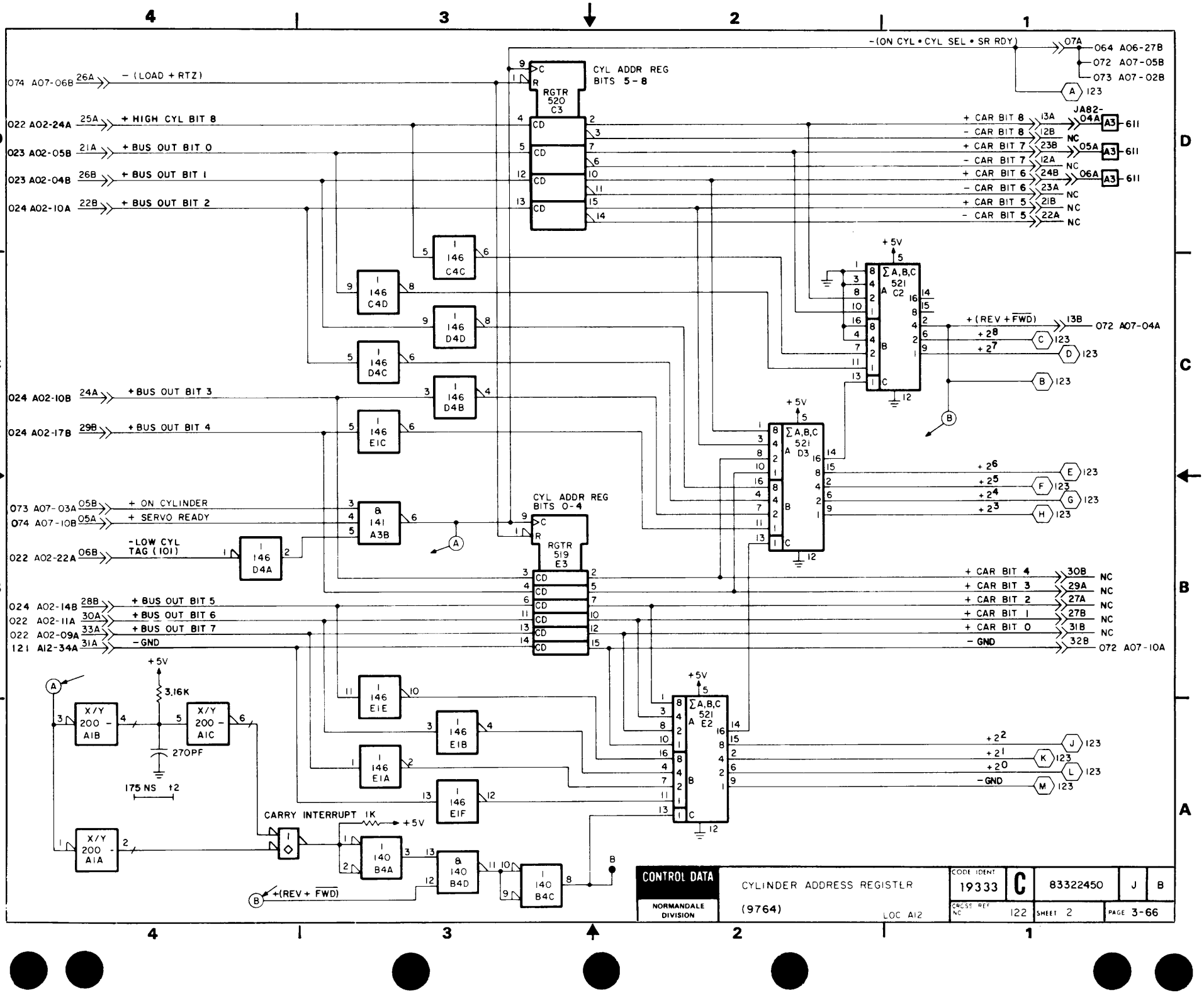


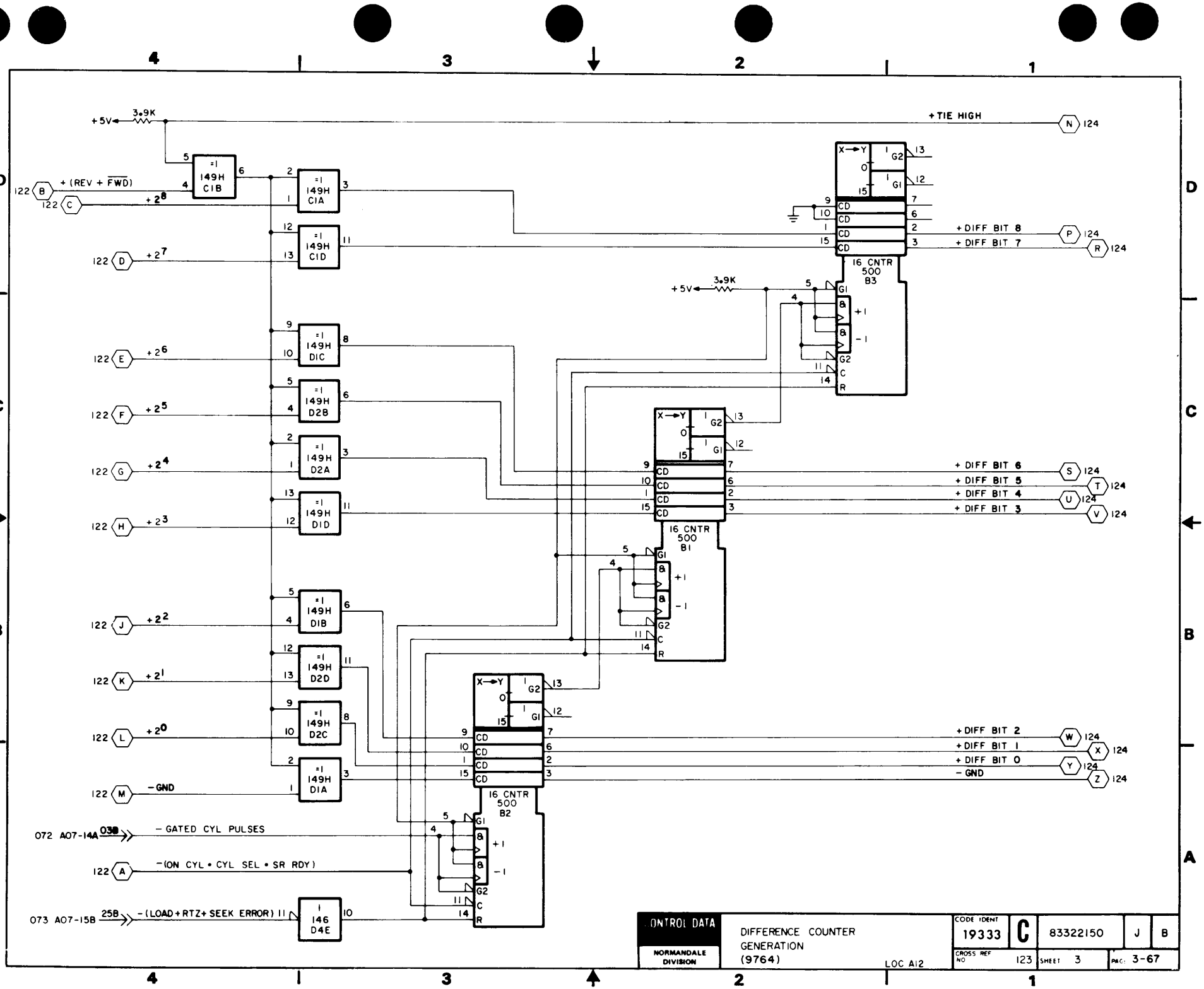


APPLICABLE ONLY TO BJ4M1 = 9764-1

DRAWN	S. BENTLER	11-3-76	CONTROL DATA	DIFFERENCE GENERATION AND CONTROL DIAGRAMS	CODE IDENT 19333	C	83322450	R D
CHECKED								
ENGINEER			NORMANDALE DIVISION	TYPE: FLWV LOC: A12	CROSS REF NO 121	SHEET 1 OF 4	PAGE 3-65	
APPROVED								

REF 83215006


-(ON CYL • CYL SEL • SR RDY)
CYL ADDR REG BITS 5-8
RGTR 520 C3
CYL ADDR REG BITS 0-4
RGTR 519 E3
074 A07-06B 26A - (LOAD + RTZ)
022 A02-24A 25A + HIGH CYL BIT 8
023 A02-05B 21A + BUS OUT BIT 0
023 A02-04B 26B + BUS OUT BIT 1
024 A02-10A 22B + BUS OUT BIT 2
024 A02-10B 24A + BUS OUT BIT 3
024 A02-17B 29B + BUS OUT BIT 4
073 A07-03A 05B + ON CYLINDER
074 A07-10B 05A + SERVO READY
022 A02-22A 06B -LOW CYL TAG (101)
024 A02-14B 28B + BUS OUT BIT 5
022 A02-11A 30A + BUS OUT BIT 6
022 A02-09A 33A + BUS OUT BIT 7
121 A12-34A 31A -GND
+ CAR BIT 8
- CAR BIT 8
+ CAR BIT 7
- CAR BIT 7
+ CAR BIT 6
- CAR BIT 6
+ CAR BIT 5
- CAR BIT 5
+ CAR BIT 4
+ CAR BIT 3
+ CAR BIT 2
+ CAR BIT 1
+ CAR BIT 0
- GND
+ (REV + FWD)
+ 2^8
+ 2^7
+ 2^6
+ 2^5
+ 2^4
+ 2^3
+ 2^2
+ 2^1
+ 2^0
- GND
+5V
3.16K
270PF
175 NS ±2
CARRY INTERRUPT 1K
+ (REV + FWD)
Σ A,B,C 521 C2
Σ A,B,C 521 D3
Σ A,B,C 521 E2
X/Y 200 - A1B
X/Y 200 - A1C
X/Y 200 - A1A
8 141 A3B
1 146 C4C
1 146 C4D
1 146 D4C
1 146 D4B
1 146 E1C
1 146 D4A
1 146 E1E
1 146 E1B
1 146 E1A
1 146 E1F
1 140 B4A
8 140 B4D
1 140 B4C
JA82-04A
05A
06A
A3
611
NC
072 A07-04A
072 A07-05B
073 A07-02B
064 A06-27B
072 A07-10A
CONTROL DATA
NORMANDALE DIVISION
CYLINDER ADDRESS REGISTER
(9764)
LOC A12
CODE IDENT 19333
C
83322450
J
B
CROSS REF NO 122
SHEET 2
PAGE 3-66

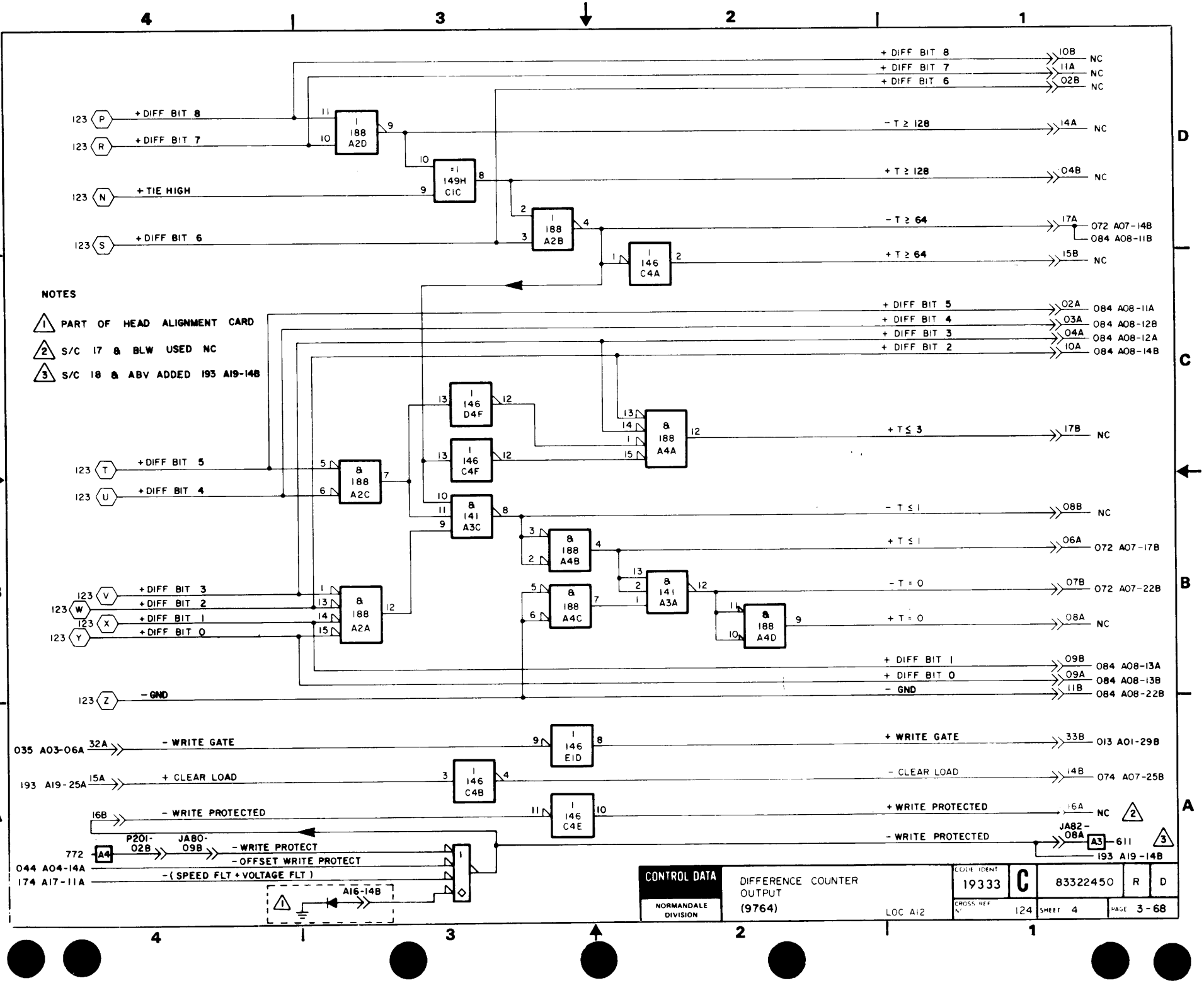


CONTROL DATA
NORMANDALE DIVISION

DIFFERENCE COUNTER GENERATION (9764)

LOC A12

CODE IDENT				
19333	C	83322150	J	B
CROSS REF NO 123	SHEET 3	PAGE 3-67		


NOTES
1 PART OF HEAD ALIGNMENT CARD
2 S/C 17 & BLW USED NC
3 S/C 18 & ABV ADDED 193 A19-14B
123 P + DIFF BIT 8
123 R + DIFF BIT 7
123 N + TIE HIGH
123 S + DIFF BIT 6
123 T + DIFF BIT 5
123 U + DIFF BIT 4
123 V + DIFF BIT 3
123 W + DIFF BIT 2
123 X + DIFF BIT 1
123 Y + DIFF BIT 0
123 Z - GND
1 188 A2D
=1 149H C1C
1 188 A2B
1 146 C4A
1 146 D4F
1 146 C4F
8 188 A4A
8 188 A2C
8 141 A3C
8 188 A4B
8 188 A4C
8 141 A3A
8 188 A4D
8 188 A2A
+ DIFF BIT 8 10B NC
+ DIFF BIT 7 11A NC
+ DIFF BIT 6 02B NC
- T ≥ 128 14A NC
+ T ≥ 128 04B NC
- T ≥ 64 17A 072 A07-14B 084 A08-11B
+ T ≥ 64 15B NC
+ DIFF BIT 5 02A 084 A08-11A
+ DIFF BIT 4 03A 084 A08-12B
+ DIFF BIT 3 04A 084 A08-12A
+ DIFF BIT 2 10A 084 A08-14B
+ T ≤ 3 17B NC
- T ≤ 1 08B NC
+ T ≤ 1 06A 072 A07-17B
- T = 0 07B 072 A07-22B
+ T = 0 08A NC
+ DIFF BIT 1 09B 084 A08-13A
+ DIFF BIT 0 09A 084 A08-13B
- GND 11B 084 A08-22B
035 A03-06A 32A - WRITE GATE
1 146 E1D
+ WRITE GATE 33B 013 A01-29B
193 A19-25A 15A + CLEAR LOAD
1 146 C4B
- CLEAR LOAD 14B 074 A07-25B
16B - WRITE PROTECTED
1 146 C4E
+ WRITE PROTECTED 16A NC
- WRITE PROTECTED JA82-08A A3 611
193 A19-14B
772 A4 P201-02B JA80-09B - WRITE PROTECT
- OFFSET WRITE PROTECT
044 A04-14A
174 A17-11A - (SPEED FLT + VOLTAGE FLT)
A16-14B
CONTROL DATA
NORMANDALE DIVISION
DIFFERENCE COUNTER OUTPUT
(9764)
LOC A12
CODE IDENT 19333
C
83322450
R
D
CROSS REF NO. 124
SHEET 4
PAGE 3-68

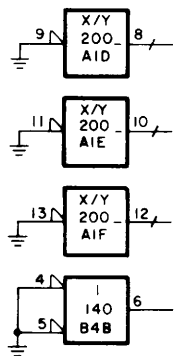
REVISION STATUS OF SHEETS

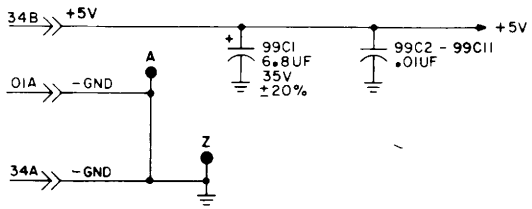
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																
B	A	A	A																
C	C	C	C																
D	C	C	D																
E	C	C	E																

REVISIONS

REV.	ECO.	DESCRIPTION	DRFT.	DATE	CHK'D
A	PE23000	RELEASED	MLA	2-17-76	
B		EDITORIAL	DM	2-14-78	
C	PE55259	LOGIC DIAG IMPROVEMENT	A A O	8 7 78	
D	PE57112	STATUS PROTECT			
E	PE57185	WIRE WRAP CHANGE	TH	9-15-79	

UNUSED LOGIC ELEMENTS

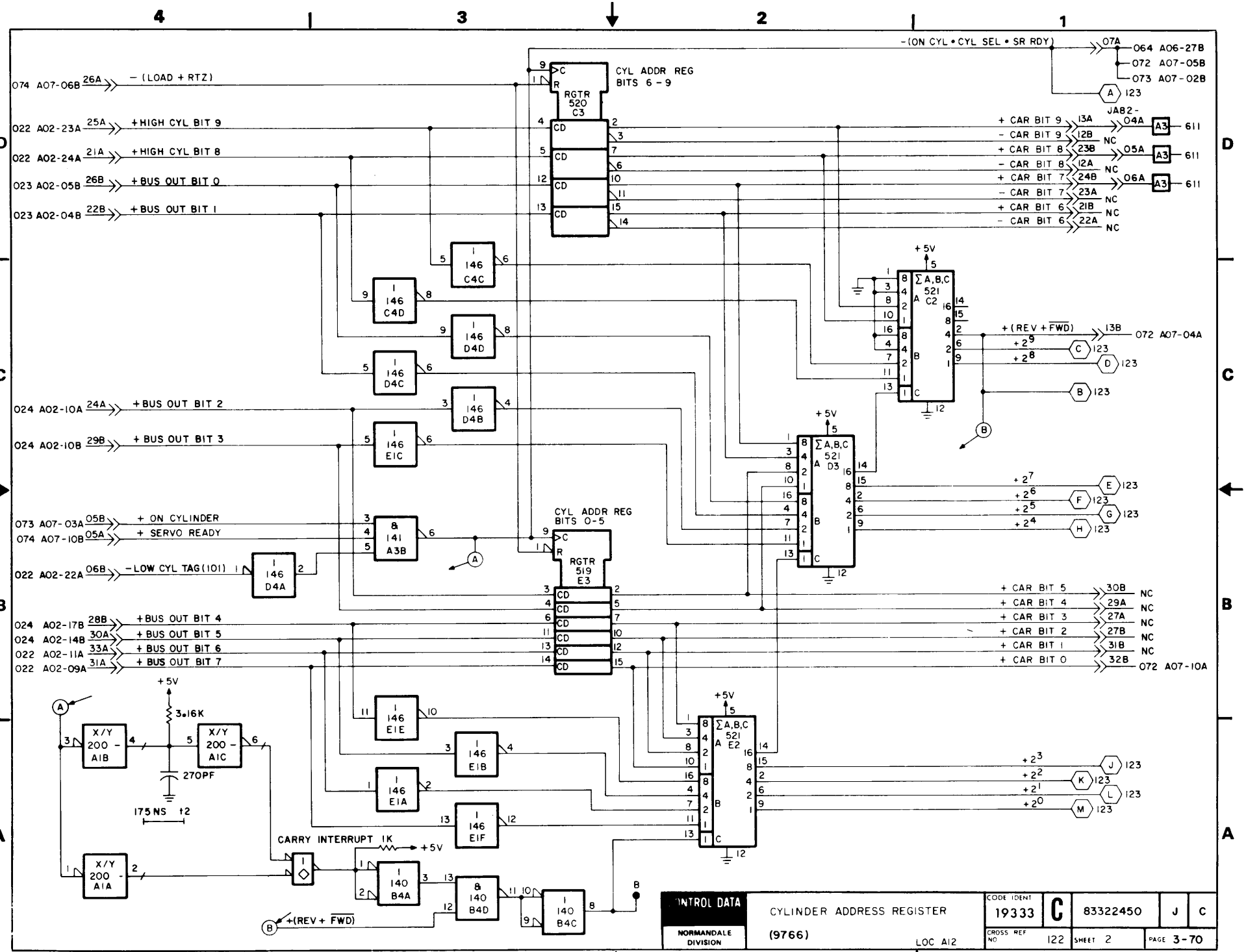


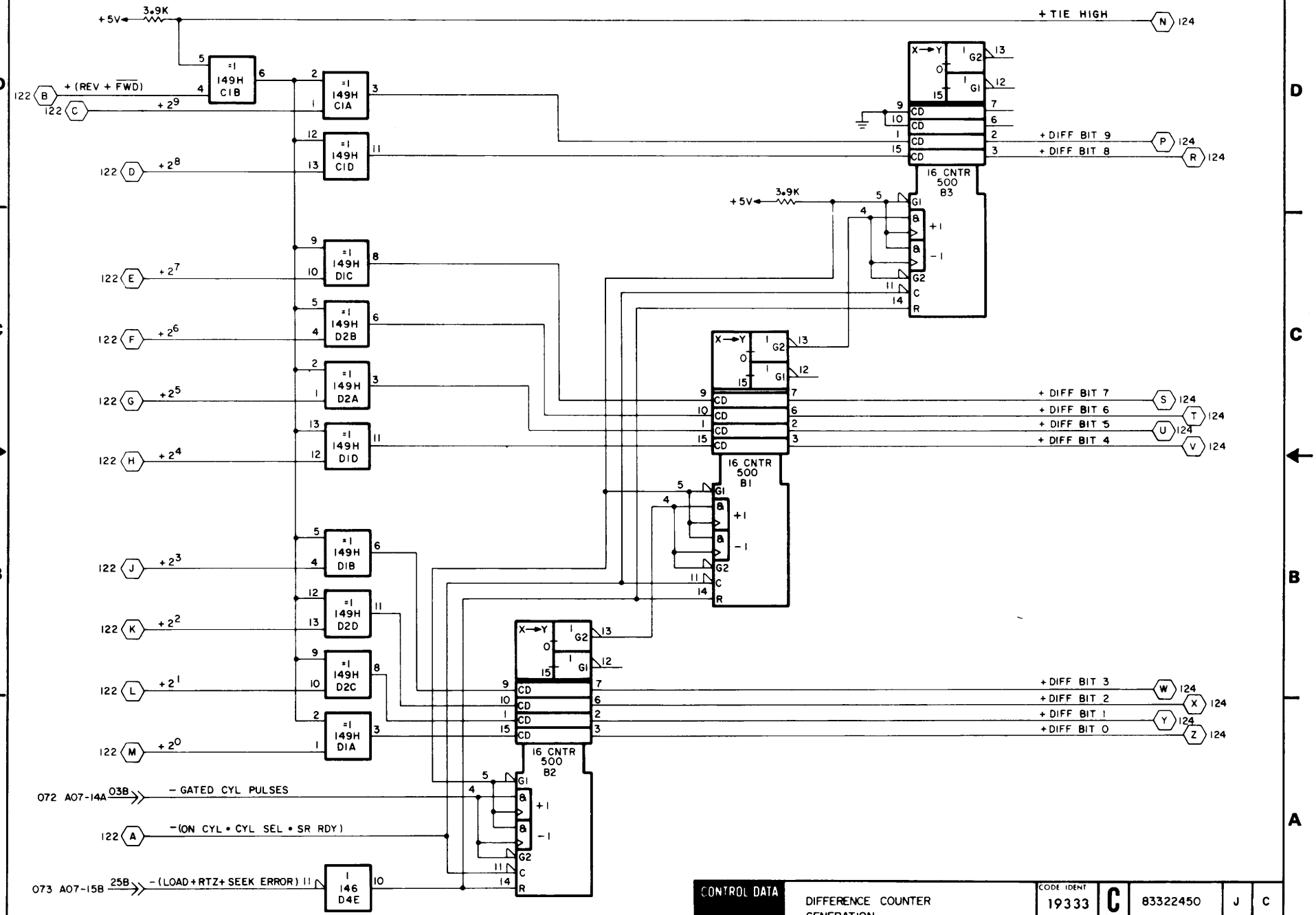


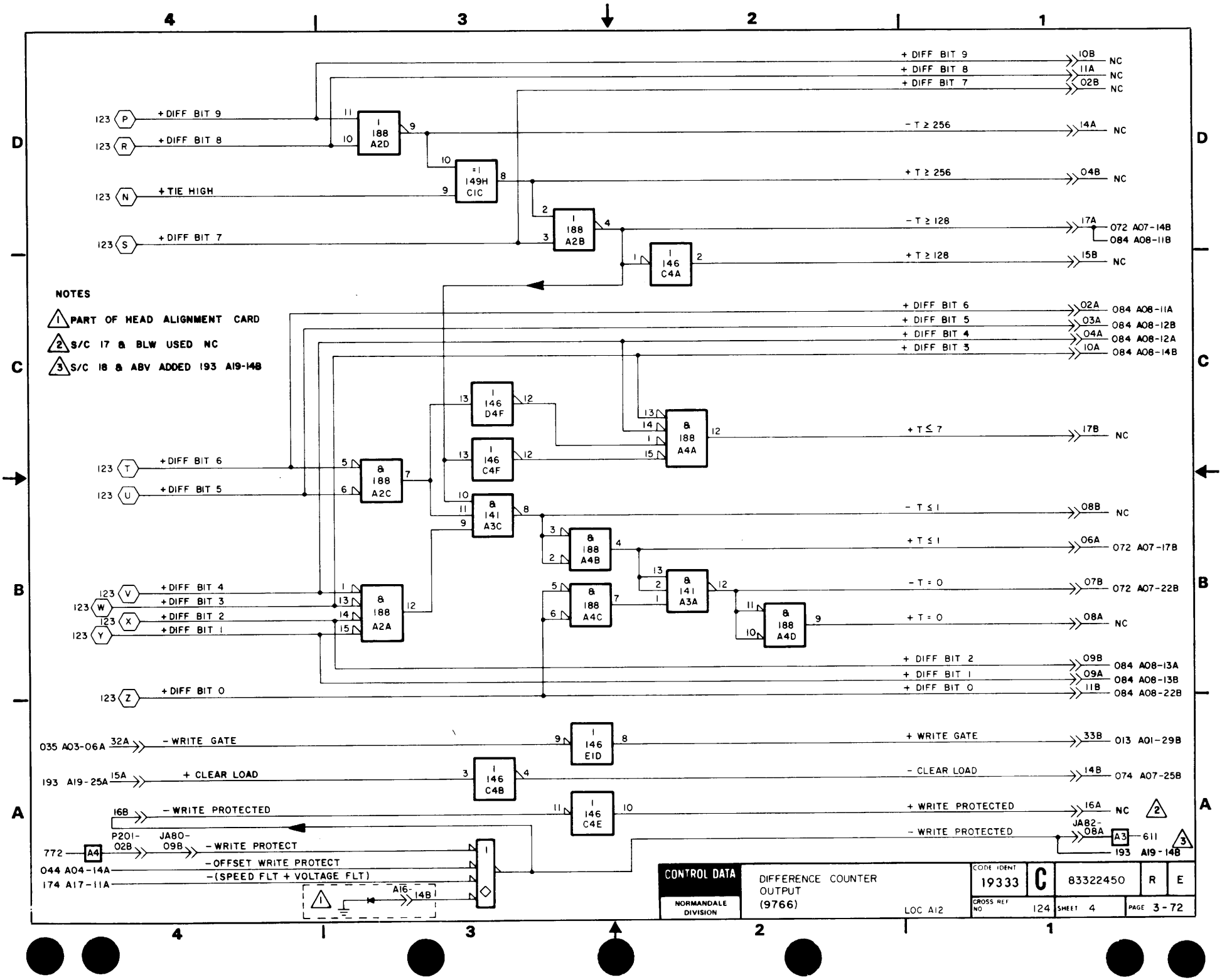
APPLICABLE ONLY TO BJ4M2, BJ402 = 9766-1

DRAWN	W.BERGSTROM	10-22-76	CONTROL DATA	DIFFERENCE GENERATION AND CONTROL DIAGRAMS	CODE IDENT 19333	C	83322450	R E
CHECKED								
ENGINEER			NORMANDALE DIVISION	TYPE FLWV LOC A12	CROSS REF NO 121	SHEET 1 OF 4	PAGE 3-69	
APPROVED								

REF 83214912


CYL ADDR REG BITS 6 - 9
RGTR 520 C3
CYL ADDR REG BITS 0-5
RGTR 519 E3
Σ A,B,C 521 C2
Σ A,B,C 521 D3
Σ A,B,C 521 E2
- (LOAD + RTZ)
+HIGH CYL BIT 9
+HIGH CYL BIT 8
+BUS OUT BIT 0
+BUS OUT BIT 1
+BUS OUT BIT 2
+BUS OUT BIT 3
+ ON CYLINDER
+ SERVO READY
-LOW CYL TAG(101)
+BUS OUT BIT 4
+BUS OUT BIT 5
+BUS OUT BIT 6
+BUS OUT BIT 7
-(ON CYL • CYL SEL • SR RDY)
+ CAR BIT 9
- CAR BIT 9
+ CAR BIT 8
- CAR BIT 8
+ CAR BIT 7
- CAR BIT 7
+ CAR BIT 6
- CAR BIT 6
+ CAR BIT 5
+ CAR BIT 4
+ CAR BIT 3
+ CAR BIT 2
+ CAR BIT 1
+ CAR BIT 0
+(REV + FWD)
CARRY INTERRUPT 1K
+5V
3.16K
270PF
175 NS ±2
CONTROL DATA
NORMANDALE DIVISION
CYLINDER ADDRESS REGISTER
(9766)
LOC A12
CODE IDENT 19333
C
83322450
J
C
CROSS REF NO 122
SHEET 2
PAGE 3-70


+5V
3.9K
+ TIE HIGH
N 124
+ (REV + FWD)
+ 2^9
+ 2^8
+ 2^7
+ 2^6
+ 2^5
+ 2^4
+ 2^3
+ 2^2
+ 2^1
+ 2^0
=1 149H C1B
=1 149H C1A
=1 149H C1D
=1 149H D1C
=1 149H D2B
=1 149H D2A
=1 149H D1D
=1 149H D1B
=1 149H D2D
=1 149H D2C
=1 149H D1A
16 CNTR 500 B3
16 CNTR 500 B1
16 CNTR 500 B2
+ 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
- GATED CYL PULSES
-(ON CYL • CYL SEL • SR RDY)
-(LOAD+RTZ+SEEK ERROR)
072 A07-14A 03B
073 A07-15B 25B
1 146 D4E
CONTROL DATA
NORMANDALE DIVISION
DIFFERENCE COUNTER GENERATION (9766)
LOC A12
CODE IDENT 19333
C
83322450
J
C
CROSS REF NO 123
SHEET 3
PAGE 3-71

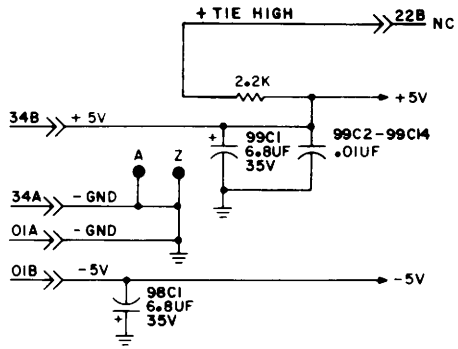

NOTES
1 PART OF HEAD ALIGNMENT CARD
2 S/C 17 & BLW USED NC
3 S/C 18 & ABV ADDED 193 A19-14B
123 P + DIFF BIT 9
123 R + DIFF BIT 8
123 N + TIE HIGH
123 S + DIFF BIT 7
123 T + DIFF BIT 6
123 U + DIFF BIT 5
123 V + DIFF BIT 4
123 W + DIFF BIT 3
123 X + DIFF BIT 2
123 Y + DIFF BIT 1
123 Z + DIFF BIT 0
1 188 A2D
=1 149H C1C
1 188 A2B
1 146 C4A
1 146 D4F
1 146 C4F
8 188 A4A
8 188 A2C
8 141 A3C
8 188 A4B
8 188 A4C
8 141 A3A
8 188 A4D
8 188 A2A
+ DIFF BIT 9 10B NC
+ DIFF BIT 8 11A NC
+ DIFF BIT 7 02B NC
- T ≥ 256 14A NC
+ T ≥ 256 04B NC
- T ≥ 128 17A 072 A07-14B 084 A08-11B
+ T ≥ 128 15B NC
+ DIFF BIT 6 02A 084 A08-11A
+ DIFF BIT 5 03A 084 A08-12B
+ DIFF BIT 4 04A 084 A08-12A
+ DIFF BIT 3 10A 084 A08-14B
+ T ≤ 7 17B NC
- T ≤ 1 08B NC
+ T ≤ 1 06A 072 A07-17B
- T = 0 07B 072 A07-22B
+ T = 0 08A NC
+ DIFF BIT 2 09B 084 A08-13A
+ DIFF BIT 1 09A 084 A08-13B
+ DIFF BIT 0 11B 084 A08-22B
035 A03-06A 32A - WRITE GATE
193 A19-25A 15A + CLEAR LOAD
16B - WRITE PROTECTED
1 146 E1D
1 146 C4B
1 146 C4E
+ WRITE GATE 33B 013 A01-29B
- CLEAR LOAD 14B 074 A07-25B
+ WRITE PROTECTED 16A NC
- WRITE PROTECTED JA82-08A A3 611
193 A19-14B
772 A4 P201-02B JA80-09B - WRITE PROTECT
- OFFSET WRITE PROTECT
044 A04-14A -(SPEED FLT + VOLTAGE FLT)
174 A17-11A
A16-14B
CONTROL DATA
NORMANDALE DIVISION
DIFFERENCE COUNTER OUTPUT (9766)
LOC A12
CODE IDENT 19333
C
83322450
R
E
CROSS REF NO 124
SHEET 4
PAGE 3-72

REVISION STATUS OF SHEETS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A																	

REVISIONS

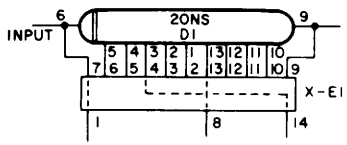
REV.	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	GR		



NOTE:

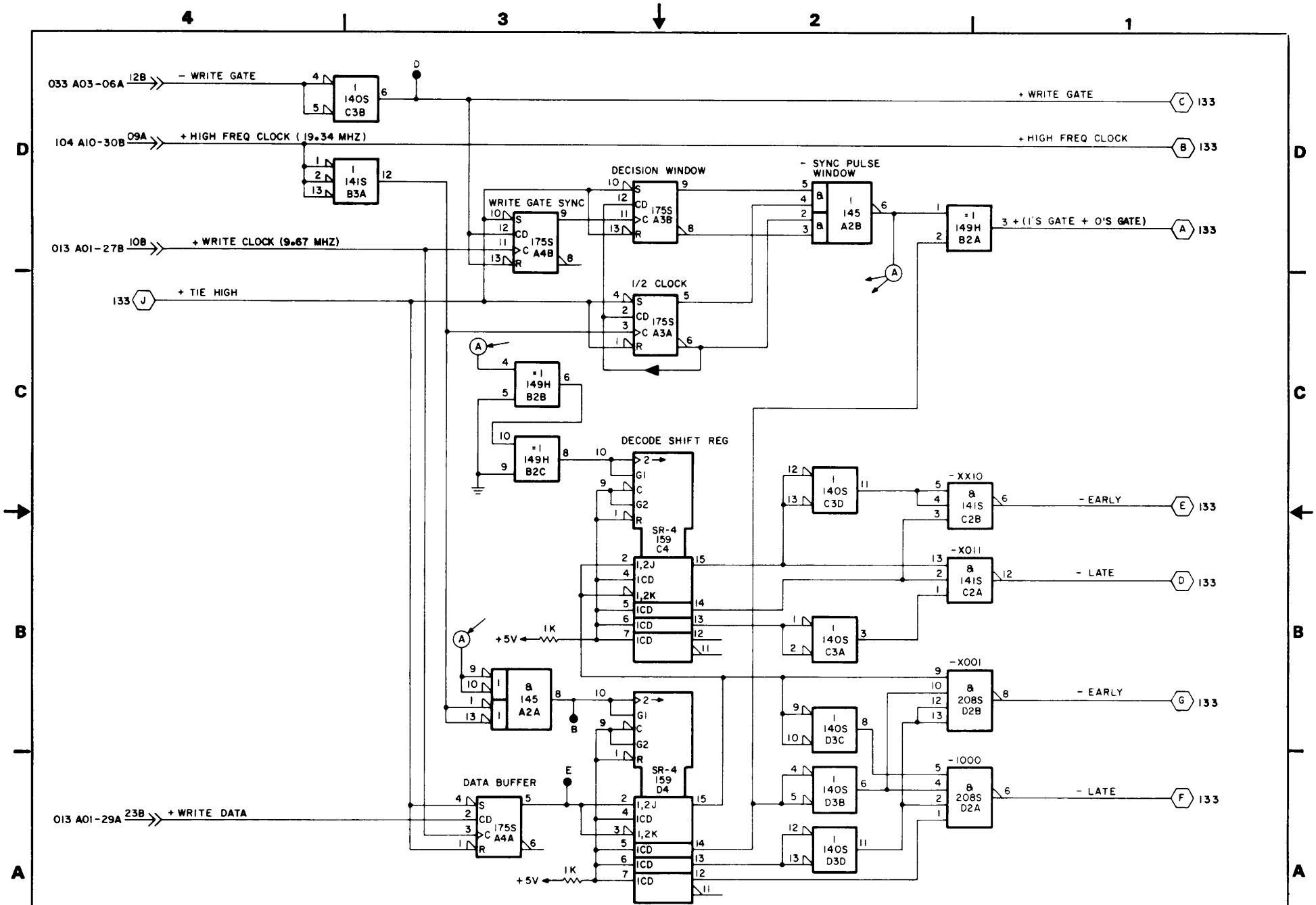
DELAY LINES ARE CONNECTED TO JUMPER BLOCK AS SHOWN IN DIAGRAM AT THE RIGHT. ACTUAL DELAYS ARE SELECTED DURING MANUFACTURING. THIS DIAGRAM SHOWS TYPICAL CONNECTIONS. DELAY TIME FOR EACH DELAY LINE PIN RELATIVE TO PIN 6 INPUT IS SHOWN IN CHART TO THE RIGHT.

PIN	20NS DELAY
5	2 NS
4	4 NS
3	6 NS
2	8 NS
1	10 NS
13	12 NS
12	14 NS
11	16 NS
10	18 NS
9	20NS

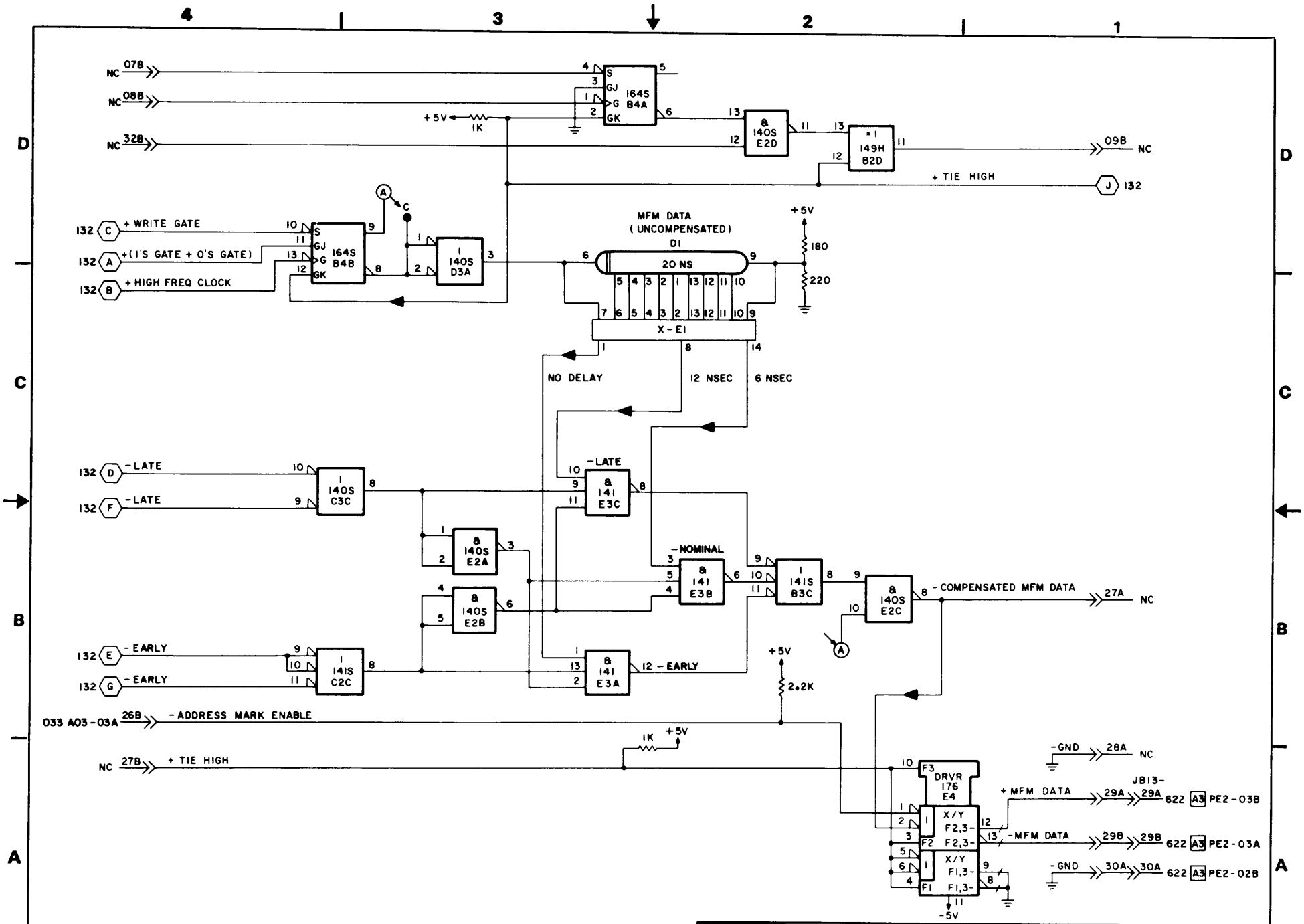


DRAWN	G RABINE	3/25/76	CONTROL DATA	NRZ TO COMPENSATED MFM DIAGRAMS	CODE IDENT 19333	C	83322450	A	A
CHECKED									
ENGINEER			NORMANDALE DIVISION	TYPE ELXV LOC A13	CROSS REF NO 131		SHEET 1 OF 3	PAGE 3-73	
APPROVED									

REF 83214913



CONTROL DATA NORMANDALE DIVISION	NRZ TO MFM DATA PART 1 LOC A13	CODE IDENT 19333	C	83322450	A A
		CROSS REF NO. 132	SHEET 2	PAGE 3-74	



CONTROL DATA NORMANDALE DIVISION	NRZ TO MFM DATA PART 2 LOC A13	CODE IDENT 19333	C	83322450	A A
		CROSS REF NO 133	SHEET 3	PAGE 3-75/76	

REVISION STATUS OF SHEETS

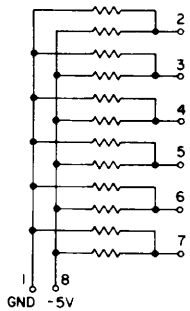
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A																	
B	A	B																	
C	A	C																	
D	A	D																	
E	A	E																	

REVISIONS

REV.	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA	2-9-76	
B	PE48543	HLRV IMPROVEMENT	MLA	9-13-77	
C	PE48918	CHG DELAY HLRV	DM	2-14-78	
D	PE22971	CORRECT SCHEMATIC	MA	4-13-78	
E	PE55259	LOGIC DIAG IMPROVEMENT	A.A.O	8-7-78	

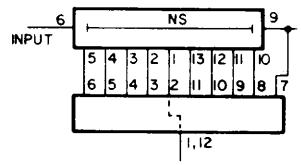
NOTES:

1. TYPICAL CONFIGURATION FOR TERMINATORS AT-C2A, AT-C2B AND AT-B4A AS FOLLOWS:

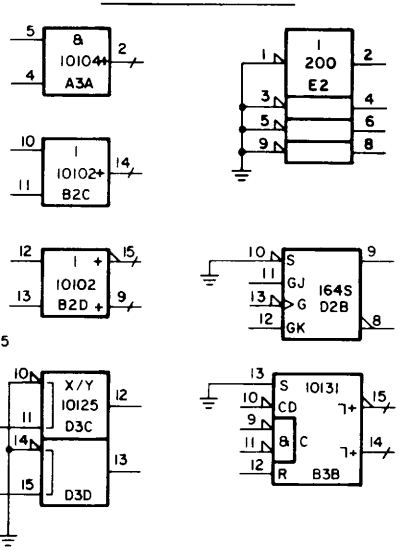


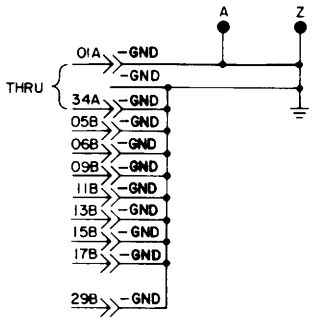
2. DELAY LINES ARE CONNECTED TO JUMPER BLOCK AS SHOWN IN DIAGRAM BELOW. ACTUAL DELAYS ARE SELECTED DURING MANUFACTURING. THIS DIAGRAM SHOWS TYPICAL CONNECTIONS. DELAY TIME FOR EACH DELAY LINE PIN RELATIVE TO PIN 6 INPUT IS SHOWN IN CHART BELOW.

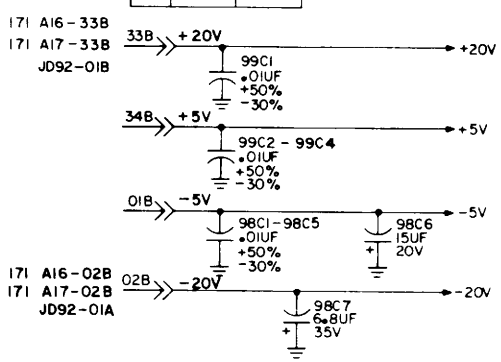
PIN	DELAY TIMES (NS) B1	A2
5	5	10
4	10	20
3	15	30
2	20	40
1	25	50
13	30	60
12	35	70
11	40	80
10	45	90
9	50	100



UNUSED LOGIC ELEMENTS

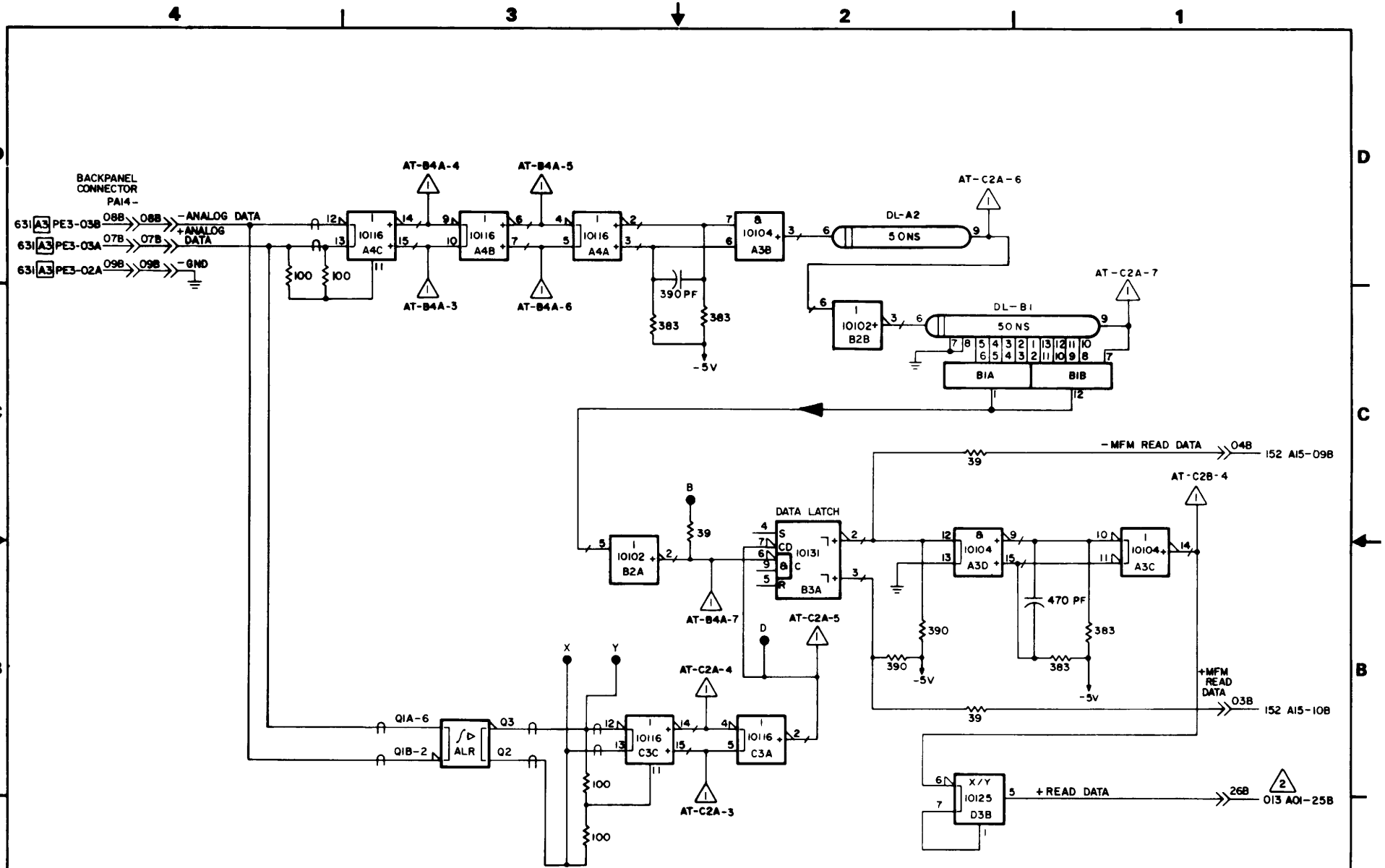






DRAWN	M.ANDERSON	CONTROL DATA	DATA LATCH DIAGRAMS	CODE IDENT 19333	C 83322450 J E
CHECKED					
ENGINEER		NORMANDALE DIVISION	TYPE-HLRV LOC A14	CROSS REF NO 141	SHEET 1 OF 3 PAGE 3-77
APPROVED					

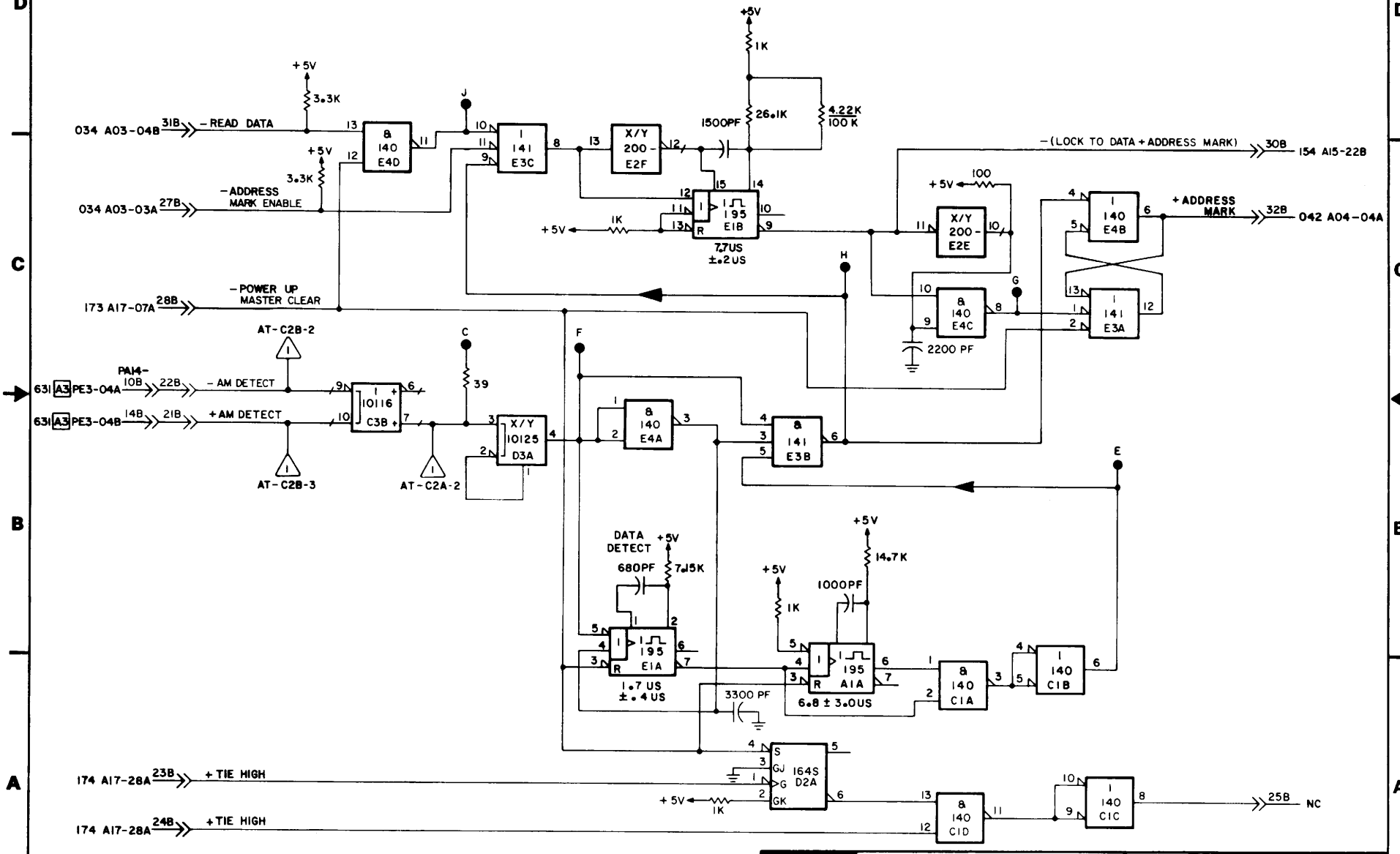
REF 83214914



NOTE:

1. REFER TO CROSS REF NUMBER 141 FOR TERMINATOR DETAILS
2. IN DRIVES WITHOUT PLO THIS POINT WILL BE WIRED TO AOI-25B. IN DRIVES WITH PLO THIS POINT WILL NOT BE USED

CONTROL DATA NORMANDALE DIVISION	ANALOG DATA TO READ DATA LOC AI4	CODE IDENT 19333	C	83322450	A A
		CROSS REF NO 142	SHEET 2	PAGE 3-78	



CONTROL DATA NORMANDALE DIVISION	LOCK TO DATA AND ADDRESS MARK DETECT LOC A14	CODE IDENT 19333	C	83322450	J E
		CROSS REF NO 143	SHEET 3	PAGE 3-79/80	

REVISION STATUS OF SHEETS

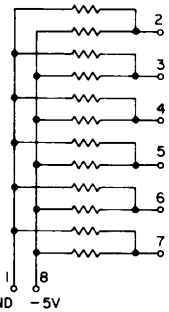
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A	A															
B	A	B	A	A															
C	C	B	A	A															

REVISIONS

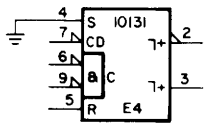
REV.	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA	1-29-76	
B	PE48625	OPEN RES. LIMITS	DM	7-8-77	
C	PE55604	CORRECT LOGIC	GR	3-28-79	

NOTES:

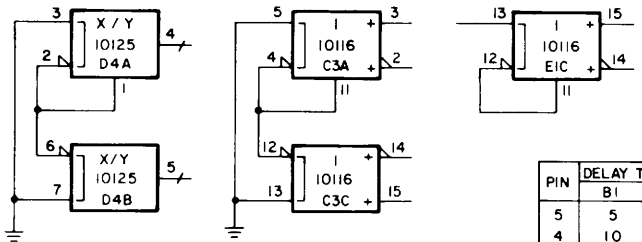
1. TYPICAL CONFIGURATION FOR TERMINATORS ATA3, ATB2, ATB3, ATB4, ATC3, ATD4, ATE2 AS FOLLOWS



NOTE:
2. SEE LOWER LEFT CORNER

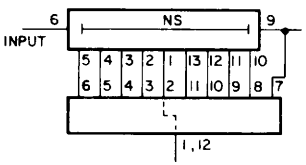


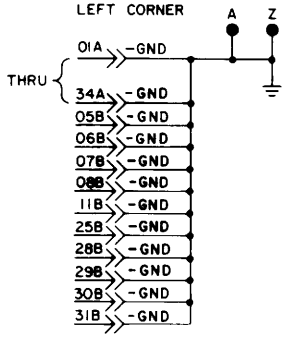
UNUSED LOGIC ELEMENTS

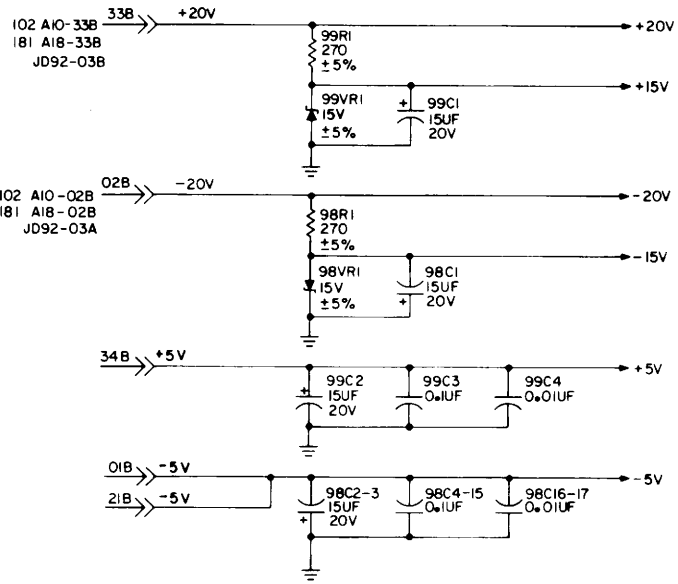


2. DELAY LINES ARE CONNECTED TO JUMPER BLOCK AS SHOWN IN DIAGRAM BELOW. ACTUAL DELAYS ARE SELECTED DURING MANUFACTURING. THIS DIAGRAM SHOWS TYPICAL CONNECTIONS. DELAY TIME FOR EACH DELAY LINE PIN RELATIVE TO PIN 6 INPUT IS SHOWN IN CHART BELOW.

PIN	DELAY TIMES (NS)	
	B1	A2
5	5	10
4	10	20
3	15	30
2	20	40
1	25	50
13	30	60
12	35	70
11	40	80
10	45	90
9	50	100







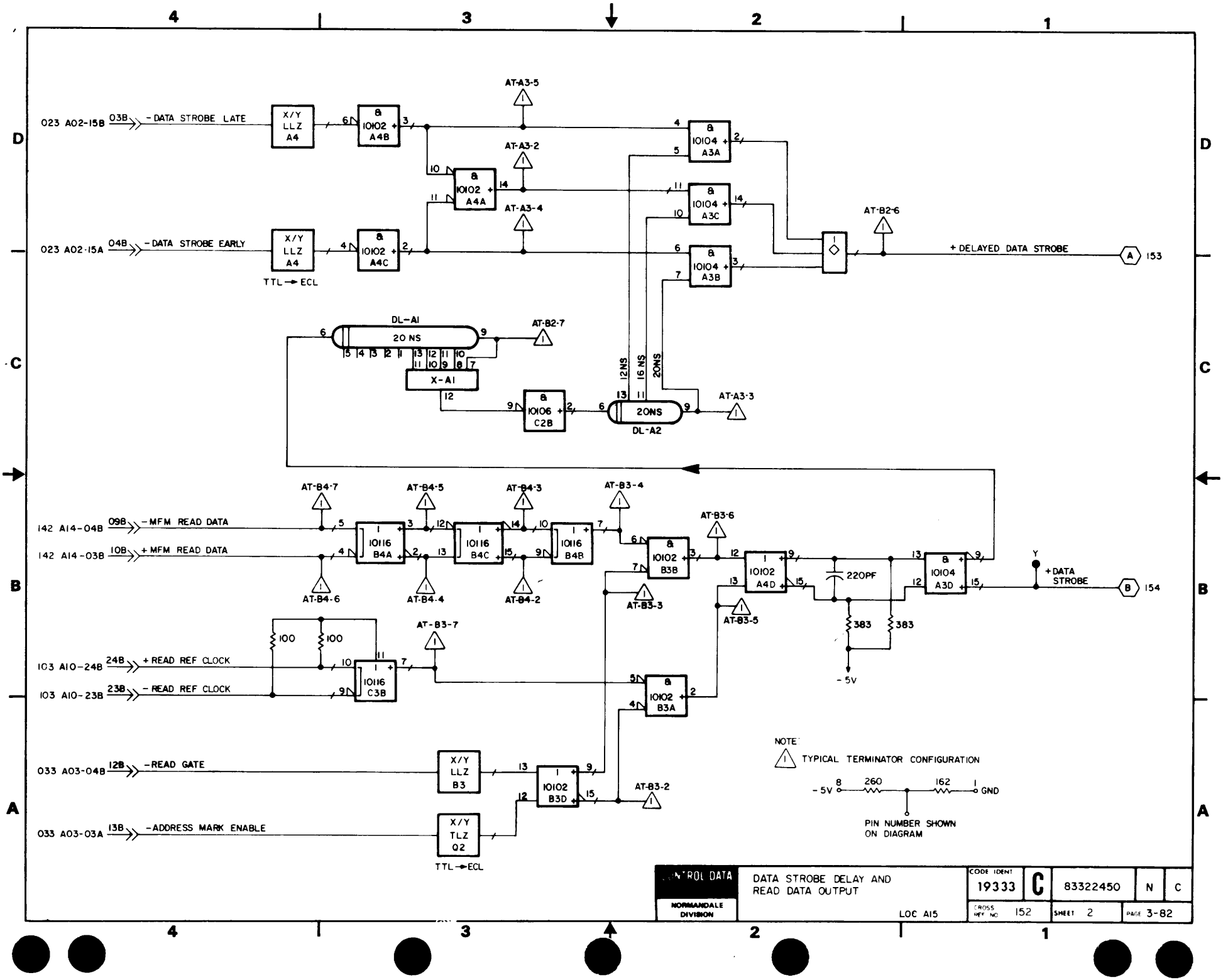
DRAWN	S. BENTLER	10-22-76	CONTROL DATA
CHECKED			NORMANDALE DIVISION
ENGINEER			
APPROVED			

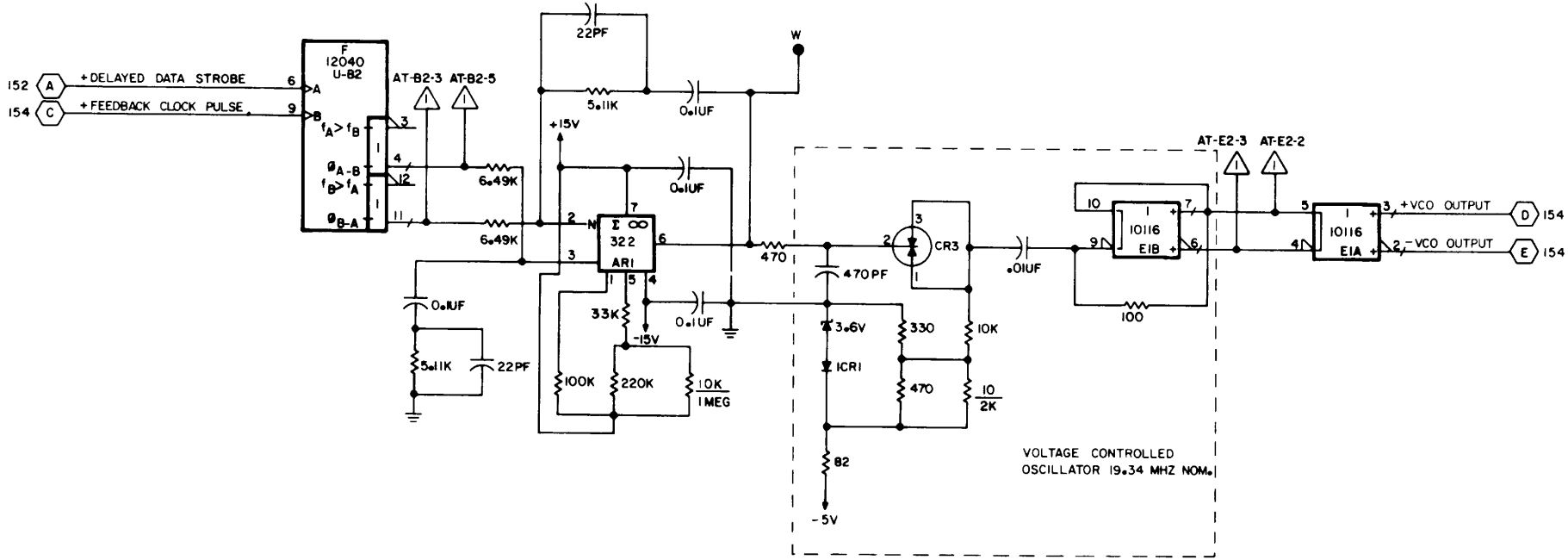
READ PLO (OPTIONAL) DIAGRAMS

TYPE BLZV LOC: A15

CODE IDENT				
19333	C	83322450	N	C
CROSS REF NO 151	SHEET 1 of 5	PAGE 3-81		

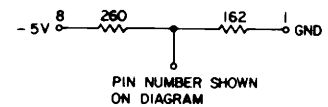
REF 83214915


023 A02-15B
03B
- DATA STROBE LATE
X/Y LLZ A4
8 10102 A4B
AT-A3-5
AT-A3-2
8 10102 A4A
AT-A3-4
023 A02-15A
04B
- DATA STROBE EARLY
X/Y LLZ A4
TTL → ECL
8 10102 A4C
8 10104 A3A
8 10104 A3C
8 10104 A3B
AT-B2-6
+ DELAYED DATA STROBE
A 153
DL-A1
20 NS
AT-B2-7
X-A1
8 10106 C2B
12NS
16 NS
20NS
20NS
DL-A2
AT-A3-3
142 A14-04B
09B
- MFM READ DATA
142 A14-03B
10B
+ MFM READ DATA
AT-B4-7
AT-B4-5
AT-B4-3
AT-B3-4
1 10116 B4A
1 10116 B4C
1 10116 B4B
AT-B4-6
AT-B4-4
AT-B4-2
8 10102 B3B
AT-B3-6
AT-B3-3
AT-B3-5
1 10102 A4D
220PF
383
383
- 5V
8 10104 A3D
Y
+ DATA STROBE
B 154
103 A10-24B
24B
+ READ REF CLOCK
103 A10-23B
23B
- READ REF CLOCK
100
100
1 10116 C3B
AT-B3-7
8 10102 B3A
033 A03-04B
12B
- READ GATE
X/Y LLZ B3
1 10102 B3D
AT-B3-2
033 A03-03A
13B
- ADDRESS MARK ENABLE
X/Y TLZ Q2
TTL → ECL
NOTE:
TYPICAL TERMINATOR CONFIGURATION
- 5V
8
260
162
1
GND
PIN NUMBER SHOWN ON DIAGRAM
CONTROL DATA
NORMANDALE DIVISION
DATA STROBE DELAY AND READ DATA OUTPUT
LOC A15
CODE IDENT 19333
C
83322450
N
C
CROSS REF NO 152
SHEET 2
PAGE 3-82



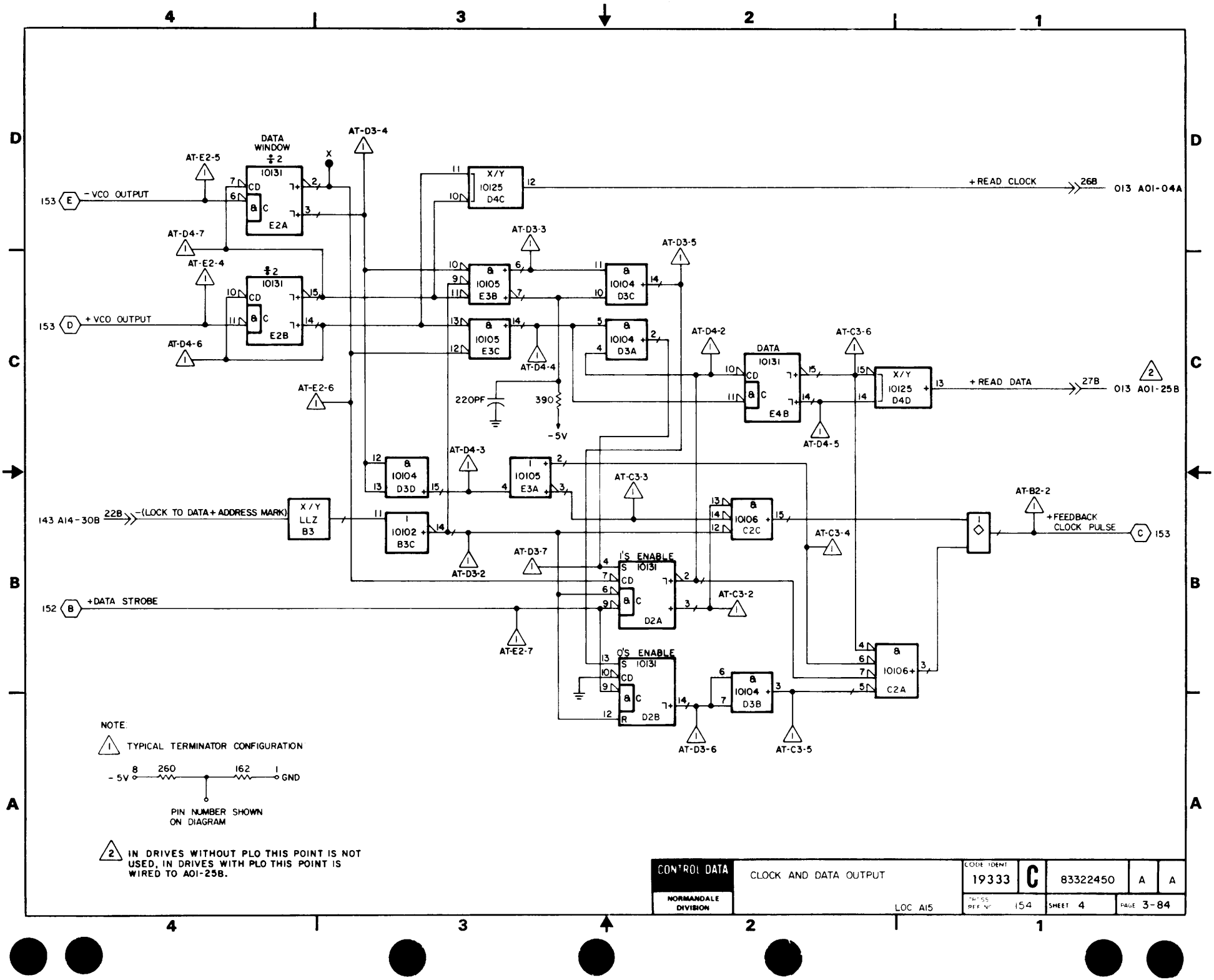
NOTE:

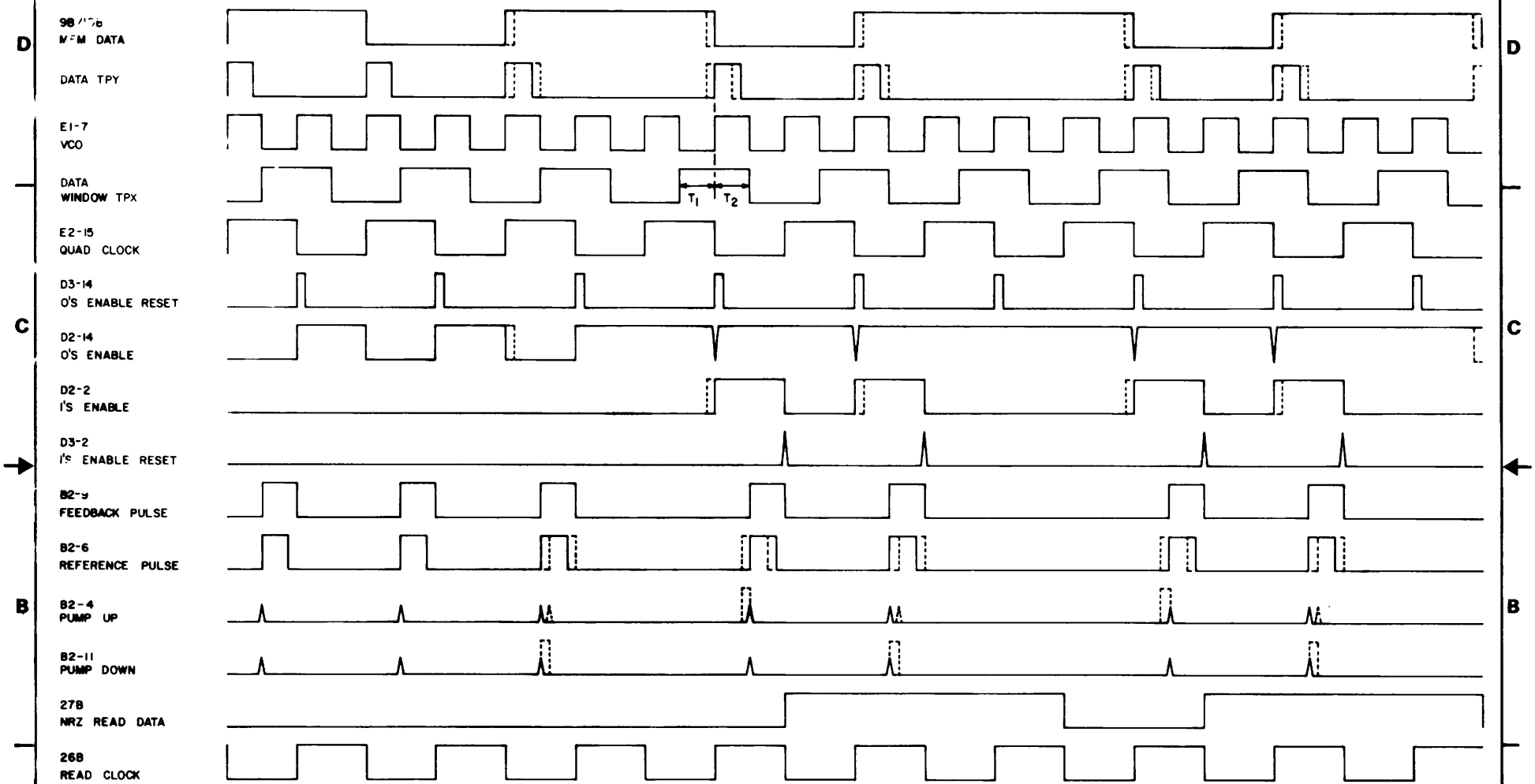
TYPICAL TERMINATOR CONFIGURATION



PIN NUMBER SHOWN ON DIAGRAM

CONTROL DATA	VCO OUTPUT	CODE IDENT 19333	C	83322450	C	B
NORMANDALE DIVISION	LOC A15	CROSS REF NO. 153	SHEET 3	PAGE 3-83		


DATA WINDOW ÷2
10131
E2A
AT-E2-5
AT-D3-4
153 E - VCO OUTPUT
AT-D4-7
AT-E2-4
÷2
10131
E2B
153 D + VCO OUTPUT
AT-D4-6
X/Y
10125
D4C
+READ CLOCK
268
013 A01-04A
AT-D3-3
AT-D3-5
10105
E3B
10104
D3C
10105
E3C
10104
D3A
AT-D4-4
AT-D4-2
AT-C3-6
AT-E2-6
220PF
390
-5V
DATA
10131
E4B
AT-D4-5
X/Y
10125
D4D
+READ DATA
27B
2
013 A01-25B
AT-D4-3
10104
D3D
10105
E3A
AT-C3-3
AT-B2-2
143 A14-30B 22B -(LOCK TO DATA+ADDRESS MARK)
X/Y
LLZ
B3
10102
B3C
AT-D3-2
10106
C2C
AT-C3-4
+FEEDBACK CLOCK PULSE
C 153
AT-D3-7
I'S ENABLE
S 10131
D2A
152 B +DATA STROBE
AT-E2-7
AT-C3-2
Q'S ENABLE
S 10131
D2B
10106+
C2A
10104
D3B
AT-D3-6
AT-C3-5
NOTE:
1 TYPICAL TERMINATOR CONFIGURATION
- 5V
8
260
162
1
GND
PIN NUMBER SHOWN ON DIAGRAM
2 IN DRIVES WITHOUT PLO THIS POINT IS NOT USED, IN DRIVES WITH PLO THIS POINT IS WIRED TO A01-25B.
CONTROL DATA
NORMANDALE DIVISION
CLOCK AND DATA OUTPUT
LOC A15
CODE IDENT 19333
C
83322450
A
A
CROSS REF NO 154
SHEET 4
PAGE 3-84



NOTE:

1. DASHED LINES INDICATE PEAK SHIFTED DATA.
2. $T_1 \simeq T_2 \simeq$ 25NS WHEN STROBE PULSE IS CENTERED IN WINDOW $(T_1 + T_2)$.
3. $T_{RISE} = T_{FALL} \simeq$ 3NS.

CONTROL DATA NORMANDALE DIVISION	READ PLO TIMING DIAGRAM LOC A15	CODE IDENT 19333	C	83322450	A	A
				DRAWING NO. 155	SHEET 5	PAGE 3-85/86

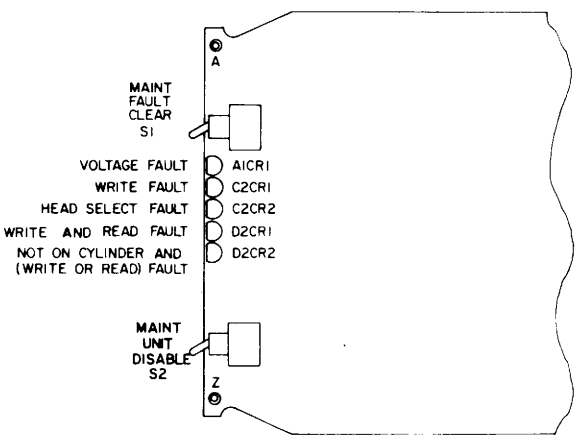
REVISION STATUS OF SHEETS

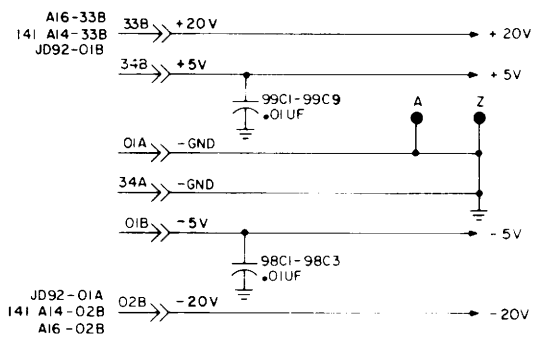
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																
B	A	B	A																
C	C	C	C																
D	C	C	D																

REVISIONS

REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23	RELEASE	MLA	1-27-76	
B	PE22926	ERROR CORRECTION	DM	7-8-77	
C	PE55259	LOGIC DIAG IMPROVEMENT	A A O	8 7 78	
D	PE57112	STATUS PROTECT			

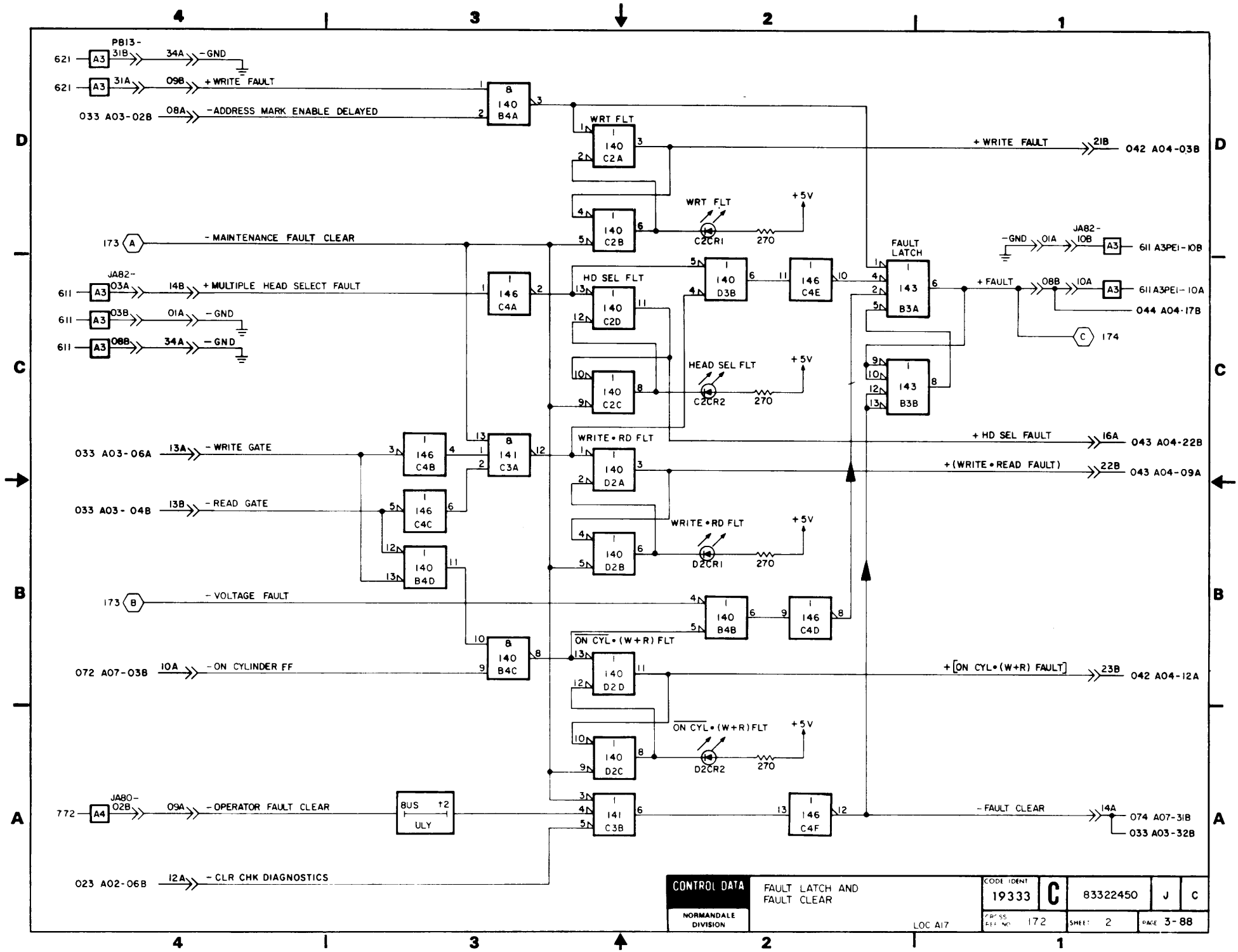
MAINTENANCE SWITCHES AND
FAULT INDICATORS ON CARD EDGE

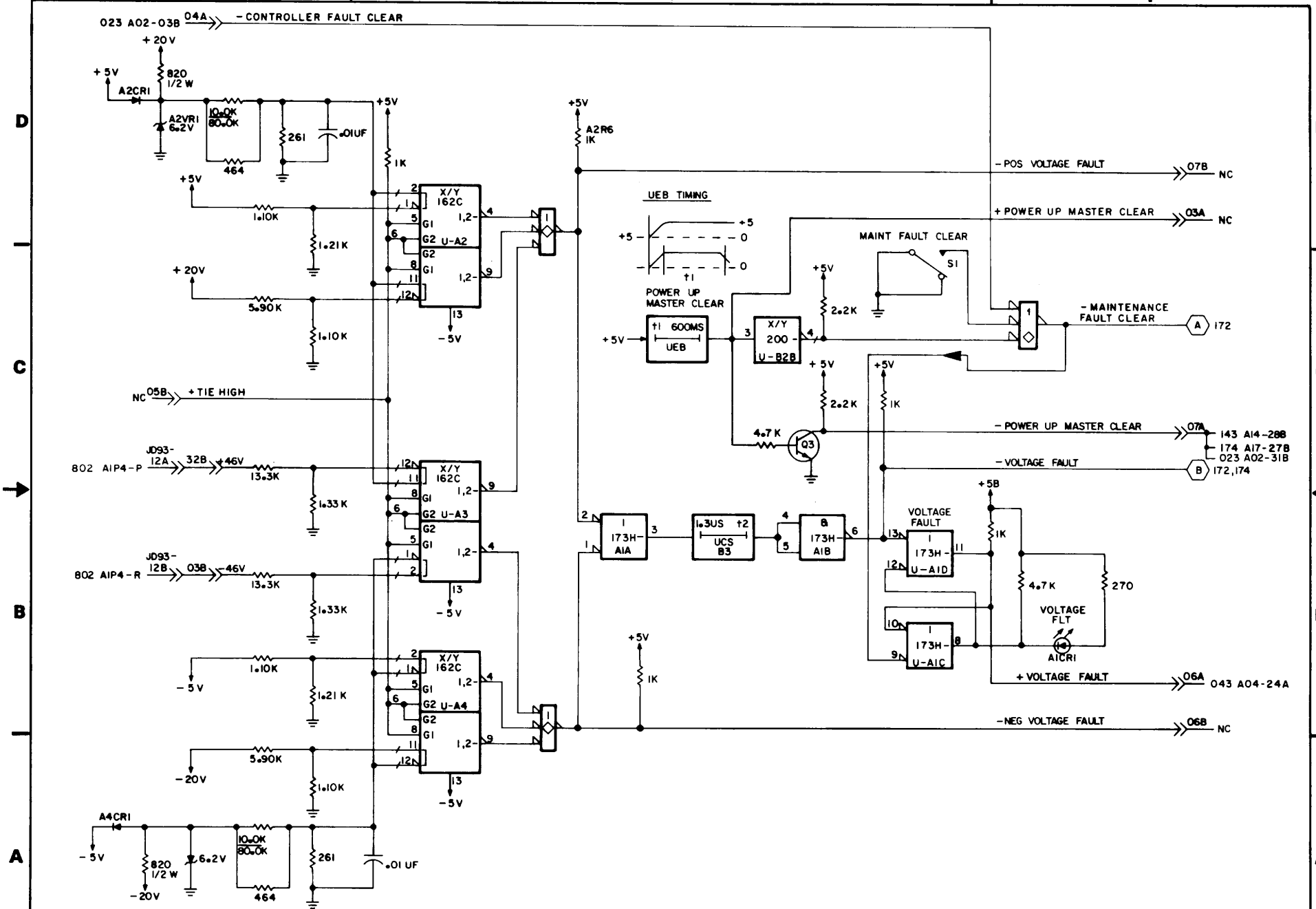




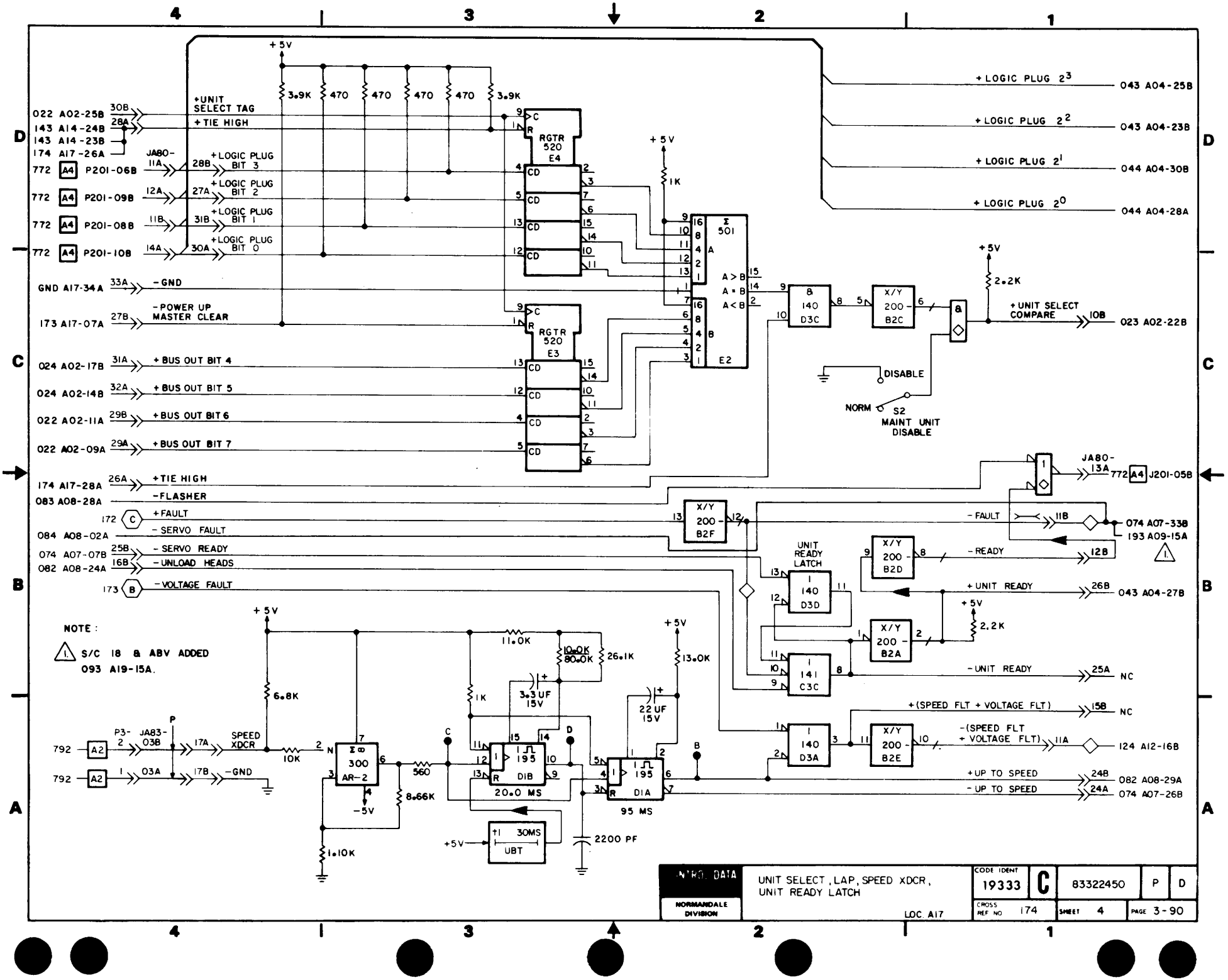
DRAWN Stephen Boucher 10-25-76	CONTROL DATA	FAULT CARD DIAGRAMS	CODE IDENT 19333	C	83322450	P	D
CHECKED							
ENGINEER	NORMANDALE DIVISION	TYPE GKFV LOC A17	171		SHEET 1 OF 4	PAGE 3-87	
APPROVED							

REF 83214917


621 A3 P813-31B 34A -GND
621 A3 31A 09B +WRITE FAULT
033 A03-02B 08A -ADDRESS MARK ENABLE DELAYED
8 140 B4A
WRT FLT 140 C2A
+WRITE FAULT 21B 042 A04-03B
WRT FLT C2CR1 270 +5V
173 A -MAINTENANCE FAULT CLEAR
140 C2B
-GND 01A JA82-10B A3 611 A3PE1-10B
FAULT LATCH 143 B3A
611 A3 JA82-03A 14B +MULTIPLE HEAD SELECT FAULT
146 C4A
HD SEL FLT 140 C2D
140 D3B 146 C4E
+FAULT 08B 10A A3 611 A3PE1-10A
044 A04-17B
C 174
611 A3 03B 01A -GND
611 A3 08B 34A -GND
HEAD SEL FLT C2CR2 270 +5V
140 C2C
143 B3B
033 A03-06A 13A -WRITE GATE
146 C4B
8 141 C3A
WRITE•RD FLT 140 D2A
+HD SEL FAULT 16A 043 A04-22B
+(WRITE•READ FAULT) 22B 043 A04-09A
033 A03-04B 13B -READ GATE
146 C4C
140 B4D
WRITE•RD FLT D2CR1 270 +5V
140 D2B
173 B -VOLTAGE FAULT
140 B4B 146 C4D
8 140 B4C
ON CYL•(W+R) FLT 140 D2D
072 A07-03B 10A -ON CYLINDER FF
+[ON CYL•(W+R) FAULT] 23B 042 A04-12A
ON CYL•(W+R)FLT D2CR2 270 +5V
140 D2C
772 A4 JA80-02B 09A -OPERATOR FAULT CLEAR
8US ↑2 ULY
141 C3B 146 C4F
-FAULT CLEAR 14A 074 A07-31B 033 A03-32B
023 A02-06B 12A -CLR CHK DIAGNOSTICS
CONTROL DATA NORMANDALE DIVISION
FAULT LATCH AND FAULT CLEAR
LOC A17
CODE IDENT 19333 C 83322450 J C
CROSS REF NO 172 SHEET 2 PAGE 3-88

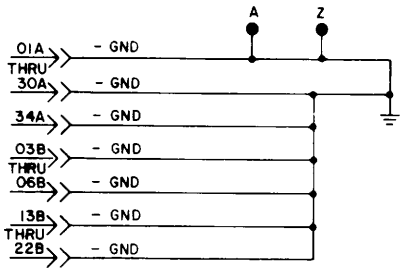


CONTROL DATA NORMANDALE DIVISION	POWER UP MASTER CLEAR, MAINT FAULT CLEAR AND VOLTAGE FAULT DETECT LOC: A17	CODE IDENT 19333	C	83322450	J C
		CROSS REF NO 173	SHEET 3	PAGE 3-89	


+5V
3.9K
470
470
470
470
3.9K
+UNIT SELECT TAG
+TIE HIGH
022 A02-25B
143 A14-24B
143 A14-23B
174 A17-26A
772 A4 P201-06B
772 A4 P201-09B
772 A4 P201-08B
772 A4 P201-10B
+LOGIC PLUG BIT 3
+LOGIC PLUG BIT 2
+LOGIC PLUG BIT 1
+LOGIC PLUG BIT 0
GND A17-34A
-GND
173 A17-07A
-POWER UP MASTER CLEAR
RGTR 520 E4
RGTR 520 E3
024 A02-17B
+BUS OUT BIT 4
024 A02-14B
+BUS OUT BIT 5
022 A02-11A
+BUS OUT BIT 6
022 A02-09A
+BUS OUT BIT 7
1K
Σ 501 E2
A>B
A=B
A<B
+LOGIC PLUG 2^3
043 A04-25B
+LOGIC PLUG 2^2
043 A04-23B
+LOGIC PLUG 2^1
044 A04-30B
+LOGIC PLUG 2^0
044 A04-28A
8 140 D3C
X/Y 200 B2C
2.0K
+UNIT SELECT COMPARE
10B
023 A02-22B
DISABLE
NORM
S2
MAINT UNIT DISABLE
174 A17-28A
+TIE HIGH
083 A08-28A
-FLASHER
172 C +FAULT
084 A08-02A
-SERVO FAULT
074 A07-07B
-SERVO READY
082 A08-24A
-UNLOAD HEADS
173 B -VOLTAGE FAULT
X/Y 200 B2F
JA80-13A
772 A4 J201-05B
-FAULT
11B
074 A07-33B
193 A09-15A
UNIT READY LATCH
I 140 D3D
X/Y 200 B2D
-READY
12B
+UNIT READY
26B
043 A04-27B
X/Y 200 B2A
2.2K
I 141 C3C
-UNIT READY
25A
NC
+(SPEED FLT + VOLTAGE FLT)
15B
NC
I 140 D3A
X/Y 200 B2E
-(SPEED FLT + VOLTAGE FLT)
11A
124 A12-16B
+UP TO SPEED
24B
082 A08-29A
-UP TO SPEED
24A
074 A07-26B
NOTE :
1. S/C 18 & ABV ADDED 093 A19-15A.
+5V
11.0K
10.0K
80.0K
26.1K
13.0K
6.8K
1K
3.3 UF 15V
22 UF 15V
792 A2 P3-2 JA83-03B
792 A2 1 03A
SPEED XDCR
10K
Σ∞ 300 AR-2
-5V
560
8.66K
1.10K
I 195 DIB
20.0 MS
I 195 DIA
95 MS
+5V
†1 30MS UBT
2200 PF
NYRO DATA
NORMANDALE DIVISION
UNIT SELECT, LAP, SPEED XDCR, UNIT READY LATCH
LOC. A17
CODE IDENT 19333
C
83322450
P
D
CROSS REF NO 174
SHEET 4
PAGE 3-90

REVISION STATUS OF SHEETS

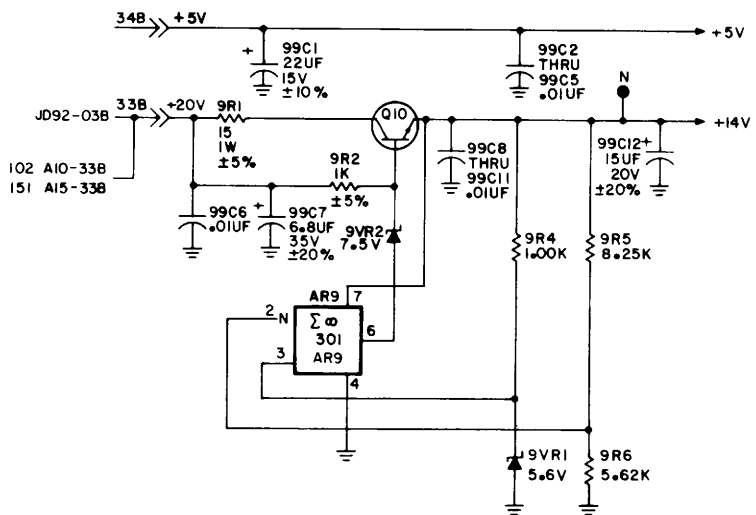
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																
B	A	A	B																

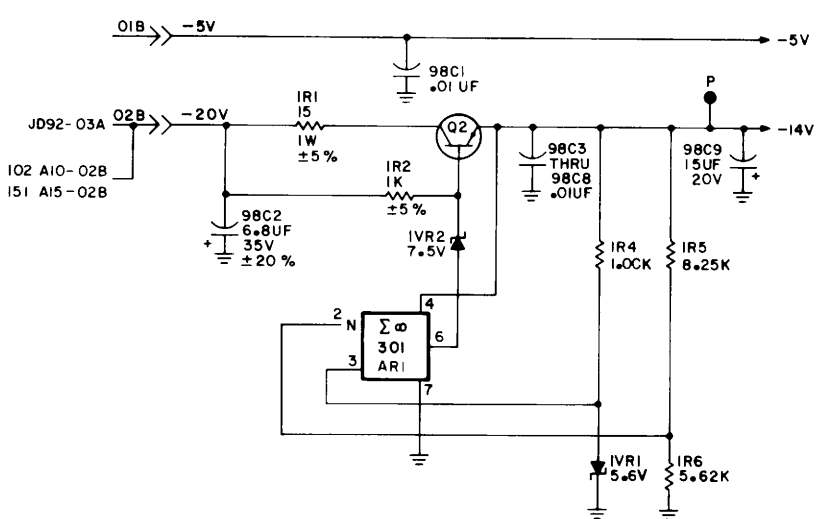


UNUSED LOGIC ELEMENTS

REVISIONS

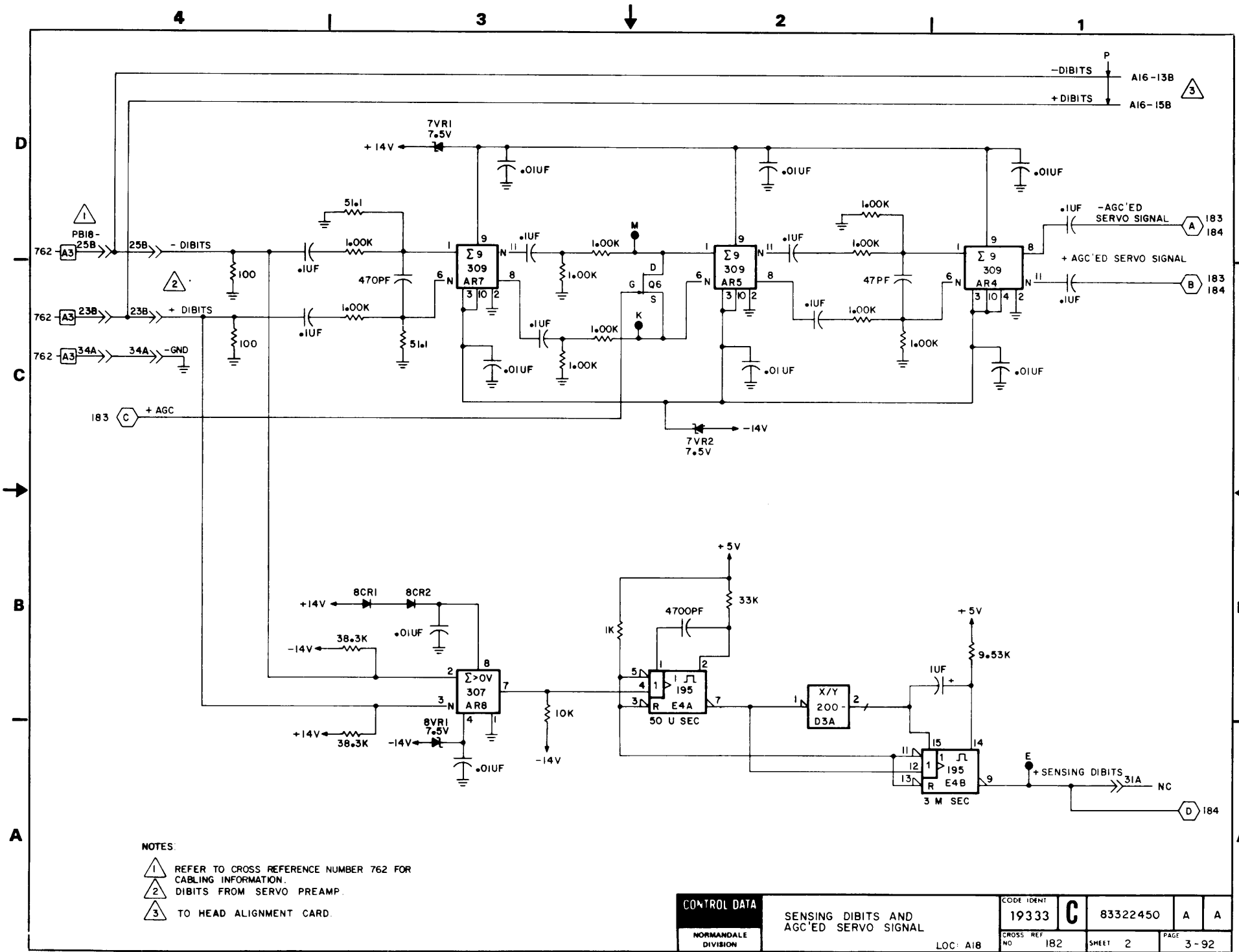
REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	[illegible]	[illegible]	
B	PE55259	LOGIC DIAG. IMPROVEMENT	A.A.O	8-7-78	





DRAWN	M ANDERSON	CONTROL DATA	FINE SERVO DECODER DIAGRAMS	CODE IDENT 19333	C	83322450	J B
CHECKED		NORMANDALE DIVISION	TYPE HFRV LOC A18	DWG 181		SHEET 1 - 4	PAGE 3-91
ENGINEER							
APPROVED							

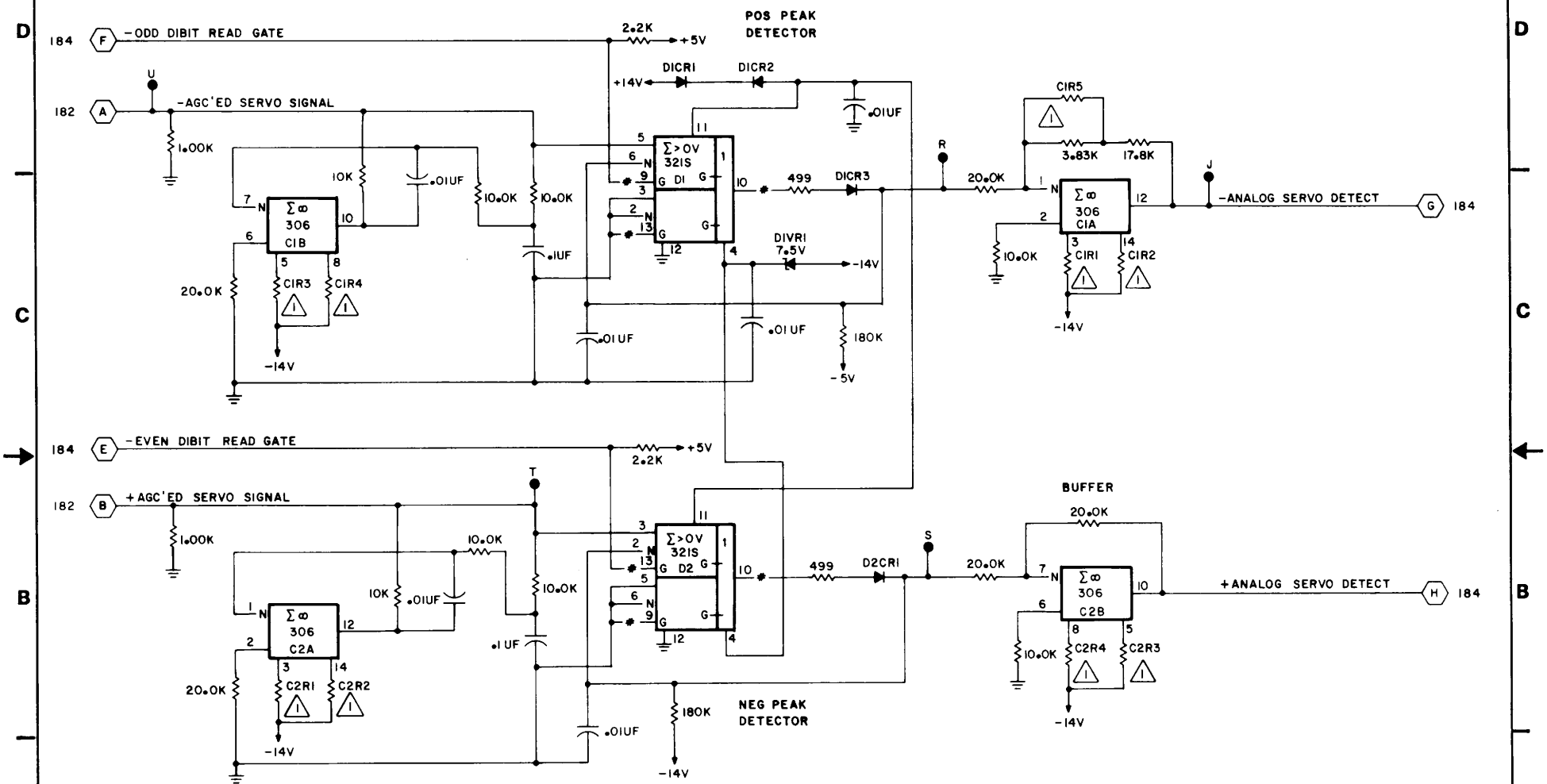
REF 83214918



NOTES:

1. REFER TO CROSS REFERENCE NUMBER 762 FOR CABLING INFORMATION.
2. DIBITS FROM SERVO PREAMP.
3. TO HEAD ALIGNMENT CARD.

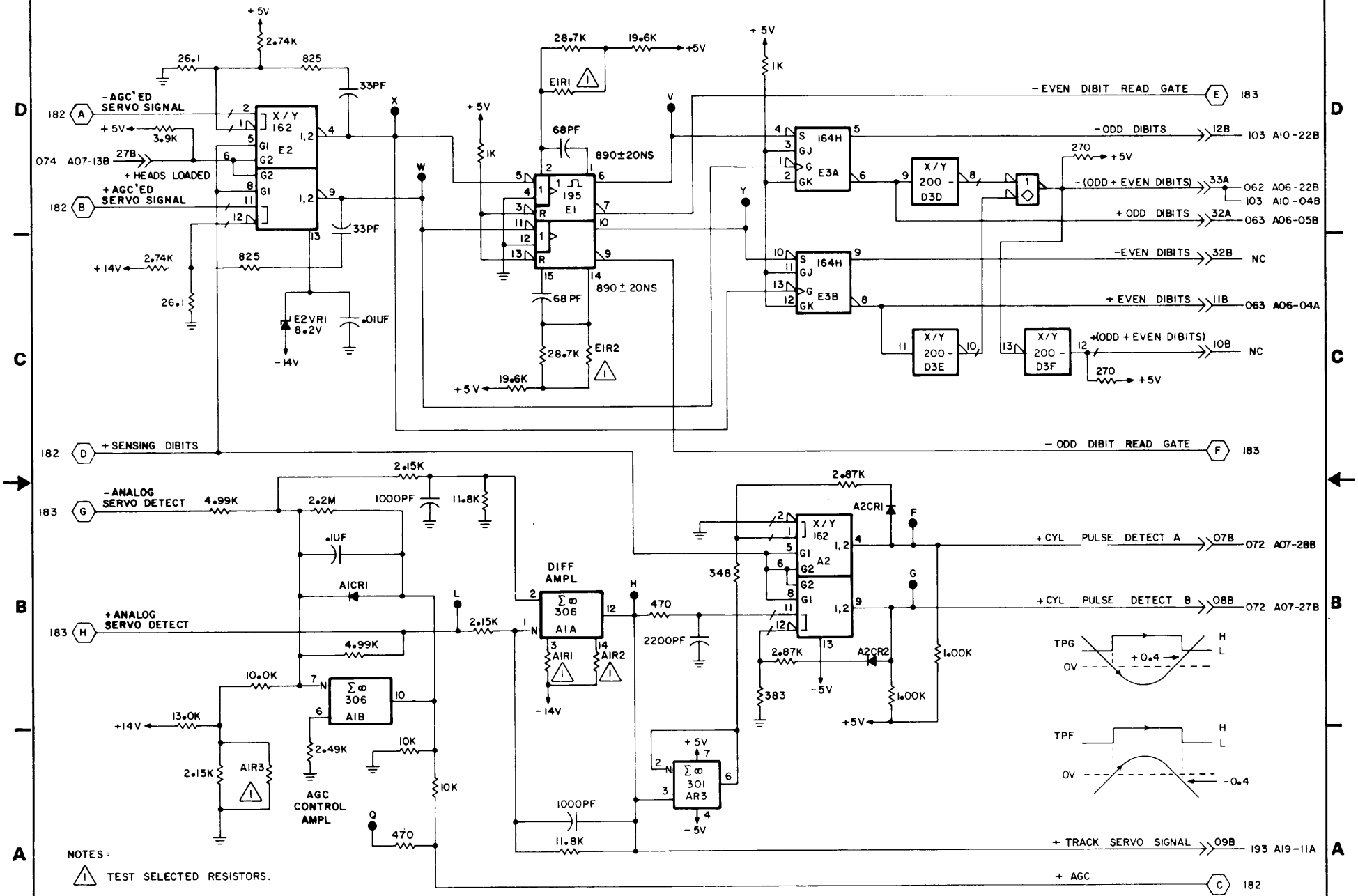
CONTROL DATA NORMANDALE DIVISION	SENSING DIBITS AND AGC'ED SERVO SIGNAL LOC: A18	CODE IDENT 19333	C	83322450	A A
		CROSS REF NO 182	SHEET 2	PAGE 3-92	



NOTES:

1. TEST SELECTED RESISTORS.

CONTROL DATA NORMANDALE DIVISION	TRACK SERVO SIGNAL AND CYL DETECT A AND B LOC A18	CODE IDENT 19333	C	83322450	A	A
		CROSS REF NO 183		SHEET 3	PAGE 3-93	



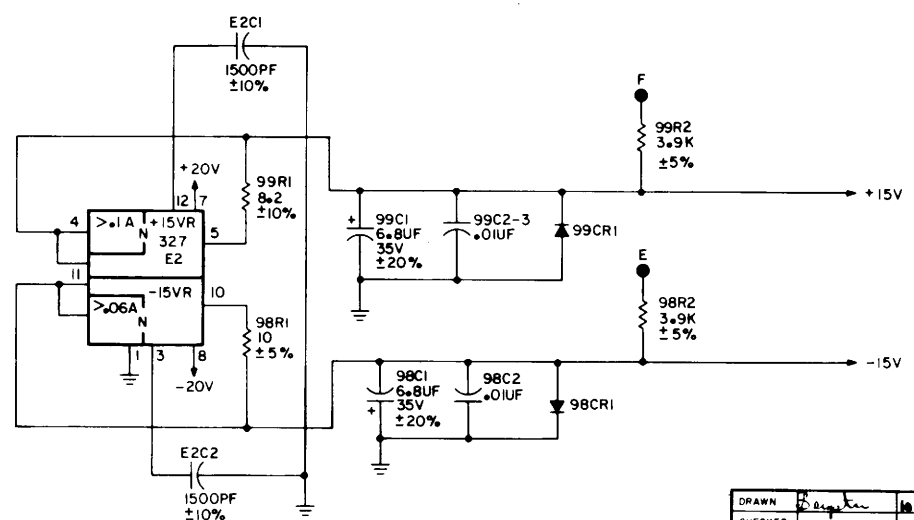
CONTROL DATA NORMANDALE DIVISION	TRACK SERVO SIGNAL AND CYL DETECT A AND B LOC. A18	CODE IDENT 19333	C	83322450	J B
		CROSS REF NO 184		SHEET 4	PAGE 3-94

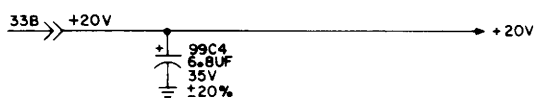
REVISION STATUS OF SHEETS

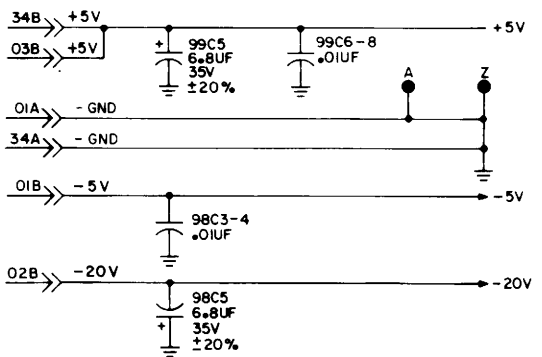
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																
B	B	B	A																
C	B	C	A																

REVISIONS

REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	ML A	1-19-76	
B	PE55259	LOGIC DIAG. IMPROVEMENT	A.A.O	8.7.78	
C	PE57112	STATUS PROTECTED			

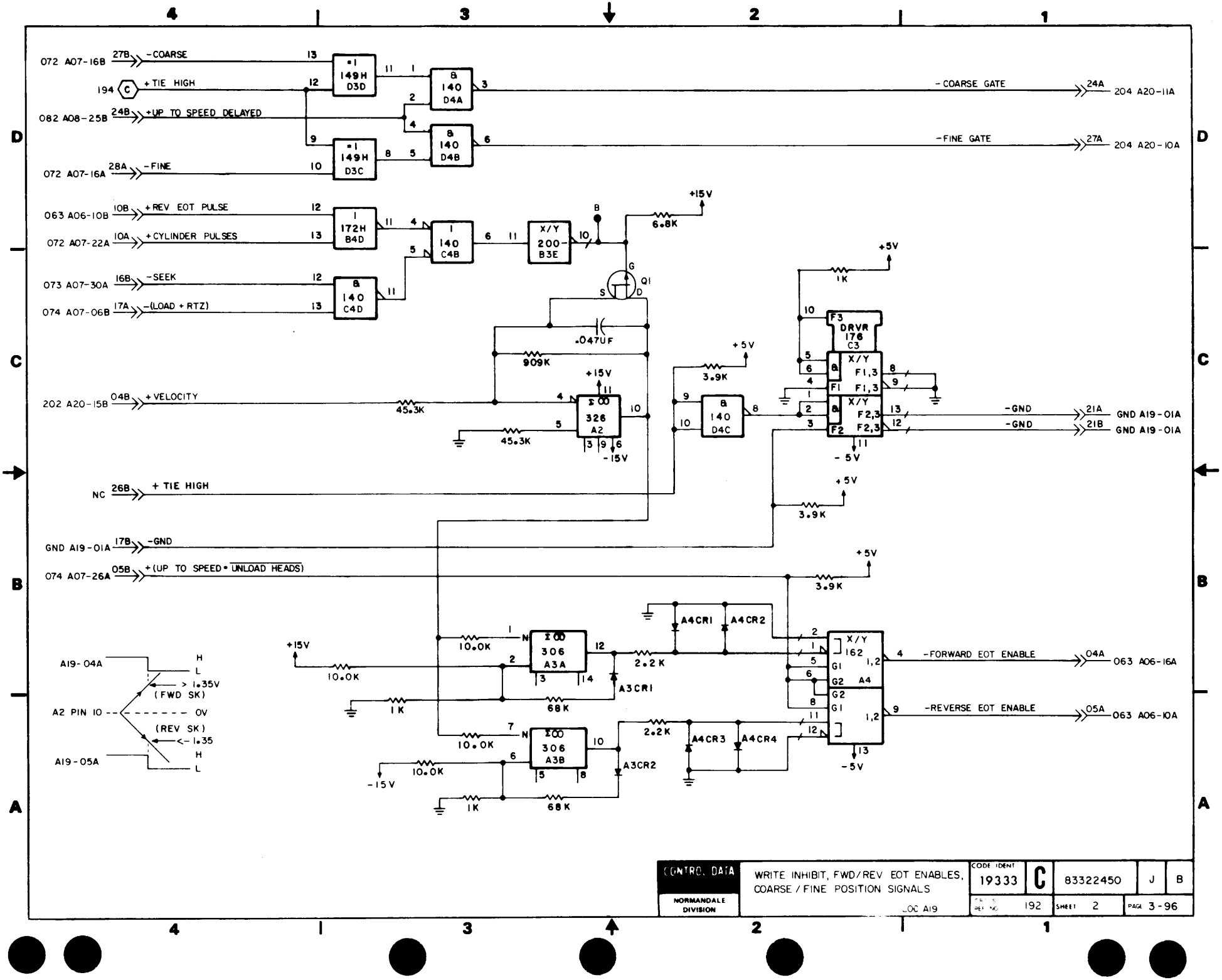




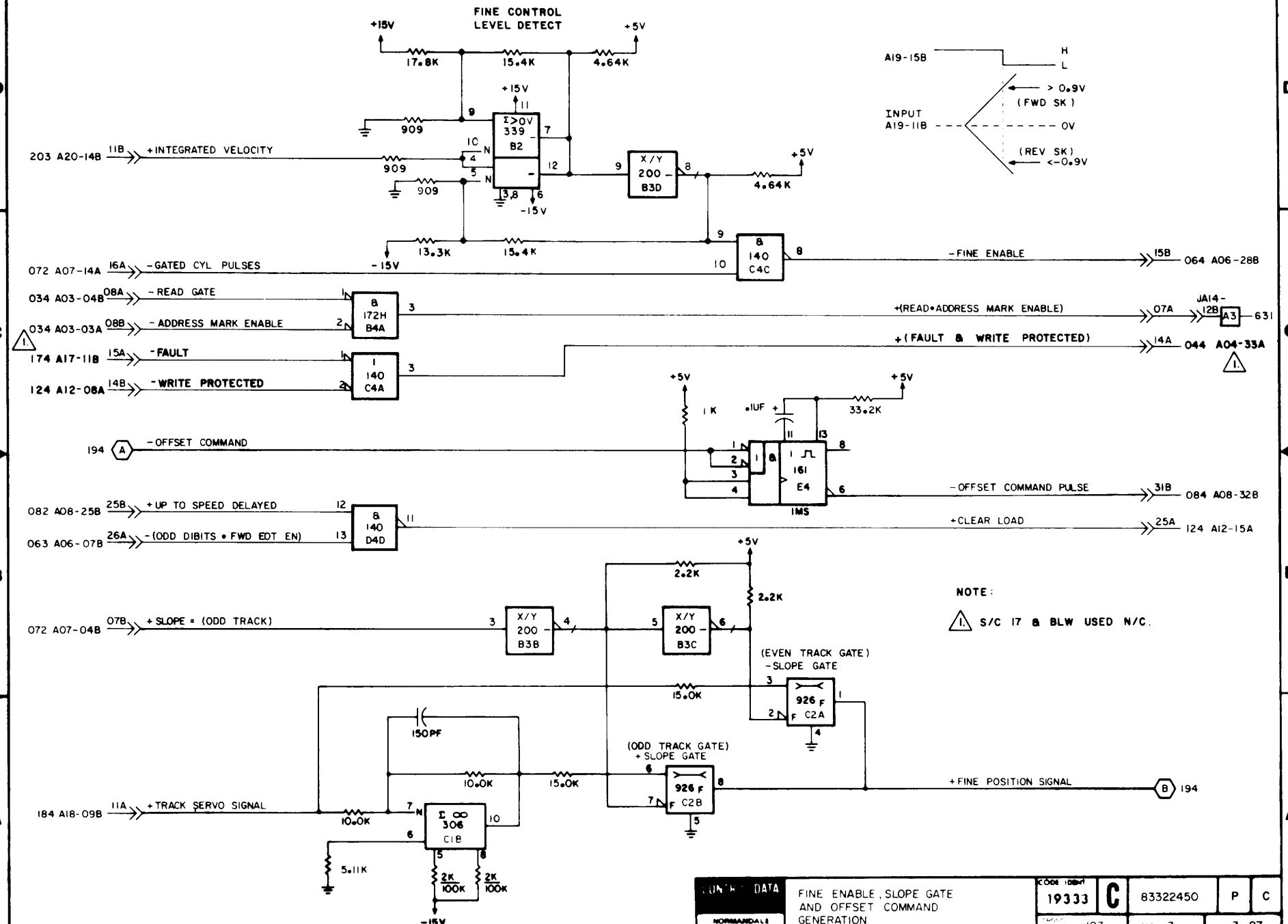


DRAWN		CONTROL DATA	ACCESS CONTROL NO. 2 DIAGRAMS	CODE IDENT 19333	C	83322450	P C
CHECKED							
ENGINEER		NORMANDALE DIVISION	TYPE AKGV LOC A19	CROSS REF NO 191	SHEET 1 OF 4	PAGE 3-95	
APPROVED							

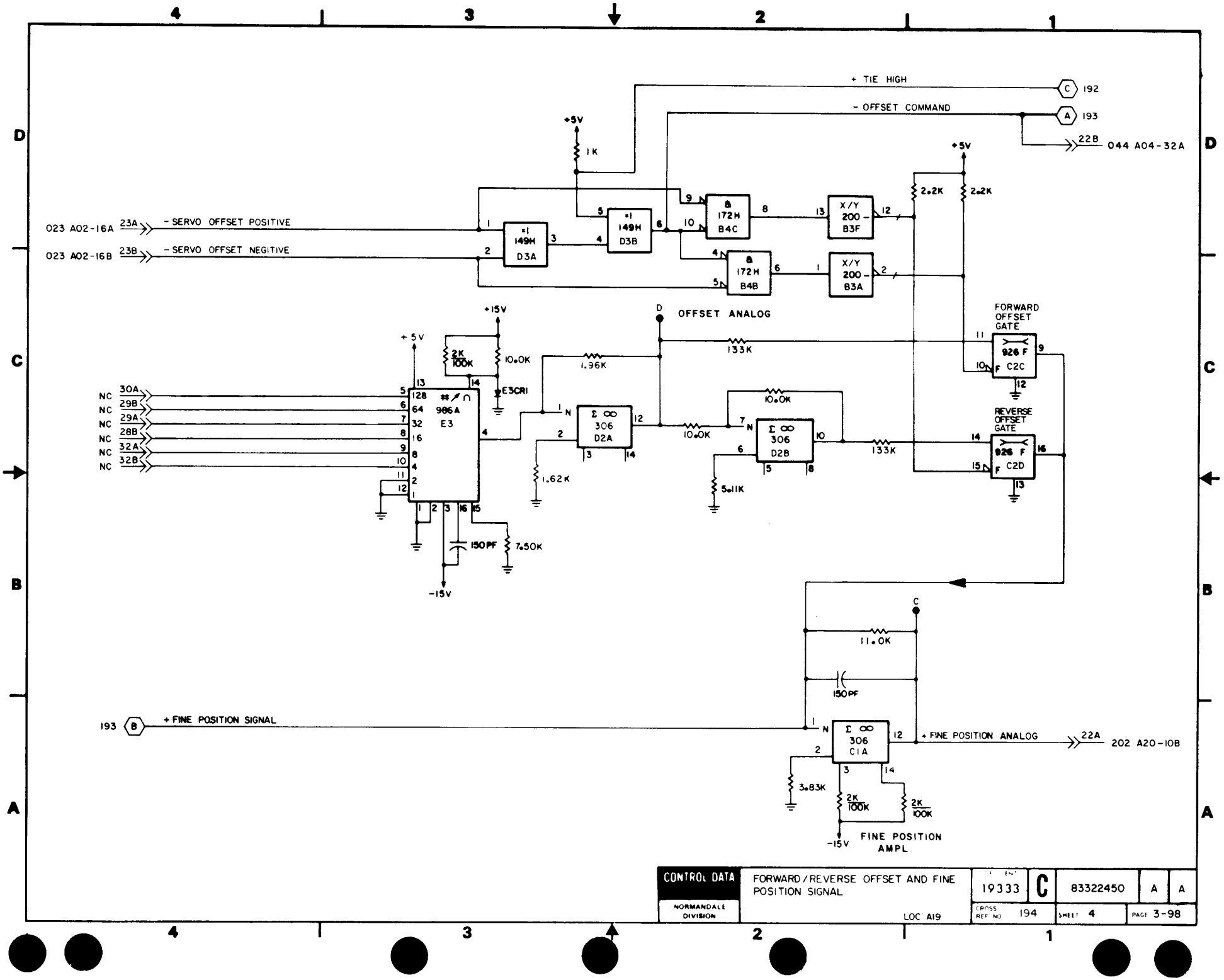
REF 83214919



CONTROL DATA NORMANDALE DIVISION	WRITE INHIBIT, FWD/REV EOT ENABLES, COARSE / FINE POSITION SIGNALS LOC A19	CODE IDENT 19333	C	83322450	J B
		REV NO 192	SHEET 2	PAGE 3-96	



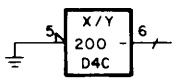
CONTROL DATA NORMANDALE DIVISION	FINE ENABLE, SLOPE GATE AND OFFSET COMMAND GENERATION LOC A19	CODE IDENT 19333	C	83322450	P C
		SERVICE REF NO. 193		SHEET 3	3-97


+ TIE HIGH
C 192
- OFFSET COMMAND
A 193
22B 044 A04-32A
+5V
1K
2.2K
2.2K
023 A02-16A 23A - SERVO OFFSET POSITIVE
023 A02-16B 23B - SERVO OFFSET NEGITIVE
÷1 149H D3A
÷1 149H D3B
8 172H B4C
8 172H B4B
X/Y 200 - B3F
X/Y 200 - B3A
+15V
+5V
2K 100K
10.0K
E3CR1
D
OFFSET ANALOG
133K
1.96K
FORWARD OFFSET GATE
926 F C2C
REVERSE OFFSET GATE
926 F C2D
NC 30A
NC 29B
NC 29A
NC 28B
NC 32A
NC 32B
986A E3
Σ∞ 306 D2A
Σ∞ 306 D2B
1.62K
5.11K
150PF
7.50K
-15V
C
11.0K
150PF
193 B + FINE POSITION SIGNAL
Σ∞ 306 C1A
+ FINE POSITION ANALOG
22A 202 A20-10B
3.83K
2K 100K
2K 100K
-15V
FINE POSITION AMPL
CONTROL DATA
NORMANDALE DIVISION
FORWARD/REVERSE OFFSET AND FINE POSITION SIGNAL
LOC A19
19333
C
83322450
A
A
CROSS REF NO 194
SHEET 4
PAGE 3-98

REVISION STATUS OF SHEETS

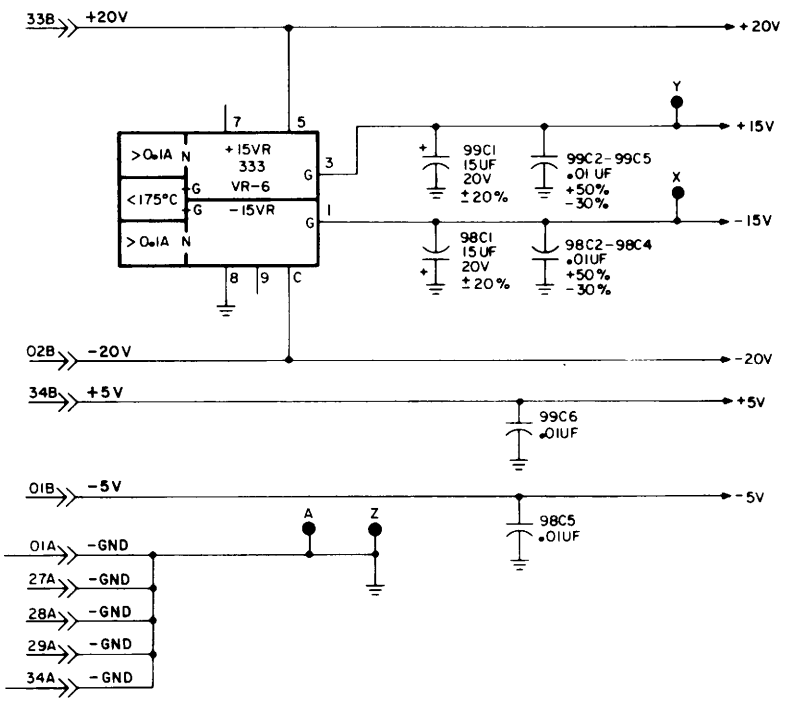
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																
B	A	B	A																
C	C	C	C																

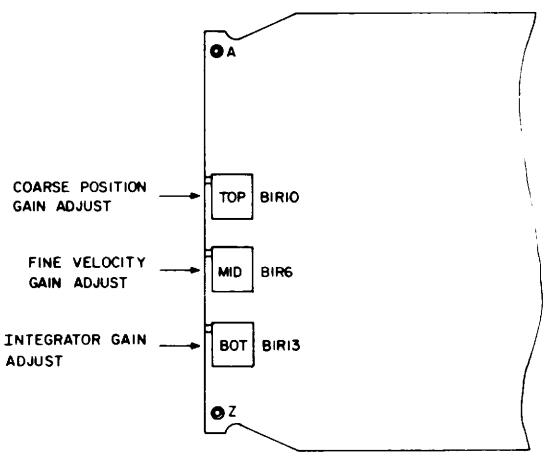
UNUSED LOGIC ELEMENT



REVISIONS

REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23005	RELEASED	V.A	6	
B	PE22926	ERROR CORRECTION	DM	7-8-77	
C	PE55259	LOGIC DIAG IMPROVEMENT	A.A.O	8-7-78	

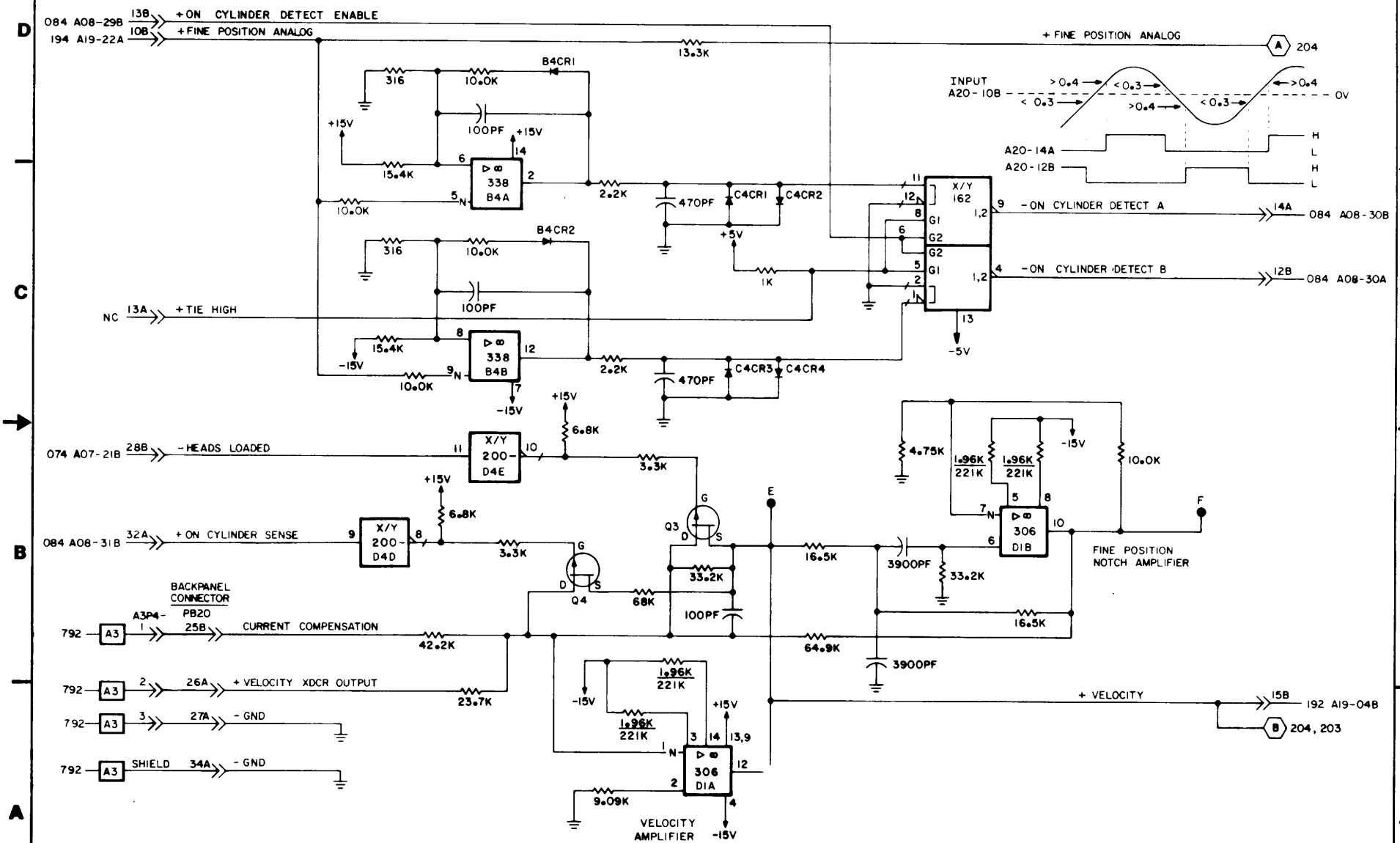




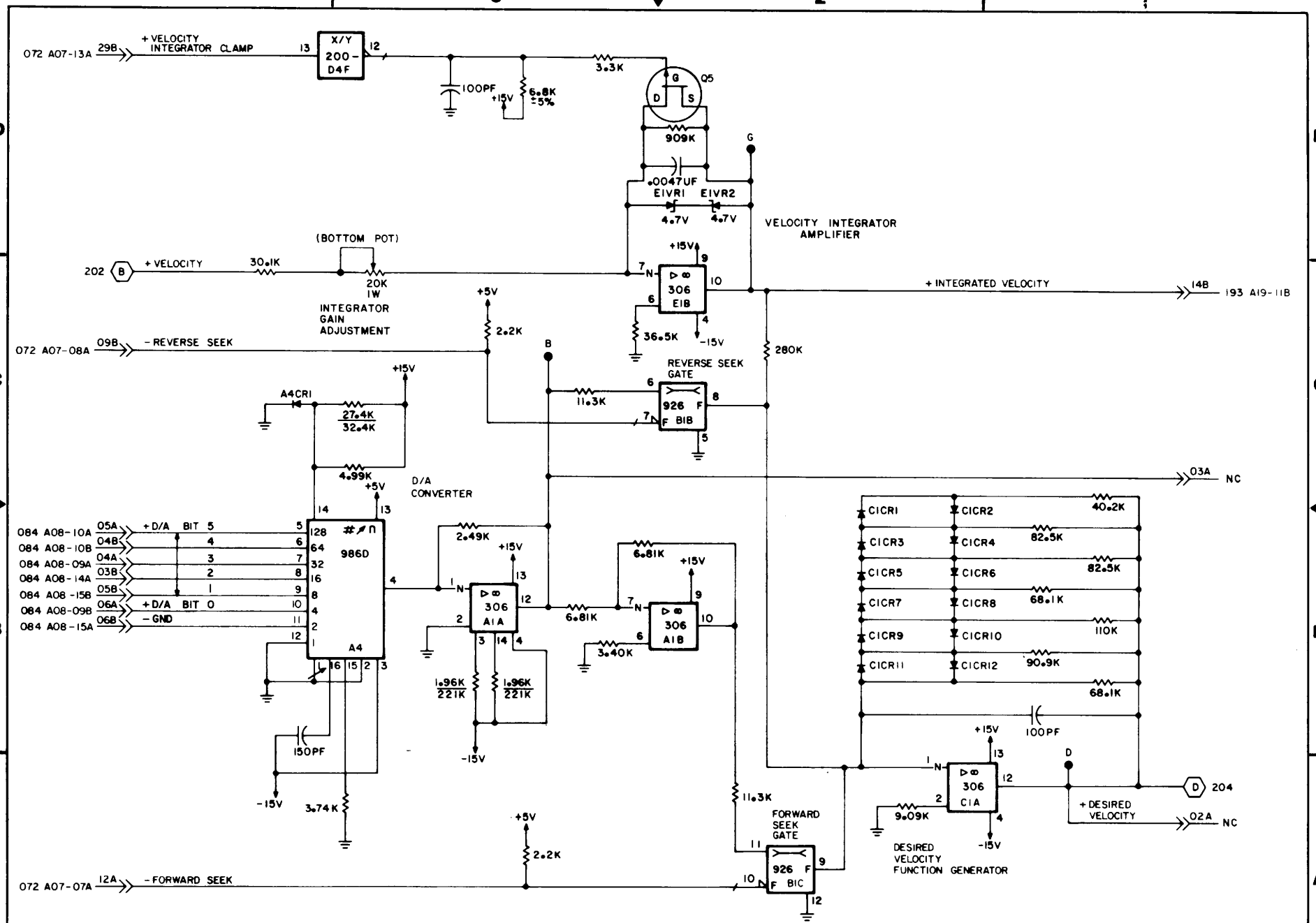
APPLICABLE ONLY TO BJ4M1-9764-1

DRAWN	W.BERGSTROM	11-3-76	CONTROL DATA	ANALOG SERVO DIAGRAMS	CODE IDENT 19333	C	83322450 J C
CHECKED							
ENGINEER			NORMANDALE DIVISION	TYPE DMSV LOC A20	CROSS REF NO 201	SHEET 1 OF 4	PAGE 3-99
APPROVED							

REF 83215007



CONTROL DATA NORMANDALE DIVISION	CYLINDER DETECT, VELOCITY, AND VELOCITY GAIN ADJUST (9764) LOC A20	CODE IDENT 19333	C	83322450	J	C
		CROSS REF NO 202		SHEET 2	PAGE 3-100	

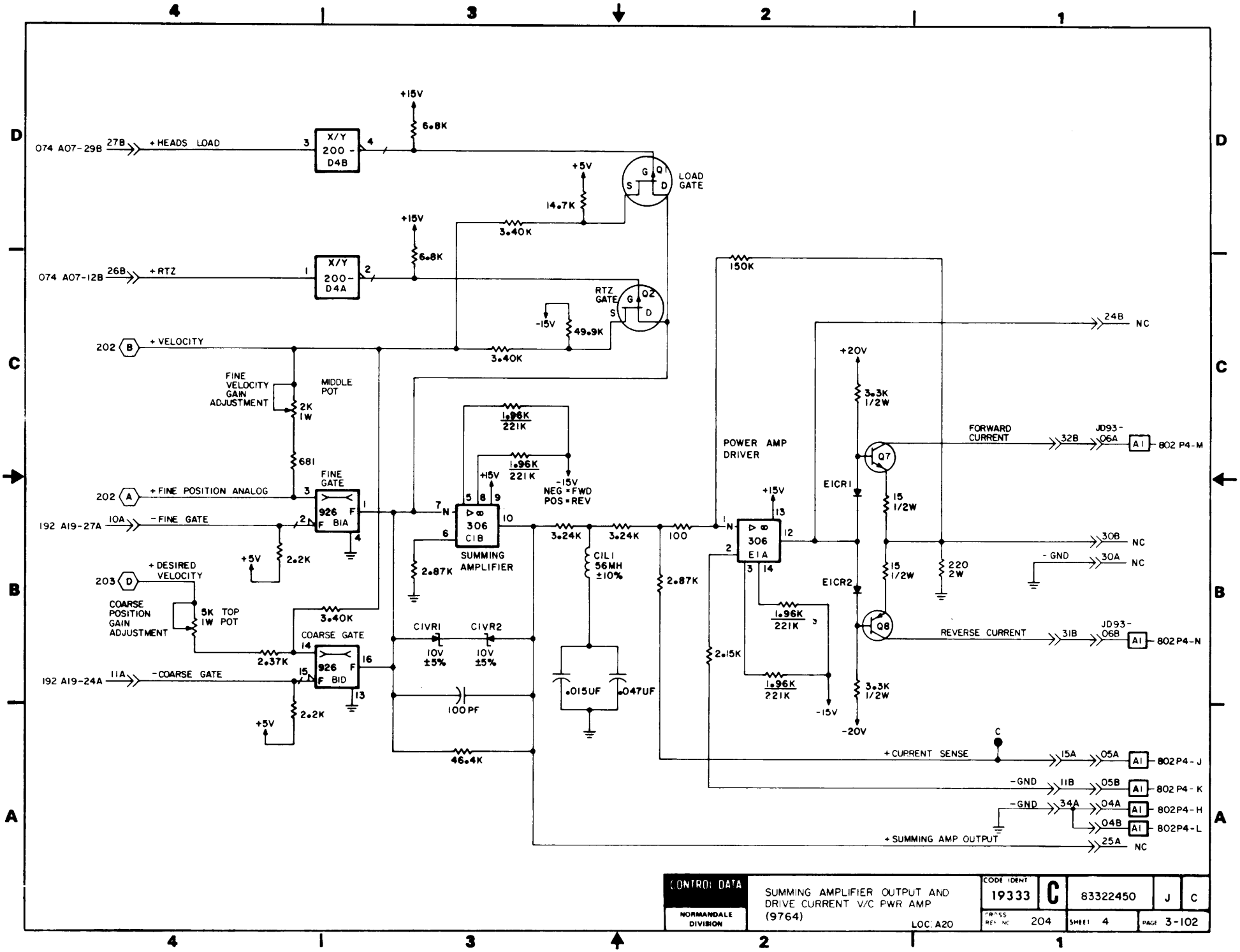


CONTROL DATA
NORMANDALE DIVISION

D/A CONVERTER AND DESIRED VELOCITY GENERATOR (9764)
LOC A20

CODE IDENT				
19333	C	83322450	J	C

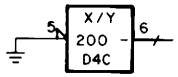
CROSS REF NO 203 | SHEET 3 | PAGE 3-101


074 A07-29B
27B
+HEADS LOAD
X/Y 200-D4B
+15V
6.8K
+5V
14.7K
LOAD GATE
3.40K
074 A07-12B
26B
+RTZ
X/Y 200-D4A
RTZ GATE
Q2
-15V
49.9K
202 B
+VELOCITY
FINE VELOCITY GAIN ADJUSTMENT
MIDDLE POT
2K 1W
681
202 A
+FINE POSITION ANALOG
FINE GATE
926 F BIA
192 A19-27A
10A
-FINE GATE
+5V
2.2K
203 D
+DESIRED VELOCITY
COARSE POSITION GAIN ADJUSTMENT
5K TOP 1W POT
2.37K
COARSE GATE
926 F BID
192 A19-24A
11A
-COARSE GATE
1.96K 221K
+15V
-15V
NEG=FWD POS=REV
306 C1B
SUMMING AMPLIFIER
2.87K
CIVR1
CIVR2
10V ±5%
100PF
46.4K
3.24K
CIL1 56MH ±10%
.015UF
.047UF
100
150K
POWER AMP DRIVER
306 E1A
+20V
3.3K 1/2W
EICR1
EICR2
15 1/2W
220 2W
2.15K
-20V
FORWARD CURRENT
32B
JD93-06A
A1
802 P4-M
24B
NC
30B
30A
-GND
REVERSE CURRENT
31B
JD93-06B
802 P4-N
+CURRENT SENSE
15A
05A
802 P4-J
11B
05B
802 P4-K
34A
04A
802 P4-H
04B
802 P4-L
+SUMMING AMP OUTPUT
25A
CONTROL DATA
NORMANDALE DIVISION
SUMMING AMPLIFIER OUTPUT AND DRIVE CURRENT V/C PWR AMP (9764)
LOC: A20
CODE IDENT 19333
C
83322450
J
C
CROSS REF NO 204
SHEET 4
PAGE 3-102

REVISION STATUS OF SHEETS

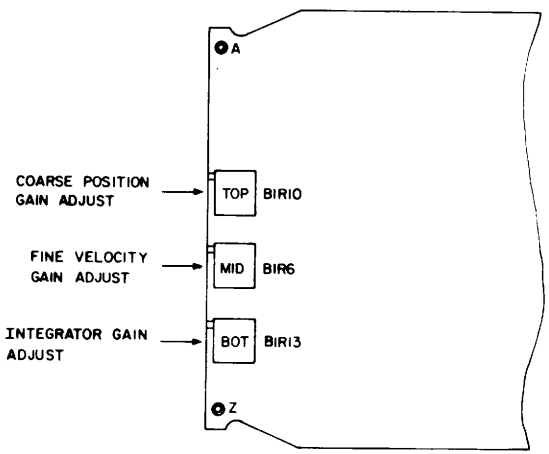
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																
B	A	B	A																
C	A	B	A																
D	D	D	D																

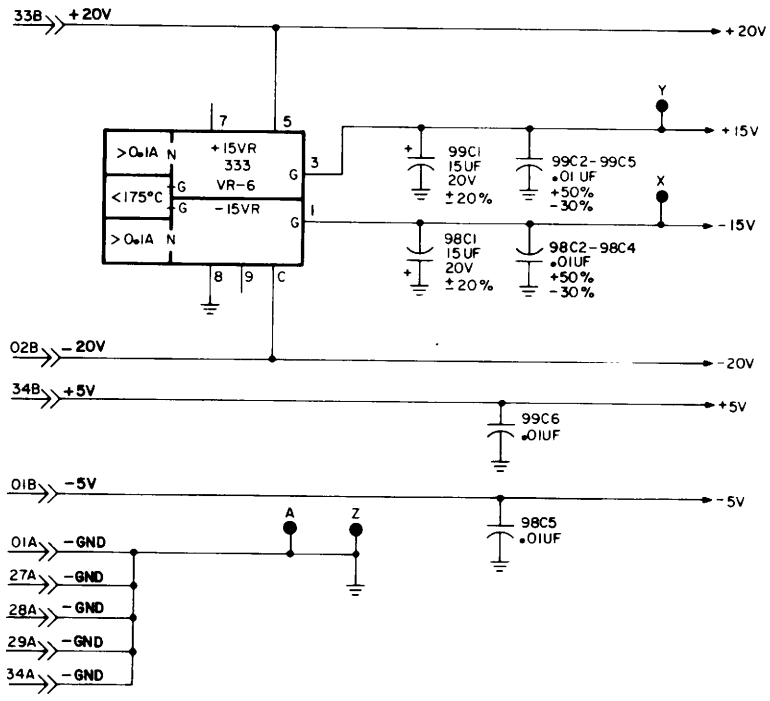
UNUSED LOGIC ELEMENT



REVISIONS

REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA	[illegible]	
B	PE22926	ERROR CORRECTION	DM	7-8-77	
C		EDITORIAL	DM	2-14-78	
D	PE55259	LOGIC DIAG IMPROVEMENT	A.A.O	8.7.78	

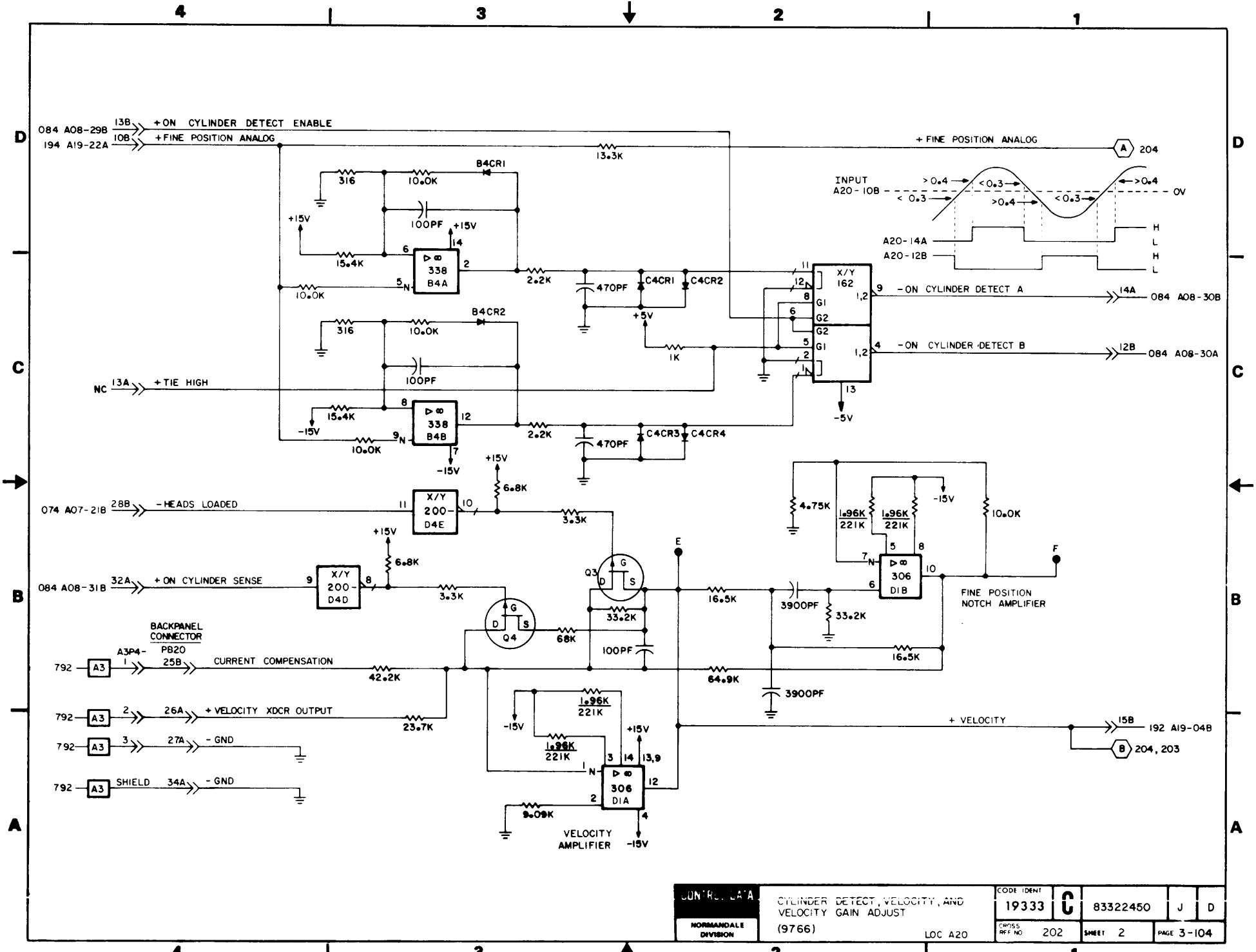




APPLICABLE ONLY TO BJ4M2, BJ402 = 9766-1

DRAWN	M.ANDERSON	[illegible]	CONTROL DATA	ANALOG SERVO DIAGRAMS	CODE IDENT 19333	C	83322450	J D
CHECKED								
ENGINEER	[illegible]							
APPROVED			NORMANDALE DIVISION	TYPE: DMSV LOC A20	CROSS REF NO 201	SHEET 1 OF 4	PAGE 3-103	

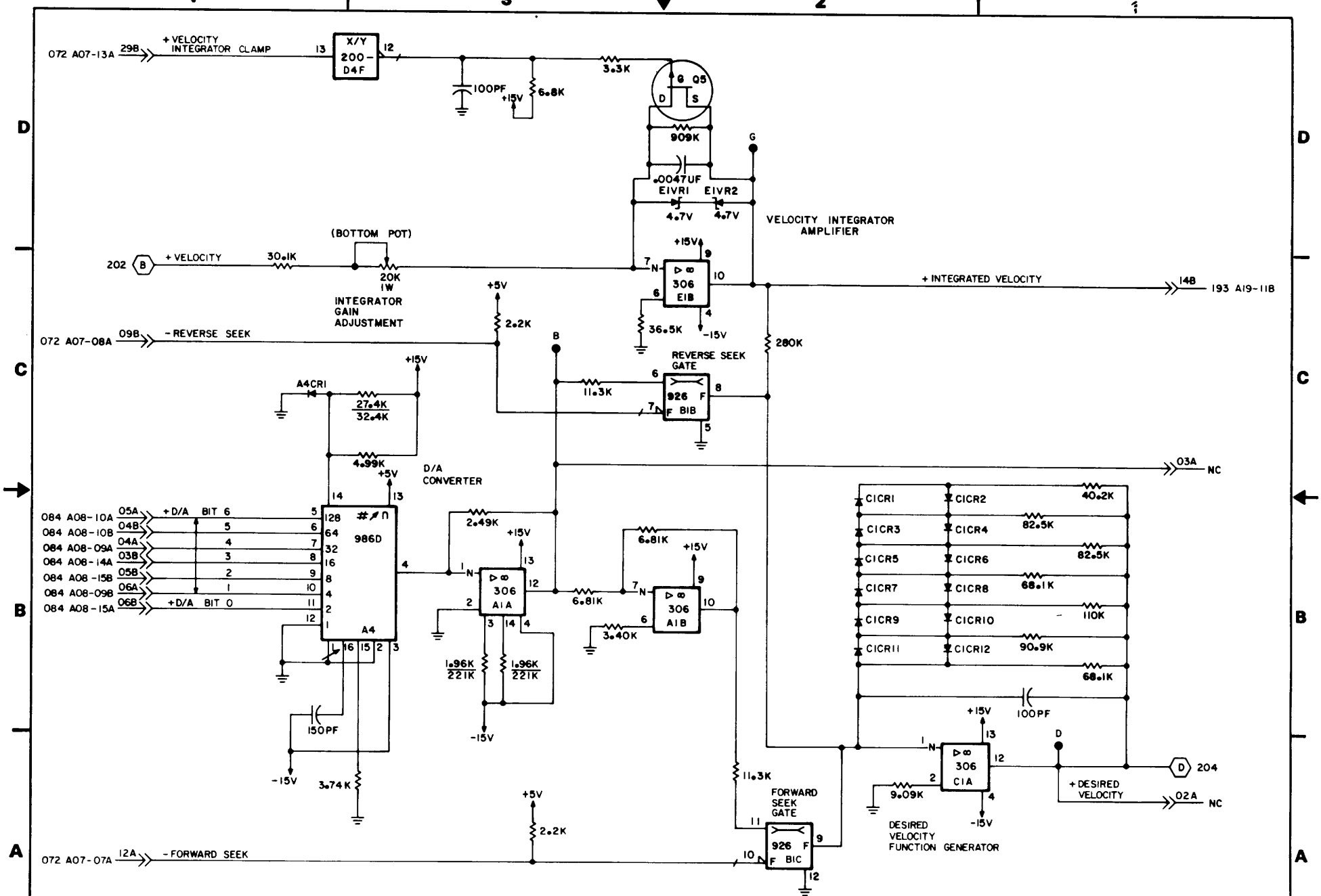
REF 83214920



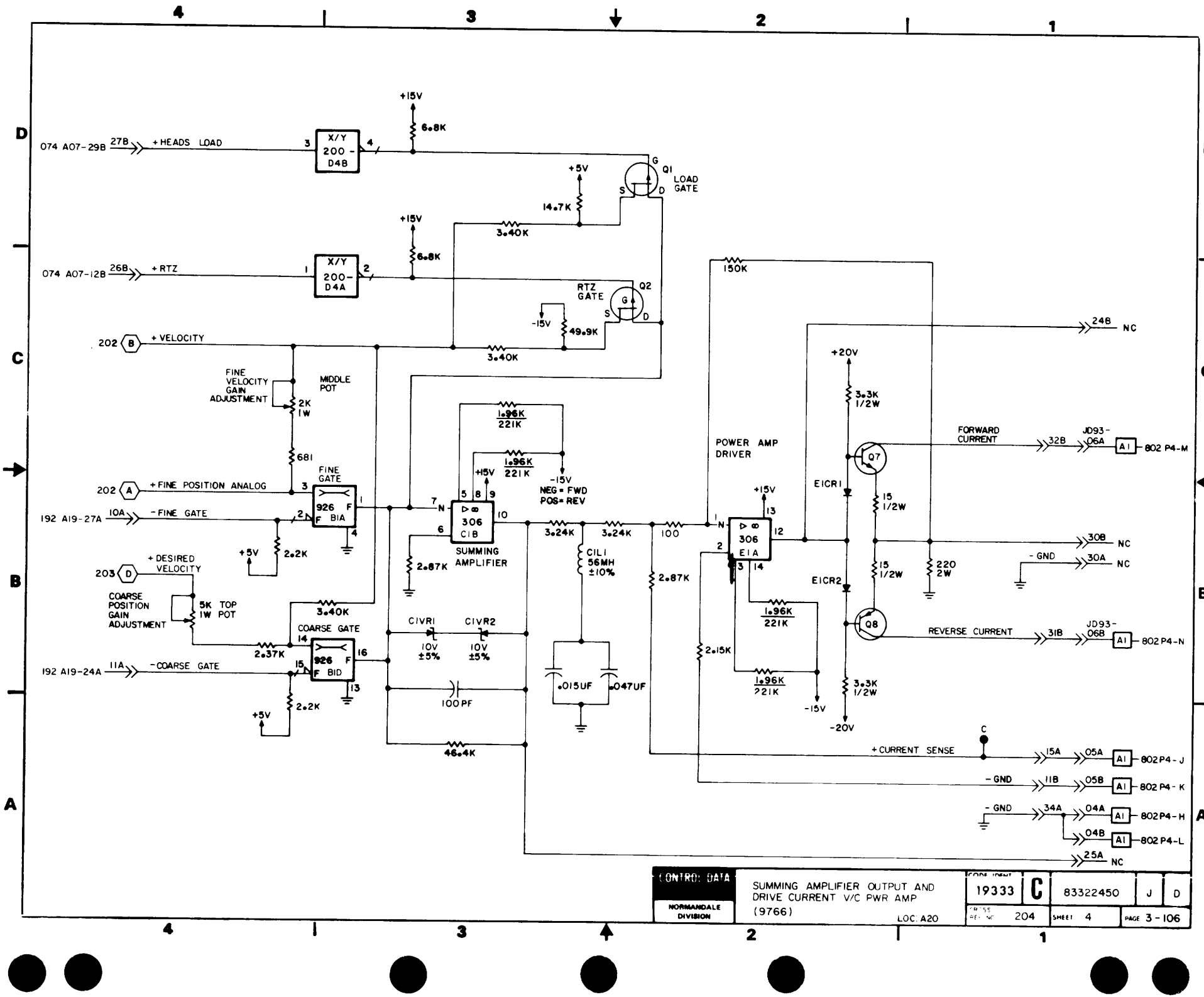
CONTROL DATA
NORMANDALE DIVISION

CYLINDER DETECT, VELOCITY, AND VELOCITY GAIN ADJUST
(9766)
LOC A20

CODE IDENT				
19333	C	83322450	J	D
CROSS REF NO 202	SHEET 2	PAGE 3-104		



CONTROL DATA NORMANDALE DIVISION	D/A CONVERTER AND DESIRED VELOCITY GENERATOR (9766) LOC A20	CODE IDENT 19333	C	83322450	J D
		CROSS REF NO 203		SHEET 3	PAGE 3-105

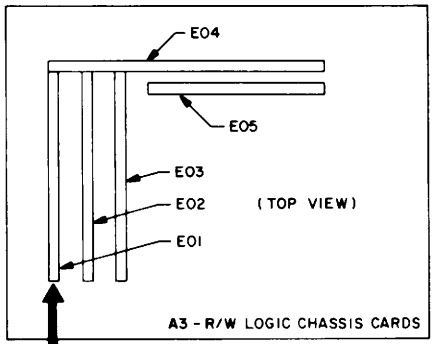

074 A07-29B 27B +HEADS LOAD
X/Y 200-D4B
+15V 6.8K
Q1 LOAD GATE
+5V 14.7K
3.40K
074 A07-12B 26B +RTZ
X/Y 200-D4A
RTZ GATE Q2
-15V 49.9K
202 B +VELOCITY
3.40K
FINE VELOCITY GAIN ADJUSTMENT
MIDDLE POT
2K 1W
681
202 A +FINE POSITION ANALOG
FINE GATE
926 F BIA
192 A19-27A 10A -FINE GATE
+5V 2.2K
1.96K 221K
+15V
-15V NEG = FWD POS = REV
SUMMING AMPLIFIER
306 C1B
2.87K
3.24K
3.24K
100
CIL1 56MH ±10%
203 D +DESIRED VELOCITY
COARSE POSITION GAIN ADJUSTMENT
5K TOP 1W POT
2.37K
3.40K
COARSE GATE
926 F BID
192 A19-24A 11A -COARSE GATE
+5V 2.2K
CIVR1 10V ±5%
CIVR2 10V ±5%
100PF
46.4K
.015UF
.047UF
POWER AMP DRIVER
306 E1A
150K
+20V
3.3K 1/2W
Q7
E1CR1
15 1/2W
FORWARD CURRENT
32B JD93-06A A1 802 P4-M
248 NC
308 NC
- GND 30A NC
220 2W
E1CR2
Q8
REVERSE CURRENT 31B JD93-06B A1 802 P4-N
2.15K
-20V
+CURRENT SENSE 15A 05A A1 802P4-J
- GND 11B 05B A1 802 P4-K
- GND 34A 04A A1 802P4-H
04B A1 802 P4-L
25A NC
CONTRO: DATA
NORMANDALE DIVISION
SUMMING AMPLIFIER OUTPUT AND DRIVE CURRENT V/C PWR AMP (9766)
LOC: A20
19333 C 83322450 J D
204
SHEET 4
PAGE 3-106

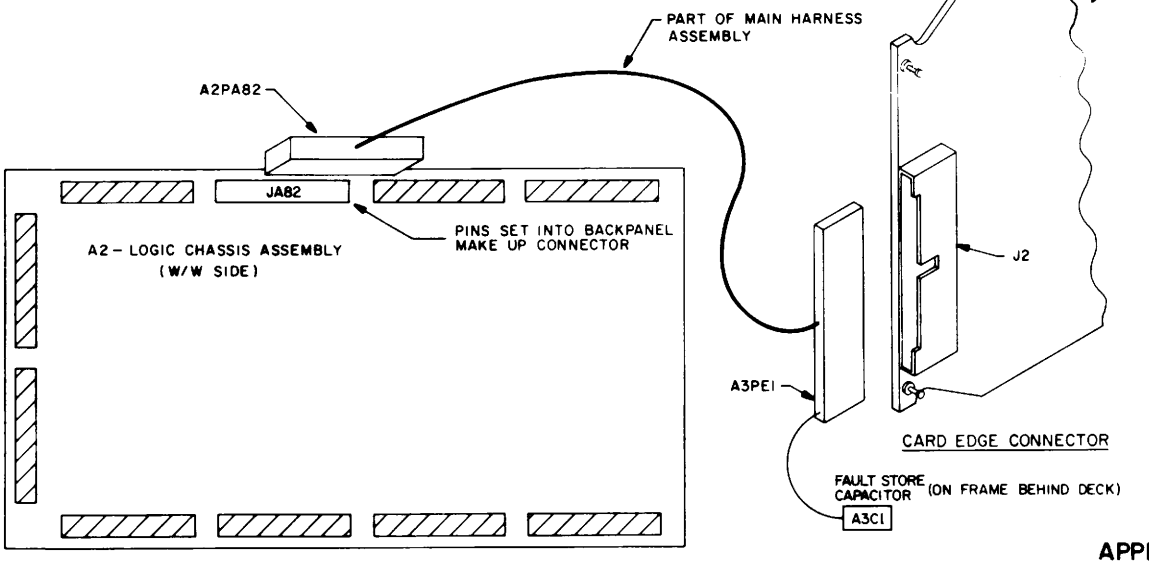
REVISION STATUS OF SHEETS

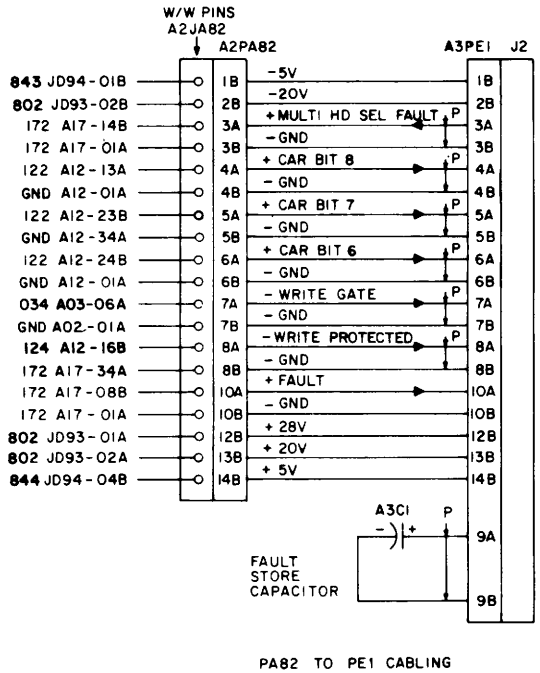
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A																	
B	B	B																	

REVISIONS

REV.	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	PE33440	RELEASED	GR		
B	PE55259	LOGIC DIAG. IMPROVEMENT	A.A.O	8.7.78	



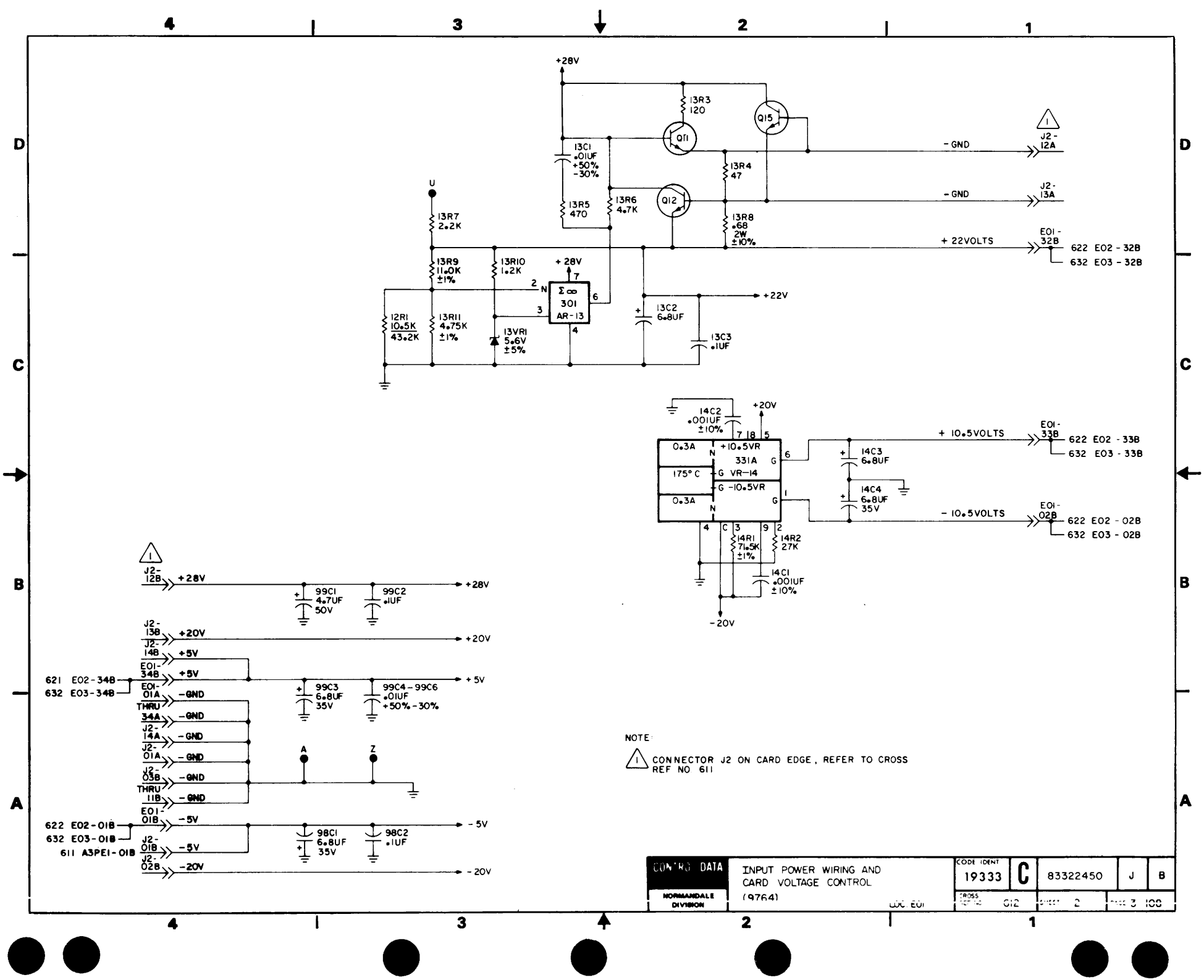




APPLICABLE ONLY TO BJ4M1 = 9764 - 1

DRAWN	S. BENTLER	11-10-76	CONTROL DATA	R/W CONTROL CABLING AND DIAGRAMS	CODE IDENT 19333	C	83322450 J B
CHECKED							
ENGINEER			NORMANDALE DIVISION	TYPE 4PKV LOC E01	CROSS REF NO 611	SHEET 1 OF 3	PAGE 3-107
APPROVED							

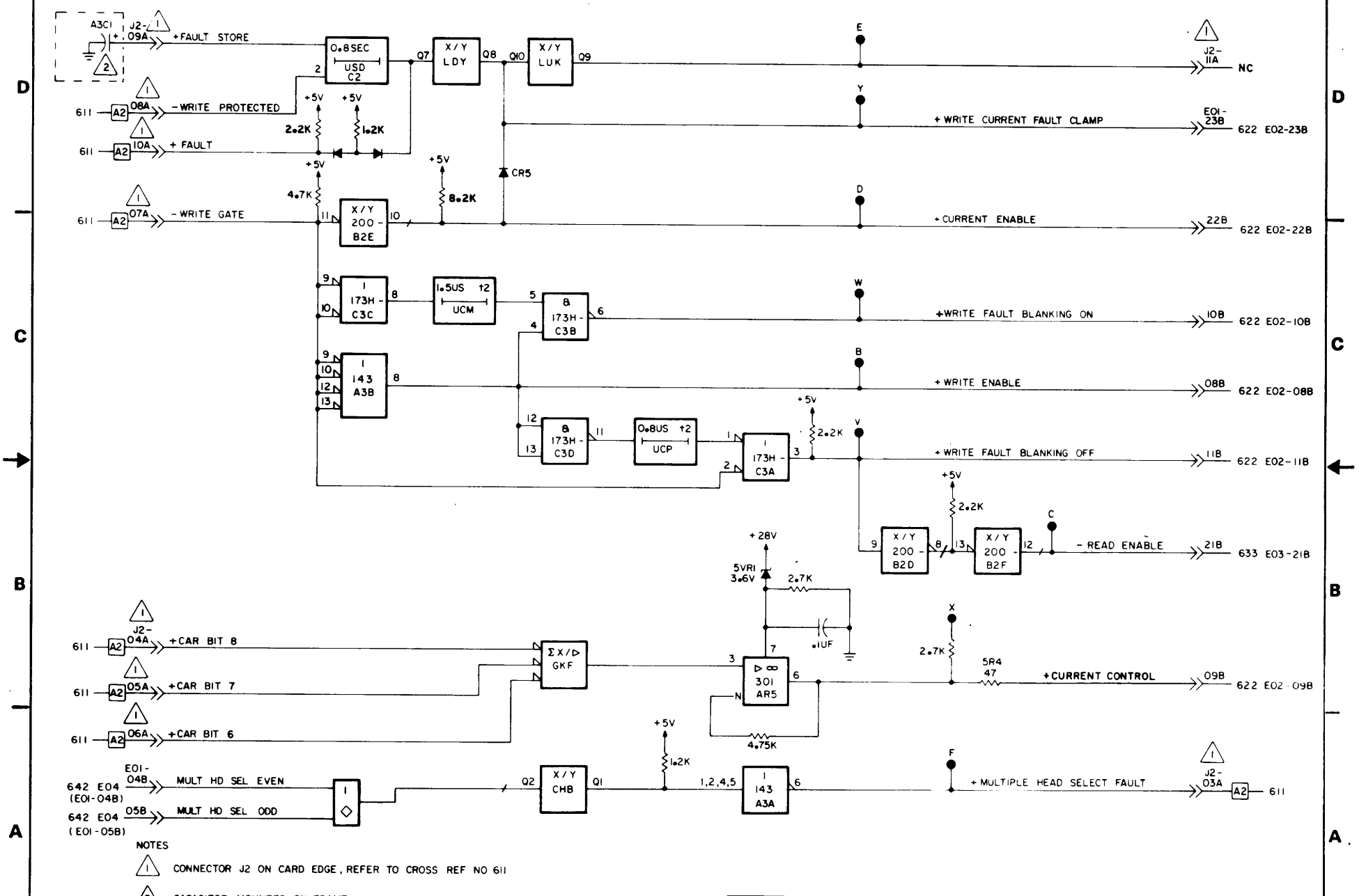
REF 83215008



NOTE:

1. CONNECTOR J2 ON CARD EDGE, REFER TO CROSS REF NO 611

CONTROL DATA NORMANDALE DIVISION	INPUT POWER WIRING AND CARD VOLTAGE CONTROL (97641)	DOC E01	CODE IDENT 19333	C	83322450 J B
			CROSS REF NO 612	SHEET 2	PAGE 3 108



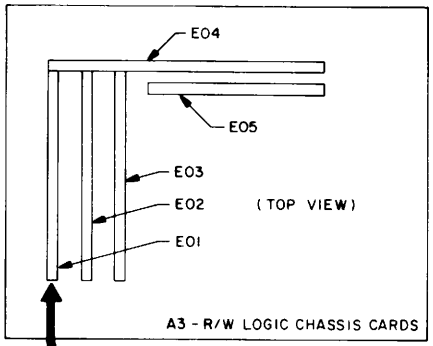
CONTROL DATA NORMANDALE DIVISION	READ / WRITE CONTROL (9764) LOC EOI	CODE IDENT 19333	C	83322450	J	B
		CROSS REF. 613		SHEET 3	PAGE 3-109/110	

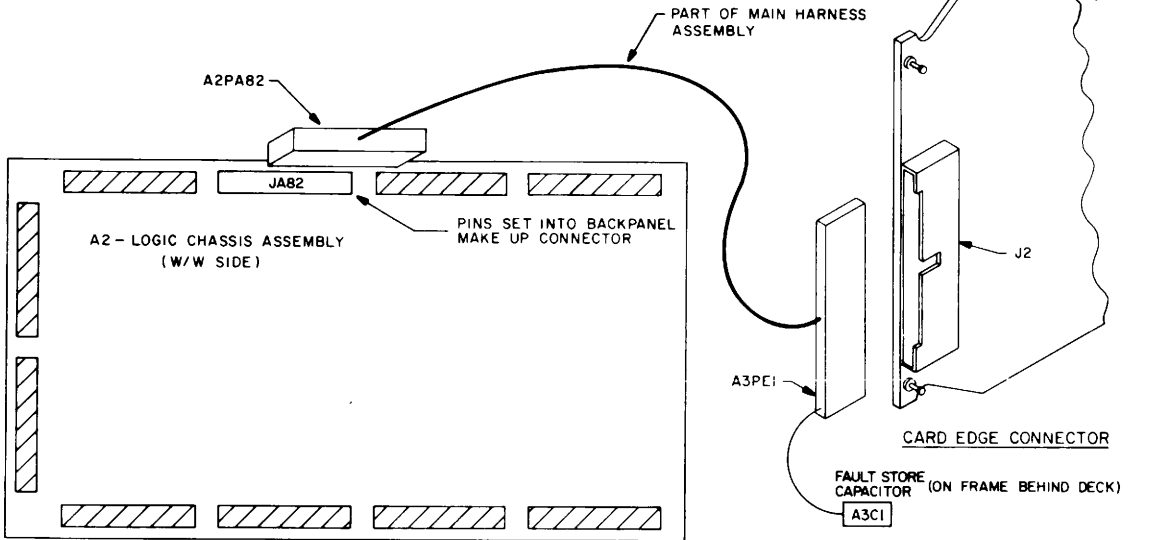
REVISION STATUS OF SHEETS

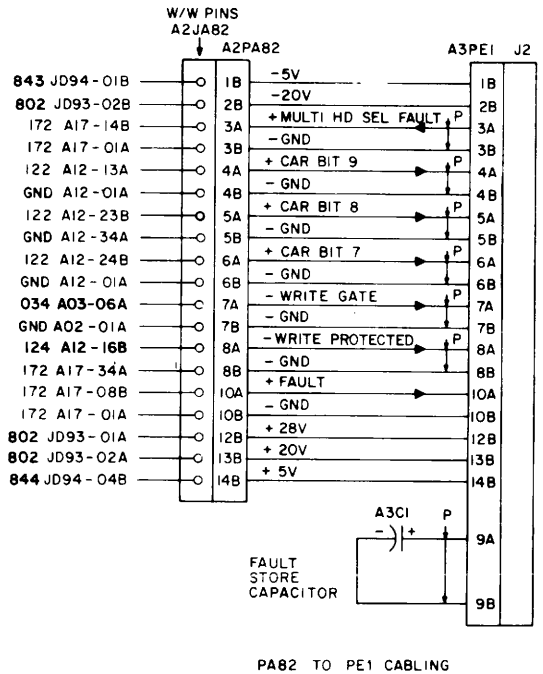
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A																	
B	A	A																	
C	C	C																	
D	C	D																	

REVISIONS

REV.	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	PE28000	RELEASE			
B		EDITORIAL	DM	2-14-78	
C	PE55259	LOGIC DIAG. IMPROVEMENT	A.A.O	8-7-78	
D	PE55259	LOGIC UPDATE	GR	3-28-79	



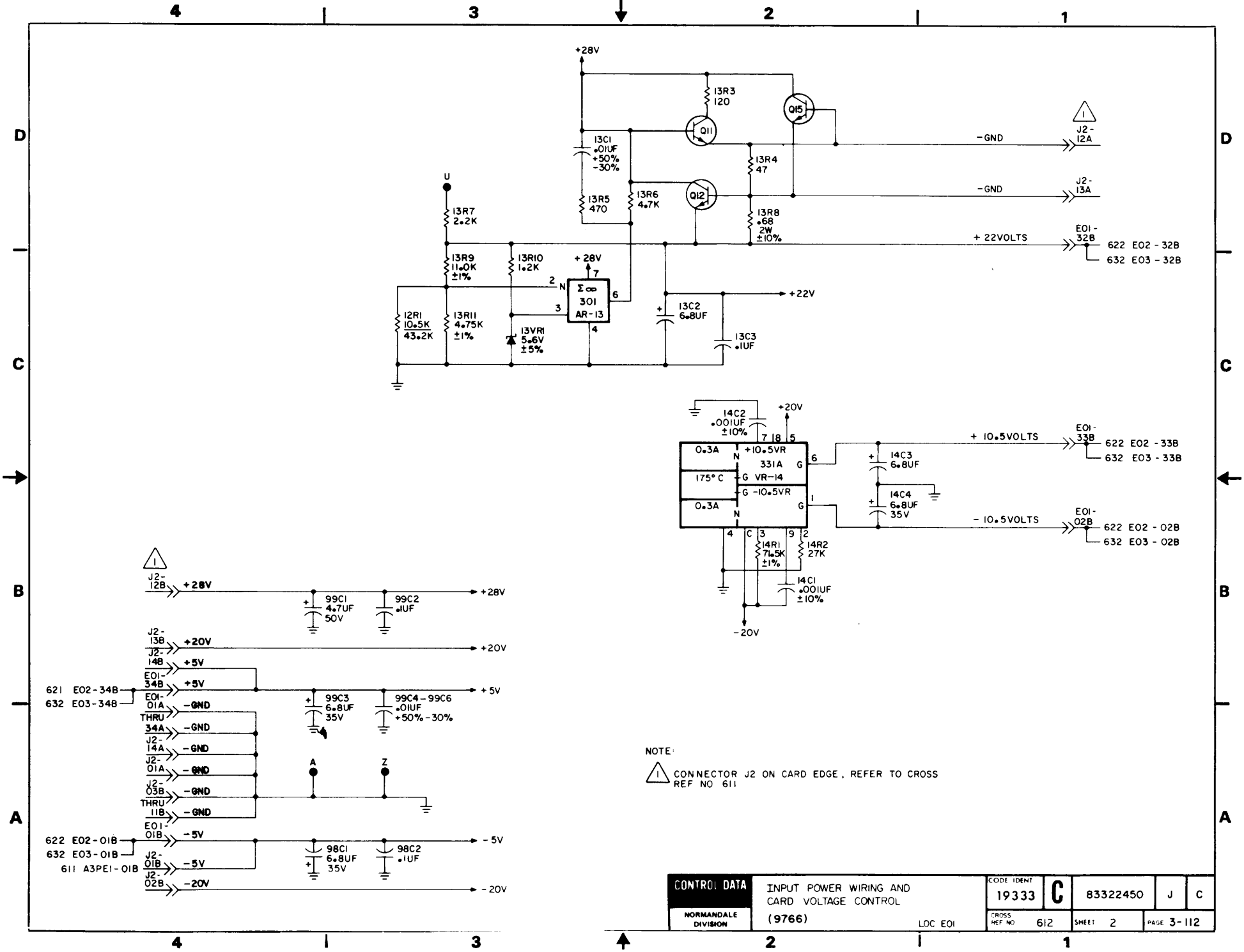




APPLICABLE ONLY TO BJ4M2, BJ402 = 9766-1

DRAWN		CONTROL DATA	R/W CONTROL CABLING AND DIAGRAMS	CODE IDENT 19333	C	83322450	N D
CHECKED							
ENGINEER		NORMANDALE DIVISION	TYPE 4PKV LOC E01	CROSS REF NO. 611	SHEET 1 OF 3	PAGE 3-111	
APPROVED							

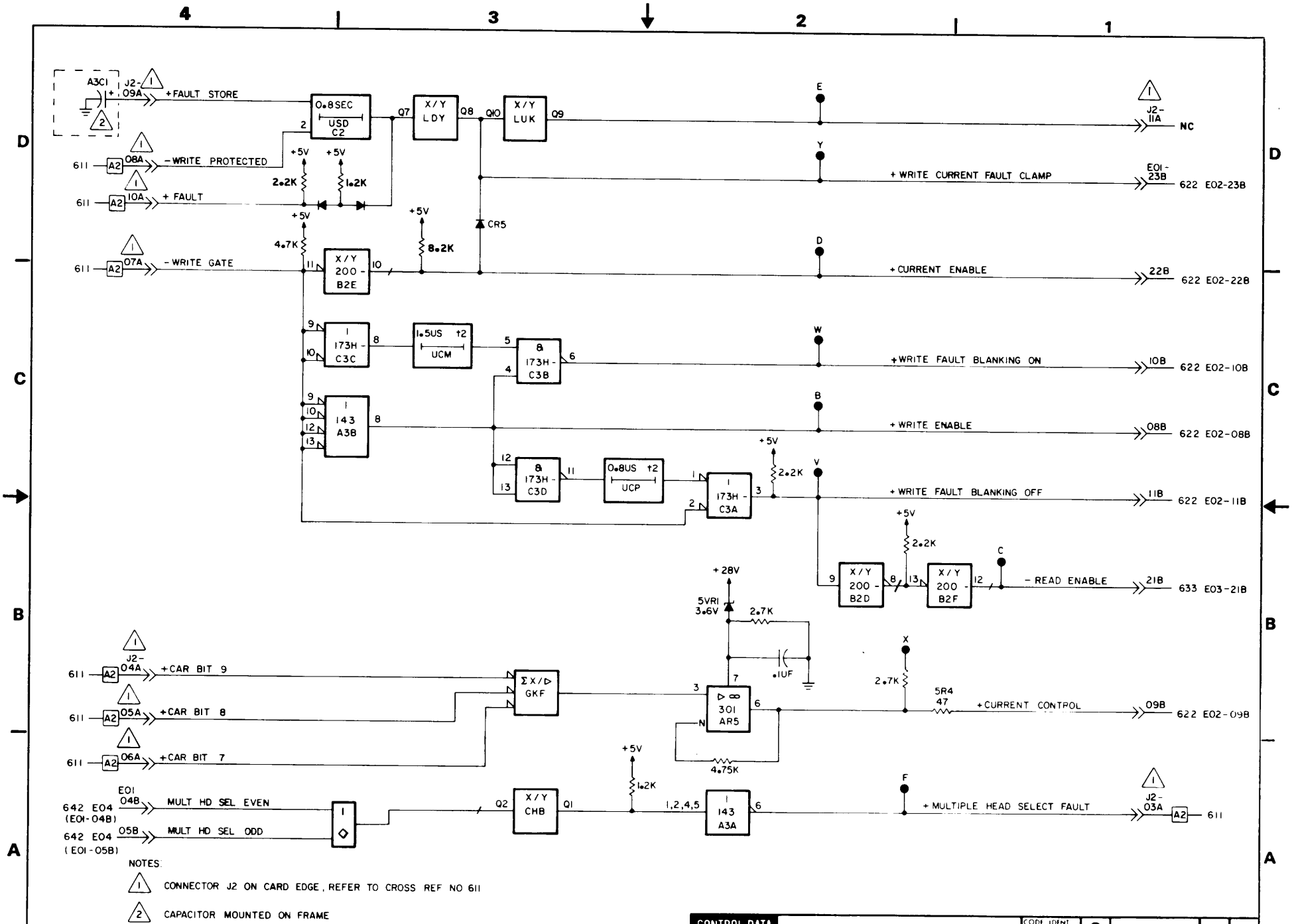
REF 83214921



NOTE:

1. CONNECTOR J2 ON CARD EDGE, REFER TO CROSS REF NO 611

CONTROL DATA NORMANDALE DIVISION	INPUT POWER WIRING AND CARD VOLTAGE CONTROL (9766) LOC E01	CODE IDENT 19333	C	83322450	J	C
		CROSS REF NO 612	SHEET 2	PAGE 3-112		

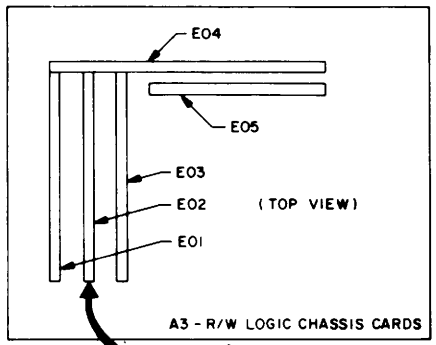

A3C1
J2-09A
+FAULT STORE
0.8SEC USD C2
X/Y LDY
X/Y LUK
611 A2 08A -WRITE PROTECTED
611 A2 10A +FAULT
2.2K
1.2K
CR5
611 A2 07A -WRITE GATE
4.7K
8.2K
X/Y 200-B2E
1 173H-C3C
1.5US t2 UCM
8 173H-C3B
1 143 A3B
0.8US t2 UCP
8 173H-C3D
1 173H-C3A
X/Y 200-B2D
X/Y 200-B2F
+28V
5VR1 3.6V
2.7K
.1UF
611 A2 04A +CAR BIT 9
611 A2 05A +CAR BIT 8
611 A2 06A +CAR BIT 7
ΣX/D GKF
301 AR5
4.75K
5R4 47
642 E04 (E01-04B) 04B MULT HD SEL EVEN
642 E04 (E01-05B) 05B MULT HD SEL ODD
X/Y CHB
1,2,4,5
1 143 A3A
+WRITE CURRENT FAULT CLAMP
+CURRENT ENABLE
+WRITE FAULT BLANKING ON
+WRITE ENABLE
+WRITE FAULT BLANKING OFF
-READ ENABLE
+CURRENT CONTROL
+MULTIPLE HEAD SELECT FAULT
J2-11A NC
E01-23B 622 E02-23B
22B 622 E02-22B
10B 622 E02-10B
08B 622 E02-08B
11B 622 E02-11B
21B 633 E03-21B
09B 622 E02-09B
J2-03A A2 611
NOTES:
1 CONNECTOR J2 ON CARD EDGE, REFER TO CROSS REF NO 611
2 CAPACITOR MOUNTED ON FRAME
CONTROL DATA
NORMANDALE DIVISION
READ / WRITE CONTROL
(9766)
LOC E01
CODE IDENT 19333
C
83322450
N
D
CROSS REF NO 613
SHEET 3
PAGE 3-113/114

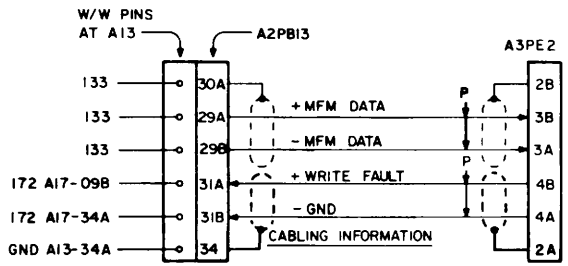
REVISION STATUS OF SHEETS

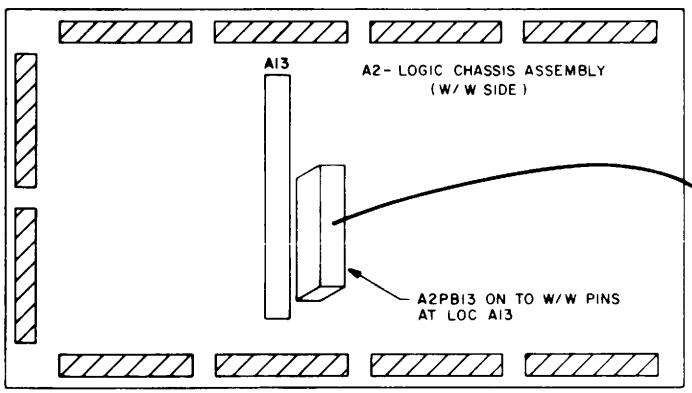
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A																		
B	B																		
C	C																		

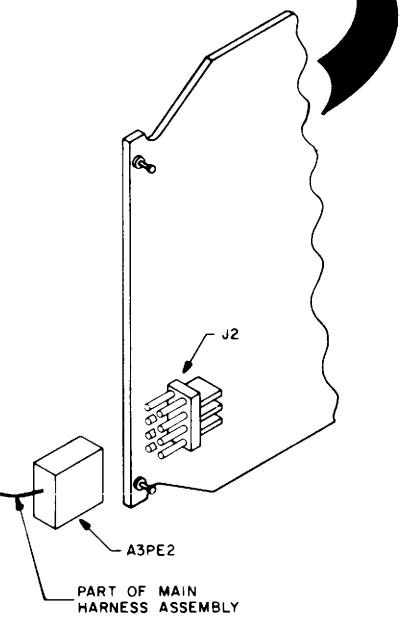
REVISIONS

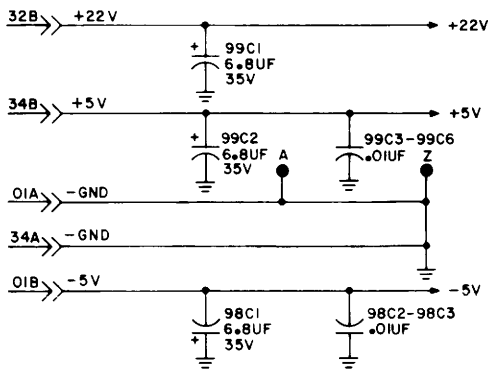
REV	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED			
B	PE22853	DIAGRAM CORRECTION	MA	3-21-77	
C	PE55259	LOGIC DIAG. IMPROVEMENT	A.A.O	8.8.78	







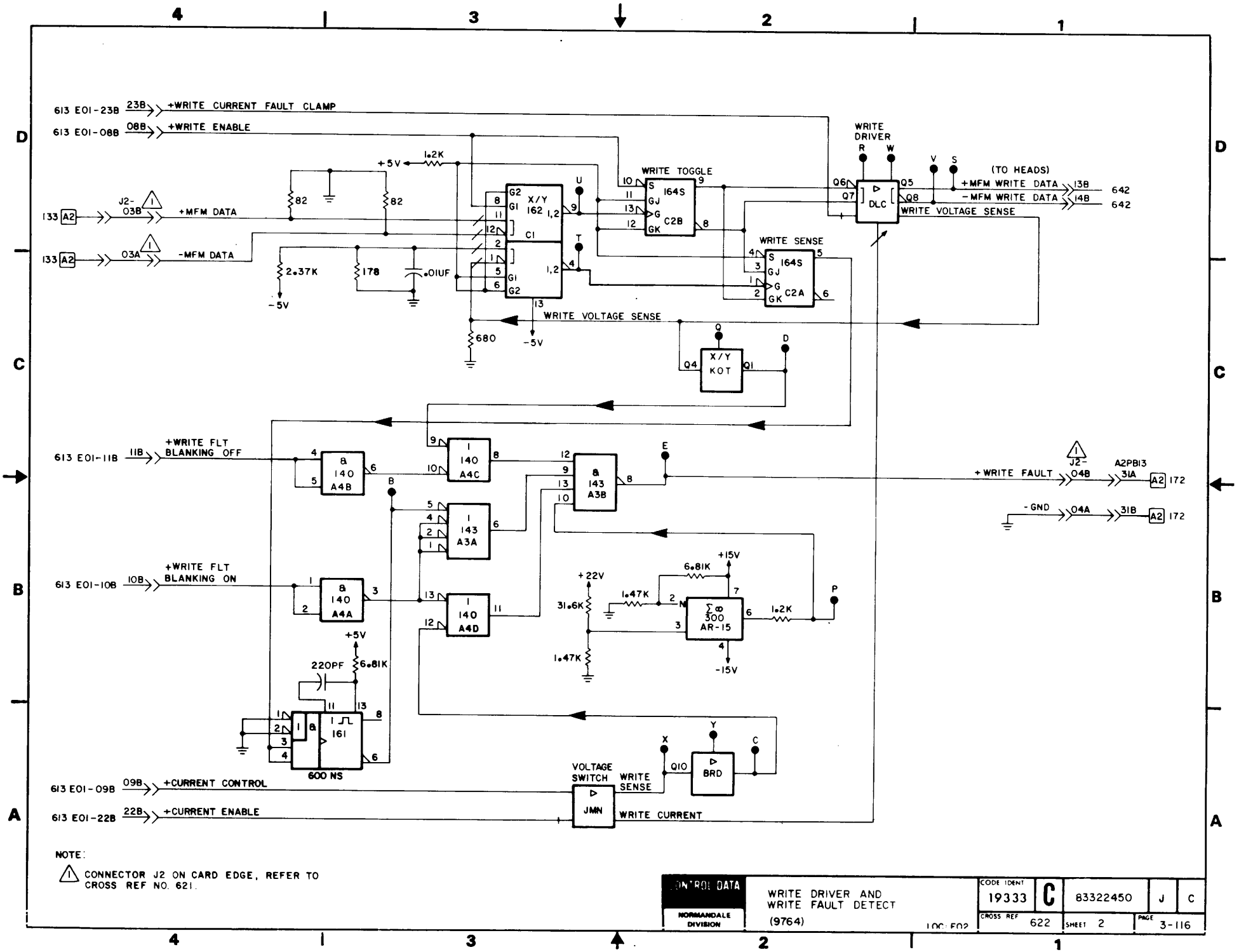




APPLICABLE ONLY TO BJ4M1 = 9764-1

DRAWN	S. BENTLER	1-10-76	CONTROL DATA	CARD EDGE CONNECTOR AND CABLING DIAGRAMS	CODE IDENT 19333	C	83322450 J C
CHECKED							
ENGINEER			NORMANDALE DIVISION	TYPE: 6PJV LOC E02	CROSS REF NO 621	SHEET 1 OF 2	PAGE 3-115
APPROVED							

REF 83215009

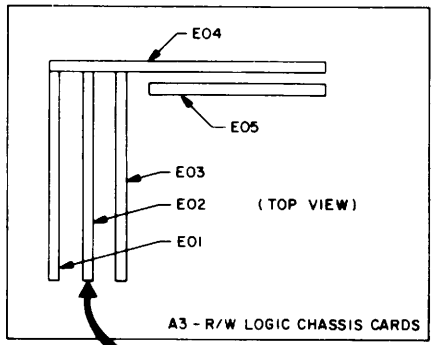

613 E01-23B
23B
+WRITE CURRENT FAULT CLAMP
613 E01-08B
08B
+WRITE ENABLE
+5V
1.2K
WRITE TOGGLE
WRITE DRIVER
R
W
V
S
(TO HEADS)
+MFM WRITE DATA
-MFM WRITE DATA
WRITE VOLTAGE SENSE
133 A2
J2-03B
+MFM DATA
82
82
133 A2
03A
-MFM DATA
2.37K
178
.01UF
-5V
X/Y 162
164S C2B
164S C2A
WRITE SENSE
680
-5V
X/Y KOT
DLC
613 E01-11B
11B
+WRITE FLT BLANKING OFF
A4B
A4C
A3B
A3A
+WRITE FAULT
J2-04B
A2PB13 31A
A2 172
-GND
04A
31B
A2 172
613 E01-10B
10B
+WRITE FLT BLANKING ON
A4A
A4D
+22V
+15V
6.81K
31.6K
1.47K
1.47K
1.2K
AR-15
-15V
+5V
220PF
6.81K
161
600 NS
613 E01-09B
09B
+CURRENT CONTROL
613 E01-22B
22B
+CURRENT ENABLE
VOLTAGE SWITCH
JMN
WRITE SENSE
WRITE CURRENT
BRD
NOTE:
CONNECTOR J2 ON CARD EDGE, REFER TO CROSS REF NO. 621.
CONTROL DATA
NORMANDALE DIVISION
WRITE DRIVER AND WRITE FAULT DETECT
(9764)
LOC: F02
CODE IDENT 19333
C
83322450
J
C
CROSS REF 622
SHEET 2
PAGE 3-116

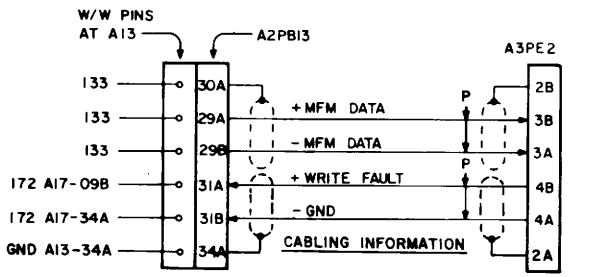
REVISION STATUS OF SHEETS

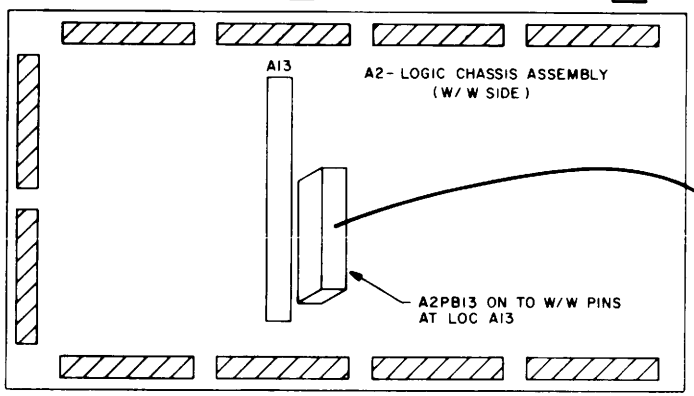
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A																		
B	A																		
C	C																		

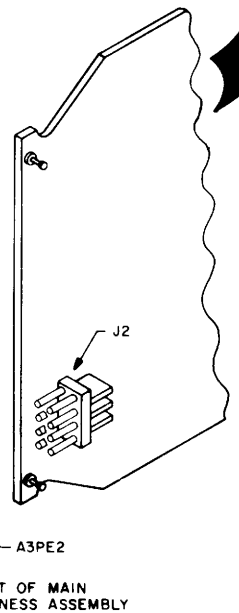
REVISIONS

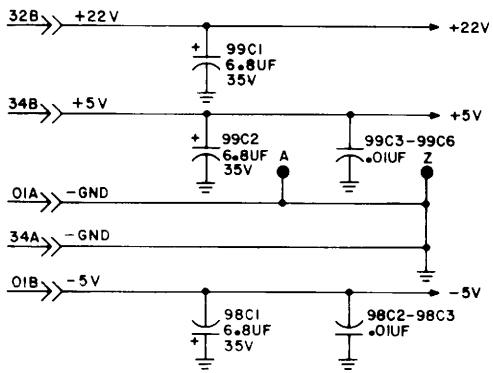
REV.	ECO.	DESCRIPTION	DRFT.	DATE	CHK'D
A	PE23000	RELEASED			
B		EDITORIAL	DM	2-14-78	
C	PE55259	LOGIC DIAG. IMPROVEMENT	A.A.O	8-8-78	







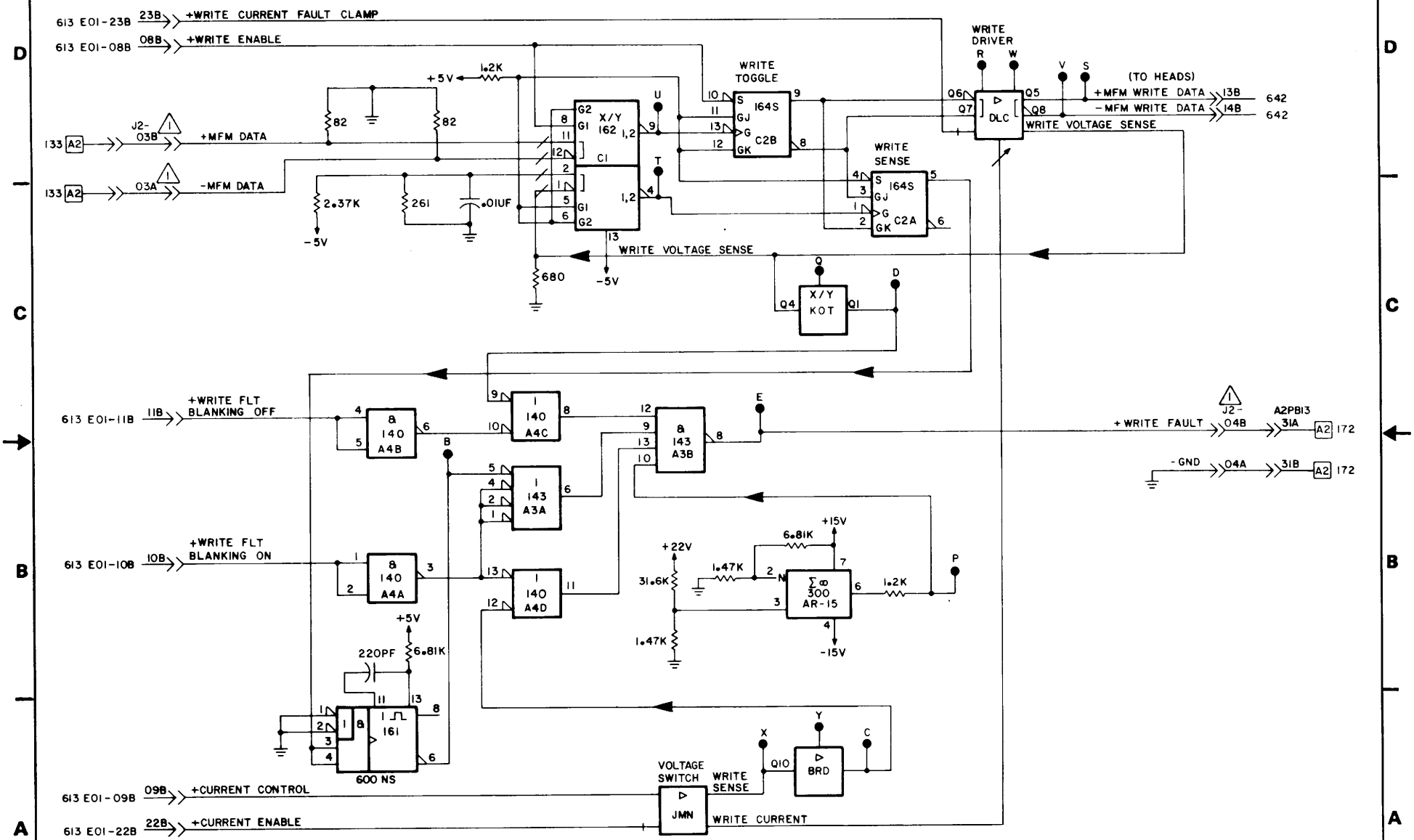




APPLICABLE ONLY TO BJ4M2, BJ402 = 9766-1

DRAWN		NORMANDALE DIVISION	WRITE DRIVER, CARD EDGE CONNECTOR AND CABLING DIAGRAMS TYPE 5PJV LOC E02	CODE IDENT 19333	C	8332245C	J C
CHECKED				CROSS REF NO 621		SHEET 1 OF 2	PAGE 3-117
ENGINEER							
APPROVED							

REF 83214922



NOTE:

⚠1 CONNECTOR J2 ON CARD EDGE, REFER TO CROSS REF NO. 621.

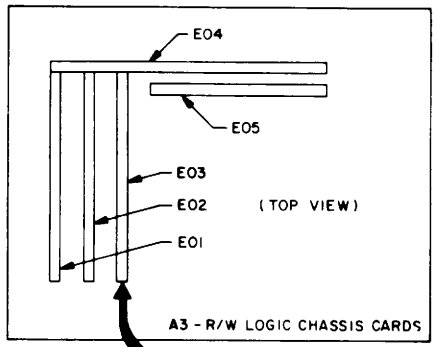
CONTROL DATA NORMANDALE DIVISION	WRITE DRIVER AND WRITE FAULT DETECT (9766) LOC: E02	CODE IDENT 19333	C	83322450	J	C	
		CROSS REF 622	SHEET 2	PAGE 3-118			

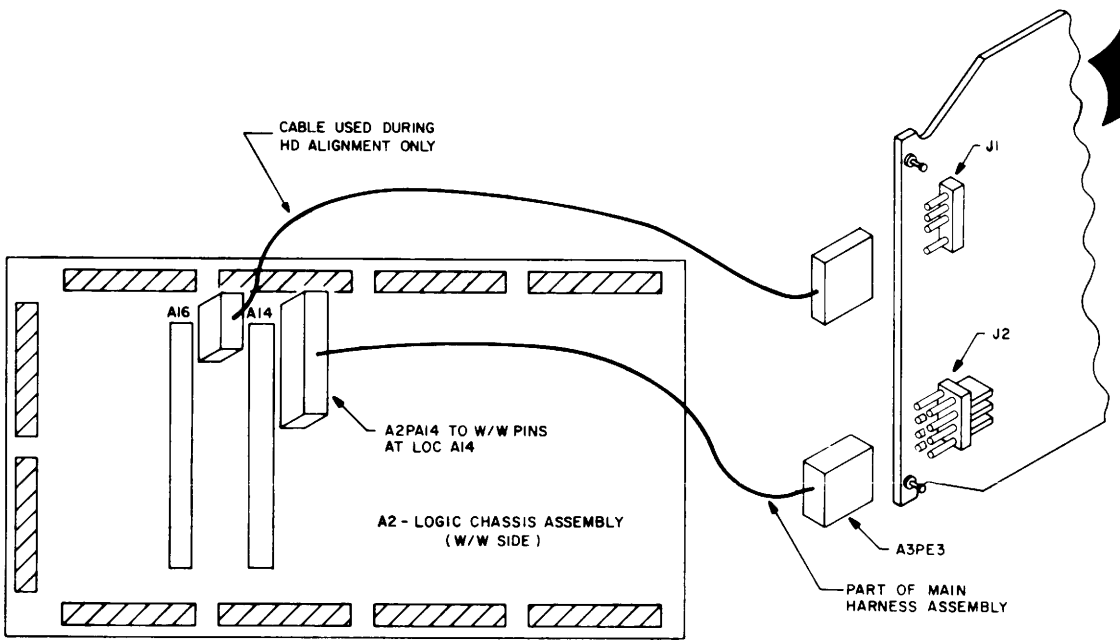
REVISION STATUS OF SHEETS

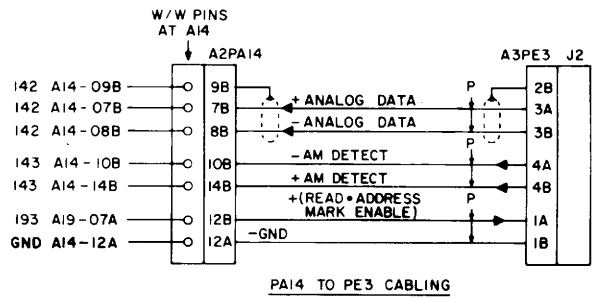
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A																	

REVISIONS

REV.	ECO.	DESCRIPTION	DRFT.	DATE	CHK'D
A	PE23000	RELEASED	WEB	10-25-76	



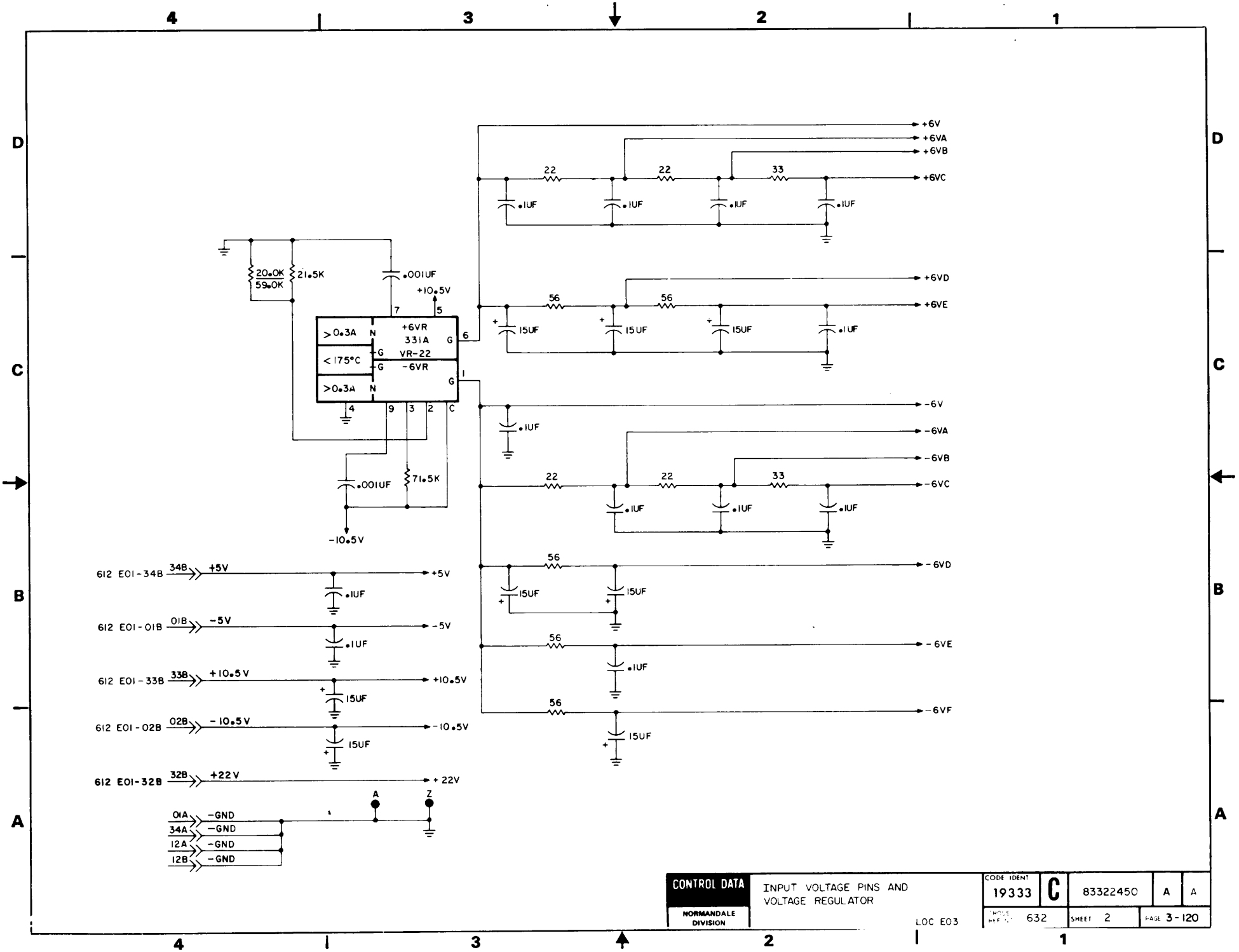




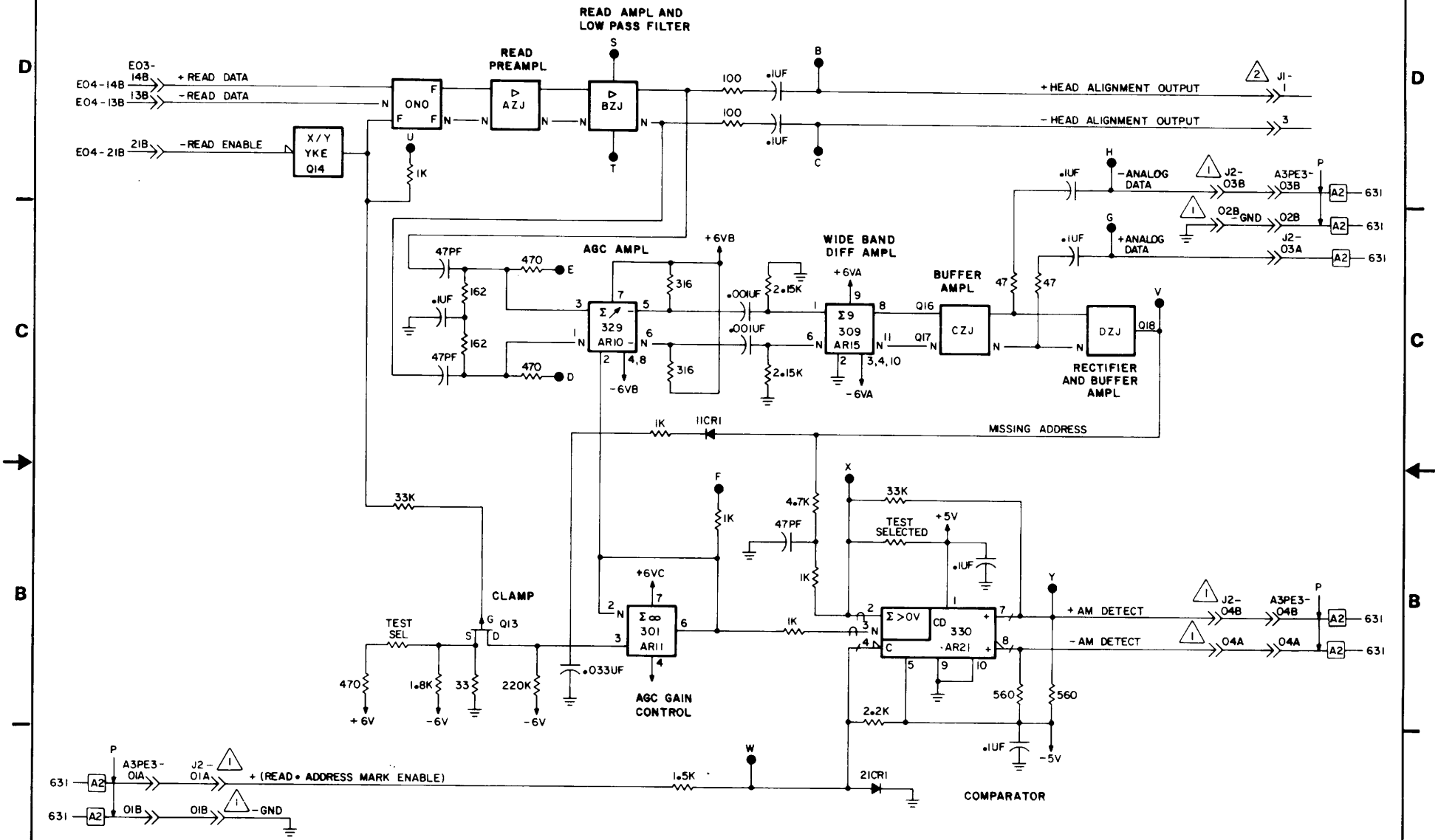
PA14 TO PE3 CABLING

DRAWN	W.BERGSTROM	10-25-76	NORMANDALE DIVISION	READ AMPLIFIER AND ADDRESS MARK DETECTION DIAGRAMS	CODE IDENT 19333	C	83322450 A A
CHECKED							
ENGINEER				TYPE: 4PHV LOC E03	CROSS REF NO 631	SHEET 1 OF 3	PAGE 3-119
APPROVED							

REF 83214923



CONTROL DATA NORMANDALE DIVISION	INPUT VOLTAGE PINS AND VOLTAGE REGULATOR	LOC E03	CODE IDENT 19333	C	83322450 A A
			CHG REF NO. 632	SHEET 2	PAGE 3-120



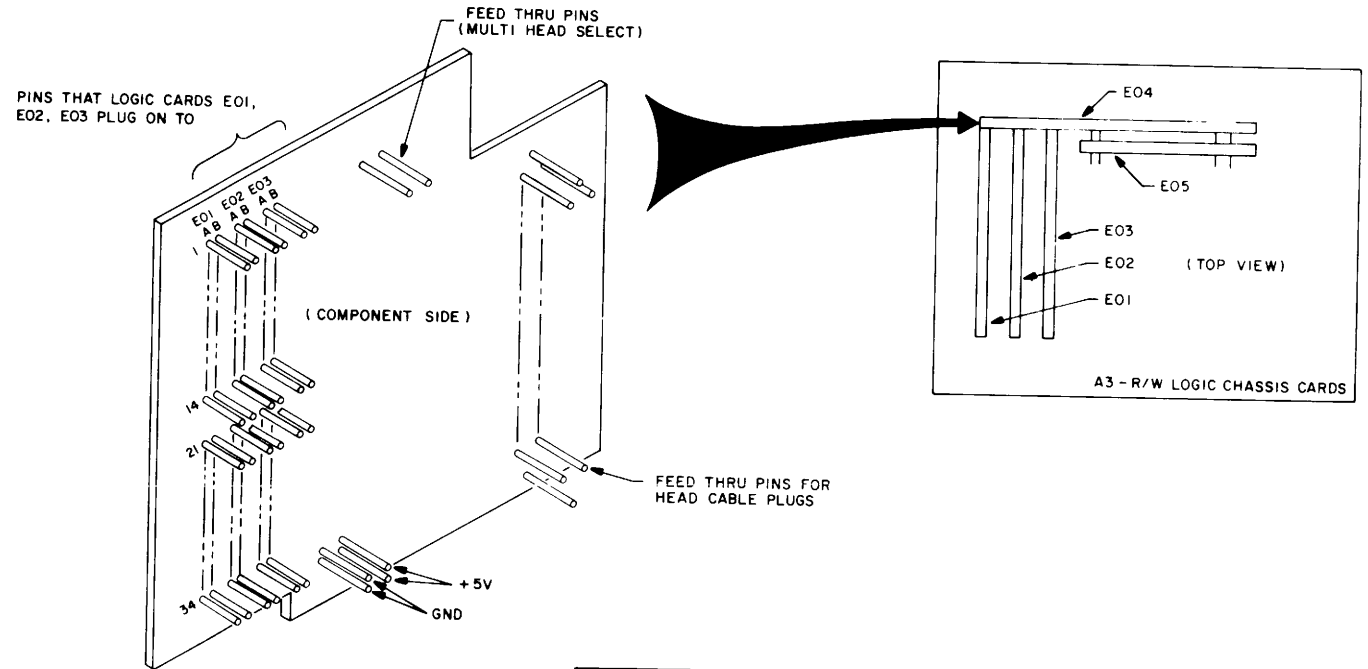
CONTROL DATA NORMANDALE DIVISION	READ AMPLIFIER AND ADDRESS MARK DETECTION LOC E03	CODE IDENT 19333	C	83322450	A A
		CROSS REF NO 633		SHEET 3	PAGE 3-121/122

REVISION STATUS OF SHEETS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A																		
B	B																		

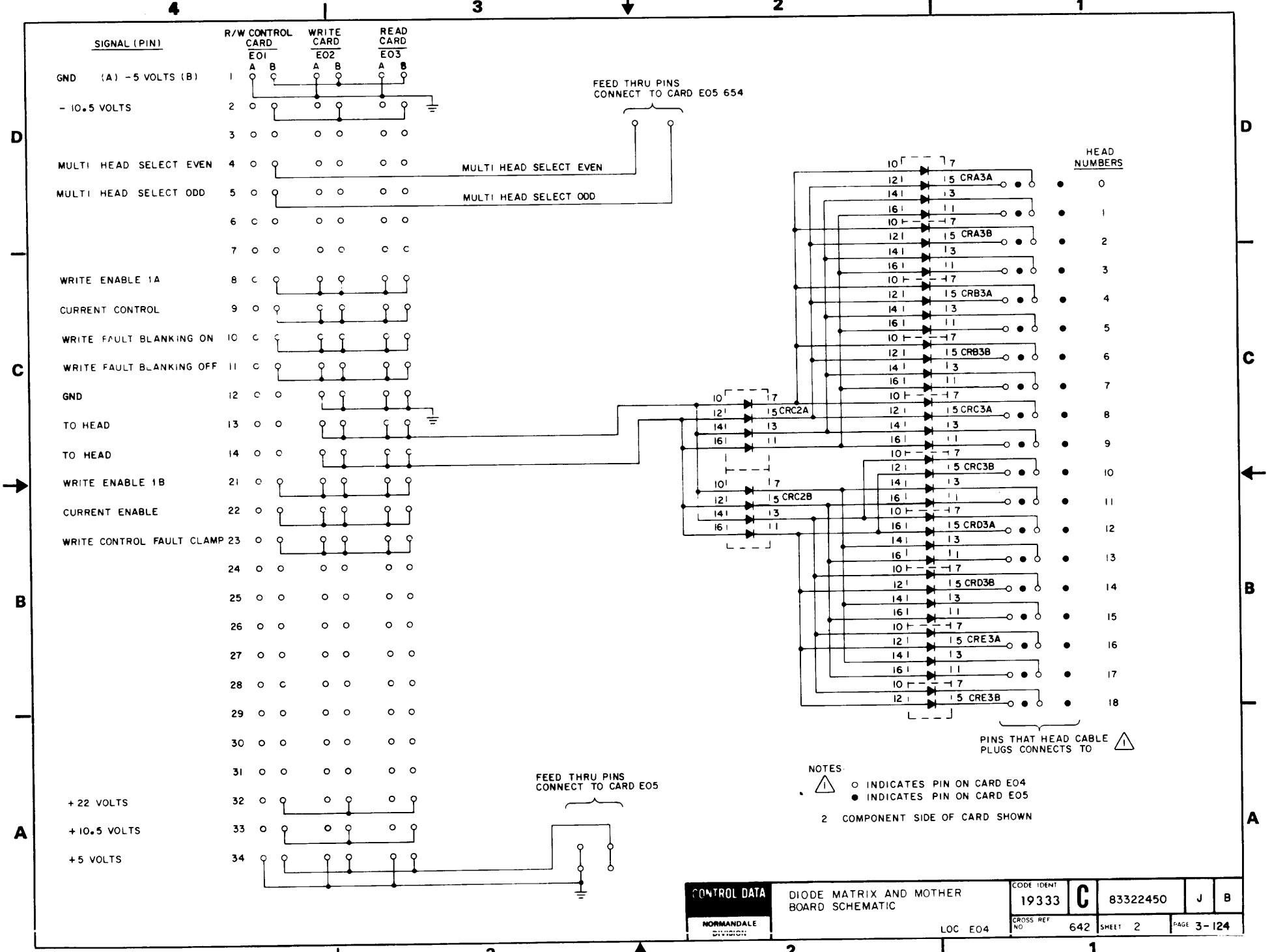
REVISIONS

REV.	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	WEB	10-25-76	
B	PE55259	LOGIC DIAG IMPROVEMENT	A.A.O	8-8-78	



DRAWN	W.BERGSTROM	10-25-76	CONTROL DATA	DIODE MATRIX AND MOTHER BOARD BOARD LAYOUT DIAGRAMS	CODE IDENT 19333	C	83322450 J B
CHECKED							
ENGINEER			NORMANDALE DIVISION	TYPE: 4XFN LOC E04	CROSS REF NO 641	SHEET 1 OF 2	PAGE 3-123
APPROVED							

REF 83214924

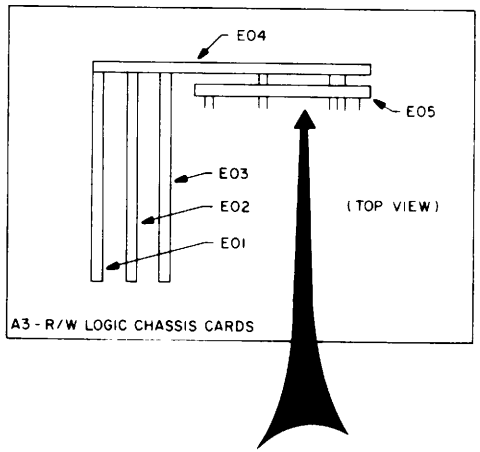

SIGNAL (PIN)
R/W CONTROL CARD E01
WRITE CARD E02
READ CARD E03
A B
GND (A) -5 VOLTS (B) 1
-10.5 VOLTS 2
3
MULTI HEAD SELECT EVEN 4
MULTI HEAD SELECT ODD 5
6
7
WRITE ENABLE 1A 8
CURRENT CONTROL 9
WRITE FAULT BLANKING ON 10
WRITE FAULT BLANKING OFF 11
GND 12
TO HEAD 13
TO HEAD 14
WRITE ENABLE 1B 21
CURRENT ENABLE 22
WRITE CONTROL FAULT CLAMP 23
24
25
26
27
28
29
30
31
+22 VOLTS 32
+10.5 VOLTS 33
+5 VOLTS 34
FEED THRU PINS CONNECT TO CARD E05 654
MULTI HEAD SELECT EVEN
MULTI HEAD SELECT ODD
FEED THRU PINS CONNECT TO CARD E05
CRA3A
CRA3B
CRB3A
CRB3B
CRC2A
CRC3A
CRC2B
CRC3B
CRD3A
CRD3B
CRE3A
CRE3B
HEAD NUMBERS
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
PINS THAT HEAD CABLE PLUGS CONNECTS TO
NOTES
1 ○ INDICATES PIN ON CARD E04
● INDICATES PIN ON CARD E05
2 COMPONENT SIDE OF CARD SHOWN
CONTROL DATA
NORMANDALE DIVISION
DIODE MATRIX AND MOTHER BOARD SCHEMATIC
LOC E04
CODE IDENT 19333
C
83322450
J
B
CROSS REF NO 642
SHEET 2
PAGE 3-124

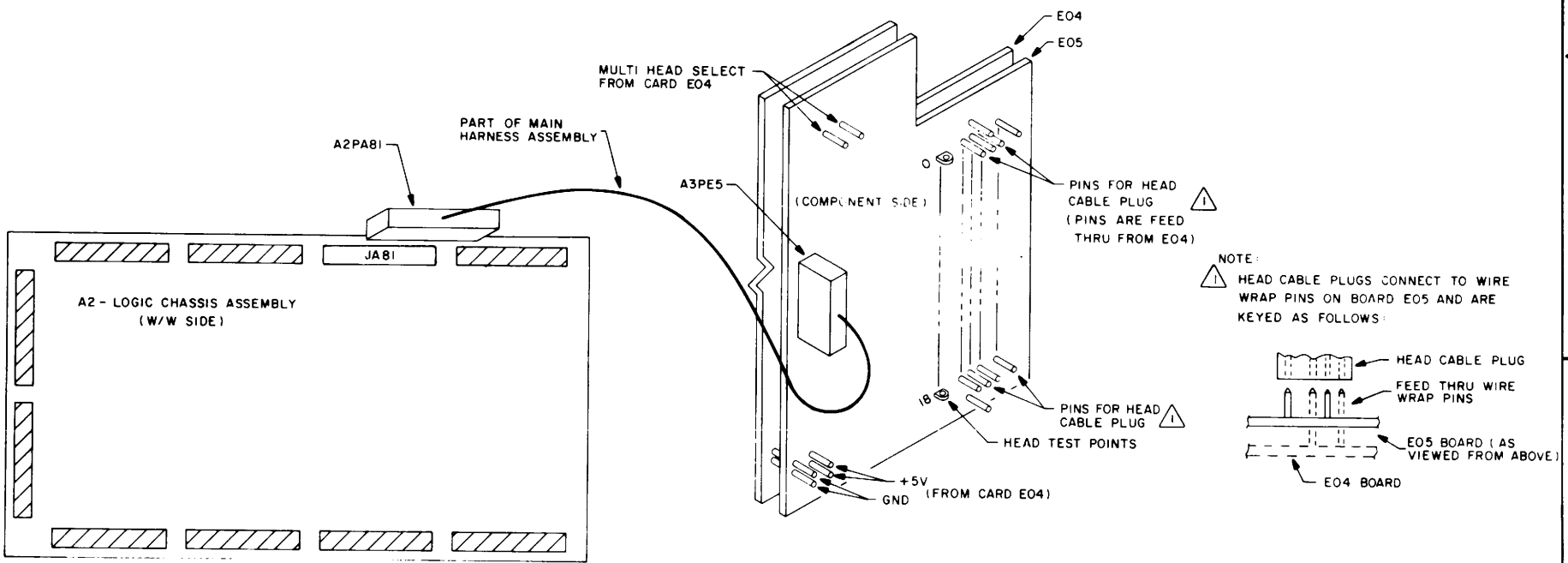
REVISION STATUS OF SHEETS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																
B	A	B	A																

REVISIONS

REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	WEB	10-25-76	
B	PE55259	LOGIC DIAG IMPROVEMENT	A.A.O.	8.8.78	

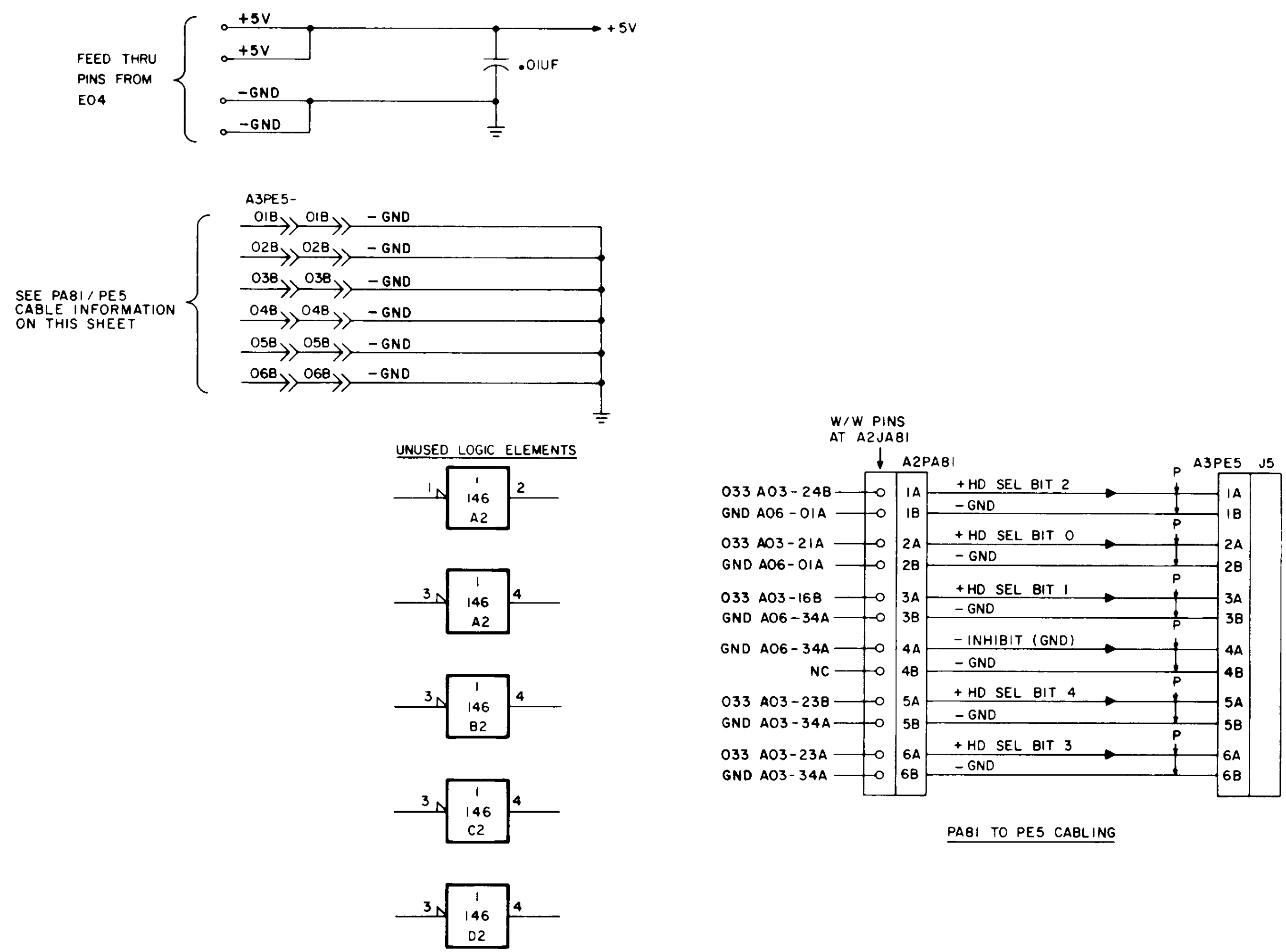




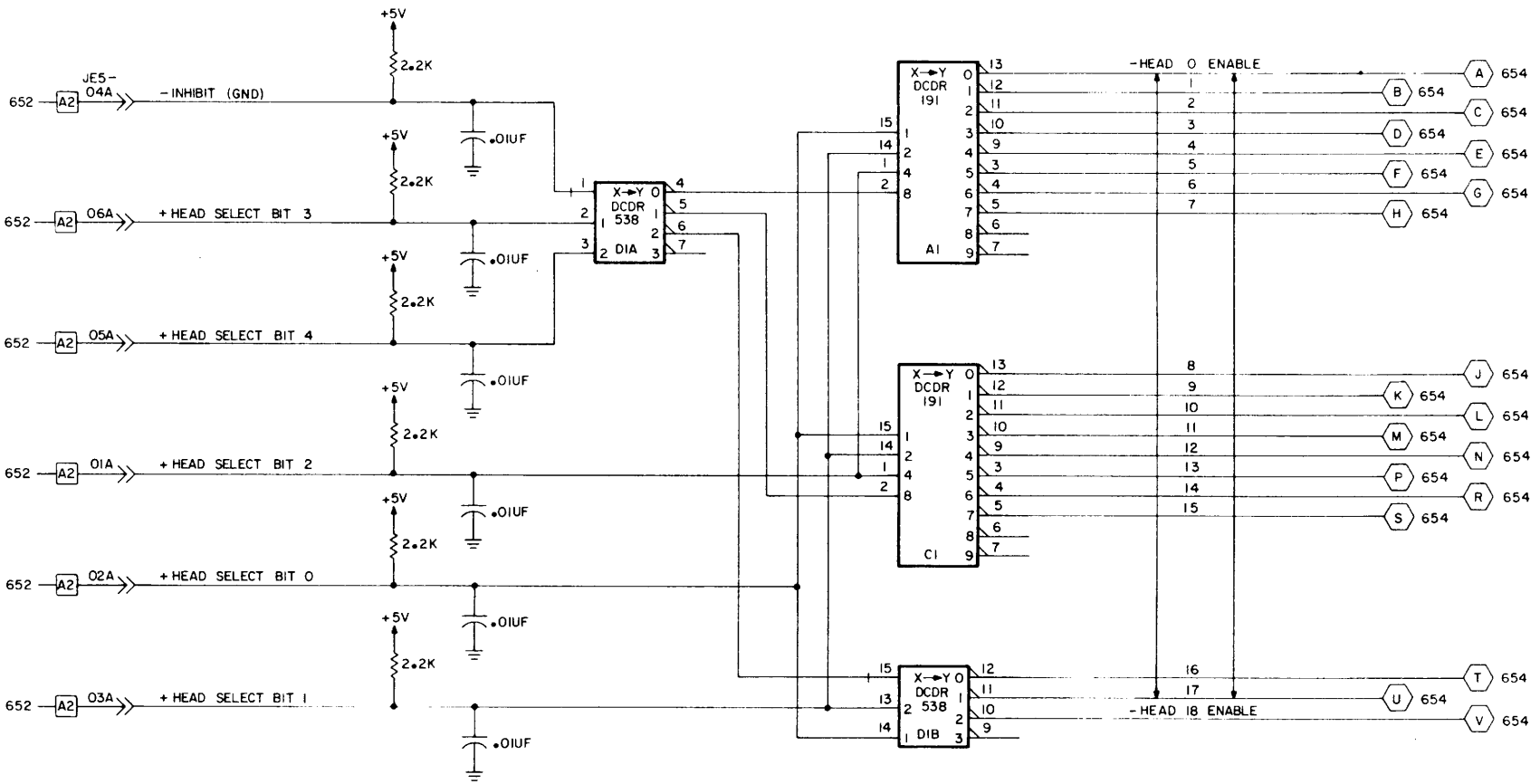
NOTE:
1. HEAD CABLE PLUGS CONNECT TO WIRE WRAP PINS ON BOARD E05 AND ARE KEYED AS FOLLOWS:

DRAWN	[illegible] 10-25-76	CONTROL DATA	HEAD SELECT BOARD, HEAD PLUG CONNECTORS, CABLING AND CARD LAYOUT DIAGRAMS	CODE IDENT 19333	C	83322450	J B
CHECKED							
ENGINEER		NORMANDALE DIVISION	TYPE BXGN LOC E05	GROSS REF NO 651	SHEET 1 OF 4	PAGE 3-125	
APPROVED							

REF 83214925



CONTROL DATA NORMANDALE DIVISION	UNUSED LOGIC ELEMENTS, VOLTAGE INPUT PINS, CABLING INFORMATION	CODE IDENT 19333	C	83322450	A	A
	LOC E05	652		SHEET 2		3-126



ELEMENT 538 TRUTH TABLE

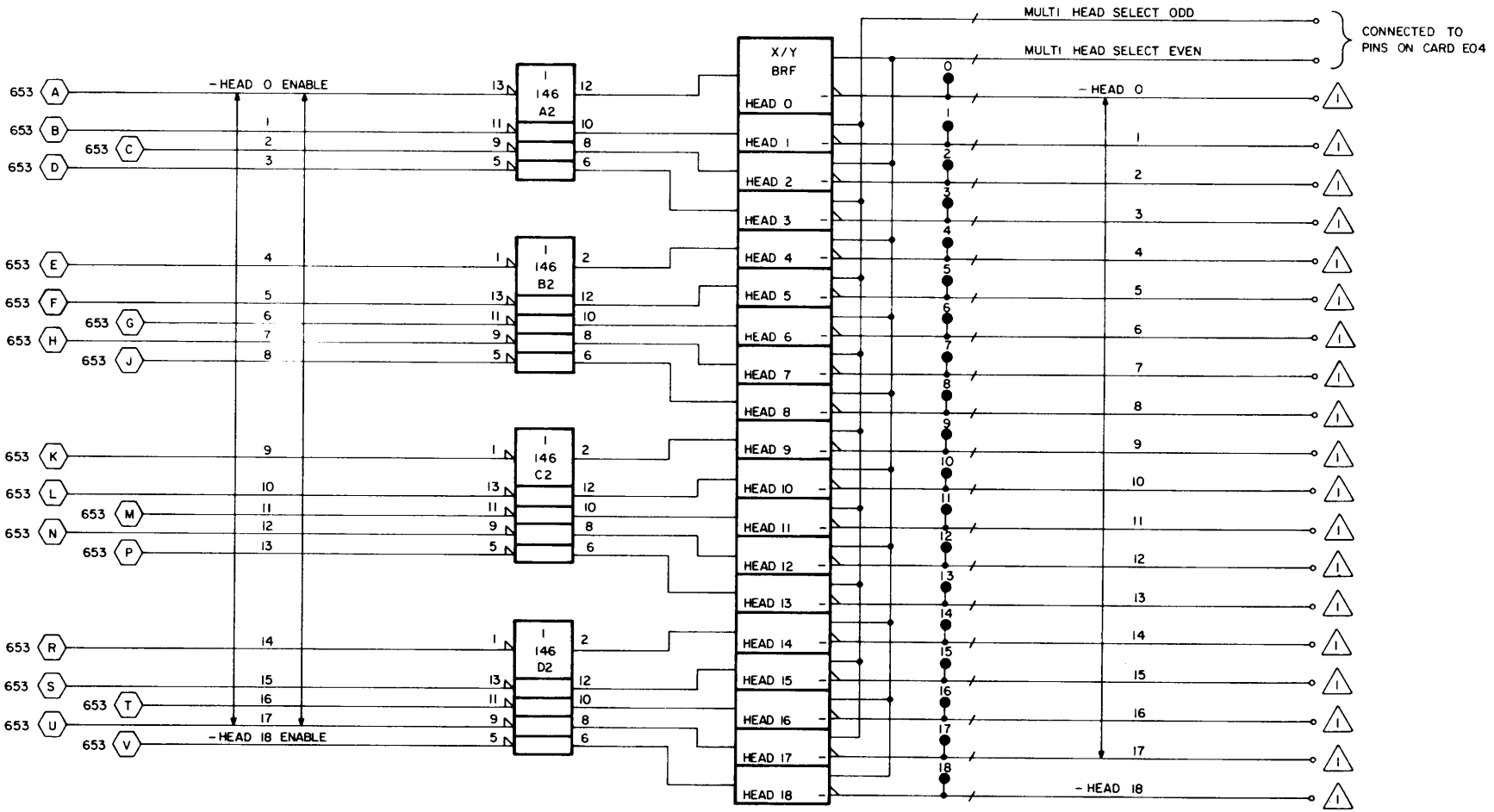
INPUT			OUTPUT BIT WEIGHT			
INHIBIT	1	2	0	1	2	3
L	L	L	L	H	H	H
L	H	L	H	L	H	H
L	L	H	H	H	L	H
L	H	H	H	H	H	L
H	L OR H	L OR H	H	H	H	H

CONTROL DATA
NORMANDALE DIVISION

HEAD SELECT DECODE AND HEAD BIT ENABLE

LOC E05

CODE IDENT				
19333	C	83322450	J	B
CROSS REF NO 653	SHEET 3	PAGE 3-127		



NOTE:

1. OUTPUT PIN CONNECTS TO HEAD CABLE PLUG (AND CENTER TAP OF HEAD COIL). REFER TO CROSS REF NO 642

CONTROL DATA NORMANDALE DIVISION	HEAD ENABLES AND MULTI HEAD SELECT LOC E05	CODE IDENT 19333	C	83322450	A	A
		CROSS REF NO 654		SHEET 4	PAGE 3-128	

REVISION STATUS OF SHEETS

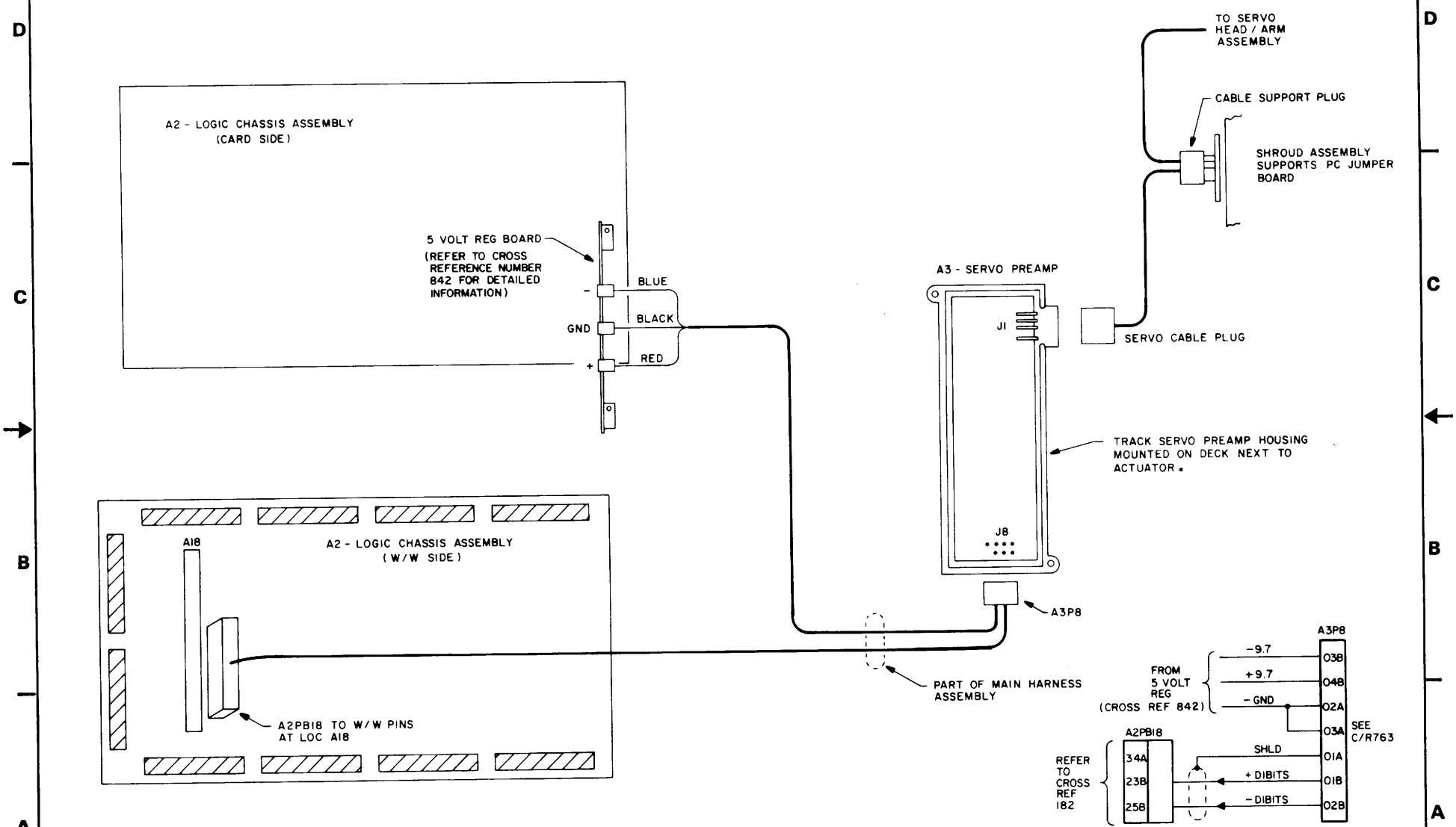
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A																	
B	B	B																	
C	B	C																	

REVISIONS

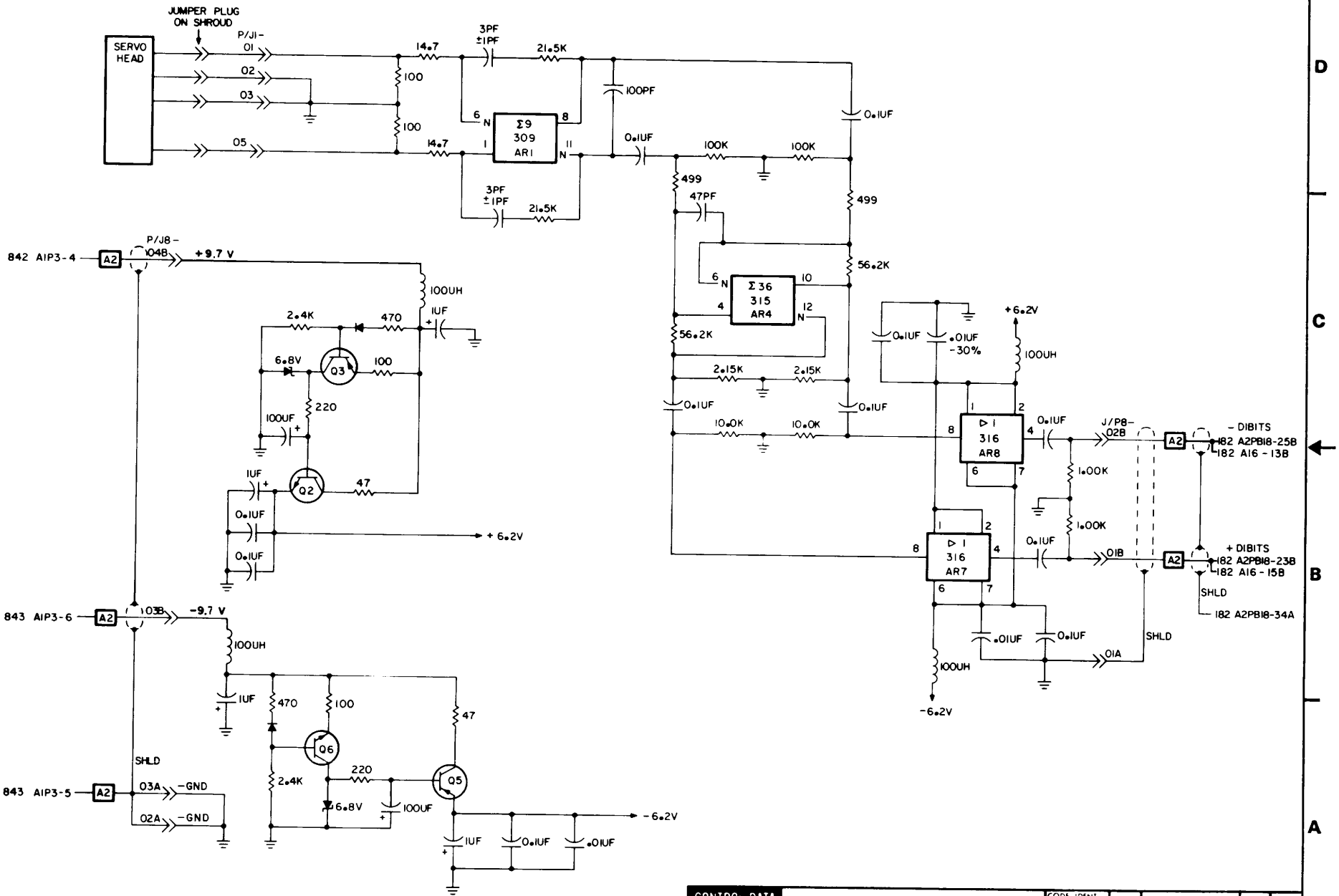
REV.	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	ML A		
B	PE55259	LOGIC DIAG. IMPROVEMENT	A.A.O	8-8-78	
C	PE55256	REMOVE UNUSED RESISTORS	MA	11-29-78	

DRAWN	M.ANDERSON	10/25/76	CONTROL DATA	TRACK SERVO PREAMP DIAGRAMS	CODE IDENT 19333	C	83322450	K	C
CHECKED									
ENGINEER		12/16/76	NORMANDALE DIVISION	TYPE: FZQN	CROSS REF NO 761	SHEET 1 OF 3	PAGE 3-129		
APPROVED									

REF 83214926



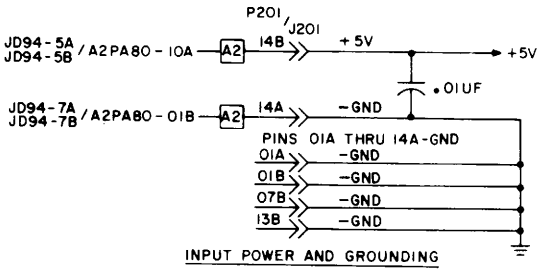
CONTROL DATA NORMANDALE DIVISION	TRACK SERVO PREAMP CABLING / PLUG CONNECTIONS	CODE IDENT 19333	C	83322450	J	B
		CROSS REF NO 762	SHEET 2	PAGE 3-130		



CONTRO: DATA NORMANDALE DIVISION	TRACK SERVO PREAMP SCHEMATIC	CODE IDENT 19333	C	83322450	K C
		CROSS REF NO 763	SHEET 3	PAGE 3-131/132	

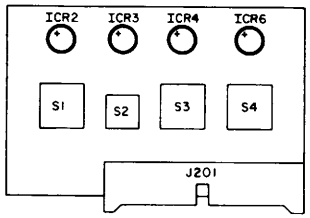
REVISION STATUS OF SHEETS

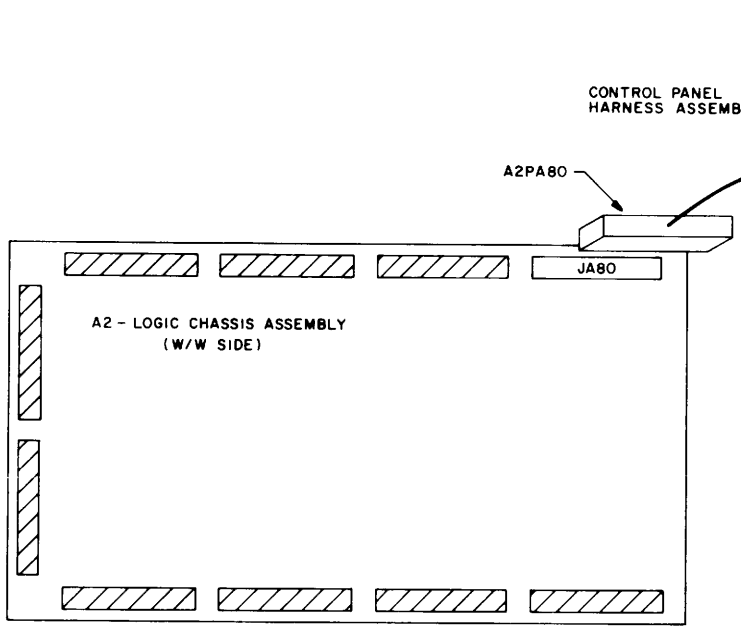
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A																	
B	A	B																	

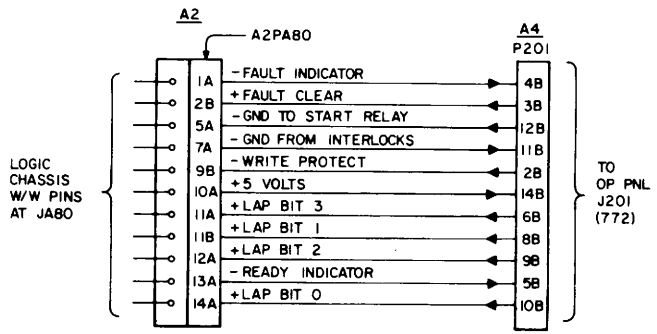


INPUT POWER AND GROUNDING

OPERATOR CONTROL PANEL
(COMPONENT LAYOUT)







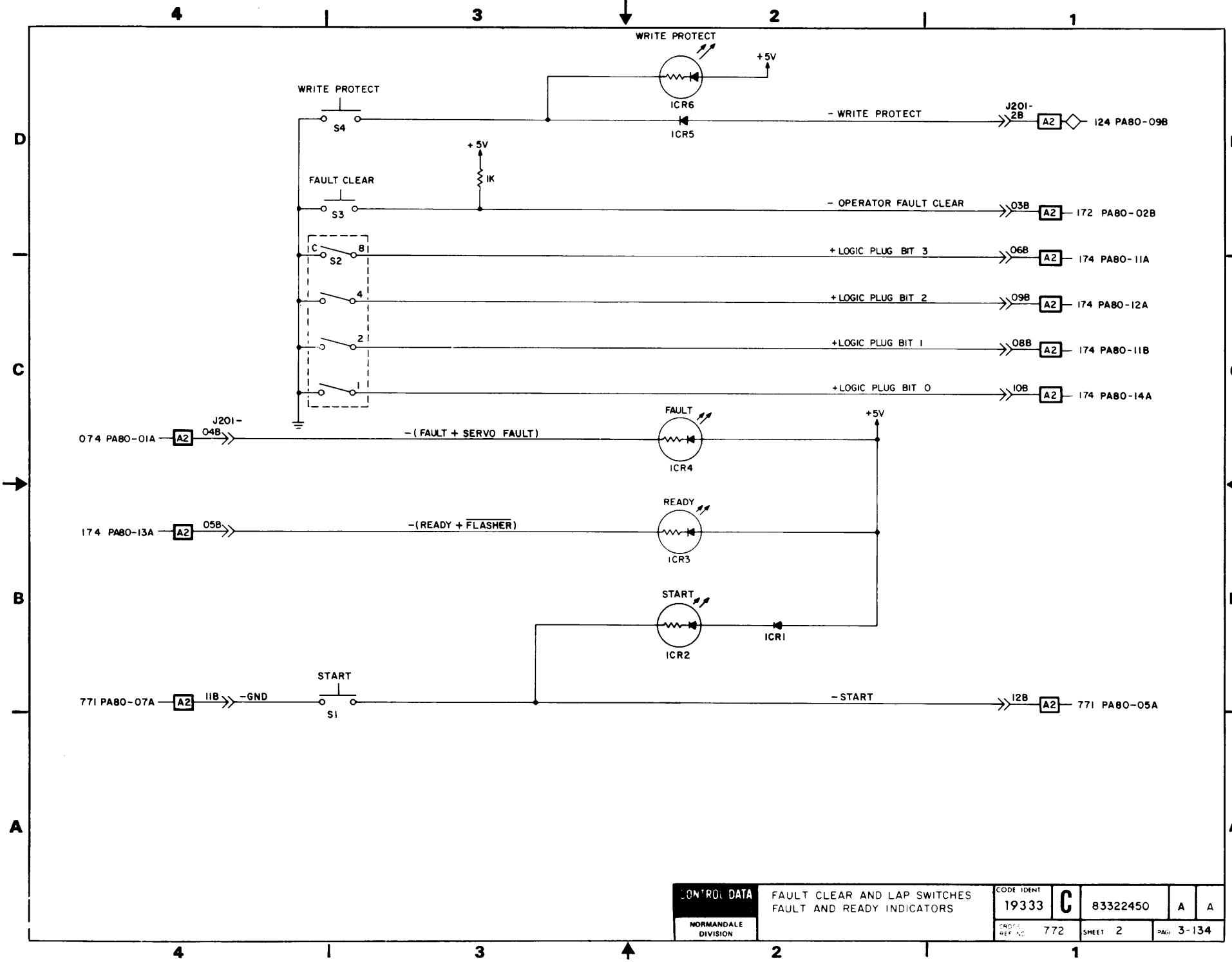
A2PA80 TO A4P201 CABLING

REVISIONS

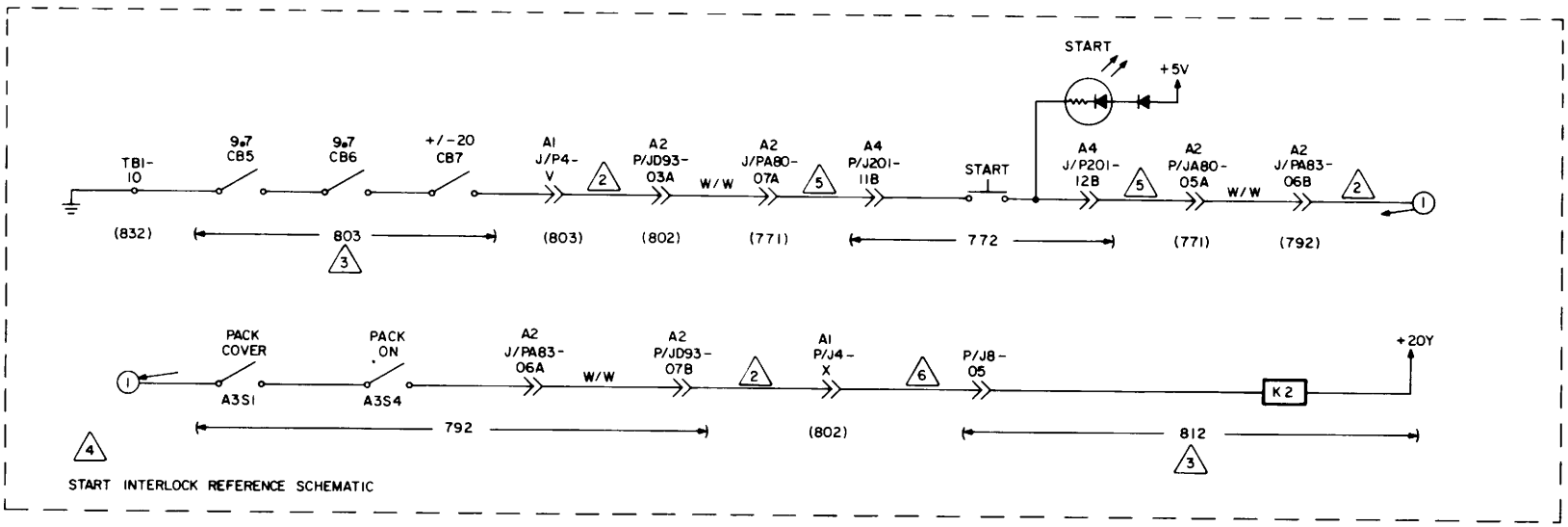
REV.	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA	2-17-76	
B	PE55259	LOGIC DIAG. IMPROVEMENT	A.A.O	8-8-78	

DRAWN	W.BERGSTROM	10-25-76	CONTROL DATA	A4 - OPERATOR CONTROL PANEL DIAGRAMS	CODE IDENT 19333	C	83322450 J B
CHECKED							
ENGINEER			NORMANDALE DIVISION	TYPE: HZYN	CROSS REF N 771	SHEET 1 OF 3	PAGE 3-133
APPROVED							

REF 83214927



CONTROL DATA NORMANDALE DIVISION	FAULT CLEAR AND LAP SWITCHES FAULT AND READY INDICATORS	CODE IDENT 19333	C	83322450	A A
		CROSS REF NO 772		SHEET 2	PAGE 3-134



START INTERLOCK REFERENCE SCHEMATIC

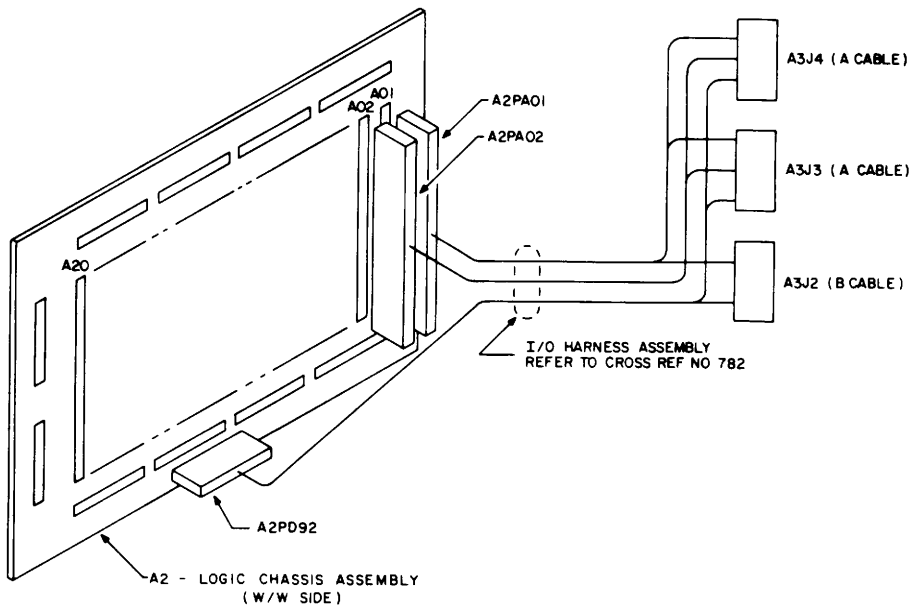
NOTES

1. W/W IS LOGIC CHASSIS WIRE WRAP CONNECTION
2. PART OF MAIN HARNESS ASSEMBLY
3. LOCATED INSIDE POWER SUPPLY
4. NUMBERS WITHIN PARENTHESIS ARE CROSS REF NUMBERS WHERE ADDITIONAL OR DETAILED INFORMATION IS LOCATED
5. PART OF CONTROL PANEL HARNESS
6. PART OF DC HARNESS

CONTROL DATA	START SWITCH/START INDICATOR START INTERLOCK REFERENCE SCHEMATIC	CODE IDENT 19333	C	83322450	J	B
NORMANDALE DIVISION		CROSS REF NO 773		SHEET 3	PAGE 3-135/136	

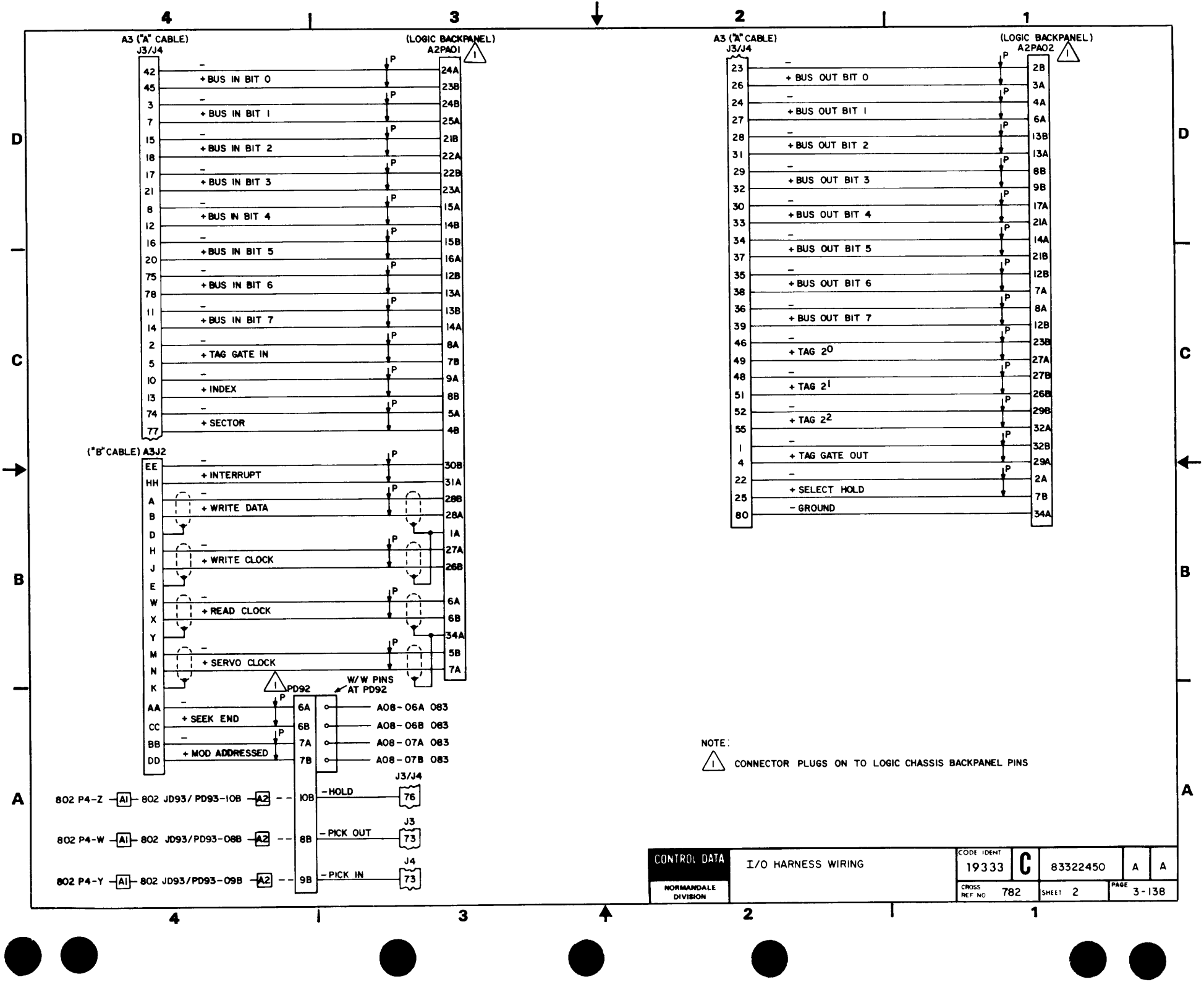
REVISION STATUS OF SHEETS																			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A																	

REVISIONS					
REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	M85000	RELEASED			



DRAWN	G. RABINE	10/11/76	CONTRC. DATA	A3 - I/O CABLING DIAGRAMS	CODE IDENT 19333	C	83322450	A	A
CHECKED									
ENGINEER			NORMANDALE DIVISION		CROSS REF NO 781	SHEET 1 OF 3		PAGE 3-137	
APPROVED									

REF 83214928


A3 ("A" CABLE) J3/J4
(LOGIC BACKPANEL) A2PA01
42 - 24A
45 + BUS IN BIT 0 23B
3 - 24B
7 + BUS IN BIT 1 25A
15 - 21B
18 + BUS IN BIT 2 22A
17 - 22B
21 + BUS IN BIT 3 23A
8 - 15A
12 + BUS IN BIT 4 14B
16 - 15B
20 + BUS IN BIT 5 16A
75 - 12B
78 + BUS IN BIT 6 13A
11 - 13B
14 + BUS IN BIT 7 14A
2 - 8A
5 + TAG GATE IN 7B
10 - 9A
13 + INDEX 8B
74 - 5A
77 + SECTOR 4B
("B" CABLE) A3J2
EE - 30B
HH + INTERRUPT 31A
A - 28B
B + WRITE DATA 28A
D 1A
H - 27A
J + WRITE CLOCK 26B
E - 6A
W + READ CLOCK 6B
X 34A
Y - 5B
M + SERVO CLOCK 7A
N
K
1 PD92
W/W PINS AT PD92
AA - 6A A08-06A 083
CC + SEEK END 6B A08-06B 083
BB - 7A A08-07A 083
DD + MOD ADDRESSED 7B A08-07B 083
802 P4-Z AI 802 JD93/PD93-10B A2 10B - HOLD J3/J4 76
802 P4-W AI 802 JD93/PD93-08B A2 8B - PICK OUT J3 73
802 P4-Y AI 802 JD93/PD93-09B A2 9B - PICK IN J4 73
A3 ("A" CABLE) J3/J4
(LOGIC BACKPANEL) A2PA02
23 - 2B
26 + BUS OUT BIT 0 3A
24 - 4A
27 + BUS OUT BIT 1 6A
28 - 13B
31 + BUS OUT BIT 2 13A
29 - 8B
32 + BUS OUT BIT 3 9B
30 - 17A
33 + BUS OUT BIT 4 21A
34 - 14A
37 + BUS OUT BIT 5 21B
35 - 12B
38 + BUS OUT BIT 6 7A
36 - 8A
39 + BUS OUT BIT 7 12B
46 - 23B
49 + TAG 2^0 27A
48 - 27B
51 + TAG 2^1 26B
52 - 29B
55 + TAG 2^2 32A
1 - 32B
4 + TAG GATE OUT 29A
22 - 2A
25 + SELECT HOLD 7B
80 - GROUND 34A
NOTE:
1 CONNECTOR PLUGS ON TO LOGIC CHASSIS BACKPANEL PINS
CONTROL DATA
NORMANDALE DIVISION
I/O HARNESS WIRING
CODE IDENT 19333
C
83322450
A
A
CROSS REF NO 782
SHEET 2
PAGE 3-138

IF TAG OUT DECODE IS → AND BUS OUT IS → DRIVE PLACES ON BUS IN

NAME	DECODE	BUS OUT BITS							
		0	1	2	3	4	5	6	7
SELECT	000					2^3	2^2	2^1	2^0
ERROR RECOVERY	001	(1) EARLY STROBE	(1) LATE STROBE	+ OFFSET	− OFFSET				
DIAGNOSTIC	010	RTZ	CLEAR ATTENTION	CLEAR CHECK DIAGNOSTIC	CLEAR FAULT STATUS	CLEAR ERROR RECOVERY	CLEAR RPS		
HEAD ADDRESS	011	RESERVE	RESERVE	RESERVE	2^4	2^3	2^2	2^1	2^0
HIGH CYLINDER	100							2^9	2^8
TARGET REGISTER	101	LOAD TARGET REGISTER	2^6	2^5	2^4	2^3	2^2	2^1	2^0
LOW CYLINDER	110	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
CONTROL	111	TRANSFER SECTOR COUNT	WRITE GATE		READ GATE	ADDRESS MARK ENABLE			

BUS IN BITS							
0	1	2	3	4	5	6	7
DEVICE ID (2)	DEVICE ID (3)	DEVICE ID (4)	ATTENTION	2^3	2^2	2^1	2^0
DEVICE ID	DEVICE ID	DEVICE ID	ATTENTION	2^3	2^2	2^1	2^0
NO HEAD SELECT	WRITE FAULT	(W+R)• OFF CYLINDER	W•R FAULT	VOLTAGE FAULT	HEAD SELECT FAULT	SEEK ERROR	WRITE PROTECTED
NO HEAD SELECT	WRITE FAULT	(W+R)• OFF CYLINDER	W•R FAULT	VOLTAGE FAULT	HEAD SELECT FAULT	SEEK ERROR	WRITE PROTECTED
ECHO READ TARGET REGISTER	SECTOR 2^6	2^5	2^4	2^3	2^2	2^1	2^0
ECHO READ TARGET REGISTER	SECTOR 2^6	2^5	2^4	2^3	2^2	2^1	2^0
AM FOUND		ON CYLINDER	UNIT READY			OFFSET ACTIVE	CHECK DIAGNOSTIC
AM FOUND		ON CYLINDER	UNIT READY			OFFSET ACTIVE	CHECK DIAGNOSTIC

NOTES.

(1) UNITS WITH PLO

(2) 0=LOW TRACK DENSITY
1=HIGH TRACK DENSITY

(3) 0=LOW HEAD COUNT
1=HIGH HEAD COUNT

(4) 0=SMD
1=RESERVED FOR FUTURE

DEVICE ID TABLE			
	BIT 0	BIT 1	BIT 2
9764-1	0	1	0
9766-1	1	1	0

CONTROL DATA
NORMANDALE DIVISION

TAG/ BUS DECODES

CODE IDENT 19333 | C | 83322450 | A | A

CROSS REF NO 783 | SHEET 3 | PAGE 3-139/140

REVISION STATUS OF SHEETS

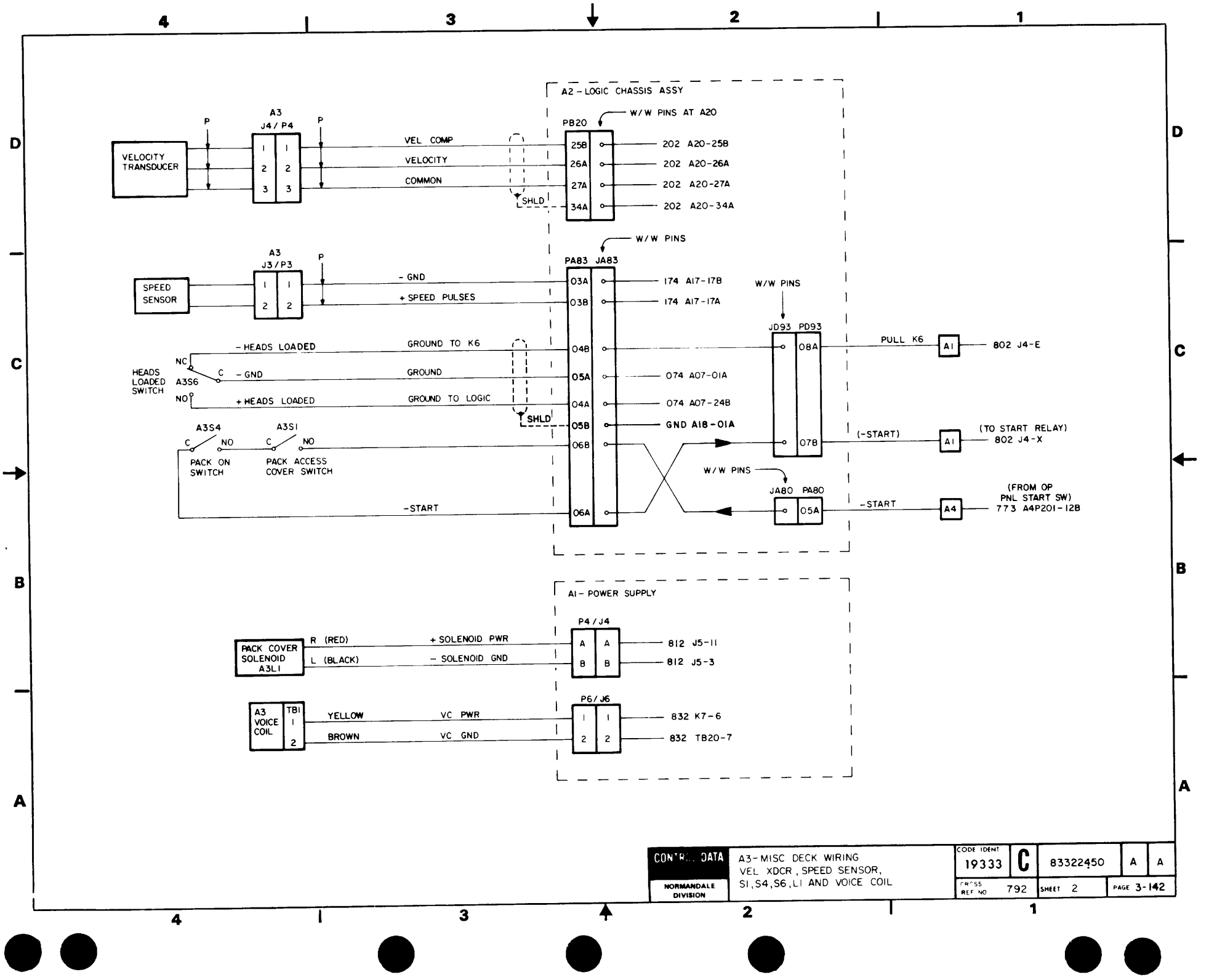
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A																		

REVISIONS

REV.	ECO	DESCRIPTION	DRFT.	DATE	CHK'D
A	PE23000	RELEASED	MLA	10-27-76	

DRAWN	S. BENTLER	10-27-76	CONTROL DATA	A3 - MISC DECK WIRING DIAGRAMS	CODE IDENT 19333	C	83322450	A	A
CHECKED									
ENGINEER					CROSS REF NO 791		SHEET 1 OF 2	PAGE 3-141	
APPROVED			NORMANDALE DIVISION						

REF 83214929



CONTROL DATA NORMANDALE DIVISION	A3-MISC DECK WIRING VEL XDCR, SPEED SENSOR, S1,S4,S6,L1 AND VOICE COIL	CODE IDENT 19333	C	83322450	A A
		CROSS REF NO 792		SHEET 2	PAGE 3-142

REVISION STATUS OF SHEETS

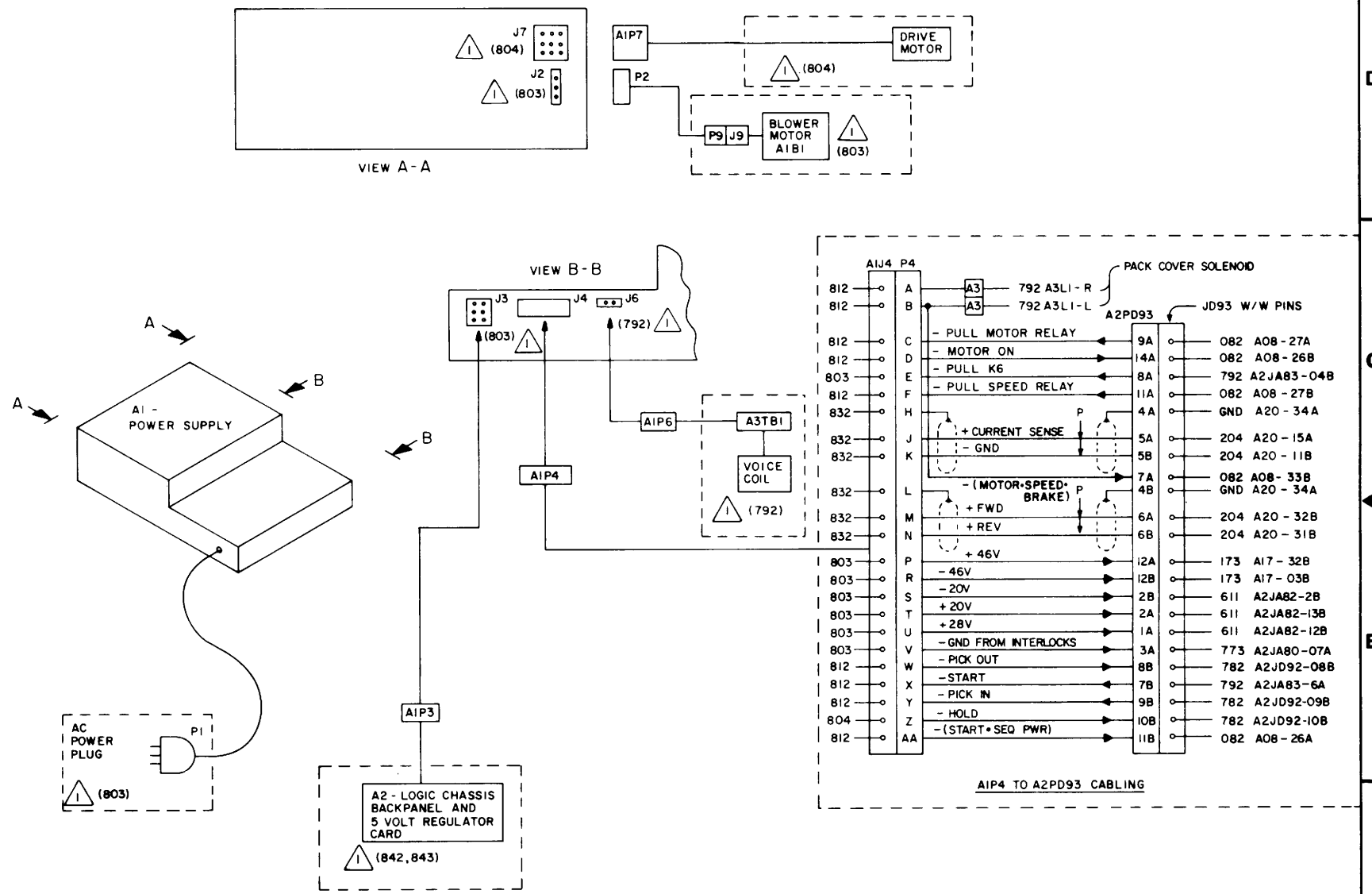
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																
B	A	B	A																

REVISIONS

REV.	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA	10-27-76	
B	PE57130	BLOWER WIRING	MA	4-18-79	

DRAWN	S. BENTLER	10-27-76	CONTROL DATA	A1 - POWER SUPPLY DIAGRAMS	CODE IDENT 19333	C	83322450	N	B
CHECKED									
ENGINEER					CROSS REF NO 801		SHEET 1 OF 4	PAGE 3-143	
APPROVED			NORMANDALE DIVISION						

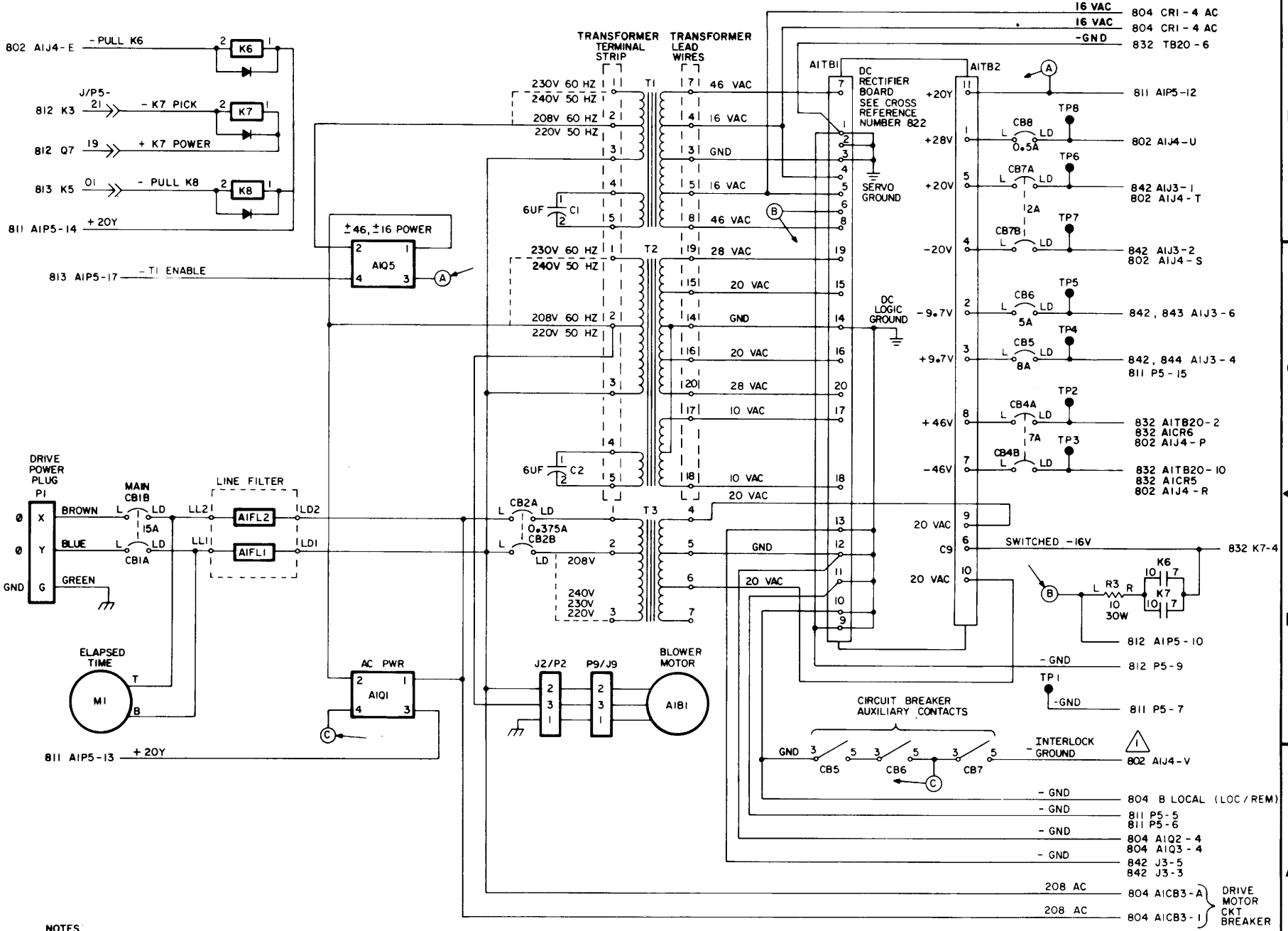
REF 83214930



NOTES:

1. NUMBERS INSIDE PARENTHESIS ARE CROSS REFERENCE NUMBERS WHERE DETAILED CABLING INFORMATION MAY BE FOUND.

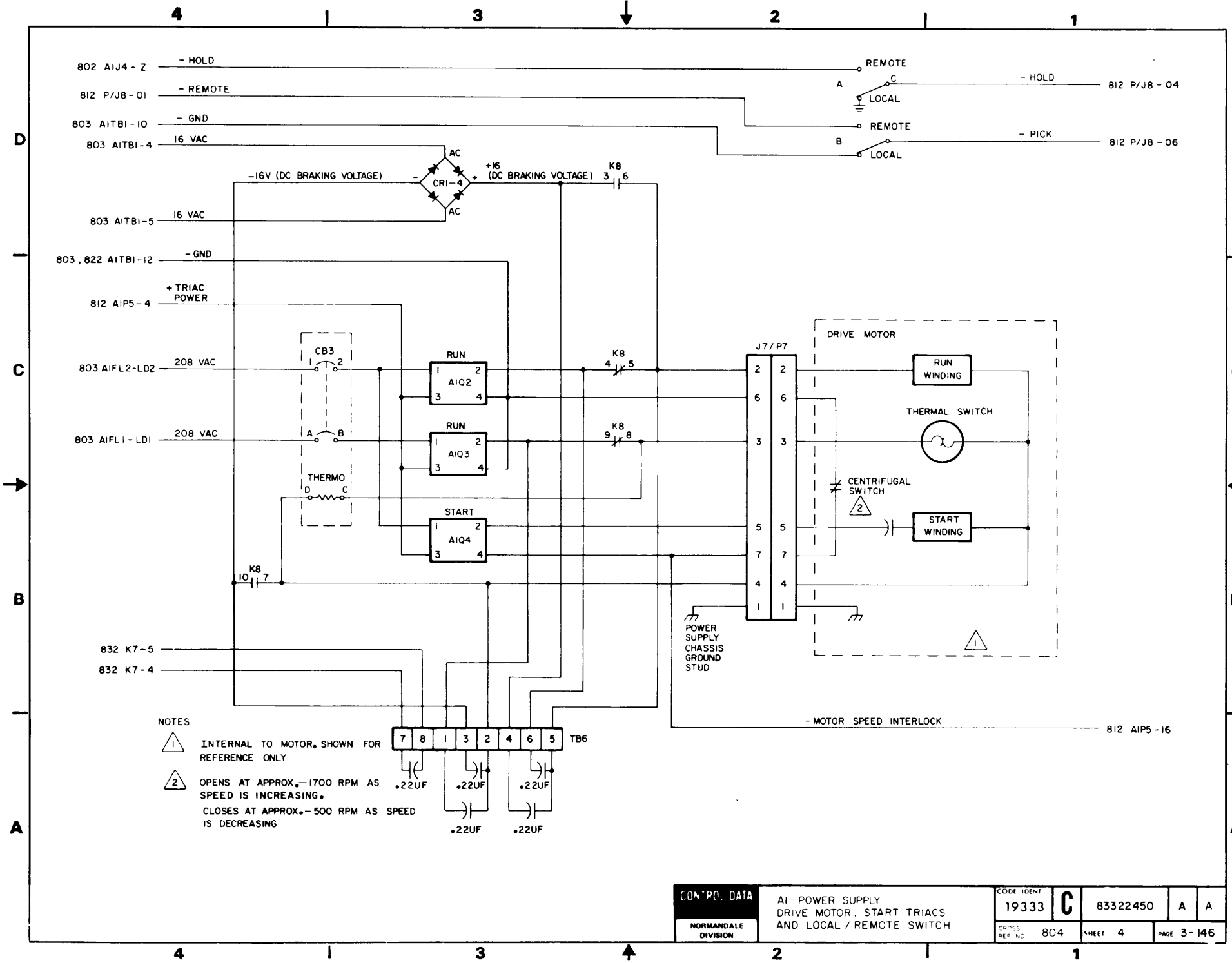
CONTROL DATA NORMANDALE DIVISION	A1 - POWER SUPPLY EXTERNAL CABLING	CODE IDENT 19333	C	83322450	A	A
		CROSS REF NO 802	SHEET 2	PAGE 3-144		



NOTES:

1. SEE CROSS REF NO 773 FOR START INTERLOCK REFERENCE SCHEMATIC

CONTROL DATA	A1 - POWER SUPPLY AC POWER, DC CIRCUIT BREAKERS AND RELAYS K6, K7, K8	CODE IDENT 19333	C	83322450	N	B
NORMANDALE DIVISION		CROSS REF NO 803	SHEET 3	PAGE 3-145		



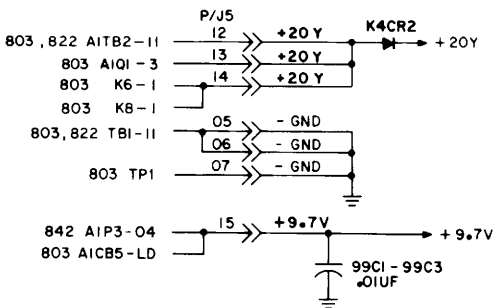
CONTROL DATA NORMANDALE DIVISION	AI - POWER SUPPLY DRIVE MOTOR, START TRIACS AND LOCAL / REMOTE SWITCH	CODE IDENT 19333	C	83322450	A	A
		CROSS REF NO 804	SHEET 4	PAGE 3-146		

REVISION STATUS OF SHEETS

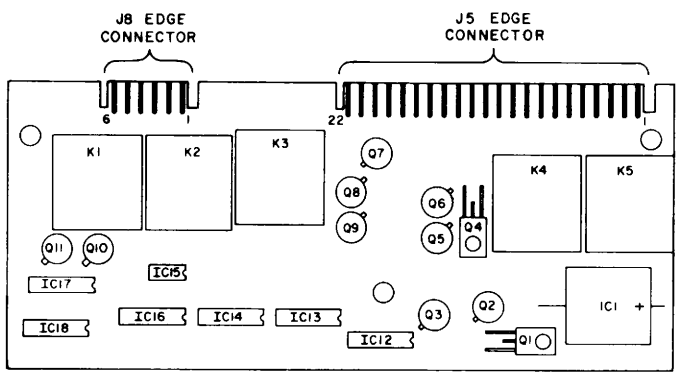
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A																		
B	A	A																		
C	C	C																		

REVISIONS

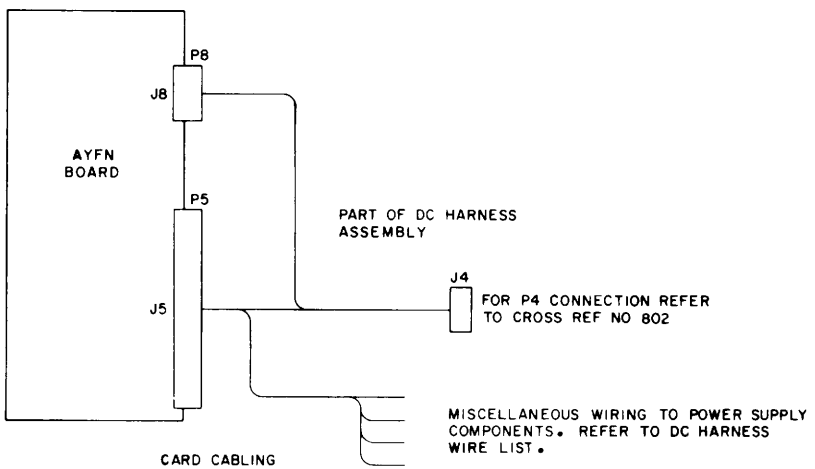
REV.	ECO	DESCRIPTION	DRFT.	DATE	CHK'D
A	PE23000	RELEASED	MLA	10-28-76	
B	PE22953	ADD DIODE TO AYFN CARD	MLA	6-6-77	
C	PE55259	LOGIC DIAG IMPROVEMENT	MA	9-14-78	



POWER WIRING



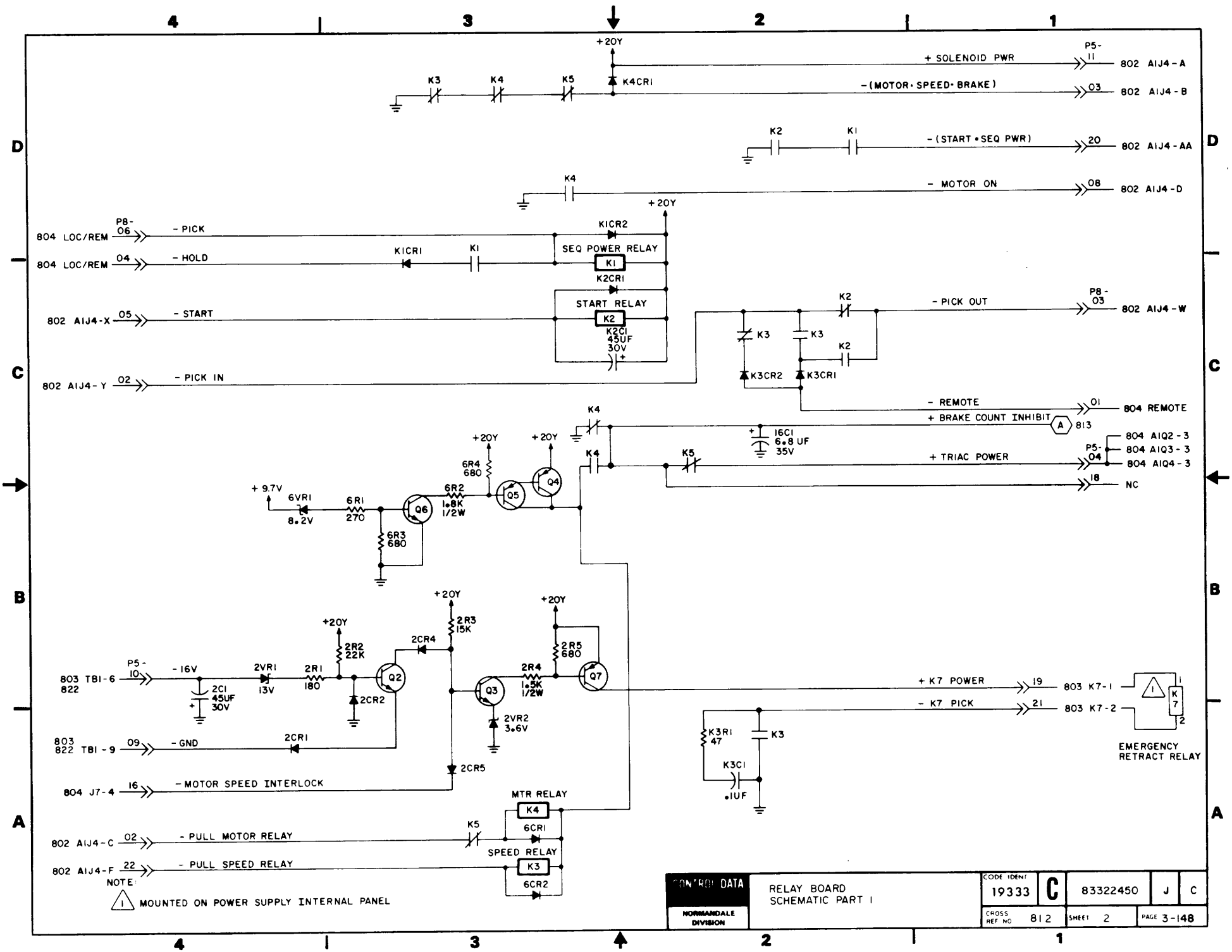
CARD COMPONENT LAYOUT

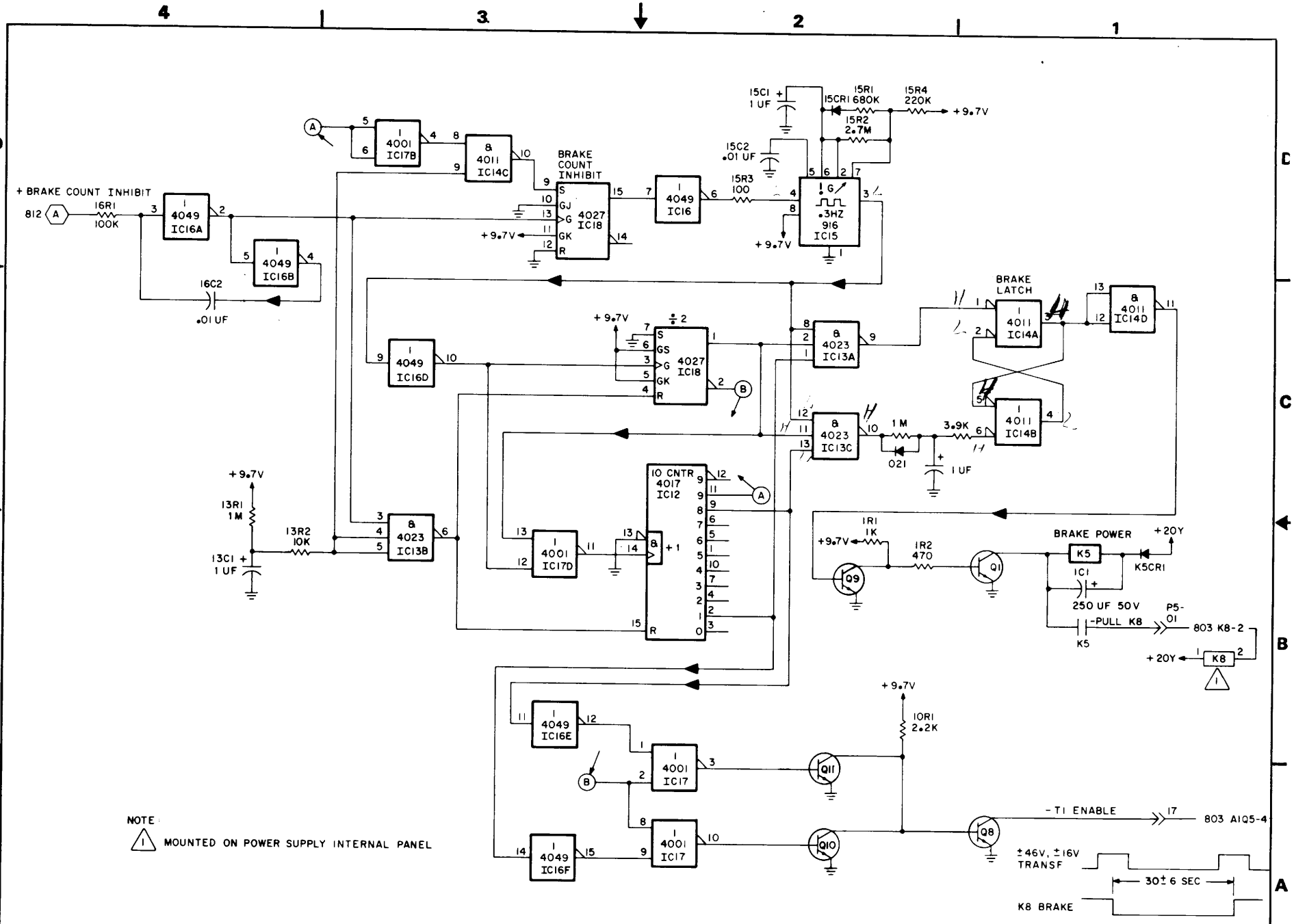


CARD CABLING

DRAWN	S. BENTLER	10-28-76	CONTROL DATA NORMANDALE DIVISION	RELAY BOARD POWER WIRING, COMPONENT LAYOUT AND CABLING DIAGRAMS TYPE: AYFN	CODE IDENT 19333	C	83322450	J C
CHECKED					CROSS REF NO 811		SHEET 1 OF 3	PAGE 3-147
ENGINEER								
APPROVED								

REF 83214931

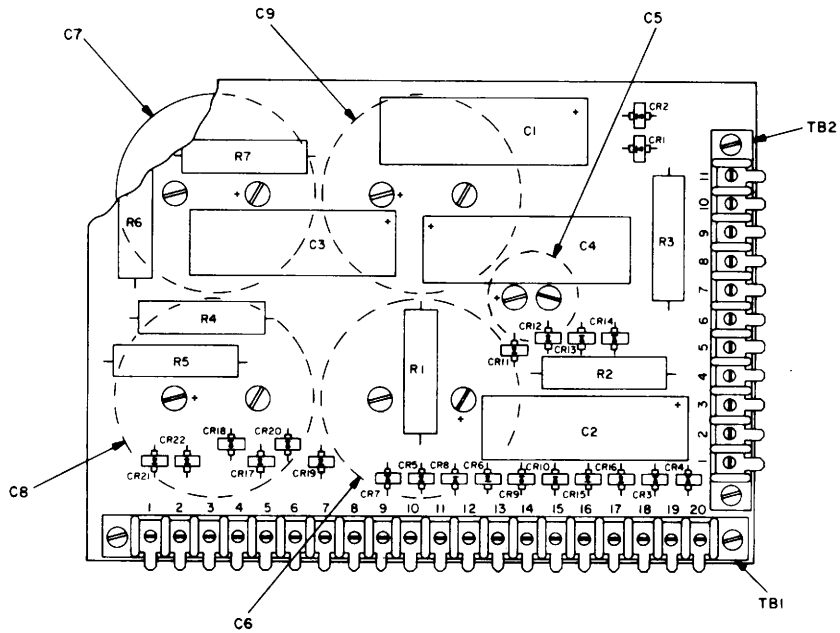

+20Y
K3
K4
K5
K4CR1
+ SOLENOID PWR
P5-11
802 AIJ4-A
-(MOTOR·SPEED·BRAKE)
03
802 AIJ4-B
K2
K1
-(START·SEQ PWR)
20
802 AIJ4-AA
K4
- MOTOR ON
08
802 AIJ4-D
804 LOC/REM
P8-06
- PICK
K1CR2
SEQ POWER RELAY
K1
804 LOC/REM
04
- HOLD
K1CR1
K1
K2CR1
START RELAY
K2
K2C1
45UF
30V
802 AIJ4-X
05
- START
802 AIJ4-Y
02
- PICK IN
K2
- PICK OUT
P8-03
802 AIJ4-W
K3
K3CR2
K3CR1
- REMOTE
01
804 REMOTE
+ BRAKE COUNT INHIBIT
A
813
16C1
6.8 UF
35V
+ TRIAC POWER
P5-04
804 AIQ2-3
804 AIQ3-3
804 AIQ4-3
18
NC
+ 9.7V
6VR1
8.2V
6R1
270
6R2
1.8K
1/2W
6R3
680
6R4
680
Q4
Q5
Q6
803 TB1-6
822
P5-10
-16V
2C1
45UF
30V
2VR1
13V
2R1
180
2R2
22K
2CR2
2CR4
2R3
15K
Q2
Q3
2R4
1.5K
1/2W
2R5
680
Q7
2VR2
3.6V
803
822 TB1-9
09
-GND
2CR1
2CR5
804 J7-4
16
-MOTOR SPEED INTERLOCK
+ K7 POWER
19
803 K7-1
- K7 PICK
21
803 K7-2
K7
EMERGENCY
RETRACT RELAY
K3R1
47
K3C1
.1UF
MTR RELAY
K4
6CR1
SPEED RELAY
K3
6CR2
802 AIJ4-C
02
- PULL MOTOR RELAY
802 AIJ4-F
22
- PULL SPEED RELAY
NOTE:
1 MOUNTED ON POWER SUPPLY INTERNAL PANEL
CONTROL DATA
NORMANDALE DIVISION
RELAY BOARD
SCHEMATIC PART 1
CODE IDENT 19333
C
83322450
J
C
CROSS REF NO 812
SHEET 2
PAGE 3-148



CONTRO. DATA NORMANDALE DIVISION	RELAY BOARD SCHEMATIC PART 2	CODE IDENT 19333	C	83322450	J C
		CROSS REF NO 813	SHEET 3		3-149/150

REVISION STATUS OF SHEETS																			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A																		

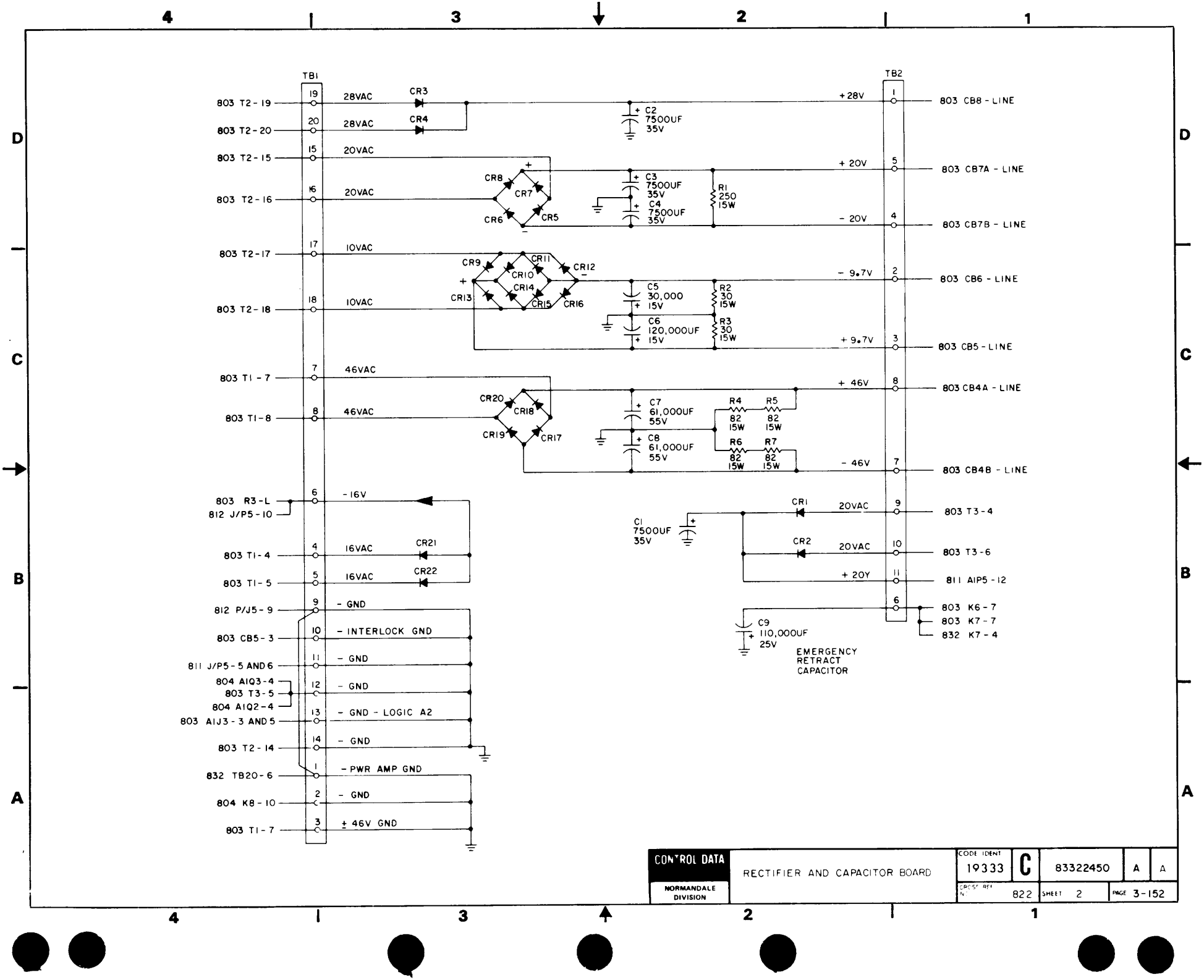
REVISIONS					
REV.	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
-	-	INITIAL	W.	-	-



BOARD IS MOUNTED ON TO CAPACITORS C5,C6,C7,C8,C9

DRAWN		CONTROL DATA	RECTIFIER AND CAPACITOR BOARD COMPONENT LAYOUT AND DIAGRAMS	CODE IDENT 19333	C	83322450	A A
CHECKED							
ENGINEER		NORMANDALE DIVISION	TYPE 5YEN	CROSS REF NO 821		SHEET 1 OF 2	PAGE 3-151
APPROVED							

REF 83214932

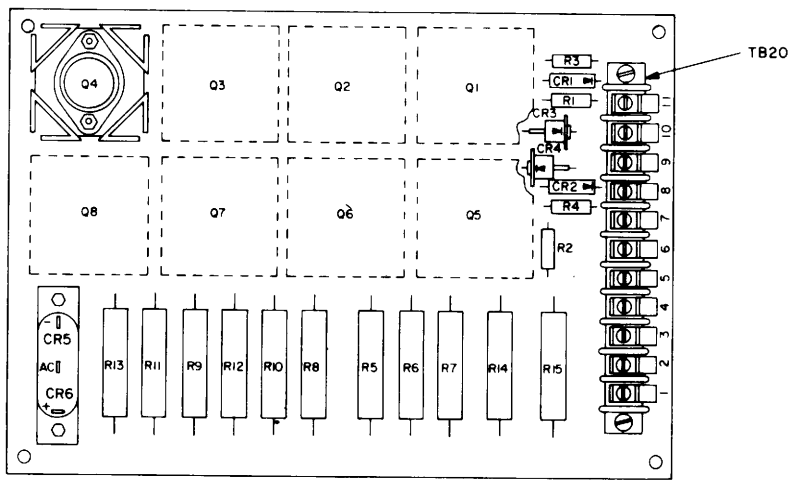

TB1
TB2
803 T2 - 19
803 T2 - 20
803 T2 - 15
803 T2 - 16
803 T2 - 17
803 T2 - 18
803 T1 - 7
803 T1 - 8
803 R3 - L
812 J/P5 - 10
803 T1 - 4
803 T1 - 5
812 P/J5 - 9
803 CB5 - 3
811 J/P5 - 5 AND 6
804 A1Q3 - 4
803 T3 - 5
804 A1Q2 - 4
803 A1J3 - 3 AND 5
803 T2 - 14
832 TB20 - 6
804 K8 - 10
803 T1 - 7
28VAC
28VAC
20VAC
20VAC
10VAC
10VAC
46VAC
46VAC
- 16V
16VAC
16VAC
- GND
- INTERLOCK GND
- GND
- GND
- GND - LOGIC A2
- GND
- PWR AMP GND
- GND
± 46V GND
CR3
CR4
CR5
CR6
CR7
CR8
CR9
CR10
CR11
CR12
CR13
CR14
CR15
CR16
CR17
CR18
CR19
CR20
CR21
CR22
C2 7500UF 35V
C3 7500UF 35V
C4 7500UF 35V
C5 30,000 15V
C6 120,000UF 15V
C7 61,000UF 55V
C8 61,000UF 55V
R1 250 15W
R2 30 15W
R3 30 15W
R4 82 15W
R5 82 15W
R6 82 15W
R7 82 15W
+28V
+ 20V
- 20V
- 9.7V
+ 9.7V
+ 46V
- 46V
803 CB8 - LINE
803 CB7A - LINE
803 CB7B - LINE
803 CB6 - LINE
803 CB5 - LINE
803 CB4A - LINE
803 CB4B - LINE
C1 7500UF 35V
CR1
CR2
20VAC
20VAC
+ 20V
803 T3 - 4
803 T3 - 6
811 A1P5 - 12
C9 110,000UF 25V
EMERGENCY RETRACT CAPACITOR
803 K6 - 7
803 K7 - 7
832 K7 - 4
CONTROL DATA
NORMANDALE DIVISION
RECTIFIER AND CAPACITOR BOARD
CODE IDENT 19333
C
83322450
A
A
CROSS REF 822
SHEET 2
PAGE 3-152

REVISION STATUS OF SHEETS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A																		
B	B																		

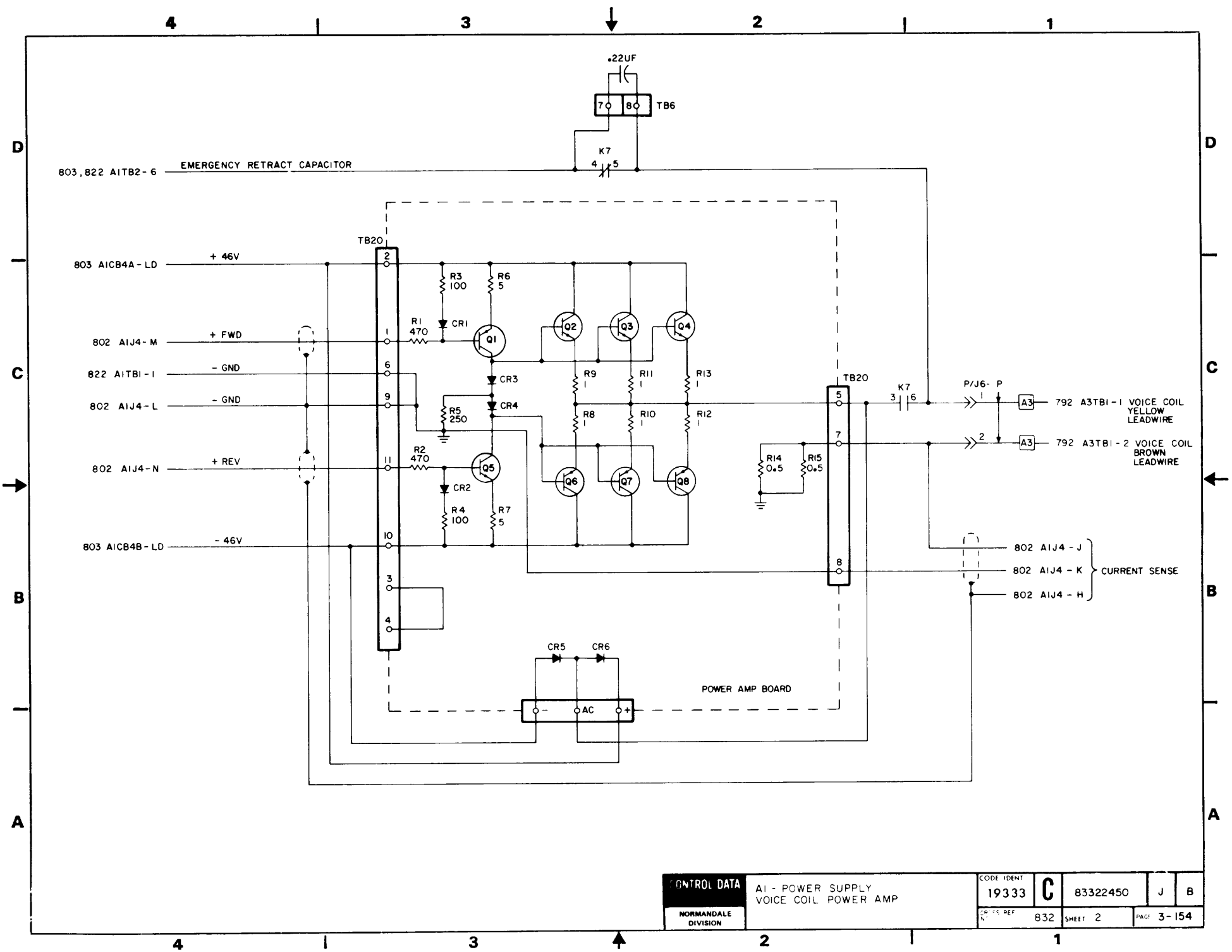
REVISIONS

REV.	ECO	DESCRIPTION	DRFT.	DATE	CHK'D
A	PE23000	RELEASED	ML A	2-20-76	
B	PE55259	LOGIC DIAG IMPROVEMENT	A.A.O	8-8-78	



DRAWN	M.ANDERSON	11-20-76	CONTROL DATA	VOICE COIL POWER AMP DIAGRAMS	CODE IDENT 19333	C	83322450 J B
CHECKED			NORMANDALE DIVISION	TYPE: AZCN	CROSS REF NO 831	SHEET 1 OF 2	PAGE 3-153
ENGINEER							
APPROVED							

REF 83214933



CONTROL DATA NORMANDALE DIVISION	A1 - POWER SUPPLY VOICE COIL POWER AMP	CODE IDENT 19333	C	83322450	J B
		CROSS REF NO. 832	SHEET 2	PAGE 3-154	

REVISION STATUS OF SHEETS

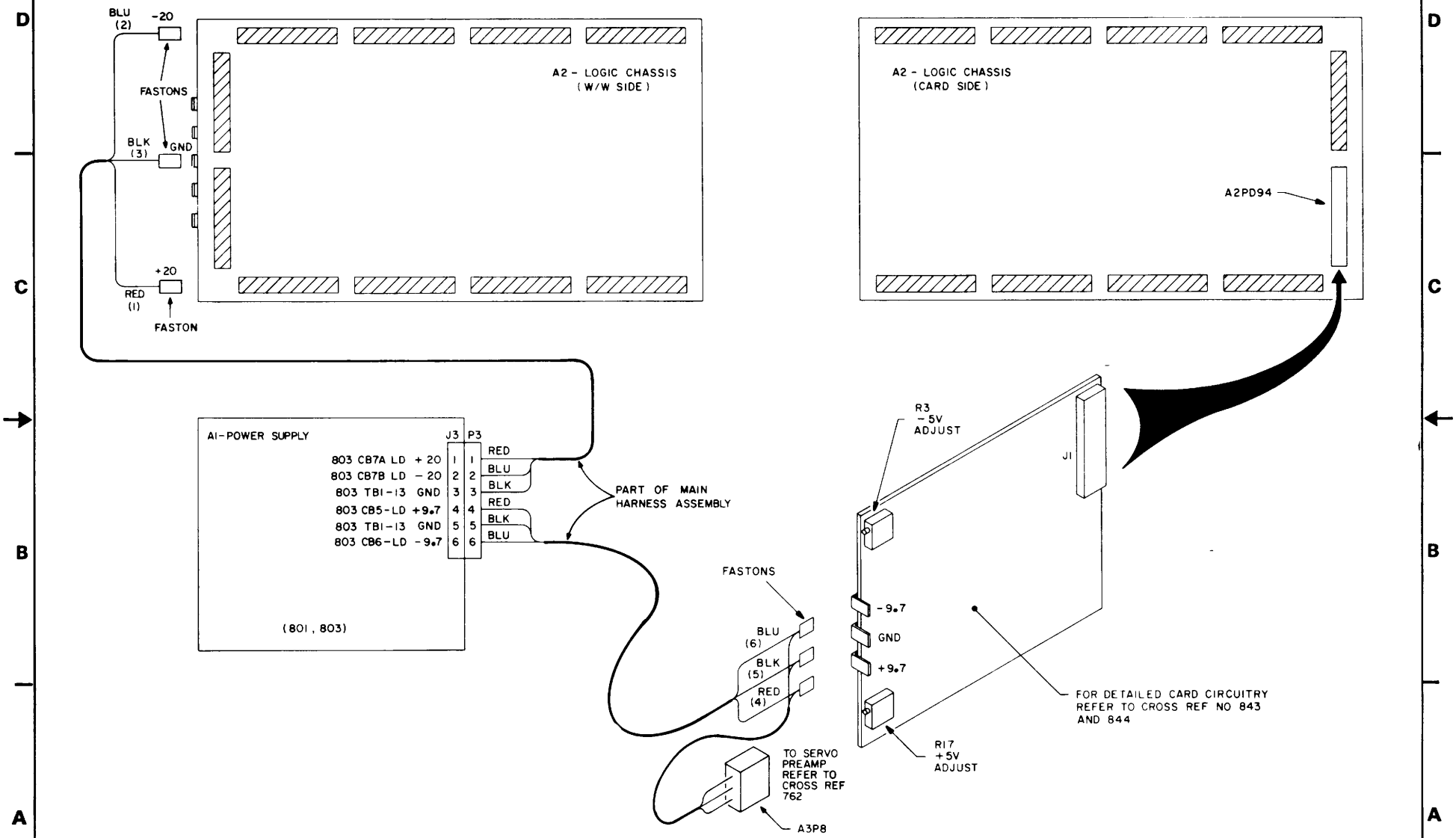
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																
B	A	B	B																

REVISIONS

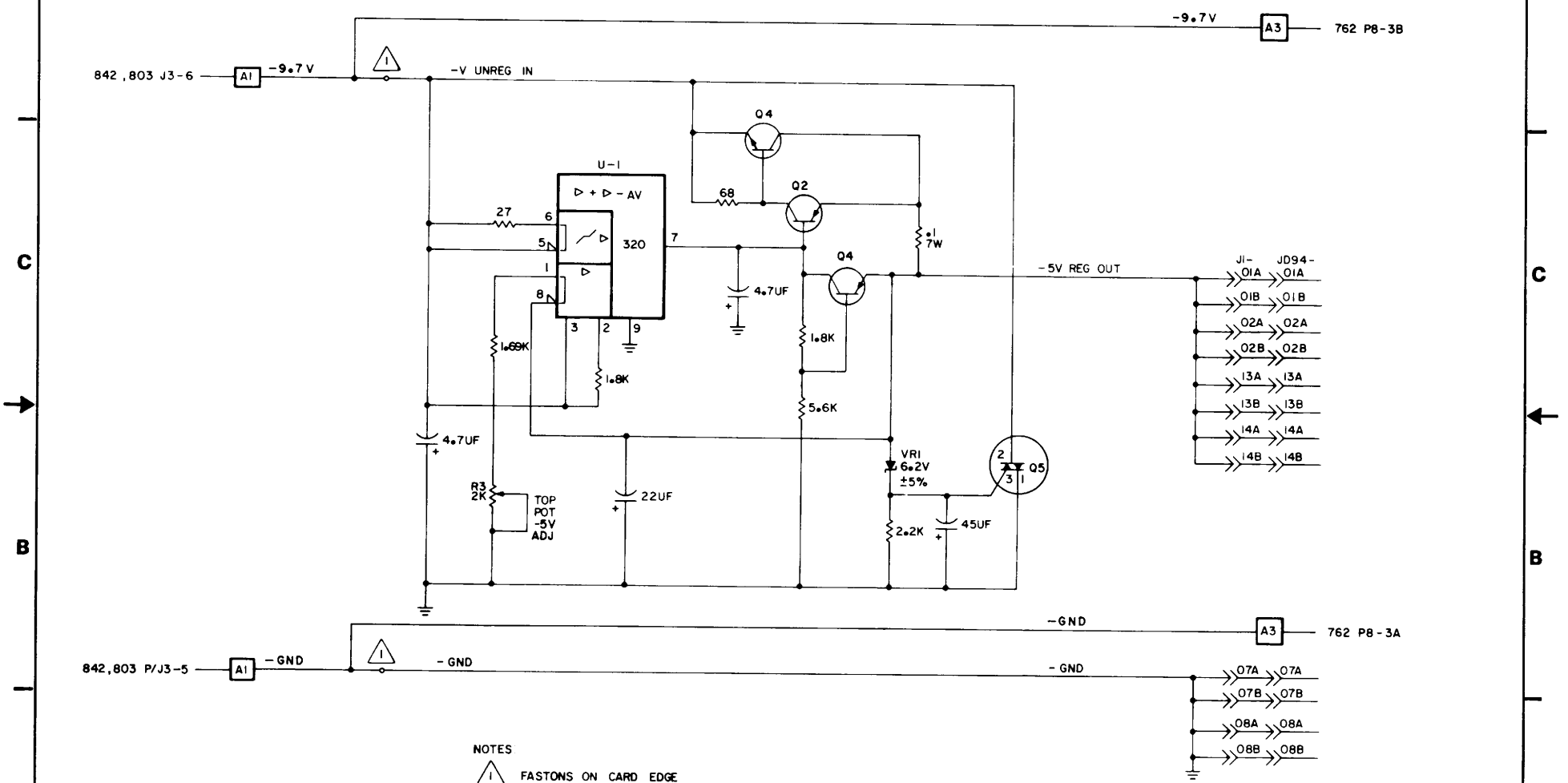
REV.	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA	2-19-76	
B	PE55259	LOGIC DIAG IMPROVEMENT	A.A.O	8-8-78	

DRAWN	W. BERGSTROM	10-29-76	CONTROL DATA	A2 5 VOLT - REGULATOR DIAGRAMS	CODE IDENT 19333	C	83322450	J	B
CHECKED									
ENGINEER					CROSS REF NO 841		SHEET 1 OF 4	PAGE 3-155	
APPROVED			NORMANDALE DIVISION						

REF 83214934



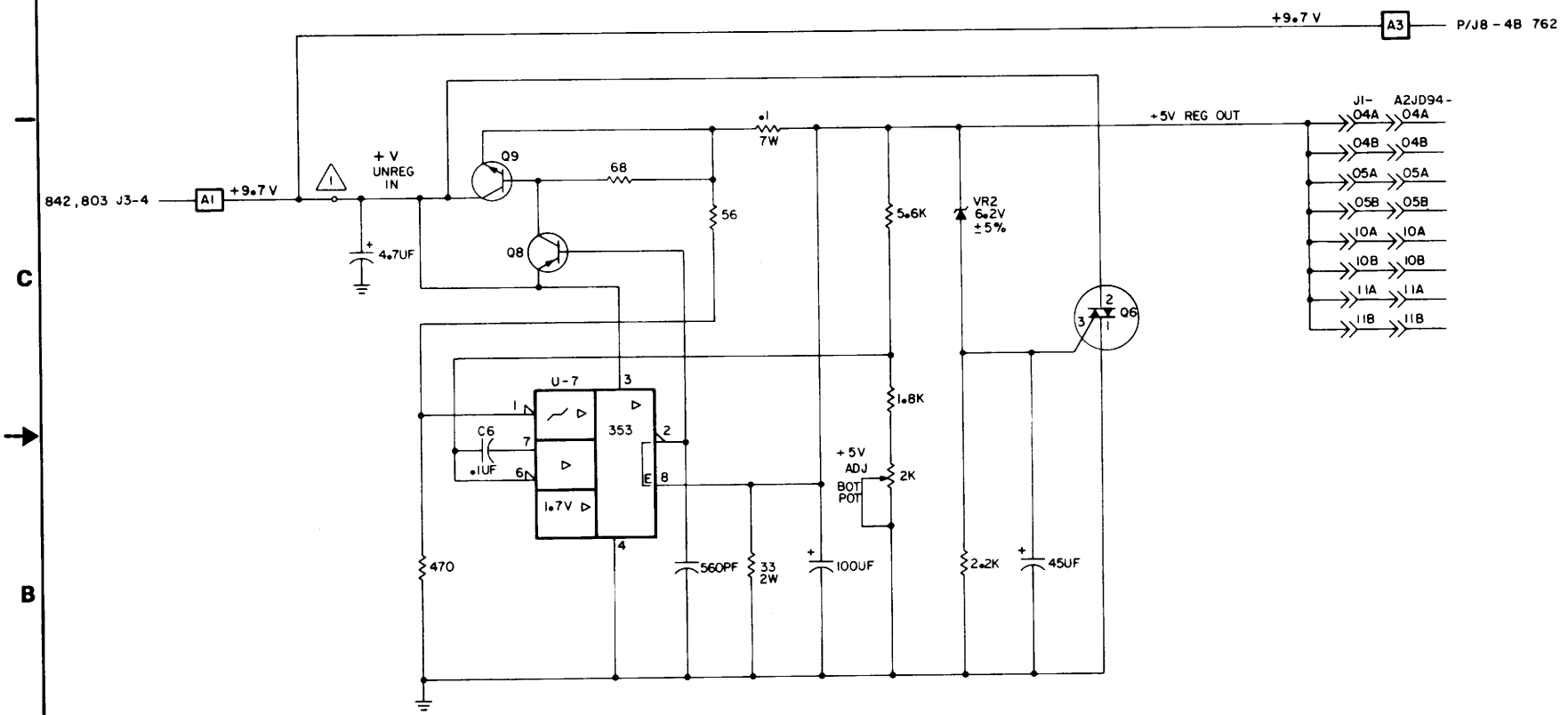
CONTROL DATA NORMANDALE DIVISION	A2-±5 VOLT REGULATORS PC BOARD AND A1P3	CODE IDENT 19333	C	83322450	A	A
		CROSS REF NO 842	SHEET 2	PAGE 3-156		



NOTES

1. FASTONS ON CARD EDGE
   REFER TO CROSS REFERENCE
   NUMBER 802

CONTROL DATA NORMANDALE DIVISION	SCHEMATIC DIAGRAM - 5V REGULATOR	CODE IDENT 19333	C	83322450	J	B
		CROSS REF NO 843		SHEET 3	PAGE 3-157	



NOTES:

1. FASTON ON CARD EDGE REFER TO CROSS REFERENCE NUMBER 802

CONTROL DATA NORMANDALE DIVISION	SCHEMATIC DIAGRAM +5V REGULATOR	CODE IDENT 19333	C	83322450	J B
		CROSS REF NO. 844	SHEET 4	PAGE 3-158	

SECTION 4

WIRE LISTS

INTRODUCTION

This section contains wire lists showing logic chassis wirewrap, interassembly, power supply, and grounding connections for the drive. These lists are useful when making repairs to the logic chassis wirewrap panel or other drive wiring. The lists are divided into the following two types:

- Logic Wirewrap List
- Non Logic Wirewrap Lists

LOGIC WIREWRAP

General

This list shows the origin, destination, and Z level of all wirewrap connections on the logic chassis backpanel.

The wires are listed in order of card location and pin number. The lowest card location is listed first and the highest last. Following the listing of connections between card locations is a list of connections between the pins at the card locations and the pins on the auxiliary connectors (JA80 - JA84 and JD90 and JD94). The pins at each card location or auxiliary jack also are listed from lowest to highest.

This list is a double ended type listing. This means that each wire is listed twice, first by the lowest card or jack it is wired to and then by the highest.

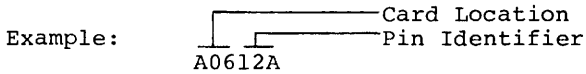
The following explains each of the columns in the wire list (refer to figure 4-1).

Signal Name or Number Identification

Indicates the point where the signal was generated (source).

Origin/Destination

These columns list both ends of each connection. The terms are defined in the following example.



The Key to Diagrams in the Diagrams section of this manual has additional information on card and pin locations.

TITLE: WIREWRAP LIST	WL	DOCUMENT NO.: LOGIC W/W	SHEET NO.: 1 of 12	REV.: A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
A0621B	A0101B	A0102A	1	
A0613B	A0102A	A0101B	1	
A0226A	A0102B	A1708A	1	
A0103A	A0103A	A0231A	1	
A0301A	A0230A	A1712A	1	
A0211B	A0230B	A0612B	1	
A1426B	A0231A	A1326B	2	
A0103A	A0231A	A0103A	1	

9E194

Figure 4-1. Example of Logic Wirewrap List

Z Level

Each pin may contain either one or two wires. If it contains two wires, they must be separated vertically (refer to figure 4-2). The Z level refers to whether the wire wrapped connection is on the level closest to the wirewrap panel surface (level 1) or farthest from it (level 2). If the pin contains only one wire, it is always a level 1 wrap. In either case the same Z level is maintained at both ends of the wire.

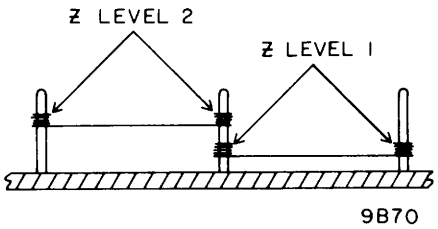


Figure 4-2. Z Levels

Notes

Contains signal names, history or other information pertaining to wire list.

NON LOGIC WIRE LISTS

General

The non logic wire list identify individual wires, cables and harnesses. There are two non logic wire lists and they are as follows:

(1) Main Harness, and (2) Ground Wiring. The Main Harness Wire Lists (refer to figure 4-3) show interassembly connections, which for the most part, are not shown in the logic diagrams. The Ground Wiring shows how the various assemblies connect to the drive ground block and system ground (refer to discussion on Grounding in the Installation and Checkout section of this manual).

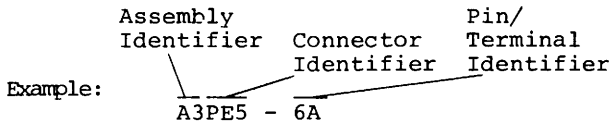
The following explains the terminology used on the non logic wire lists (refer to figure 4-4).

Signal Name/Number Identifier

Contains a number which is for factory use only.

Origin/Destination

These columns identify the origin and destination of each wire. The terms in these columns can be divided into the specific parts shown in the example.



Assembly Identifier

The assembly identifier references the specific assembly within the drive where the connector or connection is located. The various assembly designators are as follows:

A1 - Power Supply Assembly
A2 - Logic Chassis Assembly
A3 - Deck Assembly
A4 - Control Panel Assembly

Therefore, if one end of a wire connects to the power supply its identifier will be A1 and if the other end connects to the deck its identifier will be A3.

Connector Identifier

This specifies the type of connector or component to which the wire is connected. The designators and their definitions are given in table 4-1.

TABLE 4-1. CONNECTOR/COMPONENT IDENTIFIERS

Identifier	Definition
BPNL	Backpanel
C	Capacitor
CB	Circuit Breaker
FL	Line Filter
INSUL	Insulated
INTLKS	Interlocks
J	Jack
K	Relay
L	Coil (Solenoid)
MOT	Motor
P	Plug (fits onto a jack)
Q	Transistor or Triac
R	Resistor
RLY	Relay
S	Switch
SHLD	Shield
T	Transformer
TB	Terminal Board
TP	Test Point

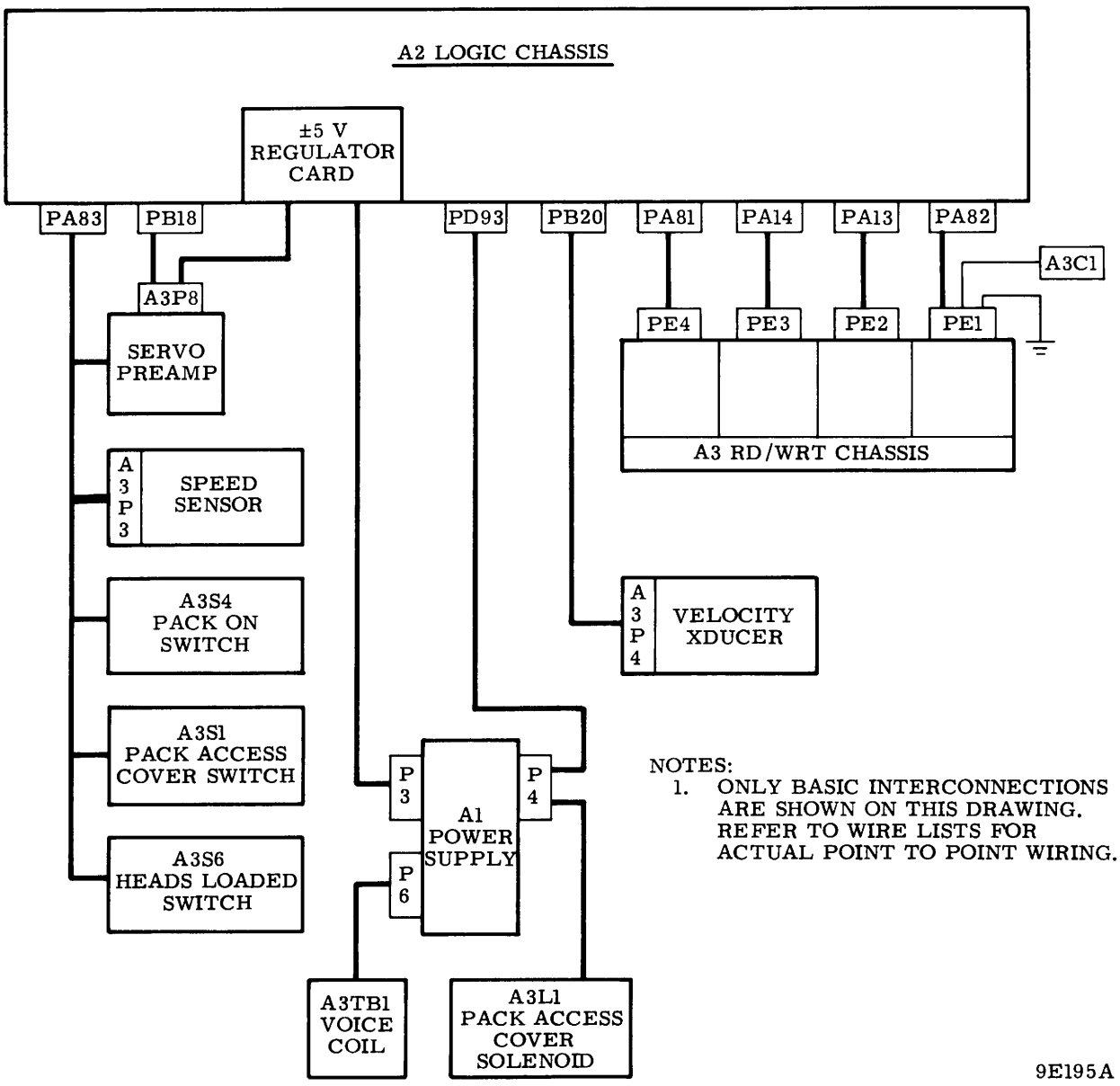


Figure 4-3. Main Harness Wiring

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
1					
1A	A2PA81-1A	A3PE5-1A	4		
1B	A2PA81-1B	A3PE5-1B	0		GND
93	A3L1-R	A1P4-A	2		TOP COVER SOL
94	A3L1-L	A1P4-B	0		TOP COVER SOL
					9E84

Figure 4-4. Example of Non Logic Wire List

Pin/Terminal Identifier

This indicates the specific number of the connection. It may be a pin in a connector (plug or jack) or a terminal on a component or assembly.

Wire Color

Solid colored wires are identified by a one digit number in this column. Multi-colored wires are identified by a number having two or three digits. Each digit of the number identifies one of the colors. The code numbers are identified as follows:

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

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

Notes

Contains signal name, history or other information pertaining to wire list.

TITLE		WL	DOCUMENT NO.	SHEET NO.	REV.
BJ4M1 LOGIC WIREWRAP (REF: 83229117)			LOGIC W/W	1 OF 8	Z

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN		DESTINATION	Z LEVEL	NOTES
A06218	1	A0102A	A0333B	1	
A06138	1	A0102B	A0333A	1	
A0226A		A0103A	A0226A	1	
A1012B		A0103B	A1012B	1	
A1526B	1	A0104A	A1526B	1	
A0432B		A0110B	A0432B	1	
A0431A		A0111A	A0431A	1	
A0426A		A0111B	A0426A	1	
A0426B		A0112A	A0426B	1	
A0407A		A0116B	A0407A	1	
A0414B		A0117A	A0414B	1	
A0413A		A0117B	A0413A	1	
A0408B		A0121A	A0408B	1	
A1426B		A0125B	A1426B	1	
A0306A	1	A0126A	A0306A	1	
A0129A		A0129A	A1323B	1	
A1233B		A0129B	A1233B	1	
A0332A		A0130A	A0332A	1	
A0201A	GND	A0201A	JA8107B	1	
A0203B		A0203B	A1704A	1	
A0204B	1	A0204B	A0308B	1	
A0205A	1	A0205A	A0612B	1	
A0205B	1	A0205B	A0309A	1	
A0206B		A0206B	A1712A	1	
A0209A	1	A0209A	A0313B	1	
A0210A	1	A0210A	A0309B	1	
A0210B	1	A0210B	A0304A	1	
A0211A	1	A0211A	A0312B	1	
A0211B		A0211B	A0327A	1	
A0214B	1	A0214B	A0305B	1	
A0215A		A0215A	A1504B	1	
A0215B		A0215B	A1503B	1	
A0216A		A0216A	A1923A	1	
A0216B		A0216B	A1923B	1	
A0217B	1	A0217B	A0305A	1	
A0222A		A0222A	A1206B	1	
A1710B		A0222B	A1710B	1	
A0223A	1	A0223A	A0633B	1	
A0224A	1	A0224A	A0632A	1	
A0225A		A0225A	A0303B	1	
A0228A		A0228A	A0331A	1	
A0228B		A0228B	A0302A	1	
A0230A		A0230A	A0416B	1	
A0231A		A0231A	A0314A	1	
A1707A	2	A0231B	A1428B	1	
A0233A	2	A0233A	A0805A	2	
A0233B	1	A0233B	A0306B	1	
A0301A	GND	A0301A	A0315B	1	
A0302B		A0302B	A1708A	1	
A0303A	1	A0303A	A1326B	1	
A0210B	2	A0304A	A0327B	2	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
BJ4M1 LOGIC WIREWRAP			2	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
A03048	1	A03048	A1431B 1	
A02178	2	A03058	A0322B 2	
A02148	2	A03058	A0322A 2	
A03068	2	A03068	A0433B 2	
A02338	2	A03068	A0416A 2	
A06258		A03078	A0625B 1	
A03078		A03078	A0402B 1	
A03088		A03088	A0405B 1	
A02048	2	A03088	A0626B 2	
A02058	2	A03098	A0611B 2	
A02108	2	A03098	A0626A 2	
A06248		A03108	A0624B 1	
A06248		A03108	A0624A 1	
A06318		A03118	A0631B 1	
A06308		A03118	A0630A 1	
A06308		A03128	A0630B 1	
A06298		A03138	A0629A 1	
A02098	2	A03138	A0317B 2	
A03268TIHI	2	A03158	A0316A 2	
A03168		A03168	JA8103A 1	
A02098	3	A03178	A0632B 1	
A03218		A03218	JA8102A 1	
A03218		A03218	A0407B 1	
A02148	3	A03228	A0623A 1	
A02178	3	A03228	A0623B 1	
A03238		A03238	JA8106A 1	
A03238		A03238	JA8105A 1	
A03248		A03248	JA8101A 1	
A03268		A03268	A0415A 1	
A03268TIHI	1	A03158	A0326B 1	
A02108	3	A03278	A0622A 1	
A03288		A03288	A0408A 1	
A03298		A03298	A0429B 1	
A03298		A03298	A0411B 2	
A03308		A03308	A0421B 1	
A03308		A03308	A0423A 1	
A04158		A03318	A0415B 1	
A1714A	1	A03328	A0731B 1	
A06138	2	A03338	A0613B 2	
A06218	2	A03338	A0621B 2	
A03348 GND	1	A03348	JA8105B 1	
A03348 GND	2	A03348	JA8106B 2	
A0401A GND	1	A0401A	A0402A 1	
A0401A GND	2	A0402A	A0403A 2	
A0401A GND	3	A0403A	A0405A 1	
A1721B		A0403B	A1721B 1	
A1432B		A0404A	A1432B 1	
A0401A GND	4	A0405A	A0406A 2	
A0401A GND	5	A0406A	A0409B 1	
A1722B		A0409A	A1722B 1	
A0401A GND	6	A0409B	A0410B 2	
A0703A	1	A0410A	A0703A 1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
BJ4M1 LOGIC WIREWRAP			3	Y

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
A0401A GND 7	A0410B	A0411A	1	
A0401A GND 8	A0411A	A0412B	2	
A1723B	A0412A	A1723B	1	
A0401A GND 9	A0412B	A0413B	1	
A0401A GND10	A0413B	A0417A	2	
A0434A GND 7	A0421A	A0422A	1	
A1716A	A0422B	A1716A	1	
A8012ALPB2 2	A0423B	A1727A	2	
A1706A	A0424A	A1706A	1	
A0434A GND 6	A0422A	A0424B	2	
A0434A GND 5	A0424B	A0425A	1	
A8011ALPB3 2	A0425B	A1728B	2	
A1726B	A0427B	A1726B	1	
A0434A GND 4	A0425A	A0428B	2	
A0434A GND 3	A0428B	A0429A	1	
A0434A GND 2	A0429A	A0430A	2	
A8011BLPB1 2	A0430B	A1731B	2	
A0711A	A0431B	A0711A	1	
A1922B	A0432A	A1922B	1	
A1914A	A0433A	A1914A	1	S/C 18 and Above
A1216A	A0433A	A1216A	1	S/C 17 and Below
A0306A 3	A0433B	A1232A	1	
A0434A GND 1	A0430A	A0434A	1	
A0601A GND 1	A0601A	JA8101B	1	
A0601A GND 2	A0601A	JA8102B	2	
A1811B	A0604A	A1811B	1	
A0721B 1	A0604B	A0721B	1	
A1832A	A0605B	A1832A	1	
A0606A	A0606A	A0711B	1	
A0606B	A0606B	A0724A	1	
A0607A	A0607A	A0732B	1	
A0607B	A0607B	A1926A	1	
A1905A	A0610A	A1905A	1	
A0610B	A0610B	A1910B	1	
A0725A	A0611A	A0725A	1	
A0205B 3	A0611B	A1226B	1	
A0713B 1	A0612A	A0713B	1	
A0205A 2	A0612B	A0727A	2	
A1026B	A0615A	A1026B	1	
A1904A	A0616A	A1904A	1	
A0616B	A0616B	A0702A	1	
A0706B 2	A0617A	A0706B	2	
A0707B 1	A0617B	A0707B	1	
A0621A	A0621A	A0717A	1	
A0210B 4	A0622A	A1229B	2	
A1833A 1	A0622B	A1004B	1	
A0214B 4	A0623A	A1230A	2	
A0217B 4	A0623B	A1228B	2	
A0211A 4	A0625A	A1233A	2	
A0210A 3	A0626A	A1224A	1	
A0204B 3	A0626B	A1222B	1	
A0627A	A0627A	A0733A	1	
A1207A 1	A0627B	A0705B	1	
A1915B	A0628B	A1915B	1	

TITLE		WL	DOCUMENT NO.	SHEET NO.	REV.
BJ4M1 LOGIC WIREWRAP				4	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
A1013B	A0631A	A1013H	1	
A0224A 2	A0632A	A1221A	2	
A0633A	A0633A	A0729A	1	
A0223A 2	A0633B	A1225A	2	
A0634A GND 1	A0634A	JA8103H	1	
A0634A GND 2	A0634A	JA8104A	2	
A0701A GND	A0701A	JA8305A	1	
A1207A 3	A0702B	A1207A	1	
A0703A 2	A0703A	A1205H	2	
A0703B	A0703B	A1710A	1	
A1213B	A0704A	A1213H	1	
A0704B	A0704B	A1907H	1	
A0829B 1	A0705A	A0829H	1	
A1207A 2	A0702B	A0705H	2	
A0706A	A0706A	A0831A	1	
A0706B 3	A0706B	A1226A	1	
A0707A	A0707A	A2012A	1	
A0707B 2	A0707B	A1725B	2	
A0708A	A0708A	A2009H	1	
A0716A 1	A0709A	A0716A	2	
A1232B	A0710A	A1232H	1	
A0710B	A0710B	A1205A	1	
A0825A	A0712A	A0825A	1	
A0712B	A0712B	A2026H	1	
A0713A	A0713A	A2029H	1	
A0713B 2	A0713B	A0832A	2	
A0714A 1	A0714A	A1203B	1	
A1217A 1	A0714B	A0811B	1	
A0831B 1	A0715A	A0831H	1	
A0715B	A0715B	A1225H	1	
A0716B	A0716B	A1927H	1	
A1206A	A0717B	A1206A	1	
A0721B 2	A0721B	A0833A	2	
A0722A	A0722A	A1910A	1	
A1207B	A0722B	A1207H	1	
A0825B 1	A0723B	A0825H	1	
A1214B	A0725B	A1214H	1	
A0726A	A0726A	A1905H	1	
A1724A	A0726B	A1724A	1	
A1808B	A0727B	A1808B	1	
A1807B	A0728B	A1807H	1	
A0729B	A0729B	A2027H	1	
A0730A	A0730A	A1916H	1	
A0731A	A0731A	A0803H	1	
A1714A 2	A0731B	A1714A	2	
A0732A	A0732A	A0805H	1	
A0734A GND	A0723A	A0734A	1	
A0801A GND 1	A0801A	A0808A	1	
A0806A	A0806A	JD9206A	1	
A0806B	A0806B	JD9206H	1	
A0807A	A0807A	JD9207A	1	
A0807B	A0807B	JD9207H	1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
BJ4M1 LOGIC WIREWRAP			5	Z

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
A0801A GND	2	A0808A	A0808B	2	
A0809A		A0809A	A2004A	1	
A0809B		A0809B	A2006A	1	
A0810A		A0810A	A2005A	1	
A0810B		A0810B	A2004B	1	
A1202A		A0811A	A1202A	1	
A1217A	2	A0811B	A1217A	2	
A1204A		A0812A	A1204A	1	
A1203A		A0812B	A1203A	1	
A1209B		A0813A	A1209B	1	
A1209A		A0813B	A1209A	1	
A0814A		A0814A	A2003B	1	
A1210A		A0814B	A1210A	1	
A0815A		A0815A	A2006B	1	
A0815B		A0815B	A2005B	1	
A1211B		A0822B	A1211B	1	
A0824A		A0824A	A1716B	1	
A0825B	2	A0825B	A1924B	2	
A0827A		A0827A	JD9309A	1	
A0827B		A0827B	JD9311A	1	
A1712B OR	2	A0828A	A1712B	2	
A1724B		A0829A	A1724B	1	
A0829B	2	A0829B	A2013B	2	
A2012B		A0830A	A2012B	1	
A2014A		A0830B	A2014A	1	
A0831B	2	A0831B	A2032A	2	
A0713B	3	A0832A	A1827B	1	
A1931B		A0832B	A1931B	1	
A0721B	3	A0833A	A2028B	1	
A10028-20V	2	A10028	JD9203A	2	
A1833A	2	A1004B	A1833A	2	
D9404B +5V		A1014B	A1034B	1	
D9401B -5V		A1001B	A1021B	1	
A1812B		A1022B	A1812B	1	
A1023B		A1023B	A1523B	1	
A1024B		A1024B	A1524B	1	
A1030B		A1030B	A1309A	1	
A1033B+20V	2	A1033B	JD9203B	2	
A1201A GND	1	A1201A	JA8204B	1	
A1201A GND	2	A1201A	JA8206B	2	
A0714A	2	A1203B	A1916A	2	
A1208A		A1208A	A1914B	1	S/C 18 only
A1213A		A1213A	JA8204A	1	
A1925A		A1215A	A1925A	1	
A1216A		A1216A	A0433A		S/C 17 and Below
A1223B		A1223B	JA8205A	1	
A1224B		A1224B	JA8206A	1	
A0706B	4	A1226A	A1917A	2	
A0217B	5	A1228B	A1731A	1	
A0214B	5	A1230A	A1732A	1	
A0209A	5	A1231A	A1729A	1	
A1234A GND		A1231A	A1234A	2	
A0306A	4	A1232A	A1312B	2	
A0211A	5	A1233A	A1729B	1	
A1234A GND		A1234A	JA8205B	1	
A1234A GND		A1234A	A1231A	2	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
BJ4M1 LOGIC WIREWRAP			6	Z

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
A0306A	5	A1312B	JA8207A	1	
A0303A	2	A1326B	A1427B	2	
A1709B INP		A1331A	A1709B	1	
A1734A GND	1	A1331B	A1734A	1	
A1402B-20V	2	A1402B	JD9201A	2	
A1403B		A1403B	A1510B	1	
A1404B		A1404B	A1509B	1	
A1410B		A1410B	A1422B	1	
A1907A		A1412B	A1907A	1	
A1414B		A1414B	A1421B	1	
A0303A	3	A1427B	A1513B	1	
A1707A	3	A1428B	A1707A	2	
A1430B		A1430B	A1522B	1	
A0304B	2	A1431B	A1512B	2	
A1433B+20V	2	A1433B	JD9201B	2	
A1002B-20V	1	A1002B	A1502B	1	
A0304B	3	A1512B	A1713B	1	
A0303A	4	A1513B	A1908B	2	
A1526B	2	A1526B	A1534A	2	
A1033B+20V	1	A1033B	A1533B	1	
A1402B-20V	1	A1402B	A1602B	1	
A1433B+20V	1	A1433B	A1633B	1	
A1701A GND	1	A1701A	JA8203B	1	
A1701A GND	2	A1701A	JA8210B	2	
A1707A	4	A1707A	A1727B	1	
A1216B		A1711A	A1914B	2	S/C 19 & Above
A0733B		A1711B	A1915A	2	S/C 18 and Above
A0304B	4	A1713B	A1908A	2	
A1734A GND	3	A1733A	JA8208B	1	
A1734A GND	2	A1733A	A1734A	2	
102121		A1801A	JA8305B	1	
A1809B		A1809B	A1911A	1	
A1901A GND	1	A1901A	A1917B	1	
A2015B		A1904B	A2015B	1	
A2014B		A1911B	A2014B	1	S/C 18 and Above
A1914A		A1914A	A0433A	1	S/C 18 and Above
A1216B		A1914B	A1711A	2	S/C 19 and Above
A1208A		A1914B	A1208A	1	S/C 18 only
A0733B		A1915A	A1711B	2	
A1901A GND	2	A1917B	A1921A	2	
A1901A GND	3	A1921A	A1921B	1	
A1922A		A1922A	A2010B	1	
A1924A		A1924A	A2011A	1	
A0825B	3	A1924B	A1925B	1	
A1927A		A1927A	A2010A	1	
A2011B		A2011B	JD9305B	1	
A2015A		A2015A	JD9305A	1	
A2031B		A2031B	JD9306B	1	
A2032B		A2032B	JD9306A	1	
A2034A GND	1	A2034A	JD9304A	1	
A2034A GND	2	A2034A	JD9304B	2	
A8002B		A1709A	JA8002B	1	
A8005A		JA8005A	JA8306B	1	
A8011ALPB3	1	A0425B	JA8011A	1	
A8011BLPB1	1	A0430B	JA8011B	1	
A8012ALPB2	1	A0423B	JA8012A	1	
A1712B OR	1	A0828A	JA8013A	1	
A8014ALPB0	1	A0428A	JA8014A	1	
A8203A		A1714B	JA8203A	1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
BJ4M1 LOGIC WIREWRAP			7	T

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
A03006A 6	A1713A	JA8207A	2	
A8303A	A1717B	JA8303A	1	
A8303B	A1717A	JA8303B	1	
A8304A	A0724B	JA8304A	2	
A8306A	JA8306A	JD9307B	1	
A14028-20V 3	A1702B	JD9201A	1	
A14338+20V 3	A1733B	JD9201B	1	
A10028-20V 3	A1802B	JD9203A	1	
A10338+20V 3	A1833B	JD9203B	1	
D9209BPK IN	JD9209B	JD9309B	1	
D9301A+28V	JA8212B	JD9301A	1	
D9302A+20V	JA8213B	JD9302A	1	
D9302B-20V	JA8202B	JD9302B	1	
D9303A-GND	JA8007A	JD9303A	1	
D9307A	A0833B	JD9307A	1	
D9310BHOLD	JD9210B	JD9310B	1	
D9311B	A0826A	JD9311B	1	
D9312A+46V	A1732B	JD9312A	1	
D9312B-46V	A1703B	JD9312B	1	
D9314A	A0826B	JD9314A	1	
D9401B -5V	A1021B	JD9401B	2	
D9401B -5V	JA8201B	JD9401B	1	
D9404B +5V	A1014B	JD9404B	2	
D9404B +5V	JA8214B	JD9404B	1	
D9405A +5V 1	JA8010A	JD9405A	1	
D9405A +5V 2	JA8010A	JD9405B	2	
D9407A GND 1	JA8001B	JD9407A	1	
D9407B GND 2	JA8001B	JD9407B	2	
A0211A 2	A0312B	A0317A	2	
A0211A 3	A0317A	A0625A	1	
A0328B	A0328B	A0427A	1	
A8014ALPB0 2	A0428A	A1730A	2	
A0209A 4	A0632B	A1231A	2	
D9308BPK OUT	JD9208B	JD9308B	1	
A1825B	A1613B	A1825B	1	
A1823B	A1615B	A1823B	1	
A8304B	JA8304B	JD9308A	1	
102121	JA8305B	A1801A	1	
A0134A GND 1	A0132A	A0134A	1	
A1728ATIHI 3	A1423B	A1424B	2	
A0134A GND 3	A0110A	A0132B	1	
A0134A GND 2	A0132A	A0132B	2	
A0706B 1	A0325A	A0617A	1	
A1728ATIHI 2	A1726A	A1728A	2	
A1728ATIHI 1	A1424B	A1728A	1	
A0706B 5	A0325A	A0325B	2	
A1216B OR 1	A0414A	A1216B	1	
A0225B	A0225B	A1730B	1	
A0324A	A0314B	A0324A	1	
A0233A 1	A0133A	A0233A	1	
A1708B 1	A0417B	JA8210A	1	
A1012B 2	A1012B	A1027B	2	
A1216A	A0433A	A1216A	1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
BJ4M1 LOGIC WIREWRAP			8	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN		DESTINATION		Z LEVEL	NOTES
A17088		2	A17088	JA8210A	2	
A01278			A01278	A1310B	1	
A07338	OR	3	A0802A	A1711B	1	
A0716A		2	A0716A	A1928A	1	
A0134A	GND	4	A0109B	A0110A	2	
A12168	OR	5	A16148	A1711A	1	
A12168	OR	4	A16148	JA8208A	2	
A12168	OR	3	JA8009B	JA8208A	1	
A12168	OR	2	A12168	JA8009B	2	
A07338	OR	2	A07338	A0802A	2	
A07338	OR	1	A07338	JA8001A	1	

TITLE		WL	DOCUMENT NO.	SHEET NO.	REV.
BJ4M2, BJ402 LOGIC WIREWRAP (REF: 77476325)			LOGIC W/W	1 OF 15	AG

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
A0621B	1 A0102A	A0333B	1	
A0613B	1 A0102B	A0333A	1	
A0226A	A0103A	A0226A	1	
A1012B	A0103B	A1012B	1	
A1526B	1 A0104A	A1526B	1	
A0134A	GND 4 A0109B	A0110A	2	
A0134A	GND 3 A0110A	A0132B	1	
A0134A	GND 4 A0110A	A0109B	2	
A0432B	A0110B	A0432B	1	
A0431A	A0111A	A0431A	1	
A0426A	A0111B	A0426A	1	
A0426B	A0112A	A0426B	1	
A0407A	A0116B	A0407A	1	
A0414B	A0117A	A0414B	1	
A0413A	A0117B	A0413A	1	
A0408B	A0121A	A0408B	1	
A1426B	A0125B	A1426B	1	
A0306A	1 A0126A	A0306A	1	
A0127B	A0127B	A1310B	1	
A0129A	A0129A	A1323B	1	
A1233B	A0129B	A1233B	1	
A0332A	A0130A	A0332A	1	
A0134A	GND 1 A0132A	A0134A	1	
A0134A	GND 2 A0132A	A0132B	2	
A0134A	GND 2 A0132B	A0132A	2	
A0134A	GND 3 A0132B	A0110A	1	
A0233A	1 A0133A	A0233A	1	
A0134A	GND 1 A0134A	A0132A	1	
A0201A	GND A0201A	JA8107B	1	
A0203B	A0203B	A1704A	1	
A0204B	1 A0204B	A0308B	1	
A0205A	1 A0205A	A0612B	1	
A0205B	1 A0205B	A0309A	1	
A0206B	A0206B	A1712A	1	
A0209A	1 A0209A	A0313B	1	
A0210A	1 A0210A	A0309B	1	
A0210B	1 A0210B	A0304A	1	
A0211A	1 A0211A	A0312B	1	
A0211B	A0211B	A0327A	1	
A0214B	1 A0214B	A0305B	1	
A0215A	A0215A	A1504B	1	
A0215B	A0215B	A1503B	1	
A0216A	A0216A	A1923A	1	
A0216B	A0216B	A1923B	1	
A0217B	1 A0217B	A0305A	1	
A0222A	A0222A	A1206B	1	
A1710B	A0222B	A1710B	1	
A0223A	1 A0223A	A0633B	1	
A0224A	1 A0224A	A0632A	2	
A0225A	A0225A	A0303B	1	
A0225B	A0225B	A1730B	1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
BJ4M2, BJ402 LOGIC WIREWRAP			2	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
A0226A	A0226A	A0103A	1	
A0228A	A0228A	A0331A	1	
A0228B	A0228B	A0302A	1	
A0230A	A0230A	A0416B	1	
A0231A	A0231A	A0314A	1	
A1707A 2	A0231B	A1428B	2	
A0233A 1	A0233A	A0133A	1	
A0233A 2	A0233A	A0805A	2	
A0233B 1	A0233B	A0306B	1	
A0301A GND	A0301A	A0315B	1	
A0228B	A0302A	A0228B	1	
A0302B	A0302B	A1708A	1	
A0303A 1	A0303A	A1326B	1	
A0225A	A0303B	A0225A	1	
A0210B 1	A0304A	A0210B	1	
A0210B 2	A0304A	A0327B	2	
A0304B 1	A0304B	A1431B	1	
A0217B 1	A0305A	A0217B	1	
A0217B 2	A0305A	A0322B	2	
A0214B 1	A0305B	A0214B	1	
A0214B 2	A0305B	A0322A	2	
A0306A 1	A0306A	A0126A	1	
A0306A 2	A0306A	A0433B	2	
A0233B 1	A0306B	A0233B	1	
A0233B 2	A0306B	A0416A	2	
A0625B	A0307A	A0625B	1	
A0307B	A0307B	A0402B	1	
A0308A	A0308A	A0405B	1	
A0204B 1	A0308B	A0204B	1	
A0204B 2	A0308B	A0626B	2	
A0205B 1	A0309A	A0205B	1	
A0205B 2	A0309A	A0611B	2	
A0210A 1	A0309B	A0210A	1	
A0210A 2	A0309B	A0626A	2	
A0624B	A0310A	A0624B	1	
A0624A	A0310B	A0624A	1	
A0631B	A0311A	A0631B	1	
A0630A	A0311B	A0630A	1	
A0630B	A0312A	A0630B	1	
A0211A 1	A0312B	A0211A	1	
A0211A 2	A0312B	A0317A	2	
A0629A	A0313A	A0629A	1	
A0209A 1	A0313B	A0209A	1	
A0209A 2	A0313B	A0317B	2	
A0231A	A0314A	A0231A	1	
A0324A	A0314B	A0324A	1	
A0326BTIHI 1	A0315A	A0326B	1	
A0326BTIHI 2	A0315A	A0316A	2	
A0301A GND	A0315B	A0301A	1	
A0326BTIHI 2	A0316A	A0315A	2	
A0316B	A0316B	JA8103A	1	
A0211A 2	A0317A	A0312B	2	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
BJ4M2, BJ402 LOGIC WIREWRAP			3	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
A0211A	3 A0317A	A0625A	1	
A0209A	2 A0317B	A0313B	2	
A0209A	3 A0317B	A0632B	1	
A0321A	A0321A	JA8102A	1	
A0321B	A0321B	A0407B	1	
A0214B	2 A0322A	A0305B	2	
A0214B	3 A0322A	A0623A	1	
A0217B	2 A0322B	A0305A	2	
A0217B	3 A0322B	A0623B	1	
A0323A	A0323A	JA8106A	1	
A0323B	A0323B	JA8105A	1	
A0324A	A0324A	A0314B	1	
A0324B	A0324B	JA8101A	1	
A0706B	1 A0325A	A0617A	1	
A0706B	5 A0325A	A0325B	2	
A0706B	5 A0325B	A0325A	2	
A0326A	A0326A	A0415A	1	
A0326BTIHI	1 A0326B	A0315A	1	
A0211B	A0327A	A0211B	1	
A0210B	2 A0327B	A0304A	2	
A0210B	3 A0327B	A0622A	1	
A0328A	A0328A	A0408A	1	
A0328B	A0328B	A0427A	1	
A0329A	A0329A	A0429B	1	
A0329B	A0329B	A0411B	2	
A0330A	A0330A	A0421B	1	
A0330B	A0330B	A0423A	1	
A0228A	A0331A	A0228A	1	
A0415B	A0331B	A0415B	1	
A0332A	A0332A	A0130A	1	
A1714A	1 A0332B	A0731B	1	
A0613B	1 A0333A	A0102B	1	
A0613B	2 A0333A	A0613B	2	
A0621B	1 A0333B	A0102A	1	
A0621B	2 A0333B	A0621B	2	
A0334A GND	1 A0334A	JA8105B	1	
A0334A GND	2 A0334A	JA8106B	2	
A0401A GND	1 A0401A	A0402A	1	
A0401A GND	1 A0402A	A0401A	1	
A0401A GND	2 A0402A	A0403A	2	
A0307B	A0402B	A0307B	1	
A0401A GND	2 A0403A	A0402A	2	
A0401A GND	3 A0403A	A0405A	1	
A1721B	A0403B	A1721B	1	
A1432B	A0404A	A1432B	1	
A0401A GND	3 A0405A	A0403A	1	
A0401A GND	4 A0405A	A0406A	2	
A0308A	A0405B	A0308A	1	
A0401A GND	4 A0406A	A0405A	2	
A0401A GND	5 A0406A	A0409B	1	
A0434A GND	8 A0406B	A0421A	2	
A0407A	A0407A	A0116B	1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
BJ4M2, BJ402 LOGIC WIREWRAP			4	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
A03218	A04078	A0321B	1	
A0328A	A0408A	A0328A	1	
A04088	A04088	A0121A	1	
A17228	A0409A	A1722B	1	
A0401A GND 5	A0409B	A0406A	1	
A0401A GND 6	A0409B	A0410B	2	
A0703A 1	A0410A	A0703A	1	
A0401A GND 6	A0410B	A0409B	2	
A0401A GND 7	A0410B	A0411A	1	
A0401A GND 7	A0411A	A0410B	1	
A0401A GND 8	A0411A	A0412B	2	
A03298	A0411B	A0329B	2	
A17238	A0412A	A1723B	1	
A0401A GND 8	A0412B	A0411A	2	
A0401A GND 9	A0412B	A0413B	1	
A0413A	A0413A	A0117B	1	
A0401A GND 9	A0413B	A0412B	1	
A0401A GND10	A0413B	A0417A	2	
A12168 OR 1	A0414A	A1216B	1	
A04148	A0414B	A0117A	1	
A0326A	A0415A	A0326A	1	
A0415B	A0415B	A0331B	1	
A02338 2	A0416A	A0306B	2	
A0230A	A0416B	A0230A	1	
A0401A GND10	A0417A	A0413B	2	
A17088 1	A0417B	JA8210A	1	
A0434A GND 7	A0421A	A0422A	1	
A0434A GND 8	A0421A	A0406B	2	
A0330A	A0421B	A0330A	1	
A0434A GND 6	A0422A	A0424B	2	
A0434A GND 7	A0422A	A0421A	1	
A1716A	A0422B	A1716A	1	
A0330B	A0423A	A0330B	1	
A8012ALPB2 1	A0423B	JA8012A	1	
A8012ALPB2 2	A0423B	A1727A	2	
A1706A	A0424A	A1706A	1	
A0434A GND 5	A0424B	A0425A	1	
A0434A GND 6	A0424B	A0422A	2	
A0434A GND 4	A0425A	A0428B	2	
A0434A GND 5	A0425A	A0424B	1	
A8011ALPB3 1	A0425B	JA8011A	1	
A8011ALPB3 2	A0425B	A1728B	2	
A0426A	A0426A	A0111B	1	
A0426B	A0426B	A0112A	1	
A0328B	A0427A	A0328B	1	
A1726B	A0427B	A1726B	1	
A8014ALPB0 1	A0428A	JA8014A	1	
A8014ALPB0 2	A0428A	A1730A	2	
A0434A GND 3	A0428B	A0429A	1	
A0434A GND 4	A0428B	A0425A	2	
A0434A GND 2	A0429A	A0430A	2	
A0434A GND 3	A0429A	A0428B	1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
BJ4M2, BJ402 LOGIC WIREWRAP			5	AE

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
A0329A	A0429B	A0329A	1	
A0434A GND 1	A0430A	A0434A	1	
A0434A GND 2	A0430A	A0429A	2	
A8011BLPB1 1	A0430B	JA8011B	1	
A8011BLPB1 2	A0430B	A1731B	2	
A0431A	A0431A	A0111A	1	
A0711A	A0431B	A0711A	1	
A1922B	A0432A	A1922B	1	
A0432B	A0432B	A0110B	1	
A1216A	A0433A	A1216A	1	S/C 17 and Below
A1914A	A0433A	A1914A	1	S/C 18 and Above
A0306A 2	A0433B	A0306A	2	
A0306A 3	A0433B	A1232A	1	
A0434A GND 1	A0434A	A0430A	1	
A0601A GND 1	A0601A	JA8101B	1	
A0601A GND 2	A0601A	JA8102B	2	
A1811B	A0604A	A1811B	1	
A0721B 1	A0604B	A0721B	1	
A1832A	A0605B	A1832A	1	
A0606A	A0606A	A0711B	1	
A0606B	A0606B	A0724A	1	
A0607A	A0607A	A0732B	1	
A0607B	A0607B	A1926A	1	
A1905A	A0610A	A1905A	1	
A0610B	A0610B	A1910B	1	
A0725A	A0611A	A0725A	1	
A0205B 2	A0611B	A0309A	2	
A0205B 3	A0611B	A1221A	1	
A0713B 1	A0612A	A0713B	1	
A0205A 1	A0612B	A0205A	1	
A0205A 2	A0612B	A0727A	2	
A0613B 2	A0613B	A0333A	2	
A1026B	A0615A	A1026B	1	
A1904A	A0616A	A1904A	1	
A0616B	A0616B	A0702A	1	
A0706B 1	A0617A	A0325A	1	
A0706B 2	A0617A	A0706B	2	
A0707B 1	A0617B	A0707B	1	
A0621A	A0621A	A0717A	1	
A0621B 2	A0621B	A0333B	2	
A0210B 3	A0622A	A0327B	1	
A0210B 4	A0622A	A1224A	2	
A1833A 1	A0622B	A1004B	1	
A0214B 3	A0623A	A0322A	1	
A0214B 4	A0623A	A1228B	2	
A0217B 3	A0623B	A0322B	1	
A0217B 4	A0623B	A1229B	2	
A0624A	A0624A	A0310B	1	
A0624B	A0624B	A0310A	1	
A0211A 3	A0625A	A0317A	1	
A0211A 4	A0625A	A1230A	2	
A0625B	A0625B	A0307A	1	
A0210A 2	A0626A	A0309B	2	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
BJ4M2, BJ402 LOGIC WIREWRAP			6	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN		DESTINATION	Z LEVEL	NOTES
A0210A	3	A0626A	A1222B	1	
A0204B	2	A0626B	A0308B	2	
A0204B	3	A0626B	A1226B	1	
A0627A		A0627A	A0733A	1	
A1207A	1	A0627B	A0705B	1	
A1915B		A0628B	A1915B	1	
A0629A		A0629A	A0313A	1	
A0630A		A0630A	A0311B	1	
A0630B		A0630B	A0312A	1	
A1013B		A0631A	A1013B	1	
A0631B		A0631B	A0311A	1	
A0224A	1	A0632A	A0224A	2	
A0224A	2	A0632A	A1225A	1	
A0209A	3	A0632B	A0317B	1	
A0209A	4	A0632B	A1233A	2	
A0633A		A0633A	A0729A	1	
A0223A	1	A0633B	A0223A	1	
A0634A	GND 1	A0634A	JA8103B	1	
A0634A	GND 2	A0634A	JA8104A	2	
A0701A	GND	A0701A	JA8305A	1	
A0616B		A0702A	A0616B	1	
A1207A	2	A0702B	A0705B	2	
A1207A	3	A0702B	A1207A	1	
A0703A	1	A0703A	A0410A	1	
A0703A	2	A0703A	A1205B	2	
A0703B		A0703B	A1710A	1	
A1213B		A0704A	A1213B	1	
A0704B		A0704B	A1907B	1	
A0829B	1	A0705A	A0829B	1	
A1207A	1	A0705B	A0627B	1	
A1207A	2	A0705B	A0702B	2	
A0706A		A0706A	A0831A	1	
A0706B	2	A0706B	A0617A	2	
A0706B	3	A0706B	A1226A	1	
A0707A		A0707A	A2012A	1	
A0707B	1	A0707B	A0617B	1	
A0707B	2	A0707B	A1725B	2	
A0708A		A0708A	A2009B	1	
A0716A	1	A0709A	A0716A	2	
A1232B		A0710A	A1232B	1	
A0710B		A0710B	A1205A	1	
A0711A		A0711A	A0431B	1	
A0606A		A0711B	A0606A	1	
A0825A		A0712A	A0825A	1	
A0712B		A0712B	A2026B	1	
A0713A		A0713A	A2029B	1	
A0713B	1	A0713B	A0612A	1	
A0713B	2	A0713B	A0832A	2	
A0714A	1	A0714A	A1203B	1	
A1217A	1	A0714B	A0811B	1	
A0831B	1	A0715A	A0831B	1	
A0715B		A0715B	A1225B	1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
BJ4M2, BJ402 LOGIC WIREWRAP			7	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN		DESTINATION	Z LEVEL	NOTES
A0716A		1	A0716A	A0709A	2	
A0716A		2	A0716A	A1928A	1	
A0716B			A0716B	A1927B	1	
A0621A			A0717A	A0621A	1	
A1206A			A0717B	A1206A	1	
A0721B		1	A0721B	A0604B	1	
A0721B		2	A0721B	A0833A	2	
A0722A			A0722A	A1910A	1	
A1207B			A0722B	A1207B	1	
A0734A	GND		A0723A	A0734A	1	
A0825B		1	A0723B	A0825B	1	
A0606B			A0724A	A0606B	1	
A8304A			A0724B	JA8304A	2	
A0725A			A0725A	A0611A	1	
A1214B			A0725B	A1214B	1	
A0726A			A0726A	A1905B	1	
A1724A			A0726B	A1724A	1	
A0205A		2	A0727A	A0612B	2	
A1808B			A0727B	A1808B	1	
A1807B			A0728B	A1807B	1	
A0633A			A0729A	A0633A	1	
A0729B			A0729B	A2027B	1	
A0730A			A0730A	A1916B	1	
A0731A			A0731A	A0803B	1	
A1714A		1	A0731B	A0332B	1	
A1714A		2	A0731B	A1714A	2	
A0732A			A0732A	A0805B	1	
A0607A			A0732B	A0607A	1	
A0627A			A0733A	A0627A	1	
A0733B	OR	1	A0733B	JA8001A	1	
A0733B	OR	2	A0733B	A0802A	2	
A0734A	GND		A0734A	A0723A	1	
A0801A	GND	1	A0801A	A0808A	1	
A0733B	OR	2	A0802A	A0733B	2	
A0733B	OR	3	A0802A	A1711B	1	
A0731A			A0803B	A0731A	1	
A0233A		2	A0805A	A0233A	2	
A0732A			A0805B	A0732A	1	
A0806A			A0806A	JD9206A	1	
A0806B			A0806B	JD9206B	1	
A0807A			A0807A	JD9207A	1	
A0807B			A0807B	JD9207B	1	
A0801A	GND	1	A0808A	A0801A	1	
A0801A	GND	2	A0808A	A0808B	2	
A0801A	GND	2	A0808B	A0808A	2	
A0809A			A0809A	A2004A	1	
A0809B			A0809B	A2006A	1	
A0810A			A0810A	A2005A	1	
A0810B			A0810B	A2004B	1	
A1202A			A0811A	A1202A	1	
A1217A		1	A0811B	A0714B	1	
A1217A		2	A0811B	A1217A	2	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
BJ4M2, BJ402 LOGIC WIREWRAP			8	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
A1204A	A0812A	A1204A	1	
A1203A	A0812B	A1203A	1	
A1209B	A0813A	A1209B	1	
A1209A	A0813B	A1209A	1	
A0814A	A0814A	A2003B	1	
A1210A	A0814B	A1210A	1	
A0815A	A0815A	A2006B	1	
A0815B	A0815B	A2005B	1	
A1211B	A0822B	A1211B	1	
A0824A	A0824A	A1716B	1	
A0825A	A0825A	A0712A	1	
A0825B 1	A0825B	A0723B	1	
A0825B 2	A0825B	A1924B	2	
D93118	A0826A	JD93118	1	
D9314A	A0826B	JD9314A	1	
A0827A	A0827A	JD9309A	1	
A0827B	A0827B	JD9311A	1	
A1712B OR 1	A0828A	JA8013A	1	
A1712B OR 2	A0828A	A1712B	2	
A1724B	A0829A	A1724B	1	
A0829B 1	A0829B	A0705A	1	
A0829B 2	A0829B	A2013B	2	
A2012B	A0830A	A2012B	1	
A2014A	A0830B	A2014A	1	
A0706A	A0831A	A0706A	1	
A0831B 1	A0831B	A0715A	1	
A0831B 2	A0831B	A2032A	2	
A0713B 2	A0832A	A0713B	2	
A0713B 3	A0832A	A1827B	1	
A1931B	A0832B	A1931B	1	
A0721B 2	A0833A	A0721B	2	
A0721B 3	A0833A	A2028B	1	
D9307A	A0833B	JD9307A	1	
D9401B -5V	A1001B	A1021B	1	
A1002B-20V 1	A1002B	A1502B	1	
A1002B-20V 2	A1002B	JD9203A	2	
A1833A 1	A1004B	A0622B	1	
A1833A 2	A1004B	A1833A	2	
A1012B	A1012B	A0103B	1	
A1012B 2	A1012B	A1027B	2	
A1013B	A1013B	A0631A	1	
D9404B +5V	A1014B	JD9404B	2	
D9404B +5V	A1014B	A1034B	1	
D9401B -5V	A1021B	JD9401B	2	
D9401B -5V	A1021B	A1001B	1	
A1812B	A1022B	A1812B	1	
A1023B	A1023B	A1523B	1	
A1024B	A1024B	A1524B	1	
A1026B	A1026B	A0615A	1	
A1012B 2	A1027B	A1012B	2	
A1030B	A1030B	A1309A	1	
A1033B+20V 1	A1033B	A1533B	1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
BJ4M2, BJ402 LOGIC WIREWRAP			9	AG

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
A1033B+20V 2	A1033B	JD9203B	2	
D9404B +5V	A1034B	A1014B	1	
A1201A GND 1	A1201A	JA8204B	1	
A1201A GND 2	A1201A	JA8206B	2	
A1202A	A1202A	A0811A	1	
A1203A	A1203A	A0812B	1	
A0714A 1	A1203B	A0714A	1	
A0714A 2	A1203B	A1916A	2	
A1204A	A1204A	A0812A	1	
A0710B	A1205A	A0710B	1	
A0703A 2	A1205B	A0703A	2	
A1206A	A1206A	A0717B	1	
A0222A	A1206B	A0222A	1	
A1207A 3	A1207A	A0702B	1	
A1207B	A1207B	A0722B	1	
A1209A	A1209A	A0813B	1	
A1209B	A1209B	A0813A	1	
A1210A	A1210A	A0814B	1	
A1211B	A1211B	A0822B	1	
A1213A	A1213A	JA8204A	1	
A1213B	A1213B	A0704A	1	
A1214B	A1214B	A0725B	1	
A1925A	A1215A	A1925A	1	
A1216A	A1216A	A0433A	1	S/C 17 and Below
A1216B OR 1	A1216B	A0414A	1	
A1216B OR 2	A1216B	JA8009B	2	
A1217A 2	A1217A	A0811B	2	
A1208A	A1208A	A1914B	1	S/C 18 only
A0205B 3	A1221A	A0611B	1	
A0210A 3	A1222B	A0626A	1	
A1223B	A1223B	JA8205A	1	
A0210B 4	A1224A	A0622A	2	
A1224B	A1224B	JA8206A	1	
A0224A 2	A1225A	A0632A	1	
A0715B	A1225B	A0715B	1	
A0706B 3	A1226A	A0706B	1	
A0706B 4	A1226A	A1917A	2	
A0204B 3	A1226B	A0626B	1	
A0214B 4	A1228B	A0623A	2	
A0214B 5	A1228B	A1732A	1	
A0217B 4	A1229B	A0623B	2	
A0217B 5	A1229B	A1731A	1	
A0211A 4	A1230A	A0625A	2	
A0211A 5	A1230A	A1729B	1	
A0306A 3	A1232A	A0433B	1	
A0306A 4	A1232A	A1312B	2	
A1232B	A1232B	A0710A	1	
A0209A 4	A1233A	A0632B	2	
A0209A 5	A1233A	A1729A	1	
A1233B	A1233B	A0129B	1	
A1234A GND	A1234A	JA8205B	1	
A1030B	A1309A	A1030B	1	
A0127B	A1310B	A0127B	1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
BJ4M2, BJ402 LOGIC WIREWRAP			10	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
A0306A 4	A13128	A1232A	2	
A0306A 5	A13128	JA8207A	1	
A0129A	A13238	A0129A	1	
A0303A 1	A13268	A0303A	1	
A0303A 2	A13268	A1427B	2	
A1709B INP	A1331A	A1709B	1	
A1734A GND 1	A1331B	A1734A	1	
A14028-20V 1	A14028	A1602B	1	
A14028-20V 2	A14028	JD9201A	2	
A1403B	A14038	A1510B	1	
A1404B	A14048	A1509B	1	
A1410B	A14108	A1422B	1	
A1907A	A14128	A1907A	1	
A1414B	A14148	A1421B	1	
A1414B	A14218	A1414B	1	
A1410B	A14228	A1410B	1	
A1728ATIHI 3	A14238	A1424B	2	
A1728ATIHI 1	A14248	A1728A	1	
A1728ATIHI 3	A14248	A1423B	2	
A1426B	A14268	A0125B	1	
A0303A 2	A14278	A1326B	2	
A0303A 3	A14278	A1513B	1	
A1707A 2	A14288	A0231B	2	
A1707A 3	A14288	A1707A	1	
A1430B	A14308	A1522B	1	
A0304B 1	A14318	A0304B	1	
A0304B 2	A14318	A1512B	2	
A1432B	A14328	A0404A	1	
A1433B+20V 1	A14338	A1633B	1	
A1433B+20V 2	A14338	JD9201B	2	
A1002B-20V 1	A1502B	A1002B	1	
A0215B	A1503B	A0215B	1	
A0215A	A1504B	A0215A	1	
A1404B	A1509B	A1404B	1	
A1403B	A1510B	A1403B	1	
A0304B 2	A1512B	A1431B	2	
A0304B 3	A1512B	A1713B	1	
A0303A 3	A1513B	A1427B	1	
A0303A 4	A1513B	A1908B	2	
A1430B	A1522B	A1430B	1	
A1023B	A1523B	A1023B	1	
A1024B	A1524B	A1024B	1	
A1526B 1	A1526B	A0104A	1	
A1526B 2	A1526B	A1534A	2	
A1033B+20V 1	A1533B	A1033B	1	
A1526B 2	A1534A	A1526B	2	
A1402B-20V 1	A1602B	A1402B	1	
A1825B	A1613B	A1825B	1	
A1216B OR 4	A1614B	JA8208A	2	
A1216B OR 5	A1614B	A1711A	1	
A1823B	A1615B	A1823B	1	
A1433B+20V 1	A1633B	A1433B	1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
BJ4M2, BJ402 LOGIC WIREWRAP			11	AG

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
A1701A GND 1	A1701A	JA8203B	1	
A1701A GND 2	A1701A	JA8210B	2	
A14028-20V 3	A1702B	JD9201A	1	
D9312B-46V	A1703B	JD9312B	1	
A0203B	A1704A	A0203B	1	
A1706A	A1706A	A0424A	1	
A1707A 3	A1707A	A1428B	1	
A1707A 4	A1707A	A1727B	2	
A0302B	A1708A	A0302B	1	
A1708B 2	A1708B	JA8210A	2	
A8002B	A1709A	JA8002B	1	
A1709B INP	A1709B	A1331A	1	
A0703B	A1710A	A0703B	1	
A1710B	A1710B	A0222B	1	
A1216B OR 5	A1711A	A1614B	1	
A1216B	A1711A	A1914B	2	S/C 19 and Above
A0733B OR 3	A1711B	A0802A	1	
A0733B	A1711B	A1915A	2	S/C 18 and Above
A0206B	A1712A	A0206B	1	
A1712B OR 2	A1712B	A0828A	2	
A0306A 6	A1713A	JA8207A	2	
A0304B 3	A1713B	A1512B	1	
A0304B 4	A1713B	A1908A	2	
A1714A 2	A1714A	A0731B	2	
A8203A	A1714B	JA8203A	1	
A1716A	A1716A	A0422B	1	
A0824A	A1716B	A0824A	1	
A8303B	A1717A	JA8303B	1	
A8303A	A1717B	JA8303A	1	
A1721B	A1721B	A0403B	1	
A1722B	A1722B	A0409A	1	
A1723B	A1723B	A0412A	1	
A1724A	A1724A	A0726B	1	
A1724B	A1724B	A0829A	1	
A0707B 2	A1725B	A0707B	2	
A1728ATIHI 2	A1726A	A1728A	2	
A1726B	A1726B	A0427B	1	
A8012ALPB2 2	A1727A	A0423B	2	
A1707A 4	A1727B	A1707A	2	
A1728ATIHI 1	A1728A	A1424B	1	
A1728ATIHI 2	A1728A	A1726A	2	
A8011ALPB3 2	A1728B	A0425B	2	
A0209A 5	A1729A	A1233A	1	
A0211A 5	A1729B	A1230A	1	
A8014ALPB0 2	A1730A	A0428A	2	
A0225B	A1730B	A0225B	1	
A0217B 5	A1731A	A1229B	1	
A8011BLPB1 2	A1731B	A0430B	2	
A0214B 5	A1732A	A1228B	1	
D9312A+46V	A1732B	JD9312A	1	
A1734A GND 2	A1733A	A1734A	2	
A1734A GND 3	A1733A	JA8208B	1	
A14338+20V 3	A1733B	JD9201B	1	
A1734A GND 1	A1734A	A1331B	1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
BJ4M2, BJ402 LOGIC WIREWRAP			12	AG

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
A1734A GND 2	A1734A	A1733A	2	
102121	A1801A	JA8305B	1	
A10028-20V 3	A18028	JD9203A	1	
A18078	A18078	A0728B	1	
A18088	A18088	A0727B	1	
A18098	A18098	A1911A	1	
A18118	A18118	A0604A	1	
A18128	A18128	A1022B	1	
A18238	A18238	A1615B	1	
A18258	A18258	A1613B	1	
A0713B 3	A18278	A0832A	1	
A1832A	A1832A	A0605B	1	
A1833A 2	A1833A	A1004B	2	
A10338+20V 3	A18338	JD9203B	1	
A1901A GND 1	A1901A	A1917B	1	
A1904A	A1904A	A0616A	1	
A2015B	A1904B	A2015B	1	
A1905A	A1905A	A0610A	1	
A0726A	A1905B	A0726A	1	
A1907A	A1907A	A1412B	1	
A0704B	A1907B	A0704B	1	
A0304B 4	A1908A	A1713B	2	
A0303A 4	A1908B	A1513B	2	
A0722A	A1910A	A0722A	1	
A0610B	A1910B	A0610B	1	
A1809B	A1911A	A1809B	1	
A2014B	A1911B	A2014B	1	
A1914A	A1914A	A0433A	1	S/C 18 and Above
A1208A	A1914B	A1208A	1	S/C 18 only
A1216B	A1914B	A1711A	2	S/C 19 & Above
A0733B	A1915A	A1711B	2	S/C 18 and Above
A1915B	A1915B	A0628B	1	
A0714A 2	A1916A	A1203B	2	
A0730A	A1916B	A0730A	1	
A0706B 4	A1917A	A1226A	2	
A1901A GND 1	A1917B	A1901A	1	
A1901A GND 2	A1917B	A1921A	2	
A1901A GND 2	A1921A	A1917B	2	
A1901A GND 3	A1921A	A1921B	1	
A1901A GND 3	A1921B	A1921A	1	
A1922A	A1922A	A2010B	1	
A1922B	A1922B	A0432A	1	
A0216A	A1923A	A0216A	1	
A0216B	A1923B	A0216B	1	
A1924A	A1924A	A2011A	1	
A0825B 2	A1924B	A0825B	2	
A0825B 3	A1924B	A1925B	1	
A1925A	A1925A	A1215A	1	
A0825B 3	A1925B	A1924B	1	
A0607B	A1926A	A0607B	1	
A1927A	A1927A	A2010A	1	
A0716B	A1927B	A0716B	1	
A0716A 2	A1928A	A0716A	1	
A1931B	A1931B	A0832B	1	
A0814A	A2003B	A0814A	1	
A0809A	A2004A	A0809A	1	
A0810B	A2004B	A0810B	1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
BJ4M2, BJ402 LOGIC WIREWRAP			13	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
A0810A		A2005A	A0810A 1	
A0815B		A2005B	A0815B 1	
A0809B		A2006A	A0809B 1	
A0815A		A2006B	A0815A 1	
A0708A		A2009B	A0708A 1	
A1927A		A2010A	A1927A 1	
A1922A		A2010B	A1922A 1	
A1924A		A2011A	A1924A 1	
A2011B		A2011B	JD9305B 1	
A0707A		A2012A	A0707A 1	
A2012B		A2012B	A0830A 1	
A0829B	2	A2013B	A0829B 2	
A2014A		A2014A	A0830B 1	
A2014B		A2014B	A1911B 1	
A2015A		A2015A	JD9305A 1	
A2015B		A2015B	A1904B 1	
A0712B		A2026B	A0712B 1	
A0729B		A2027B	A0729B 1	
A0721B	3	A2028B	A0833A 1	
A0713A		A2029B	A0713A 1	
A2031B		A2031B	JD9306B 1	
A0831B	2	A2032A	A0831B 2	
A2032B		A2032B	JD9306A 1	
A2034A GND	1	A2034A	JD9304A 1	
A2034A GND	2	A2034A	JD9304B 2	
A0733B OR	1	JA8001A	A0733B 1	
D9407A GND	1	JA8001B	JD9407A 1	
D9407B GND	2	JA8001B	JD9407B 2	
A8002B		JA8002B	A1709A 1	
A8005A		JA8005A	JA8306B 1	
D9303A-GND		JA8007A	JD9303A 1	
A1216B OR	2	JA8009B	A1216B 2	
A1216B OR	3	JA8009B	JA8208A 1	
D9405A +5V	1	JA8010A	JD9405A 1	
D9405A +5V	2	JA8010A	JD9405B 2	
A8011ALPB3	1	JA8011A	A0425B 1	
A8011BLPB1	1	JA8011B	A0430B 1	
A8012ALPB2	1	JA8012A	A0423B 1	
A1712B OR	1	JA8013A	A0828A 1	
A8014ALPB0	1	JA8014A	A0428A 1	
A0324B		JA8101A	A0324B 1	
A0601A GND	1	JA8101B	A0601A 1	
A0321A		JA8102A	A0321A 1	
A0601A GND	2	JA8102B	A0601A 2	
A0316B		JA8103A	A0316B 1	
A0634A GND	1	JA8103B	A0634A 1	
A0634A GND	2	JA8104A	A0634A 2	
A0323B		JA8105A	A0323B 1	
A0334A GND	1	JA8105B	A0334A 1	
A0323A		JA8106A	A0323A 1	
A0334A GND	2	JA8106B	A0334A 2	
A0201A GND		JA8107B	A0201A 1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
BJ4M2, BJ402 LOGIC WIREWRAP			14	U

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
D9401B -5V	JA8201B	JD9401B	1	
D9302B-20V	JA8202B	JD9302B	1	
A8203A	JA8203A	A1714B	1	
A1701A GND 1	JA8203B	A1701A	1	
A1213A	JA8204A	A1213A	1	
A1201A GND 1	JA8204B	A1201A	1	
A1223B	JA8205A	A1223B	1	
A1234A GND	JA8205B	A1234A	1	
A1224B	JA8206A	A1224B	1	
A1201A GND 2	JA8206B	A1201A	2	
A0306A 5	JA8207A	A1312B	1	
A0306A 6	JA8207A	A1713A	2	
A1216B OR 3	JA8208A	JA8009B	1	
A1216B OR 4	JA8208A	A1614B	2	
A1734A GND 3	JA8208B	A1733A	1	
A1708B 1	JA8210A	A0417B	1	
A1708B 2	JA8210A	A1708B	2	
A1701A GND 2	JA8210B	A1701A	2	
D9301A+28V	JA8212B	JD9301A	1	
D9302A+20V	JA8213B	JD9302A	1	
D9404B +5V	JA8214B	JD9404B	1	
A8303A	JA8303A	A1717B	1	
A8303B	JA8303B	A1717A	1	
A8304A	JA8304A	A0724B	2	
A8304B	JA8304B	JD9308A	1	
A0701A GND	JA8305A	A0701A	1	
102121	JA8305B	A1801A	1	
A8306A	JA8306A	JD9307B	1	
A8005A	JA8306B	JA8005A	1	
A1402B-20V 2	JD9201A	A1402B	2	
A1402B-20V 3	JD9201A	A1702B	1	
A1433B+20V 2	JD9201B	A1433B	2	
A1433B+20V 3	JD9201B	A1733B	1	
A1002B-20V 2	JD9203A	A1002B	2	
A1002B-20V 3	JD9203A	A1802B	1	
A1033B+20V 2	JD9203B	A1033B	2	
A1033B+20V 3	JD9203B	A1833B	1	
A0806A	JD9206A	A0806A	1	
A0806B	JD9206B	A0806B	1	
A0807A	JD9207A	A0807A	1	
A0807B	JD9207B	A0807B	1	
D9308BPK OUT	JD9208B	JD9308B	1	
D9209BPK IN	JD9209B	JD9309B	1	
D9310BHOLD	JD9210B	JD9310B	1	
D9301A+28V	JD9301A	JA8212B	1	
D9302A+20V	JD9302A	JA8213B	1	
D9302B-20V	JD9302B	JA8202B	1	
D9303A-GND	JD9303A	JA8007A	1	
A2034A GND 1	JD9304A	A2034A	1	
A2034A GND 2	JD9304B	A2034A	2	
A2015A	JD9305A	A2015A	1	
A2011B	JD9305B	A2011B	1	
A2032B	JD9306A	A2032B	1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
BJ4M2, BJ402 LOGIC WIREWRAP			15	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
A20318	JD93068	A20318	1	
D93078	JD93078	A08338	1	
A83068	JD93078	JA8306A	1	
A83048	JD93088	JA8304B	1	
D93088PK OUT	JD93088	JD92088	1	
A08278	JD93098	A0827A	1	
D92098PK IN	JD93098	JD9209B	1	
D93108HOLD	JD93108	JD9210B	1	
A08278	JD93118	A0827B	1	
D93118	JD93118	A0826A	1	
D93128+46V	JD93128	A1732B	1	
D93128-46V	JD93128	A1703B	1	
D93148	JD93148	A08268	1	
D94018 -5V	JD94018	JA8201B	1	
D94018 -5V	JD94018	A1021B	2	
D94048 +5V	JD94048	A1014B	2	
D94048 +5V	JD94048	JA8214B	1	
D94058 +5V 1	JD94058	JA8010A	1	
D94058 +5V 2	JD94058	JA8010A	2	
D94078 GND 1	JD94078	JA8001B	1	
D94078 GND 2	JD94078	JA8001B	2	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
MAIN HARNESS (SHIELDED Ref. 77448501)		MAIN HARN (S)	1 of 3	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
1A	A2PA81-1A	A3PE5-1A	4		
1B	A2PA81-1B	A3PE5-1B	0		GND
2A	A2PA81-2A	A3PE5-2A	4		
2B	A2PA81-2B	A3PE5-2B	0		GND
3A	A2PA81-3A	A3PE5-3A	4		
3B	A2PA81-3B	A3PE5-3B	0		GND
4A	A2PA81-4A	A3PE5-4A	4		
4B	A2PA81-4B	A3PE5-4B	0		GND
5A	A2PA81-5A	A3PE5-5A	4		
5B	A2PA81-5B	A3PE5-5B	0		GND
6A	A2PA81-6A	A3PE5-6A	4		
6B	A2PA81-6B	A3PE5-6B	0		GND
7	A2PA82-1B	A3PE1-1B	6		-5V
8	A2PA82-2B	A3PE1-2B	6		-20V
9A	A2PA82-3A	A3PE1-3A	0		
9B	A2PA82-3B	A3PE1-3B	4		GND
10A	A2PA82-4A	A3PE1-4A	0		
10B	A2PA82-4B	A3PE1-4B	4		GND
11A	A2PA82-5A	A3PE1-5A	4		
11B	A2PA82-5B	A3PE1-5B	0		GND
12A	A2PA82-6A	A3PE1-6A	4		
12B	A2PA82-6B	A3PE1-6B	0		GND
13A	A2PA82-7A	A3PE1-7A	4		
13B	A2PA82-7B	A3PE1-7B	0		GND14A
14A	A2PA82-8A	A3PE1-8A	4		
14B	A2PA82-8B	A3PE1-8B	0		GND
15	A2PA82-12B	A3PE1-12B	2		+28V
16	A2PA82-13B	A3PE1-13B	2		+20V
17	A2PA82-14B	A3PE1-14B	2		+5V
18A	A2PA82-10B	A3PE1-10B	0		GND
18B	A2PA82-10A	A3PE1-10A	4		FAULT
19A	A2PA83-3A	A3P3-1	0		SPEED
19B	A2PA83-3B	A3P3-2	4		GND
23	A2PA83-6A	A3S4-COM	0		PACK ON

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
MAIN HARNESS (SHIELDED)		MAIN HARN (S)	2	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
24	A2PA83-6B	A3S1-NO	0		PACK COVER
25A	A2PB13-34A	A3PE2-2A	SHLD		GND WIRE, 24GA BLK
25B	A2PB13-31B	A3PE2-4A	9		GND
25C	A2PB13-31A	A3PE2-4B	6		FLT
29A	A2PB13-30A	A3PE2-2B	SHLD		GND WIRE, 24 GA BLK
29B	A2PB13-29A	A3PE2-3B	9		WRT DATA
29C	A2PB13-29B	A3PE2-3A	6		
31A	A2PA14-9B	A3PE3-2B	SHLD		GND WIRE, 24 GA. BLK
31B	A2PA14-7B	A3PE3-3A	9		RD DATA
31C	A2PA14-8B	A3PE3-3B	6		
32A	A2PA14-12A	A3PE3-1B	0		GND
32B	A2PA14-12B	A3PE3-1A	4		RD ADD MRK EN
33A	A2PA14-10B	A3PE3-4A	4		MISSING ADDRESS
33B	A2PA14-14B	A3PE3-4B	0		
34A	A3C1-+	A3PE1-9A	4		
34B	A3C1--	A3PE1-9B	0		GND
35	A3S4-NO	A3S1-COM	0		
39	A2PA81-12A				HI RETEN. DUMMY PIN
40	A2PA81-12B				HI RETEN. DUMMY PIN
41	A2PA81-13A				HI RETEN. DUMMY PIN
42	A2PA81-13B				HI RETEN. DUMMY PIN
43	A2PA83-12A				HI RETEN. DUMMY PIN
44	A2PA83-12B				HI RETEN. DUMMY PIN
45	A2PA83-13A				HI RETEN. DUMMY PIN
46	A2PA83-13B				HI RETEN. DUMMY PIN
47	A2PB13-21A				HI RETEN. DUMMY PIN
48	A2PB13-21B				HI RETEN. DUMMY PIN
49	A2PB13-22A				HI RETEN. DUMMY PIN
50	A2PB13-22B				HI RETEN. DUMMY PIN
51	A2PB14-2A				HI RETEN. DUMMY PIN
52	A2PB14-2B				HI RETEN. DUMMY PIN
53	A2PB14-3A				HI RETEN. DUMMY PIN
54	A2PA14-3B				HI RETEN. DUMMY PIN
55A	A2PA83-4B	A3S6-NC	2		HDS LDD

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
MAIN HARNESS (SHIELDED)		MAIN HARN (S)	3	A

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
55B	A2PA83-5A	A3S6-C	0		
55C	A2PA83-4A	A3S6-NO	9		
55D	A2PA83-5B	FLOATING	SHLD		GND

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
MAIN HARNESS (UNSHIELDED) (REF. 83255800)		MAIN HARN (US)	1 of 2	D

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
1	A2PD93-1A	A1P4-U	2		+28V
2	A2PD93-2A	A1P4-T	2		+20V
3	A2PD93-2B	A1P4-S	6		-20V
4	A2PD93-3A	A1P4-V	4		INTLKS
5A	A2PD93-4A	A1P4-H	SHLD		SHLD
5B	A2PD93-5A	A1P4-J	9		
5C	A2PD93-5B	A1P4-K	0		GND
6A	A2PD93-4B	A1P4-L	SHLD		SHLD
6B	A2PD93-6A	A1P4-M	9		
6C	A2PD93-6B	A1P4-N	0		GND
7	A2PD93-8A	A1P4-E	0		HDS LDD
8	A2PD93-9A	A1P4-C	4		PULL MOT. RLY
9	A2PD93-11A	A1P4-F	4		PULL SPEED RLY
10	A2PD93-12A	A1P4-P	2		+46V
11	A2PD93-12B	A1P4-R	6		-46V
12	A2PD93-14A	A1P4-D	4		K3 CONTACTS
15A	A2PB18-34A	A3P8-1A	SHLD		GND Wire, 24 GA Blk.
15B	A2PB18-23B	A3P8-1B	9		
15C	A2PB18-25B	A3P8-2B	6		
16A	A2(±5 REG) -GND	A3P8-3A	SHLD		GND
16B	A2(±5 REG) +10	A3P8-4B	2		+10V
16C	A2(±5 REG) -10	A3P8-3B	0		-10V
17A	A2PB20-34A	A3J4- DECK GND	SHLD		
17B	A2PB20-27A	A3J4-3	0		COMM
17C	A2PB20-25B	A3J4-1	2		COMP VEL X DUCER
17D	A2PB20-26A	A3J4-2	9		VELOC
18	A2LGC BPNL -GND BUSS	A3DECK CHS-GND	INSUL BRAID		
19	A1P3-1	A2LGC BPNL -20 BUSS	2		
20	A1P3-2	A2LGC BPNL -20BUSS	6		
25	A1P3-3	A2LGC BPNL -GND BUSS	0		
26	A1P3-4	*	2		*A2 ±5V REG CARD-+10 BUSS
27	A1P3-5	*	0		*A2 ±5V REG CARD-GND BUSS
28	A1P3-6	*	6		*A2 ±5V REG CARD--10V
29	A1P6-2	A3TB1-2	1		VOICE COIL

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
MAIN HARNESS (UNSHIELDED)		MAIN HARN(US)	2	D

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
30	A1P6-1	A3TB1-1	4		
31	A2PD93-7B	A1P4-X	4		
32	A2PD93-8B	A1P4-W	4		LOCAL/REMOTE
33	A2PD93-9B	A1P4-Y	4		
34	A2PD93-10B	A1P4-Z	4		
35	A2PD93-11B	A1P4-AA	4		
39	A2PB18-21A				HI RETEN. DUMMY PIN
40	A2PB18-21B				HI RETEN. DUMMY PIN
41	A2PB18-22A				HI RETEN. DUMMY PIN
42	A2PB18-22B				HI RETEN. DUMMY PIN
43	A2PB18-31A				HI RETEN. DUMMY PIN
44	A2PB18-31B				HI RETEN. DUMMY PIN
45	A2PB18-32A				HI RETEN. DUMMY PIN
46	A2PB18-32B				HI RETEN. DUMMY PIN
47	A2PB20-21A				HI RETEN. DUMMY PIN
48	A2PB20-21B				HI RETEN. DUMMY PIN
49	A2PB20-22A				HI RETEN. DUMMY PIN
50	A2PB20-22B				HI RETEN. DUMMY PIN
51	A2PB20-31A				HI RETEN. DUMMY PIN
52	A2PB20-31B				HI RETEN. DUMMY PIN
53	A2PB20-32A				HI RETEN. DUMMY PIN
54	A2PB20-32B				HI RETEN. DUMMY PIN
55	A3L1-R	A1P4-A	2		TOP COVER SOLENOID
56	A3L1-L	A1P4-B	0		TOP COVER SOLENOID
57	A2PD93-7A	A1P4-B	0		

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
FINAL GROUND (REF: 77449500)		FINAL GND	1 OF 1	

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	WIRE COLOR	Z LEVEL	NOTES
1	RIGHT SIDE PANEL	FRAME			
2	LEFT SIDE PANEL	FRAME			
3	FRONT DOOR	FRAME			
4	REAR DOOR	FRAME			
5	TOP COVER	FRAME			
6	PACK ACCESS COVER	FRAME			
7	A.C.WHITE BLOCK	FRAME			
8	A.C.WHITE BLOCK	P.S.A.C FRAME			
9	LOGIC BACKPANEL	D.C.WHITE BLOCK			
	DC GND				
10	A.C.WHITE BLOCK	D.C.WHITE BLOCK			
11	P.S.D.C GROUND-TB1 2	D.C.WHITE			
12	LOGIC CHASSIS	FRAME			

SECTION 5

PARTS DATA

INTRODUCTION

This section provides an Illustrated Parts Breakdown and a Spare Parts List for all the storage module drives (SMDs) listed in the preface of this manual.

Information in this section is divided into two major categories as follows:

Illustrated Parts Breakdown - This breakdown provides part number information for all field replaceable items.

Spare Parts List - This is a list of recommended spare parts.

NOTE

Parts listed in the illustrated parts breakdown, but not in the spare parts list, may be long lead time items subject to significant delays.

SECTION 5A

ILLUSTRATED PARTS BREAKDOWN

GENERAL

The Illustrated Parts Breakdown provides the information needed to order field replaceable parts. This information is presented in assembly illustrations and parts lists.

The symbols used in this section are explained in the following paragraphs along with a definition of some of the abbreviations used. Refer to the front of this manual for a complete list of abbreviations.

The illustrated parts breakdown is structured as follows. Each major assembly is shown in an exploded view and assigned a figure number. More than one illustration per figure number may be required for a complex assembly. In this case, the illustrations are titled figure X (sheet 1); figure X (sheet 2), etc. The parts shown on the illustrations are numbered. A parts list for each illustration begins on the page facing the illustration. The numbers on the figure correspond to the index numbers on the associated part list. In some cases, the parts list will have more than one page for the corresponding sheet of a figure.

The Illustrated Parts Breakdown is divided into four columns:

Index Number Column - The numbers given in this column correspond to the numbers shown on the illustration. When more than one entry is given for a particular index number, the use of each part is defined in the Notes column. Items may be listed without index numbers, and are mentioned for reference only. These items do not appear on the illustration.

Part Number Column - This column provides the eight digit number by which a part may be ordered. There are several conditions when there will be an incomplete number or no number at all. In some cases the last two digits (referred to as tab numbers) may be shown as XX. This situation exists when an assembly changes tab numbers rapidly in the course of normal factory build. If it is necessary to order an assembly catalogued in this manner, the actual part number can be found on the part number label attached to the assembly. If the actual part number cannot be determined, be sure to include on the order the series code of the machine and a listing of all the change orders installed. If the last two digits are shown as **, the tab number can be determined by referring to table XXX (Color Code Chart). NFR in the part number column indicates that an assembly is not field replaceable. If repair of the NFR item is necessary, refer to the maintenance section of this manual for further information.

The symbol ## in the part number column indicates that the item is a recommended spare part, and that the part number is located in the Spare Parts List section. To find the part number refer to the instructions for using the Spare Parts List (section 3B).

Description Column - This column gives the name and a brief description of each part and assembly. The relationship of parts and assemblies is shown within the column by means of indentation. When an item is indented further than the previous item, it is part of the previous item.

When the attaching hardware or associated parts for an item cannot be shown on the illustration, the note (ATTACHING PARTS) or (ASSOCIATED PARTS) appears in the Description column. All attaching/associated parts for the previously listed part or assembly are listed beneath this note and are separated from the rest of the parts list by the symbol ---*---.

When necessary, items are identified as being right side or left side. Right and left are determined by facing the front (pack end) of the drive.

Notes Column - This column defines any multiple part number entries for a single index number. Multiple entries may be necessary to identify differences such as machine configuration (for example, whether the part is for a 50 Hz or 60 Hz unit) or to track history (for example, the part issued only on a series code XX unit with Engineering Change Order (ECO) XXXX installed). Information that is unique to one particular equipment or application will also be noted in this column.

Color Code Chart - The color code chart (table XXX), used in conjunction with the equipment configuration chart (see front of this manual) and the parts list, will provide the eight-digit number needed to order painted parts for all SMD units covered by this manual.

First, determine the correct color code by referring to the equipment configuration chart. Then, find that code in the color code column of table XXX. Following the code are the tab numbers for each painted part. If an entire assembly is being replaced, use the two digits listed under ASSY TAB. If just the piece part is needed use the two digits listed under PC PT TAB. The parts list contains the first six digits of each part number plus the symbol ** (for example 775601**). The complete number is obtained by substituting the tab numbers in place of the symbol **.

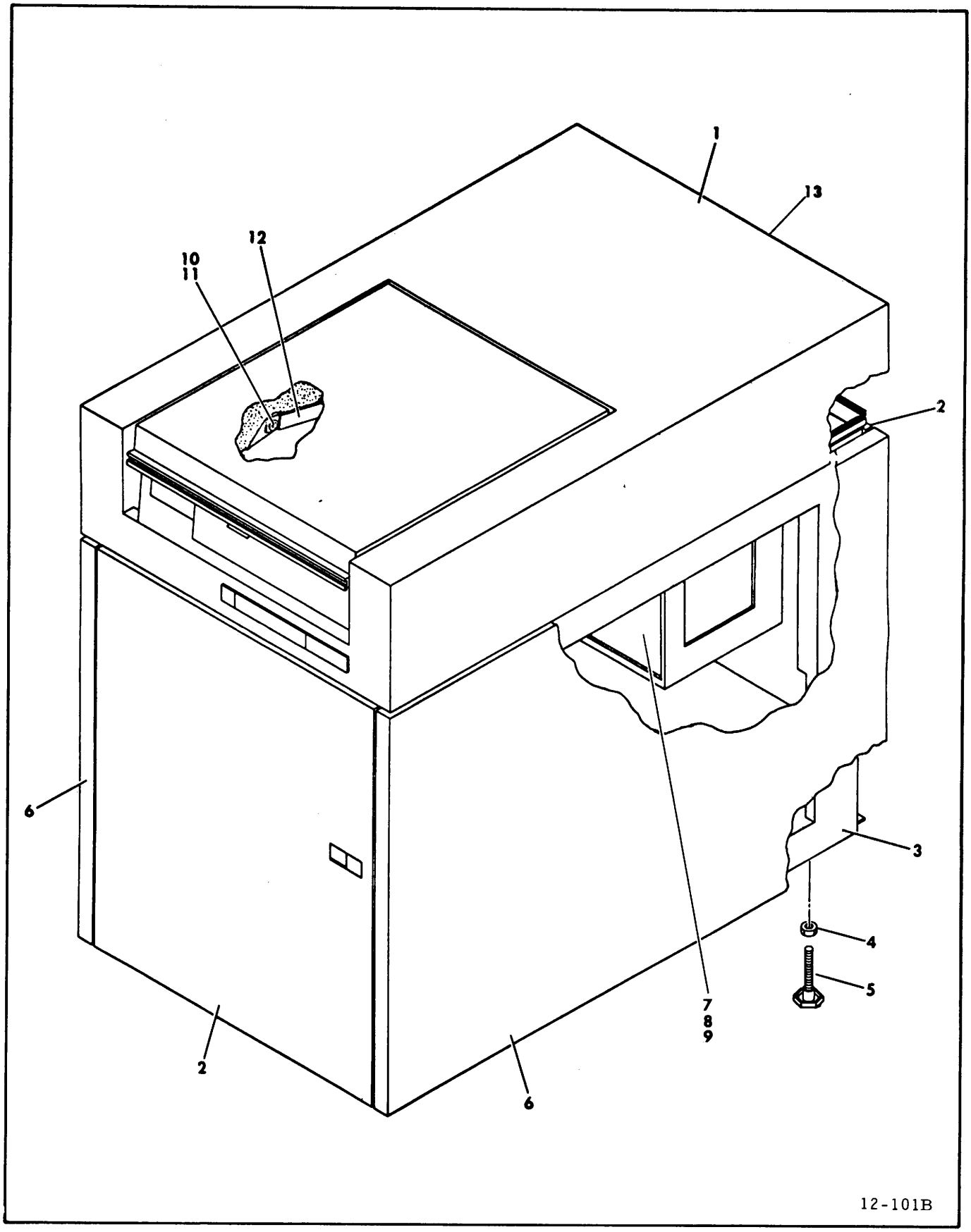


FIGURE 5-1. FINAL ASSEMBLY

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-1-	774452XX	FINAL ASSEMBLY	
1		TOP COVER ASSEMBLY (See Figure 5-3)	
		(ATTACHING PARTS)	
	93741292	SCREW, Machine, Flat Head, 10-24 x .500	
	75173305	PLATE, Nut	
		---*---	
2		DOOR ASSEMBLY (See Figure 5-4)	
		(ATTACHING PARTS)	
	70948500	PIN, Hinge	
		---*---	
3		FINAL FRAME ASSEMBLY (See Figure 5-5)	
4	93006035	NUT, Jam, Hex, 1/2-13	
5	93697014	LEVELER	
6		SIDE PANEL ASSEMBLY (See Figure 5-2)	
7	75177200	COVER, Logic Frame	
8	94317703	FASTENER, Wing	
	943724XX	KEY, Insert, Programmable (Tabs 00-15)	Packed separately and shipped with unit. Key number corresponds to part number tab.
9	94317900	RETAINER, Split Ring	
10	94047074	WASHER, Special	
11	92033069	RING, Retaining	
12	77454200	BAR, Support	
13	94238913	LABEL, CSA location	Used on most 60 Hz units
		(For information on shipping hardware, see Section 1 (Installation and Checkout).	

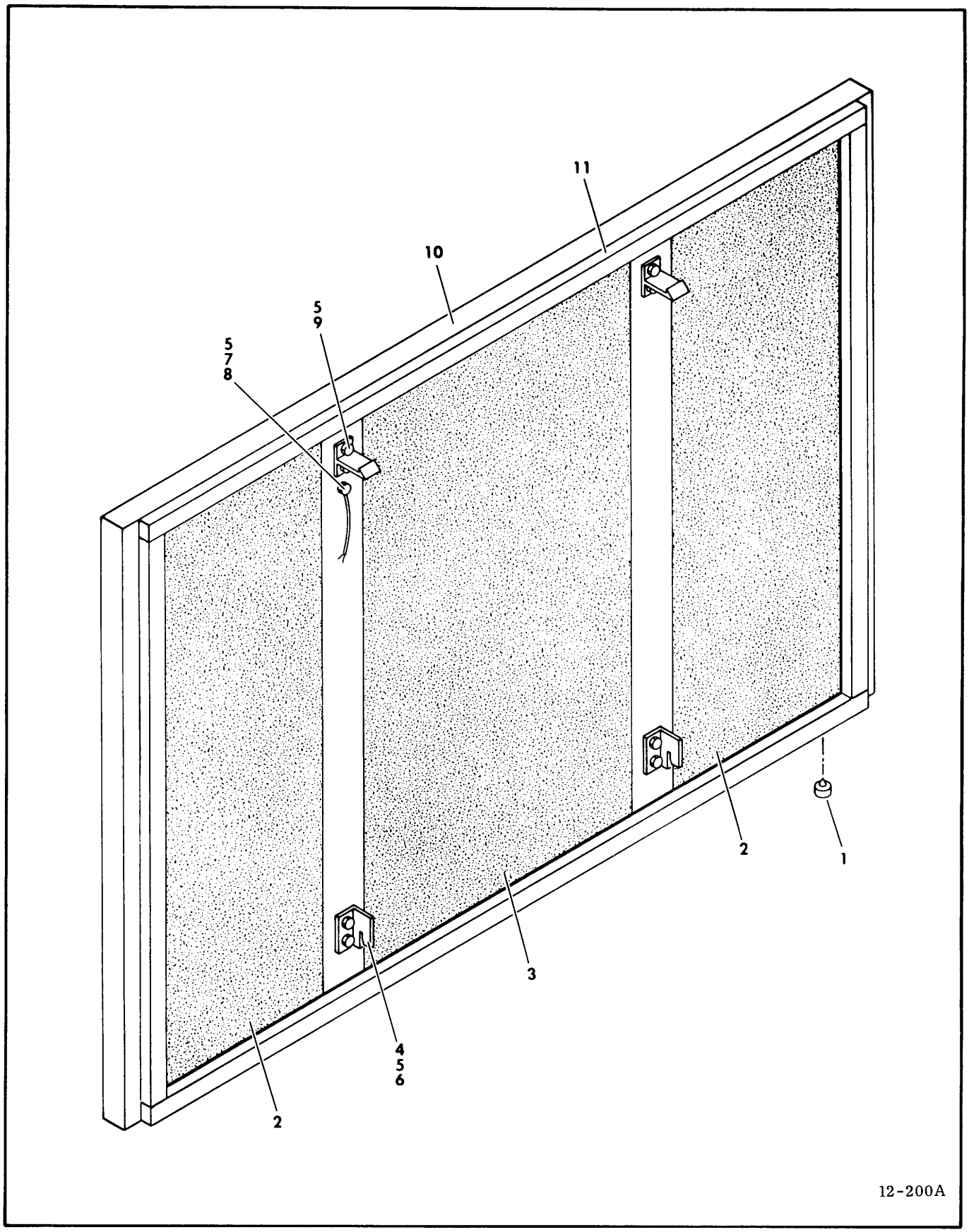


FIGURE 5-2. SIDE PANEL ASSEMBLY

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-2-	774466**	SIDE PANEL ASSEMBLY	See Note
1	92633021	BUMPER, Grommet Type	
2	77446806	PANEL, Foam, Acoustical	
3	77446805	PANEL, Foam, Acoustical	
4	75194501	BRACKET, Support	
5	93592238	SCREW, Self Tapping, Hex Head, 10-24 x .375	
6	10125607	WASHER, Flat, 10	
7	94281432	CABLE, Ground	
8	10126403	WASHER, Lock, External Tooth, 10	
9	77441800	CATCH, Side Panel	
10	774426**	PANEL, Side	See Note
11	94001034	TAPE, Foam	
		Note: See color chart at the end of this section for tab number.	

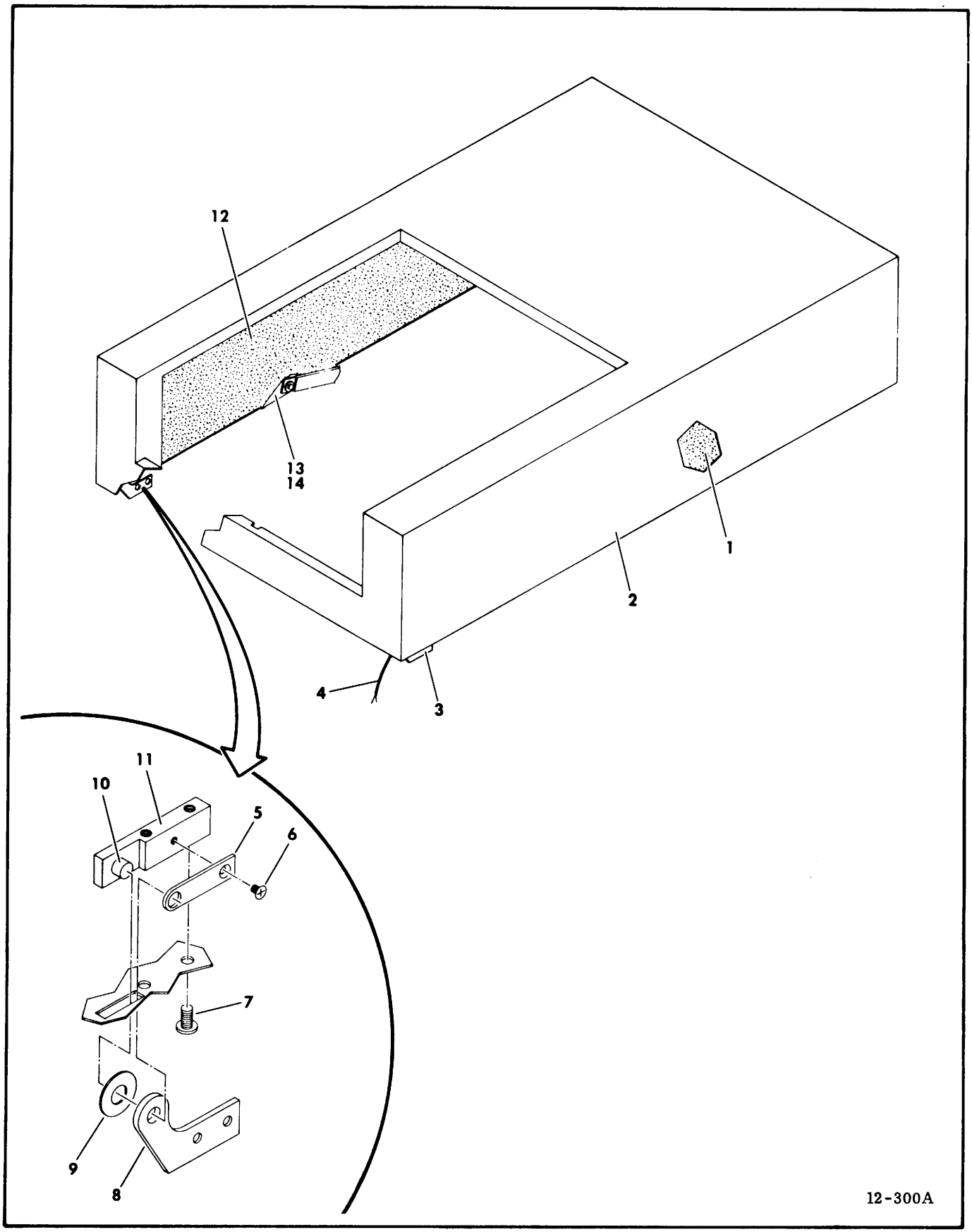


FIGURE 5-3. TOP COVER ASSEMBLY

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-3-	774464**	TOP COVER ASSEMBLY	See Note
1	77446810	PANEL, Foam, Acoustical	
2	472935**	COVER, Top	See Note
3	76533400	HINGE, Top Cover, Right	
4	94281405	CABLE, Ground	
		(ATTACHING PARTS)	
	93592234	SCREW, Self Tapping, Hex Head, 10-24 x .250	
	10126403	WASHER, Lock, External Tooth, 10	
		- - - * - - -	
5	76533300	PLATE, Wear	
6	10125711	SCREW, Cross Recessed, Flat Head, 6-32 x .188	
7	93187314	SCREW, Button Head	
8	76533401	HINGE, Top Cover, Left	
9	93564028	WASHER, Nylon	
10	76372900	SHAFT, Hinge Bearing	
11	76533100	BASE, Hinge, Top Cover	
12	77446809	PANEL, Foam, Acoustical	
13	77454300	PIVOT, Support Bar	
14	9203306º	RING, Retaining	

Note: See color chart at the end of this section for tab number.

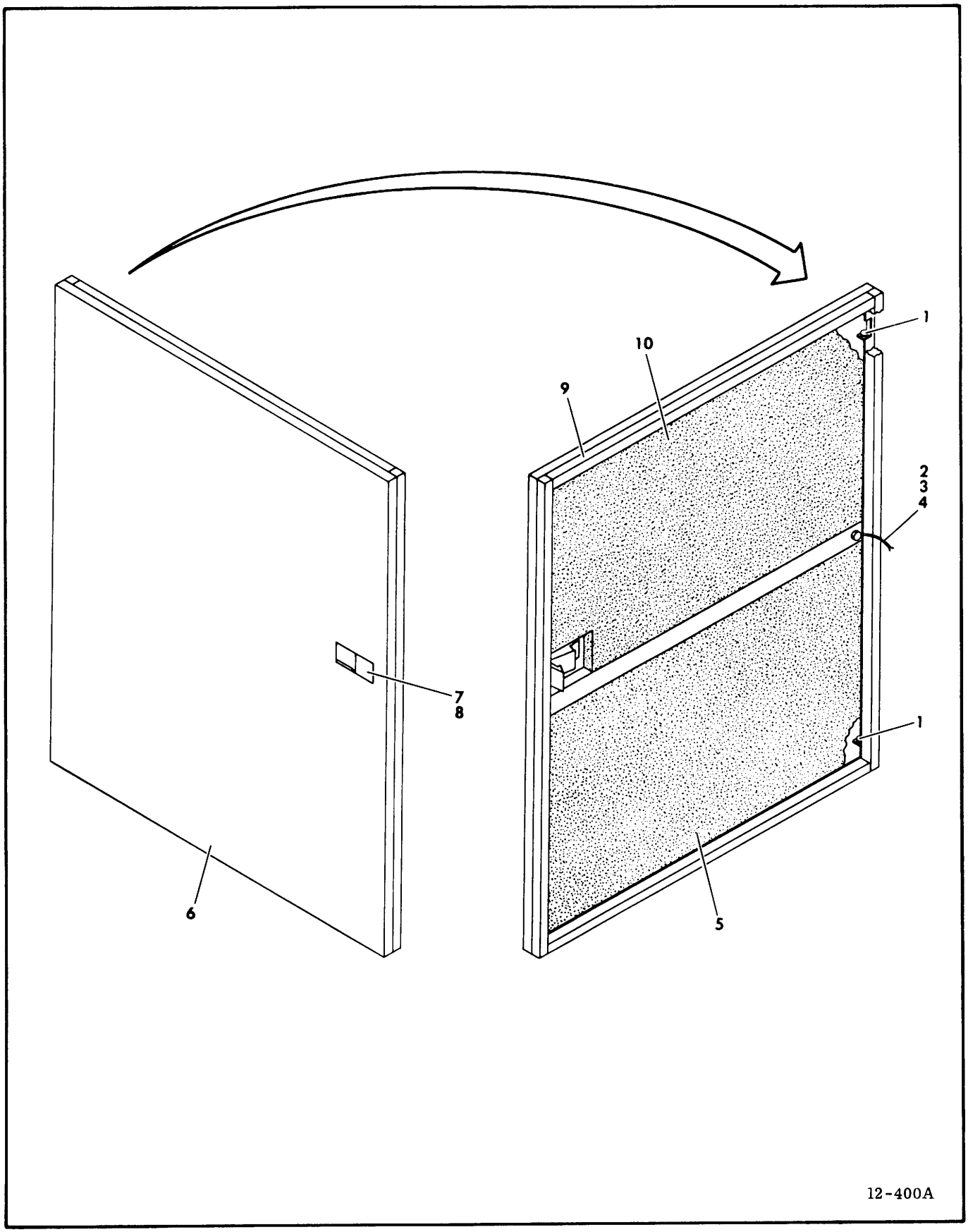


FIGURE 5-4. DOOR ASSEMBLY

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-4-	774467**	DOOR ASSEMBLY	See Note
1	92373003	NYLINER, Snap-In	
2	94281405	CABLE, Ground	
3	93592234	SCREW, Self Tapping, Hex Head	
4	10126403	WASHER, Lock, External Tooth, 10	
5	77446807	PANEL, Foam Acoustical	
6	774427**	DOOR	See Note
7	94224907	SPACER, Slam Latch	
8	94221400	LATCH, Flush	
9	94001004	TAPE, Foam	
10	77446808	PANEL, Foam, Acoustical	
		Note: See color chart at the end of this section for tab number.	

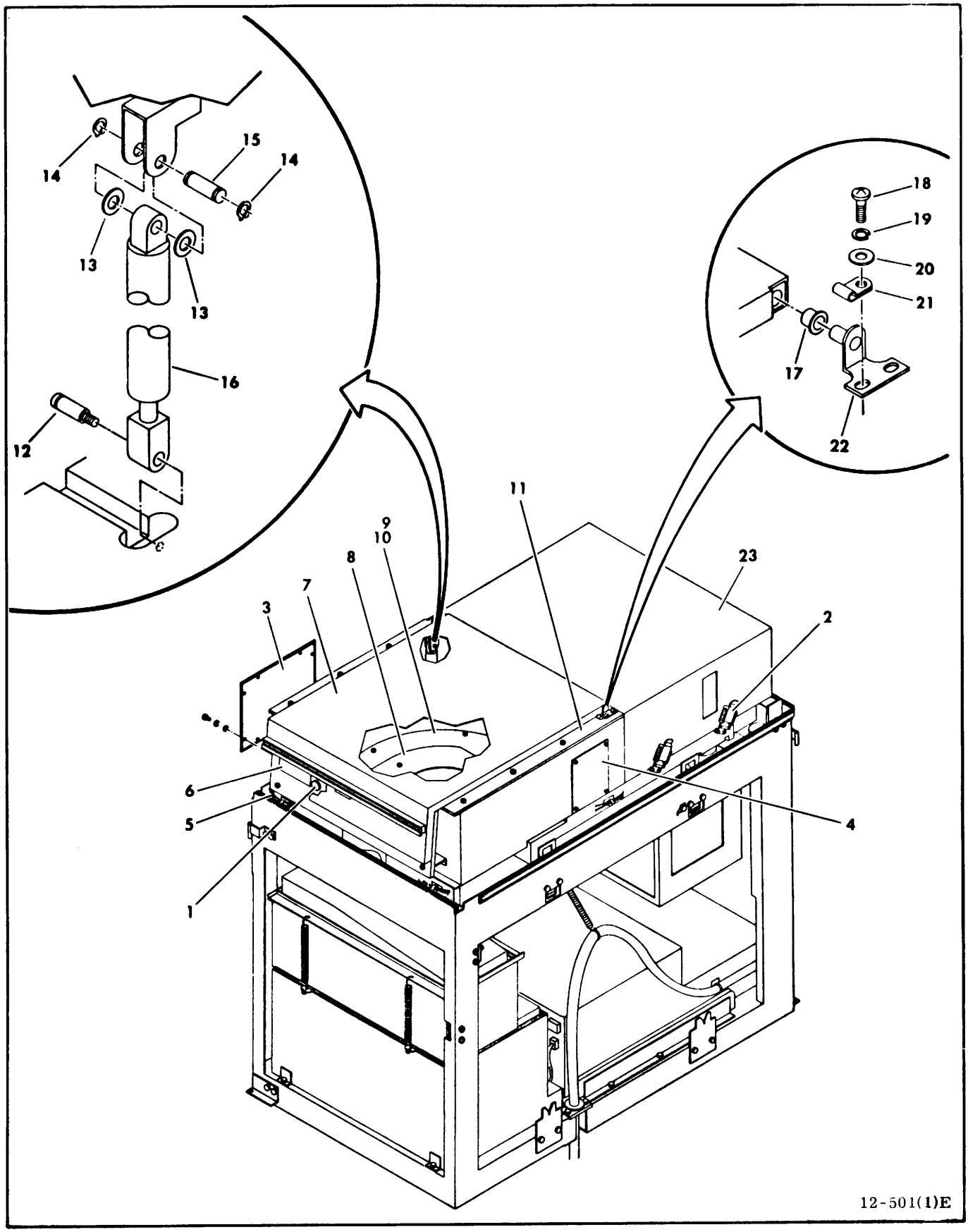


FIGURE 5-5. FINAL FRAME ASSEMBLY (SHEET 1 OF 3)

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-5-	774503XX	FINAL FRAME ASSEMBLY (Sheet 1 of 3)	
1	94279416	BUTTON, Plug	
2	94356902	CATCH, Spring Compression	
		(ATTACHING PARTS)	
	10127111	SCREW, Pan Head, 6-32 x .250	
3	77456300	COVER SIDE, Shroud	
		(ATTACHING PARTS)	
	94001100	TAPE, Foam Head, Machine	
	10127112	SCREW, Pan Head, Machine, 6-32 x .313	
	10125605	WASHER, Plain, 6	
	10125803	WASHER, Spring Lock, 6	
4	77456200	WINDOW - Shroud	
		(ATTACHING PARTS)	
	10127114	SCREW, Pan Head, Machine, 6-32 x .500	
	10125605	WASHER, Plain, 6	
	10125803	WASHER, Spring Lock, 6	
5	77448200	CONTROL PANEL HARNESS ASSEMBLY	A2PA80 to A4P201
		(ASSOCIATED PARTS)	
	94261810	BODY, Connector	
	94245602	CONTACT, Crimp	
		- - - * - - -	
6		CONTROL PANEL SWITCH ASSEMBLY (See Figure 5-9)	
7		PACK ACCESS COVER ASSEMBLY (See Figure 5-8)	
8	76041100	COVER, Parking Brake	
		(ATTACHING PARTS)	
	10127112	SCREW, Machine, Pan Head, 6-32 x .313	
	10125803	WASHER, Lock, Spring, 6	
	10125605	WASHER, Flat, 6	
		- - - * - - -	
9	94001100	TAPE, Foam	
10	83228800	SHROUD, Pack	
		(ATTACHING PARTS)	
	10127112	SCREW, Machine, Pan Head, 6-32 x .313	
	10125803	WASHER, Lock, Spring, 6	
	10125605	WASHER, Flat, 6	
		- - - * - - -	
11		SHROUD COVER ASSEMBLY (See Figure 5-6)	
		(ATTACHING PARTS)	
	92748198	SCREW, Machine, 8-32 x .313	
		- - - * - - -	
12	73229005	STUD	
13	93564002	WASHER, Nylon	
14	92033221	RING, Retaining	
15	77442800	PIN, Pivot, Cover	
16	94354904	SPRING, Gas	
17	93847002	BEARING, Flanged	
18	10127123	SCREW, Machine, Pan Head 8-32 x .500	
19	10125804	WASHER, Lock, Spring, 8	
20	93211108	WASHER, Flat, 8	
21	92602001	CLAMP, Cable, Nylon	
22	77442500	HINGE, Cover, Pack Access	
23	77446300	DECK COVER ASSEMBLY	

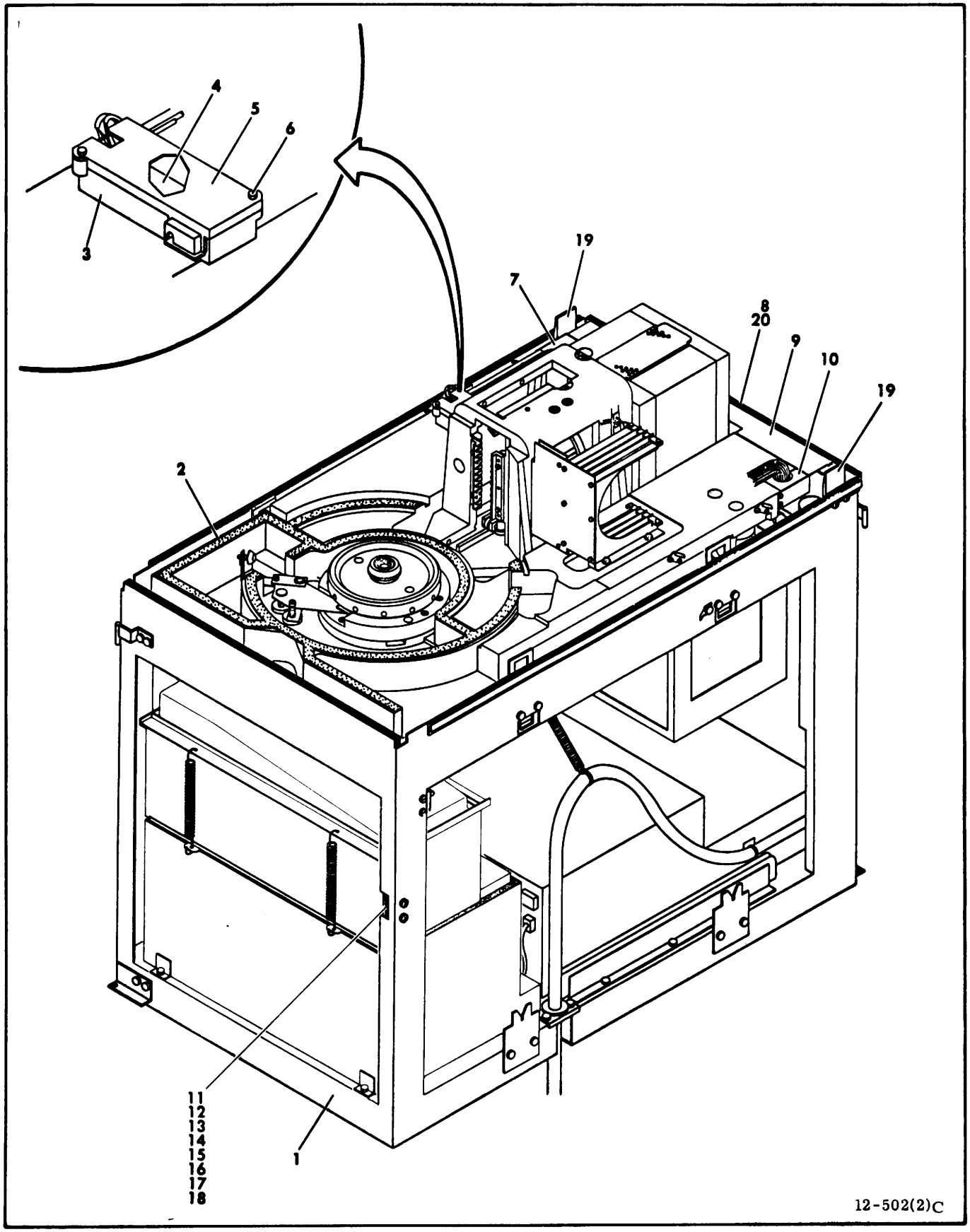


FIGURE 5-5. FINAL FRAME ASSEMBLY (SHEET 2 OF 3)

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-5-		FINAL FRAME ASSEMBLY (Sheet 2)	
1		FRAME AND DECK ASSEMBLY (See Figure 5-11)	
2	94001100	TAPE, Foam	
3	73479800	HOUSING, Premaplifier	
4		COMPONENT ASSEMBLY, Type _ZQN	
5	73479900	COVER, Premaplifier	
6	93592484	SCREW, Self Tapping, Hex Head	
7	72826001	BLOCK, Clamp, Harness	
		(ATTACHING PARTS)	
	17901508	SCREW, Thread Roll, Phillips, 6-32 x .250	
	72825900	CLAMP, Deck Harness	
8	77446200	BRACKET, Seal	
		(ATTACHING PARTS)	
	93592158	SCREW, Tapping, Hex Panel 6-32 x .250	
		- - - * - - -	
9	77444800	PANEL, Deck Seal, Rear	
10	75203500	BLOCK, Clamp, Harness	
11	77455000	LATCH, Door, Front	
12	77455100	LATCH, Door	
13	10127112	SCREW, Pan Head, Machine, 6-32 x .313	
14	10125605	WASHER, Flat, 6	
15	10126403	WASHER, Lock, External Tooth, 10	
16	10125107	NUT, Hex, 10-24	
17	10127132	SCREW, Pan Head, Machine, 10-24 x .500	
18	10125803	WASHER, Lock, Spring, 6	
		(ATTACHING PARTS)	
	17901508	SCREW, Thread Roll, Phillips, 6-32 x .250	
	72825900	CLAMP, Deck Harness	
19	77454400	GUIDE, Top Cover	
		(ATTACHING PARTS)	
	92615003	WASHER, Fibre Shoulder	
	75173312	PLATE, Nut	
	92748244	SCREW, Pan Head, Machine, Phillips 10-24 x .750	
		- - - * - - -	
20	94193202	CHANNEL, Rubber	

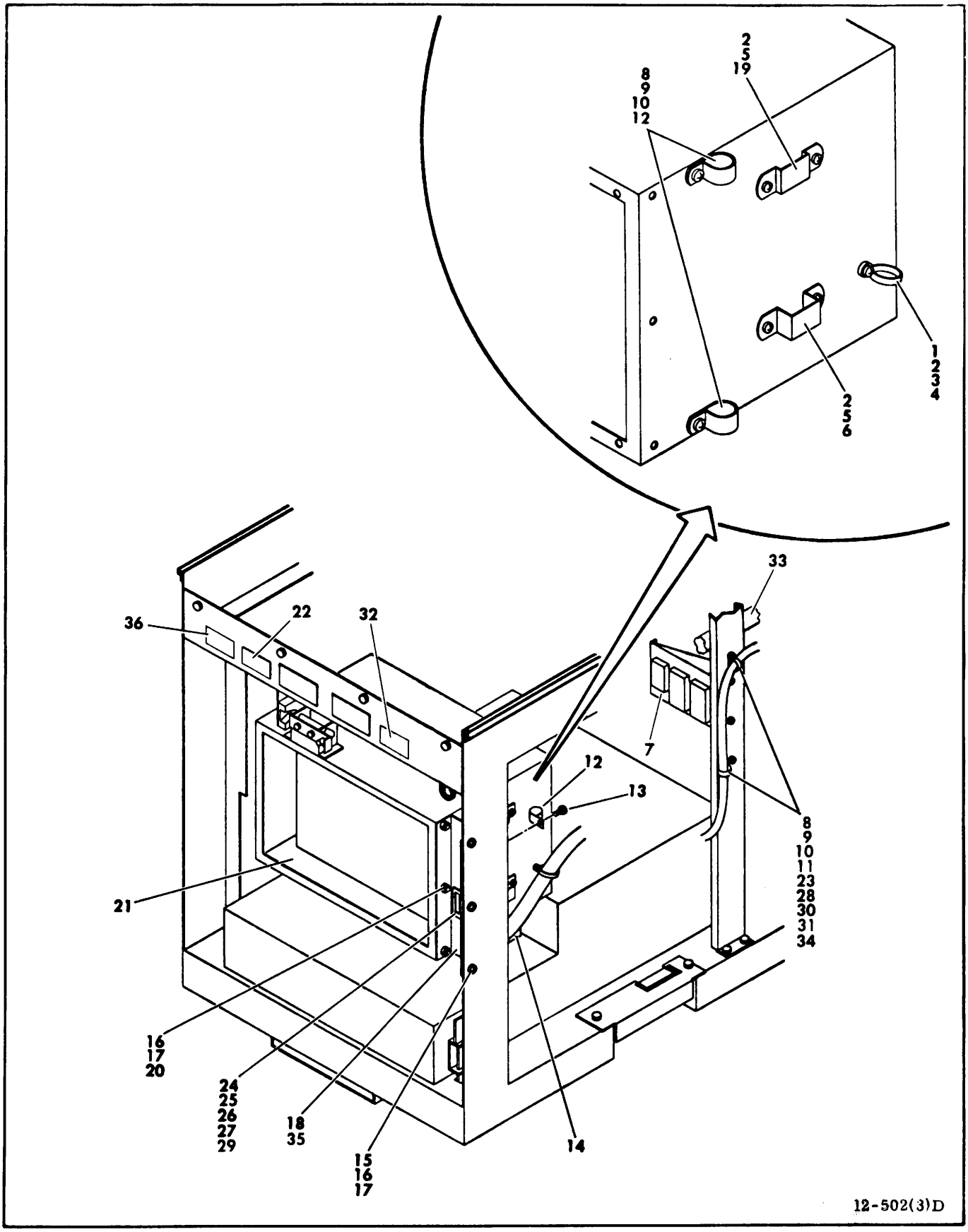


FIGURE 5-5. FINAL FRAME ASSEMBLY (SHEET 3 OF 3)

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-5-		FINAL FRAME ASSEMBLY (Sheet 3)	
1	94277406	STRAP, Cable Tie	
2	10126401	WASHER, Lock, External Tooth, 6	
3	10125605	WASHER, Flat, 6	
4	10127114	SCREW, Machine, Pan Head, 6-32 x .500	
5	10127113	SCREW, Machine, Pan Head, 6-32 x .313	
6	83278001	STRAP, Cable, Large	
7		I/O CABLE AND BRACKET ASSEMBLY (See Figure 5-10)	
		(ATTACHING PARTS)	
	10127122	SCREW, Machine, Pan Head, 8-32 x .375	
	10126402	WASHER, Lock, External Tooth, 8	
	10125106	NUT, Hex, 8-32	
		- - - * - - -	
8	10127123	SCREW, Machine, Pan Head, 8-32 x .500	
9	10126402	WASHER, Lock, External Tooth, 8	
10	10125106	NUT, Hex, 8-32	
11	92602014	CLAMP, Cable, Nylon	
12	92602011	CLAMP, Cable, Nylon	
13	93592240	SCREW, Self Tapping, Hex Head, 10-24 x .375	
14	77450100	PLENUM, Air, Logic	
		(ATTACHING PARTS)	
	10127112	SCREW, Machine, Pan Head, 6-32 x .313	
	10126401	WASHER, Lock, External Tooth, 6	
		- - - * - - -	
15	10127131	SCREW, Machine, Pan Head, 10-24 x .375	
16	10126403	WASHER, Lock, External Tooth, 10	
17	10125107	NUT, Hex, 10-24	
18	83277100	HINGE, Chassis, Logic	
19	83278002	STRAP, Cable, Large	
20	10127132	SCREW, Machine, Pan Head, 10-24 x .500	
21		LOGIC CHASSIS ASSEMBLY (See Figure 5-7)	
22	46068500	PLATE, Information	BJ4M2 A/C only
23	93109224	STANDOFF-SPACER	
24	77455100	LATCH, Door	
25	10127112	SCREW, Machine, Pan Head, 6-32 x .313	
26	10125605	WASHER, Flat, 6	
27	10125803	WASHER, Lock, Spring, 6	
28	10127128	SCREW Pan Head, Machine, 8-32 x 1.250	
29	77454900	LATCH, Door, Rear	
30	92602017	CLAMP, Cable (Nylon)	
31	93211108	WASHER, Flat, 8	
32	10127600	UL, Label	S/C 04 W/ 22863, 22857 BJ4M2A; S/C 05 thru 13 W/O 57000 60 Hz units; S/C 14 & Above W/57000
32	10127601	UL, Label	
33	94311632	HOSE, Flexible	
34	10125606	WASHER, Flat, 8	
35	94237705	SAFETY, Trim	
36	15002000	CSA, Label	

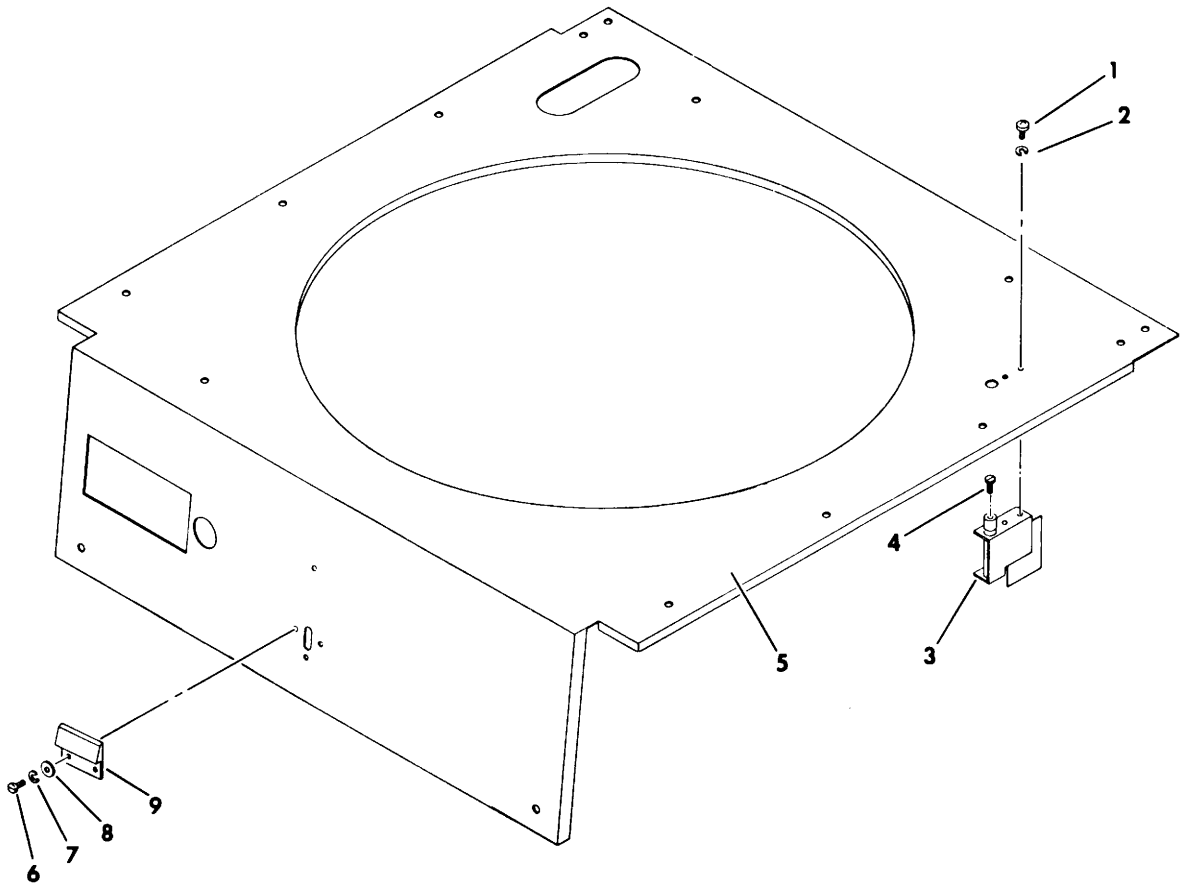


FIGURE 5-6. SHROUD COVER ASSEMBLY

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-6-	77450600	SHROUD COVER ASSEMBLY	S/C 05 and BLW
5-6-	77450604	SHROUD COVER ASSEMBLY	S/C 06 and ABV
1	92748156	SCREW, Machine, Pan Head, Phillips	
2	10125803	WASHER, Lock, Spring, 6	
3	##	SWITCH, Interlock (A351)	Pack Cover Switch
4	93342096	SCREW, Nylon	
5	77442300	COVER, Shroud	S/C 05 and BLW
5	83260200	Cover, Shroud	S/C 06 and ABV
6	92785086	SCREW, Machine, Pan Head	
7	10125801	WASHER, Lock, Spring, 4	
8	93211105	WASHER, Flat	
9	76427701	CATCH, Pack Access Cover	

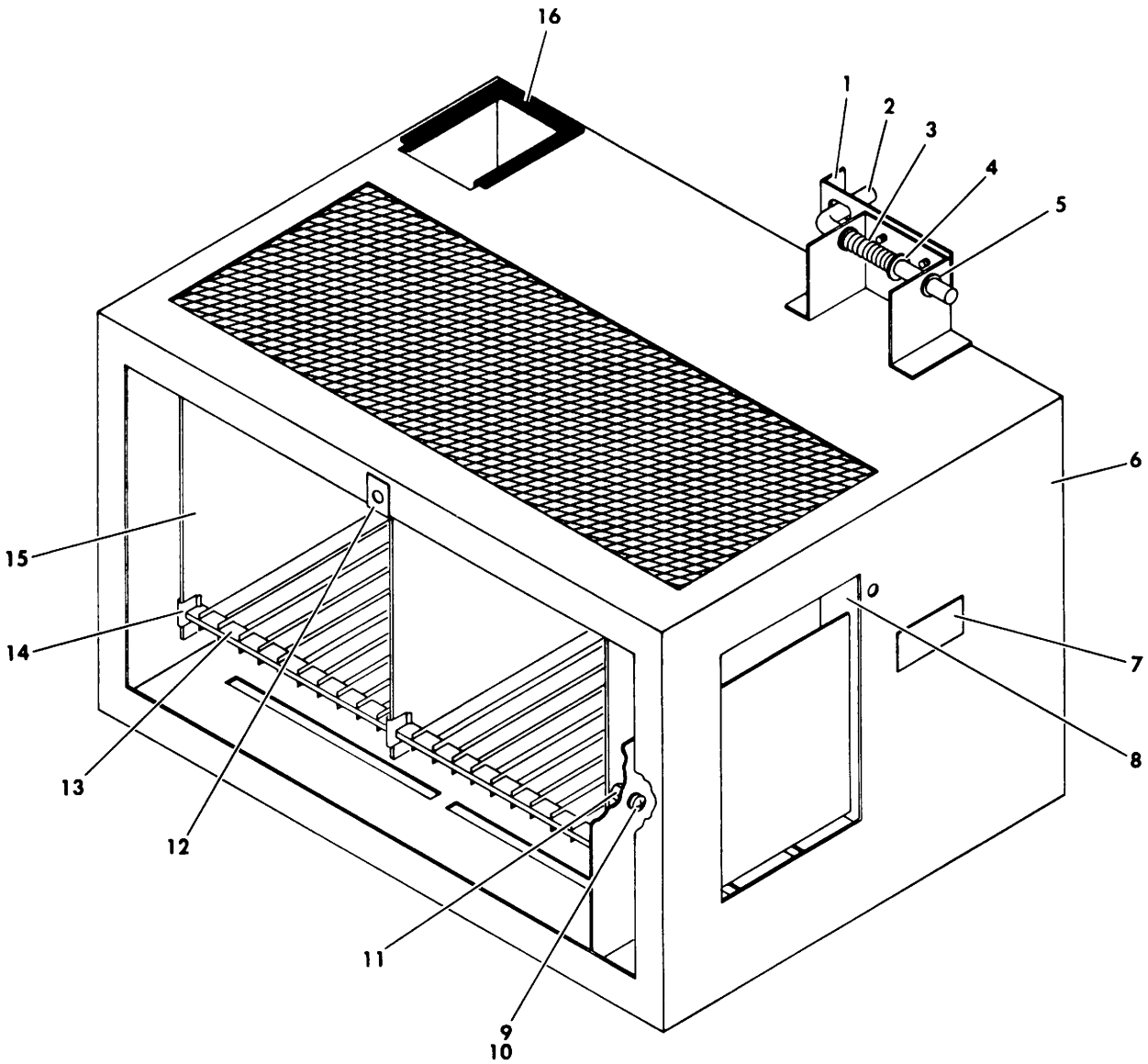


FIGURE 5-7. LOGIC CHASSIS ASSEMBLY

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-7-	774465XX	LOGIC CHASSIS ASSEMBLY	
1	70741700	GUIDE, Latch	
		(ATTACHING PARTS)	
	93592158	SCREW, Self Tapping, Flex Head, 6-32 x .250	
		- - - * - - -	
2	40032301	LATCH	
3	45229900	SPRING, Compression	
4	92033038	RING, Retaining	
5	92373005	NYLINER, Snap-In	
6	83275300	FRAME, Logic Chassis	
7	94368700	LABEL	
8	774479XX	WIRE WRAP ASSEMBLY	
		(ATTACHING PARTS)	
	95655516	SCREW, Sheet Metal, 6-20 x .375	
	95634802	NUT, Speed, U-Type	
		- - - * - - -	
9	10125803	WASHER, Lock, Spring, 6	
10	10127111	SCREW, Pan Head, Machine, 6-32 x .250	
11	93114269	STANDOFF, Tapped Post	
		(ATTACHING PARTS)	
	10126401	WASHER, Lock, External Tooth, 6	
	10127111	SCREW, Pan Head, Machine, 6-32 x .250	
		- - - * - - -	
12	94317800	RECEPTACLE, Clip-On	
13	46490201	RAIL, Guide	
14	94309003	CLIP, U-Type	
15	77388200	PANEL, Perpendicular, 3 Position	
		(ATTACHING PARTS)	
	93592200	SCREW, Self Tapping, Hex Head, 8-32 x .375	
		- - - * - - -	
16	94060002	CHANNEL, Rubber	
	76419264	SECTOR PLUG ASSEMBLY	Located on Back Panel, Location A6; Applicable only to BJ4M2D S/C 17 & Above w/ 57086

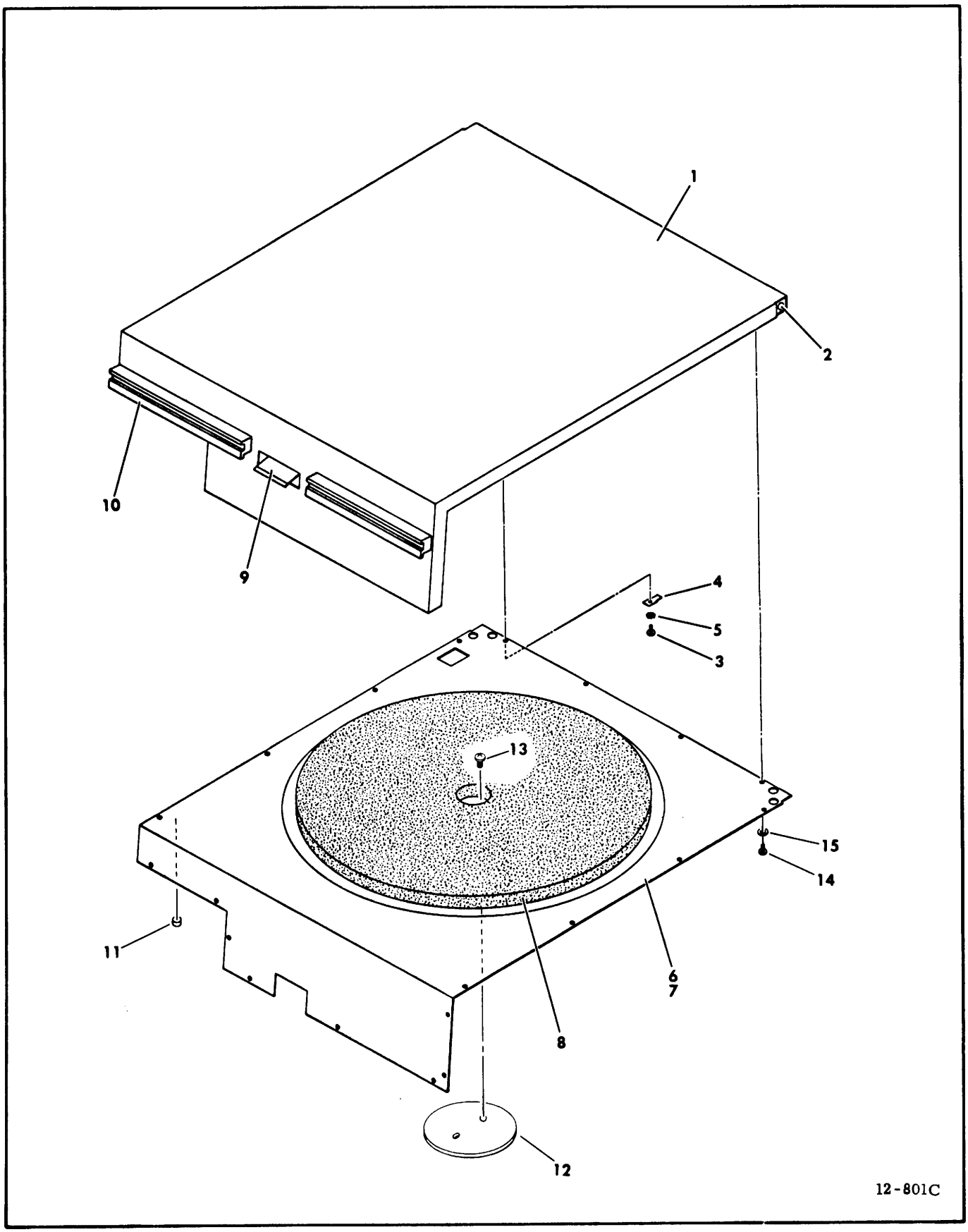


FIGURE 5-8. PACK ACCESS COVER ASSEMBLY

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-8-	774469**	PACK ACCESS COVER ASSEMBLY	See Note
1	774435**	COVER, Pack Access	See Note
2	77442400	BLOCK, Hinge	
3	93195234	SCREW, Button, 6-32 x .250	
4	94274101	TERMINAL, Quick Connect	
5	10126401	WASHER, Lock, External Tooth, 6	
6	77443900	INSERT, Cover, Access	
7	77561401	GASKET, Extended Sponge	
8	75040456	PANEL, Foam, Acoustical	
9	75071403	LATCH AND SPRING ASSEMBLY	
		(ATTACHING PARTS)	
	75070900	ROD, Pivot, Latch	
	92033107	RING, Retaining	
		- - - * - - -	
10	77462900	HANDLE, Pack Access Cover	
		(ATTACHING PARTS)	
	93195234	SCREW, Button, 6-32 x .250	
		- - - * - - -	
11	75070701	STOP, Bumper	
12	82379600	BUTTON, Access Cover	
13	94375824	SCREW, Thd Form, Pan Head, 8-16 x .375	
		Note: See color chart at the end of this section for tab number.	
14	92723196	SCREW, Button Head, Socket	
15	10125803	WASHER, Lock, 6	

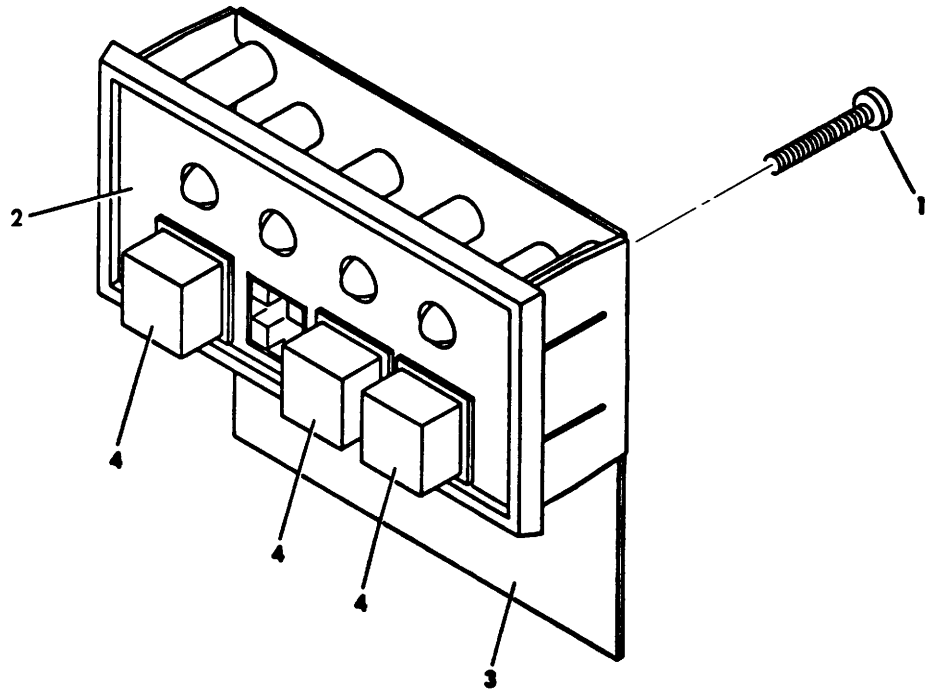


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FIGURE 5-9. CONTROL PANEL SWITCH ASSEMBLY

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-9-	##	CONTROL PANEL SWITCH ASSEMBLY	
1	17901506	SCREW, Thread Roll, Phillips, 4-40 x .750	
2	76422400	BEZEL, Panel, Front	
3	75072009	COMPONENT ASSEMBLY, Type HZYN	
4	75068300	BUTTON, Front Panel	

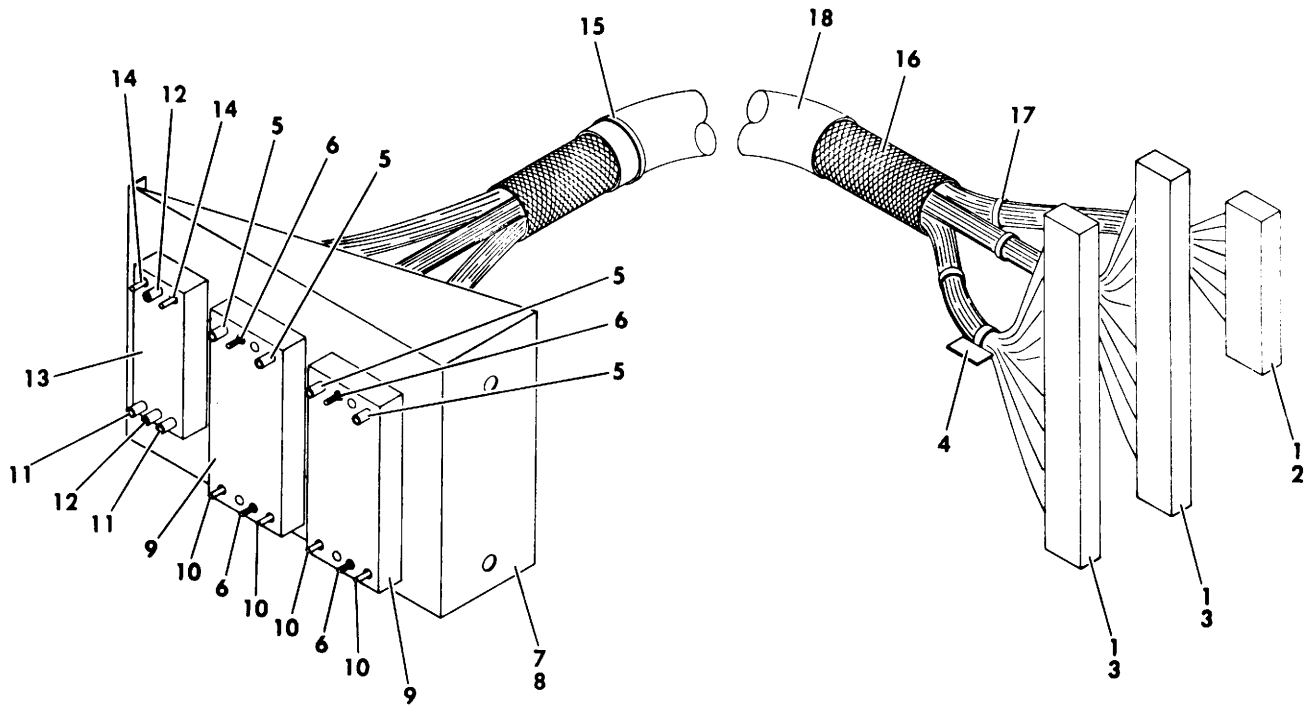

FIGURE 5-10. I/O CABLE AND BRACKET ASSEMBLY

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-10-	77447302	I/O CABLE AND BRACKET ASSEMBLY	
1	46490400	LABEL, Marker	
2	94261810	BODY, Connector (P5)	
		(ASSOCIATED PARTS)	
	94245601	CONTACT, Socket, 24 GA	
	94245607	CONTACT, Socket, 20 GA or Twisted Pair	
		- - - * - - -	
3	94261811	BODY, Connector (P1 & P2)	
		(ASSOCIATED PARTS)	
	94245601	CONTACT, Socket, 24 GA	
	94245607	CONTACT, Socket, 20 GA or Twisted Pair	
		- - - * - - -	
4	94277409	STRAP, Cable Tie	
5	93642005	CONNECTOR, Corner Guide Socket	
6	93643006	CONNECTOR, Jackscrew, Male	
7	77444300	BRACKET, I/O	
8	94208501	LABEL, Part Number	
9	94281201	CONNECTOR, 75 Pin	
		(ASSOCIATED PARTS)	
	93645003	CONTACT, Socket, 24 GA	
	93645002	CONTACT, Socket, 20 GA	
	93645001	CONTACT, Socket, 16 GA or Twisted Pair	
		- - - * - - -	
10	93642004	CONNECTOR, Corner Guide Pin	
11	93643005	CONNECTOR, Corner Guide, Socket	
12	93643007	CONNECTOR, Jackscrew, Female	
13	93643016	CONNECTOR, Block (J2)	
		(ASSOCIATED PARTS)	
	93645003	CONTACT, Socket, 24 GA	
	93645002	CONTACT, Socket, 20 GA	
		- - - * - - -	
14	93643004	CONNECTOR, Corner Guide Pin	
15	94277400	CABLE, Tie Strap	
16	93267010	SHIELDING, Flat, Braided	
17	94277401	STRAP, Cable Tie	
18	95048803	SLEEVING, Braided	

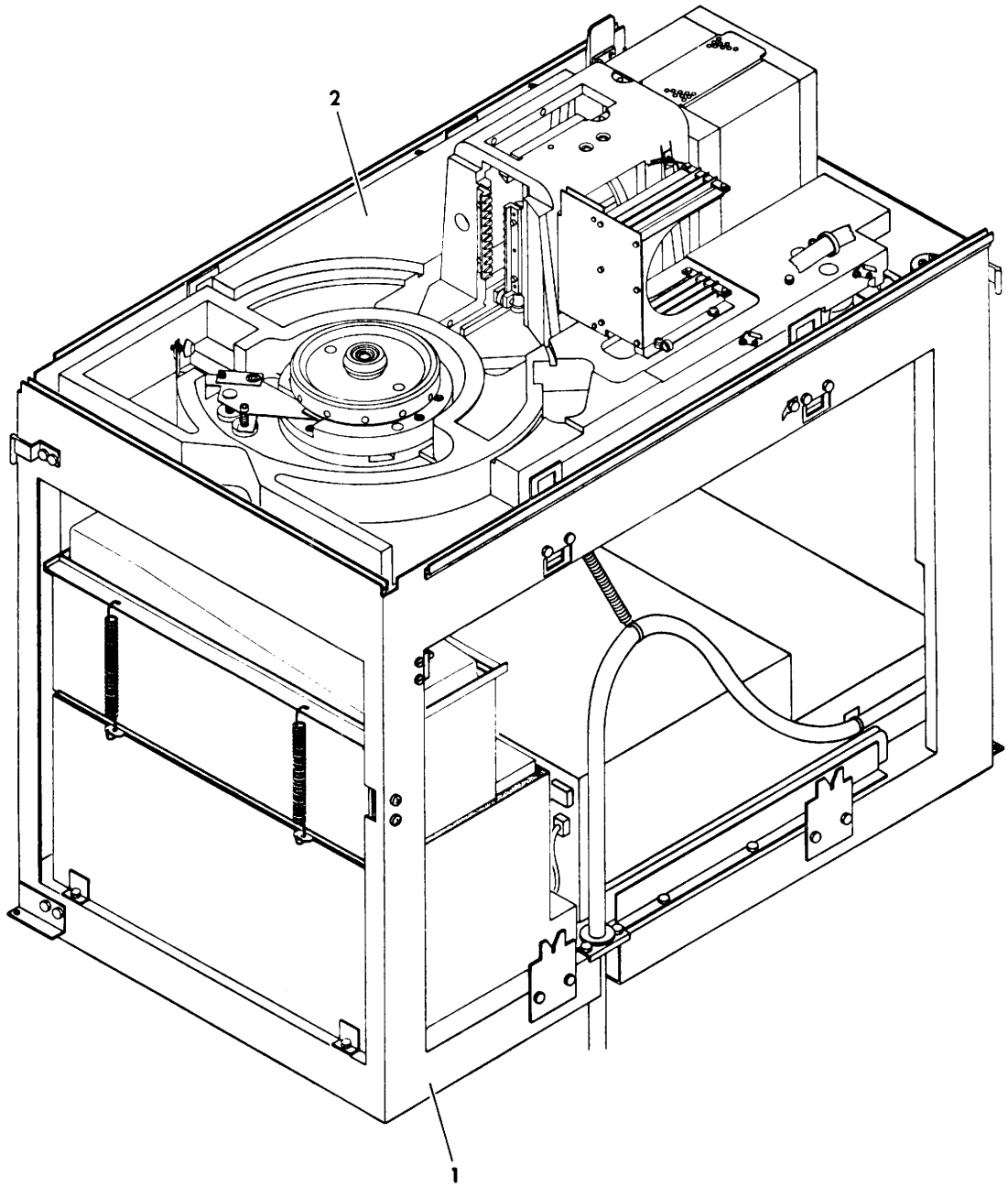

FIGURE 5-11. FRAME AND DECK ASSEMBLY

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-11-	774502XX	FRAME AND DECK ASSEMBLY	
1		FRAME ASSEMBLY (See Figure 5-12)	
2		DECK ASSEMBLY (See Figure 5-18)	

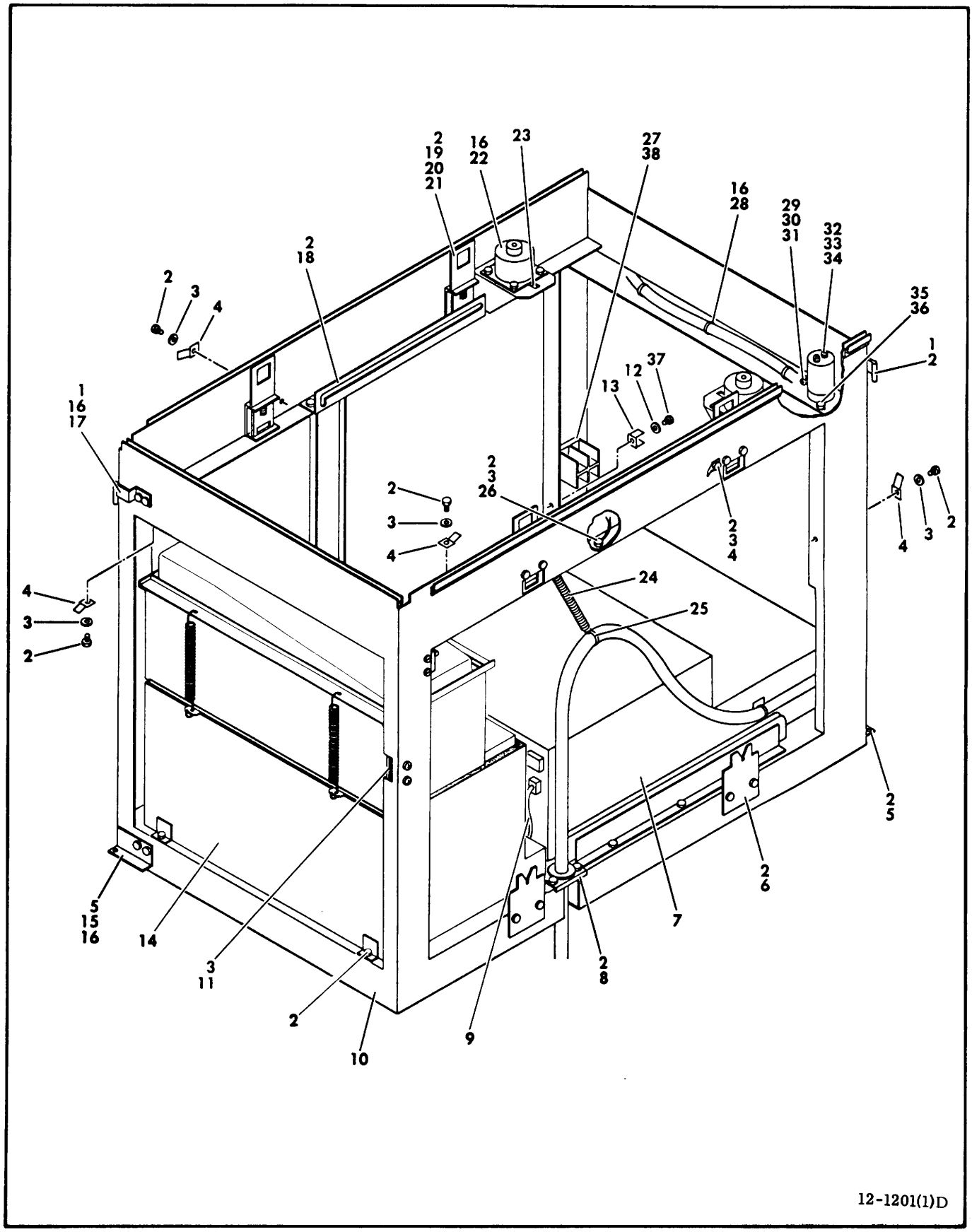

FIGURE 5-12. FRAME ASSEMBLY (SHEET 1 OF 2)

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-12-	774470XX	FRAME ASSEMBLY (Sheet 1 of 2)	
1	83242700	HINGE, Top, Door	
2	93592238	SCREW, Self Tapping, Hex Head, 10-24 x .375	
3	10126403	WASHER, Lock, External Tooth, 10	
4	94274140	TERMINAL, Quick Connect	
5	83242800	HINGE, Bottom, Door	
6	77443800	BRACKET, Panel, Side	
7		POWER SUPPLY ASSEMBLY (See Figure 5-14)	
		(ATTACHING PARTS)	
	93592238	SCREW, Self Tapping, Hex Head, 10-24 x .375	
		- - - * - - -	
8	77453800	BRACKET, Snap Bushing	
9	77448900	BLOWER CABLE ASSEMBLY	
		(ASSOCIATED PARTS)	
	51906001	CONNECTOR, Plug (P2 & P9)	
	51905800	CONTACT, Pin	
		- - - * - - -	
10	47293400	FRAME, Main	
11	10125107	NUT, Hex, 10-24	
12	10127348	SCREW, Pan Head, Machine, 8-32 x .750	
13	94274117	TERMINAL, Quick Connect	
14		BLOWER PLENUM ASSEMBLY (See Figure 5-13)	
15	77443101	SPACER, Hinge	
16	93592240	SCREW, Self Tapping, Hex Head, 10-24 x .500	
17	77443100	SPACER, Hinge	
18	77446000	SLIDE, Retaining Rod	
19	77441500	BRACKET, Latch, Side Panel	
20	77441400	LATCH, Panel, Side	
21	77454500	SPRING, Compression	
22	94245302	ISOLATOR, Vibration	
23	93602322	NUT, Self Mounting, 1/4-20	
24	77450800	SPRING, Extension	
25	94277421	STRAP, Cable Tie	
26	94369533	CABLE, Ground	
27	94391000	TERMINAL BLOCK, Heavy Duty	
		(ATTACHING PARTS)	
	10127348	SCREW, Pan Head, Machine, 8-32 x .750	
	10126402	WASHER, Lock, External Tooth, 8	
	10125106	NUT, Hex, 8-32	
		- - - * - - -	
28	94277406	STRAP, Cable Tie	
29	10125105	NUT, Hex, 6-32	
30	10127115	SCREW, Pan Head, Machine, 6-32 x .625	
31	10125605	WASHER, Flat, 6	
32	10127142	SCREW, Pan Head, Machine, 10-32 x .375	
33	10126105	WASHER, Lock, Internal Tooth, 10	
34	92632017	CAPACITOR, Electrolytic	
35	93592158	SCREW, Self Tapping, Hex Head, 6-32 x .250	
36	92691003	CLAMP, Capacitor, Mounting	
37	93592202	SCREW, Self Tapping, Hex Head, 8-32 x .500	
38		NOT Used	

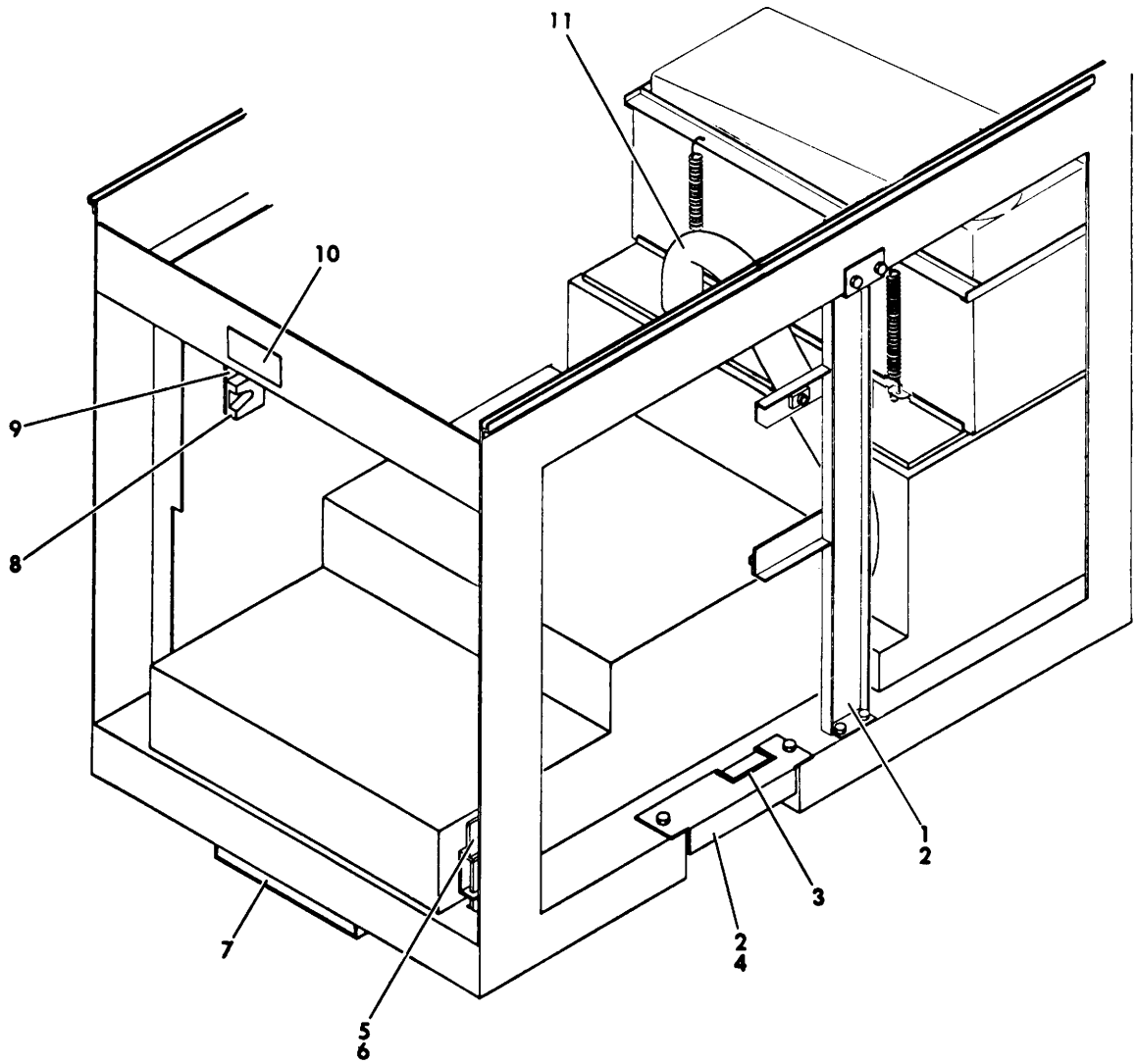

FIGURE 5-12. FRAME ASSEMBLY (SHEET 2 OF 2)

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-12-		FRAME ASSEMBLY (Sheet 2)	
1	47298600	MOUNT, Bracket, I/O	
2	93592238	SCREW, Self Tapping, Hex Head, 10-24 x .375	
3	94385500	GROMMET, Extruded	
4	77451100	COVER, I/O Cable	
5	77454500	SPRING, Compression	
6	77449600	LATCH, Power Supply	
7	##	FILTER, Aluminum, Washable	
8	70741800	LATCH, Stop	
		(ATTACHING PARTS)	
	10125607	WASHER, Flat, 10	
	92721284	SCREW, Pan Head, Machine, 10-24 x .875	
	10125107	NUT, Hex, 10-24	
	10126403	WASHER, Lock, External Tooth, 10	
		- - - * - - -	
9	77445700	BRACKET, Catch, Logic	
		(ATTACHING PARTS)	
	93592238	SCREW, Self Tapping, Hex Head, 10-24 x .375	
		- - - * - - -	
10	92006804	PLATE, ID	S/C 18 & Below
10	92006808	PLATE, ID	S/C 19 & Above
11	94311633	HOSE, Flexible	

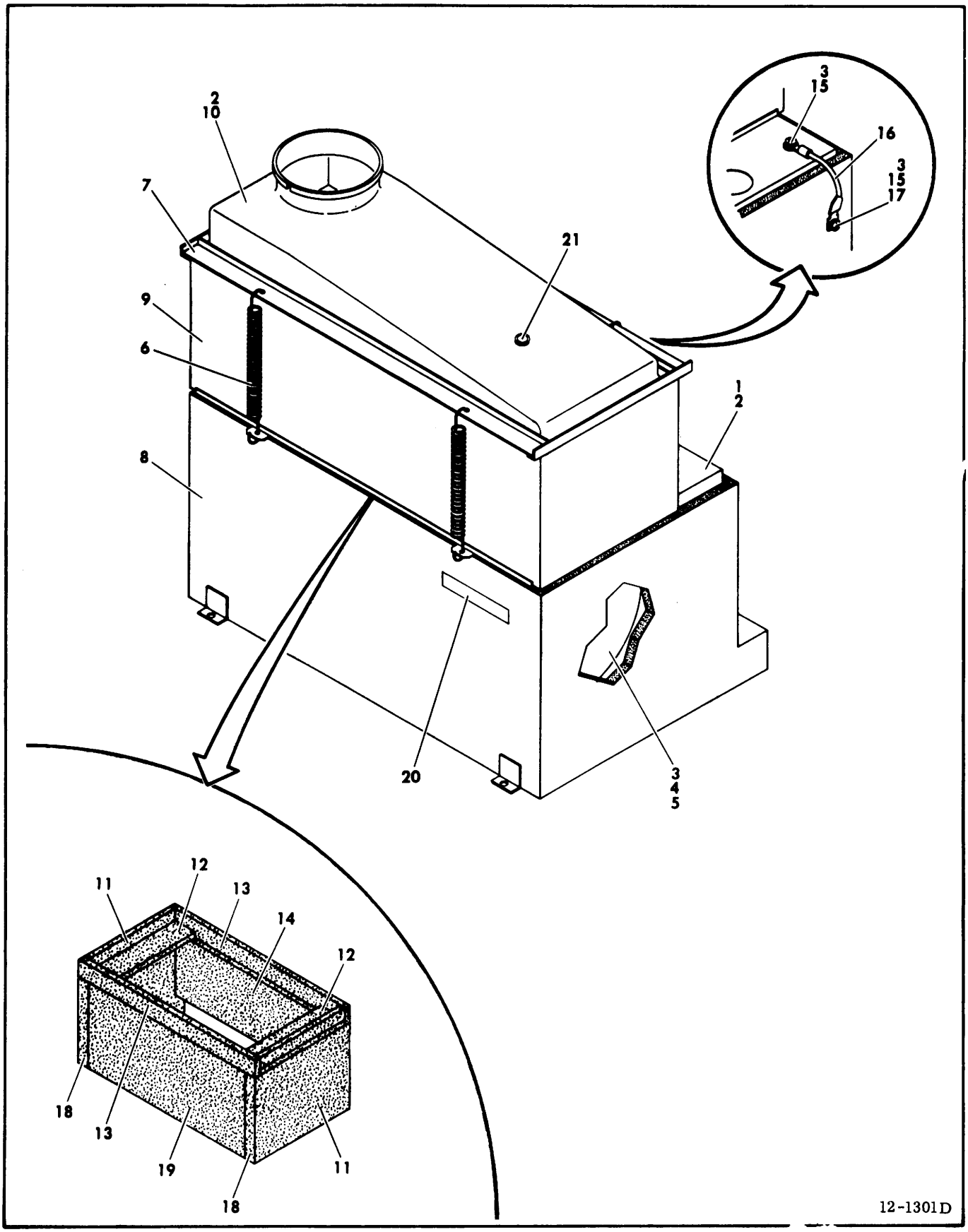

FIGURE 5-13. BLOWER PLENUM ASSEMBLY

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-13-	77448700	BLOWER PLENUM ASSEMBLY	
1	77441300	MOUNT, Blower	
2	94276600	TAPE, Foam	
3	10127130	SCREW, Machine, Pan Head, 10-24 x .313	
4	##	BLOWER AND CONNECTOR ASSEMBLY	
5	10125805	WASHER, Lock, Spring, 10	
6	41275402	SPRING, Extension	
7	77457500	CLAMP, Plenum Exhaust	
8	77441200	PLENUM, Intake	
9	##	FILTER, Air	
10	47322500	PLENUM, Exhaust	
11	77446804	PANEL, Foam, Acoustical	
12	77446811	PANEL, Foam, Acoustical	
13	77446801	PANEL, Foam, Acoustical	
14	77446802	PANEL, Foam, Acoustical	
15	10126403	WASHER, Lock, External Tooth, 10	
16	94281495	CABLE, Ground	
17	94274140	TERMINAL, Quick Connect	
18	77446803	PANEL, Foam, Acoustical	
19	77446800	PANEL, Foam, Acoustical	
20	73490301	LABEL	
21	94353207	CAPS & Plugs, Plastic (Red)	

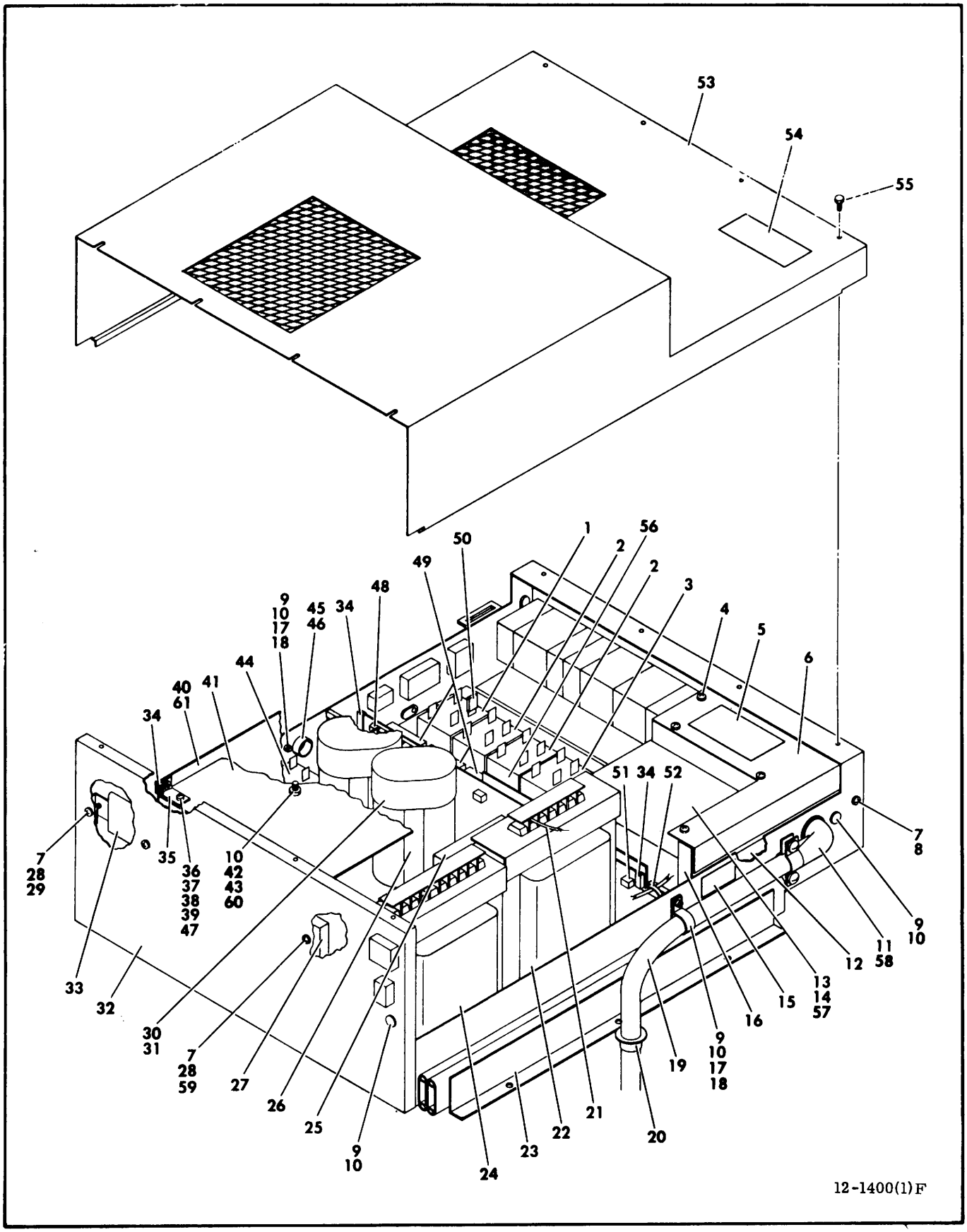

FIGURE 5-14. POWER SUPPLY ASSEMBLY (SHEET 1 OF 2)

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-14-	##	POWER SUPPLY ASSEMBLY (Sheet 1 of 2)	
1	##	SWITCH, Solid State, AC, 15 Amp (A1Q4)	
2	##	SWITCH, Solid State, AC, 30 Amp (A1Q2 & A1Q3)	
3	##	SWITCH, Solid State, AC, 15 Amp (A1Q1)	
		(ATTACHING PARTS FOR INDEX NOS 1 THRU 3)	
	93590198	SCREW, TPG., Pan Head, PHL, 8-32 x .313	
	10126402	WASHER, Lock, External Tooth, 8	
		- - - * - - -	
4	93590198	SCREW, TPG, Pan Head, PHL, 8-32 x .313	
5	92006901	PLATE, Warning	
6	77449100	COVER, Shield, Filter	
7	10126402	WASHER, Lock, External Tooth, 8	
8	10127120	SCREW, Machine, Pan Head, 8-32 x .250	
9	10125108	NUT, Hex, 10-32	
10	10126403	WASHER, Lock, External Tooth, 10	
11	93299001	CONNECTOR, 90° Angle	
12	95660411	TAPE, Glass Cloth, 2 Width	
13	##	FILTER, RFI	
14	94208302	CAP, Tube	
15	94208501	LABEL	
16	77444700	SHIELD, Filter	
17	94277406	STRAP, Cable Tie	
18	93590200	SCREW, TPG, Pan PHL, 8-32 x 3/8	
19		POWER CABLE ASSEMBLY (See Figure 5-15)	
20	15012421	BUSHING, Snap-In	
21	77447504	AC HARNESS ASSEMBLY	
22	##	TRANSFORMER, Ferro, 60 Hz (A1T2)	
		(ATTACHING PARTS)	
	10125108	NUT, Hex, 10-32	
	10126403	WASHER, Lock, External Tooth, 10	
	10125607	WASHER, Flat, 10	
		- - - * - - -	
23	94383501	SLIDE, Ball Bearing	
		(ATTACHING PARTS)	
	93590196	SCREW, Self Thread, 8-32 x 1/4	
		- - - * - - -	
24	##	TRANSFORMER, Ferro, 60 Hz (A1T1)	
		(ATTACHING PARTS)	
	10125108	NUT, Hex, 10-32	
	10126403	WASHER, Lock, External Tooth, 10	
	10125607	WASHER, Flat, 10	
	77441000	CLAMP, Transformer	
25	##	TRANSFORMER ASSEMBLY, 50/60 Hz (A1T3)	
		(ATTACHING PARTS)	
	10125606	WASHER, Flat, 8	
	10126402	WASHER, Lock, External Tooth, 8	
	93590198	SCREW, TPG, Pan Head, PHL, 8-32 x .313	
		- - - * - - -	

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-14-		POWER SUPPLY ASSEMBLY (Sheet 1 Contd.)	
26	95641704	CAPACITOR, Clamp, Hold-Down	
		(ATTACHING PARTS)	
	10125606	WASHER, Flat, 8	
	10126402	WASHER, Lock, External Tooth, 8	
	93590198	SCREW, TPG, Pan Head, PHL, 8-32 x .313	
		- - - * - - -	
27	##	RECTIFIER, Bridge	
28	10125106	NUT, Hex, 8-32	
29	10127125	SCREW, Machine, Pan Head, 8-32 x .750	
30	##	CAPACITOR, 660 VAC (A1C1 & A1C2)	
31	95582501	BOOT, Double Entrance	
32	83229500	CABINET, Power Supply	
33	95667406	RESISTOR, 30 W, 10 OHM	
34	94237705	TRIM, Safety, Black	
35	77444100	CLAMP, Board, Power Amp	
36	10125105	NUT, Hex, 6-32	
37	10126103	WASHER, Lock, Internal Tooth, 6	
38	10127112	SCREW, Machine, Pan Head, 6-32 x .313	
39	10125605	WASHER, Flat, 6	
40		COMPONENT ASSEMBLY, Type -ZCN (See Figure 5-17)	
41		COMPONENT ASSEMBLY, Type _YEN (See Figure 5-16)	
42	10125607	WASHER, Flat, 10	
43	77449200	ROD, Capacitor Board	
44	94371301	SWITCH, Solid State, AC, 15 Amp (A1Q5)	
		(ATTACHING PARTS)	
	10126401	WASHER, Lock, External Tooth, 6	
	10127114	SCREW, Machine, Pan Head, 6-32 x .500	
	10125105	NUT, Hex, 6-32	
		- - - * - - -	
45	94274101	TERMINAL, Quick Connect	
46	15012412	BUSHING, Snap-In	
47	94385500	GROMMET, Extruded	
48	94272333	BLOCK, Term Single Screw	
		(ATTACHING PARTS)	
	10127115	SCREW, Machine, Pan Head, 6-32 x .625	
	10126401	WASHER, Lock, External Tooth, 6	
	10125105	NUT, Hex, 6-32	
	10125613	WASHER, Flat, 6	
		- - - * - - -	
49	##	CONTACTOR, 24 VDC	
		(ATTACHING PARTS)	
	10126402	WASHER, Lock, External Tooth, 8	
	10125106	NUT, Hex, 8-32	
	10125606	WASHER, Flat, 8	
		- - - * - - -	
50	95595000	ADAPTER, Quick Disconnect	
51	94377500	STANDOFF, PC Board, Nylon	
52	94277400	STRAP, Cable Tie	
53	77443200	COVER, Power Supply	
54	92006903	PLATE, Warning	
55	93592196	SCREW, Self Tapping, Hex Head, 8-32 x .250	
56	##	COMPONENT ASSEMBLY, Type _YFN	
57	10127130	SCREW, Pan Head, Machine, 10-24 x .313	
58	95641521	WASHER, Flat	
59	10127126	SCREW, Pan Head, Machine, 8-32 x 7/8	
60	95673184	SPACER - Thd, 10-32 x 1	
61	94001102	TAPE, Foam	

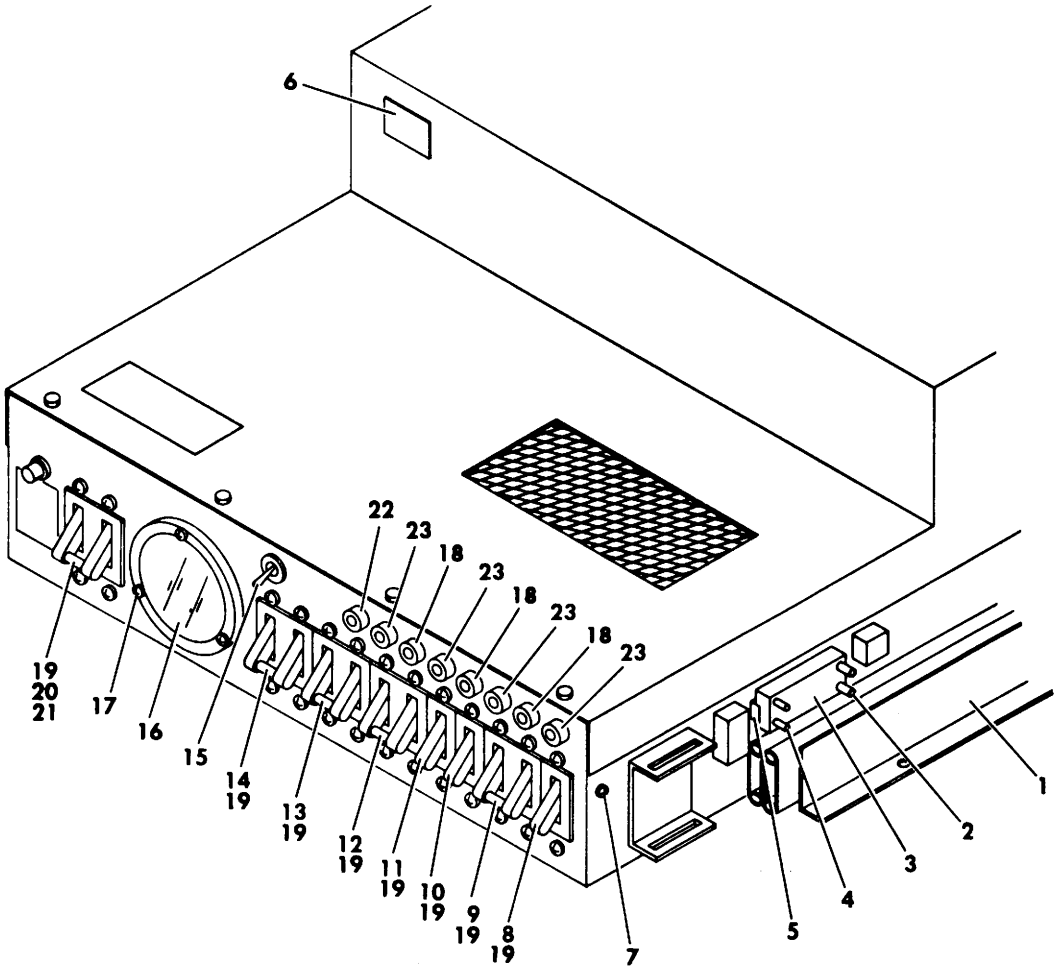

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FIGURE 5-14. POWER SUPPLY ASSEMBLY (SHEET 2 OF 2)

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-14-		POWER SUPPLY ASSEMBLY (Sheet 2)	
1	94383502	SLIDE, Ball Bearing	
		(ATTACHING PARTS)	
	93590196	SCREW, Self Thread, 8-32 x 1/4	
		- - - * - - -	
2	93643018	CONNECTOR, Corner Guide, Socket	
3	77447701	DC HARNESS ASSEMBLY	
4	93643017	CONNECTOR, Corner Guide, Pin	
5	93643020	CATCH, Connector	
6	24547559	PLATE, WARNING	
7	93590196	SCREW, Self Thread, 8-32 x 1/4	
8	##	CIRCUIT BREAKER, .5 Amp (A1CB8)	+28 V
9	##	CIRCUIT BREAKER, 2 Amp, 50 VDC (A1CB7)	±20 V
10	##	CIRCUIT BREAKER, 5 Amp (A1CB6)	-9.7 V
11	##	CIRCUIT BREAKER, 8 Amp (A1CB5)	+9.7 V
12	##	CIRCUIT BREAKER, 7 Amp, 50 VDC (A1CB4)	±46 V
13	##	CIRCUIT BREAKER, U/L Recognized (A1CB3)	Drive Motor
14	##	CIRCUIT BREAKER, .375 Amp, 250 VAC (A1CB2)	+20 Y
		(ATTACHING PARTS FOR INDEX NOS 8 THRU 14)	
	10126103	WASHER, Lock, Internal Tooth, 6	
	92745156	SCREW, Machine, Pan Head, 6-32 x .187	
		- - - * - - -	
15	##	SWITCH, Toggle	
16	##	METER, Hour, AC	
17	17901502	SCREW, Machine, Pan Head, 4-40 x 3/8	
18	95644003	JACK, Banana	
19	95524408	WASHER, Lock, 10	
20	##	CIRCUIT BREAKER, U/L Recognized (A1CB1)	AC Main Power
		(ATTACHING PARTS)	
	10126103	WASHER, Lock, Internal Tooth, 6	
	92745156	SCREW, Machine, Pan Head, 6-32 x .187	
		- - - * - - -	
21	76416500	INSULATOR, Terminal	
22	95644001	JACK, Banana	
23	95644000	JACK, Banana	

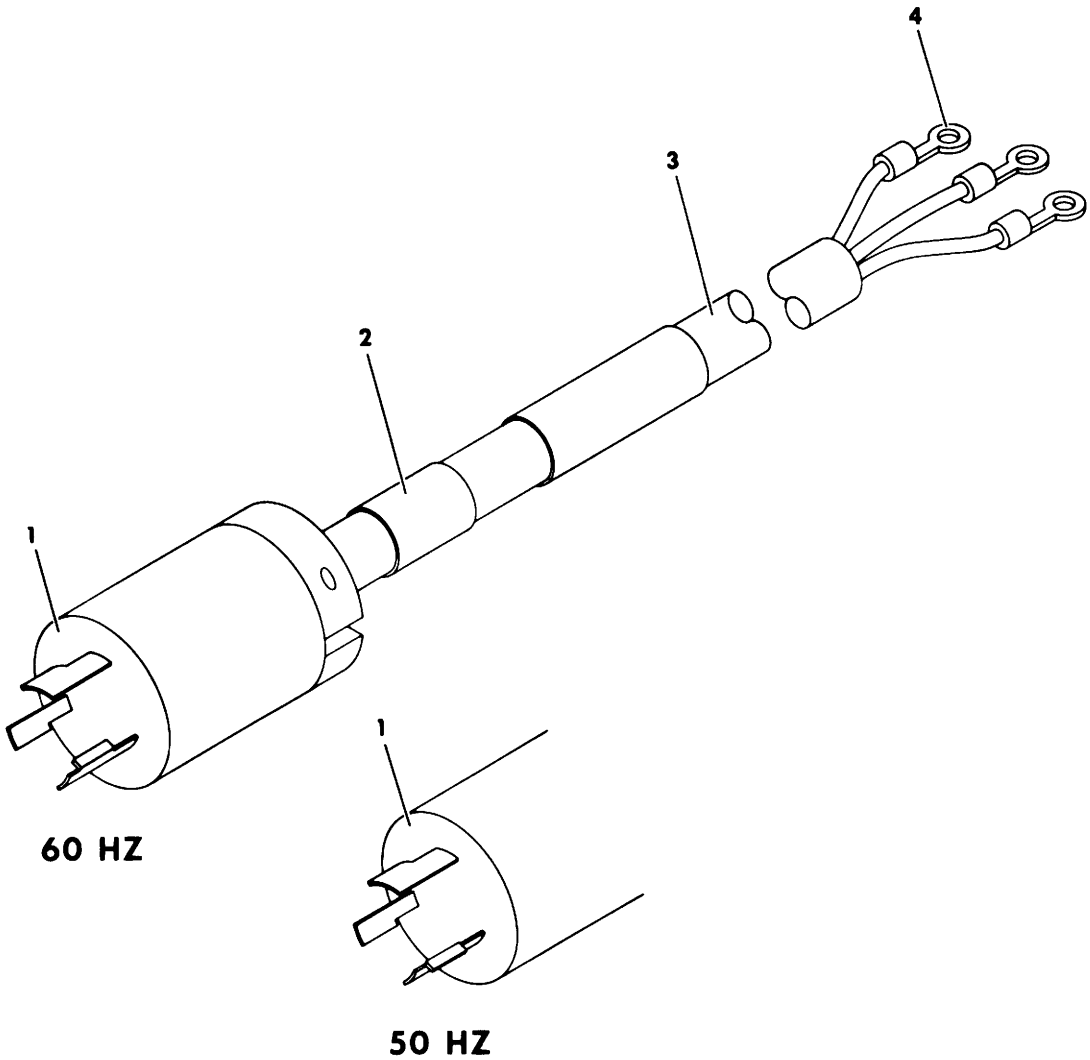

FIGURE 5-15. POWER CABLE ASSEMBLY

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-15-	70734116	POWER CABLE ASSEMBLY	60 Hz
5-15-	70734115	POWER CABLE ASSEMBLY	50 Hz
1	##	CONNECTOR, Locking, 3 Wire	60 Hz
1	94368800	CONNECTOR, Locking, 3 Wire	50 Hz
2	93154151	TUBING, Heat Shrink	
3	10124004	CABLE, Power	
4	93541028	TERMINAL, Ring Tongue	

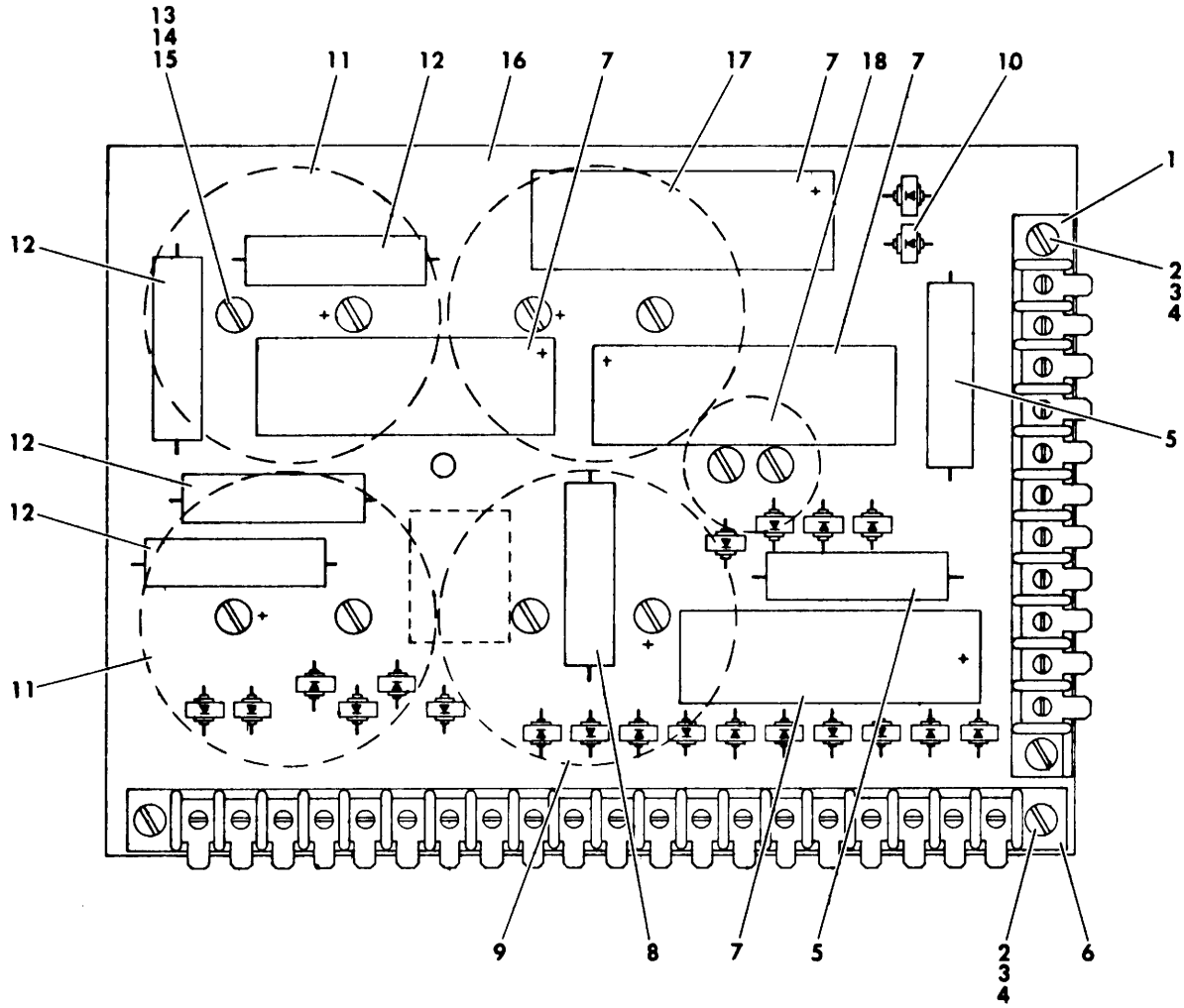

FIGURE 5-16. COMPONENT ASSEMBLY, TYPE _YEN

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-16-	##	COMPONENT ASSEMBLY, Type _YEN	
1	95591217	TERMINAL STRIP, Quick Connect, 11 Terminal	
2	10127350	SCREW, Machine, Pan Head, 8-32 x .750	
3	10125106	NUT, Hex, 8-32	
4	10126104	WASHER, Lock, Internal Tooth, 8	
5	95597910	Resistor, Fixed, 15W, 30 OHM	
6	95591218	TERMINAL STRIP, Quick Connect, 20 Terminal	
7	94383700	CAPACITOR, 35 VDC, Electrolytic (C1 thru C4)	
8	95597956	RESISTOR, Fixed, 15W	
9	94384002	CAPACITOR, Electrolytic (C6)	
10	95575001	RECTIFIER, Silicon	
11	94384000	CAPACITOR, Electrolytic (C7 & C8)	
12	95597954	RESISTOR, Fixed, 15W, 82 OHM	
13	93903356	EYELET, Rolled Flange	
14	10127143	SCREW, Machine, Pan Head, 10-32 x .500	
15	95524408	WASHER, Lock, Internal Tooth, 10	
16	77427000	BOARD, Blank	
17	94384001	CAPACITOR, Electrolytic (C9)	
18	95661319	CAPACITOR, 15 VDC (A1C5)	

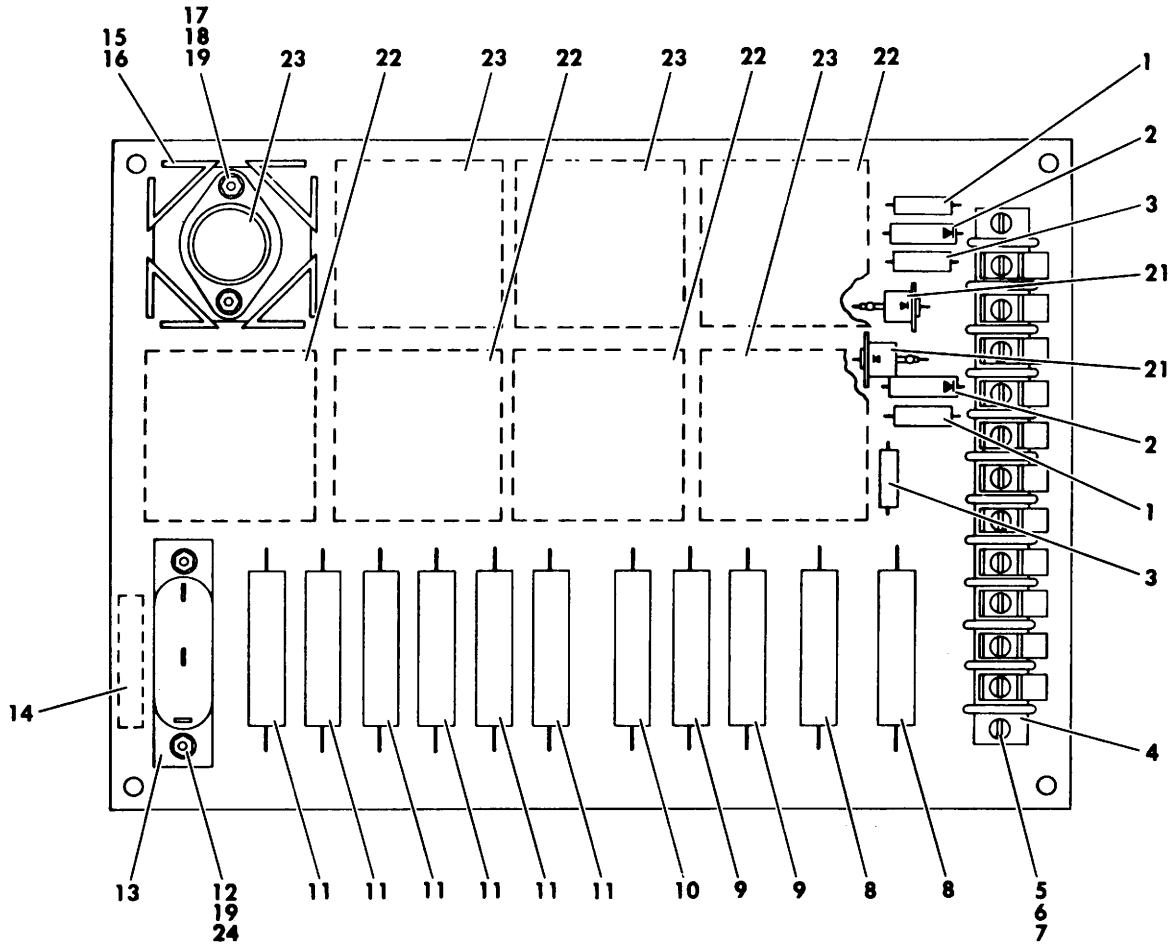

FIGURE 5-17. COMPONENT ASSEMBLY, TYPE _ZCN

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-17-	##	COMPONENT ASSEMBLY, Type _ZCN	
1	92512867	RESISTOR, 1W, 100 OHM	
2	92115037	DIODE, Silicon, Zener	
3	92512879	RESISTOR, 1W, 470 OHM	
4	95591219	TERMINAL STRIP, Quick Connect, 11 Terminal	
5	10125106	NUT, Hex, 8-32	
6	10126104	WASHER, Lock, Internal Tooth, 8	
7	10127350	SCREW, Machine, Pan Head, 8-32 x .750	
8	95597957	RESISTOR, Fixed, 15W	
9	95597955	RESISTOR, Fixed, 15W	
10	95597956	RESISTOR, Fixed, 15W	
11	95597900	RESISTOR, Fixed, 15W	
12	10127335	SCREW, Machine, Pan Head, 6-32 x .500	
13	95583503	RECTIFIER, Block, 15A	
14	73490300	LABEL	
15	95593201	RECEPTACLE, PC Board	
16	94261000	HEAT SINK, Transistor	
17	93640024	STUD, Self-Clinching	
18	95510026	NUT, Hex	
19	10126103	WASHER, Lock, Internal Tooth, 6	
20	75183501	BOARD, Blank	
21	93542001	RECTIFIER, Germanium, .22 V	
22	##	TRANSISTOR, Silicon	
23	##	TRANSISTOR, Silicon	
24	10125105	NUT, Hex, Machine, 6-32	

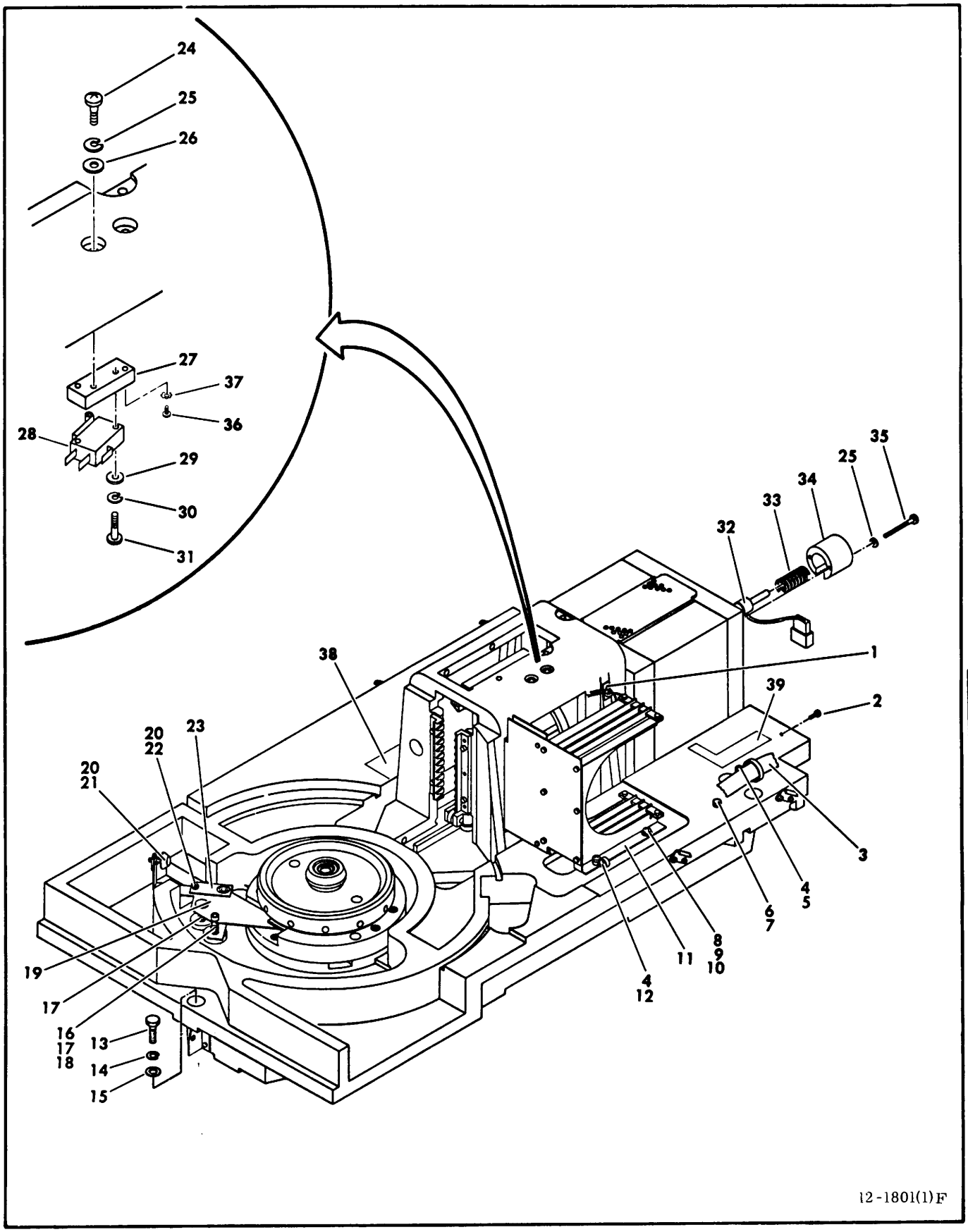

FIGURE 5-18. DECK ASSEMBLY (SHEET 1 OF 3)

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-18-	774458XX	DECK ASSEMBLY (Sheet 1 of 3)	
1	94277400	STRAP, Cable Tie	
2	93592162	SCREW, Self Tapping, Hex Head, 6-32 x .375	
3	77448401	MAIN HARNESS ASSEMBLY, Shielded	
4	94277406	STRAP, Cable Tie	
5	93592202	SCREW, Tapping, Hex Head, 8-32 x .500	
6	10126402	WASHER, Lock, External Tooth, 8	
7	93592200	SCREW, Tapping, Hex Head, 8-32 x .375	
8	10127131	SCREW, Machine, Pan Head, 10-24 x .375	
9	10125607	WASHER, Flat, 10	
10	10126105	WASHER, Lock, Internal Tooth, 10	
11		R/W CHASSIS ASSEMBLY (See Figure 5-21)	
12	10127133	SCREW, Machine, Pan Head, 10-24 x .625	
13	10126504	SCREW, Hex Head, 1/4-20 x 1	
14	10125806	WASHER, Lock, Spring, 1/4	
15	10125608	WASHER, Flat, 1/4	
16	92373005	NYLINER, Snap-In	
17	94205793	SPRING, Compression	
18	93707005	SCREW, Shoulder, Socket Head	
19	76405000	PLATE, Brake	
20	10125105	NUT, Hex, 6-32	
21	75006600	BUTTON, Brake	
22	93073250	SCREW, Set, Socket, 6-32 x .500	
23	47181300	BRACKET, Parking Brake	
24	10127124	SCREW, Machine, Pan Head, 8-32 x .625	
25	10125804	WASHER, Lock, Spring, 8	
26	10125606	WASHER, Flat, 8	
27	77437900	MOUNT, Switch	
28	##	SWITCH, Actuator, Mini Integral (A3S6)	Heads Loaded Switch
29	10125603	WASHER, Flat, 4	
30	10125801	WASHER, Lock, Spring, 4	
31	10127106	SCREW, Machine, 4-40 x .625	
32		TRANSDUCER AND CONNECTOR ASSEMBLY (See Figure 5-20)	
33	94206431	SPRING, Compression	
34	70726001	CAP, End, Transducer	
35	10127353	SCREW, Machine, Pan Head, 8-32 x 1.250	
36	10127102	SCREW, Pan Head, Machine, 4-40 x 1/4	
37	10126400	WASHER, Lock, External Tooth, 4	
38	94224674	LABEL, Information	
39	83275502	LABEL, Chassis Map	

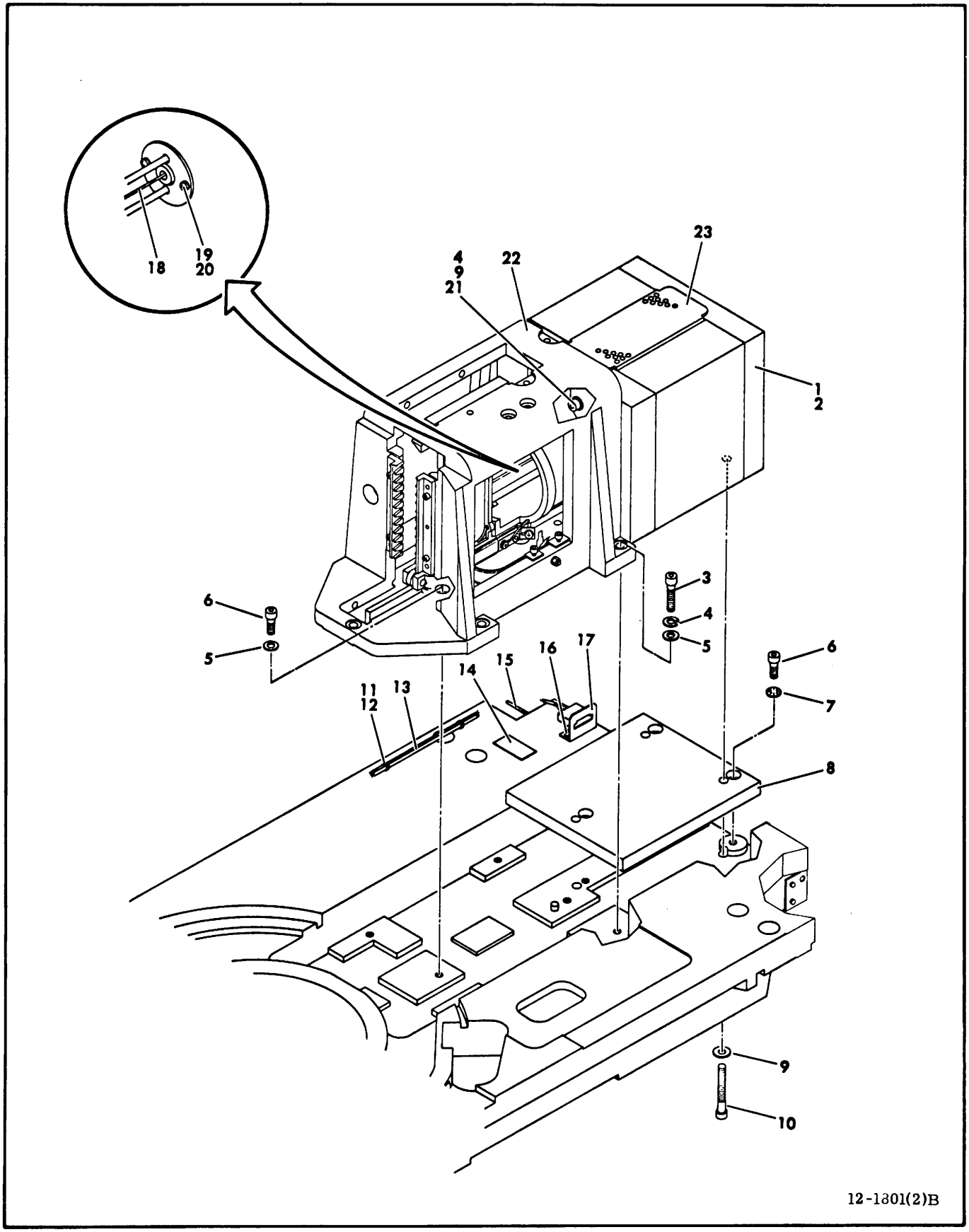

FIGURE 5-18. DECK ASSEMBLY (SHEET 2 OF 3)

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-18-		DECK ASSEMBLY (Sheet 2)	
1	77829301	MAGNET ASSEMBLY	
2	95027403	TAPE, Foam	
3	10126259	SCREW, Hex Socket, Cap Head, 1/4-20 x .250	
4	10125806	WASHER, Lock, Spring, 1/4	
5	94047033	WASHER, Special	
6	10126256	SCREW, Hex Socket, Cap Head, 1/4-20 x .750	
7	10126106	WASHER, Lock, Internal Tooth, 1/4	
8	77441600	SPACER, Magnet	
9	10125608	WASHER, Flat, 1/4	
10	93117374	SCREW, Hex Socket, Cap Head, 1/4-20 x 2	
11	94277406	STRAP, Cable Tie	
12	93592202	SCREW, Self Tapping, Hex Head, 8-32 x .500	
13	77452600	MAIN HARNESS ASSEMBLY, Unshielded	S/C 05 and BLW
13	77452601	MAIN HARNESS ASSEMBLY, Unshielded	S/C 06 and ABV
14	94368701	LABEL	
15	93532207	PIN, Roll	
16	72823900	BRACKET, Connector, 3 Pin	
17	93592196	SCREW, Self Tapping, Hex Head, 8-32 x .250	
18	70729304	ROD, Extension	
19	10127133	SCREW, Machine, Pan Head, 10-24 x .625	
20	10126105	WASHER, Lock, Internal Tooth, 10	
21	10126260	SCREW, Hex Socket, Cap Head, 1/4-20 x .500	
22		ACTUATOR ASSEMBLY (See Figure 5-22)	
23	46484001	COVER, Magnet	

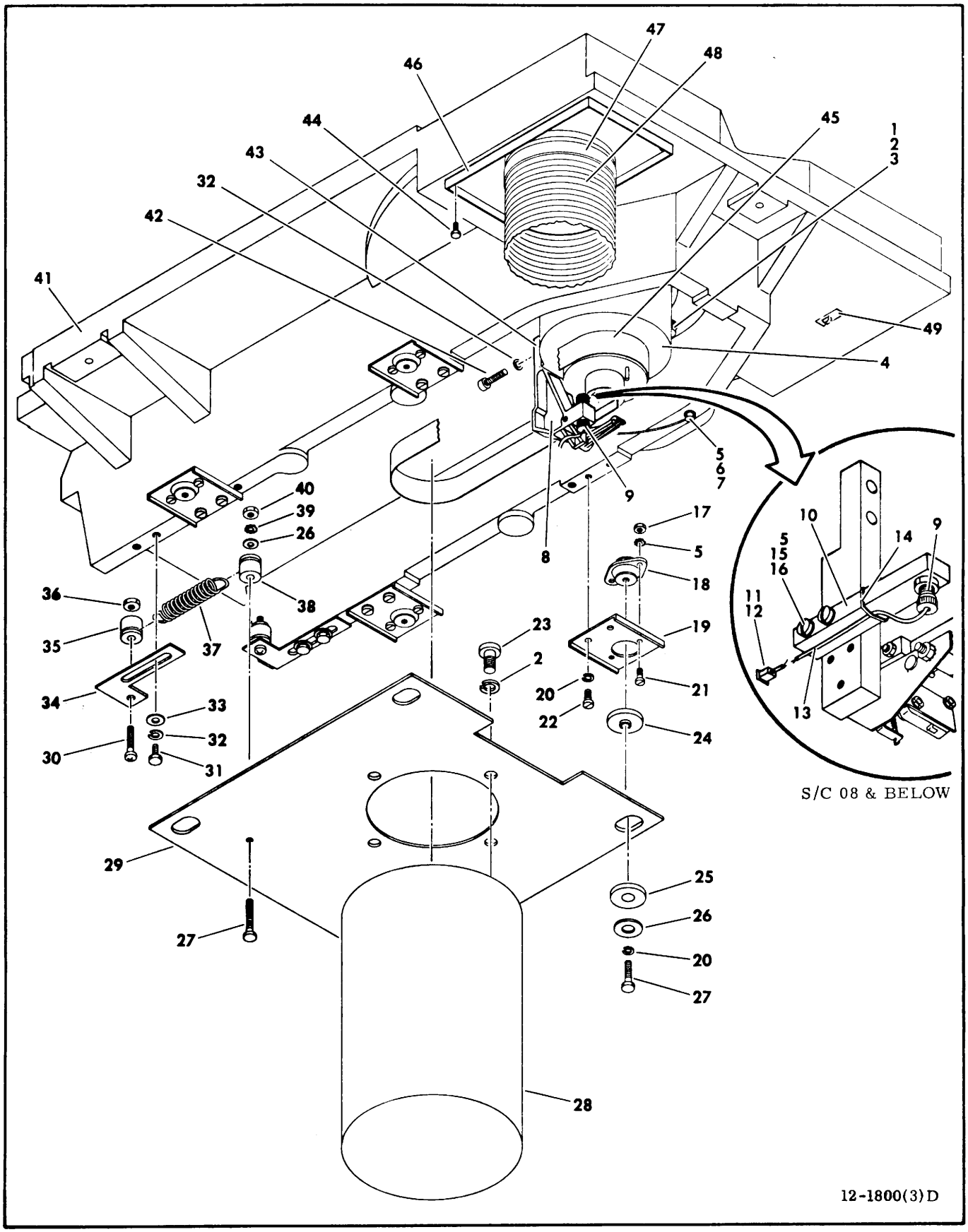

FIGURE 5-18. DECK ASSEMBLY (SHEET 3 OF 3)

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-18-		DECK ASSEMBLY (Sheet 3)	
1	10126533	SCREW, Plain, Hex Head, 3/8-16 x 1.750	
2	10125808	WASHER, Lock, Spring, 3/8	
3	10125610	WASHER, Flat, 3/8	
4		SPINDLE ASSEMBLY (See Figure 5-23)	
5	10126402	WASHER, Lock, External Tooth, 8	
6	93592196	SCREW, Self Tapping, Hex Head, 8-32 x .250	
7	94281419	CABLE, Ground	
8	##	SPEED SENSOR ASSEMBLY	
9	##	HEAD, Magnetic Pickup	
10	73586800	BRACKET, Mounting, Sensor	
11	93948004	CONNECTOR, Pin Housing	
12	93942008	CONTACT, Pin	
13	92261111	TUBING, Teflon	
14	94277400	CABLE, Tie Strap	
15	10126229	SCREW, Hex Socket, Cap Head, 8-32 x .875	S/C 08 and below
16	10125606	WASHER, Flat, 8	S/C 08 and below
17	10125106	NUT, Hex, 8-32	
18	94243003	MOUNT, Shock	
19	76376200	BRACKET, Shock Mount	
20	10125805	WASHER, Lock, Spring, 10	
21	10127348	SCREW, Machine, Pan Head, 8-32 x .500	
22	10127380	SCREW, Machine, Pan Head, 10-32 x .500	
23	10126528	SCREW, Plain, Hex Head, 3/8-16 x .750	
24	77448001	SPACER, Motor Mount	
25	70738305	INSULATOR, Motor Mount	
26	10125607	WASHER, Flat, 10	
27	10125067	SCREW, Machine, Hex Head	
28	##	DRIVE MOTOR AND PULLEY ASSEMBLY	
29	77448100	PLATE, Motor Mounting	
30	10127158	SCREW, Machine, Pan Head, 1/4-20 x 1.250	
31	10126500	SCREW, Plain, Hex Head, 1/4-20 x .500	
32	10125806	WASHER, Lock, Spring, 1/4	
33	10125608	WASHER, Flat, 1/4	
34	75093400	BRACKET, Spring, Mounting Plate	
35	72806502	STANDOFF, Spring	
36	92071004	NUT, Hex, 1/4-20	
37	77530000	SPRING, Extension	
38	72806500	STANDOFF, Spring	
39	10126403	WASHER, Lock, External Tooth, 10	
40	10125108	NUT, Hex, 10-32	
41	83242100	DECK	
42	10126258	SCREW, Hex Socket, Cap Head, 1/4-20 x 1.00	
43		PACK SENSOR ASSEMBLY (See Figure 5-19)	S/C 08 & Below
43		PACK SENSOR ASSEMBLY (See Figure 5-19.1)	S/C 09 & Above
44	00860303	SCREW, Hex Head, 6-32 x .375	
45	##	BELT, Drive, Flat	
46	77456800	ADAPTER, Hose, Deck	
47	94202331	CLAMP, Self-Tightening	
48	94311604	HOSE, Flexible	
49	94277503	BASE, Mounting	

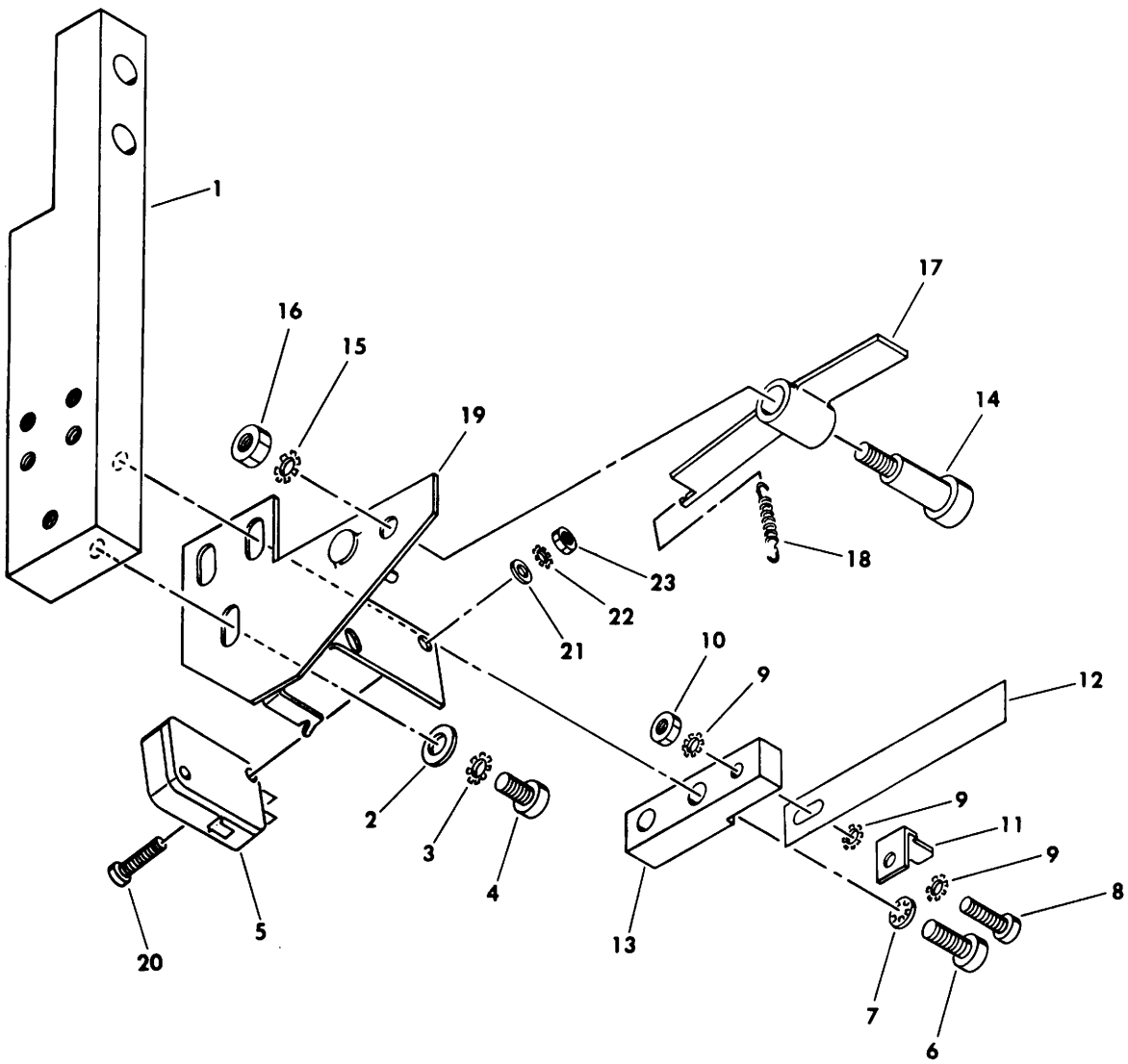

FIGURE 5-19. PACK SENSOR ASSEMBLY (S/C 08 AND BELOW)

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-19-	##	PACK SENSOR ASSEMBLY	This Pack Sensor Assembly on units S/C 08 and below. New Pack Sensor Assembly supplied when reordering.
1	73586600	MOUNT-SWITCH	
2	10125606	WASHER, Plain, 8	
3	10126402	WASHER, Lock, External Tooth, 8	
4	10127122	SCREW, Machine, Pan Head, 8-32 x 3/8	
5	##	SWITCH, Mini-Integral Actuator (A354)	Pack on Switch
6	10127124	SCREW, Machine, Pan Head, 8-32 x 5/8	
7	10126104	WASHER, Lock, Internal Tooth, 8	
8	10127336	SCREW, Machine, Pan Head, 6-32 x 5/8	
9	10126401	WASHER, Lock, External Tooth, 6	
10	10125105	NUT, Machine, Hexagon, 6-32	
11	94274107	TERMINAL, Quick Connect	
12	##	SPRING, Static Ground	
13	73478500	BRACKET, Mounting, Contact	
14	93707002	SCREW, Socket Head, 1/4-20 x 1/2	
15	10126403	WASHER, Lock, External Tooth, 10	
16	10125107	NUT, Machine, Hexagon, 10-24	
17	73587200	ARM- Actuator	
18	73225300	SPRING-EXTENSION	
19	73587300	PLATE, Mounting	
20	10127106	SCREW, Machine, Pan Head, 4-40 x 5/8	
21	10125603	WASHER, Plain, 4	
22	10126400	WASHER, Lock, External Tooth, 4	
23	10125103	NUT, Machine, Hexagon, 4-40	

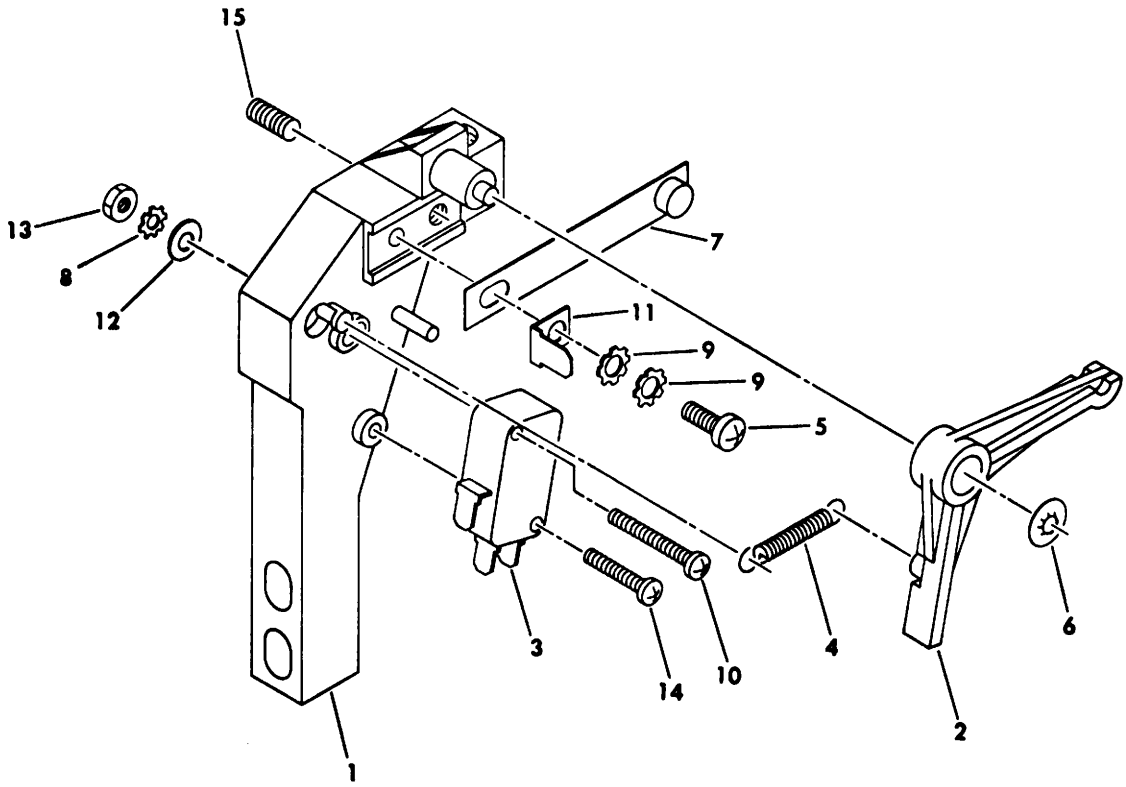

FIGURE 5-19.1. PACK SENSOR ASSEMBLY (S/C 09 AND ABOVE)

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-19.1	##	PACK SENSOR ASSEMBLY	S/C 09 and above.
1	83282900	BASE, SPINDLE END PACK ON SW	
2	83282800	ACTUATOR, PACK ON SWITCH	
3	93786012	SWITCH, MINI INTEGRAL ACTUATOR	
4	83283900	SPRING EXTENSION	
5	93590162	SCREW, PAN, PHILLIPS, 6-32 x 3/8	
6	94241401	FASTENER, BOLT RETAINER	
7	40054700	SPRING, STATIC GROUND	
8	10126400	WASHER, LOCK, EXTERNAL TOOTH , 4	
9	10126401	WASHER, LOCK, EXTERNAL TOOTH , 6	
10	10127108	SCREW, MACHINE, PAN 4-40 x 7/8	
11	94274107	TERMINAL, QUICK CONNECT	
12	10125603	WASHER, PLAIN, 4	
13	10125103	NUT, HEX, MACHINE, 4-40	
14	93590090	SCREW, SELF THREAD, 4-40 x 5/8	
15	93061288	SCREW, SET, SOCKET HEAD, 8-32 x 3/8	

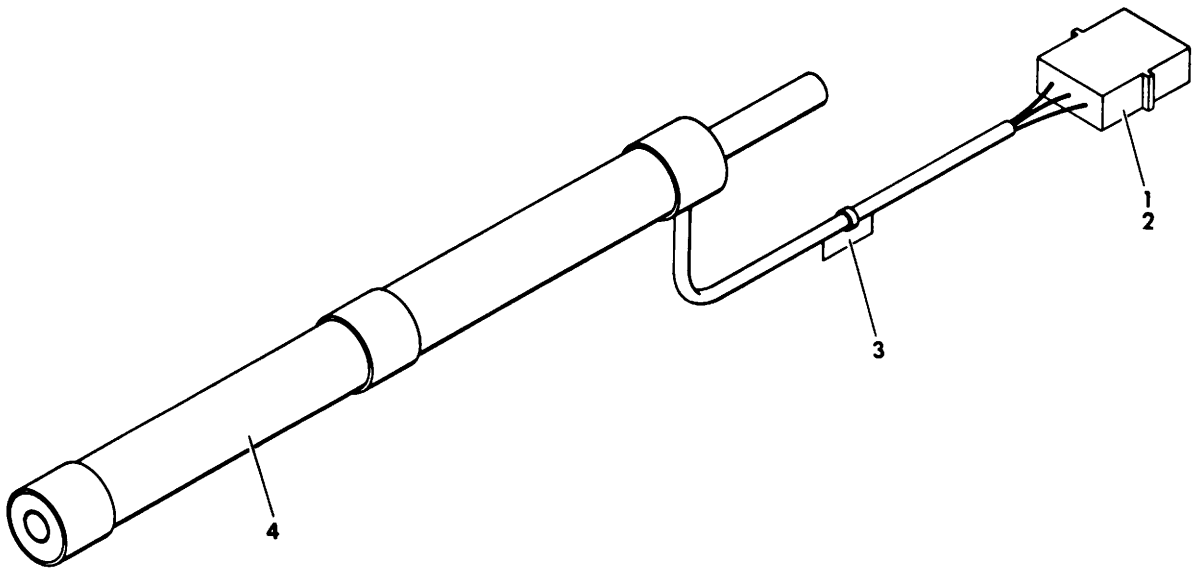

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FIGURE 5-20. TRANSDUCER AND CONNECTOR ASSEMBLY

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-20-	##	TRANSDUCER AND CONNECTOR ASSEMBLY	
1	93948003	CONNECTOR, Housing, 3 Pin (A3P4)	
2	93942015	CONTACT, Pin	
3	94277409	STRAP, Cable Tie	
4	73585001	TRANSDUCER HOUSING ASSEMBLY	

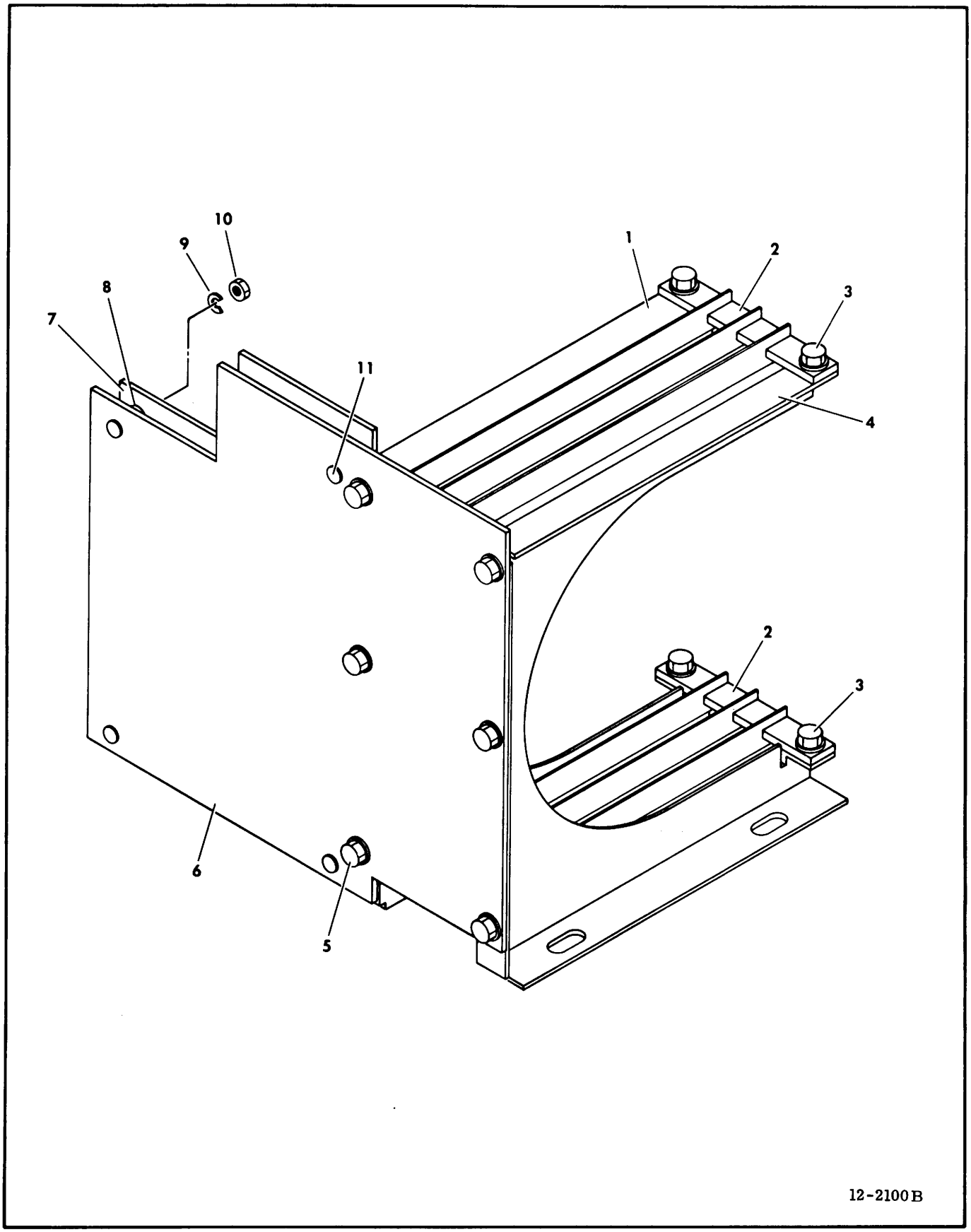

FIGURE 5-21. READ/WRITE CHASSIS ASSEMBLY

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-21-	77445901	READ/WRITE CHASSIS ASSEMBLY	
1	77443000	SUPPORT, Chassis	
2	77442000	RAIL, Guide	
3	93592200	SCREW, Self Tapping, Hex Head, 8-32 x .375	
4	77443001	SUPPORT, Chassis	
5	93592196	SCREW, Self Tapping, Hex Head, 8-32 x .250	
6	##	COMPONENT ASSEMBLY, Type _XFN	
7	##	COMPONENT ASSEMBLY, Type _XGN	
8	00865801	SPACER, Brass Threaded	
9	10125801	WASHER, Lock, Spring, 4	
10	10125103	NUT, Hex, 4-40	
11	93114301	STANDOFF	

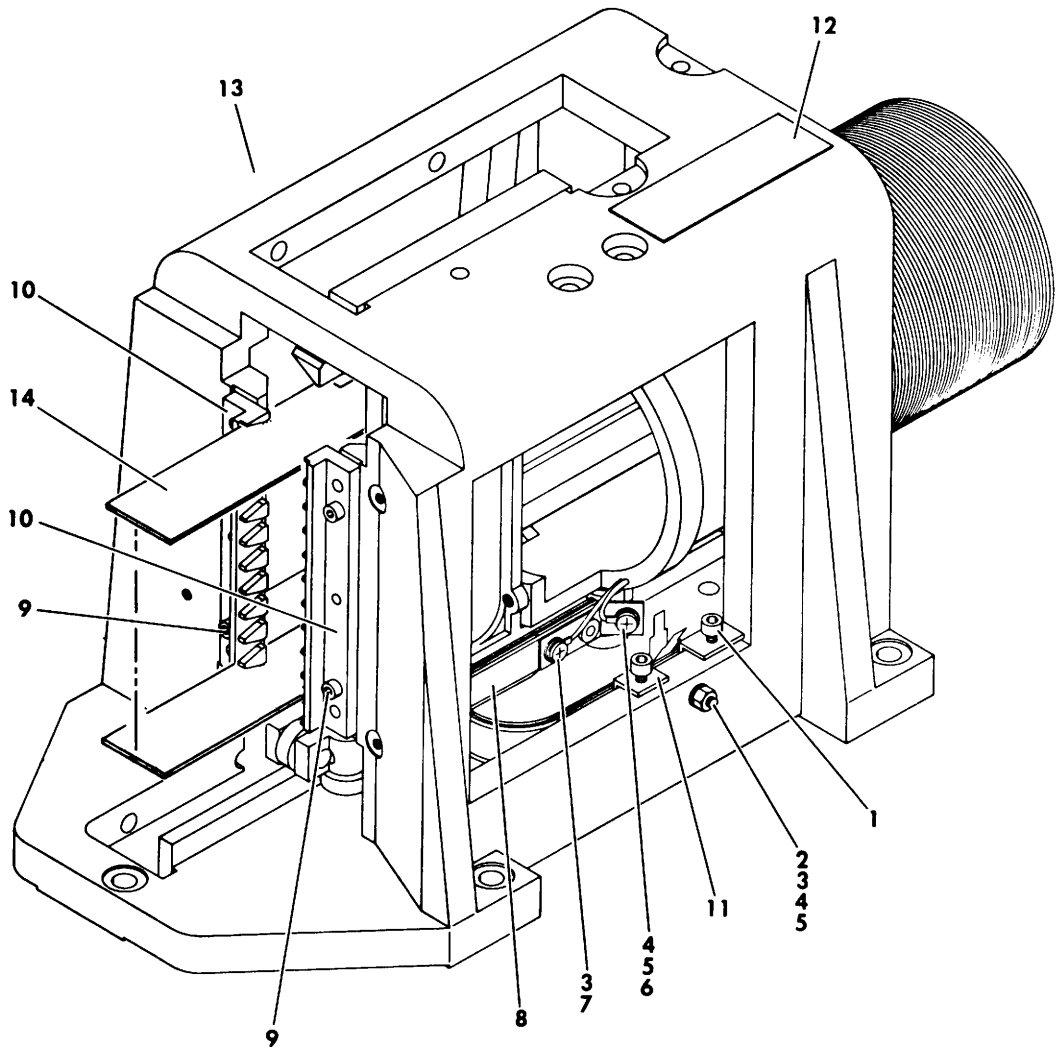

FIGURE 5-22. ACTUATOR ASSEMBLY

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-22-	##	ACTUATOR ASSEMBLY	
1	10126224	SCREW, Hex Socket, Cap Head, 8-32 x .250	
2	94350503	SCREW, Insulated, 6-32 x 1.120	
3	93564032	WASHER, Nylon	
4	10125105	NUT, Hex, 6-32	
5	10126103	WASHER, Lock, Internal Tooth, 6	
6	10127112	SCREW, Machine, Pan Head, 6-32 x .313	
7	94350501	SCREW, Insulated, 6-32 x .620	
8	##	CONDUCTOR, Flexible	
9	10126218	SCREW, Hex Socket, Cap Head, 6-32 x .375	
10	##	CAM, Tower	
11	76046400	BRACKET, Coil Leads	
12	94224671	LABEL, Information, Caution	
13	94224689	LABEL, Information, Head Location	
14	##	HEAD ARM ASSEMBLIES (ATTACHING PARTS)	
	##	SCREW, Head Arm	
		- - - * - - -	

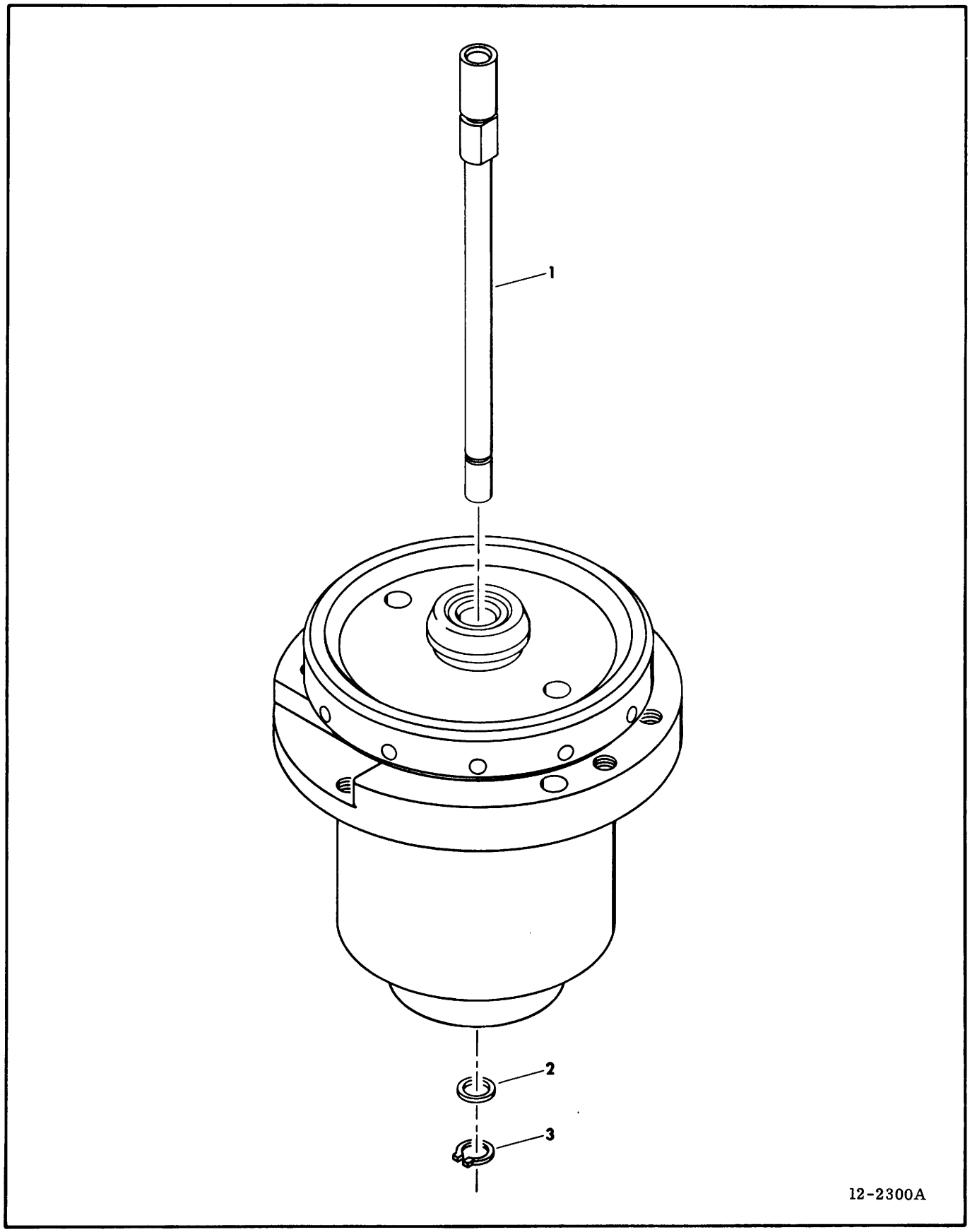

FIGURE 5-23. SPINDLE ASSEMBLY

INDEX NO.	PART NUMBER	PART DESCRIPTION	NOTES
5-23-	##	SPINDLE ASSEMBLY	
1	##	LOCKSHAFT, Spindle	
2	73476503	WASHER, .040	
3	92033301	RING, Retaining	

TABLE 5-1. COLOR CODE CHART

COLOR CODE	CASE		PACK ACCESS COVER		FRONT DOOR		REAR DOOR		LEFT SIDE PANEL		RIGHT SIDE PANEL		TOP PANEL		CASE DOOR		FILLER PANEL-UPPER		FILLER PANEL-LOWER		COMMENTS
	ASSY TAB	PC PT TAB	ASSY TAB	PC PT TAB	ASSY TAB	PC PT TAB	ASSY TAB	PC PT TAB	ASSY TAB	PC PT TAB	ASSY TAB	PC PT TAB	ASSY TAB	PC PT TAB	ASSY TAB	PC PT TAB	ASSY TAB	PC PT TAB	ASSY TAB	PC PT TAB	
A			00	09	00	09			00	03	00	03	00	03							S/C 05 & Below
A			11	09	00	09			00	03	00	03	00	03							S/C 06 & Above
B			22	83	14	82			11	82	11	82	11	82							
C			27	04	19	04			16	02	16	02	16	02							

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SECTION 5B

SPARE PARTS LIST

GENERAL

The Spare Parts List serves as an aid in determining the interchangeability of assemblies and parts to be spared. An example of the columns used in the Spare Parts List is shown below.

NOTE

The spare parts list establishes the support service level of the unit. Individual parts, assemblies, or components not on this list may be long lead time items subject to significant delays.

The Spare Parts List is divided into four columns:

Items Appear On - This column cross references **the part number in the** spare parts list to the associated figure number, page number, and index number in the illustrated parts breakdown.

Description - This column gives the name and a brief description of the part or assembly. This column also tracks series code history information.

Part Number and Replacement Part Number - These columns provide an eight digit number. The difference between the two columns is that the Part Number column gives all the possible parts numbers used for a particular part or assembly, and the Replacement Part Number column gives the interchangeable spare part number.

Notes - This column provides additional information such as Field Change Order (FCO), Special Purchase Order (SPO), serial number, and machine configuration.

EXAMPLE OF SPARE PARTS LIST

ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON			DESCRIPTION	PART NUMBER	REPLACEMENT PART NUMBER	NOTES
FIG. NO.	PAGE NO.	INDEX NO.				
			_VTN COMP ASSEMBLY (POWER AMP) A3A04			
			5VTN - Used S/C 14 and above	XXXX	XXXX	Single Channel
			6VTN - Used S/C 14 and above	XXXX	XXXX	Dual Channel
3-11	3-37	25	CONTROL PANEL ASSEMBLY, A3A01 Used S/C 14 and above	XXXX	XXXX	

FIG NO. 3-11 — PAGE NO. 3-37 — INDEX NO. 25 — THIS PART OR ASSEMBLY APPEARS IN THE ILLUSTRATED PARTS BREAKDOWN ON:

ORIGINAL PART NO. FOR EACH ITEM LISTED

PART NO. TO BE ORDERED WHEN REPLACING PART

DENOTES USE OF PART ACCORDING TO MACHINE CONFIGURATION

ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON			DESCRIPTION	PART NUMBER	REPLACE-MENT PART NUMBER	NOTES
FIG. NO.	PAGE NO.	INDEX NO.				
			THV Comp Assy - Loc A01			Transmitters
			BTHV - Used S/C 01 & Above	54162903	54162903	
			RSV Comp Assy - Loc A02			Receivers
			ARSV - Used S/C 01 & Above	54146502	54146502	
			SLV Comp Assy - Loc A03			Bus In and RPS Steering
			6SLV - Used S/C 01 & Above	54154100	54154100	
			SNV Comp Assy - Loc A04			Bus In Multiplexers
			6SNV - Used S/C 01 & Above	54154900	54154900	
			LTV Comp Assy - Loc A06			Access Control, Index-Sector Decode
			DLTV - Used S/C 01	54276905	54276905	BJ4M1
			ELTV - Used S/C 01 & Above	54276906	54276906	BJ4M2
			LVV Comp Assy - Loc A07			Access Control No 1
			MLVV - Used S/C 01 & Above	54277713	54277713	
			QPV Comp Assy - Loc A08			Diff Bits
			CQPV - Used S/C 01 & Above	54135303	54135303	
			LSV Comp Assy - Loc A10			Write Clock
			CLSV - Used S/C 01 & Above	54276503	54276503	
			LWV Comp Assy - Loc A12			Diff Gen and Control
			FLWV - Used S/C 01 & Above			
			LXV Comp Assy - Loc A13			NRZ to MFM
			ELXV - Used S/C 01 & Above	54278505	54278505	
			LRV Comp Assy - Loc A14			Data Latch
			HLRV - Used S/C 01 & Above	54276108	54276108	

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ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON FIG. NO.	PAGE NO.	INDEX NO.	DESCRIPTION	PART NUMBER	REPLACEMENT PART NUMBER	NOTES
			LZV Comp Assy - Loc A15 (installed only with PLO option) BLZV - Used S/C 01 & Above	54279303	54279303	Read PLO
			KFV Comp Assy - Loc A17 GKFV - Used S/C 01 & Above	54262107	54262107	Fault Card
			FRV Comp Assy - Loc A18 HFRV - Used S/C 01 & Above	54226113	54226113	Fine Servo Decode
			KGV Comp Assy - Loc A19 AKGV - Used S/C 01 & Above	54262501	54262501	Access Control No 2
			MSV Comp Assy - Loc A20 DMSV - Used S/C 01 & Above	54296505	54296505	Analog Servo
			PKV Comp Assy - Loc E01 4PKV - Used S/C 01 & Above	54123700	54123700	Read/Write Control
			PJV Comp Assy - Loc E02 6PJV - Used S/C 01 5PJV - Used S/C 01 & Above	54123302 54123301	54123302 54123301	Write Driver BJ4M1 BJ4M2
			PHV Comp Assy - Loc E03 HPHV - Used S/C 01 & Above	54122900	54122900	Read Amplifier
			XFN Comp Assy - Loc E04 4XFN - Used S/C 01 & Above	75208100	75208100	Mother Board
			XGN Comp Assy - Loc E05 BXGN - Used S/C 01 & Above	75208502	75208502	Head Select
			ZQN Comp Assy FZQN - Used S/C 01 & Above	73485311	73485311	Track Servo Preamp
			YFN Comp Assy AYFN - Used S/C 01 & Above	77427502	77427502	Relay Board

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ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON FIG. NO.	PAGE NO.	INDEX NO.	DESCRIPTION	PART NUMBER	REPLACE-MENT PART NUMBER	NOTES
5-17	5-45		ZCN Comp Assy			Power Amp
			AZCN - Used S/C 01 & Above	75183604	75183604	
5-16	5-43		YEN Comp Assy			Capacitor Board
			5YEN - Used S/C 01 & Above	77427100	77427100	
			ZGN Comp Assy			
			5ZGN - Used S/C 01 & Above	75243202	75243202	
			5 V regulator Comp Assy			
			Used S/C 01 & Above	75054500	75054500	
5-14	5-35		Power Supply Assy			60 Hz
			Used S/C 01 - 05	83243101	47293601	
			Used S/C 06 - 12	83243103	47293624	
			Used S/C 13 - 15	47293603	47293624	
			Used S/C 16 - 17	47293614	47293624	
			Used S/C 18 & Above	47293624	47293624	
5-14	5-25		Power Supply Assy			50 Hz
			Used S/C 01 - 05	83243102	47293602	
			Used S/C 06 - 12	83243104	47293625	
			Used S/C 13 - 15	47293604	47293625	
			Used S/C 16 - 17	47293615	47293625	
			Used S/C 18 & Above	47293625	47293625	
5-14	5-35	22	Transformer, Ferro			60 Hz
			Used S/C 01 & Above	76804000	76804000	
5-14	5-35	22	Transformer, Ferro			50 Hz
			Used S/C 01 & Above	76804100	76804100	
5-14	5-35	24	Transformer, Ferro			
			Used S/C 01 & Above	76804200	76804200	
5-14	5-35	24	Transformer, Ferro			50 Hz
			Used S/C 01 & Above	76804300	76804300	
5-14	5-39	16	Meter - Hour, AC			60 Hz
			Used S/C 01 & Above	94313808	94313808	
5-14	5-39	16	Meter - Hour, AC			
			Used S/C 01 & Above	94313809	94313809	
5-18	5-51	28	Drive Motor + Pulley Assy			60 Hz
			Used S/C 01 & Above	77454000	77454000	

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ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON			DESCRIPTION	PART NUMBER	REPLACE-MENT PART NUMBER	NOTES
FIG. NO.	PAGE NO.	INDEX NO.				
5-18	5-51	28	Drive Motor + Pulley Assy Used S/C 01 & Above	77454001	77454001	50 Hz
5-18	5-51	45	Belt, Drive - Flat, 1.00 x 27 Used S/C 01 & Above	92314087	92314087	60 Hz
5-18	5-51	45	Belt, Drive - Flat, 1.00 x 28 Used S/C 01 & Above	92314093	92314093	50 Hz
5-9	5-23		Control Panel Switch Assy Used S/C 01 & Above	76422501	76422501	
5-14	5-37	49	Contactor, 24 V DC, Power Used S/C 01 & Above	94378200	94378200	
5-14	5-35	13	Filter, RFI Used S/C 01 & Above Used S/C 07 & Above	94246001 94355401	94355401 94355401	
5-14	5-35	25	Transformer Assy, 50/60 Hz Used S/C 01 & Above	47317900	47317900	
5-14	5-37	30	Capacitor, 660 V AC, Non-PCB Used S/C 01 & Above	95686701	95686701	
5-14	5-35	2	Switch, Solid-State, AC, 30 AMP S/C 01 & Above	94371302	94371302	
5-14	5-35	1	Switch, Solid-State, AC, 15 AMP Used S/C 01 & Above	94376500	94376500	
5-14	5-35	3	Switch, Solid-State, AC, 15 AMP Used S/C 01 & Above	94371301	94371301	
5-14	5-39	15	Switch, Toggle Used S/C 01 & Above	92509057	92509057	
5-14	5-39	9	Circuit Breaker, 2 AMP, 50 V DC Used S/C 01 & Above	94268303	94268303	

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ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON			DESCRIPTION	PART NUMBER	REPLACE-MENT PART NUMBER	NOTES
FIG. NO.	PAGE NO.	INDEX NO.				
5-14	5-39	8	Circuit Breaker, 0.5 AMP MAG-HYDRA Used S/C 01 & Above	92696031	92696031	
5-14	5-39	10	Circuit Breaker, MAG-HYDRA Used S/C 01 & Above	92696023	92696023	
5-14	5-39	11	Circuit Breaker, 8 AMP Used S/C 01 & Above	92696001	92696001	
5-14	5-39	12	Circuit Breaker, 7 AMP Used S/C 01 & Above	94268308	94268308	
5-14	5-39	20	Circuit Breaker, Long, U/L Rec. Used S/C 01 & Above	94245211	94245211	
5-14	5-39	14	Circuit Breaker, .375 AMP, 250 V AC Used S/C 01 & Above	94268315	94268315	
5-14	5-39	13	Circuit Breaker, Long, U/L Rec. Used S/C 01 & Above	94345209	94245209	
5-14	5-37	27	Rectifier, Bridge Used S/C 01 - 12 Used S/C 13 - 15 Used S/C 16 & Above	 95582004 50242704 50242705	 50242705 50242705 50242705	
5-15	5-4	1	Connector, Locking (3 Wire) Used S/C 01 & Above	94368003	94368003	
5-13	5-33	4	Blower + Connector Assy Used S/C 01 & Above	77450700	77450700	
5-12	5-31	7	Filter, Aluminum, Washable Used S/C 01-06 Used S/C 07-09 Used S/C 10 & Above	 00815447 92002700 00815447	 00815447 00815447 00815447	
5-13	5-33	9	Filter, Air Used S/C 01 & Above	94358000	94358000	
5-6	5-17	3	Switch, Interlock - .187 Faston Used S/C 01 & Above	93560002	93560002	

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ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON FIG. NO.	PAGE NO.	INDEX NO.	DESCRIPTION	PART NUMBER	REPLACE-MENT PART NUMBER	NOTES
5-19	5-53	5	Switch, Mini, Integral Actuator Used S/C 01 & Above	93786012	93786012	
5-22	5-59		Head Arm Assembly Used S/C 01 & Above	75010000	75010000	BJ4M1, Head Nos 1, 3,5,7,9,10,12,14, 16,18.
5-22	5-59		Head Arm Assy Used S/C 01 & Above	75010001	75010001	BJ4M1, Head Nos 0,2, 4,6,8,11,13,15,17.
5-22	5-59		Head Arm Assy Used S/C 01 & Above	75010100	75010100	BJ4M2, Head Nos 1, 3,5,7,9,10,12,14,16, 18
5-22	5-59		Head Arm Assy Used S/C 01 & Above	75010101	75010101	BJ4M2, Head Nos 0,2, 4,6,8,11,13,15,17.
5-22	5-59		Head Arm Assembly Used S/C 01 & Above	75010109	75010109	BJ4M1, BJ4M2. Servo Head
5-22	5-59		Screw, Head Arm Used S/C 01 & Above	75017500	75017500	
5-22	5-59	10	Cam Tower Used S/C 01 & Above	75015800	75015800	
5-23	5-59		Actuator Assy Used S/C 01 - 02 Used S/C 03 & Above	77445400 77445401	77445401 77445401	
5-17	5-45	22	Transistor, NPN, Silicon Power Used S/C 01 & Above	50222700	50222700	
5-17	5-45	23	Transistor, PNP, Silicon Power Used S/C 01 & Above	50222800	50222800	
5-23	5-61		Spindle Assy Used S/C 01 & Above	73586002	73586002	
5-23	5-61	1	Lockshaft - Spindle Used S/C 01 & Above	76372300	76372300	
5-20	5-55		Transducer - Conn. Assy Used S/C 01 & Above	73618901	73618901	

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ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON			DESCRIPTION	PART NUMBER	REPLACE-MENT PART NUMBER	NOTES
FIG. NO.	PAGE NO.	INDEX NO.				
5-22	5-59	8	Flex Conductor Assy			
			Used S/C 01 - 02	72847100	77444600	
			Used S/C 03 & Above	77444600	77444600	
5-19	5-53	12	Spring, Static, Ground			
			Used S/C 01 & Above	40054700	40054700	
5-18	5-47	28	Switch, Mini, Integral Actuator			
			Used S/C 01 & Above	93786005	93786005	
5-19	5-53		Pack Sensor Assy			
			Used S/C 01 & Above	73586100	73586100	
5-18	5-51	8	Speed Sensor Assy			
			Used S/C 01 - 08	73478600	76395500	
			Used S/C 09 & above	76395500	76395500	
5-18	5-51	9	Head, Magnetic Pickup			
			Used S/C 01 & Above	93552001	93552012	
			Used S/C 14 & Above	93552012	93552012	
			Card Extender Assembly			
			Used S/C 01 & Above	54109700	54109700	

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APPENDIX A

DECISION LOGIC TABLES (DLTs)

CONTENTS

FIGURES

TABLES

APPENDIX A
DECISION LOGIC TABLES (DLTs)

INTRODUCTION

Decision logic tables help the maintenance technician to organize his thinking when problems occur in the drive. For a given fault condition (or set of conditions), actions are recommended to locate and correct the fault. The actions are arranged so that the corrective measures that are easiest to perform (checking a fuse or changing a card in the logic chassis, for example) are listed before the more difficult tasks such as replacing the head/arm assembly or drive motor.

A section called Useful Troubleshooting Aids precedes the DLT section. This section contains two general-interest maintenance procedures, as well as tables and figures that should prove helpful throughout the troubleshooting effort.

The DLT section consists of 13 tables, described briefly below.

- DLT 1 shows how to correct problems that occur when attempting to "power-up" the drive.
- DLT 2 deals with lack of control power (+20Y) used to sequence the logic power supplies.
- DLT 3 examines power and logic problems connected with the spindle drive motor.
- DLTs 4, 5 diagnose problems that involve failure to develop the proper dc logic voltages.
- DLTs 6, 7, 8 investigate faults in the loads for the various logic-voltage supplies.
- DLTs 9 through 12 are used with the FTU (TB303) to correct various seek and read/write errors.
- DLT 13 shows what to do when a drive does not "power-down" properly.

The procedures referred to in the DLTs form the last section in this appendix.

USING THE DLT

The DLT is divided into four quadrants. The upper-left quadrant, CONDITIONS, contains the various test conditions that can be answered "yes" or "no". The CONDITIONS quadrant is prefaced by any ASSUMPTIONS (that is, preconditions) that must be observed if the test results are to be valid. Sometimes, prerequisite actions other than the ASSUMPTIONS must be taken before the test for a given condition is made. Such steps are included in the CONDITIONS quadrant. The yes (Y) or no (N) answers to each condition are shown in numbered columns in the top-right Situations quadrant.

To use the DLT, first determine whether the result of a condition tested is Y or N. If two or more conditions exist simultaneously, look for a situations column that combines the appropriate Y-N answers for those conditions. A dash (-) in the top-right Situations quadrant means that the related Condition is not a factor in determining what actions are to be taken for that situation.

Next, determine what action should be taken for a given test result (i.e., situation) by following down the selected column to the row marked "1" in the lower-right Sequence quadrant. (If there is only one recommended action for a given situation, an "X" appears instead of the "1".) The recommended action is then located by moving across to the lower-left ACTIONS quadrant. A dash in a column of the Sequence quadrant indicates that the related Action isn't applicable.

After taking the first recommended action, repeat the test that gave rise to the situation. If the test results haven't changed (same situation), try recommended action 2, and so on, being sure to repeat the test after each such action.

Column 1 is generally reserved for an "everything OK" situation. If a DLT requires more than one sheet, this "no problem" column is repeated on each sheet. Similarly, the last ACTION on each sheet is a recommendation to "call field support". Don't brood over your inadequacy if you reach this last entry; not every situation can be covered in a DLT!

USEFUL TROUBLESHOOTING AIDS

USING A VOM TO CHECK A CAPACITOR

1. Remove power from the equipment.
2. Discharge capacitor by momentarily shorting the leads with a jumper wire. (Use screwdriver for large capacitors.)
3. Isolate the capacitor by disconnecting one lead from the circuit.
4. Set VOM to X1000 (ohms) scale.
5. Connect the VOM across the capacitor leads. The condition of the capacitor is interpreted as follows:

Meter reading	Interpretation
Needle goes rapidly to full scale (0Ω), then regresses to infinity (∞). (See NOTE.)	Capacitor OK
Needle goes rapidly to full scale and remains there.	Capacitor shorted
Needle deflects slightly or not at all.	Capacitor open

NOTE

Speed with which needle returns to infinity (∞) is a function of capacity rating. Return swing is rapid for small capacitors, becoming slower as capacity increases. To a lesser degree, return swing is also dependent upon which meter scale is used.

IN-CIRCUIT DIODE CHECKING WITH A VOM

A diode that is suspect can be given a preliminary check without disconnecting it from the circuit. Merely check the diode twice, reversing the meter leads between the two readings. Of course, power should be off, and for your own peace of mind any capacitors in the circuit should be discharged.

Keep in mind that the forward drop across a good diode is in the range 5 - 15 Ω; the reverse drop is on the order of 1 MΩ. Parallel resistances in the circuit will, of course, significantly reduce the higher of these two readings, but if one is low and the other high, chances are the diode is OK. If both are low, the diode is probably shorted; if both are high, it's probably open.

This check can also be used for a bridge rectifier. You'll probably want to check at least two diodes in the bridge, because back-circuits may give different readings across different diodes.

TABLE A-1. VOLTAGES USED BY ELECTRONIC COMPONENTS

Assembly	+5 V	-5 V	+9.7 V	-9.7 V	+10.5 V	-10.5 V	-16 V	+20Y	+20 V	-20 V	+22 V	+28 V	+46 V	-46 V	CARD TYPE
A1 - Power Supply															
Rect/Cap Board			✓	✓			✓	✓	✓	✓		✓	✓	✓	YEN
Relay Board			✓				✓	✓							YFN
Power Amp													✓	✓	ZCN
A2 - Logic Chassis															
±5 V Regulator Card			✓	✓											-
A01	✓	✓													THV
A02	✓	✓													RSV
A03	✓														SLV
A04	✓														SNV
A06	✓	✓													LTV
A07	✓														LVV
A08	✓	✓													QPN
A10	✓	✓							✓	✓					LSV
A12	✓														LWV
A13	✓	✓													LXV
A14	✓	✓							✓	✓					LRV
A15	✓	✓							✓	✓					LZV
A16	✓	✓							✓	✓			Reserved for Hd. Alignment Card		
A17	✓	✓							✓	✓			✓	✓	KFZ
A18	✓	✓							✓	✓					FRV
A19	✓	✓							✓	✓					KGV
A20	✓	✓							✓	✓					MSV
A3 - Deck				from A2 via PA82											
E01	✓	✓							✓	✓		✓			PKV
E02	✓	✓			①	①					②				PJV
E03	✓	✓			①	①					②				PHV
E04	✓	✓													XFN
E05	✓														XGN
Servo Preamp			✓	✓											ZQN
Voice Coil							✓								-
Pack Cover Solenoid								✓							-
A4 - Operator Panel	✓														

① Derived from ±20 V on E01
② Derived from +28 V on E01

A2 locations not used:
A05, A09, A11

TABLE A-2. DC VOLTAGE MEASUREMENTS

DC Voltage to be Measured	Probe Connections for Scope or VOM			Acceptable DC Voltage Range
	Full Load (1)	No Load		
	+Probe	+Probe	GND Probe	
+46	+46 TP	A1TB2-8	↑ Use terminals 1, 2, 3, or 9 through 14 of A1TB1 ↓	+44 → +51
-46	-46 TP	A1TB2-7		-44 → -51
+28	+28 TP	A1TB2-1		+26 → +30
+20Y	--	A1TB2-11		+18 → +22
+20	+20 TP	A1TB2-5		+18 → +24
-20	-20 TP	A1TB2-4		-18 → -24
-16 (E.R. Pwr)	--	A1TB2-6		-14 → -20
+9.7	+9.7 TP	A1TB2-3		+8.7 → +10.7
-9.7	-9.7 TP	A1TB2-2		-8.7 → -10.7
+5	A2JD94-04A	Use GND Faston on regulator card for Load or No Load condition		+5.05 → +5.15
-5	A2JD94-01A			-5.05 → -5.15
+16	K8-3	Brake power bridge rectifier is not grounded. Measure full voltage as given at right		28 → 45
-16	K8-10			

(1) Measure to GND test point on power supply panel. The corresponding dc breaker must be ON.

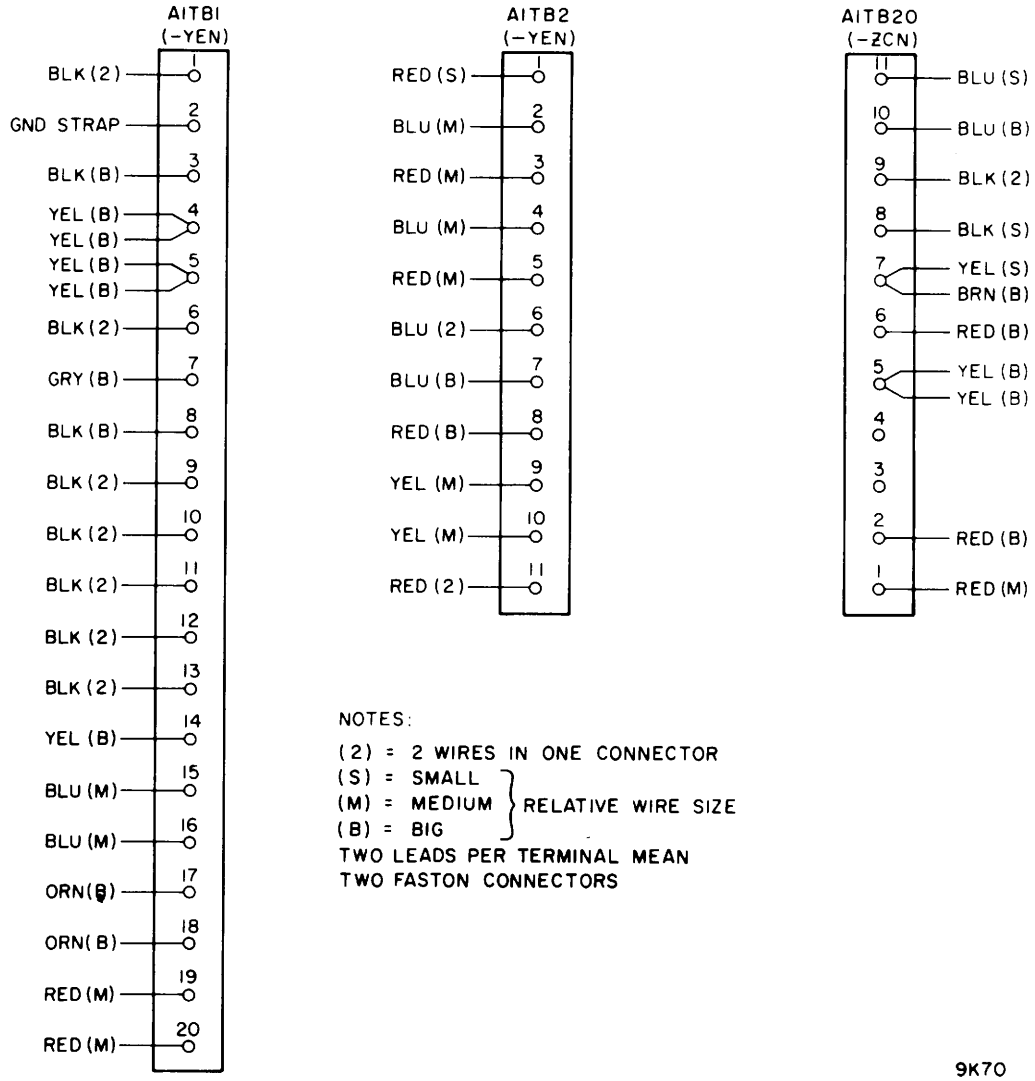

Figure A-1. _YEN, _ZCN Terminal Board Connections

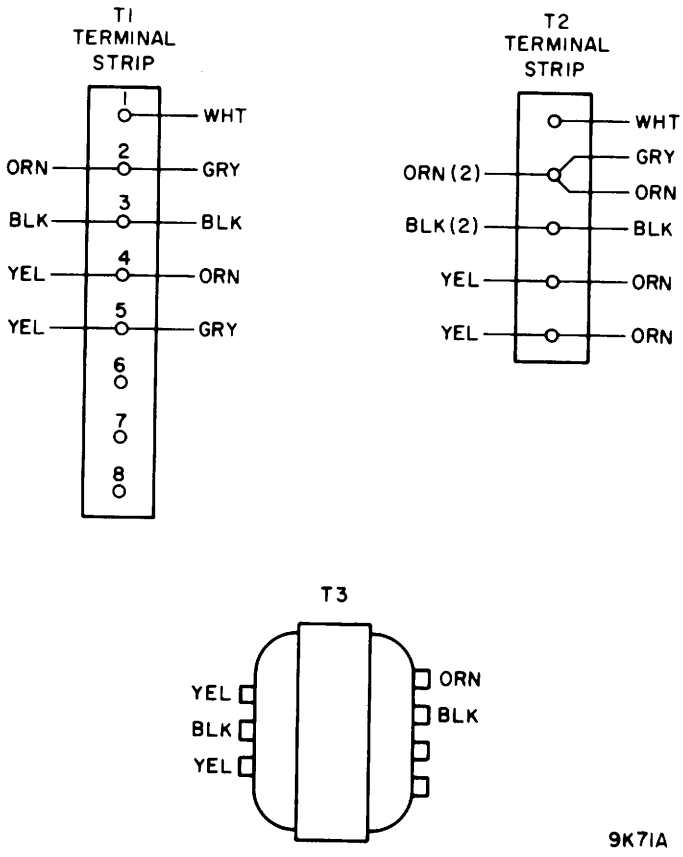

Figure A-2. Transformer Connections

DECISION LOGIC TABLES

DLT 1 — POWER UP (sheet 1 of 2)

Warning: None

Enters from: Assumptions

Procedures: None

References: Logic Diagrams

Exits to: DLTs 1 through 10, as indicated

Assumption:
1. Drive connected to site power
2. Disk installed and all covers closed
3. MAIN AC brkr OFF, all others ON.

CONDITIONS	1	2	3	4	5	6	7	8	9	10	11	12
1. Turn on MAIN AC brkr (CB1). Does blower motor start?	Y	N	-	-	-	-	-	-	-			
2. Do any breakers trip?	N	-	Y	-	-	-	-	-	-			
3. Press START switch. Does START indicator come on and READY light flash at 1-second intervals?	Y	-	-	N	-	-	-	-	-			
4. Does drive motor start?	Y	-	-	-	N	-	-	-	-			
5. Does drive motor come up to speed? (Centrifugal sw. clicks.)	Y	-	-	-	-	N	-	-	-			
6. Does drive motor cut out when 10-sec timeout expires?	N	-	-	-	-	-	Y	-	-			
7. Do heads Load?	Y	-	-	-	-	-	-	N	-			
8. Is First Seek successful? (READY light stays on.)	Y	-	-	-	-	-	-	-	N			
ACTIONS												
1. Power-up completed satisfactorily. Go to DLT 10.	X	-	-	-	-	-	-	-	-			
2. Elapsed-time meter running? YES: chk line filters & blower-cable connector. NO: chk pwr available, then for ac at LINE inputs to CB1, finally for correct phasing at pwr plug.	-	1	-	-	-	-	-	-	-			
3. See which breaker tripped and go to indicated DLT:	-	-	X	-	-	-	-	-	-			
MAIN AC (CB1)--DLT 1, sht 2												
+20 Y (CB2)--DLT 2												
MOTOR (CB3) or thrml brkr--DLT 3												
±9.7 V (CB5, CB6)-- DLT 6												
±20 V (CB7), +28 V (CB8)-- DLT 7												
±46 V (CB4) and ±16 V-- DLT 8												
4. Check that all brkrs are ON.	-	-	-	1	-	-	-	-	-			
5. Chk dc test jacks on p.s. panel. Any dc voltage means +20 Y control voltage is OK; see DLTs in Action 3 if some voltages missing. If no dc voltages, go to DLT 2 to locate fault in +20 Y.	-	-	-	2	-	-	-	-	-			
6. See that A1P/J4 is properly mated (START light).	-	-	-	3	-	-	-	-	-			
7. Chk P/JD93, P/JA80, P/J201 for proper mating (START light).	-	-	-	4	-	-	-	-	-			
8. Replace logic cards A08, A17 (READY flasher).	-	-	-	5	-	-	-	-	-			
9. Go to DLT 3 (Drive Motor).	-	-	-	-	X	X	-	-	-			
10. Chk speed sensor & logic (cards A17, A08).	-	-	-	-	-	-	1	-	-			
11. Go to DLT 9 (First Seek).	-	-	-	-	-	-	-	X	X			
12. Call Field Support.	-	2	-	6	-	-	2	-	-			

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DLT 1 POWER UP (sheet 2 of 2)

Warning: Tuning capacitors A1C1 and A1C2 are charged to 500 volts!

Enters from: Assumptions

Procedures: None

References: Power Supply diagrams (80x)

Exits to: DLT 1, DLT 3

Assumption: In attempting to power up the drive, CB1 (MAIN AC) trips when turned ON. All other brkrs are ON as a precondition for Power Up.

CONDITIONS	1	2	3	4	5	6	7	8	9	10	11	12
1. Turn off CB2 (+20 Y) and CB3 (MOTOR). Reset CB1 and try again. Does CB1 still trip?	Y	N	-	-	-	-	-	-	-	-		
2. Turn off CB1, turn on CB3. Now turn on CB1. Does either CB3 or CB1 trip?	-	-	Y	N	-	-	-	-	-	-		
3. Turn off CB1. Disconnect wire from A1Q1-2 (AC PWR triac) to kill input to T1 and T2. Reset CB1. Does CB1 still trip?	-	-	-	-	Y	N	-	-	-	-		
4. Turn off CB1. Replace wire on A1Q1-2; remove wire from A1Q5-1. (This enables input to T2.) Turn on CB1. Does CB1 trip?	-	-	-	-	-	-	Y	N	-	-		
5. Turn off CB1. Replace wire on A1Q5-1; remove wire from A1Q5-2. (This checks for grounded LOAD contacts of A1Q5.) Turn on CB1. Does CB1 trip?	-	-	-	-	-	-	-	-	Y	N		
ACTIONS												
1. Disconnect blower and try again. If trouble persists, blower is OK. Reconnect and go to next recommended Action.	1	-	-	-	-	-	-	-	-	-		
2. Disconnect time meter and try again. If trouble persists, meter is OK. Reconnect and go to next recommended Action.	2	-	-	-	-	-	-	-	-	-		
3. Chk for shorts/gnds in wiring to LINE side of CB2 and CB3.	3	-	-	-	-	-	-	-	-	-		
4. Go to Condition 2.	-	X	-	-	-	-	-	-	-	-		
5. Drive motor at fault. Go to DLT 3.	-	-	X	-	-	-	-	-	-	-		
6. Go to Condition 3.	-	-	-	X	-	-	-	-	-	-		
7. Replace AC PWR triac, A1Q1.	-	-	-	-	1	-	-	-	-	-		
8. Go to Condition 4.	-	-	-	-	-	X	-	-	-	-		
9. Check wiring to T2 for shorts/grounds.	-	-	-	-	-	-	1	-	-	-		
10. Chk for shorted tuning capacitor A1C1. Note WARNING, above.	-	-	-	-	-	-	2	-	-	-		
11. Go to DLT 4 (Fault in T2 Network).	-	-	-	-	-	-	3	-	-	-		
12. Go to Condition 5.	-	-	-	-	-	-	-	X	-	-		
13. Replace T1 ENABLE triac, A1Q5.	-	-	-	-	-	-	-	-	1	-		
14. Check wiring to T1 for shorts/grounds.	-	-	-	-	-	-	-	-	-	1		
15. Chk for shorted tuning cap A1C2. (Note WARNING, above).	-	-	-	-	-	-	-	-	-	2		
16. Go to DLT 5 (Fault in T1 Network).	-	-	-	-	-	-	-	-	-	3		
17. Call Field Support.	4	-	-	-	2	-	4	-	2	4		

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DLT 2 +20 Y (+20 VOLT RELAY POWER) MISSING (sheet 1 of 2)

Warning: None

Enters from: DLT 1 (sheet 1) or Assumption 2)

Procedures: None

References: Logic Diagrams

Exits to: Power Up sequence (retry) and, if applicable, DLT 1

Assumption: 1. Lack of +20 Y noticed during Power Up sequence (See DLT 1, Actions 3 or 5)
OR: 2. Drive motor stops; all indicator lights out, blower still on.

CONDITIONS	1	2	3	4	5	6	7	8
1. Has +20 Y breaker (CB2) tripped?	Y	N	-	-	-	-		
2. Check for short in control circuit of A1Q5 by removing Faston from A1Q5-3. Reset CB2 and try again. Does CB2 still trip?	-	-	N	Y	-	-		
3. Check for short in control circuit of A1Q1 by removing Faston from A1Q1-3. Reset CB2 and try again. Does CB2 still trip?	-	-	-	-	N	Y		
ACTIONS								
1. Go to Condition 2.	X	-	-	-	-	-		
2. Go to Condition 5 on sheet 2.	-	X	-	-	-	-		
3. Replace A1Q5.	-	-	1	-	-	-		
4. Reconnect Faston to A1Q5-3 and go to Condition 3.	-	-	-	X	-	-		
5. Replace A1Q1.	-	-	-	-	1	-		
6. Trouble is in generating +20 Y. Reconnect Faston to A1Q1-3 and go to Condition 4 on sheet 2.	-	-	-	-	-	X		
7. Call Field Support.	-	-	2	-	2	-		

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DLT 2 +20 Y (+20 VOLT RELAY POWER) MISSING (sheet 2 of 2)

Warning: None

Enters from: DLT 1 (sheet 1) or Assumption 2)

Procedures: None

References: Logic Diagrams

Exits to: Power Up sequence (retry) and, if applicable, DLT 1

Assumption: 1. Lack of +20 Y noticed during Power Up sequence (See DLT 1, Actions 3 or 5).
OR: 2. Drive motor stops; all indicator lights out, blower still on.

CONDITIONS	7	8	9	10
4. Check for shorted T3: Remove Fastons from A1TB2-9 and A1TB2-10 (to isolate T3 from +20 Y rectifier). Reset CB2 and try again. Does CB2 still trip?	N	Y	-	-
5. Turn on (or reset) CB2 and check for +20 volts at A1TB2-11 (+20 Y output). Is +20 Y present?	-	-	N	Y
ACTIONS				
8. Replace capacitor board (-YEN), then go to Condition 5.	1	-	2	-
9. Check for shorts in wiring to/from T3.	-	1	-	-
10. Replace T3, reconnect Fastons removed in Condition 4, and go to Condition 5 to check for presence of +20 Y.	-	2	-	-
11. Check T3 input to +20 Y rectifier; test for approx 20 vac between A1TB1-11 (gnd) and A1TB2, pins 9 and 10. If not present, check wiring from T3; if needed, replace T3. If ac is present, go to next recommended Action.	-	-	1	-
12. If this DLT was entered because of Assumption 1, the problem has been solved.	-	-	-	1
13. If this DLT was entered because of Assumption 2, check for +20 Y continuity: A1P5-12, A1P5-13 (on cable to relay board -YFN), A1Q1-3. If no +20 Y at A1Q1-3, go to next recommended Action. (A1Q1 controls the generation of all logic voltages.)	-	-	-	2
14. Failure of +5 V (to light the indicators) may have been caused by the tripping of the +9.7 V breaker (CB5). If so, go to DLT 4. If not, go to next recommended Action.	-	-	-	3
15. Replace A1Q1.	-	-	-	4
16. Call Field Support.	2	3	3	5

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DLT 3 DRIVE MOTOR

Warning: None

Enters from: DLT 1 or Assumptions

Procedures: None

References: Logic Diagrams

Exits to: DLT 2, DLT 4; or return to DLT 1

Assumption: 1. Drive motor fails to start, or starts prematurely, or does not come up to speed. All breakers initially ON.

OR: 2. Drive motor shuts down after it has been running properly.

CONDITIONS	1	2	3	4	5	6	7	8	9	10	11	12
1. Does drive motor start as soon as CB1 is actuated?												
2. Does drive motor start as soon as START sw is pressed?												
3. Does CB3 or motor thermal switch trip as soon as CB1 is actuated?												
4. Does CB3 or motor thermal sw trip as soon as START is pressed?												
5. Does CB3 or thrml sw trip before motor gets up to speed?												
6. Is squealing heard when motor starts to run?												
7. Is +20 Y present at pin 3 of triacs A1Q2, A1Q3, A1Q4 upon pressing START switch?												
8. Is 208 V ac present at pin 2 of A1Q2, A1Q3, A1Q4 upon pressing START switch?												
9. Is lack of motor power accompanied by illumination of one or more FAULT indicators?												
ACTIONS												
1. No problem. If READY light comes on steady, proceed to DLT 9. If not, return to DLT 1 to check cause.	X	-	-	-	-	-	-	-	-	-	-	
2. Replace card A08.	-	1	-	-	-	-	-	-	-	2	-	
3. Replace relay board (-YFN)	-	2	-	-	-	-	-	-	-	3	-	
4. Check that parking brake has released drive spindle.	-	-	1	-	-	-	-	-	-	-	-	
5. Check drive belt and tension.	-	-	2	-	-	-	-	1	1	-	-	
6. Check integrity of power wiring (P/J7) to drive motor.	-	-	-	1	-	-	-	-	-	-	-	
7. Replace drive motor.	-	-	-	2	-	-	-	-	-	-	-	
8. Replace suspected triacs.	-	-	-	-	1	-	-	-	-	-	-	
9. Failure in +20 Y circuits. Go back to DLT 2.	-	-	-	-	-	X	-	-	-	-	-	
10. Check for short on LOAD side of CB3. Replace CB3 if needed.	-	-	-	-	-	-	1	-	-	-	-	
11. Check for +9.7 V at test jack on panel. If present, go to next recommended Action. If not present, go to DLT 4.	-	-	-	-	-	-	-	-	-	1	-	
12. Troubleshoot the Faults.	-	-	-	-	-	-	-	-	-	-	1	
13. Call Field Support.	-	3	3	3	2	-	2	2	2	4	2	

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DLT 4 — FAULT IN T2 NETWORK (sheet 1 of 2)

Warning: Tuning capacitor A1C2 is charged to 500 volts!

Enters from: DLT 1 (sheet 2, Action 11)

Procedures: A

References: Diagrams

Exits to: Sheet 2 (of DLT 4)

Assumption: MAIN AC brkr (CB1) trips. Problem has been narrowed to transformer A1T2, which is the source for ±9.7, ±20, and +28 voltages, or to the generation/ distribution of those voltages.

CONDITIONS	1	2	3	4	5	6	7	8
1. Check out A1T2:								
a) Remove Faston from A1Q5-1 or A1Q5-2 (prevents energizing T1).								
b) Disconnect A1C2. Note WARNING, above.								
c) Disconnect Fastons from terminals 14 through 20 of A1TB1.								
d) Turn on CB1. Does CB1 trip?	Y	N	-	-	-	-	-	-
2. Check out ±9.7 V rectifier.								
a) Turn off CB1 and reconnect A1C2.								
b) Separate connector A1P/J3 (removes load from rectifier).								
c) Reconnect Fastons to terminals 14 (gnd), 17, and 18 of A1TB1.								
d) Turn on CB1. Does CB1 trip? (1)	-	-	Y	N	-	-	-	-
3. Check out ±20 V rectifier:								
a) Turn off CB1 and CB7 (±20 V breaker).								
b) Reconnect Fastons to terminals 15 and 16 of A1TB1.								
c) Turn on CB1. Does CB1 trip? (1)	-	-	-	-	Y	N	-	-
4. Check out +28 V rectifier:								
a) Turn off CB1 and CB8 (+20 breaker).								
b) Reconnect Fastons to terminals 19 and 20 of A1TB1.								
c) Turn on CB1. Does CB1 trip? (1)	-	-	-	-	-	-	Y	N

ACTIONS	1	2	3	4	5	6	7	8
1. Replace A1T2, then restore all connections and try again.	1	-	-	-	-	-	-	-
2. Go to Condition 2.	-	X	-	-	-	-	-	-
3. Replace capacitor brd, then restore all connections and try again.	-	-	1	-	1	-	1	-
4. Go to Condition 3.	-	-	-	X	-	-	-	-
5. Go to Condition 4.	-	-	-	-	-	X	-	-
6. No shorts/ gnds on capacitor board; continue on sheet 2.	-	-	-	-	-	-	-	X
7. Call Field Support.	2	-	2	-	2	-	2	-

(1) For a NO answer here, you may wish to check the value of the ac input, per Procedure A, particularly if the dc voltages checked on sheet 2 are low.

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DLT 4 — FAULT IN T2 NETWORK (sheet 2 of 2)

Warning: None

Enters from: Sheet 1

Procedures: None

References: Diagrams

Exits to: DLTs 5, 6, 7

Assumption: Problem in the T2 network has been further narrowed to either an open rectifier (±9.7 V, ±20 V, +28 V), or a fault in one of the loads sourced from T2.

CONDITIONS	1	2	3	4	5	6	7	8	9	10	11	12
1. Check ±9.7 voltage:												
a) Turn off CB1.												
b) Ensure that CB5 and CB6 are ON, and that A1P/J3 is separated.												
c) Turn on CB1. Are ±9.7 V present at panel test jacks? (1)	Y	N	-	-	-	-	-	-	-	-	-	-
2. Check ±9.7 V loads:												
a) Turn off CB1 and CB7 (±20 V breaker).												
b) Reconnect A1P/J3 to restore ±9.7 V load.												
c) Turn on CB1. Does either CB5 or CB6 trip?	-	-	Y	N	-	-	-	-	-	-	-	-
3. With CB1 ON and CB7 still OFF, chk for no-load ±20 V at terminals 5 and 6, respectively, of A1TB2. (Ground probe on A1TB1-14.) Are voltages present? (1)	-	-	-	-	Y	N	-	-	-	-	-	-
4. Chk ±20 V loads by turning on CB7. Does CB7 trip?	-	-	-	-	-	-	Y	N	-	-	-	-
5. With CB1 ON and CB8 (+28 V brkr) OFF, chk for no-load +28 V at A1TB2-1 (gnd probe on A1TB2-14). Is +28 V present? (1)	-	-	-	-	-	-	-	-	Y	N	-	-
6. Chk +28 V load by turning CB8 ON. Does CB8 trip?	-	-	-	-	-	-	-	-	-	-	Y	N

ACTIONS												
1. Go to Condition 2, above.	X	-	-	-	-	-	-	-	-	-	-	-
2. Inoperative rectifier--replace capacitor board.	-	1	-	-	-	1	-	-	-	1	-	-
3. Problem is in ±9.7 V loads. Go to DLT 6.	-	-	X	-	-	-	-	-	-	-	-	-
4. ±9.7 V network is OK. Go to Condition 3.	-	-	-	X	-	-	-	-	-	-	-	-
5. Go to Condition 4.	-	-	-	-	X	-	-	-	-	-	-	-
6. Problem is in the ±20 V loads. Go to DLT 7.	-	-	-	-	-	-	X	-	-	-	-	-
7. ±20 V network is OK. Go to Condition 5.	-	-	-	-	-	-	-	X	-	-	-	-
8. Go to Condition 6.	-	-	-	-	-	-	-	-	X	-	-	-
9. Problem is in the +28 V load. Go to DLT 7.	-	-	-	-	-	-	-	-	-	X	-	-
10. T2 network is OK. Go to DLT 5 to check T1.	-	-	-	-	-	-	-	-	-	-	-	X
11. Call Field Support.	-	2	-	-	-	2	-	-	-	2	-	-

(1) If voltages are present, but 10% or more below nominal, check ac input to rectifier, per Procedure A.

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DLT 5 — FAULT IN T1 NETWORK (sheet 1 of 2)

Warning: Tuning capacitor A1C1 is charged to 500 volts!

Enters from: DLT 1 (sheet 2, Action 6)

Procedures: A

References: Diagrams

Exits to: Sheet 2 (of DLT 5), DLT 8

Assumption: MAIN AC brkr (CB1) trips. Problem has been narrowed to transformer A1T1, which is the source for ±16 and ±46 voltages, or to the generation or distribution of those voltages. (That is to say, T2 network is OK.)

CONDITIONS	1	2	3	4	5	6	7	8	9	10	11	12
1. Check out A1T1:												
a) Turn off CB1.												
b) Disconnect A1C1. Note WARNING above.												
c) Reconnect Fastons to A1Q5 to place A1T1 in the ac circuit.												
d) Disconnect Fastons from terminals 4,5 (2 Fastons each) and 3,6,7,8 (one Faston each) of A1TB1. (Rectifier inputs.)												
e) Turn on CB1. Does CB1 trip?	Y	N	-	-	-	-	-	-	-	-		
2. Check out ±46 V rectifier:												
a) Turn off CB1 and CB4 (±46 V breaker).												
b) Reconnect A1C1.												
c) Reconnect Fastons to terminals 3,7,8 of A1TB1.												
d) Turn on CB1. Does CB1 trip?	-	-	Y	N	-	-	-	-	-	-		
3. Turn on CB4. Does CB4 trip?	-	-	-	-	Y	N	-	-	-	-		
4. Is ±46 V present at panel test jacks? (1)	-	-	-	-	-	-	Y	N	-	-		
5. Check out -16 V retract power rectifier:												
a) Turn off CB1.												
b) Reconnect the two yellow-wire Fastons coming from A1T1 to terminals 4 and 5 of A1TB1.												
c) Turn on CB1. Is -16 V present at A1TB1-6? (A1TB1-3 is gnd.) (1)	-	-	-	-	-	-	-	-	Y	N		
ACTIONS												
1. Replace A1T1, then restore all connections and try again.	1	-	-	-	-	-	-	-	-	-		
2. Go to Condition 2.	-	X	-	-	-	-	-	-	-	-		
3. Replace capacitor brd, then restore all connections and try again	-	-	1	-	-	-	-	1	-	1		
4. Go to Condition 3.	-	-	-	X	-	-	-	-	-	-		
5. Problem is in the ±46 V loads. Go to DLT 8.	-	-	-	-	X	-	-	-	-	-		
6. Go to Condition 4.	-	-	-	-	-	X	-	-	-	-		
7. ±46 V network is OK. Go to Condition 5.	-	-	-	-	-	-	X	-	-	-		
8. -16 V rectifier is OK. Go to Condition 6 on sheet 2.	-	-	-	-	-	-	-	-	X	-		
9. Call Field Support.	2	-	2	-	-	-	-	2	-	2		

(1) If dc voltages are 10% or more below nominal, check as input to rectifier per Procedure A.

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DLT 5	FAULT IN T1 NETWORK	(Sheet 2 of 2)
Warning:	None	
Enters from:	Sheet 1	
Procedures:	A	
References:	Logic Diagrams	
Exits to:	DLT 1	
Assumption:	Problem in the T1 network has been narrowed to the 32 V dc bridge rectifier that supplies braking current to the Run winding of the drive motor.	

CONDITIONS	
6. Check out the brake-current rectifier:	
a) Turn off CB1	
b) Reconnect the two remaining yellow wires to the second pair of Fastons on terminals 4 and 5 of A1TB1	
c) Turn on CB1. Does CB1 trip?	Y N - -
7. Is 32 V dc present between terminals 3 and 10 of brake relay K8? (Connect minus VOM probe to terminal 3.) (1)	- - Y N

ACTIONS	
10. Replace bridge rectifier (located on front wall of power supply cabinet).	1 1
11. Go to Condition 7.	X
12. All the T1 rectifiers have checked out to be OK. Return to DLT1 to complete the Power Up diagnostic	X
13. Call Field Support.	2 - - 2

(1) If dc voltages are 10% or more below nominal, check ac input to rectifier per Procedure A.

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DLT 6 — FAULT IN ±9.7 V LOADS (sheet 1 of 2)

Warning: None

Enters from: DLT 1, DLT 4

Procedures: See sheet 2

References: Logic Diagram

Exits to: Sheet 2 (DLT 6)

Assumption: With A1P/J3 and A1P/J5 connected to provide loads to the ±9.7 V power supplies, CB5 (+9.7 V) and/or CB6 (-9.7 V) trip when CB1 (MAIN AC) is actuated.

CONDITIONS	1	2	3	4	5	6	7	8
1. Limit Load to +9.7 V on relay board:								
a) Turn off CB1 and CB4 (±46 V).								
b) Separate A1P/J3 (on side of pwr supply cabinet).								
c) Reset (or turn on) CB5 and CB6, then turn on CB1.								
Does either CB5 or CB6 trip?	Y	N	-	-	-	-		
2. Limit ±9.7 loads to servo preamp:								
a) Turn off CB1 (CB4 still off).								
b) Reconnect A1P/J3.								
c) Remove the three Fastons from the ±5 V regulator card in the logic chassis. Be sure the Fastons don't touch each other.								
d) Turn on CB1. Does either CB5 or CB6 trip?	-	-	Y	N	-	-		
3. Add regulator card to ±9.7 V loads:								
a) Turn off CB1 (CB4 still off).								
b) Reconnect Fastons to regulator card, then remove card from logic chassis. Lay card on insulated surface (a folded dry rag, for example).								
c) Turn on CB1. Does either CB5 or CB6 trip?	-	-	-	-	Y	N		

ACTIONS								
1. Be sure A1P5 is properly mated to A1J5 on relay board.	1	-	-	-	-	-		
2. Check A1P5 cable for shorts/grounds (+9.7 V wire is on pin 15).	2	-	-	-	-	-		
3. Replace relay board.	3	-	-	-	-	-		
4. Go to Condition 2.	-	X	-	-	-	-		
5. Check wires from regulator-card Fastons to preamp for shorts/gnds.	-	-	1	-	-	-		
6. Replace servo preamp.	-	-	2	-	-	-		
7. Go to Condition 3.	-	-	-	X	-	-		
8. Replace regulator card.	-	-	-	-	1	-		
9. Go to Condition 4 on sheet 2.	-	-	-	-	-	X		
10. Call Field Support.	4	-	3	-	2	-		

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DLT 6 FAULT IN ±9.7 V LOADS (sheet 2 of 2)

Warning: None

Enters from: Sheet 1

Procedures: B

References: Logic Diagrams

Exits to: DLT 1 to complete Power Up sequence

Assumption: By process of elimination, the ±9.7 V load fault has been limited to either the logic chassis or the read/write chassis.

CONDITIONS	7	8	9	10
4. Add logic chassis to ±9.7 V load:				
a) Turn off CB1.				
b) Reinstall regulator card (with Fastons connected) in logic chassis.				
c) Separate A1J/PA82 (on logic chassis backpanel).				
d) Turn on CB1. Does either CB5 or CB6 trip?	Y	N	-	-
5. Add R/W chassis to complete the ±9.7 V load:				
a) Turn off CB1. CB4 (±46 V) may be turned on now if desired.				
b) Reconnect A2P/JA82.				
c) Turn on CB1. Does either CB5 or CB6 trip?	-	-	Y	N
ACTIONS				
11. Problem is in the logic chassis. To pinpoint cause, go to Procedure B.	X	-	-	-
12. Check for +5 V at A2JD94-04 (A or B), then for -5 V at A2JD94-01 (A or B). Voltages should be 5.1, ±0.05 V. Adjust pot(s) on regulator card if voltages are out of spec. Then go to Condition 5.	-	X	-	-
13. Problem is in the R/W chassis. To pinpoint cause, go to Procedure B.	-	-	X	-
14. The ±9.7 V fault has been eliminated.	-	-	-	X

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DLT 7 — FAULT IN ±20 V, +28 V LOADS

Warning: None

Enters from: DLT 1, DLT 4

Procedures: B

References: Logic Diagrams

Exits to: DLTs 1 or 4, as determined from entrance conditions

Assumption:

CONDITIONS	1	2	3	4	5	6	7	8	9	10	11	12
1. Has CB7 tripped? (±20 V load fault.)	Y	N	-	-	-	-	-	-	-	-		
2. Has CB8 tripped? (+28 V load fault.)	-	Y	-	-	-	-	-	-	-	-		
3. Restrict ±20 V load to logic chassis:												
a) Separate P/JA82.												
b) Reset CB7, then turn on CB1. Does CB7 still trip?	-	-	Y	N	-	-	-	-	-	-		
4. Turn on (or reset) CB8. Does CB8 trip?	-	-	-	-	Y	N	-	-	-	-		
5. Add R/W chassis to ±5 V load:												
a) Turn off CB1 (CB7 still ON).												
b) Reconnect P/JA82 (if separated for Condition 2).												
c) Turn on CB1. Does CB7 trip?	-	-	-	-	-	-	Y	N	-	-		
6. Turn on CB8 to add +28 V to R/W chassis. Does CB8 trip?	-	-	-	-	-	-	-	-	Y	N		
ACTIONS												
1. Go to Condition 3.	X	-	-	-	-	-	-	-	-	-		
2. Go to Procedure B to pinpoint ±20 V fault in logic chassis.	-	-	X	-	-	-	-	-	-	-		
3. Go to Condition 4 if +28 V fault exists, otherwise go to Cond. 5.	-	-	-	X	-	-	-	-	-	-		
4. Check for +28 V short/gnd in logic chassis backpanel wiring from PD93 to JA82, then go to Action 5.	-	X	-	-	X	-	-	-	-	-		
5. Turn off CB8 and go to Condition 5.	-	-	-	-	-	X	-	-	-	-		
6. Go to Procedure B to pinpoint ±20 V fault in R/W chassis.	-	-	-	-	-	-	X	-	-	-		
7. Go to Condition 6 if +28 V fault occurs, otherwise go to next recommended Action.	-	-	-	-	-	-	-	1	-	-		
8. Go to Procedure B to pinpoint +28 V fault in R/W chassis.	-	-	-	-	-	-	-	-	X	-		
9. No faults in ±20 V or +28 V loads. Return to DLT 1.	-	-	-	-	-	-	-	2	-	X		
10. Call Field Support.	-	-	-	-	-	-	-	3	-	-		

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DLT 8 — FAULT IN ±46 V LOADS

Warning: None

Enters from: DLTs 1,3,5

Procedures: None

References: Logic Diagrams

Exits to: DLTs 1,3, or 5, as determined from entrance conditions

Assumption:

CONDITIONS	1	2	3	4	5	6	7	8
1. Limit ±46 V load to power amp:								
a) Turn off CB1, then reset CB4 (±46 V).								
b) Separate A1P/J4 (on side of p.s. assy).								
c) Ensure breakers CB2-CB8 are ON, then turn on CB1.								
Does CB4 still trip?	Y	N	-	-	-	-		
2. Add logic chassis to ±46 V load:								
a) Turn off CB1.								
b) Reconnect A1P/J4.								
c) Turn on CB1. Does CB4 trip?	-	-	Y	N	-	-		
3. Restrict ±46 V load in logic chassis to backpanel wiring:								
a) Turn off CB1.								
b) Remove card from location A17.								
c) Reset CB4, then turn on CB1. Does CB4 still trip?	-	-	-	-	Y	N		
ACTIONS								
1. Replace power amp.	1	-	-	-	-	-		
2. Go to Condition 2.	-	X	-	-	-	-		
3. Go to Condition 3.	-	-	X	-	-	-		
4. Check logic chassis backpanel wiring between JD93-12A and A17-32B (+46 V), and between JD93-12B and A17-03B (-46 V).	-	-	-	-	1	-		
5. Install new card in location A17.	-	-	-	-	-	1		
6. Problem no longer exists.	-	-	-	X	-	-		
7. Call Field Support.	2	-	-	-	2	2		

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DLT 9 FIRST SEEK (sheet 1 of 2)

Warning: None

Enters from: DLT 1

Procedures: See sheet 2

References: Logic Diagrams

Exits to: DLT 10 or sheet 2 of this DLT

Assumption: START light is on, drive is up to speed. First Seek not yet completed, so READY light is still blinking.

CONDITIONS	1	2	3	4	5	6	7	8
1. READY light glows continuously, signifying successful First Seek?	Y	N	N	N	N	N		
2. First Seek attempted?	-	N	N	N	N	N		
3. Check that Heads Loaded sw is transferring:								
a) Press START sw to stop disk. Do not turn off breakers.								
b) Manually push voice coil forward to move heads off unloading								
ramp. Does voice coil resist fwd movement?	-	-	N	Y	Y	Y		
4. Check for forward drive to voice coil:								
a) Disconnect wire from terminal 2 of voice coil (one closest								
to magnet assembly).								
b) Attach + lead of VOM to this wire, - lead to logic ground.								
c) Press START sw.								
d) Wait 15-20 seconds for up-to-speed timeout to expire, then								
check voltage. Does VOM read approx. +40 V?	-	-	-	-	N	Y		

ACTIONS								
1. No problem. Go to DLT 10.	X	-	-	-	-	-		
2. Go to Condition 3.	-	X	-	-	-	-		
3. Suspect leads to (or contacts in) Em. Retract relay.	-	-	1	-	-	-		
4. Suspect open voice coil.	-	-	2	-	-	-		
5. Replace Heads Loaded switch.	-	-	3	-	-	-		
6. Replace power amp.	-	-	4	-	5	-		
7. Hds Loaded sw OK. Go to Condition 4 to chk fwd drive on v.c.	-	-	-	X	-	-		
8. Suspect card A20 (pwr amp control).	-	-	-	-	1	-		
9. Suspect card A07 (direction control).	-	-	-	-	2	-		
10. Suspect card A12 (diff cntr, CAR).	-	-	-	-	3	-		
11. Suspect cards A08, A17 (speed control).	-	-	-	-	4	-		
12. Voice coil should attempt First Seek upon expiration of up-to-speed	-	-	-	-	-	X		
timeout. Go to Condition 5 on sheet 2.								
13. Call Field Support.	-	-	5	-	6	-		

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DLT 9 FIRST SEEK (sheet 2 of 2)

Warning: None

Enters from: Sheet 1

Procedures: Trk Servo Amplitude Chk (section 2D); Hd-Arm Repl (2E); Hd Alignment (2C)

References: Logic Diagrams

Exits to: DLT 10

Assumption: START light on, drive up to speed

CONDITIONS	7	8	9	10	11	12	13
1. First Seek successful? (From sheet 1.)	N	N	N	N	N	N	N
2. First Seek successful? (From sheet 1.)	Y	Y	Y	Y	Y	Y	Y
5. Drive attempts First Seek, then unloads?	Y	Y	Y	Y	-	-	-
6. Servo preamp input to card A18 OK?	-	N	Y	Y	-	-	-
7. Track Servo signal present at A18-09B (output pin)?	-	-	N	Y	-	-	-
8. Drive seeks to forward mechanical stop, FAULT light comes on (+42 fuse blows), but heads don't unload--unit can not power down?	-	-	-	-	Y	-	-
9. Drive seeks to fwd mech stop, waits for FAULT light (+42 fuse blows), then retracts?	-	-	-	-	-	Y	-
10. Drive loads heads, hesitates, then creeps to fwd EOT?	-	-	-	-	-	-	Y
ACTIONS							
14. Not sensing dibits. Check servo preamp input to card A18 (Trk Servo Ampl Chk) and go to Condition 6.	X	-	-	-	-	-	-
15. Chk for continuity/gnds in servo preamp cable (input to A18).	-	1	-	-	-	-	-
16. Replace servo preamp.	-	2	-	-	-	-	-
17. Replace and align servo head (see Procedures, above).	-	3	-	-	-	-	-
18. Suspect card A18.	-	-	1	-	-	-	-
19. Suspect propagation of Track Servo signal through cards A19, A20.	-	-	-	1	-	-	-
20. Replace power amp.	-	-	-	-	3	2	-
21. Suspect velocity transducer and attendant logic on cards A20, (A19).	-	-	-	-	2	-	-
22. Check Fine Enable logic on cards A06, A19.	-	-	-	-	1	-	1
23. Suspect cards A17, A20.	-	-	-	-	-	-	2
24. Call Field Support.	-	4	2	2	4	3	3

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DLT 10 — RTZ, CONTINUOUS SEEKS

Warning: None

Enters from: DLT 9

Procedures: None

References: Logic Diagrams

Exits to: DLT 11

Assumption:
1. FTU (TB303) connected to drive via A and B I/O cables
2. Local/Remote switch on drive set to REMOTE
3. LAP installed and drive selected from FTU panel.

CONDITIONS	1	2	3	4	5	6	7	8
1. Actuate RTZ sw on FTU panel. Was RTZ successful?	Y	N	-	-	-			
2. Set up and perform continuous seeks:								
a) Set FTU Auto Function sw to CONT.								
b) Set all FTU Cyl Addr switches "off" (down).								
c) Press START sw on FTU panel.								
d) Sequentially select/deselect Cyl Addr switches (1,2,4...256,								
512) to stop actuator between track 0 and track selected by								
active switch. Continuous Seeks successful?	Y	-	N	-	-			
3. Select track (cyl) 822 for BJ4M1 or 410 for BJ4M2. (M2 in parens):								
• Set Cyl Addr switches to 1466_8 (632_8).								
Was seek to track 822 (410) successful?	Y	-	-	N	-			
4. Select track 823 (411):								
• Set Cyl Addr switches to 1467_8 (633_8).								
Does Seek Error result when attempting to go to track 823 (411)?	Y	-	-	-	N			

ACTIONS								
1. Seeks properly executed. Go to DLT 11.	X	-	-	-	-			
2. Replace card A06 (Access Control and Index/Sector Marks).	-	1	1	1	1			
3. Replace card A07 (Access Control 1).	-	2	-	-	-			
4. Replace card A19 (Access Control 2).	-	3	-	-	-			
5. Replace card A20 (D/A Converter).	-	4	3	3	3			
6. Replace card A02 (Rcvrs).	-	5	4	4	4			
7. Replace card A12 (Difference Generation and Control).	-	-	2	2	2			
8. Call Field Support.	-	6	5	5	5			

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DLT 11 — WRITE

Warning: None

Enters from: DLT 10

Procedures: None

References: Logic Diagrams; TB303 FTU Operating Instructions

Exits to: Sheet 2 or DLT 12

Assumption: 1. TB303 connected to drive (REMOTE operation).
2. FTU's Rd/Acc/Wr switch set to WR.

CONDITIONS	1	2	3	4	5	6	7	8	9	10	11	12
1. FAULT indication is given when drive is connected by controller but not when connected to FTU ?	N	Y	N	N	N	N	N	N	N	N		
2. FAULT light on FTU panel comes on ?	N	-	Y	Y	Y	Y	Y	Y	Y	Y		
3. FAULT light on SMD panel comes on ?	N	-	N	Y	Y	Y	Y	Y	Y	Y		
4. Is FAULT limited to certain groups of contiguous addresses ?	-	-	-	-	Y	N	-	-	-	-		
5. Check LEDs on edge of Fault card (A17):												
a) WRT FLT on ?	-	-	-	-	-	-	Y	-	-	-		
b) HD SEL FLT on ?	-	-	-	-	-	-	-	Y	-	-		
c) W · R FLT on ?	-	-	-	-	-	-	-	-	Y	-		
d) On Cyl · (W + R) on ?	-	-	-	-	-	-	-	-	-	Y		

ACTIONS												
1. No problem. Proceed to DLT 12.	X	-	-	-	-	-	-	-	-	-		
2. Check that Write Protect switches are OFF	-	X	-	-	-	-	-	-	-	-		
3. Check that +5 V is present at operator panel. If present, replace panel.	-	-	X	-	-	-	-	-	-	-		
4. Go to Condition 4.	-	-	-	X	-	-	-	-	-	-		
5. Replace card A12 (CAR bits)	-	-	-	-	1	-	-	-	-	-		
6. Go to condition 5.	-	-	-	-	-	X	-	-	-	-		
7. Check that FTU's OFFSET switch is "off" (center position).	-	-	-	-	-	-	1	1	1	1		
8. Replace card A10 (Write PLO).	-	-	-	-	-	-	2	-	-	-		
9. Replace card A13 (NRZ → MFM).	-	-	-	-	-	-	3	-	-	-		
10. Replace card A02 (Rcvrs).	-	-	-	-	2	-	4	2	2	-		
11. Replace card A03 (RPS Steering).	-	-	-	-	3	-	5	3	3	2		
12. Replace card A01 (Xmtrs).	-	-	-	-	-	-	6	4	4	3		
13. Replace card A19 (Write Protect).	-	-	-	-	-	-	7	-	5	4		
14. Replace card A20 (On Cyl).	-	-	-	-	-	-	-	-	-	5		
15. Replace Write Driver board (loc E02).	-	-	-	-	-	-	8	-	6	6		
16. Replace Read Amp board (loc E03).	-	-	-	-	-	-	5	-	-			
17. Call Field Support.	-	-	-	-	4	-	9	6	7	7		

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DLT 12 READ

Warning: None
Enters from: DLT 11
Procedures: Head Alignment (section 2C); Head Replacement (2E)
References: Logic Diagrams; TB303 Operating Instructions
Exits to: DLT 13

Assumption:
1. TB303 FTU connected to drive (REMOTE operation).
2. FTU's Rd/Acc/Wr switch set to RD.

CONDITIONS	1	2	3	4	5	6	7	8
1. Was address read properly ?	Y	Y	Y	N	N			
2. Was data read properly ?	Y	N	N	-	-			
3. Are errors head-related ?	-	N	Y	N	Y			
ACTIONS								
1. No problem. Go to DLT 13.	X	-	-	-	-			
2. Check that FTU Data switches are set to read the pattern previously written on the disk.	-	1	-	-	-			
3. Replace card A15 (Read PLO, MFM → NRZ).	-	2	-	1	-			
4. Replace card A14 (Data Latch).	-	3	-	2	-			
5. Replace card A19 (Offset).	-	4	-	3	-			
6. Replace card A02 (Rovrs).	-	5	-	4	-			
7. Replace card A03 (Bus In & RPS Steering).	-	6	1	5	1			
8. Replace card A04 (Bus In Mpxr).	-	7	2	6	2			
9. Check head alignment (see Procedures, above).	-	8	3	7	3			
10. Replace Read Amp board, location E03.	-	9	-	8	-			
11. Replace and align faulty head (s) --see Procedures, above.	-	-	4	-	4			
12. Call Field Support	-	10	4	9	4			

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DLT 13 POWER DOWN

Warning: None

Enters from: DLT 12

Procedures: None

References: Logic Diagrams

Exits to: None (Termination of diagnostic procedures)

Assumption: Remote operation--Attempt to power-down the drive from a remote location. Local operation--Press START to extinguish START light and power-down the drive.

CONDITIONS	1	2	3	4	5	6	7	8
1. START light on SMD panel goes out? (LOCAL mode only.)	Y	Y	Y	Y	N			
2. Heads unload?	Y	Y	Y	N	-			
3. Drive motor brakes to a stop? (Stops in about 30 seconds.)	Y	N	N	-	-			
4. Drive motor coasts to a stop?	N	N	Y	-	-			
ACTIONS								
1. Diagnostics have been completed satisfactorily.	X	-	-	-	-			
2. Check Deck Interlock sw (or wiring) for grounds.	-	1	-	-	-			
3. Chk that Heads Loaded sw has transferred (A07-24B at ground).	-	2	-	-	-			
4. Chk for open thermal resistor in CB3 (terminals C,D).	-	-	1	-	-			
5. Chk brake relay, K8, and connections. If pressing START sw still does not pull in K8, replace relay board (-YFN). If K8 operates properly, go to next recommended Action.	-	-	2	-	-			
6. Chk for 32 V dc between terminals 10 and 3 of K8 (terminal 10 is -16 V). If absent, replace ±16 V bridge rectifier (brake power). If 32 V dc is present, chk for broken wires to motor connector P/J7.	-	-	3	-	-			
7. Replace card A07 (RTZ Latch).	-	-	-	1	-			
8. Replace card A20 (Summing Amp, Pwr Amp Control).	-	-	-	2	-			
9. Cathode of START LED grounded. See c.r. 773 in diagrams.	-	-	-	-	1			
10. Call Field Support.	-	3	4	3	2			

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PROCEDURES

PROCEDURE A: CHECKING AC INPUTS TO POWER SUPPLIES

Procedure A verifies that a given secondary winding of ferroresonant transformers T1 or T2, or of standard transformer T3, has the requisite voltage to drive its associated power supply. This procedure should be followed whenever a transformer is suspected as the reason for a dc voltage problem. It should also be performed after repairing or replacing the rectifier/capacitor board to ensure that the previously malfunctioning supply did not damage the transformer.

SPECIAL NOTE

To prevent ferroresonant transformers T1 and T2 from oscillating, never disconnect more than one set of secondary leads from the rectifier/capacitor board at any one time. Such oscillation, though not dangerous, would make any voltage measurement meaningless. This restriction does not apply to T3 which is a standard (sine-wave output) transformer.

Table A-3 shows the oscilloscope connections for monitoring the ac inputs to the rectifiers. Figure A-3 shows the square-wave output of T1 and T2. As mentioned above, T3 produces a sine-wave output. Table A-4, at the end of this procedure, shows some common failure symptoms for power supplies.

PROCEDURE:

1. Turn off the MAIN AC breaker (CB1).

2. Determine which transformer secondary is to be checked, and set the breakers as indicated:

T3 -- CB2 (+20Y) ON, all others OFF

T1 or T2 -- CB2, CB5 (+9.7 V), CB6 (-9.7 V) ON, all others OFF

NOTE

Power to T1 and T2 is interrupted by auxiliary contacts on CB5 and CB6 if either of those breakers should trip. This ensures that all logic voltages are dropped. Damage to the voice coil might otherwise result.

TABLE A-3. AC INPUTS TO POWER SUPPLY RECTIFIERS

Xfmr	To Rect.	Scope Connections (AC)		Acceptable V ac Range Between Either +Probe Connection and Ground, as shown by "E" in figure A-3.
		+Probe Terminals (check both)	-Probe (Gnd) Terminal	
T1 ①	±16 V, -16 V	A1TB1-4, 5	A1TB1-3	16.0: Full Load 17.0: No Load ② ±5%
	±46 V	A1TB1-7, 8	A1TB1-3	44.0: Full Load 46.5: CB4 OFF ±5%
T2 ①	±9.7 V	A1TB1-17, 18	A1TB1-14	10.3: Full Load 11.1: No Load ② ±5%

① Do not measure square-wave output, as shown in figure A-3, unless tuning capacitor is connected.

② No load condition (with secondary connected to rectifier and minimum dc load) is specified in the applicable DLT.

Table continued on next page

TABLE A-3. AC INPUTS TO POWER SUPPLY RECTIFIERS (Contd)

Xfmr	To Rect.	Scope Connections (AC)		Acceptable V ac Range Between Either +Probe Connection and Ground, as shown by "E" in figure A-3.
		+Probe Terminals (check both)	-Probe (Gnd) Terminal	
① T2 (Contd)	±20 V	A1TB1-15, 16	A1TB1-14	21.0: Full Load 22.7: CB7 OFF ±5%
	+28 V	A1TB1-19, 20	A1TB1-14	27.3: Full Load 29.4: CB8 OFF ±5%
T3	+20Y	A1TB2-9, 10	A1TB1-12	25.0 ±5% ③ with Secondary Disconnected
③ Sine-wave output; voltage shown is peak to ground				

OSCILLOSCOPE SETTINGS

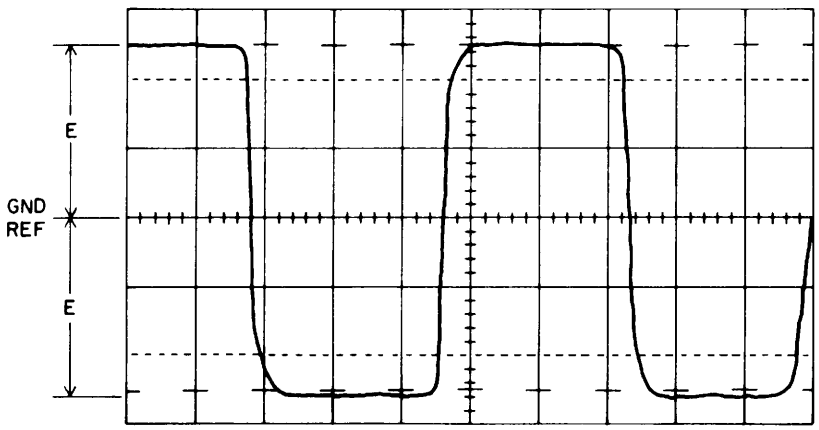
SCOPE GND TO LOGIC GND ①

VOLTS/DIV
CH 1 - ②
CH 2 - NA

TIME/DIV
A - VARY FOR CONVENIENT TRACE
B - NA

TRIGGERING
A (USE X1 PROBE) - LINE
B (USE X PROBE) - NA

PROBE CONNECTIONS
CH 1 (USE X1 PROBE) - ③
CH 2 (USE X PROBE) - NA



① FOR -PROBE (GND) CONNECTIONS, SEE TABLE A-2
② SET FOR EXPECTED VOLTAGE (E) AS GIVEN IN TABLE A-2
③ FOR +PROBE CONNECTIONS, SEE TABLE A-2 9K69

Figure A-3. AC Input (Ferroresonant) to Power Supply Rectifiers

3. From table A-3, determine the two terminals that receive the input from the transformer, and remove the Faston leads to those two terminals. It is not necessary to remove the center-tap (ground) Faston. Terminals 4 and 5 of A1TB1 each has two Fastons. If the 16 V ac input from T1 is to be checked, be sure to remove the two that come from the transformer. (The other two go to the brake-power rectifier mounted on the front wall of the power supply cabinet.

4. Plug in the test scope and set the Trigger control to LINE. Turn on the scope and when the horizontal trace becomes visible, center it on the graticule.

5. Connect the scope's ground (-) probe to the appropriate terminal given in table A-3.

6. Turn on the MAIN AC breaker (CB1).

7. Connect the scope's +Probe (CH1 or CH2, depending upon scope set-up) to either of the input leads removed in step 3.

8. Adjust scope's TIME/DIV control to secure a stable square-wave trace (ref: figure A-3).

9. Adjust scope's VOLTS/DIV control to allow easy mental reckoning of the voltage represented by the trace, as shown against the graticule lines.

10. Record the voltage (or make a mental note if you trust your visual memory) from the ground reference line on the graticule to the top and bottom of the trace (two readings) as indicated by "E" in figure A-3.

11. Repeat step 10 with the +probe connected to the other input lead.

12. If both steps 10 and 11 show a symmetrical waveshape about the ground reference line (that is, all four voltage readings are the same), and are within the tolerance specified in table A-3, the winding for that particular supply is OK.

13. If the voltage readings are not the same, or if they are the same but not within the tolerance specified in table A-3, the problem has to be a shorted winding. You may be able to confirm this by sniffing the transformer for evidence of burned insulation, although this is not a difinitive test. Execute steps 14 and 15 if either T1 or T2 is to be replaced. Proceed to step 16 if replacing T3.

WARNING

Tuning capacitors A1C1 and A1C2 are charged with 500 volts or higher. Treat them with respect!

14. Remove and replace transformer T1 or T2:

    a. Turn off CB1.

    b. Remove the fiber insulator from the terminal strip mounted on top of the transformer.

    c. With insulated long-nosed pliers, short terminals 4 and 5 (yellow wires) to discharge the tuning capacitor.

    d. Remove the two yellow wires and the orange and black power wires from the left side of terminals 2 through 5. There is no harness wire on terminal 1. (See figure A-2.)

    e. Referring to CR803 of the diagrams, remove the transformer lead wires (Fastons) from A1TB1. (Check colors with figure A-1.)

    f. Remove the nuts securing the transformer to the base and lift out the transformer.

    Reverse the order of these steps to install the new transformer.

15. Be sure to connect at least one secondary winding, as advised in the SPECIAL NOTE at the front of this procedure, then check out the newly installed transformer by repeating steps 2 through 11.

16. To remove and replace T3, proceed as follows:

    a. Turn off CB1.

    b. Remove rectifier/capacitor board as described in the "_YEN Replacement" procedure of section 2E.

c. Remove the five Fastons from the clips protruding from the windings of T3. See figure A-2 for color coding.

d. Remove the nuts securing T3 to the power supply base and lift out the transformer.

Reverse the order of these steps to install the new transformer.

17. When all Fastons have been secured to the proper terminals, turn on CB1. Check for +20 V (+20Y) at A1TB2-11 to verify proper operation of T3 and the +20Y rectifier.

TABLE A-4. FAILURE SYMPTOMS IN POWER SUPPLIES

Symptom	Probable Cause
1. Noticeable ripple at output. (checked with oscilloscope)	Open diode or open filter capacitor
2. Less then specified output. (ac input OK)	Shorted diode or shorted filter capacitor
3. Output decreases significantly when load is connected.	Open bleeder resistor

PROCEDURE B: PINPOINTING VOLTAGE FAULTS IN THE LOGIC AND READ/WRITE CHASSIS

This procedure locates ±5 V, ±20 V, and +28 V faults on cards in either the logic or read/write chassis, or in the backpanel wiring of the logic chassis. The test may be conducted in either of two ways. The first method is to check each voltage individually by entering the procedure from the applicable DLT:

±5 V -- Action 7 of DLT 6
±20 V -- Action 2 of DLT 7
+28 V -- Action 8 of DLT 7 (R/W chassis only)

The second method is to check all voltages on a given card at the same time. Since the test for each voltage fault is made by adding cards one at a time, this second method is more efficient, and is the one described. Of course, as shown in table A-1, not all cards will require all voltage checks.

NOTE

From table A-1, it can be seen that cards in the logic chassis use ±5 V and ±20 V (with the exception of Fault card A17, which also monitors ±46 V, but which is tested for that voltage by DLT 8). Cards in the R/W chassis use ±5 V, ±20 V, and +28 V.

It would be a good idea to have table A-1 available for ready reference when performing this procedure.

1. Turn off CB2 (+20Y), keeping CB1 (MAIN AC) ON. This kills all logic voltages while permitting the blower to operate.

2. Turn off CB4. (±46 V not tested in this procedure)

3. All other breakers are to be ON, except as noted in the procedural steps. The logic chassis test begins at step 4, the test for the R/W chassis at step 14.

4. Turn off CB8. (+28 V not used by the logic chassis)

5. Remove A3PE1 from the R/W control card (E01). This kills the ±5 V, ±20 voltages to the R/W chassis.

6. Remove all logic cards from the logic chassis. Be sure not to remove the ±5 V regulator card from A2PD94.

7. Turn on CB2. Power-wiring errors in (or damage to) the logic backpanel will pop the offended breaker. If a breaker trips, turn off CB2 and raise the logic chassis to the maintenance position. Then carefully examine the backpanel for grounds or shorts, most usually the product of bent pins or dangling wires. After clearing the fault, lower the logic chassis to its normal position and turn on CB2 to check.

8. Turn off CB2. You are now ready to start putting the cards back in the logic chassis one at a time, checking for faults after each card has been inserted.

9. Before inserting the selected card, examine both sides for evidence of arcing across the foil. Often the carbon residue around an arc area can be removed with an alcohol swab and the card won't give any more trouble.

10. Insert the selected card in its proper slot. Use the CARD TYPE column in table A-1 to ensure accuracy here.

11. Turn on CB2.

12. If a breaker trips, turn off CB2 and replace the card just installed with a fresh one. Then turn on CB2 to test the new card. (Don't forget to reset the tripped breaker.)

13. If the card has no faults, turn off CB2 and, selecting another card, repeat steps 9 through 13 until all cards have been inserted and found good.

The following steps check out the read/write chassis.

14. Turn off CB2 and turn on CB8.

15. Remove the small cables from cards E02, E03, and E05. Also remove cable A3PE1 from card E01 if this was not done when checking out the logic chassis (see step 5).

16. Remove cards E01, E02, E03, and E05 from their pin connections on card E04.

17. Examine E04 for bent or broken pins where the other cards plug into (or onto) it. Also examine the foil for

signs of arcing. E04 uses no power voltages, but acts as a distributor for the power voltages brought into it by E01.

18. Examine E01 for foil arcing (see step 9), then insert it into its connector on card E04.

19. Reconnect cable A3PE1 to card E01.

20. Turn on CB2.

21. If a breaker trips, turn off CB2 and replace the E01 card with a fresh one. Then reset the tripped breaker(s) and turn on CB2 to check the new card.

22. If a breaker trips after the new E01 card has been inserted, replace the E04 card. Then try the original E01 card again.

23. Turn off CB4 and, selecting another of the removed cards, examine it for foil arcing and insert it into E04.

24. Turn on CB2. If a breaker trips, turn off CB2 and try a fresh card.

25. Repeat steps 23 and 24 until all cards in the R/W chassis have been inserted and found good.

26. Reconnect the three cables to E02, E03, and E05.

PROCEDURE C: TROUBLESHOOTING HEAT-GENERATED PROBLEMS

CAUTION

If the heads perform an unscheduled retract and the START and FAULT lights are both off, immediately turn off the +20Y breaker; you have dropped +5 V and run the risk of burning up the voice coil. Only after you've thus disabled dc power should you check to see if the power-down resulted from a failure on the ac line. (Hint: is the blower still on?)

If you commit the above CAUTION to memory and act instinctively upon it, you may one day save yourself a lot of trouble; failure of the +5 V supply is a common cause for abnormal shut-downs.

Heat-related problems are easy to diagnose: they occur only when the drive gets hot, and they disappear when the drive has had a chance to cool off. If you suspect a problem is heat-related, let the drive cool down, then note the failure (or more accurately, the absence of the failure) when the drive is started up again. Often the trouble-shooting period can be shortened by applying artificial heat to the suspected area (a hair dryer is useful here). Once you've diagnosed the problem, correct it as you would any other malfunction.

Heat problems are of two types -- those originating in the power supplies and those developing in the various loads. Should a load fault trip a dc breaker, the course is clear: simply refer to the applicable "load" DLT. But if the fault merely brings up a FAULT light (on the edge of card A17), the table below should offer a starting point for correcting the problem. (If the +5 V supply goes, of course, the fault lights won't work.)

FAULT	PROBLEM RELATED TO
Voltage (except +5 V)	A17
On Cyl·(W+R)	A17, A07, A02, A08, A12, A20
Write	A17, A01, E02 (Write Driver board)
W·R	A17, A02
Hd Sel	A17, E01 (Hd Sel/Rd Amp board)

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