83337340

CONTROL DATA CORPORATION

CDC® STORAGE MODULE DRIVE

BJ4A3C

BJ4A3D

INSTALLATION AND CHECKOUT

PREVENTIVE MAINTENANCE

CORRECTIVE MAINTENANCE

DIAGRAMS

WIRE LISTS

PARTS DATA

HARDWARE MAINTENANCE MANUAL

REVISION RECORD

REVISION	DESCRIPTION
A (12-15-82)	Manual Released (Engineering Change Order 13267-A included).
B (04-09-83)	Manual updated to include additional Technical and Editorial changes.
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D (02-14-84)	Manual updated to include Engineering Change Order DJ13476. Additional Technical and Editorial changes.

REVISION LETTERS I, O, Q AND X ARE NOT USED.

Address comments concerning this manual to:
Control Data Corporation
Twin Cities Disk Division
Customer Documentation Dept.
5950 Clearwater Drive
Minnetonka, MN 55343
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 code number, as shown on the equipment FCO log, in the list below. Immediately to the right of the series code 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:

Pub No. 83337340 Rev. C

EQUIPMENT TYPE	SERIES CODE	WITH FCOs	COMMENTS
BJ4A3	32	None	First units built in series code 32.
	33	None	
	34	None	
	35	13476	

LIST OF EFFECTIVE PAGES

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New features, as well as changes, deletions, and additions to information in this manual are indicated by bars in the margins or by a dot near the page number if the entire page is affected. A bar by the page number indicates pagination rather than content has changed.

PAGE	REV	PAGE	REV
Cover	-	xxxiii	A
Blank	-	Blank	-
Title P	-	S-1 Div	-
ii	D	Blank	-
iii	D	1-1	C
Blank	-	1-2	C
v	D	1-3	C
vi	D	1-4	C
vii	D	1-5	C
viii	D	1-6	D
ix	D	1-6.1	D
x	D	1-6.2	D
xi	D	1-7	C
xii	D	1-8	C
xiii	A	1-9	C
xiv	D	1-10	C
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Blank	-	1-12	C
xvii	C	1-13	C
xviii	A	1-14	C
xix	A	1-15	C
xx	A	1-16	C
xxi	A	1-17	C
xxii	D	1-18	C
xxiii	A	1-19	C
xxiv	A	1-20	C
xxv	C	1-21	C
xxvi	A	1-22	C
xxvii	D	1-23	C
xxviii	A	1-24	C
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Blank	-	1-26	C
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xxxii	A	Blank	-

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2-1	A	2A-38	A
Blank	-	2A-39	A
S-2A Div	-	2A-40	A
Blank	-	2A-41	A
2A-1	A	Blank	-
2A-2	A	S-2B Div	-
2A-3	A	Blank	-
2A-4	D	2B-1	A
2A-5	A	2B-2	A
2A-6	D	2B-3	A
2A-7	A	2B-4	A
2A-8	A	2B-5	A
2A-9	A	2B-6	A
2A-10	A	2B-7	A
2A-11	A	2B-8	A
2A-12	A	2B-9	A
2A-13	A	2B-10	A
2A-14	A	2B-11	A
2A-15	A	2B-12	A
2A-16	A	2B-13	A
2A-17	A	2B-14	A
2A-18	A	2B-15	A
2A-19	A	2B-16	A
2A-20	A	2B-17	A
2A-21	A	2B-18	A
2A-22	A	2B-19	A
2A-23	A	2B-20	A
2A-24	A	S-2C Div	-
2A-25	A	Blank	-
2A-26	D	2C-1	A
2A-27	D	2C-2	A
2A-28	A	2C-3	A
2A-29	A	2C-4	A
2A-30	A	2C-5	A
2A-31	A	2C-6	A
2A-32	A	2C-7	A
2A-33	A	2C-8	A
2A-34	A	2C-9	D
2A-35	A	2C-10	A

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2C-11	A	2D-32	A
2C-12	A	2D-33	A
2C-13	A	2D-34	A
2C-14	A	2D-35	A
2C-15	A	Blank	-
2C-16	A	S-2E Div	-
2C-17	A	Blank	-
Blank	-	2E-1	A
S-2D Div	-	2E-2	A
Blank	-	2E-3	A
2D-1	A	2E-4	A
2D-2	A	2E-5	A
2D-3	A	2E-6	A
2D-4	A	2E-7	A
2D-5	A	2E-8	A
2D-6	A	2E-9	A
2D-7	A	2E-10	A
2D-8	A	2E-11	A
2D-9	A	2E-12	A
2D-10	A	2E-13	A
2D-11	A	2E-14	A
2D-12	A	2E-15	B
2D-13	A	2E-16	A
2D-14	A	2E-17	A
2D-15	A	2E-18	A
2D-16	A	2E-19	A
2D-17	A	2E-20	A
2D-18	A	2E-21	A
2D-19	A	2E-22	A
2D-20	A	2E-23	A
2D-21	A	2E-24	A
2D-22	A	2E-25	A
2D-23	A	2E-26	A
2D-24	A	2E-27	A
2D-25	A	2E-28	A
2D-26	A	2E-29	A
2D-27	A	2E-30	A
2D-28	A	2E-31	A
2D-29	A	2E-32	A
2D-30	D	2E-33	A
2D-31	A	2E-34	A

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PAGE	REV	PAGE	REV
2E-35	A	2F-36	D
2E-36	A	2F-37	A
2E-37	A	2F-38	A
Blank	-	2F-39	A
S-2F Div	-	2F-40	A
Blank	-	2F-41	A
2F-1	A	2F-42	A
2F-2	D	2F-43	A
2F-3	A	2F-44	A
2F-4	A	2F-45	A
2F-5	D	2F-46	A
2F-6	A	2F-47	A
2F-7	A	2F-48	A
2F-8	A	2F-49	A
2F-9	D	2F-50	A
2F-10	A	2F-51	A
2F-11	A	2F-52	A
2F-12	A	2F-53	A
2F-13	A	2F-54	A
2F-14	A	2F-55	A
2F-15	A	2F-56	A
2F-16	A	2F-57	A
2F-17	A	2F-58	A
2F-18	A	2F-59	A
2F-19	A	2F-60	A
2F-20	A	2F-61	A
2F-21	A	2F-62	A
2F-22	A	2F-63	A
2F-23	A	2F-64	A
2F-24	A	2F-65	A
2F-25	D	2F-66	A
2F-26	A	2F-67	A
2F-27	A	2F-68	A
2F-28	A	2F-69	D
2F-29	A	2F-70	A
2F-30	A	2F-71	A
2F-31	A	2F-72	A
2F-32	D	2F-73	A
2F-33	A	2F-74	A
2F-34	D	2F-75	A
2F-35	D	2F-76	A

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PAGE	REV	PAGE	REV
2F-77	A	Blank	-
2F-78	A	3-21	A
2F-79	A	3-22	A
2F-80	A	3-23	A
2F-81	B	3-24	A
2F-82	A	3-25	A
2F-83	A	3-26	A
2F-84	A	3-27	A
2F-85	A	Blank	-
2F-86	A	3-29	A
2F-87	A	3-30	A
2F-88	A	3-31	A
2F-89	A	3-32	A
2F-90	A	3-33	A
2F-91	D	3-34	A
2F-92	A	3-35	A
2F-93	A	3-36	A
2F-94	A	3-37	D
2F-95	A	3-38	D
Blank	-	3-39	A
S-3 Div	-	3-40	A
Blank	-	3-41	A
3-1	A	3-42	A
3-2	A	3-43	A
3-3	A	3-44	A
3-4	A	3-45	A
3-5	A	3-46	A
3-6	A	3-47	A
3-7	A	3-48	A
3-8	A	3-49	A
3-9	A	3-50	A
3-10	A	3-51	A
3-11	A	Blank	-
3-12	D	3-53	A
3-13	D	3-54	A
3-14	A	3-55	A
3-15	A	3-56	A
3-16	A	3-57	D
3-17	A	3-58	A
3-18	A	3-59	A
3-19	A	3-60	A

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PAGE	REV	PAGE	REV
3-61	A	3-Blank	-
Blank	-	3-103	A
3-63	A	3-104	A
3-64	A	3-105	D
3-65	A	3-106	A
3-66	A	3-107	D
3-67	A	3-Blank	-
3-68	A	3-109	A
3-69	A	3-110	A
Blank	-	3-111	A
3-71	A	3-112	A
3-72	A	3-113	A
3-73	A	3-114	A
Blank	-	3-115	A
3-75	A	Blank	-
3-76	A	3-117	A
3-77	A	3-118	A
3-78	A	3-119	A
3-79	A	Blank	-
Blank	-	3-121	B
3-81	A	3-122	B
3-82	A	3-123	B
3-83	A	Blank	-
3-84	A	3-125	A
3-85	A	3-126	A
3-86	A	3-127	A
3-87	A	Blank	-
3-88	A	3-129	B
3-89	A	3-130	B
Blank	-	3-131	B
3-91	D	3-132	B
3-92	D	3-133	A
3-93	D	3-134	B
3-94	D	3-135	D
3-95	A	3-136	D
3-96	A	3-137	A
3-97	A	Blank	-
3-98	A	3-139	A
3-99	D	3-140	A
3-100	D	3-141	A
3-101	A	3-142	A

LIST OF EFFECTIVE PAGES (Contd)

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PAGE	REV	PAGE	REV
3-143	A	5-10	D
3-144	A	5-11	A
3-145	A	Blank	-
3-146	A	5-13	D
S-4 Div	-	5-14	A
Blank	-	5-15	A
4-1	A	5-16	D
4-2	A	5-17	D
4-3	A	5-18	D
4-4	A	5-19	C
4-5	A	Blank	-
4-6	A	5-21	C
4-7	A	5-22	B
4-8	A	5-23	D
4-9	A	Blank	-
4-10	A	5-25	B
4-11	A	5-26	D
4-12	A	5-27	D
4-13	A	5-28	D
4-14	A	5-29	D
4-15	A	5-30	A
4-16	A	5-31	A
4-17	A	5-32	A
4-18	A	5-33	A
4-19	A	5-34	A
4-20	A	5-35	A
4-21	A	5-36	D
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S-5 Div	-	Blank	-
Blank	-	5-39	D
5-1	A	5-40	A
Blank	-	5-41	A
S-5A Div	-	5-42	D
Blank	-	5-43	D
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5-4	A	5-45	A
5-5	A	5-46	A
5-6	A	5-47	A
5-7	D	Blank	-
5-8	A	5-49	A
5-9	A	5-50	A

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PAGE	REV	PAGE	REV
5-51	A	5-78	A
Blank	-	5-79	A
5-53	A	Blank	-
5-54	A	S-5B Div	-
5-55	A	Blank	-
5-56	A	5-81	A
5-57	A	5-82	A
5-58	A	5-83	A
5-59	A	5-84	A
5-60	D	5-85	A
5-61	A	5-86	A
Blank	-	5-87	A
5-63	A	5-88	A
5-64	D	5-89	D
5-65	D	5-90	A
5-66	D	5-91	A
5-67	D	Blank	-
Blank	-	S-5C Div	-
5-69	D	Blank	-
5-70	A	5-93	A
5-71	A	5-94	A
5-72	A	5-95	A
5-73	A	5-96	A
5-74	A	Cmt Sht	-
5-75	A	Rtn Env	-
5-76	D	Blank	-
5-77	D	Cover	-

PREFACE

This manual contains maintenance information applicable to the CONTROL DATA®BJ4A3 Storage Module Drive (SMD).

Maintenance information is divided into five sections. These sections and a brief description of their contents are listed below.

- 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. Contains logic wirewrap information for the drive.
- Section 5 - Parts Data. Contains parts lists and illustrations showing all field replaceable parts.

Manual applicable to the BJ4A3 Storage Module Drive are as follows:

Publication Number	Title
83337340	Hardware Maintenance Manual
83337390	Hardware Reference Manual
83322440	CDC Microcircuits Manual, Volume 1: IC data sheets classified by CDC identifiers, logic families, and IC symbology.
83324440	CDC Microcircuits Manual, Volume 2: ICs identified by industry-recognized vendor type numbers.
83323780	A Guide for the Disk Drive Operator.

Any of the manuals listed above are also available from:

Control Data Corporation
Literrature Distribution Services
308 North Dale Street
St. Paul, MN 55103

To ensure the integrity of safety features built into these drives, installation and maintenance must be performed only by qualified service personnel using designated CDC/MPI parts. Also, in case of fire or other emergency, isolate the drives from main power by disconnecting the drive power plugs from their site power receptacles. In situations where pulling the plugs is not possible or practical (such as in a rack mount installation), use the system main power disconnect to isolate the drives from main power.

WARNUNG

Um das einwandfreie Funktionieren der eingebauten Schutzvorrichtungen zu gewaehrleisten, darf die Installation und Wartung nur von qualifiziertem Service-Personal unter Verwendung von Original CDC/MPI Teilen durchgefuehrt werden. Beim Ausbrechen von Feuer oder in anderen Notfaellen ist die Verbindung zum Hauptstromnetz dadurch zu unterbrechen, dass die Stecker der Antriebe aus den Steckdosen gezogen werden. Sollte dies nicht moeglich oder unpraktisch sein (z. B. dann, wenn die Stationen uebereinander installiert sind), ist der Hauptstromunterbrecher des Systems zu bedienen, um die Antriebe vom Hauptstromnets su trennen.

CONFIGURATION CHART

EQUIPMENT	POWER REQUIREMENT		DATA CAPACITY MB	ATTACHABLE CHANNELS
	Voltage (Volts)	Frequency (Hz)		
BJ4A3C	208	60	300	1
BJ4A3D	208	60	300	2

CONTENTS

FIGURES

TABLES

ABBREVIATIONS

ABR	Absolute Reserve
ABV	Above
ADDR	Address
ADRS	Address
AGC	Automatic Gain Control
AM	Address Mark
AMPL	Amplifier
AMPTD	Amplitude
BLK	Black
BLW	Below
CAR	Cylinder Address Register
CH	Channel
CHAN	Channel
CKT	Circuit
CNTLGL	Centrifugal
CNTR	Counter
COMP	Compensaton
CONFIG	Configuration
CONTD	Continued
CR REF	Cross Reference
CYL	Cylinder
DES	Desired
D/A	Digital to Analog
DCDR	Decoder
DIFF	Difference
DIR	Direction
DLY	Delay
DRV	Drive
DRVR	Driver
DSBL	Disable
ECL	Emitter Coupled Logic
ECO	Engineering Change Order
EMER	Emergency
EN	Enable
EOT	End of Travel
EQUIV	Equivalent
FCO	Field Change Order
FCTN	Function
FF	Flip Flop
FIG	Figure
FLT	Fault

ABBREVIATIONS (Contd)

FREQ	Frequency
FTU	Field Test Unit
FWD	Forward
GEN	Generator
GND	Ground
HD	Head
I/O	Input-Output
INTLK	Interlock
INTGRTR	Integrator
LD	Load
MAINT	Maintenance
MAX	Maximum
MB	Megabyte
MFM	Modified Frequency Modulation
MK	Mark
MULT	Multiple
NC	No Connection
NEG	Negative
NOM	Nominal
NORM	Normal
NRM	Normal
NRZ	Nonreturn to Zero
PCPT	Piece Part
PLO	Phase Lock Oscillator
PN	Part Number
POS	Positive
PWR	Power
RCVRS	Receivers
RD	Read
RDY	Ready
REC	Receiver
REF	Reference
REG	Register
REV	Reverse
RGTR	Register
RTM	Reserve Timer
RTZ	Return to Zero
S&IOAC	Sector and Index on A Cable
S/C	Series Code
SEC	Second
SEL	Select
SEQ	Sequence

ABBREVIATIONS (Contd)

SER	Servo
SH	Sheet
SOL	Solenoid
SR	Servo
SW	Switch
T	Track
TBS	To Be Supplied
TLA	Top Level Assembly
TP	Test Point
TRK	Track
TTL	Transistor Transistor Logic
UNREG	Unregulated
VCO	Voltage Controlled Oscillator
W+R	Write or Read
W•R	Write and Read
W/	With
W/O	Without
WRT	Write
WT	White
XDUCER	Transducer
XMTR	Transmitter

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 discussions on General Maintenance (section 2A of this manual).

This section is divided into the following areas:

- Site Preparation - Describes requirements that must be met in preparing a site for installation of a drive.
- Packaging - Provides information regarding shipment of the 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.

SITE PREPARATION

GENERAL

Site preparation information is provided to enable a user to lay out 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

Position the drive 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 shown on figure 1-1.

ENVIRONMENT

The site location must present the proper environmental conditions for the drive. Environmental requirements are listed in to table 1-1.

TABLE 1-1. ENVIRONMENTAL REQUIREMENTS

Specification	Value
Temperature	
Operating	0°C (32°F) to 50°C (122°F)
Gradient	15°C (27°F) per hour
Transit (packed)	-40°C (-40°F) to 70°C (+158°F)
Relative Humidity	
Operating	20% to 80% (No condensation)
Transit (packed)	5% to 95% (No condensation)
Altitude	
Operating	-76 m (-250 ft) to 1583 m (+6000 ft)
Transit (packed)	-76 m (-250 ft) to 92 000 m (+40 000 ft)

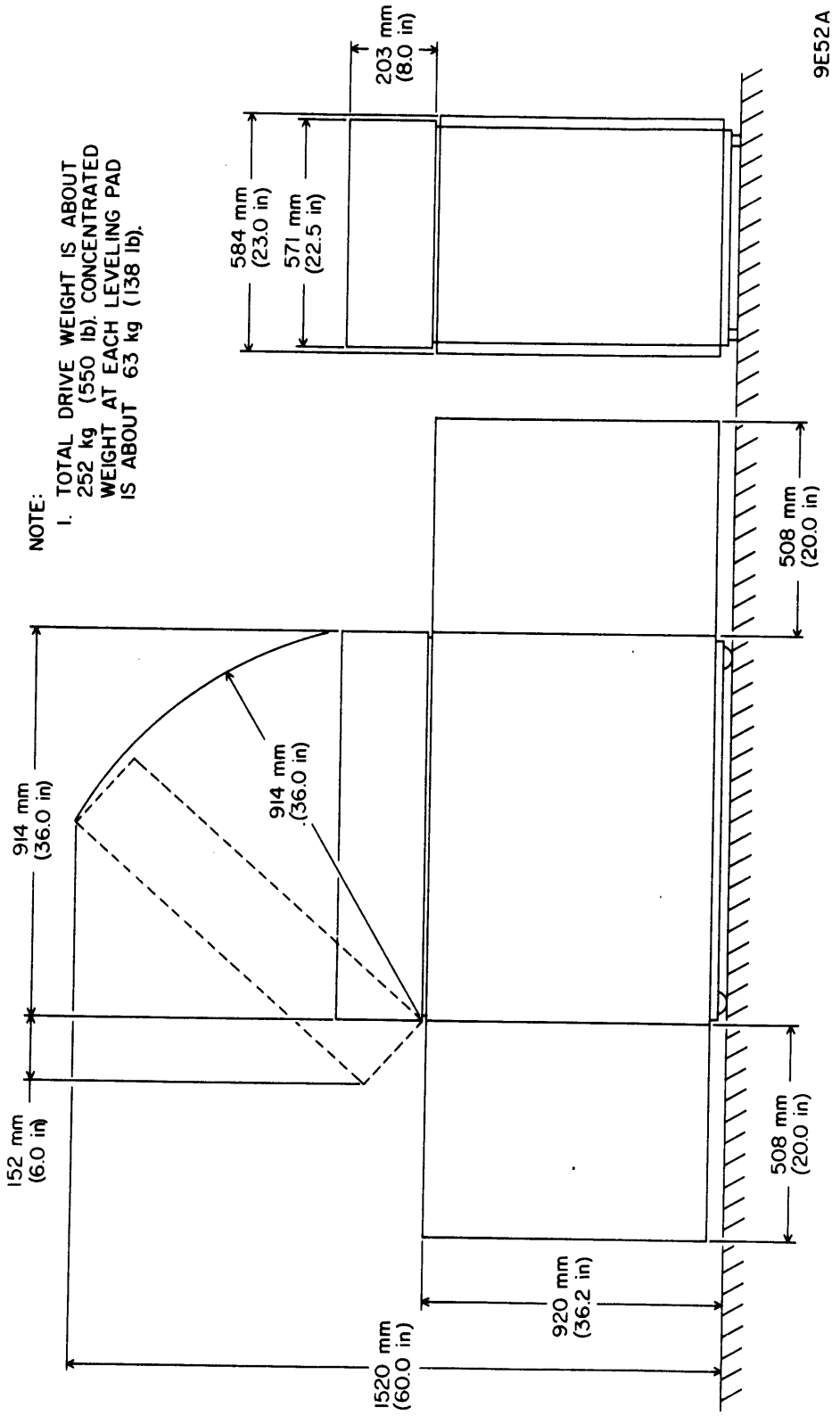


Figure 1-1. Space Requirements

POWER REQUIREMENTS

A 208 V 60 Hz ac power source connection must be provided for each drive in the system. The drives connect to the power source via 1.8 metre (6-foot) power cords. All units arrive from the factory with a power connector installed (refer to Parts Data section).

Tables 1-2 and 1-3 list the drive input voltage tolerances and power consumption requirements. Figure 1-2 shows the drive startup current.

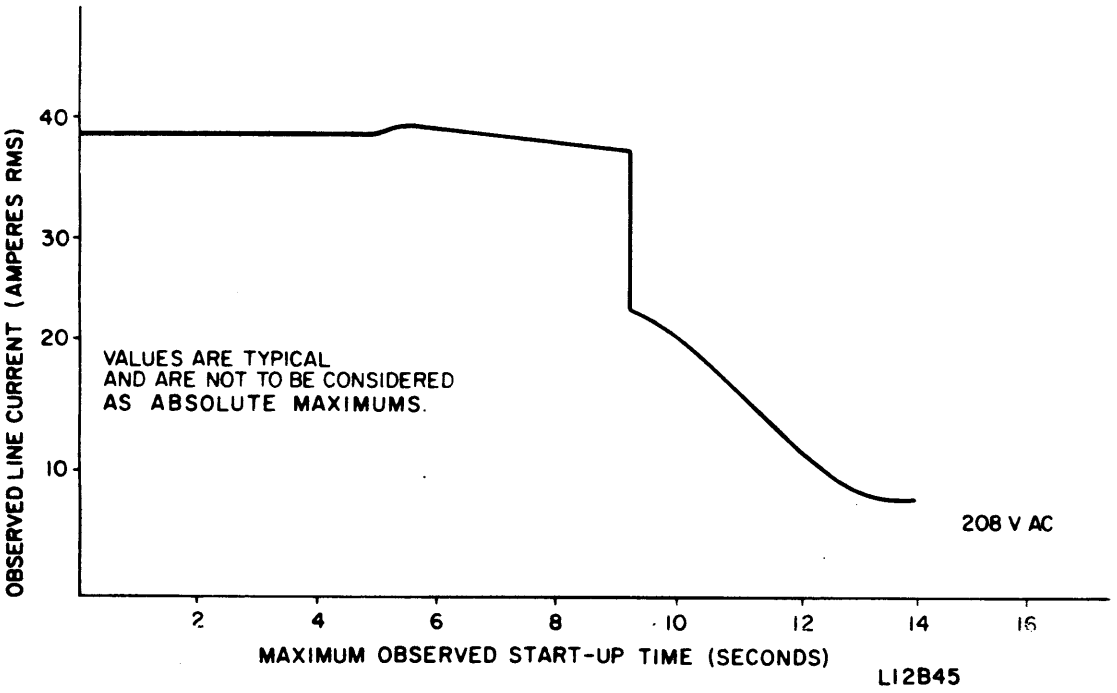


Figure 1-2. Startup Current

TABLE 1-2. DRIVE INPUT VOLTAGE

Voltage/Tolerance (ac Volts)	Frequency/Tolerance (Hz)	Phase
208 (+14.6, -29)	60 (+0.6, -1.0)	Single Phase

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	8.65	1.46	4983	.81
208 V, 60 Hz	Disks Not in Motion (Standby)	1.77	.0367	1253	1.00

* Maximum value.

WARNING

Any 3 phase, 4 wire, wye circuit where over one half of the total load consists of electric discharge lighting, data processing (such as this unit), or similar equipment must meet the requirements given in the following topic. These requirements must be met in the United States, in order to comply with the National Electrical Code, and are recommended for installations in other countries. Failure to meet these requirements may result in hazardous conditions due to high currents (and heating) in the neutral conductors and transformers supplying the system.

SPECIAL REQUIREMENTS FOR 3 PHASE, 4 WIRE, WYE SITE POWER

General

This unit uses single phase power. If the power originates from a 3 phase, wye branch or feeder circuit with a load as defined in the above warning, ensure that the circuit meets following specifications.

Specifications for Neutral Conductor

Always consider the neutral in the 3-phase, wye circuit as a current carrying conductor and ensure that it is no smaller than the line conductors.

Limiting Branch and Feeder Circuit Load Currents

Limit the maximum load current in each 3-phase, wye conductor (lines and neutral) to the values shown in table 1-3.1.

TABLE 1-3.1. CONDUCTOR LOAD CURRENT LIMITATIONS

Number of Conductors in Conduit, Cable, or Raceway	Limit to this Percentage of Value Specified by NEC* or Local or National Regulations
4 through 6	80%
7 through 24	70%
25 through 42	60%
43 and above	50%
* United States National Electrical Code.	

GROUNDING

General

To ensure safe and satisfactory operation, ground each drive properly grounded. Properly grounded drives 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 stripe) 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 that 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 that 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 that are designated as the A cable and the B cable.

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 customer supplied. The pin assignments and signal names are located in the diagrams section of this manual.

PACKAGING

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

Carefully remove the outer container. Set aside the packaging material used during shipment of the drive. Refer to the unpackaging instruction slip, which is shipped with the drive for instructions on removal of the internal blocking and hold down bolts.

If it is necessary to reorder packaging instructions, they may be obtained from:

Magnetic Peripherals Inc.
Packaging Engineer, Material Services Dept.
7801 Computer Avenue
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.

INSTALLATION PROCEDURES

General

The procedures in this discussion describe the actual installation of the drive. These procedures are based on the assumption that the site meets all requirements discussed under Site Preparation.

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

- Preinstallation Inspection
- Grounding
- AC Power Wiring
- Power Cable Routing
- I/O Cable Installation
- Setting Sector Switches
- Logic Plug Installation
- 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. File any claim for this type of damage 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 assembly.

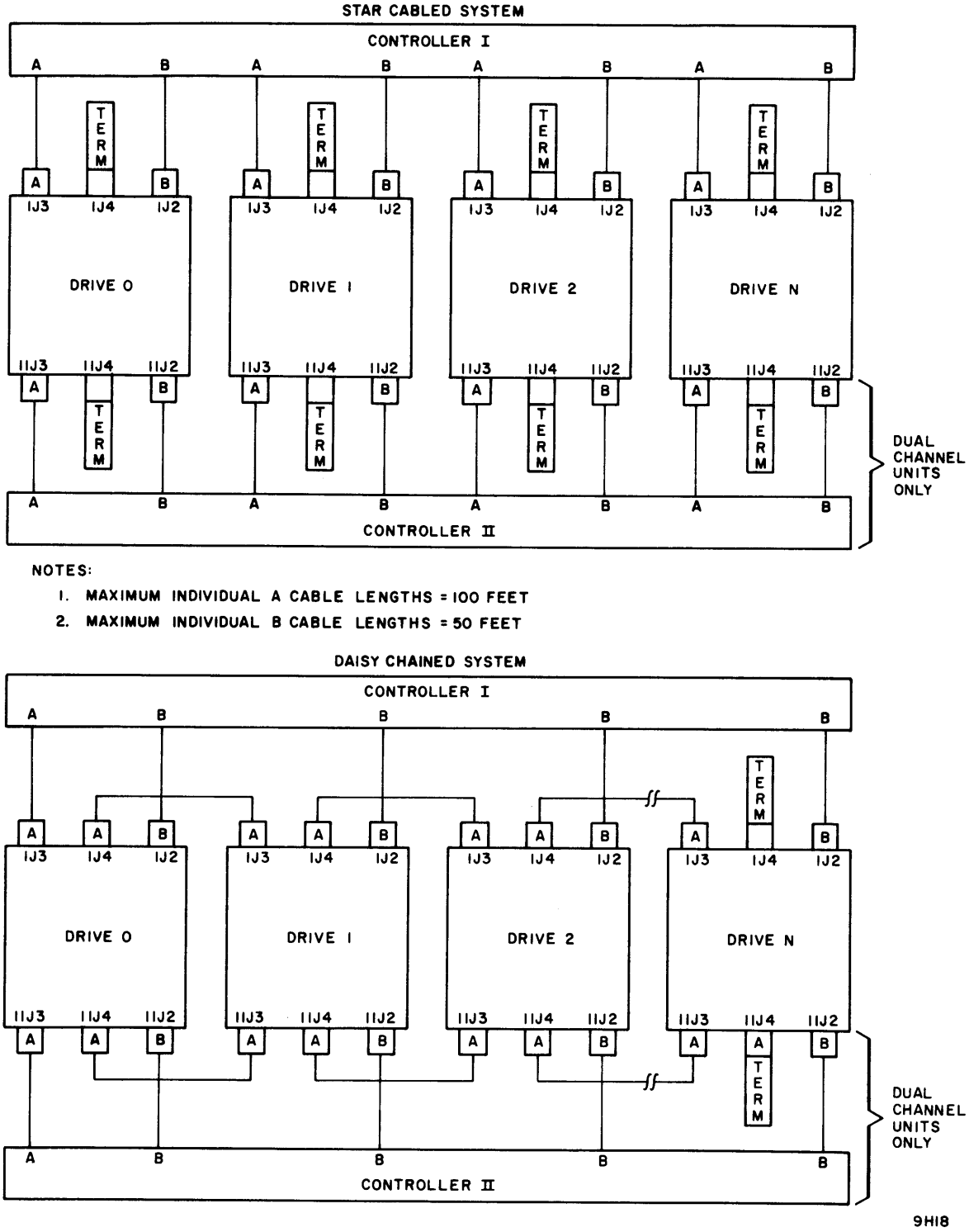


Figure 1-3. I/O Cable Configurations

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 that could cause an electrical short.

7. Check actuator and pack area for presence of material that 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 methods of grounding the drive.

Drive to Floor Grid Grounding

If a floor grid is available (either grounded or ungrounded), connect each drive individually to the floor grid (refer to figure 1-4) according to the following procedures (refer to table 1-4 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 braided 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. The drive's ac and dc grounds are connected by four jumper wires. One jumper wire is located on the grounding block (see figure 1-5) and three jumper wires connect the deck to the frame (one jumper wire across each of the three shock mounts). Therefore, only one system connection is required. It is recommended that these jumper wires remain connected to allow the drive to better withstand electrostatic discharge. However, some installations may require the isolation of ac ground from dc ground. In these cases, remove the jumpers and connect both ac and dc grounds 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). Also, remove the three jumper wires across the deck shock mounts.

9. Perform steps 1 through 6 except, when performing step 2, connect ground strap to dc terminal of grounding block instead of ac terminal.

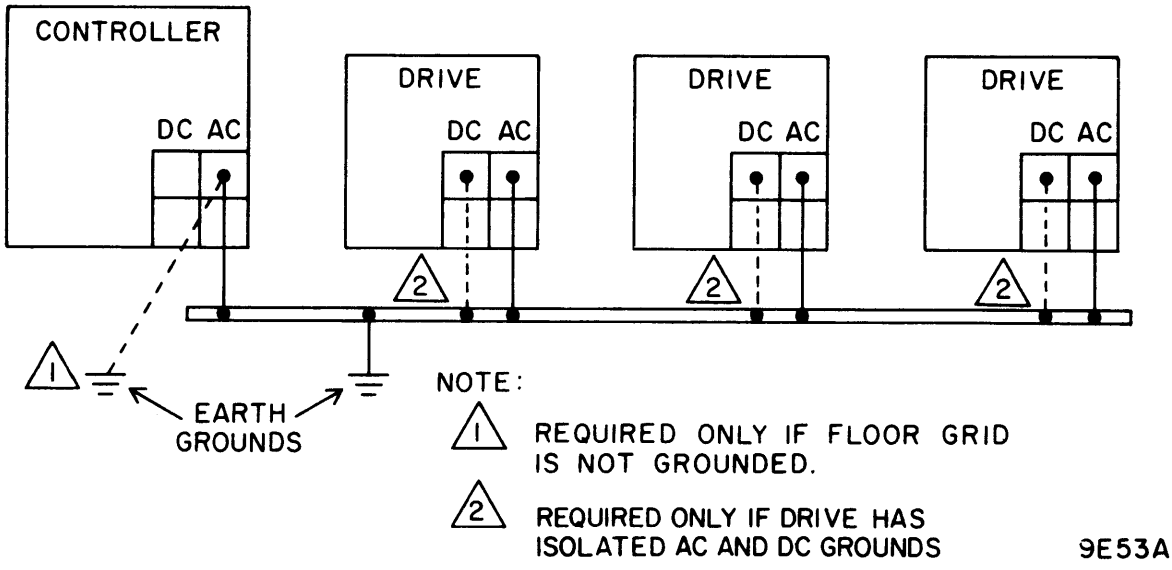


Figure 1-4. Floor Grid System Grounding

TABLE 1-4. GROUNDING ACCESSORIES

Part	CDC Part Number
Flat Braided Shielding	93267009 15.2 m (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, connect all drives to the controller in a daisy chain grounding configuration (refer to figure 1-6). Table 1-4 lists grounding accessories. Then connect the controller to earth ground. When connected in this manner, the drive must have a common ac and dc ground. Therefore, connect the jumper on the grounding block (figure 1-5) as follows:

1. Cut lengths of flat braided shielding to lengths required to go from drive to drive, from last drive in chain to controller and from 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.

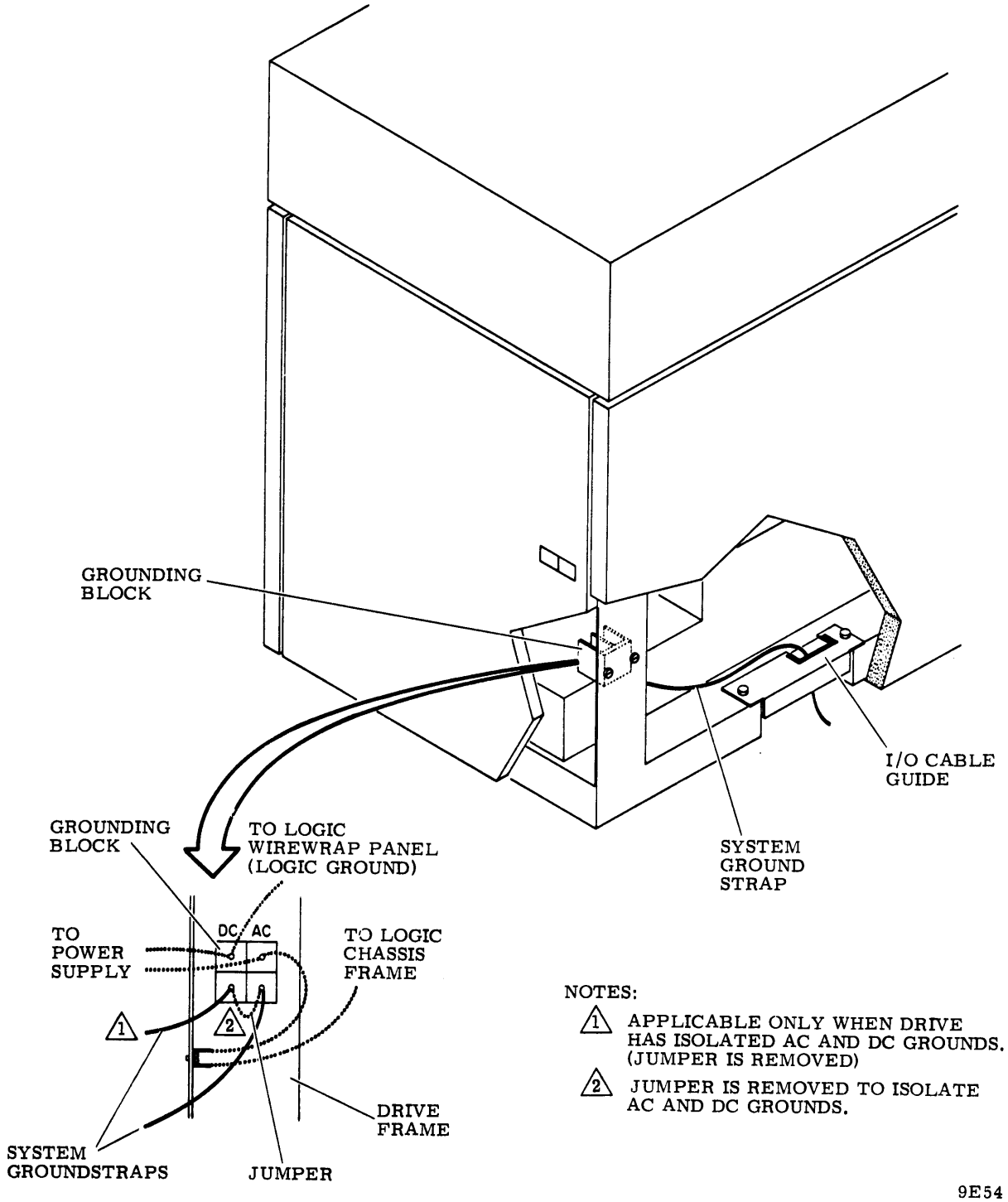


Figure 1-5. Drive Grounding Block

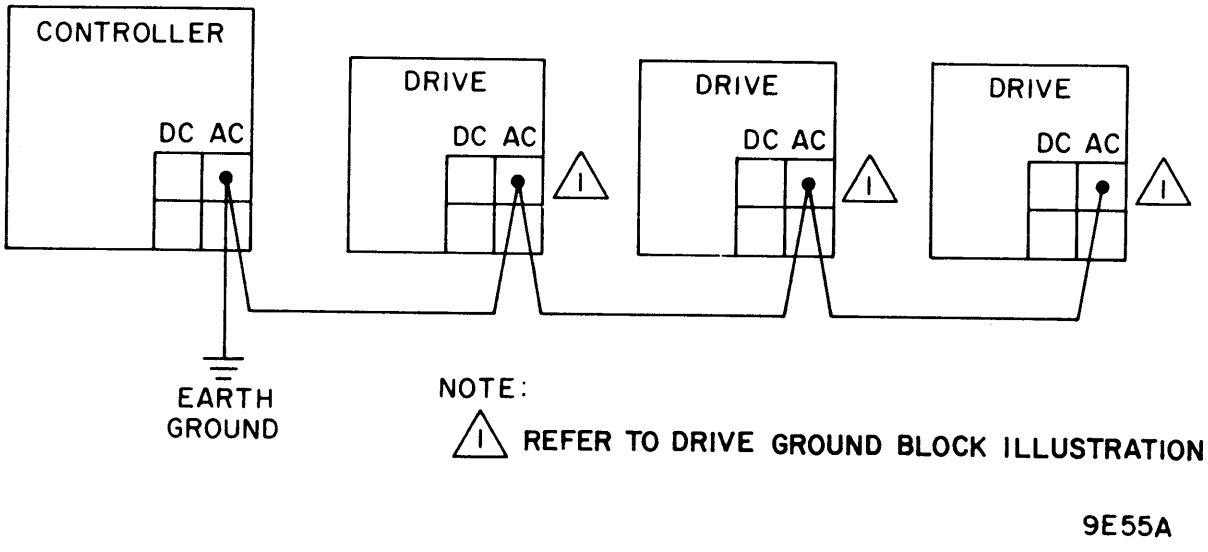


Figure 1-6. Daisy Chain System Grounding

POWER CABLE ROUTING

Route the power cable through the drive and connect it as follows (refer to figure 1-7):

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

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.

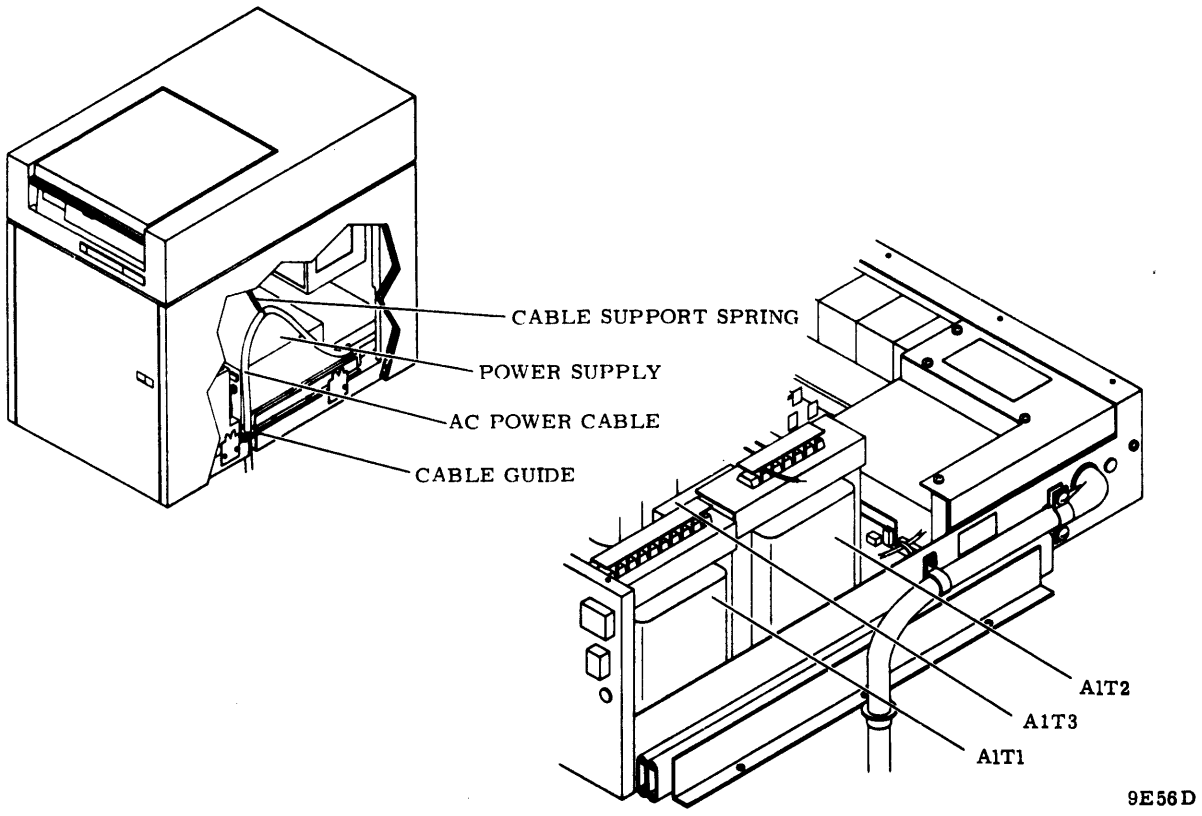


Figure 1-7. Power Cable Routing

WARNING

Ensure that AC Power Wiring procedure has been properly performed before connecting power cord connector to site source.

5. Connect power cord connector to site power source.

I/O CABLE INSTALLATION

This procedure describes the installation of drive I/O cables and terminators. You should be 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.

CAUTION

Use care not to damage cables between I/O panel and logic chassis when performing the following steps.

4. Turn I/O panel fastener (refer to figure 1-8) counterclockwise and remove I/O panel from upright support. This will allow I/O panel to be positioned so cables can be easily installed.

5. Remove screws and nuts securing I/O panel cover to I/O panel and remove cover.

NOTE

All cables installed in the following steps are routed through the I/O cable cutoff (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. See figure 1-3 for a diagram of I/O cable connections.

6. Connect B cable between controller and drive connector IJ2. For dual channel drives, connect a second B cable between channel II controller and drive connector IIJ2.

NOTE

Steps 7 and 8 apply only to systems using star I/O cabling configuration.

7. Connect A cable from controller to drive connector IJ3. For dual channel drives connect a second A cable from channel II controller to drive connector IIJ3.

8. Install terminator on IJ4. For dual channel drives install a second terminator on IIJ4. Proceed to step 12.

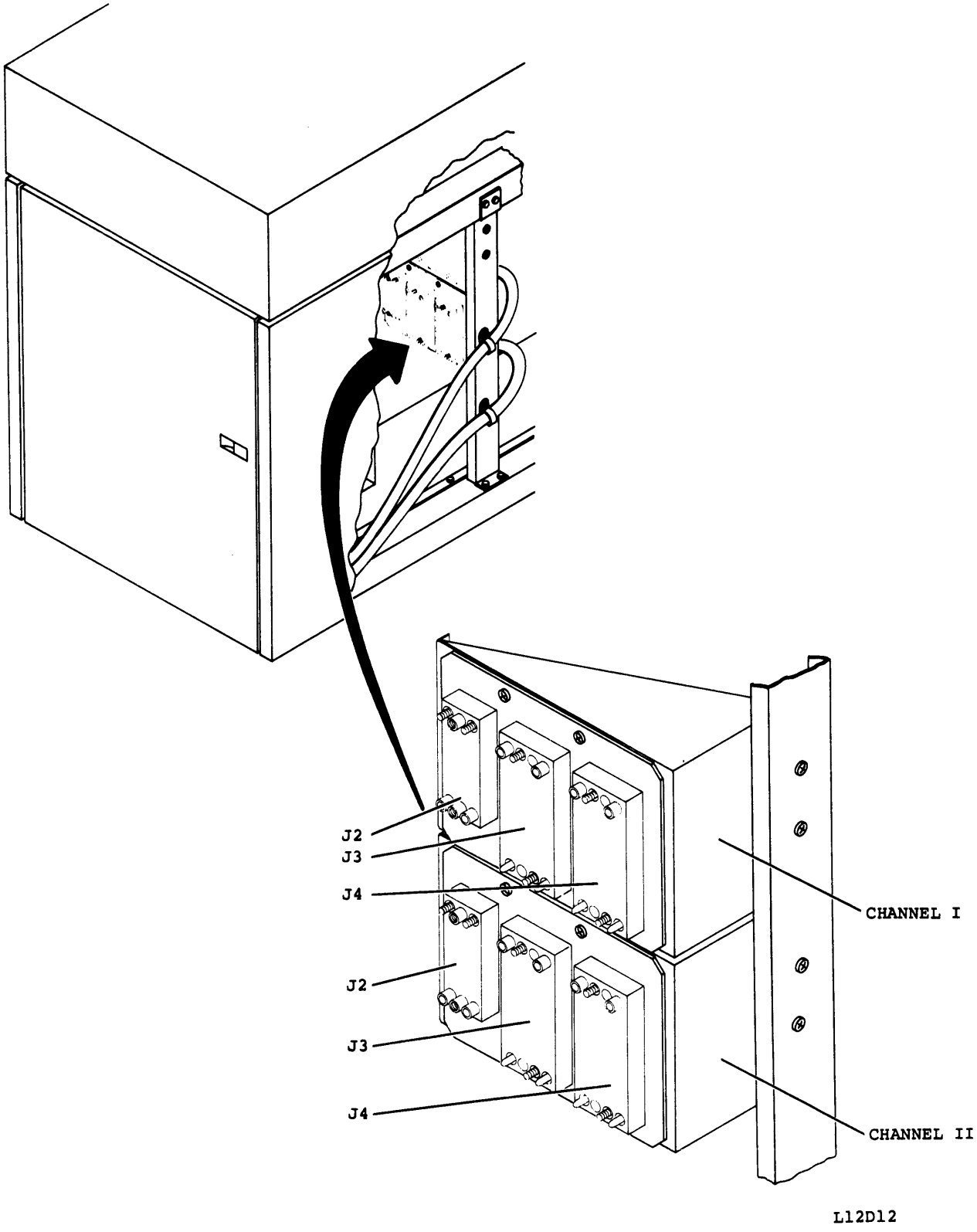


Figure 1-8. I/O Panel and I/O Cable Routing

NOTE

Steps 9 through 11 apply only to system using daisy chain I/O cabling configuration.

9. Connect A cable from controller or connector IJ4 on upstream drive (drive closest to controller on daisy chain) to drive connector IJ3. For dual channel drives connect a second A cable from channel II controller or upstream drive to drive connector IIJ3.

NOTE

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

10. Connect another A cable from drive connector IJ4 to down stream drive connector IJ3. For dual channel drives connect another A cable from drive connector IIJ4 to down stream drive connector IIJ3. Proceed to step 12.

11. Install terminator on IJ4. For dual channel drives install a second terminator on IIJ4.

12. Replace I/O panel cover on I/O panel and secure with hardware removed in step 5. Tighten cover so that cables are securely held but not so much as to damage them.

13. Position I/O panel on upright support and secure with I/O panel fastener.

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

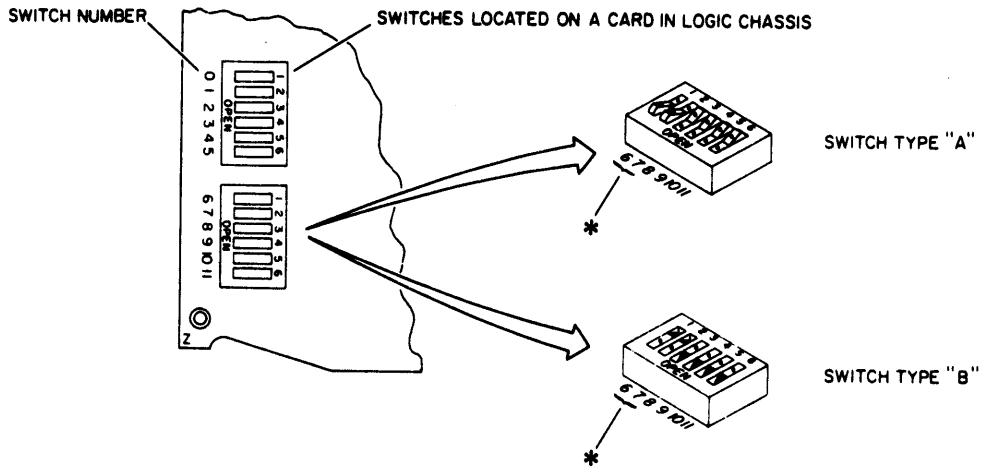
15. Replace left side panel.

SETTING SECTOR SELECT SWITCHES

The number of sectors per revolution generated by the drive logic must be matched to that required by the controller. Therefore, sector select switches are provided in the drive logic to allow selection of different sector counts. These switches are located on logic card A2A06 and appear as shown in figure 1-9.

Refer to the subsystem reference manual to determine the number of sectors required by the controller; and then locate that number in table 1-5. Across from the number of sectors listed in the table is a row of Cs and Os. C represents the Closed or On position of the sector switch. O represents the Open or Off position of the sector switch. Set the switches to the positions designated in the table while referring to figure 1-9 for an illustration of the switch positions.

ROCKER-TYPE SWITCHES

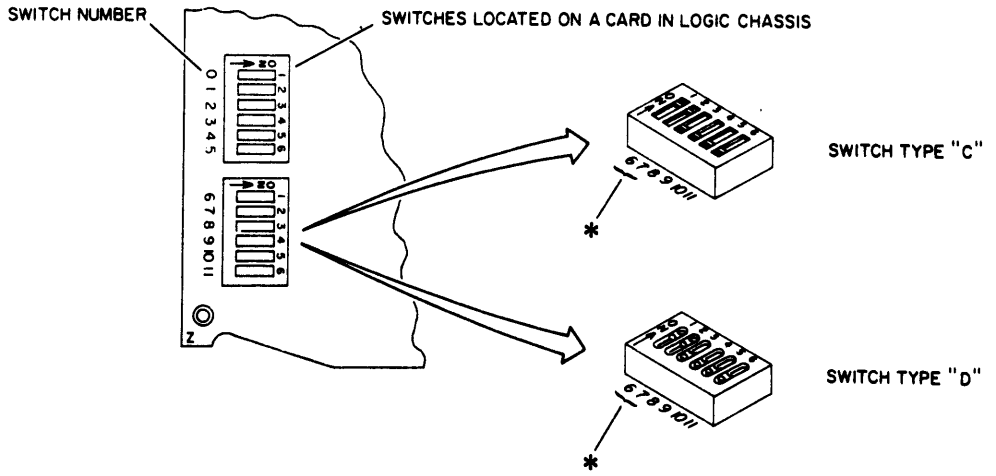


ROCKER-TYPE SWITCHES:

TO ACTUATE A SWITCH TO ITS CLOSED POSITION,
PRESS ON END OF SWITCH FARTHEST FROM "OPEN" LETTERING.

* SWITCHES 6 AND 7 SHOWN IN CLOSED POSITION.

SLIDE-TYPE SWITCHES



SLIDE-TYPE SWITCHES:

TO ACTUATE A SWITCH TO ITS ON POSITION,
SLIDE SWITCH IN DIRECTION OF ARROW SHOWN ON SWITCH.

* SWITCHES 6 AND 7 SHOWN IN ON POSITION.

9H108

Figure 1-9. Sector Select Switches

TABLE 1-5. SECTOR SELECT SWITCH SETTINGS

Number of Sectors	Switch Number											
	0	1	2	3	4	5	6	7	8	9	10	11
4	C	C	C	C	C	O	O	O	C	O	C	C
5	C	C	C	C	C	C	C	O	O	C	O	C
6	C	C	C	C	C	C	O	C	O	O	O	C
7	C	C	C	C	C	C	C	O	C	C	C	O
8	C	C	C	C	O	O	O	C	O	C	C	O
9	O	O	C	O	C	O	C	C	C	O	C	O
10	C	C	C	C	C	C	O	O	C	O	C	O
11	O	O	C	O	O	O	C	C	O	O	C	O
12	C	C	C	C	C	O	C	O	O	O	C	O
13	O	O	O	C	O	O	O	O	O	O	C	O
14	C	C	C	C	C	C	O	C	C	C	O	O
15	C	C	C	C	C	C	C	O	C	C	O	O
16	C	C	C	O	O	O	C	O	C	C	O	O
17	C	O	C	O	C	O	O	O	C	C	O	O
18	C	O	O	C	O	C	C	C	O	C	O	O
19	O	C	O	O	O	O	C	C	O	C	O	O
20	C	C	C	C	C	O	O	C	O	C	O	O
21	C	C	C	C	C	C	C	O	O	C	O	O
22	C	O	O	O	O	C	C	O	O	C	O	O
23	C	C	C	O	O	O	C	O	O	C	O	O
24	C	C	C	C	O	C	O	O	O	C	O	O
25	O	O	O	C	C	O	O	O	O	C	O	O
26	C	C	O	O	O	O	O	O	O	C	O	O
27	O	O	O	O	C	C	C	C	C	O	O	O

Table Continued on Next Page

TABLE 1-5. SECTOR SELECT SWITCH SETTINGS (Contd)

Number of Sectors	Switch Number											
	0	1	2	3	4	5	6	7	8	9	10	11
28	C	C	C	C	C	O	C	C	C	O	O	O
29	O	C	C	C	O	O	C	C	C	O	O	O
30	C	C	C	C	C	C	O	C	C	O	O	O
31	O	O	O	O	C	C	O	C	C	O	O	O
32	C	C	O	O	O	C	O	C	C	O	O	O
33	O	C	C	O	C	O	O	C	C	O	O	O
34	O	C	O	C	O	O	O	C	C	O	O	O
35	C	C	C	C	C	C	C	O	C	O	O	O
36	O	O	C	O	C	C	C	O	C	O	O	O
37	O	C	O	C	O	C	C	O	C	O	O	O
38	O	O	O	O	O	C	C	O	C	O	O	O
39	C	C	C	O	C	O	C	O	C	O	O	O
40	C	C	C	C	O	O	C	O	C	O	O	O
41	O	C	C	O	O	O	C	O	C	O	O	O
42	C	C	C	C	C	C	O	O	C	O	O	O
43	C	C	C	O	C	C	O	O	C	O	O	O
44	O	O	O	O	C	C	O	O	C	O	O	O
45	C	O	O	C	O	C	O	O	C	O	O	O
46	C	C	O	O	O	C	O	O	C	O	O	O
47	O	O	C	C	C	O	O	O	C	O	O	O
48	C	C	C	O	C	O	O	O	C	O	O	O
49	C	O	O	O	C	O	O	O	C	O	O	O
50	C	C	O	C	O	O	O	O	C	O	O	O
51	O	C	C	O	O	O	O	O	C	O	O	O

Table Continued on Next Page

TABLE 1-5. SECTOR SELECT SWITCH SETTINGS (Contd)

Number of Sectors	Switch Number											
	0	1	2	3	4	5	6	7	8	9	10	11
52	C	O	O	O	O	O	O	O	C	O	O	O
53	O	O	C	C	C	C	C	C	O	O	O	O
54	C	C	C	O	C	C	C	C	O	O	O	O
55	C	C	O	O	C	C	C	C	O	O	O	O
56	C	C	C	C	O	C	C	C	O	O	O	O
57	O	C	O	C	O	C	C	C	O	O	O	O
58	O	C	C	O	O	C	C	C	O	O	O	O
59	O	C	O	O	O	C	C	C	O	O	O	O
60	C	C	C	C	C	O	C	C	O	O	O	O
61	C	C	O	C	C	O	C	C	O	O	O	O
62	C	C	C	O	C	O	C	C	O	O	O	O
63	O	O	C	O	C	O	C	C	O	O	O	O
64	C	O	O	O	C	O	C	C	O	O	O	O
65	C	O	C	C	O	O	C	C	O	O	O	O
66	O	C	O	C	O	O	C	C	O	O	O	O
67	C	C	C	O	O	O	C	C	O	O	O	O
68	O	O	C	O	O	O	C	C	O	O	O	O
69	C	O	O	O	O	O	C	C	O	O	O	O
70	C	C	C	C	C	C	O	C	O	O	O	O
71	O	O	C	C	C	C	O	C	O	O	O	O
72	C	O	O	C	C	C	O	C	O	O	O	O
73	C	C	C	O	C	C	O	C	O	O	O	O
74	O	O	C	O	C	C	O	C	O	O	O	O
75	O	C	O	O	C	C	O	C	O	O	O	O

Table Continued on Next Page

TABLE 1-5. SECTOR SELECT SWITCH SETTINGS (Contd)

Number of Sectors	Switch Number											
	0	1	2	3	4	5	6	7	8	9	10	11
76	C	C	C	C	O	C	O	C	O	O	O	O
77	C	O	C	C	O	C	O	C	O	O	O	O
78	C	C	O	C	O	C	O	C	O	O	O	O
79	C	O	O	C	O	C	O	C	O	O	O	O
80	C	C	C	O	O	C	O	C	O	O	O	O
81	O	O	C	O	O	C	O	C	O	O	O	O
82	O	C	O	O	O	C	O	C	O	O	O	O
83	O	O	O	O	O	C	O	C	O	O	O	O
84	C	C	C	C	C	O	O	C	O	O	O	O
85	C	O	C	C	C	O	O	C	O	O	O	O
86	C	C	O	C	C	O	O	C	O	O	O	O
87	C	O	O	C	C	O	O	C	O	O	O	O
88	C	C	C	O	C	O	O	C	O	O	O	O
89	O	C	C	O	C	O	O	C	O	O	O	O
90	O	O	C	O	C	O	O	C	O	O	O	O
91	O	C	O	O	C	O	O	C	O	O	O	O
92	C	O	O	O	C	O	O	C	O	O	O	O
93	C	C	C	C	O	O	O	C	O	O	O	O
94	C	O	C	C	O	O	O	C	O	O	O	O
95	O	O	C	C	O	O	O	C	O	O	O	O
96	C	C	O	C	O	O	O	C	O	O	O	O
97	C	O	O	C	O	O	O	C	O	O	O	O
98	O	O	O	C	O	O	O	C	O	O	O	O
99	O	C	C	O	O	O	O	C	O	O	O	O

Table Continued on Next Page

TABLE 1-5. SECTOR SELECT SWITCH SETTINGS (Contd)

Number of Sectors	Switch Number											
	0	1	2	3	4	5	6	7	8	9	10	11
100	C	O	C	O	O	O	O	C	O	O	O	O
101	O	O	C	O	O	O	O	C	O	O	O	O
102	O	C	O	O	O	O	O	C	O	O	O	O
103	C	O	O	O	O	O	O	C	O	O	O	O
104	O	O	O	O	O	O	O	C	O	O	O	O
105	C	C	C	C	C	C	C	O	O	O	O	O
106	C	O	C	C	C	C	C	O	O	O	O	O
107	O	O	C	C	C	C	C	O	O	O	O	O
108	C	C	O	C	C	C	C	O	O	O	O	O
109	O	C	O	C	C	C	C	O	O	O	O	O
110	C	O	O	C	C	C	C	O	O	O	O	O
111	O	O	O	C	C	C	C	O	O	O	O	O
112	C	C	C	O	C	C	C	O	O	O	O	O
113	C	O	C	O	C	C	C	O	O	O	O	O
114	O	O	C	O	C	C	C	O	O	O	O	O
115	C	C	O	O	C	C	C	O	O	O	O	O
116	O	C	O	O	C	C	C	O	O	O	O	O
117	C	O	O	O	C	C	C	O	O	O	O	O
118	O	O	O	O	C	C	C	O	O	O	O	O
119	C	C	C	C	O	C	C	O	O	O	O	O
120	C	C	C	C	O	C	C	O	O	O	O	O
121	O	C	C	C	O	C	C	O	O	O	O	O
122	C	O	C	C	O	C	C	O	O	O	O	O
123	O	O	C	C	O	C	C	O	O	O	O	O

Table Continued on Next Page

TABLE 1-5. SECTOR SELECT SWITCH SETTINGS (Contd)

Number of Sectors	Switch Number											
	0	1	2	3	4	5	6	7	8	9	10	11
124	C	C	O	C	O	C	C	O	O	O	O	O
125	O	C	O	C	O	C	C	O	O	O	O	O
126	C	O	O	C	O	C	C	O	O	O	O	O
127	O	O	O	C	O	C	C	O	O	O	O	O
128	O	O	O	C	O	C	C	O	O	O	O	O

Note: C = Closed or On position; O = Open or Off position.

CABINET LEVELING

Cabinet leveling is not performed until the drive is in its 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 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 1-10) 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 drive's weight.

4. Adjust leveling pads 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.

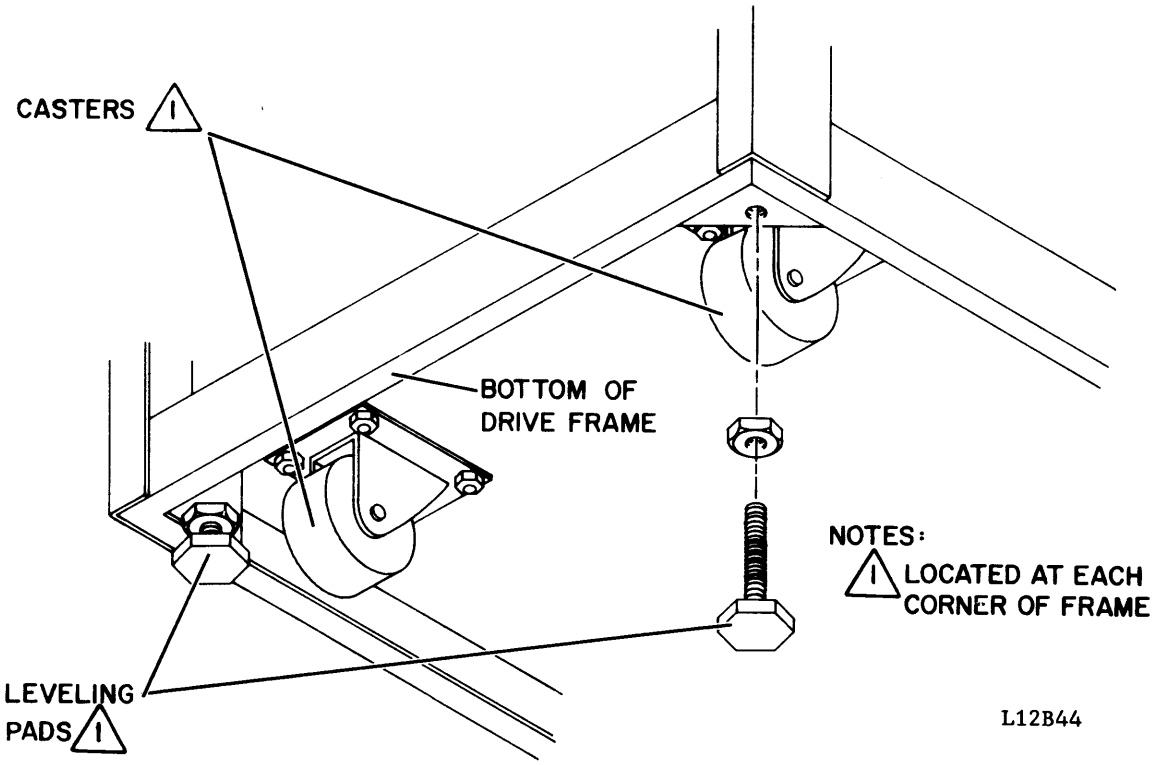


Figure 1-10. Leveling Procedure

INITIAL CHECKOUT AND STARTUP

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

1. Set all circuit breakers to off.

2. Perform Clean Shroud and Spindle procedure (refer to Preventive Maintenance section 2B).

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 back-panel 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 firmly seated in their connectors.

8. Replace deck cover and close top cover.

9. Set all circuit breakers to on, verify that blower starts, and allow it to operate for at least 10 minutes before proceeding to step 10.

10. Install scratch disk pack.

11. 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.

12. Perform following procedures:

    a. Servo System Test and Adjustment (section 2C).

    b. Head Alignment (section 2C).

SECTION 2

MAINTENANCE

INTRODUCTION

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

- General Maintenance Information - Contains general information with which a maintenance person should be familiar prior to performing maintenance on the drive.
- Preventive Maintenance - Describes preventive maintenance that must be performed to maintain proper drive operation.
- Test 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.
- Electrostatic Discharge Protection - Correct procedures for handling logic cards and assemblies which are sensitive to static electricity.
- Maintenance Tools and Materials - Lists 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 features of the drive which allow convenient access to its assemblies for maintenance.
- Maintenance Controls and Test Points - Describes location of test points (both on cards and backpanel) referred to in maintenance procedures.
- Manual Positioning of the Carriage - Describes how heads may be loaded and positioned manually.
- Special Maintenance Procedures - Describes certain procedures and practices that are important to proper maintenance of the drive.
- Head Crash Prevention - Describes the steps that should be taken to avoid head crashes.

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 Electrostatic Discharge Protection when working on _YFN card in power supply or this card may be damaged.

ELECTROSTATIC DISCHARGE PROTECTION

All drive electronic assemblies are sensitive to static electricity, due to the electrostatically sensitive devices used within the drive circuitry. Although some of these devices such as metal-oxide semiconductors are extremely sensitive, all semiconductors as well as some resistors and capacitors may be damaged or degraded by exposure to static electricity.

Electrostatic damage to electronic devices may be caused by a direct discharge of a charged conductor, or by exposure to the static fields which surround charged objects. To avoid damage to drive electronic assemblies, service personnel must observe the following precautions when servicing the drive:

- Ground yourself to the drive whenever the drive electronics are or will be exposed. Connect yourself to ground with a wrist strap (see table 2-1 for part number). Connection may be made to the ground block at the rear of the drive. As a general rule, remember that you, the drive, and the circuit cards must all be at ground potential to avoid potentially damaging static charges.

- Keep cards in conductive bags - when circuit cards are not installed in the drive, keep them in conductive static shielding bags (see table 2-1 for part number). These bags provide absolute protection from direct static discharge and from static fields surrounding charged objects. Remember that these bags are conductive and should not be placed where they might cause an electrical short circuit.

- Remove cards from bags only when you are grounded - all cards received from the factory are in static shielding bags, and should not be removed unless you are grounded.

- Turn off power to drive before removing or installing any circuit cards.

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 2A-1 along with their CDC part numbers.

TABLE 2A-1. MAINTENANCE TOOLS AND MATERIALS

Description	CDC Part Number
Adapter (3/16 Hex to 1/4 Sq)	CDC* 12262582
Adhesive, Loctite 415 1-lb. bottle	95033929
Adhesive, Sealant	95125321
Ball End Hex Driver (3/16 Hex)	CDC 12263201
Bonding Agent (Fast Setting)	CDC 95033900
Bonding Agent	CDC 95033926
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
Conduction Static Shielding Bag	CDC 12263626
Disk Pack, CE (883-51)	CDC 70430003
Disk Pack, Regular *883-91	CDC 70430513
Dust Remover ***	
Epoxy (Fast Cure)	CDC 12210960
Gauze, Lint Free	CDC 12209713
Grease, Silicone	CDC 95109000
Head Adjustment Tool	CDC 75018803
I/O Pin Removal	CDC 12212759

Table Continued on Next Page

TABLE 2A-1. MAINTENANCE TOOLS AND MATERIALS (Contd)

Description	CDC* Part Number
Hose Assembly	82346500
High Intensity Light****	12212038
Loctite, Grade C	Loctite Corp.
Loctite Primer, Grade N	Loctite Corp.
Lubricant Paste	95016101
Head Cleaning Solution	82365800
Mirror	Commercially available
Non-Metallic Feeler Gage, 0.005 inch	12205633
Oscilloscope, Dual Trace	Tektronix 454 # or equivalent
Oscilloscope Hood 016-0083-00	Tektronix
Pin Straightener	87369400
Pressure Gauge Kit, Differential (Optional)	73040100
Punch Card	NONE
Push-Pull Gage	12210797
Scope Probe Tip (Hatchet Type)	12212885
Sealant, Silicone, Rubber	95023500

Table Continued on Next Page

TABLE 2A-1. MAINTENANCE TOOLS AND MATERIALS (Contd)

Description	CDC Part Number
Thread Locking Compound, 50 ml bottle (used to secure nuts to shroud window)	CDC 95059905
Torque Screwdriver **	12218425
Torque Screwdriver Bit **	87016701
Torque Wrench, 1/4 inch	92016400
Volt/ohmmeter	Ballantine 345 # or equivalent digital voltmeter
Wire Wrap Bit, 30 Gage	12218402
Wire Wrap Gun, Electrical	12259111
Wire Wrap Removal Tool 20-30 Gage	12259183
Wire Wrap Sleeve, 30 Gage	12218403
Wrist Strap, Large	12263496

* CDC is a registered trademark of Control Data Corporation.

** Torque Screwdriver and bit are used for tightening head clamping hardware.

*** Used for head cleaning.

**** Works only with 120 V, 60 Hz. For other voltages and frequencies, use commercially available 100 or 150 watt outdoor floodlight with suitable receptacle and extension cord. Note: Light must have hard safety glass bulb and all items must be rated for use with applicable source power.

# Denotes vendor part or model number.

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

DISK PACK

General

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; therefore, be careful that this data is not destroyed 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 and removal is contained in the hardware reference manual.

HEAD ALIGNMENT KIT

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 is proportional to the distance a selected head is offset from the track centerline. The head alignment card plugs into card location A16 in the drive's logic chassis.

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

The following toggle switches control the cards operation (refer to figure 2A-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 or LED display when switch is in P position.

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

NOTE

Refer to FTU manual to determine how to decode the LED display readout.

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

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.

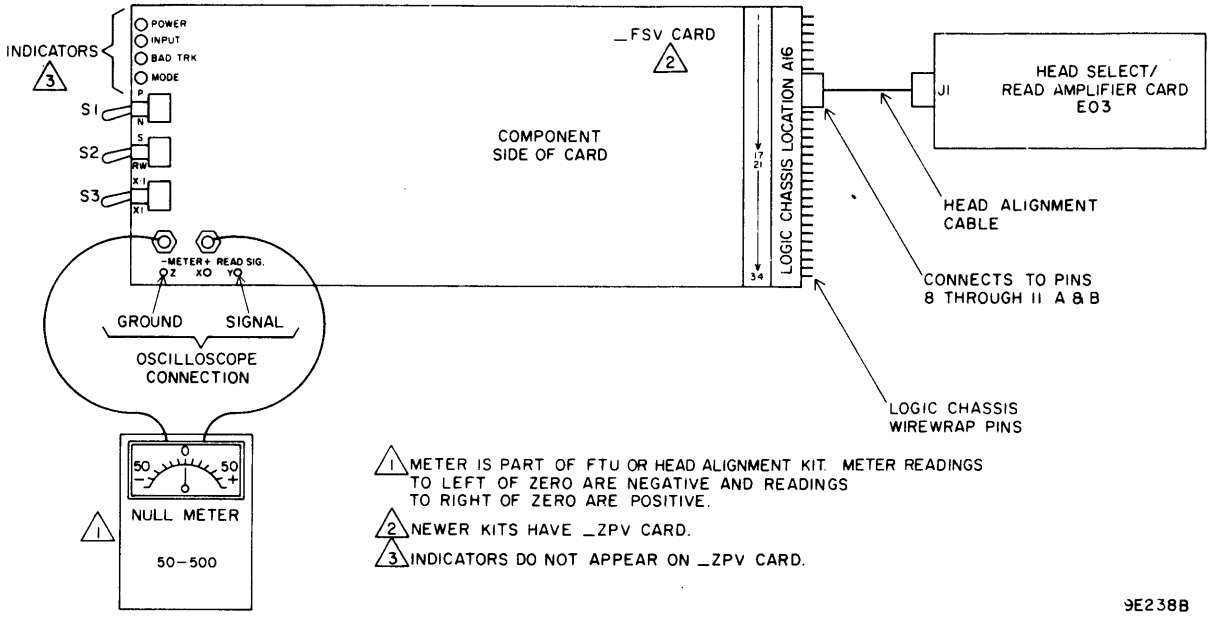


Figure 2A-1. Head Alignment Kit

Four indicators are provided on the _FSV card (but not on the _ZPV 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 switch S1 is operated.

Mode - When lighted, it indicates that either switch S2 is in the S (servo) position or switch 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 that 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 or by the FTU LED display, depending on the type of FTU that is used. In either case, the voltage is connected to the alignment card via test leads from test points X and Z.

The null meter may be a part of the FTU or a separate unit if the head alignment kit is 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 ±50 mV. When the switch is in the 500 position, the meter reads up to ±500 mV. 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 unit (FTU) or test software is required to perform most of the electrical tests and adjustments described in this manual. The FTU or test software provides 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 using the standard I/O connection or by an I/O bypass connection.

The standard I/O connection requires disconnecting the system I/O cables and connecting the FTU I/O cables in their place.

The I/O bypass connection leaves the system I/O cables in place and connects a cable from the FTU to a connector on the drive backpanel.

Both types of connections are described in the Preparation of Drive for Testing procedure. Refer to the FTU manual for more information concerning its operation, installation, and use.

Testing With Software

The drive can also be tested using 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 that for 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 procedure 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.

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 you are using the FTU and I/O bypass connection, proceed to step 6. If you are using the FTU and standard I/O connection, proceed to step 7. If you are using test software, proceed to step 8.

6. Connect FTU I/O bypass cable from FTU to A2JA84 on drive backpanel (refer to figure 2A-2), then proceed to step 8.

CAUTION

Use care not to damage cables between I/O panel and logic chassis or system I/O cables when performing step 7.

7. Connect FTU standard I/O cables to drive as follows (refer to figure 2A-3 and 1-8):

   a. Turn I/O panel fastener counter-clockwise and remove panel from upright support. This will allow panel to be positioned so cables can be easily installed.

   b. Remove screws and nuts securing I/O panel cover to I/O panel then remove cover and set it aside. Cover is not replaced until maintenance is complete.

NOTE

Steps c through f refer to either Channel I or II connections, whichever is tested.

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

   d. Terminate J4.

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

   f. Position I/O panel on upright support and secure with I/O panel fastener.

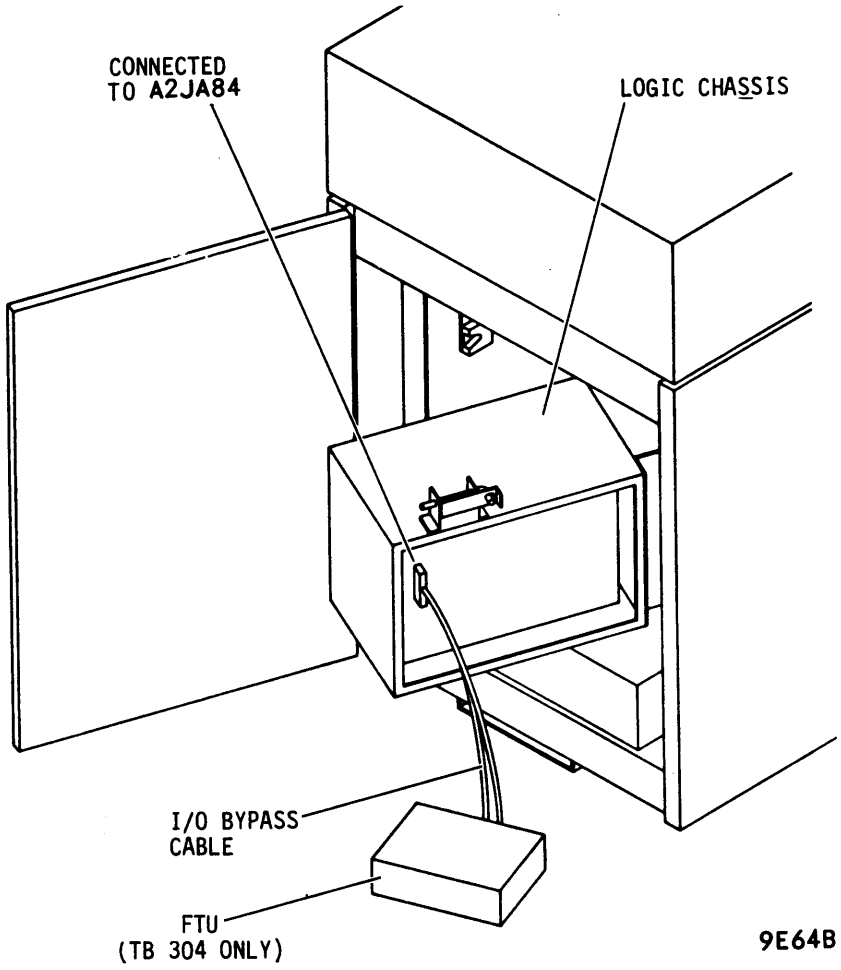


Figure 2A-2. FTU to Drive I/O Bypass Connection

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

8. Loosen turn lock fastener securing card cage cover to logic chassis and remove cover.

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

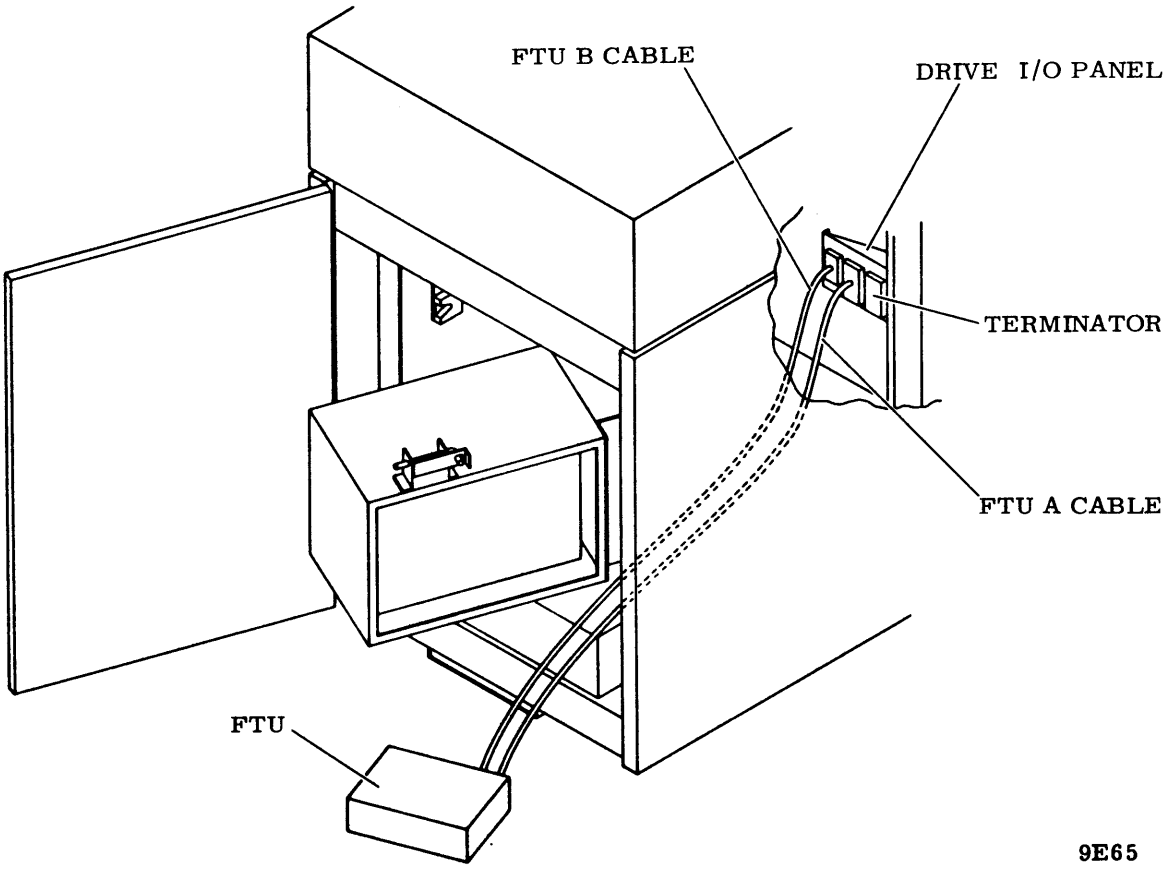


Figure 2A-3. Standard I/O Connection

10. If head alignment is being performed, proceed as follows (refer to figure 2A-1):

    a. Install head alignment card in location A16.

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

11. Set MAIN AC circuit breaker to on.

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

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

Preparation of Drive for Return Online After Testing

The following procedure 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 FTU with I/O bypass connection was used, proceed to step 2. If FTU with standard I/O connection was used, proceed to step 3. If test software was used, proceed to step 6.

2. Disconnect FTU I/O bypass cable from A2JA84 on drive backpanel and proceed to step 6.

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

4. Disconnect terminator from J4 on drive I/O panel, if it was installed during testing with an FTU and is not required for normal online operation.

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

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

7. 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.

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

9. Close logic chassis and rear door.

10. Close cabinet top cover, (if it was open).

11. 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 2A-4 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 2A-4). 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 are also accessible. The rear door allows access to the logic chassis, power supply and drive motor.

The front door is opened by pushing the latch and swinging the door outward as shown in figure 2A-4. The rear door has an additional lock. To open it, insert a 6 mm hex wrench through the hole beneath the latch and turn it to release the lock. First, remove the groundstrap, lift out the pin securing the door to the lower hinge, and slip the door off the upper hinge. To replace the door, reverse the removal procedure.

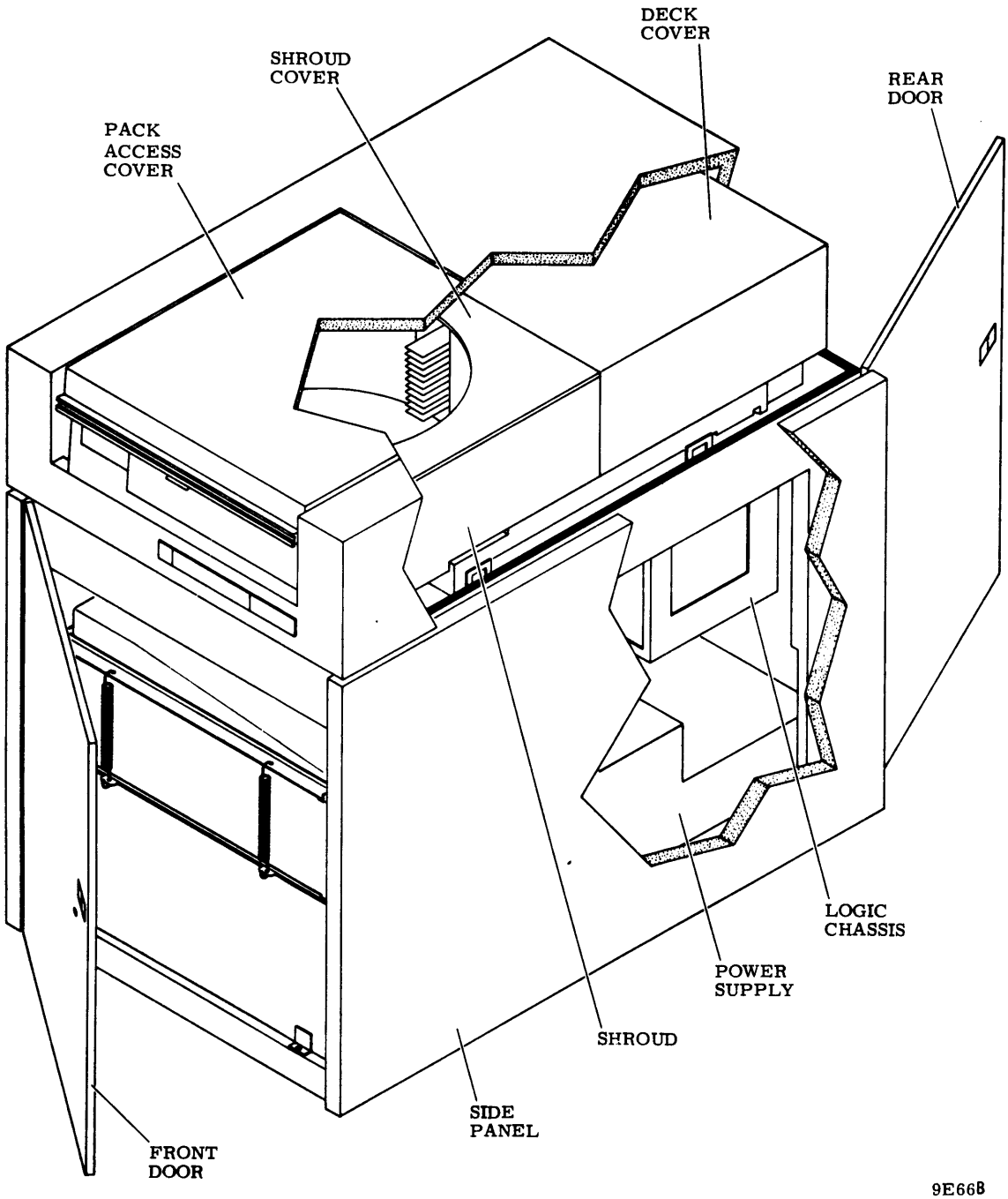


Figure 2A-4. Access For Maintenance Features

CABINET TOP COVER

General

To gain access to the deck assemblies, raise the top cover. To remove the shroud cover, shroud or pack access cover, remove the top cover first.

Open latch (if installed) and raise top cover. The top cover is raised by lifting it from the rear and raising it until the support locks into place (refer to figure 2A-5).

To raise the top cover open the rear door first and then press the standoff fastened to the top cover latch which protrudes through the hole in the frame. While pushing on the standoff, push down on the top cover to release the latch. To lock the top cover push it down until the latch catches.

The following procedure describes removal and replacement of the top cover. If the drive is installed inline with other drives, remove it from the in-line position before removing or replacing the cover.

Top Cover Removal

1. Raise top cover until support locks it in upright position.

2. Remove nutplates from screws holding each side of top cover but do not remove screws. Cover should remain in raised position, supported by screw 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.

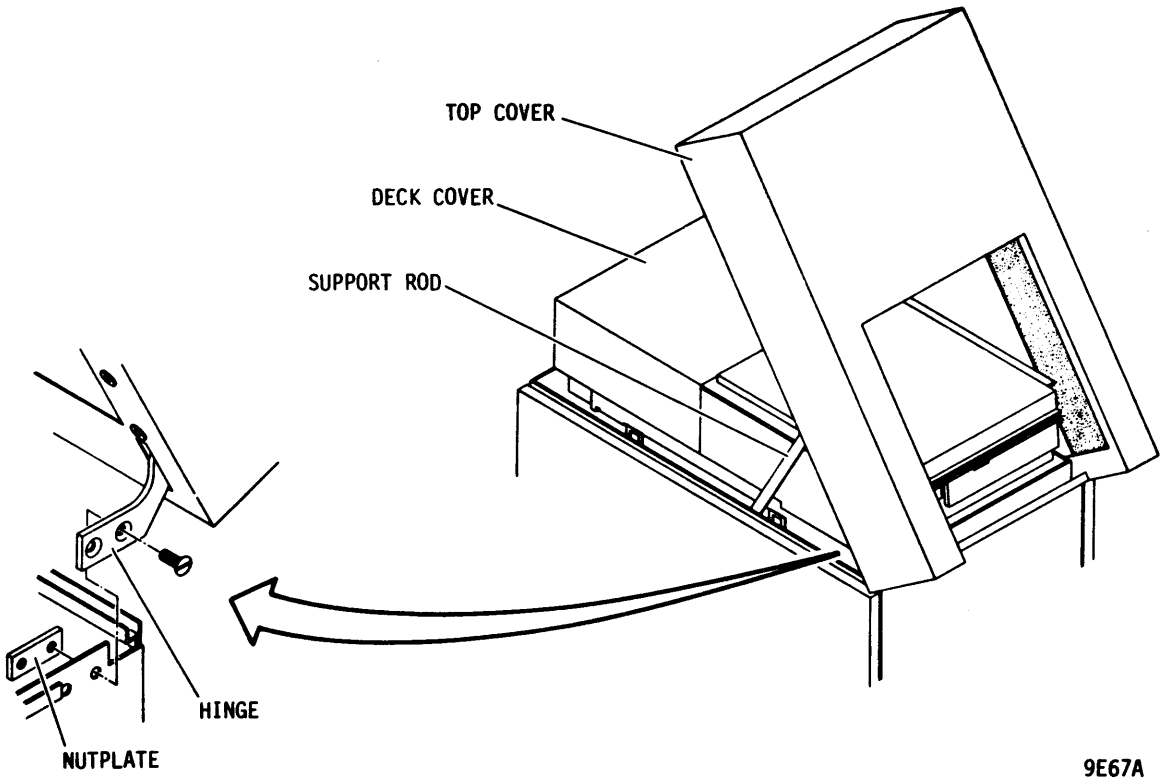


Figure 2A-5. Top and Deck Cover

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 nutplates on screws securing hinges to frame.

DECK COVER

Remove the deck cover (refer to figure 2A-5) to gain access to 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. Also, the cover is lined with acoustical foam to reduce machine noise.

Remove the cover by releasing the four latches and lifting it off the deck.

LOGIC CHASSIS

To gain access to the logic chassis located at the rear of the drive, open the rear door. Releasing the catch on the logic chassis allows it to swing outward, thereby permitting access to the card cage (refer to figure 2A-6). Remove the card cage cover 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 open, it is supported by a gas spring attached between it and the deck (refer to figure 2A-7).

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, and also when the main power circuit breaker is off.

To remove and replace the pack access cover perform 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.

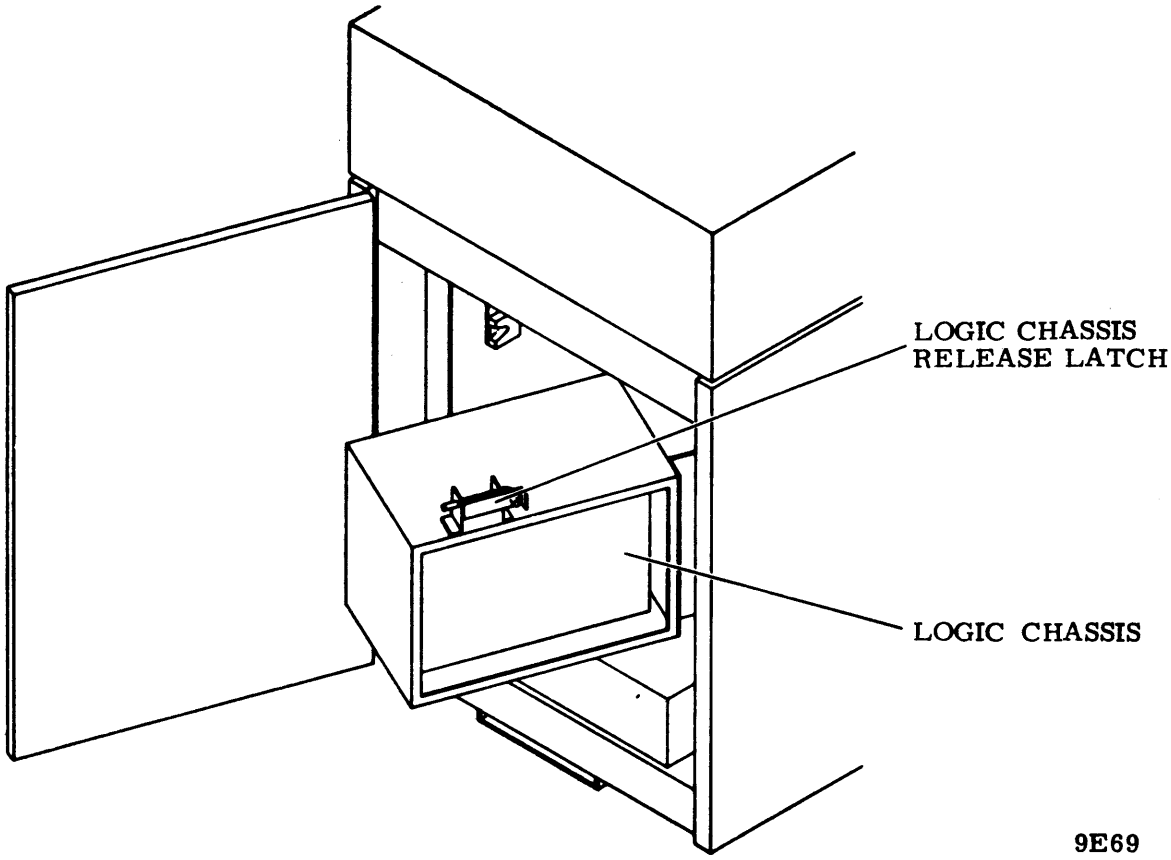


Figure 2A-6. Logic Chassis

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 2A-7).

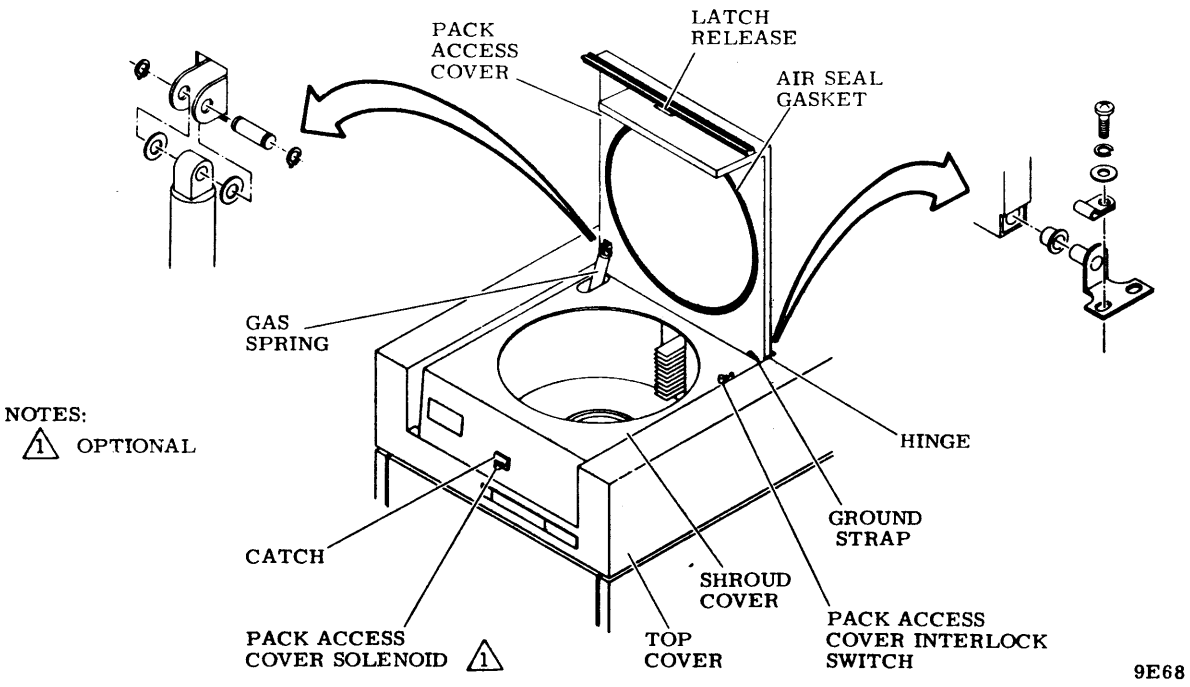


Figure 2A-7. Pack Access Cover

3. Connect ground lead to pack access cover.

NOTE

Adjustment of the solenoid is necessary if it is installed and if 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. Check this 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 necessary 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 moved out to a position convenient for maintenance. Put the supply in the maintenance position as follows:

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

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

When the power supply is in the maintenance position, removing the top cover provides access to the inside of the supply. To remove the top cover, first remove the four screws at the rear of the cover (refer to figure 2A-8) then loosen the four screws at the front of the cover and slip 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. To remove the panels pull up on the release latches, swing the panels outward far enough to disconnect the ground straps, and then remove the panels from the drive (refer to figure 2A-9). To replace the panels reverse the removal procedure. If the drive is installed in line with other drives, move it out of line to remove or replace the side panels.

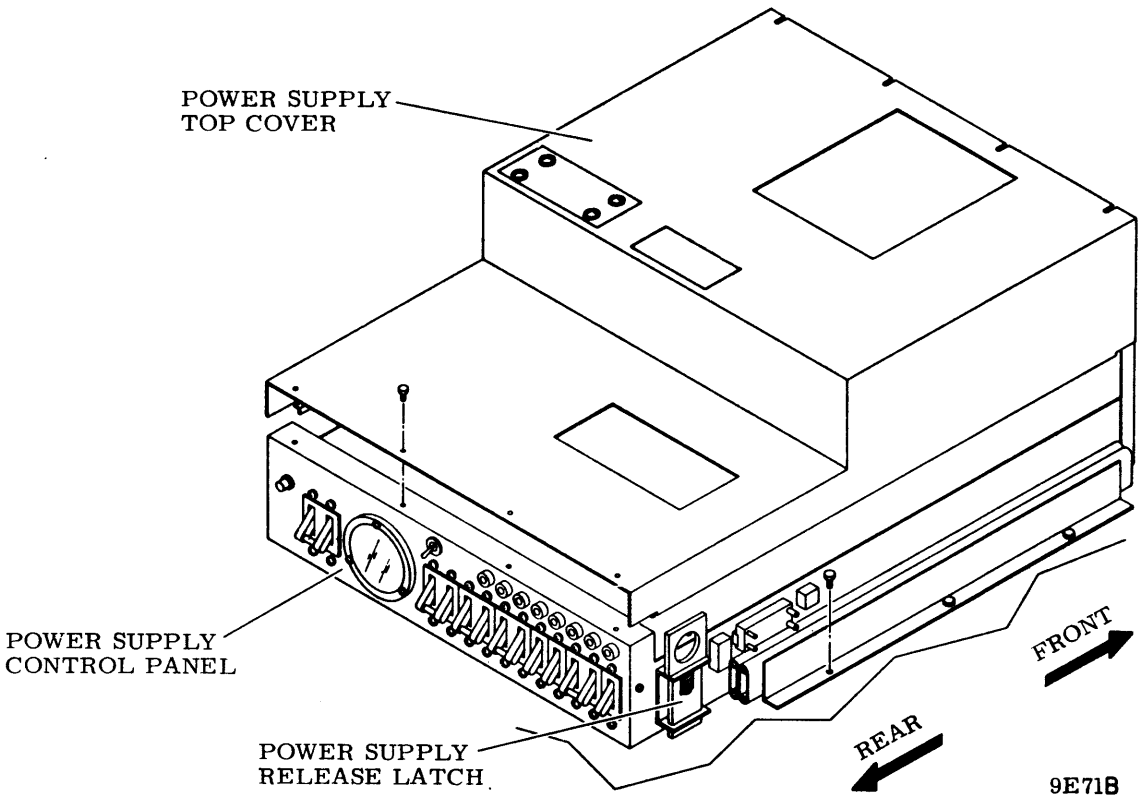


Figure 2A-8. Power Supply

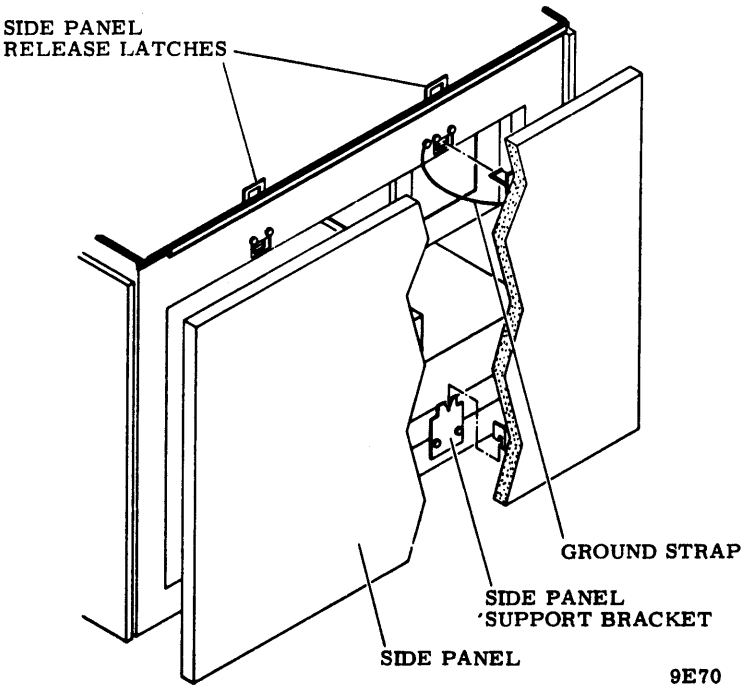


Figure 2A-9. Side Panel

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; their removal and replacement is described in the following steps (refer to figure 2A-10).

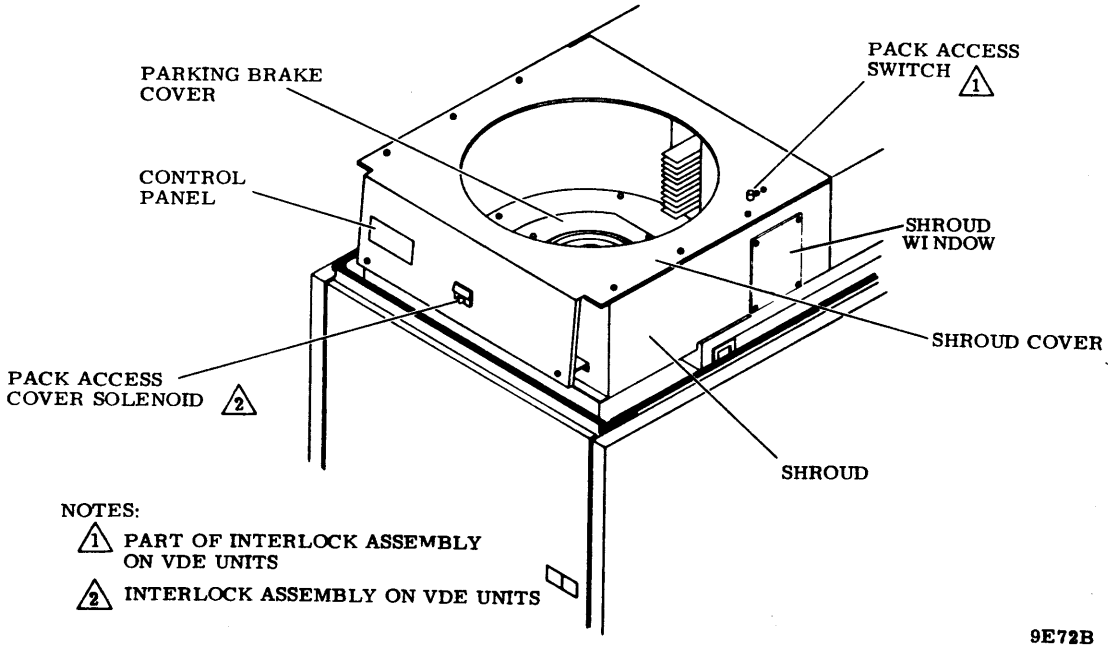


Figure 2A-10. Shroud and Shroud Cover

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.

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 parking 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.

CAUTION

Ensure that the baffle seals are not damaged and that no interference exists between the baffle seals and the head arms.

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

The switches, indicators, and test points referenced throughout this manual are described in the following paragraphs.

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 edges of cards in the logic chassis. Figure 2A-11 shows these controls and indicators and table 2A-2 defines their functions.

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 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.

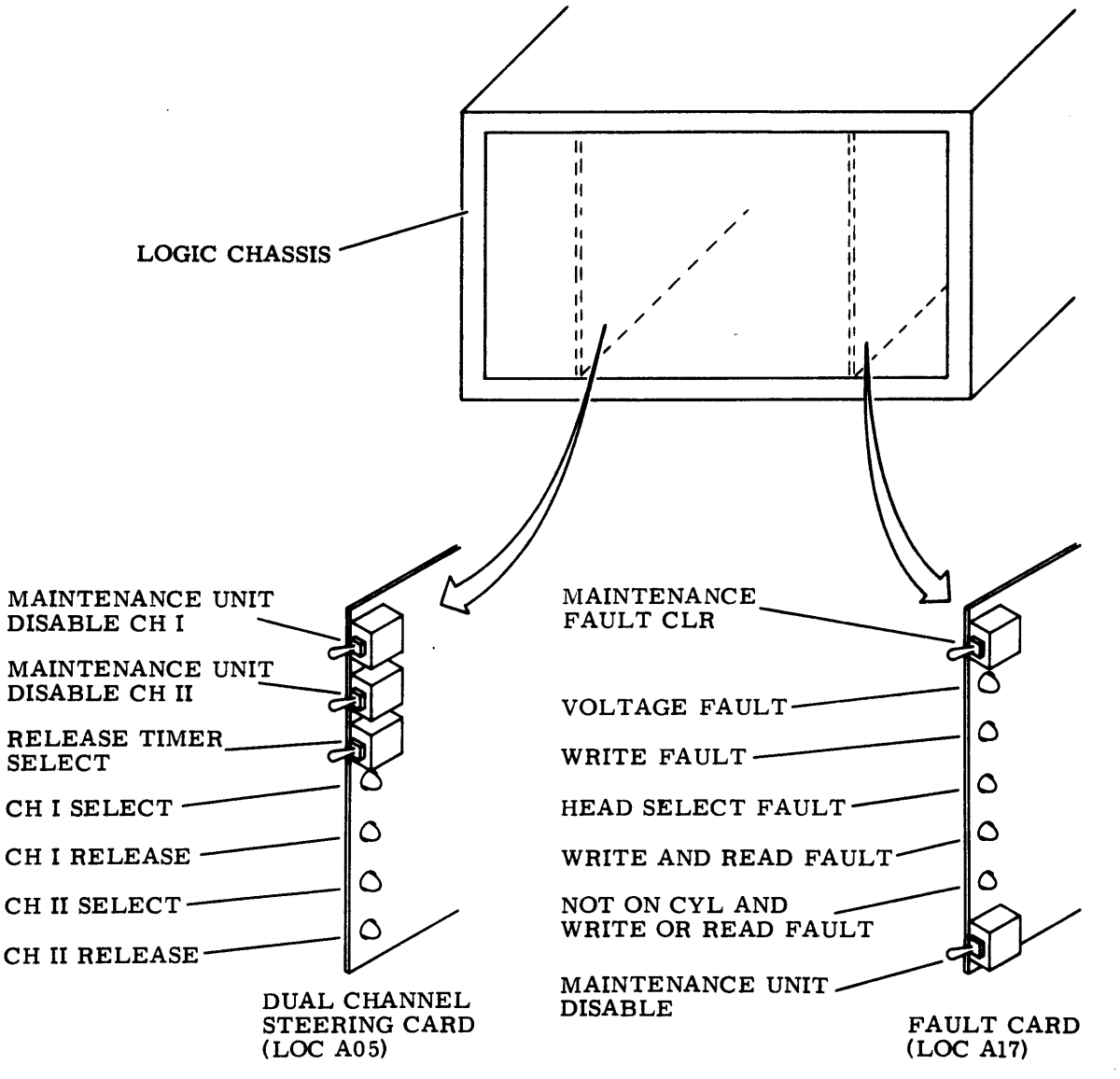


Figure 2A-11. Maintenance Controls and Indicators

TABLE 2A-2. MAINTENANCE CONTROLS AND INDICATORS

Control or Indicator	Function
Maintenance Fault Clear Switch	CLEAR position 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 is normal operating position for switch and position to which it returns when released (spring loaded).
Maintenance Unit Disable Switch	Although switch exists on both single and dual channel drives, it is used only on single channel drives; dual channel units use the CH I/II Maintenance Unit Disable switches for the same purpose. DISABLE position prevents Unit Selected from being sent to controller and disables transmitters.
Voltage Fault Indicator	Lights to indicate a below normal voltage existed.
Write Fault Indicator	Lights to indicate a write fault existed.
Multiple Head Select Fault Indicator	Lights to indicate a multiple head select occurred.
Write and Read Fault Indicator	Lights to indicate that both write and read were commanded simultaneously.

Table Continued on Next Page

TABLE 2A-2. MAINTENANCE CONTROLS AND INDICATORS (Contd)

Control or Indicator	Function
Write or Read and Off Cyl Indicator	Lights to indicate that a write or read was selected during a seek operation (not on cylinder).
Channel I/II Maintenance Unit Disable Switch	Switches apply only to dual channel units. In D1 position switch S1 disables Unit Selected signal and transmitters to channel I controller. Same is true for switch S2 when set to DII position. NORM is normal operating position for switches. When performing maintenance on drive both switches should be set to their disable position.
Release Timer Select Switch	Switch applies only to dual channel drives. Used to select between an absolute reserve and a reserve timer condition to control selection of drive by controller. In ABR (absolute reserve) position, channel selecting drive has uninterruptable control over drive until it issues a release command. During this time, opposite channel is unable to select drive. In RTM (Reserve Timer) position, channel selecting drive has nominally 500 ms (following selection) in which to use drive. Drive becomes available to opposite channel approximately 500 ms after the Select command.

Table Continued on Next Page

TABLE 2A-2. MAINTENANCE CONTROLS AND INDICATORS (Contd)

Control or Indicator	Function
Channel I Selected Indicator	Lights to indicate channel I has selected drive.
Channel I Reserved Indictor	Lights to indicate channel I has drive reserved.
Channel II Selected Indicator	Lights to indicate channel II has selected drive.
Channel II Reserved Indicator	Lights to indicate channel II has drive reserved.

Card Test Points

The card test points (refer to figure 2A-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 are 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 2A-12):

- The test point in the lower left hand corner is always ground and labelled Z.

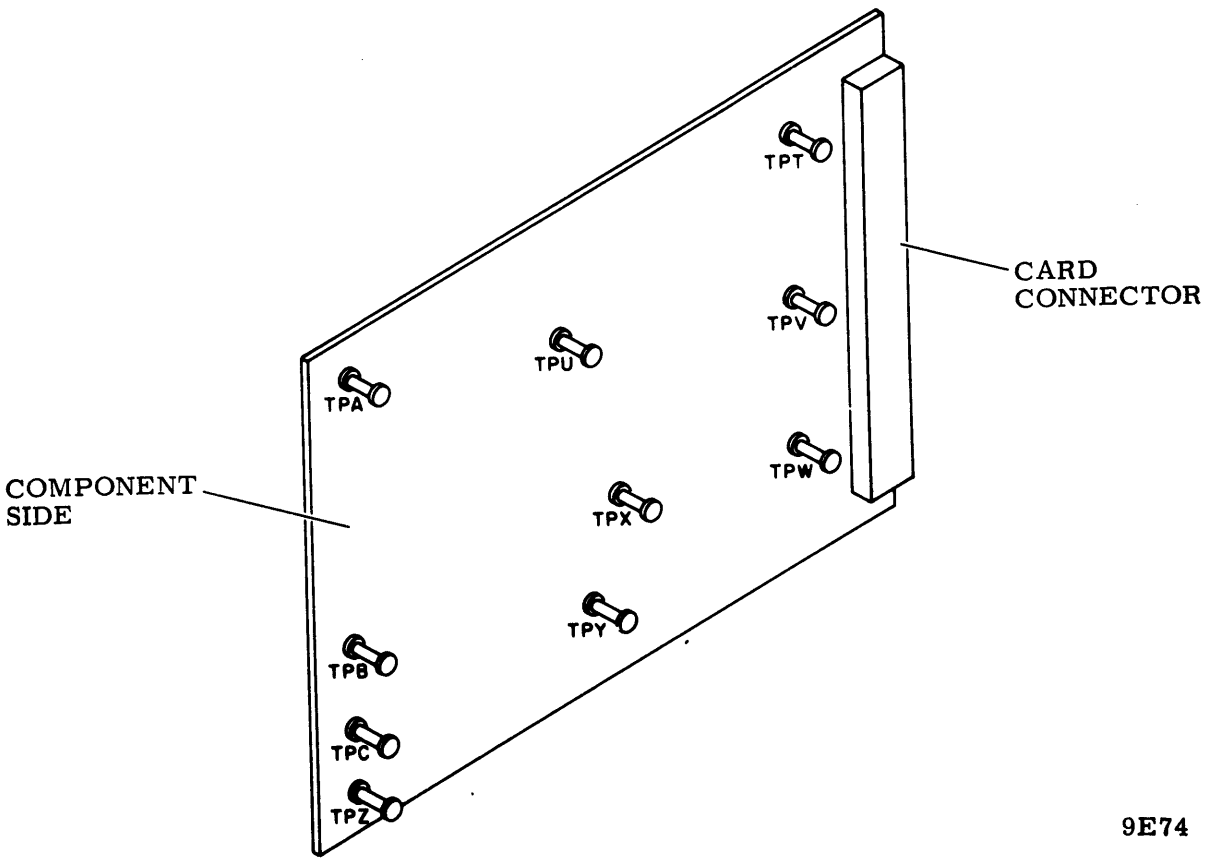


Figure 2A-12. Card Test Points

- 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 to 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 2A-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. Note that only the test points located on the outer edge of the cards are accessible 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 2A-13) contains test points to measure certain voltage outputs from the power supply. These test points consist of jacks which are suitable for making measurements with a meter.

SPECIAL MAINTENANCE PROCEDURES AND PRACTICES

GENERAL

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

MANUALLY POSITIONING CARRIAGE

Certain tests require manual operation of the positioner. Perform this procedure only if the drive will not respond or the desired results cannot be obtained with the servo under logic control. Note 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 in progress. 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.

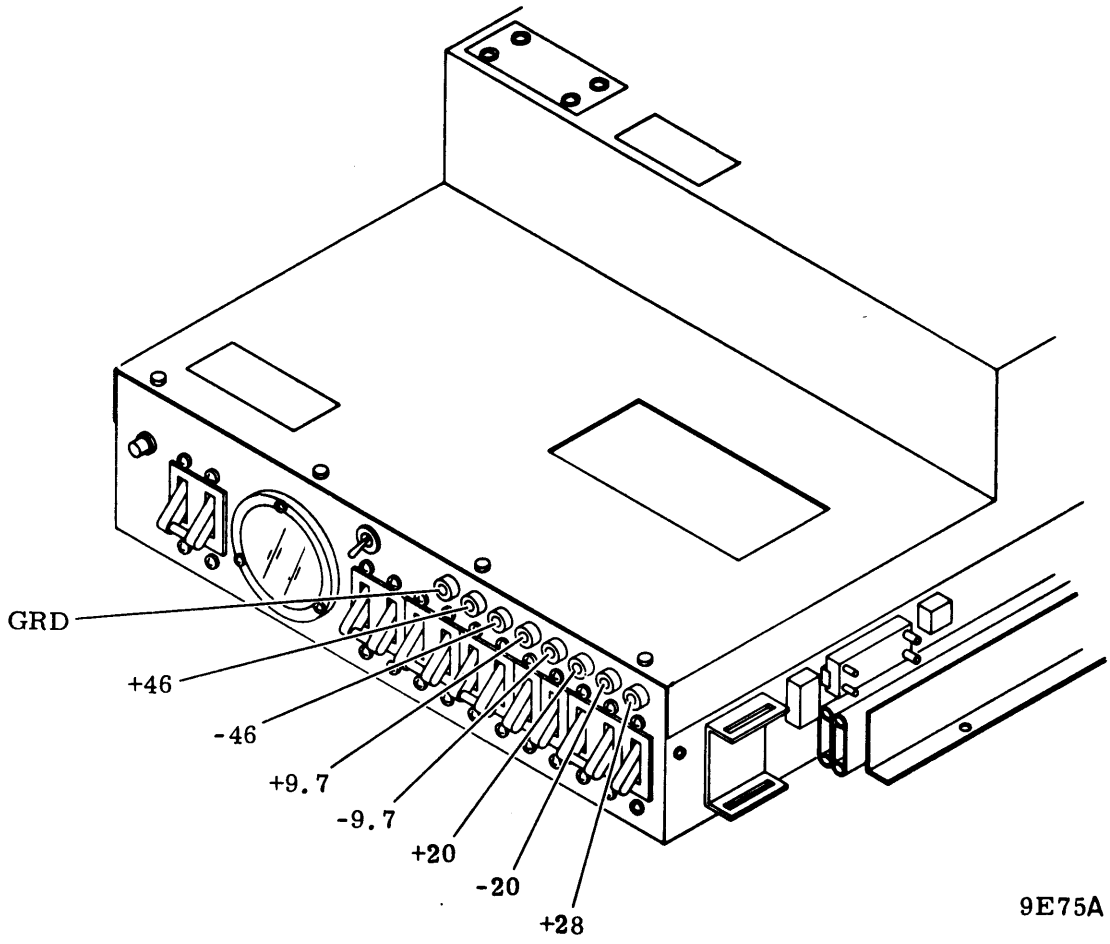


Figure 2A-13. Power Supply Control Panel Test Points

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 30 seconds for drive motor to come up to speed and 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 contains metal oxide semiconductor (MOS) integrated circuit components. These components are extremely sensitive and may be damaged by static electricity. For this reason, replace a defective _YFN card rather than attempting to repair it. Observe the following special precautions 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 installating the card, and continue to touch the chassis while removing or installing the card.

- Handle the card only by a non-circuit portion. Do not touch connector pins and circuit connection points.

- Place the card in a conductive container immediately following its removal from the unit. Be sure the card (and container) is in contact with logic chassis ground before and during the time that the card is inserted into 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.

HEAD CRASH PREVENTION

There are five primary variables that cause the great majority of head crashes. These are 1) the disk drive, 2) the disk pack, 3) the environment, 4) the maintenance and 5) the operator of the disk drive. A list of precautions that can be taken to prevent head crashes will be given for each variable.

DISK DRIVE

a. Check the action of the pack access cover latch as it is closed. Latching should occur only after the cover seal has been compressed slightly. The pumping action of the spinning disk pack can cause dirt and dust particles to be drawn into the shroud if the cover is not sealed at all points.

b. Check for adequate positive pressure air flow of 0.15 inches of water using the pressure gauge kit (CDC 73040100). This should be tested according to procedures in section 2B on absolute air filter replacement.

c. Make certain the wood shipping block is removed and the coarse filter is installed in its place. Make certain the coarse filter is not plugged.

d. Using a strip of paper (dollar bill size), check the pack access cover shroud seal by opening the pack access cover and laying the slip of paper on the shroud, then closing the cover (latched). Resistance should be felt while trying to withdraw the paper. Check at multiple places on each side of the shroud.

e. Make certain the shroud area is clean. If contaminants are present, look for the source and eliminate it.

f. If the unit goes into uncontrolled servo motion, check the heads and the disk pack for divots where oxide has been removed.

g. Examine the unit's air system to make certain air leaks do not exist. All hose clamps and fittings should be secure. The filter and plenum should be aligned with the gaskets to prevent leaks.

h. Hold the absolute filter up to a bright light to make certain it has no visible leaks. Minute leaks will allow contamination to enter the pack area. If any leaks are noted or suspected, replace the filter with a known good one.

Disk Pack

a. Do not use damaged disk packs. Inspect disk packs that arrive in damaged cartons to ensure that they are not bent.

b. Keep hands, pencils, or other objects off the disk pack surfaces. The disk pack surfaces can be contaminated, distorted, distorted, or damaged through impact or excessive pressure or abrasion.

c. Never lift or hold a disk pack by any of the recording disks. This causes permanent damage.

d. Clean the outside surfaces of the protective covers periodically to remove any build-up of dust that may occur (interiors should also be cleaned if contaminated). Use a lint free gauze pad dampened with head cleaning solution. If possible, use a vacuum cleaner to remove dust that accumulates on the cover lip.

e. If the disk drives are not in use and the blower is shut off, take the disk packs out of the drives and store them in their protective canisters.

f. Do not allow the pack to rest on or strike any other object when the bottom protective cover is removed for installation in the drive.

g. Re-assemble the disk pack bottom and top protective covers after the pack is mounted in the drive. This should be done even when no disk pack is contained in the cover to prevent dust and dirt from accumulating inside the covers.

h. Replace cracked, distorted or otherwise physically damaged pack covers.

i. Do not place disk pack identifying labels anywhere except outside the top protective cover assembly. The pack serial number may be used to maintain correct pack to canister identification.

j. The temperature of the disk pack must be stabilized to the temperature of the room in which the drive is operating.

k. Control Data does not recommend periodic field cleaning of disk packs. If field cleaning is employed, it is done at the risk of the user. Packs that are suspected for any reason should be returned to the vendor for inspection.

ENVIRONMENT

Install the drive in a room which is kept carefully dusted with particular attention given to maintaining a smooth floor mopped and a carpeted floor vacuumed. Carpeted floors can be particularly troublesome because of the dirt and dust they trap and the amount of lint they generate. Traffic in the room housing the disk drive should be kept to a minimum.

Maintain as much separation as possible between the disk drive and printers, tape, and card punch equipment. These machines can generate a lot of paper, carbon, and ink particulate matter. Do not store packs near this type of equipment.

Eliminate eating, drinking, or smoking in the disk drive area if at all possible. Particles of food and drink can be sucked into the shroud area when the pack access cover is opened and closed. Smoke particles have a sticky characteristic. The absolute filter on the disk drive can clog more rapidly in such an environment.

If at all possible, maintain the relative humidity in the disk drive operating room at 40 to 50%. Low relative humidity levels can lead to particle attraction and accumulation by static electricity.

Disk packs and disk drives must be stabilized to the same temperature.

Avoid building construction in the area of the drive or area used for pack storage. If construction is absolutely necessary make certain that protective steps are taken to avoid contamination in the area of the packs and drives.

One of the sources of head/disk contamination is the ambient air in the room in which the drive operates. Although the drive is designed to operated successfully over a wide range of ambient air conditions, it follows that the cleaner the room air can be maintained, the better and longer the drive air filtering and handling system can do its job of keeping potentially destructive particles out of the head/disk gap.

MAINTENANCE

a. Clean the primary air filter quarterly or at 1500 running hours whichever comes first. Make certain the primary air filter is not clogged.

b. Periodically wipe out the shroud cavity surfaces with a lint free gauze pad soaked in head cleaning solution. The recommended solution is a reagent grade hydrogenated hydrocarbon/alcohol mixture. Be sure, however, to keep the head cleaning solution from contacting the access cover seal. This can harden the seal material and reduce its effectiveness. (Head cleaning solution P/N 82365800).

c. Check the air pressure of the drive by using the pressure gauge kit (CDC 73040100). This should be tested according to the preventive maintenance procedure in section 2B of this manual. The filter should be replaced if the air pressure drops below 0.15 inches of water, or biennially, or at 9000 hours whichever occurs first.

d. Examine the unit's air system making certain to check all connections, hoses, and filters for possible leaks.

e. Do not under any circumstances clean the heads while they are in the unit. If head cleaning is required, remove the heads from the unit and clean according to the procedures in section 2B of this manual. This should be performed by trained personnel.

f. Control Data does not recommend periodic field cleaning of disk packs. If field cleaning is employed, it is done at the risk of the user. Packs that are suspect for any reason should be returned to the vendor for disposition.

g. Do not over lubricate the spindle lockshaft.

h. Do not use any type of oil or lubricant on the drive except for the very small amount used on the lockshaft.

Operator

a. Keep the disk drive pack access cover closed and latched if at all possible, and keep the shroud blower energized at all times. This will help greatly in keeping contaminants out of the shroud cavity and away from the heads. Remove the pack and store it in its protective canister if the blower motor is not energized.

b. Do not store packs on top of drives - vibration will shake them off.

c. Never lift or hold a disk pack by any of the recording disks, as permanent damage and/or contamination will result.

d. Keep disk packs out of the drives and locked in their protective covers when not in use.

e. Do not allow the pack to rest on or strike any other object when its bottom protective cover is removed for installation in the drive.

f. Re-assemble the disk pack bottom and top protective covers. This should be done even when no disk pack is contained in the cover, to prevent dust and dirt from accumulating inside the covers.

g. Do not place disk pack identifying labels anywhere except outside the top protective cover assembly. The pack serial number may be used to maintain correct pack to canister identification.

h. Do not eat, smoke, or allow beverages near the drive or pack.

SECTION 2B

PREVENTIVE MAINTENANCE

GENERAL

This section describes the preventive maintenance procedures required to keep the drive operating properly. This maintenance is performed regularly on a schedule determined by the preventive maintenance index (see table 2B-1).

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

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

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

TABLE 2B-1. PREVENTIVE MAINTENANCE INDEX

Level*	Est. Time (Minutes)	Procedure
**	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 often depending on level of dust contamination in operating area.

** The head dusting procedure is optional. The procedure is normally required only on sites that have a high level of environmental contamination. The interval depends on site conditions.

TABLE 2B-2. PREVENTIVE MAINTENANCE LEVELS

Level	Time Schedule
Level 1	Weekly or 150 hours (no preventive maintenance scheduled).
Level 2	Bi-Monthly 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	Biannually or 9,000 hours.

LEVEL 2 MAINTENANCE PROCEDURES

HEAD DUSTING

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

- Super Dry Dust Remover
- Hose Assembly
- High Intensity Light
- Lint-free Tube Gauze
- Two Inch Minimum Square Front Surface Mirror
- Head Cleaning Solution
- Lint-free Cloth

NOTE

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

Proceed as follows:

1. Turn off drive motor.

2. Before removing the disk pack, use a lint-free cloth moistened with head 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 circuit breaker to off.

5. Place index finger on top surface of the top head arm assembly, as shown in figure 2B-1. 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.

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 2B-2.)

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 2B-3.)

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.

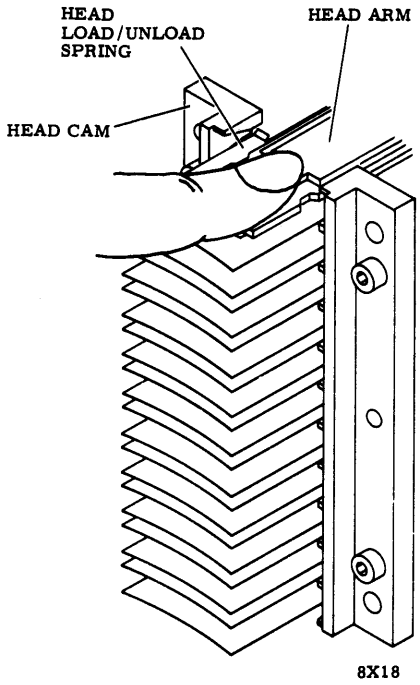


Figure 2B-1. Positioning Head Arm Assemblies

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 2B-4.)

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

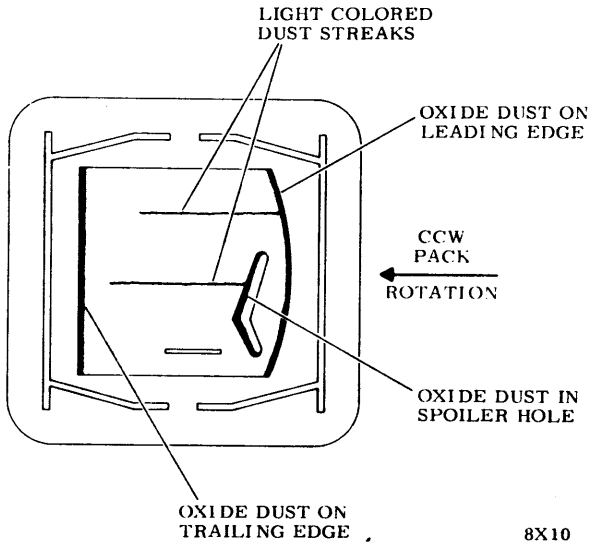


Figure 2B-2. Typical Formation of Oxide Particles on Head Pad

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 steps 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, remove the heads from the drive and clean them as described in the head cleaning procedure in this manual.

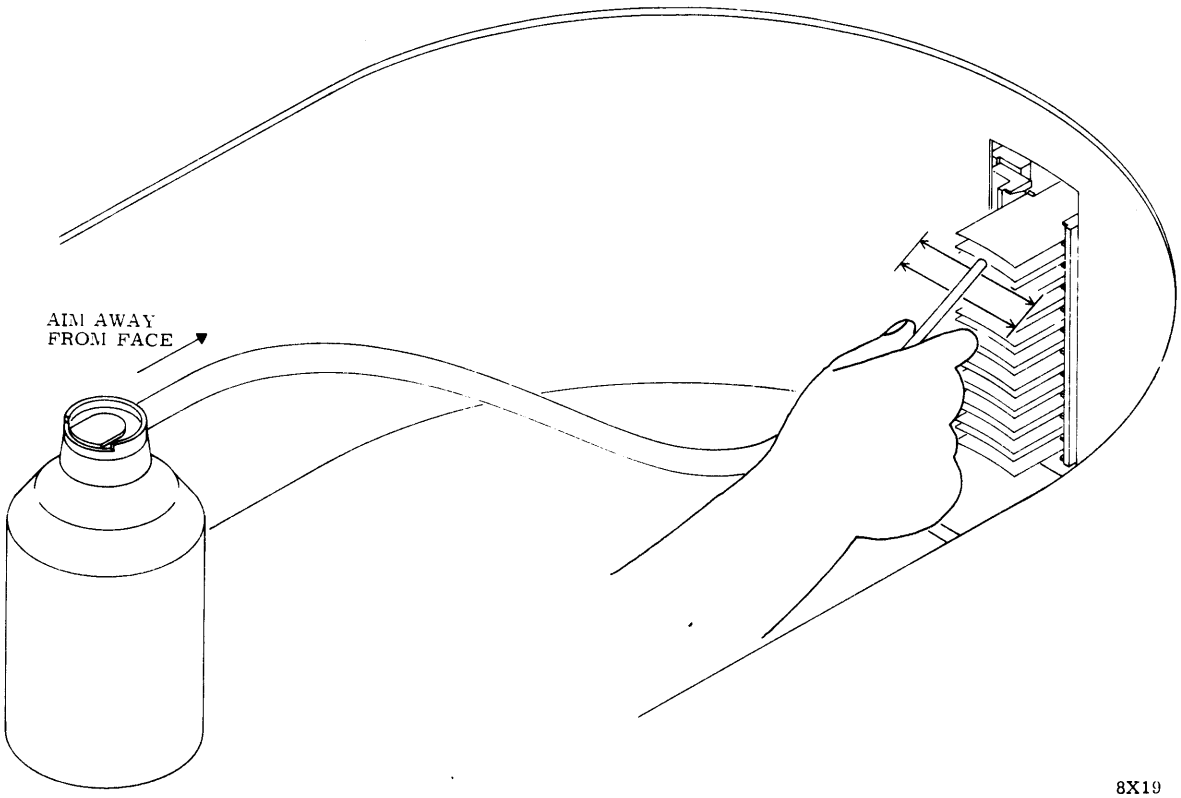


Figure 2B-3. Using Super Dry Dust Remover

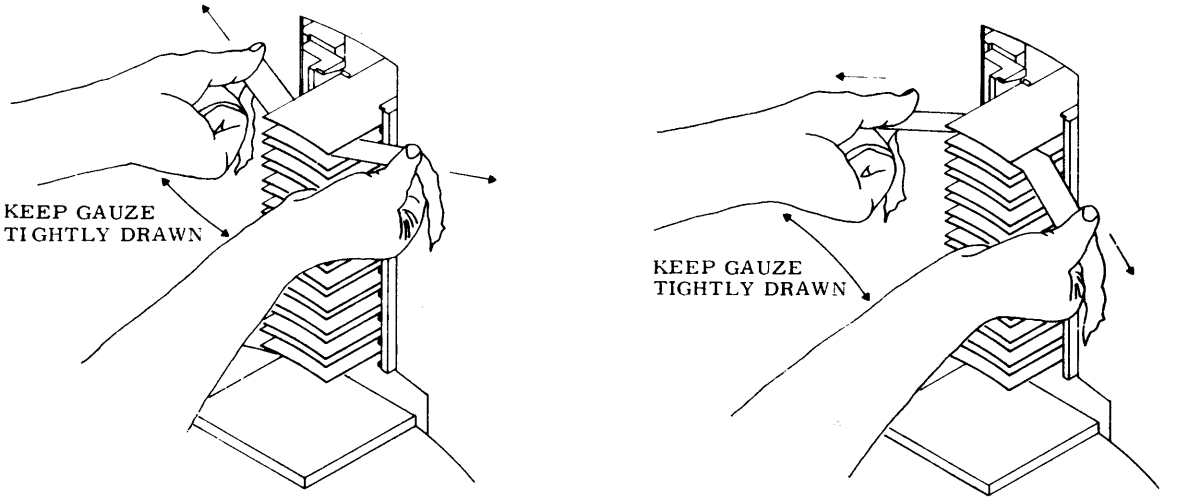


Figure 2B-4. Wiping Head Pads

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

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 2B-5. Push the head arm assemblies back to the retracted position. Avoid touching the head load/unload springs.

11. Set Main AC circuit breaker to on.

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

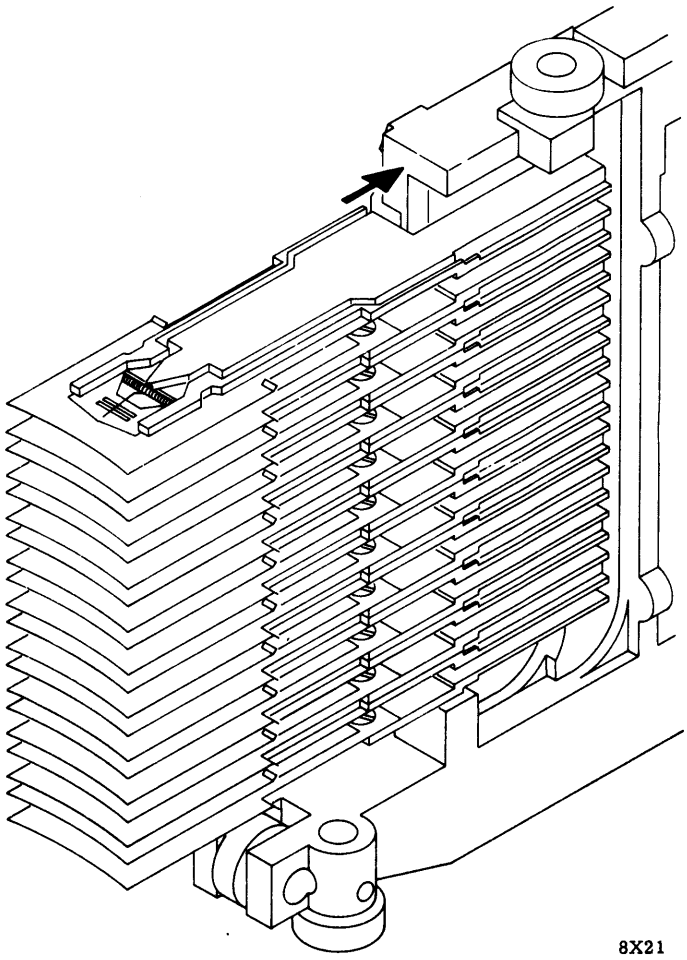


Figure 2B-5. Returning Head Arm Assemblies to Retracted Position

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 drive and observe that drive functions properly.

15. Return drive to computer operator.

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 2B-6).

1. Remove power from the drive as follows:

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

   b. Set MAIN AC circuit breaker to off.

2. Remove disk pack.

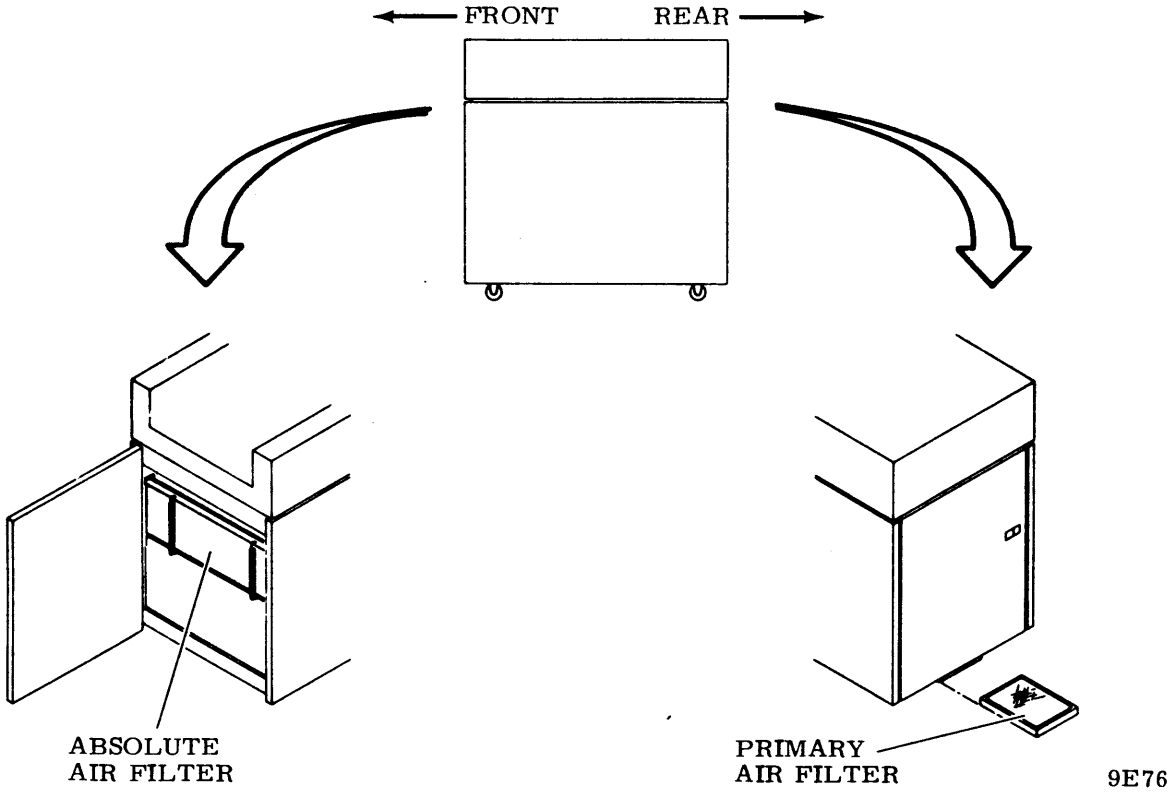


Figure 2B-6. Air Filters

3. Remove air filter by pulling it out of its bracket (refer to figure 2B-6).

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. 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

Check these outputs by performing the +5 Volt and -5 Volt Test and Adjustment procedure (see section 2C).

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 the pack rests.

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

CAUTION

Do not allow head 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 head cleaning solution.

4. Inspect shroud and spindle for any particles that were not picked up with 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 2B-7).

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 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.

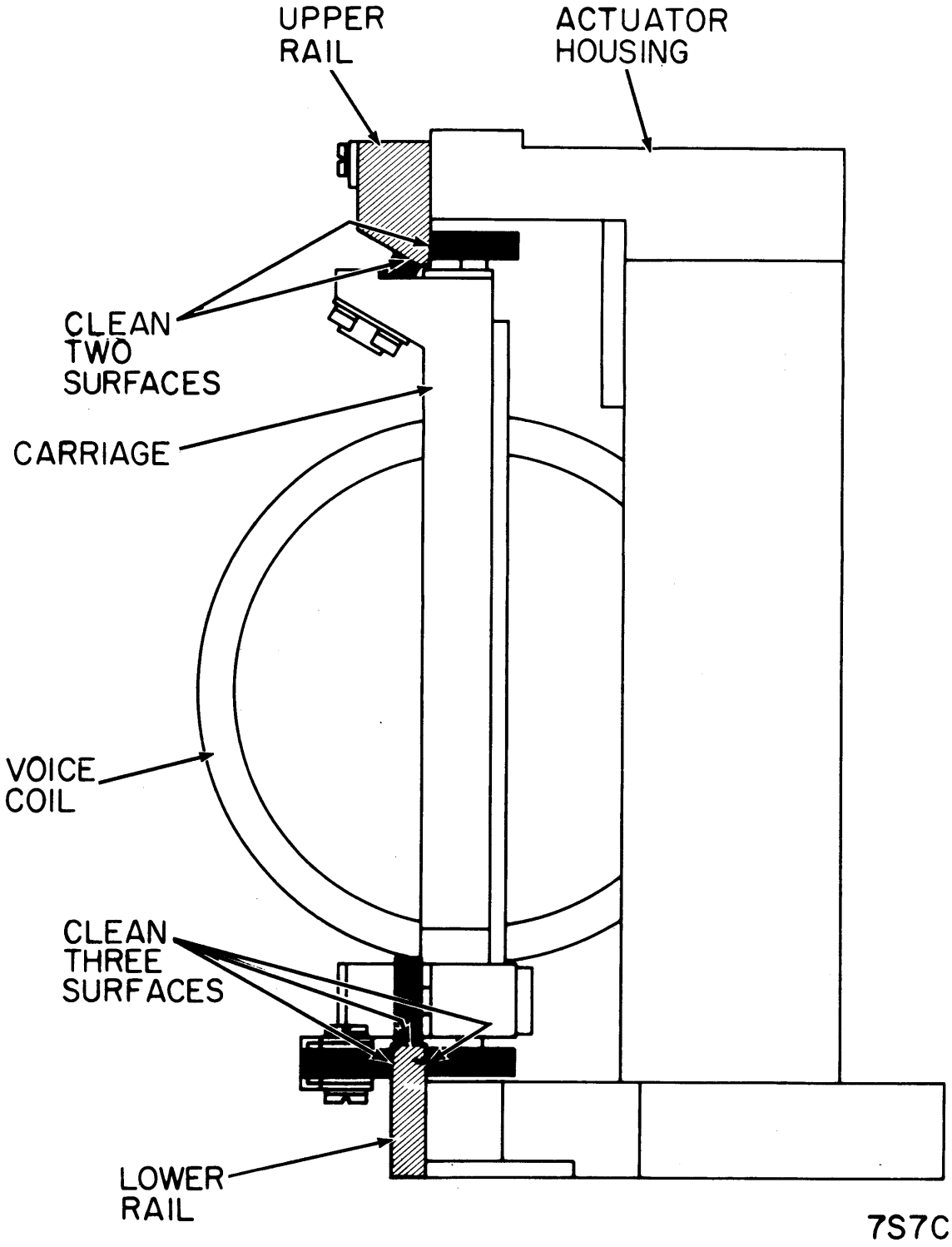


Figure 2B-7. Clean Carriage Rails and Bearings

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 and bearings. Do not confuse pressure of flex leads and head leads with a sudden irregularity in motion. Pressure from leads is a smooth change.

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.

CAUTION

Do not allow media solution to run into the bearings since it may remove some of the bearing lubricant.

8. Using a cotton swab dampened (not soaked) in head 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. 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 the 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. 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

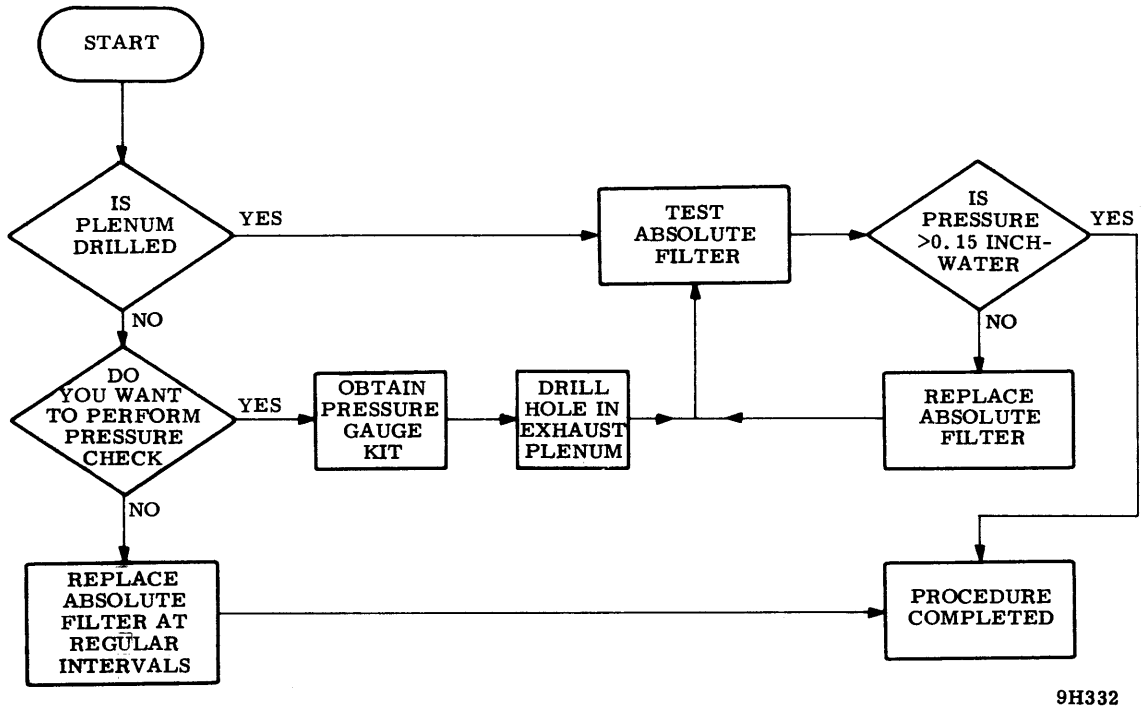
An adequate supply of clean air to the pack area is essential for proper operation of the drive. The absolute filter traps particles too small to be stopped by the primary filter. Eventually the filter becomes too clogged to yield a sufficient airflow, and it must be replaced. Its useful life depends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

You have two options, the first of which is to replace the absolute filter at fixed intervals dependent on site environment. The second option is to obtain a pressure gauge (see table 2B-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 noncomputer room environment, replace the absolute filter every year or whenever there is doubt about the ability of the filter to pass air into the shroud area.

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

Figure 2B-8 is a flow chart showing the procedure included in this section and the available options. Use the flow chart to determine which of the following procedures are applicable.



Filter Replacement

CAUTION

Do not touch filter cells when handling replacement filter. They puncture and crush easily.

1. Examine replacement filter to determine if filter is usable. Do not use filter if cells are punctured, crushed, or otherwise damaged.

2. 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.

3. Remove disk pack.

4. Open cabinet front door.

5. 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. Disconnect blower motor connector P9 from its connector on blower enclosure.

CAUTION

Do not stress plastic hoses when sliding blower assembly out of frame. Overstretching will tear hoses.

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

6. Detach four springs securing exhaust plenum and absolute filter.

7. Lift plenum and remove filter from blower assembly.

8. Use a clean cloth to wipe inside of exhaust outlet, exhaust plenum, and portion of blower mount that touches filter.

9. Set replacement filter, with arrows pointing up, on blower mount. Ensure the filter rests squarely on flanges of mount.

10. Set exhaust plenum on top of absolute filter.

11. Replace four springs securing exhaust plenum and absolute filter to blower mount.

CAUTION

Following reassembly of blower assembly, perform Shroud Cleaning procedure, then allow blower to purge system for at least two minutes before installing a disk pack.

12. Replace blower assembly in drive as follows:

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. Reconnect blower motor connector P9.

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

d. Slip large air hose over exhaust outlet on top of blower and secure with clamp.

13. Close cabinet front door.

Drilling Hole in Exhaust Plenum

1. Perform steps 1 through 6 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 2B-9.

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 11 through 13 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 0.037 kPa (0.15 inch water) or less, filter should be replaced. If pressure is greater, 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.

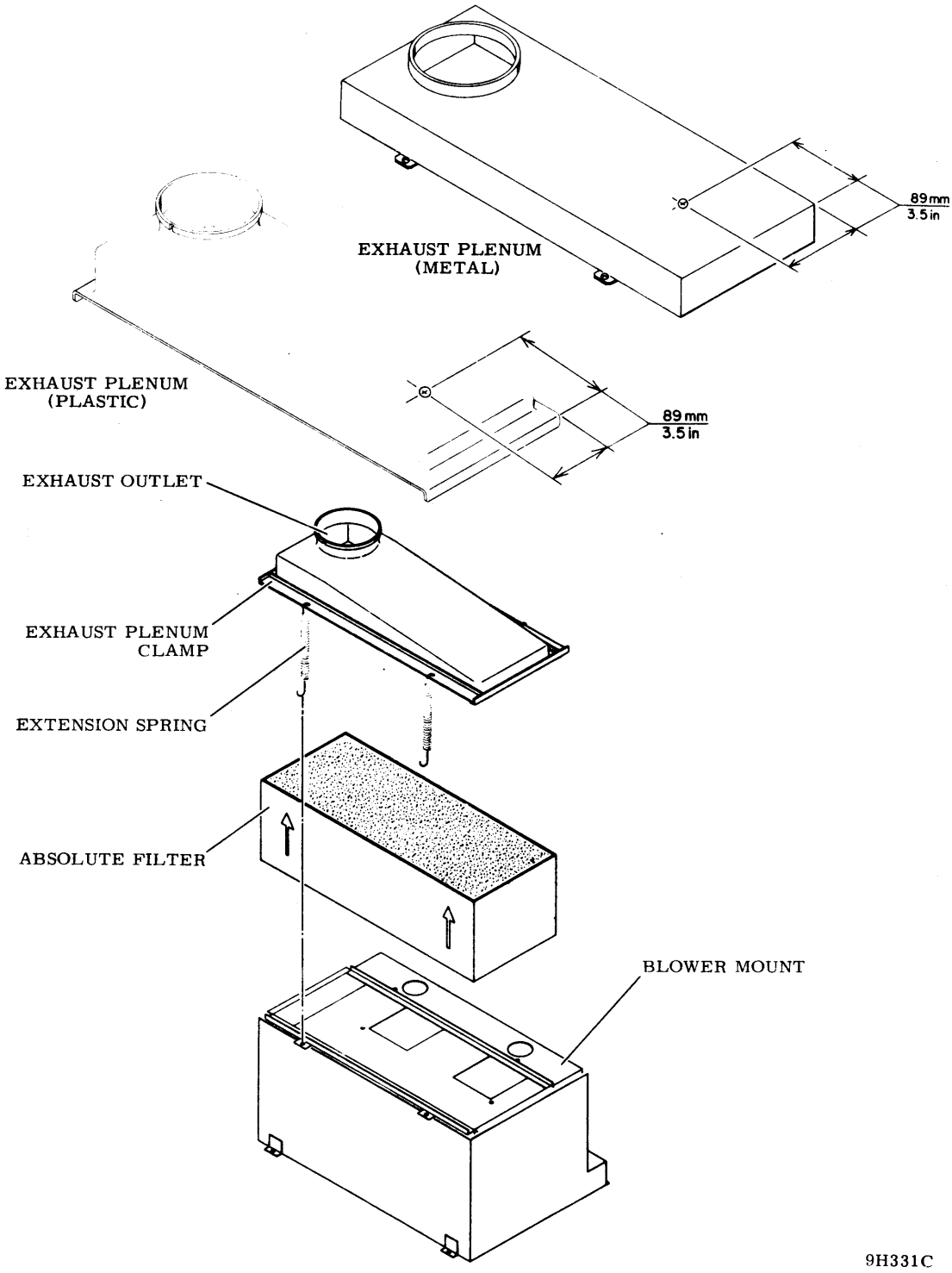


Figure 2B-9. Plenum Removal and Drilling

SECTION 2C

TEST AND ADJUSTMENTS

GENERAL

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

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 of figure 2C-1).

1. Prepare drive for use with test software or FTU.
2. Command continuous seeks between cylinders 000 and 257.
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 (±0.05) V. If it is not, 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.

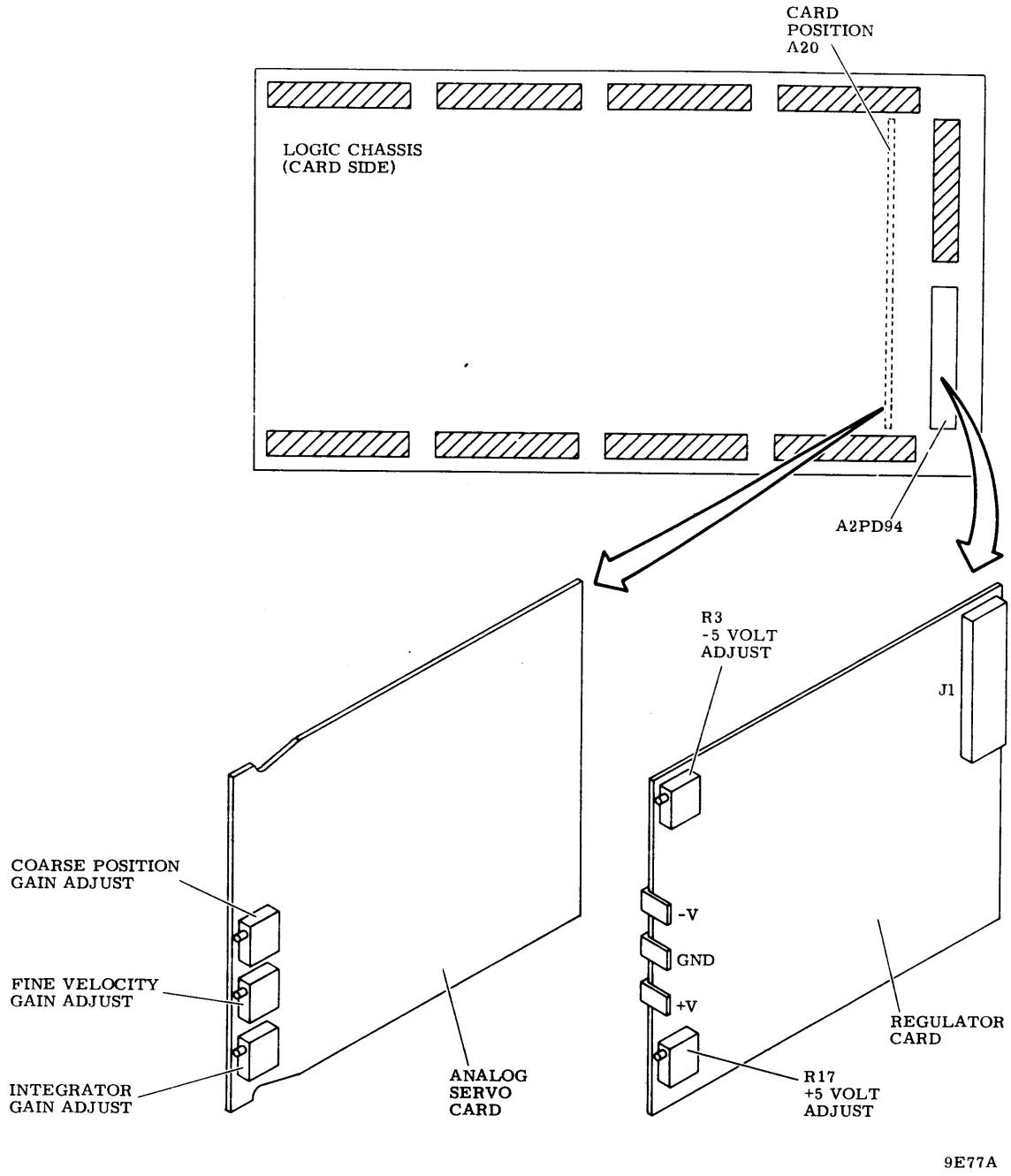


Figure 2C-1. Voltage Regulator and Servo Adjustments

c. Measured voltage should be -5.1 (±0.05) V. If it is not, adjust top pot on regulator board until voltage is within specific limits.

5. Prepare drive for return to online operation.

HEAD ALIGNMENT

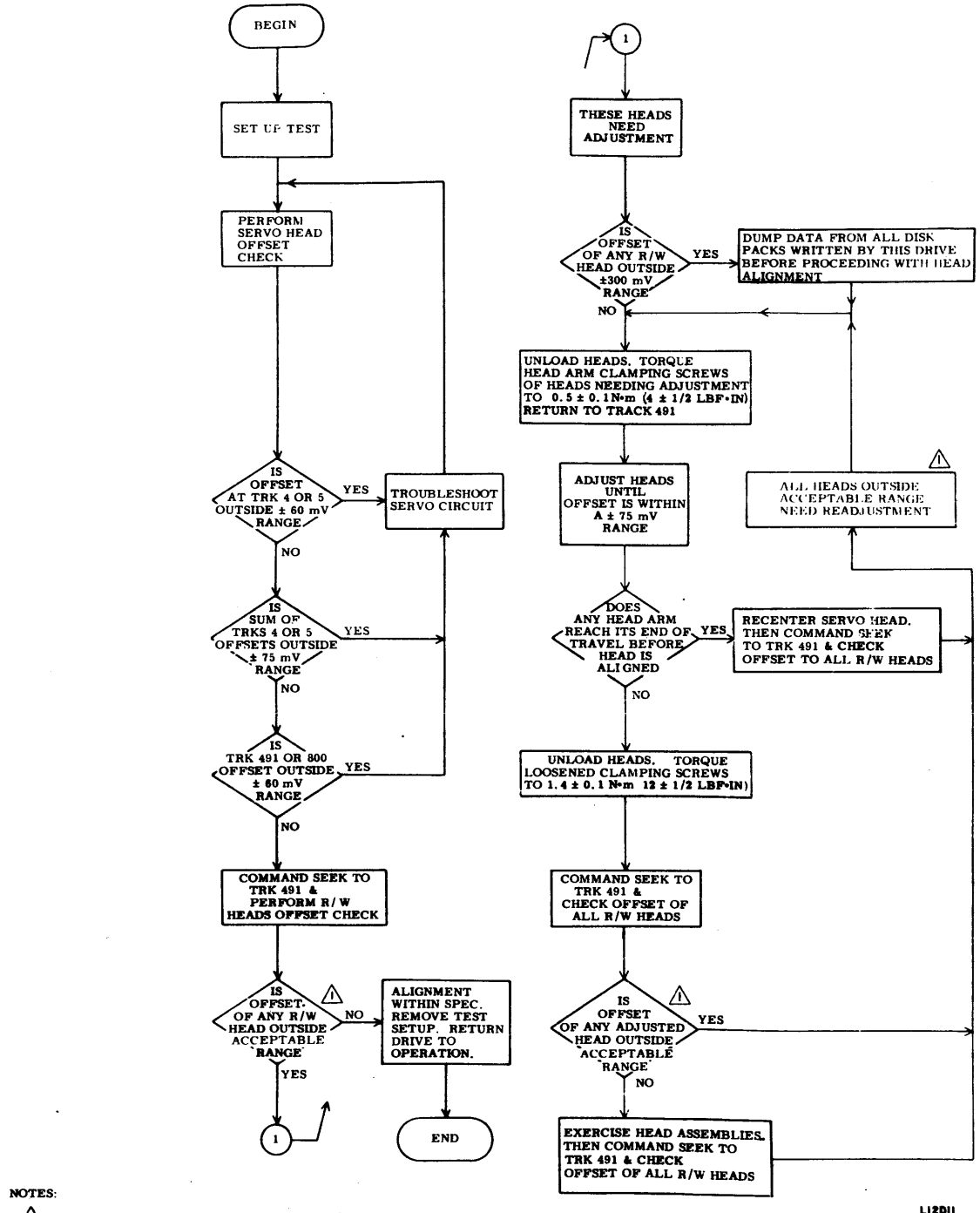
GENERAL

Check alignment of the heads under any of 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, adjust the head arm to bring the alignment of the head within specifications. Figure 2C-2 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.



NOTES:

⚠ ACCEPTABLE RANGE DEPENDS ON CE PACK:
- IF PACK IS SAME ONE USED FOR LAST ALIGNMENT, RANGE IS 0 ±150 mV
- IF PACK IS NOT SAME ONE USED FOR LAST ALIGNMENT, RANGE IS 0 ±325 mV

Figure 2C-2. Basic Head Alignment Check and Adjustment 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 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.

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.

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.
4. Observe dibit pattern on oscilloscope. It should be similar to that shown on figure 2C-3.

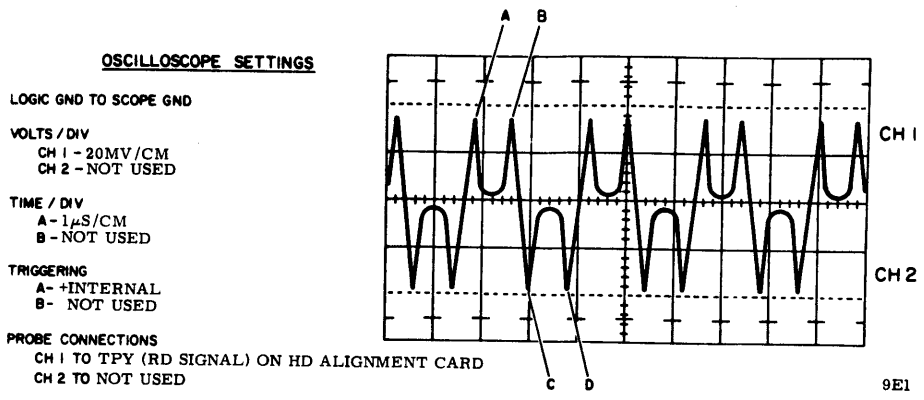


Figure 2C-3. Head Alignment Waveform

5. Toggle P/N switch to both P and N positions and record null meter 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, troubleshoot servo system before proceeding with head alignment.

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.

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 and repeat steps 4 through 8.

12. Command direct seek to cylinder 491.

13. Install carriage locking pin into alignment hole (refer to figure 2C-4) 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 2C-3.

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.

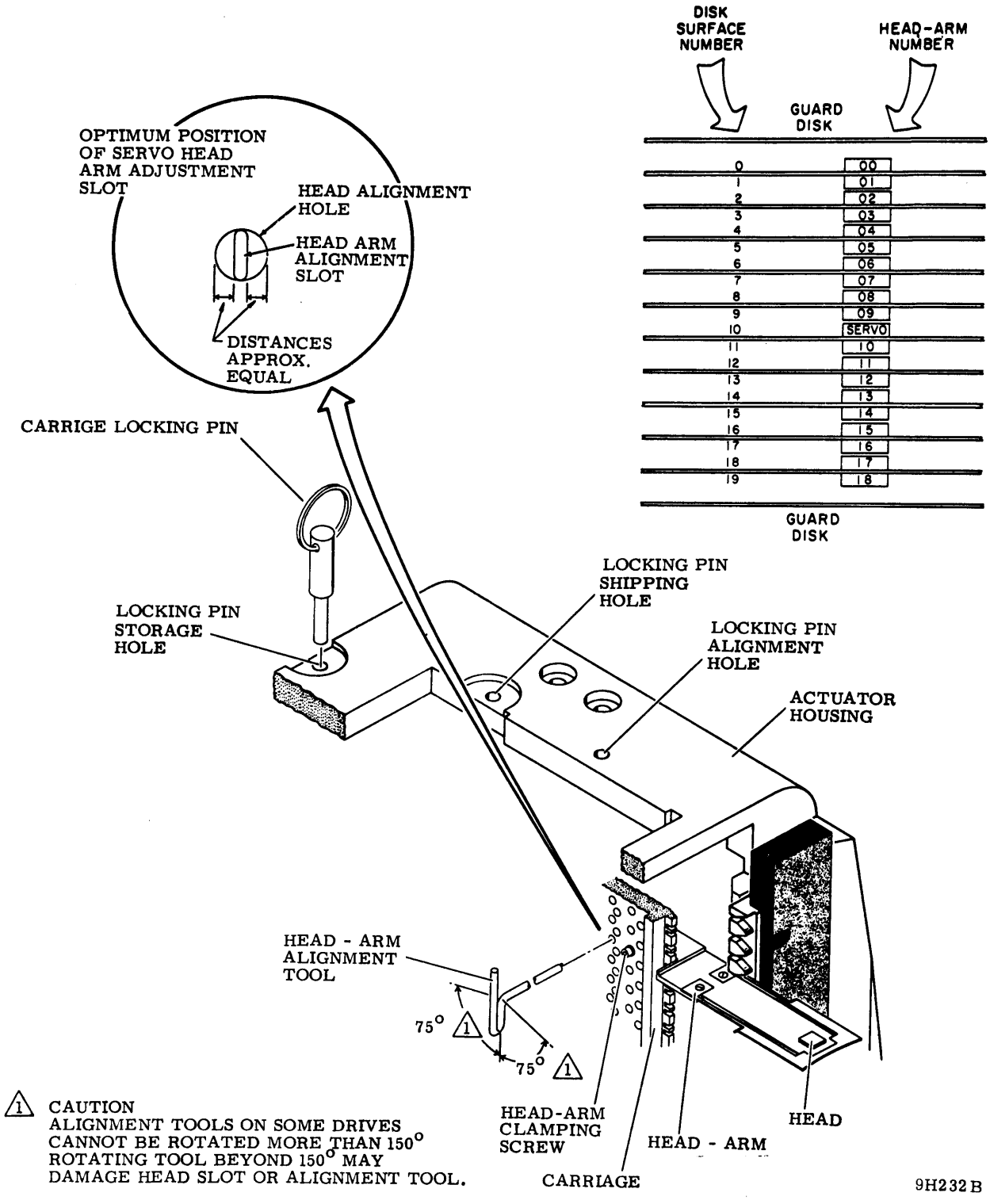


Figure 2C-4. Head Arm Alignment

CAUTION

If any offset exceeds a 0.±300 mV range, those heads are excessively misaligned. Therefore, to avoid possible loss of data, transfer data from packs written with those heads to other storage before proceeding with alignment.

4. Evaluate read/write head offset as follows:

   a. When using same CE pack as used for last alignment, offsets must range between ±150 mV and -150 mV. If all offsets are within this range, alignment is satisfactory so proceed to step 15.

   b. When using a different CE pack than the one used for last alignment, offsets must range between +225 mV and -225 mV. If all offsets are within this range, alignment is satisfactory so proceed to step 15.

   c. In any offsets are outside acceptable range, as defined in steps a or b (whichever applies), these heads are misaligned. Proceed to step 5.

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 0.5 +0.1 N·m (4 ±0.5 lbf·in).

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

8. Command direct seek to cylinder 491.

NOTE

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 2C-4).

   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 2C-3).

   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, note that any slight adjustment of the servo head requires realignment of all read/write heads. Torque servo head to 1.4 $\pm$0.1 N·m (12 $\pm$0.5 lbf·in).

   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 1.4 $\pm$0.1 N·m (12 +0.5 lbf·in). While tightening screws, use only straight arm allen wrench and keep it as perfectly aligned as possible with screws. Be careful during this operation to avoid pushing a head out of alignment.

13. Check each head adjusted to see if torqueing screws affected alignment. If any heads are outside acceptable range (as defined in step 4), 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 491.

    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

This 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 track). This adjustment enables seek time to achieve a speed 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 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 track); this adjustment optimizes servo system response by minimizing overshoot without overdamping the system.

Since these adjustments are interactive, it is important to follow the proper sequence as shown on figure 2C-5. The following procedures describe test and adjustment of the servo system.

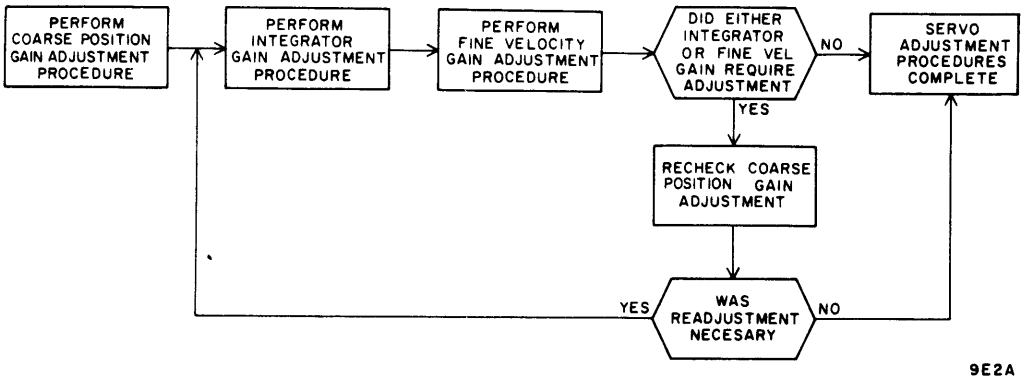


Figure 2C-5. Servo System Adjustments Flow Chart

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.

   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 from trailing edge of first on cylinder pulse to leading edge of second on cylinder pulse is not within 50 to 54 ms, 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.

   b. Setup oscilloscope as indicated on figure 2C-6 and adjust it until the two sloped curves shown on figure 2C-6 are displayed.

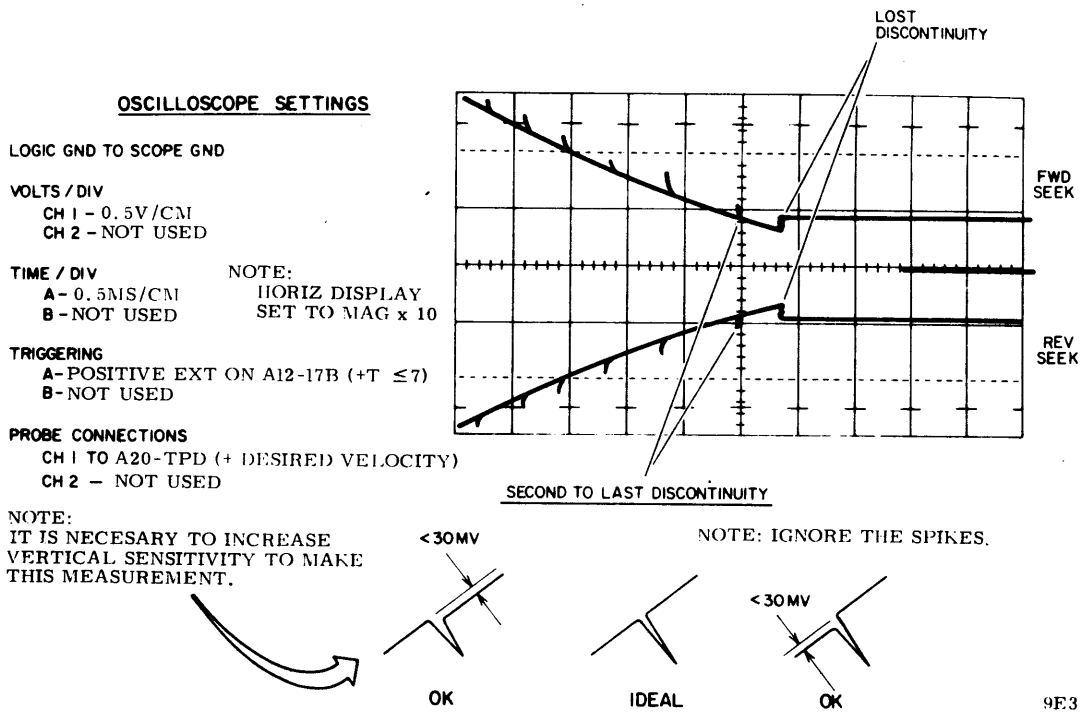


Figure 2C-6. Integrator Gain Waveform

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 2C-6) and that it has a difference of 0±.03 V or less (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.

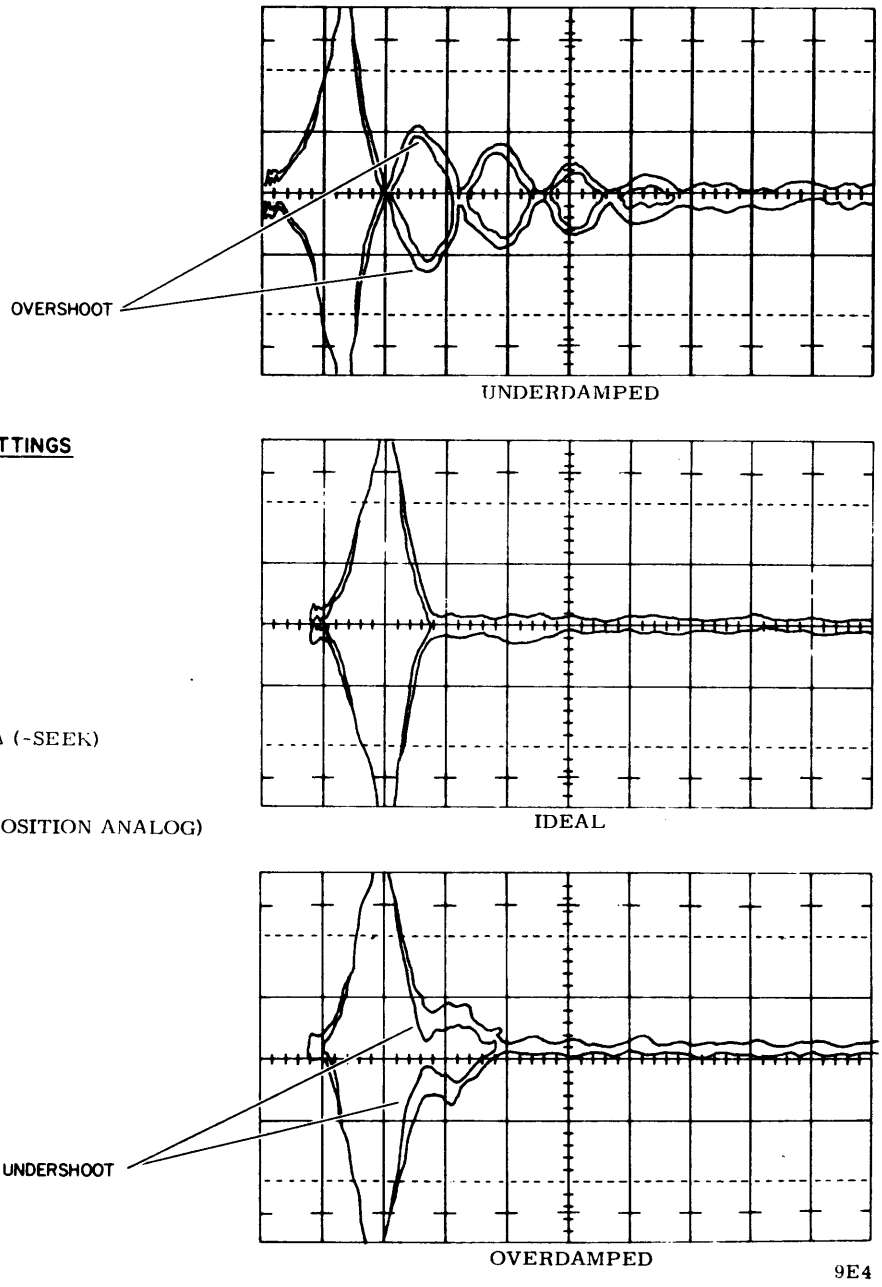
   b. Connect and setup oscilloscope as indicated in figure 2C-7.

c. Referring to figure 2C-7, 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 2C-7.

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

e. Note that displayed signal is as shown on figure 2C-8 at each cylinder. If overshoot exceeds 0.5 V 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 - 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

Figure 2C-7. Fine Velocity Initial Check Waveform

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

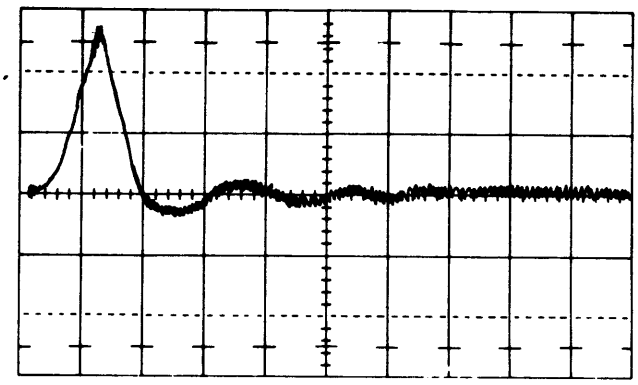


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Figure 2C-8. Fine Velocity Gain Final Check Waveform

SECTION 2D

TROUBLE ANALYSIS

GENERAL

This section is divided into two parts. The first part describes checking various portions of the drive circuitry that are critical to proper drive operation. The second part contains basic troubleshooting aids that are helpful in defining and solving problems within the drive.

The purpose of the procedures and troubleshooting aids 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.

MAINTENANCE PROCEDURES

The procedures are divided into the following major areas:

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

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.
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.

   +46 (-2, +5) V
   -46 (+2, -5) V
   +9.7 (±1) V
   -9.7 (±1) V
   +20 (±2) V
   -20 (±2) V
   +28 (±2) V

5. Disconnect voltmeter, then set up and connect oscilloscope 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
+46	4.5 V
-46	4.5 V
+20	1.0 V
-20	1.0 V
+28	1.0 V

SERVO SYSTEM CHECK

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

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

The manually 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 obtained through the use of the FTU or test software.

Logic Controlled Servo Checks

The following procedures describe various tests that can be performed 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 set up oscilloscope as shown on figure 2D-1.
3. Command continuous seeks between cylinders 000 and 128.
4. Check that the observed waveforms are as shown on figure 2D-1. 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 0.07 V in amplitude (refer to figure 2D-2).
5. Prepare drive for return to online operation.

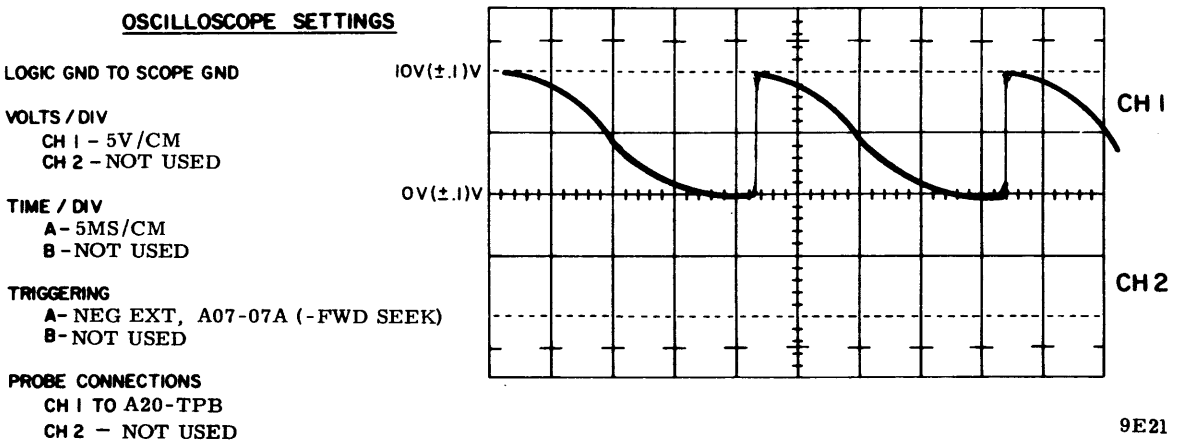


Figure 2D-1. D/A Converter Output Waveform

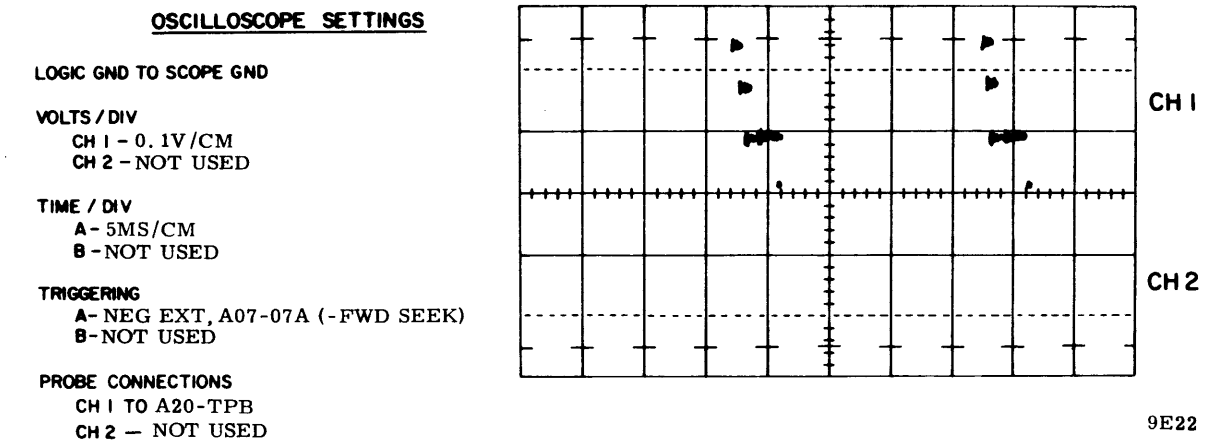


Figure 2D-2. D/A Converter Output Waveform Expanded

Cylinder Pulse Blanking Delay Check

This procedure checks the delay which prevents 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 a "1" for 950 (±50) us.
5. Prepare drive for return to online operation.

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 set up 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 "1" for 7.5 to 12.5 us.
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 use with either test software or FTU.

2. Command 1 cylinder sequential forward seeks between cylinders 000 and 822.

3. Connect and set up oscilloscope as indicated on figure 2D-3. Note that this figure actually shows four different checks, each having a separate resulting waveform.

4. Evaluate results as shown on figure 2D-3.

5. Prepare drive for return to online operation.

Fine Enable Switching Level Check

This procedure verifies that the Fine Enable signal switches 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 set up oscilloscope as indicated on figure 2D-4.

3. Command continuous seeks between cylinders 000 and 001.

4. Observe that the waveforms are as indicated on figure 2D-4. Note that fine enable switches to a zero level when integrated velocity is between +0.82 and +0.98 V for forward seeks and -0.82 and -0.98 V for reverse seeks.

5. Prepare drive for return to online operation.

OSCILLOSCOPE SETTINGS

LOGIC GND TO SCOPE GND

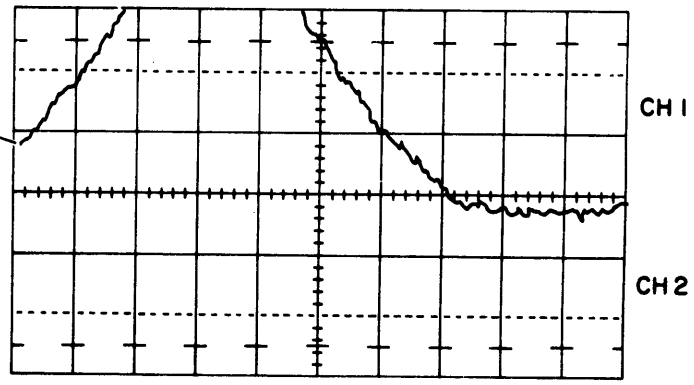
TIME / DIV
A - 0.2 MS/CM
B - NOT USED

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.

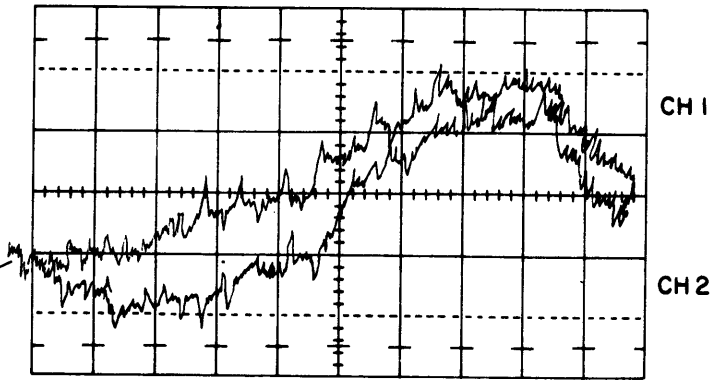
VOLTS / DIV
CH 1 - 0.5V/CM
CH 2 - NOT USED

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



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

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



9E16-1B

Figure 2D-3. Cylinder Pulse Switching Level Waveform (Sheet 1 of 2)

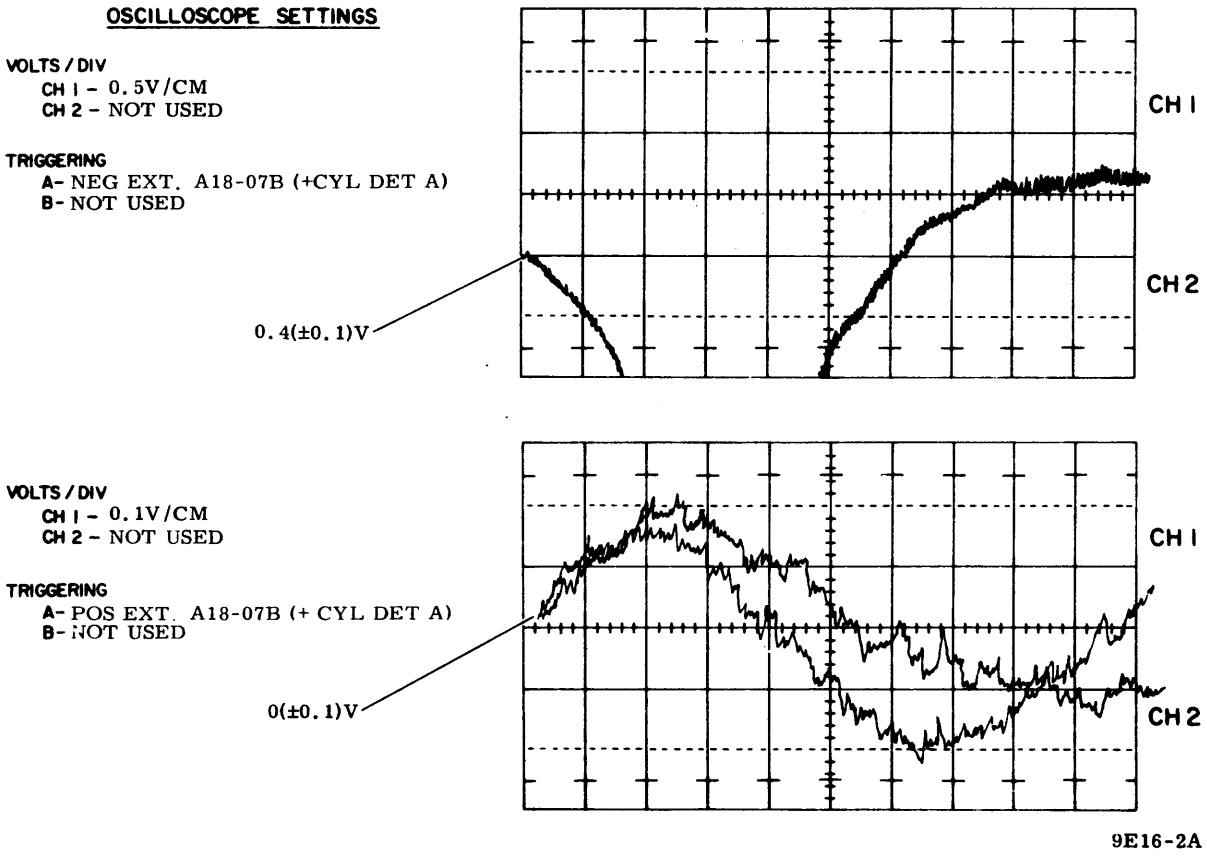


Figure 2D-3. Cylinder Pulse Switching Level Waveform (Sheet 2)

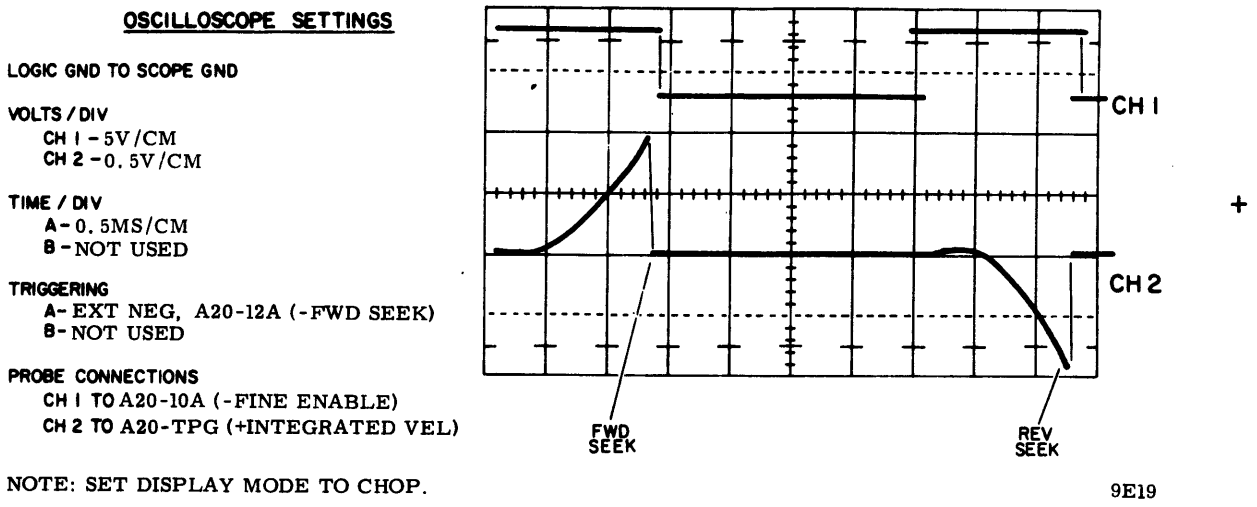


Figure 2D-4. Fine Enable Switching Level Waveform

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 set up oscilloscope as follows:
   a. Connect channel I 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 On Cylinder is a "1" for 1.40 to 2.1 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.

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 measurements required in step 4 of this procedure.
4. Observe that On Cylinder Dropout delay is zero for 500 to 1100 us.
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 0.25 to 0.35 us.
5. Prepare drive for return to online operation.

On Cylinder Switching Level Check

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

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

2. Set up and connect oscilloscope as shown on figure 2D-5.

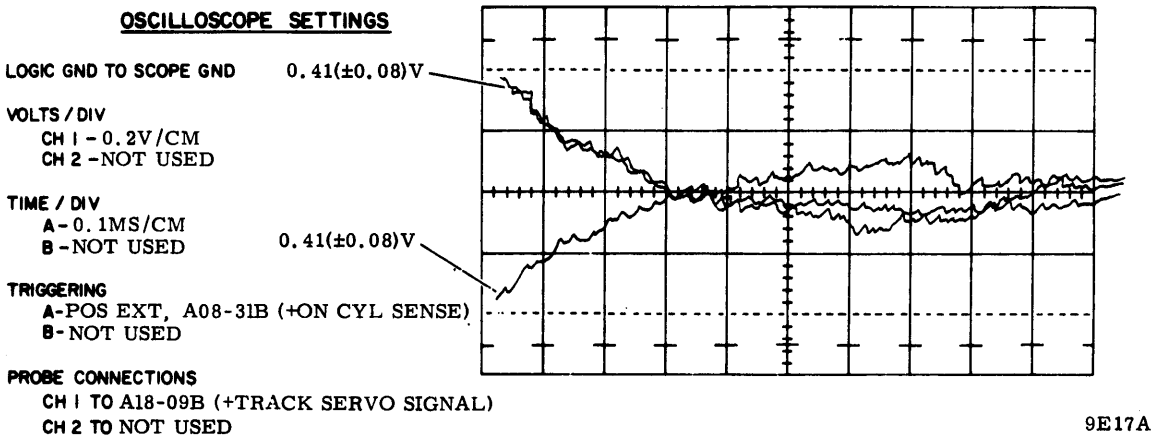


Figure 2D-5. On Cylinder Switching Level - Waveform I

3. Command continuous 2-track seeks between cylinder 000 to 002.

4. Check that resulting waveforms agree with those shown on figure 2D-5.

5. Set up and connect oscilloscope as shown on figure 2D-6.

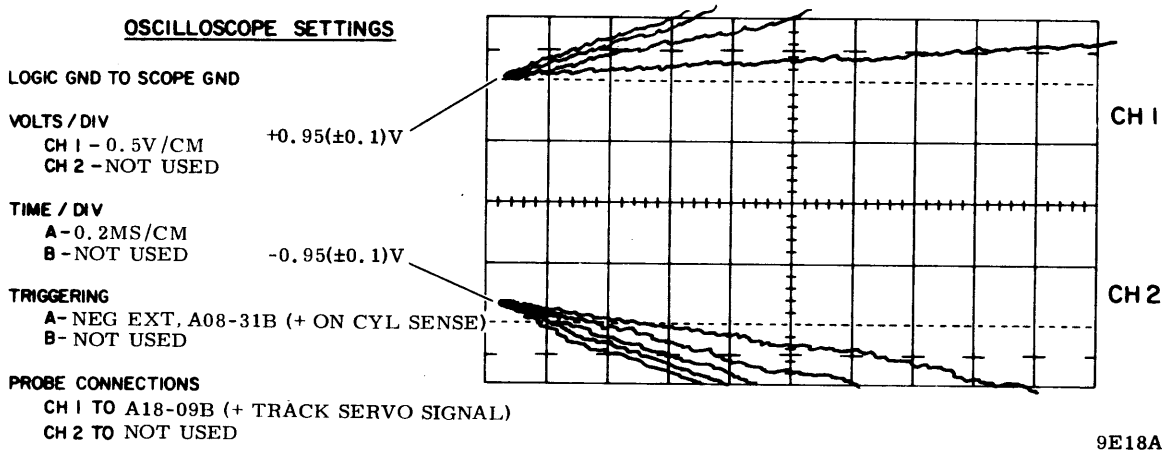


Figure 2D-6. On Cylinder Switching Level - Waveform II

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 2D-6.

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. Perform a read operation between each seek.

3. Connect and set up 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 8 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.

3. Connect and set up oscilloscope as follows:

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

   b. Set channel A sweep trigger mode to AUTO.

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

NOTE

Measure average dc level in steps 4 and 5.

4. Command carriage offset plus (forward offset) and observe that the scope indicates +0.5 to +0.7.

5. Command carriage offset minus (reverse offset) and observe that the scope indicates -0.5 to -0.7.

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.

3. Connect and set up 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 2D-7. 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 sinusoidal 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.

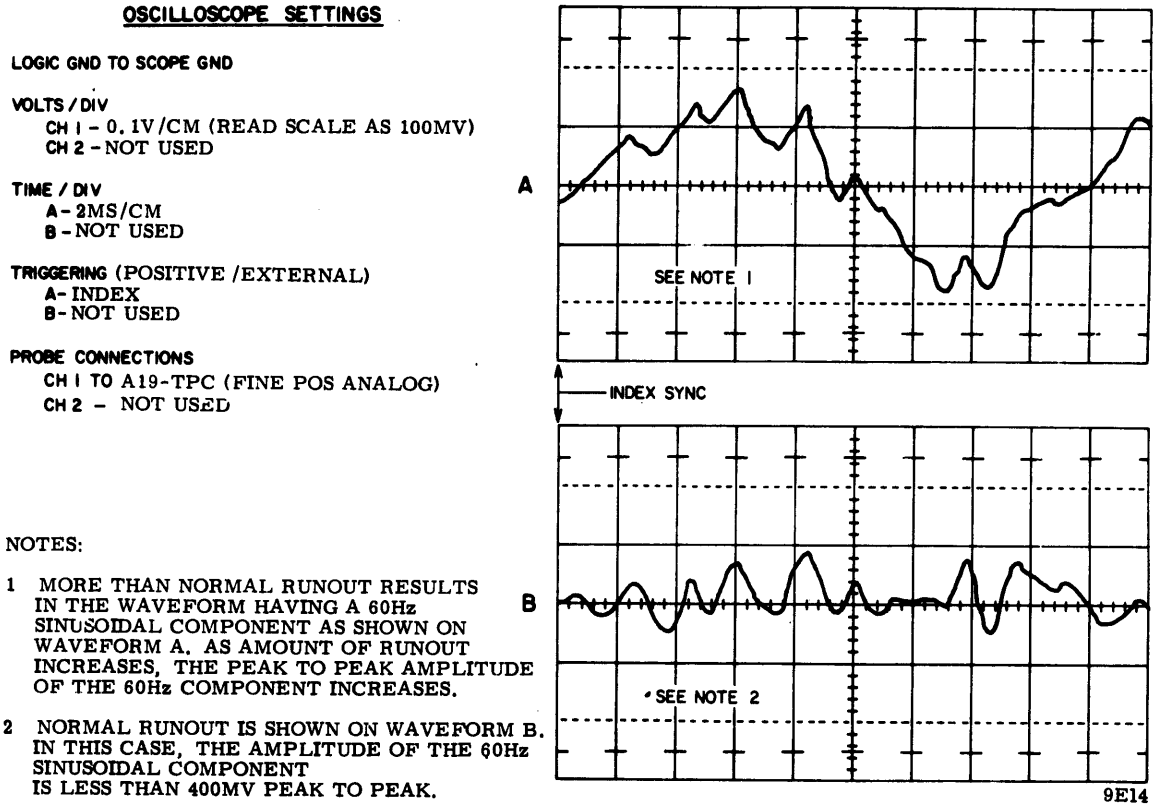


Figure 2D-7. Track Following Check Waveform

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 run-out.

9. Command direct seek to cylinder 400.

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 an input to the track servo circuit.

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

2. Connect and set up oscilloscope as indicated on figure 2D-8.

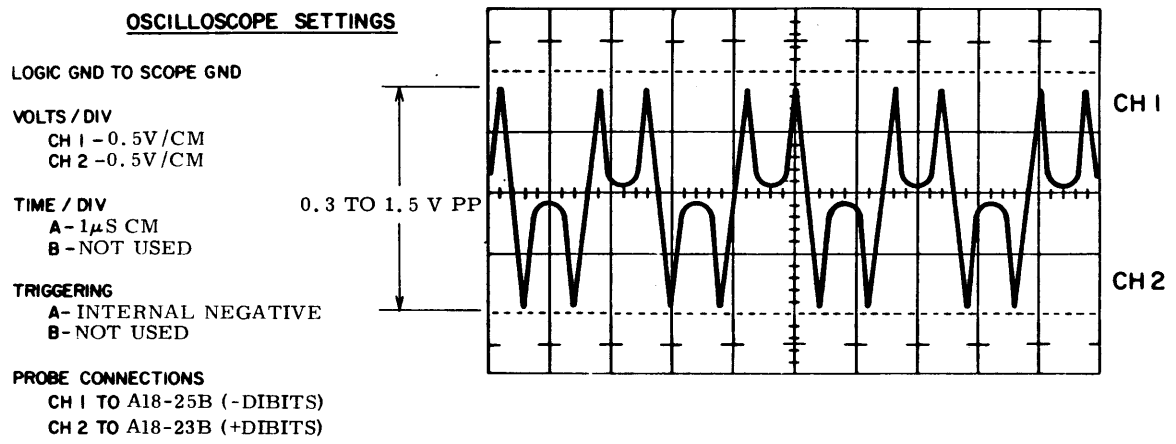


Figure 2D-8. Track Servo Amplitude Waveform

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

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

5. Check that waveforms observed in steps 3 and 4 is between 0.3 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 2D-9.

3. Command continuous seeks between cylinders 000 and 822.

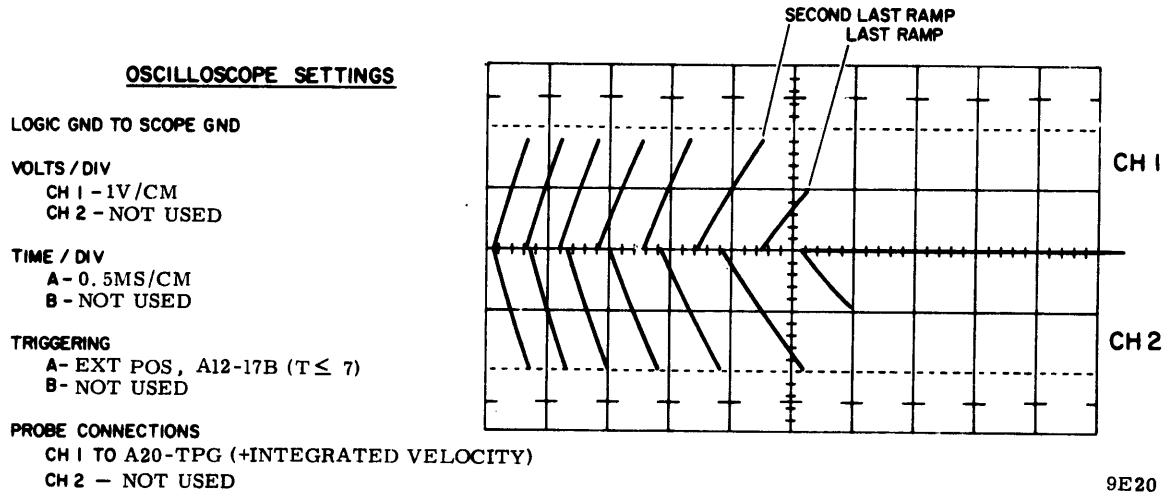


Figure 2D-9. Integrated Velocity Waveform

4. Observe waveforms as shown on figure 2D-9, check to ensure that the amplitude of the second to last positive and negative ramps are each in the range from 1.8 to 2.2 V and the difference between the two is 0.3 V maximum. Note that the positive ramps are produced during forward seeks and negative during reverse seeks.

Manually 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 .01 MS/CM.

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

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

   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 -10 V when drive motor gets up to speed by performing the following procedure.

a. Connect and set up 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.

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

   a. Set up oscilloscope as follows:

      - Vertical sensitivity to .05V/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 (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 signal is observed as specified in step b below, track servo and servo head are functioning properly.

   a. Set up 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 approximate 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 polarity of Fine Positioning 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 positioner 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 set up 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 Outlet).

   b. Move carriage in forward then reverse direction.

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

   a. Connect and set up 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 that was disconnected from voice coil.

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

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 2D-10). If the signals at these points are correct, the write 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.

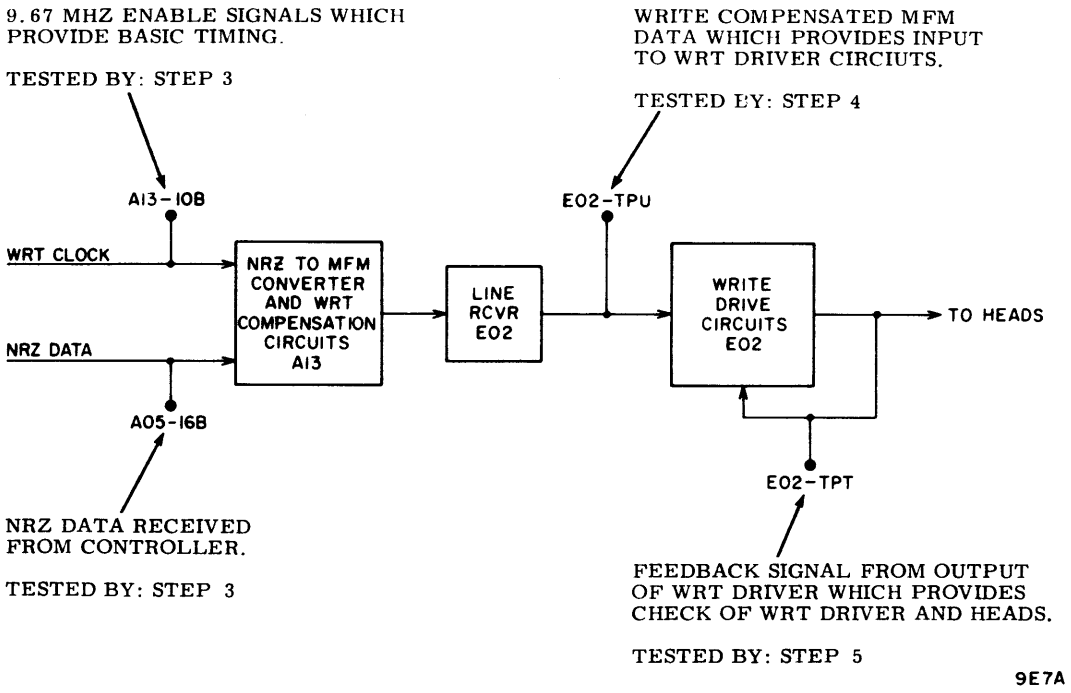


Figure 2D-10. Write Circuits Test Points

3. Check inputs to NRZ to MFM converter and write compensation circuits. Timing relationships between NRZ data and 9.67 MHz Enable signals must be correct if NRZ to MFM conversion and write compensation circuits are to operate properly.

   a. Connect and set up oscilloscope as shown in figure 2D-11.

   b. Observe that signals have timing relationships as shown in figure 2D-11.

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

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

   b. Observe that signals have approximately the relationship shown in figure 2D-12 and that channel 2 signal has proper polarity.

OSCILLOSCOPE SETTINGS

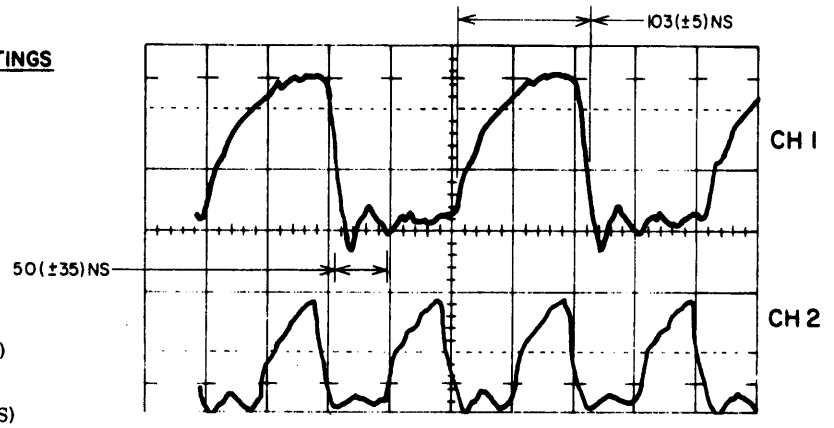
LOGIC GND TO SCOPE GND

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

TIME / DIV
A - 2MS/CM
B - 0.05μS/CM

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

PROBE CONNECTIONS (10X PROBES)
CH 1 TO A05-16B (NRZ DATA)
CH 2 TO A13-10B (WRT CLOCK)



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

9E11A

Figure 2D-11. NRZ Write Data Input Waveform

OSCILLOSCOPE SETTINGS

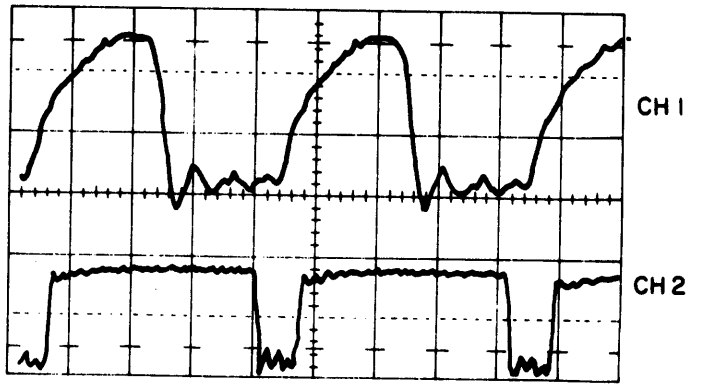
LOGIC GND TO SCOPE GND

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

TIME / DIV
A - 2MS/CM
B - 0.05μS/CM

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

PROBE CONNECTIONS (10X PROBES)
CH 1 TO A05-16B (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)

9E12A

Figure 2D-12. Write Driver Input Waveform

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 in figure 2D-13.

6. Prepare drive for return to online operation.

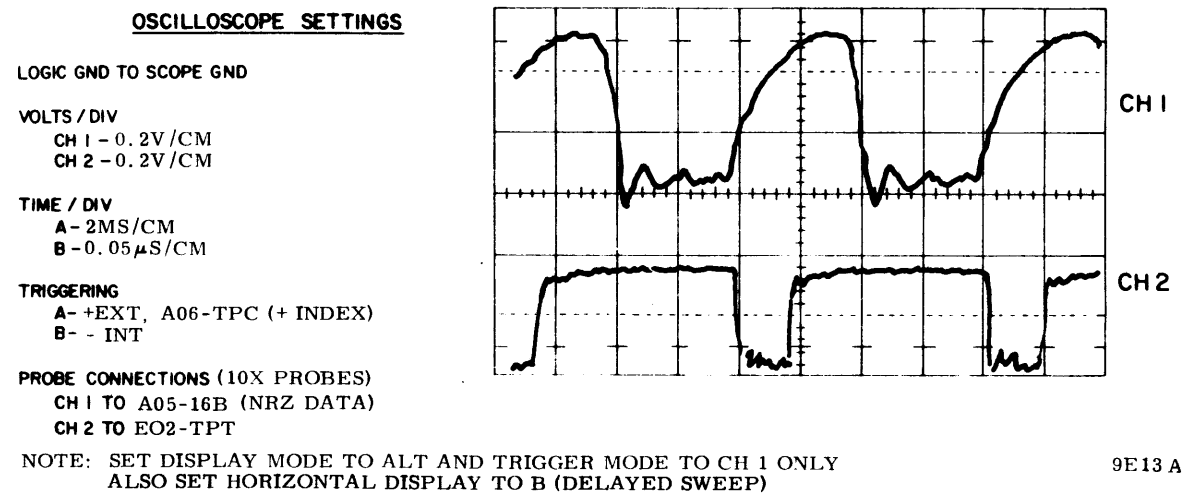


Figure 2D-13. Write Driver Output Waveform

Read Circuit Checks

This procedure checks the basic operation of the read circuits (refer of figure 2D-14). If the observed signals are correct, 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, the analog data detection circuits are functioning.

   a. Connect and set up oscilloscope as indicated in figure 2D-15.

   b. Observe that signal is approximately as shown on figure 2D-15 with approximately 200 ns between zero crossings.

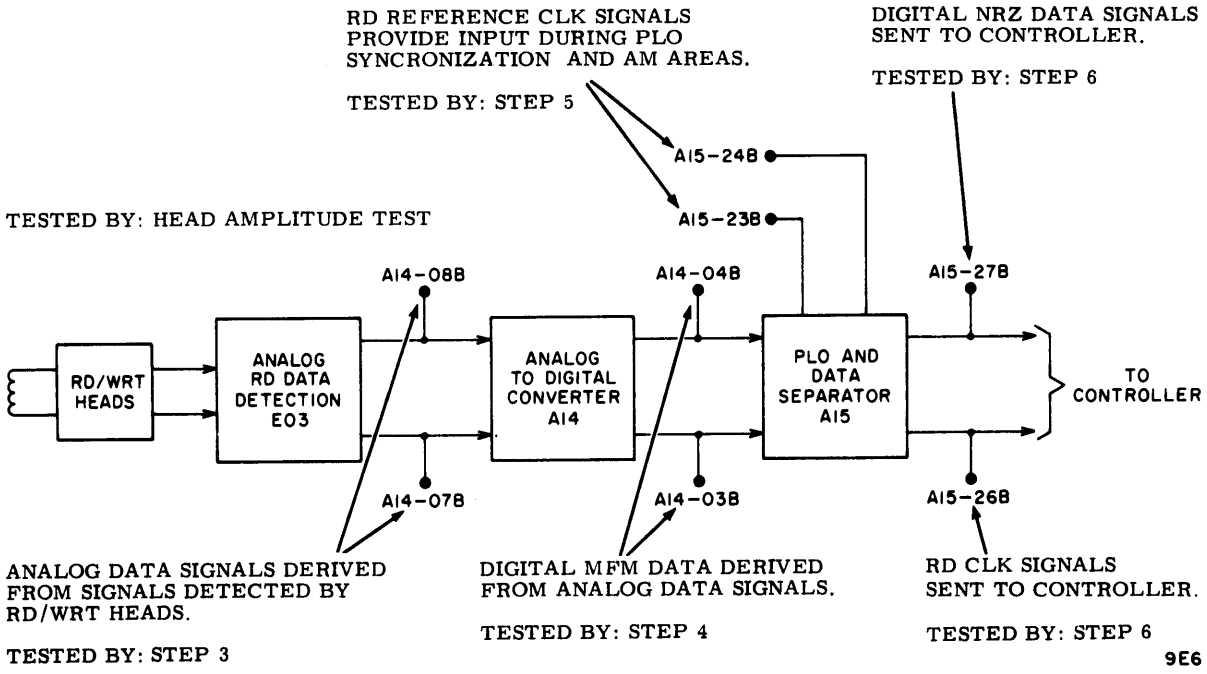


Figure 2D-14. Read Circuits Test Points

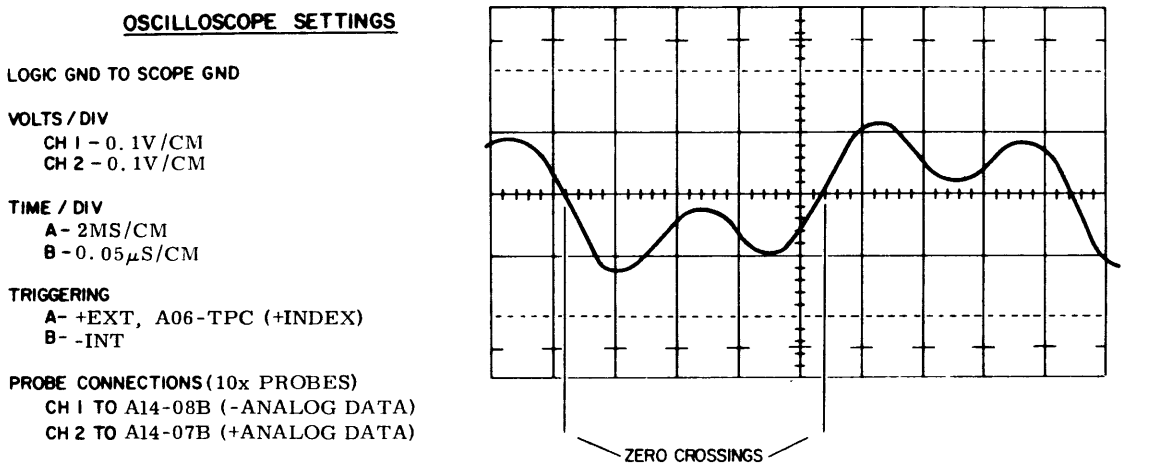


Figure 2D-15. Analog Read Data Waveform

5. Check output of Data latch. If observed signals are correct, the high and low resolution channels and Data latch are functioning.

   a. Connect and set up oscilloscope as shown on figure 2D-16.

   b. Observe that signal is approximately as shown in figure 2D-16.

6. Check frequency of Read Reference Clock signals.

   a. Connect and set up oscilloscope as shown on figure 2D-15 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.

OSCILLOSCOPE SETTINGS

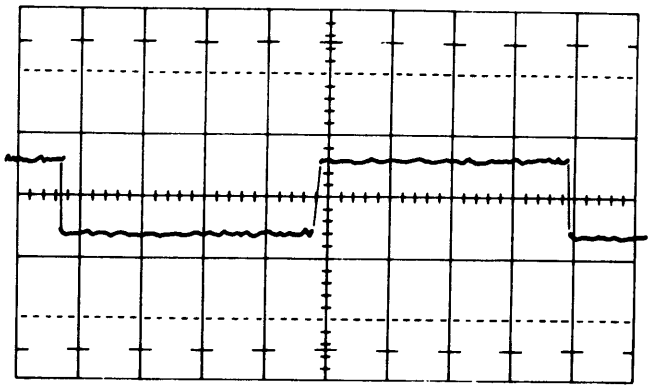
LOGIC GND TO SCOPE GND

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)



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

9E9

Figure 2D-16. Data Latch Output Waveform

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

   a. Connect and set up oscilloscope as shown on figure 2D-17.

   b. Observe that displayed signals have timing relationships as shown on figure 2D-17.

8. Prepare drive for return to online operation.

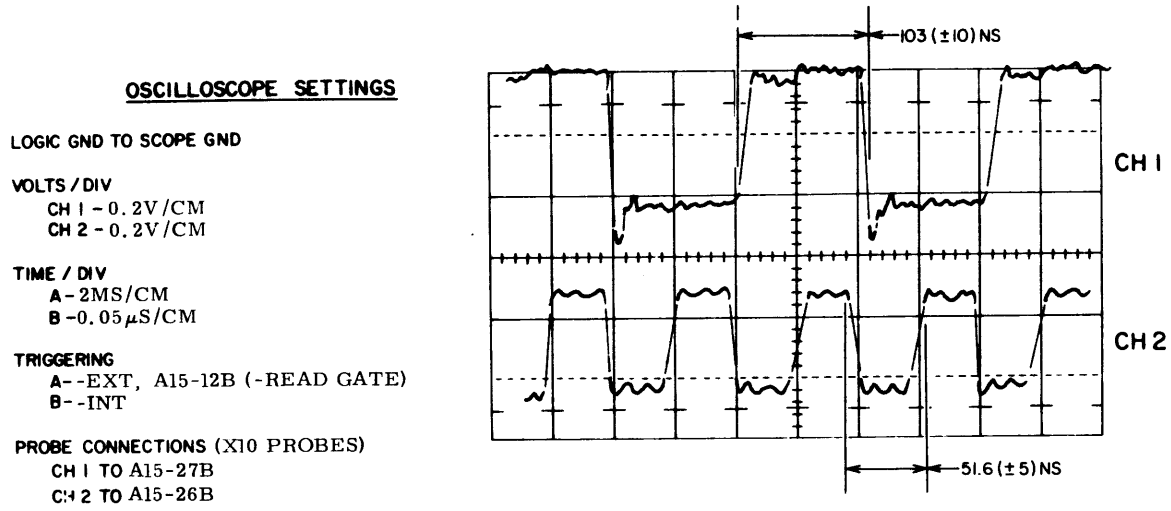


Figure 2D-17. Read Data To Read Clock Timing

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 "0s" or all "1s" 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 and write an all ones pattern.

3. Connect and set up 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.

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 "1" for 2.5 ($\pm$.03) us.

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 is 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 0.6 volt. If not, recheck speed sensor gap.

4. Prepare drive for return to online operation.

HEAD CRASHES

The following paragraphs provide the information required to determine whether a head crash has occurred, how to troubleshoot the cause of the crash, and perform recovery procedures.

DETECTION

It is important that the drive operator be aware of a number of head crash warnings and/or indications provided by the drive itself.

Advanced Warning

Warnings of impending head crashes are very often provided by the data signals picked up by the heads. Under conditions of increasing contamination in the air cushion on which the head flies, variations in flying height can become a significant proportion of the nominal height. These variations in flying height can result in the generation of data errors. Continuous monitoring of the data error rate is strongly recommended. A significant increase in the data error rate on the order of five to ten times normal should be heeded as a definite warning signal.

Crash In Progress

Head to disk contact may be occurring if an audible "ping" (scratching noise), or a burning odor is detected when the heads are over the disk.

After a Crash

Head-to-disk contact has occurred if concentric rings or divots are observed on the disk surface.

CAUTION

If any of the above are detected, shut down the drive at once. Do not move the pack to another drive without first checking to see if it has been damaged or contaminated. Do not attempt to operate the drive with another disk pack until full assurance is made that no damage or contamination has occurred to the drive heads or shroud area.

DETERMINING THE CAUSE OF A HEAD CRASH

If the drive has been shut down because of a suspected head crash, the following steps should be taken to determine the cause of the head crash.

1. Reconstruct the operating history of the drive and pack.

a. Evaluate drive failures that have occurred on the unit prior to the one in question.

b. Check to determine if the failure was propagated by moving the pack from one drive to another.

c. Check to determine whether anything unusual happened prior to the failure.

d. Try to reconstruct the mode of operation prior to the failure.

e. How long had the pack been on the drive before the crash occurred? Was the pack new? Was the drive new? Any shipping damage?

Reconstruct the pre-crash conditions of the drive, drive heads and pack.

a. Open the circuit breaker - disconnect the power cord

b. Remove the top cover

c. Reinstall the crashed disk pack if it has been removed.

d. Manually position the head arm assemblies toward the spindle to the point at which the head arms slide off the head cam towers.

e. Looking through the shroud observation window with a high intensity lamp, check to see if the heads appear to be equidistant with respect to the disk surfaces. Under no circumstances should any part of the head be in contact with a disk prior to sliding off the cam surface.

f. With the heads still resting on the head cam towers, manually turn the pack (by rotating the top trim shield) and verify that the head to disk spacing remains constant.

g. Look at the recording surfaces and make note of which disk pack surfaces and heads have had contact.

h. With the disk pack stationary, slide the head arms off the head cam towers onto the disks but do not push the heads forward. Check the head assemblies (particularly those that have not crashed) to see if any part of the head load spring is relatively close to or touching the disk. If closeness is noted, further inspection, once the heads are removed from the drive, is required.

i. Retract the carriage and remove the pack.

Evaluating the Drive

a. With the disk pack removed, manually position the carriage so that the heads are in a loaded position. Traverse the carriage repeatedly between the front stops and where the heads contact the head cams. If resistance is found, check for the following possible causes: bound velocity transducer; flex head retainer mispositioned and striking the rail bracket; worn rail; bad carriage bearing; obstruction caught on magnet; and foreign material on the rails. Retract the carriage to the fully retracted position.

b. Connect the power cord and turn on the breaker. Check for adequate air flow entering the shroud area. If questionable, either compare with another drive in the area or replace absolute filter with another filter as described in the Corrective Maintenance section.

c. Using a strip of paper (dollar bill size), check the pack access cover-shroud seal. Open the pack access cover and lay the slip of paper on the shroud. After closing the cover (latched), resistance should be felt while trying to withdraw the paper. Check several places on each side of the shroud.

d. Clean the shroud area and look for possible foreign material (paper, plastic, etc.). If contamination exists, try to determine the type and its possible source.

e. Note head positions, then remove all heads for evaluation and cleaning.

Evaluating the Heads

a. If any part of the head load spring appears to be close to a disk, the possibility exists that the fixed arm (part attached to the carriage) may be bent. Look at the subject head for evidence of burnishing on the head arm assembly where it might possibly have struck the disk.

b. Compare crashed heads to non-crashed heads and look for possible mechanical failure differences such as bent gimbal springs, etc.

c. Dispose of heads as described in this maintenance manual and return non-recoverable head assemblies to the manufacturer for further analysis.

Evaluating Disk Pack

a. Install the crashed pack back on the drive (use a pack inspector if available) and try to determine if pack has been damaged in any way. Using observation window in shroud and high intensity light, rotate pack and note any concentric scratches or disk fluctuations (up and down). No fluctuation should be in evidence including upper and lower cover disks.

b. Look on pack trim shield (top of pack) for any evidence of adhesive. A pack identification label might have been applied.

c. Look for an unusually high amount of "dings" or divots (chipping) at the outer area of the data disks. If found, these may be due to carriage slams - a drive malfunction.

RECOVERY

Use the following procedure to insure that all contamination is removed from a unit after a head crash. This is essential to eliminate propagation to other packs and drives. Consult the repair and replacement section of this manual for details on these steps.

1. Remove all power from the drive.

2. Remove the top cover assembly by backing out the two screws on each side of the unit frame and removing the C clip holding the top cover latch rod.

3. Remove the deck cover assembly by unsnapping the four spring clips.

4. Remove the heads and shroud/pack access cover assembly performing the following steps;

   a. Remove the twelve screws on the inside of the pack well.

   b. Remove the eight screws holding the panel located on the left side of the shroud. Behind this plate remove the three screws holding down the shroud.

   c. Remove one C clip from the shroud gas spring and slide out the holding pin to free the spring.

   d. Remove the operator panel.

   e. Remove the faston and P-clamp to free the pack access cover ground strap.

   f. Remove the two screws on the pack access cover interlock to free the switch.

   g. Remove the two wires from the pack access solenoid.

   h. Remove the shroud/pack access cover assembly from the drive.

   i. Clean the deck and exposed air system with head cleaning solution.

j. Clean the pack well area making certain to reach behind the perforated area to remove all contamination. Use lint free cloth and head cleaning solution.

k. Remove all twenty heads from the unit.

l. Reinstall the shroud/pack access cover by reversing steps a-g.

m. Clean the inside of the pack access cover and shroud with lint free cloths and head cleaning solution. Do not let any solution contact the rubber gasket in the pack access cover.

n. Consult the section in this maintenance manual for Repair and Replacement - Head Arm Replacement Criteria. Replace any heads that are defective per this criteria. Replacement heads should be new heads or those that are cleaned by properly trained personnel only.

5. Reinstall the top cover.

6. Do a head alignment per the procedure called out in the Test and Adjustment section of this manual.

7. Reinstall the deck cover assembly.

SECTION 2E

DECISION LOGIC TABLES (DLT'S)

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 subtopic called Useful Troubleshooting Aids precedes the DLTs. 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 (TB304) to correct various seek and read/write errors.
- DLT 13 shows what to do when a drive does not "powerdown" properly.

The DLTS are located at the end of this subsection.

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 you must remember if you expect valid test results. Sometimes, you must take prerequisite actions other than the ASSUMPTIONS before the test for a given condition. 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 you should take 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 (0 ohm), 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 capacitance. Return swing is rapid for small capacitors, becoming slower as capacitance 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 ohm; the reverse drop is on the order of 1 M ohm. Parallel resistances in the circuit will, of course, significantly reduce the higher of these two readings, but if one is low and other high, chances are the diode is good. If both are low, the diode is probably shorted; if both are high, it's probably open.

Use this check for a bridge rectifier also. You'll probably want to check at least two diodes in the bridge, because back-circuits may give different readings across different diodes.

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 required voltage to drive its associated power supply. Follow this procedure whenever a transformer is suspected as the reason for a dc voltage problem. Perform it also 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 2E-1 shows the oscilloscope connections for monitoring the ac inputs to the rectifiers. Figure 2E-1 shows the square-wave output of T1 and T2. As mentioned above, T3 produces a sinewave output. Table 2E-2 shows some common failure symptoms for power supplies.

TABLE 2E-1. AC INPUT TO RECTIFIERS

Xfmr	To Rectifier	+Probe Terminals (Check Both)	-Probe Terminal (GND)	Acceptable Range ±5%	Condition Remarks
T1 (1)	±16 V −16 V	A1TB1-4 A1TB1-5	A1TB1-3	16.0 FL 17.0 NL	Min DC load condition as indicated in DLT.
T1	±46 V	A1TB1-7 A1TB1-8	A1TB1-3	44.0 FL 46.5 NL	No Load = CB4 OFF
T2 (1)	±9.7 V	A1TB1-7 A1TB1-18	A1TB1-14	10.3 FL 11.1 NL	Min DC load condition as indicated in DLT.
T2 (1)	±20 V	A1TB1-15 A1TB1-16	A1TB1-14	21.0 FL 22.7 NL	No Load = CB7 OFF
T2	±28 V	A1TB1-19 A1TB1-20	A1TB1-14	27.3 FL 29.4 NL	No Load = CB8 OFF
T3	+20 Y	A1TB2-9 A1TB2-10	A1TB1-12	25.0	Secondary disconnected. Sine wave output. Voltages peak to ground

(1) Do not measure square-wave output, as shown in figure 2E-1, unless tuning capacitor is connected.

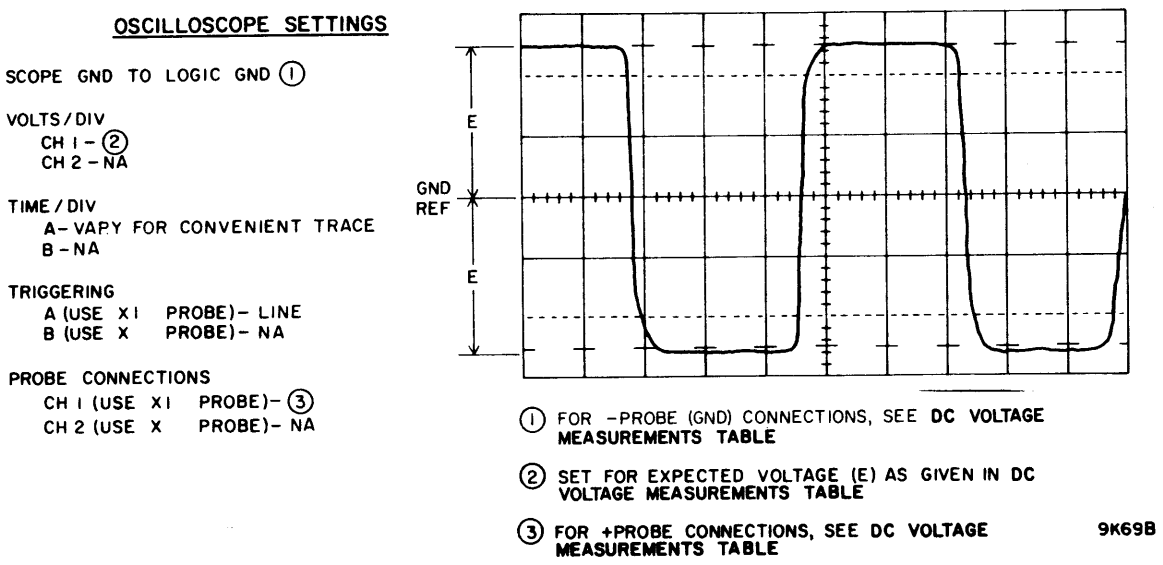


Figure 2E-1. AC Input (Ferroresonant) to Power Supply Rectifiers

TABLE 2E-2. 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 good)	Shorted diode or shorted filter capacitor
3. Output decreases significantly when load is connected.	Open bleeder resistor

PROCEDURE:

1. Turn off the MAIN AC breaker (CB1).

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.

2. Determine which transformer secondary you want to check, and set the breakers as follows:

   - T3 -- CB2 (+20Y) ON, all others OFF
   - T1 or T2 -- CB2, CB5 (+9.7 V), CB6 (-9.7 V) ON, all others OFF

3. From table 2E-1, 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 have two Fastons. If the 16 V ac input from T1 is in question, be sure to remove the two wires with Fastons that come from the transformer. (The other two go to the breaker 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 track becomes visible, center it on the graticule.

5. Connect the scope's ground (-) probe to the appropriate terminal given in table 2E-1.

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 2E-1).

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 2E-1.

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 2E-1, the winding for that particular supply is good.

13. If the voltage readings are not the same, or if they are the same but not within the tolerance specified in table 2E-3, the problem is a shorted winding. You may be able to confirm this by sniffing the transformer for evidence of burned insulation, although this is not a definitive test. Execute steps 14 and 15 if either T1 or T2 is 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 2E-2.)

    e. Referring to CR803 of the diagrams, remove the transformer lead wires (Fastons) from A1TB1. (Check colors with figure 2E-3.)

TABLE 2E-3. DC VOLTAGE MEASUREMENTS

DC Voltage to be Measured	Probe Connection for Scope or VOM			Acceptable DC Voltage Range	
	Full Load (1)	No Load			
	+Probe	+Probe	GND Probe		
+46	+46 TP	A1TB2-8		+44	+51
-46	-46 TP	A1TB2-7		-44	-51
+28	+28 TP	A1TB2-1		+26	+30
+20Y	--	A1TB2-11	Use terminals	+18	+22
+20	+20 TP	A1TB2-5	1, 2, 3,	+18	+24
-20	-20 TP	A1TB2-4	14 of A1TB1	-18	-24
16 (E.R. Pwr)	--	A1TB2-6	14 of A1TB1	-14	-20
+9.7	+9.7TP	A1TB2-3		+8.7	-10.7
-9.7	-9.7TP	A1TB2-2		-8.7	-10.7
+5	A2JD94-04A	Use GND Faston on regulator		+5.05	+5.15
-5	A2JD94-01A	card for Load or No Load condition		-5.05	-5.15
+16	K8-3	Brake power bridge rectifier is not grounded. Measure full voltage as given at right		28	45
-16					

(1) Measure to GND test point on power supply panel. The corresponding dc breaker must be ON.

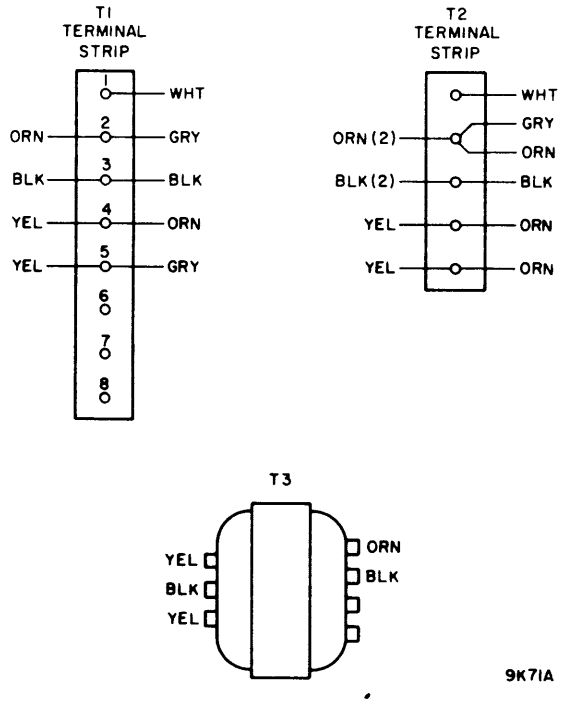


Figure 2E-2. Transformer Connections

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 beginning 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 2E-3 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. After securing all Fastons 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.

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. Conduct the test in either of two ways. The first method is to check each voltage individually by entering the procedure from the applicable DLT:

±5V -- Action 7 of DLT 6

±20 V -- Action 2 of DLT 7

+28 V -- Action 8 of the 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 2E-4, not all cards will require all voltage checks.

NOTE

From table 2E-4, notice that cards in the logic chassis use both ±5 V and +20 V (with the exception of Fault card A17, which also monitors ±46V, 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 2E-4 available for ready reference when performing this procedure.

1. Turn off CB2 (+20Y), keeping CB1 (MAIN AC) ON. This removes all logic voltages while permitting the blower to operate.

2. Turn off CB4. (±46 V not tested in this procedure).

3. All other breakers must 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.

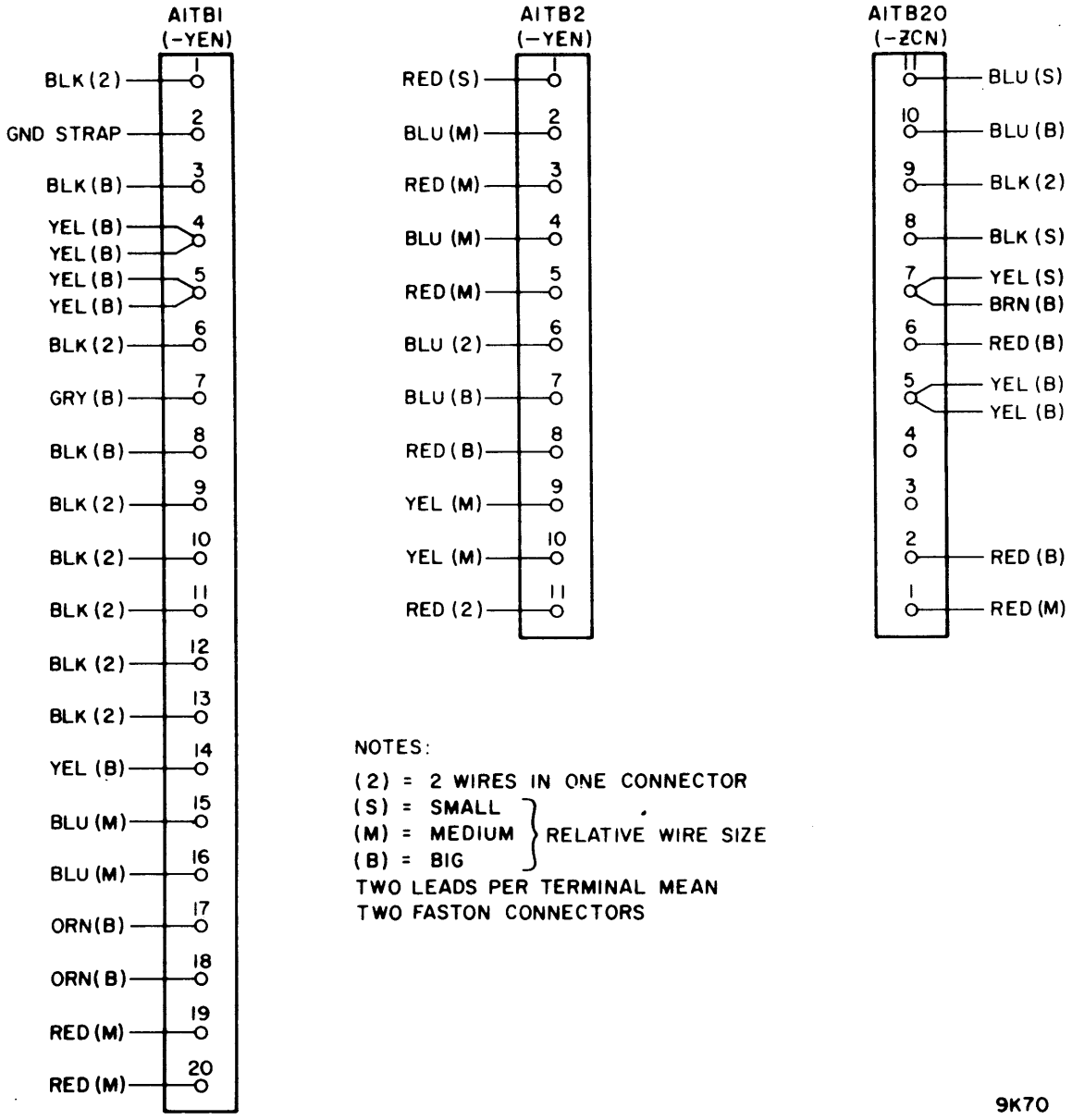


Figure 2E-3. _YEN, _ZCN Terminal Board Connections

4. Turn off CB8. (+28 V not used by the logic chassis).

5. Remove A3PE1 from the R/W control card (E01). This removes the ±5 V, ±20 V voltages from 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 2E-4 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 the 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.

TABLE 2E-4. VOLTAGE USAGE

	+5V -5V	+9.7V -9.7V	+10.5V -10.5V	-16V	+20Y	+20V -20V	+22	+28	+46 -46	Card Type
A4 Operator Panel	+									
Rectifier/Cap		X		X	X	X		X	X	-YEN
Relay Board		+		X	X					-YFN
Power Amp									X	-ZCN
E01	X					X		X		-PKV
E02	X		X				X			-PJV
E03	X		X				X			-PHV
E04	X									-XFN
E05	+									-XGN
Servo Preamp		X								-ZQN
Voice Coil				X					-	
Pack Cover Sol					X					
5 V Reg		X								--
A01/ A03	X									-TVV

Table Continued on Next Page

TABLE 2E-4. VOLTAGE USAGE (Contd)

	+5V -5V	+9.7V -9.7V	+10.5V -10.5V	-16V	+20Y	+20V -20V	+22	+28	+46 -46	Card Type
A02/ A04	X									-RVV
A05										-KHV
A06	X									-LTV
A07	+									-LVV
A08	X									-QPV
A09	X	X								-SMV
A10	X					X				-LSV
A11	X	X								-UKN
A12	+									-LWV
A13	X									-LXV
A14/ A15/ A16	X X X					X X X				-LRV -LZV HD Align
A17	X							X		-KFV
A18/	X					X				-FRV
A19/	X					X				-KGV
A20	X					X				-MSV

NOTES

An "X" in a column indicates all voltages at top of column apply.

A "-" in a column indicates only negative voltages at top of column apply.

A "+" in a column indicates only positive voltages at top of column apply.

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 shutdowns.

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 troubleshooting 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)

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	-	-			

9E259-1

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		

9E259-2

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	-		

9E259-3

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

9E259-4

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?	N	N	N	N	N	N	N	N	N	Y	-	
2. Does drive motor start as soon as START sw is pressed?	Y	Y	Y	Y	N	N	N	N	N	-	-	
3. Does CB3 or motor thermal switch trip as soon as CB1 is actuated?	N	N	N	N	N	N	N	N	N	N	Y	
4. Does CB3 or motor thermal sw trip as soon as START is pressed?	N	N	N	Y	-	-	-	-	-	-	-	
5. Does CB3 or thrml sw trip before motor gets up to speed?	N	Y	Y	-	-	-	-	-	-	-	-	
6. Is squealing heard when motor starts to run?	N	N	Y	-	-	-	-	-	-	-	-	
7. Is +20 Y present at pin 3 of triacs A1Q2, A1Q3, A1Q4 upon pressing START switch?	-	-	-	-	Y	Y	N	N	-	-	-	
8. Is 208 V ac present at pin 2 of A1Q2, A1Q3, A1Q4 upon pressing START switch?	-	-	-	-	Y	N	-	-	-	-	-	
9. Is lack of motor power accompanied by illumination of one or more FAULT indicators?	-	-	-	-	-	-	-	N	Y	-	-	
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.	-	-	-	-	-	-	-	2	2	1	-	
3. Replace relay board (-YFN)	-	-	-	-	-	-	-	3	3	2	-	
4. Check that parking brake has released drive spindle.	-	-	1	1	-	-	-	-	-	-	-	
5. Check drive belt and tension.	-	1	2	-	-	-	-	-	-	-	-	
6. Check integrity of power wiring (P/J7) to drive motor.	-	-	-	-	1	-	-	-	-	-	-	
7. Replace drive motor.	-	-	-	-	2	-	-	-	-	-	-	
8. Replace suspected triacs.	-	-	-	-	-	2	-	-	-	-	-	
9. Failure in +20 Y circuits. Go back to DLT 2.	-	-	-	-	-	-	2	-	-	-	-	
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	1	1	-	-	-	
12. Troubleshoot the Faults.	-	-	-	-	-	-	-	-	1	-	-	
13. Call Field Support.	-	2	3	2	3	3	3	4	4	3	2	

9E259-5

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. 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.

9E259-6

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.

9E259-7

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	2	3	4	5	6	7	8	9	10	11	12
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	-		

9E259-10

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

9E259-11

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	-	-		

9E259-12

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		

9E259-13

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	2	3	4	5	6	7	8
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 timeout. Go to Condition 5 on sheet 2.	-	-	-	-	-	X		
13. Call Field Support.	-	-	5	-	6	-		

9E259-14

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

9E259-15

DLT 10 — RTZ, CONTINUOUS SEEKS

Warning: None

Enters from: DLT 9

Procedures: None

References: Logic Diagrams

Exits to: DLT 11

Assumption:
1. FTU (TB304) 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 Access Mode 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 BK7 or 410 for BK6. (BK6 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 cards A02 (Ch. 1 Rcurs), A04 (Ch. 2 Rcurs).	-	5	4	4	4			
7. Replace card A12 (Difference Generation and Control).	-	-	2	2	2			
8. Call Field Support.	-	6	5	5	5			

9E259-16

DLT 11 WRITE/WRITE FORMAT (sheet 1 of 2)

Warning: None

Enters from: DLT 10

Procedures: None

References: Logic Diagrams; TB304 Operating Instructions

Exits to: DLT 12 or sheet 2 of this DLT

Assumption: FTU connected to drive and FTU switches set per "Preliminary Set-Up" in Operation section of TB304 manual. In addition, FTU Wrt-Rd Select switch set for either a WRT or WRT FORMAT operation.

CONDITIONS	1	2	3	4	5	6	7	8
1. FAULT indication given when drive is connected to controller but not								
when connected to FTU?	N	Y	-	-				
2. FAULT light on FTU panel comes on?	N	N	Y	Y				
3. FAULT light on SMD panel comes on?	N	N	N	Y				
ACTIONS								
1. No problem. Go to DLT 12.	X	-	-	-				
2. Check that Write Protect switches are OFF.	-	X	-	-				
3. Check that +5V is present at operator panel (-ZYN brd). If present,	-	-	X	-				
replace -ZYN board. (Ref: c.r. 772.)								
4. Go to Condition 4 on sheet 2.	-	-	-	X				

9E259-17

DLT 11 — WRITE/WRITE FORMAT — (sheet 2 of 2)

Warning: None

Enters from: Sheet 1

Procedures: None

References: Logic Diagrams, TB304 Operating Instructions

Exits to: DLT 12

Assumption: FTU connected to drive and FTU switches set per "Preliminary Set-Up" in Operation section of TB304 manual. In addition, FTU Wrt-Rd Select switch set for either a WRT or WRT FORMAT operation.

CONDITIONS	5	6	7	8	9	10	11	12	13	14
2,3. FAULT lights lit on both SMD and FTU panels? (From Sheet 1.)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4. Is Fault limited to certain groups of contiguous addresses?	Y	N	-	-	-	-	-	-	-	-
5. Does Fault appear only for WRT FORMAT operations?	-	-	Y	N	-	-	-	-	-	-
6. Set FTU Addr Mk/Sect Mk sw to SECT MK and try again.										
Does FAULT light still come on?	-	-	-	-	N	Y	-	-	-	-
7. Check LEDs on edge of Fault card (A17):										
a) WRT FLT on?	-	-	-	-	-	-	Y	-	-	-
b) HEAD SEL FLT on?	-	-	-	-	-	-	-	Y	-	-
c) W · R FLT on?	-	-	-	-	-	-	-	-	Y	-
d) $\overline{\text{ON CYL}}$ · (W + R) FLT on?	-	-	-	-	-	-	-	-	-	Y

ACTIONS										
5. Replace card A12 (CAR bits 7,8 for BK6; 7,8,9 for BK7).	1	-	-	-	-	-	-	-	-	-
6. Go to Condition 5.	-	X	-	-	-	-	-	-	-	-
7. Go to Condition 6.	-	-	X	-	-	-	-	-	-	-
8. Go to Condition 7.	-	-	-	X	-	-	-	-	-	-
9. Suspect cards A02, A01, A17 (Addr Mk Enable).	-	-	-	-	1	-	-	-	-	-
10. Restore sw to ADDR MK position; repeat test and go to Condition 7.	-	-	-	-	-	X	-	-	-	-
11. Chk that FTU Servo Offset sw is "off" (center position).	-	-	-	-	-	-	1	1	1	1
12. Replace card A10 (Write PLO).	-	-	-	-	-	-	2	-	-	-
13. Replace card A13 (NRZ → MFM).	-	-	-	-	-	-	3	-	-	-
14. Replace cards A02, (Ch. 1 Rcurs) A04 (Ch. 2 Rcurs).	-	-	-	-	-	-	4	2	2	-
15. Replace card A19 (Write Protect).	-	-	-	-	-	-	5	-	3	2
16. Replace card A20 (On Cyl).	-	-	-	-	-	-	-	-	-	3
17. Replace Write Driver board (loc E02).	2	-	-	-	2	-	6	-	4	4
18. Replace Read Amp board (loc E03).	-	-	-	-	-	-	-	3	-	-
19. Call Field Support.	3	-	-	-	3	-	7	4	5	5

9E259-18

DLT 12 READ

Warning: None

Enters from: DLT 11

Procedures: Head Alignment (section 2C); Head Replacement (2E)

References: Logic Diagrams; TB304 Operating Instructions

Exits to: DLT 13

Assumption: FTU connected to drive and FTU switches set per "Preliminary Set-Up" in Operation section of TB304 manual. In addition, FTU Wrt-Rd Select switch set to RD position.

CONDITIONS	1	2	3	4	5	6	7	8
1. Was address read properly? (1)	Y	Y	Y	N	N			
2. Was data read properly? (1)	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	-	2	-			
4. Replace card A14 (Data Latch).	-	3	-	3	-			
5. Replace card A19 (Offset).	-	4	-	4	-			
6. Replace cards A02 (Ch. 1 Rcurs), A04 (Ch. 2 Rcurs).	-	5	-	5	-			
7. Replace cards A01 (Ch. 1 Xmtrs), A03 (Ch. 2 Xmtrs).	-	6	1	6	1			
8. Check head alignment (see Procedures, above).	-	7	2	7	2			
9. Replace Read Amp board, location E03.	-	8	-	8	-			
10. Replace and align faulty head(s)--see Procedures, above.	-	-	3	-	3			
11. Reformat disk, using WRT FORMAT procedure in FTU manual.	-	-	-	1	-			
12. Call Field Support.	-	9	4	9	4			

(1) A NO answer here implies that the procedures given in the TB304 manual's Trouble Analysis DLT have already been executed in an attempt to recover the address/data, but to no avail.

9E259-19

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			

9E259-20

SECTION 2F

REPAIR AND REPLACEMENT

GENERAL

This section contains information concerning the mechanical replacement and adjustment of the drive 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 that 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.

Note that all procedures in this section are based on the assumption that the drive is installed in line with other drives and that components are accessible only from front and rear.

If it is not installed in the in-line position, certain procedures are more easily performed by removing side panels to gain access to the drive from the side.

Figure 2F-2 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 2F-1).

The following describes the entire procedure for replacing the actuator assembly. Figure 2F-2 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.

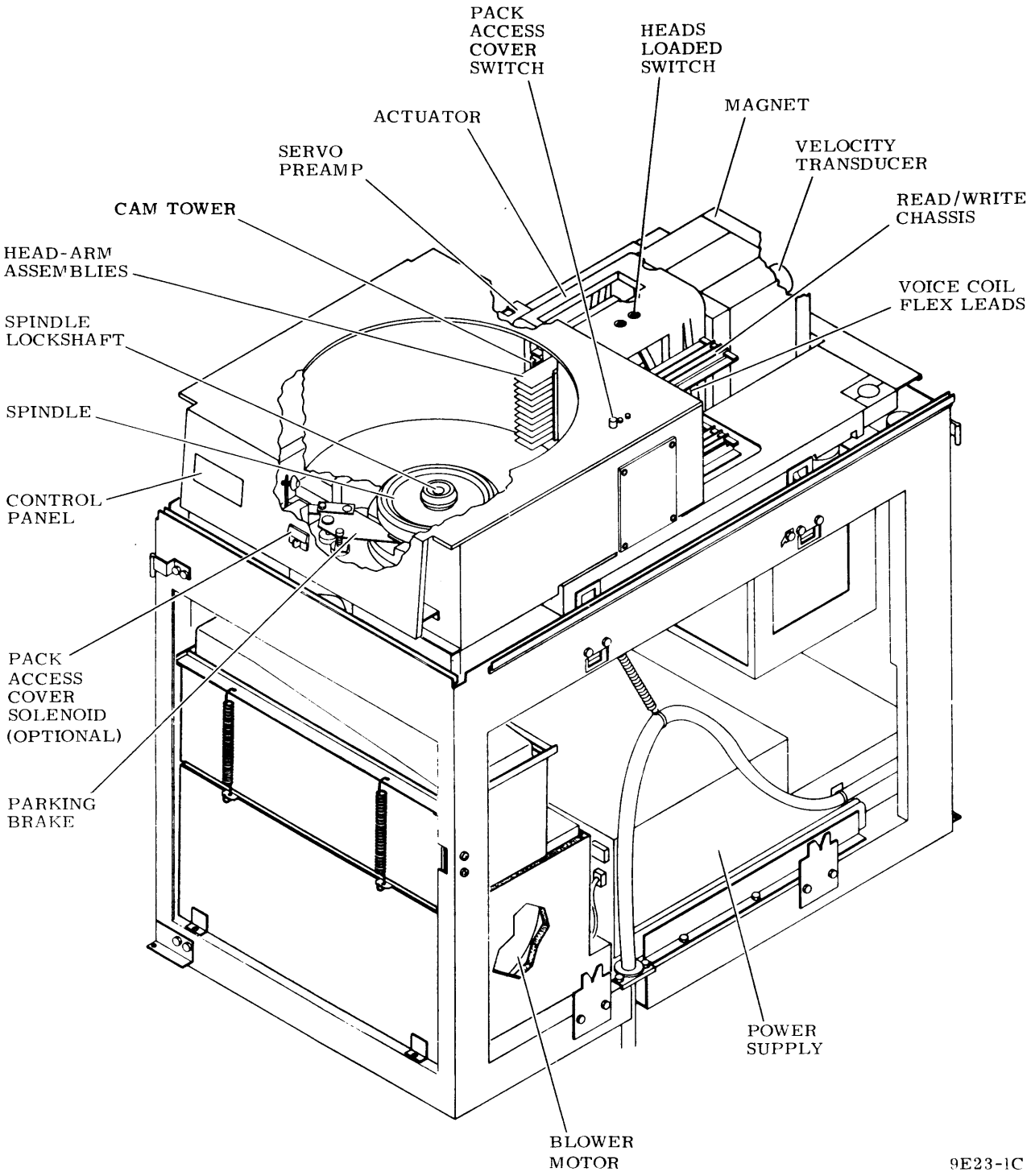
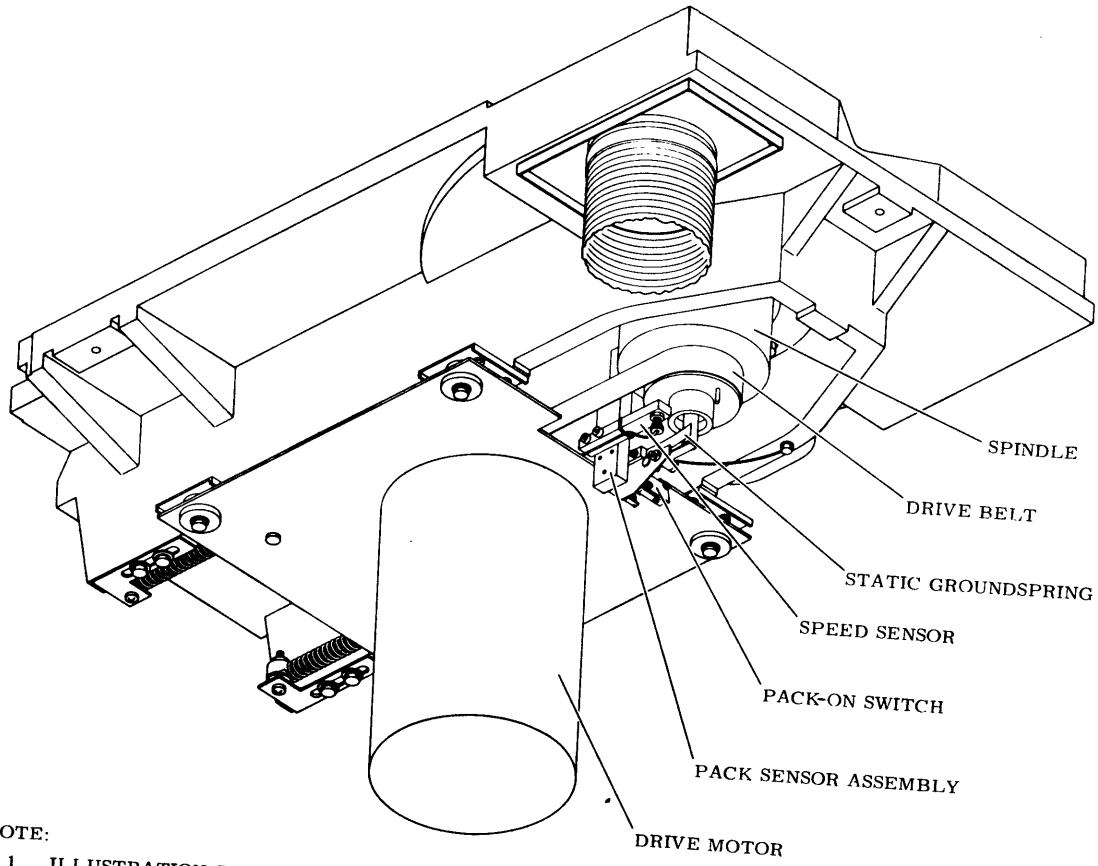


Figure 2F-1. Assembly Locator (Sheet 1 of 2)



NOTE:

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

9E23-2B

Figure 2F-1. Assembly Locator (Sheet 2)

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 drive out of line to remove the top cover.

NOTE

To ease alignment, remove drive belt from spindle pulley before proceeding. Refer to drive belt replacement procedure.

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 the 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.

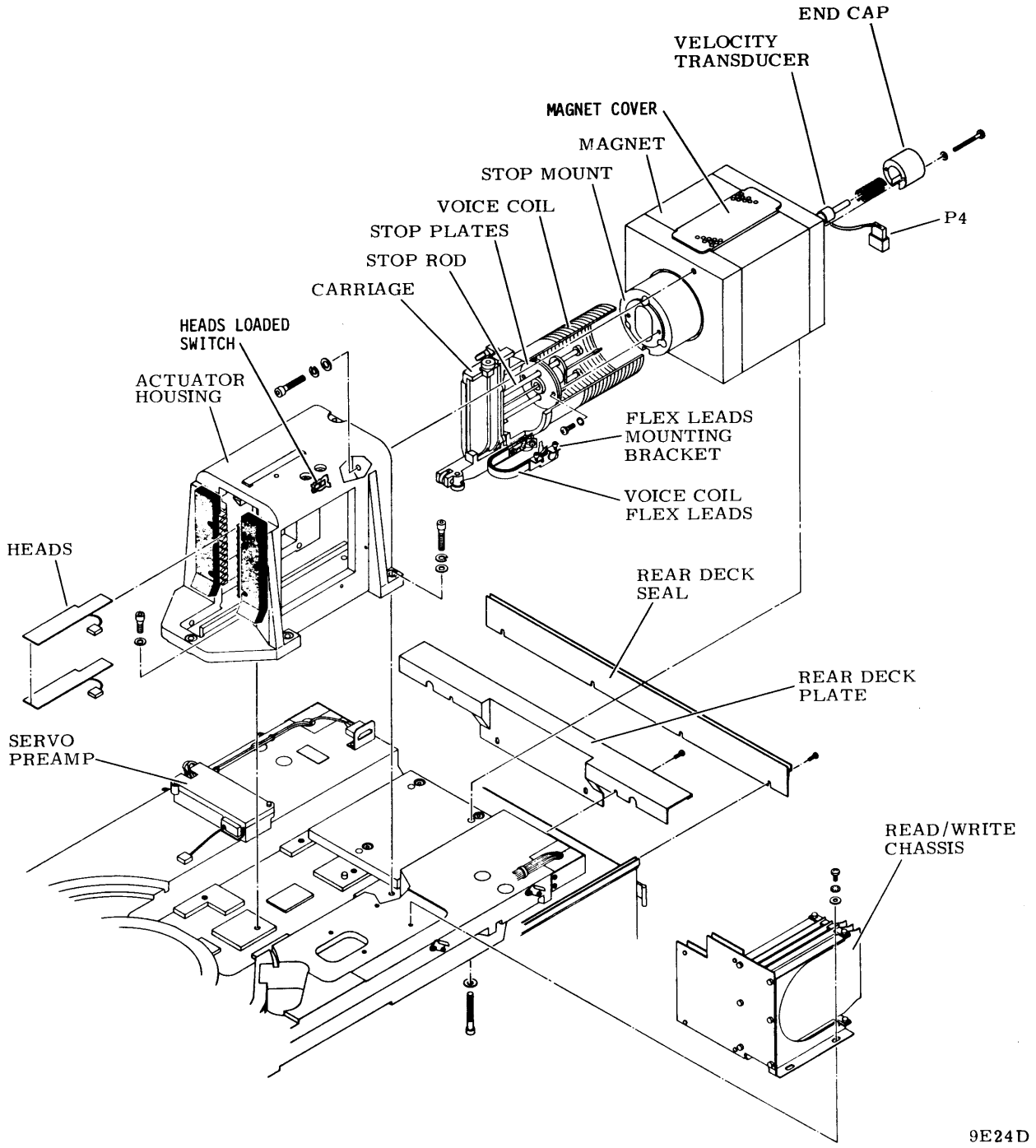


Figure 2F-2. Actuator Replacement

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

d. Move housing to one side leaving leadwires connected.

CAUTION

Remove only one head-arm assembly at a time. As each head-arm assembly is removed, 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 2F-2):

    a. Loosen four screws securing rear deck seal to frame and remove rear deck 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 care 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 2F-2):

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 hub is between 0.05 and 0.1 mm (.002 and .004 in) (refer to figure 2F-3).

    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 carriage from actuator housing.

NOTE

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

    f. Tighten seven screws securing actuator housing to deck. Torque each bolt to 6.8 $\pm$0.5 N·m (60 $\pm$5 lbf·in).

    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.

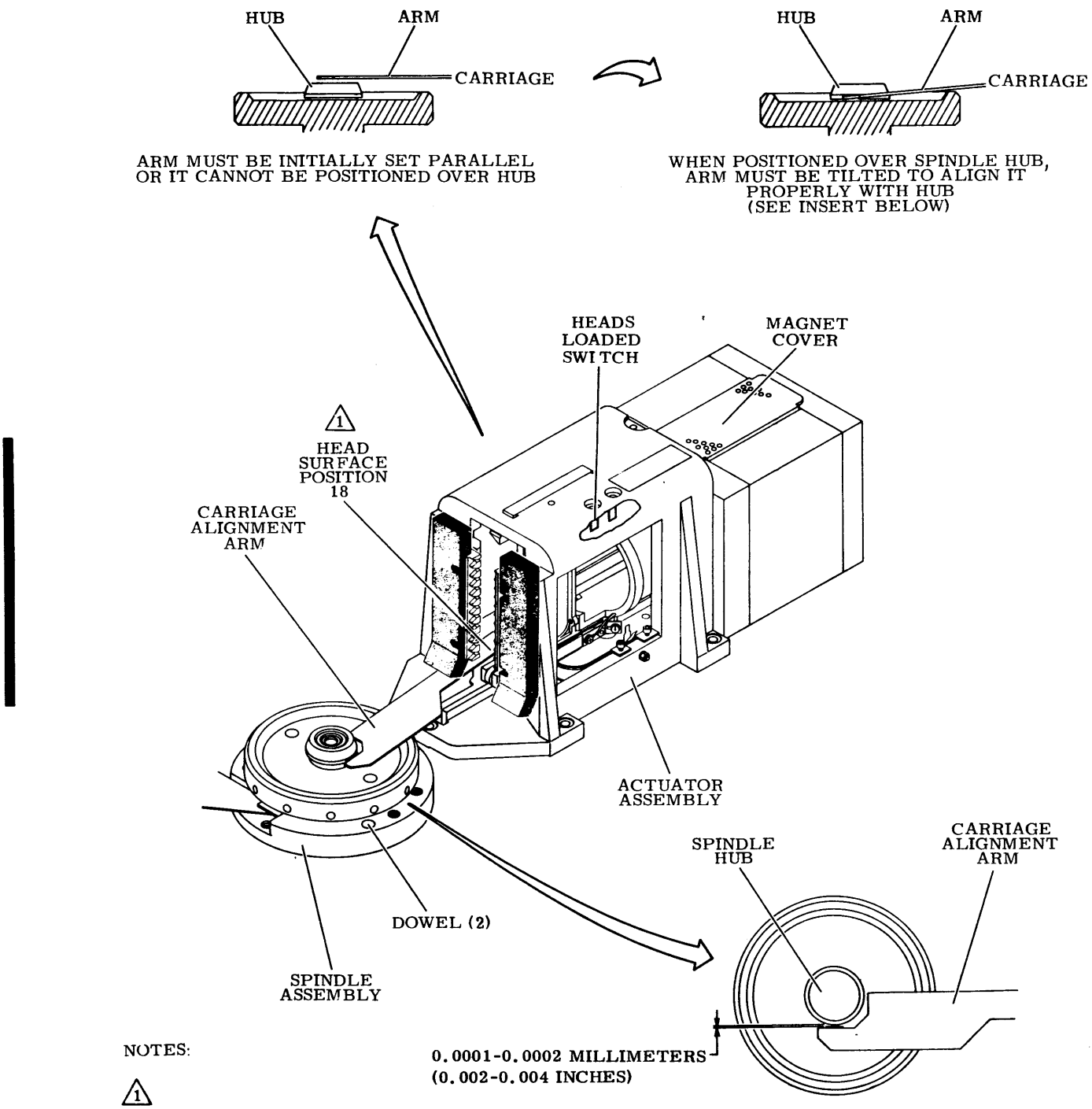


Figure 2F-3. Spindle-to-Carriage Alignment

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 0.15 mm (0.005 in) non-metallic feeler gauge between coil and magnet to ensure that the coil is centered to within 0.25 mm (0.010 in) inside the magnet.

d. Torque screw through top of actuator to 6.8 ±0.2 N·m (60 ±2 lbf·in)

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 3.4 ±0.1 N·m (30 ±1 lbf·in)

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 2F-4) 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.

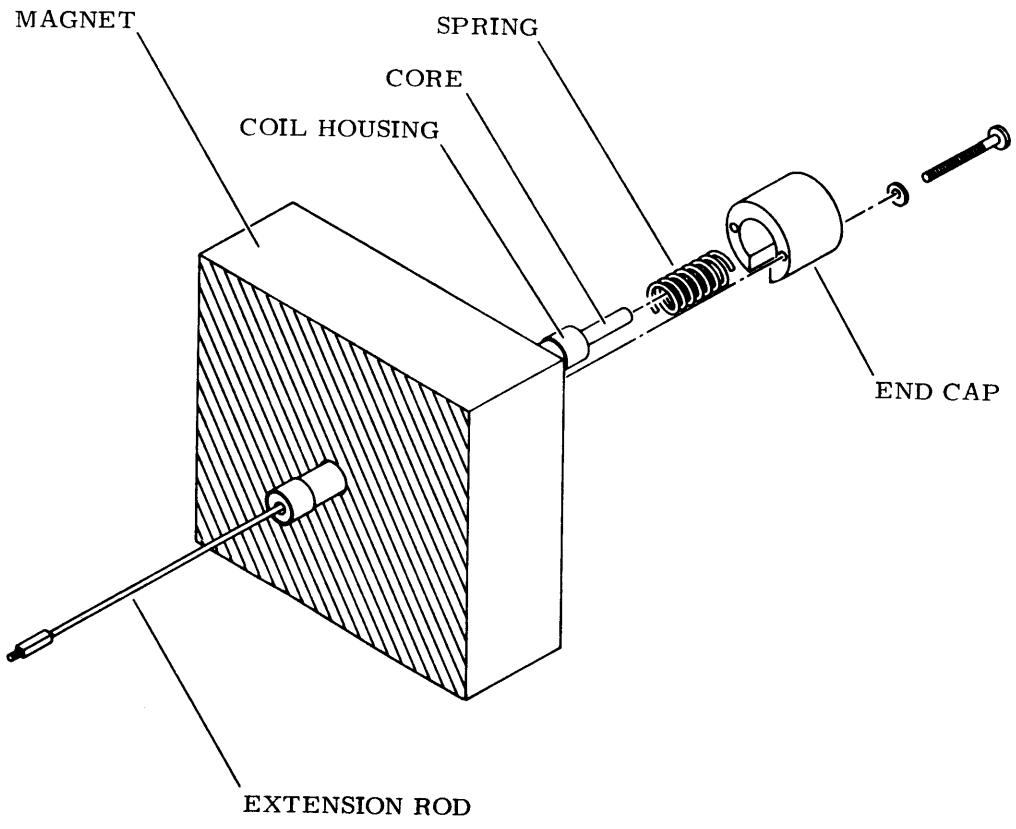


Figure 2F-4. Velocity Transducer Replacement

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 those 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 0.45 N·m (4 lbf·in)

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

d. Install each remaining head by repeating steps a through c.

34. Replace voice coil leadwire.

35. Secure heads loaded switch and voice coil lead wires to side to 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 rear deck plate on deck and securely tightening four screws (refer to figure 2F-2).

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

39. Replace shroud and shroud cover.

40. Replace pack access cover.

NOTE

If it was necessary to move drive from the in-line 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

43. Replace drive belt on spindle pulley and check adjustment. (Refer to drive belt replacement/adjustment procedures).

BLOWER MOTOR REPLACEMENT

The blower motor is located within the blower assembly as shown in figure 2F-5. 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.

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.

CAUTION

Do not stretch plastic hoses when sliding blower out of frame. Overstretching will tear hoses.

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

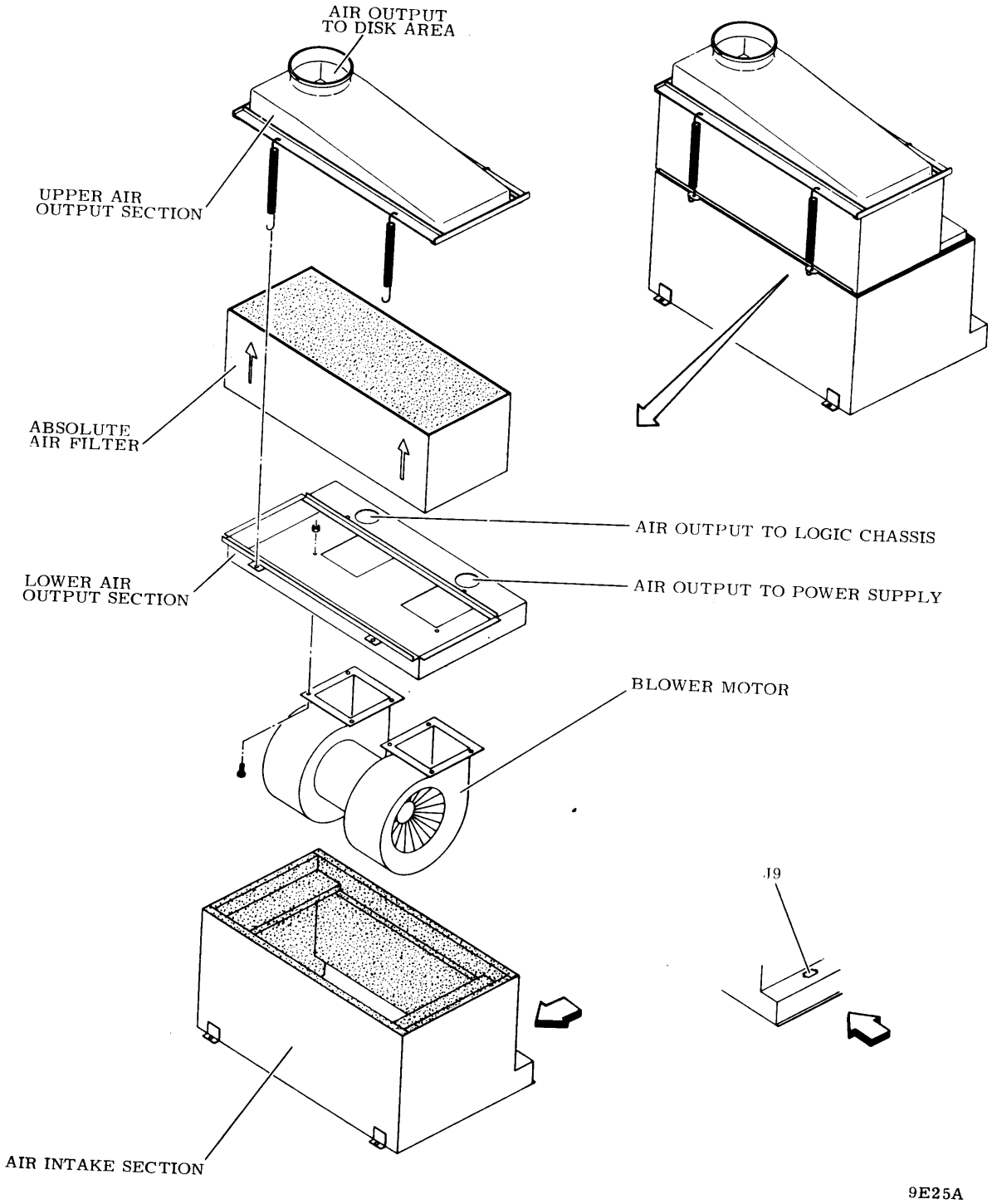


Figure 2F-5. Blower Motor Replacement

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. Detach four springs (or four posts in older units) 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 remover motor.

NOTE

Before beginning reassembly, wipe off disassembled parts with a clean cloth.

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 springs (or four posts in older units).

CAUTION

Following replacement of blower assembly, perform Shroud Cleaning procedure (Section 2B), and then allow the blower 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 counterclockwise into holes. (Refer to figure 2F-5 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 2F-6) 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.

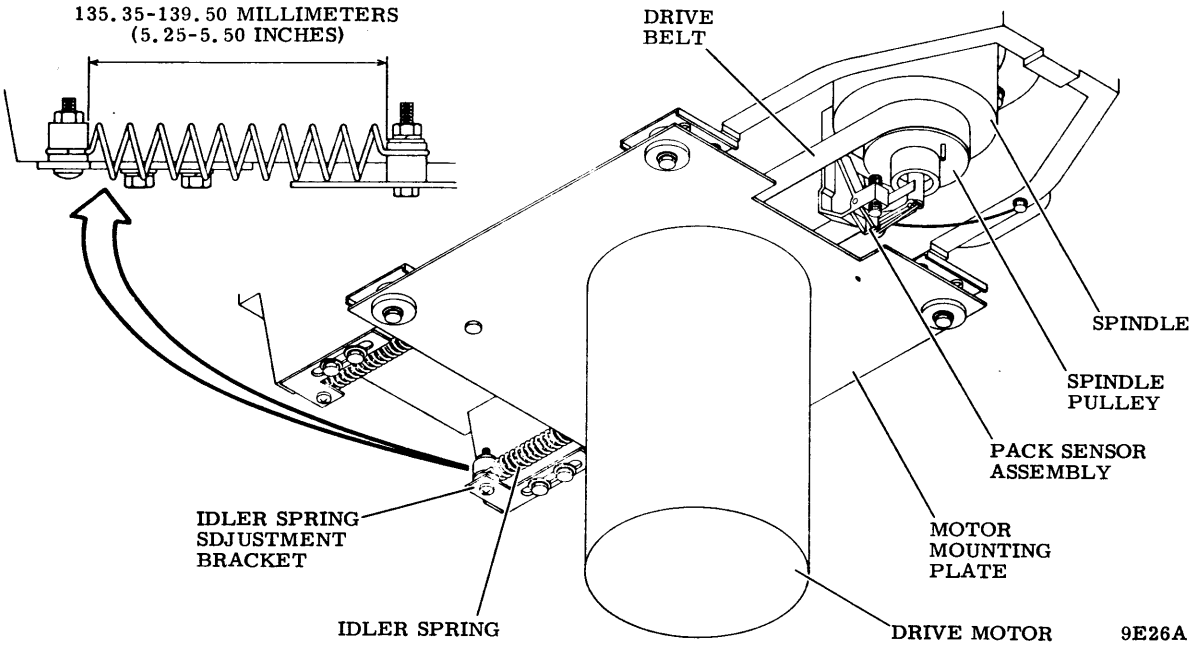


Figure 2F-6. Drive Belt Replacement/Adjustment

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 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 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 2F-6).

   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.

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 2F-6). 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 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 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 2F-6).

   This distance should be from 133 to 140 mm (5.25 to 5.5 in). 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, take it 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 2F-7):

   a. Disconnect drive motor cable plug AIP7 from rear of power supply.

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 2F-7 and secure it with four screws.

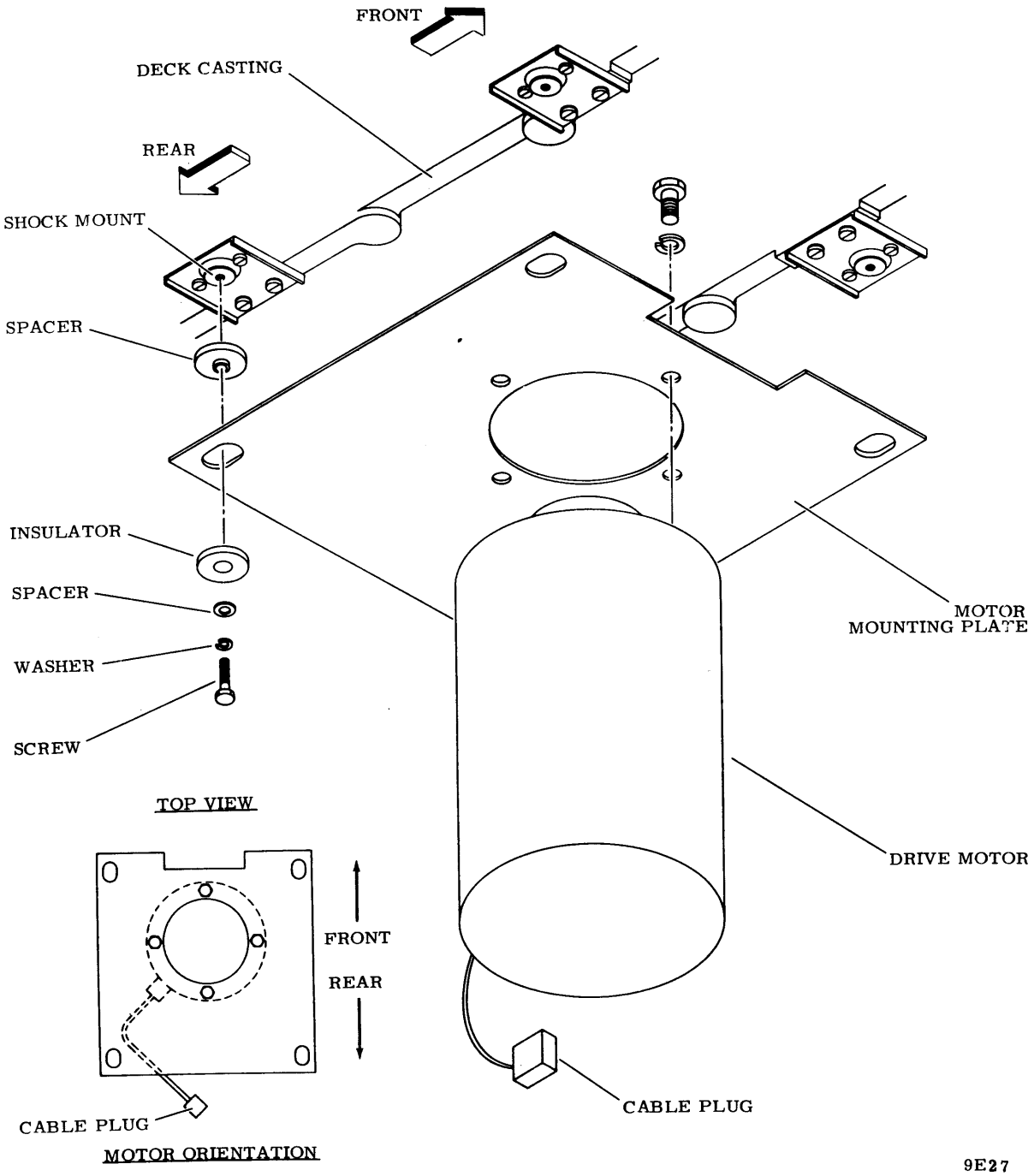


Figure 2F-7. Drive Motor Replacement

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 2F-7 and secure with hardware removed in step 5.

c. Check that motor mounting plate is free to move forward and backward 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 ASSEMBLY REPAIR

GENERAL

The following describes head inspection, head cleaning and gives criteria for determining if a head-arm assembly should be replaced. A procedure for replacing one or more of the head-arm assemblies is also included.

HEAD ARM ASSEMBLIES

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:

CAUTION

If any of the following conditions exist 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.

1. A problem is tracked 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 surface.

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).

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 2F-8, observe the head arm assembly, and perform the suggested remedy as follows:

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.

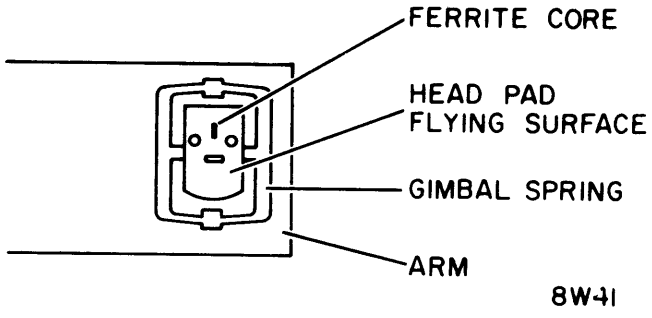


Figure 2F-8. Typical Head Arm Components

Head Cleaning

CAUTION

Head cleaning is a delicate procedure that is not recommended. It should not be undertaken unless it is absolutely necessary, and then it should be performed only by properly trained personnel.

Refer to figure 2F-9 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 nozzle 6 to 13 mm (0.25 to 0.5 in) 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.

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 2F-9.

CAUTION

Take care to avoid using 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 head cleaning solution. (Refer to the list of Maintenance Tools and Materials.)

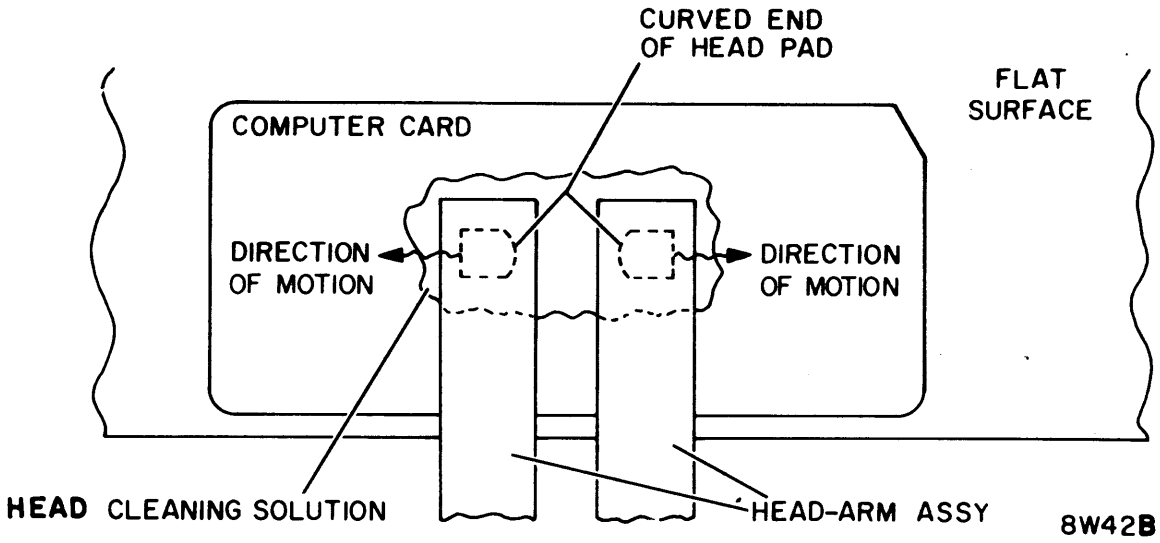


Figure 2F-9. Head Cleaning Motion

CAUTION

Inspect the head 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 2F-9. 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 in step 1.

NOTE

Discoloration of head 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 head 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 2F-10.

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, disconnect head cable plug of head to be removed from XGN card in read/write chassis location E05. 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.

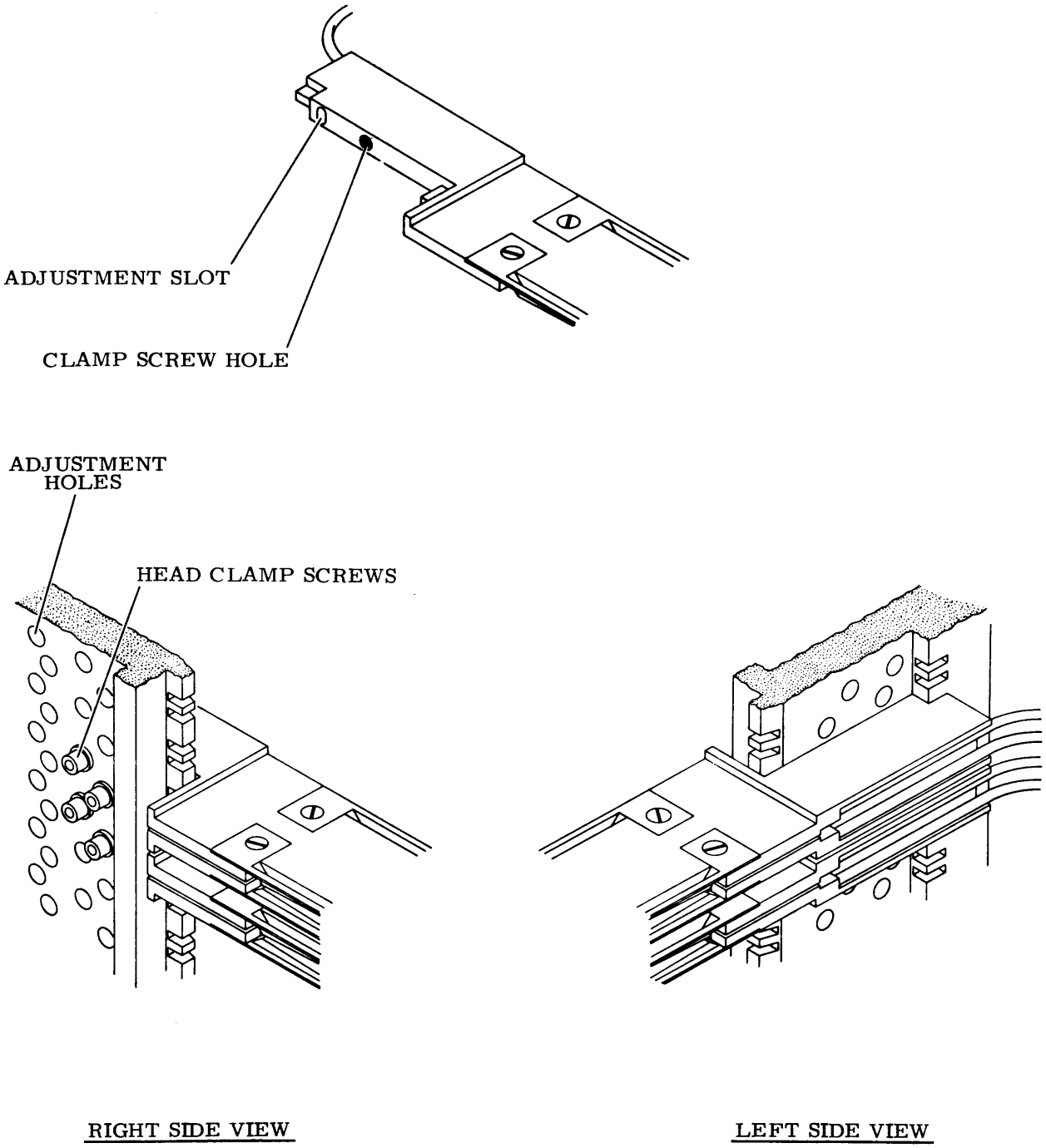


Figure 2F-10. Head-Arm Assembly Replacement

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 0.45 N·m (4 lbf·in).

c. In installing read/write head, 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.

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 13.

a. Using head-arm adjustment tool, center servo head-arm adjustment slot in the head adjustment hole (refer to figure 2F-10).

b. Torque head-arm clamp screw to 1.35 $\pm$0.1 N·m (12 $\pm$0.5 lbf·in).

13. Check alignment of all heads and adjust as necessary (refer to Head Alignment procedure).

CAM TOWER REPLACEMENT

This procedure describes removal and replacement of the cam towers, baffles, and baffle seals. The top cover, pack access cover, shroud, and shroud cover must be removed to gain access to the cam towers. The cam towers snap onto dowel pins on the actuator housing and require no adjustment after installation.

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

2. Open pack access cover, remove pack, close cover and set MAIN AC circuit breaker to OFF.

NOTE

If drive is installed inline 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 cam tower, baffle, and baffle seal to actuator housing.

CAUTION

Before replacing cam towers ensure that mating surfaces of actuator housing and cam towers are clean.

8. Replace baffle and baffle seal by pulling straight off from the cam tower.

9. Remove cam towers from dowel pins on actuator housing.

CAUTION

Before replacing cam towers ensure that mating surfaces of actuator housing and cam towers are clean. Also clean residual foam particles on actuator housing located along sides of cam towers before installing replacement baffles and baffle seals.

10. Install replacement cam towers as follows: (refer to figure 2F-11).

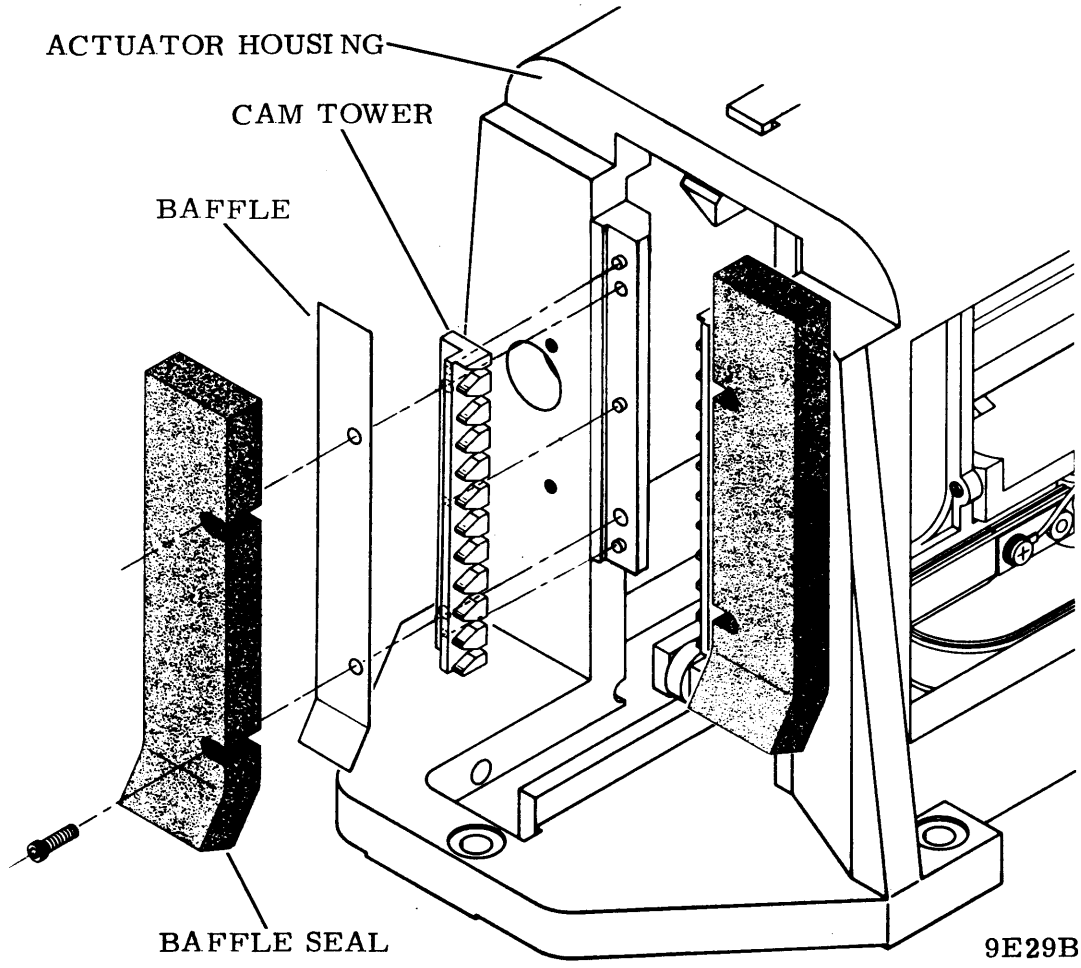


Figure 2F-11. Cam Towers

a. Snap the cam towers onto the three dowel pins located on the actuator housing so they are flush against housing.

NOTE

Before performing step b, if replacing new baffle seals on existing baffles, make sure the baffle is free of any residual foam particles.

b. Attach the baffle seals to the baffles by removing the adhesive strip.

c. Align the baffles to fit flush against the shoulder of the cam tower. Slots cut in the baffle seals must be aligned over the holes in the baffles. (Curved end towards base of actuator housing.

d. Install screws and torque to 0.45 N·m (4 lbf·in).

11. Manually unload heads.

12. Replace shroud and shroud cover.

13. Replace pack access 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. Replace disk pack.

HEADS LOADED SWITCH REPLACEMENT

This switch is mounted on the actuator housing (refer to figure 2F-12) and indicates to the drive logic whether or not the heads are loaded. The following describes the removal and replacement of this switch. This switch also requires adjustment, which is explained in the Heads Loaded Switch 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. Remove disk pack.

3. Open cabinet top cover and remove deck cover.

4. Move carriage back to retracted stop.

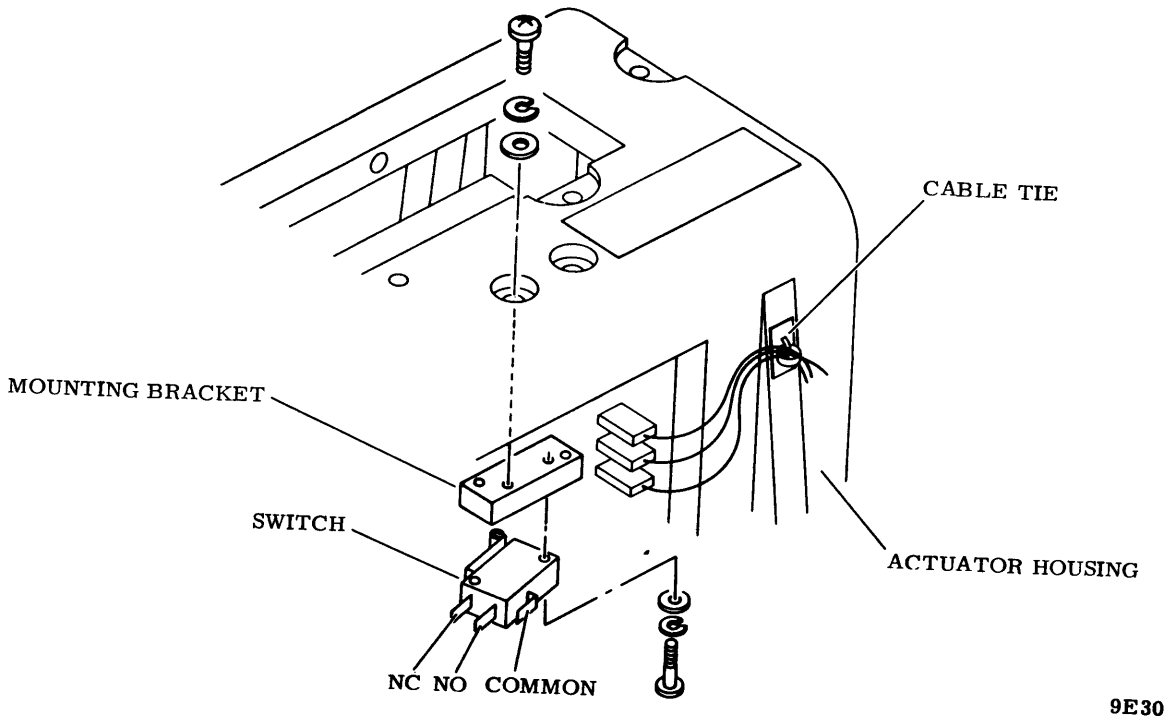


Figure 2F-12. Heads Loaded Switch Replacement

5. Remove heads loaded switch from actuator housing as follows (refer to figure 2F-12):

   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 ohmmeter (set to Rx1 scale) across common and normally closed (NC) terminals of the switch (refer to figure 2F-12).

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 measure distance traveled. If distance is between 2.5 and 5.0 mm (0.1 to 0.2 in) inch 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 gauges together until their combined thickness is from 2.5 to 4.5 mm (0.1 to 0.18 in). Check their thickness with a steel rule.

10. Insert 3.8 mm (0.15 ±0.05 in) shim between stop on magnet and shock stop on carriage assembly (refer to figure 2F-13).

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.

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 2.5 and 5.0 mm (0.1 and 0.2 in) 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 paragraphs.

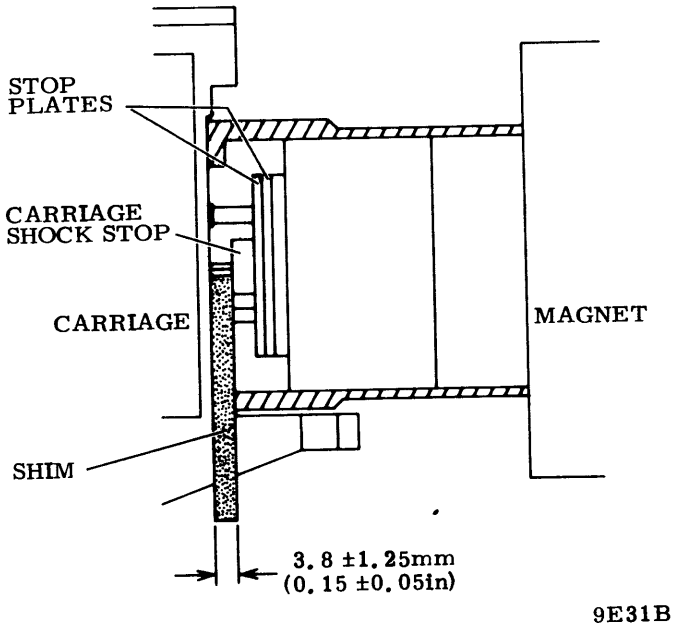


Figure 2F-13. Heads Loaded Switch Adjustment

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 placed 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 2F-14).

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.

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 left 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 2F-14).

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.

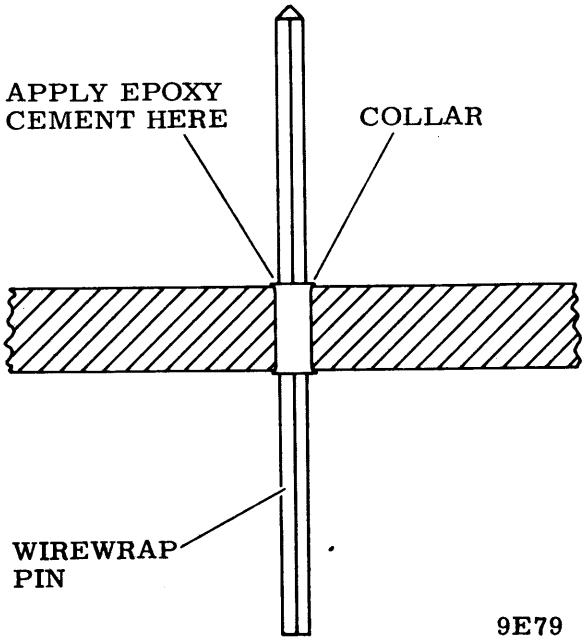


Figure 2F-14. Wirewrap Pin Replacement

WIREWRAP REPLACEMENT

This procedures 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 top wire too. In this case, use care not to damage the top wire.

3. Unwrap each end of wire as follows. Using end of wire-wrap 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 30 mm (1.125 in) 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, leaving a small gap between bottom of post or lower pin 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 2F-15).

5. Snap operator control panel out of its position in shroud cover (refer to figure 2F-15).

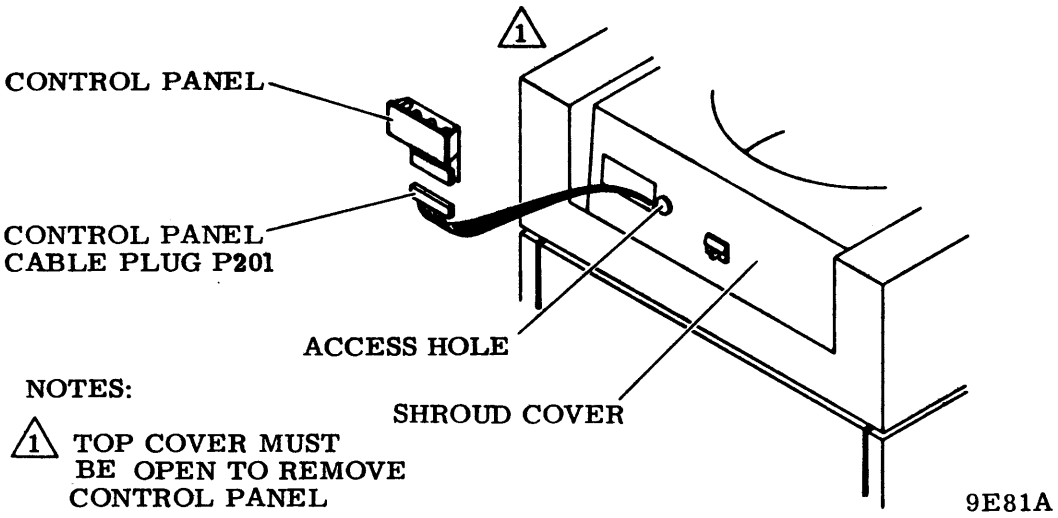


Figure 2F-15. Operator Control Panel Replacement

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 2F-16) and prevents the pack access cover from being opened while the spindle is turning. The following steps describe replacement, and adjustment is covered in the Pack Access Cover Solenoid 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. 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 beneath 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.

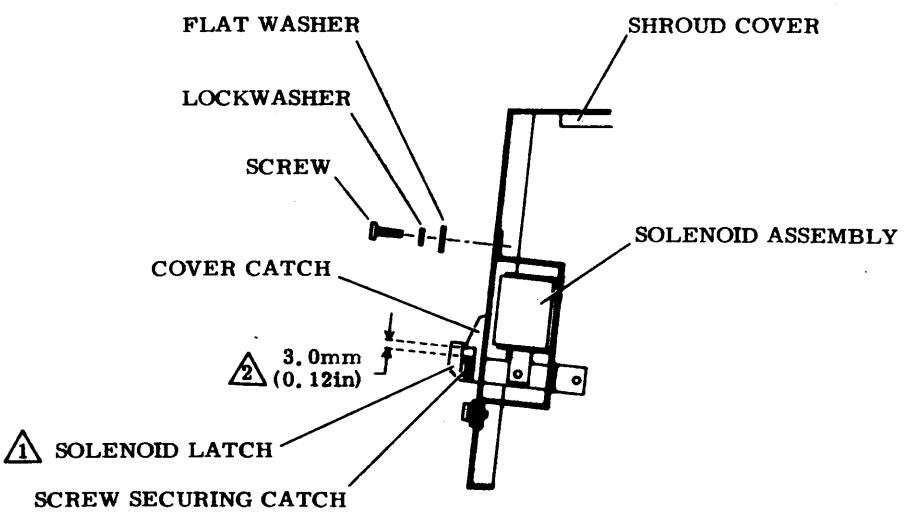
13. Replace operator control panel in shroud cover.

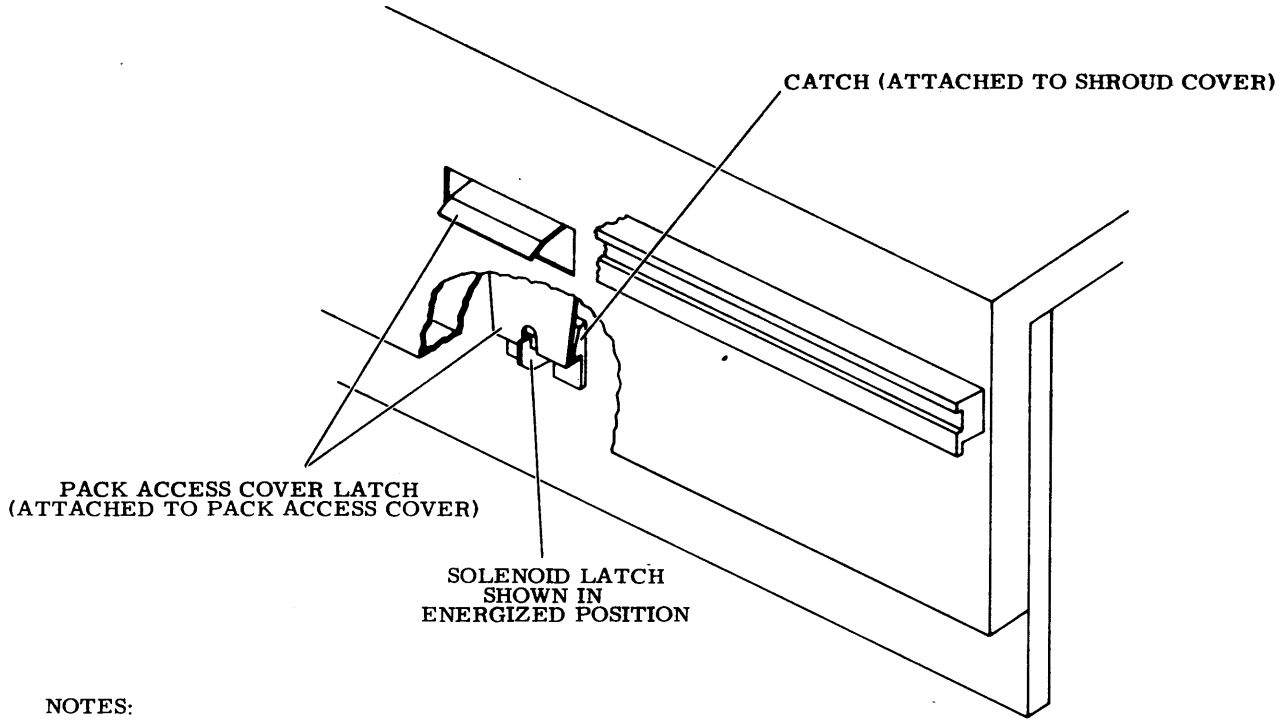
NOTE

If is 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.





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 2F-16. Pack Access Cover Solenoid Replacement/Adjustment

PACK ACESS COVER SOLENOID ADJUSTMENT

This adjustment consists of moving the solenoid assembly (installed on the shroud cover) up or down until the clearance between it and the cover catch is correct. When this 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, then measuring distance between it and catch on shroud cover (refer to figure 2F-16).

6. If distance measured in step 5 is as indicated on figure 2F-16 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 2F-17. 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.

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 2F-17):

   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.

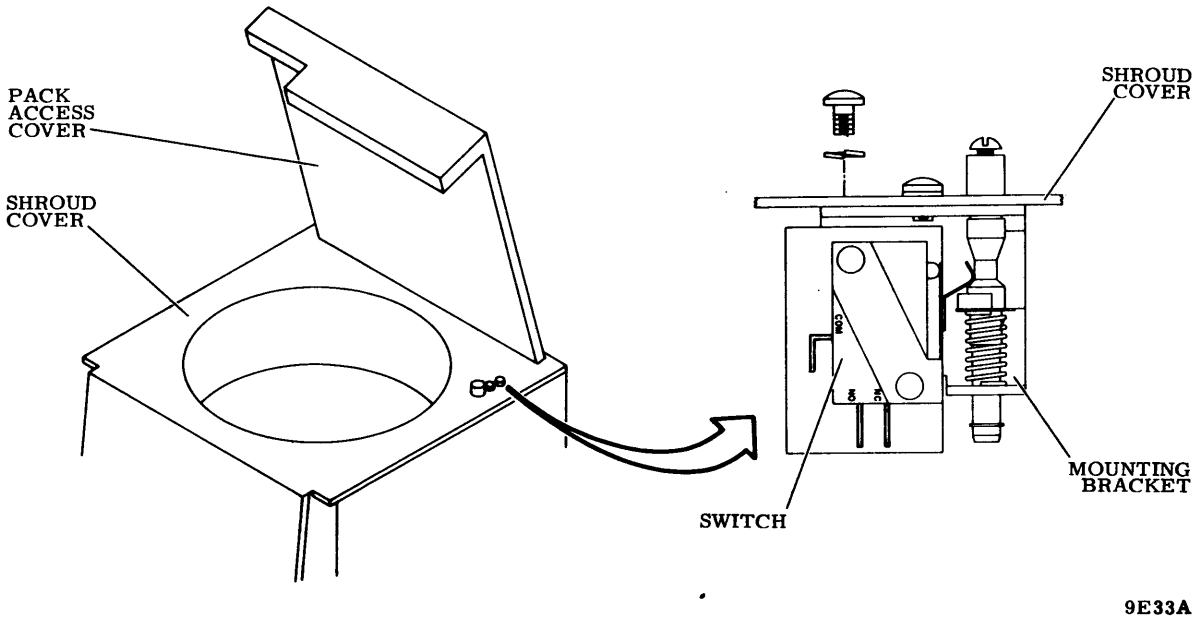


Figure 2F-17. Pack Access Cover Switch Replacement

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

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 2F-18).
6. Remove two screws, washers, 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.

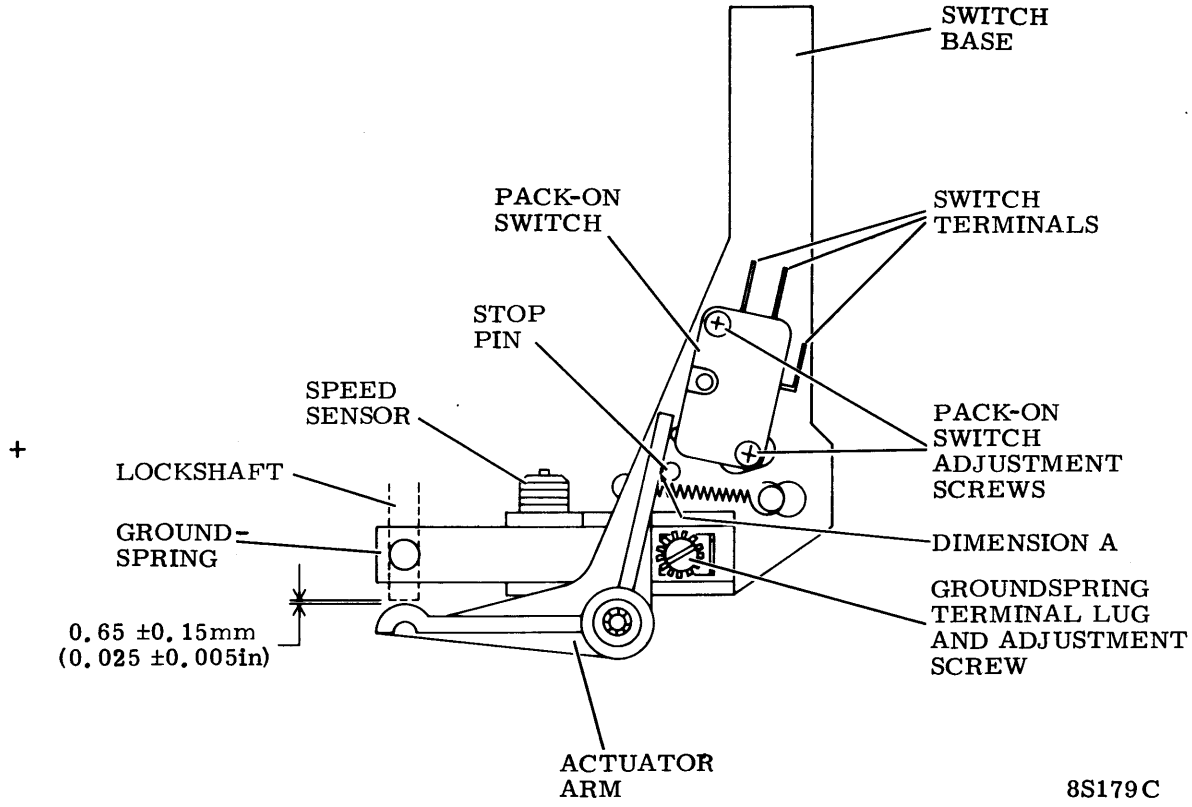


Figure 2F-18. Pack On Switch Replacement/Adjustment

ADJUSTMENT

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 2F-18). Disconnect wires at switch terminals.

6. Dimension between actuator arm and lockshaft must be as specified in figure 2F-18. 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 2F-18).

8. Position switch base bracket until dimension between actuator arm and lockshaft is as specified in figure 2F-18. Tighten screws.

9. Connect a multimeter (set to Rxl) to pack sensor switch terminals (figure 2F-18). 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 0.3 mm (0.011 in.) thick feeler gauge between actuator arm and stop pin (dimension A of figure 2F-19).

12. Multimeter must indicate infinity. If not, go to step 13. If correct, remove feeler gauge 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 gauge. 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 Groundspring 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. The two main elements of the pack sensor assembly are the static groundspring 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

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 (figure 2F-19) as follows:

   a. Disconnect static groundspring leadwire from terminal on ground spring.

   b. Cut tie wrap on leadwires.

   c. Note leadwire connections and disconnect leadwires from pack on switch.

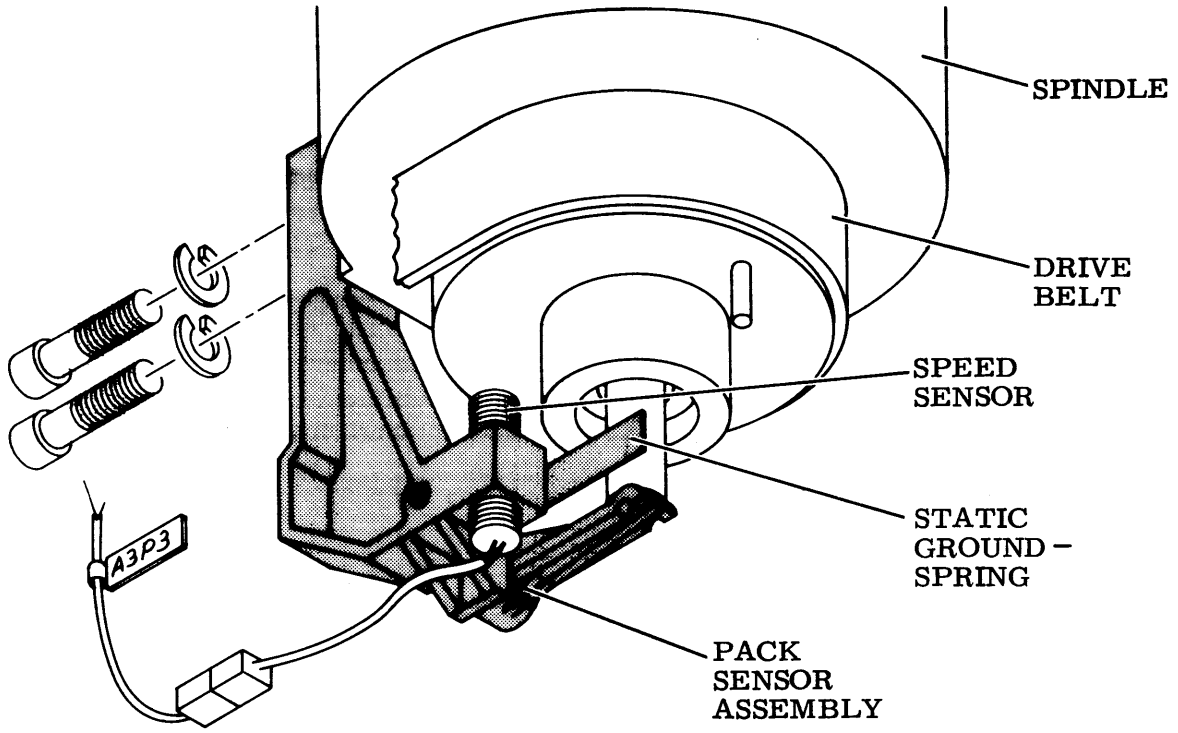
   d. Disconnect speed sensor cable plug.

   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.



NOTES: 1. SHADED AREAS REPRESENT PACK SENSOR ASSEMBLY.

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Figure 2F-19. Pack Sensor Assembly Replacement

b. Replace drive belt (refer to figure 2F-6 Drive Belt Replacement).

c. Connect speed sensor cable plug A3P3.

d. Connect leadwires to pack on switch and static ground-spring 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 2F-20). It is necessary to remove only the brake cover plate to access the parking brake for removal and replacement. Adjustment 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 2F-20) 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.

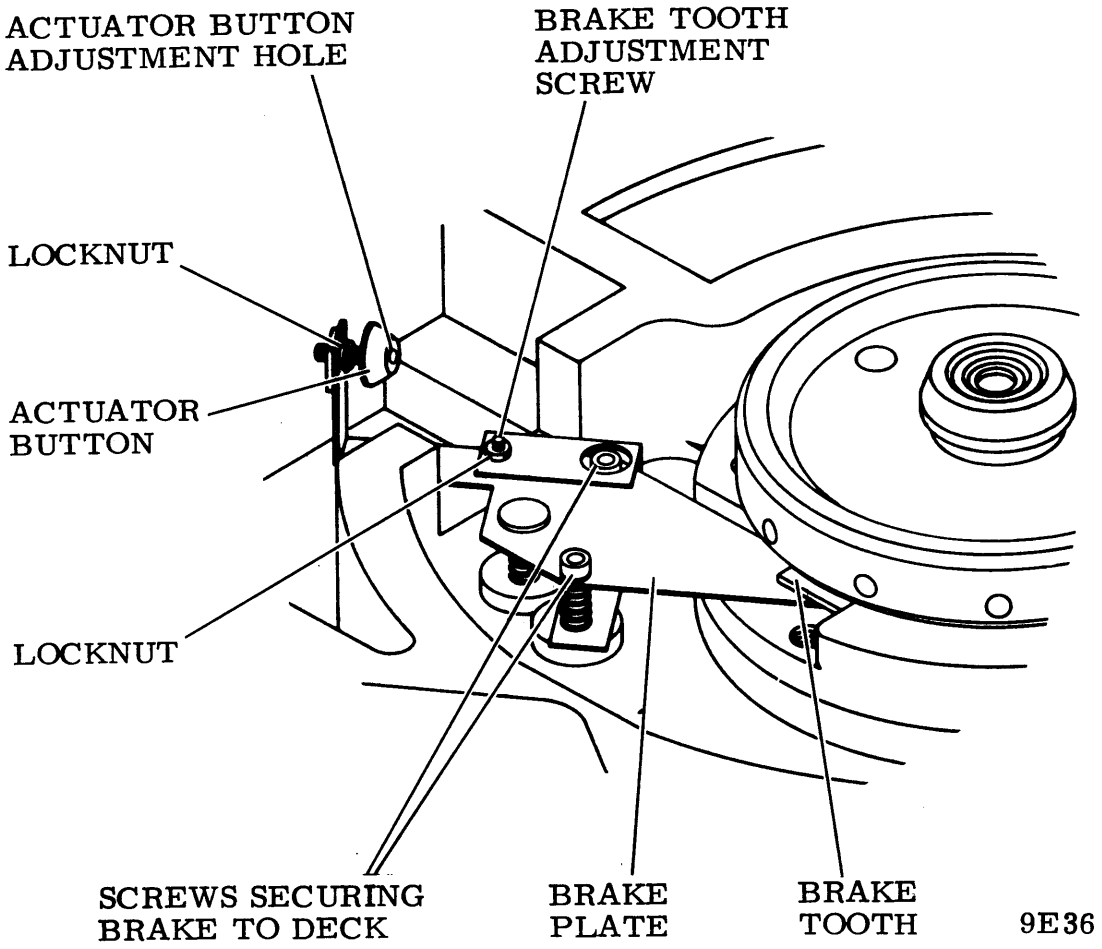


Figure 2F-20. Parking Brake Replacement/Adjustment

PARKING BRAKE ADJUSTMENT

The parking brake has two adjustments (refer to figure 2F-20); they 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 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 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 0.15 to 0.5 mm (0.005 to 0.020 in). 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 0.15 to 0.5 mm (0.005 to 0.020 in). 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 gauge. However, a suitable tool can be constructed by taping the proper feeler gauge 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 0.25 and 0.5 mm (0.01 and 0.02 in). 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 0.25 and 0.5 mm (0.01 and 0.02 in). 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 2F-21). 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, pull it 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.

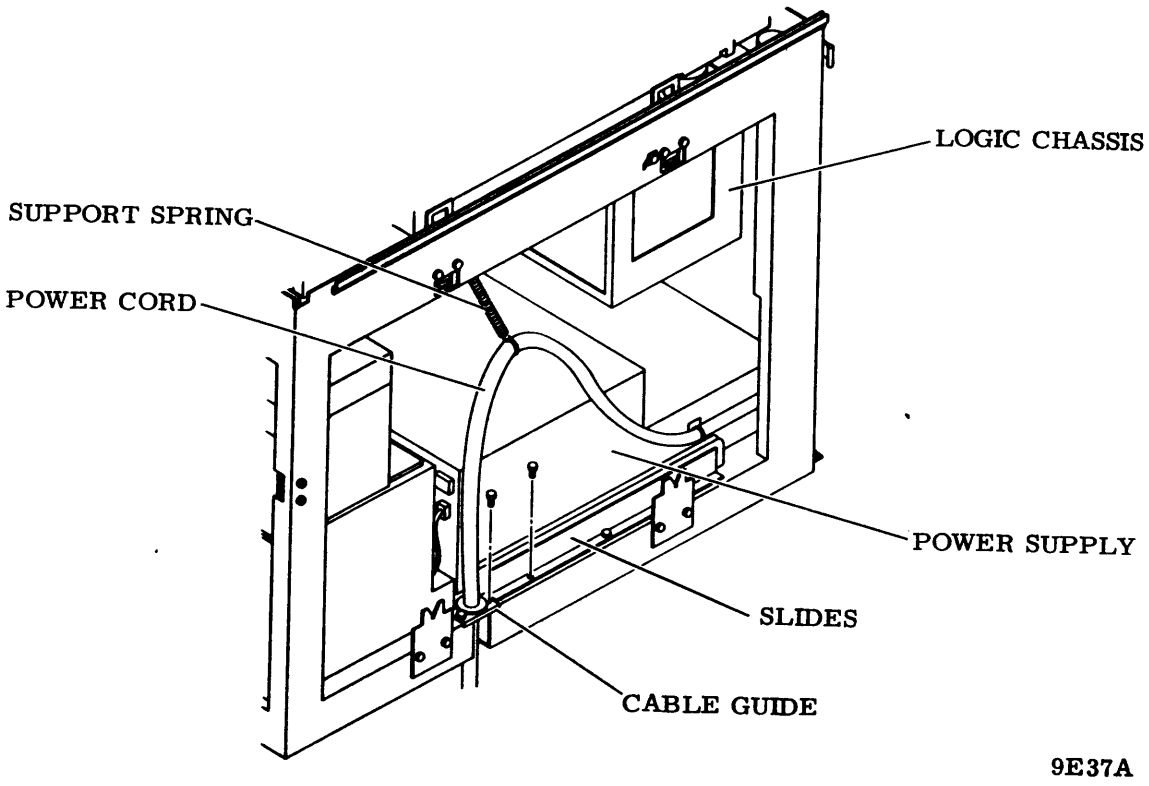


Figure 2F-21. Power Supply Assembly Replacement

5. Disconnect five plug connectors to power supply. Also disconnect air hose by turning in counterclockwise direction until it comes free.

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

7. Remove power supply top cover.

8. Disconnect ac and dc ground straps (refer to figure 2F-22) 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 2F-22.

12. Connect power wiring as described in AC Power Wiring discussion in the Installation and Checkout section of the manual.

13. Replace top cover on power supply.

14. Reconnect five plugs to power supply. Also reconnect air hose by screwing it clockwise into hole.

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.

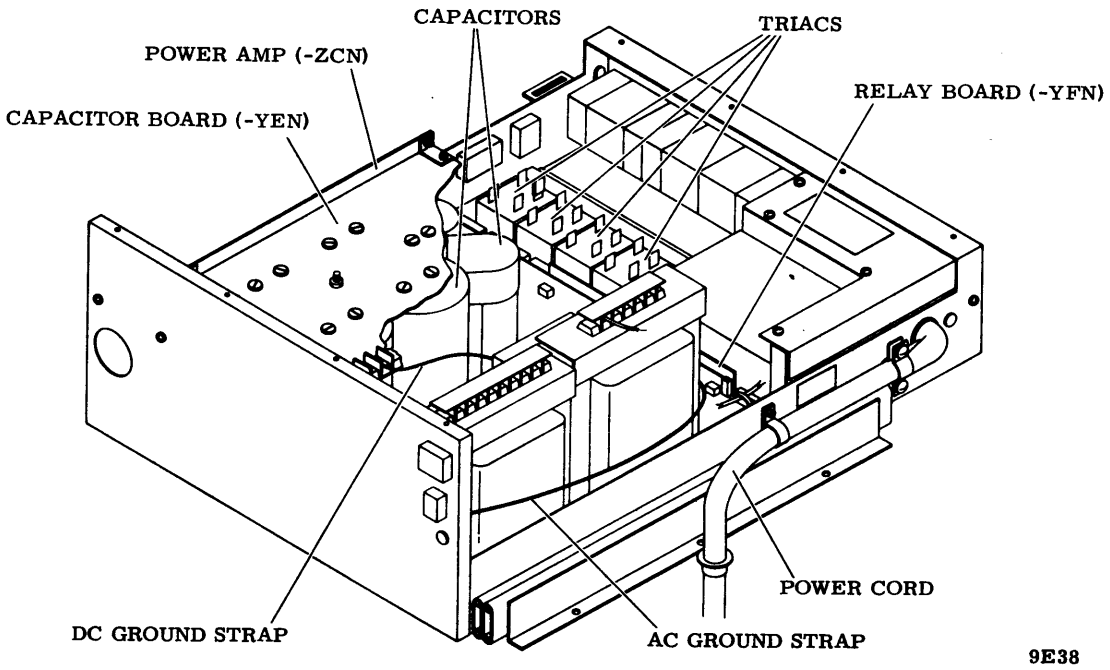


Figure 2F-22. Power Supply Card Replacement

19. Perform following procedures:

    a. +5 volt and -5 volt Test and Adjustment.

    b. DC Voltage Output Check.

_ZCN (POWER AMPLIFIER) CARD REPLACEMENT

The following procedure describes removal and replacement of only the _ZCN card (refer to figure 2F-22).

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. 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 2F-22).

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.

_YFN (RELAY BOARD) REPLACEMENT

The following procedure describes removal and replacement of the _YFN card (refer to figure 2F-22).

CAUTION

Observe precautions described in discussion on Handling Electrostatic Devices in section 2A, when working with _YFN card.

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, complete the following procedures:

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 silicon 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 2F-23).

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 2F-23):

   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. Note connections and remove head cable plugs from _XGN card starting with top plug.

   d. Remove four screws and washers securing read/write chassis to deck and remove chassis from deck.

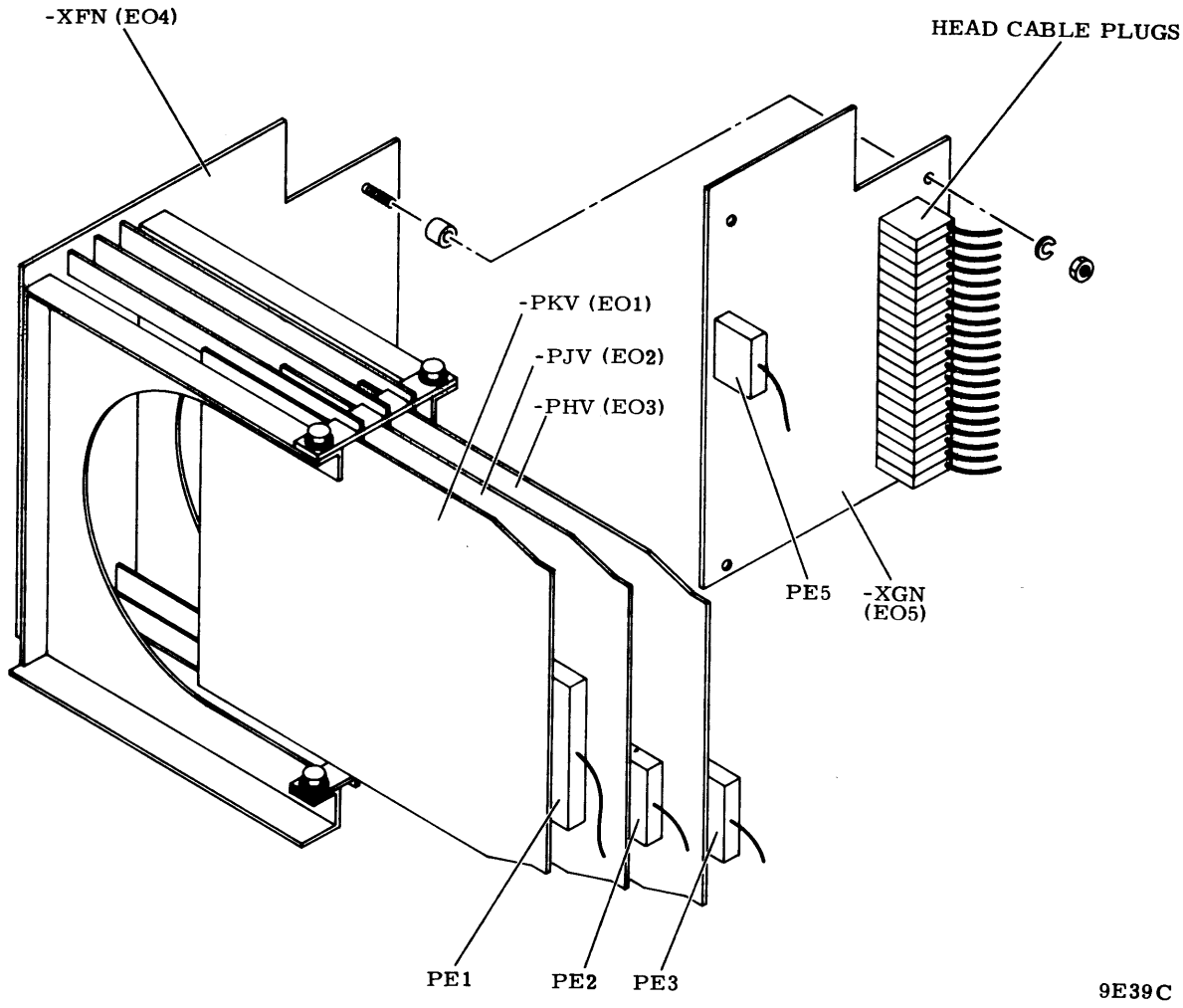


Figure 2F-23. Read/Write Chassis Card Replacement

5. Remove _XGN card from mother board as follows (refer to figure 2F-23):

   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 that 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 while 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. Replace cards E01, E02 and E03 in read/write chassis.

   e. 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 2F-23) 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 2F-24). Replacing the board involves removing the board from the preamp housing.

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.

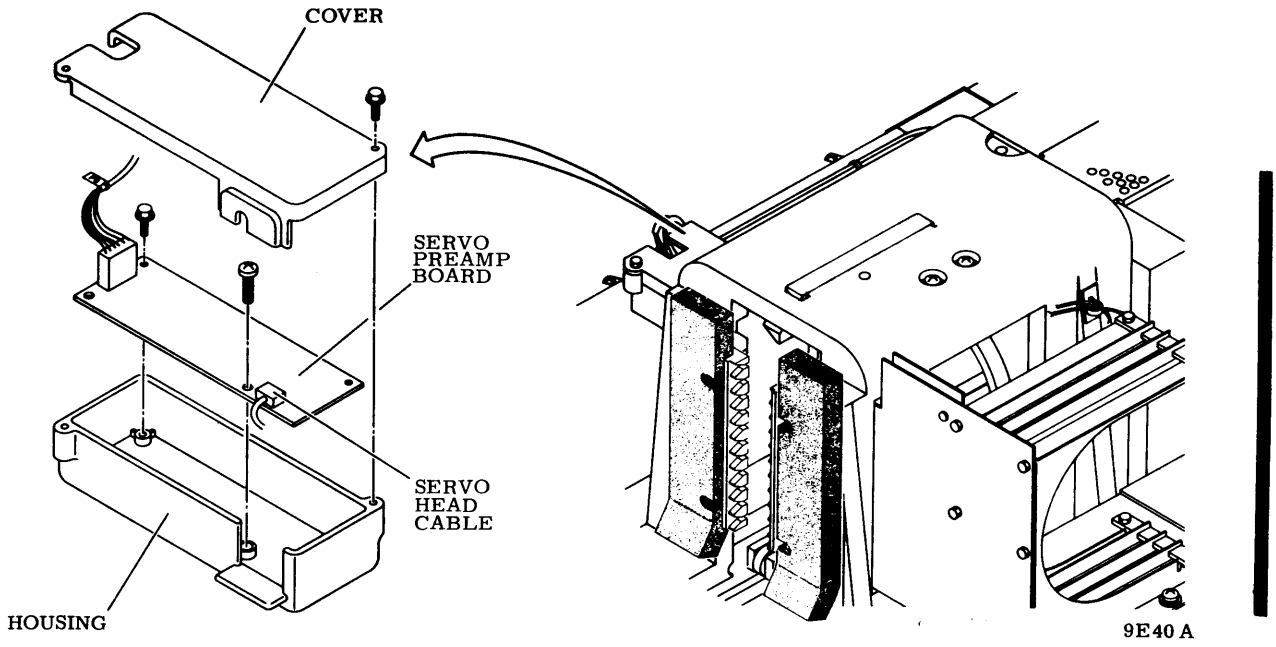


Figure 2F-24. Servo Preamp Board Replacement

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.

   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

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. Open cabinet front door.

4. Remove blower assembly (refer to Blower Motor Replacement procedure step 4).

5. Refer to figure 2F-25 and 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.

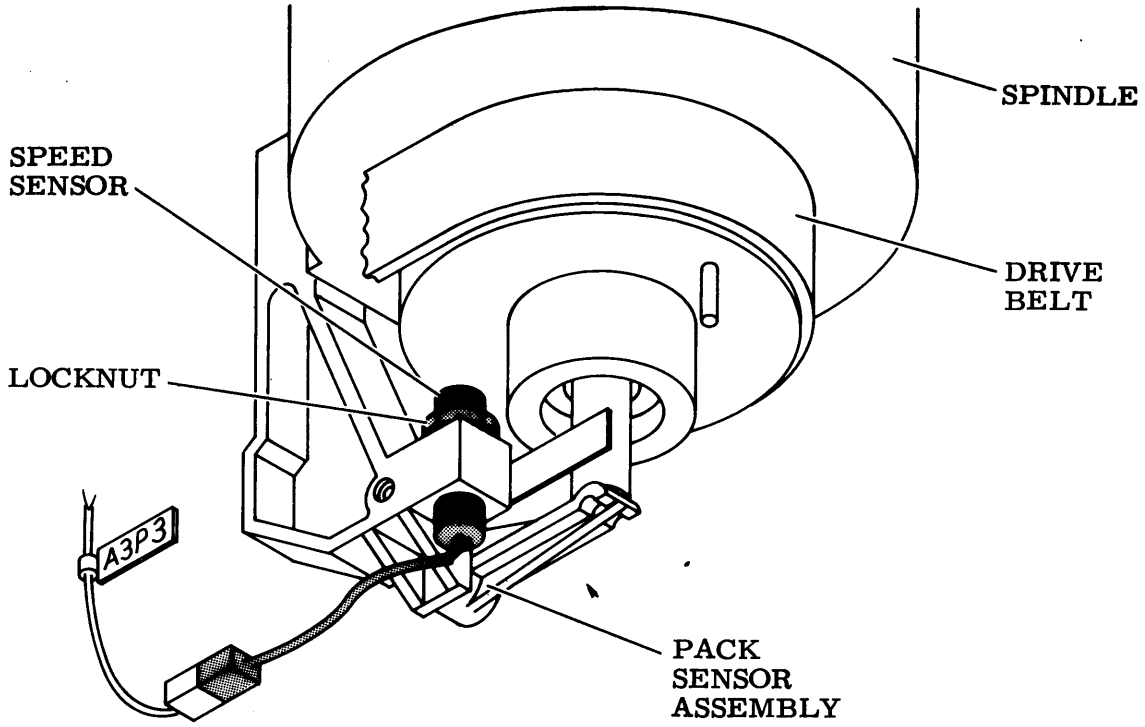
6. Replace speed sensor assembly as follows:

   a. Install new speed sensor in switch base.

   b. Reinstall locknut on speed sensor. Torque to maximum 0.6 N·m (5 lbf·in).

   c. Connect speed sensor cable plug A3P3.

   d. Secure speed sensor leadwire to speed sensor switch base with a tie wrap.



NOTES: 1. SHADED AREAS INDICATE SPEED SENSOR ASSEMBLY.

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Figure 2F-25. Speed Sensor Assembly Replacement

e. Perform speed sensor adjustment.

SPEED SENSOR ASSEMBLY ADJUSTMENT

The speed sensor assembly must be adjusted whenever the spindle assembly, pack sensor 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

1. Stop spindle motor.

2. Remove disk pack.

3. Set UNIT POWER circuit breaker to off.

4. Use feeler gauge to ensure that gap between sensor tip and pin is 0.5 ±0.05 mm (0.019 ±0.003 in) (figure 2F-26).

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

Do not over tighten locknut in next step, or you might damage plastic threads.

   c. Torque locknut to 0.6 ±0.1 N·m (5 ±1 lbf·in).

   d. Recheck dimension of gap.

6. Perform Speed Sensing procedure of miscellaneous Logic Checkout (in Section 2D).

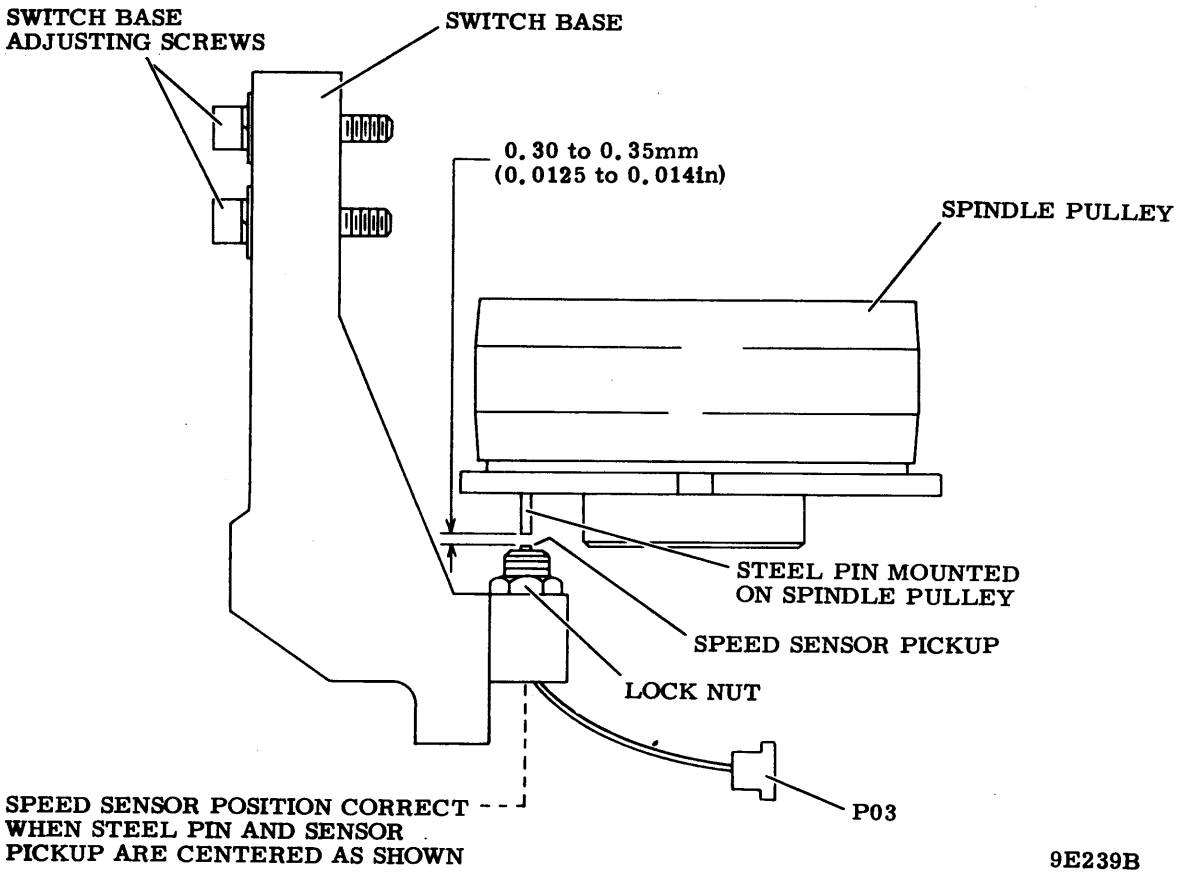


Figure 2F-26. Speed Sensor Assembly Adjustment

SPINDLE LOCKSHAFT REPLACEMENT

The lockshaft is located within the spindle assembly (refer to figure 2F-27); however, the lockshaft is removed without removing the spindle. There is no adjustment for the lockshaft replacement.

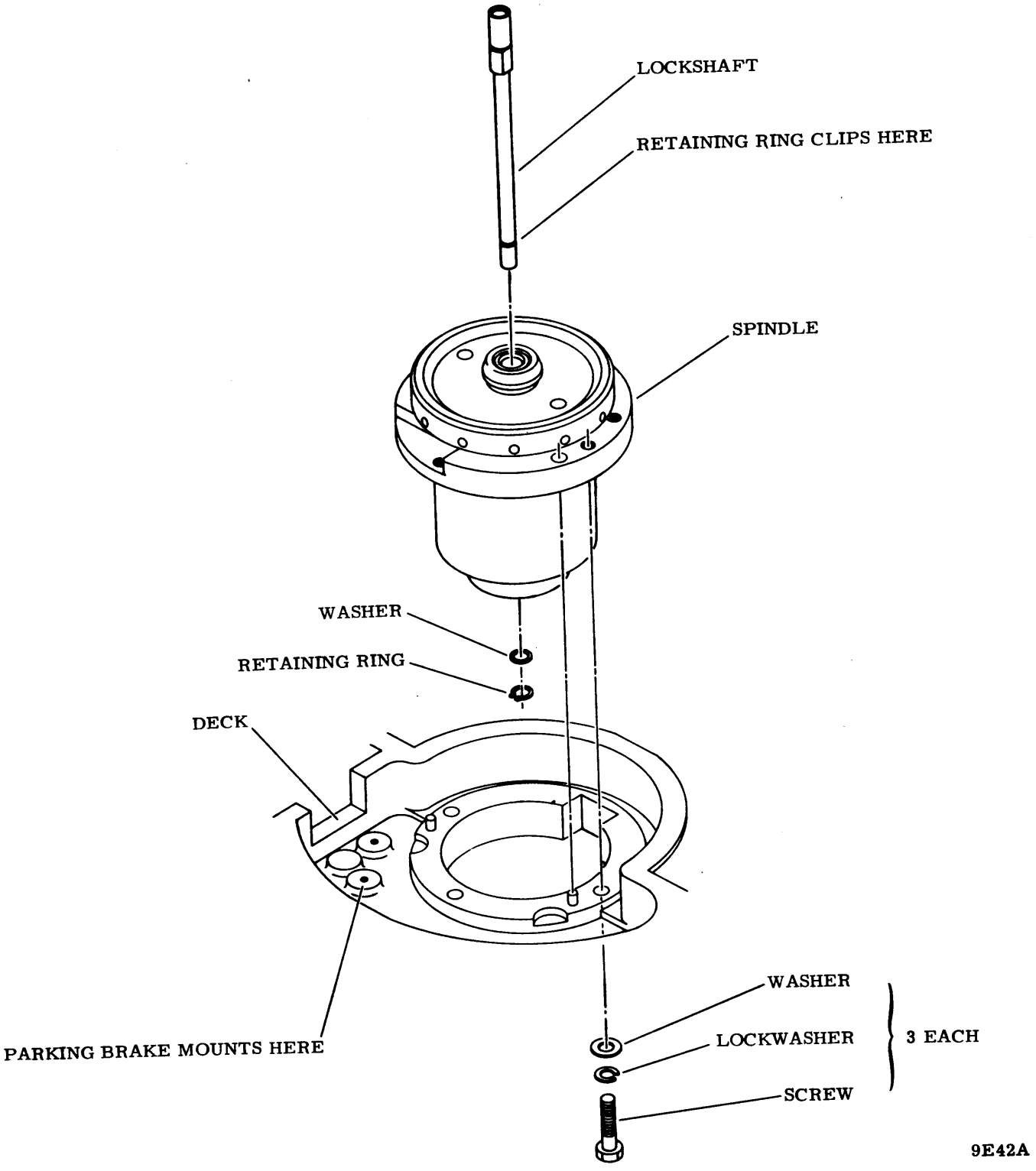


Figure 2F-27. Spindle and Lockshaft Replacement

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.

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. 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. Remove pack sensor assembly (refer to pack sensor assembly replacement).

NOTE

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

6. Remove retaining ring and flat washer from lower end of lockshaft (refer to figure 2F-27).

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. 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 ground spring.

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.

SPINDLE ASSEMBLY REPLACEMENT

The spindle assembly (refer to figure 2F-27) 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. 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.

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 2F-6).

   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 2F-20):

   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 2F-27):

    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 2F-18. 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 groundspring 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 2F-28).

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 2F-3):

   a. Install carriage alignment arm in surface position 18 and at an angle approximately parallel to the deck. Torque clamp screw to 0.5 $\pm$0.1 N·m (4 $\pm$0.5 lbf·in).

   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 2F-3, then torque clamp screw to 0.5 $\pm$0.1 N·m (4 $\pm$0.5 lbf·in).

   d. Close top cover thus allowing pack access cover to fully open.

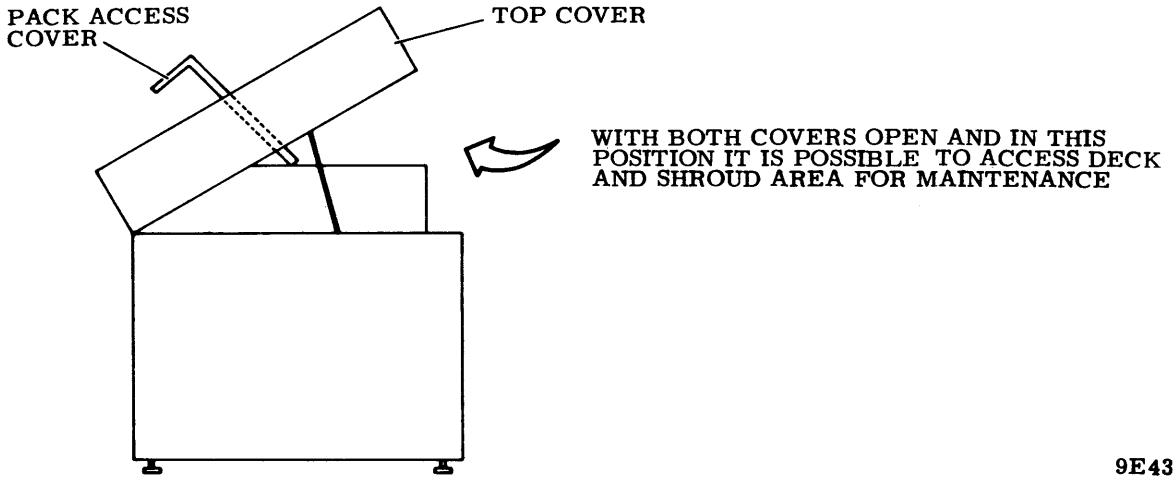


Figure 2F-28. Cabinet with Pack Access and Top Cover Open

6. Check to see if clearance between carriage alignment arm and spindle hub is as specified in figure 2F-3. 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 2F-28.

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 2F-28.

12. Install and position carriage alignment are as instructed in step 5.

13. Close top cover allowing pack access cover to fully open.

14. Loosen three screw 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, 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 2F-3.

16. Align spindle to carriage by moving actuator housing as follows:

    a. Move spindle until dowel pins (refer to 2F-3) 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 2F-28.

    c. Unload heads and remove carriage alignment arm.

    d. Close pack access and top covers.

    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 2F-28.

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.

STATIC GROUNDSPRING REPLACEMENT

The static groundspring is mounted on the static groundspring 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. This is described in the Static Groundspring Adjustment procedure.

REPLACEMENT

1. Stop spindle motor.

2. Remove disk pack.

3. Set UNIT POWER circuit breaker to off

4. Refer to Side Panel Removal/Installation procedure and remove left (viewed from front) side panel.

5. Refer to figure 2F-29 and remove static ground spring leadwire.

6. Remove self threading screw, lockwasher, terminal lug, and groundspring from switch base bracket.

7. Install replacement groundspring on switch base bracket using screw, lockwasher, and terminal lug.

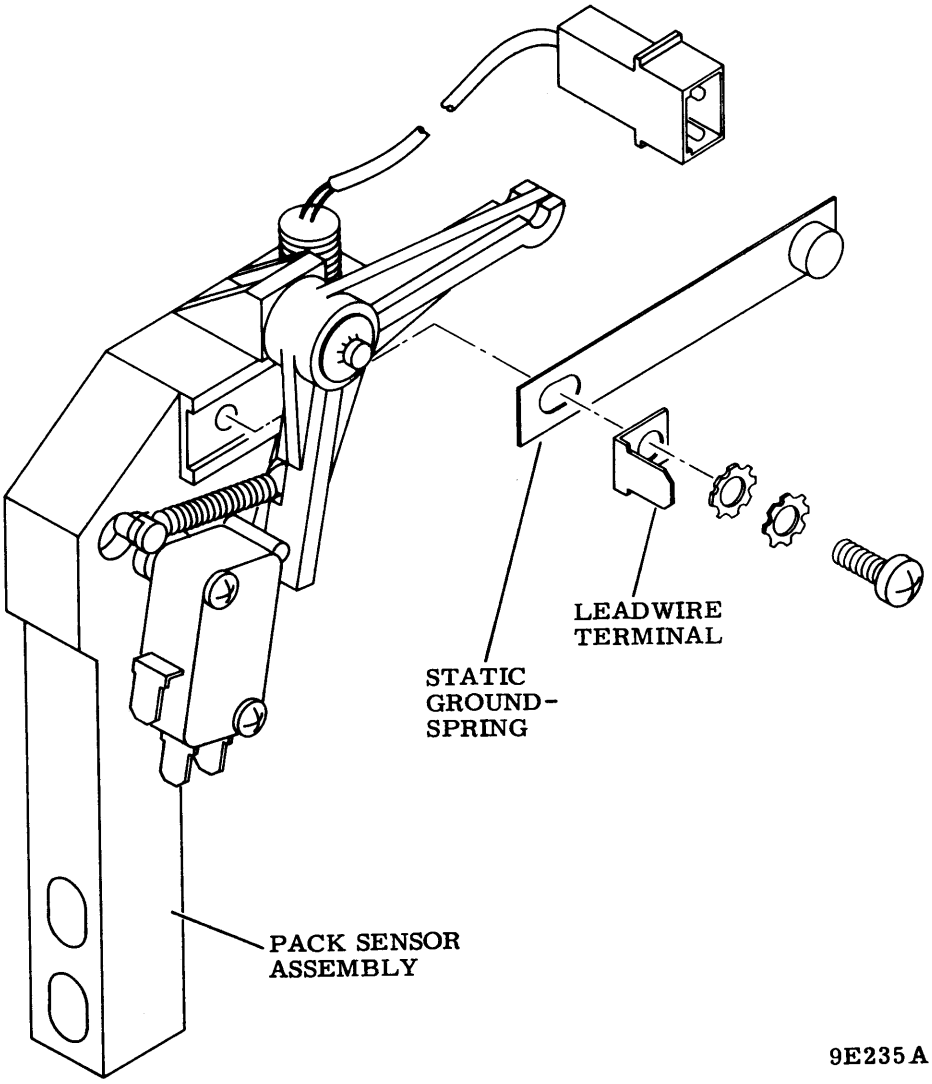


Figure 2F-29. Static Groundspring Replacement

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

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 2F-30 and visually check that groundspring is approximately centered on lockshaft.

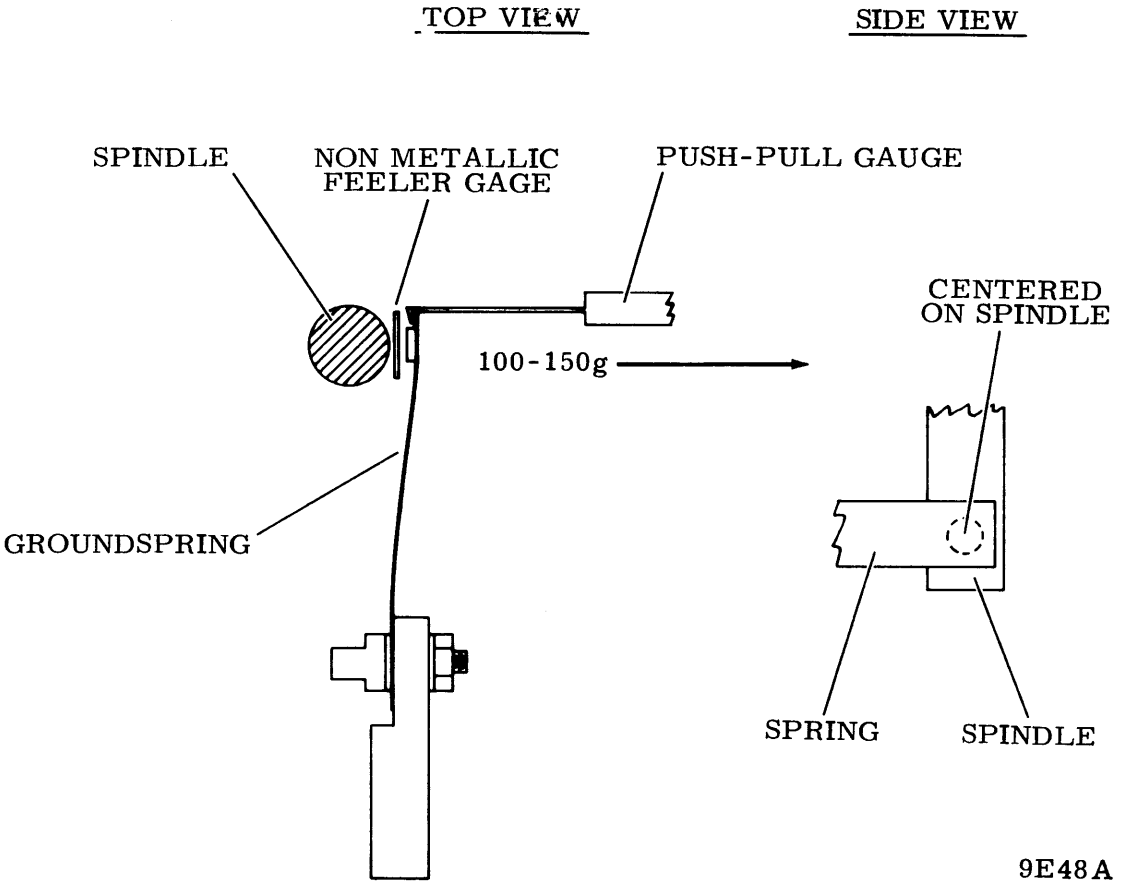


Figure 2F-30. Static Groundspring Adjustment

6. If required, loosen screw securing groundspring to mounting bracket and center spring as required. Tighten screw.

7. Place a 0.5 ±0.05 mm (0.019 ±0.003 in) non-metallic feeler gauge 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 gauge 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 2F-4).

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 voice coil yellow 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 2F-4). 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.

CAUTION

Transducer core can be rendered unusable if it comes in contact with a ferromagnetic object.

d. Carefully remove coil housing and transducer core (connected to extension rod) from magnet and set aside.

6. Carefully remove replacement coil and core from shipping container and set on a nonferrous 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 indicating the north pole end 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 nonferrous surface.

CAUTION

Grasp extension rod 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.

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 until core is completely contained in housing.

11. Install replacement transducer core and coil housing in magnet 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 the 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 2A (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 2A.

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 the 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 procedure 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. Remove these cards and set them aside.

5. Disconnect voice coil leadwires from power amplifier to voice coil flex leads (refer to figure 2F-31).

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.

   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. Remove insulated screw and nylon washer securing number two leadwire, flex leads and backing plate to carriage.

   f. Disconnect number one leadwire by removing screw, nut and washer securing it to flex lead.

   g. Remove voice coil flex leads 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 2F-31 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 one leadwire to flex conductor using screw, nut and lockwasher.

   c. Secure number two leadwire, flex lead and backing plate to carriage using insulated screw and nylon washer.

d. Secure flex lead mounting bracket and flex leads to actuator housing as shown on figure 2F-31.

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 kinking 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.

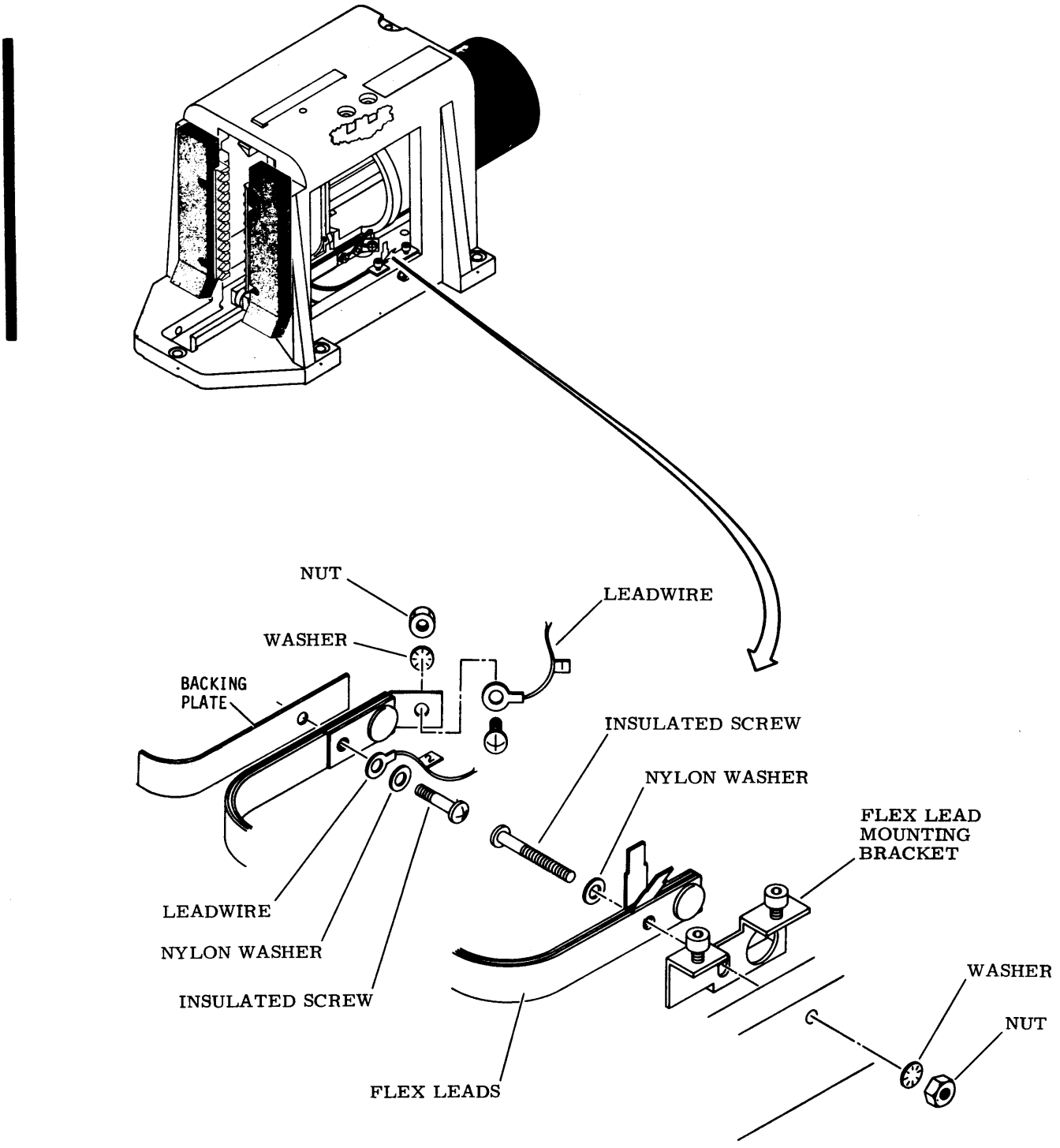


Figure 2F-31. Voice Coil Flex Lead Replacement

VOICE COIL REPLACEMENT

The following procedure describes replacement of the voice coil without removing the carriage or heads (refer to figure 2F-2).

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 and remove deck cover.

CAUTION

The magnetic field generated by the magnet is very strong. Permanent watch damage could occur if watch gets near magnet.

4. Remove Read/Write logic cards from locations E01, E02, and E03.

5. Manually position carriage so that carriage locking pin can be inserted into locking pin alignment hole to lock the carriage in the track alignment position.

NOTE

Remember positioning and routing of voice coil leadwires and where they attach to carriage for reassembly.

6. Remove the insulated screw attaching the number two voice coil leadwire and the flex leads to the carriage.

7. Remove flex lead backing plate.

8. Refer to Velocity Transducer Replacement procedure and remove the velocity transducer from the magnet assembly.

WARNING

Do not disassemble the velocity transducer.

9. Remove magnet assembly as follows.

NOTE

To assure realignment of the magnet during reassembly, make sure to make alignment marks where magnet and actuator meet and where the magnet rests on the deck casting.

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

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

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

CAUTION

Be careful when removing screw in the next step. The magnet will cause a pulling pressure to the wrench being used and could damage the actuator housing.

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

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

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

CAUTION

Be careful when removing magnet assembly so voice coil won't be damaged. Also, make sure magnet is away from metal filings and other metallic objects.

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

CAUTION

When removing only the voice coil, do not remove carriage from actuator housing. Removal could cause bearing-to-rail misalignment.

10. Remove four screws and lockwashers securing the voice coil to the carriage. Gently rest the coil on the deck casting.

11. Remove the screw, nut, and lockwasher attaching the number one voice coil leadwire to the flex lead. Remove the voice coil.

NOTE

Apply one drop of Loctite, Grade C, to screws used in steps 12 and 14.

12. Gently rest replacement voice coil on deck casting and secure the number one coil leadwire to the flex lead using screw, nut, and lockwasher.

CAUTION

Be careful when attaching voice coil to carriage; otherwise, servo circuit could become unstable and cause "ringing".

13. Attach replacement voice coil to the carriage using four screws and lockwashers. Position coil on alignment pin and tighten screws in a cross pattern to 12 $\pm$ 1 inch--pounds (1.3 $\pm$ 0.1 N·m). Avoid any mechanical distortion.

14. Secure number two leadwire, flex lead, and backing plate to carriage using insulated screw and nylon washer.

CAUTION

To avoid damaging voice coil windings, use care when performing the following step.

15. Install magnet assembly by carefully sliding magnet into position and loosely secure it to deck using three screws and washers.

CAUTION

To avoid voice coil damage, use care when performing the following step.

16. 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 (0.15 mm) non metallic feeler gauge between coil and magnet to ensure a 0.005 (0.15 mm) inch gap exists all around coil.

d. Torque screw through top of actuator, to 60 $\pm$ 2 inch-pounds (6.8 $\pm$ 0.2 N·m).

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 $\pm$ 1 inch-pounds (3.4 $\pm$ 0.1 N·m).

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

17. 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.

18. Replace plastic magnet shield.

19. Install velocity transducer assembly as described in Velocity Transducer Assembly Replacement procedure.

20. Inspect and adjust voice coil leadwires and voice coil flex leads as described in the Voice Coil Flex Lead Replacement procedure.

21. Remove carriage locking pin, place it in storage hole, and return carriage to fully retracted position.

22. Install logic cards in read/write chassis.

23. Replace cable connectors on read/write cards.

24. Replace deck seal and rear deck plate.

25. Replace deck cover and lower top cover.

26. Replace disk pack.

SECTION 3

DIAGRAMS

INTRODUCTION

This section contains diagrams describing all electrical circuitry and wiring contained in the drive. It also contains information concerning the interpretation of logic circuit (Key to Logic) and wiring diagrams. This results in the diagrams set actually containing three different type of diagrams: (1) electrical power circuits, (2) logic card schematics, and (3) cabling, and harnessing schematics.

The diagrams set begins with the key to logic diagrams. These sheets contain information concerning interpretation of the actual logic circuits. Additional information concerning their interpretation is located in the Key to Logic section of the hardware reference manual.

The logic card schematics, electrical power circuits, and cabling and harnessing diagrams follow the key to diagrams and make up the major portion of the diagrams set. The logic 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. The power circuits show schematics of power supplies and interconnecting wiring.

Information concerning applicability is contained on the schematics themselves in the form of notes. Therefore, 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 of this manual. It is shown on each sheet of a manual.
- Manual Revision Letter - Indicates the manual revision level at which this sheet was changed and printed; the latest revision level of the manual is shown on the revision record sheet in the front matter of this manual.

- Diagram Revision Letter - Indicates revision level of this sheet only and changes each time an engineering change order affects it.

- Card Type - Indicates the type of card containing the circuitry shown on this diagram set. The card type is included only on the first sheet of each diagram set and 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) has a unique 3 digit cross reference number. The first two digits pertain to the physical location of that circuitry within the drive. The last digit indicates the sheet number within a diagram set.

- Sheet Number - Indicates the sheet number within a diagram set. This number should match the last digit of the cross reference number.

- Page Number - Indicates the page number of this sheet within the manual.

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. Note that where several sheets have the same title and cross reference number they will contain different information because they apply to different units.

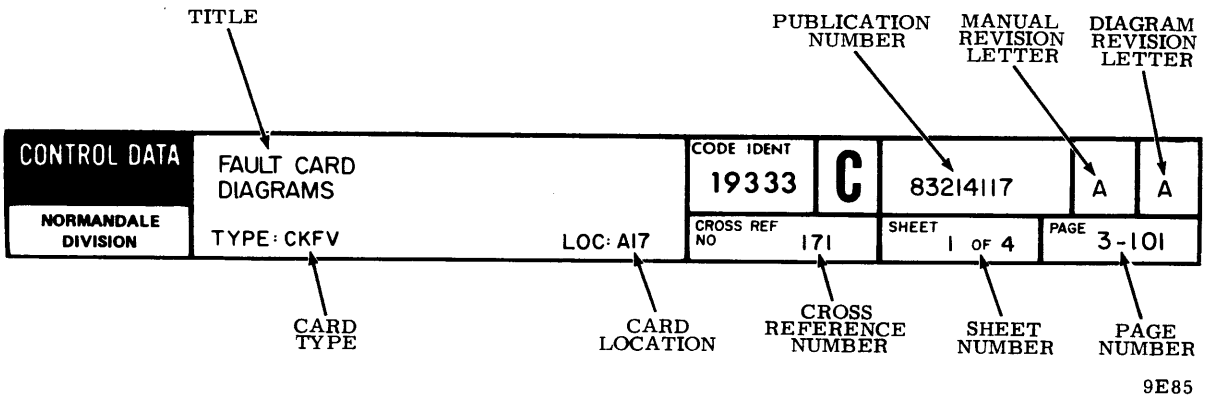


Figure 3-1. Diagram Title Block

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 - Wirewrap Panel
		Key to Diagrams - Miscellaneous
011	A2A01	Transmitters, Receivers, Address Mark Delay (_TVV)
012	A2A01	Channel I Transmitters
013	A2A01	Channel I Receivers and Head Address Registers
021	A2A02	Channel I Receivers Diagrams (_RVV)
022	A2A02	Channel I Receivers
023	A2A02	Channel I Receivers
023	A2A03	Channel I Receivers
031	A2A03	Channel II Transmitters and Receivers Diagrams (_TVV)
032	A2A03	Channel II Transmitters
033	A2A03	Channel II Receivers
041	A2A04	Channel II Receivers Diagrams
042	A2A04	Channel II Receivers

Table Continued on Next Page

TABLE 3-1. CONTENTS OF DIAGRAM (Contd)

Cross Reference Number	Module* Location	Diagram Title
083	A2A08	Head Select Register, Unit Sel XMtr/Rcvr, Seek End Xmtr
084	A2A08	Difference Bits
091	A2A09	Dual Channel Interrupt Diagrams (_SMV)
092	A2A09	Dual Channel Interrupts
093	A2A09	Seek End and Disable
101	A2A10	Write Clock 806 Khz to 9.67 Mhz Diagrams (_LSV)
102	A2A10	Power Input Pins and Unused Logic Elements
103	A2A10	Sector, Index, Ref and Write PLO Clocks
104	A2A10	Servo and Read Clocks
111	A2A11	Heads Unloaded, Airflow Monitor, High Temp Status (_UKV)
112	A2A11	Airflow + High Temp, Heads Loaded, Unit Selected
113	A2A11	Write Fault Monitor, Up To Speed
114	A2A11	Airflow Monitor Logic
115	A2A11	Airflow Sensor Interface
121	A2A12	Difference Generation and Control Diagrams (_LWV)

Table Continued on Next Page

TABLE 3-1. CONTENTS OF DIAGRAM (Contd)

Cross Reference Number	Module* Location	Diagram Title
122	A2A12	Cylinder Address Register
123	A2A12	Difference Counter Generation
124	A2A12	Difference Counter Output
131	A2A13	NRZ to Compensated MFM Diagrams (_LKV)
132	A2A13	NRZ Data to MFM Data-Part I
133	A2A13	NRZ Data to MFM Data-Part II
141	A2A14	Data Latch Diagrams (_LRV)
142	A2A14	Analog Data to Read Data
143	A2A14	Lock to Data and Address Mark Detect
151	A2A15	Read PLO Diagrams (_LZV)
152	A2A15	Data Strobe Delay and Read Data Output
153	A2A15	VCO Output
154	A2A15	Clock and Data Output
155	A2A15	Read PLO Timing Diagram
171	A2A17	Fault Card Diagrams (_KFV)
172	A2A17	Fault Latch and Fault Clear
173	A2A17	Power Up Master Clear, Maint Master Clear and Voltage Fault Detect
174	A2A17	Unit Select, Lap Speed Xdcr, Unit Ready Latch

Table Continued on Next Page

TABLE 3-1. CONTENTS OF DIAGRAM (Contd)

Cross Reference Number	Module* Location	Diagram Title
181	A2A18	Fine Servo Decoder Diagrams (_FRV)
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
185	A2A18	Track Servo Signal and Cyl Detect A and B
191	A2A19	Access Control NO. 2 Diagrams (_KGV)
192	A2A19	Write Inhibit, Fwd/Rev EOT Enables, Coarse/Fine Position Signals
193	A2A19	Fine Enable, Slope Gate and Offset Command Generation
194	A2A19	Forward/Reverse Offset and Fine Position Signal
201	A2A20	Analog Servo Diagrams (_MSV)
202	A2A20	Cylinder Detect, Velocity and Velocity Gain Adjust
203	A2A20	D/A Converter and Desired Velocity Generator
204	A2A20	Summing Amplifier Output and Drive Current V/C PWR AMP
611	A3E01	R/W Control Cabling and Diagrams (_PKV)

Table Continued on Next Page

TABLE 3-1. CONTENTS OF DIAGRAM (Contd)

Cross Reference Number	Module* Location	Diagram Title
612	A3E01	Input Power Wiring and Card Voltage Control
613	A3E01	Read/Write Control
621	A3E02	Write Driver Card Edge Connector and Cabling Diagrams (_PJV)
622	A3E02	Write Driver and Write Fault Detect
631	A3E03	Read Amplifier and Address Mark Detection Diagrams (_PHV)
632	A3E03	Input Voltage Pins and Voltage Regulator
633	A3E03	Read Amplifier and Address Mark Detection
641	A3E04	Diode Matrix and Mother Board Layout Diagrams (_XFN)
642	A3E04	Diode Matrix and Mother Board Schematic
651	A3E05	Head Select Board, Head Plug Connectors, Cabling and Card Layout Diagrams (_XGN)
652	A3E05	Unused Logic Elements, Voltage Input Pins Cabling Information
653	A3E05	Head Select Decode and head Bit Enable
654	A3E05	Head Enables and Multi Head Select

Table Continued on Next Page

TABLE 3-1. CONTENTS OF DIAGRAM (Contd)

Cross Reference Number	Module* Location	Diagram Title
751	A5	Airflow Sensor Elements Diagram (_AGN)
761	A3	Track Servo Preamp Diagrams (_ZQN)
762	A3	Track Servo Preamp Cabling/Plug Connections
763	A3	Track Servo Preamp Schematic
771	A4	A4 - Operator Control Panel Diagrams
772	A4	Fault Clear and Lap Switches, Fault and Ready Indicators
773	A4	Start Switch/Start Indicator, Start Interlock Reference Schematic
781	A3	A3 - I/O Cabling
782	A3	I/O Harness Wiring and Tag Bus Decode - Channel I
783	A3	I/O Harness Wiring and Tag Bus Decode - Channel II
791	A3	A3 - Misc Deck Wiring Diagrams
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 and Relays K6, K7, K8

Table Continued on Next Page

TABLE 3-1. CONTENTS OF DIAGRAM (Contd)

Cross Reference Number	Module* Location	Diagram Title
804	A1	Drive Motor, Start Triacs and Local/Remote Switch
811	A1	Relay Board Power Wiring, Component Layout and Cabling Diagrams
812	A1	Relay Board Schematic Part 1
813	A1	Relay Board Schematic Part 2
821	A1	Rectifier and Capacitor Board Component Layout and Diagrams
822	A1	Rectifier and Capacitor Board
831	A1	A1 Power Supply Voice Coil Power Amp Diagrams
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														

REVISIONS

REV	ECO.	DESCRIPTION	DRF	DATE
A	DH23000 DH13203A	CREATE BJ4A3C/D	CM	9-2-

DRAWN	G. RABINE	1/21/79	CONTROL DATA LARGE DISK DIVISION	STORAGE MODULE DRIVE KEY TO LOGIC DIAGRAM	CODE IDENT 19333	C	DWG NO 83337340	A	A
CHECKED					CROSS REF NO		SHEET 1 OF 6	PAGE 3-11	
ENGINEER									
APPROVED									

REF 81201200

1. CHASSIS MAP

KEY

FUNCTIONAL NAME / CROSS REF NO	MODULE TYPE IDENTIFIER

LOGIC CHASSIS

A01	XMTRS/RCVRS, ADRS MK DLY 011-013	_TVV
A02	RCVRS 021-023	_RVV
A03	XMTRS/RCVRS (4) 031-033	-TVV
A04	RCVRS (4) 041-043	-RVV
A05	DUAL CHANNEL STEERING (4) 051-054	-KHV
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	DUAL CHANNEL INTERRUPT (4) 091-093	-SMV
A10	WRT CLK 101-104	_LSV
A11	HDS UNLOADED/HIGH TEMP STATUS 111-124	_UKV
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	_LZV
A16	NOT USED	
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 LOCATED IN SECTION 5C.

(4) CARD APPLICABLE TO DUAL CHANNEL ONLY.

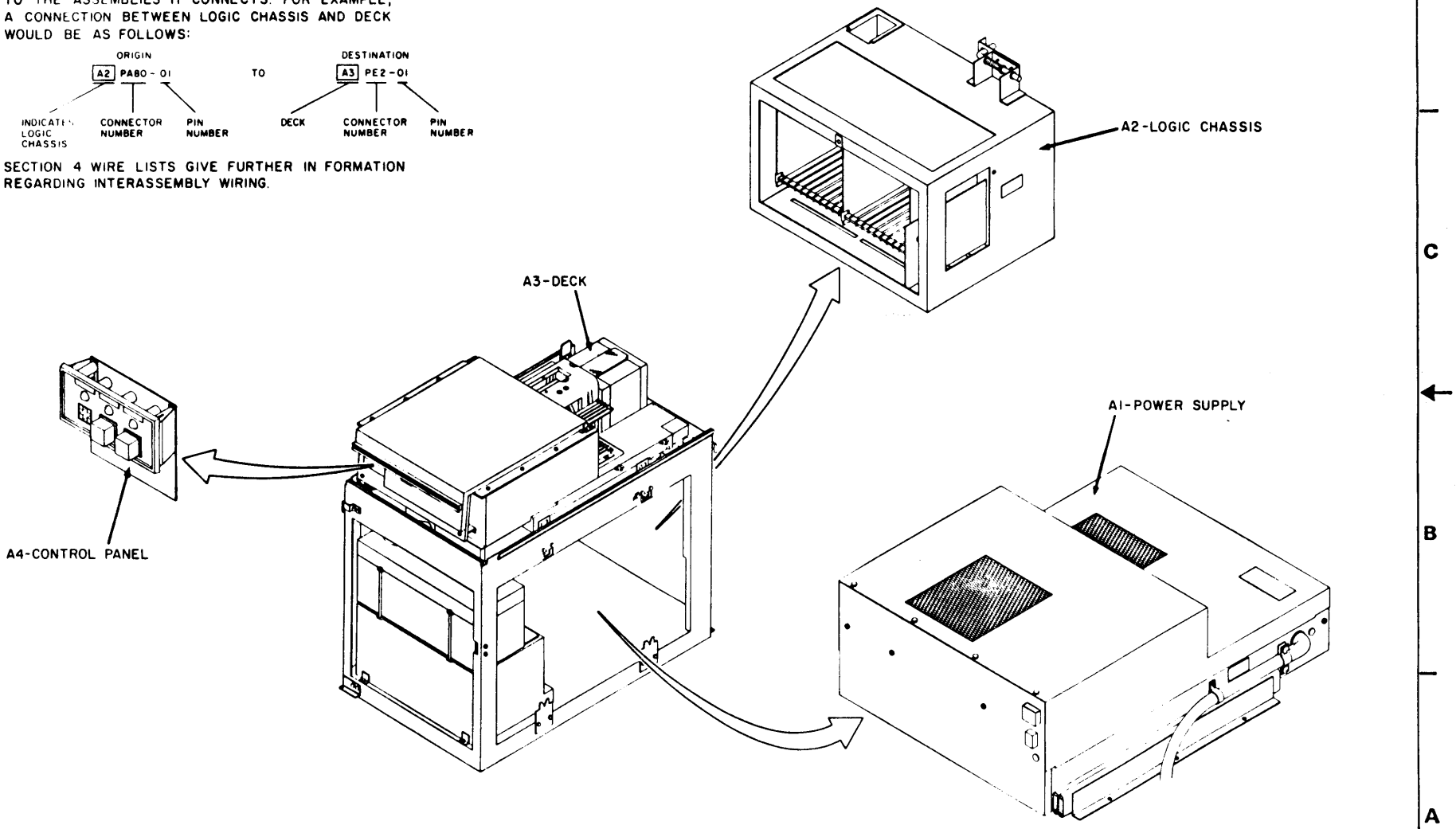
2. CONFIGURATION

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:

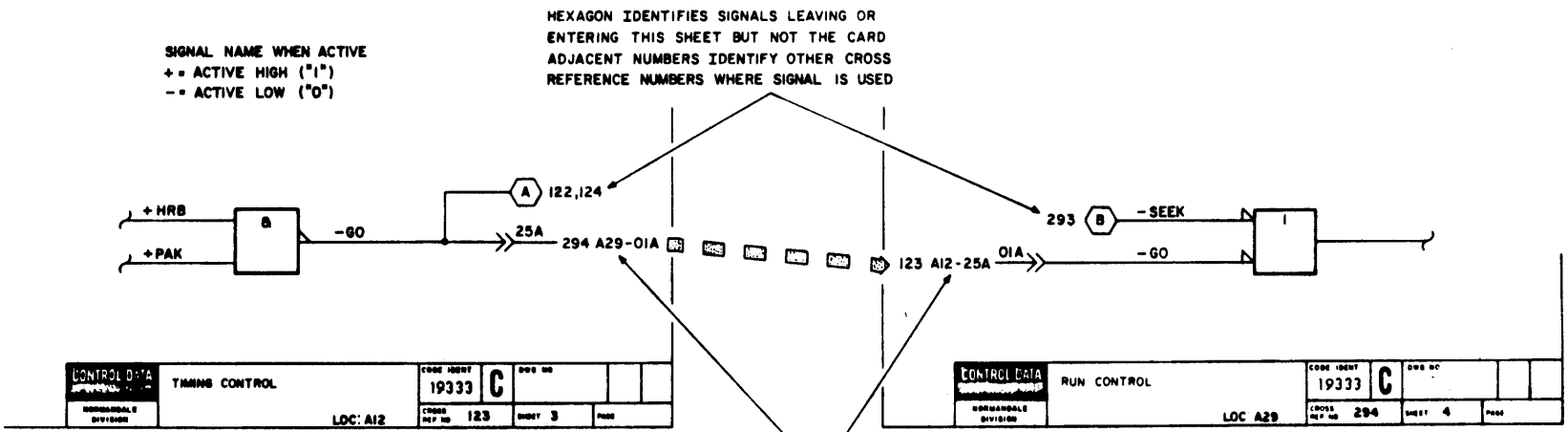
SECTION 4 WIRE LISTS GIVE FURTHER IN FORMATION REGARDING INTERASSEMBLY WIRING.



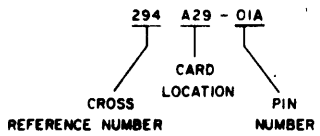
CONTROL DATA LARGE DISK DIVISION	CONFIGURATION	CODE IDENT 19333	C	DWG. NO. 83337340	D	A
		CROSS REF NO		SHEET 3	PAGE 3-13	

3. INTERSHEET REFERENCING

THE FOLLOWING EXPLAINS THE BASIC METHOD OF INTER-SHEET REFERENCING.
FOR MORE INFORMATION REFER TO CDC-STD 1.41.108



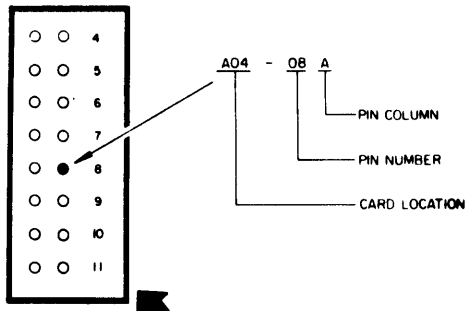
DESTINATIONS SHOW ALL LOCATIONS WHERE OUTPUT SIGNALS GO WITHOUT REGARD TO ACTUAL BACKPANEL WIRE ROUTING, IN THE EXAMPLE SHOWN IT IS AS FOLLOWS

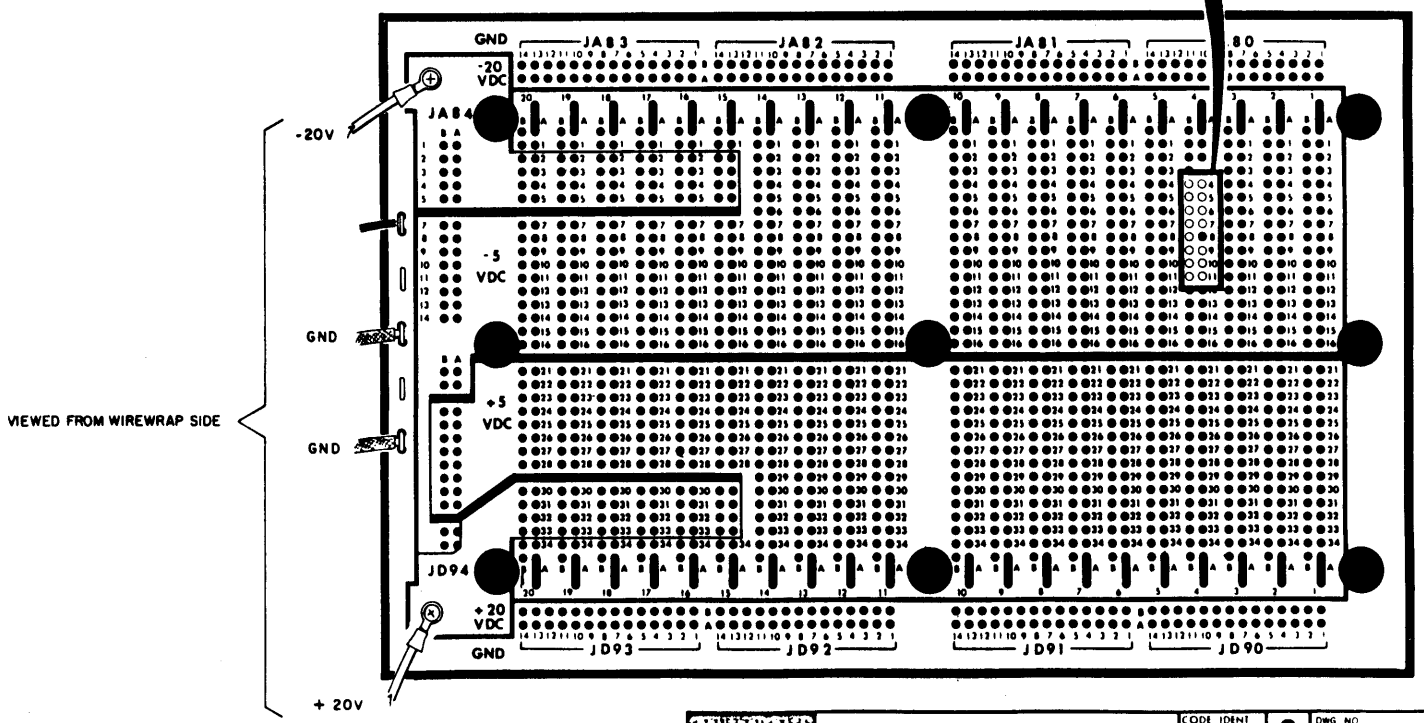


CONTROL DATA LARGE DISK DIVISION	INTERSHEET REFERENCING	CODE IDENT 19333	C	DWG NO 83337340	A	A
		CROSS REF NO		SHEET 4	PAGE 3-14	

4. LOGIC CHASSIS WIREWRAP PANEL

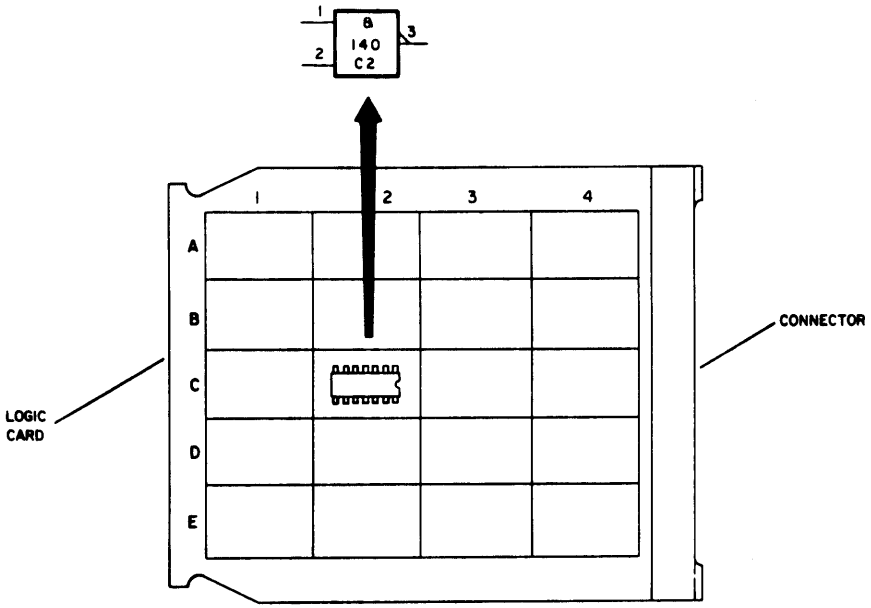
1. VOLTAGE DISTRIBUTED AS FOLLOWS:
   - +20V TO PIN 33B AT LOCATIONS A15 THROUGH A20
   - -20V TO PIN 02B AT LOCATIONS A15 THROUGH A20
   - +5V TO PIN 34B AT ALL LOCATIONS
   - -5V TO PIN 01B AT ALL LOCATIONS
2. GROUND DISTRIBUTED TO PINS 01A AND 34A AT ALL LOCATIONS
3. JA80 THROUGH JA84 AND JD90 THROUGH JD94 ARE AUXILIARY CONNECTORS USED TO CONNECT WIRE WRAP PANEL TO OTHER ASSEMBLIES.





CONTROL DATA LARGE DISK DIVISION	WIREWRAP PANEL	CODE IDENT 19333	C	DWG NO 83337340	A A
		CROSS REF NO		SHEET 5	TABLE 3-15

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 THIS MANUAL

10. CIRCUIT DESCRIPTIONS

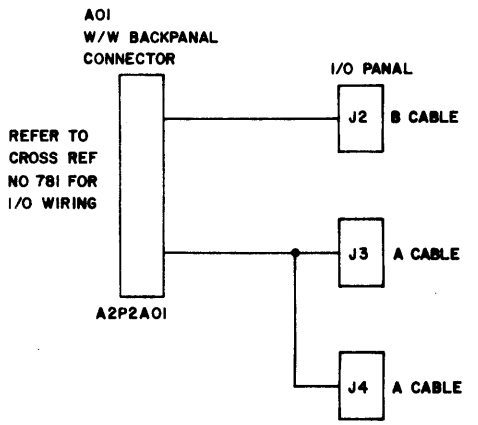
DESCRIPTIONS OF ALL DISCRETE AND INTEGRATED CIRCUITS ARE FOUND IN THE DISCRETE COMPONENT CIRCUITS SECTION OF THE HARDWARE REFERENCE MANUAL. DESCRIPTIONS OF ALL INTEGRATED CIRCUITS ARE FOUND IN THE NORMANDALE CIRCUITS MANUAL

REVISION STATUS OF SHEETS

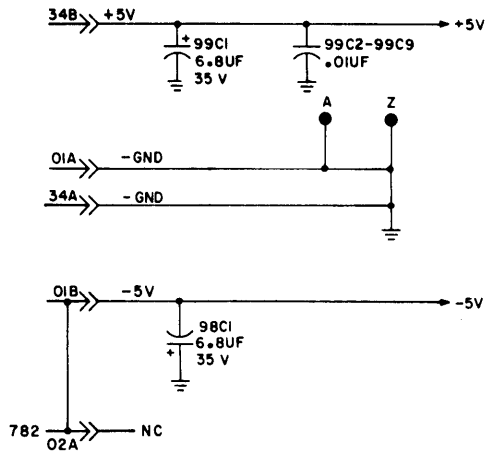
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A																	

REVISIONS

REV.	ECO.	DESCRIPTION	DRFT.	DATE	CHK'D
A	DH23000 DH32038A	CREATE BJ4A3C/D	HDK	9-29-82	

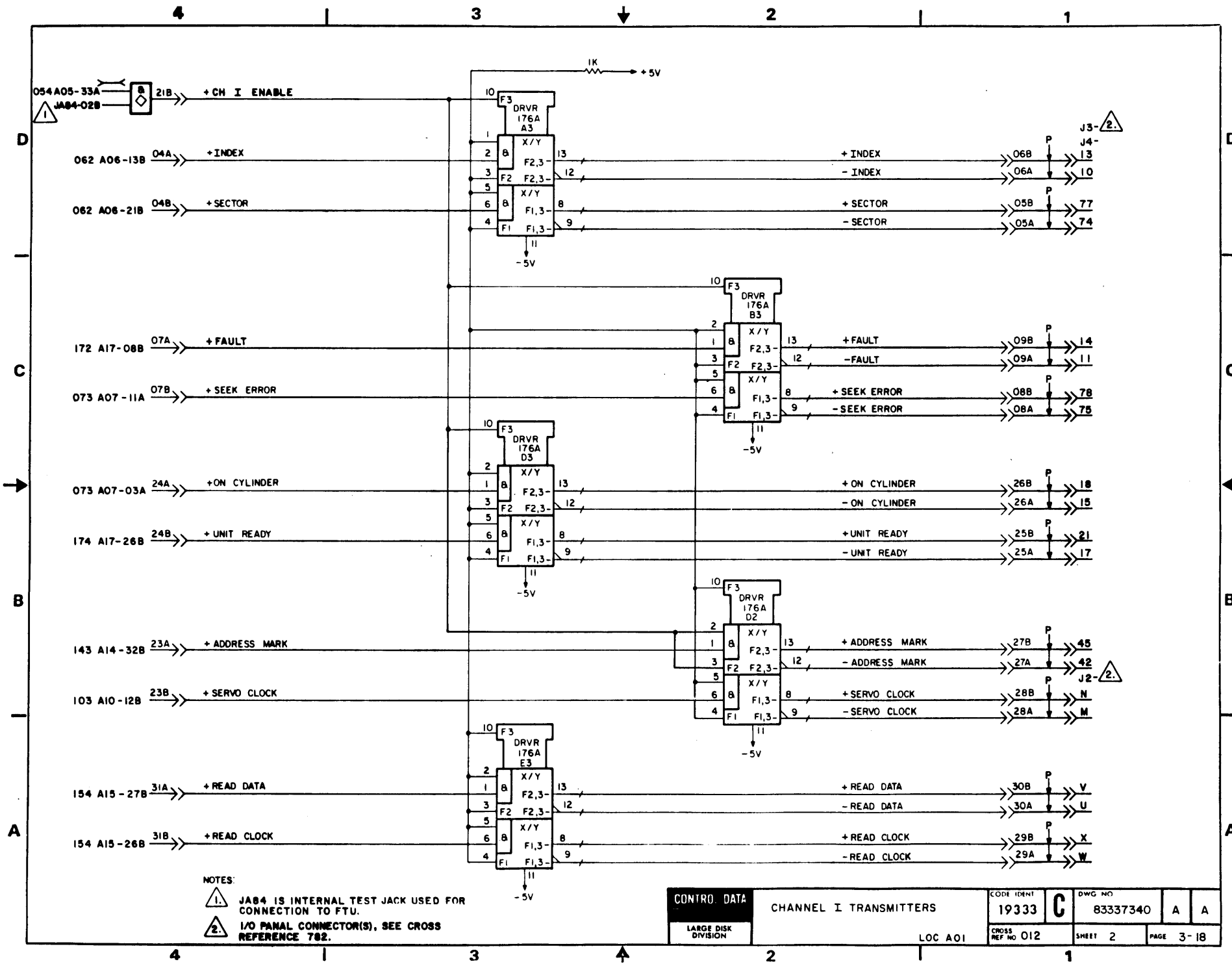


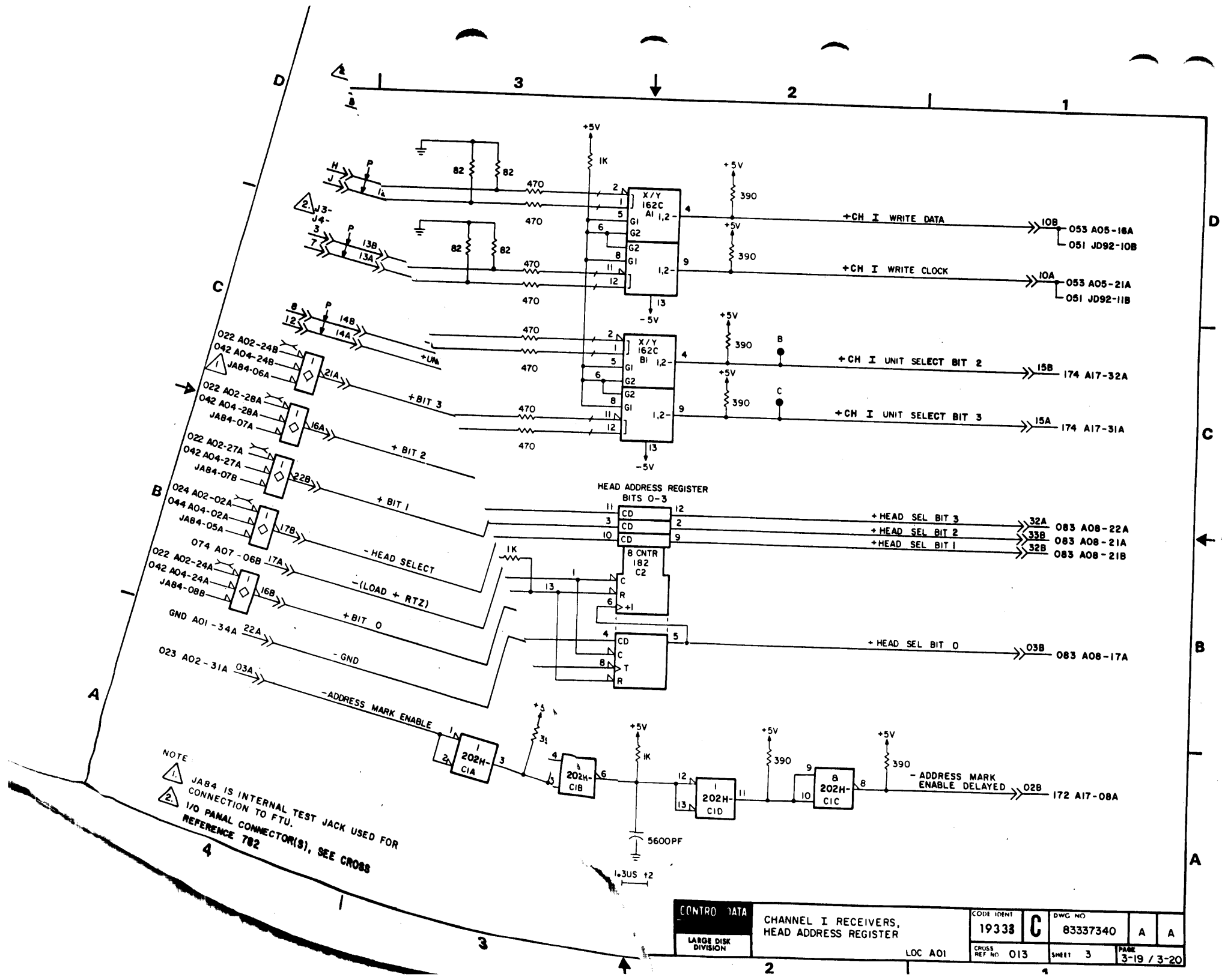
CABLING FROM A01 W/W PINS TO I/O PANAL



DRAWN	W. BERGSTROM	10-14-76	CONTROL DATA	CHANNEL I XMTRS, RCVRS, ADRS MK DLY DIAGRAMS	CODE IDENT 19333	C	DWG NO 83337340 A A
CHECKED							
ENGINEER			LARGE DISK DIVISION	TYPE:KTVV LOC:A01	CROSS REF NO 011		SHEET 1 OF 3 PAGE 3-17
APPROVED							

REF 81201201


054 A05-33A
JA84-02B
21B
+CH I ENABLE
1K
+5V
DRVR 176A A3
062 A06-13B
04A
+INDEX
062 A06-21B
04B
+SECTOR
+INDEX
-INDEX
+SECTOR
-SECTOR
J3-2.
J4-
06B
06A
05B
05A
DRVR 176A B3
172 A17-08B
07A
+FAULT
073 A07-11A
07B
+SEEK ERROR
-FAULT
-SEEK ERROR
09B
09A
08B
08A
DRVR 176A D3
073 A07-03A
24A
+ON CYLINDER
174 A17-26B
24B
+UNIT READY
-ON CYLINDER
-UNIT READY
26B
26A
25B
25A
DRVR 176A D2
143 A14-32B
23A
+ADDRESS MARK
103 A10-12B
23B
+SERVO CLOCK
-ADDRESS MARK
-SERVO CLOCK
27B
27A
28B
28A
J2-2.
DRVR 176A E3
154 A15-27B
31A
+READ DATA
154 A15-26B
31B
+READ CLOCK
-READ DATA
-READ CLOCK
30B
30A
29B
29A
-5V
NOTES:
1. JA84 IS INTERNAL TEST JACK USED FOR CONNECTION TO FTU.
2. I/O PANAL CONNECTOR(S), SEE CROSS REFERENCE 782.
CONTRO DATA
LARGE DISK DIVISION
CHANNEL I TRANSMITTERS
LOC A01
CODE IDENT 19333
C
DWG NO 83337340
A
A
CROSS REF NO 012
SHEET 2
PAGE 3-18


+5V
1K
82
470
X/Y 162C A1
+CH I WRITE DATA
+CH I WRITE CLOCK
390
-5V
X/Y 162C B1
+CH I UNIT SELECT BIT 2
+CH I UNIT SELECT BIT 3
022 A02-24B
042 A04-24B
JA84-06A
+BIT 3
022 A02-28A
042 A04-28A
JA84-07A
+BIT 2
022 A02-27A
042 A04-27A
JA84-07B
+BIT 1
024 A02-02A
044 A04-02A
JA84-05A
-HEAD SELECT
074 A07-06B
022 A02-24A
042 A04-24A
JA84-08B
-(LOAD + RTZ)
+BIT 0
GND A01-34A
-GND
023 A02-31A
-ADDRESS MARK ENABLE
HEAD ADDRESS REGISTER BITS 0-3
8 CNTR 182 C2
+HEAD SEL BIT 3
+HEAD SEL BIT 2
+HEAD SEL BIT 1
+HEAD SEL BIT 0
202H-C1A
202H-C1B
202H-C1C
202H-C1D
- ADDRESS MARK ENABLE DELAYED
5600PF
1.3US ±2
NOTE
1. JA84 IS INTERNAL TEST JACK USED FOR CONNECTION TO FTU.
2. I/O PANAL CONNECTOR(S), SEE CROSS REFERENCE 782
CONTROL DATA
LARGE DISK DIVISION
CHANNEL I RECEIVERS, HEAD ADDRESS REGISTER
LOC A01
CODE IDENT 19333
C
DWG NO 83337340
A
A
CROSS REF NO 013
SHEET 3
PAGE 3-19 / 3-20

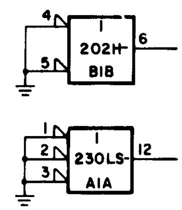
REVISION STATUS OF SHEETS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																

REVISIONS

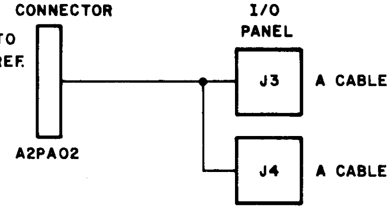
REV	ECO.	DESCRIPTION	DRFT.	DATE	CHK'D
A	DH23000 DH13203A	CREATE BJ4A3C/D	DLF	9-29-82	Dms

UNUSED LOGIC ELEMENTS

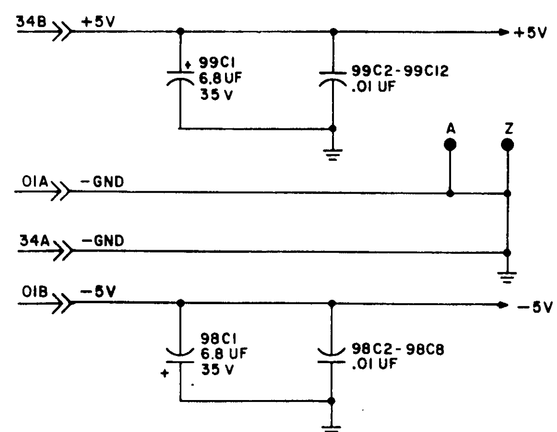


A02
W/W BACKPANEL
CONNECTOR

REFER TO
CROSS REF.
NO 781
FOR I/O
WIRING

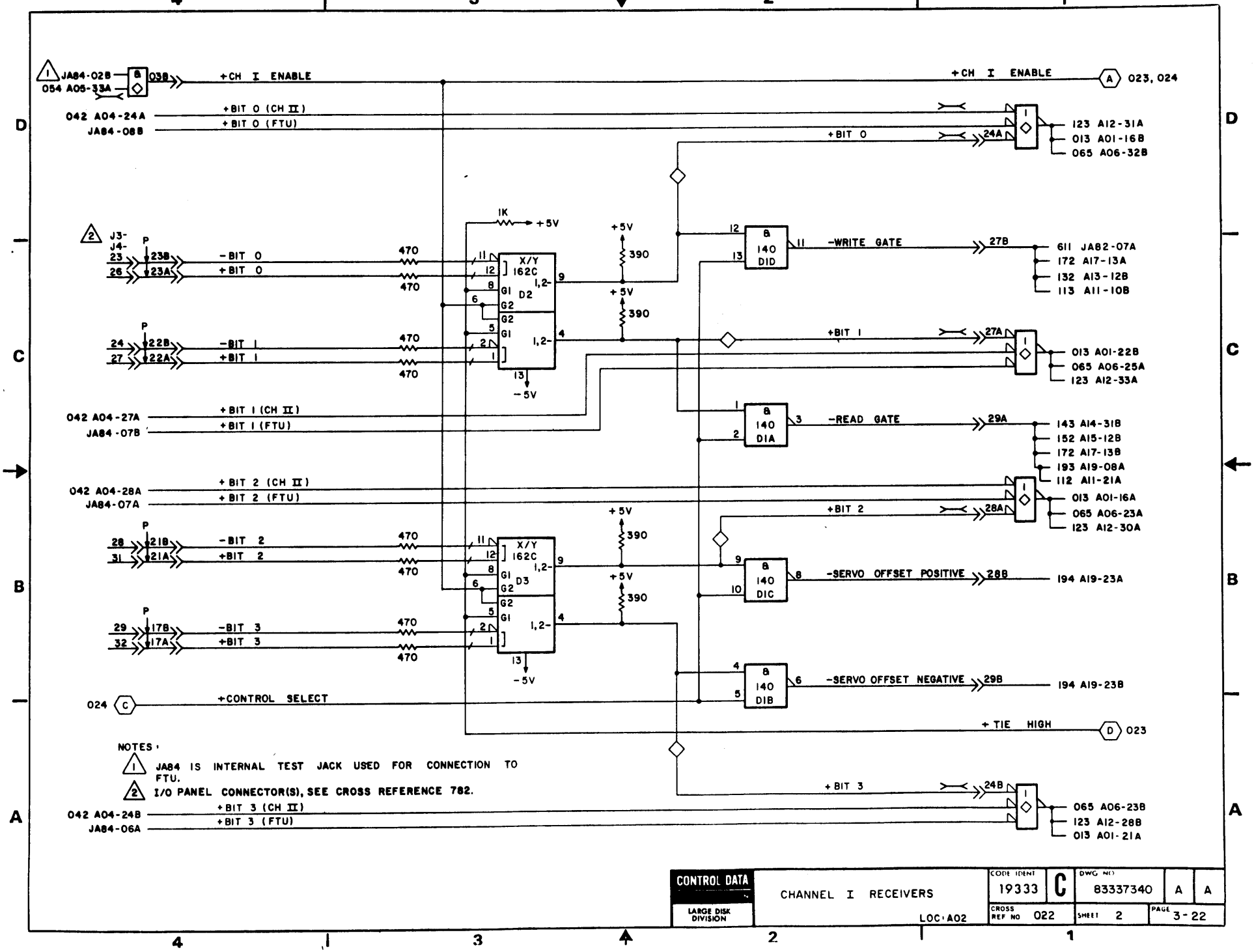


CABLING FROM A02 W/W PINS TO I/O PANEL

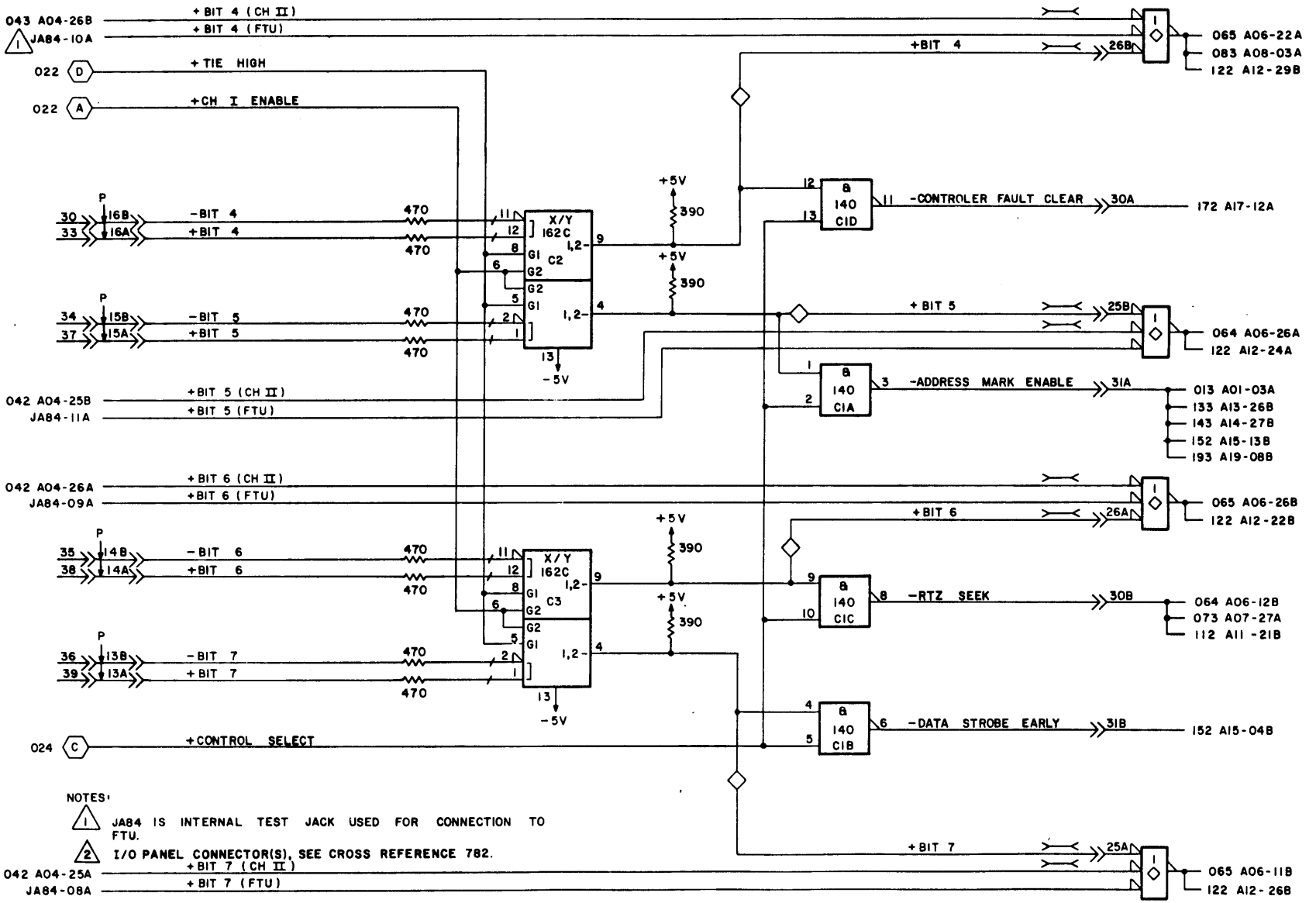


DRAWN	Stephen Smith	10/14/76	CONTROL DATA	CHANNEL I RECEIVERS DIAGRAMS	CODE IDENT 19333	C	DWG NO 83337340	A	A
CHECKED			LARGE DISK DIVISION	TYPE: KRVV LOC: A02	CROSS REF NO. 021		SHEET 1 OF 4	PAGE 3-21	
ENGINEER									
APPROVED									

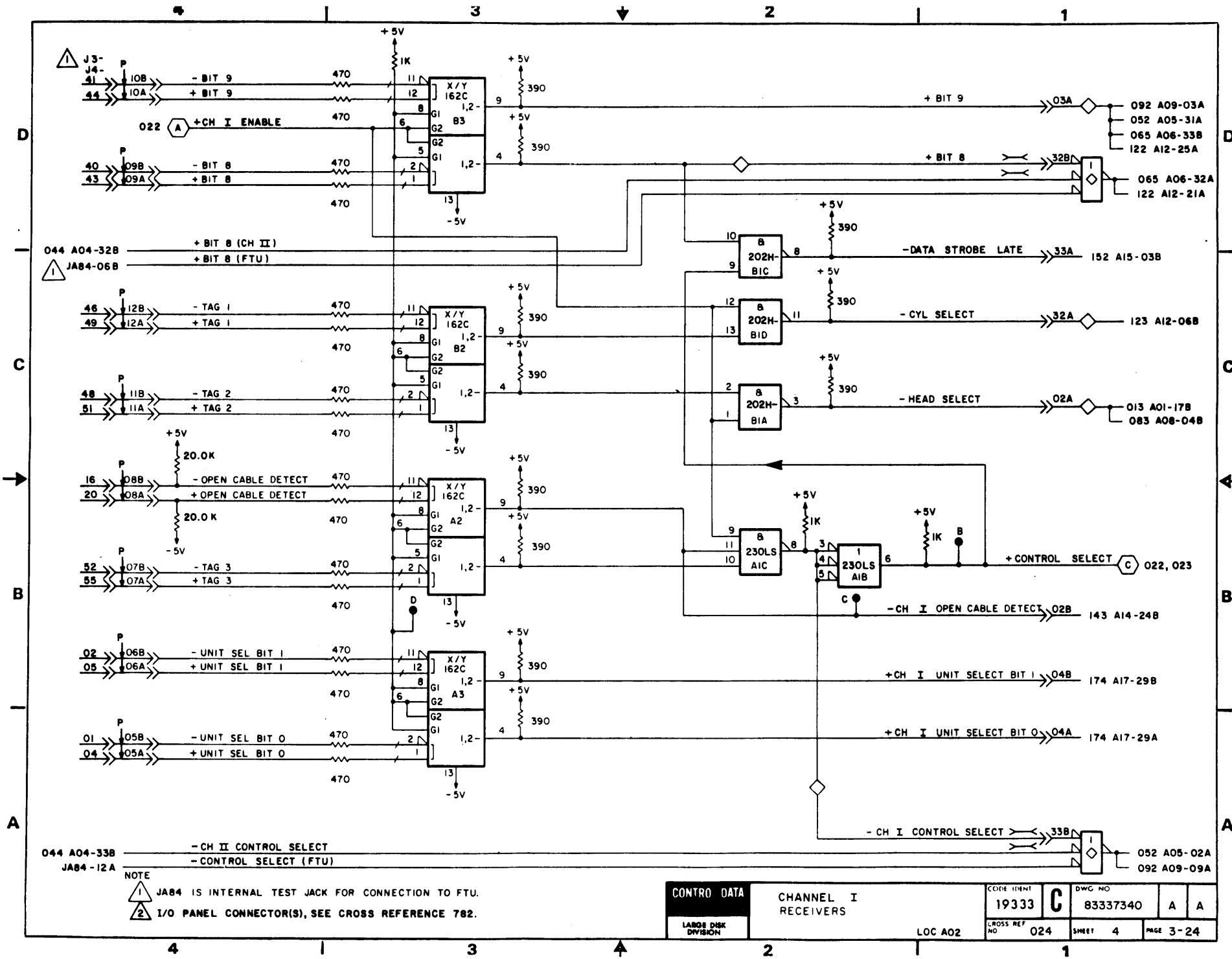
REF 81201202



CONTROL DATA LARGE DISK DIVISION	CHANNEL I RECEIVERS LOC: A02	CODE IDENT 19333	C	DWG NO 83337340	A A
		CROSS REF NO 022		SHEET 2	PAGE 3-22



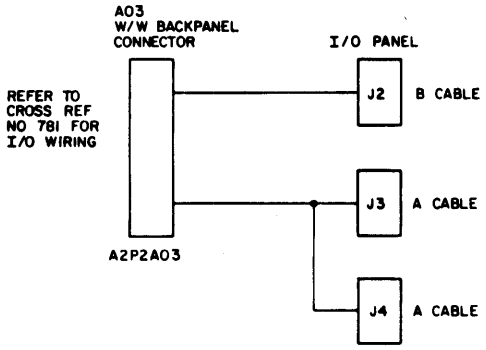
CONTRO DATA LARGE DISK DIVISION	CHANNEL I RECEIVERS LOC:A02	CODE IDENT 19333	C	DWG NO 83337340	A A
		CROSS REF NO 023		SHEET 3	PAGE 3-23


+5V
1K
J3-
J4-
41
44
P
10B
10A
- BIT 9
+ BIT 9
470
X/Y
162C
B3
1,2-
G1
G2
390
-5V
022
A
+CH I ENABLE
40
43
09B
09A
- BIT 8
+ BIT 8
+ BIT 9
03A
092 A09-03A
052 A05-31A
065 A06-33B
122 A12-25A
+ BIT 8
32B
065 A06-32A
122 A12-21A
044 A04-32B
JA84-06B
+ BIT 8 (CH II)
+ BIT 8 (FTU)
-DATA STROBE LATE
33A
152 A15-03B
-CYL SELECT
32A
123 A12-06B
-HEAD SELECT
02A
013 A01-17B
083 A08-04B
46
49
12B
12A
- TAG 1
+ TAG 1
B2
48
51
11B
11A
- TAG 2
+ TAG 2
A2
20.0K
16
20
08B
08A
- OPEN CABLE DETECT
+ OPEN CABLE DETECT
52
55
07B
07A
- TAG 3
+ TAG 3
A3
02
05
06B
06A
- UNIT SEL BIT 1
+ UNIT SEL BIT 1
01
04
05B
05A
- UNIT SEL BIT 0
+ UNIT SEL BIT 0
8
202H-
B1C
B1D
B1A
230LS
A1C
A1B
IK
B
C
D
+CONTROL SELECT
C
022, 023
-CH I OPEN CABLE DETECT
02B
143 A14-24B
+CH I UNIT SELECT BIT 1
04B
174 A17-29B
+CH I UNIT SELECT BIT 0
04A
174 A17-29A
- CH I CONTROL SELECT
33B
052 A05-02A
092 A09-09A
044 A04-33B
JA84-12A
- CH II CONTROL SELECT
- CONTROL SELECT (FTU)
NOTE
1 JA84 IS INTERNAL TEST JACK FOR CONNECTION TO FTU.
2 I/O PANEL CONNECTOR(S), SEE CROSS REFERENCE 782.
CONTRO DATA
LARGE DISK DIVISION
CHANNEL I
RECEIVERS
LOC A02
CODE IDENT 19333
C
DWG NO 83337340
A
A
CROSS REF NO 024
SHEET 4
PAGE 3-24

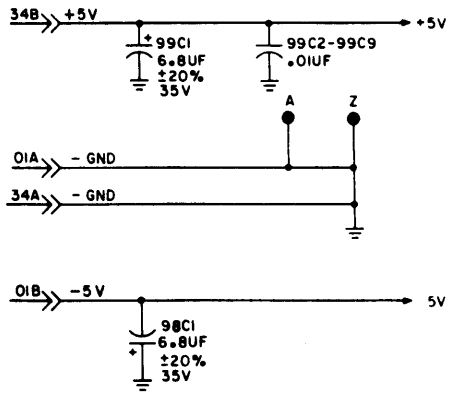
REVISION STATUS OF SHEETS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A																	

REVISIONS					
REV.	ECO.	DESCRIPTION	DRFT.	DATE	CHK'D
A	DH23000 DH13203A	CREATE BJ4A3C/D	DLF	10-4-82	

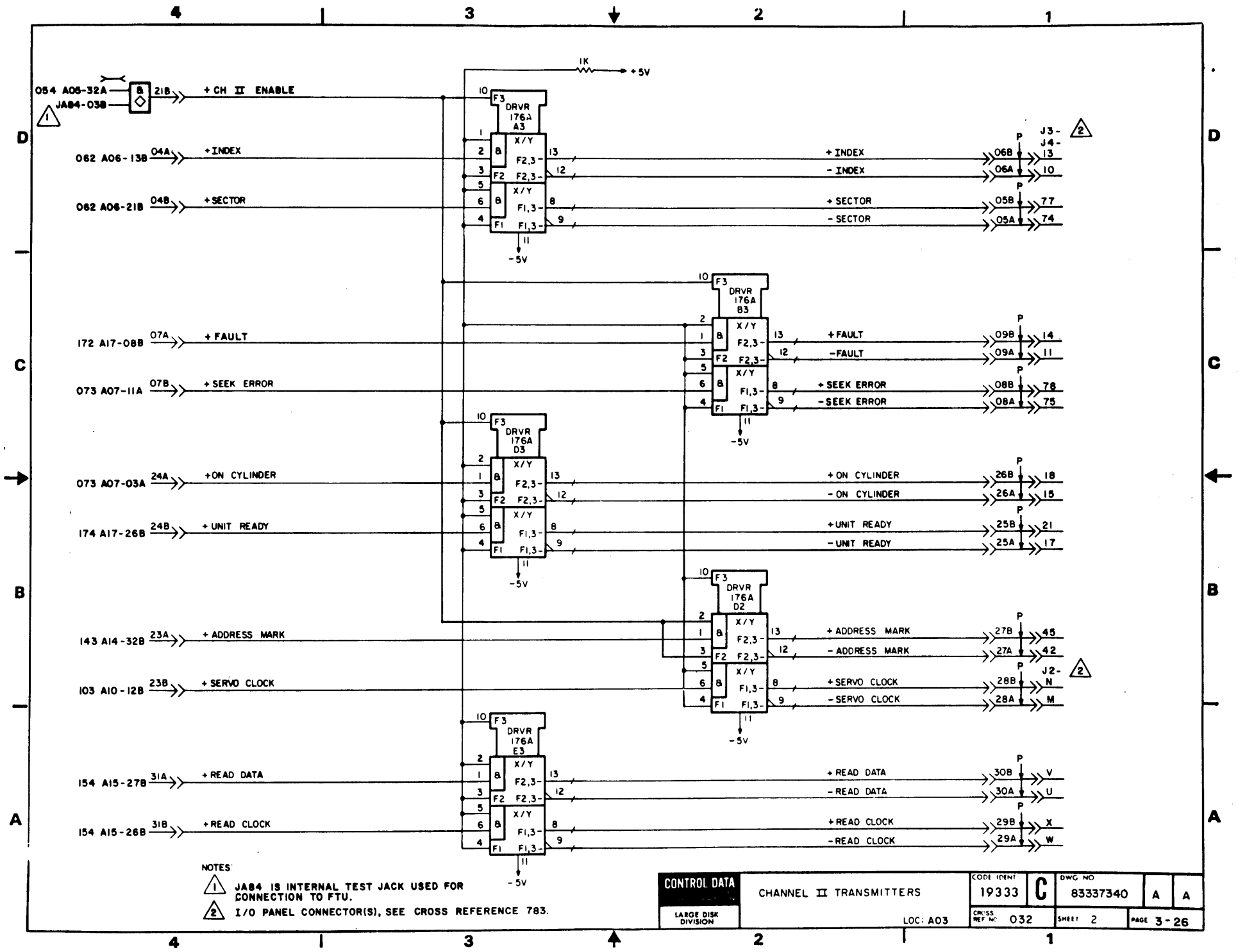


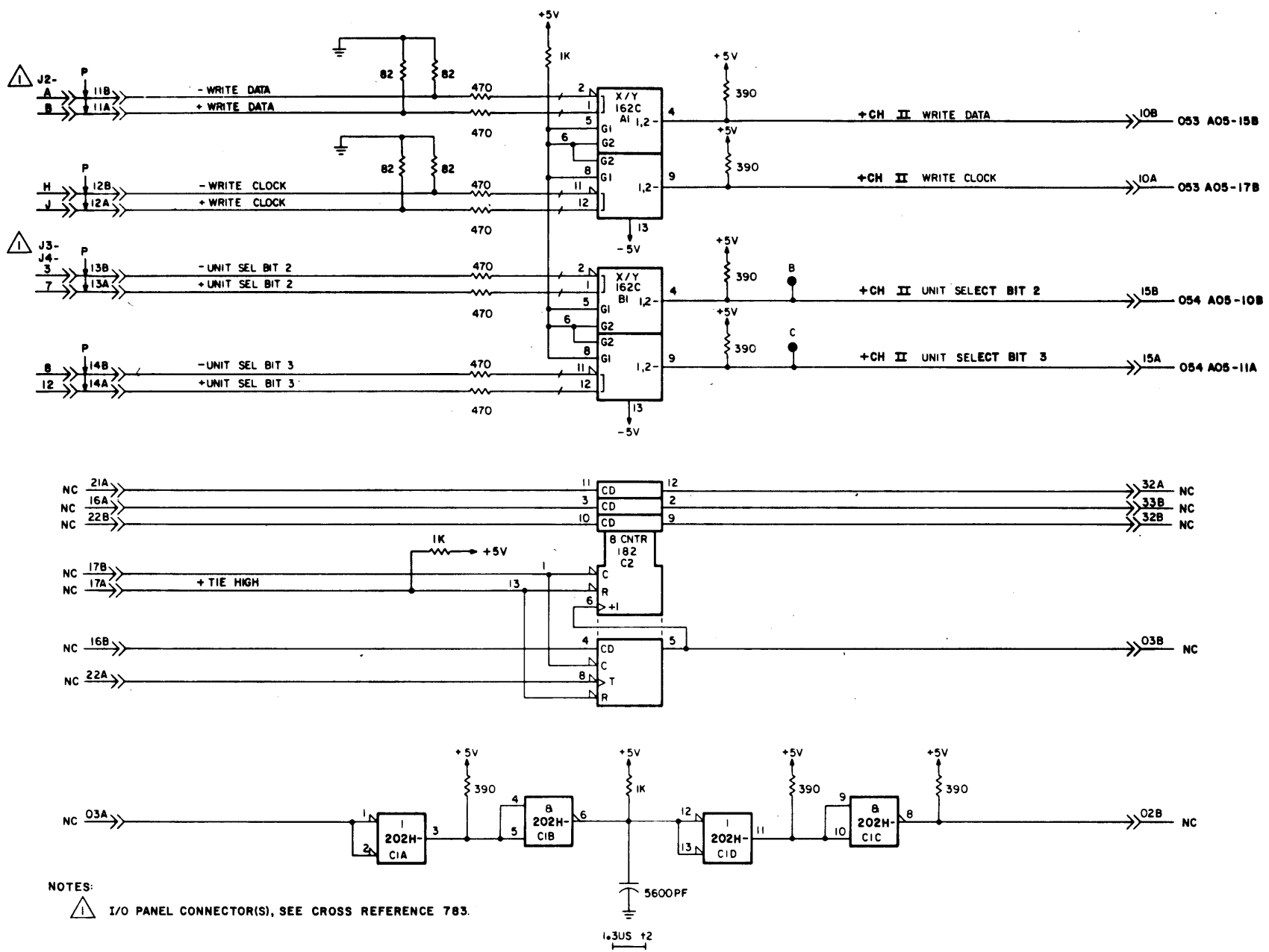
CABLING FROM A03 W/W PINS TO I/O PANEL



DRAWN	G Raging	12/14/79	CONTROL DATA	CHANNEL II TRANSMITTERS AND RECEIVERS DIAGRAMS	CODE IDENT 19333	C	DWG NO 83337340	A A
CHECKED								
ENGINEER			LARGE DISK DIVISION	TYPE: KTVV LOC: A03	CROSS REF NO 031		SHEET 1 OF 3	PAGE 3-25
APPROVED								

REF 81201203


054 A05-32A
JA84-03B
21B
+CH II ENABLE
1K
+5V
062 A06-13B
04A
+INDEX
062 A06-21B
04B
+SECTOR
DRVR 176A A3
-5V
+INDEX
-INDEX
+SECTOR
-SECTOR
J3-J4-
06B 13
06A 10
05B 77
05A 74
172 A17-08B
07A
+FAULT
073 A07-11A
07B
+SEEK ERROR
DRVR 176A B3
-FAULT
-SEEK ERROR
08B 78
08A 75
09B 14
09A 11
073 A07-03A
24A
+ON CYLINDER
174 A17-26B
24B
+UNIT READY
DRVR 176A D3
-ON CYLINDER
-UNIT READY
26B 18
26A 15
25B 21
25A 17
143 A14-32B
23A
+ADDRESS MARK
103 A10-12B
23B
+SERVO CLOCK
DRVR 176A D2
-ADDRESS MARK
-SERVO CLOCK
27B 45
27A 42
28B
28A
J2-N
M
154 A15-27B
31A
+READ DATA
154 A15-26B
31B
+READ CLOCK
DRVR 176A E3
-READ DATA
-READ CLOCK
30B V
30A U
29B X
29A W
NOTES:
1 JA84 IS INTERNAL TEST JACK USED FOR CONNECTION TO FTU.
2 I/O PANEL CONNECTOR(S), SEE CROSS REFERENCE 783.
CONTROL DATA
LARGE DISK DIVISION
CHANNEL II TRANSMITTERS
LOC: A03
CODE IDENT 19333
C
DWG NO 83337340
A
A
CROSS REF NO 032
SHEET 2
PAGE 3-26



NOTES:

1. I/O PANEL CONNECTOR(S), SEE CROSS REFERENCE 783.

CONTROL DATA LARGE DISK DIVISION	CHANNEL II RECEIVERS LOC : A03	CODE IDENT 19333	C	DWG NO 83337340	A	A
		CROSS REF NO 033		SHEET 3	PAGE 3-27/3-28	

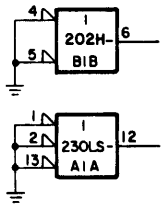
REVISION STATUS OF SHEETS

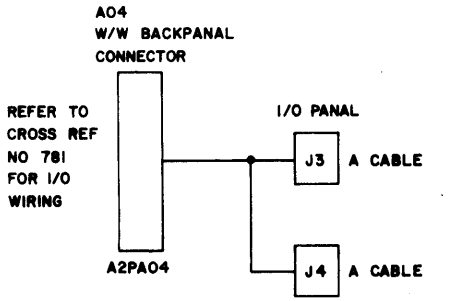
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																

REVISIONS

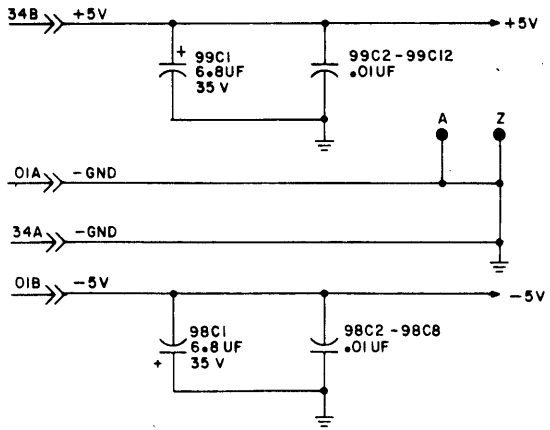
REV	ECO.	DESCRIPTION	DRFT.	DATE	CHK'D
A	DH23000 DH13203A	CREATE 8J43C/D	HDK	9-29-76	

UNUSED LOGIC ELEMENTS

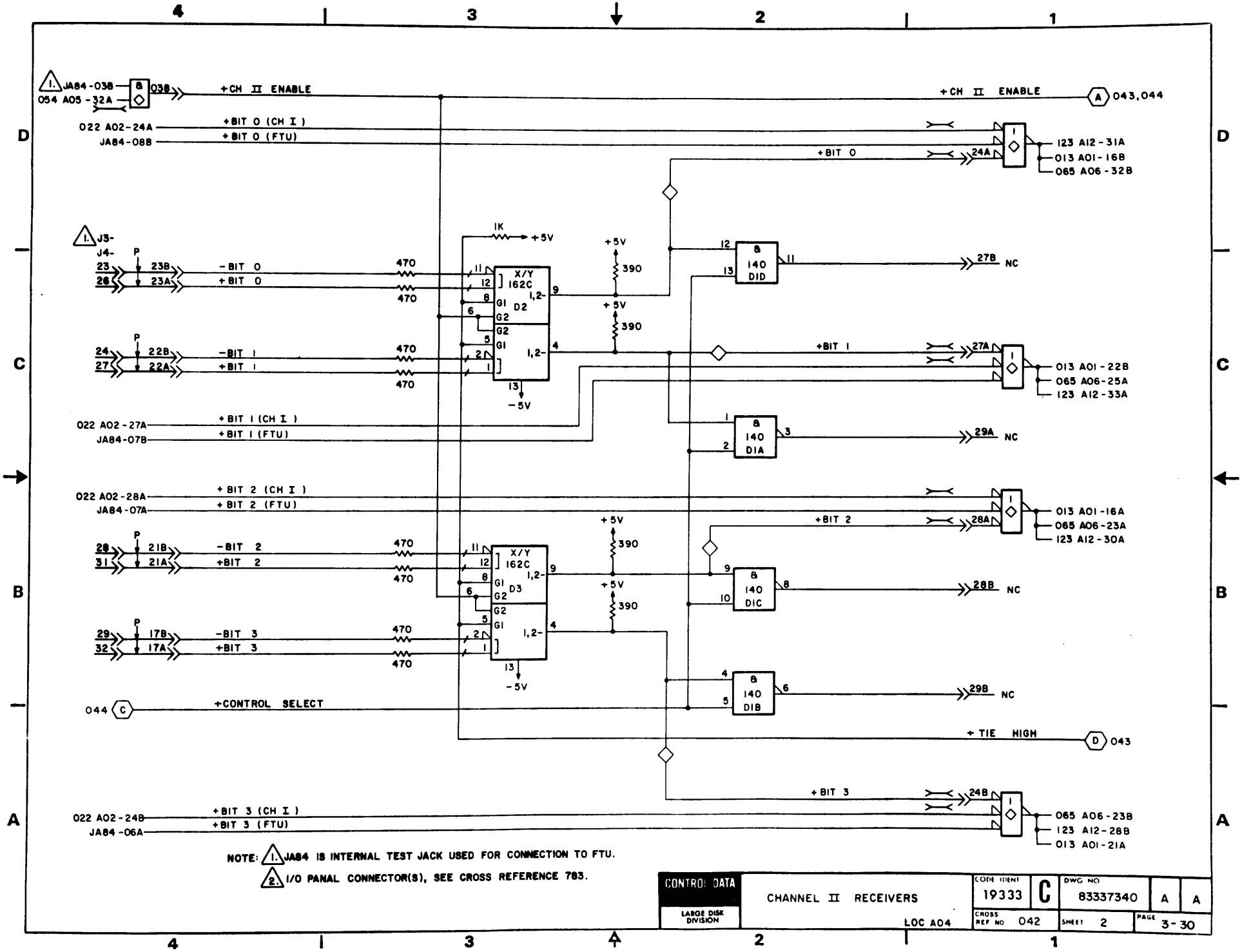


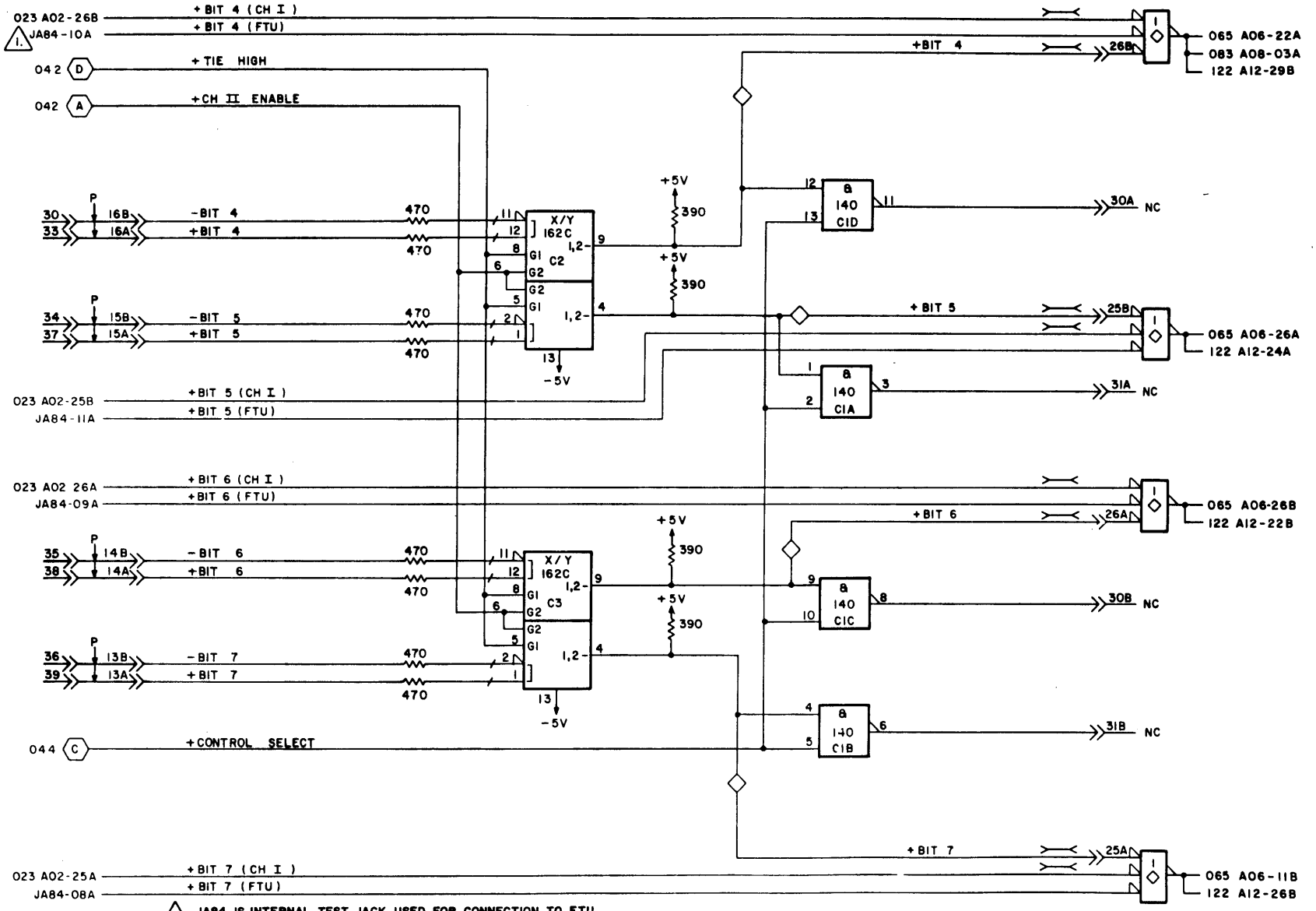


CABLING FROM A04 W/W PINS TO I/O PANAL



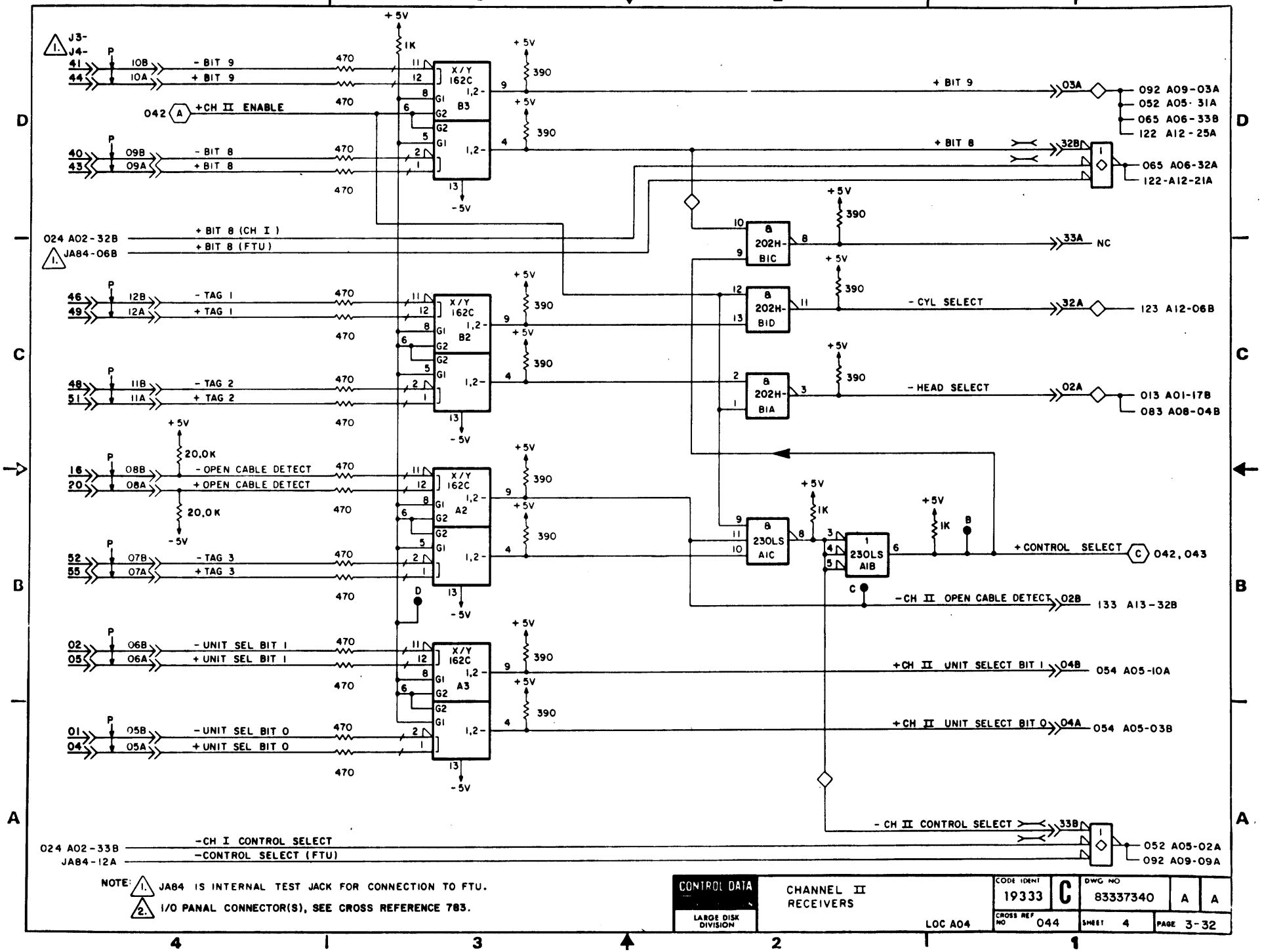
DRAWN	W.BERGSTROM	10-13-76	CONTROL DATA	CHANNEL II RECEIVERS DIAGRAMS	CODE IDENT 19333	C	DWG NO 83337340 A A
CHECKED			LARGE DISK DIVISION	TYPE: KRVV LOC A04	CROSS REF. NO. 041		SHEET 1 OF 4 PAGE 3-29
APPROVED		11/11/76			REF 81201204		


1. JA84-03B
054 A05-32A
03B
+CH II ENABLE
+CH II ENABLE
A 043,044
022 A02-24A
JA84-08B
+BIT 0 (CH I)
+BIT 0 (FTU)
+BIT 0
24A
123 A12-31A
013 A01-16B
065 A06-32B
1. J3-
J4-
P
23
26
23B
23A
-BIT 0
+BIT 0
470
470
1K
+5V
X/Y
162C
D2
1,2-
G1
G2
390
+5V
12
13
8 140 DID
11
27B
NC
24
27
22B
22A
-BIT 1
+BIT 1
470
470
+BIT 1
27A
013 A01-22B
065 A06-25A
123 A12-33A
-5V
022 A02-27A
JA84-07B
+BIT 1 (CH I)
+BIT 1 (FTU)
1
2
8 140 DIA
3
29A
NC
022 A02-28A
JA84-07A
+BIT 2 (CH I)
+BIT 2 (FTU)
013 A01-16A
065 A06-23A
123 A12-30A
+BIT 2
28A
28
31
21B
21A
-BIT 2
+BIT 2
470
470
X/Y
162C
D3
9
8 140 DIC
10
8
28B
NC
29
32
17B
17A
-BIT 3
+BIT 3
470
470
4
5
8 140 DIB
6
29B
NC
044 C
+CONTROL SELECT
+TIE HIGH
D 043
+BIT 3
24B
065 A06-23B
123 A12-28B
013 A01-21A
022 A02-24B
JA84-06A
+BIT 3 (CH I)
+BIT 3 (FTU)
NOTE: 1. JA84 IS INTERNAL TEST JACK USED FOR CONNECTION TO FTU.
2. I/O PANAL CONNECTOR(S), SEE CROSS REFERENCE 783.
CONTROL DATA
LARGE DISK DIVISION
CHANNEL II RECEIVERS
LOC A04
CODE IDENT 19333
C
DWG NO 83337340
A
A
CROSS REF NO 042
SHEET 2
PAGE 3-30



NOTE: 1. JA84 IS INTERNAL TEST JACK USED FOR CONNECTION TO FTU.
2. I/O PANAL CONNECTOR(S), SEE CROSS REFERENCE 783.

CONTROL DATA LARGE DISK DIVISION	CHANNEL II RECEIVERS LOC: A04	CODE IDENT 19333	C	DWG NO 83337340	A	A
		CROSS REF NO 043		SHEET 3	PAGE 3-31	


J3-
J4-
41
44
P
10B
10A
- BIT 9
+ BIT 9
1K
470
X/Y 162C
B3
+5V
390
042 A
+CH II ENABLE
40
43
09B
09A
- BIT 8
+ BIT 8
+ BIT 9
03A
092 A09-03A
052 A05-31A
065 A06-33B
122 A12-25A
+ BIT 8
32B
065 A06-32A
122-A12-21A
024 A02-32B
JA84-06B
+ BIT 8 (CH I)
+ BIT 8 (FTU)
8 202H-BIC
33A
NC
46
49
12B
12A
- TAG 1
+ TAG 1
B2
48
51
11B
11A
- TAG 2
+ TAG 2
8 202H-BID
- CYL SELECT
32A
123 A12-06B
8 202H-BIA
- HEAD SELECT
02A
013 A01-17B
083 A08-04B
20.0K
-5V
16
20
08B
08A
- OPEN CABLE DETECT
+ OPEN CABLE DETECT
A2
52
55
07B
07A
- TAG 3
+ TAG 3
A3
8 230LS A1C
1 230LS A1B
+CONTROL SELECT
C
042, 043
- CH II OPEN CABLE DETECT
02B
133 A13-32B
02
05
06B
06A
- UNIT SEL BIT 1
+ UNIT SEL BIT 1
+CH II UNIT SELECT BIT 1
04B
054 A05-10A
01
04
05B
05A
- UNIT SEL BIT 0
+ UNIT SEL BIT 0
+CH II UNIT SELECT BIT 0
04A
054 A05-03B
- CH II CONTROL SELECT
33B
024 A02-33B
JA84-12A
-CH I CONTROL SELECT
-CONTROL SELECT (FTU)
052 A05-02A
092 A09-09A
NOTE:
1. JA84 IS INTERNAL TEST JACK FOR CONNECTION TO FTU.
2. I/O PANAL CONNECTOR(S), SEE CROSS REFERENCE 783.
CONTROL DATA
LARGE DISK DIVISION
CHANNEL II RECEIVERS
LOC A04
CODE IDENT 19333
C
DWG NO 83337340
A
A
CROSS REF NO 044
SHEET 4
PAGE 3-32

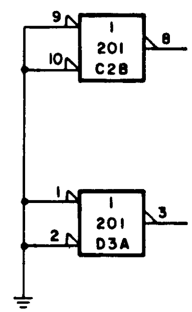
REVISION STATUS OF SHEETS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																

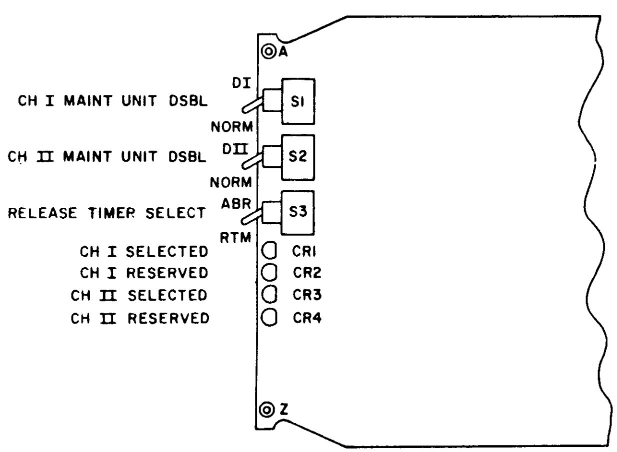
REVISIONS

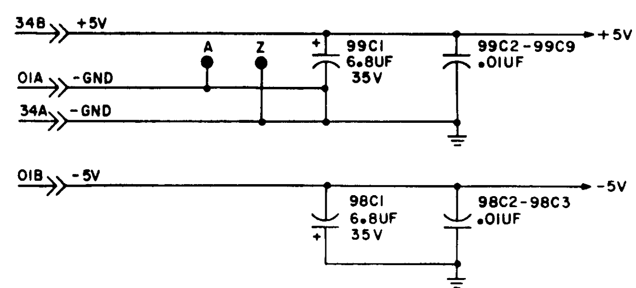
REV.	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	DH13203A	CREATE 8J4A3C/D	SMS	9-29-82	

UNUSED LOGIC ELEMENTS



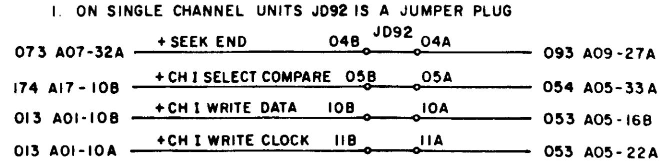
MAINTANCE SWITCHES AND STATUS INDICATORS ON CARD EDGE





NOTE:

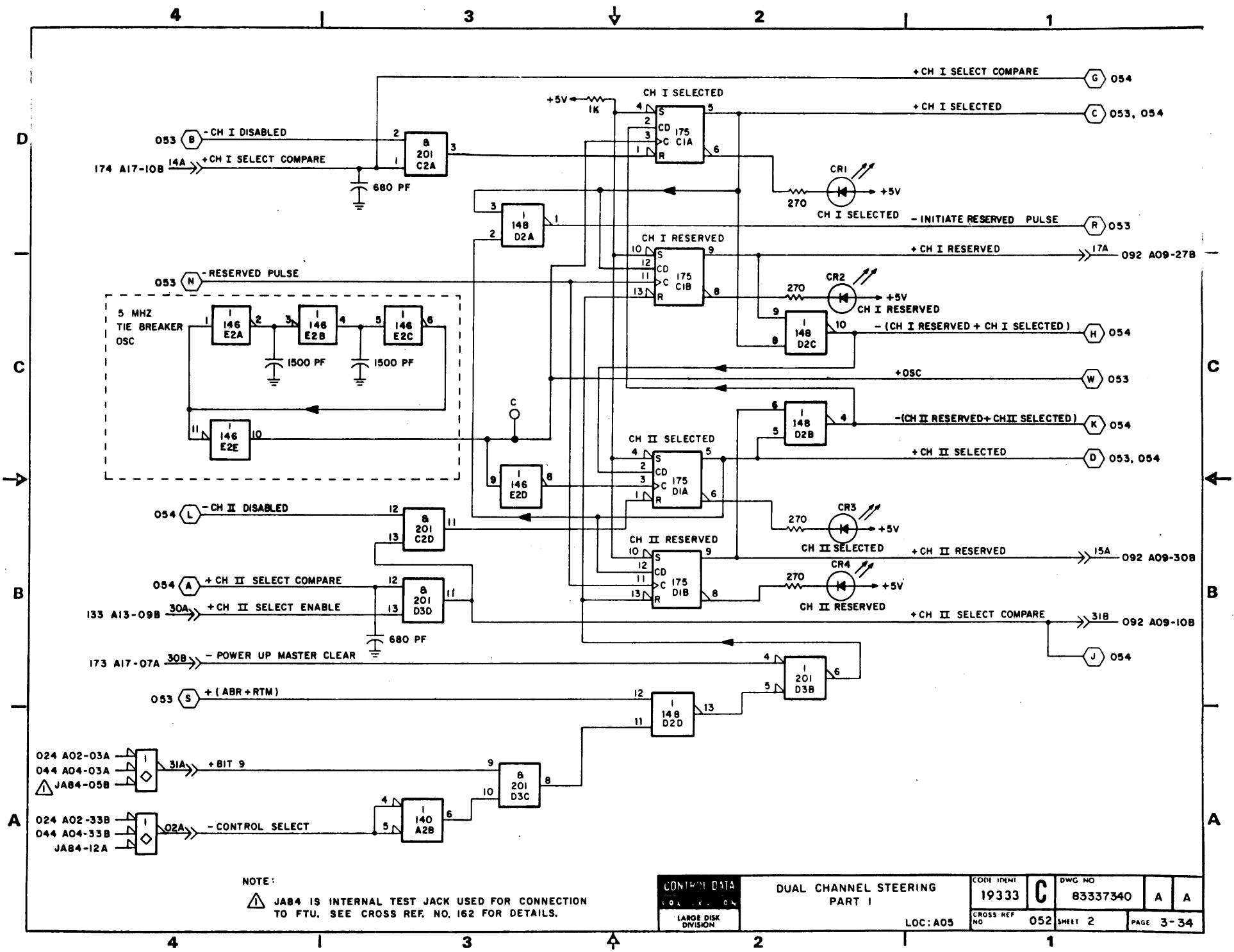
1. ON SINGLE CHANNEL UNITS JD92 IS A JUMPER PLUG



DRAWN		10/15/76	CONTROL DATA	DUAL CHANNEL STEERING DIAGRAMS
CHECKED			LARGE DISK DIVISION	TYPE: MKHV LOC: A05
ENGINEER				
APPROVED				

CODE IDENT	SIZE	DWG NO		
19333	C	83337340	A	A
CROSS REF NO 051		SHEET 1 OF 4	PAGE 3-33	

REF 81201205



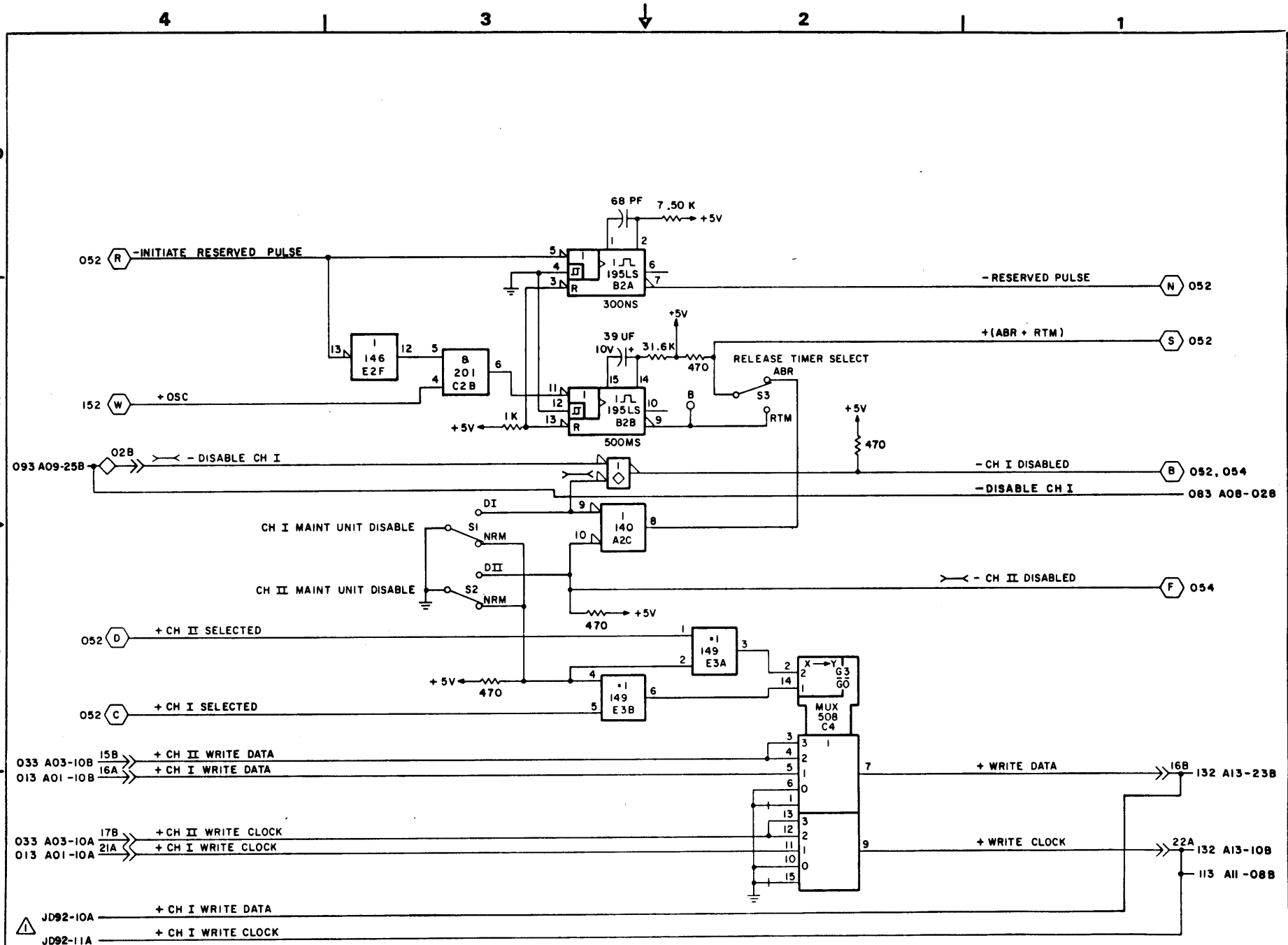
NOTE:

⚠1 JA84 IS INTERNAL TEST JACK USED FOR CONNECTION TO FTU. SEE CROSS REF. NO. 162 FOR DETAILS.

CONTROL DATA CORPORATION
LARGE DISK DIVISION

DUAL CHANNEL STEERING
PART 1
LOC: A05

CODE IDENT		DWG NO		
19333	C	83337340	A	A
CROSS REF NO 052	SHEET 2	PAGE 3-34		



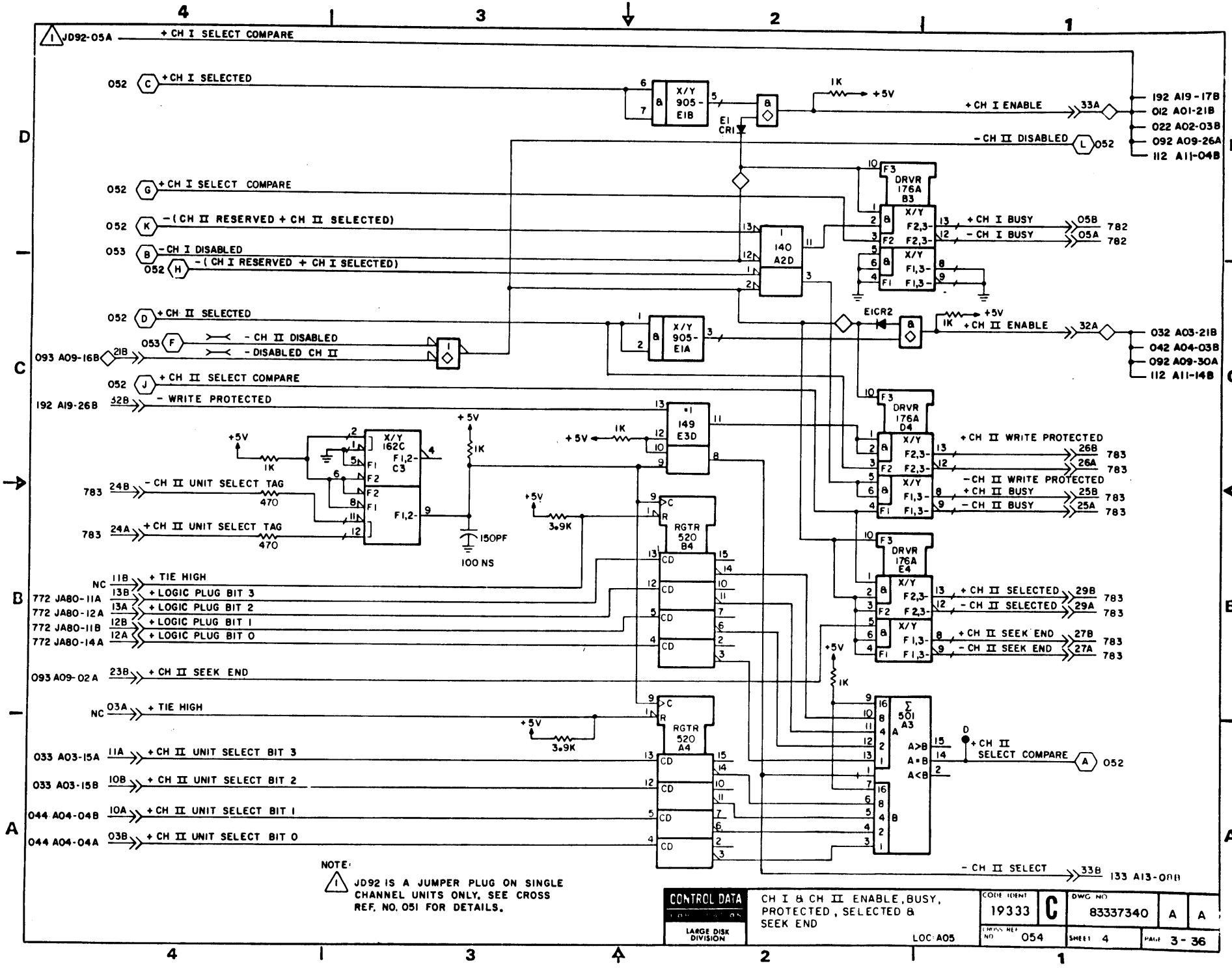
NOTE:

⚠ JD92 IS A JUMPER PLUG ON A SINGLE CHANNEL UNITS ONLY. SEE CROSS REF. NO. 051 FOR DETAILS.

CONTROL DATA
LARGE DISK DIVISION

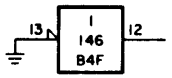
DUAL CHANNEL STEERING
PART 2
LOC:A05

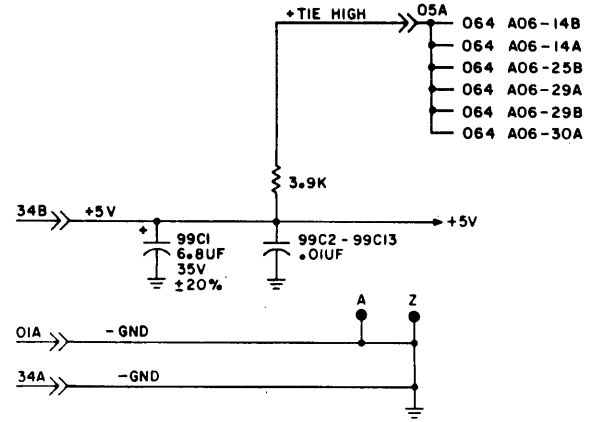
CODE IDENT		DWG. NO.		
19333	C	83337340	A	A
CROSS REF NO 053		SHEET 3	PAGE 3-35	


1 JD92-05A + CH I SELECT COMPARE
052 C +CH I SELECTED
X/Y 905-E1B
E1 CR1
1K +5V
+CH I ENABLE 33A
192 A19-17B
012 A01-21B
022 A02-03B
092 A09-26A
112 A11-04B
-CH II DISABLED L 052
052 G +CH I SELECT COMPARE
052 K -(CH II RESERVED + CH II SELECTED)
053 B -CH I DISABLED
052 H -(CH I RESERVED + CH I SELECTED)
I 140 A2D
F3 DRVR 176A B3
X/Y F2,3-
X/Y F1,3-
+CH I BUSY 05B 782
-CH I BUSY 05A 782
052 D +CH II SELECTED
053 F -CH II DISABLED
-DISABLED CH II
093 A09-16B 21B
X/Y 905-E1A
E1CR2
+5V 1K +CH II ENABLE 32A
032 A03-21B
042 A04-03B
092 A09-30A
112 A11-14B
052 J +CH II SELECT COMPARE
192 A19-26B 32B -WRITE PROTECTED
I 149 E3D
F3 DRVR 176A D4
+CH II WRITE PROTECTED 26B 26A 783
-CH II WRITE PROTECTED
+CH II BUSY 25B 783
-CH II BUSY 25A 783
X/Y 162C F1,2-C3
783 24B -CH II UNIT SELECT TAG 470
783 24A +CH II UNIT SELECT TAG 470
150PF
100 NS
3.9K
RGTR 520 B4
F3 DRVR 176A E4
+CH II SELECTED 29B 29A 783
-CH II SELECTED
+CH II SEEK END 27B 27A 783
-CH II SEEK END
NC 11B +TIE HIGH
772 JA80-11A 13B +LOGIC PLUG BIT 3
772 JA80-12A 13A +LOGIC PLUG BIT 2
772 JA80-11B 12B +LOGIC PLUG BIT 1
772 JA80-14A 12A +LOGIC PLUG BIT 0
093 A09-02A 23B +CH II SEEK END
NC 03A +TIE HIGH
RGTR 520 A4
Σ 501 A3
A>B A=B A<B
D +CH II SELECT COMPARE A 052
033 A03-15A 11A +CH II UNIT SELECT BIT 3
033 A03-15B 10B +CH II UNIT SELECT BIT 2
044 A04-04B 10A +CH II UNIT SELECT BIT 1
044 A04-04A 03B +CH II UNIT SELECT BIT 0
-CH II SELECT 33B 133 A13-08B
NOTE:
1 JD92 IS A JUMPER PLUG ON SINGLE CHANNEL UNITS ONLY. SEE CROSS REF. NO. 051 FOR DETAILS.
CONTROL DATA LARGE DISK DIVISION
CH I & CH II ENABLE, BUSY, PROTECTED, SELECTED & SEEK END
LOC: A05
CODE IDENT 19333 C
DWG NO 83337340 A A
CROSS REF NO 054
SHEET 4
PAGE 3-36

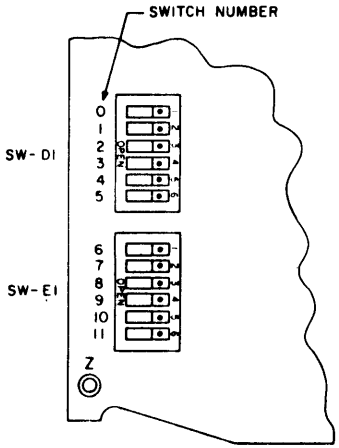
REVISIONS					
REV.	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	DH23000 DH13203A	CREATE BJ4A3C/D	SMS	9-30-82	
B	DJ13400	CHG QLTV OSC TIME	M.C.	2-9-84	

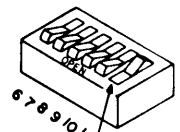
UNUSED LOGIC ELEMENT





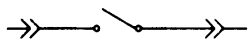
SECTOR SWITCHES





SWITCH 11 SHOWN IN OPEN POSITION

SWITCH POSITIONING



(OPEN POSITION)

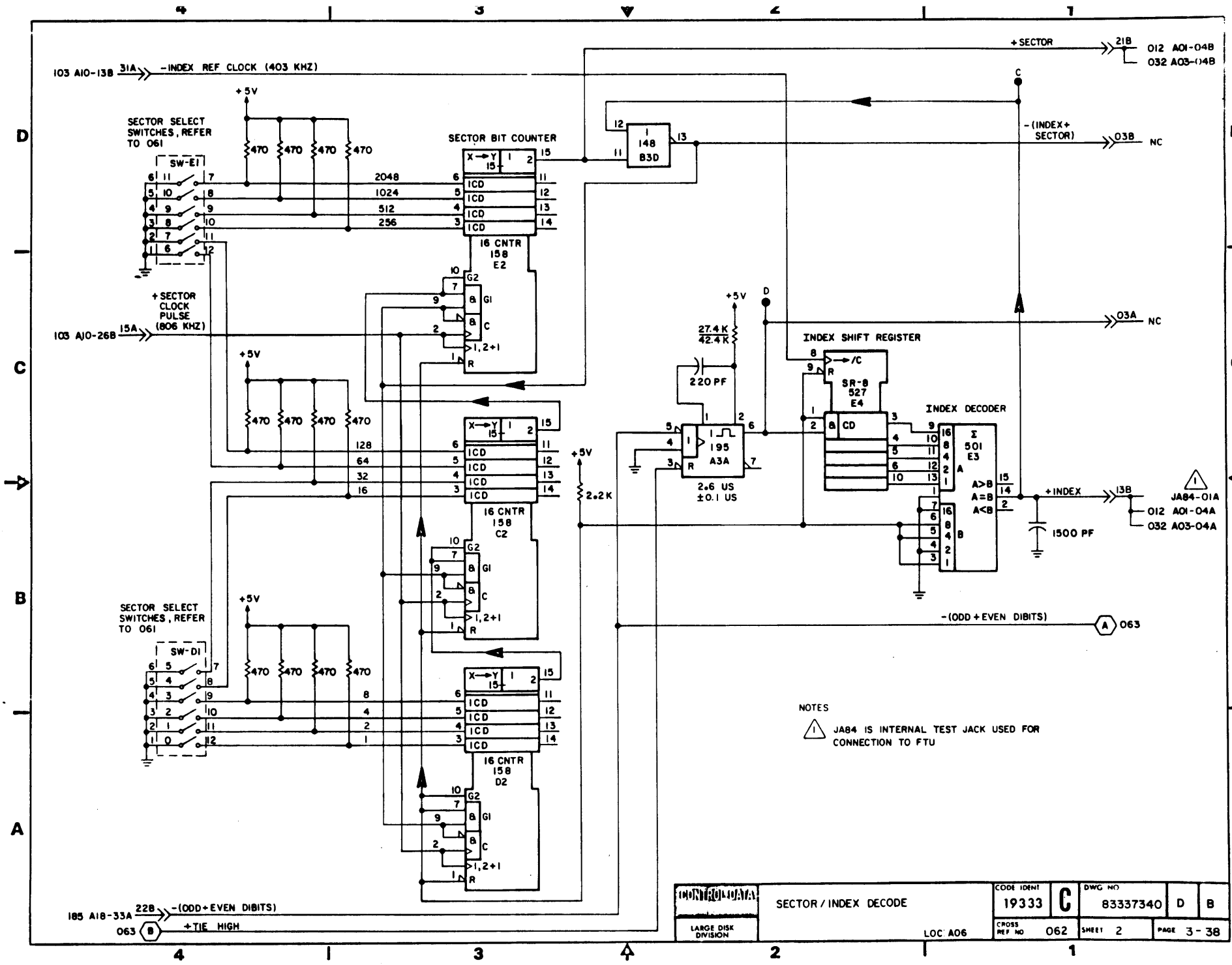
SWITCH CONVENTION

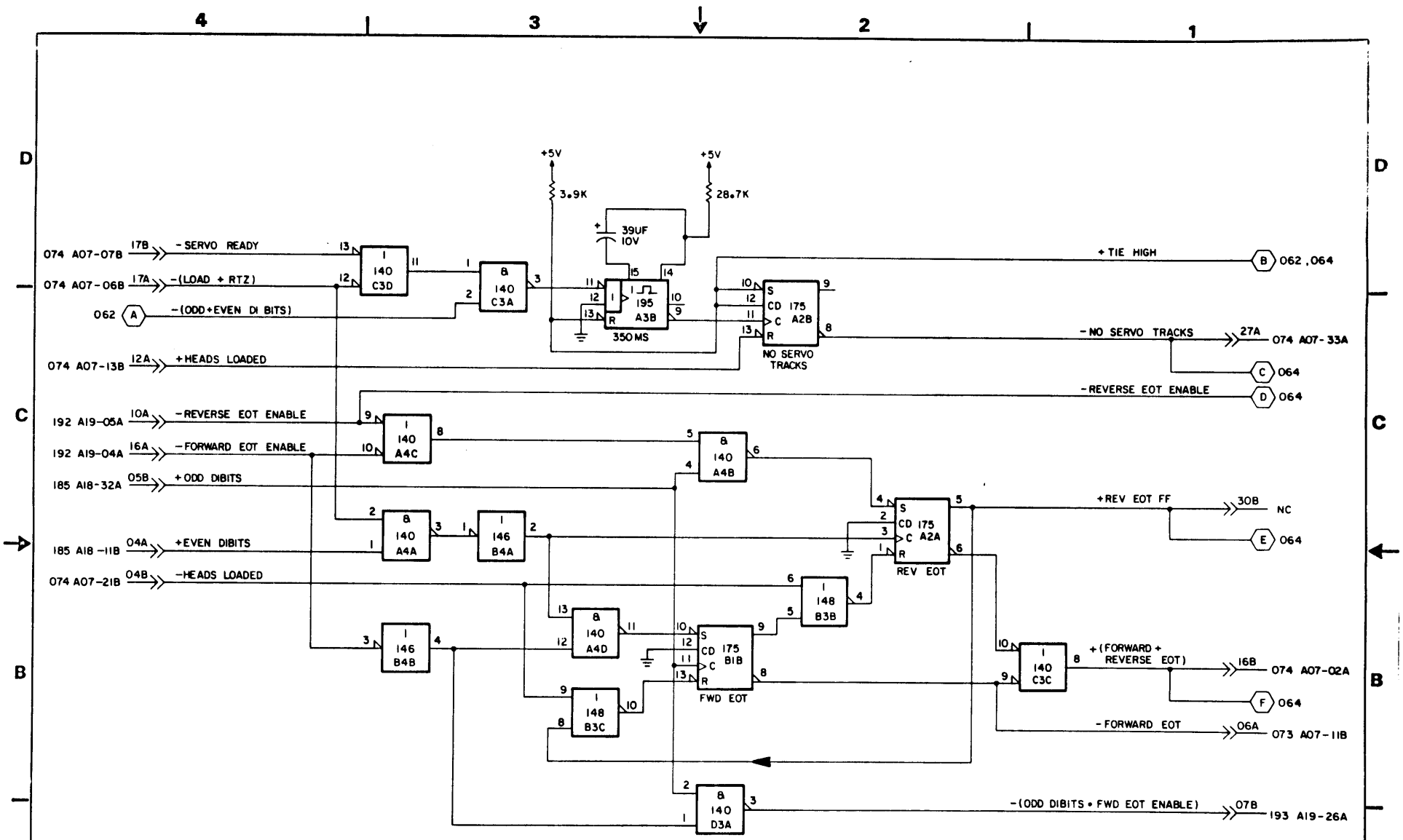
NOTE

1 REFER TO SECTION 1 OF MAINTENANCE MANUAL FOR INFORMATION ON HOW TO SELECT DIFFERENT SECTOR COUNTS.

DRAWN	M. Carlson	1-20-7	CONTROL DATA LARGE DISK DIVISION	ACCESS CONTROL AND INDEX / SECTOR DECODE DIAGRAMS	CODE IDENT 19333	C	DWG NO 83337340	D	B
CHECKED									
ENGINEER					CROSS REF NO 061		SHEET 1 OF 4	PAGE 3-37	
APPROVED				TYPE QLTV LOC A06					

REF 81201206


103 A10-13B 31A -INDEX REF CLOCK (403 KHZ)
+SECTOR 21B 012 A01-04B 032 A03-04B
SECTOR SELECT SWITCHES, REFER TO 061
SW-E1
+5V
470
SECTOR BIT COUNTER
2048
1024
512
256
ICD
16 CNTR 158 E2
+SECTOR CLOCK PULSE (806 KHZ)
103 A10-26B 15A
1,2+1
148 B3D
-(INDEX+ SECTOR) 03B NC
03A NC
INDEX SHIFT REGISTER
27.4 K
42.4 K
220 PF
195 A3A
2.6 US ±0.1 US
SR-8 527 E4
INDEX DECODER
501 E3
A>B
A=B
A<B
+INDEX 13B
JA84-01A
012 A01-04A
032 A03-04A
1500 PF
2.2K
128
64
32
16
16 CNTR 158 C2
SECTOR SELECT SWITCHES, REFER TO 061
SW-D1
8
4
2
1
16 CNTR 158 D2
-(ODD+EVEN DIBITS) A 063
NOTES
JA84 IS INTERNAL TEST JACK USED FOR CONNECTION TO FTU
185 A18-33A 22B -(ODD+EVEN DIBITS)
063 B +TIE HIGH
SECTOR / INDEX DECODE
LOC A06
CODE IDENT 19333
C
DWG NO 83337340
D
B
CROSS REF NO 062
SHEET 2
PAGE 3-38



CONTROL DATA
LARGE DISK DIVISION

EOT DETECT AND NO SERVO TRACK FAULT

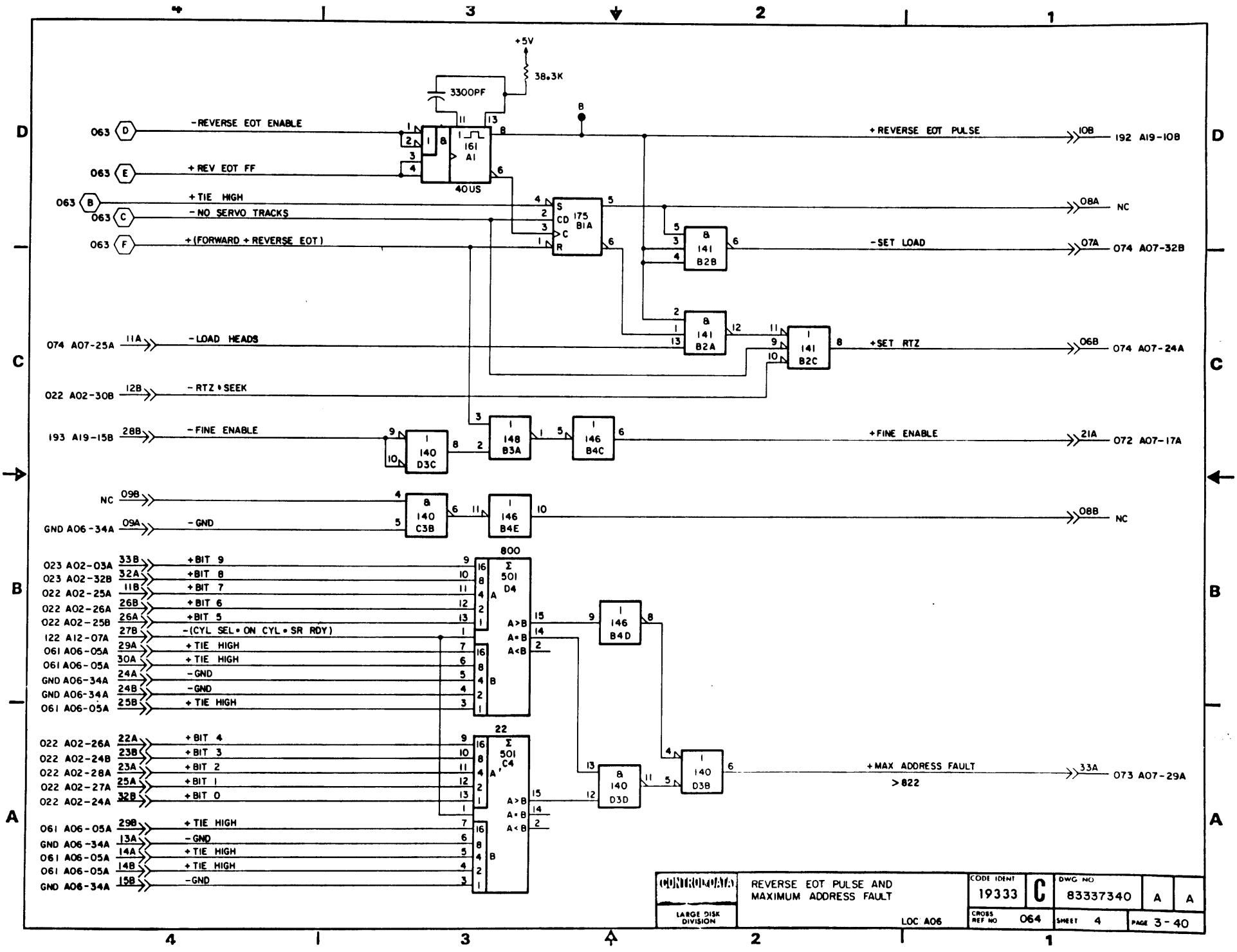
LOC A06

CODE IDENT		DWG NO		
19333	C	83337340	A	A
CROSS REF NO 063		SHEET 3	PAGE 3-39	

TABLE 3-1. CONTENTS OF DIAGRAM (Contd)

Cross Reference Number	Module* Location	Diagram Title
043	A2A04	Channel II Receivers
044	A2A04	Channel II Receivers
051	A2A05	Dual Channel Steering Diagrams (_KHV)
052	A2A05	Dual Channel Steering Part 1
053	A2A05	Dual Channel Steering Part 2
054	A2A05	CH I & CH II Enable, Busy Protected, Selected & Seek End
061	A2A06	Access Control and Index/Sector Decode (_LTV)
062	A2A06	Sector/Index Decode
063	A2A06	EOT Detect and Servo Track Fault
064	A2A06	Reverse EOT Pulse and Maximum Address Fault
071	A2A07	Access Control No. 1 Diagrams (_LVV)
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, Head Reg, Speed Enable, Unit Select Diagrams (_QPV)
082	A2A08	Speed Relay and Motor Relay Control, Up to Speed

Table Continued on Next Page


+5V
38.3K
3300PF
063 D -REVERSE EOT ENABLE
063 E +REV EOT FF
161 A1
40US
+REVERSE EOT PULSE
108
192 A19-108
063 B +TIE HIGH
063 C -NO SERVO TRACKS
063 F +(FORWARD + REVERSE EOT)
S CD 175 B1A C R
08A NC
141 B2B
-SET LOAD
07A
074 A07-32B
074 A07-25A 11A -LOAD HEADS
141 B2A
141 B2C
+SET RTZ
06B
074 A07-24A
022 A02-30B 12B -RTZ • SEEK
193 A19-15B 28B -FINE ENABLE
140 D3C
148 B3A
146 B4C
+FINE ENABLE
21A
072 A07-17A
NC 09B
GND A06-34A 09A -GND
140 C3B
146 B4E
08B
NC
800
Σ 501 D4
023 A02-03A 33B +BIT 9
023 A02-32B 32A +BIT 8
022 A02-25A 11B +BIT 7
022 A02-26A 26B +BIT 6
022 A02-25B 26A +BIT 5
122 A12-07A 27B -(CYL SEL • ON CYL • SR RDY)
061 A06-05A 29A +TIE HIGH
061 A06-05A 30A +TIE HIGH
GND A06-34A 24A -GND
GND A06-34A 24B -GND
061 A06-05A 25B +TIE HIGH
A>B A=B A<B
146 B4D
22
Σ 501 C4
022 A02-26A 22A +BIT 4
022 A02-24B 23B +BIT 3
022 A02-28A 23A +BIT 2
022 A02-27A 25A +BIT 1
022 A02-24A 32B +BIT 0
061 A06-05A 29B +TIE HIGH
GND A06-34A 13A -GND
061 A06-05A 14A +TIE HIGH
061 A06-05A 14B +TIE HIGH
GND A06-34A 15B -GND
140 D3D
140 D3B
+MAX ADDRESS FAULT
>822
33A
073 A07-29A
REVERSE EOT PULSE AND MAXIMUM ADDRESS FAULT
LOC A06
LARGE DISK DIVISION
CODE IDENT 19333
C
DWG NO 83337340
A
A
CROSS REF NO 064
SHEET 4
PAGE 3-40

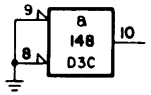
REVISION STATUS OF SHEETS

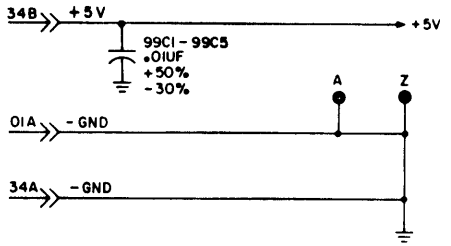
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																

REVISIONS

REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	DH23000 DH13203A	CREATE BJ4A3 C/D	SMS	9-30-82	

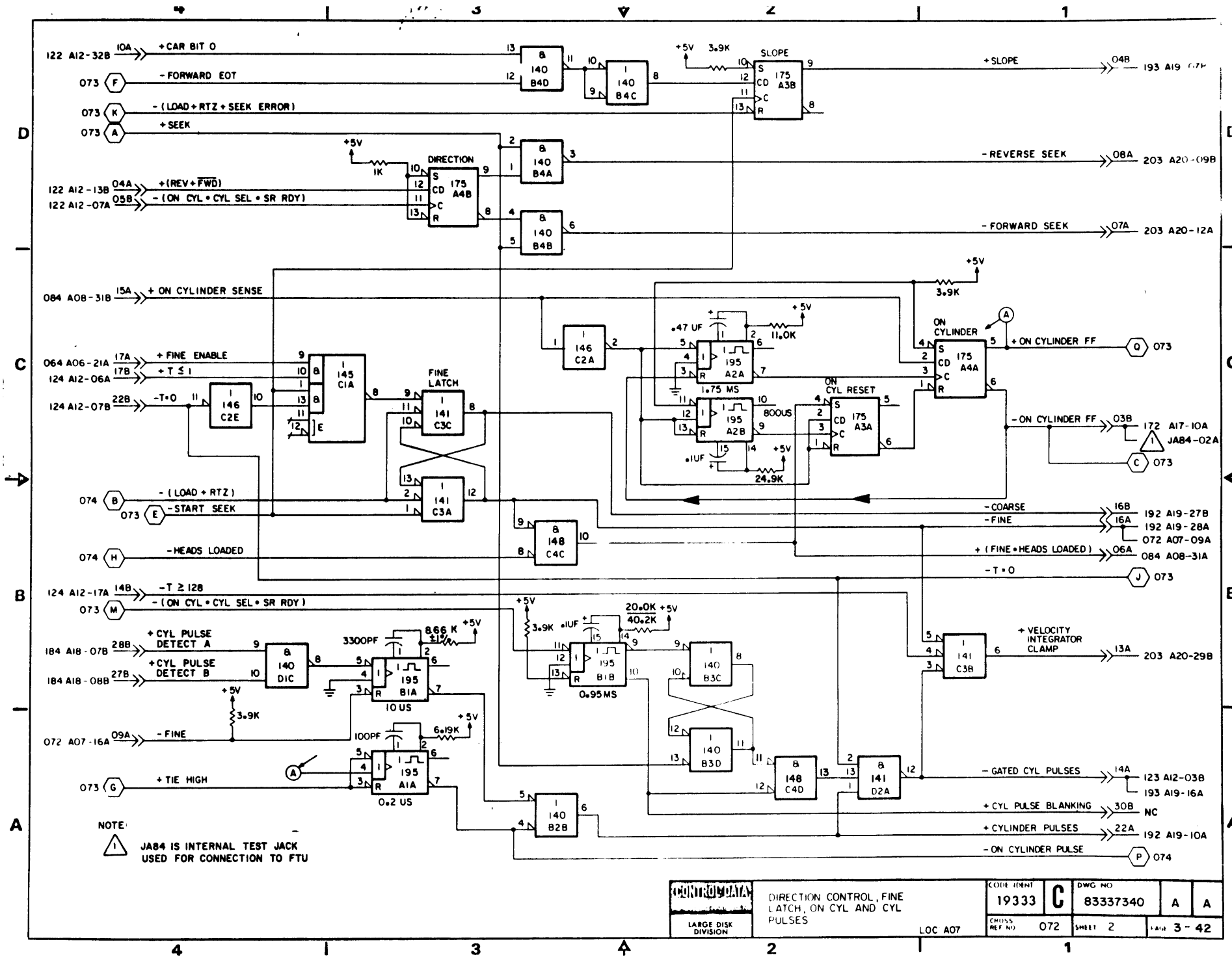
UNUSED LOGIC ELEMENT

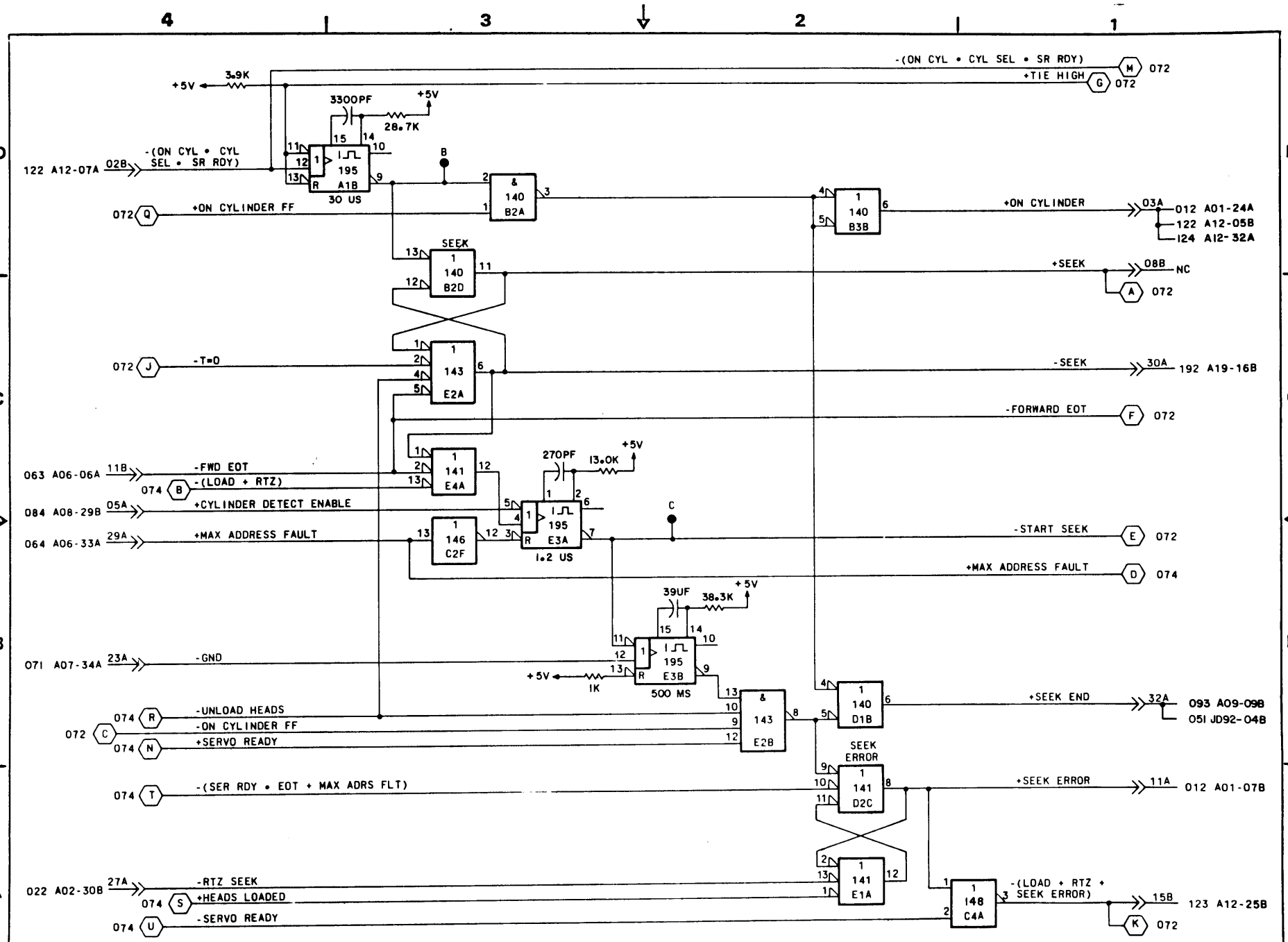


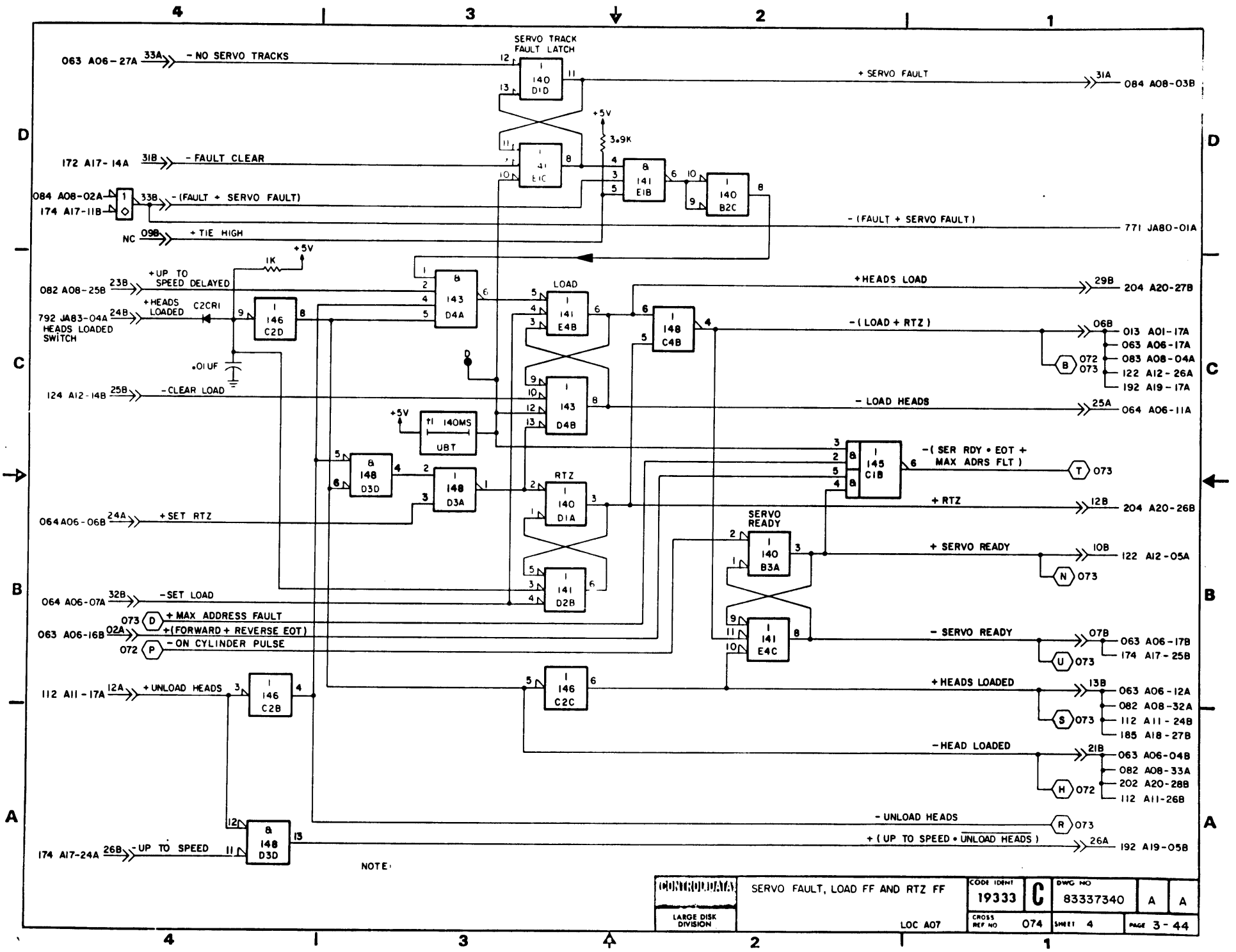


DRAWN	G RABINE	1-25-79	HONEYWELL	ACCESS CONTROL NO. 1 DIAGRAMS	CODE IDENT 19333	C	DWG. NO. 83337340	A	A
CHECKED									
ENGINEER		19	LARGE DISK DIVISION	TYPE: QLVV LOC: A07	CROSS REF NO 071		SHEET 1 OF 4	PAGE 3-41	
APPROVED									

REF 81201207


122 A12-32B
10A
+CAR BIT 0
073 F
-FORWARD EOT
073 K
-(LOAD+RTZ+SEEK ERROR)
073 A
+SEEK
122 A12-13B
04A
+(REV+FWD)
122 A12-07A
05B
-(ON CYL • CYL SEL • SR RDY)
DIRECTION
SLOPE
+SLOPE
04B
193 A19
-REVERSE SEEK
08A
203 A20-09B
-FORWARD SEEK
07A
203 A20-12A
084 A08-31B
15A
+ON CYLINDER SENSE
064 A06-21A
17A
+FINE ENABLE
124 A12-06A
17B
+T ≤ 1
124 A12-07B
22B
-T=0
FINE LATCH
ON CYLINDER
ON CYL RESET
+ON CYLINDER FF
Q 073
-ON CYLINDER FF
03B
172 A17-10A
JA84-02A
C 073
074 B
-(LOAD+RTZ)
073 E
-START SEEK
074 H
-HEADS LOADED
-COARSE
16B
192 A19-27B
-FINE
16A
192 A19-28A
072 A07-09A
+(FINE•HEADS LOADED)
06A
084 A08-31A
-T=0
J 073
124 A12-17A
14B
-T ≥ 128
073 M
-(ON CYL • CYL SEL • SR RDY)
184 A18-07B
28B
+CYL PULSE DETECT A
184 A18-08B
27B
+CYL PULSE DETECT B
3300PF
8.66 K
10 US
3.9K
072 A07-16A
09A
-FINE
100PF
6.19K
073 G
+TIE HIGH
0.2 US
20.0K
40.2K
0.95 MS
+VELOCITY INTEGRATOR CLAMP
13A
203 A20-29B
-GATED CYL PULSES
14A
123 A12-03B
193 A19-16A
+CYL PULSE BLANKING
30B
NC
+CYLINDER PULSES
22A
192 A19-10A
-ON CYLINDER PULSE
P 074
NOTE:
1 JA84 IS INTERNAL TEST JACK USED FOR CONNECTION TO FTU
CONTROL DATA
LARGE DISK DIVISION
DIRECTION CONTROL, FINE LATCH, ON CYL AND CYL PULSES
LOC A07
CODE IDENT 19333
C
DWG NO 83337340
A
A
CROSS REF NO 072
SHEET 2
PAGE 3-42


-(ON CYL • CYL SEL • SR RDY)
+TIE HIGH
M 072
G 072
+5V
3.9K
3300PF
+5V
28.7K
122 A12-07A
02B
-(ON CYL • CYL SEL • SR RDY)
195 A1B
30 US
B
072 Q
+ON CYLINDER FF
& 140 B2A
1 140 B3B
+ON CYLINDER
03A
012 A01-24A
122 A12-05B
124 A12-32A
SEEK
1 140 B2D
+SEEK
08B
NC
A 072
072 J
-T=0
1 143 E2A
-SEEK
30A
192 A19-16B
-FORWARD EOT
F 072
1 141 E4A
270PF
13.0K
+5V
063 A06-06A
11B
-FWD EOT
074 B
-(LOAD + RTZ)
084 A08-29B
05A
+CYLINDER DETECT ENABLE
064 A06-33A
29A
+MAX ADDRESS FAULT
1 146 C2F
195 E3A
1.2 US
C
-START SEEK
E 072
+MAX ADDRESS FAULT
D 074
39UF
38.3K
+5V
071 A07-34A
23A
-GND
195 E3B
500 MS
+5V
1K
074 R
-UNLOAD HEADS
072 C
-ON CYLINDER FF
074 N
+SERVO READY
& 143 E2B
1 140 D1B
+SEEK END
32A
093 A09-09B
051 JD92-04B
SEEK ERROR
074 T
-(SER RDY • EOT + MAX ADRS FLT)
1 141 D2C
+SEEK ERROR
11A
012 A01-07B
022 A02-30B
27A
-RTZ SEEK
074 S
+HEADS LOADED
074 U
-SERVO READY
1 141 E1A
1 148 C4A
-(LOAD + RTZ + SEEK ERROR)
15B
123 A12-25B
K 072
MAGNETIC PERIPHERALS INC.
SEEK FF AND SEEK ERROR DETECTION
LOC: A07
LARGE DISK DIVISION
C
DWG NO 83337340
A
A
CODE IDENT 19333
CROSS REF NO 073
SHEET 3
PAGE 3 - 43


063 A06-27A 33A - NO SERVO TRACKS
SERVO TRACK FAULT LATCH
1 140 D1D
+ SERVO FAULT 31A 084 A08-03B
+5V
3.9K
172 A17-14A 31B - FAULT CLEAR
1 141 E1C
8 141 E1B
1 140 B2C
084 A08-02A 174 A17-11B 33B - (FAULT + SERVO FAULT)
- (FAULT + SERVO FAULT) 771 JA80-01A
NC 09B + TIE HIGH
1K +5V
082 A08-25B 23B +UP TO SPEED DELAYED
792 JA83-04A 24B HEADS LOADED SWITCH
+HEADS LOADED C2CR1
1 146 C2D
8 143 D4A
LOAD
1 141 E4B
1 148 C4B
+HEADS LOAD 29B 204 A20-27B
- (LOAD + RTZ) 06B 013 A01-17A 063 A06-17A 072 073 083 A08-04A 122 A12-26A 192 A19-17A
.01 UF
124 A12-14B 25B - CLEAR LOAD
1 143 D4B
- LOAD HEADS 25A 064 A06-11A
+5V 1 140MS UBT
8 148 D3D
1 148 D3A
1 145 C1B
- (SER RDY • EOT + MAX ADRS FLT) T 073
RTZ
1 140 D1A
+ RTZ 12B 204 A20-26B
064 A06-06B 24A + SET RTZ
SERVO READY
1 140 B3A
+ SERVO READY 10B 122 A12-05A N 073
1 141 D2B
064 A06-07A 32B - SET LOAD
073 D + MAX ADDRESS FAULT
063 A06-16B 02A + (FORWARD + REVERSE EOT)
072 P - ON CYLINDER PULSE
1 141 E4C
- SERVO READY 07B 063 A06-17B 174 A17-25B U 073
112 A11-17A 12A + UNLOAD HEADS
1 146 C2B
1 146 C2C
+HEADS LOADED 13B 063 A06-12A 082 A08-32A 112 A11-24B 185 A18-27B S 073
- HEAD LOADED 21B 063 A06-04B 082 A08-33A 202 A20-28B 112 A11-26B H 072
- UNLOAD HEADS R 073
8 148 D3D
174 A17-24A 26B - UP TO SPEED
+ (UP TO SPEED • UNLOAD HEADS) 26A 192 A19-05B
NOTE:
CONTROL DATA
LARGE DISK DIVISION
SERVO FAULT, LOAD FF AND RTZ FF
LOC A07
CODE IDENT 19333
C
DWG NO 83337340
A
A
CROSS REF NO 074
SHEET 4
PAGE 3-44

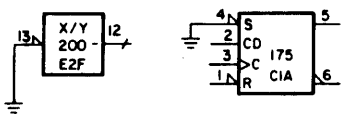
REVISION STATUS OF SHEETS

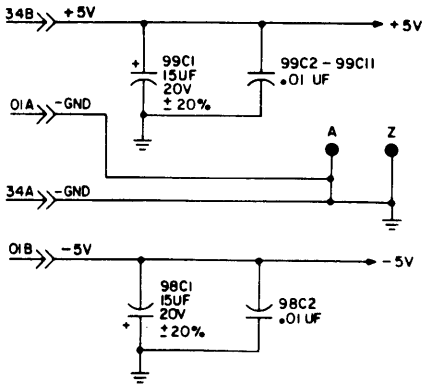
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																

REVISIONS

REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	DH23000 DH13203	CREATE BJ4A3C/D	HDK	10-8-82	

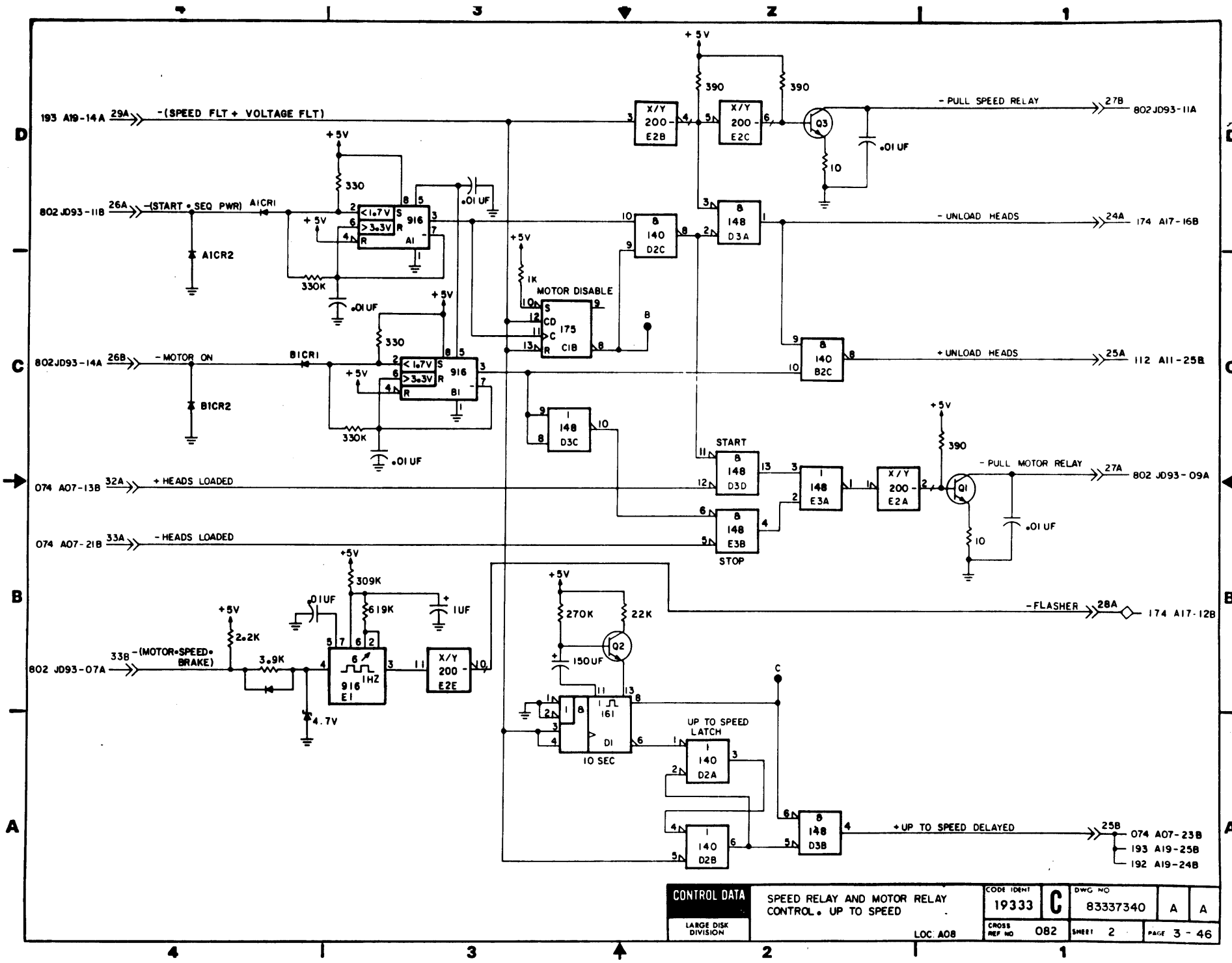
UNUSED LOGIC ELEMENTS



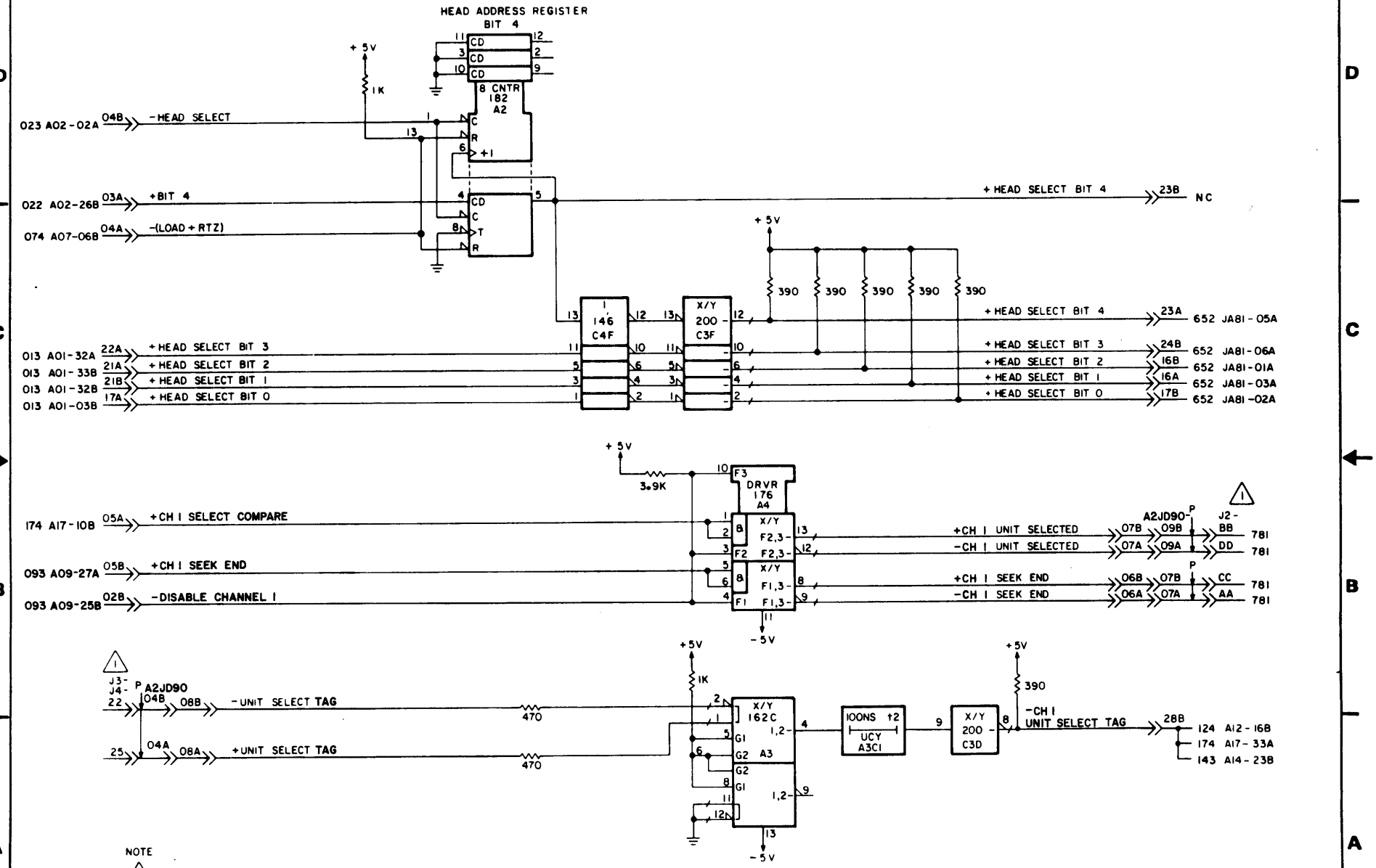


DRAWN	MANDERSON	1/25/79	CONTROL DATA	DIFF BITS, HEAD REG, SPEED ENABLE, UNIT SELECT DIAGRAMS TYPE DQPV LOC A08	CODE IDENT 19333	C	DWG NO 83337340	CD A / REV A
CHECKED								
ENGINEER	L Winthrop	2-9-79	LARGE DISK DIVISION		CROSS REF NO 081		SHEET 1 OF 4	PAGE 3-45
APPROVED								

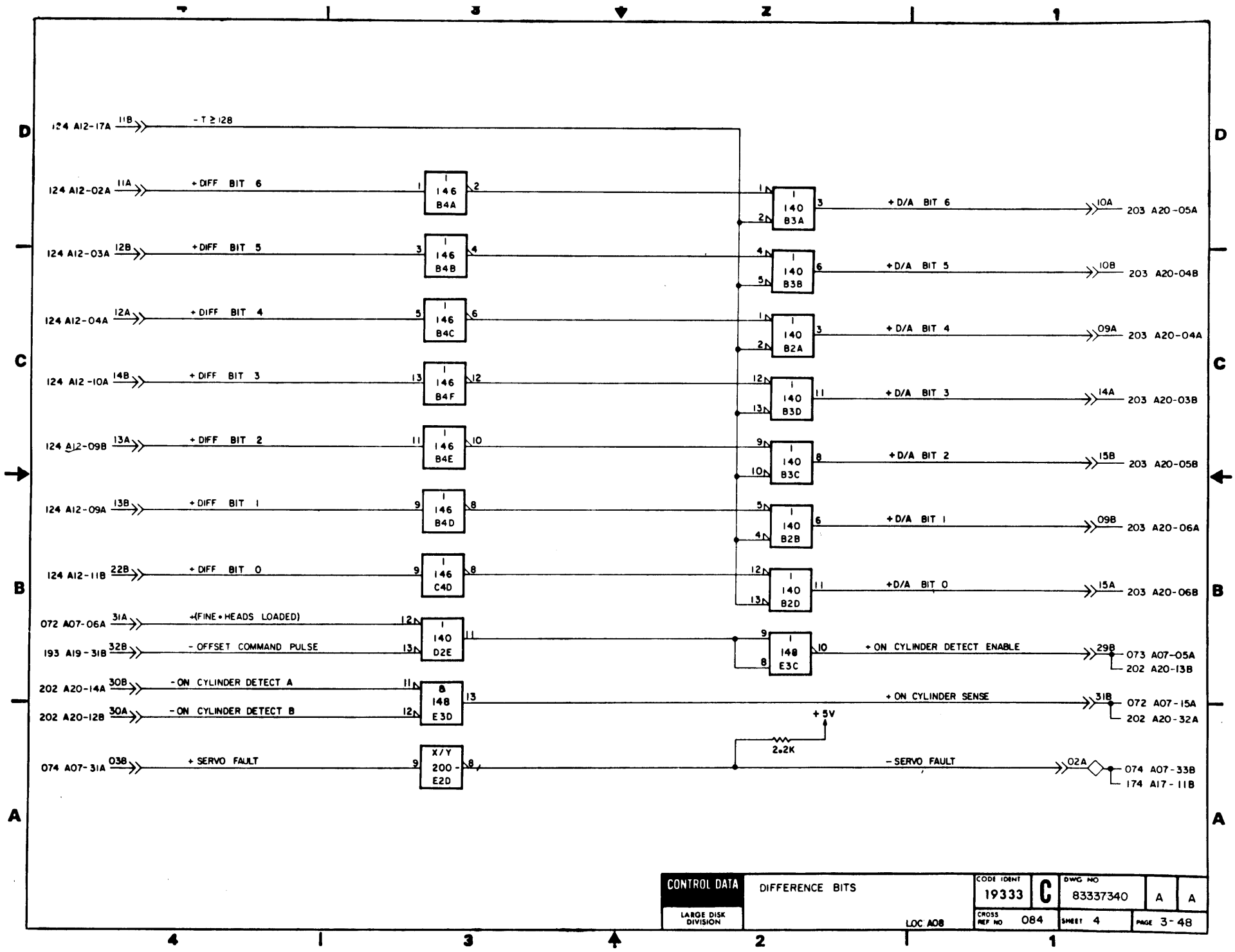
REF 81201208



CONTROL DATA LARGE DISK DIVISION	SPEED RELAY AND MOTOR RELAY CONTROL • UP TO SPEED LOC: A08	CODE IDENT 19333	C	DWG NO 83337340	A A
		CROSS REF NO 082		SHEET 2	PAGE 3 - 46



CONTROL DATA LARGE DISK DIVISION	HEAD SELECT REGISTER UNIT SELECT XMTR/RCVR SEEK END XMTR LOC A08	CODE IDENT 19333	C	DWG NO 83337340	A A
		CROSS REF NO 083		SHEET 3	PAGE 3-47



CONTROL DATA LARGE DISK DIVISION	DIFFERENCE BITS LOC A08	CODE IDENT 19333	C	DWG NO 83337340	A A
		CROSS REF NO 084		SHEET 4	PAGE 3-48

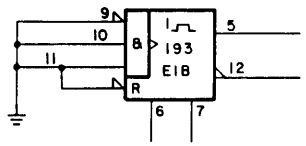
REVISION STATUS OF SHEETS

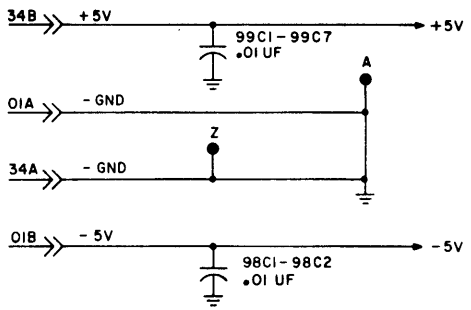
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A																	

REVISIONS

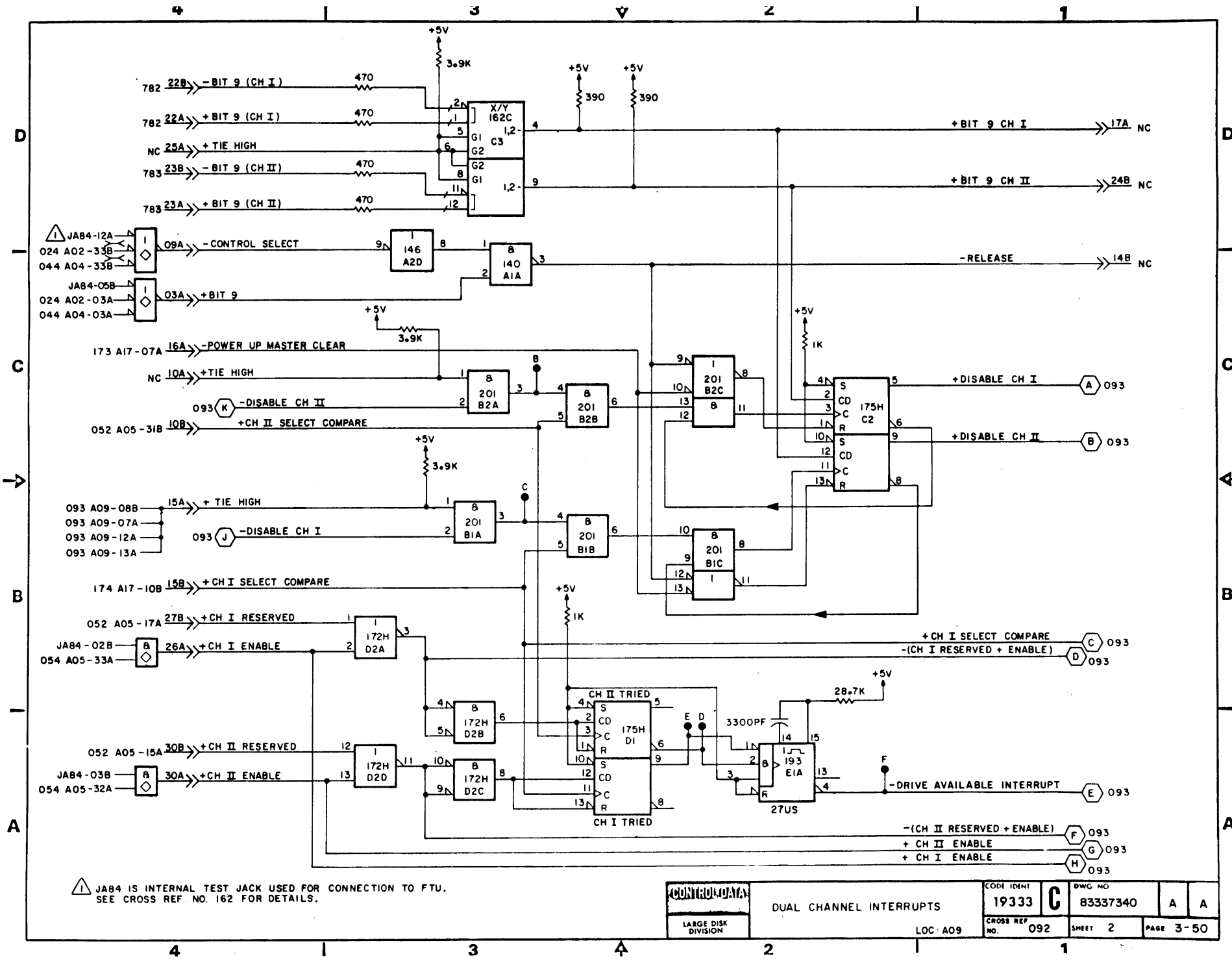
REV.	ECO.	DESCRIPTION	DRFT.	DATE	CHK'D
A	DH23000 DH13203A	CREATE BJ4A3 C/D	SMS	9-30-82	

UNUSED LOGIC ELEMENT





DRAWN	W.BERGSTROM	10-18-76	CONTROL DATA LARGE DISK DIVISION	DUAL CHANNEL INTERRUPT DIAGRAMS	CODE IDENT 19333	C	DWG NO 83337340 A A
CHECKED							
ENGINEER					CROSS REF NO 091		SHEET 1 OF 3 PAGE 3-49
APPROVED				TYPE FSMV LOC A09 REF 81201209			



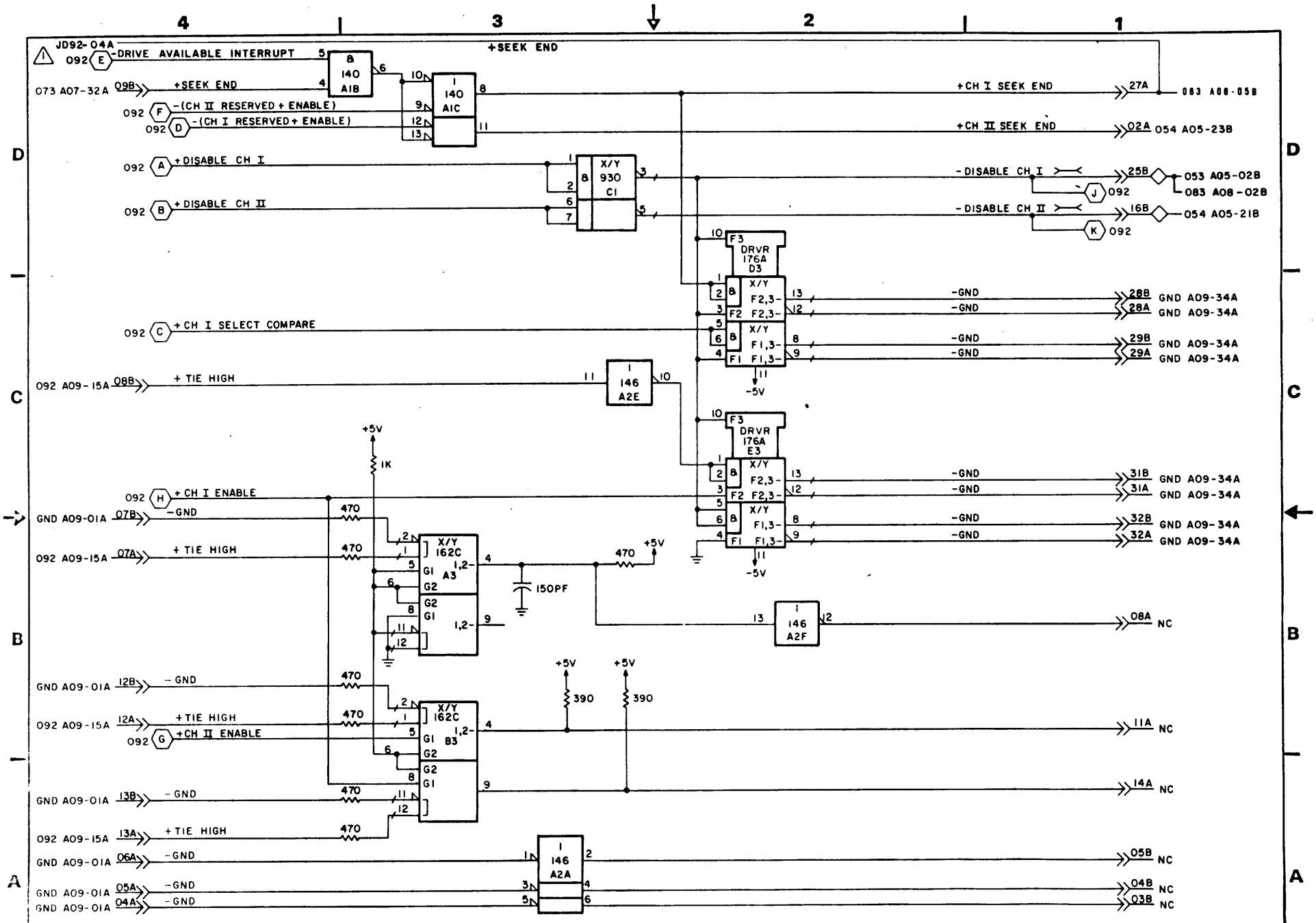
1 JA84 IS INTERNAL TEST JACK USED FOR CONNECTION TO FTU. SEE CROSS REF. NO. 162 FOR DETAILS.

CONTROL DATA — LARGE DISK DIVISION

DUAL CHANNEL INTERRUPTS

LOC: A09

CODE IDENT	DWG NO		
19333	C 83337340	A	A
CROSS REF NO. 092	SHEET 2	PAGE 3-50	


JD92-04A
092 E -DRIVE AVAILABLE INTERRUPT
+SEEK END
073 A07-32A Q9B +SEEK END
092 F -(CH II RESERVED + ENABLE)
092 D -(CH I RESERVED + ENABLE)
092 A +DISABLE CH I
092 B +DISABLE CH II
092 C +CH I SELECT COMPARE
092 A09-15A Q8B + TIE HIGH
092 H +CH I ENABLE
GND A09-01A Q7B -GND
092 A09-15A Q7A + TIE HIGH
GND A09-01A 12B -GND
092 A09-15A 12A +TIE HIGH
092 G +CH II ENABLE
GND A09-01A 13B -GND
092 A09-15A 13A +TIE HIGH
GND A09-01A Q6A -GND
GND A09-01A Q5A -GND
GND A09-01A Q4A -GND
8 140 A1B
1 140 A1C
8 X/Y 930 C1
F3 DRVR 176A D3
F3 DRVR 176A E3
X/Y F2,3-
X/Y F1,3-
1 146 A2E
1 146 A2F
1 146 A2A
X/Y 162C A3
X/Y 162C B3
1K
470
150PF
390
+5V
-5V
+CH I SEEK END 27A 083 A08-05B
+CH II SEEK END 02A 054 A05-23B
-DISABLE CH I 25B 053 A05-02B 083 A08-02B
-DISABLE CH II 16B 054 A05-21B
-GND 28B GND A09-34A
-GND 28A GND A09-34A
-GND 29B GND A09-34A
-GND 29A GND A09-34A
-GND 31B GND A09-34A
-GND 31A GND A09-34A
-GND 32B GND A09-34A
-GND 32A GND A09-34A
08A NC
11A NC
14A NC
05B NC
04B NC
03B NC
NOTE:
JD92 IS A JUMPER PLUG ON SINGLE CHANNEL UNITS ONLY.
SEE CROSS REF NO 051 FOR DETAILS.
CONTROL DATA
LARGE DISK DIVISION
SEEK END AND DISABLE
LOC A09
CODE IDENT 19333
C
DWG NO 83337340
A
A
CROSS REF NO. 093
SHEET 3
PAGE 3-51/3-52

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																

REVISIONS

REV	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	DH23000 DH13203A	CREATE BJ4A3C/D	DLF	9-30-82	DWL

DRAWN	Q RABINE	12/14/82
CHECKED		
ENGINEER		
APPROVED		

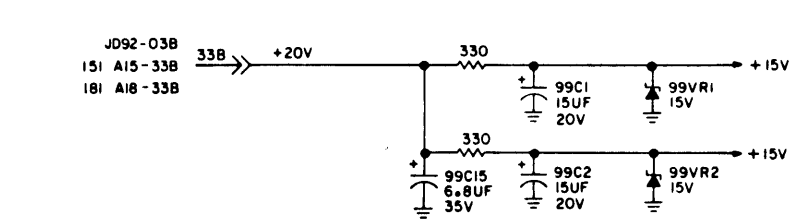
CONTROL DATA
LARGE DISK DIVISION

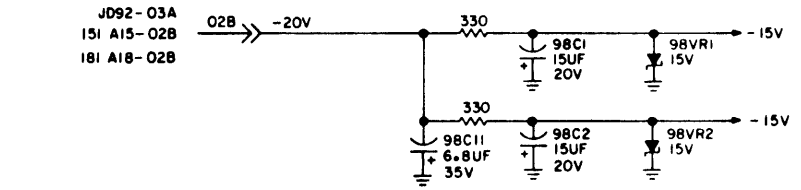
WRITE CLOCK 806 KHZ
TO 9.67 MHZ
DIAGRAMS

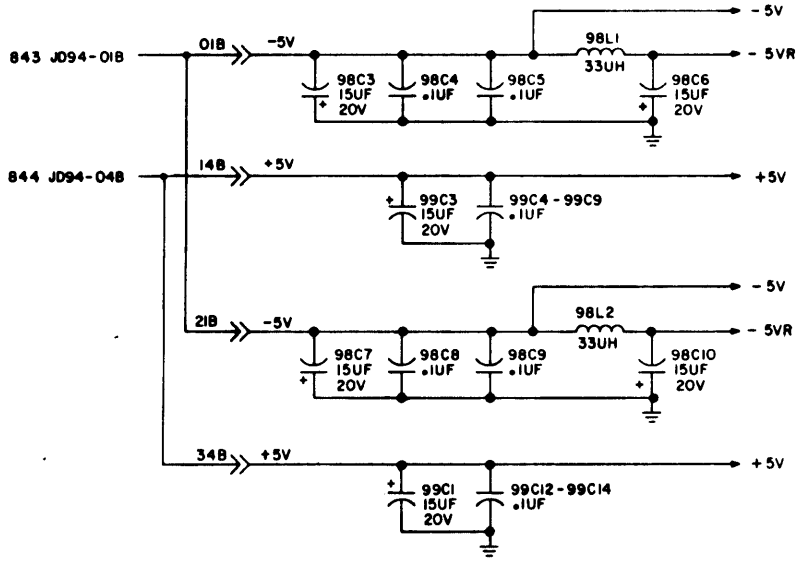
TYPE: ELSV LOC: A10

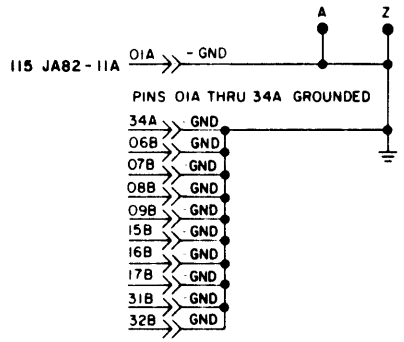
CODE IDENT 19333	C	DWG NO 83337340	A	A
CROSS REF NO 101		SHEET 1 OF 4	PAGE 3-53	

REF 81201210

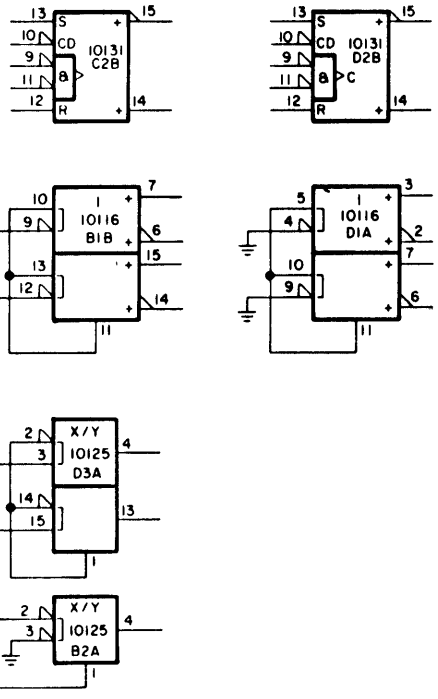




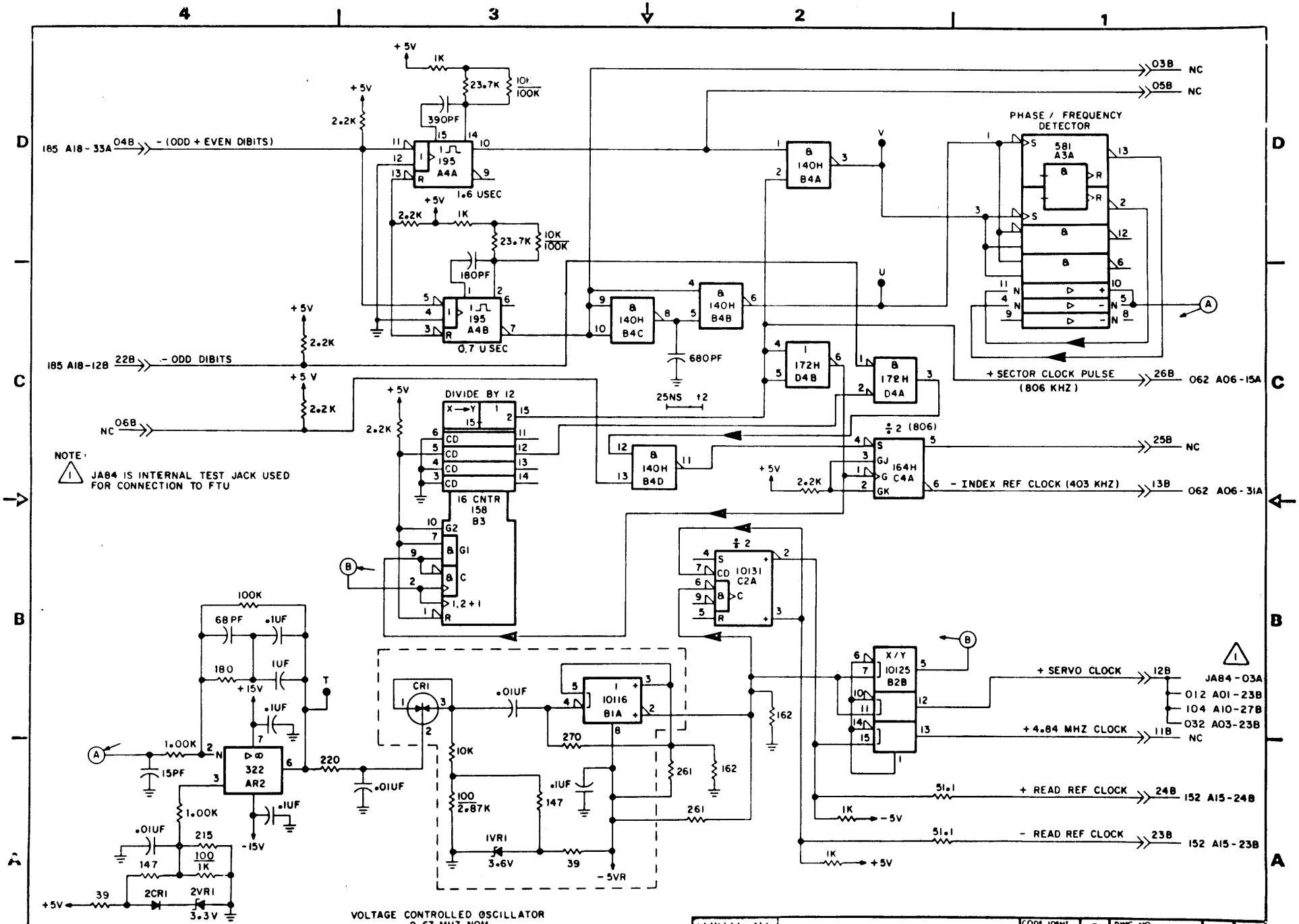


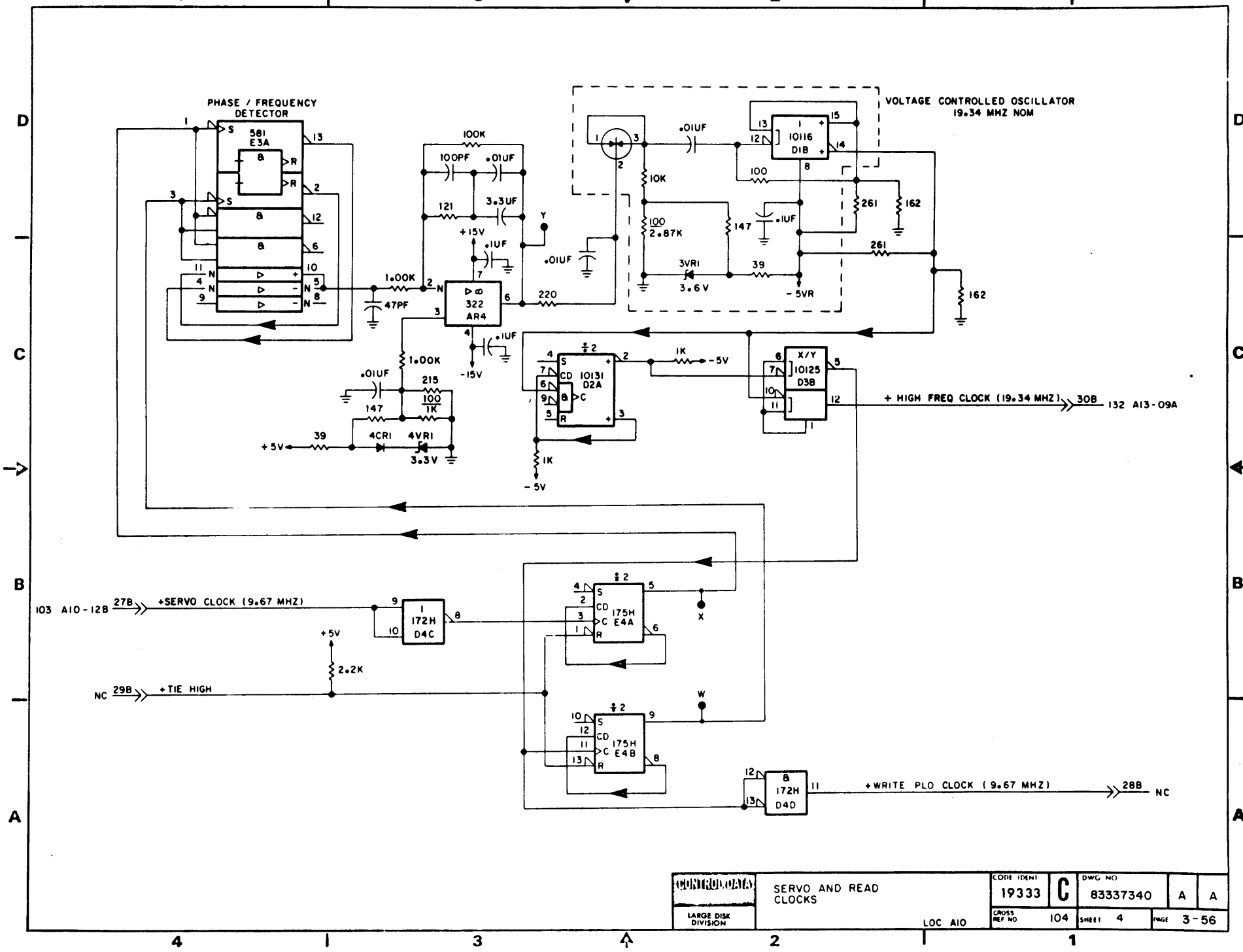


UNUSED LOGIC ELEMENTS



CONTROL DATA LARGE DISK DIVISION	POWER INPUT PINS AND UNUSED LOGIC ELEMENTS LOC A10	CODE IDENT 19333	C	DWG NO 83337340	A A
		CROSS REF NO 102		SHEET 2	PAGE 3-54


185 A18-33A
04B
- (ODD + EVEN DIBITS)
185 A18-12B
22B
- ODD DIBITS
NC
06B
NOTE:
1
JA84 IS INTERNAL TEST JACK USED FOR CONNECTION TO FTU
+5V
1K
23.7K
10K 100K
390PF
2.2K
195 A4A
1.6 USEC
180PF
195 A4B
0.7 USEC
140H B4A
140H B4B
140H B4C
140H B4D
680PF
25NS ±2
172H D4B
172H D4A
581 A3A
PHASE / FREQUENCY DETECTOR
03B NC
05B NC
+ SECTOR CLOCK PULSE (806 KHZ)
26B
062 A06-15A
÷2 (806)
164H C4A
25B NC
- INDEX REF CLOCK (403 KHZ)
13B
062 A06-31A
DIVIDE BY 12
16 CNTR 158 B3
÷2 10131 C2A
X/Y 10125 B2B
+ SERVO CLOCK
12B
JA84-03A
012 A01-23B
104 A10-27B
032 A03-23B
+4.84 MHZ CLOCK
11B
NC
+ READ REF CLOCK
24B
152 A15-24B
- READ REF CLOCK
23B
152 A15-23B
-5V
+5V
100K
68PF
.1UF
180
1UF
+15V
T
1.00K
15PF
322 AR2
220
.01UF
CR1
10116 B1A
10K
270
162
261
100 2.87K
147
1VR1
3.6V
39
-5VR
215
100 1K
2CR1
2VR1
3.3V
-15V
VOLTAGE CONTROLLED OSCILLATOR
9.67 MHZ NOM.
CONTROL DATA
LARGE DISK DIVISION
SECTOR, INDEX, REF AND WRITE PLO CLOCKS
LOC A10
CODE IDENT 19333
C
DWG NO 83337340
A
A
CROSS REF NO 103
SHEET 3
PAGE 3 - 55

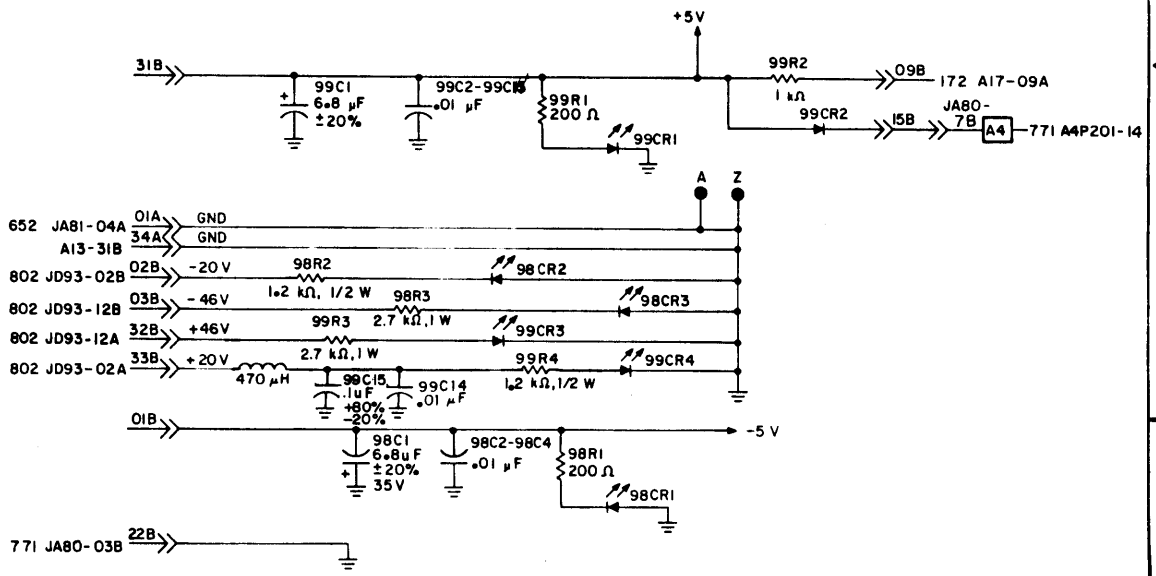


CONTROL DATA LARGE DISK DIVISION	SERVO AND READ CLOCKS	CODE IDENT 19333	C	DWG NO 83337340	A A
	LOC A10	CROSS REF NO 104		SHEET 4	PAGE 3-56

REVISIONS					
REV	ECO	DESCRIPTION	UNIT	DATE	CHK'D
A	DH23000 DH13203A	CREATE BJ4A3C/D	DLF	9-30-82	
B	DJ13362	CHG. LOGIC DIAGRAMS	M.L.C.	2-9-84	

UNUSED LOGIC ELEMENTS

ELEMENT	LOCATION	OUTPUT PIN (S)
148	B3	10, 13
175	D3	5, 6
195	A3	9, 10
200	A2	2, 4, 6, 8, 10
148	D4	13



DRAWN	M. Parker	12/19/79
CHECKED		
ENGINEER	D. Wells	1/10/1
APPROVED		

MAGNETIC PERIPHERALS INC.
A Subsidiary of CONTROL DATA CORPORATION

HEADS UNLOADED, AIRFLOW MONITOR, HIGH TEMP STATUS

TYPE: EUKV LOC: A11

LARGE DISK DIVISION

C

DWG NO 83337340

D B

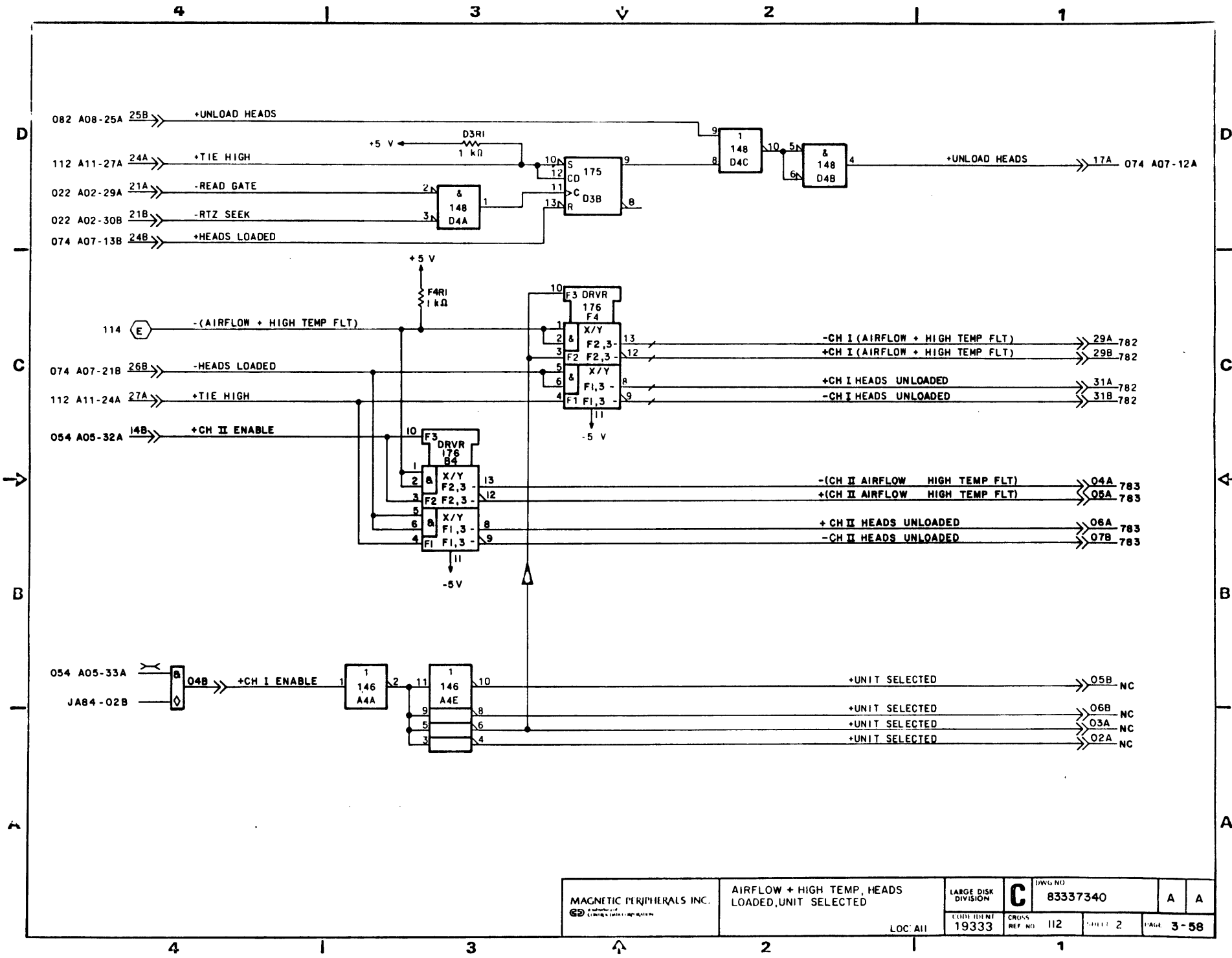
CODE IDENT 19333

REV 111

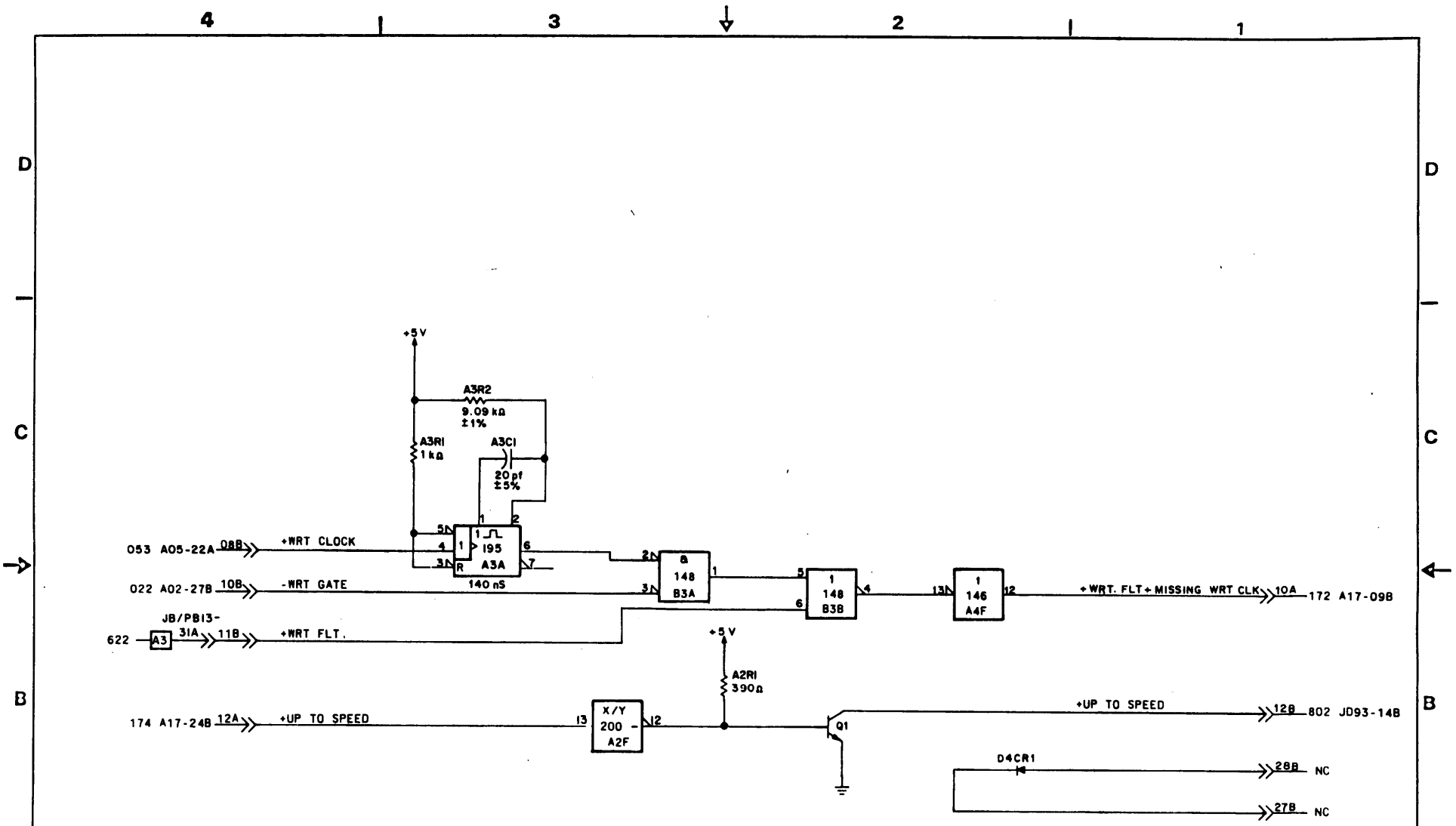
SHEET 1 OF 5

PAGE 3-57

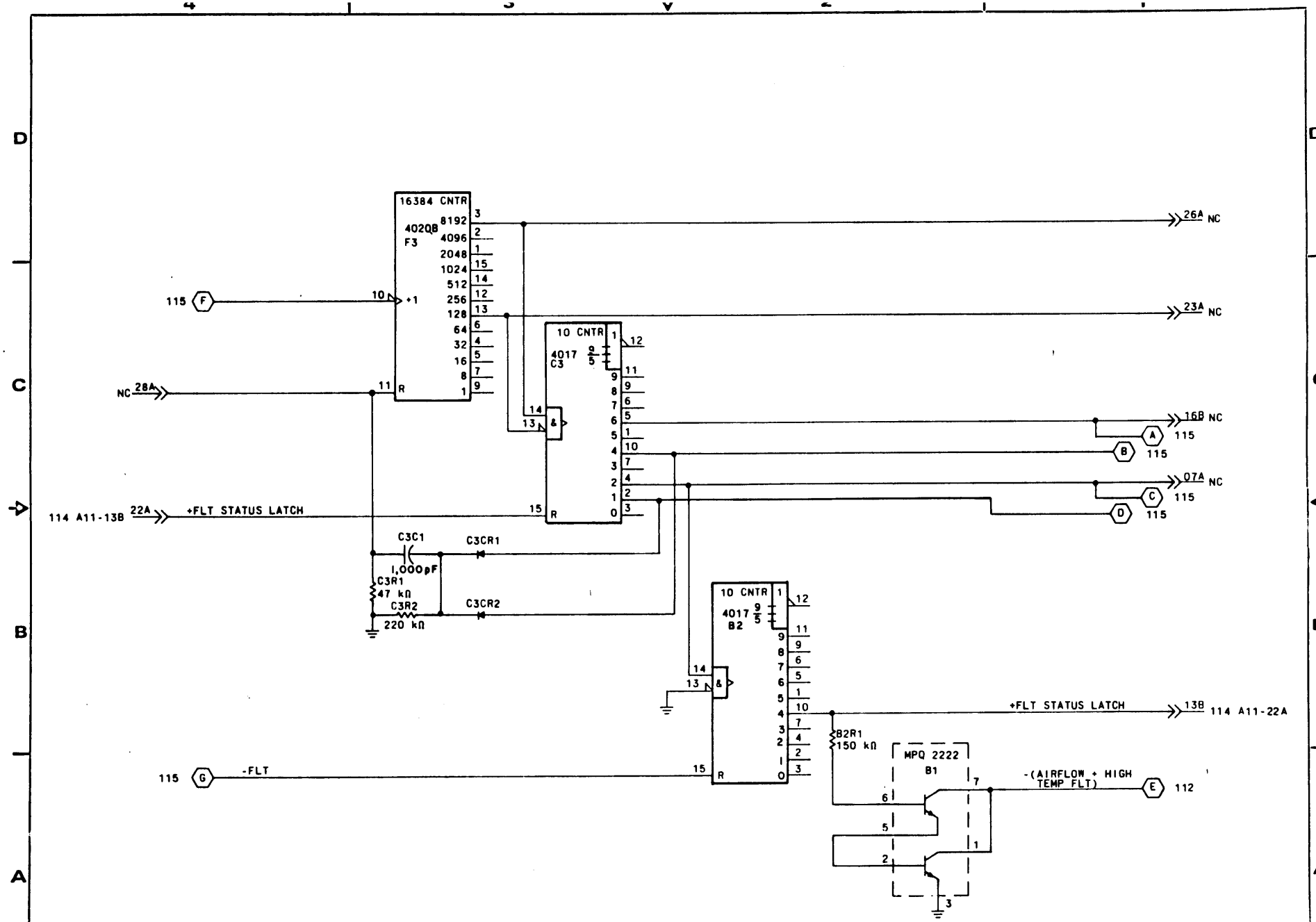
REF 81201211



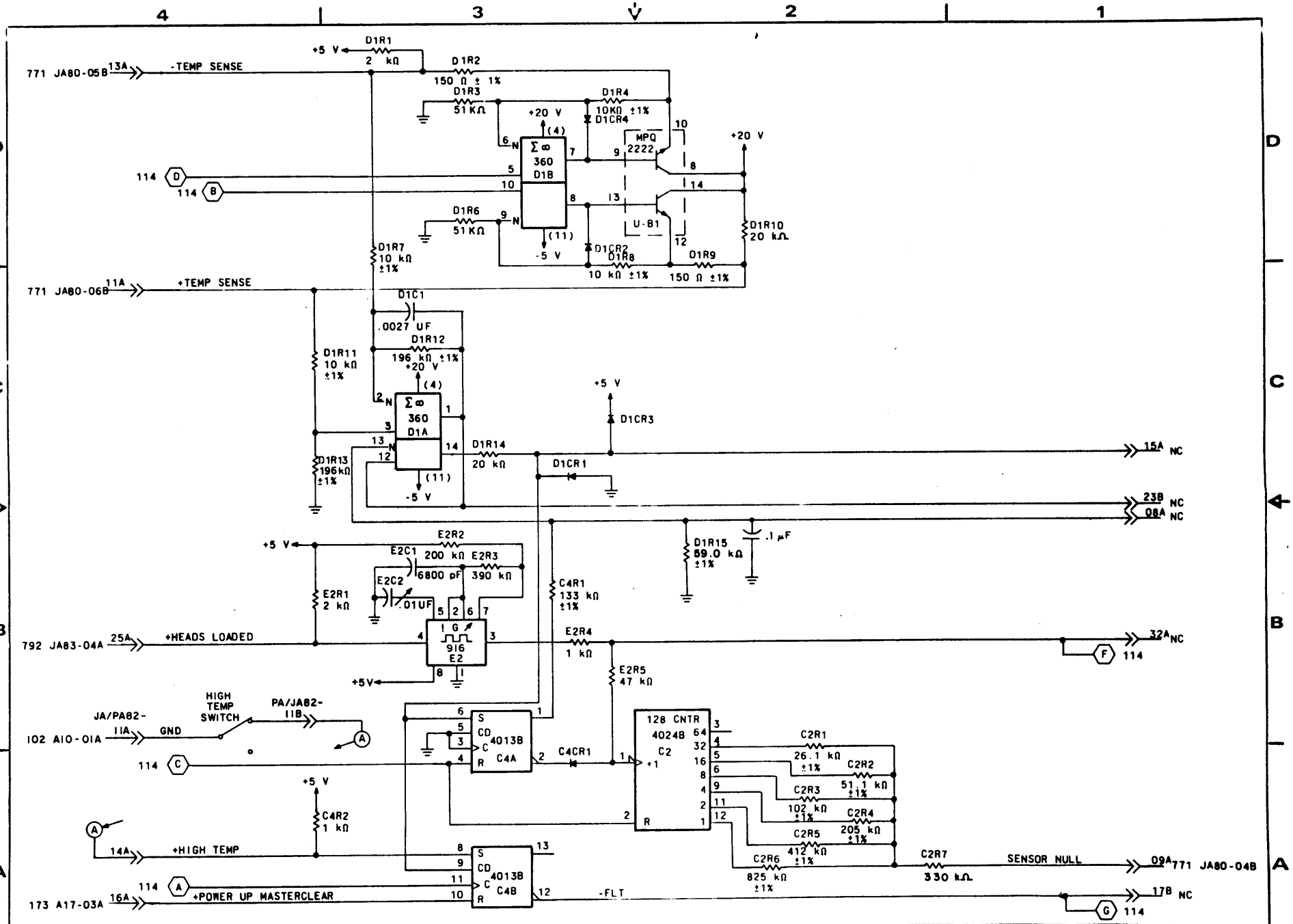
MAGNETIC PERIPHERALS INC.	AIRFLOW + HIGH TEMP, HEADS LOADED, UNIT SELECTED	LARGE DISK DIVISION	C	DWG NO 83337340	A A
	LOC: A11	CODE IDENT 19333	CROSS REF NO 112	SHEET 2	PAGE 3-58



MAGNETIC PERIPHERALS INC.	WRITE FAULT MONITOR, UP TO SPEED	LARGE DISK DIVISION	C	DWG NO 83337340	A A
	LOC: AII	CODE IDENT 19333	CROSS REF NO 113	SHEET 3	PAGE 3-59



MAGNETIC PERIPHERALS INC.	AIRFLOW MONITOR LOGIC	LARGE DISK DIVISION	C	DWG NO 83337340	A A
	LOC A11	CODE IDENT 19333	CROSS REF NO 114	SHEET 4	PAGE 3-60


771 JA80-05B 13A -TEMP SENSE
+5 V
D1R1 2 kΩ
D1R2 150 Ω ± 1%
D1R3 51 KΩ
D1R4 10KΩ ±1%
D1CR4
+20 V
(4)
Σ∞ 360 D1B
MPQ 2222
U-B1
D1R6 51 KΩ
(11)
-5 V
D1CR2
D1R8 10 kΩ ±1%
D1R9 150 Ω ±1%
D1R10 20 kΩ
D1R7 10 kΩ ±1%
114 D
114 B
771 JA80-06B 11A +TEMP SENSE
D1C1 .0027 UF
D1R12 196 kΩ ±1%
D1R11 10 kΩ ±1%
Σ∞ 360 D1A
D1R13 196kΩ ±1%
D1R14 20 kΩ
D1CR3
D1CR1
15A NC
23B NC
08A NC
D1R15 59.0 kΩ ±1%
.1 μF
E2R2 200 kΩ
E2C1 6800 pF
E2R3 390 kΩ
E2C2 .01UF
E2R1 2 kΩ
C4R1 133 kΩ ±1%
792 JA83-04A 25A +HEADS LOADED
I G 916 E2
E2R4 1 kΩ
32A NC
F 114
E2R5 47 kΩ
+5V
HIGH TEMP SWITCH
JA/PA82-11A GND
102 A10-01A
PA/JA82-11B
A
114 C
S CD 4013B C R C4A
C4CR1
128 CNTR 4024B C2 +1 R
C2R1 26.1 kΩ ±1%
C2R2 51.1 kΩ ±1%
C2R3 102 kΩ ±1%
C2R4 205 kΩ ±1%
C2R5 412 kΩ ±1%
C2R6 825 kΩ ±1%
C2R7 330 kΩ
SENSOR NULL
09A 771 JA80-04B
C4R2 1 kΩ
14A +HIGH TEMP
S CD 4013B C R C4B
114 A +POWER UP MASTERCLEAR
173 A17-03A 16A
-FLT
17B NC
G 114
MAGNETIC PERIPHERALS INC.
AIRFLOW SENSOR INTERFACE
LOC: All
LARGE DISK DIVISION
C
DWG NO 83337340
A A
CODE IDENT 19333
CROSS REF NO 115
SHEET 5
PAGE 3-61/3-62

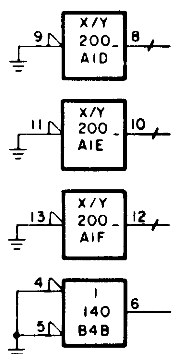
REVISION STATUS OF SHEETS

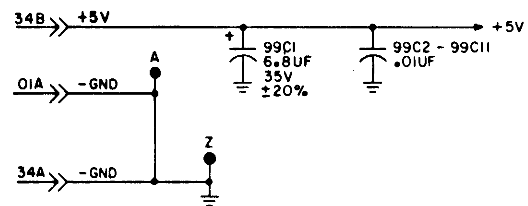
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																

REVISIONS

REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	DH23000 DH13203A	CREATE 8J4A3 C/D	SMS	9-30-82	RMS

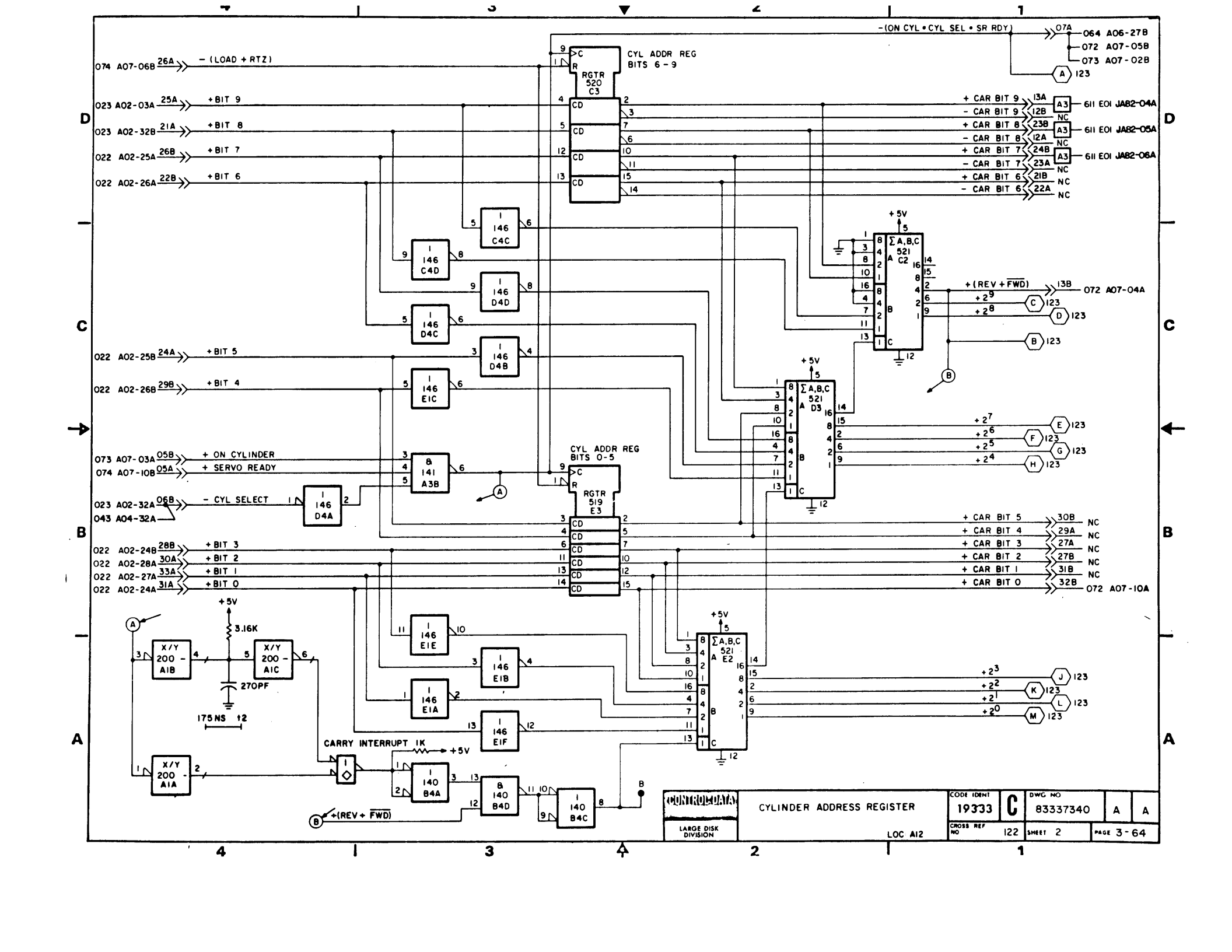
UNUSED LOGIC ELEMENTS

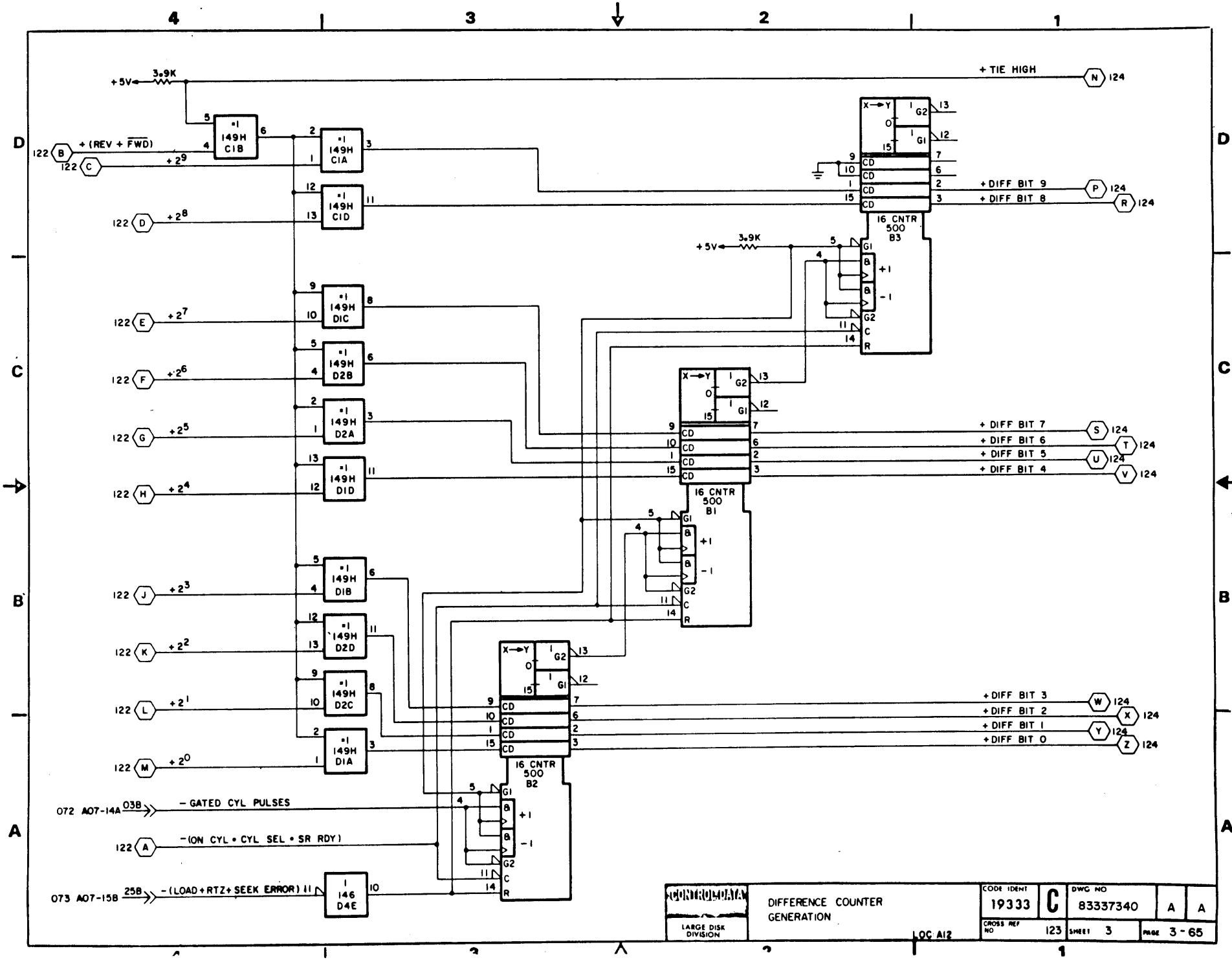


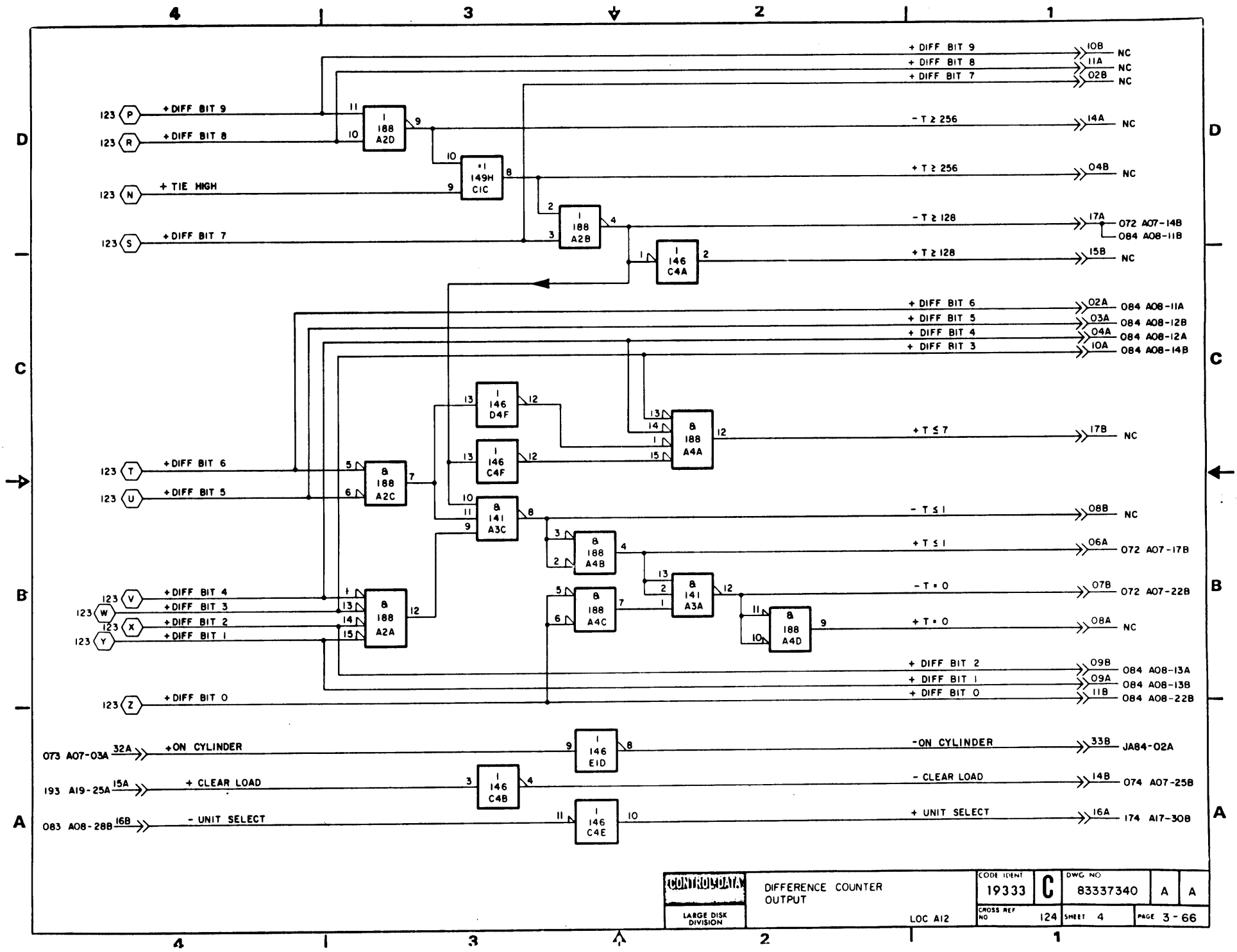


DRAWN	B. Kabine	1-29-79	CONTROL DATA	DIFFERENCE GENERATION AND CONTROL DIAGRAMS	CODE IDENT 19333	C	DWG NO 83337340	A A
CHECKED								
ENGINEER	L. Whitely	2-5-79	LARGE DISK DIVISION	TYPE: GLWV LOC A12	CROSS REF NO 121		SHEET 1 OF 4	PAGE 3-63
APPROVED								

REF 81201212


-(ON CYL • CYL SEL • SR RDY)
074 A07-06B 26A - (LOAD + RTZ)
CYL ADDR REG BITS 6-9
RGTR 520 C3
023 A02-03A 25A +BIT 9
023 A02-32B 21A +BIT 8
022 A02-25A 26B +BIT 7
022 A02-26A 22B +BIT 6
+ CAR BIT 9
- CAR BIT 9
+ CAR BIT 8
- CAR BIT 8
+ CAR BIT 7
- CAR BIT 7
+ CAR BIT 6
- CAR BIT 6
611 EOI JA82-04A
611 EOI JA82-05A
611 EOI JA82-06A
+5V
ΣA,B,C 521 C2
+(REV + FWD)
072 A07-04A
022 A02-25B 24A +BIT 5
022 A02-26B 29B +BIT 4
ΣA,B,C 521 D3
073 A07-03A 05B + ON CYLINDER
074 A07-10B 05A + SERVO READY
023 A02-32A 06B - CYL SELECT
043 A04-32A
CYL ADDR REG BITS 0-5
RGTR 519 E3
+ CAR BIT 5
+ CAR BIT 4
+ CAR BIT 3
+ CAR BIT 2
+ CAR BIT 1
+ CAR BIT 0
022 A02-24B 28B +BIT 3
022 A02-28A 30A +BIT 2
022 A02-27A 33A +BIT 1
022 A02-24A 31A +BIT 0
072 A07-10A
ΣA,B,C 521 E2
3.16K
270PF
175NS 12
X/Y 200 - A1B
X/Y 200 - A1C
X/Y 200 - A1A
CARRY INTERRUPT 1K
+5V
+(REV + FWD)
CONTROL DATA
LARGE DISK DIVISION
CYLINDER ADDRESS REGISTER
LOC A12
CODE IDENT 19333
C
DWG NO 83337340
A
A
CROSS REF NO 122
SHEET 2
PAGE 3-64

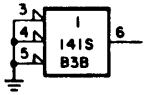

+5V
3.9K
+ TIE HIGH
N 124
122 B + (REV + FWD)
122 C + 2^9
122 D + 2^8
122 E + 2^7
122 F + 2^6
122 G + 2^5
122 H + 2^4
122 J + 2^3
122 K + 2^2
122 L + 2^1
122 M + 2^0
072 A07-14A 03B - GATED CYL PULSES
122 A -(ON CYL • CYL SEL • SR RDY)
073 A07-15B 25B -(LOAD+RTZ+SEEK ERROR)
*1 149H C1B
*1 149H C1A
*1 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
1 146 D4E
16 CNTR 500 B3
16 CNTR 500 B1
16 CNTR 500 B2
X→Y
G1
G2
CD
+1
-1
C
R
+ DIFF BIT 9 P 124
+ DIFF BIT 8 R 124
+ DIFF BIT 7 S 124
+ DIFF BIT 6 T 124
+ DIFF BIT 5 U 124
+ DIFF BIT 4 V 124
+ DIFF BIT 3 W 124
+ DIFF BIT 2 X 124
+ DIFF BIT 1 Y 124
+ DIFF BIT 0 Z 124
DIFFERENCE COUNTER GENERATION
LARGE DISK DIVISION
CODE IDENT 19333
C
DWG NO 83337340
A
A
CROSS REF NO 123
SHEET 3
PAGE 3 - 65

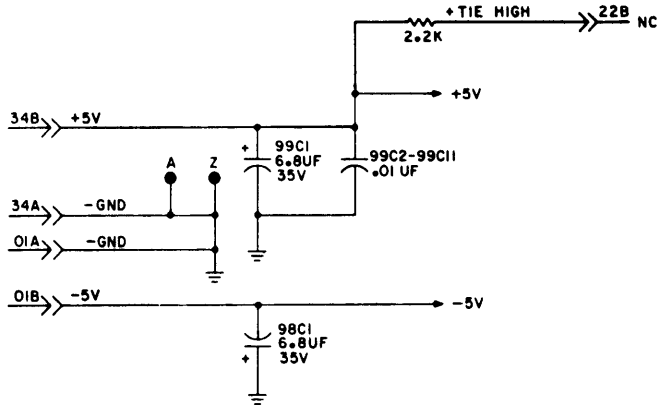

+DIFF BIT 9
+DIFF BIT 8
+DIFF BIT 7
+TIE HIGH
+DIFF BIT 6
+DIFF BIT 5
+DIFF BIT 4
+DIFF BIT 3
+DIFF BIT 2
+DIFF BIT 1
+DIFF BIT 0
+ON CYLINDER
+ CLEAR LOAD
- UNIT SELECT
- T ≥ 256
+ T ≥ 256
- T ≥ 128
+ T ≥ 128
+ T ≤ 7
- T ≤ 1
+ T ≤ 1
- T = 0
+ T = 0
-ON CYLINDER
- CLEAR LOAD
+ UNIT SELECT
1 188 A2D
1 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
1 146 E1D
1 146 C4B
1 146 C4E
NC
072 A07-14B
084 A08-11B
084 A08-11A
084 A08-12B
084 A08-12A
084 A08-14B
072 A07-17B
072 A07-22B
084 A08-13A
084 A08-13B
084 A08-22B
JA84-02A
074 A07-25B
174 A17-30B
CONTROL DATA
LARGE DISK DIVISION
DIFFERENCE COUNTER OUTPUT
LOC A12
CODE IDENT 19333
C
DWG NO 83337340
A
A
CROSS REF NO 124
SHEET 4
PAGE 3 - 66

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	DH23000 DH13203A	CREATE BJ4A3 C/D	SMS	9-30-82	

UNUSED LOGIC ELEMENTS

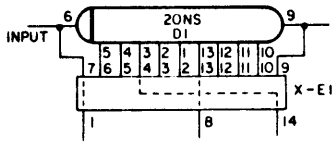




NOTE

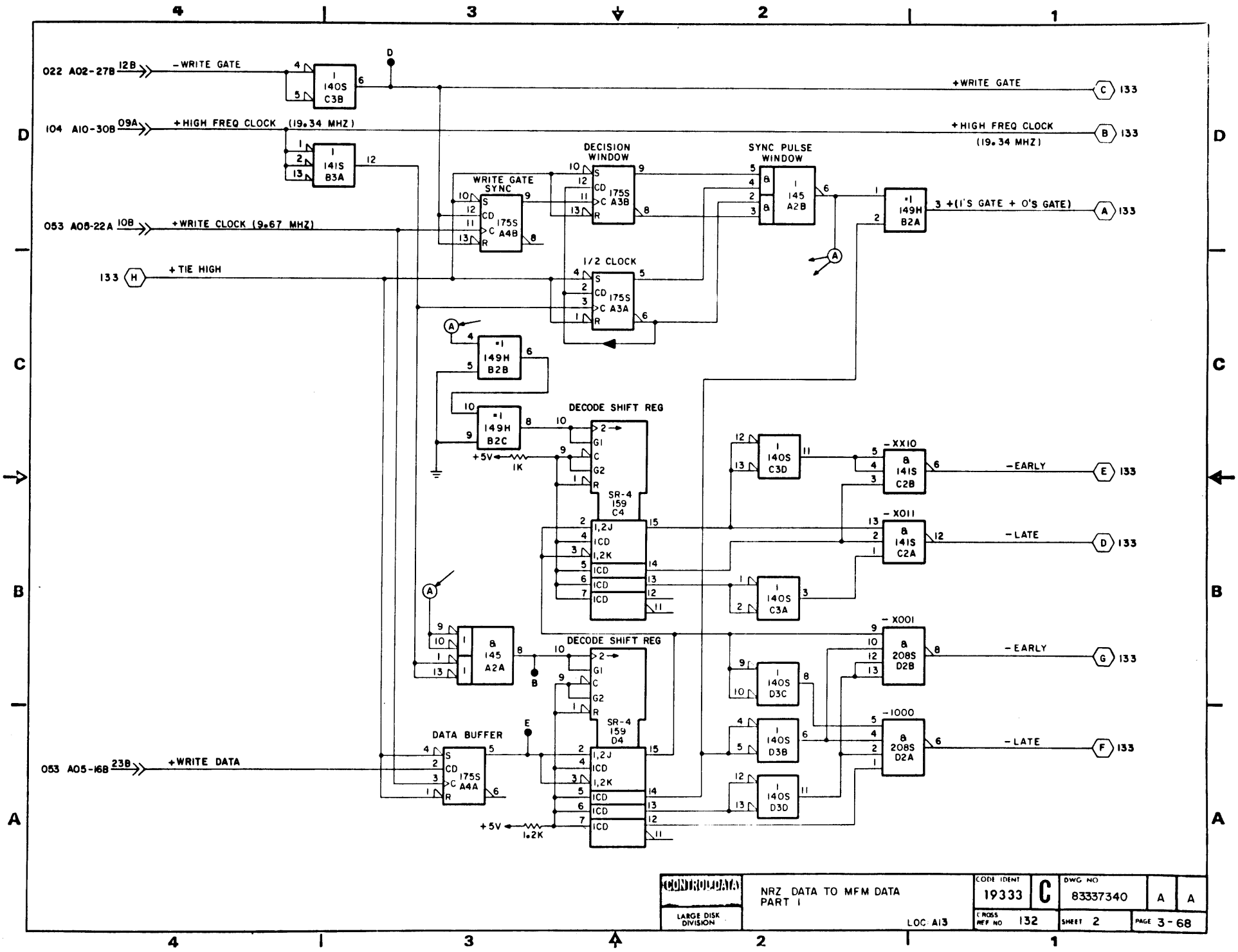
1 DELAY LINES ARE CONNECTED TO JUMPER BLOCK AS SHOWN IN DIAGRAM AT THE RIGHT. ACTUAL DELAYS ARE SELECTED DURING MANUFACTURING. THIS DIAGRAM SHOWS TYPICAL CONNECTIONS. DELAY TIME FOR EACH DELAY LINE PIN RELATIVE TO PIN 6 INPUT IS SHOWN IN CHART TO THE RIGHT.

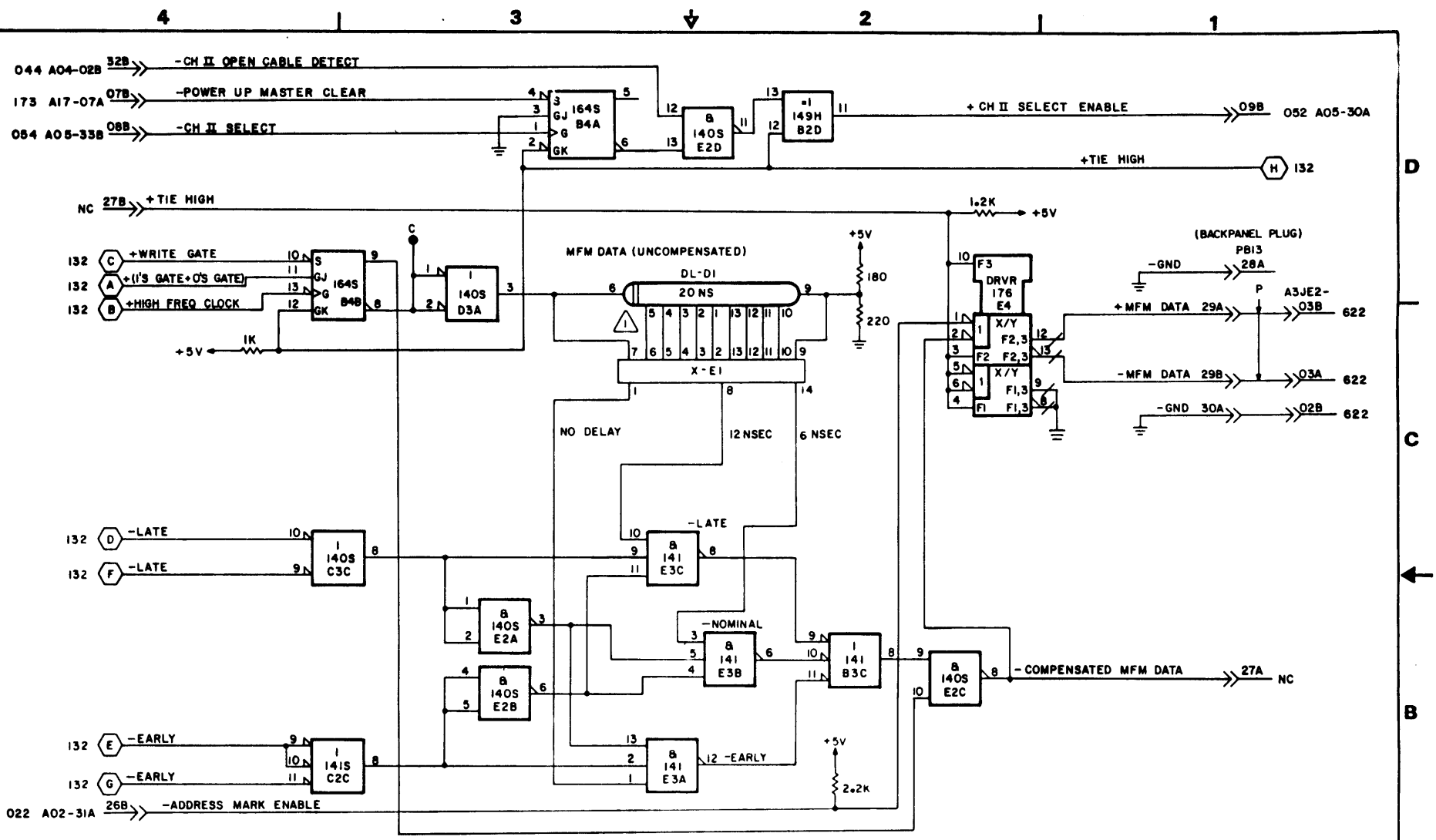
PIN	20NS DELAY
5	2 NS
4	4 NS
3	6 NS
2	8 NS
1	10 NS
13	12 NS
12	14 NS
11	16 NS
10	18 NS
9	20 NS



DRAWN				NRZ TO COMPENSATED MFM DIAGRAMS	CODE IDENT 19333	C	DWG NO 83337340	A	A
CHECKED									
ENGINEER					CROSS REF NO 131		SHEET 1 OF 3	PAGE 3-67	
APPROVED				TYPE: HLXV LOC: A13					
			LARGE DISK DIVISION						

REF 81201213


022 A02-27B 12B
-WRITE GATE
1 140S C3B
+WRITE GATE
C 133
104 A10-30B 09A
+HIGH FREQ CLOCK (19.34 MHZ)
1 141S B3A
+HIGH FREQ CLOCK (19.34 MHZ)
B 133
DECISION WINDOW
SYNC PULSE WINDOW
WRITE GATE SYNC
175S A3B
1 145 A2B
053 A05-22A 10B
+WRITE CLOCK (9.67 MHZ)
175S A4B
1 149H B2A
3 +(1'S GATE + 0'S GATE)
A 133
133 H
+TIE HIGH
1/2 CLOCK
175S A3A
1 149H B2B
1 149H B2C
DECODE SHIFT REG
+5V
1K
SR-4 159 C4
1 140S C3D
-XX10
8 141S C2B
-EARLY
E 133
-XX11
8 141S C2A
-LATE
D 133
1 140S C3A
8 145 A2A
DECODE SHIFT REG
-XX01
8 208S D2B
-EARLY
G 133
1 140S D3C
DATA BUFFER
SR-4 159 D4
-1000
8 208S D2A
-LATE
F 133
053 A05-16B 23B
+WRITE DATA
175S A4A
+5V
1.2K
1 140S D3B
1 140S D3D
CONTROL DATA
LARGE DISK DIVISION
NRZ DATA TO MFM DATA
PART 1
LOC A13
CODE IDENT 19333
C
DWG NO 83337340
A
A
CROSS REF NO 132
SHEET 2
PAGE 3-68



CONFIDENTIAL	NRZ DATA TO MFM DATA PART 2	CODE IDENT 19333	C	DWG NO 83337340	A	A
LARGE DISK DIVISION	LOC: A13	CROSS REF NO 133		SHEET 3	PAGE 3-69/3-70	

REVISION STATUS OF SHEETS

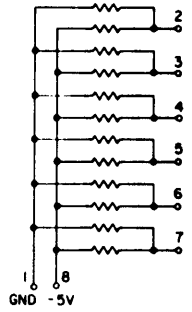
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A																	

REVISIONS

REV.	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	DM23000 DM13203A	CREATE BJ4A3 C/D	SMS	930-82	

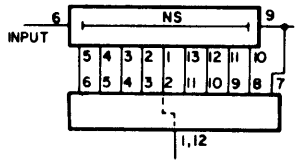
NOTES:

1. TYPICAL CONFIGURATION FOR TERMINATORS AT-C2A, AT-C2B AND AT-B4A AS FOLLOWS

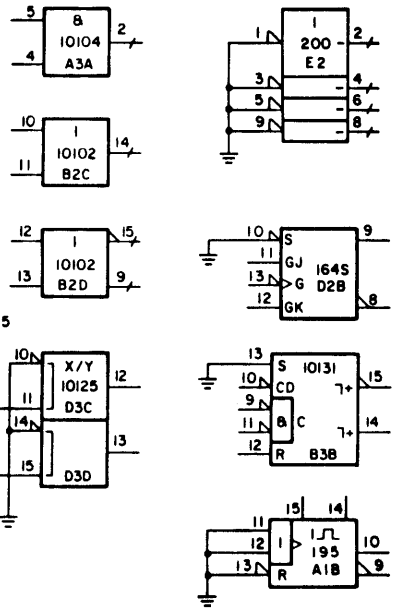


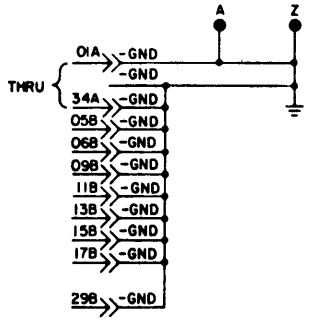
2. DELAY LINES ARE CONNECTED TO JUMPER BLOCK AS SHOWN IN DIAGRAM BELOW. ACTUAL DELAYS ARE SELECTED DURING MANUFACTURING. THIS DIAGRAM SHOWS TYPICAL CONNECTIONS. DELAY TIME FOR EACH DELAY LINE PIN RELATIVE TO PIN 6 INPUT IS SHOWN IN CHART BELOW.

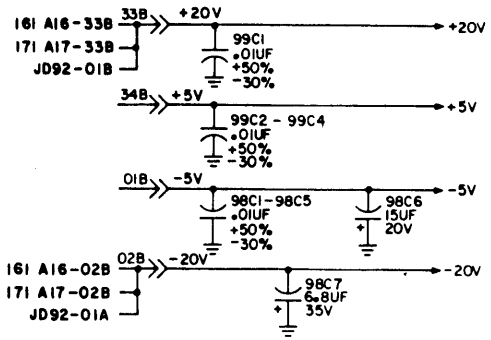
PIN	DELAY TIMES (NS) B1	A2
5	5	10
4	10	20
3	15	30
2	20	40
1	25	50
13	30	60
12	35	70
11	40	80
10	45	90
9	50	100



UNUSED LOGIC ELEMENTS

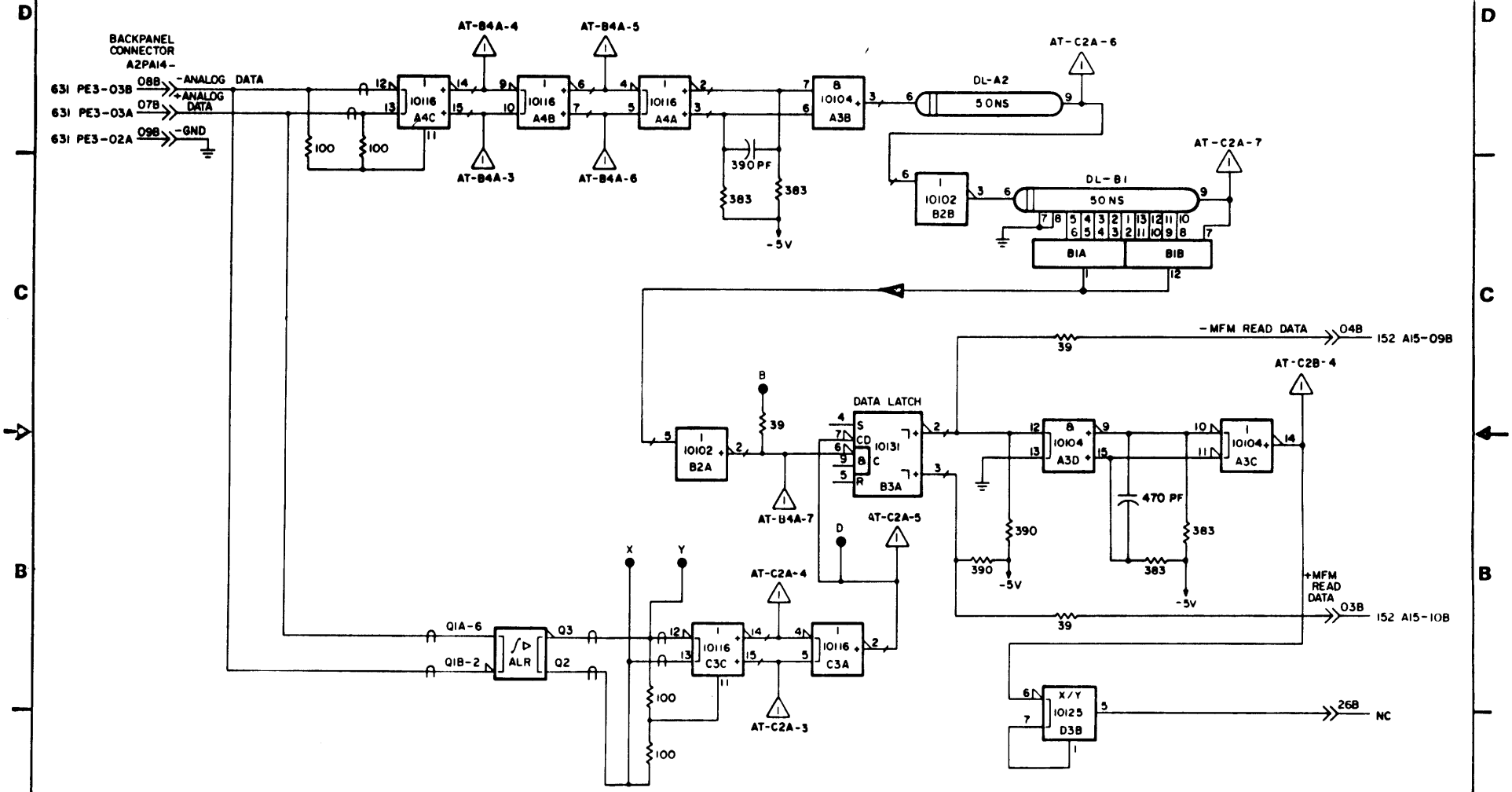






DRAWN	M ANDERSON 1 JA-79	MOTOROLA INC.	DATA LATCH DIAGRAMS	CODE IDENT 19333	C	DWG NO 83337340	CD A	REV A
CHECKED								
ENGINEER		LARGE DISK DIVISION	TYPE MLRV	LOC AI4	CROSS REF NO 141	SHEET 1 OF 3	PAGE 3-71	
APPROVED								

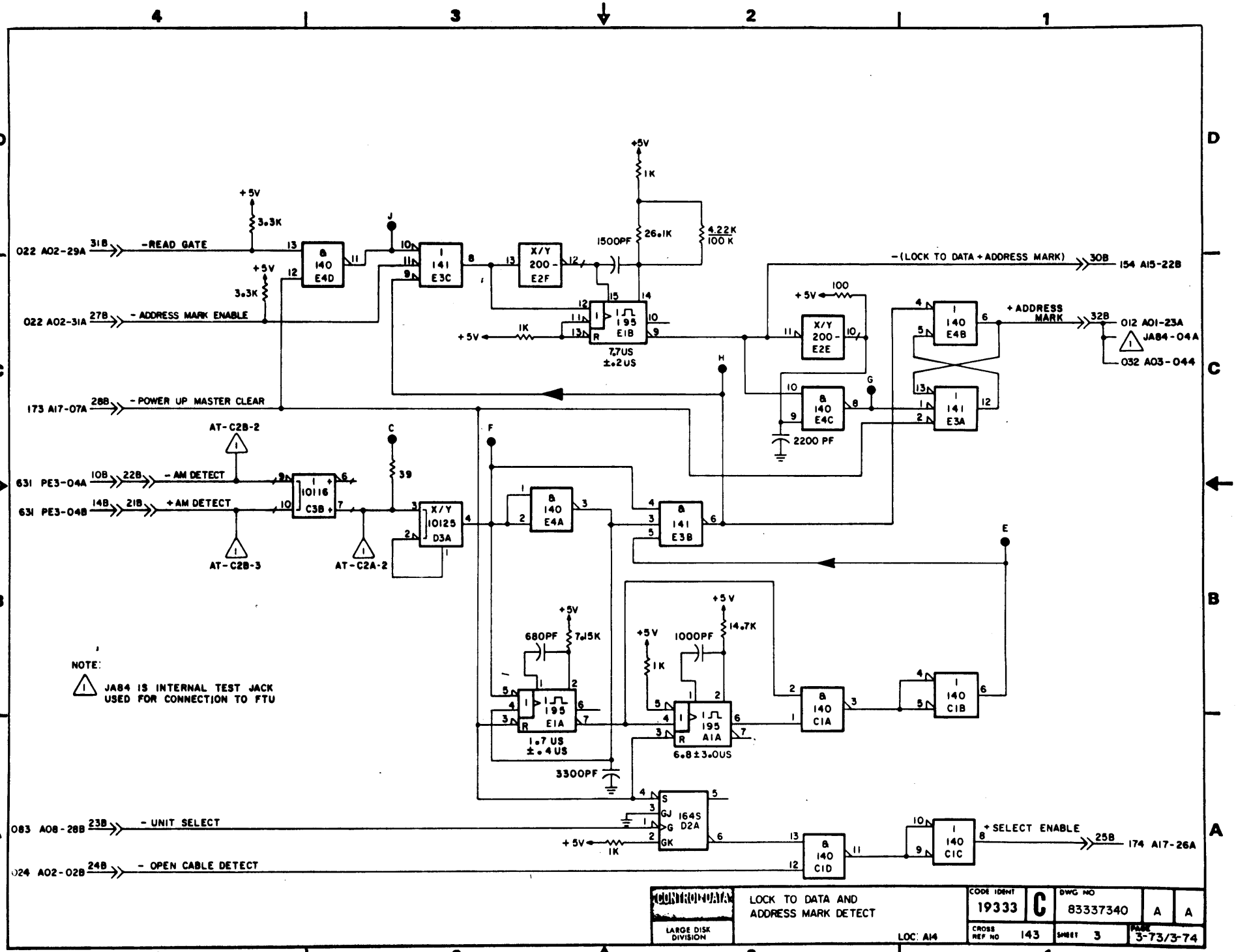
REF 81201214



NOTE

⚠1 REFER TO CROSS REF NUMBER 141 FOR TERMINATOR DETAILS

CONTROL DATA LARGE DISK DIVISION	ANALOG DATA TO READ DATA LOC A14	CODE IDENT 19333	C	DWG NO 83337340	A A
		CROSS REF NO 142		SHEET 2	PAGE 3-72


022 A02-29A
-READ GATE
022 A02-31A
- ADDRESS MARK ENABLE
173 A17-07A
- POWER UP MASTER CLEAR
631 PE3-04A
- AM DETECT
631 PE3-04B
+AM DETECT
083 A08-28B
- UNIT SELECT
024 A02-02B
- OPEN CABLE DETECT
-(LOCK TO DATA + ADDRESS MARK)
154 A15-22B
+ADDRESS MARK
012 A01-23A
JA84-04A
032 A03-044
+SELECT ENABLE
174 A17-26A
AT-C2B-2
AT-C2B-3
AT-C2A-2
7.7US ±.2US
1.7 US ±.4 US
6.8±3.0US
NOTE:
JA84 IS INTERNAL TEST JACK USED FOR CONNECTION TO FTU
LOCK TO DATA AND ADDRESS MARK DETECT
LOC: A14
CODE IDENT 19333
C
DWG NO 83337340
A
A
CROSS REF NO 143
SHEET 3
3-73/3-74

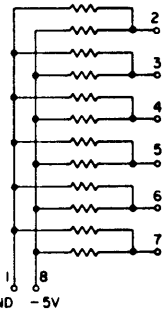
REVISION STATUS OF SHEETS

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															

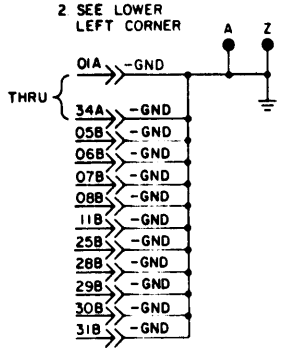
REVISIONS					
REV.	ECO.	DESCRIPTION	DRFT.	DATE	CHK'D
A	DM23000 DM3203A	CREATE BJ4A3C/D	H D K	10-7-82	

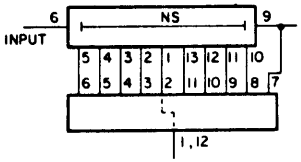
NOTES:

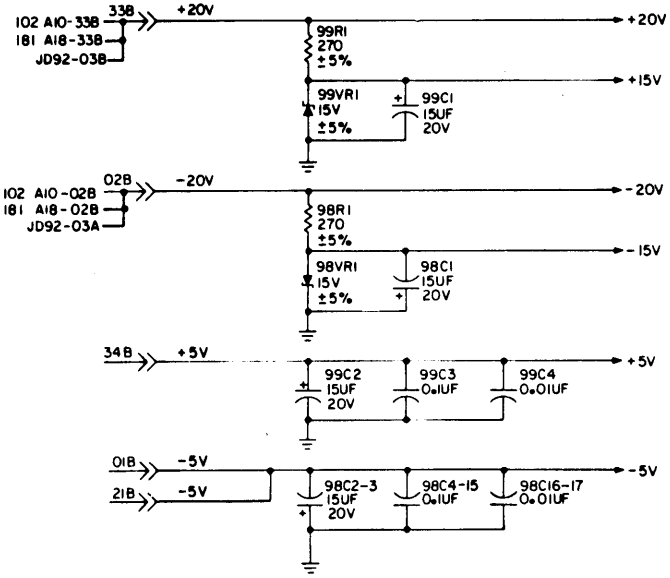
1 TYPICAL CONFIGURATION FOR TERMINATORS ATA3, ATB2, ATB3, ATB4, ATC3, ATD4, ATE2 AS FOLLOWS

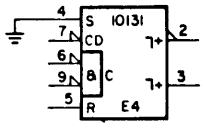


NOTE:
2 SEE LOWER LEFT CORNER

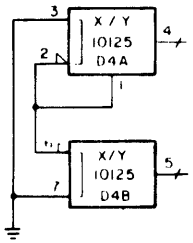


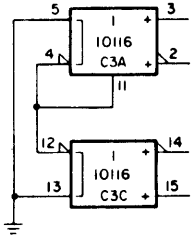


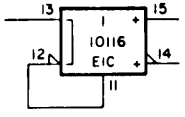




UNUSED LOGIC ELEMENTS





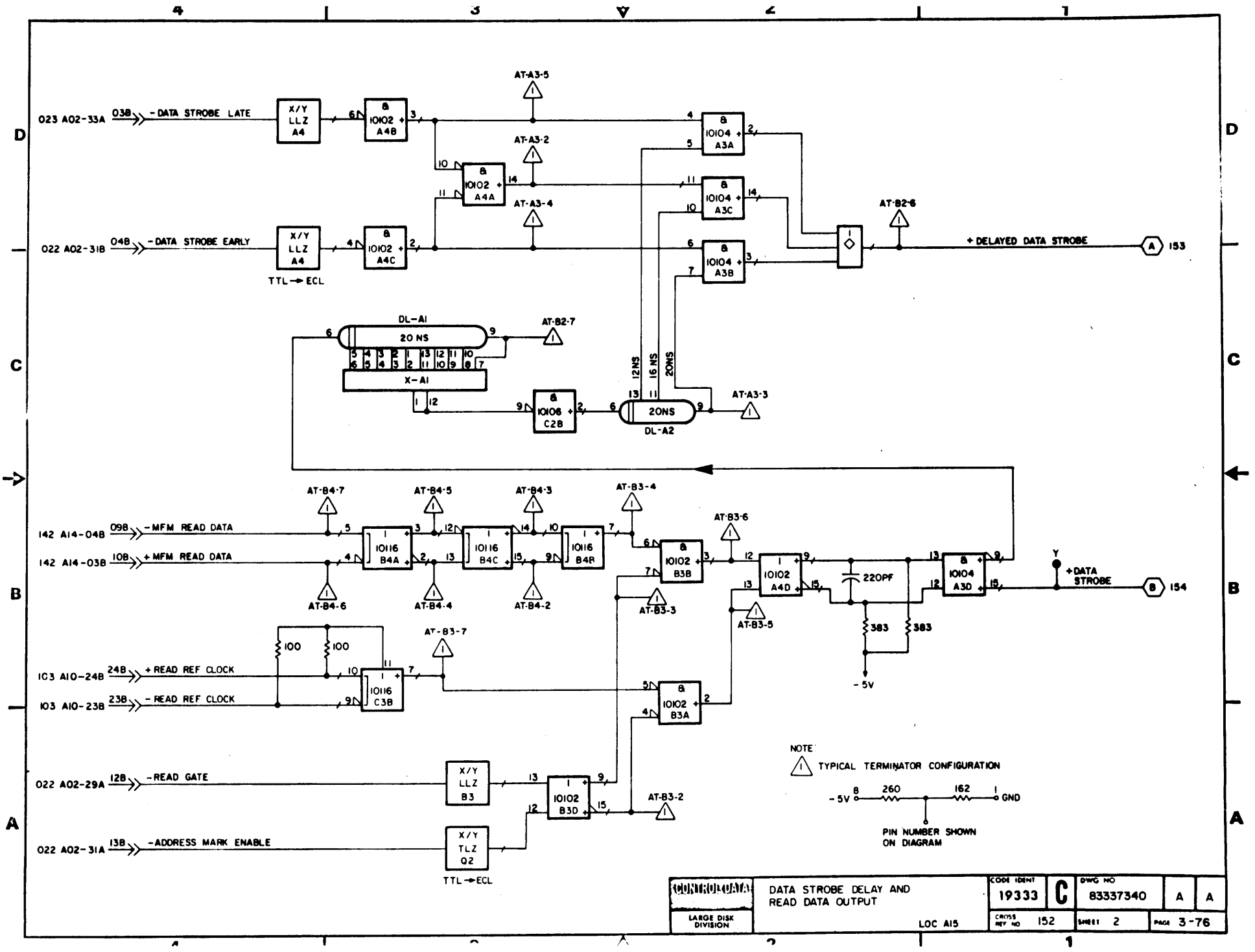


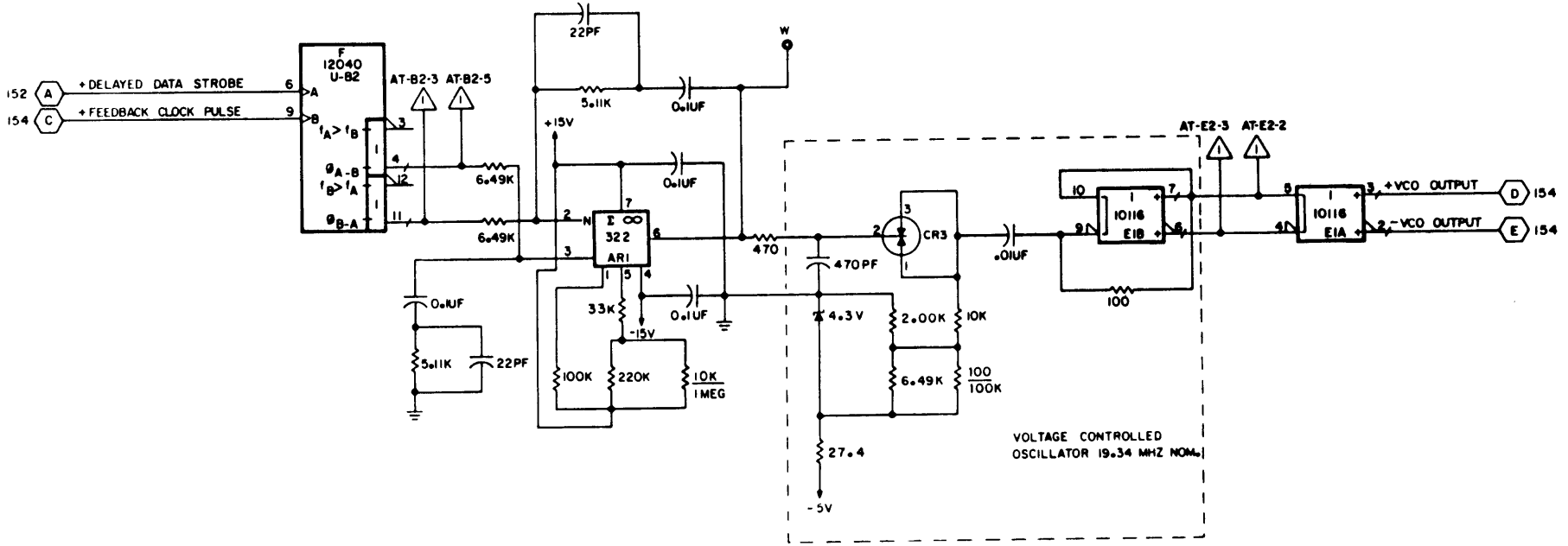
2 DELAY LINES ARE CONNECTED TO JUMPER BLOCK AS SHOWN IN DIAGRAM BELOW. ACTUAL DELAYS ARE SELECTED DURING MANUFACTURING. THIS DIAGRAM SHOWS TYPICAL CONNECTIONS. DELAY TIME FOR EACH DELAY LINE PIN RELATIVE TO PIN 6 INPUT IS SHOWN IN CHART BELOW.

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	M ANDERSON	1-24-83	CONTROL DATA	READ PLO DIAGRAMS	CODE IDENT 19333	C	DWG NO 83337340	A	A
CHECKED									
ENGINEER			LARGE DISK DIVISION	TYPE FLZV	LOC A15	ENGR REF NO 151	SHEET 1 OF 5	PAGE 3-75	
APPROVED									

REF 81201215


023 A02-33A
03B
-DATA STROBE LATE
X/Y LLZ A4
10102 A4B
AT-A3-5
AT-A3-2
10102 A4A
AT-A3-4
022 A02-31B
04B
-DATA STROBE EARLY
X/Y LLZ A4
TTL→ECL
10102 A4C
10104 A3A
10104 A3C
10104 A3B
AT-B2-6
+DELAYED DATA STROBE
A 153
DL-A1
20 NS
AT-B2-7
X-A1
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
10116 B4A
10116 B4C
10116 B4R
AT-B4-7
AT-B4-5
AT-B4-3
AT-B3-4
AT-B4-6
AT-B4-4
AT-B4-2
AT-B3-3
10102 B3B
AT-B3-6
AT-B3-5
10102 A4D
220PF
383
383
-5V
10104 A3D
Y
+DATA STROBE
B 154
100
100
AT-B3-7
103 A10-24B
24B
+READ REF CLOCK
103 A10-23B
23B
-READ REF CLOCK
10116 C3B
10102 B3A
022 A02-29A
12B
-READ GATE
X/Y LLZ B3
10102 B3D
AT-B3-2
022 A02-31A
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
LARGE DISK DIVISION
DATA STROBE DELAY AND READ DATA OUTPUT
LOC A15
CODE IDENT 19333
C
DWG NO 83337340
A
A
CROSS REF NO 152
SHEET 2
PAGE 3-76

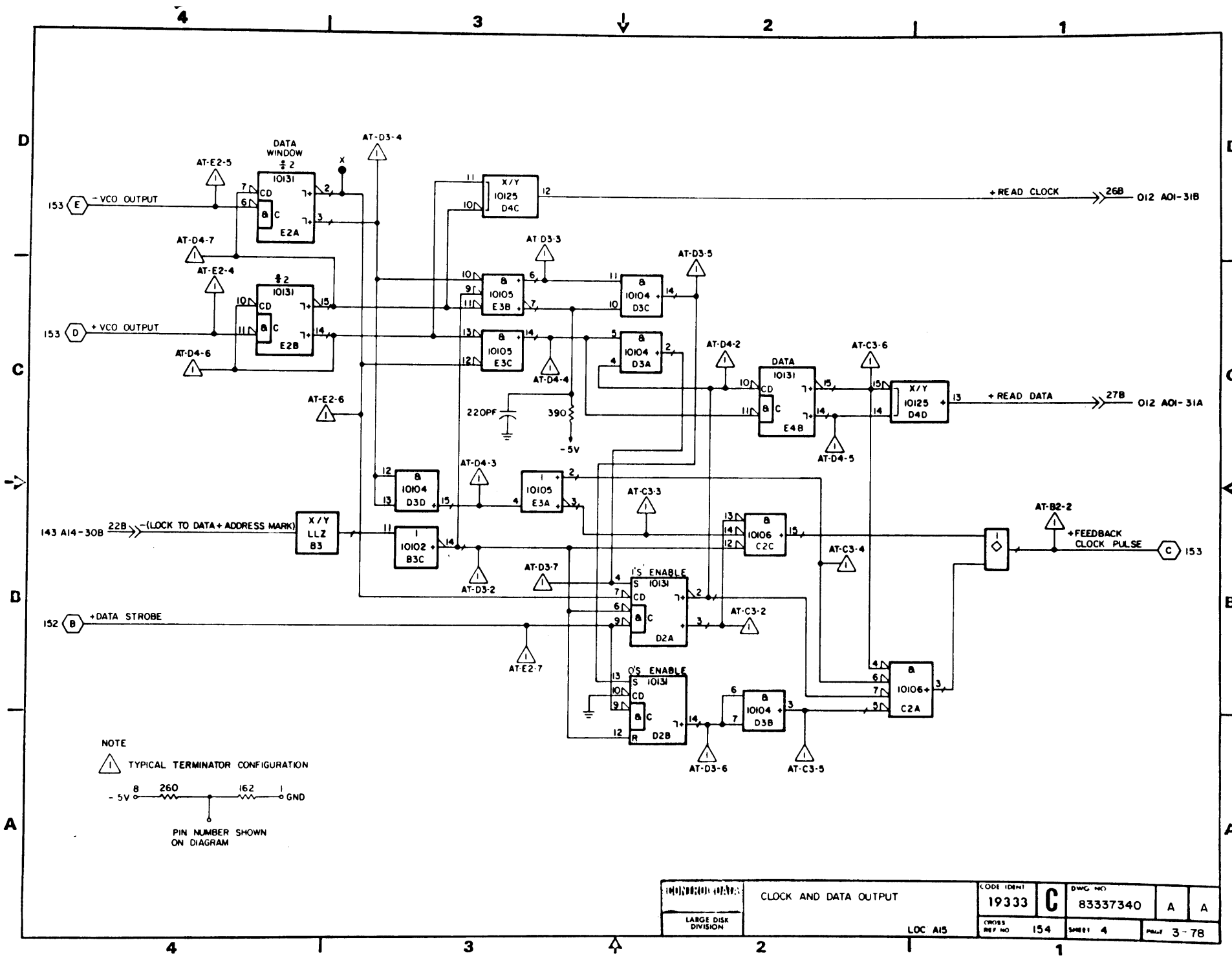


NOTE

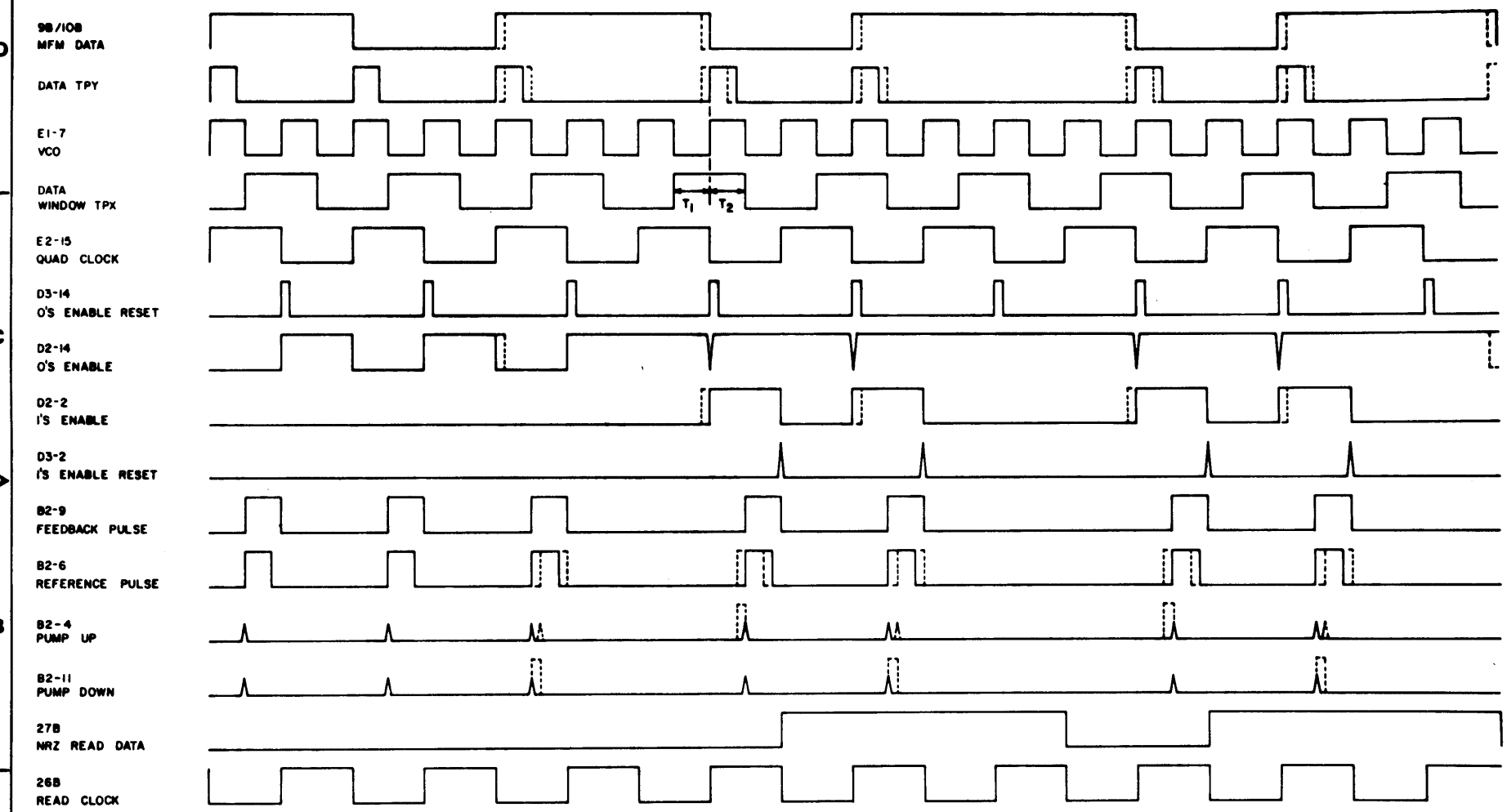
1 TYPICAL TERMINATOR CONFIGURATION

PIN NUMBER SHOWN ON DIAGRAM

CONTROL DATA LARGE DISK DIVISION	VCO OUTPUT LOC A15	CODE IDENT 19333	C	DWG. NO 83337340	A A
		CROSS REF NO 153		SHEET 3	PAGE 3-77



LARGE DISK DIVISION	CLOCK AND DATA OUTPUT LOC A15	CODE IDENT 19333	C	DWG NO 83337340	A A
		CROSS REF NO 154		SHEET 4	PAGE 3-78



NOTE:

1. DASHED LINES INDICATE PEAK SHIFTED DATA.
2. $T_1 \propto T_2 \simeq 25$NS WHEN STROBE PULSE IS CENTERED IN WINDOW $(T_1 + T_2)$.
3. $T_{RISE} = T_{FALL} \simeq 3$NS.

CONTROL DATA LARGE DISK DIVISION	READ PLO TIMING DIAGRAM	CODE IDENT 19333	C	DWG NO 83337340	A	A
	LOC A15	CR SS REF NO 155		SHEET 5		PAGE 3-79/3-80

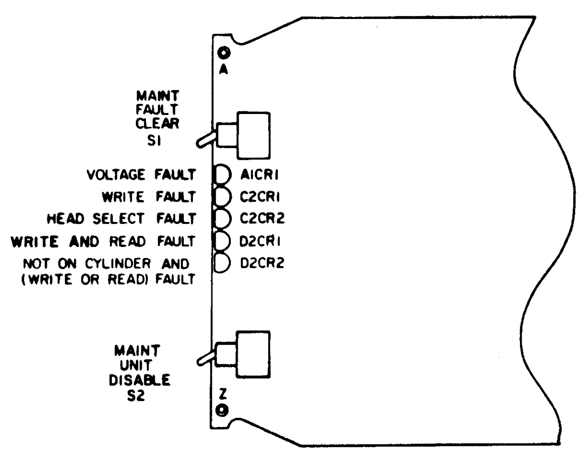
REVISION STATUS OF SHEETS

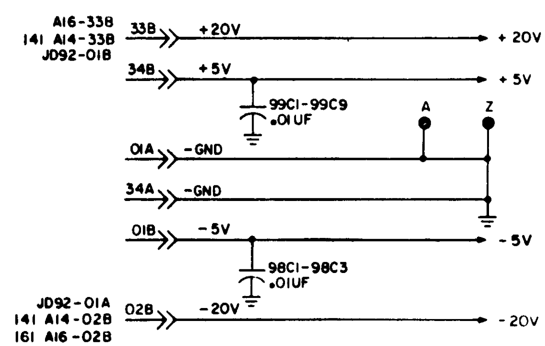
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																

REVISIONS

REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	DH23000 DH13203A	CREATE BJ4A3C/D	H D K	10-4-82	

MAINTENANCE SWITCHES AND FAULT INDICATORS ON CARD EDGE

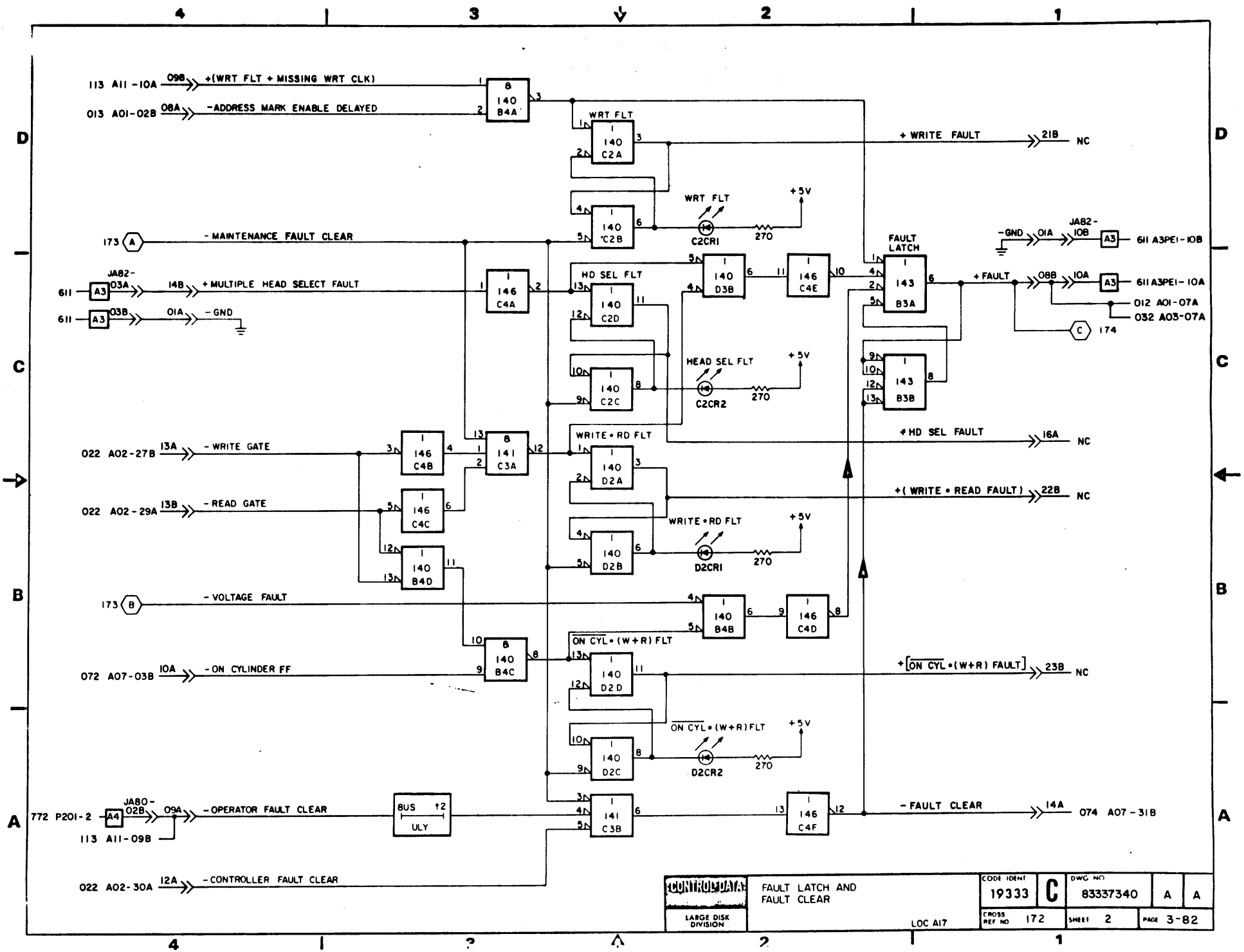


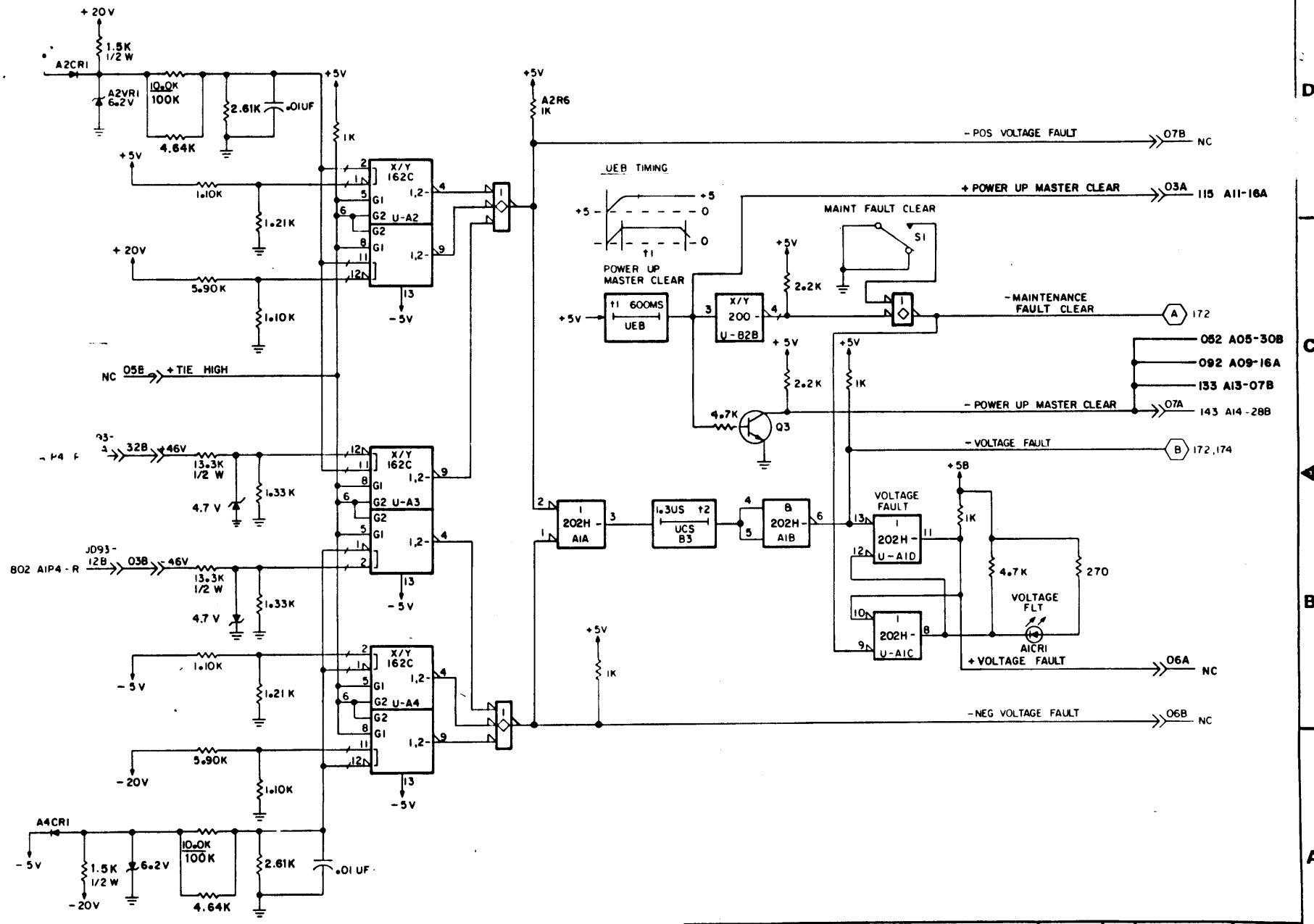


DRAWN		CONTROL DATA	FAULT CARD DIAGRAMS
CHECKED		LARGE DISK DIVISION	TYPE: KKFV LOC A17
ENGINEER			
APPROVED			

CODE IDENT	SIZE	DWG NO		
19333	C	83337340	A	A
CROSS REF NO 171		SHEET 1 of 4	PAGE 3-81	

REF 81201217

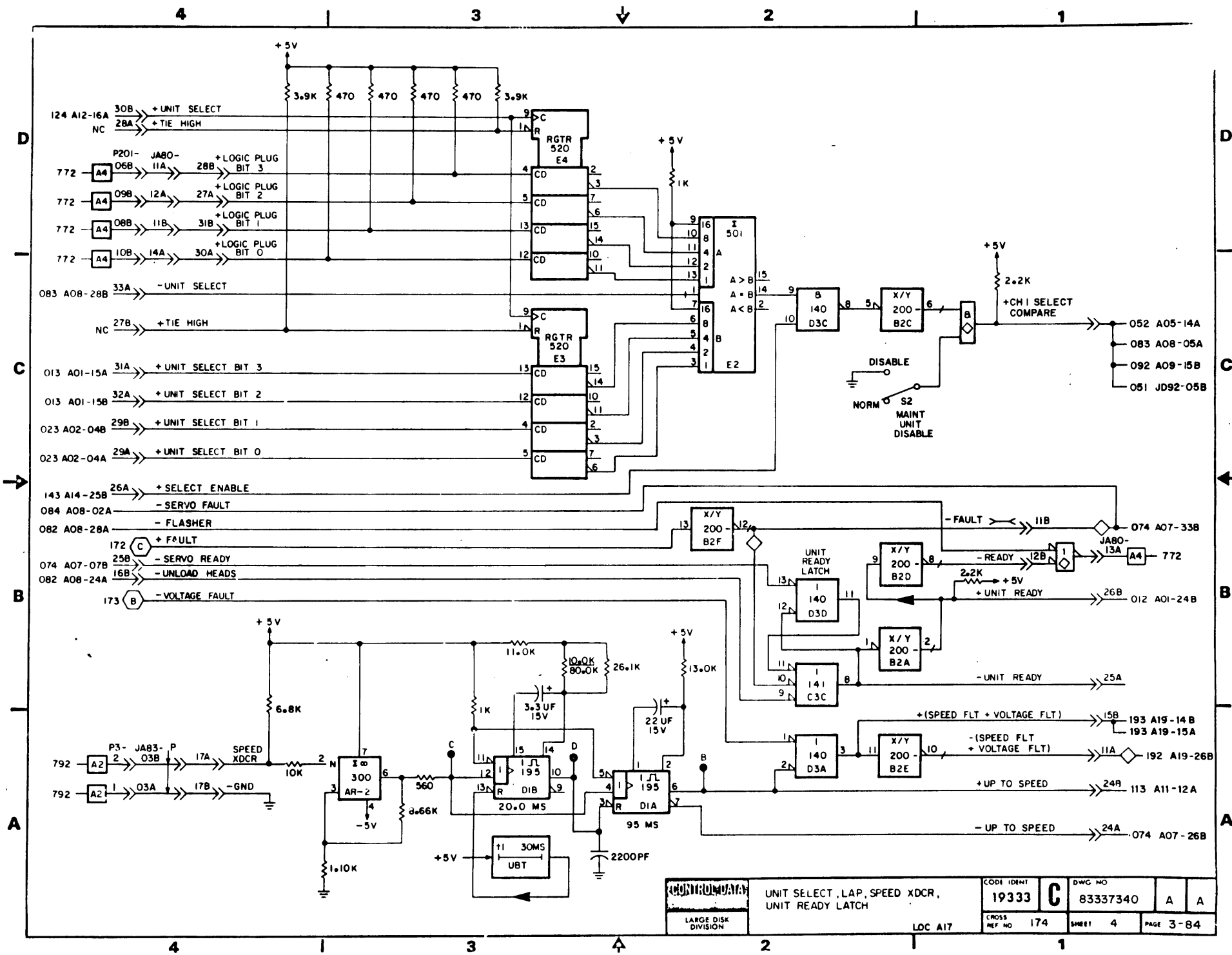

113 A11 -10A
09B
+(WRT FLT + MISSING WRT CLK)
013 A01-02B
08A
-ADDRESS MARK ENABLE DELAYED
B 140 B4A
WRT FLT
140 C2A
+ WRITE FAULT
218
NC
140 C2B
WRT FLT
C2CR1
270
+5V
173 A
- MAINTENANCE FAULT CLEAR
JA82-
611 A3
03A
14B
+ MULTIPLE HEAD SELECT FAULT
611 A3
03B
01A
- GND
146 C4A
HD SEL FLT
140 C2D
140 D3B
146 C4E
FAULT LATCH
143 B3A
+ FAULT
08B
10A
611 A3PE1-10A
012 A01-07A
032 A03-07A
C 174
-GND
01A
JA82-
10B
A3
611 A3PE1-10B
140 C2C
HEAD SEL FLT
C2CR2
270
+5V
143 B3B
WRITE • RD FLT
HD SEL FAULT
16A
NC
022 A02-27B
13A
- WRITE GATE
146 C4B
B 141 C3A
140 D2A
+(WRITE • READ FAULT)
22B
NC
022 A02-29A
13B
- READ GATE
146 C4C
140 B4D
140 D2B
WRITE • RD FLT
D2CR1
270
+5V
173 B
- VOLTAGE FAULT
140 B4B
146 C4D
ON CYL • (W+R) FLT
B 140 B4C
072 A07-03B
10A
- ON CYLINDER FF
140 D2D
+[ON CYL • (W+R) FAULT]
23B
NC
ON CYL • (W+R) FLT
140 D2C
D2CR2
270
+5V
772 P201-2
A4
JA80-
02B
09A
- OPERATOR FAULT CLEAR
113 A11-09B
8US ↑2
ULY
141 C3B
146 C4F
- FAULT CLEAR
14A
074 A07-31B
022 A02-30A
12A
- CONTROLLER FAULT CLEAR
CONTROL DATA
LARGE DISK DIVISION
FAULT LATCH AND FAULT CLEAR
LOC A17
CODE IDENT 19333
C
DWG NO 83337340
A
A
CROSS REF NO 172
SHEET 2
PAGE 3-82



CONTROL DATA
LARGE DISK DIVISION

POWER UP MASTER CLEAR, MAINT FAULT CLEAR AND VOLTAGE FAULT DETECT
LOC: A17

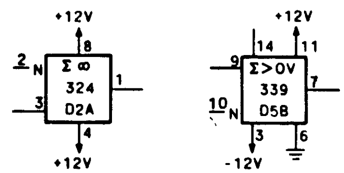
CODE IDENT		DWG NO		
19333	C	83337340	A	A
CROSS REF NO 173		SHEET 3	PAGE 3-83	

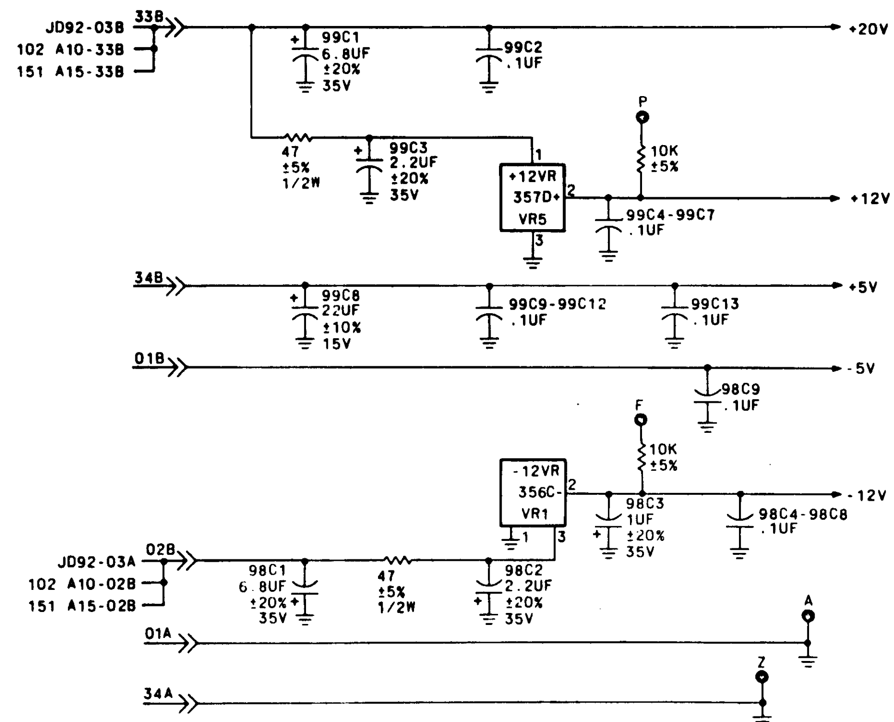

+5V
3.9K
470
470
470
470
3.9K
124 A12-16A
308 +UNIT SELECT
NC
28A +TIE HIGH
RGTR 520 E4
772 A4 P201-06B JA80-11A 28B +LOGIC PLUG BIT 3
772 A4 09B 12A 27A +LOGIC PLUG BIT 2
772 A4 08B 11B 31B +LOGIC PLUG BIT 1
772 A4 10B 14A 30A +LOGIC PLUG BIT 0
083 A08-28B 33A -UNIT SELECT
NC 27B +TIE HIGH
RGTR 520 E3
013 A01-15A 31A +UNIT SELECT BIT 3
013 A01-15B 32A +UNIT SELECT BIT 2
023 A02-04B 29B +UNIT SELECT BIT 1
023 A02-04A 29A +UNIT SELECT BIT 0
Σ 501 E2
A>B A=B A<B
1K
8 140 D3C
X/Y 200 B2C
2.2K
+CH I SELECT COMPARE
052 A05-14A
083 A08-05A
092 A09-15B
051 JD92-05B
DISABLE
NORM S2 MAINT UNIT DISABLE
143 A14-25B 26A +SELECT ENABLE
084 A08-02A -SERVO FAULT
082 A08-28A -FLASHER
172 C +FAULT
074 A07-07B 25B -SERVO READY
082 A08-24A 16B -UNLOAD HEADS
173 B -VOLTAGE FAULT
X/Y 200 B2F
-FAULT 11B
074 A07-33B
UNIT READY LATCH
1 140 D3D
X/Y 200 B2D
-READY 12B
JA80-13A A4 772
2.2K +5V
+UNIT READY 26B
012 A01-24B
X/Y 200 B2A
1 141 C3C
-UNIT READY 25A
+(SPEED FLT + VOLTAGE FLT) 15B
193 A19-14B
193 A19-15A
1 140 D3A
X/Y 200 B2E
-(SPEED FLT + VOLTAGE FLT) 11A
192 A19-26B
+UP TO SPEED 24B
113 A11-12A
-UP TO SPEED 24A
074 A07-26B
792 A2 P3-2 JA83-03B 17A SPEED XDCR
792 A2 1 03A 17B -GND
6.8K
10K
Σ∞ 300 AR-2
-5V
560
8.66K
1.10K
11.0K
10.0K 80.0K
26.1K
1K
3.3UF 15V
1 195 DIB
20.0 MS
22UF 15V
13.0K
1 195 DIA
95 MS
2200PF
+5V
↑↓ 30MS UBT
CONTROL DATA
LARGE DISK DIVISION
UNIT SELECT, LAP, SPEED XDCR, UNIT READY LATCH
LOC A17
CODE IDENT 19333
C
DWG NO 83337340
A
A
CROSS REF NO 174
SHEET 4
PAGE 3-84

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															

REVISIONS					
REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	DH23000 DH13203A	CREATE BJ4A3C/D	SMS	10-1-82	[illegible]

UNUSED LOGIC ELEMENTS





DRAWN	M. Anderson	1-29-79
CHECKED		
ENGINEER	L. Wahling	2-8-79
APPROVED		

MAGNETIC PERIPHERALS INC.
A subsidiary of CONTROL DATA CORPORATION

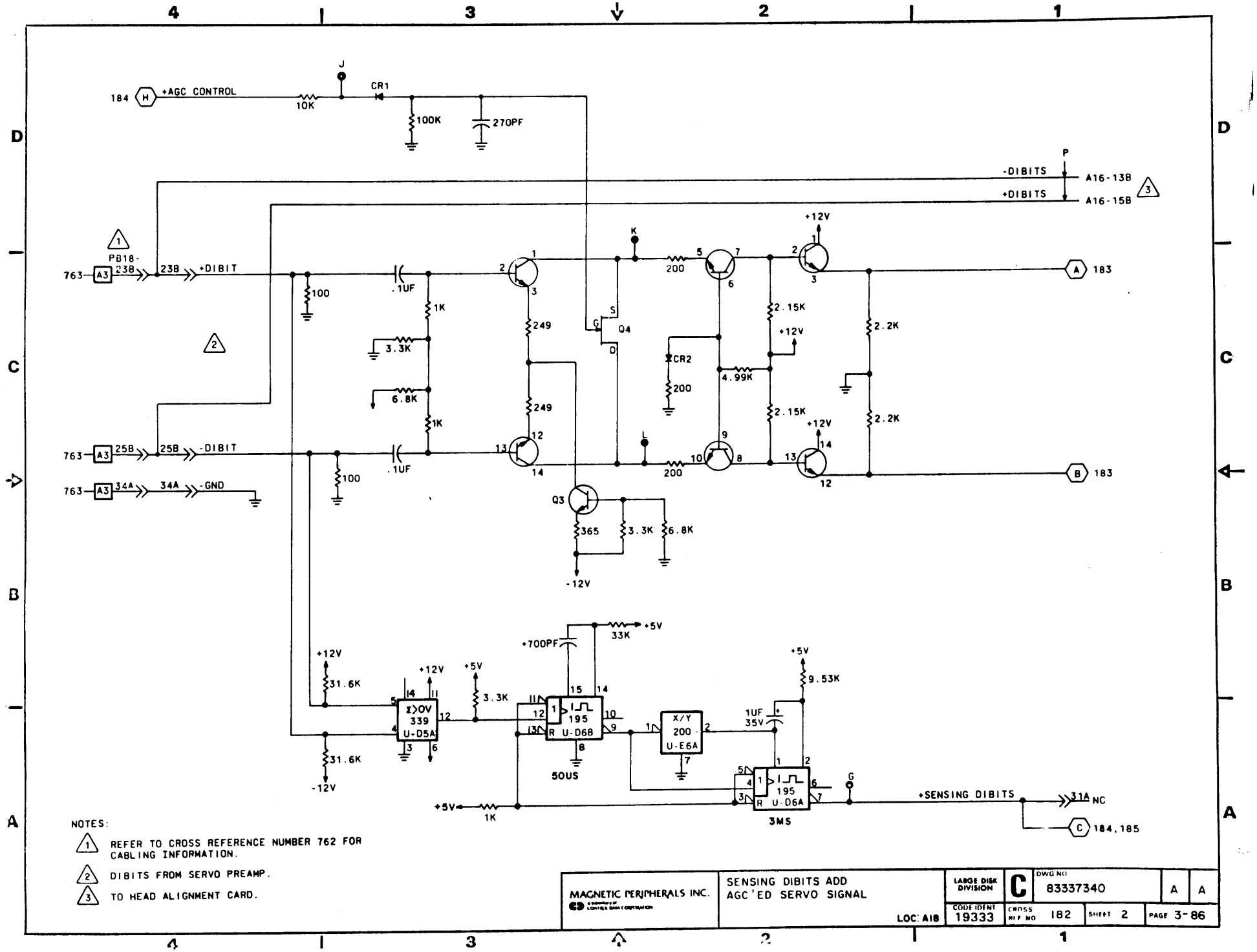
FINE SERVO DECODE
DIAGRAMS

TYPE: QFRV LOC: A18

LARGE DISK DIVISION | C | DWG NO 83337340 | A | A

CODE IDENT 19333 | CROSS REF NO 181 | SHEET 1 OF 5 | PAGE 3-85

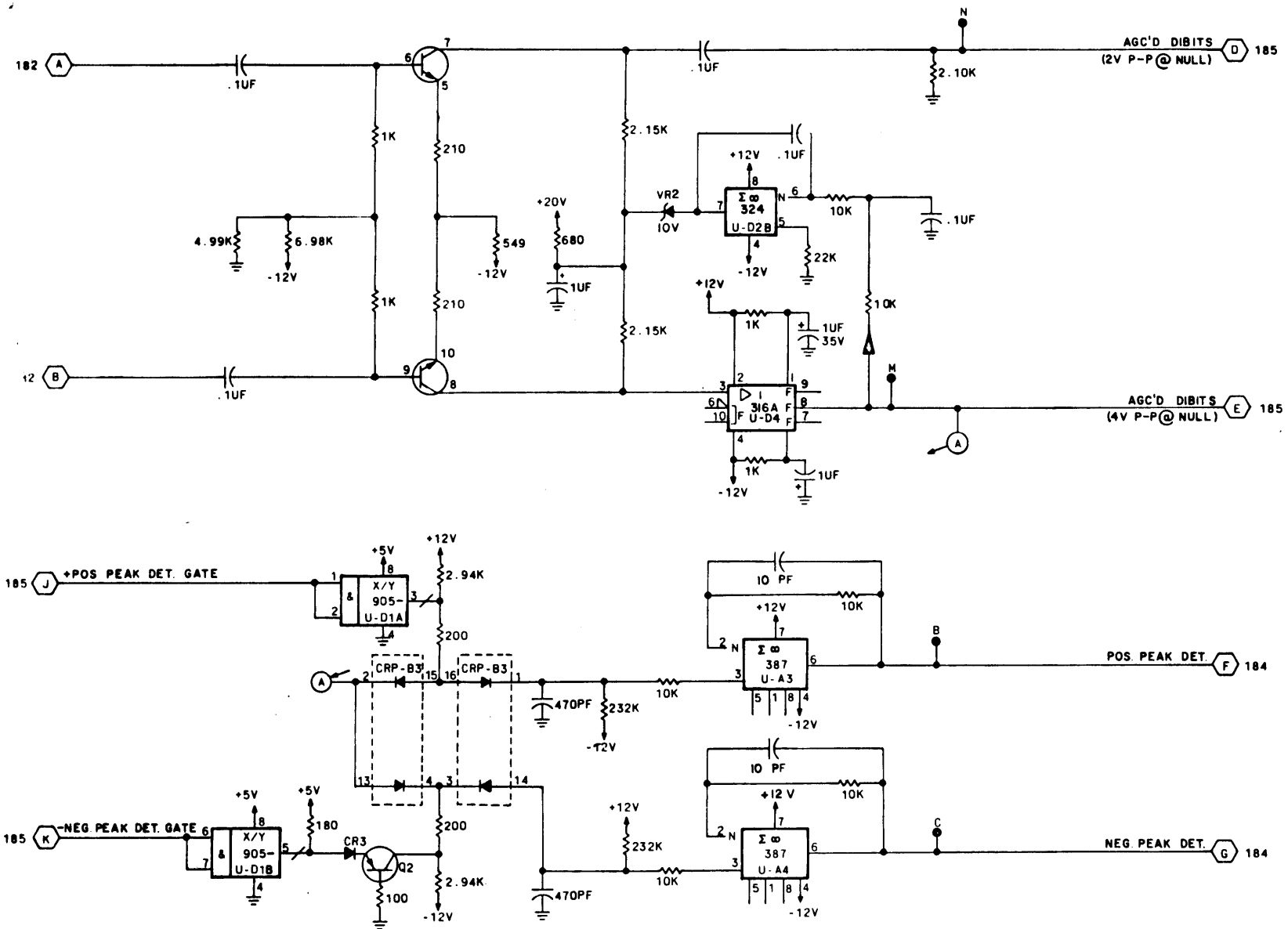
REF 81201218



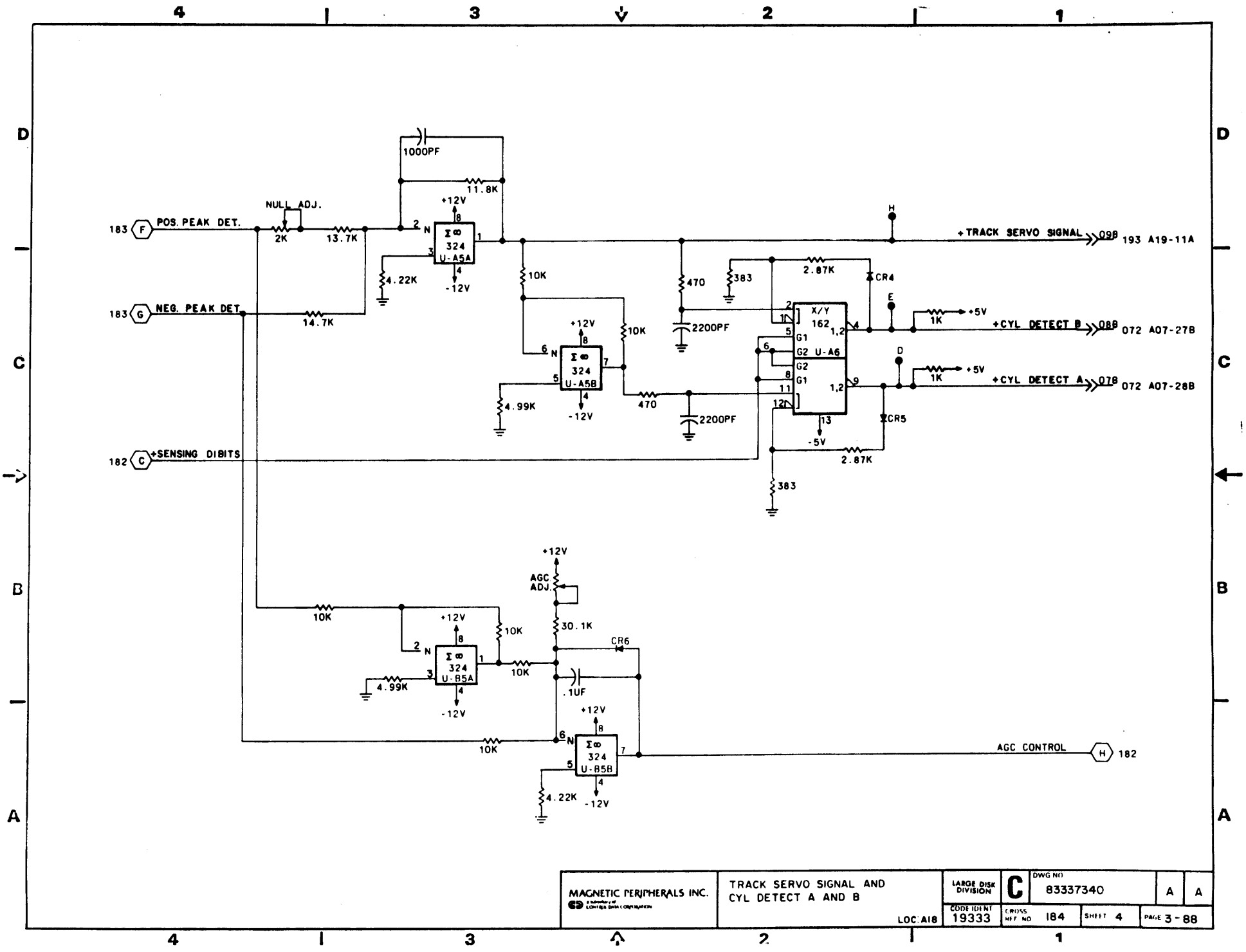
NOTES:

1. REFER TO CROSS REFERENCE NUMBER 762 FOR CABLING INFORMATION.
2. DIBITS FROM SERVO PREAMP.
3. TO HEAD ALIGNMENT CARD.

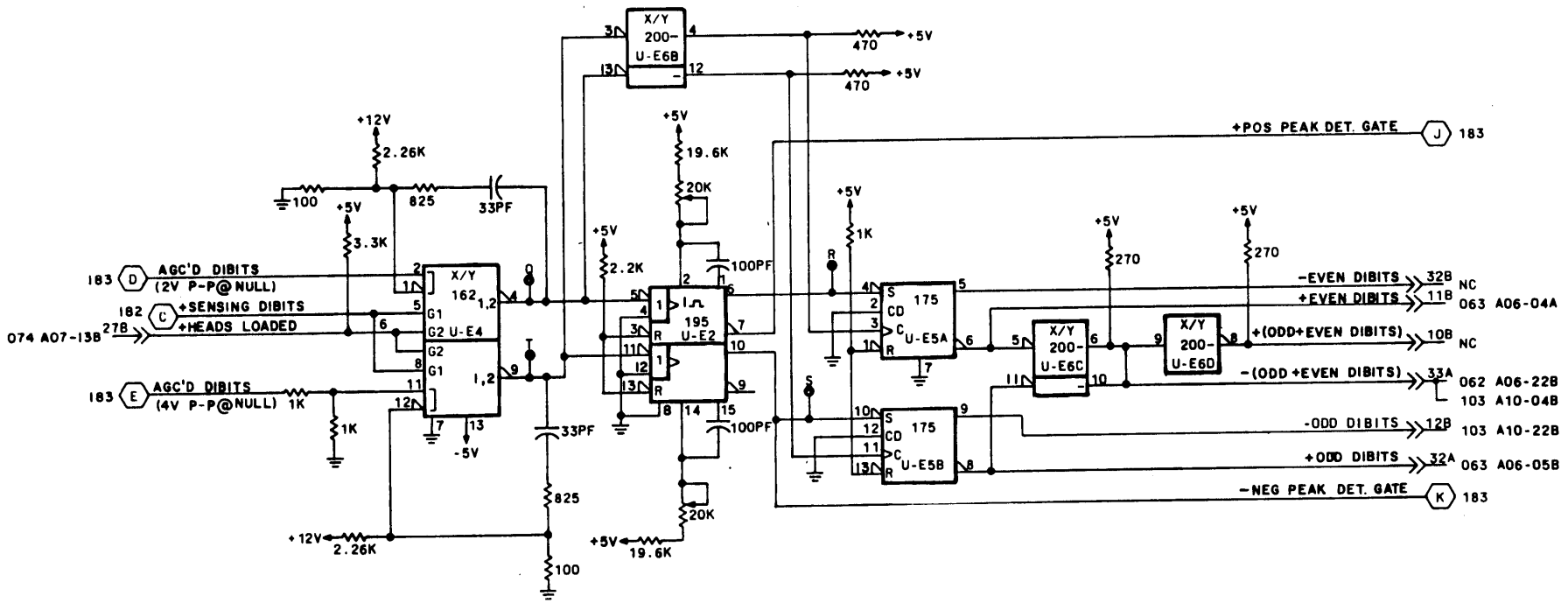
MAGNETIC PERIPHERALS INC.	SENSING DIBITS ADD AGC'ED SERVO SIGNAL	LARGE DISK DIVISION	C	DWG NO 83337340	A	A
	LOC: A18	CODE IDENT 19333	CROSS REF NO 182	SHEET 2	PAGE 3-86	



MAGNETIC PERIPHERALS INC.	TRACK SERVO SIGNAL AND CYL DETECT A AND B	LARGE DISK DIVISION	C	DWG NO 83337340	A A
	LOC: A18	CODE IDENT 19333	CROSS REF NO 183	SHEET 3	PAGE 3-87

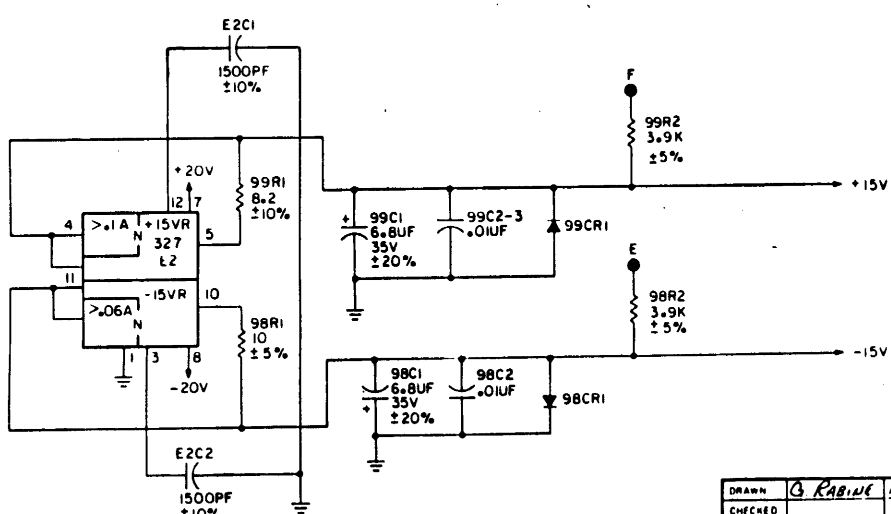


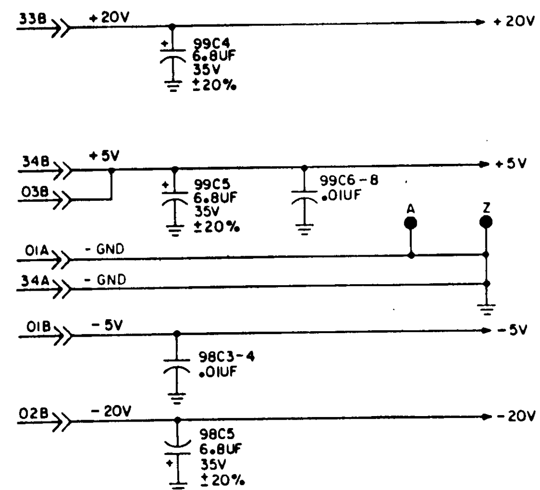
MAGNETIC PERIPHERALS INC.	TRACK SERVO SIGNAL AND CYL DETECT A AND B	LARGE DISK DIVISION	C	DWG NO 83337340 A A
	LOC: A18	CODE IDENT 19333	CROSS REF NO 184	SHEET 4 PAGE 3-88



MAGNETIC PERIPHERALS INC.	TRACK SERVO SIGNAL AND CYL DETECT A AND B	LARGE DISK DIVISION	C	DWG NO 83337340	A A
	LOC:A18	CODE IDENT 19333	CROSS REF NO 185	SHEET 5	PAGE 3-89/3-90

REVISIONS					
REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	DH23000 DH13203A	CREATE 8J4A3 C/D	SMS	10-1-82	
B	DH13271	CKGV IC CHG.	M.C.	2-9-84	



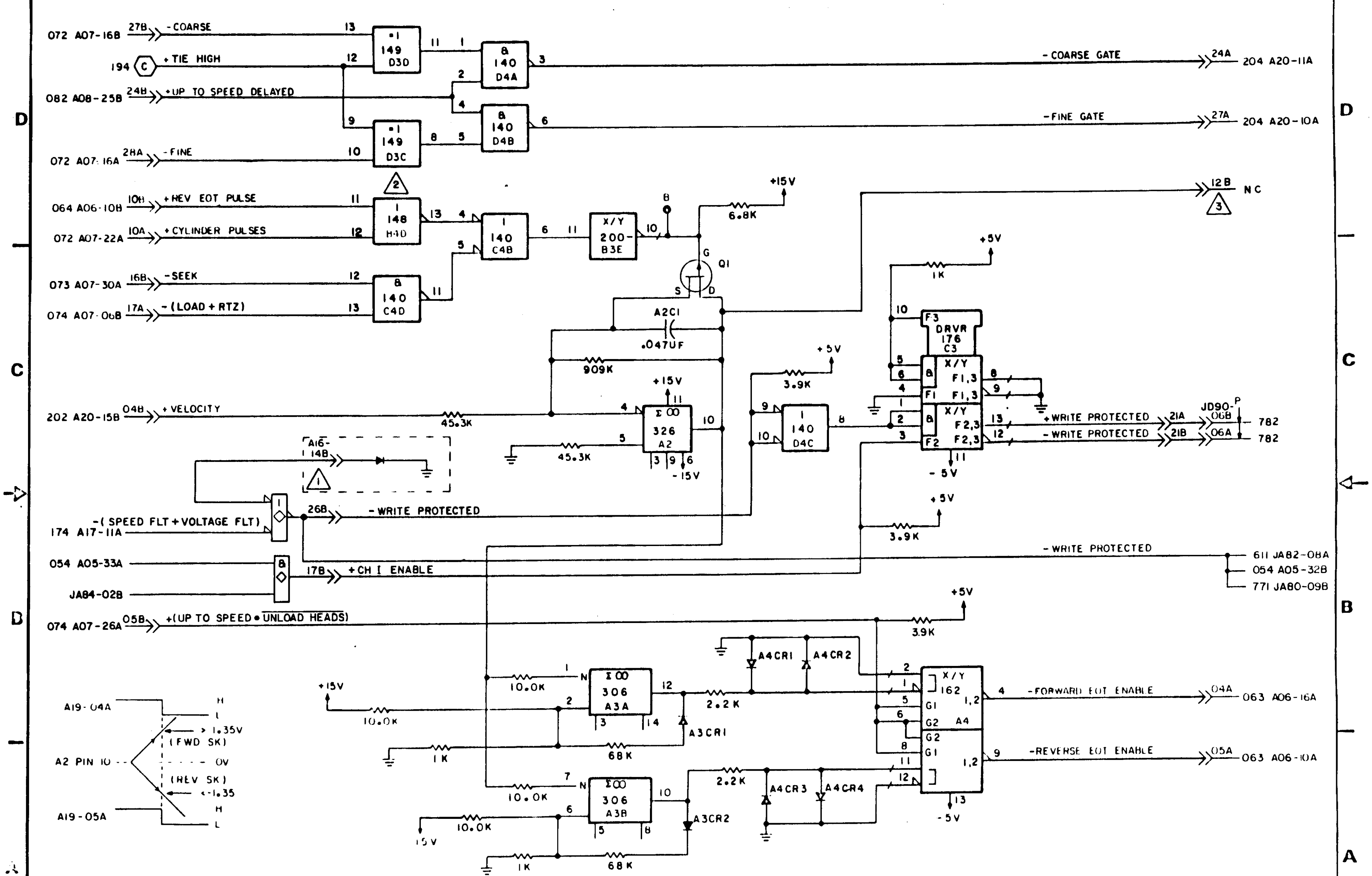


DRAWN	G. RABINE	1-18-79	CONTROL DATA LARGE DISK DIVISION	ACCESS CONTROL NO. 2 DIAGRAMS
CHECKED				
ENGINEER		1-6-79		TYPE CKGV LOC A19
APPROVED				

CODE IDENT 19333 | C | DWG NO 83337340 | D | B

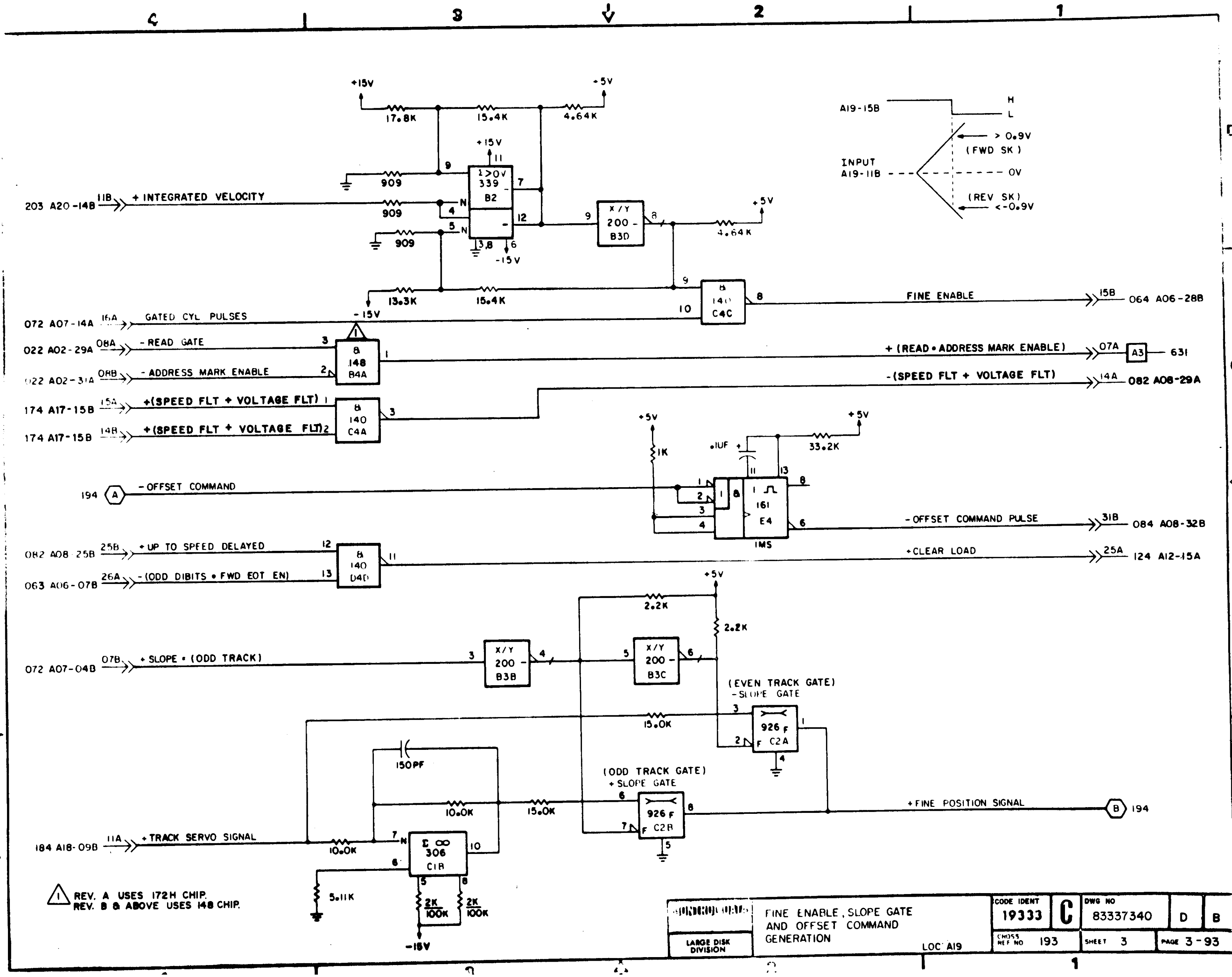
CROSS REF NO 191 | SHEET 1 OF 4 | PAGE 3-91

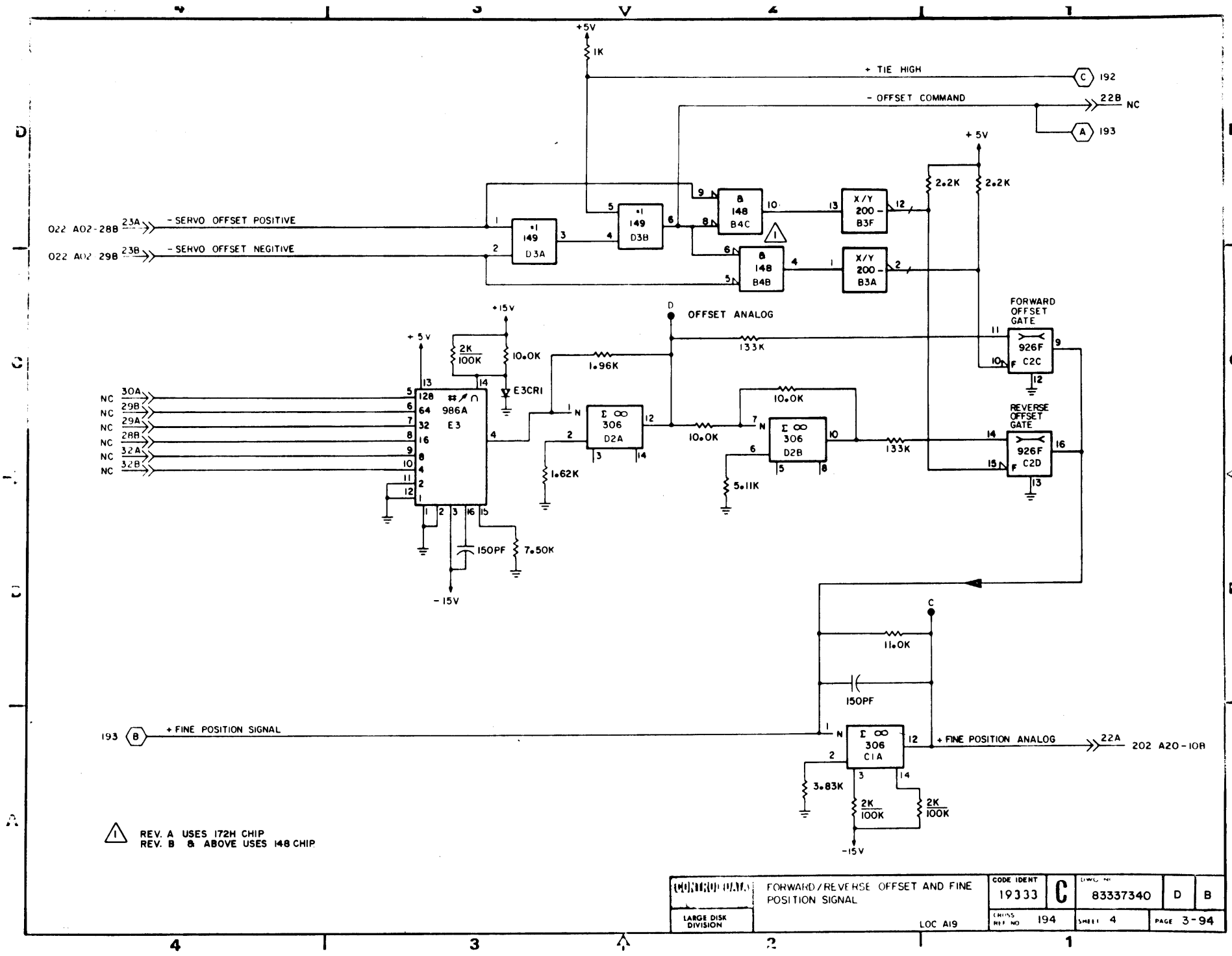
REF 81201219



1. PART OF HEAD ALIGNMENT CARD
2. REV. A USES 172H CHIP
   REV. B & ABOVE USES 148 CHIP
3. APPLICABLE TO REV. B & ABOVE ONLY.

CONTROL DATA LARGE DISK DIVISION	WRITE INHIBIT, FWD/REV EOT ENABLES, COARSE / FINE POSITION SIGNALS LOC A19	19333	C	DWG NO 83337340	D	B
		CROSS REF NO 192		SHEET 2	PAGE 3-92	


+15V
+5V
17.8K
15.4K
4.64K
909
339
B2
203 A20-14B
11B
+ INTEGRATED VELOCITY
X/Y
200
B3D
13.3K
15.4K
-15V
FINE ENABLE
15B
064 A06-28B
140
C4C
072 A07-14A
16A
GATED CYL PULSES
022 A02-29A
08A
- READ GATE
148
B4A
+ (READ • ADDRESS MARK ENABLE)
07A
A3
631
022 A02-31A
08B
- ADDRESS MARK ENABLE
-(SPEED FLT + VOLTAGE FLT)
14A
082 A08-29A
174 A17-15B
15A
+(SPEED FLT + VOLTAGE FLT)
174 A17-15B
14B
+(SPEED FLT + VOLTAGE FLT)
C4A
1K
.1UF
33.2K
194
- OFFSET COMMAND
161
E4
1MS
- OFFSET COMMAND PULSE
31B
084 A08-32B
082 A08 25B
25B
+ UP TO SPEED DELAYED
063 A06-07B
26A
-(ODD DIBITS • FWD EOT EN)
D4D
+ CLEAR LOAD
25A
124 A12-15A
2.2K
072 A07-04B
07B
+ SLOPE • (ODD TRACK)
B3B
B3C
(EVEN TRACK GATE)
- SLOPE GATE
926
C2A
15.0K
150PF
10.0K
(ODD TRACK GATE)
+ SLOPE GATE
C2B
+ FINE POSITION SIGNAL
194
184 A18-09B
11A
+ TRACK SERVO SIGNAL
306
C1B
5.11K
2K
100K
-15V
A19-15B
INPUT
A19-11B
H
L
> 0.9V
(FWD SK)
0V
(REV SK)
<-0.9V
REV. A USES 172H CHIP.
REV. B & ABOVE USES 148 CHIP.
LARGE DISK DIVISION
FINE ENABLE, SLOPE GATE
AND OFFSET COMMAND
GENERATION
LOC A19
CODE IDENT 19333
C
DWG NO 83337340
D
B
CROSS REF NO 193
SHEET 3
PAGE 3-93


+5V
1K
+ TIE HIGH
C 192
- OFFSET COMMAND
228 NC
A 193
+5V
2.2K
2.2K
022 A02-28B 23A - SERVO OFFSET POSITIVE
022 A02 29B 23B - SERVO OFFSET NEGITIVE
1 149 D3A
1 149 D3B
8 148 B4C
8 148 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
926F C2C
NC 30A
NC 29B
NC 29A
NC 28B
NC 32A
NC 32B
128
64
32
16
8
4
2
1
986A E3
Σ ∞ 306 D2A
Σ ∞ 306 D2B
10.0K
10.0K
133K
1.62K
5.11K
REVERSE OFFSET GATE
926F C2D
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
1 REV. A USES 172H CHIP
REV. B & ABOVE USES 148 CHIP
DIABLO
LARGE DISK DIVISION
FORWARD/REVERSE OFFSET AND FINE POSITION SIGNAL
LOC A19
CODE IDENT 19333
C
DWG NO 83337340
D
B
CROSS REF NO 194
SHEET 4
PAGE 3-94

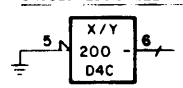
REVISION STATUS OF SHEETS

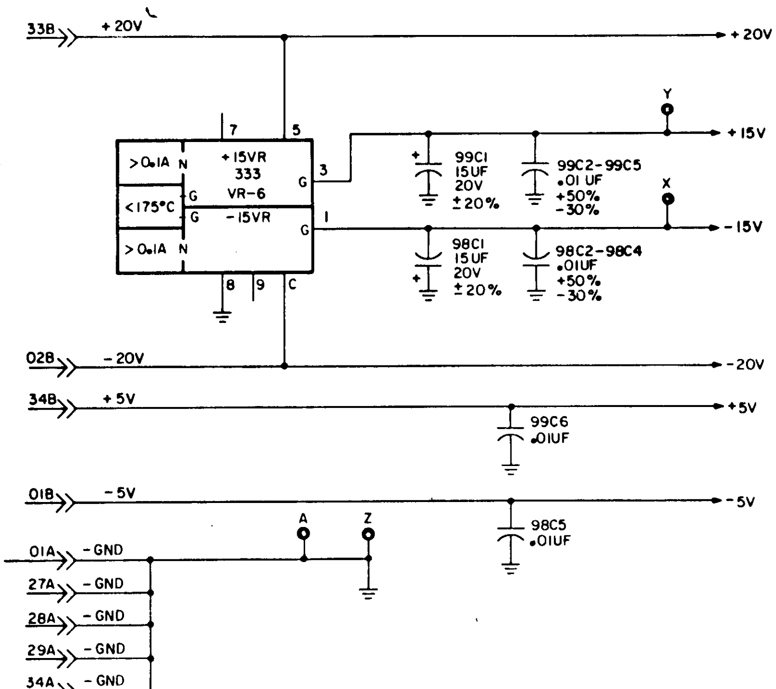
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																

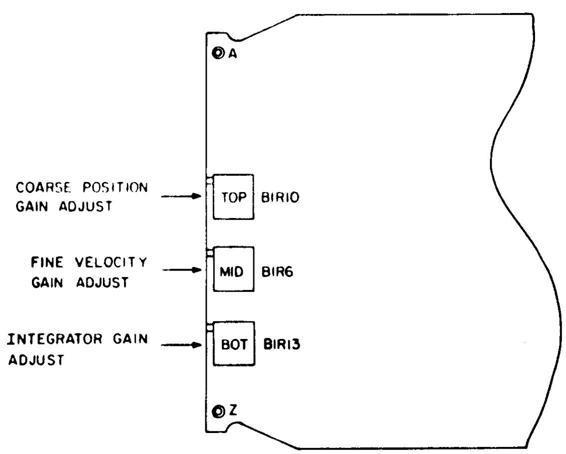
REVISIONS

REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	DH23000 DH13203A	CREATE BJ4A3 C/D	SMS	10-1-82	[illegible]

UNUSED LOGIC ELEMENT

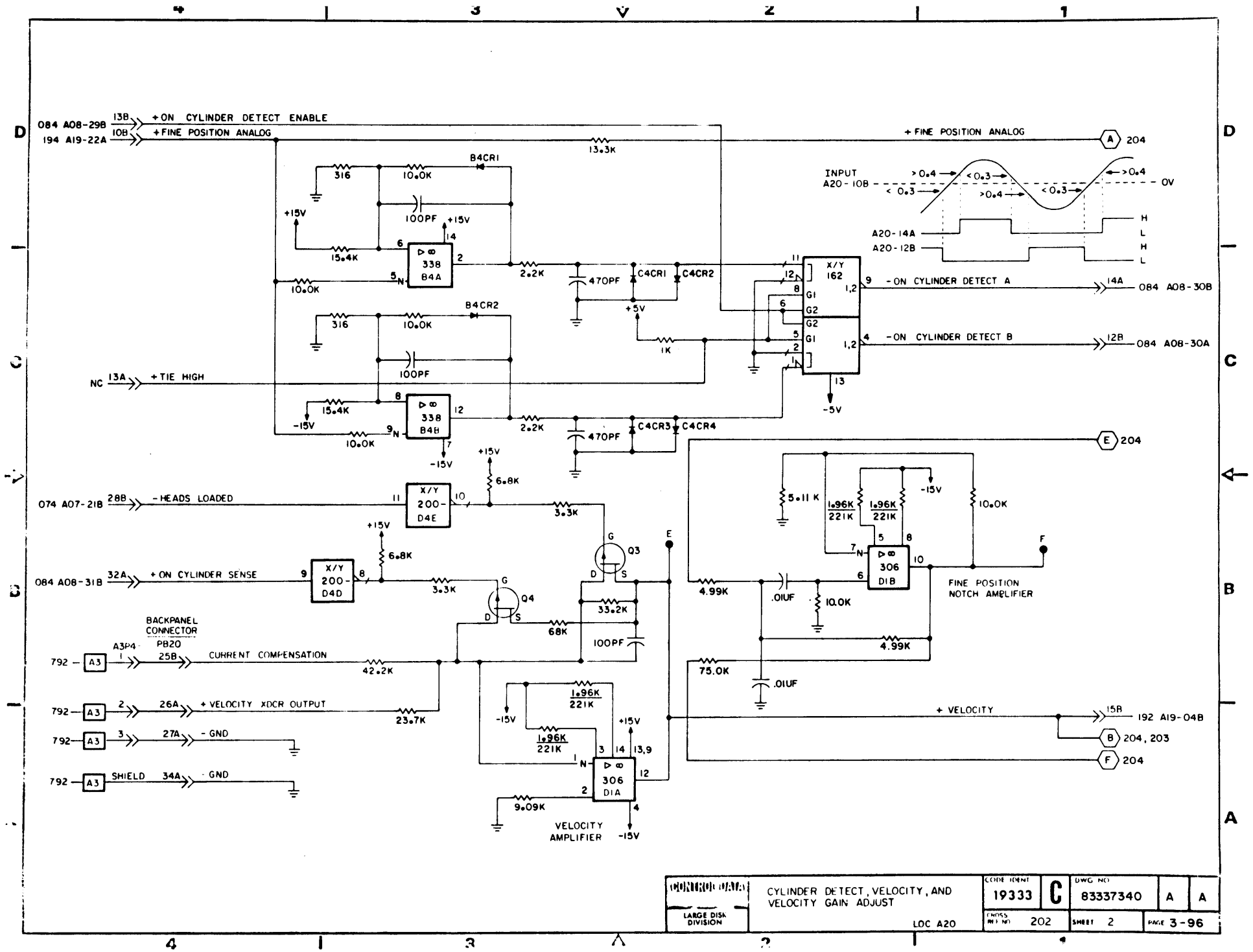




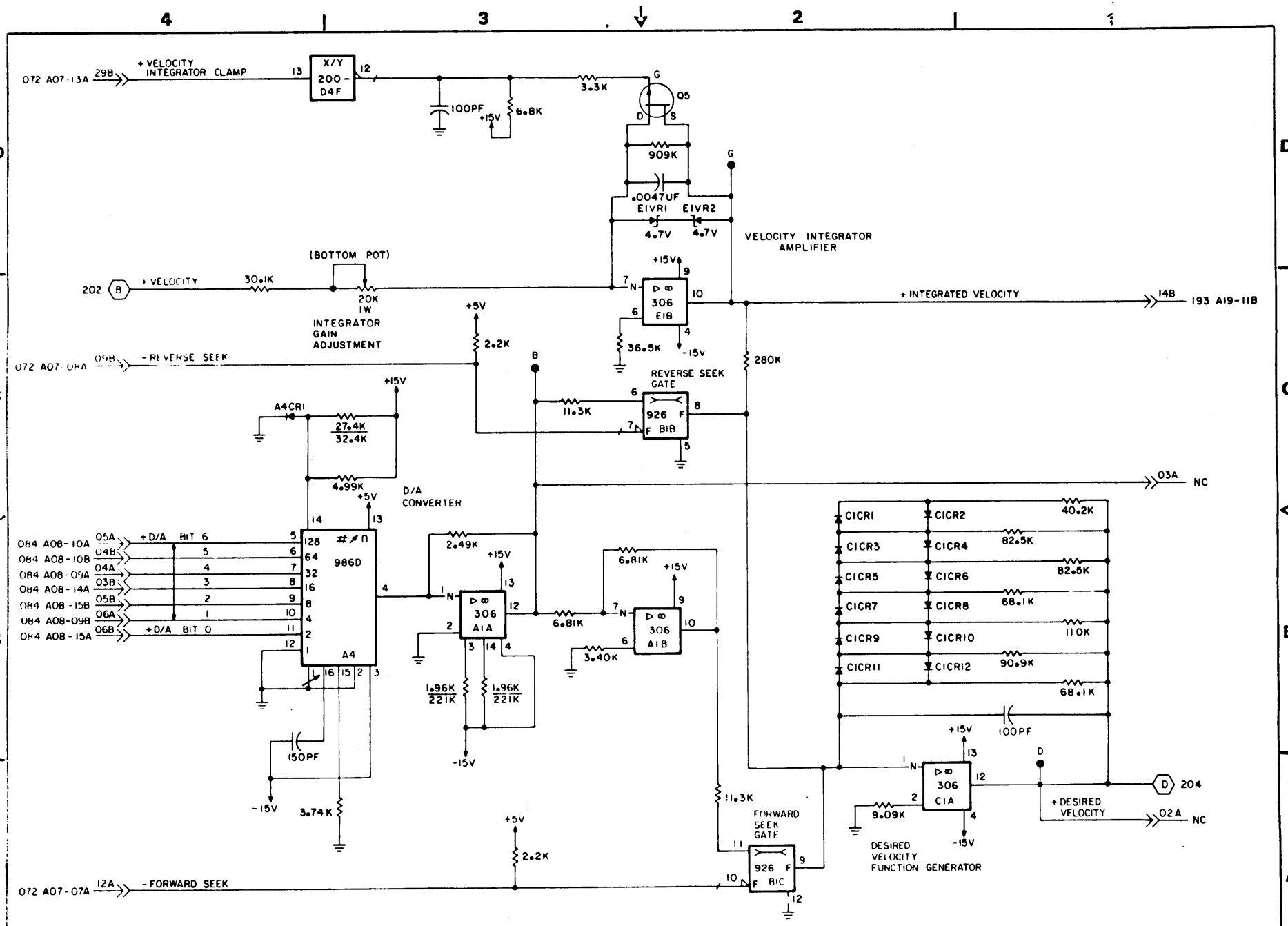


DRAWN	G. A...	CONTROL DATA LARGE DISK DIVISION	ANALOG SERVO DIAGRAMS	CODE IDENT 19333	C	DWG NO 83337340	A	A
CHECKED								
ENGINEER			TYPE: GMSV LOC: A20	CROSS REF NO 201		SHEET 1 OF 4	PAGE 3-95	
APPROVED								

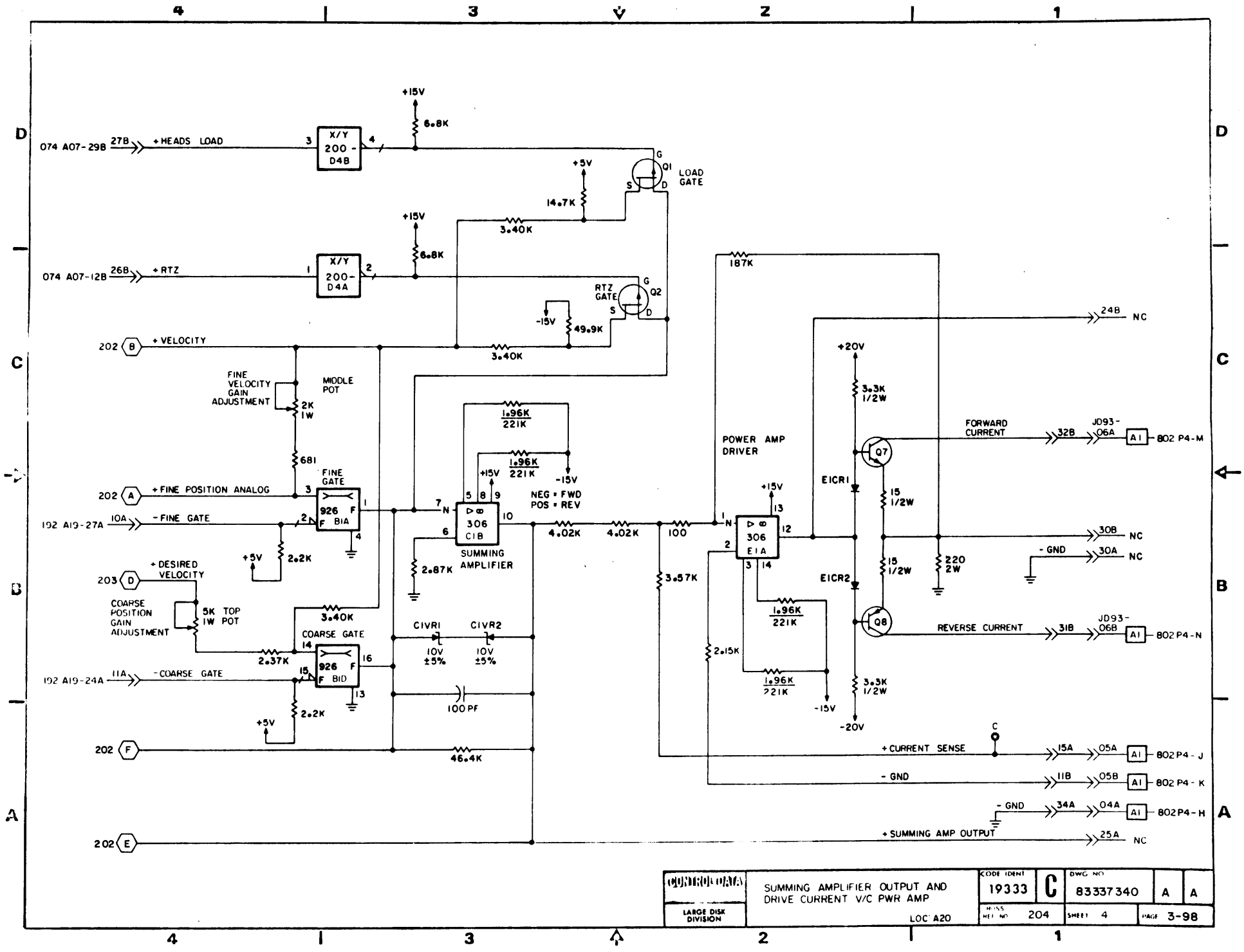
REF 81201220



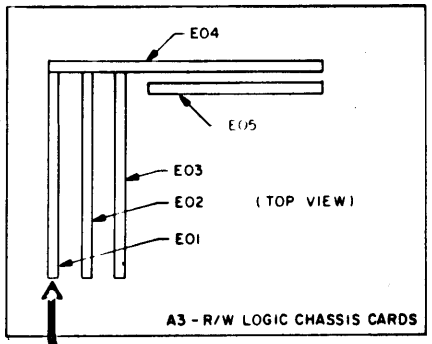
LARGE DISK DIVISION	CYLINDER DETECT, VELOCITY, AND VELOCITY GAIN ADJUST LOC A20	CODE IDENT 19333	C	DWG NO 83337340	A	A
		CROSS REF NO 202		SHEET 2	PAGE 3-96	

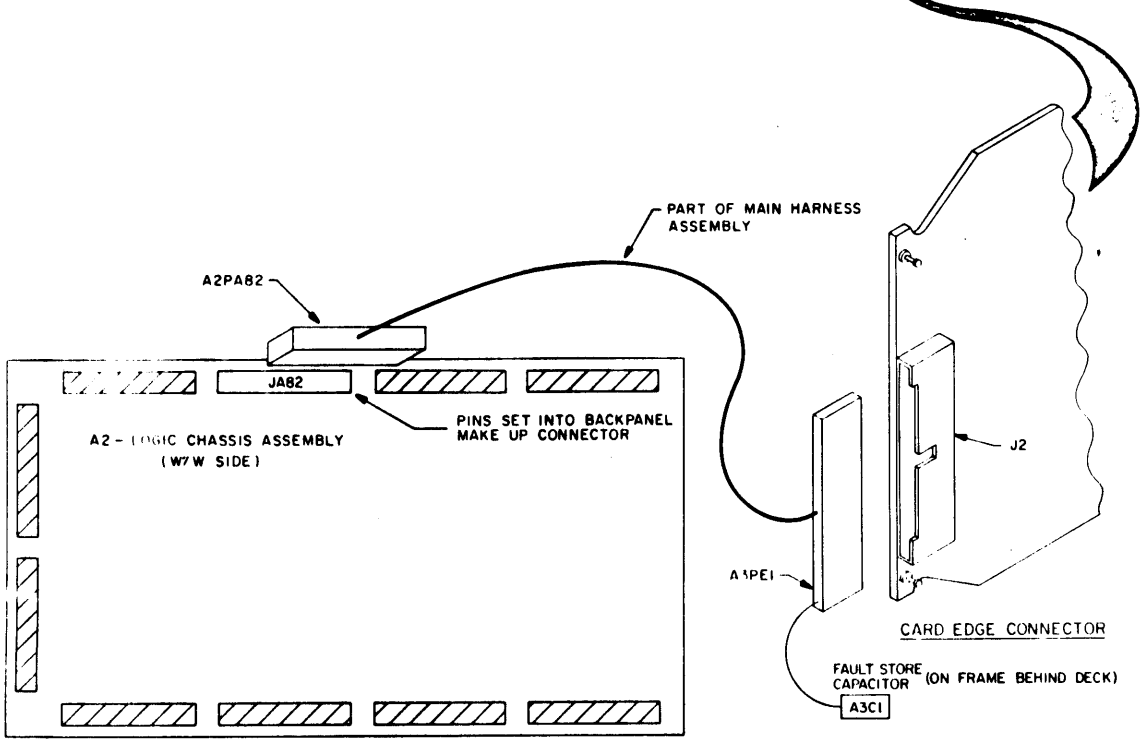


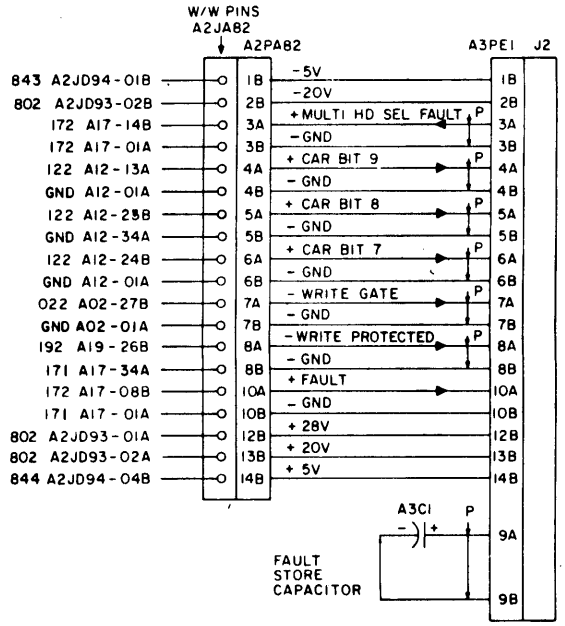
CONTROL DATA LARGE DISK DIVISION	D/A CONVERTER AND DESIRED VELOCITY GENERATOR LOC A20	CODE IDENT 19333	C	DWG NO 83337340	A	A
		CROSS REF NO 203		SHEET 3	PAGE 3-97	


+15V
6.8K
074 A07-29B
27B
+HEADS LOAD
X/Y 200 - D4B
Q1
LOAD GATE
+5V
14.7K
3.40K
074 A07-12B
26B
+RTZ
X/Y 200 - D4A
Q2
RTZ GATE
-15V
49.9K
202 B
+VELOCITY
FINE VELOCITY GAIN ADJUSTMENT
2K 1W
MIDDLE POT
681
202 A
+FINE POSITION ANALOG
FINE GATE
926 F BIA
192 A19-27A
10A
-FINE GATE
2.2K
1.96K 221K
NEG = FWD POS = REV
SUMMING AMPLIFIER
306 C1B
2.87K
4.02K
100
3.57K
POWER AMP DRIVER
306 E1A
187K
+20V
3.3K 1/2W
EICR1
EICR2
15 1/2W
220 2W
Q7
Q8
FORWARD CURRENT
REVERSE CURRENT
24B NC
32B
31B
JD93-06A
JD93-06B
A1
802 P4-M
802 P4-N
30B NC
30A NC
- GND
203 D
+DESIRED VELOCITY
COARSE POSITION GAIN ADJUSTMENT
5K TOP 1W POT
COARSE GATE
926 F BID
192 A19-24A
11A
-COARSE GATE
2.37K
3.40K
CIVR1
CIVR2
10V ±5%
100 PF
46.4K
202 F
202 E
+CURRENT SENSE
-GND
+SUMMING AMP OUTPUT
15A
11B
34A
25A
05A
05B
04A
802 P4-J
802 P4-K
802 P4-H
SUMMING AMPLIFIER OUTPUT AND DRIVE CURRENT V/C PWR AMP
LOC A20
LARGE DISK DIVISION
CODE IDENT 19333
C
DWG NO 83337340
A
A
REV NO 204
SHEET 4
PAGE 3-98

REVISIONS					
REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	DH23000 DH13203A	CREATE 8J4A3C/D	SMS	10-4-82	
B	DJ13603	APKV LOG DIAG CHG.	M.C.	2-8-84	



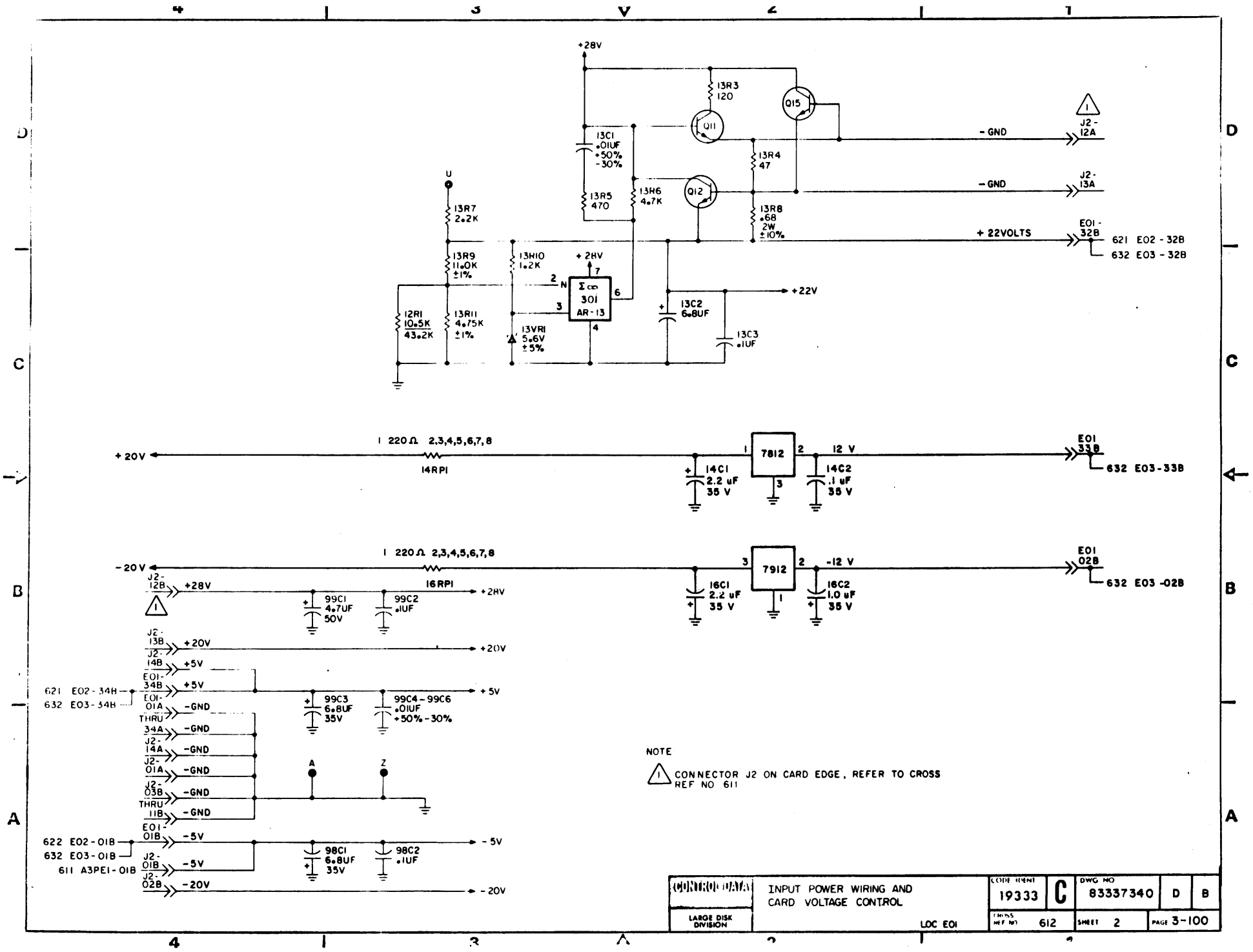


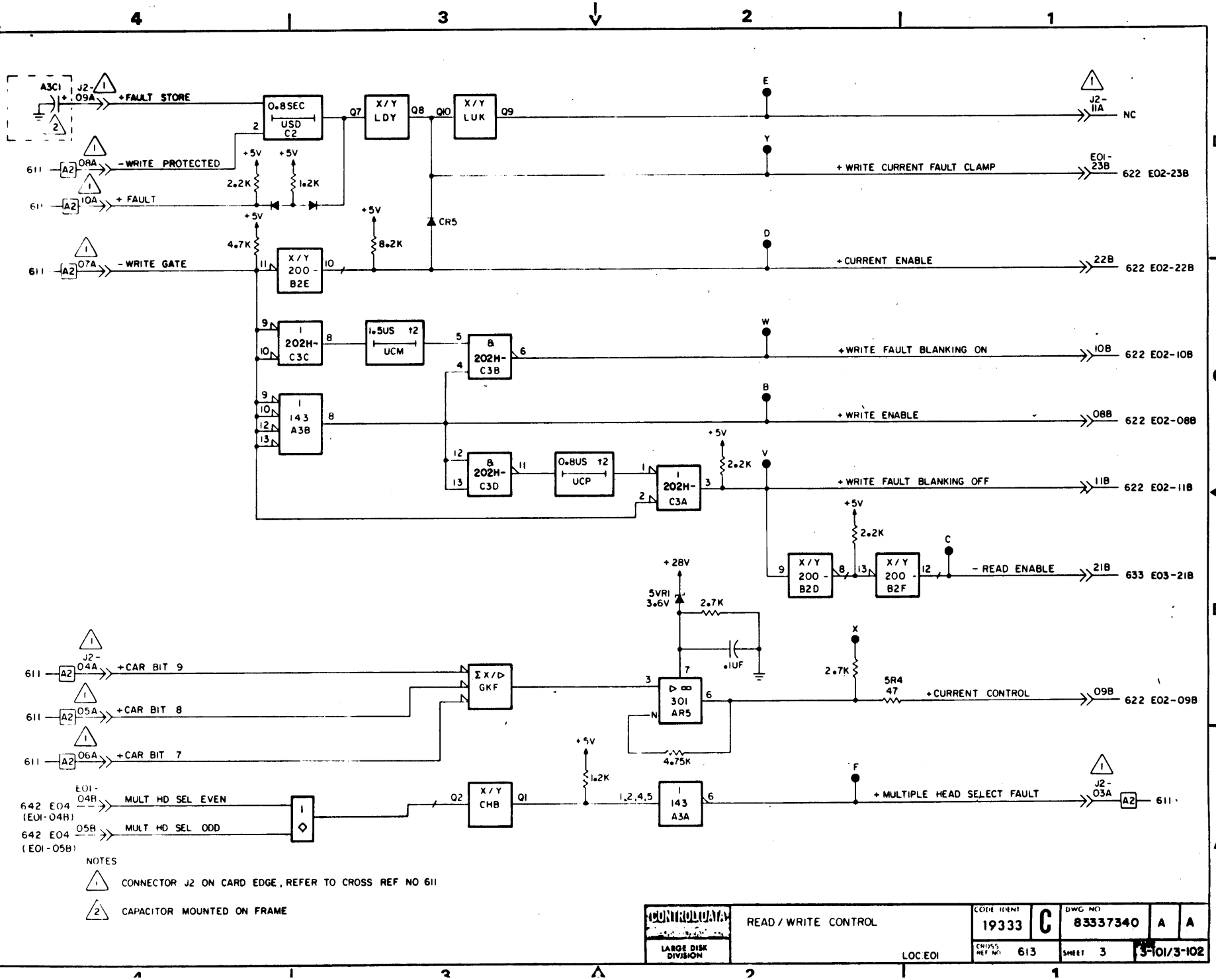


PA82 TO PE1 CABLING

DRAWN	C. Kilgore	CONTROL DATA	R/W CONTROL CABLING AND DIAGRAMS	CODE IDENT 19333	C	DWG NO 83337340	D B
CHECKED							
ENGINEER		LARGE DISK DIVISION	TYPE: APKV LOC: E01	CROSS REF NO 611		SHEET 1 OF 3	PAGE 3-99
APPROVED							

REF 81201221


+28V
13R3 120
Q15
Q11
13C1 .01UF +50% -30%
13R4 47
13R5 470
13R6 4.7K
Q12
13R8 .68 2W ±10%
U
13R7 2.2K
13R9 11.0K ±1%
13R10 1.2K
+28V
2
N
3
Σ∞ 301 AR-13
7
6
4
12R1 10.5K 43.2K
13R11 4.75K ±1%
13VR1 5.6V ±5%
+22V
13C2 6.8UF
13C3 .1UF
- GND
J2- 12A
- GND
J2- 13A
+ 22VOLTS
E01- 32B
621 E02 - 32B
632 E03 - 32B
+ 20V
1 220Ω 2,3,4,5,6,7,8
14RP1
14C1 2.2 uF 35 V
7812
12 V
14C2 .1 uF 35 V
E01 33B
632 E03-33B
- 20V
1 220Ω 2,3,4,5,6,7,8
16RP1
7912
-12 V
16C1 2.2 uF 35 V
16C2 1.0 uF 35 V
E01 02B
632 E03 -02B
J2- 12B
+28V
99C1 4.7UF 50V
99C2 .1UF
+28V
J2- 13B
+20V
+20V
J2- 14B
+5V
E01- 34B
+5V
621 E02 - 34B
632 E03 - 34B
E01- 01A
-GND
99C3 6.8UF 35V
99C4 - 99C6 .01UF +50% -30%
+5V
THRU 34A
-GND
J2- 14A
-GND
J2- 01A
-GND
J2- 03B
-GND
THRU 11B
-GND
A
Z
E01- 01B
-5V
622 E02 - 01B
632 E03 - 01B
611 A3PE1 - 01B
98C1 6.8UF 35V
98C2 .1UF
- 5V
J2- 01B
-5V
J2- 02B
-20V
- 20V
NOTE
1 CONNECTOR J2 ON CARD EDGE, REFER TO CROSS REF NO 611
INPUT POWER WIRING AND CARD VOLTAGE CONTROL
LOC E01
LARGE DISK DIVISION
CODE IDENT 19333
C
DWG NO 83337340
D
B
CROSS REF NO 612
SHEET 2
PAGE 3-100

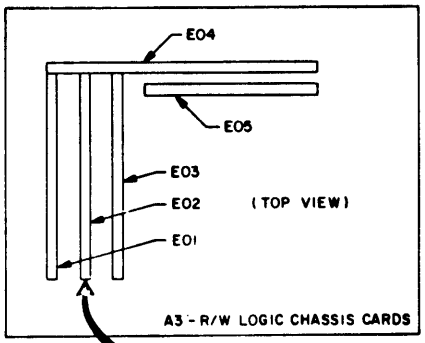

A3C1
J2-09A
+FAULT STORE
0.8SEC USD C2
Q7
X/Y LDY
Q8
Q10
X/Y LUK
Q9
E
J2-11A
NC
611 A2 08A -WRITE PROTECTED
Y
+WRITE CURRENT FAULT CLAMP
E01-23B
622 E02-23B
611 A2 10A +FAULT
2.2K
1.2K
+5V
CR5
8.2K
4.7K
611 A2 07A -WRITE GATE
X/Y 200-B2E
D
+CURRENT ENABLE
22B
622 E02-22B
1 202H-C3C
1.5US t2 UCM
8 202H-C3B
W
+WRITE FAULT BLANKING ON
10B
622 E02-10B
1 143 A3B
B
+WRITE ENABLE
08B
622 E02-08B
8 202H-C3D
0.8US t2 UCP
1 202H-C3A
V
+WRITE FAULT BLANKING OFF
11B
622 E02-11B
X/Y 200-B2D
X/Y 200-B2F
C
-READ ENABLE
21B
633 E03-21B
+28V
5VRI 3.6V
2.7K
.1UF
X
5R4 47
+CURRENT CONTROL
09B
622 E02-09B
611 A2 J2-04A +CAR BIT 9
611 A2 05A +CAR BIT 8
611 A2 06A +CAR BIT 7
ΣX/D GKF
301 AR5
4.75K
642 E04 (E01-04B) E01-04B MULT HD SEL EVEN
642 E04 (E01-05B) 05B MULT HD SEL ODD
X/Y CHB
Q2
Q1
1,2,4,5
143 A3A
F
+MULTIPLE HEAD SELECT FAULT
J2-03A
A2 611
NOTES
1 CONNECTOR J2 ON CARD EDGE, REFER TO CROSS REF NO 611
2 CAPACITOR MOUNTED ON FRAME
CONTROL DATA
LARGE DISK DIVISION
READ / WRITE CONTROL
LOC E01
CODE IDENT 19333
C
DWG NO 83337340
A
A
CROSS REF NO 613
SHEET 3
3-101/3-102

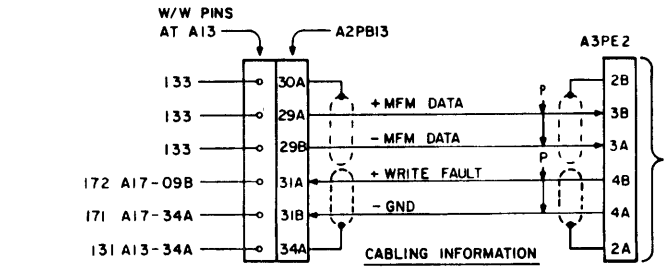
REVISION STATUS OF SHEETS

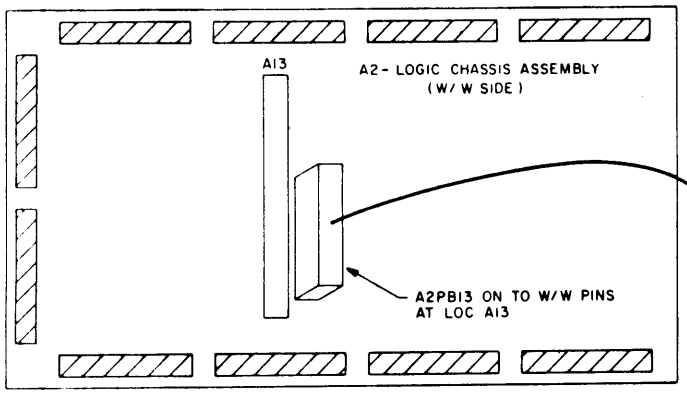
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A																		

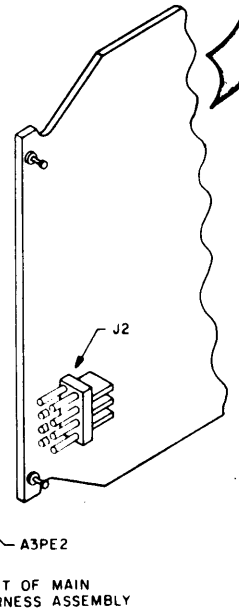
REVISIONS

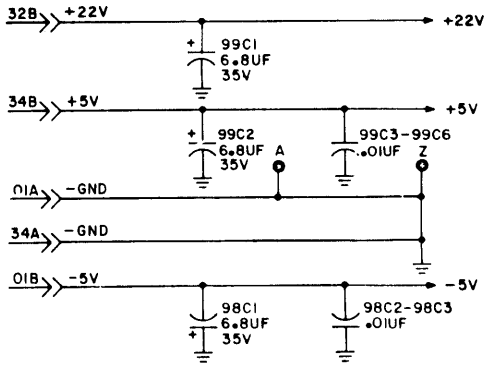
REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	DH23000 DH13203A	CREATE BJ4A3 C / D	SMS	10-4-82	





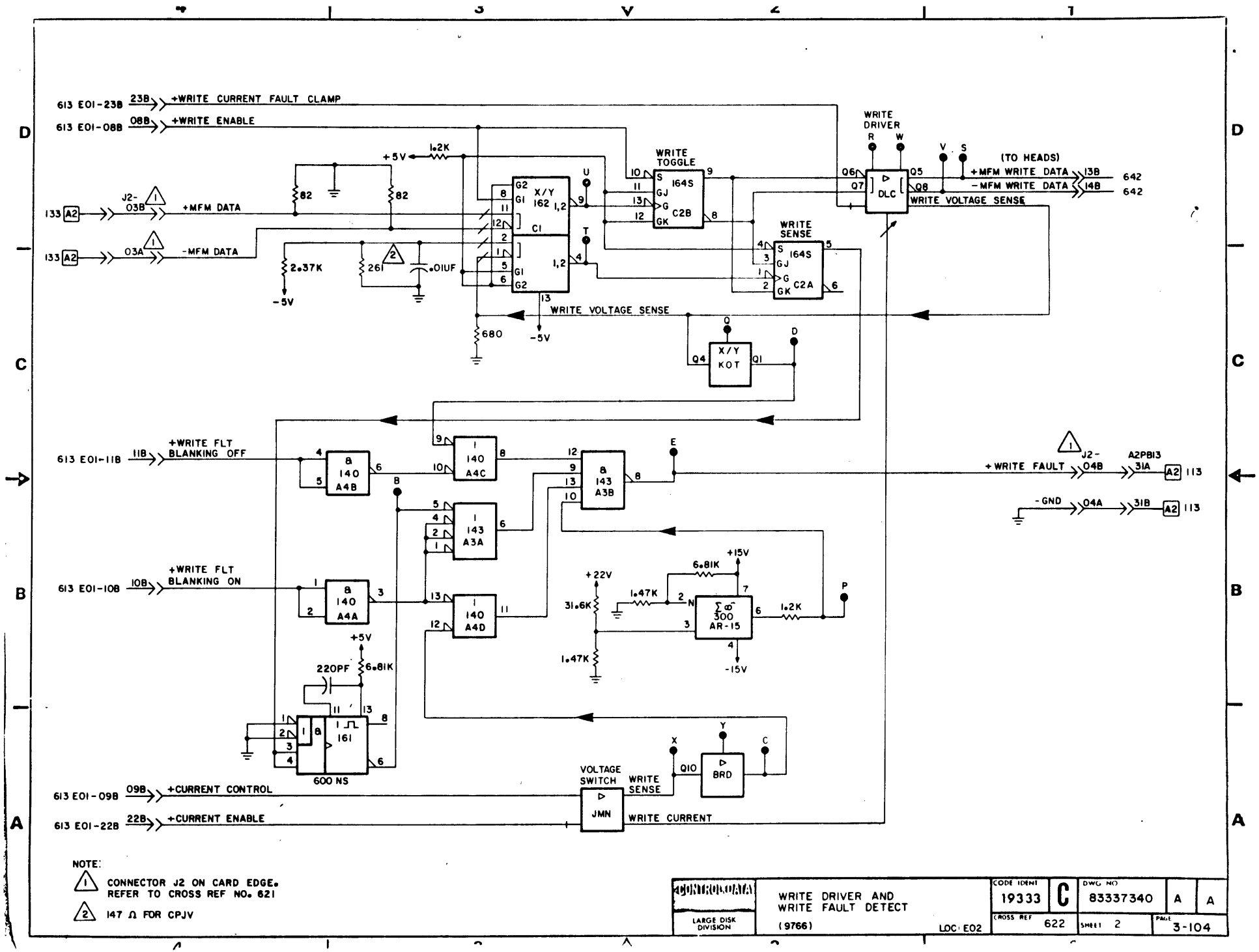




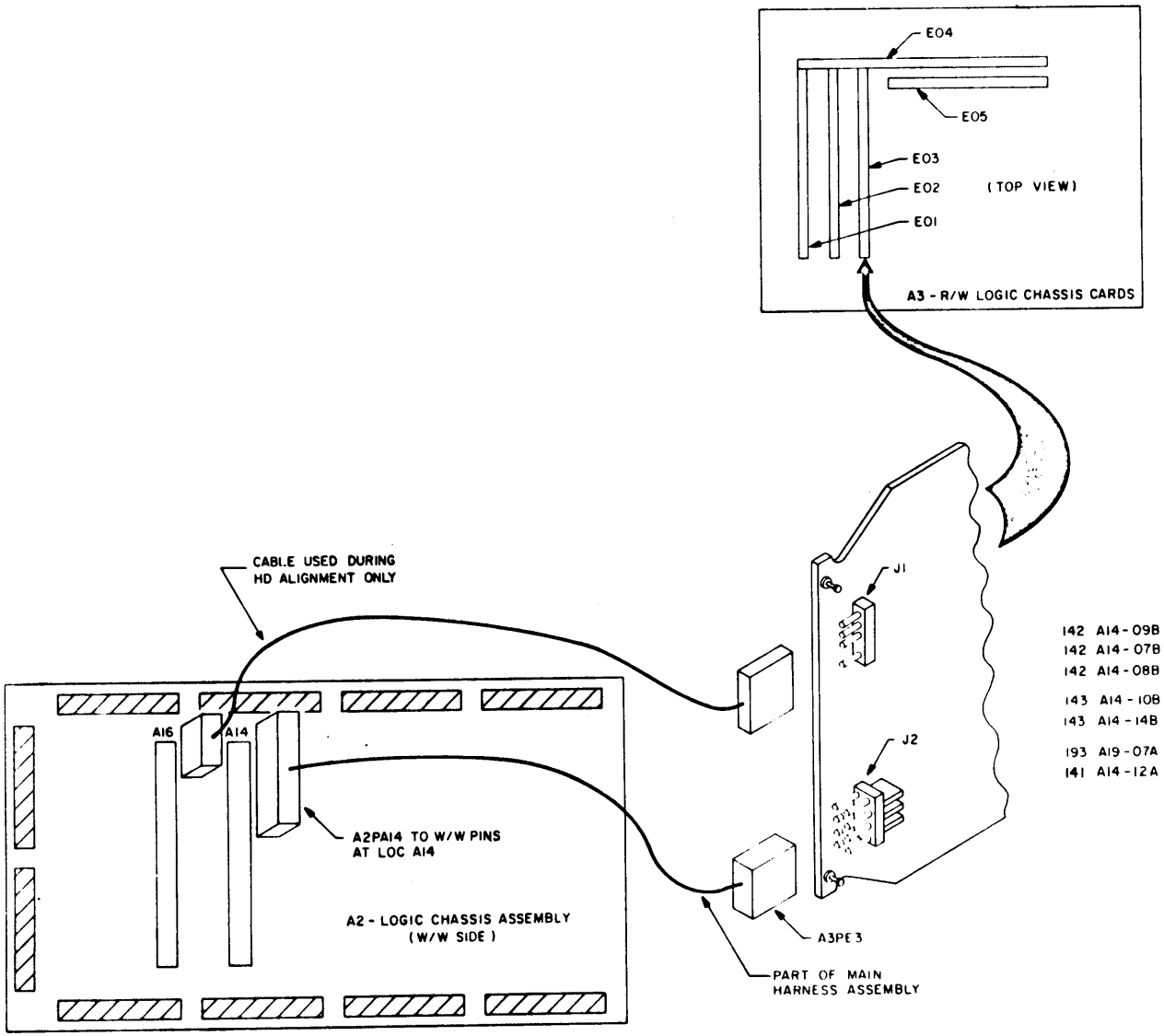


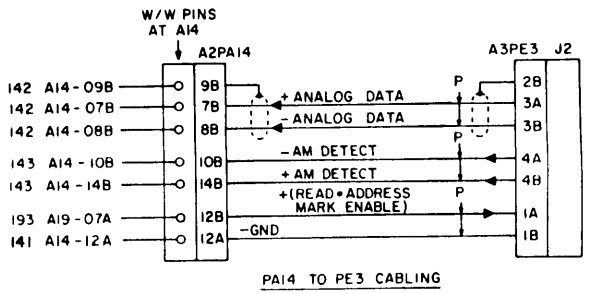
DRAWN	G RABAUE	1 30 29	CONTROL DATA	WRITE DRIVER CARD EDGE CONNECTOR AND CABLING DIAGRAMS	CODE IDENT 19333	C	DWG NO 83337340	A	A
CHECKED									
ENGINEER					CROSS REF NO 621		SHEET 1 of 2	PAGE 3-103	
APPROVED			LARGE DISK DIVISION	TYPE APJV/CPJV LOC E02					

REF 81201222


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
J2-03B
+MFM DATA
133 A2
82
82
J2-03A
-MFM DATA
2.37K
261
.01UF
-5V
X/Y 162
C1
WRITE SENSE
164S
C2B
C2A
DLC
680
-5V
WRITE VOLTAGE SENSE
X/Y KOT
613 E01-11B
11B
+WRITE FLT BLANKING OFF
613 E01-10B
10B
+WRITE FLT BLANKING ON
140 A4B
140 A4C
140 A4D
143 A3A
143 A3B
140 A4A
+WRITE FAULT
J2-04B
A2PB13
31A
A2 113
-GND
04A
31B
A2 113
+22V
+15V
6.81K
31.6K
1.47K
1.47K
1.2K
300 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:
1 CONNECTOR J2 ON CARD EDGE. REFER TO CROSS REF NO. 621
2 147 Ω FOR CPJV
LARGE DISK DIVISION
WRITE DRIVER AND WRITE FAULT DETECT
(9766)
LOC: E02
CODE IDENT 19333
C
DWG NO 83337340
A
A
CROSS REF 622
SHEET 2
PAGE 3-104

REVISIONS					
REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	DH23000 DH13203A	CREATE BJ4A3C/D	SMS	10/4/82	
B	DJ13448	CHG. RESISTORS	M.L.C.	2-10-84	

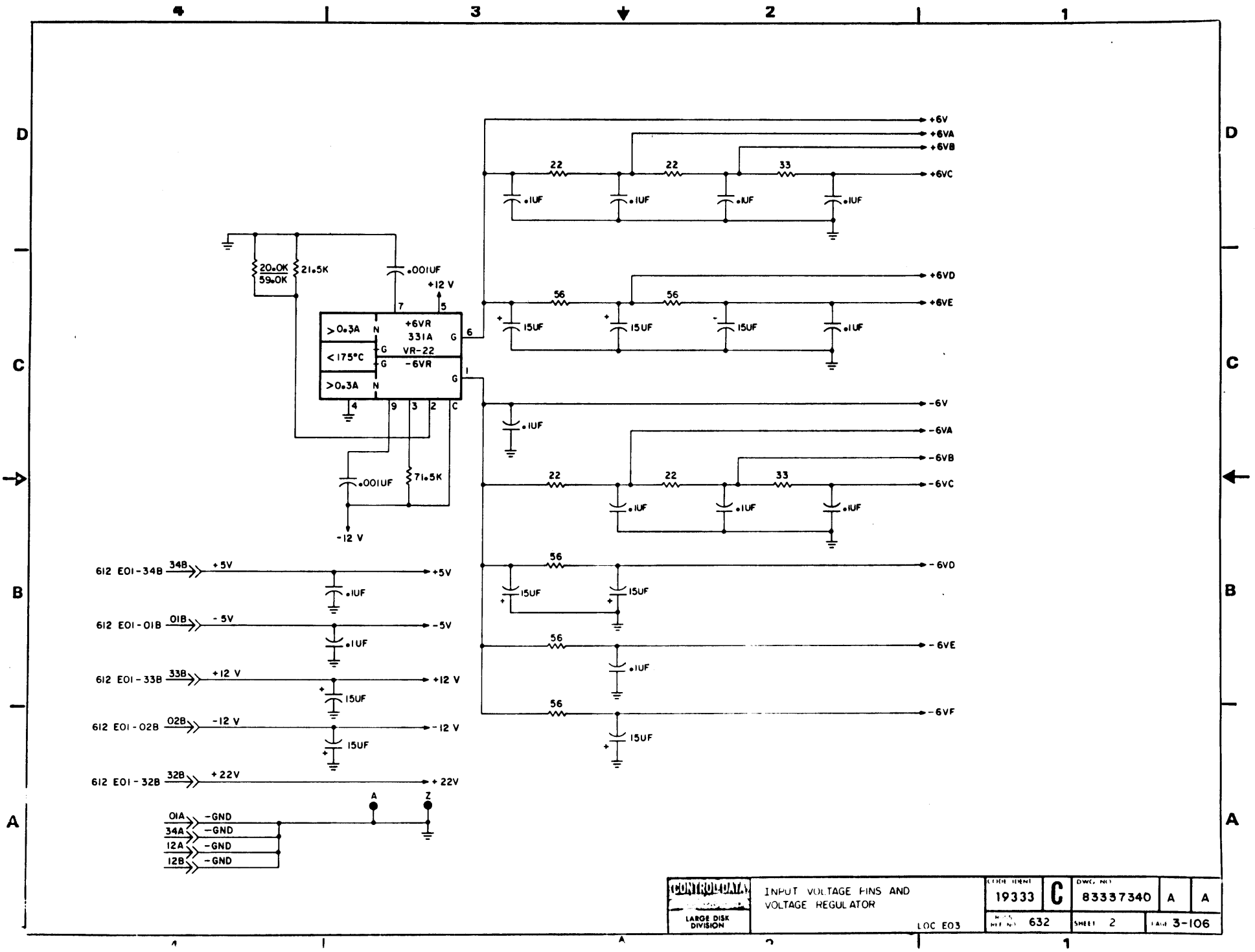


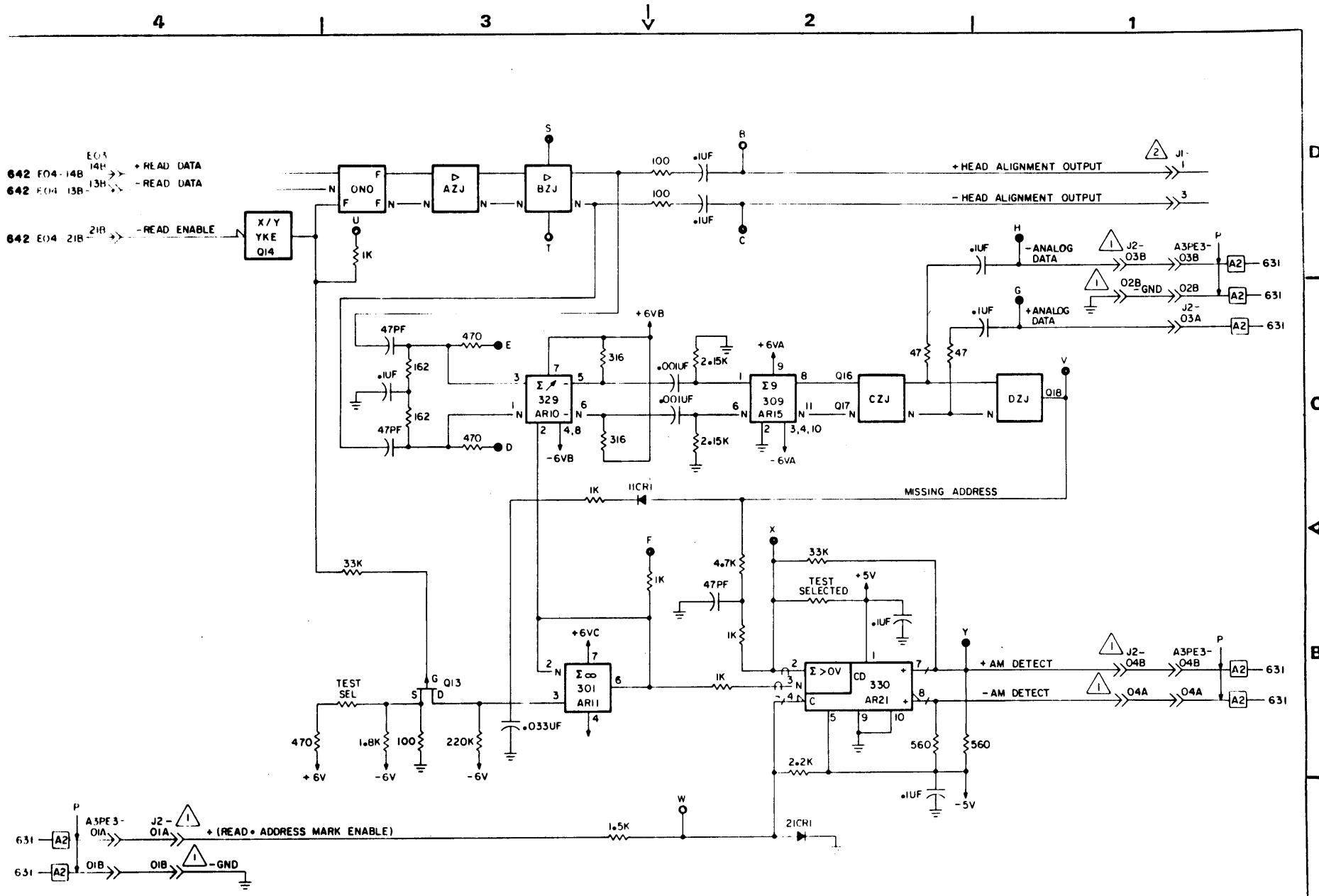


PA14 TO PE3 CABLING

DRAWN				READ AMPLIFIER AND ADDRESS MARK DETECTION DIAGRAMS	CODE IDENT 19333	C	DWG NO 83337340	D	B
CHECKED									
ENGINEER				TYPE BPHV LOC E03	CROSS REF NO 631		SHEET 1 of 3	PAGE 3-105	
APPROVED				LARGE DISK DIVISION					

REF 81201223


+6V
+6VA
+6VB
+6VC
+6VD
+6VE
-6V
-6VA
-6VB
-6VC
-6VD
-6VE
-6VF
22
33
56
.1UF
15UF
20.0K
59.0K
21.5K
.001UF
+12 V
-12 V
71.5K
>0.3A
+6VR
331A
VR-22
<175°C
-6VR
612 E01-34B
34B
+5V
612 E01-01B
01B
-5V
612 E01-33B
33B
612 E01-02B
02B
612 E01-32B
32B
+22V
01A
34A
12A
12B
-GND
A
Z
CONTROL DATA
LARGE DISK DIVISION
INPUT VOLTAGE PINS AND VOLTAGE REGULATOR
LOC E03
CODE IDENT
19333
C
DWG NO
83337340
A
A
REV NO
632
SHEET 2
PAGE 3-106



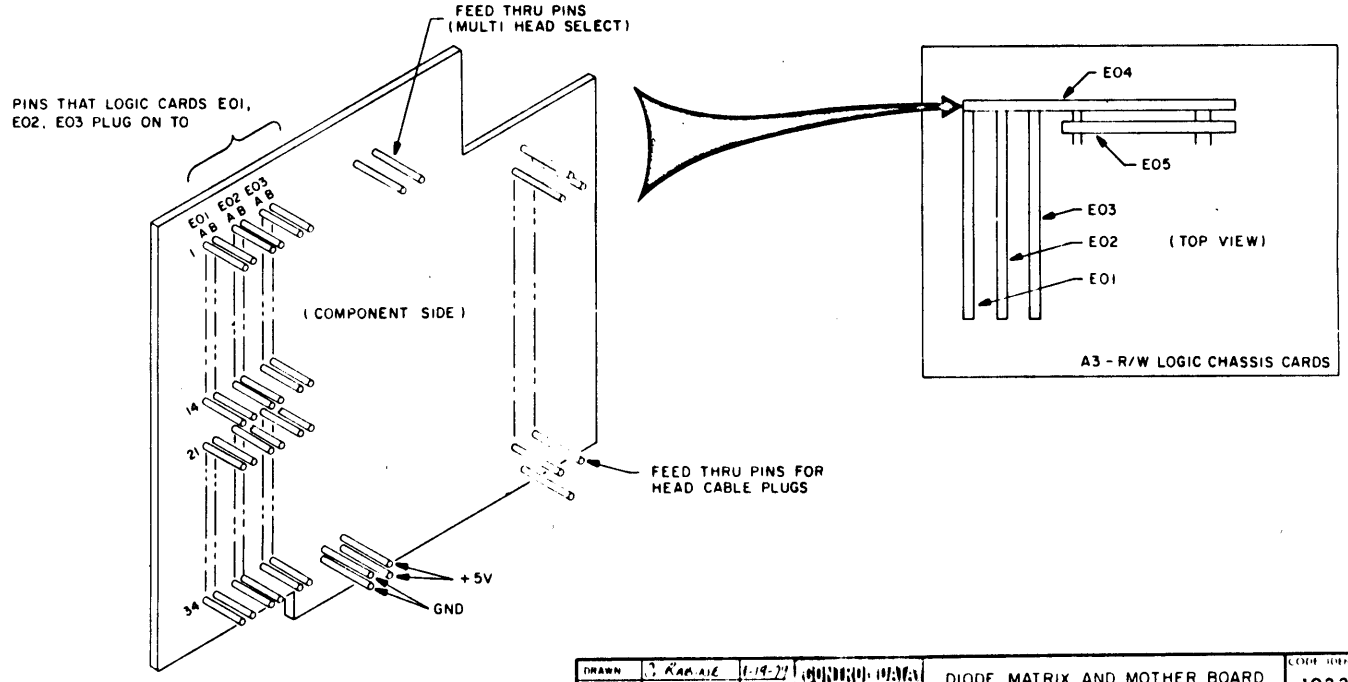
NOTE

1. CONNECTOR J2 ON CARD EDGE, REFER TO CROSS REF NO 631
2. CONNECTOR J1 ON CARD EDGE, REFER TO CROSS REF NO 631

CONTROL DATA LARGE DISK DIVISION	READ AMPLIFIER AND ADDRESS MARK DETECTION LOC E03	CODE IDENT 19333	C	DWG NO 83337340	D	B
		CROSS REF NO 633		SHEET 3	PAGE 3-107/3-108	

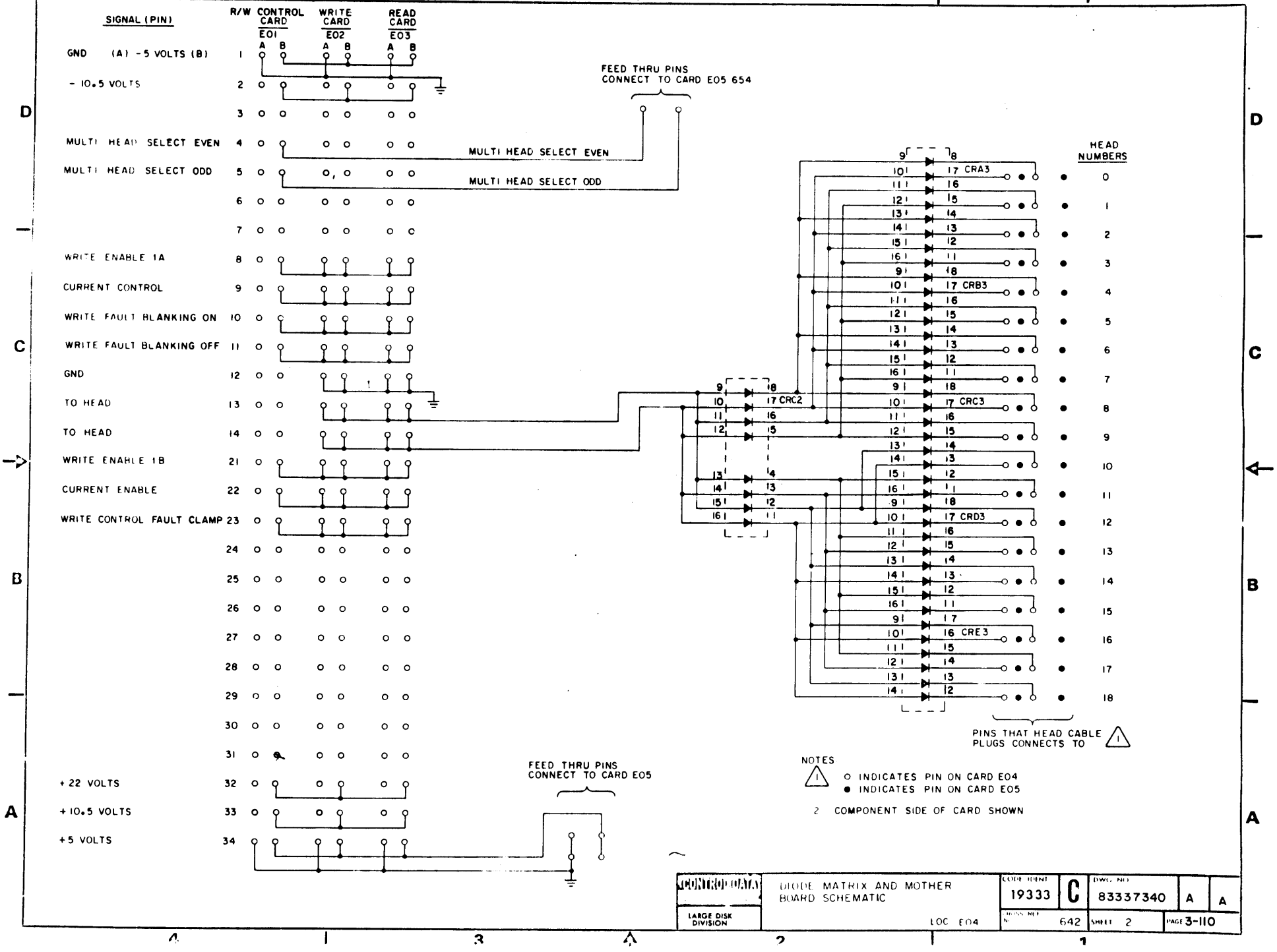
REVISION STATUS OF SHEETS																			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A																		

REVISIONS					
REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	DH23000 DH13203A	CREATE BJ4A3C/D	DLF	10-4-82	



DRAWN	J. KAMAIE	1-19-71	GENERAL DATA	DIODE MATRIX AND MOTHER BOARD BOARD LAYOUT DIAGRAMS	CODE IDENT 19333	C	DWG. NO. 83337340	A	A
CHECKED									
ENGINEER			LARGE DISK DIVISION	TYPE AXFN LOC E04	CROSS REF NO. 641		SHEET 1 OF 2	PAGE 3-109	
APPROVED									

REF 81201224

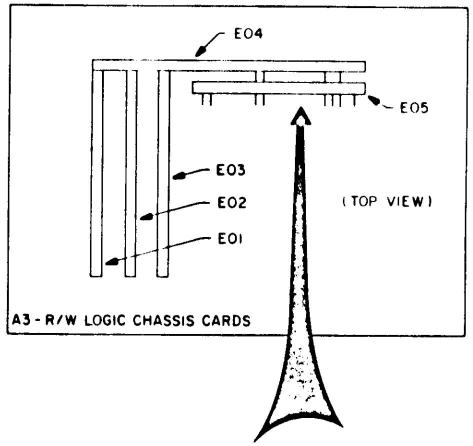

SIGNAL (PIN)
R/W CONTROL CARD E01
WRITE CARD E02
READ CARD E03
A B
GND (A) -5 VOLTS (B) 1
-10.5 VOLTS 2
3
MULTI HEAD SELECT EVEN 4
MULTI HEAD SELECT ODD 5
6
7
WRITE ENABLE 1A 8
CURRENT CONTROL 9
WRITE FAULT BLANKING ON 10
WRITE FAULT BLANKING OFF 11
GND 12
TO HEAD 13
TO HEAD 14
WRITE ENABLE 1B 21
CURRENT 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
17 CRA3
17 CRB3
17 CRC2
17 CRC3
17 CRD3
16 CRE3
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 O INDICATES PIN ON CARD E04
● INDICATES PIN ON CARD E05
2 COMPONENT SIDE OF CARD SHOWN
CONTROL DATA
LARGE DISK DIVISION
DIODE MATRIX AND MOTHER BOARD SCHEMATIC
LOC E04
CODE IDENT 19333
C
DWG. NO 83337340
A
A
ENGR NO 642
SHEET 2
PAGE 3-110

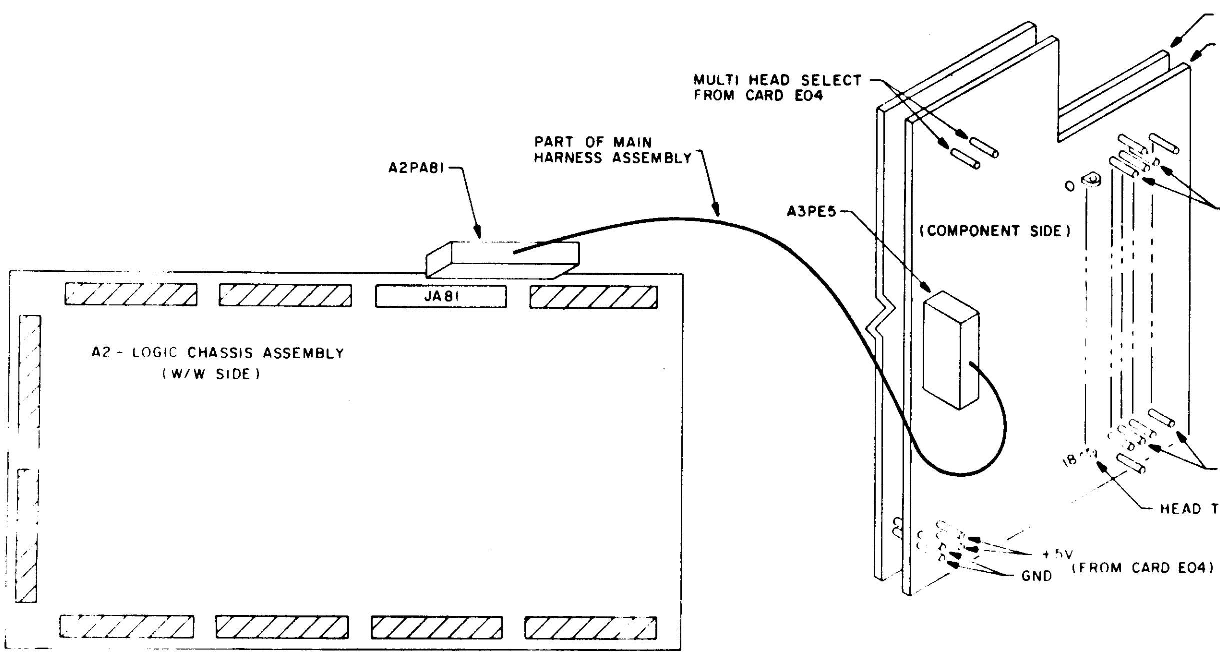
REVISION STATUS OF SHEETS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																

REVISIONS

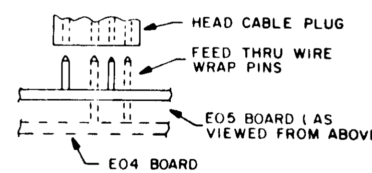
REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	DH23000 DH13203A	CREATE BJ4A3 C/D	SMS	10-4-82	Sms





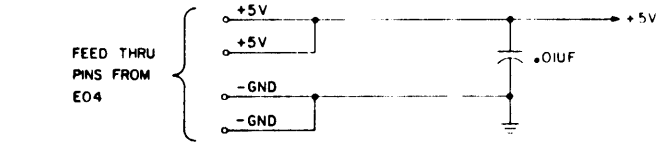
NOTE

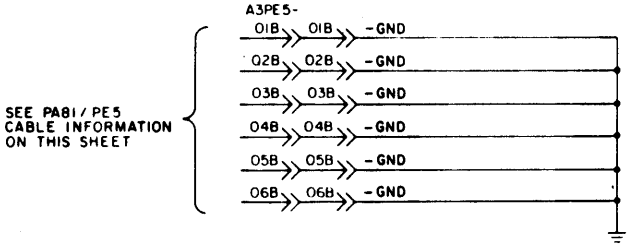
⚠1 HEAD CABLE PLUGS CONNECT TO WIRE WRAP PINS ON BOARD E05 AND ARE KEYED AS FOLLOWS:



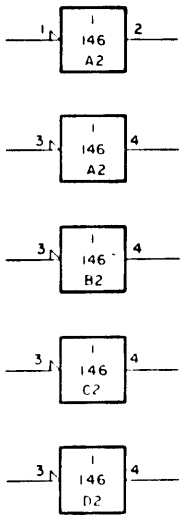
DRAWN	Graham	1-23-79	CONTROL DATA	HEAD SELECT BOARD HEAD PLUG CONNECTORS, CABLING AND CARD LAYOUT DIAGRAMS
CHECKED				
ENGINEER			LARGE DISK DIVISION	TYPE BXGN LOC E05
APPROVED				

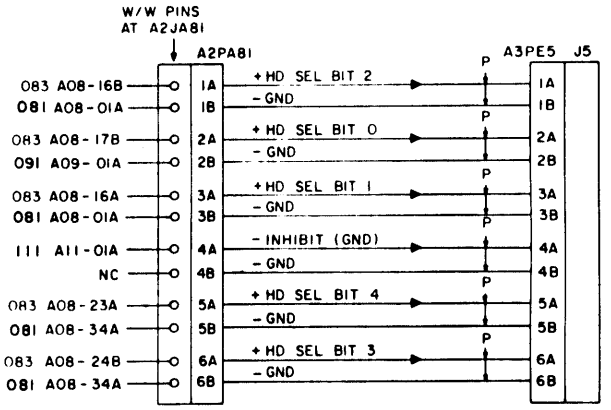
CODE IDENT	SIZE	DWG NO		
19333	C	83337340	A	A
CROSS REF NO 651		SHEET 1 OF 4	PAGE 3-111	





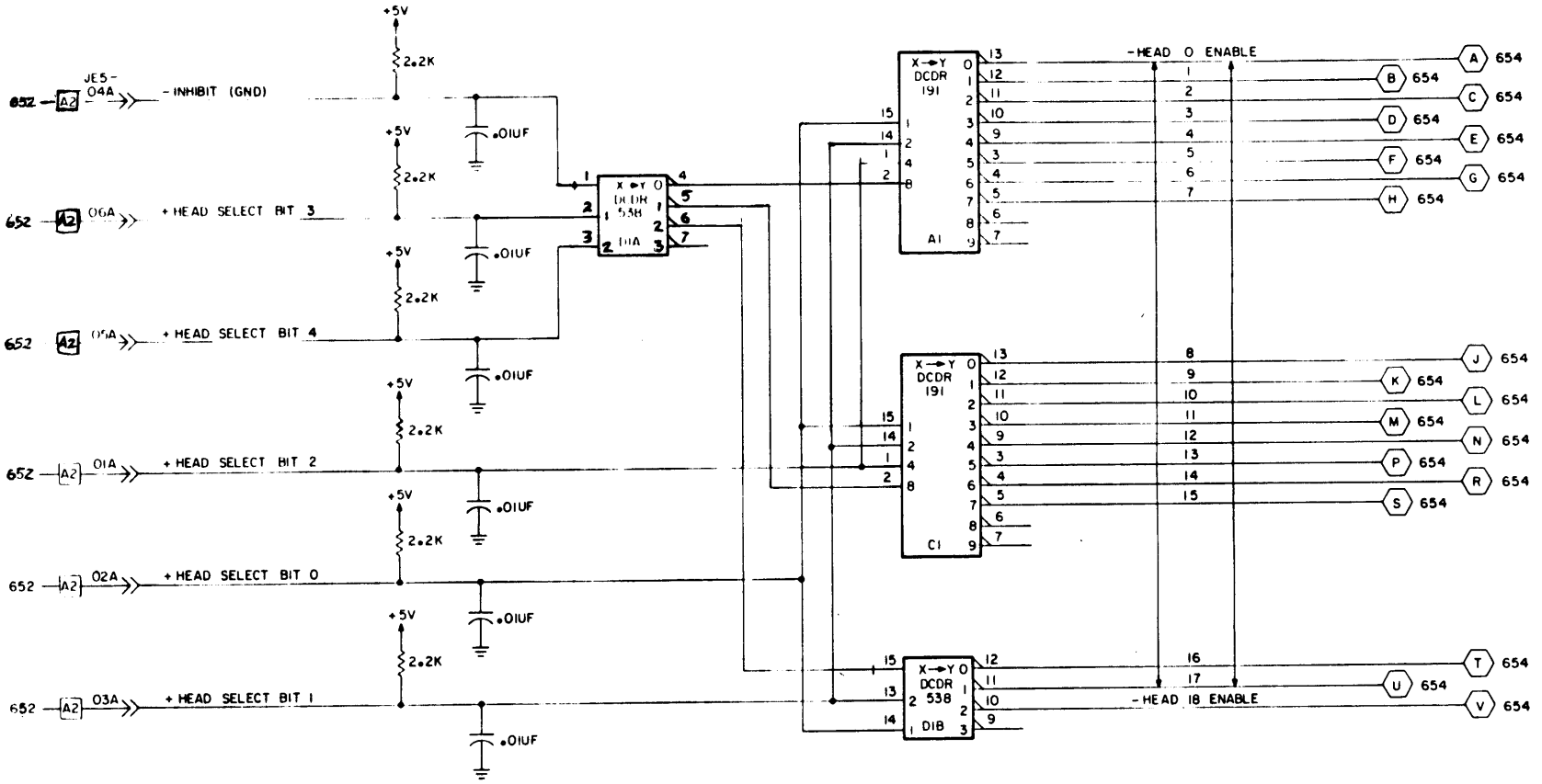
UNUSED LOGIC ELEMENTS





PA81 TO PE5 CABLING

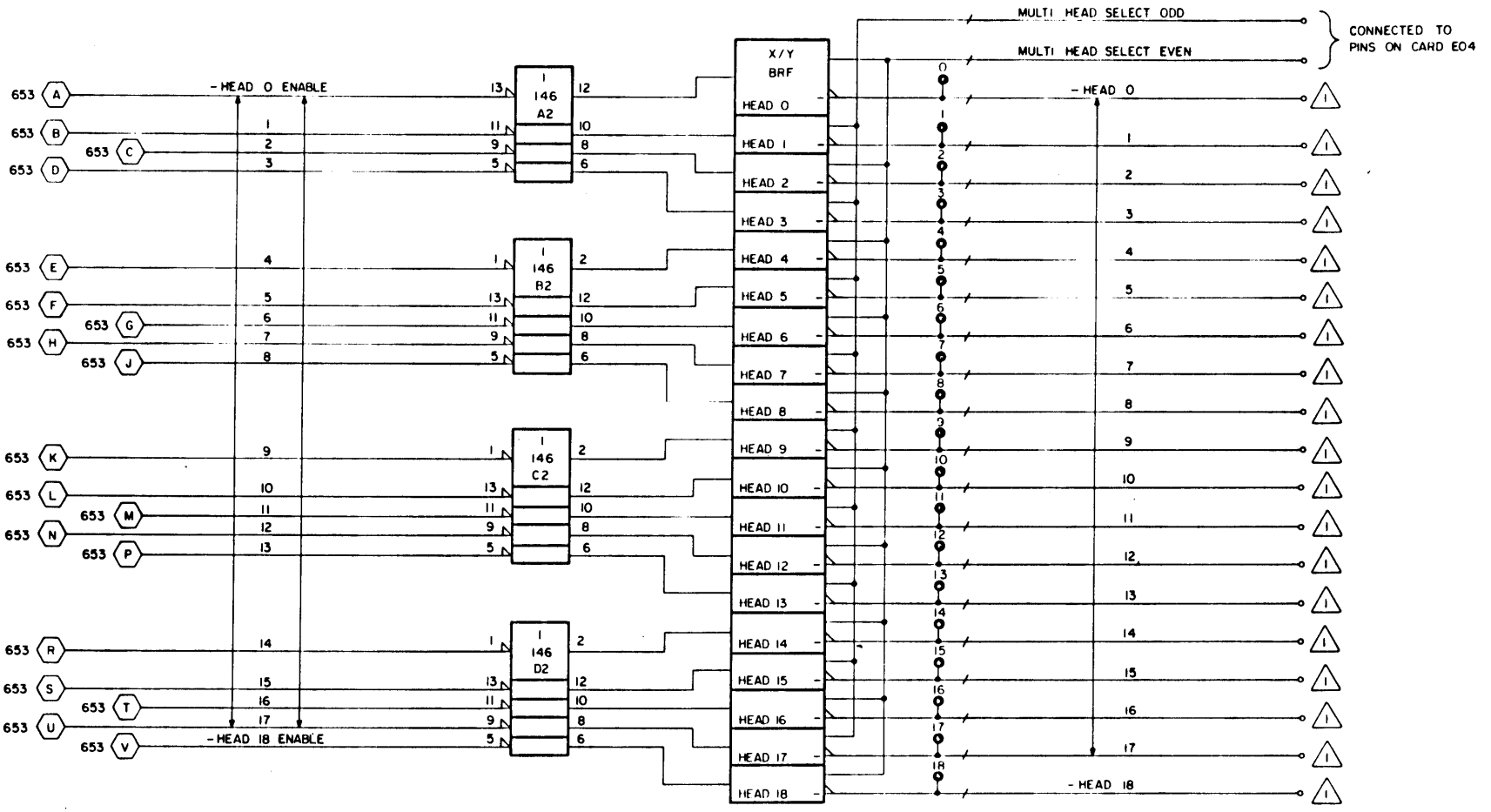
LARGE DISK DIVISION	UNUSED LOGIC ELEMENTS, VOLTAGE INPUT PINS, CABLING INFORMATION LOC E05	CODE IDENT 19333	C	DWG NO 83337340	A A
		UNISS NEXT NO 652		SHEET 2	PAGE 3-112



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 LARGE DISK DIVISION	HEAD SELECT DECODE AND HEAD BIT ENABLE	LOC F05	CODE IDENT 19333	C	DWG NO 83337340	A	A
			REV LTR	653	SHEET 3	PAGE 3-113	



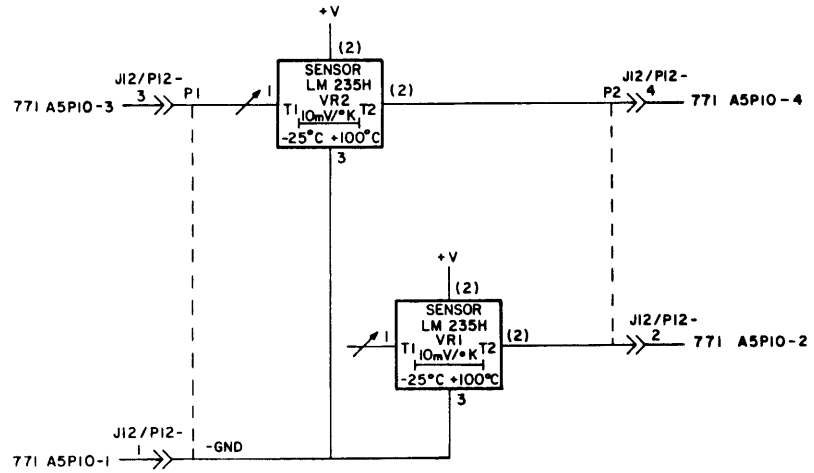
NOTE

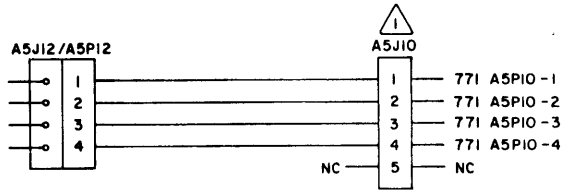
1. OUTPUT PIN CONNECTS TO HEAD CABLE PLUG (AND CENTER TAP OF HEAD COIL). REFER TO CROSS REF NO 642

LARGE DISK DIVISION	HEAD ENABLES AND MULTI HEAD SELECT LOC E05	CODE IDENT 19333	C	DWG NO 83337340	A A
		UNIVS REF NO 654		SHEET 4	PAGE 3-114

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																			

REVISIONS					
REV	ECO	DESCRIPTION	DWN	DATE	CHKD
A	DH23000 DH13203A	CREATE BJ4A3C/D	HDK	10-7-88	





NOTE:

1. A5J10 IS LOCATED ON THE BLOWER PLENUM

DRAWN	M Anderson	12/17/99	MAGNETIC PERIPHERALS INC.	AIRFLOW SENSOR ELEMENTS DIAGRAM	LARGE DISK DIVISION	C	DWG NO 83337340 A A
CHECKED							
ENGINEER	S. Gurll	1/10/[illegible]		TYPE: AAGN LOC: A5	CODE IDENT 19333	CROSS REF NO 751	SHEET 1 OF 1 PAGE 3-115/3-116
APPROVED							

REF 81201226

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	DH23000 DH13203A	CREATE BJ4A3C/D	DLF	10-4-82	

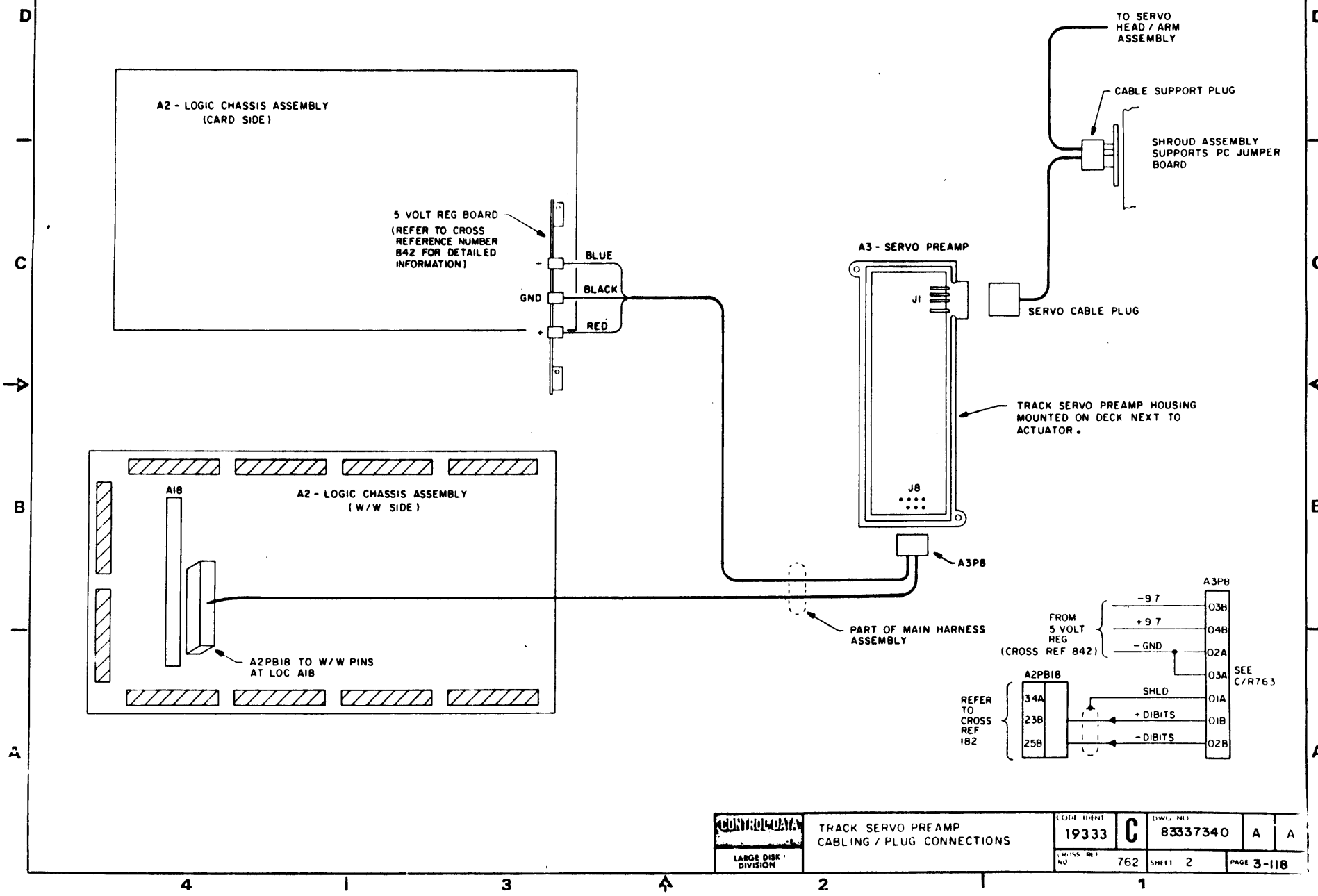
DRAWN	M.ANDERSON	1-24-79	CONTROL DATA
CHECKED			
ENGINEER		2 8 79	LARGE DISK DIVISION
APPROVED			

TRACK SERVO PREAMP DIAGRAMS

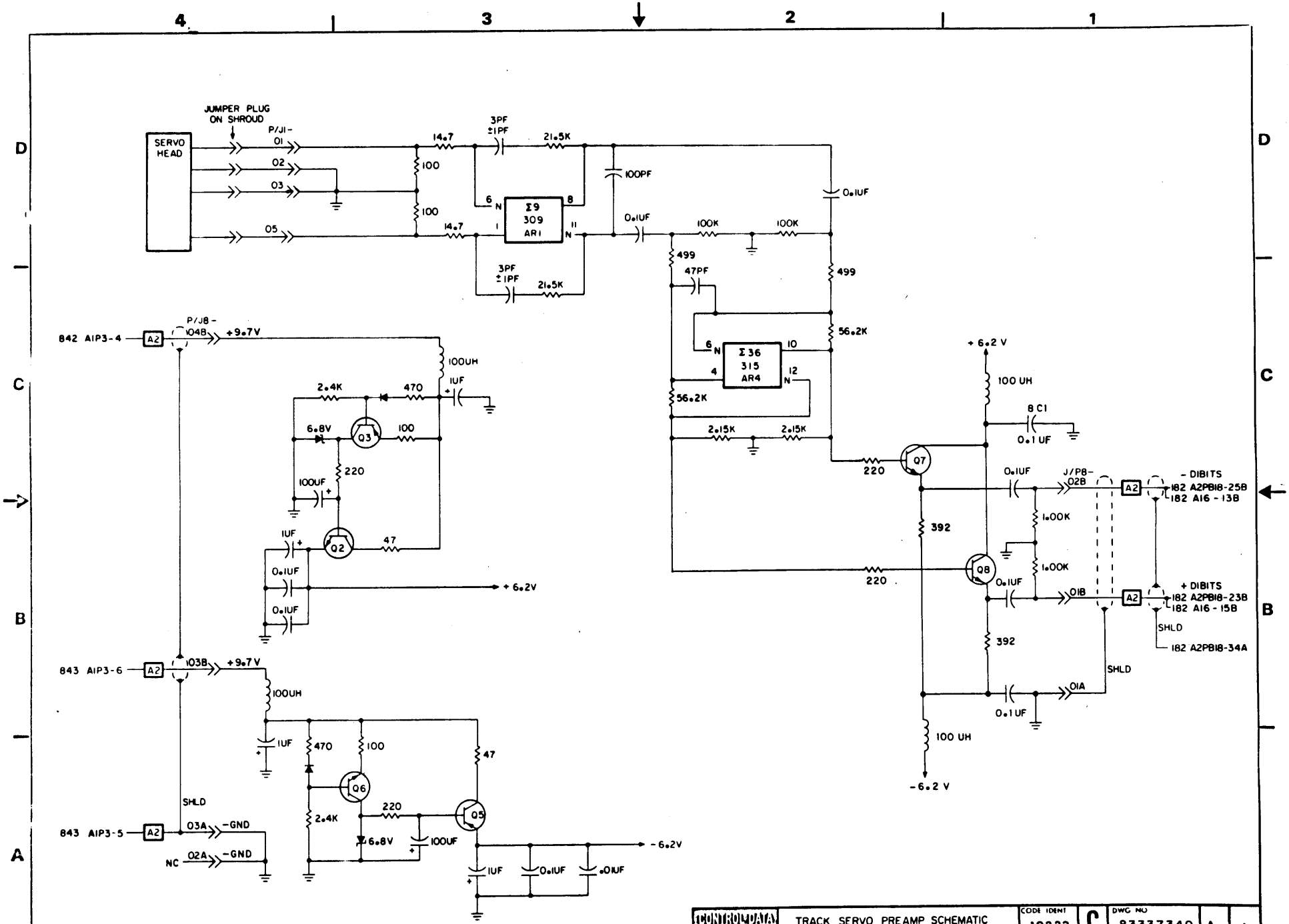
TYPE HZQN

CODE IDENT		DWG NO		
19333	C	83337340	A	A
CROSS REF NO 761		SHEET 1 OF 3	PAGE 3-117	

REF 81201227



CONTROL DATA LARGE DISK DIVISION	TRACK SERVO PREAMP CABLING / PLUG CONNECTIONS	CODE IDENT 19333	C	DWG. NO 83337340	A	A
		CROSS REF NO 762		SHEET 2	PAGE 3-118	



CONTROL DATA LARGE DISK DIVISION	TRACK SERVO PREAMP SCHEMATIC	CODE IDENT 19333	C	DWG NO 83337340	A A
		CROSS REF NO 763		SHEET 3	PAGE 3-119/3-120

REVISION STATUS OF SHEETS

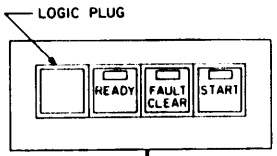
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A																	
B	B	B																	

REVISIONS

REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	DH23000 DH13203A	CREATE BJ4A3C/D	H D K	10-7-82	
B	DH13267-A	INC TAB 76 P.S.	M R B	3-14-83	

INPUT POWER AND GROUNDING

OPERATOR CONTROL PANEL
(COMPONENT LAYOUT)



CONTROL PANEL CABLE ASSEMBLY

CONTROL PANEL HARNESS ASSEMBLY

A2PA80

A4J201

A4P201

A5P10

JA80

A2 - LOGIC CHASSIS ASSEMBLY
(W/W SIDE)

A2PA80

3B	GND	1	751 A5J10-1
5B	-TEMP SENSE	2	751 A5J10-2
4B	SENSOR NULL	3	751 A5J10-3
6B	+TEMP SENSE	4	751 A5J10-4
		NC 5	NC

A5P10

A4 P201/J201

LOGIC CHASSIS W/W PINS AT JA80

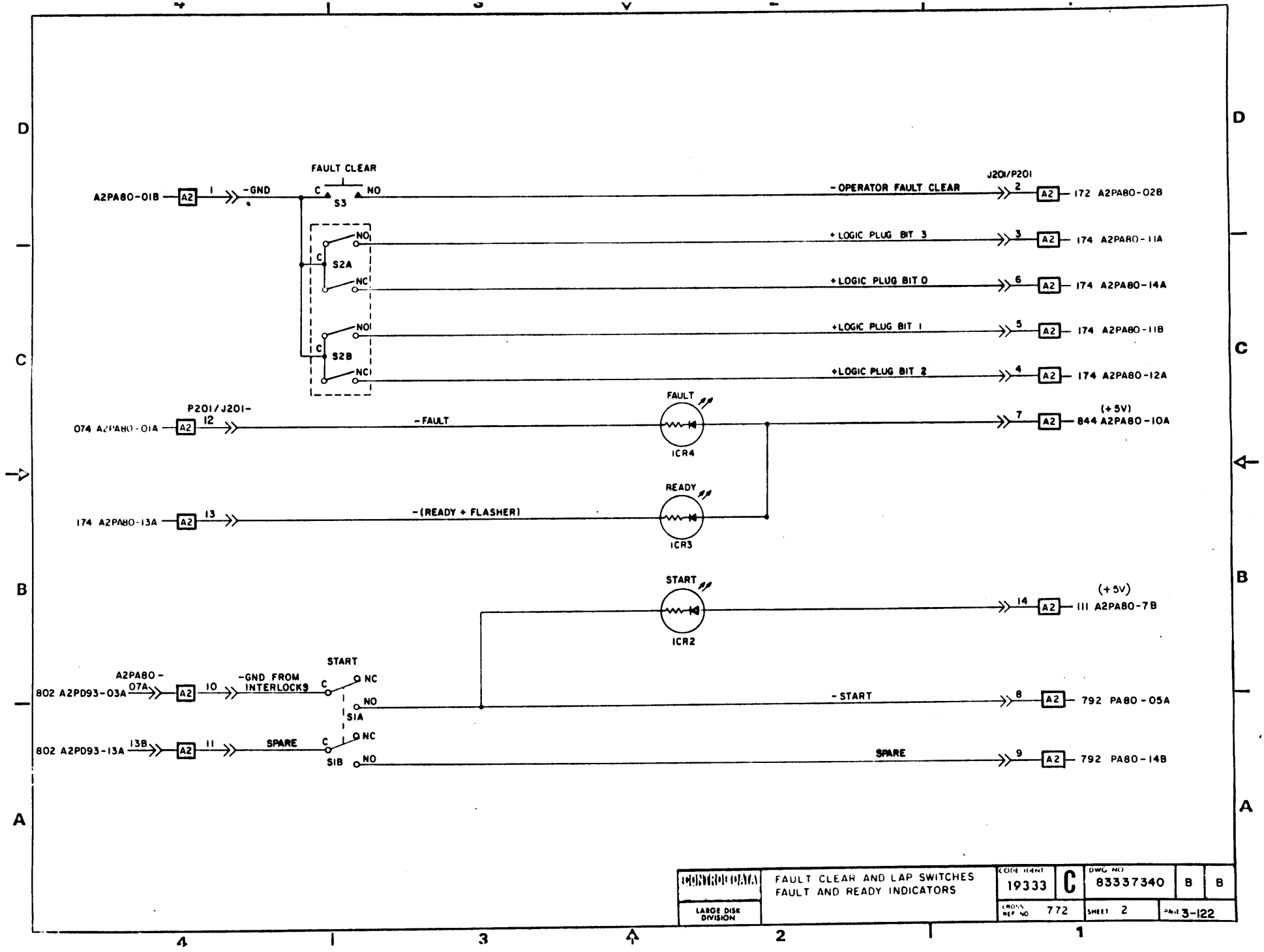
1A	-FAULT INDICATOR	12	
1B	-GND	1	
2B	+FAULT CLEAR	2	
5A	-GND TO START RELAY	8	
7A	-GND FROM INTERLOCKS	10	
7B	+5V START LED	14	
10A	+5 VOLTS	7	
11A	+LAP BIT 3	3	
11B	+LAP BIT 1	5	
12A	+LAP BIT 2	4	
13A	-READY INDICATOR	13	
13B	SPARE	11	
14A	+LAP BIT 0	6	
14B	SPARE	9	

TO OP PNL (772)

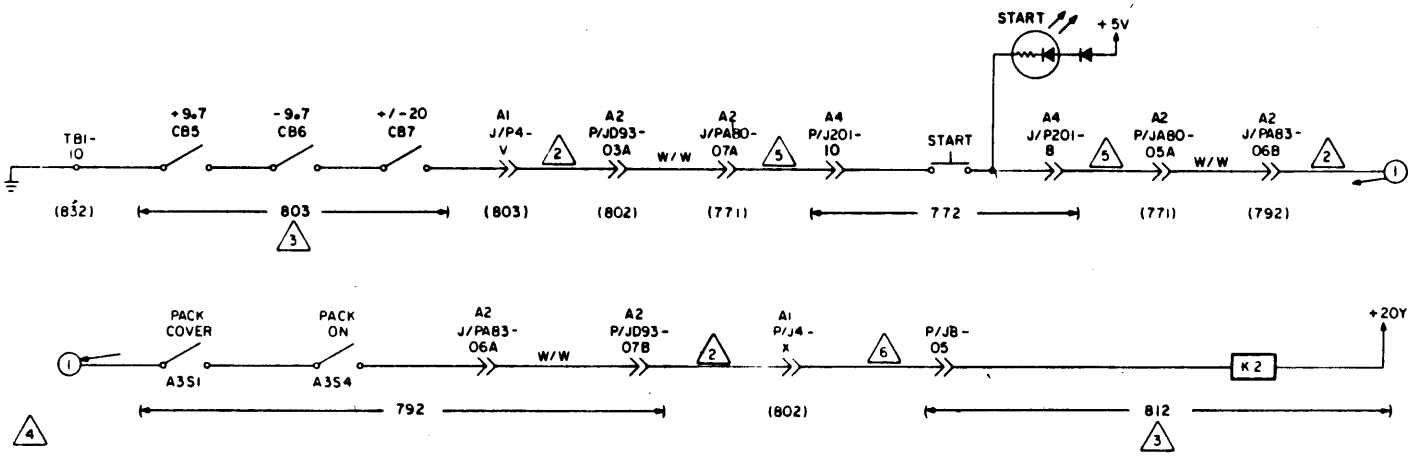
A2PA80 TO A4P201 CABLING

DRAWN			CONTROL DATA	A4 - OPERATOR CONTROL PANEL DIAGRAMS	CODE IDENT 19333	C	DWG NO 83337340	B	B
CHECKED									
ENGINEER			LARGE DISK DIVISION		CROSS REF NO 771		SHEET 1 OF 3	PAGE 3-121	
APPROVED									

REF 81201228



LARGE DISK DIVISION	FAULT CLEAR AND LAP SWITCHES FAULT AND READY INDICATORS	CODE IDENT 19333	C	DWG NO 83337340	B	B
		CROSS REF NO 772		SHEET 2	PAGE 3-122	



START INTERLOCK REFERENCE SCHEMATIC

NOTES

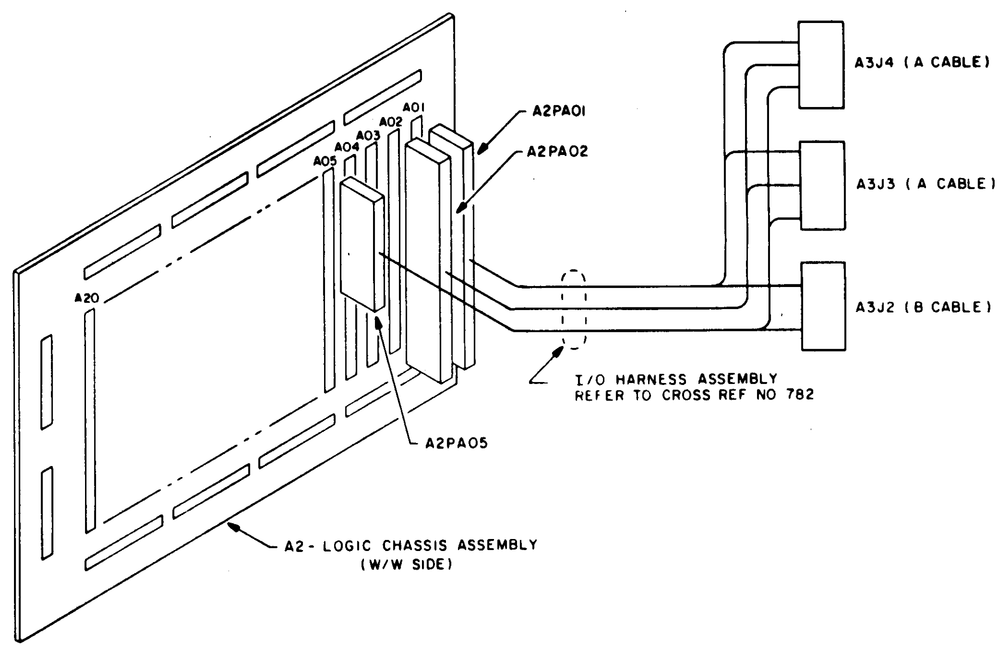
1. W/W IS LOGIC CHASSIS WIRE WRAP CONNECTION
2. PART OF MAIN HARNESS ASSEMBLY
3. LOCATED INSIDE POWER SUPPLY
4. NUMBERS WITHIN PARENTHESIS ARE CROSS REF NUMBERS WHERE ADDITIONAL OR DETAILED INFORMATION IS LOCATED
5. PART OF CONTROL PANEL HARNESS
6. PART OF DC HARNESS

GENERAL DATA LARGE DISK DIVISION	START SWITCH/START INDICATOR START INTERLOCK REFERENCE SCHEMATIC	CODE IDENT 19333	C	DWG NO 83337340	B B
		CROSS REF NO 773		SHEET 3	PAGE 3-123/3-124

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																	

REVISIONS

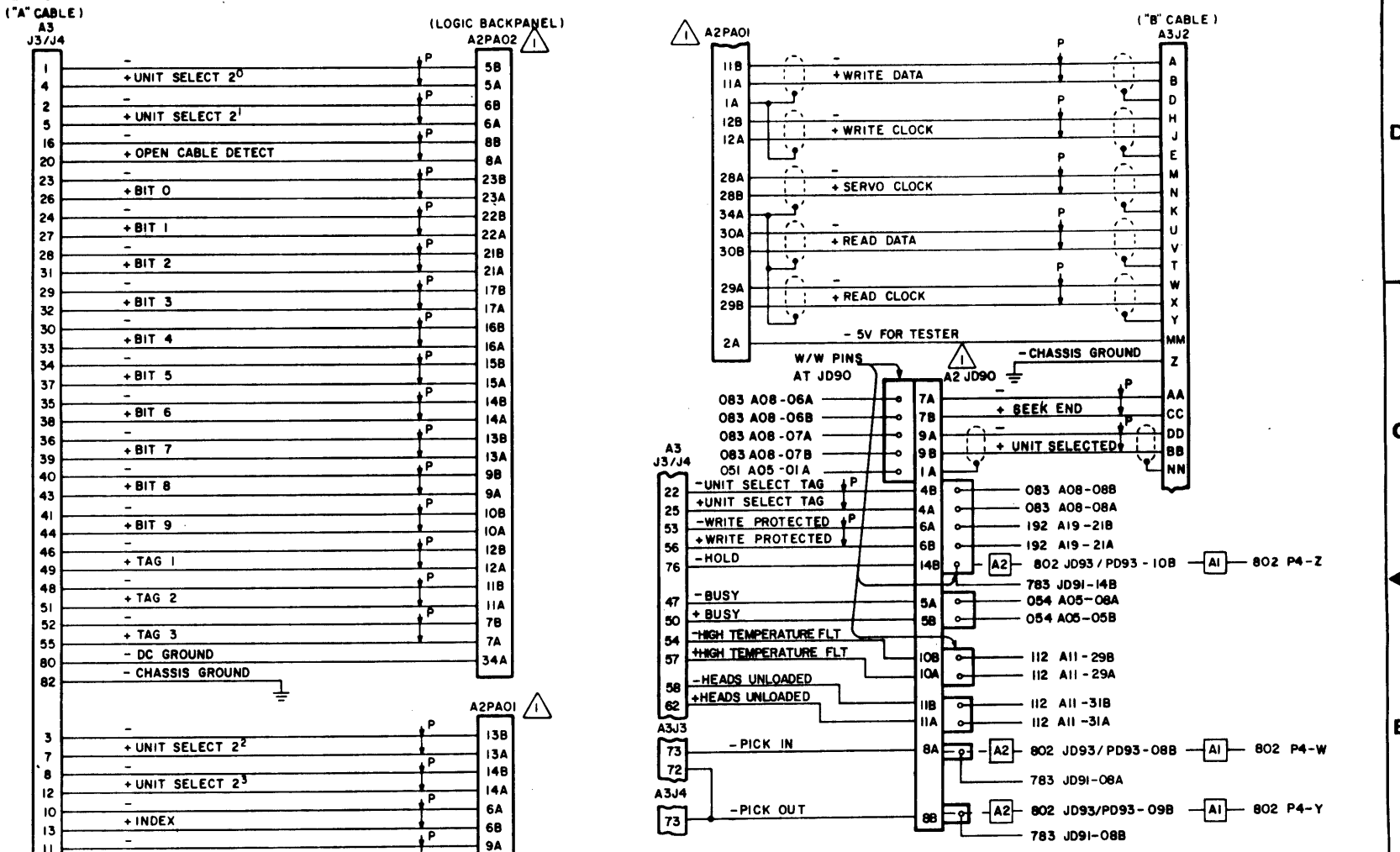
REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	DH23000 DH13203A	CREATE BJ4A3C/D	SMS	10-4-82	DMA



DRAWN	G RABINE	1-22-79	CONTROL DATA	A3 - I/O CABLING DIAGRAMS	
CHECKED			LARGE DISK DIVISION		
ENGINEER	L W. Farby	79			
APPROVED					

CODE IDENT	SIZE	DWG NO		
19333	C	83337340	A	A
CROSS REF NO 781		SHEET 1 of 3	PAGE 3-125	

REF 81201229



	BUS BITS									
	0	1	2	3	4	5	6	7	8	9
TAG 1 CYLINDER SELECT	2^0	2^1	2^2	2^3	2^4	2^5	2^6	2^7	2^8	2^9
TAG 2 HEAD SELECT	2^0	2^1	2^2	2^3	2^4	—	—	—	—	—
TAG 3 CONTROL SELECT	WRITE	READ	OFFSET +	OFFSET −	FAULT CLEAR	AM ENABLE	RTZ	STROBE EARLY	STROBE LATE	RELEASE

NOTES

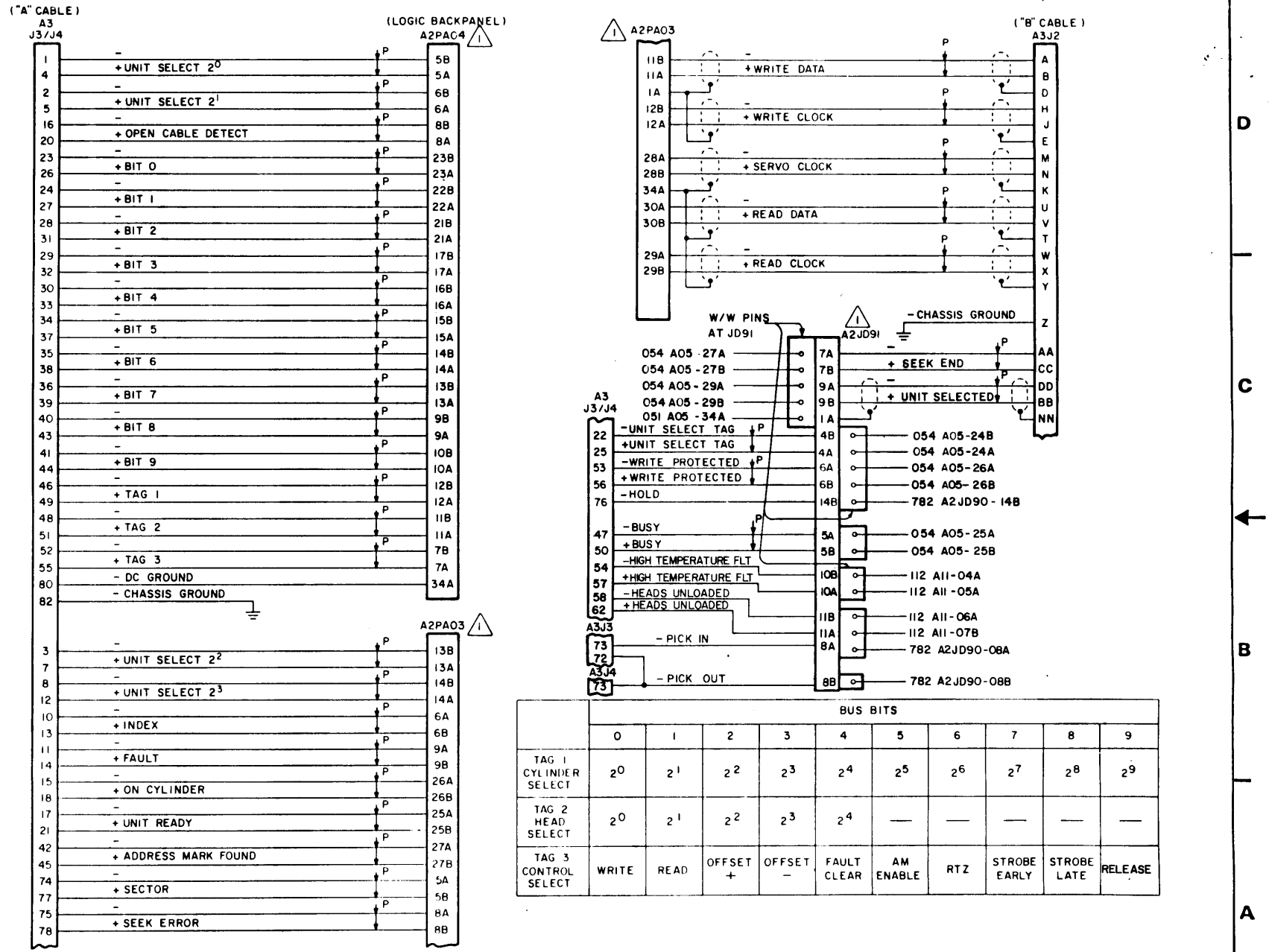
1. CONNECTOR PLUGS ON TO LOGIC CHASSIS BACKPANEL PINS

CONTROL DATA
LARGE DISK DIVISION

I/O HARNESS WIRING AND TAG/BUS DECODE CHANNEL I

CODE IDENT 19333 | C | DWG NO 83337340 | A | A

CROSS REF NO 782 | SHEET 2 | PAGE 3-126



	BUS BITS									
	0	1	2	3	4	5	6	7	8	9
TAG 1 CYLINDER SELECT	2^0	2^1	2^2	2^3	2^4	2^5	2^6	2^7	2^8	2^9
TAG 2 HEAD SELECT	2^0	2^1	2^2	2^3	2^4	—	—	—	—	—
TAG 3 CONTROL SELECT	WRITE	READ	OFFSET +	OFFSET −	FAULT CLEAR	AM ENABLE	RTZ	STROBE EARLY	STROBE LATE	RELEASE

NOTES

1. CONNECTOR PLUGS ON TO LOGIC CHASSIS BACKPANEL PINS

CONTROL DATA
LARGE DISK DIVISION

I/O HARNESS WIRING AND TAG/BUS DECODE CHANNEL II

CODE IDENT 19333 | C | DWG NO 83337340 | A | A

CROSS REF NO 783 | SHEET 3 | PAGE 3-127/3-128

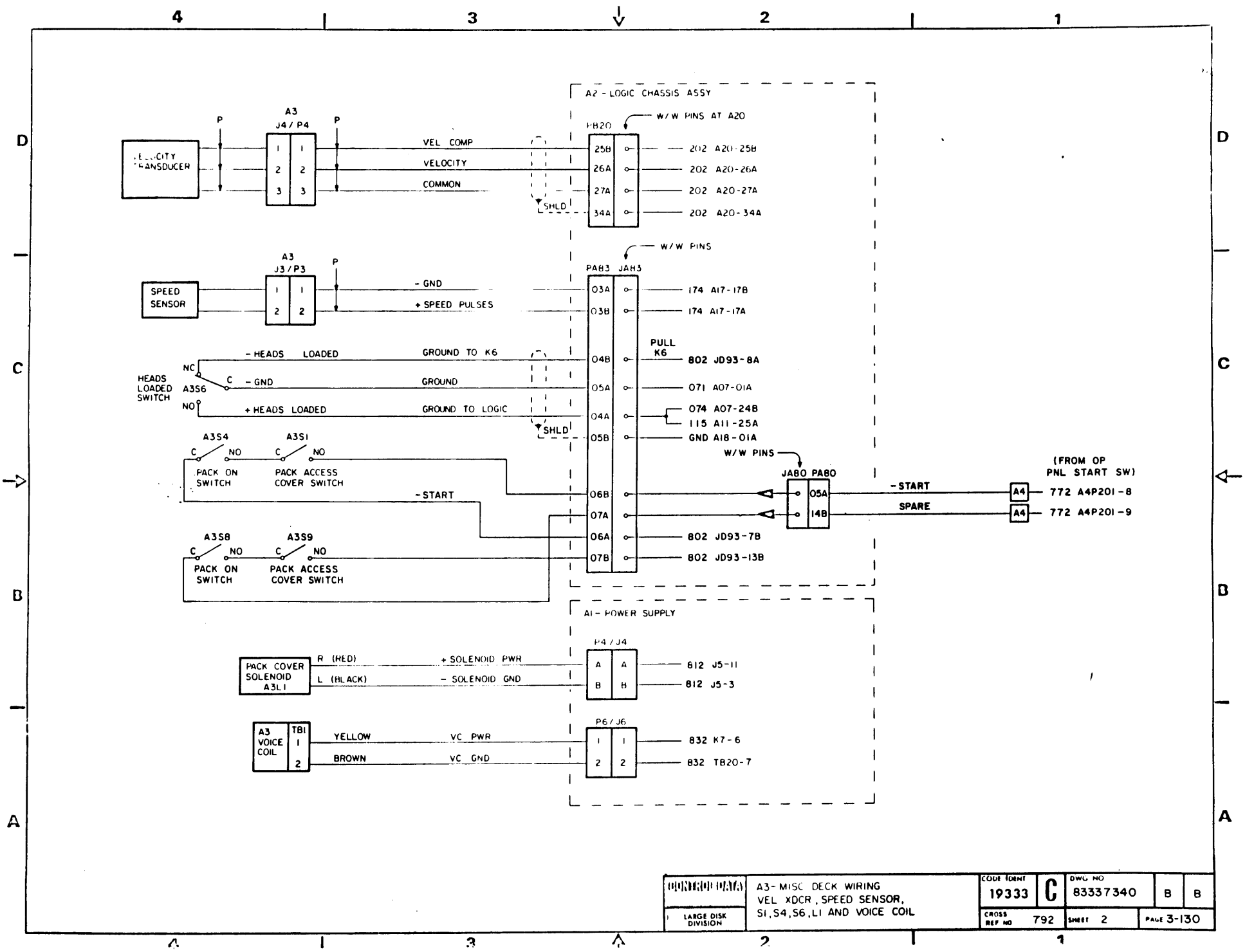
REVISION STATUS OF SHEETS																			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A																		
B	B																		

REVISIONS

REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	DH23000 DH13203A	CREATE BJ4 A3 C/D	SMS	10 1 82	
B	DH13267-A	INC TAB 76 P.S.	M R B	3-14-83	

DRAWN		12-31-29	CONTROL DATA	A3 - MISC DECK WIRING DIAGRAMS	CONTENT 19333	C	DWG NO 83337340	B	B
CHECKED									
ENGINEER		1/20/82	LARGE DISK DIVISION		CROSS REF NO. 791		SHEET 1 OF 2	PAGE 3-129	
APPROVED									

1 REF 81201230



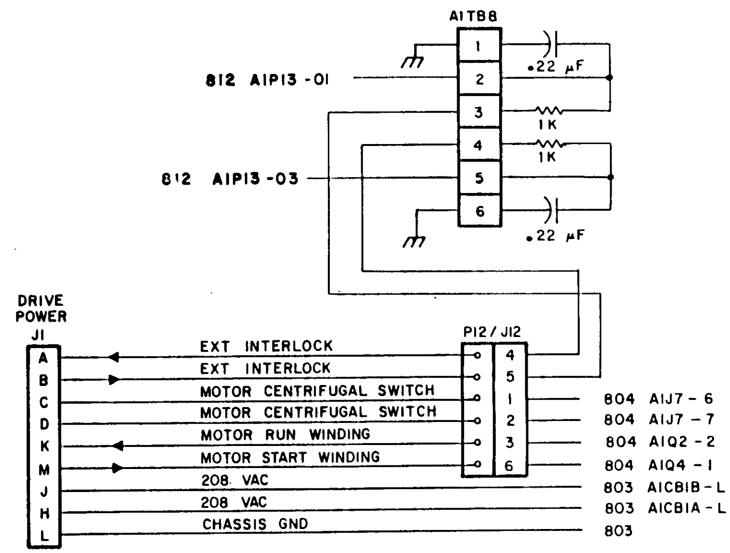
LARGE DISK DIVISION	A3 - MISC DECK WIRING VEL XDCR, SPEED SENSOR, S1, S4, S6, L1 AND VOICE COIL	CODE IDENT 19333	C	DWG NO 83337340	B B
		CROSS REF NO 792		SHEET 2	PAGE 3-130

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	B																

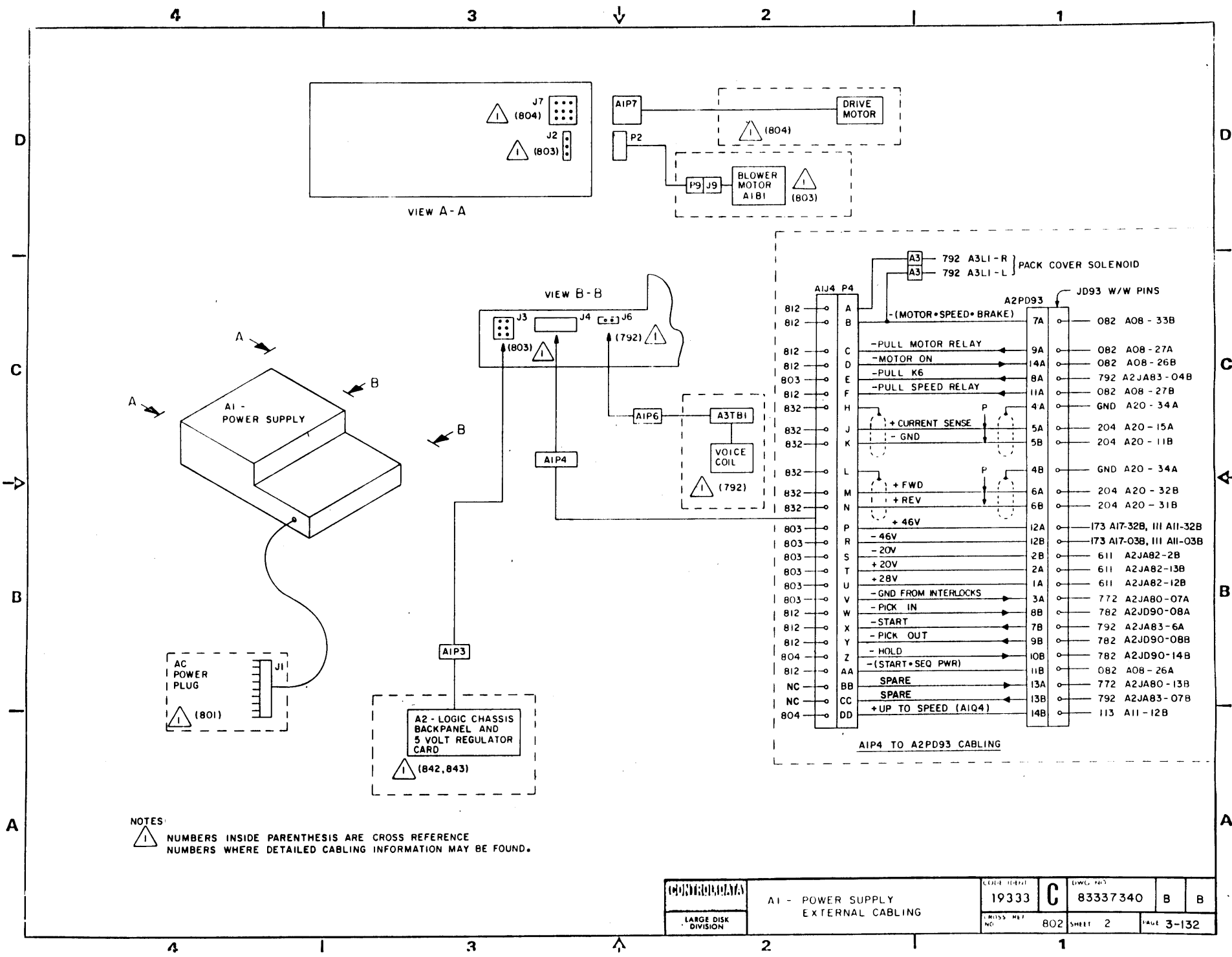
REVISIONS

REV	ECO	DESCRIPTION	DRFT	DATE	CHK D
A	DH23000 DH13203A	CREATE 8J4A3C/D	HDK	10-4-82	
B	DH13267A	INC. TAB 76 P.S.	SMS	12-9-82	



DRAWN	G. KABINE	1-30-81	CONTROL DATA	A1 - POWER SUPPLY DIAGRAMS	CODE IDENT 19333	C	DWG NO 83337340	B	B
CHECKED			LARGE DISK DIVISION		CROSS REF NO 801		SHEET 1 OF 4	PAGE 3-131	
ENGINEER									
APPROVED									

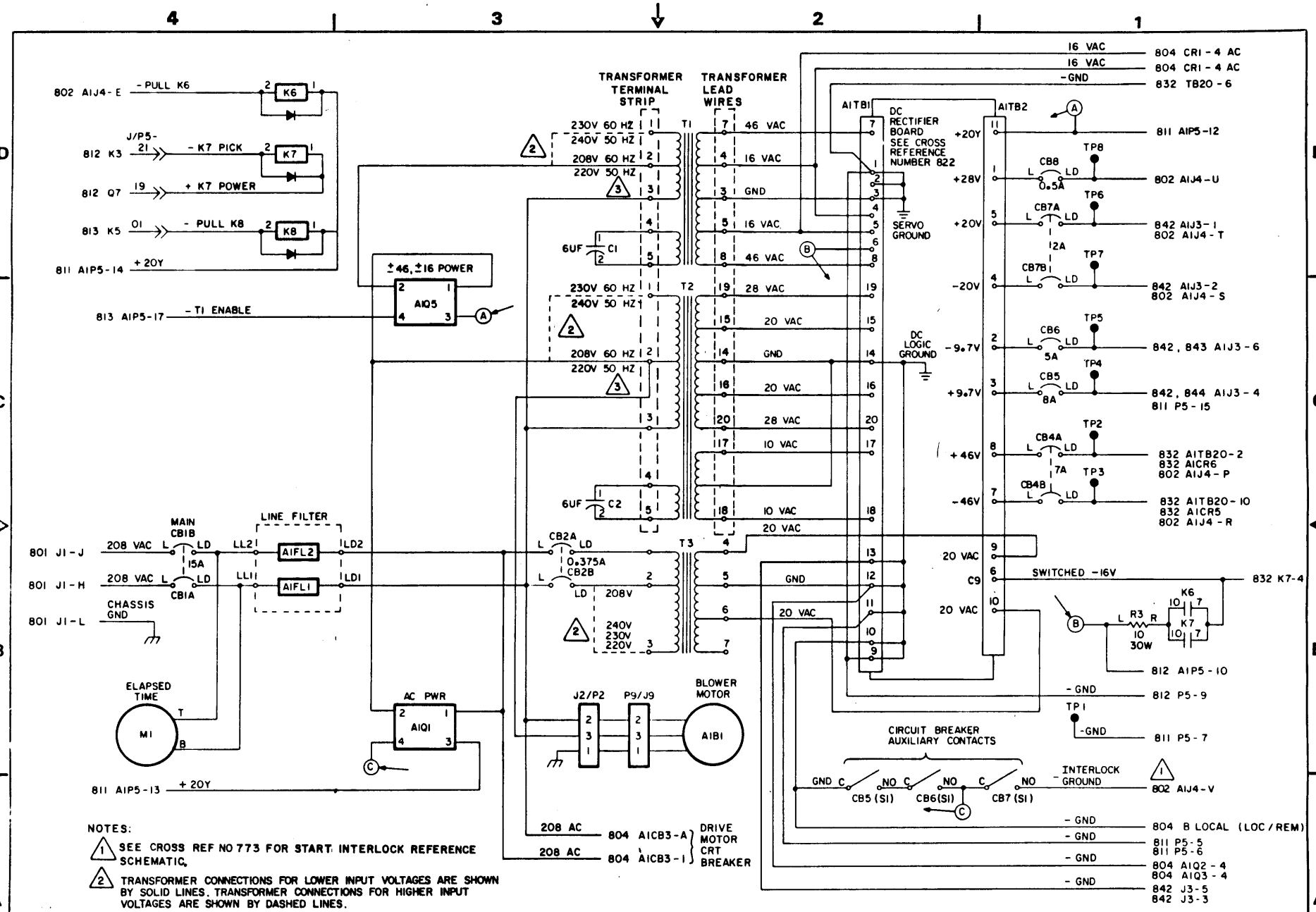
REF 81201231



NOTES:

1. NUMBERS INSIDE PARENTHESIS ARE CROSS REFERENCE NUMBERS WHERE DETAILED CABLING INFORMATION MAY BE FOUND.

CONTROL DATA LARGE DISK DIVISION	A1 - POWER SUPPLY EXTERNAL CABLING	CODE IDENT 19333	C	DWG NO 83337340	B B
		CROSS REF NO 802	SHEET 2	PAGE 3-132	



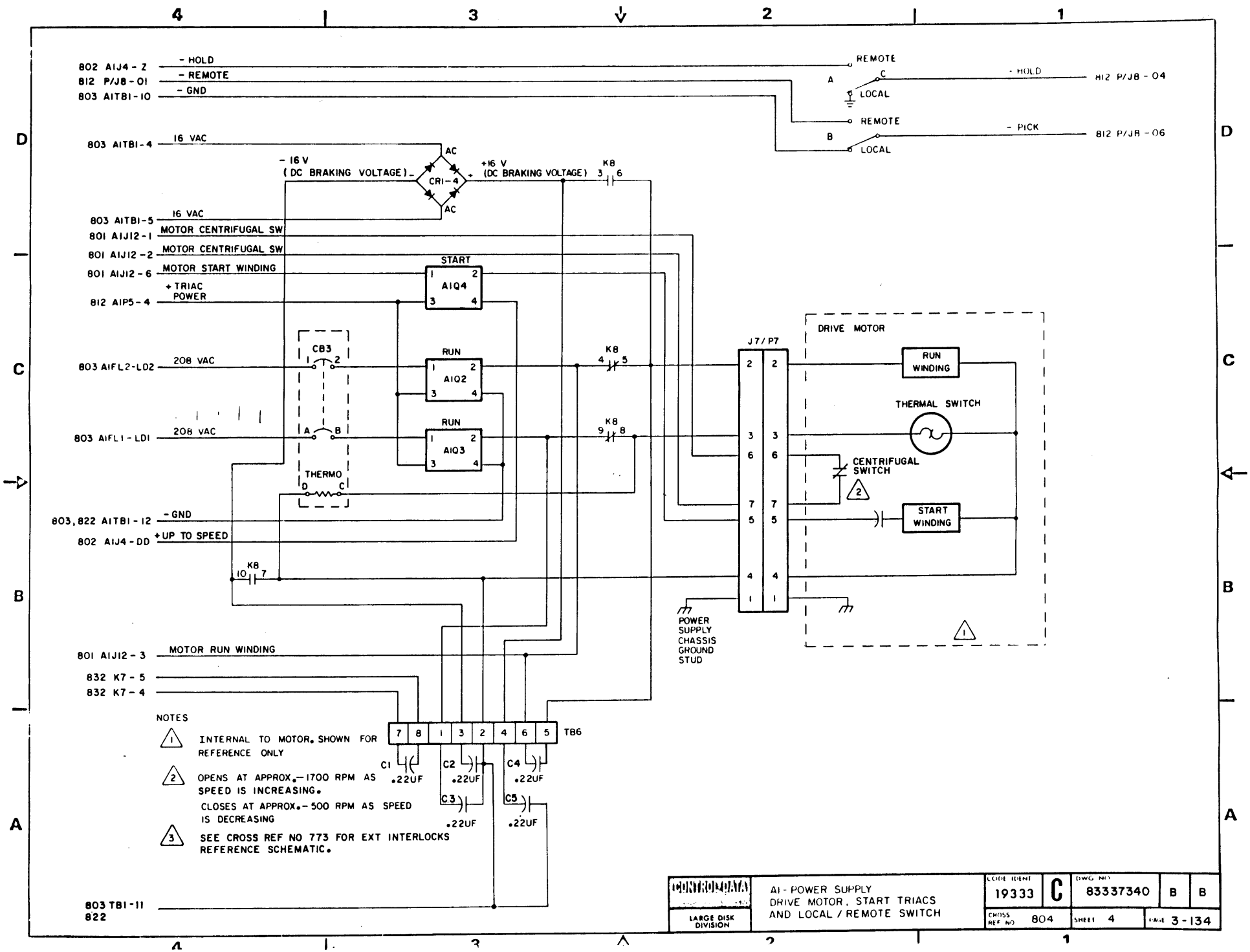
NOTES:

1. SEE CROSS REF NO 773 FOR START INTERLOCK REFERENCE SCHEMATIC.
2. TRANSFORMER CONNECTIONS FOR LOWER INPUT VOLTAGES ARE SHOWN BY SOLID LINES. TRANSFORMER CONNECTIONS FOR HIGHER INPUT VOLTAGES ARE SHOWN BY DASHED LINES.
3. BLOWER MOTOR CONNECTIONS MUST ALWAYS GO TO THE TRANSFORMER TERMINALS AS SHOWN BY SOLID LINES. INSURE THAT FOR 230 V, 60 Hz OR 240 V, 50 Hz OPERATION A1Q5 PIN 1 AND A1Q1 PIN 2 ARE MOVED TO TERMINAL 1 OF T2 AND THAT THE BLOWER MOTOR LEAD REMAINS CONNECTED TO TERMINAL 2 OF T2.

CONTROL DATA — LARGE DISK DIVISION

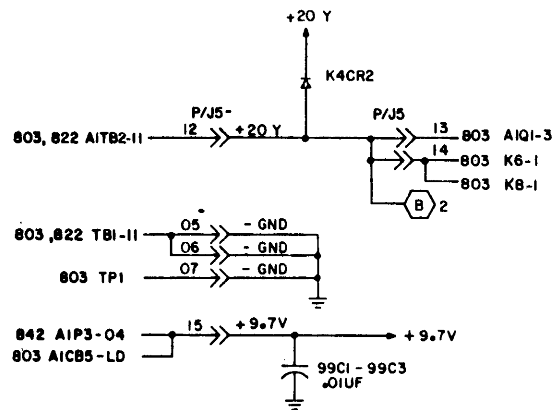
A1 - POWER SUPPLY
AC POWER, DC CIRCUIT BREAKERS AND RELAYS K6, K7, K8

CODE IDENT		DWG NO		
19333	C	83337340	A	A
CROSS REF NO 803		SHEET 3	PAGE 3-133	

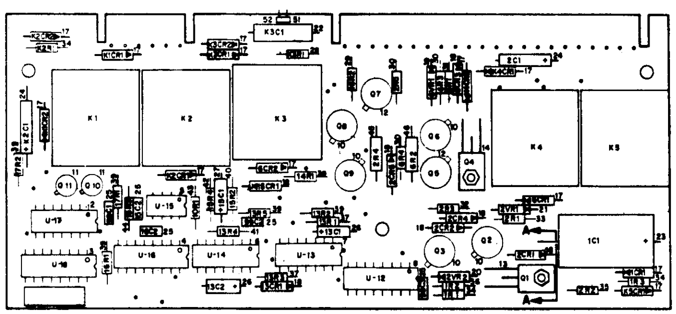

802 AIJ4-Z
- HOLD
812 P/J8-01
- REMOTE
803 AITB1-10
- GND
REMOTE
A
C
- HOLD
LOCAL
812 P/J8-04
REMOTE
B
- PICK
LOCAL
812 P/J8-06
803 AITB1-4
16 VAC
AC
- 16 V
(DC BRAKING VOLTAGE)
CR1-4
+16 V
(DC BRAKING VOLTAGE)
K8
3
6
AC
803 AITB1-5
16 VAC
801 AIJ12-1
MOTOR CENTRIFUGAL SW
801 AIJ12-2
MOTOR CENTRIFUGAL SW
801 AIJ12-6
MOTOR START WINDING
START
A1Q4
812 AIP5-4
+ TRIAC POWER
CB3
803 AIFL2-LD2
208 VAC
RUN
A1Q2
K8
4
5
803 AIFL1-LD1
208 VAC
A
B
RUN
A1Q3
K8
9
8
THERMO
D
C
803,822 AITB1-12
- GND
802 AIJ4-DD
+UP TO SPEED
K8
10
7
J7/P7
DRIVE MOTOR
RUN WINDING
THERMAL SWITCH
CENTRIFUGAL SWITCH
2
START WINDING
POWER SUPPLY CHASSIS GROUND STUD
1
801 AIJ12-3
MOTOR RUN WINDING
832 K7-5
832 K7-4
7
8
1
3
2
4
6
5
TB6
C1
.22UF
C2
.22UF
C3
.22UF
C4
.22UF
C5
.22UF
803 TB1-11
822
NOTES
1 INTERNAL TO MOTOR. SHOWN FOR REFERENCE ONLY
2 OPENS AT APPROX.-1700 RPM AS SPEED IS INCREASING.
CLOSES AT APPROX.-500 RPM AS SPEED IS DECREASING
3 SEE CROSS REF NO 773 FOR EXT INTERLOCKS REFERENCE SCHEMATIC.
LARGE DISK DIVISION
A1-POWER SUPPLY
DRIVE MOTOR, START TRIACS
AND LOCAL / REMOTE SWITCH
CODE IDENT
19333
C
DWG NO
83337340
B
B
CROSS REF NO
804
SHEET
4
PAGE
3-134

REVISIONS

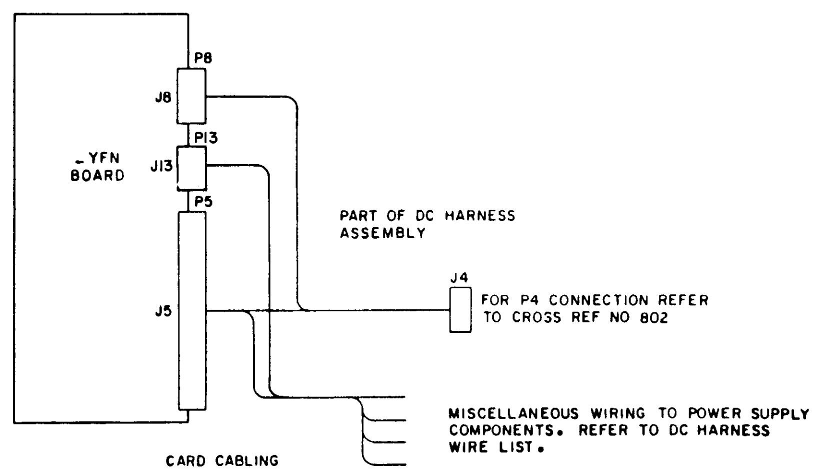
REV	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	DH23000 DH13203A	CREATE BJ4A3C/D	HDK	10·4·82	
B	DH13225	EYFN TO FYFN	SMS	12·7·82	
C	DH13267A	INC TAB 76 P.S.	SMS	12·7·82	
D	DJ13486	BTL FYFN LOG. DIAG CHG	MLC	2-10-84	



POWER WIRING



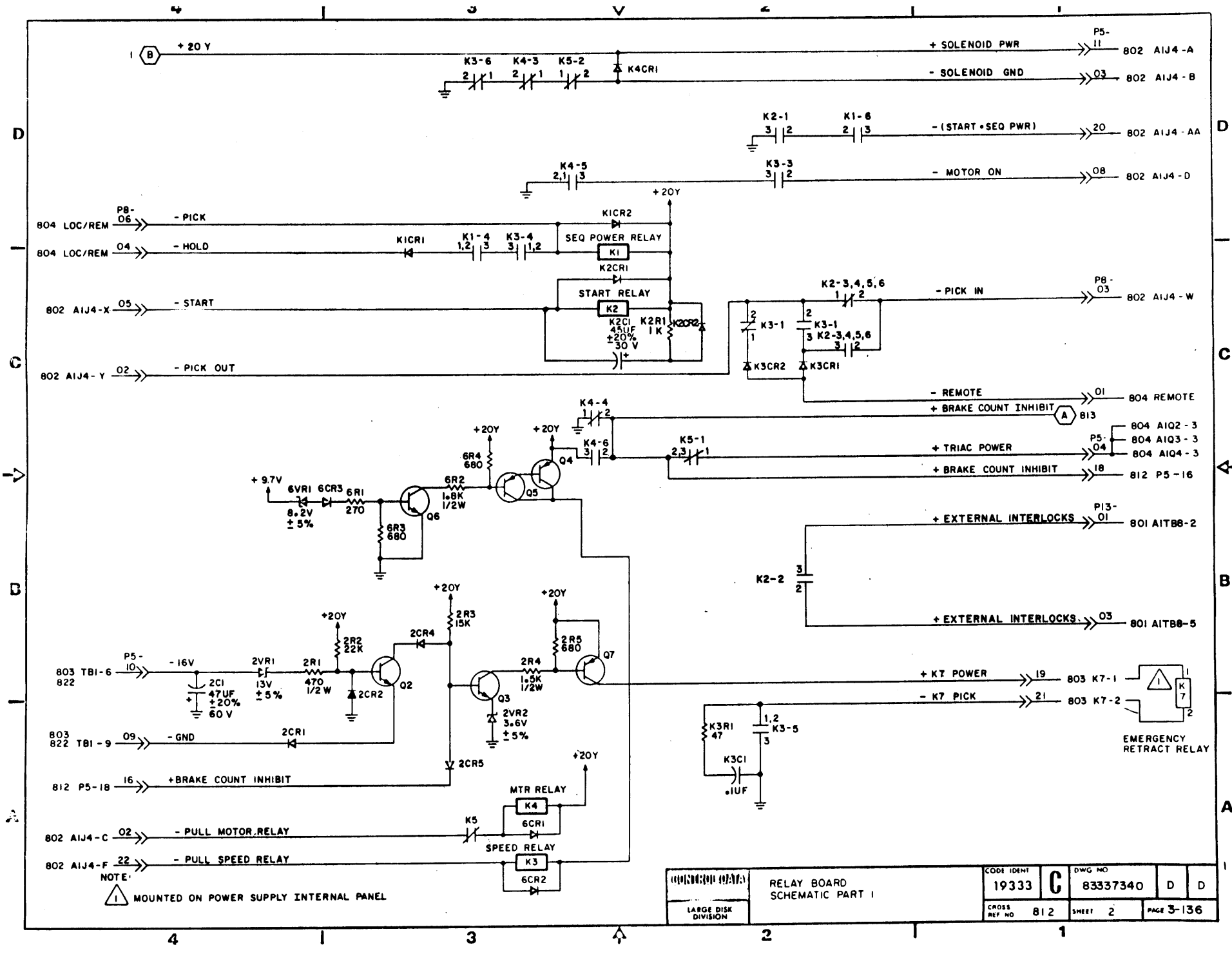
CARD COMPONENT LAYOUT

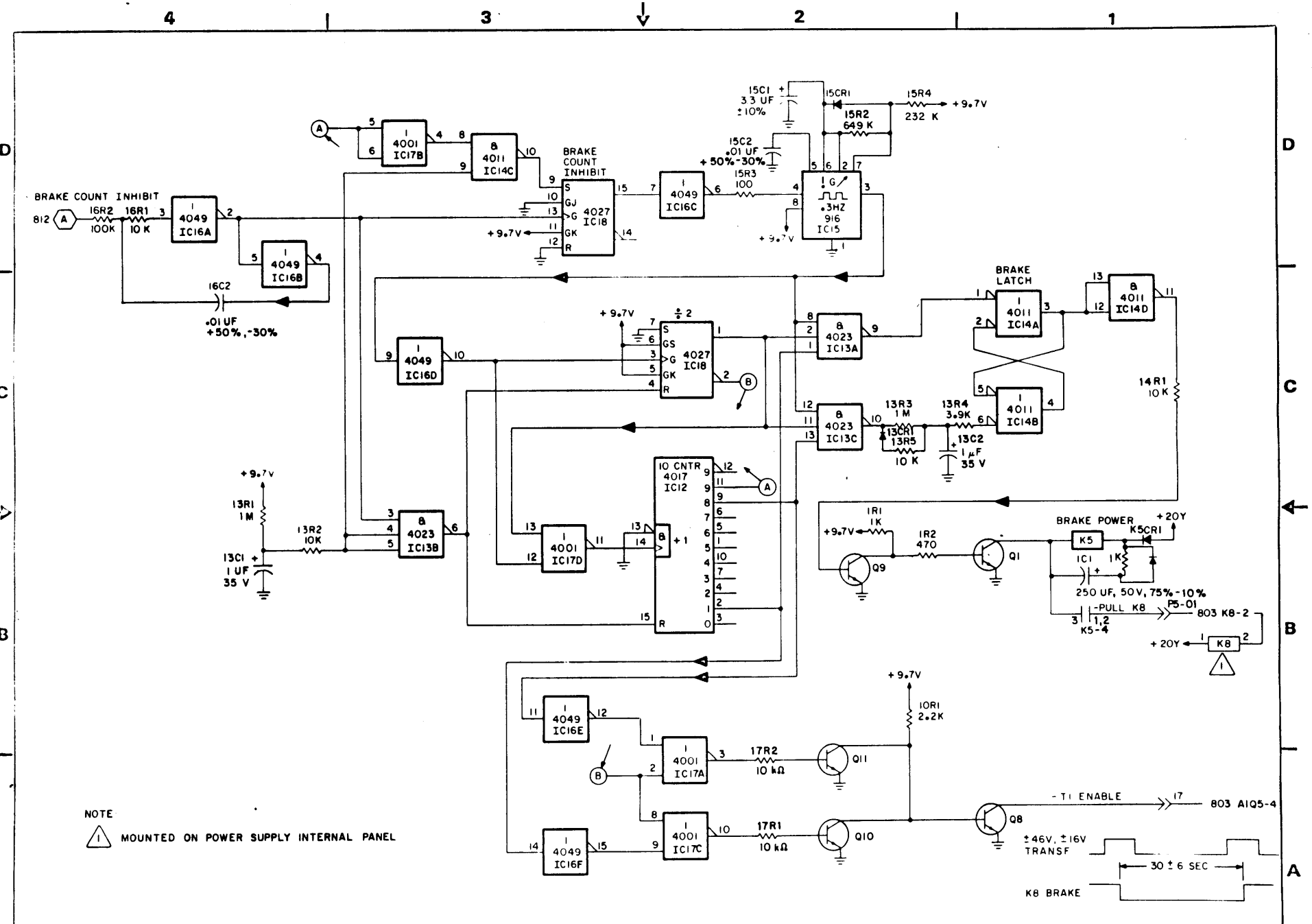


CARD CABLING

DRAWN	G RABINA	1.30.79	CONTROL DATA	RELAY BOARD POWER WIRING, COMPONENT LAYOUT AND CABLING DIAGRAMS TYPE FYFN	CODE IDENT 19333	C	DWG NO 83337340	D D
CHECKED								
ENGINEER	[signature]	2.9.79	LARGE DISK DIVISION		CROSS REF NO 811		SHEET 1 of 3	PAGE 3-135
APPROVED								

REF 81201232

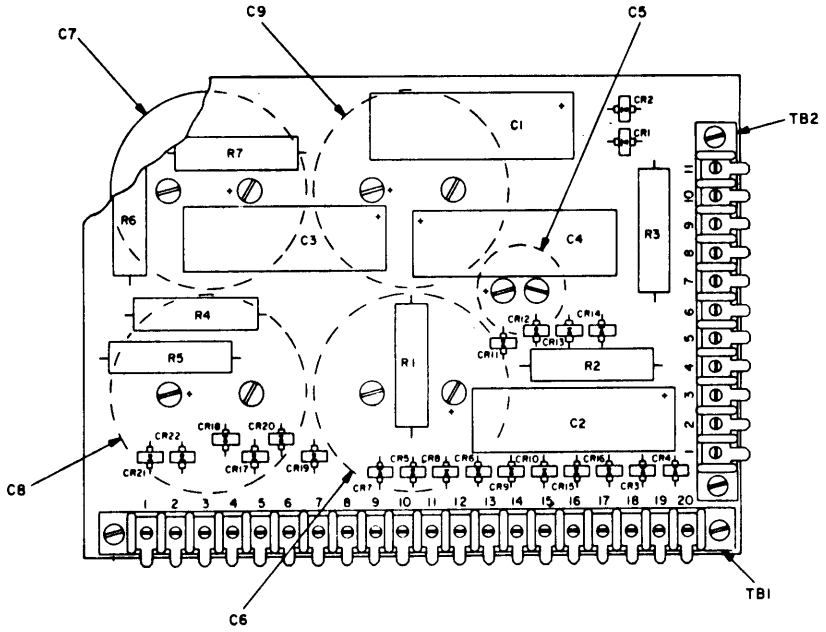

+20Y
K3-6
K4-3
K5-2
K4CR1
+ SOLENOID PWR
P5-11
802 AIJ4-A
- SOLENOID GND
03
802 AIJ4-B
K2-1
K1-6
- (START • SEQ PWR)
20
802 AIJ4-AA
K4-5
K3-3
- MOTOR ON
08
802 AIJ4-D
804 LOC/REM
P8-06
- PICK
K1CR2
SEQ POWER RELAY
K1
804 LOC/REM
04
- HOLD
K1CR1
K1-4
K3-4
K2CR1
START RELAY
K2
802 AIJ4-X
05
- START
K2C1 45UF ±20% 30V
K2R1 1K
K2CR2
K2-3,4,5,6
- PICK IN
P8-03
802 AIJ4-W
K3-1
K3CR2
K3CR1
802 AIJ4-Y
02
- PICK OUT
- REMOTE
01
804 REMOTE
K4-4
+ BRAKE COUNT INHIBIT
A
813
804 AIQ2-3
804 AIQ3-3
804 AIQ4-3
K5-1
K4-6
P5-04
+ TRIAC POWER
+ BRAKE COUNT INHIBIT
18
812 P5-16
+ 9.7V
6VR1
6CR3
6R1
270
8.2V ±5%
6R2
1.8K 1/2W
6R3
680
6R4
680
Q4
Q5
Q6
+ EXTERNAL INTERLOCKS
P13-01
801 AITB8-2
K2-2
+ EXTERNAL INTERLOCKS
03
801 AITB8-5
2R3
15K
2R2
22K
2CR4
2R5
680
Q7
2R4
.5K 1/2W
Q2
Q3
2VR2
3.6V ±5%
2CR2
2CR5
803 TB1-6
822
P5-10
-16V
2C1
47UF ±20% 60V
2VR1
13V ±5%
2R1
470 1/2W
+ K7 POWER
19
803 K7-1
- K7 PICK
21
803 K7-2
K7
EMERGENCY RETRACT RELAY
K3R1
47
K3-5
K3C1
.1UF
803 822 TB1-9
09
- GND
2CR1
812 P5-18
16
+BRAKE COUNT INHIBIT
MTR RELAY
K4
6CR1
802 AIJ4-C
02
- PULL MOTOR RELAY
K5
SPEED RELAY
K3
6CR2
802 AIJ4-F
22
- PULL SPEED RELAY
NOTE:
1 MOUNTED ON POWER SUPPLY INTERNAL PANEL
CONTROL DATA
LARGE DISK DIVISION
RELAY BOARD SCHEMATIC PART 1
CODE IDENT 19333
C
DWG NO 83337340
D
D
CROSS REF NO 812
SHEET 2
PAGE 3-136



CONTROLDATA LARGE DISK DIVISION	RELAY BOARD SCHEMATIC PART 2	CODE IDENT 19333	C	DWG NO 83337340	A A
		CROSS REF NO 813		SHEET 3	PAGE 3-137/3-138

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																		

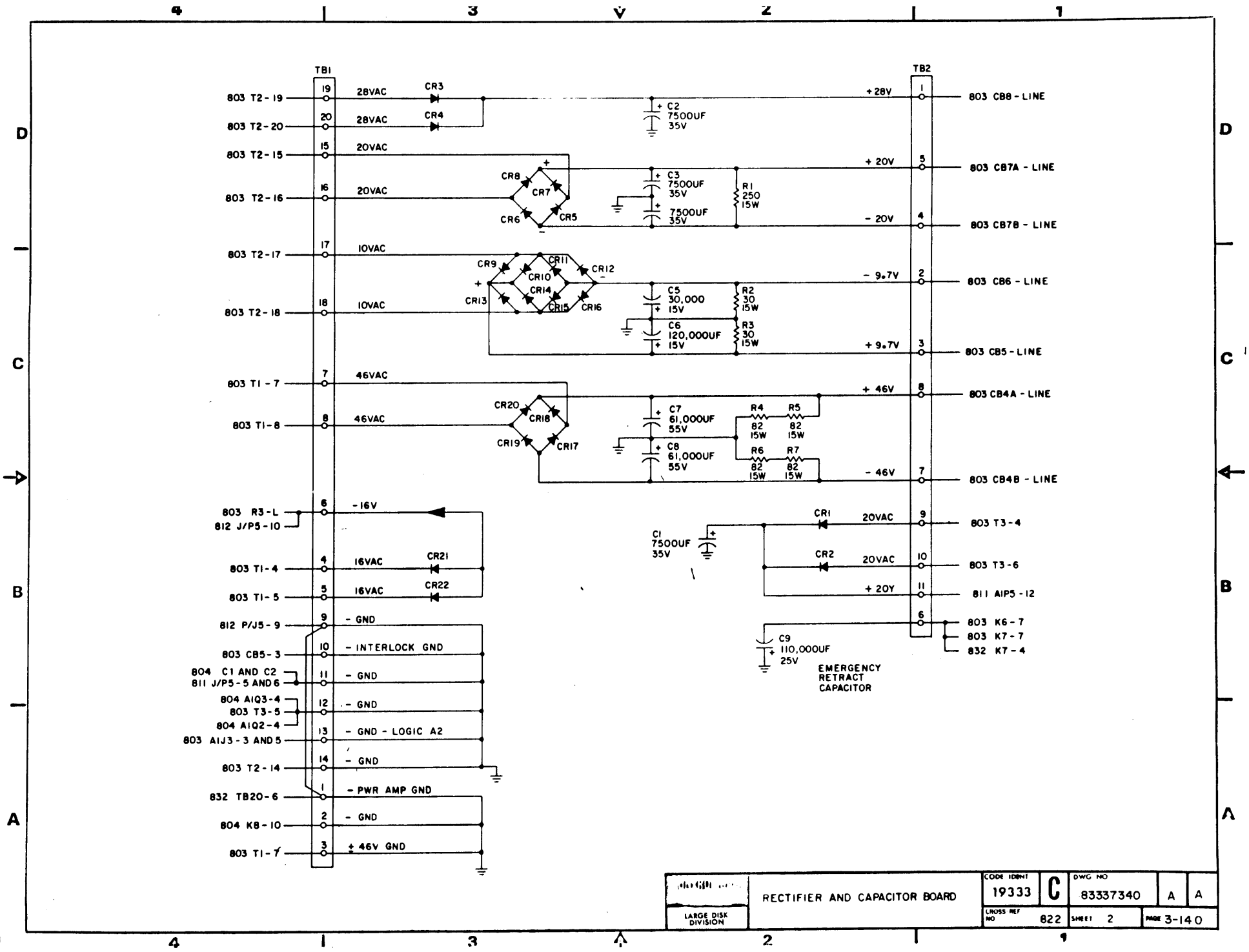
REVISIONS					
REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	DH23000 DH13203A	CREATE BJ4A3C/D	SMS	10-4-82	



BOARD IS MOUNTED ON TO CAPACITORS C5,C6,C7,C8,C9

DRAWN	W.BERGSTROM 1-21-74	CONTROL DATA	RECTIFIER AND CAPACITOR BOARD COMPONENT LAYOUT AND DIAGRAMS TYPE: AYEN	CODE IDENT 19333	C	DWG NO 83337340	A	A
CHECKED				CROSS REF NO 821		SHEET 1 OF 2	PAGE 3-139	
ENGINEER								
APPROVED		LARGE DISK DIVISION						

REF 81201233



LARGE DISK DIVISION

RECTIFIER AND CAPACITOR BOARD

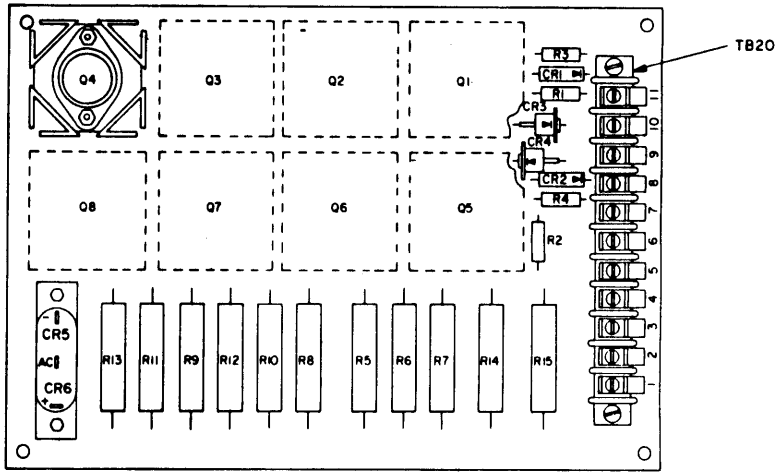
CODE IDENT		DWG NO		
19333	C	83337340	A	A
CROSS REF NO 822		SHEET 2	PAGE 3-140	

REVISION STATUS OF SHEETS

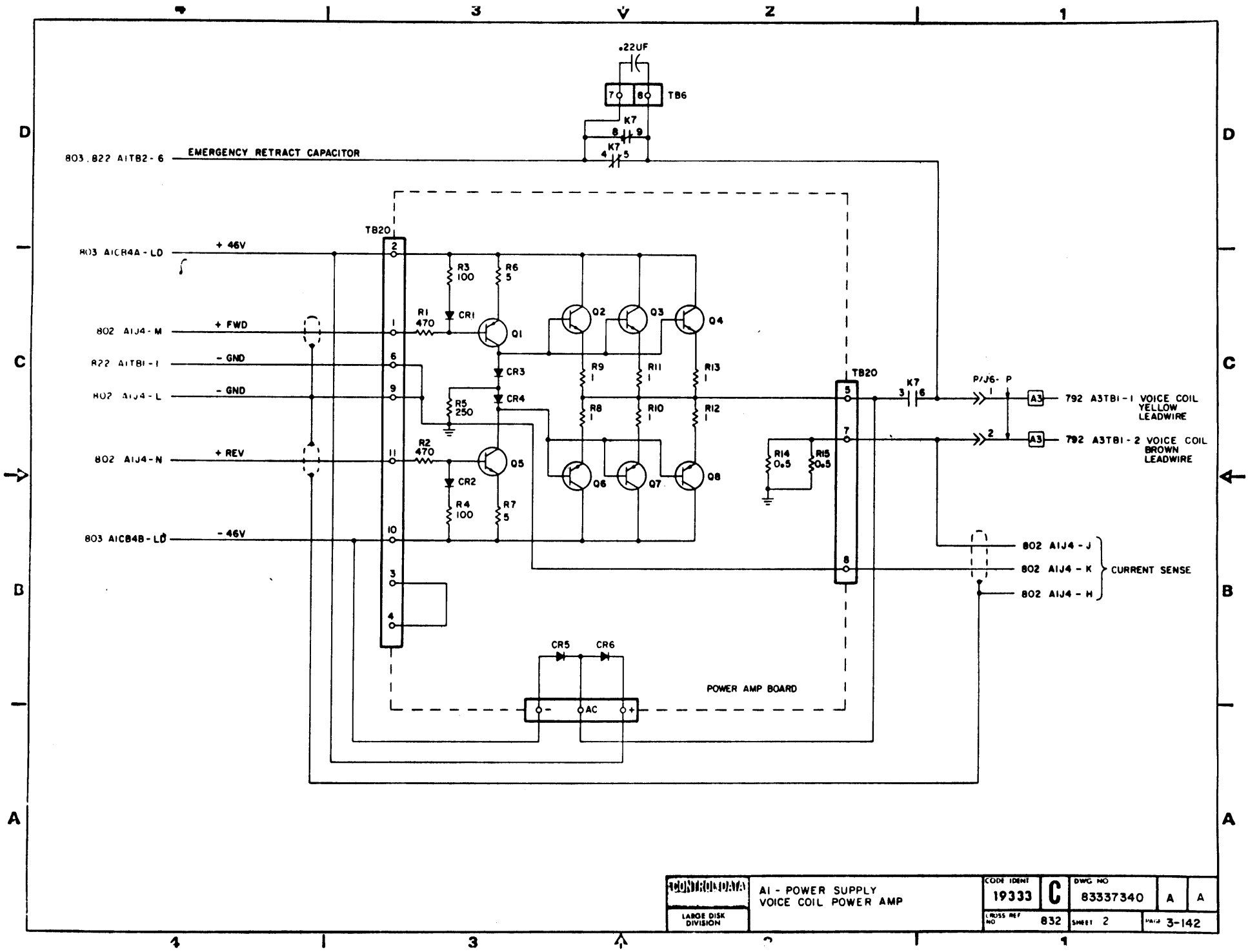
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A																		

REVISIONS

REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	DH23000 DH13203A	CREATE BJ4A3C/D	DLF	10-4-82	



DRAWN	MANDERSON	1-29-79	CONTROL DATA	A1 - POWER SUPPLY VOICE COIL POWER AMP DIAGRAMS	CODE IDENT 19333	C	DWG NO 83337340	A	A
CHECKED									
ENGINEER		1-29-79	LARGE DISK DIVISION	TYPE: BZCN	CROSS REF NO 831		SHEET 1 OF 2	PAGE 3-141	
APPROVED									


.22UF
TB6
K7
803.822 A1TB2-6
EMERGENCY RETRACT CAPACITOR
TB20
803 A1CB4A-LD
+ 46V
802 A1J4-M
+ FWD
R22 A1TB1-1
- GND
802 A1J4-L
- GND
802 A1J4-N
+ REV
803 A1CB4B-LD
- 46V
R1 470
R2 470
R3 100
R4 100
R5 250
R6 5
R7 5
CR1
CR2
CR3
CR4
CR5
CR6
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
R8
R9
R10
R11
R12
R13
R14 0.5
R15 0.5
P/J6-P
A3
792 A3TB1-1 VOICE COIL YELLOW LEADWIRE
792 A3TB1-2 VOICE COIL BROWN LEADWIRE
802 A1J4-J
802 A1J4-K
802 A1J4-H
CURRENT SENSE
POWER AMP BOARD
AC
A1 - POWER SUPPLY
VOICE COIL POWER AMP
LARGE DISK DIVISION
CODE IDENT 19333
C
DWG NO 83337340
A
A
CROSS REF NO 832
SHEET 2
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																

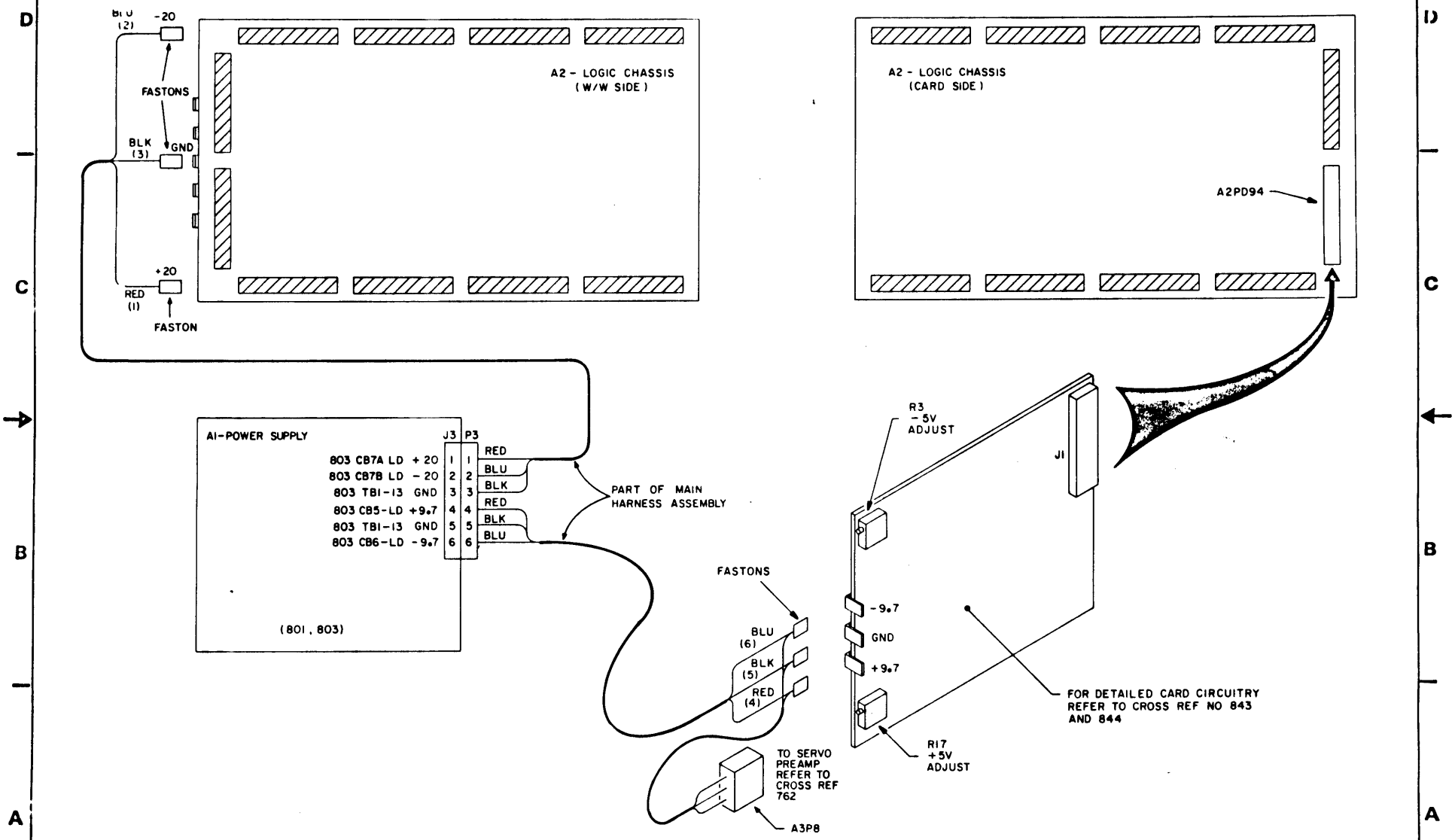
REVISIONS

REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	DH23000 DH13203A	CREATE BJ4A3C/D	DLF	10·4·82	[signature]

DRAWN	[signature]	1-29-79	MAGNETIC PERIPHERALS INC. a subsidiary of CONTROL DATA CORPORATION
CHECKED			
ENGINEER	L. [signature]	2-8-79	
APPROVED			

A2 5 VOLT - REGULATOR DIAGRAMS

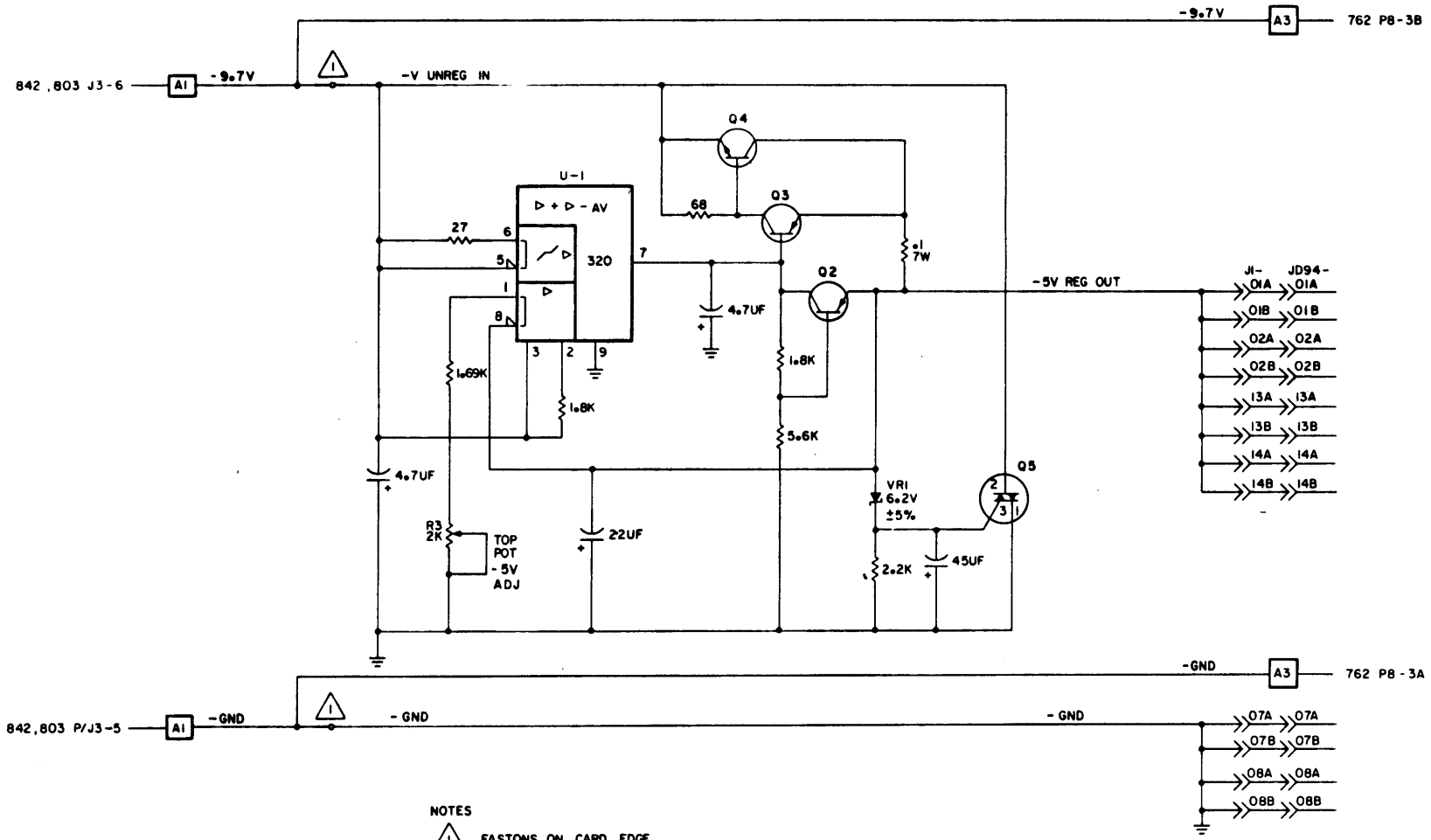
LARGE DISK DIVISION	C	DWG NO 83337340	A	A
CODE IDENT 19333	CROSS REF NO 841	SHEET 1 OF 4	PAGE 3-143	



CONTROL DATA
LARGE DISK DIVISION

A2-±5 VOLT REGULATORS
PC BOARD AND A1P3

CODE IDENT		DWG NO		
19333	C	83337340	A	A
CROSS REF NO 842		SHEET 2	PAGE 3-144	



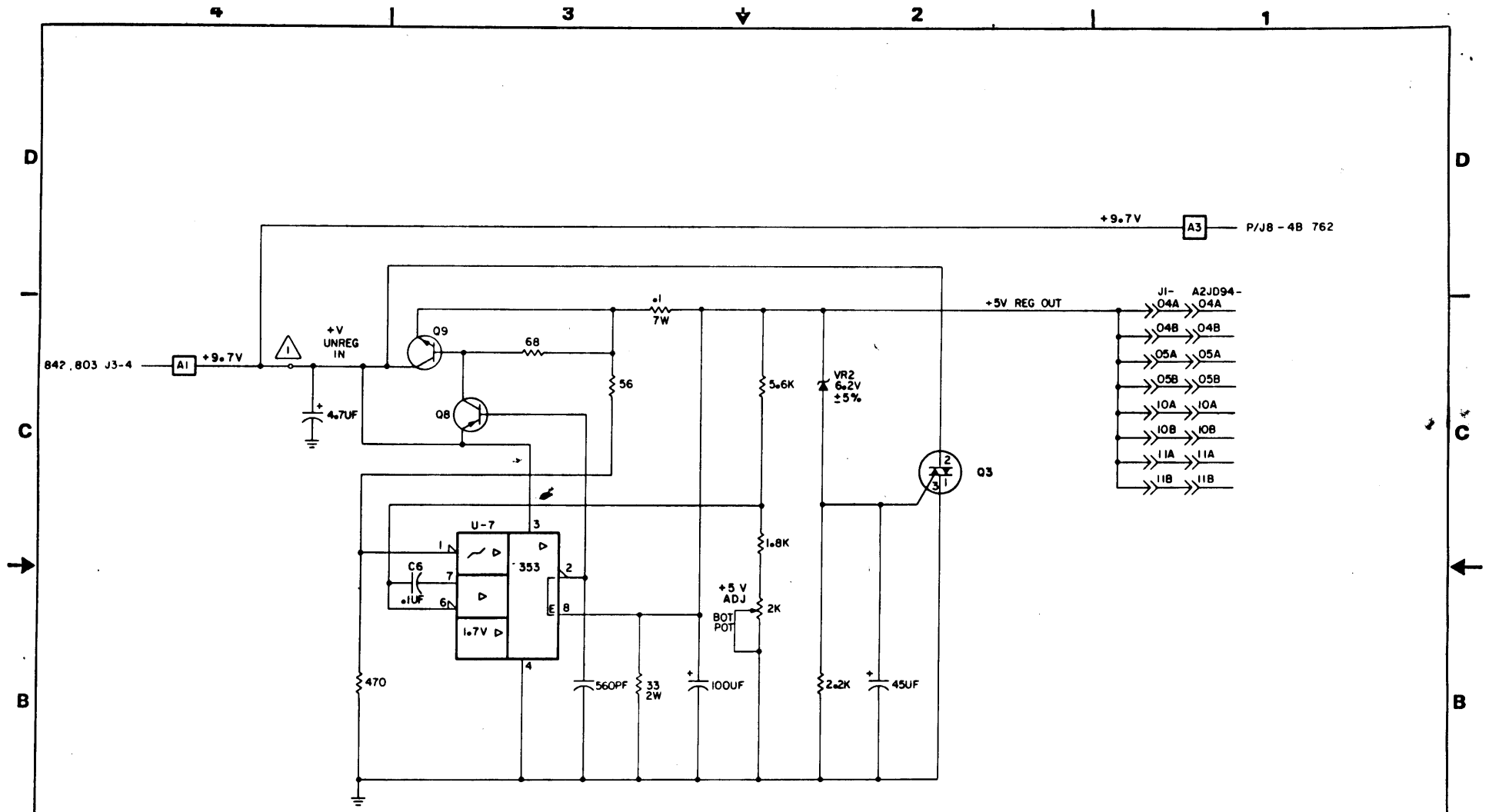
NOTES

1. FASTONS ON CARD EDGE REFER TO CROSS REFERENCE NUMBER 802

CONTROL DATA
LARGE DISK DIVISION

SCHEMATIC DIAGRAM
- 5V REGULATOR

CODE IDENT		DWG NO		
19333	C	83337340	A	A
CROSS REF NO 843		SHEET 3	PAGE 3-145	



NOTES

1. FASTON ON CARD EDGE REFER TO CROSS REFERENCE NUMBER 802

CONTROL DATA LARGE DISK DIVISION	SCHEMATIC DIAGRAM +5V REGULATOR	CODE IDENT 19333	C	DWG NO 83337340	A A
		CROSS REF NO 844		SHEET 4	PAGE 3-146

SECTION 4

WIRE LISTS

INTRODUCTION

This section contains the wire list for the logic chassis wirewrap. This list is useful when making repairs to the logic chassis wirewrap panel.

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).

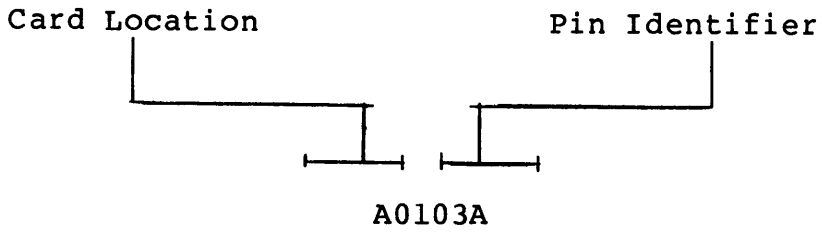
Signal Name or Number Identification

Contains a number which is for factory use only.

Origin/Destination

These colums list both ends of each connection. The terms are defined in the following example:

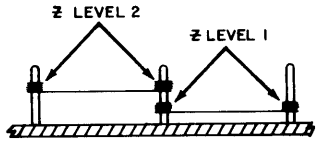
EXAMPLE:



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	DESTI-NATION	Z LEVEL	NOTES
102111	A0101B	A0102A	1	
102111	A0102A	A0101B	1	
100108	A0102B	A1708A	1	
100211	A0103A	A0231A	1	
100206	A0230A	A1712A	1	
100205	A0230B	A0612B	1	
100203	A0231A	A1326B	2	
100211	A0231A	A0103A	1	



9E82

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 4-1). 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 1 wrap. In eithe case the same Z level is maintained at both ends of the wire.

Notes

Contains signal names, history or other information pertaining to wire list.

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIREWRAP LISTING		77476350	1	BF

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
102111	A0101B	A0102A	1	
102111	A0102A	JD9402A	2	
102111	A0102A	A0101B	1	
100108	A0102B	A1708A	2	
100211	A0103A	A0231A	1	
100107	A0103B	A0817A	2	
100601	A0104A	A0613B	1	
100601	A0104A	A0304A	2	
100600	A0104B	A0304B	2	
100600	A0104B	A0621B	1	
101700	A0107A	A1708B	2	
101700	A0107A	A0307A	1	
100713	A0107B	A0711A	1	
100713	A0107B	A0307B	2	
100101	A0110A	A0521A	1	
100101	A0110A	JD9211B	2	
100100	A0110B	A0516A	2	
100100	A0110B	JD9210B	1	
100103	A0115A	A1731A	2	
100102	A0115B	A1732A	1	
100206	A0116A	A0228A	1	
100206	A0116A	A0428A	2	
100202	A0116B	A0224A	2	
100202	A0116B	A0424A	1	
100722	A0117A	A0804A	2	
100221	A0117B	A0202A	2	
100221	A0117B	A0402A	1	
100208	A0121A	A0224B	1	
100208	A0121A	A0424B	2	
100500	A0121B	A0203B	1	
100500	A0121B	A0926A	2	
100109	A0122A	A0134A	2	
100204	A0122B	A0227A	2	
100204	A0122B	A0427A	1	
101403	A0123A	A1432B	2	
101403	A0123A	A0323A	1	
101000	A0123B	A1012B	1	
101000	A0123B	A0323B	2	
100703	A0124A	A0703A	1	
100703	A0124A	A0324A	2	
101707	A0124B	A1726B	2	
101707	A0124B	A0324B	1	
101501	A0131A	A1527B	2	
101501	A0131A	A0331A	1	
101500	A0131B	A1526B	2	
101500	A0131B	A0331B	1	
100104	A0132A	A0822A	1	
100106	A0132B	A0621B	1	
100105	A0133B	A0821A	2	
100109	A0134A	A0122A	2	
100201	A0201A	JA8207B	2	

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TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIREWRAP LISTING			2	

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTI-NATION	Z LEVEL	NOTES
100221	A0202A	A0804B	1	
100221	A0202A	A0117B	2	
100222	A0202B	A1424B	2	
100217	A0203A	A0633B	2	
100217	A0203A	A0403A	1	
100500	A0203B	A0121B	1	
100500	A0203B	A0533A	2	
100224	A0204A	A1729A	1	
100223	A0204B	A1729B	2	
100227	A0210A	A0922A	1	
100226	A0210B	A0922B	1	
100202	A0224A	A0116B	2	
100202	A0224A	A0632B	1	
100208	A0224B	A0121A	1	
100208	A0224B	A0623B	2	
100216	A0225A	A0611B	1	
100216	A0225A	A0425A	2	
100212	A0225B	A0626A	1	
100212	A0225B	A0425B	2	
100214	A0226A	A0626B	2	
100214	A0226A	A0426A	1	
100210	A0226B	A0622A	2	
100210	A0226B	A0426B	1	
100204	A0227A	A0122B	2	
100204	A0227A	A0625A	1	
100200	A0227B	JA8207A	1	
100200	A0227B	A1110B	2	
100206	A0228A	A0116A	1	
100206	A0228A	A0623A	2	
100205	A0228B	A1923A	1	
100203	A0229A	A1431B	2	
100203	A0229A	A1121A	1	
100207	A0229B	A1923B	1	
100209	A0230A	A1712A	1	
100213	A0230B	A0612B	2	
100213	A0230B	A1121B	1	
100211	A0231A	A1326B	2	
100211	A0231A	A0103A	1	
100215	A0231B	A1504B	2	
100220	A0232A	A1206B	1	
100220	A0232A	A0432A	2	
100218	A0232B	A0632A	1	
100218	A0232B	A0432B	2	
100219	A0233A	A1503B	1	
100225	A0233B	JA8412A	2	
100225	A0233B	A0433B	1	
100601	A0304A	A0104A	2	
100600	A0304B	A0104B	2	
101700	A0307A	A0107A	1	
100713	A0307B	A0107B	2	
100301	A0310A	A0517B	2	
100300	A0310B	A0515B	1	

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TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIREWRAP LISTING			3	

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTI-NATION	Z LEVEL	NOTES
100303	A0315A	A0511A	2	
100302	A0315B	A0510B	1	
100502	A0321B	A0403B	1	
100502	A0321B	A1114B	2	
101403	A0323A	A0123A	1	
101000	A0323B	A0123B	2	
101000	A0323B	A1027B	1	
100703	A0324A	A0124A	2	
101707	A0324B	A0124B	1	
101501	A0331A	A0131A	1	
101500	A0331B	A0131B	1	
100221	A0402A	A0117B	1	
100400	A0402B	A1332B	2	
100217	A0403A	A0203A	1	
100217	A0403A	A0531A	2	
100502	A0403B	A0321B	1	
100502	A0403B	A0532A	2	
100402	A0404A	A0503B	1	
100401	A0404B	A0510A	2	
100404	A0410A	A0923A	1	
100403	A0410B	A0923B	2	
100202	A0424A	A0116B	1	
100208	A0424B	A0121A	2	
100216	A0425A	A0225A	2	
100212	A0425B	A0225B	2	
100214	A0426A	A0226A	1	
100210	A0426B	A0226B	1	
100204	A0427A	A0122B	1	
100206	A0428A	A0116A	2	
100220	A0432A	A0232A	2	
100218	A0432B	A0232B	2	
100225	A0433B	A0233B	1	
100225	A0433B	A0502A	2	
	A0501A	JD9001A	2	
100225	A0502A	A0433B	2	
100225	A0502A	A0909A	1	
100902	A0502B	A0925B	1	
100902	A0502B	A0802B	2	
100402	A0503B	A0404A	1	
	A0505A	JD9005A	2	
	A0505B	JD9005B	2	
100401	A0510A	A0404B	2	
100302	A0510B	A0315B	1	
100303	A0511A	A0315A	2	
101723	A0512A	JA8014A	2	
101722	A0512B	JA8011B	2	
101721	A0513A	JA8012A	1	
101720	A0513B	JA8011A	1	
101710	A0514A	A1710B	1	
101710	A0514A	A0805A	2	
100505	A0515A	A0930B	1	
100300	A0515B	A0310B	1	

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TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIREWRAP LISTING			4	

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
100100	A0516A	A0110B	2	
100503	A0516B	A1323B	1	
100503	A0516B	JD9210A	2	
100506	A0517A	A0927B	2	
100301	A0517B	A0310A	2	
100101	A0521A	A0110A	1	
100903	A0521B	A0916B	2	
100504	A0522A	A1310B	2	
100504	A0522A	JD9211A	1	
100901	A0523B	A0902A	2	
	A0524A	JD9104A	2	
	A0524B	JD9104B	1	
	A0525A	JD9105A	2	
	A0525B	JD9105B	1	
	A0526A	JD9106A	1	
	A0526B	JD9106B	2	
	A0527A	JD9107A	2	
	A0527B	JD9107B	2	
	A0529A	JD9109A	1	
	A0529B	JD9109B	2	
101301	A0530A	A1309B	2	
101724	A0530B	A1428B	2	
100217	A0531A	A0403A	2	
100217	A0531A	A0903A	1	
100508	A0531B	A0910B	1	
100502	A0532A	A0403B	2	
100502	A0532A	A0930A	1	
101911	A0532B	A1926B	1	
100500	A0533A	A0203B	2	
100500	A0533A	A1917B	1	
100507	A0533B	A1308B	1	
	A0534A	JD9101A	1	
101806	A0604A	A1811B	1	
100718	A0604B	A0721B	2	
100612	A0605A	A0614A	2	
101805	A0605B	A1832A	2	
100606	A0606A	A0711B	1	
100607	A0606B	A0724A	1	
100604	A0607A	A0732B	2	
100609	A0607B	A1926A	1	
100611	A0609A	A0613A	1	
101901	A0610A	A1905A	2	
100603	A0610B	A1910B	1	
100720	A0611A	A0725A	2	
100216	A0611B	A0225A	1	
100216	A0611B	A1226B	2	
100724	A0612A	A0713B	2	
100724	A0612A	A1124B	1	
100213	A0612B	A0230B	2	
100213	A0612B	A0727A	1	
100611	A0613A	A0609A	1	
100611	A0613A	A0615B	2	

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TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIREWRAP LISTING			5	

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
100601	A0613B	A0104A	1	
100601	A0613B	JA8401A	2	
100612	A0614A	A0605A	2	
100612	A0614A	A0614B	1	
100612	A0614B	A0625B	2	
100612	A0614B	A0614A	1	
101003	A0615A	A1026B	1	
100611	A0615B	A0613A	2	
100611	A0615B	A0624B	1	
101900	A0616A	A1904A	1	
100605	A0616B	A0702A	2	
100722	A0617A	A0706B	2	
100722	A0617A	A1226A	1	
100716	A0617B	A0707B	2	
100608	A0621A	A0717A	2	
100600	A0621B	A0104B	1	
101304	A0621B	A1307A	2	
100210	A0622A	A0603A	1	
100210	A0622A	A0226B	2	
101804	A0622B	A1004B	2	
100206	A0623A	A1230A	1	
100206	A0623A	A0228A	2	
100208	A0623B	A1228B	1	
100208	A0623B	A0224B	2	
100611	A0624A	A0634A	1	
100611	A0624A	A0624B	2	
100611	A0624B	A0624A	2	
100611	A0624B	A0615B	1	
100204	A0625A	A1233A	2	
100204	A0625A	A0227A	1	
100612	A0625B	A0614B	2	
100612	A0625B	A0629B	1	
100212	A0626A	A1224A	2	
100212	A0626A	A0225B	1	
100214	A0626B	A1222B	1	
100214	A0626B	A0226A	2	
100602	A0627A	A0733A	1	
101208	A0627B	A0705B	2	
101906	A0628B	A1915B	1	
100612	A0629A	A0630A	1	
100612	A0629A	A0629B	2	
100612	A0629B	A0629A	2	
100612	A0629B	A0625B	1	
100612	A0630A	A0629A	1	
101004	A0631A	A1013B	2	
100218	A0632A	A1221A	2	
100218	A0632A	A0232B	1	
100202	A0632B	A1231A	2	
100202	A0632B	A0224A	1	
100610	A0633A	A0729A	2	
100217	A0633B	A0203A	2	
100217	A0633B	A1225A	1	

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TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIREWRAP LISTING			6	

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTI-NATION	Z LEVEL	NOTES
100611	A0634A	A0624A	1	
100728	A0701A	JA8305A	1	
100605	A0702A	A0616B	2	
101208	A0702B	A0705B	1	
101208	A0702B	A1207A	2	
100703	A0703A	A1205B	2	
100703	A0703A	A0124A	1	
100704	A0703B	A1710A	1	
101206	A0704A	A1213B	2	
100702	A0704B	A1907B	2	
100804	A0705A	A0829B	2	
101208	A0705B	A0702B	1	
101208	A0705B	A0627B	2	
100706	A0706A	A0831A	1	
100722	A0706B	A0617A	2	
100722	A0706B	A0804A	1	
100701	A0707A	A2012A	1	
100716	A0707B	A0617B	2	
100716	A0707B	A1725B	1	
100700	A0708A	A2009B	2	
100707	A0709A	A0716A	1	
101207	A0710A	A1232B	1	
100717	A0710B	A1205A	1	
100713	A0711A	A0107B	1	
100606	A0711B	A0606A	1	
100801	A0712A	A1117A	2	
100721	A0712B	A2026B	1	
100710	A0713A	A2029B	1	
100724	A0713B	A0832A	1	
100724	A0713B	A0612A	2	
100708	A0714A	A1203B	2	
101209	A0714B	A0811B	2	
100800	A0715A	A0831B	1	
100714	A0715B	A1225B	1	
100707	A0716A	A1928A	2	
100707	A0716A	A0709A	1	
100705	A0716B	A1927B	1	
100608	A0717A	A0621A	2	
101213	A0717B	A1206A	2	
100718	A0721B	A0833A	1	
100718	A0721B	A0604B	2	
100709	A0722A	A1910A	2	
101214	A0722B	A1207B	1	
100725	A0723A	A0734A	2	
100803	A0723B	A0825B	2	
100607	A0724A	A0606B	1	
100726	A0724B	JA8304A	1	
100720	A0725A	A0611A	2	
101215	A0725B	A1214B	2	
100723	A0726A	A1905B	1	
101709	A0726B	A1724A	2	
100213	A0727A	A0612B	1	

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TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIREWRAP LISTING			7	

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTI-NATION	Z LEVEL	NOTES
101801	A0727B	A1808B	2	
101800	A0728B	A1807B	1	
100610	A0729A	A0633A	2	
100719	A0729B	A2027B	1	
100711	A0730A	A1916B	2	
100715	A0731A	A0803B	2	
101705	A0731B	A1714A	2	
100712	A0732A	A0909B	1	
100712	A0732A	JD9204B	2	
100604	A0732B	A0607A	2	
100602	A0733A	A0627A	1	
101702	A0733B	JA8001A	2	
101702	A0733B	A0802A	1	
100725	A0734A	A0723A	2	
100818	A0801A	JA8101B	2	
100820	A0801A	JA8103B	1	
101702	A0802A	A0733B	1	
101702	A0802A	A1711B	2	
100902	A0802B	A0502B	2	
100210	A0803A	A1229B	2	
100210	A0803A	A0622A	1	
100715	A0803B	A0731A	2	
100722	A0804A	A0117A	2	
100722	A0804A	A0706B	1	
100221	A0804B	A0202A	1	
100221	A0804B	JA8405A	2	
101710	A0805A	A0915B	1	
101710	A0805A	A0514A	2	
100900	A0805B	A0927A	1	
100832	A0806A	JD9007A	2	
100831	A0806B	JD9007B	1	
100830	A0807A	JD9009A	2	
100829	A0807B	JD9009B	1	
100834	A0808A	JD9004A	2	
100833	A0808B	JD9004B	1	
100807	A0809A	A2004A	1	
100810	A0809B	A2006A	2	
100805	A0810A	A2005A	1	
100806	A0810B	A2004B	2	
101210	A0811A	A1202A	1	
101209	A0811B	A0714B	2	
101209	A0811B	A1217A	1	
101212	A0812A	A1204A	1	
101211	A0812B	A1203A	2	
101217	A0813A	A1209B	2	
101218	A0813B	A1209A	1	
100808	A0814A	A2003B	2	
101216	A0814B	A1210A	1	
100811	A0815A	A2006B	1	
100809	A0815B	A2005B	1	
100819	A0816A	JA8103A	2	
100817	A0816B	JA8101A	2	

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TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIREWRAP LISTING			8	

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
100107	A0817A	A0103B	2	
100821	A0817B	JA8102A	2	
100105	A0821A	A0133B	2	
100106	A0821B	A0132B	1	
100104	A0822A	A0132A	1	
101219	A0822B	A1211B	2	
100813	A0823A	JA8105A	1	
100802	A0824A	A1716B	1	
100815	A0824B	JA8106A	2	
100801	A0825A	A1125B	1	
100803	A0825B	A1924B	1	
100803	A0825B	A0723B	2	
100823	A0826A	JD9311B	1	
100825	A0826B	JD9314A	2	
100827	A0827A	JD9309A	2	
100826	A0827B	JD9311A	1	
101706	A0828A	A1712B	1	
100812	A0828B	A1216B	2	
100812	A0828B	A1733A	1	
101912	A0829A	A1914A	1	
100804	A0829B	A2013B	1	
100804	A0829B	A0705A	2	
102001	A0830A	A2012B	2	
102000	A0830B	A2014A	2	
100706	A0831A	A0706A	1	
100800	A0831B	A2032A	2	
100800	A0831B	A0715A	1	
100724	A0832A	A0713B	1	
100724	A0832A	A1827B	2	
101907	A0832B	A1931B	2	
100718	A0833A	A2028B	2	
100718	A0833A	A0721B	1	
102121	A0833B	JD9307A	2	
100814	A0834A	JA8105B	1	
100816	A0834A	JA8106B	2	
100822	A0901A	JA8102B	2	
100905	A0901A	A0904A	1	
100901	A0902A	A0523B	2	
100217	A0903A	A0531A	1	
100905	A0904A	A0901A	1	
100905	A0904A	A0905A	2	
100905	A0905A	A0906A	1	
100905	A0905A	A0904A	2	
100905	A0906A	A0905A	1	
100905	A0906A	A0907B	2	
100906	A0907A	A0908B	1	
100905	A0907B	A0912B	1	
100905	A0907B	A0906A	2	
100906	A0908B	A0907A	1	
100906	A0908B	A0912A	2	
100225	A0909A	A0502A	1	
100712	A0909B	A0732A	1	

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TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIREWRAP LISTING			9	

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
100508	A0910B	A0531B	1	
100906	A0912A	A0908B	2	
100906	A0912A	A0913A	1	
100905	A0912B	A0913B	2	
100905	A0912B	A0907B	1	
100906	A0913A	A0912A	1	
100906	A0913A	A0915A	2	
100905	A0913B	A0912B	2	
100906	A0915A	A0913A	2	
101710	A0915B	JD9205B	2	
101710	A0915B	A0805A	1	
101724	A0916A	A1707A	2	
101724	A0916A	A1307B	1	
100903	A0916B	A0521B	2	
100227	A0922A	A0210A	1	
100226	A0922B	A0210B	1	
100404	A0923A	A0410A	1	
100403	A0923B	A0410B	2	
100902	A0925B	A0502B	1	
100500	A0926A	A0121B	2	
100500	A0926A	A1104B	1	
100900	A0927A	A0805B	1	
100900	A0927A	JD9204A	2	
100506	A0927B	A0517A	2	
100904	A0928A	A0929B	2	
100904	A0928A	A0928B	1	
100904	A0928B	A0928A	1	
100904	A0929A	A0929B	1	
100904	A0929A	A0931B	2	
100904	A0929B	A0928A	2	
100904	A0929B	A0929A	1	
100502	A0930A	JA8403B	2	
100502	A0930A	A0532A	1	
100505	A0930B	A0515A	1	
100904	A0931A	A0932B	2	
100904	A0931A	A0931B	1	
100904	A0931B	A0931A	1	
100904	A0931B	A0929A	2	
100904	A0932A	A0934A	2	
100904	A0932A	A0932B	1	
100904	A0932B	A0931A	2	
100904	A0932B	A0932A	1	
100904	A0934A	A0932A	2	
	A1001A	JA8211A	2	
102110	A1001B	A1021B	1	
102104	A1002B	JD9203A	2	
102104	A1002B	A1502B	1	
101804	A1004B	A0622B	2	
101804	A1004B	A1633A	1	
101000	A1012B	A0123B	1	
101000	A1012B	JA8403A	2	
101004	A1013B	A0631A	2	

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TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIREWRAP LISTING			10	

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
102112	A1014B	JD9404A	2	
102112	A1014B	A1034B	1	
102110	A1021B	JD9401B	2	
102110	A1021B	A1001B	1	
101803	A1022B	A1812B	1	
101002	A1023B	A1523B	2	
101001	A1024B	A1524B	1	
101003	A1026B	A0615A	1	
101000	A1027B	A0323B	1	
101006	A1030B	A1309A	2	
102107	A1033B	JD9203B	2	
102107	A1033B	A1533B	1	
102112	A1034B	A1014B	1	
100828	A1101A	JA8104A	1	
102105	A1102B	JD9302B	1	
101717	A1103B	A1703B	1	
	A1104A	JD9110B	2	
100500	A1104B	A0926A	1	
	A1105A	JD9110A	1	
	A1106A	JD9111A	1	
	A1107B	JD9111B	2	
100504	A1108B	JD9211A	2	
	A1109A	JA8004B	2	
101711	A1109B	A1709A	1	
101712	A1110A	A1709B	1	
100200	A1110B	A0227B	2	
	A1111A	JA8006B	2	
101712	A1111B	A1331A	2	
101708	A1112A	A1724B	1	
	A1112B	JD9314B	1	
102111	A1113A	JA8005B	1	
	A1113B	A1122A	2	
	A1114A	JA8211B	2	
100502	A1114B	A0321B	2	
102122	A1115B	JA8007B	1	
	A1116A	A1703A	2	
100801	A1117A	A0712A	2	
100203	A1121A	A0229A	1	
100213	A1121B	A0230B	1	
	A1122A	A1113B	2	
	A1122B	JA8003B	1	
	A1124A	A1127A	1	
100724	A1124B	A0612A	1	
100726	A1125A	JA8304A	2	
100801	A1125B	A0825A	1	
100718	A1126B	A2028B	1	
	A1127A	A1124A	1	
	A1129A	JD9010B	1	
	A1129B	JD9010A	2	
	A1131A	JD9011A	1	
	A1131B	JD9011B	1	
10716	A1132B	A1732B	1	

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TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIREWRAP LISTING			11	

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
102108	A1133B	JD9302A	1	
101713	A1134A	A1331B	1	
101201	A1201A	JA8204B	2	
101205	A1201A	JA8206B	1	
101210	A1202A	A0811A	1	
101211	A1203A	A0812B	2	
100708	A1203B	A1916A	1	
100708	A1203B	A0714A	2	
101212	A1204A	A0812A	1	
100717	A1205A	A0710B	1	
100703	A1205B	A0703A	2	
100703	A1205B	A1232A	1	
101213	A1206A	A0717B	2	
100220	A1206B	JA8414A	2	
100220	A1206B	A0232A	1	
101208	A1207A	A0702B	2	
101214	A1207B	A0722B	1	
101218	A1209A	A0813B	1	
101217	A1209B	A0813A	2	
101216	A1210A	A0814B	1	
101219	A1211B	A0822B	2	
101200	A1213A	JA8204A	1	
101206	A1213B	A0704A	2	
101215	A1214B	A0725B	2	
101903	A1215A	A1925A	1	
101220	A1216A	A1730B	1	
100812	A1216B	A0828B	2	
101209	A1217A	A0811B	1	
100218	A1221A	A0632A	2	
100218	A1221A	JA8406B	1	
100214	A1222B	A0626B	1	
100214	A1222B	JA8409A	2	
101202	A1223B	JA8205A	1	
100212	A1224A	A0626A	2	
100212	A1224A	JA8411A	1	
101204	A1224B	JA8206A	2	
100217	A1225A	A0633B	1	
100217	A1225A	JA8405B	2	
100714	A1225B	A0715B	1	
100722	A1226A	A1917A	2	
100722	A1226A	A0617A	1	
100216	A1226B	A0611B	2	
100216	A1226B	JA8408A	1	
100208	A1228B	A0623B	1	
100208	A1228B	JA8406A	2	
100210	A1229B	A0803A	2	
100210	A1229B	JA8410A	1	
100206	A1230A	JA8407A	2	
100206	A1230A	A0623A	1	
100202	A1231A	JA8408B	1	
100202	A1231A	A0632B	2	
100703	A1232A	A1205B	1	

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TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIREWRAP LISTING			12	

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
101207	A1232B	A0710A	1	
100204	A1233A	JA8407B	1	
100204	A1233A	A0625A	2	
101221	A1233B	JA8402A	1	
101203	A1234A	JA8205B	2	
101304	A1305A	A1307A	1	
101303	A1305B	A1306A	2	
101303	A1306A	JA8401A	1	
101303	A1306A	A1305B	2	
101302	A1306B	A1327B	2	
101304	A1307A	A1305A	1	
101304	A1307A	A0621B	2	
101724	A1307B	A0916A	1	
100507	A1308B	A0533B	1	
101006	A1309A	A1030B	2	
101301	A1309B	A0530A	2	
100504	A1310B	A0522A	2	
100200	A1312B	A1713A	1	
100200	A1312B	JA8207A	2	
100503	A1323B	A0516B	1	
100211	A1326B	A0231A	2	
100211	A1326B	A1513B	1	
101302	A1327B	A1306B	2	
101712	A1331A	A1111B	2	
101713	A1331B	A1134A	1	
100400	A1332B	A0402B	2	
102103	A1402B	JD9201A	2	
102103	A1402B	A1602B	1	
101401	A1403B	A1510B	2	
101400	A1404B	A1509B	1	
101404	A1410B	A1422B	1	
101902	A1412B	A1907A	2	
101405	A1414B	A1421B	2	
101405	A1421B	A1414B	2	
101404	A1422B	A1410B	1	
100812	A1423B	A1733A	2	
100222	A1424B	A0202B	2	
101406	A1425B	A1726A	1	
100211	A1427B	A1908B	1	
101724	A1428B	A1707A	1	
101724	A1428B	A0530B	2	
101402	A1430B	A1522B	2	
100203	A1431B	A1512B	1	
100203	A1431B	A0229A	2	
101403	A1432B	A0123A	2	
101403	A1432B	JA8404A	1	
102106	A1433B	JD9201B	2	
102106	A1433B	A1633B	1	
102104	A1502B	A1002B	1	
100219	A1503B	A0233A	1	
100215	A1504B	A0231B	2	
101400	A1509B	A1404B	1	

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TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIREWRAP LISTING			13	

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTI-NATION	Z LEVEL	NOTES
101401	A1510B	A1403B	2	
100203	A1512B	A1713B	2	
100203	A1512B	A1431B	1	
100211	A1513B	A1908B	2	
100211	A1513B	A1326B	1	
101402	A1522B	A1430B	2	
101002	A1523B	A1023B	2	
101001	A1524B	A1024B	1	
101500	A1526B	A0131B	2	
101501	A1527B	A0131A	2	
102107	A1533B	A1033B	1	
102103	A1602B	A1402B	1	
101807	A1613B	A1823B	1	
101703	A1614B	A1711A	2	
101703	A1614B	JA8009B	1	
101808	A1615B	A1825B	1	
102106	A1633B	A1433B	1	
101701	A1701A	JA8210B	2	
101715	A1701A	JA8203B	1	
102103	A1702B	JD9201A	1	
	A1703A	A1116A	2	
101717	A1703B	JD9312B	2	
101717	A1703B	A1103B	1	
101724	A1707A	A1428B	1	
101724	A1707A	A0916A	2	
100108	A1708A	A0102B	2	
101700	A1708B	A0107A	2	
101700	A1708B	JA8210A	1	
101711	A1709A	JA8002B	2	
101711	A1709A	A1109B	1	
101712	A1709B	A1110A	1	
100704	A1710A	A0703B	1	
101710	A1710B	A0514A	1	
101703	A1711A	A1614B	2	
101703	A1711A	JA8208A	1	
101702	A1711B	A0802A	2	
100209	A1712A	A0230A	1	
101706	A1712B	JA8013A	2	
101706	A1712B	A0828A	1	
100200	A1713A	A1312B	1	
100203	A1713B	A1512B	2	
100203	A1713B	A1908A	1	
101705	A1714A	A0731B	2	
101714	A1714B	JA8203A	2	
101725	A1715B	A1914B	2	
100802	A1716B	A0824A	1	
101718	A1717A	JA8303B	2	
101719	A1717B	JA8303A	1	
101709	A1724A	A0726B	2	
101708	A1724B	A1112A	1	
100716	A1725B	A0707B	1	
101406	A1726A	A1425B	1	

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TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIREWRAP LISTING			14	

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
101707	A1726B	A0124B	2	
101721	A1727A	JA8012A	2	
101720	A1728B	JA8011A	2	
100224	A1729A	A0204A	1	
100223	A1729B	A0204B	2	
101723	A1730A	JA8014A	1	
101220	A1730B	A1216A	1	
100103	A1731A	A0115A	2	
101722	A1731B	JA8011B	1	
100102	A1732A	A0115B	1	
101716	A1732B	JD9312A	2	
10716	A1732B	A1132B	1	
100812	A1733A	A0828B	1	
100812	A1733A	A1423B	2	
102106	A1733B	JD9201B	1	
101704	A1734A	JA8208B	2	
102121	A1801A	JA8305B	1	
102104	A1802B	JD9203A	1	
101800	A1807B	A0728B	1	
101801	A1808B	A0727B	2	
101802	A1809B	A1911A	2	
101806	A1811B	A0604A	1	
101803	A1812B	A1022B	1	
101807	A1823B	A1613B	1	
101808	A1825B	A1615B	1	
100724	A1827B	A0832A	2	
101805	A1832A	A0605B	2	
101804	A1833A	A1004B	1	
102107	A1833B	JD9203B	1	
101900	A1904A	A0616A	1	
102002	A1904B	A2015B	1	
101901	A1905A	A0610A	2	
100723	A1905B	A0726A	1	
101902	A1907A	A1412B	2	
100702	A1907B	A0704B	2	
100203	A1908A	A1713B	1	
100211	A1908B	A1513B	2	
100211	A1908B	A1427B	1	
100709	A1910A	A0722A	2	
100603	A1910B	A0610B	1	
101802	A1911A	A1809B	2	
102003	A1911B	A2014B	2	
101912	A1914A	A0829A	1	
101725	A1914B	A1715B	2	
101725	A1914B	A1915A	1	
101725	A1915A	A1914B	1	
101906	A1915B	A0628B	1	
100708	A1916A	A1203B	1	
100711	A1916B	A0730A	2	
100722	A1917A	A1226A	2	
100500	A1917B	JA8402B	2	
100500	A1917B	A0533A	1	

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TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIREWRAP LISTING			15	

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
101909	A1921A	JD9006B	1	
101910	A1921B	JD9006A	1	
101908	A1922A	A2010B	1	
100205	A1923A	A0228B	1	
100207	A1923B	A0229B	1	
101904	A1924A	A2011A	2	
100803	A1924B	A1925B	2	
100803	A1924B	A0825B	1	
101903	A1925A	A1215A	1	
100803	A1925B	A1924B	2	
100609	A1926A	A0607B	1	
101911	A1926B	JA8009B	2	
101911	A1926B	A0532B	1	
101905	A1927A	A2010A	1	
100705	A1927B	A0716B	1	
100707	A1928A	A0716A	2	
101907	A1931B	A0832B	2	
100808	A2003B	A0814A	2	
100807	A2004A	A0809A	1	
100806	A2004B	A0810B	2	
100805	A2005A	A0810A	1	
100809	A2005B	A0815B	1	
100810	A2006A	A0809B	2	
100811	A2006B	A0815A	1	
100700	A2009B	A0708A	2	
101905	A2010A	A1927A	1	
101908	A2010B	A1922A	1	
101904	A2011A	A1924A	2	
102008	A2011B	JD9305B	1	
100701	A2012A	A0707A	1	
102001	A2012B	A0830A	2	
100804	A2013B	A0829B	1	
102000	A2014A	A0830B	2	
102003	A2014B	A1911B	2	
102007	A2015A	JD9305A	2	
102002	A2015B	A1904B	1	
100721	A2026B	A0712B	1	
100719	A2027B	A0729B	1	
100718	A2028B	A0833A	2	
100718	A2028B	A1126B	1	
100710	A2029B	A0713A	1	
102005	A2031B	JD9306B	2	
100800	A2032A	A0831B	2	
102004	A2032B	JD9306A	1	
102006	A2034A	JD9304B	1	
102009	A2034A	JD9304A	2	
101702	JA8001A	A0733B	2	
102114	JA8001B	JD9407A	2	
102114	JA8001B	JD9407B	1	
101711	JA8002B	A1709A	2	
	JA8003B	A1122B	1	
	JA8004B	A1109A	2	

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TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIREWRAP LISTING			16	

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
102101	JA8005A	JA8306B	2	
102111	JA8005B	A1113A	1	
	JA8006B	A1111A	2	
102102	JA8007A	JD9303A	1	
102122	JA8007B	A1115B	1	
101703	JA8009B	A1614B	1	
101911	JA8009B	A1926B	2	
102113	JA8010A	JD9410A	1	
101720	JA8011A	A1728B	2	
101720	JA8011A	A0513B	1	
101722	JA8011B	A1731B	1	
101722	JA8011B	A0512B	2	
101721	JA8012A	A1727A	2	
101721	JA8012A	A0513A	1	
101706	JA8013A	A1712B	2	
	JA8013B	JD9313A	1	
101723	JA8014A	A1730A	1	
101723	JA8014A	A0512A	2	
	JA8014B	JA8307A	2	
100817	JA8101A	A0816B	2	
100818	JA8101B	A0801A	2	
100821	JA8102A	A0817B	2	
100822	JA8102B	A0901A	2	
100819	JA8103A	A0816A	2	
100820	JA8103B	A0801A	1	
100828	JA8104A	A1101A	1	
100813	JA8105A	A0823A	1	
100814	JA8105B	A0834A	1	
100815	JA8106A	A0824B	2	
100816	JA8106B	A0834A	2	
102110	JA8201B	JD9401B	1	
102110	JA8201B	JD9401A	2	
102105	JA8202B	JD9302B	2	
101714	JA8203A	A1714B	2	
101715	JA8203B	A1701A	1	
101200	JA8204A	A1213A	1	
101201	JA8204B	A1201A	2	
101202	JA8205A	A1223B	1	
101203	JA8205B	A1234A	2	
101204	JA8206A	A1224B	2	
101205	JA8206B	A1201A	1	
100200	JA8207A	A1312B	2	
100200	JA8207A	A0227B	1	
100201	JA8207B	A0201A	2	
101703	JA8208A	A1711A	1	
101704	JA8208B	A1734A	2	
101700	JA8210A	A1708B	1	
101701	JA8210B	A1701A	2	
	JA8211A	A1001A	2	
	JA8211B	A1114A	2	
102109	JA8212B	JD9301A	2	
102108	JA8213B	JD9302A	2	

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SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
102112	JA8214B	JD9404A	1	
102112	JA8214B	JD9404B	2	
101719	JA8303A	A1717B	1	
101718	JA8303B	A1717A	2	
100726	JA8304A	A0724B	1	
100726	JA8304A	A1125A	2	
100727	JA8304B	JD9308A	1	
100728	JA8305A	A0701A	1	
102121	JA8305B	A1801A	1	
102100	JA8306A	JD9307B	1	
102101	JA8306B	JA8005A	2	
	JA8307A	JA8014B	2	
	JA8307B	JD9313B	1	
100601	JA8401A	A0613B	2	
101303	JA8401A	A1306A	1	
102116	JA8401B	JD9408A	1	
101221	JA8402A	A1233B	1	
100500	JA8402B	A1917B	2	
100500	JA8402B	JD9205A	1	
101000	JA8403A	A1012B	2	
100502	JA8403B	A0930A	2	
101403	JA8404A	A1432B	1	
102117	JA8404B	JD9408B	1	
100221	JA8405A	A0804B	2	
100217	JA8405B	A1225A	2	
100208	JA8406A	A1228B	2	
100218	JA8406B	A1221A	1	
100206	JA8407A	A1230A	2	
100204	JA8407B	A1233A	1	
100216	JA8408A	A1226B	1	
100202	JA8408B	A1231A	1	
100214	JA8409A	A1222B	2	
100210	JA8410A	A1229B	1	
100212	JA8411A	A1224A	1	
100225	JA8412A	A0233B	2	
102116	JA8413A	JD9408A	2	
100220	JA8414A	A1206B	2	
	JD9001A	A0501A	2	
100834	JD9004A	A0808A	2	
100833	JD9004B	A0808B	1	
	JD9005A	A0505A	2	
	JD9005B	A0505B	2	
101910	JD9006A	A1921B	1	
101909	JD9006B	A1921A	1	
100832	JD9007A	A0806A	2	
100831	JD9007B	A0806B	1	
	JD9008A	JD9108A	1	
102118	JD9008A	JD9308B	2	
	JD9008B	JD9108B	1	
102119	JD9008B	JD9309B	2	
100830	JD9009A	A0807A	2	
100829	JD9009B	A0807B	1	

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TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIREWRAP LISTING			18	

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
	JD9010A	A1129B	2	
	JD9010B	A1129A	1	
	JD9011A	A1131A	1	
	JD9011B	A1131B	1	
	JD9014B	JD9114B	1	
102120	JD9014B	JD9310B	2	
	JD9101A	A0534A	1	
	JD9104A	A0524A	2	
	JD9104B	A0524B	1	
	JD9105A	A0525A	2	
	JD9105B	A0525B	1	
	JD9106A	A0526A	1	
	JD9106B	A0526B	2	
	JD9107A	A0527A	2	
	JD9107B	A0527B	2	
	JD9108A	JD9008A	1	
	JD9108B	JD9008B	1	
	JD9109A	A0529A	1	
	JD9109B	A0529B	2	
	JD9110A	A1105A	1	
	JD9110B	A1104A	2	
	JD9111A	A1106A	1	
	JD9111B	A1107B	2	
	JD9114B	JD9014B	1	
102103	JD9201A	A1402B	2	
102103	JD9201A	A1702B	1	
102106	JD9201B	A1733B	1	
102106	JD9201B	A1433B	2	
102104	JD9203A	A1002B	2	
102104	JD9203A	A1802B	1	
102107	JD9203B	A1033B	2	
102107	JD9203B	A1833B	1	
100900	JD9204A	A0927A	2	
100712	JD9204B	A0732A	2	
100500	JD9205A	JA8402B	1	
101710	JD9205B	A0915B	2	
100503	JD9210A	A0516B	2	
100100	JD9210B	A0110B	1	
100504	JD9211A	A0522A	1	
100504	JD9211A	A1108B	2	
100101	JD9211B	A0110A	2	
102109	JD9301A	JA8212B	2	
102108	JD9302A	JA8213B	2	
102108	JD9302A	A1133B	1	
102105	JD9302B	JA8202B	2	
102105	JD9302B	A1102B	1	
102102	JD9303A	JA8007A	1	
102009	JD9304A	A2034A	2	
102006	JD9304B	A2034A	1	
102007	JD9305A	A2015A	2	
102008	JD9305B	A2011B	1	
102004	JD9306A	A2032B	1	

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TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIREWRAP LISTING			19	

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTI-NATION	Z LEVEL	NOTES
102005	JD9306B	A2031B	2	
102121	JD9307A	A0833B	2	
102100	JD9307B	JA8306A	1	
100727	JD9308A	JA8304B	1	
102118	JD9308B	JD9008A	2	
100827	JD9309A	A0827A	2	
102119	JD9309B	JD9008B	2	
102120	JD9310B	JD9014B	2	
100826	JD9311A	A0827B	1	
100823	JD9311B	A0826A	1	
101716	JD9312A	A1732B	2	
101717	JD9312B	A1703B	2	
	JD9313A	JA8013B	1	
	JD9313B	JA8307B	1	
100825	JD9314A	A0826B	2	
	JD9314B	A1112B	1	
102110	JD9401A	JA8201B	2	
102110	JD9401B	JA8201B	1	
102110	JD9401B	A1021B	2	
102111	JD9402A	A0102A	2	
102112	JD9404A	JA8214B	1	
102112	JD9404A	A1014B	2	
102112	JD9404B	JA8214B	2	
102114	JD9407A	JA8001B	2	
102114	JD9407B	JA8001B	1	
102116	JD9408A	JA8413A	2	
102116	JD9408A	JA8401B	1	
102117	JD9408B	JA8404B	1	
102113	JD9410A	JA8010A	1	

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SECTION 5

PARTS DATA

PARTS DATA 5

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 follow:

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. NFR in the part number column indicates that as 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 5B).

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/assocated 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 unit with Engineering Change Order (ECO) installed).

NOTE

Since these machines were first built in Series Code 32, references to earlier Series Codes (for example S/C 01-31) will not appear in this manual.

Information that is unique to one particular equipment or application will also be noted in this column.

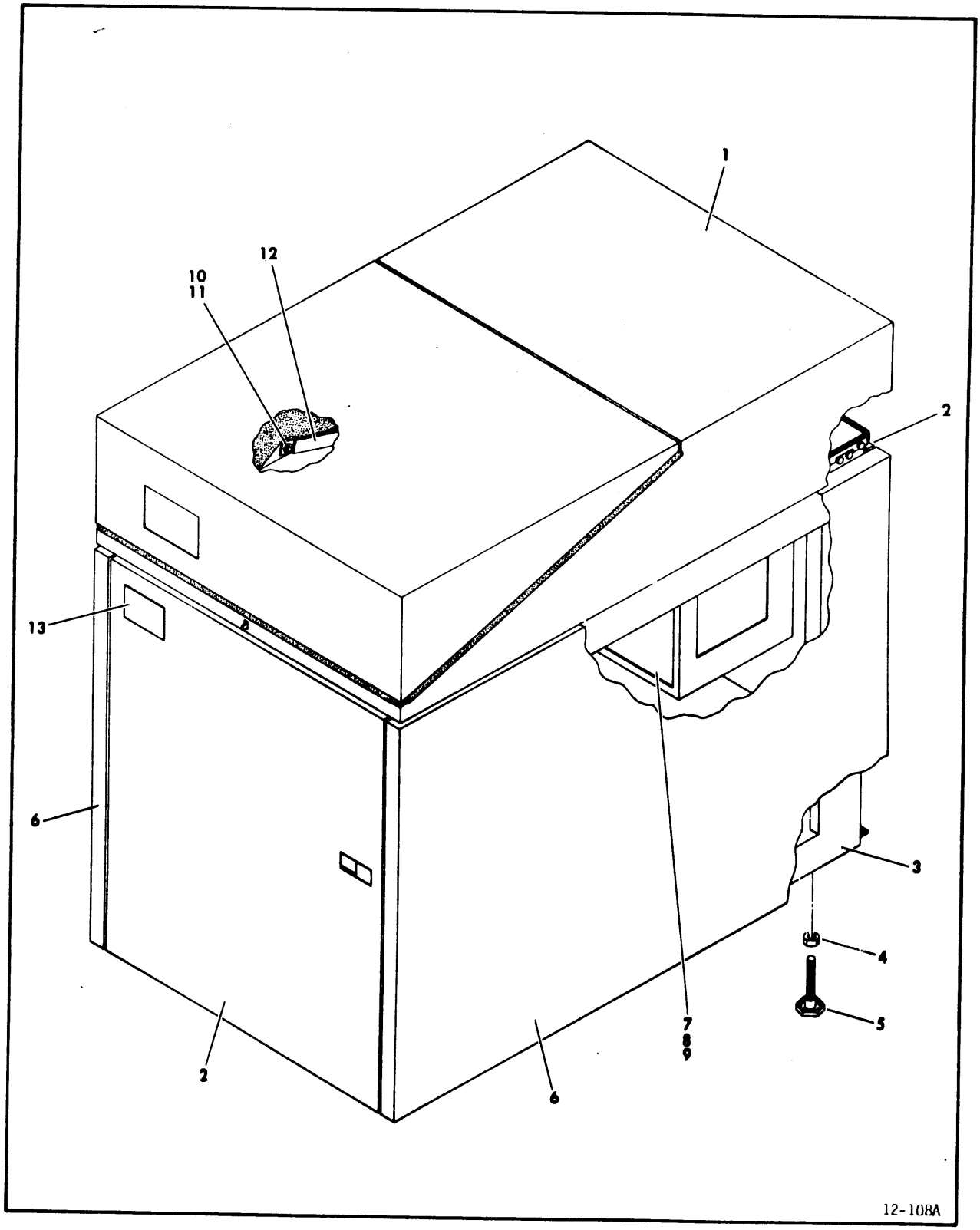

Figure 5-1. Final Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-1	77445031	FINAL ASSEMBLY	BJ4A3C
5-1	77445032	FINAL ASSEMBLY	BJ4A3D
1		TOP COVER SET ASSEMBLY (See Figure 5-3)	
2		DOOR ASSEMBLY (See Figure 5-4) (ATTACHING PARTS)	
	70948501	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	
	75128000	LENS, Button, Encoding Set (Tabs 00-15) (Logical Address Plug)	Packed separately and shipped with unit. Lens number corresponds to part number tab.
	85011800	SPL BTL KIT KS22072 L102	
9	94317900	RETAINER, Split Ring	
10	94047074	WASHER, Special	
11	92033059	RING, Retaining	
12	77454200	BAR, Support	
13	92010301	PLATE, Disk Drive	

(For information on shipping hardware, see Section 1 (Installation and Checkout).

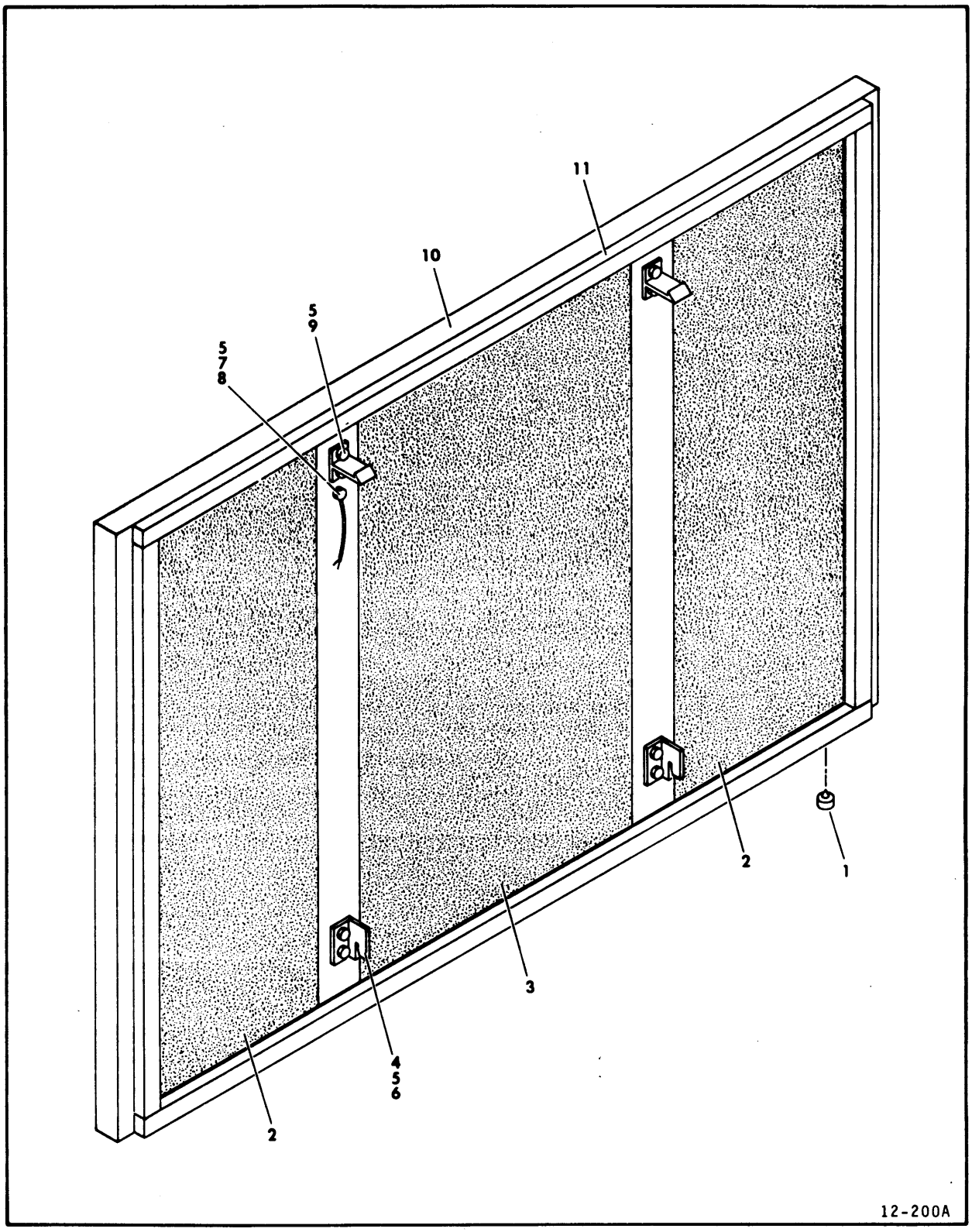

Figure 5-2. Side Panel Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-2	77446600	SIDE PANEL ASSEMBLY	
1	92633021	BUMPER, Grommet Type	
2	77446806	PANEL, Foam, Acoustical	
3	77446805	PANEL, Foam, Acoustical	
4	75194501	BR^CKET, Support	
5	93592238	SCREW, Hex Washer Head Self Tapping, 10-24 x 0.375	
6	10125607	WASHER, Flat, #10	
7	94281432	CABLE, Ground	
8	10126403	WASHER, External Tooth Lock, #10	
9	77441800	CATCH, Side Panel	
10	77442603	PANEL, Side	
11	94001034	TAPE, Foam	

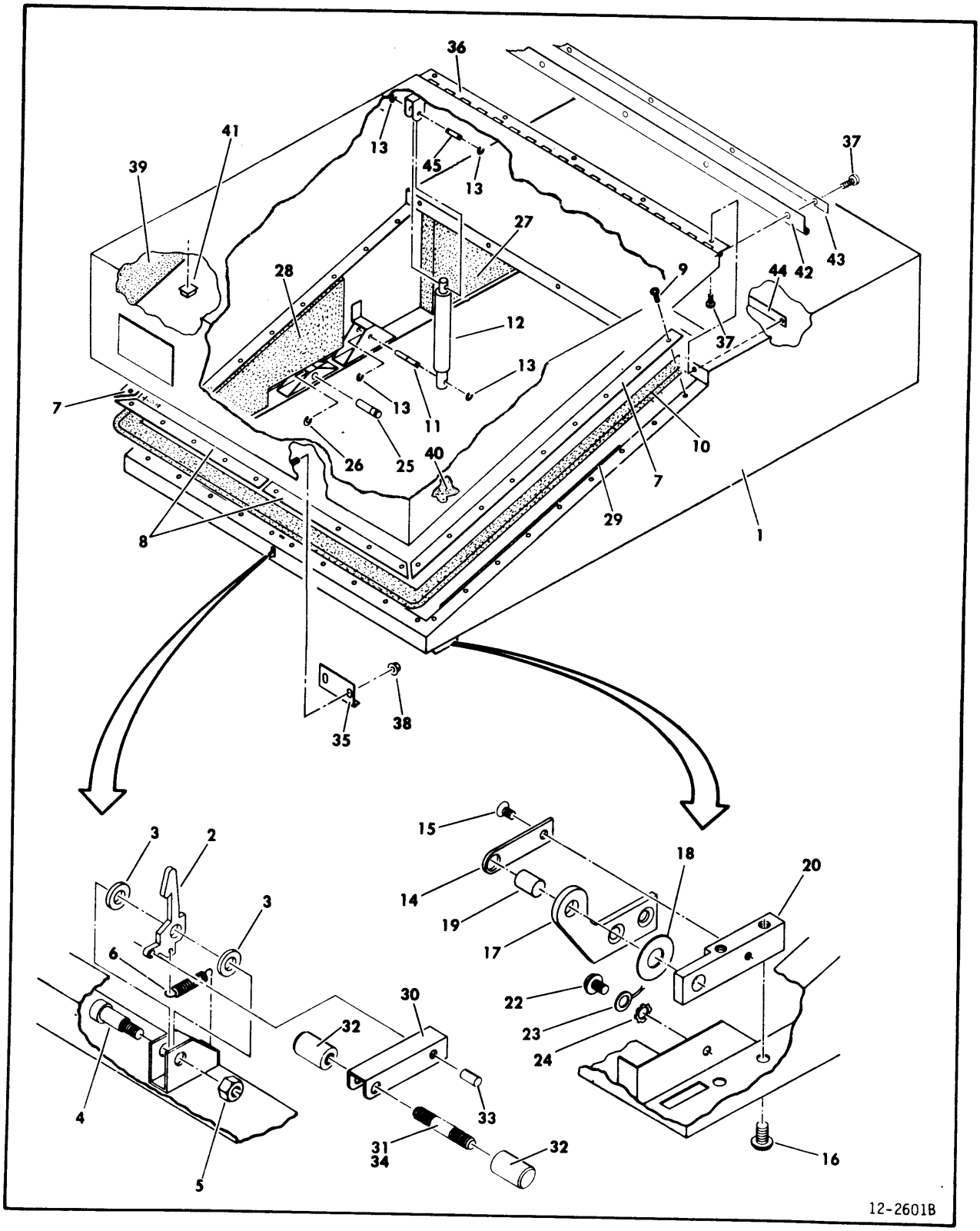

Figure 5-3. Top Cover Set Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-3	73047600	TOP COVER SET ASSEMBLY	
1	92034903	COVER, Top, Set	
2	73041801	LATCH	
3	76421900	SPACER, Interlock	
4	92541001	SCREW, Shoulder, 10-24 x 3/8 x 1/2	
5	94218004	NUT, Self-Locking, Thin	
6	94203657	SPRING, Extension	
7	73046300	GASKET, Strip-Mounting	
8	73046400	GASKET, Strip-Mounting	
9	95655516	SCREW, Sheet Metal, 6-20 x 0.375	
10	11060828	GASKET, RFI	
11	73041900	PIN, Pivot, Cover	
12	94354901	SPRING, Gas	
13	92033221	RING, Retaining	
14	76533300	PLTAE, Wear	
15	10125711	SCREW, Flat Head, Cross Recessed, 6-32 x 0.188	
16	93187314	SCREW, Button Head, Socket Drive Nylock	
17	76533401	HINGE, Top Cover, Left	
18	93564028	WASHER, Nylon	
19	76372900	SHAFT, Hinge, Bearing	
20	76533100	BASE, Hinge, Top Cover	
21	76533400	HINGE, Top Cover, Right	
22	93592234	SCREW, Hex Washer Head Self Tapping, 10-24 x 0.250	
23	94281405	CABLE, Ground	
24	10126403	WASHER, External Tooth Lock, #10	
25	77454300	PIVOT, Support Bar	
26	92033069	RING, Retaining	
27	77446827	PANEL, Foam, Acoustical	
28	77446828	PANEL, Foam, Acoustical	
29	77446929	PANEL, Foam, Acoustical	
30	73072300	EXTENSION, Latch, Lever	
31	73072400	EXTENSION, Latch, Stud	
32	73072500	EXTENSION, Latch, Arm	
33	93530003	PIN, Roll, 1/16 x 3/16	
34	95044203	SEALANT, Anaerobic, R-green	
35	73041700	KEEPER, Latch	

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INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-3	73047600	TOP COVER SET ASSEMBLY (Contd)	
36	73044000	HINGE, Modified	
37	93199274	SCREW, Button Head, Socket Drive	
38	92376012	NUT, Self Locking, #8-32	
39	77446831	PANEL, Foam, Acoustical	
40	77446830	PANEL, Foam, Acoustical	
41	51805800	BUMPER, Self Sticking	
42	11060826	GASKET, RFI	
43	73040900	GASKET, Strip Hinge	
44	94376713	PLATE, Nut, Design	
45	75071700	PIN, Pivot, Cover	

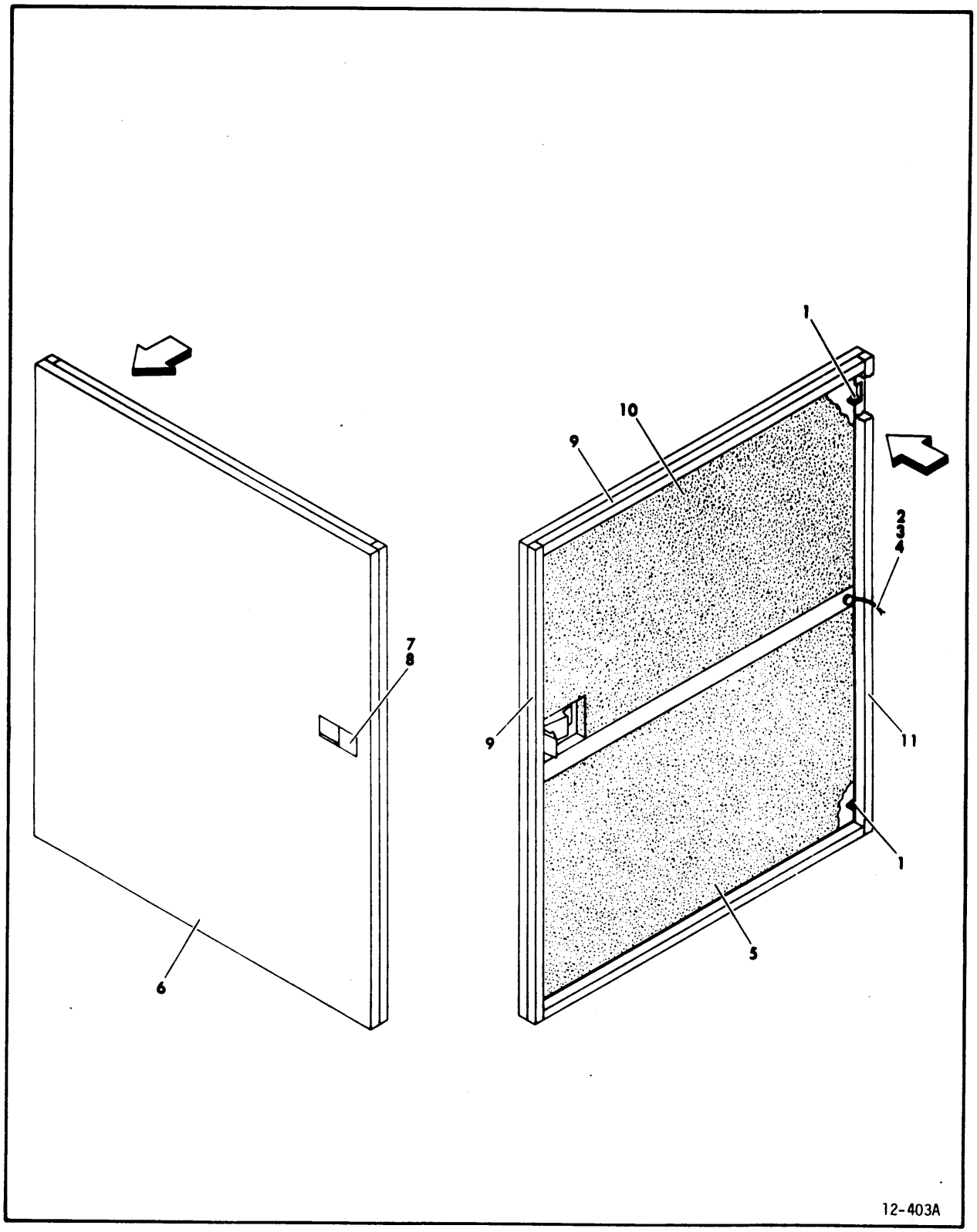

Figure 5-4. Door Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-4	77446700	DOOR ASSEMBLY	
1	92373003	NYLINER, Snap-In	
2	94281405	CABLE, Ground	
3	93592238	SCREW, Hex Washer Head Self Tapping, 10-24 x 0.250	
4	10126403	WASHER, External Tooth Lock, #10	
5	77446807	PANEL, Foam Acoustical	
6	77442709	DOOR	
7	94224907	SPACER, Slam Latch	
8	94221400	LATCH, Flush	
9	94001004	TAPE, Foam	
10	77446808	PANEL, Foam, Acoustical	
11	94001002	TAPE, Foam	

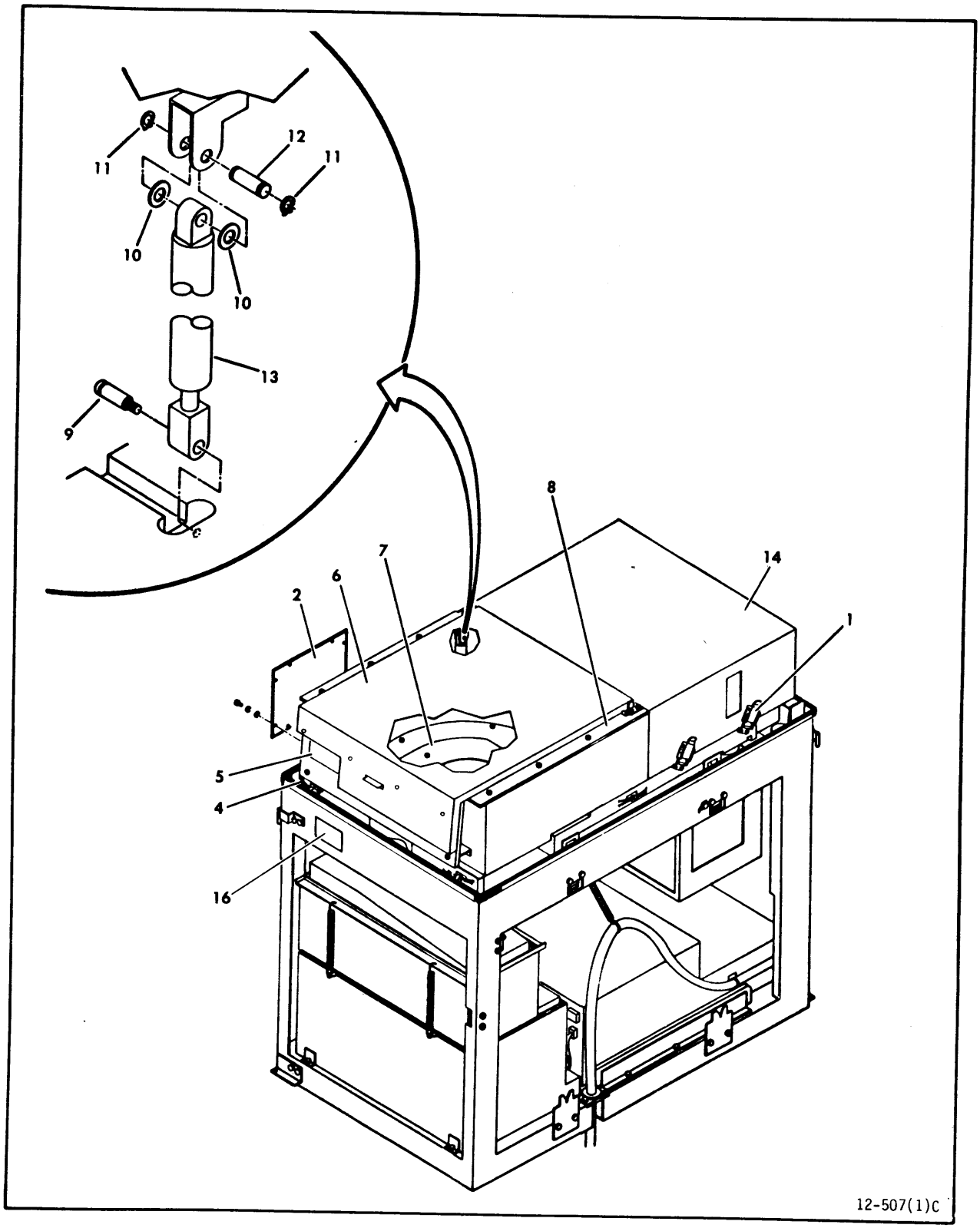

Figure 5-5. Final Frame Assembly (Sheet 1 of 3)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-5	77450335	FINAL FRAME ASSEMBLY	BJ4A3C
5-5	77450336	FINAL FRAME ASSEMBLY (Sheet 1 of 3)	BJ4A3D
1	94356902	CATCH, Spring Compression	
		(ATTACHING PARTS)	
	17901509	SCREW, Phillips Thread Roll Machine, 6-32 x 0.375	
2	77456300	COVER, Side, Shroud	
		(ATTACHING PARTS)	
	94001100	TAPE, Foam	
	10127112	SCREW, Phillips Pan Head Machine, 6-32 x 0.312	
	10125605	WASHER, Flat, #6	
	10125803	WASHER, Spring Lock, #6	
3		NOT USED	
4	47340300	CONTROL PANEL HARNESS ASSEMBLY	A2PA80 to A4P201
		(ASSOCIATED PARTS)	
	94261810	CONNECTOR, Body	
	94245602	CONTACT, Crimp	
		- - - * - - -	
5		CONTROL PANEL SWITCH ASSEMBLY (See Figure 5-9)	
6		PACK ACCESS COVER ASSEMBLY (See Figure 5-8)	
7	76041100	COVER, Parking Brake	
		(ATTACHING PARTS)	
	10127112	SCREW, Phillips Pan Head Machine, 6-32 x 0.312	
	10125803	WASHER, Spring Lock, #6	
	10125605	WASHER, Flat, #6	
		- - - * - - -	
8		SHROUD COVER ASSEMBLY (See Figure 5-6)	
9	73229005	STUD	
10	93564002	WASHER, Nylon	
11	92033221	RING, Retaining	
12	77442800	PIN, Pivot, Cover	
13	94354904	SPRING, Gas	
14	77446300	DECK COVER ASSEMBLY	
15		NOT USED	
16	21987640	LABEL, FCC, Compliance	S/C 34 & Above only.

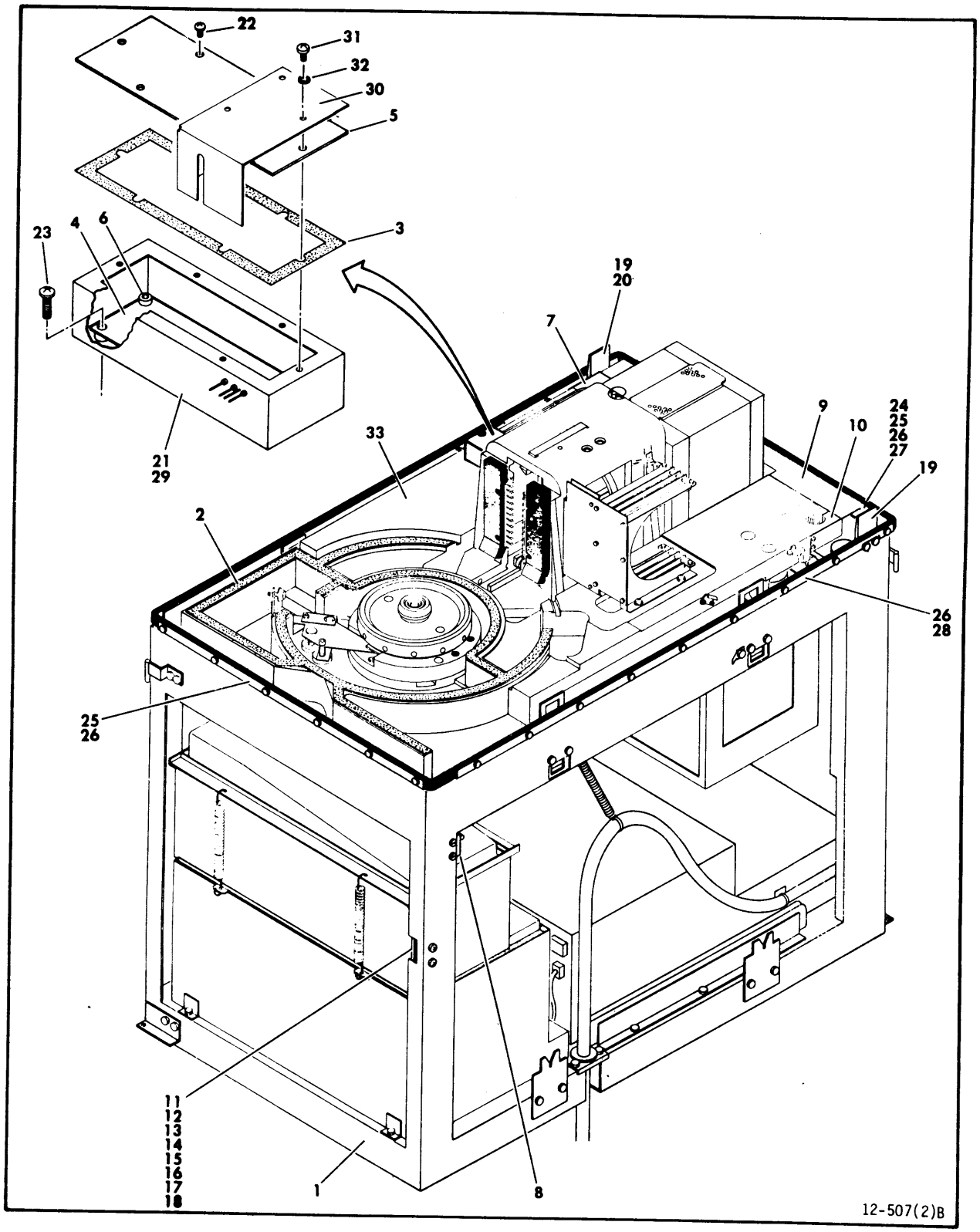

Figure 5-5. Final Frame Assembly (Sheet 2 of 3)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-5		FINAL FRAME ASSEMBLY (Sheet 2)	
1		FRAME ASSEMBLY (See Figure 5-11)	
2	94001100	TAPE, Foam	
3	82337100	GASKET BOX, Preamplifier	
4	##	COMPONENT ASSEMBLY, Type _ZQN	
5	82334900	COVER, Preamplifier	
6	10126217	SCREW, Hexagon Socket Head Cap, 6-32 x 0.250	
7	72826001	BLOCK, Clamp, Harness (Right)	
		(ATTACHING PARTS)	
	93592162	SCREW, Hex Washer Head Self Tapping, 6-32 x 0.375	
	72825900	CLAMP, Deck Harness	
		- - - * - - -	
8	77455900	BAR, Front	
		(ASSOCIATED PARTS)	
	92615003	WASHER, Fibre Shoulder	
	10127335	SCREW, Pan Head Machine, 6-32 x 0.500	
	10125605	WASHERS, Flat, #6	
	10126103	WASHERS, Internal Tooth Lock, #6	
	10125105	NUT, Hex, #6-32	
		- - - * - - -	
9	77444800	PANEL, Deck Seal, Rear	
10	75203500	BLOCK, Clamp, Harness	
		(ATTACHING PARTS)	
	93592162	SCREW, Hex Washer Head Self Tapping, 6-32 x 0.375	
	72825900	CLAMP, Deck Harness	
		- - - * - - -	
11	77455000	LATCH, Door, Front	
	72825900	CLAMP, Deck Harness	
12	77455100	LATCH, DOOR	
13	10127112	SCREW, Pan Head Machine, 6-32 x 0.312	
14	10125605	WASHER, Flat, #6	
15	10126403	WASHER, External Tooth Lock, #10	
16	10125107	NUT, Hex, #10-24	
17	10127132	SCREW, Phillips Pan Head Machine, 10-24 x 0.500	
18	10125803	WASHER, Spring Lock, #6	

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-5		FINAL FRAME ASSEMBLY (Sheet 2 Contd)	
19	77454400	GUIDE, Top Cover	
		(ATTACHING PARTS)	
	92615003	WASHER, Fibre Shoulder	
	75173305	NUT, Plate	
	92748244	SCREW, Phillips Pan Head Machine, 10-24 x 0.750	
		- - - * - - -	
20	77455800	BAR, Back	
21	82333201	CAPACITOR & BOX ASSEMBLY	
22	10127102	SCREW, Phillips Pan Head Machine, 4-40 x 0.250	
23	17901510	SCREW, Phillips Thread Roll, 6-32 x 0.500	
24	73047000	BRACKET, Seal	
25	73046900	STRIP, EMC, Gasket	
26	93592158	SCREW, Hex Washer Head Self Tapping, 6-32 x 0.250	
27	11060828	GASKET, RFI	
28	73046800	STRIP, EMC, Gasket	
29	47286000	BOX, Pre-Amp	
30	72877420	SHIELD, Servo Connector	
31	10127104	SCREW, Phillips Pan Head Machine, 4-40 x 0.375	
32	10126401	WASHER, External Tooth Lock, #4	
33		DECK ASSEMBLY (See Figure 5-17)	

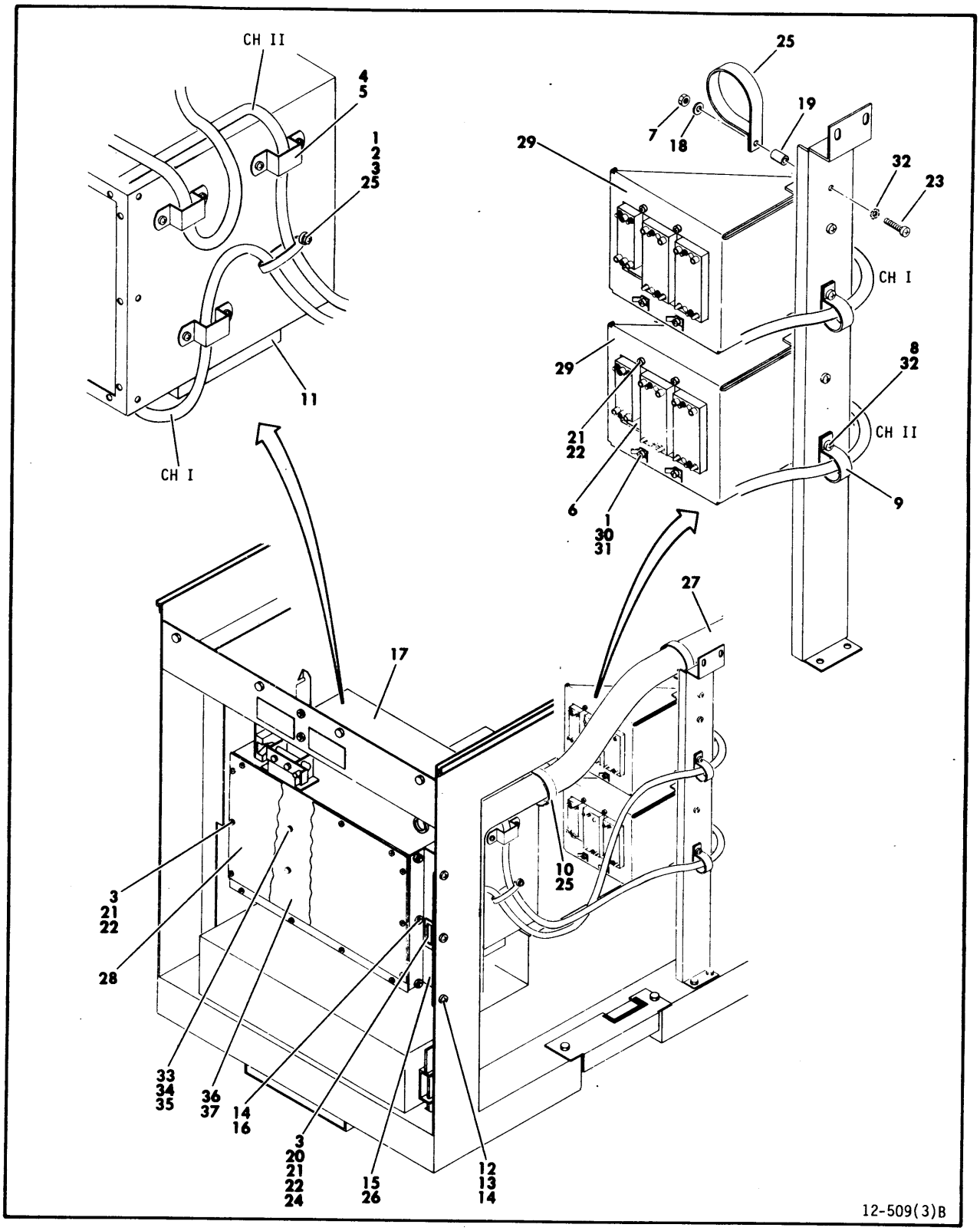

Figure 5-5. Final Frame Assembly (Sheet 3 of 3)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-5		FINAL FRAME ASSEMBLY (Sheet 3)	
1	10126401	WASHER, External Tooth Lock, #6	
2	10125605	WASHER, Flat, #6	
3	10127114	SCREW, Phillips Pan Head Machine, 6-32 x 0.500	
4	93660043	SCREW, Phillips Pan Head Machine, 6-32 x 0.375	
5	83278001	STRAP, Cable, Large	
6		I/O CABLE AND BRACKET ASSEMBLY (See Figure 5-10)	
7	53777903	NUT, Lock, Captivated, #8	
8	10127123	SCREW, Phillips Pan Head Machine, 8-32 x 0.500	
9	92602014	CLAMP, Cable, Nylon	
10	93592240	SCREW, Hex Washer Head, Self Tapping, 10-24 x 0.500	
11	72874620	PLENUM, Air, Logic	
		(ATTACHING PARTS)	
	10127112	SCREW, Phillips Pan Head Machine, 6-32 x 0.312	
	93660041	SCREW, Pan Head Machine, 6-32 x 0.312	
	10126401	WASHER, External Tooth Lock, #6	
		- - - * - - -	
12	10127131	SCREW, Phillips Pan Head Machine, 10-24 x 0.375	
13	10126403	WASHER, External Tooth Lock, #10	
14	53777904	NUT, Lock, Captivated, #10	
15	83277100	HINGE, Chassic, Logic	
16	10127132	SCREW, Phillips Pan Head Machine, 10-24 x 0.500	
17		LOGIC CHASSIS ASSEMBLY (See Figure 5-7)	
18	10125606	WASHER, Flat, #8	
19	93109224	STANDOFF, Spacer	
20	77455100	LATCH, Door	
21	10127112	SCREW, Phillips Pan Head Machine, 6-32 x 0.312	
22	10125803	WASHER, Spring Lock, #6	
23	10127128	SCREW, Phillips Pan Head Machine, 8-32 x 1.250	

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-5		FINAL FRAME ASSEMBLY (Sheet 3 Contd)	
24	77454900	LATCH, Door, Rear	
25	92602017	CLAMP, Cable, Nylon	
26	94237705	SAFETY, Trim	
27	94311632	HOSE, Flexible	
28	73046500	COVER, Logic Chassis, Rear	
29	73048102	PANEL-I/O-Marked	CH I
29	73048103	PANEL-I/O-Marked	CH II
30	94274113	TERMINAL, Quick Connect	
31	10127113	SCREW, Phillips Pan Head Machine, 6-32 x 0.375	
32	10126402	WASHER, External Tooth Lock, #8	
33	93592200	SCREW, Hex Washer Head, Self Tapping, 8-32 x 0.375	
34	95655516	SCREW, Sheet Metal, 6-20 x 0.375	
35	95634809	NUT, Speed, U-Type	
36	774479XX	WIRE WRAP ASSEMBLY	
37	47203101	JUMPER PLUG ASSEMBLY	

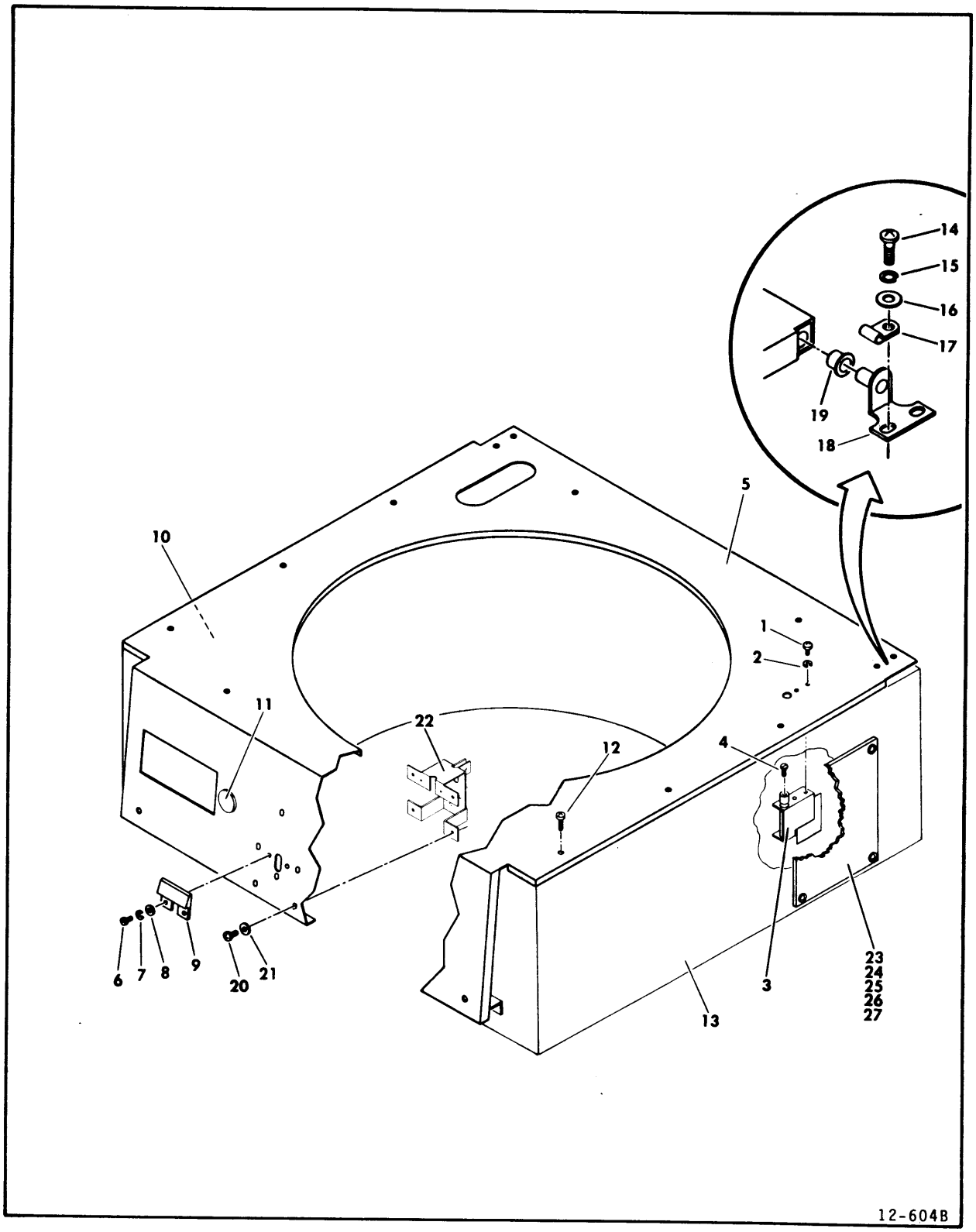

Figure 5-6. Shroud Cover Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-6	77450619	SHROUD COVER ASSEMBLY	
1	92748156	SCREW, Phillips Pan Head Machine, 6-32 x 0.188	
2	10125803	WASHER, Spring, Lock, #6	
3	##	SWITCH, Interlock, (A3S1) Pack Cover Switch	
4	93342096	SCREW, Nylon	
5	83260201	COVER, Shroud	
6	92785088	SCREW, Pan Head Machine, 4-40 x 0.500	
7	10125801	WASHER, Spring Lock, #4	
8	93211105	WASHER, Flat, #4	
9	73076801	CATCH, Pack Access Cover	
10	94001100	TAPE, Foam	
11	94279416	BUTTON, Plug	
12	92748198	SCREW, Phillips Pan Head Machine, 8-32 x 0.312	
13	83228800	SHROUD, Pack	
14	10127123	SCREW, Phillips Pan Head Machine, 8-32 x 0.500	
15	10125804	WASHER, Spring Lock, #8	
16	93211108	WASHER, Flat, #8	
17	92602001	CLAMP, Cable, Nylon	
18	77442501	HINGE, Cover, Pack Access	
19	93847002	BEARING, Flanged	
20	92748160	SCREW, Phillips Pan Head Machine, 6-32 x 0.312	
21	93211107	WASHER, Flat, #6	
22	73078000	BRACKET, Solenoid	
23	92070300	BAFFLE, Air	
24	10125105	NUT, Hex, #6-32	
25	77456200	WINDOW, Shroud	
26	93749164	SCREW, Pan Head Lockwasher	
27	76579108	GASKET, Air Seal	

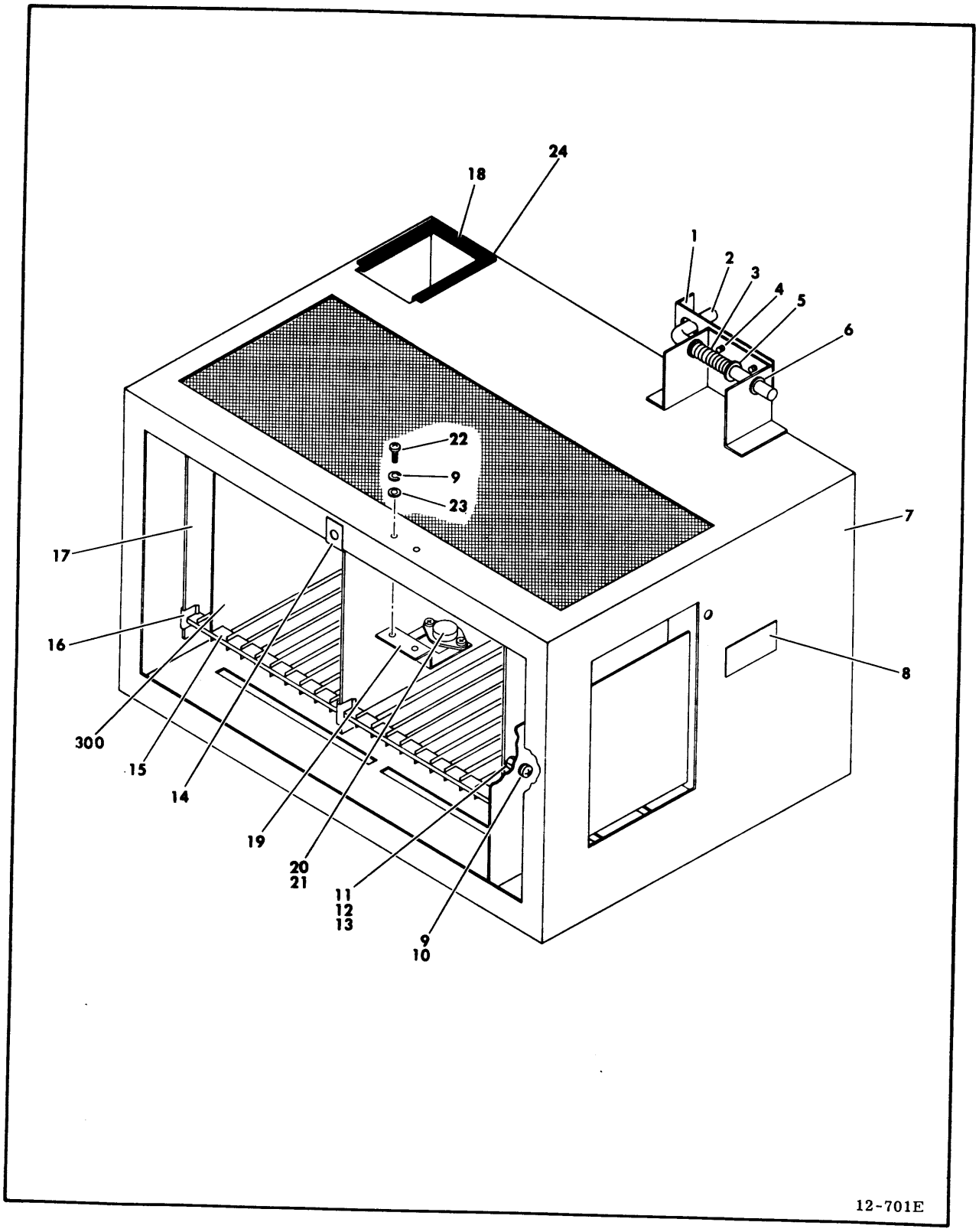

Figure 5-7. Logic Chassis Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-7	774465XX	LOGIC CHASSIS ASSEMBLY	
1	70741700	GUIDE, Latch	
2	40032301	LATCH	
3	45229900	SPRING, Compression	
4	93592158	SCREW, Hex Washer Head Self Tapping, 6-32 x 0.250	
5	92033038	RING, Retaining	
6	92373005	NYLINER, Snap-In	
7	83275302	FRAME, Logic Chassis	
8	73490302	LABEL	
9	10125803	WASHER, Spring Lock, #6	
10	10127111	SCREW, Pan Head Machine, 6-32 x 0.250	
11	10126401	WASHER, External Tooth Lock, #6	
12	93114275	STANDOFF, Tapped Post	
13	10127331	SCREW, Pan Head Machine, 6-32 x 0.188	
14	94317800	RECEPTACLE, Clip-On	
15	46490201	RAIL, Guide	
16	94309003	CLIP, U-Type	
17	77388200	PANEL, Perpendicular, 3 Position	
18	95116302	TAPE, Electrical	
19	82372000	BRACKET, Heat Switch	
20	94379103	THERMOSTAT, Manual Reset (A253)	
21	17901501	SCREW, Phillips Thread Roll, 4-40 x 0.250	
22	10127112	SCREW, Pan Head Machine, 6-32 x 0.312	
23	10125605	WASHER, Flat, #6	
24	94237706	TRIM Safety, Black	
		(ITEMS LISTED BELOW ARE NOT PART OF THE LOGIC CHASSIS ASSEMBLY)	
300	##	LOGIC CARDS	

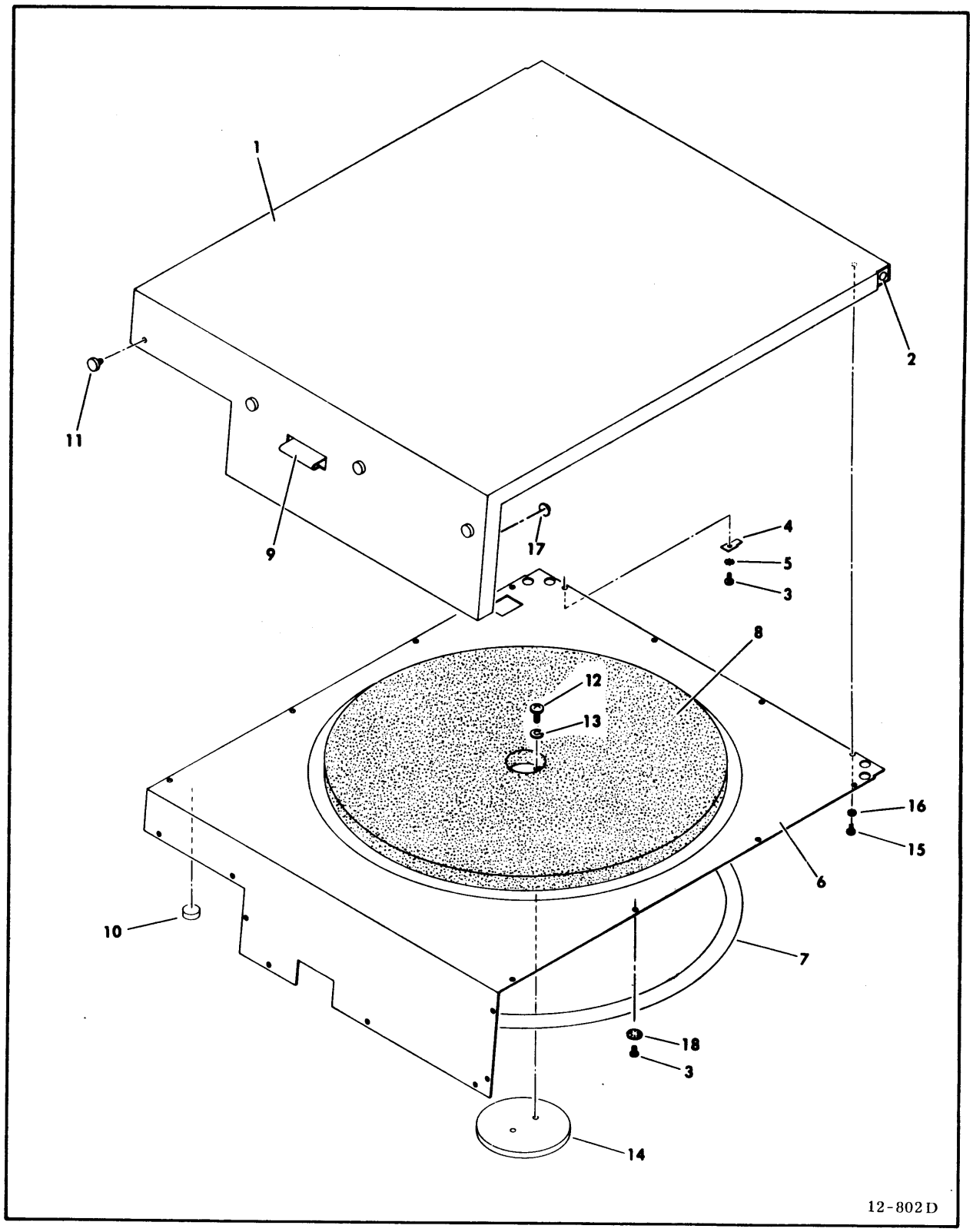

Figure 5-8. Pack Access Cover Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-8	77446936	PACK ACCESS COVER ASSEMBLY	
1	77443509	COVER, Pack Access	
2	77442400	BLOCK, Hinge	
3	93195234	SCREW, Button, 6-32 x 0.250	
4	94274101	TERMINAL, Quick Connect	
5	10126401	WASHER, External Tooth Lock, #6	
6	77443900	INSERT, Cover, Access	
7	77561403	GASKET, Extended Sponge	
8	75040456	PANEL, Foam, Acoustical	
9	75071404	LATCH AND SPRING ASSEMBLY	
10	75070701	BUMPER, Stop	
11	93549002	BUMPER	
12	10127131	SCREW, Pan Head Machine, 10-24 x 0.375	
13	10125805	WASHER, Spring Lock	
14	82379600	BUTTON, Access Cover	
15	92723196	SCREW, Button Head, Socket	
16	10125803	WASHER, Lock, #6	
17	92633026	BUMPER, Grommet	

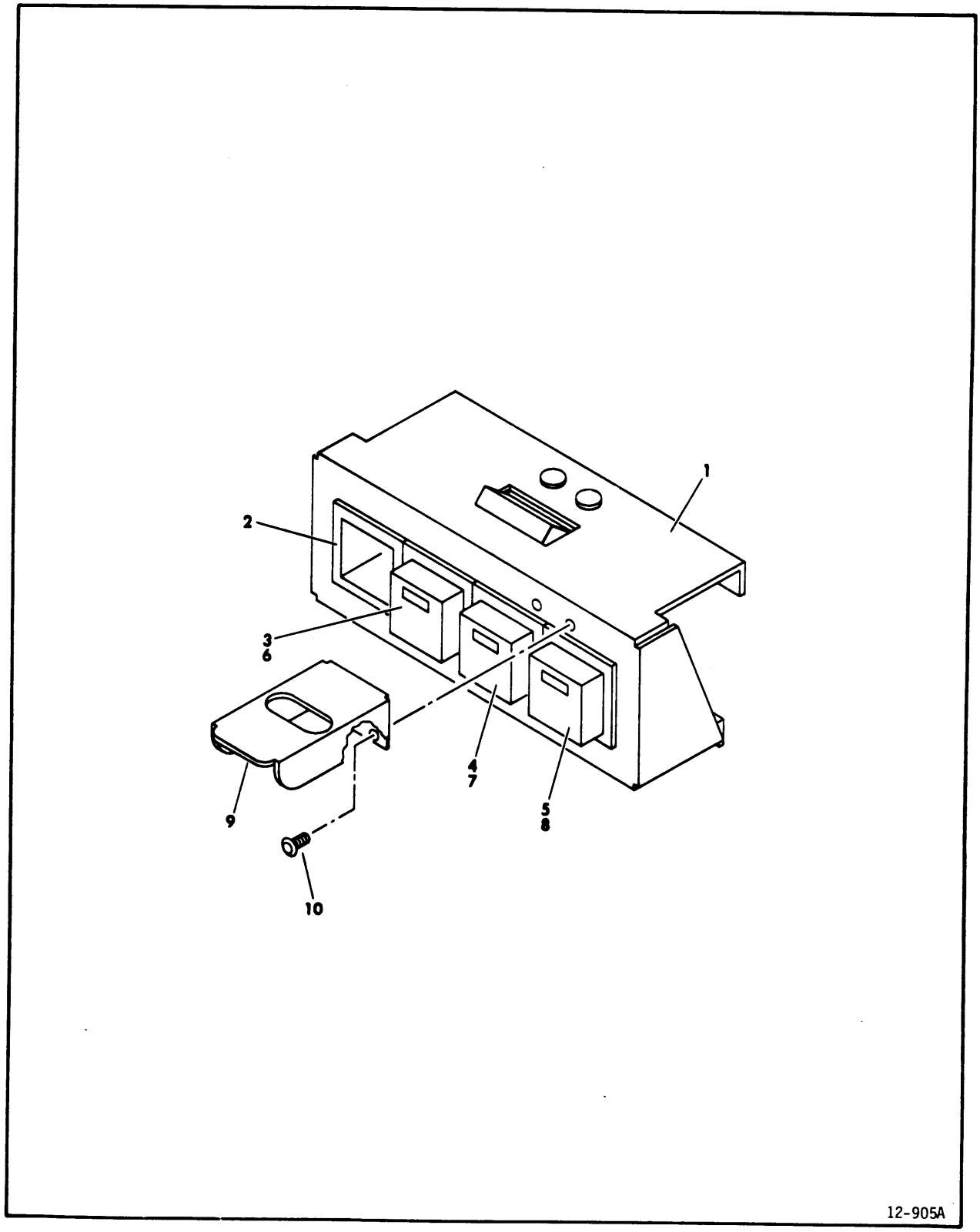

Figure 5-9. Control Panel Switch Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-9	##	CONTROL PANEL SWITCH ASSEMBLY	
1	73049600	BRACKET, Switch Assembly	
2	94398904	SWITCH, Encoding	
3	94394101	INDICATOR, Panel	
4	94394000	SWITCH, P.B. Panel w/LED Indicator (A4S3)	
5	94394009	SWITCH, P.B. Panel w/LED Indicator (A4S1)	
6	94394200	LENS-Lettered	
7	94394201	LENS-Lettered	
8	94394203	LENS-Lettered	
9	73049700	SWITCH, Cover Assembly	
10	93195156	SCREW, Button Head	
11	73048600	CABLE, Control Panel	

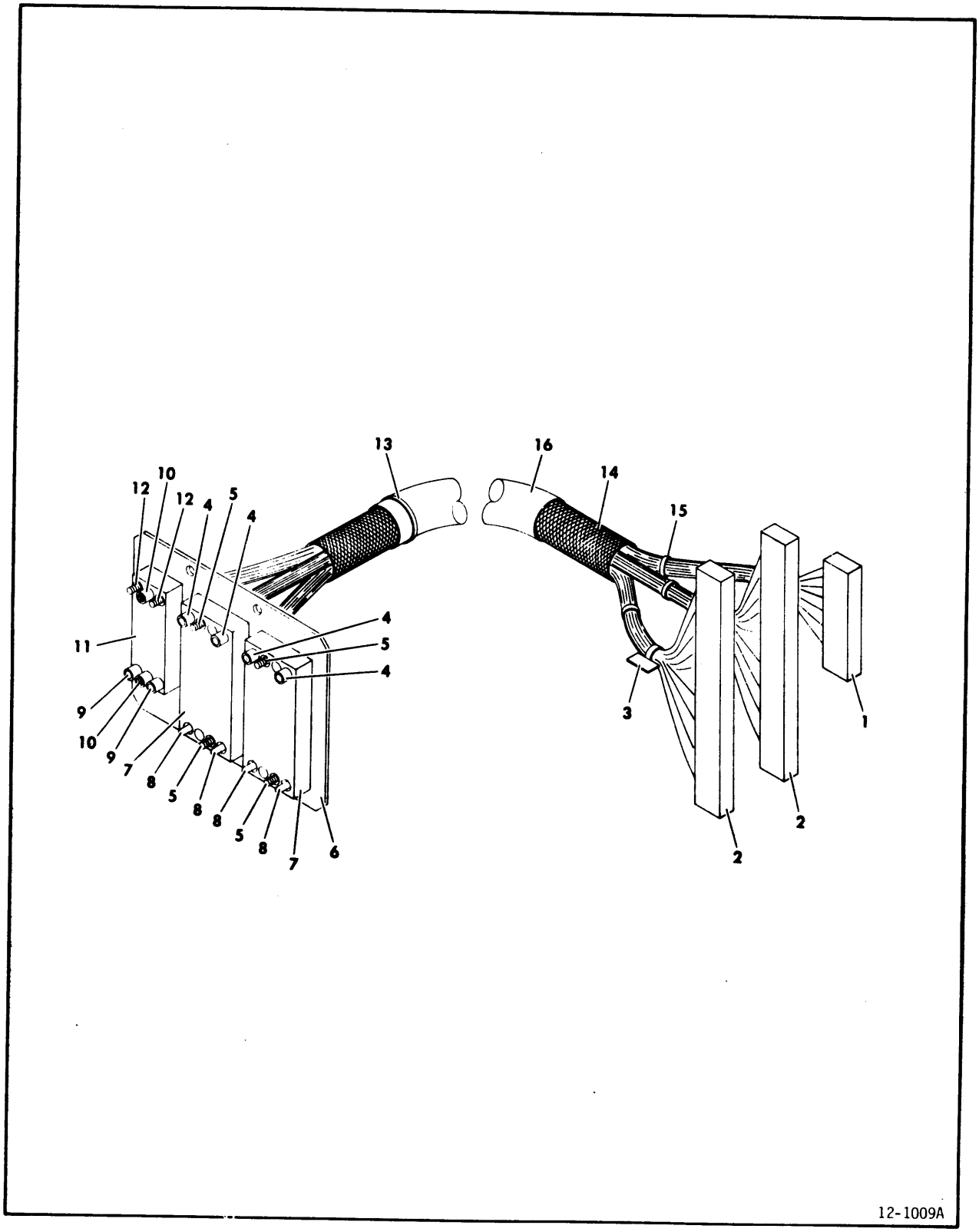

Figure 5-10. I/O Cable and Bracket Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-10	77447310	I/O CABLE AND BRACKET ASSEMBLY	CH I
5-10	77447311	I/O CABLE AND BRACKET ASSEMBLY	CH II
1	94261810	CONNECTOR, Body (A2PA05)	
		(ASSOCIATED PARTS)	
	94245601	CONTACT, Socket, 24 GA	
	94245606	CONTACT, Socket, 20 Ga or Twisted Pair	
		- - - * - - -	
2	94261811	CONNECTOR, Body, (A2PA01-A2PA02)	
		(ASSOCIATED PARTS)	
	94245601	CONTACT, Socket, 24 GA	
	94245606	CONTACT, Socket, 20 GA or Twisted Pair	
		- - - * - - -	
3	94277409	STRAP, Cable Tie	
4	93642005	CONNECTOR, Corner Guide Socket	
5	93643006	CONNECTOR, Jackscrew, Male	
6	82355600	PLATE, I/O Panel	
7	94281201	CONNECTOR, 75 Pin (A3J3-A3J4)	
		(ASSOCIATED PARTS)	
	93645026	CONTACT, Socket, 24 GA	
	93645015	CONTACT, Socket, 20 GA	
	93645027	CONTACT, Socket, 16 GA or Twisted Pair	
		- - - * - - -	
8	93642004	CONNECTOR, Corner Guide Pin	
9	93643005	CONNECTOR, Corner Guide, Socket	
10	93643007	CONNECTOR, Jackscrew, Female	
11	93643016	CONNECTOR, Block (A3J2)	
		(ASSOCIATED PARTS)	
	93645026	CONTACT, Socket, 24 GA	
	93645015	CONTACT, Socket, 20 GA	
		- - - * - - -	
12	93643004	CONNECTOR, Corner Guide Pin	
13	94277400	CABLE, Tie Strap	
14	24534811	SHIELDING, Elec. Braided, Bulk	
15	94277411	STRAP, Cable Tie	
16	95048803	SLEEVING, Braided	

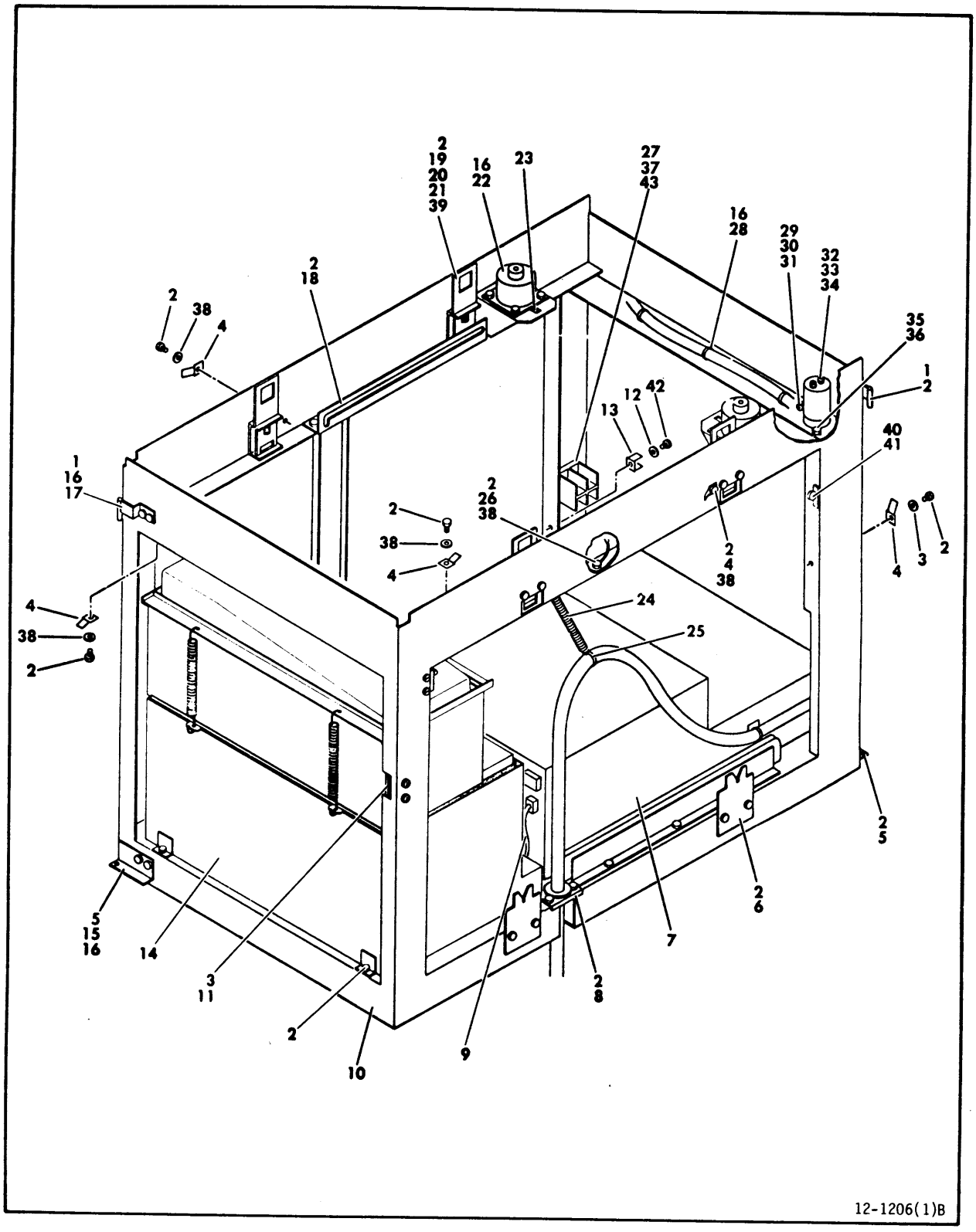

Figure 5-11. Frame Assembly (Sheet 1 of 2)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-11	77447026	FRAME ASSEMBLY (Sheet 1 of 2)	
1	83242700	HINGE, Top, Door	
2	93592238	SCREW, Hex Washer Head Self Tapping, 10-24 x 0.375	
3	10126403	WASHER, External Tooth Lock, #10	
4	94274140	TERMINAL, Quick Connect	
5	83242800	HINGE, Bottom, Door	
6	77443801	BRACKET, Panel, Side	
7		POWER SUPPLY ASSEMBLY (See Figure 5-13)	
		(ATTACHING PARTS)	
	93592238	SCREW, Hex Washer Head Self Tapping, 10-24 x 0.375	
		- - - * - - -	
8	77453800	BRACKET, Snap Bushing	
9	77448900	BLOWER CABLE ASSEMBLY	
		(ASSOCIATED PARTS)	
	51906001	CONNECTOR, Plug (A1P2 & A1P9)	
	51905800	CONTACT, Pin	
		- - - * - - -	
10	73046701	FRAME, Main	
11	10125107	NUT, Hex, #10-24	
12	09040203	WASHER, Lock, Dished Type	
13	94274117	TERMINAL, Quick Connect	
14		BLOWER PLENUM ASSEMBLY (See Figure 5-12)	
15	77443101	SPACER, Hinge	
16	93592240	SCREW, Hex Washer Head Self Tapping, 10-24 x 0.500	
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	

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INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-11	774470XX	FRAME ASSEMBLY (Sheet 1 of 2 Contd))	
27	94391000	TERMINAL BLOCK, Heavy Duty	
		(ATTACHING PARTS)	
	10127348	SCREW, Pan Head Machine, 8-32 x 0.750	
	53777903	NUT & CAPTIVE WASHER	
		- - - * - - -	
28	94277406	STRAP, Cable Tie	
29	10125105	NUT, Hex, #6-32	
30	10127115	SCREW, Phillips Pan Head Machine, 6-32 x 0.625	
31	10125605	WASHER, Flat, #6	
32	10127142	SCREW, Phillips Pan Head Machine, 10-32 x 0.375	
33	10126105	WASHER, Internal Tooth Lock, #10	
34	92632017	CAPACITOR, Electrolystic (A3C1)	
35	93592158	SCREW, Hex Washer Head Self Tapping, 6-32 x 0.250	
36	92691003	CLAMP, Capacitor, Mounting	
37	93592202	SCREW, Hex Washer Head Self Tapping, 8-32 x 0.500	
38	09040204	WASHER, Lock, Dished Type	
39	73046600	SHIM, Side Panel	
40	94277503	BASE, Mounting	
41	94277401	STRAP, Cable Tie	
42	93592200	SCREW, Hex Washer Head Self Tapping, 8-32 x 0.375	
43	94356700	CABLE, Vinyl Coated Braid	

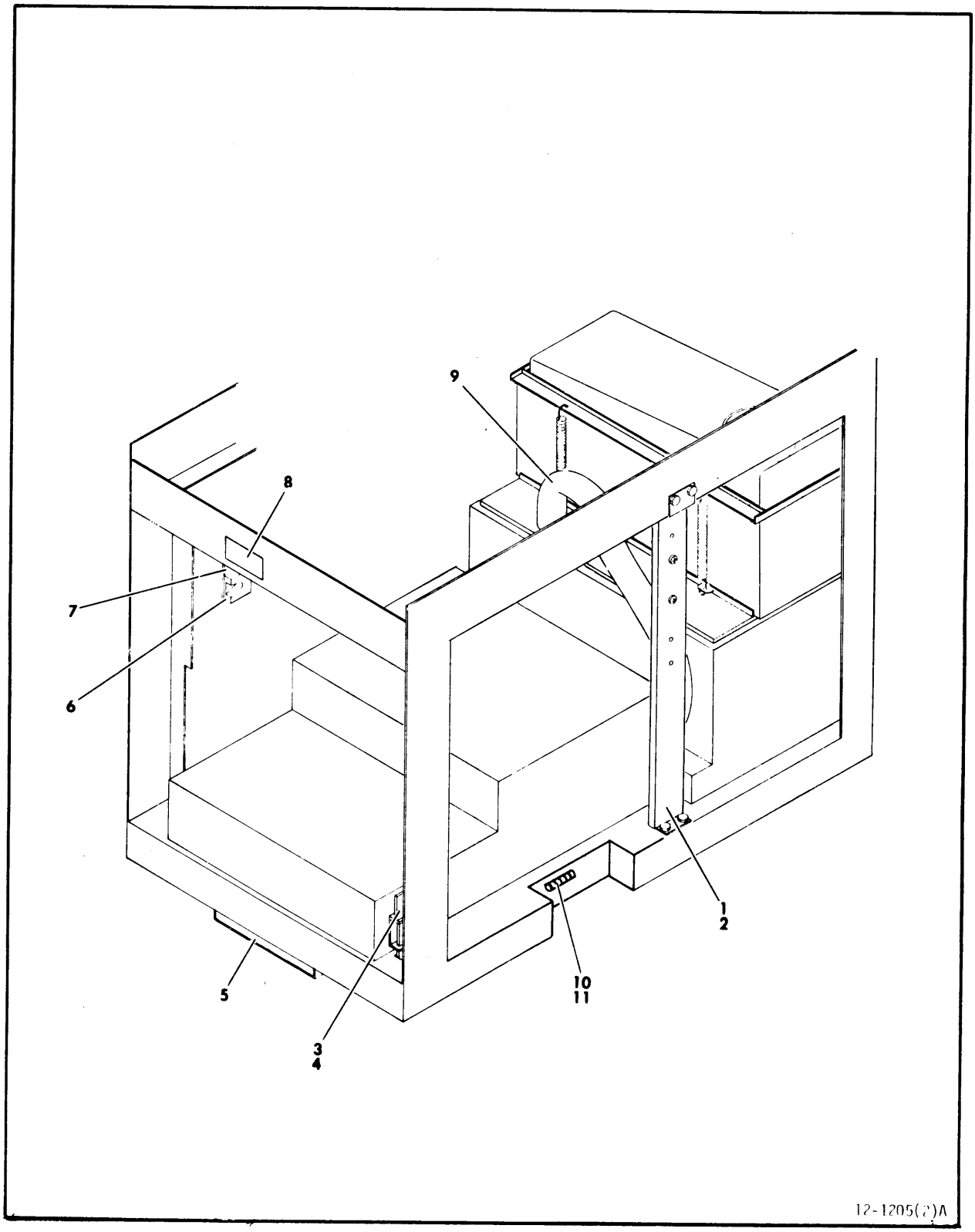

Figure 5-11. Frame Assembly (Sheet 2 of 2)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-11		FRAME ASSEMBLY (Sheet 2)	
1	47298602	MOUNT, Bracket, I/O	
2	93592238	SCREW, Hex Washer Head Self Tapping, 10-24 x 0.375	
3	77454500	SPRING, Compression	
4	77449600	LATCH, Power Supply	
5	##	FILTER, Aluminum, Washable	
6	70741800	LATCH, Stop	
		(ATTACHING PARTS)	
	10125607	WASHER, Flat, #10	
	92721284	SCREW, Button, Socket Head	
	92071007	NUT, Hex, #10-24	
		- - - * - - -	
7	77445700	BRACKET, Catch, Logic	
		(ATTACHING PARTS)	
	93592238	SCREW, Hex Washer Head Self Tapping, 10-24 x 0.375	
		- - - * - - -	
8	92006808	PLATE, ID	
9	94311633	HOSE, Flexible	
10	73050901	CLAMP, Cable	
11	93592210	SCREW, Hex Washer Self Tapping, 8-32 x 1.000	

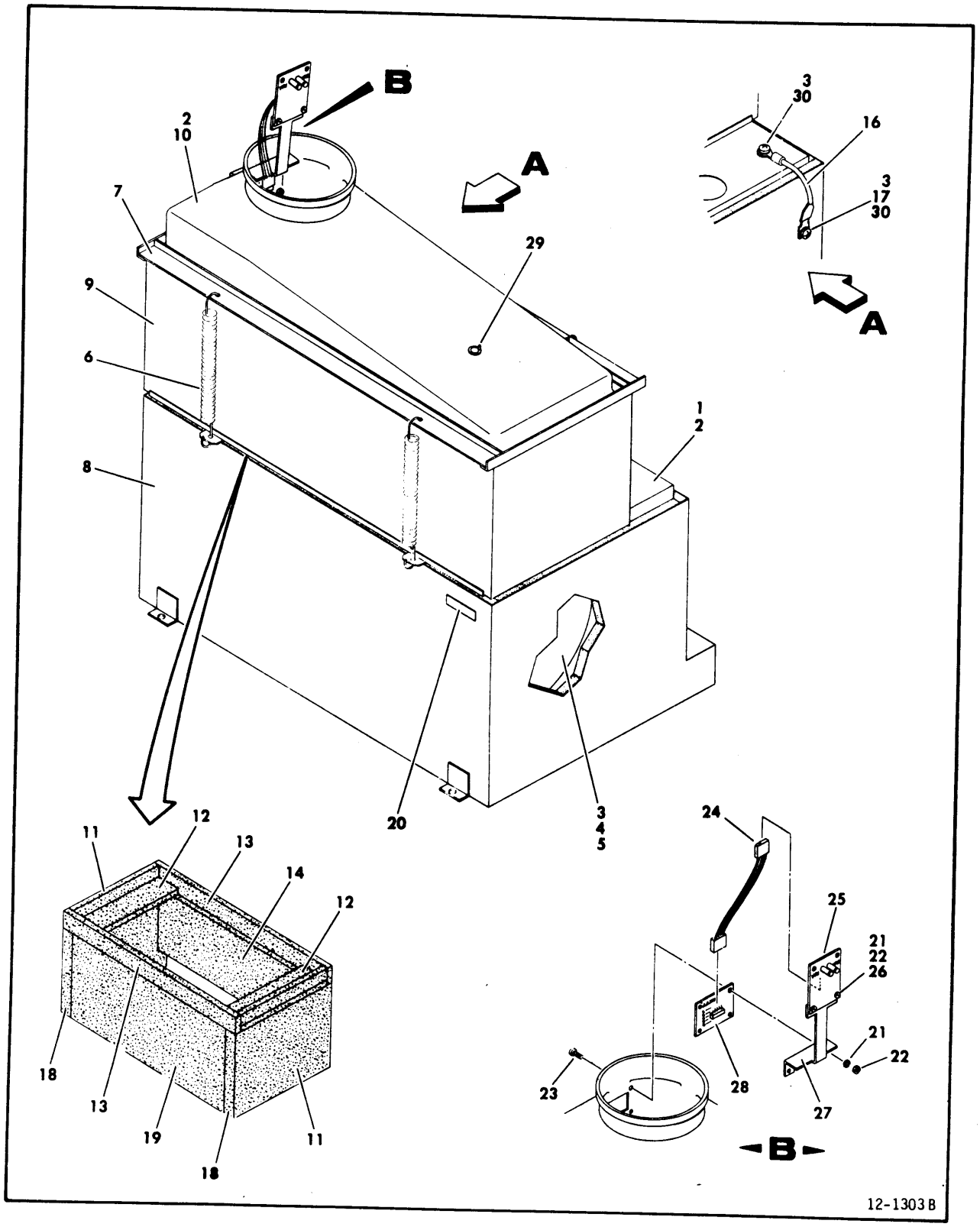

Figure 5-12. Blower Plenum Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-12	72877000	BLOWER PLENUM ASSEMBLY	
1	77441300	MOUNT, Blower	
2	94276600	TAPE, Foam	
3	93660123	SCREW, Phillips Pan Head Machine, 10-24 x 0.312	
4	##	BLOWER AND CONNECTOR ASSEMBLY	
5	10125805	WASHER, Spring Lock, #10	
6	41275402	SPRING, Extension	
7	77457500	CLAMP, Plenum Exhaust	
8	77441200	PLENUM, Intake	
9	##	FILTER, Air	
10	47406500	PLENUM, Exhaust	
11	77446804	PANEL, Foam, Acoustical	
12	77446811	PANEL, Foam, Acoustical	
13	77446801	PANEL, Foam, Acoustical	
14	77446802	PANEL, Foam, Acoustical	
15		NOT USED	
16	94281495	CABLE, Ground	
17	94274140	TERMINAL, Quick Connect	
18	77446803	PANEL, Foam, Acoustical	
19	77446800	PANEL, Foam, Acoustical	
20	73490302	LABEL	
21	10125801	WASHER, Spring Lock, #4	
22	10125103	NUT, Hex, Machine, #4-40	
23	10127322	SCREW, Pan Head Machine, 4-40 x 0.375	
24	47408000	JUMPER CABLE ASSEMBLY AAGN	
25	50102500	COMPONENT ASSEMBLY	
26	10127320	SCREW, Pan Head Machine, 4-40 x 0.250	
27	47406600	BRACKET, Sensor Mounting	
28	50108500	COMPONENT ASSEMBLY AAXN	
29	94353207	CAPS & PLUGS, Plastic (Red)	
30	09040204	WASHER, Lock, Dished	

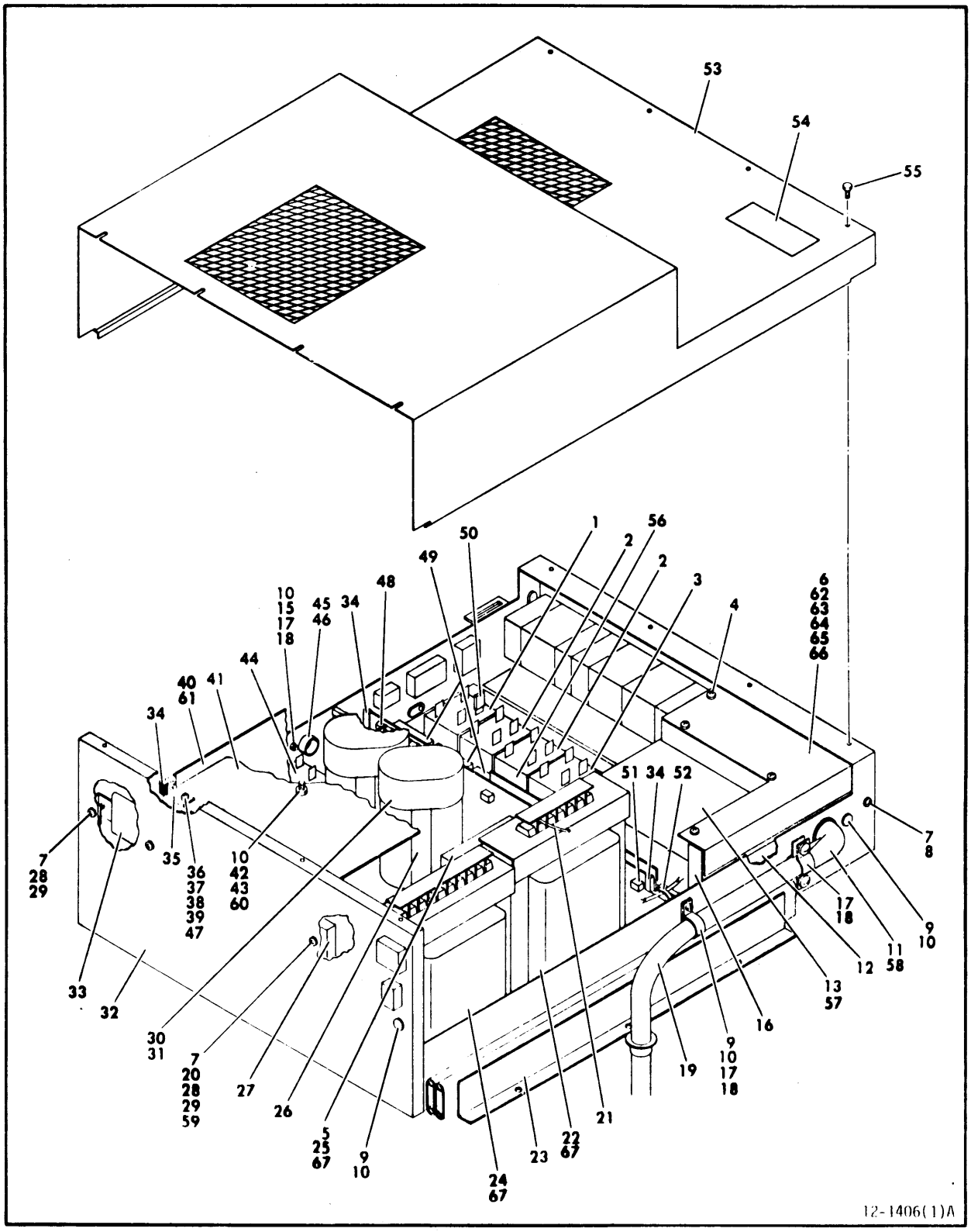

Figure 5-13. Power Supply Assembly (Sheet 1 of 2)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-13	##	POWER SUPPLY ASSEMBLY (Sheet 1 of 2)	
1	##	SWITCH, Solid State, AC, 15 A (A1Q4)	
2	##	SWITCH, Solid State, AC, 30 A (A1Q2 & A1Q3)	
3	##	SWITCH, Solid State, AC, 15 A (A1Q1)	
		(ATTACHING PARTS FOR INDEX NOS 1 THRU 3)	
	93590198	SCREW, Phillips Pan Head Self Tapping, 8-32 x 0.312	
	10126402	WASHER, External Tooth Lock, #8	
	93590200	SCREW, Phillips Pan Head Self Tapping, 8-32 x 0.375	
		- - - * - - -	
4	93590198	SCREW, Phillips Pan Head Self Tapping, 8-32 x 0.312	
5	77441000	CLAMP, Transformer	
6	75166900	COVER, Shield, Filter	
7	10126402	WASHER, External Tooth Lock, #8	
8	10127120	SCREW, Pan Head Machine, 8-32 x 0.250	
9	10125108	NUT, Hex, #10-32	
10	10126403	WASHER, External Tooth Lock, #10	
11	93299001	CONNECTOR, 90 Angle	
12	95660411	TAPE, Glass Cloth, 2 Width	
13	##	FILTER, RFI	
14		NOT USED	
15	95673184	SPACER, Thread, 10-32 x 1.000	
16	73049000	SHIELD, Filter	
17	94277406	STRAP, Cable Tie	
18	93590200	SCREW, Phillips Pan Head Self Tapping 8-32 x 0.375	

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-13		POWER SUPPLY ASSEMBLY (Sheet 1 of 2 Contd)	
19		POWER CABLE ASSEMBLY (See Figure 5-14)	
20	10127126	SCREW, Phillips Pan Head Machine, 8-32 x 0.875	
21	77447508	AC HARNESS ASSEMBLY	
22	##	TRANSFORMER, Ferro, (A1T2)	
		(ATTACHING PARTS)	
	10125108	NUT, Hex, #10-32	
	10126403	WASHER, External Tooth Lock, #10	
	10125607	WASHER, Flat, #10	
		- - - * - - -	
23	94383501	SLIDE, Ball Bearing	
		(ATTACHING PARTS)	
	93590196	SCREW, Phillips Pan Head Self Threading, 8-32 x 0.250	
		- - - * - - -	
24	##	TRANSFORMER, Ferro, (A1T1)	
		(ATTACHING PARTS)	
	10125108	NUT, Hex, #10-32	
	10126403	WASHER, External Tooth Lock, #10	
	10125607	WASHER, Flat, #10	
		- - - * - - -	
25	##	TRANSFORMER ASSEMBLY (A1T3)	
		(ATTACHING PARTS)	
	10125606	WASHER, Flat, #8	
	93590200	SCREW. Phillips Pan Head Self Threading, 8-32 x 0.375	
		- - - * - - -	

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-13		POWER SUPPLY ASSEMBLY (Sheet 1 of 2 Contd)	
26	95641708	CAPACITOR, Clamp, Hold-Down	
		(ATTACHING PARTS)	
	10125606	WASHER, Flat, #8	
	10126402	WASHER, External Tooth Lock, #8	
	93590198	SCREW, Phillips Pan Head Self Threading, 8-32 x 0.312	
		- - - * - - -	
27	##	RECTIFIER, Bridge (A1CR1-A1CR4)	
28	10125106	NUT, Hex, #8-32	
29	10127125	SCREW, Pan Head Machine, 8-32 x 0.750	
30	##	CAPACITOR, 660 V ac (A1C1 & A1C2)	
31	95582501	BOOT, Double Entrance	
32	83229500	CABINET, Power Supply	
33	95667406	RESISTOR, 30 W, 10 ohm (A1R3)	
34	94237705	TRIM, Safety, Black	
35	77444100	CLAMP, Board, Power A	
36	10125105	NUT, Hex, #6-32	
37	10126103	WASHER, Internal Tooth Lock, #6	
38	10127112	SCREW, Pan Head Machine, 6-32 x 0.312	
39	10125605	WASHER, Flat, #6	
40		COMPONENT ASSEMBLY, Type _ZCN (See Figure 5-16)	
41		COMPONENT ASSEMBLY, Type _YEN (See Figure 5-15)	
42	10125607	WASHER, Flat, #10	
43	77449200	ROD, Capacitor Board	
44	94371301	SWITCH, Solid State, AC, 15 A (A1Q5)	
		(ATTACHING PARTS)	
	10126401	WASHER, External Tooth Lock, #6	
	10127114	SCREW, Pan Head Machine, 6-32 x 0.500	
	10125105	NUT, Hex, #6-32	
		- - - * - - -	
45	94274101	TERMINAL- Quick Connect	
46	15012412	BUSHING, Snap-In	
47	94385500	GROMMET, Extruded	

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INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-13		POWER SUPPLY ASSEMBLY (Sheet 1 of 2 Contd)	
48	94272333	TERMINAL BLOCK, Single Screw	
		(ATTACHING PARTS)	
	10127115	SCREW, Pan Head Machine, 6-32 x 0.625	
	10126401	WASHER, External Tooth Lock, #6	
	10125105	NUT, Hex, #6-32	
	10125613	WASHER, Flat, #6	
	92496433	CAPACITOR, Non Electrolytic, 220 V, 0.22 uf	
		- - - * - - -	
49	##	CONTACTOR, 24 V dc (A1K6, A1K7, A1K8)	
		(ATTACHING PARTS)	
	10126402	WASHER, External Tooth Lock, #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	77443201	COVER, Power Supply	
54	92006903	PLATE, Warning	
55	93592196	SCREW, Hex Washer Head Self Tapping, 8-32 x 0.250	
56	##	COMPONENT ASSEMBLY, Type -YFN	
57	10127130	SCREW, Phillips Pan Head Machine, 10-24 x 0.312	
58	95641521	WASHER, Flat	
59	10127126	SCREW, Phillips Pan Head Machine, 8-32 x 0.875	
60	95673184	SPACER, Thread, 10-32 x 1.000	
61	94001025	TAPE, Foam	
62	75167100	RC FILTER, Assembly	
63	10127116	SCREW, Phillips Pan Head Machine, 6-32 x 0.750	
64	10125605	WASHER, Flat, #6	
65	10126401	WASHER, External Tooth Lock, #	
66	10125105	NUT, Hex, #6-32	
67	92376014	NUT, Lock	

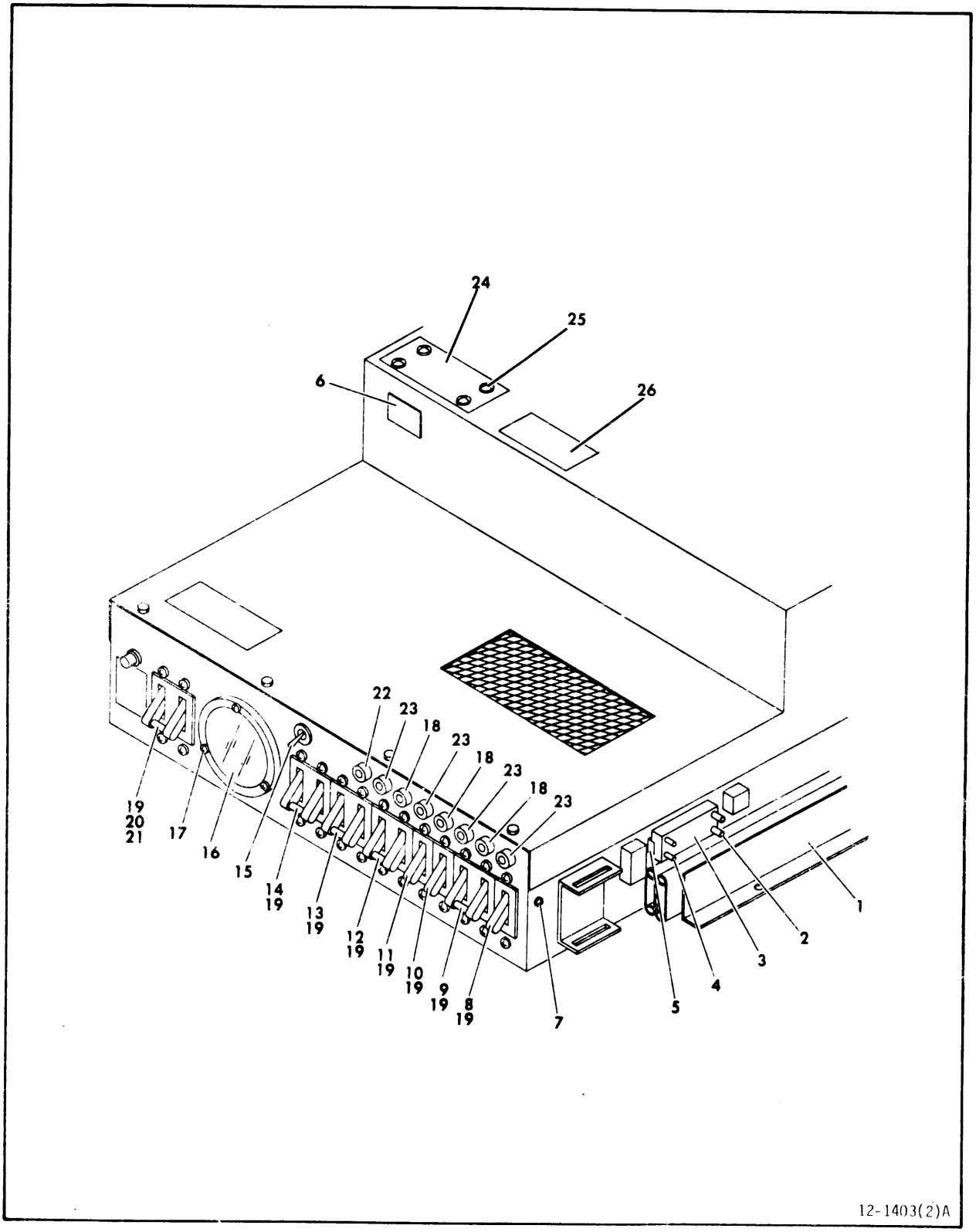

Figure 5-13. Power Supply Assembly (Sheet 2 of 2)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-13		POWER SUPPLY ASSEMBLY (Sheet 2)	
1	94383502	SLIDE, Ball Bearing	
		(ATTACHING PARTS)	
	93590196	SCREW, Phillips Pan Head Self Threading, 8-32 x 0.250	
		- - - * - - -	
2	93643005	CONNECTOR, Corner Guide, Socket	
3	77447704	DC HARNESS ASSEMBLY	
4	93643004	CONNECTOR, Corner Guide, Pin	
5	93643020	CATCH, Connector	
6	24547559	PLATE, Warning	
7	93590196	SCREW, Phillips Pan Head Self Threading, 8-32 x 0.250	
8	##	CIRCUIT BREAKER, 0.5 A ±28 V (A1CB8)	
9	##	CIRCUIT BREAKER, 2 A, 50 V dc +20 V (A1CB7)	
10	##	CIRCUIT BREAKER, 5 A -9.7 V (A1CB6)	
11	##	CIRCUIT BREAKER, 8 A +9.7 V (A1CB5)	
12	##	CIRCUIT BREAKER, 7 A, 50 V dc +46 V (A1CB4)	
13	##	CIRCUIT BREAKER, U/L Recognized, Drive Motor (A1CB3)	
14	##	CIRCUIT BREAKER, 0.375 A, 250 V ac +20Y (A1CB2)	
		(ATTACHING PARTS FOR INDEX NOS 8 THRU 14)	
	10126103	WASHER, Internal Tooth Lock, #6	
	93749158	SCREW, Pan Head Machine, 6-32 x 0.188	
		- - - * - - -	
15	##	SWITCH, Toggle (Local/Remote)	
16	##	METER, Hour, AC (A1M1)	
17	17901502	SCREW, Pan Head Machine, 4-40 x 0.375	

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INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-13		POWER SUPPLY ASSEMBLY (Sheet 2 Contd)	
18	95644003	JACK, Banana (A1TP3, A1TP5, A1TP7)	
19	95524408	WASHER, Lock, #10	
20	##	CIRCUIT BREAKER, U/L Recognized, AC Main Power (A1CB1)	
		(ATTACHING PARTS)	
	10126103	WASHER, Internal Tooth Lock, #6	
	93749158	SCREW, Pan Head Machine, 6-32 x 0.188	
		- - - * - - -	
21	76416500	INSULATOR, Terminal	
22	95644001	JACK, Banana (A1TP1)	
23	95644000	JACK, Banana, (A1TP2, A1TP4, A1TP6, A1TP8)	
24	72896000	COVER, Fuse	
25	17901515	SCREW, Pan Head Machine, 8-32 x 0.250	
26	92006905	LABEL, Warning	

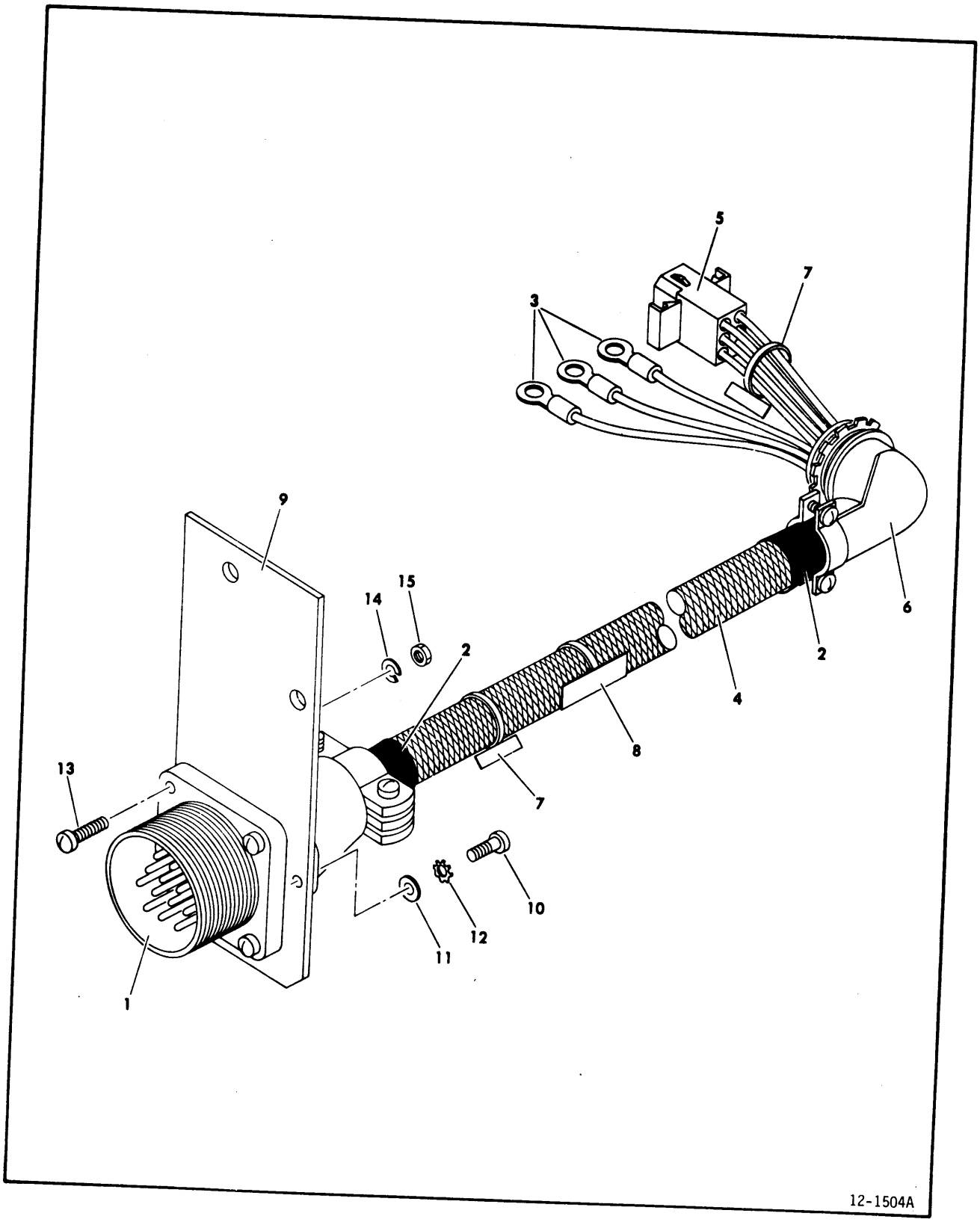

Figure 5-14. Power Cable Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-14	73048800	POWER CABLE ASSEMBLY	
1	94399800	RECEPTACLE, Wall Mount (A1J1)	
2	93154150	TUBING, Heat Shrinkable, Black	
3	93541028	TERMINAL, Ring Tongue Insulated	
4	95048801	SLEEVING, Braided	
5	51833463	CONNECTOR, Receptacle, 0.093 Series (A1P2)	
		(ASSOCIATED PARTS)	
	51863612	CONTACT, Female, 0.093 Dia.	
		- - - * - - -	
6	93299001	CONNECTOR, 90 Angle	
7	94277409	STRAP, Cable Tie	
8	94277407	STRAP, Cable Tie	
9	73048000	BRACKET, A.C. Power Cable	
10	10127334	SCREW, Pan Head Machine, 6-32 x 0.375	
11	10125605	WASHER, Flat, #6	
12	10126401	WASHER, External Tooth Lock, #6	
13	10127335	SCREW, Pan Head Machine, 6-32 x 0.500	
14	10125803	WASHER, Spring Lock, #6	
15	10125105	NUT, Machine, Hex, #6-32	

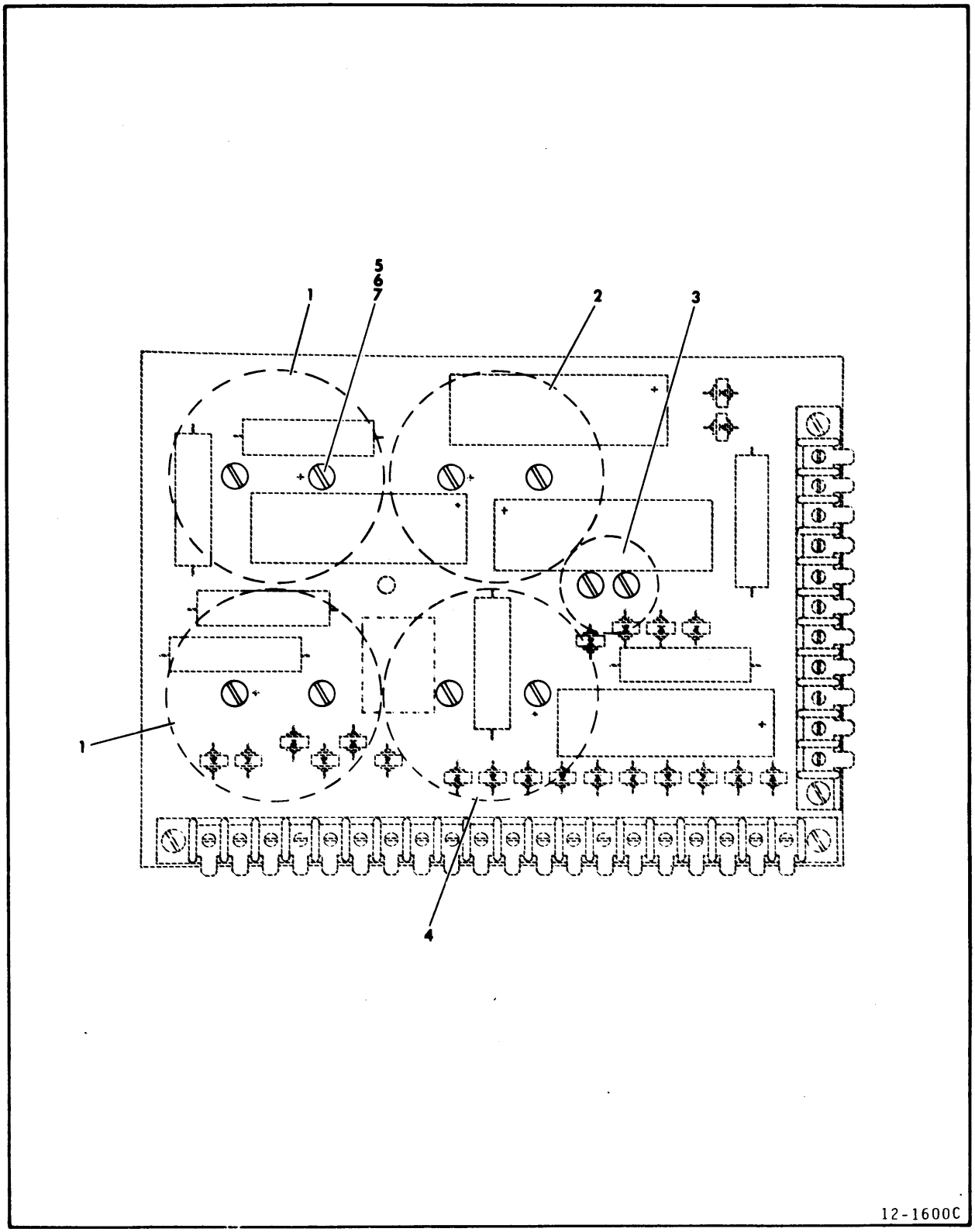

Figure 5-15. Component Assembly, Type _YEN

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-15	##	COMPONENT ASSEMBLY, Type _YEN	
1	95591217	TERMINAL STRIP, Quick Connect, 11 Terminal (TB2)	
2	10127350	SCREW, Pan Head Machine, 8-32 x 0.750	
3	10125106	NUT, Hex, #8-32	
4	10126104	WASHER, Internal Tooth Lock, #8	
5	95597910	RESISTOR, Fixed, 15 W, 30 ohm (R3)	
6	95591218	TERMINAL STRIP, Quick Connect, 20 Terminal (TB1)	
7	94383700	CAPACITOR, 35 V dc, Electrolytic (C1 thru C4)	
8	95597956	RESISTOR, Fixed, 15 W (R1)	
9	94384002	CAPACITOR, Electrolytic (C6)	
10	95575001	RECTIFIER, Silicon (CR1 thru CR22)	
11	94384000	CAPACITOR, Electrolytic (C7 & C8)	
12	95597954	RESISTOR, Fixed, 15 W, 82 ohm (R4 thru R7)	
13	93903356	EYELET, Rolled, Flange	
14	10127143	SCREW, Phillips Pan Head Machine, 10-32 x 0.500	
15	95524408	WASHER, Internal Tooth Lock, #10	
16	77427000	BOARD, Blank	
17	94384001	CAPACITOR, Electrolytic (C9)	
18	95661319	CAPACITOR, 15 V dc (C5)	

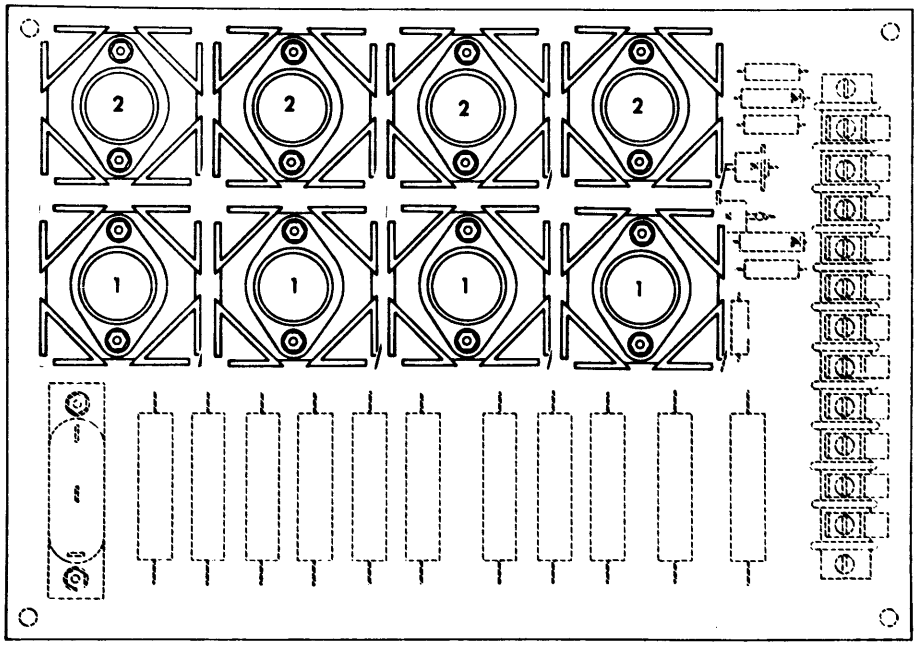

Figure 5-16. Component Assembly, Type _ZCN

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-16	##	COMPONENT ASSEMBLY, Type ZCN	
1	92512867	RESISTOR, 1 W, 100 ohm (R3,R4)	
2	92115037	DIODE, Silicon, Zener (CR1,CR2)	
3	92512879	RESISTOR, 1 W, 470 ohm (R1,R2)	
4	95591219	TERMINAL STRIP, Quick Connect, 11 Terminal (TB20)	
5	10125106	NUT, Hex, #8-32	
6	10126104	WASHER, Internal Tooth Lock, #8	
7	10127350	SCREW, Pan Head Machine, 8-32 x 0.750	
8	95597957	RESISTOR, Fixed, 15 W, 0.5 ohm (R14, R15)	
9	95597955	RESISTOR, Fixed, 15 W, 5 ohm (R6, R7)	
10	95597956	RESISTORk Fixed, 15 W, 250 ohm (R5)	
11	95597900	RESISTOR, Fixed, 15 W, 1 ohm (R8 thru R13)	
12	10127335	SCREW, Pan Head Machine, 6-32 x 0.500	
13	95583503	RECTIFIER, Block, 15 A (CR5, CR6)	
14		NOT USED	
15	95593201	RECEPTACLE, PC Board	
16	94261000	HEAT SINK, Transistor	
17	93640024	STUD, Self-Cliching	
18	95510026	NUT, Hex	
19	10126103	WASHER, Internal Tooth Lock, #6	
20	75183501	BOARD, Blank	
21	93542001	RECTIFIER, Germanium, 0.22 V (CR3, CR4)	
22	##	TRANSISTOR, PNP, Silicon, Power (Q1, Q6, Q7, Q8)	
23	##	TRANSISTOR, NPN, Silicon, Power (Q2 thru Q5)	
24	10125105	NUT, Hex, Machine, #6-32	

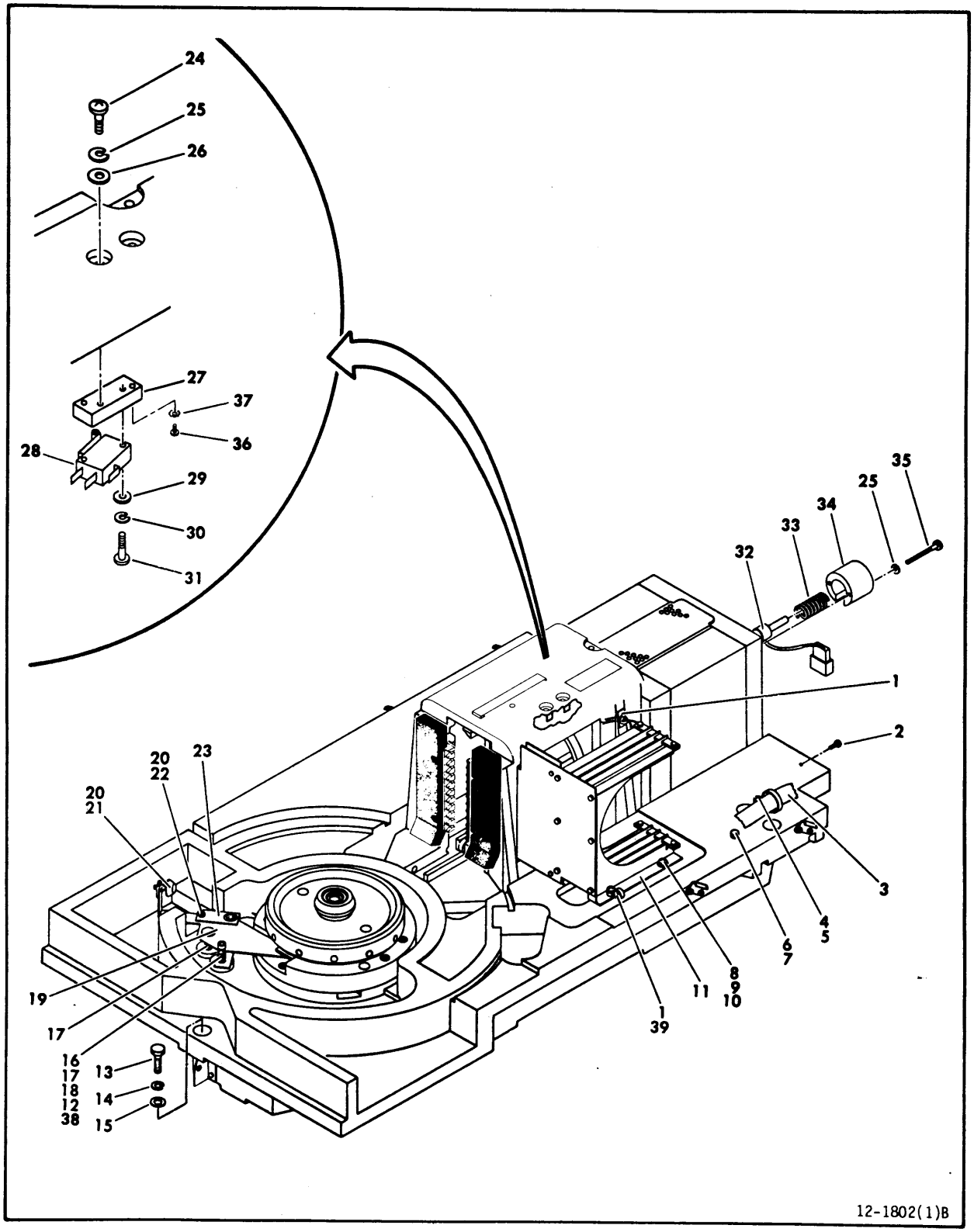

Figure 5-17. Deck Assembly (Sheet 1 of 2)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-17	77445821	DECK ASSEMBLY (Sheet 1 of 3)	
1	94277400	STRAP, Cable Tie	
2	93592162	SCREW, Hex Washer Head Self Tapping, 6-32 x 0.375	
3	47339201	MAIN HARNESS ASSEMBLY, Shielded	
4	94277406	STRAP, Cable Tie	
5	93592202	SCREW, Hex Washer Head Self Tapping, 8-32 x 0.500	
6	10126402	WASHER, External Tooth Lock, #8	
7	93592200	SCREW, Hex Washer Head Self Tapping, 8-32 x 0.375	
8	10127131	SCREW, Phillips Pan Head Machine, 10-24 x 0.375	
9	10125607	WASHER, Flat, #10	
10	10126105	WASHER, Internal Tooth Lock, #10	
11		R/W CHASSIS ASSEMBLY (See Figure 5-20)	
12	10126401	WASHER, External Tooth Lock, #6	
13	10126505	SCREW, Hex Head, 1/4-20 x 1.000	
14	10125806	WASHER, Spring Lock, 1/4	
15	10125608	WASHER, Flat, 1/4	
16	94347111	WASHER, Shoulder, Nylon	
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 0.500	
23	47181300	BRACKET, Parking Brake	
24	10127124	SCREW, Phillips Pan Head Machine, 8-32 x 0.625	
25	10125804	WASHER, Spring Lock, #8	
26	10125606	WASHER, Flat, #8	

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INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-17		DECK ASSEMBLY (Sheet 1 of 3 Contd)	
27	77437900	MOUNT, Switch	
28	##	SWITCH, Actuator, Mini, Integral, Heads Loaded (A3S6)	
29	10125603	WASHER, Flat, #4	
30	10125801	WASHER, Spring Lock, #4	
31	10127106	SCREW, Phillips Pan Head Machine, 4-40 x 0.625	
32		TRANSDUCER AND CONNECTOR ASSEMBLY (See Figure 5-19)	
33	94206431	SPRING, Compression	
34	70726001	CAP, End Transducer	
35	10127353	SCREW, Phillips Pan Head Machine, 8-32 x 1.250	
36	10127120	SCREW, Phillips Pan Head Machine, 4-40 x 0.250	
37	10126400	WASHER, External Tooth Lock, #4	
38	94047033	WASHER, Special	
39	94277503	BASE, Mounting	

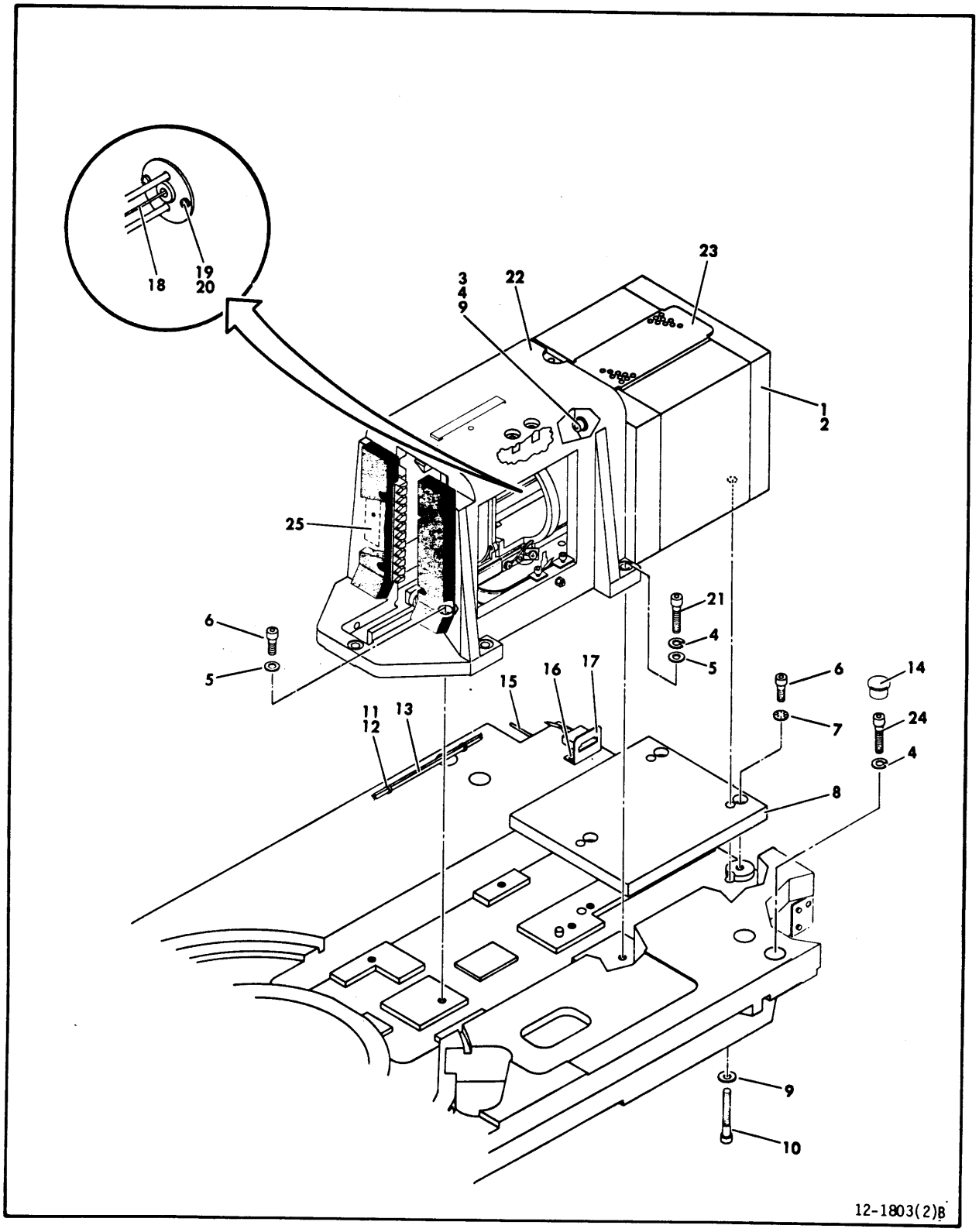

Figure 5-17. Deck Assembly (Sheet 2 of 3)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-17		DECK ASSEMBLY (Sheet 2)	
1	77829301	MAGNET ASSEMBLY	
2	95027403	TAPE, Foam	
3	10126259	SCREW, Hex Head Socket Cap, 1/4-20 x 0.250	
4	10125806	WASHER, Spring Lock, 1/4	
5	94047033	WASHER, Special	
6	10126256	SCREW, Hex Head Socket Cap, 1/4-20 x 0.750	
7	10126106	WASHER, Internal Tooth Lock, 1/4	
8	77441600	SPACER, Magnet	
9	10125608	WASHER, Flat, 1/4	
10	93117374	SCREW, Hex Head Socket Cap, 1/4-20 x 2.000	
11	94277406	STRAP, Cable Tie	
12	93592202	SCREW, Hex Washer Head Self Tapping, 8-32 x 0.500	
13	77452602	MAIN HARNESS ASSEMBLY, Unshielded	
14	94353212	CAPS AND PLUGS, Plastic	
15	93532207	PIN, Roll	
16	72823900	BRACKET, Connector, 3 Pin	
17	93592196	SCREW, Hex Washer Head Self Tapping, 8-32 x 0.250	
18	70729304	ROD, Extension	
19	10127133	SCREW, Phillips Pan Head Machine, 10-24 x 0.625	
20	10126105	WASHER, Internal Tooth Lock, #10	
21	10126258	SCREW, Hex Head Socket Cap, 1/4-20 x 1.000	
22		ACTUATOR ASSEMBLY (See Figure 5-21)	
23	46484001	COVER, Magnet	
24	10126264	SCREW, Hex Head Socket Cap, 1/4-20 x 2.500	
25	##	_ZGN COMPONENT ASSEMBLY	

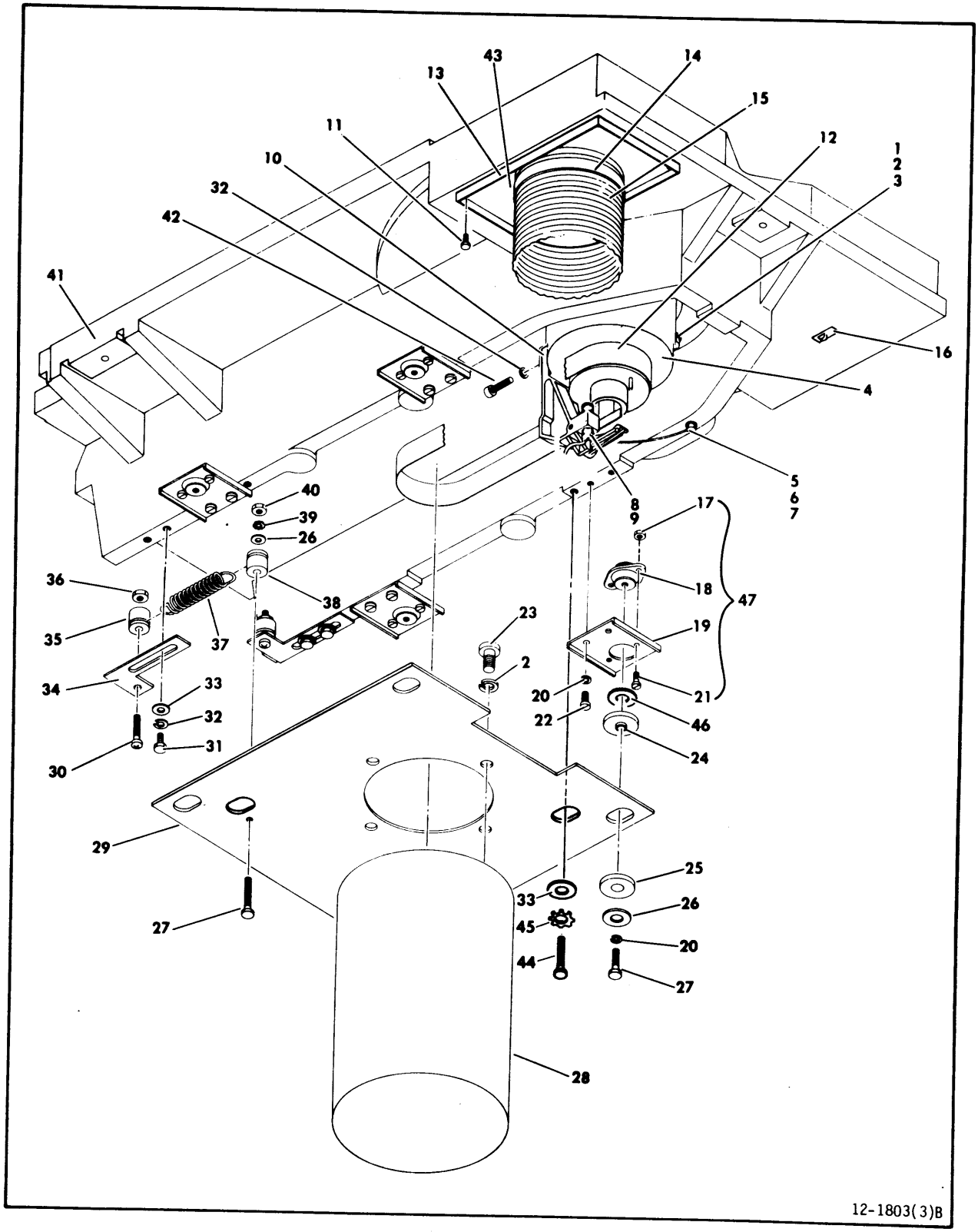

Figure 5-17. Deck Assembly (Sheet 3 of 3)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-17		DECK ASSEMBLY (Sheet 3)	
1	10126533	SCREW, Hex Head Plain, 3/8-16 x 1.750	
2	10125808	WASHER, Spring Lock, 3/8	
3	10125610	WASHER, Flat, 3/8	
4	##	SPINDLE ASSEMBLY (See Figure 5-22)	
5	10126402	WASHER, External Tooth Lock, #8	
6	93592200	SCREW, Hex Washer Head Self Tapping, 8-32 x 0.375	
7	94281419	CABLE, Ground	
8	##	SPEED SENSOR ASSEMBLY	
9	93552012	HEAD, Magnetic Pickup	
10	##	PACK SENSOR ASSEMBLY (See Figure 5-18)	
11	00860304	SCREW, Hex Head, 6-32 x 0.500	
12	##	BELT, Drive, Flat	
13	83640800	ADAPTER, Hose, Deck	
14	72875366	CLAMP, Hose, Self Tightening	
15	72875280	HOSE, Flexible	
16	94277503	BASE, Mounting	
17	53777903	NUT & CAPTIVE WASHER	
18	94243003	MOUNT, Shock	
19	76376200	BRACKET, Shock Mount	
20	10125805	WASHER, Spring Lock, #10	
21	10127348	SCREW, Pan Head Machine, 8-32 x 0.500	
22	10127380	SCREW, Pan Head Machine, 10-32 x 0.500	
23	10126528	SCREW, Hex Head Plain, 3/18-16 x 0.750	
24	70738308	INSULATOR, Motor Mount	
25	70738305	INSULATOR, Motor Mount	
26	10125607	WASHER, Flat, #10	
27	10125067	SCREW, Hex Head Machine	
28	##	DRIVE MOTOR AND PULLEY ASSEMBLY (ASSOCIATED PARTS)	
	##	CAPACITOR, Motor, AC	
29	77448100	PLATE, Motor Mounting	
30	10127158	SCREW, Phillips Pan Head Machine, 1/4-20 x 1.250	
31	10126500	SCREW, Hex Head Plain, 1/4-20 x 0.500	

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-17		DECK ASSEMBLY (Sheet 3 Contd)	
32	10125806	WASHER, Spring Lock, 1/4	
33	10125608	WASHER, Flat, 1/4	
34	75093401	BRACKET, Mounting Plate, Spring	
35	72806502	STANDOFF, Spring	
36	92071004	NUT, Hex, 1/4-20	
37	77530000	SPRING, Extension	
38	73806500	STANDOFF, Spring	
39	10126403	WASHER, External Tooth Lock, #10	
40	10125108	NUT, Hex, #10-32	
41	83242100	DECK	
42	10126258	SCREW, Hex Head Socket Cap, 1/4-20 x 1.000	
43	76579106	GASKET, Air Seal	
44	10126504	SCREW, Hex Head Plain, 1/4 - 20 x 1.000	
45	10126404	WASHER, External Tooth Lock, 1/4	
46	93211009	WASHER, Flat	
47	47276900	SHOCK MOUNT ASSEMBLY	

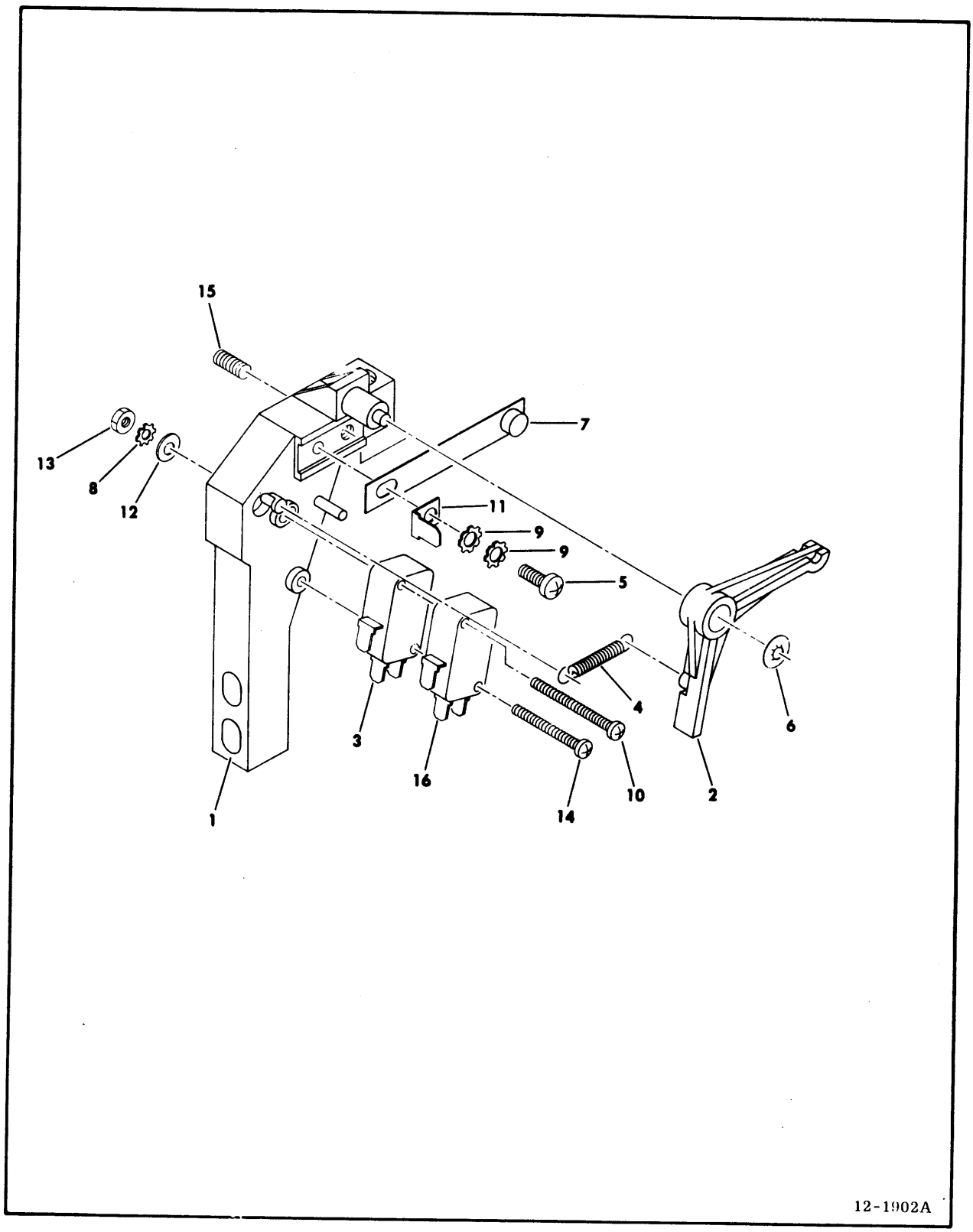

Figure 5-18. Pack Sensor Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-18	##	PACK SENSOR ASSEMBLY	
1	83282900	BASE, Spindle End, Pack On Switch	
2	83282800	ACTUATOR, Pack On Switch	
3	##	SWITCH, Actuator Mini Integral	
4	83283900	SPRING, Extension	
5	93590162	SCREW, Phillips Pan Head Self Tapping, 6-32 x 0.375	
6	94241401	FASTENER, Bolt Retainer	
7	##	SPRING, Static Ground	
8	10126400	WASHER, External Tooth Lock, #4	
9	10126401	WASHER, External Tooth Lock, #6	
10	10127110	SCREW, Phillips Pan Head Machine, 4-40 x 1.250	
11	94274107	TERMINAL, Quick Connect	
12	10125603	WASHER, Flat, #4	
13	10125103	NUT, Machine Hex, #4-40	
14	93590096	SCREW, Phillips Pan Head Self Threading 4-40 x 1.000	
15	93061288	SCREW, Set, Socket Head, 8-32 x 0.375	
16	##	SWITCH, Actuator, Mini Integral	

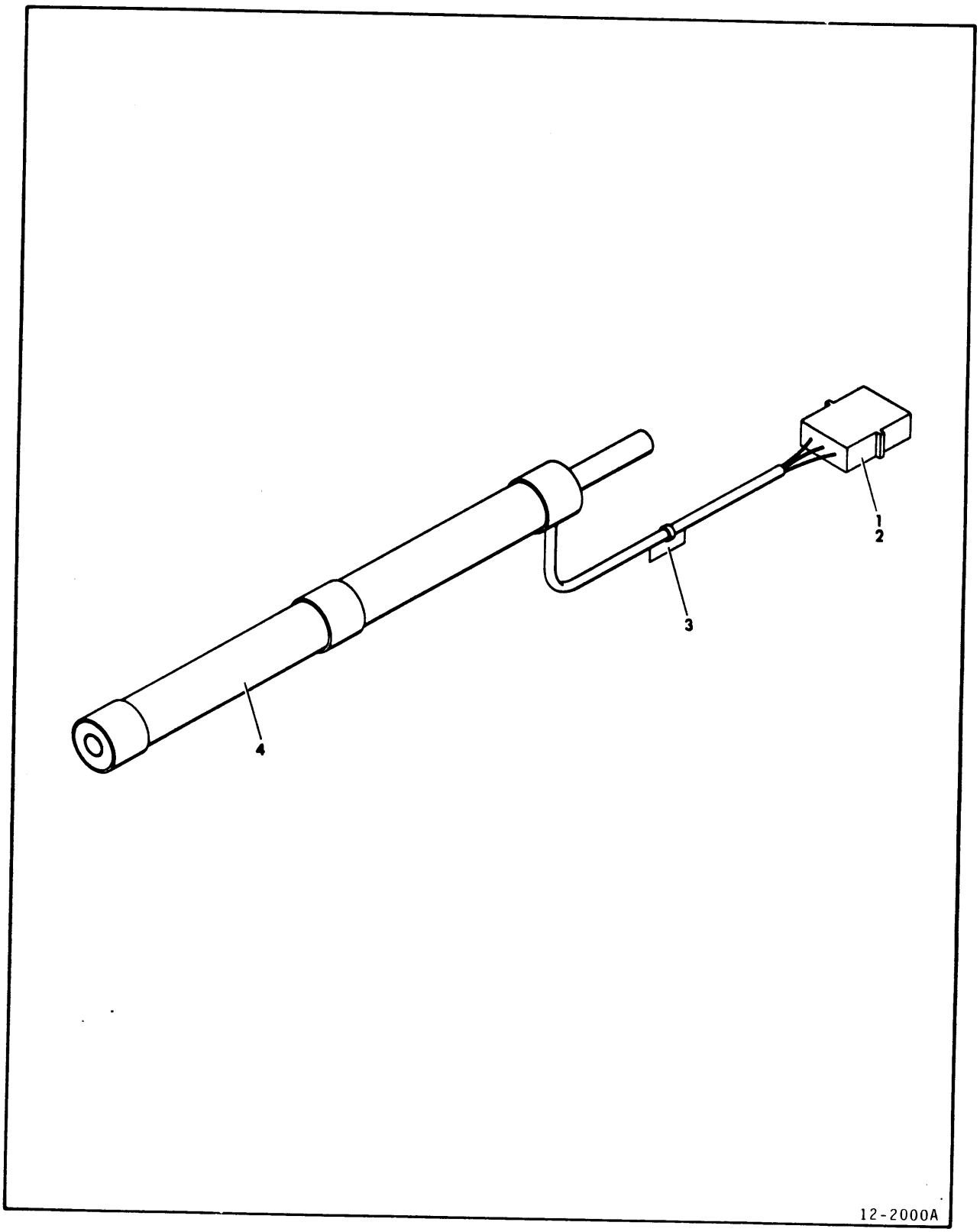

Figure 5-19. Transducer and Connector Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-19	##	TRANSDUCER AND CONNECTOR ASSEMBLY	
1	93948003	CONNECTOR, Housing, 3 Pin	
2	93942015	CONTACT, Pin	
3	94277409	STRAP, Cable Tie	
4	73585001	TRANSDUCER HOUSING ASSEMBLY	

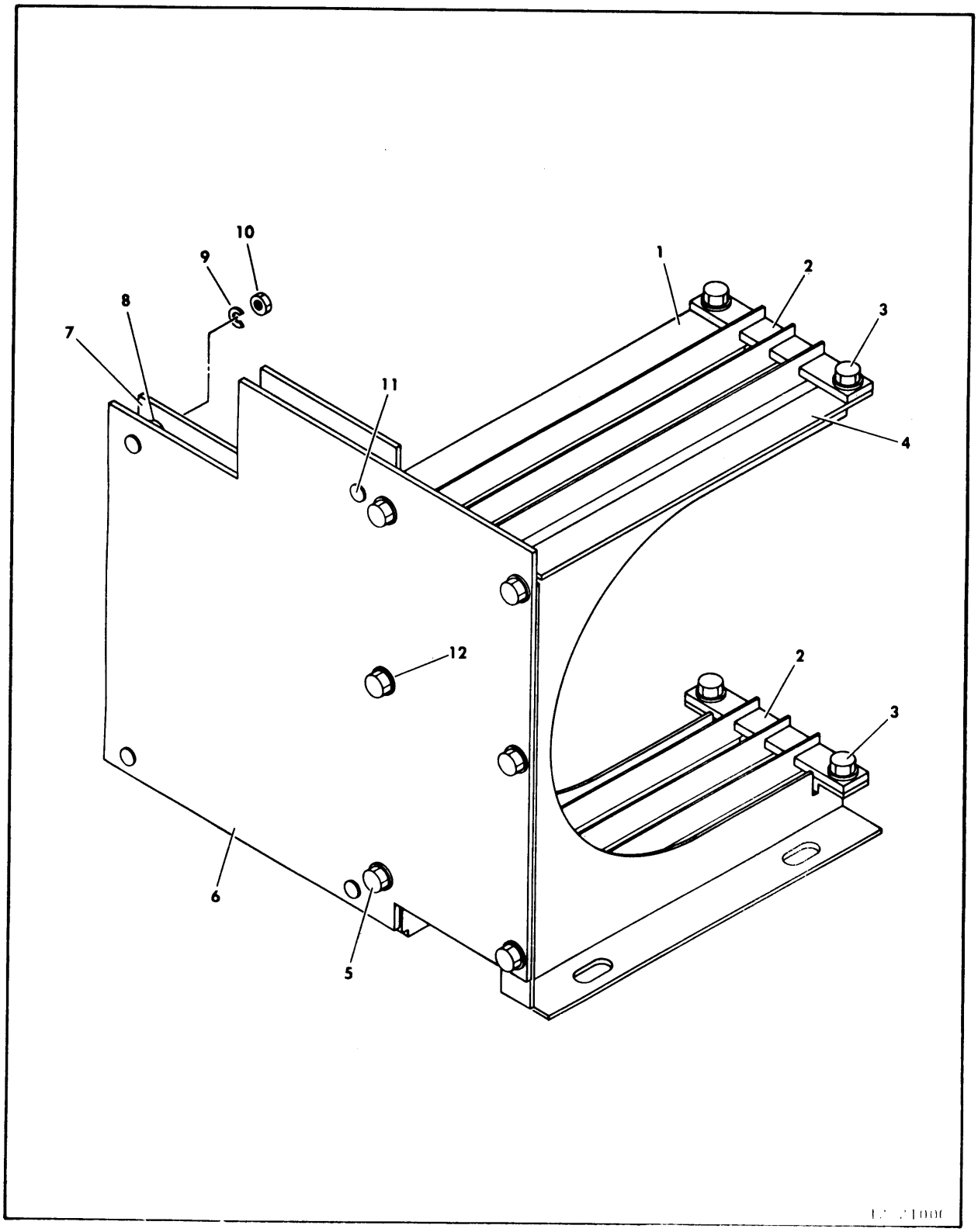

Figure 5-20. Read/Write Chassis Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-20	77445904	READ/WRITE CHASSIS ASSEMBLY	
1	77443000	SUPPORT, Chassis	
2	77442000	RAIL, Guide	
3	93592200	SCREW, Hex Washer Head Self Tapping, 8-32 x 0.375	
4	77443002	SUPPORT, Chassis	
5	93592196	SCREW, Hex Washer Head Self Tapping, 8-32 x 0.250	
6	##	COMPONENT ASSEMBLY, Type _XFN	
7	##	COMPONENT ASSEMBLY, Type _XGN	
8	00865801	SPACER, Brass Threaded	
9	10125801	WASHER, Spring Lock, #4	
10	10125103	NUT, Hex, #4-40	
11	93114301	STANDOFF	
12	94047042	WASHER, Flat, #8	

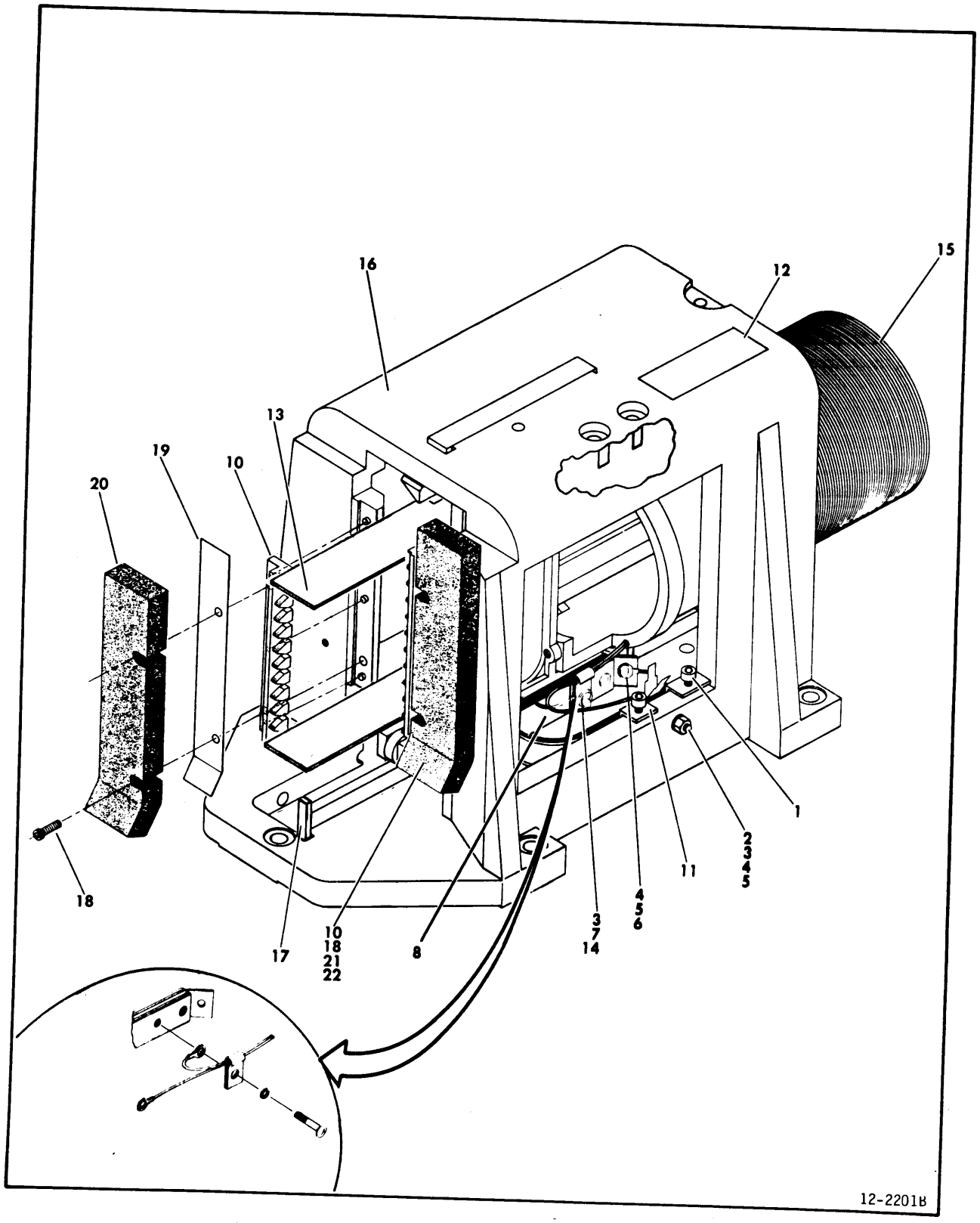

Figure 5-21. Actuator Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-21	##	ACTUATOR ASSEMBLY	
1	10126224	SCREW, Hex Head Socket Cap, 8-32 x 0.250	
2	94350503	SCREW, Insulated, 6-32 x 1.120	
3	93564032	WASHER, Nylon	
4	10125105	NUT, Hex, #6-32	
5	10126103	WASHER, Internal Tooth Lock, #6	
6	10127112	SCREW, Phillips Pan Head Machine, 6-32 x 0.312	
7	94350501	SCREW, Insulated, 6-32 x 0.620	
8	##	CONDUCTOR, Flexible	
9		NOT USED	
10	##	CAM, Tower	
11	76046400	BRACKET, Coil Leads	
12	94224671	LABEL, Information, Caution	
13	##	HEAD ARM ASSEMBLIES (ATTACHING PARTS)	
	##	SCREW, Head Arm	
14	92602001	CLAMP, Nylon Cable	
15	##	COIL ASSEMBLY	
16	72874270	RETAINER, Head Cable	
17	72876320	STOPPER, Carriage	
18	10126219	SCREW, Hexagon Socket Head Cap, 6-32 x 0.500	
19	94486321	BAFFLE, L.H.	
20	94486331	BAFFLE, Seal, L.H.	
21	94486320	BAFFLE, R.H.	
22	94486330	BAFFLE, Seal, R.H.	

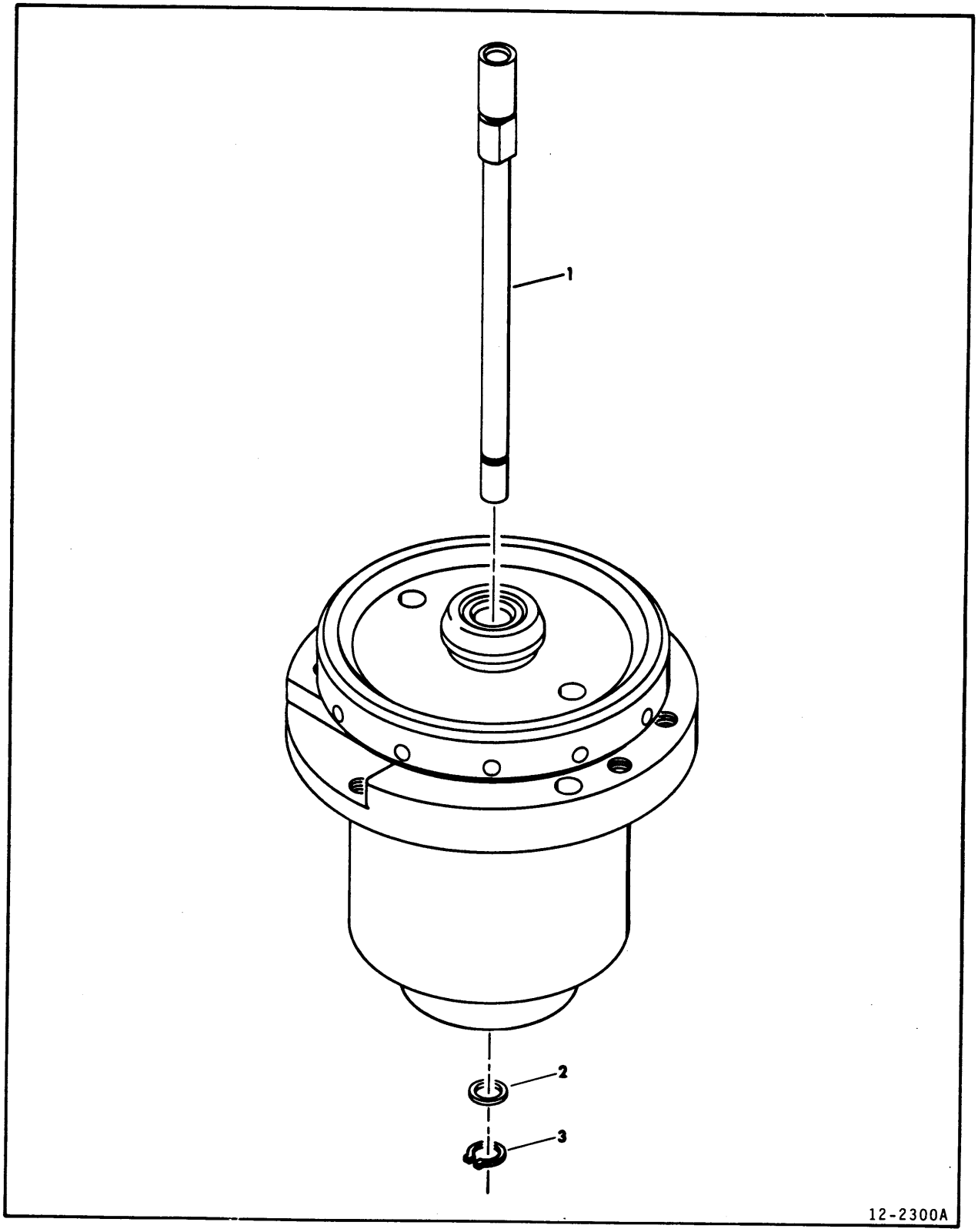

Figure 5-22. Spindle Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
5-22	##	SPINDLE ASSEMBLY	
1	##	LOCKSHAFT, Spindle	
2	73476503	WASHER, 0.040	
3	92033301	RING, Retaining	

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 on the next page.

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 part numbers used for a particular part or assembly, while 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	REPLACE-MENT PART NUMBER	NOTES
Fig. No.	Page No.	Index No.				
5-9	5-33		CONTROL PANEL SWITCH ASSEMBLY Used S/C 32 and above	WWWWW	XXXXX	

In the example above, the control panel assembly is referenced on figure 5-9, which appears on page 5-33.

The original part number for S/C 32 units was WWWWW; order part number XXXXX if it must be replaced.

ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON Fig. No.	Page No.	Index No.	DESCRIPTION	PART NUMBER	REPLACE-MENT PART NUMBER	NOTES
			PARTS & ASSEMBLIES			
5-6	5-27	3	SWITCH, Interlock (Pack Access Cover A3S1) Used S/C 32 & Above	94400700	94400700	
5-9	5-33		CONTROL PANEL SWITCH ASSEMBLY Used S/C 32 & Above	73049500	73049500	
5-11	5-41	5	FILTER, Aluminum, Washable Used S/C 32 & Above	00815447	00815447	
5-12	5-43	4	BLOWER AND CONNECTOR ASSEMBLY Used S/C 32 & Above	77450700	77450700	
5-12	5-43	9	FILTER, Air Used S/C 32 & Above	94358000	94358000	
5-13	5-45		POWER SUPPLY ASSEMBLY (A1) Used S/C 32 & Above	47293676	47293676	

ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON Fig. No.	Page No.	Index No.	DESCRIPTION	PART NUMBER	REPLACE-MENT PART NUMBER	NOTES
5-13	5-45	1	SWITCH, Solid State, AC, 15 A (A1Q4) Used S/C 32 & Above	94376504	94376504	
5-13	5-45	2	SWITCH, Solid State, AC, 30 A (A1Q2 & A1Q3) Used S/C 32 & Above	94371302	94371302	
5-13	5-45	3	SWITCH, Solid State, AC, 15 A (A1Q1) Used S/C 32 & Above	94371301	94371301	
5-13	5-45	13	FILTER, RFI Used S/C 32 & Above	94355403	94355403	
5-13	5-46	22	TRANSFORMER, Ferro, (A1T2) Used S/C 32 & Above	76804000	76804000	
5-13	5-46	24	TRANSFORMER, Ferro, (A1T1) Used S/C 32 & Above	76804200	76804200	

ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON Fig. No.	Page No.	Index No.	DESCRIPTION	PART NUMBER	REPLACE-MENT PART NUMBER	NOTES
5-13	5-46	25	TRANSFORMER ASSEMBLY (A1T3) Used S/C 32 & Above	47317900	47317900	
5-13	5-47	27	RECTIFIER, Bridge (A1CR1-A1CR4) Used S/C 32 & Above	50242705	50242705	
5-13	5-47	30	CAPACITOR, 660 V ac (A1C1 & A1C2) Used S/C 32 & Above	95686701	95686701	
5-13	5-49	49	CONTACTOR, 24 V dc (A1K6, A1K7, A1K8) Used S/C 32 & Above	94378200	94378200	
5-13	5-51	8	CIRCUIT BREAKER, 0.5 A (A1CB8) Used S/C 32 & Above	92696031	92696031	±28 V
5-13	5-51	9	CIRCUIT BREAKER, 2A (A1CB7) Used S/C 32 & Above	94268316	94268316	±20 V

ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON Fig. No.	Page No.	Index No.	DESCRIPTION	PART NUMBER	REPLACE-MENT PART NUMBER	NOTES
5-13	5-51	10	CIRCUIT BREAKER, 5A (A1CB6) Used S/C 32 & Above	92696083	92696083	-9.7 V
5-13	5-51	11	CIRCUIT BREAKER, 8 A (A1CB5) Used S/C 32 & Above	92696082	92696082	+9.7 V
5-13	5-51	12	CIRCUIT BREAKER, 7 A, (A1CB4) Used S/C 32 & Above	94268308	94268308	±46 V
5-13	5-51	13	CIRCUIT BREAKER, (A1CB3) Used S/C 32 & Above	94245209	94245209	Drive Motor
5-13	5-51	14	CIRCUIT BREAKER, 0.375 A, (A1CB2) Used S/C 32 & Above	94268315	94268315	+20 Y
5-13	5-51	15	SWITCH, Toggle (Local Remote) Used S/C 32 & Above	92509057	92509057	

ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON Fig. No.	Page No.	Index No.	DESCRIPTION	PART NUMBER	REPLACEMENT PART NUMBER	NOTES
5-13	5-51	16	METER, Hour, AC (A1M1) Used S/C 32 & Above	94313808	94313808	
5-13	5-53	20	CIRCUIT BREAKER, (A1CB1) Used S/C 32 & Above	94245211	94245211	AC Main Power
5-16	5-59	22	TRANSISTOR, Silicon, (Q1, Q6, Q7, Q8) Used S/C 32 & Above	50222800	50222800	
5-16	5-59	23	TRANSISTOR, Silicon, (Q2 thru Q5) Used S/C 32 & Above	50222700	50222700	
5-17	5-63	28	SWITCH, Actuator, Mini, Integral Used S/C 32 & Above	93786005	93786005	
5-17	5-67	8	SPEED SENSOR ASSEMBLY Used S/C 32 & Above	76395500	76395500	

ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON Fig. No.	Page No.	Index No.	DESCRIPTION	PART NUMBER	REPLACE-MENT PART NUMBER	NOTES
5-17	5-67	12	BELT, Drive, Flat Used S/C 32 & Above	92314087	92314087	
5-17	5-67	28	DRIVE MOTOR AND PULLEY ASSEMBLY Used S/C 32 & Above	77454003	77454003	
5-17	5-67		CAPACITOR, Motor, AC Used S/C 32 & Above	94255121	94255121	
5-18	5-71		PACK SENSOR ASSEMBLY Used S/C 32 & Above	73586101	73586101	
5-18	5-71	3	SWITCH, Actuator Mini Integral Used S/C 32 & Above	93786020	93786020	
5-18	5-71	7	SPRING, Static Ground Used S/C 32 & Above	40054700	40054700	
5-18	5-71	16	SWITCH, Actuator, Mini Integral Used S/C 32 & Above	93786023	93786023	

ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON Fig. No.	Page No.	Index No.	DESCRIPTION	PART NUMBER	REPLACEMENT PART NUMBER	NOTES
5-19	5-73		TRANSDUCER AND CONNECTOR ASSEMBLY Used S/C 32 & Above	73618901	73618901	
5-21	5-77		ACTUATOR ASSEMBLY Used S/C 32 & Above	77445405	77445405	
5-21	5-77	8	CONDUCTOR, Flexible Used S/C 32 & Above	77444600	77444600	
5-21	5-77	10	CAM, Tower Used S/C 32 & Above	75015800	75015800	

NOTE:

The following head arm assemblies are in special spares kit 85011900:

PART NO.	QTY
75010400	10
75010401	9
75010409	1

ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON Fig. No.	Page No.	Index No.	DESCRIPTION	PART NUMBER	REPLACE-MENT PART NUMBER	NOTES
5-21	5-77	13	HEAD ARM ASSEMBLIES Used S/C 32 & Above	75010400	75010400	
5-21	5-77	13	HEAD ARM ASSEMBLIES Used S/C 32 & Above	75010401	75010401	
5-21	5-77	13	HEAD ARM ASSEMBLIES Used S/C 32 & Above	75010409	75010409	
5-21	5-77		SCREW, Head Arm Used S/C 32 & Above	75017500	75017500	
5-21	5-77	15	COIL ASSEMBLY Used S/C 32 & Above	75217001	75217001	
5-22	5-79		SPINDLE ASSEMBLY Used S/C 32 & Above	73586002	73586002	
5-22	5-79	1	LOCKSHAFT, Spindle Used S/C 32 & Above	76372300	76372300	