Seagate

STORAGE MODULE DRIVE

BJ4A1
BJ4A2
BJ4M2-F,G

INSTALLATION
GENERAL MAINTENANCE INFORMATION
PREVENTIVE MAINTENANCE
TESTS AND ADJUSTMENTS
TROUBLE ANALYSIS
REPAIR AND REPLACEMENT
DIAGRAMS
WIRE LISTS
PARTS DATA

HARDWARE MAINTENANCE MANUAL

83319100

REVISION RECORD

REVISION	DESCRIPTION
01 (03-23-76)	Preliminary Edition
02 (04-24-76)	Preliminary Edition
03 (06-25-76)	Preliminary Edition
A (07-27-76)	Manual released including the following Engineering Change Orders: PE22679, 22691, 22721, 22722, 22736, 22738, 22749, 22764, 22765, 22777.
B (10-07-76)	Manual updated to include the following Engineering Change Orders: PE22763, 22767 and Field Change Orders: PE22749, 22765.
C (12-14-76)	Manual updated. Technical and Editorial changes.
D (01-20-77)	Manual updated to include the following Engineering Change Orders: PE22766, 22805 and Field Change Order: PE22805.
E (04-05-77)	Manual updated to include the following Engineering Change Orders: PE22768, 22833, 22863, 22857 and Field Change Order: PE22833. Technical and Editorial changes.
F (06-01-77)	Manual updated to include the following Engineering Change Orders: PE22889, 22820, 22882, 22777 and Field Change Orders: PE22882 and 22777. Technical and Editorial changes.
G (07-29-77)	Manual updated. Technical and Editorial changes.
H (10-04-77)	Manual updated. Technical and Editorial changes.
J (12-08-77)	Manual updated to include Engineering Change Order: PE22932. Technical and Editorial changes.
K (03-07-78)	Manual updated. Technical and Editorial changes.

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

Address comments concerning this manual to:
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Technical Publications Dept.
12701 Whitewater Drive
Minnetonka, MN 55343
or use Comment Sheet in the back of this manual.

REVISION RECORD (Contd)

REVISION	DESCRIPTION
L (05-12-78)	Manual updated. Technical and Editorial changes. Add Appendix A, containing Decision Logic Tables.
M (07-28-78)	Manual updated to include Engineering Change Order: PE55112. Technical and Editorial changes.
N (10-10-78)	Manual updated to include Engineering Change Order: PE22961. Technical and Editorial changes.
P (12-04-78)	Manual updated to include Engineering Change Orders: PE57014, 57000, 22960. Technical and Editorial changes.
R (12-22-78)	Manual updated. Technical and Editorial changes.
S (03-02-79)	Manual updated to include Engineering Change Order: PE57043. Technical and Editorial changes.
T (05-18-79)	Manual updated to include Engineering Change Order: PE57130 and Field Change Order: PE57130.
U (08-03-79)	Manual updated. Technical and Editorial changes.
V (02-15-80)	Manual updated to include Engineering Change Orders: PE57243, 57168, 57196-A and additional Technical and Editorial changes.
W (04-25-80)	Manual updated to include Engineering Change Order: PE57257 and additional Technical and Editorial changes.
Y (06-10-80)	Manual updated to include Engineering Change Order: PE57297-B. Additional Technical and Editorial changes.
Z (10-02-80)	Manual updated to include Engineering Change Orders: PE57326 and 57325. Additional Technical and Editorial changes.
AA (01-30-81)	Manual updated to include Engineering Change Orders: PE57426-A and 57481. Additional Technical and Editorial changes.
AB (06-29-81)	Manual updated to include Engineering Change Orders: PE57551, 57411-A, 57582-A, 57465-B and 57523. Additional Technical and Editorial changes.
AC (10-07-81)	Manual updated to include Engineering Change Orders: PE57522-B, 13012, 57581-A and 57619-A. Additional Technical and Editorial changes.

REVISION RECORD (Contd)

REVISION	DESCRIPTION
AD (12-18-81)	Manual updated to include Technical and Editorial changes.
AE (03-30-82)	Manual updated to include Engineering Change Orders: DH13070-A, 13071 and 13098-A. Additional Technical and Editorial changes.
AF (04-29-82)	Manual updated to include Engineering Change Order: DH13099. Additional Technical and Editorial changes.
AG (08-09-82)	Manual updated to include Engineering Change Orders: DJ13182, 13235 and 13122-D. Additional Technical and Editorial changes.
AH (10-25-82)	Manual updated to include Technical and Editorial changes.
AJ (10-05-83)	Manual updated to include Engineering Change Orders: DJ13266-B, 13378-B, 13340 and 13372-A. Additional Technical and Editorial changes.
AK (02-13-84)	Manual updated to include Engineering Change Orders: DJ13406B and DJ13476. Additional Technical and Editorial changes.
AL (06-06-84)	Manual updated to include Technical and Editorial changes.
AM (07-19-84)	Manual updated to include Engineering Change Order DJ13504-A. Additional Technical and Editorial changes.
AN (11-08-84)	Manual updated to include the following Class II ECO's: DJ13529, 13543A, 13561, 13575, 13539A, 13524, 13528, 13596, 13538, 13515, 13568, 00699, PE64998, and 64956. Additional Technical and Editorial changes.
AP (01-17-85)	Manual updated to include Class I ECO DJ13616-B; Class II ECOs DJ13560, DJ13620, DJ13655; Class III ECO DJ13647. Additional Technical and Editorial changes.
AR (04-12-85)	Manual updated to include Class I ECO DJ13602-A; Class II ECOs DJ13621, DJ13650, DJ13668. Additional Technical and Editorial changes.
AS (11-22-85)	Manual updated to include Class II ECOs DJ00713, 00735A, 00761C, 00788, 00824, 13631, 13635, 13664, 13690A, 13711, 13716, 13737, 13738, 13753, 13754, 13755; Technical changes.
AT (07-20-88)	Manual updated to include Class I ECO DJ13882. Class II ECOs DJ00857, 00858, 13646, 13650, 13671, 13689, 13713, 13771, 13774, 13807, 13814, 13830, 13847, 13854, 13866, 13869, 13912; Documented BJ4M2-F,G; Technical changes.
AU (01-22-90)	Editorial changes only.

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:

Publication No. 83319200

EQUIPMENT TYPE	SERIES CODE	WITH FCOs	COMMENTS
BJ4A1/4A2	01	22749	4A2 A-H
		22777	4A2 A-H
		22793	4A2 A-P
	02	22805	4A2 C
	03	22833	4A2 J-K
		22841	4A2 A-J
	04	22861	4A1 A/B, 4A2 A-D
	05	22882	4A2 C/D
	06-16	None	
	17	57130	4A2 A-Z
		57127	4A2 only (not all units affected by this FCO).
	18	None	
	19	None	
	20	None	
	21	None	
	22	57326	4A1 A-D, 4A2 A-Z
	23	57426	
	24	57605	(Not all units affected)
	25	57629	
	26	57627	(optional FCO)
		57631	
	27	None	
	28	None	
	29	None	
	30	None	
	31	None	
	32	13465*	*(50 Hz units only, optional FCO)

MANUAL TO EQUIPMENT LEVEL CORRELATION (Contd)

EQUIPMENT TYPE	SERIES CODE	WITH FCOs	COMMENTS
BJ4A1/4A2	33	13465*	*(50 Hz units only, optional FCO)
	34	13465*	
	35	13465*	
		13476	
	36-43	None	

LIST OF EFFECTIVE PAGES

Sheet 1 of 10

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	AR
Blank	-	xxxiv	AN
Title P	-	xxxv	AU
ii	AU	Blank	-
iii	AS	xxxvii	AN
iv	AU	xxxviii	AT
v	AK	xxxix	AN
vi	AS	xl	AT
vii	AU	xli	AT
viii	AU	Blank	-
ix	AR	S-1 Div	-
x	AR	Blank	-
xi	AT	1-1	AJ
xii	AT	1-2	AJ
xiii	AT	1-3	AT
xiv	AU	1-4	AJ
xv	AU	1-4.1	AK
xvi	AT	Blank	-
xvii	AU	1-5	AK
xviii	AU	1-6	AN
xix	AU	1-6.1	AU
Blank	-	Blank	-
xxi	AN	1-7	AN
xxii	AN	1-8	AT
xxiii	AN	1-9	AJ
xxiv	AL	1-10	AL
xxv	AR	1-11	AL
xxvi	AL	1-12	AJ
xxvii	AR	1-13	AK
xxviii	AR	1-14	AK
xxix	AP	1-15	AK
xxx	AN	1-16	AK
xxxi	AK	1-17	AJ
xxxii	AJ	1-18	AJ

LIST OF EFFECTIVE PAGES (Contd)

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PAGE	REV	PAGE	REV
1-19	AJ	2-30	AN
1-20	AJ	2-31	AN
1-21	AJ	2-32	AR
1-22	AJ	2-33	AN
1-23	AJ	2-34	AN
1-24	AJ	2-35	AU
1-25	AJ	2-36	AN
1-26	AJ	2-37	AU
1-27	AJ	2-38	AU
1-28	AJ	2-39	AN
1-29	AN	Blank	-
1-30	AN	S-3 Div	-
S-2 Div	-	Blank	-
Blank	-	3-1	AJ
2-1	AJ	3-2	AJ
2-2	AU	3-3	AJ
2-3	AU	3-4	AJ
2-4	AU	3-5	AJ
2-5	AU	3-6	AJ
2-6	AU	3-7	AJ
2-7	AN	3-8	AJ
2-8	AN	3-9	AJ
2-9	AN	3-10	AJ
2-10	AN	3-11	AJ
2-11	AN	3-12	AJ
2-12	AN	S-4 Div	-
2-13	AN	Blank	-
2-14	AN	4-1	AJ
2-15	AN	4-2	AJ
2-16	AN	4-3	AR
2-17	AN	4-4	AJ
2-18	AN	4-5	AJ
2-19	AN	4-6	AJ
2-20	AN	4-7	AJ
2-21	AN	4-8	AN
2-22	AT	4-9	AK
2-23	AT	4-10	AJ
2-24	AN	4-11	AJ
2-25	AN	4-12	AJ
2-26	AN	4-13	AJ
2-27	AN	4-14	AJ
2-28	AN	4-15	AJ
2-29	AN	4-16	AJ

LIST OF EFFECTIVE PAGES (Contd)

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PAGE	REV	PAGE	REV
S-5 Div	-	5-39	AR
Blank	-	5-40	AJ
5-1	AJ	5-41	AJ
5-2	AL	5-42	AJ
5-3	AL	5-43	AJ
5-4	AJ	5-44	AR
5-5	AJ	5-44.1	AR
5-6	AJ	5-44.2	AR
5-7	AJ	5-44.3	AR
5-8	AJ	Blank	-
5-9	AJ	5-45	AJ
5-10	AJ	5-46	AJ
5-11	AJ	5-47	AN
5-12	AJ	5-48	AN
5-13	AJ	5-49	AN
5-14	AJ	5-50	AJ
5-15	AJ	5-51	AJ
5-16	AJ	5-52	AJ
5-17	AJ	5-53	AJ
5-18	AJ	5-54	AJ
5-19	AJ	5-55	AJ
5-20	AJ	5-56	AJ
5-21	AJ	5-57	AJ
5-22	AJ	5-58	AJ
5-23	AJ	5-59	AJ
5-24	AJ	5-60	AJ
5-25	AJ	5-61	AJ
5-26	AJ	5-62	AJ
5-27	AJ	5-63	AJ
5-28	AJ	5-64	AJ
5-29	AJ	5-65	AJ
5-30	AJ	5-66	AJ
5-31	AJ	5-67	AN
5-32	AJ	5-68	AJ
5-32.1	AR	5-69	AJ
Blank	-	5-70	AJ
5-33	AR	5-71	AN
5-34	AJ	5-72	AJ
5-35	AR	5-73	AJ
5-36	AJ	5-74	AJ
5-37	AJ	5-75	AJ
5-38	AJ	5-76	AJ

LIST OF EFFECTIVE PAGES (Contd)

Sheet 4 of 10

PAGE	REV	PAGE	REV
5-77	AJ	6-27	AK
5-78	AJ	6-28	AJ
5-79	AJ	6-29	AJ
5-80	AJ	6-30	AP
5-81	AJ	6-31	AP
5-82	AN	6-32	AP
5-83	AJ	6-33	AJ
5-84	AJ	6-34	AJ
5-85	AJ	6-35	AK
5-86	AN	6-36	AJ
5-87	AJ	6-37	AK
Blank	-	6-38	AK
S-6 Div	-	6-38.1	AK
Blank	-	Blank	-
6-1	AJ	6-39	AK
6-2	AK	6-40	AJ
6-3	AJ	6-41	AJ
6-4	AK	6-42	AJ
6-5	AJ	6-43	AJ
6-6	AJ	6-44	AJ
6-7	AK	6-45	AJ
6-8	AJ	6-46	AJ
6-9	AJ	6-47	AJ
6-10	AJ	6-48	AJ
6-11	AK	6-49	AJ
6-12	AJ	6-50	AJ
6-13	AJ	6-51	AJ
6-14	AJ	6-52	AJ
6-15	AJ	6-53	AJ
6-16	AJ	6-54	AJ
6-17	AJ	6-55	AJ
6-18	AJ	6-56	AJ
6-19	AJ	6-57	AJ
6-20	AJ	6-58	AJ
6-21	AJ	6-59	AJ
6-22	AN	6-60	AJ
6-22.1	AN	6-61	AJ
6-22.2	AN	6-62	AJ
6-23	AN	6-63	AJ
6-24	AR	6-64	AJ
6-25	AN	6-65	AJ
6-26	AJ	6-66	AJ

LIST OF EFFECTIVE PAGES (Contd)

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PAGE	REV	PAGE	REV
6-67	AJ	6-108	AJ
6-68	AR	6-109	AJ
6-69	AJ	6-110	AK
6-70	AJ	6-111	AJ
6-71	AJ	6-112	AJ
6-72	AJ	6-113	AJ
6-73	AJ	6-114	AJ
6-74	AJ	6-115	AJ
6-75	AJ	Blank	-
6-76	AR	S-7 Div	-
6-77	AJ	Blank	-
6-78	AJ	7-1	AJ
6-79	AJ	7-2	AJ
6-80	AJ	7-3	AJ
6-81	AJ	7-4	AJ
6-82	AK	7-5	AJ
6-83	AJ	7-6	AJ
6-84	AJ	7-7	AJ
6-85	AJ	7-8	AJ
6-86	AJ	7-9	AJ
6-87	AJ	7-10	AJ
6-88	AJ	7-11	AJ
6-89	AJ	7-12	AJ
6-90	AJ	7-13	AJ
6-91	AJ	7-14	AJ
6-92	AJ	7-15	AJ
6-93	AJ	Blank	-
6-94	AJ	7-17	AJ
6-95	AJ	7-18	AT
6-96	AJ	7-19	AJ
6-97	AJ	7-20	AJ
6-98	AJ	7-21	AP
6-99	AJ	7-22	AJ
6-100	AJ	7-23	AS
6-101	AJ	7-24	AS
6-102	AJ	7-25	AN
6-103	AJ	Blank	-
6-104	AJ	7-27	AJ
6-105	AJ	7-28	AJ
6-106	AJ	7-29	AJ
6-107	AJ	Blank	-

LIST OF EFFECTIVE PAGES (Contd)

Sheet 6 of 10

PAGE	REV	PAGE	REV
7-31	AJ	Blank	-
7-32	AJ	7-73	AN
7-33	AJ	7-74	AJ
Blank	-	7-75	AJ
7-35	AJ	7-76	AN
7-36	AJ	7-77	AN
7-37	AJ	7-78	AJ
Blank	-	7-79	AJ
7-39	AS	7-80	AN
7-40	AS	7-81	AJ
7-41	AJ	7-82	AJ
7-42	AN	7-83	AJ
7-43	AN	Blank	-
7-44	AK	7-85	AN
7-45	AJ	7-86	AT
7-46	AN	7-87	AN
7-47	AP	Blank	-
7-48	AJ	7-89	AJ
7-49	AJ	7-90	AJ
7-50	AP	7-91	AJ
7-51	AN	Blank	-
7-52	AN	7-93	AS
7-53	AJ	7-94	AJ
7-54	AJ	7-95	AS
7-55	AJ	Blank	-
7-56	AJ	7-97	AJ
7-57	AJ	7-98	AJ
7-58	AJ	7-99	AJ
7-59	AJ	7-100	AJ
7-60	AJ	7-101	AJ
7-61	AJ	Blank	-
7-62	AJ	7-103	AJ
7-63	AJ	7-104	AJ
7-64	AJ	7-105	AJ
7-65	AJ	7-106	AJ
7-66	AJ	7-107	AJ
7-67	AT	7-108	AJ
7-68	AT	7-109	AJ
7-69	AJ	7-110	AJ
7-70	AT	7-111	AT
7-71	AT	7-112	AJ

LIST OF EFFECTIVE PAGES (Contd)

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PAGE	REV	PAGE	REV
7-113	AM	7-150	AT
7-114	AM	7-150.1	AT
7-115	AP	Blank	-
Blank	-	7-151	AJ
7-117	AJ	7-152	AJ
7-118	AJ	7-153	AJ
7-119	AJ	7-154	AJ
7-120	AJ	7-155	AJ
7-121	AT	7-156	AJ
7-122	AT	7-157	AS
7-123	AJ	7-158	AJ
7-124	AM	7-159	AS
7-125	AS	Blank	-
7-126	AS	7-161	AS
7-127	AS	7-162	AS
7-128	AS	7-163	AS
7-128.1	AS	7-164	AS
Blank	-	7-165	AS
7-129	AT	Blank	-
7-130	AS	7-167	AS
7-131	AS	7-168	AS
7-132	AS	7-169	AS
7-132.1	AS	7-170	AS
Blank	-	7-171	AS
7-133	AK	Blank	-
7-134	AT	7-173	AS
7-135	AJ	7-174	AS
Blank	-	7-175	AS
7-137	AJ	7-176	AS
7-138	AT	7-177	AS
7-139	AJ	7-178	AS
Blank	-	7-179	AS
7-141	AJ	7-180	AS
7-142	AJ	7-181	AS
7-143	AJ	7-182	AS
7-144	AJ	7-183	AS
7-145	AJ	7-184	AS
7-146	AJ	7-185	AS
7-147	AT	7-186	AS
7-148	AT	7-187	AS
7-149	AT	7-188	AS

LIST OF EFFECTIVE PAGES (Contd)

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PAGE	REV	PAGE	REV
7-189	AS	7-232	AS
Blank	-	7-233	AS
7-191	AS	7-234	AS
7-192	AS	7-235	AS
7-193	AS	7-236	AS
7-194	AT	7-237	AS
7-195	AS	7-238	AS
Blank	-	S-8 Div	-
7-197	AS	Blank	-
7-198	AS	8-1	AJ
7-199	AS	8-2	AJ
Blank	-	8-3	AJ
7-201	AS	Blank	-
7-202	AS	8-5	AJ
7-203	AS	8-6	AJ
Blank	-	8-7	AJ
7-205	AS	8-8	AJ
7-206	AS	8-9	AJ
7-207	AS	8-10	AJ
7-208	AS	8-11	AJ
7-209	AS	8-12	AJ
7-210	AS	8-13	AJ
7-211	AS	8-14	AJ
7-212	AS	8-15	AJ
7-213	AS	8-16	AJ
Blank	-	8-17	AJ
7-215	AS	Blank	-
7-216	AS	S-9 Div	-
7-217	AS	Blank	-
Blank	-	9-1	AU
7-219	AS	Blank	-
7-220	AS	S-9A Div	-
7-221	AS	Blank	-
Blank	-	9A-1	AJ
7-223	AS	9A-2	AJ
7-224	AS	9A-3	AJ
7-225	AS	Blank	-
7-226	AS	9A-5	AT
7-227	AS	9A-6	AR
7-228	AS	9A-7	AT
7-229	AS	Blank	-
7-230	AS	9A-9	AR
7-231	AS	9A-10	AT

LIST OF EFFECTIVE PAGES (Contd)

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PAGE	REV	PAGE	REV
9A-11	AT	Blank	-
9A-12	AS	9A-53	AK
9A-13	AT	9A-54	AT
9A-14	AN	9A-55	AT
9A-15	AT	9A-56	AS
9A-16	AK	9A-57	AS
9A-17	AT	9A-58	AT
Blank	-	9A-59	AT
9A-19	AK	9A-60	AT
9A-20	AP	9A-61	AN
9A-21	AN	Blank	-
Blank	-	9A-63	AJ
9A-23	AS	9A-64	AT
9A-24	AT	9A-65	AT
9A-25	AT	Blank	-
Blank	-	9A-67	AJ
9A-27	AT	9A-68	AJ
9A-28	AP	9A-69	AJ
9A-29	AP	9A-70	AJ
9A-30	AP	9A-71	AJ
9A-30.1	AS	9A-72	AR
Blank	-	9A-73	AR
9A-31	AU	Blank	-
9A-32	AK	9A-75	AR
9A-33	AM	9A-76	AR
Blank	-	9A-76.1	AR
9A-35	AM	9A-76.2	AR
9A-36	AL	9A-76.3	AR
9A-37	AS	9A-76.4	AR
9A-38	AJ	9A-76.5	AR
9A-39	AJ	9A-76.6	AR
9A-40	AJ	9A-77	AR
9A-41	AP	9A-78	AR
Blank	-	9A-79	AR
9A-43	AJ	9A-80	AJ
9A-44	AK	9A-81	AP
9A-45	AJ	9A-82	AN
Blank	-	9A-83	AN
9A-47	AK	Blank	-
9A-48	AM	9A-85	AN
9A-49	AT	9A-86	AT
9A-50	AK	9A-87	AT
9A-51	AK	9A-88	AP

LIST OF EFFECTIVE PAGES (Contd)

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PAGE	REV	PAGE	REV
9A-89	AP	9B-3	AK
Blank	-	9B-4	AJ
9A-91	AP	9B-5	AJ
9A-92	AJ	9B-6	AJ
9A-93	AJ	9B-7	AK
9A-94	AJ	9B-8	AJ
9A-95	AJ	9B-9	AR
9A-96	AJ	9B-10	AT
9A-97	AL	9B-11	AR
9A-98	AP	9B-12	AT
9A-99	AP	9B-13	AR
9A-100	AK	9B-14	AR
9A-101	AK	9B-15	AT
9A-102	AJ	9B-16	AR
9A-103	AJ	9B-17	AR
9A-104	AP	9B-18	AR
9A-105	AR	9B-19	AT
Blank	-	Blank	-
S-9B Div	-	Cmt Sht	-
Blank	-	Rtn Env	-
9B-1	AJ	Blank	-
9B-2	AJ	Cover	-

PREFACE

This manual contains maintenance information applicable to the Seagate BJ4A1, BJ4A2, and BJ4M2 Storage Module Drives (SMD's).

The specific types of drive covered and their configuration are listed in the configuration chart (refer to table of contents).

Most of the information in this manual is applicable to all types of BJ4A1, BJ4A2, and BJ4M2 drives. However, where information is applicable only to specific types, this is noted in the text.

References are made throughout this manual to the terms "VDE" and "Non-VDE". VDE units contain a VDE-approved power supply and have other associated electrical and mechanical differences. For explanation of Non-VDE and VDE refer to Table 9A-1 Symbology located in the Parts Data section.

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

Section 1 - Installation. Provides information on installing the drive and preparing it for initial use.

Section 2 - General Maintenance Information. Provides general information relating to the maintenance of the drive.

Section 3 - Preventive Maintenance. Provides information regarding the preventive maintenance that must be performed on the drive to keep it operating properly.

Section 4 - Tests and Adjustments. Contains procedures describing drive electronic adjustments.

Section 5 - Trouble Analysis. Contains information on analyzing problems in the drive.

Section 6 - Repair and Replacement. Contains information concerning the mechanical replacement and adjustment of the drives field replaceable parts.

Section 7 - Diagrams. Contains logic and wiring diagrams for the drive.

Section 8 - Wire Lists. Provides wire lists for the logic, power supply, and interassembly wiring.

Section 9 - Parts Data. Contains parts lists and illustrations showing all field replaceable parts.

Manuals applicable to the BJ4A1, BJ4A2, and BJ4M2 Storage Module Drives are as follows:

Publication No.	Title
83319100	Hardware Maintenance Manual
83319200	Hardware Reference Manual

A Guide for the Disk Drive Operator, publication number 83323780, is also available. The guide, as well as any of the manuals listed above, may be ordered through the following address:

Seagate Technology Inc.
Customer Services
12701 Whitewater Drive
Minnetonka, MN 55343

Phone: (612) 931-8612
Fax: (612) 931-8817

To ensure the integrity of safety features built into these drives, installation and maintenance must be performed only by qualified service personnel using designated Seagate 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.

Um das einwandfreie Funktionieren der eingebauten Schutzvorrichtungen zu gewaehrleisten, darf die Installation und Wartung nur von qualifiziertem Service-Personal unter Verwendung von Original Seagate 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.

CONTENTS

FIGURES

TABLES

IMPORTANT SAFETY INFORMATION AND PRECAUTIONS

Proper safety and repair is important to the safe, reliable operation of this unit. Service should be done by qualified personnel only. This maintenance manual describes procedures recommended by the manufacturer as effective methods of servicing the unit. Some of these procedures require the use of specially designed tools. For proper maintenance and safety, these specially designed tools should be used as recommended.

The procedures in this maintenance manual and labels on the unit contain warnings and cautions which must be carefully read and observed in order to minimize or eliminate the risk of personal injury. The warnings point out conditions or practices that are potentially hazardous to maintenance personnel. The cautions point out practices which, if disregarded, could damage the unit and make it unsafe for use.

For the safety of maintenance and operating personnel, the following precautions must be observed:

- Perform all maintenance by following the procedures given in this manual and using only Seagate replacement parts.
- Read and observe all cautions and warnings provided in the procedures and labeled on the unit.
- Use the special tools called out in the maintenance procedures.
- Observe sound safety practices when performing maintenance.
- Use caution when troubleshooting a unit that has voltages present. Remove power from unit before servicing or replacing components.
- Wear safety glasses when servicing units.
- Wear safety shoes when removing or replacing heavy components.

It is also important to understand that these warnings and cautions are not exhaustive. The manufacturer could not possibly know, evaluate and advise maintenance personnel of all conceivable ways in which maintenance might be performed or the possible risk of each maintenance technique. Consequently, the manufacturer has not completed any such broad evaluation. Thus, any persons who use any non-approved maintenance procedure or tool must first satisfy themselves that neither their safety nor the unit performance will be jeopardized by the maintenance techniques they select.

CONFIGURATION CHART

EQUIP	TLA[1]	POWER[4]		DATA CAP (MB)	COLOR CODE[3]	STANDARD OPTIONS[2]		
		V	Hz			INDEX SECTOR IN B CABLE	WRT PROT[5]	PACK COVER INTLK
BJ4A1A	77445202	208/240	60	150	A	Yes	No	No
BJ4A1B	77445203	220	50	150	A	Yes	No	Yes[6]
BJ4A1C	77445207	208/240	60	150	C	Yes	No	No
BJ4A1D	77445208	220	50	150	C	Yes	No	Yes[6]
BJ4A2A	77445002	208/240	60	300	A	No	No	No
BJ4A2B	77445003	220	50	300	A	No	No	Yes[6]
BJ4A2C	77445004	208/240	60	300	B	Yes	Yes	Yes
BJ4A2D	77445005	220	50	300	B	Yes	Yes	Yes[6]
BJ4A2E	77445006	208/240	60	300	C	No	No	No
BJ4A2F	77445007	220	50	300	C	No	No	Yes[6]
BJ4A2G	77445008	208/240	60	300	D	No	No	No
BJ4A2H	77445009	220	50	300	D	No	No	Yes[6]
BJ4A2J	77445010	208/240	60	300	E	Yes	Yes	Yes
BJ4A2K	77445011	220	50	300	E	Yes	Yes	Yes[6]
BJ4A2L	77445012	208/240	60	300	F	No	No	No
BJ4A2M	77445013	220	50	300	F	No	No	Yes[6]
BJ4A2N	77445014	208/240	60	300	G	No	No	Yes
BJ4A2P	77445015	220	50	300	G	No	No	Yes[6]
BJ4A2R	77445019	208/240	60	300	H	Yes	No	No
BJ4A2S	77445033	220	50	300	M	No	No	Yes[6]
BJ4A2T	77445020	220	50	300	H	Yes	No	Yes[6]
BJ4A2U	77445023	208/240	60	300	J	No	No	No

CONFIGURATION CHART (Contd)

EQUIP	TLA[1]	POWER[4]		DATA CAP (MB)	COLOR CODE[3]	STANDARD OPTIONS[2]		
		V	Hz			INDEX SECTOR IN B CABLE	WRT PROT[5]	PACK COVER INTLK
BJ4A2V	77445024	220	50	300	K	Yes	No	Yes[6]
BJ4A2Z	77445027	220	50	300	L	No	No	Yes[6]
BJ4M2F	95172002	220	50	300	N	No	No	No
BJ4M2G	95172003	208/240	60	300	P	No	No	No

[1] For factory use only.

[2] Defined in General Description of Hardware Reference manual.

[3] See Table 9A-2 Color Code chart in Parts Data Section.

[4] 208 Volt, 60 Hz drives can be rewired for 230 Volt, 60 Hz (208/240 is for CSA requirements only), and 220 Volt, 50 Hz can be rewired for 240 Volt, 50 Hz. See Installation section for instructions.

S/C 30 & Below units W/O 13235 will read 208 voltage
S/C 30 & Above units W/ 13235 will read 208/240 voltage
NOTE: 208/240 is for CSA requirements only

[5] S/C 01-19 do not have Write Protect feature.
S/C 20 and above do have Write Protect feature.

[6] S/C 31 & Below units do not have interlock.

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
CNTLGL	Centrifugal
CNTR	Counter
COMP	Compensation
CONFIG	Configuration
CONT	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
FREQ	Frequency

ABBREVIATIONS (Contd)

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
NON-VDE	(See Preface)
NORM	Normal
NRM	Normal
NRZ	Nonreturn to Zero
PCPT	Piece Part
PHH	Phillips
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

ABBREVIATIONS (Contd)

S&IOBC	Sector and Index on B Cable
S/C	Series Code
SEC	Second
SEL	Select
SEQ	Sequence
SER	Servo
SH	Sheet
SKT	Socket
SOL	Solenoid
SR	Servo
STP	Self-Tapping
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
VDE	(See Preface)
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

INSTALLATION 1

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 will all information in the discussion 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 the 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 layout an installation site. Consideration is given to:

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

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

SPACE AND CLEARANCES

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

ENVIRONMENT

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

POWER REQUIREMENTS

An ac power connection must be provided for each drive in the system. The drives connect to the power source via 3.05 mm (10-foot) long power cords.

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

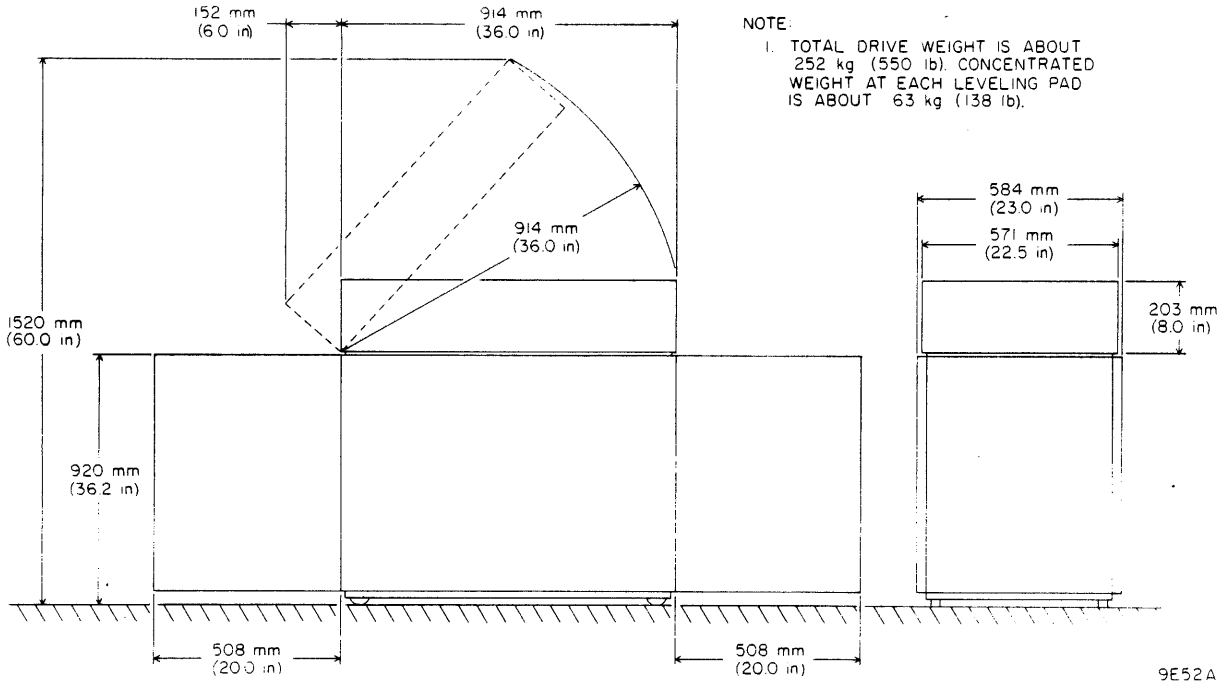


Figure 1-1. Space Requirements

TABLE 1-1. ENVIRONMENTAL REQUIREMENTS

Specification	Value
Temperature	
Operating	15.0°C (59°F) to 32°C (90°F)
Gradient	6.7°C (12°F) per hour
Transit (packed)	-40.4°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	-305 m (-1000 ft) to 2000 m (+6500 ft)
Transit (packed)	-305 m (-1000 ft) to 4572 m (+15000 ft)

TABLE 1-2. DRIVE INPUT VOLTAGE REQUIREMENTS

Drive* Type	Voltage/Tolerance (ac volts)	Frequency/Tolerance (Hz)	Phase
BJ4A1/BJ4A2 A, C, E, G, J, L, N; BJ4M2G	**208 (+14.6, -29)	60 (+.6, -1.0)	1
	230 (+16.0, -32)	60 (+.6, -1.0)	1
BJ4A1/BJ4A2 B, D, F, H, K, M, P; BJ4M2F	**220 (+15.0, -25)	50 (+.5, -1.0)	1
	240 (+17.0, -27)	50 (+.5, -1.0)	1

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

** Drive comes from factory wired for this voltage.

TABLE 1-3. DRIVE POWER CONSUMPTION REQUIREMENTS

Input Voltage	Unit Status	Line * Current	Consumption * KW	BTU/HR	Power Factor
208 V, 50/60 Hz	Disks and carriage in motion	8.60	1.40	4778	0.78
208 V, 60 Hz		8.65	1.46	4983	0.81
230 V, 60 Hz		7.80	1.45	4949	0.81
220 V, 50 Hz		9.18	1.50	5119	0.74
240 V, 50 Hz		8.56	1.51	5153	0.74
208 V, 50/60 Hz	Disks not in motion (standby)	1.77	0.367	1253	1.0
208 V, 60 Hz		1.77	0.367	1253	1.0
230 V, 60 Hz		1.63	0.370	1263	0.99
220 V, 50 Hz		1.80	0.348	1188	0.88
240 V, 50 Hz		1.79	0.349	1191	0.81

* These are maximum values.

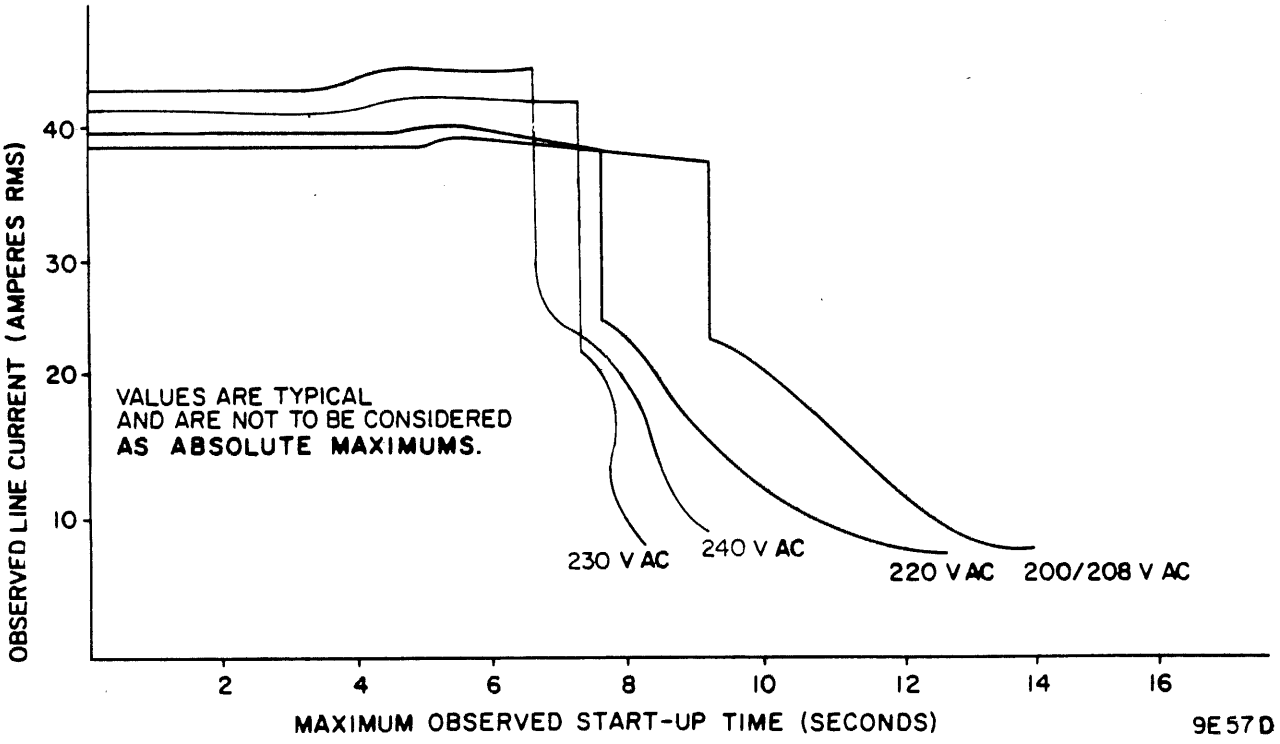


Figure 1-2. Startup Current

It is important to note that drives come from the factory wired to accept input power of either 208 volts, 60 Hz or 220 volts, 50 Hz. If a different line voltage is required, rewire the drive as described in the Wiring and Power Cable Routing procedures. Converting Non-VDE drives from 50 Hz to 60 Hz (or 60 Hz to 50 Hz) requires extensive reworking and is not recommended as a field procedure. If such a conversion is necessary, contact your factory representative.

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 LIMIATIONS

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

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

Site Power System Safety Ground

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

System Grounding

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

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

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

NOTE

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

- Daisy Chain - Drive 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 which are designated as the A cable and the B cable.

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

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

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

WARNING

When installing or replacing cables on a 60 Hz unit, S/C 34 with DJ13378-B and above, observe the following warning. To meet F.C.C. requirements for electromagnetic interference, it is mandatory that the round I/O cabling listed in table 1-4 is used for drive installation. If flat cabling listed in table 1-4 is used, it is the users responsibility to provide additional shielding, and obtain F.C.C. approval. Also, see warning in Preface of Hardware Reference manual.

Both the I/O cables and terminators are considered accessories and must be obtained separately from the drive. The part numbers of the terminators and the various available lengths of I/O cables are listed in table 1-4. The pin assignments and signal names may be found in the diagrams section of this manual.

PACKAGING

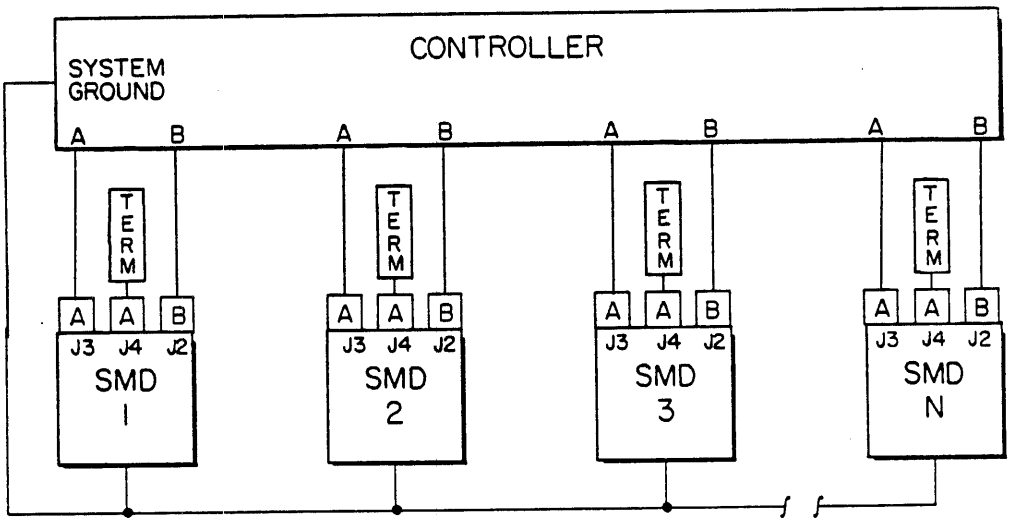
The drive must be properly packaged whenever it is shipped from one location to another.

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 holdown bolts.

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

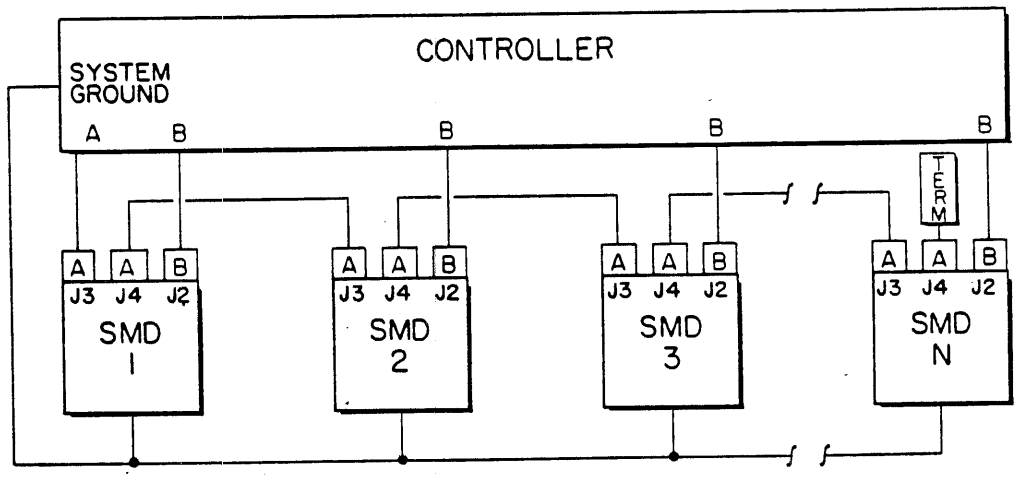
Seagate Technology, Inc.
Customer Services
12701 Whitewater Drive
Minnetonka, MN 55343

PHONE: 1-800-382-6060
FAX: (612) 931-8817



STAR-CABLED SYSTEM

NOTES: 1. MAXIMUM INDIVIDUAL A CABLE LENGTHS = 100 FT.
2. MAXIMUM INDIVIDUAL B CABLE LENGTHS = 50 FT.



DAISY CHAIN-CABLED SYSTEM

NOTES: 1. MAXIMUM CUMULATIVE A CABLE LENGTHS = 100 FT.*
2. MAXIMUM INDIVIDUAL B CABLE LENGTHS = 50 FT.
*EXCLUDES INTERNAL DRIVE CABLE.

90348

Figure 1-3. System Cabling

TABLE 1-4. CABLE AND ACCESSORIES LIST

	CABLE LENGTH IN FEET/METRES							
	05 1.5	10 3.0	15 4.5	20 6.1	25 7.6	30 9.1	40 12.2	50 15.3
A CABLE								
471912XX (Shielded)*	53	54	55	56	57	58	60	62
774391XX (Unshielded)	02	03	04	05	06	07	08	09
B CABLE								
471912XX (Shielded)*	01	02	03	04	14	05	06	07
752413XX (Unshielded)	00	01	02	03	13	04	14	05

OTHER ACCESSORIES

I/O Plug Terminator	40067209
A Cable Straight-In Kit	95050700**

NOTES:

* Shielded A and B cables are used in high noise environments.

** Kit used to modify 90° connector (standard on factory units) to 180° connector.

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 assume that the requirements discussed under Site Preparation have been met.

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

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

NOTE

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

PREINSTALLATION INSPECTION

Perform the following inspection prior to installing the drive.

1. Inspect drive for possible shipping damage. Any claim for this type of damage should be filed promptly with the transporter involved. If a claim is filed, save the original shipping materials.

2. Verify that all logic cards are firmly seated in logic chassis and power supply.

3. Verify that all connectors are firmly seated, and check for loose hardware.

4. Verify that the control panel is firmly seated in shroud.

5. Verify that all cabling is intact and that there are no broken or damaged wires.

6. Check entire drive for presence of foreign material which could cause an electrical short.

NOTE

Non-VDE: To gain access to the pack area while the drive is powered down, pull down on the solenoid latch and up on the pack access cover latch release.

VDE: To gain access to the pack area it is necessary to have the main circuit breaker on for at least 30 seconds.

7. Check actuator and pack area for presence of material which could obstruct movement of carriage and heads.

8. Check Pack Access Cover for tight seal. (Refer to the Pack Access Cover Adjustment procedure in section 2).

GROUNDING

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

Drive to Floor Grid Grounding

If a floor grid is available (either grounded or ungrounded), each drive is individually connected to the floor grid (refer to figure 1-4). The following describes this procedure (refer to table 1-5 for grounding accessories).

1. Crimp and solder a terminal lug to one end of a length of flat braided shielding.

2. Connect terminal lug to ac terminal of grounding block (refer to figure 1-5).

3. Route free end of braid strap through I/O cable guide and into cutout in floor.

4. Cut strap to proper length and attach terminal lug to free end as done in step 1.

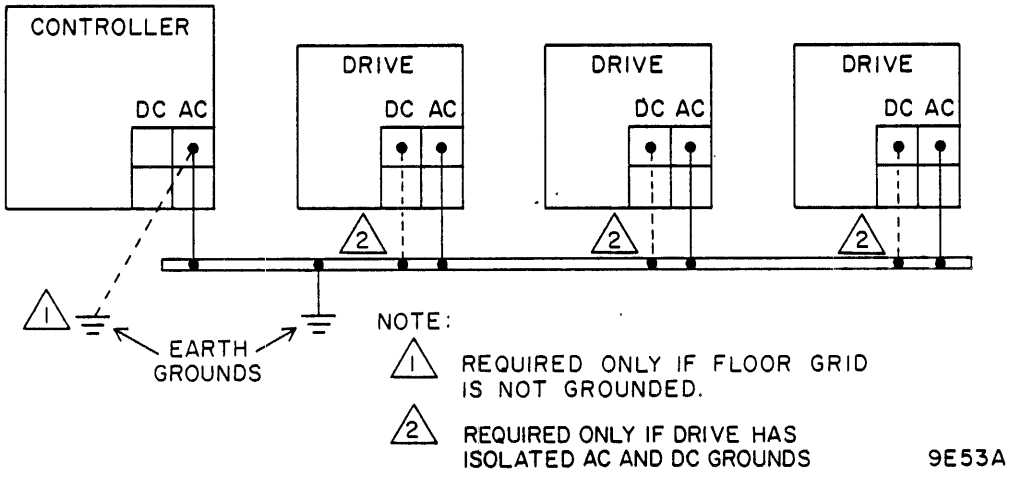


Figure 1-4. Floor Grid System Grounding

TABLE 1-5. GROUNDING ACCESSORIES

Part	CDC Part Number
Flat Braided Shielding	93267009 (50 ft)
Terminal Lug	40125601
Lockwasher, external tooth, #10	10126403
Screw, Cross Recessed, Pan Head, 10 x 32 x 1/2	17901524

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.

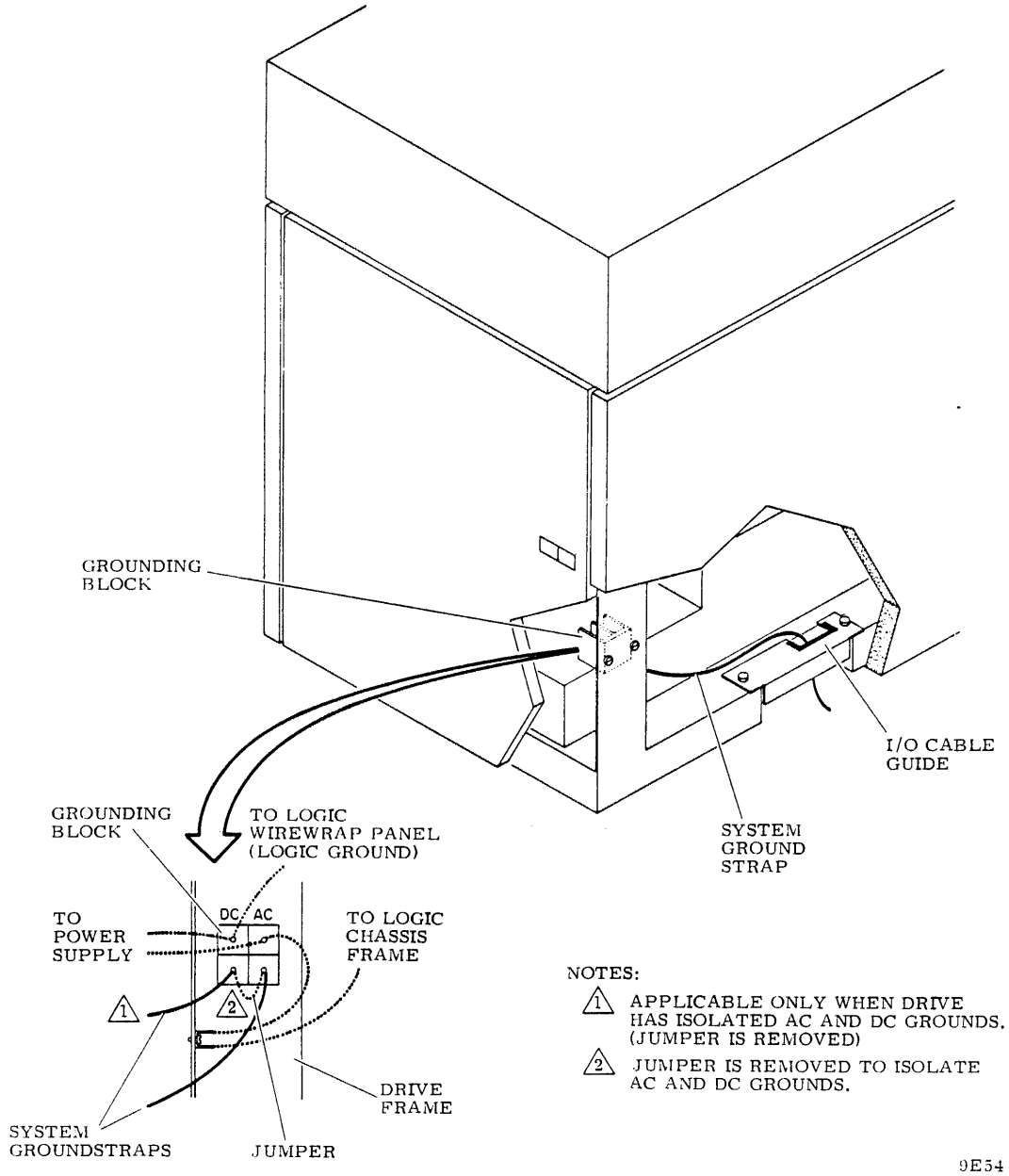


Figure 1-5. Drive Grounding Block

NOTE

The system ground must connect both the drive dc (logic) and ac (frame) ground to earth. The drives ac and dc grounds are tied together by four jumper wires and through the shielding of the drives internal I/O. One jumper wire is located on the grounding block (refer to 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 ground 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 ac and dc grounds to be isolated. In these cases, remove the four jumpers described above and isolate the main harness shielding from the deck. The main harness can be isolated from the deck by placing adequate electrical insulation between the main harness shielding and the cable clamp that secures the harness to the deck near the read/write chassis. Then 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.

Daisy Chain Grounding

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

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

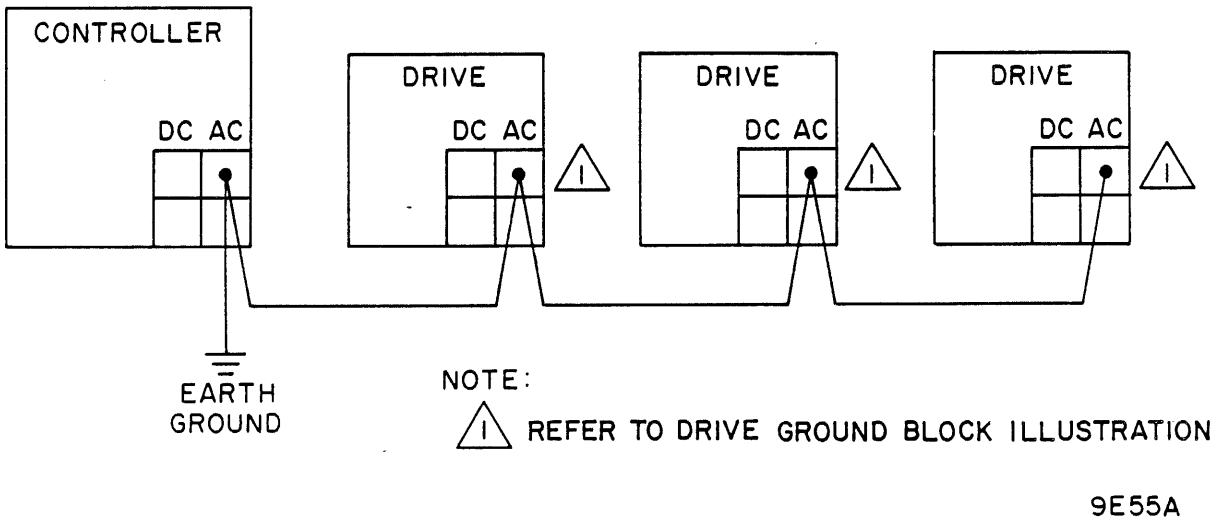


Figure 1-6. Daisy Chain System Grounding

2. Crimp and solder a terminal lug to ends of each strap.

3. Connect two straps to ac terminal of grounding block, route straps through I/O cable guide and connect to each of the two closest drives.

4. Ensure that the following conditions exist:

   - All drives and controller are connected in daisy chain.
   - Drive closest to controller is connected to controller.
   - Controller is connected to earth ground.

AC POWER WIRING

Two types of power supplies are used in the drive. Non-VDE units use the power supply shown on figure 1-7. The power supply shown on figure 1-8 is used on VDE drives. The two power supplies differ significantly and, as a result, ac power wiring is different. After examining figures 1-7 and 1-8 to determine which power supply is used, perform the appropriate power cable routing procedures.

POWER CABLING ROUTING (NON-VDE)

The power supply shown in figure 1-7 is factory wired to accept 208 volts, 60 Hz, or 220 volts, 50 Hz input power. It is possible to rewire 60 Hz units to accept 230 volts, and 50 Hz units to accept 240 volts by moving wires on transformers A1T1, A1T2 and A1T3. Refer to figure 1-7. The required transformer wiring for each input voltage is shown on cross reference number 803 in the logic diagrams.

CAUTION

When changing input connections make certain that the blower motor lead remains connected to terminal 2 of transformer T2.

60 Hz drives cannot be converted to 50 Hz, and 50 Hz drives cannot be converted to 60 hz without making transformer changes and additional wiring changes.

The drive power cable is connected and routed as follows:

1. Remove the screws securing the cable guide to the frame and remove the cable guide.
2. Route the power cable through the cable guide.
3. Position the cable guide on the frame and secure it with the mounting screws.
4. Connect the support spring to the power cable.
5. Do not connect the power cord to site power source at this time. All other cabling should be performed first.

POWER CABLE ROUTING (VDE)

The power supply shown in figure 1-8 is factory-wired for 208 V, 60 Hz or 220 V, 50 Hz. Wiring options are: 200 V, 50 or 60 Hz; 230 V, 60 Hz; 240 V, 50 Hz. Drive power wiring must match the site power source.

CAUTION

When changing input connections make certain that blower motor lead remains connected to transformer T2 taps as follows: For 50 Hz: tap 4, for 60 Hz: tap 2.

If only a voltage change is required, refer to logic diagram cross reference numbers 803 and 804 for wiring information. If

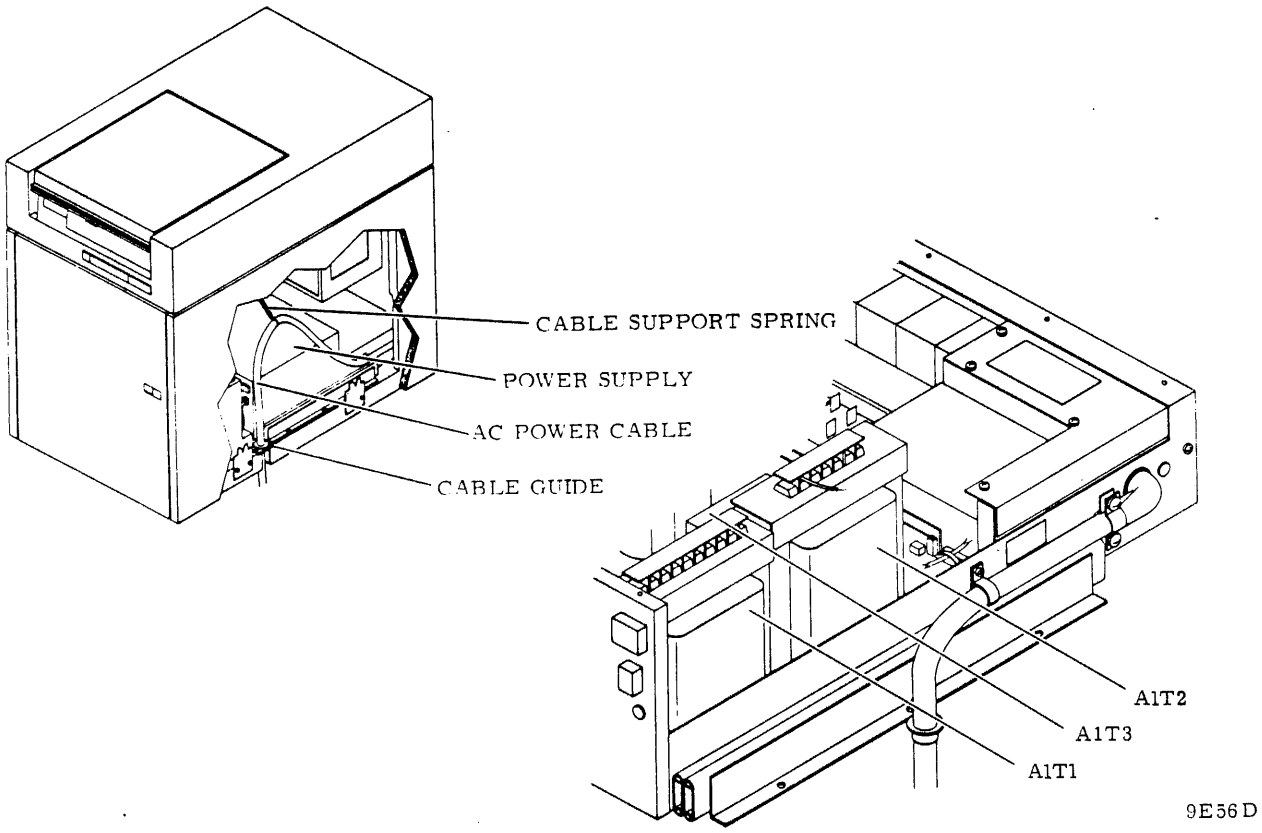


Figure 1-7. Power Cable Routing (Non-VDE)

a change is required for 50 Hz to 60 Hz, or 60 Hz to 50 Hz, the drive motor, power cord, hour meter, and drive belt must be changed.

No special power cable routing is required. Check the power cord connection on the power supply control panel to ensure it is firmly seated. Ensure the cable is secured to the top of the power supply with a cable strap as shown in figure 1-8.

Do not connect the power cord to the site power source at this time. All other connections should be performed first.

I/O CABLE INSTALLATION

This procedure describes the installation of drive I/O cables and terminators. The person performing the installation should be familiar with the information under I/O cabling presented earlier in this section. (Refer to figure 1-9).

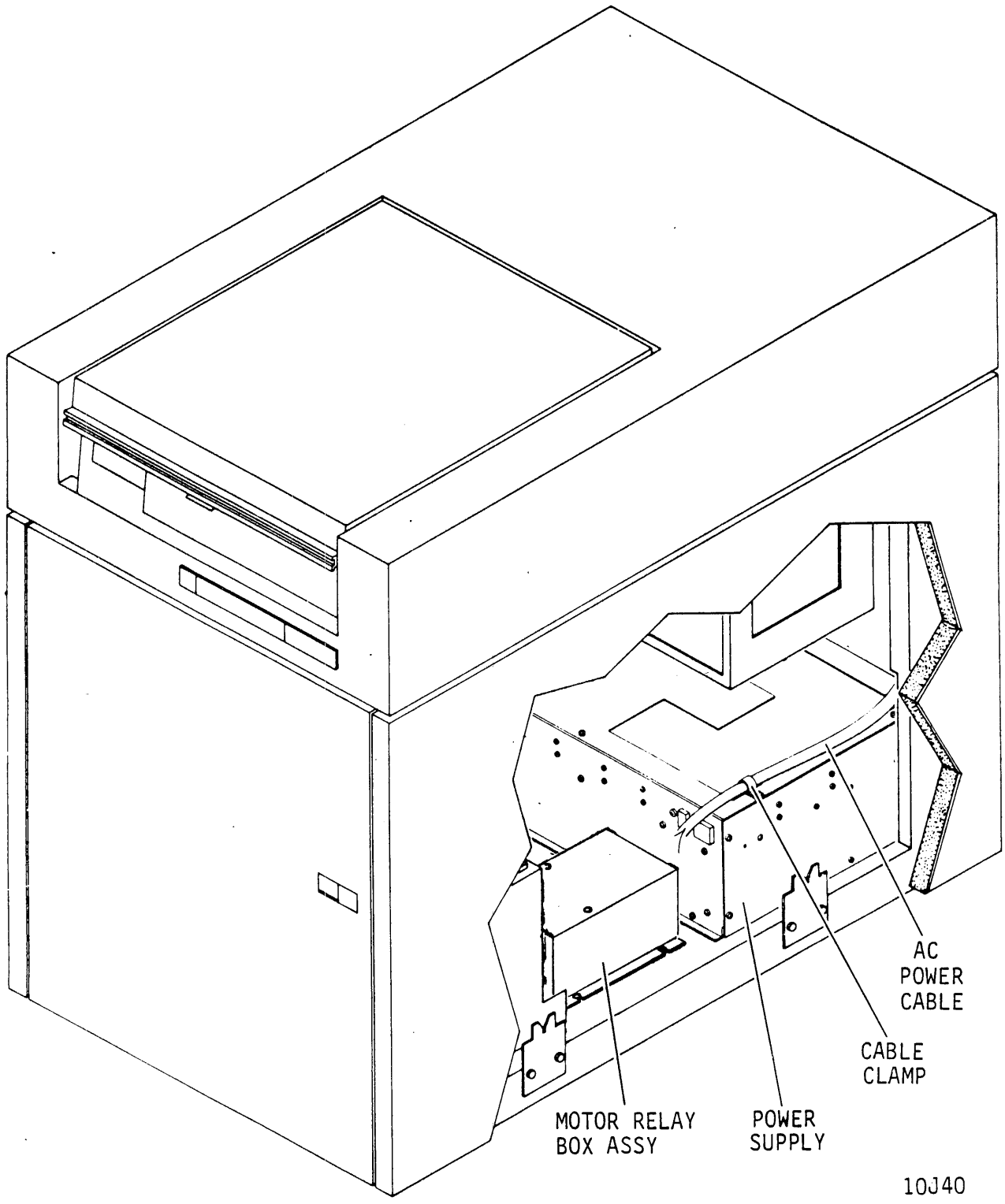


Figure 1-8. Power Cable Routing (VDE)

1. Remove power from drive by setting MAIN AC circuit breaker to off and ensure the power cord is disconnected from the site power source.

2. Remove left side panel.

NOTE

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.

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

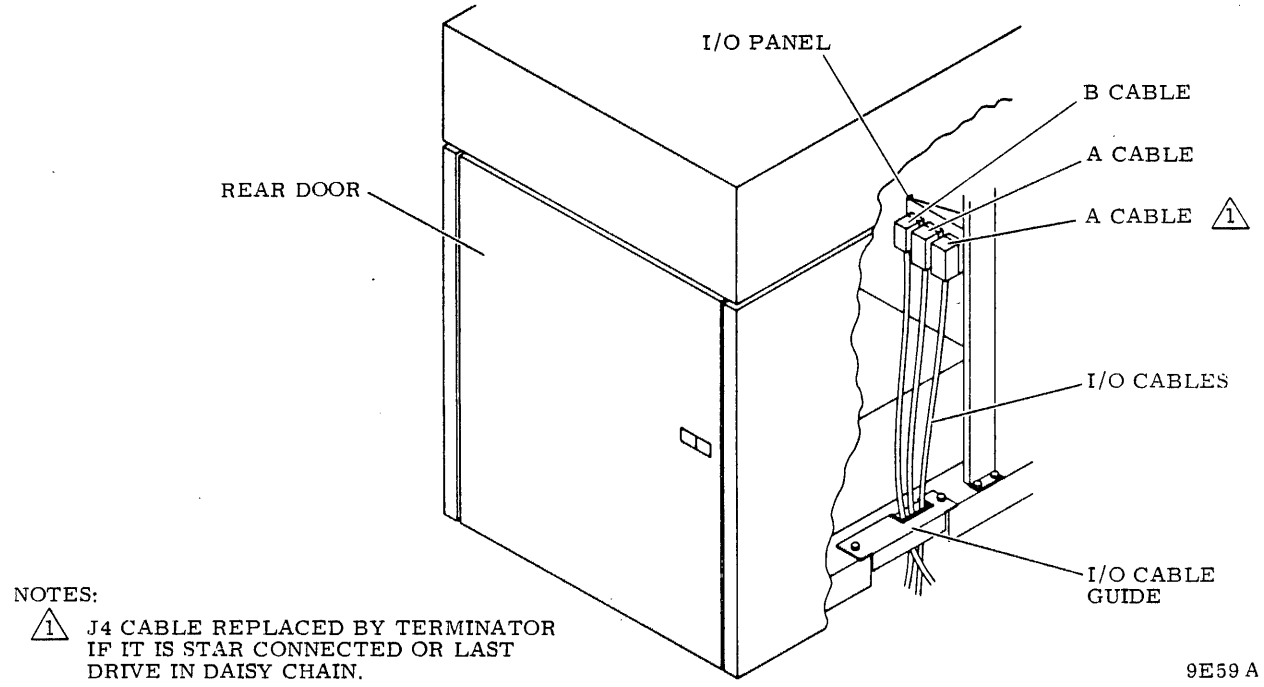


Figure 1-9. I/O Signal Cable Routing

NOTE

Steps 4 and 5 apply only to systems using star I/O cable configuration.

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

5. Install terminator on J4.

NOTE

Steps 6 through 9 apply only to systems using daisy chain I/O cabling configuration.

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

NOTE

If drive is not last in daisy chain perform step 7. If drive is last in daisy chain, perform step 11.

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

8. Install terminator on J4.

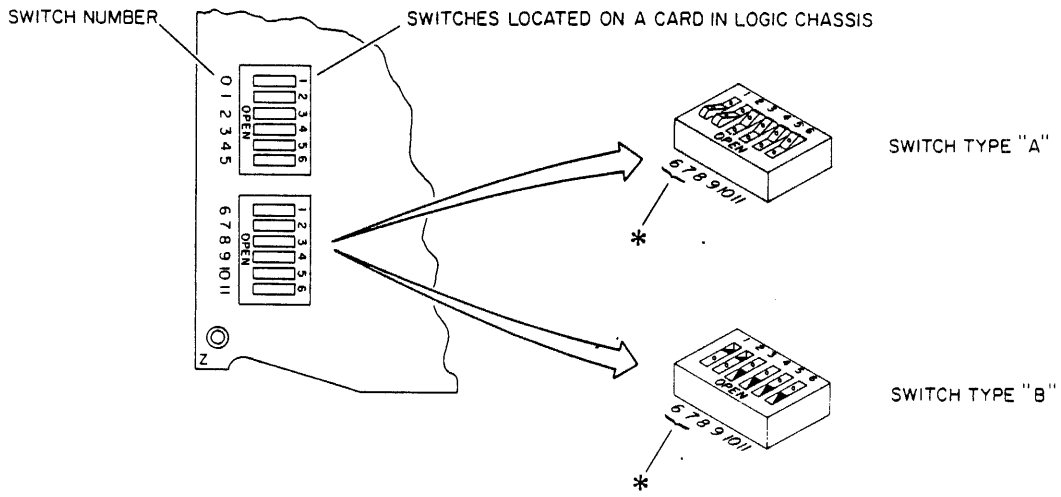
9. Replace left side panel.

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 1-10.

Refer to the subsystem reference manual to determine the number of sectors required by the controller; and then locate that number in table 1-6. 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 1-10 for an illustration of the switch positions.

ROCKER-TYPE SWITCHES

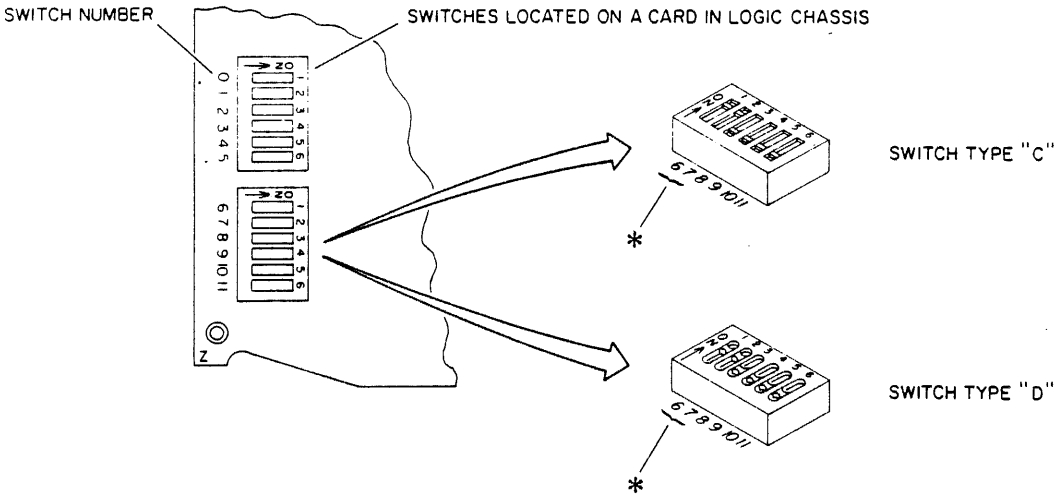


ROCKER-TYPE SWITCHES:

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.

9H10B

Figure 1-10. Sector Select Switches

The switch settings listed in table 1-6 have been determined from a formula. Use of this formula is demonstrated below to provide the user with an additional tool for determining sector switch settings.

Each sector will contain a certain number of dibits (received from the servo tracks). The number of dibits in each sector is the result of the number of sectors required by the controller. Thus:

$$\text{Total Dibits per Sector} = \frac{13\,440}{\text{Number of Sectors}} - 1$$

NOTE

Ignore any remainder in the calculation. However, the existance of a remainder adds a "short" sector before index.

Each sector switch represents a binary and decimal value of dibits (as counted in the logic). The values related to each switch are as follows:

Switch No.	Binary Value	Decimal Value
0	2^0	1
1	2^1	2
2	2^2	4
3	2^3	8
4	2^4	16
5	2^5	32
6	2^6	64
7	2^7	128
8	2^8	256
9	2^9	512
10	2^{10}	1024
11	2^{11}	2048

Here is an example of determining the switch settings for selecting 63 sectors:

$$\text{Total Dibits per Sector} = \frac{13\,440}{63} - 1 = 212$$

NOTE

Remainder is ignored.

Determine which switches to place in the Closed or On position as follows:

Total Dibits per sector	212
Dibits selected by switch 7	128
(Difference)	84
Dibits selected by switch 6	64
(Difference)	20
Dibits selected by switch 4	16
(Difference)	4
Dibits selected by switch 2	4
(Difference)	0

Thus, placing switches 2, 4, 6, and 7 in the Closed or On position selects 63 sectors of 212 dibits per sector. Since a remainder existed in the calculation formula, an additional "short" sector of 21 Sector Clock Pulses (806 kHz) will be present just before index.

TABLE 1-6. 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

Table Continued on Next Page

TABLE 1-6. SECTOR SELECT SWITCH SETTINGS (Contd)

Number of Sectors	Switch Number											
	0	1	2	3	4	5	6	7	8	9	10	11
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
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

Table Continued on Next Page

TABLE 1-6. SECTOR SELECT SWITCH SETTINGS (Contd)

Number of Sectors	Switch Number											
	0	1	2	3	4	5	6	7	8	9	10	11
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
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

Table Continued on Next Page

TABLE 1-6. SECTOR SELECT SWITCH SETTINGS (Contd)

Number of Sectors	Switch Number											
	0	1	2	3	4	5	6	7	8	9	10	11
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
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

Table Continued on Next Page

TABLE 1-6. SECTOR SELECT SWITCH SETTINGS (Contd)

Number of Sectors	Switch Number											
	0	1	2	3	4	5	6	7	8	9	10	11
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
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

Table Continued on Next Page

TABLE 1-6. SECTOR SELECT SWITCH SETTINGS (Contd)

Number of Sectors	Switch Number											
	0	1	2	3	4	5	6	7	8	9	10	11
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
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 should not be performed until drive is in final location and there is no further necessity to move it.

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

1. Install jam nut on each leveling pad and install a leveling pad at each corner of cabinet frame (see figure 1-11) by raising corner of cabinet and threading leveler into weldnut on frame.

2. Locate drive in final position.

3. Turn leveling pads down until they support drives' weight.

4. Adjust leveling 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.

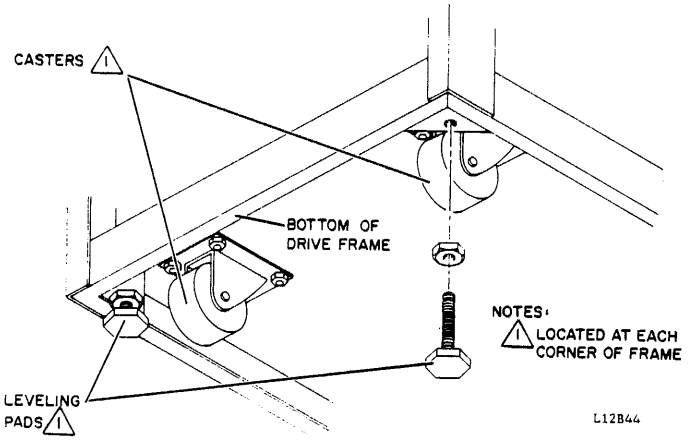


Figure 1-11. Leveling Procedure

INITIAL CHECKOUT AND STARTUP

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

1. Set all circuits breakers to OFF.

NOTE

Non-VDE: To gain access to the pack area while the drive is powered down, pull down on the solenoid latch and up on the pack access cover latch release.

VDE: To gain access to the pack area, it is necessary to have the main circuit breaker on for at least 30 seconds.

2. Perform Clean Shroud and Spindle procedure (refer to Preventive Maintenance section 3).

3. Open cabinet rear door, release logic chassis catch and swing logic chassis open.

4. Remove logic chassis card cover and verify that all cards are firmly seated in their connectors.

5. Verify that all connectors are firmly seated on the backpanel pins, and check for loose or broken wires.

6. Open top cover and remove deck cover.

7. Verify that all cards in the read/write chassis are firmly seated in their connectors.

8. Replace deck cover and close top cover.

9. Install logical address plug in operator control panel.

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

11. Install scratch disk pack.

12. 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.

13. Perform following procedures:

    a. Servo System Test and Adjustment (section 4).

    b. Head Alignment (section 4).

SECTION 2

GENERAL MAINTENANCE INFORMATION

GENERAL MAINTENANCE INFORMATION 2

INTRODUCTION

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

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

- Safety Precautions - Lists safety precautions that must be observed when working on the drive.
- Maintenance Tools and Materials - Lists the tools and materials required to perform maintenance on the drive. This includes discussions on the types of disk packs used during maintenance procedures, the head alignment kit card which is used during head alignment, and the use of test software or field test unit for performing drive test and adjustments.
- Accessing Drive for Maintenance - Describes the features of the drive which allow convenient access to its assemblies for maintenance.
- Maintenance Controls and Test Points - Describes location of test points (both on cards and backpanel) referred to in maintenance procedures.
- Manually Positioning Carriage - Describes how the heads may be loaded and positioned manually.
- Special Maintenance Procedures - Describes certain procedures and practices that are important to proper maintenance of the drive.
- Head Crash Prevention - Describes the steps that should be taken to avoid head crashes.

SAFETY PRECAUTIONS

The following topic provides warnings and precautions that must be observed during maintenance. Refer also to Important Safety Information and Precautions located in the front of this manual following the table of contents. Failure to observe the warnings, precautions, and other safety information provided in this manual could result in personal injury.

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

- Use only Seagate replacement parts. Using non-Seagate replacement parts can adversely affect safety. Using other manufacturers' parts could also degrade reliability, increase maintenance downtime, and void warranty coverage.

- 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 trouble-shooting 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 in Handling Electrostatic Devices when working on _YFN card in power supply or this card may be damaged.

MAINTENANCE TOOLS AND MATERIALS

GENERAL

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

TABLE 2-1. MAINTENANCE TOOLS AND MATERIALS

Description	Part Number
Adapter (3/16 Hex to 1/4 Sq)	12262582
Adhesive, Loctite 415 1-lb. bottle	95033929
Adhesive, 3M FC1711 5 oz. tube (used to secure gasket to P.A. cover insert)	95017301
Adhesive, Sealant	95125321
Ball End Hex Driver (3/16 Hex)	12263201
Bonding Agent (Fast Setting)	95033900

Table Continued on Next Page

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

Description	Part Number
Bonding Agent	95033926
Card Extender (Full-Size)	54109701
Card Extraction Tool	87399200
Carriage Alignment Arm	75018400
Chip Extender (Chipclip)	12212196
Cloth, Lint Free	94211400
Disk Pack, CE (883-51)	70430003
Disk Pack, Regular (883-91)	70430513
Dust Remover***	95047800
Epoxy (Fast Cure)	To be supplied
Gauze, Lint Free	12209713
Grease, Silicone	95109000
Head Adjustment Tool	75018803
Head Alignment Kit	77440503
Head Cleaning Solution	82365800
High Intensity Light****	12212038
Hose Assembly	82346500
I/O Pin Removal	12212759
Pressure Gauge Kit, Differential (Optional)	73040100

Table Continued on Next Page

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

Description	Part Number
Loctite, Grade C	Loctite Corp.
Loctite Primer, Grade N	Loctite Corp.
Lubricant Paste	95016101
Mirror	Commercially Available
Non-Metallic Feeler Gauge, 0.005 inch	12205633
Oscilloscope, Dual Trace	Tektronix 454 or equivalent
Oscilloscope Hood	Tektronix 016-0083-00
Pin Straightener	87369400
Blank Tab Card (Computer Punch Card)	70631686
Push-Pull Gauge	12210797
Scope Probe Tip (Hatchet Type)	12212885
Sealant, Silicone, Rubber	95023500
Spindle Adjustment Tool	87059900
Spring Puller	84480900
Static Ground Wrist Strap 6 1/2 to 8 Inch Wrist Up to 6 1/2 Inch Wrist	 12263496 12263623
Static Shielding Bag	12263626
Thread Locking Compound, 50 ml bottle (used to secure nuts to shroud window)	95059905

Table Continued on Next Page

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

Description	Part Number
Thread Locking Compound, 50 ml bottle (used to secure stud to deck)	95059909
Torque Screwdriver**	92016400
Torque Screwdriver Bit**	87016701
Torque Tool	12218425
Torque Wrench, 1/4 inch	12263205
Volt/ohmmeter	Ballantine 345 or equivalent digital voltmeter
Wire Wrap Bit, 30 Gauge	12218402
Wire Wrap Gun, Electric	12259111
Wire Wrap Removal Tool, 20-30 Gauge	12259183
Wire Wrap Sleeve, 30 Gauge	12218403

** Torque screwdriver and bit are used for torquing 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.

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 in lieu of the field test unit).

DISK PACK

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

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

The CE pack contains special prerecorded information used during maintenance and care must be taken that this data is not 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 found in the hardware reference manual.

HEAD ALIGNMENT KIT

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

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

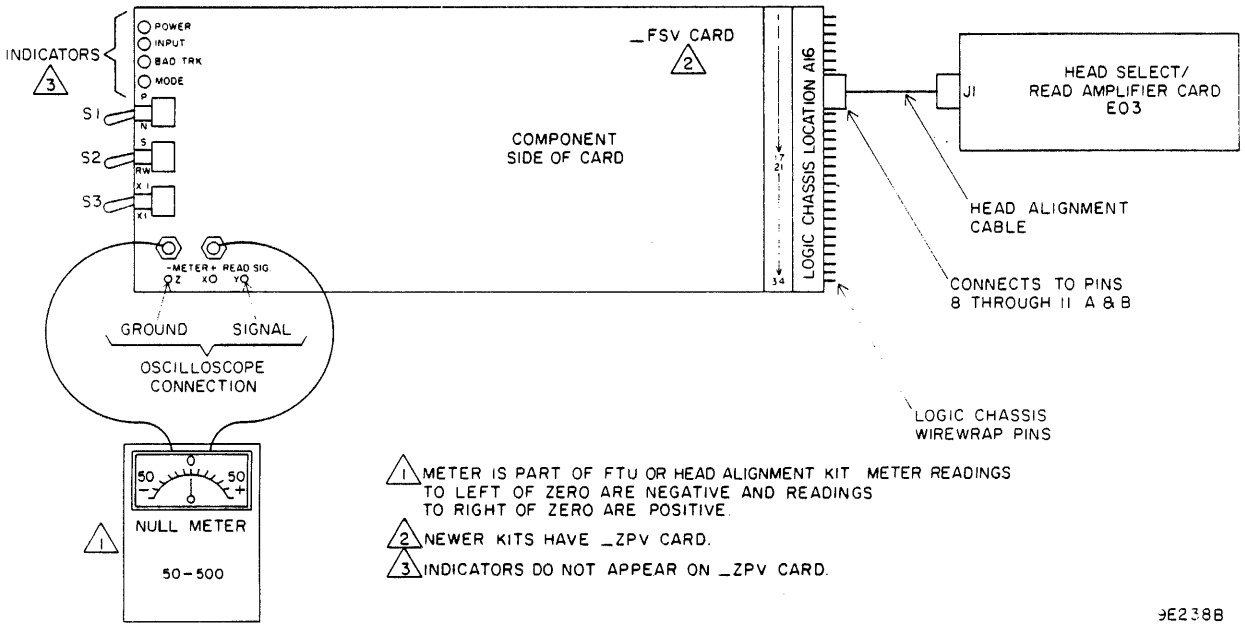


Figure 2-1. Head Alignment Kit

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 2-1).

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

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

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

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

c. Subtract N reading from P reading to determine alignment error. For example: If P = +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.

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 exist, read/write head alignment error cannot be measured.

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

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

The switch on the meters front panel changes the sensitivity of the meter. When the switch is in the 50 position, the meter reads up to $\pm$50 mV. When the switch is in the 500 position, the meter reads up to $\pm$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 exerciser (FTU) or test software is required to perform most of the electrical tests and adjustments described in this manual. The FTU or test software 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 by way of 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 manual applicable to the FTU for more information concerning its operation, installation, and use.

Testing With Software

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

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

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

Preparation of Drive for Testing

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

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

NOTE

Disable I/O by deselecting drive at controller before performing step 2.

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

NOTE

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

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

4. Close pack access cover.

5. Release logic chassis latch and swing chassis open.

NOTE

If test software is to be used, proceed to step 8. If FTU is used with I/O bypass connection, proceed to step 6. If FTU is used with the standard I/O connection, proceed to step 7.

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

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

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

   b. Terminate J4.

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

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

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).

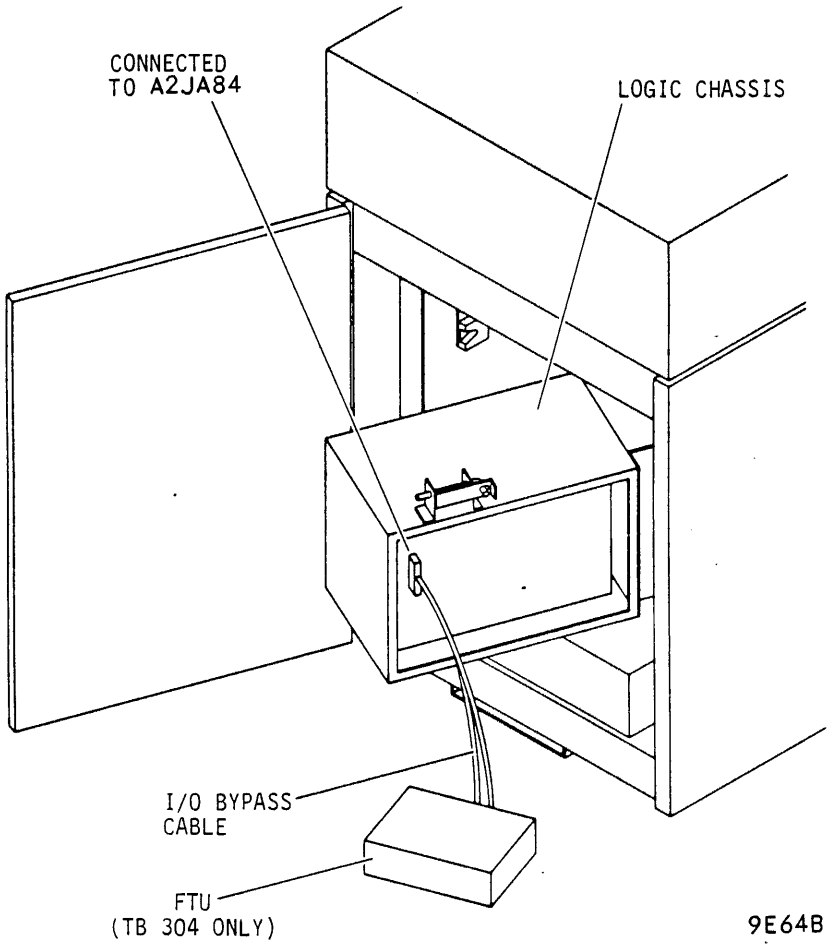


Figure 2-2. FTU to Drive I/O Bypass Connection

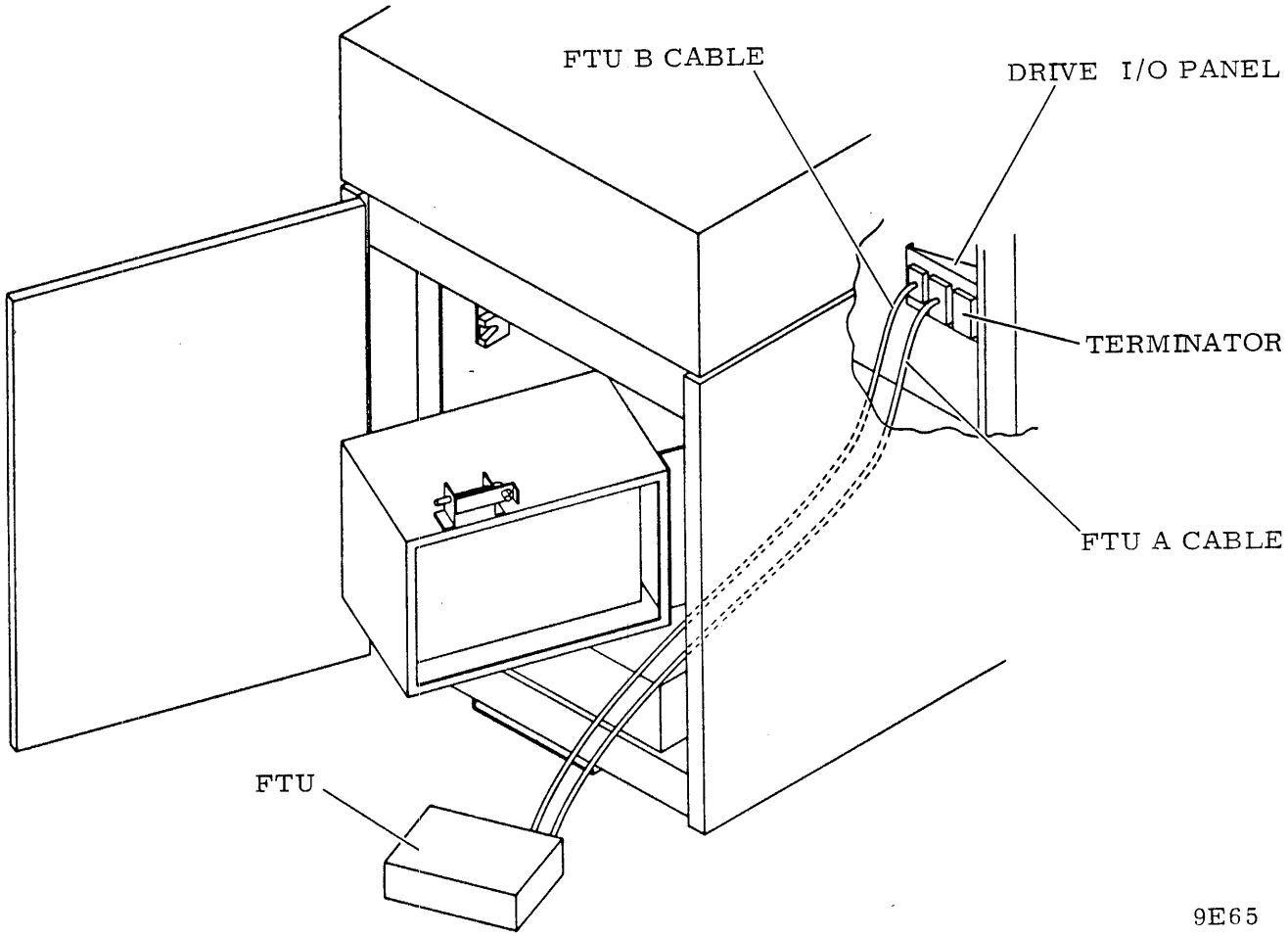


Figure 2-3. FTU to Drive Standard I/O Connection

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

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

1. Remove power from drive as follows:

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

   b. Set MAIN AC circuit breaker to off.

   NOTE

   If test software was used, proceed to step 6. 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.

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 installation of 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. Figures 2-4 and 2-5 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 figures 2-4 and 2-5). The front door provides access to the blower assembly. If the blower assembly is removed, the lower part of the spindle and its associated parts may also be accessed. The rear door allows access to the logic chassis, power supply and drive motor.

The front door is opened by pushing the latch and swinging it outward as shown on figures 2-4 and 2-5. The rear door on VDE units has an additional lock. Insert a 6 mm hex key through the hole beneath the latch, and turn it to release the lock. The doors are removed by first removing the groundstrap, then lifting out the pin securing the door to the lower hinge and slipping the door off the upper hinge. The doors are replaced by reversing the removal procedure.

CABINET TOP COVER

General

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

The top cover is raised by lifting it from the rear and raising it until the support locks into place (refer to figure 2-6). VDE units have a latch that is released by opening the rear door and pushing the latch release.

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

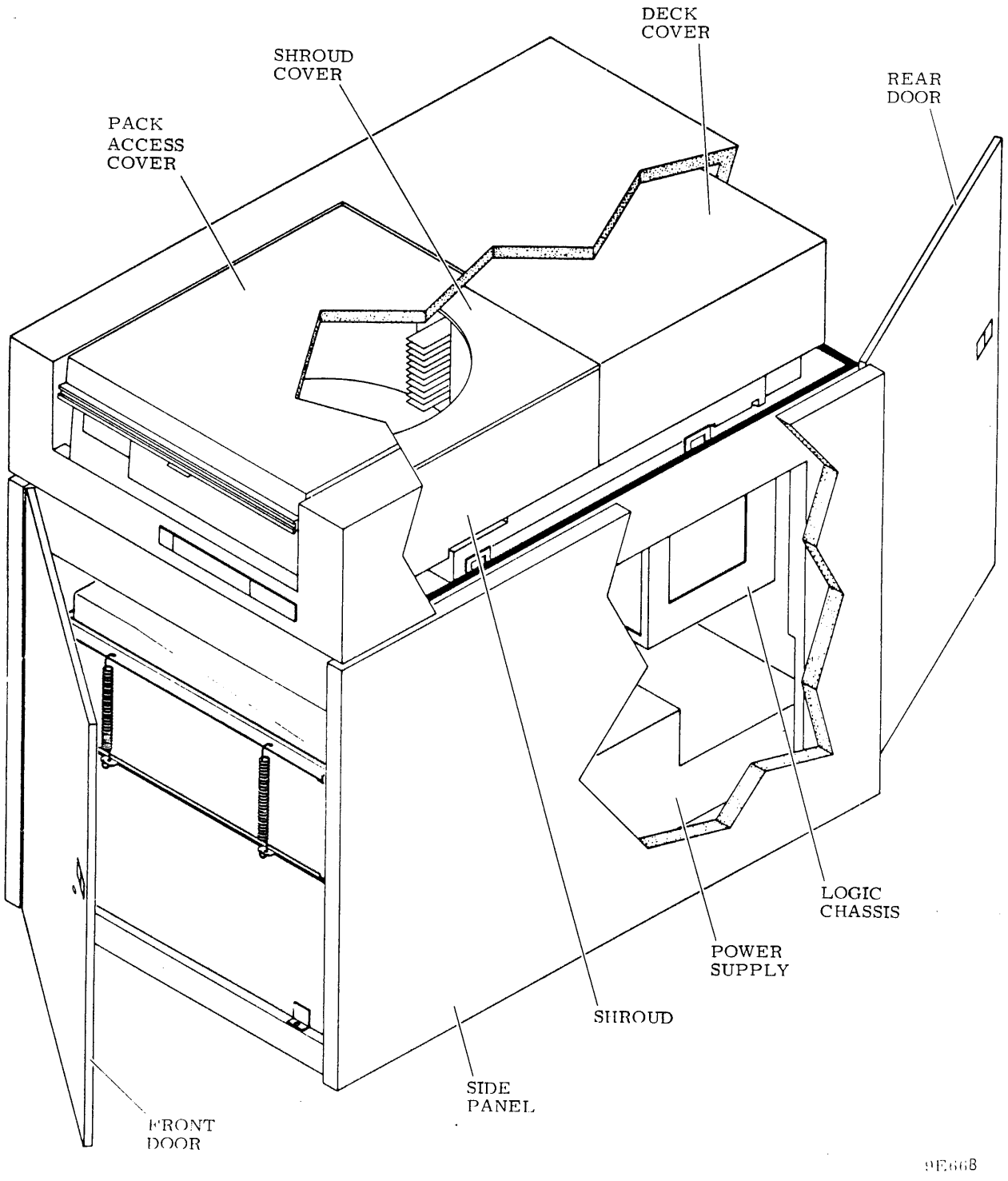


Figure 2-4. Access For Maintenance Features (Non-VDE)

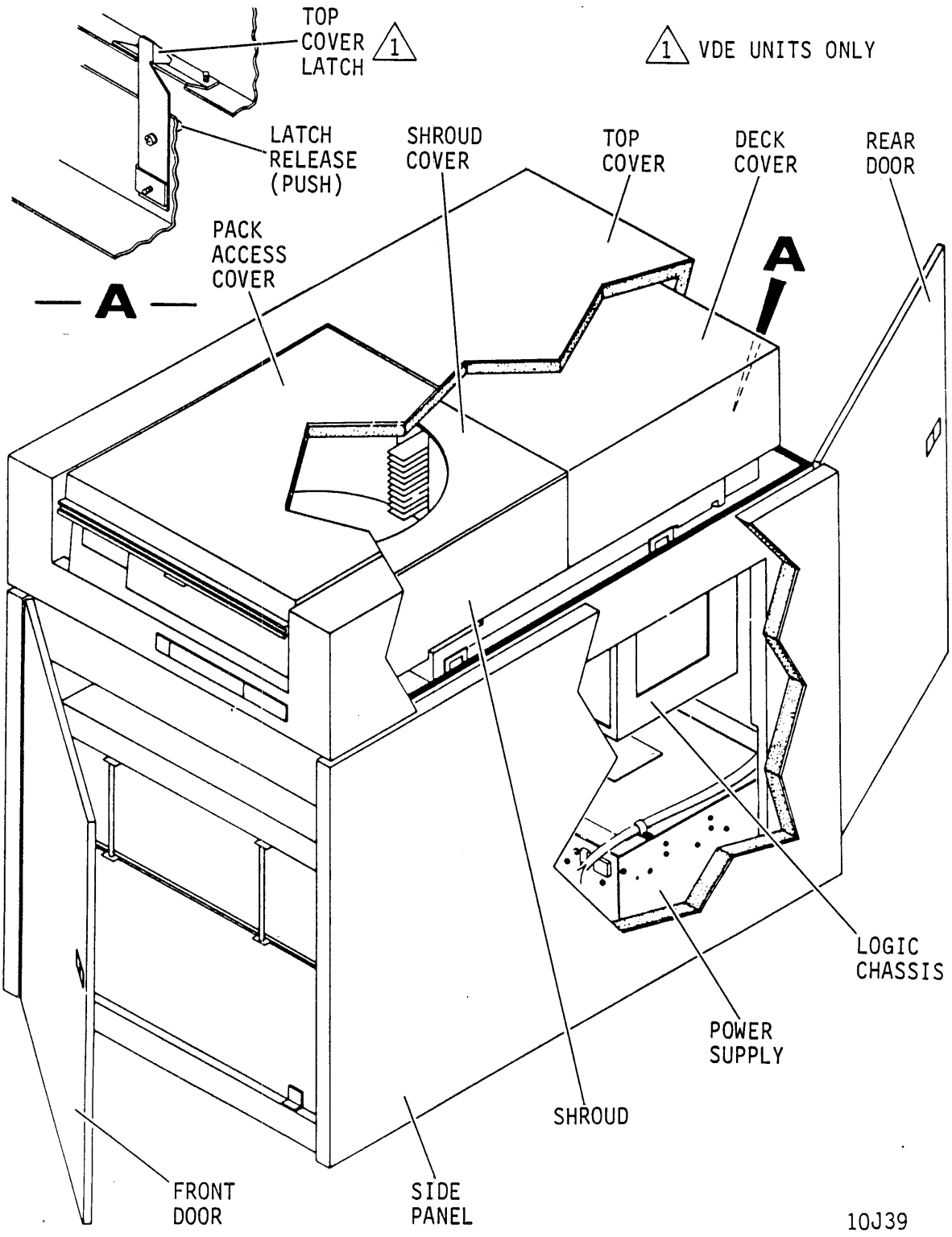


Figure 2-5. Access For Maintenance Features (VDE)

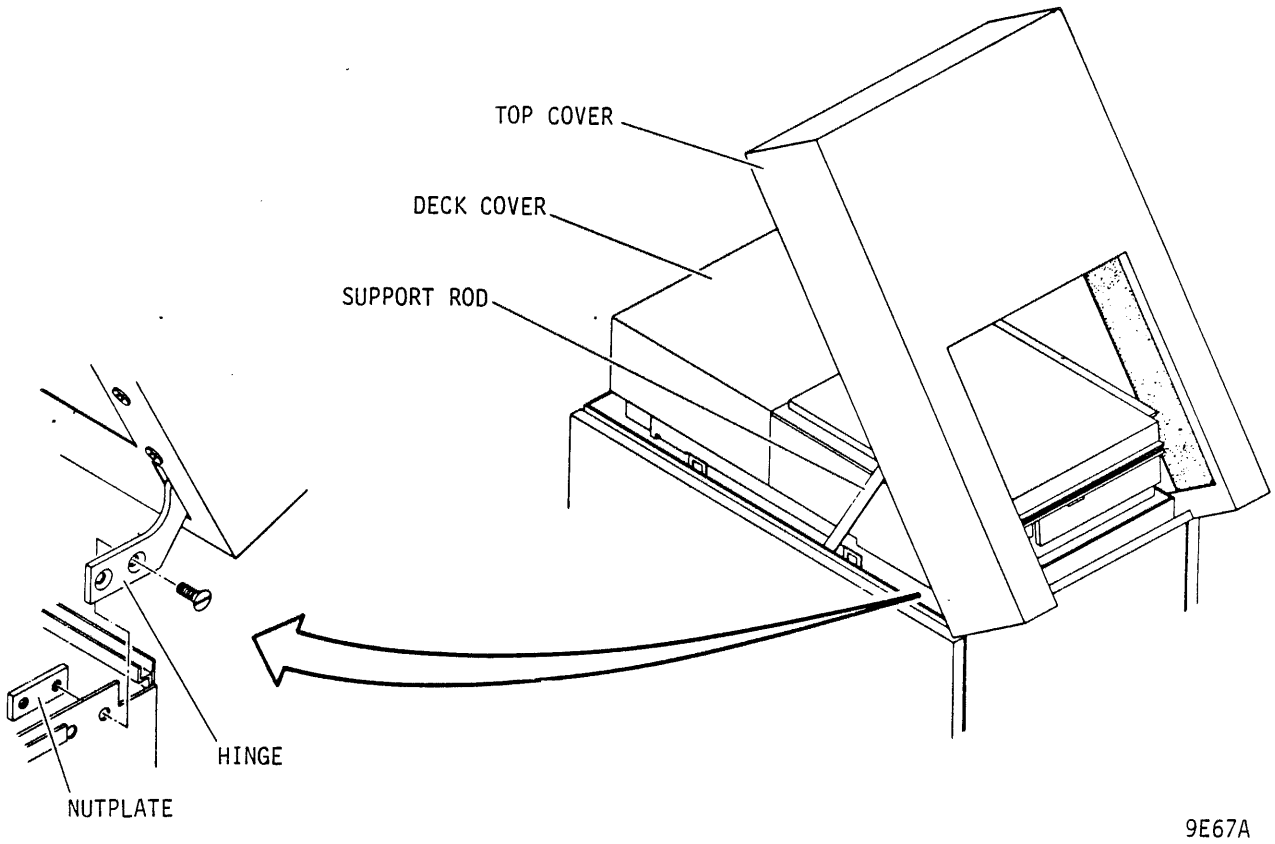


Figure 2-6. Top and Deck Cover

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 screws and support brackets.

3. Remove C clip securing support bracket to top cover, then lower support bracket and top cover to closed position.

4. Remove screws from top cover hinges and lift top cover off drive.

Top Cover Replacement

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

NOTE

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

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

DECK COVER

The deck cover (refer to figure 2-6) must be removed to access the rear half of the deck. This includes the actuator and magnet assemblies. The purpose of this cover is to provide an electromagnetic interference shield for the drive. This cover is lined with acoustical foam to reduce machine noise.

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

LOGIC CHASSIS

The logic chassis is located at the rear of the drive and is accessed by opening the rear door. Releasing the catch on the logic chassis allows it to swing outward thus permitting access to the card cage (refer to figure 2-7). The card cage cover must be removed in order to reach the logic cards. Use care to avoid damages to cables or air hose when opening and closing the logic chassis.

PACK ACCESS COVER

General

Raising the pack access cover allows access to the disk pack and shroud area of the drive. Once opened, the cover is held in place by a gas spring (refer to figure 2-8). A solenoid, located on the front of the shroud cover, prevents accidental opening of the pack access cover while the drive is in use or when the drive is completely powered down. In fact, the only time the cover can be opened (without overriding the solenoid) is when the MAIN AC circuit breaker is ON, but the START switch is OFF.

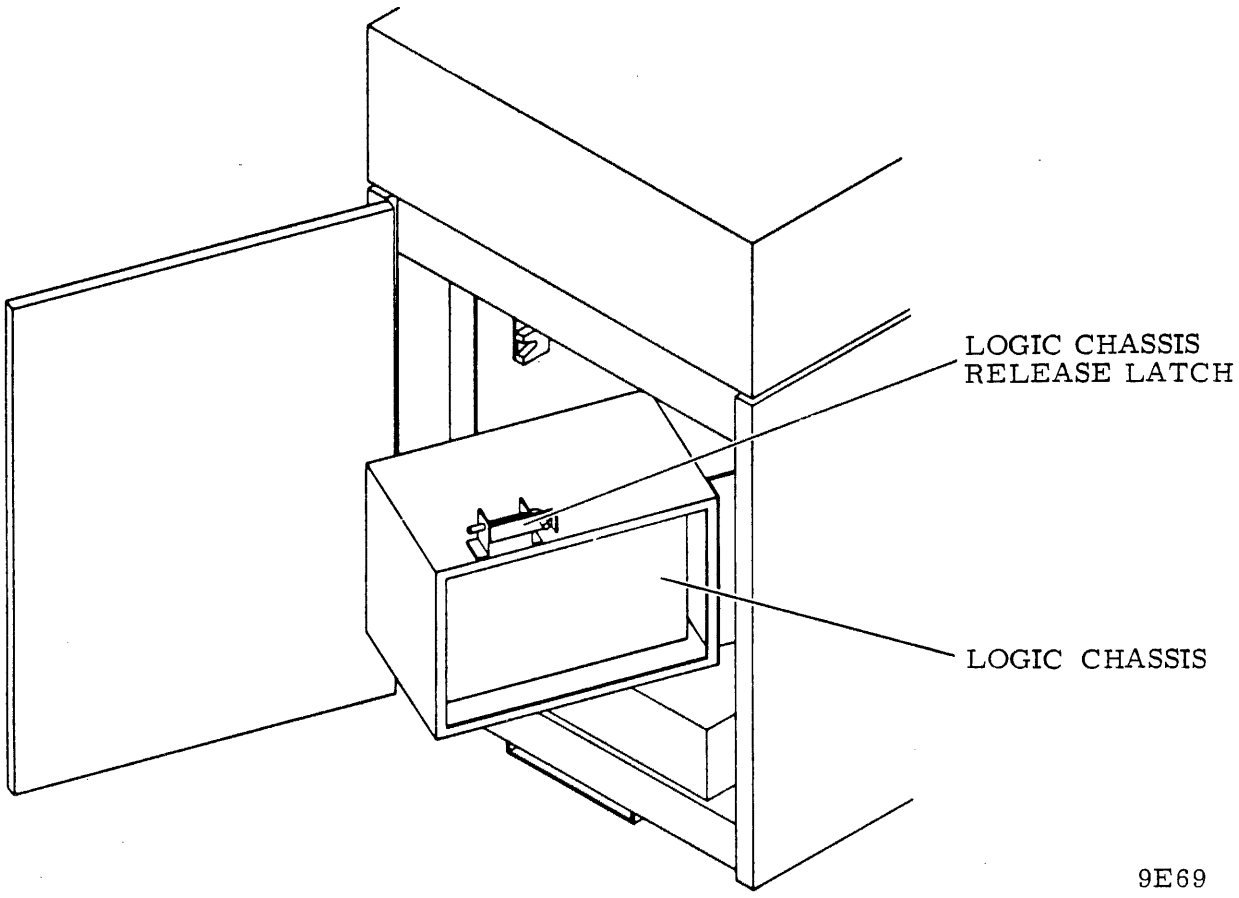


Figure 2-7. Logic Chassis

The pack access cover solenoid can be manually actuated on Non-VDE units. Pull down on the solenoid latch while pulling up on the pack access cover latch release. On VDE units, the drive must be in the standby mode (power on, motor stopped) to open the cover. The pack access cover will remain locked for approximately 30 seconds after the MAIN AC circuit is turned on.

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

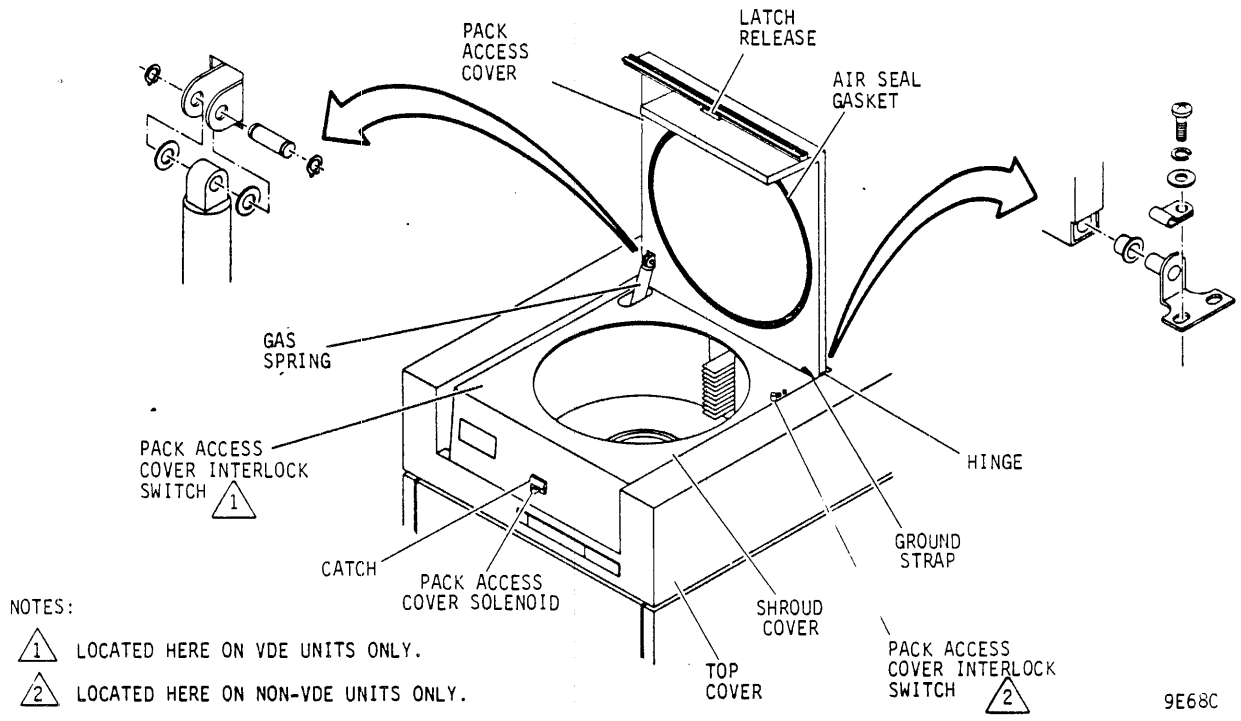


Figure 2-8. Pack Access Cover

Pack Access Cover Removal

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

Pack Access Cover Replacement

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

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

2. Secure gas spring to pack access cover using pin, nylon spacers and C clip (refer to figure 2-8).

3. Connect ground lead to pack access cover.

NOTE

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

4. Close pack access cover.

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

6. Install cabinet top cover.

POWER SUPPLY

General

Two types of power supplies are used in the drives. Their physical appearance and mounting methods differ significantly. The power supply shown in figure 2-9 is used on all Non-VDE units. The power supply shown in figure 2-10 is used on all VDE units.

Non-VDE Power Supply Access

Newer drives: The power supply is mounted on support brackets at the bottom rear of the drive cabinet. The brackets are secured to the frame with front mounting screws and blocks at the rear of the brackets. For maintenance, remove the front mounting screws and pull the power supply out to maintenance position.

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

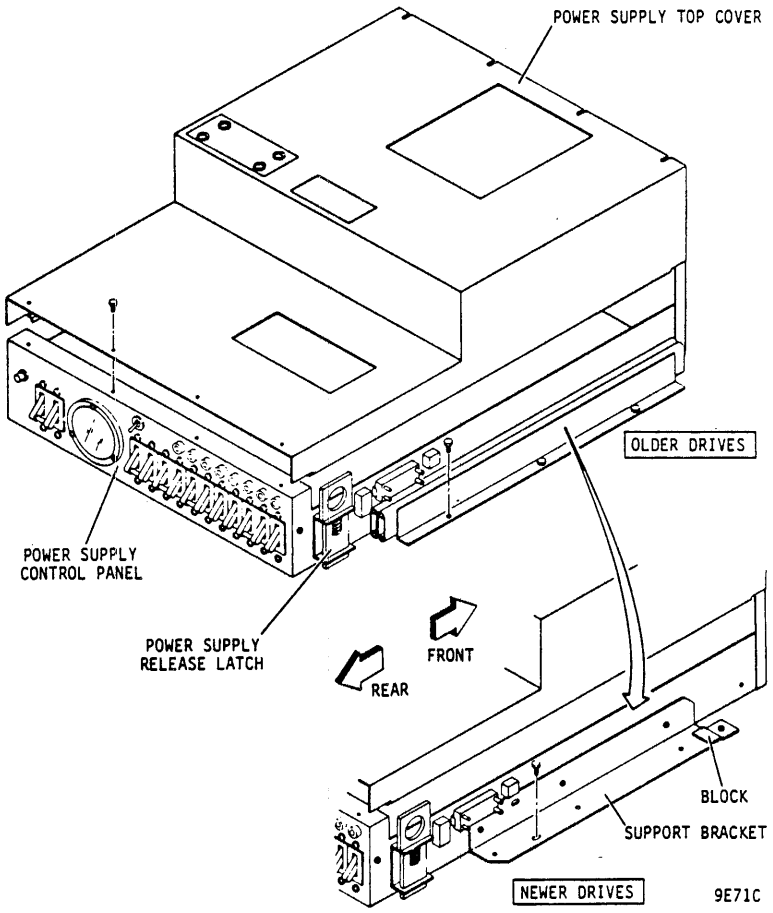


Figure 2-9. Power Supply (Non-VDE)

2. Lift power supply release latch (refer to figure 2-9) and pull power supply out to maintenance position.

When the power supply is in the maintenance position, the top cover can be removed to provide access to the inside of the supply. The top cover is removed by first removing the screws at the rear of the cover (refer to figure 2-9) then loosening the screws at the front of the cover and slipping the cover off.

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

VDE Power Supply Access

The power supply shown in figure 2-10, is mounted directly to the cabinet base. A lip at the back edge of the power supply slides under a bracket secured to the cabinet base. Two #10-24 x 3/8 self tapping screws and external tooth lockwashers secure the front edge of the power supply to the cabinet base.

Removal of the two #10-24 mounting screws permits the power supply to be pulled rearward within the limits of the free length of the cables and blower hose. Servicing of the power supply will generally require its removal from the cabinet. With the cover removed, the power supply can be repositioned in the cabinet if power on tests must be performed. Procedures for removal of the power supply and its cover are as follows:

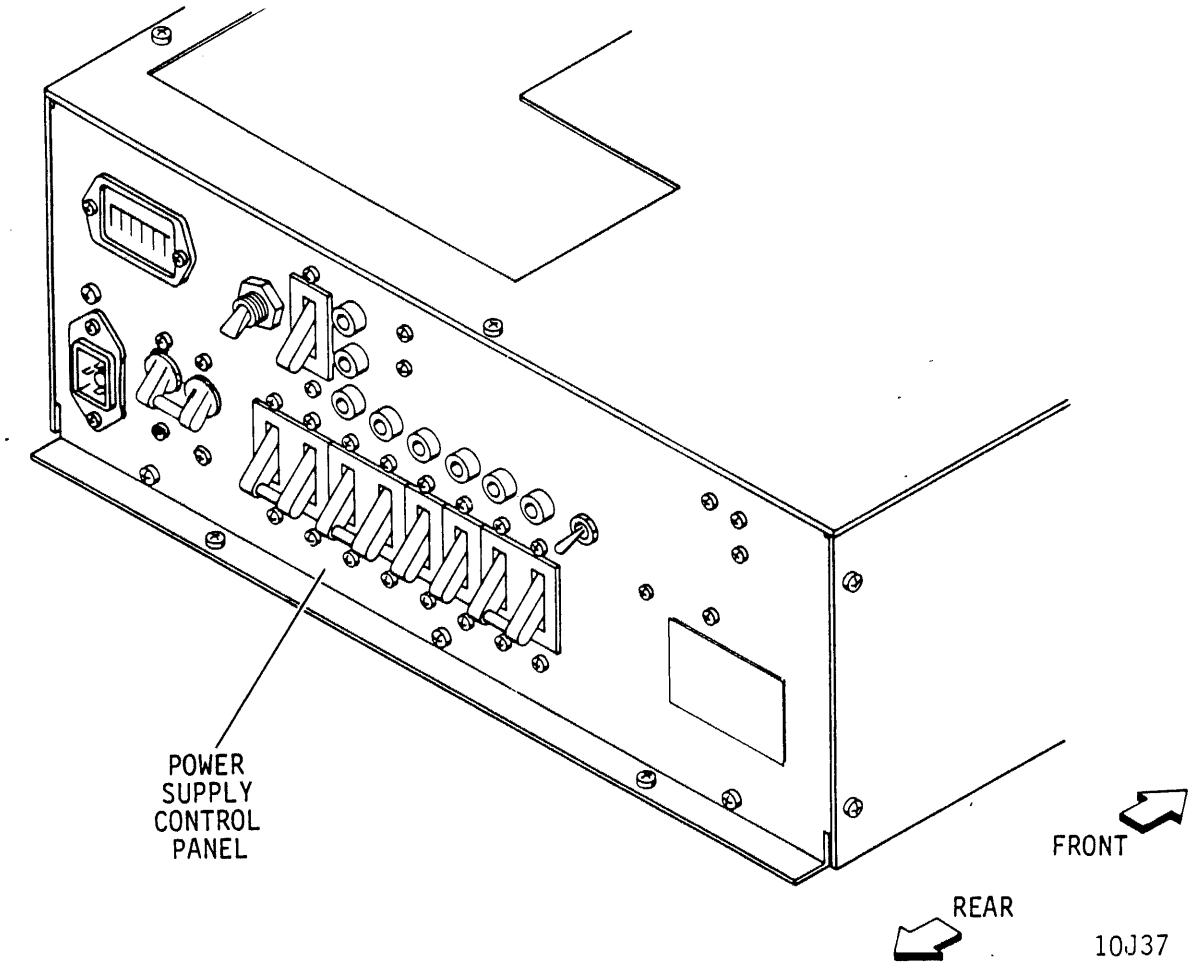


Figure 2-10. Power Supply (VDE)

1. Place the MAIN AC circuit breaker in the OFF position and disconnect the power cord from the site power source.

2. Disconnect the blower hose from the backpanel.

3. Disconnect the drive motor cable (A1P7), blower motor cable (P2), and brake cable (P8) from connectors J7, J2, and J8 respectively on the side panel of the power supply.

4. Disconnect the voice coil cable (A1P6), 5 volt regulator cable (A1P3), and external cable (A1P4) from connector J6, J3, and J4 respectively.

5. Remove the two 10-24 mounting screws that secure the control panel end of the power supply to the chassis.

6. Pull the power supply straight to the rear of the cabinet until the flange at the rear of the power supply clears the retaining bracket.

7. Remove the supply from the chassis.

8. Remove the screws that secure the cover to the power supply.

9. The power supply may be reinstalled in the cabinet and all cables connected to operate the drive with the cover removed. Ensure the blower hose is connected.

SIDE PANELS

The drive has both left and right side panels. The panels are removed by pulling up on the release latches, swinging the panels outward far enough to disconnect the ground straps, and then removing the panels from the drive (refer to figure 2-11). The panels are replaced by reversing the removal procedure. Note that if the drive is installed inline with other drives, it must be moved out of line to remove or replace the side panels.

SHROUD AND SHROUD COVER

General

The shroud and shroud cover enclose the pack area and the front portion of the deck. They must be removed to perform certain maintenance procedures and their removal and replacement is described in the following (refer to figure 2-12).

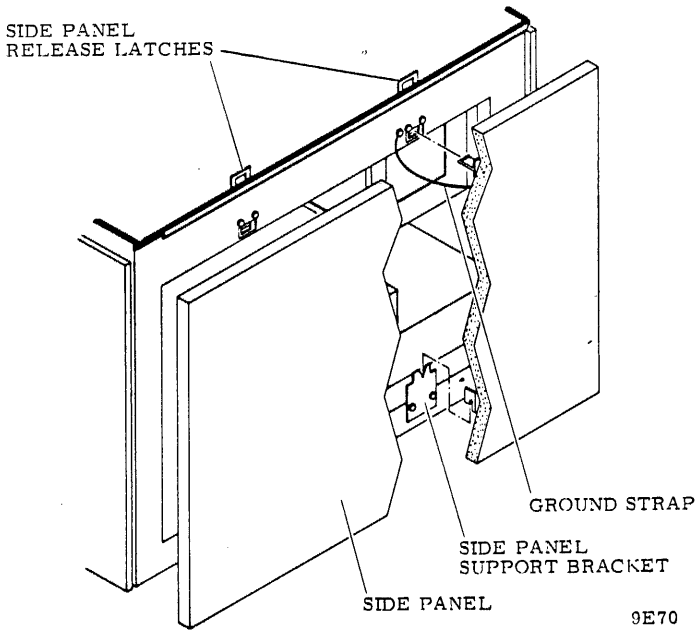


Figure 2-11. Side Panel

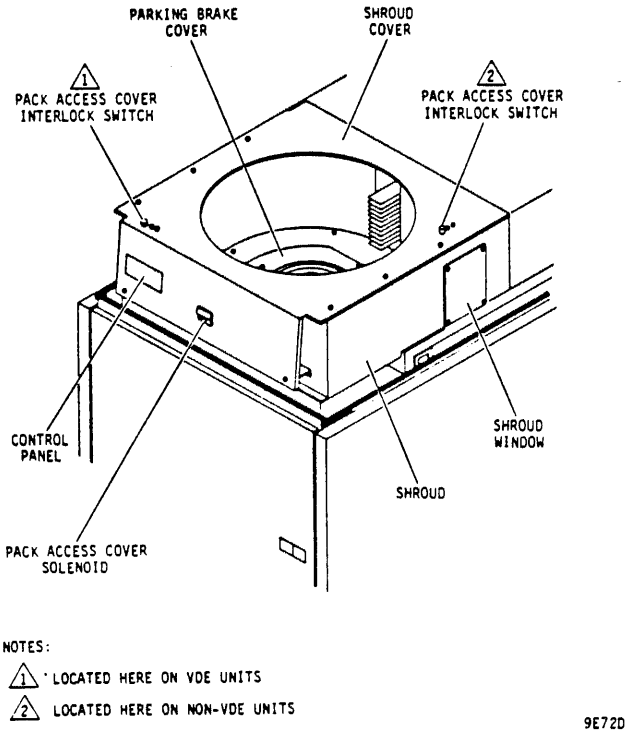


Figure 2-12. Shroud and Shroud Cover

Shroud and Shroud Cover Removal

1. Remove cabinet top cover.
2. Remove pack access cover.
3. Remove pack access cover switch if so equipped, 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, then snap control panel back into place.
5. Move shroud cover far enough forward to disconnect solenoid leadwires and connector A3P9 on VDE units.
6. Remove hardware securing shroud cover to shroud and remove shroud cover.
7. Remove hardware securing packing brake cover to shroud cover and remove parking brake cover.
8. Remove hardware securing shroud to deck and remove shroud.

Shroud and Shroud Cover Replacement

1. Position shroud on deck and secure.

CAUTION

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

2. Reconnect solenoid leadwires and connector A3P9 before securing shroud cover to shroud.
3. Position shroud cover on shroud and secure.
4. Secure parking brake cover to shroud.
5. 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.
6. Position pack access cover switch under shroud cover and secure.

7. Replace pack access cover.

8. Replace top cover.

MAINTENANCE CONTROLS AND TEST POINTS

GENERAL

Throughout this manual, references are made to switches, indicators, and test points. These are located and described in the following 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 edge of the Fault card in location A17 of the logic chassis. Figure 2-13 shows these controls and indicators and Table 2-2 defines their functions.

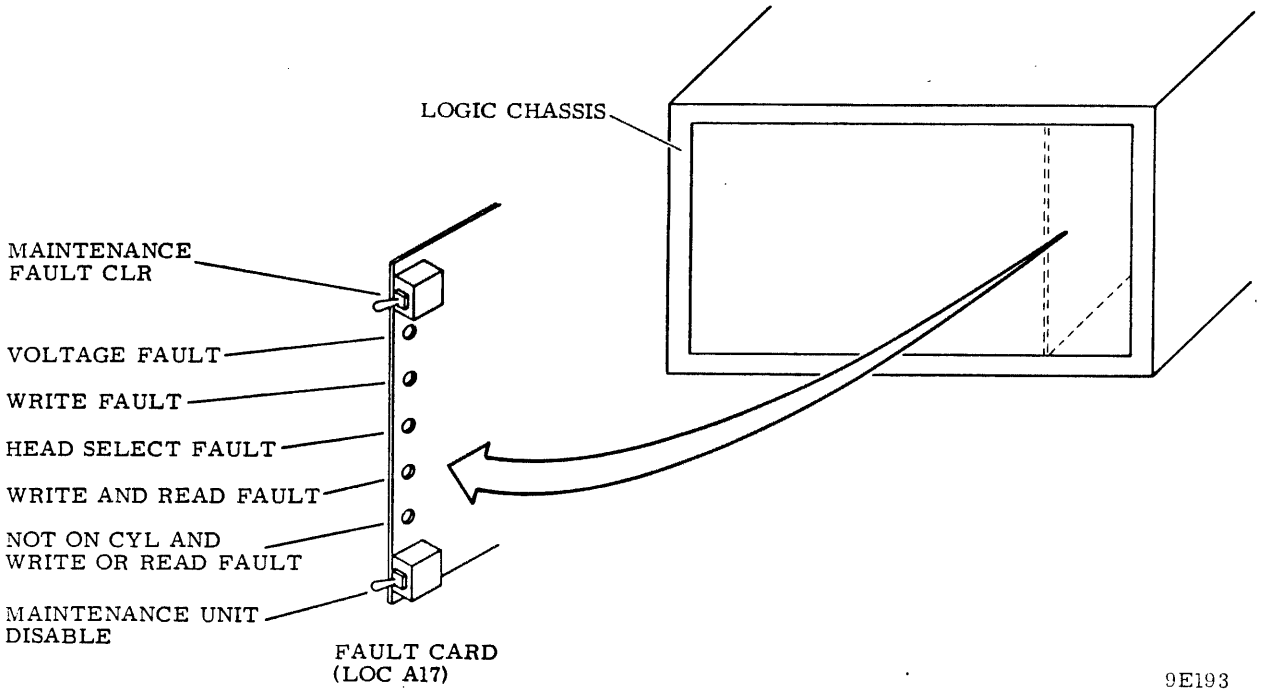


Figure 2-13. Maintenance Controls and Indicators

TABLE 2-2. MAINTENANCE CONTROLS AND INDICATORS

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

TEST POINTS

General

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

Wirewrap Pins

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

Card Test Points

The card test points (refer to figure 2-14) are located on logic cards located in either the logic or read write chassis. These test points are located on the component side of the cards and consist of studs to which an oscilloscope can be attached.

The test points can be located anywhere on the component side of a card and are lettered alphabetically (omitting letters I and O). When viewed from the component side with the connector at the right, the test points appear as follows (refer to figure 2-14).

- The test point in the lower left hand corner is always ground and labeled Z.
- The upper test point (on the left) is also ground and labeled A.
- Other test points on the card edge are labeled B, C, D, etc.
- All other test points are assigned in reverse order from the end of the alphabet (Y, X, W, etc). Y is nearest the bottom right of the card and the letters progress (in reverse order) from right to left in successive rows from bottom to top (refer to figure 2-14).

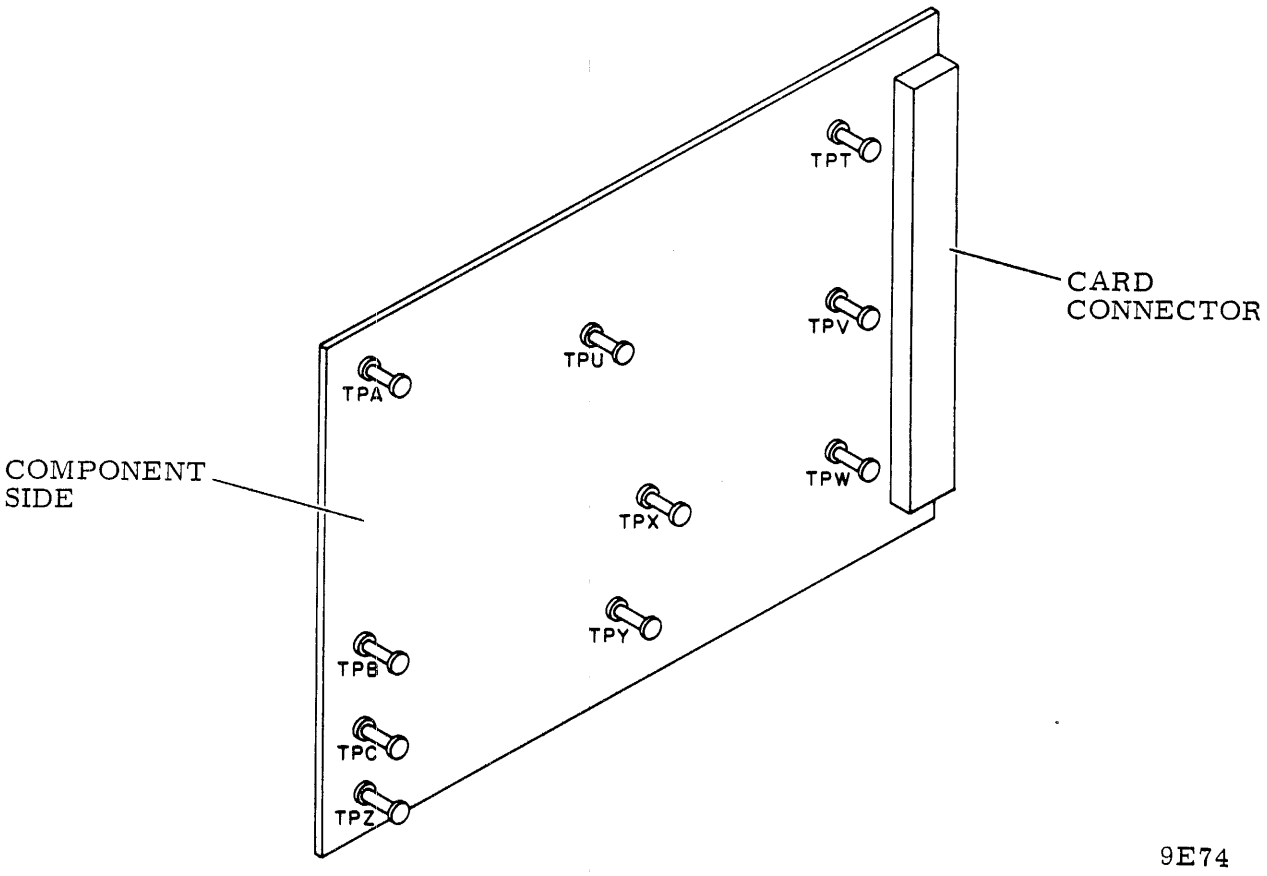


Figure 2-14. Card Test Points

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

Power Supply Test Points

The power supply control panel (refer to figure 2-15) contains test points to measure certain voltage outputs from the power supply. These consist of jacks into which a meter probe can be inserted to make the measurement.

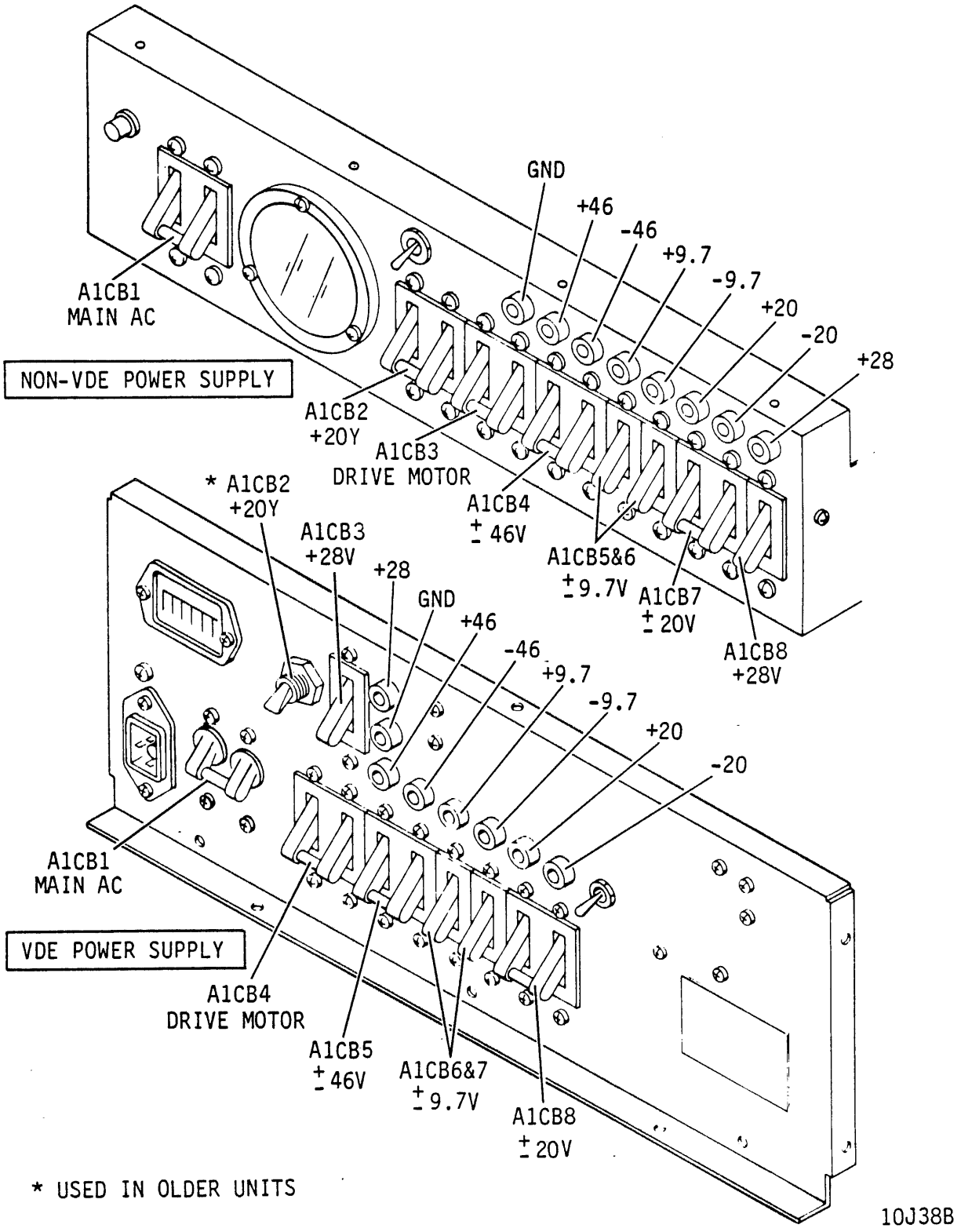


Figure 2-15. Power Supply Control Panel Test Points

SPECIAL MAINTENANCE PROCEDURES AND PRACTICES

GENERAL

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

MANUALLY POSITIONING CARRIAGE

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

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

CAUTION

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

5. Carefully grasp voice coil and load heads.

CAUTION

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

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

CAUTION

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

7. When tests are completed, manually unload heads to fully retracted position.

8. Press START switch to stop drive motor.

WARNING

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

9. Reconnect yellow leadwire to voice coil.

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

ELECTROSTATIC DISCHARGE PROTECTION

All drive electronic assemblies are sensitive to static electricity, due to the electrostatically sensitive devices use 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 the 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 discharges.

- 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 ob-

jects. 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.

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. This should be tested according to procedures in section 3 on absolute air filter replacement by using the pressure gauge kit (73040100).

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. Look for possible foreign materials and if present find the source and eliminate it.

f. If the unit goes into a mode of uncontrolled servo motion then 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 in position 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. If disk packs arrive in damaged cartons or are suspected of having been dropped, have them inspected before use as the disks may have been bent.

b. Keep hands, pencils, or other objects off the disk pack surfaces. The disk pack surfaces not only can be contaminated this way, but also can be distorted or damaged through impact or excessive pressure or abrasion.

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

d. Clean the outside (interiors should also be cleaned if contaminated), surfaces of the protective covers periodically to remove any build-up of dust that may occur. 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 its bottom protective cover is removed for installing 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. Seagate 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, 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 drive.

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 operate 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. Refer to table 2-1 for head cleaning solution P/N.

c. Check the air pressure of the drive by using the pressure gauge kit. Refer to table 2-1 for pressure gauge kit P/N. This should be tested according to the preventive maintenance procedure in section 3 of this manual. The filter should be replaced if the air pressure drops below 0.15 inches of water, or biennially, or at 9,000 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 clean the heads while they are in the unit under any circumstances. If head cleaning is required, remove the heads from the unit and clean according to the procedures in section 3 of this manual. This must only be performed by trained personnel.

f. Seagate 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 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 and if at all possible 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 pack on drive - 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 corrective pack-to-canister identification.

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

SECTION 3

PREVENTIVE MAINTENANCE

INTRODUCTION

This section describes the preventive maintenance that must be performed on the drive to keep it operating properly. This maintenance is performed regularly on a schedule determined by the preventive maintenance index. The preventive maintenance index is shown in table 3-1.

TABLE 3-1. PREVENTIVE MAINTENANCE INDEX

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

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

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

The levels of preventive maintenance are based on a calendar period of hours of operation (whichever comes first). Table 3-2 lists the levels of preventive maintenance.

TABLE 3-2. PREVENTIVE MAINTENANCE LEVELS

Level	Time Schedule
Level 1	Quarterly or 1,500 hours
Level 2	Semiannually or 3,000 hours
Level 3	Biennially or 9,000 hours

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.

LEVEL 1 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 3-1).

1. Press START switch to stop drive motor and unload heads.
2. Open pack access cover and remove pack, close cover, and set MAIN AC circuit breaker to OFF.
3. Remove air filter by pulling it out of its bracket (refer to figure 3-1).
4. Clean filter by agitating in mild detergent solution. Rinse by thoroughly flushing filter with water from a low pressure nozzle.

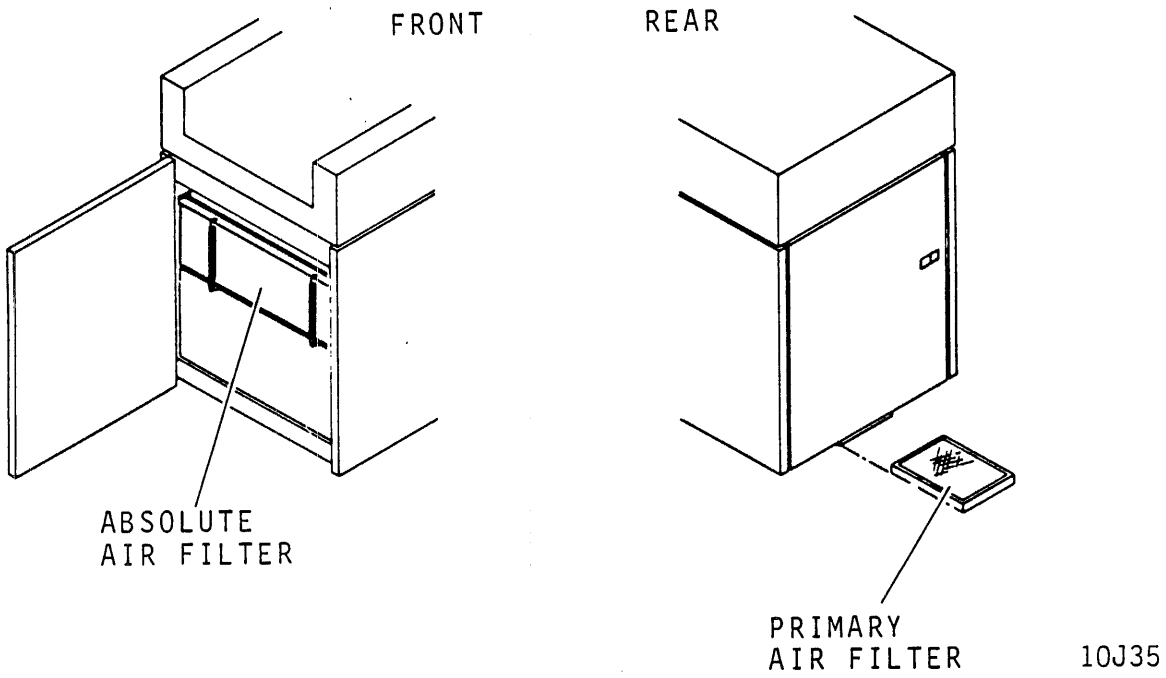


Figure 3-1. Air Filters

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

6. Set MAIN AC circuit breaker to ON and allow blowers to purge unit for at least 2 minutes, then set MAIN AC circuit breaker to OFF.

CHECK +5 VOLT AND -5 VOLT OUTPUTS

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

LEVEL 2 MAINTENANCE PROCEDURES

CLEAN SHROUD AND SPINDLE

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

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

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

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

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

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 3-2).

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

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

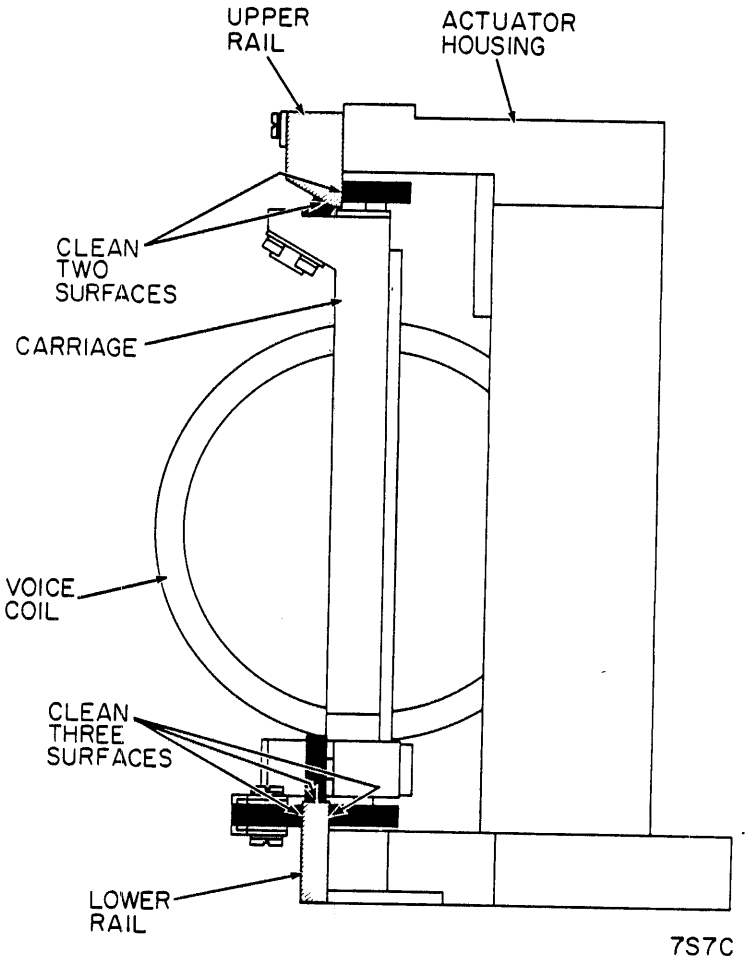


Figure 3-2. Clean Carriage Rails and Bearings

3. Open cabinet top cover and remove deck cover.

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

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

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

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

8. Using a cotton swab dampened (not soaked) in 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. Raise logic chassis as required to gain access from left side of actuator. Move carriage back and forth while cleaning in order to ensure all surfaces are reached.

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

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

10. Replace deck cover and close cabinet top cover.

LEVEL 3 MAINTENANCE PROCEDURES

ABSOLUTE AIR FILTER REPLACEMENT

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

You have two options:

1. Replace the absolute filter at fixed intervals dependent on site environment, or

2. Obtain a pressure gauge (see table 2-1) and replace the absolute filter when it fails the testing procedure given below.

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

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

Figure 3-3 is a flow chart showing the procedure included in this section and the options available to maintenance personnel. Use the flow chart to determine which of the following procedures are applicable.

Filter Replacement

CAUTION

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

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

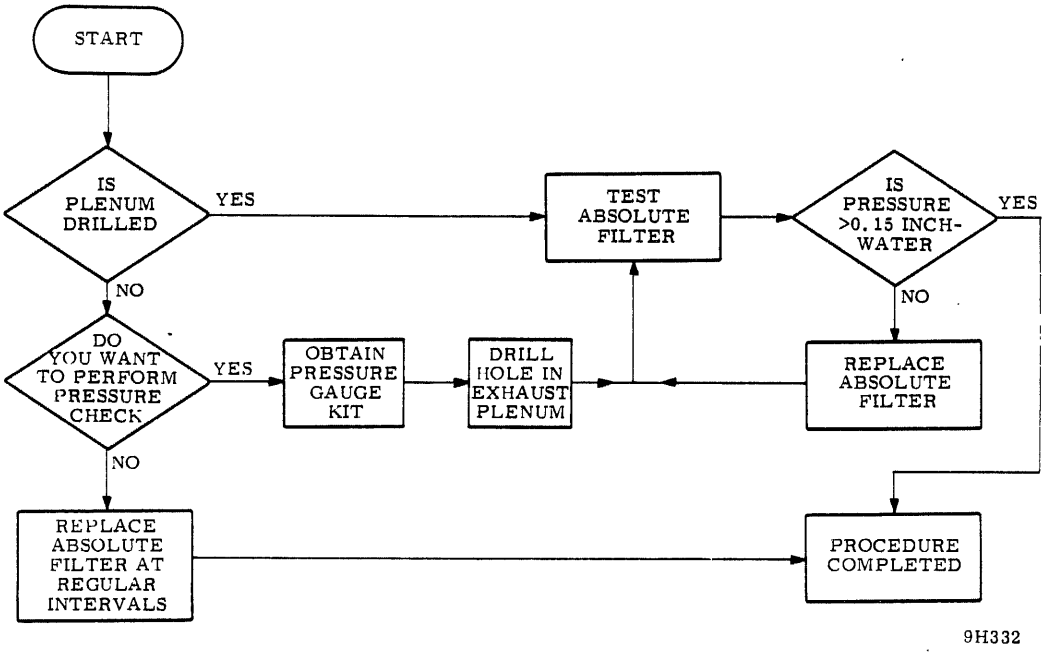


Figure 3-3. Filter Procedure Flow Chart

2. Remove power from drive as follows:

   a. Press START switch to stop and 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 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 springs (or posts in older drives) 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.

NOTE

Before installing new air filter, record the date and hour meter reading on label located on the side of 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 springs (or posts in older drives) 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: (refer to figure 3-4).

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.

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 3-4.

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

4. Remove power from drive as follows:

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

   b. Set MAIN AC circuit breaker to OFF.

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

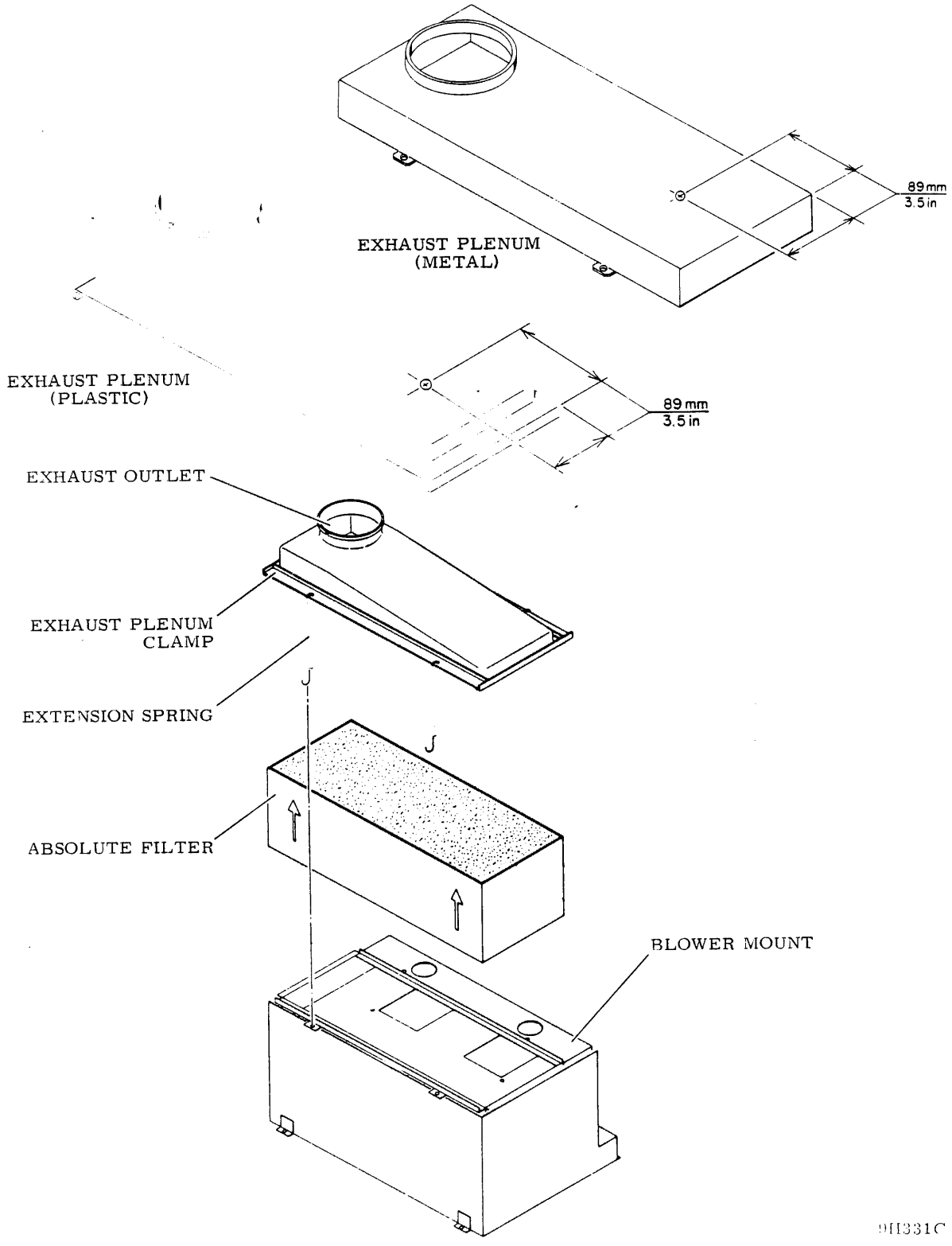


Figure 3-4. Plenum Removal and Drilling

SECTION 4

TESTS AND ADJUSTMENTS

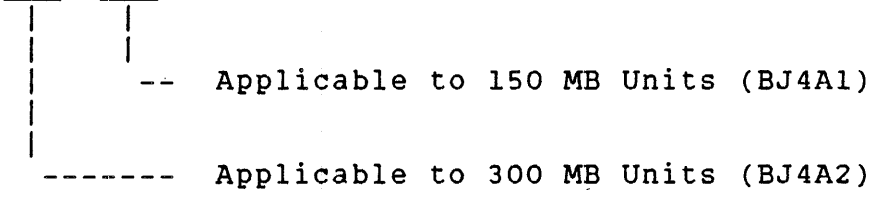
INTRODUCTION

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

It should be noted that some of the following procedures differ slightly, depending on whether they are performed on a 150 MB (BJ4A1) or 300 MB (BJ4A2) drive.

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

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



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

Before performing these procedures, 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 to figure 4-1).

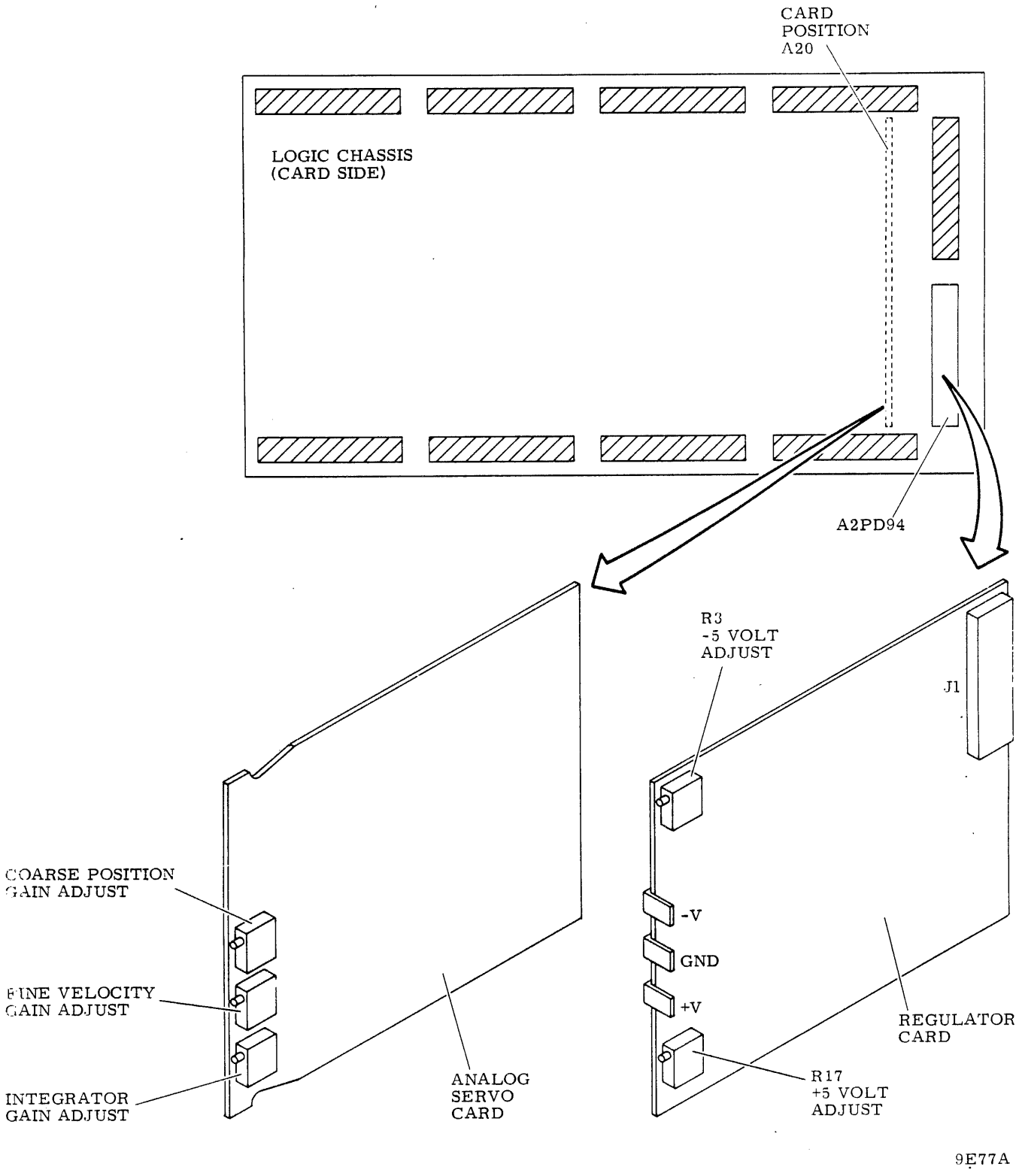


Figure 4-1. Voltage Regulator and Servo Adjustments

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

2. Command continuous seeks between cylinders 000 through 128 for 150 MB and 000 through 256 for 300 MB.

3. Check and adjust +5 volts as follows:

   a. Connect positive meter lead to PE1-14B at location E01 on the read/write chassis.

   b. Connect negative meter lead to terminal marked gnd on front edge of regulator card.

   c. Measured voltage should be +5.1 ($\pm$.05) V dc. If this requirement is not met, adjust bottom pot on regulator card until voltage is within specified limits.

4. Check and adjust -5 volts as follows:

   a. Connect positive meter lead to terminal marked gnd on front edge of regulator board.

   b. Connect negative meter lead to PE1-1B at location E01 on the read/write chassis.

   c. Measured voltage should be -5.1 ($\pm$.05) V dc. If this adjustment is not met, adjust top pot on regulator board until voltage is within specific limits.

5. Prepare drive for return to online operation.

HEAD ALIGNMENT

GENERAL

Check alignment of the heads under the following conditions:

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

If it is determined that a head is misaligned, the head arm is adjusted to bring the alignment of the head within specifications. Figure 4-2 is a flowchart summarizing the basic functions of the head alignment check and adjustment procedure.

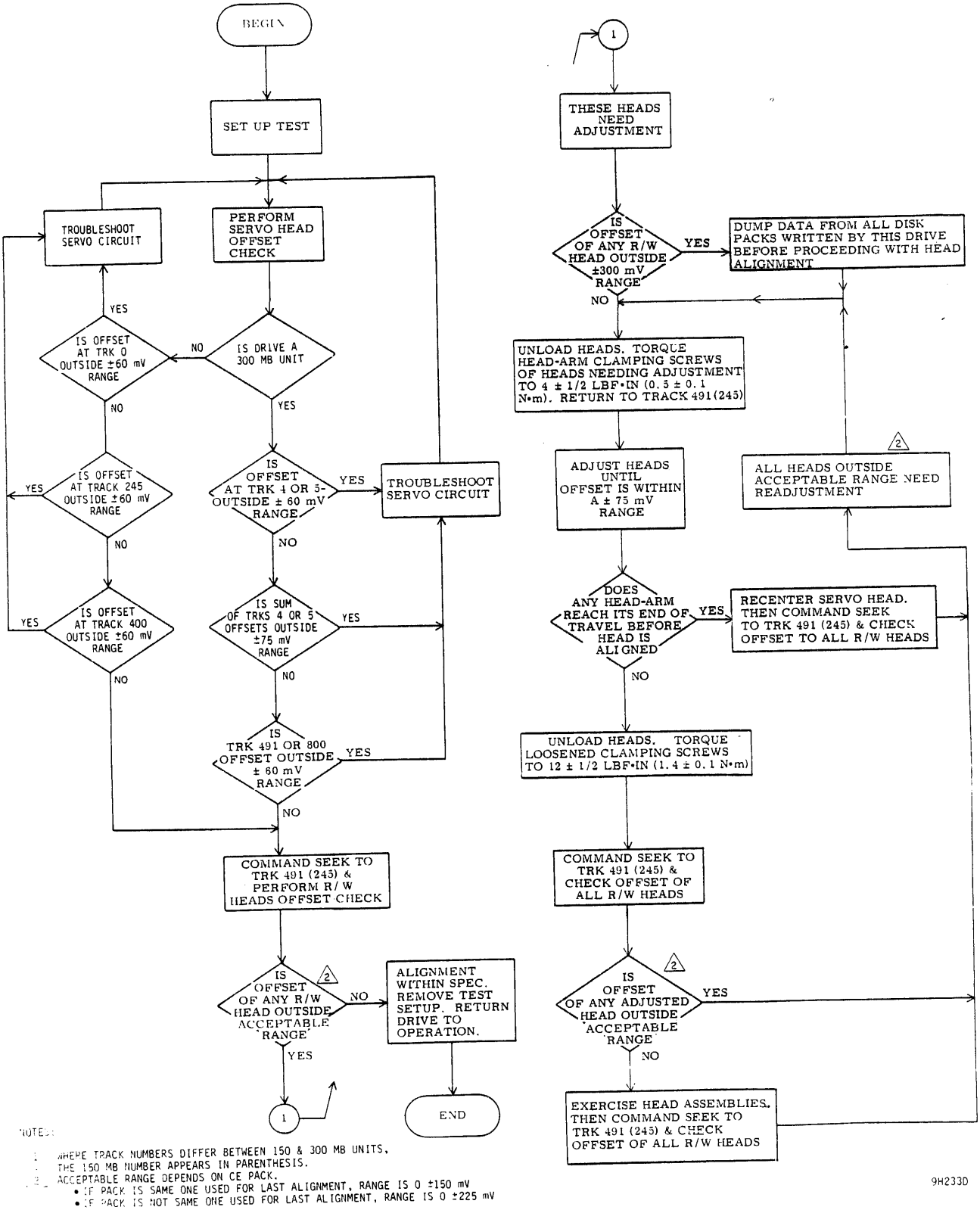


Figure 4-2. Basic Head Alignment Check and Adjustment Procedure

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

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

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

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

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

INITIAL SETUP

1. Prepare drive for use with FTU (refer to Preparation of Drive For testing procedure).

2. Ensure that CE pack is thermally stabilized.

3. Connect oscilloscope to test points Z (ground) and Y (dibits) on head alignment card.

4. Connect test leads between head alignment card and FTU null meter.

SERVO HEAD OFFSET CHECK

1. Set head alignment card S/RW switch to S and X.1/X1 switch to X.1.

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

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

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

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.1/X1 switch can be set to X1 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.

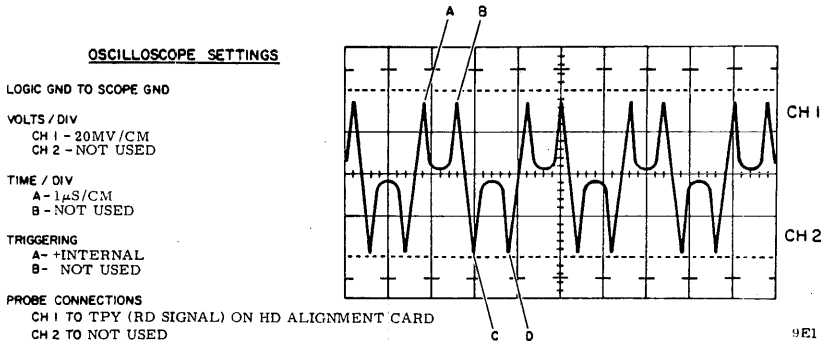


Figure 4-3. Head Alignment Waveform

NOTE

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

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

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

    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 $\pm$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 $\pm$75 mV range and is therefore unacceptable. Servo system troubleshooting is required.

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

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

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

READ/WRITE HEADS CHECK AND ADJUSTMENT

1. Set S/RW switch to RW. Observe that dibit pattern is similar to that shown on figure 4-3.

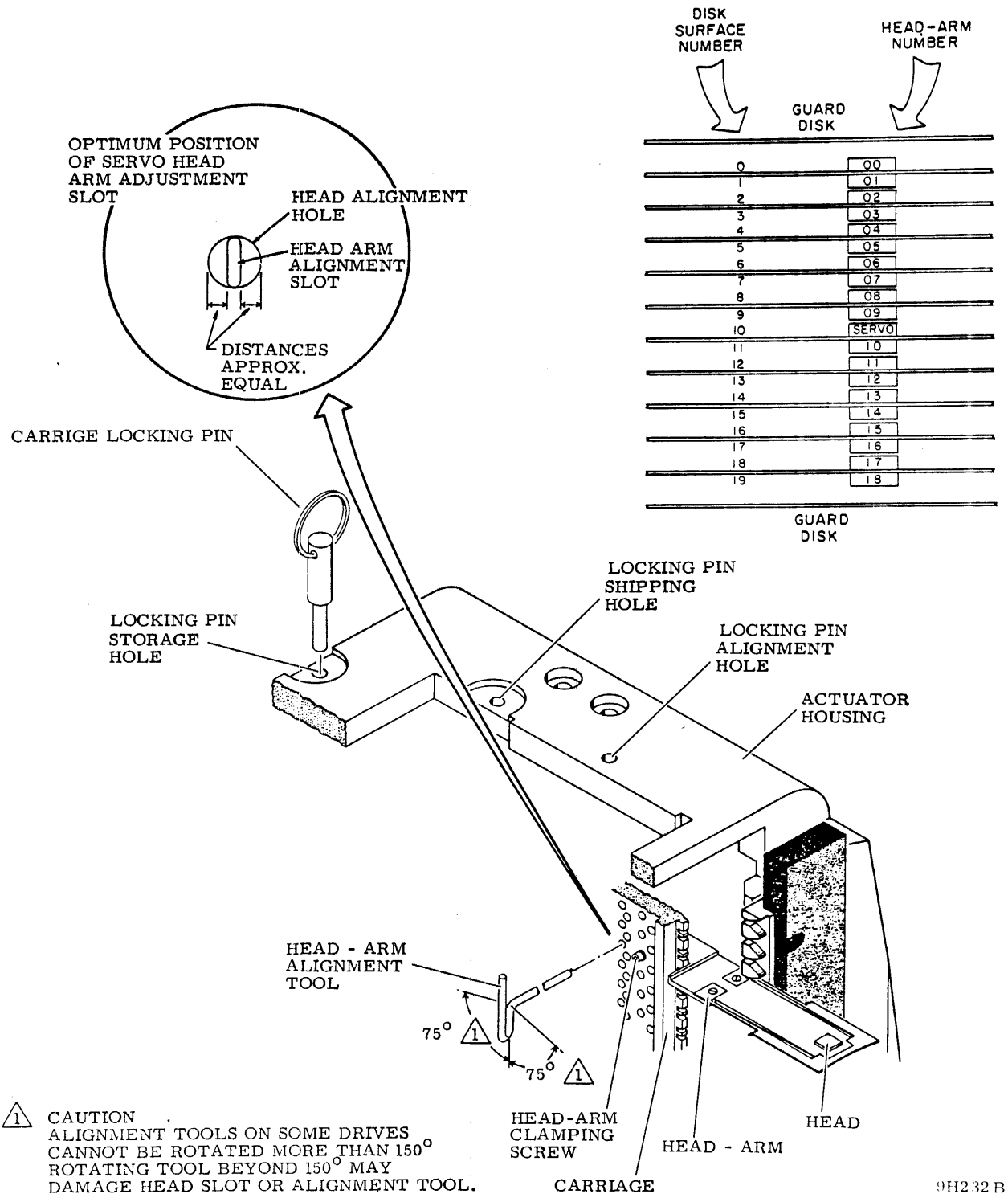


Figure 4-4. Head Arm Alignment

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.

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. If 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 ±1/2 lbf·in).

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

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

NOTE

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

9. Align as follows:

   a. Select head to be aligned.

WARNING

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

   b. Install head alignment tool so that tool pin engages head-arm alignment slot (refer to figure 4-4).

   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 4-3).

   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, it should be noted that any slight adjustment of the servo head requires realignment of all read/write heads. Torque servo head to 1.4 $\pm$0.2 N·m (12 $\pm$1.0 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 ±0.2 N·m (12 ±1.0 lbf·in). While torqueing screws, use only straight arm allen wrench and keep it as perfectly aligned as possible with screws. If care is not taken during this operation, head may be pushed out of alignment.

13. Check each head adjusted to see if torqueing screws affected alignment. If any heads are outside 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 (245).

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

15. Prepare drive for return to online operation.

SERVO SYSTEM TEST AND ADJUSTMENT

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

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

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

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

These adjustments are interactive and therefore must be made in the proper sequence. The proper sequence is shown on figure 4-5. The following describes test and adjustment of the servo system.

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

2. Test and adjust coarse position gain as follows:

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

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

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

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

   e. Observe display. If distance between on cylinder pulses is not within 50 to 54 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 4-6 and adjust it until the two sloped curves are displayed.

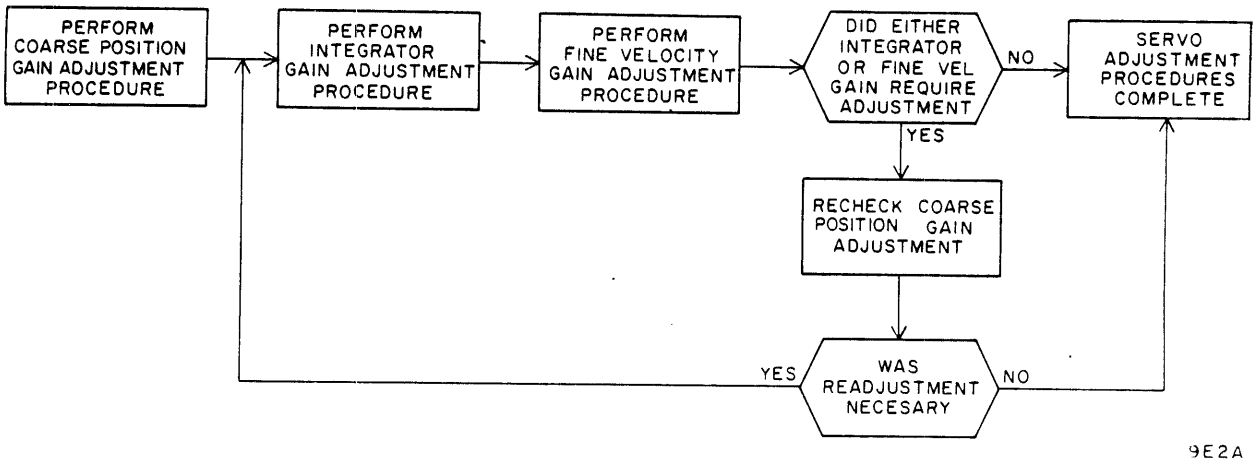


Figure 4-5. Servo System Adjustments Flow Chart

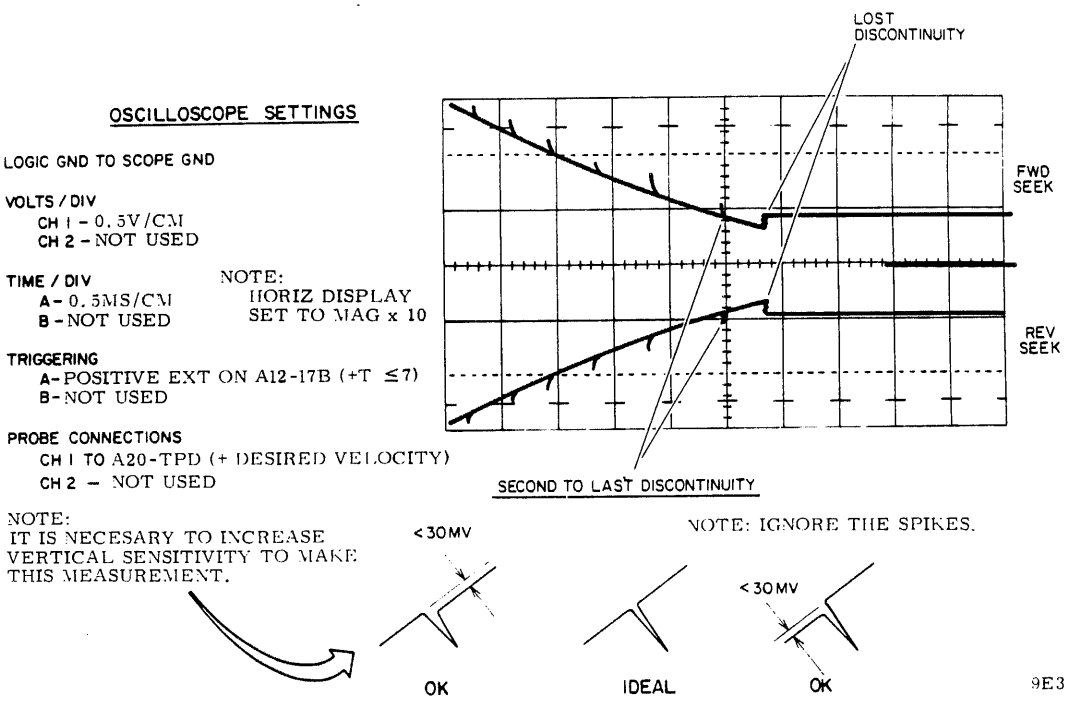


Figure 4-6. Integrator Gain Waveform

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 4-6) and that it has a difference of 0 $\pm$.03 V (ignore the spike). If it exceeds this value, adjust bottom pot on A20 so that it meets these requirements.

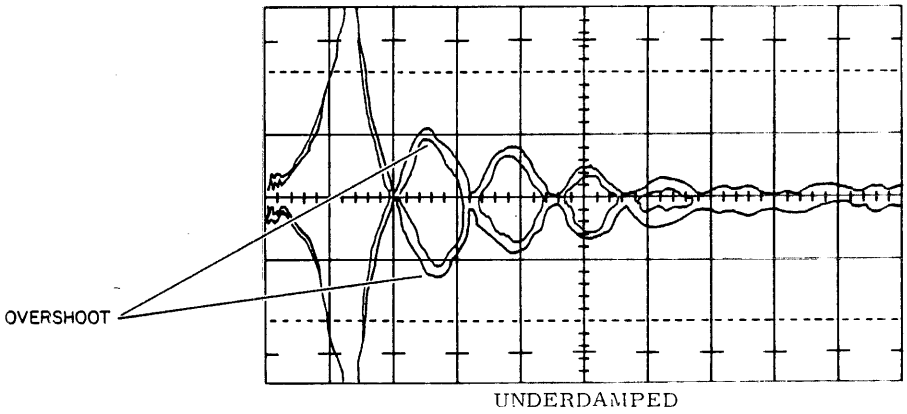
NOTE

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 4-7.



UNDERDAMPED

OSCILLOSCOPE SETTINGS

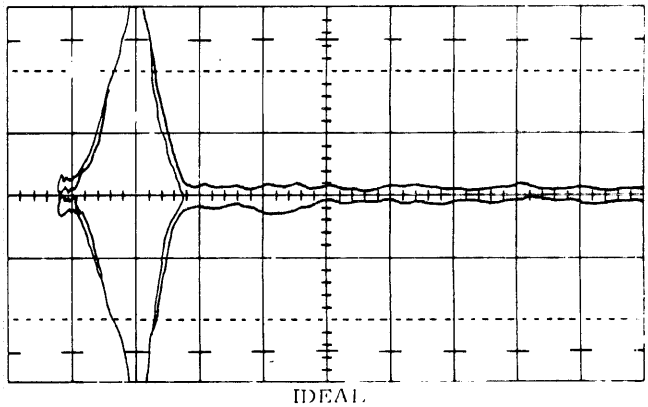
LOGIC GND TO SCOPE GND

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

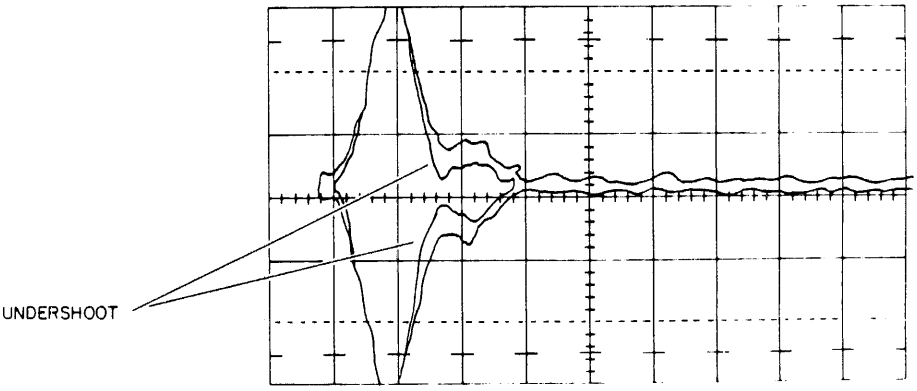
TIME / DIV
- A - 1MS/CM
- B - NOT USED

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

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



IDEAL



OVERDAMPED

Figure 4-7. Fine Velocity Initial Check Waveform

c. Referring to figure 4-7, 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 4-7.

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

e. Note that displayed signal is as shown on figure 4-8 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.

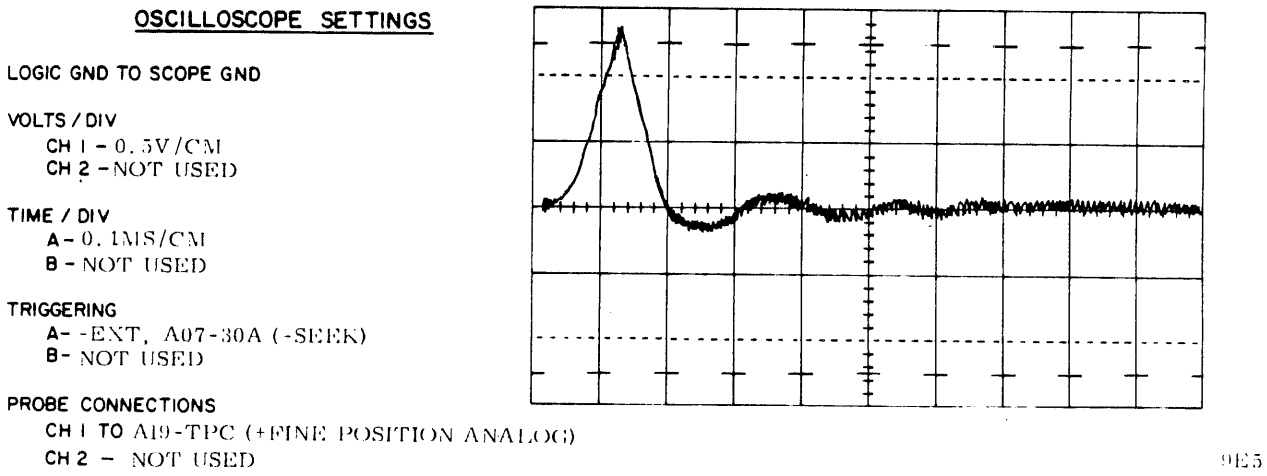


Figure 4-8. Fine Velocity Gain Final Check Waveform

SECTION 5

TROUBLE ANALYSIS

INTRODUCTION

This section contains information on analyzing problems in the drive. The section is divided into three parts and they appear in the following order:

- Electrical Checks
- Troubleshooting Procedures
- Decision Logic Tables

The first part contains instructions on checking specific circuits or components. The last two parts describe procedures for localizing and correcting problems in the drive when their cause is not known.

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

ELECTRICAL CHECKS

GENERAL

The following procedures assist you in isolating problems causing improper drive operation. If the drive appears to be operating properly, failure to meet a specification given in these procedures does not in itself indicate improper drive operation.

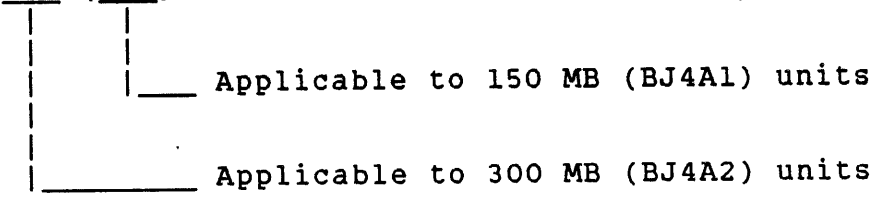
The procedures are divided into the following major areas:

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

It should be noted that some of the following procedures differ slightly depending on whether they are performed on a 150 MB (BJ4A1) or 300 MB (BJ4A2) drive.

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

Example: Command drive to perform a direct seek to cylinder 822 (410).



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

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.

	Nominal	Acceptable Range
a.	+46 V dc	+44 to +51 V
b.	-46 V dc	-44 to -51 V
c.	+9.7 V dc	+8.7 to +10.7 V
d.	-9.7 V dc	-8.7 to -10.7 V
e.	+20 V dc	+18 to +22 V (Non-VDE) +19.5 to +24.5 V (VDE)
f.	-20 V dc	-18 to -22 V (Non-VDE) -19.5 to -24.5 V (VDE)
g.	+28 V dc	+26 to +30 V

5. Disconnect voltmeter, then setup 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 is within the specified limits.

	Test Jack	Ripple
a.	+46	4.5 V
b.	-46	4.5 V
c.	+9.7	nominal
d.	-9.7	nominal
e.	+20	1.0 V
f.	-20	1.0 V
g.	+28	1.0 V

SERVO SYSTEM CHECKS

The servo system checks consist of procedures that test various points in the drives servo logic. These procedures are divided into two categories: (1) logic controlled checks and (2) manual controlled checks.

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

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

Logic Controlled Servo Checks

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

D/A Converter Output Check

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

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

2. Connect and setup oscilloscope as shown on figure 5-1.

3. Command continuous seeks between cylinders 000 and 128.

4. Check that the observe waveforms are as shown on figure 5-1. 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 5-2).

5. Prepare drive for return to online operation.

Cylinder Pulse Blanking Delay Check

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

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

2. Command continuous seeks between cylinders 000 and 003.

3. Connect and setup oscilloscope as follows:

   a. Connect channel 1 to A07-30B (+Cylinder Pulse Blanking).

   b. Trigger positive internal.

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

4. Observe that the Cylinder Pulse Blanking delay is one for 950 ($\pm$50) µs.

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 setup oscilloscope as follows:

   a. Connect channel 1 to A07-22A (+Cylinder Pulses).

OSCILLOSCOPE SETTINGS

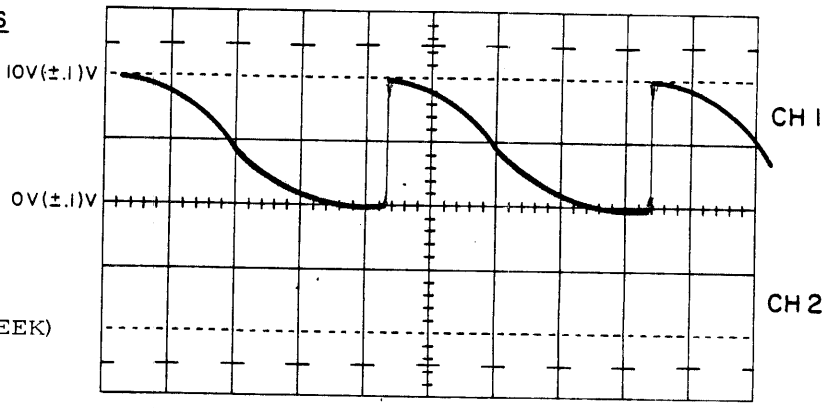
LOGIC GND TO SCOPE GND

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

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

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

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



9E21

Figure 5-1. D/A Converter Output Waveform

OSCILLOSCOPE SETTINGS

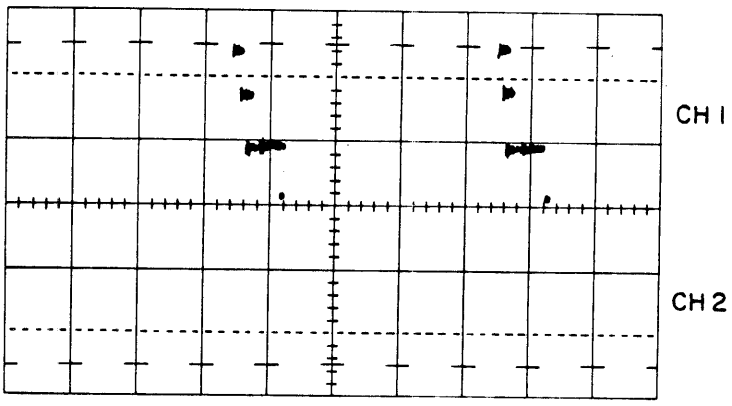
LOGIC GND TO SCOPE GND

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

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

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

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



9E22

Figure 5-2. D/A Converter Output Waveform Expanded

b. Trigger positive internal.

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

4. Observe that Cylinder Pulse one shot is one for 10 (±2.5) ns.

5. Prepare drive for return to online operation.

Cylinder Pulse Switching Level Check

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

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

2. Command 1 cylinder sequential forward seeks between cylinders 000 and 822 (410).

3. Connect and setup oscilloscope as indicated on figure 5-3. Note that this figure actually shows four different checks each having a separate resulting waveform.

4. Evaluate results as shown on figure 5-3.

5. Prepare drive for return to online operation.

Fine Enable Switching Level Check

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

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

2. Connect and setup oscilloscope as indicated on figure 5-4.

3. Command continuous seeks between cylinders 000 and 001.

4. Observe that the waveforms are as indicated on figure 5-4. 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.

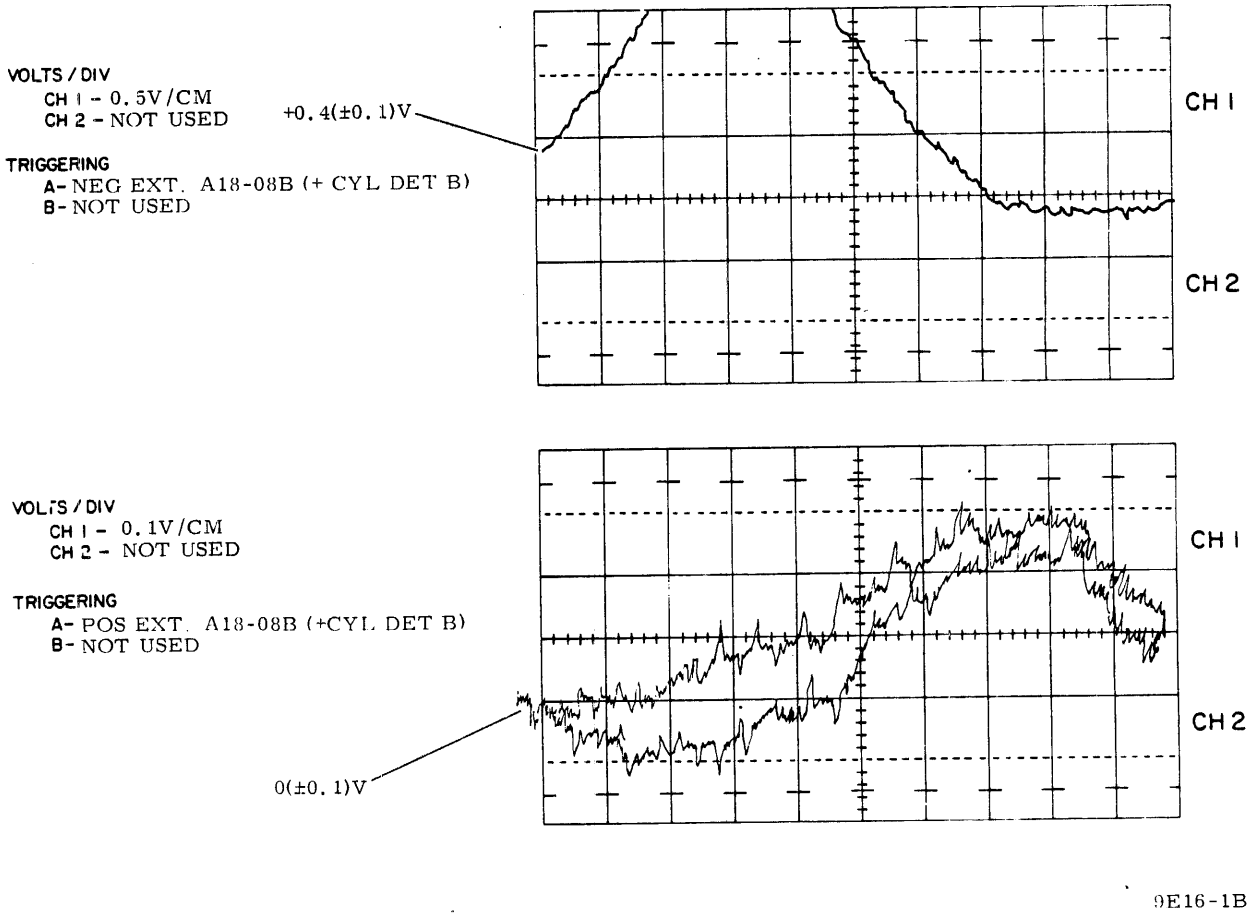


Figure 5-3. Cylinder Pulse Level Waveform (Sheet 1 of 2)

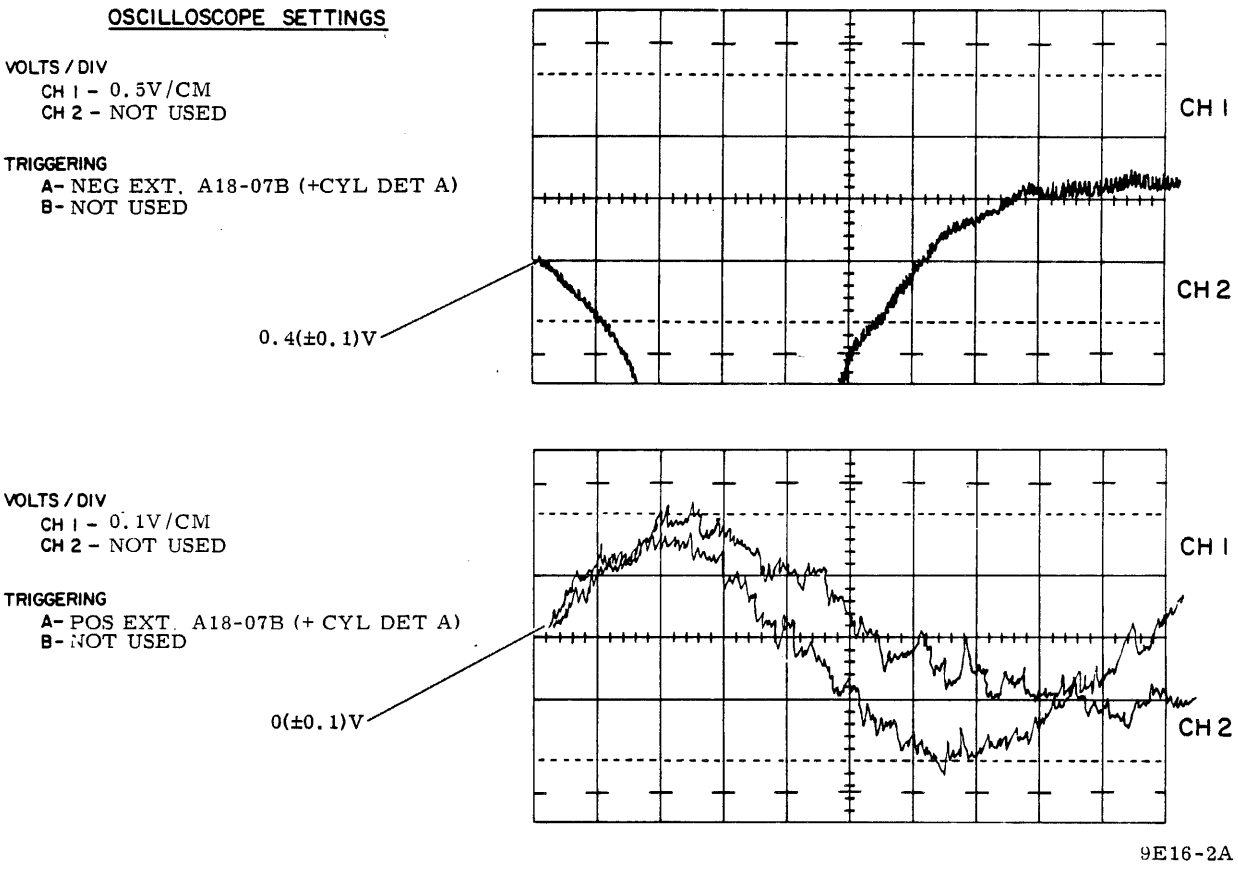


Figure 5-3. Cylinder Pulse Switching Level Waveform (Sheet 2)

On Cylinder Delay Check

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

1. Prepare drive for use with test software or FTU.
2. Command continuous seeks between cylinder 000 and 003.
3. Connect and setup oscilloscope as follows:
   a. Connect channel 1 to A07-03B (-On Cylinder).
   b. Trigger positive on A07-15A (+On Cylinder Sense).
   c. Set other controls as appropriate to make measurement required in step 4.

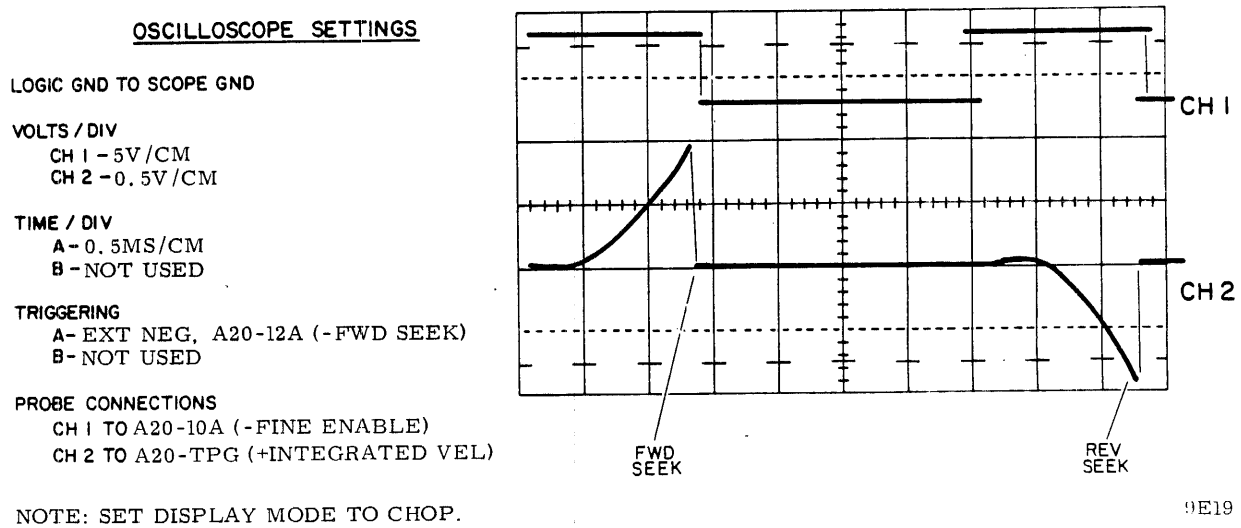


Figure 5-4. Fine Enable Switching Level Waveform

4. Observe that not On Cylinder is a logic one for 1.75 (±0.35) ms.

5. Prepare drive for return to online operation.

On Cylinder Dropout Delay Check

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

NOTE

Place card on 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 stepup oscilloscope as follows:

   a. Connect channel 1 to pin 3 of chip in position A3.

   b. Trigger negative internal.

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

4. Observe that On Cylinder Dropout delay is zero for 800 (±300) µs.

5. Prepare drive for return to online operation.

On Cylinder Pulse Check

This procedure measures duration of On Cylinder pulse.

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

2. Command continuous seeks between cylinders 000 and 001.

3. Connect and setup oscilloscope as follows:

   a. Connect channel 1 to A07-22A (+Cylinder Pulses).

   b. Trigger positive internal.

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

4. Observe that On Cylinder pulse is one for 0.3 (±0.05) µs.

5. Prepare drive for return to online operation.

On Cylinder Switching Level Check

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

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

2. Setup and connect oscilloscope as shown on figure 5-5.

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

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

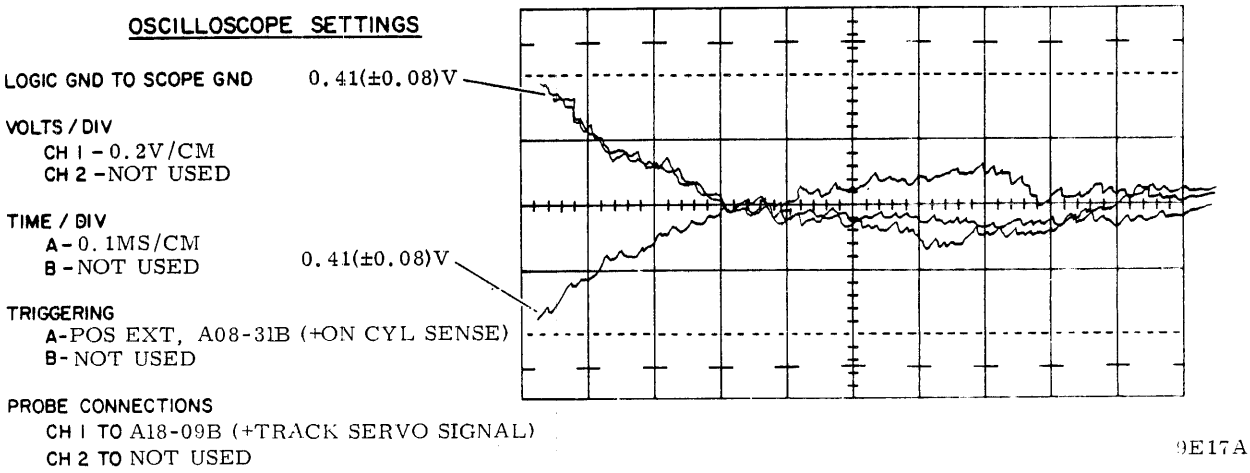


Figure 5-5. On Cylinder Switching Level - Waveform I

5. Setup and connect oscilloscope as shown on figure 5-6.

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 5-6.

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.

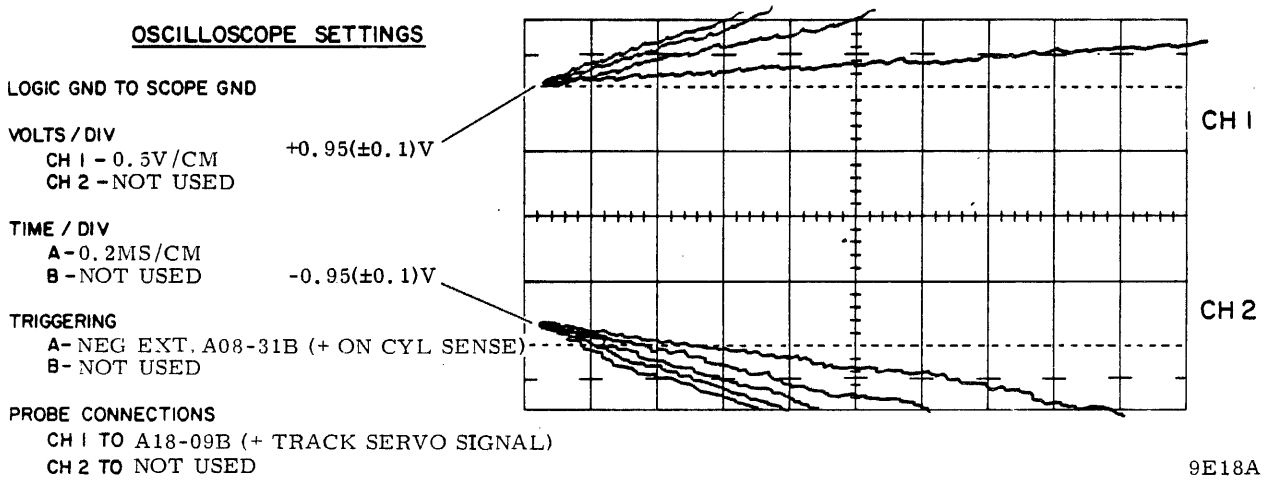


Figure 5-6. On Cylinder Switching Level - Waveform II

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

3. Connect and setup oscilloscope as follows:

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

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

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

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

5. Prepare drive for return to online operation.

Positioner Offset Voltage Check

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

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

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

3. Connect and setup oscilloscope as follows:

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

   b. Set channel A sweep trigger mode to AUTO.

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

4. Command carriage offset plus (forward offset) and observe that the scope indicates +0.6 ±0.1 V.

5. Command carriage offset minus (reverse offset) and observe that the scope indicates -0.6 ±0.1 V.

6. Prepare drive for return to online operation.

Track Following Check

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

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

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

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

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

3. Connect and setup oscilloscope as follows:

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

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

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

4. Observe display and refer to figure 5-7. As runout increases, waveform sinusoidal amplitude increase.

OSCILLOSCOPE SETTINGS

LOGIC GND TO SCOPE GND

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

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

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

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

NOTES:

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

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

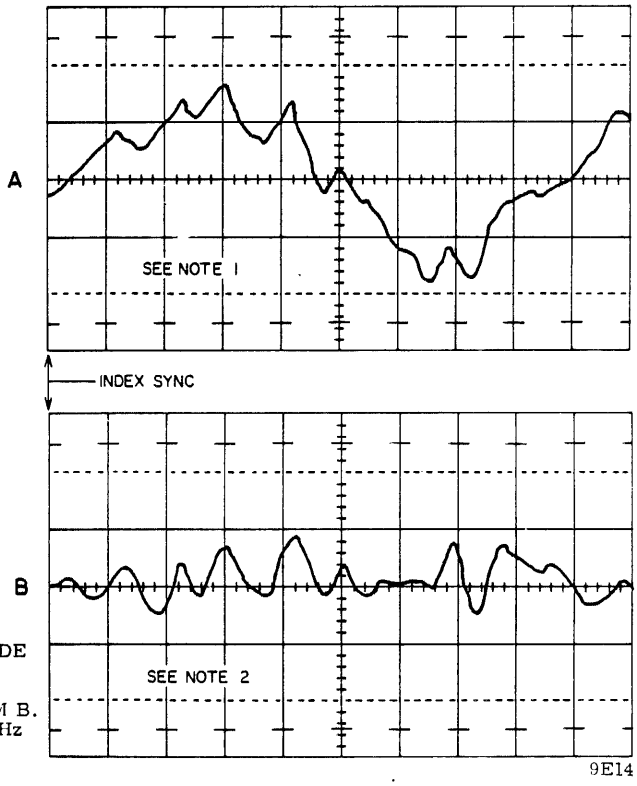


Figure 5-7. Track Following Check Waveform

5. Interpret display as follows:

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

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

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

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

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

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

NOTE

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

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

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

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

11. Prepare drive for return to online operation.

Track Servo Amplitude Check

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

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

2. Connect and setup oscilloscope as indicated on figure 5-8.

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

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

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.

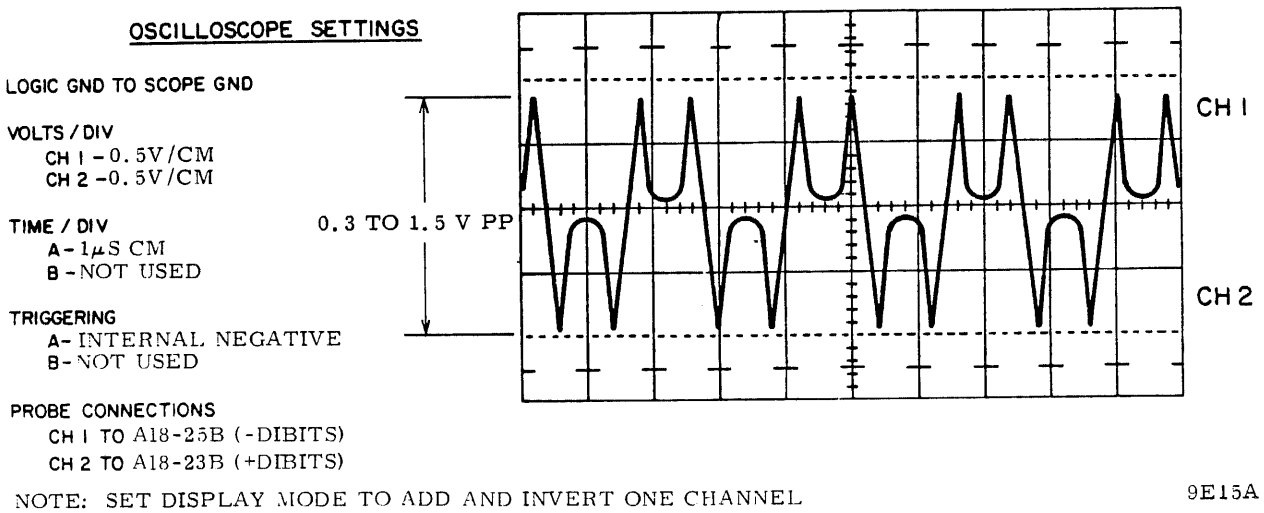


Figure 5-8. Track Servo Amplitude Waveform

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 5-9.

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

4. Observe waveforms as shown on figure 5-9, check that the amplitude of the second to last positive and negative ramps are each 1.8 V to 2.2 V and the difference between the two is 0.3 V maximum. Note that the positive ramps are produced during first seeks and negative during reverse seek.

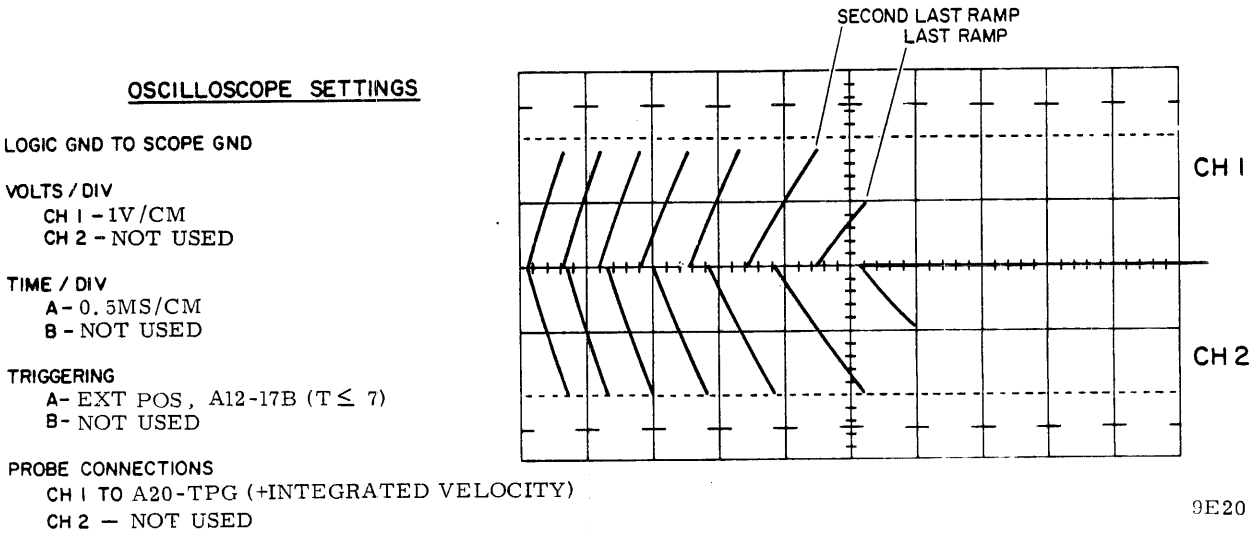


Figure 5-9. Integrated Velocity Waveform

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 is 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 setup oscilloscope as in step 2.

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

CAUTION

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

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

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

a. 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 (410) (forward direction). Signal should go negative and amplitude should increase as speed of carriage increases.

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

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

a. Setup and connect oscilloscope as follows:

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

b. Observe an 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 Position Analog signal. If observed signals are as specified it ensures that the Fine Position Analog signal has the proper polarity when it is applied to the fine gate.

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

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

c. Observe that Fine Position Analog signal is at 0 volts.

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

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

   a. Connect and setup oscilloscope as follows:

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

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

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

   a. Connect and setup oscilloscope as follows:

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

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

CAUTION

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

10. Manually unload heads.

11. Press START switch to stop drive motor.

12. Set MAIN AC circuit breaker to OFF.

13. Reconnect yellow leadwire 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 5-10). If the signals at these points are correct, it indicates the circuits are performing their basic function.

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

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

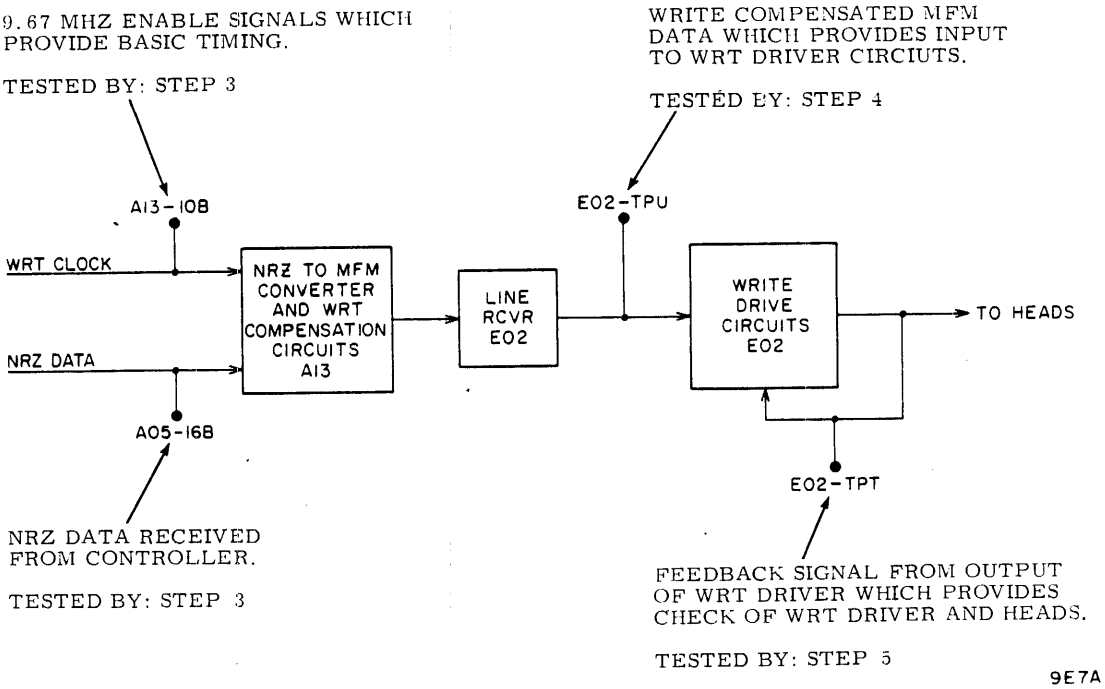


Figure 5-10. Write Circuits Test Points

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

   a. Connect and setup oscilloscope as shown in figure 5-11.

   b. Observe that signals have timing relationships as shown in figure 5-11.

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

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

   b. Observe that signals have approximately the relationship shown in figure 5-12 and that channel 2 signal has proper polarity.

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

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

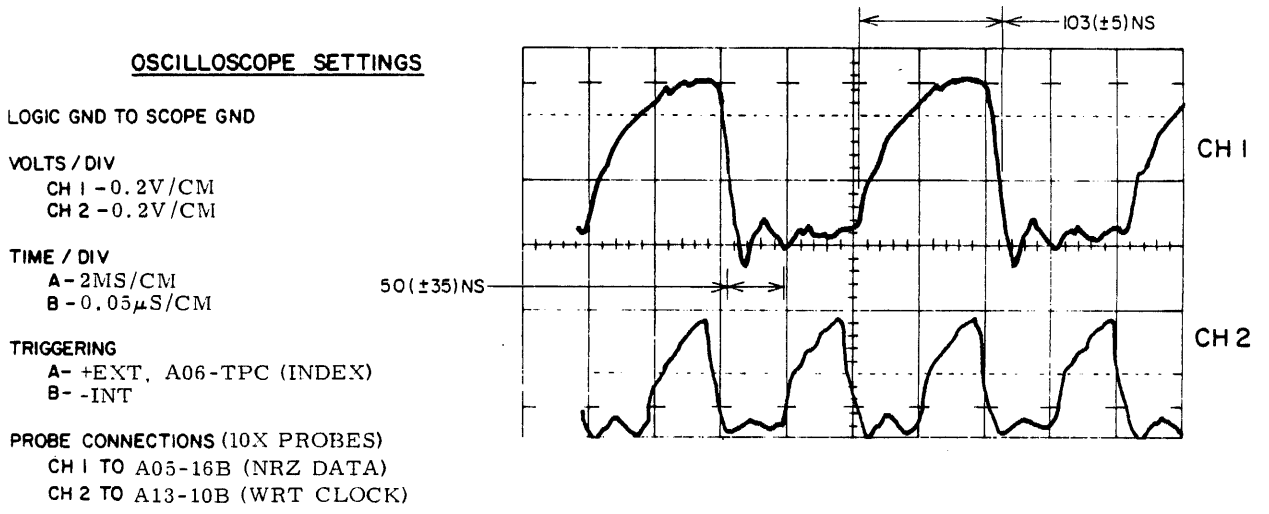


Figure 5-11. NRZ Write Data Input Waveform

OSCILLOSCOPE SETTINGS

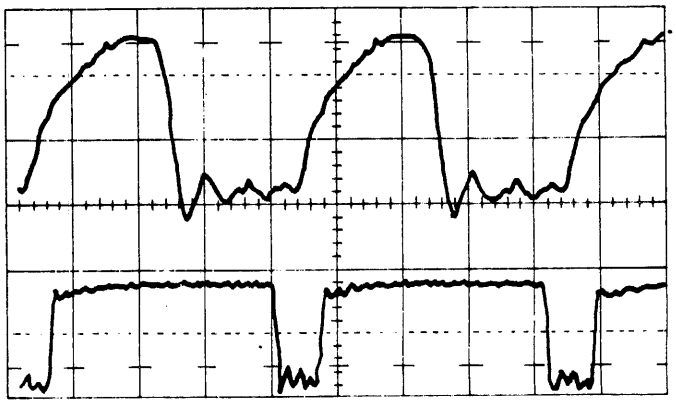
LOGIC GND TO SCOPE GND

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

TIME / DIV
A - 2MS/CM
B - 0.05 μS/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



9E12 A

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

Figure 5-12. Write Driver Input Waveform

b. Observe that signals are approximately as shown on figure 5-13.

6. Prepare drive for return to online operation.

Read Circuit Checks

This procedure checks the basic operation of the read circuits (refer to figure 5-14). If the observed signals are correct it indicates these circuits are performing their basic functions.

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

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

3. Command drive to read 1010 bit pattern.

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

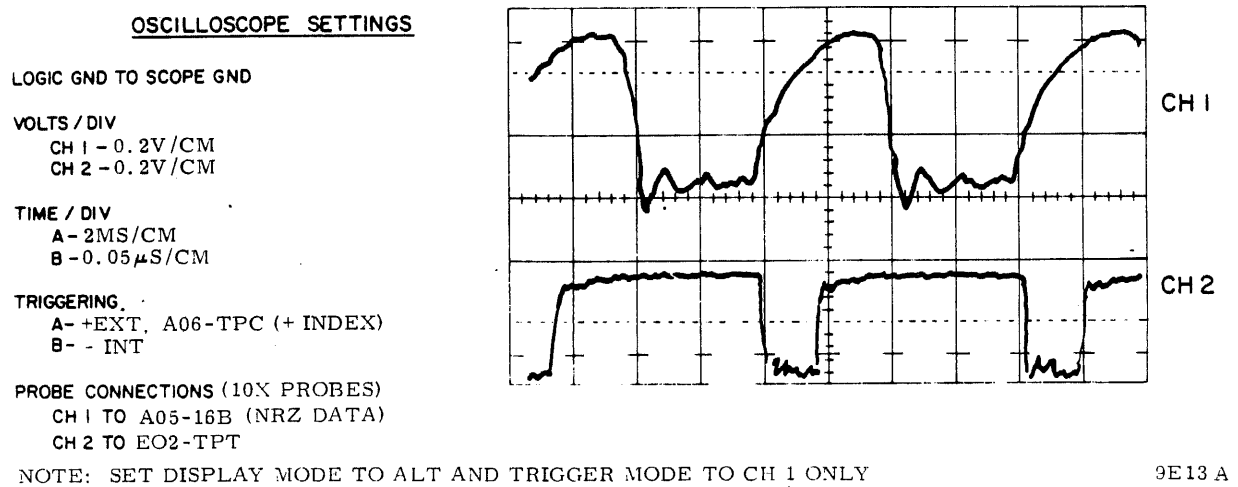


Figure 5-13. Write Driver Output Waveform

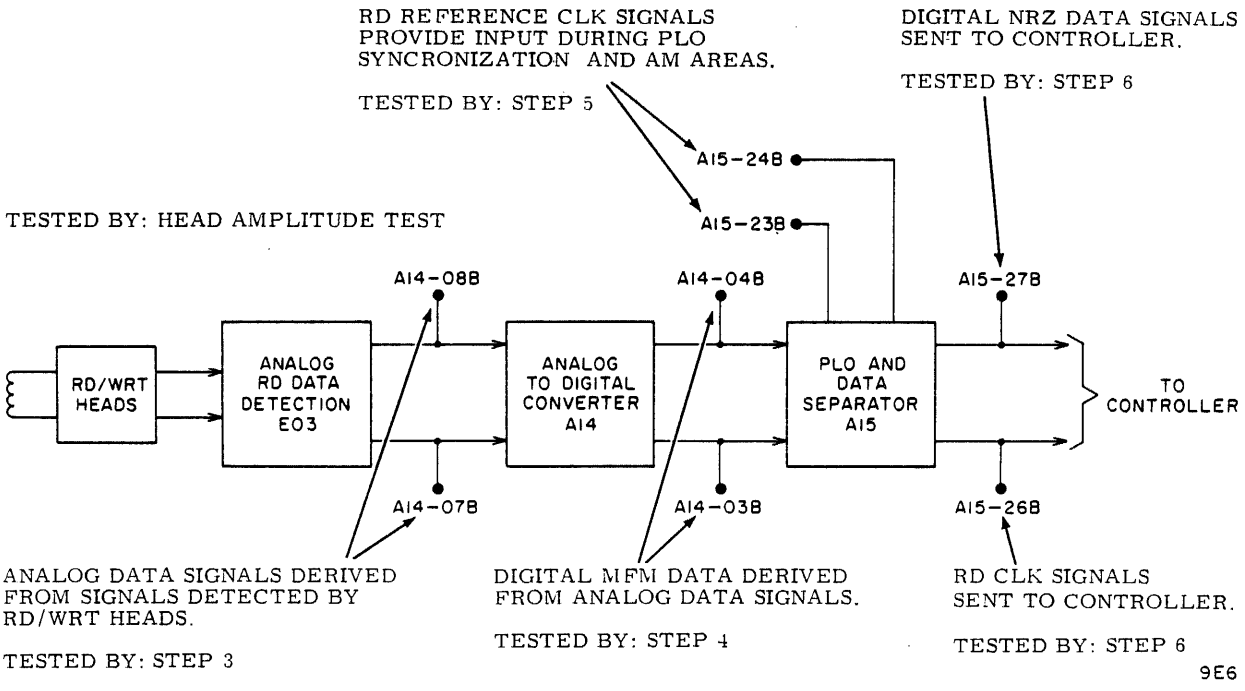


Figure 5-14. Read Circuits Test Points

a. Connect and setup oscilloscope as indicated on figure 5-15.

b. Observe that signal is approximately as shown on figure 5-15 with approximately 200 ns between zero crossings.

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

a. Connect and setup oscilloscope as shown on figure 5-16.

b. Observe that signal is approximately as shown on figure 5-16.

6. Check frequency of Read Reference Clock signals.

a. Connect and setup oscillscope as shown on figure 5-15 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.

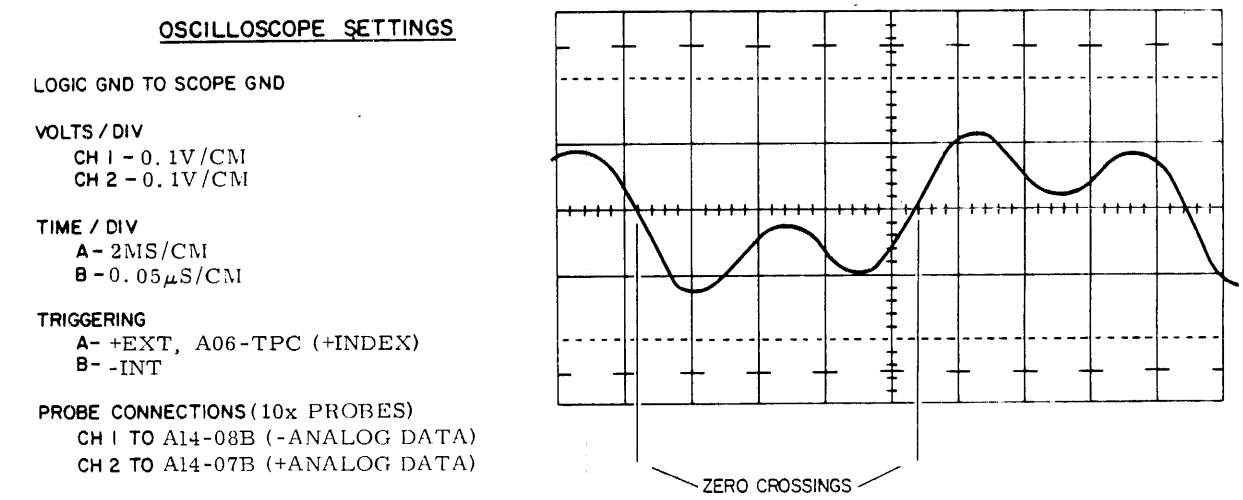


Figure 5-15. Analog Read Data Waveform

OSCILLOSCOPE SETTINGS

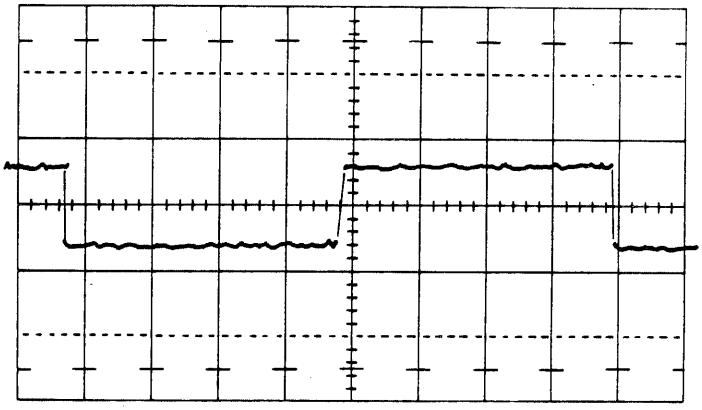
LOGIC GND TO SCOPE GND

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

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

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

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



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

9E9

Figure 5-16. Data Latch Output Waveform

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

   a. Connect and setup oscilloscope as shown in figure 5-17.

   b. Observe that displayed signals have timing relationships as shown on figure 5-17.

8. Prepare drive for return to online operation.

Head Amplitude Check

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

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

OSCILLOSCOPE SETTINGS

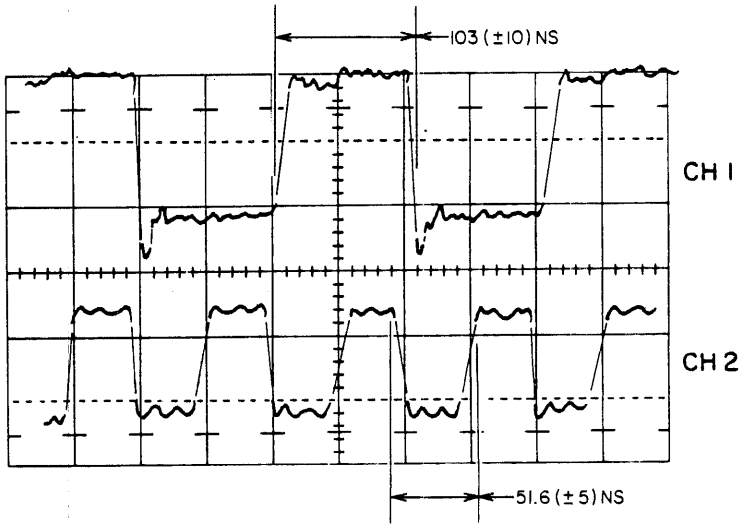
LOGIC GND TO SCOPE GND

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

TIME / DIV
A - 2MS/CM
B - 0.05μS/CM

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

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



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

9E10

Figure 5-17. Read Data to Read Clock Timing

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

3. Connect and setup oscilloscope as follows:

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

   b. Connect channel 1 to E03-TPB.

   c. Connect channel 2 to E03-TPC.

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

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

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

5. Command direct seek to cylinder 001 and write 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 one for 2.5 ($\pm$0.3) µs.

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

5. Prepare drive for return to online operation.

Speed Sensor Output Check

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

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

2. Connect and setup oscilloscope as follows:

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

   b. Trigger positive internal.

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

3. Check oscilloscope waveform for the following:

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

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

   b. Observe amplitude of waveform on oscilloscope. Signal should have positive and negative amplitudes of at least 0.6 volts. If not, recheck speed sensor gap.

4. Prepare drive for return to online operation.

TROUBLESHOOTING PROCEDURES

GENERAL

The following procedures specify how to check ac inputs to the power supplies, pinpoint voltage faults in the logic chassis and read/write chassis, troubleshoot heat-generated problems in the drive, and troubleshoot head crashes. They are identified as Procedures A, B, C, and D and are referenced as such in the procedures entries in the heading blocks of the decision logic tables.

PROCEDURE A: CHECKING AC INPUTS TO POWER SUPPLIES

Procedure A verifies that a given secondary winding of a ferroresonant or standard transformer provides the required voltage to drive the associated power supply. This procedure should be followed whenever a transformer is suspected as the reason for a dc voltage problem. It should also be performed after repairing or replacing the rectifier/filter circuits. This ensures the previously malfunctioning supply did not damage the transformer.

Two unique power supplies are used in the drive. Non-VDE units use a power supply with two ferroresonant and one standard transformer. VDE units use a smaller power supply that has one ferroresonant transformer and one standard transformer. Table 5-1, shows some common failure symptoms for power supplies.

TABLE 5-1. 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

NOTE

To prevent the ferroresonant transformer from oscillating, never disconnect more than one set of secondary leads from the rectifier/-filter circuits at any given time. Such oscillation, although not dangerous, would make voltage measurement meaningless. This does not apply to standard transformers that have sine-wave outputs.

Procedure:

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

2. Determine which transformer secondary is to be checked, and set the breakers as follows:

   a. Non-VDE

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

   b. VDE

      T1 - CB2(+20Y) ON. All others OFF.
      T2 - CB2, CB3(+28 V), CB6(+9.7 V), CB7(-9.7 V) and CB8 ($\pm$20 V) ON. All others OFF.

NOTE

Power to transformer T1 and T2 (step 2a above) is interrupted by auxiliary contacts on CB5 and CB6. Power to transformer T2 (step 2b above) is interrupted by CB3, CB6, CB7, and CB8. If any of these breakers trip, logic voltages are dropped to prevent possible voice coil damage.

3. Refer to table 5-2 and determine the terminals that receive the input from the transformer winding being tested. The winding is disconnected by removing Fastons (Non-VDE), or by removing fuses (VDE). It is not necessary to disconnect the center tap.

4. Plug in the test oscilloscope and set the Trigger control to LINE. Turn on the oscilloscope and center the horizontal trace.

5. Connect the scope's ground (-) probe to the appropriate terminal indicated in figure 5-18.

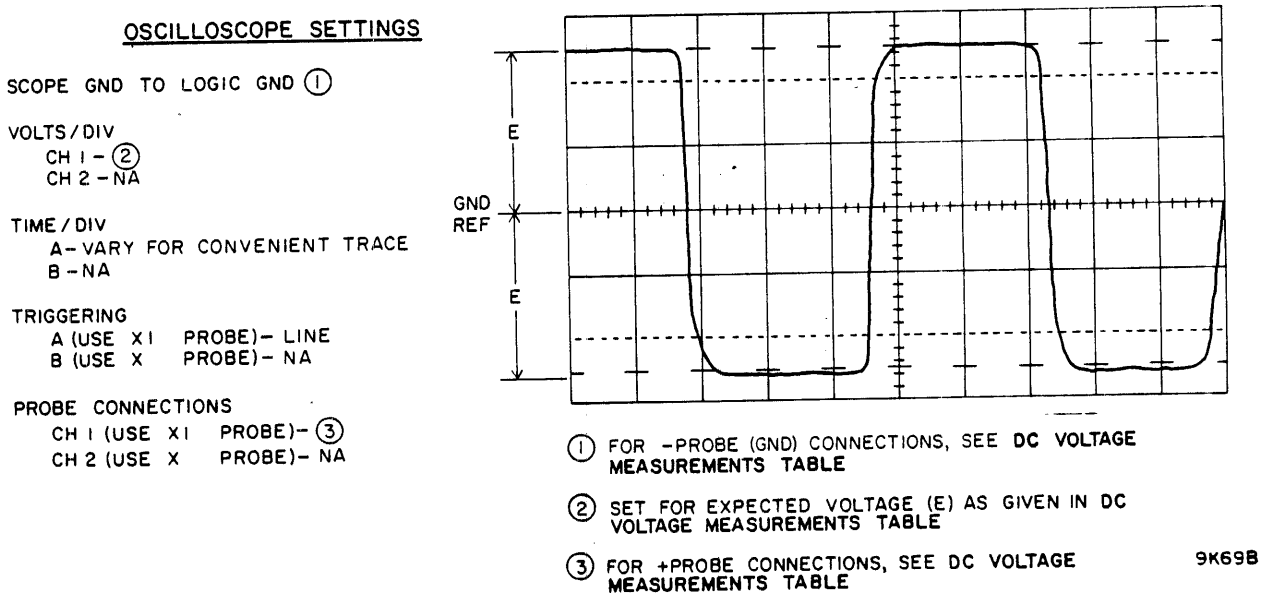


Figure 5-18. AC Input (Ferroresonant) to Power Supply Rectifiers

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 the TIME/DIV control to secure a stable square-wave trace as shown in figure 5-18.

9. Adjust the VOLTS/DIV control to allow easy mental reckoning of the voltage represented by the trace.

TABLE 5-2. AC INPUT TO RECTIFIERS

Xfmr	To Rectifier	+Probe Terminals (Check Both)	-Probe Terminal (GND)	Acceptable Range ±5%	Condition Remarks
	Non-VDE				
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	A1TB1-17 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
(1) Do not measure square-wave output, as shown in figure 5-18, unless tuning capacitor is connected.					
T2	±28 V	A1TB1-19 A1TB1-20	A1TB1-14	27.3 FL 29.4 NL	No Load = CB8 OFF

Table Continued on Next Page

TABLE 5-2. AC INPUT TO RECTIFIERS (Contd)

Xfmr	To Rectifier	+Probe Terminals (Check Both)	-Probe Terminal (GND)	Acceptable Range ±5%	Condition Remarks
	Non-VDE (Continued)				
T3	+20Y	A1TB2-9 A1TB2-10	A1TB1-12	25.0	Secondary disconnected. Sine wave output. Voltages peak to ground
	VDE-S/C 40 & Below				
T1	+20Y	A1P2-1 A1P2-3	A1P2-2	19.5 FL 20.6 NL	P2/J2 disconnected on control board _CFN. Sine-waveoutput. Voltage is peak to ground.
T2	±9.7 V	A1F1 A1F2 (Line Side)	T2J3 - 1	9.36 FL 10.66 NL	Fuse removed = No Load. Fuse In = Full Load
T2	+28 V	A1F3 A1F4 (Line Side)	T2J3 - 3	27.0 FL 30.5 NL	Fuse removed = No Load. Fuse In = Full Load
T2	±20 V	A1F7 A1F8 (Line Side)	T2J3 - 3	19.0 FL 22.1 NL	Fuse Removed = No Load. Fuse In = Full Load
T2	±46 V	A1F5 A1F6 (Line Side)	T2J3 - 2	45.83 FL 49.60 NL	Fuse Removed = No Load. Fuse In = Full Load

TABLE 5-2. AC INPUT TO RECTIFIERS (Contd)

Xfrm	To Rect-fier	+Probe Terminals (Check Both)	-Probe Terminal (GND)	Acceptable Range ±5%	Condition Remarks
VDE-S/C 41 & Above					
T2	±20Y	A1P2-1 A1P2-2	A1J3-2	22.0 FL 23.1 NL	P2/J2 disconnected on control board - CFN. Sinewave output. Voltage is peak to ground.
T2	±9.7 V	A1F1 A1F2 (Line Side)	T2J1 - 1	9.36 FL 10.66 NL	Fuse removed = No Load. Fuse In = Full Load
T2	±28 V	A1F3 A1F4 (Line Side)	T2J1 - 8	27.0 FL 30.5 NL	Fuse removed = No Load. Fuse In = Full Load
T2	±20 V	A1F7 A1F8 (Line Side)	T2J1 - 4	22.0 FL 23.1 NL	Fuse Removed = No Load. Fuse In = Full Load
T2	+46 V	CB9 CB10 (Line Side)	T2J1 - 3	45.83 FL 49.60 NL	CB Off = No Load. CB On = Full Load

10. Record the voltage from the ground reference line to the top and bottom of the trace (two readings "E") in figure 5-18.

11. Repeat step 10 with the +probe connected to the other input lead.

12. If steps 10 and 11 show a symmetrical waveform about the ground reference line (that is, all four voltage readings are the same), and are within the tolerance specified in table 5-2, the winding being tested is OK.

13. If the voltage readings are not the same, or if they are the same but not within the tolerance specified in table 5-3, 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.

Procedures for removal and replacement of transformers are:

- Non-VDE

  a. T1 - Steps 14 & 15.

  b. T2 - Steps 14 & 15.

  c. T3 - Step 16.

- VDE

  a. T1 - Step 18

  b. T2 - Step 19

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.

TABLE 5-3. DC VOLTAGE MEASUREMENTS

DC Voltage to be Measured	Probe Connection for Scope or VOM			Acceptable DC Voltage Range	
	Full Load ⚠1	No Load ⚠2			
	+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 ⚠2
				+21	+24 ⚠1
+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 card for Load or No Load condition		+5.05	+5.15
-5	A2JD94-01A			-5.05	-5.15
+16 ⚠2	K8-3 Brake power bridge rectifier is not grounded. Measure full voltage as given at right			28	45
-16 ⚠2					

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

⚠2 Non-VDE only

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 5-19).

e. Referring to CR803 of the diagrams, remove the transformer leadwires (Fastons) from A1TB1. (Check colors with figure 5-20).

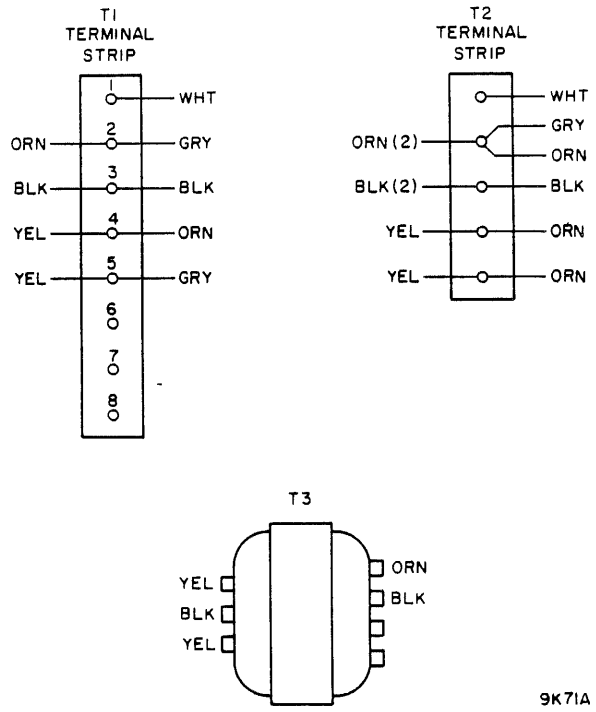


Figure 5-19. Non-VDE Transformer Connections

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.

NOTE

To prevent the ferroresonant transformer from oscillating, never disconnect more than one set of secondary leads from the rectifier/filter circuits at any given time. Such oscillation, although not dangerous, would make voltage measurement meaningless. This does not apply to standard transformers that have sine-wave outputs.

15. Be sure to connect at least one secondary winding, then check out the newly installed transformer by repeating steps 2 through 11.

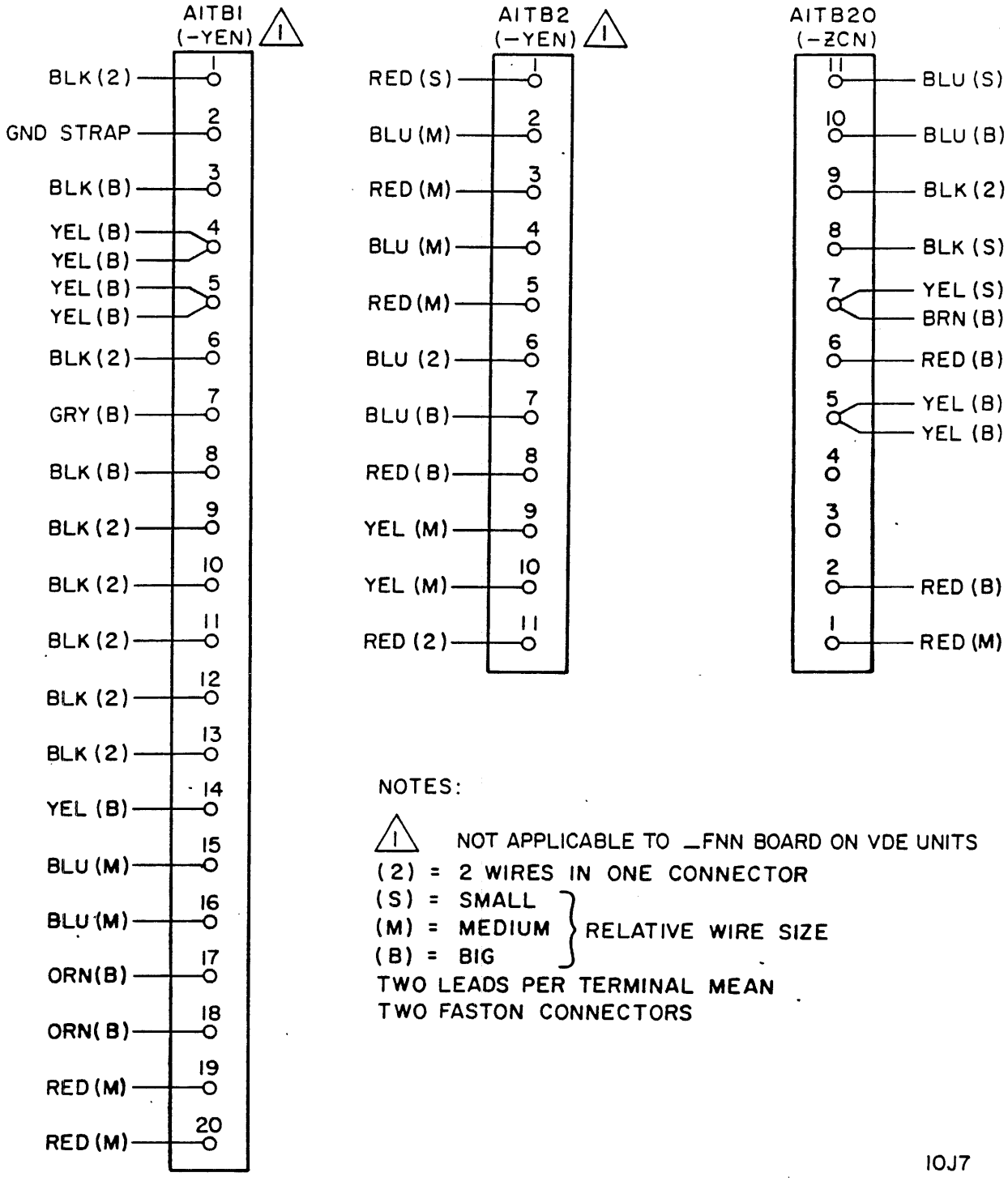


Figure 5-20. Terminal Board Connections

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 6.

    c. Remove the five Fastons from the clips protruding from the windings of T3. See figure 5-20 for color coding.

    d. Remove the nuts securing T3 to the power supply base and lift out the transformer.

    e. Reverse the order of these steps to install the new transformer.

17. When all Fastons have been secured to the proper terminals, turn on CB1. Check for +20 V (+20Y) at A1TB2-11 to verify proper operation of T3 and the +20Y rectifier.

18. To remove and replace transformer T1 on VDE units proceed as follows:

    a. Turn off CB1.

    b. Disconnect P2/J2 on the control board (_CFN).

    c. Disconnect the primary leads. Note or tag lead position.

    d. Remove the hardware securing the transformer to the chassis and remove the transformer.

    e. Reverse the procedure to install the replacement transformer.

    f. Check operation of the newly installed transformer.

19. To remove and replace transformer T2 on VDE units proceed as follows:

    a. Turn off MAIN AC breaker CB1.

    b. Short tuning capacitor C1 to discharge it.

    c. Disconnect the primary winding leads. Tag them or note position.

    d. Disconnect P2 and P3. P1 cable is not used.

    e. Remove the mounting hardware and remove the transformer.

f. Reverse the procedures to install the replacement transformer.

g. Check operation of the newly installed transformer.

PROCEDURE B: PINPOINTING VOLTAGE FAULTS IN THE LOGIC AND READ/WRITE CHASSIS - NON VDE

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. As shown in table 5-4, not all cards will require all voltage checks.

NOTE

From table 5-4, notice that cards in the logic chassis use both ±5 V and ±20 V (with the exception of Fault card A17, which also monitors ±46 V, but which is tested for that voltage by DLT 8). Cards in the R/W chassis use ±5 V, ±20 V, and +28 V.

It would be a good idea to have table 5-4 available for ready reference when performing this procedure.

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

2. Turn off ±46 V breaker (CB4 or CB5 depending on power supply type). (±46 V is 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.

TABLE 5-4. 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	+									-ZYN
Control Board	+	+			+			+		-CFN (2)
Rectifier/ Filter		X				X		+	X	-CBN (2)
Rectifier/ Cap		X		-	+	X		+	X	-YEN (1)
Relay Board					+				-	-FNN (2)
Relay Board		+		-	+					-YFN (1)
Power Amp									X	-ZCN (1&2)
E01	X					X		+		-PKV
E02	X		X				+			-PJV
E03	X		X				+			-PHV
E04	X									-XFN
E05	+									-XGN

Table Continued on Next Page

TABLE 5-4. VOLTAGE USAGE (Contd)

	+5V -5V	+9.7V -9.7V	+10.5V -10.5V	-16V	+20Y	+20V -20V	+22	+28	+46 -46	Card Type
Servo Preamp		X								-ZQN
Voice Coil				-					-	
Pack Cover Sol					+					
5 V Reg		X								--
A01/ A02	X									-TVV/ -RVV
A06	X									-LTV
A07	+									-LVV
A08	X									-QPV
A10	X					X				-LSV
A12	+									-LWV
A13	X									-LXV
A14	X					X				-LRV
A15	X					X				-LZV
A16	X					X				HD Align
A17	X							+		-KFV
A18	X					X				-FRV

Table Continued on Next Page

TABLE 5-4. VOLTAGE USAGE (Contd)

	+5V -5V	+9.7V -9.7V	+10.5V -10.5V	-16V	+20Y	+20V -20V	+22	+28	+46 -46	Card Type
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.

⚠1 Non-VDE

⚠2 VDE

4. Turn off +28 V breaker. If unit has a VDE power supply, the ±20 V breaker CB3 must be ON.

5. Remove A3PE1 from the R/W control card (E01). This kills 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 often 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 5-4 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 (+28 V) or CB3 depending on power supply type.

15. Remove the small cables from cards E02, E03, and E05. Also remove cable A3PE1 from card E01 if this was not done when checking out the logic chassis (see step 5).

16. Remove cards E01, E02, E03, and E05 from their pin connections on card E04.

17. Examine E04 for bent or broken pins where the other cards plug into (or onto) it. Also examine the foil for signs of arcing. E04 uses no power voltages, but acts as a distributor for the power voltages brought into it by E01.

18. Examine E01 for foil arcing (see step 9), then insert it into its connector on card E04.

19. Reconnect cable A3PE1 to card E01.

20. Turn on CB2.

21. If a breaker trips, turn off CB2 and replace the E01 card with a fresh one. Then reset the tripped breaker(s) and turn on CB2 to check the new card.

22. If a breaker trips after the new E01 card has been inserted, replace the E04 card. Then try the original E01 card again.

23. Turn off CB4 and, selecting another of the removed cards, examine it for foil arcing and insert it into E04.

24. Turn on CB2. If a breaker trips, turn off CB2 and try a fresh card.

25. Repeat steps 23 and 24 until all cards in the R/W chassis have been inserted and found good.

26. Reconnect the three cables to E02, E03, and E05.

PROCEDURE B: PINPOINTING VOLTAGE FAULTS IN THE LOGIC AND READ/WRITE CHASSIS - VDE

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. As shown in table 5-4, not all cards will require all voltage checks.

NOTE

From table 5-4, notice that cards in the logic chassis use both ±5 V and ±20 V (with the exception of Fault card A17, which also monitors ±46 V, but which is tested for that voltage by DLT 8). Cards in the R/W chassis use ±5 V, ±20 V, and +28 V.

It would be a good idea to have table 5-4 available for ready reference when performing this procedure.

1. Turn off CB1. This removes all logic voltages.

2. Turn off ±46 V breaker (CB4 or CB5 depending on power supply type). (±46 V is 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.

4. Turn off +28 V breaker. If unit has a VDE power supply, the ±20 V breaker CB3 must be ON.

5. Remove A3PE1 from the R/W control card (E01). This kills 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 CB1. Power-wiring errors in (or damage to) the logic backpanel will pop the offended breaker. If a breaker trips, turn off CB1 and raise the logic chassis to the maintenance position. Then carefully examine the backpanel for grounds or shorts, most often the product of bent pins or dangling wires. After clearing the fault, lower the logic chassis to its normal position and turn on CB1 to check.

8. Turn off CB1. 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 5-4 to ensure accuracy here.

11. Turn on CB1.

12. If a breaker trips, turn off CB1 and replace the card just installed with a fresh one. Then turn on CB1 to test the new card. (Don't forget to reset the tripped breaker).

13. If the card has no faults, turn off the CB1 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 CB1 and turn on CB8 (+28 V) or CB3 depending on power supply type.

15. Remove the small cables from cards E02, E03, and E05. Also remove cable A3PE1 from card E01 if this was not done when checking out the logic chassis (see step 5).

16. Remove cards E01, E02, E03, and E05 from their pin connections on card E04.

17. Examine E04 for bent or broken pins where the other cards plug into (or onto) it. Also examine the foil for signs of arcing. E04 uses no power voltages, but acts as a distributor for the power voltages brought into it by E01.

18. Examine E01 for foil arcing (see step 9), then insert it into its connector on card E04.

19. Reconnect cable A3PE1 to card E01.

20. Turn on CB1.

21. If a breaker trips, turn off CB1 and replace the E01 card with a fresh one. Then reset the tripped breaker(s) and turn on CB1 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 CB1. If a breaker trips, turn off CB1 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 (Non VDE) and turn off main circuit breaker, CB1 (VDE); you have dropped +5 V and run the risk of burning up the voice coil. Only after you've disabled dc power should you check to see if the powerdown resulted from a failure on the ac line. (Hint for Non VDE units: check if the blower is 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)

PROCEDURE D: HEAD CRASHES

The following paragraphs provide the information required to determine whether a head crash has occurred, 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, since both the magnetic intensity of the data pulse as recorded on the disk and the pulse as read from the disk, are greatly influenced by head gap-to--disk distance, variations in flying height can result in the generation of data errors. Continuous monitoring the data error rate is strongly recommended. A significant increase in the data error rate or 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 the following conditions are noted when the heads are over the disk:

a. An audible "ping" or scratching noise.

b. A burning odor is detected.

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 drive new? Any shipping damage?

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

a. Open the circuit breakers, 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 removes 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 of 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

1. 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 lead retainer mispositioned and striking the rail bracket; worn rail; bad carriage bearing; obstruction caught on magnet; foreign material on the rail. Carriage to the fully retracted position.

2. 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.

3. 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 several places on each side of the shroud.

4. 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.

5. Note head positions. Then remove all heads for evaluation and cleaning.

Evaluating the Heads

1. 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 a burnish mark on the head arm assembly where it might possibly have struck the disk.

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

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

Evaluating the Disk Pack

1. 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 fluctuations should be in evidence including upper and lower cover disks.

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

3. Look for any 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 by:

   a. Removing 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 to free the device.

   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 cover.

DECISION LOGIC TABLES

GENERAL

Decision logic tables help you organize your 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.

Two sets of DLTs are provided. The first set applies to all Non-VDE units. The second set applies to all VDE units.

The DLTs consist of two groups (Non-VDE and VDE) 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 drive motor.

- DLT 4 through 8 (Non-VDE) and 4 through 6 (VDE), diagnose problems that involve dc logic voltages.

- DLTs 9 through 12 (Non-VDE) and 7 through 10 (VDE) are used with the FTU to correct various seek and read/write errors.

- DLT 13 (Non-VDE) and 11 (VDE) shows what to do when a drive does not "powerdown" properly.

The procedures referred to in the DLTs form the last portion of this discussion.

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 rather than ASSUMPTIONS before the test for a given condition is made. Such steps are included in the CONDITIONS quadrant. The yes (Y) or no (N) answers to each condition are shown in numbered columns in the top-right Situations quadrant.

To use the DLT, first determine whether the result of a condition tested is Y or N. If two or more conditions exist simultaneously, look for a situations column that combines the appropriate Y-N answers for those conditions. A dash (-) in the top-right Situations quadrant means that the related Condition is not a factor in determining what actions are to be taken for that situation.

Next, determine what action 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.

DLT 1 — POWER UP — (sheet 1 of 2)

Warning: None

Enters from: Assumptions

Procedures: None

References: Logic Diagrams

Exits to: DLTs 1 through 10, as indicated

Assumption:
1. Drive connected to site power
2. Disk installed and all covers closed
3. MAIN AC brkr OFF, all others ON.

CONDITIONS	1	2	3	4	5	6	7	8	9	10	11	12
1. Turn on MAIN AC brkr (CB1). Does blower motor start?	Y	N	-	-	-	-	-	-	-			
2. Do any breakers trip?	N	-	Y	-	-	-	-	-	-			
3. Press START switch. Does START indicator come on and READY light flash at 1-second intervals?	Y	-	-	N	-	-	-	-	-			
4. Does drive motor start?	Y	-	-	-	N	-	-	-	-			
5. Does drive motor come up to speed? (Centrifugal sw. clicks.)	Y	-	-	-	-	N	-	-	-			
6. Does drive motor cut out when 10-sec timeout expires?	N	-	-	-	-	-	Y	-	-			
7. Do heads Load?	Y	-	-	-	-	-	-	N	-			
8. Is First Seek successful? (READY light stays on.)	Y	-	-	-	-	-	-	-	N			
ACTIONS												
1. Power-up completed satisfactorily. Go to DLT 10.	X	-	-	-	-	-	-	-	-			
2. Elapsed-time meter running? YES: chk line filters & blower-cable connector. NO: chk pwr available, then for ac at LINE inputs to CB1, finally for correct phasing at pwr plug.	-	1	-	-	-	-	-	-	-			
3. See which breaker tripped and go to indicated DLT:	-	-	X	-	-	-	-	-	-			
MAIN AC (CB1)--DLT 1, sht 2												
+20 Y (CB2)--DLT 2												
MOTOR (CB3) or thrml brkr--DLT 3												
±9.7 V (CB5, CB6)-- DLT 6												
±20 V (CB7), +28 V (CB8)-- DLT 7												
±46 V (CB4) and ±16 V-- DLT 8												
4. Check that all brkrs are ON.	-	-	-	1	-	-	-	-	-			
5. Chk dc test jacks on p.s. panel. Any dc voltage means +20 Y control voltage is OK; see DLTs in Action 3 if some voltages missing. If no dc voltages, go to DLT 2 to locate fault in +20 Y.	-	-	-	2	-	-	-	-	-			
6. See that A1P/J4 is properly mated (START light).	-	-	-	3	-	-	-	-	-			
7. Chk P/JD93, P/JA80, P/J201 for proper mating (START light).	-	-	-	4	-	-	-	-	-			
8. Replace logic cards A08, A17 (READY flasher).	-	-	-	5	-	-	-	-	-			
9. Go to DLT 3 (Drive Motor).	-	-	-	-	X	X	-	-	-			
10. Chk speed sensor & logic (cards A17, A08).	-	-	-	-	-	-	1	-	-			
11. Go to DLT 9 (First Seek).	-	-	-	-	-	-	-	X	X			
12. Call Field Support.	-	2	-	6	-	-	2	-	-			

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DLT 1 POWER UP (sheet 2 of 2)

Warning: Tuning capacitors A1C1 and A1C2 are charged to 500 volts!

Enters from: Assumptions

Procedures: None

References: Power Supply diagrams (80x)

Exits to: DLT 1, DLT 3

Assumption: In attempting to power up the drive, CB1 (MAIN AC) trips when turned ON. All other brkrs are ON as a precondition for Power Up.

CONDITIONS	1	2	3	4	5	6	7	8	9	10	11	12
1. Turn off CB2 (+20 Y) and CB3 (MOTOR). Reset CB1 and try again. Does CB1 still trip?	Y	N	-	-	-	-	-	-	-	-		
2. Turn off CB1, turn on CB3. Now turn on CB1. Does either CB3 or CB1 trip?	-	-	Y	N	-	-	-	-	-	-		
3. Turn off CB1. Disconnect wire from A1Q1-2 (AC PWR triac) to kill input to T1 and T2. Reset CB1. Does CB1 still trip?	-	-	-	-	Y	N	-	-	-	-		
4. Turn off CB1. Replace wire on A1Q1-2; remove wire from A1Q5-1. (This enables input to T2.) Turn on CB1. Does CB1 trip?	-	-	-	-	-	-	Y	N	-	-		
5. Turn off CB1. Replace wire on A1Q5-1; remove wire from A1Q5-2. (This checks for grounded LOAD contacts of A1Q5.) Turn on CB1. Does CB1 trip?	-	-	-	-	-	-	-	-	Y	N		
ACTIONS												
1. Disconnect blower and try again. If trouble persists, blower is OK. Reconnect and go to next recommended Action.	1	-	-	-	-	-	-	-	-	-		
2. Disconnect time meter and try again. If trouble persists, meter is OK. Reconnect and go to next recommended Action.	2	-	-	-	-	-	-	-	-	-		
3. Chk for shorts/gnds in wiring to LINE side of CB2 and CB3.	3	-	-	-	-	-	-	-	-	-		
4. Go to Condition 2.	-	X	-	-	-	-	-	-	-	-		
5. Drive motor at fault. Go to DLT 3.	-	-	X	-	-	-	-	-	-	-		
6. Go to Condition 3.	-	-	-	X	-	-	-	-	-	-		
7. Replace AC PWR triac, A1Q1.	-	-	-	-	1	-	-	-	-	-		
8. Go to Condition 4.	-	-	-	-	-	X	-	-	-	-		
9. Check wiring to T2 for shorts/grounds.	-	-	-	-	-	-	1	-	-	-		
10. Chk for shorted tuning capacitor A1C1. Note WARNING, above.	-	-	-	-	-	-	2	-	-	-		
11. Go to DLT 4 (Fault in T2 Network).	-	-	-	-	-	-	3	-	-	-		
12. Go to Condition 5.	-	-	-	-	-	-	-	X	-	-		
13. Replace T1 ENABLE triac, A1Q5.	-	-	-	-	-	-	-	-	1	-		
14. Check wiring to T1 for shorts/grounds.	-	-	-	-	-	-	-	-	-	1		
15. Chk for shorted tuning cap A1C2. (Note WARNING, above).	-	-	-	-	-	-	-	-	-	2		
16. Go to DLT 5 (Fault in T1 Network).	-	-	-	-	-	-	-	-	-	3		
17. Call Field Support.	4	-	-	-	2	-	4	-	2	4		

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DLT 2 +20 Y (+20 VOLT RELAY POWER) MISSING (sheet 1 of 2)

Warning: None

Enters from: DLT 1 (sheet 1) or Assumption 2)

Procedures: None

References: Logic Diagrams

Exits to: Power Up sequence (retry) and, if applicable, DLT 1

Assumption: 1. Lack of +20 Y noticed during Power Up sequence (See DLT 1, Actions 3 or 5)
OR: 2. Drive motor stops; all indicator lights out, blower still on.

CONDITIONS	1	2	3	4	5	6	7	8
1. Has +20 Y breaker (CB2) tripped?	Y	N	-	-	-	-		
2. Check for short in control circuit of A1Q5 by removing Faston from A1Q5-3. Reset CB2 and try again. Does CB2 still trip?	-	-	N	Y	-	-		
3. Check for short in control circuit of A1Q1 by removing Faston from A1Q1-3. Reset CB2 and try again. Does CB2 still trip?	-	-	-	-	N	Y		
ACTIONS								
1. Go to Condition 2.	X	-	-	-	-	-		
2. Go to Condition 5 on sheet 2.	-	X	-	-	-	-		
3. Replace A1Q5.	-	-	1	-	-	-		
4. Reconnect Faston to A1Q5-3 and go to Condition 3.	-	-	-	X	-	-		
5. Replace A1Q1.	-	-	-	-	1	-		
6. Trouble is in generating +20 Y. Reconnect Faston to A1Q1-3 and go to Condition 4 on sheet 2.	-	-	-	-	-	X		
7. Call Field Support.	-	-	2	-	2	-		

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DLT 2 +20 Y (+20 VOLT RELAY POWER) MISSING (sheet 2 of 2)

Warning: None

Enters from: DLT 1 (sheet 1) or Assumption 2)

Procedures: None

References: Logic Diagrams

Exits to: Power Up sequence (retry) and, if applicable, DLT 1

Assumption: 1. Lack of +20 Y noticed during Power Up sequence (See DLT 1, Actions 3 or 5).
OR: 2. Drive motor stops; all indicator lights out, blower still on.

CONDITIONS	7	8	9	10
4. Check for shorted T3: Remove Fastons from A1TB2-9 and A1TB2-10 (to isolate T3 from +20 Y rectifier). Reset CB2 and try again. Does CB2 still trip?	N	Y	-	-
5. Turn on (or reset) CB2 and check for +20 volts at A1TB2-11 (+20 Y output). Is +20 Y present?	-	-	N	Y
ACTIONS				
8. Replace capacitor board (-YEN), then go to Condition 5.	1	-	2	-
9. Check for shorts in wiring to/from T3.	-	1	-	-
10. Replace T3, reconnect Fastons removed in Condition 4, and go to Condition 5 to check for presence of +20 Y.	-	2	-	-
11. Check T3 input to +20 Y rectifier; test for approx 20 vac between A1TB1-11 (gnd) and A1TB2, pins 9 and 10. If not present, check wiring from T3; if needed, replace T3. If ac is present, go to next recommended Action.	-	-	1	-
12. If this DLT was entered because of Assumption 1, the problem has been solved.	-	-	-	1
13. If this DLT was entered because of Assumption 2, check for +20 Y continuity: A1P5-12, A1P5-13 (on cable to relay board -YFN), A1Q1-3. If no +20 Y at A1Q1-3, go to next recommended Action. (A1Q1 controls the generation of all logic voltages.)	-	-	-	2
14. Failure of +5 V (to light the indicators) may have been caused by the tripping of the +9.7 V breaker (CB5). If so, go to DLT 4. If not, go to next recommended Action.	-	-	-	3
15. Replace A1Q1.	-	-	-	4
16. Call Field Support.	2	3	3	5

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DLT 3 — DRIVE MOTOR

Warning: None

Enters from: DLT 1 or Assumptions

Procedures: None

References: Logic Diagrams

Exits to: DLT 2, DLT 4; or return to DLT 1

Assumption: 1. Drive motor fails to start, or starts prematurely, or does not come up to speed. All breakers initially ON.
OR: 2. Drive motor shuts down after it has been running properly.

CONDITIONS	1	2	3	4	5	6	7	8	9	10	11	12
1. Does drive motor start as soon as CB1 is actuated?	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	

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DLT 4 — FAULT IN T2 NETWORK (sheet 1 of 2)

Warning: Tuning capacitor A1C2 is charged to 500 volts!

Enters from: DLT 1 (sheet 2, Action 11)

Procedures: A

References: Diagrams

Exits to: Sheet 2 (of DLT 4)

Assumption: MAIN AC brkr (CB1) trips. Problem has been narrowed to transformer A1T2, which is the source for ±9.7, ±20, and +28 voltages, or to the generation/ distribution of those voltages.

CONDITIONS	1	2	3	4	5	6	7	8
1. Check out A1T2:								
a) Remove Faston from A1Q5-1 or A1Q5-2 (prevents energizing T1).								
b) Disconnect A1C2. Note WARNING, above.								
c) Disconnect Fastons from terminals 14 through 20 of A1TB1.								
d) Turn on CB1. Does CB1 trip?	Y	N	-	-	-	-	-	-
2. Check out ±9.7 V rectifier.								
a) Turn off CB1 and reconnect A1C2.								
b) Separate connector A1P/J3 (removes load from rectifier).								
c) Reconnect Fastons to terminals 14 (gnd), 17, and 18 of A1TB1.								
d) Turn on CB1. Does CB1 trip? (1)	-	-	Y	N	-	-	-	-
3. Check out ±20 V rectifier:								
a) Turn off CB1 and CB7 (±20 V breaker).								
b) Reconnect Fastons to terminals 15 and 16 of A1TB1.								
c) Turn on CB1. Does CB1 trip? (1)	-	-	-	-	Y	N	-	-
4. Check out +28 V rectifier:								
a) Turn off CB1 and CB8 (+20 breaker).								
b) Reconnect Fastons to terminals 19 and 20 of A1TB1.								
c) Turn on CB1. Does CB1 trip? (1)	-	-	-	-	-	-	Y	N

ACTIONS								
1. Replace A1T2, then restore all connections and try again.	1	-	-	-	-	-	-	-
2. Go to Condition 2.	-	X	-	-	-	-	-	-
3. Replace capacitor brd, then restore all connections and try again.	-	-	1	-	1	-	1	-
4. Go to Condition 3.	-	-	-	X	-	-	-	-
5. Go to Condition 4.	-	-	-	-	-	X	-	-
6. No shorts/ gnds on capacitor board; continue on sheet 2.	-	-	-	-	-	-	-	X
7. Call Field Support.	2	-	2	-	2	-	2	-

(1) For a NO answer here, you may wish to check the value of the ac input, per Procedure A, particularly if the dc voltages checked on sheet 2 are low.

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DLT 4 FAULT IN T2 NETWORK (sheet 2 of 2)

Warning: None

Enters from: Sheet 1

Procedures: None

References: Diagrams

Exits to: DLTs 5, 6, 7

Assumption: Problem in the T2 network has been further narrowed to either an open rectifier (±9.7 V, ±20 V, +28 V), or a fault in one of the loads sourced from T2.

CONDITIONS	1	2	3	4	5	6	7	8	9	10	11	12
1. Check ±9.7 voltage:												
a) Turn off CB1.												
b) Ensure that CB5 and CB6 are ON, and that A1P/J3 is separated.												
c) Turn on CB1. Are ±9.7 V present at panel test jacks? (1)	Y	N	-	-	-	-	-	-	-	-	-	-
2. Check ±9.7 V loads:												
a) Turn off CB1 and CB7 (±20 V breaker).												
b) Reconnect A1P/J3 to restore ±9.7 V load.												
c) Turn on CB1. Does either CB5 or CB6 trip?	-	-	Y	N	-	-	-	-	-	-	-	-
3. With CB1 ON and CB7 still OFF, chk for no-load ±20 V at terminals 5 and 6, respectively, of A1TB2. (Ground probe on A1TB1-14.) Are voltages present? (1)	-	-	-	-	Y	N	-	-	-	-	-	-
4. Chk ±20 V loads by turning on CB7. Does CB7 trip?	-	-	-	-	-	-	Y	N	-	-	-	-
5. With CB1 ON and CB8 (+28 V brkr) OFF, chk for no-load +28 V at A1TB2-1 (gnd probe on A1TB2-14). Is +28 V present? (1)	-	-	-	-	-	-	-	-	Y	N	-	-
6. Chk +28 V load by turning CB8 ON. Does CB8 trip?	-	-	-	-	-	-	-	-	-	-	Y	N

ACTIONS												
1. Go to Condition 2, above.	X	-	-	-	-	-	-	-	-	-	-	-
2. Inoperative rectifier--replace capacitor board.	-	1	-	-	-	1	-	-	-	1	-	-
3. Problem is in ±9.7 V loads. Go to DLT 6.	-	-	X	-	-	-	-	-	-	-	-	-
4. ±9.7 V network is OK. Go to Condition 3.	-	-	-	X	-	-	-	-	-	-	-	-
5. Go to Condition 4.	-	-	-	-	X	-	-	-	-	-	-	-
6. Problem is in the ±20 V loads. Go to DLT 7.	-	-	-	-	-	-	X	-	-	-	-	-
7. ±20 V network is OK. Go to Condition 5.	-	-	-	-	-	-	-	X	-	-	-	-
8. Go to Condition 6.	-	-	-	-	-	-	-	-	X	-	-	-
9. Problem is in the +28 V load. Go to DLT 7.	-	-	-	-	-	-	-	-	-	-	X	-
10. T2 network is OK. Go to DLT 5 to check T1.	-	-	-	-	-	-	-	-	-	-	-	X
11. Call Field Support.	-	2	-	-	-	2	-	-	-	2	-	-

(1) If voltages are present, but 10% or more below nominal, check ac input to rectifier, per Procedure A.

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	-		

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DLT 6 FAULT IN ±9.7 V LOADS (sheet 2 of 2)

Warning: None

Enters from: Sheet 1

Procedures: B

References: Logic Diagrams

Exits to: DLT 1 to complete Power Up sequence

Assumption: By process of elimination, the ±9.7 V load fault has been limited to either the logic chassis or the read/write chassis.

CONDITIONS	7	8	9	10
4. Add logic chassis to ±9.7 V load:				
a) Turn off CB1.				
b) Reinstall regulator card (with Fastons connected) in logic chassis.				
c) Separate A1J/PA82 (on logic chassis backpanel).				
d) Turn on CB1. Does either CB5 or CB6 trip?	Y	N	-	-
5. Add R/W chassis to complete the ±9.7 V load:				
a) Turn off CB1. CB4 (±46 V) may be turned on now if desired.				
b) Reconnect A2P/JA82.				
c) Turn on CB1. Does either CB5 or CB6 trip?	-	-	Y	N
ACTIONS				
11. Problem is in the logic chassis. To pinpoint cause, go to Procedure B.	X	-	-	-
12. Check for +5 V at A2JD94-04 (A or B), then for -5 V at A2JD94-01 (A or B). Voltages should be 5.1, ±0.05 V. Adjust pot(s) on regulator card if voltages are out of spec. Then go to Condition 5.	-	X	-	-
13. Problem is in the R/W chassis. To pinpoint cause, go to Procedure B.	-	-	X	-
14. The ±9.7 V fault has been eliminated.	-	-	-	X

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DLT 7 — FAULT IN ±20 V, +28 V LOADS

Warning: None

Enters from: DLT 1, DLT 4

Procedures: B

References: Logic Diagrams

Exits to: DLTs 1 or 4, as determined from entrance conditions

Assumption:

CONDITIONS	1	2	3	4	5	6	7	8	9	10	11	12
1. Has CB7 tripped? (±20 V load fault.)	Y	N	-	-	-	-	-	-	-	-		
2. Has CB8 tripped? (+28 V load fault.)	-	Y	-	-	-	-	-	-	-	-		
3. Restrict ±20 V load to logic chassis:												
a) Separate P/JA82.												
b) Reset CB7, then turn on CB1. Does CB7 still trip?	-	-	Y	N	-	-	-	-	-	-		
4. Turn on (or reset) CB8. Does CB8 trip?	-	-	-	-	Y	N	-	-	-	-		
5. Add R/W chassis to ±5 V load:												
a) Turn off CB1 (CB7 still ON).												
b) Reconnect P/JA82 (if separated for Condition 2).												
c) Turn on CB1. Does CB7 trip?	-	-	-	-	-	-	Y	N	-	-		
6. Turn on CB8 to add +28 V to R/W chassis. Does CB8 trip?	-	-	-	-	-	-	-	-	Y	N		
ACTIONS												
1. Go to Condition 3.	X	-	-	-	-	-	-	-	-	-		
2. Go to Procedure B to pinpoint ±20 V fault in logic chassis.	-	-	X	-	-	-	-	-	-	-		
3. Go to Condition 4 if +28 V fault exists, otherwise go to Cond. 5.	-	-	-	X	-	-	-	-	-	-		
4. Check for +28 V short/gnd in logic chassis backpanel wiring from PD93 to JA82, then go to Action 5.	-	X	-	-	X	-	-	-	-	-		
5. Turn off CB8 and go to Condition 5.	-	-	-	-	-	X	-	-	-	-		
6. Go to Procedure B to pinpoint ±20 V fault in R/W chassis.	-	-	-	-	-	-	X	-	-	-		
7. Go to Condition 6 if +28 V fault occurs, otherwise go to next recommended Action.	-	-	-	-	-	-	-	1	-	-		
8. Go to Procedure B to pinpoint +28 V fault in R/W chassis.	-	-	-	-	-	-	-	-	X	-		
9. No faults in ±20 V or +28 V loads. Return to DLT 1.	-	-	-	-	-	-	-	2	-	X		
10. Call Field Support.	-	-	-	-	-	-	-	3	-	-		

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DLT 8 — FAULT IN ±46 V LOADS

Warning: None

Enters from: DLTs 1,3,5

Procedures: None

References: Logic Diagrams

Exits to: DLTs 1,3, or 5, as determined from entrance conditions

Assumption:

CONDITIONS	1	2	3	4	5	6	7	8
1. Limit ±46 V load to power amp:								
a) Turn off CB1, then reset CB4 (±46 V).								
b) Separate A1P/J4 (on side of p.s. assy).								
c) Ensure breakers CB2-CB8 are ON, then turn on CB1.								
Does CB4 still trip?	Y	N	-	-	-	-		
2. Add logic chassis to ±46 V load:								
a) Turn off CB1.								
b) Reconnect A1P/J4.								
c) Turn on CB1. Does CB4 trip?	-	-	Y	N	-	-		
3. Restrict ±46 V load in logic chassis to backpanel wiring:								
a) Turn off CB1.								
b) Remove card from location A17.								
c) Reset CB4, then turn on CB1. Does CB4 still trip?	-	-	-	-	Y	N		
ACTIONS								
1. Replace power amp.	1	-	-	-	-	-		
2. Go to Condition 2.	-	X	-	-	-	-		
3. Go to Condition 3.	-	-	X	-	-	-		
4. Check logic chassis backpanel wiring between JD93-12A and A17-32B (+46 V), and between JD93-12B and A17-03B (-46 V).	-	-	-	-	1	-		
5. Install new card in location A17.	-	-	-	-	-	1		
6. Problem no longer exists.	-	-	-	X	-	-		
7. Call Field Support.	2	-	-	-	2	2		

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DLT 9 — FIRST SEEK — (sheet 1 of 2)

Warning: None

Enters from: DLT 1

Procedures: See sheet 2

References: Logic Diagrams

Exits to: DLT 10 or sheet 2 of this DLT

Assumption: START light is on, drive is up to speed. First Seek not yet completed, so READY light is still blinking.

CONDITIONS	1	2	3	4	5	6	7	8
1. READY light glows continuously, signifying successful First Seek?	Y	N	N	N	N	N		
2. First Seek attempted?	-	N	N	N	N	N		
3. Check that Heads Loaded sw is transferring:								
a) Press START sw to stop disk. Do not turn off breakers.								
b) Manually push voice coil forward to move heads off unloading ramp. Does voice coil resist fwd movement?	-	-	N	Y	Y	Y		
4. Check for forward drive to voice coil:								
a) Disconnect wire from terminal 2 of voice coil (one closest to magnet assembly).								
b) Attach + lead of VOM to this wire, - lead to logic ground.								
c) Press START sw.								
d) Wait 15-20 seconds for up-to-speed timeout to expire, then check voltage. Does VOM read approx. +40 V?	-	-	-	-	N	Y		

ACTIONS								
1. No problem. Go to DLT 10.	X	-	-	-	-	-		
2. Go to Condition 3.	-	X	-	-	-	-		
3. Suspect leads to (or contacts in) Em. Retract relay.	-	-	1	-	-	-		
4. Suspect open voice coil.	-	-	2	-	-	-		
5. Replace Heads Loaded switch.	-	-	3	-	-	-		
6. Replace power amp.	-	-	4	-	5	-		
7. Hds Loaded sw OK. Go to Condition 4 to chk fwd drive on v.c.	-	-	-	X	-	-		
8. Suspect card A20 (pwr amp control).	-	-	-	-	1	-		
9. Suspect card A07 (direction control).	-	-	-	-	2	-		
10. Suspect card A12 (diff cntr, CAR).	-	-	-	-	3	-		
11. Suspect cards A08, A17 (speed control).	-	-	-	-	4	-		
12. Voice coil should attempt First Seek upon expiration of up-to-speed timeout. Go to Condition 5 on sheet 2.	-	-	-	-	-	X		
13. Call Field Support.	-	-	5	-	6	-		

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DLT 9 — FIRST SEEK — (sheet 2 of 2)

Warning: None

Enters from: Sheet 1

Procedures: Trk Servo Amplitude Chk (section 5); Hd-Arm Repl (6); Hd Alignment (4)

References: Logic Diagrams

Exits to: DLT 10

Assumption: START light on, drive up to speed

	CONDITIONS	7	8	9	10	11	12	13
1.	First Seek successful? (From sheet 1.)	N	N	N	N	N	N	N
2.	First Seek successful? (From sheet 1.)	Y	Y	Y	Y	Y	Y	Y
5.	Drive attempts First Seek, then unloads?	Y	Y	Y	Y	-	-	-
6.	Servo preamp input to card A18 OK?	-	N	Y	Y	-	-	-
7.	Track Servo signal present at A18-09B (output pin)?	-	-	N	Y	-	-	-
8.	Drive seeks to forward mechanical stop, FAULT light comes on (+42 fuse blows), but heads don't unload--unit can not power down?	-	-	-	-	Y	-	-
9.	Drive seeks to fwd mech stop, waits for FAULT light (+42 fuse blows), then retracts?	-	-	-	-	-	Y	-
10.	Drive loads heads, hesitates, then creeps to fwd EOT?	-	-	-	-	-	-	Y
	ACTIONS							
14.	Not sensing dibits. Check servo preamp input to card A18 (Trk Servo Ampl Chk) and go to Condition 6.	X	-	-	-	-	-	-
15.	Chk for continuity/gnds in servo preamp cable (input to A18).	-	1	-	-	-	-	-
16.	Replace servo preamp.	-	2	-	-	-	-	-
17.	Replace and align servo head (see Procedures, above).	-	3	-	-	-	-	-
18.	Suspect card A18.	-	-	1	-	-	-	-
19.	Suspect propagation of Track Servo signal through cards A19, A20.	-	-	-	1	-	-	-
20.	Replace power amp.	-	-	-	-	3	2	-
21.	Suspect velocity transducer and attendant logic on cards A20, (A19).	-	-	-	-	2	-	-
22.	Check Fine Enable logic on cards A06, A19.	-	-	-	-	1	-	1
23.	Suspect cards A17, A20.	-	-	-	-	-	-	2
24.	Call Field Support.	-	4	2	2	4	3	3

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DLT 10 — RTZ, CONTINUOUS SEEKS

Warning: None
Enters from: DLT 9
Procedures: None
References: Logic Diagrams
Exits to: DLT 11

Assumption:
1. FTU (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 card A02 (Ch. 1 Rcurs).	-	5	4	4	4			
7. Replace card A12 (Difference Generation and Control).	-	-	2	2	2			
8. Call Field Support.	-	6	5	5	5			

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DLT 11 — WRITE/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				

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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	-	-	-	-	-	X	-	-	-	-
	Condition 7.										
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 card A02 (Ch. 1 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

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DLT 12 READ

Warning: None

Enters from: DLT 11

Procedures: Head Alignment (section 4); Head Replacement (6)

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 Rcvrs), A04 (Ch. 2 Rcvrs).	-	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.

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DLT 13 POWER DOWN

Warning: None

Enters from: DLT 12

Procedures: None

References: Logic Diagrams

Exits to: None (Termination of diagnostic procedures)

Assumption: Remote operation--Attempt to power-down the drive from a remote location. Local operation--Press START to extinguish START light and power-down the drive.

CONDITIONS	1	2	3	4	5	6	7	8
1. START light on SMD panel goes out? (LOCAL mode only.)	Y	Y	Y	Y	N			
2. Heads unload?	Y	Y	Y	N	-			
3. Drive motor brakes to a stop? (Stops in about 30 seconds.)	Y	N	N	-	-			
4. Drive motor coasts to a stop?	N	N	Y	-	-			
ACTIONS								
1. Diagnostics have been completed satisfactorily.	X	-	-	-	-			
2. Check Deck Interlock sw (or wiring) for grounds.	-	1	-	-	-			
3. Chk that Heads Loaded sw has transferred (A07-24B at ground).	-	2	-	-	-			
4. Chk for open thermal resistor in CB3 (terminals C,D).	-	-	1	-	-			
5. Chk brake relay, K8, and connections. If pressing START sw still does not pull in K8, replace relay board (-YFN). If K8 operates properly, go to next recommended Action.	-	-	2	-	-			
6. Chk for 32 V dc between terminals 10 and 3 of K8 (terminal 10 is -16 V). If absent, replace ±16 V bridge rectifier (brake power). If 32 V dc is present, chk for broken wires to motor connector P/J7.	-	-	3	-	-			
7. Replace card A07 (RTZ Latch).	-	-	-	1	-			
8. Replace card A20 (Summing Amp, Pwr Amp Control).	-	-	-	2	-			
9. Cathode of START LED grounded. See c.r. 773 in diagrams.	-	-	-	-	1			
10. Call Field Support.	-	3	4	3	2			

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VDE UNITS

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
1. Turn on MAIN AC brkr (CB1). Does blower motor start?	Y	N	-	-	-	-	-	-	-
2. Do any breakers trip or fuses open?	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**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1. Power-up completed satisfactorily. Go to DLT 8.	X	-	-	-	-	-	-	-	-
2. Elapsed-time meter running? YES: chk line filters & blower-	-	1	-	-	-	-	-	-	-
cable connector. NO: chk pwr available, then for ac at LINE									
inputs to CB1, finally for correct phasing at pwr plug.									
3. See which breaker tripped or fuses opened and go to indicated DLT	-	-	X	-	-	-	-	-	-
MAIN AC (CB1) --DLT 1, sht 2									
+20Y (CB2) --DLT 2									
MOTOR (CB4) or thrml brkr--DLT 3									
±9.7 V (CB6, CB7) (F1, F2) DLT 4									
±20 V (CB8) (F7, F8) +28 V (CB3) DLT 7									
±46 V (CB5) (F5, F6) DLT 6									
4. Check that all brkrs are ON.	-	-	-	1	-	-	-	-	-
5. Chk dc test jacks on p.s. panel. Any dc voltage means +20Y	-	-	-	2	-	-	-	-	-
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									
+20Y.									
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 7 (First Seek).	-	-	-	-	-	-	-	X	X
12. Call Field Support.	-	2	-	6	-	-	2	-	-

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DLT 1 POWER UP Sheet 2 of 2

Warning:
Enters from: Assumptions
Procedures: None
References: Power Supply Diagrams (80X)
Exits to: DLT 1, DLT 4

Assumption: CB1 trips when attempting to power up. All other breakers are on as a precondition for power up.

CONDITIONS	1	2	3	4	5	6	7	8	9
1. Turn off CB2 (+20Y) and CB4 (motor). Reset CB1 and try									
again. Does CB1 still trip?	Y	N	-	-	-	-			
2. Turn off CB1, turn on CB4 and then turn on CB1. Does either									
CB1 or CB4 trip?	-	-	Y	N	-	-			
3. Disconnect P2/J2 and C1 on T2. Turn on CB1. Does CB1 trip?	-	-	-	-	Y	N			
ACTIONS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1. Disconnect blower and retry. If trouble persists blower is	1	-	-	-	-	-			
OK. Reconnect and go to next action.									
2. Disconnect time meter and retry. If trouble persists time meter	2	-	-	-	-	-			
is OK. Reconnect and go to next action.									
3. Check wiring in line side of CB2 and CB4.	3	-	-	-	-	-			
4. Go to condition 2.	-	X	-	-	-	-			
5. Disconnect J1/P1 on -CFN and retry. If trouble persists,	-	-	1	-	-	-			
check wiring on Load side of CB4. IF CB4 stays on, go to next									
action.									
6. Replace -CFN.	-	-	2	-	-	-			
7. Go to condition 3. Fault is in T2 network.	-	-	-	X	-	-			
8. Replace transformer T2 and reconnect.	-	-	-	-	X	-			
9. Problem has been corrected. Return to DLT 1.	-	-	-	-	-	X			
10. Call Field Support.	4	-	3	-	-	-	-		

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DLT 2 +20 Y (+20 VOLT RELAY POWER) MISSING

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)
2. Drive motor stops; all indicator lights out, blower still on.

CONDITIONS	1	2	3	4	5	6	7	8	9
1. Has +20 Y breaker (CB2) tripped?	N	Y	-	-					
2. Disconnect P2/J2 on –CFN and check for raw ac at P2. Is 20 vac present at P2?	-	-	Y	N					
ACTIONS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1. Check for +20 Y at rectifier (CR1/CR2) on –CFN. If +20 Y is present, check continuity of +20 Y and if necessary replace the –CFN. If +20 Y is not present, go to condition 2.	X	-	-	-					
2. Disconnect P2/J2 on –CFN and retry. If CB2 still trips, check wiring to/from T1 for shorts or grounds, and if necessary, replace T1.	-	X	-	-					
3. Replace –CFN board, connect P2/J2 and return to DLT 1.	-	-	X	-					
4. Check for raw 20 vac at T1. If present, check wiring from T1 to P2 for opens. If 20 vac missing, check wiring from CB2 to T1.	-	-	-	X					
5. Call Field Support.	-	-	-	-					

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DLT 3 MOTOR (Sheet 1 of 2)

Warning: None
Enters from: DLT 1 or Assumption
Procedures: None
References: Logic Diagrams
Exits to: DLT 4, DLT 8, (return) DLT 1

Assumption: 1. Drive motor fails to start, starts prematurely, or fails to come up to speed, (CB2-CB8 ON). Conditions below are initiated by actuating CB1.
or 2. Drive motor shuts down after a period of proper operation.

CONDITIONS	1	2	3	4	5	6	7	8	9
1. Does CB4 (motor) trip when CB1 (main ac) is actuated?	N	N	N	N	N	N	N	N	
2. Does drive motor start when CB1 is actuated?	N	N	N	N	N	N	N	N	
3. Does drive motor start when START switch is pressed?	Y	Y	Y	Y	N	N	N	N	
4. Does CB4 or thermal breaker trip when START switch is pressed?	N	N	N	Y	-	-	-	-	
5. Does CB4 or thermal breaker trip before motor is up to speed?	N	Y	Y	-	-	-	-	-	
6. Is squealing heard when motor starts?	N	N	Y	-	-	-	-	-	
7. Is motor power present at J7/P7 (motor) when START switch is pressed.	-	-	-	-	Y	N	N	N	
8. Is lack of motor power accompanied by one or more FAULT indications?	-	-	-	-	-	-	N	Y	
ACTIONS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1. If READY light flashes after motor starts go to DLT 7. If READY light is on steady (successful first seek), go to DLT 8.	X	-	-	-	-	-	-	-	
2. Check drive belt and tension. Go to next recommended action.	-	1	2	-	-	-	-	-	
3. Check brake and associated wiring. Replace brake or –CFN if necessary. If OK go to next recommended action.	-	2	-	-	-	-	-	-	
4. Check that parking brake has released spindle.	-	-	1	1	-	-	-	-	
5. Check for tight or seized motor and/or spindle bearings.	-	-	-	2	-	-	-	-	
6. Check wiring between P7/J7 and motor.	-	-	-	-	1	-	-	-	
7. Replace motor.	-	-	-	-	2	-	-	-	
8. Check for +9.7 V at test jack. If present go to next recommended action. If not present, go to DLT 4.	-	-	-	-	-	1	1	-	
9. Check wiring between P7/J7 and –CFN.	-	-	-	-	-	2	-	-	
10. Replace card A08 (Start Control).	-	-	-	-	-	-	2	-	
11. Replace –FNN card (Relay board).	-	-	-	-	-	-	3	-	
12. Replace –CFN card (Control).	-	-	-	-	-	3	4	-	
13. Troubleshoot fault(s).	-	-	-	-	-	-	-	1	
14. Call Field Support.	-	3	3	3	3	4	5	2	

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DLT 3 MOTOR (Sheet 2 of 2)

Warning: None
Enters from: DLT 1 or Assumptions
Procedures: None
References: Logic Diagrams
Exits to: DLT 4, DLT 8 (return) DLT 1

Assumption:

CONDITIONS	1	2	3	4	5	6	7	8	9
1. Does CB4 (motor) trip when CB1 is actuated?	N	Y	-	-	-	-	-	-	
2. Does drive motor start when CB1 is actuated?	Y	-	-	-	-	-	-	-	
+ **ACTIONS**	1	2	3	4	5	6	7	8	9
1. Replace -CFN card (Control).	1	-	-	-	-	-	-	-	
2. Replace -FNN card (Relay).	2	-	-	-	-	-	-	-	
3. Check for shorts or grounds in wiring on load side of CB4.	-	1	-	-	-	-	-	-	
Replace CB4 if necessary.									
4. Call Field Support.	3	2	-	-	-	-	-	-	

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DLT 4 FAULT IN ±9 V CIRCUITS

Warning: None
Enters from: DLT 1, DLT 3
Procedures:
References: Logic Diagrams
Exits to: DLT 1 (return)

Assumption:
1. Circuit breaker CB6 and/or CB7 trips when attempting to power up.
and/or 2. Fuses F1 or F2 open.
and/or 3. ±9.7 V dc missing at test jacks.

CONDITIONS	1	2	3	4	5	6	7	8	9
1. Did fuse F1 or F2 open?	Y	N	-	-	-	-			
2. Turn off CB1. Disconnect J3/P3 on power supply. Turn on CB6									
and CB7. Did CB6 or CB7 trip?	-	-	Y	N	-	-			
3. Turn off CB1. Disconnect A3P8 on servo preamp. Connect J3/P3									
on power supply. Turn on CB5 and CB6, then CB1. Did CB5 or									
CB6 trip?	-	-	-	-	Y	N			
ACTIONS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1. Turn off CB1 and replace open fuses.	1	-	-	-	-	-			
2. If CB6 and/or CB7 tripped, go to condition 2. If CB6 or CB7	2	1	-	-	-	-			
did not trip, go to next action.									
3. Replace control board -CFN.	4	-	-	-	-	-			
4. Check wiring between load side of breakers and J3 on power	-	-	X	-	-	-			
supply.									
5. Go to condition 3.	-	-	-	X	-	-			
6. If ±9.7 is present at test jacks, no problem exists. If ±9.7	-	2	-	-	-	-			
is missing go to next action.									
7. Check rectifier/filter circuits on -CBN. Replace board if	3	3	-	-	-	-			
necessary.									
8. Check for ac to transformer T2. If ac is present go to next	-	4	-	-	-	-			
action. If ac is not present, replace control board -CFN.									
9. Check transformer T2 and replace if necessary.	-	5	-	-	-	-			
10. Replace ±5 volt regulator board.	-	-	-	-	X	-			
11. Replace servo preamp.	-	-	-	-	-	X			
12. Call Field Support.	5	6	-	-	-	-			

DLT 5 FAULT IN ±20 and/or +28 V LOADS

Warning: None
Enters from: DLT 1
Procedures:
References: Logic Diagrams
Exits to: DLT 1 (return)

Assumption: 1. Circuit breaker CB3 (+28 V) and/or CB8 (-20 V) tripped when powering up.
and/or 2. Fuses F7 an/or F8 (20 V) and/or F3 and/or F4 (28 V) open when powering up.
and/or 3. ±20 V and/or +28 V missing at test jacks.

CONDITIONS	1	2	3	4	5	6	7	8	9
1. Are fuses F3, F4, F7, and/or F8 open?	Y	N	-	-	-	-			
2. Turn off CB1 and disconnect J4/P4 and J3/P3 on power supply.									
Turn on CB3, CB8, and then CB1. Did CB3 or CB8 trip?	-	-	Y	N	-	-	-	-	
3. Turn off CB1 and connect J3/P3 on power supply. Leave J4/P4									
disconnected. Turn on CB3, CB8, and then CB1. Did CB8 trip?	-	-	-	-	Y	N	-	-	
4. Turn off CB1 and connect J4/P4. Turn off CB8. Turn on CB3 and									
then CB1. Did CB3 trip?	-	-	-	-	-	-	Y	N	
ACTIONS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1. Turn off CB1 and replace open fuse(s).	1	-	-	-	-	-	-	-	
2. If CB3 or CB8 tripped go to condition 2. If CB3 or CB8 did not	2	1	-	-	-	-	-	-	
trip, go to next action.									
3. Troubleshoot rectifier/filter board –CBN or replace it if	3	3	-	2	-	-	-	-	
necessary.									
4. If dc voltages are present at test jacks, no problem exists. Go	-	2	-	-	-	-	-	-	
to DLT 1. If voltages are not present go to next action.									
5. Check transformer T2 and replace it if necessary.	-	4	-	4	-	-	-	-	
6. Check wiring between load side of CB3/CB8 for shorts or grounds.	-	-	1	-	-	-	-	-	
7. If dc voltages are present at test jacks, problem is in load be-	-	-	-	1	-	-	-	-	
yond J3/P3 and/or J4/P4 on power supply. Go to condition 3.									
If dc voltages are missing, go to next action.									
8. Check for ac to T2. If ac is missing at T2, troubleshoot	-	5	-	3	-	-	-	-	
control board –CFN and replace it if necessary. If ac is									
available at T2, go to next action.									
9. Troubleshoot ±20 V circuits between logic chassis and J3/P3	-	-	-	-	1	-	-	-	
on power supply.									
10. Go to condition 4.	-	-	-	-	-	X	-	-	
11. Troubleshoot +28 V circuits beyond J4/P4 on power supply.	-	-	-	-	-	-	1	-	
12. Troubleshoot ±20 V circuits beyond J4/P4 on power supply.	-	-	-	-	-	-	-	1	
13. Call Field Support.	4	6	2	5	2	-	2	2	

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DLT 6 FAULT IN ±46 V LOAD

Warning: None
Enters from: DLT 1
Procedures:
References: Logic Diagrams
Exits to: DLT 1 (return)

Assumption:
1. Circuit breaker CB5 trips when attempting to power up.
and/or 2. Fuses F5 and/or F6 open when attempting to power up.
and/or 3. ±46 V dc missing when measuring at test jacks.

CONDITIONS	1	2	3	4	5	6	7	8	9
1. Did fuse F5 and/or F6 open?	Y	N	-	-	-	-	-	-	
2. Trip CB1. Limit load to power amp. Disconnect J4/P4 on power supply and J1/P1 on –FNN. Turn on CB5 and then CB1. Did CB5 trip?	-	-	Y	N	-	-	-	-	
3. Turn off CB1. Connect J4/P4 on logic chassis. Turn on CB5 and then CB1. Did CB5 trip?	-	-	-	-	Y	N	-	-	
4. Turn off CB1. Connect J1/P1 on relay board –FNN. Turn on CB5 and then CB1. Did CB5 trip?	-	-	-	-	-	-	Y	N	
ACTIONS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1. Turn off CB1 and replace open fuse(s).	1	-	-	-	-	-	-	-	
2. If CB5 tripped go to condition 2. If CB5 did not trip, go to next action.	2	1	-	-	-	-	-	-	
3. Troubleshoot rectifier/filter board –CBN and replace it if necessary.	3	3	-	-	-	-	-	-	
4. If ±46 V is present at test jacks no problem exists. Go back to DLT 1.. If voltages are not present, go to next action.	-	2	-	-	-	-	-	-	
5. Check for ac to transformer T2. If ac is not present, troubleshoot control board –CFN and replace it if necessary. If ac is present at T2, go to next action.	-	6	-	-	-	-	-	-	
6. Check transformer T2 and replace it if necessary.	-	7	-	-	-	-	-	-	
7. Replace control board –CFN.	4	-	-	-	-	-	-	-	
8. Replace power amp.	-	-	X	-	-	-	-	-	
9. Power amp is OK. Go to condition 3.	-	-	-	X	-	-	-	-	
10. Troubleshoot ±46 volt distribution beyond P4/J4 on power supply.	-	-	-	-	1	-	-	-	
11. ±46 V distribution beyond J4/P4 is OK. Go to condition 4.	-	-	-	-	-	X	-	-	
12. Check -46 V distribution beyond P3/J3 on –CBN.	-	4	-	-	-	-	-	-	
13. Replace –CFN board.	-	5	-	-	-	-	-	-	
14. Replace relay board –FNN.	-	-	-	-	-	-	1	-	
15. Problem no longer exists. Go to DLT 1.	-	-	-	-	-	-	-	X	
16. Call Field Support.	5	8	-	-	2	-	2	-	

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DLT 7 FIRST SEEK (Sheet 1 of 2)

Warning: None
Enters from: DLT 1
Procedures: See Sheet 2
References: Logic Diagrams
Exits to: DLT 8 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	9
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**	**9**
1. No problem. Go to DLT 8.	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	-			

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DLT 7 FIRST SEEK (Sheet 2 of 2)

Warning: None
Enters from: Sheet 1
Procedures: Trk Servo Amplitude Chk (section 5); Hd-Arm Repl (6); Hd Alignment (4)
References: Logic Diagrams
Exits to: DLT 8

Assumption: START light on, drive up to speed

CONDITIONS	1	2	3	4	5	6	7	8	9
1. First Seek successful? (From sheet 1.)	N	N	N	N	N	N	N		
2. First Seek attempted? (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 (CB5 trips) but heads don't unload--unit can not power down?	-	-	-	-	Y	-	-		
9. Drive seeks to fwd mech stop, waits for FAULT light (CB5 trips) then retracts?	-	-	-	-	-	Y	-		
10. Drive loads heads, hesitates, then creeps to fwd EOT?	-	-	-	-	-	-	Y		
ACTIONS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1. Not sensing dibits. Check servo preamp input to card A18 (Trk Servo Ampl Chk) and go to Condition 6.	X	-	-	-	-	-	-		
2. Chk for continuity/gnds in servo preamp cable (input to A18).	-	1	-	-	-	-	-		
3. Replace servo preamp.	-	2	-	-	-	-	-		
4. Replace and align servo head (see Procedures, above).	-	3	-	-	-	-	-		
5. Suspect card A18.	-	-	1	-	-	-	-		
6. Suspect propagation of Track Servo signal through cards A19, A20.	-	-	-	1	-	-	-		
7. Replace power amp.	-	-	-	-	3	2	-		
8. Suspect velocity transducer and attendant logic on cards A20, A19.	-	-	-	-	2	-	-		
9. Check Fine Enable logic on cards A06, A19.	-	-	-	-	1	-	1		
10. Suspect cards A17, A20.	-	-	-	-	-	-	2		
11. Call Field Support.	-	4	2	2	4	3	3		

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DLT 8 RTZ, CONTINUOUS SEEKS

Warning: None
Enters from: DLT 9
Procedures: None
References: Logic Diagrams
Exits to: DLT 9

Assumption:
1. FTU 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	9
1. Command an RTZ seek with FTU. Was RTZ successful?	Y	N	-	-	-				
2. Set up FTU to command continuous seeks between track 0 and the following tracks (1, 2, 4, ..., 256, 512). Are continuous seeks successful?	Y	-	N	-	-				
3. Command a seek to track 822 with FTU. Was seek to track 822 successful?	Y	-	-	N	-				
4. Command a seek to track 823 with FTU. Does Seek Error result when attempting to go to track 823?	Y	-	-	-	N				
ACTIONS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1. Seeks properly executed. Go to DLT 9.	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 Rcvrs), A04 (Ch. 2 Rcvrs).	-	5	4	4	4				
7. Replace card A12 (Difference Generation and Control).	-	-	2	2	2				
8. Call Field Support.	-	6	5	5	5				

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DLT 9 WRITE/WRITE FORMAT (Sheet 1 of 2

Warning: None
Enters from: DLT 8
Procedures: None
References: Logic Diagram/FTU Operating Instructions
Exits to: DLT 10 or sheet 2 of this DLT

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

CONDITIONS	1	2	3	4	5	6	7	8	9
1. FAULT indication given when drive is connected to controller									
but not when connected to FTU?	N	Y	-	-	-	-			
2. FAULT light on FTU panel come on?	N	N	Y	Y	Y	Y			
3. FAULT light on SMD panel come on?	N	N	N	Y	Y	Y			
4. Is fault limited to a certain group of contiguous addresses?	-	-	-	-	Y	N			
ACTIONS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1. No problem. Go to DLT 10.	X	-	-	-	-	-			
2. Check that WRITE PROTECT switches are OFF.	-	X	-	-	-	-	-	-	
3. Check that +5 V is present at operator panel (-ZYN).	-	-	X	-	-	-			
If present, replace -ZYN.									
4. Go to condition 4.	-	-	-	X	-	-			
5. Replace card A12.	-	-	-	-	1	-			
6. Replace write driver board (E02).	-	-	-	-	2	-			
7. Go to condition 5 (sheet 2).	-	-	-	-	-	X			
8. Call Field Support.	-	-	-	-	3	-			

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DLT 9 WRITE/WRITE FORMAT (Sheet 2 of 2)

Warning: None
Enters from: Sheet 1
Procedures: None
References: Logic Diagrams, FTU Operating Instructions
Exits to: DLT 10

Assumption: FTU connected to drive and FTU switches set per "Preliminary Set-Up" in Operation section of FTU 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	9
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) NOT ON CYL * (W + R) FLT on?	-	-	-	-	-	-	-	Y	
ACTIONS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1. Go to Condition 6.	X	-	-	-	-	-	-	-	
2. Go to Condition 7.	-	X	-	-	-	-	-	-	
3. Suspect cards A02, A01, A17 (Addr Mk Enable).	-	-	1	-	-	-	-	-	
4. Restore sw to ADDR MK position; repeat test and go to Condition 7.	-	-	-	X	-	-	-	-	
5. Chk that FTU Servo Offset sw is "off" (center position).	-	-	-	-	1	1	1	1	
6. Replace card A10 (Write PLO).	-	-	-	-	2	-	-	-	
7. Replace card A13 (NRZ to MFM).	-	-	-	-	3	-	-	-	
8. Replace cards A02, (Ch. 1 Rcvrs) A04 (Ch. 2 Rcvrs).	-	-	-	-	4	2	2	-	
9. Replace card A19 (Write Protect).	-	-	-	-	5	-	3	2	
10. Replace card A20 (On Cyl).	-	-	-	-	-	-	-	3	
11. Replace Write Driver board (loc E02).	-	-	2	-	6	-	4	4	
12. Replace Read Amp board (loc E03).	-	-	-	-	-	3	-	-	
13. Call Field Support.	-	-	3	-	7	4	5	5	

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DLT 10 READ

Warning: None
Enters from: DLT 9
Procedures: Head Alignment (section 4); Head Replacement (6)
References: Logic Diagrams; FTU Operating Instructions
Exits to: DLT 11

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

CONDITIONS	1	2	3	4	5	6	7	8	9
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**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1. No problem. Go to DLT 11.	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 to NRZ).	-	2	-	2	-				
4. Replace card A14 (Data Latch).	-	3	-	3	-				
5. Replace card A19 (Offset).	-	4	-	4	-				
6. Replace cards A02 (Ch. 1 Rcvrs), A04 (Ch. 2 Rcvrs).	-	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 FTU manual's Trouble Analysis DLT have already been executed in an attempt to recover the address/data, but to no avail.

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DLT 11 POWER DOWN

Warning: None
Enters from: 10
Procedures: None
References: Logic Diagrams
Exits to: None

Assumption: Remote operation - Attempt to power down drive from remote location.
Local operation - Press START to turn off START indicator and power down the drive.

CONDITIONS	1	2	3	4	5	6	7	8	9
1. START light on control panel goes off (Local mode)?	Y	Y	Y	N					
2. Heads Unload?	Y	Y	N	-					
3. Drive motor brakes to a stop?	Y	N	-	-					
4. Drive motor coasts to a stop?	N	Y	-	-					
ACTIONS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1. Diagnostics have been satisfactorily completed.	X	-	-	-					
2. Check for +20Y at brake connector J8/P8. If +20Y is not present, replace control board -CFN. If +20Y present, go to next action.	-	1	-	-					
3. Check brake assembly and replace if necessary.	-	2	-	-					
4. Replace A07 board. (RTZ latch).	-	-	1	-					
5. Replace A20 board. (Power amp control).	-	-	2	-					
6. Cathode of START LED grounded.	-	-	-	1					

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SECTION 6

REPAIR AND REPLACEMENT

REPAIR AND REPLACEMENT 6

INTRODUCTION

This section contains information concerning the mechanical replacement and adjustment of the drives 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 a 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 can be accessed only from front and rear.

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

Figure 6-1 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 are included in the Parts Data section of this manual.

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

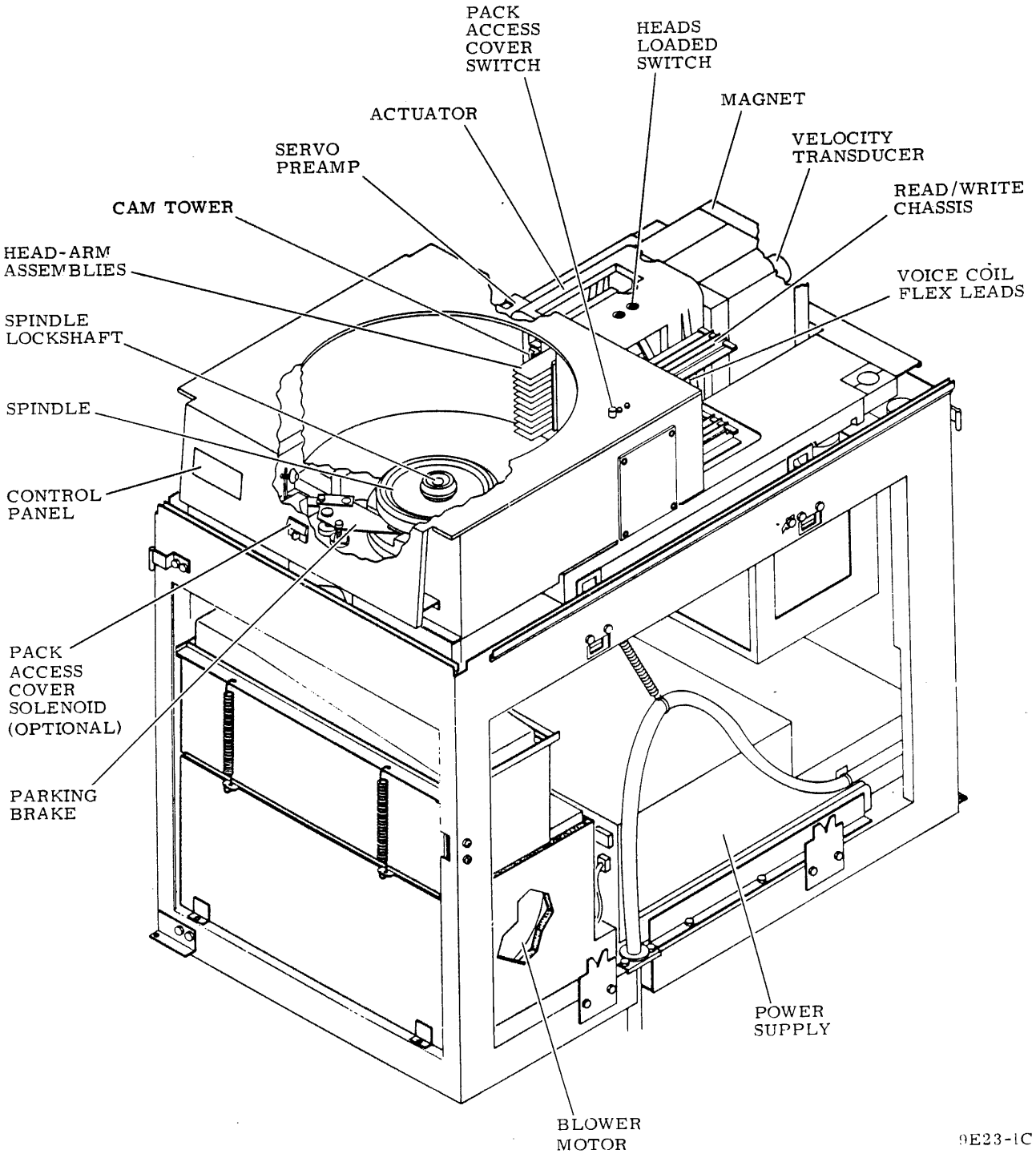
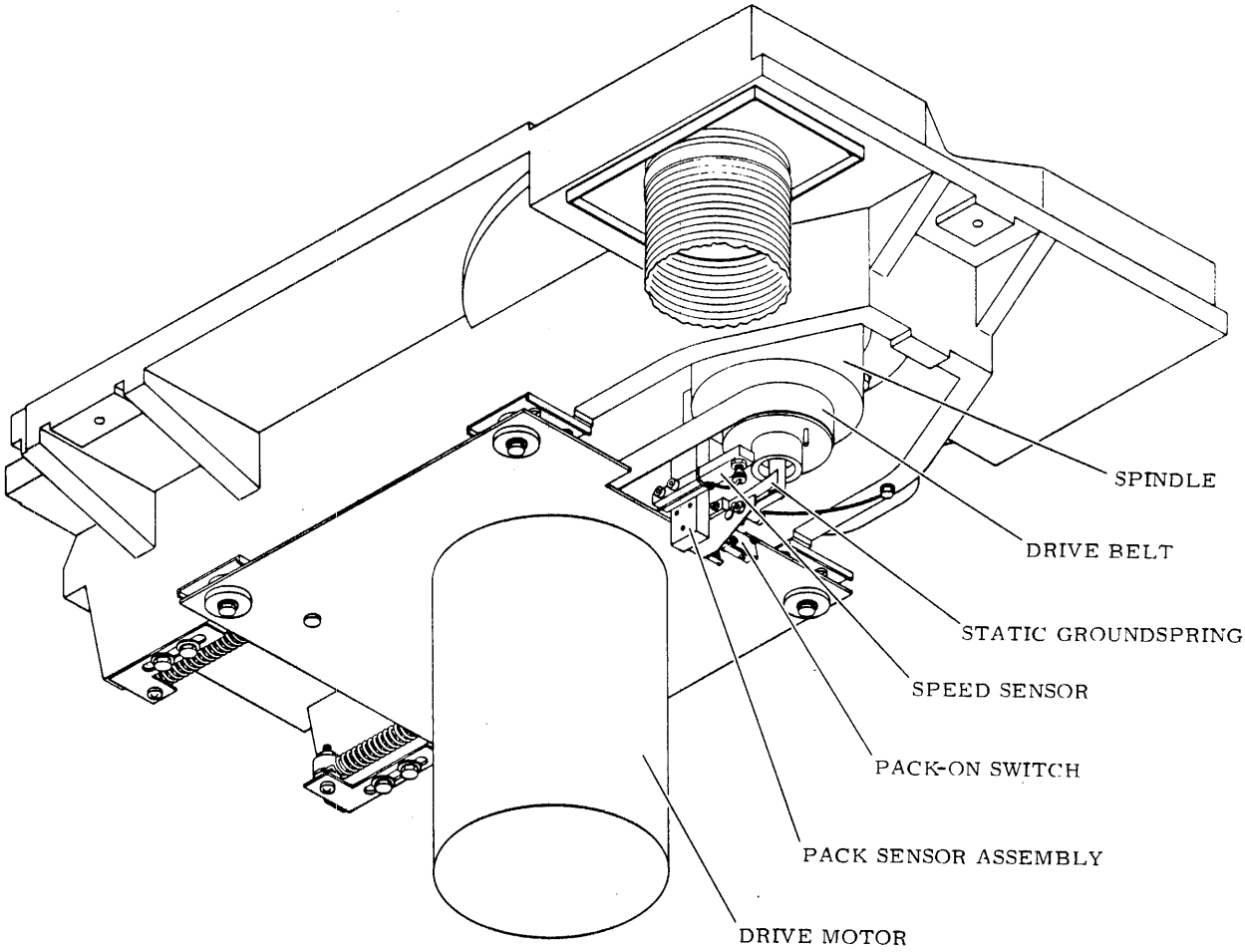


Figure 6-1. Assembly Locator (Non-VDE) (Sheet 1 of 2)



NOTE:

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

9E23-2B

Figure 6-1. Assembly Locator (Non-VDE) (Sheet 2)

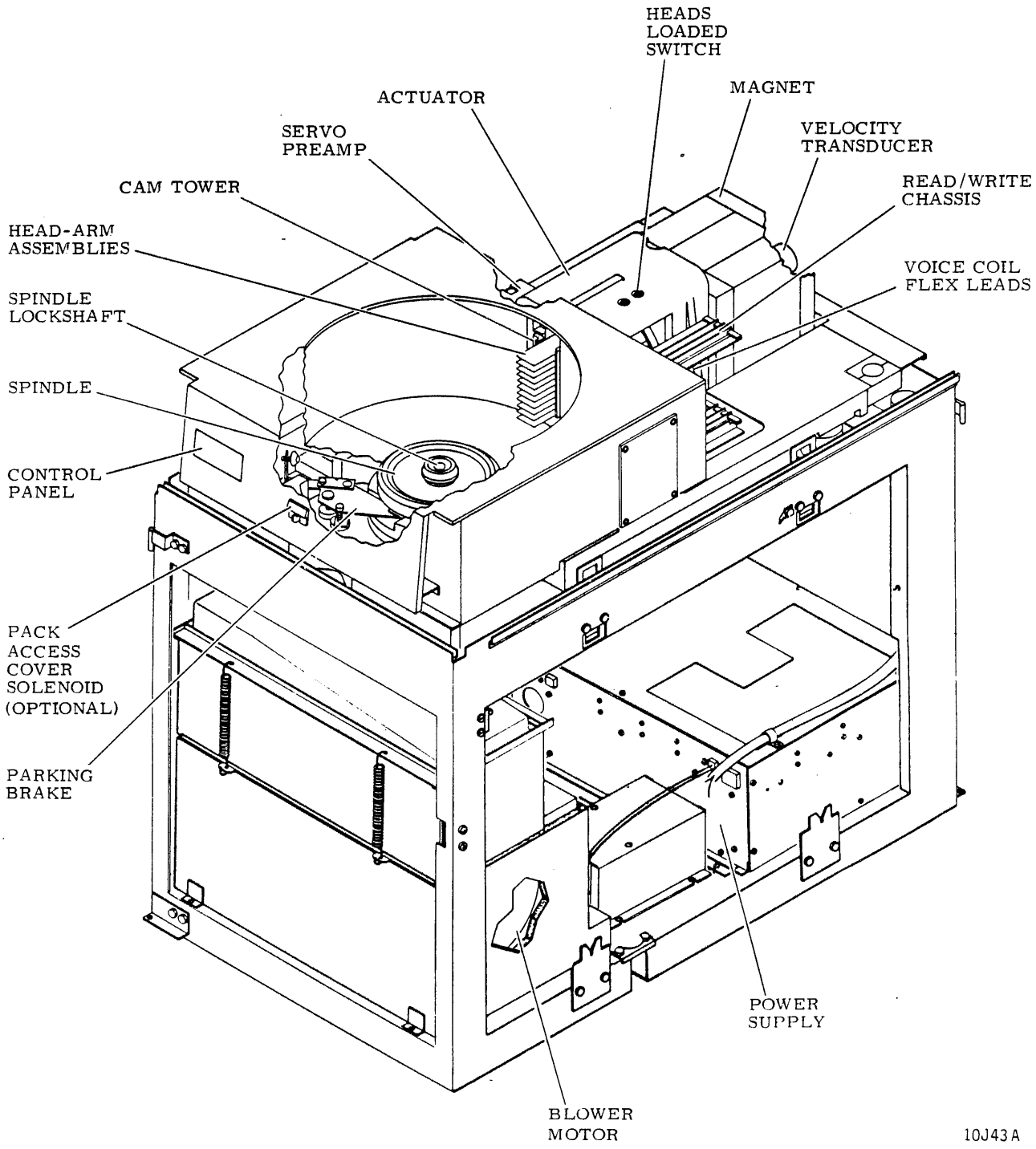


Figure 6-1. Assembly Locator (VDE) (Sheet 1 of 2)

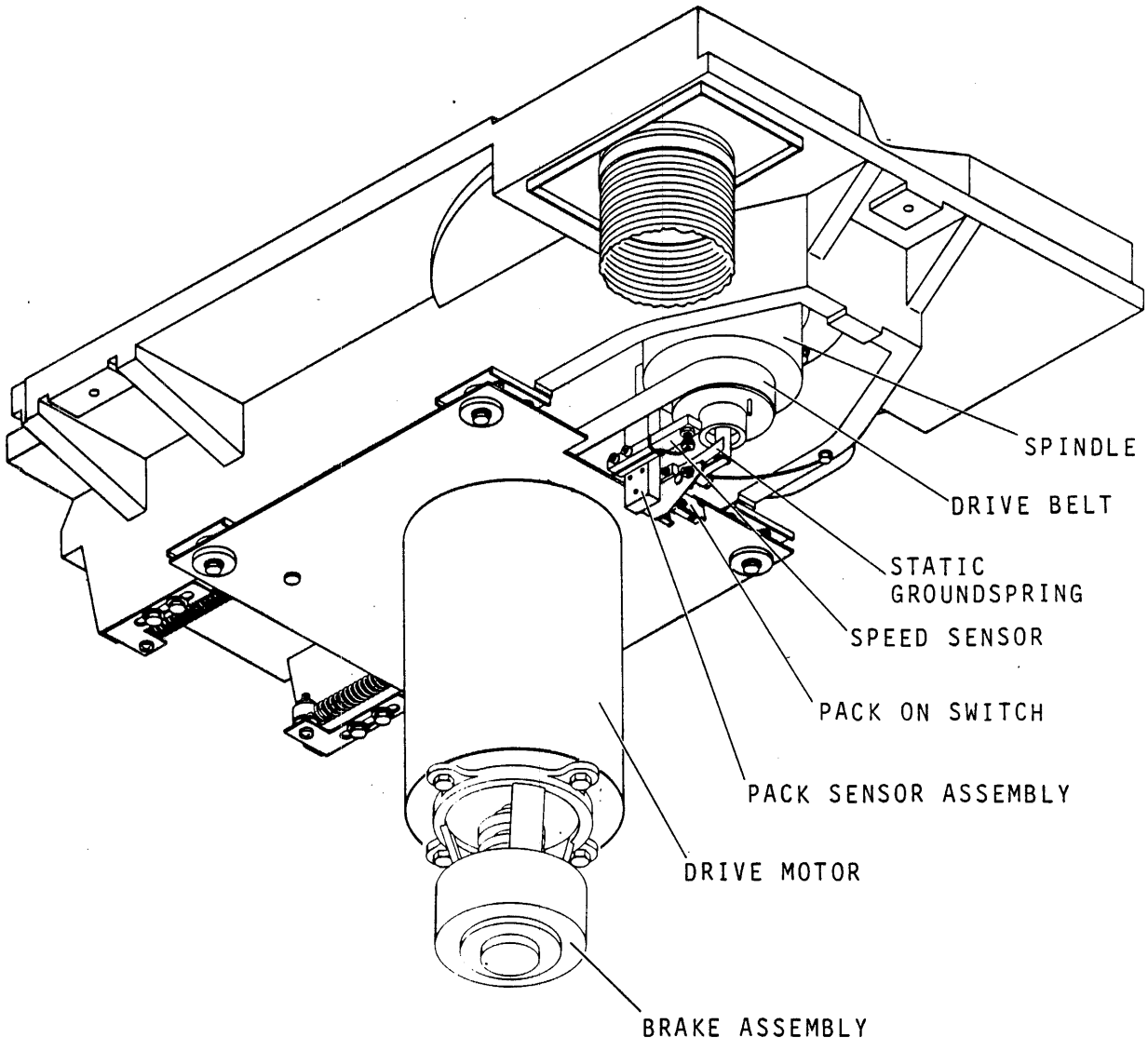


Figure 6-1. Assembly Locator (VDE) (Sheet 2)

ACTUATOR ASSEMBLY REPLACEMENT

The actuator is located on the deck assembly (refer to figure 6-1).

The following describes the entire procedure for replacing the actuator assembly. Figure 6-2 is an exploded view of the deck assemblies involved in actuator replacement.

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

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

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.

3. Remove cabinet top cover.

4. Remove deck cover.

5. Remove pack access cover.

6. Remove shroud and shroud cover.

CAUTION

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

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

8. Disconnect velocity transducer cable plug P4.

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

10. Remove hardware 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 hardware securing cover to preamp housing and remove cover.

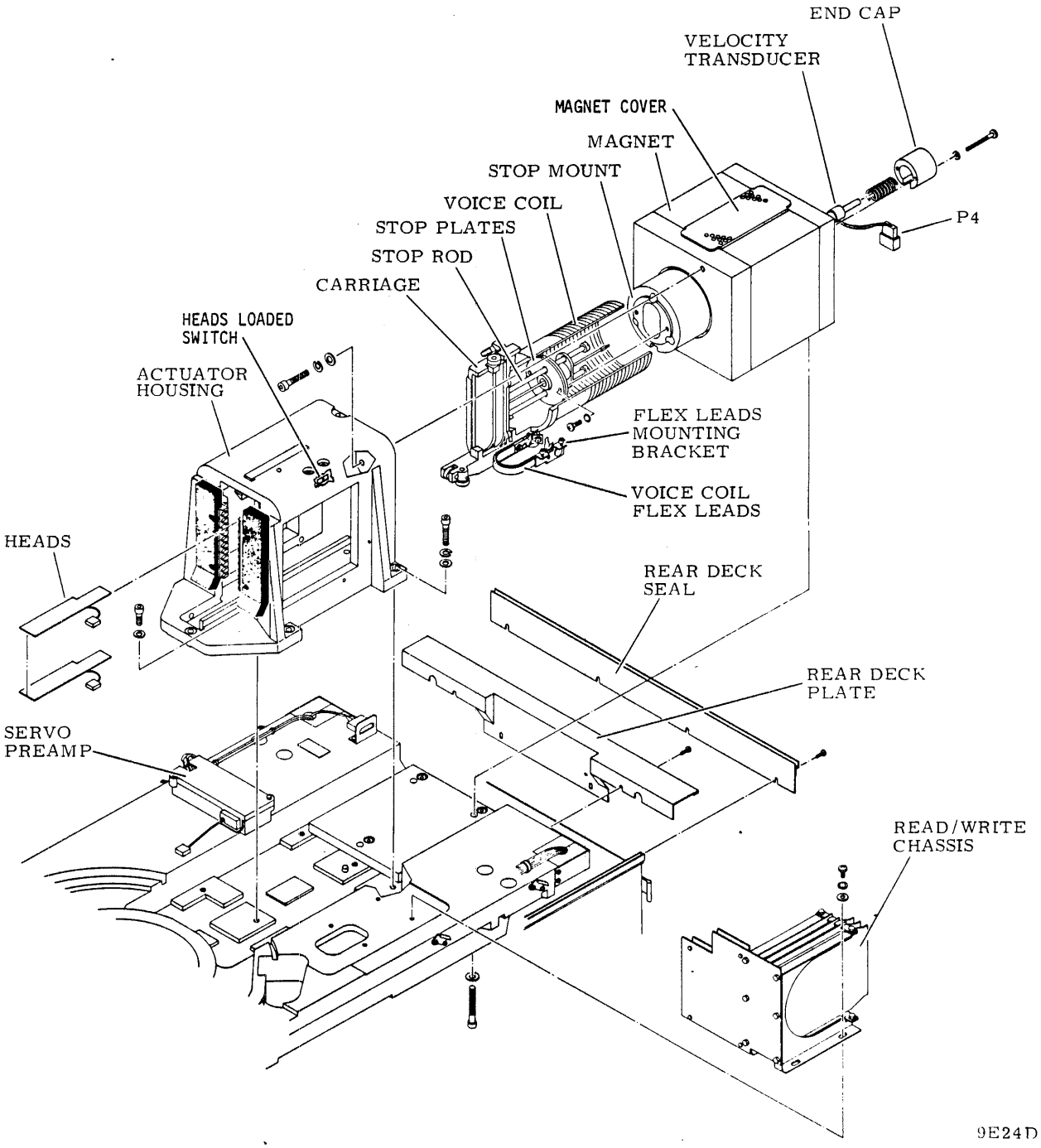


Figure 6-2. Actuator Replacement

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

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

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

13. Remove read/write logic chassis as follows:

    a. Remove connectors from cards.

    b. Remove hardware 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 6-2):

    a. Loosen hardware securing deck rear seal to frame and remove rear deck seal.

    b. Loosen hardware securing rear deck plate to deck and remove rear deck plate.

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

CAUTION

The screws 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 hardware securing stop rod plate to stop mount on magnet.

g. Remove hardware (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 6-2):

a. Remove hardware 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 hardware 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 hardware 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. Mount actuator housing on deck.

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 0.0001 and 0.0002 mm (0.002 and 0.004 inches) (refer to figure 6-3).

    c. If requirements of step b 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. Secure actuator housing to deck using a torque of 6.8 ($\pm$0.4) N·m (60 $\pm$5 lbf·in).

    g. Slide carriage into actuator housing.

    h. Check to ensure alignment was not distributed 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.

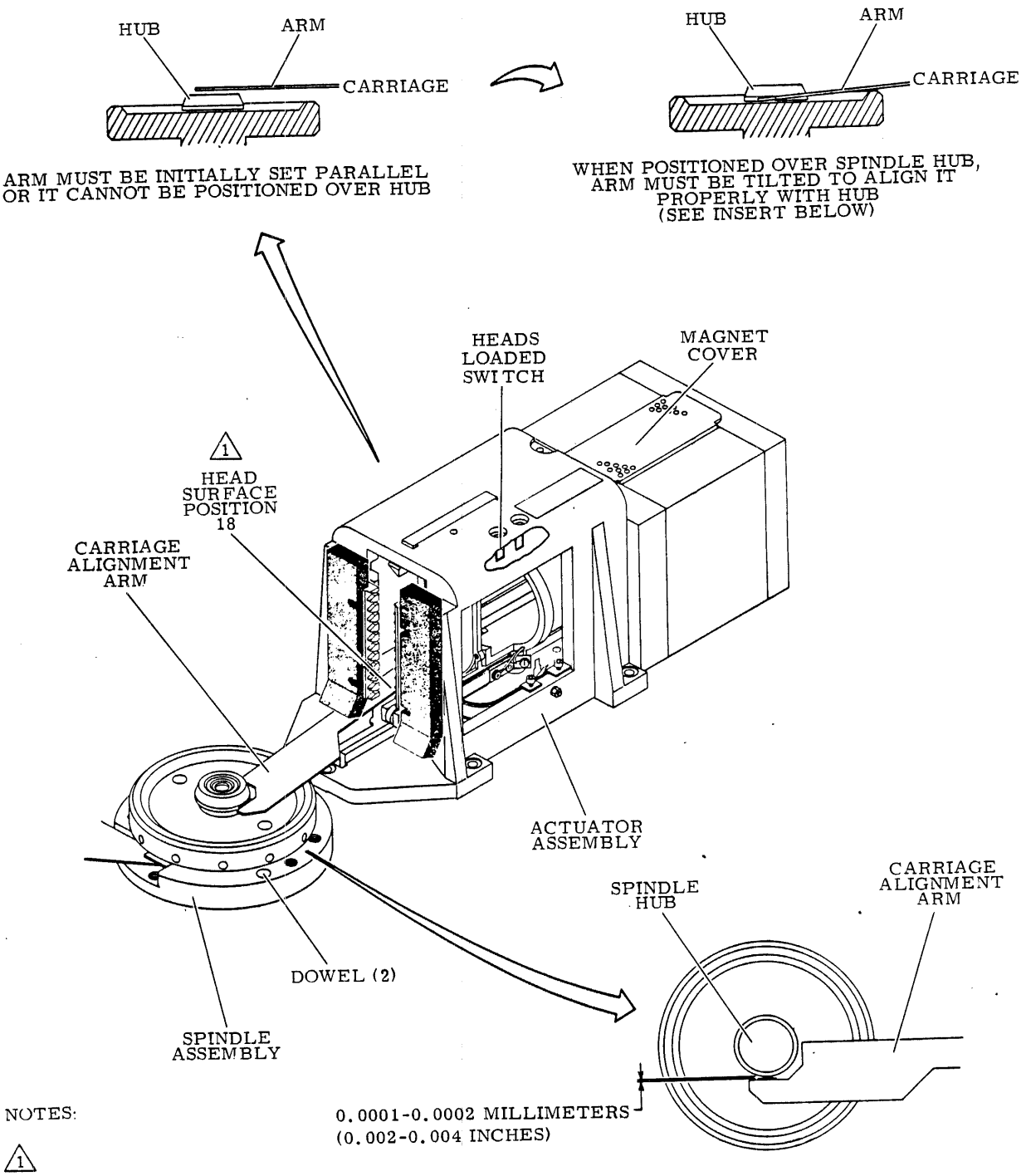


Figure 6-3. Spindle-To-Carriage Alignment

i. Remove carriage alignment arm.

j. Back carriage out of actuator housing.

k. Loosen hardware 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.

CAUTION

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

25. Align magnet and voice coil as follows:

    a. Loosely install hardware through top of actuator into magnet assembly.

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

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

d. Secure screw through top 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. Secure magnet to deck using a torque of 3.4 ±0.1 N·m (30 ±1 lbf·in).

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

26. Secure stop rod plates to magnet assembly. 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 6-4) as follows:

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

b. Secure end cap and spring to magnet.

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. Secure heads loaded switch to actuator housing.

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

31. Secure read/write chassis to deck.

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

NOTE

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

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

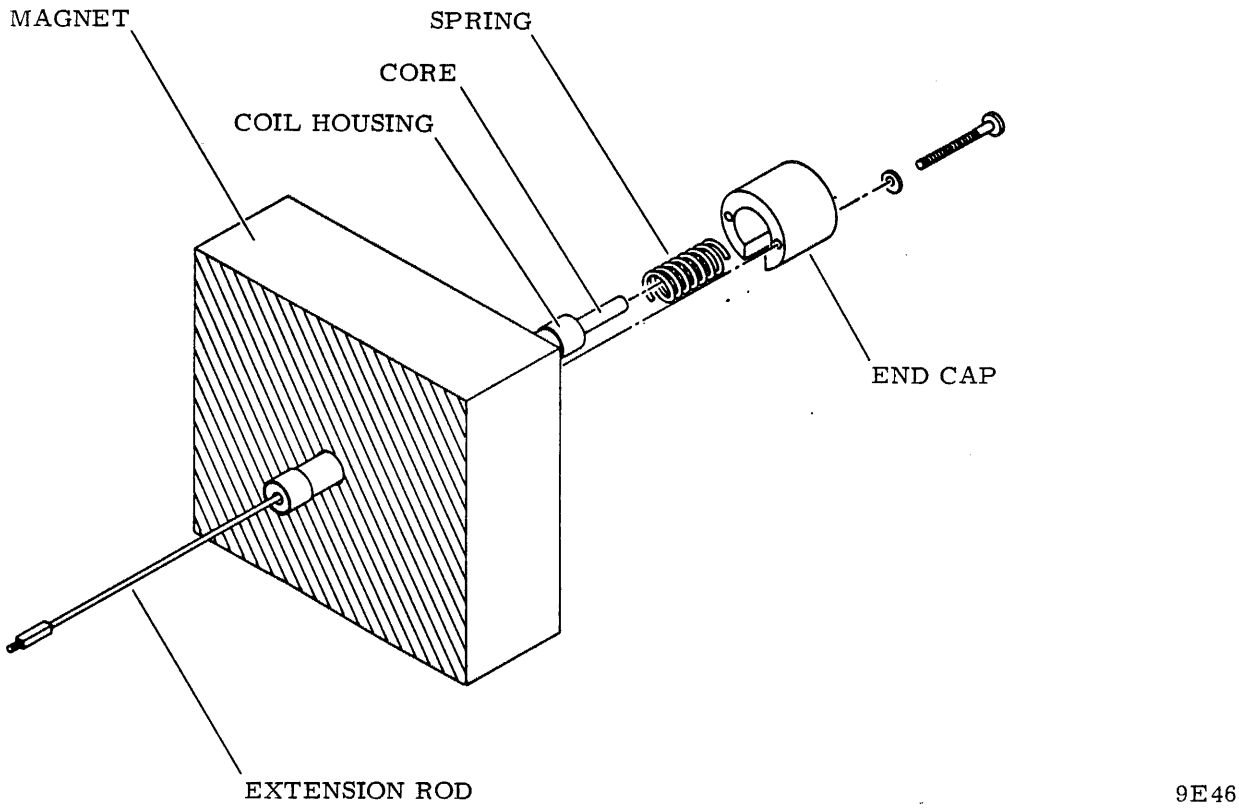


Figure 6-4. Velocity Transducer Replacement

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 (0.45 N·m) screw and torque to 4 inch-pounds.

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

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

34. Replace voice coil leadwire.

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

36. Replace servo preamp assembly as follows:

    a. Secure servo preamp housing to deck.

    b. Connect servo head plug to servo preamp board.

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

37. Secure rear deck plate on deck (refer to figure 6-2).

38. Secure rear deck seal to frame (refer to figure 6-2).

39. Replace shroud and shroud cover.

40. Replace pack access cover.

NOTE

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

41. Replace cabinet top cover.

CAUTION

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

42. Perform following procedures:

    a. Head Alignment

    b. Servo System Adjustment

BLOWER MOTOR REPLACEMENT

The blower motor is located within the blower assembly as shown in figure 6-5. Replacing the motor requires removing the entire blower assembly from the drive. The following describes removal and replacement of the blower motor.

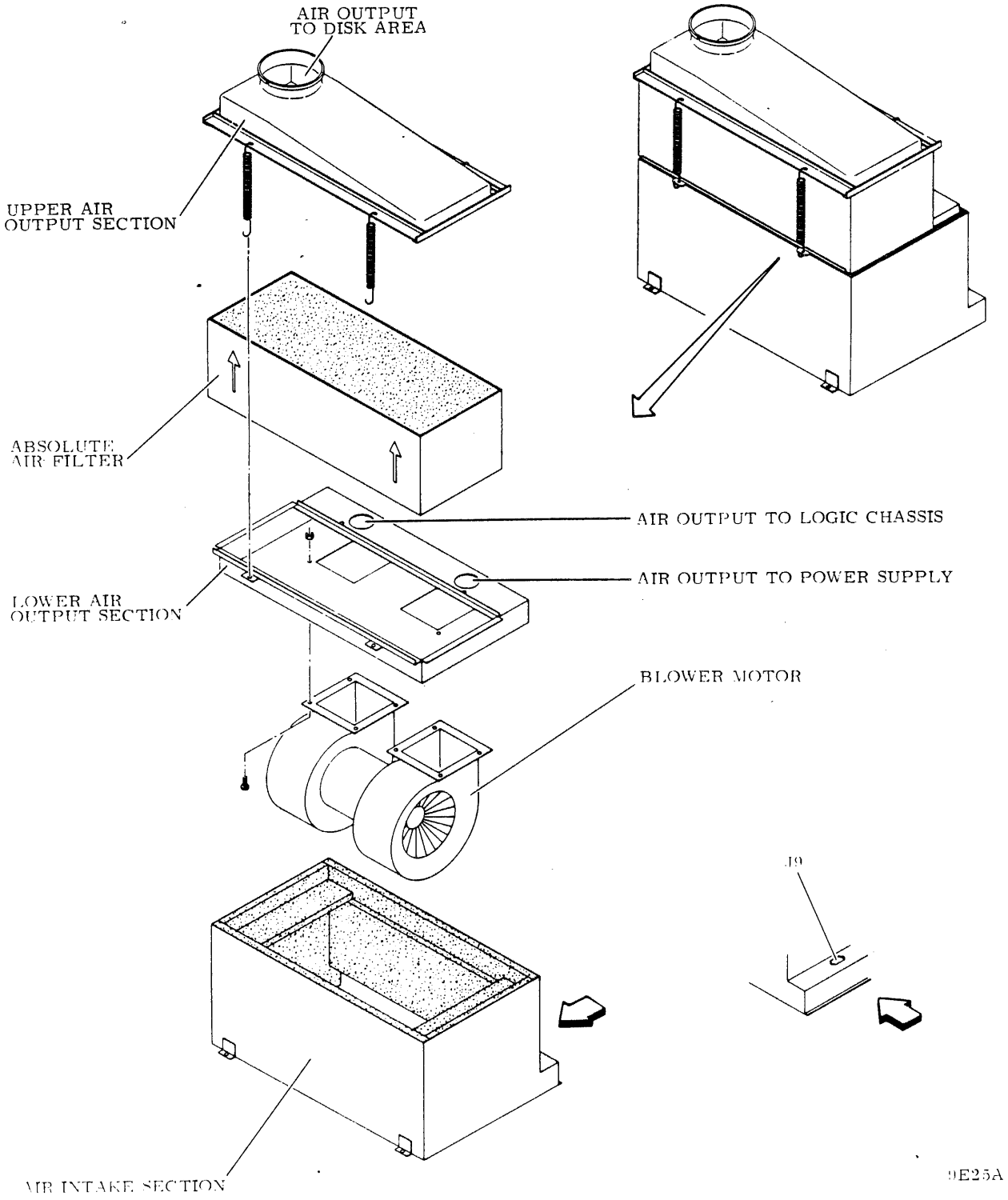


Figure 6-5. Blower Motor Replacement

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

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

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 hardware securing bottom front of blower enclosure to deck.

CAUTION

Do not stress 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.

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 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 springs (or 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 hardware securing blower motor to lower air input section and remove motor.

NOTE

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

10. Secure replacement blower motor to lower air input section.

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 springs (or posts in older units).

CAUTION

Following replacement of blower assembly, perform Shroud Cleaning procedure, 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. (Refer to figure 6-5 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.

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

16. Close cabinet front door.

BRAKE REPLACEMENT (VDE ONLY)

The brake assembly, on units so equipped, is mounted on a bracket attached to the bottom of the drive motor. The brake applies its braking force to the motor through a flexible coupling connecting the motor and brake shafts.

When replacing a drive motor the brake assembly must be transferred to the replacement motor. Use the following procedure to transfer the assembly, or to replace the brake.

1. Remove the drive motor using the Drive Motor Replacement procedure. It is not necessary to remove the motor from the mounting plate if the motor is not being replaced.

2. Remove the hardware securing the brake mounting bracket to the bottom of the motor. See figure 6-6.

3. Separate the brake and bracket assembly from the motor.

NOTE

If the brake is being transferred to a replacement motor, go to step 4. If the brake is being replaced, go to step 9.

4. Loosen the setscrews in the flexible coupling on the motor shaft and slip the coupling off the motor shaft.

5. Install the coupling on the replacement motor, lightly tighten the setscrews.

6. Assemble the brake and bracket to the motor using the hardware removed in step 2. Ensure the flexible coupling components engage properly.

7. Slide the flexible coupling on the motor shaft downward. Ensure all coupling components engage properly and tighten all setscrews.

8. Skip steps 9-15 and install the drive motor using the Drive Motor Replacement procedure, beginning with step 8.

9. Loosen the setscrew that secures the flexible coupling to the brake shaft.

10. Slip the coupling off the brake shaft.

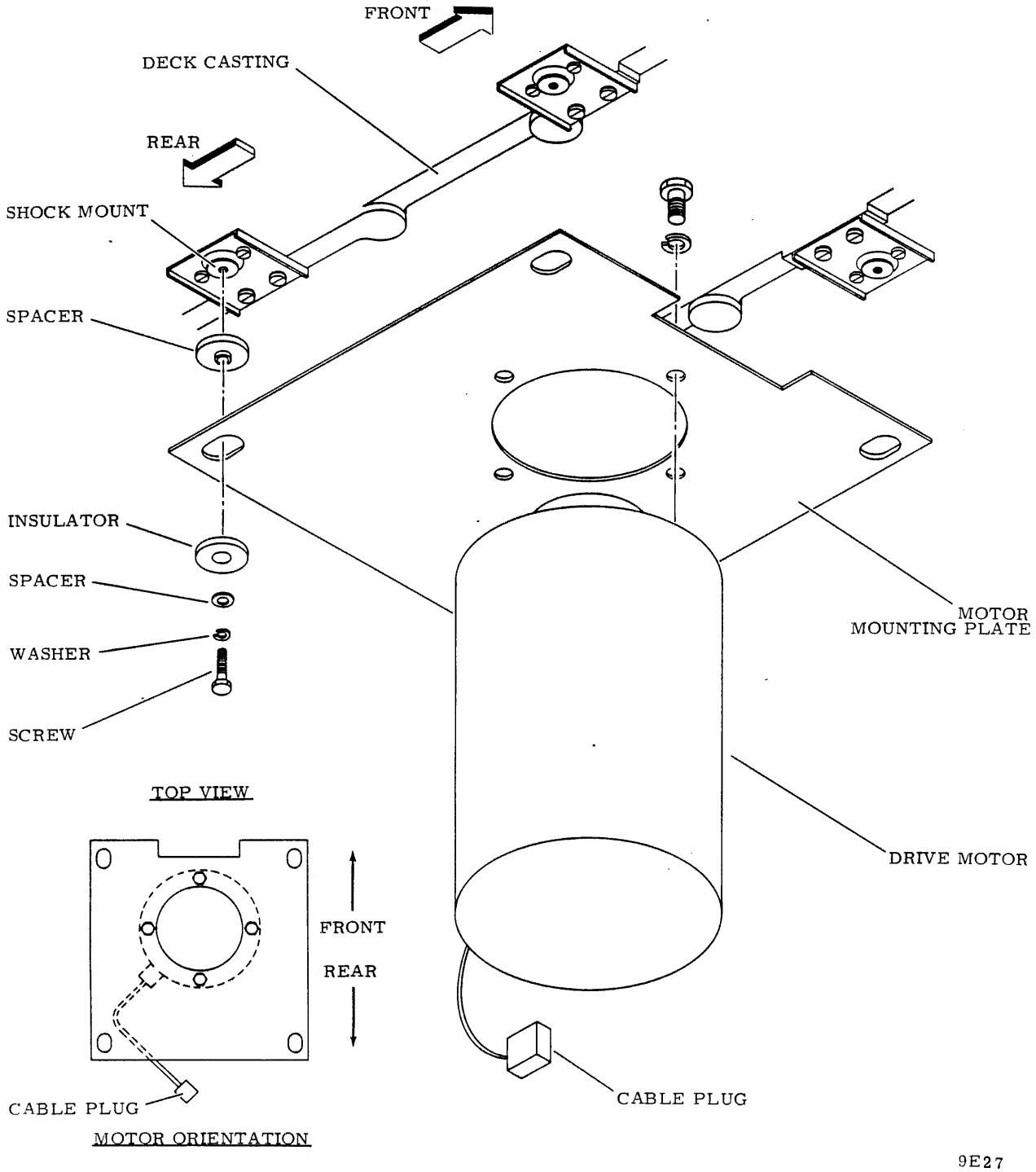


Figure 6-6. Drive Motor Replacement (Non-VDE)

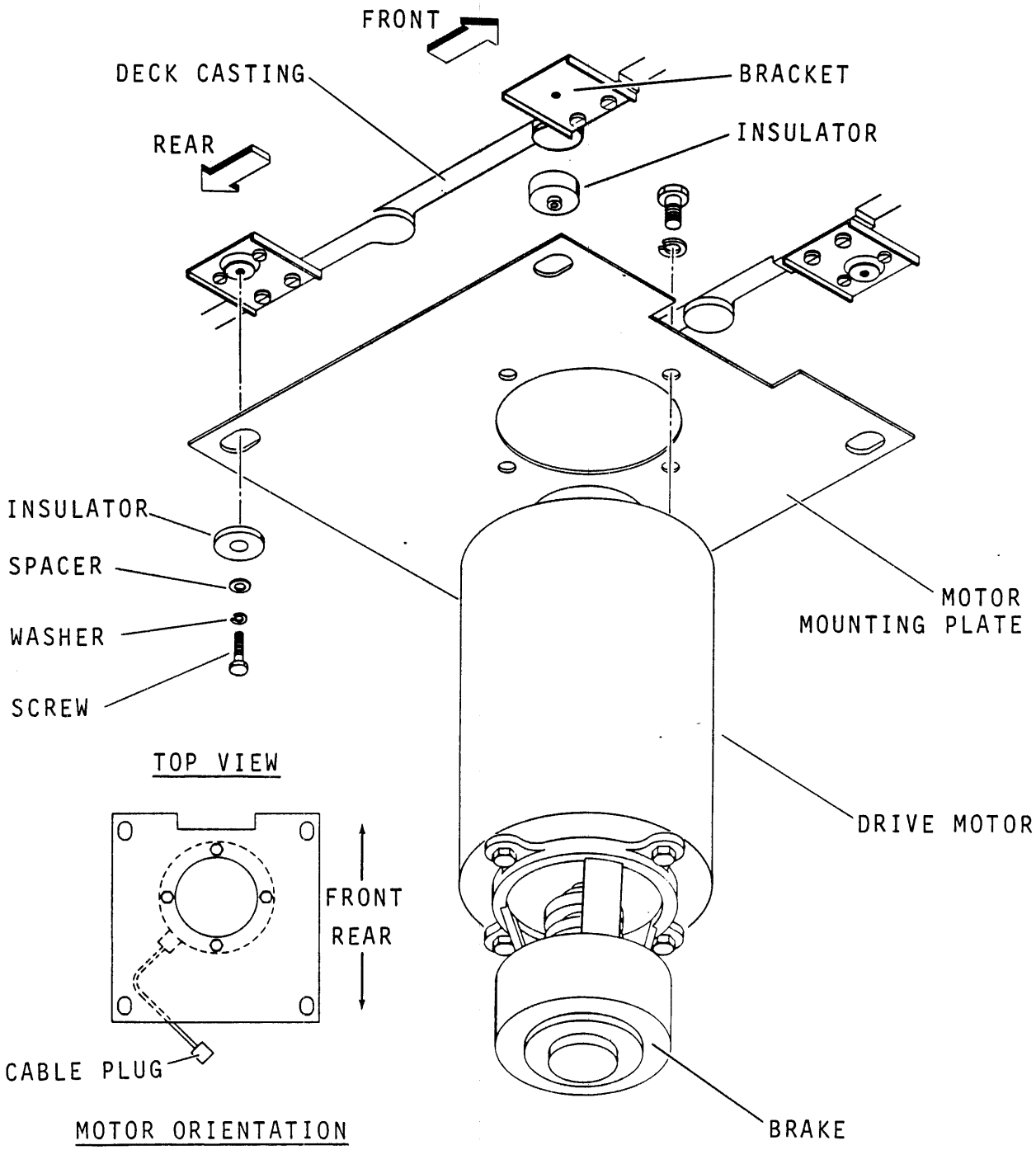


Figure 6-6. Drive Motor Replacement (VDE)

11. Remove the screws that secure the brake to the mounting bracket.

12. Assemble the replacement brake to the mounting bracket using the hardware removed in step 11.

13. Slip the flexible coupling onto the brake shaft. Leave the setscrews in the coupling loose.

14. Position the brake and bracket assembly on the motor and secure it with the hardware removed in step 2.

15. Raise the flexible coupling on the brake shaft so it engages the coupling components. Tighten all setscrews securely.

16. Install the drive motor using the Drive Motor Replacement procedure beginning with step 8.

DRIVE BELT REPLACEMENT

The drive belt (refer to figures 6-6.1 and 6-6.2) 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 should be checked and adjusted if necessary. This adjustment is covered in the Drive Belt Adjustment procedure. The following describes removal and replacement of the drive belt.

CAUTION

A drive belt should only be removed by first removing the idler 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.

NOTE

In any other procedures where the drive motor idler springs are removed, refer to steps 7 and 8 of this procedure for proper use of the spring puller.

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

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

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

4. Remove static groundspring leadwire from static ground spring.

5. Disconnect speed sensor cable plug A3P3.

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

CAUTION

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

7. Remove drive belt as follows (refer to figures 6-6.1 and 6-6.2).

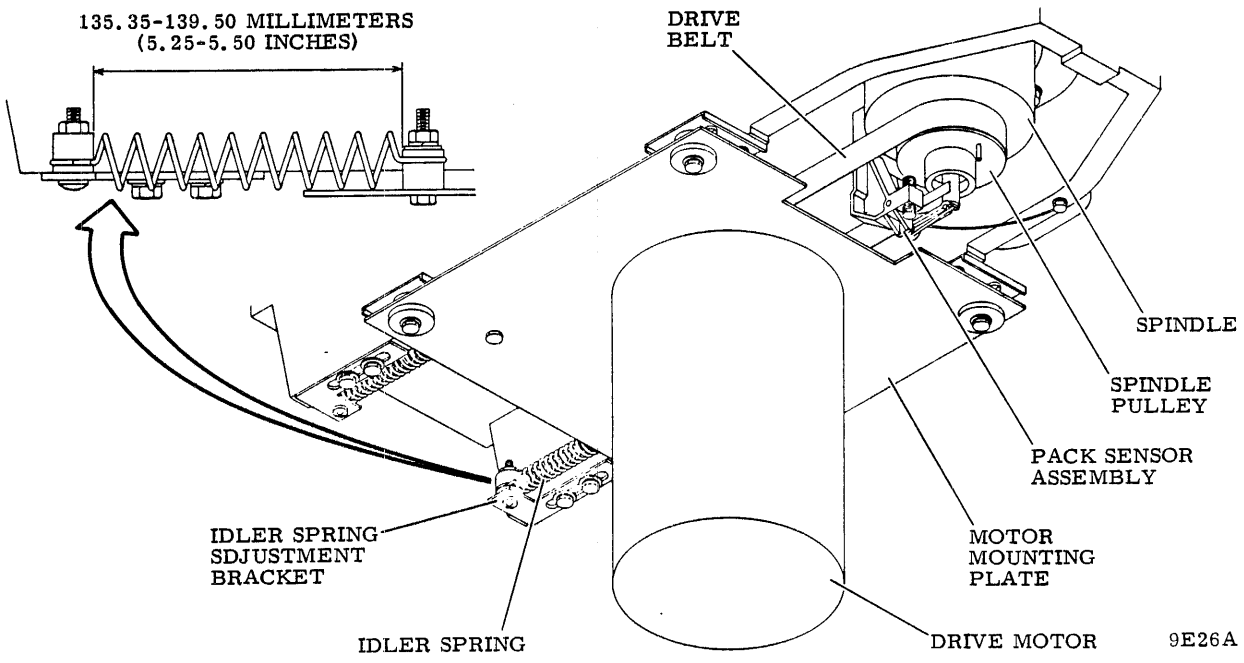


Figure 6-6.1. Drive Belt Replacement/Adjustment (Non-VDE)

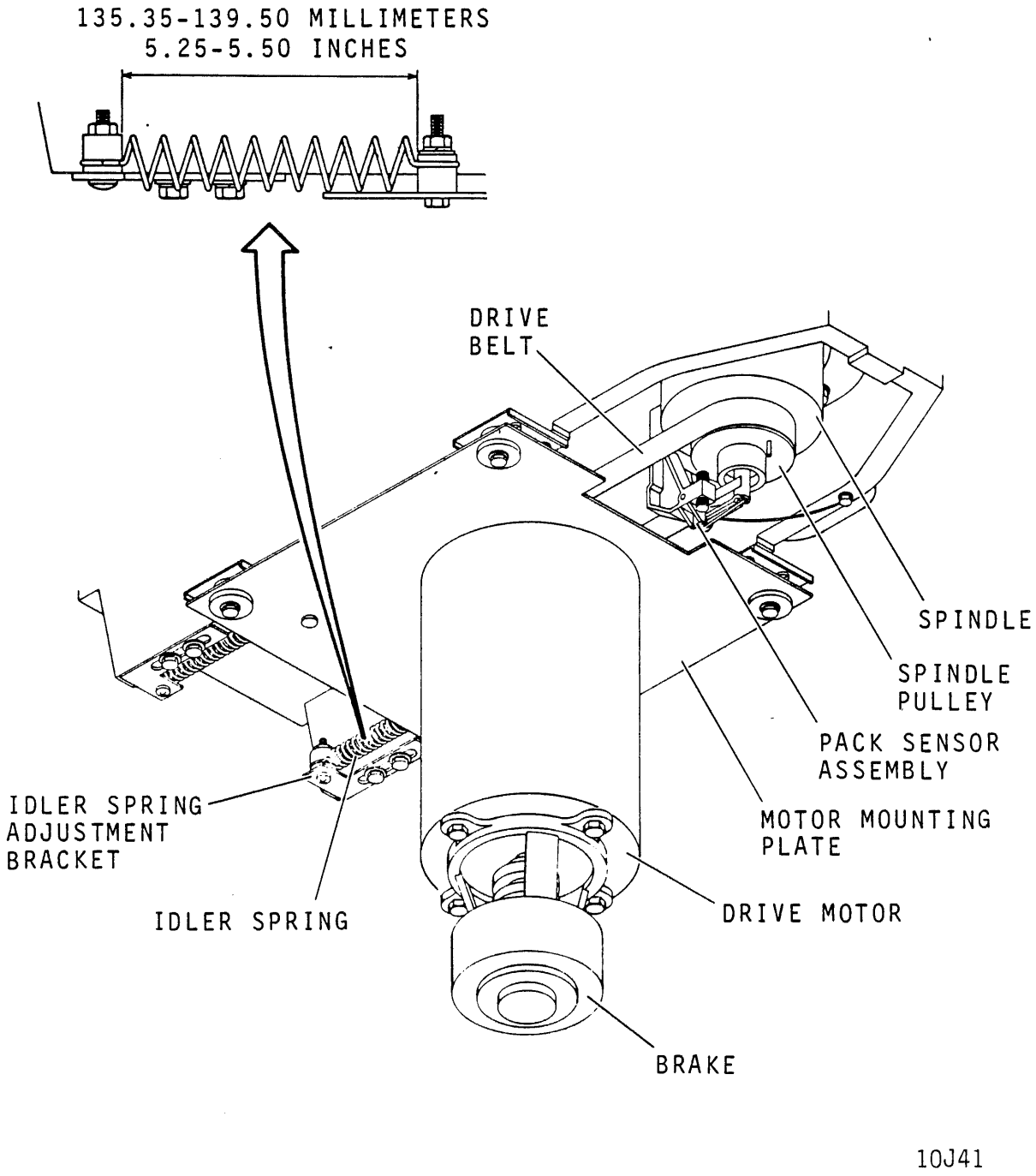


Figure 6-6.2. Drive Belt Replacement/Adjustment (VDE)

WARNING

To prevent possible eye injury, safety glasses must be worn when removing or replacing idler springs.

a. Attach spring puller (refer to list of maintenance tools in section 2) to spring. Check to ensure that spring is inserted into spring puller groove and end of spring is seated in the round hole at the outer end of the tool (see figure 6-7).

b. Exert a force on the spring sufficient to remove it from the spring bracket standoff.

c. Slowly release the tension on the spring and remove it from the motor mounting plate standoff.

d. Twist the spring puller to remove it from the spring.

e. Remove the other spring using the same procedure.

f. Move motor mounting plate toward spindle to relieve tension on drive belt then slip belt off pulleys and set aside.

8. Install replacement belt as follows:

a. Move drive motor and mounting plate back and forth several times to ensure the mounting plate is free to move.

WARNING

To prevent possible eye injury, safety glasses must be worn when removing or replacing idler springs.

b. Fit one end of spring over the motor mounting plate standoff.

c. Attach spring puller (refer to list of maintenance tools in section 2) to spring. Check to ensure that spring is inserted into the spring puller groove and the end of the spring is seated in the round hole at the outer end of the tool (see figure 6-7).

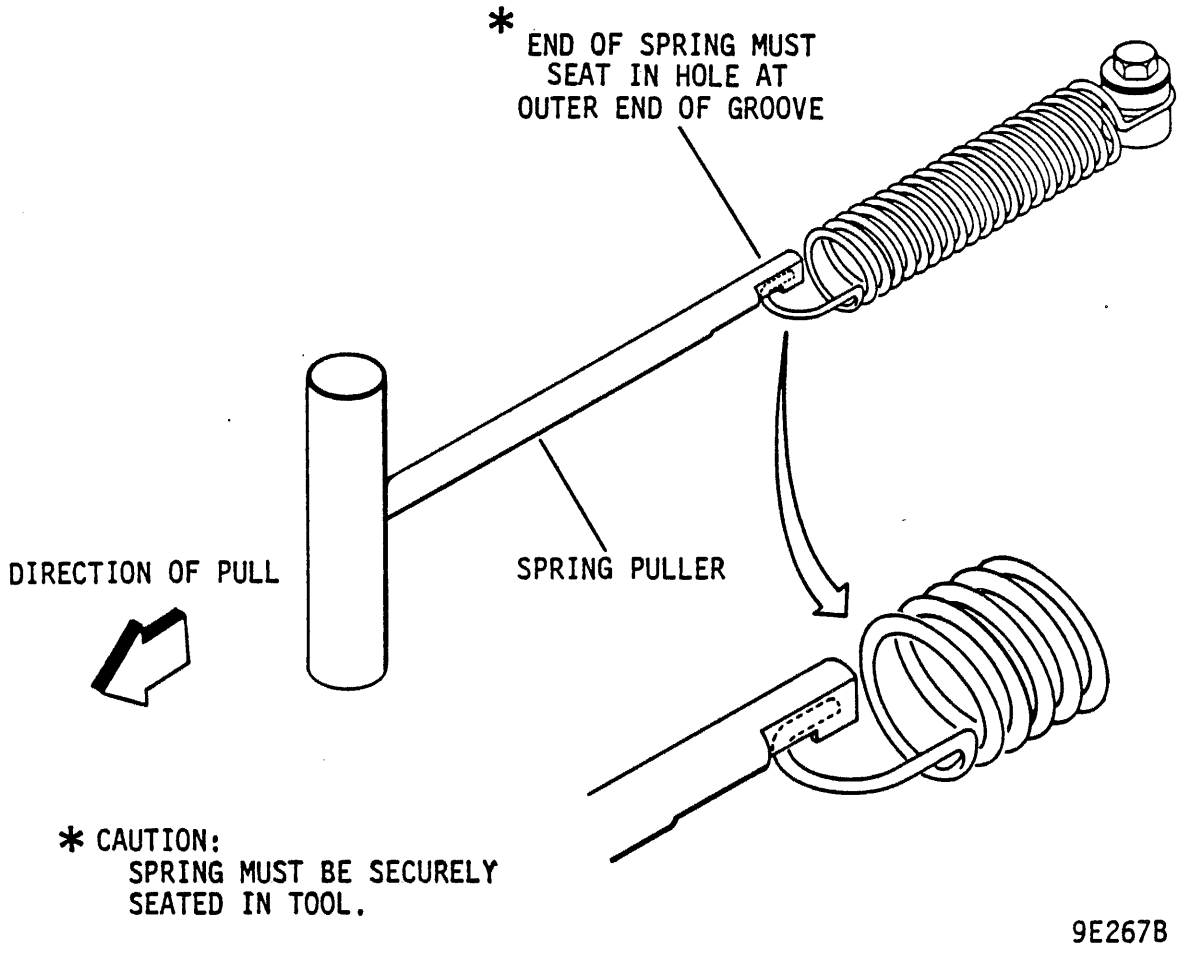


Figure 6-7. Spring Puller Usage

d. Install the belt (smooth side against pulleys) on both pulleys and exert a sufficient force on the motor mounting plate to maintain the belt in this position.

e. Exert a force on the spring sufficient to allow the end of the spring to be placed over the spring bracket standoff. Check to ensure that the curved ends of the spring are seated in the groove of each standoff.

f. Remove the spring puller from the spring by twisting and pushing at the same time.

g. Install the other spring using the same procedure.

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

9. Connect speed sensor plug A3P3 and static groundspring leadwire.

10. Connect pack on switch leadwires to switch terminals.

11. Close cabinet front door.

12. 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 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 figures 6-6.1 and 6-6.2). 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. Press START switch to stop drive motor and unload heads.

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

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 figures 6-6.1 and 6-6.2).

This distance should be from 135.35 to 139.50 mm (5.25 to 5.50 inches). If distance is not within these limits adjustment is required, so go to step 6. If distance is within these limits, no adjustment is required, go to step 7.

6. Adjust idler spring tension (and therefore drive belt tension) as follows:

   a. Remove idler spring from idler spring post connected to adjustment bracket.

   b. Loosen 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.

If the drive motor includes an externally mounted brake assembly it must be removed from the old motor and installed on the replacement motor.

CAUTION

When replacing the drive motor on 50 Hz Non-VDE drives, it may also be necessary to replace the start triac, run triac, and _YFN card. If these parts are defective and not replaced it can cause premature failure of the new motor.

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 inline with other drives, it must be taken out of line to remove side panels.

2. Remove cabinet side panels.

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

CAUTION

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

4. Remove drive belt by performing Drive Belt Replacement procedure, steps 5 through 8.

5. Remove drive motor and motor mounting plate as follows: (refer to figure 6-6).

   a. Disconnect drive motor cable plug AIP7 from rear of power supply. If the motor includes an externally mounted brake, disconnect A1P8 on the 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 hardware securing drive motor to motor mounting plate, remove drive motor and pulley from plate and set aside. Remove the externally mounted brake (if so equipped) using the brake replacement procedure and install it on the replacement motor.

7. Replace drive motor and motor mounting plate as follows:

   a. Orient replacement drive motor and pulley as shown on figure 6-6 and secure it to mounting plate.

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 6-6 and secure with hardware removed in step 5.

   c. Check that motor mounting plate is free to move forward and backwards between motor mount spacers. If not, loosen 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 inline position prior to removing side panels, reinstall drive inline 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 traced to a specific head or heads; for example, excessive data errors.

2. Head to disk contact is suspected. This may be indicated by an audible ping, scratching noise, or a burning odor when the heads are over the disk area.

3. Concentric scratches are observed on the disk surfaces.

4. Contamination of pack is suspected (possibility 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 6-8, 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.

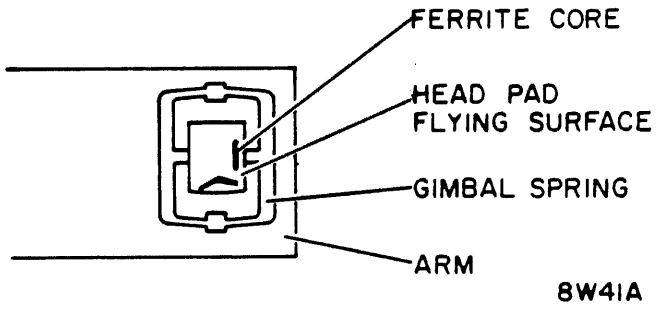


Figure 6-8. Typical Head/Arm Components

CAUTION

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

Refer to figure 6-9 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.

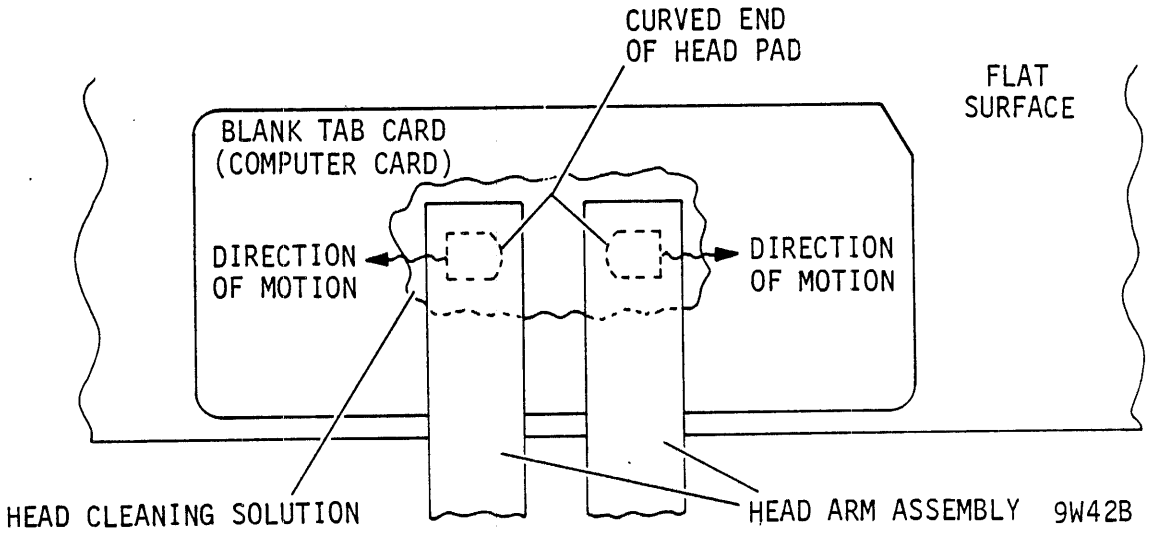


Figure 6-9. Head Cleaning Motion

2. Clean a smooth, flat working surface, for example, a glass or formica table top.

3. Place a blank tab card (see list of Maintenance Tools and Materials) or a new, unpunched, clean computer card with the back side up (printing down) on the clean flat working surface as shown in figure 6-9.

CAUTION

Care should be taken to avoid excess cleaning solution. Excess solution on the head cable may remove the plasticizer and make the cable stiff. A stiff cable reduces the flexibility of the head pad and could cause broken wires.

4. Moisten a small area in the center of the card with media cleaning solution. (Refer to the list of Maintenance Tools and Materials).

CAUTION

Inspect the media cleaning solution for contamination, rust, dirt, etc. Do not use contaminated solution.

5. Very carefully place the head pad flying surface on moistened area and move head pad from moistened area to dry area in a zig-zag motion as shown in figure 6-9. 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 media cleaning solution and tab card indicate that oxide particles are being removed from head pad flying surface.

7. Repeat steps 3, 4, 5, and 6 using a clean computer card and clean media cleaning solution each time until no discoloration on card is present.

8. After discoloration has ceased, inspect head to determine that oxide deposits were removed. If deposits remain but show signs of being removed, repeat cleaning procedure until deposits are removed.

9. If oxide deposits cannot be removed, replace head arm assembly.

10. If oxide deposits were removed and head passes inspection according to the Head Arm Replacement Criteria, reinstall head.

11. Follow read/write or servo head arm replacement procedure to install cleaned head or a replacement head as required.

Head Arm Replacement Criteria

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

1. Consistent oxide buildup on the same head, indicating repeated head to disk contact.

2. Appreciable oxide buildup which cannot be removed.

3. Scratches on the head flying surface.

4. Imbedded particles in the head pad flying surface.

5. Bent or damaged gimbal spring.

6. Any apparent physical damage to head arm assembly.

HEAD-ARM ASSEMBLY REPLACEMENT

The following describes replacement of read/write and/or the servo head-arm assemblies. Head alignment must be performed on any head-arm assembly replaced. Replacing the servo head-arm assembly requires alignment of all heads. Head alignment is covered in a separate procedure.

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

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

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 hardware securing cover to housing and remove cover.

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

   c. Remove hardware 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 6-10.

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.

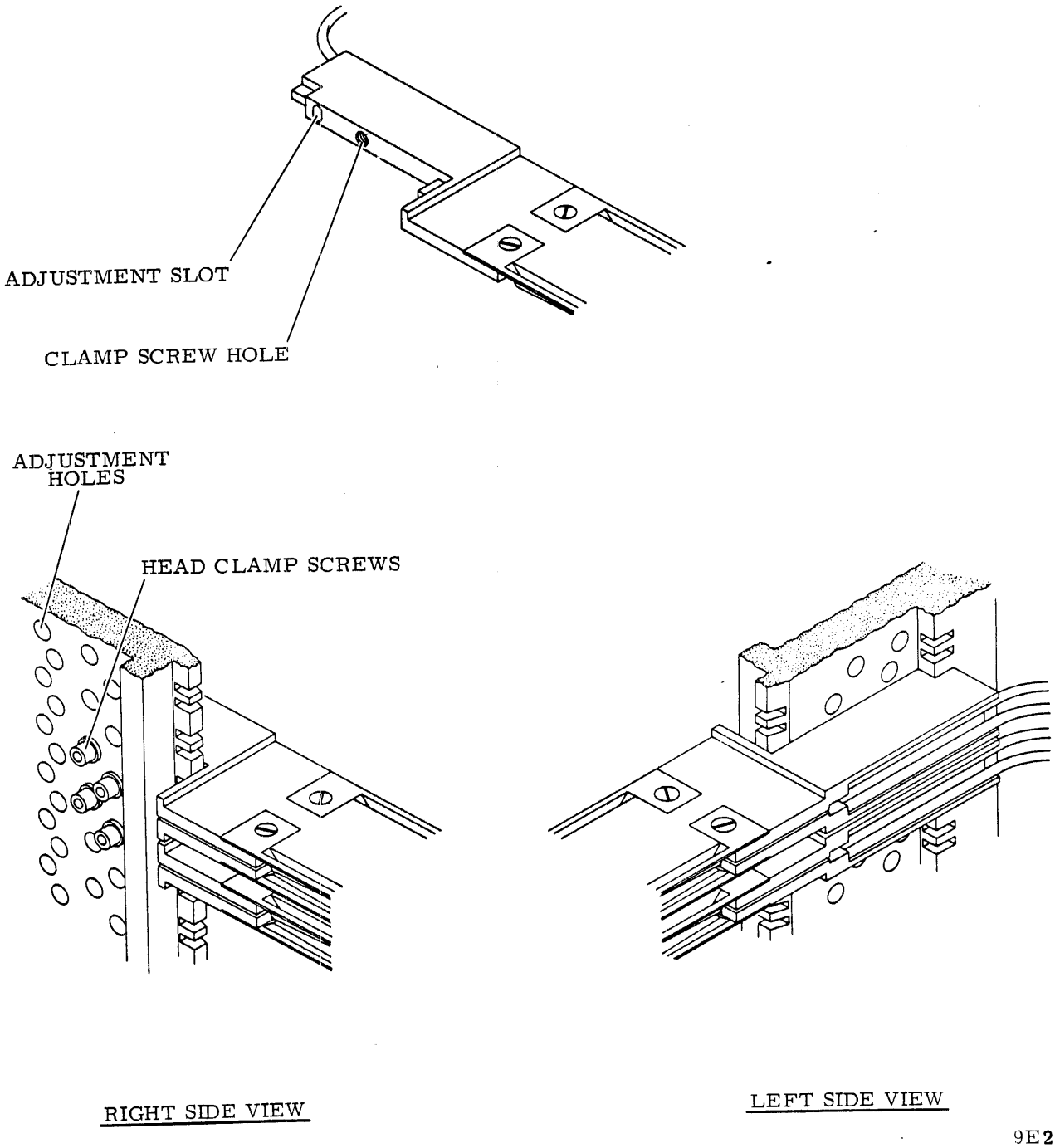


Figure 6-10. Head Arm Assembly Replacement

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 is to be removed, remove clamping screws one at a time as heads are removed.

b. Remove clamping screw securing head-arm to be removed.

c. Slide head-arm assembly forward from its position in carriage until it can be grasped from front, then carefully remove head arm, cable, and plug from carriage assembly.

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

NOTE

Inspect heads before installing them and clean if necessary (refer to Head Inspection and Cleaning procedure).

9. Install heads as follows:

CAUTION

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

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

b. Install head-arm clamp screw and torque to 0.45 N·m (4 lbf·in).

c. If 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. Secure servo preamp housing to deck.

    b. Reconnect servo head cable plug to preamp board.

    c. Secure servo preamp housing.

NOTE

Do not adjust servo head arm if it was not replaced because all read/write heads must be realigned whenever this adjustment is disturbed.

12. If servo head-arm was replaced, adjust it as follows, otherwise proceed to step 14.

    a. Using head-arm adjustment tool, center servo head-arm adjustment slot in the head adjustment hole (refer to figure 6-10).

    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 and 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. Remove 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 6-11).

    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.

CAUTION

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

13. Replace pack access cover.

NOTE

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

14. Replace cabinet top cover.

15. Replace disk pack.

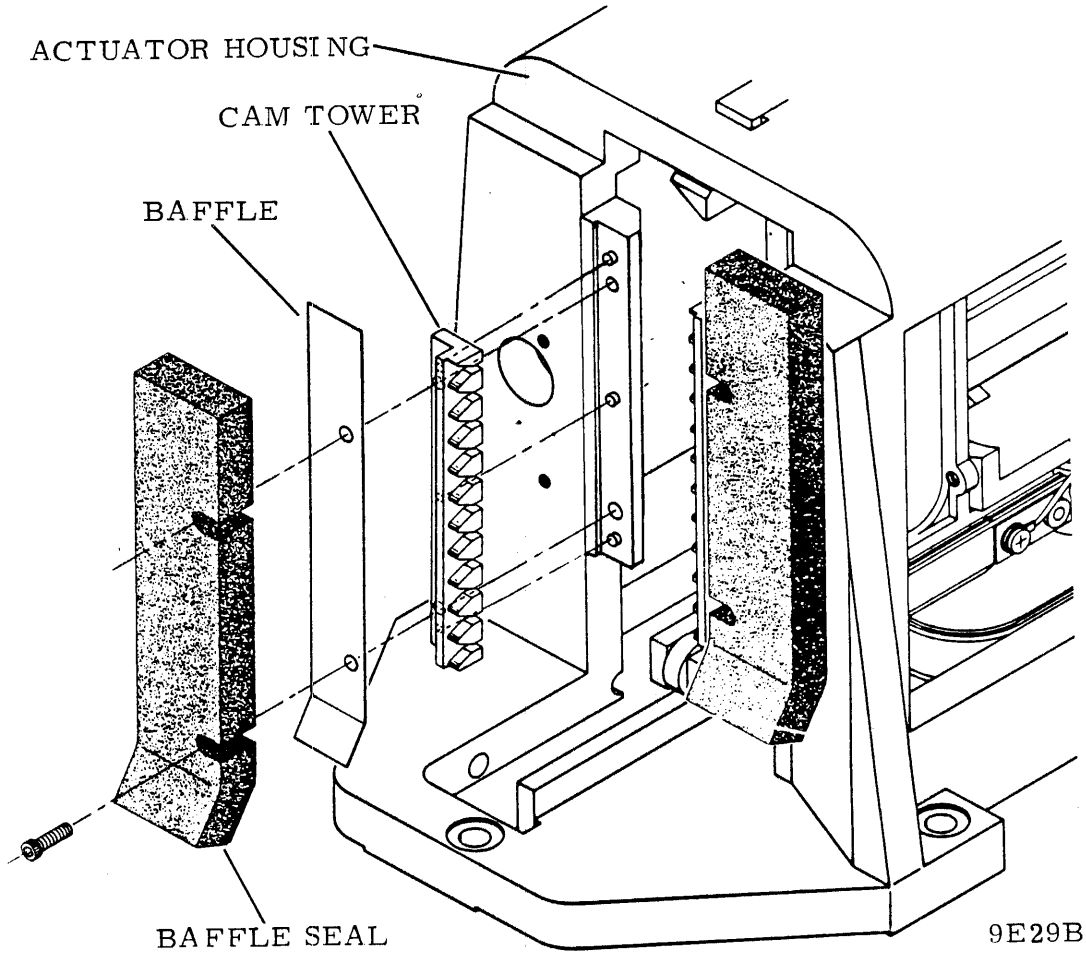


Figure 6-11. Cam Towers

HEADS LOADED SWITCH REPLACEMENT

This switch is mounted on the actuator housing (refer to figure 6-12) 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. Press START switch to stop drive motor and unload heads.
2. Open pack access cover and remove pack, close cover, and set MAIN AC circuit breaker to OFF.
3. Open cabinet top cover and remove deck cover.

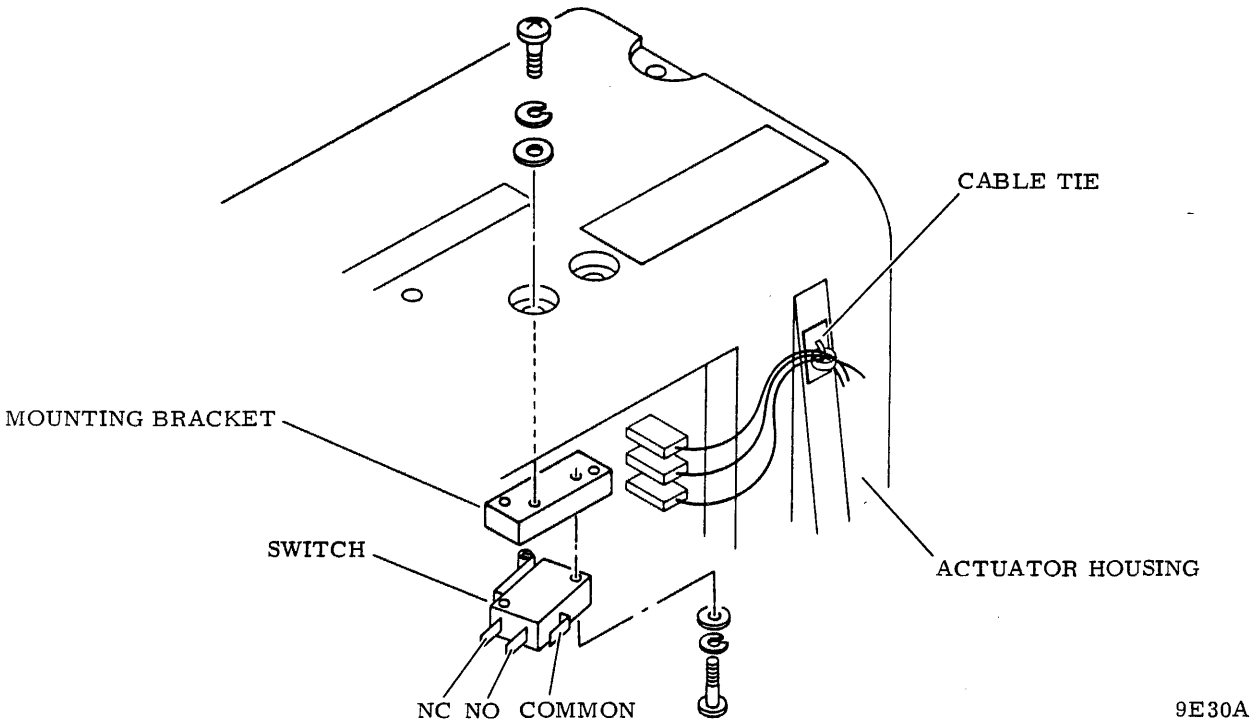


Figure 6-12. Heads Loaded Switch Replacement

4. Move carriage back to retracted stop.

5. Remove heads loaded switch from actuator housing as follows (refer to figure 6-12):

   a. Cut cable tie securing heads loaded switch leadwires to actuator housing.

   b. Remove hardware 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 hardware 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 Adjustment 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. Press START switch to stop drive motor and unload heads.

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

3. Open cabinet top cover and remove deck cover.

4. Move carriage back to retracted stop.

5. Note heads loaded switch leadwire connection and disconnect leadwires.

6. Connect an ohmeter (set to Rx1 scale) across common and normally closed (NC) terminals of the switch (refer to figure 6-12).

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 measures distance traveled. If distance is between .1 and .2 inches proceed to step 17. If distance is not between these limits, proceed to step 8.

8. Loosen screws securing switch mounting block to actuator housing then move block and switch as far back as possible toward magnet. Meter should now indicate infinity.

9. Disconnect one of meter leads at meter.

NOTE

In next step, a suitable shim is constructed by taping a number of feeler gauges together until their combined thickness is from 0.1 to 0.18 inches. 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 6-13).

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.

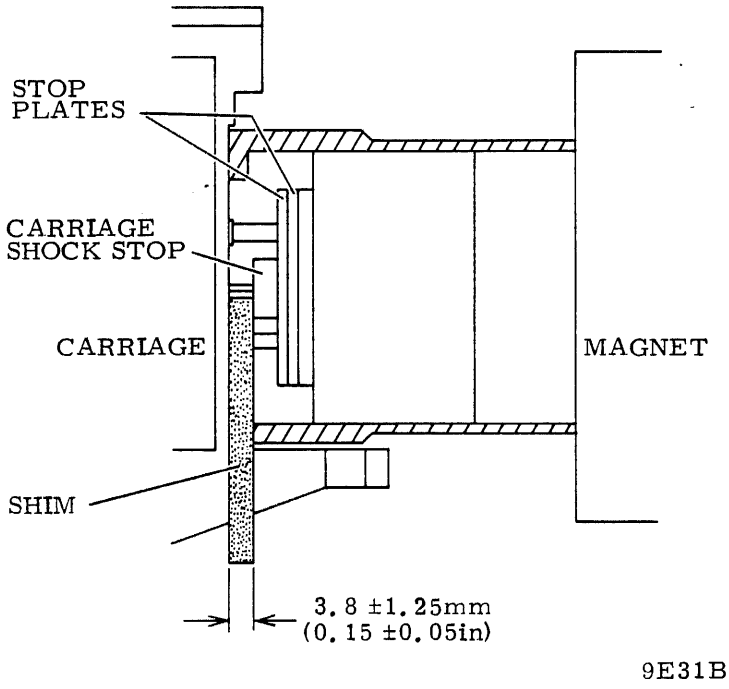


Figure 6-13. Heads Loaded Switch Adjustment

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.

WIREWRAP PIN REPLACEMENT

This procedure describes removing a damaged pin from the backpanel and replacing it with a new one.

1. Remove power from drive as follows:

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

   b. Set MAIN AC circuit breaker to OFF.

   NOTE

   Use care not to damage wires when removing them from pin. Also note level of wires so they are replaced in the same position as they were removed.

2. Open cabinet rear door and remove cover from logic chassis card cage.

3. Remove all wires from pin (refer to wirewrap replacement procedure step 3).

4. Remove card associated with pin to be replaced.

5. Slide post removal tool over pin and apply pressure toward backpanel until bond breaks between pin and collar (refer to figure 6-14).

6. Grasp shank of pin (with long nosed 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 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 6-14).

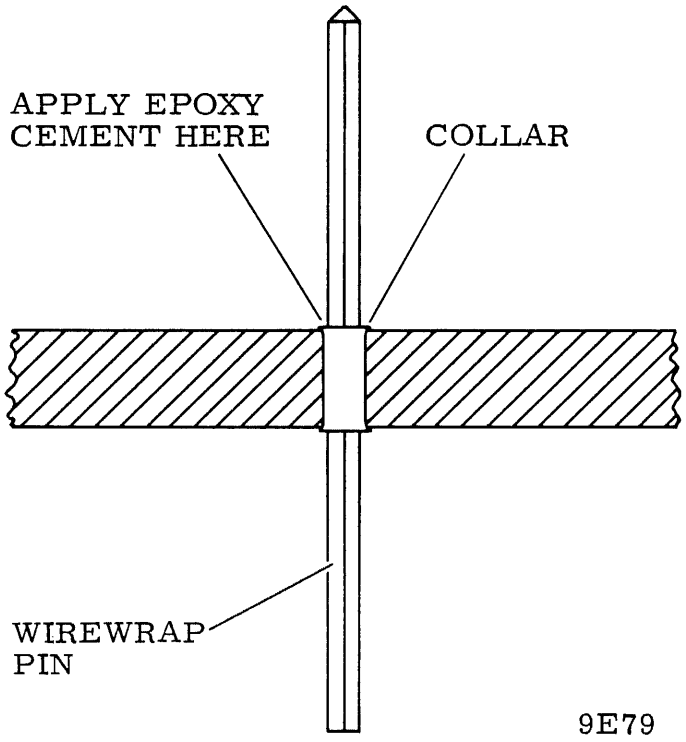


Figure 6-14. Wirewrap Pin Replacement

10. Replace wires removed in step 3 (refer to wirewrap replacement procedure steps 5 through 9).

11. Replace cover on logic chassis card cage and close cabinet rear door.

WIREWRAP REPLACEMENT

This procedure describes removal and replacement of backpanel wirewrap connections.

1. Remove power from drive as follows:

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

   b. Set MAIN AC circuit breaker to OFF.

2. Open cabinet rear door.

NOTE

If pin has two wires and wire to be replaced is closest to backpanel it is necessary to remove the 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 wirewrap tool with notch opposing direction of wrap, slide tool over pin and carefully turn tool to unwrap wire.

4. Cut replacement wire to proper length and strip approximately 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 pin, leaving a small gap between bottom of post or lower wrap level and new wire.

7. Hold wire securely (allow small amount of slack to assure one turn of insulation) and twist tool to wrap wire around pin. As tool is twisted, wire wrapping around pin forces tool up and off wire.

8. When wire is completely wrapped, remove tool and proceed to wrap other end of wire to its pin.

9. Ensure that each connection has one turn of insulation and six to seven turns of bare wire around pin.

10. Close cabinet rear door.

OPERATOR CONTROL PANEL REPLACEMENT

The operator control panel is replaced by snapping it out of the shroud cover, removing it from the connector and replacing it with a new control panel assembly.

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

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

3. Open cabinet top cover.

4. Remove plastic plug from access hole in shroud cover (refer to figure 6-15).

5. Snap operator control panel out of its position in shroud cover (refer to figure 6-15).

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. Reinstall pack and close pack access cover.

PACK ACCESS COVER SOLENOID REPLACEMENT (NON-VDE)

This solenoid is mounted on the front of the shroud cover (refer to figure 6-16) and prevents the pack access cover from being opened when the drive is powered down or while the spindle is turning. The following describes replacement, and adjustment is covered in the Pack Access Cover Solenoid Adjustment procedure.

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

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

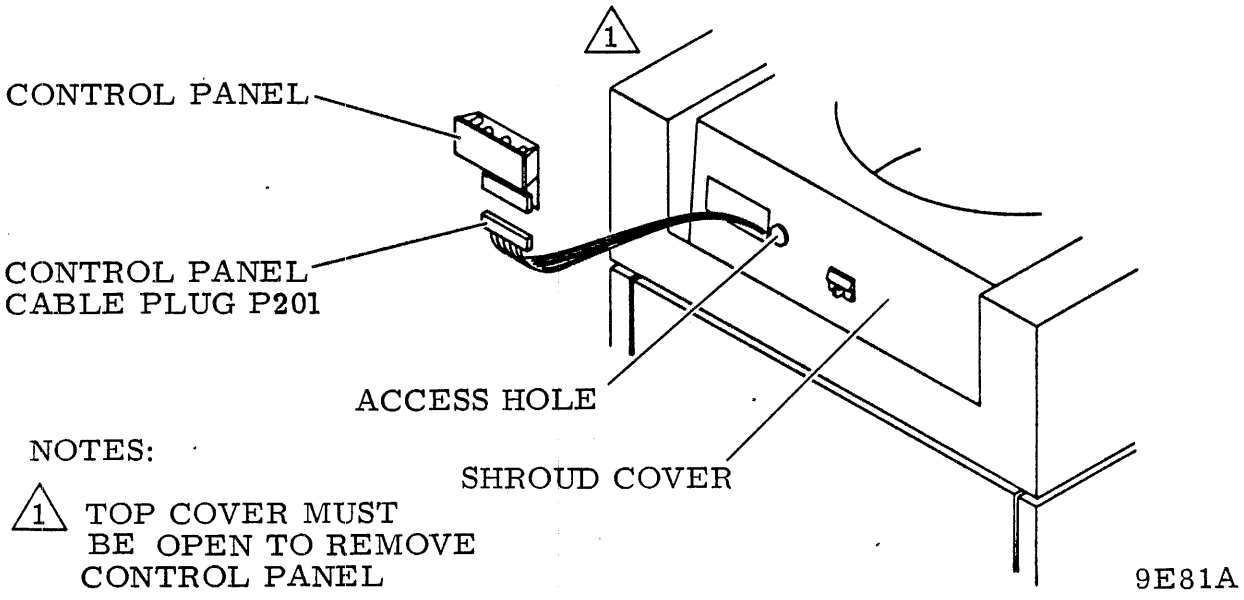


Figure 6-15. Operator Control Panel Replacement

NOTE

If drive is installed inline 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 hardware securing shroud cover to shroud and move shroud cover forward far enough to allow access to pack access cover solenoid assembly.

7. Remove hardware 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.

10. Connect leadwires to solenoid.

11. Move shroud cover back into position and secure.

12. Replace pack access cover.

13. Replace operator control panel in shroud cover.

NOTE

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

14. Replace cabinet top cover.

15. Perform Pack Access Cover Solenoid Adjustment procedure.

PACK ACCESS COVER SOLENOID ADJUSTMENT (NON-VDE)

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 drive is powered down or while the spindle is turning.

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

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

3. Carefully raise cabinet top cover so that it clears pack access cover.

4. Raise pack access cover as far as possible.

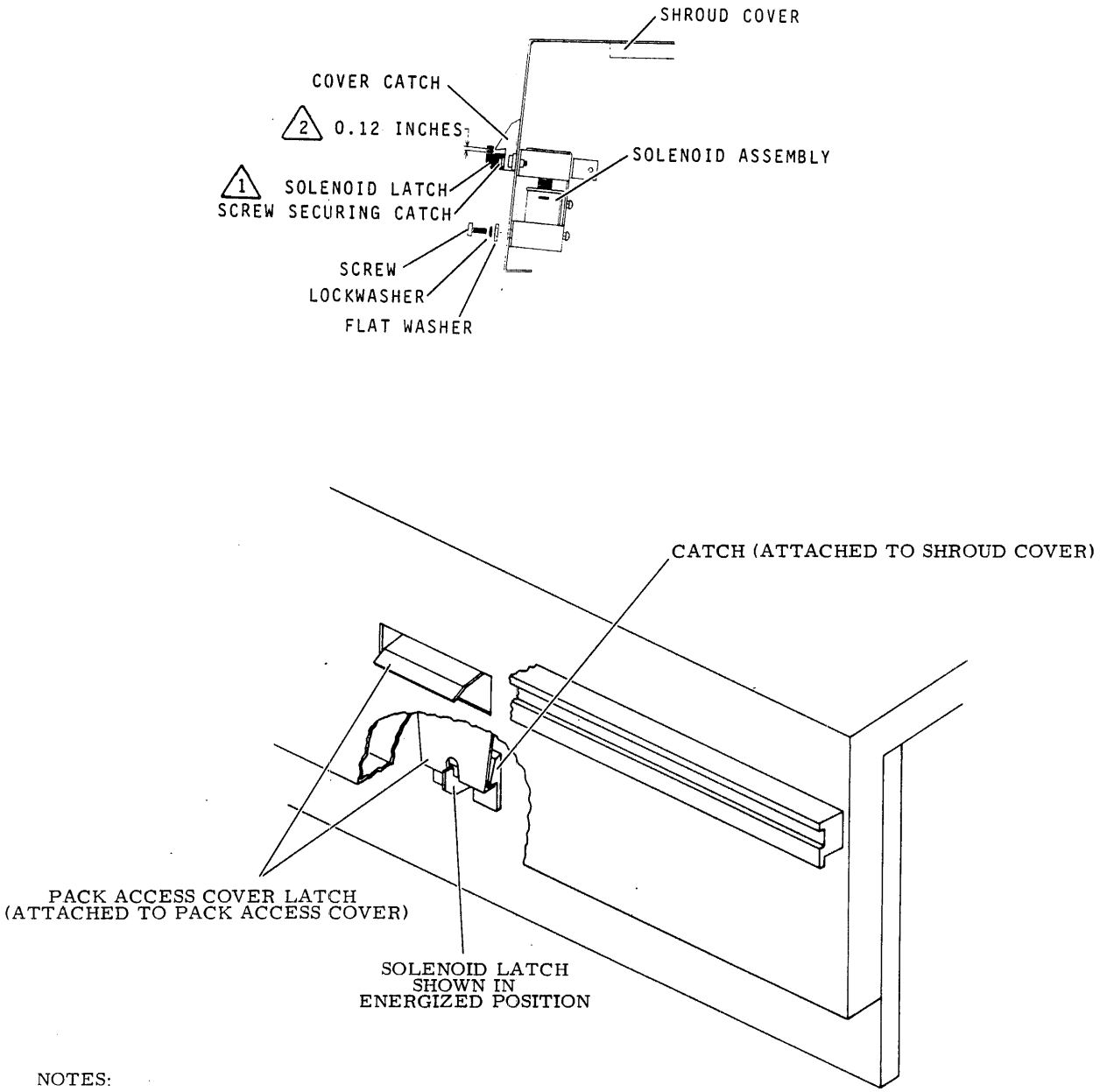
5. Check adjustment solenoid with deenergized (solenoid latch up). Measure distance between it and catch on shroud cover (refer to figure 6-16).

6. If distance measured in step 5 is as indicated on figure 6-16 proceed to step 7 otherwise adjust as follows:

   a. Loosen screws securing solenoid assembly to shroud cover.

   b. Adjust solenoid assembly until proper clearance is obtained.

   c. Tighten screws securing solenoid assembly to shroud cover.



NOTES:

1. SHOWN IN ENERGIZED POSITION
2. NOT CRITICAL HOWEVER DISTANCE MUST ENSURE PACK ACCESS COVER WILL BE LOCKED SHUT BY SOLENOID LATCH

9E32 C

Figure 6-16. Pack Access Cover Solenoid Replacement/Adjustment (Non-VDE)

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. Solenoid should engage and prevent cover from opening.

   c. Set MAIN AC circuit breaker to ON. Solenoid energizes and cover should open.

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

   e. Solenoid should deenergize 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. Press START switch to stop drive motor and unload heads.

9. Remove disk pack.

10. Set MAIN AC circuit breaker to OFF.

11. Close pack access cover.

PACK ACCESS COVER SWITCH REPLACEMENT (NON-VDE)

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 6-17. The following procedure describes its removal and replacement. This switch requires no adjustments.

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

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

3. Carefully raise cabinet top cover so that it clears the pack access cover.

4. Open pack access cover as far as possible.

5. Remove pack access cover switch assembly as follows (refer to figure 6-17):

   a. Remove hardware securing pack access cover switch assembly to shroud cover and remove switch assembly from beneath shroud cover.

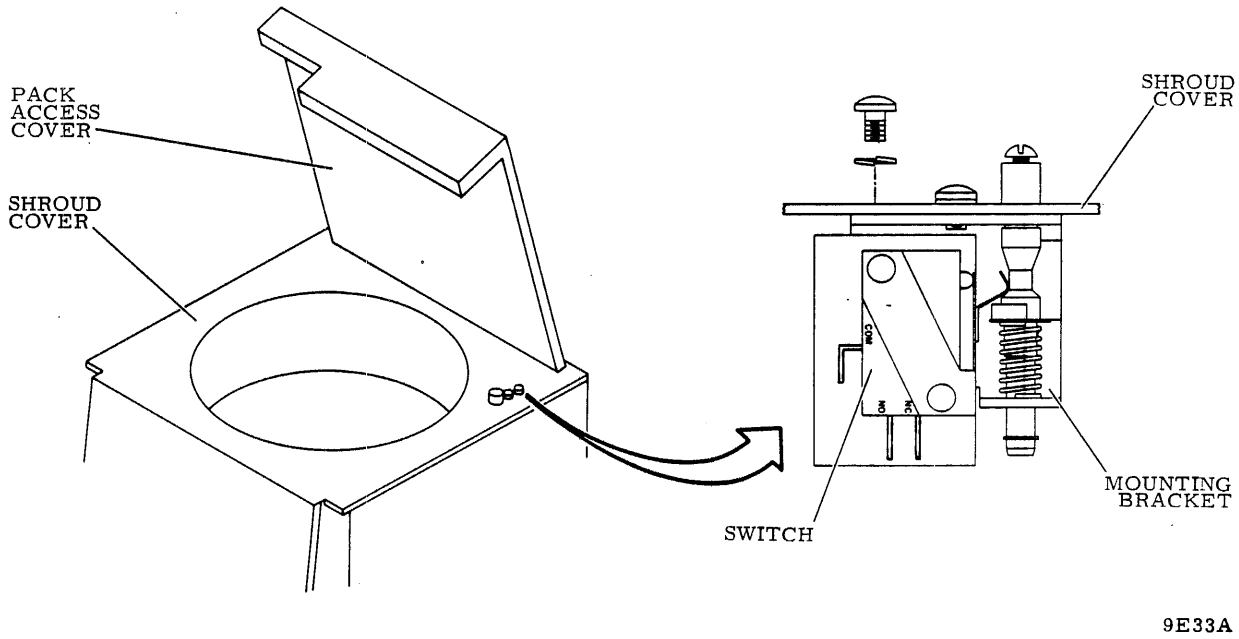


Figure 6-17. Pack Access Cover Switch Replacement (Non-VDE)

b. Note leadwire connections and remove leadwires from switch.

c. Remove hardware securing switch to its mounting bracket, then remove switch from bracket and set aside.

6. Replace pack access cover switch assembly as follows:

a. Position replacement switch on mounting bracket and secure.

b. Connect leadwires to switch terminals.

c. Position switch under shroud cover and secure.

7. Close pack access cover.

8. Replace deck cover and close cabinet top cover.

INTERLOCK SOLENOID AND SWITCH REPLACEMENT (VDE)

The interlock assembly shown in figure 6-18 is used on VDE units. Its purpose is to lock the pack access cover so it can only be opened when the drive is in the standby mode (MAIN AC breaker on and drive motor stopped). It also prevents the drive motor from starting if the pack access cover is open. The following procedure details removal and replacement of the interlock assembly.

1. Press the START switch to stop the drive.
2. Open the pack access, turn off the MAIN AC breaker and remove the disk pack.
3. Remove the cabinet top cover.
4. Remove the pack access cover.
5. Remove the shroud cover attaching hardware and slide the cover forward far enough to allow access to the interlock assembly.
6. Disconnect interlock connector A3P9.
7. Note the lead position on the solenoid and disconnect them.
8. Remove the hardware securing the interlock assembly to the shroud. Slip the assembly out of the drive.
   - If the solenoid is being replaced, proceed with step 9.
   - If the interlock switch is being replaced, go to step 14.
   - If the entire interlock assembly is being replaced, reverse steps 1-8 to install the new assembly.
9. Remove the hardware that secures the solenoid to the bracket.
10. Remove the solenoid and plunger.
11. Install the solenoid plunger and solenoid on the bracket and secure it with the hardware removed in step 9.
12. Manually operate the solenoid and check for freedom of movement. The solenoid body can be repositioned within limits of the attaching hardware to eliminate slight binding.

13. Reverse steps 1-8 to install the interlock assembly.

14. Note lead position on the interlock switch and disconnect them.

15. Remove the hardware that secures the switch to the latch.

16. Install the new switch with the hardware removed in step 15.

17. Attach the leads to the switch.

18. Reverse steps 1-8 to install the interlock assembly.

With the interlock assembly installed, the pack access cover should lock when the drive motor is running, or when the MAIN AC breaker of OFF.

NOTE

The interlock solenoid will not release the latch (energize) for 30 seconds after the MAIN AC breaker is turned ON.

The interlock hook on the pack access cover must actuate the interlock switch when the cover is closed. If this does not occur, the drive motor will fail to start when the START switch is pressed.

PACK ON SWITCH REPLACEMENT

This switch is located on the pack sensor assembly. The following describes replacement of the pack on switch. The switch must be adjusted following replacement and this is covered in the Pack On Switch Adjustment procedure.

REPLACEMENT (S/C 08 AND BELOW)

1. Remove power from drive as follows:

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

   b. Set MAIN AC circuit breaker to OFF.

2. Remove disk pack.

3. Remove blower assembly (refer to Blower Motor Replacement procedure steps 3 and 4).

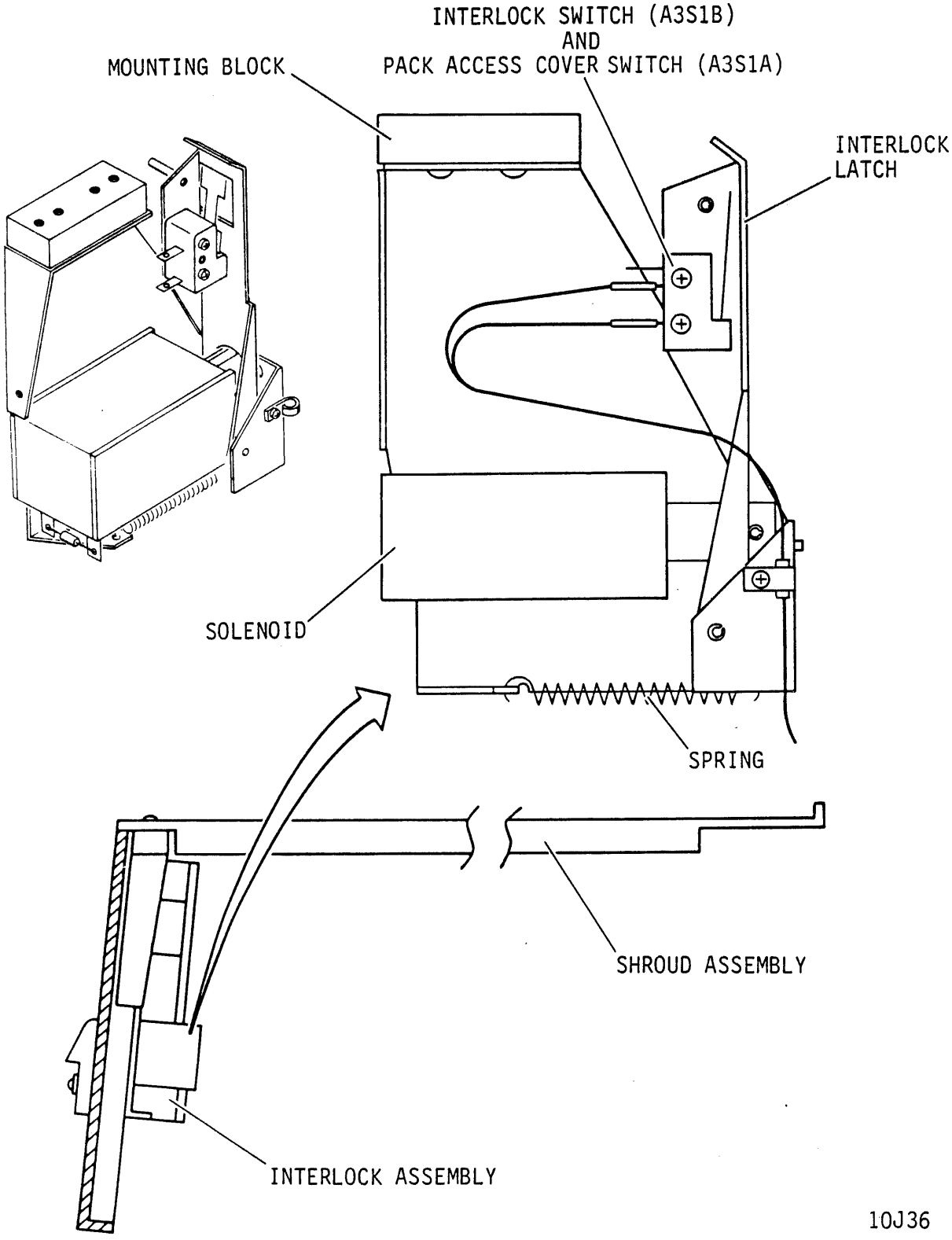


Figure 6-18. Interlock Assembly (VDE)

4. Note leadwire connections and disconnect leadwires at pack on switch terminals (refer to figure 6-19).

5. Remove small spring located behind pack on switch.

6. Remove hardware securing switch to mounting bracket then remove switch.

7. Install replacement switch on mounting bracket, then replace small spring.

8. Perform Pack On Switch Adjustment procedure starting with step 4.

REPLACEMENT (S/C 09 AND ABOVE)

1. Stop spindle motor.

2. Remove disk pack.

3. Set UNIT POWER circuit breaker to OFF.

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

5. Identify pack sensor switch leadwires. Disconnect wires at switch (Figure 6-20).

6. Remove hardware securing switch to switch base bracket. Remove faulty switch.

7. Install replacement switch to switch base bracket. Do not tighten screws.

8. Perform Pack Sensor Switch Adjustment procedure.

PACK ON SWITCH ADJUSTMENT

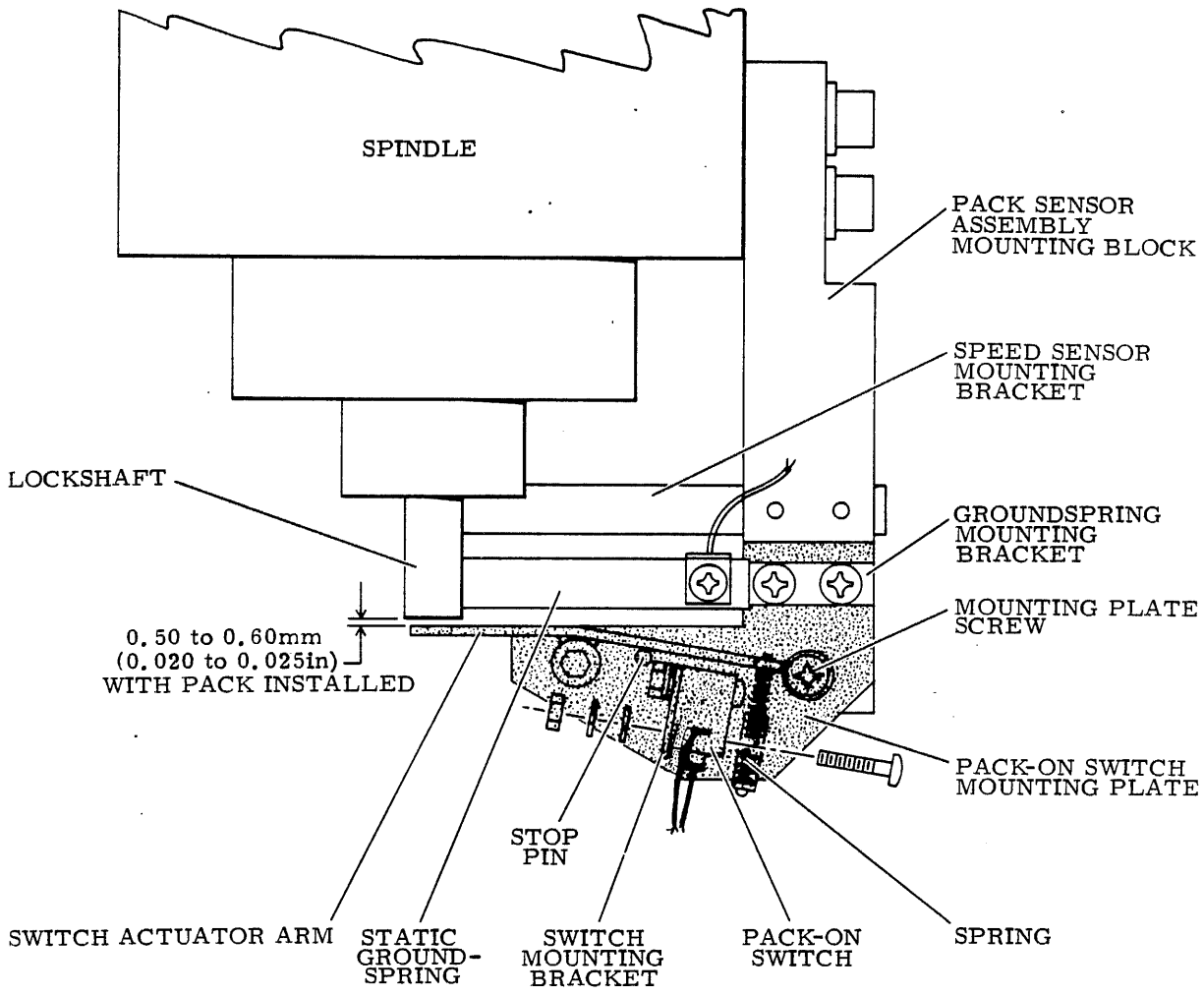
This procedure describes adjustment of the pack on switch so it opens and closes at the proper points. The switch should close when a pack is installed and open when the pack is removed.

ADJUSTMENT (S/C 08 AND BELOW)

1. Remove power from drive as follows:

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

   b. Set MAIN AC circuit breaker to OFF.



NOTES:

1 SHADED AREAS INDICATE PARTS RELEVANT TO PACK ON SWITCH ADJUSTMENT AND REPLACEMENT

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Figure 6-19. Pack On Switch Replacement/Adjustment (S/C 08 and Below)

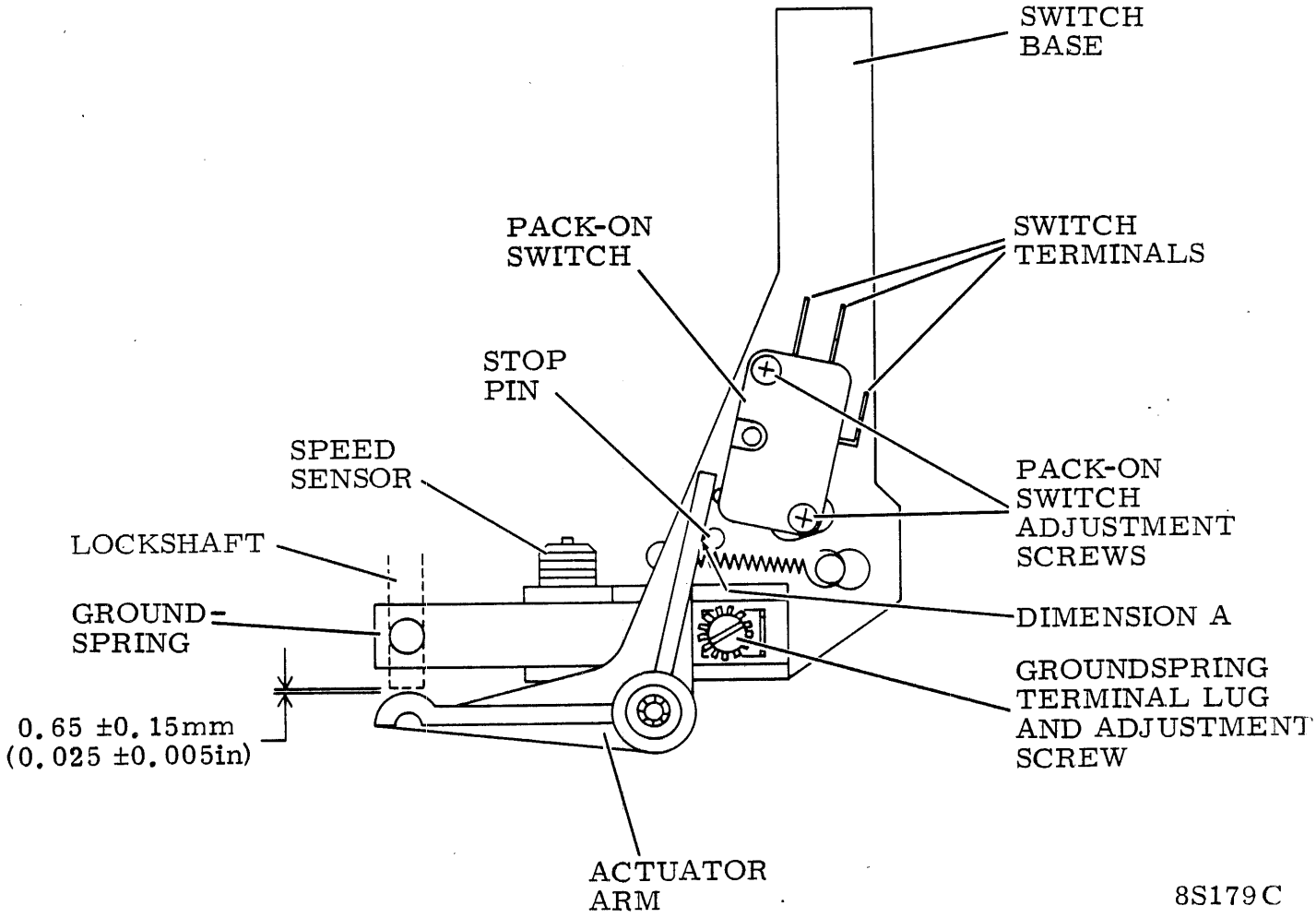


Figure 6-20. Pack On Switch Replacement/Adjustment (S/C 09 and Above)

2. Remove customer disk pack and install a scratch pack.

3. Remove blower assembly (refer to Blower Motor Replacement procedure steps 3 and 4).

4. Note leadwire connection, then remove leadwire from pack on switch.

5. Check that gap between actuator arm and lockshaft is as specified in figure 6-19. If gap is not as specified, proceed to step 6. If it is as specified, proceed to step 7.

6. Adjust mounting plate as follows to obtain clearance specified in step 5.

   a. Loosen hardware securing static groundspring mounting bracket to mounting plate.

   b. Loosen mounting plate adjustment screw.

   c. Position switch mounting plate until gap between actuator arm and lockshaft is as specified in figure 6-19.

   d. Tighten mounting adjustment screw and hardware securing static groundspring mounting bracket to mounting plate.

   e. Recheck gap and readjust if necessary.

7. Check as follows to ensure that pack on switch is closed.

   a. Connect multimeter (set to Rx1) across pack sensor terminals as follows:

      - Black (ground) lead to pack on switch terminal C.

      - Red (positive) lead to pack on switch terminal NO.

   b. Observe that meter indicates zero ohms. If it does go to step 9. If it does not go to step 8.

8. Adjust pack on switch to close at proper point as follows:

   a. Loosen hardware securing switch to mounting bracket.

   b. Position switch until meter just indicates zero ohms.

   c. Tighten hardware securing switch to mounting bracket.

9. Check as follows to see that switch opens at the proper point:

   a. Insert 0.3 mm (0.011 inch) feeler gauge between actuator arm and stop pin (refer to figure 6-19).

   b. Meter should indicate infinity. If not, go to step 10, if correct remove feeler gauge and go to step 11.

10. Adjust pack on switch to open at proper point as follows:

    a. Loosen hardware securing pack on switch to mounting bracket.

    b. Position switch until meter just indicates infinity.

c. Tighten screws.

d. Remove feeler gauge and note that meter goes to zero. If meter does not go to zero, repeat procedure starting with step 9. If meter does go to zero proceed to step 11.

11. Remove multimeter probes from pack on switch terminals.

12. Reconnect pack on switch leadwires to switch terminals.

13. If mounting plate was adjusted (step 6) perform Static Groundspring Adjustment procedure steps 4 and 5.

14. Remove scratch disk pack.

15. Install blower assembly (refer to Blower Motor Replacement procedure step 15).

16. Close cabinet front door.

ADJUSTMENT (S/C 09 & ABOVE)

NOTE

The following adjustment procedure applies to units with S/C 09 and above. The new pack sensor assembly is interchangeable, but the adjustment varies.

1. Stop spindle motor.

2. Install a disk pack.

3. Set UNIT POWER circuit breaker to OFF.

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

5. Identify pack sensor switch leadwires (figure 6-20). Disconnect wires at switch terminals.

6. Dimension between actuator arm and lockshaft must be as specified in figure 6-20. If dimension is as specified, go to step 9. If adjustment is required, go to step 7.

7. Loosen hardware on switch base bracket (figure 6-20).

8. Position switch base bracket until dimension between actuator arm and lockshaft is as specified in figure 6-20. Tighten screws.

9. Connect a multimeter (set to Rx1) to pack sensor switch terminals (figure 6-20). 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 inch) thick feeler gauge between actuator arm and stop pin (dimension A of figure 6-20).

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 (refer to figure 6-21) are the static ground spring, and pack on switch. The procedure for individually replacing each of these are contained elsewhere in this section. The following describes replacement of the entire pack sensor assembly.

REPLACEMENT (S/C 08 AND BELOW)

1. Remove power from drive as follows:

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

   b. Set MAIN AC circuit breaker to OFF.

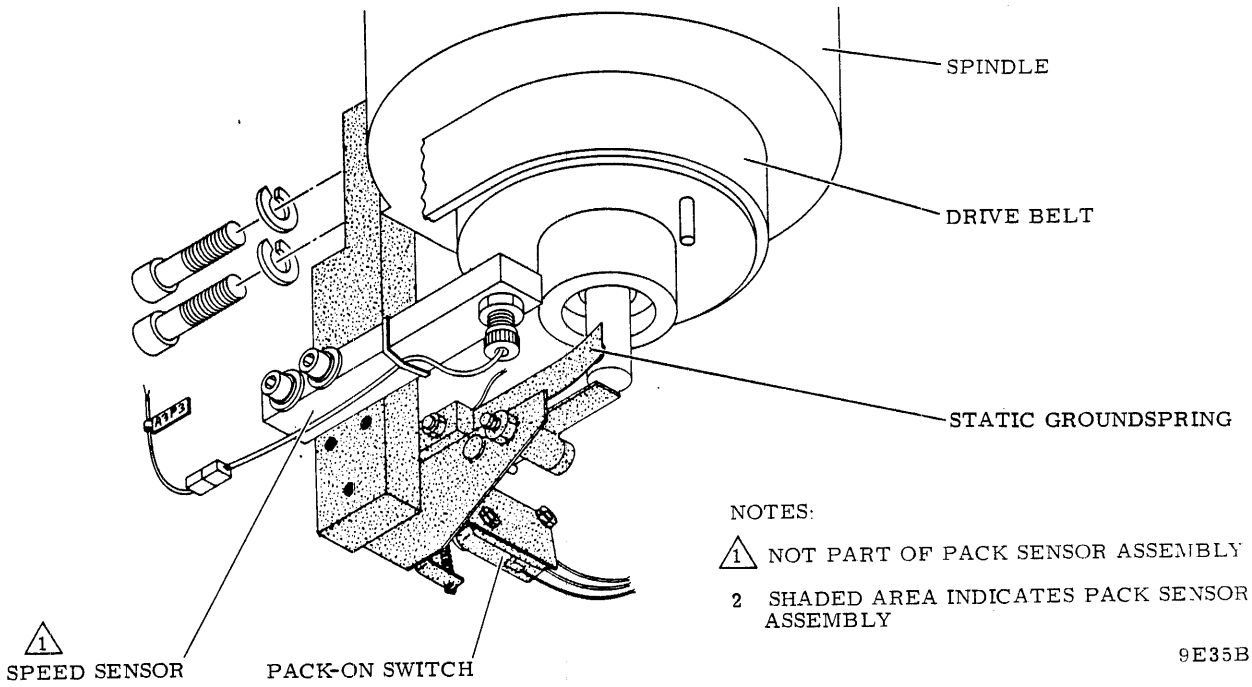


Figure 6-21. Pack Sensor Assembly Replacement (S/C 08 and Below)

2. Remove disk pack.

3. Remove blower assembly (refer to Blower Motor Replacement procedure steps 3 and 4).

4. Remove pack sensor assembly as follows:

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

   b. Note leadwire connections and disconnect leadwire from pack on switch.

   c. Disconnect speed sensor cable plug.

   d. Remove hardware securing pack sensor assembly to spindle assembly then remove pack sensor assembly and set aside.

5. Remove speed sensor assembly from old pack sensor assembly by removing hardware. Install speed sensor assembly on replacement pack sensor assembly.

6. Install replacement pack sensor assembly as follows:

   a. Position replacement pack sensor assembly on rear of spindle assembly and secure.

   b. Connect speed sensor cable plug A3P3.

   c. Connect leadwire to pack on switch and static groundspring.

7. Perform the following procedures:

   a. Pack On Switch Adjustment steps 4 through 14.

   b. Static Groundspring Adjustment steps 4 and 5.

   c. Speed Sensor Adjustment Steps 4 through 7.

8. Install blower assembly (refer to Blower Motor Replacement procedure step 15).

9. Perform Speed Sensor Output Check procedure.

REPLACEMENT (S/C 09 AND ABOVE)

1. Remove power from drive as follows:

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

   b. Set MAIN AC circuit breaker to OFF.

2. Remove disk pack.

3. Remove blower assembly (refer to Blower Motor Replacement procedure steps 3 and 4).

4. Remove pack sensor assembly (figure 6-22) as follows:

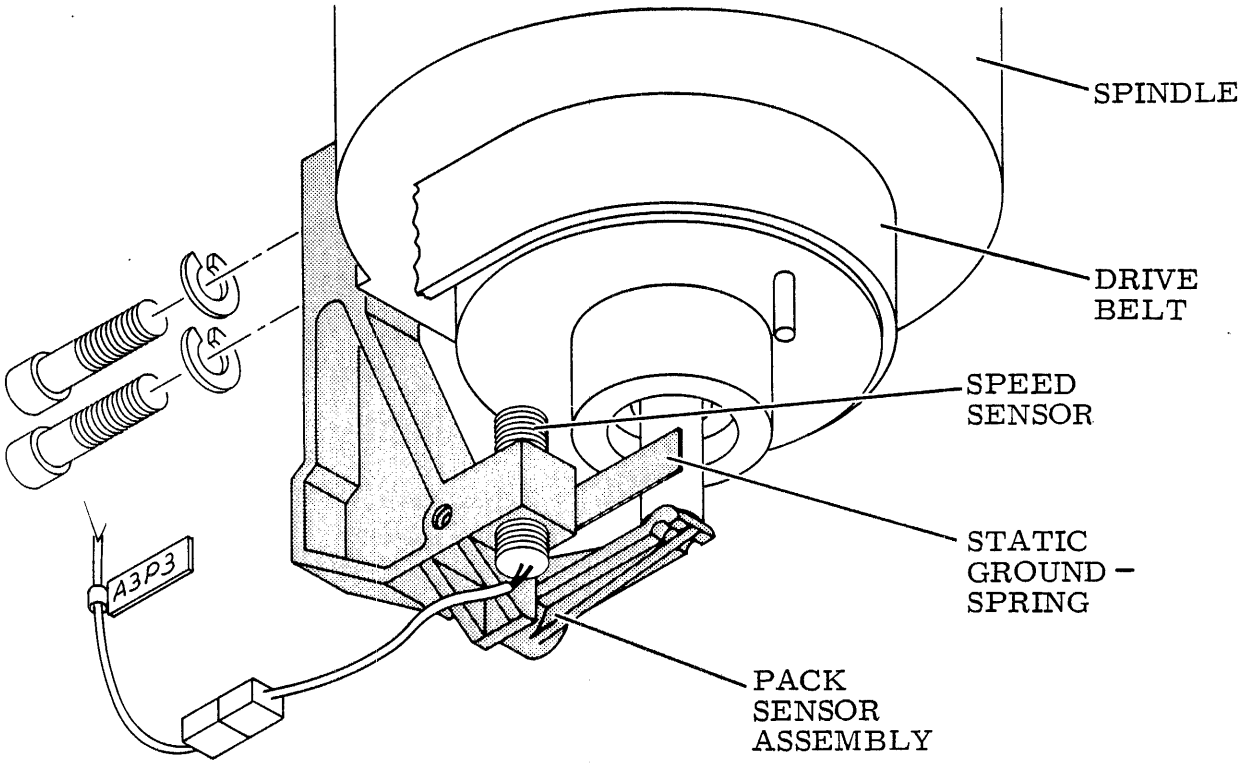
   a. Disconnect static groundspring leadwire from terminal on groundspring.

   b. Cut tie wrap on leadwires.

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

   d. Disconnect speed sensor cable plug.

   e. Remove drive belt (refer to Drive Belt).



NOTES: 1. SHADED AREAS REPRESENT PACK SENSOR ASSEMBLY.

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Figure 6-22. Pack Sensor Assembly Repacement (S/C 09 and Above)

f. Remove hardware 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.

b. Replace drive belt (refer to figure 6-6 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 6-23). 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. Press START switch to stop drive motor and unload heads.

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

3. Remove hardware securing brake plate cover to deck then remove cover.

4. Remove hardware securing parking brake assembly to deck (refer to figure 6-23) 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.

6. Perform Parking Brake Adjustment procedure starting with step 4.

PARKING BRAKE ADJUSTMENT

The Parking Brake has two adjustments (refer to figure 6-23). These are the actuator button to pack clearance and the brake tooth to bottom of spindle clearance.

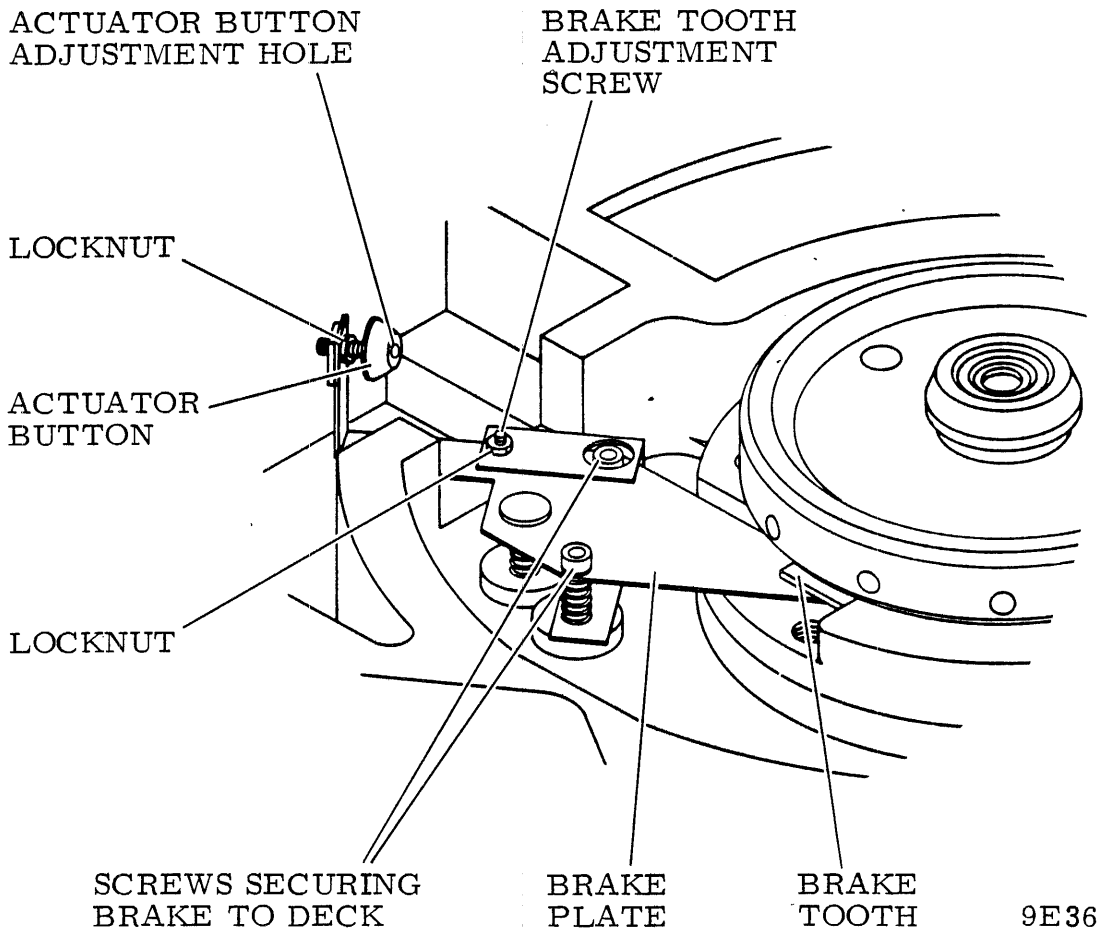


Figure 6-23. Parking Brake Replacement/Adjustment

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

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

3. Remove hardware 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 inch). 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 inch). Turning setscrew clockwise narrows gap and counterclockwise widens gap.

   c. When gap is correct tighten setscrew.

6. Install a scratch disk pack.

NOTE

In step 7 it is impossible to check the clearance with a conventional feeler gauge. However, a suitable tool can be constructed by taping the proper feeler gauge to the end of a long object such as a screwdriver.

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 inch). If this 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 scratch disk pack.

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.

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 inch). 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 inline position to remove top cover, reinstall drive inline 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, at the rear of the cabinet. Two types of power supplies are used. These are illustrated in figure 6-24. As illustrated, one power supply is mounted on slides that permits extending it out the rear of the cabinet. The other power supply, is mounted on the base of the cabinet and does not incorporate the slides. Both power supplies contain replaceable cards. The chart below illustrates card usage.

CARD TYPE VDE	CARD TYPE Non-VDE	DESCRIPTION
_ZCN	_ZCN	Power Amplifier
_FNN*	_YFN	Relay Board
----	_YEN	Capacitor Board
_CBN	----	Rectifier/Filter Board
_CFN	----	Control Board

*This card applicable to units S/C 40 and Below.

The following procedure describes 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 (NON-VDE)

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 inline with other drives it will have to be pulled out of line to remove side panels.

2. Remove cabinet side panels.

3. Remove hardware securing cable guide to frame and remove cable guide.

4. Disconnect support spring from power cable.

5. Disconnect five plug connectors from power supply and 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.

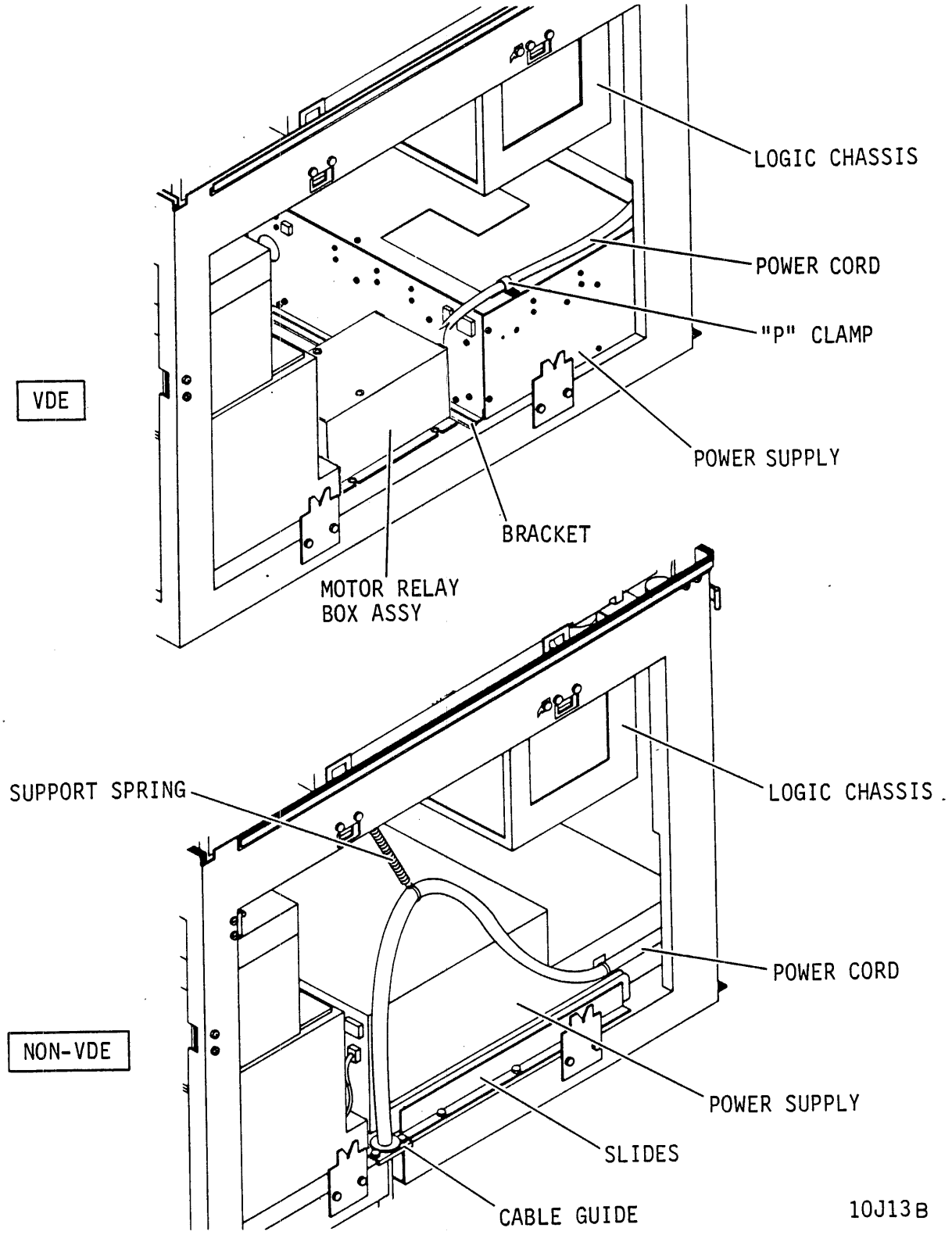


Figure 6-24. Power Supply Assembly Replacement

8. Disconnect ac and dc ground straps (refer to figure 6-25) and remove them from power supply. Replace top cover on power supply.

9. Remove hardware 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.

11. Remove top cover from replacement power supply and connect ground straps (removed in step 8) as shown in figure 6-25.

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

13. Replace top cover on power supply.

14. Reconnect plugs to power supply and 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 inline.

19. Perform following procedures:

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

    b. DC Voltage Output Check.

—ZCN (POWER AMPLIFIER) CARD REPLACEMENT (NON-VDE)

The following procedure describes removal replacement of only the _ZCN card (refer to figure 6-25).

1. Remove power from drive as follows:

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

    b. Set MAIN AC circuit breaker to OFF.

    c. Disconnect power cable from site main power receptacle.

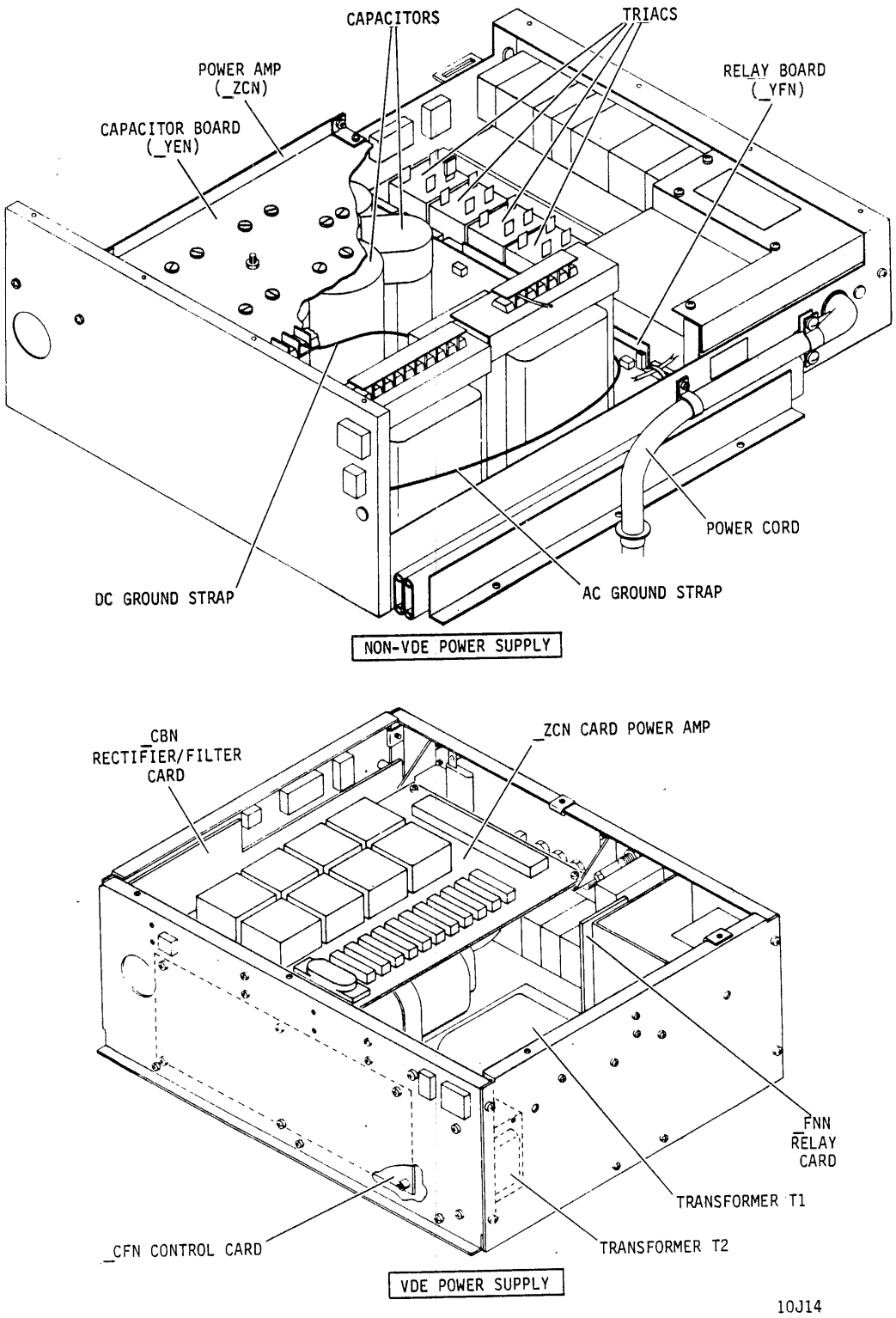


Figure 6-25. Power Supply Card Replacement

2. Slide power supply out and remove power supply top cover.

3. Note connections then disconnect all wires from _ZCN card.

4. Remove hardware 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.

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 (NON-VDE)

The following procedure describes removal and replacement of the _YEN card (refer to figure 6-25).

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 hardware securing _ZCN card, remove insulated spring clip, then remove _ZCN card away from _YEN.

4. Note connections, then disconnect all wires from _YEN card.

5. Remove hardware securing card to capacitors.

6. Remove hardware 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 screws.

8. Install hardware on stud and tighten.

9. Reposition _ZCN card and secure. 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 (NON-VDE)

The following procedure describes removal and replacement of the _YFN card (refer to figure 6-25).

CAUTION

Observe precautions described in discussion on Handling Electrostatic Devices in section 2 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 connectors from _YFN card.

4. Carefully pry card off fasteners and remove from power supply.

5. Install replacement _YFN card in power supply by pushing it carefully onto fasteners.

6. Install 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.

POWER SUPPLY REPLACEMENT (VDE)

The following procedure describes removal and replacement of the entire power supply assembly used on VDE units.

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

2. Set the MAIN AC circuit breaker to OFF.

3. Disconnect the power cord from the site power receptacle.

NOTE

If the drive is installed inline with other drives it must be pulled out of line to remove cabinet panels.

4. Remove the cabinet side panels and open the rear door.

5. Remove the screw securing the power cord clamp to the top of the power supply.

6. Disconnect the power cord from the power supply control panel.

7. Disconnect plugs P2, P3, P4, P6, P7 and P8 on the power supply.

8. Disconnect the air hose at the rear of the power supply by turning it counterclockwise.

9. Remove the hardware that secures the control panel end of the power supply to the cabinet base.

10. Pull the power supply out the rear of the cabinet.

11. To install the power supply, rest it on the cabinet base and push it toward the front of the drive until the lip at the rear of the power supply slips under the mounting bracket.

12. Secure the control panel end of the power supply to the chassis with the hardware removed in step 9.

13. Connect plugs P2, P3, P4, P6, P7 and P8 and attach the air hose by turning it clockwise into the power supply.

14. Connect the power cord to the receptacle on the power supply control panel.

15. Attach the power cord clamp to the top of the power supply.

16. Connect the power cord to the site power receptacle.

17. Place the MAIN AC circuit breaker in the ON position.

18. Perform DC voltage checks and ±5 V test and adjustment.

19. Replace the cabinet panels and position the drive inline with the other drives.

–ZCN (POWER AMPLIFIER) CARD REPLACEMENT (VDE)

The following procedure describes removal and replacement of the _ZCN card used in VDE units (see figure 6-25).

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

2. Remove the power supply using the Power Supply Replacement procedure.

3. Remove the power supply cover.

4. Note all lead connections on the _ZCN card. Then disconnect all leads.

5. Remove the hardware that secures the _ZCN card to the mounting brackets, and remove the card.

6. Position the replacement card on the mounting brackets and secure it with the hardware removed in step 5.

7. Connect all leads to the _ZCN card.

8. Install the power supply top cover.

9. Install the power supply in the cabinet.

10. Perform steps 1 and 9 of the manual controlled servo checks procedure.

—FNN (RELAY) CARD REPLACEMENT (VDE) - S/C 40 & BELOW

The following procedure describes removal and replacement of the _FNN card used in VDE units (see figure 6-25).

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

2. Remove the power supply using the Power Supply Replacement procedure.

3. Remove the power supply cover.

4. Disconnect P1 at the _FNN card.

5. Remove the hardware that secures the card to the power supply chassis and then remove the card.

6. Reverse steps 1-5 to install the replacement _FNN card.

—CFN (CONTROL) CARD REPLACEMENT (VDE)

The following procedure describes removal and replacement of the _CFN card used in VDE units (see figure 6-25).

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

2. Remove the power supply using the Power Supply Replacement procedure.

3. Remove the power supply cover.

4. Remove the _ZCN (Control) card.

5. Disconnect connectors P1, P2, P3 and P4 on the _CFN card.

6. Remove the hardware that secures the _CFN card to the rear panel of the power supply. Remove the card.

7. Position the replacement _CFN card on the rear panel of the power supply and secure it with the hardware removed in step 6.

8. Reverse steps 1-5 to complete the installation.

—CBN (RECTIFIER/FILTER) CARD REPLACEMENT (VDE)

The following procedure describes removal and replacement of the _CBN card used in VDE units (see figure 6-25).

1. Press the START switch to stop the drive motor and unload the heads.
2. Remove the power supply using the Power Supply Replacement procedure.
3. Remove the power supply cover.
4. _ZCN (Power Amplifier) card.
5. Disconnect connectors P1, P2 and P3 and the _CBN card.
6. Remove the hardware that secures the _CBN card to the power supply side panel. Remove the card.
7. Place the replacement _CBN card in position and secure it with the hardware removed in step 6.
8. Reverse steps 1-5 to complete the installation.
9. Perform DC voltage check procedures.

TRIAC AND POWER TRANSISTOR REPLACEMENT

When replacing triacs or power transistors, the following procedure should be performed.

1. Remove power from drive as follows:
   a. Press START switch to stop drive motor and unload heads.
   b. Set MAIN AC circuit breaker to OFF.
   c. Disconnect power cable from site power receptacle.
2. Swing logic chassis open, slide power supply out, and remove power supply top cover.
3. Remove defective triac or power transistor.
4. Apply a coating of silicone grease to mating surfaces of replacement triac or power transistor and power supply (or heat sink in case of power transistor).
5. Install replacement triac or power transistor.

6. Replace cover on power supply and slide power supply into normal position.

7. Close logic chassis and cabinet rear door.

READ/WRITE CHASSIS –XGN CARD REPLACEMENT

The _XGN card is located in read/write chassis location E05. It is mounted on the _XFN card in location E04 (the _XFN card is also referred to as the mother board). Replacing the _XGN card involves removing the read/write chassis from the deck and then removing the _XGN card from its position on the mother board (refer to figure 6-26).

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 6-26):

   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 hardware securing read/write chassis to deck and remove chassis from deck.

5. Remove _XGN card from mother board as follows (refer to figure 6-26):

   a. Remove hardware securing _XGN card to mother board.

CAUTION

Use care not to damage pins.

   b. Pry _XGN card from mother board.

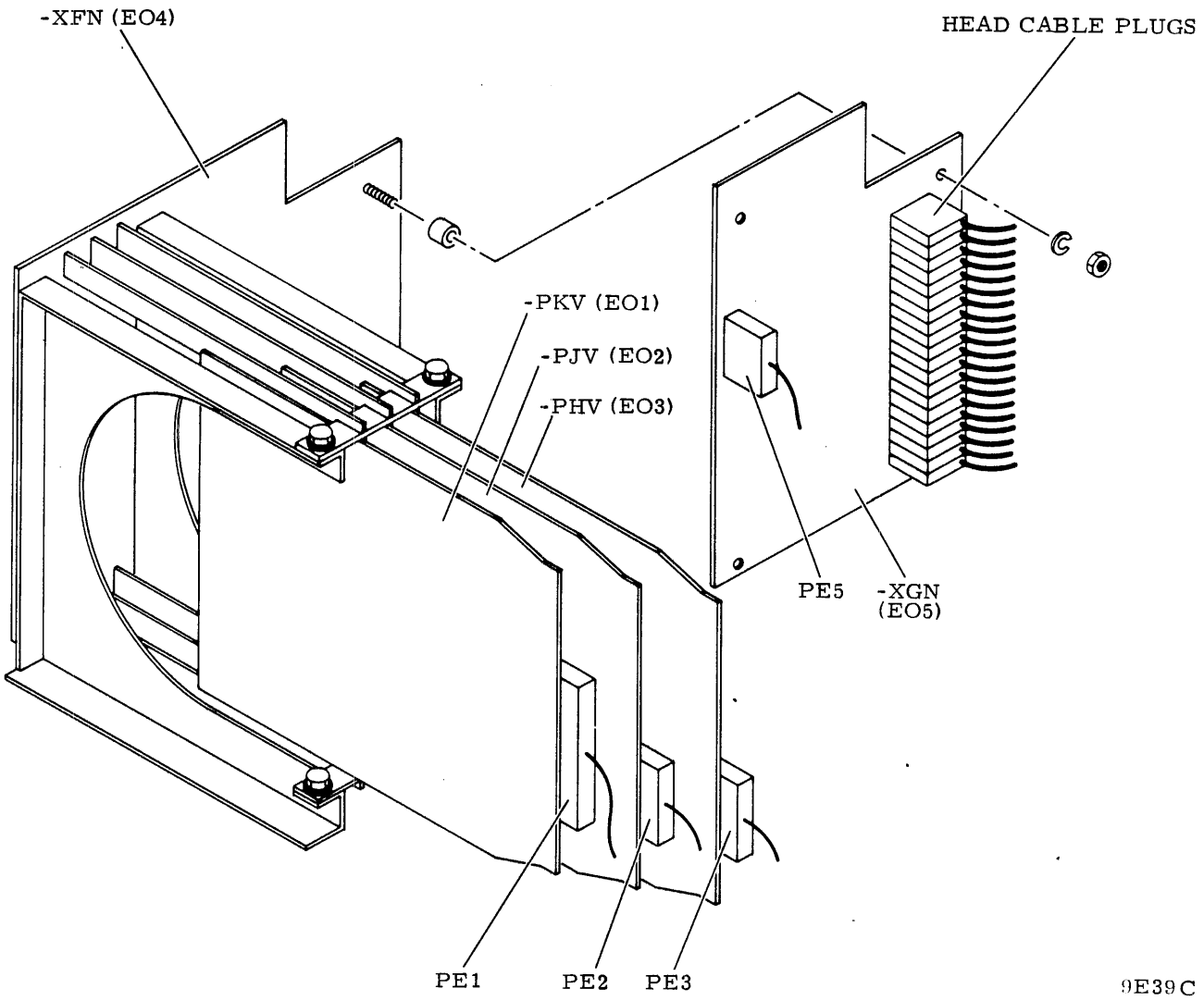


Figure 6-26. Read/Write Chassis Card Replacement

6. Install replacement _XGN card to mother board as follows:

CAUTION

Ensure that all pins go through the proper holes and all pins are straight.

a. Position __XGN card over pins on mother board then press cards together.

b. Secure _XGN card to mother board.

7. Install read/write chassis on deck as follows:

a. Position read/write chassis on deck ensuring that mother board engages the clip on actuator housing.

b. Secure read/write chassis to deck.

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 read 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 hardware (refer to figure 6-26) then set mother board aside.

3. Position replacement mother board on read/write chassis and secure.

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 6-27). Replacing the board involves removing the board from the preamp housing.

1. Remove power to drive as follows:

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

   b. Set MAIN AC circuit breaker to OFF.

2. Remove disk pack.

3. Open cabinet top cover and remove deck cover.

4. Remove Servo Preamp board as follows:

   a. Remove hardware securing servo preamp cover and remove cover.

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

   c. Remove hardware inside preamp housing that secures housing to deck.

   d. Remove hardware 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.

   b. Secure housing to deck.

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

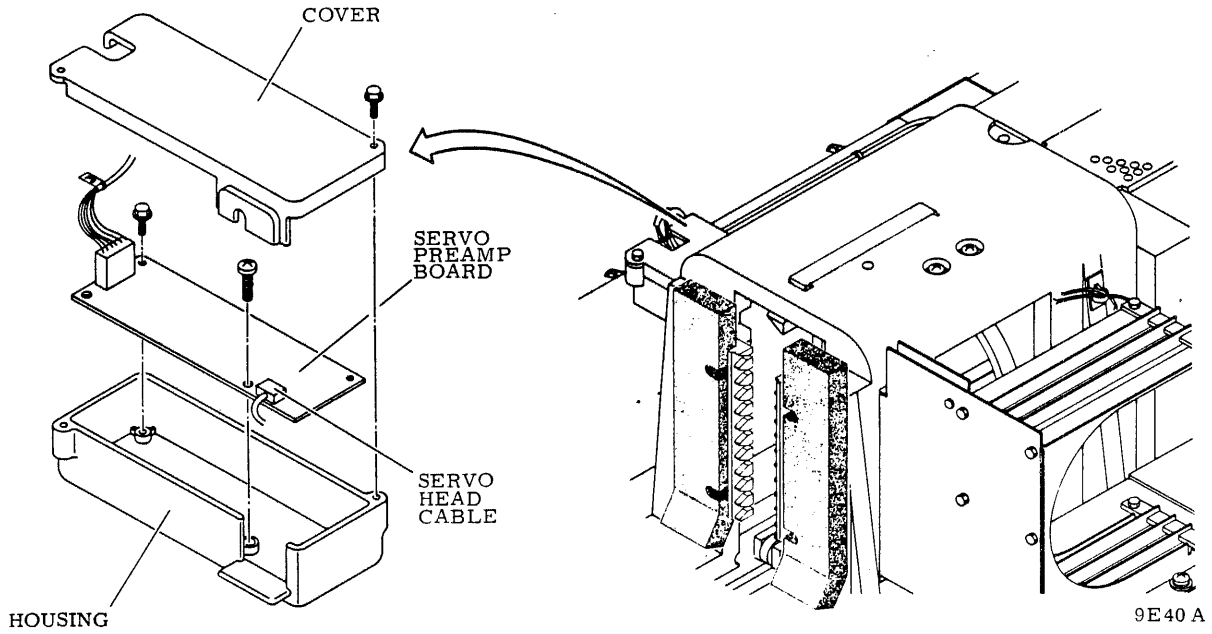


Figure 6-27. Servo Preamp Board Replacement

d. Secure housing cover to housing.

6. Install deck cover and close cabinet top cover.

SPEED SENSOR ASSEMBLY REPLACEMENT

The speed sensor assembly consists of the speed sensor and its mounting bracket and is located on the pack sensor assembly. The following procedure describes speed sensor assembly replacement. Speed sensor adjustment is covered in the Speed Sensor Adjustment procedure.

REPLACEMENT (S/C 08 AND BELOW)

1. Remove power to the drive as follows:

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

   b. Set MAIN AC circuit breaker to OFF.

2. Remove disk pack.

3. Open cabinet front door.

4. Remove blower assembly (refer to Blower Motor Replacement procedure steps 3 and 4).

5. Refer to figure 6-28 and remove speed sensor assembly as follows:

   a. Disconnect speed sensor cable plug A3P3.

   b. Remove hardware securing speed sensor mounting bracket to pack sensor assembly and remove speed sensor assembly.

6. Install replacement speed sensor assembly as follows:

   a. Secure replacement speed sensor assembly to pack sensor assembly.

   b. Connect speed sensor cable plug A3P3.

   c. Secure speed sensor leadwire to speed sensor assembly mounting bracket with two cable ties.

7. Perform Speed Sensor Assembly Adjustment procedure starting with step 4.

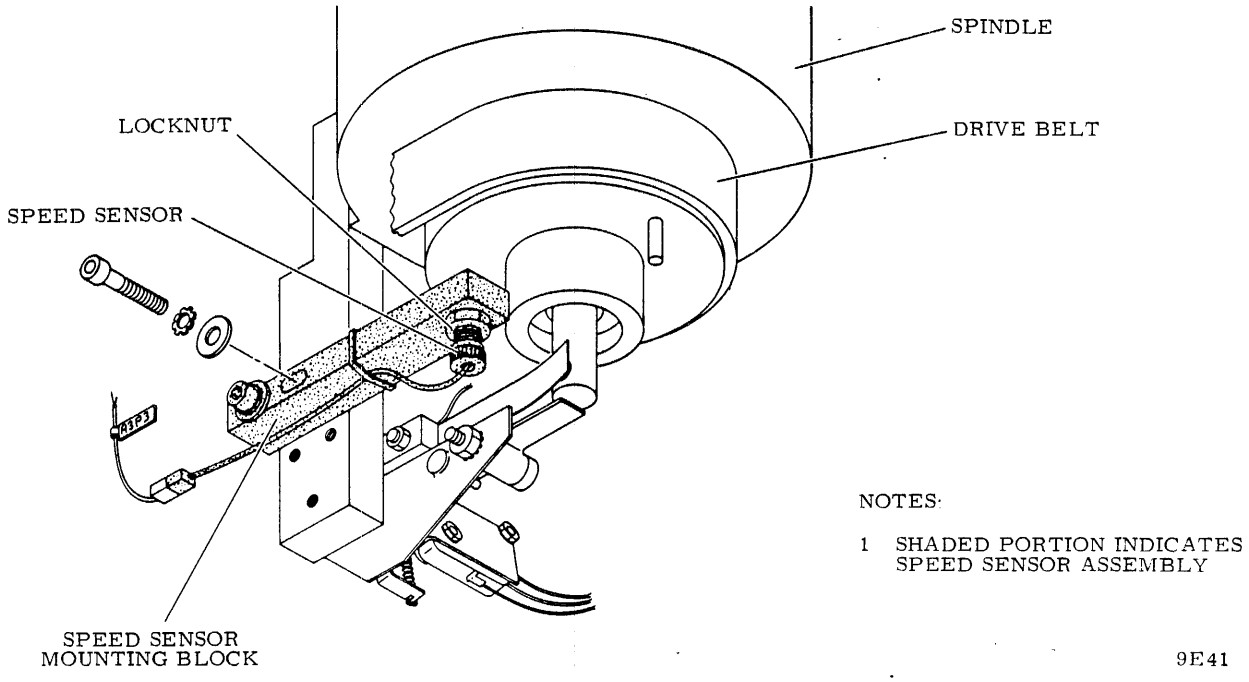


Figure 6-28. Speed Sensor Assembly Replacement (S/C 08 and Below)

REPLACEMENT (S/C 09 AND ABOVE)

1. Remove power to the drive as follows:

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

   b. Set MAIN AC circuit breaker to OFF.

2. Remove disk pack.

3. Open cabinet front door.

4. Remove blower assembly (refer to Blower Motor Replacement procedure steps 3 and 4).

5. Refer to figure 6-29 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.

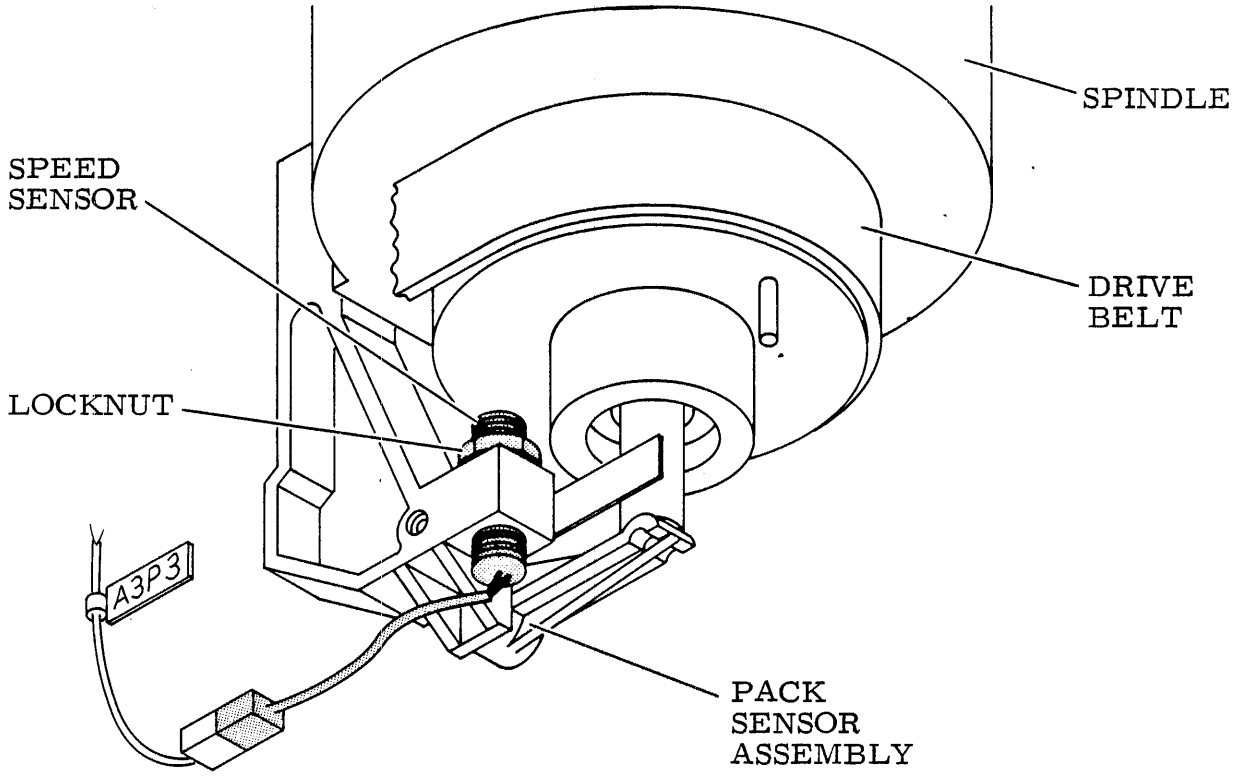
   d. Secure speed sensor leadwire to speed sensor switch base with a tie wrap.

   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 inline with the steel pin on the spindle pulley.



NOTES: 1. SHADED AREAS INDICATE SPEED SENSOR ASSEMBLY.

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Figure 6-29. Speed Sensor Assembly Replacement (S/C 09 and Above)

The gap adjustment is accomplished by turning the speed sensor to achieve a specific distance between the sensor tip and the steel pin in the spindle pulley.

ADJUSTMENT (S/C 08 AND BELOW)

1. Remove power from the drive as follows:

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

   b. Set MAIN AC circuit breaker to OFF.

2. Remove disk pack.

3. Remove blower assembly (refer to Blower Motor Replacement procedure steps 3 and 4).

CAUTION

Ensure that steel pin in pulley does not contact speed sensor. This could happen if speed sensor was significantly out of adjustment as for example, the following replacement.

4. Check lateral alignment of sensor tip and steel pin in spindle pulley as follows:

   a. Rotate spindle until speed pin in bottom of pulley is as close as possible to being centered over sensor tip.

   b. If steel pin will not center over sensor tip (refer to figure 6-28) proceed to step 5. If it is centered as in figure 6-30 proceed to step 6.

5. Adjust lateral alignment as follows (refer to figure 6-30):

   a. Loosen hardware securing sensor mounting bracket to pack sensor assembly.

   b. Move sensor mounting bracket either forward or backward until steel pin can be centered over sensor tip.

   c. Tighten screws in sensor mounting bracket.

   d. Recheck alignment and readjust if necessary.

6. Check gap between steel pin and sensor tip as follows (refer to figure 6-30):

   a. Rotate spindle pulley until steel pin is centered over sensor tip.

   b. Using a non-metallic feeler gauge, check that gap between steel pin and sensor tip is between (0.40 and 0.50 mm (0.016 and 0.022 in).

   c. If gap is not within limits specified go to step 7. If it is within limits proceed to step 8.

7. Adjust gap between steel pin and sensor tip as follows:

   a. Loosen locknut on speed sensor by turning counterclockwise.

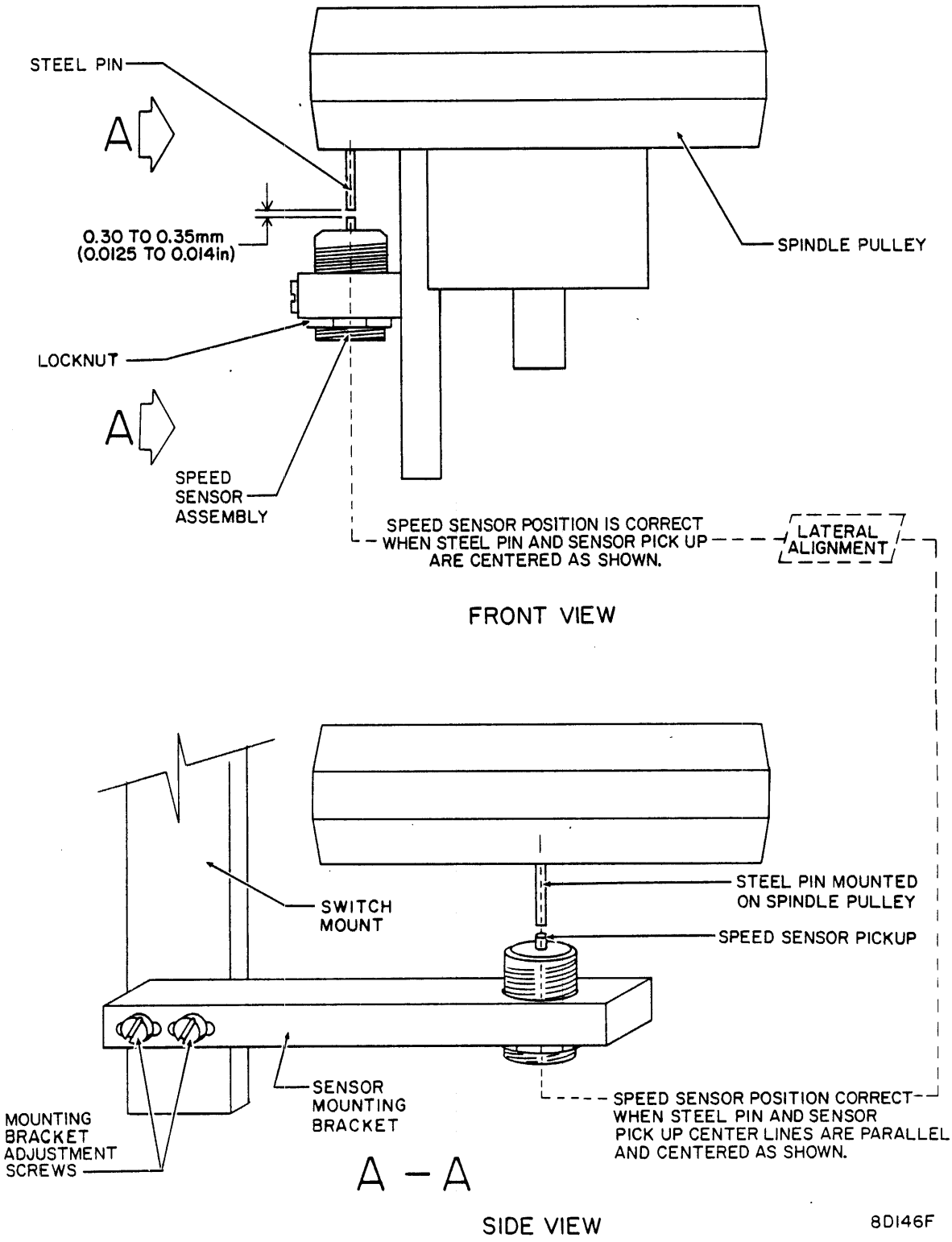


Figure 6-30. Speed Sensor Assembly Adjustment (S/C 08 and Below)

CAUTION

Do not allow sensor tip to contact steel pin in pulley or damage to sensor tip or steel pin will result.

b. Turn sensor clockwise (looking from below) to narrow gap or counterclockwise to widen gap until gap specified in step 6 is obtained.

CAUTION

Do not overtighten speed sensor locknut or damage to speed sensor will result.

c. After adjusting speed sensor for correct gap, hold sensor stationary and tighten locknut.

d. Recheck gap as instructed in step 6.

8. Replace blower assembly (refer to Blower Motor Replacement procedure step 15).

9. Close cabinet front door.

10. Perform Speed Sensor Output Check procedure.

ADJUSTMENT (S/C 09 AND ABOVE)

1. Stop spindle motor.

2. Remove disk pack.

3. Set UNIT POWER circuit breaker to OFF.

4. Use feeler gauge to check that gap between sensor tip and pin is as follows (refer to figure 6-31):

   Non-VDE: 0.152 to 0.254 mm (0.006 to 0.010) in
   VDE: 0.100 to 0.203 mm (0.004 to 0.008) in

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:

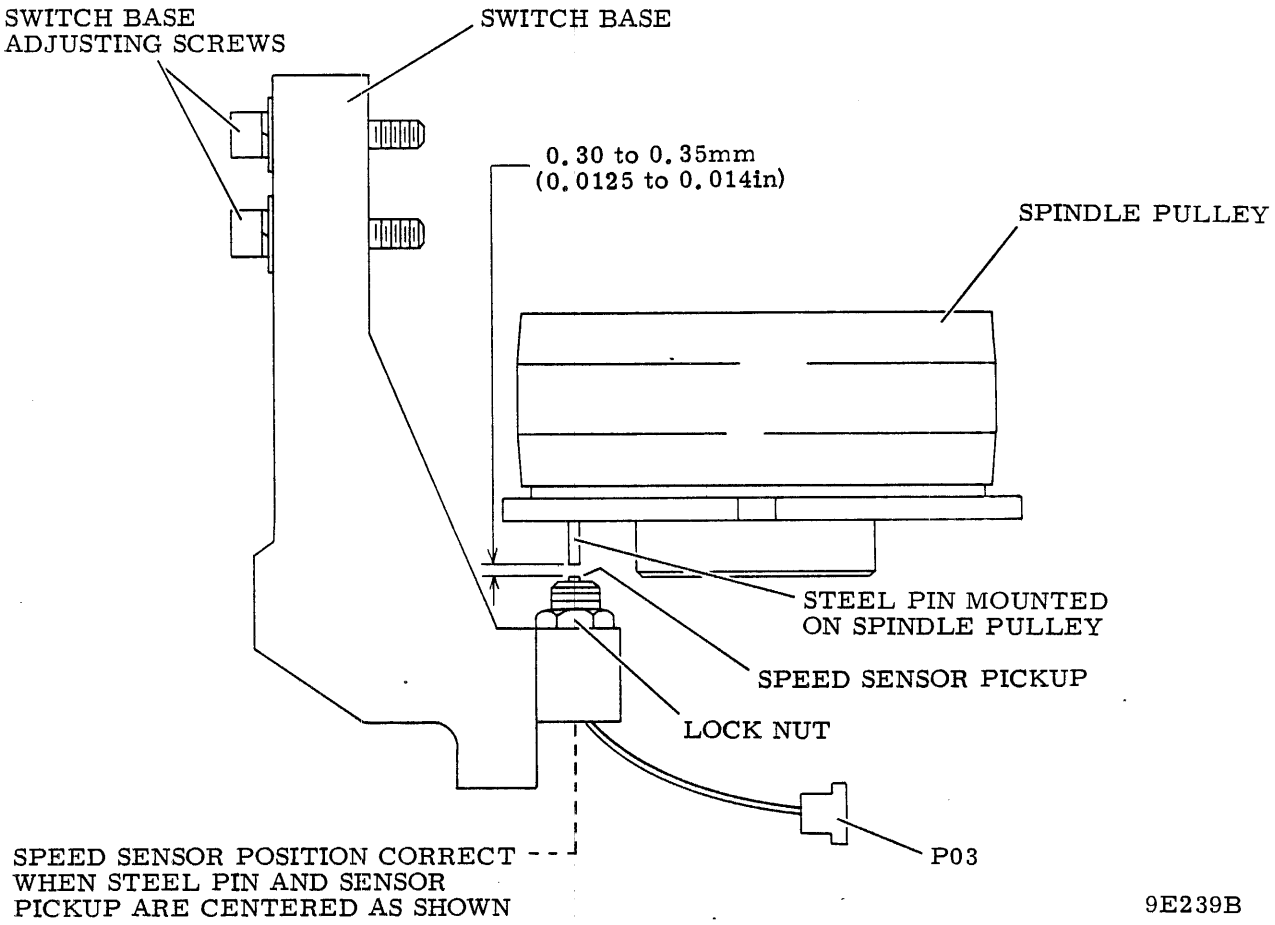


Figure 6-31. Speed Sensor Assembly Adjustment (S/C 09 and Above)

a. Loosen locknut on speed sensor assembly.

b. Adjust sensor assembly (clockwise rotation closes gap, counterclockwise rotation widens gap) to meet the requirements of step 3.

CAUTION

To avoid damage to the plastic threads do not over tighten locknut in next step.

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

d. Recheck dimension of gap.

6. Perform Speed Sensing procedure of Miscellaneous Logic Checkout.

SPINDLE LOCKSHAFT REPLACEMENT

The lockshaft is located within the spindle assembly (refer to figure 6-32); however, the lockshaft is removed without removing the spindle. There is no adjustment for the 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 (S/C 08 AND BELOW)

1. Remove power from drive as follows:

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

   b. Set MAIN AC circuit breaker to OFF.

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

3. Open cabinet front door.

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

5. Remove leadwire to static groundspring.

6. Remove hardware securing groundspring mounting bracket to pack sensor assembly mounting block (refer to figure 6-30), then remove groundspring and mounting block.

7. Loosen pack on switch mounting plate adjustment screw (refer to figure 6-19) and swing mounting plate down so it will not interfere with lockshaft removal.

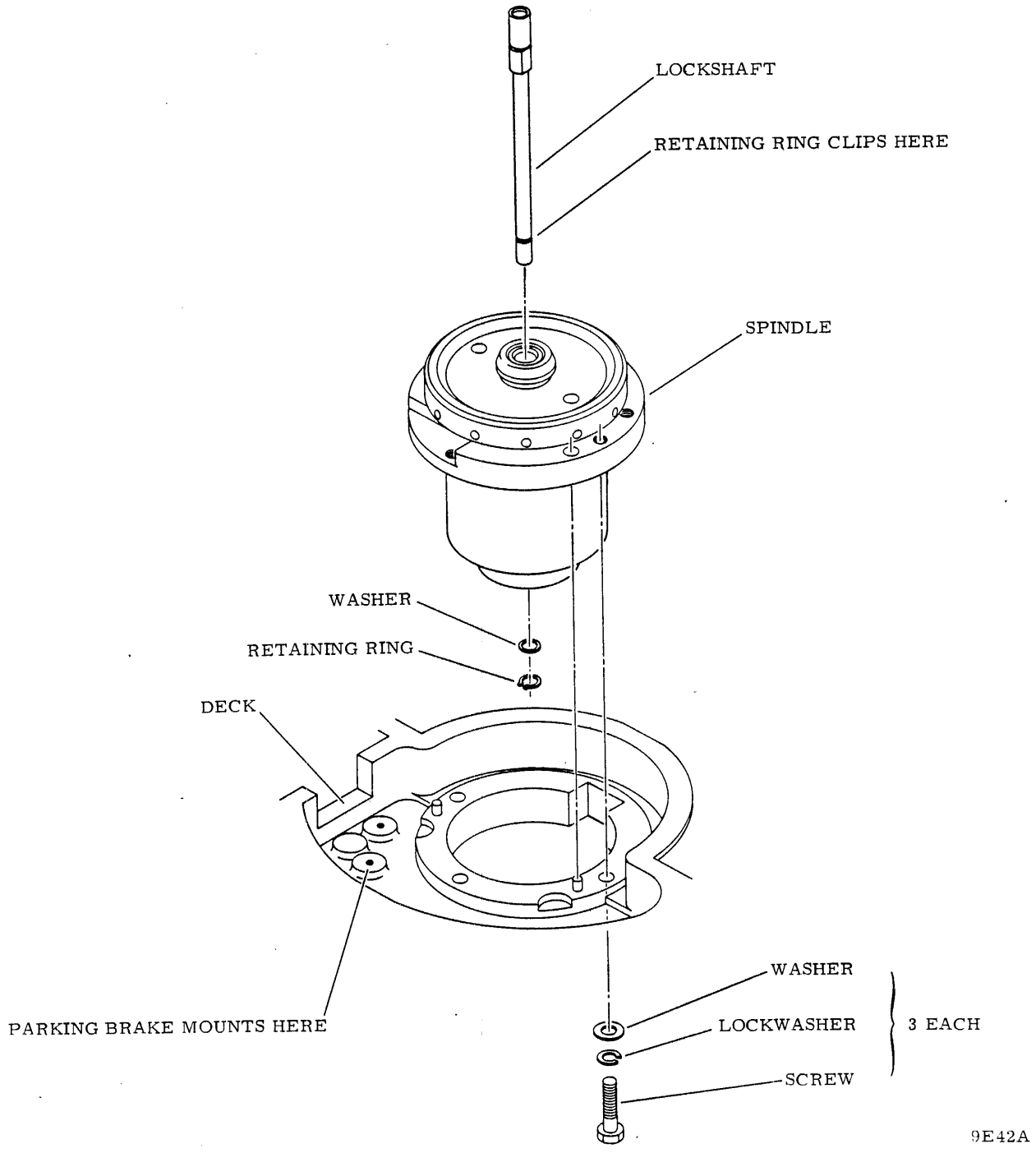


Figure 6-32. Spindle and Lockshaft Replacement

NOTE

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

8. Remove retaining ring and hardware from lower end of lockshaft (refer to figure 6-32).

9. Carefully raise lockshaft out of top of spindle assembly.

10. Lower replacement lockshaft into spindle then push lockshaft down until washer and retaining ring can be snapped into place, thus securing lockshaft in spindle assembly.

CAUTION

Push down on lockshaft making certain that it is free to move downward against internal spring force. Lockshaft must be free and not bind.

11. Position pack on switch mounting plate so that it is approximately in its normal position and tighten adjustment screw (refer to figure 6-19).

12. Position ground spring mounting bracket on pack sensor assembly mounting block, so that contact on end of spring is contacting lockshaft, then loosely secure block with hardware (refer to figure 6-34).

13. Perform pack on switch adjustment procedure steps 4 through 14.

14. Reconnect leadwire to static groundspring.

15. Perform Static Groundspring Adjustment procedure steps 4 and 5.

16. Reinstall blower assembly (refer to Blower Motor Replacement procedure step 15).

17. Close cabinet front door.

CAUTION

When spindle assembly is removed from drive or shipping container, do not allow it to rest on pulley end of assembly. When it must be set down, lay it on its side or on spindle face plate. Improper handling of spindle assembly may cause damage to spindle bearings which could result in premature failure of spindle or even damage to disks and heads.

REPLACEMENT (S/C 09 AND ABOVE)

1. Remove power from drive as follows:

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

   b. Set MAIN AC circuit breaker to OFF.

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

3. Open cabinet front door.

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

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

NOTE

In the following step, do not remove retaining ring securing spring 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 6-32).

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 bind.

9. Reinstall pack sensor assembly (refer to pack sensor assembly replacement).

10. Perform pack on switch adjustment.

11. Reconnect leadwire to static groundspring.

12. Perform Status Groundspring Adjustment procedure steps 4 and 5.

13. Reinstall blower assembly (refer to Blower Motor Replacement procedure step 15).

14. Close cabinet front door.

CAUTION

When spindle assembly is removed from drive or shipping container, do not allow it to rest on pulley end of assembly. When it must be set down, lay it on its side or on spindle face plate. Improper handling of spindle assembly may cause damage to spindle bearings which could result in premature failure of spindle or even damage to disks and heads.

SPINDLE ASSEMBLY REPLACEMENT

The spindle assembly (refer to figure 6-32) includes the spindle, and lockshaft. It is removed from the top of the deck with the pack sensor assembly still attached. The pack sensor assembly is then transferred to the replacement spindle and they are both replaced in the drive. The spindle must be realigned to the carriage following a spindle replacement and this is covered in the Spindle to Carriage Alignment procedure.

1. Remove power from drive as follows:

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

   b. Set MAIN AC circuit breaker to OFF.

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 6-6).

   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 6-23):

   a. Open pack access cover.

   b. Remove hardware securing brake cover to shroud then remove cover and set aside.

   c. Remove hardware securing parking brake assembly to deck casting then remove and set assembly aside.

10. Remove spindle assembly as follows (refer to figure 6-32):

   a. Remove hardware (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 6-19. 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. 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.

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

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

3. Raise top cover, then open pack access cover as far as possible (refer to figure 6-33).

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 6-3):

   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).

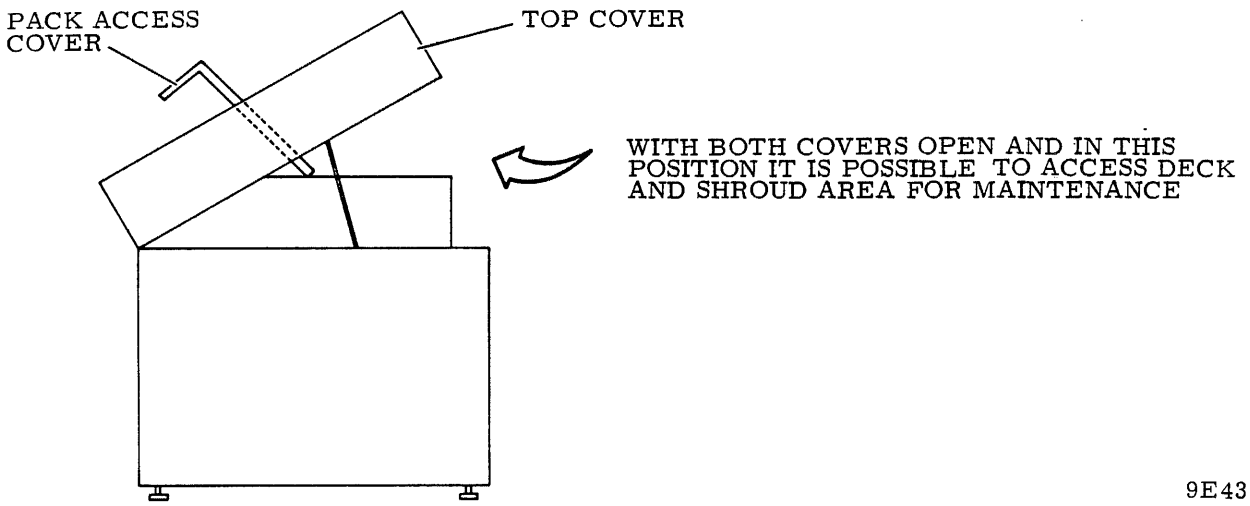


Figure 6-33. Cabinet With Pack Access and Top Covers Open

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 6-3, then torque clamp screw to 0.5 ±0.1 N·m (4 ±0.5 lbf·in).

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

6. Check to see if clearance between carriage alignment arm and spindle post is as specified in figure 6-3. 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 6-33.

8. Unload heads and remove carriage alignment arm.

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

10. Remove hardware securing parking brake cover to shroud and remove cover.

11. Raise top cover so that covers are as shown in figure 6-33.

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

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

14. Loosen hardware securing spindle to deck thus allowing lateral movement of spindle assembly.

NOTE

If specified clearance is obtained in step 15, proceed to step 17. However, if it is too far out of alignment to be adjusted in this manner, it will be necessary to move the actuator housing to obtain the proper clearance. In this case proceed to step 16.

15. Using spindle adjustment tool, move spindle to obtain clearance specified in figure 6-3.

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

    a. Move spindle until dowel pins (refer to figure 6-3) are centered in spindle slots, then tighten screws securing spindle to deck.

    b. Raise top cover so that covers are as shown in figure 6-33.

    c. Unload heads and remove carriage alignment arm.

    d. Close pack access and top covers.

NOTE

Upon completion of step e, spindle to carriage alignment will have been performed. Therefore, do not complete steps 17 through 24 of this procedure.

    e. Perform Actuator Assembly Replacement procedure except that instead of replacing the actuator housing in steps 17, 18, and 19 only loosen the screws securing it to the deck.

NOTE

To gain access to the pack area while the drive is powered down, pull down on the solenoid latch and up on the pack access cover latch release.

17. Open pack access cover and secure spindle by tightening 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 6-33.

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.

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 and this is described in the Static Groundspring Adjustment procedure.

REPLACEMENT (S/C 08 AND BELOW)

1. Remove power from drive as follows:

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

   b. Set MAIN AC circuit breaker to OFF.

2. Remove disk pack.

3. Remove blower assembly. (Refer to Blower Motor Replacement procedure steps 3 and 4).

4. Refer to figure 6-34 and remove static groundspring leadwire from terminal on groundspring.

5. Remove static groundspring from its mounting block and set aside.

6. Install replacement groundspring on static groundspring mounting block.

7. Replace static groundspring leadwire to groundspring terminal.

8. Perform Static Groundspring adjustment procedure starting at step 4.

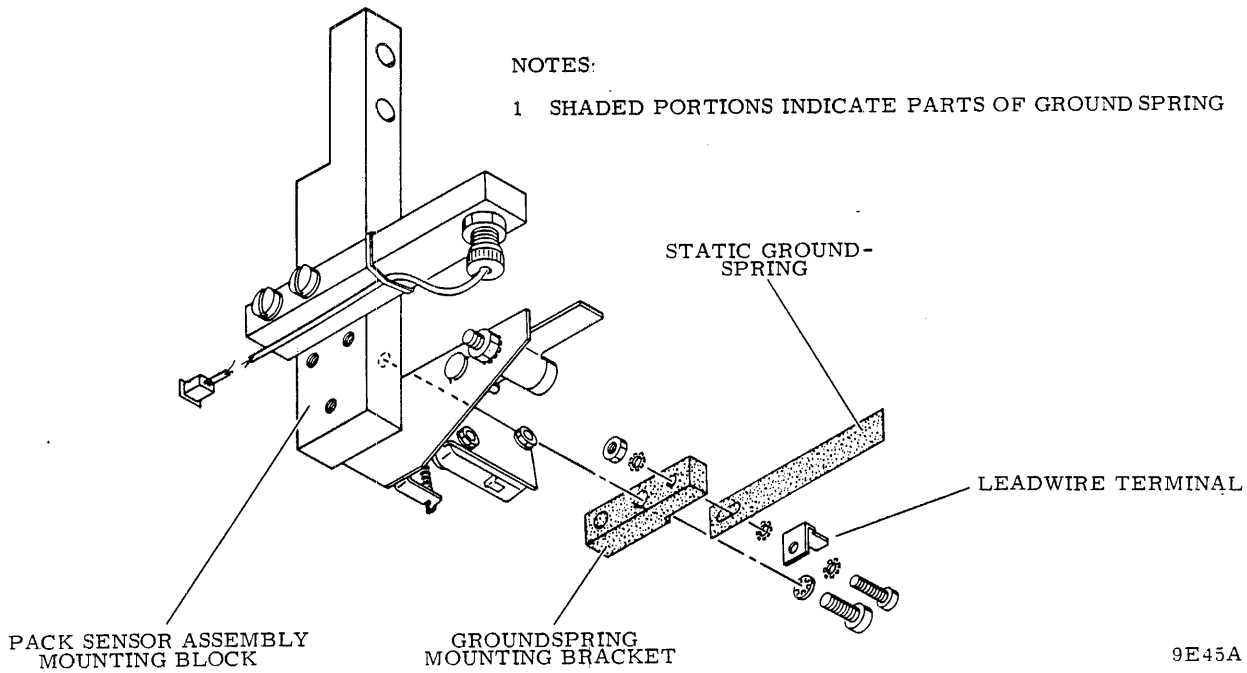


Figure 6-34. Static Groundspring Replacement (S/C 08 and Below)

REPLACEMENT (S/C 09 AND ABOVE)

1. Stop spindle motor.
2. Remove disk pack.
3. Set UNIT POWER circuit breaker to OFF.
4. Refer to Side Panel Removal/Installation procedure and remove left (viewed from front) side panel.
5. Refer to figure 6-35 and remove static groundspring leadwire.
6. Remove hardware and groundspring from switch base bracket.
7. Install replacement groundspring on switch base bracket using screw, lockwasher, and terminal lug.

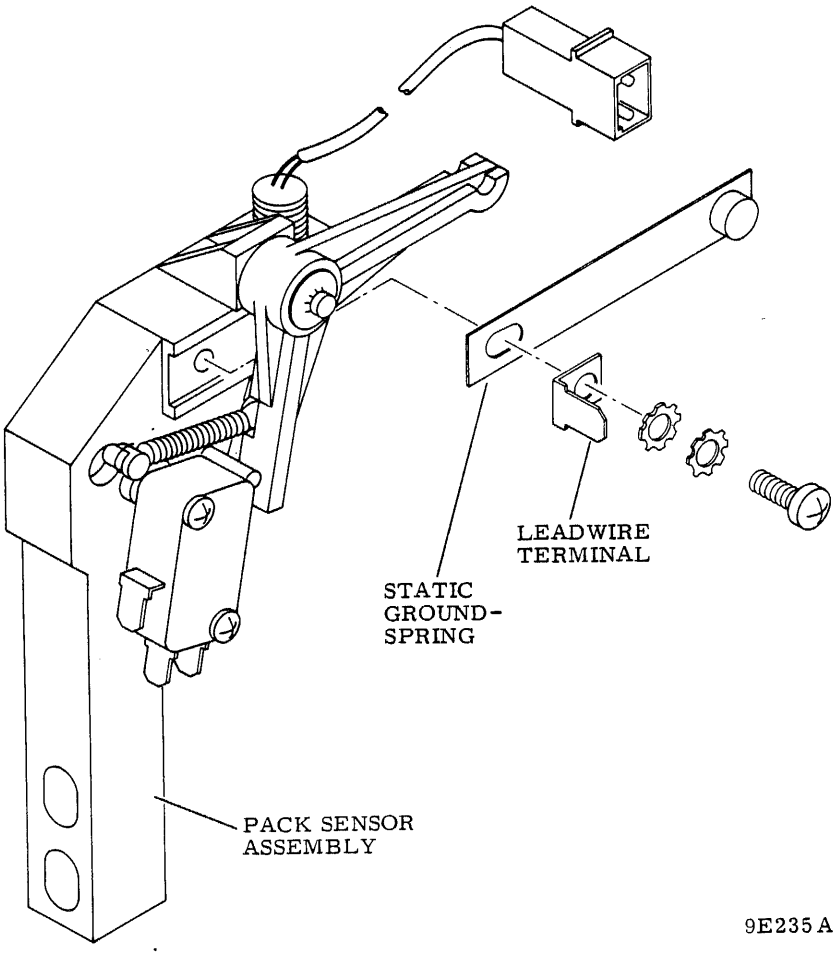


Figure 6-35. Static Groundspring Replacement (S/C 09 and Above)

8. Perform Static Groundspring Adjustment procedure.

9. Connect groundspring leadwire.

10. Install side panel per Side Panel Removal/Installation procedure.

STATIC GROUNDSPRING ADJUSTMENT

This adjustment properly positions the static groundspring in relation to the lockshaft. A check is also made to ensure the groundspring has the correct tension.

ADJUSTMENT (S/C 08 AND BELOW)

1. Remove power from drive as follows:

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

   b. Set MAIN AC circuit breaker to OFF.

2. Remove disk pack.

3. Remove blower assembly (refer to Blower Motor Replacement procedure steps 3 and 4).

4. Refer to figure 6-34 and check that static groundspring is approximately centered vertically and on lockshaft (refer to figure 6-36). If spring is not centered, loosen screw securing spring to its mounting bracket, center spring as required then tighten screw.

5. Check static groundspring tension as follows:

   a. Place 0.05 to 0.10 mm (0.002 to 0.005 in) non-metallic feeler gauge between groundspring and lockshaft.

   b. Hook push pull gauge to outer end of groundspring and note force required to allow feeler gauge to fall free. Force should be from 100 to 150 grams.

   c. If requirements of step b are not met, carefully bend groundspring to adjust tension.

6. Replace blower assembly (refer to Blower Motor Replacement procedure step 15).

7. Close cabinet front door.

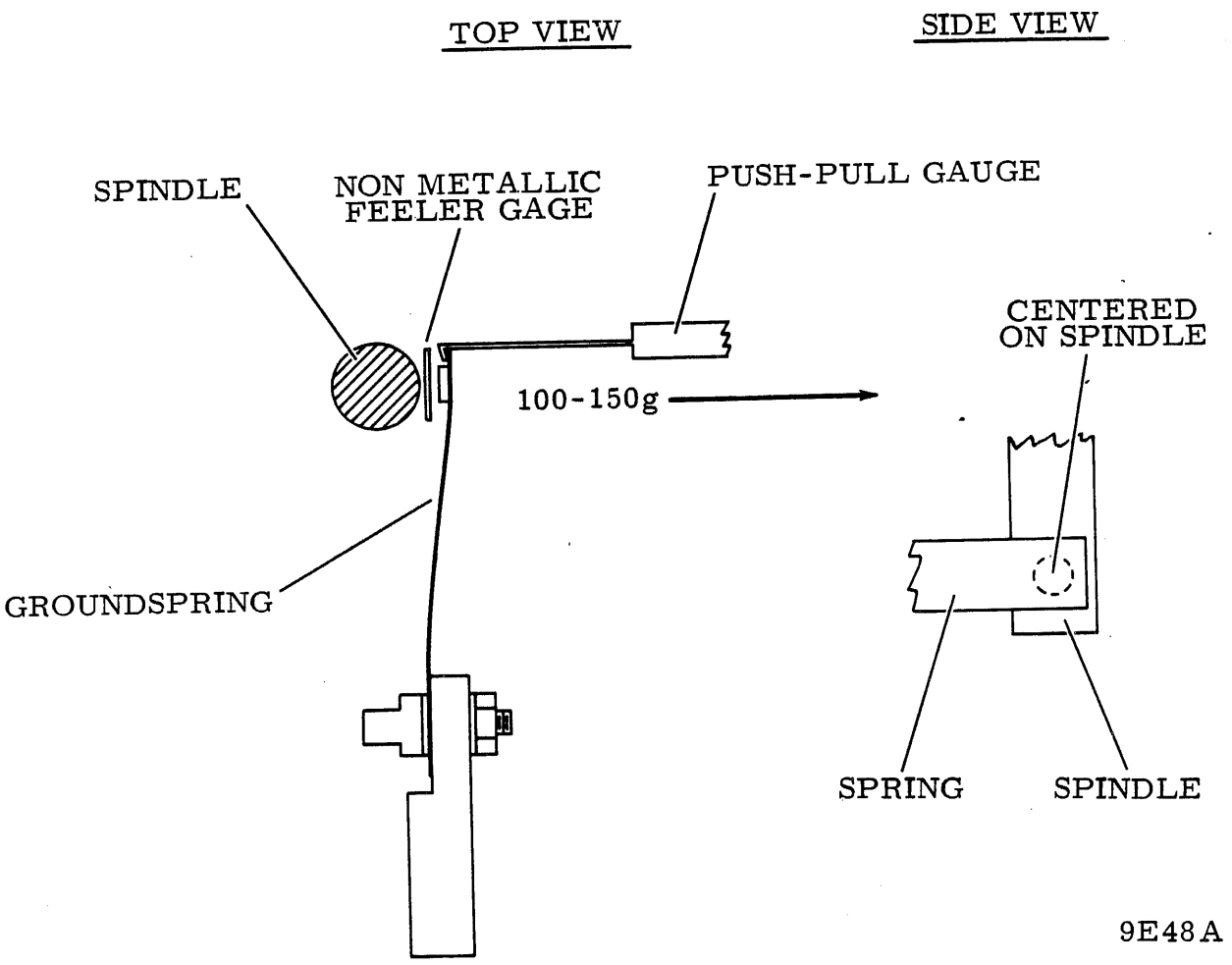


Figure 6-36. Static Groundspring Adjustment

ADJUSTMENT (S/C 09 AND ABOVE)

1. Stop spindle motor.
2. Remove disk pack.
3. Set UNIT POWER circuit breaker to OFF.
4. Refer to Side Panel Removal/Installation procedure and remove left (viewed from front) side panel.
5. Refer to figure 6-35 and visually check that groundspring is approximately centered on lockshaft.
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 ground spring and lockshaft.

8. Hook a push-pull gauge 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 setscrew in switch base bracket for proper spring tension.

11. Install side panel per Side Panel Removal/Installation procedure.

TRIAC AND POWER TRANSISTOR REPLACEMENT

When replacing triacs or power transistors, the following procedure should be performed.

1. Remove power from drive as follows:

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

   b. Set MAIN AC circuit breaker to OFF.

   c. Disconnect power cable from site power receptacle.

2. Swing logic chassis open, slide power supply out, and remove power supply top cover.

3. Remove defective triac or power transistor.

4. Apply a coating of silicone grease to mating surfaces of replacement triac or power transistor and power supply (or heat sink in case of power transistor).

5. Install replacement triac or power transistor.

6. Replace cover on power supply and slide power supply into normal position.

7. Close logic chassis and cabinet rear door.

VELOCITY TRANSDUCER ASSEMBLY REPLACEMENT

The velocity transducer assembly consists of the coil housing, transducer core and the extension rod (refer to figure 6-4).

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

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

3. Open cabinet top cover and remove deck cover.

4. Disconnect yellow voice coil leadwire.

5. Remove transducer coil and core assembly as follows:

   a. Manually move carriage forward until end of extension rod can be unthreaded from carriage (refer to figure 6-4). However, do not remove transducer core and rod until instructed to do so.

   b. Remove Velocity transducer cable plug P4.

   c. Remove hardware securing velocity transducer end cap to magnet and remove end cap.

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

CAUTION

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

6. Carefully remove replacement coil and core from shipping container and set on a non-ferrous surface.

7. Determine which end of replacement transducer core is to be connected to extension rod as follows:

NOTE

Replacement transducer core should have a red dot or stripe at one end indicating that end is the north pole of the core. Therefore, the unmarked end is the core's south pole. The unmarked end (south pole) always connects to the extension rod. Whether or not core has a marked end, always check replacement core to determine polarity.

a. Place end of replacement transducer core (end without red marking if it is marked) next to end of defective transducer core which is connected to extension rod. If cores repel each other, this is the end of replacement transducer core that connects to extension rod. If cores attract each other, opposite end connects to extension rod.

b. After determining which end of replacement transducer core to connect to extension rod, place replacement transducer core on a non-ferrous surface.

CAUTION

Extension rod must be grasped at end nearest transducer core when separating or connecting the two.

8. Carefully unthread extension rod from defective transducer core assembly and set defective transducer core aside.

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.

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. Set MAIN AC circuit breaker to ON.

14. Install scratch disk pack.

15. Ensure velocity transducer output has proper polarity by performing following check.:

a. Open cabinet rear door.

b. Open logic chassis and remove card cover.

c. Connect oscilloscope channel 1 (using 10X probe) to A20 - TPE.

d. Trigger oscilloscope positive internal.

e. Press START switch to start drive motor.

CAUTION

Refer to Manually Positioning Carriage procedure in General Maintenance section (steps 4 and 5) when performing steps f and g.

f. Manually load heads.

g. Manually move carriage in a forward direction and observe that oscilloscope waveform goes in a negative direction. If signal goes positive, transducer core is in backwards. In this case, remove core, turn it end for end and repeat this check.

h. Manually retract heads as instructed in step 7 of Manually Positioning Carriage procedure.

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

16. Set MAIN AC circuit breaker to OFF.

17. Reconnect yellow leadwire to voice coil.

18. Replace deck cover and close top cover.

19. Perform following procedures:

    a. Servo System Adjustments.

    b. Velocity Transducer Gain Uniformity Check.

VOICE COIL FLEX LEAD REPLACEMENT

The voice coil flex leads are attached between the carriage and actuator housing. They consist of flexible copper strips separated by flexible insulators. The following describes replacement and adjustment of the flex leads. Adjustment is required so they do not bind, kink or restrict carriage travel.

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

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

3. Open drive top cover and remove deck cover.

4. Remove connectors from cards E01, E02, and E03 in read/-write chassis, then remove these cards and set a side.

5. Disconnect voice coil leadwires from power amplifier to voice coil flex leads (refer to figure 6-37).

6. Remove voice coil flex lead as follows:

    a. Remove hardware 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 hardware securing number two leadwire, flex leads and backing plate to carriage.

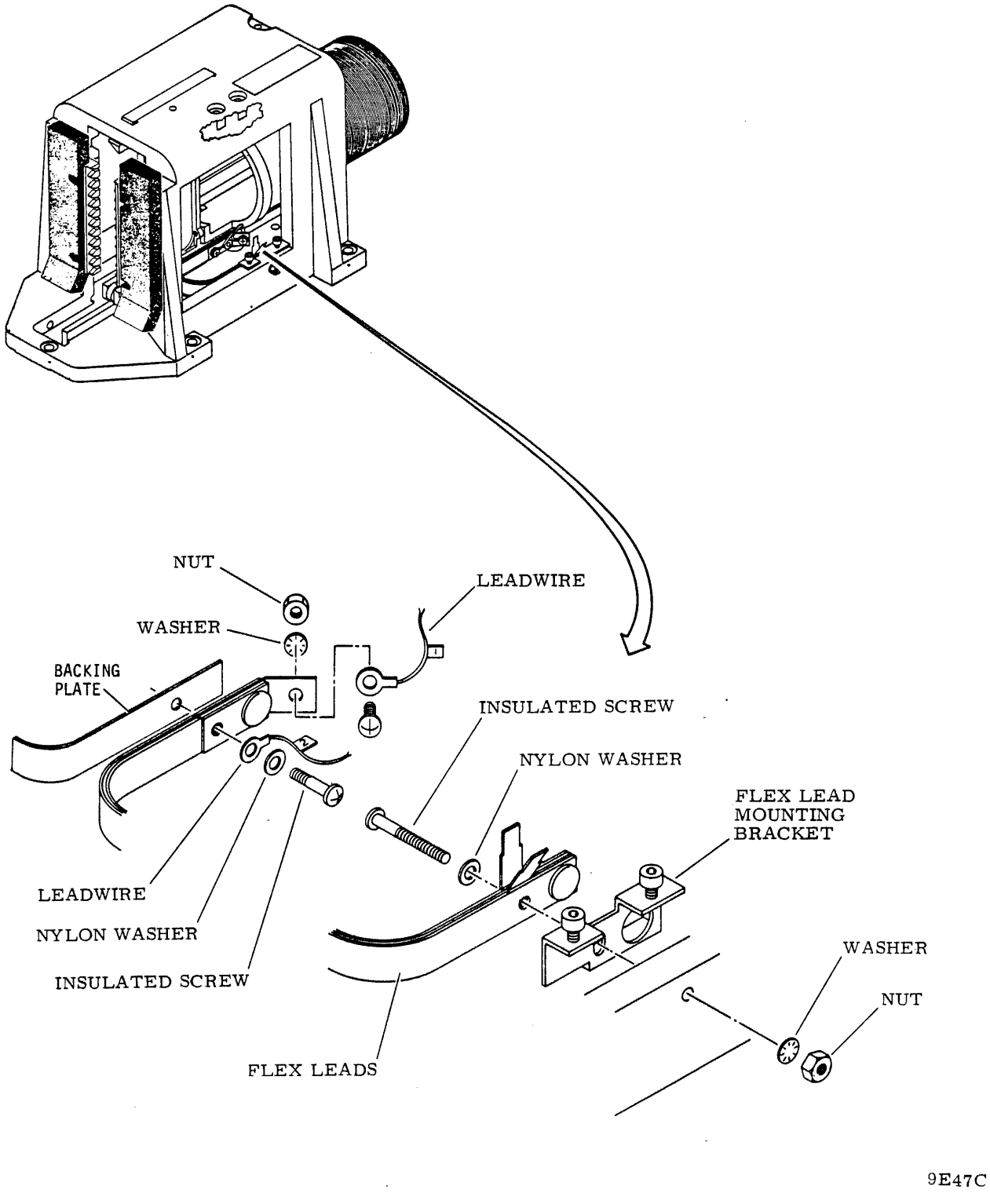


Figure 6-37. Voice Coil Flex Lead Replacement

f. Disconnect number one leadwire from 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 insulation is complete.

7. Install replacement voice coil flex leads as follows:

   a. Position flex leads inside actuator housing as shown in figure 6-37, 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.

   c. Secure number two leadwire, flex lead and backing plate to carriage.

   d. Secure flex lead mounting bracket and flex leads to actuator housing as shown on figure 6-37.

8. Inspect and adjust voice coil flex leads as follows:

   a. Ensure that number one flex lead does not touch carriage casting. If necessary, carefully bend lead until this requirement is met.

   b. Ensure that copper strips are parallel. If necessary, loosen all screws and adjust copper strips until they are parallel.

   c. Check that flex leads travel freely, without linking or interfering with carriage movement, through entire range of travel. If necessary, adjust mounting bracket or flex lead connections.

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.

VOICE COIL REPLACEMENT

The following procedure describes replacement of the voice coil without removing the carriage or heads. Refer to figure 6-2.

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 hardware securing rear deck seal to frame and remove rear deck seal.

b. Loosen hardware 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 hardware securing stop rod plate to stop mount on magnet.

f. Remove hardware (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 the carriage from actuator housing. Removal could cause bearing-to-rail misalignment.

10. Remove hardware securing the voice coil to the carriage. Gently rest the coil on the deck casting.

11. Remove the hardware 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.

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. Position coil on alignment pin and tighten screws in a cross pattern to 1.3 $\pm$0.1 N·m (12 $\pm$1 lbf·in). Avoid any mechanical distortion.

14. Secure number two leadwire, flex lead, and backing plate to carriage.

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.

CAUTION

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

16. Align magnet and voice coil as follows:

    a. Loosely install hardware through top of actuator into magnet assembly.

b. Remove carriage locking pin from alignment hole and place in storage hole.

c. 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.

d. 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 a 0.15 mm (0.005 in) gap exists all around coil.

e. Torque screw through top of actuator, to 6.8 $\pm$ 0.2 N·m (60 $\pm$ 2 in).

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

g. Torque hardware securing magnet to deck to 3.4 $\pm$ 0.1 N·m (30 $\pm$ 1 in).

h. 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. Ensure that stop rods do not rub on stop plates during carriage movement. Torque to 2.0 $\pm$ 0.1 N·m (18 $\pm$ 1 in).

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. 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 7

DIAGRAMS

INTRODUCTION

This section contains diagrams describing all electrical circuitry and wiring contained in the drive. It also contains information concerning the interpretation of the electrical circuit and wiring diagrams. Therefore, the diagrams set actually contains three different types of diagrams: (1) key to logic, (2) logic, cabling, and harnessing schematics and, (3) card interchangeability charts.

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

The card, cabling and harnessing diagrams follow the Key to diagrams and make up the major portion of the diagrams set. The logic diagrams are schematics of the circuit cards used in the drive. The cabling and harnessing diagrams show the wiring that interconnects cards and other circuitry contained in the drive.

Additional information concerning applicability may also be contained on the schematics themselves in the form of notes. This makes it necessary to check carefully for notes (particularly on the cover sheet of the schematics) when using the diagrams to ensure that they are interpreted correctly.

Either of two different power supplies may be installed in the drive. One is VDE approved and the other is not. Notes on the diagrams and other references to Non-VDE/VDE applicability are interpreted as follows:

- Non-VDE: All 60 Hz units. 50 Hz units S/C 31 & below.
- VDE: 50 Hz units only, S/C 32 & Above.

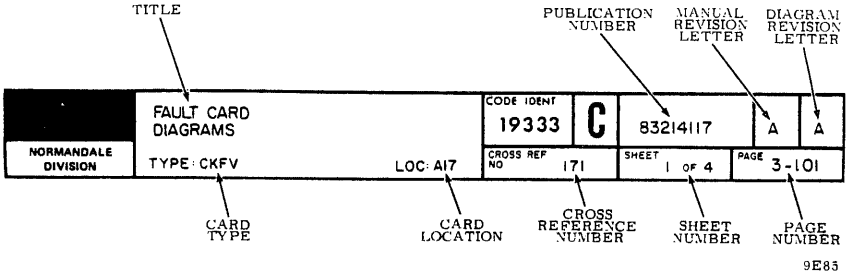


Figure 7-1. Diagram Title Block

Each sheet in the diagrams has a title block containing the information shown on figure 7-1. This information is explained as follows:

- Title - Descriptive of the information contained on that sheet.
- Publication Number - Indicates the publication number of this manual. This location is used on diagrams in lieu of the number usually found at the bottom of each page.
- Manual Revision Letter - Indicates the manual revision level of this sheet and should correspond to that indicated on the revision sheet in the front matter of the manual.
- Diagram Revision Letter - Indicates revision level of this diagram and changes each time the diagram changes due to engineering change order etc.
- Card Type - Indicates the type of card containing the circuitry shown on this diagram. This is included only on the first sheet of each card type but not on diagrams showing key to logic, card interchangeability, cabling or harnessing information.
- Card Location - Applicable only to cards located in the logic or read/write chassis, this number indicates the location of the card within the chassis.

- Cross Reference Number - Each sheet (except those in key to logic or card interchangeability charts) has a unique 3 digit cross reference number. The first two digits of this number indicate physical location of that circuitry within the drive. The last digit pertains to the number of sheets required to show this circuitry.

- Sheet Number - Pertains to the number of sheets required to show this circuitry and should match the last digit of the cross reference number.

- Page Number - Indicates the page number of this sheet within the manual. This number is in lieu of the number usually found at the bottom of each sheet.

Table 7-1 lists the contents of the diagrams set and includes the cross reference number, location and title of each sheet in the set. However, each title and cross reference number is listed only once. This is important to note where several sheets have the same title and cross reference number but contain different information because they apply to different units.

TABLE 7-1. CONTENTS OF DIAGRAMS

Cross Reference Number	Module * Location	Diagrams Title
		Key to Diagrams - Chassis Map
		Key to Diagrams - Configuration
		Key to Diagrams - Intersheet Referencing
		Key to Diagrams - Wirewrap Panel
		Key to Diagrams - Miscellaneous
011	A2A01	XMTRS, RCVERS, ADRS MK DLY DIAGRAMS (Applicable to units W/O Index and Sector in B cable)
012		Transmitters
013		Receivers and Address Mark Delay
011	A2A01	XMTRS, RCVERS, ADRS MK DLY DIAGRAMS (applicable to units W/Index and Sector in B cable)
012		Transmitters
013		Receivers, and Address Mark Delay
021	A2A02	RECEIVERS DIAGRAMS (BJ4A1)
022		Receivers 1
023		Receivers 2

Table Continued on Next Page

TABLE 7-1. CONTENTS OF DIAGRAMS (Contd)

Cross Reference Number	Module * Location	Diagrams Title
021	A2A02	RECEIVERS DIAGRAMS (BJ4A2)
022		Receivers Part 1
023		Receivers Part 2
061	A2A06	ACCESS CONTROL AND INDEX/SECTOR DECODE DIAGRAMS (BJ4A1)
062		Sector/Index Decode
063		Reverse EOT Pulse
064		Reverse EOT Pulse and Max Address Fault
061	A2A06	ACCESS CONTROL AND INDEX/SECTOR DECODE DIAGRAMS (BJ4A2)
062		Sector/Index Decode
063		Reverse EOT Pulse
064		Reverse EOT Pulse and Max Address Fault
071	A2A07	ACCESS CONTROL NO. 1 DIAGRAMS (BJ4A1)
072		Direction Control, Fine Latch, On Cyl and Cyl Pulses
073		Seek FF and Seek Error Detection
074		Servo Fault, Load FF, and RTZ FF

Table Continued on Next Page

TABLE 7-1. CONTENTS OF DIAGRAMS (Contd)

Cross Reference Number	Module * Location	Diagrams Title
071	A2A07	ACCESS CONTROL NO. 1 DIAGRAMS (BJ4A2)
072		Direction Control, Fine Latch, On Cyl and Cyl Pulses
073		Seek FF and Seek Error Detection
074		Servo Fault, Load FF, and RTZ FF
081	A2A08	DIFF BITS, HEAD REG, SPEED ENABLE, UNIT SELECT DIAGRAMS (BJ4A1)
082		Speed Relay and Motor Relay Control. Up To Speed
083		Head Select Register, Unit Select, Xmtr/Rcvr, Seek End Xmtr
084		Difference Bits
081	A2A08	DIFF BITS, HEAD REG, SPEED ENABLE, UNIT SELECT DIAGRAMS (BJ4A2-C,D,N & P)
082		Speed Relay and Motor Relay Control. Up To Speed
083		Head Select Register, Unit Select, Xmtr/Rcver, Seek End Xmtr
084		Difference Bits

Table Continued on Next Page

TABLE 7-1. CONTENTS OF DIAGRAMS (Contd)

Cross Reference Number	Module * Location	Diagrams Title
081	A2A08	DIFF BITS, HEAD REG, SPEED ENABLE, UNIT SELECT DIAGRAMS (All BJ4A2's except 4A2-C,D,N & P)
082		Speed Relay and Motor Relay Control. Up To Speed
083		Head Select Register, Unit Select, Xmtr/Rcver, Seek End Xmtr
084		Difference Bits
101	A2A10	WRITE CLOCK 806 kHz to 9.67 mHz Diagrams
102		Power Input Pins and Unused Logic Elements
103		Sector, Index, Ref and Write PLO Clocks
104		Servo and Read Clocks
121	A2A12	DIFFERENCE GENERATION AND CONTROL DIAGRAMS (BJ4A1)
122		Cylinder Address Register
123		Difference Counter Generation
124		Difference Counter Output

Table Continued on Next Page

TABLE 7-1. CONTENTS OF DIAGRAMS (Contd)

Cross Reference Number	Module * Location	Diagrams Title
121	A2A12	DIFFERENCE GENERATION AND CONTROL DIAGRAMS (BJ4A2)
122		Cylinder Address Register
123		Difference Counter Generation
124		Difference Counter Output
131	A2A13	NRZ TO COMPENSATED MFM DIAGRAMS
132		NRZ To MFM Data Part 1
133		NRZ to MFM Data Part 2
141	A2A14	DATA LATCH DIAGRAMS
142		Analog Data To Read Data
143		Lock To Data and Address Mark Detect
141	A2A14	DATA LATCH DIAGRAMS (BJ4A2C,D)
142		Analog Data To Read Data
143		Lock To Data and Address Mark Detect

Table Continued on Next Page

TABLE 7-1. CONTENTS OF DIAGRAMS (Contd)

Cross Reference Number	Module * Location	Diagrams Title
151	A2A15	READ PLO DIAGRAMS
152		Data Strobe Delay and Read Data Output
153		VCO Output
154		Clock and Data Output
155		Read PLO Timing Diagram
171	A2A17	FAULT CARD DIAGRAMS
172		Fault Latch and Fault Clear
173		Power Up Master Clear, Maint Fault Clear and Voltage Fault Detect
174		Unit Select, LAP, Speed Xdcr, Unit Ready Latch
181	A2A18	FINE SERVO DECODER DIAGRAMS
182		Sensing Dibits and AGC'ed Servo Signal
183		Track Servo Signal and Cyl Detect A and B Part 1
184		Track Servo Signal and Cyl Detect A and B Part 2
185		Track Servo Signal and Cyl Detect A and B Part 3

Table Continued on Next Page

TABLE 7-1. CONTENTS OF DIAGRAMS (Contd)

Cross Reference Number	Module * Location	Diagrams Title
191	A2A19	ACCESS CONTROL NO. 2 DIAGRAMS
192		Write Inhibit, Fwd/Rev EOT Enables, Coarse/Fine Position Signals
193		Fine Enable, Slope Gate, Offset Command Generation
194		Forward/Reverse Offset And Fine Position Signal
201	A2A20	ANALOG SERVO DIAGRAMS (BJ4A1)
202		Cylinder Detect, Velocity, and Velocity Gain Adjust
203		D/A Converter and Desired Velocity Generator
204		Summing Amplifier Output and Drive Current V/C Pwr Amp
201	A2A20	ANALOG SERVO DIAGRAMS (BJ4A2)
202		Cylinder Detect, Velocity, and Velocity Gain Adjust
203		D/A Converter and Desired Velocity Generator
204		Summing Amplifier Output and Drive Current V/C Pwr Amp

Table Continued on Next Page

TABLE 7-1. CONTENTS OF DIAGRAMS (Contd)

Cross Reference Number	Module * Location	Diagrams Title
611	A3E01	R/W CONTROL CABLING AND DIAGRAMS (BJ4A1)
612		Input Power Wiring and Card Voltage Control
613		Read/Write Control
611	A3E01	R/W CONTROL CABLING AND DIAGRAMS (BJ4A2)
612		Input Power Wiring and Card Voltage Control
613		Read/Write Control
621	A3E02	WRITE DRIVER, CARD EDGE CONNECTOR AND CABLING DIAGRAMS (BJ4A1)
622		Write Driver and Write Fault Detect
621	A3E02	WRITE DRIVER, CARD EDGE CONNECTOR AND CABLING DIAGRAMS (BJ4A2)
622		Write Driver and Write Fault Detect
631	A3E03	READ AMPLIFIER AND ADDRESS MARK DETECTION DIAGRAMS
632		Input Voltage Pins and Voltage Regulator
633		Read Amplifier and Address Mark Detection

Table Continued on Next Page

TABLE 7-1. CONTENTS OF DIAGRAMS (Contd)

Cross Reference Number	Module * Location	Diagrams Title
641	A3E04	DIODE MATRIX AND MOTHER BOARD LAYOUT DIAGRAMS
642		Diode Matrix and Mother Board Schematic
651	A3E05	HEAD SELECT BOARD, HEAD PLUG CONNECTORS, CABLING AND CARD LAYOUT DIAGRAMS
652		Unused Logic Elements, Voltage Input Pins, Cabling Information
653		Head Select Decode and Head Bit Enable
654		Head Enables and Multi Head Select
761	A3	TRACK SERVO PREAMP DIAGRAMS
762		Track Servo Preamp Cabling/Plug Connections
763		Track Servo Preamp Schematic
771	A4	A4 - OPERATOR CONTROL PANEL DIAGRAMS (units w/o write protect)
772		Fault Clear and LAP Switches, Fault and Ready Indicators
773		Start Switch/Start Indicator, Start Interlock Reference Schematic

Table Continued on Next Page

TABLE 7-1. CONTENTS OF DIAGRAMS (Contd)

Cross Reference Number	Module * Location	Diagrams Title
771	A4	A4 - OPERATOR CONTROL PANEL DIAGRAMS (units w/write protect)
772		Fault Clear and LAP Switches, Fault and Ready Indicators
773		Start Switch/Start Indicator, Start Interlock Reference Schematic
781	A3	A3 - I/O CABLING (Index and Sector in A cable)
782		I/O Harness Wiring and Tag/Bus Decode
781	A3	A3 - I/O CABLING DIAGRAMS (Index And Sector In B Cable)
782		I/O Harness Wiring and Tag/Bus Decode
791	A3	A3 - MISC DECK WIRING
792		Vel Xdcr, Speed Sensor, S1, S4, S6, L1 and Voice Coil
801	A1	A1 - POWER SUPPLY DIAGRAMS
802		A1 - Power Supply External Cabling
803		AC Power, DC Circuit Breakers and Relays K6, K7, K8

Table Continued on Next Page

TABLE 7-1. CONTENTS OF DIAGRAMS (Contd)

Cross Reference Number	Module * Location	Diagrams Title
803**		AC Power, Motor, Brake, and Local/Remote Switch
804		Drive Motor, Start Triacs and Local/Remote Switch
804**		AC Power DC Circuit Breakers.
805**		Relay Box and Drive Motor Diagrams
811	A1	RELAY BOARD POWER WIRING, COMPONENT LAYOUT, AND CABLING DIAGRAMS (BJ4A2-C,D,N & P) (_YFN)
812		Relay Board Schematic Part 1
813		Relay Board Schematic Part 2
811	A1	RELAY BOARD POWER WIRING, COMPONENT LAYOUT, AND CABLING DIAGRAMS (All units except BJ4A2-C,D,N & P)
812		Relay Board Schematic Part 1
813		Relay Board Schematic Part 2
811**	A1	A1 - RECTIFIER/FILTER BOARD (-CBN)
812**		A1 - Rectifier/Filter Board
821		RECTIFIER AND CAPACITOR BOARD COMPONENT LAYOUT DIAGRAMS (_YEN)

Table Continued on Next Page

TABLE 7-1. CONTENTS OF DIAGRAMS (Contd)

Cross Reference Number	Module * Location	Diagrams Title
822		Recitifier and Capacitor Board
821**		CONTROL BOARD DIAGRAMS (-CFN)
822**		Control Board Part 1
823**		Control Board Part 2
831	A1	VOICE COIL POWER AMP DIAGRAMS (_ZCN)
832		Voice Coil Power Amp
841	A2	A2 - 5 VOLT REGULATOR DIAGRAMS
842		±5 Volt Regulators, PC Board and AIP3
843		-5 Volt Regulator Schematic
844		+5 Volt Regulator Schematic
851**	A4	RELAY BOARD DIAGRAMS (_FNN)
852**		Relay Board

* 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).

** Applicable to VDE units only.

REVISION STATUS OF SHEETS

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

REVISIONS

REV.	ECO.	DESCRIPTION	DRFT.	DATE	CHK'D
A	PE23000	RELEASE	GR		
B		TECH. CHANGES	SB	10/19/76	
C	PE22842	SCHEMATIC CORRECTION	GR	1-10-77	
D		EDITORIAL	MA	5-20-77	
E	PE55259	LOGIC DIA IMPROVEMENT	GR	10 4 78	
F	OH13266-B	INC. VDE P.S.	M R B	5-10-83	

DRAWN	G. RABINE	7/21/76	NORMANDALE DIVISION	STORAGE MODULE DRIVE KEY TO LOGIC DIAGRAM	CODE IDENT 19333	C	83319100 AJ
CHECKED					CROSS REF NO		SHEET 1 OF 6 PAGE 7-17
ENGINEER							
APPROVED							REF 83214100

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	NOT USED	
A04	NOT USED	
A05	NOT USED	
A06	ACCESS CNTL, INDEX/SECTOR DECODE 061-065	_LTV
A07	ACCESS CNTL NO. 1 071-074	_LVV
A08	DIFF BITS, HD REG, SPEED, UNIT SEL 081-084	_QPV
A09	NOT USED	
A10	WRT CLK 101-103	_LSV
A11	NOT USED	
A12	DIFF GEN AND CNTL 121-124	_LWV
A13	NRZ TO MFM 131-133	_LXV
A14	DATA LATCH 141-142	_LRV
A15	READ PLO 151-155	_LZV
A16	(4)	
A17	FAULT CARD 171-174	_KFV

LOGIC CHASSIS

A18	FINE SERVO DECODE 181-184	_FRV
A19	ACCESS CONTROL NO. 2 191-194	_KGV
A20	ANALOG SERVO 201-205	_MSV

(1) READ/WRT CHASSIS

E01	RD/WRT CNTL 611-613	_PKV
E02	WRT DRVR 621-622	_PJV
E03	RD AMPLIFIER 631-635	_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 (5)

RELAY BOARD 811-813	_YFN
CAPACITOR BOARD 821-822	_YEN
POWER AMP 831-832	_ZCN

LOGIC CHASSIS

(2)	±5 VOLT REGULATOR 841-843	

POWER SUPPLY (6)

RECTIFIER FILTER BOARD 811-812	_CBN
CONTROL BOARD 821-823	_CFN
POWER AMP 831-832	_ZCN
RELAY BOARD 851-852	_FNN

NOTES:

(1) LOCATED ON DECK

(2) PLUGS INTO A2PD94 FROM CARD SIDE OF LOGIC CHASSIS

3. FOR SPECIFIC CARD TYPE REFER TO CARD INTERCHANGEABILITY CHART AT BACK OF DIAGRAM SET

(4) RESERVED FOR HEAD ALIGNMENT CARD

(5) NON-VDE POWER SUPPLY

(6) VDE POWER SUPPLY

NORMANDALE DIVISION	CHASSIS MAP	CODE IDENT 19333	C	83319100	AT
		CROSS REF NO		SHEET 2	PAGE 7-18

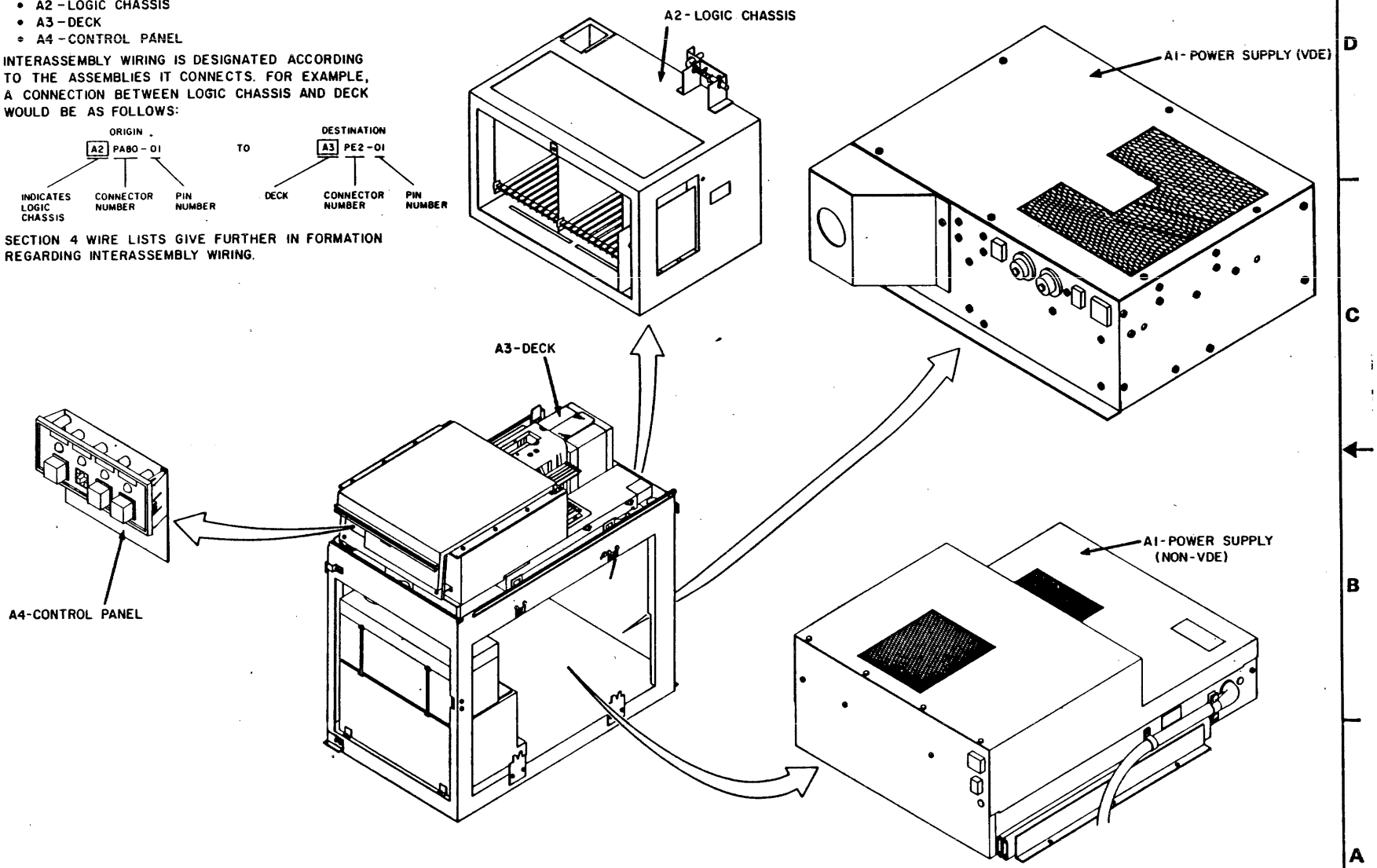
2. CONFIGURATION

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:

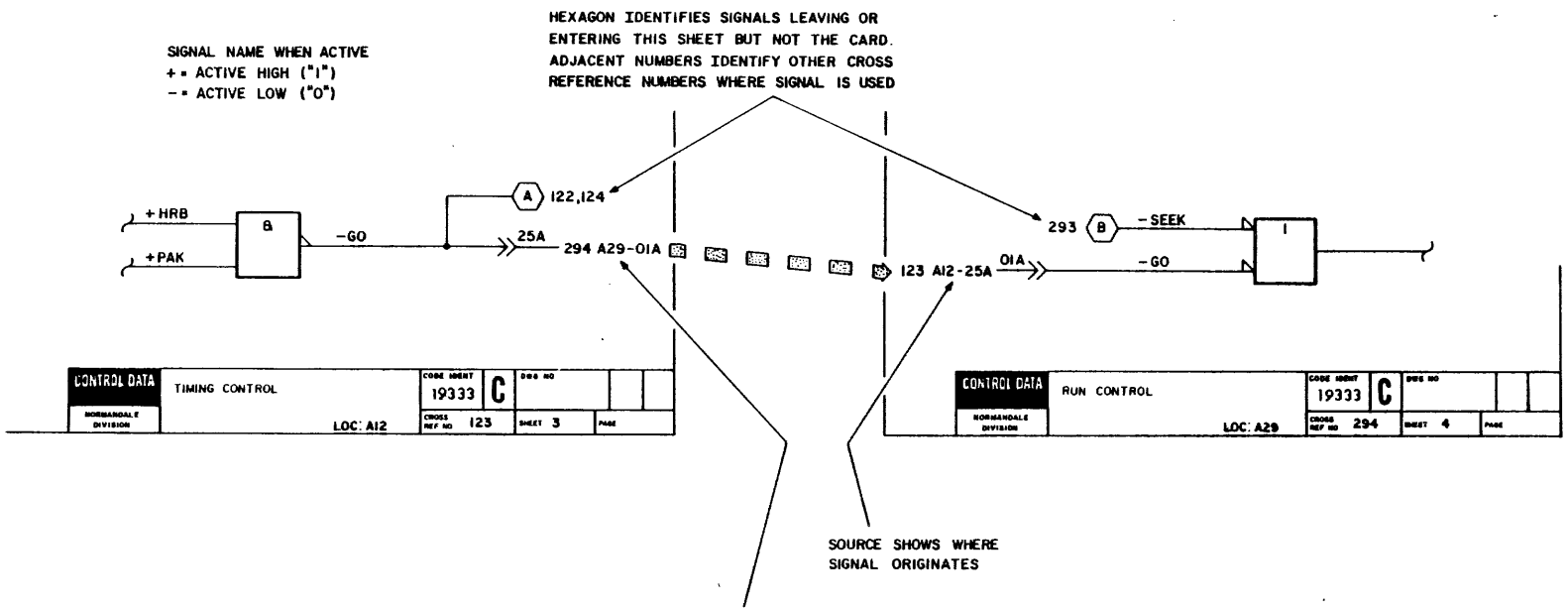
SECTION 4 WIRE LISTS GIVE FURTHER IN FORMATION REGARDING INTERASSEMBLY WIRING.



NORMANDALE DIVISION	CONFIGURATION	CODE IDENT 19333	C	83322450	AJ F
		CROSS REF NO		SHEET 3	PAG 7-19

3. INTERSHEET REFERENCING

THE FOLLOWING EXPLAINS THE BASIC METHOD OF INTER-SHEET REFERENCING.



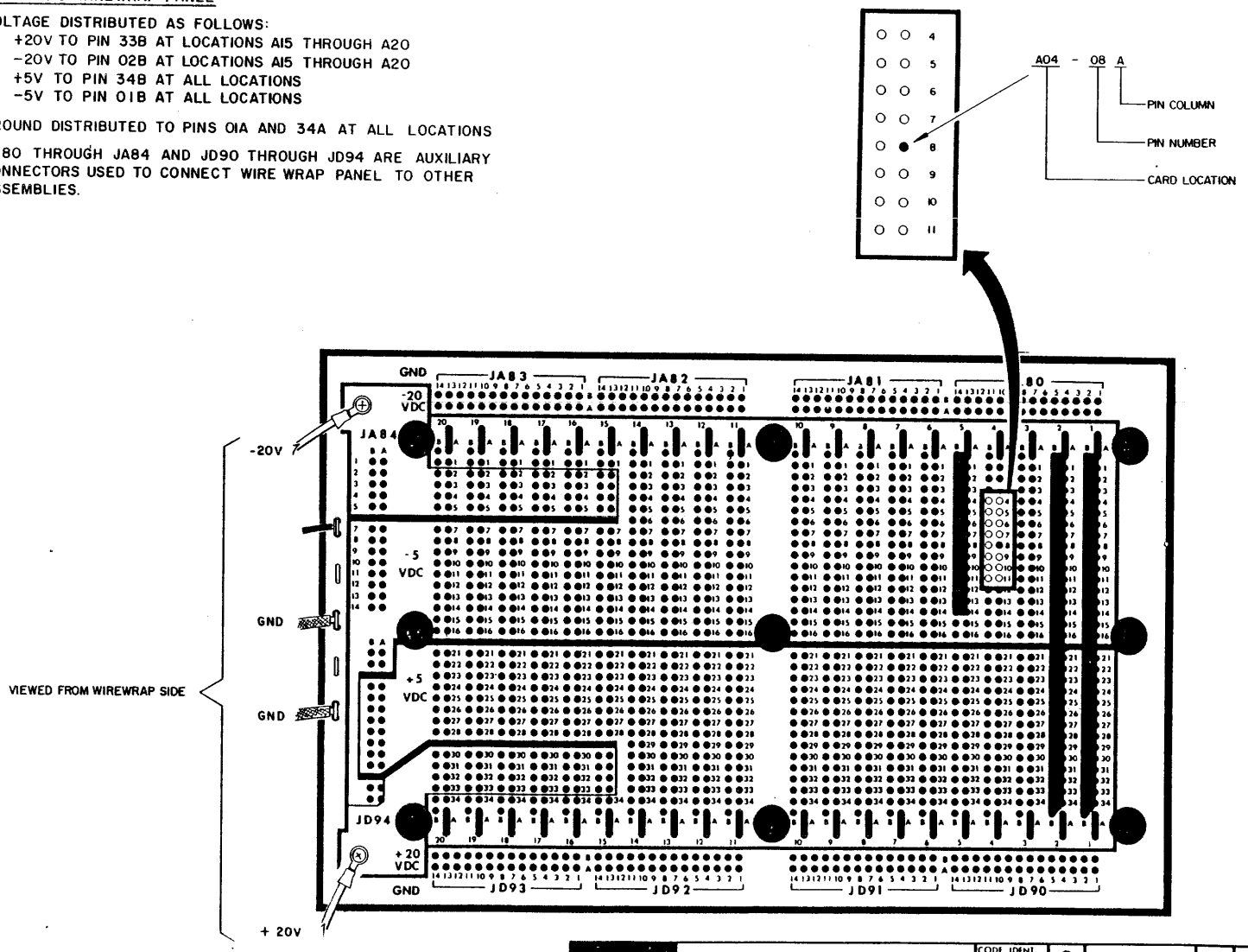
DESTINATIONS SHOW ALL LOCATIONS WHERE OUTPUT SIGNALS GO WITHOUT REGARD TO ACTUAL BACKPANEL WIRE ROUTING, IN THE EXAMPLE SHOWN IT IS AS FOLLOWS:

294 A29 - 01A

- 294 — CROSS REFERENCE NUMBER
- A29 — CARD LOCATION
- 01A — PIN NUMBER

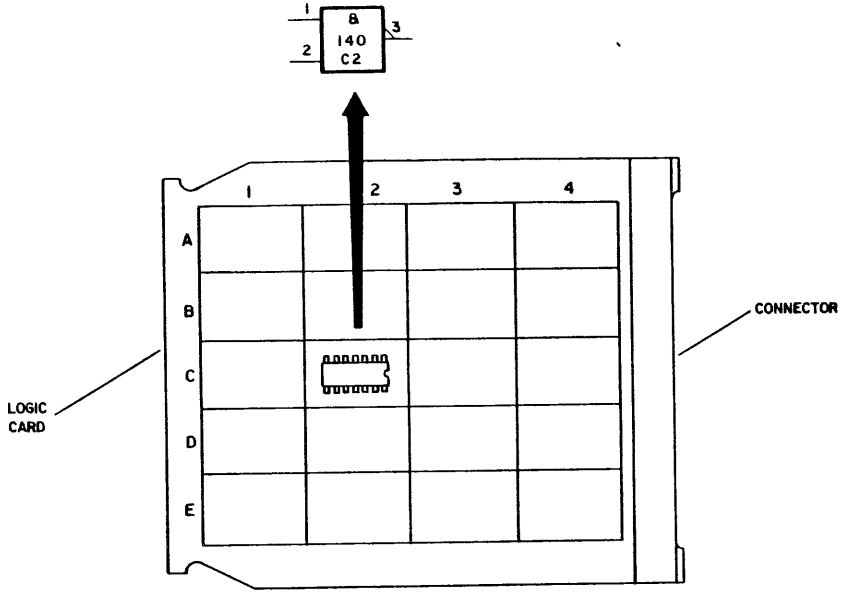
4. LOGIC CHASSIS WIREWRAP PANEL

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.



TWIN CITIES DISK DIVISION	WIREWRAP PANEL	CODE IDENT 19333	C	83319100	AP A
		CROSS REF NO		SHEET 5	PAGE 7-21

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.

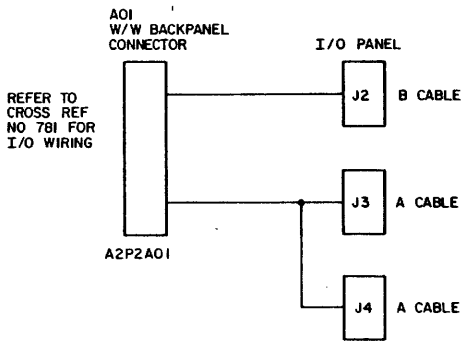
10. CIRCUIT DESCRIPTIONS

DESCRIPTIONS OF ALL DISCRETE AND INTEGRATED CIRCUITS ARE FOUND IN THE NORMANDALE CIRCUITS MANUAL.

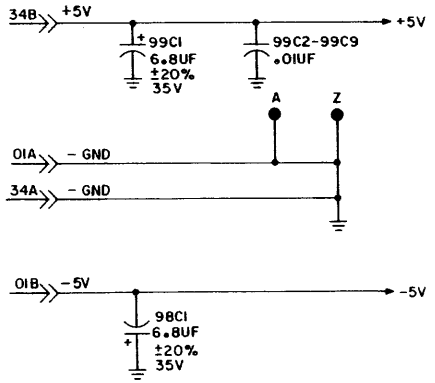
REVISIONS					
REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23100	RELEASED	MLA	1-13-76	
B	PE22842	SCHEMATIC CORRECTION	MA	12-28-76	
C		EDITORIAL	MA	5-20-77	
D	PE55259	LOGIC DIA IMPROVEMENT	GR	10 4 78	
E	PE57173	CHG IC FAMILIES	CB	3-16-82	
F	DJ00669	CHG FTVV IC CAPS	JL	10-9-84	
G	DJ00824	ADD JUMPER WIRE	DHS	4-12-85	

NOTE:

⚠1 ADD JUMPER WIRE

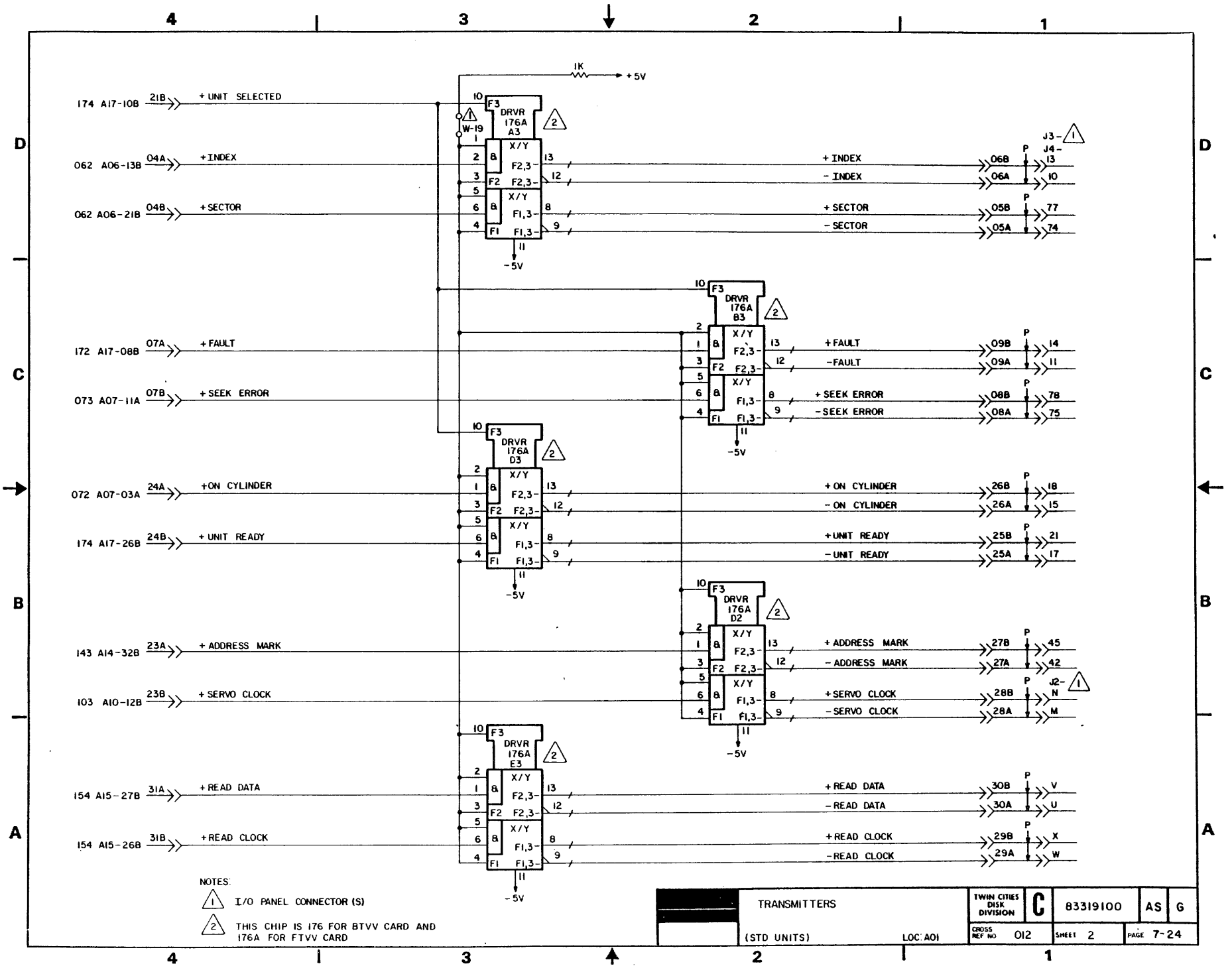


CABLING FROM A01 W/W PINS TO I/O PANEL



APPLICABLE ONLY TO UNITS WITHOUT
INDEX AND SECTOR IN B CABLE OPTION

DRAWN	M.ANDERSON	1-13-76	XMTRS, RCVRS, ADRS MRK DLY DIAGRAMS	TWIN CITIES DISK DIVISION	C	83319100	AS	G
CHECKED								
ENGINEER			TYPE BTVV / FTVV LOC A01	CROSS REF NO	011	SHEET 1 OF 3	PAGE	7 - 23
APPROVED						REF 83214101		

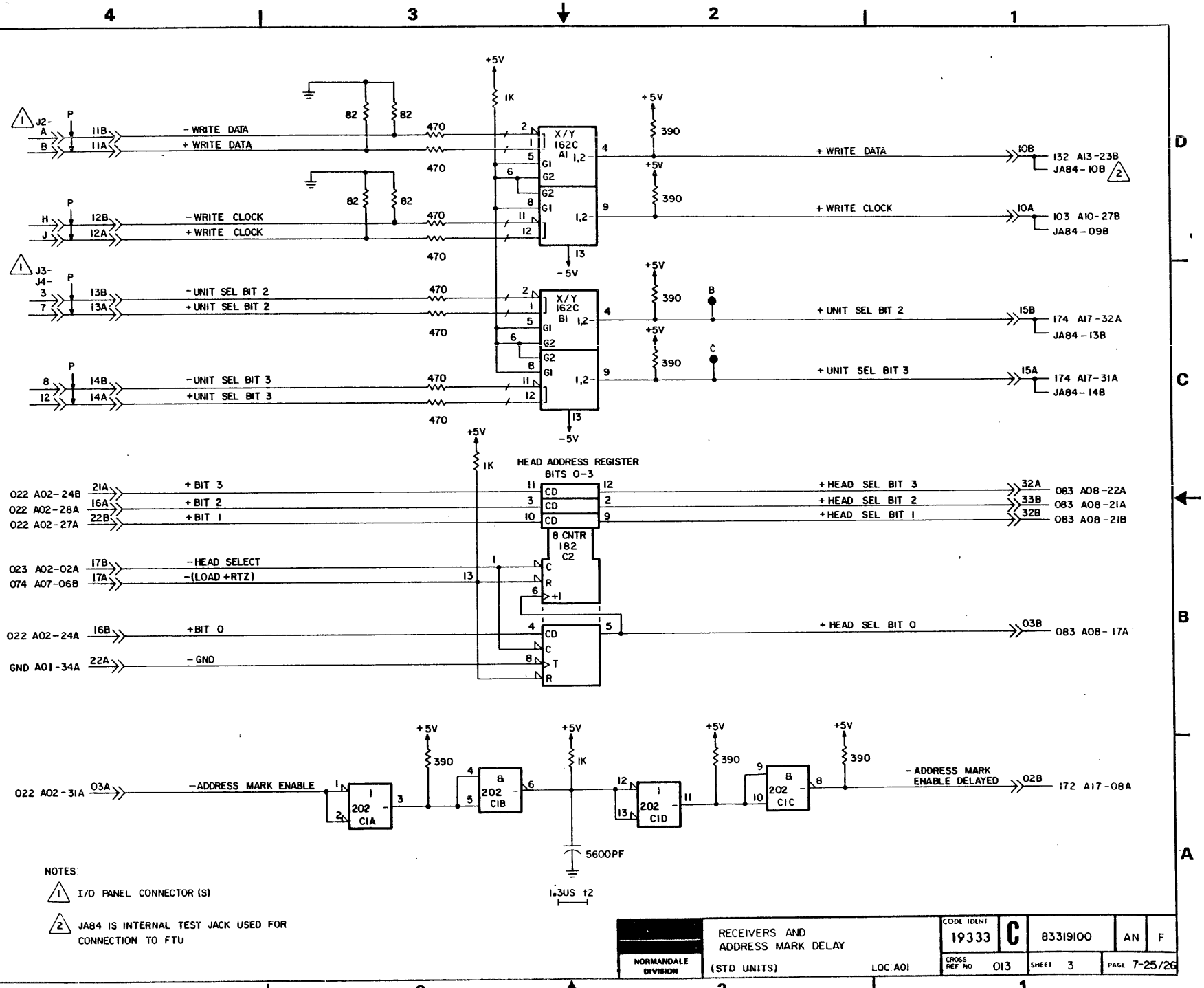


TRANSMITTERS

(STD UNITS) LOC: A01

TWIN CITIES DISK DIVISION | C | 83319100 | AS | G

CROSS REF NO 012 | SHEET 2 | PAGE 7-24



NOTES:

1. I/O PANEL CONNECTOR (S)
2. JA84 IS INTERNAL TEST JACK USED FOR CONNECTION TO FTU

NORMANDALE DIVISION	RECEIVERS AND ADDRESS MARK DELAY (STD UNITS) LOC A01	CODE IDENT 19333	C	83319100	AN F
		CROSS REF NO 013	SHEET 3	PAGE 7-25/26	

REVISION STATUS OF SHEETS

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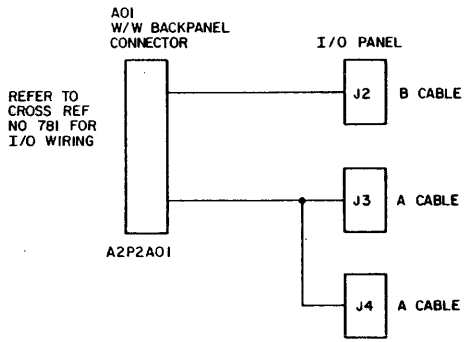
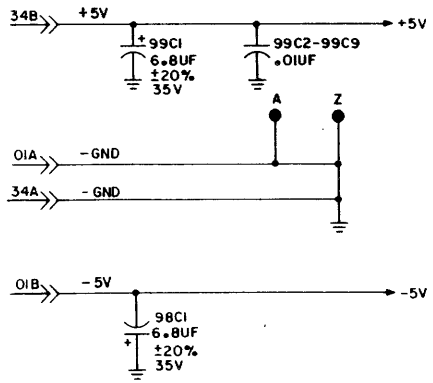
B	A	B																	
C	A	C																	
D	A	C																	
E	E	E																	

REVISIONS

REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE [illegible]	RELEASE	MA	1-13-76	
B	PE22805	TECHNICAL CHANGES	MA	12-28-76	
C	PE22842	SCHEMATIC CORRECTIONS	MA	12-28-76	
D		EDITORIAL	MA	5-20-77	
E	PE55259	LOGIC DIA IMPROVEMENT	GR	10-4-78	



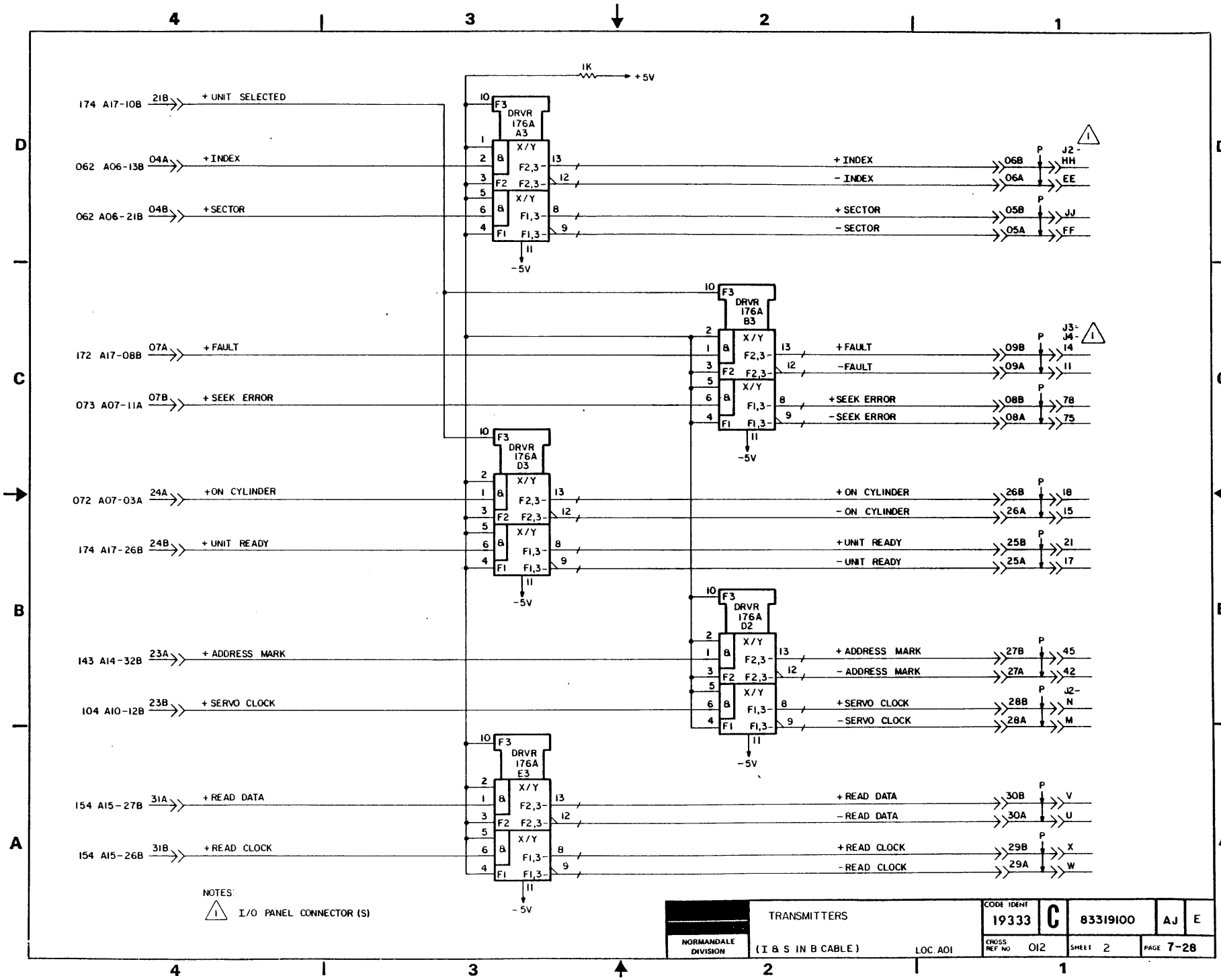
CABLING FROM A01 W/W PINS TO I/O PANEL

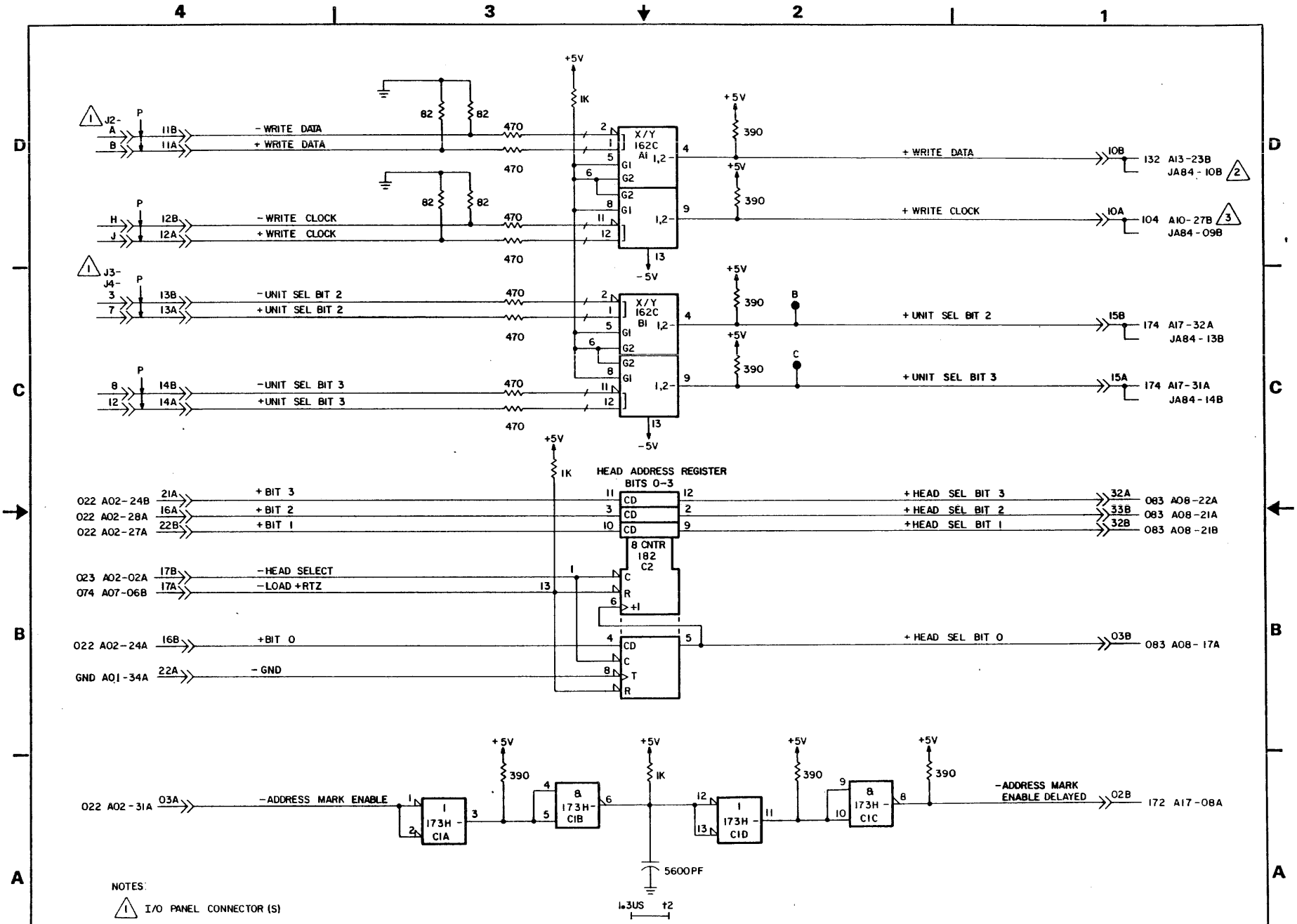


APPLICABLE ONLY TO UNITS WITH INDEX AND SECTOR IN B CABLE OPTION

DRAWN	M.ANDERSON	1-13-76	NORMANDALE DIVISION	XMTRS, RCVRS, ADRS MK DLY DIAGRAMS	CODE IDENT 19333	C	DWG NO 83319100 AJ E
CHECKED							
ENGINEER				TYPE GTVV LOC A01	CROSS REF NO 011	SHEET 1 OF 3	PAGE 7-27
APPROVED							

REF 83214185


1K
+5V
174 A17-10B
21B
+ UNIT SELECTED
062 A06-13B
04A
+INDEX
062 A06-21B
04B
+SECTOR
172 A17-08B
07A
+FAULT
073 A07-11A
07B
+SEEK ERROR
072 A07-03A
24A
+ON CYLINDER
174 A17-26B
24B
+ UNIT READY
143 A14-32B
23A
+ ADDRESS MARK
104 A10-12B
23B
+ SERVO CLOCK
154 A15-27B
31A
+ READ DATA
154 A15-26B
31B
+ READ CLOCK
DRVR 176A A3
DRVR 176A B3
DRVR 176A D3
DRVR 176A D2
DRVR 176A E3
-5V
+INDEX
-INDEX
+SECTOR
-SECTOR
+FAULT
-FAULT
+SEEK ERROR
-SEEK ERROR
+ON CYLINDER
-ON CYLINDER
+UNIT READY
-UNIT READY
+ADDRESS MARK
-ADDRESS MARK
+SERVO CLOCK
-SERVO CLOCK
+READ DATA
-READ DATA
+READ CLOCK
-READ CLOCK
J2-HH
J2-EE
J2-JJ
J2-FF
J3-J4-14
J3-J4-11
J3-J4-78
J3-J4-75
J3-J4-18
J3-J4-15
J3-J4-21
J3-J4-17
J3-J4-45
J3-J4-42
J2-N
J2-M
J3-J4-V
J3-J4-U
J3-J4-X
J3-J4-W
NOTES:
1 I/O PANEL CONNECTOR (S)
NORMANDALE DIVISION
TRANSMITTERS
(I & S IN B CABLE)
LOC AOI
CODE IDENT 19333
C
83319100
AJ
E
CROSS REF NO 012
SHEET 2
PAGE 7-28



NOTES:

1. I/O PANEL CONNECTOR (S)
2. JA84 IS INTERNAL TEST JACK USED FOR CONNECTION TO FTU
3. AI3-10B ON BJ4A2C,D UNITS

NORMANDALE DIVISION	RECEIVERS AND ADDRESS MARK DELAY (I & S IN B CABLE) LOC A01	CODE IDENT 19333	C	83319100	AJ E
		CROSS REF NO 013	SHEET 3	PAGE 7-29/30	

REVISION STATUS OF SHEETS

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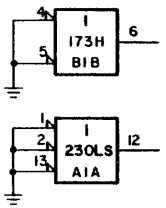
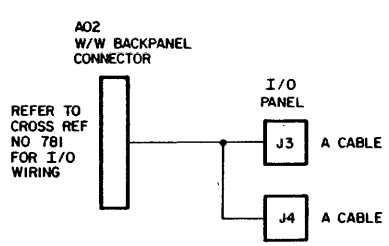
B	B	B																	
C	B	B																	
D	B	D																	
E	E	E																	

UNUSED LOGIC ELEMENTS

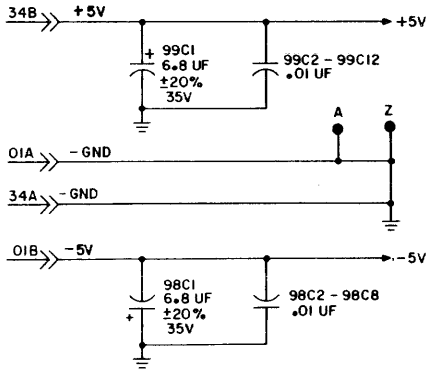


REVISIONS

REV.	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA	2-15-76	
B	PE22842	SCHEMATIC CORRECTIONS	MA	12-28-76	
C	PE	EDITORIAL	MA	5-20-77	
D	PE22926	ERROR CORRECTION	DM	7-26-77	
E	PE55259	LOGIC DIA IMPROVEMENT	GR	10 4 78	



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



APPLICABLE ONLY TO BJ4AI

DRAWN	G RABIJE	1-15-75
CHECKED		
ENGINEER		
APPROVED		

NORMANDALE DIVISION

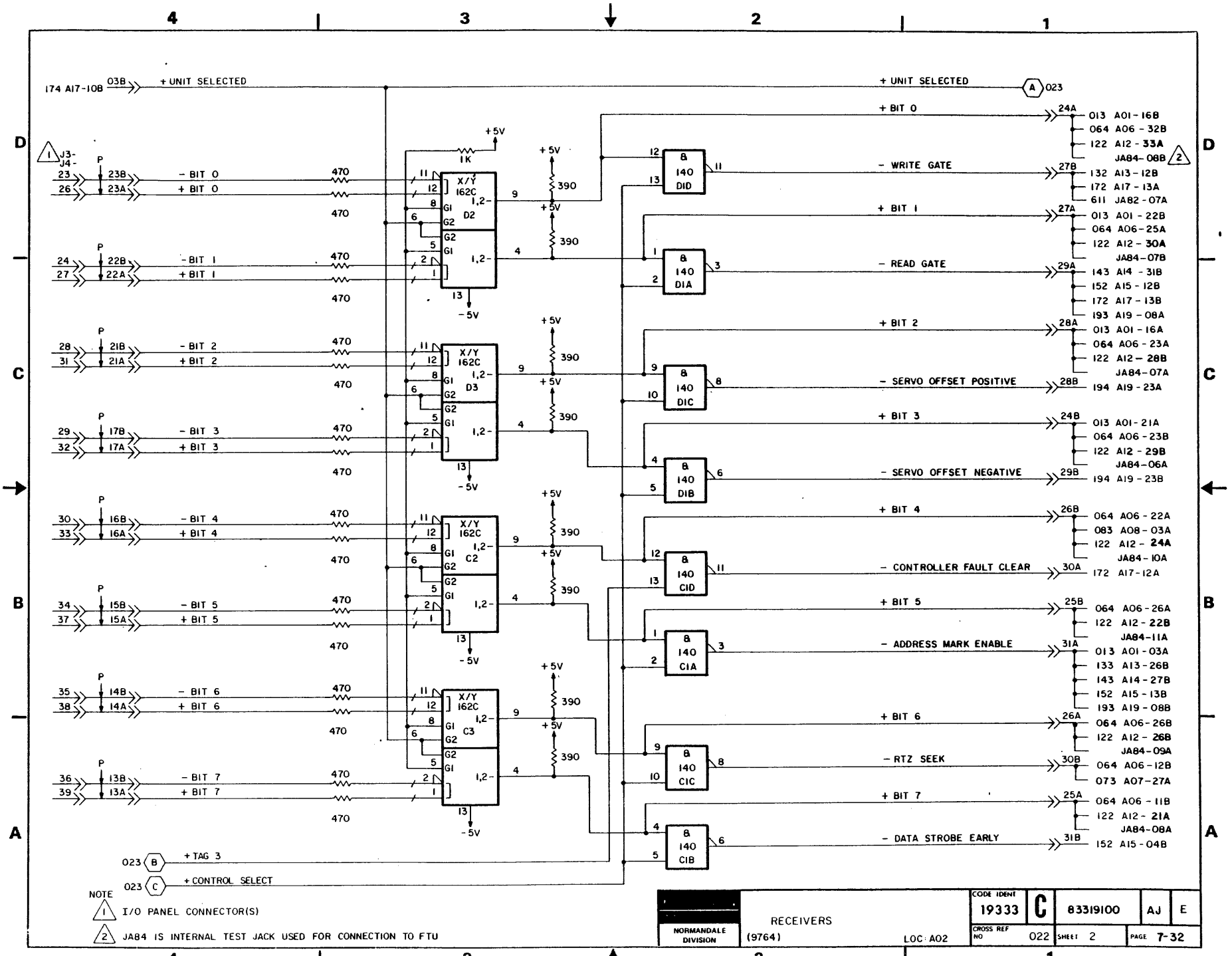
RECEIVERS DIAGRAMS

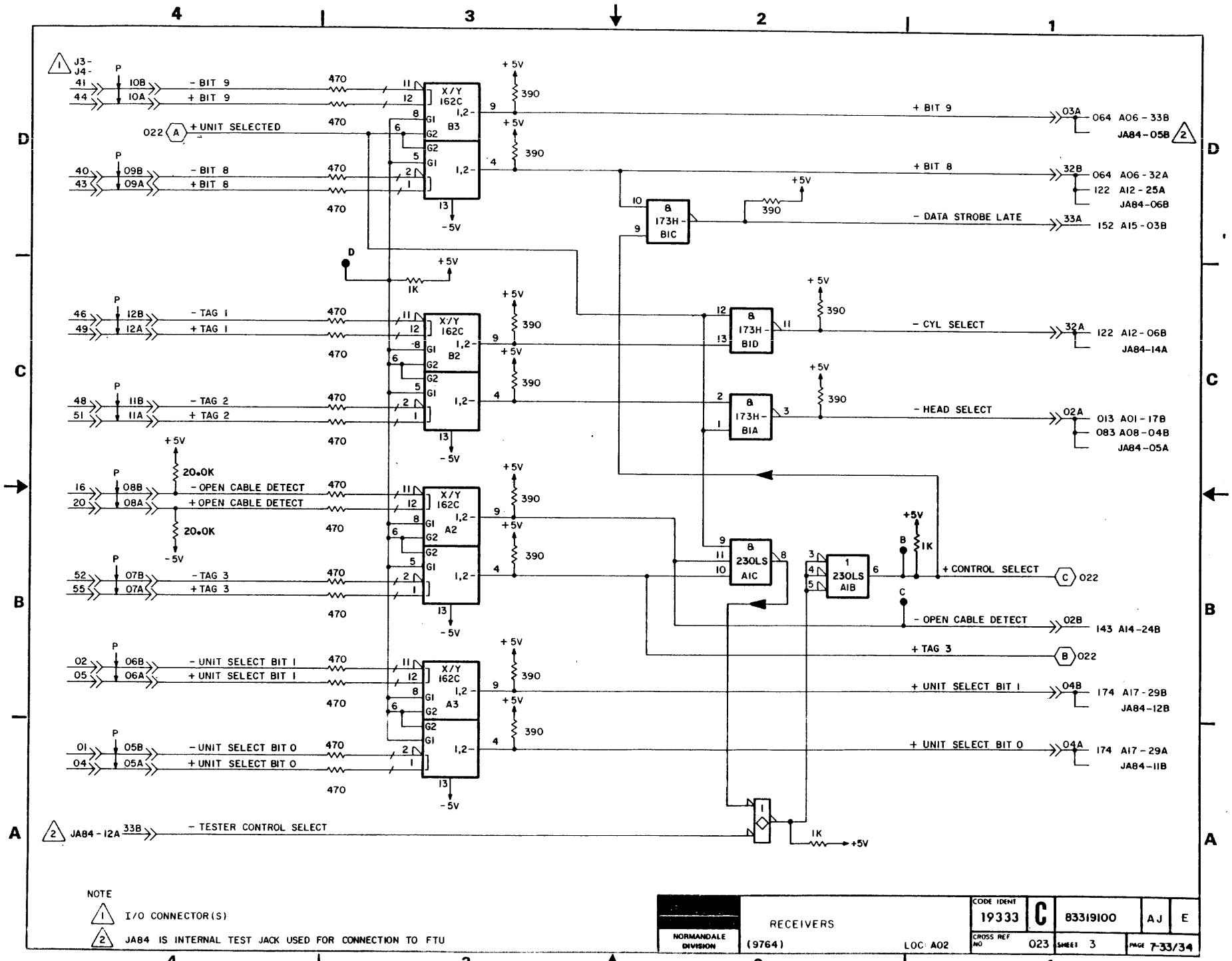
TYPE GRVV LOC A02

CODE IDENT				
19333	C	83319100	AJ	E

CROSS REF NO 021 | SHEET 1 OF 3 | PAGE 7-31

REF 83214601


174 AI7-10B
03B
+ UNIT SELECTED
+ UNIT SELECTED
A 023
+ BIT 0
- WRITE GATE
+ BIT 1
- READ GATE
+ BIT 2
- SERVO OFFSET POSITIVE
+ BIT 3
- SERVO OFFSET NEGATIVE
+ BIT 4
- CONTROLLER FAULT CLEAR
+ BIT 5
- ADDRESS MARK ENABLE
+ BIT 6
- RTZ SEEK
+ BIT 7
- DATA STROBE EARLY
- BIT 0
+ BIT 0
- BIT 1
+ BIT 1
- BIT 2
+ BIT 2
- BIT 3
+ BIT 3
- BIT 4
+ BIT 4
- BIT 5
+ BIT 5
- BIT 6
+ BIT 6
- BIT 7
+ BIT 7
J3-
J4-
P
X/Y 162C
D2
D3
C2
C3
1,2-
8 140 DID
8 140 DIA
8 140 DIC
8 140 DIB
8 140 CID
8 140 CIA
8 140 CIC
8 140 CIB
+5V
-5V
1K
390
470
023 B +TAG 3
023 C +CONTROL SELECT
NOTE
1 I/O PANEL CONNECTOR(S)
2 JA84 IS INTERNAL TEST JACK USED FOR CONNECTION TO FTU
NORMANDALE DIVISION
RECEIVERS
(9764)
LOC: A02
CODE IDENT 19333
C
83319100
AJ
E
CROSS REF NO 022
SHEET 2
PAGE 7-32



NOTE

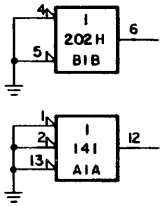
1. I/O CONNECTOR(S)
2. JA84 IS INTERNAL TEST JACK USED FOR CONNECTION TO FTU

NORMANDALE DIVISION	RECEIVERS (9764) LOC A02	CODE IDENT 19333	C	83319100	AJ	E
		CROSS REF NO 023	SHEET 3	PAGE 7-33/34		

REVISION STATUS OF SHEETS

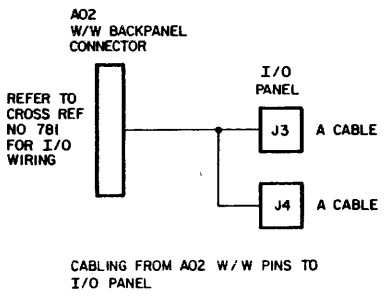
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A																	
B	A	B																	
C	A	B																	
D	A	D																	
E	E	E																	
F	E	F																	

UNUSED LOGIC ELEMENTS

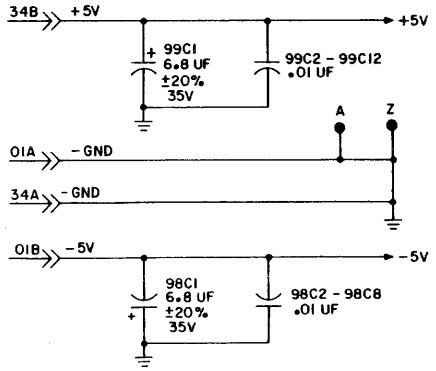


REVISIONS

REV.	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA	2-15-76	
B	PE22842	SCHEMATIC CORRECTIONS	MA	12-28-76	
C		EDITORIAL	MA	5-20-77	
D	PE22926	ERROR CORRECTION	DM	7-26-77	
E	PE55259	LOGIC DIA IMPROVEMENT	GR	10-4-78	
F	PE57173	CHG IC FAMILIES	CB	3-16-82	



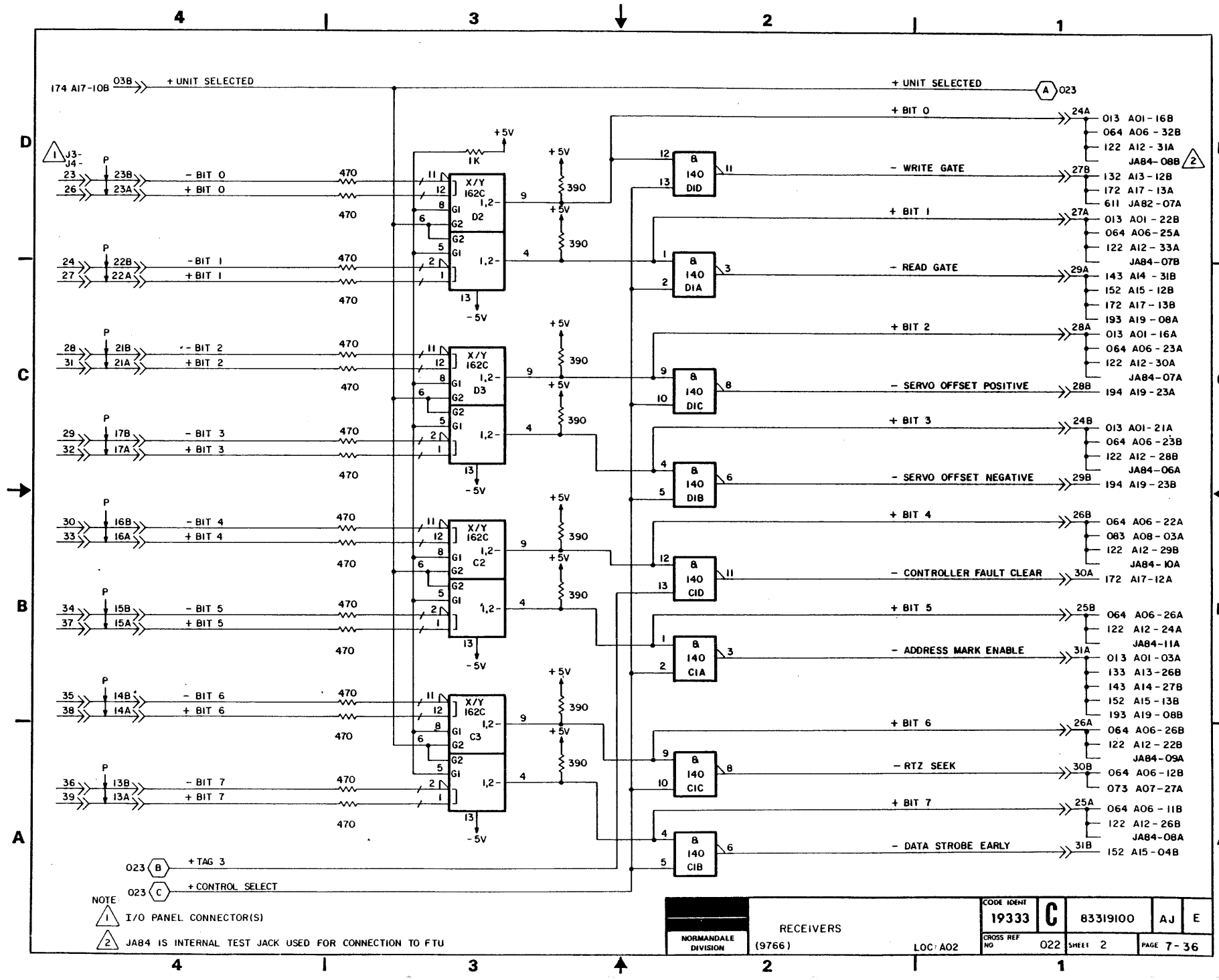
CABLING FROM A02 W/W PINS TO I/O PANEL

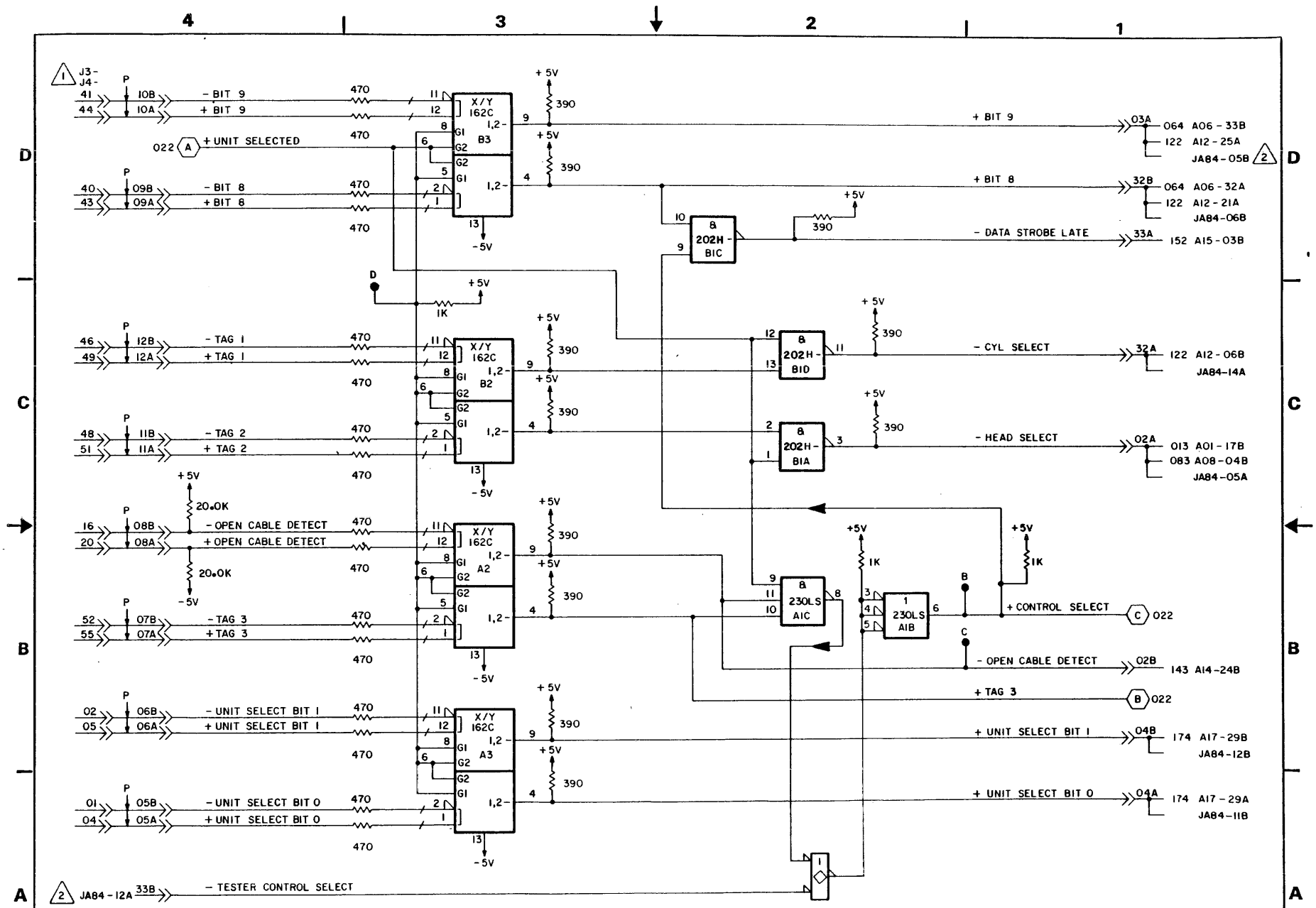


APPLICABLE ONLY TO BJ4A2

DRAWN	G RABINE	1-15-25	NORMANDALE DIVISION	RECEIVERS DIAGRAMS	CODE IDENT 19333	C	83319100	A J	F
CHECKED									
ENGINEER				TYPE: GRVV LOC: A02	CROSS REF NO 021	SHEET 1 of 3	PAGE 7-35		
APPROVED									

REF 83214102


174 A17-10B
03B
+ UNIT SELECTED
+ UNIT SELECTED
A 023
J3-
J4-
P
23 23B - BIT 0
26 23A + BIT 0
24 22B - BIT 1
27 22A + BIT 1
28 21B - BIT 2
31 21A + BIT 2
29 17B - BIT 3
32 17A + BIT 3
30 16B - BIT 4
33 16A + BIT 4
34 15B - BIT 5
37 15A + BIT 5
35 14B - BIT 6
38 14A + BIT 6
36 13B - BIT 7
39 13A + BIT 7
470
1K
+5V
-5V
390
X/Y 162C 1,2- D2
X/Y 162C 1,2- D3
X/Y 162C 1,2- C2
X/Y 162C 1,2- C3
1,2-
G1
G2
8 140 DID
8 140 DIA
8 140 DIC
8 140 DIB
8 140 CID
8 140 CIA
8 140 CIC
8 140 CIB
+ BIT 0
- WRITE GATE
+ BIT 1
- READ GATE
+ BIT 2
- SERVO OFFSET POSITIVE
+ BIT 3
- SERVO OFFSET NEGATIVE
+ BIT 4
- CONTROLLER FAULT CLEAR
+ BIT 5
- ADDRESS MARK ENABLE
+ BIT 6
- RTZ SEEK
+ BIT 7
- DATA STROBE EARLY
24A 013 A01-16B
064 A06-32B
122 A12-31A
JA84-08B 2
27B 132 A13-12B
172 A17-13A
611 JA82-07A
27A 013 A01-22B
064 A06-25A
122 A12-33A
JA84-07B
29A 143 A14-31B
152 A15-12B
172 A17-13B
193 A19-08A
28A 013 A01-16A
064 A06-23A
122 A12-30A
JA84-07A
28B 194 A19-23A
24B 013 A01-21A
064 A06-23B
122 A12-28B
JA84-06A
29B 194 A19-23B
26B 064 A06-22A
083 A08-03A
122 A12-29B
JA84-10A
30A 172 A17-12A
25B 064 A06-26A
122 A12-24A
JA84-11A
31A 013 A01-03A
133 A13-26B
143 A14-27B
152 A15-13B
193 A19-08B
26A 064 A06-26B
122 A12-22B
JA84-09A
30B 064 A06-12B
073 A07-27A
25A 064 A06-11B
122 A12-26B
JA84-08A
31B 152 A15-04B
023 B + TAG 3
023 C + CONTROL SELECT
NOTE
1 I/O PANEL CONNECTOR(S)
2 JA84 IS INTERNAL TEST JACK USED FOR CONNECTION TO FTU
NORMANDALE DIVISION
RECEIVERS
(9766)
LOC: A02
CODE IDENT 19333
C
83319100
AJ
E
CROSS REF NO 022
SHEET 2
PAGE 7-36



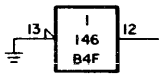
NOTE

1. I/O CONNECTOR(S)
2. JA84 IS INTERNAL TEST JACK USED FOR CONNECTION TO FTU

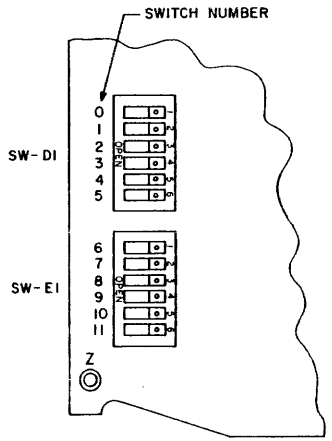
NORMANDALE DIVISION	RECEIVERS (9766) LOC A02	CODE IDENT 19333	C	83319100	AJ	F
		CROSS REF NO 023	SHEET 3	PAGE 7-37/38		

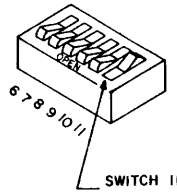
REVISIONS					
REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA	2-15-76	
B	PE22842	SCHEMATIC CORRECTIONS	MA	12-28-76	
C		EDITORIAL	MA	5-20-77	
D		EDITORIAL	MA	4-11-78	
E	PE55259	LOGIC DIA IMPROVEMENT	GR	10-4-78	
F	DJ13400	CHG QLTV OSC TIME	KM	2-8-84	
G	DJ00713	CHG TOL CAP --TV'S	JL	10-9-84	
H	DJ0076IC	IMPROVE TEST SELECT RESISTOR CIRCUIT	DHS	11-12-85	

UNUSED LOGIC ELEMENT

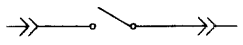


SECTOR SWITCHES

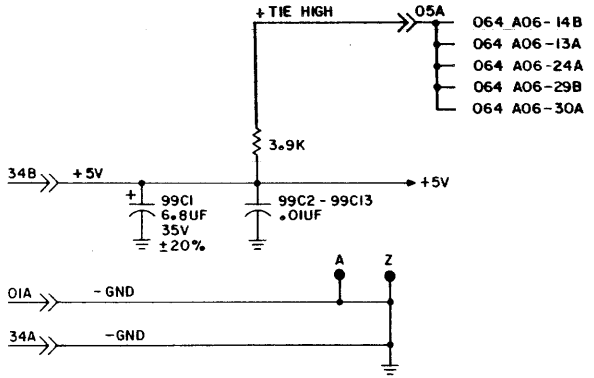




SWITCH POSITIONING



(OPEN POSITION)
SWITCH CONVENTION

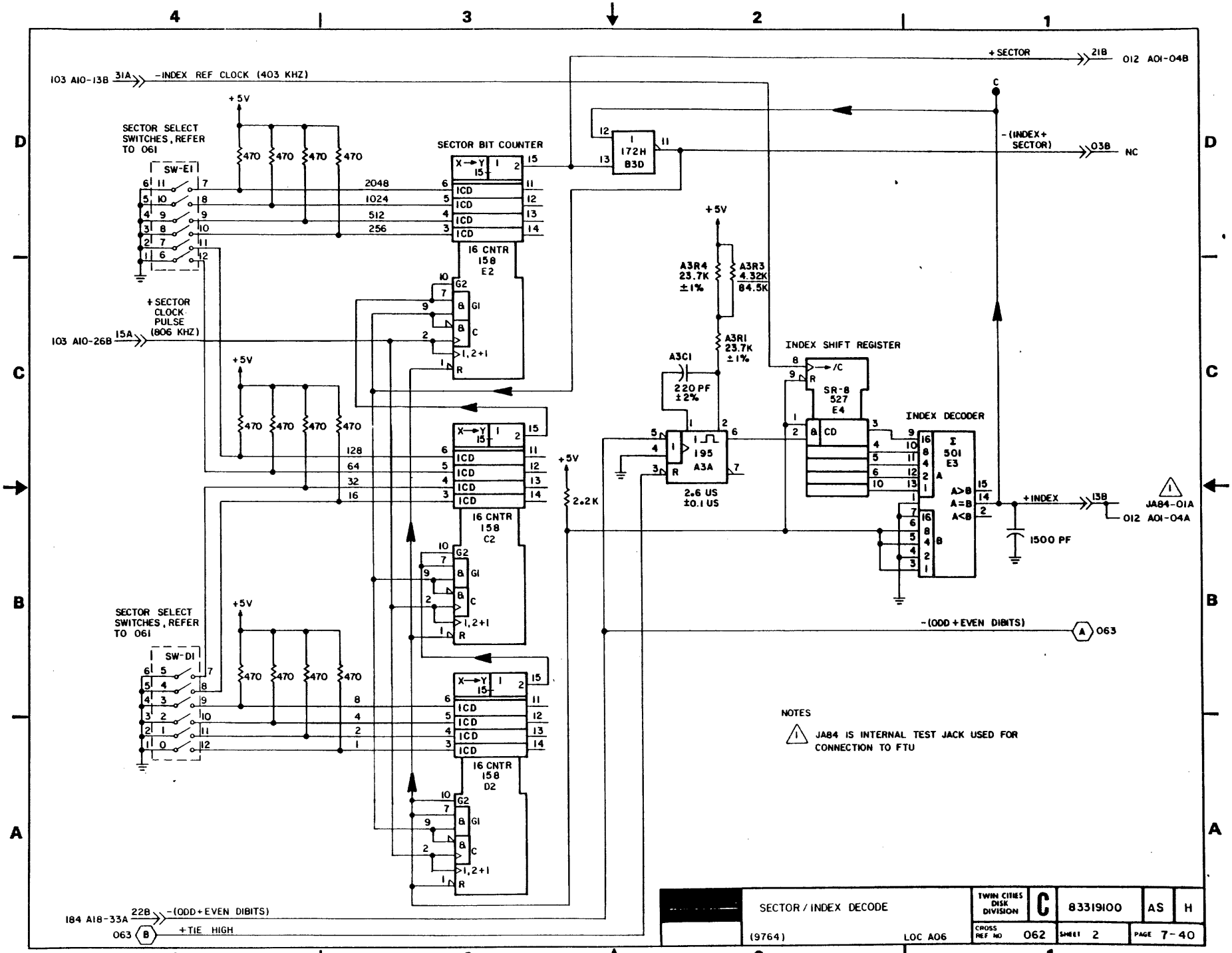


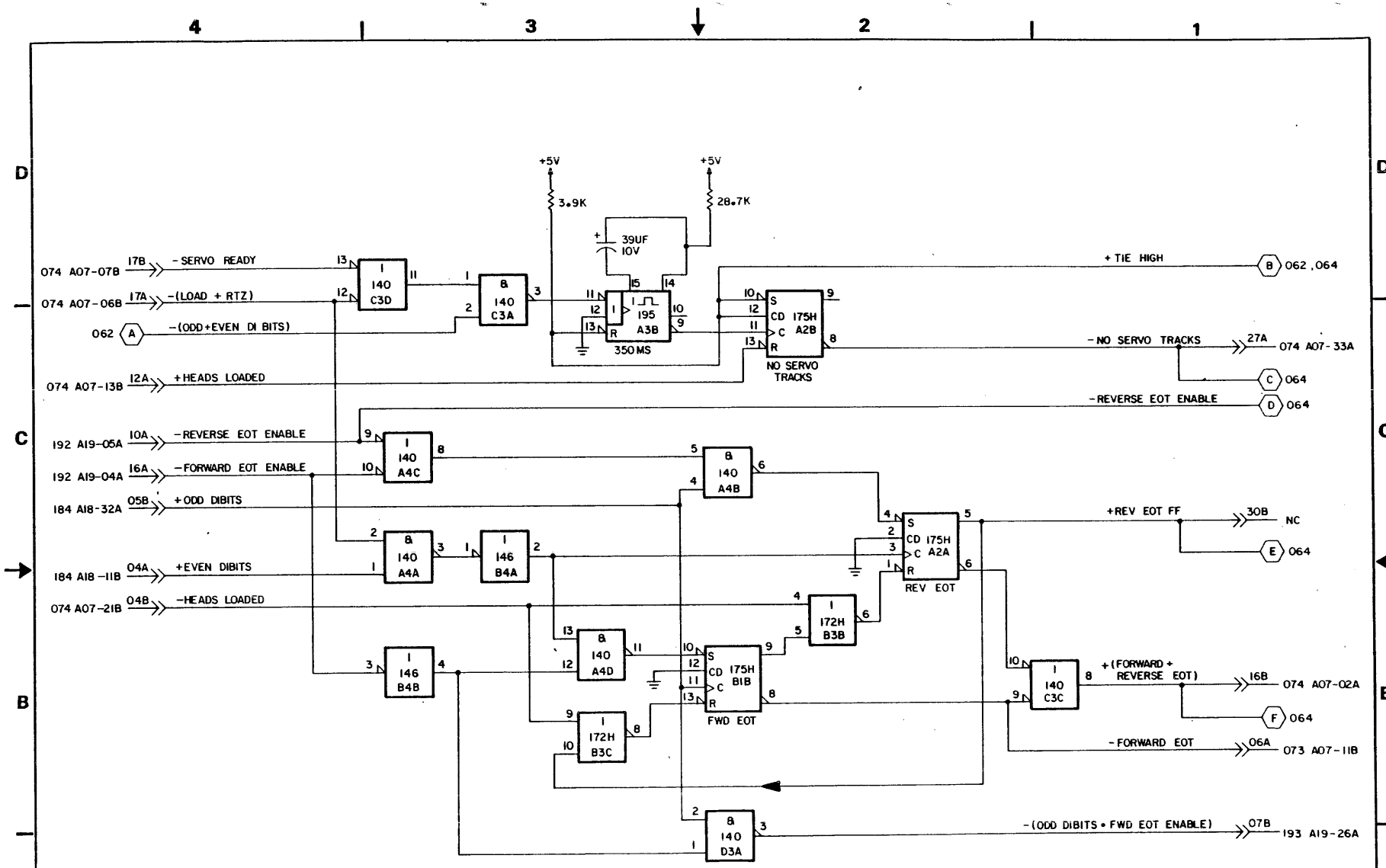
NOTE:
1 REFER TO SECTION 1 OF MAINTENANCE MANUAL FOR INFORMATION ON HOW TO SELECT DIFFERENT SECTOR COUNTS.

APPLICABLE ONLY TO BJ4A1

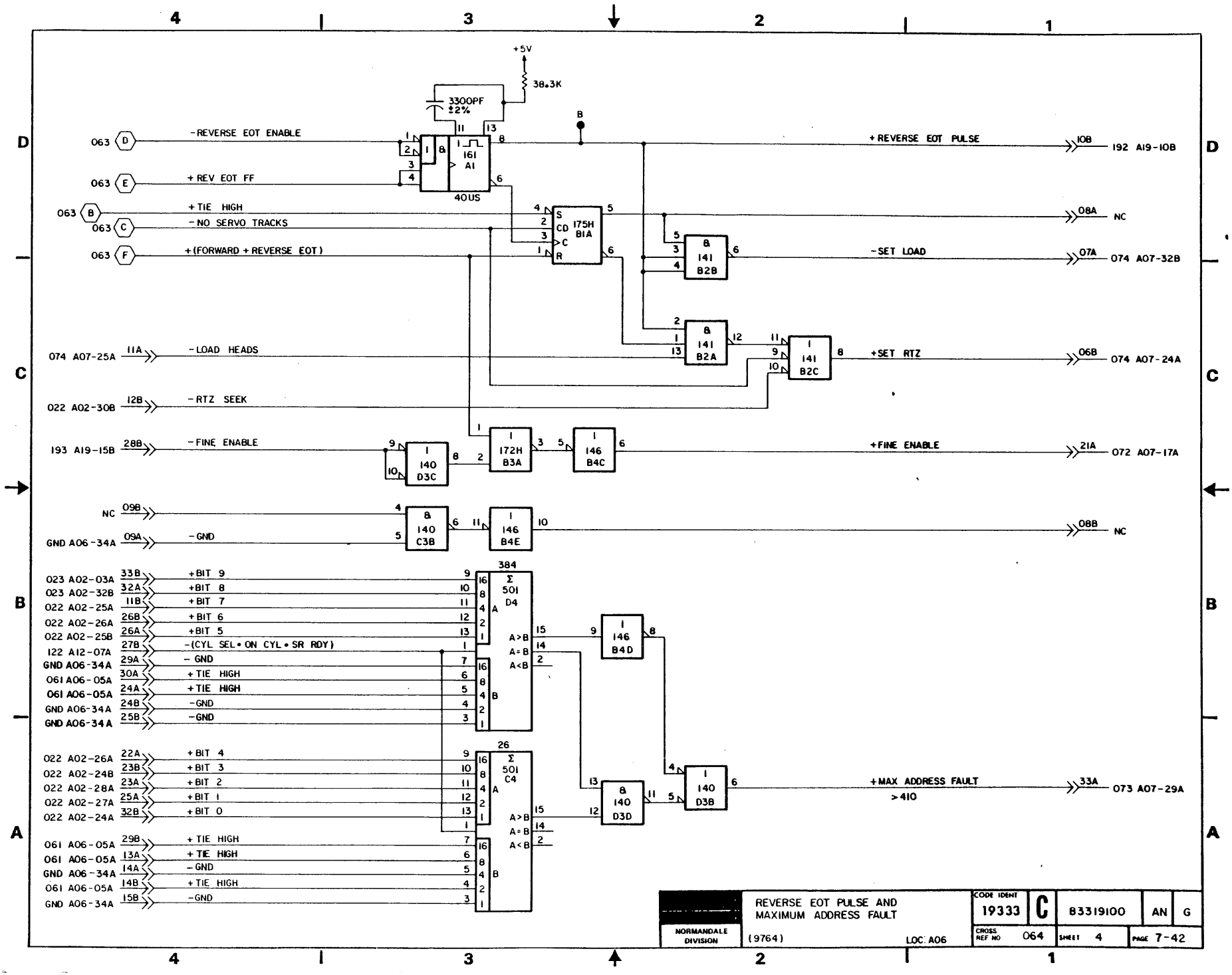
DRAWN		ACCESS CONTROL AND INDEX / SECTOR DECODE DIAGRAMS	TWIN CITIES DISK DIVISION	C	83319100	AS H
CHECKED						
ENGINEER						
APPROVED		TYPE FLTV LOC A06	CROSS REF NO 061	SHEET 1 OF 4	PAGE 7-39	

REF 83214602


+SECTOR
218
012 A01-04B
103 A10-13B
31A
-INDEX REF CLOCK (403 KHZ)
SECTOR SELECT SWITCHES, REFER TO 061
SW-E1
+5V
470
2048
1024
512
256
SECTOR BIT COUNTER
16 CNTR 158 E2
+SECTOR CLOCK PULSE (806 KHZ)
103 A10-26B
15A
128
64
32
16
16 CNTR 158 C2
SECTOR SELECT SWITCHES, REFER TO 061
SW-D1
8
4
2
1
16 CNTR 158 D2
2.2K
172H 83D
-(INDEX+ SECTOR)
038
NC
A3R4 23.7K ±1%
A3R3 4.32K 84.5K
A3R1 23.7K ±1%
A3C1 220 PF ±2%
195 A3A
2.6 US ±0.1 US
INDEX SHIFT REGISTER
SR-8 527 E4
INDEX DECODER
Σ 501 E3
A>B
A=B
A<B
+INDEX
138
JA84-01A
012 A01-04A
1500 PF
-(ODD+EVEN DIBITS)
063
NOTES
1 JA84 IS INTERNAL TEST JACK USED FOR CONNECTION TO FTU
184 A18-33A
22B
-(ODD+EVEN DIBITS)
063
B
+TIE HIGH
SECTOR / INDEX DECODE
(9764)
LOC A06
TWIN CITIES DISK DIVISION
C
83319100
AS
H
CROSS REF NO 062
SHEET 2
PAGE 7-40

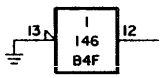


NORMANDALE DIVISION	REVERSE EOT PULSE (9764) LOC A06	CODE IDENT 19333	C	83319100	AJ	E
		CROSS REF NO 063		SHEET 3	PAGE 7-41	

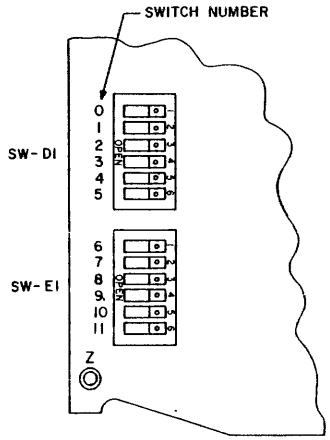

+5V
38.3K
3300PF ±2%
063 D -REVERSE EOT ENABLE
063 E +REV EOT FF
161 A1
40US
+REVERSE EOT PULSE
108
192 A19-10B
063 B +TIE HIGH
063 C -NO SERVO TRACKS
175H B1A
08A NC
063 F +(FORWARD + REVERSE EOT)
141 B2B
-SET LOAD
07A
074 A07-32B
141 B2A
074 A07-25A 11A -LOAD HEADS
141 B2C
+SET RTZ
06B
074 A07-24A
022 A02-30B 12B -RTZ SEEK
193 A19-15B 28B -FINE ENABLE
140 D3C
172H B3A
146 B4C
+FINE ENABLE
21A
072 A07-17A
NC 09B
GND A06-34A 09A -GND
140 C3B
146 B4E
08B NC
384
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)
GND A06-34A 29A - GND
061 A06-05A 30A +TIE HIGH
061 A06-05A 24A +TIE HIGH
GND A06-34A 24B -GND
GND A06-34A 25B -GND
A>B
A=B
A<B
146 B4D
26
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
061 A06-05A 13A +TIE HIGH
GND A06-34A 14A -GND
061 A06-05A 14B +TIE HIGH
GND A06-34A 15B -GND
140 D3D
140 D3B
+MAX ADDRESS FAULT
>410
33A
073 A07-29A
REVERSE EOT PULSE AND MAXIMUM ADDRESS FAULT
NORMANDALE DIVISION
(9764)
LOC: A06
CODE IDENT 19333
C
83319100
AN
G
CROSS REF NO 064
SHEET 4
PAGE 7-42

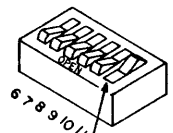
REVISIONS					
REV.	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA	2-15-76	
B	PE22842	SHEMATIC CORRECTIONS	MA	12-28-76	
C		EDITORIAL	MA	5-2077	
D		EDITORIAL	MA	4 11 78	
E	PE55259	LOGIC DIA IMPROVEMENT	GR	10 4 78	
F	PE60129A	HFRV COST REDUCTION	CB	3-16-82	
G	DJ13400	CHG QLTV 05'C TIME	MC	2-7-84	
H	DJ00713	CHG TOL CAP --TV'S	JL	10984	

UNUSED LOGIC ELEMENT



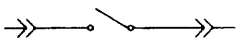
SECTOR SWITCHES





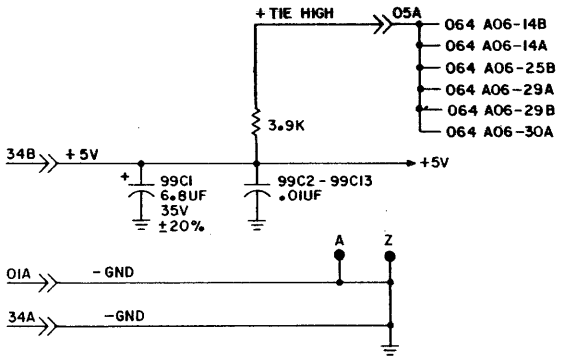
SWITCH II SHOWN IN OPEN POSITION

SWITCH POSITIONING



(OPEN POSITION)

SWITCH CONVENTION



NOTE:

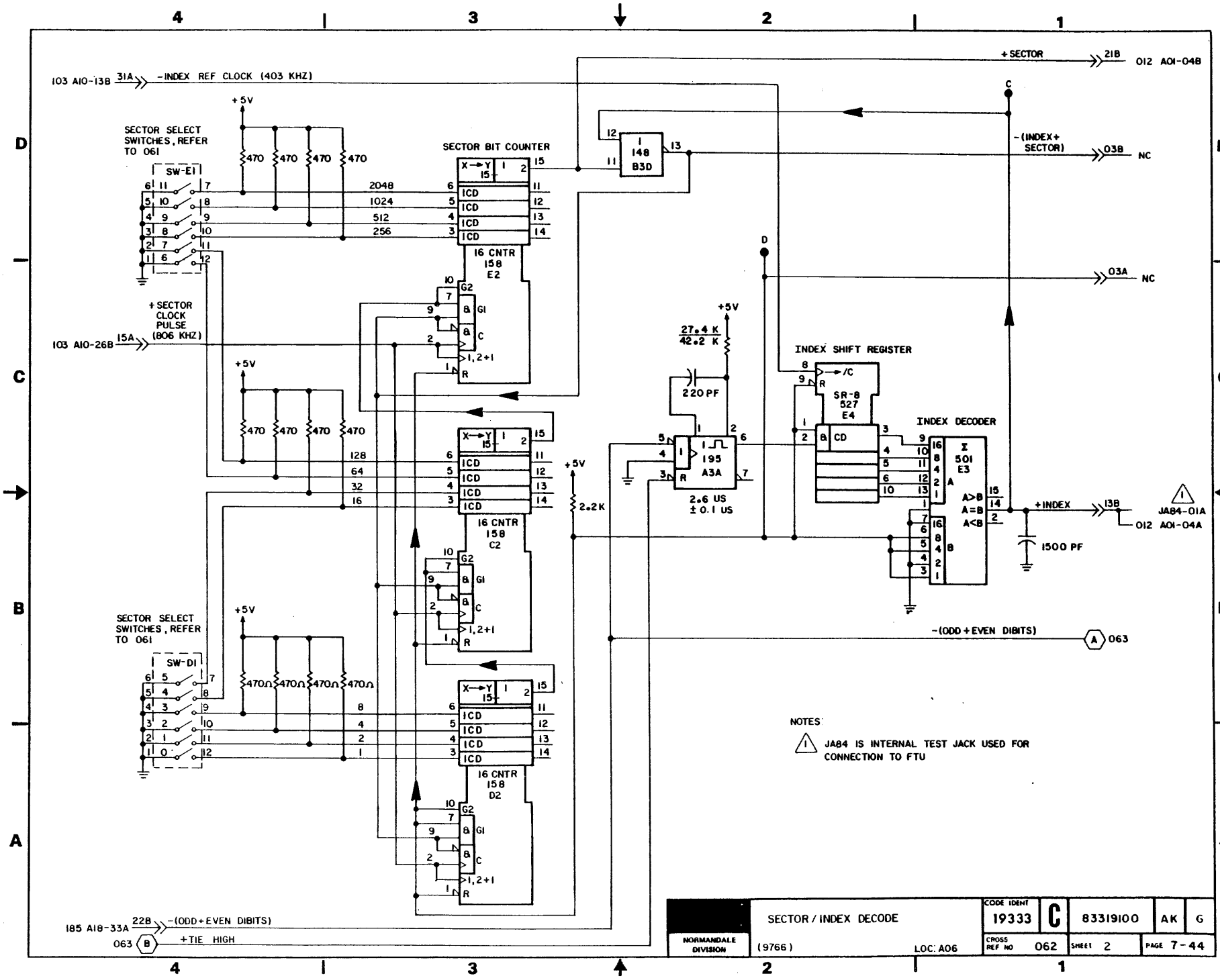
1. REFER TO SECTION 1 OF MAINTENANCE MANUAL FOR INFORMATION ON HOW TO SELECT DIFFERENT SECTOR COUNTS.

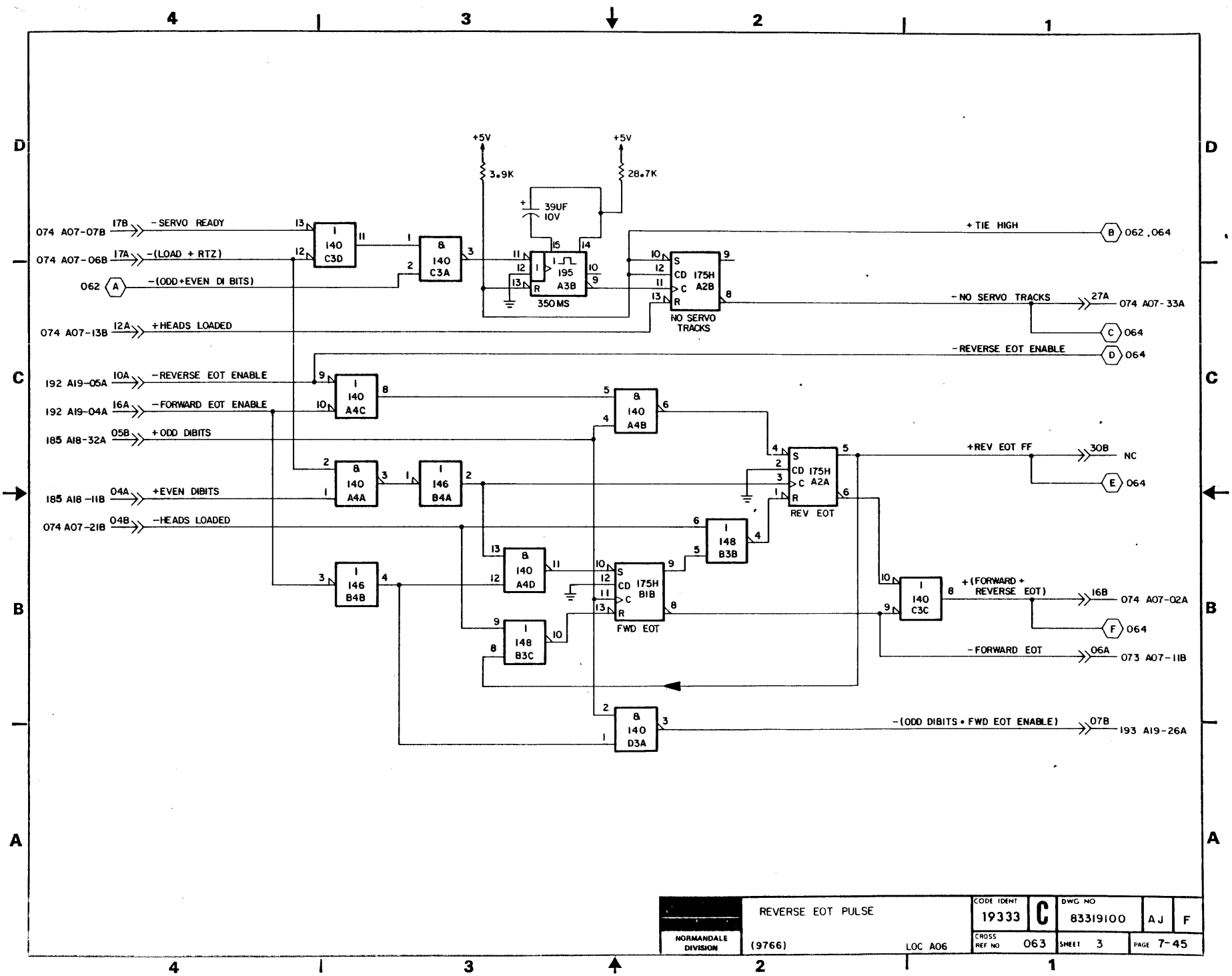
APPLICABLE ONLY TO BJ4A2

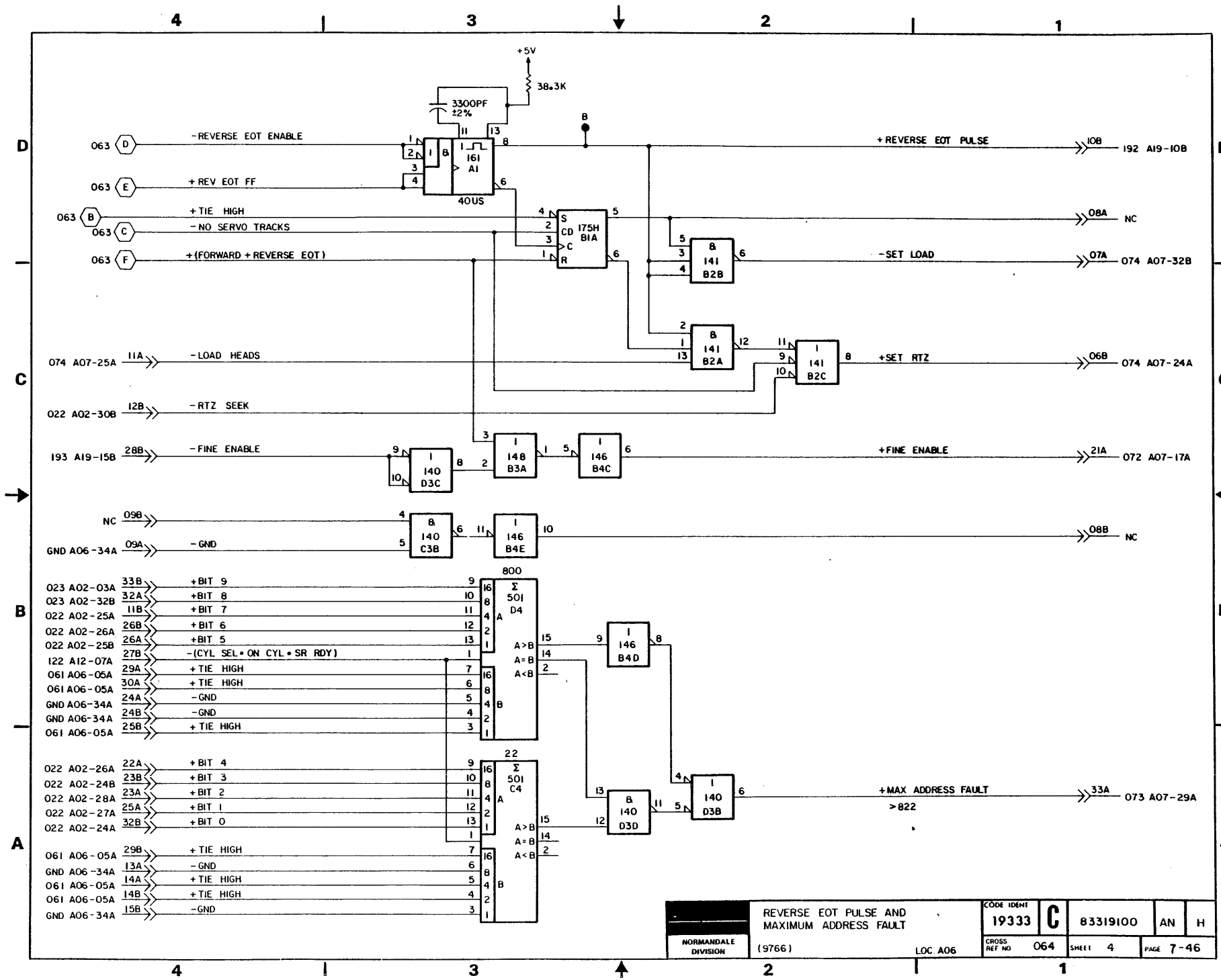
DRAWN		NORMANDALE DIVISION	ACCESS CONTROL AND INDEX / SECTOR DECODE DIAGRAMS
CHECKED			TYPE: FLTV LOC: A06
ENGINEER			
APPROVED			

CODE IDENT 19333	C	83319100	AN	H
CROSS REF NO 061	SHEET 1 OF 4	PAGE 7-43		

REF 83214106


103 A10-13B 31A -INDEX REF CLOCK (403 KHZ)
+SECTOR 21B 012 A01-04B
SECTOR SELECT SWITCHES, REFER TO 061
SW-E1
+5V
470 470 470 470
SECTOR BIT COUNTER
2048
1024
512
256
16 CNTR 158 E2
+SECTOR CLOCK PULSE (806 KHZ)
103 A10-26B 15A
128
64
32
16
16 CNTR 158 C2
SECTOR SELECT SWITCHES, REFER TO 061
SW-D1
470Ω 470Ω 470Ω 470Ω
8
4
2
1
16 CNTR 158 D2
185 A18-33A 22B -(ODD+EVEN DIBITS)
063 B +TIE HIGH
148 B3D
-(INDEX+ SECTOR) 03B NC
03A NC
27.4 K
42.2 K
220 PF
195 A3A
2.6 US ± 0.1 US
INDEX SHIFT REGISTER
SR-8 527 E4
INDEX DECODER
Σ 501 E3
A>B
A=B
A<B
+INDEX 13B
JA84-01A
012 A01-04A
1500 PF
2.2K
-(ODD+EVEN DIBITS) A 063
NOTES:
1 JA84 IS INTERNAL TEST JACK USED FOR CONNECTION TO FTU
NORMANDALE DIVISION
SECTOR / INDEX DECODE
(9766)
LOC: A06
CODE IDENT 19333
C
83319100
AK
G
CROSS REF NO 062
SHEET 2
PAGE 7-44

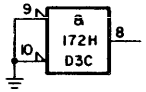

+5V
3.9K
+5V
28.7K
39UF
10V
074 A07-07B 17B -SERVO READY
074 A07-06B 17A -(LOAD + RTZ)
062 A -(ODD+EVEN DI BITS)
074 A07-13B 12A +HEADS LOADED
1 140 C3D
8 140 C3A
1 195 A3B
350MS
CD 175H A2B
NO SERVO TRACKS
+TIE HIGH
B 062,064
-NO SERVO TRACKS
27A
074 A07-33A
C 064
-REVERSE EOT ENABLE
D 064
192 A19-05A 10A -REVERSE EOT ENABLE
192 A19-04A 16A -FORWARD EOT ENABLE
185 A18-32A 05B +ODD DIBITS
185 A18-11B 04A +EVEN DIBITS
074 A07-21B 04B -HEADS LOADED
1 140 A4C
8 140 A4B
8 140 A4A
1 146 B4A
1 146 B4B
8 140 A4D
1 148 B3B
1 148 B3C
CD 175H B1B
FWD EOT
CD 175H A2A
REV EOT
+REV EOT FF
30B
NC
E 064
1 140 C3C
+(FORWARD + REVERSE EOT)
16B
074 A07-02A
F 064
-FORWARD EOT
06A
073 A07-11B
8 140 D3A
-(ODD DIBITS • FWD EOT ENABLE)
07B
193 A19-26A
REVERSE EOT PULSE
NORMANDALE DIVISION
(9766)
LOC A06
CODE IDENT 19333
C
DWG NO 83319100
AJ
F
CROSS REF NO 063
SHEET 3
PAGE 7-45

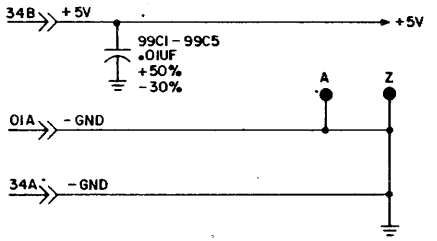

+5V
38.3K
3300PF ±2%
063 D -REVERSE EOT ENABLE
063 E +REV EOT FF
161 A1
40US
+REVERSE EOT PULSE
108
192 A19-10B
063 B +TIE HIGH
063 C -NO SERVO TRACKS
063 F +(FORWARD + REVERSE EOT)
175H B1A
08A NC
141 B2B
-SET LOAD
07A
074 A07-32B
074 A07-25A 11A -LOAD HEADS
141 B2A
141 B2C
+SET RTZ
06B
074 A07-24A
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
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
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
(9766)
LOC A06
NORMANDALE DIVISION
CODE IDENT 19333
C
83319100
AN
H
CROSS REF NO 064
SHEET 4
PAGE 7-46

REVISIONS

REV.	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA	1-19-76	
B	PE22842	SCHEMATIC CORRECTION	MA	12-28-76	
C	PE22838	CHANGE MLVV MLVV CARD	MA	5-20-77	
D	PE55259	LOGIC DIA IMPROVEMENT	GR	10-4-78	
E	PE60493A	TIMING RES CHG	CB	3-16-82	
F	DJ0090A	CHG ONE SHOT RES	CB	3-23-82	
G	DJ13655	LOGIC DIAG CORR	A J	9-17-85	

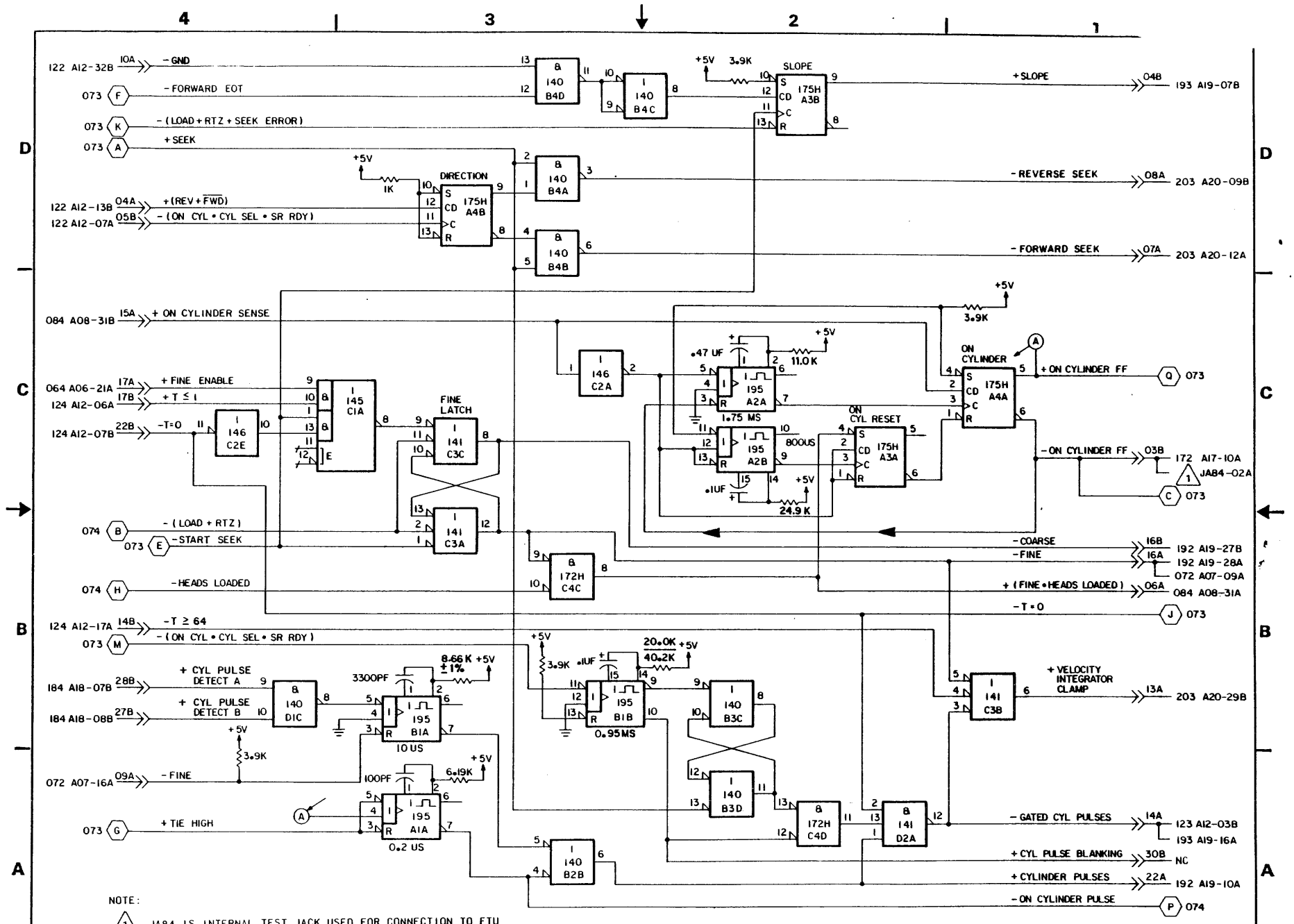
UNUSED LOGIC ELEMENT

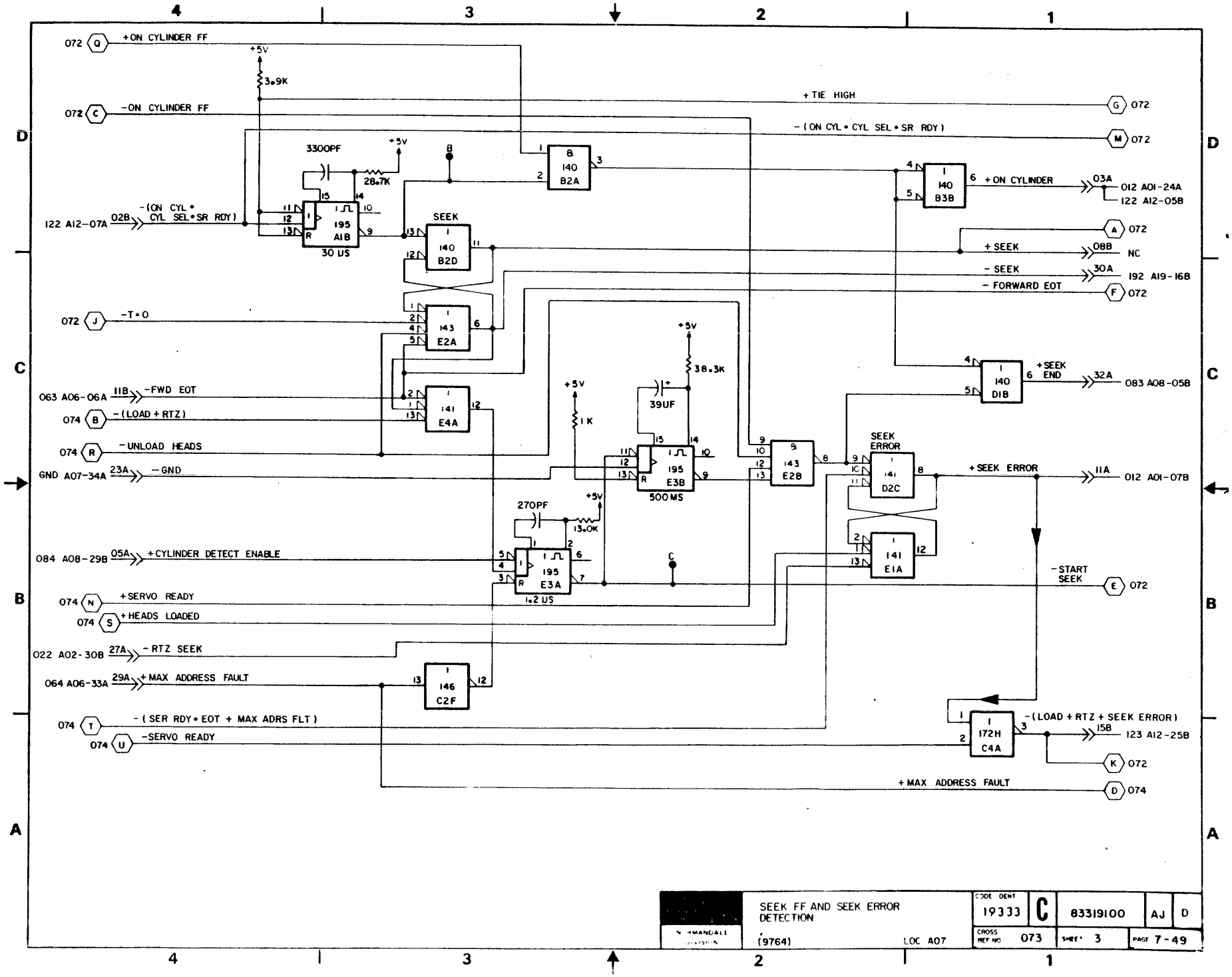




APPLICABLE ONLY TO BJ4AI

DRAWN	M.ANDERSON		ACCESS CONTROL NO. 1 DIAGRAMS	CODE IDENT 19333	C	83319100	AP	G
CHECKED				CROSS REF NO 071		SHEET 1 OF 4	PAGE 7-47	
ENGINEER			TWIN CITIES DISK DIVISION	TYPE MLVV	LOC A07	REF 83214603		
APPROVED								

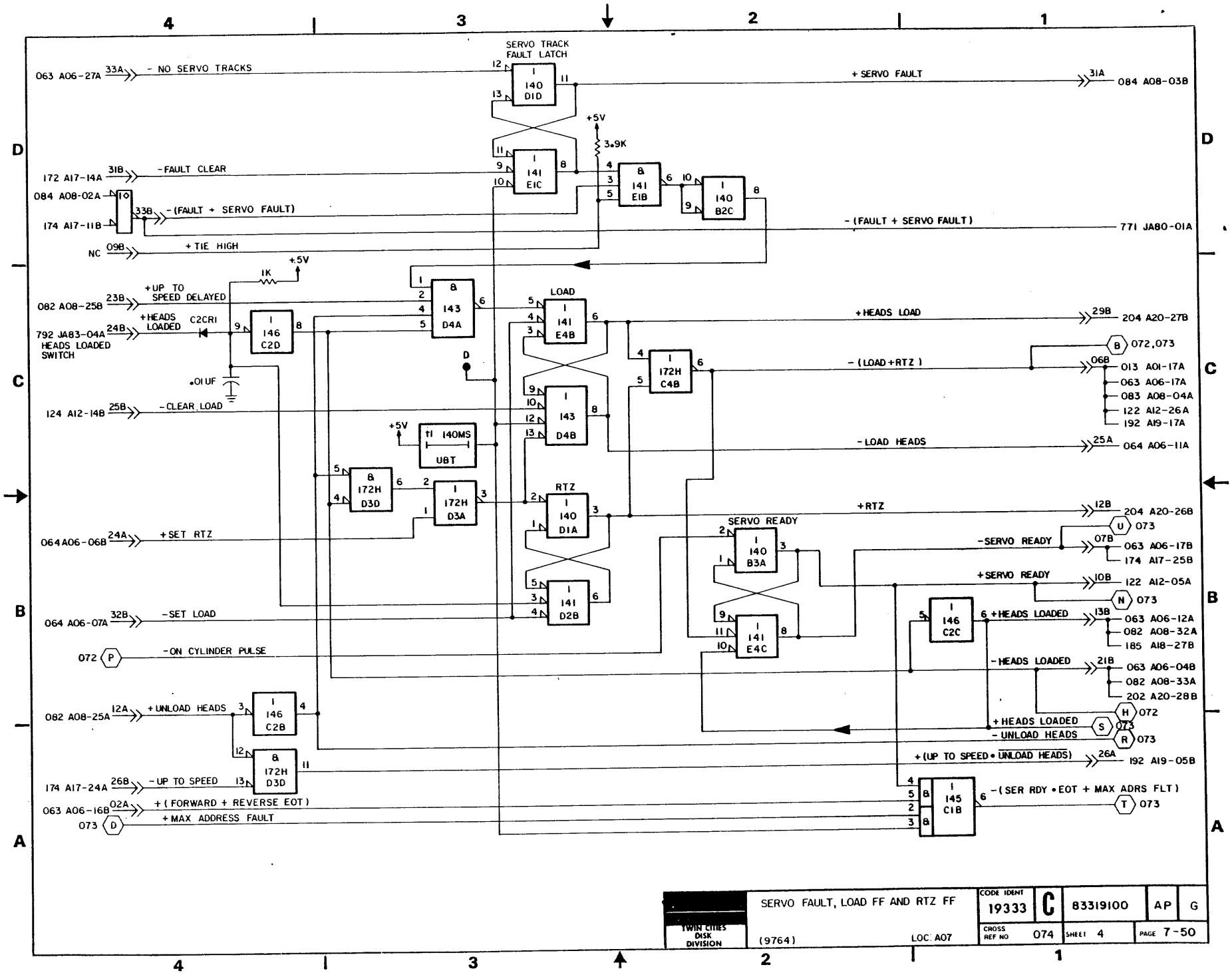

122 A12-32B 10A - GND
073 F - FORWARD EOT
073 K - (LOAD + RTZ + SEEK ERROR)
073 A + SEEK
122 A12-13B 04A + (REV + FWD)
122 A12-07A 05B - (ON CYL • CYL SEL • SR RDY)
DIRECTION
SLOPE
+5V 3.9K
1K
+SLOPE 04B 193 A19-07B
-REVERSE SEEK 08A 203 A20-09B
-FORWARD SEEK 07A 203 A20-12A
084 A08-31B 15A + ON CYLINDER 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
.47 UF
11.0K
1.75 MS
800US
.1UF
24.9K
+ON CYLINDER FF 04B 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 ≥ 64
073 M - (ON CYL • CYL SEL • SR RDY)
+ CYL PULSE DETECT A 28B
+ CYL PULSE DETECT B 27B
184 A18-07B
184 A18-08B
3300PF
8.66K ±1%
10US
3.9K
072 A07-16A 09A - FINE
100PF
6.19K
073 G + TIE HIGH
0.2 US
.1UF
20.0K
40.2K
0.95MS
+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
NORMANDALE DIVISION
DIRECTION CONTROL, FINE LATCH, ON CYL AND CYL PULSES (9764)
LOC: A07
CODE IDENT 19333
C
DWG NO 83319100
AJ
F
CROSS REF NO 072
SHEET 2
PAGE 7-48



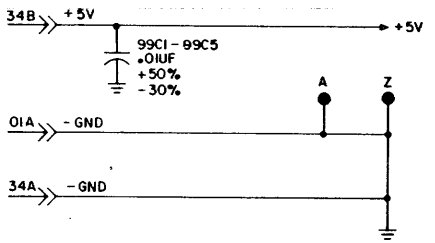
SEEK FF AND SEEK ERROR DETECTION

(9764) LOC A07

CODE IDENT				
19333	C	83319100	AJ	D
CROSS REF NO 073		SHEET 3	PAGE 7-49	


SERVO TRACK FAULT LATCH
063 A06-27A 33A - NO SERVO TRACKS
I 140 D1D
+ SERVO FAULT
31A 084 A08-03B
+5V
3.9K
172 A17-14A 31B -FAULT CLEAR
084 A08-02A
174 A17-11B 33B -(FAULT + SERVO FAULT)
I 141 E1C
B 141 E1B
I 140 B2C
-(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 HEADS LOADED SWITCH
C2CR1
I 146 C2D
B 143 D4A
LOAD
I 141 E4B
+HEADS LOAD 29B 204 A20-27B
I 172H C4B
-(LOAD+RTZ) B 072,073 068B 013 A01-17A 063 A06-17A 083 A08-04A 122 A12-26A 192 A19-17A
.01UF
124 A12-14B 25B -CLEAR LOAD
I 143 D4B
-LOAD HEADS 25A 064 A06-11A
+5V T1 140MS UBT
B 172H D3D
I 172H D3A
RTZ
I 140 D1A
+RTZ 12B 204 A20-26B
064 A06-06B 24A +SET RTZ
SERVO READY
I 140 B3A
-SERVO READY 07B U 073 063 A06-17B 174 A17-25B
+SERVO READY 10B 122 A12-05A N 073
I 141 D2B
064 A06-07A 32B -SET LOAD
I 141 E4C
I 146 C2C
+HEADS LOADED 13B 063 A06-12A 082 A08-32A 185 A18-27B
072 P -ON CYLINDER PULSE
-HEADS LOADED 21B 063 A06-04B 082 A08-33A 202 A20-28B H 072
+HEADS LOADED S 073
-UNLOAD HEADS R 073
082 A08-25A 12A +UNLOAD HEADS
I 146 C2B
B 172H D3D
+(UP TO SPEED • UNLOAD HEADS) 26A 192 A19-05B
174 A17-24A 26B -UP TO SPEED
063 A06-16B 02A +(FORWARD + REVERSE EOT)
073 D +MAX ADDRESS FAULT
I 145 C1B
-(SER RDY • EOT + MAX ADRS FLT) T 073
TWIN CITIES DISK DIVISION
SERVO FAULT, LOAD FF AND RTZ FF
(9764)
LOC: A07
CODE IDENT 19333
C
83319100
AP
G
CROSS REF NO 074
SHEET 4
PAGE 7-50

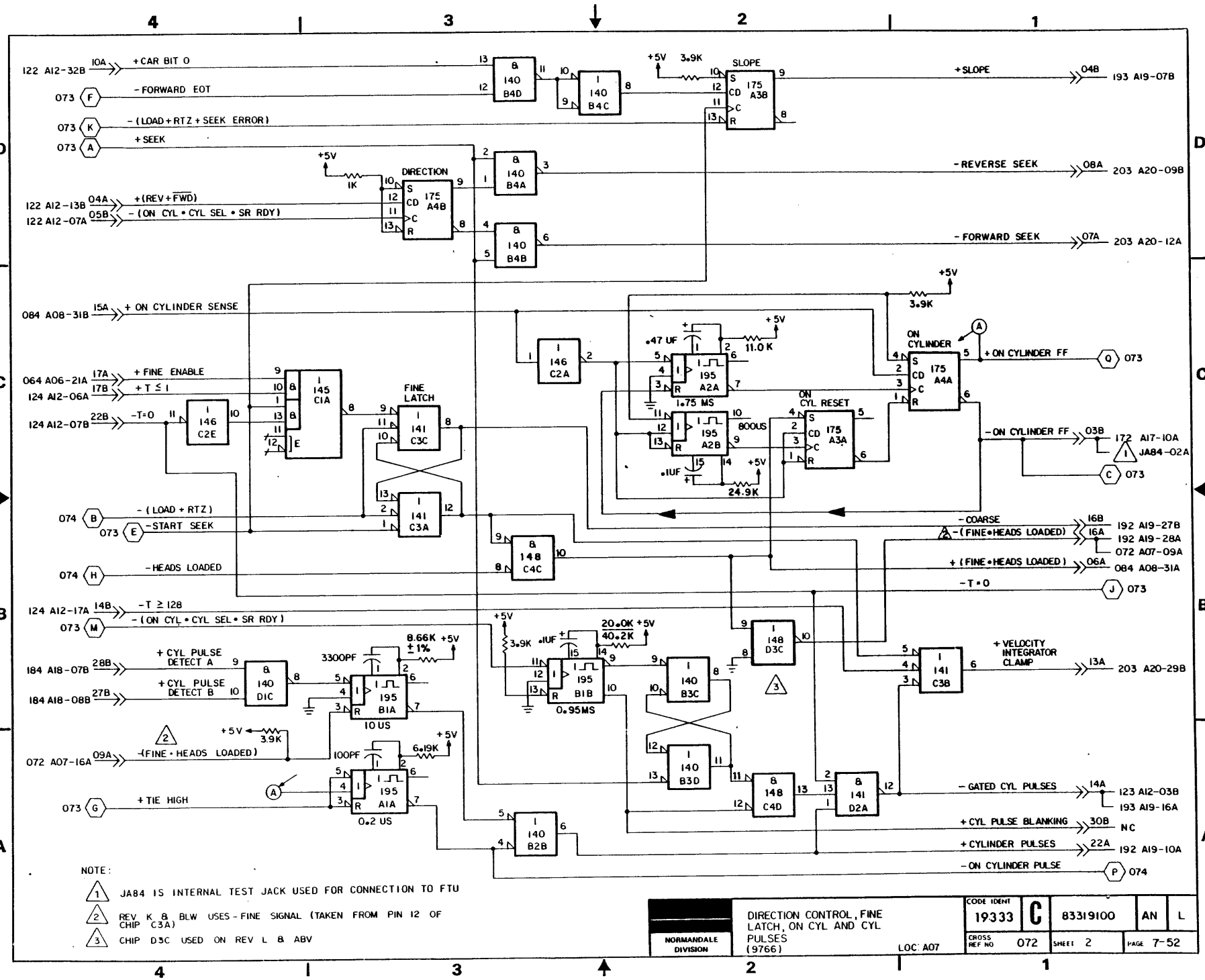
REVISIONS					
REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE2[illegible]	RELEASE	MLA	1-19-76	
B	PE48[illegible]		MA	7-14-76	
C	PE22842	SCHEMATIC CORRECTIONS	MA	12-28-76	
D	PE22838	CHANGE MLVV MLVV CARD	MA	5-20-77	
E		EDITORIAL	MA	4-11-78	
F	PE55259	LOGIC DIA IMPROVEMENT	GR	10 4 78	
G	PE60129A	MFRV COST REDUCTION	CB	3-17-82	
H	PE60342	LOGIC DIA UPDATES	"	"	
J	PE60493A	TIMING RES CHG	"	"	
K	DJ00089A	CHG ONE-SHOT RES	"	"	
L	DJ00666	MLVV-FINE SIGNAL	JL	10-9-84	

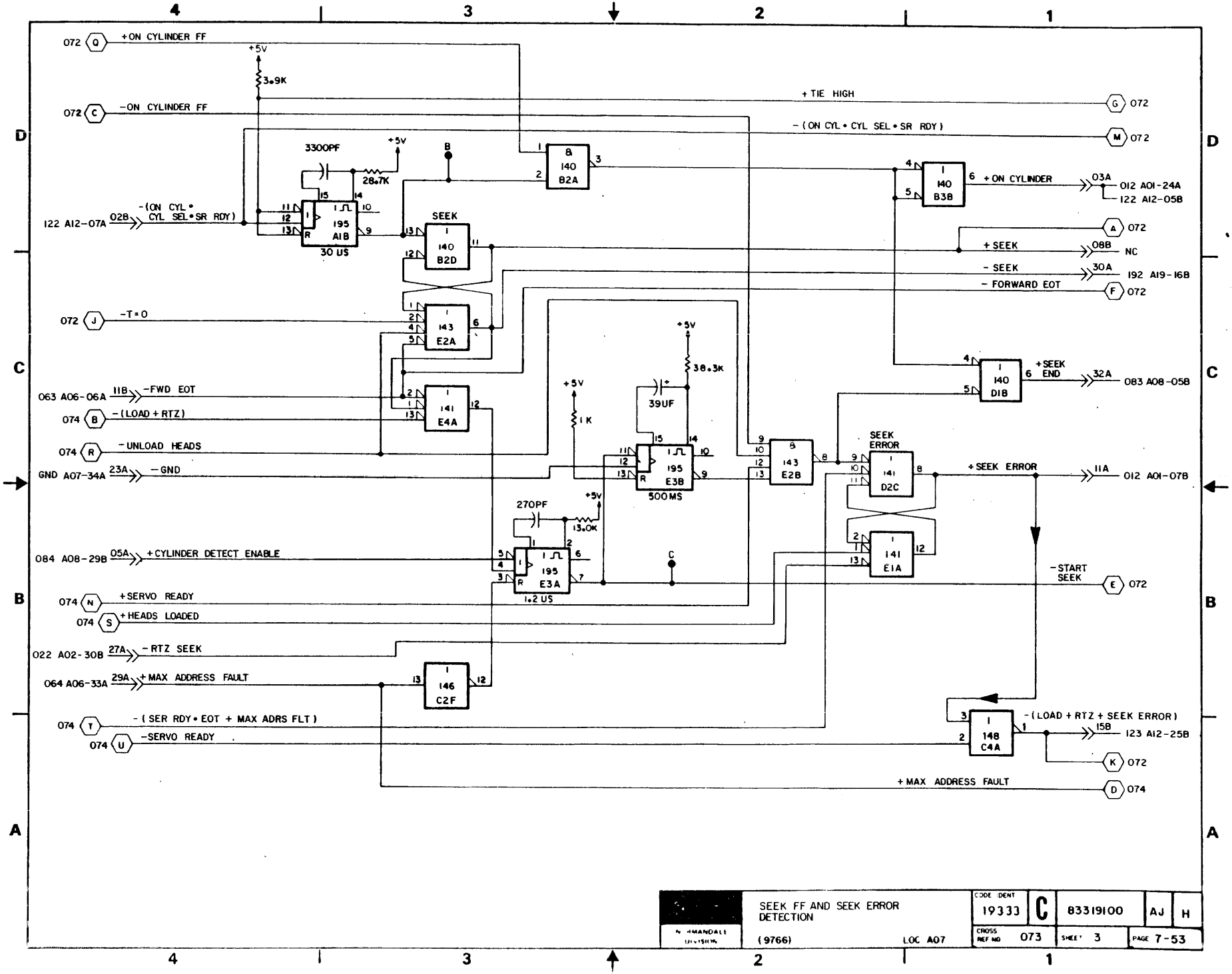


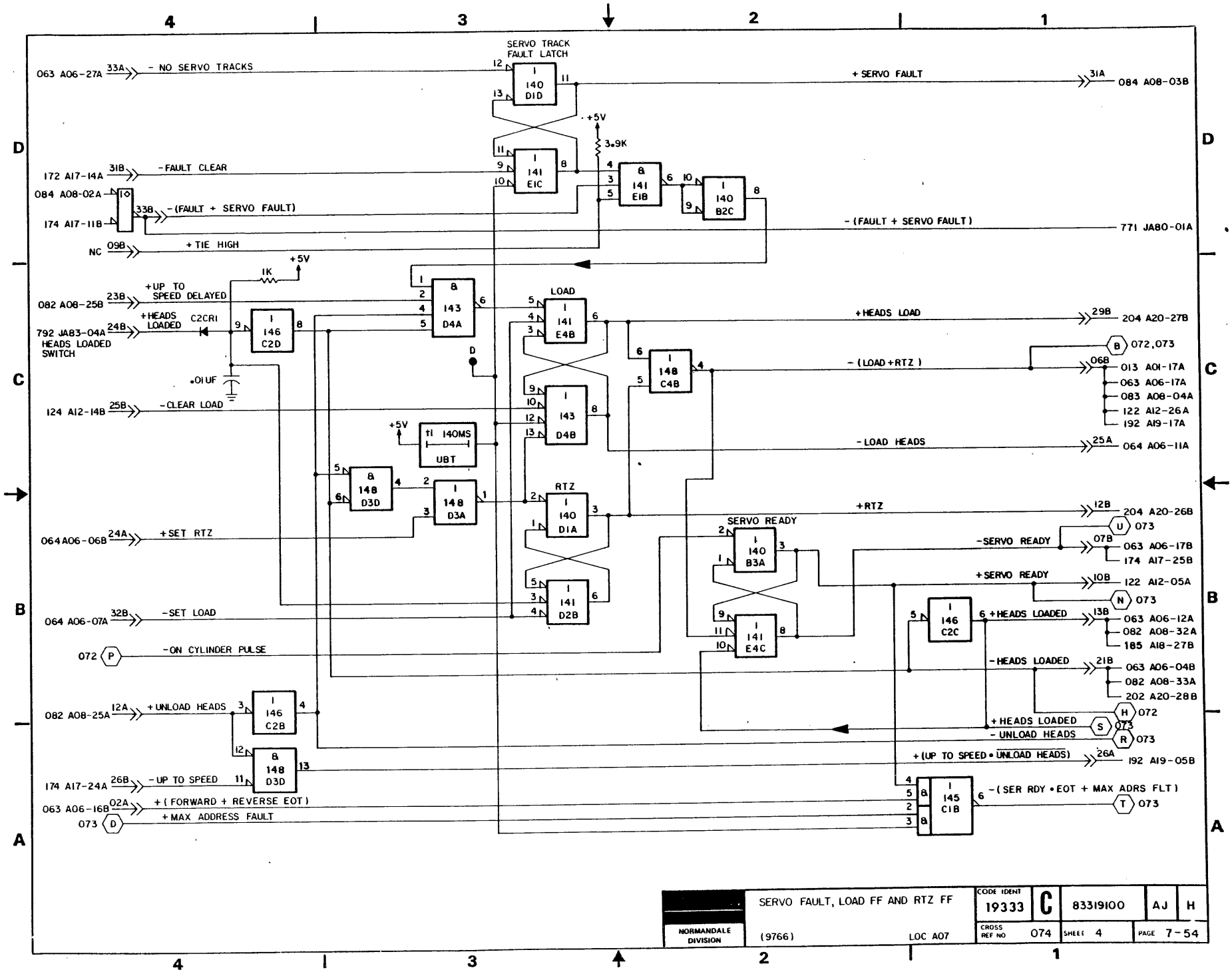
APPLICABLE ONLY TO BJ4A2

DRAWN	M.ANDERSON		ACCESS CONTROL NO. 1 DIAGRAMS	CODE IDENT 19333	C	83319100	AN	L
CHECKED								
ENGINEER			NORMANDALE DIVISION					
APPROVED			TYPE MLVV LOC A07	CROSS REF NO 071		SHEET 1 of 4	PAGE 7-51	

REF 83214107


122 AI2-32B 10A +CAR BIT 0
073 F -FORWARD EOT
073 K -(LOAD+RTZ+SEEK ERROR)
073 A +SEEK
122 AI2-13B 04A +(REV+FWD)
122 AI2-07A 05B -(ON CYL • CYL SEL • SR RDY)
DIRECTION
+5V 1K
+5V 3.9K
SLOPE
+SLOPE 04B 193 AI9-07B
-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 AI2-06A 17B +T ≤ 1
124 AI2-07B 22B -T=0
FINE LATCH
.47 UF
11.0 K
1.75 MS
800US
.1UF
24.9K
ON CYLINDER
ON CYL RESET
+ON CYLINDER FF Q 073
-ON CYLINDER FF 03B 172 AI7-10A JA84-02A C 073
074 B -(LOAD+RTZ)
073 E -START SEEK
074 H -HEADS LOADED
-COARSE 16B 192 AI9-27B
-(FINE•HEADS LOADED) 16A 192 AI9-28A 072 A07-09A
+(FINE•HEADS LOADED) 06A 084 A08-31A
-T=0 J 073
124 AI2-17A 14B -T ≥ 128
073 M -(ON CYL • CYL SEL • SR RDY)
+CYL PULSE DETECT A 28B
+CYL PULSE DETECT B 27B
184 AI8-07B
184 AI8-08B
3300PF
8.66K ±1%
10 US
20.0K 40.2K
0.95MS
+VELOCITY INTEGRATOR CLAMP 13A 203 A20-29B
072 A07-16A 09A -(FINE • HEADS LOADED)
100PF
6.19K
073 G +TIE HIGH
0.2 US
-GATED CYL PULSES 14A 123 AI2-03B 193 AI9-16A
+CYL PULSE BLANKING 30B NC
+CYLINDER PULSES 22A 192 AI9-10A
-ON CYLINDER PULSE P 074
NOTE:
1 JA84 IS INTERNAL TEST JACK USED FOR CONNECTION TO FTU
2 REV K & BLW USES -FINE SIGNAL (TAKEN FROM PIN 12 OF CHIP C3A)
3 CHIP D3C USED ON REV L & ABV
NORMANDALE DIVISION
DIRECTION CONTROL, FINE LATCH, ON CYL AND CYL PULSES (9766)
LOC: A07
CODE IDENT 19333
C
83319100
AN
L
CROSS REF NO 072
SHEET 2
PAGE 7-52


072 Q +ON CYLINDER FF
+5V
3.9K
072 C -ON CYLINDER FF
+TIE HIGH
G 072
-(ON CYL • CYL SEL • SR RDY)
M 072
3300PF
+5V
28.7K
B
8 140 B2A
4 1 140 B3B 6 +ON CYLINDER 03A 012 A01-24A 122 A12-05B
122 A12-07A 028 -(ON CYL • CYL SEL • SR RDY)
1 195 A1B R
30 US
SEEK
1 140 B2D
A 072
+SEEK 08B NC
-SEEK 30A 192 A19-16B
-FORWARD EOT F 072
072 J -T=0
1 143 E2A 6
+5V
38.3K
4 1 140 D1B 6 +SEEK END 32A 083 A08-05B
063 A06-06A 11B -FWD EOT
074 B -(LOAD + RTZ)
1 141 E4A 12
+5V
1K
39UF
074 R -UNLOAD HEADS
GND A07-34A 23A -GND
1 195 E3B R
500MS
8 143 E2B 8
SEEK ERROR
1 141 D2C 8 +SEEK ERROR 11A 012 A01-07B
270PF
+5V
13.0K
084 A08-29B 05A +CYLINDER DETECT ENABLE
1 195 E3A R
1.2 US
C
1 141 E1A 12
-START SEEK E 072
074 N +SERVO READY
074 S +HEADS LOADED
022 A02-30B 27A -RTZ SEEK
064 A06-33A 29A +MAX ADDRESS FAULT
1 146 C2F 12
074 T -(SER RDY • EOT + MAX ADRS FLT)
074 U -SERVO READY
1 148 C4A 1 -(LOAD + RTZ + SEEK ERROR) 15B 123 A12-25B
K 072
+MAX ADDRESS FAULT
D 074
SEEK FF AND SEEK ERROR DETECTION
(9766)
LOC A07
CODE IDENT 19333
C
83319100
AJ
H
CROSS REF NO 073
SHEET 3
PAGE 7-53



NORMANDALE DIVISION	SERVO FAULT, LOAD FF AND RTZ FF	CODE IDENT 19333	C	83319100	AJ	H
(9766)	LOC A07	CROSS REF NO 074	SHEET 4	PAGE 7-54		

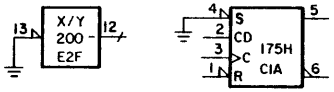
REVISION STATUS OF SHEETS

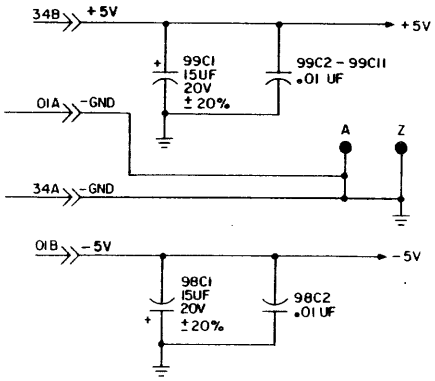
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																
B	B	B	A																
C	C	B	A																
D	C	B	A																
E	E	E	E																
F	F	E	E																

REVISIONS

REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA	1-30-76	
B	PE22842	SCHEMATIC CORRECTIONS	MA	12-28-76	
C	PE48403	ADD PULL UP TO COPV	MA	3-21-77	
D		EDITORIAL	MA	5-20-77	
E	PE55259	LOGIC DIA IMPROVEMENT	GR	10 4 78	
F	PE57622A	ADD FILTER DIODES	CB	3-17-82	

UNUSED LOGIC ELEMENTS

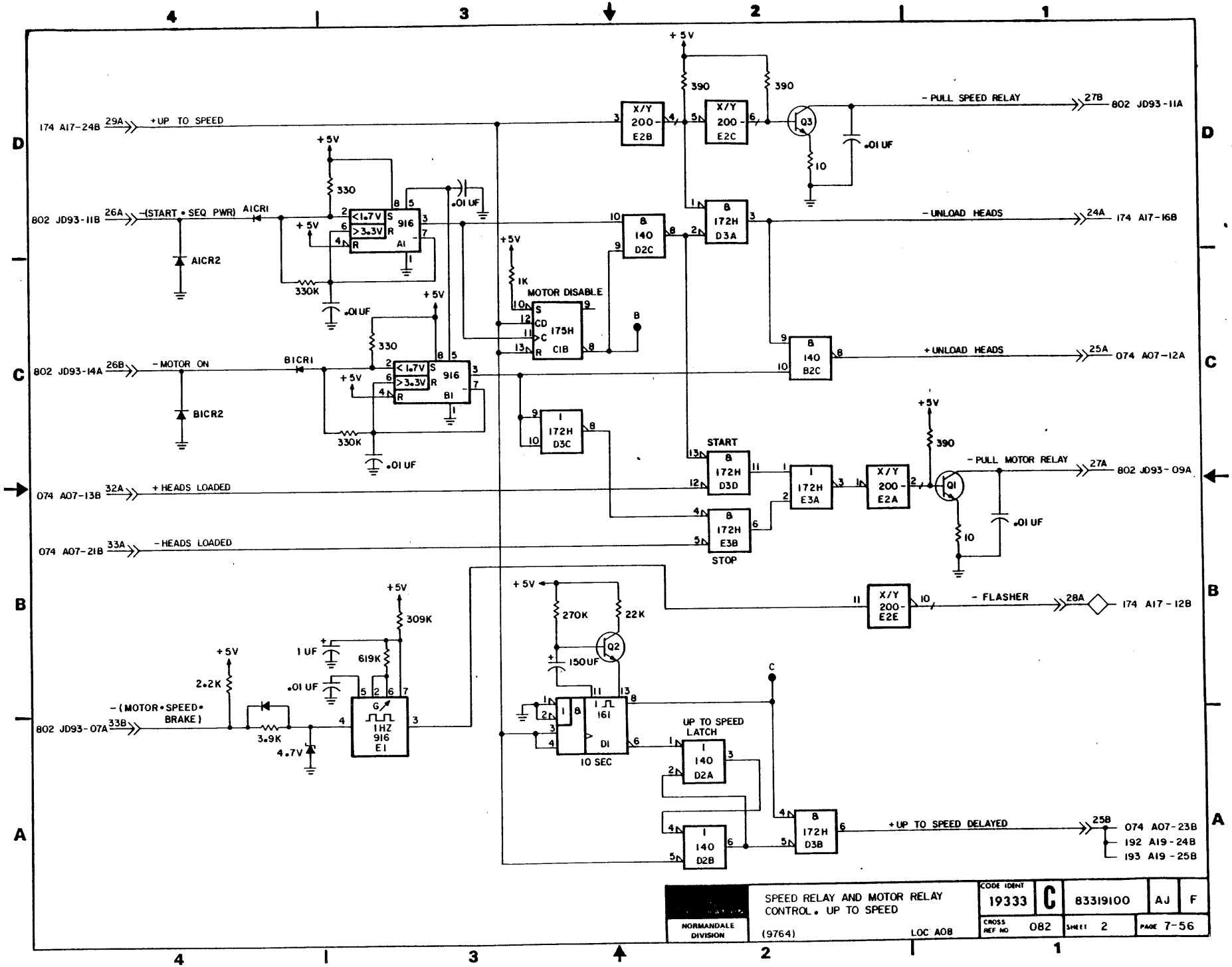


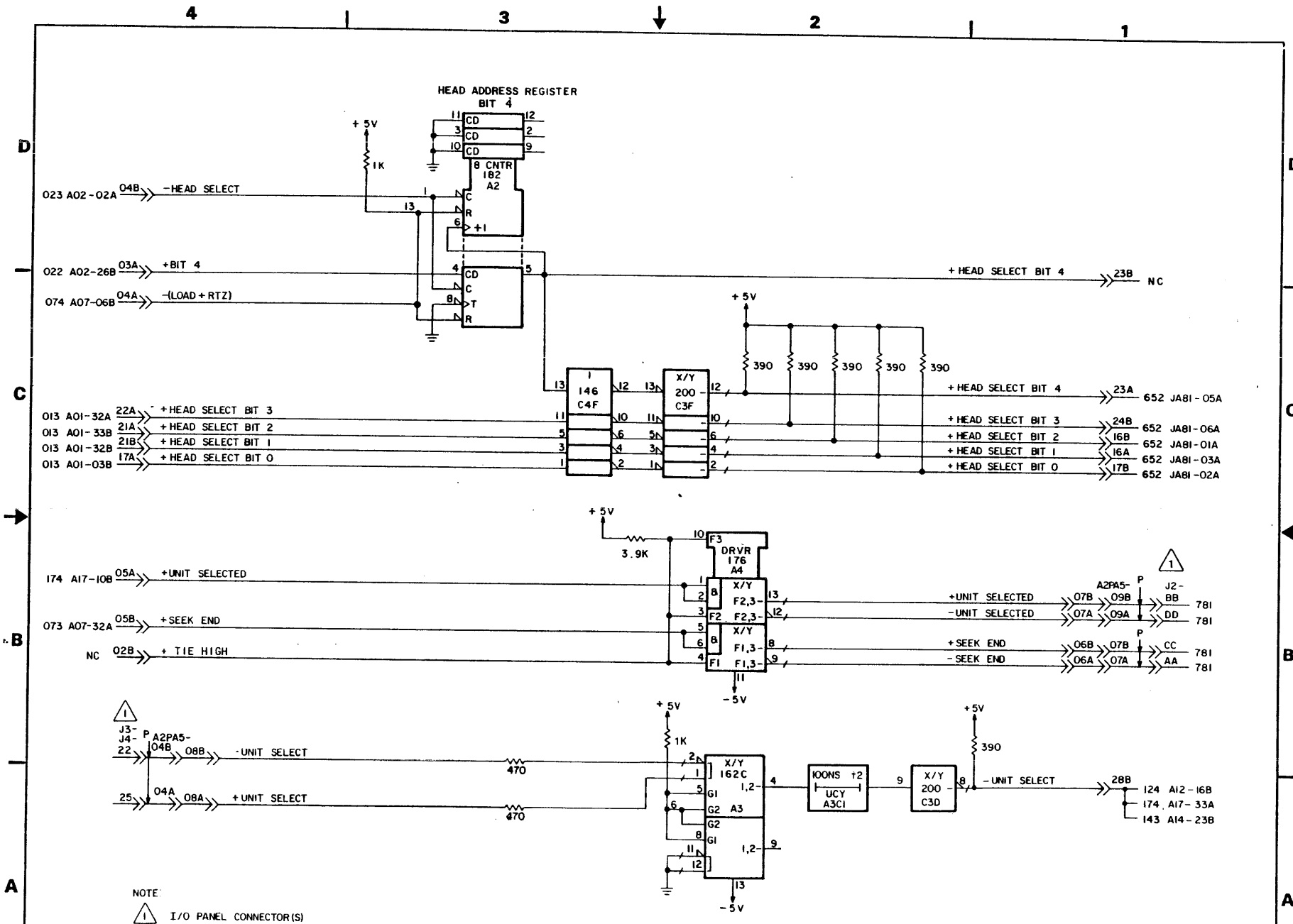


APPLICABLE ONLY TO BJ4AI

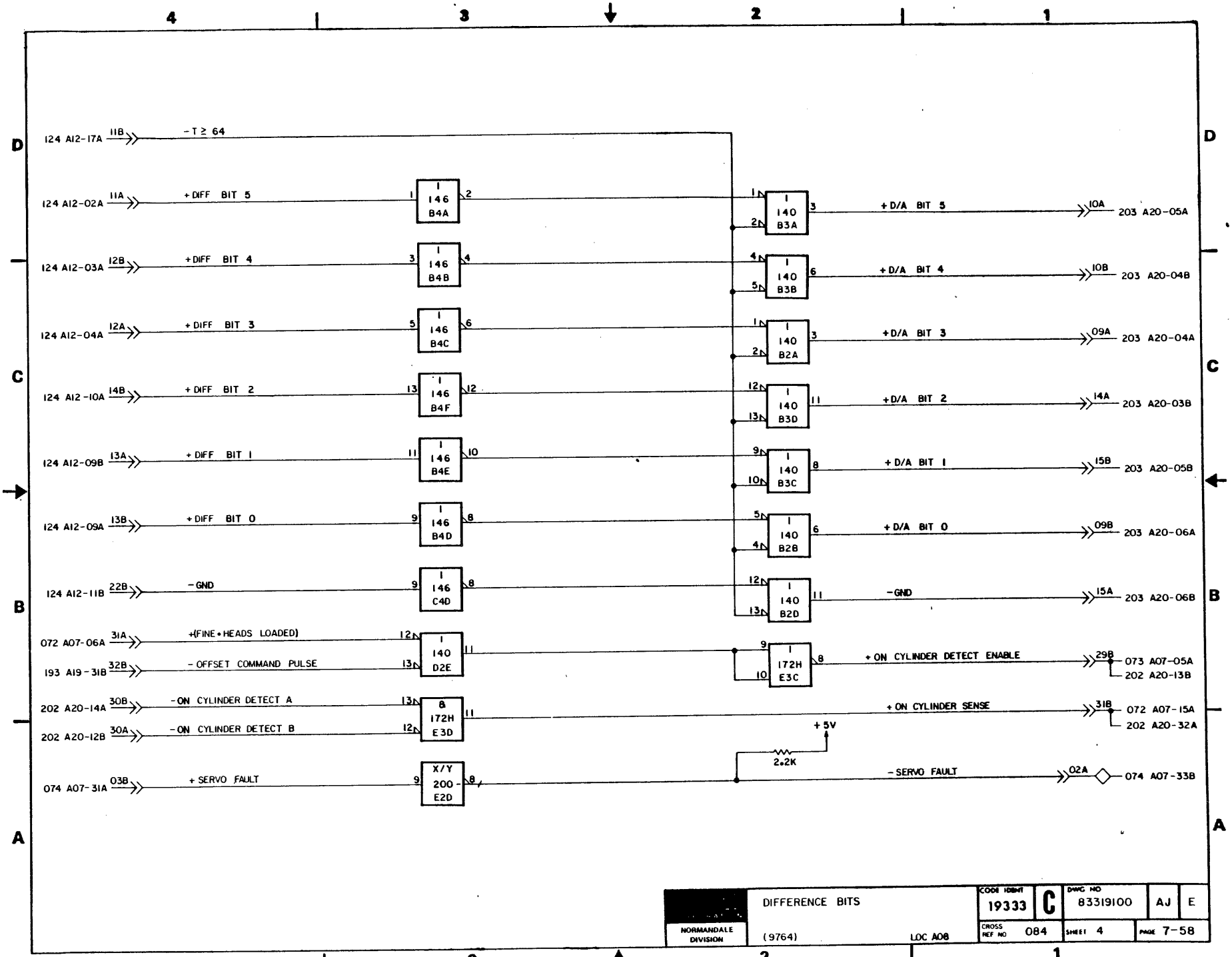
DRAWN	MANDERSON	1-30-76	NORMANDALE DIVISION	DIFF BITS, HEAD REG SPEED ENABLE, UNIT SELECT DIAGRAMS	CODE IDENT 19333	C	83319100	AJ	F
CHECKED									
ENGINEER									
APPROVED				TYPE CQPV LOC A08	CROSS REF NO 081		SHEET 1 OF 4	PAGE 7-55	

REF 83214604


+5V
390
390
X/Y 200-E2B
X/Y 200-E2C
Q3
-PULL SPEED RELAY
27B
802 JD93-11A
.01 UF
10
174 A17-24B
29A
+UP TO SPEED
330
802 JD93-11B
26A
-(START • SEQ PWR)
A1CR1
<1.7V S
>3.3V R
916 A1
330K
.01 UF
A1CR2
1K
MOTOR DISABLE
S
CD
C
R
175H C1B
8 140 D2C
8 172H D3A
-UNLOAD HEADS
24A
174 A17-16B
802 JD93-14A
26B
-MOTOR ON
B1CR1
916 B1
B1CR2
1 172H D3C
8 140 B2C
+UNLOAD HEADS
25A
074 A07-12A
START
8 172H D3D
1 172H E3A
X/Y 200-E2A
Q1
-PULL MOTOR RELAY
27A
802 JD93-09A
074 A07-13B
32A
+HEADS LOADED
074 A07-21B
33A
-HEADS LOADED
8 172H E3B
STOP
X/Y 200-E2E
-FLASHER
28A
174 A17-12B
309K
1 UF
619K
2.2K
-(MOTOR•SPEED•BRAKE)
802 JD93-07A
33B
3.9K
4.7V
1HZ 916 E1
270K
22K
Q2
150UF
161 D1
10 SEC
UP TO SPEED LATCH
1 140 D2A
1 140 D2B
8 172H D3B
+UP TO SPEED DELAYED
25B
074 A07-23B
192 A19-24B
193 A19-25B
NORMANDALE DIVISION
SPEED RELAY AND MOTOR RELAY CONTROL • UP TO SPEED
(9764)
LOC A08
CODE IDENT 19333
C
83319100
AJ
F
CROSS REF NO 082
SHEET 2
PAGE 7-56



NORMANDALE DIVISION	HEAD SELECT REGISTER UNIT SELECT XMTR/RCVR SEEK END XMTR (9764) LOC A08	CODE IDENT 19333	C	83319100	AJ E
		CROSS REF NO 083		SHEET 3	PAGE 7-57


124 A12-17A 11B -T ≥ 64
124 A12-02A 11A +DIFF BIT 5
124 A12-03A 12B +DIFF BIT 4
124 A12-04A 12A +DIFF BIT 3
124 A12-10A 14B +DIFF BIT 2
124 A12-09B 13A +DIFF BIT 1
124 A12-09A 13B +DIFF BIT 0
124 A12-11B 22B -GND
072 A07-06A 31A +(FINE•HEADS LOADED)
193 A19-31B 32B -OFFSET COMMAND PULSE
202 A20-14A 30B -ON CYLINDER DETECT A
202 A20-12B 30A -ON CYLINDER DETECT B
074 A07-31A 03B +SERVO FAULT
I 146 B4A
I 146 B4B
I 146 B4C
I 146 B4F
I 146 B4E
I 146 B4D
I 146 C4D
I 140 D2E
8 I72H E3D
X/Y 200 - E2D
I 140 B3A
I 140 B3B
I 140 B2A
I 140 B3D
I 140 B3C
I 140 B2B
I 140 B2D
I72H E3C
+5V
2.2K
+D/A BIT 5 10A 203 A20-05A
+D/A BIT 4 10B 203 A20-04B
+D/A BIT 3 09A 203 A20-04A
+D/A BIT 2 14A 203 A20-03B
+D/A BIT 1 15B 203 A20-05B
+D/A BIT 0 09B 203 A20-06A
-GND 15A 203 A20-06B
+ON CYLINDER DETECT ENABLE 29B 073 A07-05A 202 A20-13B
+ON CYLINDER SENSE 31B 072 A07-15A 202 A20-32A
-SERVO FAULT 02A 074 A07-33B
DIFFERENCE BITS
NORMANDALE DIVISION
(9764)
LOC A08
CODE IDENT 19333 C
DWG NO 83319100 AJ E
CROSS REF NO 084
SHEET 4
PAGE 7-58

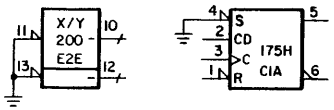
REVISION STATUS OF SHEETS

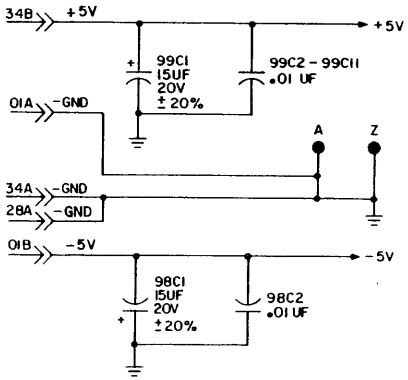
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																
B	A	B	B																
C	A	B	B																
D	A	D	B																
E	A	D	B																
F	F	F	F																
G	G	F	F																
H	H	F	F																

REVISIONS

REV.	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA	1-30-76	
B	PE22842	SCHEMATIC CORRECTIONS	MA	12-28-76	
C	PE22854	ERROR CORRECTION	GR	3-14-77	
D	PE48403	ADD PULL UP TO COPV	MA	3-21-77	
E		EDITORIAL	MA	5-20-77	
F	PE55259	LOGIC DIA IMPROVEMENT	GR	10-4-78	
G	PE57426	CHG WIRE WRAP	CB	2-18-81	
H	PE57622A	ADD FILTER DIODES	CB	3-17-82	

UNUSED LOGIC ELEMENTS

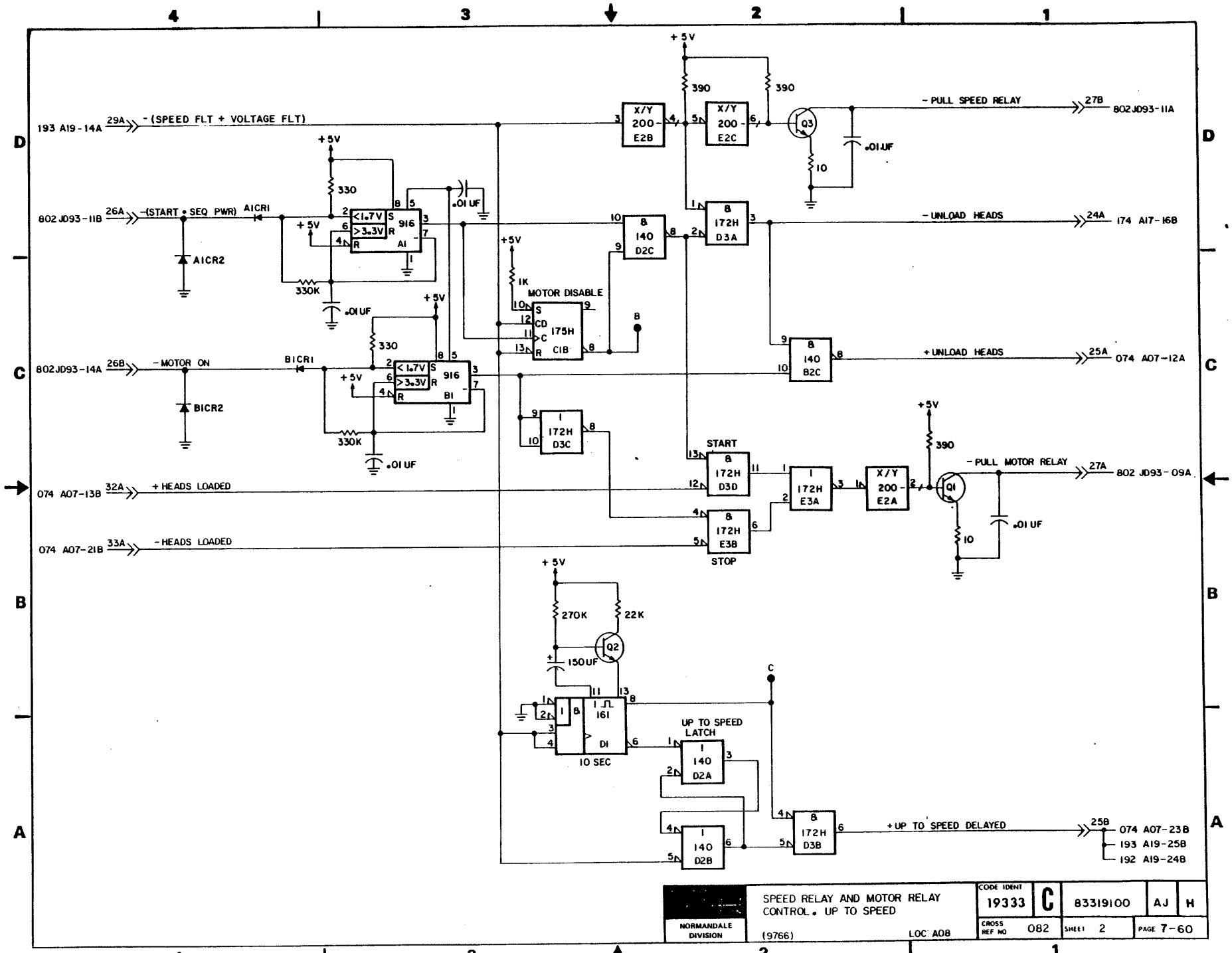




APPLICABLE ONLY TO BJ4A2 - C, D, N & P

DRAWN	MANDERSON		DIFF BITS, HEAD REG SPEED ENABLE, UNIT SELECT DIAGRAMS TYPE: BQPV	CODE IDENT 19333	C	83319100	AJ H
CHECKED							
ENGINEER							
APPROVED			NORMANDALE DIVISION	LOC: A08	CROSS REF NO 081	SHEET 1 OF 4	PAGE 7-59

REF 83214108

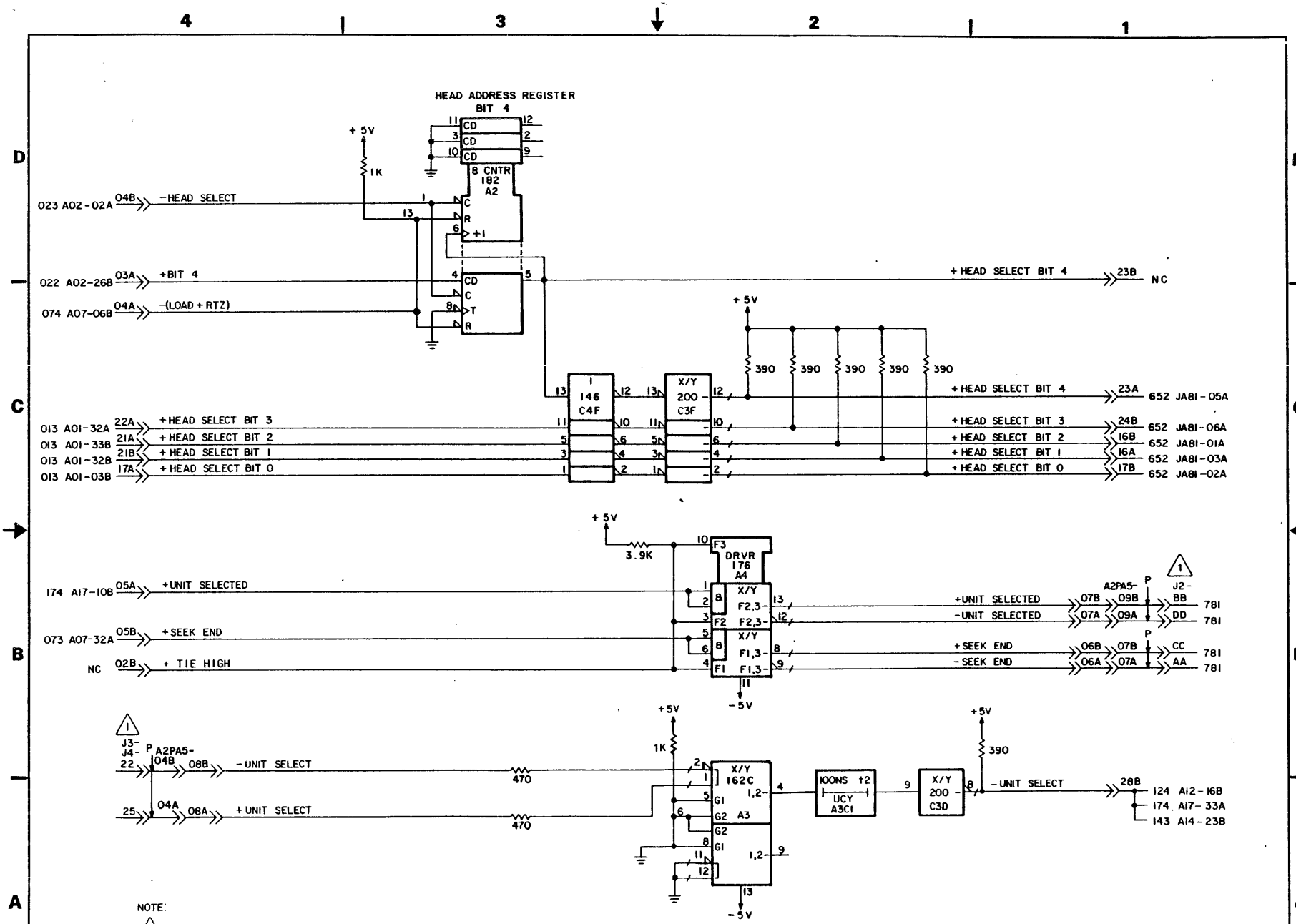


NORMANDALE DIVISION

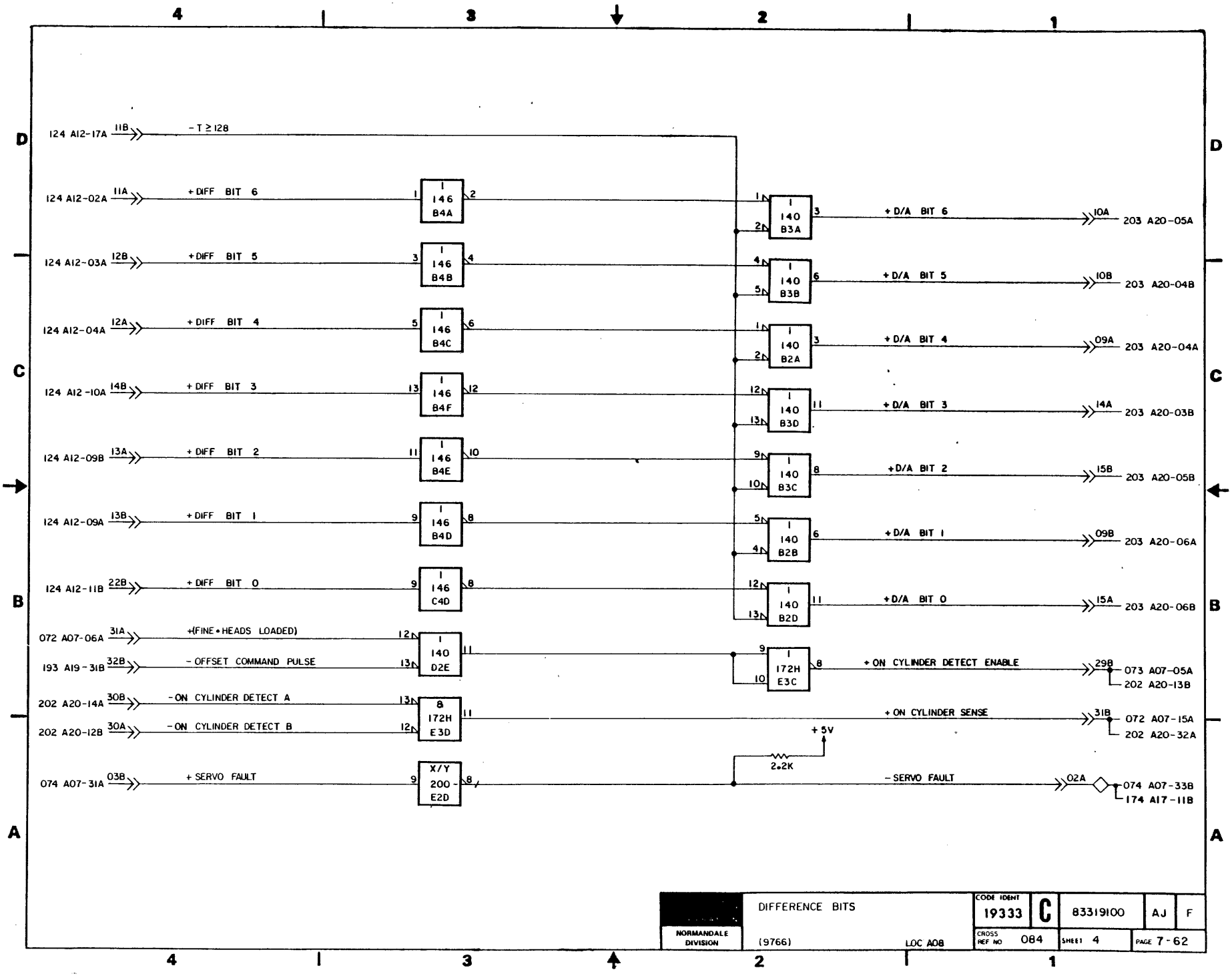
SPEED RELAY AND MOTOR RELAY CONTROL • UP TO SPEED

(9766) LOC: A08

CODE IDENT				
19333	C	83319100	AJ	H
CROSS REF NO 082	SHEET 2	PAGE 7-60		



NORMANDALE DIVISION	HEAD SELECT REGISTER UNIT SELECT XMTR/RCVR SEEK END XMTR (9766) LOC A08	CODE IDENT 19333	C	83319100	AJ F
		CROSS REF NO 083	SHEET 3	PAGE 7-61	



NORMANDALE DIVISION	DIFFERENCE BITS	CODE IDENT 19333	C	83319100	AJ	F
	(9766) LOC A08	CROSS REF NO 084		SHEET 4	PAGE 7-62	

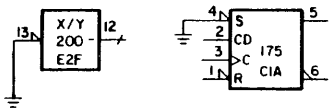
REVISION STATUS OF SHEETS

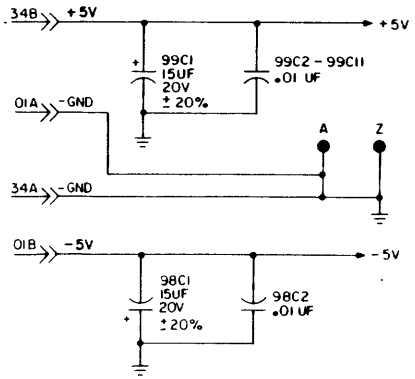
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																
B	B	A	A																
C	C	C	C																
D	D	D	D																
E	E	D	D																
F	F	D	F																

REVISIONS

REV	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	PF25000 PE22820	RELEASED			
B	PE48403	ADD PULL UP	MA	1-19-77	
C	PE22854	ERROR CORRECTION	MA	2-15-77	
D	PE55259	LOGIC DIAG IMPROVEMENT	MA	10-4-78	
E	PE57426	CH6 WIRE WRAP	TF	6-5-81	
F	PE57597	LOGIC DIAG CH6'S	TF	6-5-81	

UNUSED LOGIC ELEMENTS

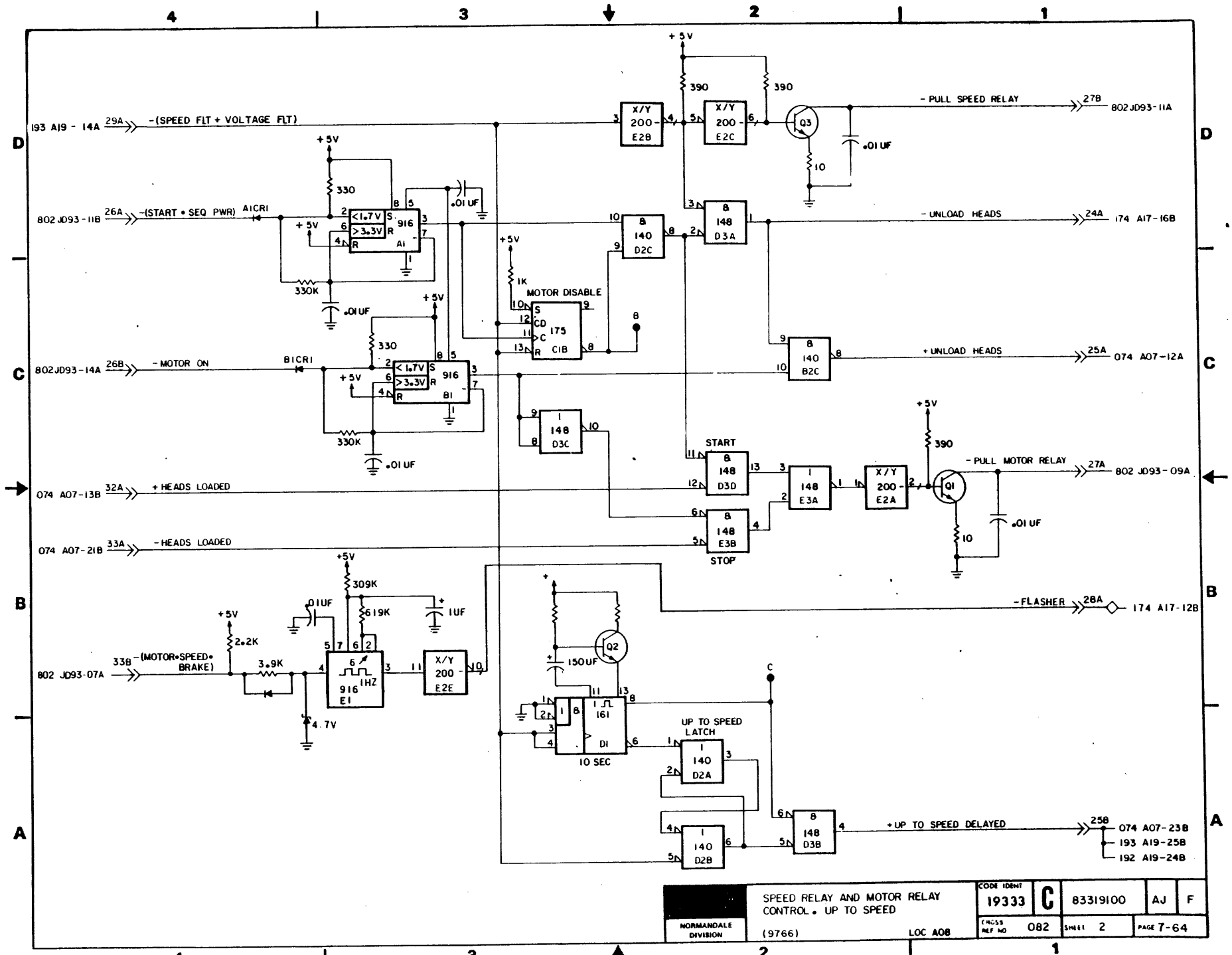




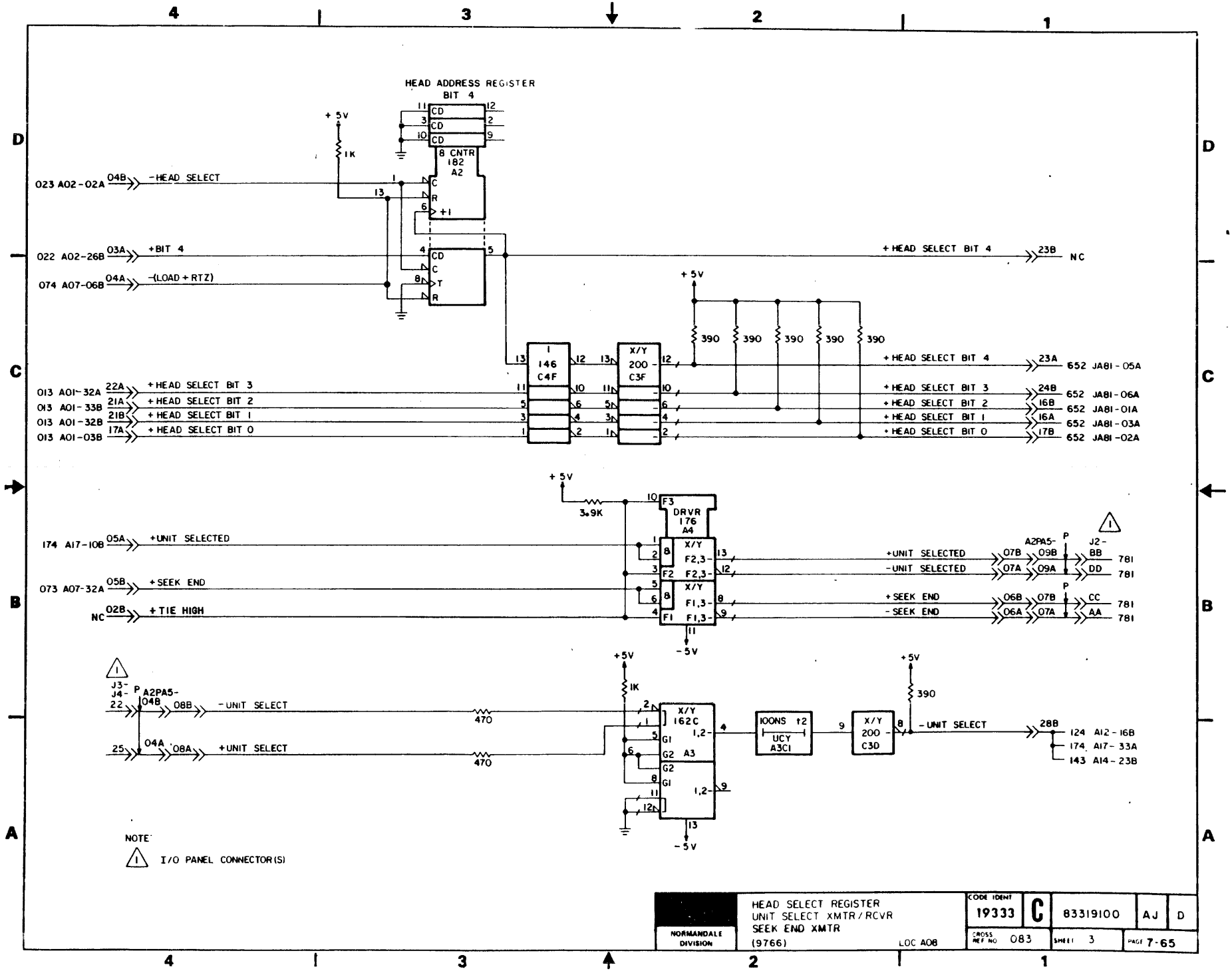
APPLICABLE TO ALL BJ4A2'S
EXCEPT BJ4A2-C,D,N&P

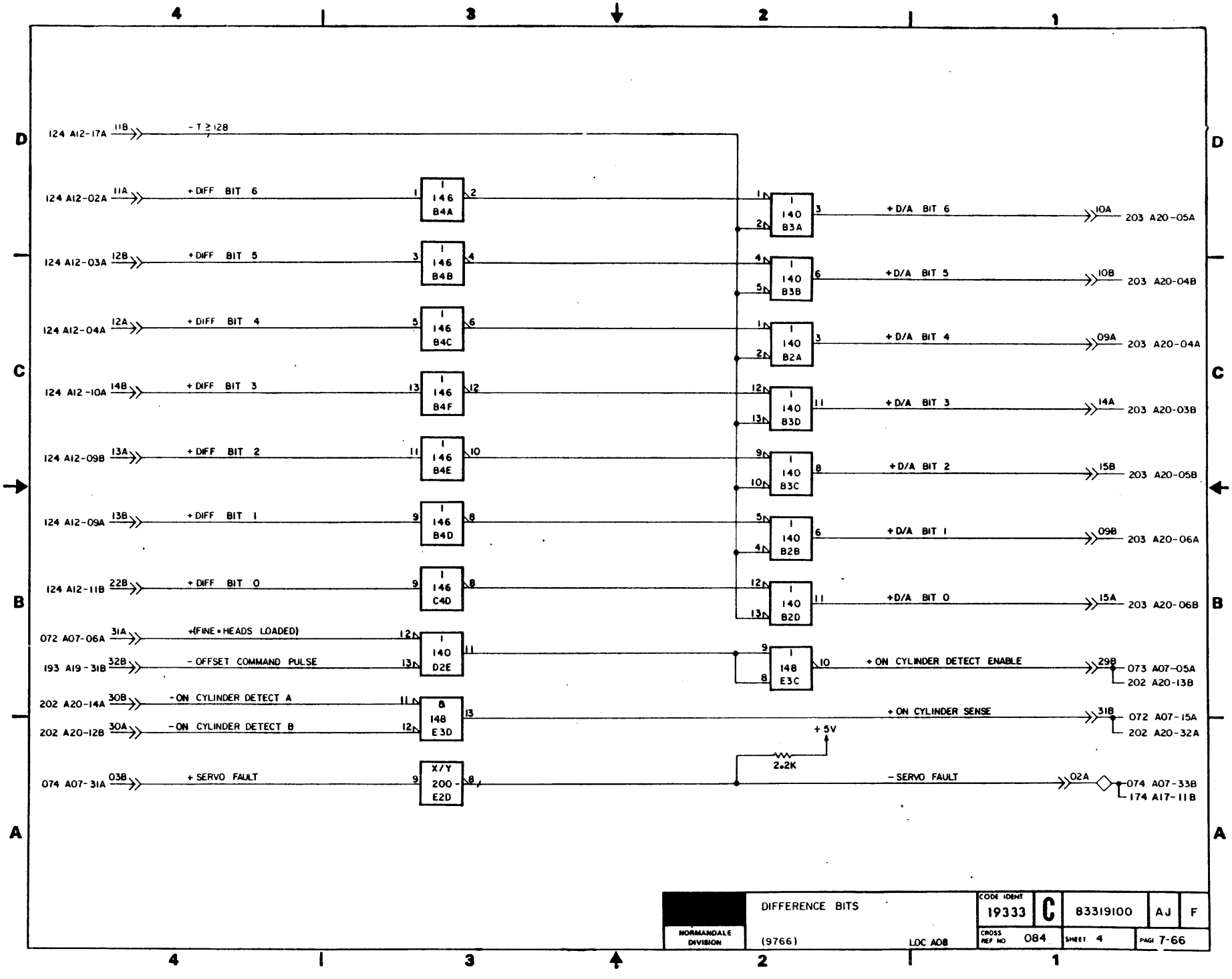
DRAWN	MANDERSON		DIFF BITS, HEAD REG, SPEED ENABLE, UNIT SELECT DIAGRAMS	CODE IDENT 19333	C	83319100	AJ F
CHECKED							
ENGINEER		NORMANDALE DIVISION	TYPE CQPV LOC A08	CROSS REF 081		SHEET 1 of 4	PAGE 7-63
APPROVED							

REF 83214188



NORMANDALE DIVISION	SPEED RELAY AND MOTOR RELAY CONTROL • UP TO SPEED (9766) LOC A08	CODE IDENT 19333	C	83319100	AJ F
		CROSS REF NO 082	SHEET 2	PAGE 7-64	


HEAD ADDRESS REGISTER BIT 4
8 CNTR 182 A2
+5V
1K
023 A02-02A 04B -HEAD SELECT
022 A02-26B 03A +BIT 4
074 A07-06B 04A -(LOAD + RTZ)
+HEAD SELECT BIT 4 23B NC
146 C4F
X/Y 200 C3F
390
013 A01-32A 22A +HEAD SELECT BIT 3
013 A01-33B 21A +HEAD SELECT BIT 2
013 A01-32B 21B +HEAD SELECT BIT 1
013 A01-03B 17A +HEAD SELECT BIT 0
+HEAD SELECT BIT 4 23A 652 JA81-05A
+HEAD SELECT BIT 3 24B 652 JA81-06A
+HEAD SELECT BIT 2 16B 652 JA81-01A
+HEAD SELECT BIT 1 16A 652 JA81-03A
+HEAD SELECT BIT 0 17B 652 JA81-02A
3.9K
DRVR 176 A4
174 A17-10B 05A +UNIT SELECTED
073 A07-32A 05B +SEEK END
NC 02B +TIE HIGH
+UNIT SELECTED 07B 07A
-UNIT SELECTED
+SEEK END 06B 06A
-SEEK END
A2PA5- J2- BB 781 DD 781 CC 781 AA 781
-5V
J3- J4- A2PA5- 22 25 04B 04A 08B 08A
-UNIT SELECT
+UNIT SELECT
470
X/Y 162C
100NS t2 UCY A3C1
X/Y 200 C3D
-UNIT SELECT 28B 124 A12-16B 174 A17-33A 143 A14-23B
NOTE
I/O PANEL CONNECTOR(S)
NORMANDALE DIVISION
HEAD SELECT REGISTER
UNIT SELECT XMTR/RCVR
SEEK END XMTR
(9766) LOC A08
CODE IDENT 19333
C
83319100
AJ
D
CROSS REF NO 083
SHEET 3
PAGE 7-65



NORMANDALE DIVISION	DIFFERENCE BITS	CODE IDENT 19333	C	83319100	AJ	F
	(9766) LOC A08	CROSS REF NO 084		SHEET 4	PAGE 7-66	

REVISIONS					
REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
AA	DJ23000	REVISED AND REDRAWN. SEE M-F HISTORY FOR REVS A-Y	RB	9-13-85	

NOTE:

1. DRAWINGS WHERE TAB NUMBERS CREATE NEW COVER SHEET, TABS 00-99 ARE RESERVED.
2. TERMINATOR RESISTOR- 1KΩ TO -5.1 V.
3. JA84 IS INTERNAL TEST JACK USED FOR CONNECTION TO FTU.
4. ALSO A10-27B ON BJA2C, D UNITS.
5. A10-13B SERVO CLOCK ON BJ4A2C, D UNITS.
6. NOT USED IN BJ4A2C, D UNITS.

83214110

DRAWN	T. COOPER	3-8-85
CHECKED		3-26-85
ENGINEER		7/25/85
APPROVED		

WRITE CLOCK 806 KHz TO 9.67 MHz
DIAGRAMS
TYPE: CLSV LOC A10

TWIN CITIES DISK DIVISION | C | 83319100 | AT

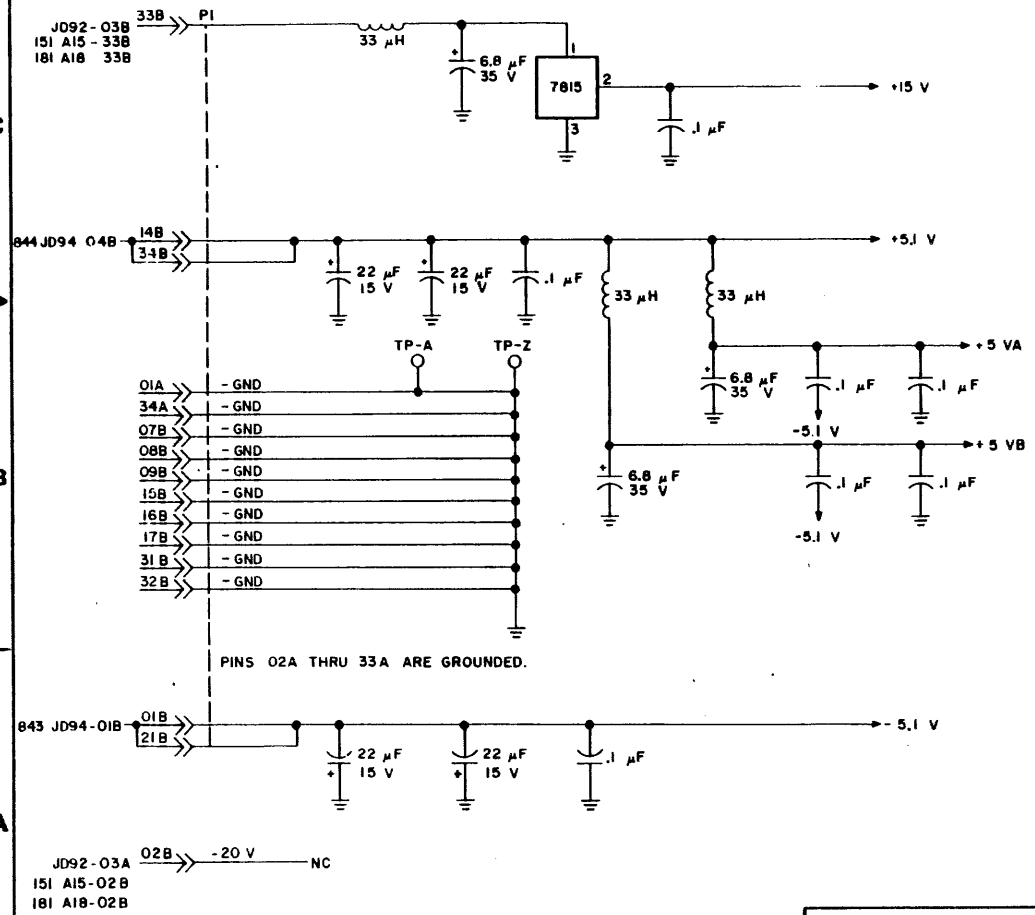
CODE IDENT 19333 | CROSS REF NO 101 | SHEET 1 OF 4 | PAGE 7-67

UNUSED LOGIC ELEMENTS

ELEMENT	LOCATION	OUTPUT PIN(S)
10102	U-A2	2

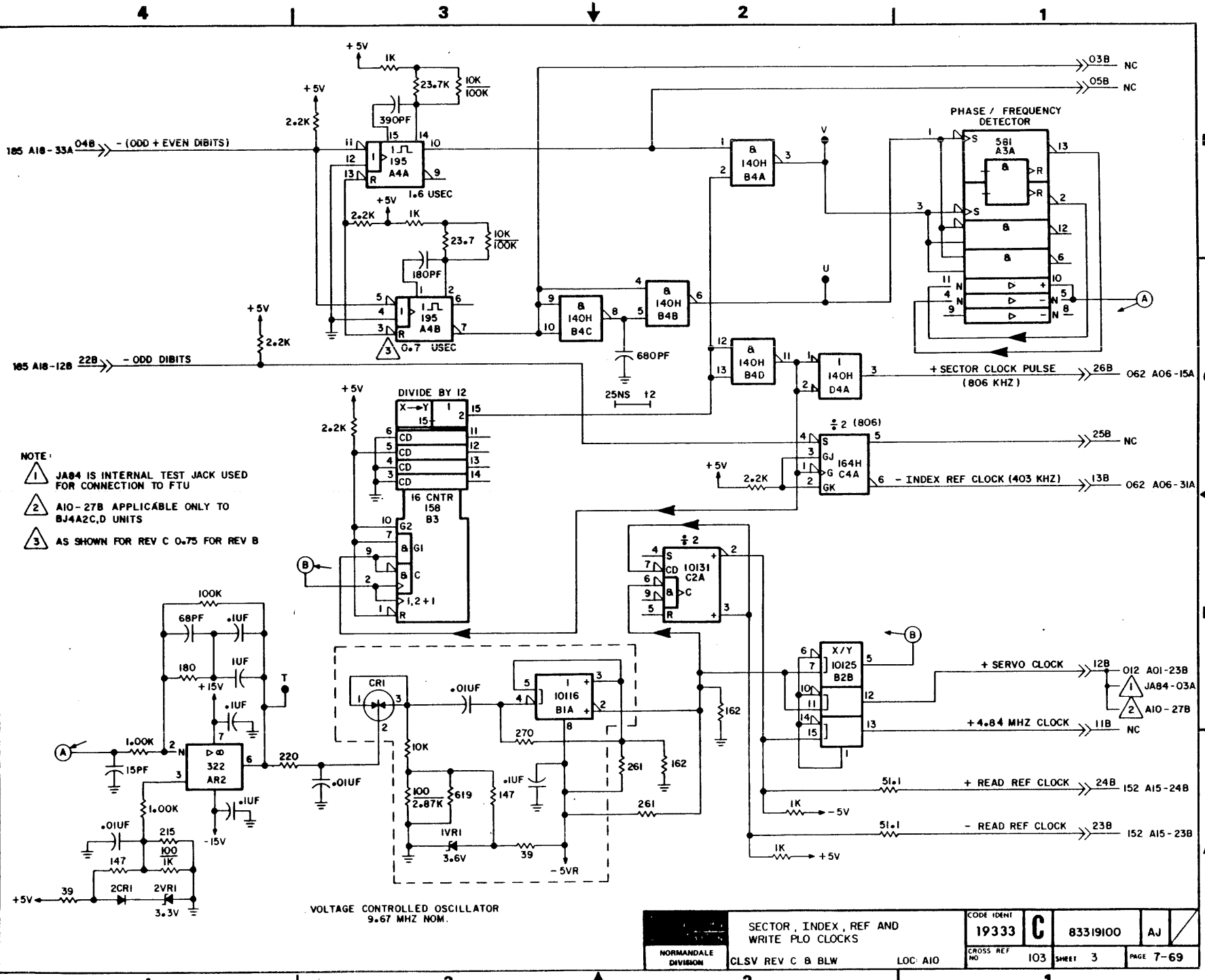
FILTER CAPS

.1 μF		
+15 V	+5.1 V	-5.1 V
B2C1	B3C1	A2C1
D2C3	B4C1	A3C1
C3C3	C3C2	B1C2
	C4C2	C3C1
	D4C2	C4C1
		D1C2
		E2C1
		E3C1
		E4C2

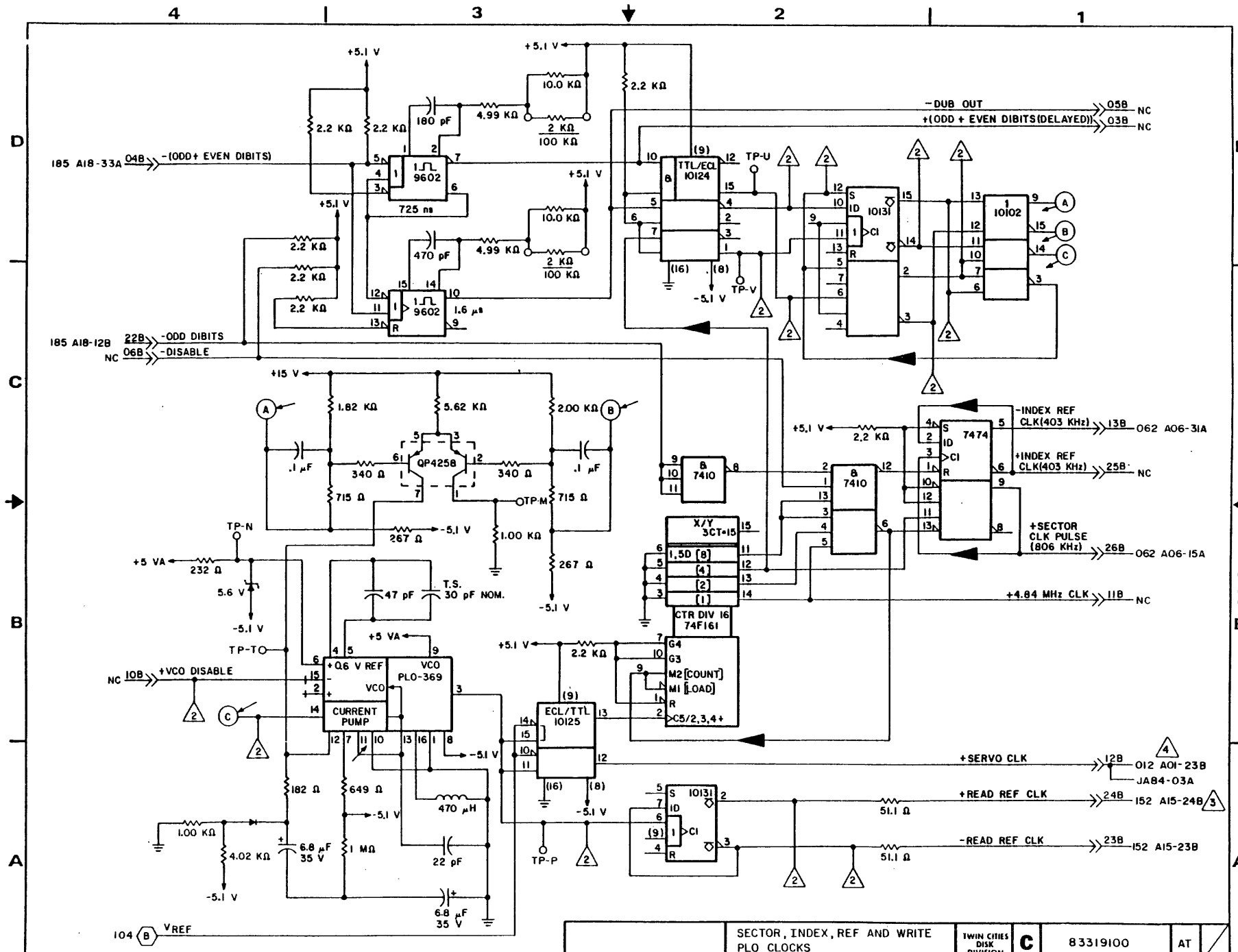


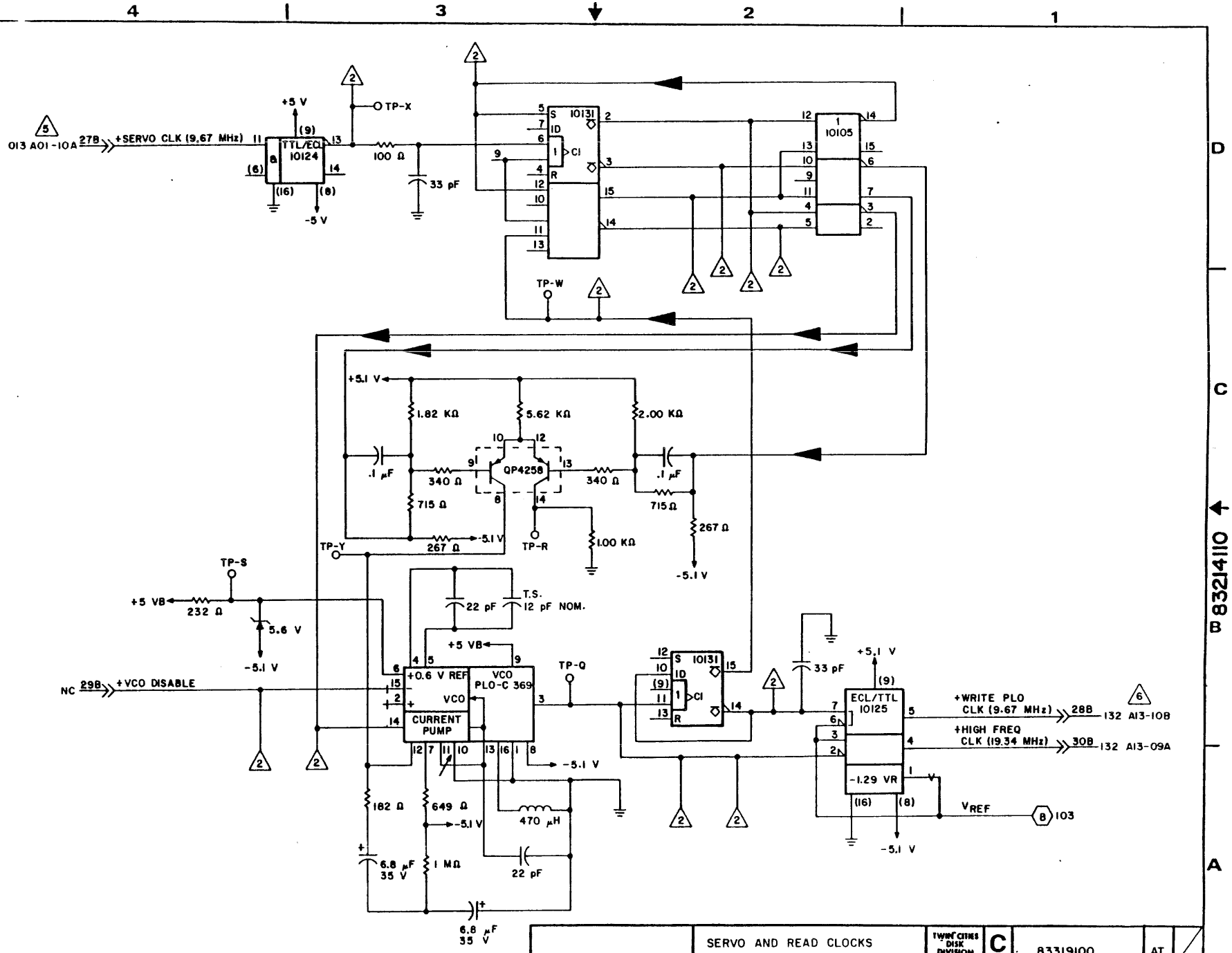
	POWER INPUT PINS AND UNUSED LOGIC ELEMENTS	TWIN CITIES DISK DIVISION	C	83319100 AT
	TYPE: CLSV LOC A10	CODE IDENT 19333	102	SHEET 2 7-68

83214110



NORMANDALE DIVISION	SECTOR, INDEX, REF AND WRITE PLO CLOCKS	CODE IDENT 19333	C	83319100	AJ
	CLSV REV C & BLW LOC: A10	CROSS REF NO 103	SHEET 3	PAGE 7-69	


+5.1 V
2.2 KΩ
180 pF
4.99 KΩ
10.0 KΩ
2 KΩ
100 KΩ
185 A18-33A 04B -(ODD+ EVEN DIBITS)
1 9602
725 ns
470 pF
1.6 μs
185 A18-12B 22B -ODD DIBITS
NC 06B -DISABLE
TTL/ECL 10124
TP-U
TP-V
-5.1 V
-DUB OUT 05B NC
+(ODD + EVEN DIBITS(DELAYED)) 03B NC
S ID 10131 CI R
10102
+15 V
1.82 KΩ
5.62 KΩ
2.00 KΩ
.1 μF
QP4258
340 Ω
715 Ω
TP-M
267 Ω
1.00 KΩ
TP-N
+5 VA
232 Ω
5.6 V
47 pF
T.S. 30 pF NOM.
8 7410
X/Y 3CT=15
1,5D [8]
[4]
[2]
[1]
CTR DIV 16 74F161
G4
G3
M2 [COUNT]
MI [LOAD]
C5/2,3,4+
7474
-INDEX REF CLK(403 KHz) 13B 062 A06-31A
+INDEX REF CLK(403 KHz) 25B NC
+SECTOR CLK PULSE (806 KHz) 26B 062 A06-15A
+4.84 MHz CLK 11B NC
TP-T
NC 10B +VCO DISABLE
+0.6 V REF
VCO
PLO-369
CURRENT PUMP
182 Ω
649 Ω
470 μH
1.00 KΩ
4.02 KΩ
6.8 μF 35 V
1 MΩ
22 pF
104 B VREF
ECL/TTL 10125
TP-P
+SERVO CLK 12B 012 A01-23B JA84-03A
+READ REF CLK 24B 152 A15-24B
-READ REF CLK 23B 152 A15-23B
51.1 Ω
SECTOR, INDEX, REF AND WRITE PLO CLOCKS
CLSV REV D & ABV
LOC: A2A01
TWIN CITIES DISK DIVISION
C
83319100
AT
CODE IDENT 19333
CROSS REF NO. 103
SHEET 3A
7-70
83214110

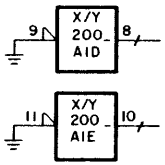


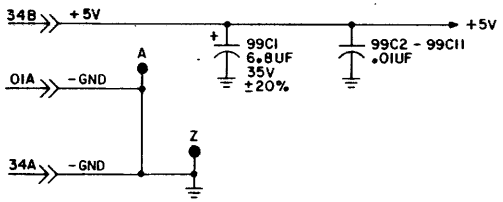
SERVO AND READ CLOCKS	TWIN CITIES DISK DIVISION	C	83319100	AT
TYPE: CLSV LOC:A2A01	CODE IDENT 19333	CROSS REF NO. 104	SHEET 4	7-71

83214110 B

REVISIONS					
REV	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA	2-17-76	
B	PE22842	SCHEMATIC CORRECTION	MA	12-28-76	
C		EDITORIAL	MA	5-20-77	
D	PE55259	LOGIC DIAG IMPROVEMENT	MA	10-4-78	
E	DJ00652	ELIM IC 9015 FLWV	JL	10-9-84	

UNUSED LOGIC ELEMENTS

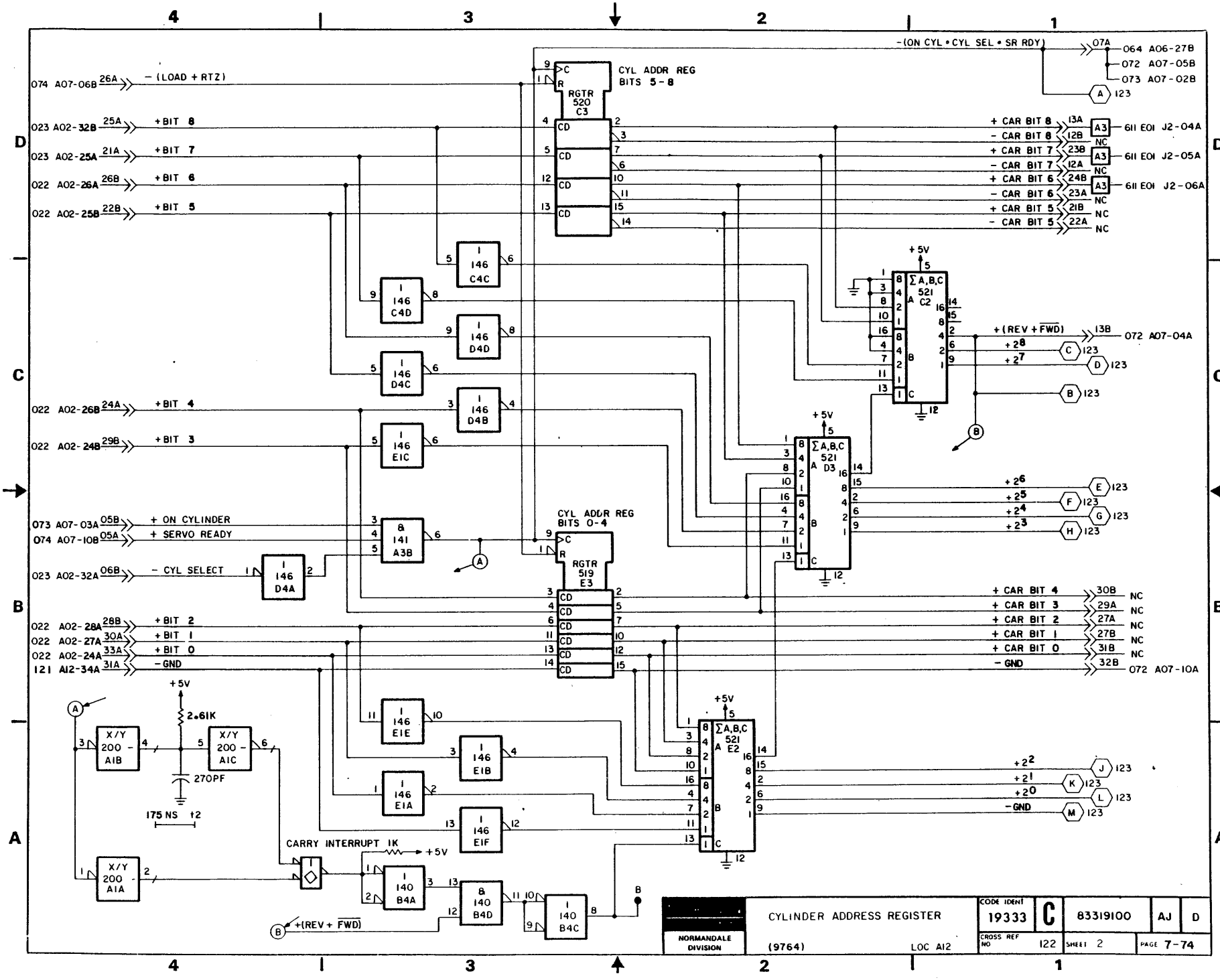


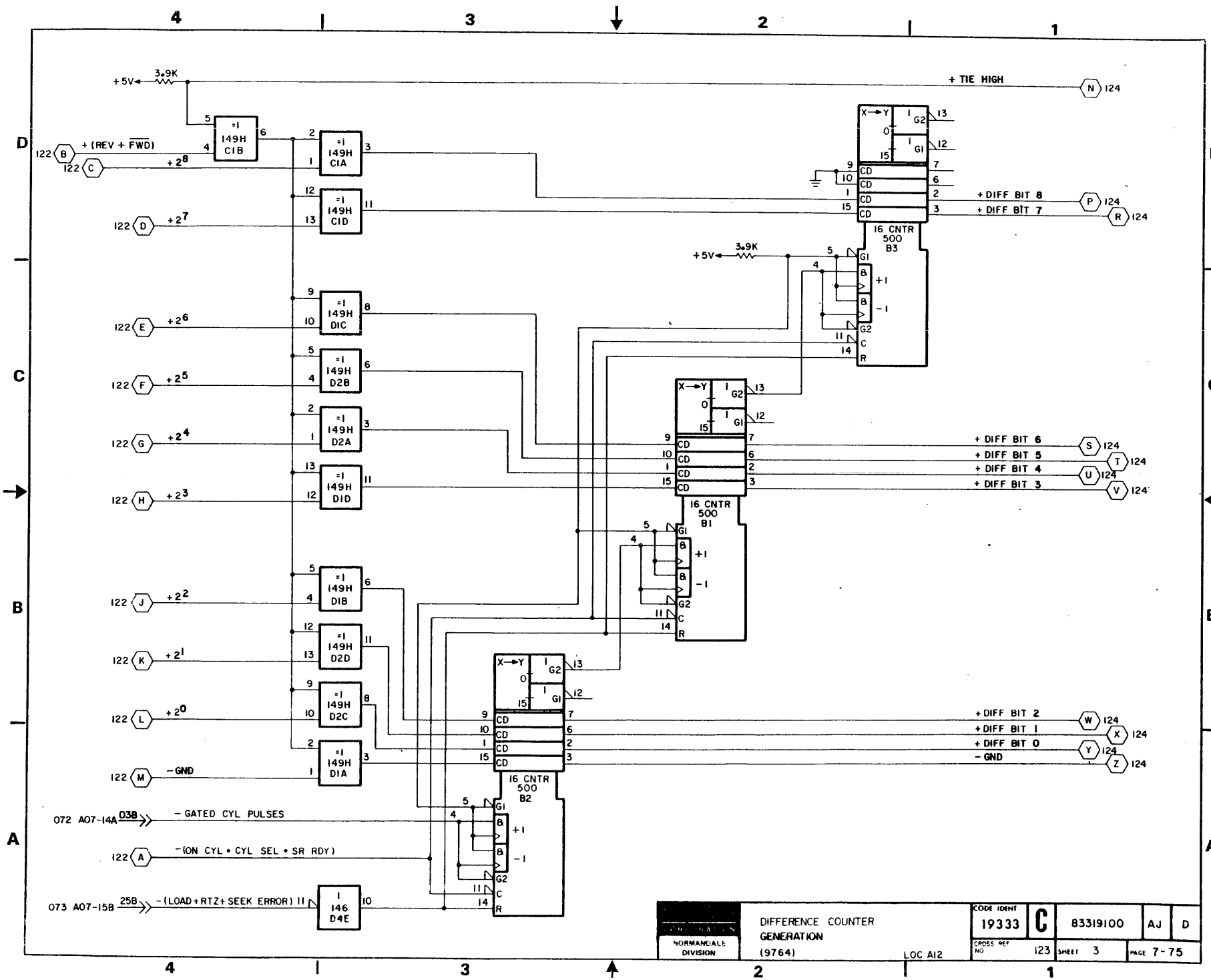


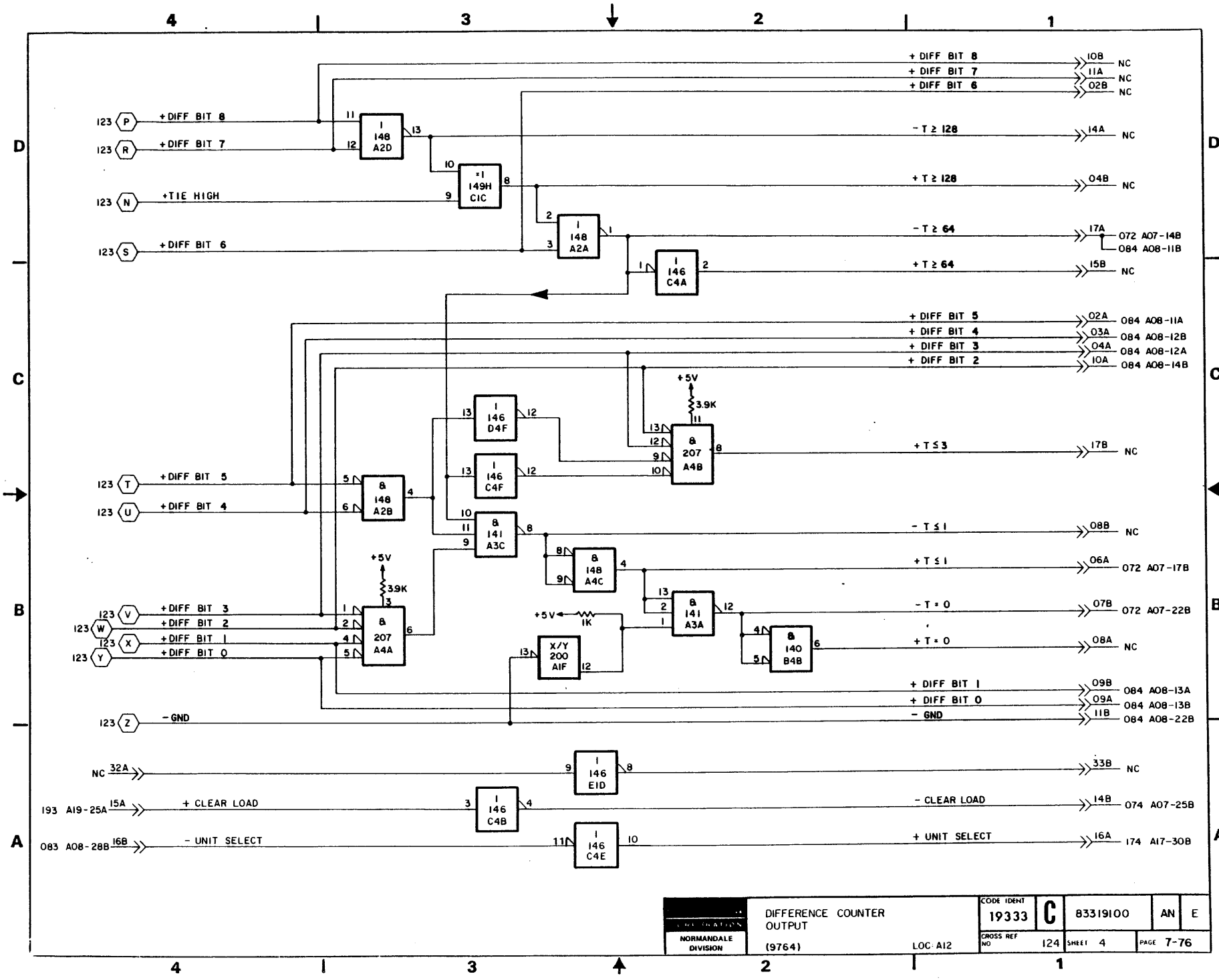
APPLICABLE ONLY TO BJ4A1

DRAWN	G CARLINE 1-21-76	NORMANDALE DIVISION	DIFFERENCE GENERATION AND CONTROL DIAGRAMS	CODE IDENT 19333	C	83319100	AN	E
CHECKED			TYPE FLWV LOC A12	CROSS REF NO 121		SHEET 1 OF 4	PAGE 7-73	
ENGINEER								
APPROVED								

REF 83214605


CYL ADDR REG BITS 5-8
RGTR 520 C3
CYL ADDR REG BITS 0-4
RGTR 519 E3
- (LOAD + RTZ)
+ BIT 8
+ BIT 7
+ BIT 6
+ BIT 5
+ BIT 4
+ BIT 3
+ BIT 2
+ BIT 1
+ BIT 0
- GND
+ ON CYLINDER
+ SERVO READY
- CYL SELECT
-(ON CYL • CYL SEL • SR RDY)
+ CAR BIT 8
- CAR BIT 8
+ CAR BIT 7
- CAR BIT 7
+ CAR BIT 6
- CAR BIT 6
+ CAR BIT 5
- CAR BIT 5
+ CAR BIT 4
+ CAR BIT 3
+ CAR BIT 2
+ CAR BIT 1
+ CAR BIT 0
+(REV + FWD)
+5V
2.61K
270PF
175 NS ±2
CARRY INTERRUPT 1K
NORMANDALE DIVISION
CYLINDER ADDRESS REGISTER
(9764)
LOC A12
CODE IDENT 19333
C
83319100
AJ
D
CROSS REF NO 122
SHEET 2
PAGE 7-74


+5V
3.9K
+ TIE HIGH
N 124
122 B + (REV + FWD)
122 C +2^8
122 D +2^7
122 E +2^6
122 F +2^5
122 G +2^4
122 H +2^3
122 J +2^2
122 K +2^1
122 L +2^0
122 M -GND
=1 149H C1B
=1 149H C1A
=1 149H C1D
=1 149H D1C
=1 149H D2B
=1 149H D2A
=1 149H D1D
=1 149H D1B
=1 149H D2D
=1 149H D2C
=1 149H D1A
16 CNTR 500 B3
16 CNTR 500 B1
16 CNTR 500 B2
+DIFF BIT 8
+DIFF BIT 7
+DIFF BIT 6
+DIFF BIT 5
+DIFF BIT 4
+DIFF BIT 3
+DIFF BIT 2
+DIFF BIT 1
+DIFF BIT 0
-GND
072 A07-14A 03B - GATED CYL PULSES
122 A -(ON CYL • CYL SEL • SR RDY)
073 A07-15B 25B -(LOAD+RTZ+SEEK ERROR) 11
I 146 D4E
DIFFERENCE COUNTER GENERATION
(9764)
LOC A12
NORMANDALE DIVISION
CODE IDENT 19333
C
83319100
AJ
D
CROSS REF NO 123
SHEET 3
PAGE 7-75

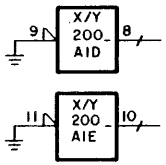


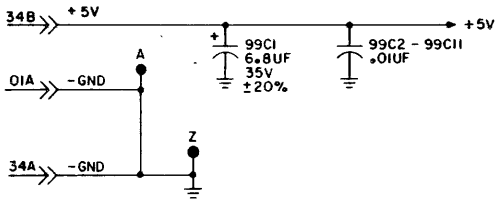
NORMANDALE DIVISION	DIFFERENCE COUNTER OUTPUT (9764) LOC: A12	CODE IDENT 19333	C	83319100	AN	E
		CROSS REF NO 124	SHEET 4	PAGE 7-76		

REVISIONS

REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA	2-17-76	
B	PE22781	CORRECT SCHEMATICS	MA	12 29-76	
C	PE22842	SCHEMATIC CORRECTIONS	MA	5-20-77	
D	PE55259	LOGIC DIAG IMPROVEMENT	MA	10-4-78	
E	0.000652	ELIM IC 9015 FLWV	JL	10-11-84	

UNUSED LOGIC ELEMENTS

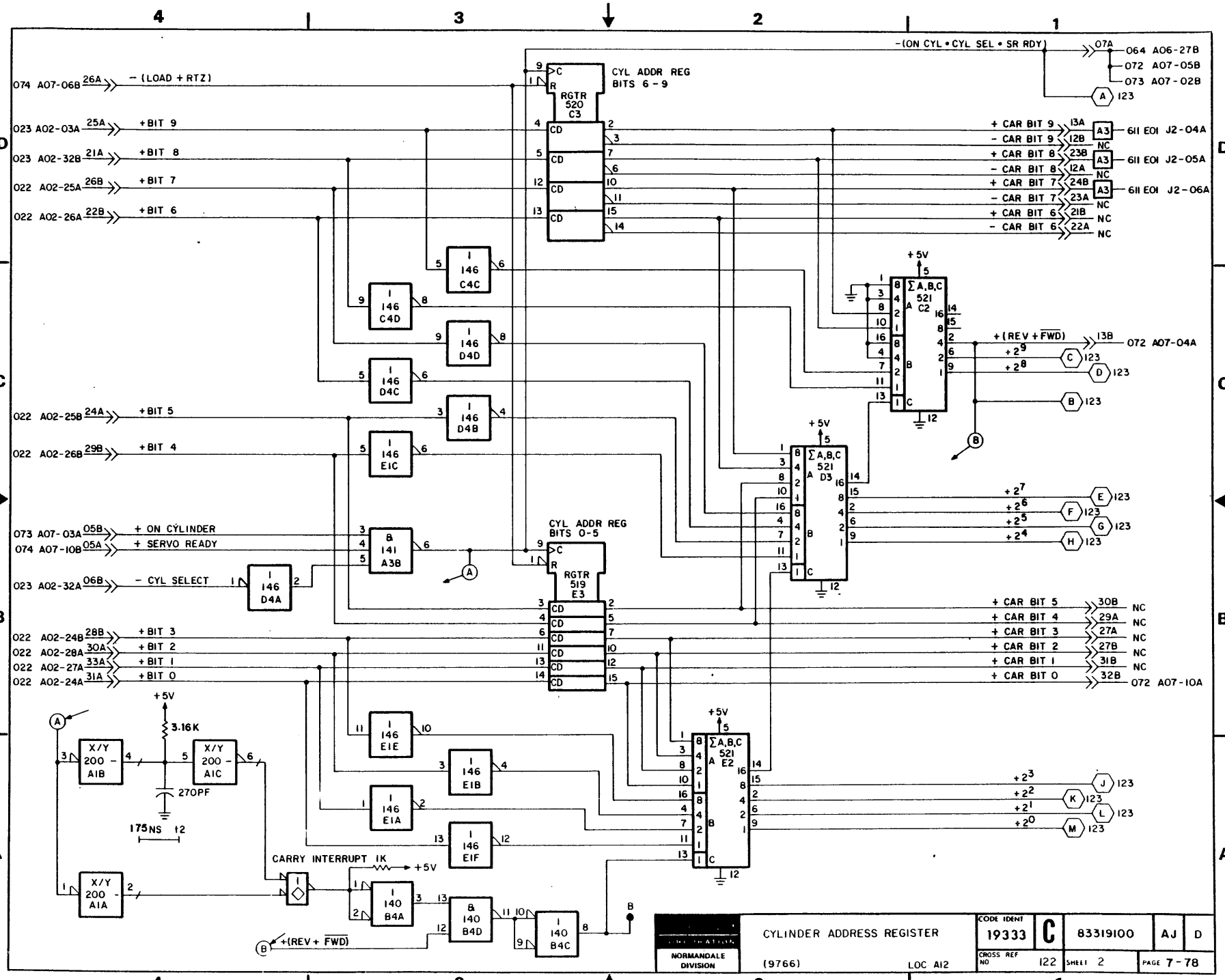


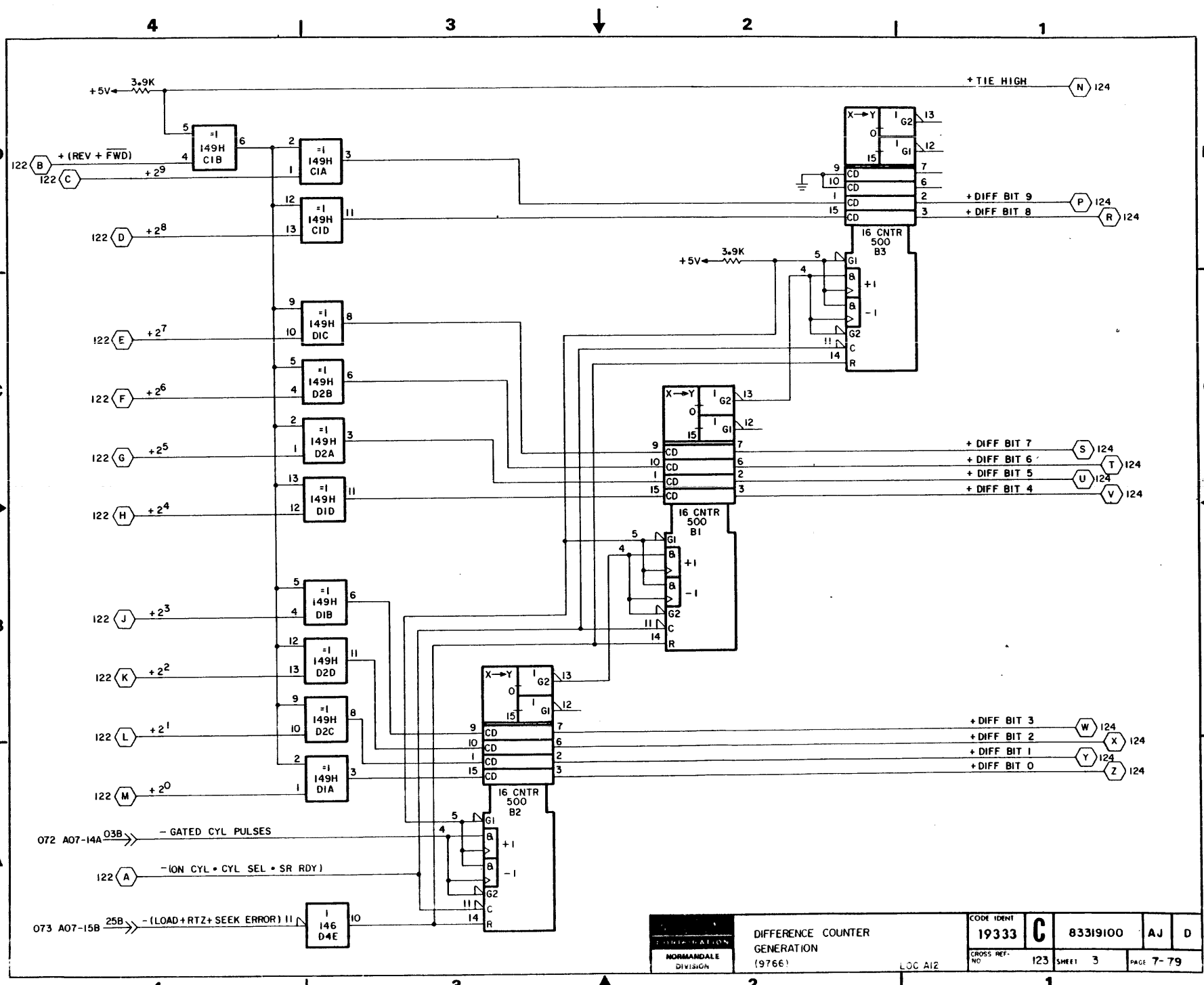


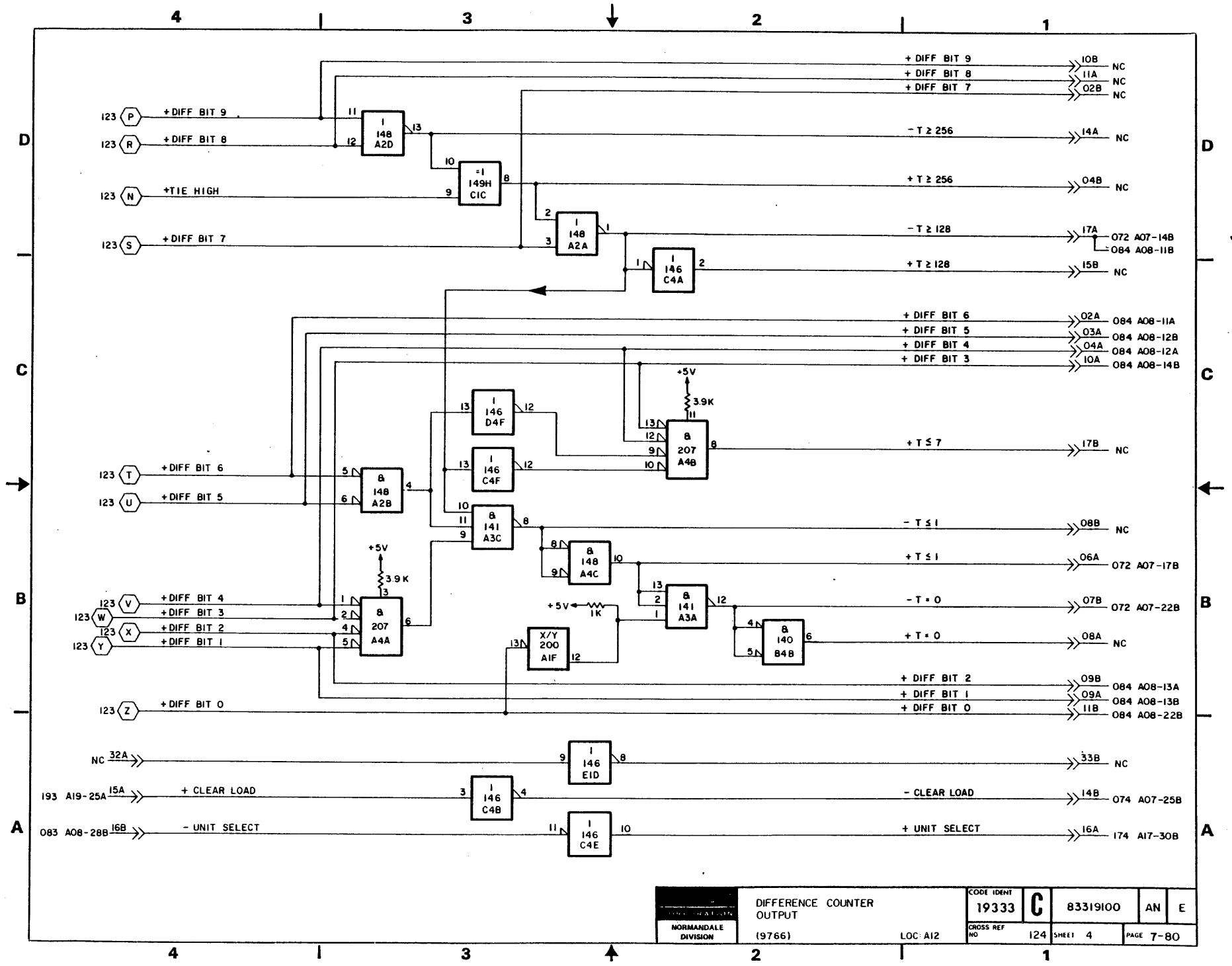
APPLICABLE ONLY TO BJ4A2

DRAWN		NORMANDALE DIVISION	DIFFERENCE GENERATION AND CONTROL DIAGRAMS TYPE FLWV LOC A12	CODE IDENT 19333	C	83349100	AN E
CHECKED				CROSS REF NO 121		SHEET 1 of 4	PAGE 7-77
ENGINEER							
APPROVED							

REF 83214112


CYL ADDR REG BITS 6 - 9
RGTR 520 C3
CYL ADDR REG BITS 0-5
RGTR 519 E3
Σ A,B,C 521 C2
Σ A,B,C 521 D3
Σ A,B,C 521 E2
- (LOAD + RTZ)
+ BIT 9
+ BIT 8
+ BIT 7
+ BIT 6
+ BIT 5
+ BIT 4
+ BIT 3
+ BIT 2
+ BIT 1
+ BIT 0
+ ON CYLINDER
+ SERVO READY
- CYL SELECT
-(ON CYL • CYL SEL • SR RDY)
+ CAR BIT 9
- CAR BIT 9
+ CAR BIT 8
- CAR BIT 8
+ CAR BIT 7
- CAR BIT 7
+ CAR BIT 6
- CAR BIT 6
+ CAR BIT 5
+ CAR BIT 4
+ CAR BIT 3
+ CAR BIT 2
+ CAR BIT 1
+ CAR BIT 0
+ (REV + FWD)
CARRY INTERRUPT IK
3.16K
270PF
175NS ±2
+5V
CYLINDER ADDRESS REGISTER
NORMANDALE DIVISION
(9766)
LOC A12
CODE IDENT 19333
C
83319100
AJ
D
CROSS REF NO 122
SHEET 2
PAGE 7-78


+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
=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
072 A07-14A 03B - GATED CYL PULSES
122 A -(ON CYL • CYL SEL • SR RDY)
073 A07-15B 25B -(LOAD+RTZ+SEEK ERROR) 11
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
(9766)
LOC A12
NORMANDALE DIVISION
CODE IDENT 19333
C
83319100
AJ
D
CROSS REF-NO 123
SHEET 3
PAGE 7-79



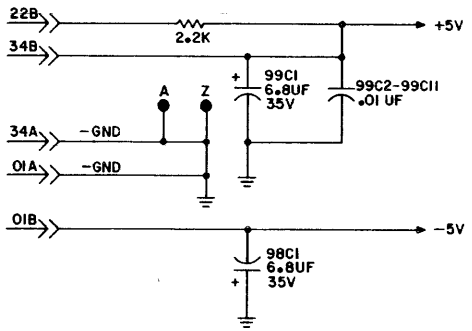
NORMANDALE DIVISION	DIFFERENCE COUNTER OUTPUT (9766) LOC: A12	CODE IDENT 19333	C	83319100	AN	E
		CROSS REF NO 124	SHEET 4	PAGE 7-80		

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																	
B	B	A																	
C	B	A																	

REVISIONS

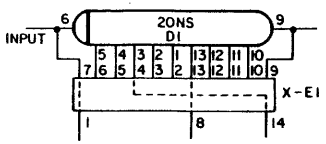
REV.	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA	11-14	
B	PE22805				
C		EDITORIAL	MA	5-20-77	



NOTE:

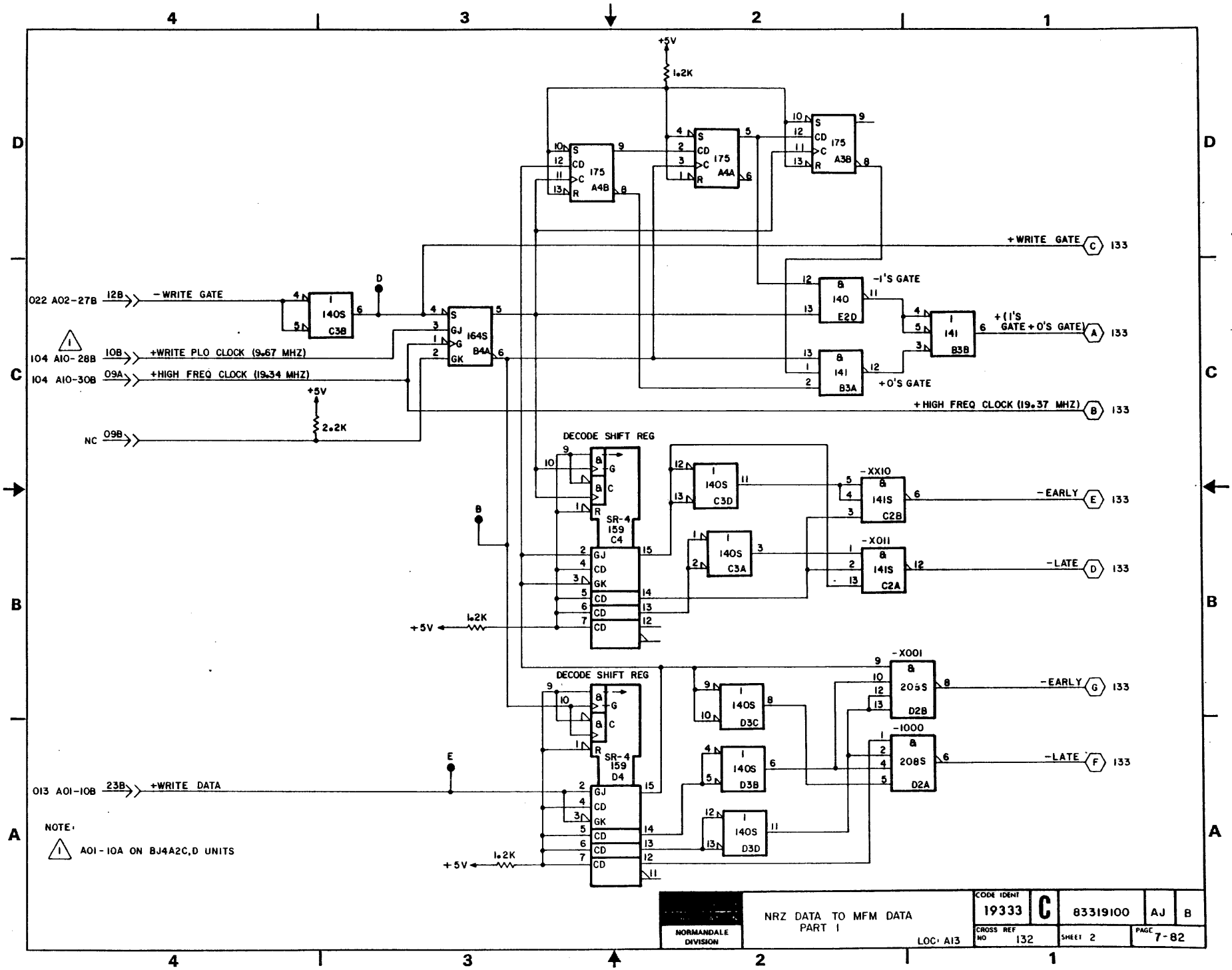
1. DELAY LINES ARE CONNECTED TO JUMPER BLOCK AS SHOWN IN DIAGRAM AT THE RIGHT. ACTUAL DELAYS ARE SELECTED DURING MANUFACTURING. THIS DIAGRAM SHOWS TYPICAL CONNECTIONS. DELAY TIME FOR EACH DELAY LINE PIN RELATIVE TO PIN 6 INPUT IS SHOWN IN CHART TO THE RIGHT.

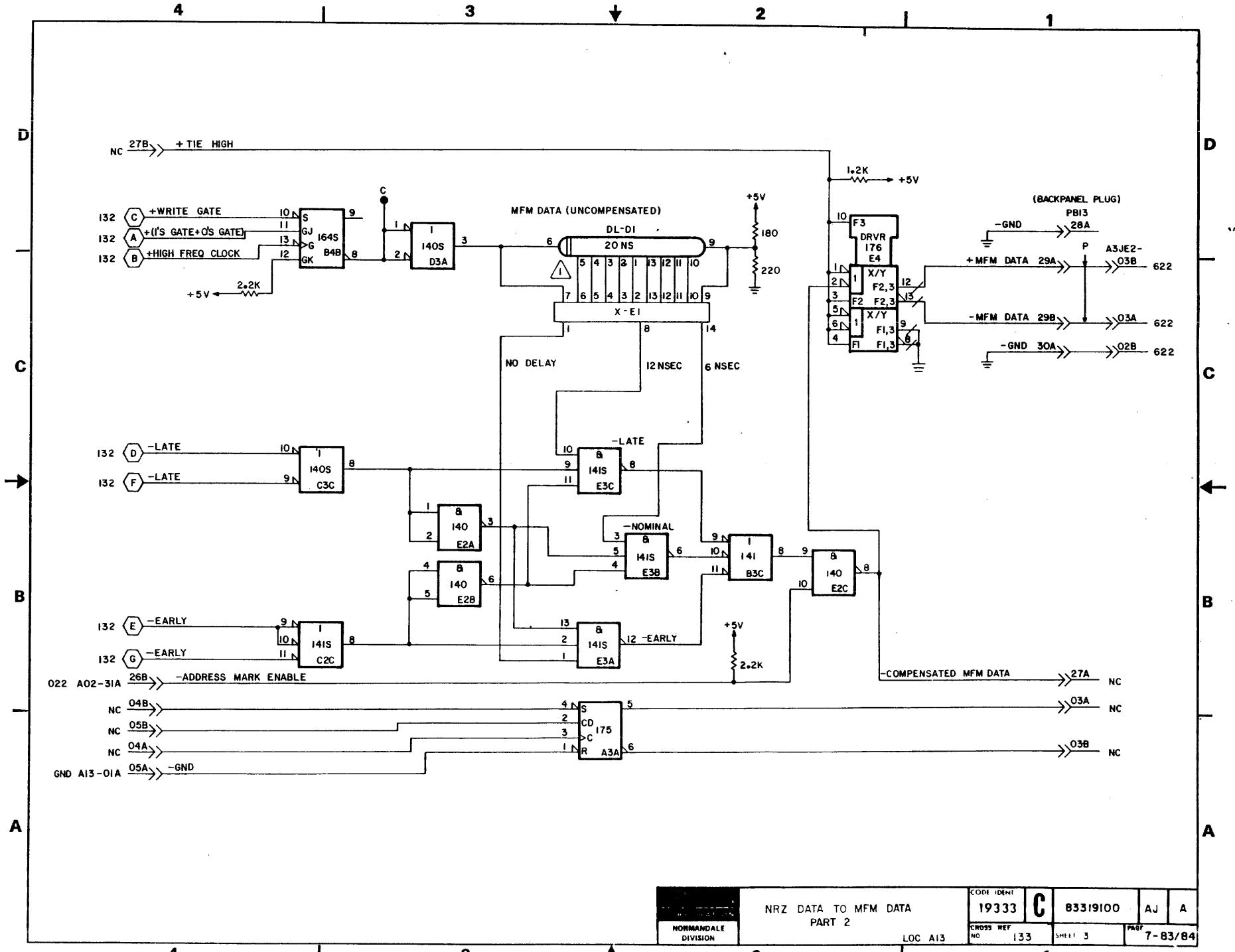
PIN	20NS DELAY
5	2 NS
4	4 NS
3	6 NS
2	8 NS
1	10 NS
13	12 NS
12	14 NS
11	16 NS
10	18 NS
9	20 NS



DRAWN		2-3-76	NORMANDALE DIVISION	NRZ TO COMPENSATED MFM	CODE IDENT 19333	C	83319100 AJ C
CHECKED							
ENGINEER				TYPE CLXV	LOC A13	CROSS REF NC 131	SHEET 1 OF 3
APPROVED							PAGE 7-81

REF 83214113


+5V
1.2K
175 A4B
175 A4A
175 A3B
+WRITE GATE
C 133
-1'S GATE
140 E2D
141 B3B
+(1'S GATE + 0'S GATE)
A 133
141 B3A
+0'S GATE
+HIGH FREQ CLOCK (19.37 MHZ)
B 133
022 A02-27B 12B -WRITE GATE
140S C3B
164S B4A
104 A10-28B 10B +WRITE PLO CLOCK (9.67 MHZ)
104 A10-30B 09A +HIGH FREQ CLOCK (19.34 MHZ)
NC 09B
2.2K
DECODE SHIFT REG
SR-4 159 C4
140S C3D
140S C3A
-XX10
141S C2B
-EARLY
E 133
-XX11
141S C2A
-LATE
D 133
+5V
1.2K
DECODE SHIFT REG
SR-4 159 D4
-X001
205S D2B
-EARLY
G 133
140S D3C
-1000
208S D2A
-LATE
F 133
140S D3B
140S D3D
013 A01-10B 23B +WRITE DATA
NOTE:
1 A01-10A ON BJ4A2C,D UNITS
NORMANDALE DIVISION
NRZ DATA TO MFM DATA
PART 1
LOC: A13
CODE IDENT 19333
C
83319100
AJ
B
CROSS REF NO 132
SHEET 2
PAGE 7-82

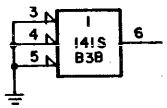


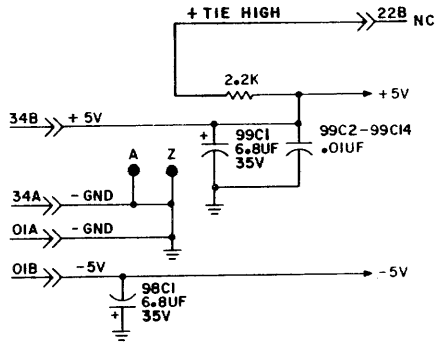
NORMANDALE DIVISION	NRZ DATA TO MFM DATA PART 2 LOC A13	CODE IDENT 19333	C	83319100	AJ A
		CROSS REF NO 133		SHEET 3	PAGE 7-83/84

REVISIONS

REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	GR		
B	PE48260	TECHNICAL CORRECTIONS	MA		
C	PE22842	SCHEMATIC CORRECTIONS	MA	12-28-76	
D		EDITORIAL	MA	5-20-77	
E	DJ00708	CHG ELXV COMP AY	JL	10 11 84	

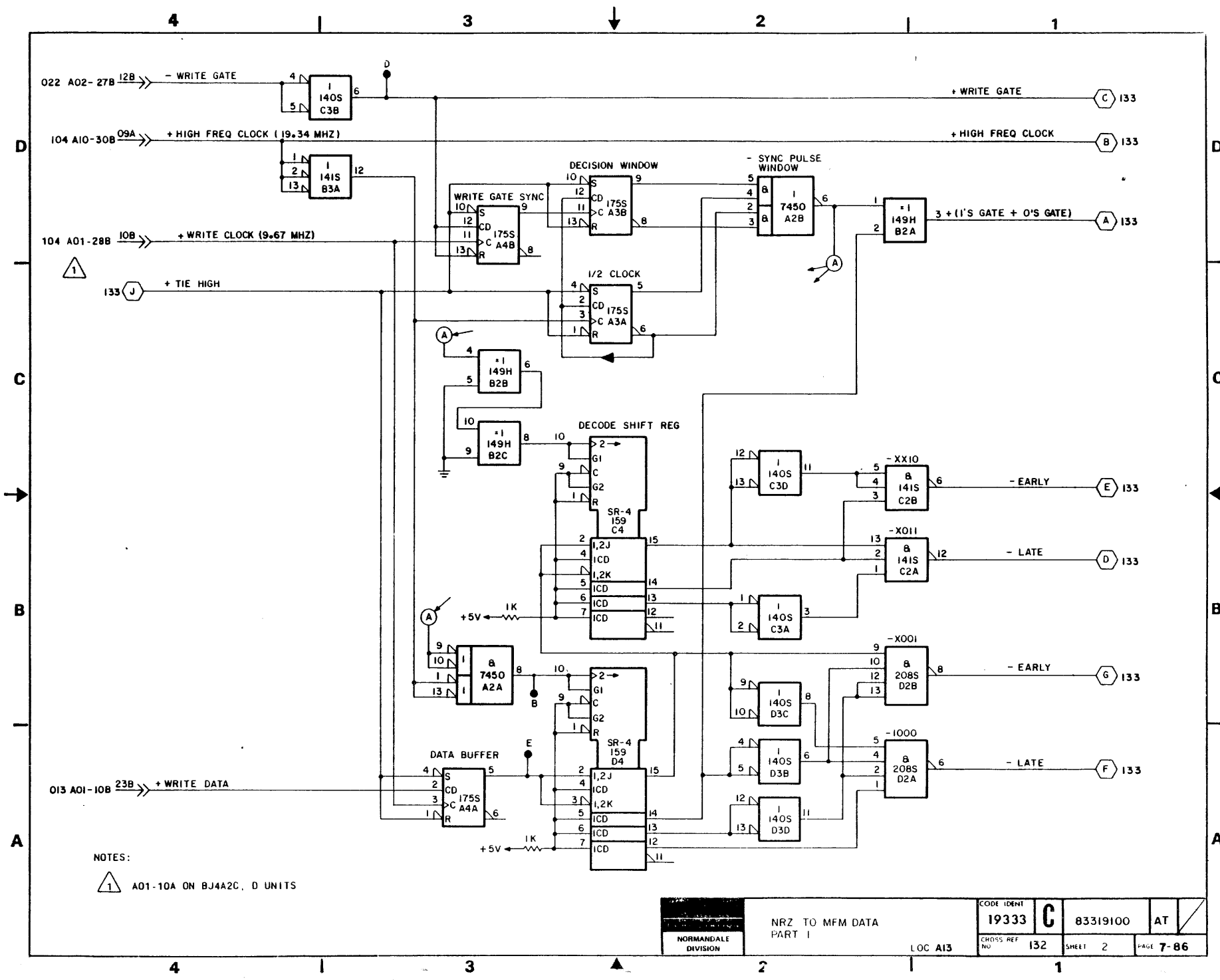
UNUSED LOGIC ELEMENT

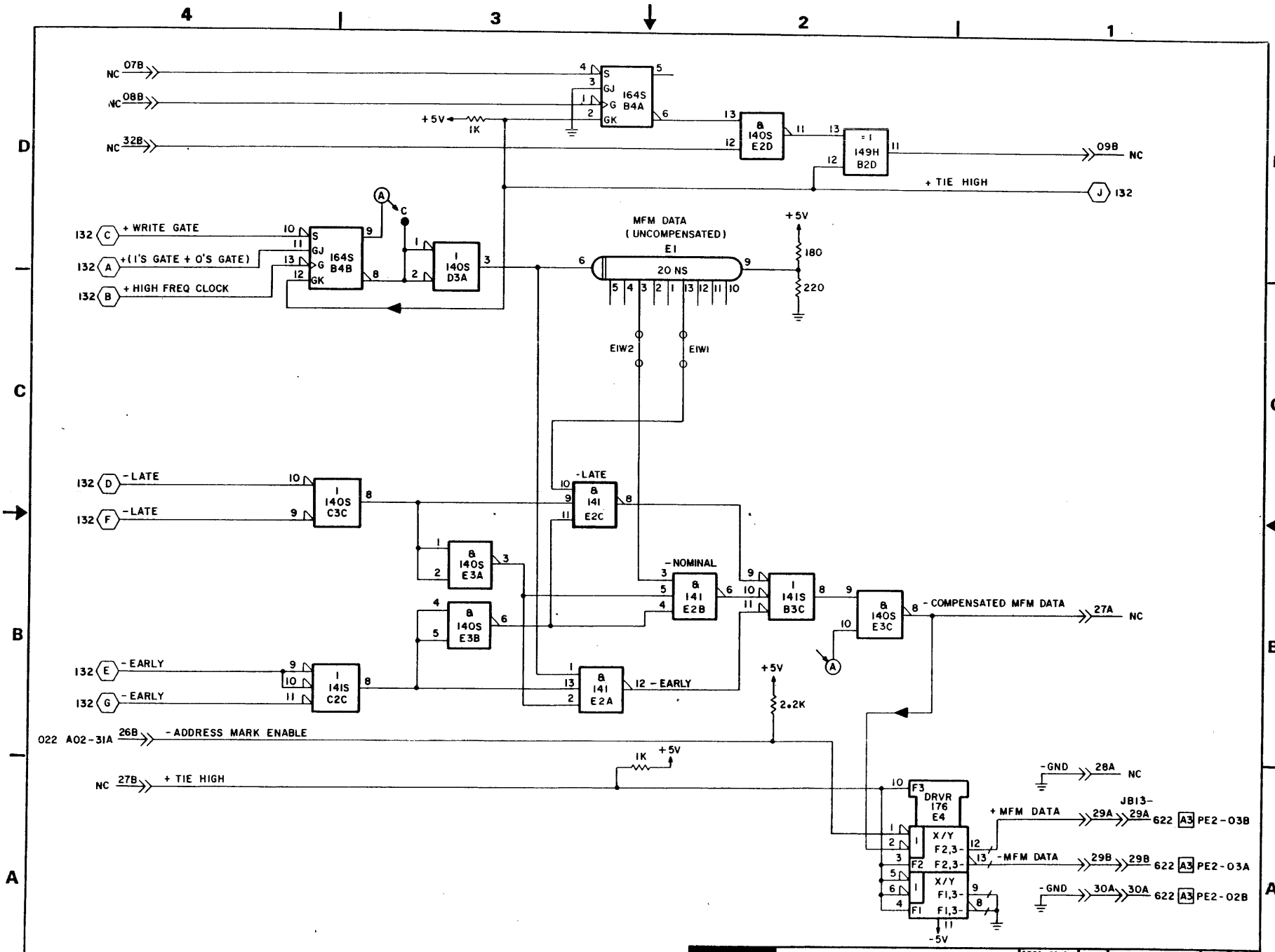




DRAWN	G RABINE 8/25/76	NORMANDALE DIVISION	NRZ TO COMPENSATED MFM DIAGRAMS	CODE IDENT 19333	C	83319100	AN
CHECKED							
ENGINEER			TYPE ELXV LOC A13	CROSS REF NO 131	SHEET 1 OF 3	PAGE 7-85	
APPROVED							

REF 83214113


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
B 133
104 A01-28B 10B
+ WRITE CLOCK (9.67 MHZ)
133 J
+ TIE HIGH
WRITE GATE SYNC
175S A4B
DECISION WINDOW
175S C A3B
1/2 CLOCK
175S C A3A
- SYNC PULSE WINDOW
8 7450 A2B
=1 149H B2A
3 + (1'S GATE + 0'S GATE)
A 133
=1 149H B2B
=1 149H B2C
DECODE SHIFT REG
SR-4 159 C4
SR-4 159 D4
1K
+5V
8 7450 A2A
DATA BUFFER
175S A4A
013 A01-10B 23B
+ WRITE DATA
1 140S C3D
1 140S C3A
1 140S D3C
1 140S D3B
1 140S D3D
-XX10
8 141S C2B
- EARLY
E 133
-XO11
8 141S C2A
- LATE
D 133
-X001
8 208S D2B
- EARLY
G 133
-1000
8 208S D2A
- LATE
F 133
NOTES:
1 A01-10A ON BJ4A2C, D UNITS
NORMANDALE DIVISION
NRZ TO MFM DATA
PART 1
LOC A13
CODE IDENT 19333
C
83319100
AT
CROSS REF NO 132
SHEET 2
PAGE 7-86



NORMANDALE DIVISION	NRZ TO MFM DATA PART 2 LOC A13	CODE IDENT 19333	C	83319100	AN E
		CROSS REF NO 133	SHEET 3	PAGE 7-87/88	

REVISION STATUS OF SHEETS

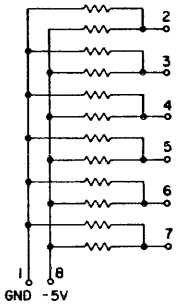
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A																	
B	A	B																	
C	A	B																	
D	A	D																	
E	A	E																	
F	A	F																	
G	A	G																	

REVISIONS

REV.	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA	1-29-76	
B	PE22842	SCHEMATIC CORRECTIONS	MA	2-29-76	
C		EDITORIAL	MA	5-20-77	
D	PE48543	HLRV IMPROVEMENT	MA	9-13-77	
E	PE48918	CHG DELAY HLRV	DM	2-14-78	
F	PE22971	CORRECT SCHEMATIC	MA	4-8-78	
G	PE55259	LOGIC DIAG IMPROVMENT	MA	10-4-78	

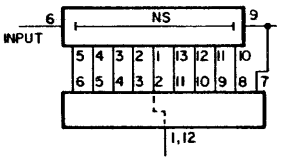
NOTES:

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

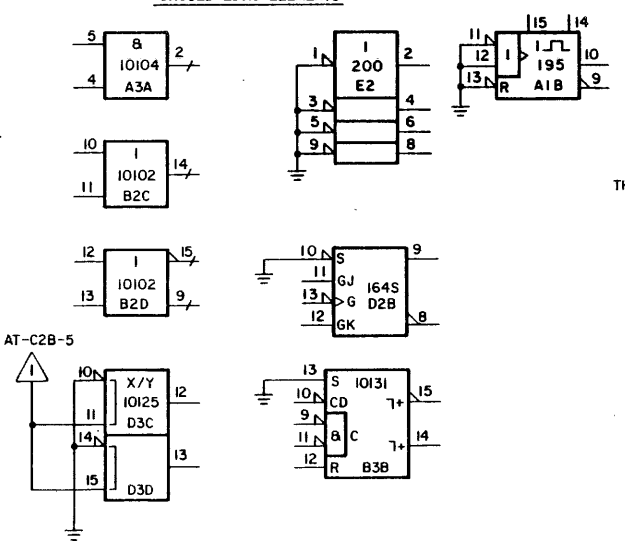


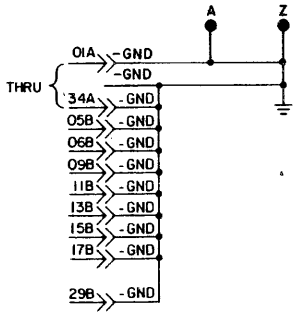
2. DELAY LINES ARE CONNECTED TO JUMPER BLOCK AS SHOWN IN DIAGRAM BELOW. ACTUAL DELAYS ARE SELECTED DURING MANUFACTURING. THIS DIAGRAM SHOWS TYPICAL CONNECTIONS. DELAY TIME FOR EACH DELAY LINE PIN RELATIVE TO PIN 6 INPUT IS SHOWN IN CHART BELOW.

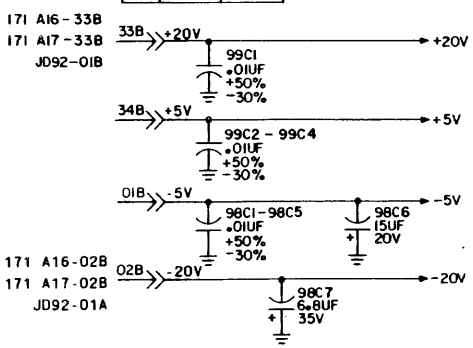
PIN	DELAY TIMES (NS) B1	A2
5	5	10
4	10	20
3	15	30
2	20	40
1	25	50
13	30	60
12	35	70
11	40	80
10	45	90
9	50	100



UNUSED LOGIC ELEMENTS

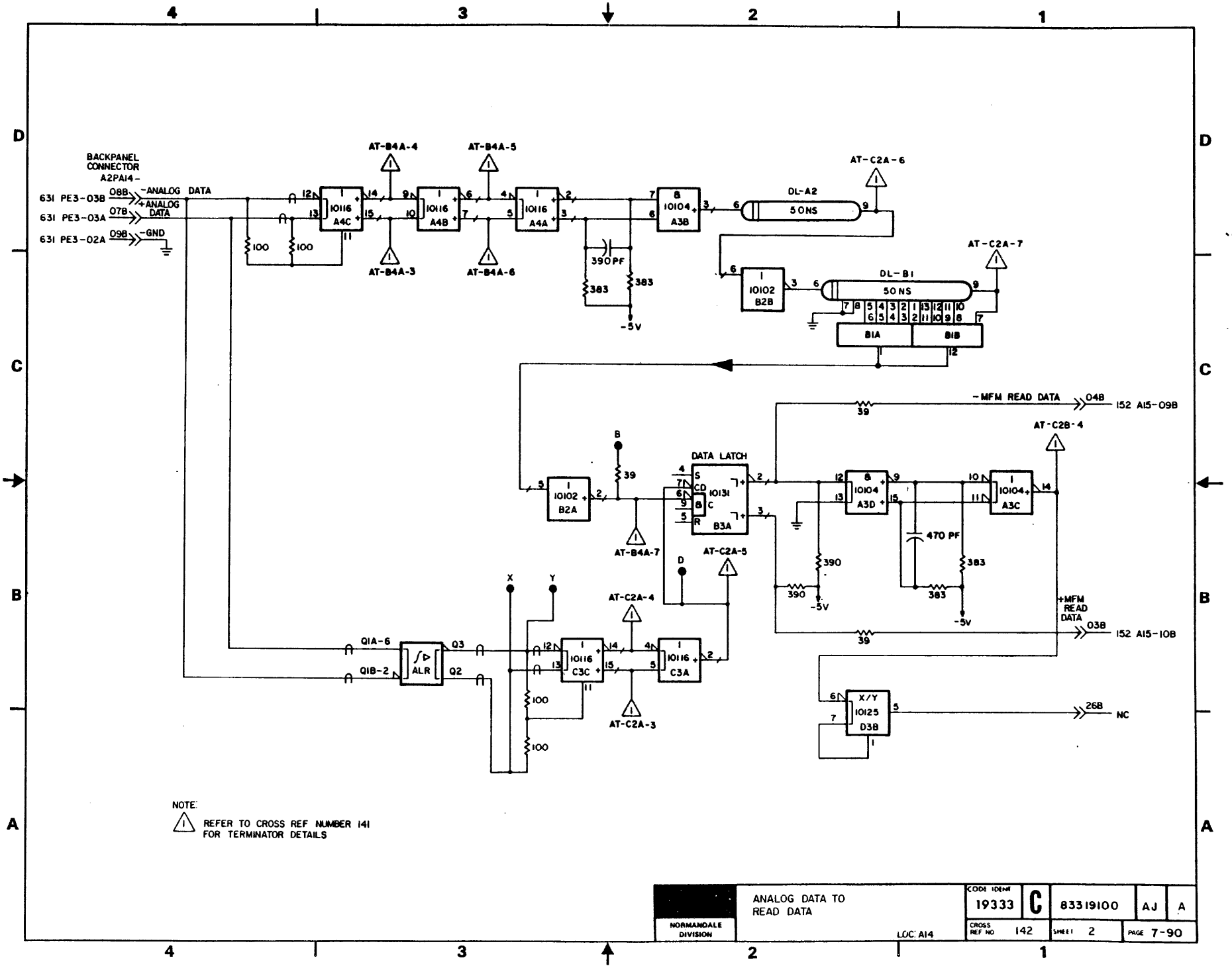


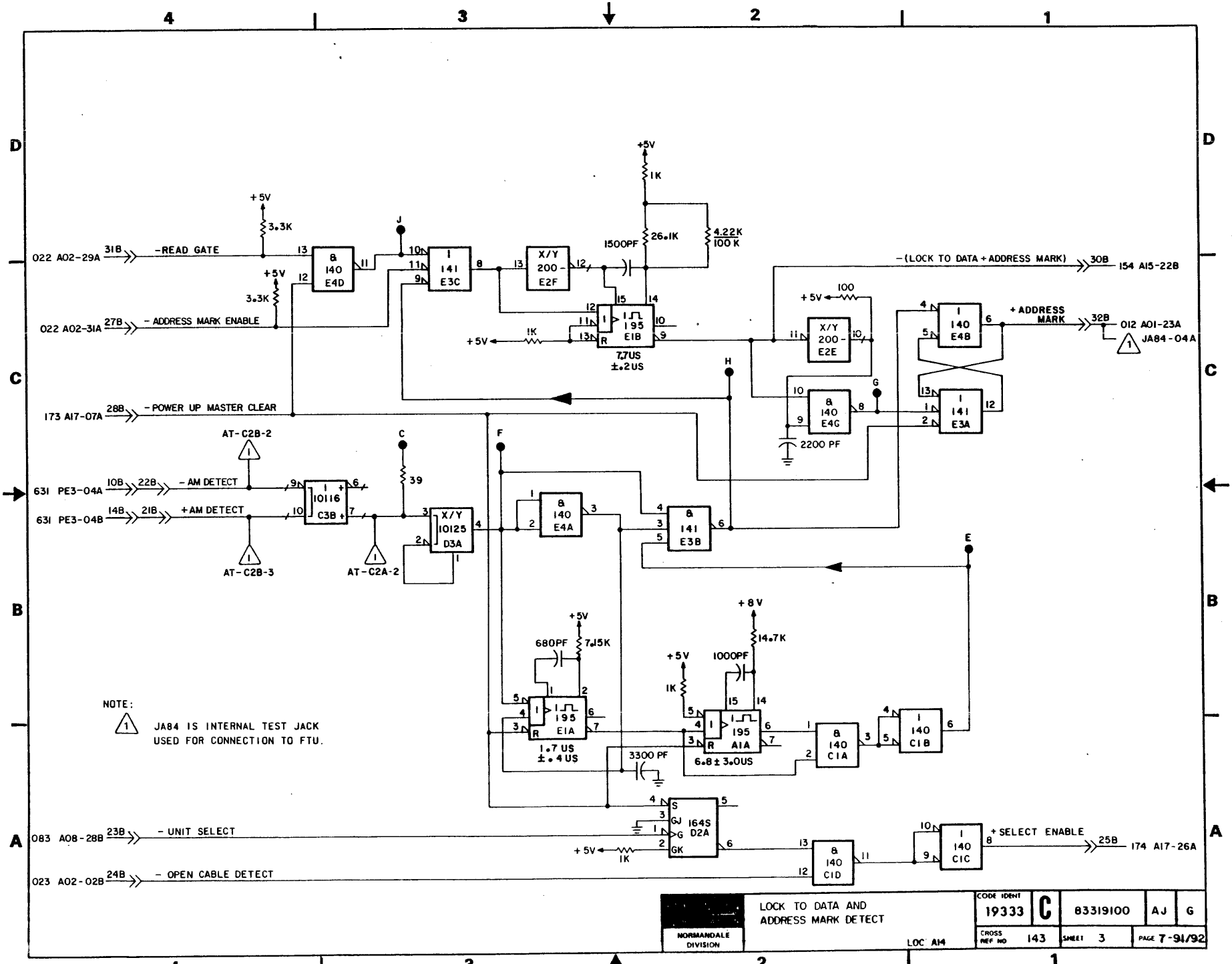




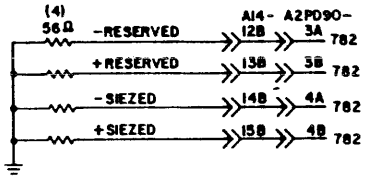
DRAWN	M.ANDERSON		NORMANDALE DIVISION	DATA LATCH DIAGRAMS	CODE IDENT 19333	C	83319100	AJ	G
CHECKED									
ENGINEER									
APPROVED				TYPE HLRV	LOC A14	CROSS REF NO 141	SHEET 1 OF 3	PAGE 7-89	

REF 83214114


BACKPANEL CONNECTOR A2PAI4-
631 PE3-038 08B -ANALOG DATA
631 PE3-03A 07B +ANALOG DATA
631 PE3-02A 09B -GND
AT-B4A-4
AT-B4A-5
AT-B4A-3
AT-B4A-6
10116 A4C
10116 A4B
10116 A4A
10104 A3B
100
390PF
383
-5V
DL-A2
50NS
AT-C2A-6
AT-C2A-7
10102 B2B
DL-B1
50NS
B1A
B1B
-MFM READ DATA
048
152 AI5-09B
39
AT-C2B-4
B
DATA LATCH
10102 B2A
10131 B3A
AT-B4A-7
AT-C2A-5
D
10104 A3D
10104 A3C
470 PF
390
+MFM READ DATA
038
152 AI5-10B
X
Y
AT-C2A-4
QIA-6
QIB-2
ALR
Q3
Q2
10116 C3C
10116 C3A
AT-C2A-3
X/Y 10125 D3B
26B
NC
NOTE:
REFER TO CROSS REF NUMBER 141 FOR TERMINATOR DETAILS
NORMANDALE DIVISION
ANALOG DATA TO READ DATA
LOC: AI4
CODE IDENT 19333
C
83319100
AJ
A
CROSS REF NO 142
SHEET 2
PAGE 7-90

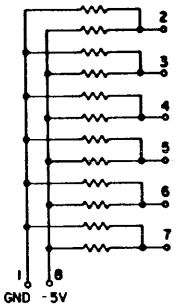

-READ GATE
- ADDRESS MARK ENABLE
- POWER UP MASTER CLEAR
- AM DETECT
+AM DETECT
- UNIT SELECT
- OPEN CABLE DETECT
-(LOCK TO DATA + ADDRESS MARK)
+ ADDRESS MARK
+ SELECT ENABLE
NOTE:
JA84 IS INTERNAL TEST JACK USED FOR CONNECTION TO FTU.
LOCK TO DATA AND ADDRESS MARK DETECT
NORMANDALE DIVISION
LOC A14
CODE IDENT 19333
C
83319100
AJ
G
CROSS REF NO 143
SHEET 3
PAGE 7-91/92

REVISIONS					
REV.	ECO.	DESCRIPTION	DRFT.	DATE	CHK'D
A	PE55112 PE23000	RELEASED			
B	DJ00788	ADD JUMPER	DHS	8-12-85	



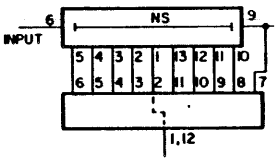
NOTES:

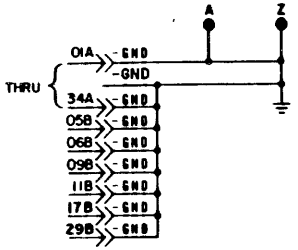
1. TYPICAL CONFIGURATION FOR TERMINATORS AT-C2A, AT-C2B AND AT-B4A AS FOLLOWS:

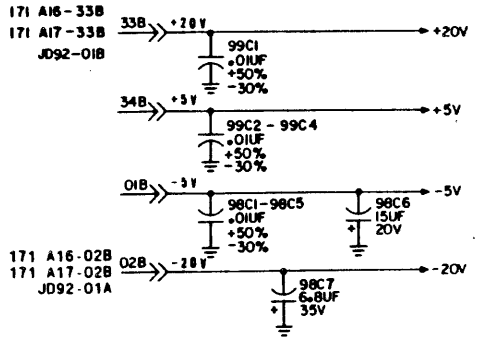


2. DELAY LINES ARE CONNECTED TO JUMPER BLOCK AS SHOWN IN DIAGRAM BELOW. ACTUAL DELAYS ARE SELECTED DURING MANUFACTURING. THIS DIAGRAM SHOWS TYPICAL CONNECTIONS. DELAY TIME FOR EACH DELAY LINE PIN RELATIVE TO PIN 6 INPUT IS SHOWN IN CHART BELOW.

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

TYPE	LOCATION	OUTPUT PIN(S)
195	A1	9,10
140	C1B	6
164S	D2B	9,8
10102	B2C	14
10102	B2D	15,9
10104	A3A	2
10125	D3C	12,13
10131	B3B	15,14
200	E2	2,4,6,8

APPLICABLE ONLY TO BJ4A2 C,D

DRAWN	M.ANDERSON	6 8 78
CHECKED		
ENGINEER		
APPROVED		

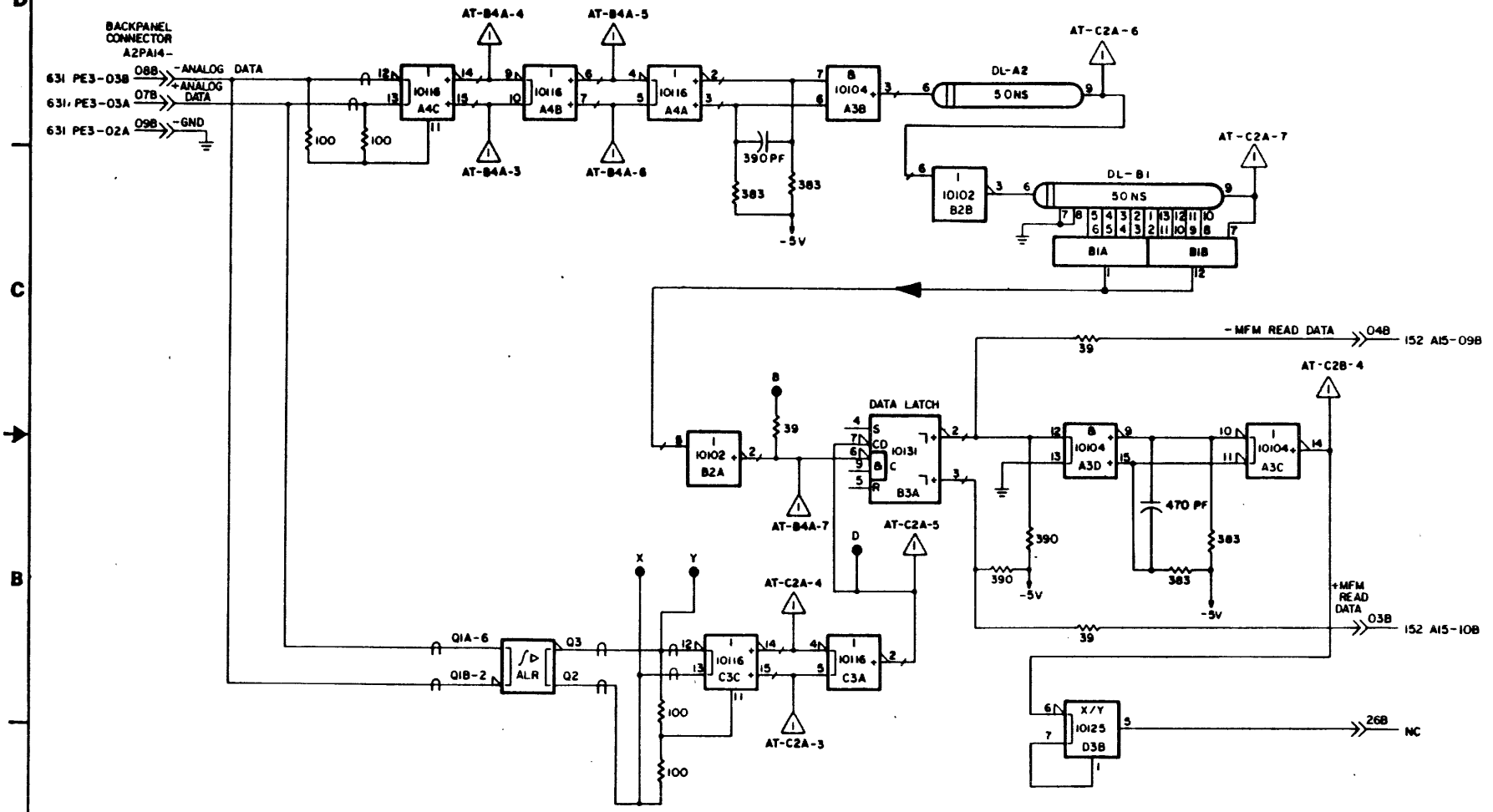
DATA LATCH DIAGRAMS

TYPE KLRV LOC A14

TWIN CITIES DISK DIVISION | C | 83319100 | AS | B

CROSS REF NO 141 | SHEET 1 OF 3 | PAGE 7-93

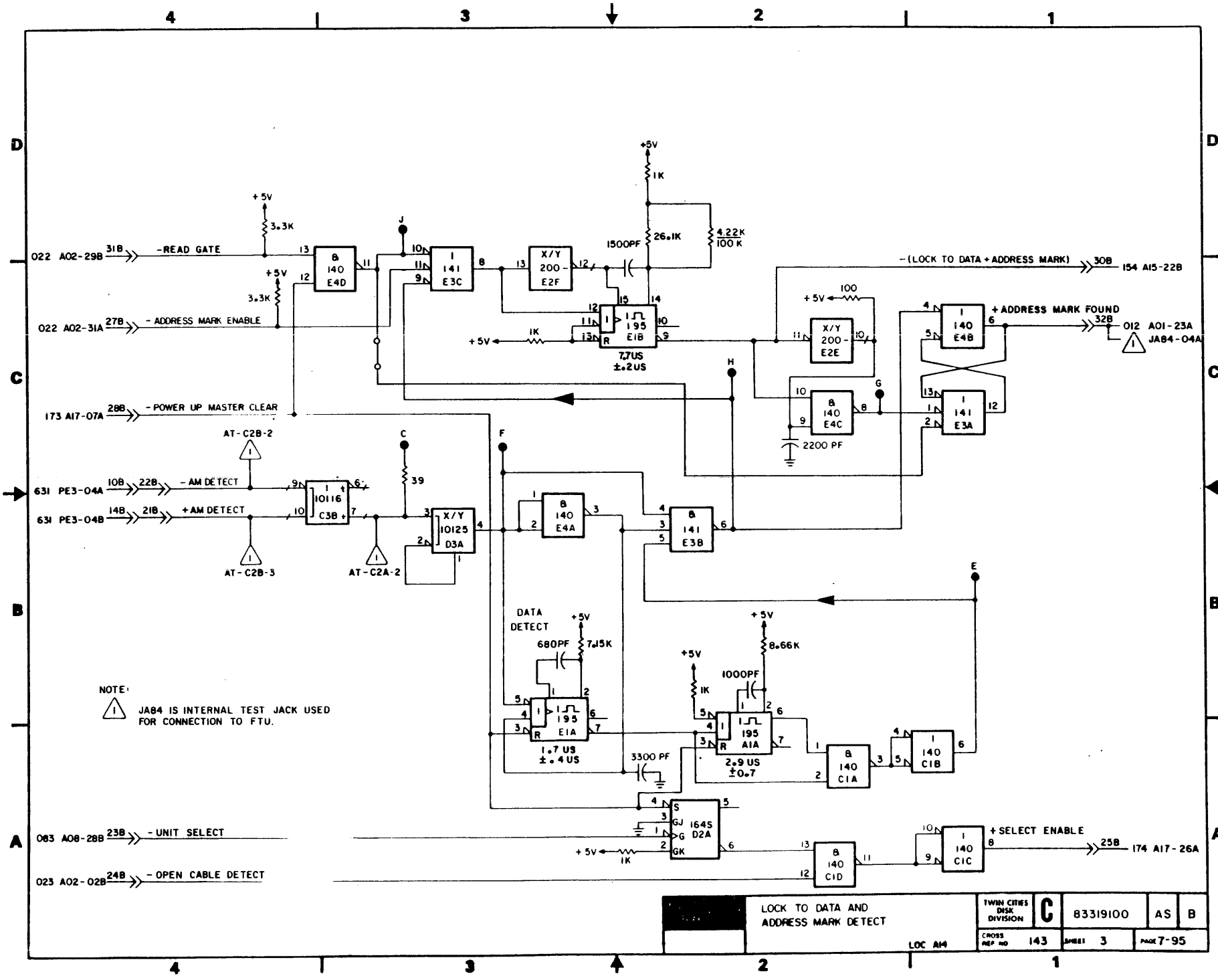
REF 83214189



NOTE

⚠1 REFER TO CROSS REF NUMBER 141 FOR TERMINATOR DETAILS

	ANALOG DATA TO READ DATA	TWIN CITIES DISK DIVISION	C	83319100	AJ A
	LOC A14	CROSS REF NO 142	SHEET 2	PAGE 7-94	


-READ GATE
- ADDRESS MARK ENABLE
- POWER UP MASTER CLEAR
- AM DETECT
+AM DETECT
- UNIT SELECT
- OPEN CABLE DETECT
-(LOCK TO DATA + ADDRESS MARK)
+ ADDRESS MARK FOUND
+ SELECT ENABLE
DATA DETECT
7.7US ±.2US
1.7 US ±.4 US
2.9 US ±0.7
NOTE:
JA84 IS INTERNAL TEST JACK USED FOR CONNECTION TO FTU.
LOCK TO DATA AND ADDRESS MARK DETECT
LOC A14
TWIN CITIES DISK DIVISION
C
83319100
AS
B
CROSS REF NO 143
SHEET 3
PAGE 7-95

REVISION STATUS OF SHEETS

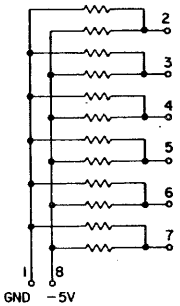
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A	A															
B	A	A	A	A															
C	A	A	A	A															
D	A	D	A	A															
E	E	D	A	A															
F	F	D	F	A															
G	G	D	F	A															
H	G	H	F	A															

REVISIONS

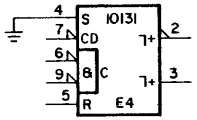
REV.	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA	1-29-76	
B	PE22842	SCHEMATIC CORRECTIONS	MA	12-29-76	
C		EDITORIAL	MA	5-20-77	
D	PE48625	OPEN RES LIMITS	DM	7-26-77	
E	PE55604	CORRECT LOGIC	GR	4-3-79	
F	DH13020	LOGIC DIAGRAM ERRORS	S. A. W.	8/8/81	
G	PE57618	UPDATE SCH BLZV	DLF	6-30-82	
H	DJ00439	BD BLANK CHG BLZV	NP	9-1-83	

NOTES:

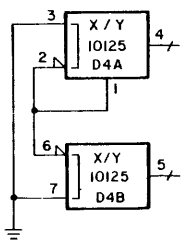
1. TYPICAL CONFIGURATION FOR TERMINATORS ATA3, ATB2, ATB3, ATB4, ATC3, ATD4, ATE2 AS FOLLOWS

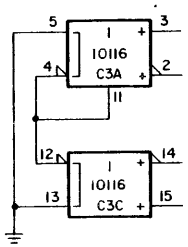


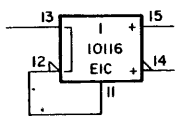
NOTE:
2. SEE LOWER LEFT CORNER



UNUSED LOGIC ELEMENTS

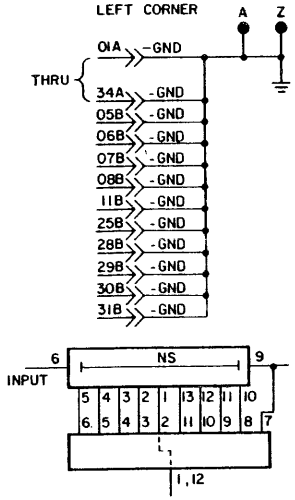


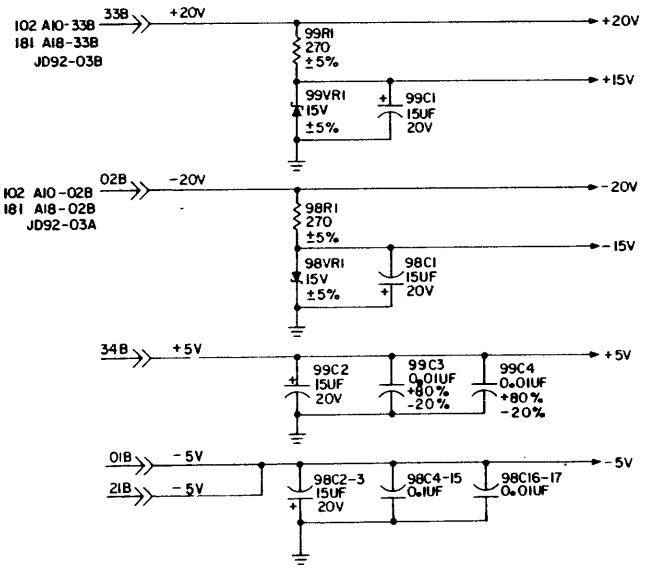




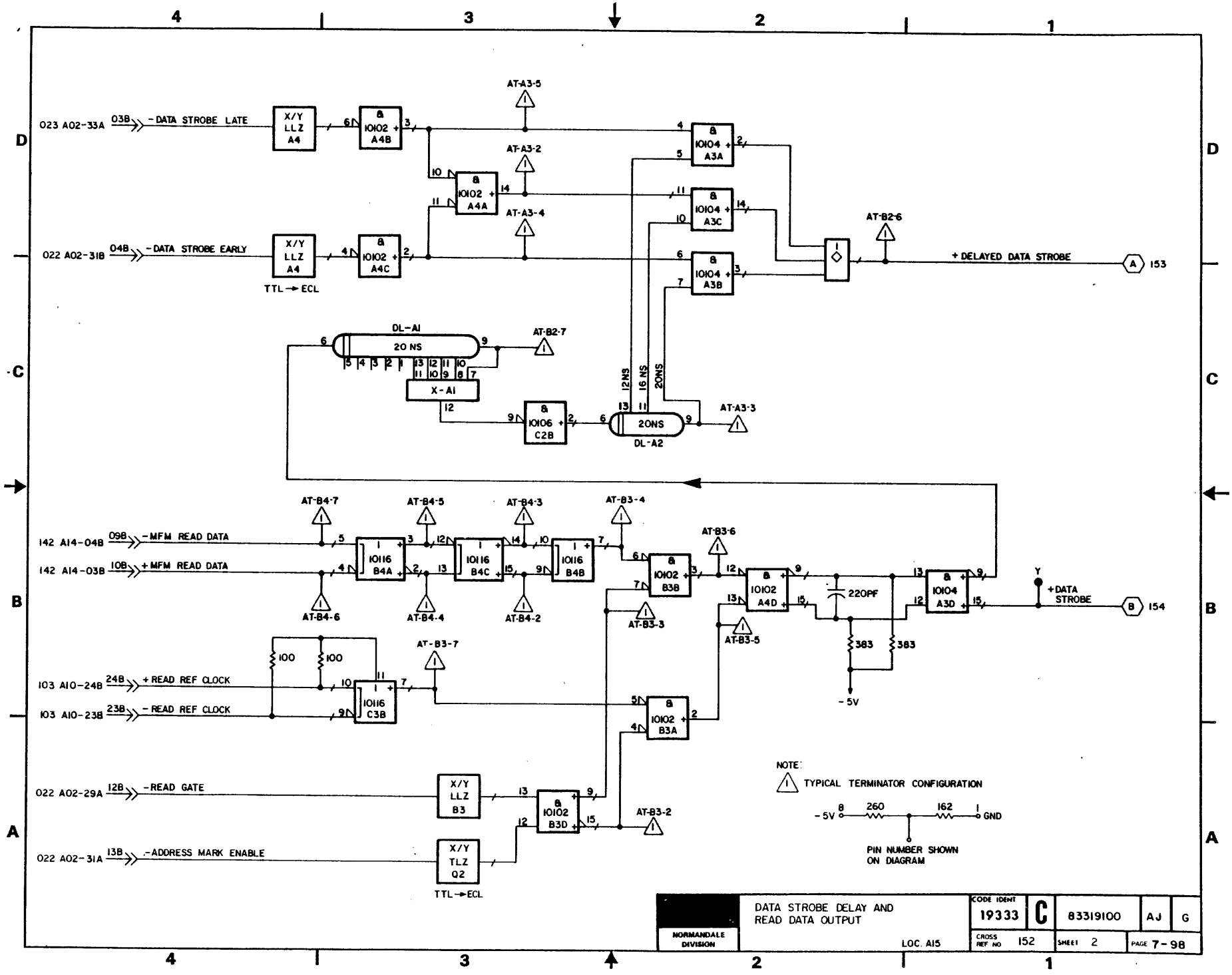
PIN	DELAY TIMES (NS) B1	A2
5	5	10
4	10	20
3	15	30
2	20	40
1	25	50
13	30	60
12	35	70
11	40	80
10	45	90
9	50	100

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.





DRAWN	M.ANDERSON		NORMANDALE DIVISION	READ PLO DIAGRAMS	CODE IDENT 19333	C	83319100	AJ	H
CHECKED									
ENGINEER				TYPE BLZV	LOC A15	CROSS REF NO 151	SHEET 1 of 5	PAGE 7-97	
APPROVED							REF 83214115		

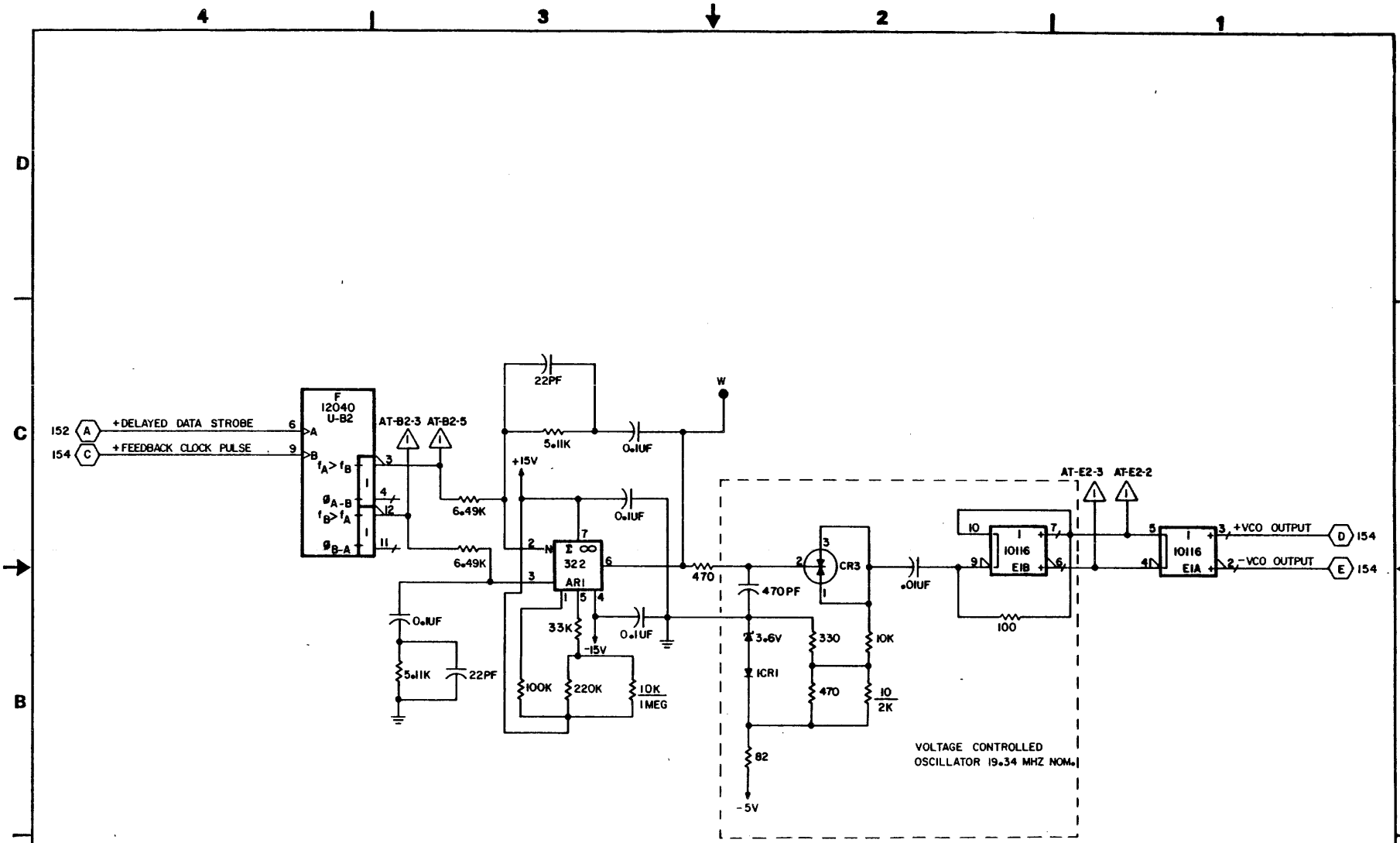


NORMANDALE DIVISION

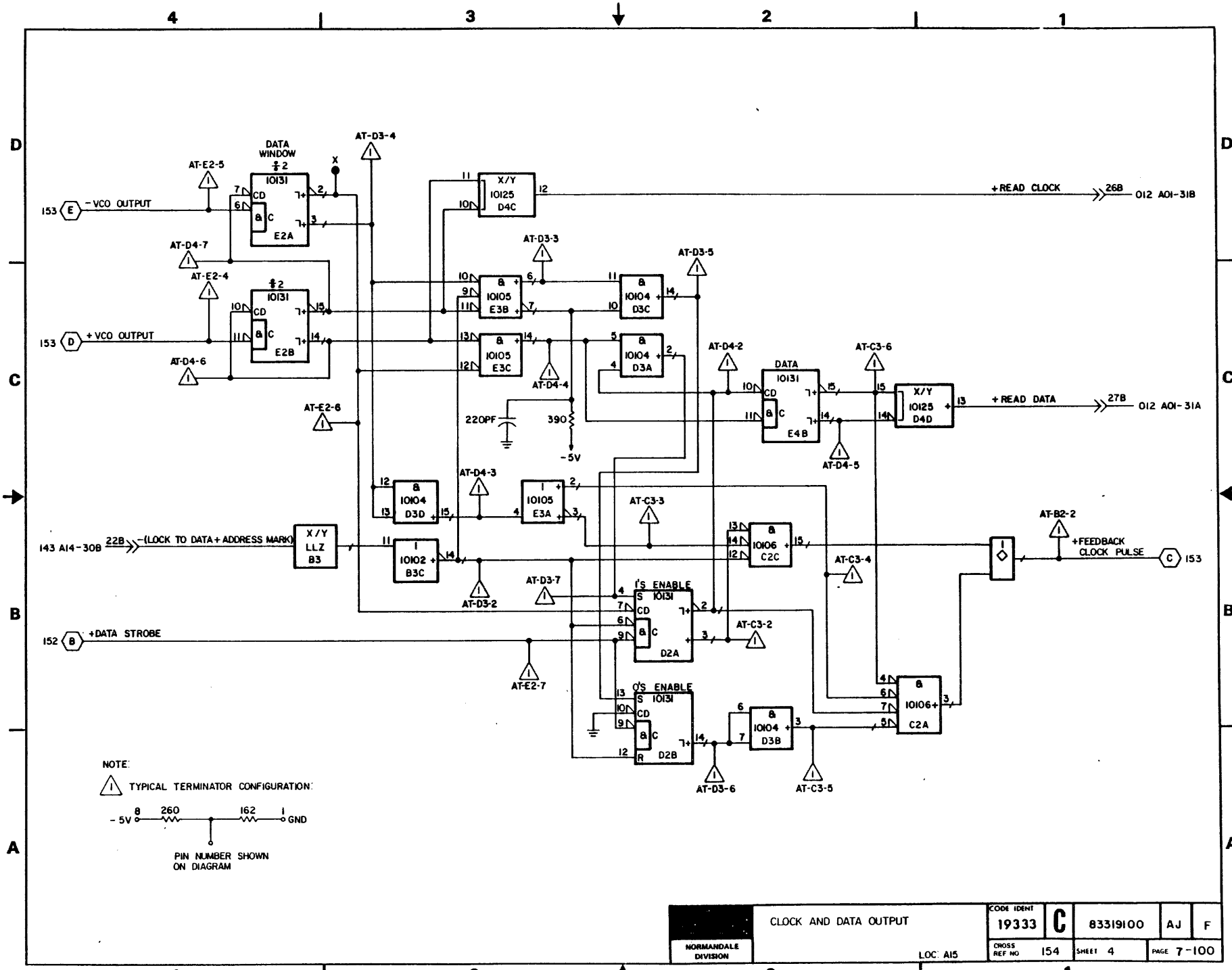
DATA STROBE DELAY AND READ DATA OUTPUT

LOC. A15

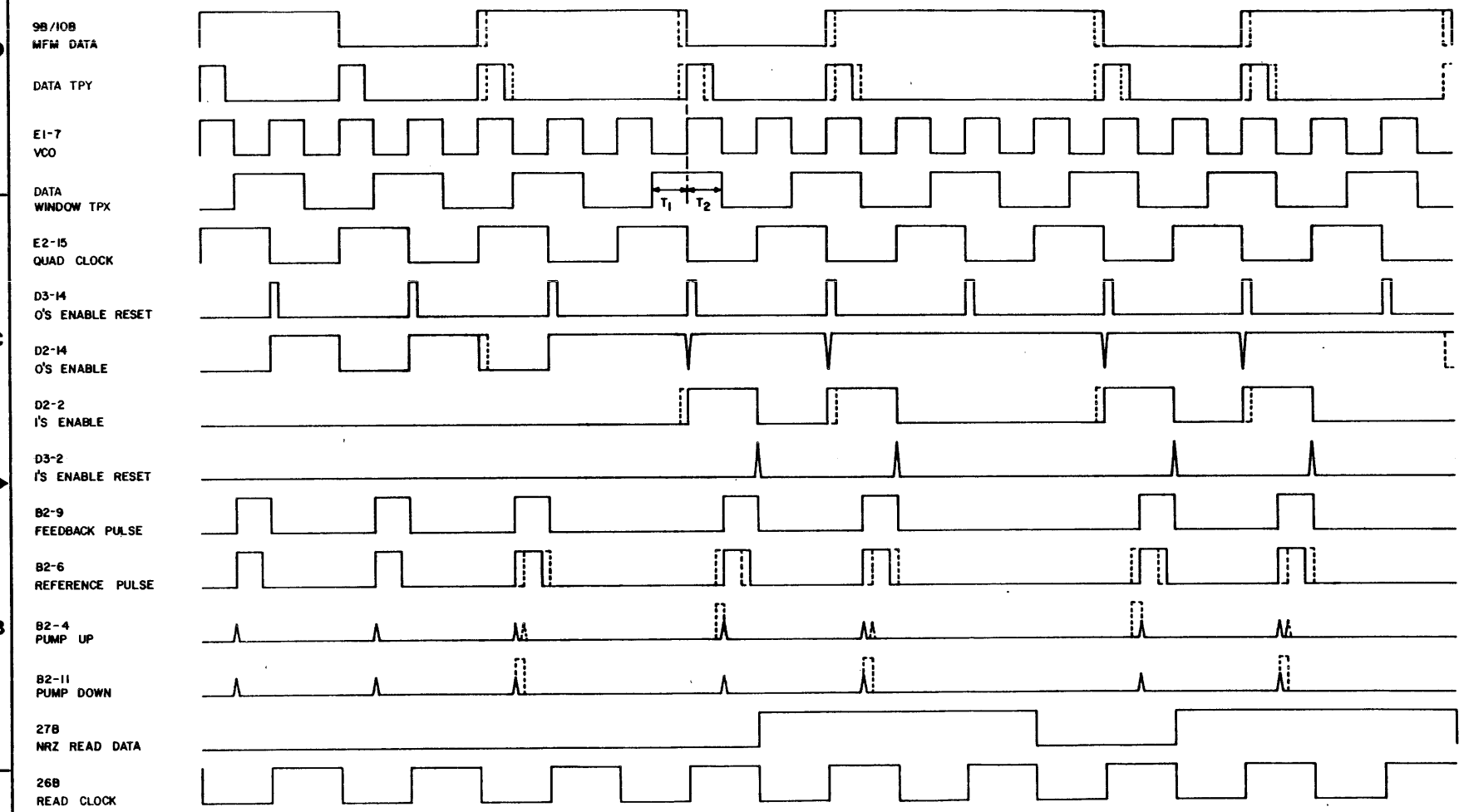
CODE IDENT				
19333	C	83319100	AJ	G
CROSS REF NO 152		SHEET 2	PAGE 7-98	



NORMANDALE DIVISION	VCO OUTPUT	CODE IDENT 19333	C	83319100	AJ	H
	LOC A15	CROSS REF NO 153	SHEET 3	PAGE 7-99		



NORMANDALE DIVISION	CLOCK AND DATA OUTPUT LOC: A15	CODE IDENT 19333	C	83319100	AJ F
		CROSS REF NO 154	SHEET 4	PAGE 7-100	



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.

NORMANDALE DIVISION	READ PLO TIMING DIAGRAM	CODE IDENT 19333	C	83319100	AJ	A
	LOC A15	CROSS REF NO 155		SHEET 5	PAGE 7-101/102	

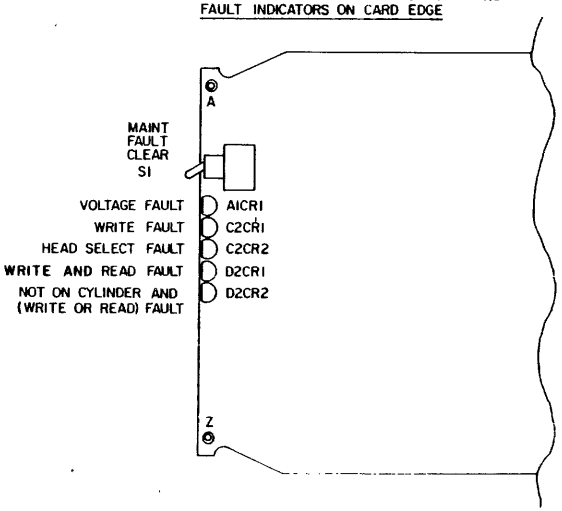
REVISION STATUS OF SHEETS

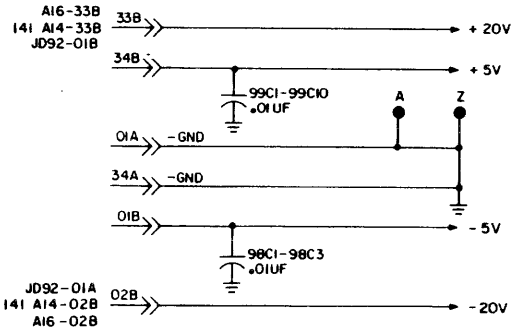
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																
B	B	B	B																
C	C	C	C																
D	C	C	C																
E	C	C	E																

REVISIONS

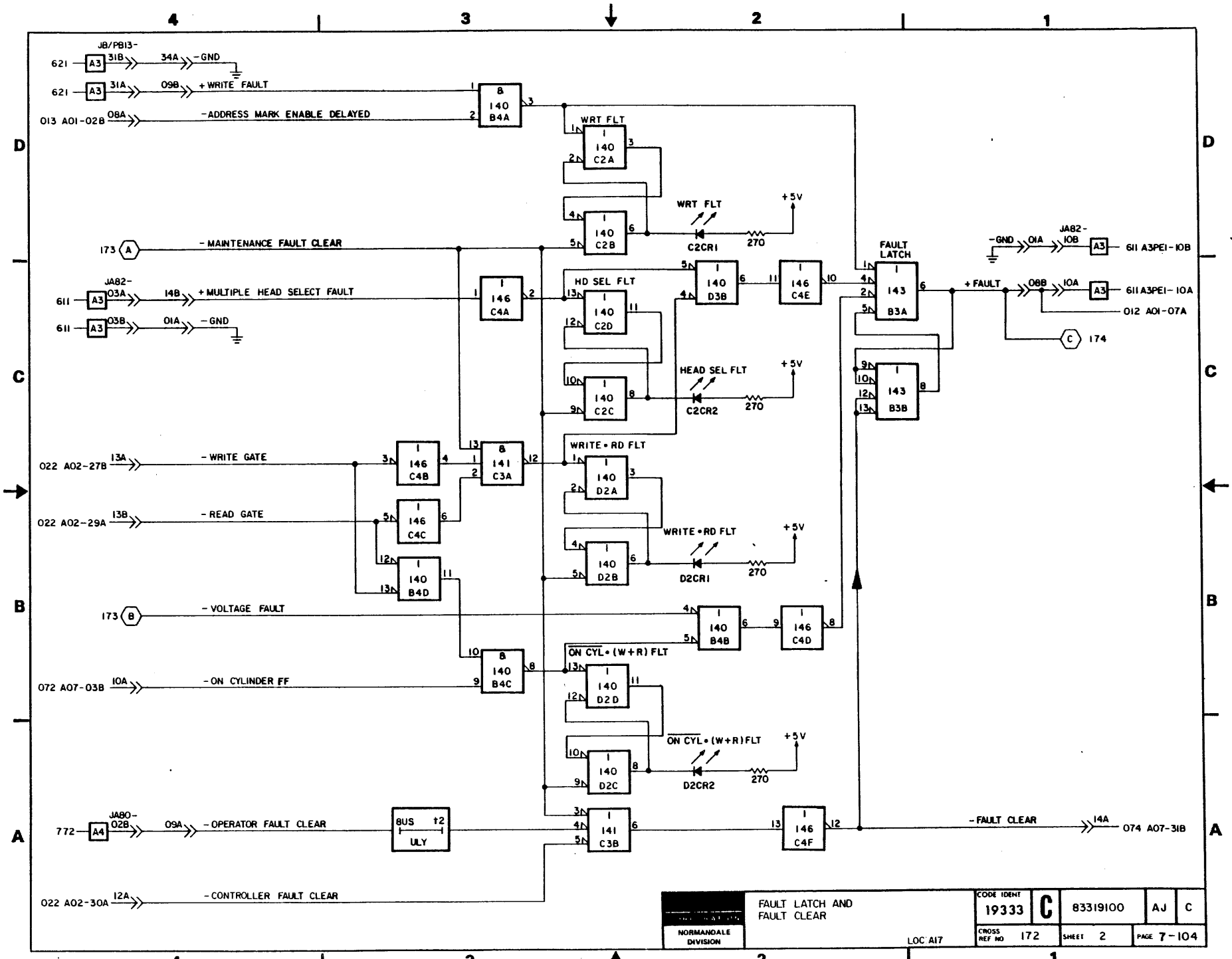
REV.	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA	1-27-76	
B	PE22763	DISABLE READY SIGNAL	MLA	10-11-76	
C	PE22805				
D		EDITORIAL	MA	5-20-77	
E	PE55259	LOGIC DIAG IMPROVEMENT	MA	10-5-78	

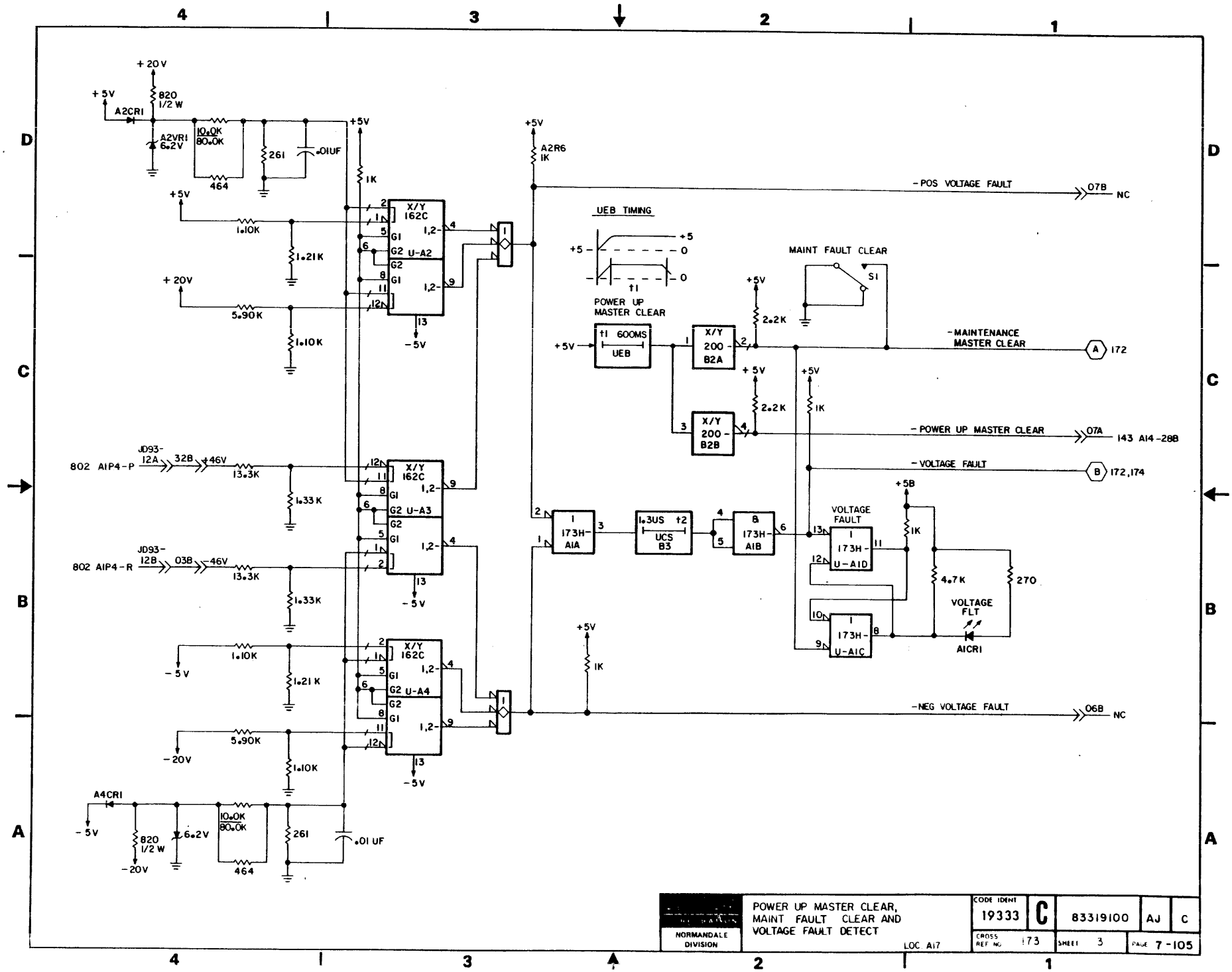
MAINTENANCE FAULT CLR SWITCH AND
FAULT INDICATORS ON CARD EDGE





DRAWN	M.ANDERSON	NORMANDALE DIVISION	FAULT CARD DIAGRAMS	CODE IDENT 19333	C	83319100	AJ E
CHECKED			TYPE 5KFV LOC A17	CROSS REF N. 171	SHEET 1 OF 4	PAGE 7-103	
ENGINEER						REF 83214117	


JB/PB13-
621 A3 31B 34A -GND
621 A3 31A 09B +WRITE FAULT
013 A01-02B 08A -ADDRESS MARK ENABLE DELAYED
8 140 B4A
WRT FLT
140 C2A
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
-GND 01A JA82- 10B A3 611 A3PE1-10B
+FAULT 08B 10A A3 611 A3PE1-10A
012 A01-07A
C 174
HEAD SEL FLT
140 C2C
C2CR2
270
+5V
143 B3B
022 A02-27B 13A -WRITE GATE
146 C4B
8 141 C3A
WRITE • RD FLT
140 D2A
022 A02-29A 13B -READ GATE
146 C4C
140 B4D
WRITE • RD FLT
140 D2B
D2CR1
270
+5V
173 B -VOLTAGE FAULT
140 B4B
146 C4D
ON CYL • (W+R) FLT
140 D2D
072 A07-03B 10A -ON CYLINDER FF
8 140 B4C
ON CYL • (W+R) FLT
140 D2C
D2CR2
270
+5V
772 A4 JA80- 02B 09A -OPERATOR FAULT CLEAR
8US t2 ULY
141 C3B
146 C4F
-FAULT CLEAR 14A 074 A07-31B
022 A02-30A 12A -CONTROLLER FAULT CLEAR
NORMANDALE DIVISION
FAULT LATCH AND FAULT CLEAR
LOC A17
CODE IDENT 19333
C
83319100
AJ
C
CROSS REF NO 172
SHEET 2
PAGE 7-104



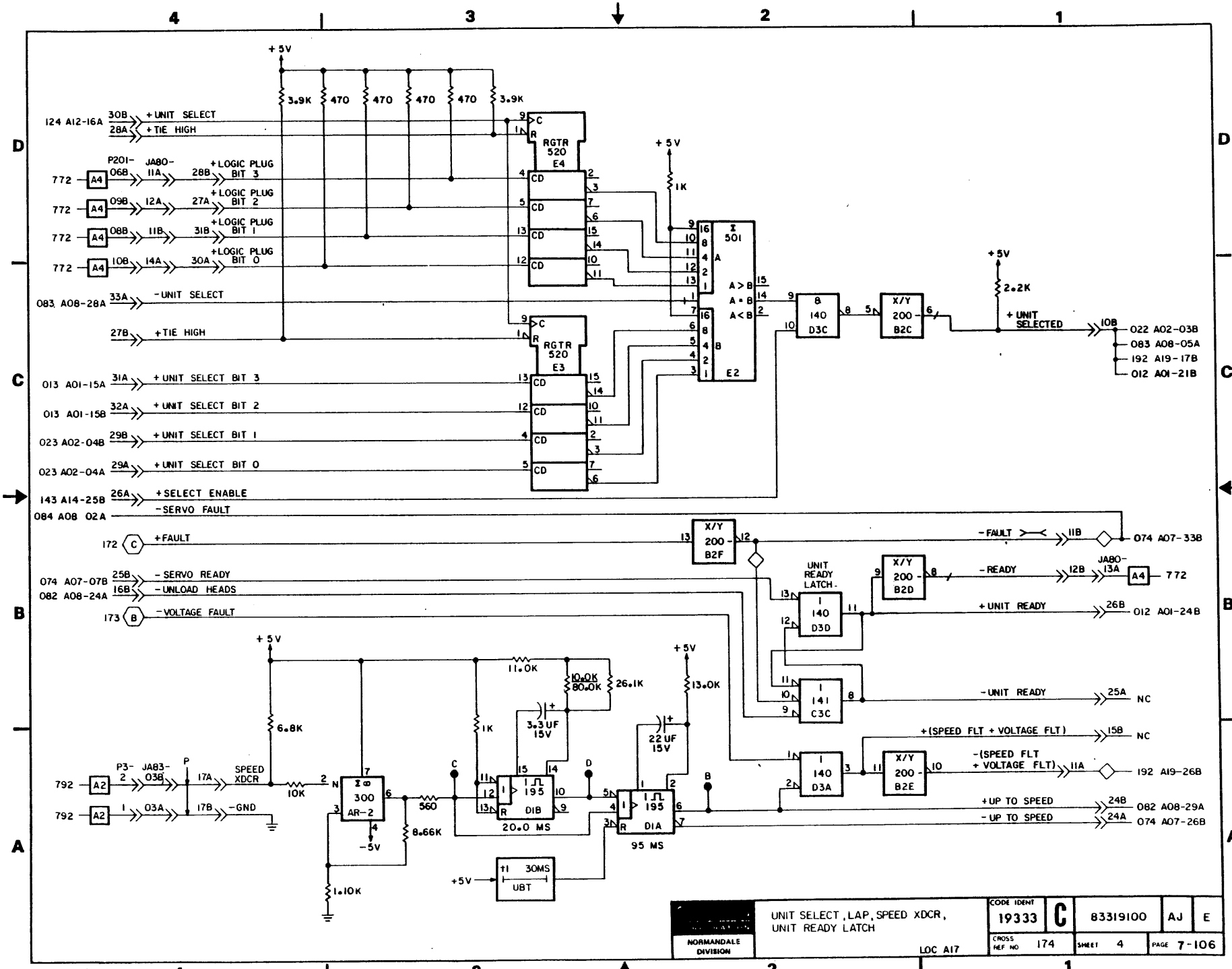
NORMANDALE DIVISION

POWER UP MASTER CLEAR, MAINT FAULT CLEAR AND VOLTAGE FAULT DETECT

LOC A17

CODE IDENT				
19333	C	83319100	AJ	C

CROSS REF NO 173 | SHEET 3 | PAGE 7-105


+5V
3.9K
470
470
470
470
3.9K
124 A12-16A
30B +UNIT SELECT
28A +TIE HIGH
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 A08-28A 33A -UNIT SELECT
27B +TIE HIGH
RGTR 520 E4
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
143 A14-25B 26A +SELECT ENABLE
084 A08 02A -SERVO FAULT
172 C +FAULT
074 A07-07B 25B -SERVO READY
082 A08-24A 16B -UNLOAD HEADS
173 B -VOLTAGE FAULT
1K
I 501 E2
A>B A=B A<B
8 140 D3C
X/Y 200 B2C
2.2K
+UNIT SELECTED 10B
022 A02-03B
083 A08-05A
192 A19-17B
012 A01-21B
X/Y 200 B2F
-FAULT 11B
074 A07-33B
UNIT READY LATCH
I 140 D3D
X/Y 200 B2D
-READY 12B JA80-13A A4 772
+UNIT READY 26B 012 A01-24B
I 141 C3C
-UNIT READY 25A NC
+(SPEED FLT + VOLTAGE FLT) 15B NC
I 140 D3A
X/Y 200 B2E
-(SPEED FLT + VOLTAGE FLT) 11A 192 A19-26B
+UP TO SPEED 24B 082 A08-29A
-UP TO SPEED 24A 074 A07-26B
792 A2 P3-2 JA83-03B P 17A SPEED XDCR
792 A2 1 03A 17B -GND
6.8K
10K
I∞ 300 AR-2
-5V
560
8.66K
1.10K
11.0K
10.0K
80.0K
26.1K
1K
3.3UF 15V
I 195 DIB
20.0 MS
13.0K
22UF 15V
I 195 DIA
95 MS
+5V
I1 30MS UBT
NORMANDALE DIVISION
UNIT SELECT, LAP, SPEED XDCR, UNIT READY LATCH
LOC A17
CODE IDENT 19333
C
83319100
AJ
E
CROSS REF NO 174
SHEET 4
PAGE 7-106

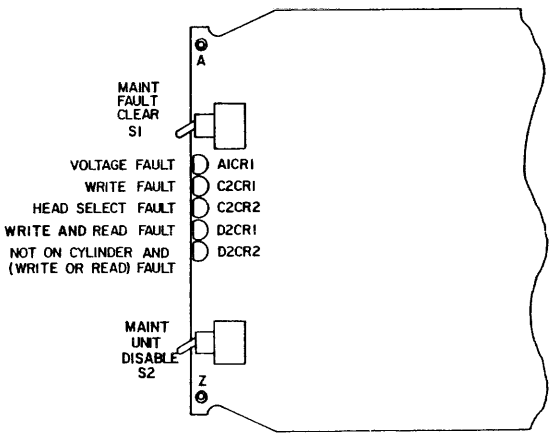
REVISION STATUS OF SHEETS

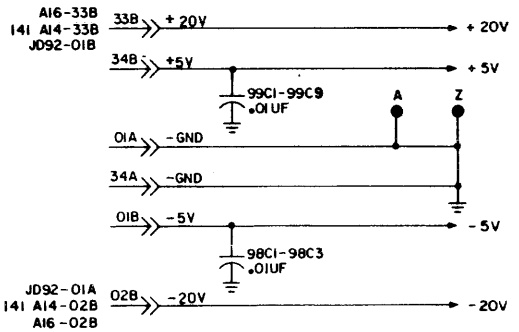
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																
B	B	B	B																
C	B	C	C																
D	B	C	D																
E	B	E	E																
F	B	F	E																
G	G	G	G																
H	G	H	G																
J	G	H	J																

REVISIONS

REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA	1-27-76	
B	PE22763	CHG TO CKFV	MA	7-14-76	
C	PE22781	CORRECT SCHEMATICS	CB	9-18-80	
D	PE22820	ADD FLASHER FOR READY LIGHT	"	"	
E	PE22842	CORRECT SCHEMATIC	"	"	
F	PE22926	ERR CORR	DM	7-26-77	
G	PE58259	LOGIC DIAGRAM	CB	9-18-80	
H	PE57326	CHG-KFV COMP ASSY	"	"	
J	PE57426	CHG WIRE WRAP	CB	1-28-80	

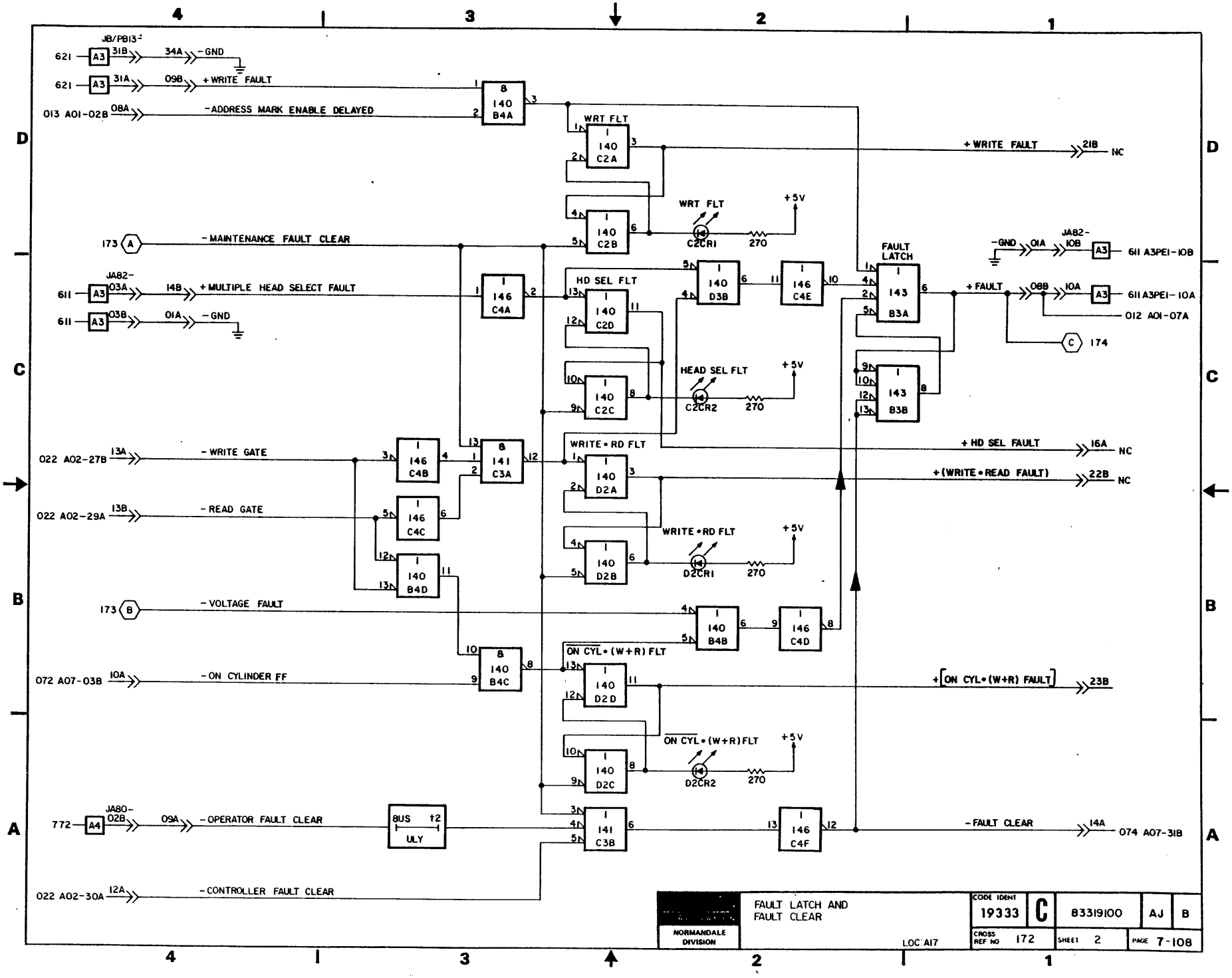
MAINTENANCE SWITCHES AND FAULT INDICATORS ON CARD EDGE

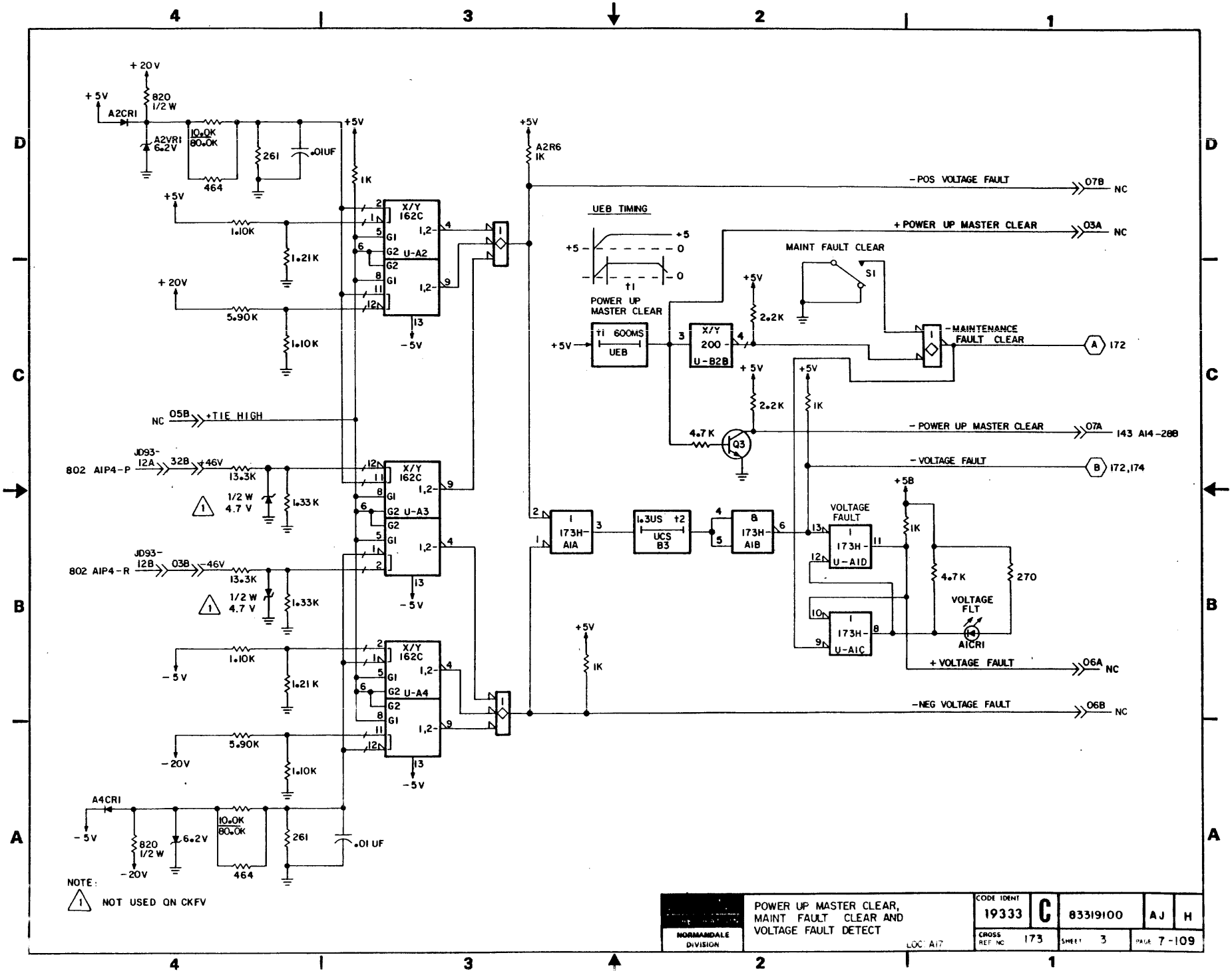




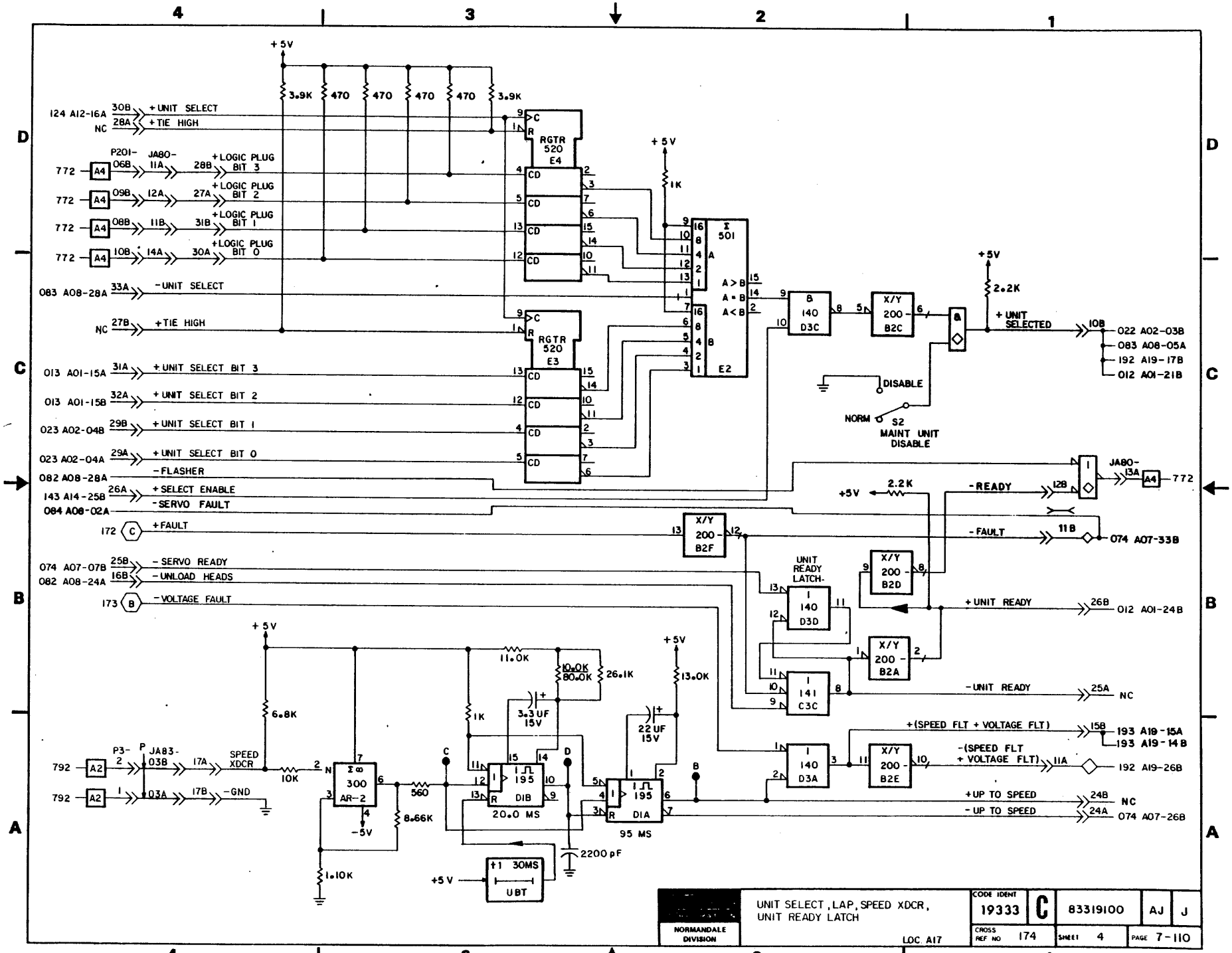
DRAWN	M.ANDERSON		NORMANDALE DIVISION	FAULT CARD DIAGRAMS	CODE IDENT 19333	C	83319100 AJ J
CHECKED							
ENGINEER							
APPROVED				TYPE C / MKFV LOC A17	CROSS REF NO 171	SHEET 1 of 4	PAGE 7-107

REF 83214117

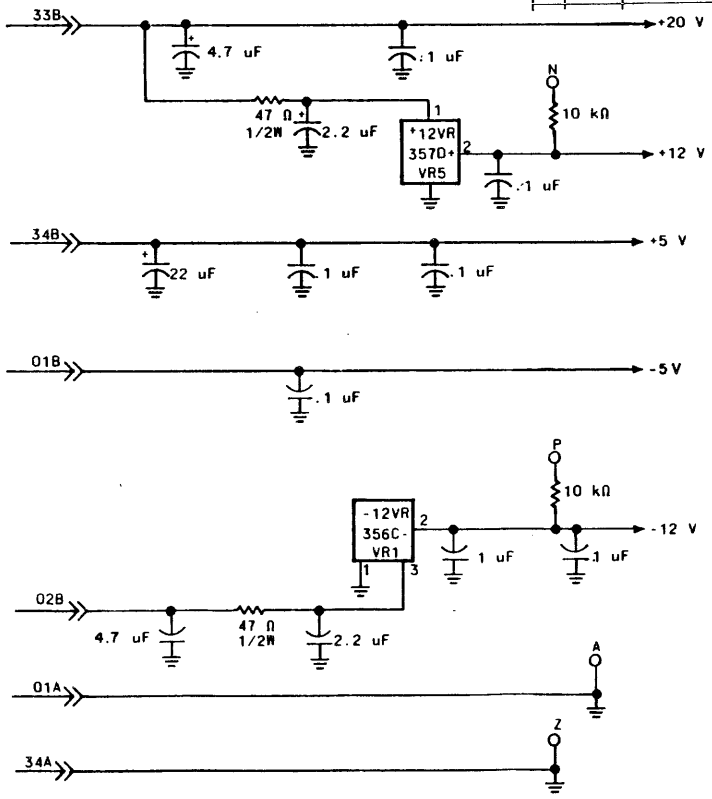

JB/PB13
621 A3 31B 34A -GND
621 A3 31A 09B +WRITE FAULT
013 A01-02B 08A -ADDRESS MARK ENABLE DELAYED
8 140 B4A
WRT FLT
140 C2A
+WRITE FAULT 21B NC
WRT FLT
+5V
140 C2B
C2CR1
270
173 A -MAINTENANCE FAULT CLEAR
FAULT LATCH
-GND 01A JA82- 10B A3 611 A3PE1-10B
JA82-
611 A3 03A 14B +MULTIPLE HEAD SELECT FAULT
611 A3 03B 01A -GND
146 C4A
HD SEL FLT
140 C2D
140 D3B
146 C4E
143 B3A
+FAULT 08B 10A A3 611 A3PE1-10A
012 A01-07A
C 174
HEAD SEL FLT
+5V
140 C2C
C2CR2
270
143 B3B
022 A02-27B 13A -WRITE GATE
146 C4B
8 141 C3A
WRITE•RD FLT
+HD SEL FAULT 16A NC
140 D2A
+(WRITE•READ FAULT) 22B NC
022 A02-29A 13B -READ GATE
146 C4C
WRITE•RD FLT
+5V
140 D2B
D2CR1
270
140 B4D
173 B -VOLTAGE FAULT
140 B4B
146 C4D
ON CYL•(W+R) FLT
072 A07-03B 10A -ON CYLINDER FF
8 140 B4C
140 D2D
+[ON CYL•(W+R) FAULT] 23B
ON CYL•(W+R)FLT
+5V
140 D2C
D2CR2
270
772 A4 JA80- 02B 09A -OPERATOR FAULT CLEAR
BUS f2 ULY
141 C3B
146 C4F
-FAULT CLEAR 14A 074 A07-31B
022 A02-30A 12A -CONTROLLER FAULT CLEAR
NORMANDALE DIVISION
FAULT LATCH AND FAULT CLEAR
LOC A17
CODE IDENT 19333
C
83319100
AJ
B
CROSS REF NO 172
SHEET 2
PAGE 7-108



NORMANDALE DIVISION	POWER UP MASTER CLEAR, MAINT FAULT CLEAR AND VOLTAGE FAULT DETECT LOC: A17	CODE IDENT 19333	C	83319100	AJ H
		CROSS REF NO 173	SHEET 3	PAGE 7-109	


+5V
3.9K
470
470
470
470
3.9K
124 A12-16A
30B
+UNIT SELECT
NC
28A
+TIE HIGH
772
A4
P201-06B
JA80-11A
28B
+LOGIC PLUG BIT 3
09B
12A
27A
+LOGIC PLUG BIT 2
08B
11B
31B
+LOGIC PLUG BIT 1
10B
14A
30A
+LOGIC PLUG BIT 0
083 A08-28A
33A
-UNIT SELECT
NC
27B
+TIE HIGH
RGTR 520 E4
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
082 A08-28A
-FLASHER
143 A14-25B
26A
+SELECT ENABLE
084 A08-02A
-SERVO FAULT
172
C
+FAULT
074 A07-07B
25B
-SERVO READY
082 A08-24A
16B
-UNLOAD HEADS
173
B
-VOLTAGE FAULT
1K
Σ 501 E2
A>B
A=B
A<B
B 140 D3C
X/Y 200-B2C
2.2K
+UNIT SELECTED
10B
022 A02-03B
083 A08-05A
192 A19-17B
012 A01-21B
DISABLE
NORM
S2 MAINT UNIT DISABLE
JA80-13A
-READY
12B
-FAULT
11B
074 A07-33B
X/Y 200-B2F
UNIT READY LATCH-
I 140 D3D
X/Y 200-B2D
+UNIT READY
26B
012 A01-24B
X/Y 200-B2A
I 141 C3C
-UNIT READY
25A
NC
+(SPEED FLT + VOLTAGE FLT)
15B
193 A19-15A
193 A19-14B
-(SPEED FLT + VOLTAGE FLT)
11A
192 A19-26B
I 140 D3A
X/Y 200-B2E
+UP TO SPEED
24B
NC
-UP TO SPEED
24A
074 A07-26B
792
A2
P3-2
P
JA83-03B
17A
SPEED XDCR
6.8K
10K
03A
17B
-GND
Σ∞ 300 AR-2
-5V
560
8.66K
1.10K
11.0K
10.0K
80.0K
26.1K
1K
3.3 UF 15V
I 195 DIB
20.0 MS
13.0K
22 UF 15V
I 195 DIA
95 MS
2200 pF
+5V
t1 30MS
UBT
UNIT SELECT, LAP, SPEED XDCR, UNIT READY LATCH
NORMANDALE DIVISION
LOC. A17
CODE IDENT 19333
C
83319100
AJ
J
CROSS REF NO 174
SHEET 4
PAGE 7-110

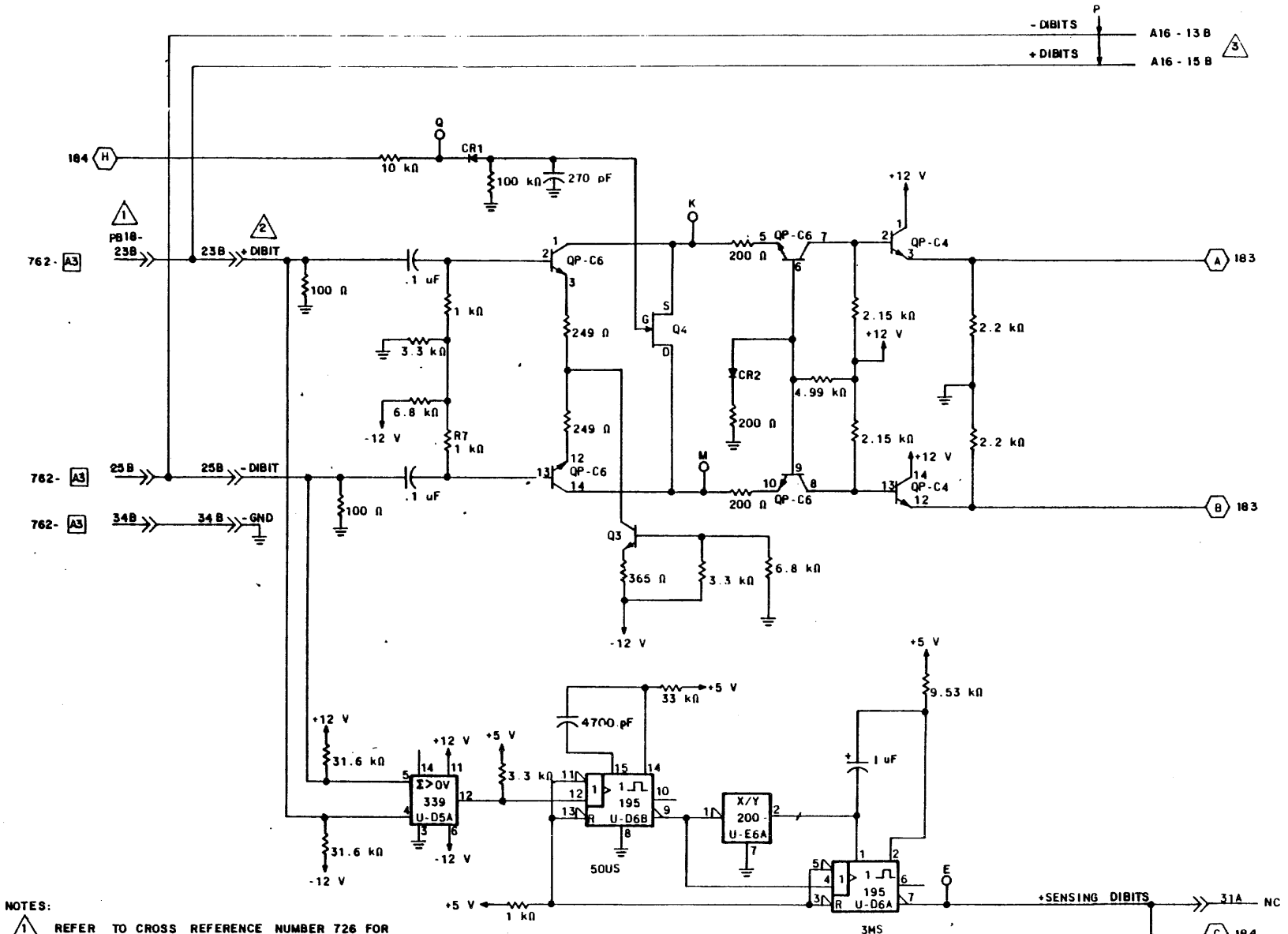
REVISIONS				
REV	ECO	DESCRIPTION	DRFT	DA
A	PE23000	RELEASED	[illegible]	
B	PE22842	CORRECT DIAGRAMS	WEB	1[illegible]
C	PE55259	LOGIC DIA CORR	GR	5
D	PE55593	321S TO 370	MA	
E	PE55944	CHG IC FAMILIES	[illegible]	[illegible]
F	PE55986	CHG RES VALUES	[illegible]	[illegible]
G	PE60129	HFRV COST REDUCTION		5 [illegible]
H	PE60129A	HFRV COST REDUCTION		
J	DJ00280	CHG CAP ON HFRV	SCHLIEP	4-27-82
K	DJI3358	CHG HFRV & QFRV	JG	7-16-84
L	DJI3655	CORR LOGIC DIAG	AJ	5-15-85
M	DJ00858	CHG CAPACITOR		



NOTE: THIS SET USED FOR HFRV REV G AND ABOVE.

DRAWN	M ANDERSON	12/	TWIN CITIES DISK DIVISION	FINE SERVO DECODER DIAGRAMS	CODE IDENT 19333	C	83319100 AT
CHECKED							
ENGINEER		5/25/82		TYPE: HFRV LOC A18	CROSS REF NO 181	SHEET 1 of 5	PAGE 7-111
APPROVED							

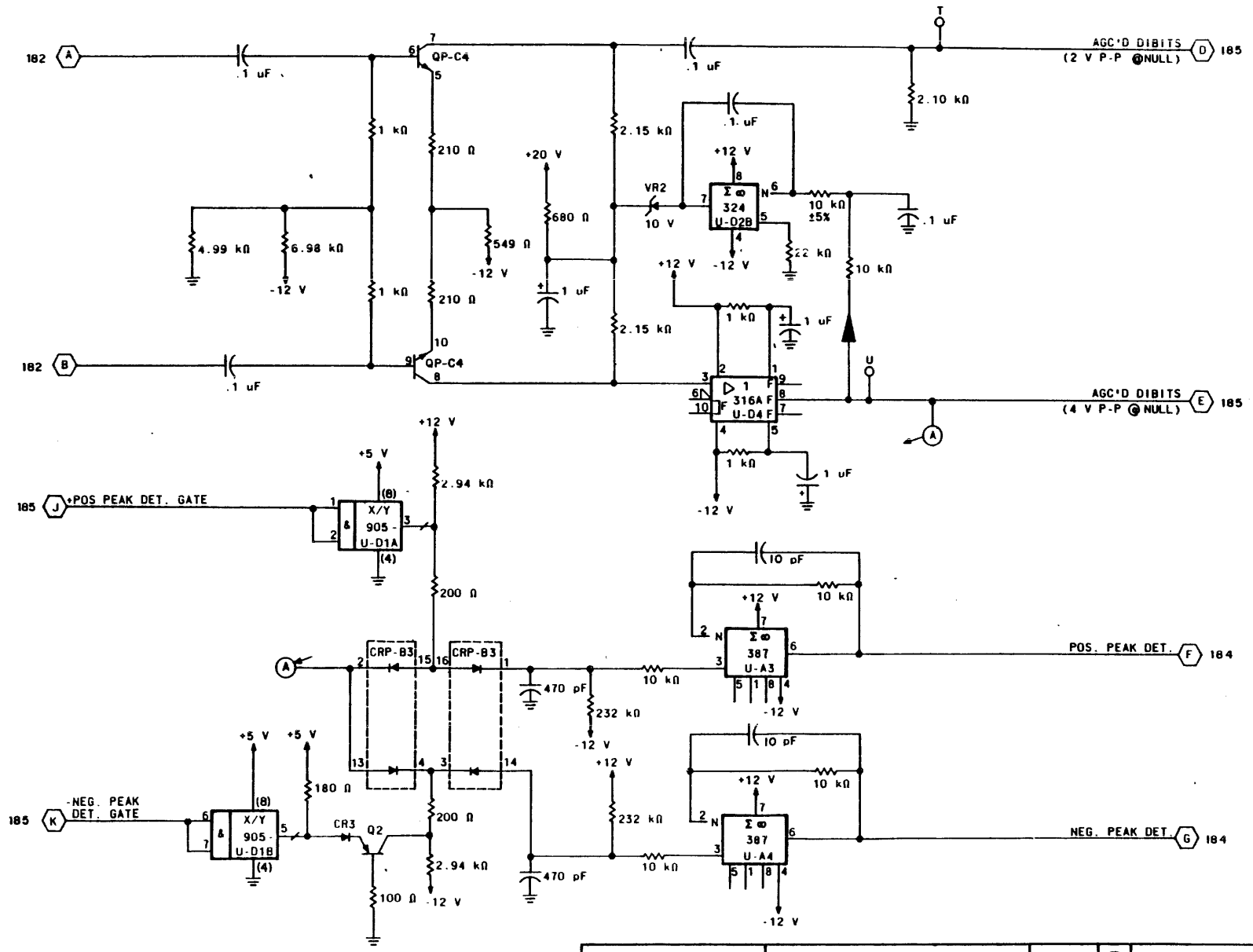
REF 83214118



NOTES:

1. REFER TO CROSS REFERENCE NUMBER 726 FOR CABLING INFORMATION.
2. DIBITS FROM SERVO PREAMP
3. TO HEAD ALIGNMENT CARD.

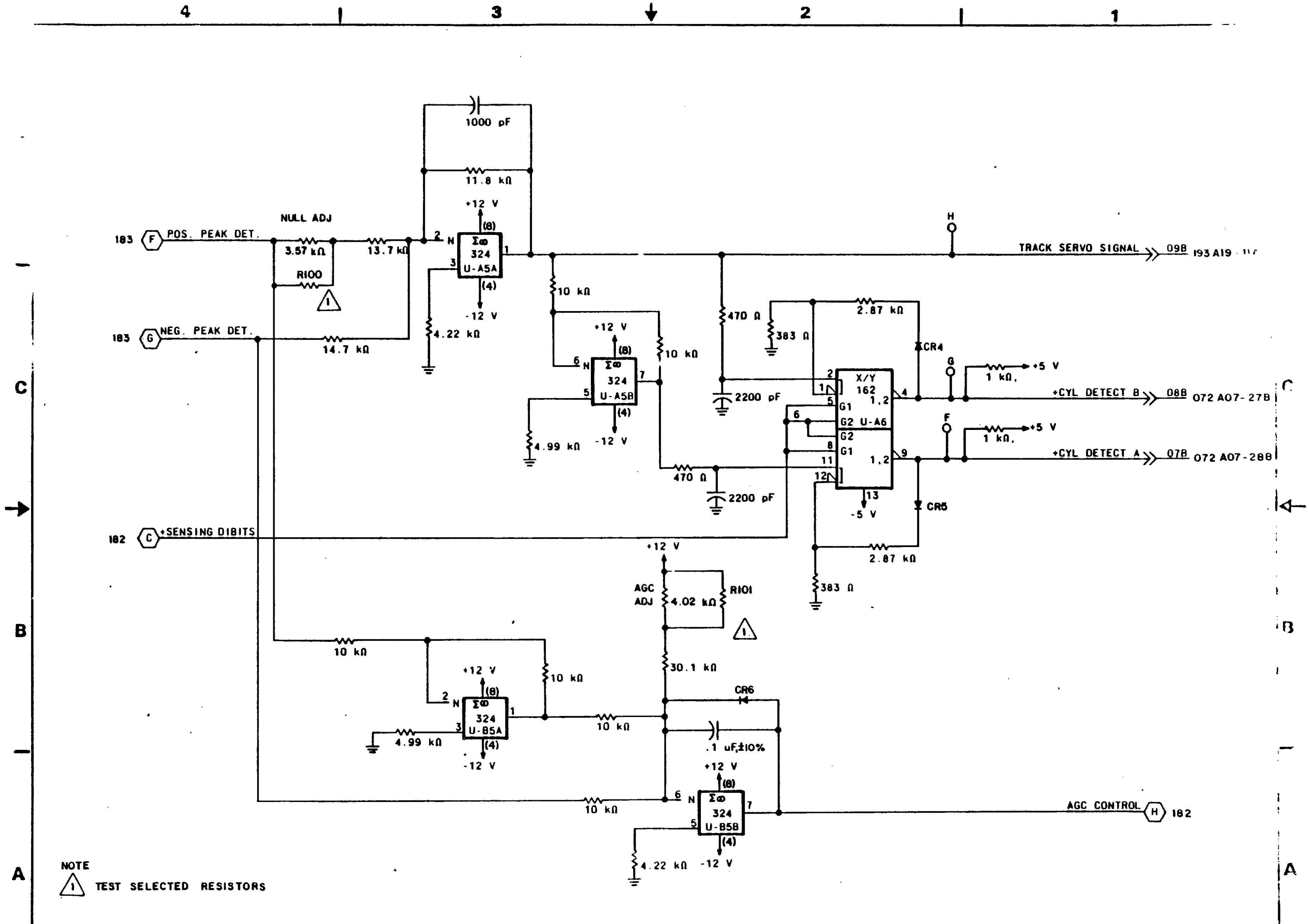
SENSING DIBITS AND AGC'ED SERVO SIGNAL LOC: A18	NORMANDALE OPERATIONS	C	83319100		AJ
	CODE IDENT 19333	CROSS REF NO 182	SHEET 2	PAGE 7-112	



TRACK SERVO SINAL AND CYL DETECT A AND B

LOC: A18

NORMANDALE OPERATIONS	C	83319100	AM	K
CODE IDENT 19333	CROSS REF NO. 183	SHEET 3	PAGE 7-113	

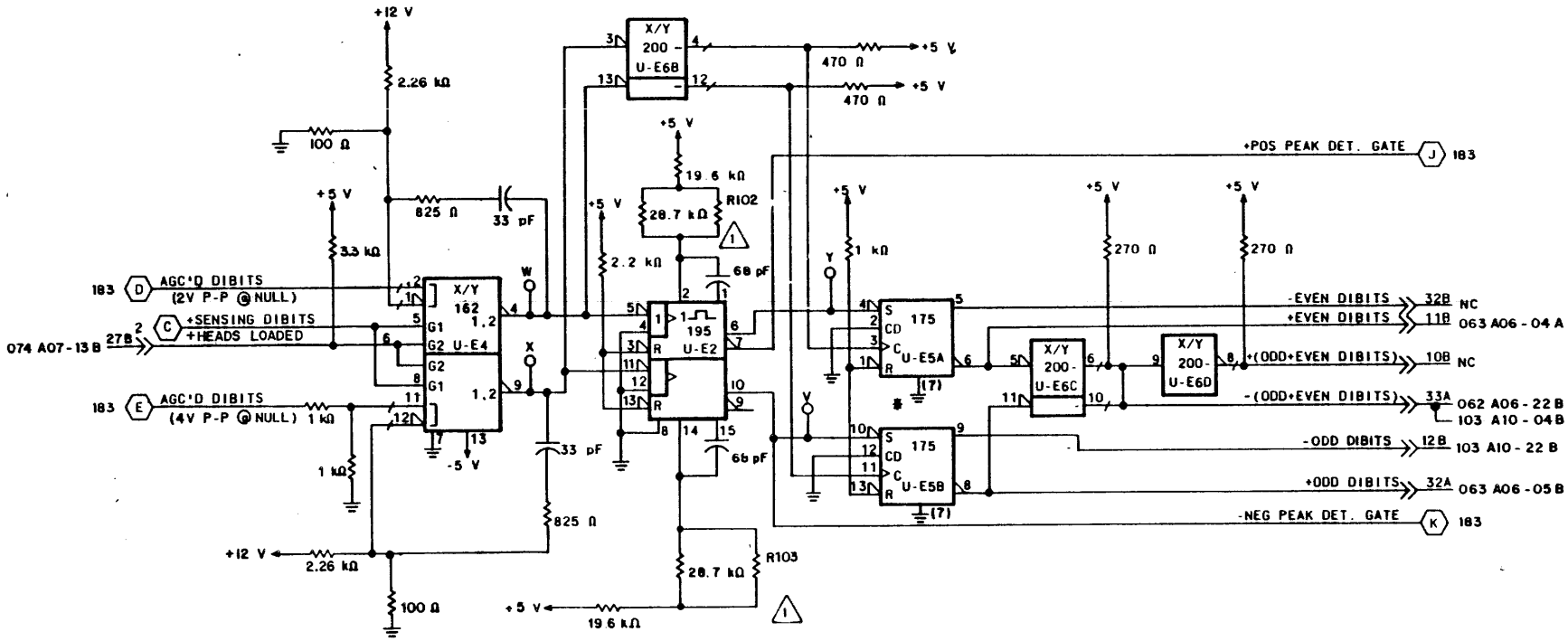


TRACK SERVO SIGNAL AND CYL DETECT A AND B

LOC: A18

NORMANDALE OPERATIONS | C | 83319100 | AM | K

CODE IDENT 19333 | CROSS REF NO 184 | SHEET 4 | PAGE 7-114

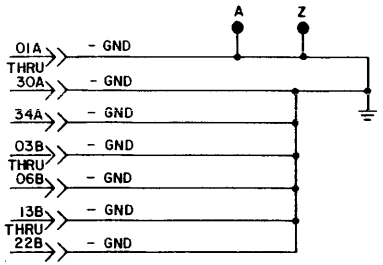


NOTE:
1 TEST SELECTED RESISTOR

	TRACK SERVO SIGNAL CYL DETECT A AND B LOC A18	TWIN CITIES DISK DIVISION	C	83319100	AP L
		CODE IDENT 19333	DWG REF NO 185	SHEET 5	PAGE 7-115/7-116

REVISION STATUS OF SHEETS

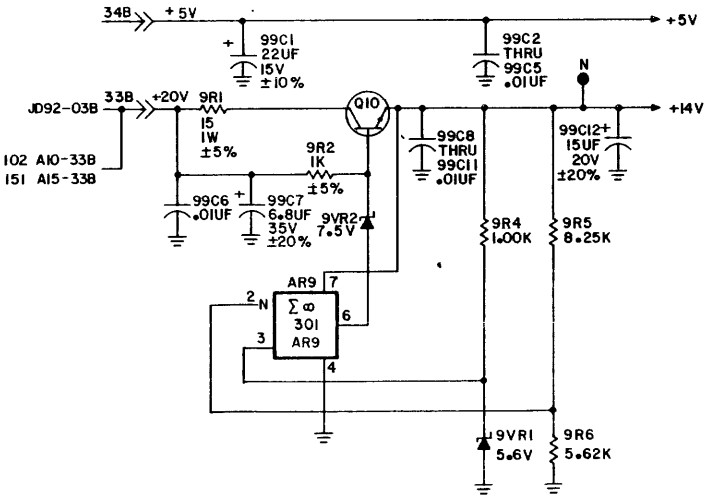
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A	A																
B	B	B	B																
C	B	B	B																
D	B	B	D																
E	B	E	D																

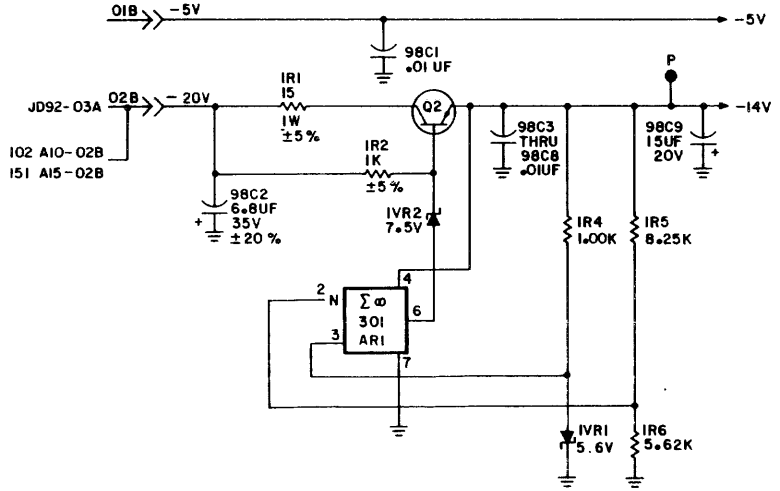


UNUSED LOGIC ELEMENTS

REVISIONS

REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA	2-17-77	
B	PE22892	SCHEMATIC CORRECTIONS			
C		EDITORIAL	MA	5-20-77	
D	PE55259	LOGIC DIAG IMPROVEMENT	MA	10-4-78	
E	PE55593	CHANGE I C			



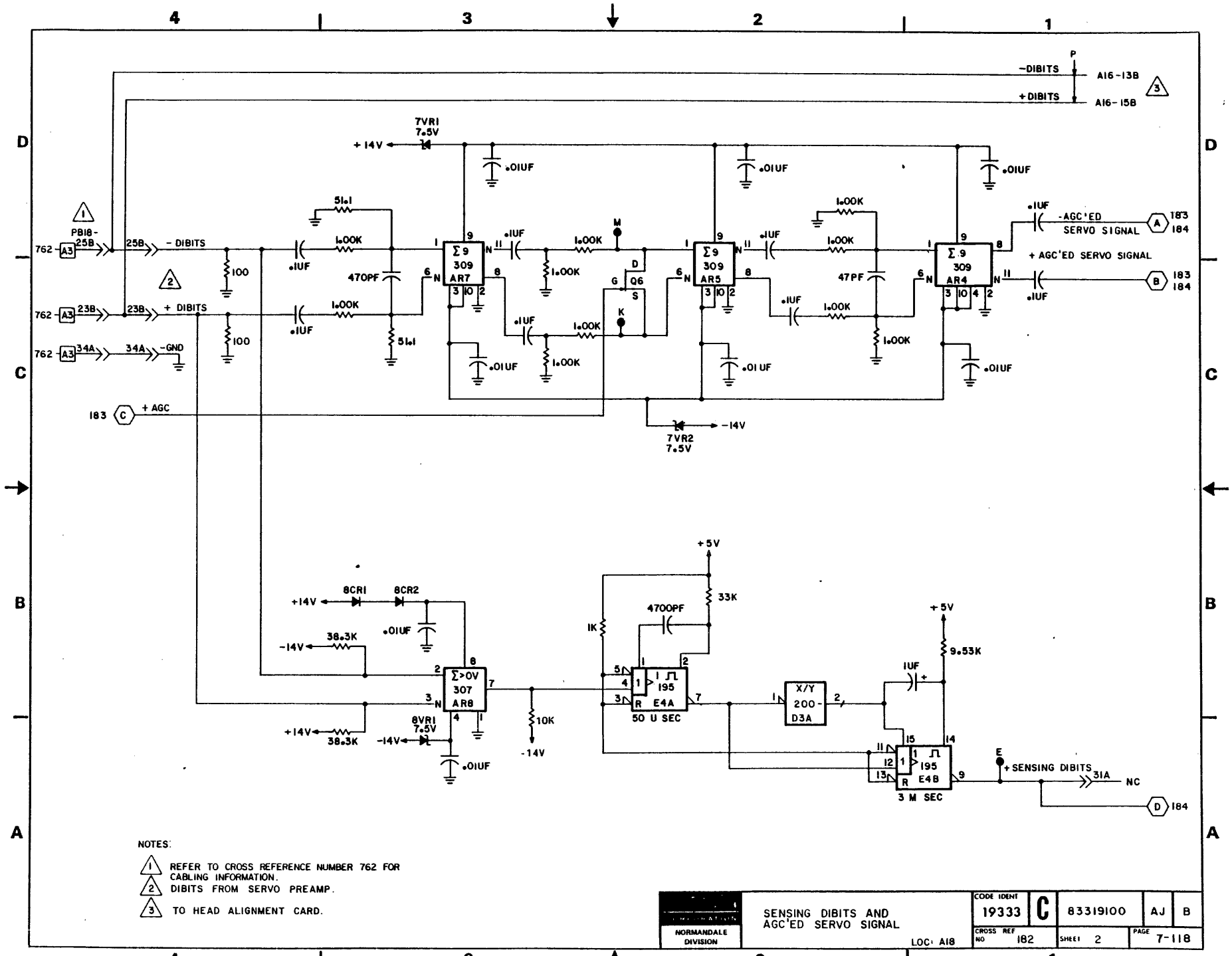


NOTES:

1. THIS SET USED FOR HFRV REV F AND BELOW.

DRAWN	M ANDERSON		NORMANDALE DIVISION	FINE SERVO DECODER DIAGRAMS	CODE IDENT 19333	C	83319100	AJ	E
CHECKED									
ENGINEER				TYPE HFRV LOC A18	CROSS REF NO 181		SHEET 1 OF 4	PAGE 7-117	
APPROVED									

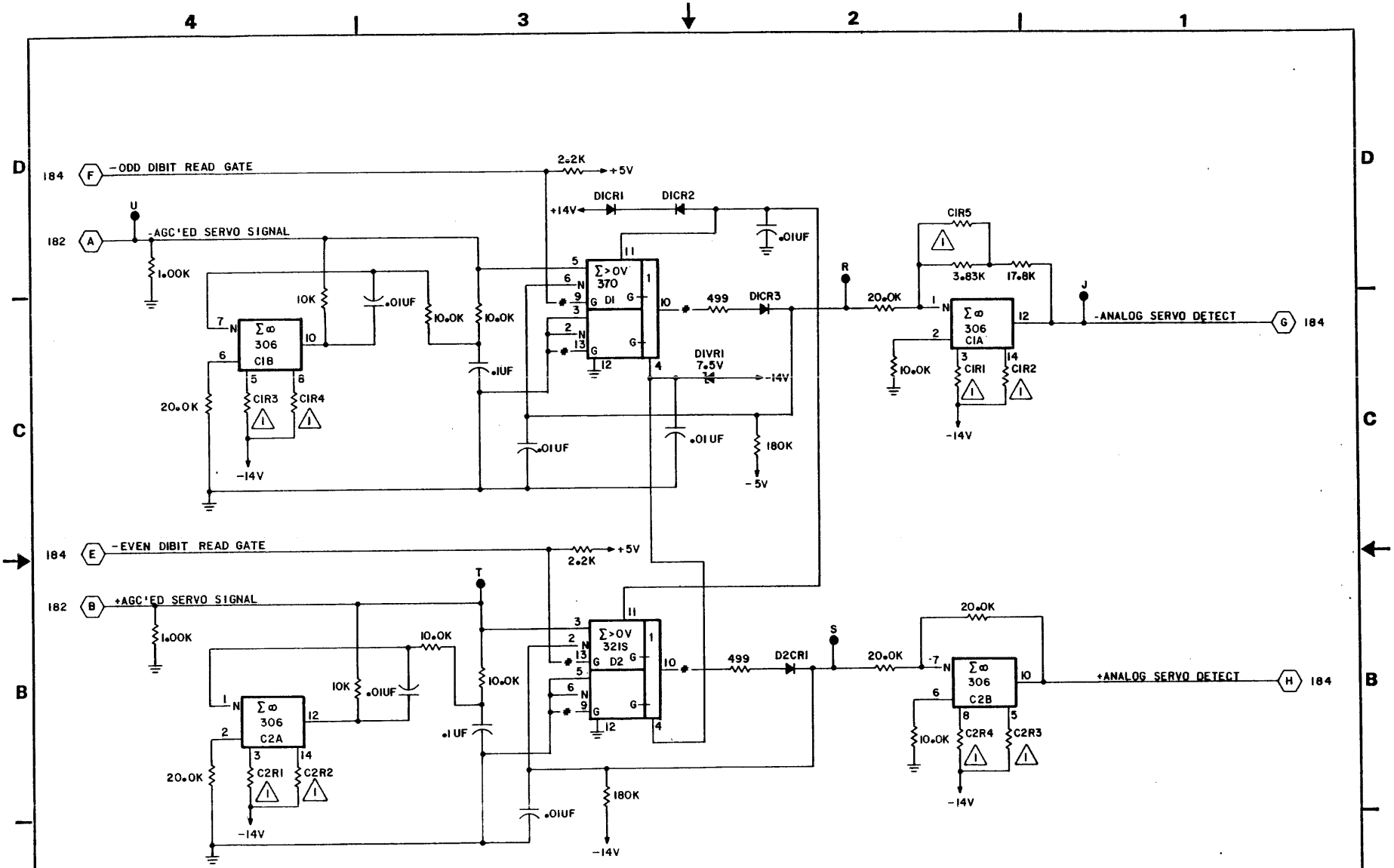
REF 83214118



NOTES:

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

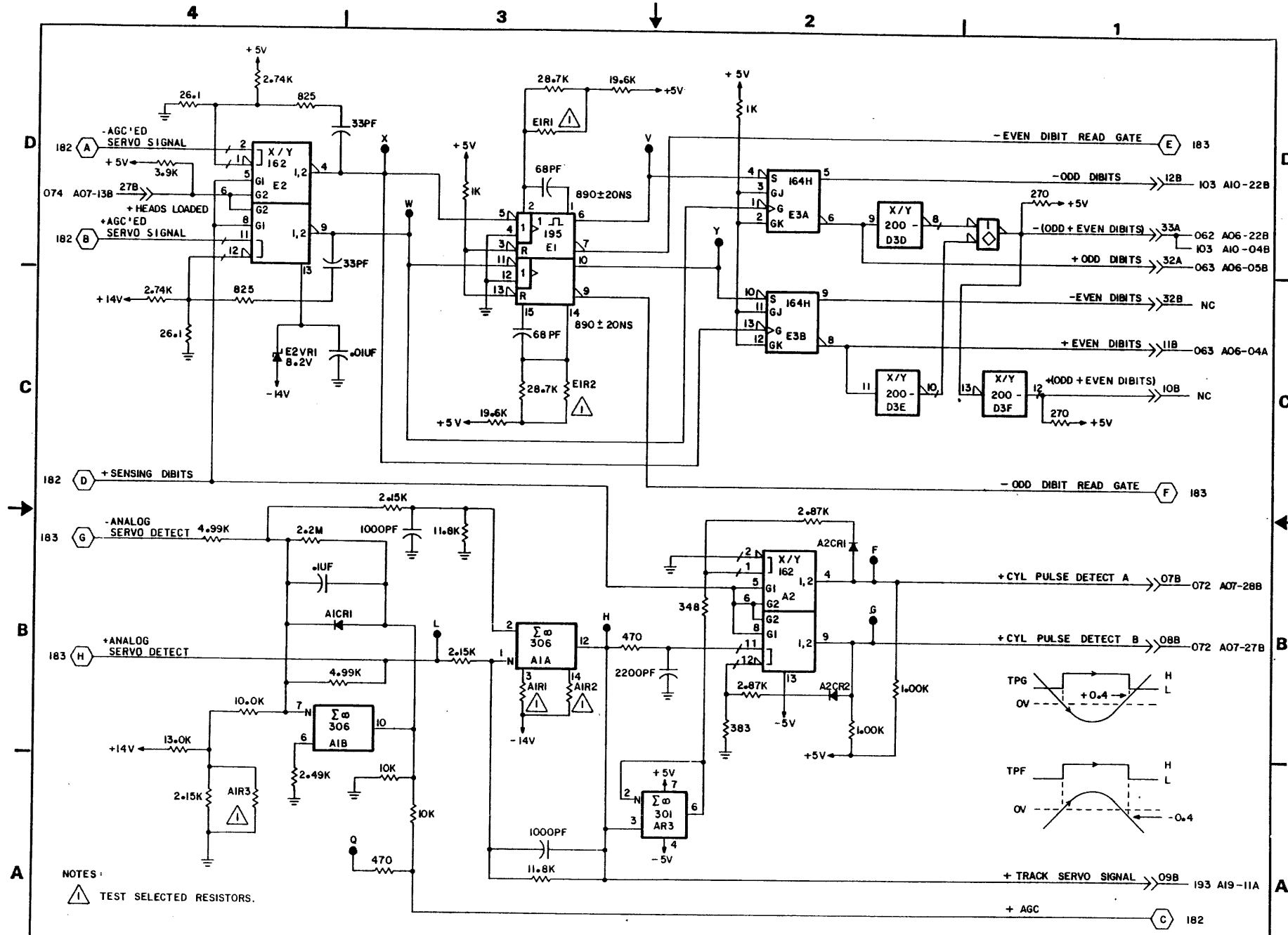
NORMANDALE DIVISION	SENSING DIBITS AND AGC'ED SERVO SIGNAL LOC: A18	CODE IDENT 19333	C	83319100	AJ B
		CROSS REF NO 182		SHEET 2	PAGE 7-118



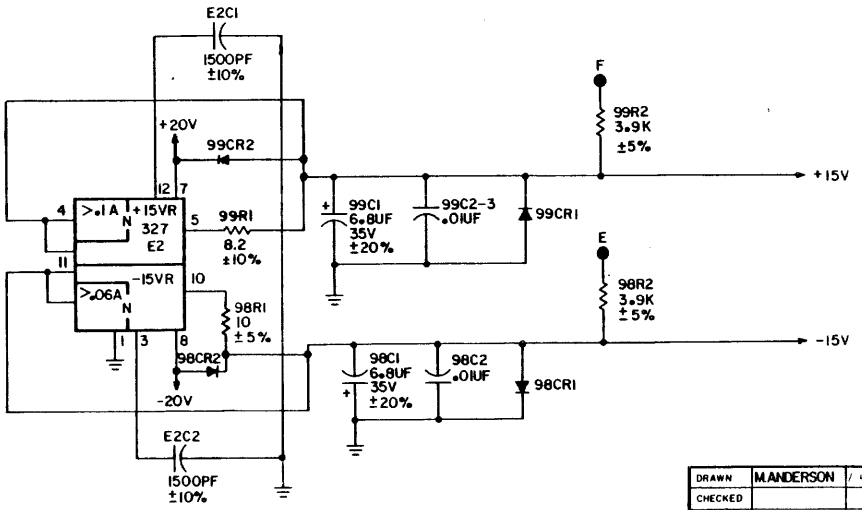
NOTES:

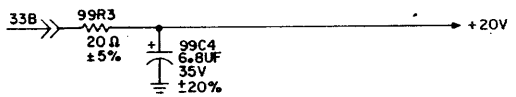
⚠1 TEST SELECTED RESISTORS.

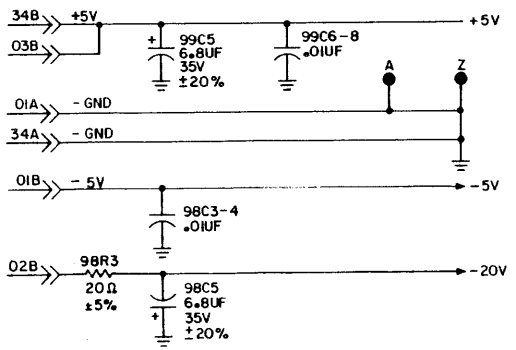
NORMANDALE DIVISION	TRACK SERVO SIGNAL AND CYL DETECT A AND B LOC A18	CODE IDENT 19333	C	83319100	AJ E
		CROSS REF NO 183	SHEET 3	PAGE 7-119	


+5V
2.74K
26.1
825
33PF
-AGC'ED SERVO SIGNAL
182 A
+5V
3.9K
074 A07-13B
27B
+HEADS LOADED
+AGC'ED SERVO SIGNAL
182 B
X/Y 162 E2
33PF
+14V
2.74K
825
26.1
E2VR1 8.2V
-14V
.01UF
X
W
+5V
1K
68PF
890±20NS
28.7K
19.6K
+5V
E1R1
1
195 E1
68 PF
890 ± 20NS
28.7K
E1R2
19.6K
+5V
V
Y
+5V
1K
-EVEN DIBIT READ GATE
E 183
S 164H GJ G GK E3A
-ODD DIBITS
12B
103 A10-22B
270
+5V
-(ODD + EVEN DIBITS)
33A
062 A06-22B
103 A10-04B
+ODD DIBITS
32A
063 A06-05B
X/Y 200 - D3D
S 164H GJ G GK E3B
-EVEN DIBITS
32B
NC
+EVEN DIBITS
11B
063 A06-04A
X/Y 200 - D3E
X/Y 200 - D3F
+(ODD + EVEN DIBITS)
10B
NC
270
+5V
182 D
+SENSING DIBITS
-ODD DIBIT READ GATE
F 183
183 G
-ANALOG SERVO DETECT
4.99K
2.15K
2.2M
1000PF
11.8K
.1UF
A1CR1
183 H
+ANALOG SERVO DETECT
4.99K
2.15K
L
Σ∞ 306 A1A
A1R1
A1R2
-14V
470
2200PF
H
10.0K
13.0K
+14V
Σ∞ 306 A1B
2.49K
10K
10K
A1R3
2.15K
Q
470
1000PF
11.8K
+5V
Σ∞ 301 AR3
-5V
2.87K
A2CR1
F
X/Y 162 A2
348
G
2.87K
A2CR2
383
-5V
1.00K
1.00K
+5V
+CYL PULSE DETECT A
07B
072 A07-28B
+CYL PULSE DETECT B
08B
072 A07-27B
TPG
+0.4
0V
H
L
TPF
0V
H
L
-0.4
+ TRACK SERVO SIGNAL
09B
193 A19-11A
+ AGC
C 182
NOTES:
1 TEST SELECTED RESISTORS.
NORMANDALE DIVISION
TRACK SERVO SIGNAL AND CYL DETECT A AND B
LOC: A18
CODE IDENT 19333
C
83319100
AJ
D
CROSS REF NO 184
SHEET 4
PAGE 7-120

REVISIONS					
REV.	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	ML A	1-19-76	
B	PE22842	SCHEMATIC CORRECTIONS	MA	12-29-76	
C		EDITORIAL	MA	5-20-77	
D		EDITORIAL	MA	4-11-78	
E	PE55259	LOGIC DIAG. IMPROVEMENT	MA	10-4-78	
F	PE57426	CHANGE WIRE WRAP	S. A. W.	9/8/81	
G	PE57544-A	CHANGE IC FAMILIES	S. A. W.	9/8/81	
H	DH13128	CORRECT AKGV SCH	CB	3-17-82	
J	DJI3621	CORRECT SCH	BJP	4-15-85	
K	DJI3771	ADD DIODES			

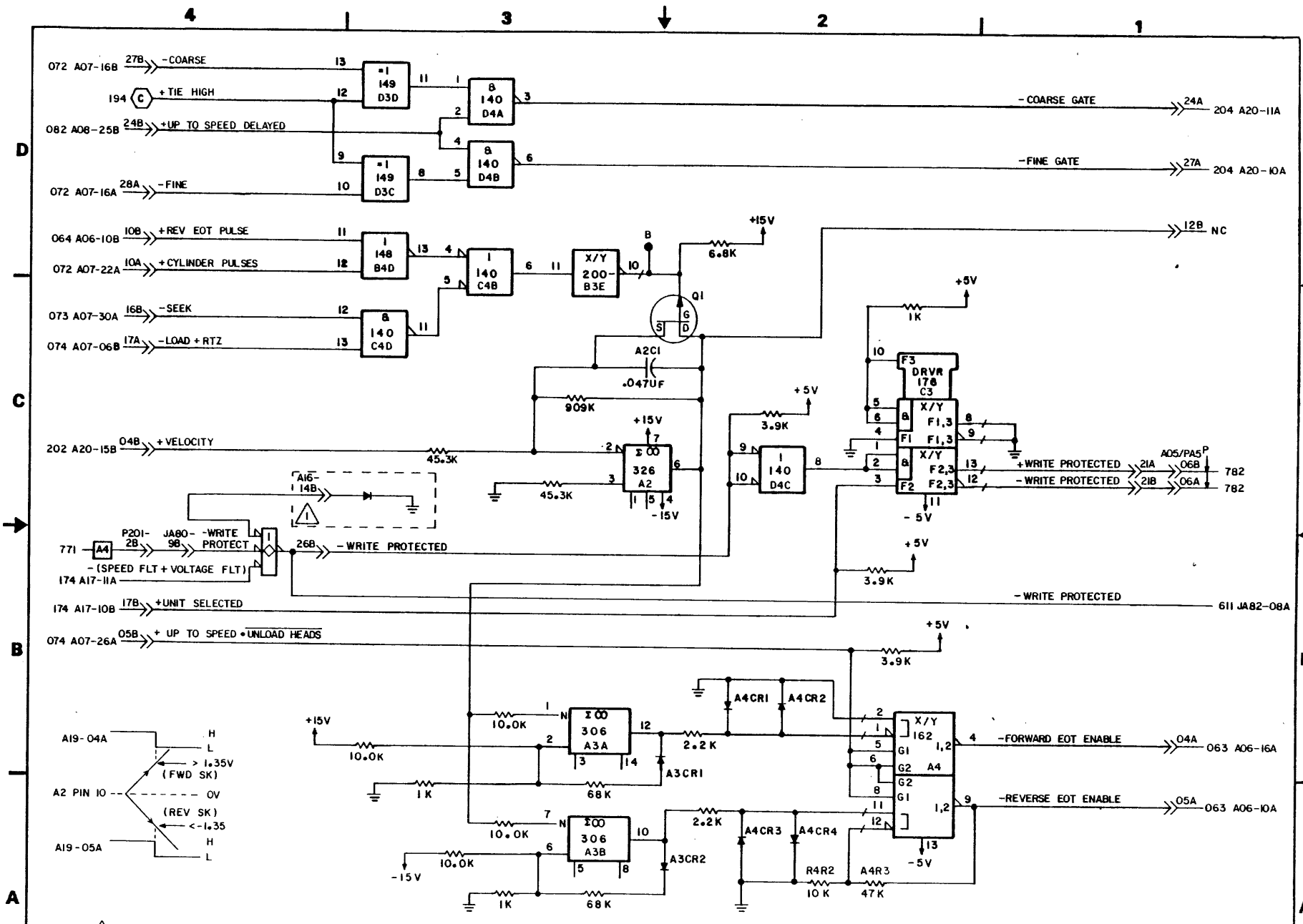


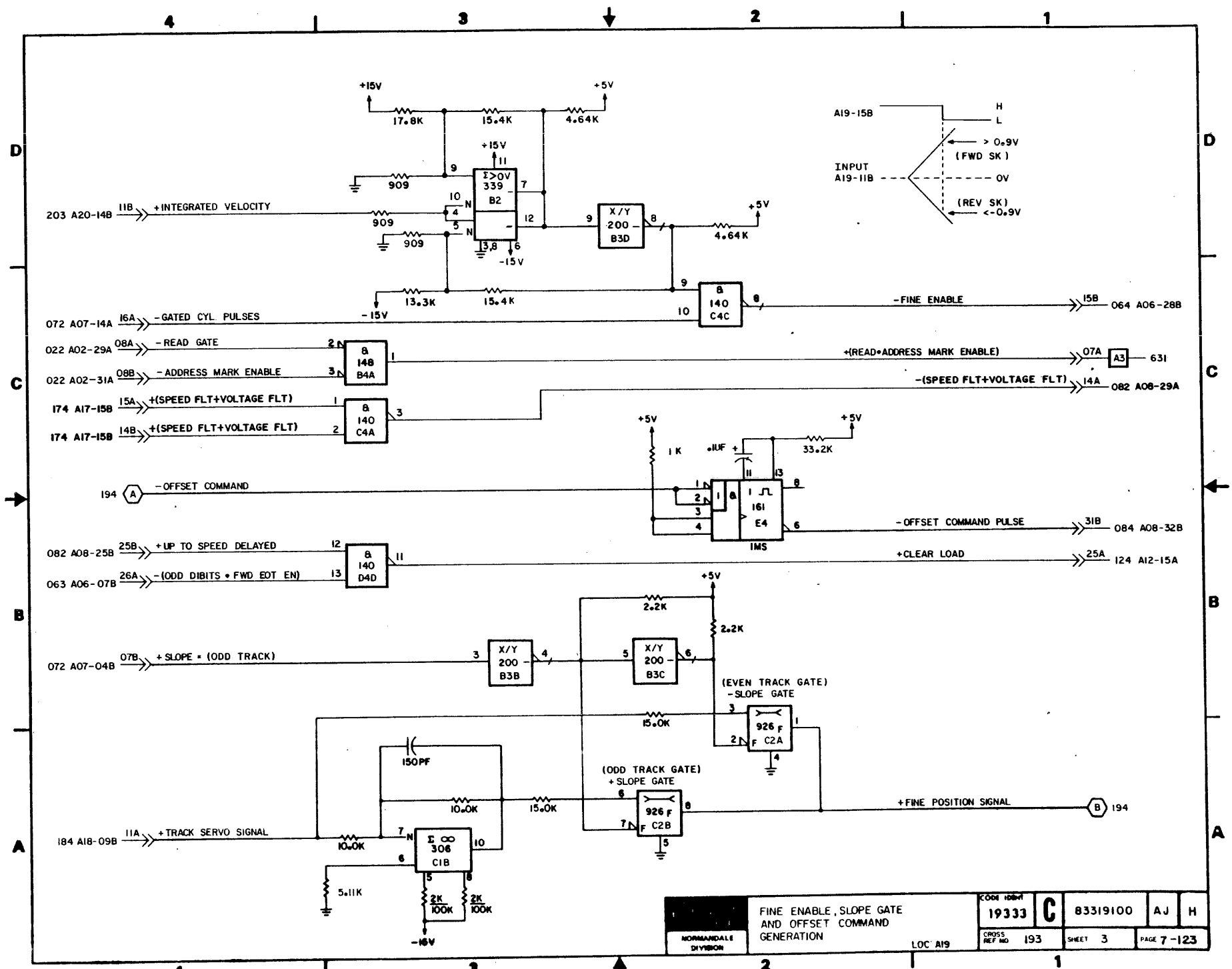




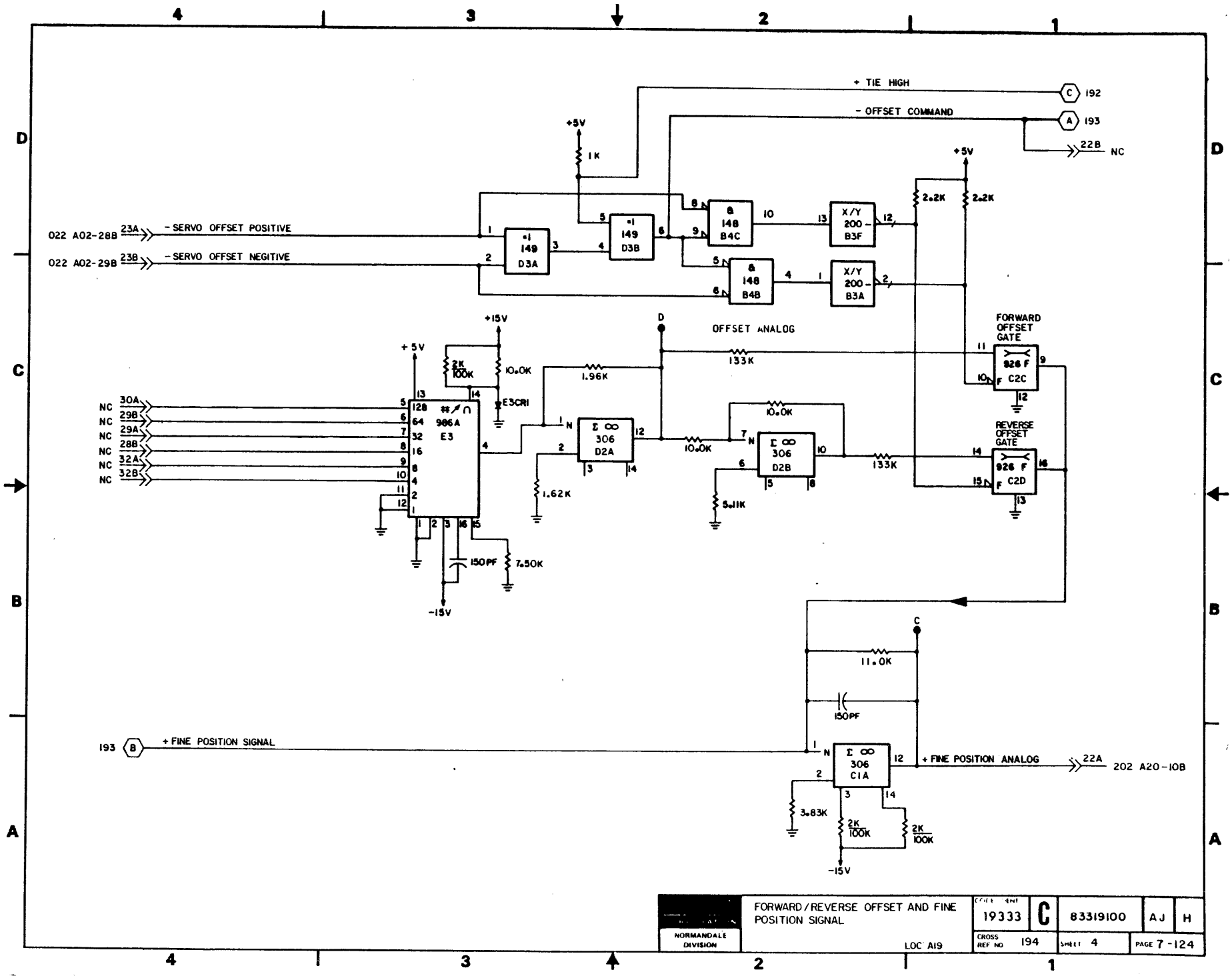
DRAWN	M.ANDERSON		NORMANDALE DIVISION	ACCESS CONTROL NO. 2 DIAGRAMS	CODE IDENT 19333	C	83319100	AT
CHECKED				TYPE: AKGV LOC: A19	CROSS REF NO 191	SHEET 1 OF 4	PAGE 7-121
ENGINEER							
APPROVED							

2 REF: 83214119


072 A07-16B 27B -COARSE
194 +TIE HIGH
082 A08-25B 24B +UP TO SPEED DELAYED
072 A07-16A 28A -FINE
149 D3D
149 D3C
140 D4A
140 D4B
-COARSE GATE
24A
204 A20-11A
-FINE GATE
27A
204 A20-10A
064 A06-10B 10B +REV EOT PULSE
072 A07-22A 10A +CYLINDER PULSES
148 B4D
140 C4B
X/Y 200- B3E
+15V
6.8K
12B NC
073 A07-30A 16B -SEEK
074 A07-06B 17A -LOAD + RTZ
140 C4D
Q1
A2C1
.047UF
909K
1K
+5V
F3 DRVR 176 C3
X/Y F1,3
X/Y F2,3
202 A20-15B 04B +VELOCITY
45.3K
326 A2
-15V
3.9K
140 D4C
+WRITE PROTECTED
-WRITE PROTECTED
A05/PA5
06B
06A
782
-5V
A16-14B
771 A4 P201-28 JA80-98 -WRITE PROTECT
-(SPEED FLT + VOLTAGE FLT) 174 A17-11A
26B -WRITE PROTECTED
174 A17-10B 17B +UNIT SELECTED
611 JA82-08A
074 A07-26A 05B + UP TO SPEED • UNLOAD HEADS
A19-04A
A2 PIN 10
> 1.35V (FWD SK)
OV
(REV SK) <-1.35
A19-05A
H
L
+15V
10.0K
306 A3A
306 A3B
2.2K
68K
A3CR1
A3CR2
A4CR1
A4CR2
A4CR3
A4CR4
162 A4
-FORWARD EOT ENABLE
-REVERSE EOT ENABLE
04A
05A
063 A06-16A
063 A06-10A
R4R2
10 K
A4R3
47K
PART OF HEAD ALIGNMENT CARD
NORMANDALE DIVISION
WRITE INHIBIT, FWD/REV EOT ENABLES, COARSE / FINE POSITION SIGNALS
LOC A19
CODE IDENT 19333
C
83319100
AT
CROSS REF NO 192
SHEET 2
PAGE 7-122



NORMANDALE DIVISION	FINE ENABLE, SLOPE GATE AND OFFSET COMMAND GENERATION LOC A19	CODE IDENT 19333	C	83319100	AJ H
		CROSS REF NO 193		SHEET 3	PAGE 7-123



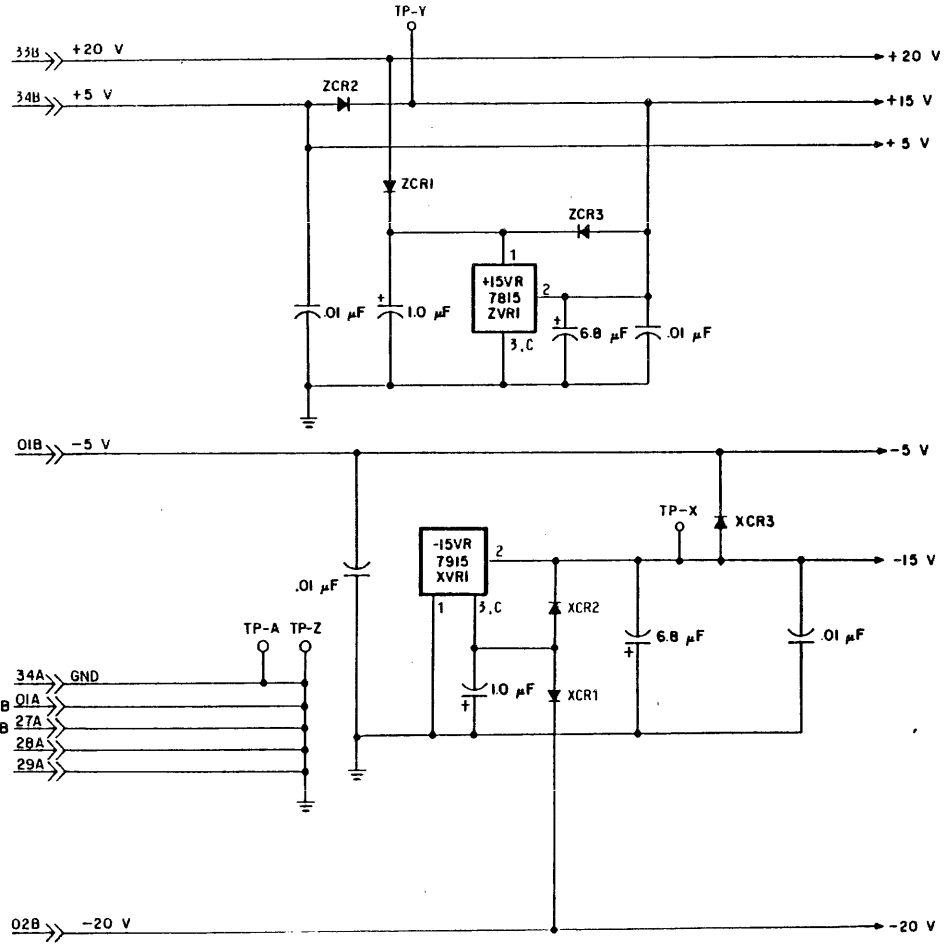
NORMANDALE DIVISION	FORWARD/REVERSE OFFSET AND FINE POSITION SIGNAL	CAGE IDENT 19333	C	83319100	AJ H
	LOC A19	CROSS REF NO 194		SHEET 4	PAGE 7-124

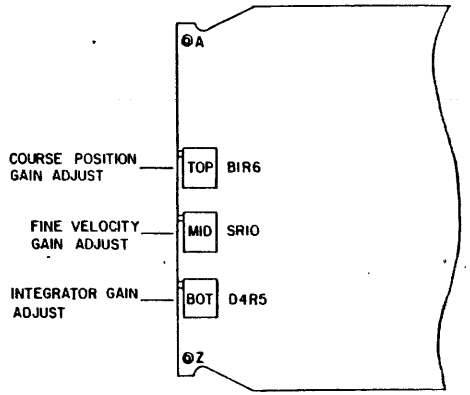
UNUSED LOGIC ELEMENTS

ELEMENT	LOCATION	OUTPUT PINS
7406	U-E4	2,8

REVISIONS

REV.	ECO	DESCRIPTION	DRFT	DATE	CHK'D
-	DJ2300	SEE MF HISTORY FOR REV A THRU H	JKL	11-1-84	
J	DJI3642	REDESIGN DMSV REVISED & REDRAWN	JKL	11-1-84	
K	DJI3696	CHG DMSV RES	SMW	3-19-85	
L	DJI3690A	CORR DMSV CAP QTY	CJB	6-19-85	
M	DJI3755	DMSV MARGIN INCR	CJB	9-4-85	
N	DJI3754	DMSV DECR NOISE	MJ	9-17-85	





APPLICABLE TO BJ4A1

DRAWN	SUE S.	8-21-84
CHECKED		9-29-84
ENGINEER		9-5-84
APPROVED		

ANALOG SERVO DIAGRAMS

TYPE · DMSV LOC · A20

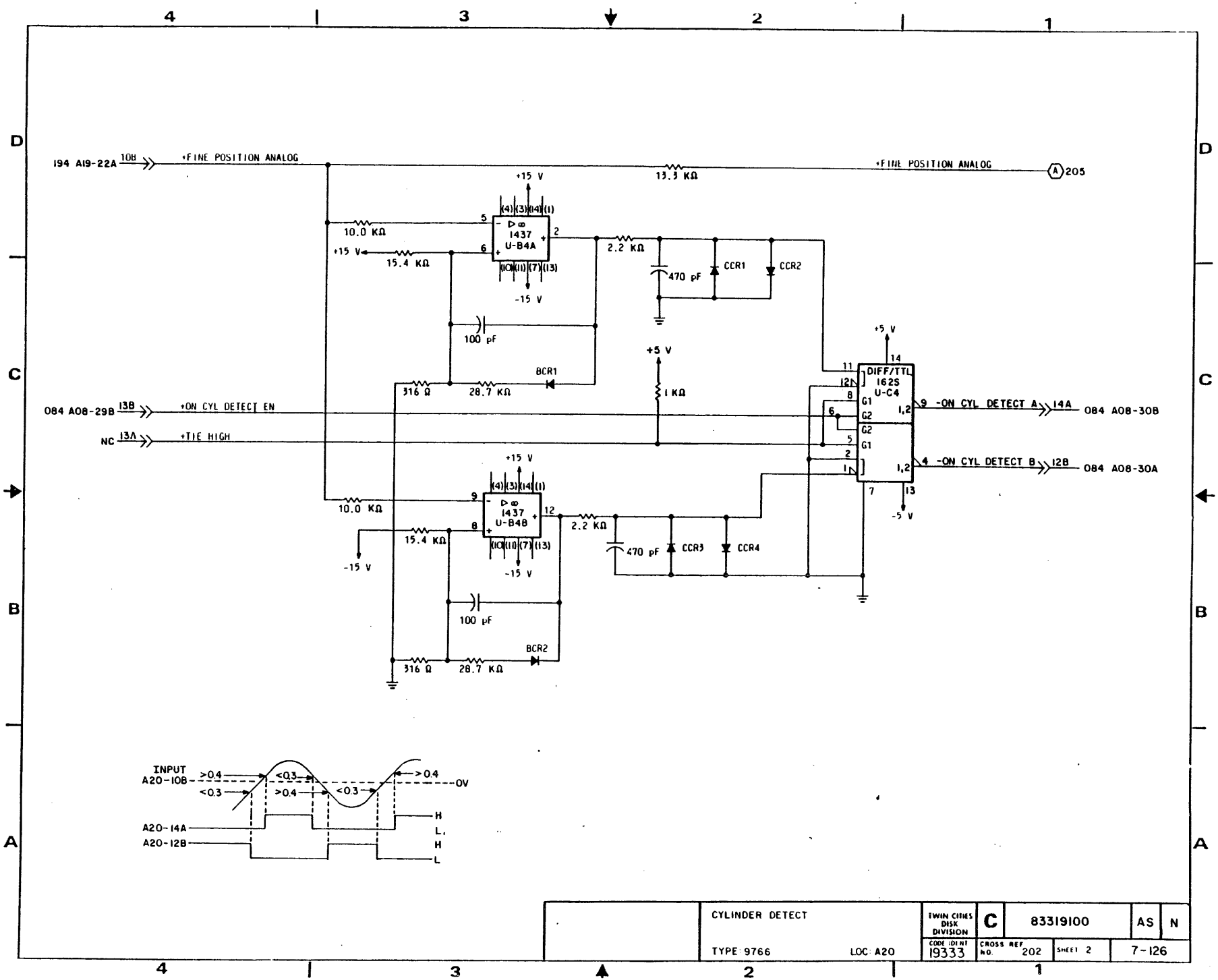
TWIN CITIES DISK DIVISION

CODE IDENT 19333

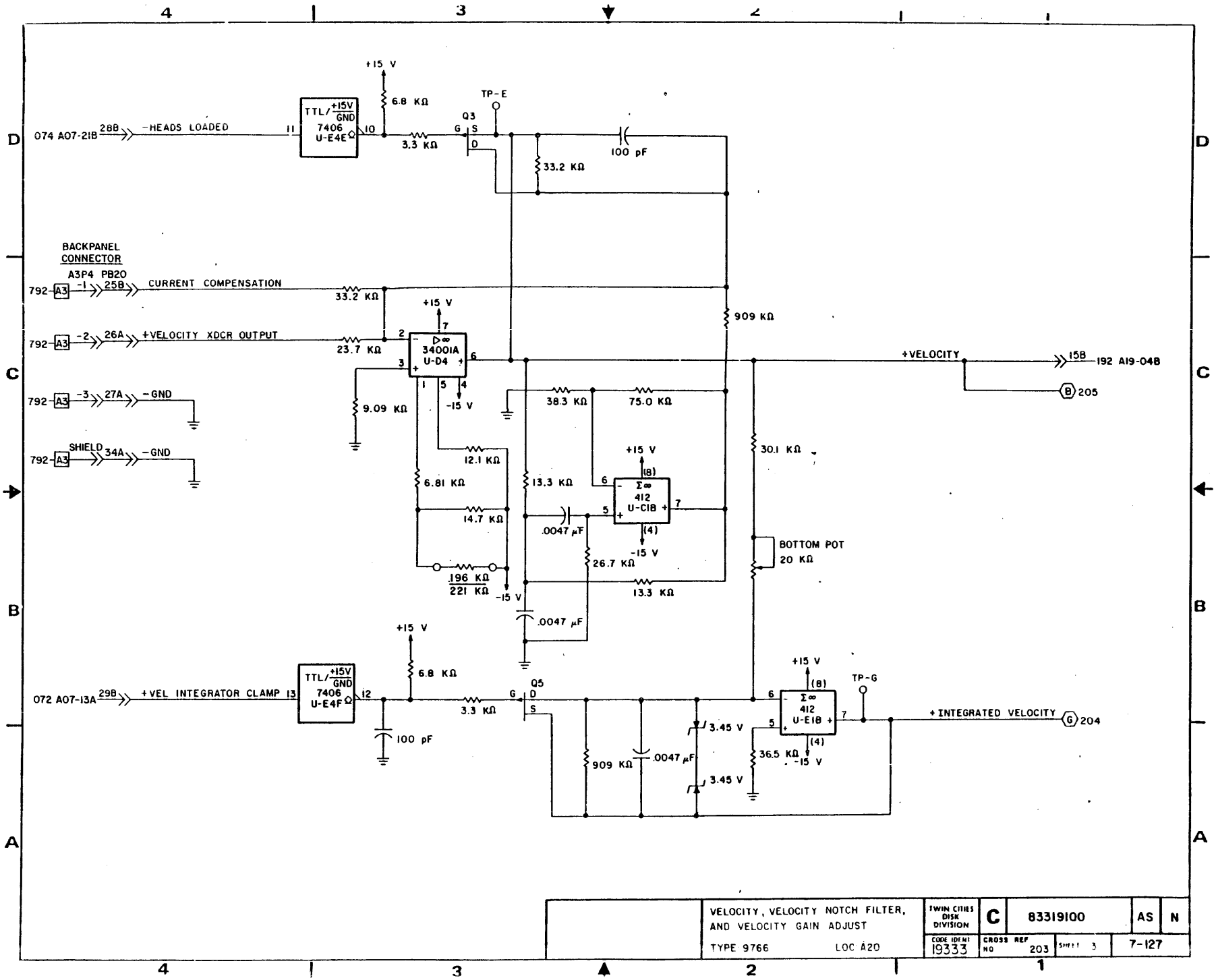
C 83319100 AS N

CROSS REF NO 201 SHEET 1 OF 5 PAGE 7-125

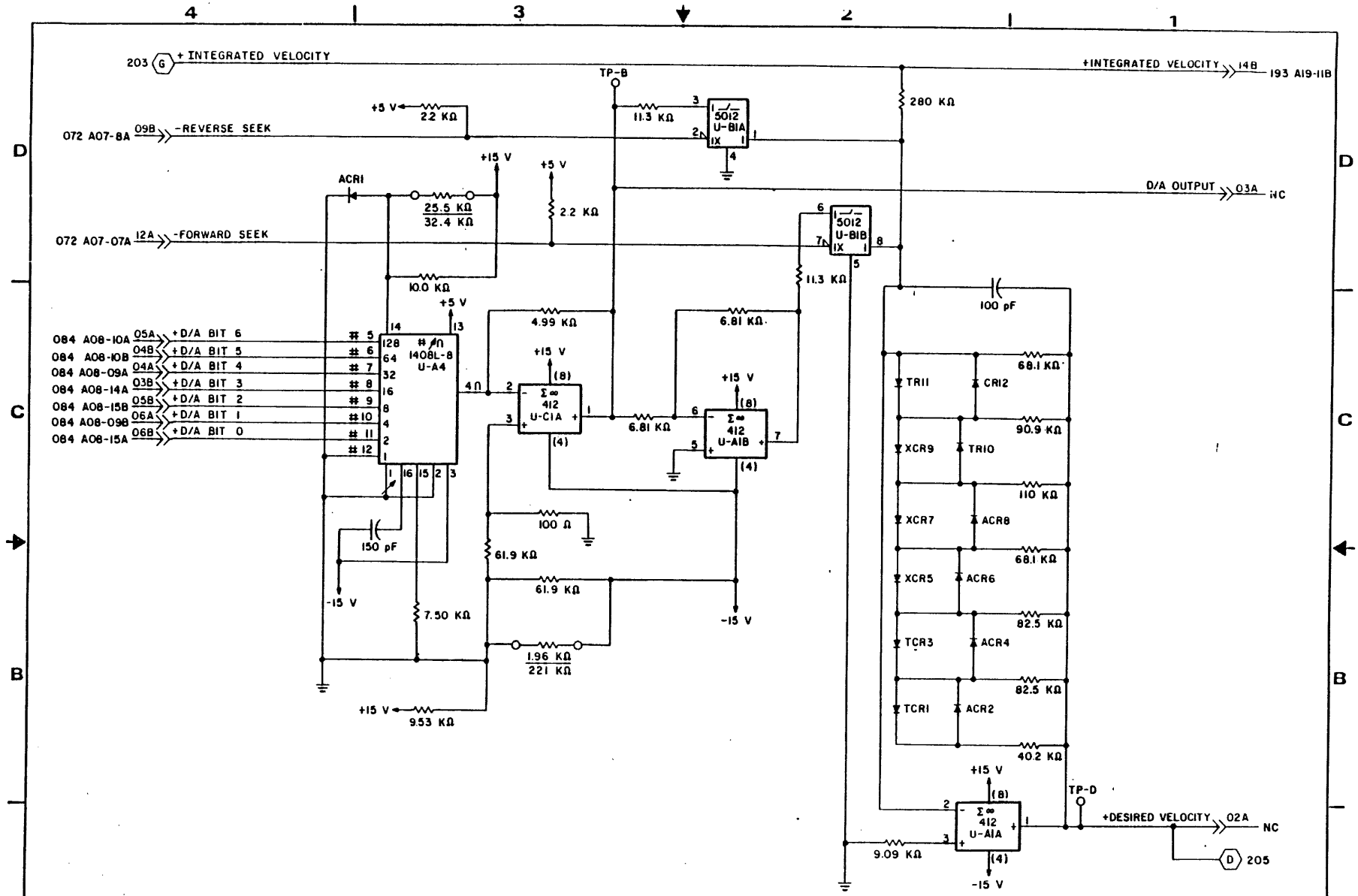
REF · 83214606



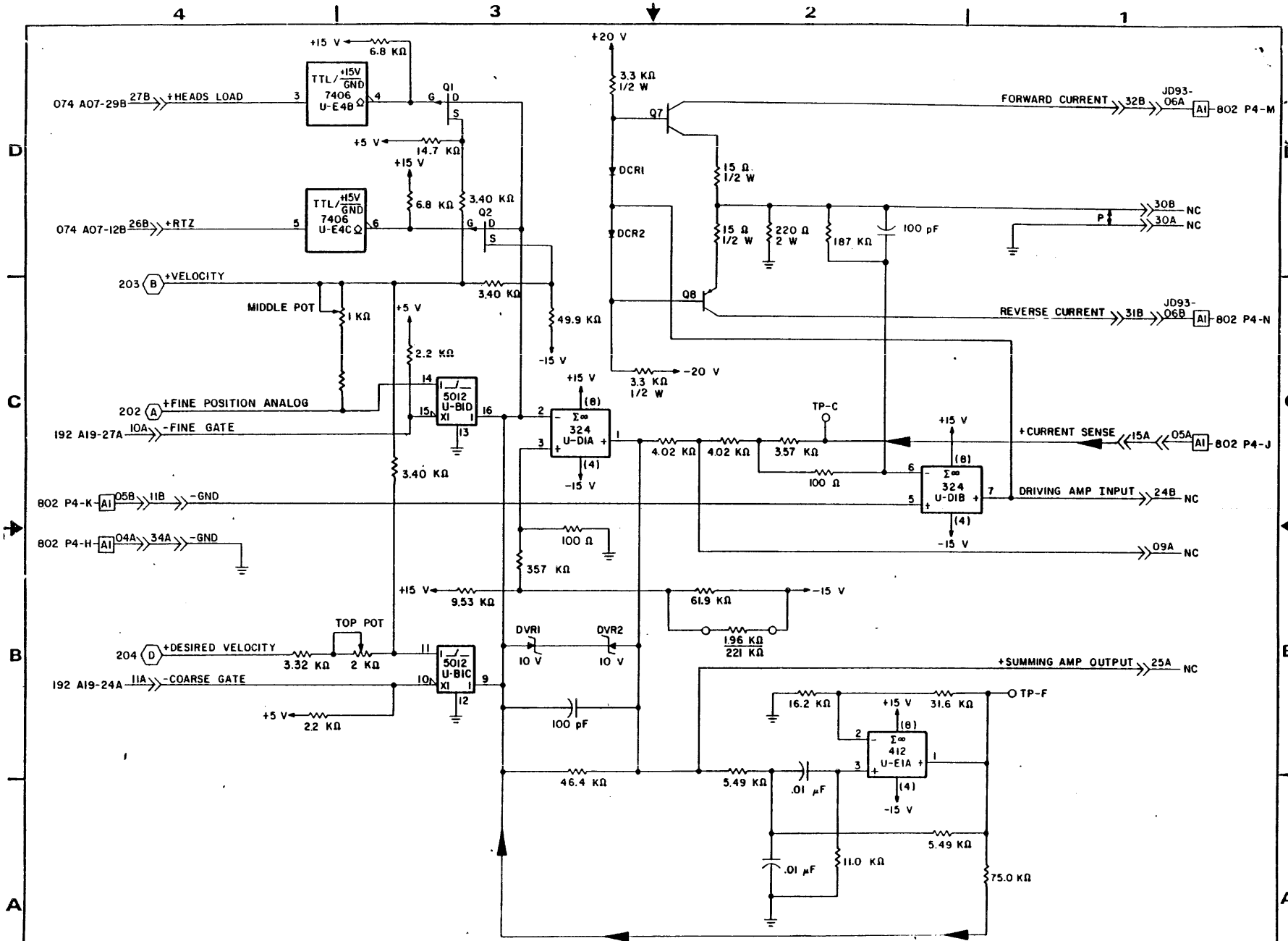
	CYLINDER DETECT	TWIN CITIES DISK DIVISION	C	83319100	AS	N
	TYPE 9766 LOC A20	CODE IDENT 19333	CROSS REF. NO. 202	SHEET 2	7-126	



	VELOCITY, VELOCITY NOTCH FILTER, AND VELOCITY GAIN ADJUST TYPE 9766 LOC A20	TWIN CITIES DISK DIVISION	C	83319100	AS	N
		CODE IDENT 19333	CROSS REF NO 203	SHEET 3	7-127	



	D/A CONVERTER AND DESIRED VELOCITY GENERATOR	TWIN CITIES DISK DIVISION	C	83319100		AS	N
	TYPE: 9766 LOC: A20	CODE IDENT 19333	CROSS REF NO. 204	SHEET 4	7-128		



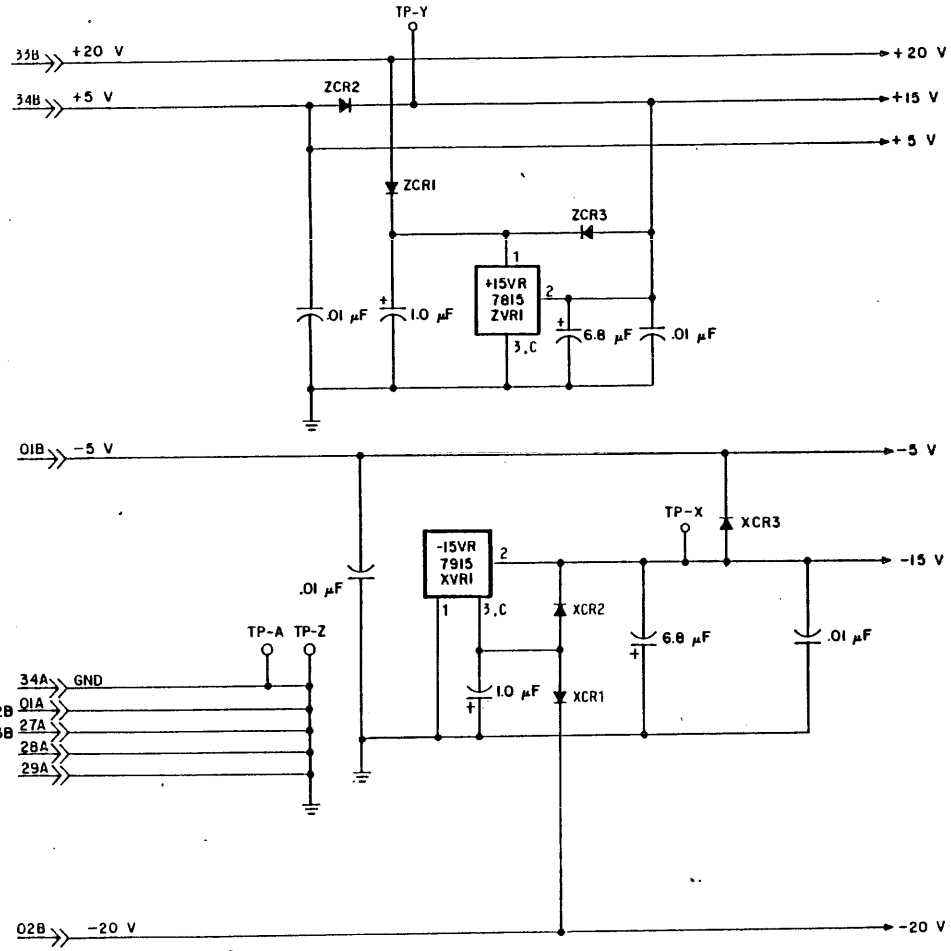
SUMMING AMPLIFIER OUTPUT AND DRIVE CURRENT V/C POWER AMP	TWIN CITIES DISK DIVISION	C	83319100	AS	N
TYPE 9766 LOC A20	CODE IDENT 19333	CROSS REF KO 205	SHEET 5	7-128.1	

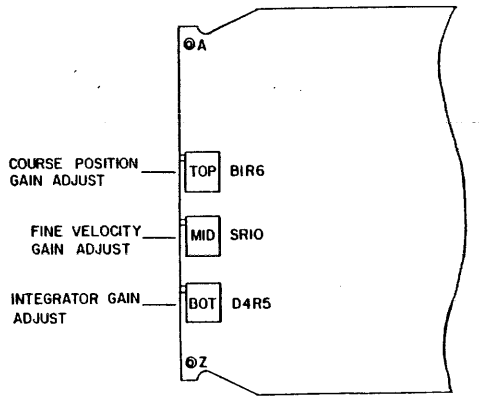
UNUSED LOGIC ELEMENTS

ELEMENT	LOCATION	OUTPUT PINS
7406	U-E4	2,8

REVISIONS

REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
	DJ23000	SEE MF HISTORY FOR REV A THRU J	JKL	11-1-84	
K	DJ13642	REDESIGN DMSV REVISED & REDRAWN	JKL	11-1-84	
L	DJ13696	CHG DMSV RES	SMW	3-19-85	
M	DJ13690A	CORR DMSV CAP QTY	CJB	6-19-85	
N	DJ13755	DMSV MARGIN INCR	CJB	9-4-85	
P	DJ13754	DMSV DECR NOISE	MJ	9-17-86	





APPLICABLE TO BJ4A2, BJ4M2

DRAWN	SUE S.	8-21-84
CHECKED		
ENGINEER		9-5-84
APPROVED		

ANALOG SERVO DIAGRAMS

TYPE: DMSV LOC: A20

TWIN CITIES DISK DIVISION

CODE IDENT 19333

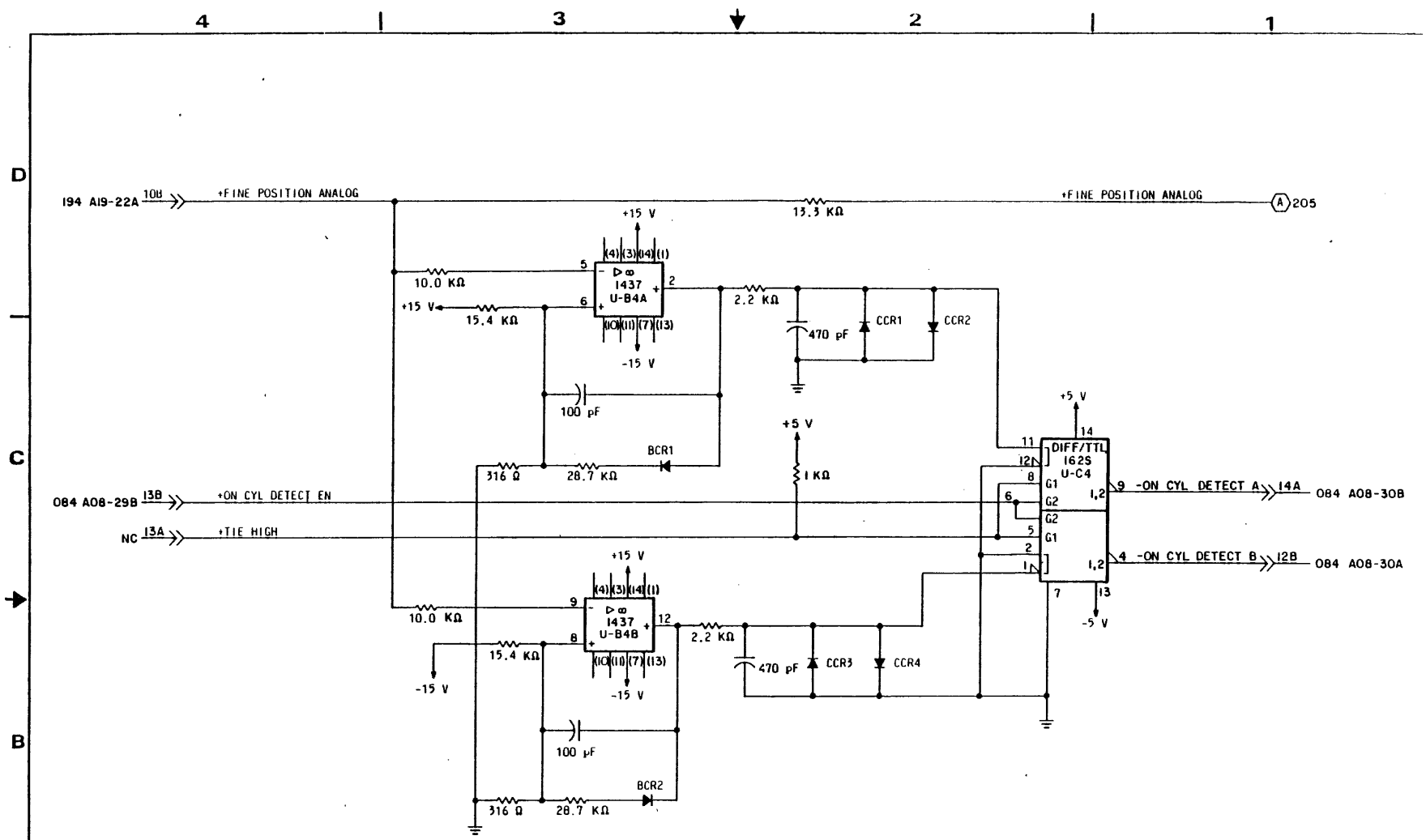
C 83319100 AT

CROSS REF NO 201

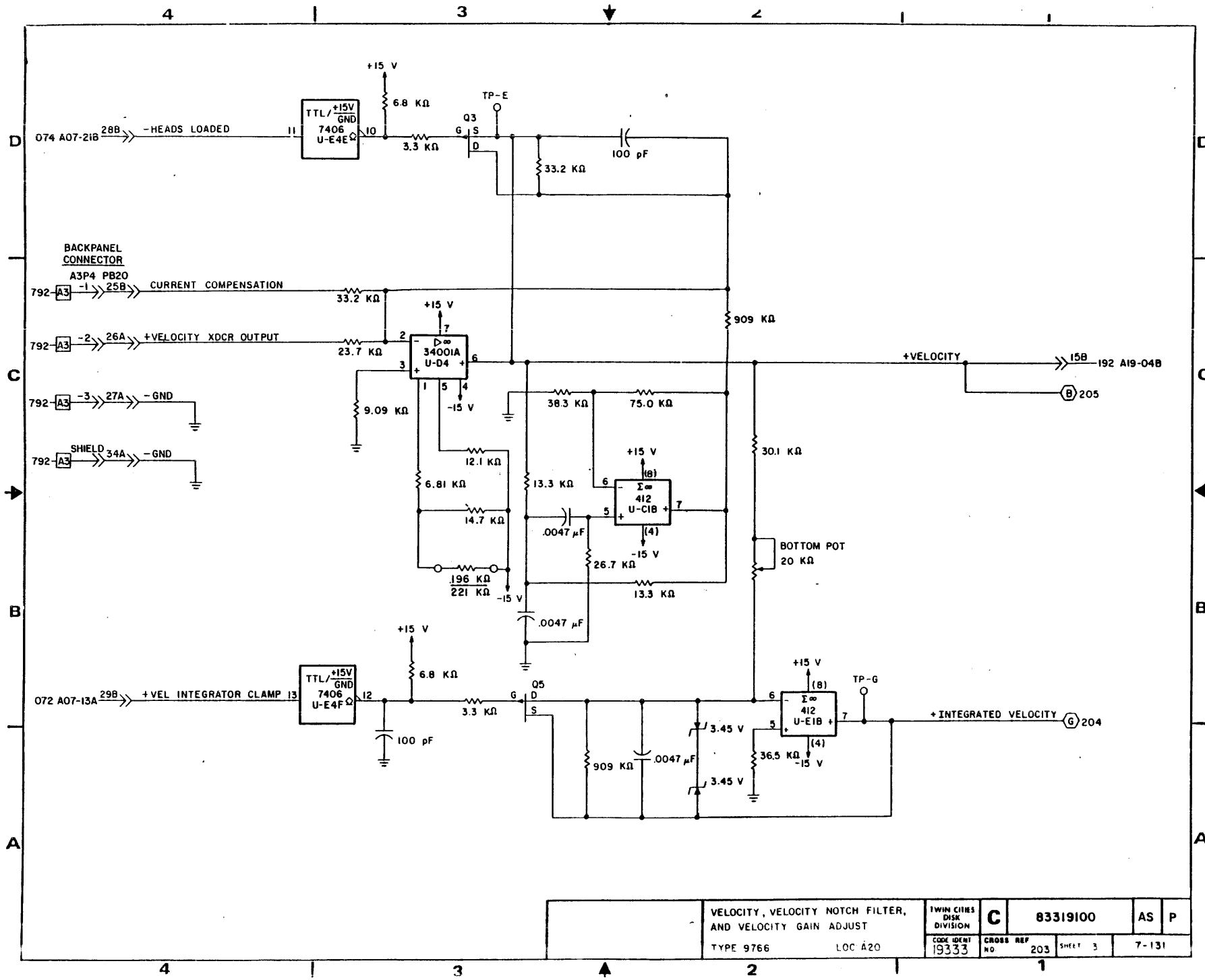
SHEET 1 of 5

PAGE 7-129

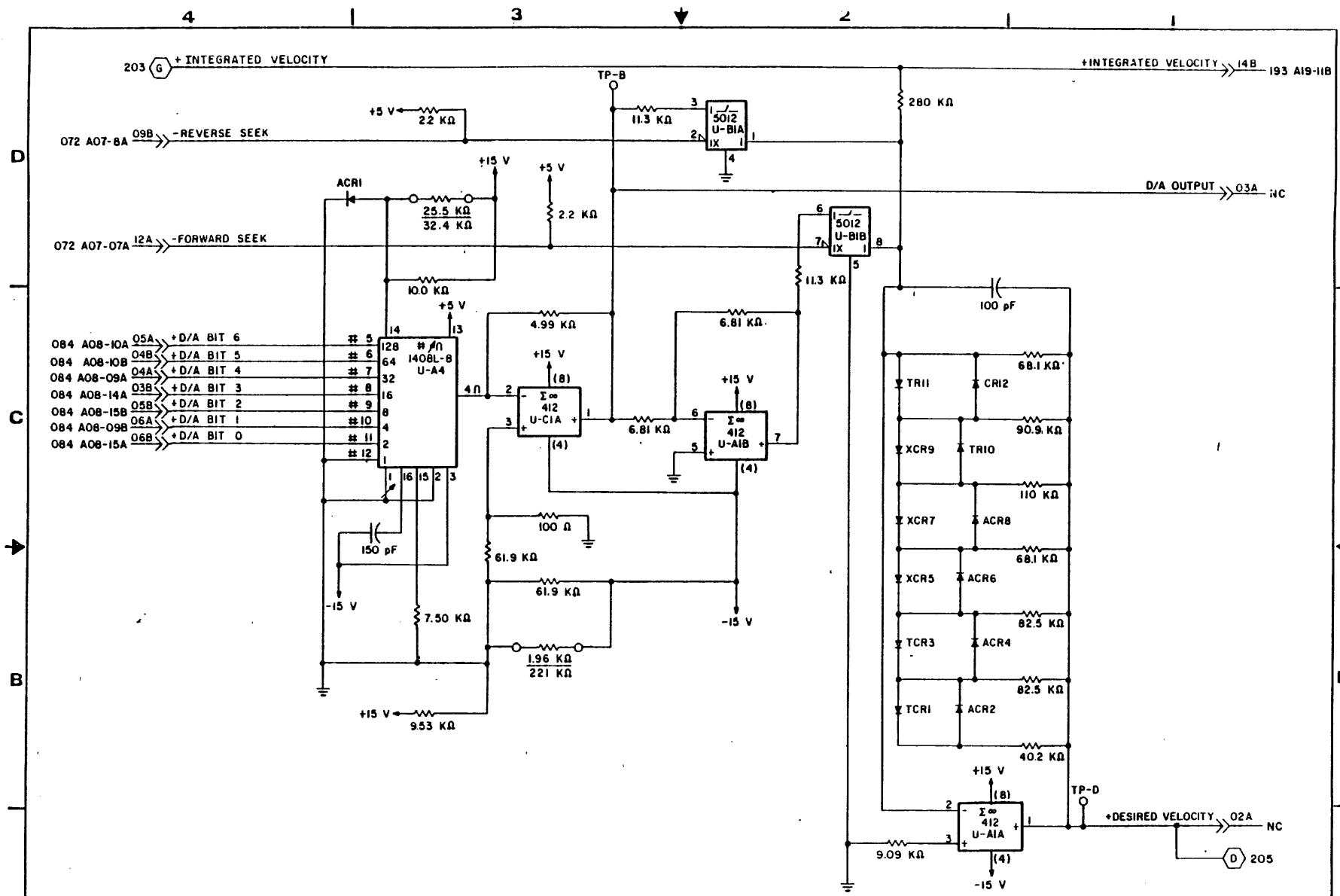
REF 83214120



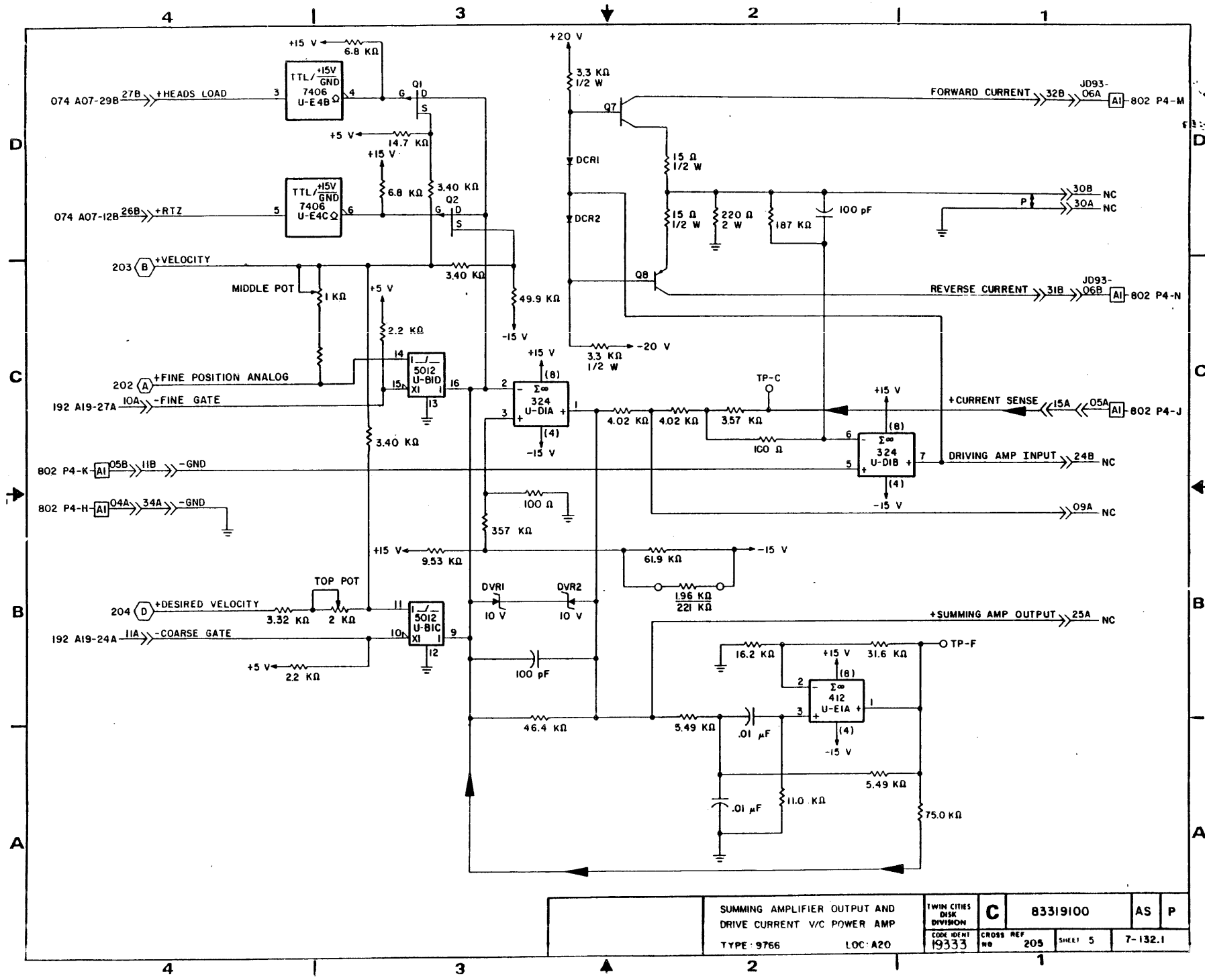
	CYLINDER DETECT	TWIN CITIES DISK DIVISION	C	83319100	AS	
	TYPE 9766 LOC: A20	CODE IDENT 19333	CROSS REF NO. 202	SHEET 2	7-130	



	VELOCITY, VELOCITY NOTCH FILTER, AND VELOCITY GAIN ADJUST	TWIN CITIES DISK DIVISION	C	83319100	AS	P
	TYPE 9766 LOC A20	CODE IDENT 19333	CROSS REF NO 203	SHEET 3	7-131	

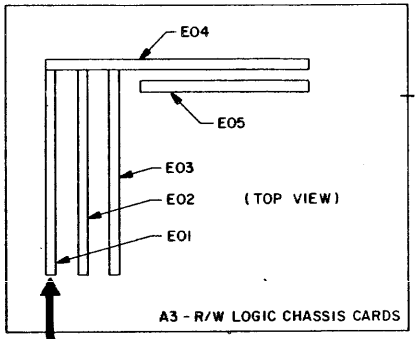


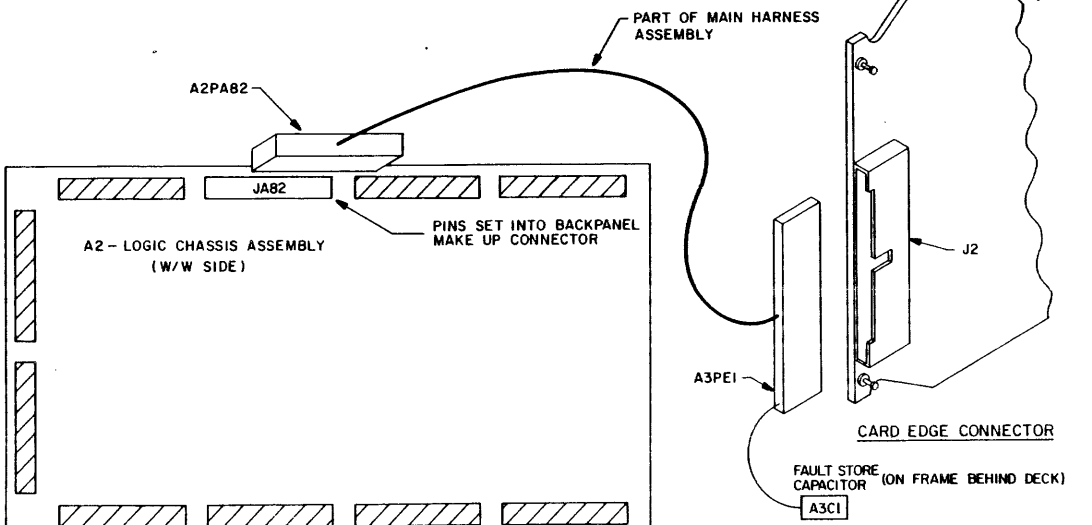
	D/A CONVERTER AND DESIRED VELOCITY GENERATOR	TWIN CITIES DISK DIVISION	C	83319100	AS P
	TYPE: 9766 LOC: A20	CODE IDENT 19333	CROSS REF NO. 204	SHEET 4	7-132

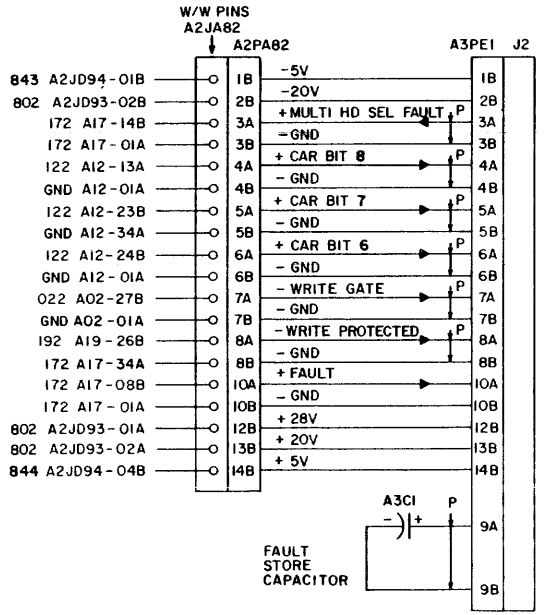


SUMMING AMPLIFIER OUTPUT AND DRIVE CURRENT V/C POWER AMP	TWIN CITIES DISK DIVISION	C	83319100	AS	P	
TYPE 9766 LOC A20	CODE IDENT 19333	CROSS REF NO 205	SHEET 5	7-132.1		

REVISIONS					
REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASE	MLA	3/17/76	
B	PE22842	SCHEMATIC CORRECTIONS	MA	12-29-76	
C		EDITORIAL	MA	5-23-77	
D	PE55258	LOGIC DIAG IMPROVEMENT	MA	10-4-78	
E	DH13112A	REWORK 4PKV CARD	DmT	1-30-82	
F	DH13337	A/4PKV BD BLANK	MC	2-7-84	



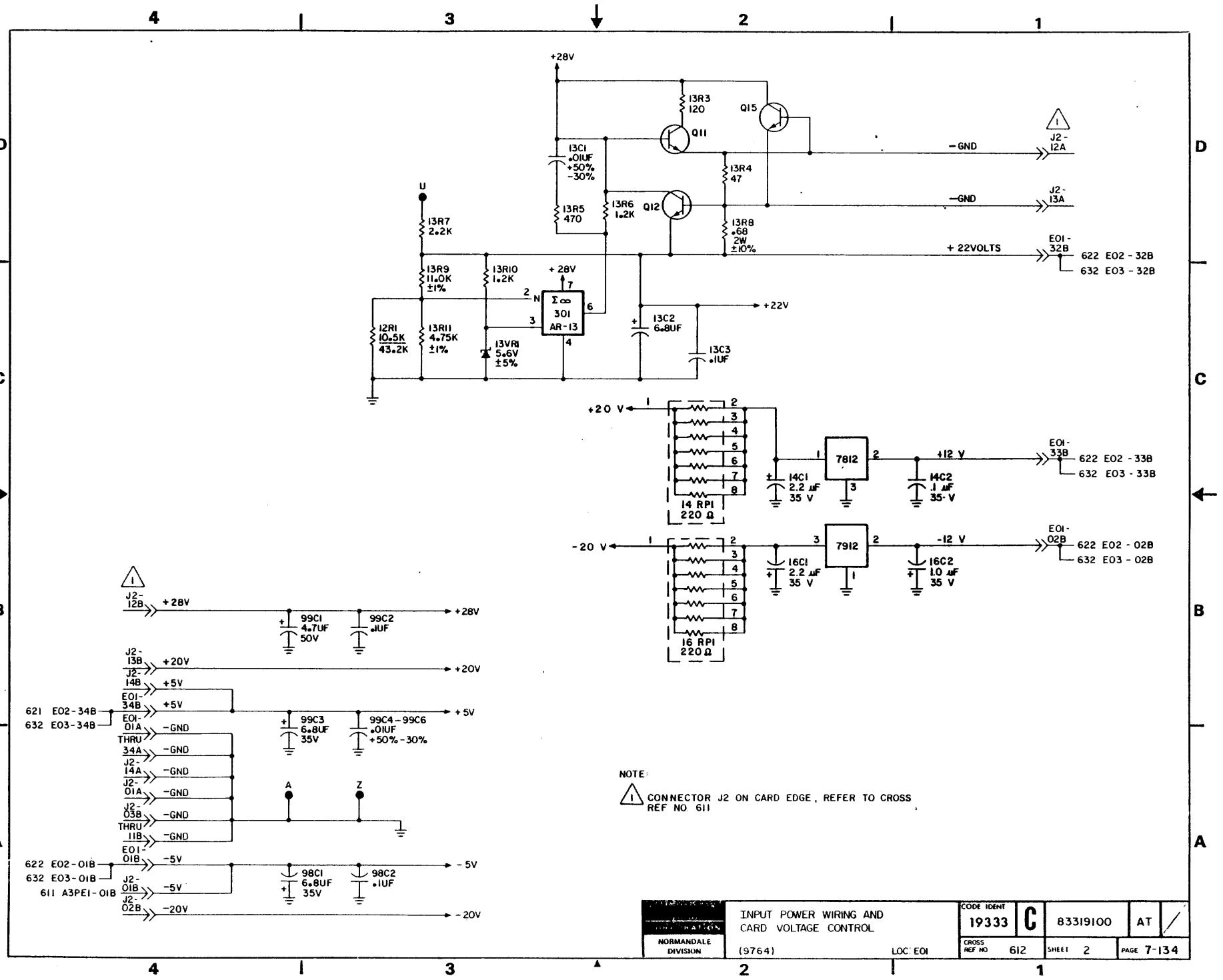


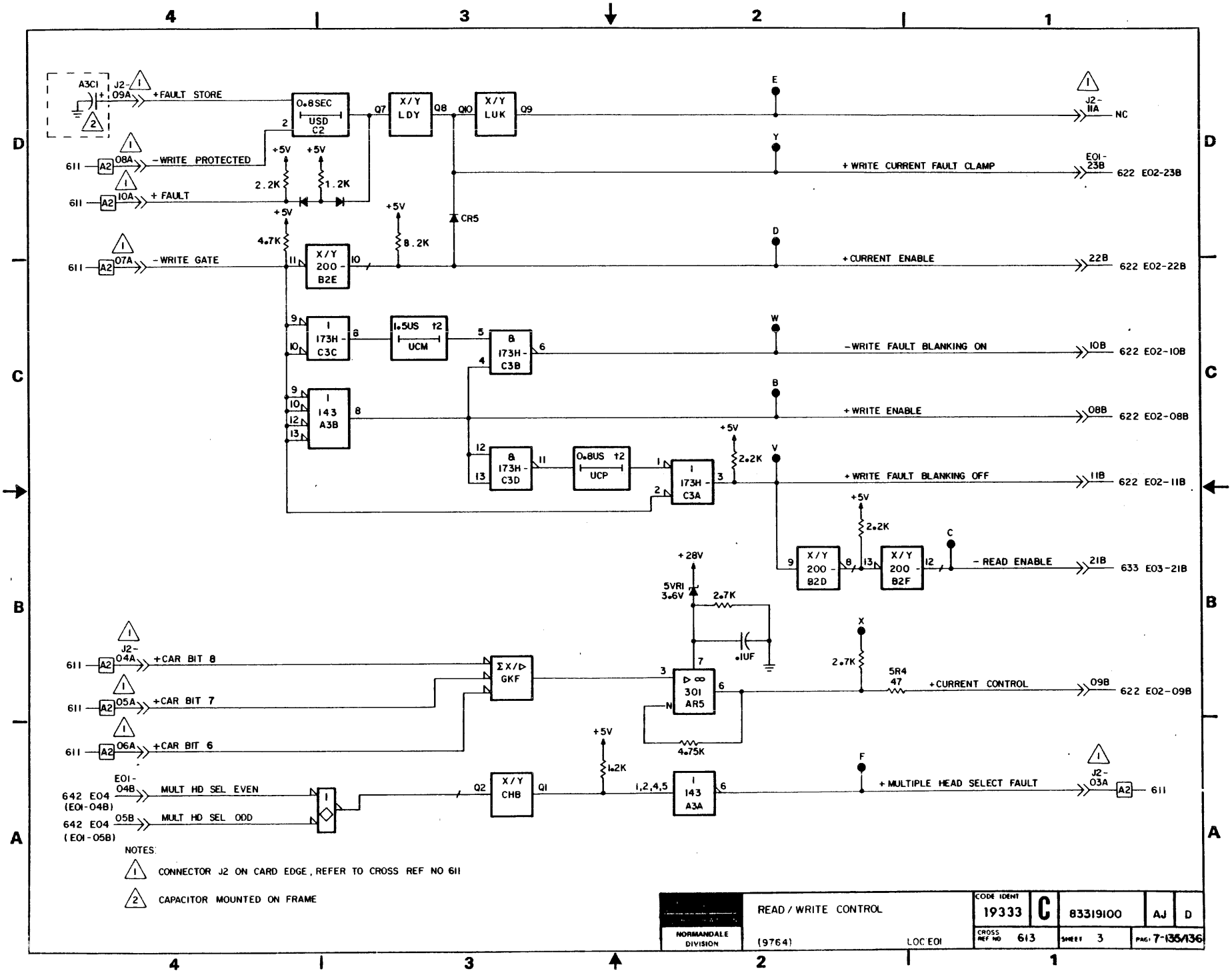


PA82 TO PE1 CABLING

APPLICABLE ONLY TO BJ4A1

DRAWN	G. RABINE 2/4/76	R/W CONTROL CABLING AND DIAGRAMS	CODE IDENT 19333	C	83319100	AK
CHECKED						
ENGINEER		NORMANDALE DIVISION	CROSS REF NO 611	SHEET 1 of 3	PAGE 7-133	
APPROVED		TYPE 4PKV LOC E01	REF 83214600			


+28V
13R3 120
Q15
Q11
13C1 .01UF +50% -30%
13R4 47
13R5 470
13R6 1.2K
Q12
13R8 .68 2W ±10%
U
13R7 2.2K
13R9 11.0K ±1%
13R10 1.2K
+28V
2
N
Σ∞ 301 AR-13
7
6
3
4
12R1 10.5K 43.2K
13R11 4.75K ±1%
13VR1 5.6V ±5%
13C2 6.8UF
13C3 .1UF
+22V
-GND
J2- 12A
-GND
J2- 13A
+ 22VOLTS
E01- 32B
622 E02 - 32B
632 E03 - 32B
+20 V
1
2
3
4
5
6
7
8
14 RP1 220 Ω
7812
+12 V
14C1 2.2 µF 35 V
14C2 .1 µF 35 V
E01- 33B
622 E02 - 33B
632 E03 - 33B
-20 V
16 RP1 220 Ω
7912
-12 V
16C1 2.2 µF 35 V
16C2 1.0 µF 35 V
E01- 02B
622 E02 - 02B
632 E03 - 02B
1
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
99C3 6.8UF 35V
99C4 - 99C6 .01UF +50% -30%
+5V
E01- 01A
THRU 34A
J2- 14A
J2- 01A
J2- 03B
THRU 11B
-GND
A
Z
E01- 01B
622 E02-01B
632 E03-01B
611 A3PE1-01B
J2- 01B
J2- 02B
-5V
98C1 6.8UF 35V
98C2 .1UF
-5V
-20V
-20V
NOTE:
1 CONNECTOR J2 ON CARD EDGE, REFER TO CROSS REF NO. 611
NORMANDALE DIVISION
INPUT POWER WIRING AND CARD VOLTAGE CONTROL
(9764)
LOC: E01
CODE IDENT 19333
C
83319100
AT
CROSS REF NO 612
SHEET 2
PAGE 7-134

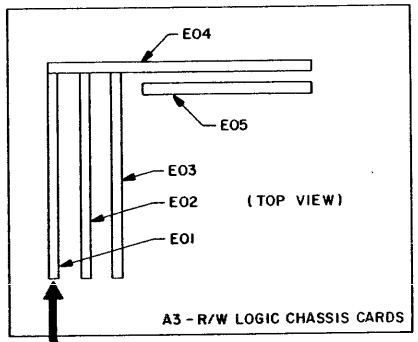

A3C1
J2-09A
+FAULT STORE
0.8SEC USD C2
Q7
X/Y LDY
Q8
Q10
X/Y LUK
Q9
E
J2-11A
NC
611 A2 08A
-WRITE PROTECTED
611 A2 10A
+ FAULT
+5V
2.2K
1.2K
Y
+ WRITE CURRENT FAULT CLAMP
E01-23B
622 E02-23B
CR5
4.7K
8.2K
611 A2 07A
-WRITE GATE
X/Y 200-B2E
D
+CURRENT ENABLE
22B
622 E02-22B
1 173H-C3C
1.5US t2 UCM
8 173H-C3B
W
-WRITE FAULT BLANKING ON
10B
622 E02-10B
1 143 A3B
B
+WRITE ENABLE
08B
622 E02-08B
8 173H-C3D
0.8US t2 UCP
1 173H-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
611 A2 J2-04A
+CAR BIT 8
611 A2 05A
+CAR BIT 7
611 A2 06A
+CAR BIT 6
ΣX/D GKF
301 AR5
X
2.7K
5R4 47
+CURRENT CONTROL
09B
622 E02-09B
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
1.2K
1,2,4,5
1 143 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
NORMANDALE DIVISION
READ / WRITE CONTROL
(9764)
LOC E01
CODE IDENT 19333
C
83319100
AJ
D
CROSS REF NO 613
SHEET 3
PAGE 7-135/136

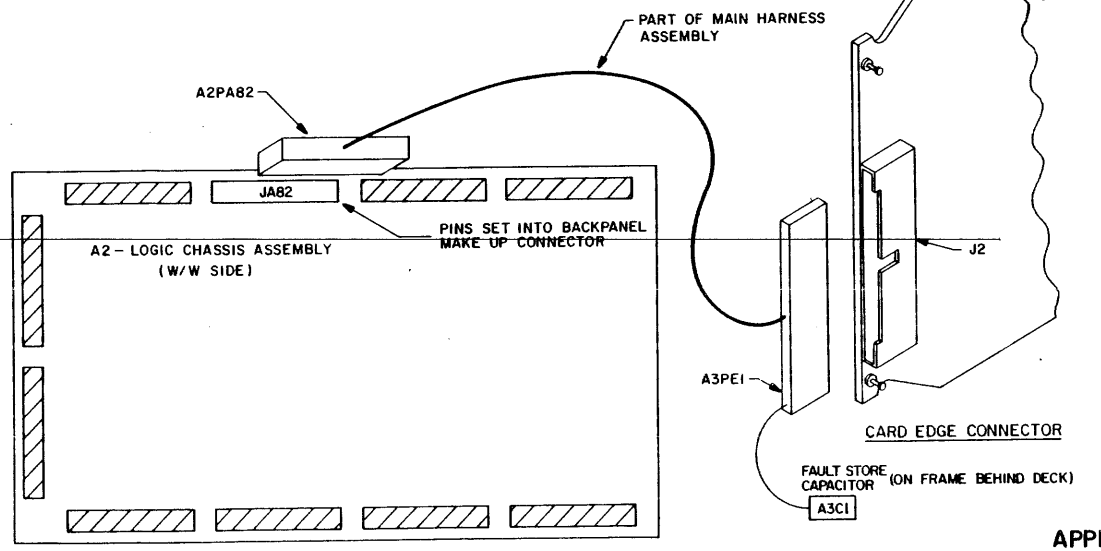
REVISION STATUS OF SHEETS

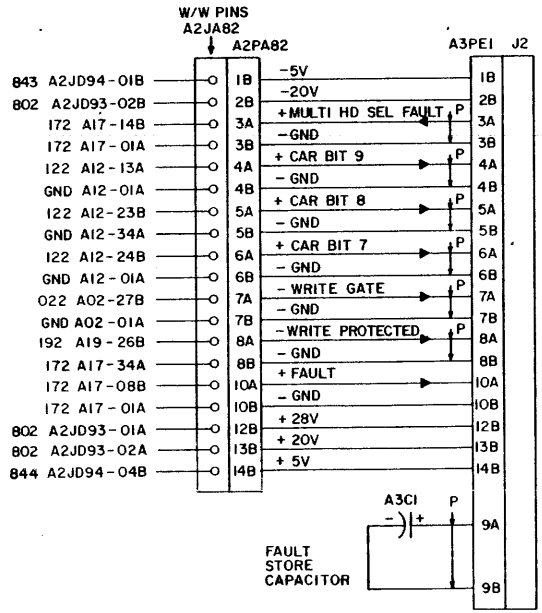
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	A																	
B	B	B																	
C	B	B																	
D	D	D																	
E	E	D																	
F	E	F																	

REVISIONS

REV.	ECO.	DESCRIPTION	DRFT.	DATE	CHK'D
A	[illegible]	[illegible]	MLA	5-25-76	
B	PE22842	SCHEMATIC CORRECTIONS	MA	12-29-76	
C		EDITORIAL	MA	5-23-77	
D	PE55259	LOGIC DIAG IMPROVEMENT	MA	10-4-78	
E	DH31112A	REWORK 4PKV CARD	Dmt	1-30-82	
F	DH57173	CHG I.C. FAMILIES	SCHLIEP	4-27-82	







PA82 TO PE1 CABLING

APPLICABLE ONLY TO BJ4A2

DRAWN	C. RABINE	2/14/76
CHECKED		
ENGINEER		
APPROVED		

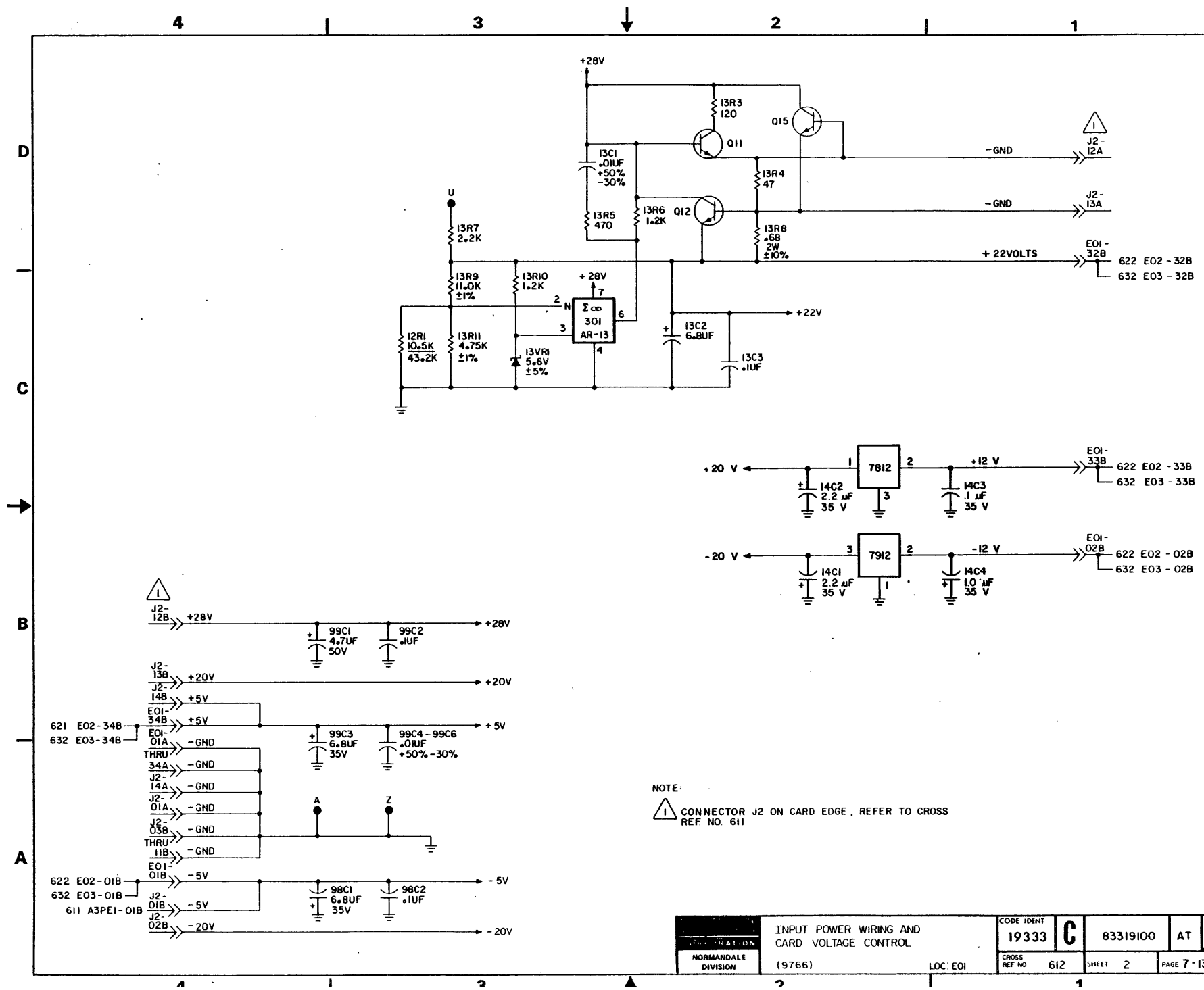
NORMANDALE DIVISION

R/W CONTROL CABLING AND DIAGRAMS

TYPE 4PKV LOC E01

CODE IDENT			
19333	C	83319100	AJ
CROSS REF NO 611	SHEET 1 OF 3	PAGE 7-137	

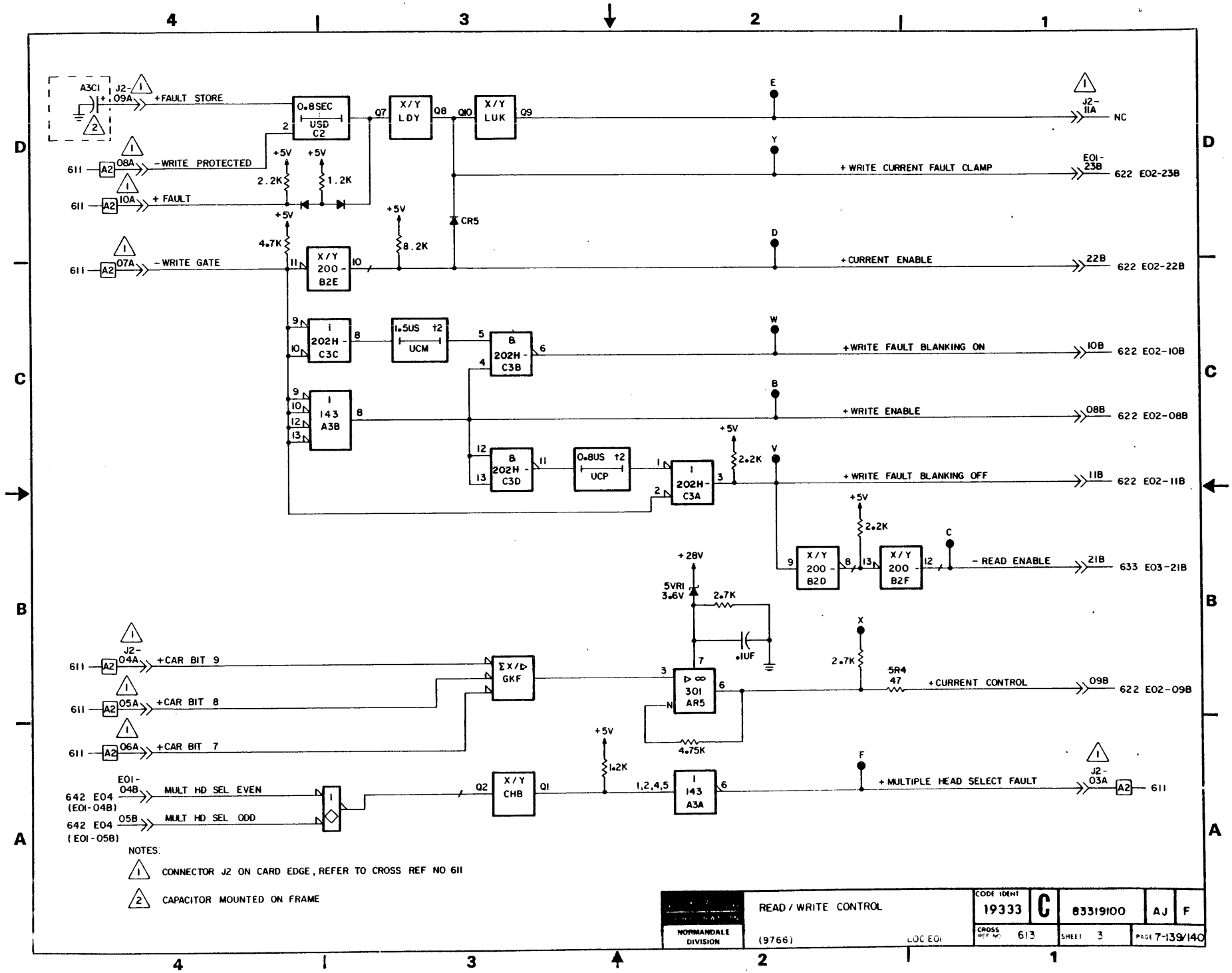
REF 83214161



NOTE:

1. CONNECTOR J2 ON CARD EDGE, REFER TO CROSS REF NO. 611

NORMANDALE DIVISION	INPUT POWER WIRING AND CARD VOLTAGE CONTROL (9766) LOC E01	CODE IDENT 19333	C	83319100	AT
		CROSS REF NO 612		SHEET 2	PAGE 7-138

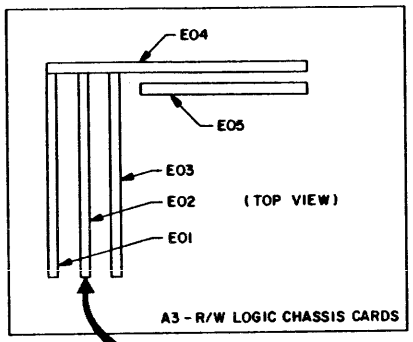

A3C1
J2-09A
+FAULT STORE
0.8SEC USD C2
Q7
X/Y LDY
Q8
Q10
X/Y LUK
Q9
E
J2-11A
NC
611 A2 08A
-WRITE PROTECTED
Y
+WRITE CURRENT FAULT CLAMP
E01-23B
622 E02-23B
611 A2 10A
+ FAULT
2.2K
1.2K
+5V
CR5
4.7K
8.2K
611 A2 07A
-WRITE GATE
X/Y 200-B2E
D
+CURRENT ENABLE
22B
622 E02-22B
202H-C3C
1.5US t2 UCM
202H-C3B
W
+WRITE FAULT BLANKING ON
10B
622 E02-10B
143 A3B
B
+WRITE ENABLE
08B
622 E02-08B
202H-C3D
0.8US t2 UCP
202H-C3A
2.2K
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
5VR1 3.6V
2.7K
.1UF
611 A2 J2-04A
+CAR BIT 9
611 A2 05A
+CAR BIT 8
611 A2 06A
+CAR BIT 7
ΣX/Y GKF
301 AR5
X
5R4 47
+CURRENT CONTROL
09B
622 E02-09B
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
1.2K
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
NORMANDALE DIVISION
(9766)
LOC E01
READ / WRITE CONTROL
CODE IDENT 19333
C
83319100
AJ
F
CROSS REF NO 613
SHEET 3
PAGE 7-139/140

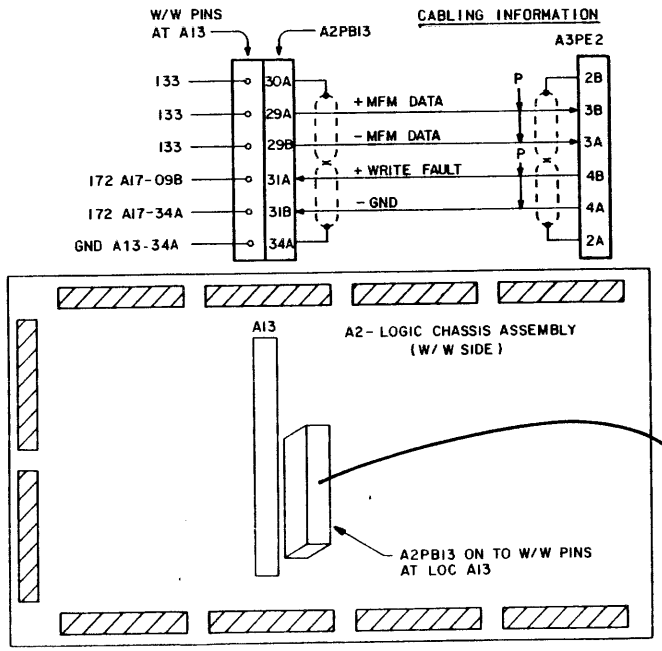
REVISION STATUS OF SHEETS

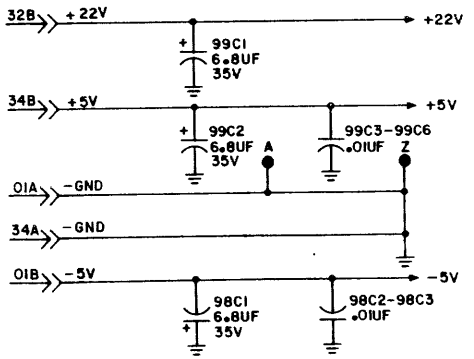
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A																		
B	B																		
C	C																		
D	C																		
E	E																		

REVISIONS

REV.	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED			
B	PE22842	SCHEMATIC CORRECTION	MA	12-29-76	
C	PE22853	DIAGRAM CORRECTION	MA	3-21-77	
D		EDITORIAL	MA	5-23-77	
E	PE55259	LOGIC DIAG. IMPROVEMENT	MA	10-4-78	







APPLICABLE ONLY TO BJ4AI

DRAWN	G. LABINE	7/7/76
CHECKED		
ENGINEER		
APPROVED		

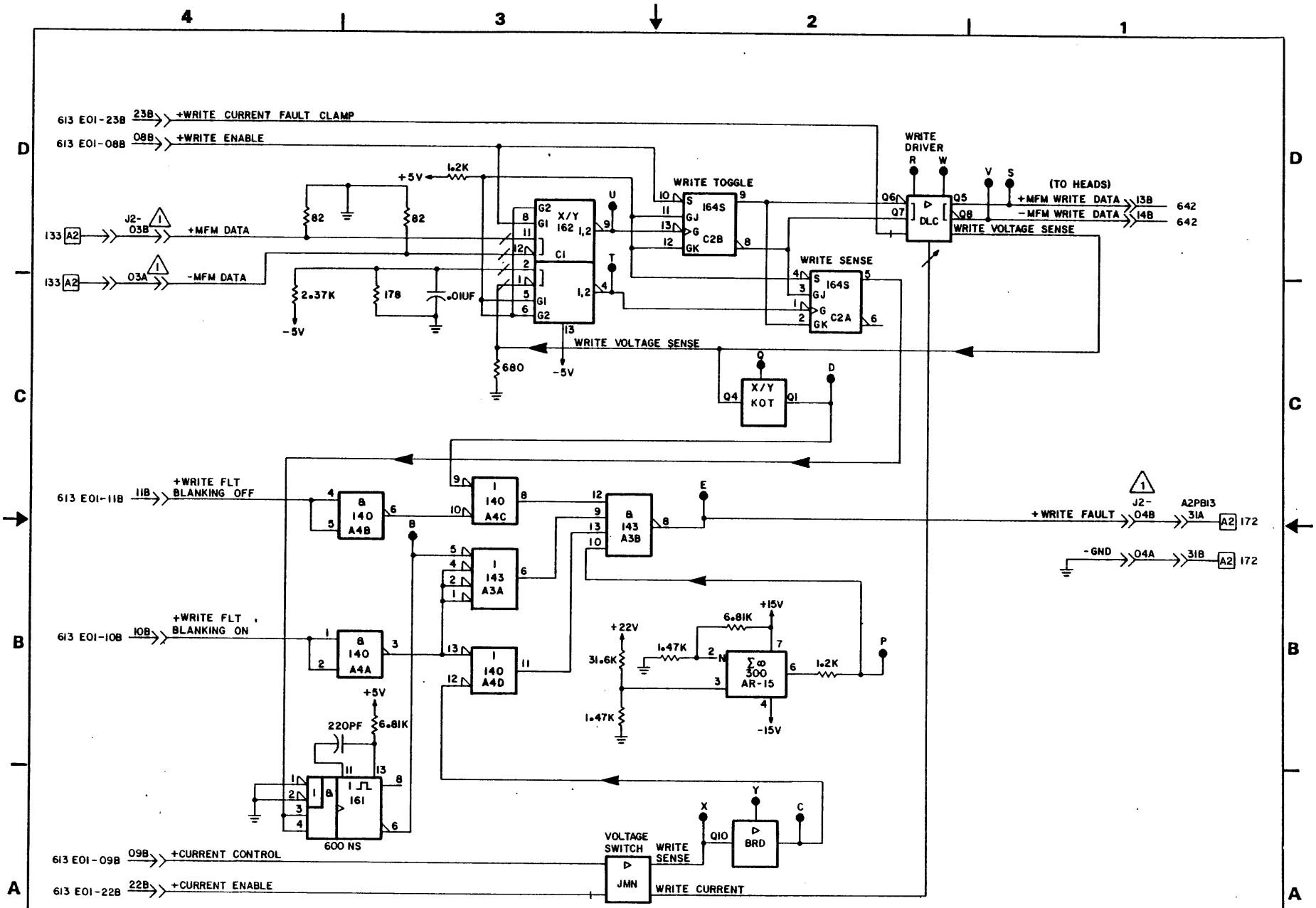
NORMANDALE DIVISION

WRITE DRIVER, CARD EDGE CONNECTOR AND CABLING DIAGRAMS

TYPE 6PJV LOC E02

CODE IDENT				
19333	C	83319100	AJ	E
CROSS REF NO 621	SHEET 1 of 2	PAGE 7-141		

REF 83214607



NOTE:

1. CONNECTOR J2 ON CARD EDGE, REFER TO CROSS REF NO. 621.

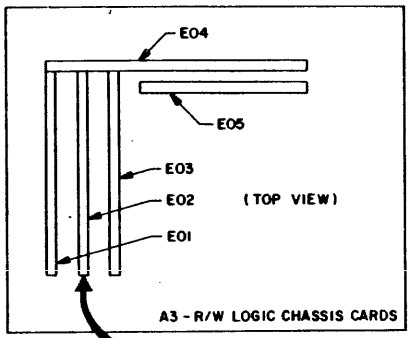
NORMANDALE DIVISION	WRITE DRIVER AND WRITE FAULT DETECT (9764) LOC: E02	CODE IDENT 19333	C	83319100	AJ	E
		CROSS REF 622		SHEET 2	PAGE 7-142	

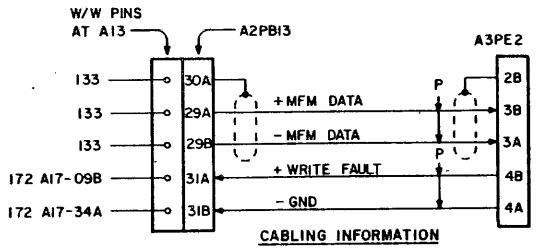
REVISION STATUS OF SHEETS

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

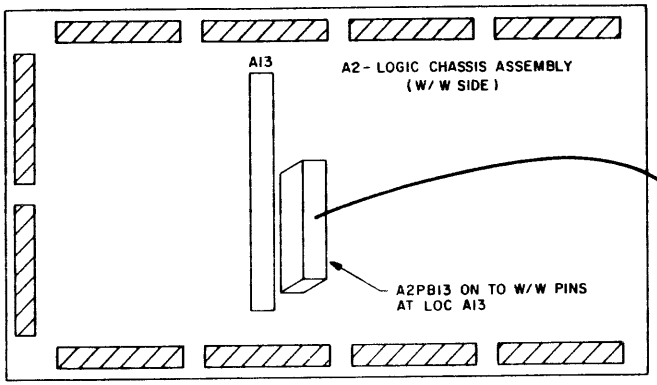
REVISIONS

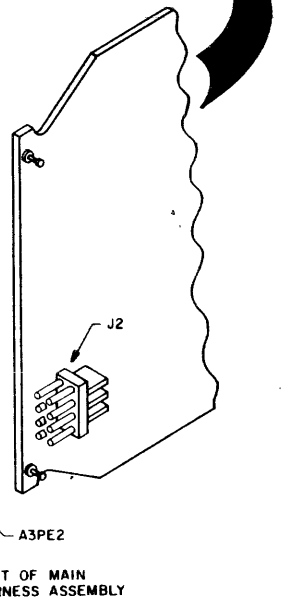
REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED			
B		EDITORIAL	MA	5-23-77	
C	PE55259	LOGIC DIAG. IMPROVEMENT	MA	10-4-78	

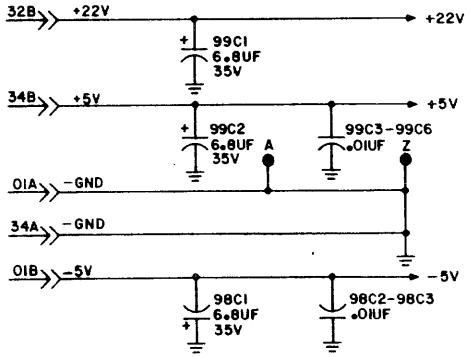




CABLING INFORMATION



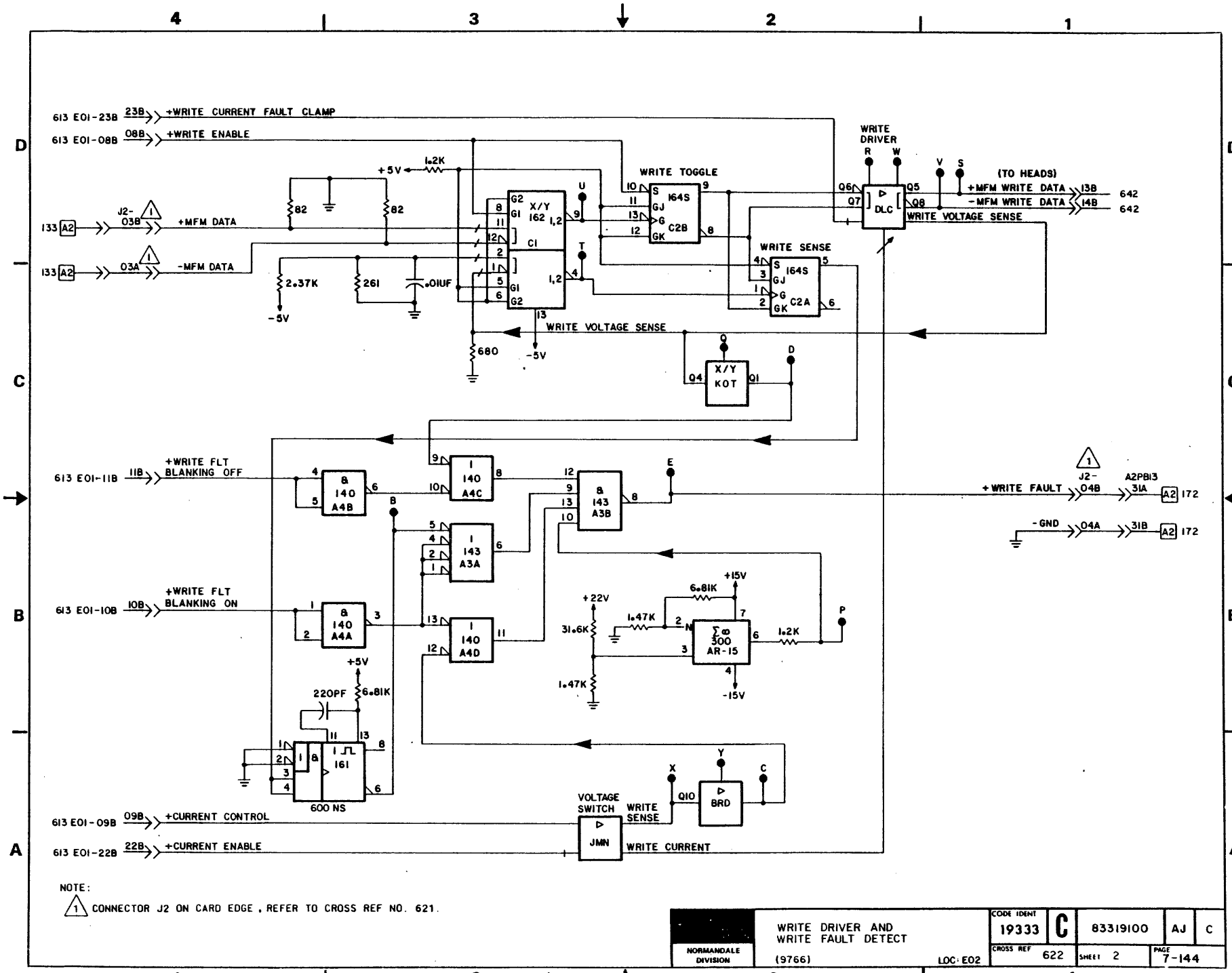




APPLICABLE ONLY TO BJ4A2

DRAWN	G. RABINE	7/12/76	NORMANDALE DIVISION	WRITE DRIVER, CARD EDGE CONNECTOR AND CABLING DIAGRAMS TYPE 4PJV LOC E02	CODE IDENT 19333	C	83319100 AJ C
CHECKED					CROSS REF NO 621	SHEET 1 of 2	PAGE 7-143
ENGINEER		7/12/76					
APPROVED							

REF 83214162



NOTE:

1. CONNECTOR J2 ON CARD EDGE, REFER TO CROSS REF NO. 621.

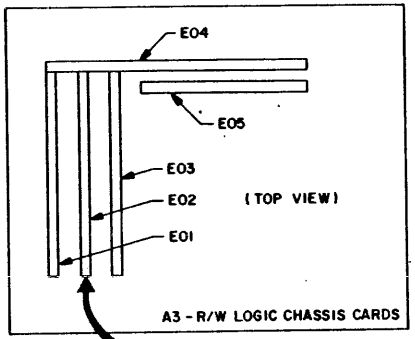
NORMANDALE DIVISION	WRITE DRIVER AND WRITE FAULT DETECT (9766) LOC: E02	CODE IDENT 19333	C	83319100	AJ	C	
		CROSS REF 622		SHEET 2	PAGE 7-144		

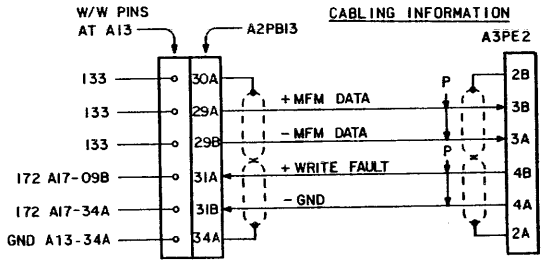
REVISION STATUS OF SHEETS

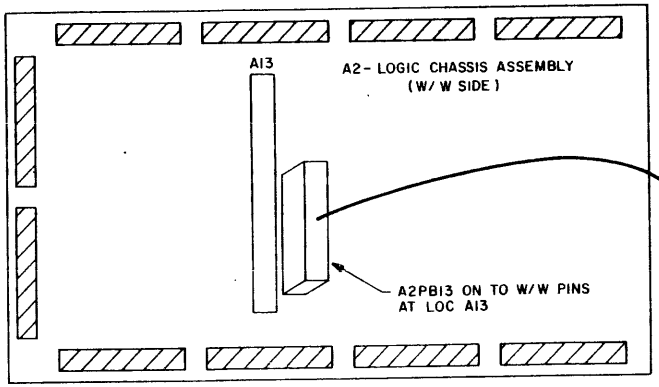
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A																		
B	B																		
C	C																		
D	C																		
E	E																		
F	F																		

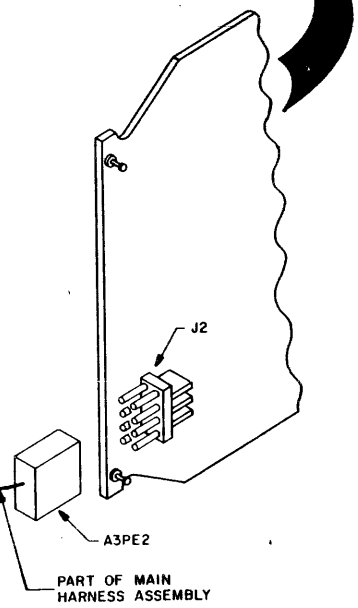
REVISIONS

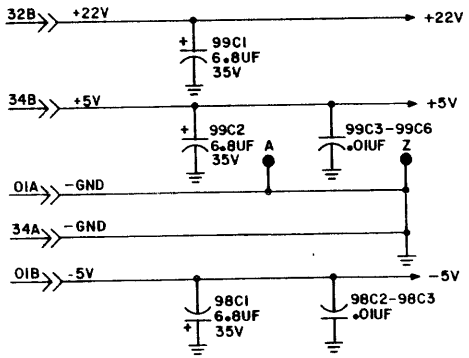
REV	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED			
B	PE22842	SCHEMATIC CORRECTIONS	MA	12-30-76	
C	PE22853	DIAGRAM CORRECTION	GR	5-14-77	
D		EDITORIAL	MA	5-23-77	
E	PE55259	LOGIC DIAG. IMPROVEMENT	MA	10-4-78	
F	PE57582	8PJV TO 8PJV	TF	6-5-81	











APPLICABLE ONLY TO BJ4A2

DRAWN	G. RABINE	3/21/74
CHECKED		
ENGINEER		
APPROVED		

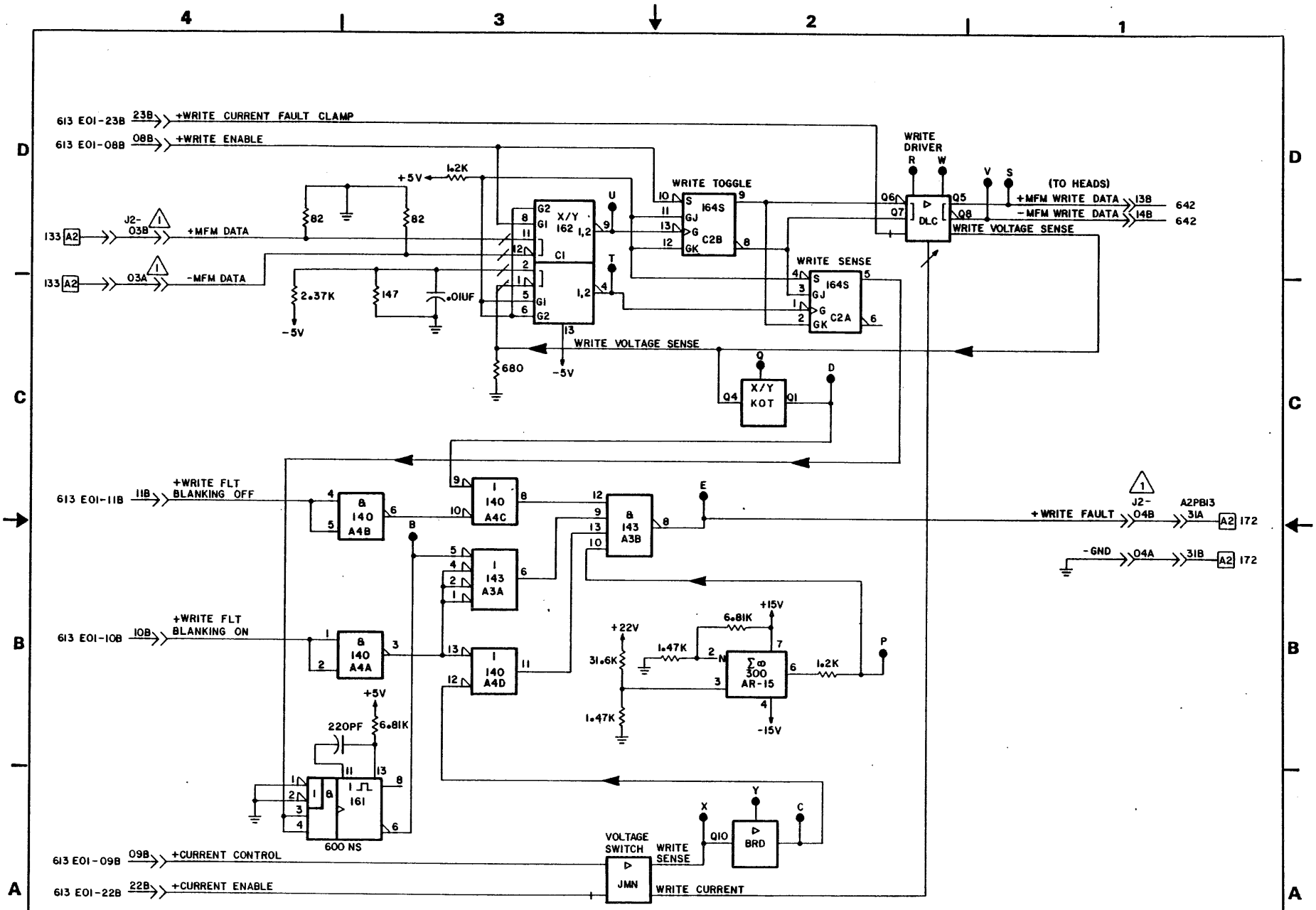
NORMANDALE DIVISION

WRITE DRIVER, CARD EDGE CONNECTOR AND CABLING DIAGRAMS
TYPE: 8PJV LOC: E02

CODE IDENT			
19333	C	83319100	AJ F

CROSS REF NO 621 | SHEET 1 OF 2 | PAGE 7-145

REF 83214162

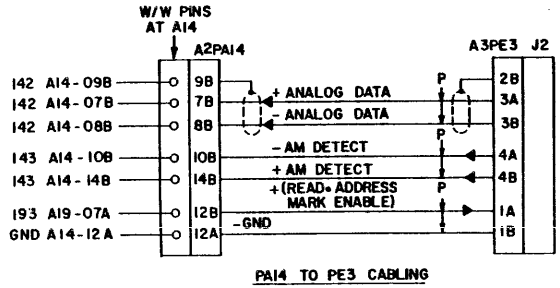


NOTE:

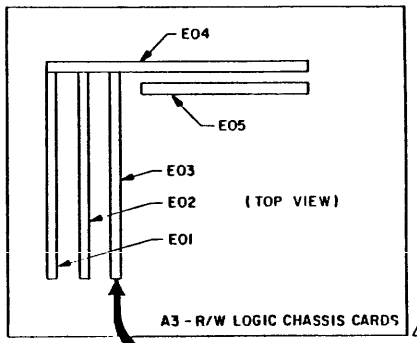
1. CONNECTOR J2 ON CARD EDGE, REFER TO CROSS REF NO. 621.

CONTROL DATA CORPORATION NORMANDALE DIVISION	WRITE DRIVER AND WRITE FAULT DETECT (9766) LOC: E02	CODE IDENT 19333	C	83319100	AJ	F
		CROSS REF 622		SHEET 2	PAGE 7-146	

REVISIONS					
REV.	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
/	DJ23000	REVISED & REDRAWN, SEE MF HIST. FOR REVS A–D	D.O.	9/19/	AD
E	DJI3869	ELIMINATE REWORK	D.O.	9-29-82	

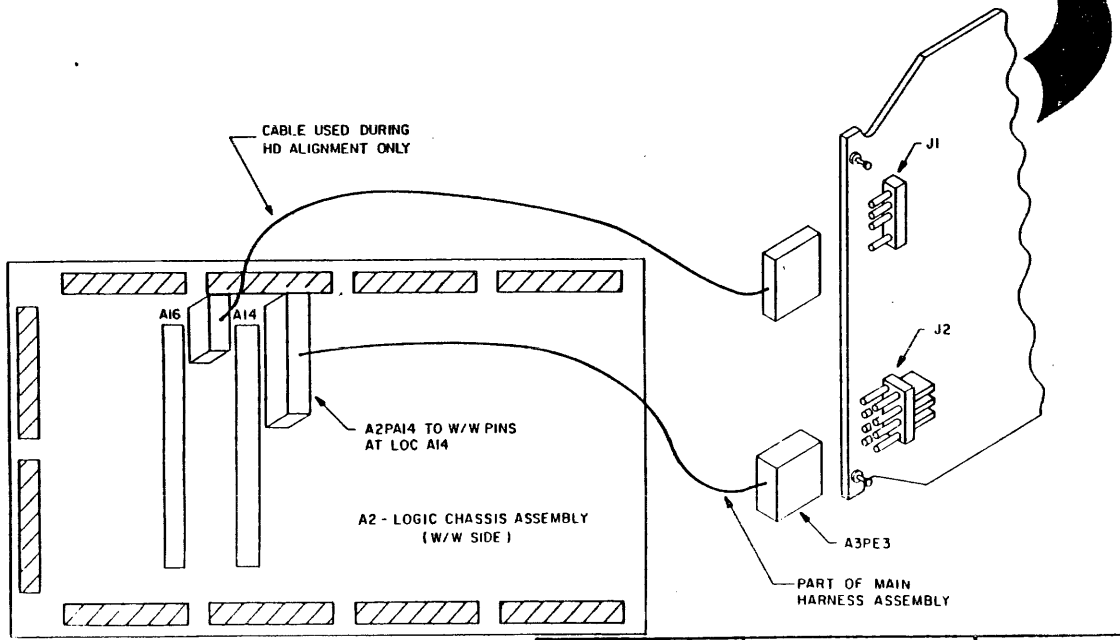


PAI4 TO PE3 CABLING



NOTES:

1. CONNECTOR J2 ON CARD EDGE, REFER TO CROSS REF NO 631.
2. CONNECTOR J1 ON CARD EDGE, REFER TO CROSS REF NO 631.



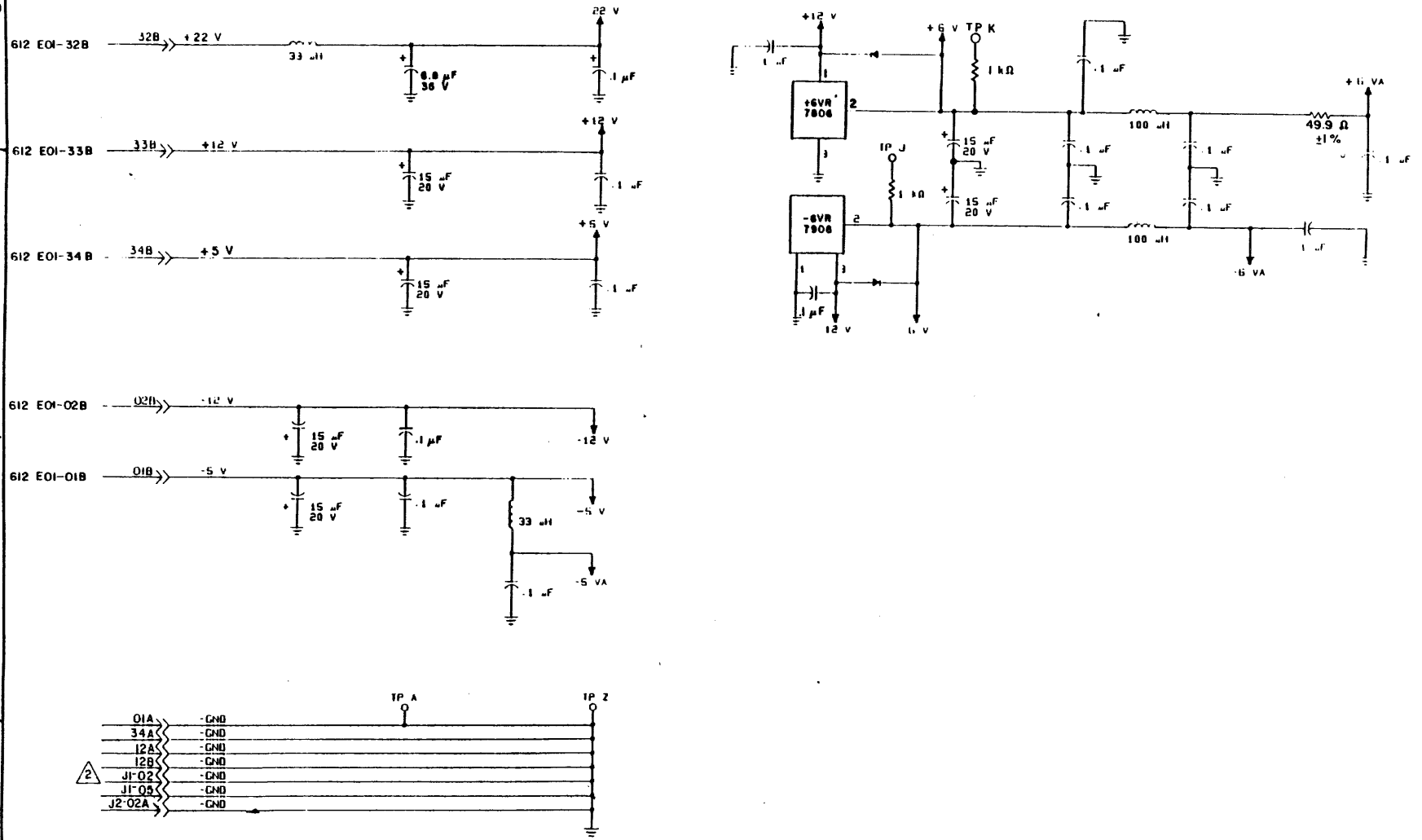
75121523

DRAWN	D.O.	
CHECKED		
ENGINEER		12.17.81
APPROVED		

READ AMPLIFIER AND ADDRESS MARK DETECTION DIAGRAMS

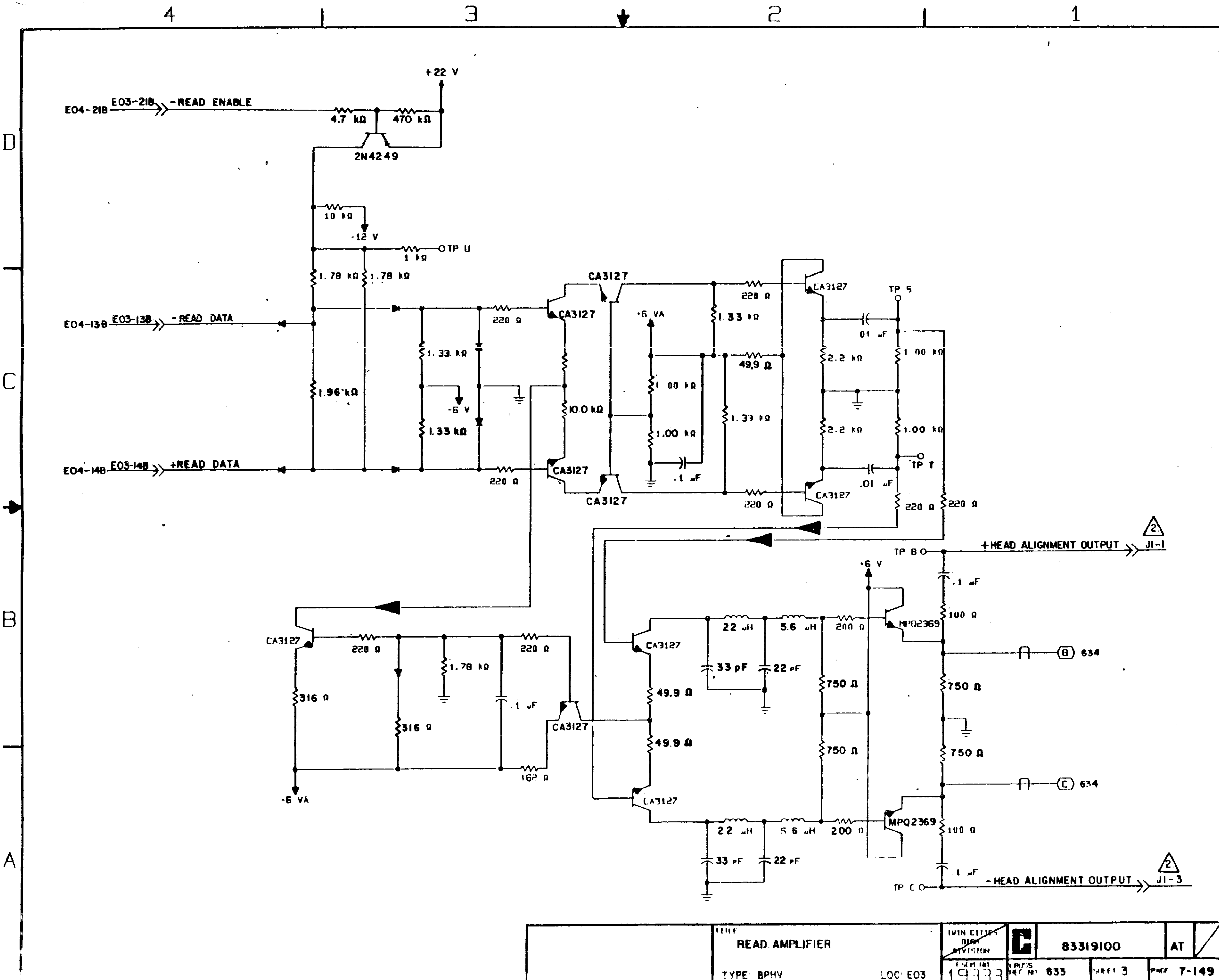
TYPE: BPHV LOC E03

TWIN CITIES DISK DIVISION	C	83319100	AT
CODE IDENT 19333	CROSS REF NO 631	SHEET 1 OF 5	PAGE 7-147



	INPUT VOLTAGE PINS AND VOLTAGE REGULATOR	TWIN CITIES DISK DIVISION	C	83319100	AT
	TYPE: BPHV LOC E03	CODE IDENT 19333	CROSS REF NO 632	SHEET 2	7-148

7512523



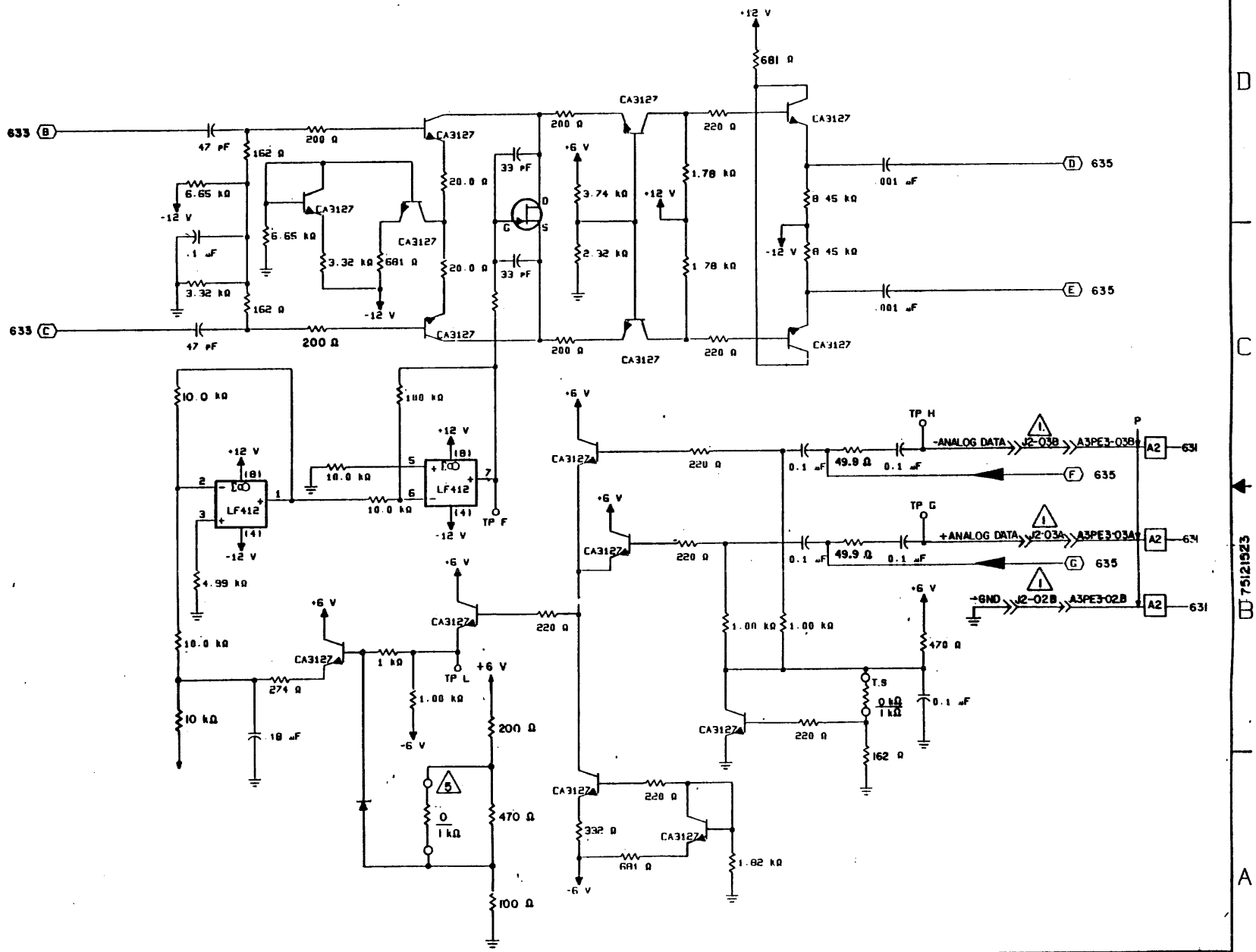
READ AMPLIFIER

TYPE BPHV LOC E03

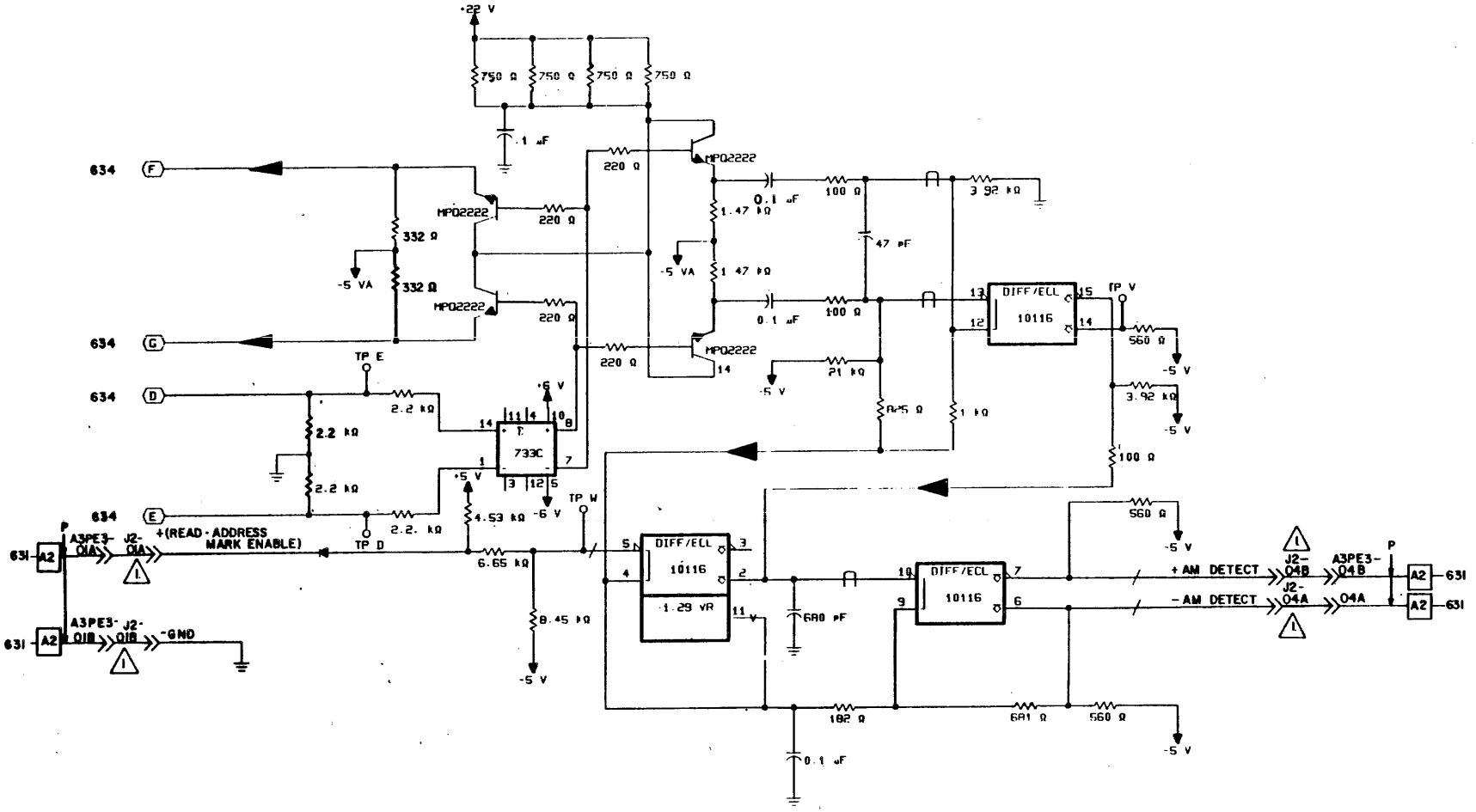
TWIN CITIES DISK DIVISION

83319100 AT

19333 REF NO 633 SHEET 3 PAGE 7-149



	TITLE: READ AMPLIFIER	TWIN CITIES DISK DIVISION		83319100	AT
	TYPE: 4PHV LOC: E03	FSCM NO. 19333	CROSS REF NO. 634	SHEET 4	PAGE 7-150



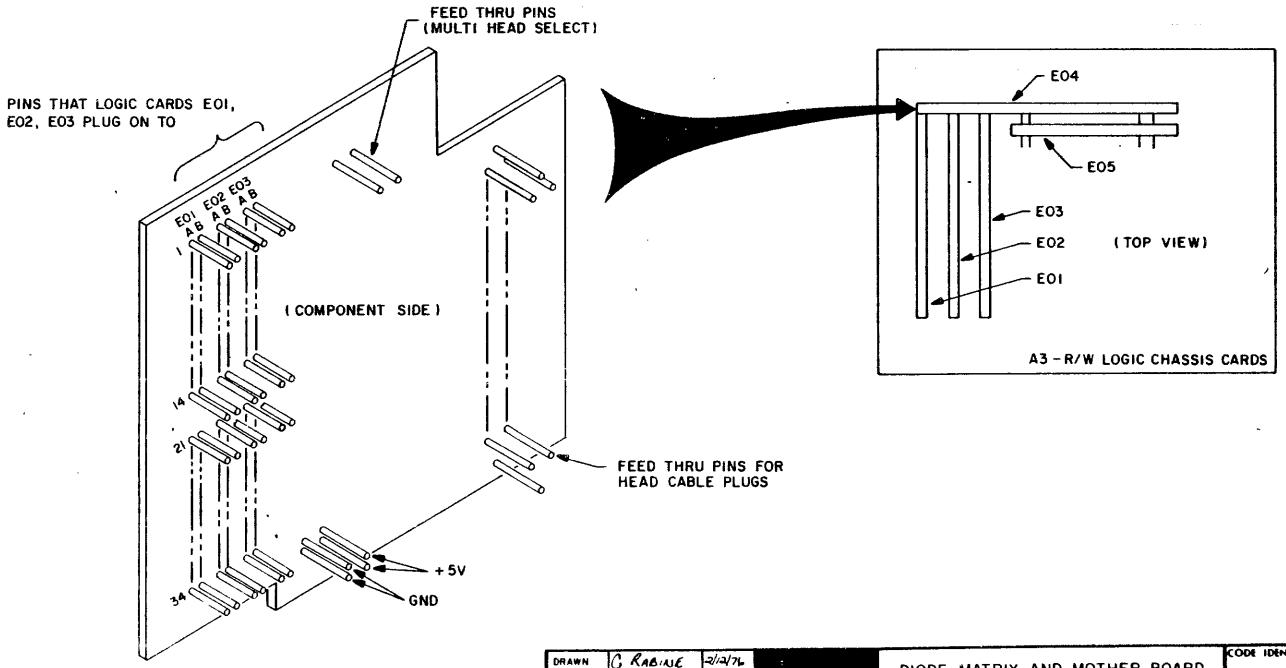
TITLE: ADDRESS MARK DETECTION	TWIN CITIES DIVISION	83319100	AT		
TYPE: 4PHV LOC: E03	FSCM NO 19333	CROSS REF NO 635	SHEET 5	PAGE 7-150.1	

REVISION STATUS OF SHEETS

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

REVISIONS

REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MA	12-30-76	
B	PE22842	SCHEMATIC CORRECTIONS	MA	12-30-76	
C		EDITORIAL	MA	5-23-77	
D	PE55259	LOGIC DIAG IMPROVEMENT	MA	10-4-78	
E	PE57498	DIODE ARRAY	TF	8-8-81	



DRAWN	C RABASE	2/2/76
CHECKED		
ENGINEER		
APPROVED		

NORMANDALE DIVISION

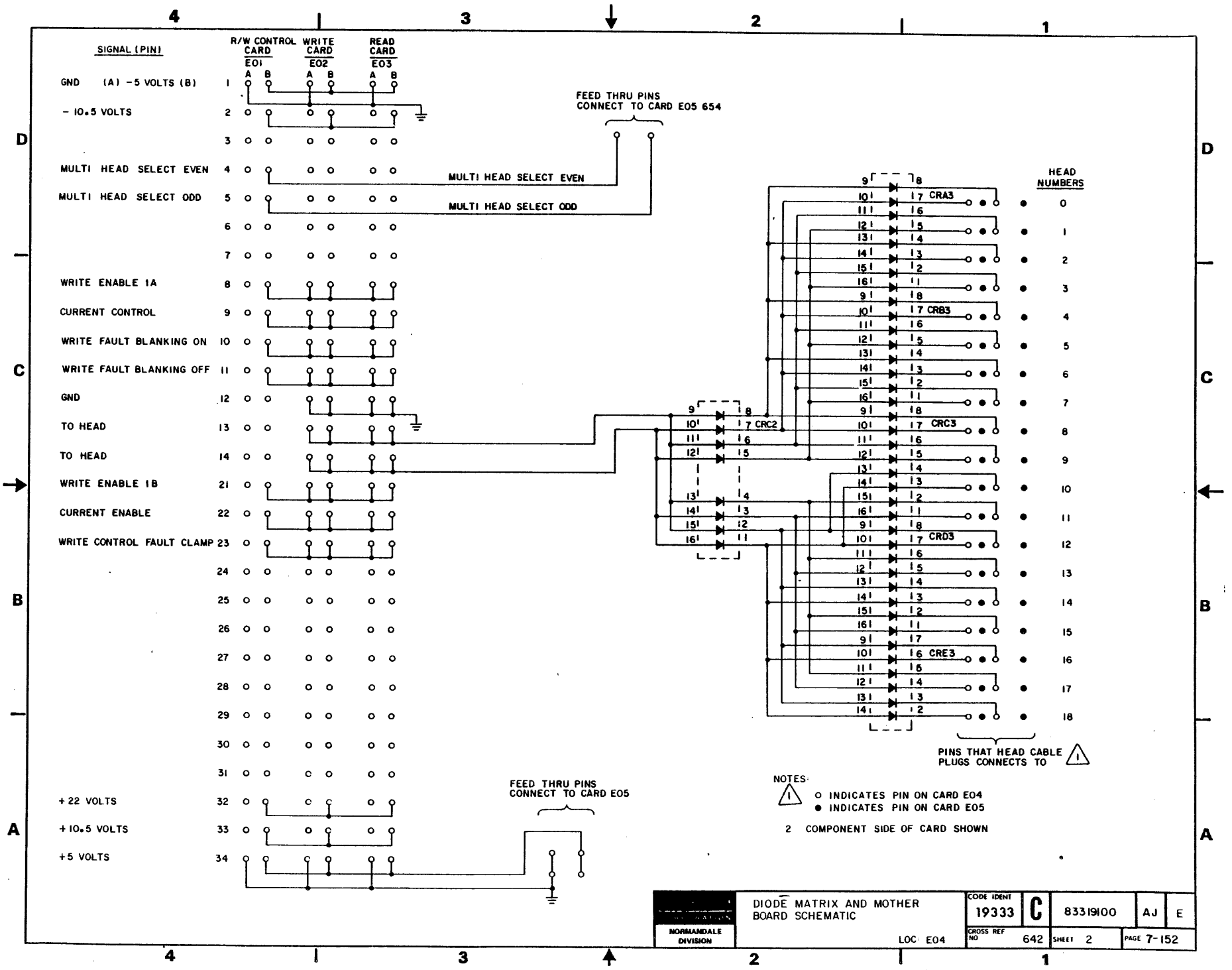
DIODE MATRIX AND MOTHER BOARD
BOARD LAYOUT DIAGRAMS

TYPE: 4XFN LOC E04

CODE IDENT				
19333	C	83319100	AJ	E

CROSS REF NO 641 | SHEET 1 OF 2 | PAGE 7-151

REF 83214164

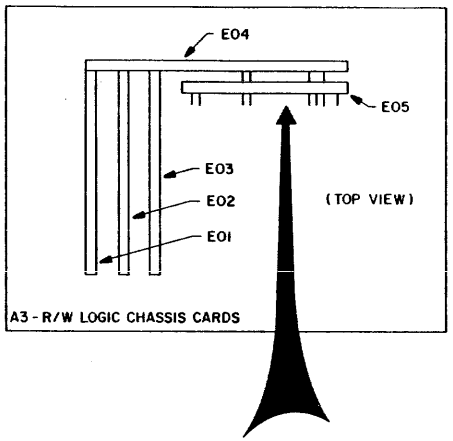

SIGNAL (PIN)
R/W CONTROL CARD E01
WRITE CARD E02
READ CARD E03
A B
GND (A) -5 VOLTS (B) 1
- 10.5 VOLTS 2
3
MULTI HEAD SELECT EVEN 4
MULTI HEAD SELECT ODD 5
6
7
WRITE ENABLE 1A 8
CURRENT CONTROL 9
WRITE FAULT BLANKING ON 10
WRITE FAULT BLANKING OFF 11
GND 12
TO HEAD 13
TO HEAD 14
WRITE ENABLE 1B 21
CURRENT 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
CRA3
CRB3
CRC2
CRC3
CRD3
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
NORMANDALE DIVISION
DIODE MATRIX AND MOTHER BOARD SCHEMATIC
LOC E04
CODE IDENT 19333
C
83319100
AJ
E
CROSS REF NO 642
SHEET 2
PAGE 7-152

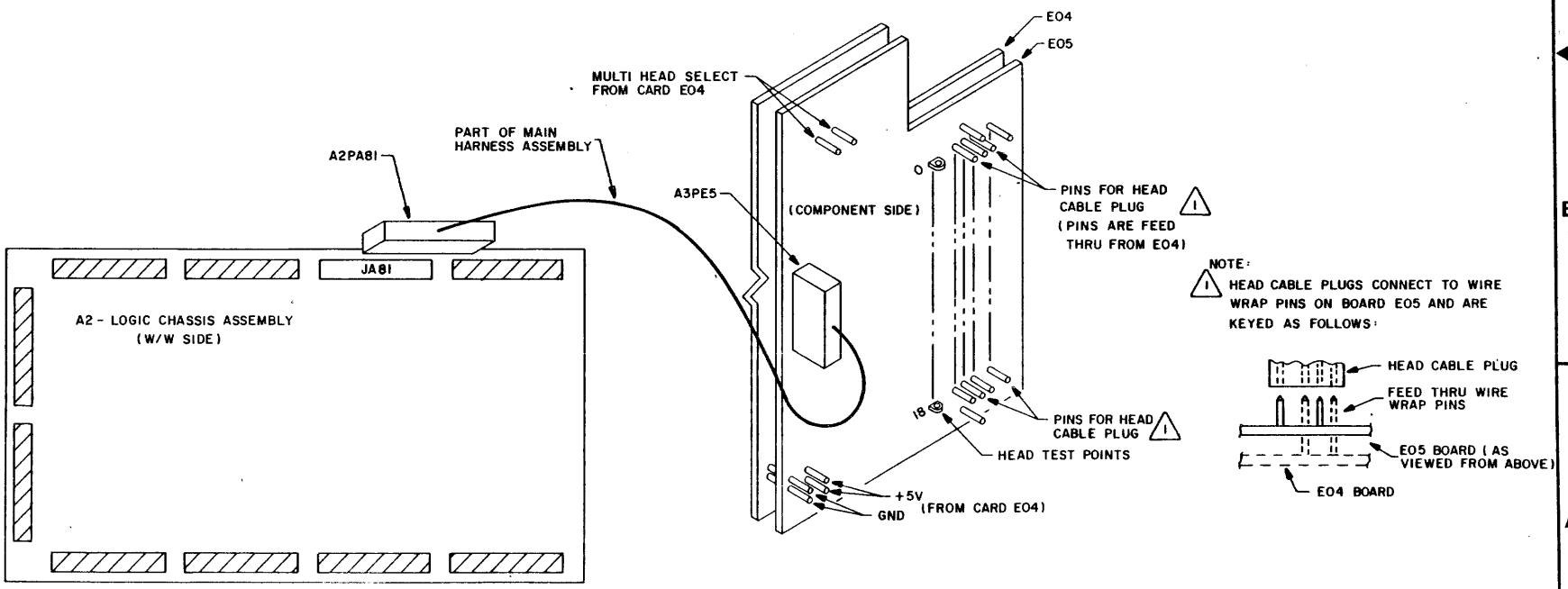
REVISION STATUS OF SHEETS

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

REVISIONS

REV.	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MA		
B	PE22842	SCHEMATIC CORRECTIONS	MA	12-30-76	
C		EDITORIAL	MA	5-23-77	
D	PE55259	LOGIC DIAG. IMPROVEMENT	MA	10-4-78	





DRAWN	G RABINE	2/11/76
CHECKED		
ENGINEER		
APPROVED		

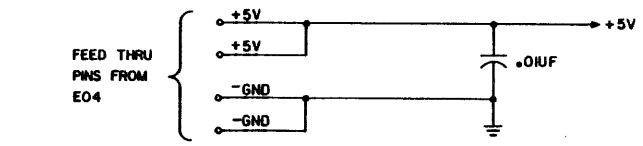
NORMANDALE DIVISION

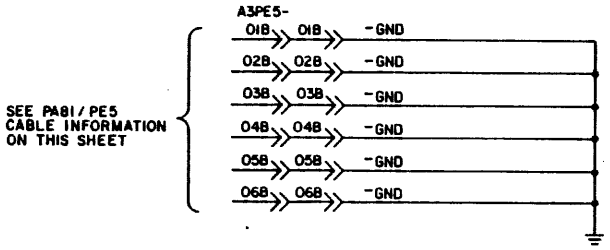
HEAD SELECT BOARD. HEAD PLUG CONNECTORS, CABLING AND CARD LAYOUT DIAGRAMS

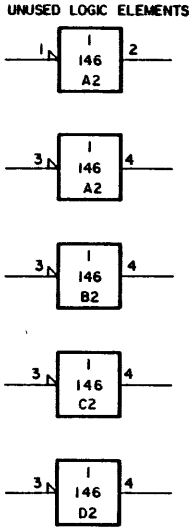
TYPE BXGN LOC E05

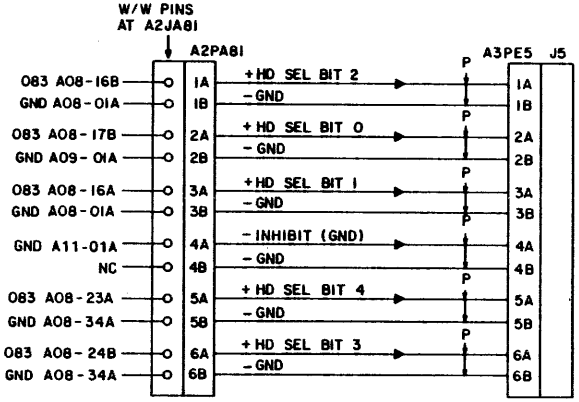
CODE IDENT				
19333	C	83319100	AJ	D
CROSS REF NO 651	SHEET 1 OF 4	PAGE 7-153		

REF 83214165



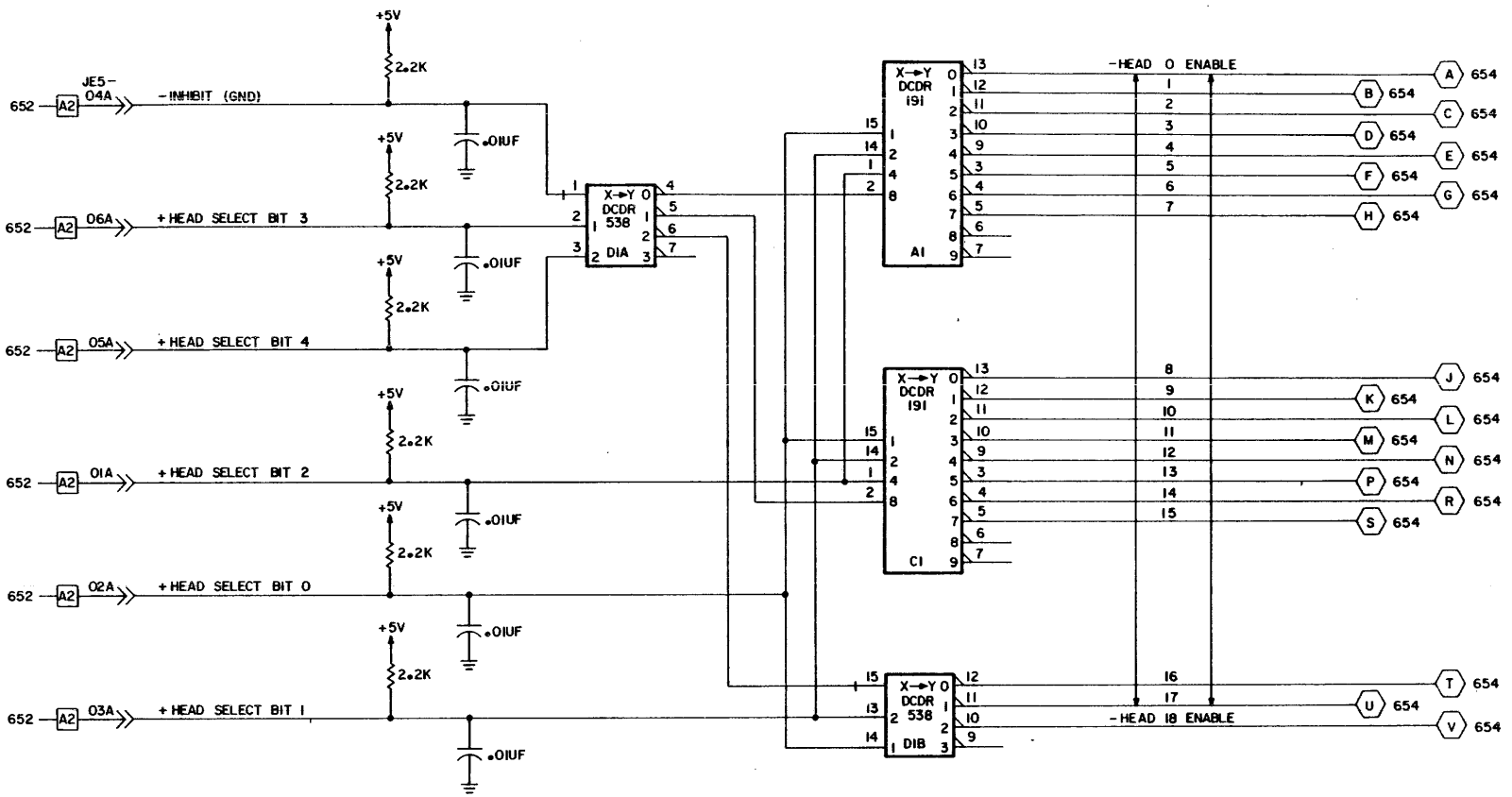






PA8I TO PE5 CABLING

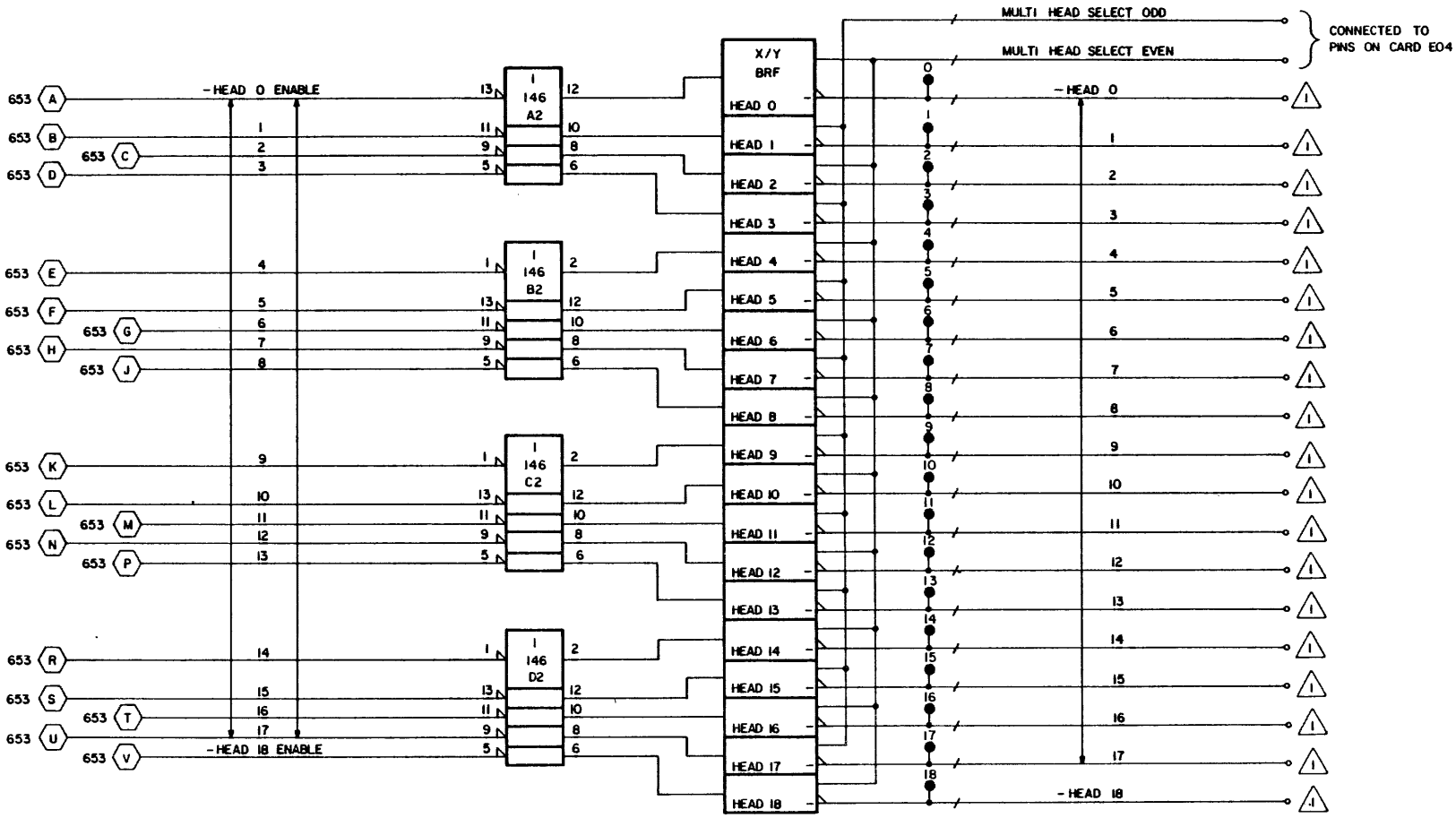
NORMANDALE DIVISION	UNUSED LOGIC ELEMENTS, VOLTAGE INPUT PINS, CABLING INFORMATION LOC: E05	CODE IDENT 19333	C	83319100	AJ B
		CROSS REF NO 652		SHEET 2	PAGE 7-154



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

NORMANDALE DIVISION	HEAD SELECT DECODE AND HEAD BIT ENABLE	CODE IDENT 19333	C	83319100	AJ D
	LOC E05	CROSS REF NO 653	SHEET 3	PAGE 7-155	



NOTE:

1. OUTPUT PIN CONNECTS TO HEAD CABLE PLUG (AND CENTER TAP OF HEAD COIL). REFER TO CROSS REF NO 642

NORMANDALE DIVISION	HEAD ENABLES AND MULTI HEAD SELECT LOC E05	CODE IDENT 19333	C	83319100	AJ	A
		CROSS REF NO 654		SHEET 4	PAGE 7-156	

REVISIONS

REV.	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	M.A	2-15-76	
B	PE22842	SCHEMATIC CORRECTIONS	MA	12-30-76	
C		EDITORIAL	MA	5-23-77	
D	PE55259	LOGIC DIAG. IMPROVEMENT	MA	10-4-78	
E	PE55256	REMOVE UNUSED RESISTOR	MA	11-14-78	
F	DJ007354	CHANGE CAP.	DHS	11-12-85	

DRAWN	M.ANDERSON	2-15-76	
CHECKED			
ENGINEER			
APPROVED			

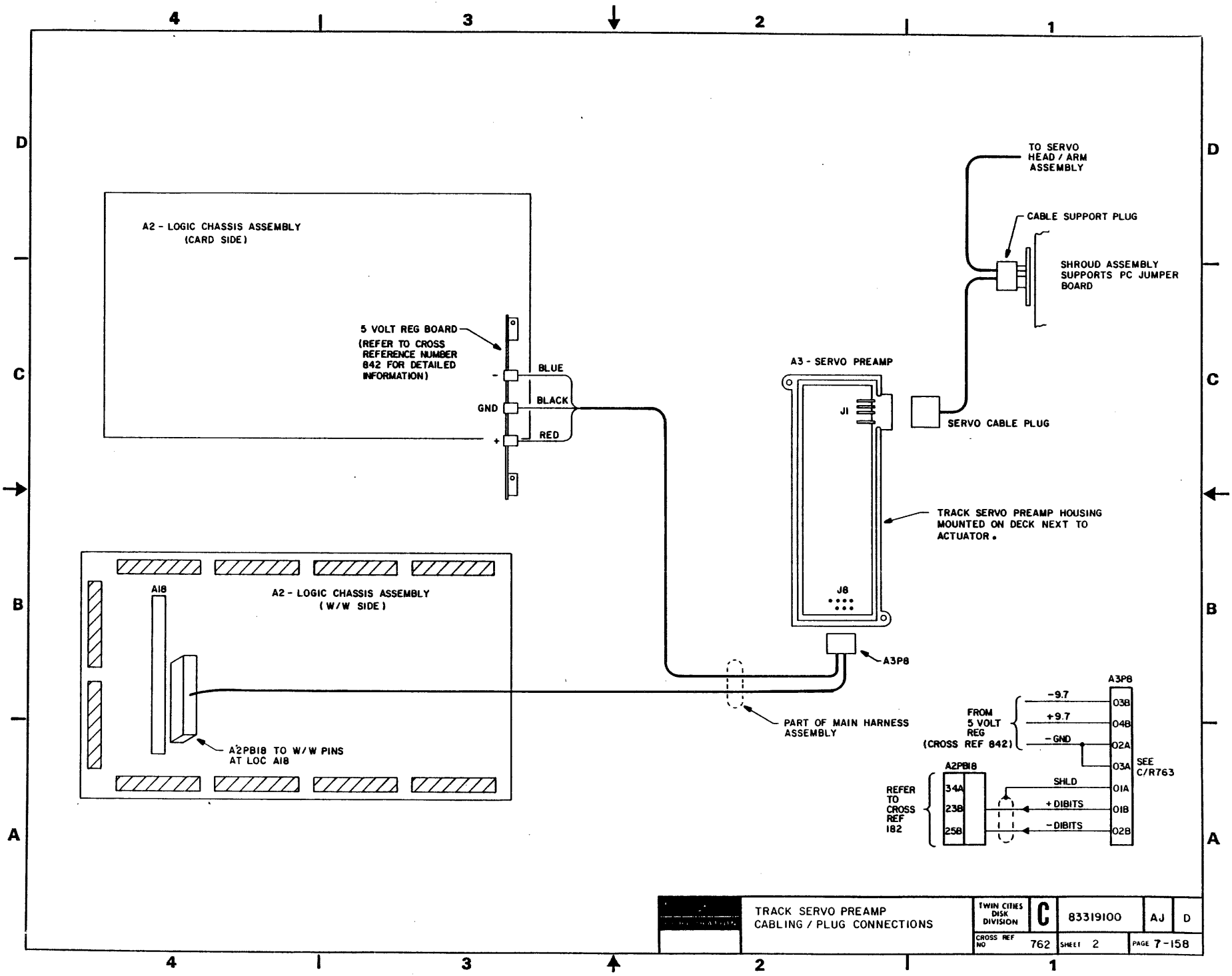
TRACK SERVO PREAMP DIAGRAMS

TYPE: FZQN

TWIN CITIES DISK DIVISION | C | 83319100 | AS | F

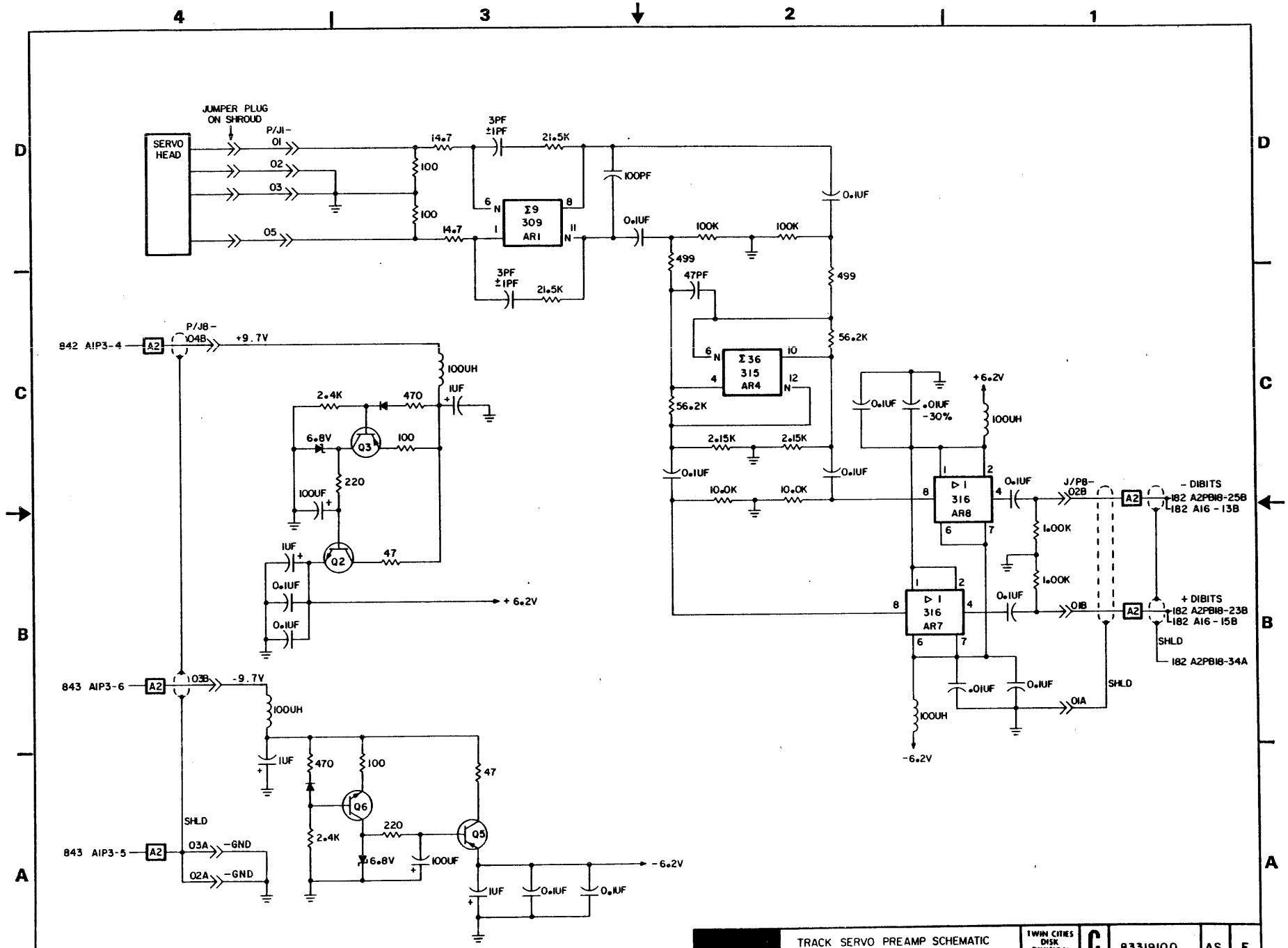
CROSS REF NO 761 | SHEET 1 OF 3 | PAGE 7-157

REF 83214176



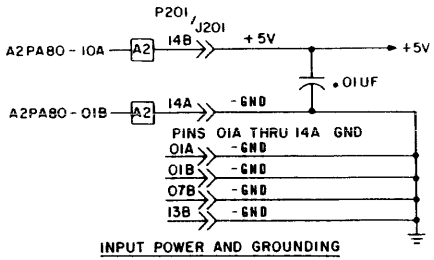
TRACK SERVO PREAMP
CABLING / PLUG CONNECTIONS

TWIN CITIES DISK DIVISION	C	83319100	AJ	D	
CROSS REF NO	762	SHEET 2	PAGE 7-158		



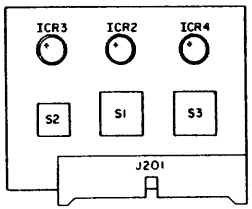
	TRACK SERVO PREAMP SCHEMATIC	TWIN CITIES DISK DIVISION	C	83319100	AS F
		CROSS REF NO 763		SHEET 3	PAGE 7-159

REVISIONS					
REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA	6-2-76	
B	PE22820	ADD FLASHER TO READY	MA	11-17-76	
C	PE22842	CORRECT DIAGRAMS	WEB	12-2-76	
D	PE22854	ERROR DIAGRAMS	MA	2-15-77	
E	PE55259	LOGIC DIA CORR	GR	5 16 78	
F	DH13266	INC VDE P/S	SM1	11-23-82	
G	DJ22000	TRANSFER FROM PE	BCK	12/0/84	
H	DJ15711	VDE NON-VDE LOGIC	BJP	6-25-85	



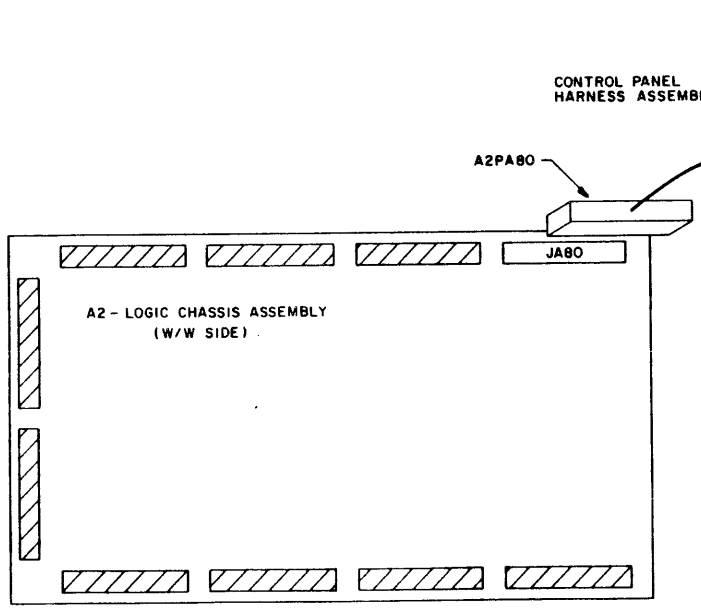
INPUT POWER AND GROUNDING

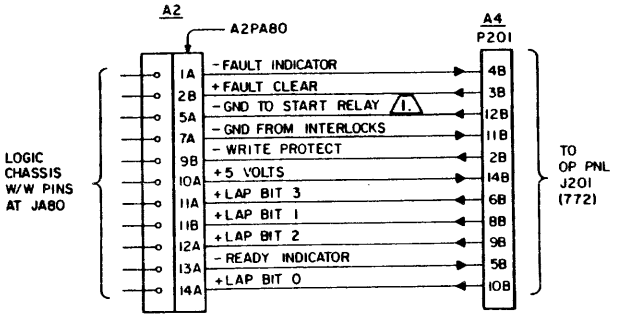
OPERATOR CONTROL PANEL
(COMPONENT LAYOUT)



NOTES:

1. START SIGNAL MODIFIED BY P.A. COVER SEAL SW A3S9 SEE CROSS REF 772.





A2PA80 TO A4P201 CABLING

APPLICABLE ONLY TO UNITS WITHOUT WRITE PROTECT OPTION

DRAWN	G RAGUE	2/2/76
CHECKED		
ENGINEER	S Jones	5/15/76
APPROVED		

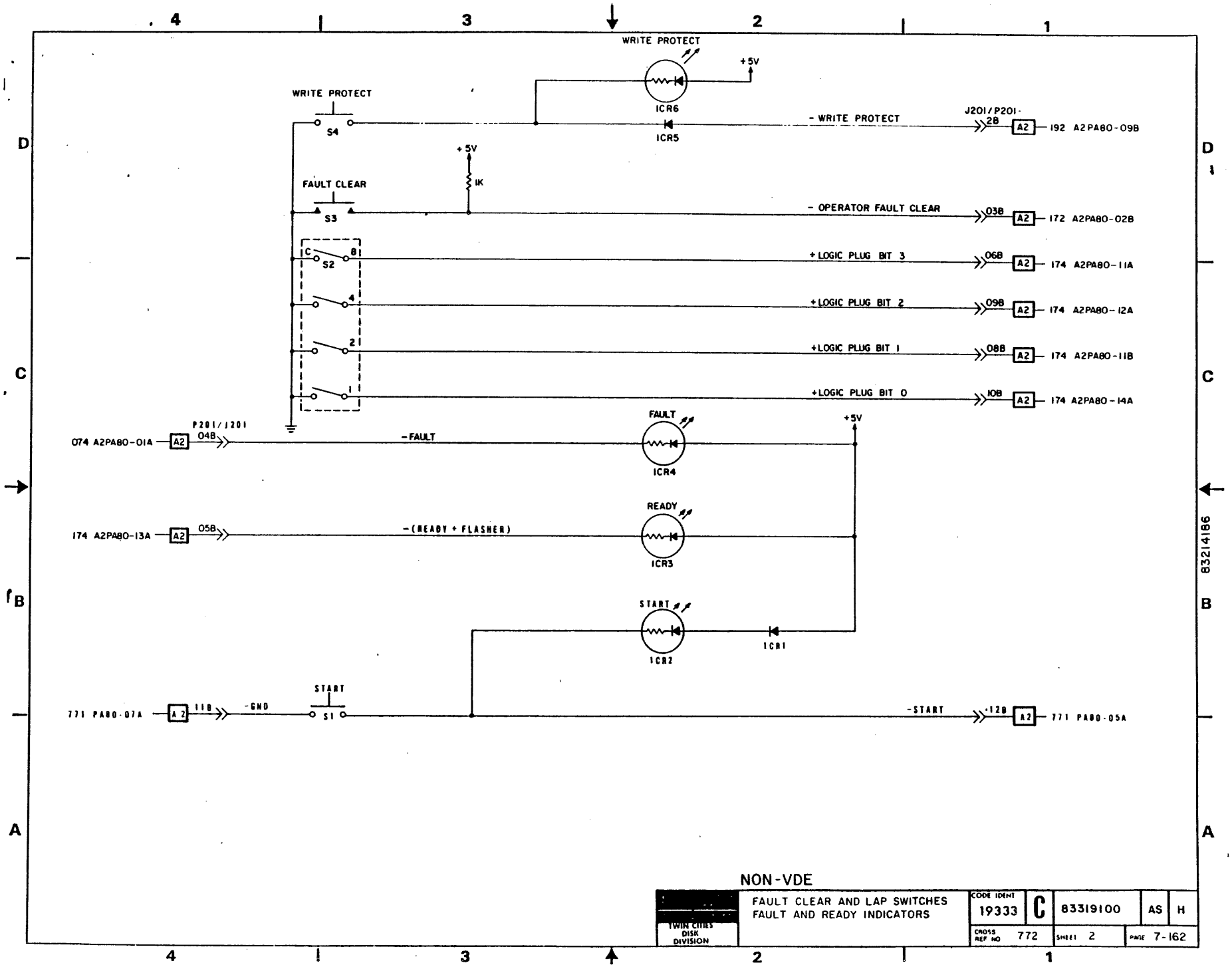
TWIN CITIES DATA SYSTEMS DIVISION

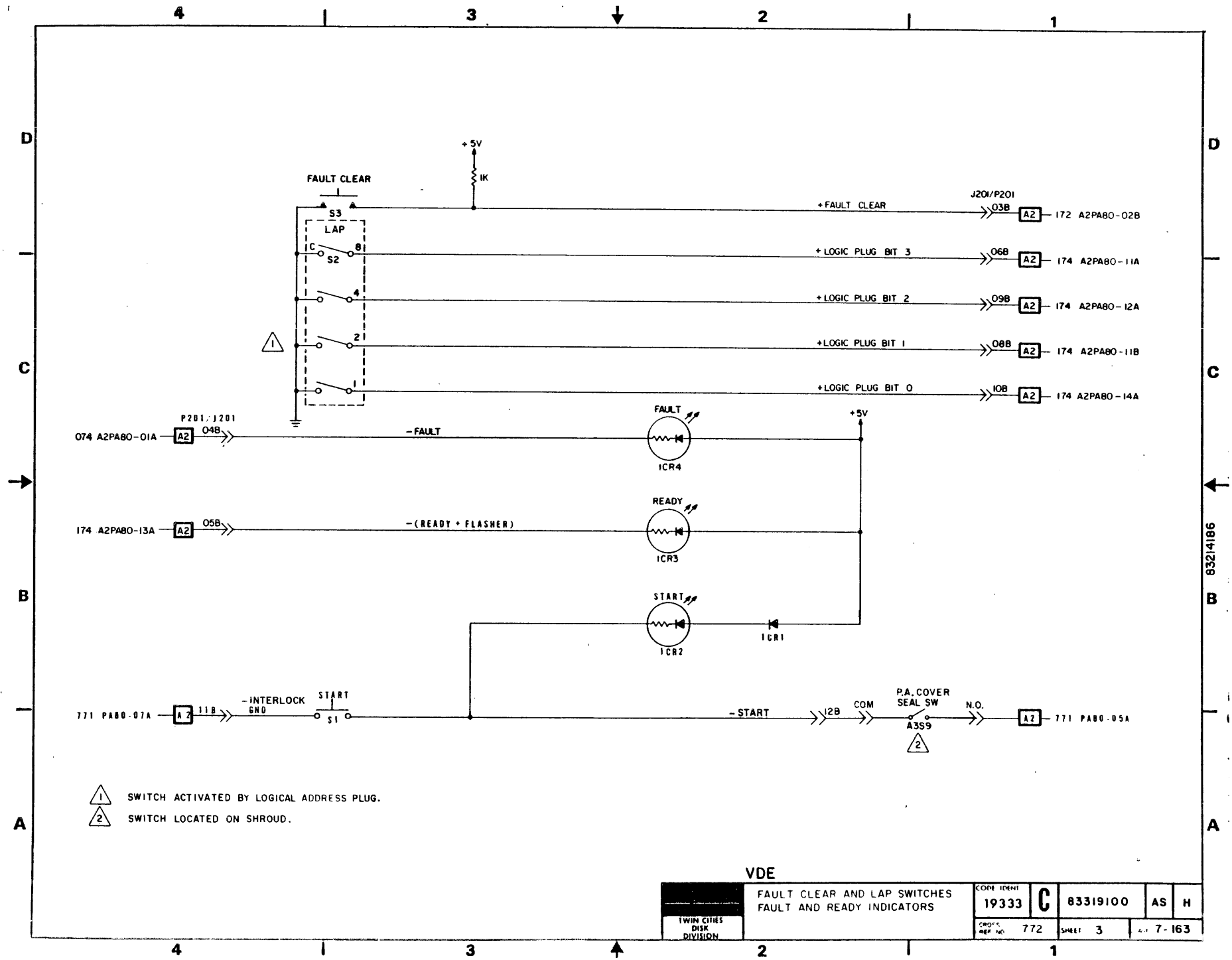
A4 - OPERATOR CONTROL PANEL DIAGRAMS

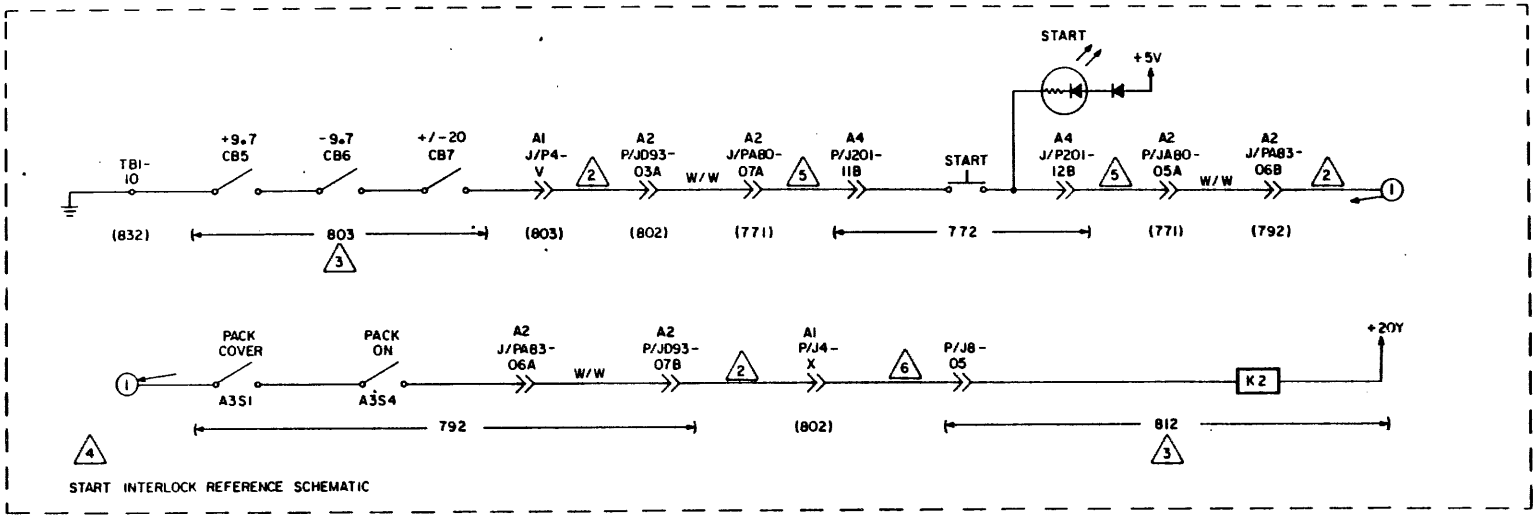
TYPE: JZYN

CODE IDENT				
19333	C	83319100	AS	H
CROSS REF NO 771	SHEET 1 of 5	PAGE 7-161		

83214186


WRITE PROTECT
+5V
ICR6
WRITE PROTECT
S4
ICR5
- WRITE PROTECT
J201/P201-28
A2
192 A2PA80-09B
+5V
1K
FAULT CLEAR
S3
- OPERATOR FAULT CLEAR
038
172 A2PA80-02B
C
S2
8
4
2
1
+LOGIC PLUG BIT 3
068
174 A2PA80-11A
+LOGIC PLUG BIT 2
098
174 A2PA80-12A
+LOGIC PLUG BIT 1
088
174 A2PA80-11B
+LOGIC PLUG BIT 0
108
174 A2PA80-14A
P201/J201
074 A2PA80-01A
04B
-FAULT
FAULT
ICR4
+5V
READY
174 A2PA80-13A
05B
-(READY + FLASHER)
ICR3
START
ICR2
ICR1
START
771 PA80-07A
11B
-GND
S1
-START
12B
771 PA80-05A
83214186
NON-VDE
TWIN CITIES DISK DIVISION
FAULT CLEAR AND LAP SWITCHES
FAULT AND READY INDICATORS
CODE IDENT 19333
C
83319100
AS
H
CROSS REF NO 772
SHEET 2
PAGE 7-162


+5V
1K
FAULT CLEAR
S3
LAP
C
S2
8
4
2
1
+FAULT CLEAR
+LOGIC PLUG BIT 3
+LOGIC PLUG BIT 2
+LOGIC PLUG BIT 1
+LOGIC PLUG BIT 0
J201/P201
03B
06B
09B
08B
10B
A2
172 A2PA80-02B
174 A2PA80-11A
174 A2PA80-12A
174 A2PA80-11B
174 A2PA80-14A
P201/J201
074 A2PA80-01A
04B
-FAULT
FAULT
1CR4
+5V
174 A2PA80-13A
05B
-(READY + FLASHER)
READY
1CR3
START
1CR2
1CR1
771 PA80-07A
11B
-INTERLOCK GND
START
S1
-START
12B
COM
P.A. COVER SEAL SW
A3S9
N.O.
771 PA80-05A
1
2
SWITCH ACTIVATED BY LOGICAL ADDRESS PLUG.
SWITCH LOCATED ON SHROUD.
VDE
TWIN CITIES DISK DIVISION
FAULT CLEAR AND LAP SWITCHES
FAULT AND READY INDICATORS
CODE IDENT 19333
C
83319100
AS
H
CROSS REF NO. 772
SHEET 3
A1 7-163
83214186



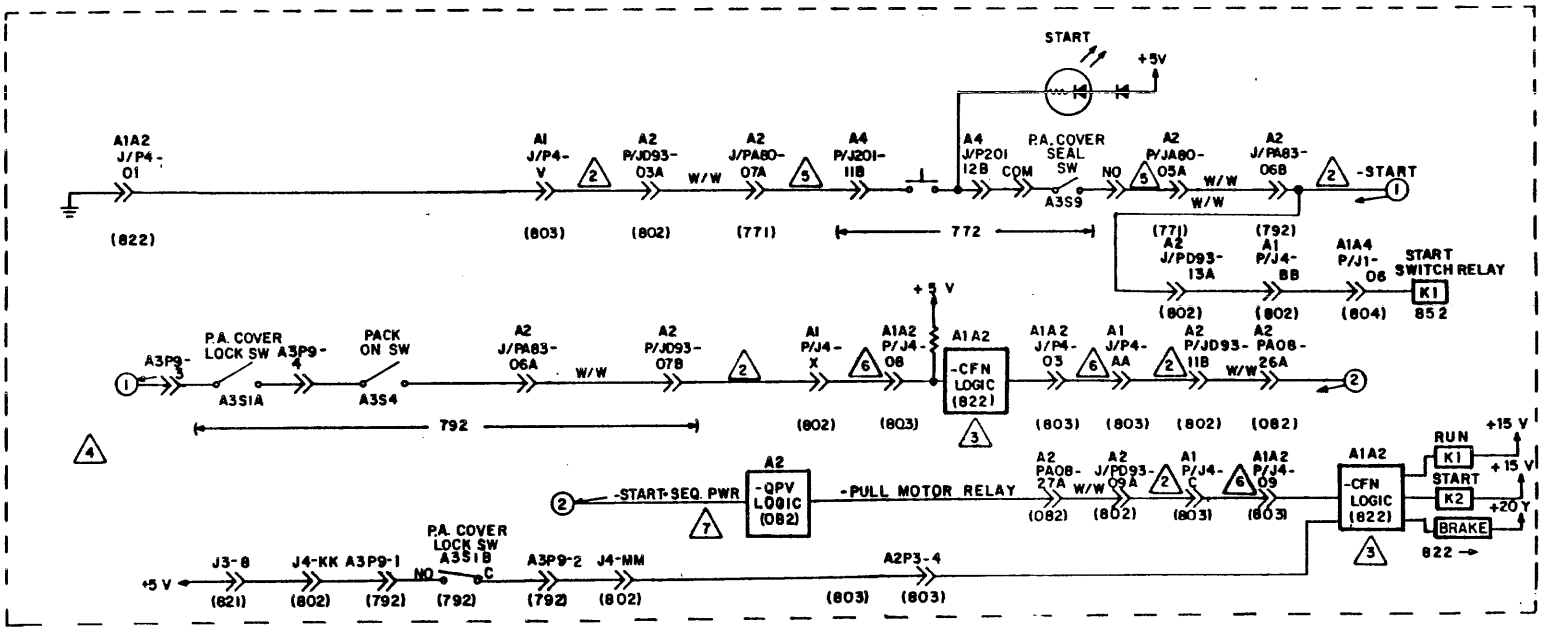
NOTES

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

NON-VDE

TWIN CITIES DISK DIVISION	START SWITCH/START INDICATOR START INTERLOCK REFERENCE SCHEMATIC	CODE IDENT 19333	C	83319100	AS H
		CROSS REF NO. 773		SHEET 4	PAGE 7-164

83214186



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 P3 HARNESS

7 LOCATED INSIDE LOGIC CHASSIS

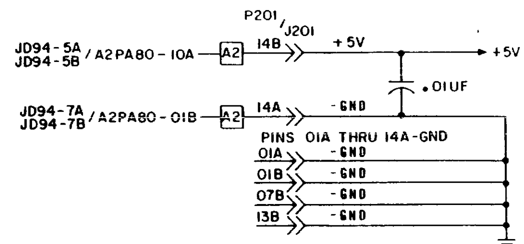
VDE

TWIN CITIES DISK DIVISION	START SWITCH/START INDICATOR START INTERLOCK REFERENCE SCHEMATIC	CODE IDENT 19333	C	83319100	AS H
		CROSS REF NO 773		SHEET 5	PAGE 7-165

83214186

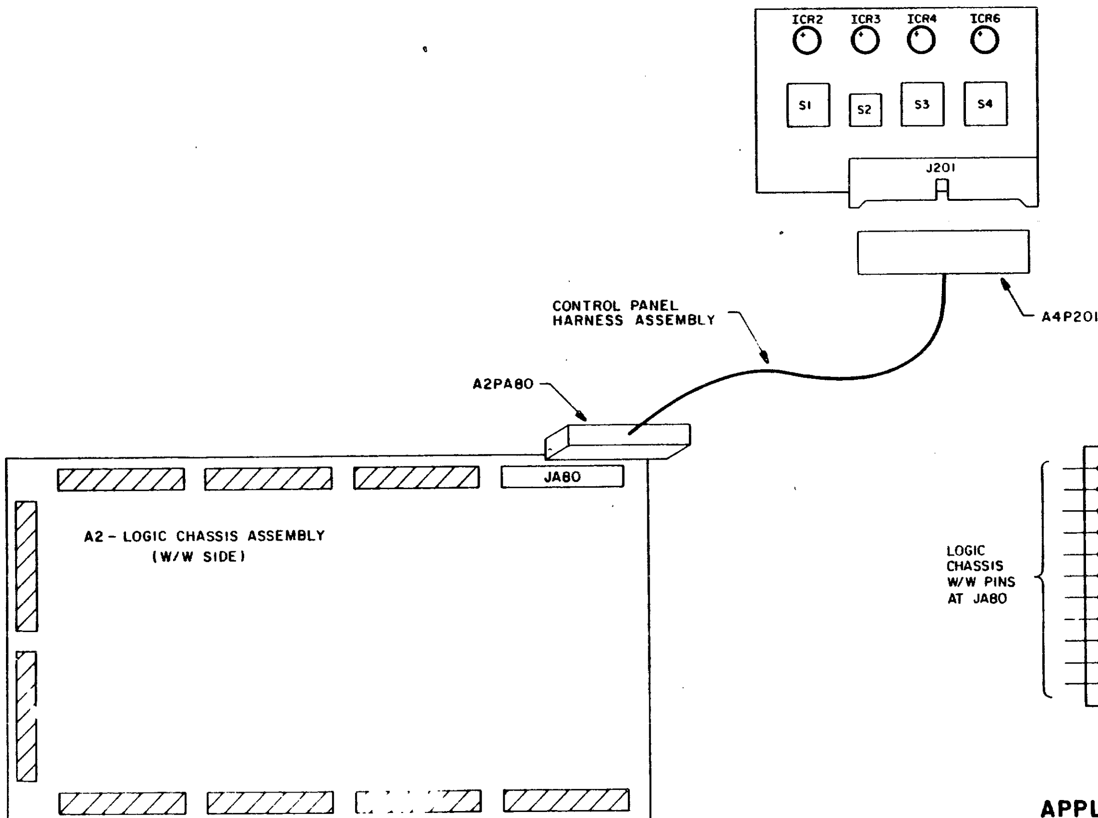
REVISIONS

REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA	6-2-76	MK
B	PE22820	ADD FLASHER TO READY	MA	11 17 76	[illegible]
C	PE22842	CORRECT DIAGRAMS	WEB	12-2-76	
D	PE22854	CORRECT ERRORS	MA	2 15 77	[illegible]
E	PE55259	LOGIC DIA CORR	GR	5 16 78	[illegible]
F	DJ22000	XFER FROM PE	[illegible]	1 18 85	[illegible]
G	DJ13711	VDE NON-VDE LOGIC	BJP	6-24-88	[illegible]



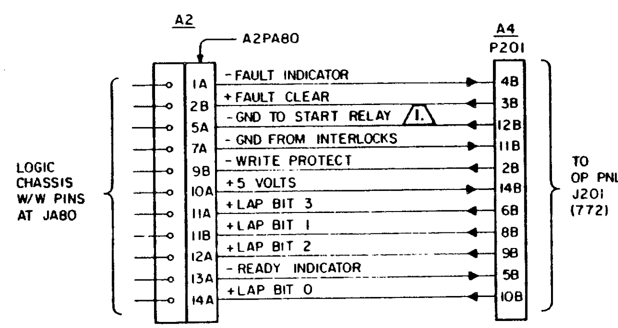
INPUT POWER AND GROUNDING

OPERATOR CONTROL PANEL
(COMPONENT LAYOUT)



NOTES:

1. START SIGNAL MODIFIED BY P.A. COVER SEAL SW A3S9 SEE CROSS REF 772.



A2PA80 TO A4P201 CABLING

APPLICABLE ONLY TO UNITS WITH WRITE PROTECT OPTION

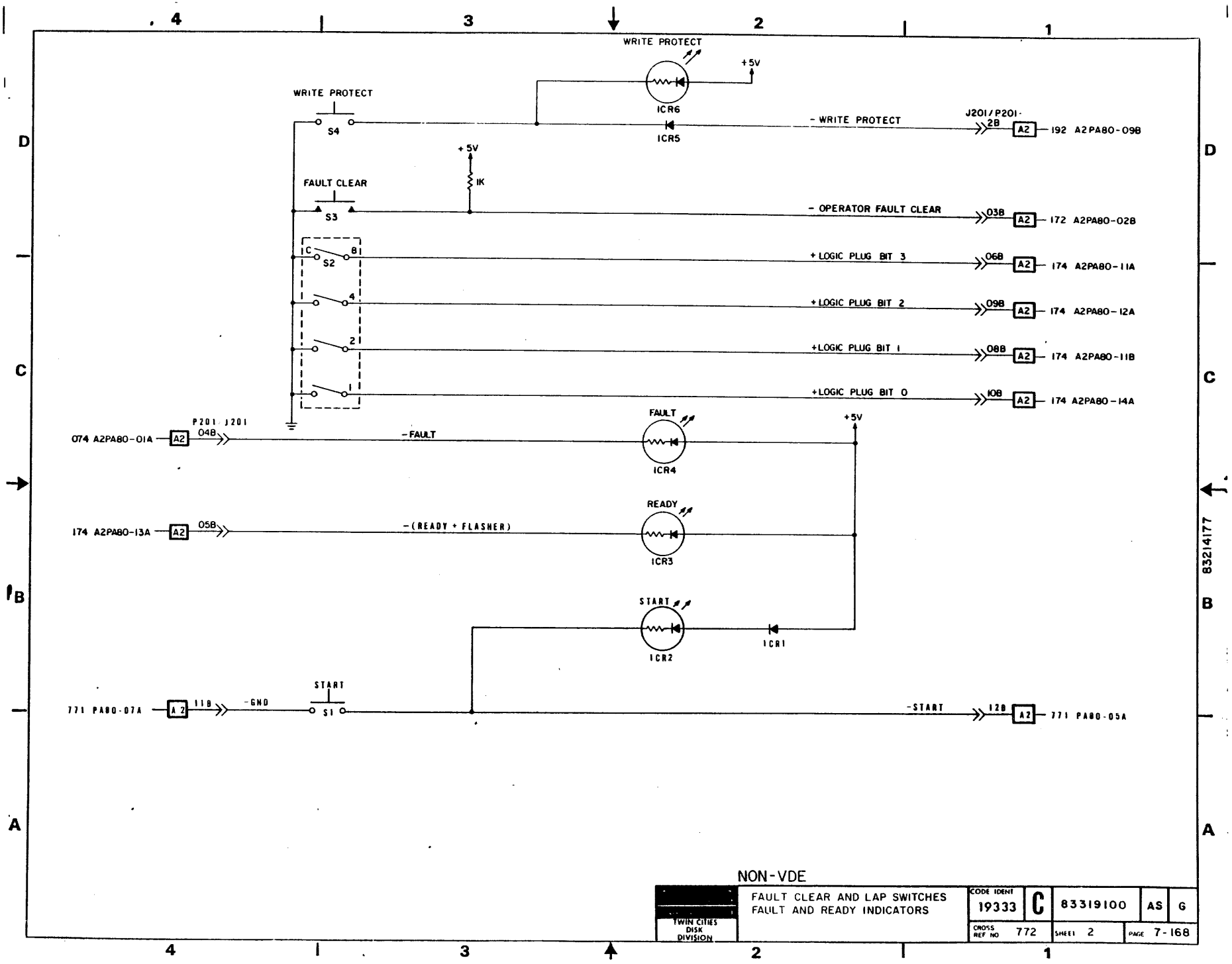
83214177

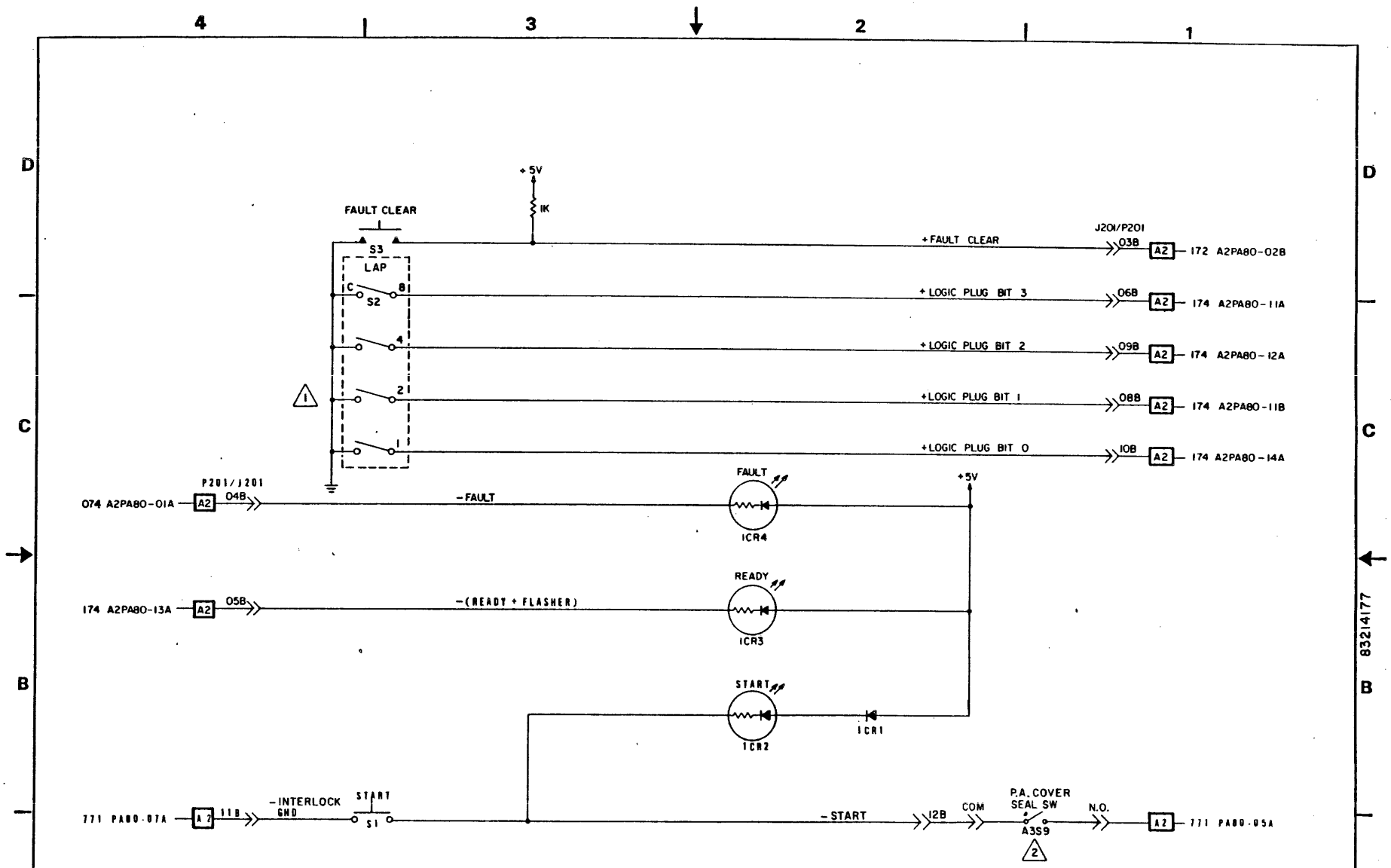
DRAWN	G KABNE	[illegible]	TWIN CITIES DISK DIVISION
CHECKED			
ENGINEER	[illegible]	[illegible]	
APPROVED			

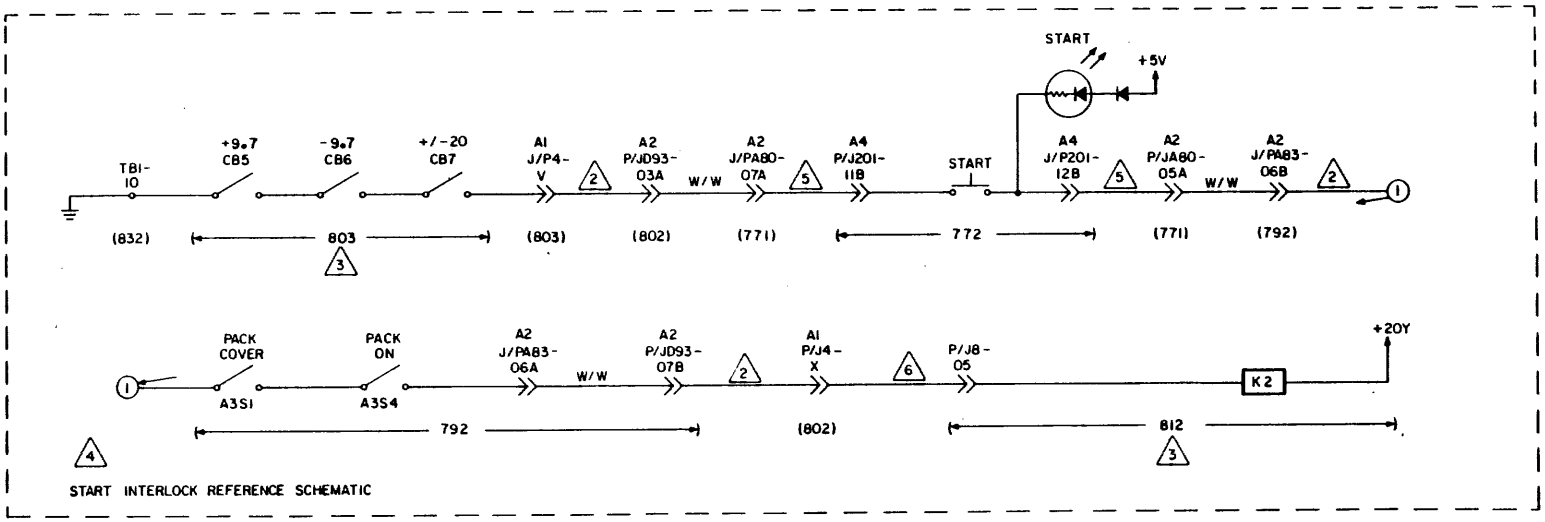
A4 - OPERATOR CONTROL PANEL DIAGRAMS

TYPE HZYN

CODE IDENT	SIZE	DWG NO.		REV
19333	C	83319100	AS	G
CROSS REF NO. 771	SHEET 1 of 5	PAGE 7-167		


WRITE PROTECT
+5V
ICR6
WRITE PROTECT
S4
ICR5
- WRITE PROTECT
J201/P201-28
A2
192 A2PA80-09B
+5V
1K
FAULT CLEAR
S3
- OPERATOR FAULT CLEAR
03B
172 A2PA80-02B
C
S2
8
4
2
1
+LOGIC PLUG BIT 3
06B
174 A2PA80-11A
+LOGIC PLUG BIT 2
09B
174 A2PA80-12A
+LOGIC PLUG BIT 1
08B
174 A2PA80-11B
+LOGIC PLUG BIT 0
10B
174 A2PA80-14A
FAULT
+5V
P201 J201
074 A2PA80-01A
04B
-FAULT
ICR4
READY
174 A2PA80-13A
05B
-(READY + FLASHER)
ICR3
START
ICR2
ICR1
START
771 PA80-07A
11B
-GND
S1
-START
12B
771 PA80-05A
NON-VDE
FAULT CLEAR AND LAP SWITCHES
FAULT AND READY INDICATORS
TWIN CITIES DISK DIVISION
CODE IDENT 19333
C
83319100
AS
G
CROSS REF NO 772
SHEET 2
PAGE 7-168
83214177


+5V
1K
FAULT CLEAR
S3
LAP
C
S2
8
4
2
1
+FAULT CLEAR
J201/P201
03B
A2
172 A2PA80-02B
+LOGIC PLUG BIT 3
06B
174 A2PA80-11A
+LOGIC PLUG BIT 2
09B
174 A2PA80-12A
+LOGIC PLUG BIT 1
08B
174 A2PA80-11B
+LOGIC PLUG BIT 0
10B
174 A2PA80-14A
P201/J201
04B
074 A2PA80-01A
-FAULT
FAULT
ICR4
+5V
174 A2PA80-13A
05B
-(READY + FLASHER)
READY
ICR3
START
ICR2
ICR1
771 PA80-07A
A7
11B
-INTERLOCK GND
START
S1
-START
12B
COM
P.A. COVER SEAL SW
N.O.
A3S9
771 PA80-05A
SWITCH ACTIVATED BY LOGICAL ADDRESS PLUG.
SWITCH LOCATED ON SHROUD.
VDE
TWIN CITIES DISK DIVISION
FAULT CLEAR AND LAP SWITCHES
FAULT AND READY INDICATORS
CODE IDENT 19333
C
83319100
AS
G
CROSS REF NO 772
SHEET 3
PAGE 7-169
83214177



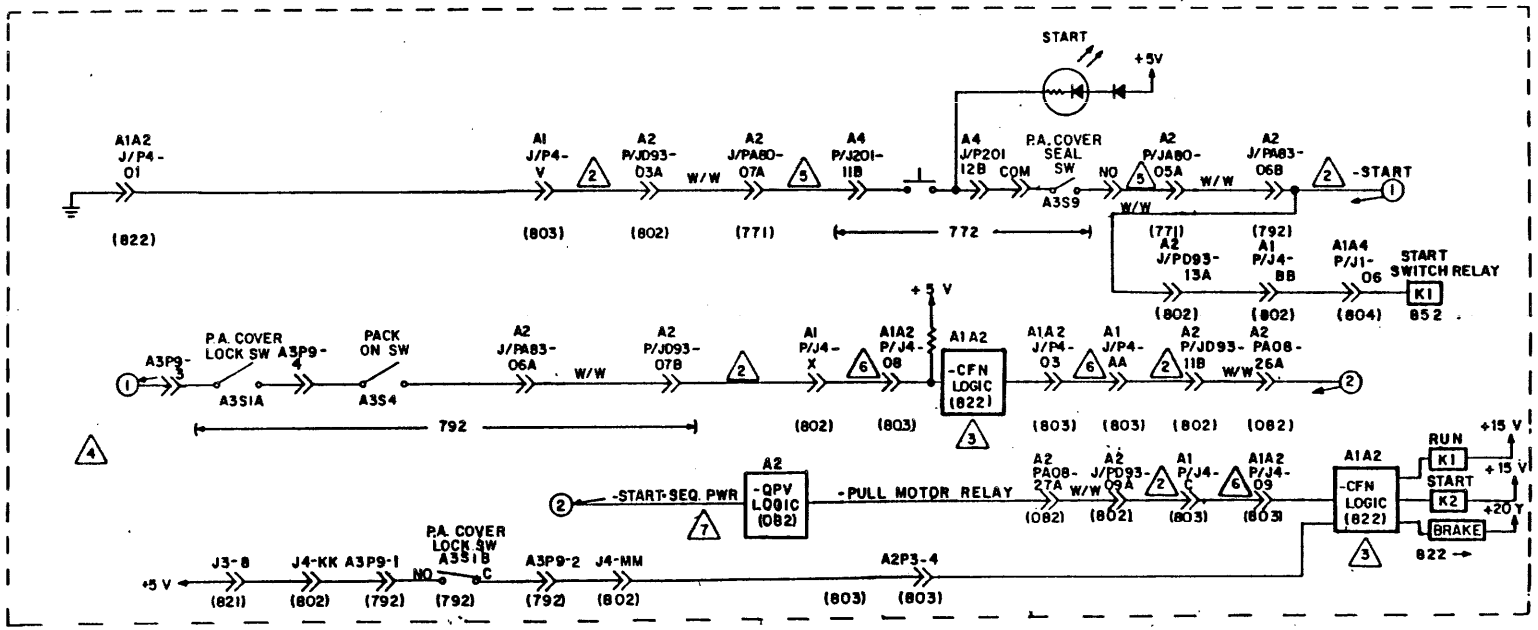
NOTES

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

NON-VDE

TWIN CITIES DISK DIVISION	START SWITCH/START INDICATOR START INTERLOCK REFERENCE SCHEMATIC	CODE IDENT 19333	C	83319100	AS	G
		CROSS REF NO 773		SHEET 4	PAGE 7-170	

83214177



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 P9 HARNESS

7 LOCATED INSIDE LOGIC CHASSIS

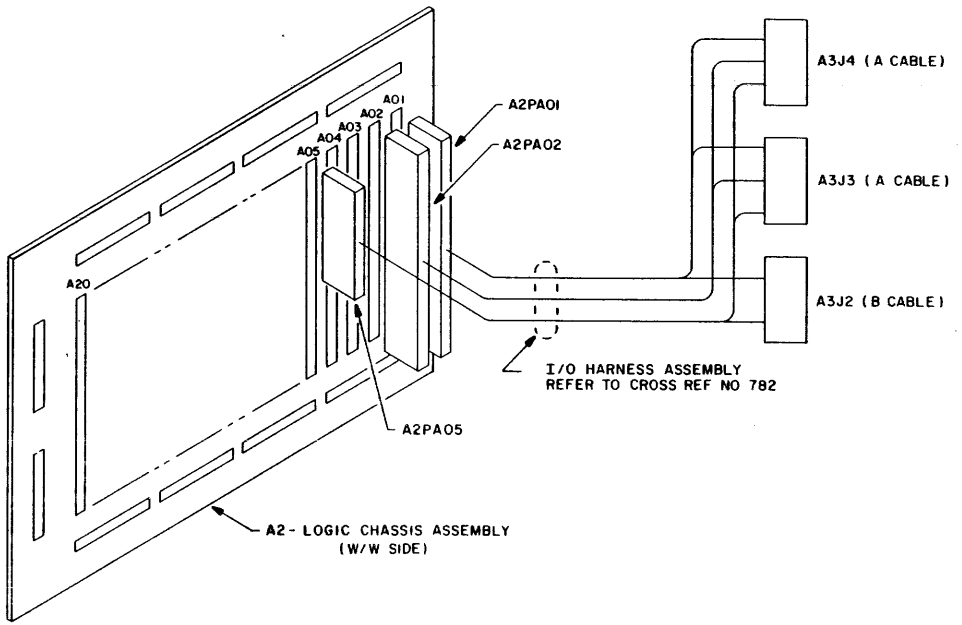
VDE

TWIN CITIES DISK DIVISION	START SWITCH/START INDICATOR START INTERLOCK REFERENCE SCHEMATIC	CODE IDENT 19333	C	83319100	AS G
		CROSS REF NO 773	SHEET 5	PAGE 7-171	

83214177

REVISIONS

REV	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MA		
B	PE22842	SCHEMATIC CORRECTION	MA	12-30-76	
C		EDITORIAL	MA	5-23-77	
D	PE57523	ADD TO B CABLE	TLF	6-5-81	
E	DJI3340	CORRECT I/O PICK	MRB	8-13-83	



APPLICABLE TO INDEX AND SECTOR IN A CABLE OPTION

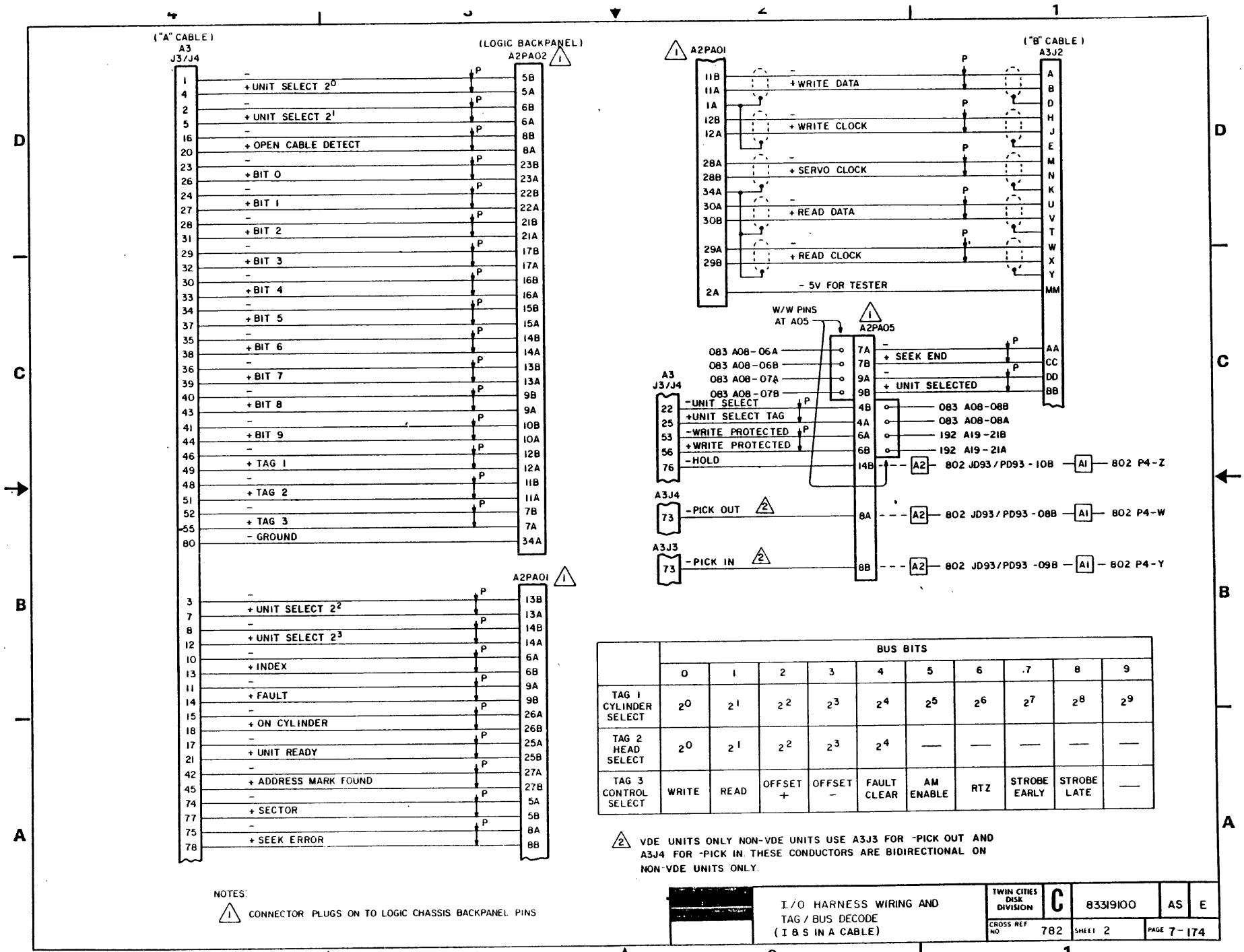
DRAWN	G Rabine	2/14/74
CHECKED		
ENGINEER		
APPROVED		

A3 - I/O CABLING DIAGRAMS

TWIN CITIES DISK DIVISION | C | 83319100 | AS | E

CROSS REF NO 781 | SHEET 1 of 2 | PAGE 7-173

REF 83214178



	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	—

(2) VDE UNITS ONLY NON-VDE UNITS USE A3J3 FOR -PICK OUT AND A3J4 FOR -PICK IN. THESE CONDUCTORS ARE BIDIRECTIONAL ON NON-VDE UNITS ONLY.

NOTES:

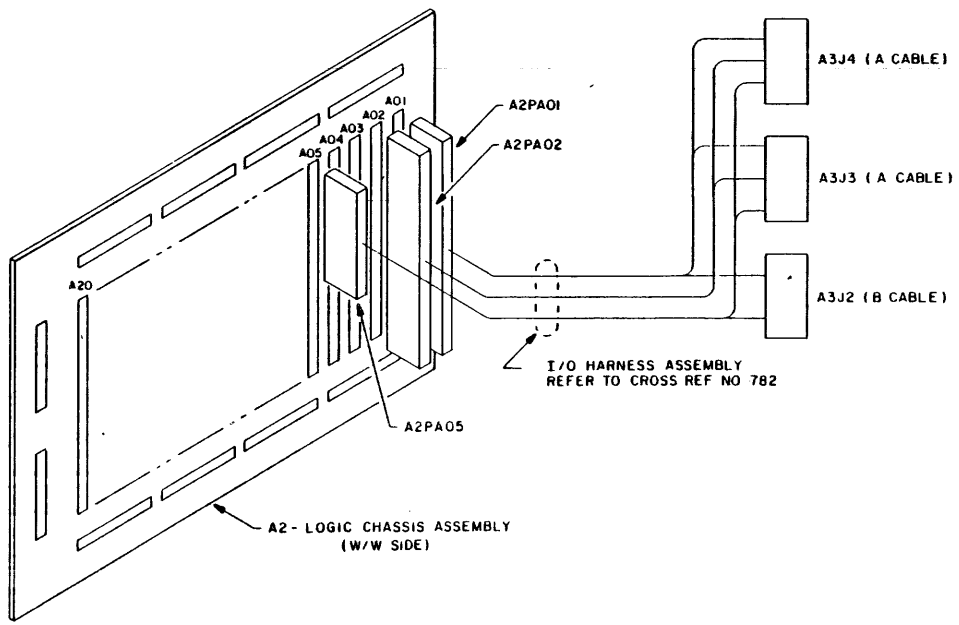
(1) CONNECTOR PLUGS ON TO LOGIC CHASSIS BACKPANEL PINS

I/O HARNESS WIRING AND TAG/BUS DECODE (1 BUS IN A CABLE)

TWIN CITIES DISK DIVISION | C | 83319100 | AS | E

CROSS REF NO 782 | SHEET 2 | PAGE 7-174

REVISIONS					
REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	A29000	RELEASE	MC	3/14/81	DDG
B	PE57523	ADD TO B CABLE	TLF	6-18-81	MKP
C	DJ13340	CORRECT I/O PICK	M.R.B.	5-12-83	



APPLICABLE TO INDEX AND SECTOR IN B CABLE OPTION.

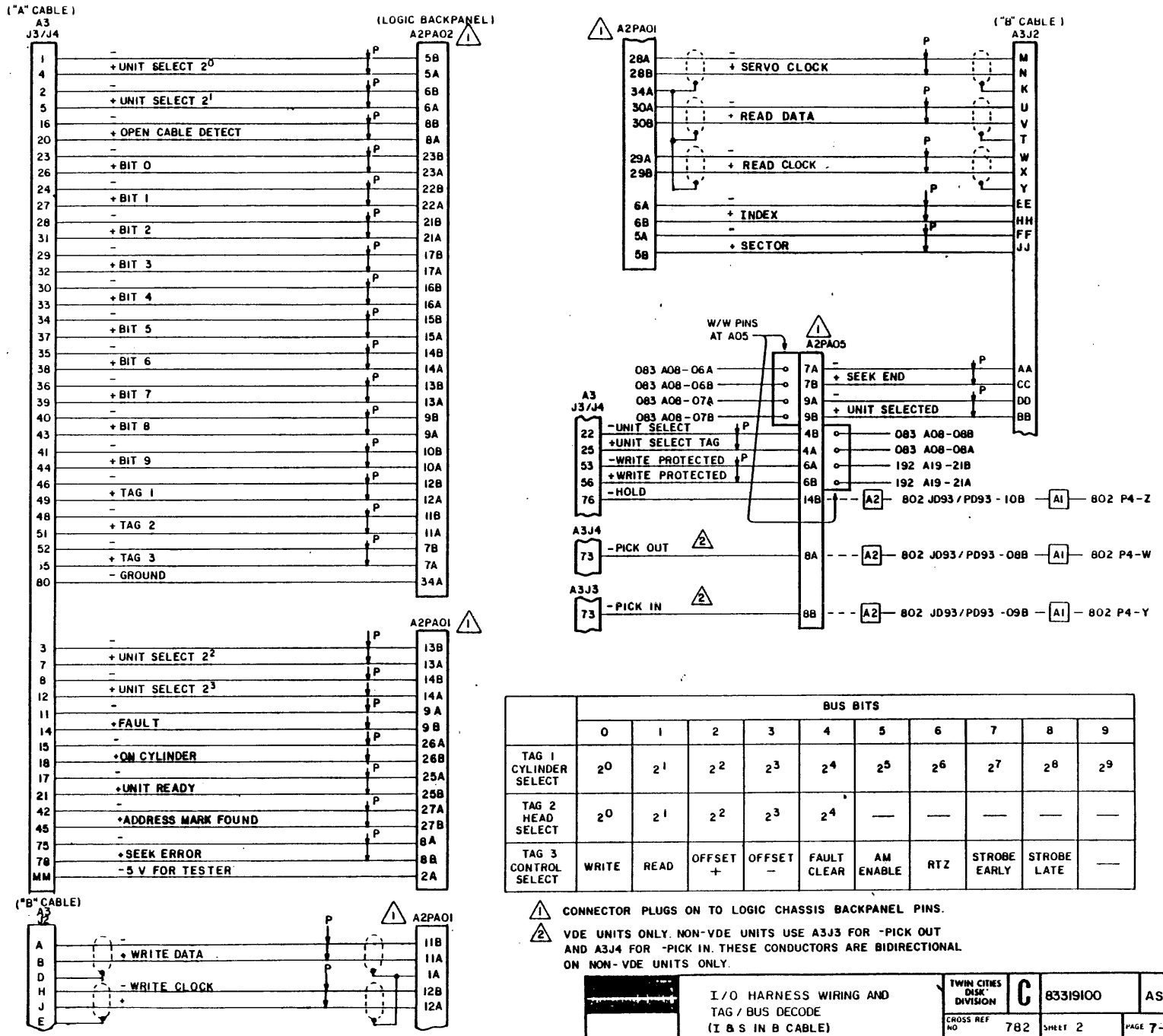
DRAWN	G. ANDRE	2/14/78
CHECKED		
ENGINEER		
APPROVED		

A3 - I/O CABLING DIAGRAMS

TWIN CITIES DISK DIVISION | C | 83319100 | AS | C

CROSS REF NO 781 | SHEET 1 OF 2 | PAGE 7-175

REF: 83214190



	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	—

1. CONNECTOR PLUGS ON TO LOGIC CHASSIS BACKPANEL PINS.
2. VDE UNITS ONLY. NON-VDE UNITS USE A3J3 FOR -PICK OUT AND A3J4 FOR -PICK IN. THESE CONDUCTORS ARE BIDIRECTIONAL ON NON-VDE UNITS ONLY.

[redacted]

I/O HARNESS WIRING AND TAG/BUS DECODE (I & S IN B CABLE)

TWIN CITIES DISK DIVISION	C	83319100	AS	C
CROSS REF NO 782		SHEET 2	PAGE 7-176	

REVISIONS					
REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA	6-2-76	
B	PE22842	CORRECT DIAGRAMS	WEB	12-2-76	
C	DH13266	INC VDE P/S	SMI	11-24-82	GAM
D	PE68333A	TRANSFER TO DJ	CR	11-29-83	CR
E	DJ13406C	CHG DIAGRAMS	DLS	1-27-84	BJP
F	DJ13631	SEE SHEET 2	JHM	10-24-84	BJP
G	DJ13711	VDE NON-VDE LOGIC	BJP	6-28-85	

83214179

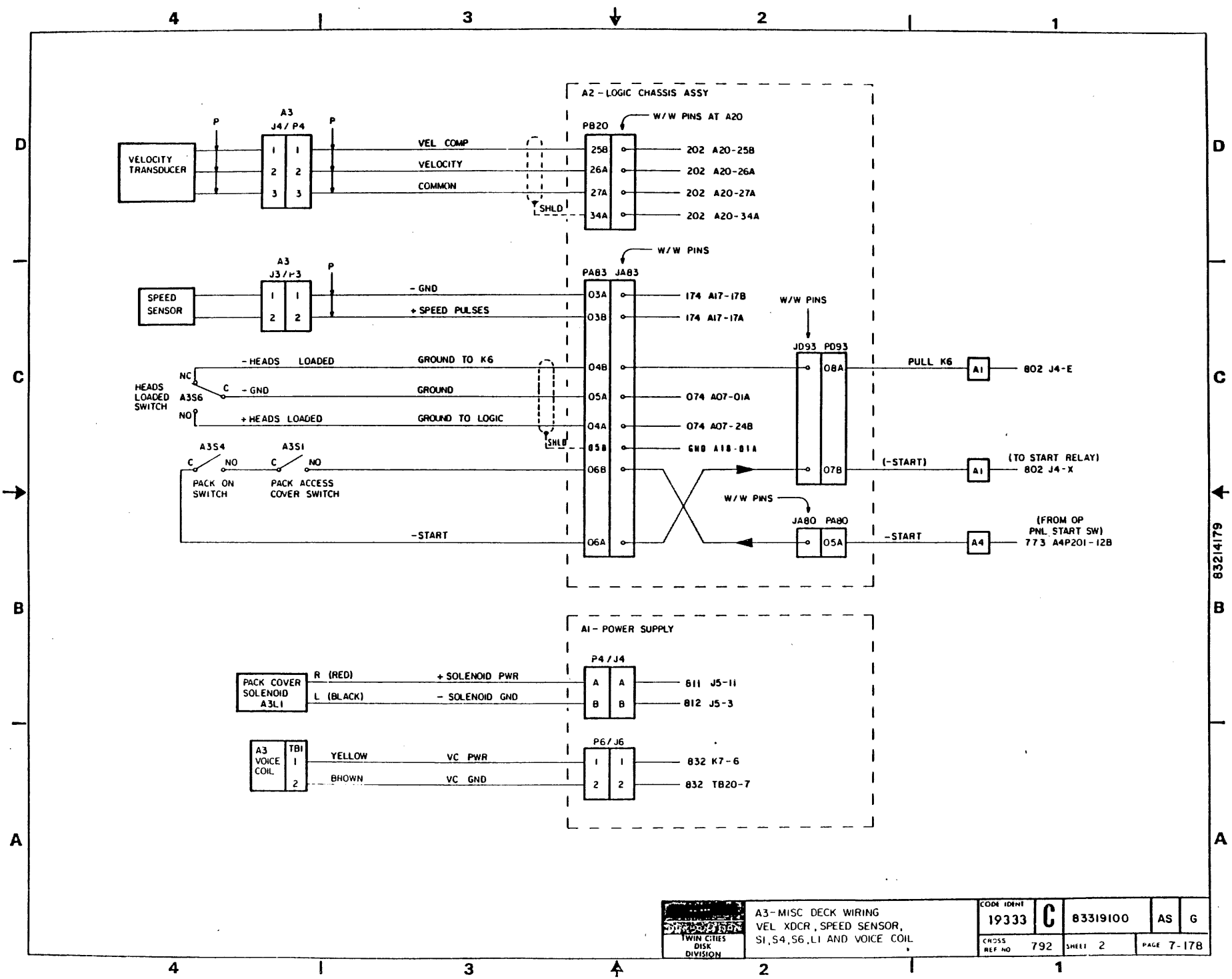
NON- VDE ONLY

DRAWN	M ANDERSON	5/1-/76
CHECKED		
ENGINEER		5/25/76
APPROVED		

TWIN CITIES DISK DIVISION

A3 - MISC DECK WIRING DIAGRAMS

CODE IDENT 19333	C	83319100	AS	G
CROSS REF NO 791		SHEET 1 OF 2	PAGE 7-177	



CONTROL DATA TWIN CITIES DISK DIVISION	A3-MISC DECK WIRING VEL XDCR, SPEED SENSOR, S1,S4,S6,L1 AND VOICE COIL	CODE IDENT 19333	C	83319100	AS	G
		CROSS REF NO 792	SHEET 2	PAGE 7-178		

REVISIONS					
REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	DJ23000 DJ3711	CLASS A RELEASED BY ECO	BJP	72385	

8321496

VDE ONLY

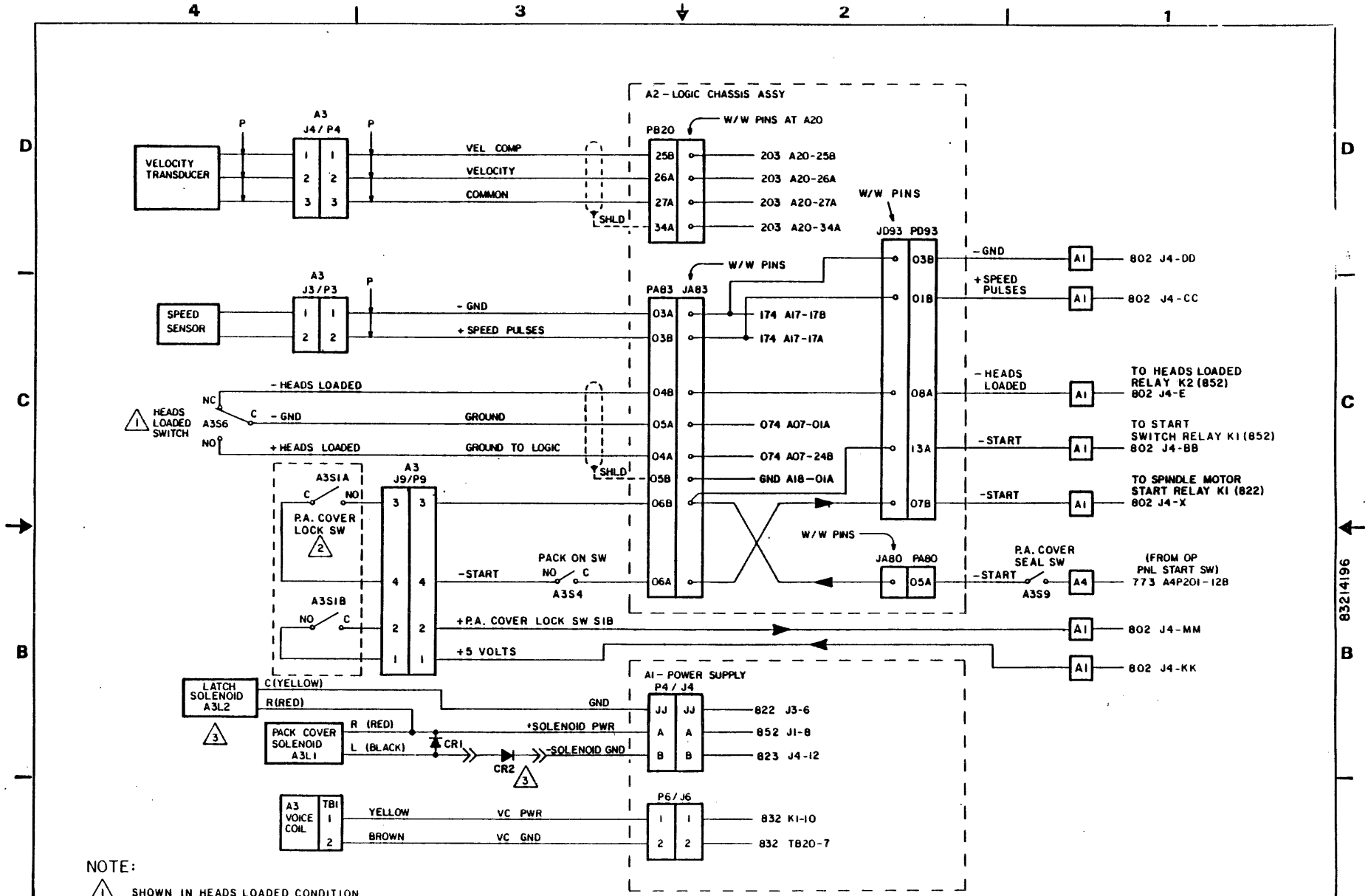
DRAWN	BJP	8.9.85
CHECKED		
ENGINEER	B WEIST	8.9.85
APPROVED		

TWIN CITIES DISK DIVISION

A3 - MISC DECK WIRING DIAGRAMS

CODE IDENT				
19333	C	83319100	AS	A

CROSS REF NO 791 | SHEET 1 OF 2 | PAGE 7-179



NOTE:

1. SHOWN IN HEADS LOADED CONDITION.
2. START SW "ON" CAUSES S1A AND S1B TO CLOSE.
3. FOR OPTIONAL LATCH SOLENOID ONLY.

TWIN CITIES DISK DIVISION	A3-MISC DECK WIRING VEL XDCR, SPEED SENSOR, S1,S4,S6,S9,L1 AND VOICE COIL	CODE IDENT 19333	C	83319100	AS A
		CROSS REF NO 792		SHEET 2	PAGE 7-180

83214196

REVISIONS

REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA	6-2-76	MK
B	PE22820	ADD PACK COVER	MA	11-17-76	MK
C	PE22842	CORRECT DIAGRAMS	WEB	12-2-76	MK
D	PE57130	BLOWER WIRING	MA	4-16-79	MK
E	PE57381	CHG NOISE CAPS	TH	9-25-80	MK
F	PE57552	CHG TO FUSED P/S	DLM	5-12-81	MKP
G	PE57552A	POWER SUPPLY IS FAILING	DLM	6-8-81	MKP
H	PE13013	ADD NOTES TO L/D	CB	6-30-81	MMP
J	DH13070	NEW NON-VDE P/S	MKP	10-9-81	
K	DH13070A	NEW NON-VDE P/S	CB	8-26-82	
L	DH13152	ADD NOTES TO L.D.	DMF	2-3-82	
M	DH13238	CHG CKT BREAKER	DLF	8-2-82	GAM
N	DH13304	CORRECT DIAGRAMS	HDK	10-8-82	SMS
P	DH13266	INC VDE P/S	DLF	11-23-82	GAM
R	DJ22000	XFER FROM PE	DLS	1-29-84	BJP
T	DJ13406C	CHG DIAGRAMS	DLS	1-29-84	BJP
U	DJ13631	SEE SHEET 2	JHM	10-23-84	BJP
V	DJ13711	VDE NON-VDE LOGIC	BJP	6-25-85	BJP

8321480

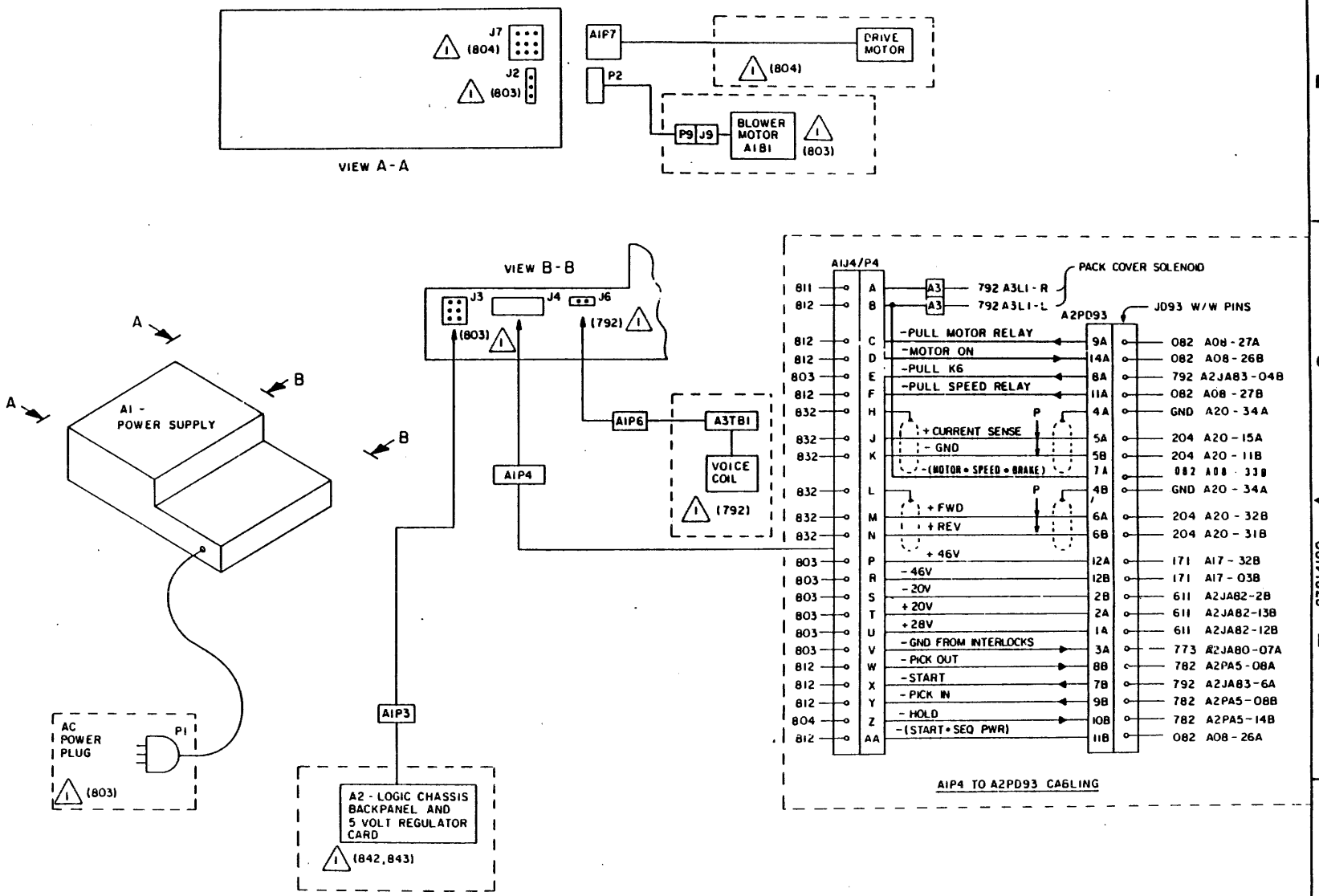
NON-VDE ONLY

DRAWN	G. RABINE	2/4/76
CHECKED		
ENGINEER	G. Rabine	2/17/76
APPROVED		

TWIN CITIES DISK DIVISION

A1 - POWER SUPPLY DIAGRAMS

CODE IDENT				
19333	C	83319100	AS	V
CROSS REF NO 801	SHEET 1 of 4	DWG 7-181		

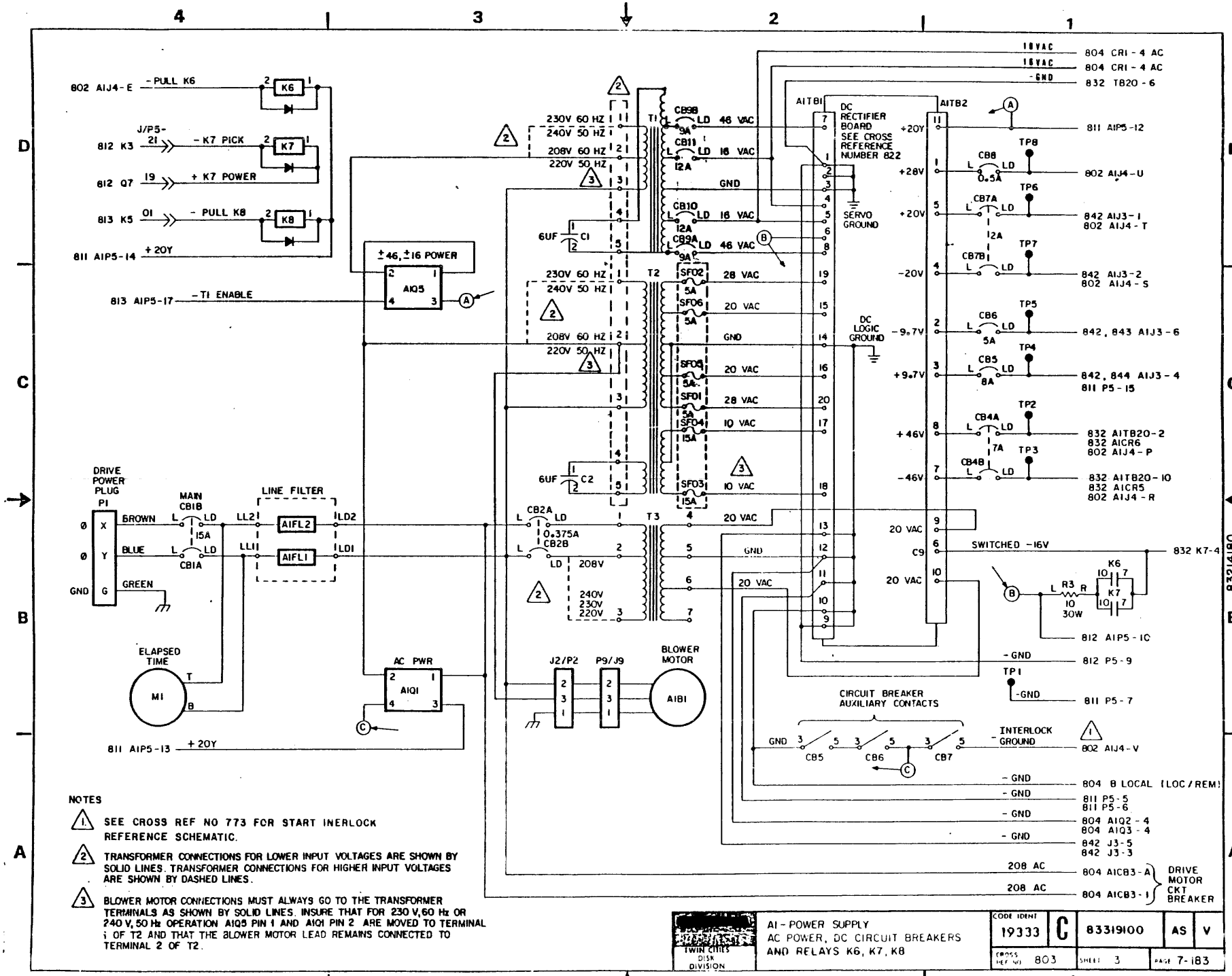


NOTES:

(1) NUMBERS INSIDE PARENTHESIS ARE CROSS REFERENCE NUMBERS WHERE DETAILED CABLING INFORMATION MAY BE FOUND.

83219180

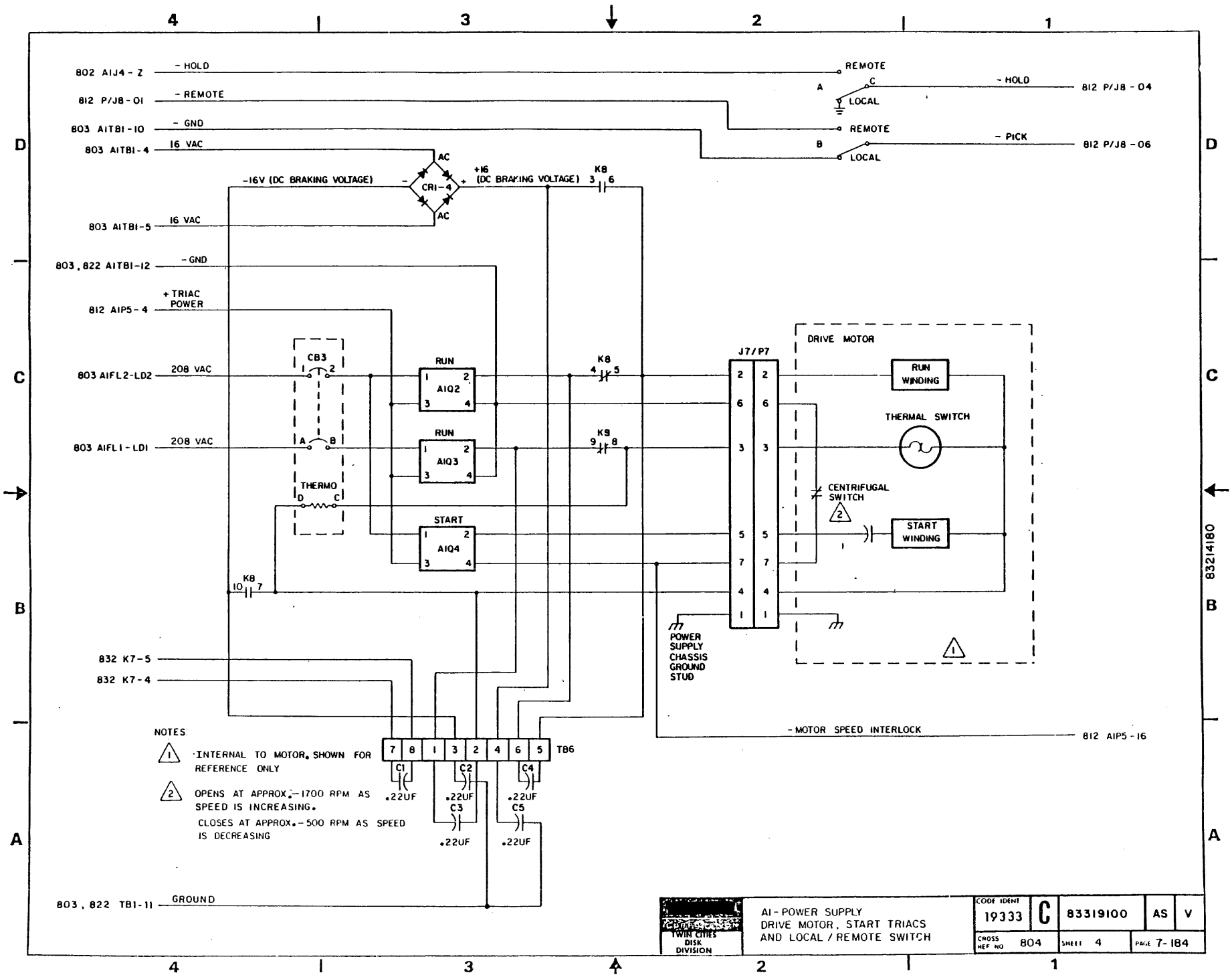
CONTROL DATA CORPORATION TWIN CITIES DISK DIVISION	A1 - POWER SUPPLY EXTERNAL CABLING	CODE IDENT 19333	C	83319100	AS V
		CROSS REF NO 802	SHEET 2	PAGE 7-182	



NOTES

1. SEE CROSS REF NO 773 FOR START INERLOCK 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.

TWIN CITIES DISK DIVISION	A1 - POWER SUPPLY AC POWER, DC CIRCUIT BREAKERS AND RELAYS K6, K7, K8	CODE IDENT 19333	C	83319100	AS V
		CROSS REF NO 803	SHEET 3	PAGE 7-183	



CONTROL DATA TWIN CITIES DISK DIVISION	AI-POWER SUPPLY DRIVE MOTOR, START TRIACS AND LOCAL / REMOTE SWITCH	CODE IDENT 19333	C	83319100	AS V
		CROSS REF NO 804	SHEET 4	PAGE 7-184	

REVISIONS					
REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	DJ23000 DJ13711	CLASS A RELEASED BY ECO	BJP	72385	

VDE ONLY

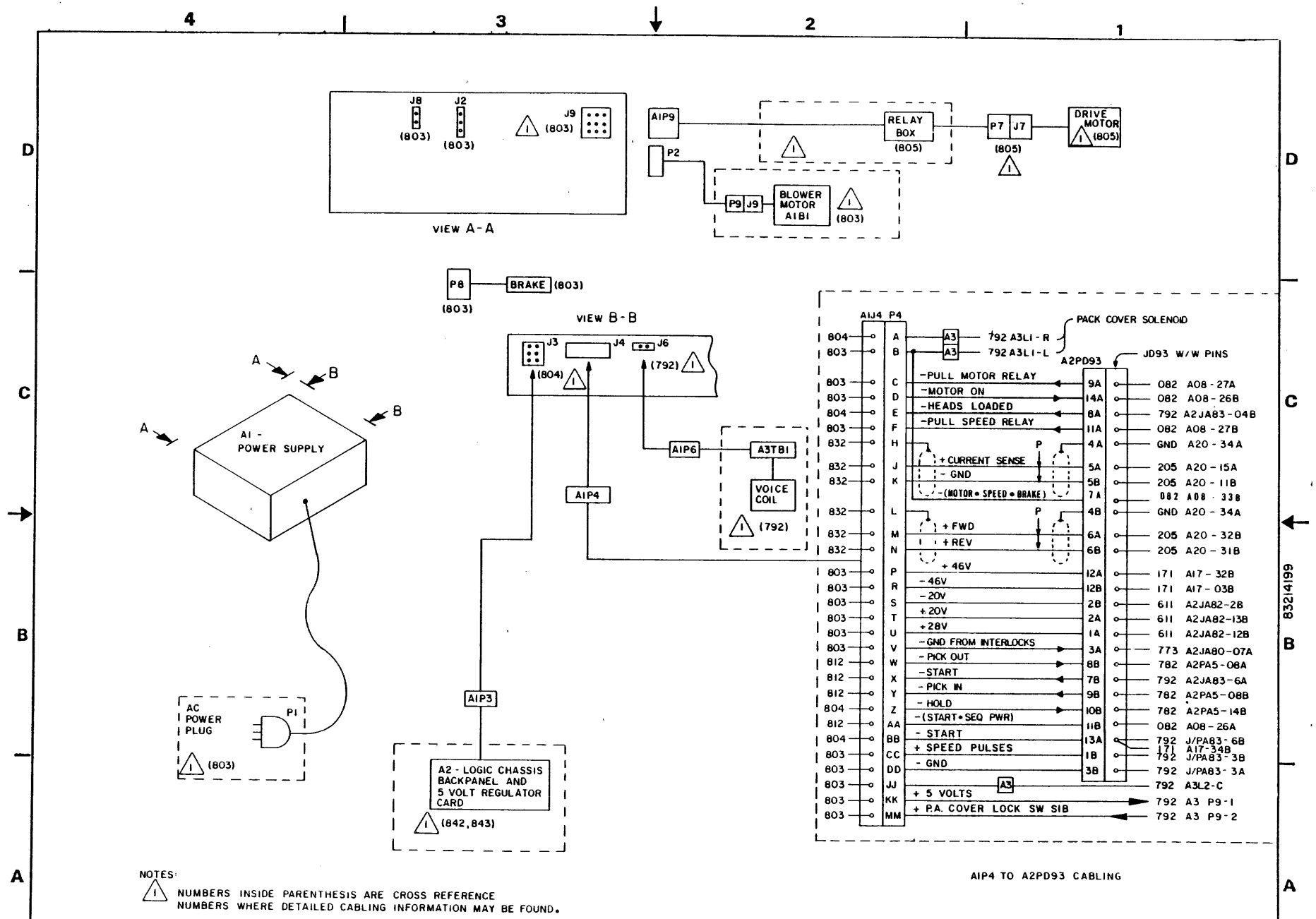
DRAWN	BJP	8.7.85
CHECKED		
ENGINEER	B WEIST	8.7.85
APPROVED		

TWIN CITIES DISK DIVISION

A1 - POWER SUPPLY DIAGRAMS

CODE IDENT NO				
19333	C	83319100	AS	A
CROSS REF NO 801	SHEET 1 OF 5	PAGE 7-185		

83214199

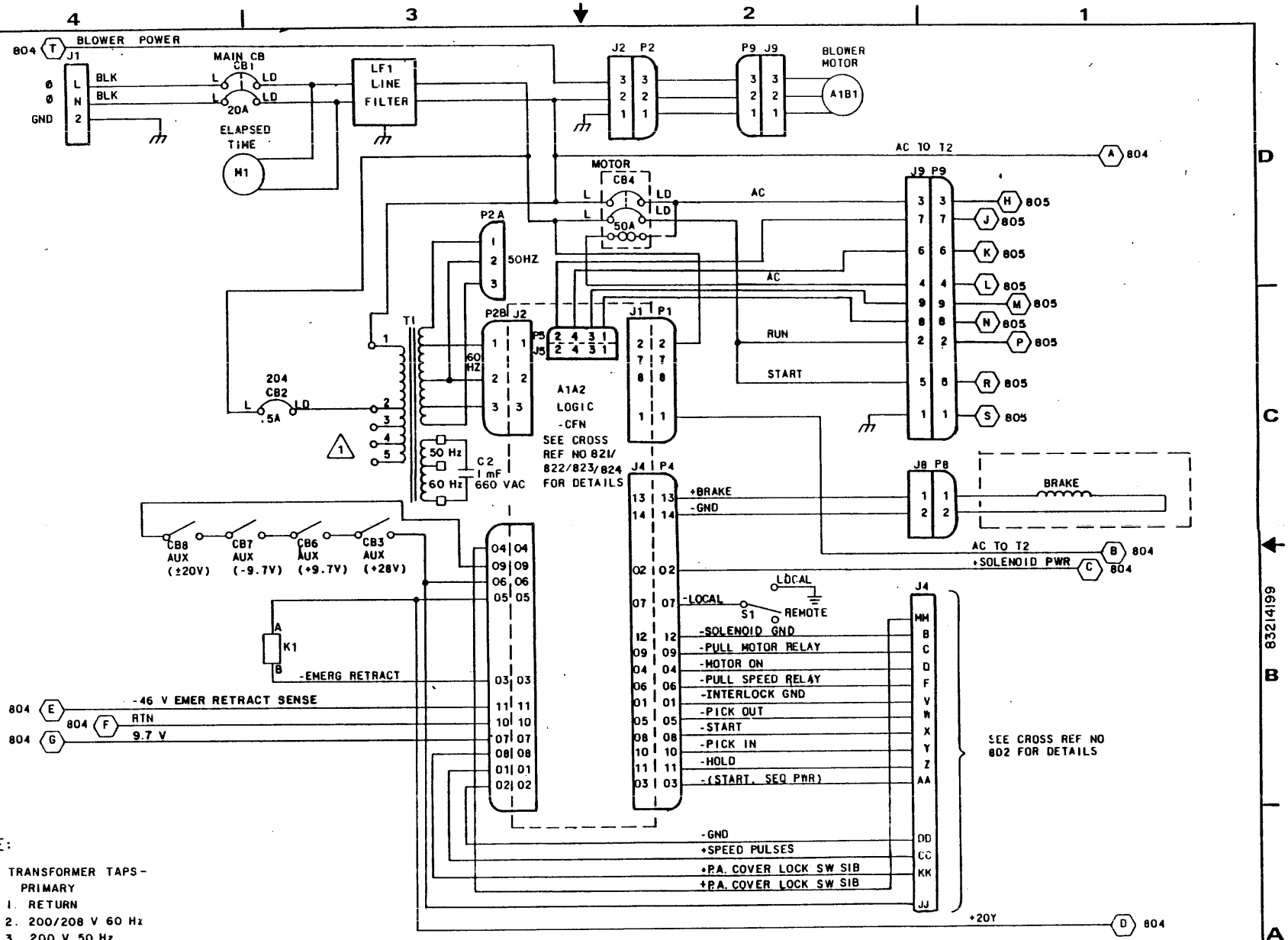


NOTES:

(1) NUMBERS INSIDE PARENTHESIS ARE CROSS REFERENCE NUMBERS WHERE DETAILED CABLING INFORMATION MAY BE FOUND.

TWIN CITIES DISK DIVISION	A1 - POWER SUPPLY EXTERNAL CABLING	CODE IDENT 19333	C	83319100	AS A
		CROSS REF NO 802	SHEET 2	PAGE 7-186	

83214199



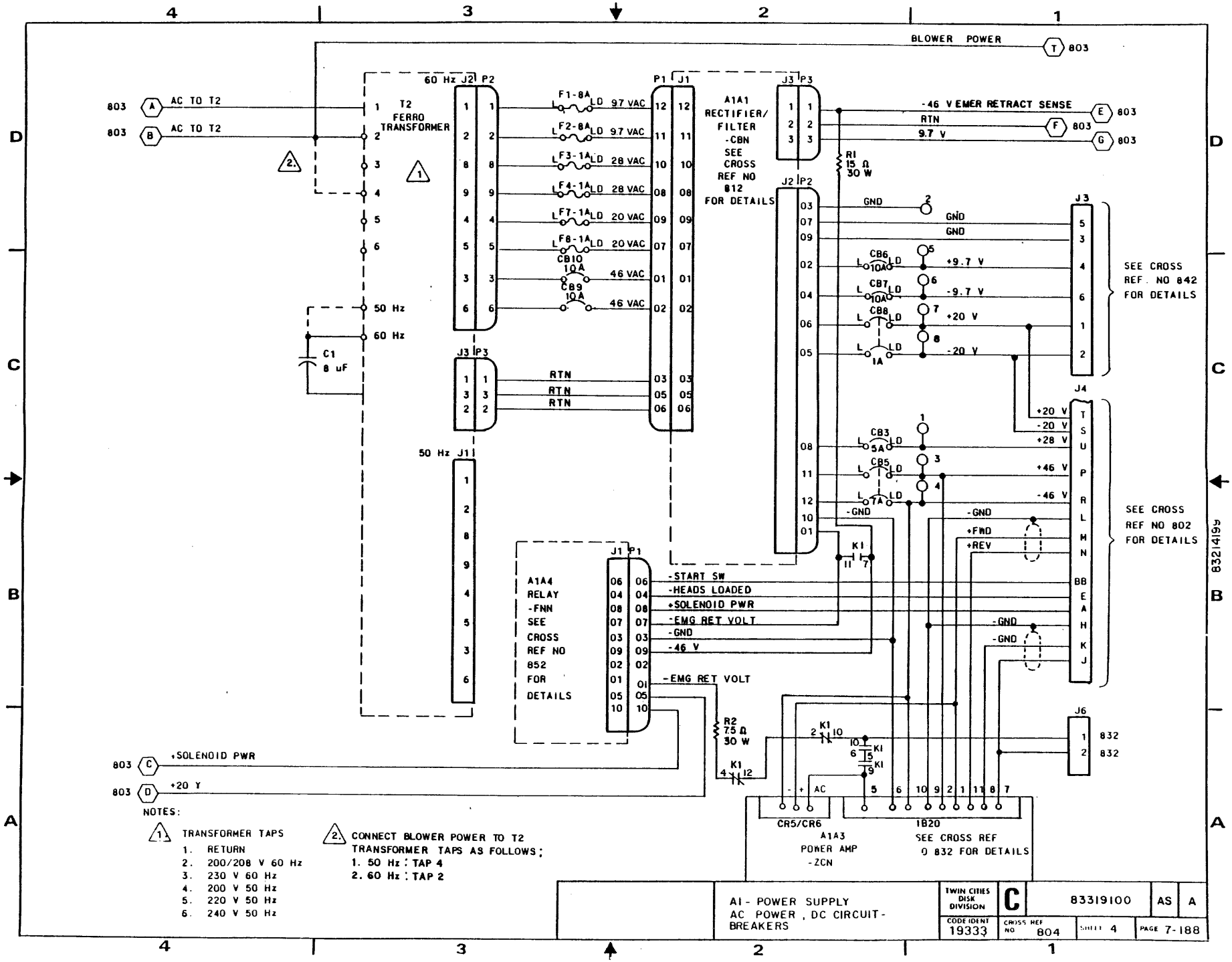
NOTE:

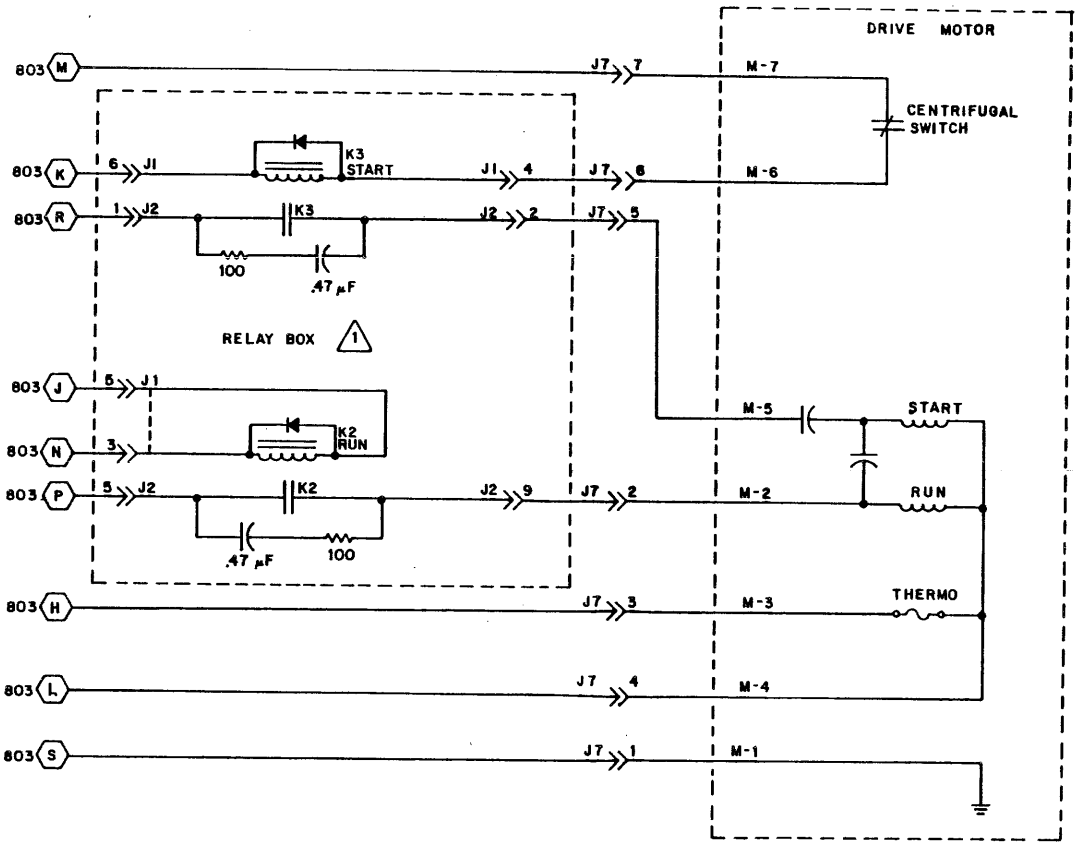
1. TRANSFORMER TAPS -
   PRIMARY
   1. RETURN
   2. 200/208 V 60 Hz
   3. 200 V 50 Hz
   3. 230 V 60 Hz
   4. 220 V 50 Hz
   5. 240 V 50 Hz

   SECONDARY
   INSTALL P2A AT J2 FOR 50 Hz
   INSTALL P2B AT J2 FOR 60 Hz

AI-POWER SUPPLY AC POWER, MOTOR, BRAKE AND LOCAL/REMOTE SWITCH	TWIN CITIES DISK DIVISION	C	83319100	AS A
	CODE IDENT 19333	CROSS REF NO 803	SHEET 3	PAGE 7-187

83214199


BLOWER POWER
T 803
803 A AC TO T2
803 B AC TO T2
T2 FERRO TRANSFORMER
60 Hz J2 P2
50 Hz
60 Hz
C1 8 uF
F1-8A LD 97 VAC
F2-8A LD 97 VAC
F3-1A LD 28 VAC
F4-1A LD 28 VAC
F7-1A LD 20 VAC
F8-1A LD 20 VAC
CB10 10A 46 VAC
CB9 10A 46 VAC
P1 J1
J3 P3
RTN
RTN
RTN
50 Hz J11
A1A1 RECTIFIER/ FILTER -CBN SEE CROSS REF NO 812 FOR DETAILS
-46 V EMER RETRACT SENSE
RTN
9.7 V
E 803
F 803
G 803
R1 15 Ω 30 W
J2 P2
GND
GND
GND
CB6 10A +9.7 V
CB7 10A -9.7 V
CB8 1A +20 V
-20 V
J3
SEE CROSS REF. NO 842 FOR DETAILS
J4
+20 V
-20 V
CB3 5A +28 V
CB5 7A +46 V
-46 V
-GND
-GND
+FWD
+REV
SEE CROSS REF NO 802 FOR DETAILS
K1
A1A4 RELAY -FNN SEE CROSS REF NO 852 FOR DETAILS
J1 P1
-START SW
-HEADS LOADED
+SOLENOID PWR
-EMG RET VOLT
-GND
-46 V
-EMG RET VOLT
R2 7.5 Ω 30 W
K1 J2
803 C +SOLENOID PWR
803 D +20 V
J6
832
832
CR5/CR6 A1A3 POWER AMP -ZCN
1B20 SEE CROSS REF 0 832 FOR DETAILS
NOTES:
1. TRANSFORMER TAPS
1. RETURN
2. 200/208 V 60 Hz
3. 230 V 60 Hz
4. 200 V 50 Hz
5. 220 V 50 Hz
6. 240 V 50 Hz
2. CONNECT BLOWER POWER TO T2 TRANSFORMER TAPS AS FOLLOWS;
1. 50 Hz : TAP 4
2. 60 Hz : TAP 2
A1- POWER SUPPLY
AC POWER , DC CIRCUIT-BREAKERS
TWIN CITIES DISK DIVISION
C
83319100
AS
A
CODE IDENT 19333
CROSS REF NO 804
SHEET 4
PAGE 7-188
83214199



1 RELAY BOX MOUNTED TO FRAME, BETWEEN POWER SUPPLY AND DRIVE MOTOR.

	RELAY BOX AND DRIVE MOTOR DIAGRAMS	TWIN CITIES DISK DIVISION	C	83319100	AS	A
		CODE IDENT 19333	CROSS REF NO 805	SHEET 5	PAGE 7-189	

REVISIONS					
REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	DJ23000 DJ13602	CLASS A RELEASE BY ECO	T T	9 18 84	JL

VDE ONLY APPLICABLE TO S/C 41 AND ABOVE

DRAWN	Thomas B. Thiss	10-17-84
CHECKED	LOHMACHAN	10-25-84
ENGINEER	B.WEIST	8-17-84
APPROVED		

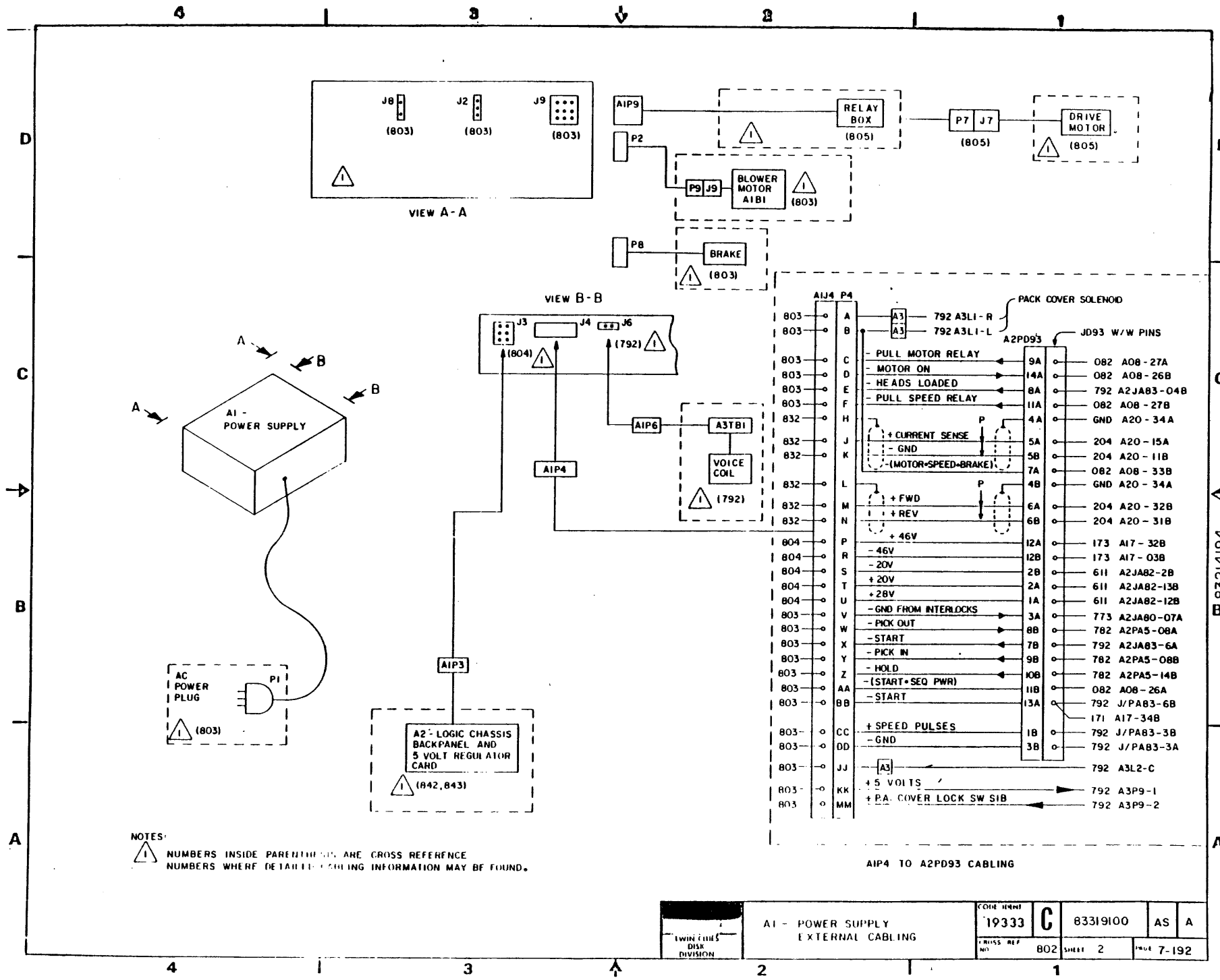
[redacted]
TWIN CITIES DISK DIVISION

AI - POWER SUPPLY DIAGRAMS

CODE IDENT				
19333	C	83319100	AS	A
CROSS REF NO 801	SHEET 1 OF 5	PAGE 7-191		

2 REF 83214194

83214194 B



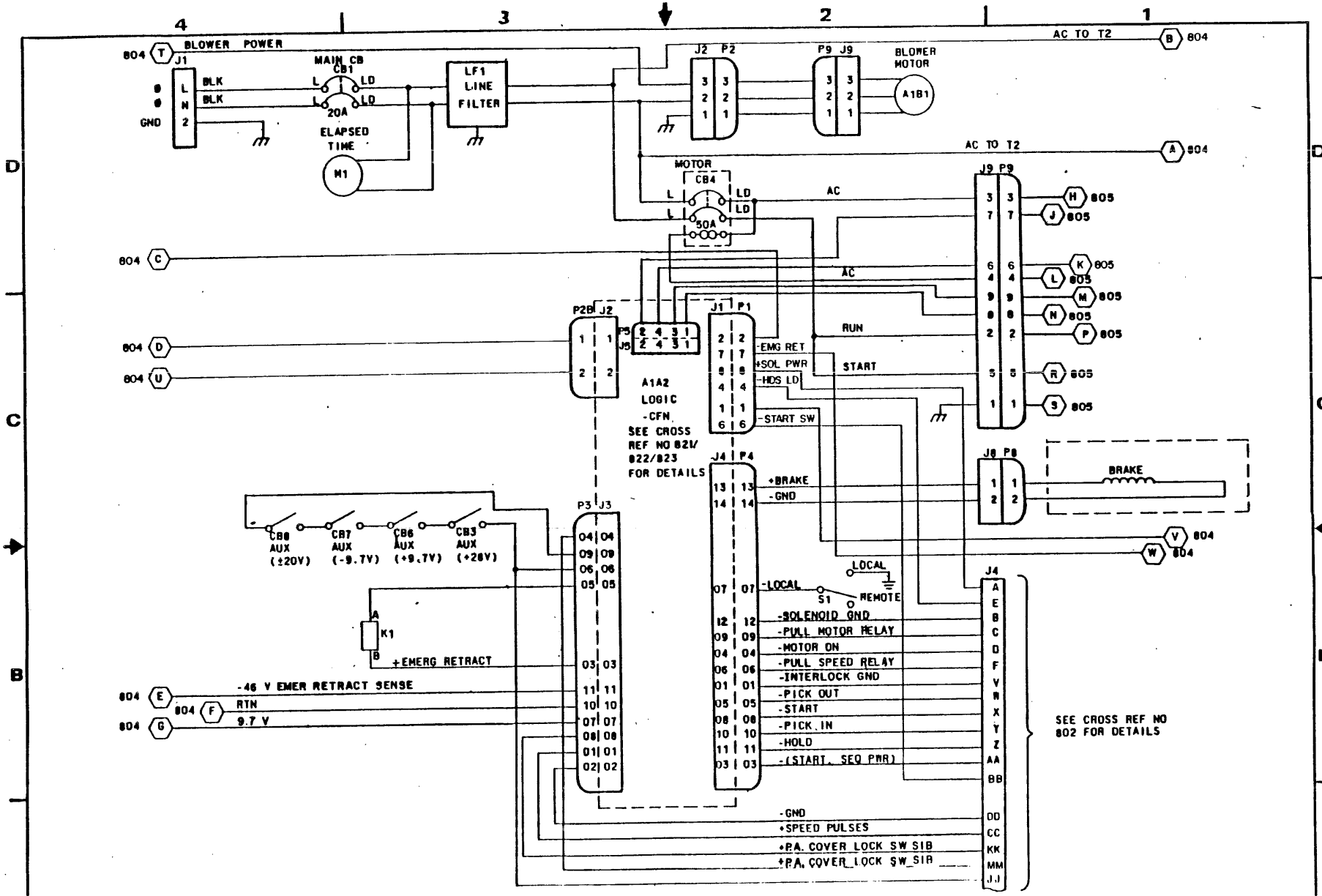
AIP4 TO A2PD93 CABLING

NOTES:

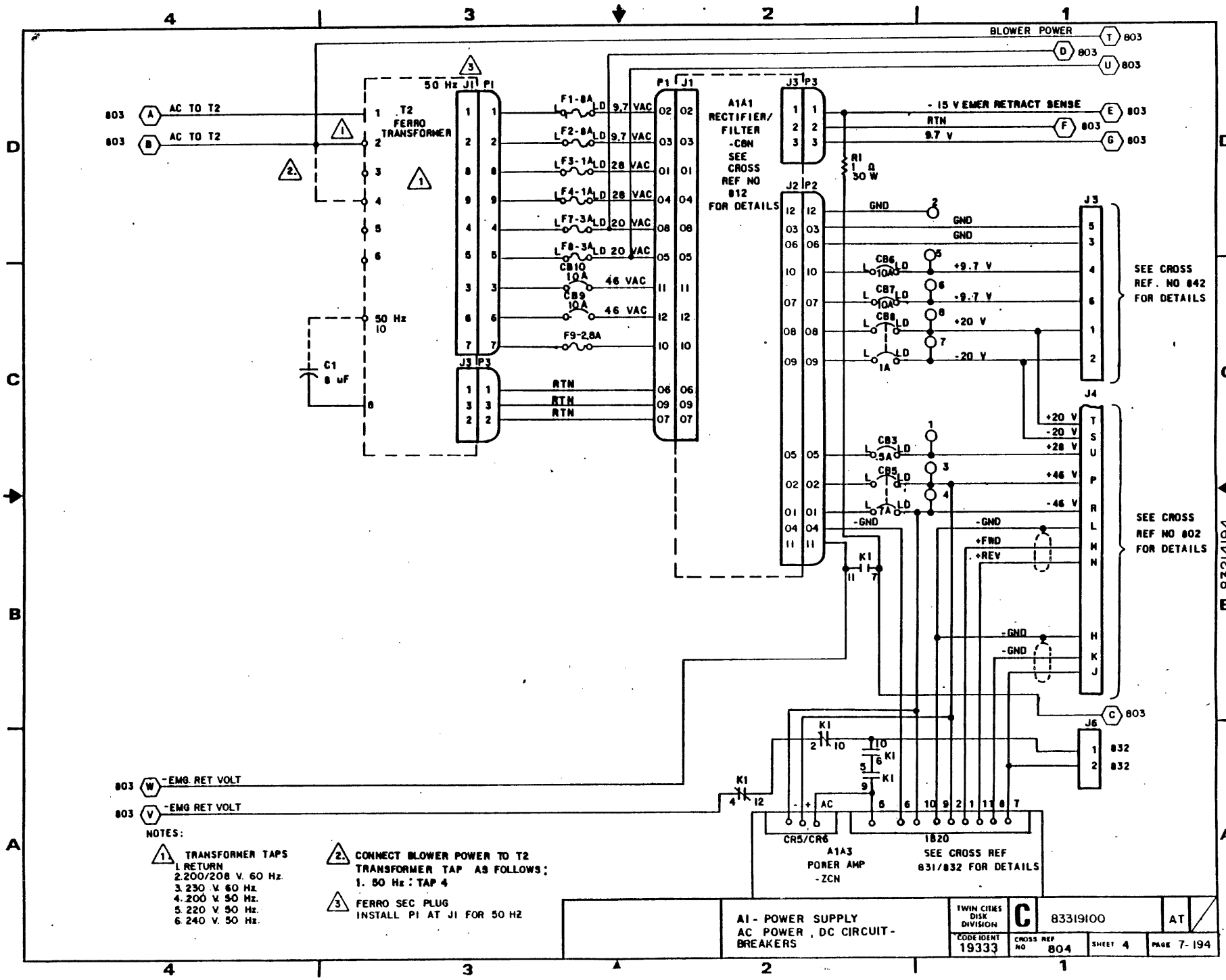
1. NUMBERS INSIDE PARENTHESES ARE CROSS REFERENCE NUMBERS WHERE DETAILED CABLING INFORMATION MAY BE FOUND.

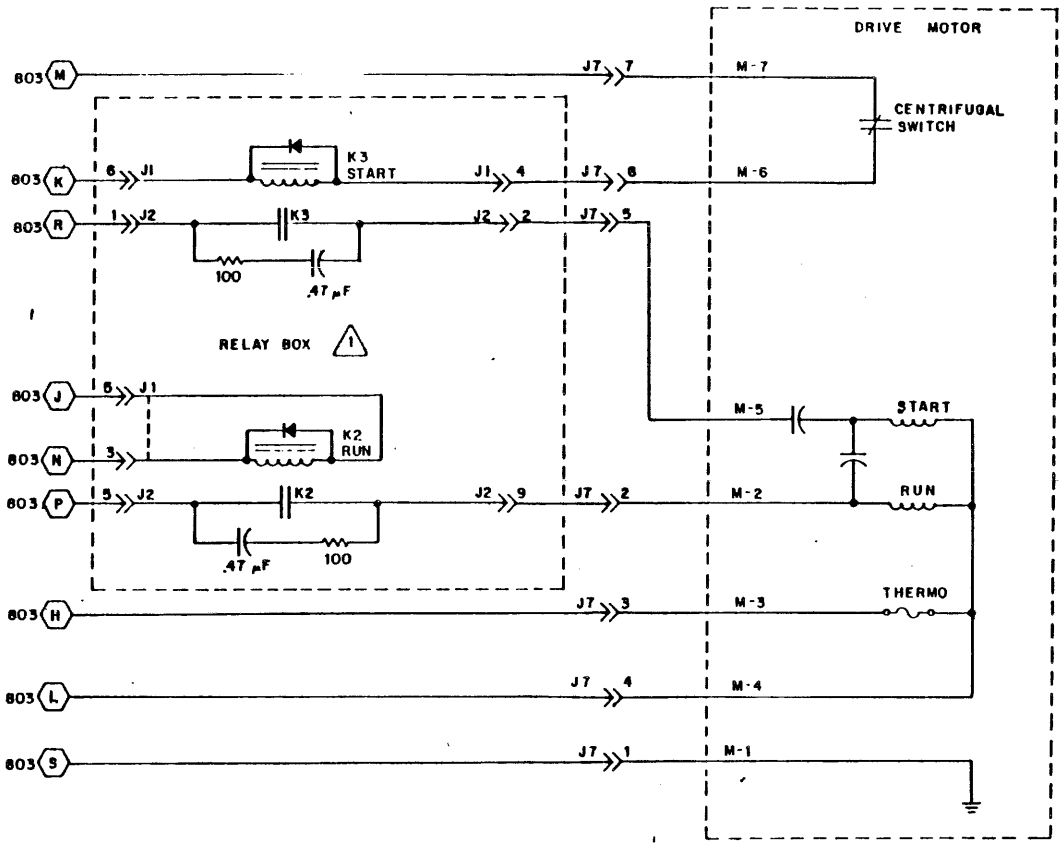
TWIN CITIES DISK DIVISION	A1 - POWER SUPPLY EXTERNAL CABLING	CODE IDENT 19333	C	83319100	AS A
		CROSS REF NO 802	SHEET 2	ISSUE 7-192	

83214194



	A1-POWER SUPPLY AC POWER, MOTOR, BRAKE AND LOCAL/REMOTE SWITCH	TWIN CITIES DISK DIVISION	C	83319100	AS
		CIDE IDENT 19333	CROSS REF NO 803	SHEET 3	PAGE 7-193


BLOWER POWER
T 803
D 803
U 803
803 A AC TO T2
803 B AC TO T2
T2 FERRO TRANSFORMER
50 Hz J1 P1
F1-8A LD 9.7 VAC
F2-8A LD 9.7 VAC
F3-1A LD 28 VAC
F4-1A LD 28 VAC
F7-3A LD 20 VAC
F8-3A LD 20 VAC
CB10 10A 46 VAC
CB9 10A 46 VAC
F9-2.8A
50 Hz 10
C1 8 uF
RTN
RTN
RTN
A1A1 RECTIFIER/ FILTER -CBN SEE CROSS REF NO 812 FOR DETAILS
J3 P3
J2 P2
J1 P1
R1 1 Ω 30 W
- 15 V EMER RETRACT SENSE
RTN
9.7 V
E 803
F 803
G 803
GND
GND
GND
CB6 10A LD +9.7 V
CB7 10A LD -9.7 V
CB8 LD +20 V
1A LD -20 V
SEE CROSS REF. NO 842 FOR DETAILS
J4
+20 V
-20 V
+28 V
CB3 5A LD
CB5 LD +46 V
7A LD -46 V
-GND
-GND
+FWD
+REV
K1
SEE CROSS REF NO 802 FOR DETAILS
-GND
-GND
C 803
J6
1 832
2 832
803 W -EMG. RET VOLT
803 V -EMG RET VOLT
K1
K1
K1
K1
- + AC
CR5/CR6
A1A3 POWER AMP -ZCN
1820
SEE CROSS REF 831/832 FOR DETAILS
NOTES:
1. TRANSFORMER TAPS
L RETURN
2. 200/208 V. 60 Hz.
3. 230 V. 60 Hz.
4. 200 V. 50 Hz.
5. 220 V. 50 Hz.
6. 240 V. 50 Hz.
2. CONNECT BLOWER POWER TO T2 TRANSFORMER TAP AS FOLLOWS:
1. 50 Hz : TAP 4
3. FERRO SEC PLUG
INSTALL P1 AT J1 FOR 50 HZ
A1 - POWER SUPPLY
AC POWER , DC CIRCUIT-BREAKERS
TWIN CITIES DISK DIVISION
C
83319100
AT
CODE IDENT 19333
CROSS REF NO 804
SHEET 4
PAGE 7-194
83214194

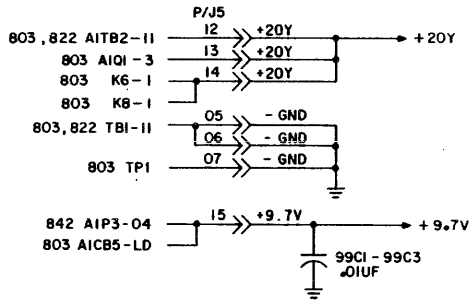


1 RELAY BOX MOUNTED TO FRAME, BETWEEN POWER SUPPLY AND DRIVE MOTOR.

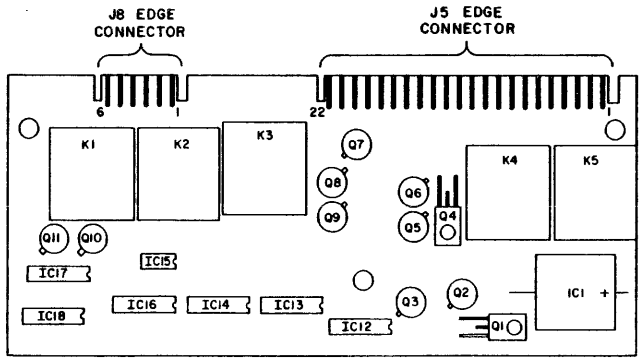
	RELAY BOX AND DRIVE MOTOR DIAGRAMS	TWIN CITIES DISK DIVISION	C	83319100	AS A
		CODE IDENT 19333	CROSS REF NO 805	SHEET 5	PAGE 7-195

83214194

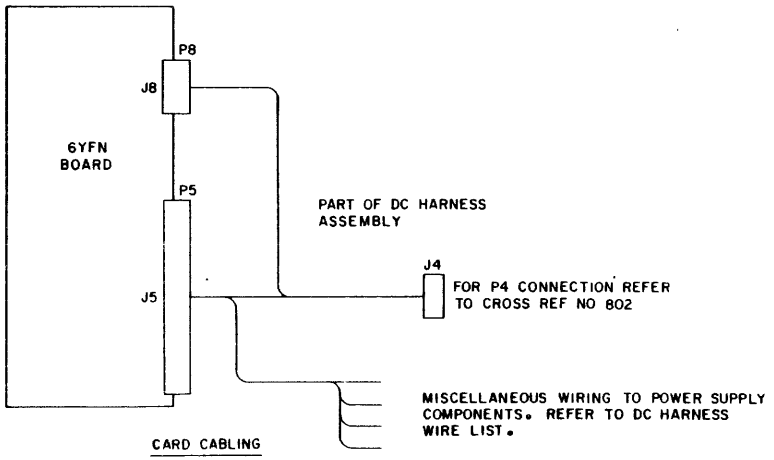
REVISIONS					
REV.	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA	2-19-76	
B	PE22842	SCHEMATIC CORRECTIONS	MLA	1-4-76	
C	PE22854	ERROR CORRECTIONS	GR	3-15-77	
D		EDITORIAL	MA	5-23-77	
E	PE55259	LOGIC DIAG IMPROVEMENT	MA	10-4-78	



POWER WIRING



CARD COMPONENT LAYOUT



CARD CABLING

APPLICABLE ONLY BJ4A2 - C, D, N & P

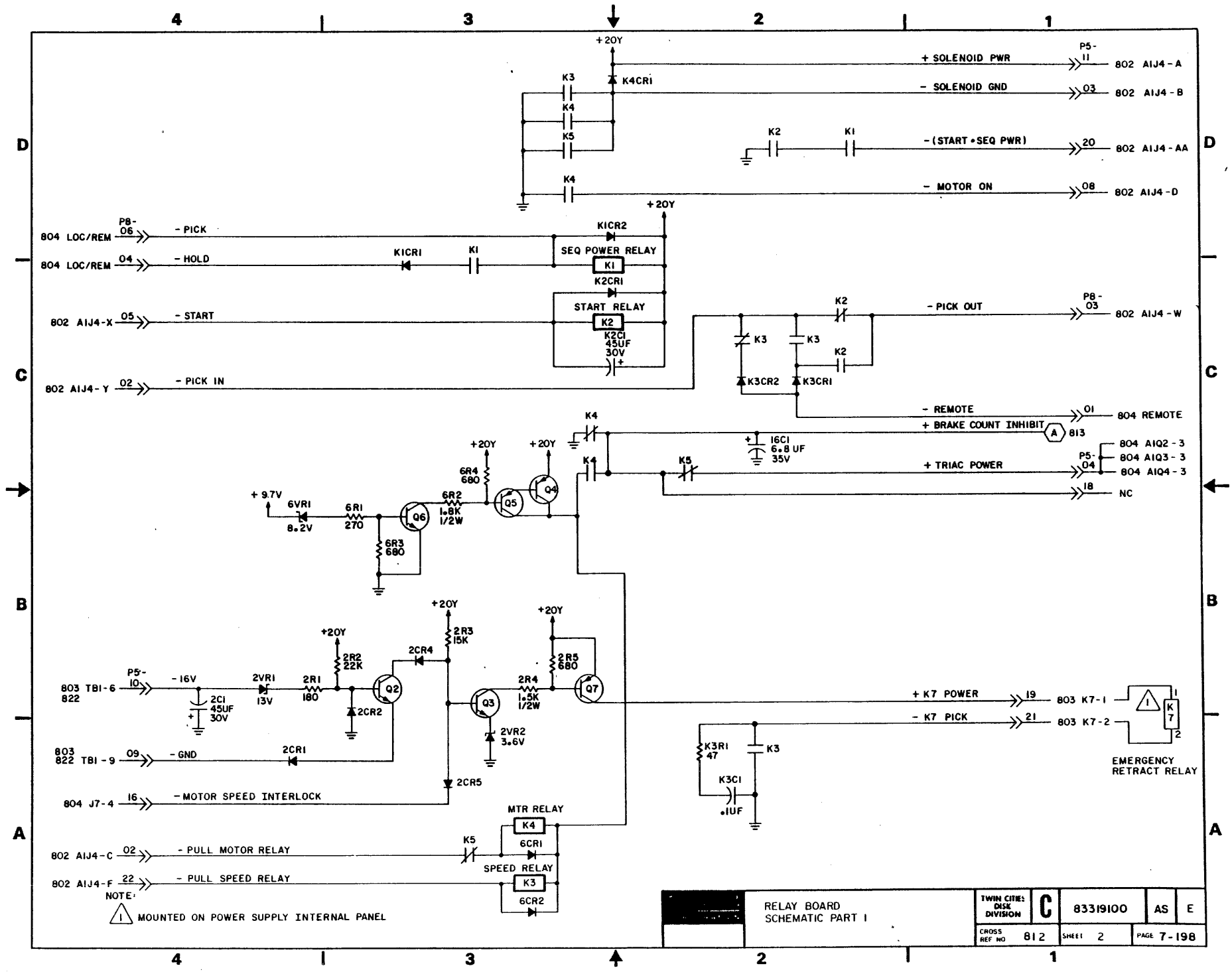
DRAWN	G RABINE	2/11/76
CHECKED		
ENGINEER		
APPROVED		

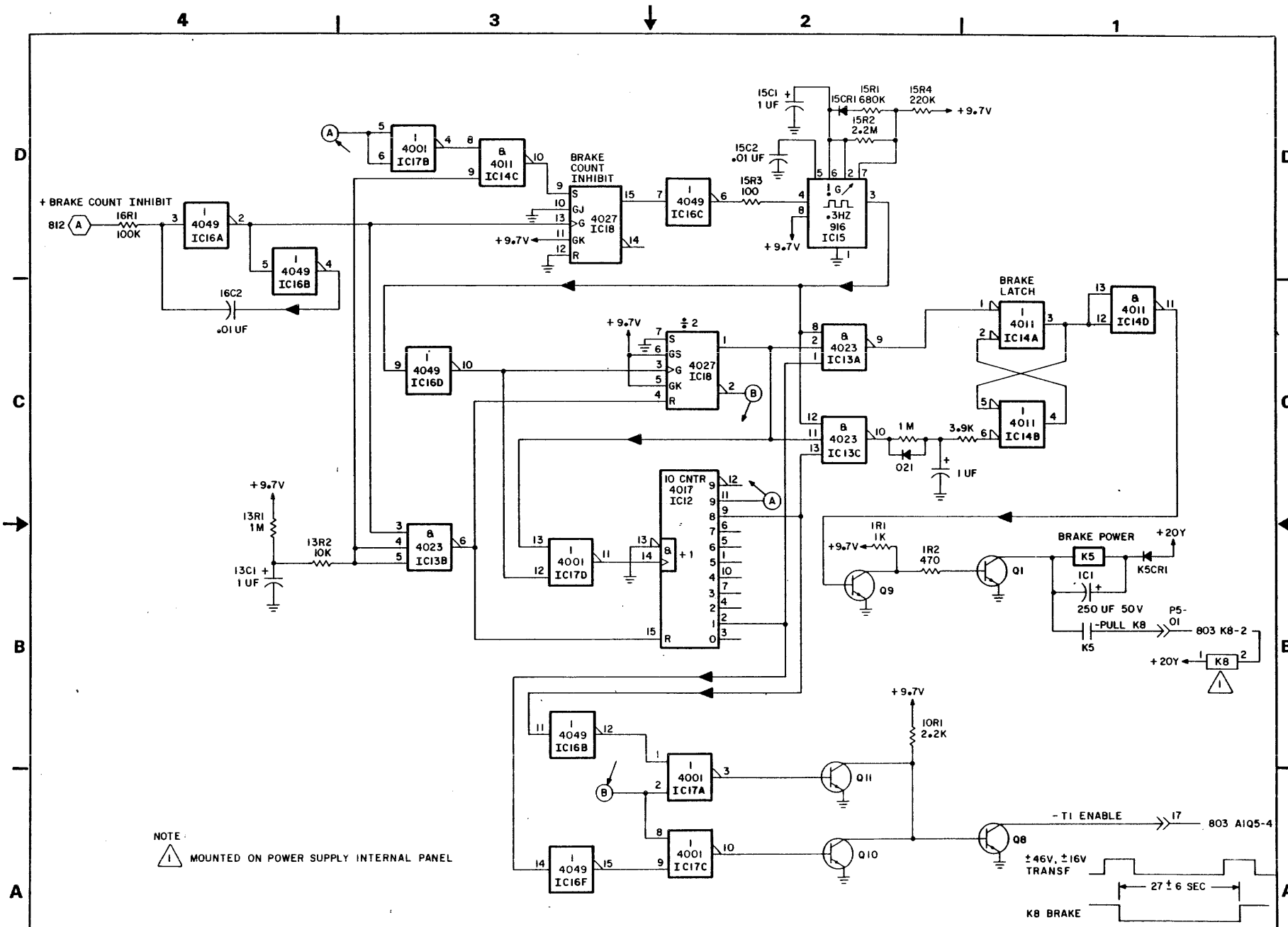
RELAY BOARD POWER WIRING, COMPONENT LAYOUT AND CABLING DIAGRAMS
TYPE 6YFN

TWIN CITIES DISK DIVISION | C | 83319100 | AS | E

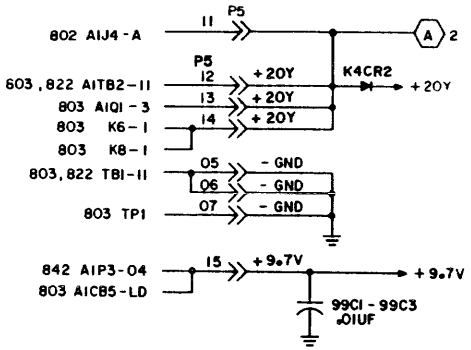
CROSS REF NO 811 | SHEET 1 OF 3 | PAGE 7-197

REF 83214181

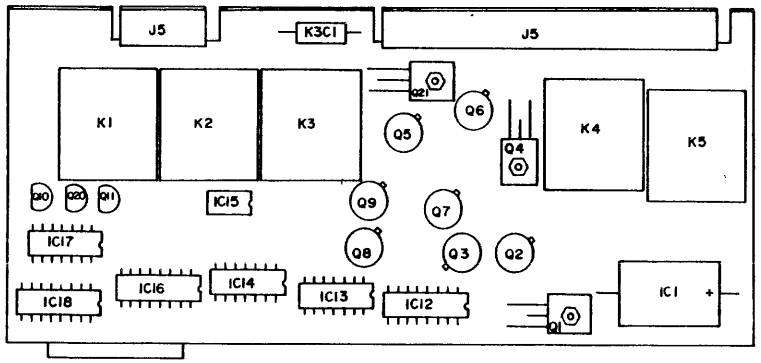

+20Y
+ SOLENOID PWR
P5-11
802 AIJ4-A
K3
K4CR1
K4
- SOLENOID GND
03
802 AIJ4-B
K5
K2
K1
-(START•SEQ PWR)
20
802 AIJ4-AA
K4
- MOTOR ON
08
802 AIJ4-D
804 LOC/REM
P8-06
- PICK
K1CR2
SEQ POWER RELAY
K1
804 LOC/REM
04
- HOLD
K1CR1
K1
K2CR1
START RELAY
K2
802 AIJ4-X
05
- START
K2C1
45UF
30V
802 AIJ4-Y
02
- PICK IN
K2
- PICK OUT
P8-03
802 AIJ4-W
K3
K3
K2
K3CR2
K3CR1
- REMOTE
01
804 REMOTE
K4
+ BRAKE COUNT INHIBIT
A
813
16C1
6.8 UF
35V
804 AIQ2-3
804 AIQ3-3
804 AIQ4-3
K4
K5
+ TRIAC POWER
P5-04
18
NC
+ 9.7V
6VR1
8.2V
6R1
270
6R3
680
6R2
1.8K
1/2W
6R4
680
Q6
Q5
Q4
803 TB1-6
822
P5-10
-16V
2C1
45UF
30V
2VR1
13V
2R1
180
2R2
22K
2CR2
Q2
2CR4
2R3
15K
Q3
2VR2
3.6V
2R4
1.5K
1/2W
2R5
680
Q7
+ K7 POWER
19
803 K7-1
- K7 PICK
21
803 K7-2
K7
EMERGENCY
RETRACT RELAY
K3R1
47
K3C1
.1UF
K3
803
822 TB1-9
09
- GND
2CR1
804 J7-4
16
- MOTOR SPEED INTERLOCK
2CR5
MTR RELAY
K4
6CR1
802 AIJ4-C
02
- PULL MOTOR RELAY
K5
SPEED RELAY
802 AIJ4-F
22
- PULL SPEED RELAY
K3
6CR2
NOTE:
1 MOUNTED ON POWER SUPPLY INTERNAL PANEL
RELAY BOARD
SCHEMATIC PART 1
TWIN CITIES DISK DIVISION
C
83319100
AS
E
CROSS REF NO 812
SHEET 2
PAGE 7-198


+ BRAKE COUNT INHIBIT
812
16R1 100K
16C2 .01 UF
BRAKE COUNT INHIBIT
15C1 1 UF
15R1 680K
15CR1
15R4 220K
+9.7V
15R2 2.2M
15C2 .01 UF
15R3 100
.3HZ 916 IC15
BRAKE LATCH
13R1 1M
13R2 10K
13C1 1 UF
10 CNTR 4017 IC12
1R1 1K
1R2 470
Q1
Q9
BRAKE POWER
K5
K5CR1
+20Y
1C1 250 UF 50V
-PULL K8
P5-01
803 K8-2
K8
10R1 2.2K
Q11
Q10
Q8
-T1 ENABLE
803 A1Q5-4
±46V, ±16V TRANSF
27 ± 6 SEC
K8 BRAKE
NOTE
1 MOUNTED ON POWER SUPPLY INTERNAL PANEL
RELAY BOARD SCHEMATIC PART 2
TWIN CITIES DISK DIVISION
C
83319100
AS
E
CROSS REF NO 813
SHEET 3
PAGE 7-199

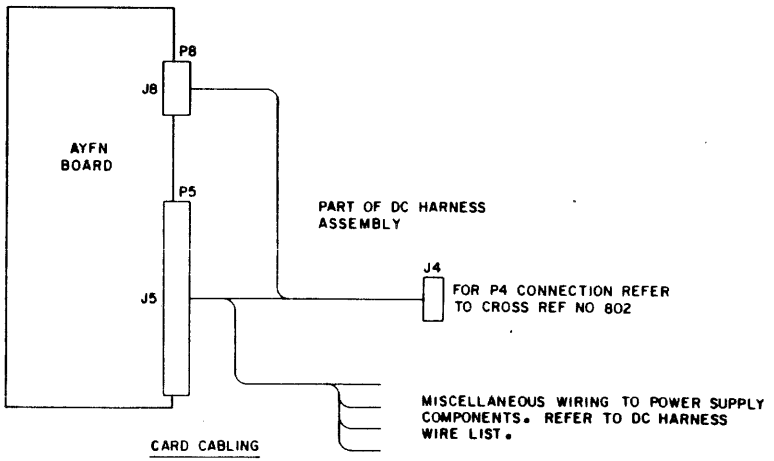
REVISIONS					
REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000 PE22820	RELEASED	SF	1-14-76	
B	PE22854	ERROR CORRECT	MA	2-15-77	
C	PE22953	ADD DIODE TO AYFN CARD	A.A.O	6-27-78	
D	PE55259	LOGIC DIAG. IMPROVEMENT	MA	10-5-78	
E	PE57450	IMP TIMING NETWORK	CB	1-27-81	
F	PE57512	REWORK AYFN	CB	3-19-82	
G	DH13230	CORRECT LOGIC DIAGRAMS	MLC	2-15-84	
H	DJ13711	CORRECTIONS	GP	9-13-85	



POWER WIRING



CARD COMPONENT LAYOUT



CARD CABLING

APPLICABLE TO ALL UNITS EXCEPT BJ4A2-C,D,N,&P

NON-VDE ONLY

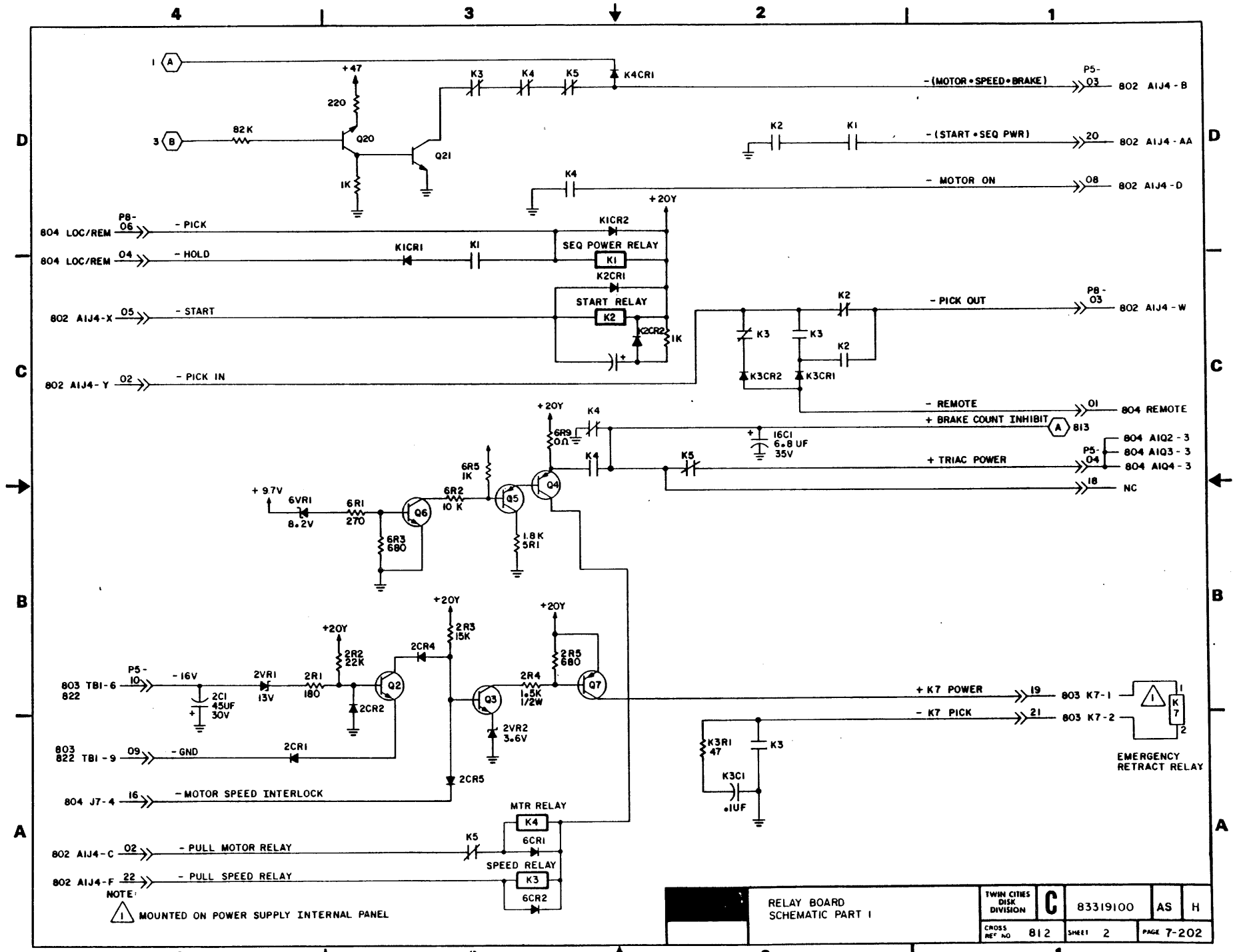
DRAWN	G. KABINE	2-11-76
CHECKED		
ENGINEER	[illegible]	3/13/76
APPROVED		

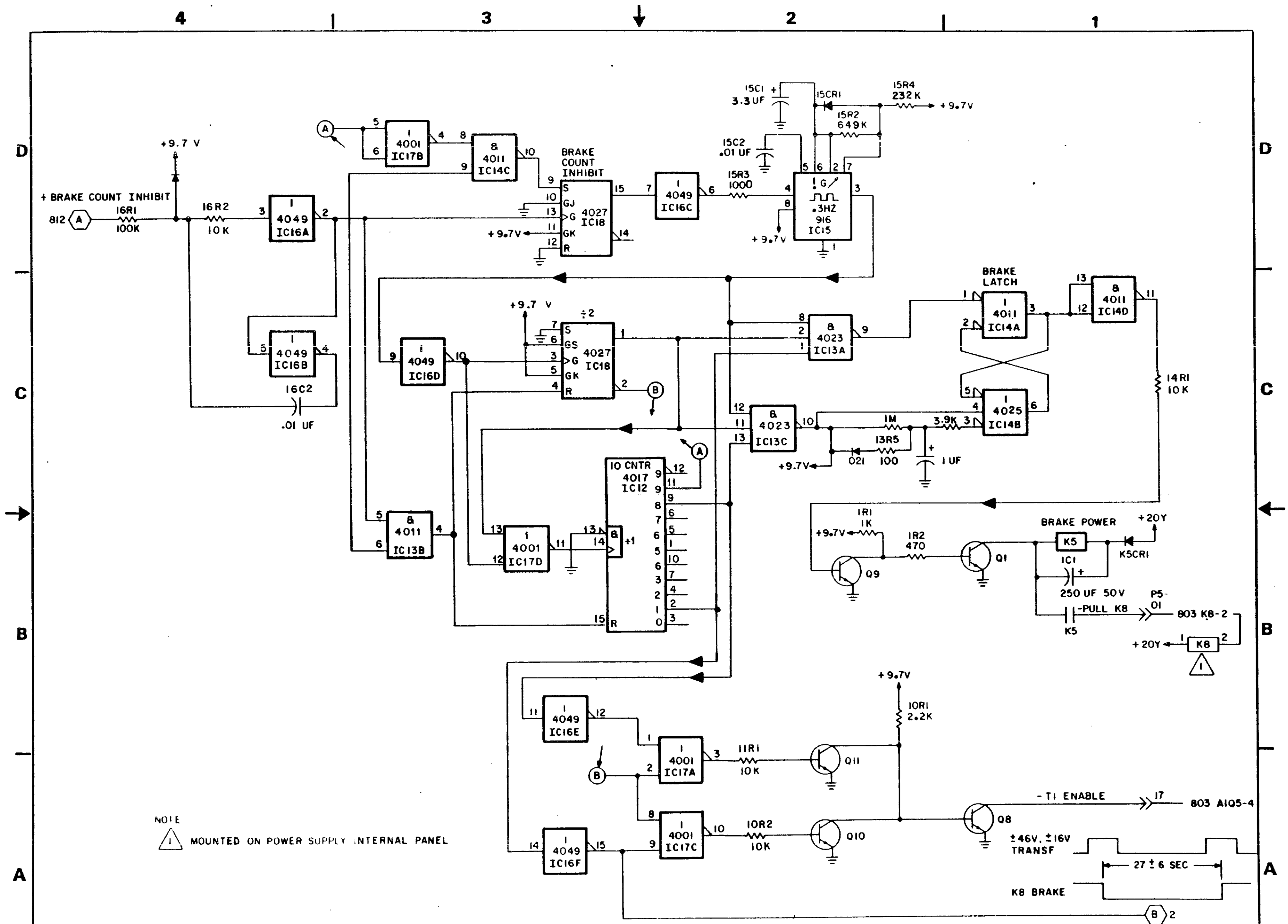
RELAY BOARD POWER WIRING, COMPONENT LAYOUT AND CABLING DIAGRAMS
TYPE AYFN

TWIN CITIES DISK DIVISION | C | 83319100 | AS | H

CROSS REF NO 811 | SHEET 1 of 3 | PAGE 7-201

REF 83214187


4
3
2
1
D
C
B
A
+47
220
82K
Q20
Q21
1K
K3
K4
K5
K4CR1
- (MOTOR • SPEED • BRAKE)
P5-03
802 AIJ4 - B
K2
K1
- (START • SEQ PWR)
20
802 AIJ4 - AA
K4
- MOTOR ON
08
802 AIJ4 - D
+20Y
804 LOC/REM
P8-06
- PICK
K1CR2
SEQ POWER RELAY
K1
804 LOC/REM
04
- HOLD
K1CR1
K2CR1
START RELAY
K2
802 AIJ4-X
05
- START
K2CR2
1K
802 AIJ4-Y
02
- PICK IN
K3
K2
- PICK OUT
P8-03
802 AIJ4 - W
K3CR2
K3CR1
- REMOTE
01
804 REMOTE
+ BRAKE COUNT INHIBIT
A
813
6R9 0Ω
16C1 6.8 UF 35V
804 AIQ2 - 3
804 AIQ3 - 3
804 AIQ4 - 3
+ TRIAC POWER
P5-04
18
NC
+ 9.7V
6VR1 8.2V
6R1 270
6R2 10 K
6R5 1K
Q4
Q5
Q6
6R3 680
1.8K 5R1
+20Y
2R2 22K
2CR4
2R3 15K
2R5 680
2R4 1.5K 1/2W
Q2
Q3
Q7
P5-10
- 16V
2VR1 13V
2R1 180
2C1 45UF 30V
2CR2
2VR2 3.6V
803 TB1-6 822
803 822 TB1-9
09
- GND
2CR1
2CR5
804 J7-4
16
- MOTOR SPEED INTERLOCK
+ K7 POWER
19
803 K7-1
- K7 PICK
21
803 K7-2
K3R1 47
K3C1 .1UF
EMERGENCY RETRACT RELAY
MTR RELAY
K4
6CR1
K5
802 AIJ4-C
02
- PULL MOTOR RELAY
SPEED RELAY
K3
6CR2
802 AIJ4-F
22
- PULL SPEED RELAY
NOTE:
1 MOUNTED ON POWER SUPPLY INTERNAL PANEL
RELAY BOARD SCHEMATIC PART 1
TWIN CITIES DISK DIVISION
C
83319100
AS
H
CROSS REF NO 812
SHEET 2
PAGE 7-202

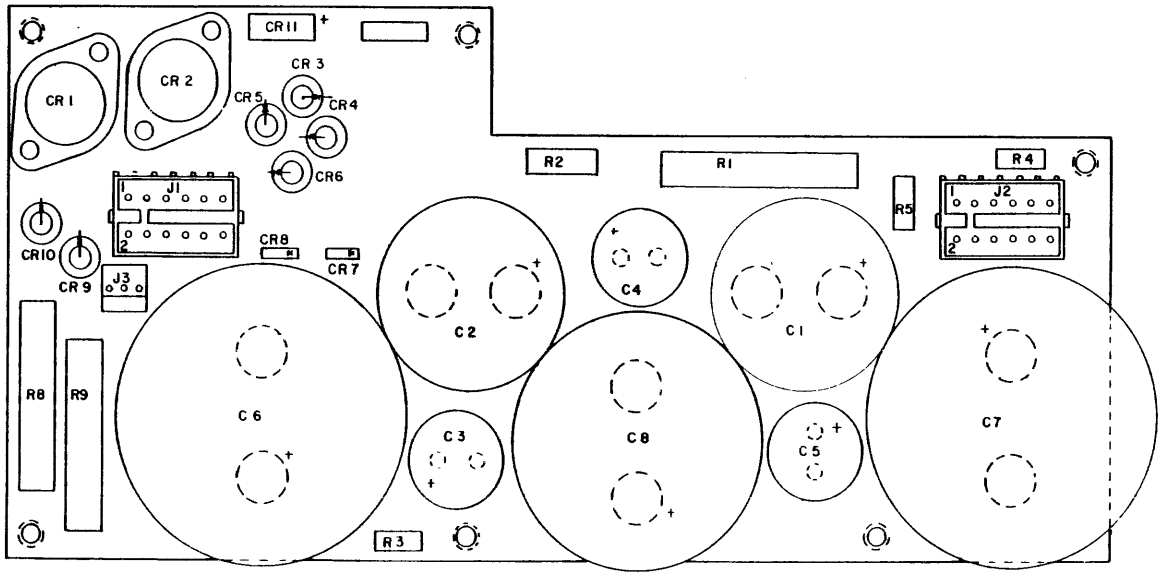


RELAY BOARD
SCHEMATIC PART 2

TWIN CITIES DISK DIVISION	C	83319100	AS	G
CROSS REF NO 813	SHEET 3	PAGE 7-203		

REVISIONS

REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE-3000	RELEASED			
B	DH3266-B	INC VDE P.S	M R B	5-17-83	
C	DJ13445	_YFN/_CBN LOGIC CHG	MLC	2-7-84	



VDE ONLY APPLICABLE TO S/C 40 AND BELOW

DRAWN	T. Koenig	4/4/84
CHECKED		
ENGINEER		
APPROVED		

RECTIFIER/FILTER BOARD (A1A1)

TYPE: CCBN

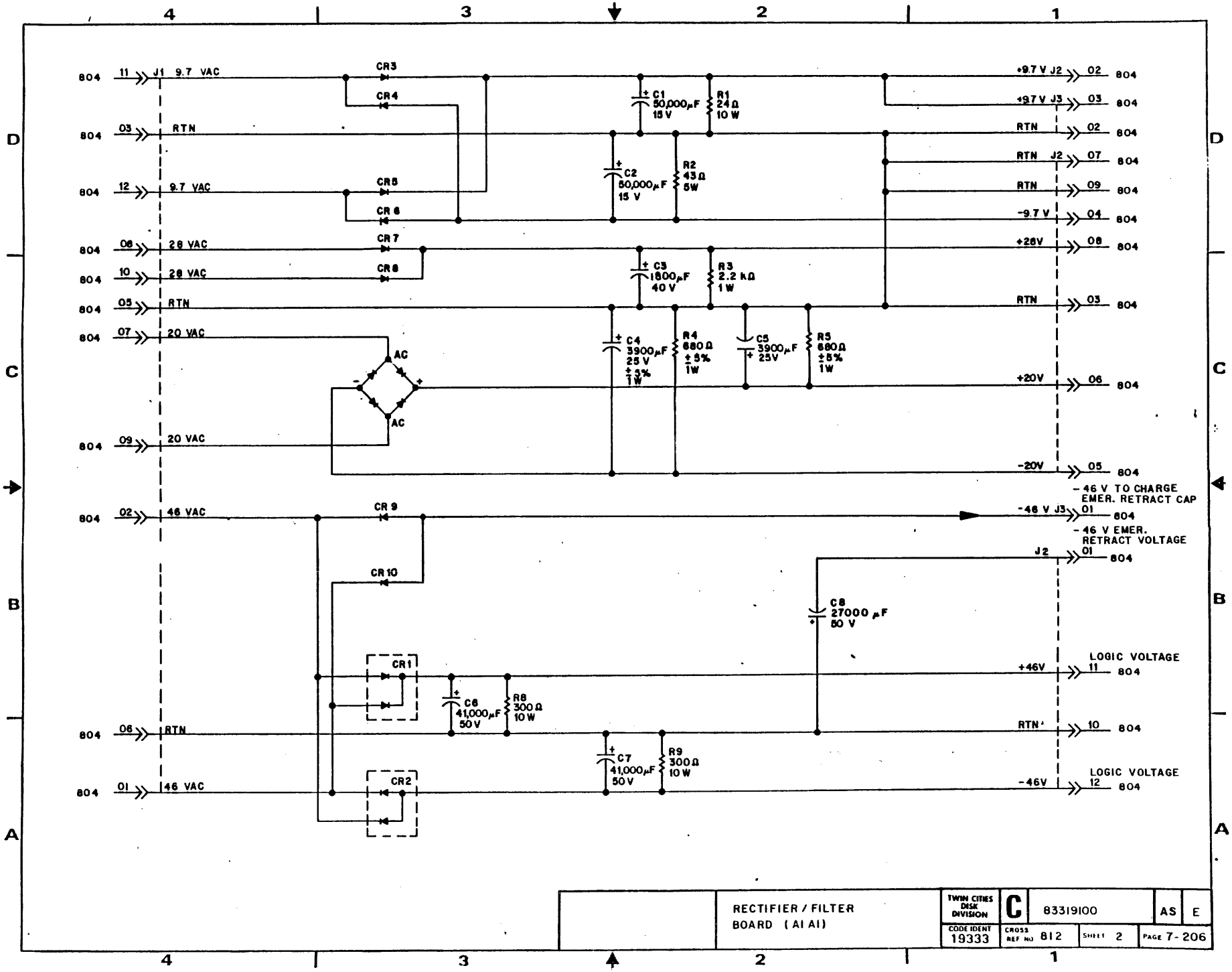
LOC:

TWIN CITIES DISK DIVISION

C | 83319100 | AS | C

CODE IDENT 19333 | CROSS REF NO 811 | SHEET 1 OF 2 | PAGE 7-205

REF 83214192



	RECTIFIER / FILTER BOARD (A1A1)	TWIN CITIES DISK DIVISION	C	83319100	AS E
		CODE IDENT 19333	CROSS REF NO 812	SHEET 2	PAGE 7-206

REVISIONS

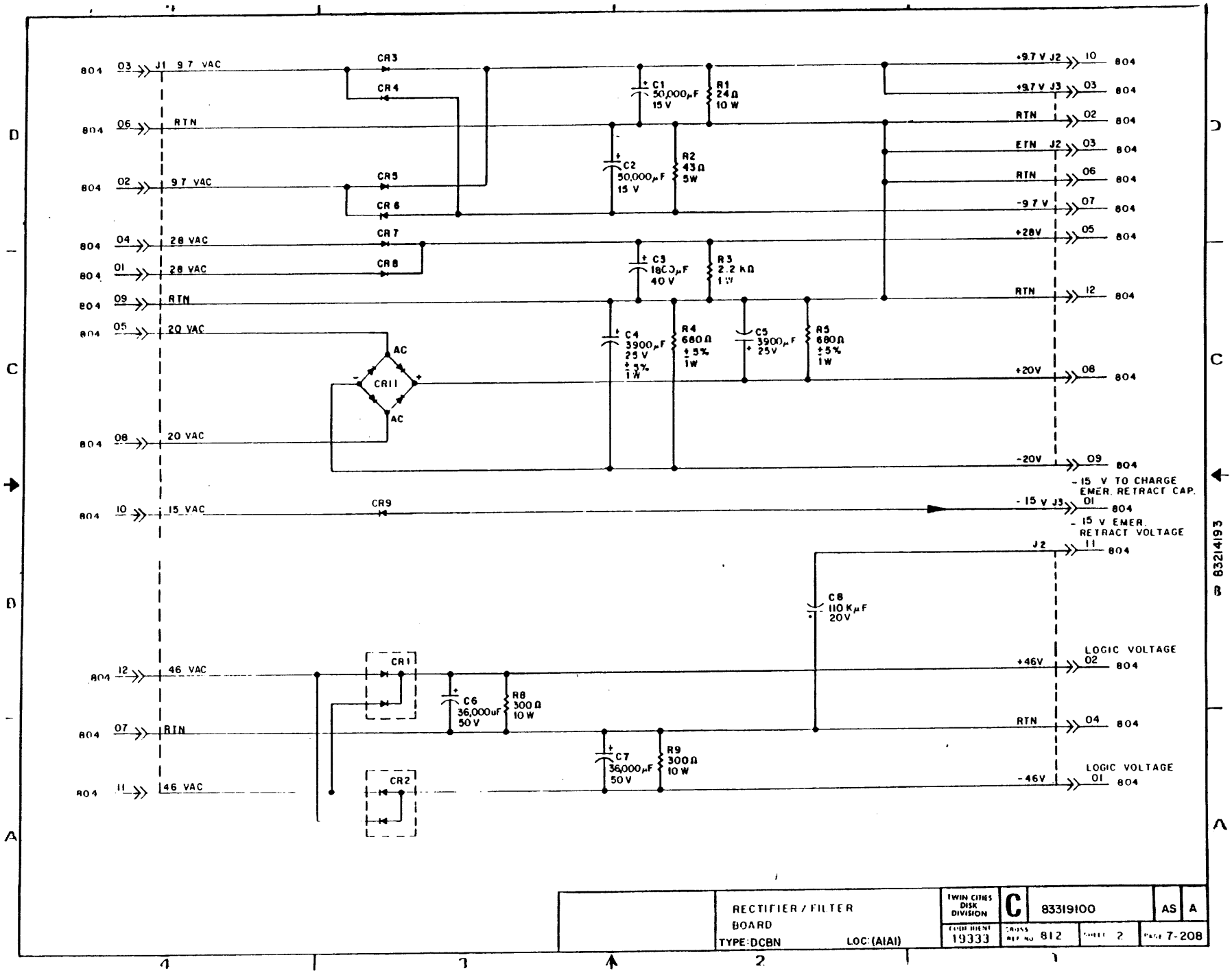
REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	DJ23000 DJ13602	CLASS A RELEASE BY ECO	TT	91784	JL

83214193

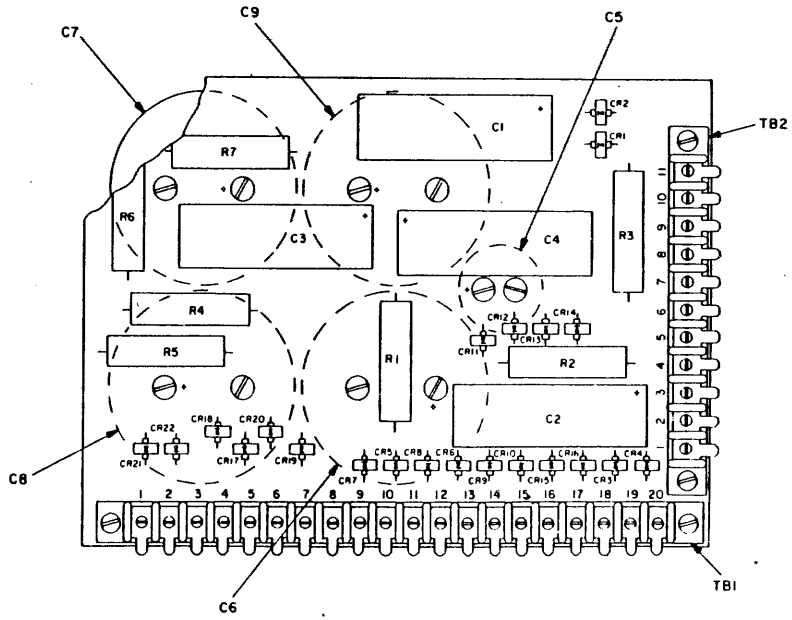
VDE ONLY APPLICABLE TO S/C 41 AND ABOVE

DRAWN	Thomas A. Thai	10 18 84	RECTIFIER/FILTER BOARD	TWIN CITIES DISK DIVISION	C	DWG NO 83319100	AS	A
CHECKED	LOHNAGHAN	10/24/84					
ENGINEER	B.WEIST	8 17 84	TYPE: DCBN LOC (A1A1)	CODE IDENT 19333	CROSS REF NO. 811	SHEET 1 of 2	PAGE 7-207
APPROVED							

REF 83214193


804 03 J1 9.7 VAC
804 06 RTN
804 02 9.7 VAC
804 04 28 VAC
804 01 28 VAC
804 09 RTN
804 05 20 VAC
804 08 20 VAC
804 10 15 VAC
804 12 46 VAC
804 07 RTN
804 11 46 VAC
CR3
CR4
CR5
CR6
CR7
CR8
CR9
CR11
CR1
CR2
AC
AC
C1 50,000µF 15 V
R1 24Ω 10 W
C2 50,000µF 15 V
R2 43Ω 5W
C3 1800µF 40 V
R3 2.2 kΩ 1W
C4 3900µF 25 V ±5% 1W
R4 680Ω ±5% 1W
C5 3900µF 25V
R5 680Ω ±5% 1W
C6 36,000uF 50 V
R8 300Ω 10 W
C7 36,000µF 50 V
R9 300Ω 10 W
C8 110 KµF 20V
+9.7 V J2 10 804
+9.7 V J3 03 804
RTN 02 804
ETN J2 03 804
RTN 06 804
-9.7 V 07 804
+28V 05 804
RTN 12 804
+20V 08 804
-20V 09 804
-15 V TO CHARGE EMER. RETRACT CAP.
-15 V J3 01 804
-15 V EMER. RETRACT VOLTAGE
J2 11 804
LOGIC VOLTAGE
+46V 02 804
RTN 04 804
LOGIC VOLTAGE
-46V 01 804
B 8321493
RECTIFIER / FILTER BOARD
TYPE:DCBN LOC:(A1A1)
TWIN CITIES DISK DIVISION
C
83319100
AS
A
19333
812
2
7-208

REVISIONS					
REV	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	PE-25000	RELEASE	GR	9/1/76	GW
B	PE22842	CORRECT DIAGRAMS	WEB	12-2-78	
C	PE57381	CHG NOISE CAPS	TH	9-23-80	
D	DH13266	INC VDE P/S	SMI	11 29 82	GAM
E	DJ22000	XFER FROM PE	DS	2 1 84	BJP
F	DJ13406C	CHG DIAGRAMS	DS	2 1 84	BJP
G	DJ13711	VDE NON-VDE LOGIC	BJP	6 25 85	

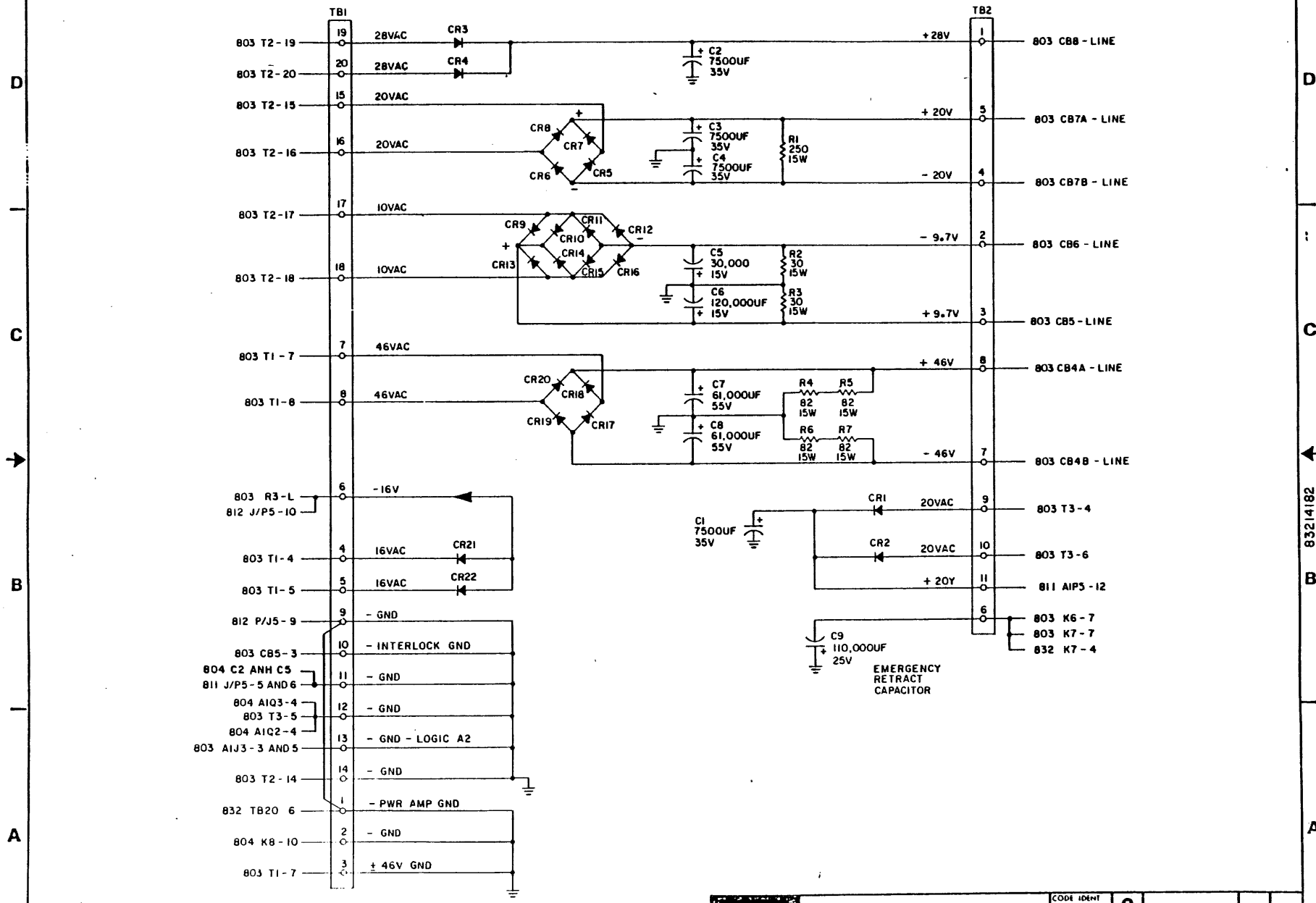


BOARD IS MOUNTED ON TO CAPACITORS C5,C6,C7,C8,C9

NON-VDE ONLY

DRAWN	W.BERGSTROM	1-20-76	[redacted]	RECTIFIER AND CAPACITOR BOARD COMPONENT LAYOUT AND DIAGRAMS TYPE 5YEN	CODE IDENT 19333	C	83319100	AS	G
CHECKED									
ENGINEER			TWIN CITIES DISK DIVISION		CROSS REF 621		SHEET 1 OF 2	PAGE 7-209	
APPROVED									

83214182



TWIN CITIES DISK DIVISION

RECTIFIER AND CAPACITOR BOARD

CODE IDENT				
19333	C	83319100	AS	G
HUSS REF NO 822	SHEET 2	PAGE 7-210		

83214182

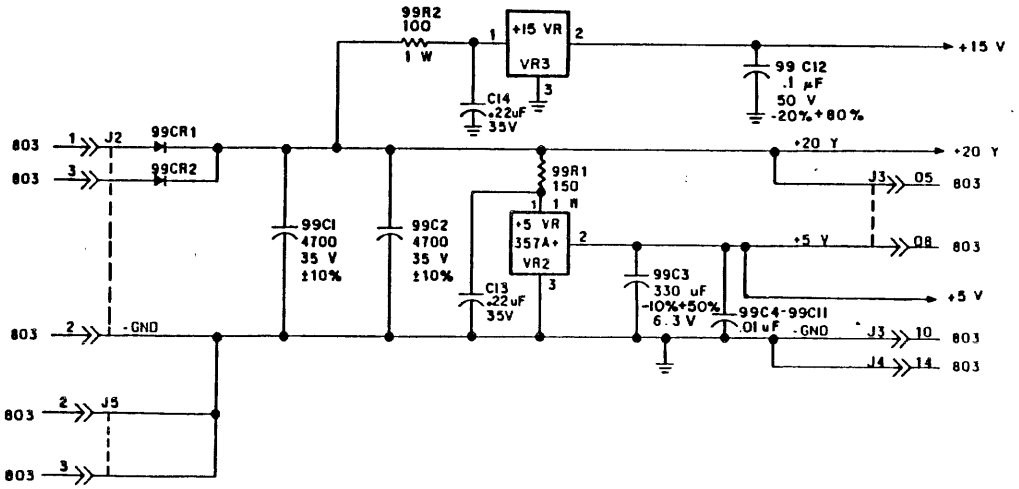
REVISIONS					
REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	DJ23000 DJ13711	CLASS A RELEASE BY ECO	BJP	7 23 85	

UNUSED RESISTOR PACKS

LOCATION	PINS
RP-A3	15
RP-B1	4,5,6

UNUSED LOGIC ELEMENTS

ELEMENT	LOCATION	OUTPUT PINS
148LS	U-C3	4,10
341	U-B1	13
MC1413	U-C1	10,16



VDE ONLY

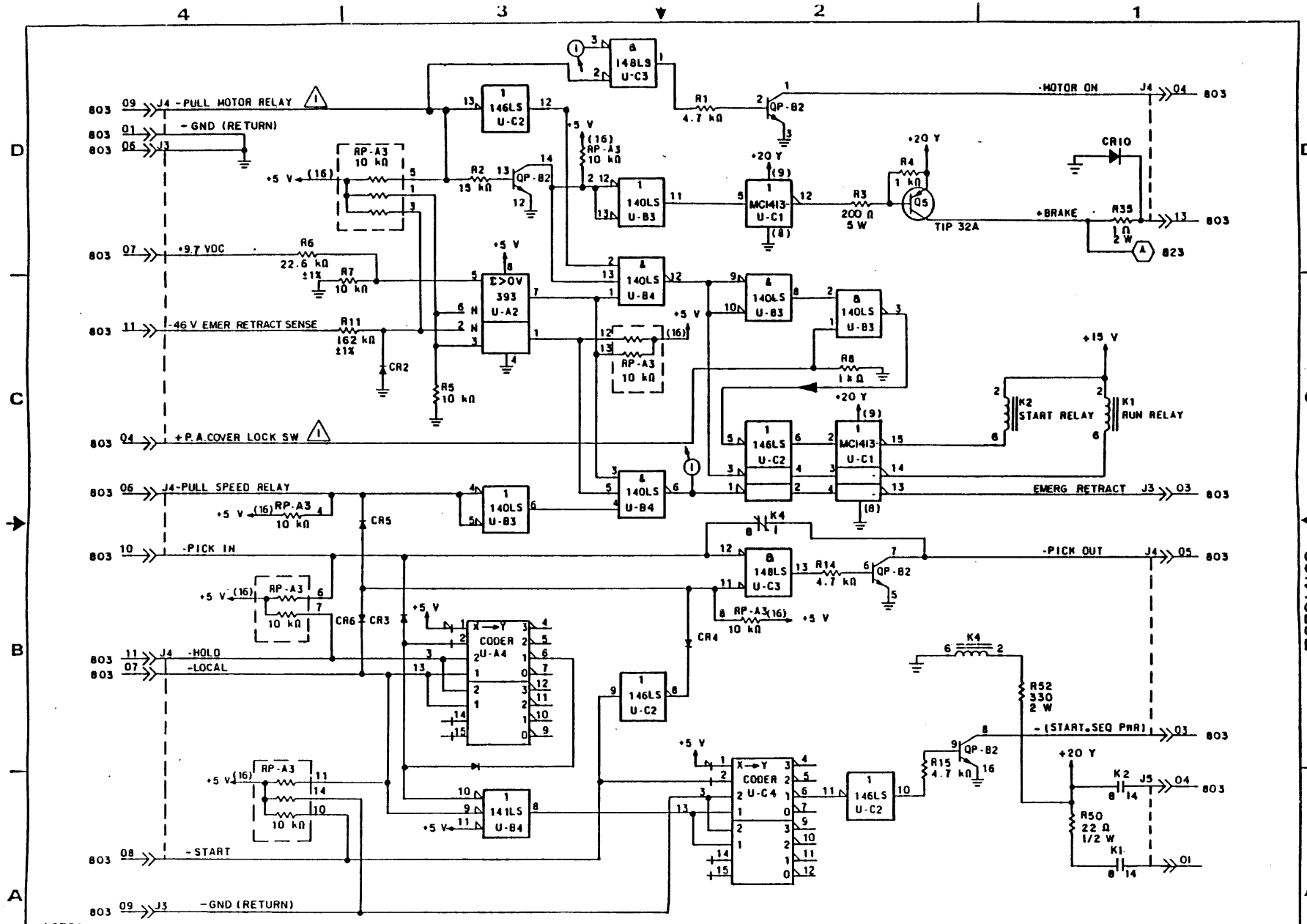
DRAWN	BJP	8.14.85
CHECKED		
ENGINEER	B WEIST	8.14.85
APPROVED		

CONTROL BOARD DIAGRAMS
(A1 A2)
TYPE: HCFN

TWIN CITIES DISK DIVISION | C | 83319100 | AS | A

CODE IDENT 19333 | CROSS REF NO 821 | SHEET 1 OF 3 | PAGE 7-211

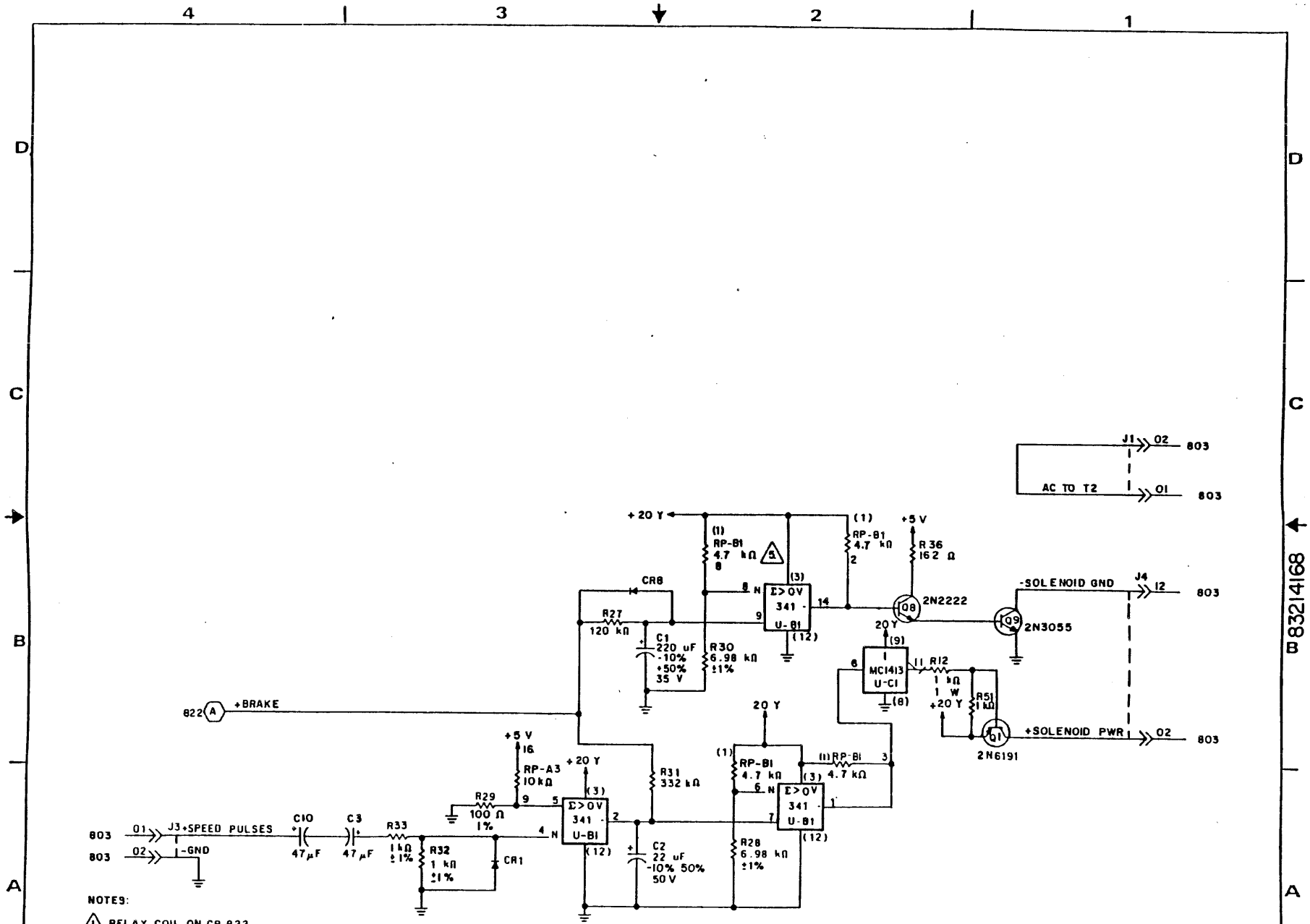
B 8321468



NOTES:

1. SEE CROSS REF 773 FOR DETAILS OF PULL MOTOR RELAY CKT.

83214168



CONTROL BOARD
PART 2

TWIN CITIES DIGE DIVISION | C | 83319100 | AS | A
CODE IDENT 19333 | CROSS REF NO 823 | SHEET 3 | PAGE 7-213

83214168 B

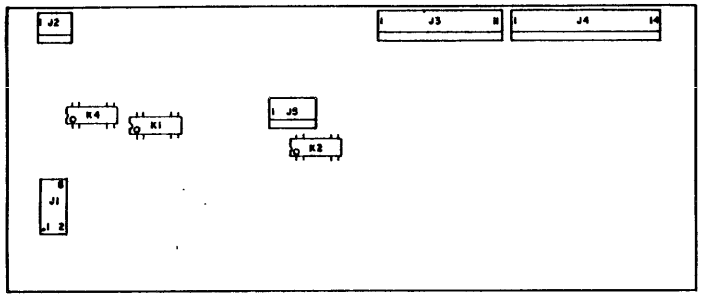
REVISIONS					
REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	DJ23000 DJ13711	CLASS A RELEASED BY ECO	BJP	72385	

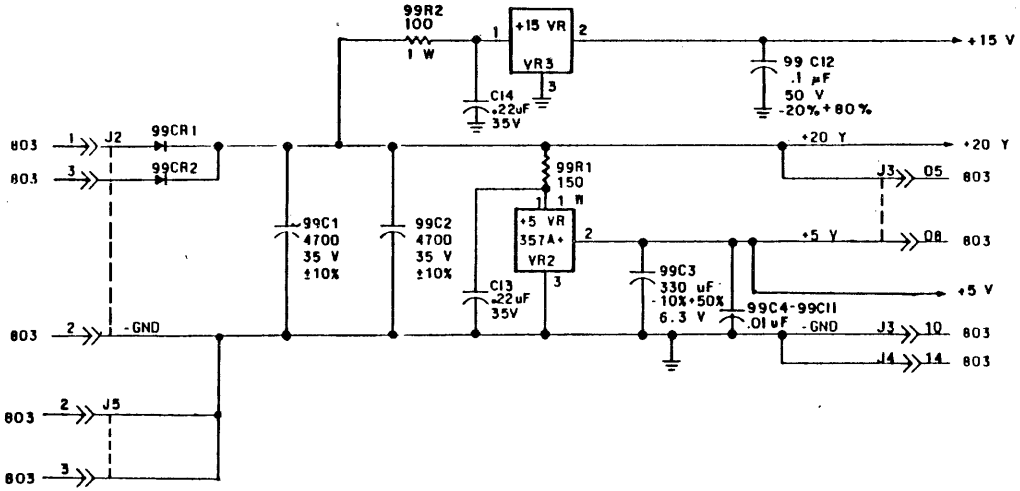
UNUSED RESISTOR PACKS

LOCATION	PINS
RP-A3	15
RP-B1	4,5,6

UNUSED LOGIC ELEMENTS

ELEMENT	LOCATION	OUTPUT PINS
148LS	U-C3	4,10
341	U-B1	13
MC1413	U-C1	10,16





VDE ONLY

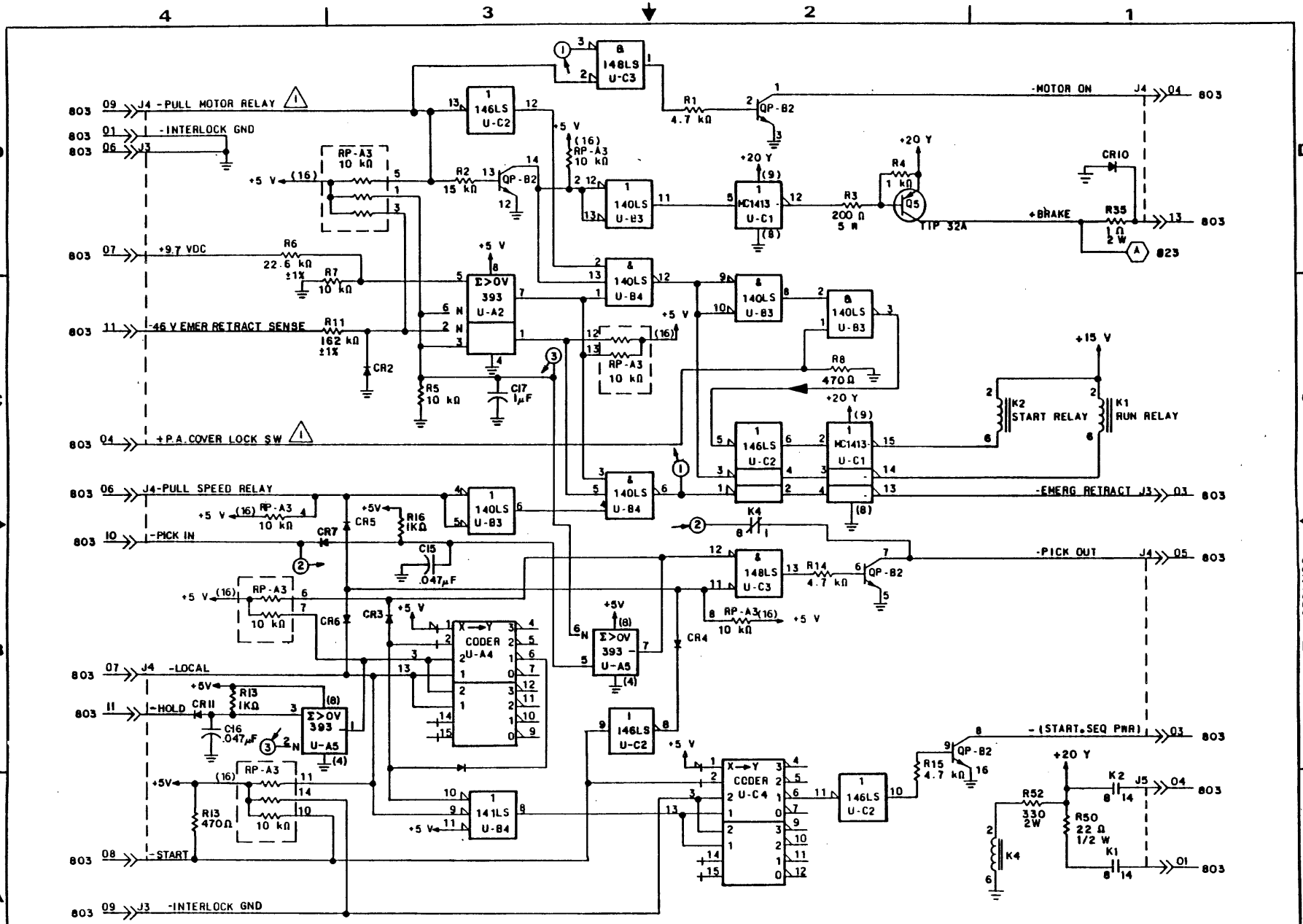
DRAWN	BJP	8.7.85
CHECKED		
ENGINEER	B WEIST	8.7.85
APPROVED		

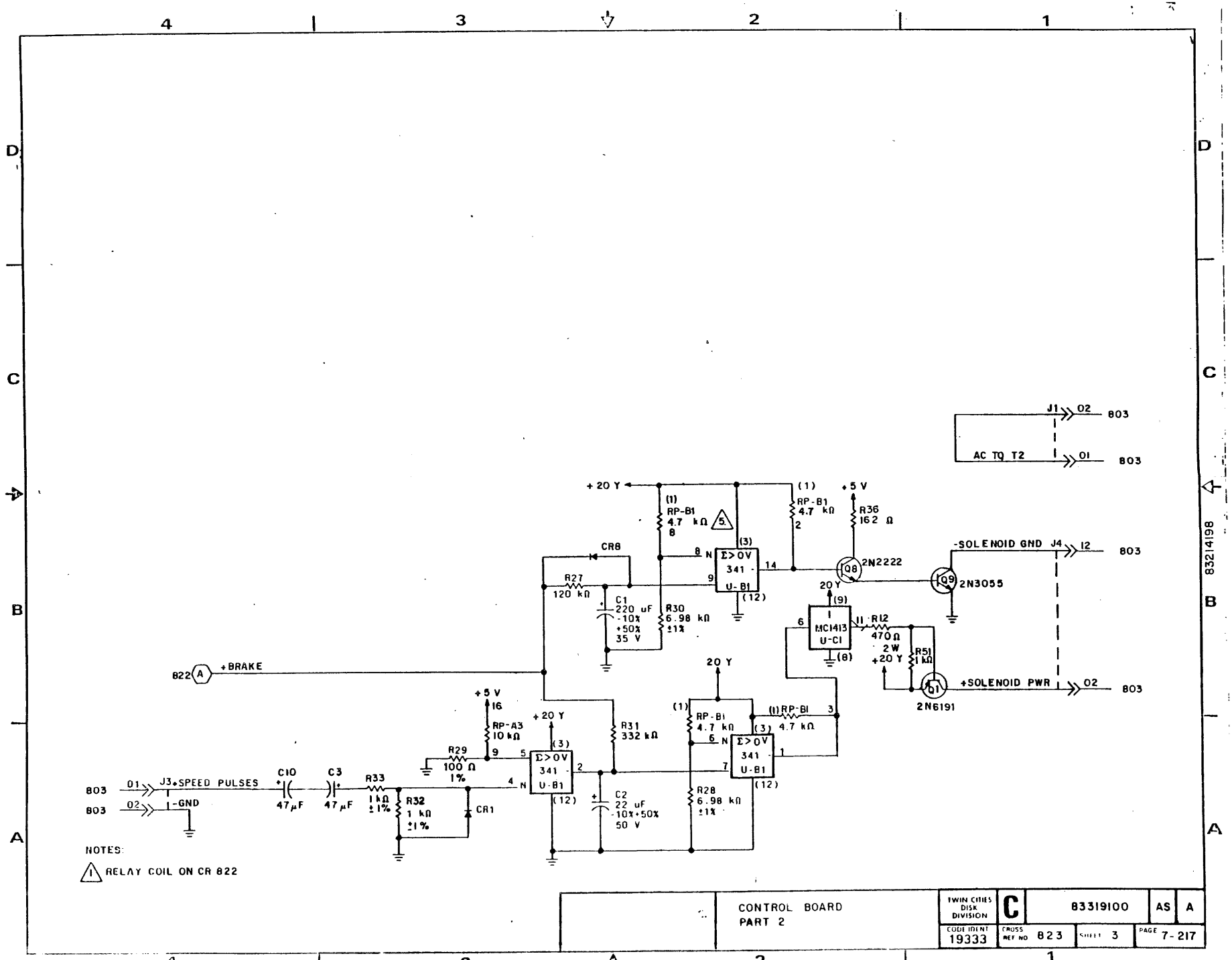
CONTROL BOARD DIAGRAMS
(A1 A2)
TYPE: JCFN

TWIN CITIES DISK DIVISION | C | 83319100 | AS | A

CUSTOMER 19333 | CROSS REF NO 821 | SHEET 1 OF 3 | PAGE 7-215

83214198


-PULL MOTOR RELAY
-INTERLOCK GND
+9.7 VDC
-46 V EMER RETRACT SENSE
+P.A.COVER LOCK SW
-PULL SPEED RELAY
-PICK IN
-LOCAL
-HOLD
-START
-INTERLOCK GND
-MOTOR ON
+BRAKE
-EMERG RETRACT J3
-PICK OUT
-(START.SEQ PWR)
+20 Y
+15 V
+5 V
K1 RUN RELAY
K2 START RELAY
K4
TIP 32A
CODER U-A4
CODER U-C4
NOTES:
SEE CROSS REF 773 FOR START SEQUENCE.
CONTROL BOARD PART I
TWIN CITIES DISK DIVISION
83319100
AS A
CODE IDENT 19333
CROSS REF NO 822
SHEET 2
PAGE 7-216



	CONTROL BOARD PART 2	TWIN CITIES DISK DIVISION	C	83319100	AS A
		CODE IDENT 19333	CROSS REF NO 823	SHEET 3	PAGE 7-217

REVISIONS

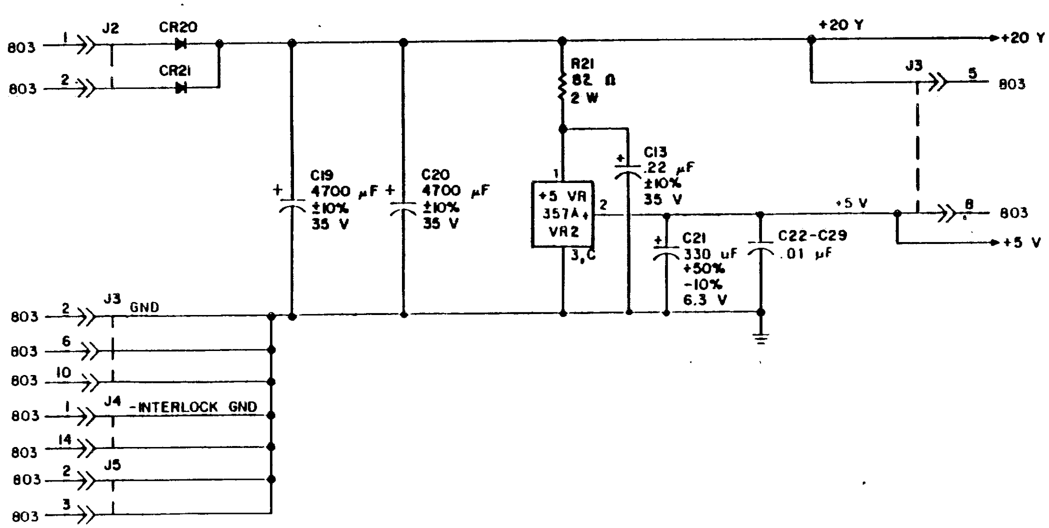
REV	ECO.	DESCRIPTION	DRFT	DATE	CHK'D
A	DJ23000 DJ13602	CLASS A RELEASE BY ECO	TT	9-18-84	JL
B	DJ13602A	TAB 14 VDE PS CHG	TT	9-29-84	JL

UNUSED RESISTOR PACKS

LOCATION	PINS
RP1	5, 10, 11, 15
RP2	4, 5, 6

UNUSED LOGIC ELEMENTS (2)

ELEMENT	LOCATION	OUTPUT PINS
148LS	U8	10
MC1413	U6	10, 16



NOTES:

1. UNLESS OTHERWISE SPECIFIED:

   ALL 14 PIN IC'S HAVE PIN 7 CONNECTED TO GROUND AND PIN 14 CONNECTOR TO +5 V.

   ALL 16 PIN IC'S HAVE PIN 8 CONNECTED TO GROUND AND PIN 16 CONNECTOR TO +5 V.

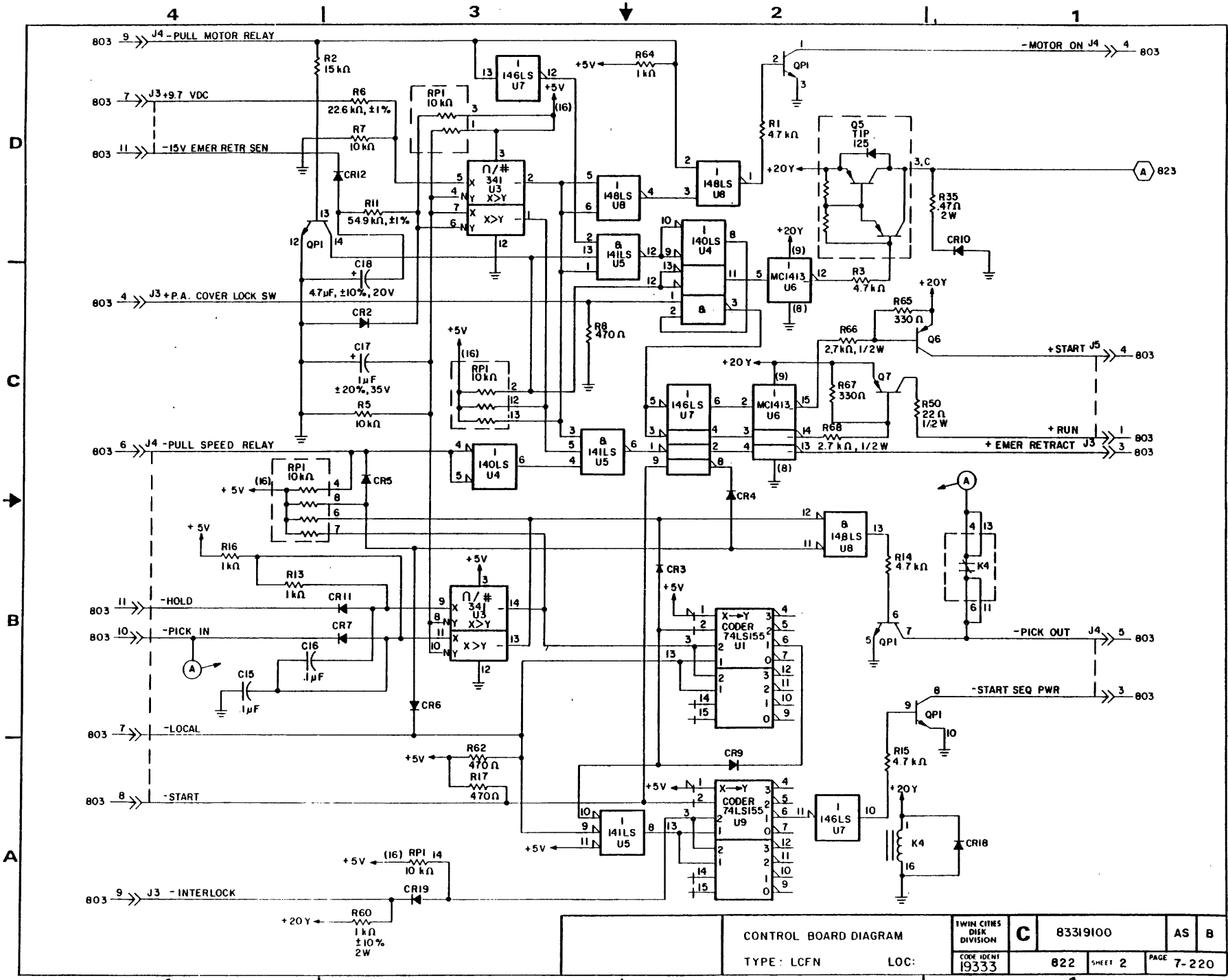
(2) INPUT PINS OF UNUSED LOGIC ELEMENTS ARE GROUNDED.

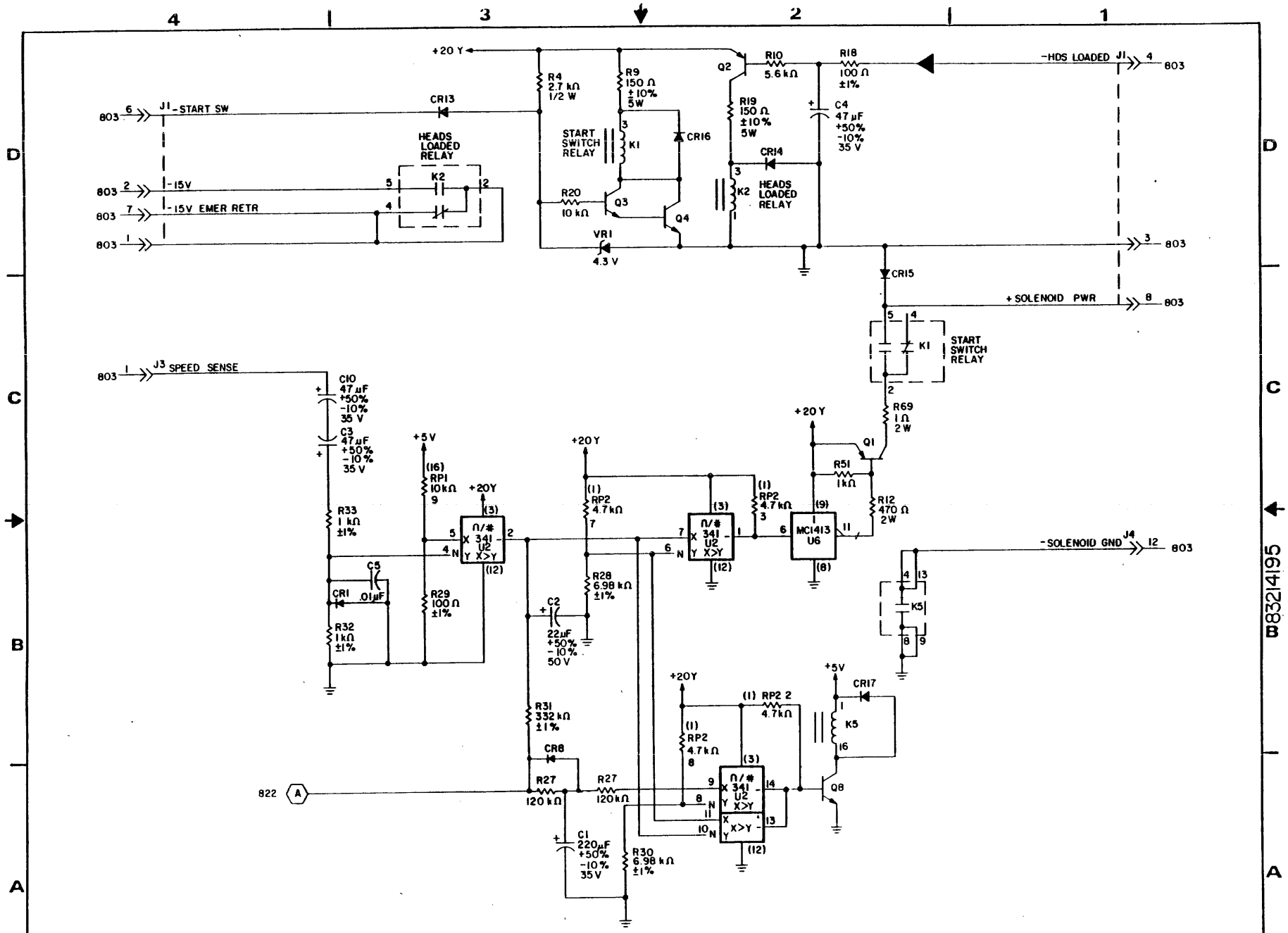
B 83214195

VDE ONLY APPLICABLE TO S/C 41 AND ABOVE

DRAWN	Thomas R. Thein	10-18-84		CONTROL BOARD DIAGRAM	CODE IDENT 19333	C	83319100	AS	B
CHECKED	LOWNAGHAN	10/25/84							
ENGINEER	B. WEIST	8-17-84	TWIN CITIES DISK DIVISION	TYPE LCFN LOC	CROSS REF NO 821	SHEET 1 OF 3	PAGE 7-219		
APPROVED									

REF 83214195

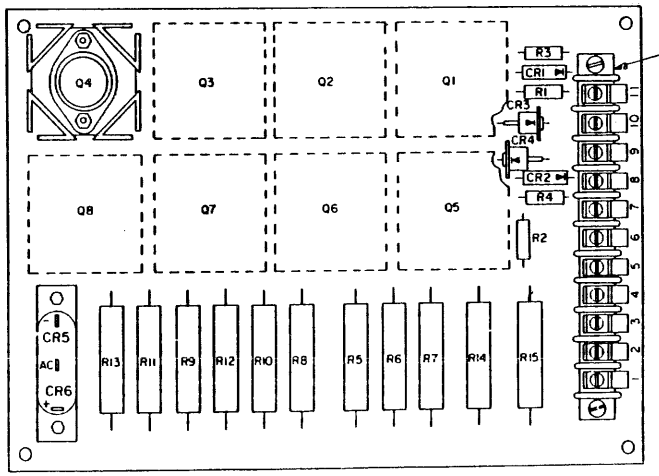

803 9 J4 -PULL MOTOR RELAY
803 7 J3 +9.7 VDC
803 11 -15V EMER RETR SEN
803 4 J3 +P.A. COVER LOCK SW
803 6 J4 -PULL SPEED RELAY
803 11 -HOLD
803 10 -PICK IN
803 7 -LOCAL
803 8 -START
803 9 J3 -INTERLOCK
-MOTOR ON J4 4 803
+START J5 4 803
+ RUN 1 803
+ EMER RETRACT J3 3 803
-PICK OUT J4 5 803
-START SEQ PWR 3 803
A 823
R2 15kΩ
R6 22.6kΩ, ±1%
R7 10kΩ
R11 54.9kΩ, ±1%
C18 4.7μF, ±10%, 20V
CR2
C17 1μF ±20%, 35V
R5 10kΩ
R8 470Ω
RP1 10kΩ
R64 1kΩ
R1 4.7kΩ
Q5 TIP 125
R35 47Ω 2W
CR10
R3 4.7kΩ
R65 330Ω
R66 2.7kΩ, 1/2W
Q6
R67 330Ω
Q7
R50 22Ω 1/2W
R68 2.7kΩ, 1/2W
CR4
CR5
R16 1kΩ
R13 1kΩ
CR11
CR7
C16 .1μF
C15 .1μF
CR6
CR3
R14 4.7kΩ
K4
R15 4.7kΩ
R62 470Ω
R17 470Ω
CR9
CR18
R60 1kΩ ±10% 2W
CR19
U1 CODER 74LS155
U3 341 X>Y
U4 140LS
U5 141LS
U6 MC1413
U7 146LS
U8 148LS
U9 CODER 74LS155
+5V
+20Y
CONTROL BOARD DIAGRAM
TYPE: LCFN LOC:
TWIN CITIES DISK DIVISION
C 83319100 AS B
CODE IDENT 19333
822 SHEET 2 PAGE 7-220
B 83214195



	CONTROL BOARD DIAGRAM	TWIN CITIES DISK DIVISION	C	83319100	AS B
	TYPE: LCFN LOC:	CODE IDENT 19333	823	SHEET 3	PAGE 7-221

83214195 B

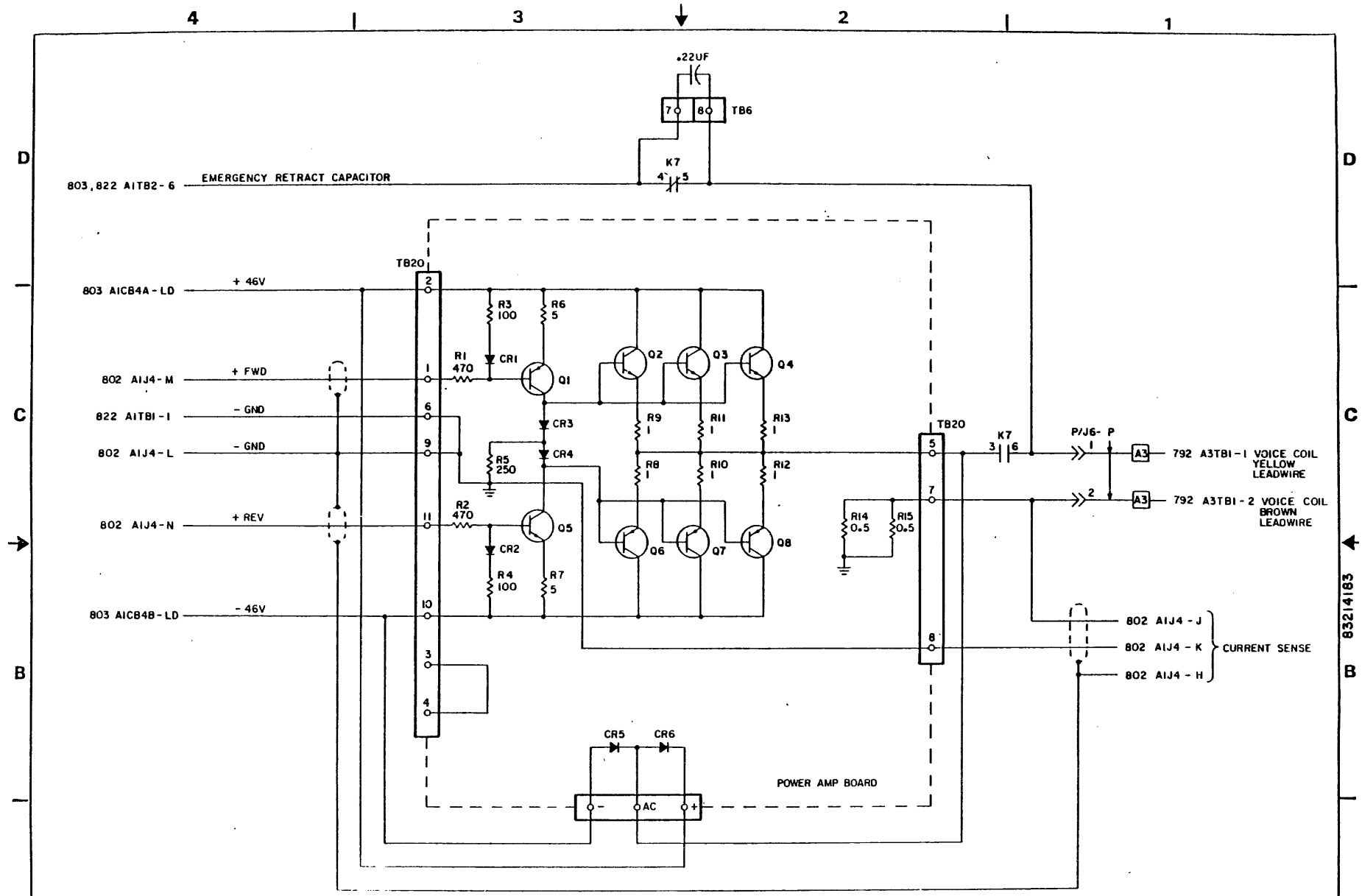
REVISIONS					
REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	ML A	4/3/78	BLW
B	PE55259	LOGIC DIA CORR	MA	7-16-78	LA
C	DH13266	INC VDE P/S	SMI	2 3 82	SMS
D	DJ22000	TRANSFER FROM PE	CJB	6-11-84	JD
E	DJ13641	SEE SHEETS 1,2	JHM	11-12-84	BJP
F	DJ13711	VDE NON-VDE LOGIC	BJP	6-25-85	BJP
G	DJ13641B	CANCEL ECO DJ13641	BJP	9-4-85	BJP



83214183

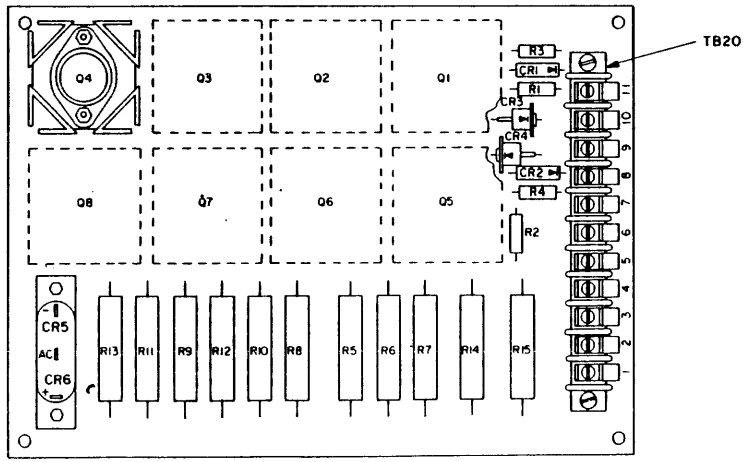
NON-VDE ONLY

DRAWN	MANDERSON		TWIN CITIES DISK DIVISION	AI - POWER SUPPLY VOICE COIL POWER AMP DIAGRAMS TYPE AZCN	CODE IDENT 19333	C	83319100 AS A
CHECKED					CHNG. REF 831	SHEET 1 of 2	PAGE 7-223
ENGINEER							
APPROVED							



TWIN CITIES DISK DIVISION	A1 - POWER SUPPLY VOICE COIL POWER AMP	CODE IDENT 19333	C	83319100	AS	G
		CROSS REF NO 832	SHEET 2	PAGE 7-224		

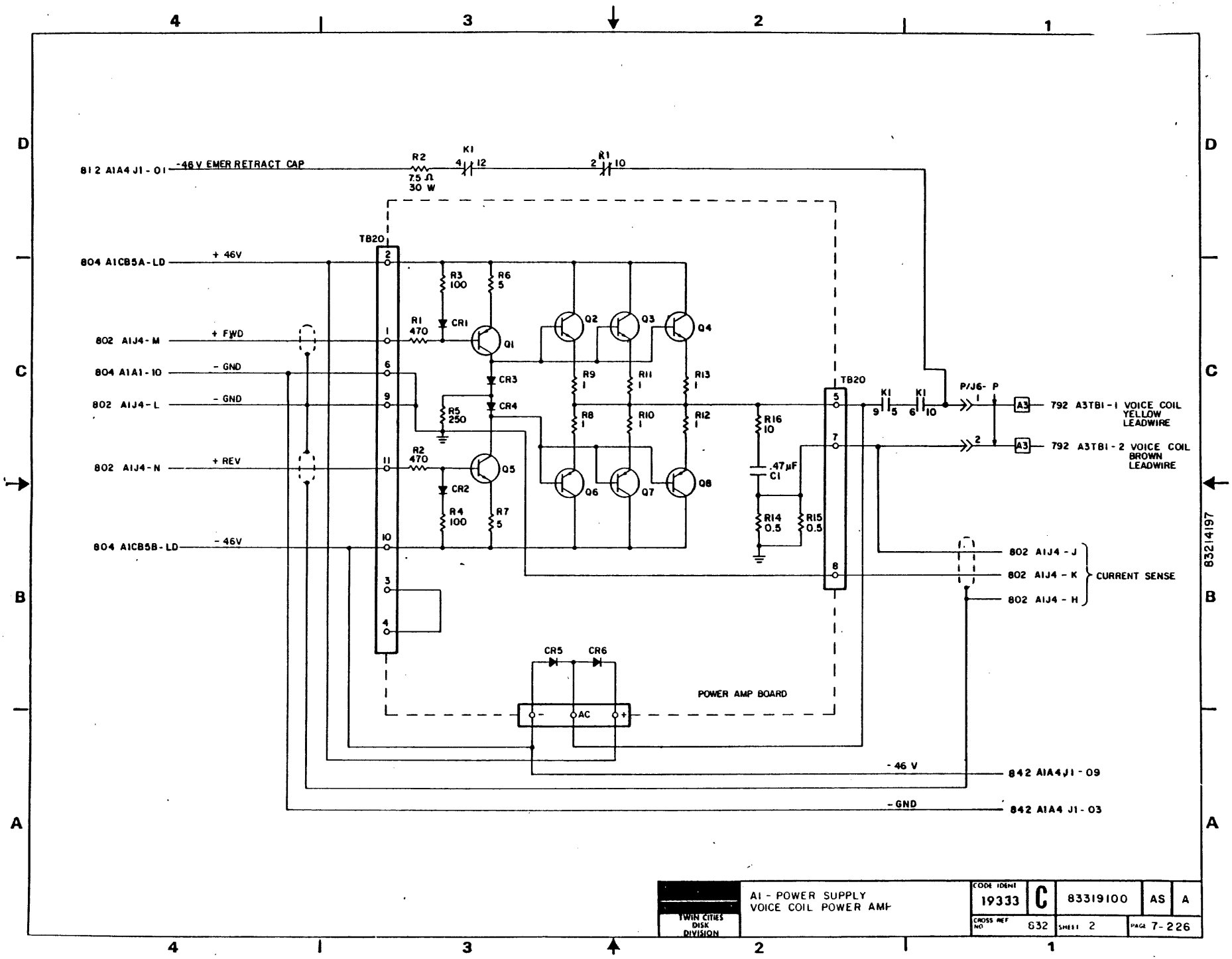
REVISIONS					
LTR	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	DJ23000 DJ3711	CLASS A RELEASED BY ECO	BJP	7236[illegible]	



83214197

VDE ONLY

DRAWN	BJP	8.7.85	TWIN CITIES DISK DIVISION	AI - POWER SUPPLY VOICE COIL POWER AMP DIAGRAMS TYPE A2CN	CODE IDENT 19333	C	83319100	AS	A
CHECKED					CROSS REF NO 831		SHEET 1 OF 2	PAGE 7-225	
ENGINEER	B WEIST	8.7.85							
APPROVED									



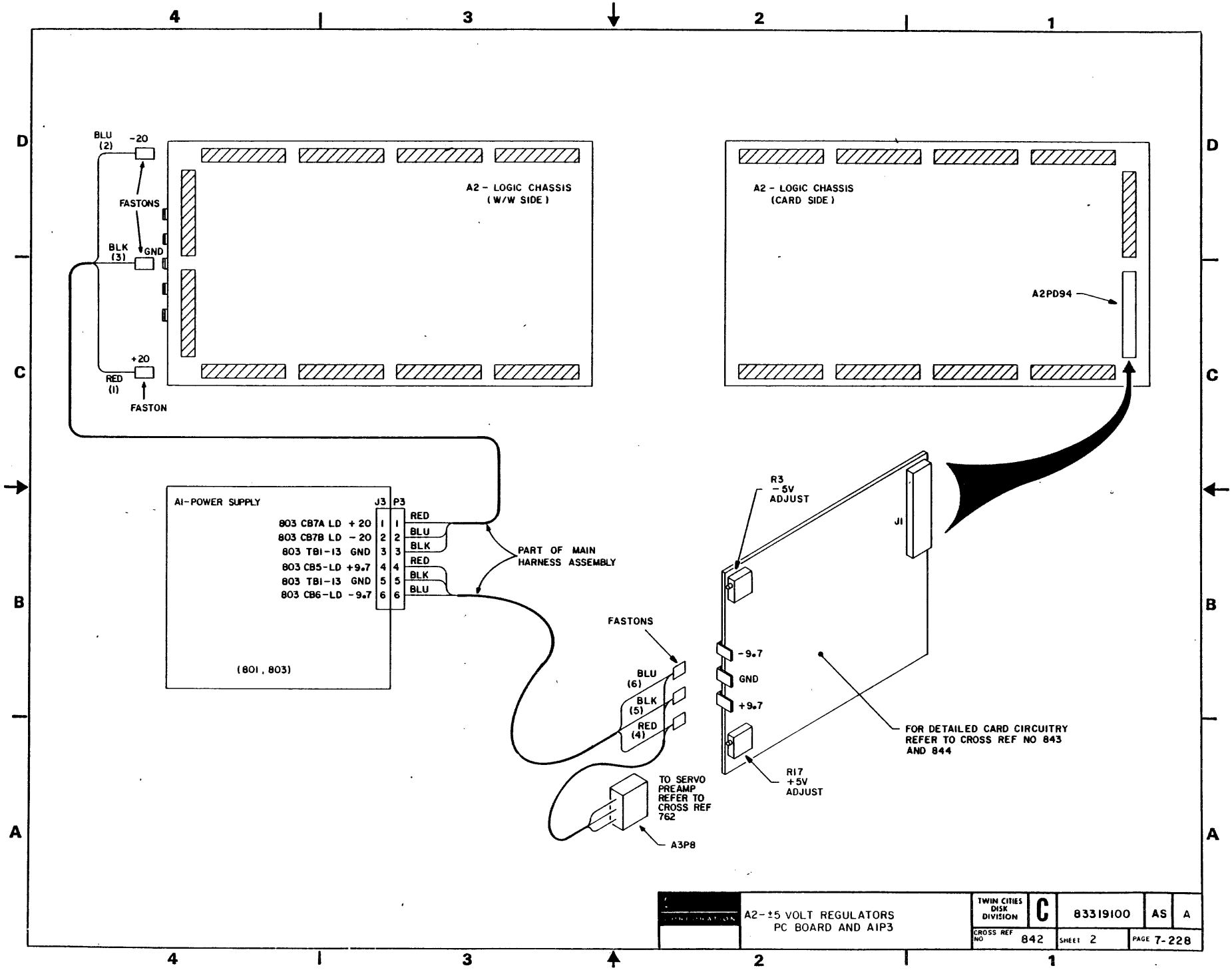
TWIN CITIES DISK DIVISION	A1 - POWER SUPPLY VOICE COIL POWER AMP	CODE IDENT 19333	C	83319100	AS A
		CROSS REF NO. 832	SHEET 2	PAGE 7-226	

REVISIONS					
REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	PE23000	RELEASED	MLA	2-19-76	
B	PE22842	SCH CORRECTION	MA	1-4-77	
C		EDITORIAL	MA	5-23-77	
D	PE55259	LOGIC DIAG IMPROVEMENT	MA	10-5-78	

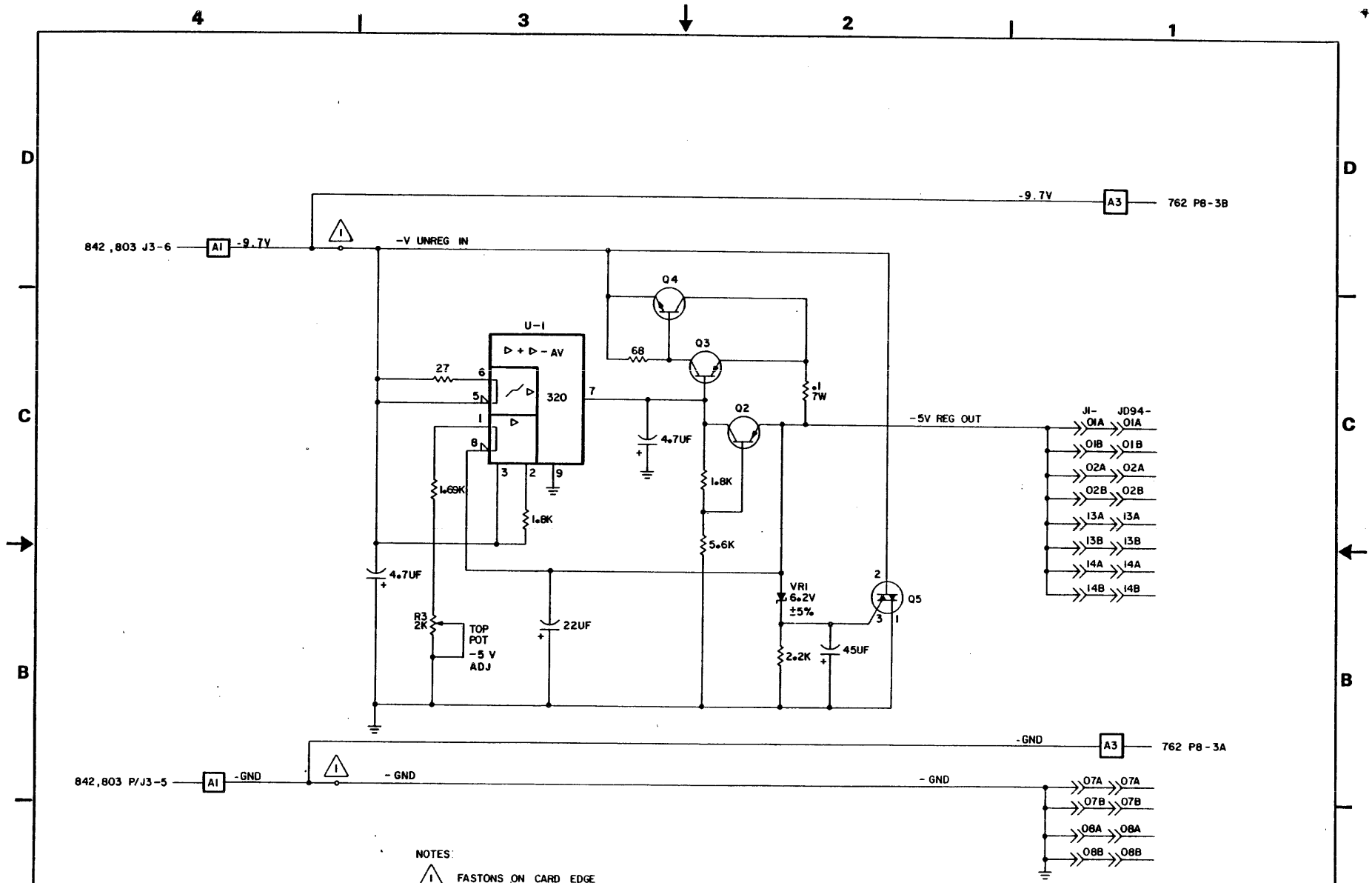
NON-VDE ONLY

DRAWN			A2 5 VOLT-REGULATOR DIAGRAMS	TWIN CITIES DISK DIVISION	C	83319100	AS D
CHECKED							
ENGINEER				CROSS REF NO 841		SHEET 1 OF 4	PAGE 7-227
APPROVED							

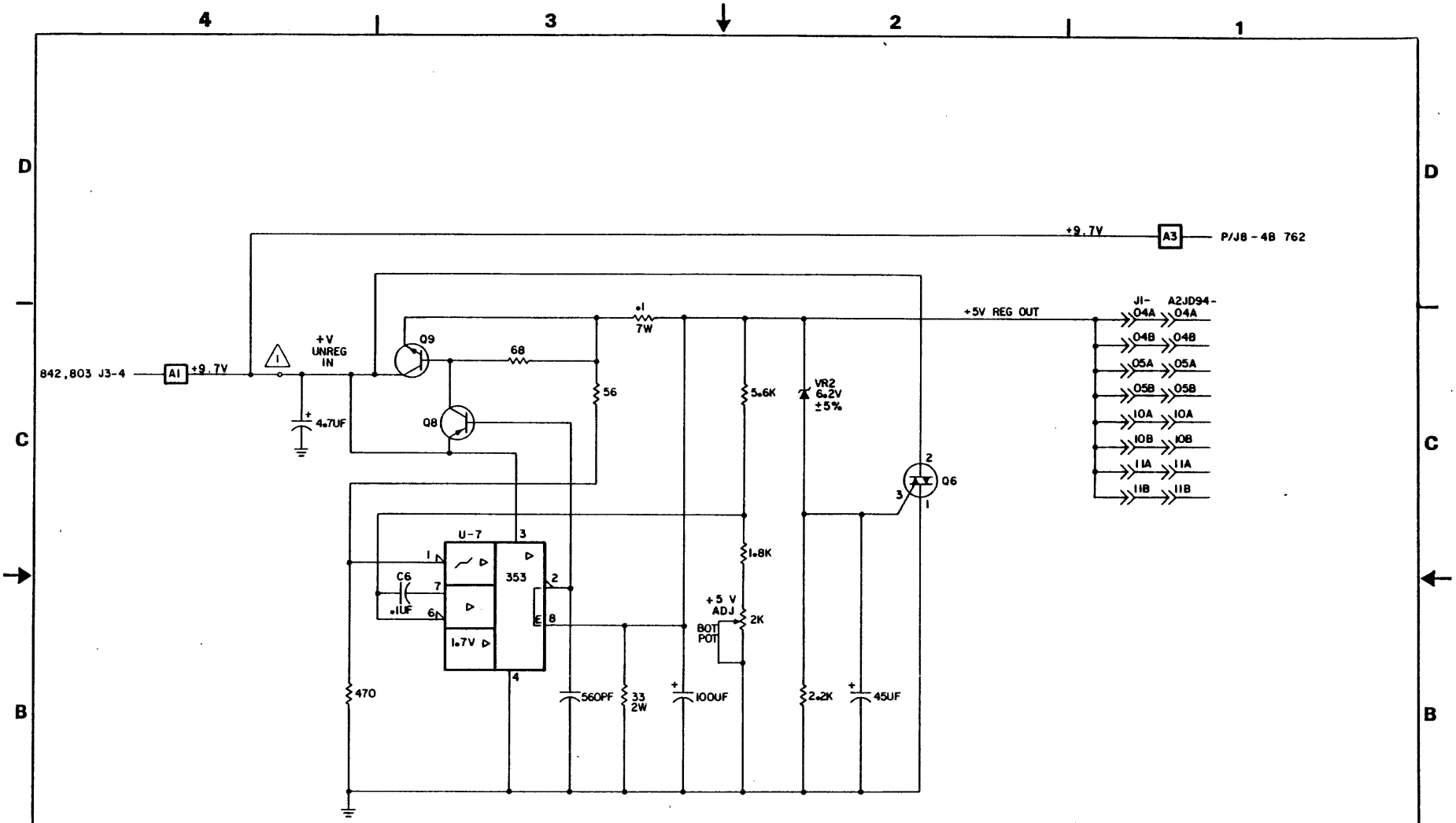
REF 83214184



	A2-±5 VOLT REGULATORS PC BOARD AND A1P3	TWIN CITIES DISK DIVISION	C	83319100	AS A
		CROSS REF NO 842		SHEET 2	PAGE 7-228



	SCHEMATIC DIAGRAM - 5V REGULATOR	TWIN CITIES DISK DIVISION	C	83319100	AS	D
		CROSS REF NO 843		SHEET 3	PAGE 7-229	



NOTES:

1. FASTON ON CARD EDGE REFER TO CROSS REFERENCE NUMBER 802

	SCHEMATIC DIAGRAM +5V REGULATOR	TWIN CITIES DISK DIVISION	C	83319100	AS D
		CROSS REF NO 844	SHEET 4	PAGE 7-230	

REVISIONS

REV	ECO	DESCRIPTION	DRFT	DATE	CHK'D
A	DJ23000 DJ13711	CLASS A RELEASED BY ECO	BJP	7-23-85	

83214166

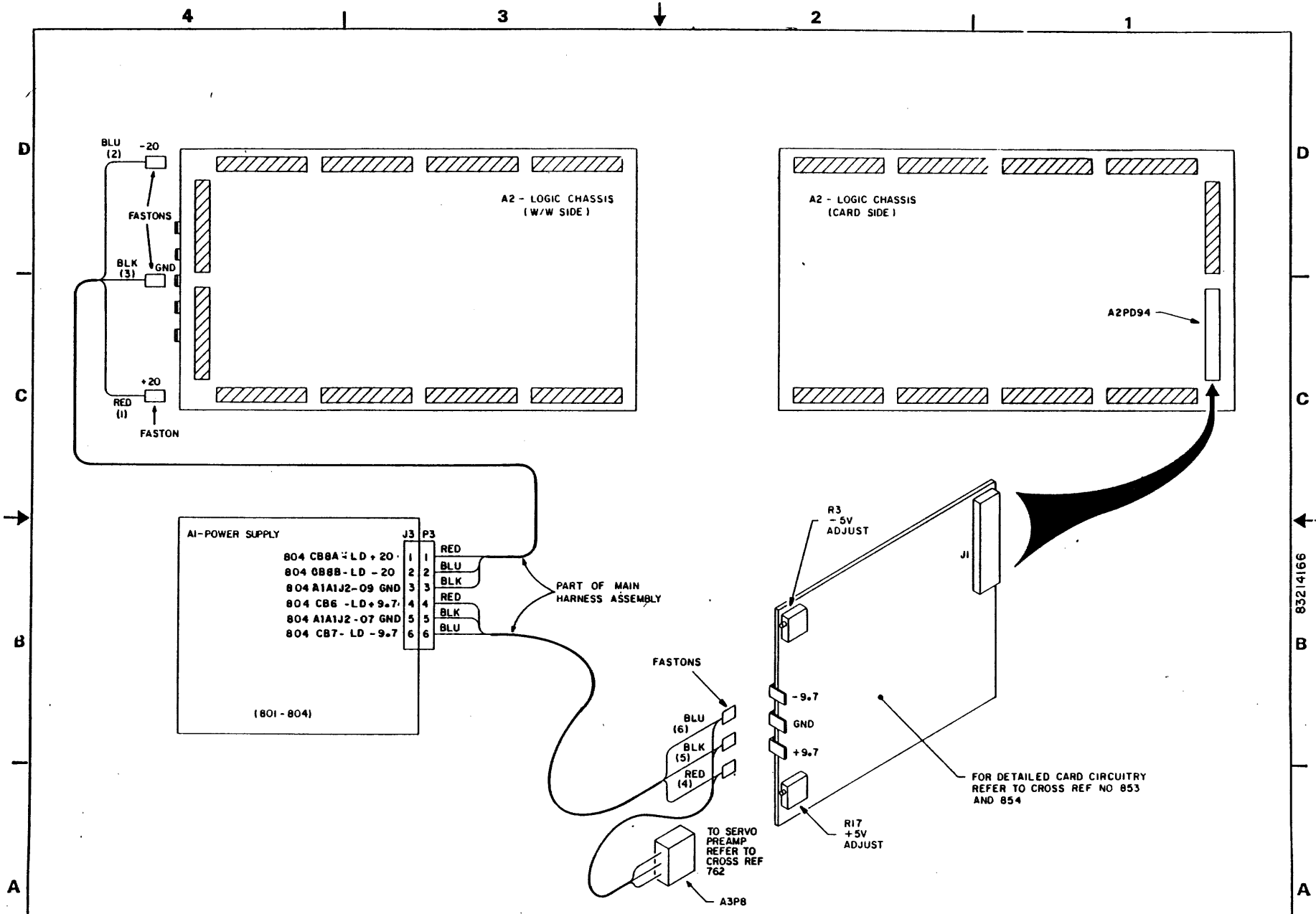
VDE ONLY

DRAWN	BJP	8.14.85
CHECKED		
ENGINEER	B WEIST	8.14.85
APPROVED		

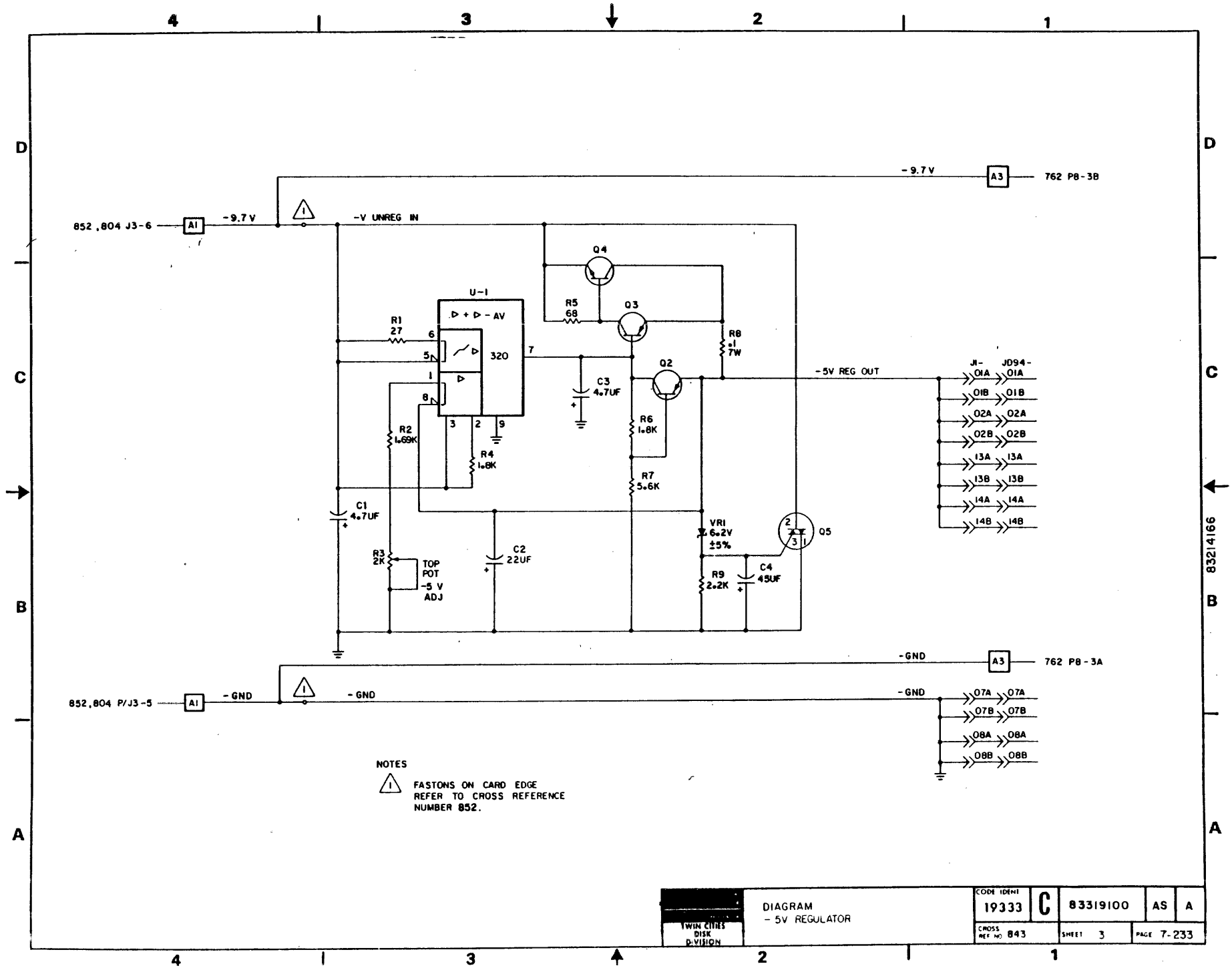
TWIN CITIES DISK DIVISION

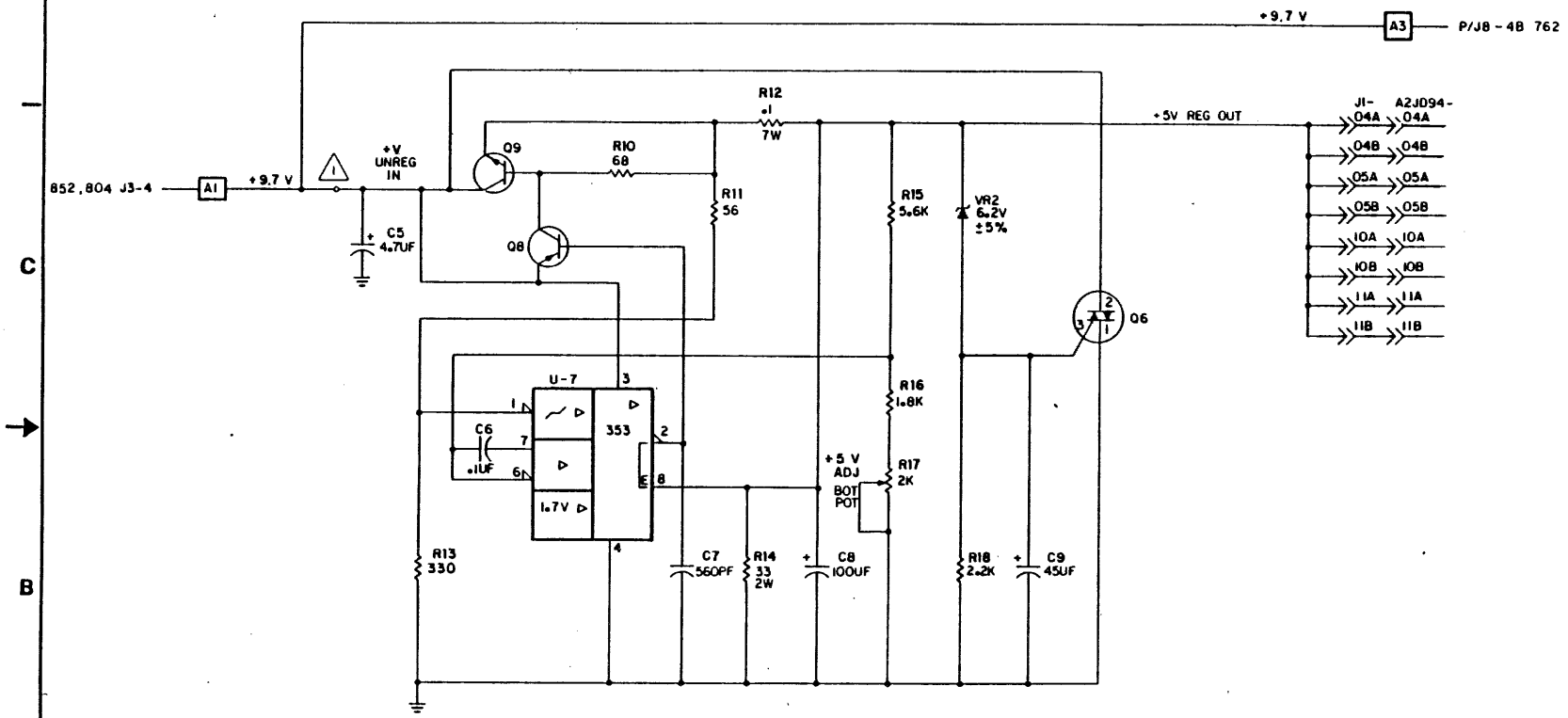
A2 5 VOLT-REGULATOR DIAGRAMS

CODE IDENT 19333	C	83319100	AS	A
CROSS REF NO 841	SHEET 1 of 4	PAGE 7-231		



TWIN CITIES DISK DIVISION	A2-±5 VOLT REGULATORS PC BOARD AND A1P3	CODE IDENT 19333	C	83319100	AS A
		CROSS REF NO 842	SHEET 2	PAGE 7-232	


-9.7V
A3
762 P8-3B
852,804 J3-6
A1
-9.7V
-V UNREG IN
U-1
R1
27
320
R5
68
Q4
Q3
R8
1
7W
Q2
-5V REG OUT
J1-
JD94-
C3
4.7UF
R6
1.8K
R7
5.6K
R2
1.69K
R4
1.8K
C1
4.7UF
C2
22UF
R3
2K
TOP
POT
-5 V
ADJ
VR1
6.2V
±5%
Q5
R9
2.2K
C4
45UF
-GND
852,804 P/J3-5
NOTES
1
FASTONS ON CARD EDGE
REFER TO CROSS REFERENCE
NUMBER 852.
DIAGRAM
- 5V REGULATOR
TWIN CITIES
DISK
DIVISION
CODE IDENT
19333
C
83319100
AS
A
CROSS
REF NO 843
SHEET 3
PAGE 7-233
83214166

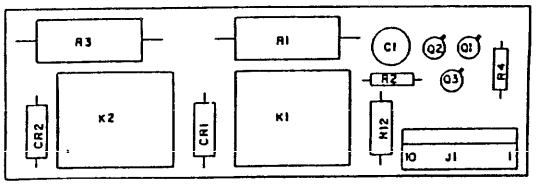


NOTES

1. FASTON ON CARD EDGE REFER TO CROSS REFERENCE NUMBER 852.

TWIN CITIES DISK DIVISION	DIAGRAM +5V REGULATOR	CODE IDENT 19333	C	83319100	AS	A
		CROSS REF NO 844		SHEET 4	PAGE 7-234	

83214166



REVISIONS					
REV	ECO	DESCRIPTION	CHKT	DATE	CHK'D
A	CH23CCO CH13286	RELEASED	SMS	11-22-82	
B	DJ13406C	CHG DIAGRAMS	DK	1-20-84	
C	DJ13602 DJ72000A	TAB 14 VDE PS CHG FORMAT CHG	TT	9-27-84	
D	DJ13711	VDE NON-VDE LOGIC	BJP	6-25-85	

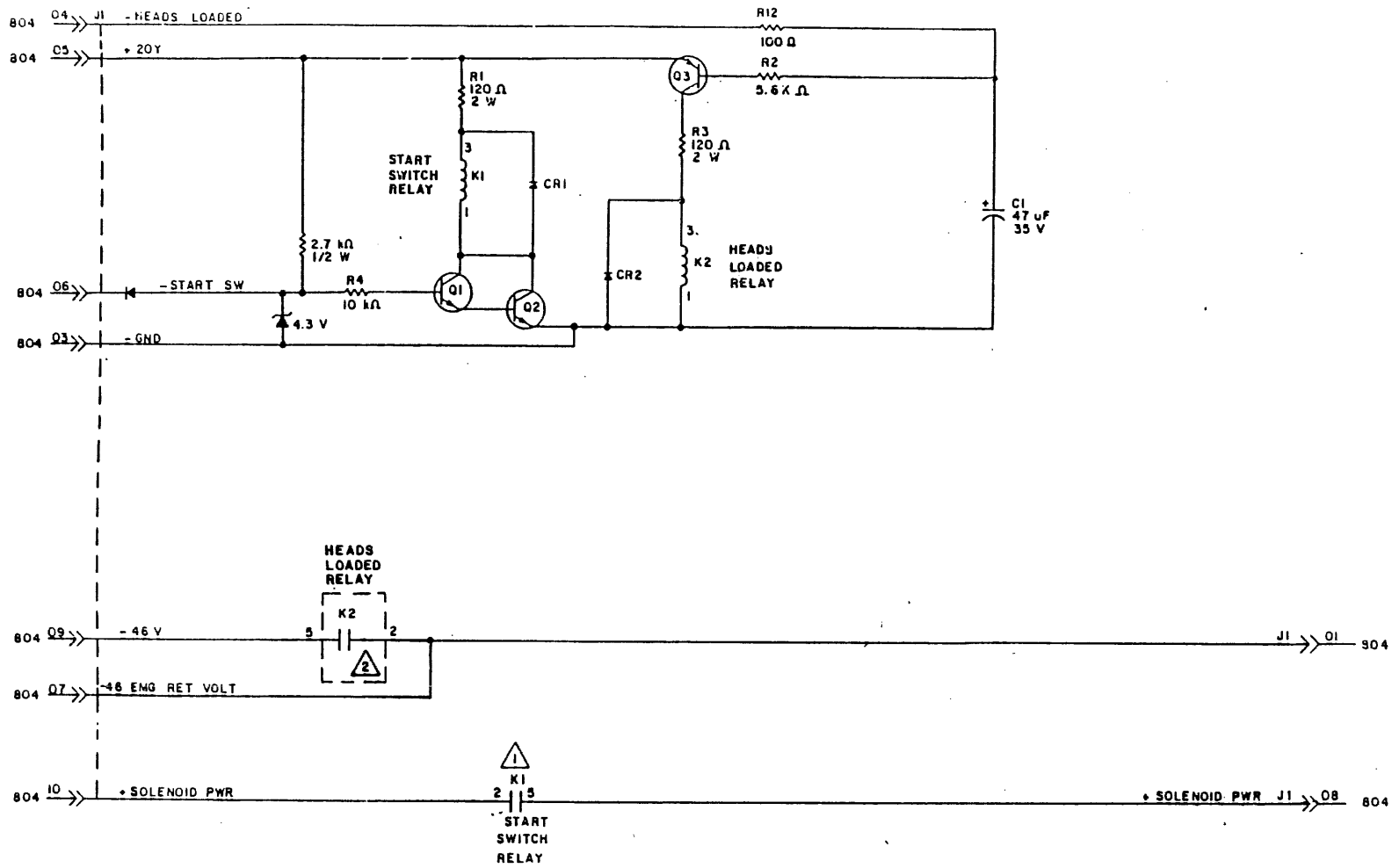
DRAWN	T. [illegible]	10-15-84
CHECKED		
ENGINEER	[illegible]	10-17-84
APPROVED		

RELAY BOARD
DIAGRAMS (A1A41)
TYPE DFNN

TWIN CITIES DISK DIVISION | C | 83319100 | AS | D

COPYRIGHT 1983 | REV PER NO 851 | 1 of 2 | PAGE 7-235

83214191



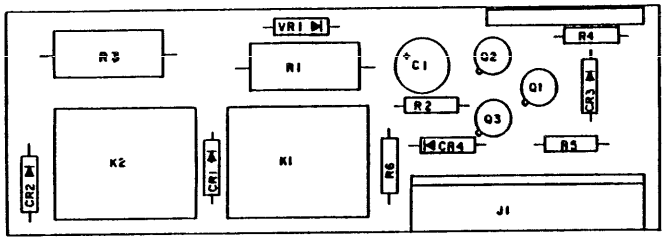
NOTES:

1. CLOSED WHEN START SW OFF.
2. CLOSED WHEN HEADS ARE LOADED.

	RELAY BOARD	TWIN CITIES DISK DIVISION	C	83319100	AS	D
		CODE IDENT 19333	CAGE NO 952	SHEET 2	PAGE 7-236	

83214191

REVISIONS					
REV	ECO	DESCRIPTION	SHEET	DATE	APPD
A	DJ23000 DJ13711	CLASS A RELEASED BY ECO	BJP	72385	



83214167

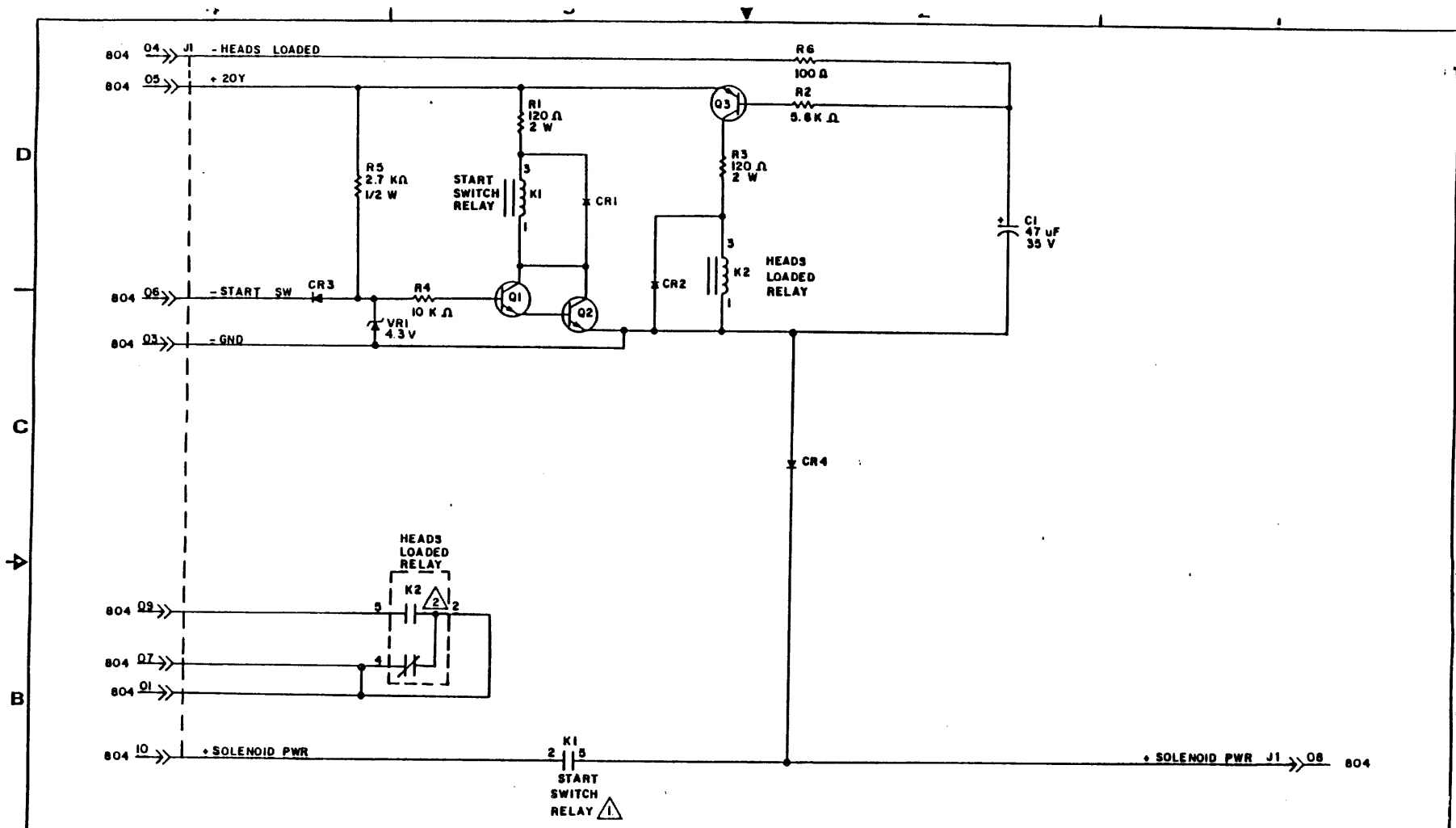
DRAWN	BJP	8.14.85
CHECKED		8.19.85
ENGINEER	B WEIST	8.14.85
APPROVED		

RELAY BOARD DIAGRAMS (A1 A4)

TYPE: EFNN

TWIN CITIES DISK DIVISION | C | 83319100 | AS | A

CODE IDENT 19333 | ENGR REF NO 851 | SHEET 1 of 2 | PAGE 7-237



	RELAY BOARD	TWIN CITIES DISK DIVISION	C	83319100	AS	A
		CODE IDENT 19333	CROSS REF NO 852	SHEET 2	PAGE 7-238	

B83214167

SECTION 8

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.

The logic wire 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 is listed first and the highest last. Following the listing of connections between card locations is a list of connection 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.

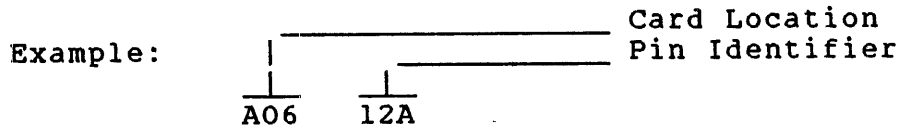
The following explains each of the columns in the wire list (refer to figure 8-1).

SIGNAL NAME OR NUMBER IDENTIFICATION

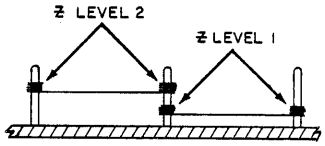
Contains a number which is for factory use only.

ORIGIN/DESTINATION

These columns list both ends of each connection. The terms are defined in the following example.



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 8-1. Example of Logic Wirewrap List

The Key to Diagrams in the Diagrams section of this manual has additional information on card and pin locations.

Z LEVEL

Each pin may contain either one or two wires. If it contains two wires, they must be separated vertically (refer to figure 8-2). The Z level refers to whether the wire wrapped connection is on the level closest to the wirewrap panel surface (level 1) or farthest from it (level 2). If the pin contains only one wire, it is always a level 1 wrap. In either case the same Z level is maintained at both ends of the wire.

NOTES

Contains signal names, history or other information pertaining to wire list.

For explanation of Non-VDE and VDE (refer to section 1, page 7-1 of the Diagrams section).

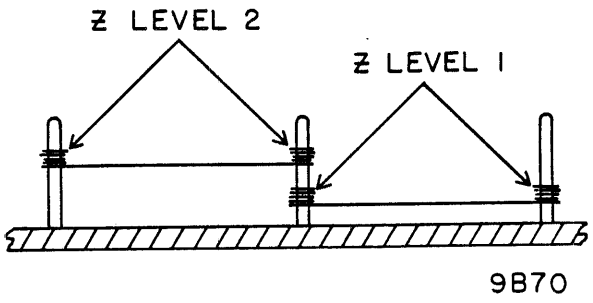


Figure 8-2. Z Levels

TITLE LOGIC WIREWRAP WIRELIST FOR REF NUMBERS SEE NOTE BELOW	WL	DOCUMENT NO. LOGIC W/W	SHEET NO. 1 OF 13	REV.

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
102111	A0101B	A0102A	1	
102111	A0102A	A0101B	1	
102111	A0102A	JD9402A	2	
100108	A0102B	A1708A	1	
100211	A0103A	A0231A	1	
100107	A0103B	A0817A	1	
100601	A0104A	A0613B	2	
100600	A0104B	A0621B	1	
101700	A0107A	A1708B	1	
100713	A0107B	A0711A	1	
100101	A0110A	A1310B	1	BJ4A2C,D ONLY
100100	A0110B	A1323B	1	
100103	A0115A	A1731A	1	
100102	A0115B	A1732A	1	
100206	A0116A	A0228A	1	
100202	A0116B	A0224A	1	
100722	A0117A	A0804A	1	
100221	A0117B	A0202A	1	
100208	A0121A	A0224B	1	
101710	A0121B	A0203B	1	
100109	A0122A	A0134A	1	
100204	A0122B	A0227A	1	
101403	A0123A	A1432B	1	
101000	A0123B	A1012B	1	
100703	A0124A	A0703A	1	
101707	A0124B	A1726B	1	
101501	A0131A	A1527B	1	
101500	A0131B	A1526B	1	
100104	A0132A	A0822A	1	
100106	A0132B	A0821B	1	
100105	A0133B	A0821A	1	
100109	A0134A	A0122A	1	
100201	A0201A	JA8207B	1	
100221	A0202A	A0804B	2	
100221	A0202A	A0117B	1	
100222	A0202B	A1424B	1	
100217	A0203A	A0633B	1	
101710	A0203B	A0121B	1	
101710	A0203B	A0805A	2	
100224	A0204A	A1729A	2	
100223	A0204B	A1729B	2	
100202	A0224A	A0632B	2	
100202	A0224A	A0116B	1	
100208	A0224B	A0121A	1	
100208	A0224B	A0623B	2	
100216	A0225A	A0611B	2	
100212	A0225B	A0626A	2	
100214	A0226A	A0626B	2	
100210	A0226B	A0622A	2	
100204	A0227A	A0625A	2	
100204	A0227A	A0122B	1	
100200	A0227B	JA8207A	1	

REF: 83229118 (BJ4A1) NON-VDE
REF: 83229123 (BJ4A1) VDE
REF: 77476335 (ALL BJ4A2's Except BJ4A2-C,D,N,& P) NON-VDE
REF: 77476353 (ALL BJ4A2's Except BJ4A2-C,D,N,& P) VDE
REF: 77476334 (BJ4A2-C,D only) NON-VDE
REF: 77476352 (BJ4A2-C,D only) VDE
REF: 77476345 (BJ4A2-N,P only) NON-VDE
REF: 77476359 (BJ4A2-N,P only) VDE

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIREWRAP		LOGIC W/W	2	

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
100206	A0228A	A0623A	2	
100206	A0228A	A0116A	1	
100205	A0228B	A1923A	1	
100203	A0229A	A1431B	1	
100207	A0229B	A1923B	1	
100209	A0230A	A1712A	1	
100213	A0230B	A0612B	1	
100211	A0231A	A1326B	2	
100211	A0231A	A0103A	1	
100215	A0231B	A1504B	1	
100220	A0232A	A1206B	1	
100218	A0232B	A0632A	2	
100219	A0233A	A1503B	1	
100225	A0233B	JA8412A	1	
100834	A0504A	A0808A	1	
100833	A0504B	A0808B	1	
101910	A0506A	A1921B	1	
101909	A0506B	A1921A	1	
100832	A0507A	A0806A	1	
100831	A0507B	A0806B	1	
102118	A0508A	JD93088	1	
102119	A0508B	JD93098	1	
100830	A0509A	A0807A	1	
100829	A0509B	A0807B	1	
102120	A0514B	JD93108	1	
101806	A0604A	A1811B	1	
100718	A0604B	A0721B	1	
100612	A0605A	A0614A	1	
100611	A0605A	A0630A	1	BJ4A2 ONLY
101805	A0605B	A1832A	1	BJ4A1 ONLY
100606	A0606A	A0711B	1	
100607	A0606B	A0724A	1	
100604	A0607A	A0732B	1	
100609	A0607B	A1926A	1	
100611	A0609A	A0613A	1	BJ4A2 ONLY
100611	A0609A	A0629A	2	BJ4A1 ONLY
101901	A0610A	A1905A	1	
100603	A0610B	A1910B	1	
100720	A0611A	A0725A	1	
100216	A0611B	A0225A	2	
100216	A0611B	A1226B	1	BJ4A2 ONLY
100724	A0612A	A0713B	1	
100213	A0612B	A0727A	2	
100213	A0612B	A0230B	1	
100611	A0613A	A0615B	2	BJ4A2 ONLY
100611	A0613A	A0609A	1	BJ4A2 ONLY
100612	A0613A	A0629B	2	BJ4A1 ONLY
100612	A0613A	A0614B	1	BJ4A1 ONLY
100601	A0613B	A0104A	2	
100601	A0613B	JA8401A	1	
100612	A0614A	A0605A	1	BJ4A2 ONLY
100612	A0614A	A0614B	2	BJ4A2 ONLY
100612	A0614B	A0614A	2	BJ4A2 ONLY
100612	A0614B	A0625B	1	BJ4A2 ONLY
100611	A0614A	A0615B	2	BJ4A1 ONLY
100611	A0614A	A0625B	1	BJ4A1 ONLY
100612	A0614B	A0613A	1	BJ4A1 ONLY
101003	A0615A	A1026B	1	
100611	A0615B	A0613A	2	
100611	A0615B	A0614A	2	BJ4A1 ONLY
100611	A0615B	A0634A	1	BJ4A1 ONLY

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIREWRAP		LOGIC W/W	3	

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTI-NATION	Z LEVEL	NOTES
100611	A0615B	A0624B	1	
101900	A0616A	A1904A	1	
100605	A0616B	A0702A	1	
100722	A0617A	A1226A	2	
100722	A0617A	A0706B	1	
100716	A0617B	A0707B	1	
100608	A0621A	A0717A	1	
100600	A0621B	A0104B	1	
100210	A0622A	A0803A	1	
100210	A0622A	A0226B	2	
101804	A0622B	A1004B	2	
100206	A0623A	A0228A	2	
100206	A0623A	A1230A	1	BJ4A2 ONLY
100206	A0623A	A1228B	1	BJ4A1 ONLY
100208	A0623B	A1228B	1	BJ4A2 ONLY
100208	A0623B	A1229B	1	BJ4A1 ONLY
100208	A0623B	A0224B	2	
100611	A0624A	A0634A	1	BJ4A2 ONLY
100611	A0624A	A0624B	2	BJ4A2 ONLY
100611	A0624B	A0624A	2	BJ4A2 ONLY
100611	A0624B	A0615B	1	BJ4A2 ONLY
100612	A0624A	A0629B	1	BJ4A1 ONLY
100612	A0624A	A0630A	2	BJ4A1 ONLY
100611	A0624B	A0629A	1	BJ4A1 ONLY
100611	A0624B	A0625B	2	BJ4A1 ONLY
100204	A0625A	A0227A	2	
100204	A0625A	A1233A	1	BJ4A2 ONLY
100204	A0625A	A1230A	1	BJ4A1 ONLY
100612	A0625B	A0614B	1	BJ4A2 ONLY
100612	A0625B	A0629B	2	BJ4A2 ONLY
100611	A0625B	A0614A	1	BJ4A1 ONLY
100611	A0625B	A0624B	2	BJ4A1 ONLY
100212	A0626A	A1224A	1	BJ4A2 ONLY
100212	A0626A	A1222B	1	BJ4A1 ONLY
100212	A0626A	A0225B	2	
100214	A0626B	A1222B	1	BJ4A2 ONLY
100214	A0626B	A1226B	1	BJ4A1 ONLY
100214	A0626B	A0226A	2	
100602	A0627A	A0733A	1	
101208	A0627B	A0705B	1	
101906	A0628B	A1915B	1	
100612	A0629A	A0630A	2	BJ4A2 ONLY
100612	A0629A	A0629B	1	BJ4A2 ONLY
100612	A0629B	A0629A	1	BJ4A2 ONLY
100612	A0629B	A0625B	2	BJ4A2 ONLY
100612	A0630A	A0629A	2	BJ4A2 ONLY
100611	A0629A	A0624B	1	BJ4A1 ONLY
100611	A0629A	A0609A	2	BJ4A1 ONLY
100612	A0629B	A0624A	1	BJ4A1 ONLY
100612	A0629B	A0613A	2	BJ4A1 ONLY
100612	A0630A	A0605A	1	BJ4A1 ONLY
100612	A0630A	A0624A	2	BJ4A1 ONLY
101004	A0631A	A0103B	1	
100218	A0632A	A0232B	2	
100218	A0632A	A1221A	1	BJ4A2 ONLY
100218	A0632A	A1225A	1	BJ4A1 ONLY
100202	A0632B	A0224A	2	
100202	A0632B	A1231A	1	BJ4A2 ONLY
100202	A0632B	A1233A	1	BJ4A1 ONLY
100610	A0633A	A0729A	1	
100217	A0633B	A1225A	2	BJ4A2 ONLY
100217	A0633B	JA8405B	2	BJ4A1 ONLY
100217	A0633B	A0203A	1	
100611	A0634A	A0624A	1	BJ4A2 ONLY
100611	A0634A	A0615B	1	BJ4A2 ONLY
100728	A0701A	JA8305A	1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIREWRAP		LOGIC W/W	4	

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
100605	A0702A	A0616B	1	
101208	A0702B	A0705B	2	
101208	A0702B	A1207A	1	
100703	A0703A	A1205B	2	
100703	A0703A	A0124A	1	
100704	A0703B	A1710A	1	
101206	A0704A	A1213B	1	
100702	A0704B	A1907B	1	
100804	A0705A	A0829B	2	
101208	A0705B	A0627B	1	
101208	A0705B	A0702B	2	
100706	A0706A	A0831A	1	
100722	A0706B	A0617A	1	
100722	A0706B	A0804A	2	
100701	A0707A	A2012A	1	
100716	A0707B	A0617B	1	
100716	A0707B	A1725B	2	
100700	A0708A	A2009B	1	
100707	A0709A	A0716A	2	
101207	A0710A	A1232B	1	
100717	A0710B	A1205A	1	
100713	A0711A	A0107B	1	
100606	A0711B	A0606A	1	
100801	A0712A	A0825A	1	
100721	A0712B	A2026B	1	
100710	A0713A	A2029B	1	
100724	A0713B	A0612A	1	
100724	A0713B	A0832A	2	
100708	A0714A	A1203B	1	
101209	A0714B	A0811B	2	
100800	A0715A	A0831B	1	
100714	A0715B	A1225B	1	
100707	A0716A	A1928A	1	
100707	A0716A	A0709A	2	
100705	A0716B	A1927B	1	
100608	A0717A	A0621A	1	
101213	A0717B	A1206A	1	
100718	A0721B	A0604B	1	
100718	A0721B	A0833A	2	
100709	A0722A	A1910A	1	
101214	A0722B	A1207B	1	
100725	A0723A	A0734A	1	
100803	A0723B	A0825B	1	
100607	A0724A	A0606B	1	
100726	A0724B	JA8304A	1	
100720	A0725A	A0611A	1	
101215	A0725B	A1214B	1	
100723	A0726A	A1905B	1	
101709	A0726B	A1724A	1	
100213	A0727A	A0612B	2	
101801	A0727B	A1808B	1	
101800	A0728B	A1807B	1	
100610	A0729A	A0633A	1	
100719	A0729B	A2027B	1	
100711	A0730A	A1916B	1	
100715	A0731A	A0803B	1	
101705	A0731B	A1714A	1	
100712	A0732A	A0805B	1	
100604	A0732B	A0607A	1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIREWRAP		LOGIC W/W	5	

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
100602	A0733A	A0627A	1	
101702	A0733B	JA8001A	1	
101702	A0733B	A0802A	2	
100725	A0734A	A0723A	1	
100818	A0801A	JA8101B	1	
100820	A0801A	JA8103B	2	
101702	A0802A	A0733B	2	
101702	A0802A	A1711B	1	
100210	A0803A	A1229B	2	BJ4A1 ONLY
100210	A0803A	A1224A	2	BJ4A1 ONLY
100210	A0803A	A0622A	1	
100715	A0803B	A0731A	1	
100722	A0804A	A0117A	1	
100722	A0804A	A0706B	2	
100221	A0804B	A0202A	2	
100221	A0804B	JA8405A	1	
101710	A0805A	A0203B	2	
101710	A0805A	A1710B	1	
100712	A0805B	A0732A	1	
100832	A0806A	A0507A	1	
100831	A0806B	A0507B	1	
100830	A0807A	A0509A	1	
100829	A0807B	A0509B	1	
100834	A0808A	A0504A	1	
100833	A0808B	A0504B	1	
100807	A0809A	A2004A	1	
100810	A0809B	A2006A	1	
100805	A0810A	A2005A	1	
100806	A0810B	A2004B	1	
101210	A0811A	A1202A	1	
101209	A0811B	A0714B	2	
101209	A0811B	A1217A	1	
101212	A0812A	A1204A	1	
101211	A0812B	A1203A	1	
101217	A0813A	A1209B	1	
101218	A0813B	A1209A	1	
100808	A0814A	A2003B	1	
101216	A0814B	A1210A	1	
100811	A0815A	A2006B	1	
100809	A0815B	A2005B	1	
100819	A0816A	JA8103A	1	
100817	A0816B	JA8101A	1	
100107	A0817A	A0103B	1	
100821	A0817B	JA8102A	1	
100105	A0821A	A0133B	1	
100106	A0821B	A0132B	1	
100104	A0822A	A0132A	1	
101219	A0822B	A1211B	1	
100813	A0823A	JA8105A	1	
100802	A0824A	A1716B	1	
100815	A0824B	JA8106A	1	
100801	A0825A	A0712A	1	
100803	A0825B	A1924B	2	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIREWRAP		LOGIC W/W	6	

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
100803	A0825B	A0723B	1	
100823	A0826A	JD9311B	1	
100825	A0826B	JD9314A	1	
100827	A0827A	JD9309A	1	
100826	A0827B	JD9311A	1	
101706	A0828A	A1712B	2	S/C 06 AND ABV
100812	A0828B	A1216B	2	
100812	A0828B	A1733A	1	
101912	A0829A	A1914A	1	
100804	A0829B	A0705A	2	
100804	A0829B	A2013B	1	
102001	A0830A	A2012B	1	
102000	A0830B	A2014A	1	
100706	A0831A	A0706A	1	
100800	A0831B	A2032A	2	
100800	A0831B	A0715A	1	
100724	A0832A	A0713B	2	
100724	A0832A	A1827B	1	
101907	A0832B	A1931B	1	
100718	A0833A	A0721B	2	
100718	A0833A	A2028B	1	
102121	A0833B	JD9307A	1	S/C 06 AND ABV
100816	A0834A	JA8106B	2	
100814	A0834A	JA8105B	1	
100822	A0901A	JA8102B	1	
102110	A1001B	A1021B	1	
102104	A1002B	A1502B	1	
102104	A1002B	JD9203A	2	
101804	A1004B	A0622B	2	
101804	A1004B	A1833A	1	
101000	A1012B	A0123B	1	
101000	A1012B	JA8403A	2	
101004	A1013B	A0631A	1	
102112	A1014B	A1034B	1	
102112	A1014B	JD9404A	2	
102110	A1021B	JD9401B	2	
102110	A1021B	A1001B	1	
101803	A1022B	A1812B	1	
101002	A1023B	A1523B	1	
101001	A1024B	A1524B	1	BJ4A2C,D ONLY
101003	A1026B	A0615A	1	BJ4A2C,D ONLY
100101	A1027B	JA8409B	2	
101000	A1027B	A0123B	2	
101006	A1030B	A1309A	1	
102107	A1033B	A1533B	1	
102107	A1033B	JD9203B	2	
102112	A1034B	A1014B	1	
100828	A1101A	JA8104A	1	
101205	A1201A	JA8206B	2	
101201	A1201A	JA8204B	1	
101210	A1202A	A0811A	1	
101211	A1203A	A0812B	1	
100708	A1203B	A1916A	2	
100708	A1203B	A0714A	1	
101212	A1204A	A0812A	1	
100717	A1205A	A0710B	1	
100703	A1205B	A0703A	2	
100703	A1205B	A1232A	1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIREWRAP		LOGIC W/W	7	

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
101213	A1206A	A0717B	1	
100220	A1206B	A0732A	1	
100220	A1206B	JA8414A	2	
101208	A1207A	A0702B	1	
101214	A1207B	A0722B	1	
101218	A1209A	A0813B	1	
101217	A1209B	A0813A	1	
101216	A1210A	A0814B	1	
101219	A1211B	A0822B	1	
101200	A1213A	JA8204A	1	
101206	A1213B	A0704A	1	
101215	A1214B	A0725B	1	
101903	A1215A	A1925A	1	
101220	A1216A	A1730B	1	
100812	A1216B	A0828B	2	
101209	A1217A	A0811B	1	
100218	A1221A	A0632A	1	BJ4A2 ONLY
100218	A1221A	JA8406B	2	BJ4A2 ONLY
100214	A1222B	A0626B	1	BJ4A2 ONLY
100214	A1222B	JA8409A	2	BJ4A2 ONLY
100216	A1221A	A0611B	1	BJ4A1 ONLY
100216	A1221A	JA8408A	2	BJ4A1 ONLY
100212	A1222B	A0626A	1	BJ4A1 ONLY
100212	A1222B	JA8411A	2	BJ4A1 ONLY
101202	A1223B	JA8205A	1	
100212	A1224A	A0626A	1	BJ4A2 ONLY
100212	A1224A	JA8411A	2	BJ4A2 ONLY
100210	A1224A	JA8410A	1	BJ4A1 ONLY
100210	A1224A	A0803A	2	BJ4A1 ONLY
101204	A1224B	JA8206A	1	
100217	A1225A	A0633B	2	BJ4A2 ONLY
100217	A1225A	JA8405B	1	BJ4A2 ONLY
100218	A1225A	A0632A	1	BJ4A1 ONLY
100218	A1225A	JA8406B	2	BJ4A1 ONLY
100714	A1225B	A0715B	1	
100722	A1226A	A1917A	1	
100722	A1226A	A0617A	2	
100216	A1226B	JA8408A	2	
100216	A1226B	A0611B	1	
100208	A1228B	A0623B	1	
100208	A1228B	JA8406A	2	
100210	A1229B	A0803A	2	
100210	A1229B	JA8410A	1	
100206	A1230A	A0623A	1	
100206	A1230A	JA8407A	2	
100202	A1231A	A0632B	1	
100202	A1231A	JA8408B	2	
100214	A1226B	A0626B	1	BJ4A1 ONLY
100214	A1226B	JA8409A	2	BJ4A1 ONLY
100206	A1228B	A0623A	1	BJ4A1 ONLY
100206	A1228B	JA8407A	2	BJ4A1 ONLY
100208	A1229B	A0623B	1	BJ4A1 ONLY
100208	A1229B	JA8406A	2	BJ4A1 ONLY
100204	A1230A	A0625A	1	BJ4A1 ONLY
100204	A1230A	JA8407B	2	BJ4A1 ONLY
100203	A1231A	A1234A	2	BJ4A1 ONLY
100703	A1232A	A1205B	1	
101207	A1232B	A0710A	1	
100204	A1233A	JA8407B	2	BJ4A2 ONLY
100204	A1233A	A0625A	1	BJ4A2 ONLY
100202	A1233A	A0632A	1	BJ4A1 ONLY
100202	A1233A	JA8408B	2	BJ4A1 ONLY
101221	A1233B	JA8402A	1	
101203	A1234A	JA8205B	1	
100203	A1234A	A1231A	2	BJ4A1 ONLY

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIREWRAP		LOGIC W/W	8	

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTI-NATION	Z LEVEL	NOTES
101300	A1305A	A1301A	1	
101006	A1309A	A1030B	1	
100101	A1310B	A0110A	1	BJ4A2C,D ONLY
100101	A1310B	JA8409B	2	BJ4A2C,D ONLY
100200	A1312B	A1713A	1	
100200	A1312B	JA8207A	2	
100100	A1323B	JA8410B	2	
100100	A1323B	A0110B	1	
100211	A1326B	A0231A	2	
100211	A1326B	A1513B	1	
101712	A1331A	A1709B	1	
101713	A1331B	A1734A	1	
102103	A1402B	JD9201A	2	
102103	A1402B	A1602B	1	
101401	A1403B	A1510B	1	
101400	A1404B	A1509B	1	
101404	A1410B	A1422B	1	
101902	A1412B	A1907A	1	
101405	A1414B	A1421B	1	
101405	A1421B	A1414B	1	
101404	A1422B	A1410B	1	
100812	A1423B	A1733A	2	
100222	A1424B	A0202B	1	
101406	A1425B	A1726A	1	
100211	A1427B	A1908B	1	
101724	A1428B	A1707A	1	
101402	A1430B	A1522B	1	
100203	A1431B	A1512B	2	
100203	A1431B	A0229A	1	
101403	A1432B	A0123A	1	
101403	A1432B	JA8404A	2	
102106	A1433B	JD9201B	2	
102106	A1433B	A1633B	1	
102104	A1502B	A1002B	1	
100219	A1503B	A0233A	1	
100215	A1504B	A0231B	1	
101400	A1509B	A1404B	1	
101401	A1510B	A1403B	1	
100203	A1512B	A1713B	1	
100203	A1512B	A1431B	2	
100211	A1513B	A1326B	1	
100211	A1513B	A1908B	2	
101402	A1522B	A1430B	1	
101002	A1523B	A1023B	1	
101001	A1524B	A1024B	1	
101500	A1526B	A0131B	1	
101501	A1527B	A0131A	1	
102107	A1533B	A1033B	1	
102103	A1602B	A1402B	1	
101807	A1613B	A1823B	1	
101703	A1614B	A1711A	1	
101703	A1614B	JA8009B	2	
101808	A1615B	A1825B	1	
102106	A1633B	A1433B	1	
101715	A1701A	JA8203B	1	
101701	A1701A	JA8210B	2	
102103	A1702B	JD9201A	1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIREWRAP		LOGIC W/W	9	

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTI-NATION	Z LEVEL	NOTES
101717	A1703B	JD9312B	1	
101724	A1707A	A1428B	1	
100108	A1708A	A0102B	1	
101700	A1708B	JA8210A	2	
101700	A1708B	A0107A	1	
101711	A1709A	JA8002B	1	
101712	A1709B	A1331A	1	
100704	A1710A	A0703B	1	
101710	A1710B	A0805A	1	
101710	A1710B	A1917B	2	
101703	A1711A	A1614B	1	
101703	A1711A	JA8208A	2	
101702	A1711B	A0802A	1	
100209	A1712A	A0230A	1	
101706	A1712B	JA8013A	1	
101706	A1712B	A0828A	1	S/C 06 AND ABV
100200	A1713A	A1312B	1	
100203	A1713B	A1512B	1	
100203	A1713B	A1908A	2	
101705	A1714A	A0731B	1	
101714	A1714B	JA8203A	1	
101725	A1715B	A1914B	2	
100802	A1716B	A0824A	1	
101718	A1717A	JA8303B	1	
101719	A1717B	JA8303A	1	
101709	A1724A	A0726B	1	
100716	A1725B	A0707B	2	
101406	A1726A	A1425B	1	
101707	A1726B	A0124B	1	
101721	A1727A	JA8012A	1	
101720	A1728B	JA8011A	1	
100224	A1729A	A0204A	2	
100224	A1729A	JA8411B	1	
100223	A1729B	JA8412B	1	
100223	A1729B	A0204B	2	
101723	A1730A	JA8014A	1	
101220	A1730B	A1216A	1	
100103	A1731A	JA8414B	2	
100103	A1731A	A0115A	1	
101722	A1731B	JA8011B	1	
100102	A1732A	JA8413B	2	
100102	A1732A	A0115B	1	
101716	A1732B	JD9312A	1	
100812	A1733A	A1423B	2	
100812	A1733A	A0828B	1	
102106	A1733B	JD9201B	1	
101713	A1734A	A1331B	1	
101704	A1734A	JA8208B	2	
102104	A1802B	JD9203A	1	
102121	A1801A	JA8305B	1	
101800	A1807B	A0728B	1	
101801	A1808B	A0727B	1	
101802	A1809B	A1911A	1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIREWRAP		LOGIC W/W	10	

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTI-NATION	Z LEVEL	NOTES
101806	A1811B	A0604A	1	
101803	A1812B	A1022B	1	
101807	A1823B	A1613B	1	
101808	A1825B	A1615B	1	
100724	A1827B	A0832A	1	
101805	A1832A	A0605B	1	
101804	A1833A	A1004B	1	
102107	A1833B	JD9203B	1	
101900	A1904A	A0616A	1	
102002	A1904B	A2015B	1	
101901	A1905A	A0610A	1	
100723	A1905B	A0726A	1	
101902	A1907A	A1412B	1	
100702	A1907B	A0704B	1	
100203	A1908A	A1713B	2	
100211	A1908B	A1513B	2	
100211	A1908B	A1427B	1	
100709	A1910A	A0722A	1	
100603	A1910B	A0610B	1	
101802	A1911A	A1809B	1	
102003	A1911B	A2014B	1	
101912	A1914A	A0829A	1	
101725	A1914B	A1915A	1	
101725	A1914B	A1715B	2	
101725	A1915A	A1914B	1	
101906	A1915B	A0628B	1	
100708	A1916A	A1203B	2	
100711	A1916B	A0730A	1	
100722	A1917A	A1226A	1	
101710	A1917B	A1710B	2	
101909	A1921A	A0506B	1	
101910	A1921B	A0506A	1	
101908	A1922A	A2010B	1	
100205	A1923A	A0228B	1	
100207	A1923B	A0229B	1	
101904	A1924A	A2011A	1	
100803	A1924B	A1925B	1	
100803	A1924B	A0825B	2	
101903	A1925A	A1215A	1	
100803	A1925B	A1924B	1	
100609	A1926A	A0607B	1	
101911	A1926B	JA8009B	1	
101905	A1927A	A2010A	1	
100705	A1927B	A0716B	1	
100707	A1928A	A0716A	1	
101907	A1931B	A0832B	1	
102115	A2001A	JA8403B	2	
102115	A2001A	JA8402B	1	
100808	A2003B	A0814A	1	
100807	A2004A	A0809A	1	
100806	A2004B	A0810B	1	
100805	A2005A	A0810A	1	
100809	A2005B	A0815B	1	
100810	A2006A	A0809B	1	
100811	A2006B	A0815A	1	
100700	A2009B	A0708A	1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIREWRAP		LOGIC W/W	11	

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
101905	A2010A	A1927A	1	
101908	A2010B	A1922A	1	
101904	A2011A	A1924A	1	
102008	A2011B	JD9305B	1	
100701	A2012A	A0707A	1	
102001	A2012B	A0830A	1	
100804	A2013B	A0829B	1	
102000	A2014A	A0830B	1	
102003	A2014B	A1911B	1	
102007	A2015A	JD9305A	1	
102002	A2015B	A1904B	1	
100721	A2026B	A0712B	1	
100719	A2027B	A0729B	1	
100718	A2028B	A0833A	1	
100710	A2029B	A0713A	1	
102005	A2031B	JD9306B	1	
100800	A2032A	A0831B	2	
102004	A2032B	JD9306A	1	
102006	A2034A	JD9304B	1	
102009	A2034A	JD9304A	2	
101702	JA8001A	A0733B	1	
102114	JA8001B	JD9407A	1	
102114	JA8001B	JD9407B	2	
101711	JA8002B	A1709A	1	
102101	JA8005A	JA8306B	1	
102111	JA8005B	JD9402B	2	
102111	JA8005B	JD9402A	1	
102102	JA8007A	JD9303A	1	
101911	JA8009B	A1926B	1	
101703	JA8009B	A1614B	2	
102113	JA8010A	JD9405B	2	
102113	JA8010A	JD9405A	1	
101720	JA8011A	A1728B	1	
101722	JA8011B	A1731B	1	
101721	JA8012A	A1727A	1	
101706	JA8013A	A1712B	1	
101723	JA8014A	A1730A	1	
100817	JA8101A	A0816B	1	
100818	JA8101B	A0801A	1	
100821	JA8102A	A0817B	1	
100822	JA8102B	A0901A	1	
100819	JA8103A	A0816A	1	
100820	JA8103B	A0801A	2	
100828	JA8104A	A1101A	1	
100813	JA8105A	A0823A	1	
100814	JA8105B	A0834A	1	
100815	JA8106A	A0824B	1	
100816	JA8106B	A0834A	2	
102110	JA8201B	JD9401B	1	
102110	JA8201B	JD9401A	2	
102105	JA8202B	JD9302B	1	
101714	JA8203A	A1714B	1	

TITLE	WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIREWRAP		LOGIC W/W	12	

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
101715	JA8203B	A1701A	1	
101200	JA8204A	A1213A	1	
101201	JA8204B	A1201A	1	
101202	JA8205A	A1223B	1	
101203	JA8205B	A1234A	1	
101204	JA8206A	A1224B	1	
101205	JA8206B	A1201A	2	
100200	JA8207A	A0227B	1	
100200	JA8207A	A1312B	2	
100201	JA8207B	A0201A	1	
101703	JA8208A	A1711A	2	
101704	JA8208B	A1734A	2	
101700	JA8210A	A1704B	2	
101701	JA8210B	A1701A	2	
102109	JA8212B	JD9301A	1	
102108	JA8213B	JD9302A	1	
102112	JA8214B	JD9404B	2	
102112	JA8214B	JD9404A	1	
101719	JA8303A	A1717B	1	
102124	JA8303A	JD9303B	2	VDE ONLY
101718	JA8303B	A1717A	1	
102123	JA8303B	JD9301B	2	VDE ONLY
100726	JA8304A	A0724B	1	
100727	JA8304B	JD9308A	1	
100728	JA8305A	A0701A	1	
102121	JA8305B	A1801A	1	
102100	JA8306A	JD9307B	1	
102101	JA8306B	JA8005A	1	
102101	JA8306B	JD9313A	2	VDE ONLY
100601	JA8401A	A0613B	1	
102116	JA8401B	JD9408A	2	
101221	JA8402A	A1233B	1	
102115	JA8402B	A2001A	1	
101000	JA8403A	A1012B	2	
102115	JA8403B	A2001A	2	
101403	JA8404A	A1432B	2	
102117	JA8404B	JD9408B	1	
100221	JA8405A	A0804B	1	
100217	JA8405B	A1225A	1	BJ4A2 ONLY
100208	JA8406A	A1228B	2	BJ4A2 ONLY
100218	JA8406B	A1221A	2	BJ4A2 ONLY
100206	JA8407A	A1230A	2	BJ4A2 ONLY
100204	JA8407B	A1233A	2	BJ4A2 ONLY
100216	JA8408A	A1226B	2	BJ4A2 ONLY
100202	JA8408B	A1231A	2	BJ4A2 ONLY
100214	JA8409A	A1222B	2	BJ4A2 ONLY
100217	JA8405B	A0633B	2	BJ4A1 ONLY
100208	JA8406A	A1229B	2	BJ4A1 ONLY
100218	JA8406B	A1225A	2	BJ4A1 ONLY
100206	JA8407A	A1228B	2	BJ4A1 ONLY
100204	JA8407B	A1230A	2	BJ4A1 ONLY
100216	JA8408A	A1221A	2	BJ4A1 ONLY
100202	JA8408B	A1233A	2	BJ4A1 ONLY
100214	JA8409A	A1226B	2	BJ4A1 ONLY
100101	JA8409B	A1027B	2	
100210	JA8410A	A1229B	1	BJ4A2 ONLY
100100	JA8410B	A1323B	2	
100212	JA8411A	A1224A	2	BJ4A2 ONLY
100212	JA8411B	A1222B	2	BJ4A2 ONLY
100224	JA8411B	A1729A	1	
100225	JA8412A	A0233B	1	
100223	JA8412B	A1729B	1	
102116	JA8413A	JD9408A	1	
100102	JA8413B	A1732A	2	
100220	JA8414A	A1206B	2	

TITLE		WL	DOCUMENT NO.	SHEET NO.	REV.
LOGIC WIREWRAP			LOGIC W/W	13	

SIGNAL NAME OR NUMBER IDENTIFICATION	ORIGIN	DESTINATION	Z LEVEL	NOTES
100103	JA8414B	A1731A	?	
102103	JD9201A	A1702B	1	
102103	JD9201A	A1402B	?	
102106	JD9201B	A1433B	?	
102106	JD9201B	A1733B	1	
102104	JD9203A	A1802B	1	
102104	JD9203A	A1002B	?	
102107	JD9203B	A1833B	1	
102107	JD9203B	A1033B	?	
102109	JD9301A	JA8212B	1	
102123	JD9301B	JA8303B	2	VDE ONLY
102108	JD9302A	JA8213B	1	
102105	JD9302B	JA8202B	1	
102102	JD9303A	JA8007A	1	
102124	JD9303B	JA8303A	2	VDE ONLY
102009	JD9304A	A2034A	?	
102006	JD9304B	A2034A	1	
102007	JD9305A	A2015A	1	
102008	JD9305B	A2011B	1	
102004	JD9306A	A2032B	1	
102005	JD9306B	A2031B	1	
102121	JD9307A	A0833B	1	S/C 06 AND ABV
102100	JD9307B	JA8306A	1	
100727	JD9308A	JA8304B	1	
102118	JD9308B	A0508A	1	
100827	JD9309A	A0827A	1	
102119	JD9309B	A0508B	1	
102120	JD9310B	A0514B	1	
100826	JD9311A	A0827B	1	
100823	JD9311B	A0826A	1	
101716	JD9312A	A1732B	1	
101717	JD9312B	A1703B	1	
102101	JD9313A	JA8306B	2	VDE ONLY
100825	JD9314A	A0826B	1	
102110	JD9401A	JA8201B	?	
102110	JD9401B	JA8201B	1	
102110	JD9401B	A1021B	?	
102111	JD9402A	JA8005B	1	
102111	JD9402A	A0102A	2	
102111	JD9402B	JA8005B	?	
102112	JD9404A	JA8214B	1	
102112	JD9404A	A1014B	?	
102112	JD9404B	JA8214B	?	
102113	JD9405A	JA8010A	1	
102113	JD9405B	JA8010A	?	
102114	JD9407A	JA8001B	1	
102114	JD9407B	JA8001B	?	
102116	JD9408A	JA8413A	1	
102116	JD9408A	JA8401B	2	
102117	JD9408B	JA8404B	1	

SECTION 9

PARTS DATA

INTRODUCTION

This section provides an Illustrated Parts Breakdown and a Spare Parts List for all the storage module drives (SMD) listed in the preface of this manual. Use only Seagate replacement parts. Using non-Seagate replacement parts can adversely affect safety. Using other manufacturers' parts could also degrade reliability, increase maintenance downtime, and void warranty coverage.

Information in this section is divided into two major categories as follows:

Illustrated Parts Breakdown - This breakdown provides part number information for all field replaceable items.

Spare Parts List - This is a list of recommended spare parts.

NOTE

Parts listed in the illustrated parts breakdown, but not in the spare parts list, may be long lead time items subject to significant delays.

SECTION 9A

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 table 9A-1. 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 9A-1 (sheet 1); figure 9A-1 (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 parts 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. In some cases the last two digits (referred to as tab numbers) are replaced by a symbol. Table 9A-1 explains the use of those symbols.

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.

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 01 unit with Engineering Change Order (ECO) 12345 installed). Information that is unique to one particular equipment or application will also be noted in this column.

Color Code Chart - The color code chart (table 9A-2), used in conjunction with the equipment configuration chart (see front of this manual) and the parts list, will provide the eight-digit number needed to order painted parts for all SMD units covered by this manual.

First, determine the correct color code by referring to the equipment configuration chart. Then, find that code in the color code column of table 9A-2. Following the code are the tab numbers for each painted part. If an entire assembly is being replaced, use the two digits listed under ASSY TAB. If just the piece part is needed use the two digits listed under PC PT TAB. The parts list contains the first six digits of each part number plus the symbol ** (for example 775601**). The complete number is obtained by substituting the tab numbers in place of the symbol **.

TABLE 9A-1. SYMBOLOGY

##	Used to indicate 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 9B).
XX	Used to replace tab numbers when an assembly changes tab numbers rapidly in the course of normal factory build. To order replacement 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 change orders installed.
NFR	Used in the part number column to indicate that an assembly is not field replaceable. If repair of the NFR item is necessary, refer to the maintenance section of this manual for further information.
---*---	Used when the attaching hardware or associated parts for an item cannot be shown on the illustration, the note (ATTACHING PARTS) or (ASSOCIATED PARTS) appears in the Description column. All attaching/associated parts for the previously listed part or assembly are listed beneath this note and are separated from the rest of the parts list by this 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.
Non-VDE	All 60 Hz units. 50 Hz units S/C 31 and below.
VDE	50 Hz units only, S/C 32 and above.

TABLE 9A-2. BJ4A1-4A2 COLOR CODE CHART

CLR CODE	ASSEMBLY & PIECE PART TABS												COMMENTS
	TOP COVER		PACK ACCESS COVER		FRONT DOOR		REAR DOOR		LEFT SIDE PANEL		RIGHT SIDE PANEL		
	ASSY	PC	ASSY	PC	ASSY	PC	ASSY	PC	ASSY	PC	ASSY	PC	
A	44	03	00	09	00	09	57	09	00	03	00	03	S/C 05 & BLW
A	44	03	11	09	00	09	57	09	00	03	00	03	S/C 06 & ABV
B	45	36	01	36	01	36	61	37	01	37	01	37	
C	46	22	02	22	03	22	62	22	02	23	02	23	S/C 05 & BLW
C	46	22	12	22	03	22	62	22	02	23	02	23	S/C 06 & ABV
D	47	42	04	42	04	42	63	42	03	43	03	43	S/C 05 & BLW
D	47	42	13	42	04	42	63	42	03	43	03	43	S/C 06 & ABV
E	48	47	05	48	05	48	64	48	04	47	04	47	S/C 05 & BLW
E	48	47	14	48	05	48	64	48	04	47	04	47	S/C 06 & ABV
F	49	45	06	46	06	45	65	44	05	44	05	44	S/C 05 & BLW
F	49	45	15	46	06	45	65	44	05	44	05	44	S/C 06 & ABV
G	51	50	07	49	08	50	66	50	06	50	06	50	
H	55	90	24	89	16	89	71	89	13	90	13	90	
J	62	29	32	30	26	30	78	30	20	29	20	29	
K	64	20	34	21	29	21	80	21	22	20	22	20	
L	66	41	37	40	32	40	82	40	24	41	24	41	
M	97	39	56	43	04	49	03	47	59	40	59	40	
N	47	42	11	09	04	42	63	42	03	43	03	43	
P	06	54	69	59	17	65	18	60	69	55	69	55	

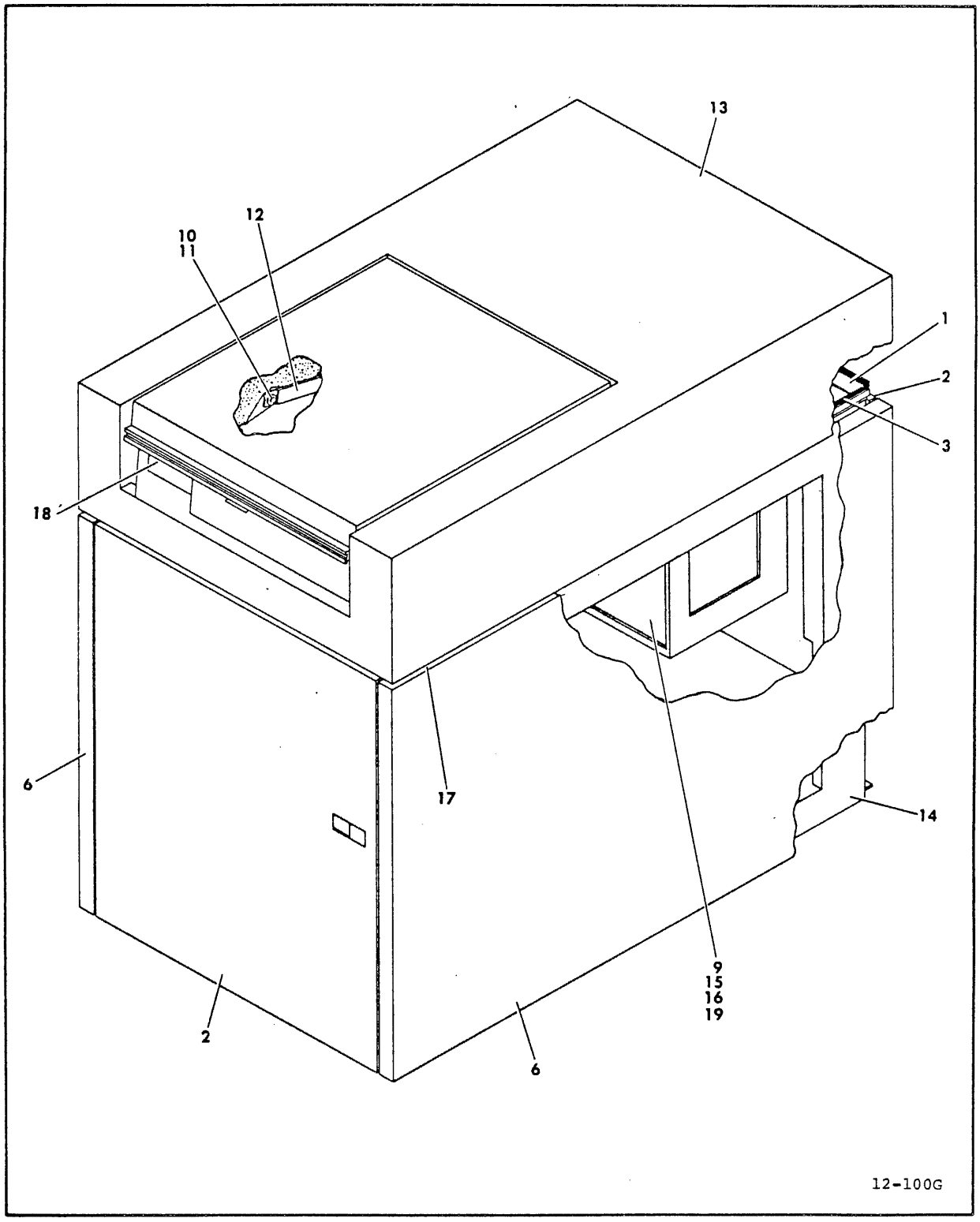


Figure 9A-1. Final Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-1	774450XX	FINAL ASSEMBLY	BJ4A2
9A-1	774452XX	FINAL ASSEMBLY	BJ4A1
9A-1	951720XX	FINAL ASSEMBLY	BJ4M2
1	77446200	BRACKET, Seal	
		(ATTACHING PARTS)	
	93592158	SCREW, STP, 6-32 x 1/4	
		- - - * - - -	
2		DOOR ASSEMBLY (See Figure 9A-4)	
		(ATTACHING PARTS)	
	70948501	PIN, Hinge	
		- - - * - - -	
3	94193202	CHANNEL, Rubber	
4		NOT USED	
5		NOT USED	
6		SIDE PANEL ASSEMBLY	
		(See Figure 9A-2)	
7		NOT USED	
8		NOT USED	
9	94317901	RETAINER, Split Ring	
10	94047074	WASHER, Special	
11	92033059	RING, Retaining	
12	77454200	BAR, Support	
13		TOP COVER ASSEMBLY	
		(See Figure 9A-3)	
14		FINAL FRAME ASSEMBLY	
		(See Figure 9A-5)	
15	75177200	COVER, Logic Frame	
16	94317703	FASTENER, Wing	

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-1		FINAL ASSEMBLY (Contd)	
17	92633026	BUMPER, Grommet	
18	943724XX	KEY, Insert, Programmable (Tabs 00-15)	Packed separately and shipped with unit. Key number corresponds to part number tab. BJ4A1 only
19	77446836	FOAM, Tape	
		For Information on shipping hardware, see Section 1 (Installation and Checkout).	

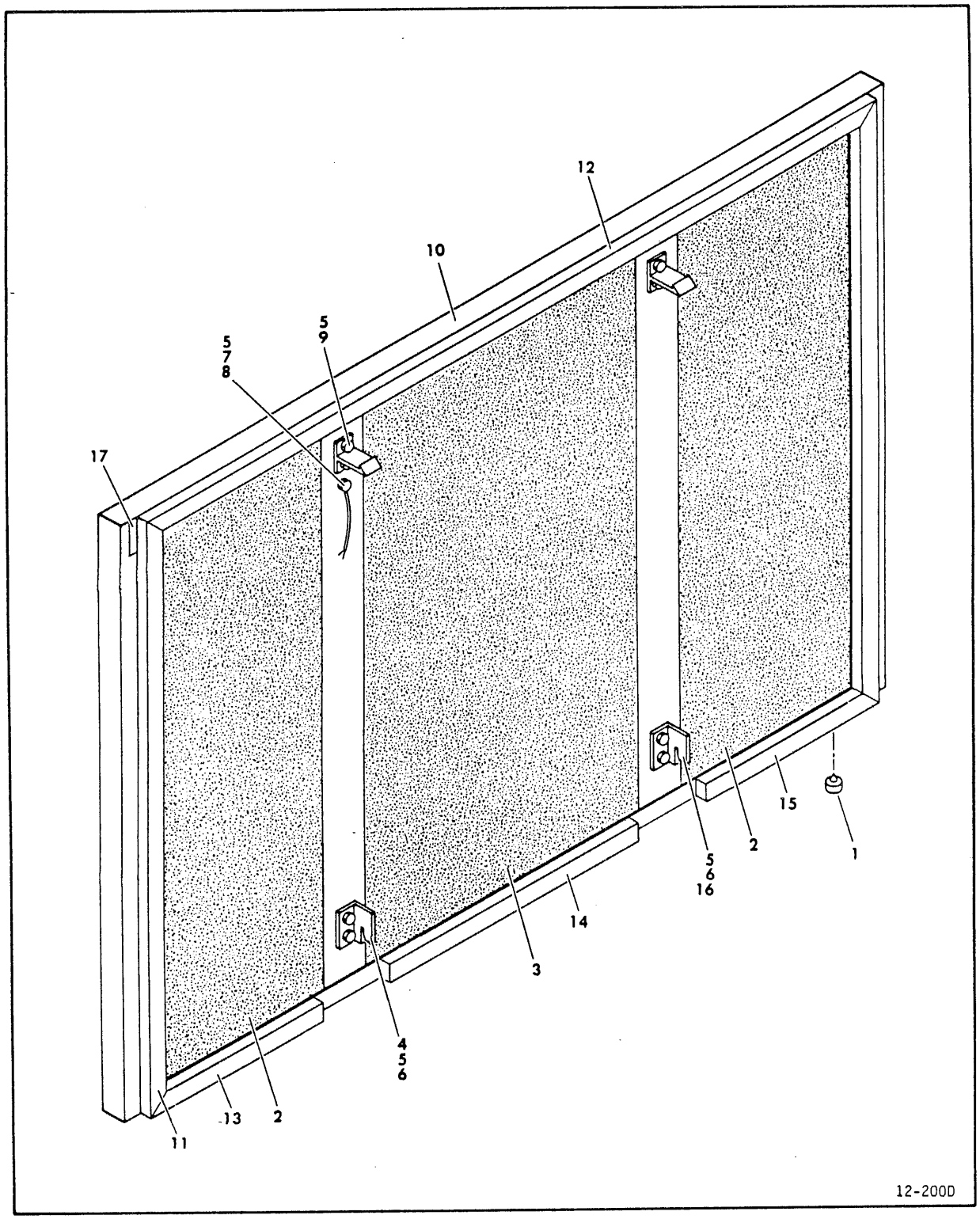


Figure 9A-2. Side Panel Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-2	774466**	SIDE PANEL ASSEMBLY	See note
1	92633021	BUMPER, Grommet Type	
2	77446806	PANEL, Foam, Acoustical	
3	77446805	PANEL, Foam, Acoustical	
4	75194501	BRACKET, Support	
5	93592238	SCREW, STP, 10-24 x 3/8	
6	10125607	WASHER, Flat, #10	
7	94281432	CABLE, Ground	
8	09040204	WASHER, Lock, Dished Type	
9	77441800	CATCH, Side Panel	
10	774426**	PANEL, Side	See note
11	76429363	SEAL	
12	76429364	SEAL	
13	76429368	SEAL	
14	76429370	SEAL	
15	76429369	SEAL	

NOTE: See color code chart at the beginning of this section for tab number.

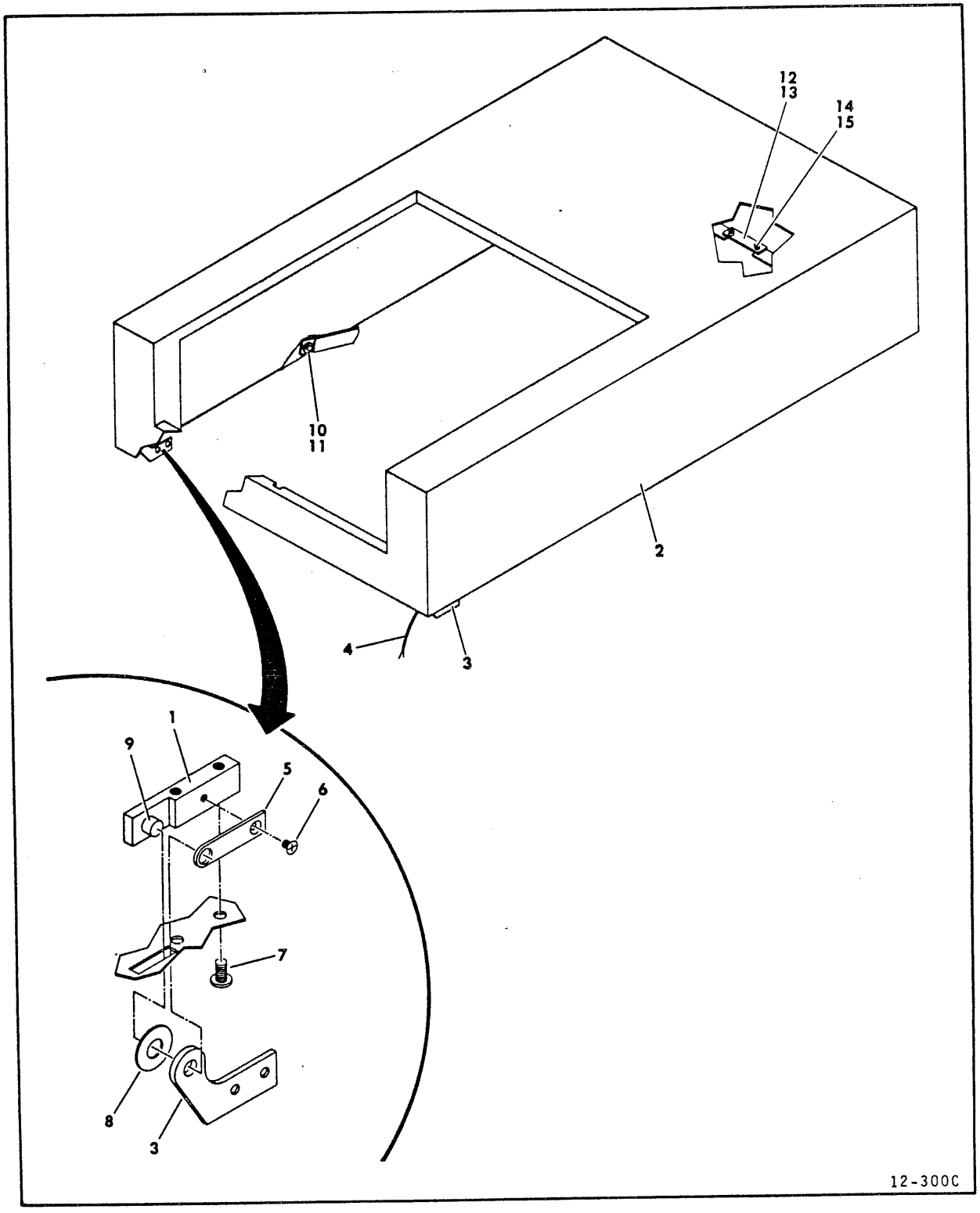


Figure 9A-3. Top Cover Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-3	774464**	TOP COVER ASSEMBLY	See note 1
9A-3	929932**	TOP COVER ASSEMBLY	See note 2
1	76533100	BASE, Hinge, Top Cover	
2	472935**	COVER, Top	
3	76533402	HINGE, Top Cover	
4	94281405	CABLE, Ground	
		(ATTACHING PARTS)	
	93592234	SCREW, STP, 10-24 x 1/4	
	09040204	WASHER, Lock, Dished Type	
		- - - * - - -	
5	76533300	PLATE, Wear	
6	10125711	SCREW, Cross Recessed, 6-32 x 3/16	
7	93187314	SCREW, Button Head	
8	93564028	WASHER, Nylon	
9	76372900	SHAFT, Hinge Bearing	
10	77454300	PIVOT, Support Bar	
11	92033069	RING, Retaining	
12	46641750	LATCH, Guard	
13	10127111	SCREW, PHH, 6-32 x 1/4	S/C 25 & Above only
14	10126103	WASHER, Lock #6	S/C 25 & Above only
15	73073200	LATCH, Keeper	S/C 25 & Above only

NOTES:

1. Used on all BJ4A1/4A2, BJ4M2F units.

2. Used on BJ4M2G units.

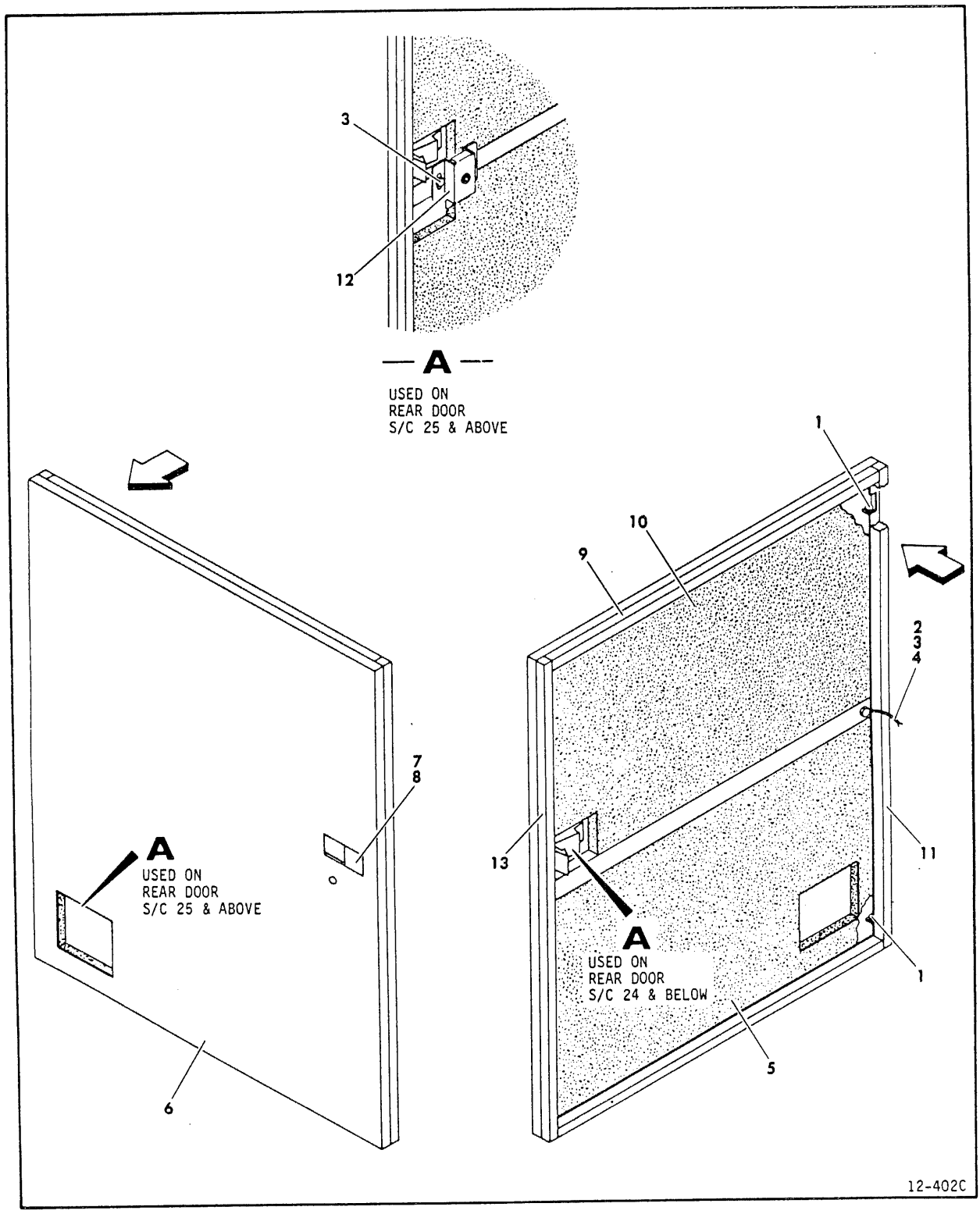


Figure 9A-4. Door Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-4	774467**	FRONT AND REAR DOOR ASSEMBLY	See note 1
9A-4	819322**	FRONT AND REAR DOOR ASSEMBLY	See note 2
1	92373003	CYLINDER, Snap-In	
2	94281405	CABLE, Ground	
3	93592238	SCREW, STP, 10-24 x 3/8	Used on all front and rear doors
4	09040204	WASHER, Lock, Dished Type	
5	77446807	PANEL, Foam, Acoustical	Used on all front doors, rear, S/C 24 & Below
5	77446837	PANEL, Foam, Acoustical	Rear, S/C 25 & Above
6	774427**	DOOR, Front/Rear	Used on all front doors, rear, S/C 24 & Below
6	730300**	DOOR, Rear	S/C 25 & Above
7	94224907	SPACER, Slam Latch	
8	94221400	LATCH, Flush	
9	76429366	SEAL	
10	77446808	PANEL, Foam, Acoustical	
11	76429367	SEAL	
12	92008601	LATCH	S/C 25 & Above only
13	76429365	SEAL	

NOTES:

1. Used on all BJ4A1/4A2 units except BJ4A2S, BJ4M2F.

2. Used only on the following units: BJ4A2S, BJ4M2G.

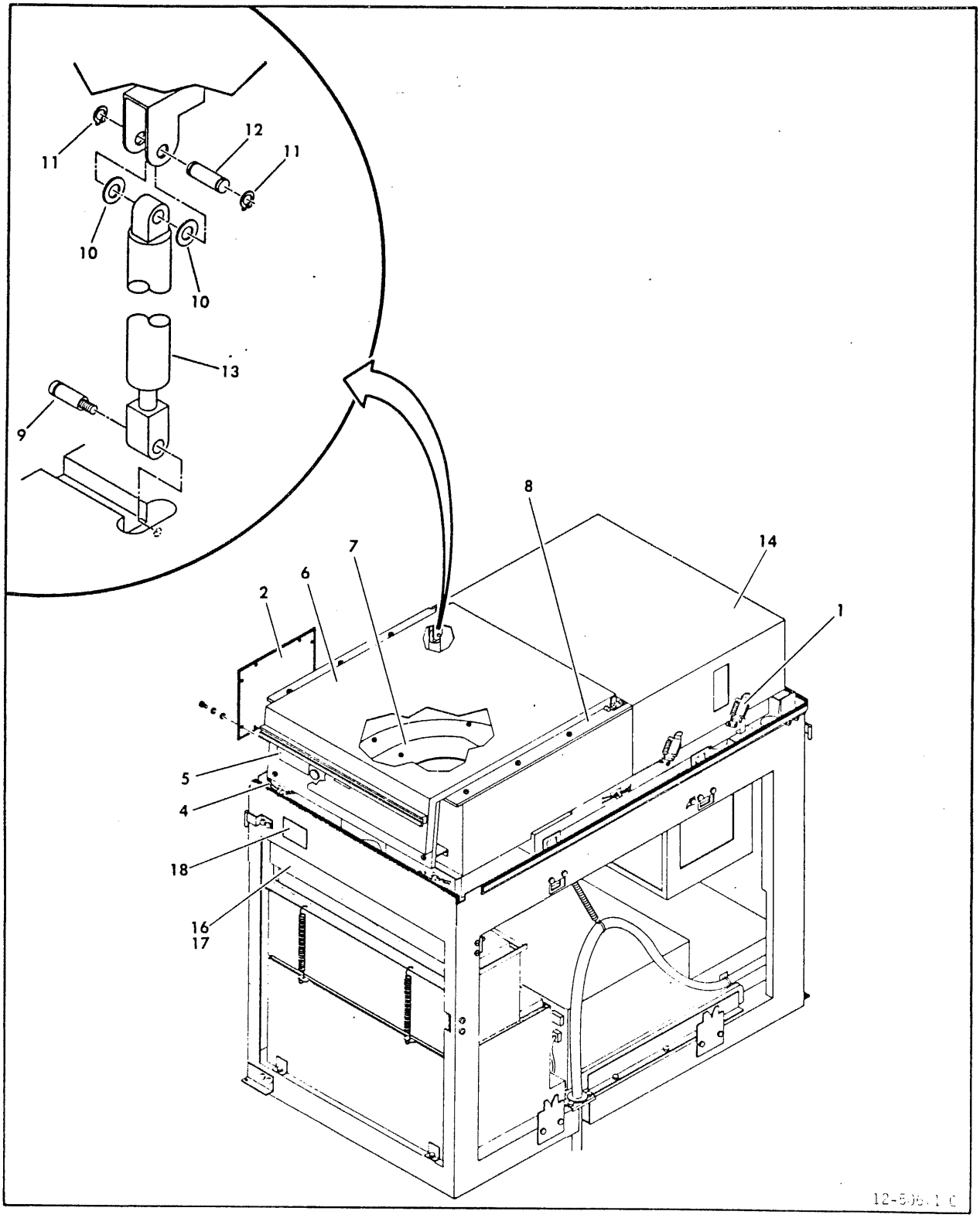


Figure 9A-5. Final Frame Assembly (Sheet 1 of 3)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-5	774503XX	FINAL FRAME ASSEMBLY (Sheet 1 of 3)	
1	94356902	CATCH, Spring Compression	
		(ATTACHING PARTS)	
	17901509	SCREW, PHH, 6-32 x 3/8	
		- - - * - - -	
2	77456300	COVER SIDE, Shroud	
		(ATTACHING PARTS)	
	94001100	TAPE, Foam	
	10127112	SCREW, PHH, 6-32 x 5/16	
	10125605	WASHER, Flat, #6	
	10125803	WASHER, Spring Lock, #6	
		- - - * - - -	
3		NOT USED	
4	77448200	CONTROL PANEL HARNESS ASSEMBLY	A2PA80 to A4P201
4	77448205	CONTROL PANEL HARNESS ASSEMBLY (Shielded)	
		(ASSOCIATED PARTS)	
	94261810	CONNECTOR, Body	
	94245602	CONTACT, Crimp	
		- - - * - - -	
5		CONTROL PANEL SWITCH ASSEMBLY (See Figure 9A-9)	
6		PACK ACCESS COVER ASSEMBLY (See Figure 9A-8)	
7	76041100	COVER, Parking Brake	
		(ATTACHING PARTS)	
	10127112	SCREW, PHH, 6-32 x 5/16	
	10125803	WASHER, Spring Lock, #6	
	10125605	WASHER, Flat, #6	
		- - - * - - -	
8		SHROUD COVER ASSEMBLY (See Figure 9A-6)	
9	73229002	STUD	S/C 37 & Below
9	73229007	STUD	S/C 38 & Above

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-5		FINAL FRAME ASSEMBLY (Sheet 1 Contd)	
10	93564002	WASHER, Nylon	
11	92033221	RING, Retaining	
12	77442800	PIN, Pivot, Cover	
13	94354904	SPRING, Gas	
14	77446300	DECK COVER ASSEMBLY	S/C 22 & Above only
		(ASSOCIATED PARTS)	
	95023500	SEALANT, Silicone, Rubber	
		- - - * - - -	
15		NOT USED	
16	73030800	SHIELD, Safety	S/C 25 & Above only
17	93592238	SCREW, Hex Washer Head Self Tapping, 10-24 x 0.375	S/C 25 & Above only
18	21987640	LABEL, FCC, Compliance	60 Hz units only S/C 34 & Above

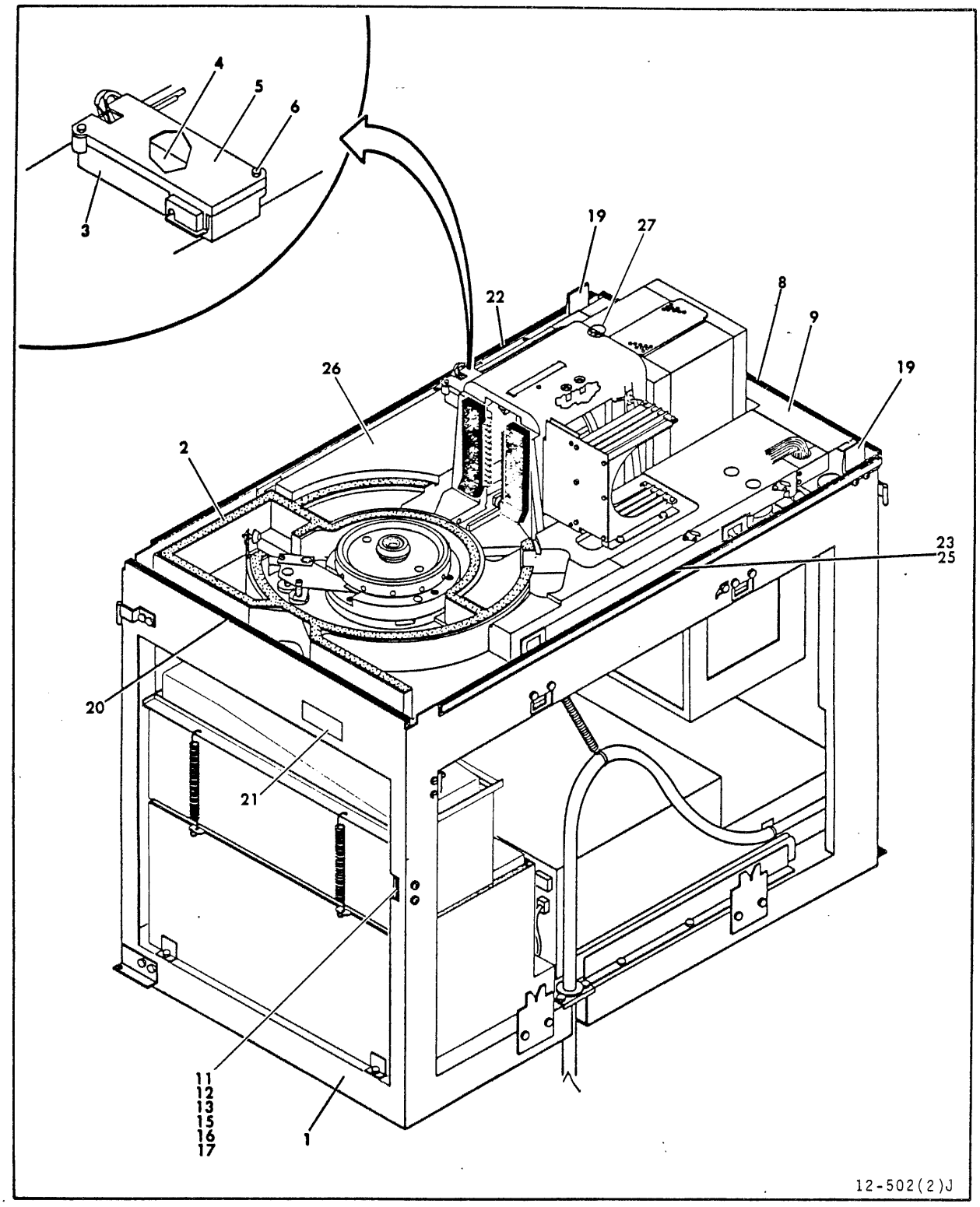


Figure 9A-5. Final Frame Assembly (Sheet 2 of 3)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-5		FINAL FRAME ASSEMBLY (Sheet 2)	
1		FRAME ASSEMBLY (See Figures 9A-11 & 9A-12)	
2	94001100	TAPE, Foam	
3	73479800	HOUSING, Preamplifier	
4	##	_ZQN COMPONENT ASSEMBLY	
5	73479900	COVER, Preamplifier	
6	93592484	SCREW, Hex Washer Head Self Tapping, 4-40 x 0.312	
7		NOT USED	
8	77446200	BRACKET, Seal	
		(ATTACHING PARTS)	
	93592158	SCREW, Hex Washer Head Self Tapping, 6-32 x 0.250	
9	77444800	PANEL, Deck Seal, Rear	
10		NOT USED	
11	77455000	LATCH, Door, Front	
12	77455100	LATCH, Door	
13	92001702	SCREW, Captive Washer	
14		NOT USED	
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		NOT USED	
19	77454400	GUIDE, Top Cover	
		(ATTACHING PARTS)	
	92615003	WASHER, Fibre Shoulder	
	75173312	PLATE, Nut	
	92748244	SCREW, Philips Pan Head Machine, 10-24 x 0.750	
		- - - * - - -	
20	72875106	CHANNEL, Rubber	

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-5		FINAL FRAME ASSEMBLY (Sheet 2 Contd)	
21	72875107	CHANNEL, Rubber	
22	94277504	BASE, Mounting	
23		NOT USED	
24	15452181	ADHESIVE, Cyanoacrylate	
25		DECK ASSEMBLY (See Figure 9A-20)	
26	76425201	SHIPPING & LOCKING PIN ASSEMBLY	

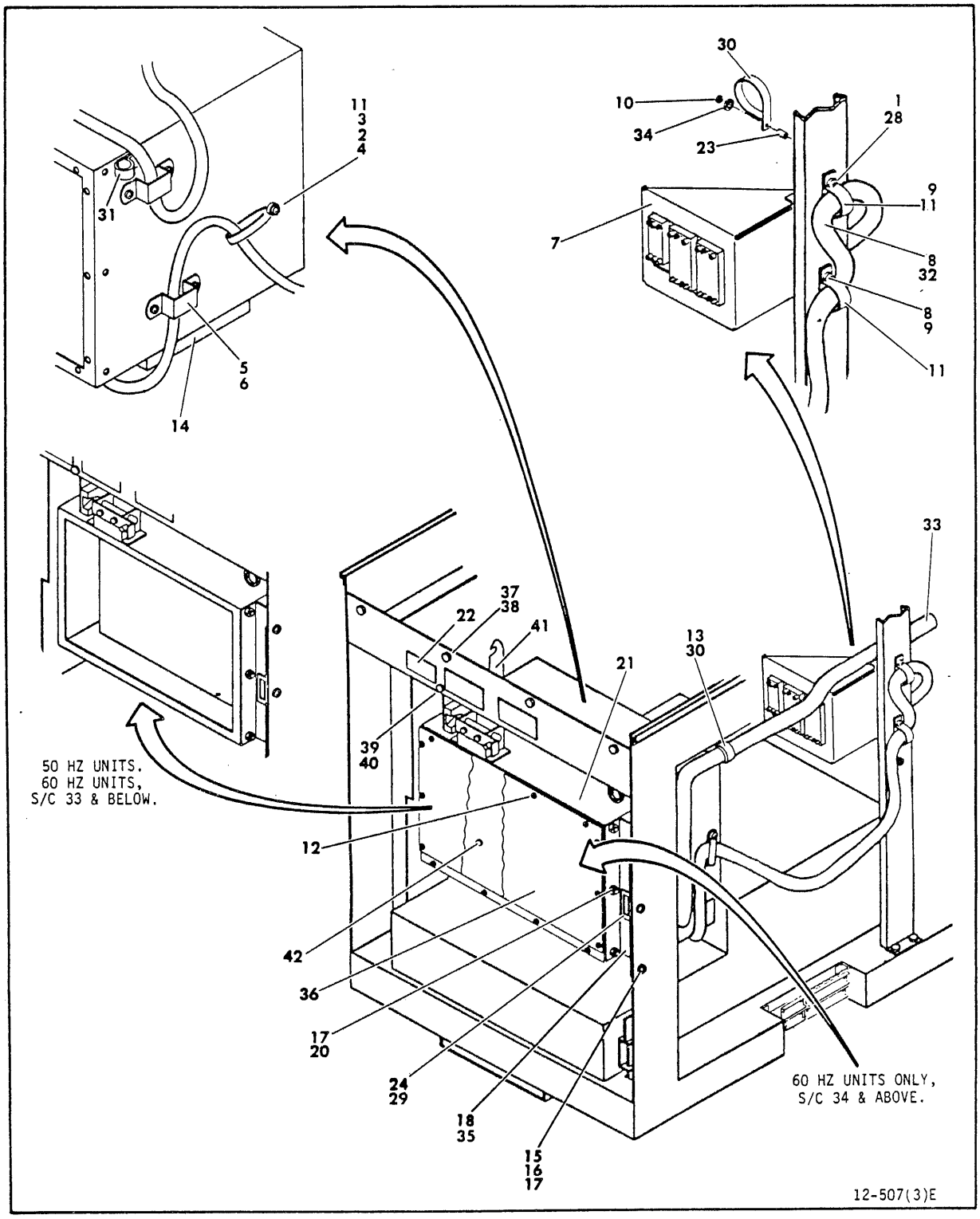


Figure 9A-5. Final Frame Assembly (Sheet 3 of 3)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-5		FINAL FRAME ASSEMBLY (Sheet 3)	
1	83278003	STRAP, Cable Tie	
2	10126401	WASHER, Lock, #6	
3	10125605	WASHER, Flat, #6	
4	10127114	SCREW, PHH, 6-32 x 1/2	
5	93660043	SCREW, PHH, 6-32 x 3/8	
6	83278001	STRAP, Cable, Large	
7		I/O CABLE AND BRACKET ASSEMBLY (See Figure 9A-10)	
8	10127123	SCREW, PHH, 8-32 x 1/2	
9	10126402	WASHER, Lock, #8	
10	53777903	NUT, Lock, Captivated, #8	
11	92602014	CLAMP, Cable, Nylon	
12	92001702	SCREW, PHH, 6-32 x 5/16	
13	93592240	SCREW, STP, 10-24 x 1/2	
14	72874620	PLENUM, Air, Logic	
		(ATTACHING PARTS)	
	10127112	SCREW, PHH, 6-32 x 5/16	
	93660041	SCREW, PHH, 6-32 x 5/16	
	10126401	WASHER, Lock, #6	
		- - - * - - -	
15	10127131	SCREW, PHH, 10-24 x 3/8	
16	10126403	WASHER, Lock, #10	
17	53777904	NUT, Lock, Captivated, #10	
18	83277100	HINGE, Chassis, Logic	
19	83278002	STRAP, Cable, Large	
20	10127132	SCREW, PHH, 10-24 x 1/2	

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-5		FINAL FRAME ASSEMBLY (Sheet 3 Contd)	
21		LOGIC CHASIS ASSEMBLY (See Figure 9A-7)	
22	46068500	PLATE, Information	Applicable to BJ4A2A,C,E,G,J,L, M only
23	93109224	STANDOFF, Spacer	
24	77455100	LATCH, Door	
25	10127112	SCREW, PHH, 6-32 x 5/16	
26	10125605	WASHER, Flat, #6	
27	10125803	WASHER, Spring Lock, #6	
28	10127128	SCREW, PHH, 8-32 x 1-1/4	
29	77454900	LATCH, Door, Rear	
30	92602017	CLAMP, Cable, Nylon	
31	92777193	CLAMP, Cable	
32	10127122	SCREW, PHH, 8-32 x 3/8	
33	94311643	HOSE, Flexible	
34	10125606	WASHER, Flat, #8	
35	94237705	TRIM, Safety	
36	73046500	COVER, Logic Chassis, Rear	50 Hz units. 60 Hz units S/C 34 & Above
37	10125803	WASHER, Spring Lock, #6	S/C 25 & Above only
38	93112369	STANDOFF, 6-32 x 3/8	S/C 25 & Above only
39	10127132	SCREW, PHH, 10-24 x 1/2	S/C 25 & Above only
40	92196013	NUT, Speed	S/C 25 & Above only
41	72874800	LATCH, Top Cover	S/C 25-27
41	72874801	LATCH, Top Cover	S/C 28 & Above
42	774479XX	WIRE WRAP ASSEMBLY (ATTACHING PARTS)	
	95655516	SCREW, PHH, 6-20 x 3/8	
	95634802	NUT, Speed, U-Type	

- - - * - - -

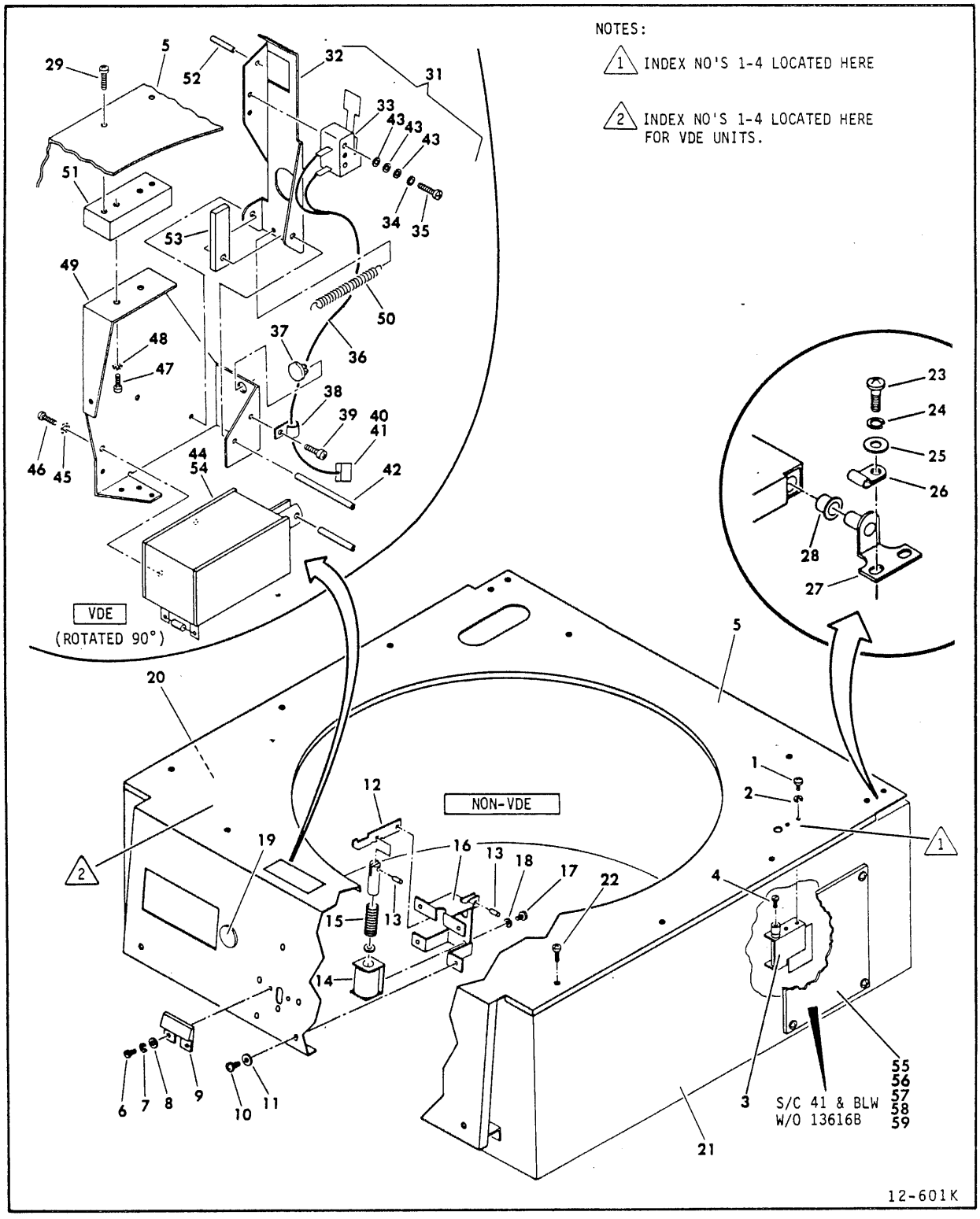


Figure 9A-6. Shroud Cover Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-6	77450617	SHROUD COVER ASSEMBLY	Non-VDE W/ DC Solenoid, BJ4A2C/D/N/P only, S/C 41 & Below, W/O DJ13616-B
9A-6	77450624	SHROUD COVER ASSEMBLY	Non-VDE W/ DC Solenoid, BJ4A2C/D/N/P only S/C 41 & Above W/DJ13616-B
9A-6	77450615	SHROUD COVER ASSEMBLY	Non-VDE W/ DC Solenoid, BJ4A2J/K/Z only, S/C 41 & Below, W/O DJ13616-B
9A-6	77450622	SHROUD COVER ASSEMBLY	Non-VDE W/ DC Solenoid, BJ4A2J/K/Z only S/C 41 & Above W/DJ13616-B
9A-6	77450618	SHROUD COVER ASSEMBLY	Non-VDE W/O DC Solenoid
9A-6	77450625	SHROUD COVER ASSEMBLY	Non-VDE W/O DC Solenoid S/C 41 & Above W/ DJ13616-B
9A-6	77450616	SHROUD COVER ASSEMBLY	VDE S/C 41 & Below, W/O DJ13616-B
9A-6	77450623	SHROUD COVER ASSEMBLY	VDE S/C 41 & Above, W/ DJ13616-B
1	92748156	SCREW, Philips Pan Head Machine, 6-32 x 0.188	
2	10125803	WASHER, Spring Lock, #6	
3	##	SWITCH, Interlock (A3S1)	NON-VDE
3	##	SWITCH, Interlock (A3S9)	VDE
4	93342096	SCREW, Nylon	
5	77442300	COVER, Shroud	Non-VDE S/C 05 & Below
5	83260200	COVER, Shroud	Non-VDE S/C 06-25 W/O 57465-B
5	83260201	COVER, Shroud	Non-VDE S/C 25-31 W/57465-B
5	72883700	COVER, Shroud	VDE only

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-6		SHROUD COVER ASSEMBLY (Contd)	
6	92785086	SCREW, Pan Head Machine, 4-40 x 0.375	S/C 25 & Below W/O 57465-B
6	92785088	SCREW, Pan Head Machine, 4-40 x 0.500	S/C 25 & Above W/57465-B
7	10125801	WASHER, Spring Lock, #4	
8	93211105	WASHER, Flat, #4	
9	73076801	CATCH, Pack Access Cover	Units W/ DC Solenoid
10	92748160	SCREW, Philips Pan Head Machine, 6-32 x 0.312	
11	93211107	WASHER, Flat, #6	
12	77450400	LATCH, Interlock	S/C 06 & Above W/ DC Solenoid, BJ4A2C,D,N,P only
12	77455400	LATCH, Interlock	S/C 06 & Above W/ DC Solenoid, BJ4A2J,K,Z only
13	93533079	PIN, Roll	Units W/ DC Solenoid
14	94237902	SOLENOID, DC. (A3L1)	NON-VDE Units W/ DC Solenoid
14	94237902	SOLENOID, DC. (A3L2)	VDE
15	77455300	SPRING, Compression	
16	77454100	BRACKET, Interlock	S/C 06-25 w/ DC Solenoid, BJ4A2C,D,N,P only w/o 57465-B
16	73078100	BRACKET, Interlock	S/C 25 & Above w/ DC Solenoid, BJ4A2C,D,N,P only w/ 57465-B
16	77454100	BRACKET, Solenoid	S/C 06-25 w/ DC Solenoid, BJ4A2J,K,Z only w/o 57465-B
16	73078000	BRACKET, Solenoid	S/C 25 & Above w/ DC Solenoid, BJ4A2J,K,Z only w/ 57465-B
16	73078100	BRACKET, Solenoid	S/C 25 & Above w/o DC Solenoid w/ 57465-B
17	92742156	SCREW, Philips Pan Head Machine, 6-32 x 0.188	Units w/ DC Solenoid

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-6		SHROUD COVER ASSEMBLY (Contd) (ITEMS LISTED BELOW THIS NOTE ARE PART OF THE INTERLOCK ASSEMBLY)	
18	10125803	WASHER, Spring Lock, #6	
19	94279416	BUTTON, Plug	
20	94001100	TAPE, Foam	
21	83228800	SHROUD, Pack	
22	92748198	SCREW, Philips Pan Head Machine, 8-32 x 0.250	
23	10127123	SCREW, Philips Pan Head Machine, 8-32 x 0.500	
24	10125804	WASHER, Spring Lock, #8	
25	10125606	WASHER, Flat, #8	
26	92602001	CLAMP, Cable, Nylon	
27	77442501	HINGE, Cover, Pack Access	
28	93847002	BEARING, Flanged	
29	92748238	SCREW, Pan Head Machine, 10-24 x 0.375	VDE Only
30		NOT USED	
31	73077702	INTERLOCK ASSEMBLY	VDE Only
32	83641100	LATCH, Interlock	
33	83627600	SWITCH (A3S1)	
34	10126100	WASHER, Internal Tooth Lock, #2	
35	10127315	SCREW, Pan Head Machine, 2-56 x 0.625	
36	73077800	CABLE ASSEMBLY, Top Cover	
37	93549009	BUMPER, Nylon	
38	42602001	CLAMP, Cable, Nylon	
39	10127345	SCREW, Pan Head Machine	
40	93943001	CONTACT, Socket	
41	93947009	CONNECTOR 6 Pin Socket Housing (A3P9)	
42	93533146	PIN, Roll, 1.250 x 0.125	
43	10125602	WASHER, Flat #2	
44	73076100	SOLENOID ASSEMBLY (A3L1)	
45	10126402	WASHER, External Tooth Lock, #8	
46	10127120	SCREW, Pan Head Machine, 8-32 x 0.250	
47	10127131	SCREW, Pan Head Machine, 10-24 x 0.375	
48	10126403	WASHER, External Tooth Lock, #10	
49	83641000	BRACKET, Mounting, Interlock	
50	40063200	SPRING, Extension	
51	83641200	BLOCK, Mounting, Interlock	

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-6		SHROUD COVER ASSEMBLY (Contd) (ITEMS LISTED BELOW THIS NOTE ARE PART OF THE INTERLOCK ASSEMBLY)	
52	93533085	PIN, Roll, .500 x .094	
53	94376723	PLATE, Nut	
54	95660411	TAPE, Poly (Class H App.)	
55	92070300	BAFFLE, Air	S/C 41 & Below W/O DJ13616-B
56	10125105	NUT, Hex, #6-32	S/C 41 & Below W/O DJ13616-B
57	77456200	WINDOW, Shroud	S/C 41 & Below W/O DJ13616-B
58	93749164	SCREW, Pan Head Lockwasher	S/C 41 & Below W/O DJ13616-B
59	76579108	GASKET, Air Seal	S/C 41 & Below W/O DJ13616-B

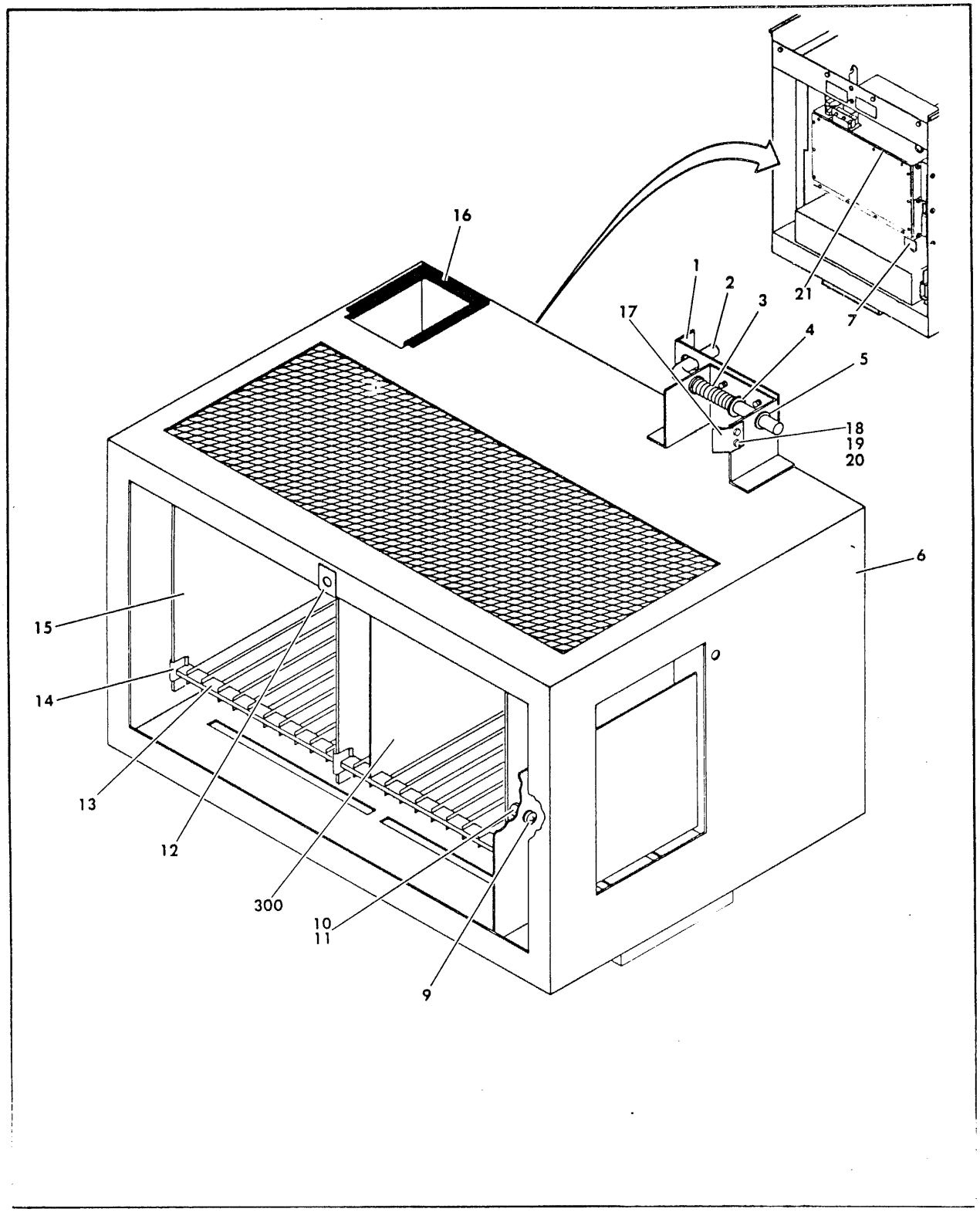


Figure 9A-7. Logic Chassis Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-7	774465XX	LOGIC CHASSIS ASSEMBLY	60 Hz units S/C 33 & Below
9A-7	932984XX	LOGIC CHASSIS ASSEMBLY	50 Hz units. 60 Hz units S/C 34 & Above
1	70741700	GUIDE, Latch	
		(ATTACHING PARTS)	
	93592158	SCREW, Hex Washer Head Self Tapping, 6-32 x 0.250	
		- - - * - - -	
2	40032301	LATCH	
3	45229900	SPRING, Compression	
4	92033038	RING, Retaining	
5	92373005	NYLINER, Snap-In	
6	83275300	FRAME, Logic Chassis	50 Hz units. 60 Hz units S/C 33 & Below
6	83275302	FRAME, Logic Chassis	60 Hz units only S/C 34 & Above
7	47354900	LATCH, Keeper	
8		NOT USED	
9	10125803	WASHER, Spring Lock, #6	
10	10127331	SCREW, Philips Pan Head Machine, 6-32 x 0.188	
11	93114275	STANDOFF, Tapped Post	
		(ATTACHING PARTS)	
	10126401	WASHER, External Tooth Lock, #6	
	10127111	SCREW, Philips Pan Head Machine, 6-32 x 0.250	
		- - - * - - -	
12	94317800	RECEPTACLE, Clip-On	
13	46490201	RAIL, Guide	
14	94309003	CLIP, U-Type	
15	77388200	PANEL, Perpendicular, 3 Position	
		(ATTACHING PARTS)	
	93592200	SCREW, Hex Washer Head Self Tapping, 8-32 x 0.375	
		- - - * - - -	
16	95116302	TAPE, Electrical	

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-7		LOGIC CHASSIS ASSEMBLY (Contd) (ITEMS LISTED BELOW ARE NOT PART OF THE LOGIC CHASSIS ASSEMBLY)	
17	81860750	WIPER, Ground Spring	50 Hz units. 60 Hz units S/C 34 & Above
18	93276375	SCREW, Butt Head, 4-40 x 0.250	50 Hz units. 60 Hz units S/C 34 & Above
19	10125801	WASHER, Spring Lock, #4	50 Hz units. 60 Hz units S/C 34 & Above
20	10125103	NUT, Hex, #4-40	50 Hz units. 60 Hz units S/C 34 & Above
21	94237706	TRIM, Safety, Black	
300	##	LOGIC CARDS	

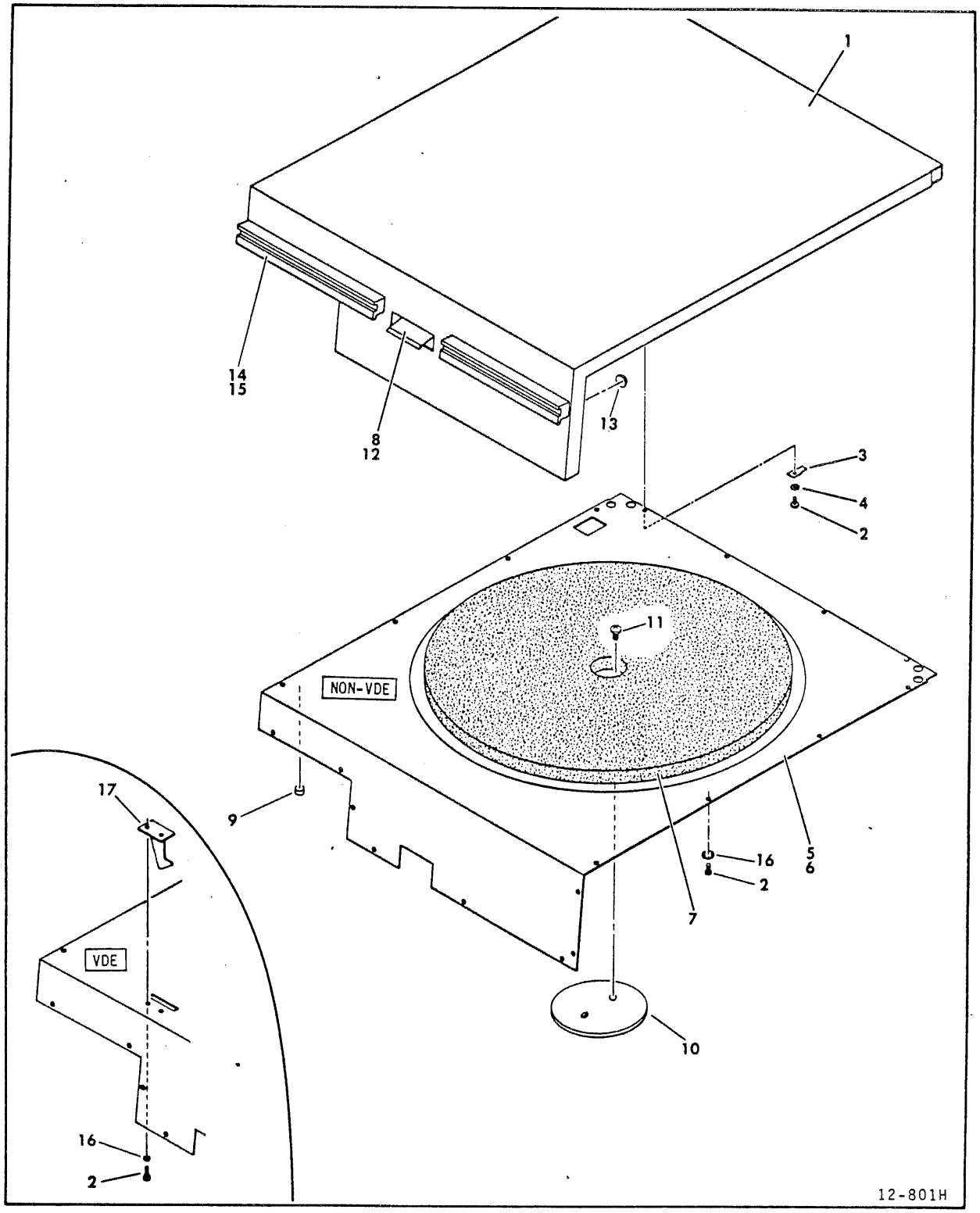


Figure 9A-8. Pack Access Cover Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-8	774469**	PACK ACCESS COVER ASSEMBLY	See note Non-VDE
9A-8	728873**	PACK ACCESS COVER ASSEMBLY	See note VDE only
1	774435**	COVER, Pack Access	See note
2	93195234	SCREW, Button, 6-32 x 0.250	
3	94274101	TERMINAL, Quick Connect	
4	10126401	WASHER, External Tooth Lock, #6	
5	77443900	INSERT, Cover, Access	Non-VDE
5	77443902	INSERT, Cover, Access	VDE
6	77561401	GASKET, Extended Sponge	
7	75040456	PANEL, Foam, Acoustical	
8	75071404	LATCH AND SPRING ASSEMBLY	S/C 05 & Below
8	75071406	LATCH AND SPRING ASSEMBLY	S/C 06 & Above
		(ATTACHING PARTS)	
	75070900	ROD, Pivot	
	92033107	RING, Retaining	
	94206500	SPRING, Compression	
		- - - * - - -	
9	92633015	BUMPER, Grommet	
10	82379600	BUTTON, Access Cover	
11	94375824	SCREW, Pan Head Thread Form, 8-16 x 0.375	
12	94397660	WASHER, Foam	
13	92633026	BUMPER, Grommet	BJ4A2 only
14	77462900	HANDLE, Pack	
15	92097032	SCREW, Socket Head Cap (Nylon) 6-32 x 0.250	
16	10126103	WASHER, Internal Tooth Lock, #6	
17	83641300	HOOK, Interlock	VDE only

NOTE: See color code chart at the beginning of this section for tab number.

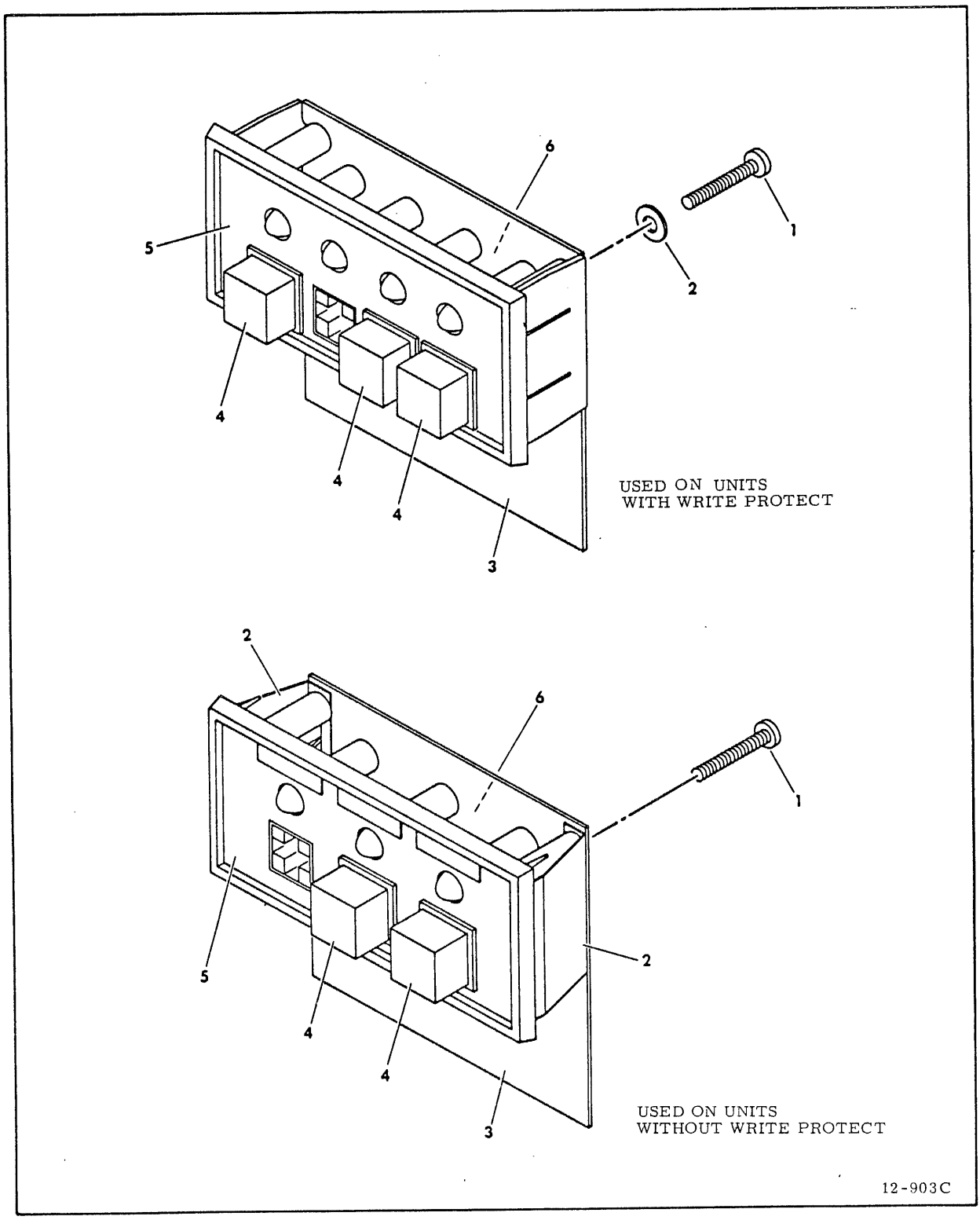


Figure 9A-9. Control Panel Switch Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-9	##	CONTROL PANEL SWITCH ASSEMBLY	Used on units w/o Write Protect
1	17901506	SCREW, Philips, Thread Roll 4-40 x 0.750	
2	75070600	SPRING, Retainer	
3	75072010	COMPONENT ASSEMBLY, Type JZYN	
4	75068300	BUTTON, Panel, Front	
5	75256800	BEZEL, Panel, Front	
6	94208501	LABEL, Part Number	
9A-9	##	CONTROL PANEL SWITCH ASSEMBLY	Used on units w/ Write Protect
1	17901506	SCREW, Philips, Thread Roll, 4-40 x 0.750	
2	10125603	WASHER, Flat, #4	
3	75072009	COMPONENT ASSEMBLY, Type HZYN	
4	75068300	BUTTON, Panel, Front	
5	76422400	BEZEL, Panel, Front	
6	94208501	LABEL, Part Number	

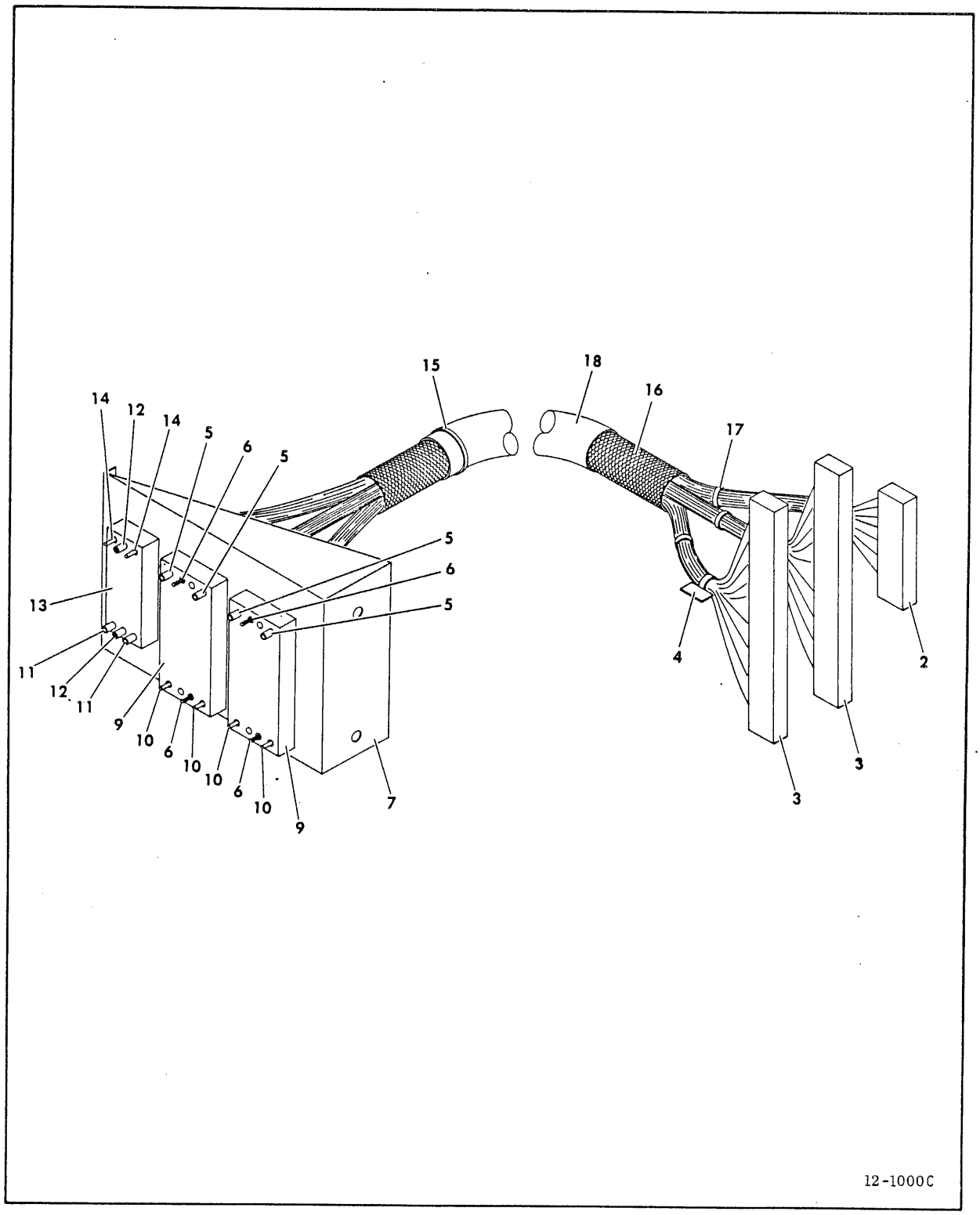


Figure 9A-10. I/O Cable and Bracket Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-10	77447315	I/O CABLE AND BRACKET ASSEMBLY	Non-VDE & 60 Hz units S/C 33 & Below
9A-10	77447321	I/O CABLE AND BRACKET ASSEMBLY	VDE & 60 Hz units S/C 34 & Above
9A-10	77447316	I/O CABLE AND BRACKET ASSEMBLY	Non-VDE & 60 Hz units S/C 33 & Below
9A-10	77447322	I/O CABLE AND BRACKET ASSEMBLY	VDE & 60 Hz units S/C 34 & Above
1		NOT USED	
2	94261810	CONNECTOR, Body, (P5)	
		(ASSOCIATED PARTS)	
	94245601	CONTACT, Socket, 24 GA	
	94245607	CONTACT, Socket, 20 GA or Twisted Pair	
		- - - * - - -	
3	94261811	CONNECTOR, Body, (P1 & P2)	
		(ASSOCIATED PARTS)	
	94245601	CONTACT, Socket, 24 GA	
	94245607	CONTACT, Socket, 20 GA or Twisted Pair	
		- - - * - - -	
4	94277409	STRAP, Cable Tie	
5	93642005	CONNECTOR, Corner Guide Socket	
6	93643006	CONNECTOR, Jackscrew, Male	
7	77444300	BRACKET, I/O	
8		NOT USED	
9	94281201	CONNECTOR, 75 Pin	
		(ASSOCIATED PARTS)	
	93645003	CONTACT, Socket, 24 GA	
	93645002	CONTACT, Socket, 20 GA	
	93645001	CONTACT, Socket, 16 GA or Twisted Pair	
		- - - * - - -	
10	93642004	CONNECTOR, Corner Guide Pin	
11	93643005	CONNECTOR, Corner Guide, Socket	
12	93643007	CONNECTOR, Jackscrew, Female	
13	93643016	CONNECTOR, Block (J2)	
		(ASSOCIATED PARTS)	
	93645003	CONTACT, Socket, 24 GA	
	93645002	CONTACT, Socket, 20 GA	
		- - - * - - -	
14	93643004	CONNECTOR, Corner Guide Pin	

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-10		I/O CABLE AND BRACKET ASSEMBLY (Contd)	
15	94277400	CABLE, Tie Strap	
16	24534811	SHIELDING, Flat, Braided	
17	94277411	STRAP, Cable Tie	
18	95048803	SLEEVING BRAIDED	

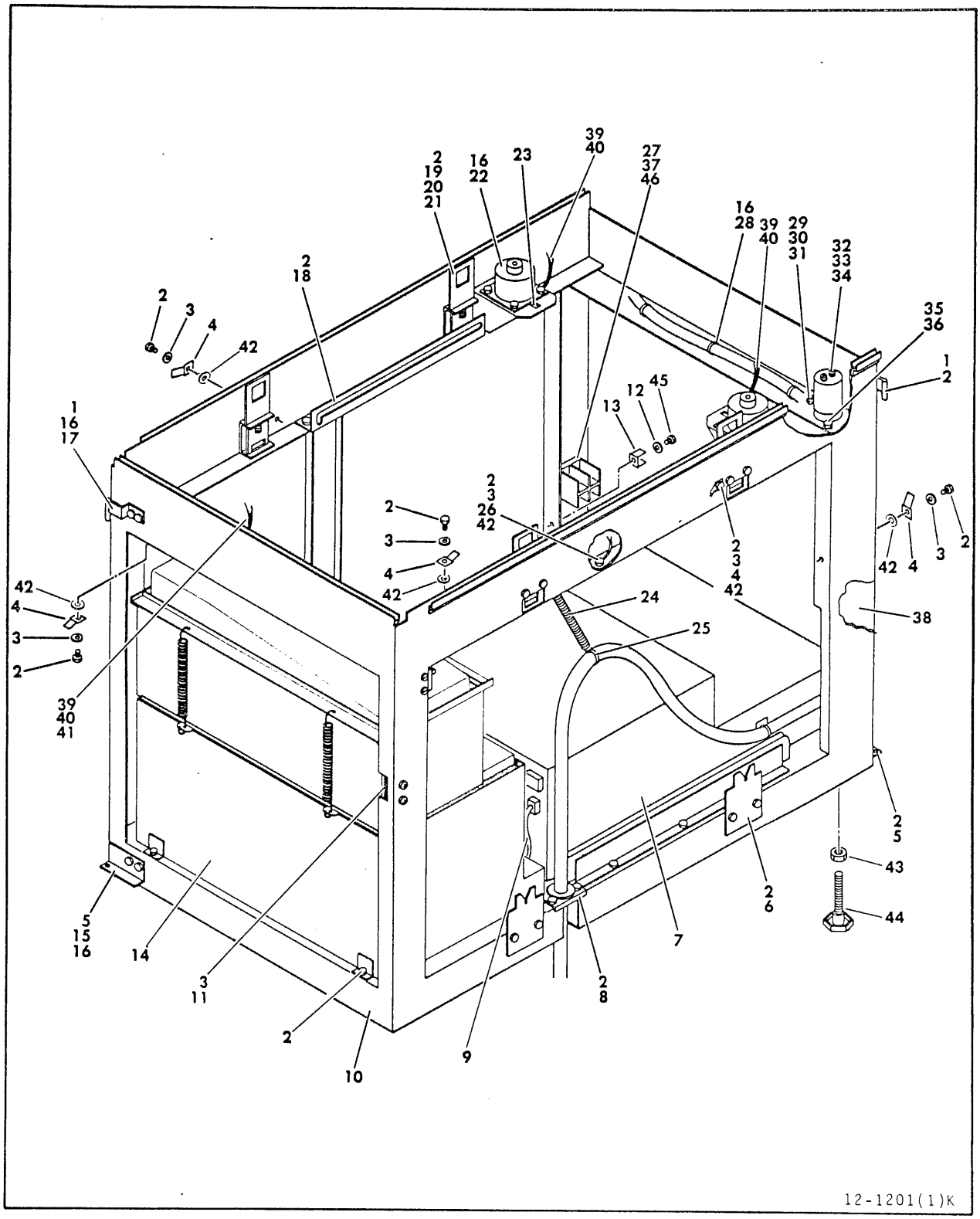


Figure 9A-11. Frame Assembly Front (Non-VDE)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-11	774470XX	FRAME ASSEMBLY Front (Non-VDE)	
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	77443800	BRACKET, Panel, Side	
7		POWER SUPPLY ASSEMBLY (See Figure 9A-14)	
		(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 (P2 & P9)	
	51905800	CONTACT, Pin	
		- - - * - - -	
10	73077200	FRAME, Main	S/C 26 & Below w/o 13014
10	72884400	FRAME, Main	S/C 26 & Above w/ 13014 & earlier units w/ 13014
11	10125107	NUT, Hex, #10-24	
12	10127348	SCREW, Pan Head Machine 8-32 x 0.750	
13	94274117	TERMINAL, Quick Connect	
14		BLOWER PLENUM ASSEMBLY (See Figure 9A-13)	
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	

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-11		FRAME ASSEMBLY Front (Non-VDE) (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, Pan Head Machine, 6-32 x 0.625	
31	10125605	WASHER, Flat, #6	
32	10127142	SCREW, Pan Head Machine, 10-32 x 0.375	
33	10126105	WASHER, Internal Tooth Lock, #10	
34	92632017	CAPACITOR, Electrolytic	
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	09040203	WASHER, Lock, Dished Type	
39	94369555	CABLE, Ground	S/C 22 & Above only
40	10126401	WASHER, External Tooth Lock, #6	S/C 22 & Above only
41	93592162	SCREW, Hex Washer Head Self Tapping, 6-32 x 0.375	S/C 22 & Above only
42	09040204	WASHER, Lock, Dished Type	
43	93006035	NUT, Jam, Hex, #1/2 -13	
44	93697014	LEVELER	S/C 28 & Below
44	93697025	LEVELER	S/C 29 & Above
45	93592200	SCREW, Hex Washer Head Self Tapping, 8-32 x 0.375	
46	94356700	CABLE, Vinyl Coated Braid	

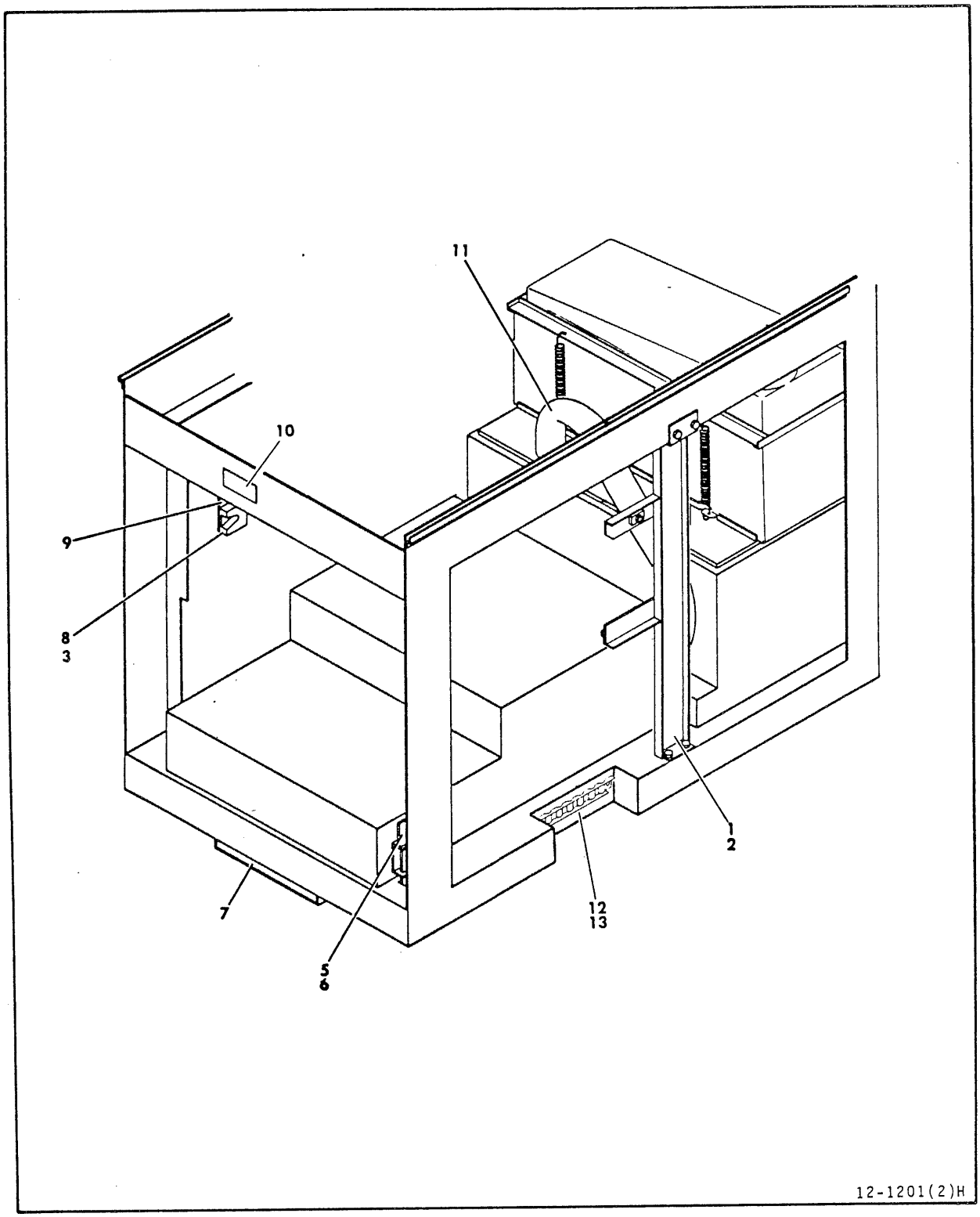


Figure 9A-11. Frame Assembly Rear (Non-VDE)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-11		FRAME ASSEMBLY Rear (Non-VDE)	
1	47298602	MOUNT, Bracket, I/O	
2	93592238	SCREW, STP, 10-24 x 3/8	
3	81860740	SPRING, Ground	60 Hz units only S/C 34 & Above
4		NOT USED	
5	77454500	SPRING, Compression	Note 1
6	77449600	LATCH, Power Supply	Note 1
7	##	FILTER, Aluminum, Washable	
8	70741800	LATCH, Stop	
		(ATTACHING PARTS)	
	10125607	WASHER, Flat, #10	
	92721284	SCREW, Button, Socket Head	
	92071007	NUT, Hex, #10-24	
		- - - * - - -	
9	77445700	BRACKET, Catch, Logic	
		(ATTACHING PARTS)	
	93592238	SCREW, STP, 10-24 x 3/8	
		- - - * - - -	
10	92006804	PLATE, ID	S/C 18 & Below
10	92006808	PLATE, ID	S/C 19 & Above
11	94311633	HOSE, Flexible	
12	73050901	CLAMP, Cable	
13	93592210	SCREW, STP, 8-32 x 1	

NOTE:

1. Used on drives with power supplies that have slides installed. Retain these parts when ordering a new supply.

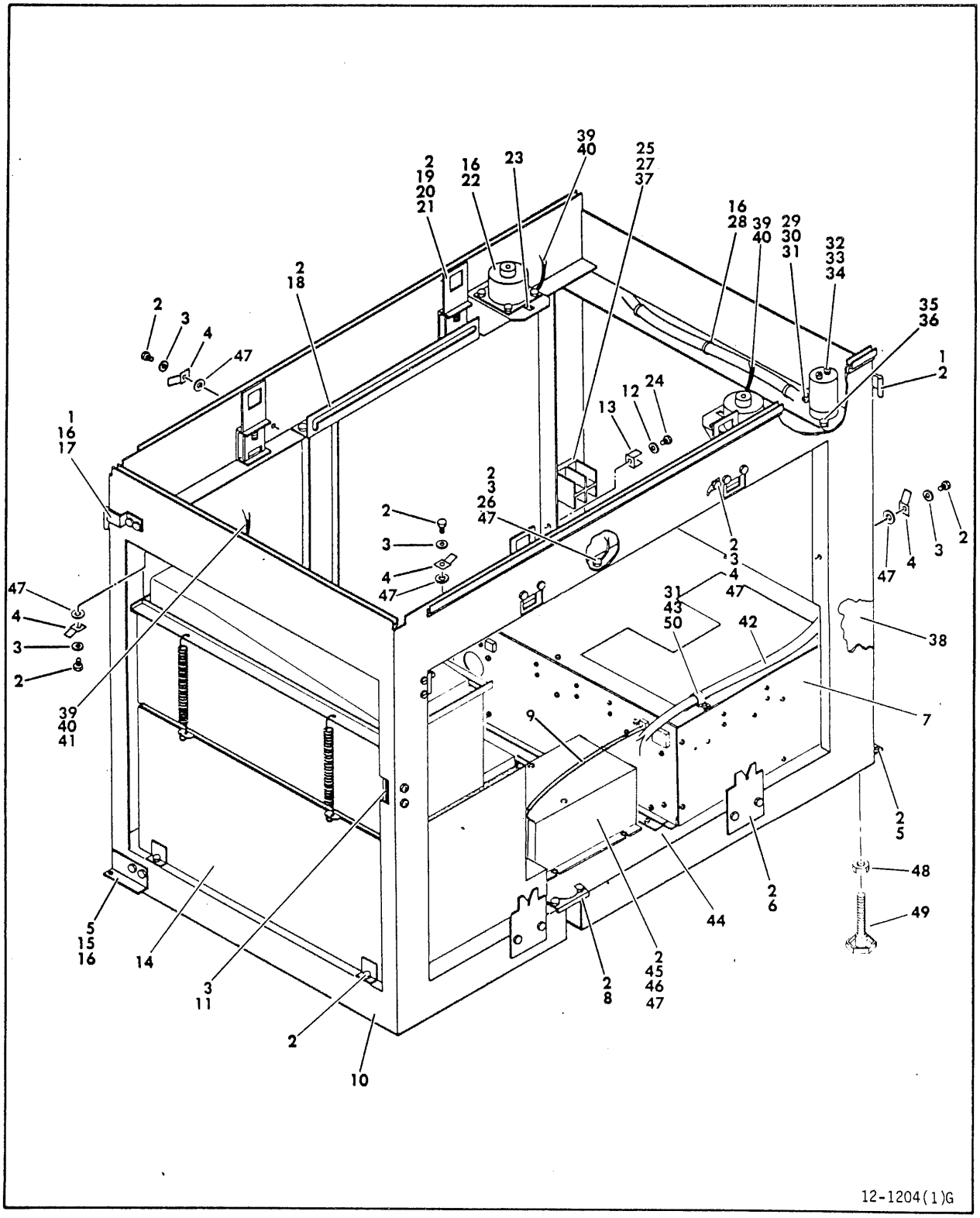


Figure 9A-12. Frame Assembly Front (VDE)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-12	774470XX	FRAME ASSEMBLY Front (VDE)	
1	83242700	HINGE, Door Top	
2	93592238	SCREW, Self-Tapping Hex Head, 10-24 x 0.375	
3	10126403	WASHER, External Tooth Lock, #10	
4	94274140	TERMINAL, Quick Connect	
5	83242800	HINGE, Door Bottom	
6	77443800	BRACKET, Side Panel	
7		POWER SUPPLY ASSEMBLY (See Figure 9A-17)	
		(ATTACHING PARTS)	
	93592238	SCREW, Self-Tapping Hex Head, 10-24 x 0.375	
		- - - * - - -	
8	77453800	BRACKET, Snap Bushing	
9	77448901	BLOWER CABLE ASSEMBLY	
		(ASSOCIATED PARTS)	
	51906001	CONNECTOR, Plug (P2 & P9)	
	51905800	CONTACT, Pin	
		- - - * - - -	
10	72884400	FRAME, Main	
11	10125107	NUT, Hex, #10-24	
12	10127348	SCREW, Pan Head Machine, 8-32 x 0.750	
13	94274117	TERMINAL, Quick Connect	
14		BLOWER PLENUM ASSEMBLY (See Figure 9A-13)	
15	77443101	SPACER, Hinge	
16	93592240	SCREW, Self-Tapping Hex Head, 10-24 x 0.500	
17	77443100	SPACER, Hinge	
18	77446000	SLIDE, Retaining Rod	
19	77441500	SPACER, Hinge	
20	77441400	LATCH, Side Panel	
21	77454500	SPRING, Compression	
22	94245302	ISOLATOR, Vibration	
23	93602322	NUT, Self Mounting, #1/4-20	
24	93592200	SCREW, Hex Washer Head Self Tapping, 8-32 x 0.375	
25	94356700	CABLE, Vinyl Coated Braid	
26	94369533	CABLE, Ground	

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-12	774470XX	FRAME ASSEMBLY Front (VDE) (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, Pan Head Machine, 6-32 x 0.625	
31	10125605	WASHER, Flat, #6	
32	10127142	SCREW, Pan Head Machine, 10-32 x 0.375	
33	10126105	WASHER, Internal Tooth Lock, #10	
34	92632017	CAPACITOR, Electrolytic	
35	93592158	SCREW, Self-Tapping Hex Head, 6-32 x 0.250	
36	92691003	CLAMP, Capacitor Mounting	
37	93592202	SCREW, Self-Tapping Hex Head, 8-32 x 0.500	
38	09040203	WASHER, Lock Dished Type	
39	94369555	CABLE, Ground	
40	10126401	WASHER, External Tooth Lock, #6	
41	93592162	SCREW, Self-Tapping Hex Head, 6-32 x 0.375	
42	##	POWER CABLE ASSEMBLY (See Figure 9A-19)	
43	92602004	CLAMP, Cable	
44	73077500	BRACKET, Mounting, P.S.	
45	##	MOTOR, Relay Box Assy.	
46	##	AWNV PC ASSEMBLY	
47	09040204	WASHER, Lock, Dished Type	
48	93006035	NUT, Jam, Hex, #1/2-13	
49	93697025	LEVELER	

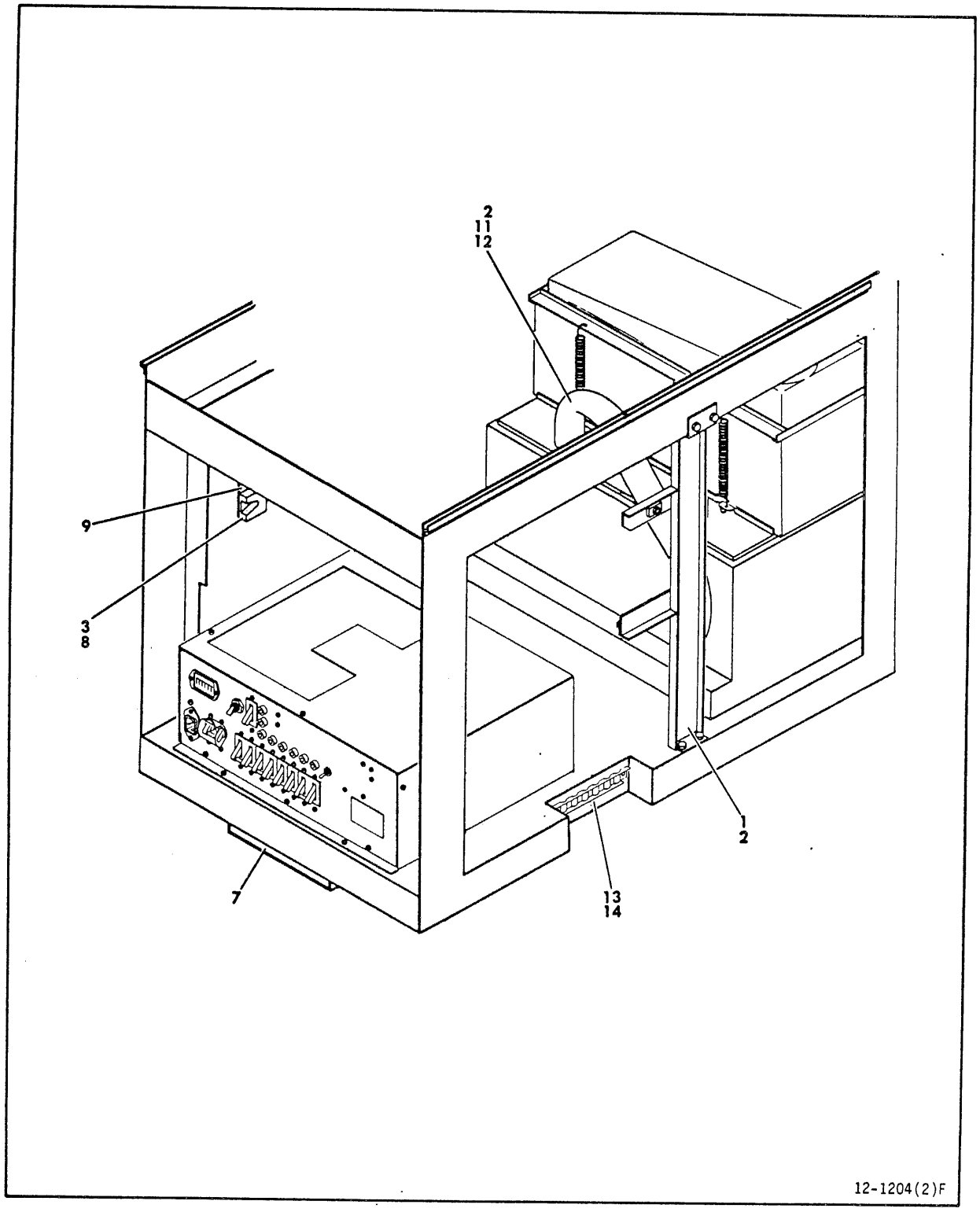


Figure 9A-12. Frame Assembly Rear (VDE)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-12		FRAME ASSEMBLY Rear (VDE)	
1	83275200	BRACKET, I/O Mount	
		(ASSOCIATED PARTS)	
	94303500	RECEPTACLE	
		- - - * - - -	
2	93592238	SCREW, STP, 10-24 x 3/8	
3	81860740	SPRING, Ground	
4		NOT USED	
5		NOT USED	
6		NOT USED	
7	##	FILTER, Washable Aluminum	
8	70741800	LATCH, Stop	
		(ATTACHING PARTS)	
	10125607	WASHER, Flat, #10	
	92721284	SCREW, Button Socket Head	
	92071007	NUT, Hex, #10-24	
		- - - * - - -	
9	77445700	BRACKET, Logic Catch	
		(ATTACHING PARTS)	
	93592238	SCREW, STP, 10-24 x 3/8	
		- - - * - - -	
10	92006812	PLATE, ID	
11	94311642	HOSE, Flexible	
12	92602017	CLAMP, Cable	
13	73050901	CLAMP, Cable	
14	93592210	SCREW, STP, 8-32 x 1	

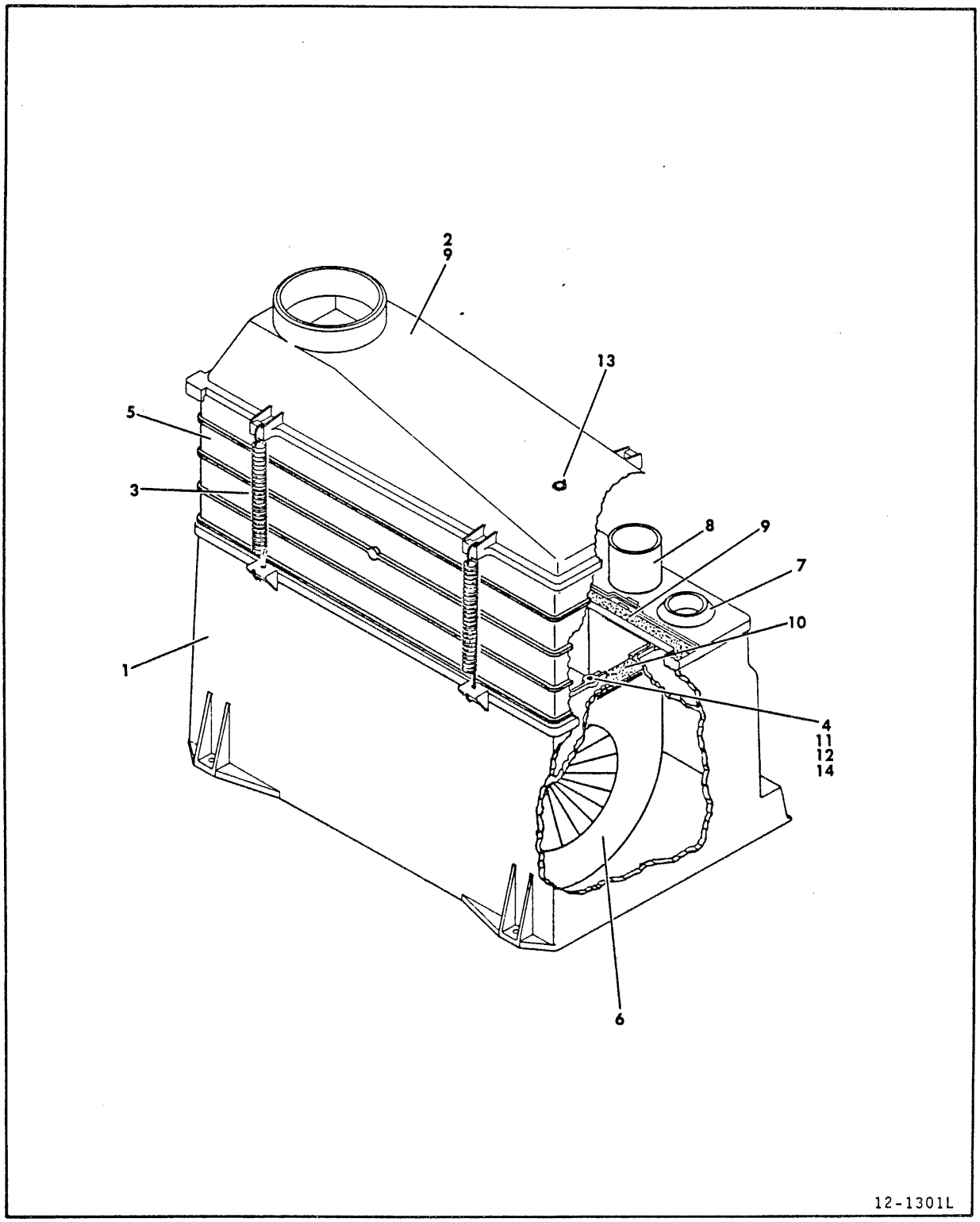


Figure 9A-13. Blower Plenum Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-13	72877001	BLOWER PLENUM ASSEMBLY	
1	72874470	HOUSING, Air Plenum & Blower	
2	72874200	PLENUM, Exhaust	
3	41275402	SPRING, Extension	
4	92196013	NUT, Speed	
5	##	FILTER, Air	
6	##	BLOWER AND CONNECTOR ASSEMBLY	
7	94279420	BUTTON, Plug, Recessed/ Flush Hd	
8	94376602	HOSE, End	
9	94276600	TAPE, Foam	
10	76579110	GASKET, Air Seal	
11	10125805	WASHER, Spring Lock, #10	
12	10126135	SCREW, Phillips Pan Head Machine, 10-24 x 0.875	
13	94353207	CAPS & PLUGS, Plastic (RED)	
14	10125607	WASHER, Flat, #10	

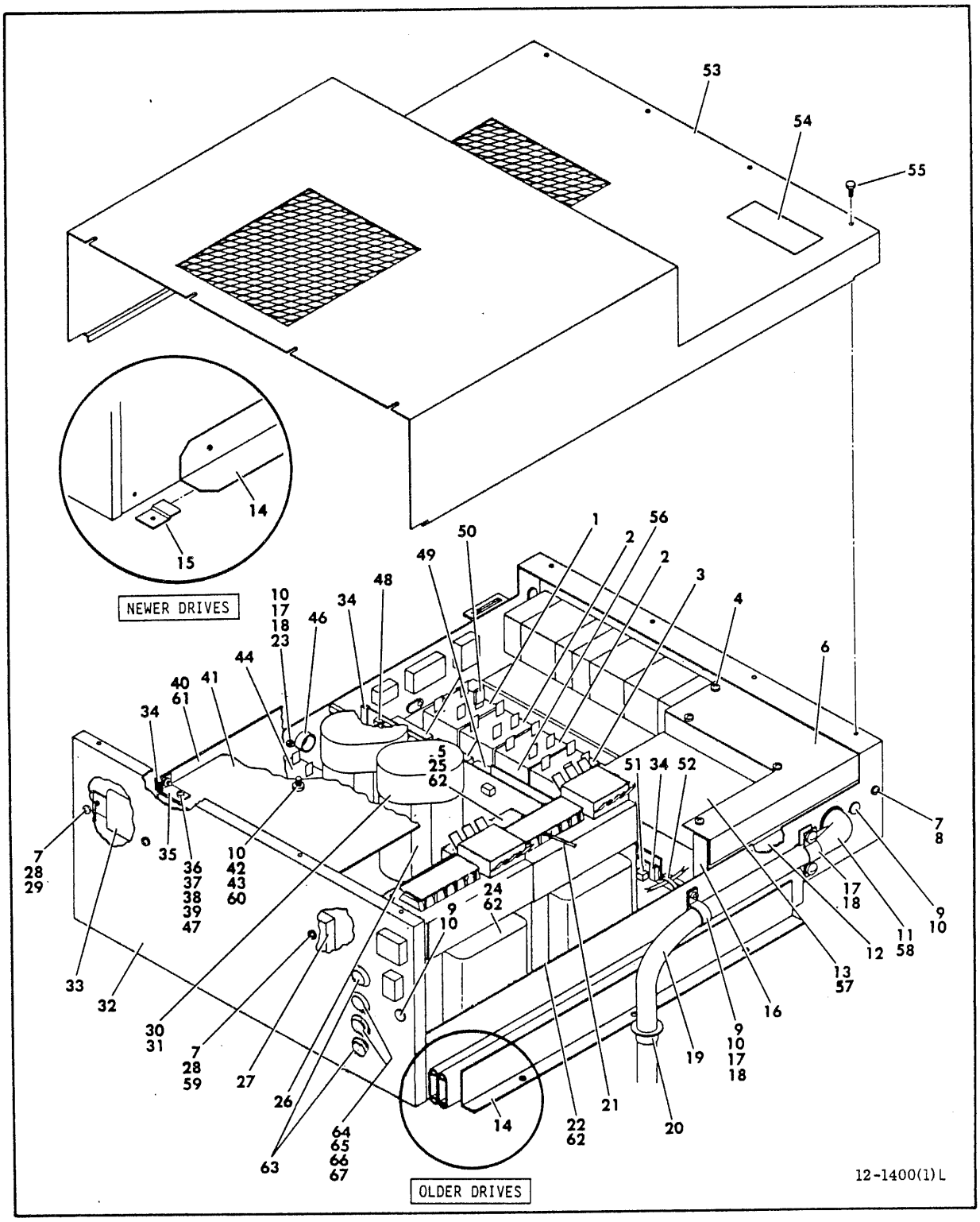


Figure 9A-14. Power Supply Assembly Rear (Non-VDE)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-14	##	POWER SUPPLY ASSEMBLY Rear (Non-VDE)	
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, PHH, 8-32 x 5/16	
	10126402	WASHER, External Tooth Lock, #8	
		- - - * - - -	
4	93590198	SCREW, PHH, 8-32 x 5/16	
5	77441000	CLAMP, Transformer	
6	77449100	COVER, Shield, Filter	
7	10126402	WASHER, Lock, #8	
8	10127120	SCREW, PHH, 8-32 x 1/4	
9	10125108	NUT, Hex, #10-32	
10	10126403	WASHER, Lock, #10	
11	93299001	CONNECTOR, 90° Angle	
12	95660411	TAPE, Glass Cloth, 2 Width	
13	##	FILTER, RFI	
14	94383501*	SLIDE, Ball Bearing	Older drives
		(ATTACHING PARTS)	
	93590196*	SCREW, PHH, 8-32 x 1/4	
		- - - * - - -	
14	47097480	SUPPORT, Power Supply	Newer drives
15	47097490	BLOCK, Power Supply	Newer drives
		(ATTACHING PARTS)	
	93592238	SCREW, STP, 10-24 x 3/8	
	93592200	SCREW, STP, 8-32 x 3/8	
		- - - * - - -	
16	77444700	SHIELD, Filter	
17	94277406	STRAP, Cable Tie	
18	93590200	SCREW, PHH, 8-32 x 3/8	
19		POWER CABLE ASSEMBLY (See Figure 9A-19)	
20	15012421	BUSHING, Snap-In	
21	77447512	AC HARNESS ASSEMBLY	

NOTE:

* When ordering a new power supply for an older drive, these parts must be retained for installation.

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-14		POWER SUPPLY ASSEMBLY Rear (Non-VDE) (Contd)	
22	##	TRANSFORMER, Ferro, 60 HZ (A1T2)	
		(ATTACHING PARTS)	
	10125108	NUT, Hex, #10-32	
	10126403	WASHER, Lock, #10	
	10125607	WASHER, Flat, #10	
		- - - * - - -	
23	93114352	STANDOFF, Tapped Post 10-32 x 1	
24	##	TRANSFORMER, Ferro, 60 HZ (A1T1)	
		(ATTACHING PARTS)	
	10125108	NUT, Hex, #10-32	
	10126403	WASHER, Lock, #10	
	10125607	WASHER, Flat, #10	
		- - - * - - -	
25	##	TRANSFORMER ASSEMBLY, 50/60 HZ (A1T3)	
		(ATTACHING PARTS)	
	10125606	WASHER, Flat, #8	
	93590200	SCREW, PHH, 8-32 x 3/8	
		- - - * - - -	
26	95641708	CAPACITOR, Clamp, Hold-Down	
		(ATTACHING PARTS)	
	10125606	WASHER, Flat, #8	
	10126402	WASHER, Lock, #8	
	93590198	SCREW, PHH, 8-32 x 5/16	
		- - - * - - -	
27	##	RECTIFIER, Bridge	
28	10125106	NUT, Hex, #8-32	
29	10127125	SCREW, PHH, 8-32 x 3/4	

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-14		POWER SUPPLY ASSEMBLY Rear (Non-VDE) (Contd)	
30	##	CAPACITOR, 660 V ac (A1C1 & A1C2)	
31	95582501	BOOT, Double Entrance	
32	83229501	CABINET, Power Supply	Used on P.S. tabs 47, 49, 65 & 66
32	83229502	CABINET, Power Supply	Used on P.S. tabs 68, 69, 72, & 73
33	95667406	RESISTOR, 30 W, 10 ohm	
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, Philips Pan Head Machine, 6-32 x 0.312	
39	10125605	WASHER, Flat, #6	
40		COMPONENT ASSEMBLY, TYPE _ZCN (See Figure 9A-16)	
41		COMPONENT ASSEMBLY, TYPE _YEN (See Figure 9A-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, Philips Pan Head Machine, 6-32 x 0.500	
	10125105	NUT, Hex, #6-32	
		- - - * - - -	
45		NOT USED	
46	15012412	BUSHING, Snap-In	
47	94385500	GROMMET, Extruded	
48	22950034	TB06 TERMINAL BLOCK ASSEMBLY	
		(ATTACHING PARTS)	
	10127115	SCREW, Philips 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	
		- - - * - - -	

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-14		POWER SUPPLY ASSEMBLY Rear (Non-VDE) (Contd)	
49	##	CONTACTOR, 24 V dc (K6, K7, K8)	
		(ATTACHING PARTS)	
	10126402	WASHER, External Tooth Lock, #8	
	10125106	NUT, Hex, #8-32	
	10125606	WASHER, Flat, #8	
		- - - * - - -	
50	95595000	ADAPTER, Quick Connect	
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	##	_YFN COMPONENT ASSEMBLY	
57	10127130	SCREW, Philips Pan Head Machine, 10-24 x 0.312	
58	95641521	WASHER, Flat	
59	10127126	SCREW, Pan Head Machine, 8-32 x 0.875	
60	95673184	SPACER, Thread, 10-32 x 1.000	
61	94001025	TAPE, Foam	
62	92376014	NUT, Lock	
63	##	CIRCUIT BREAKER, 9 A	S/C 28 & Above only w/ 13070-A
64	##	CIRCUIT BREAKER, 12 A	S/C 28 & Above only w/ 13070-A
65	76846700	WIRE, Harness	S/C 28 & Above only w/ 13070-A
66	##	FUSE, Cartridge, 5 A	S/C 28 & Above only w/ 13070-A
67	##	FUSE, Cartridge, 15 A	S/C 28 & Above only w/ 13070-A

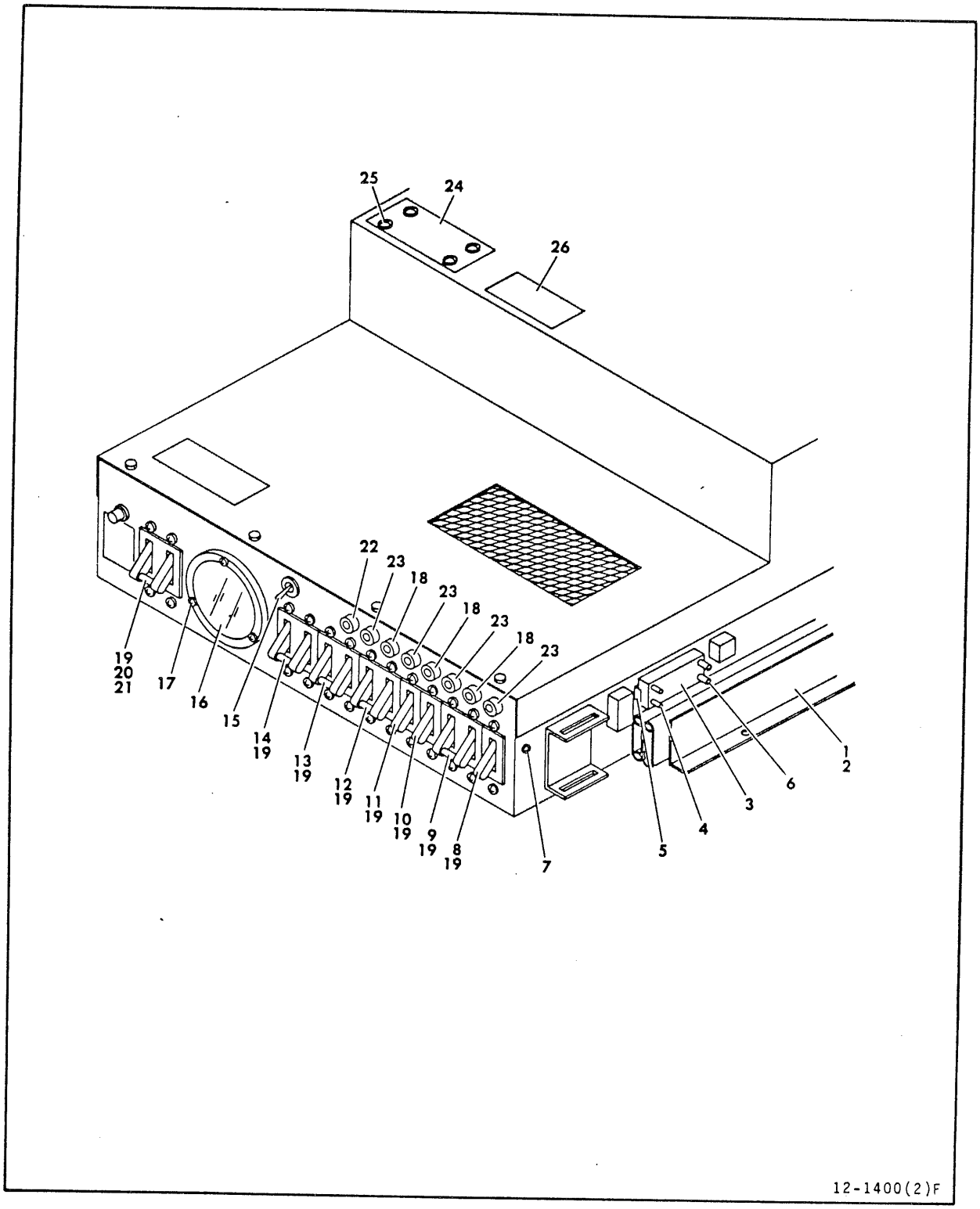


Figure 9A-14. Power Supply Assembly Front (Non-VDE)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-14		POWER SUPPLY ASSEMBLY Front (Non-VDE)	
1	94383502*	SLIDE, Ball Bearing	Older drives
		(ATTACHING PARTS)	
	93590196*	SCREW, PHH, 8-32 x 1/4	
		- - - * - - -	
2	47097480	SUPPORT, Power Supply	Newer drives
2	47097490	BLOCK, Power Supply	Newer drives
		(ATTACHING PARTS)	
	93592238	SCREW, STP, 10-24 x 3/8	
	93592200	SCREW, STP, 8-32 x 3/8	
		- - - * - - -	
3	77447701	DC HARNESS ASSEMBLY	
4	93643004	CONNECTOR, Corner Guide, Pin	
5	93643020	CATCH, Connector	
6	93643005	CONNECTOR, Corner Guide, Socket	
7	93590196	SCREW, PHH, 8-32 x 1/4	
8	##	CIRCUIT BREAKER, 0.5 A ±28 V (A1CB8)	
9	##	CIRCUIT BREAKER, 2 A, ±20 V 50 V dc (A1CB7)	
10	##	CIRCUIT BREAKER, 5 A -9.7 V (A1CB6)	
11	##	CIRCUIT BREAKER, 8 A +9.7 V (A1CB5)	
12	##	CIRCUIT BREAKER, 7 A, ±46 V 50 V dc (A1CB4)	
13	##	CIRCUIT BREAKER, U/L Recognized, Drive Motor (A1CB3)	
14	##	CIRCUIT BREAKER, 3/8 A, +20Y 250 V ac (A1CB2)	
		(ATTACHING PARTS FOR INDEX NOS 8 THRU 14)	
	10126103	WASHER, Lock, #6	
	93749158	SCREW, PHH, 6-32 x 3/16	
		- - - * - - -	
15	##	SWITCH, Toggle	
16	##	METER, Hour, AC	
17	17901502	SCREW, PHH, 4-40 x 3/8	

NOTE:

* When ordering a new power supply for an older drive, these parts must be retained for installation.

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-14		POWER SUPPLY ASSEMBLY Front (Non-VDE) (Contd)	
18	95644003	JACK, Banana	
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	
23	95644000	JACK, Banana	
24	72896000	COVER, Fuse	
25	17901515	SCREW, Pan Head Machine, 8-32 x 0.250	
26	92006905	LABEL, Warning	

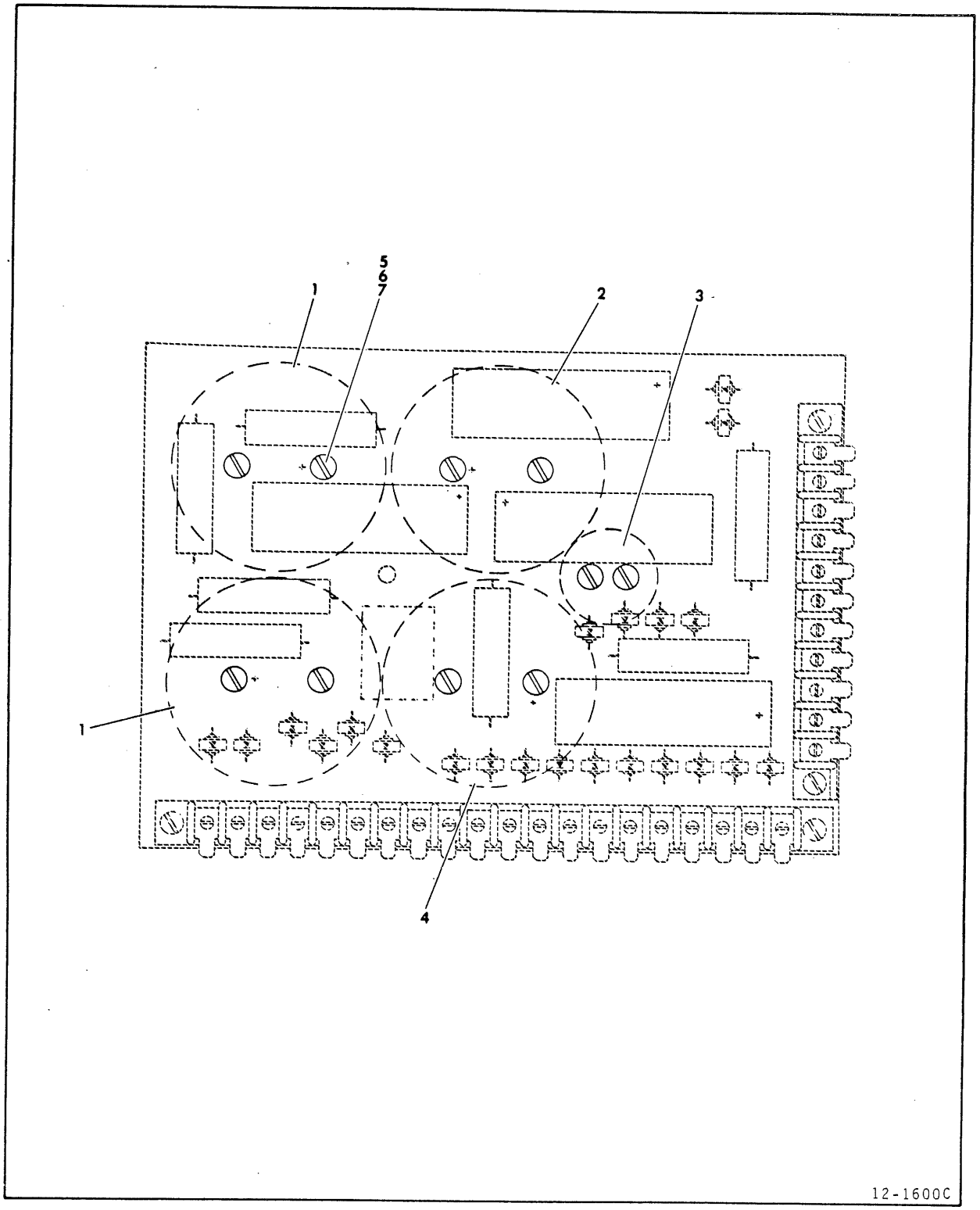


Figure 9A-15. _YEN Component Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-15	##	_YEN COMPONENT ASSEMBLY	Non-VDE
1	94384000	CAPACITOR, Electrolytic (C7 & C8)	
2	94384001	CAPACITOR, Electrolytic (C9)	
3	95661319	CAPACITOR, 15 V dc (A1C5)	
4	94384002	CAPACITOR, Electrolytic (C6)	
5	93903356	EYELET, Rolled Flange	
6	10127143	SCREW, Philips Pan Head Machine, 10-32 x 0.500	
7	95524408	WASHER, Internal Tooth Lock, #10	

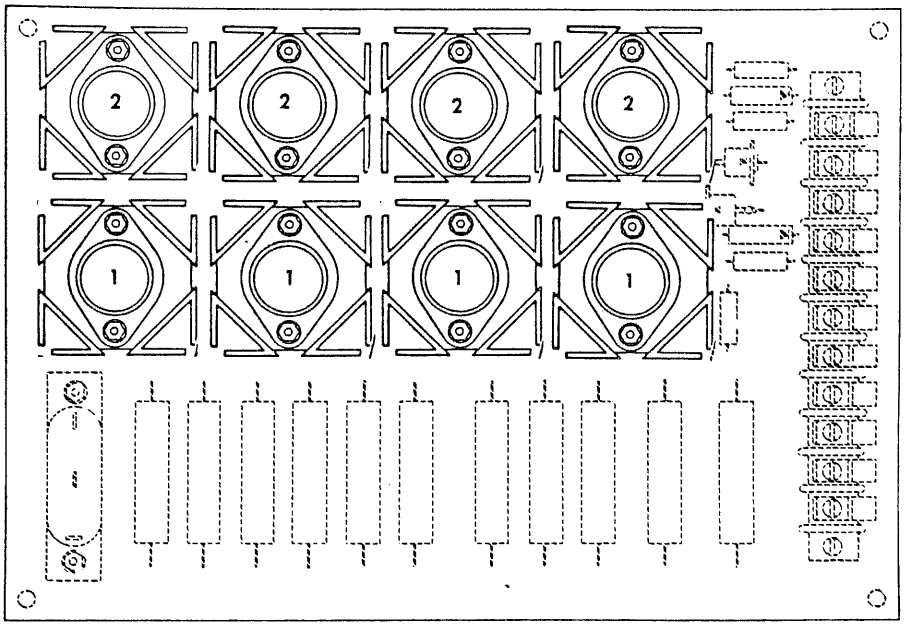


Figure 9A-16. _ZCN Component Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-16	##	_ZCN COMPONENT ASSEMBLY	Non-VDE & VDE
1	##	TRANSISTOR, NPN Silicon, Power	
2	##	TRANSISTOR, PNP Silicon, Power	

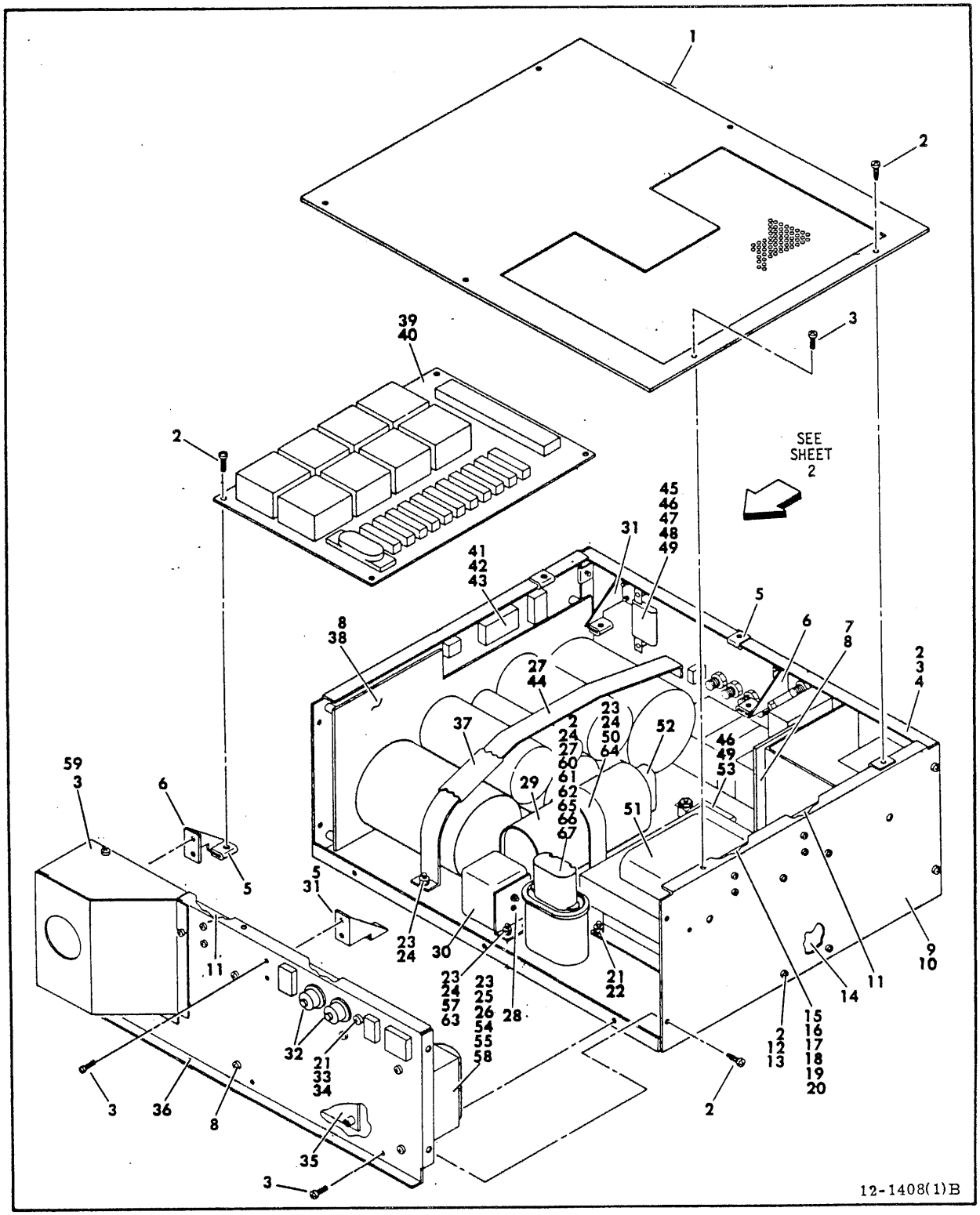


Figure 9A-17. Power Supply Assembly Rear (VDE) (S/C 40 & Below)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-17	##	POWER SUPPLY ASSEMBLY Rear (VDE)	(S/C 40 & Below)
1	92155830	COVER, Power Supply	(Input/Output voltage connection data located on Power Supply cover)
2	95655516	SCREW, Sheet Metal, 6-20 x 0.375	
3	17901509	SCREW, Philips, Thread Roll 6-32 x 0.375	
4	70106403	PANEL, Front	
5	95634816	NUT, Speed, U Type	
6	76876201	BRACKET, P.C. Card	
7	##	_FNN COMPONENT ASSEMBLY	
8	93749160	SCREW, Philips Pan Head Machine, 6-32 x 0.312	
9	70106203	CHASSIS	
10	94397658	PANEL, Foam, Acoustical	
11	##	FUSE, Cartridge, 1 Amp	
12	95634809	NUT, Speed, U Type	
13	95524409	WASHER, Internal Tooth Lock #8	
14	##	FILTER, RFI 115-275 V ac 20A	
15	51785403	FUSE BLOCK, 3 AG Quick Connect	
16	10127104	SCREW, Pan Head Machine, 4-40 x 0.375	
17	95641502	WASHER, Flat	
18	10126101	WASHER, Internal Tooth Lock #4	
19	95510024	NUT, Hexagon Machine	
20	##	FUSE, Cartridge, 8 Amp	
21	10126403	WASHER, External Tooth Lock #10	
22	92376014	NUT, Self-Locking #10-32	
23	10125105	NUT, Hexagon Machine, #6-32	
24	10126103	WASHER, Internal Tooth Lock #6	
25	##	TRANSFORMER, Ferro (A1T1)	
26	95655517	SCREW, Sheet Metal, 6-20 x 0.500	
27	95634801	NUT, Speed, U-Type	
28	76879600	BRACKET, Relay	
29	##	CAPACITOR, 660 V ac	
30	##	RELAY PLUG, 14 Pin	
31	76876200	BRACKET, P.C. Card	
32	##	CIRCUIT BREAKER (A1CB10)	
33	10125108	NUT, Hexagon Machine, #10-32	
34	10127143	SCREW, Pan Head Machine, 10-32 x 0.500	

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-17		POWER SUPPLY ASSEMBLY Rear (VDE) (Contd)	
35	##	_CFN COMPONENT ASSEMBLY	
36	92155840	PANEL, Back	
37	94001053	TAPE, Foam	
38	##	_CBN COMPONENT ASSEMBLY (See Figure 9A-18.1)	
39	94385500	GROMMET, Strip	
40	##	_ZCN COMPONENT ASSEMBLY (See Figure 9A-16)	
41	93643020	CONNECTOR, Catch	
42	93643004	CONNECTOR, Corner Guide Pin	
43	93643005	CONNECTOR, Corner Guide Socket	
44	70106000	BRACKET, Capacitor	
45	95667407	RESISTOR, 30 W, 15 ohms	
46	10125106	NUT, Hexagon Machine, #8-32	
47	10127125	SCREW, Pan Head Machine Philips, 8-32 x 0.750	
48	95641506	WASHER, Flat, #8	
49	10126104	WASHER, Internal Tooth Lock #8	
50	70105300	CLAMP, Capacitor	
51	##	TRANSFORMER, Ferro (A1T2)	
52	95582501	BOOT, Double Entrance	
53	95667405	RESISTOR, 30 W, 7.5 ohms	
54	95634832	NUT, Tinnerman	
55	10126401	WASHER, External Tooth Lock, #6	
56	95051043	INSULATION	
.	70112301	AC INPUT HARNESS ASSEMBLY	
	70120402	DC HARNESS ASSEMBLY	
	70108003	AC1 HARNESS ASSEMBLY	
	70117202	AC2 HARNESS ASSEMBLY	
57	93749162	SCREW, Philips Pan Head Machine, 6-32 x 0.375	
58	10127114	SCREW, Pan Head Machine, 6-32 x 0.500	
59	92155820	PLENUM	
60	##	CAPACITOR, 660 V ac	
61	95656900	CLAMP, Capacitor, Wraparound	
62	95582500	BOOT, Capacitor	
63	94297200	ADAPTER, dual tab	
64	94277403	STRAP, Cable Tie	
65	94001000	TAPE, foam	
66	95510026	NUT, Mini, #6-32	
67	10125613	WASHER, Flat, #6	

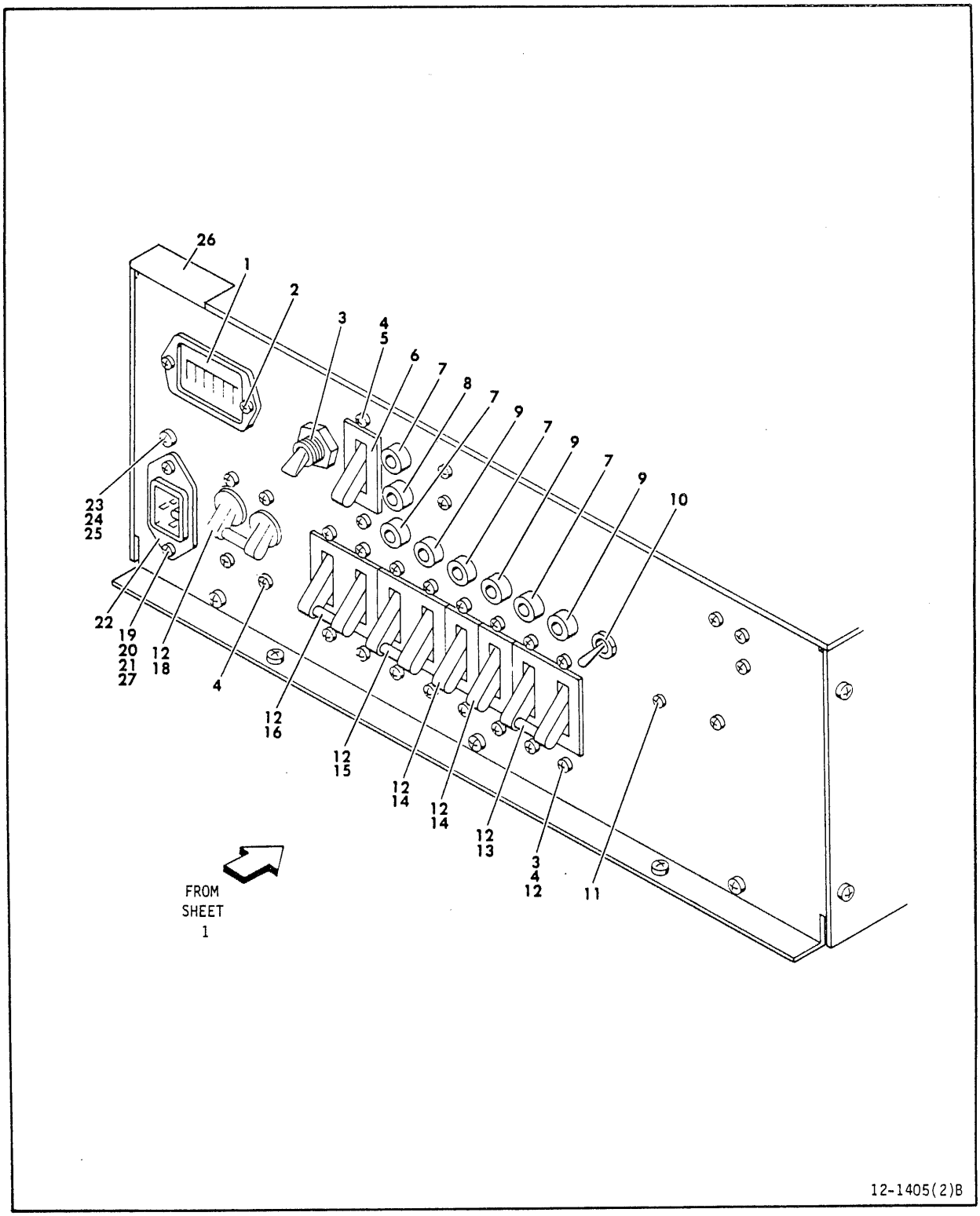


Figure 9A-17. Power Supply Assembly Front (VDE) (S/C 40 & Below)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-17		POWER SUPPLY ASSEMBLY Front (VDE)	S/C 40 & Below
1	##	METER, Time Elapsed	
2	17901509	SCREW, Phillips, Thread Roll, 6-32 x 0.375	
3	##	CIRCUIT BREAKER, 0.5A (A1CB2)	
4	93749158	SCREW, Phillips Pan Head Machine, 6-32 x 0.250	
5	95524408	WASHER, Internal Tooth Lock #10	
6	##	CIRCUIT BREAKER, 0.5A (A1CB3)	
7	95644000	JACK, Banana	
8	95644001	JACK, Banana	
9	95644003	JACK, Banana	
10	##	SWITCH, Toggle	
11	95655517	SCREW, Sheet Metal, 6-20 x 0.500	
12	76416500	INSULATOR, Terminal	
13	##	CIRCUIT BREAKER, 1.0A (A1CB8)	
14	##	CIRCUIT BREAKER, 10A (A1CB6&7)	
15	##	CIRCUIT BREAKER, 7A (A1CB5)	
16	##	CIRCUIT BREAKER, (A1CB4)	
17		NOT USED	
18	##	CIRCUIT BREAKER, 20.0 (A1CB1)	
19	10126101	WASHER, Internal Tooth Lock #4	
20	10127104	SCREW, Pan Head Machine, 4-40 x 0.375	
21	10125103	NUT, Hexagon Machine, 4-40	
22	51870401	RECEPTACLE, Power A.C. 3-pin (Keyed)	
23	10126401	WASHER, External Tooth Lock #6	
24	10127114	SCREW, Pan Head Machine, 6-32 x 0.500	
25	10125105	NUT, Hexagon Machine, #6-32	
26	95660407	TAPE, Insulating	
27	95641502	WASHER, Flat	

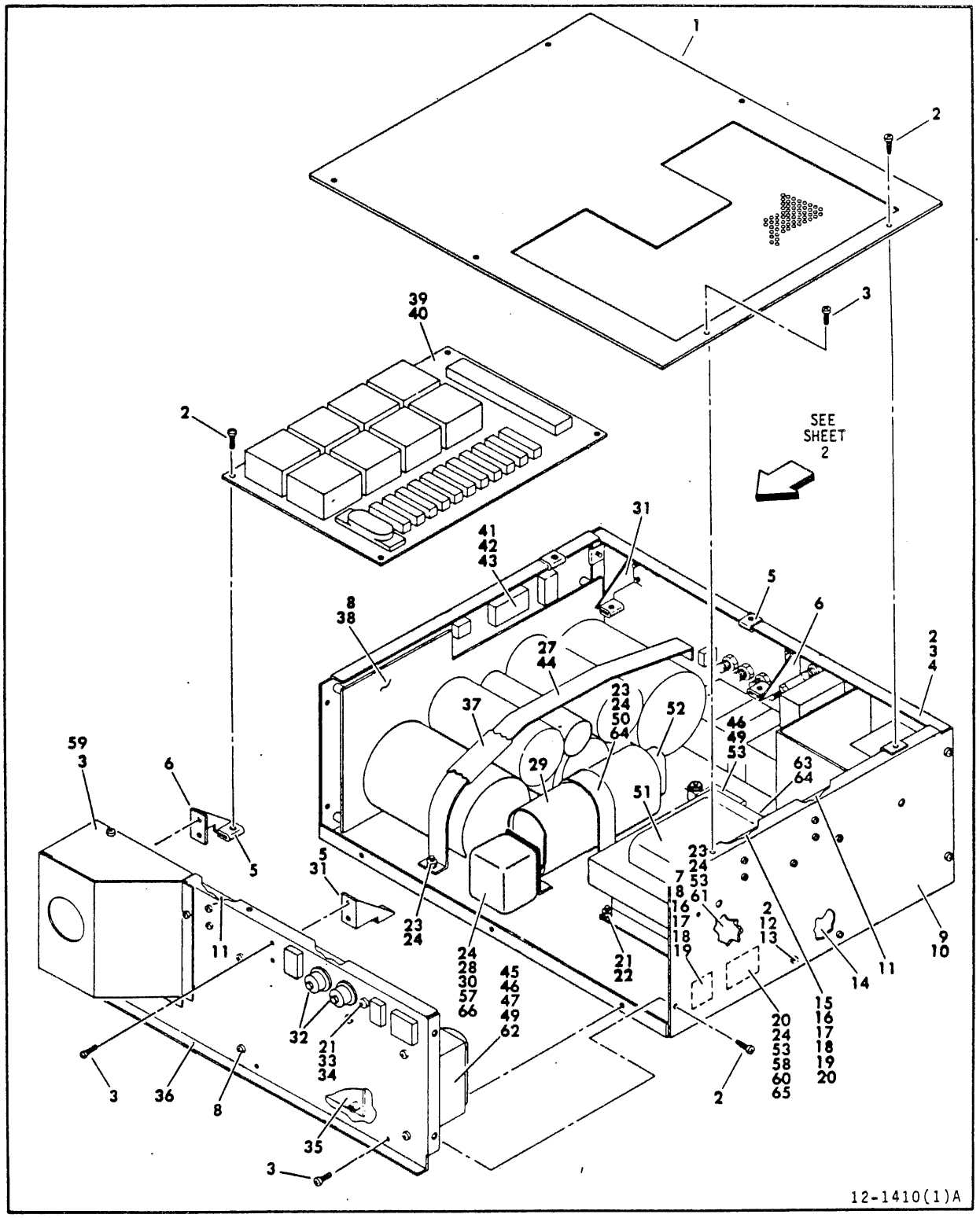


Figure 9A-18. Power Supply Assembly Rear (VDE)
(S/C 41 & Above)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-18	##	POWER SUPPLY ASSEMBLY Rear (VDE)	S/C 41 & Above
1	92155831	COVER, Power Supply	(Input/Output voltage connection data located on Power Supply cover)
2	95655516	SCREW, Sheet Metal, 6-20 x 0.375	
3	17901509	SCREW, Phillips Thread Roll, 6-32 x 0.375	
4	70106404	PANEL, Front	
5	95634816	NUT, Speed U Type	
6	76876201	BRACKET, P.C. Card	
7	##	BLOCK, Fuse	
8	##	FUSE, 125 V	
9	70106204	CHASSIS	
10	94397658	PANEL, Foam, Acoustical	
11	##	FUSE, Cartridge, 1 Amp	
12	95634809	NUT, Speed U Type	
13	95524409	WASHER, Internal Tooth Lock #8	
14	##	FILTER, RFI 115-275 V ac 20A	
15	51785403	FUSE BLOCK, 3 AG Quick Connect	
16	10127104	SCREW, Pan Head Machine, 4-40 x 0.375	
17	95641502	WASHER, Flat	
18	10126101	WASHER, Internal Tooth Lock #4	
19	95510024	NUT, Hexagon Machine	
20	##	FUSE, Cartridge, 10 Amp	
21	10126403	WASHER, External Tooth Lock #10	
22	92376014	NUT, Self-Locking #10-32	
23	10125105	NUT, Hexagon Machine, #6-32	
24	10126103	WASHER, Internal Tooth Lock #6	
25	##	TRANSFORMER, Ferro (A1T1)	
26	95655517	SCREW, Sheet Metal, 6-20 x 0.500	
27	95634801	NUT, Speed U-Type	
28	76879600	BRACKET, Relay	

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-18		POWER SUPPLY ASSEMBLY Rear (VDE) (Contd)	
29	##	CAPACITOR, 660 V ac	
30	##	RELAY PLUG, 14 Pin	
31	76876200	BRACKET, P.C. Card	
32	##	CIRCUIT BREAKER	
33	10125108	NUT, Hexagon Machine, #10-32	
34	10127143	SCREW, Pan Head Machine, 10-32 x 0.500	
35	##	_CFN COMPONENT ASSEMBLY	
36	92155841	PANEL, Back	
37	94001053	TAPE, Foam	
38	##	_CBN COMPONENT ASSEMBLY (See Figure 9A-18.1)	
39	94385500	GROMMET, Strip	
40	##	_ZCN COMPONENT ASSEMBLY (See Figure 3-16)	
41	93643020	CONNECTOR, Catch	
42	93643004	CONNECTOR, Corner Guide Pin	
43	93643005	CONNECTOR, Corner Guide Socket	
44	70106000	BRACKET, Capacitor	
45	95667401	RESISTOR, 30 W, 1 ohm	
46	10125106	NUT, Hexagon Machine, #8-32	
47	10127125	SCREW, Pan Head Machine Phillips, 8-32 x 0.750	
48	95641506	WASHER, Flat, #8	
49	10126104	WASHER, Internal Tooth Lock #8	
50	70105300	CLAMP, Capacitor	
51	##	TRANSFORMER, Ferro (A1T2)	
52	95582501	BOOT, Double Entrance	
53	76793501	BLOCK, Fuse	
54	95634832	NUT, Tinnerman	
55	10126401	WASHER, External Tooth Lock #6	
56	95051043	INSULATION	
	70112302	AC INPUT HARNESS ASSEMBLY	
	70120404	DC HARNESS ASSEMBLY	
	70108004	AC1 HARNESS ASSEMBLY	
	70117203	AC2 HARNESS ASSEMBLY	

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-18		POWER SUPPLY ASSEMBLY Rear (VDE) (Contd)	
57	93749162	SCREW, Pan Head Machine Phillips, 6-32 x 0.375	
58	10127114	SCREW, Pan Head Machine, 6-32 x 0.500	
59	92155820	PLENUM	
60	95510026	NUT, Mini, #6-32	
61	10127115	SCREW, Pan Head, Machine, 6-32 x 0.625	
62	10125606	WASHER, Plain, #8	
63	17901510	SCREW, Phillips Thread Roll 6-32 x 1	
64	10125605	WASHER, Plain, #6	
65	10125613	WASHER, Flat, #6	

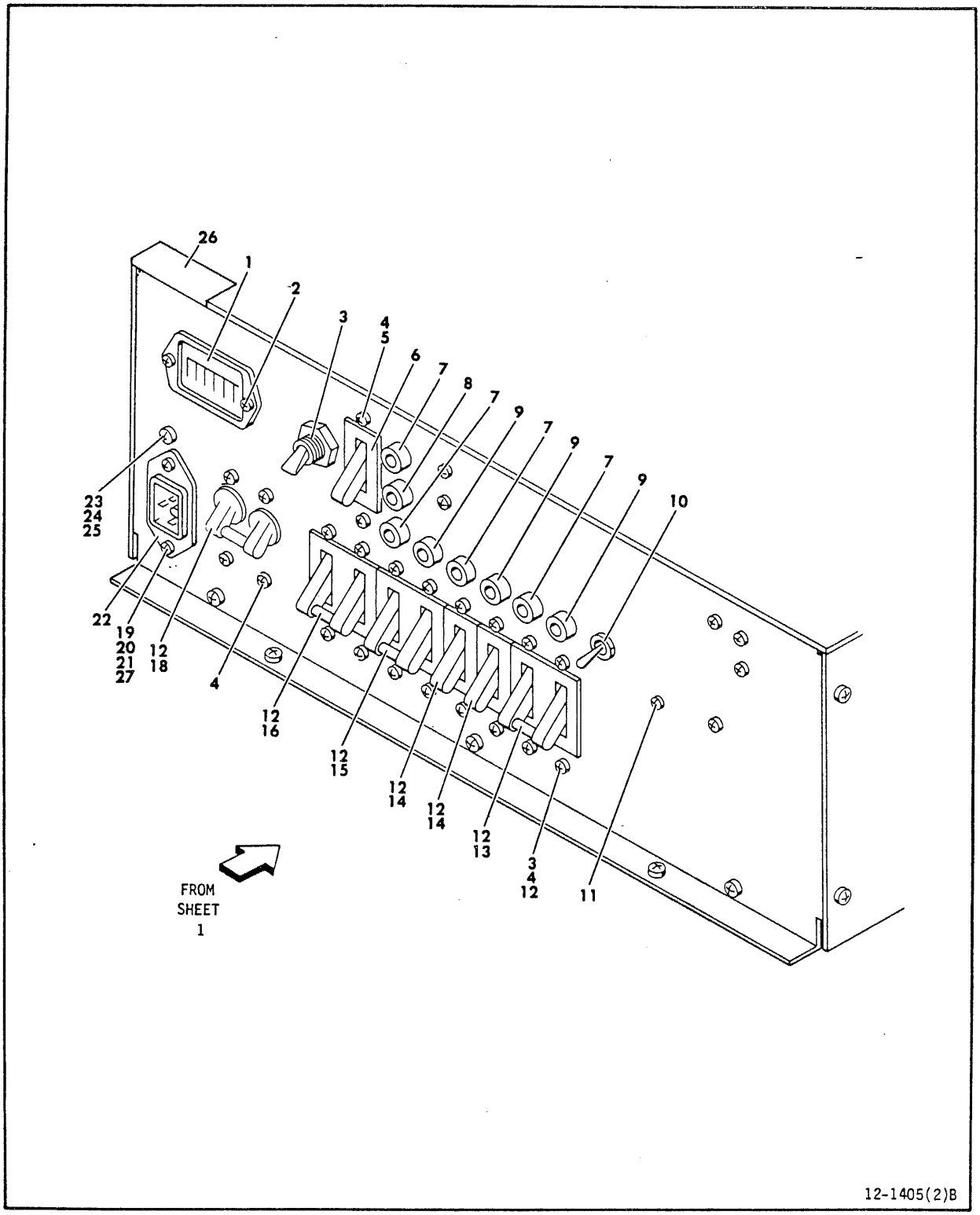


Figure 9A-18. Power Supply Assembly Front (VDE)
(S/C 41 & Above)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-18		POWER SUPPLY ASSEMBLY Front (VDE)	
1	##	METER, Time Elapsed	
2	17901509	SCREW, Phillips, Thread Roll, 6-32 x 0.375	
3		NOT USED	
4	93749158	SCREW, Phillips Pan Head Machine, 6-32 x 0.250	
5	95524408	WASHER, Internal Tooth Lock #10	
6	##	CIRCUIT BREAKER, 0.5A (A1CB3)	
7	95644000	JACK, Banana	
8	95644001	JACK, Banana	
9	95644003	JACK, Banana	
10	##	SWITCH, Toggle	
11	95655517	SCREW, Sheet Metal, 6-20 x 0.500	
12	76416500	INSULATOR, Terminal	
13	##	CIRCUIT BREAKER, 1.0A (A1CB8)	
14	##	CIRCUIT BREAKER, 10A (A1CB6&7)	
15	##	CIRCUIT BREAKER, 7A (A1CB5)	
16	##	CIRCUIT BREAKER, (A1CB4)	
17		NOT USED	
18	##	CIRCUIT BREAKER, 20.0 (A1CB1)	
19	10126101	WASHER, Internal Tooth Lock #4	
20	10127104	SCREW, Pan Head Machine, 4-40 x 0.375	
21	10125103	NUT, Hexagon Machine, 4-40	
22	51870401	RECEPTACLE, Power A.C. 3-pin (Keyed)	
23	10126401	WASHER, External Tooth Lock #6	
24	10127114	SCREW, Pan Head Machine, 6-32 x 0.500	
25	10125105	NUT, Hexagon Machine, #6-32	
26	95660407	TAPE, Insulating	
27	95641502	WASHER, Flat	

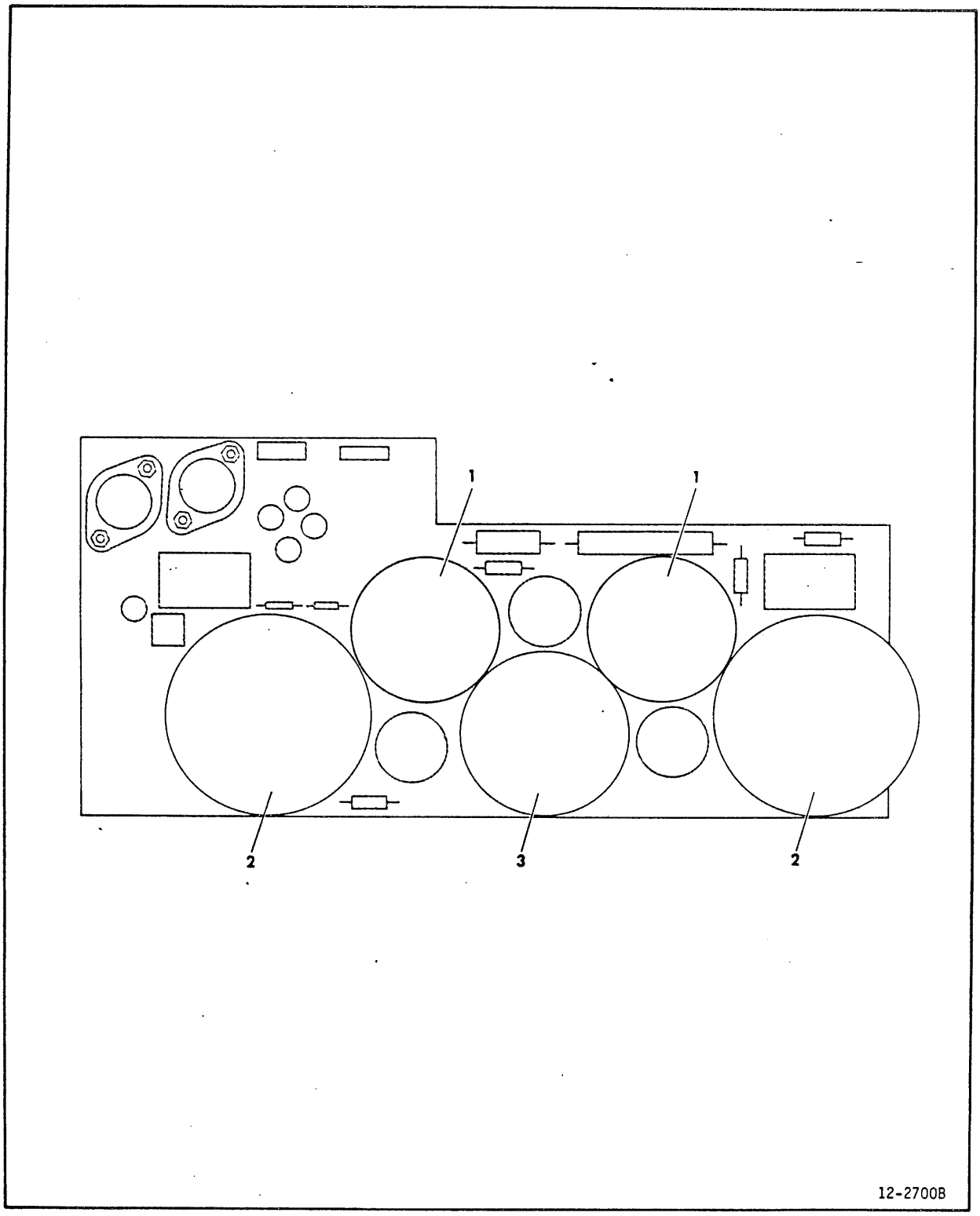


Figure 9A-18.1. _CBN Component Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-18.1	##	_CBN COMPONENT ASSEMBLY	VDE only
1	95661307	CAPACITOR, 15 V dc	
2	12117910	CAPACITOR, 50 V dc	S/C 40 & Below
2	12117509	CAPACITOR, 20 V dc	S/C 41 & Above
3	12117906	CAPACITOR, Aluminum, Elect	S/C 40 & Below
3	95595801	CAPACITOR, 60 V dc	S/C 41 & Above

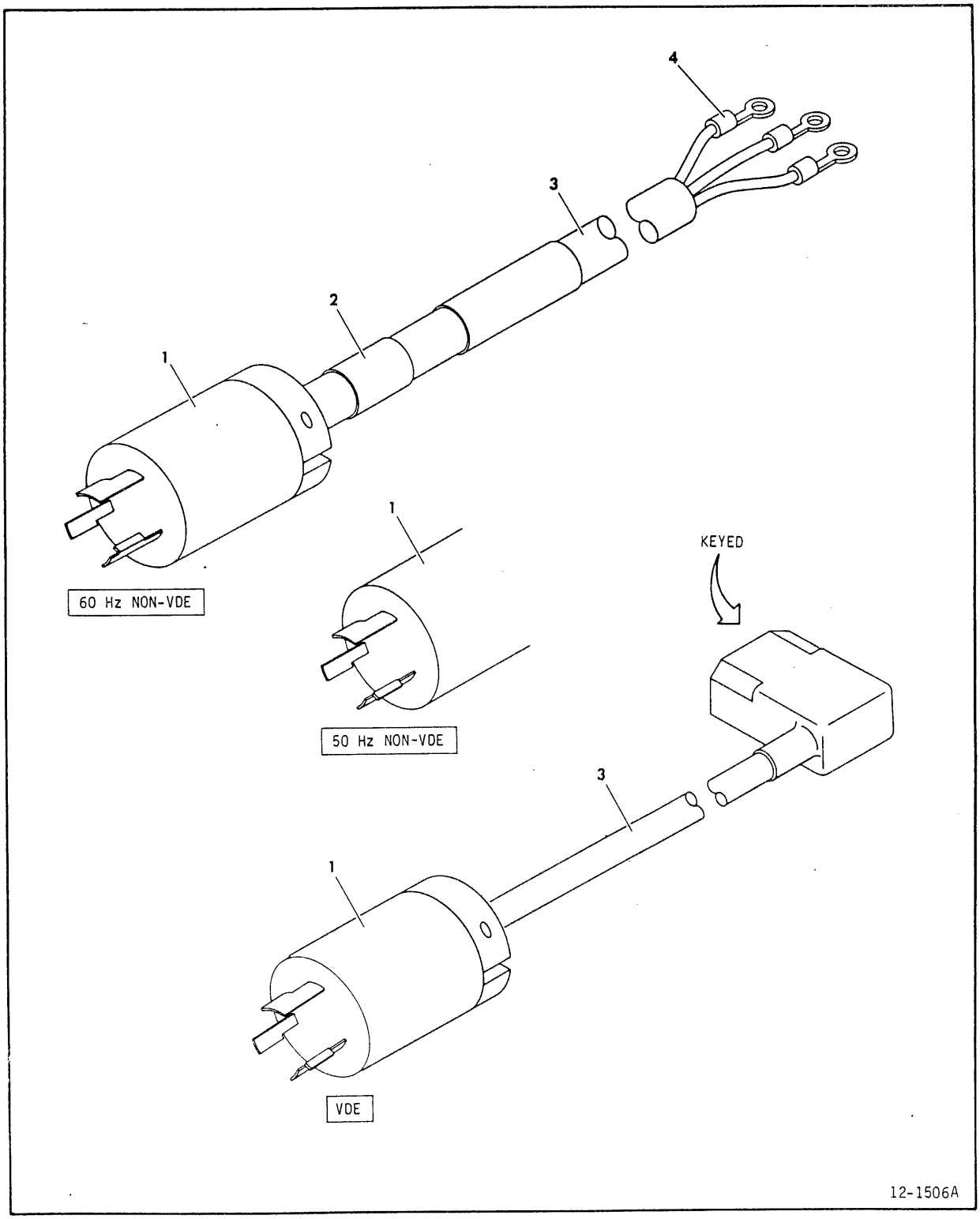


Figure 9A-19. Power Cable Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-19	70734116	POWER CABLE ASSEMBLY	60 Hz Non-VDE
9A-19	70734115	POWER CABLE ASSEMBLY	50 Hz Non-VDE
9A-19	##	POWER CABLE ASSEMBLY	VDE only
1	##	CONNECTOR, Locking, 3 Wire	60 Hz
1	##	CONNECTOR, Locking, 3 Wire	50 Hz
2	93154151	TUBING, Heat Shrink	Non-VDE
3	92017503	CABLE, Power	Non-VDE
3	75168314	CORD, Power	VDE only
4	95604057	TERMINAL, Ring Tongue	Non-VDE

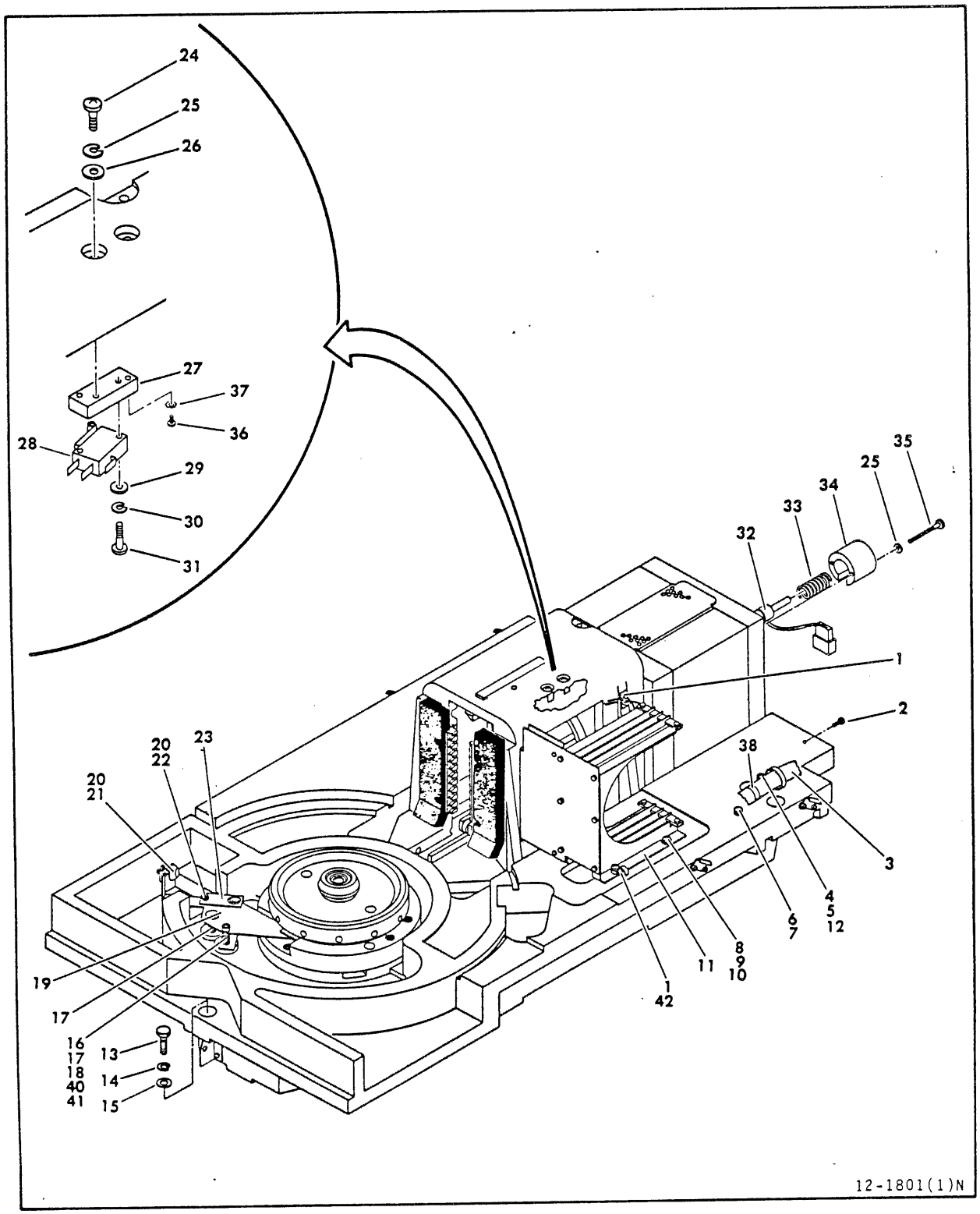


Figure 9A-20. Deck Assembly (Sheet 1 of 3)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-20	774458XX	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	77448401	MAIN HARNESS ASSEMBLY, Shielded	Non-VDE
3	77448402	MAIN HARNESS ASSEMBLY, Shielded	VDE only
3	77448404	MAIN HARNESS ASSEMBLY, Shielded	60 Hz units S/C 34 & Above
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, 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 9A-24)	
12	92777190	STRAP, Cable Tie	60 Hz units only S/C 34 & Above
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, Socket Head, Shoulder	
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, Philips Pan Head Machine, 8-32 x 0.625	
25	10125804	WASHER, Spring Lock, #8	
26	10125606	WASHER, Flat, #8	
27	77437900	MOUNT, Switch	

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-20	774458XX	DECK ASSEMBLY (Sheet 1 of 3 Contd)	
28	##	SWITCH, Actuator, Mini Integral, (Heads Loaded Switch A3S6)	
29	10125603	WASHER, Flat, #4	
30	10125801	WASHER, Spring Lock, #4	
31	10127106	SCREW, Philips Pan Head Machine, 4-40 x 0.625	
32		TRANSDUCER AND CONNECTOR ASSEMBLY (See Figure 9A-23)	
33	94206431	SPRING, Compression	
34	70726001	CAP, End, Transducer	
35	10127353	SCREW, Pan Head Machine, 8-32 x 1.250	
36	10127102	SCREW, Pan Head Machine, 4-40 x 0.250	
37	10126400	WASHER, External Tooth Lock, #4	
38	94277415	STRAP, Cable Tie	
39		NOT USED	
40	10126401	WASHER, External Tooth Lock, #6	
41	94047033	WASHER, Special	
42	94277503	BASE, Mounting	S/C 26 & Above only

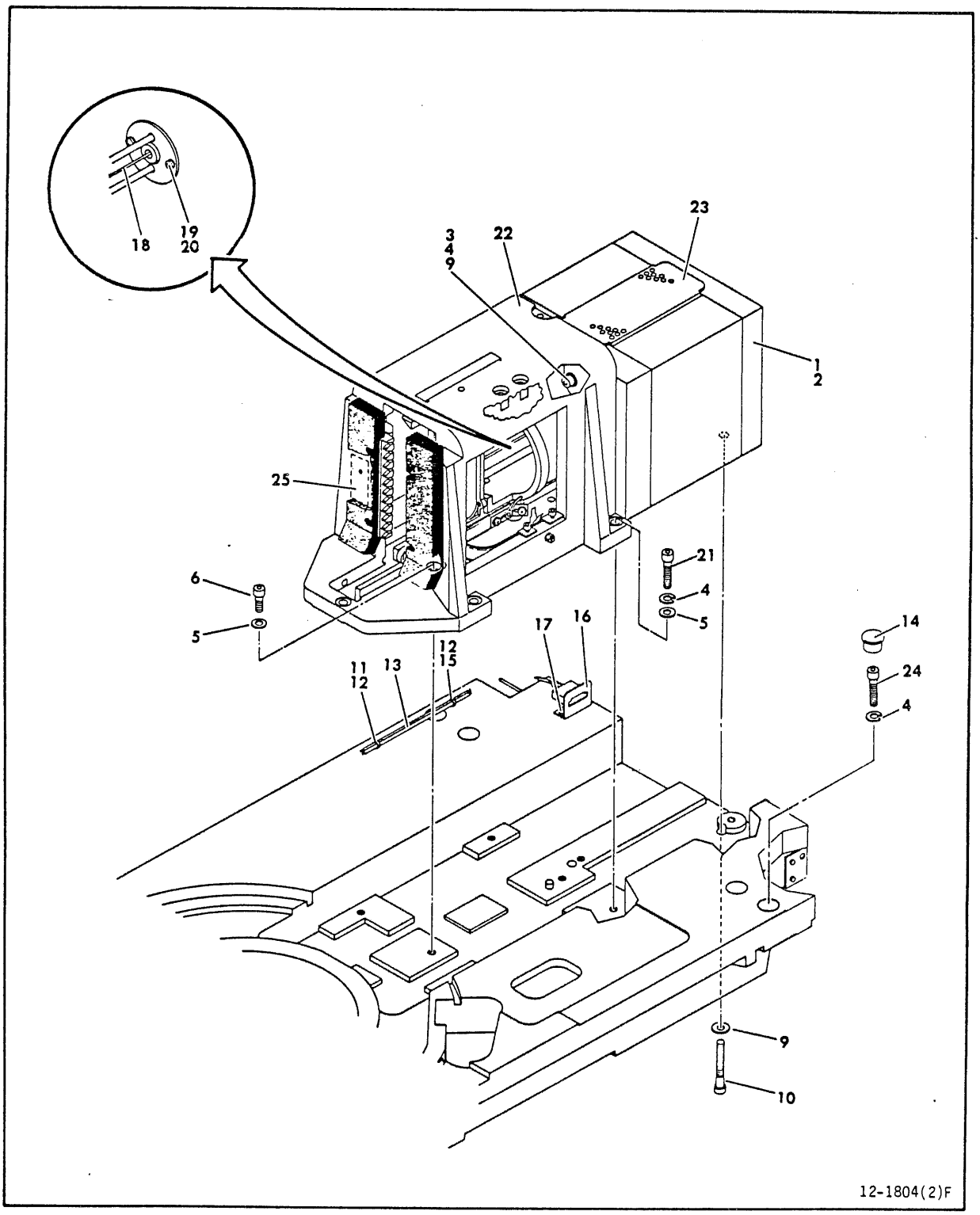


Figure 9A-20. Deck Assembly (Sheet 2 of 3)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-20		DECK ASSEMBLY (Sheet 2)	
1	77829301	MAGNET ASSEMBLY	
2	95027403	TAPE, Foam	
3	10126259	SCREW, Hex Socket Head Cap, 1/4-20 x 1/4	
4	10125806	WASHER, Spring Lock, # 1/4	
5	94047033	WASHER, Special	
6	10126256	SCREW, Hex Socket Head Cap, 1/4-20 x 3/4	
7		NOT USED	
8		NOT USED	
9	10125608	WASHER, Flat, # 1/4	
10	93117374	SCREW, Hex Socket Head Cap, 1/4-20 x 2	
11	94277406	STRAP, Cable Tie	
12	93592202	SCREW, STP, 8-32 x 1/2	
13	77452600	MAIN HARNESS ASSEMBLY, Unshielded	S/C 05 & Below
13	77452601	MAIN HARNESS ASSEMBLY, Unshielded	S/C 06-31
13	77452608	MAIN HARNESS ASSEMBLY, Unshielded	VDE only
14	94353212	CAPS AND PLUGS, Plastic	
15		NOT USED	
16	72823900	BRACKET, Connector, 3 Pin	
17	93592196	SCREW, STP, 8-32 x 1/4	
18	70729304	ROD, Extension	
19	10127133	SCREW, PHH, 10-24 x 5/8	
20	10126105	WASHER, Lock, #10	
21	10126258	SCREW, Hex Head Socket Cap, 1/4-20 x 1	
22		ACTUATOR ASSEMBLY (See Figure 9A-25)	
23	46484001	COVER, Magnet	
24	10126264	SCREW, Hex Socket Head Cap, 1/4-20 x 2-1/2	
25	##	_ZGN Component Assembly	

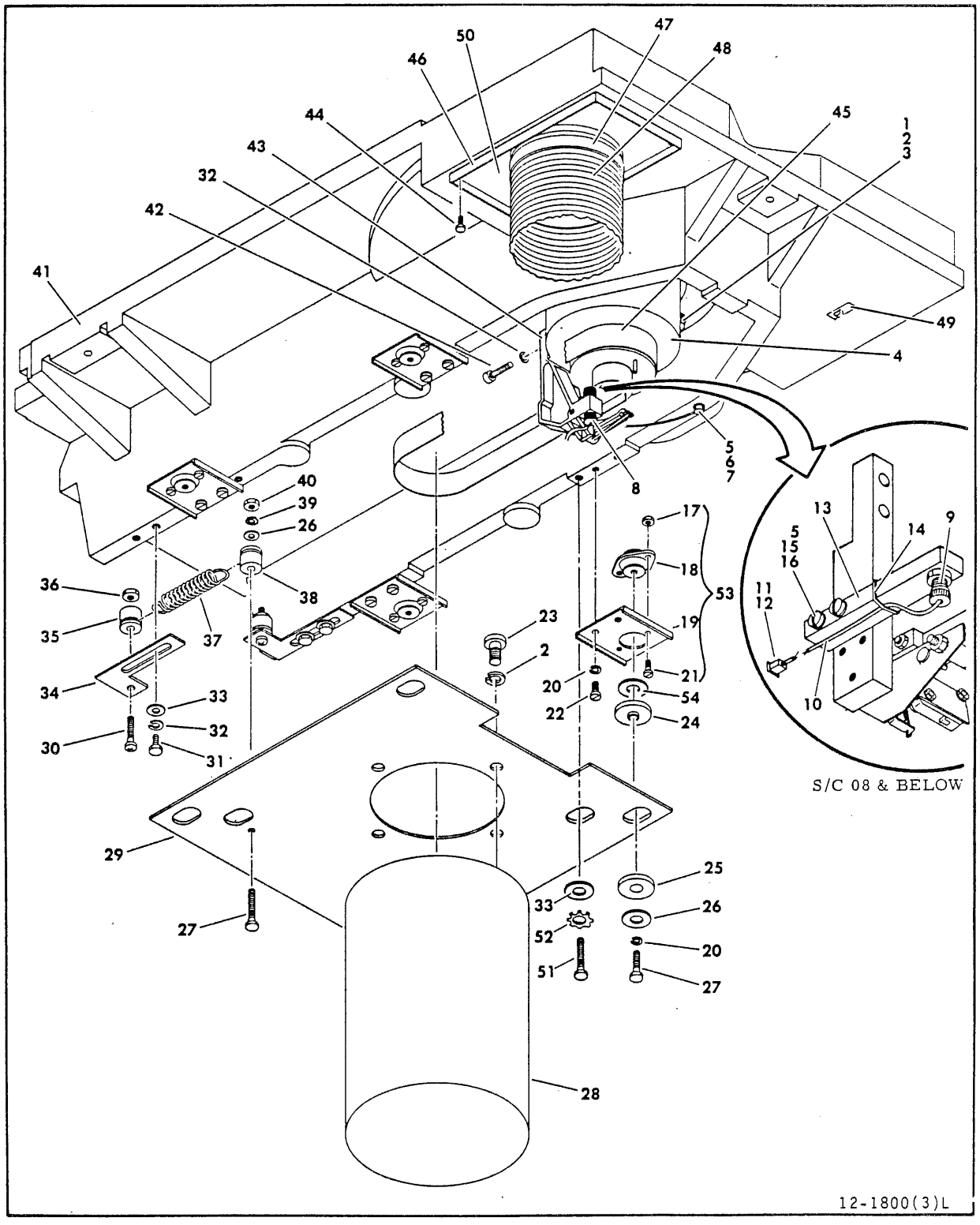


Figure 9A-20. Deck Assembly (Sheet 3 of 3)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-20		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 9A-26)	
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	92261011	TUBING, Teflon	
11	93948004	CONNECTOR, Pin Housing	
12	93942022	CONTACT, Pin	
13	73586800	BRACKET, Mounting, Sensor	
14	94277400	CABLE, Tie Strap	
15	10126229	SCREW, Hex Socket Head Cap, 8-32 x 0.875	S/C 08 and Below
16	10125606	WASHER, Flat, #8	S/C 08 and Below
17	53777903	NUT & CAPTIVE WASHER	
18	94243003	MOUNT, Shock	
19	76376200	BRACKET, Shock Mount	Non-VDE
19	76376201	BRACKET, Shock Mount	VDE
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, 1/8-16 x 0.750	
24	70738308	INSULATOR, Motor Mount	
25	70738305	INSULATOR, Motor Mount	Non-VDE
25	70738307	INSULATOR, Motor Mount	VDE
26	10125607	WASHER, Flat, #10	
27	10125067	SCREW, Hex Head Machine	
28	##	DRIVE MOTOR AND PULLEY ASSEMBLY	Non-VDE
	##	CAPACITOR, Motor	
29	77448100	PLATE, Motor Mounting	Non-VDE
30	10127158	SCREW, Philips 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
9A-20		DECK ASSEMBLY (Sheet 3 Contd)	
32	10125806	WASHER, Spring Lock, # 1/4	
33	10125608	WASHER, Flat, # 1/4	
34	75093401	BRACKET, Spring, Mounting Plate	
35	72806502	STANDOFF, Spring	
36	92071004	NUT, Hex, 1/4-20	
37	77530000	SPRING, Extension	
38	72806500	STANDOFF, Spring	
39	10126403	WASHER, External Tooth Lock, #10	
40	10125108	NUT, Hex, #10-32	
41	77444400	DECK	S/C 01 only
41	92122330	DECK	S/C 02 & Above
42	10126258	SCREW, Hex Socket Head Cap, 1/4-20 x 1.000	
43	##	PACK SENSOR ASSEMBLY (See Figure 9A-21)	S/C 08 & Below
43	##	PACK SENSOR ASSEMBLY (See Figure 9A-22)	S/C 09 & Above
44	00860304	SCREW, Hex Head, 6-32 x 0.500	
45	##	BELT, Drive, Flat	
46	83640800	ADAPTER, Hose, Deck	
47	72875366	CLAMP, Self-Tightening	
48	94311604	HOSE, Flexible	
49	94277503	BASE, Mounting	
50	76579109	GASKET, Air Seal	S/C 24 & Above only
51	10126504	SCREW, Hex Head, Plain, 1/4-20 x 1.000	
52	10126404	WASHER, External Tooth Lock, # 1/4	
53	47276900	SHOCK MOUNT ASSEMBLY	
54	93211009	WASHER, Flat	

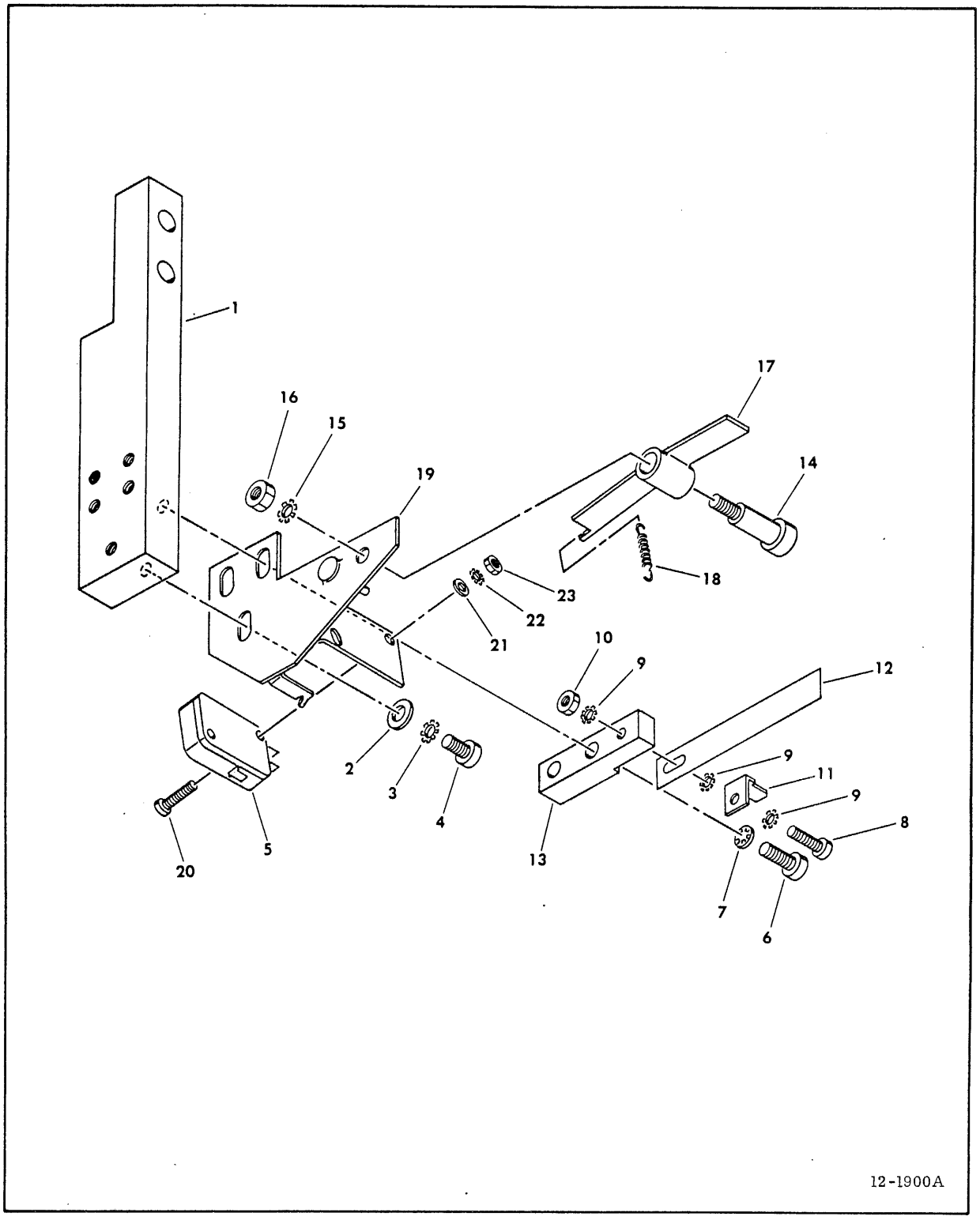


Figure 9A-21. Pack Sensor Assembly (S/C 08 and Below)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-21	##	PACK SENSOR ASSEMBLY	This pack sensor assembly on units S/C 08 & Below. New pack sensor assembly supplied when reordering.
1	73586600	MOUNT-SWITCH	
2	10125606	WASHER, Flat, #8	
3	10126402	WASHER, External Tooth Lock, #8	
4	10127122	SCREW, Philips Pan Head Machine, 8-32 x 0.375	
5	##	SWITCH, Mini-Integral Actuator, (Pack On Switch A3S4)	
6	10127124	SCREW, Philips Pan Head Machine, 8-32 x 0.625	
7	10126104	WASHER, Internal Tooth Lock, #8	
8	10127336	SCREW, Pan Head Machine, 6-32 x 0.625	
9	10126401	WASHER, External Tooth Lock, #6	
10	10125105	NUT, Hexagon Machine, #6-32	
11	94274107	TERMINAL, Quick Connect	
12	##	SPRING, Static Ground	
13	73478500	BRACKET, Mounting, Contact	
14	93707002	SCREW, Socket Head, 1/4-20 x 0.500	
15	10126403	WASHER, External Tooth Lock, #10	
16	10125107	NUT, Hex Machine, #10-24	
17	73587200	ARM, Actuator	
18	73225300	SPRING, Extension	
19	73587300	PLATE, Mounting	
20	10127106	SCREW, Philips Pan Head Machine, 4-40 x 0.625	
21	10125603	WASHER, Flat, #4	
22	10126400	WASHER, External Tooth Lock, #4	
23	10125103	NUT, Hexagon Machine, #4-40	

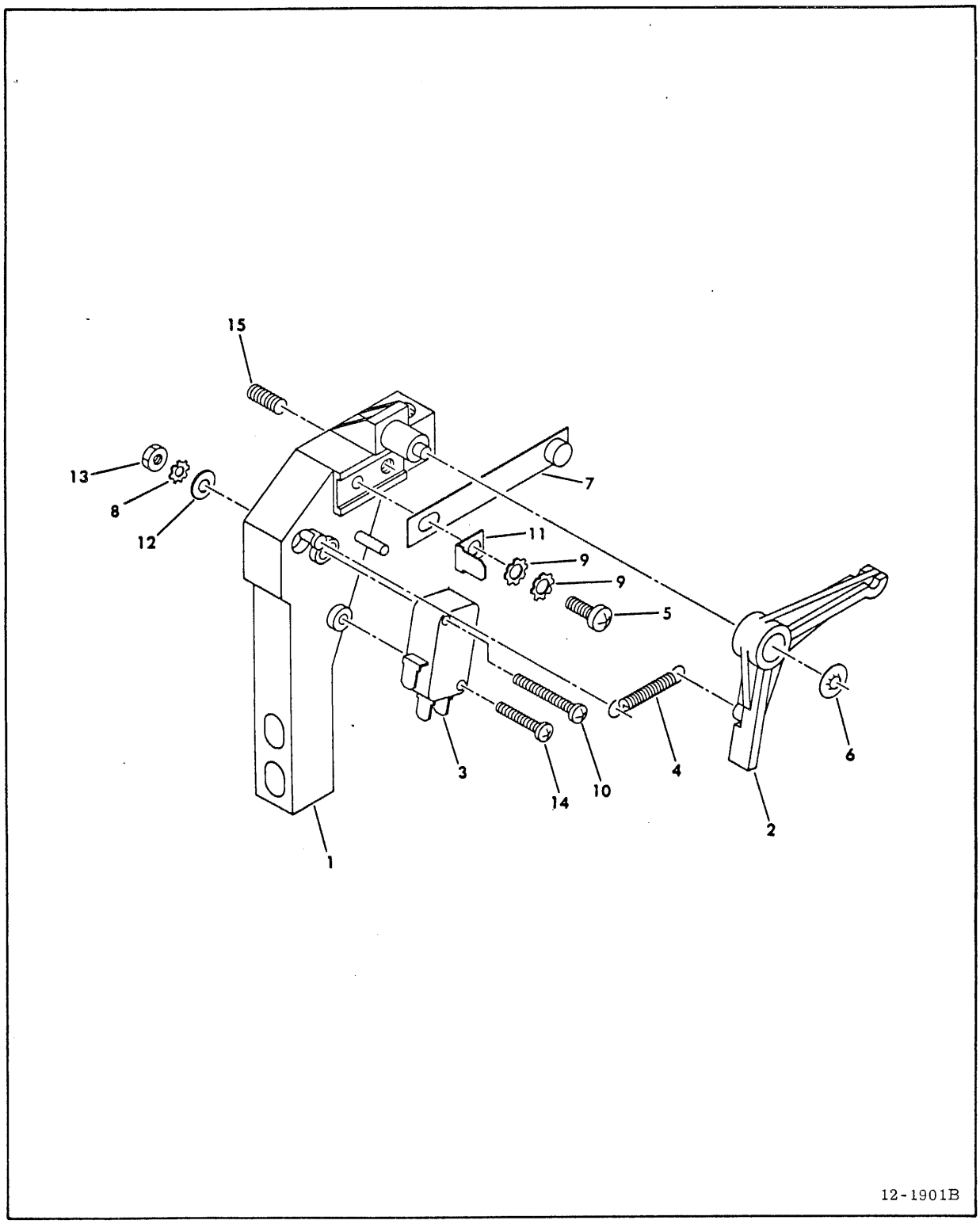


Figure 9A-22. Pack Sensor Assembly (S/C 09 and Above)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-22	##	PACK SENSOR ASSEMBLY	S/C 09 & Above
1	83282900	BASE, Spindle End, Pack On Switch	
2	83282800	ACTUATOR, Pack On Switch	
3	##	SWITCH, Mini Integral Actuator	
4	83283900	SPRING, Extension	
5	93590162	SCREW, Philips Pan Head Self Threading, 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	10127108	SCREW, Philips Pan Head Machine, 4-40 x 0.875	
11	94274107	TERMINAL, Quick Connect	
12	10125603	WASHER, Flat, #4	
13	10125103	NUT, Hexagon, Machine, #4-40	
14	93590090	SCREW, Philips Pan Head Self Tapping, 4-40 x 0.625	
15	93061288	SCREW, Socket Head, Set, 8-32 x 0.375	

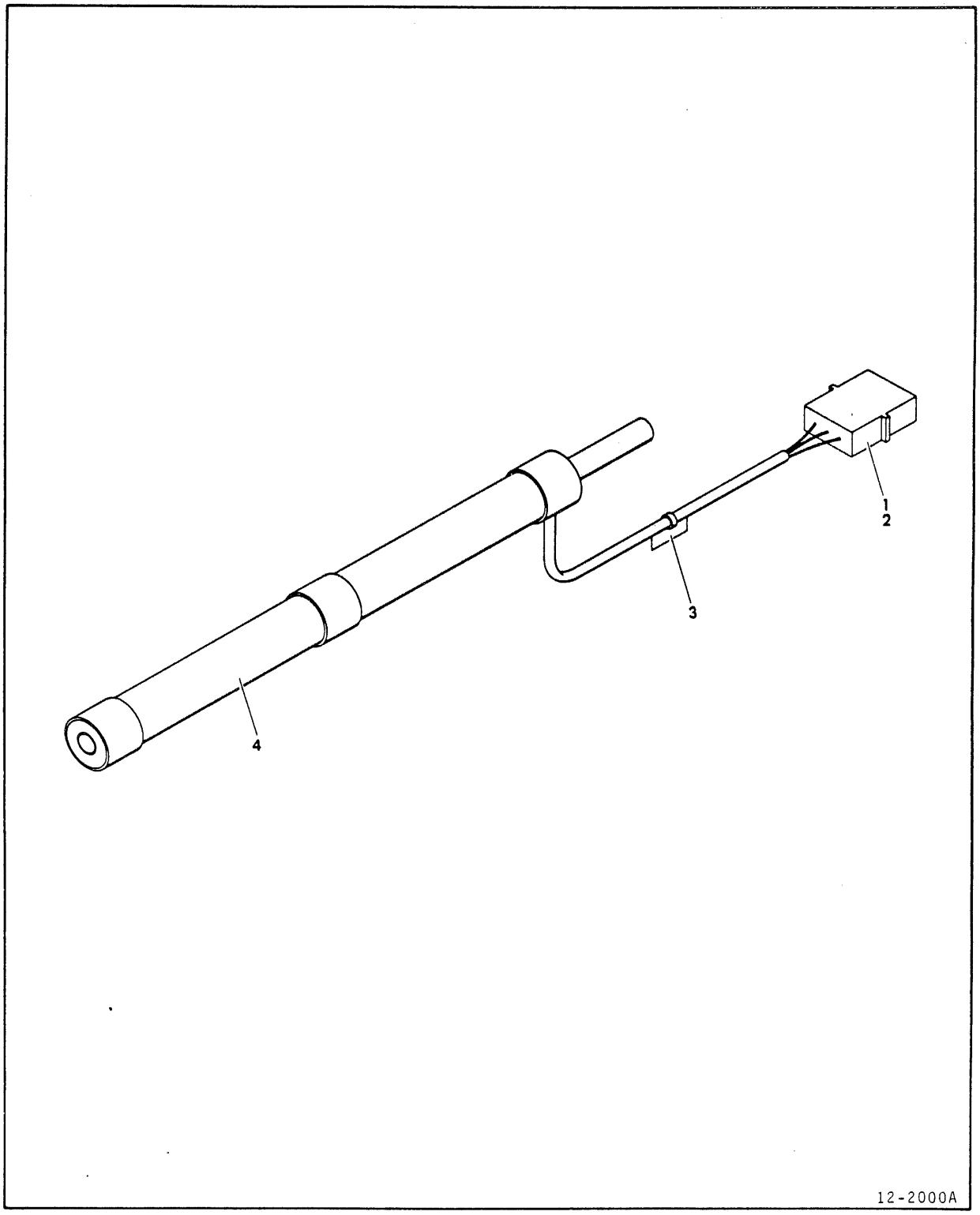


Figure 9A-23. Transducer and Connector Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-23	##	TRANSDUCER AND CONNECTOR ASSEMBLY	
1	93948003	CONNECTOR, Housing, 3 Pin (A3P4)	
2	93942015	CONTACT, Pin	
3	94277409	STRAP, Cable Tie	
4	73585001	TRANSDUCER HOUSING ASSEMBLY (ASSOCIATED PART)	
	76501000	ROD, Transducer (Magnet)	

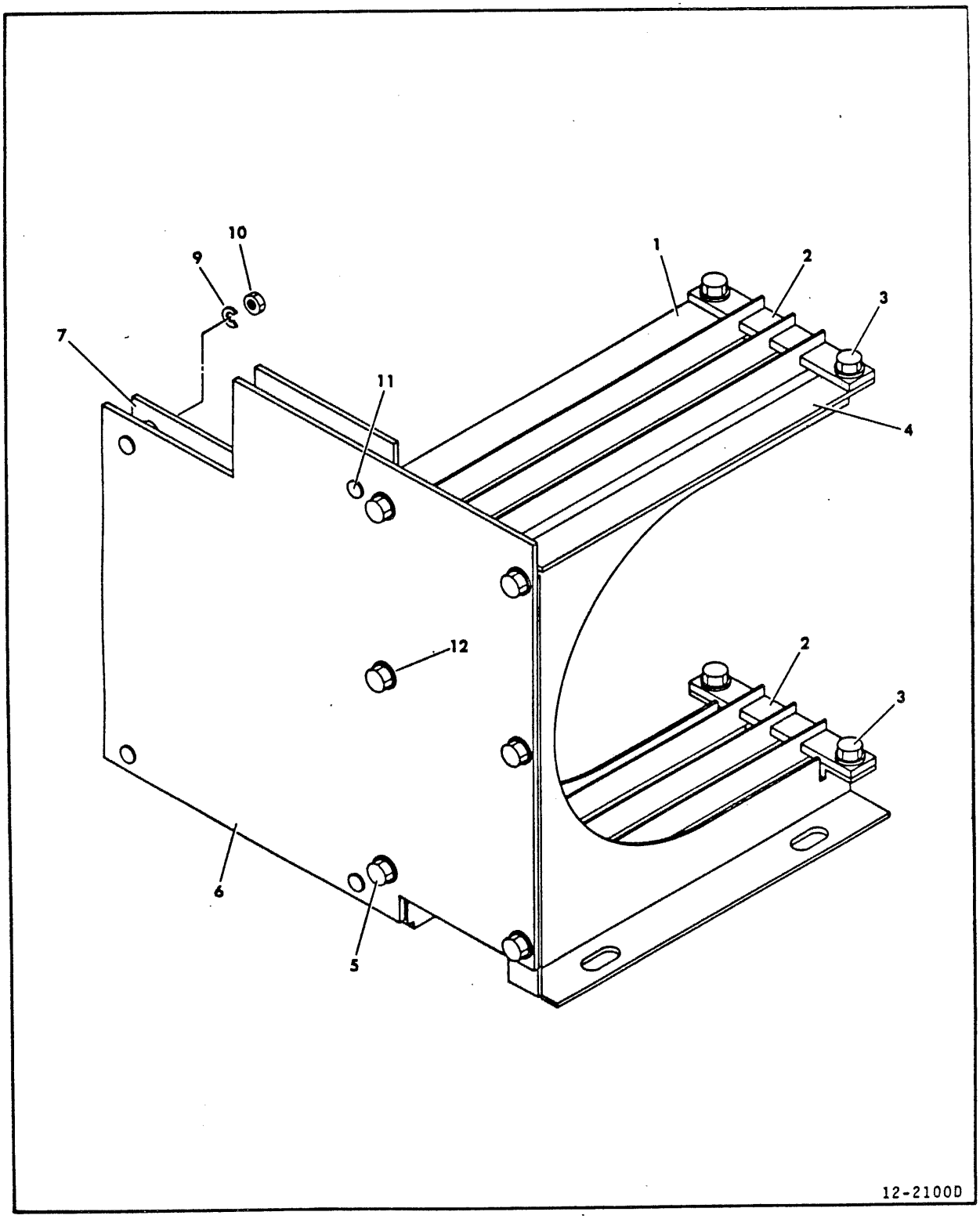


Figure 9A-24. Read/Write Chassis Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-24	77445901	READ/WRITE CHASSIS ASSEMBLY	S/C 25 & Below
9A-24	77445903	READ/WRITE CHASSIS ASSEMBLY	S/C 26 & Above
1	77443000	SUPPORT, Chassis	
2	77442000	RAIL, Guide	
3	93592200	SCREW, Hex Washer Head Self Tapping, 8-32 x 0.375	
4	77443001	SUPPORT, Chassis	S/C 25 & Below
4	77443002	SUPPORT, Chassis	S/C 26 & Above
5	93592196	SCREW, Hex Washer Head Self Tapping, 8-32 x 0.250	
6	##	_XFN COMPONENT ASSEMBLY	
7	##	_XGN COMPONENT ASSEMBLY	
8		NOT USED	
9	10125801	WASHER, Spring Lock, #4	
10	10125103	NUT, Hex, #4-40	
11	93114301	STANDOFF	
12	94047042	WASHER, Flat, #8	

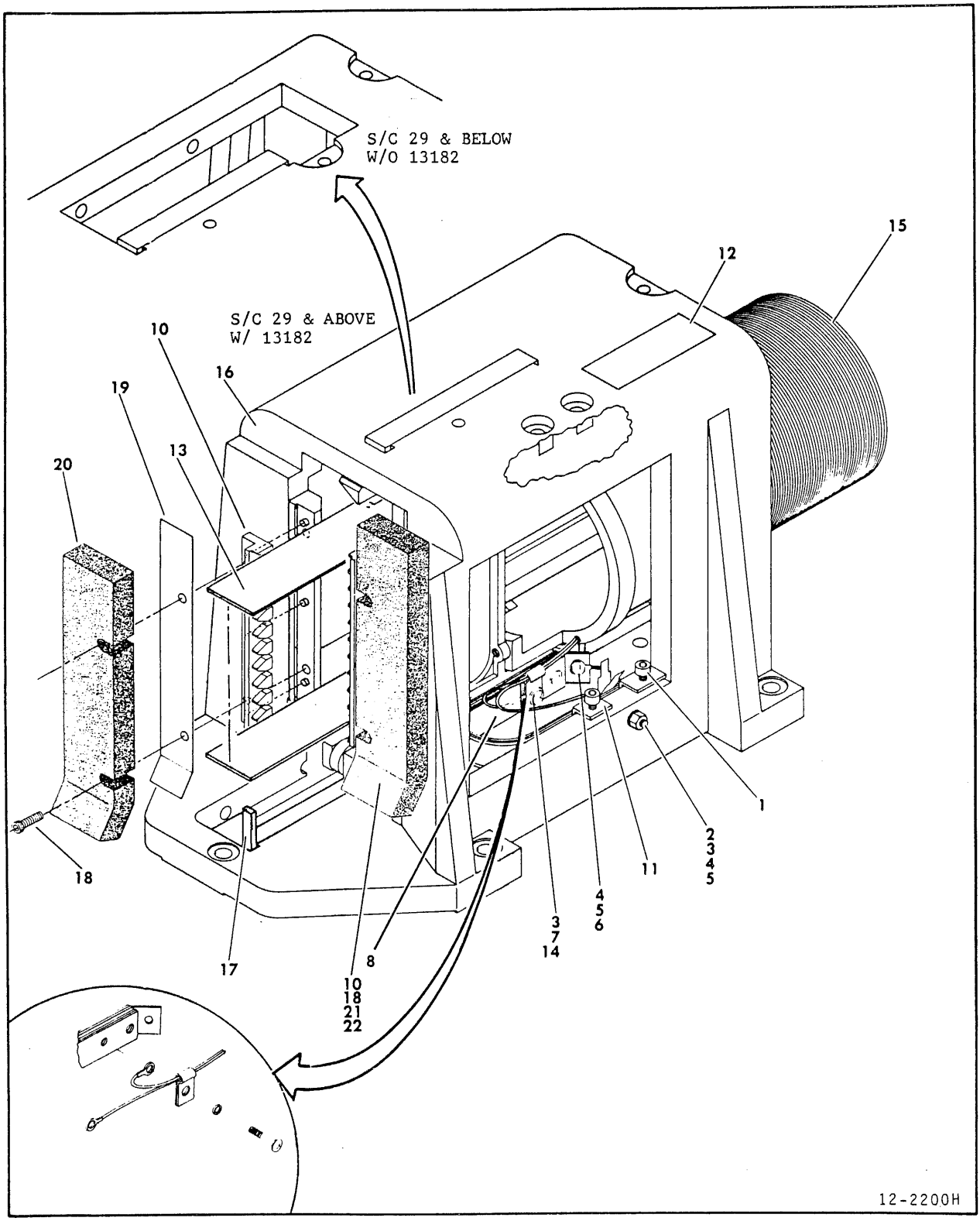


Figure 9A-25. Actuator Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-25	##	ACTUATOR ASSEMBLY	
1	10126224	SCREW, Hex Socket Head 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, Philips 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, Cable, Nylon	
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.	

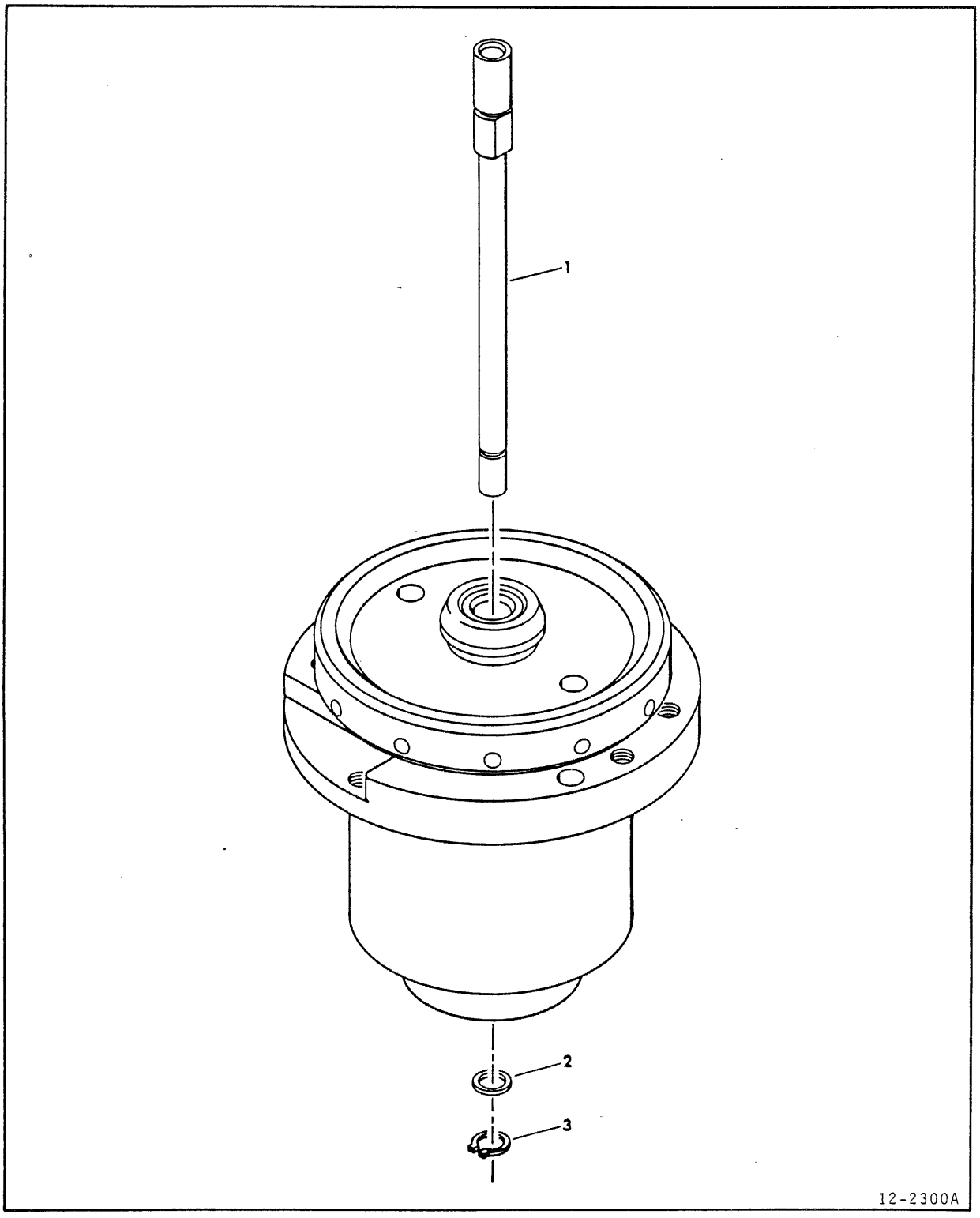


Figure 9A-26. Spindle Assembly

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-26	##	SPINDLE ASSEMBLY	
1	##	LOCKSHAFT, Spindle	
2	73476503	WASHER, 0.040	
3	92033301	RING, Retaining	

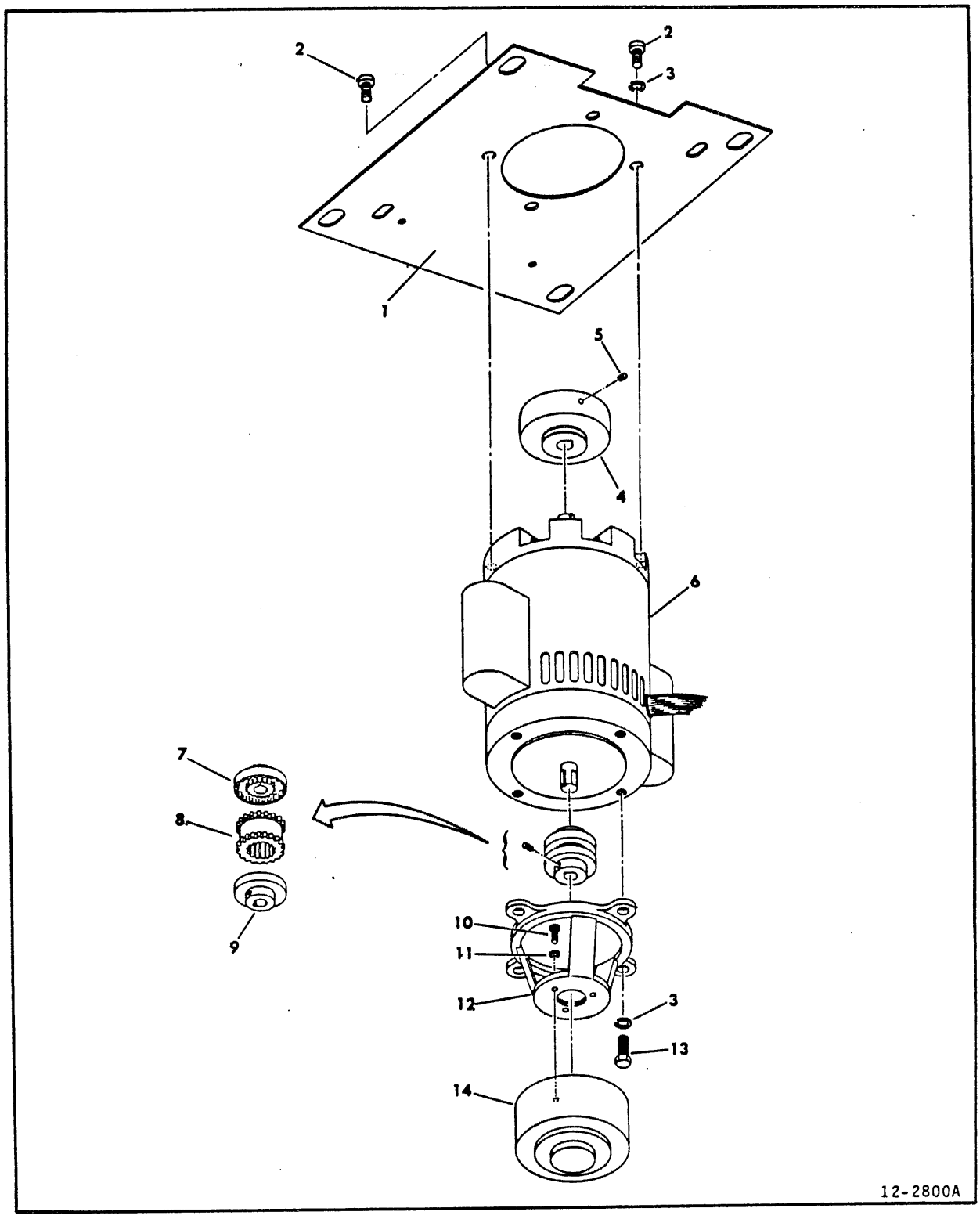


Figure 9A-27. Motor and Brake Assembly (VDE)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
9A-27	##	MOTOR AND BRAKE ASSEMBLY	VDE
1	47424801	PLATE, Motor Mounting	
2	10126528	SCREW, Hex Head, Plain, 3/8-16 x 0.750	
3	10125808	WASHER, Spring Lock, 3/8	
4	72806908	PULLEY, Drive Motor	
5	93071408	SCREW, Set, Socket Hex, 1/4-20 x 0.375	
6	77431507	DRIVE MOTOR ASSEMBLY	
	77430801	MOTOR, Double End	
	93358027	SLEEVING, Vinyl, Black	
	51906004	CONNECTOR, Plug-9	
	51905800	CONTACT, Pin	
	94277409	STRAP, Cable Tie	
7	77424101	FLANGE, Coupling	
8	77424103	SLEEVE, Rubber	
9	77424102	FLANGE, Coupling	
10	10127144	SCREW, Pan Head Machine, 10-32 x 0.625	
11	10125805	WASHER, Spring Lock, 10	
12	77420000	MOUNT, Motor Brake	
13	10126530	SCREW, Plain, Hex Head, 3/8-16 x 1	
14	##	BRAKE ASSEMBLY	
	75094801	BRAKE, Hysteresis	
	94277409	STRAP, Cable Tie	
	51906000	CONNECTOR, Plug	
	51905800	CONTACT, Pin	

SECTION 9B

SPARE PARTS LIST

GENERAL

The sole purpose of the spare parts list is to aid in determining the assembly or component to be replaced and its appropriate 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.

Replacement Part Number - This column provides the replacement part number for the purpose of ordering parts.

Notes - This column provides additional information such as machine configuration or special information relating to logic cards, etc.

EXAMPLE OF SPARE PARTS LIST

ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON Fig. No.	Page No.	Index No.	DESCRIPTION	REPLACEMENT PART NUMBER	NOTES
9A-5	9A-17	5	CONTROL PANEL SWITCH ASSEMBLY	XXXXX	Units w/o write protect
				ZZZZZ	Units w/ write protect

In the example above, the control panel assembly is referenced as index 5 on figure 9A-5, which appears on page 9A-17. When ordering, first determine if write protect is needed, then order part number accordingly.

ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON Fig. No.	Page No.	Index No.	DESCRIPTION	REPLACEMENT PART NUMBER	NOTES
			TOOLS & MATERIALS		
			CARD EXTENDER	54109701	
			PARTS & ASSEMBLIES		
9A-5	9A-21	4	_ZQN COMPONENT ASSEMBLY FZQN	73485311	Track Servo Preamp
9A-6	9A-29	3	SWITCH, Interlock	93560003	
9A-9	9A-39		CONTROL PANEL SWITCH ASSEMBLY	77447200	Units without Write Protect
9A-9	9A-39		CONTROL PANEL SWITCH ASSEMBLY	76422501	Units with Write Protect
9A-11	9A-49	7	FILTER - Aluminum, Washable	00815447	Non-VDE

ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON Fig. No.	Page No.	Index No.	DESCRIPTION	REPLACEMENT PART NUMBER	NOTES
9A-12	9A-53	45	MOTOR RELAY BOX ASSEMBLY	72875180	VDE only
9A-12	9A-53	46	AWNV PC ASSEMBLY	54194900	VDE only
9A-12	9A-55	7	FILTER, Washable Aluminum	00815447	VDE only
9A-13	9A-57	4	BLOWER & CONNECTOR ASSEMBLY	77450701	
9A-13	9A-57	9	FILTER, Air	94358000	
9A-14	9A-59		POWER SUPPLY ASSEMBLY	47293668	60 Hz, BJ4A2C/N only, S/C 28 & Above w/13070-A
9A-14	9A-59		POWER SUPPLY ASSEMBLY	47293669	60 Hz, all except BJ4A2C/N, S/C 28 & Above w/13070-A

ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON Fig. No.	Page No.	Index No.	DESCRIPTION	REPLACEMENT PART NUMBER	NOTES
9A-14	9A-59		POWER SUPPLY ASSEMBLY	47293672	50 Hz, BJ4A2D/P only, S/C 28 & Above w/13070-A
9A-14	9A-59		POWER SUPPLY ASSEMBLY	47293673	50 Hz, all except BJ4A2D/P, S/C 28 & Above w/13070-A
9A-14	9A-59	1	SWITCH, Solid State AC - 15 A	94376504	Non-VDE
9A-14	9A-59	2	SWITCH, Solid State AC - 30 A	94371302	Non-VDE
9A-14	9A-59	3	SWITCH, Solid State AC - 15 A	94371301	Non-VDE
9A-14	9A-59	13	FILTER, RFI	94355403	
9A-14	9A-60	22	TRANSFORMER, Ferro (A1T2)	76844800	60 Hz, Used on P.S. tabs 68 & 69 only

ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON Fig. No.	Page No.	Index No.	DESCRIPTION	REPLACEMENT PART NUMBER	NOTES
9A-14	9A-60	22	TRANSFORMER, Ferro (A1T2)	76801000	50 Hz, Used on P.S. tabs 72 & 73 only
9A-14	9A-60	24	TRANSFORMER, Ferro (A1T1)	76846500	50 Hz, Used on P.S. tabs 72 & 73 only
9A-14	9A-60	24	TRANSFORMER, Ferro (A1T1)	76846400	60 Hz, Used on P.S. tabs 68 & 69 only
9A-14	9A-60	25	TRANSFORMER ASSEMBLY (A1T3)	47317900	Non-VDE 50/60 Hz
9A-14	9A-60	27	RECTIFIER, Bridge	50242705	Non-VDE
9A-14	9A-61	30	CAPACITOR, 660 V ac Non-PCB	95686701	Non-VDE
9A-14	9A-63	49	CONTACTOR, 24 V dc, Power	94378200	Non-VDE

ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON Fig. No.	Page No.	Index No.	DESCRIPTION	REPLACEMENT PART NUMBER	NOTES
9A-14	9A-63	56	_YFN COMPONENT ASSEMBLY		Relay Board
			6YFN	77427502	Non-VDE
			AYFN	77427502	
9A-14	9A-63	63	CIRCUIT BREAKER 9 A	15165935	
9A-14	9A-63	64	CIRCUIT BREAKER 12 A	15165943	
9A-14	9A-63	66	FUSE, CARTRIDGE 5 A	93418333	
9A-14	9A-63	67	FUSE, CARTRIDGE 15 A	93418140	
9A-14	9A-65	8	CIRCUIT BREAKER, 0.5 A (A1CB8)	92696031	Non-VDE
9A-14	9A-65	9	CIRCUIT BREAKER 2 A 50 V dc (A1CB7)	94268303	Non-VDE
9A-14	9A-65	10	CIRCUIT BREAKER, 5 A (A1CB6)	92696023	Non-VDE

ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON Fig. No.	Page No.	Index No.	DESCRIPTION	REPLACEMENT PART NUMBER	NOTES
9A-14	9A-65	11	CIRCUIT BREAKER, 8 A (A1CB5)	92696001	Non-VDE
9A-14	9A-65	12	CIRCUIT BREAKER, 7 A 50 V dc (A1CB4)	94268308	Non-VDE
9A-14	9A-65	13	CIRCUIT BREAKER, Long U/L Recog. (A1CB3)	94245209	Non-VDE
9A-14	9A-65	14	CIRCUIT BREAKER, 0.375 A 250 V ac (A1CB2)	94268315	Non-VDE
9A-14	9A-65	15	SWITCH, Toggle	92509057	Non-VDE
9A-14	9A-65	16	METER, Hour ac	94313808	60 Hz
9A-14	9A-65	16	METER, Hour ac	94313809	Non-VDE 50 Hz
9A-14	9A-67	20	CIRCUIT BREAKER, Long U/L Recog. (A1CB1)	94245211	Non-VDE
9A-15	9A-69		_YEN COMPONENT ASSEMBLY 5YEN	77427100	Capacitor Board Non-VDE

ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON Fig. No.	Page No.	Index No.	DESCRIPTION	REPLACEMENT PART NUMBER	NOTES
9A-16	9A-71		_ZCN COMPONENT ASSEMBLY		Power Amp Non-VDE
			6ZCN	75183604	& VDE
			AZCN	75183604	
9A-16	9A-71	1	TRANSISTOR, NPN Silicon Power	50222800	
9A-16	9A-71	2	TRANSISTOR, PNP Silicon Power	50222700	
9A-17	9A-73		POWER SUPPLY ASSEMBLY	73133110	VDE only S/C 40 & Below
9A-17	9A-73	7	_FNN COMPONENT ASSEMBLY		VDE only
			DFNN	50184905	S/C 40 & Below
			EFNN	50184905	
9A-17	9A-73	11	FUSE, Cartridge, 1A	51650217	VDE only S/C 40 & Below
9A-17	9A-73	14	FILTER, RFI 115275 V ac 20A	51899705	VDE only S/C 40 & Below
9A-17	9A-73	20	FUSE, Cartridge, 8A	51650232	VDE only S/C 40 & Below
9A-17	9A-73	25	TRANSFORMER, Ferro (A1T1)	72893300	VDE only S/C 40 & Below
9A-17	9A-73	29	CAPACITOR, 660 V ac (A1C1 & A1C2)	76879007	VDE only S/C 40 & Below

ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON Fig. No.	Page No.	Index No.	DESCRIPTION	REPLACEMENT PART NUMBER	NOTES
9A-17	9A-73	30	PLUG, Relay 14 Pin	94378516	VDE only S/C 40 & Below
9A-17	9A-73	32	CIRCUIT BREAKER (A1CB10)	15165934	VDE only S/C 40 & Below
9A-17	9A-75	35	_CFN COMPONENT ASSEMBLY		Control Board
			HCFN	50122108	VDE only
			JCFN	50122108	S/C 40 & Below
9A-17	9A-75	51	TRANSFORMER, Ferro (A1T2)	70127204	VDE only S/C 40 & Below
9A-17	9A-75	60	CAPACITOR, 660 V ac	76879000	VDE only S/C 40 & Below
9A-17	9A-76.1	1	METER, Time Elapsed	94390902	VDE only S/C 40 & Below
9A-17	9A-76.1	3	CIRCUIT BREAKER, 5A (A1CB2)	15165864	VDE only S/C 40 & Below
9A-17	9A-76.1	6	CIRCUIT BREAKER, 5A (A1CB3)	92696037	VDE only S/C 40 & Below
9A-17	9A-76.1	10	SWITCH, Toggle	94332110	VDE only S/C 40 & Below
9A-17	9A-76.1	13	CIRCUIT BREAKER, 1A (A1CB8)	95647231	VDE only S/C 40 & Below

ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON Fig. No.	Page No.	Index No.	DESCRIPTION	REPLACEMENT PART NUMBER	NOTES
9A-17	9A-76.1	14	CIRCUIT BREAKER, 10A (A1CB6&7)	95657052	VDE only S/C 40 & Below
9A-17	9A-76.1	15	CIRCUIT BREAKER, 7A (A1CB5)	94268308	VDE only S/C 40 & Below
9A-17	9A-76.1	16	CIRCUIT BREAKER (A1CB4)	94245209	VDE only S/C 40 & Below
9A-17	9A-76.1	18	CIRCUIT BREAKER, 20A (A1CB1)	95587134	VDE only S/C 40 & Below
9A-18	9A-76.3		POWER SUPPLY ASSEMBLY	73133114	VDE only S/C 41 & Above
9A-18	9A-76.3	7	BLOCK, Fuse	51785402	VDE only S/C 41 & Above
9A-18	9A-76.3	8	FUSE, 125V	93419228	VDE only S/C 41 & Above
9A-18	9A-76.3	11	FUSE, Cartridge, 1A	93419322	VDE only S/C 41 & Above
9A-18	9A-76.3	20	FUSE, Cartridge, 10A	95586428	VDE only S/C 41 & Above
9A-18	9A-76.4	29	CAPACITOR, 660 V ac, (A1C1 & A1C2)	76879007	VDE only S/C 41 & Above

ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON Fig. No.	Page No.	Index No.	DESCRIPTION	REPLACEMENT PART NUMBER	NOTES
9A-18	9A-76.4	30	PLUG, Relay, 14 Pin	94378516	VDE only S/C 41 & Above
9A-18	9A-76.4	32	CIRCUIT BREAKER (A1CB10)	15165934	VDE only S/C 41 & Above
9A-18	9A-76.4	35	_CFN COMPONENT ASSEMBLY LCFN	50122110	VDE only S/C 41 & Above
9A-18	9A-76.4	51	TRANSFORMER, Ferro (A1T2)	70127204	VDE only S/C 41 & Above
9A-18	9A-76.4	60	CAPACITOR, 660 V ac	76879000	VDE only S/C 41 & Above
9A-18	9A-77	1	METER, Time Elapsed	94390902	VDE only S/C 41 & Above
9A-18	9A-77	6	CIRCUIT BREAKER, 5 A (A1CB3)	92696037	VDE only S/C 41 & Above
9A-18	9A-77	10	SWITCH, Toggle	94332110	VDE only S/C 41 & Above
9A-18	9A-77	13	CIRCUIT BREAKER, 1A (A1CB8)	95647231	VDE only S/C 41 & Above
9A-18	9A-77	14	CIRCUIT BREAKER, 10 A (A1CB6, A1CB7)	95657052	VDE only S/C 41 & Above

ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON Fig. No.	Page No.	Index No.	DESCRIPTION	REPLACEMENT PART NUMBER	NOTES
9A-18	9A-77	15	CIRCUIT BREAKER, 7A (A1CB5)	94268308	VDE only S/C 41 & Above
9A-18	9A-77	16	CIRCUIT BREAKER, 1A (A1CB4)	94245209	VDE only S/C 41 & Above
9A-18	9A-77	18	CIRCUIT BREAKER	95587137	VDE only S/C 41 & Above
9A-18.1	9A-79		_CBN COMPONENT ASSEMBLY		VDE only
			CCBN	50120502	S/C 40 & Below
			DCBN	50120503	S/C 41 & Above
9A-19	9A-81		POWER CABLE ASSEMBLY	70734122	VDE only
9A-19	9A-81	1	CONNECTOR, Locking (3 Wire)	94368003	60 Hz
9A-19	9A-81	1	CONNECTOR, Locking (3 Wire)	94368800	50 Hz
9A-20	9A-85	28	SWITCH, Mini Integral Actuator	93786005	
9A-20	9A-87	25	_ZGN COMPONENT ASSEMBLY		Servo Connector
			5ZGN	75243202	Board
9A-20	9A-89	8	SPEED SENSOR ASSEMBLY	76395500	
9A-20	9A-89	28	DRIVE MOTOR & PULLEY ASSEMBLY	77454000	Non-VDE 60 Hz
9A-20	9A-89	28	DRIVE MOTOR & PULLEY ASSEMBLY	77454004	Non-VDE 50 Hz

ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON Fig. No.	Page No.	Index No.	DESCRIPTION	REPLACEMENT PART NUMBER	NOTES
9A-20	9A-89		CAPACITOR, Motor	94365802	
9A-20	9A-91	45	BELT, Drive-Flat 1.00 x 27	92314087	60 Hz
9A-20	9A-91	45	BELT, Drive-Flat 1.00 x 28	92314093	50 Hz
9A-22	9A-95		PACK SENSOR ASSEMBLY	73586100	
9A-22	9A-95	3	SWITCH, Mini Integral Actuator	93786017	
9A-22	9A-95	7	SPRING, Static Ground	40054700	
9A-23	9A-97		TRANSDUCER & CONNECTOR ASSEMBLY	73618901	
9A-25	9A-101		ACTUATOR ASSEMBLY	77445405	
9A-25	9A-101	8	CONDUCTOR, Flexible	77444600	
9A-25	9A-101	10	CAM, Tower	75015800	
9A-25	9A-101	13	HEAD ARM ASSEMBLY	75010000	BJ4A1, Head Nos. 1,3,5,7,9,10,12, 14,16,18
9A-25	9A-101	13	HEAD ARM ASSEMBLY	75010001	BJ4A1, Head Nos. 0,2,4,6,8,11,13, 15,17

ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON Fig. No.	Page No.	Index No.	DESCRIPTION	REPLACEMENT PART NUMBER	NOTES
9A-25	9A-101	13	HEAD ARM ASSEMBLY	75010100	BJ4A2, Head Nos. 1,3,5,7,9,10,12, 14,16,18
9A-25	9A-101	13	HEAD ARM ASSEMBLY	75010101	BJ4A2, Head Nos. 0,2,4,6,8,11,13, 15,17
9A-25	9A-101	13	HEAD ARM ASSEMBLY	75010109	BJ4A1, BJ4A2, Servo Head
9A-25	9A-101		SCREW, Head Arm Used S/C 01 & Above	75017500	Servo Head
9A-25	9A-101		SCREW, Head Arm Used S/C 01 & Above	75017502	Data Head
9A-25	9A-101	15	COIL ASSEMBLY	75217001	
9A-26	9A-103		SPINDLE ASSEMBLY	73586002	
9A-26	9A-103	1	LOCKSHAFT, Spindle	76372300	
9A-27	9A-105		MOTOR & BRAKE ASSEMBLY	77431607	VDE 50 Hz
9A-27	9A-105	14	BRAKE	75094801	VDE only

ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON Fig. No.	Page No.	Index No.	DESCRIPTION	REPLACEMENT PART NUMBER	NOTES
			LOGIC CARDS		
			5 V REGULATOR COMPONENT ASSEMBLY	75054500	
			LOC A01		
			_TVV COMPONENT ASSEMBLY		Transmitters
			BTVV	54167707	
			DTVV	54167707	
			FTVV	54167707	
			LOC A01		Transmitters
			_TVV COMPONENT ASSEMBLY		
			(With "B" cable Sector & Index)		
			ETVV	54167708	
			GTVV	54167708	
			LOC A02		
			_RVV COMPONENT ASSEMBLY		Receivers
			GRVV	54147708	
			LOC A06		
			_LTV COMPONENT ASSEMBLY		Access Control,
			FLTV	54276907	Index/Sector Decode
			LOC A07		
			_LVV COMPONENT ASSEMBLY		Access Control
			MLVV	54277713	No. 1

ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON Fig. No.	Page No.	Index No.	DESCRIPTION	REPLACEMENT PART NUMBER	NOTES
			LOC A08		
			_QPV COMPONENT ASSEMBLY		Diff. and Head
			BQPV	54135303	Reg.
			CQPV	54135303	
			LOC A10		
			_LSV COMPONENT ASSEMBLY		Write Clock
			CLSV	54276503	
			LOC A12		
			_LWV COMPONENT ASSEMBLY		Diff. Gen. and
			FLWV	54278107	Control
			LOC A13		
			_LXV COMPONENT ASSEMBLY		NRZ to MFM
			CLXV	54278505	
			ELXV	54278505	
			LOC A14		
			_LRV COMPONENT ASSEMBLY		Data Latch
			HLRV	54276108	
			KLRV	54276111	For BJ4A2C/D only
			LOC A15		
			_LZV COMPONENT ASSEMBLY		Read PLO
			BLZV	54279303	

ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON Fig. No.	Page No.	Index No.	DESCRIPTION	REPLACEMENT PART NUMBER	NOTES
			LOC A17		
			_KFV COMPONENT ASSEMBLY		Fault Card
			5KFV	54262112	
			BKFV	54262112	
			CKFV	54262112	
			MKFV	54262112	
			LOC A18		
			_FRV COMPONENT ASSEMBLY		Fine Servo Decode
			HFRV	54226113	
			LOC A19		
			_KGV COMPONENT ASSEMBLY		Access Control
			AKGV	54262501	No. 2
			LOC A20		
			_MSV COMPONENT ASSEMBLY		Analog Servo
			DMSV	54296505	
			LOC E01		
			_PKV COMPONENT ASSEMBLY		Read/Write
			4PKV	54123700	Control
			LOC E02		
			_PJV COMPONENT ASSEMBLY		BJ4A2, Write
			4PJV	54123304	Driver
			5PJV	54123304	
			BPJV	54123304	

ENGINEERING RECOMMENDED SPARE PARTS LIST

ITEMS APPEAR ON Fig. No.	Page No.	Index No.	DESCRIPTION	REPLACEMENT PART NUMBER	NOTES
			LOC E02		
			_PJV COMPONENT ASSEMBLY		BJ4A1, Write
			6PJV	54123302	Driver
			LOC E03		
			_PHV COMPONENT ASSEMBLY		Read Amplifier
			BPHV	54122902	
			LOC E04		
			_XFN COMPONENT ASSEMBLY		Mother Board
			4XFN	75208100	
			LOC E05		
			_XGN COMPONENT ASSEMBLY		Head Select
			AXGN	75208502	
			BXGN	75208502	

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