

MANUAL 359  
Issue 2, February 1982  
T.O. 31W4-4-300-1

TEMPEST  
**model 40**  
SHOP MANUAL

Including Manual 355 Model 40 Printer

**VOLUME I**



TELETYPE  
CORPORATION

©1976 and 1982 by Teletype Corporation  
All rights reserved  
Printed in U.S.A.

**SERVICE CENTERS**

ALABAMA	BIRMINGHAM	230 OXMOOR CIRCLE SUITE 1113, HOMEWOOD, AL 35209	(205) 942-2574
	MOBILE	3207 INTERNATIONAL DR., SUITE B, MOBILE, AL 36606	(205) 473-8888
ARIZONA	PHOENIX	2113 S. 48TH ST., SUITE 104, TEMPE, AZ 85282	(602) 894-9891
	TUCSON	2015 N. FORBES BLVD., TUCSON, AZ 85705	(602) 623-6419
ARKANSAS	LITTLE ROCK	7501 INTERSTATE 30, SUITE 43, LITTLE ROCK, AR 72209	(501) 582-0266
CALIFORNIA	▲ LOS ANGELES	5445 SHEILA, CITY OF COMMERCE, CA 90040	(213) 728-2222
	OAKLAND	7305 EDGEWATER, SUITE C, OAKLAND, CA 94621	(415) 430-0202
	ORANGE COUNTY	11552 KNOTT, SUITE 9, GARDEN GROVE, CA 92641	(714) 891-2628
	SACRAMENTO	4221 NORTHGATE BLVD. NO. 4, SACRAMENTO, CA 95834	(916) 924-1933
	SAN DIEGO	7283 ENGINEER RD., SUITE B, SAN DIEGO, CA 92111	(714) 565-4375
	SANTA CLARA	3285 KIFER RD., SANTA CLARA, CA 95051	(408) 730-9083
	VENTURA COUNTY	2696 LAVERY COURT, SUITE 1, NEWBURY PARK, CA 91320	(805) 498-9655
COLORADO	▲ COLORADO SPRINGS	905 GARDEN OF THE GODS RD., SUITE B, COLORADO SPRINGS, CO 80907	(303) 593-1222
	▲ DENVER	7100 BROADWAY, BUILDING 3-J, DENVER, CO 80221	(303) 429-9555
CONNECTICUT	HARTFORD	441 GOVERNORS HWY., SOUTH WINDSOR, CT 06074	(203) 568-9610
DIST. OF COLUMBIA	▲ LORTON, VA	9022 TELEGRAPH RD., LORTON, VA 22079	(703) 550-7507
FLORIDA	▲ FT. LAUDERDALE	6858 N.W. 20TH AVE., FT. LAUDERDALE, FL 33309	(305) 974-4660
	JACKSONVILLE	6002 BOWDENDALE AVE., JACKSONVILLE, FL 32216	(904) 739-1170
	MIAMI	12802 S.W. 122ND AVE., MIAMI, FL 33186	(305) 252-1370
	ORLANDO	102 LIVE OAKS BLVD., CASSELBERRY, FL 32707	(305) 834-3818
	TAMPA	5474 JETPORT INDUSTRIAL BLVD., TAMPA, FL 33614	(813) 885-7413
GEORGIA	▲ ATLANTA	2520 PARK CENTRAL BLVD., DECATUR, GA 30035	(404) 981-7267
IDAHO	BOISE	172 S. COLE RD., BOISE, ID 83709	(208) 343-3629
ILLINOIS	▲ CHICAGO NORTH	2330 EASTERN AVE., ELK GROVE VILLAGE, IL 60007	(312) 860-5602
	▲ CHICAGO SOUTH	2900 21ST AVE., BROADVIEW, IL 60153	(312) 345-7920
	DECATUR	3501 RUPP PKWY., DECATUR, IL 62526	(217) 875-1092
	INDIANAPOLIS	6240 LAS PAS TRAIL, INDIANAPOLIS, IN 46268	(317) 255-4566
INDIANA	DES MOINES	8345 UNIVERSITY BLVD., DES MOINES, IA 50311	(515) 223-8444
IOWA	KANSAS CITY	6339 W. 110TH ST., OVERLAND PARK, KS 66211	(913) 383-3370
KANSAS	LOUISVILLE	3600 CHAMBERLAIN, SUITE 348, LOUISVILLE, KY 40222	(502) 426-4312
KENTUCKY	NEW ORLEANS	5626 JEFFERSON HWY., HARAHAN, LA 70123	(504) 733-4823
LOUISIANA	SHREVEPORT	5150 INTERSTATE P.O. 9128, SHREVEPORT, LA 71109	(318) 636-7104
	BALTIMORE	8980 ROUTE 108, COLUMBIA, MD 21045	(301) 796-1166
MARYLAND	BOSTON	131 FLANDERS RD., P.O. BOX 566, WESTBORO, MA 01581	(617) 366-8881
MASSACHUSETTS	DETROIT	12916 FARMINGTON RD., LIVONIA, MI 48150	(313) 525-5356
MICHIGAN	KALAMAZOO	126 E. KILGORE RD., KALAMAZOO, MI 49001	(616) 344-1944
	LANSING	3202 S. PENNSYLVANIA AVE., LANSING, MI 48910	(517) 394-6250
MINNESOTA	DULUTH	HWY 61 & CANOSIA RD., ESKO, MN 55733	(218) 879-1225
	MINNEAPOLIS	8824 SEVENTH AVE., NO., GOLDEN VALLEY, MN 55427	(612) 546-0808
	JACKSON	137 TURN-POWE PLAZA, PEARL, MS 39208	(601) 932-1273
MISSISSIPPI	ST. LOUIS	117766 WESTLINE INDUSTRIAL DR., ST. LOUIS, MO 63141	(314) 567-5910
MISSOURI	OMAHA	13415 B STREET BAY 2, OMAHA, NE 68144	(402) 330-3606
NEBRASKA	RENO	23 GLEN-CARRAN CIRCLE, SPARKS, NV 89431	(702) 356-8022
NEVADA	▲ FAIRFIELD	90 CLINTON ROAD, FAIRFIELD, NJ 07006	(201) 575-8240
NEW JERSEY	EDISON	1245 ROUTE 1, EDISON, NJ 08817	(201) 494-8288
NEW MEXICO	ALBUQUERQUE	2820 BROADBENT PKWY., N.E., ALBUQUERQUE, NM 87107	(505) 345-1854
NEW YORK	ALBANY	4 NORMANSKILL BLVD., ELSMERE, NY 12054	(518) 462-9937
	BUFFALO	1505 CLEVELAND DR., CHEEKTOWAGA, NY 14225	(716) 634-7233
	LONG ISLAND	195 PARK AVENUE, BETHPAGE, NY 11714	(516) 822-3533
	MANHATTAN	42 BROADWAY, SUITE 1633, NEW YORK, NY 10004	(212) 785-2530
	ROCHESTER	115 METRO PARK, ROCHESTER, NY 14623	(716) 475-1740
	SYRACUSE	5 ADLER DR., EAST SYRACUSE, NY 13057	(315) 463-4666
NORTH CAROLINA	CHARLOTTE	11190 DOWNS RD., PINEVILLE, NC 28134	(704) 588-3297
	DURHAM	500 E. WILLIAMS ST., APEX, NC 27502	(919) 362-4469
	GREENSBORO	727 E. MOUNTAIN ST., KERNERSVILLE, NC 27284	(919) 996-4934
OHIO	CINCINNATI	4890 DUFF DR., SUITE E, CINCINNATI, OH 45246	(513) 874-2586
	CLEVELAND	5325 NAIMAN PKWY, SUITE F, SOLON, OH 44139	(216) 248-0288
	COLUMBUS	6969 WORTHINGTON, GALENA RD., WORTHINGTON, OH 43085	(614) 436-2065
	TOLEDO	1000 S. REYNOLDS RD., TOLEDO, OH 43615	(419) 381-8900
OKLAHOMA	OKLAHOMA CITY	1000 CORNELL PKWY., SUITE 700, OKLAHOMA CITY, OK 73108	(405) 947-0969
	TULSA	2002 S. 114TH EAST AVE., TULSA, OK 74128	(918) 437-2010
OREGON	PORTLAND	7950 S. W. CIRRRUS DR., BEAVERTON, OR 97005	(503) 641-9575
PENNSYLVANIA	HARRISBURG	4407-D CARLISLE PIKE, CAMPHILL, PA 17011	(717) 737-0405
	PHILADELPHIA	103 ROCK ROAD, HORSHAM, PA 19044	(215) 674-2181
	PITTSBURGH	780 PINE VALLEY DR., PITTSBURGH, PA 15239	(412) 325-4403
SOUTH CAROLINA	COLUMBIA	6007 TWO NOTCH RD., COLUMBIA, SC 29204	(803) 786-2927
TENNESSEE	MEMPHIS	1835 NONCONNAH BLVD., SUITE 121, MEMPHIS, TN 38132	(901) 346-8840
	NASHVILLE	220 GREAT CIRCLE RD., SUITE 134, NASHVILLE, TN 37228	(615) 254-0546
TEXAS	▲ DALLAS	222 N. STORY RD., SUITE 126, IRVING, TX 75061	(214) 254-4189
	HOUSTON	8981 INTERCHANGE DRIVE, HOUSTON, TX 77054	(713) 666-1671
	SAN ANTONIO	4243 CENTER GATE, SAN ANTONIO, TX 78217	(512) 656-9370
	SALT LAKE CITY	3650 W. 2100 SOUTH, SALT LAKE CITY, UT 84120	(801) 972-6332
UTAH	LORTON (DC AREA)	5701-G GENERAL WASHINGTON DR., ALEXANDRIA, VA 22312	(703) 941-6202
VIRGINIA	NORFOLK	5308-D VIRGINIA BEACH BLVD., NORFOLK, VA 23502	(804) 461-1778
	RICHMOND	8427 GLAZEBROOK AVE., RICHMOND, VA 23228	(804) 262-4062
WASHINGTON	SEATTLE	635 STRANDER BLVD., SEATTLE, WA 98188	(206) 575-4515
WEST VIRGINIA	CHARLESTON	808 MAIN STREET, NITRO, WV 25143	(304) 755-3300
WISCONSIN	APPLETON	324 W. WISCONSIN AVE., SUITE 3, APPLETON, WI 54911	(414) 731-1494
	EAU CLAIRE	1806 WARDEN ST., EAU CLAIRE, WI 54701	(715) 832-4431
	MADISON	3680 KINSMAN BLVD., MADISON, WI 53704	(608) 249-5999
	MILWAUKEE	448 W. RAWSON AVE., OAK CREEK, WI 53154	(414) 764-6500
	WAUSAU	120 E. STEWART AVE., WAUSAU, WI 54401	(715) 845-8688
CANADA	▲ TORONTO	31 KLONDIKE DR., WESTON, ONTARIO, CANADA M9L 1S1	(416) 745-9474

▲ REGIONAL OFFICES

Teletype Corporation Product Service and Education Services

On the following page is a list of Teletype Corporation Product Service locations which provide maintenance service and repair on all Teletype Corporation products. For more information call toll free (US 800-323-4226) (IL 800-942-4192) 7:00 A.M. — 4:00 P.M. CST.

In addition, Teletype Corporation provides Customer Technical Training at its headquarters at 5555 W. Touhy Avenue, Skokie, IL in the northwest suburban area of Chicago. The training covers the installation, maintenance and repair of all Teletype Corporation products. Arrangements can also be made for training to be conducted at customer-selected field sites.

For information about class schedules, enrollment, tuition, on-site training or any special training needs, please contact:

Education Services  
Teletype Corporation  
5555 W. Touhy Avenue  
Skokie, Illinois 60077  
Telephone (312) 982-3940  
TLX 25-4051  
TWX 901-223-3611

INDEX

	<u>PART</u>	<u>ISSUE</u>	
	1	2	INTRODUCTION
	2	1	CASSETTE DRIVE
VOLUME I	3	-	RESERVED FOR FURTHER USE
	4	2	DISPLAY 40MN202RA
	5	2	OPCONS
	6	2	POWER SUPPLY
	7	2	CONTROLLER
VOLUME II	8	2	CABINETS, PAPER WINDER AND FACILITIES
	9	1	SETS
	10	1	MASTER COMPONENT PARTS INDEX

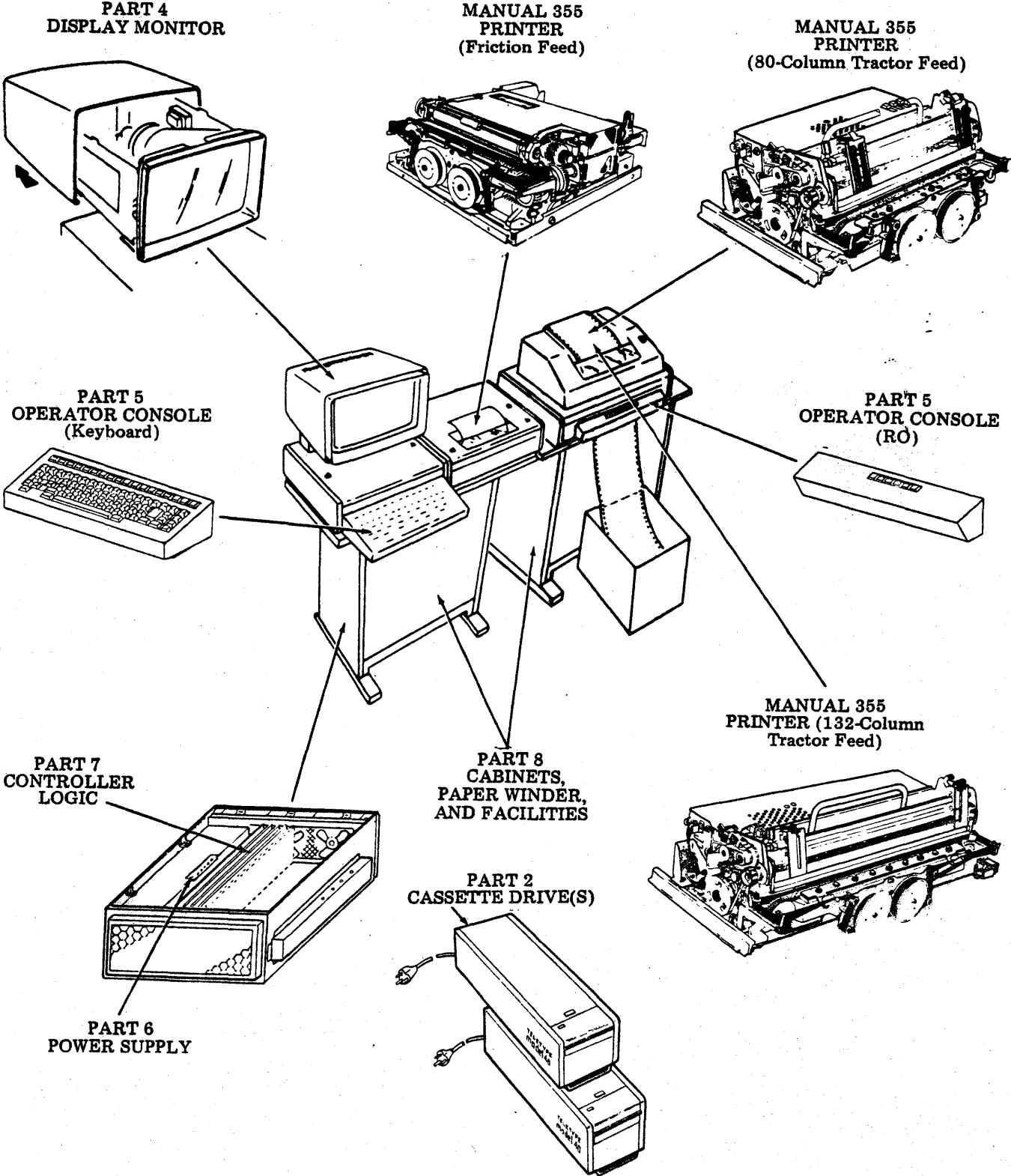
  

VOLUMES III & IV	MANUAL 355 (Volumes I & II)	MODEL 40 PRINTER SHOP MANUAL
------------------	--------------------------------	------------------------------



PART 1 -- INTRODUCTION  
A. GENERAL

This Shop Manual is structured to facilitate maintenance and/or repair of Teletype Corporation Tempest Model 40 Sets and Components. A KDP-RO Set arrangement detailing the components covered in Parts 2 through 8 is shown here. Part 9 covers various set arrangements. Part 10 contains a master numerical component parts list.



### A. GENERAL (Cont)

In addition to a knowledge of supplementary information and comprehensive training on Model 40 equipment, it will be advantageous to the Shop Manual user to become thoroughly familiar with the contents before attempting maintenance or repair. The Shop Manual should also be consulted when planning a shop in order to organize a most convenient work place, and to assemble the necessary tools, test equipment, cleaning and packing materials, and spare parts stock.

Each part numbered 2 through 9 is prefaced with an index containing a detailed listing of section contents as follows:

A. GENERAL: Provides a brief description of equipment covered in the section and a list of tools and test equipment required for performing all operations contained in the section.

B. SHOP PROCEDURES: Contains general information relative to repair of equipment covered in the section. Also includes specific information regarding cleaning and refinishing, conversions from one arrangement to another, and approved methods and materials for packing.

C. TESTING: Waveform illustrations, diagrams, adjustment and troubleshooting section references are provided as supplementary aids to the testing procedural text.

D. TROUBLESHOOTING: Step-by-step analysis of encountered troubles are supported by charts, diagrams, and adjustment section references. In most cases, the diagnostic steps should lead the repair person to a particular defective component or maladjustment.

When troubleshooting the controller, the additional diagrams and circuit descriptions contained in the appropriate Wiring Diagram Package (WDP), as listed on Pages 1-3 and 1-4, B. REFERENCE MATERIAL, will be useful.

E. ADJUSTMENTS AND LUBRICATION: Contains requirements, instructions, and descriptive views for each adjustment and lubrication point of the subject component.

On equipment having interrelated adjustments, particularly the Model 40 Printer, a table is included listing any related adjustments for a specific adjustment. The related adjustment table should be followed to insure proper equipment functioning.

F. DISASSEMBLY/REASSEMBLY AND PARTS: Provides detailed procedures for removing and replacing various subassemblies and individual piece parts of components covered in Parts 2 through 9. The sequenced textual instructions are directly supported by part numbered illustrations. In addition, a complete parts listing is included that contains a brief description of each part along with the page numbers on which the part is illustrated.

Part 10, Sets, contains additional information and illustrations relevant to interconnecting and placement of cables.

Part 11, Master Component Parts List, contains a master numerical components parts list, excluding general mounting hardware which are listed in the component parts section for each component.



B. REFERENCE MATERIAL

TECHNICAL DATA

Power Source Requirements

115 Vac +10% 50/60 hertz connection to most sets is made by using a terminal block (No. 10 screws) in the interface assembly of the set. Some sets provide a power cord equipped with a three prong plug. Refer to Part 10 for set arrangements.

Note: When operating from a 50 cycle power source, a pulley change is required on the printer, the cassette drives and the flexible diskette drives.

Depending on set configuration up to six ac outlets with ground connection (3 prong) is required. Each cassette drive requires an outlet. On certain set configurations, the controller pedestal requires an outlet. The paper winder (if supplied) requires an outlet.

**DANGER: SETS MUST BE PROPERLY GROUNDED TO PREVENT SHOCK HAZARD.**

Power Consumption and Heat Dissipation

			<u>Approx Current Draw</u>
KDP	500 Watts	1720 BTU/Hr	4.5 Amps
KD	365 Watts	1250 BTU/Hr	3.35 Amps
ROP	260 Watts	885 BTU/Hr	3.15 Amps
KP	330 Watts	1130 BTU/Hr	3.65 Amps
CD (each)	150 Watts	367 BTU/Hr	1.0 Amps

Environmental Restrictions

Environmental conditions should be maintained within the following limits to avoid damage and provide proper operation.

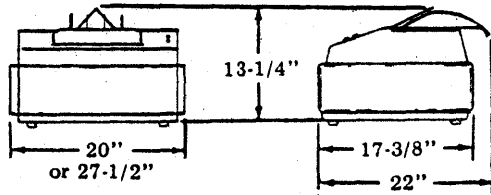
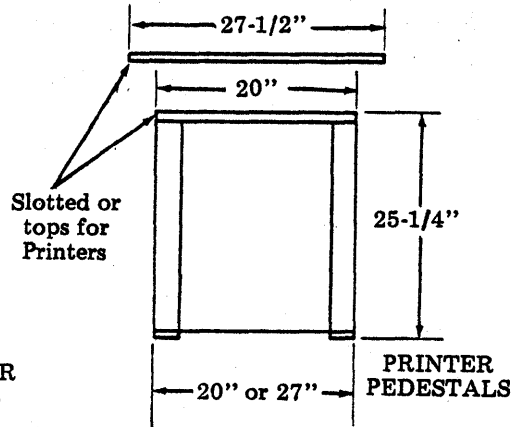
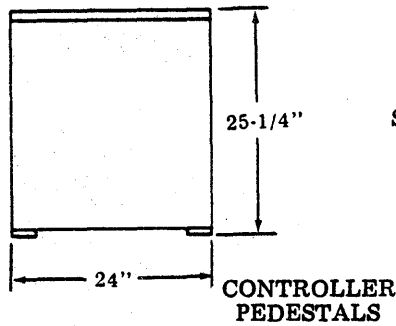
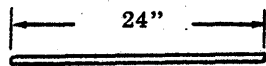
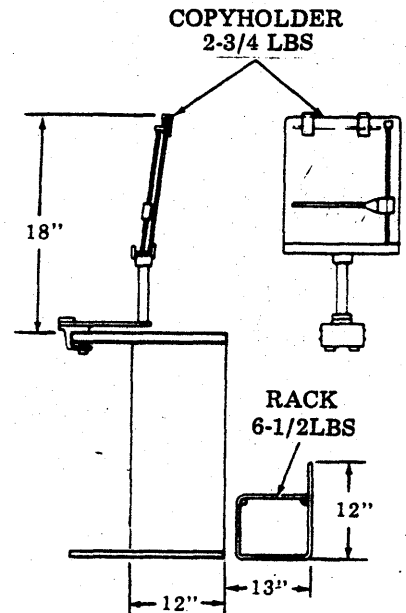
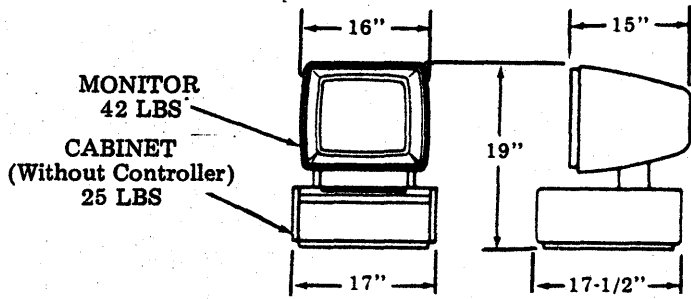
<u>Environmental Condition</u>	<u>Storage or Transportation</u>		<u>Operation</u>	
	<u>Min</u>	<u>Max</u>	<u>Min</u>	<u>Max</u>
Temperature	-40°F	+150°F	+40°F	+110°F
Humidity	2%	95%	2%	95%
Altitude	Sea Level	50,000 ft	Sea Level	10,000 ft

Note: As with any device that can be damaged by water, sudden temperature changes that can cause condensation should be avoided.

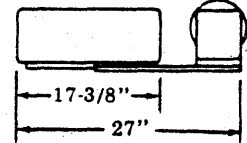
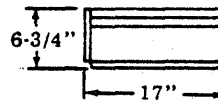
Example: A device stored in subzero temperatures will collect frost when unpacked in a warm humid room.

**B. REFERENCE MATERIAL (Contd)**

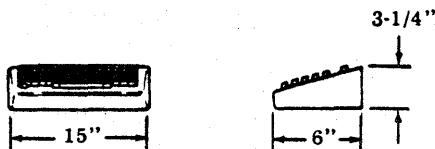
**COMPONENT SPACE REQUIREMENTS AND WEIGHTS**



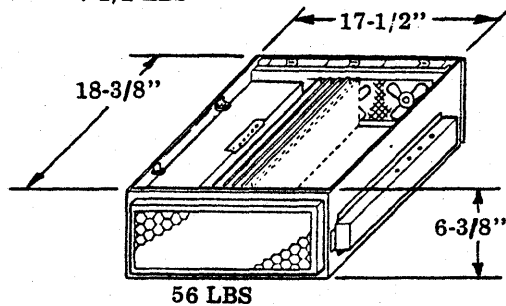
**PRINTER IN CABINET**  
(80-132-Column Tractor Feed)  
85 LBS OR 108 LBS



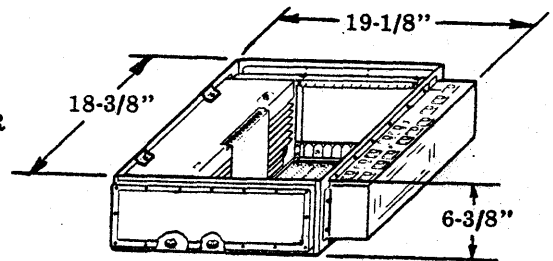
**PRINTER IN CABINET**  
(Friction Feed) 55 LBS



**KEYBOARD**  
7-1/2 LBS



**40C430, 431, 432, 433, 437, 438 CONTROLLERS**



**40C434, 435, 436 CONTROLLERS**

SUPPLEMENTARY MANUALS

The following manuals provide important information concerning operation, installation and field servicing of Model 40 Sets and Components. The manuals are broken down into two categories How to Operate and Installation and Service Manuals. Listed below are manuals applicable to the Tempest Model 40 Set Configuration and the sets that they cover. These manuals may be ordered from Teletype Corporation by the titles shown.

How To Operate Manuals

The "How to Operate" manuals are oriented toward the operator. The operating function and features of the various Tempest Model 40 Set Configurations and their access or control by the operator are presented in an easy to understand now technical format.

<u>Manual</u>	<u>Title</u>	<u>Equipment Covered</u>
354	How to Operate Tempest Model 40	Set Configurations Containing the 40C430 to 40C432 Controllers (40/8A)
362	How to Operate Tempest Model 40 ASR	Set Configurations Containing the 40C433 Controllers (40/8A)
370	How to Operate Tempest Model 40 Dual ASR	Set Configurations Containing the 40C434/ACW/063 Controller
405	How to Operate Tempest Model 40/8B ASR	Set Configurations Containing the 40435/AEE/091 Controller (40/8B)
413	How to Operate Tempest Model 40/8C	Set Configuration Containing the 40C435
445	How to Operate Tempest Model 40/8A Ruggedized Rack Mounted ASR	Set Configuration Containing the 40C430 to 40C432 Controllers (40/8A)
446	How to Operate Tempest Model 40/8B and 40/8B II KDP with Cassette Drives	Sets Configurations Containing the 40C437/AEE/091 (40/8B) 40C437/AEL/106 (40/8B II)
491	How to Operate Tempest Model 40/8A ROP-KP-KP3	Set Configurations Containing the 40C432/AEM/103, 40C433/AEN/104, 40C438/AEP/105 Controllers
526	How to Operate Tempest Model 40/8B I KDP with Cassette Drives	Set Configuration Containing the 40C437/AEL/106 Controller
559	How to Operate Tempest Model 40/8B II KDP with Cassette Drives	Set Configuration Containing the 40C437/AEL/107 Controller

B. REFERENCE MATERIAL (Contd)INSTALLATION AND SERVICE MANUALS

The "Installation and Service Manuals" provide in depth information required for set or station assembly, installation and for field troubleshooting and maintenance. The subject includes?

- Installation
- Operational Checkout
- Troubleshooting
- Adjustments
- Component Access
- Routine Maintenance

The "Installation Manuals" provide information required for assembly, optioning and installation of set or station. The "Service Manuals" provide in depth information for operational checkout and in field troubleshooting and maintenance.

<u>Manual</u>	<u>Title</u>	<u>Equipment Covered</u>
353	Tempest Model 40 Installation and Servicing Manual	Set Configurations Containing the 40C430 to 40C432 Controllers (40/8A)
358	Tempest Model 40 132 Column Printer Set Installation and Servicing Manual	Tempest 132 Column ROP Sets (40/8A)
363	Tempest Model 40 ASR Installation and Servicing Manual	Set Configurations Containing the 40C433 Controllers
371	Tempest Model 40 Dual ASR Installation and Servicing Manual	Set Configuration Containing the 40C434/ACW/063 Controller
404	Tempest Model 40/8B ASR With Cassetes Installation Manual	Set Configuration Containing the 40C435/AEE/091 Controller (40/8B)
408	Tempest Model 40/8B ASR With Cassetes Servicing Manual	Set Configurations Containing the 40C435/AEE/091 Controller (40/8B)
414	Tempest Model 40 Synchronous 40/8C Installation Manual	Set Configurations Containing the 40C436/ADK/075 40C436/ADU/095 40C436/ADN/094 40C436/ADD/093 40C436/ADA/092 Controllers (40/8C)

<u>Manual</u>	<u>Title</u>	<u>Equipment Covered</u>
415	Tempest Model 40 Synchronous 40/8C Service Manual	Set Configuration Containing the 40C436/ADK/075 40C436/ADU/095 40C436/ADN/094 40C436/ADD/093 40C436/ADA/092 Controllers (40/8C)
447	Ruggedized Rack Mounted Tempest Model 40/8A Installation Manual	Set Configuration Containing the 40C430 to 40C432 Controllers (40/8A)
448	Ruggedized Rack Mounted Tempest Model 40/8A Service Manual	Same as Manual 447
449	Ruggedized Rack Mounted Tempest Model 40/8B and 8BII ASR With Cassette Drives Installation Manual	Set Configuration Containing the 40C437/AEE/091 (40/8B) 40C437/AEL/107 Controllers (40/8BII)
450	Ruggedized Rack Mount Tempest Model 40/8B and 8BII ASR With Cassette Drives Service Manual	Same as Manual 449
492	Tempest Model 40/8A ROP-KP-KP <sup>3</sup> Installation Manual	Set Configuration Containing the 40C431/AEM/103 40C432/AEN/104 40C438/AEP/105 Controllers
493	Tempest Model 40/8A ROP-KP-KP <sup>3</sup> Service Manual	Same as Manual 493
527	Tempest Model 40/8BI/KDP also Tempest Model 40/8B/KDP With Cassette Drives and 403142 Modification Kit	Set Configuration Containing the 40C437/AEL/106 Controller
528	Tempest Model 40/8BI/KDP also Tempest Model 40/8B/KDP With Cassette Drives and 403142 Modification Kit	Same as Manual 527
560	Tempest Model 40/8BII/KDP With Cassette Drives Installation Manual	Set Configurations Containing 40C437/AEL/107 Controller (40/8BII)
561	Tempest Model 40/8BII/KDP With Cassette Drives Service Manual	Same as Manual 560

B. REFERENCE MATERIAL (Contd)FACTORY AUTHORIZED SERVICE

Teletype Corporation maintains a nationwide Product Service Organization to serve users of Teletype Corporation equipment. Refer to Pages 1-10 and 1-11 for details of services offered and a listing of Service Center locations.

WIRING DIAGRAM PACKAGE (WDP) LISTING

The following WDPs covering the component are supplied with the set.

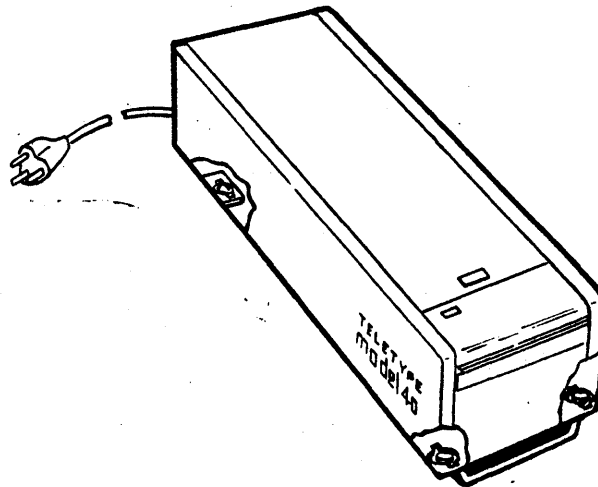
WDP0435	40P 20-Column Friction Feed Printer
WDP0453	40CAB202/RA, RO 80-Column Friction Feed Printer Cabinet
WDP0454	40CAB352/RA, RO 80-Column Tractor Feed Printer Cabinet
WDP0456	40CAB354/RA 132-Column Tractor Feed Printer Cabinet
WDP0457	40CAB903 Pedestals
WDP0458	40K103 Keyboards
WDP0460	40MN202/RA Display
WDP0461	40C430/ZZZ/000 Controller Without Cards
WDP0462	40P201 & 40P202/ZZ 132-Column Tractor Feed Printer Cabinet
WDP0464	40C431/ZZZ/000 Controller Without Cards
WDP0465	40C432/ZZZ/000 Controller Without Cards
WDP0468	40CD101 Cassette Drive (Non-Tempest)
WDP0469	40C430/AAT/017 Controller With Cards RCMP
WDP0470	40C431/ABE/026 & 40C432/ABF/027 Controllers 40/8A
WDP0471	40C430/ABD/025 Controller With Cards 40/8A
WDP0475	4016AB/001/AB Cassette Drive Set (Non-Tempest)
WDP0476	40C433/ZZZ/000 Controller Without Cards
WDP0478	40C433/ACS/059 Controller With Cards Samson
WDP0479	40P154/ZZ 80-Column Tractor Feed Printer
WDP0484	40C434/ZZZ/000 Controller Without Cards
WDP0485	40C434/ACW/063 Controller With Cards TERP I
WDP0488	40C435/ZZZ/000 Controller Without Cards
WDP0489	40C435/AEB/088 Controller With Cards Samson
WDP0495	40C435/AEE/091 & 40C437/AEE/091 Controller With Cards 40/8B
WDP0501	4016RA/001/RA & 4016RB/001/RA Cassette Drives
WDP0506 &	
WDP0507	M40 Paper Tape 5 & 8 Level
WDP0519	40C436/ADK/075 Controller With Cards 40/8C SCC
WDP0520	40C436/ADU/095 Controller With Cards 40/8C DCC-A
WDP0521	40C436/ADN/094 Controller With Cards 40/8C DCC-B
WDP0522	40C436/ADD/093 Controller With Cards 40/8C MCC-A
WDP0523	40C436/ADA/092 Controller With Cards 40/8C MCC-B
WDP0524	40C436/ZZZ/000 Controller With Cards
WDP0525	40K108 Keyboards
WDP0542	40C435/AEE/099 Controller With Cards 40/8D
WDP0546	408828 Modification Kit- 40/8B to 40/8D
WDP0547	40M103/BC Memory System
WDP0548	40M803/BC Memory System
WDP0551	40C434/AEK/101 Controller With Cards TERP II
WDP0554	40C437/ZZZ/000 Controller Without Cards
WDP0572	40K109/CAA Keyboard (40/7)

WDP0573 Terminal With 40C405 Controller (40/7)  
WDP0581 40C437/AEL/106 Controller With Cards 40/8B1  
WDP0582 40C431/AEM/103 Controller With Cards 40/8AI KP  
WDP0583 40C432/AEN/104 Controller With Cards 40/8AI ROP  
WDP0584 &  
WDP0585 40C438/AEP/105 Controller With Cards 40/8AI KP3  
WDP0587 413330 Modification Kit Clock-Phase Correction  
WDP0592 40C437/AEL/107 Controller With Cards 40/8BII





PART 2 -- TEMPEST MODEL 40 CASSETTE DRIVE



INDEX

	<u>PAGE</u>
A. GENERAL	3
1. DESCRIPTION . . . . .	3
2. TOOLS, TEST EQUIPMENT AND MISCELLANEOUS . . . . .	4
B. SHOP PROCEDURES	5
1. GENERAL . . . . .	5
2. CLEANING. . . . .	5
3. INSPECTION. . . . .	7
4. MARKING AND PACKING . . . . .	8
C. TESTING	11
1. GENERAL . . . . .	11
2. PRELIMINARY CHECKS. . . . .	11
3. OFF-LINE CHECKOUT PROCEDURE . . . . .	12
4. MONITOR TAPE CASSETTE CHECKOUT. . . . .	21
5. ON-LINE CHECKOUT. . . . .	26
6. CASSETTE TEST PROGRAMS. . . . .	29
D. TROUBLESHOOTING	40
1. GENERAL . . . . .	40
2. ERROR ANALYSIS. . . . .	44
3. COMPONENT ANALYSIS. . . . .	47
4. CIRCUIT CARD ANALYSIS (410043). . . . .	53
5. CIRCUIT CARD ANALYSIS (410764). . . . .	57
6. FUNCTIONAL SCHEMATICS . . . . .	86
E. ADJUSTMENTS AND LUBRICATION	93
1. GENERAL . . . . .	93
2. ASSEMBLIES. . . . .	93
3. CASSETTE HOLDER ADJUSTMENTS . . . . .	95
4. DRIVE MECHANISM ADJUSTMENTS . . . . .	106
5. 410764 CIRCUIT CARD ADJUSTMENT. . . . .	110
6. CASSETTE DRIVE LUBRICATION. . . . .	111

PART 2 -- TEMPEST MODEL 40 CASSETTE DRIVE (Contd)INDEX (Contd)PAGE

F.	DISASSEMBLY/REASSEMBLY AND PARTS	114
1.	REMOVAL AND REPLACEMENT OF UPPER CABINET ASSEMBLY . . . . .	114
2.	SUBASSEMBLY IDENTIFICATION. . . . .	116
3.	DISASSEMBLY/REASSEMBLY DRIVE. . . . .	116
4.	DISASSEMBLY/REASSEMBLY SSI/AC INTERFACE . . . . .	121
5.	PARTS . . . . .	135
6.	COMPONENT PARTS LIST. . . . .	144

PART 2 -- TEMPEST MODEL 40 CASSETTE DRIVEA. GENERAL1. DESCRIPTION

The function of the Tempest Model 40 Cassette Drive is to record (store) and retrieve data on a magnetic tape media. The cassette drive accomodates a "Phillips" type cassette which conforms with the exception of tape length to the proposed ANSI standard for digital cassettes for the purpose of storing data. The cassette drive is designed to be used with Model 40 equipment containing a C400 or equivalent controller. Transmission of data and control signals between the cassette drive and the controller conform to the Teletype Standard Serial Interface (SSI), system. The cassette drive has no local controls and functions only in response to commands from the associated controller.

Tape movement is accomplished by means of a synchronous motor and a reel to reel drive arrangement wherein the drive (forward) and rewind (reverse) shafts are controlled by electromechanical clutches and electromagnetic brakes.

The cassette drive is designed to operate as a block device. Operation is synchronous within a block and asynchronous by block. As such, transmission to or from the cassette drive may be selected as required by the controller, but once the transmission has started the entire block must be transmitted. Tempest applications of the cassette drive utilize a 256 SSI word (512 ASCII characters) block size. The cassette storage capacity with the 256 SSI word block format is 500 blocks or 256,000 characters.

The cassette drive contains a single control logic circuit card which contains all logic required to control the cassette drive. The control logic card of the cassette drive receives commands from the controller and translates them into the appropriate signals to control the clutches, brakes and the read/write head. The control logic card interprets the input from cassette-in-place and write inhibit switches and the BOT photo sensor and translates them into the proper signals to the controller. It also provides drive for the BOT sensor lamp and the status (Run-Stop) lamp.

The cassette drive utilizes a single two channel read/write magnetic tape head to record and read data on the magnetic tape. Both channels are used during either the read or write operations.

The cassette drive contains a power supply to supply the voltage and current required by the cassette drive control logic card. The ac power to the cassette drive motor and power supply is controlled by an attendant accessible switch.

Refer to WDP 0501 for a general circuit description with block diagram and for further details of the major component functions.

The cassette drive is designed for operation with a supply voltage of 115 V ac  $\pm 10$  percent 50 or 60 hertz  $\pm 5$  percent. Operating power is 105 watts and heat generation is 367 BTU per hour. When operating on 50 hertz power, a pulley change is required at the cassette drive motor.

A. GENERAL (Contd)2. TOOLS, TEST EQUIPMENT AND MISCELLANEOUSTools

The tools listed below are supplementary to common types such as pliers, screwdrivers, wrenches, etc and may be procured locally or ordered from Teletype Corporation.

NOTE: When ordering parts, prefix each part number with the letters "TP" unless otherwise specified.

<u>Description</u>	<u>Part No.</u>
• Pull Spring Hook	75765
• Nut Driver Wrench 1/4 Inch	89954
• Nut Driver Wrench 5/16 Inch	89955
• Nut Driver Wrench 3/16 Inch	125752
• Terminal Extractor	182697
• Allen Wrench 0.050 Inch	104457
• Allen Wrench 0.078 Inch	110271
• Ruler 6 inch	95960
• Gauge (Brake and Clutch Gap)	406130
• Wrench, Drive (402274/402275 Drive Hubs)	406131
• Soldering Iron, Weller Model W-MCP-750 With MP2C Tip, or Equivalent (Procure Locally)	
• Desoldering Tool, EDSYN Model MMS005 Soldapullit <sup>®</sup> , or Equivalent (Procure Locally)	

Test Equipment

The following equipment or equivalent is required for testing, troubleshooting and adjusting the cassette drive.

- Volt-Ohm-Millimeter, Triplet Model 630 APL
- Digital Multimeter, Fluke Model 8100A
- Oscilloscope, Tektronix Model 7904 E/W:
  - 2 -- 7A16A Single Trace Amplifiers
  - 1 -- 7B70 Time Base Unit
  - 2 -- RX10 Circuit Probes
- High Voltage DC Breakdown Tester, Slaughter Company Model 108-2.5MW
- Tempest Model 40 KDP Set E/W 40C433/ACS/059
- Cassette Drive Program
 

The test program used with a C400 controller provides a 38 step program for recording, reading and verifying approximately ten million characters on a block by block basis.

The Cassette Drive Test Program is available from:

Teletype Custom Systems Division  
5555 Touhy Avenue  
Skokie, Illinois 60677  
312-982-2000

- Cassette Drive Test Program - CP10.006
- Modified 410504 Circuit Card With Cassette Tape
- Loader EPROMS - CP10.006.010

Miscellaneous

Grease -- 145867 (4 ounce can) or 143484 (1 pound can)  
 Oil -- 88970 (1 quart can)  
 Degreaser (Freon TF) -- 337449 (6 ounce aerosol can)  
 Tape Head Cleaner -- 337401 (6 ounce aerosol can)

B. SHOP PROCEDURES1. GENERAL

This section details the cleaning, refinishing and inspection procedures to be followed prior to testing and troubleshooting the cassette drive. In many cases, careful inspection will save later troubleshooting by revealing broken or loose connections, damaged components, possible short circuits, etc.

Refer to Page 114 F. DISASSEMBLY/REASSEMBLY AND PARTS whenever detailed information on removing cassette drive components is required.

The packing materials detailed in this section are designed for protection against damage from rough handling in shipping.

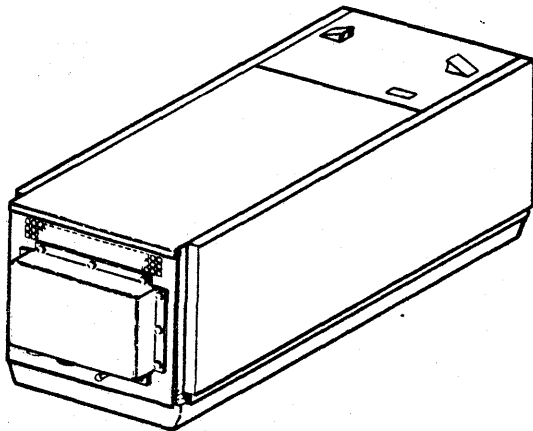
2. CLEANING

Immersion type cleaning is NOT recommended for the cassette drive.

**CAUTION:** AVOID THE USE OF HARSH OR ABRASIVE CLEANING AGENTS OR SOLVENTS WHICH COULD SCRATCH OR DAMAGE THE EXTERNAL SURFACES OF THE CASSETTE DRIVE CABINET.

Exterior

Remove upper cabinet assembly.



40CAB102RA  
CABINET

Clean all surfaces as follows:

- ① Wipe with soft cloth moistened with water and wrung almost dry.
- ② When necessary a very weak solution of mild detergent may be used to remove stubborn dirt, grease, or finger prints.
- ③ Vacuum louvers in rear of cabinet to remove all dust.

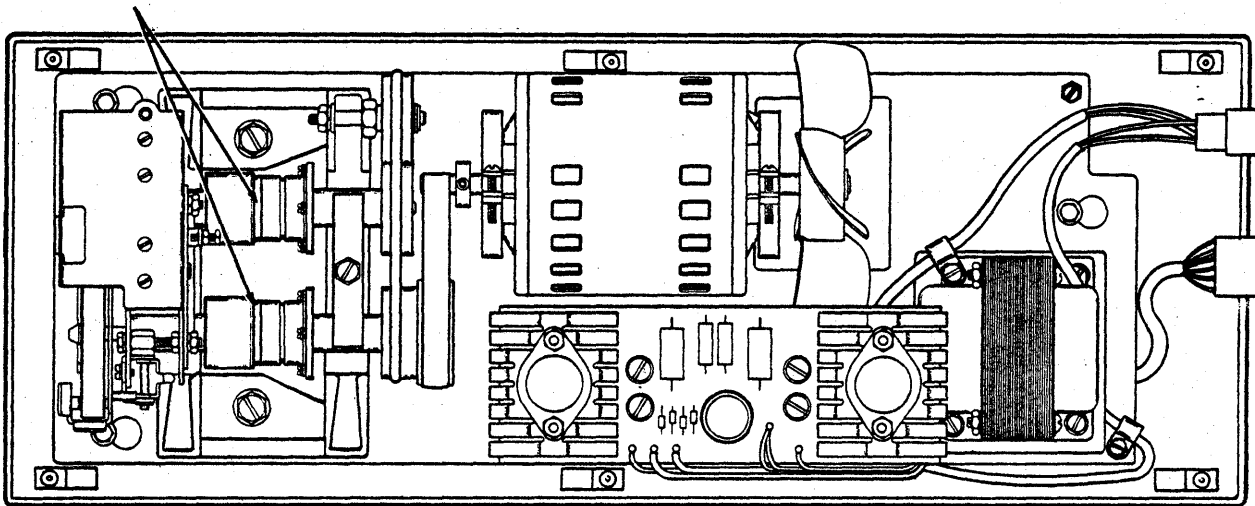
B. SHOP PROCEDURES (Contd)2. Cleaning (Contd)Interior

Remove cassette if present from drive mechanism before cleaning is started.

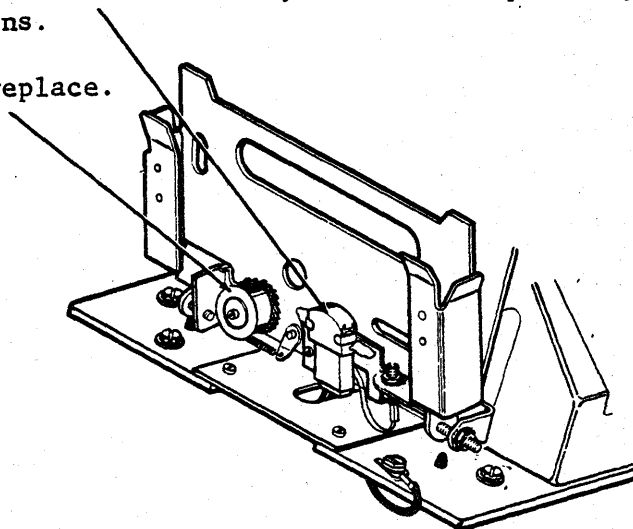
- ① Clean drive mechanism by using a vacuum, brushing or wiping away dust and foreign material.

**CAUTION:** EXTREME CARE SHOULD BE EXERCISED WHEN CLEANING IN THE AREA OF THE TAPE READ/WRITE HEAD TO PREVENT DAMAGE TO THE HEAD PARTICULARLY SCRATCHES OR DENTS ON THE TAPE HEAD POLE PIECES.

- ② Clean mating surfaces of the armature and rotor faces; place a small piece of paper saturated with 337401 recording head cleaner between the armature and rotor faces of each clutch assembly; apply pressure to each face; withdraw paper from between the armature and rotor. Repeat for each pole face until the withdrawn paper is clean.



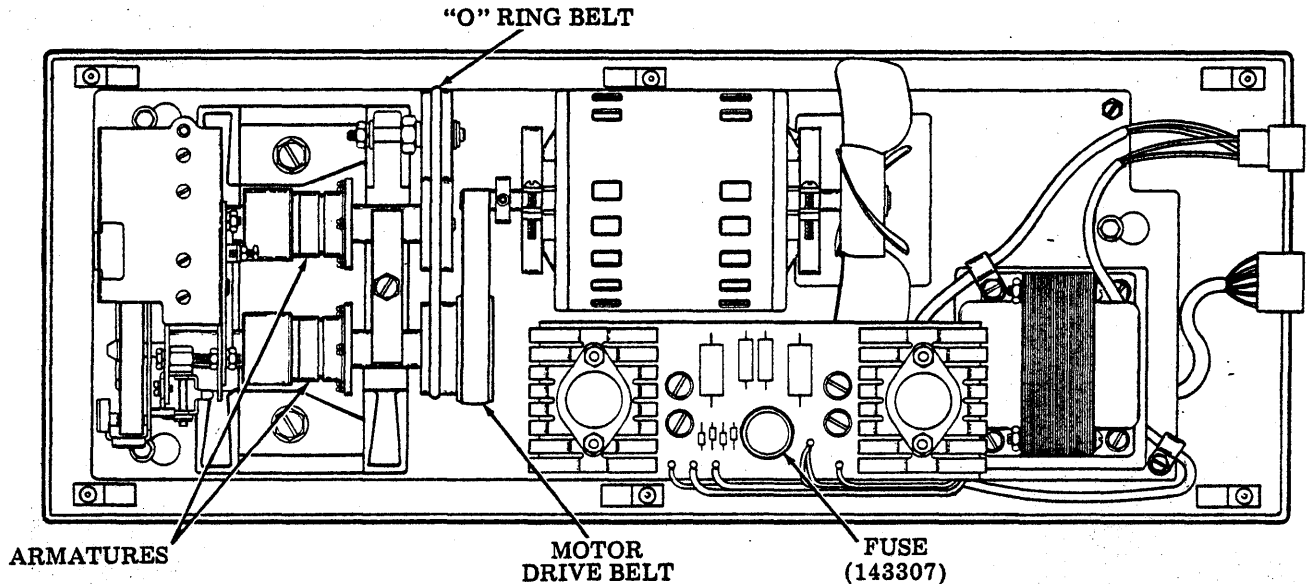
- ③ Using 337401 recording head cleaner and a cotton swab, clean the tape head, hub drivers and cassette locating pins.
- ④ Check 403238 tape cleaner, if dirty replace.



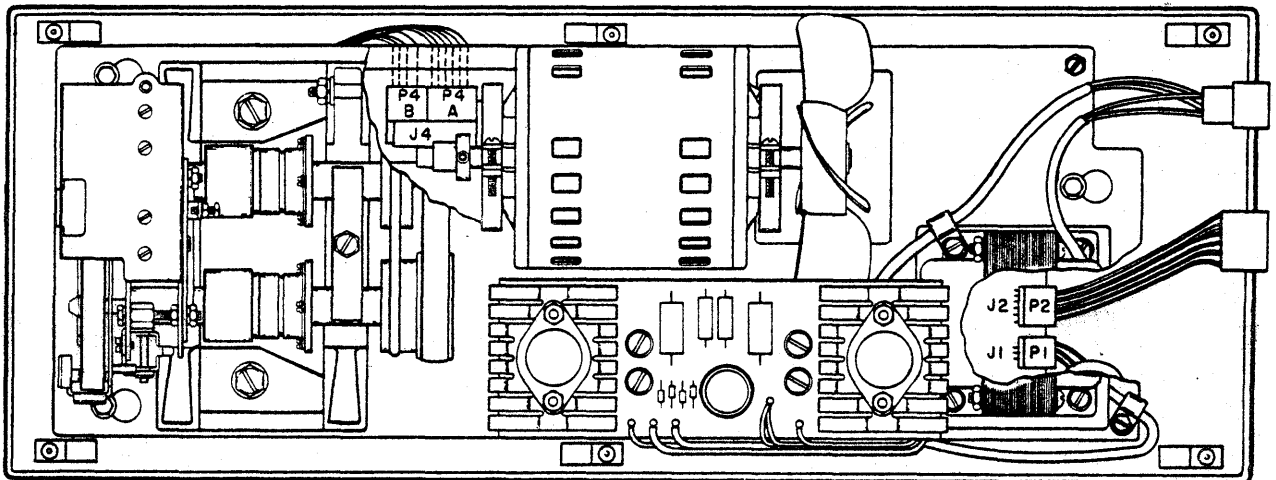
3. INSPECTION

Interior

- a. Check that the motor drive belt and the "O" ring are present and free from cracks and are not frayed.
- b. Check that all three pulleys and both armatures turn when motor is turned by hand at fan end. (Turn clockwise as viewed from fan end.)



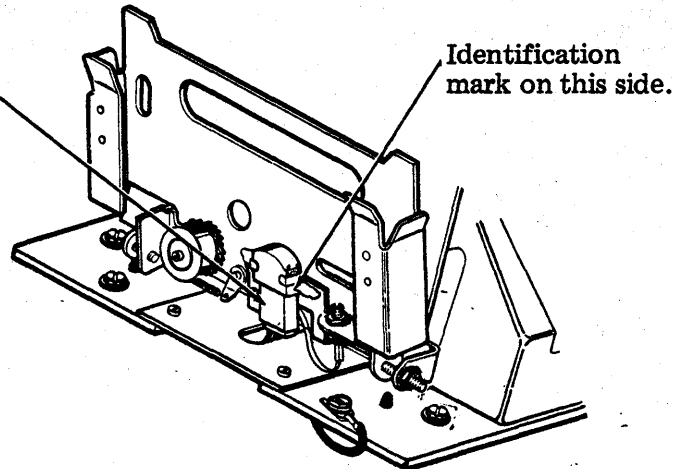
- c. Check that power supply fuse is present, not blown and correct value (0.6 amp SL-BL).
- d. Check that plug P1, P2, P4A and P4B are fully seated in their respective connectors on the 410764 control logic circuit card. Connectors are under the cassette drive base plate.



- e. Remove cassette if present.

B. SHOP PROCEDURES (Contd)3. INSPECTION (Contd)Interior (Contd)

- f. Check that the tape load connector is fully seated in the tape head and is orientated in the correct direction.

4. MARKING AND PACKINGPacking

Factory-type packing may be duplicated by ordering material shown below and applying as follows. PK designated items should be ordered from Teletype Corporation.

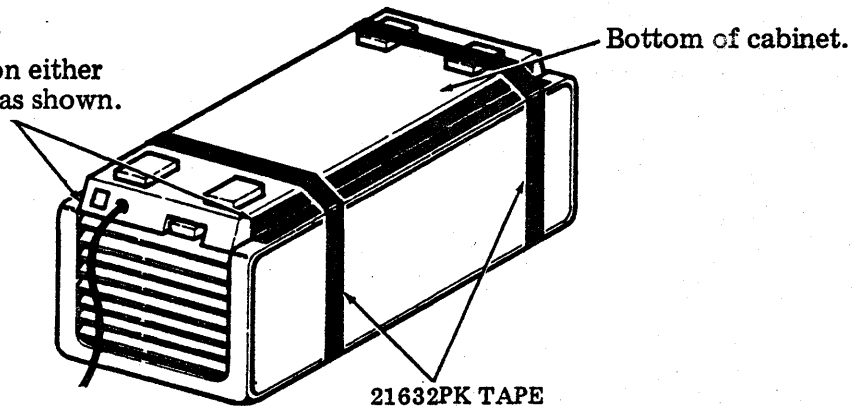
<u>Qty.</u>	<u>Materials Required</u>
1	10774PK Corrugated Carton
1	9861PK Corrugated Carton
8	28278PK Corner Details
1	28218PK Detail A
1	28218PK Detail B
1	23457PK Plastic Bag
2	27643PK Labels
-	21719PK Tape (as required)
-	21632PK Tape (as required)
-	21480PK Tape (as required)

- (1) Carefully turn set upside down. Apply a strip of 21480PK tape on either side of unit base. Each tape strip must overlap both the base and cover side plate, as shown. Turn set right side up.
- (2) Apply two bands of 21632PK tape around set as shown. Apply a third strip of tape across top and front of set to hold lid down.
- (3) Place set in a 23457PK plastic bag. Leave line cord extended outside of bag.

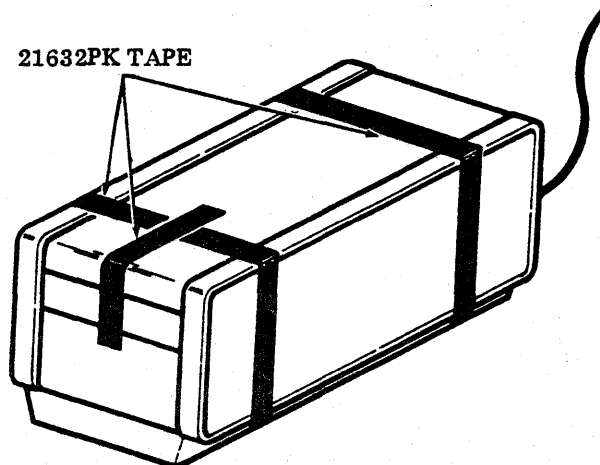


- (4) Position a 28218PK Detail A on right side of unit and a 28218PK Detail B on left side of unit as shown. Position line cord on top of unit.
- (5) Form a 9861PK carton. Close and seal bottom flaps with a strip of 21719PK tape applied at the center seam and extending at least three inches up the sides of the carton.
- (6) Place set and details in the carton. Close and seal top flaps of carton as outlined in Step 5. Apply a 27643PK label to upper left hand portion of top of carton.
- (7) Form a 10774PK carton. Close and seal bottom of flaps with three strips of 21719PK tape. Apply tape to center and end seams.
- (8) Secure a 28278PK detail to each of the four bottom corners of the inner carton by means of the pressure sensitive tape on each detail.
- (9) Place carton and details in the outer carton.
- (10) Position a 28278PK detail on each of the four top corners of the inner carton.
- (11) Close and seal top flaps of carton and seal as indicated in Step 7.
- (12) Moisten and apply a 27643PK label to upper left hand portion of top of carton.

Apply a strip of 21480PK tape on either side of cabinet, as shown.



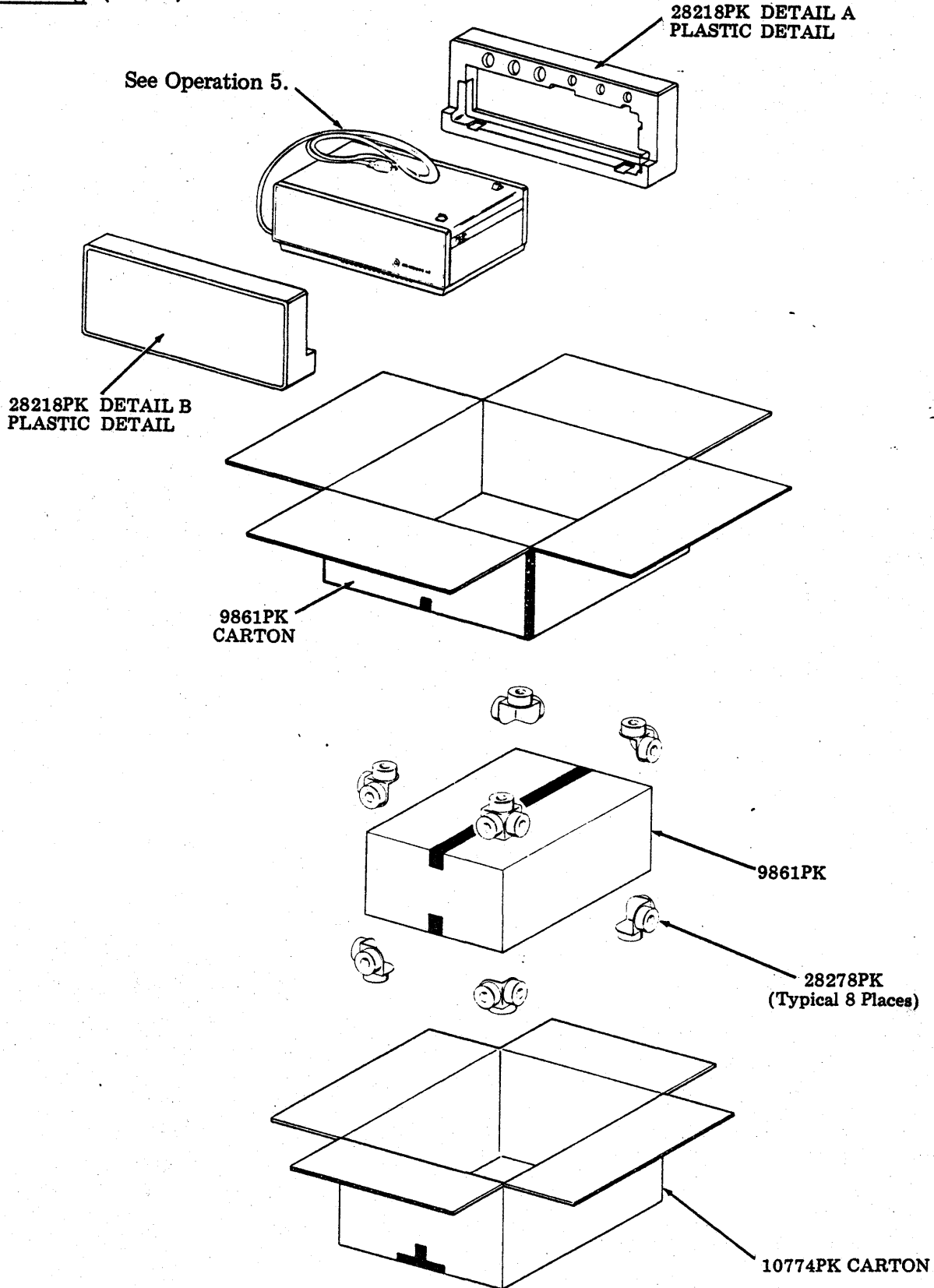
21632PK TAPE



B. SHOP PROCEDURES (Contd)

4. MARKING AND PACKING (Contd)

Packing (Contd)



C. TESTING1. GENERAL

Testing of the Tempest Model 40 Cassette Drive Units is accomplished with the cassette drive(s) connected as part of a Tempest C400 Station. The test is performed in two stages:

- (1) Off-line/on-line checkout,
- (2) Functional test using the Teletype Custom Systems Division CP10.006 Cassette Test Program.

Each test procedure should be performed from start to finish with no omissions.

Whenever the cassette drive fails a particular test, refer to Page 2-40, D. TROUBLESHOOTING and/or Page 2-93, E. ADJUSTMENTS AND LUBRICATION to locate the trouble. After the trouble has been located and corrected, repeat the test that disclosed the trouble and if found OK, resume testing from that point.

NOTE: When ordering replaceable parts or components, unless otherwise specified, prefix each part number with the letters "TP" (ie, TP410055).

An operational checkout should be performed upon installation or on trouble calls.

If the indicated response is not obtained in any step of a checkout procedure, repeat the step to make sure that the procedure has been performed correctly. If the results are still unsatisfactory, perform the indicated trouble analysis.

Always perform the checkout in the order given in the chart.

The trouble analysis steps are based on satisfactory results of all previous steps.

2. PRELIMINARY CHECKS

Before turning on any equipment, check the following:

- a. Are all circuit cards and cable connectors fully seated?
- b. Are all fuses in place?
- c. Are all cabinet lids and pedestal doors closed?
- d. Do all printers have paper and ribbon properly installed?
- e. Is the station connected to a properly grounded ac service?
- f. Have the station options been installed and are they properly recorded?
- g. Prior to applying ac power to the controller, insure that power is on to the tape cassette drives and the cassette is in the unlatched (cassettes disengaged) position.
- h. Insure that all tape cassettes are properly formatted, each tape cassette must be placed in the receive tape cassette drive and the erase function performed. The erase function must be performed prior to the off-line checkout of the cassette drive. Refer to How to Operate Manual 405, Page 19 for procedure to erase cassettes.

C. TESTING (Contd)

3. OFF-LINE CHECKOUT PROCEDURE

NOTE: Immediately when power is turned on, various LED displays will be lighted on the opcon depending upon station type and applicable controller. See appropriate service manual for operation of particular stations.

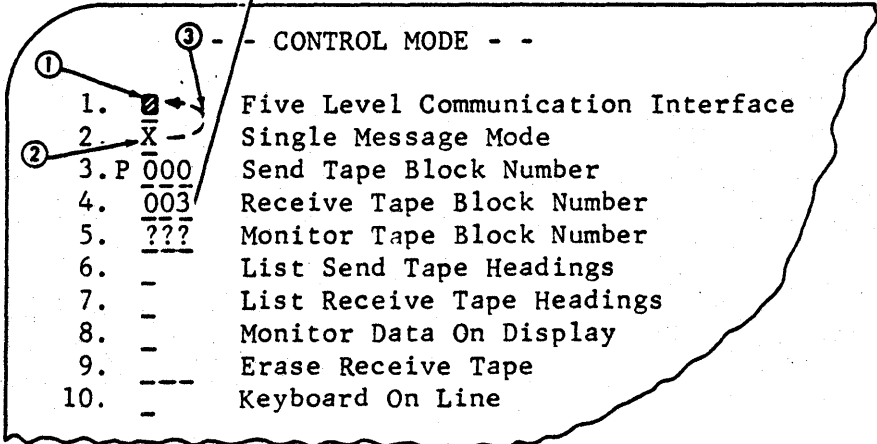
STEP	PROCEDURE	RESULTS																																												
1	<p>Depress CNTRL MODE keytop.</p> <p style="text-align: center;">CURSOR POSITION</p> <div style="border: 1px solid black; padding: 5px; margin: 10px auto; width: fit-content;"> <p style="text-align: center;">-- CONTROL MODE --</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 5%; text-align: right;">1.</td> <td style="width: 5%; text-align: center;">█</td> <td style="width: 10%;"></td> <td style="width: 80%;">Five Level Communication Interface</td> </tr> <tr> <td>2.</td> <td style="text-align: center;">-</td> <td></td> <td>Single Message Mode</td> </tr> <tr> <td>3.</td> <td style="text-align: center;">P 000</td> <td></td> <td>Send Tape Block Number</td> </tr> <tr> <td>4.</td> <td style="text-align: center;">.000</td> <td></td> <td>Receive Tape Block Number</td> </tr> <tr> <td>5.</td> <td style="text-align: center;">.???</td> <td></td> <td>Monitor Tape Block Number</td> </tr> <tr> <td>6.</td> <td style="text-align: center;">-</td> <td></td> <td>List Send Tape Headings</td> </tr> <tr> <td>7.</td> <td style="text-align: center;">-</td> <td></td> <td>List Receive Tape Headings</td> </tr> <tr> <td>8.</td> <td style="text-align: center;">-</td> <td></td> <td>Monitor Data On Display</td> </tr> <tr> <td>9.</td> <td style="text-align: center;">-</td> <td></td> <td>Erase Receive Tape</td> </tr> <tr> <td>10.</td> <td style="text-align: center;">-</td> <td></td> <td>Keyboard On Line</td> </tr> <tr> <td>11.</td> <td style="text-align: center;">-</td> <td></td> <td>Tape Ports ST = 1 RT = 2 MT = 3</td> </tr> </table> </div> <p>INDICATES POSITION OF SEND AND RECEIVE TAPES</p> <p>INDICATES MONITOR TAPE IS NOT PRESENT</p> <p>Number indicates cassette drive assigned for that function.            ST = Send Tape            RT = Receive Tape            MT = Monitor Tape            0 will appear if no cassette drive is available for that function.</p>	1.	█		Five Level Communication Interface	2.	-		Single Message Mode	3.	P 000		Send Tape Block Number	4.	.000		Receive Tape Block Number	5.	.???		Monitor Tape Block Number	6.	-		List Send Tape Headings	7.	-		List Receive Tape Headings	8.	-		Monitor Data On Display	9.	-		Erase Receive Tape	10.	-		Keyboard On Line	11.	-		Tape Ports ST = 1 RT = 2 MT = 3	<p>CNTRL MODE lamp lights and the following message appears on the display.</p>
1.	█		Five Level Communication Interface																																											
2.	-		Single Message Mode																																											
3.	P 000		Send Tape Block Number																																											
4.	.000		Receive Tape Block Number																																											
5.	.???		Monitor Tape Block Number																																											
6.	-		List Send Tape Headings																																											
7.	-		List Receive Tape Headings																																											
8.	-		Monitor Data On Display																																											
9.	-		Erase Receive Tape																																											
10.	-		Keyboard On Line																																											
11.	-		Tape Ports ST = 1 RT = 2 MT = 3																																											
<p>LOCAL CHECKOUT KDPM<sup>2</sup> AND KDPM<sup>3</sup></p>																																														
2	<p>Using cursor positioning key</p> <div style="display: flex; align-items: center; gap: 10px;"> <div style="border: 1px solid black; width: 20px; height: 20px; display: flex; align-items: center; justify-content: center;">↓</div> <div style="border: 1px solid black; width: 20px; height: 20px; display: flex; align-items: center; justify-content: center;">→</div> </div> <p>① position cursor to the first underline to the right of 2.</p> <p>② Type an upper case X.</p>	<p>Cursor moves under direction of cursor key.</p> <p>X appears, cursor moves one space to the right.</p>																																												

STEP	PROCEDURE	RESULTS
<p>2 (Contd)</p>	<p>Depress LINE FEED key.</p> <div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <p style="text-align: center;">-- CONTROL MODE --</p> <p>① 1. <u>2</u> Five Level Communication Interface                  2. <u>X</u> Single Message Mode                  ② 3. P <u>000</u> Send Tape Block Number                  4. <u>000</u> Receive Tape Block Number                  5. <u>???</u> Monitor Tape Block Number                  6. - List Send Tape Headings                  7. - List Receive Tape Headings                  8. - Monitor Data On Display                  9. --- Erase Receive Tape                  10. - Keyboard On Line                  11. - Tape Port: ST = 1 RT = 2 MT = 3</p> </div> <p><u>NOTE</u>: For KDPM<sup>3</sup>, line 5 will contain the current block number for the monitor tape cassette.</p>	<p>X remains, cursor returns to its original position.</p>
<p>3</p>	<p>Depress CNTRL MODE key.</p>	<p>Message on screen extinguishes, cursor goes to home position.</p>
<p>4</p>	<p>Enter a line of "Quick Brown Fox". End line with <sup>E</sup>T<sub>X</sub>. Enter several new lines. Enter a line of "Now is the time" end with <sup>E</sup>T<sub>X</sub>.</p> <p>Depress HOME.</p> <p>Depress PTR LCL.</p> <p>Depress REC TAPE LCL.</p> <p>Depress DISP SEND.</p> <p>Depress DISP LCL.</p>	<p>Message appears on display as typed.</p> <p>Cursor goes home.</p> <p>PTR LCL lamp lights.</p> <p>REC TAPE lamp lights.</p> <p>DISP SEND lamp lights.</p> <p>DISP LCL lamp lights.</p> <p>Cursor moves across message and stops at character position after first <sup>E</sup>T<sub>X</sub>.                  Printer motor starts and copies message. REC TAPE positions cassette to next available recording block and records message.</p> <p>When cursor reaches the first <sup>E</sup>T<sub>X</sub>, DISP LCL will extinguish.</p>

C. TESTING (Contd)

3. OFF-LINE CHECKOUT PROCEDURE (Contd)

STEP	PROCEDURE	RESULTS
5	Depress DISP LCL again.  NOTE: If terminal is optioned for home on send, the cursor will go to the HOME position and the first message will be sent again.	Cursor moves from present position to next ETx. Printer and REC TAPE copy message as in Step 4.
6	Depress PTR LCL.  Depress DISP SEND.  Depress REC TAPE LCL.	PTR LCL lamp extinguishes.  DISP SEND lamp extinguishes.  REC TAPE LCL lamp extinguishes.
7	Depress CNTRL MODE key.	Prepared message extinguishes, and control mode message appears.
8	① Using cursor positioning key, position cursor over X placed in line 2.  ② Depress SPACE BAR key.  ③ Depress LINE FEED key.  NOTE: Rec Tape Block number has changed from 000 to 003 indicating the Rec Tape has recorded two messages.	Cursor moves under direction of cursor control keys.  X is deleted.  Cursor returns to its original position.
9	Depress CNTRL MODE key.	Control mode message extinguishes, and original typed message appears. Cursor in HOME position.



STEP	PROCEDURE	RESULTS
10	Depress PTR LCL. Depress REC TAPE LCL. Depress DISP SEND. Depress DISP LCL.  Depress DISP LCL again. See Note in Step 5.	PTR LCL lamp lights. REC TAPE LCL lamp lights. DISP SEND lamp lights. DISP LCL lamp lights Cursor moves through messages until first <sup>E</sup> T <sub>X</sub> is reached. Printer and REC TAPE copy message. DISP LCL lamp extinguishes when the first <sup>E</sup> T <sub>X</sub> is reached. Cursor moves to next <sup>E</sup> T <sub>X</sub> , and DISP LCL lamp extinguishes.
11	Depress PTR LCL. Depress REC TAPE LCL. Depress DISP SEND.	PTR LCL lamp extinguishes. REC TAPE LCL lamp extinguishes. DISP SEND lamp extinguishes.
12	Depress CNTRL MODE key.	Typed message extinguishes, and control message appears on display.
13	Using the cursor control keys, position the cursor over the underline next to 7. Type an upper case X.  Depress LINE FEED key.	Cursor moves under control of cursor control keys.  X appears on display.  The control mode message extinguishes the REC TAPE rewinds and the following appears on the display.

INDICATES  
BLOCK NUMBER

```

001 THE QUICK BROWN FOX JUMPED
002 <<<<<<<<< NOW IS THE TIME
003 THE QUICK BROWN FOX JUMPED
004 <<<<<<<< NOW IS THE TIME
    
```

└──────────────────────────────────┘  
FIRST 56 CHARACTERS OF MESSAGE IN THAT BLOCK.

NOTE: When listing is complete, alarm will sound once.  
If no messages are recorded on tape, alarm will sound once and display will be blank.

## C. TESTING (Contd)

## 3. OFF-LINE CHECKOUT PROCEDURE (Contd)

STEP	PROCEDURE	RESULTS
14	Depress SPACE BAR.	Tape heading listing extinguishes, and control mode message appears on display.
15	<p>Using the cursor control keys, position cursor.</p> <p>① To character space to left of Receive Tape Block Number and enter an upper case R.</p> <p>② Position cursor over X in line 7 and depress Space Bar.</p> <p>③ Depress LINE FEED.</p>	<p>Cursor moves under control of cursor control key. R appears on display.</p> <p>X is deleted from display.</p> <p>Cursor returns to its original position. REC TAPE rewinds.</p> <p>When rewind is complete.</p> <p>4. 000 REC TAPE BLOCK NUMBER is displayed.</p>
16	<p>Using the cursor control keys, or CURSOR TAB key.</p> <p>(1) Position cursor to underline next to 11 in line 11.</p> <p>(2) Enter an upper case X.</p> <p>(3) Position cursor to 1 after ST = 1 in line 11.</p> <p>(4) Overwrite the 1 with a 2.</p> <p>(5) Position cursor to 2 after RT = 2 in line 11.</p> <p>(6) Overwrite the 2 with a 1.</p> <p>(7) Depress LINE FEED key.</p> <p><b>NOTE:</b> The above procedure has reassigned Cassette 1 as the receive cassette and Cassette 2 as the send cassette.</p>	<p>Cursor moves under control of the cursor positioning keys.</p> <p>X appears on display.</p> <p>Cursor moves under control of the cursor positioning keys.</p> <p>2 appears on display.</p> <p>Cursor moves under control of the cursor positioning keys.</p> <p>1 appears on display.</p> <p>Cursor returns to its original position in line 1.</p>



STEP	PROCEDURE	RESULTS
17	<p>Using the cursor control keys, or CURSOR TAB key.</p> <p>(1) Position cursor to first underline in row 6.</p> <p>(2) Enter a upper case X.</p> <p>(3) Depress LINE FEED.</p> <p style="text-align: center;">INDICATES BLOCK NUMBER</p> <pre>001 THE QUICK BROWN FOX JUMPED 002 &lt; NOW IS THE TIME 003 THE QUICK BROWN FOX JUMPED 004 &lt; NOW IS THE TIME</pre> <p style="text-align: center;">FIRST 56 CHARACTERS OF MESSAGE IN THAT BLOCK.</p> <p><u>NOTE:</u> When listing is complete, alarm will sound once. If no messages are recorded on tape, alarm will sound once and display will be blank.</p> <p><u>NOTE:</u> At any time during the listing of tape heading, the space bar may be depressed halting the tape heading listing. Depressing the space again will start the listings.</p> <p>If listing exceeds 24 lines (capacity of display), listing will stop at 24th line. Depressing the space bar will cause the next 24 listings to be displayed.</p>	<p>Cursor moves under control.</p> <p>X appears on display.</p> <p>Control mode message extinguishes, and the send tape headings are listed.</p>
18	Depress SPACE BAR.	The send tape heading listing extinguishes, and the control message appears on display.

## C. TESTING (Contd)

## 3. OFF-LINE CHECKOUT PROCEDURE (Contd)

STEP	PROCEDURE	RESULTS
19	<p>Using the cursor control keys or CURSOR TAB key.</p> <p>(1) Position cursor over first 0 in line 3.</p> <p>(2) Enter 001.</p> <p>(3) Depress LINE FEED.</p>	<p>Cursor moves under control of the cursor control keys.</p> <p>The current block number is overwritten with 001.</p> <p>Send block number changes counting down to 000 and then up to 001.</p>
20	Depress CNTRL MODE key.	Control mode message extinguishes and cursor returns to HOME position.
21	<p>Depress DISP LCL.</p> <p>Depress REC TAPE LCL.</p> <p>Depress PTR LCL.</p> <p>Depress SEND TAPE LCL.</p>	<p>DISP LCL lamp lights.</p> <p>REC TAPE LCL lamp lights.</p> <p>PTR LCL lamp lights.</p> <p>The SEND TAPE transfers all its messages (4). The display will copy to first <sup>E</sup>Tx, and DISP LCL will extinguish. The printer and REC TAPE will copy all messages.</p> <p>The SEND TAPE LCL lamp will extinguish when the message transfer is completed.</p>
22	<p>Depress REC TAPE LCL.</p> <p>Depress PTR LCL.</p> <p>Depress HOME.</p> <p>Depress CLEAR.</p>	<p>REC TAPE LCL lamp extinguishes.</p> <p>PTR LCL lamp extinguishes.</p> <p>Cursor goes to HOME position.</p> <p>Message is cleared from display.</p>
23	Depress CNTRL MODE key.	Send tape message on display extinguishes, and control mode message appears.

STEP	PROCEDURE	RESULTS
24	Using the cursor control keys. (1) Position cursor over first 0 in send tape block number. (2) Enter 001. (3) Position cursor over underline in line 8. (4) Enter an upper case X. (5) Depress LINE FEED.	Cursor moves under control of the cursor control keys. 001 appears in send tape block number. Cursor moves under control of cursor control key. X appears on display. Send tape rewinds to block 001. DISP LINE and DISP LCL lamps start flashing indicating monitor data on display mode.
25	Depress CNTRL MODE key.	Control mode message extinguishes and blank display with cursor in HOME position is displayed.
26	Depress REC TAPE LCL. Depress PTR LCL. Depress DISP LCL. Depress SEND TAPE LCL.	REC TAPE LCL lamp lights. PTR LCL lamp lights. DISP LCL lamp stays on steady DISP LINE continues to flash. SEND TAPE LCL lamp lights. Send tape transmits all four messages recorded on it. Printer, receive tape and monitor copy all four messages.
27	Depress REC TAPE LCL. Depress PTR LCL. Depress DISP LCL.	REC TAPE LCL lamp extinguishes. PTR LCL lamp extinguishes. DISP LCL starts to flash.
28	Depress CONTROL MODE key.	Received message extinguishes, and control message appears on display.

## C. TESTING (Contd)

## 3. OFF-LINE CHECKOUT PROCEDURE (Contd)

STEP	PROCEDURE	RESULTS
29	<p>Using the cursor control keys or CURSOR TAB key.</p> <ol style="list-style-type: none"> <li>(1) Position cursor over P in line 3.</li> <li>(2) Enter an upper case R.</li> <li>(3) Position cursor over X in line 8, depress SPACE BAR.</li> <li>(4) Position cursor to first underline in line 9. Enter three upper case Xs.</li> <li>(5) Depress LINE FEED.</li> </ol>	<p>Cursor moves under control of the cursor control keys.</p> <p>R overwrites P.</p> <p>X is deleted from display.</p> <p>XXX appears on display.</p> <p>DISP LINE and DISP LCL lamps stop flashing and are extinguished. Send and receive tapes rewind. *** appear in the tape block numbers while rewind is completed, 000 appears in the receive tape block number. 000 appears in the send block number.</p>
30	<p>Using the cursor control keys or CURSOR TAB key.</p> <ol style="list-style-type: none"> <li>(1) Position the cursor to the underline next to ll in line ll.</li> <li>(2) Enter an upper case X.</li> <li>(3) Position the cursor to the 2 after ST=2.</li> <li>(4) Overwrite the 2 with a 1.</li> <li>(5) Position the cursor to the 1 after RT=1.</li> <li>(6) Overwrite the 1 with a 2.</li> <li>(7) Depress the LINE FEED key.</li> </ol> <p><b>NOTE:</b> The above procedure has reassigned Cassette 1 as the send cassette and Cassette 2 as the receive cassette.</p>	<p>Cursor moves under control of the cursor positioning keys.</p> <p>X appears on display.</p> <p>Cursor moves under control of the cursor positioning keys.</p> <p>1 appears on display.</p> <p>Cursor moves under control of the cursor positioning keys.</p> <p>2 appears on display.</p> <p>Cursor returns to its original position in line 1.</p>

STEP	PROCEDURE	RESULTS
31	Using the cursor positioning keys or CURSOR TAB key, position the cursor to the first underline following 9 in line 9.  Enter three upper case Xs.  Depress the LINE FEED key.	Cursor moves under control of the cursor position keys.  XXX appears on display.  Cursor returns to its original position in line 1. REC TAPE (Cassette 2) rewinds. *** appears in the tape block number while rewind is taking place.
32	For KDPM <sup>2</sup> sets, go to 5. On-Line Checkout, Page 2-82.  For KDPM <sup>3</sup> sets, go to 4. Monitor Tape Cassette Checkout.	

#### 4. MONITOR TAPE CASSETTE CHECKOUT

The off-line checkout procedure of Part C does not check the operation of the monitor tape cassette since the monitor tape cassette (Cassette 3) has no local mode of operation. To perform an on-line check of the monitor tape cassette drive, two methods are available, depending on system protocol.

##### 1. METHOD 1

If the system provides for on-line testing of terminals, a sample test message may be sent to the Test Center. After the test message has been sent, Cassette 3 should be rewound, reassigned to the send cassette and a local send tape to display transfer done. The message can then be checked to insure the monitor tape correctly copied the sent message. Rewind the tape, reassign Cassette 3 to be the receive tape. Perform the erase function on Cassette 3 and then reassign Cassette 3 to be the monitor tape cassette.

##### 2. METHOD 2

If system protocol does not allow on-line testing, temporarily disconnect the terminal from the line by removing the line connections. Add the half-duplex strap between terminals 2 and 3 of TB101 of interface, if it was removed during installation. For this test, the clear-to-send input must be turned on or temporarily remove the 303181 or 303184 circuit card in slot Z4 of the interface assembly. Now, the following procedure may be followed to check out the monitor tape cassette drive. During this test, the set must be in the manual mode of operation (POLL/SEL lamp not lit).

## C. TESTING (Contd)

4. MONITOR TAPE CASSETTE CHECKOUT (Contd)CHECKOUT PROCEDURE

STEP	PROCEDURE	RESULTS
1	Prepare a test message on display in keyboard-display mode (DISP LINE, DISP LCL and DISP SEND lamps not lit). Start message with SO <sub>H</sub> . End message with E <sub>Tx</sub> . Home cursor.	Message appears on display as typed on keyboard.
2	Depress PTR LINE.  Depress DISP SEND.  Depress DISP LINE.	PTR LINE lamp lights.  DISP SEND lamp lights.  DISP LINE lamp lights. Cursor moves through message and stops at character position after E <sub>Tx</sub> . Printer motor starts and printer copies message. Display lamps will extinguish, if Option U2 is installed. The DISP SEND lamp will extinguish if Option U1 is installed.
3	Depress DISP LINE if lit.  Depress CNTRL MODE.	DISP LINE lamp extinguishes.  Test message disappears from display and control message appears.
4	Using cursor control keys or CURSOR TAB key.  (1) Position cursor to the character position to the left of the tape block number in line 5.  (2) Enter an upper case R.  (3) Depress the LINE FEED key.	Cursor moves under control of the cursor positioning keys.  R appears on display.  Cursor returns to its original position in line 1. *** appears in the monitor tape block while the monitor tape is rewinding. When the rewind is completed, 000 appears in the monitor tape block.

STEP	PROCEDURE	RESULTS
5	<p>Using the cursor positioning keys.</p> <p>(1) Position cursor to the underline after l1 in line 11.</p> <p>(2) Enter an upper case X.</p> <p>(3) Position cursor to the 1 after ST=1.</p> <p>(4) Overwrite the 1 with a 3.</p> <p>(5) Position the cursor to the 3 after MI=3.</p> <p>(6) Overwrite the 3 with a 1.</p> <p>(7) Depress the LINE FEED key.</p> <p><u>NOTE:</u> Cassette 3 (monitor) has now been reassigned as the send tape and Cassette 1 has been reassigned as the monitor tape.</p>	<p>Cursor moves under control of the cursor positioning key.</p> <p>X appears on display.</p> <p>Cursor moves under control of the cursor positioning keys.</p> <p>3 appears on display.</p> <p>Cursor moves under control of the cursor positioning keys.</p> <p>1 appears on display.</p> <p>Cursor returns to its original position in line 1.</p>
6	<p>Enter block number of test message (001 if cassette was not used before) in line 3. Depress LINE FEED.</p>	<p>Send tape cassette positions to test message.</p>
7	<p>Depress CNTRL MODE. Position cursor to the beginning of the line after original message.</p> <p>Depress DISP LCL.</p> <p>Depress SEND TAPE LCL.</p>	<p>Control message disappears and original test message appears.</p> <p>DISP LCL lamp lights. SEND TAPE LCL lamp lights.</p> <p>Test message appears on display below original message. These messages should be the same, except line feeds (≡) which were sent and stored on monitor tape are displayed as ←, ← ≡.</p>
8	<p>Depress the SEND TAPE LCL key.</p> <p>Home cursor.</p> <p>Depress CLEAR key.</p>	<p>SEND TAPE LCL lamp extinguishes.</p> <p>Cursor goes to HOME position.</p> <p>Both messages are cleared from display.</p>
9	<p>Depress CNTRL MODE key.</p>	<p>Control message appears on display.</p>

## C. TESTING (Contd)

4. MONITOR TAPE CASSETTE CHECKOUT (Contd)

STEP	PROCEDURE	RESULTS
10	<p>Using the cursor positioning key or CURSOR TAB key.</p> <p>(1) Position the cursor to the character space to the left of the send tape block number.</p> <p>(2) Enter an uppercase R.</p> <p>(3) Depress the LINE FEED key.</p>	<p>Cursor moves under control of the cursor positioning key.</p> <p>R appears on display.</p> <p>Cursor returns to its original position in line 1. *** appears in the send tape block number while the send tape is rewinding. 000 appears in the send tape block number when rewind is completed.</p>
11	<p>Using cursor positioning keys,</p> <p>(1) Position cursor to underline after 11 in line 11.</p> <p>(2) Enter an uppercase X.</p> <p>(3) Position cursor to the 3 after ST=3.</p> <p>(4) Overwrite the 3 with a 2.</p> <p>(5) Position the cursor to the 2 after RT=2.</p> <p>(6) Overwrite the 2 with a 3.</p> <p>(7) Depress the LINE FEED key.</p> <p><u>NOTE:</u> Cassette 3 has now been reassigned as the receive tape and Cassette 2 has been reassigned as the send tape.</p>	<p>Cursor moves under control of the cursor positioning keys.</p> <p>X appears on display.</p> <p>Cursor moves under control of the cursor positioning keys.</p> <p>2 appears on display.</p> <p>Cursor moves under control of the cursor positioning keys.</p> <p>3 appears on display.</p> <p>Cursor returns to its original position in line 1.</p>
12	<p>Position the cursor to the first underline following 9 in line 9.</p> <p>Enter three uppercase Xs.</p> <p>Depress the LINE FEED key.</p>	<p>Cursor moves under control of the cursor positioning keys.</p> <p>XXX appears on display.</p> <p>Cursor returns to the original position in line 1. The erase function is performed on the tape in Cassette 2.</p>



STEP	PROCEDURE	RESULTS
13	<p>Using the cursor positioning key or CURSOR TAB key.</p> <p>(1) Position the cursor to the underline after ll in line ll.</p> <p>(2) Enter an uppercase X.</p> <p>(3) Position the cursor to the 2 after ST=2.</p> <p>(4) Overwrite the 2 with a 1.</p> <p>(5) Position the cursor to the 3 after RT=3.</p> <p>(6) Overwrite the 3 with a 2.</p> <p>(7) Position the cursor to the 1 after MT=1.</p> <p>(8) Overwrite the 1 with a 3.</p> <p>(9) Depress the LINE FEED key.</p> <p><b>NOTE:</b> Cassette 1 has now been reassigned as the send tape, Cassette 2 has been reassigned as the receive tape and Cassette 3 has been reassigned as the monitor tape.</p>	<p>Cursor moves under control of the cursor positioning keys.</p> <p>X appears on display.</p> <p>Cursor moves under control of the cursor positioning keys.</p> <p>1 appears on display.</p> <p>Cursor moves under control of the cursor positioning keys.</p> <p>2 appears on display.</p> <p>Cursor moves under control of the cursor positioning keys.</p> <p>3 appears on display.</p> <p>Cursor returns to its original position in line 1.</p>

Remove the half-duplex strap between terminals 2 and 3 of TB101 of the interface assembly, if it was installed for this test. Replace the 303181 or 303184 circuit card in slot Z4, if it was removed for this test. Reconnect the signal line connections in the interface unit at the rear of the test.

### C. TESTING (Contd)

#### 5. ON-LINE CHECKOUT

To perform an on-line check of the set, two methods are available depending on system protocol.

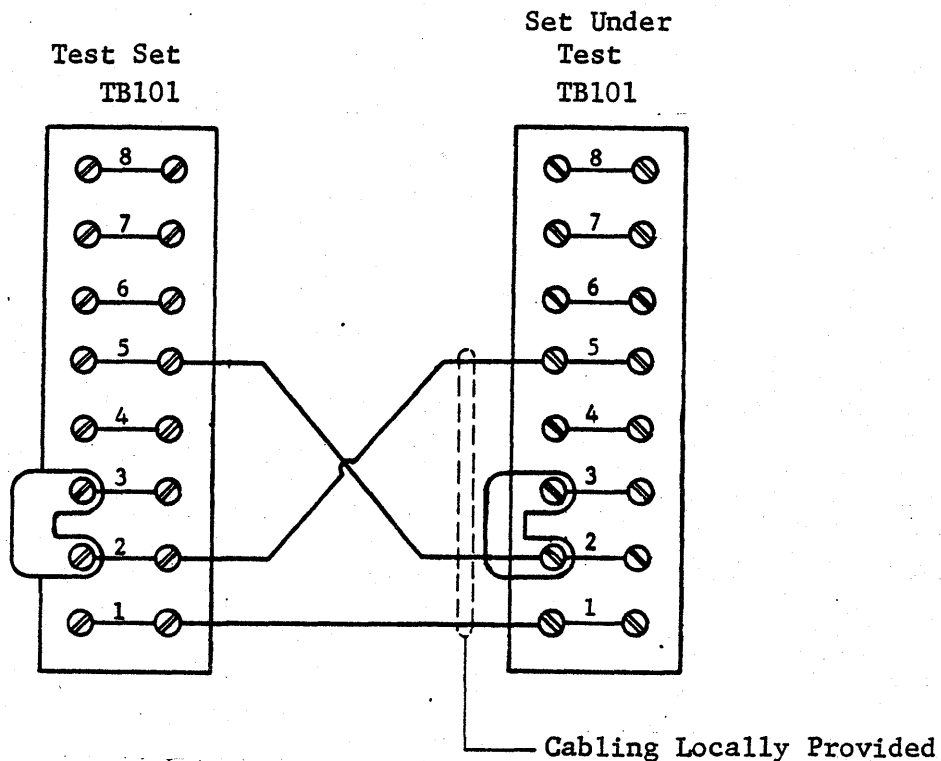
##### 1. METHOD 1

If system protocol allows for on-line testing, a sample test message may be sent to the Test Center in both the manual and poll/select modes. In the poll/select mode, the Test Center must send polling sequences before the set under test can send, and selecting sequences before the set under test can receive.

##### 2. METHOD 2

If system protocol does not allow on-line testing or if transmission facilities to the Test Center are not available, an alternative method called back-to-back can be used.

This method requires the use of another functional KD Set (referred to as test set). The test set should be optioned for 8-level ASCII code operation at the same baud rate as the set being tested is optioned (Option ZZ). The test set should be connected as indicated below.



In either arrangement, the clear-to-send input must be turned on (+6 V). If no clear-to-send input is available, temporarily remove the 303181 or 303184 circuit card in slot Z4 of each interface assembly.

MANUAL MODE CHECKOUT

The manual mode checkout must be performed with the POLL/SEL lamp not lit and the 5-level communication interface not selected (no character X in line 1 of control mode) in both the test set and the set under test.

STEP	PROCEDURE	RESULTS
1	Locally prepare a test message on set under test. Start message with $S_{OH}$ and end message with $E_{TX}$ .	Message appears on display.
2	Condition test set to receive (DISP SEND and POLL/SEL not lit; DISP LINE lamp lit).	
3	Home cursor on set under test.  Depress DISP SEND.  Depress DISP LINE.	Cursor goes to HOME position.  DISP SEND lamp lights.  DISP LINE lamp lights.  Cursor moves through message and stops at character position after $E_{TX}$ .  Message is received on display of test set.
4	<p><u>NOTE:</u> If Option Z1 (Home on Send) is installed, the cursor will go to home when the DISP LINE key is depressed. If Option F1 (printer on-line required to send), PTR LINE indicator must be lighted before sending will start. If Option H1 (monitor tape on required to send) is installed, MONITOR TAPE indicator must be lit before sending will start.</p> Locally copy test message on display on receive tape (Cassette 2) of the set under test. (Refer to How to Operate Manual 405 for procedure.)  Reassign Cassette 2 as the send tape. (Refer to How to Operate Manual 405 for procedure.)  Position send tape to send test message. Condition test set to receive.  Depress SEND TAPE LINE.	Send tape sends test message and test set receives message on display.

C. TESTING (Contd)5. ON-LINE CHECKOUT (Contd)

STEP	PROCEDURE	RESULTS
5	<p>On set under test, enter control mode and place keyboard on-line. Type a character X in line 10 and depress LINE FEED. Exit control mode. Condition test set to receive.</p> <p>Type a test message on keyboard.</p>	<p>Message will be received on test set display.</p> <p><u>NOTE:</u> If Option D2 was selected, message will be copied on set under test display also.</p>
6	<p>Enter control mode. Delete the X in line 10 and depress the LINE FEED key.</p> <p>Exit control mode.</p>	
7	<p>Locally prepare a test message on test set. Start message with <math>S_{OH}</math> and end with <math>E_{OT}</math>.</p> <p>Condition set under test to receive (DISP SEND lamp not lit; DISP LINE, PTR LINE, and REC TAPE LINE lamps lit).</p> <p>Send test message from test set.</p>	<p>Display, printer and receive tape receive message from test set.</p> <p><u>NOTE:</u> Set under test will take received <math>E_{OT}</math>, transform it into an <math>E_{XT}</math>, display it on display and record it on receive tape.</p>
8	<p>To check receive tape: Depress CNTRL MODE. Place an X in line 7 of control message.</p> <p>Depress LINE FEED.</p>	<p>Control mode message appears.</p> <p>Receive tape listing will be displayed with first 56 characters of test message.</p>

STEP	PROCEDURE	RESULTS
9	Depress the space bar.  Delete the X in line 7.  Rewind all tapes and reassign Cassettes 1, 2 and 3 so that Cassette 1 is send tape, Cassette 2 is receive tape and Cassette 3 is monitor tape. Refer to How to Operate Manual 405 for procedures.	The control mode message appears on display.

## 6. CASSETTE TEST PROGRAM

### Program Description

The CP10.006 Cassette Test Program consists of a programmed cassette tape and a modified 410504 circuit card, which functions to load the program tape into the C400 Controller.

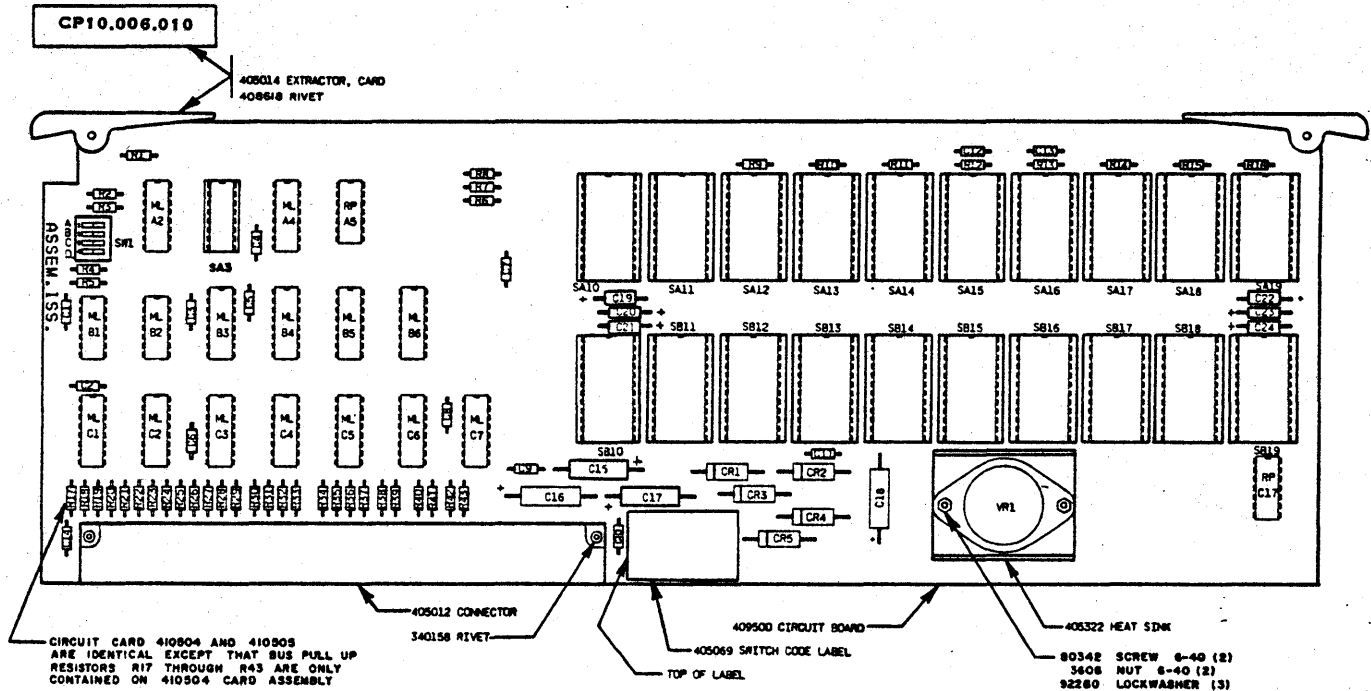
The parts required for this test are as follows:

### Parts List

<u>Part No.</u>	<u>Description</u>
CP10.006.004	Programmed Cassette - CD Test Program for 40C434 Controller
CP10.006.010	Modified 410504 Circuit Card With Four Programmed EPROMS Containing Program Tape Loader Program (See Fig. 1.)
CP10.006.100	EPROM
CP10.006.101	EPROM
TP405403	EPROM
TP451003-1	EPROM

## C. TESTING (Contd)

## 6. CASSETTE TEST PROGRAM (Contd)



The Basic 410504 Circuit Card Becomes  
CSD Part No. CP10.006.010 When The  
Following Components Are Added:

<u>LOCATION</u>	<u>PART NUMBER</u>
MLA3	405403
MLA8	451002-1
MLA9	CP10.006.100
MLB8	451003-1
MLB9	CP10.006.101

Fig. 1

Parts can be obtained from Teletype Custom Systems Division. See Page 2-4 for ordering information.

This program functions to:

Verify the condition of cassette tapes.

Provide the user with an aid for troubleshooting cassette drives (CD's).

Two parts constitute the program.

Part one is the cassette tape verification stage. Test characters are written from controller memory to the tape which is to be verified. The tape is then read nine times and compared to controller memory. Word numbers of errored words will print out during each read cycle. This test will run approximately 25 minutes.

Part two of the test program consists of 38 steps which write and read approximately 10 million characters to/from the cassette on a block by block basis. Errored blocks will print out and indicate the type of error.

The test program will classify cassette tape errors as "soft" errors. It will rerun the errored blocks up to nine times. If the error does not clear, the program will classify it as a "hard" error. Other types of error messages are as follows:

#### Error Printouts

1. Cassette not in place
2. Soft error (cassette error).
3. Hard error (repeated cassette error)
4. Positioning error (controller could not find marker)
5. In write mode not received -- disabled!
6. Two wrong positions -- off until rewritten!
7. This tape failed at word #
8. Drive disabled -- no SS1 or no cassette!
9. Drive disabled -- too many errors!
10. Tape fails tape test -- drive disabled!  
(Possible response to "REC TAPE LINE" "Y".)

Part two of this program will run for approximately six hours to complete the 38 steps one time, unless otherwise terminated. This will give the maintenance personnel adequate time to perform cassette drive analysis.

Table 1 lists the specific test program steps. Steps 1A and 1B constitute the tape verification stage. This test is initiated by depressing the "REC TAPE LINE", "Y" keys on the operator console.

**NOTE:** References in this procedure will be to "REC TAPE LINE" key, however, on some units containing a 40K108RDF keyboard (Terp System), the depressed key will be "NEXT INCOM". In any case, the depressed key should be the eighth keytop from the left in the top row of keytops.

"REC TAPE LINE" "Z" will execute "REC TAPE LINE" "Y" repeatedly.

Steps 1C through 38 are part two of the test program and function on "REC TAPE LINE" "Q".

Any other commands are not related to this test procedure even if they are functional.

Operating the "DISP LINE" ("LOCAL" for Terp) key after the test has begun, will stop the test and rewind all cassette tapes.

One to six cassette drives can be accommodated by the program. When multiple drives are used, the drive input port number will print out with the program responses. This allows service personnel to relate the printout to the drive that caused it. Sample test copy is included in this procedure for the user's reference.

The user is required to provide one 40C400 Controller for test program use. The controller must be reconfigured and optioned as follows.

C. TESTING (Contd)

6. CASSETTE TEST PROGRAM (Contd)

Test Terminal Configuration

Arrange the controller circuit cards and option them as shown in Fig. 2.

**CAUTION:** BEFORE HANDLING CIRCUIT CARDS, ATTACH A 346392 STATIC DISCHARGE WRIST STRAP OR EQUIVALENT. ALSO, ALWAYS TURN CONTROLLER DC POWER OFF BEFORE REMOVING OR INSERTING CIRCUIT CARDS.

CONTROLLER CONFIGURATION

Arrange Circuit Cards -- Remove Extra Cards

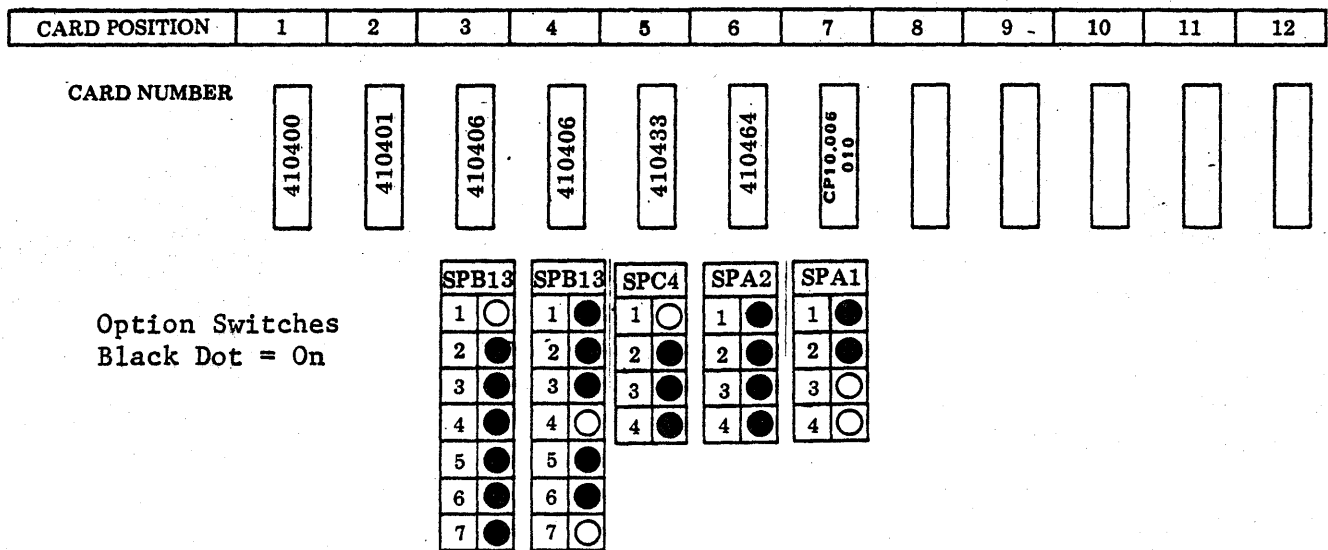


Fig. 2

One Model 40 Printer and one operator console (opcon) are required. The printer must be optioned for no error character on parity error. Connect the SSI cables of these units to the controller as shown in Fig. 3.

Two additional cassette drives may be connected to the controller as shown in Fig. 3.



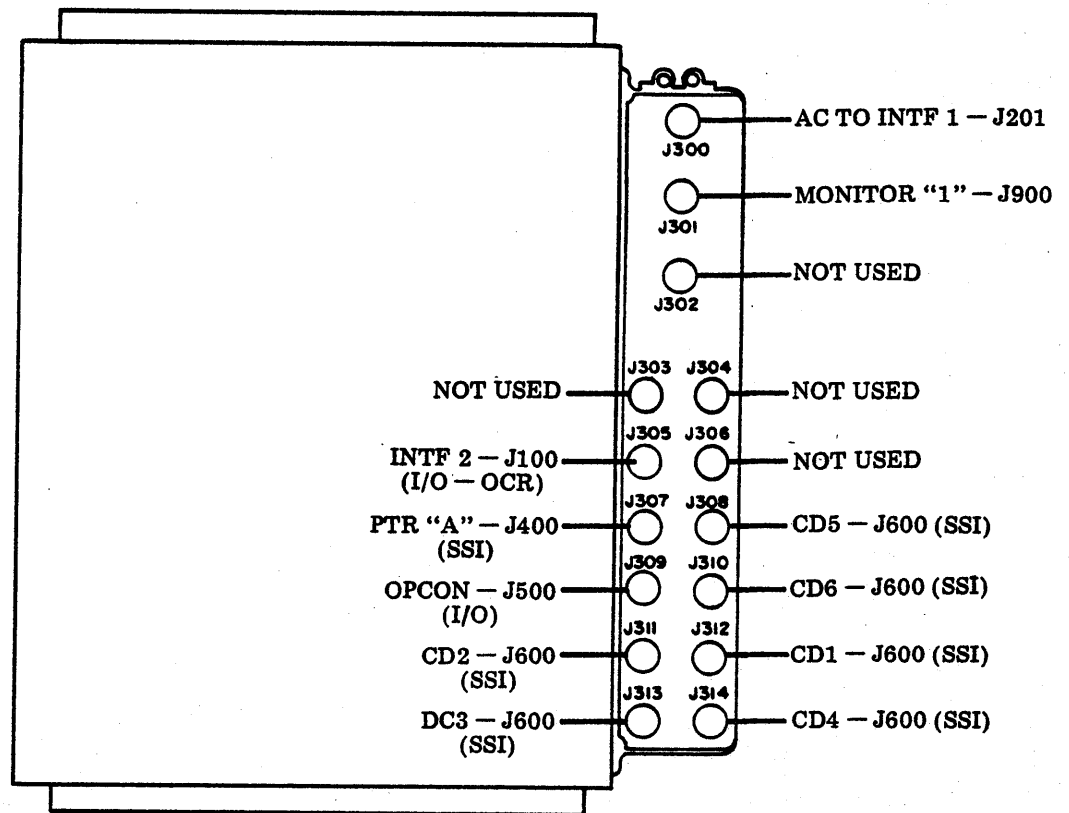
CONTROLLER INPUT-OUTPUT

Fig. 3

Pretest Precautions

Observe all usual precautions when handling cassette tapes such as never turning off ac power when a cassette is running.

The CP10.006.004 cassette should have been delivered in the write protect (write inhibit) mode. Be sure the write protect tab is up and to the right before using. Refer to Fig. 4.

C. TESTING (Contd)6. CASSETTE TEST PROGRAM (Contd)

NOTE: Write inhibit tab of CP10.006.004 cassette program tape must ALWAYS be to the right (window uncovered) to prevent destruction of program.

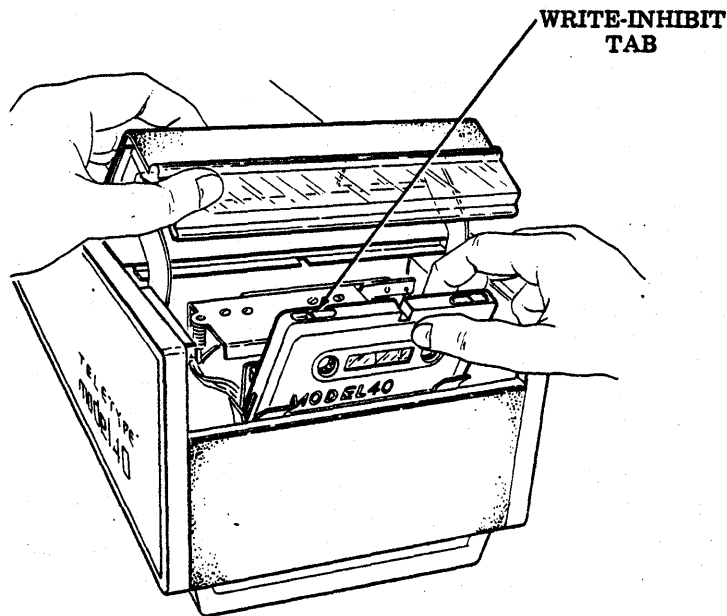


Fig. 4

Clean all cassette drive heads before and after testing. Check the 403238 tape cleaner and replace if required.

Double check test terminal cable connections, Fig. 3, and controller card arrangement and options according to Fig. 2.

Program Loading

Remove all cassette tapes, if any, from all cassette drives.

Turn on ac power to the test terminal.

Power On Reset (POR) the 40C400 controller by operating its power supply switch to the OFF and then ON position.

Be sure the CP10.006 program cassette is write inhibited. Insert the program tape into any one of the cassette drives which is known to be in good working order. Push the cassette forward to start in the normal manner. The test program will load into the controller memory.

The monitor cursor will appear and the "DISP LINE" ("LOCAL" for Terp) lamp will light if the program has loaded properly.

If the program did not load properly, repeat the load procedure by power on resetting the power supply.

When the cassette drive RUN/TEST lamp has gone off, remove the program tape from the drive and store away. Never remove a cassette when the lamp is on.

Load the desired number of drives with cassette tapes to be checked. All tapes will go thru the normal self test upon loading. A flashing RUN/TEST lamp indicates that the self-test has failed.

New cassettes may not be added after testing has begun. However, any drive may be removed from test at any time by disconnecting its SSI cable from the controller.

Program Execution

Tape verification. Operator console should now have "DISP LINE" (or "LOCAL") lighted.

Home the cursor (HOME position is fourth line down). Now Clear.

Depress "REC TAPE LINE" "Y" on the opcon. See below for sample copy for explanation of this command.

Cassette Drive 38 Step Exercise

Depress "DISP LINE" (or "LOCAL"). Home the cursor and clear the monitor.

Depress "REC TAPE LINE" "Q". Refer to Page 2-36 for explanation of this command and see the sample copy.

Depressing the "DISP LINE" (or "LOCAL") key during the test will stop the test and cause all cassettes to rewind.

Printout from "REC TAPE LINE" "Y". Only the port number column has meaning at the right hand side last four columns. The first column will indicate the number of times "REC TAPE LINE" "Y" has been repeated if "REC TAPE LINE" "Z" has been used to do "Y" repeatedly.

Response to "REC TAPE LINE" "Y"

Monitor will display "40 CD TEST PROGRAM".

If tape has no errors, no other printout will occur.

Monitor will display "TEST COMPLETE" after end of test.

```

40CD TEST PROGRAM
THIS TAPE FAILED AT WORD #000,411      01      5 01
THIS TAPE FAILED AT WORD #000,411      01      5 01
THIS TAPE FAILED AT WORD #001,195      01      5 01
THIS TAPE FAILED AT WORD #001,195      01      5 01
THIS TAPE FAILED AT WORD #000,914      01      5 01
THIS TAPE FAILED AT WORD #000,914      01      5 01
THIS TAPE FAILED AT WORD #001,195      01      5 01
THIS TAPE FAILED AT WORD #000,914      01      5 01
THIS TAPE FAILED AT WORD #000,914      01      5 01
TEST COMPLETE
    
```

Printout using "REC TAPE LINE" "Q" when there are no cassettes in any of the cassette drives. This sample is included to illustrate the meaning of the columns at the right-hand side of the page. The two digits at the extreme right will indicate the program step in process during the execution of "REC TAPE LINE" "Q".

C. TESTING (Contd)

6. CASSETTE TEST PROGRAM (Contd)

Program Execution (Contd)

The next column to the left is the input port number of the cassette SSI cable to the C400 controller; Port 6 will correspond to controller SSI connector J310, Port 5 will correspond to connector J308 etc. The next two three digit numbers to the left are the block number and the last column to the left has no significance to this procedure.

	PROGRAM STEP NUMBER				
		CASSETTE DRIVE PORT NUMBER			
			BLOCK NUMBER		
CD TEST PROGRAM					
DRIVE DISABLED -- NO SSI OR NO CASSTTE!	01	000	000	1	01
DRIVE DISABLED -- NO SSI OR NO CASSTTE!	01	000	000	2	01
DRIVE DISABLED -- NO SSI OR NO CASSTTE!	01	000	000	3	01
DRIVE DISABLED -- NO SSI OR NO CASSTTE!	01	000	000	4	01
DRIVE DISABLED -- NO SSI OR NO CASSTTE!	01	000	000	5	01
DRIVE DISABLED -- NO SSI OR NO CASSTTE!	01	000	000	6	01

Printout from "REC TAPE LINE" "Q". This sample shows the entire 38 steps of the program using a good cassette tape being read from the cassette drive which is connected to Port 5 (J308). Note that the printout indicates that Ports 1, 2, 3, 4, and 6 are either not being used or have defective drives and/or cassette tapes. Also note that the cassette tape ran error free until block 461 during Step No. 36. At this time an error was detected; when the controller reread the tape the fifth time, the error had cleared and the program continued.



C. TESTING (Contd)6. CASSETTE TEST PROGRAM (Contd)

## CHART

STEP	PROCEDURE
Step 1A	The ASCII characters "+" and "3" are written onto the tape continuously over an area equivalent to approximately 520 blocks.
Step 1B	The tape is then read and each character received by the C400 is compared bit by bit to "+" and "3".
Step 1C	The ASCII characters "+" and "3" are written onto Channel 1 and the ASCII characters "T" and "L" are written onto Channel 2. There will be 129 SSI words containing +3 on Channel 1 and 129 SSI words containing TL on Channel 2. In addition, there will be two more SSI words on Channel 1, a word containing (New Line-ETX) and a block check word. Also, Channel 2 will contain one more SSI word (Block No.). The above block of 261 SSI words or 522 characters is written onto the tape with "markers". A total of 500 blocks are written (0 to 499).
Step 2 through Step 10	Read one block at a time.
Step 11	The same as Step 1C except TL is written onto Channel 1 and +3 is written onto Channel 2. The blocks are written without "markers".
Step 12	Read block 490 and then read block 10.
Step 13 through Step 21	Read one block at a time.
Step 22	The same as Step 1C.
Step 23	The same as Step 12.
Step 24 through Step 32	Read one block at a time.
Step 33	Write with "markers" (TL on Channel 1 and +3 on Channel 2) followed by a "REW" and then a READ. This test is performed one block at a time.
Step 34	Write without "markers" (+3 on Channel 1 and TL on Channel 2) followed by a "REW" and then a READ. This test is performed one block at a time.

## CHART (Contd)

STEP	PROCEDURE
Step 35	Same as Step 12.
Step 36	Same as Step 33.
Step 37	Same as Step 34.
Step 38	Read Block 0, 50, 100, 150, 200, 250, 300, 350, 400, 450, 490, 451, 401, 351, 301, 251, 201, 151, 101, 51 and 10.

The following procedure is used to check the outputs of the magnetic tape head assembly. The controller should be configured as it was for use with the Cassette Test Program. See Fig. 2, Page 2-32 for configuration. After execution of this procedure, the controller should be configured in it's original state. The tape head checkout procedure utilizes a special cassette tape No. 10.006.020 which is available from Teletype Custom Systems Division. See Page 2-4 for ordering information. The 410764 circuit card contained in the cassette drive unit must be electrically extended from the base to provide access to the components. Refer to D. TROUBLESHOOTING, Page 2-40 for further information.

Observe all usual precautions when handling cassette tapes such as never turning off ac power when a cassette is running.

The CP10.006.020 Cassette Tape should have been delivered in the write protect (write inhibit) mode. Be sure the write protect tab is up and to the right before using.

Turn on ac power to the test terminal.

Power On Reset (POR) the 40C400 controller by operating its power supply switch to the OFF and then ON position.

Be sure the CP10.006.020 Program Cassette is write inhibited. Insert the program tape into the cassette drive. Push the cassette forward to start in the normal manner. The tape should be allowed to run to the end and the check should be made only with the tape moving in the forward direction.

If the program did not load properly, repeat the load procedure by power on resetting the power supply. The power supply should also be reset before each new check.

C. TESTING (Contd)

6. CASSETTE TEST PROGRAM (Contd)

With tape moving in the forward direction, check anode of CR16 (with Channel 1 of scope), and anode of CR17 (with Channel 2 of scope) for waveform shown in Fig. 5. The two waveforms must be in phase within  $\pm 10$  microseconds. If waveforms do not meet requirement, replace the 403241 tape head assembly. Refer to F. DISSASSEMBLY/ REASSEMBLY AND PARTS for replacement procedure.

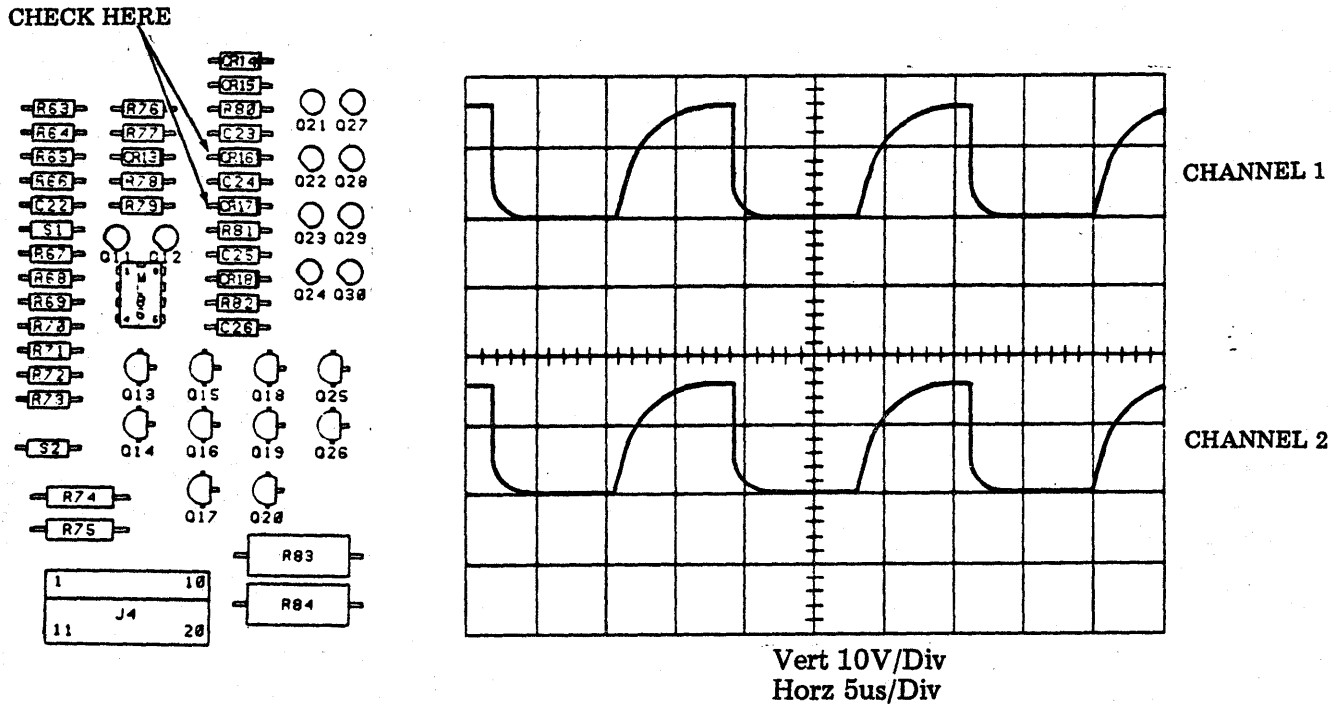


Fig. 5

D. TROUBLESHOOTING

1. GENERAL

This section provides troubleshooting methods to be followed in repairing the Tempest Model 40 Cassette Drive Units.

When trouble is encountered in testing a cassette drive, the diagnostic steps and corrective measures should be followed to arrive at the trouble source. After corrective steps have been verified by successfully repeating the test that disclosed the problem, the testing procedure should be resumed.

Functional schematics have been supplied in 6. FUNCTIONAL SCHEMATICS of this section as an aid to troubleshooting.

Waveshapes and voltage levels specified for troubleshooting the cassette drive logic circuit card are to be checked with an oscilloscope unless stated otherwise.

Continuity and dc voltage checks specified for troubleshooting are to be made with a multimeter.



If the cassette drive fails to perform its intended function, the difficulty should be analyzed in a logical manner to recognize the source of the problem. Above all, make certain it is the cassette drive which is causing the problem rather than associated apparatus or electronics.

Take the time to pinpoint the exact nature of the difficulty rather than just a general description. For example, it would be of much more use to be able to say that "The brake fails to operate properly" rather than "The unit is failing to transmit data paoperly".

Check to see that all springs are attached and parts mounted properly. No adjustment should be changed indiscriminately in an effort to correct a difficulty which is not fully understood. Very often this will only result in more than one difficulty being present.

As an aid to troubleshooting, the following list of troubles and remedies are intended to serve as a guide in the analysis and correction of difficulties. The associated schematic wiring diagrams of this specification are required for reference. These remedies are intended for field repair and, as such, will call for the most expeditious solution to the problem. For instance, if a clutch fails, the immediate solution would be to replace it.

1. GENERAL (Contd)

<u>SYMPTOM</u>	<u>POSSIBLE CAUSE</u>	<u>REMEDY</u>
Cassette drive motor does not turn on.	1. Loss of ac power.	Check all fuses and switches between 40CD101 and ac source.
Motor runs, but nothing else operates, self-test is not performed.	1. Interface circuit open.	Make sure interface circuit is complete.
	2. No dc power.	Check power source and replace faulty portion.
	3. Cassette in place or file protect switch are inoperative.	Readjust switches per <u>E. ADJUSTMENTS AND LUBRICATION.</u>
Either brake or clutch fail to operate.	1. Open coil.	Replace complete set of faulty items.
Either clutch fails to operate properly.	1. Dirty clutch armature rotor faces.	Clean faces.
	2. Improper clutch adjustment.	Readjust clutch per <u>E. ADJUSTMENTS AND LUBRICATION.</u>
Either brake fails to operate properly (usually evidenced by slack in the tape).	1. Dirty armature face.	Clean armature face.
	2. Improper brake adjustment.	Readjust per <u>E. ADJUSTMENTS AND LUBRICATION.</u>
Garbling of data in read or write mode.	1. Dirty head or tape.	Clean the tape head.
	2. Damaged tape, ie, wrinkled tape or oxide layer is scratched.	Use new tape cassette.
	3. Dirty tape cleaner.	Replace cleaner.
	4. Faulty belt adjustments.	Readjust "O Ring" belt and flat belt per <u>E. ADJUSTMENTS AND LUBRICATION.</u>

D. TROUBLESHOOTING (Contd)

SYMPTOM

Cleaning bobbin fails to rotate.

POSSIBLE CAUSE

1. Faulty adjustment.
2. Weak flat spring.
3. Weak tension spring.

REMEDY

Readjust bobbin per E. ADJUSTMENTS AND LUBRICATION.

Bend spring per E. ADJUSTMENTS AND LUBRICATION.

Replace spring.

D. TROUBLESHOOTING (Contd)2. ERROR ANALYSIS

Table A is provided as a guide for associating errors with likely causes and recommends specific areas of the cassette drive to be checked.

TABLE A

## Errors Caused By Acceleration Problem:

1. Generally occur in first third of block.
2. Can result in incomplete block error with more than one missing SSI word.
3. Will usually cause errors on both channels.
4. Errors will usually change with each reread.
5. Will not cause character errors with just one or two bits incorrect.
6. If written with acceleration problem, data cannot be recovered correctly no matter how many rereads are attempted.

## Errors Caused By Tape:

1. Can occur anywhere in block.
2. Can occur on one or both channels.
3. Damaged tape will usually cause incomplete block errors. (Even if rewritten, block cannot be recovered correctly.)
4. Debris on tape will usually cause one character error which could be distributed throughout the block.
5. Blocks written with debris on tape cannot be recovered correctly no matter how many rereads are made even if debris falls off of tape.

## Errors Caused By Tape Head:

1. If head has debris on it, incomplete block errors will result. (Lost data could be from one or both channels).
2. If skew adjustment is out, data errors will result throughout block.
3. If mechanical dimensions are out, data errors and incomplete blocks will result.

## Errors Caused By Circuit Card:

1. Generally circuit card errors will result in many or all blocks being either written or read incorrectly.

Types of errors and the manner in which they manifest themselves are listed in Table B. The following procedures are recommended for testing and analyzing test results.

The drive in question should be allowed to complete enough steps of the test program to allow sufficient data for analysis.

The first step of error analysis is to remove the tape from the drive in question and verify the tape in a known good drive. If the tape does not verify properly, it should be discarded and another properly conditioned tape installed in the drive in question. The drive in question should be watched closely because it may be damaging tapes. If the tape verifies properly, the drive in question should be examined.

If errors occur on both channels and near the beginning of the block, acceleration is most likely the cause of the errors. Check the items listed under ACCELERATION ERRORS, and also check the items listed under IRREGULAR DATA PATTERN.

If the errors occur only on one channel, the items listed under HEAD RELATED ERRORS may apply. If these items are suspected, replace the 410764 circuit card with a known good card.

If the errors occur anywhere throughout a block and on both channels, check the items listed under ACCELERATION ERRORS and IRREGULAR DATA PATTERN. If these items are okay, replace the 410764 circuit card with a known good card.

If the errors are positioning type errors, check the items listed under COAST PROBLEMS and CLUTCH PICKUP PROBLEMS.

If a cassette drive will not verify a cassette tape, check the items listed under MOTION PROBLEMS.

#### TABLE B

##### ACCELERATION ERRORS

1. Check connections at Berg connector (brakes and clutches).
2. Check brake gap adjustment (forward and reverse).
3. Check holdback torque with tension monitor.
4. Check belt tension.
5. Check clutch torque.
6. Check yield spring tension.
7. Check end play and side to side play of all shafts.
8. Check brake disc and armature (both forward and reverse).

##### IRREGULAR DATA PATTERN

1. Check end play and side to side play of all shafts.
2. Check clutch torque.
3. Check belt tension.
4. Check yield spring tension.
5. Check brake disc and armature.

##### HEAD RELATED ERRORS

1. Channel amplitude incorrect.
2. Skew (read head outputs out of phase).
3. Flutter (one channel jittering with respect to other).
4. Check for wear.

D. TROUBLESHOOTING (Contd)

2. ERROR ANALYSIS (Contd)

TABLE B (Contd)

COAST PROBLEMS

1. Check connections at Berg connector.
2. Clean clutches and brake disc.
3. Check polarity of clutches and brakes.
4. Check brake and clutch gaps.
5. Check resistance of brake coils.

CLUTCH PICKUP PROBLEMS

1. Check connections at Berg connector.
2. Clean clutches and brake disc.
3. Check brake and clutch gaps.
4. Check resistance of clutch coils.

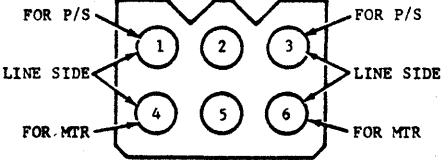
MOTION PROBLEMS

1. Check end play and side to side play of all shafts.
2. Check clutch torque.
3. Clean clutches.
4. Check belt tension.
5. Check head.

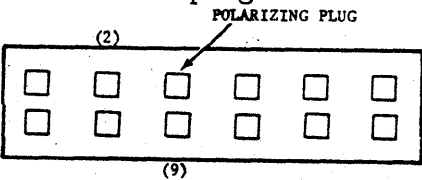
Refer to Section E. ADJUSTMENTS AND LUBRICATION for adjustment procedures.

3. COMPONENT ANALYSIS

**NOTE:** In the following sections, where references are made to specific adjustments and/or lubrications, refer to E. ADJUSTMENTS AND LUBRICATION for procedures. Perform repair steps listed in the "NO" RESPONSE DIRECTIVE column in the order specified until trouble is corrected.

ANALYSIS QUESTION	"YES" RESPONSE DIRECTIVE	"NO" RESPONSE DIRECTIVE
1. With the Cassette Drive power switch in the "ON" position, does motor run?	Go to 4.	Go to 2.
2. Is 115 volts available at source?	Go to 3.	Repair or replace voltage.
3. With motor connector removed from ac distribution assembly connector, is 115 volts present at ac distribution assembly connector? 	(a) Disconnect power supply from motor connector and replace motor. (b) Replace connector	(a) Replace 408598 SSI/AC interface assembly. (b) Replace connector.
4. With no cassette in the cassette holder and power switch in the "ON" position, is the BOT/EOT lamp lit?	Go to 9.	Go to 5.
5. Is power supply fuse "open"? Check continuity.	Replace fuse, recheck. Recheck if fuse continues to "blow". Recheck power supply.	Go to 6.
6. Is -12 volts present at power supply? Check for -12 volts dc between terminals marked common and -12.	Go to 5. <u>CIRCUIT CARD ANALYSIS</u> . (410764)	Go to 7.
7. Is transformer output voltage present (approximately 31.6 volts ac) present between unmarked terminals on power supply circuit card?	(a) Go to 4. <u>CIRCUIT CARD ANALYSIS</u> . (410043) (b) Replace 406101 power supply.	Go to 8.

D. TROUBLESHOOTING (Contd)3. COMPONENT ANALYSIS (Contd)

ANALYSIS QUESTION	"YES" RESPONSE DIRECTIVE	"NO" RESPONSE DIRECTIVE
8. Is transformer input voltage present (103 to 127 volts ac) between pins 1 and 3 of connector P8?	Replace 406103 transformer.	Replace 408598 SSI/AC interface assembly.
9. Is RUN (Status ) lamp lit?	Go to 5. <u>CIRCUIT CARD ANALYSIS</u> (410764)	Go to 10.
10. Does RUN (Status) lamp light when the "Cassette in Place" switch is manually activated?	Go to 13.	Go to 11.
11. Is +12 volts dc present at power supply? Check for +12 volts dc between terminals marked common and +12.	Go to 12.	(a)Go to 4. <u>CIRCUIT CARD ANALYSIS</u> . (410043) (b)Replace power supply 406101.
12. With power removed from the cassette drive, the cassette drive removed from its base, and plug P4 removed from the J4 connector, is there continuity between terminals 2 and 9 of plug P4?  	Go to 5. <u>CIRCUIT CARD ANALYSIS</u> (410764)	(a)Go to 5. <u>CIRCUIT CARD ANALYSIS</u> . (410764) (b)Replace 406111 cassette in place switch. (c)Perform switch height adjustment.
13. Does left drive shaft (rewind) hub rotate when "Cassette in Place" switch is manually activated?	Go to 18.	Go to 14.
14. Does left drive shaft (rewind) rotor rotate?	Go to 15.	Go to 18.
15. Is clutch activated when the "Cassette in Place" switch is actuated?	Perform pulley and shaft end play adjustment.	Go to 16.
16. Is clutch out of adjustment?	Adjust clutch.	Go to 17.



ANALYSIS QUESTION	"YES" RESPONSE DIRECTIVE	"NO" RESPONSE DIRECTIVE
17. With power removed from cassette drive, drive removed from base and the P4B connector removed from J4 connector is resistance between terminals 3 and 8 of P4B 32 to 50 ohms?	Go to <u>5. CIRCUIT CARD ANALYSIS</u> . (410764)	(a) Replace 402271 clutch assembly. (b) Perform clutch adjustment. (c) Perform pulley alignment adjustment.
18. Does right drive shaft (forward drive) rotor rotate?	Go to 19.	Go to 23.
19. Is O-Ring belt present?	Go to 20.	Assemble O-Ring belt.
20. Are left drive shaft (rewind) pulley and idler pulley present?	Go to 21.	Assemble missing pulley/pullies.
21. Are left drive shaft (rewind) Pulley set screws (2) tight?	Go to 22.	Tighten set screws.
22. Does left drive shaft (rewind) pulley bind on casting?	Adjust for end play.	(a) Replace 403296 brake assembly. (b) Perform brake adjustment. (c) Perform pulley and shaft end play adjustment. (d) Perform latch adjustments.
23. Is motor drive belt present?	Go to 24.	Assemble Belt.
24. Are right drive shaft (forward drive) pulley set screws tight?	Go to 25.	Tighten set screws.
25. Are motor pulley set screws tight?	Go to 26.	Tighten set screws.
26. Does right drive shaft (forward drive) pulley bind on casting?	Adjust for end play.	(a) Perform motor drive belt adjustment. (b) Perform motor pulley adjustments. (c) Replace 403296 brake assembly. (d) Perform brake adjustment.

D. TROUBLESHOOTING (Contd)3. COMPONENT ANALYSIS (Contd)

ANALYSIS QUESTION	"YES" RESPONSE DIRECTIVE	"NO" RESPONSE DIRECTIVE
26. (Contd)		(e) Perform pulley and shaft end play adjustment. (f) Perform latch adjustments. (g) Go to 5. <u>CIRCUIT CARD ANALYSIS.</u> (410764)
27. With a partially unwound standard cassette placed wrong side out, is the cassette held flat against inside surface of the cassette holder?	Go to 28.	Adjust cassette pressure spring.
28. Is cassette holder properly latched?	Go to 29.	Adjust latch.
29. Does the left drive (rewind) shaft rotate?	Adjust "Cassette in Place Switch".	Go to 30.
30. When removing cassette does latch open too far?	Adjust latch stop screw.	Go to 31.
31. Is cassette holder ejected from drive mechanism?	Go to 32.	Adjust cassette holder pressure spring.
32. With the cassette properly assembled to the cassette holder, did the cassette rewind?	Go to 34.	Go to 33.
33. With the cassette removed from the cassette holder, do both reels rotate freely?	Adjust "Cassette in Place" switch height.	Replace cassette.
34. After rewinding, does the tape move forward and rewind?	Go to 36.	(a) Cassette drive not plugged into mating equipment. (b) Go to 35.
35. With power switch in the OFF position, remove system cable from mating equipment connector and connect it to a known good part. Restore power to cassette drive, does tape move forward and rewind?	Replace or repair mating equipment. Restore Cassette Drive to proper configuration.	(a) Replace system cable. (b) Replace 408598 SSI/AC interface assembly. (c) Go to 5. <u>CIRCUIT CARD ANALYSIS.</u> (410764)

ANALYSIS QUESTION	"YES" RESPONSE DIRECTIVE	"NO" RESPONSE DIRECTIVE
36. Does tape move forward and reverse a second time?	Go to 38.	Go to 37.
37. Does cassette have red tab on left side folded back so that notch is exposed?	Go to 38.	(a)Adjust "Write Inhibit Switch".
38. Does the RUN (Status) lamp turn off or flash when tape is rewound?	Go to 41.	Go to 39.
39. Is the tape between the BOT/EOT sensor tube mechanism transparent?	Go to 40.	(a)Replace cassette. (b)Go to 5. <u>CIRCUIT CARD ANALYSIS.</u> (410764) (c)Replace 406123 cable assembly. (d)Perform sensor tube adjustment.
40. Is the hole in the underside of the sensor tube over the BOT/EOT lamp?	Go to 5. <u>CIRCUIT CARD ANALYSIS.</u> (410764)	Perform sensor tube adjustment.
41. Does the RUN (Status) lamp flash?	Go to 42.	Go to 43.
42. Remove cassette and place in known good Cassette Drive. Does RUN (Status) lamp flash after moving forward and reversing when "Write Inhibit" tab is folded back (see Step 37) or after moving forward, reversing, moving forward again and reversing a second time for "Write Inhibit" tab not folded back?	Cassette bad - replace.	Go to 45.
43. With the cassette drive connected to a M40 KD or KDP capable of receiving from a cassette drive and using a cassette previously recorded on the cassette drive, can text be sent to the display?	Go to 44.	Go to 48.
44. Is text garbled?	Go to 45.	Cassette drive good.

D. TROUBLESHOOTING (Contd)3. COMPONENT ANALYSIS (Contd)

ANALYSIS QUESTION	"YES" RESPONSE DIRECTIVE	"NO" RESPONSE DIRECTIVE
45. Replace the cassette used in Step 43 with a known properly recorded cassette - does garbling still occur?	Go to 46.	Go to 5. <u>CIRCUIT CARD ANALYSIS.</u> (410764)
46. Is the tape cleaner bobbin indexed as the cassette is inserted and removed?	Go to 47.	(a) Adjust bobbin latch spring. (b) Check bobbin ratchet spring - requirement. (c) Check bobbin stepper spring requirement. (d) Replace tape cleaner bobbin.
47. Is "O" Ring Belt frayed?	Replace "O" Ring Belt 403289.	Go to 48.
48. Is tape cleaner bobbin dirty?	Replace 403238 tape cleaner bobbin.	(a) Check <u>Drive Belt</u> adjustment. (b) Check <u>"O" Ring Belt</u> adjustment. (c) Clean recording head. (d) Clean clutch faces. (e) Clean brake faces. (f) Adjust clutches. (g) Adjust brakes. (h) Go to 5. <u>CIRCUIT CARD ANALYSIS.</u> (410764)
49. Does associated display indicate Block Number *** or 000?	Cassette drive good - mating equipment at fault.	(a) Replace System Cable. (b) Replace 408598 SSI/AC interface assembly. (c) Go to 5. <u>CIRCUIT CARD ANALYSIS.</u> (410764)

4. CIRCUIT CARD ANALYSIS (410043)

If the repair troubleshooting instructions do not serve to correct the defective card, refer to functional schematics in this section for further analysis.

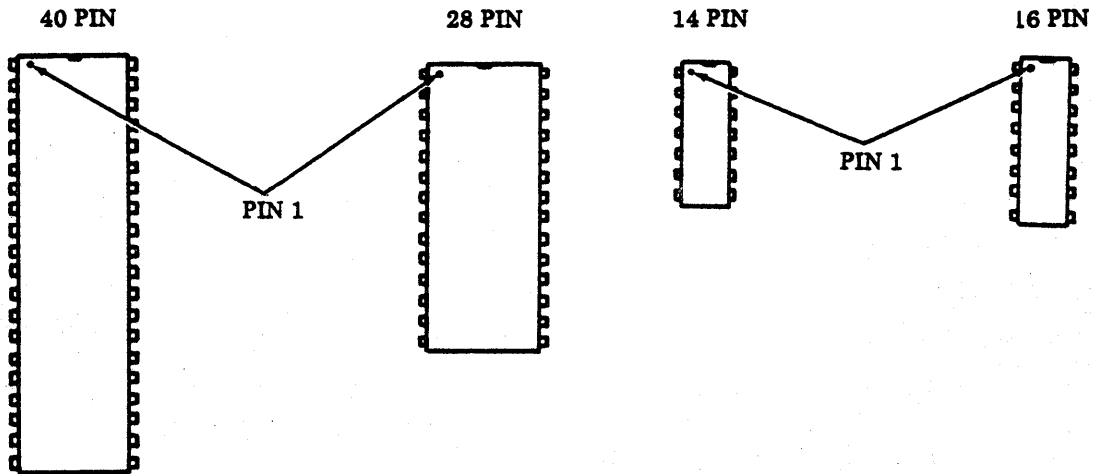
View of circuit card connection looking from the top of all components. These designations are for reference only.

DIODE

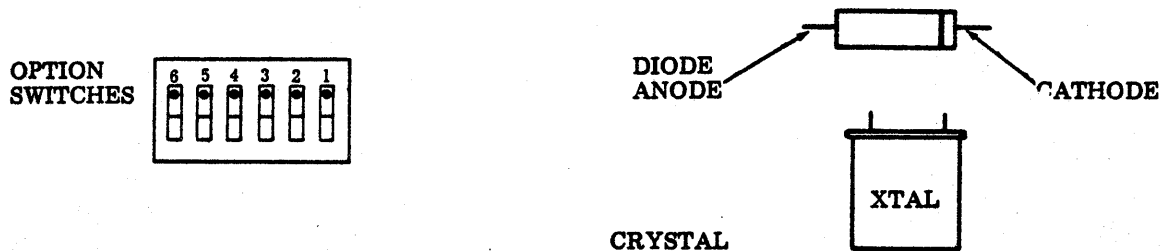
E = emitter  
C = collector  
B = base



Pin callouts for different size circuit packs.

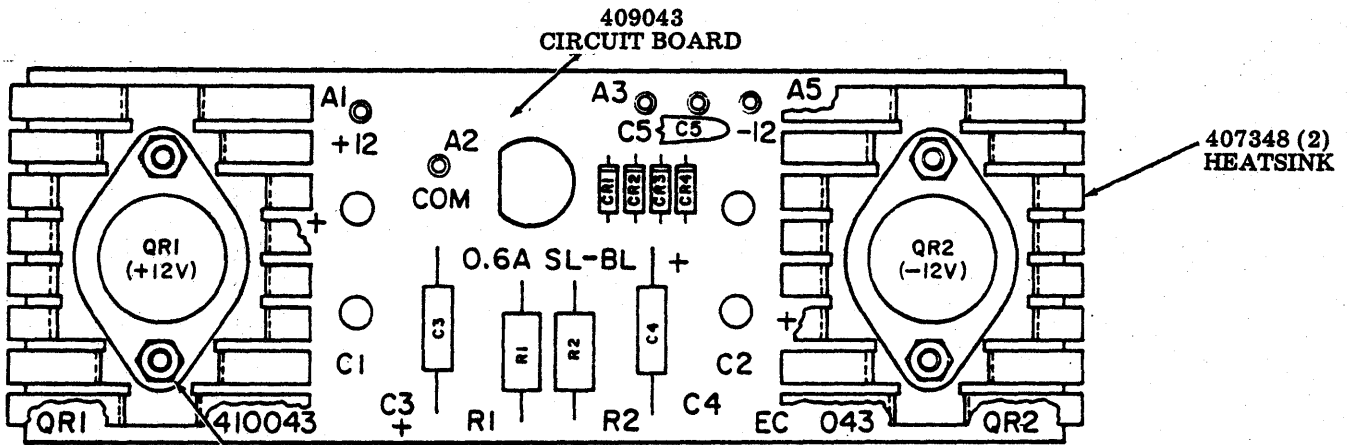


Miscellaneous component identification callouts.



D. TROUBLESHOOTING (Contd)

4. CIRCUIT CARD ANALYSIS (Contd)



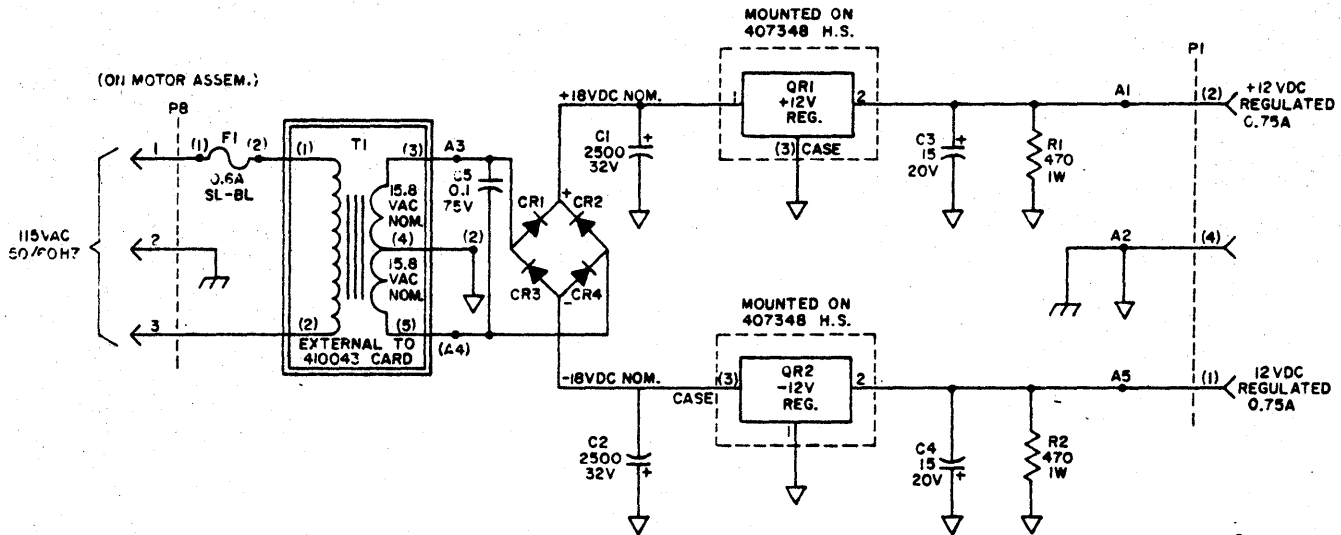
- 111017 (4) SCREW
- 107116 (4) WASHER
- 3606 (4) NUT

REF. DESIG.	PART NO. REQ.	Q <sub>T</sub> Y	DESCRIPTION
QR1	402201	1	REGULATOR, +12V
QR2	402204	1	REGULATOR, -12V
R1, R2	171580	2	RESISTOR 470, 1W
C3, C4	305455	2	CAPACITOR, 15 MFD
C5	321158	1	CAPACITOR, 0.1 MFD
CR1-4	312341	4	DIODE, IN4004
A1-A5	137471	5	POST
	407348	2	HEAT SINK
	111017	4	SCREW, 6-40X .312 PAN
	107116	4	WASHER, STAR
	3606	4	NUT, 6-40 HEX.
	409043	1	BOARD, CIRCUIT

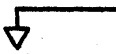
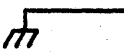
410043 Power Supply Circuit Card

ANALYSIS QUESTION	"YES" RESPONSE DIRECTIVE	"NO" RESPONSE DIRECTIVE
1. Is 15.8 volts ac (RMS) present at terminal marked A3?	Go to 2.	Go to 3. <u>COMPONENT ANALYSIS.</u>
2. Is +18 volts dc (approximately) present at cathodes of CR1 and CR2?	Go to 3.	(a) Replace CR1-CR2. (312341) (b) Replace C5. (321158) (c) Replace C1. (336027)
3. Is +12 volts dc present at terminal marked A1?	Go to 4.	(a) Replace QR1. (402201) (b) Replace C3. (305455) (c) Replace R1. (171580)
4. Is 15.8 volts ac (RMS) present at terminal marked A4?	Go to 5.	Go to 3. <u>COMPONENT ANALYSIS.</u>
5. Is -18 volts dc (approximately) present at anodes of CR3 and CR4?	Go to 6.	(a) Replace CR3-CR4. (312341) (b) Replace C5. (321158) (c) Replace C2. (336027)
6. Is -12 volts dc present at terminal marked A5?	410043 card is good.	(a) Replace QR2. (402204) (b) Replace C4. (305455) (c) Replace R2. (171580)

## D. TROUBLESHOOTING (Contd)

4. CIRCUIT CARD ANALYSIS (410043) (Contd)

## Information Notes:

1. Terminal designations enclosed in parenthesis are for reference only and are not marked on the components.
2. All resistors are 1/4 watt and all resistance values in ohms, unless otherwise specified.
3. All capacitance values in microfarads unless otherwise specified.
4.  Indicates Common.
5.  Indicates Frame Ground.
6. SL-BL Indicates Slow Blowing.



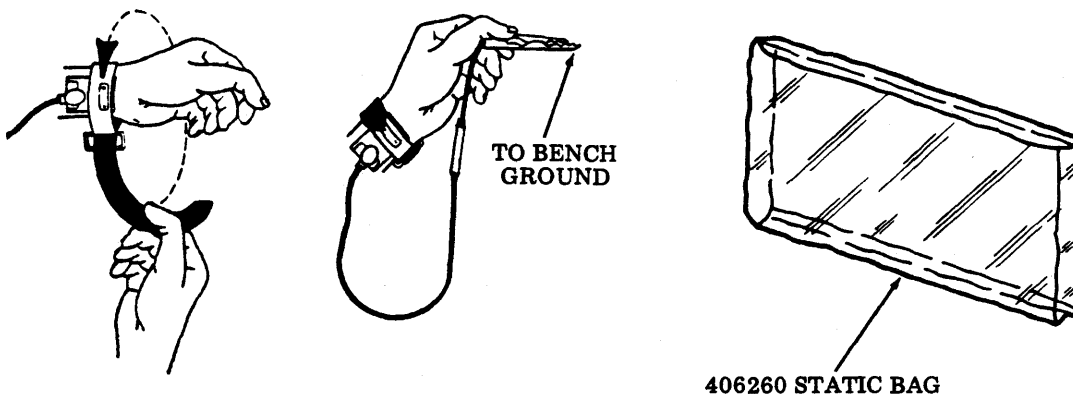
## 5. CIRCUIT CARD ANALYSIS (410764)

### General

**CAUTION 1:** TO AVOID POSSIBLE INTERNAL DAMAGE TO THE MOS DEVICES, OR CARD WITH MOS DEVICES, DUE TO ELECTRICAL STATIC DISCHARGE BY SERVICE PERSONNEL, THE DETAILED PROCEDURES LISTED SHOULD BE FOLLOWED.

- (a) ALL MOS DEVICES SHOULD BE DELIVERED AND STORED IN CONDUCTIVE CARRIERS SUCH AS FOAM PADS OR ALUMINUM TUBES.
- (b) ALL HANDLING OF MOS DEVICES, OR CARDS WITH MOS DEVICES, SHOULD BE DONE AT A GROUNDED BENCH WITH A CONDUCTIVE FOAM PAD OR AT A LOCATION WHERE THE SERVICE PERSONNEL CAN BE MAINTAINED AT GROUND POTENTIAL.\*
- (c) ALL PERSONNEL HANDLING MOS DEVICES, OR CARDS WITH MOS DEVICES, MUST WEAR A STATIC PROTECTION GROUNDING STRAP ADJUSTED TO MAKE FIRM CONTACT WITH THE SKIN AT ALL TIMES.
- (d) MOS DEVICES DELIVERED IN ALUMINUM TUBES OR FOAM PADS MAY BE TRANSFERRED TO WORK AREA PAD BY TOUCHING CARRIER OR PAD FIRST, AND REMOVING DEVICES BY THEIR PACKAGE (BODY), RATHER THAN BY THE LEADS, IF AT ALL POSSIBLE. HOWEVER, THESE DEVICES SHALL ALWAYS BE POSITIONED SO THAT THE LEGS ARE IN CONTACT WITH THE FOAM AT ALL TIMES.
- (e) SOLDERING IRONS, TEST, AND INSERTION EQUIPMENT MUST BE GROUNDED.

\*Service personnel are never to be connected directly to ground, but rather through a high resistance discharge path of a minimum of 1 megohm where 110 volts is present. Use 346392 static discharge strap.



**CAUTION 2:** TO AVOID POSSIBLE INTERNAL DAMAGE TO MOS CIRCUITRY WHENEVER THE 410764 CIRCUIT CARD IS REMOVED, THE 346392 STATIC GROUND STRAP MUST BE WORN. THE STRAP IS NOT TO BE WORN OVER CLOTHING BUT MUST CONTACT THE SKIN TIGHTLY. THE GROUND STRAP MUST BE CONNECTED TO GROUND (EITHER "EARTH" GROUND OR FRAME GROUND) VIA ITS ASSOCIATED CLIP.

**CAUTION 3:** TURN OFF ALL POWER OR SIGNAL SOURCES BEFORE REMOVING OR REPLACING ANY COMPONENT.

### Grounding Precautions

The 410764 circuit card contains MOS logic which requires careful handling. If the card is not already installed in the unit it should be handled while stored in its protective 406260 static bag.

D. TROUBLESHOOTING (Contd)

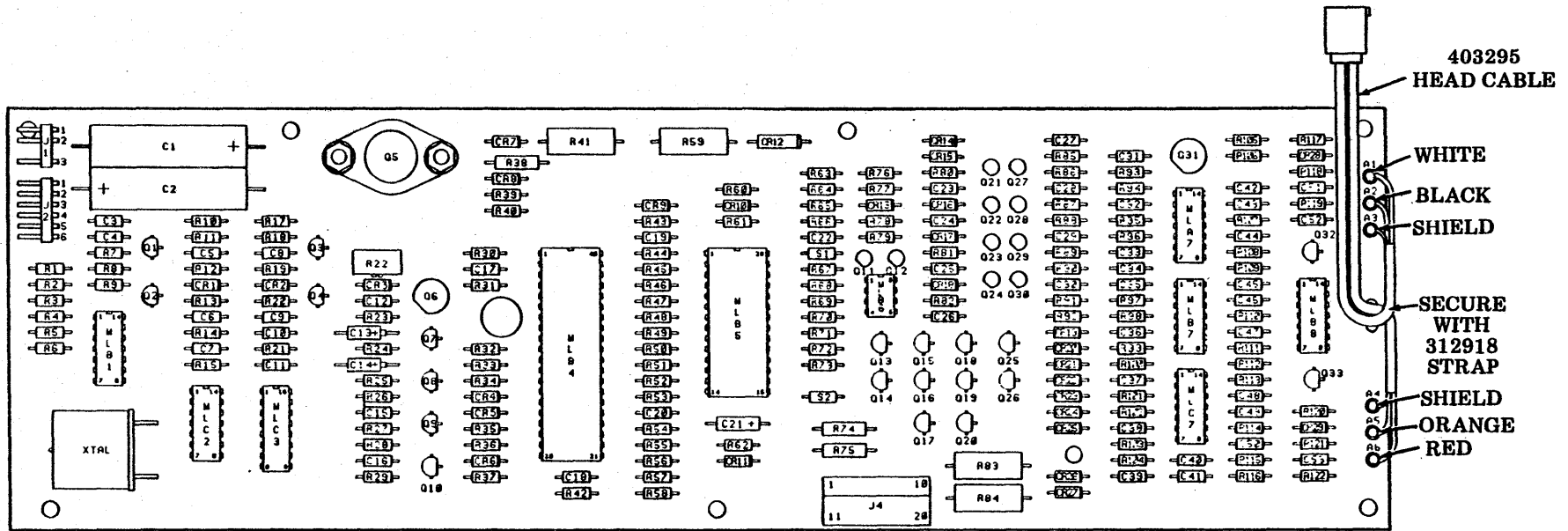
5. CIRCUIT CARD ANALYSIS (410764) (Contd)

Before troubleshooting of the 410764 logic circuit card can be undertaken, it must be removed from the cassette drive unit and extended away so that it may lie flat on a surface which is accessible to the repair person.

Refer to F. DISASSEMBLY/REASSEMBLY AND PARTS for procedure to remove circuit card from cassette drive unit.

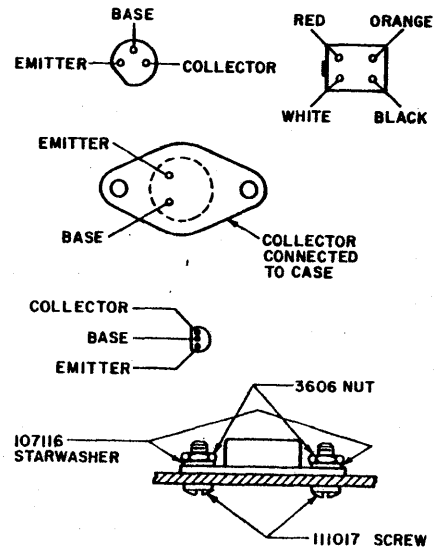
Extender cables necessary for the circuit card are number CP10.019.000 and may be ordered from:

Teletype Custom Systems Division  
5555 Touhy Avenue  
Skokie, Illinois 60677  
(312) 982-2000



BOTTOM VIEW OF TRANSISTORS

END VIEW OF HEAD CABLE



5. CIRCUIT CARD ANALYSIS (410764) (Cont'd)

D. TROUBLESHOOTING (Cont'd)

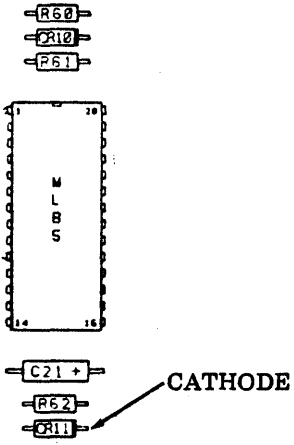
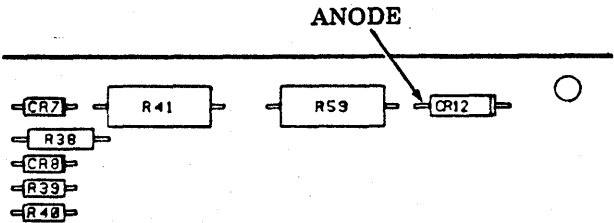
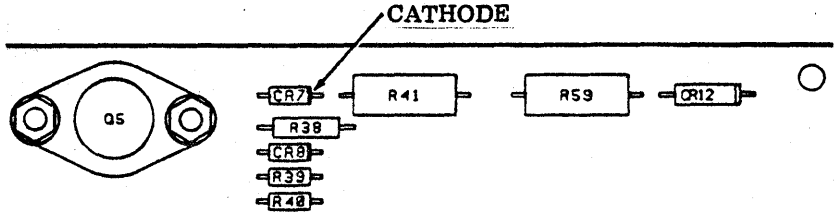
REF. DESIG.	PART NO. REQ.	T	DESCRIPTION	REF. DESIG.	PART NO. REQ.	T	DESCRIPTION	REF. DESIG.	PART NO. REQ.	T	DESCRIPTION	REF. DESIG.	PART NO. REQ.	T	DESCRIPTION
MLB1	404239	2	QUAD VOLTAGE COMP.	RS1,RS2			SAME AS R39	C5	325034	9	CAPACITOR, 120PF	CR23,24			SAME AS CR19
MLC2	333380	1	QUAD 2-INPUT NOR	R53			SAME AS R39	C6, C7	405686	2	CAPACITOR, .05MFD+50-20%	CR25,26			SAME AS CR19
MLC3	333022	1	DUAL J-K FLIP FLOP	R54			SAME AS R8	C8, C9			SAME AS C5	CR27			SAME AS CR18
MLB4	402279	1	INTERFACE LOGIC	RS5,RS6			SAME AS R26	C10	321518	1	CAPACITOR, 68PF	CR28,29			SAME AS CR1
MLB5	405683	1	CONTROL LOGIC	RS7,RS8			SAME AS R26	C11,C12			SAME AS C3				
MLB6	404555	1	TIMER	R59	327793	1	RESISTOR, 10 OHM, 3W, 1/2	C13	310921	1	CAPACITOR, .022MFD	S1, S2	336470	2	STRAP
MLA7	337347	3	DUAL OPERATIONAL AMP.	RS0,RS1	315955	2	RESISTOR, 2.2K, 1/4W	C14	310929	1	CAPACITOR, 1.8MFD	01, 02	325076	4	TRANSISTOR, 2N3646
MLB7			SAME AS MLA7	R62			SAME AS R31	C15,C16			SAME AS C5	03, 04			SAME AS O1
MLC7			SAME AS MLA7	RS3,RS4			SAME AS R16	C17	346351	1	CAPACITOR, 10PF ±5%	05	337340	1	TRANSISTOR, 2N3740A
MLB8			SAME AS MLB1	RS5,RS6			SAME AS R16	C18,C19			SAME AS C3	06	325077	1	TRANSISTOR, 2N4355
				RS7,RS8			SAME AS R16	C20	300057	6	CAPACITOR, .01MFD±20%	07, 08	341638	3	TRANSISTOR, 2N3725
R1, R2	315956	2	RESISTOR, 2.7K, 1/4W	R71,R72			SAME AS R16	C21	337335	1	CAPACITOR, 15MFD	09,010	321517	4	TRANSISTOR, 2N3642
R3	315985	6	RESISTOR, 5.1K, 1/4W	R73			SAME AS R16	C22	315976	7	CAPACITOR, 470PF ±20%	011,012	323934	10	TRANSISTOR, 2N3565
R4	320787	2	RESISTOR, 120K, 1/4W	R74	137438	1	RESISTOR, 100 OHM, 1/2W	C23,C25			SAME AS C5	013,015	315930	5	TRANSISTOR, 2N3568
R5, R6	315957	5	RESISTOR, 3.3K, 1/4W	R75	300255	1	RESISTOR, 120 OHM, 1/2W	C24			SAME AS C20	014,016	333241	4	TRANSISTOR, 2N4401-B
R7, R9			SAME AS R5	R76	315960	1	RESISTOR, 5.6K, 1/4W	C26			SAME AS C3	017,018			SAME AS O13
R8	320275	19	RESISTOR, 10K, 1/4W	R77,R79	330643	3	RESISTOR, 56K, 1/4W	C27,C28			SAME AS C20	019,020			SAME AS O14
R10,R11			SAME AS R8	R78			SAME AS R4	C29,C30			SAME AS C20	021,022			SAME AS O11
R12,R19	315954	10	RESISTOR, 1.5K, 1/4W	R80,R81			SAME AS R8	C31	335801	6	CAPACITOR, 22PF	023,024			SAME AS O11
R13,R20	315948	4	RESISTOR, 100 OHM, 1/4W	R82	315974	3	RESISTOR, 300K, 1/4W	C32			SAME AS C22	025			SAME AS O13
R14,R15			SAME AS R8	RS3,RS4	301767	2	RESISTOR, 75 OHM, 1W	C33,C34			SAME AS C3	026			SAME AS O7
R16	315989	12	RESISTOR, 30K, 1/4W	RS5,RS7	326593	4	RESISTOR, 36 OHM, 1/4W	C35,C37			SAME AS C31	027,028			SAME AS O11
R17,R18			SAME AS R8	RS6,RS8			SAME AS R3	C36,C38			SAME AS C22	029,030			SAME AS O11
R21	320785	1	RESISTOR, 330 OHM, 1/4W	RS9,RS1			SAME AS R5	C39,C40			SAME AS C3	031	315931	1	TRANSISTOR, 2N3638
R22	341666	1	RESISTOR, VARIABLE, 10K	RS2,RS2			SAME AS R3	C41,C45			SAME AS C5	032,033			SAME AS O9
R23	315959	1	RESISTOR, 4.7K, 1/4W	RS3,RS10	333410	2	RESISTOR, 60K, 1/4W	C42,C48			SAME AS C3				
R24	323148	1	RESISTOR, 10K, 1/4W	RS4,RS8			SAME AS R12	C43			SAME AS C31				
R25	326573	1	RESISTOR, 1.0 NEG, 1/4W	RS5,RS6	320273	0	RESISTOR, 7.5K, 1/4W	C44,C47			SAME AS C22	403412	1		SOCKET, DIP (40 PIN)
RS6,RS8	315950	0	RESISTOR, 3.6K, 1/4W	RS7,RS9			SAME AS R5	C46,C49			SAME AS C31	406060	1		SOCKET, DIP (20 PIN)
R27			SAME AS R12	RS0,RS11			SAME AS R26	C50			SAME AS C22				
R29	321213	1	RESISTOR, 1K, 1/4W	R102			SAME AS R12	C51,C53	323141	2	CAPACITOR, 680PF	XTAL	405605	1	CRYSTAL, 1.792 MHz
RS0,RS3			SAME AS R8	RS3,RS4			SAME AS R5	C52			SAME AS C3				
RS1,RS2	321508	3	RESISTOR, 100K, 1/4W	R105			SAME AS R77					A1-A6	137471	6	LUG, TERMINAL
R34			SAME AS R3	RS6,RS9			SAME AS R8	CR1,CR2	197464	17	DIODE, 1N4140	J1	405690	1	HEADER, BERG, 3 TERM.
RS5,RS7			SAME AS R13	RS2,RS11			SAME AS R82	CR3,CR4			SAME AS CR1	J2	405691	1	HEADER, BERG, 6 TERM.
R36			SAME AS R12	RS0,RS11			SAME AS R12	CR5,CR6			SAME AS CR1				
R38	182180	1	RESISTOR, 220 OHM, 1/2W	R108,RS12			SAME AS R55	CR7	312922	1	DIODE, ZENER, 1N4733A, 5.1V, 1W	J4	406110	1	HEADER, BERG, 19 TERM.
RS9,RS40	333408	9	RESISTOR, 15K, 1/4W	R115,RS17			SAME AS R8	CR8	346713	1	DIODE, ZENER, 1N4746A, 10V, 1W				
R41	194963	1	RESISTOR, 120 OHM, 3W	R116			SAME AS R12	CR9,RS10			SAME AS CR1		403295	1	CABLE, HEAD
R42			SAME AS R16	R118,RS12	320026	2	RESISTOR, 3.9K, 1/4W	CR11			SAME AS CR1		111017	2	SCREW, 6-40X.312 P, HD
R43	333413	1	RESISTOR, 220K, 1/4W	R119			SAME AS R8	CR12	341735	1	DIODE, ZENER, 1N5348B, 9.1V, 5W		107116	2	STAR WASHER
R44			SAME AS R5	R120,RS12			SAME AS R8	CR13,RS14			SAME AS CR1		3606	2	NUT, 6-40 HEX
R45	333414	1	RESISTOR, 27K, 1/4W					CR15,RS16			SAME AS CR1		312918	1	STRAP, CABLE
R46	328786	1	RESISTOR, 11K, 1/4W					CR17,RS18			SAME AS CR1		403764	1	BOARD, ETCHED CIRCUIT
RS7,RS8			SAME AS R39	C1, C2	401042	2	CAPACITOR, 25MFD, 50-10%	CR19,RS20	312341	9	DIODE, 1N4224		144495	3	PAD, TRANSISTOR
RS9,RS0			SAME AS R39	C3, C4	405324	14	CAPACITOR, .1MFD, 50-20%	CR21,RS22			SAME AS CR19				

1

2

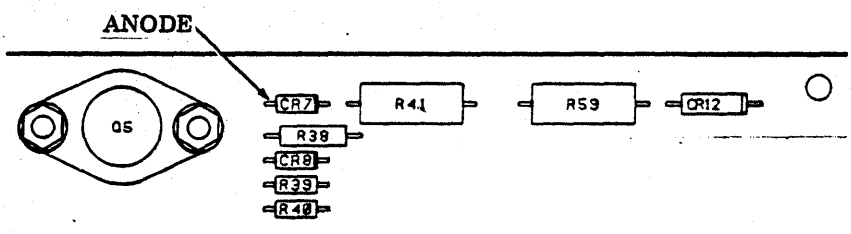
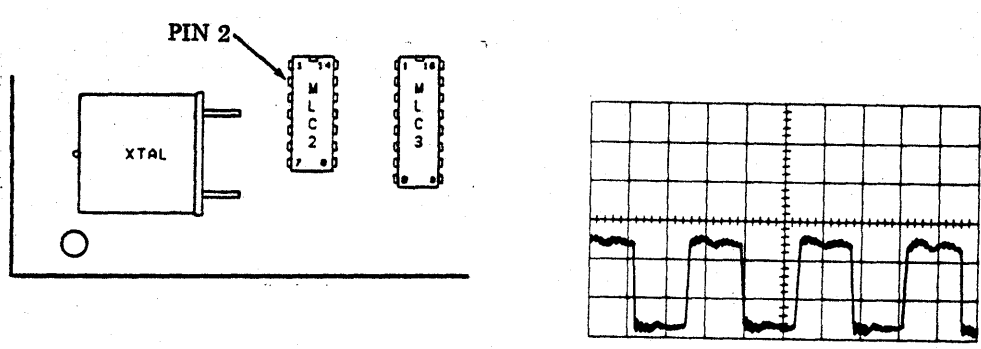
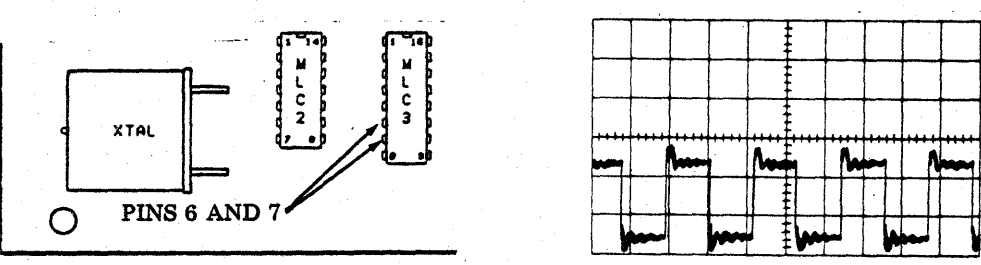
3

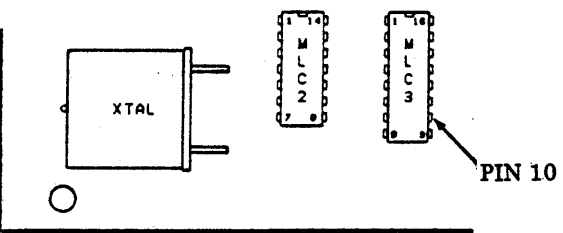
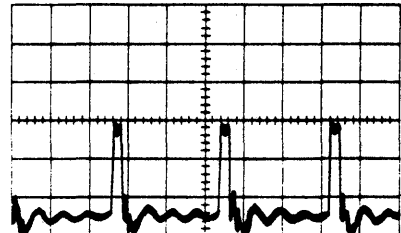
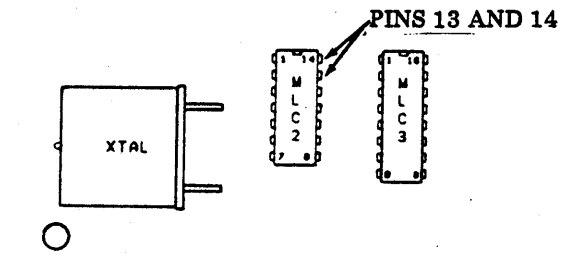
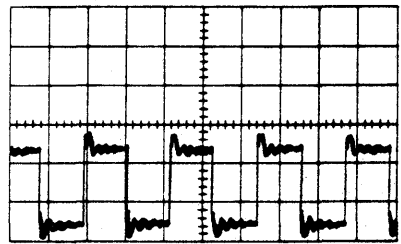
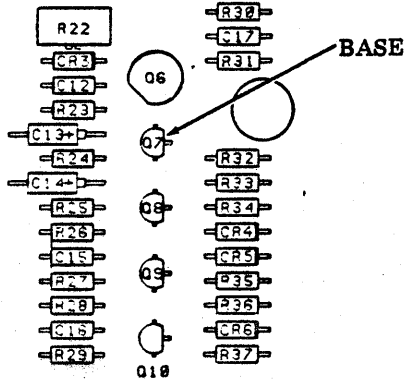
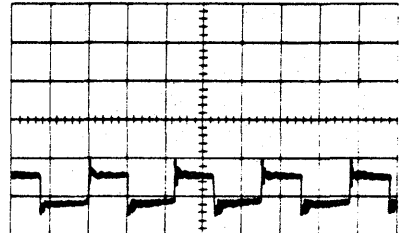
4

ANALYSIS QUESTION	YES, NO RESPONSE DIRECTIVE
<p><b>"POR"</b>  <b>Step 1.</b> Check Cathode of CR11. When power is applied to cassette drive, does voltage change from 0 volts to +12 volts and slowly back to 0 volts?</p>  <p>Replace C21 with 337335.          Replace CR11 with 197464.          Replace R62 with 321508.</p>	<p>Yes          Go to 2.</p> <p>No</p>
<p><b>"CIRCUIT VOLTAGES"</b>  <b>Step 2.</b> Check Anode of CR12. Is voltage level +3 volts dc?</p>  <p>Replace CR12 with 341735.          Replace R59 with 327793.</p>	<p>Yes          Go to 3.</p> <p>No</p>
<p><b>Step 3.</b> Check Cathode of CR7. Is voltage level approximately -1 volt dc?</p>  <p>Replace CR7 with 312922.          Replace R41 with 194963.          Replace CR8 with 346713.          Replace R38 with 182180.</p>	<p>Yes          Go to 4.</p> <p>No</p>

D. TROUBLESHOOTING (Contd)

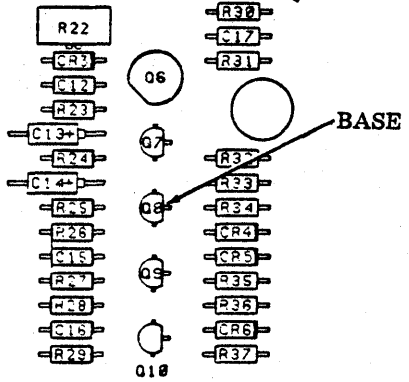
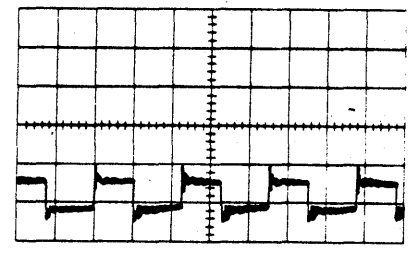
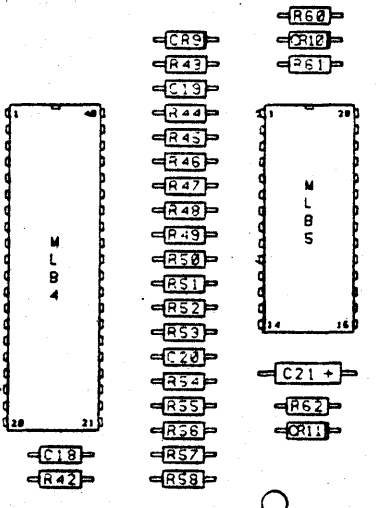
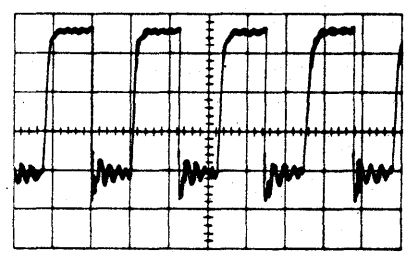
5. CIRCUIT CARD ANALYSIS (410764) (Contd)

ANALYSIS QUESTION	YES, NO RESPONSE DIRECTIVE
<p><u>Step 4.</u> Check Anode of CR7. Is voltage level approximately -6 volts dc?</p>  <p>Replace CR7 with 312922.            Replace Q5 with 337340.            Replace R41 with 194963.            Replace CR8 with 346713.            Replace R38 with 182180.</p>	<p>Yes Go to 5.</p> <p>No</p>
<p>"CLOCKS" <u>Step 5.</u> Check MLC2 pin 2 for waveform.</p>  <p>Replace MLC2 with 339380.            Replace XTAL with 406685.</p> <p>Vert .2V/Div.            Horz .2us/Div.</p>	<p>Yes Go to 6.</p> <p>No</p>
<p><u>Step 6.</u> Check MLC3 pins 6 and 7 for waveform.</p>  <p>Replace MLC3 with 339022.</p> <p>Vert .2V/Div.            Horz .5us/Div.</p>	<p>Yes Go to 7.</p> <p>No</p>

ANALYSIS QUESTION	YES, NO RESPONSE DIRECTIVE
<p><b>Step 7.</b> Check MLC3 pin 10 for waveform.</p>  <p>Replace MLC3 with 339022.</p>  <p>Vert .2V/Div. Horz .2us/Div.</p>	<p>Yes Go to 8.</p> <p>No</p>
<p><b>Step 8.</b> Check MLC2 pins 13 and 14 for waveform.</p>  <p>Replace MLC2 with 339380.</p>  <p>Vert .2V/Div. Horz .5us/Div.</p>	<p>Yes Go to 9.</p> <p>No</p>
<p><b>Step 9.</b> Check base of Q7 for waveform.</p>  <p>Replace C15 with 325034. Replace R26 with 320275.</p>  <p>Vert .2V/Div. Horz .5us/Div.</p>	<p>Yes Go to 10.</p> <p>No</p>

D. TROUBLESHOOTING (Contd)

5. CIRCUIT CARD ANALYSIS (410764) (Contd)

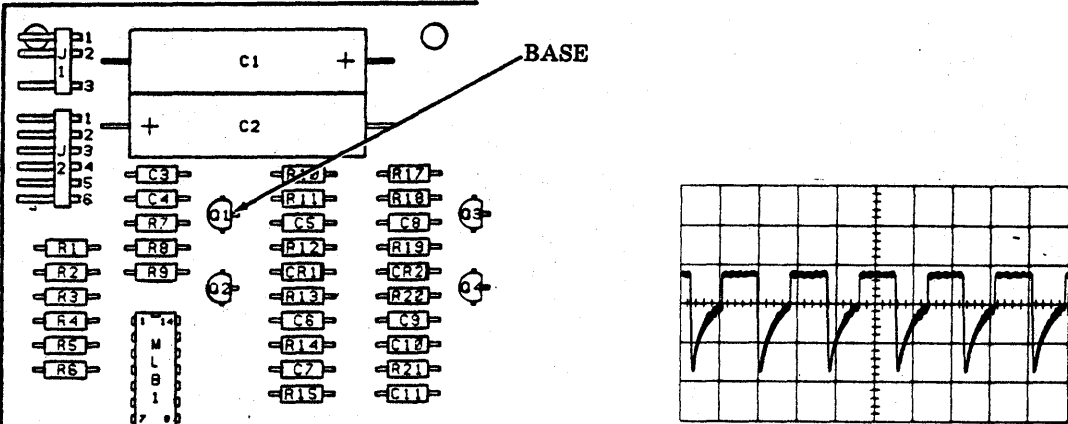
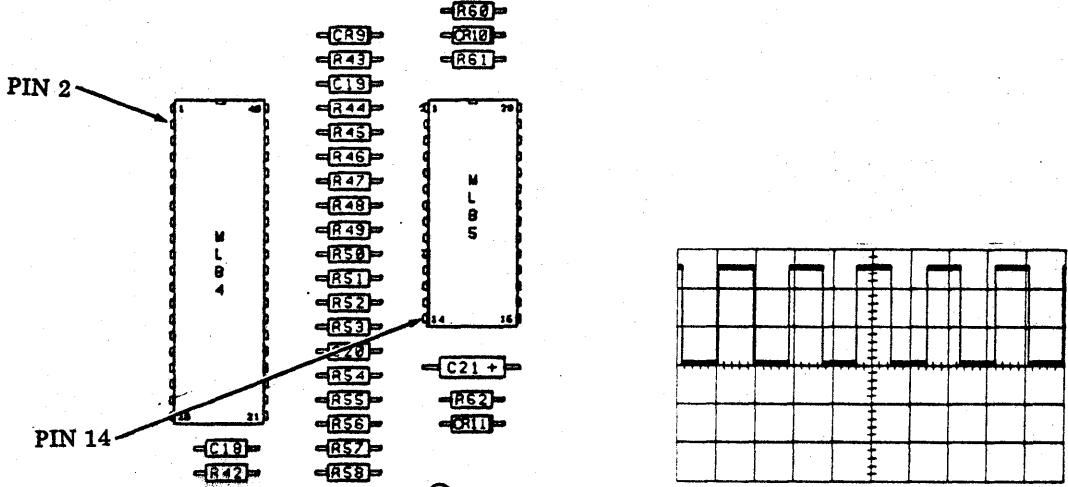
ANALYSIS QUESTION	YES, NO RESPONSE DIRECTIVE
<p><u>Step 10.</u> Check base of Q8 for waveform.</p>   <p>Replace C16 with 197464. Replace R28 with 320275.</p> <p>Vert .2V/Div. Horz .5 us/Div.</p>	<p>Yes Go to 11.</p> <p>No</p>
<p><u>Step 11.</u> Check MLB4 pin 18 for waveform.</p>   <p>Replace Q7 with 341091. Replace Q9 with 341091. Replace CR5 with 197464. Replace R27 with 315954. Replace R35 with 315948.</p> <p>Vert .5V/Div. Horz .5us/Div.</p>	<p>Yes Go to 12.</p> <p>No</p>

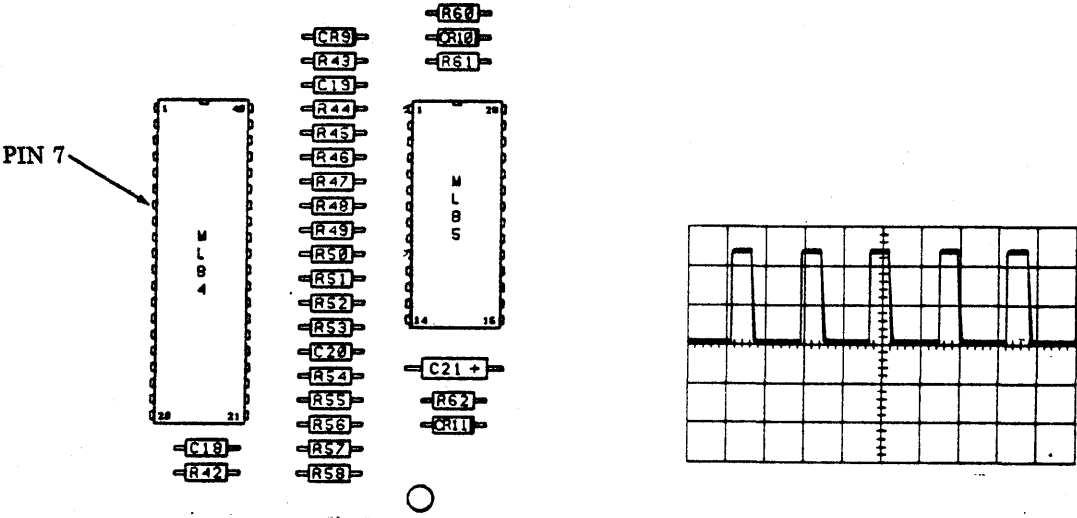
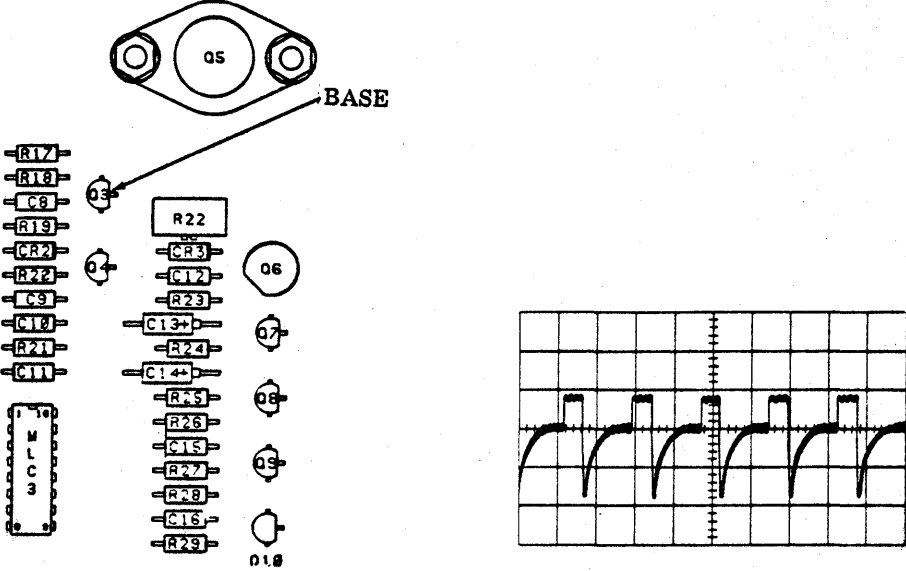


ANALYSIS QUESTION		YES, NO RESPONSE DIRECTIVE
<p><u>Step 12.</u> Check MLB4 pin 21 for waveform.</p> <div> </div> <div> </div> <p>Vert .5V/Div. Horz .5us/Div.</p> <p>Replace Q7 with 341091. Replace Q10 with 341091. Replace CR6 with 197464. Replace R36 with 315954. Replace R37 with 315948.</p>	<p>Yes Go to 13.</p> <p>No</p>	
<p><u>Step 13.</u> Check MLB4 pin 8 for waveform.</p> <div> </div> <div> </div> <p>Vert .5V/Div. Horz 10us/Div.</p> <p>Replace MLB4 with 402279.</p>	<p>Yes Go to 14.</p> <p>No</p>	

D. TROUBLESHOOTING (Contd)

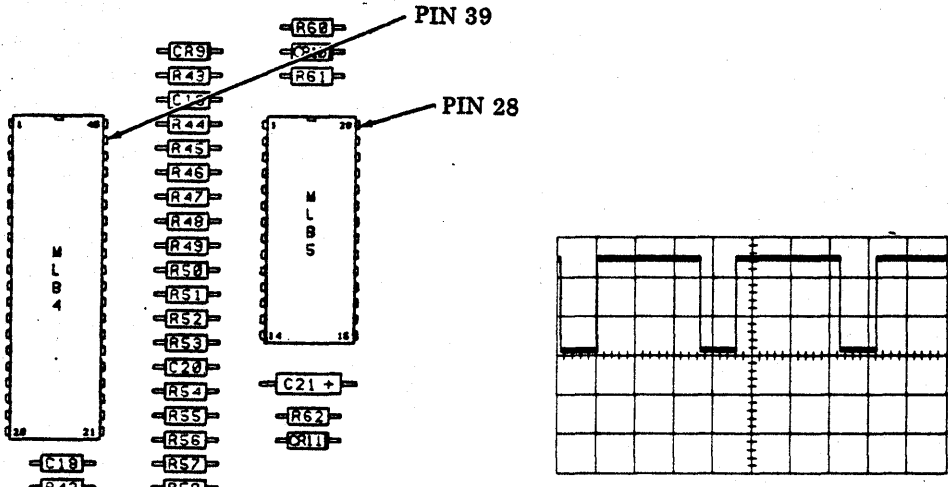
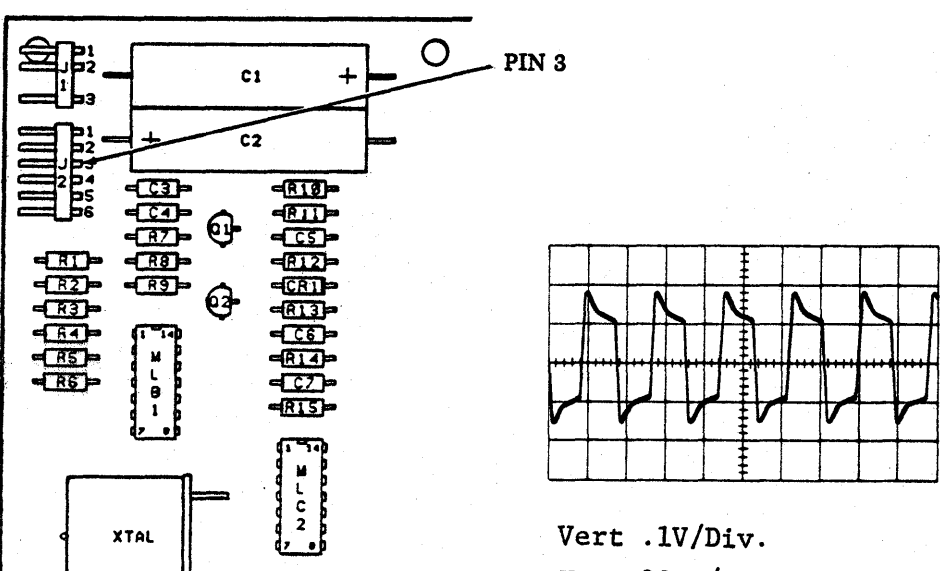
5. CIRCUIT CARD ANALYSIS (410764) (Contd)

ANALYSIS QUESTION	YES, NO RESPONSE DIRECTIVE
<p><b>Step 14.</b> Check base of Q1 for waveform.</p>  <p>Replace C5 with 325034. Replace R11 with 320275. Replace R10 with 320275.</p> <p>Vert .1V/Div. Horz 10us/Div.</p>	<p>Yes Go to 15.</p> <p>No</p>
<p><b>Step 15.</b> Check MLB4 pin 2 and MLB5 pin 14 for waveform.</p>  <p>Replace Q1 with 341091. Replace Q2 with 341091. Replace CR1 with 197464. Replace R12 with 315954. Replace R13 with 315948.</p> <p>Vert .5V/Div. Horz 10us/Div.</p>	<p>Yes Go to 16.</p> <p>No</p>

ANALYSIS QUESTION	YES, NO RESPONSE DIRECTIVE
<p><u>Step 16.</u> Check MLB4 pin 7 for waveform.</p>  <p>PIN 7</p> <p>Replace MLB4 with 402279.</p> <p>Vert .5V/Div. Horz 10us/Div.</p>	<p>Yes Go to 17.</p> <p>No</p>
<p><u>Step 17.</u> Check base of Q3 for waveform.</p>  <p>BASE</p> <p>Replace C8 with 325034. Replace R18 with 320275. Replace R17 with 320275.</p> <p>Vert .1V/Div. Horz 10us/Div.</p>	<p>Yes Go to 18.</p> <p>No</p>

D. TROUBLESHOOTING (Contd)

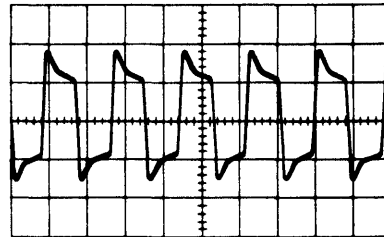
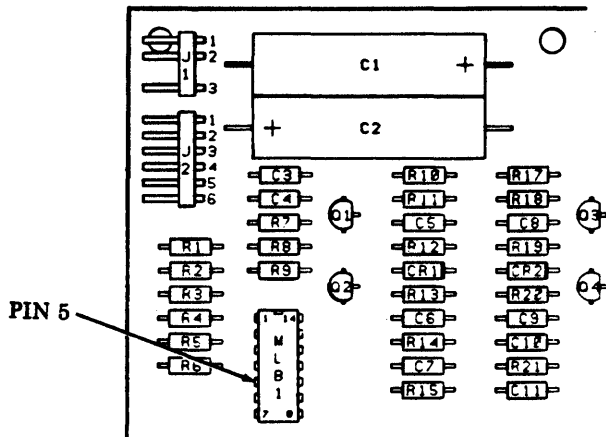
5. CIRCUIT CARD ANALYSIS (410764) (Contd)

ANALYSIS QUESTION	YES, NO RESPONSE DIRECTIVE
<p><u>Step 18.</u> Check MLB4 pin 39 and MLB5 pin 28 for waveform.</p>  <p>Replace Q3 with 341091.          Replace Q4 with 341091.          Replace CR2 with 197464.          Replace R19 with 315954.          Replace R20 with 315948.</p> <p>Vert .5V/Div.          Horz 5us/Div.</p>	<p>Yes Go to 19.</p> <p>No</p>
<p><u>Step 19.</u> Check J2 pin 3 for waveform.</p>  <p>Replace 408598 SSI/AC Distribution Assembly.          Go to 3. <u>COMPONENT ANALYSIS.</u></p> <p>Vert .1V/Div.          Horz 20us/Div.</p>	<p>Yes Go to 20.</p> <p>No</p>

ANALYSIS QUESTION

YES, NO  
RESPONSE  
DIRECTIVE

Step 20. Check MLB1 pin 5 for waveform.



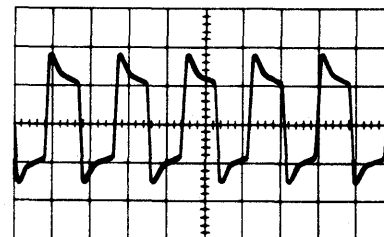
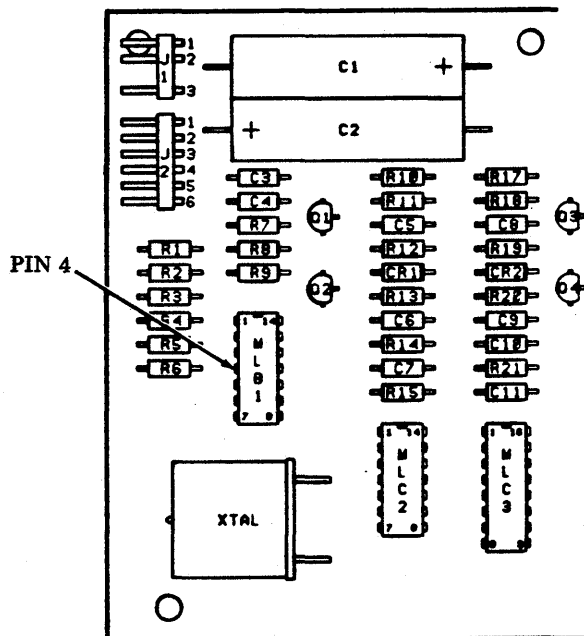
Replace R1 with 315956.  
Replace R2 with 315956.  
Replace R3 with 315985.

Vert .1V/Div.  
Horz 20us/Div.

Yes  
Go to 21.

No

Step 21. Check MLB1 pin 4 for waveform.



Replace R1 with 315956.  
Replace R2 with 315956.  
Replace R3 with 315985.

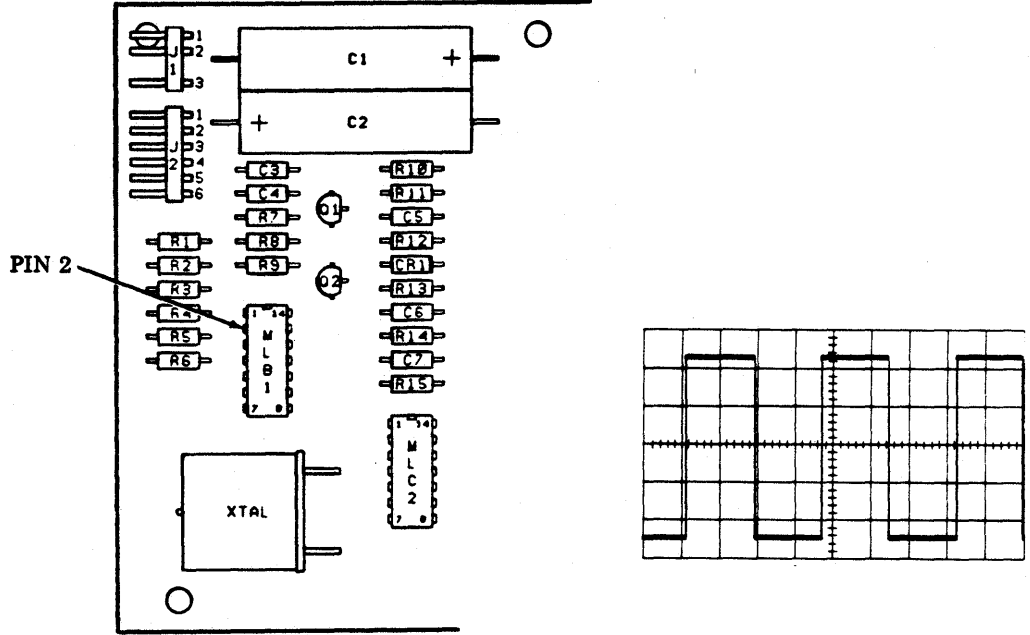
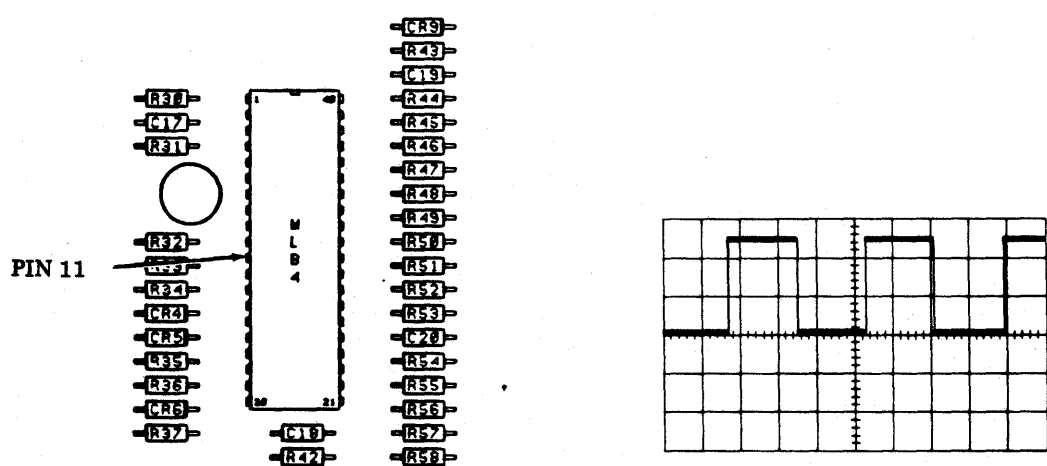
Vert .1V/Div.  
Horz 20us/Div.

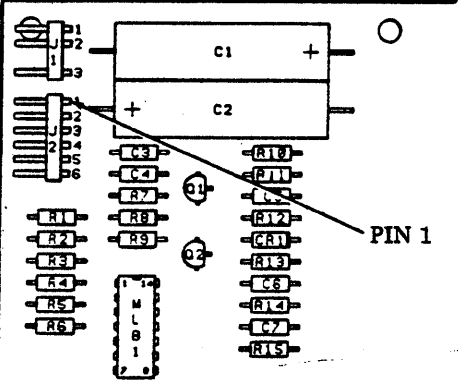
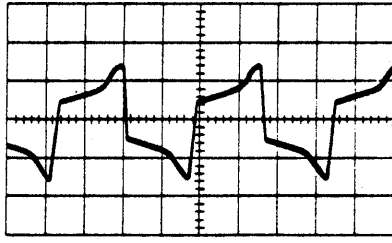
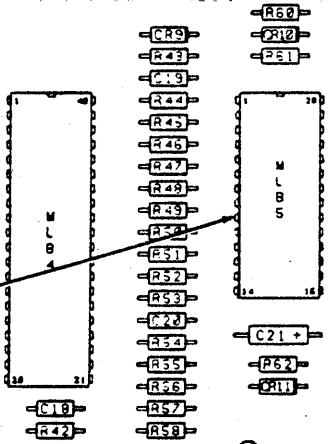
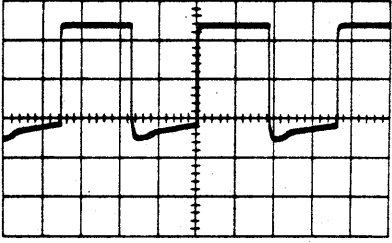
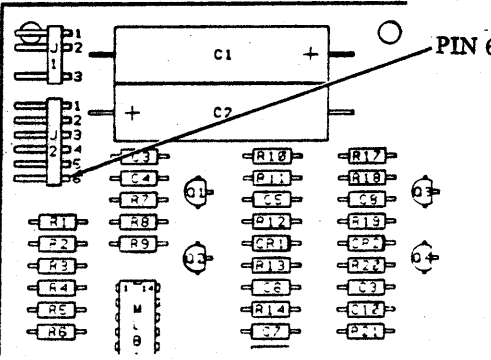
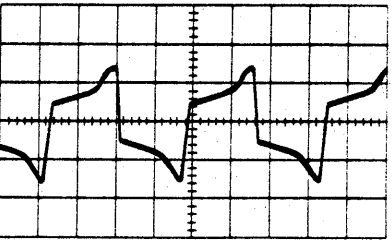
Yes  
Go to 22.

No

D. TROUBLESHOOTING (Contd)

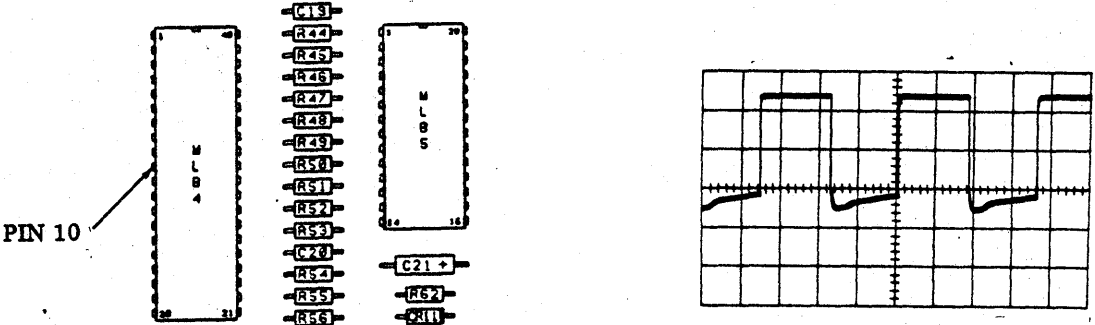
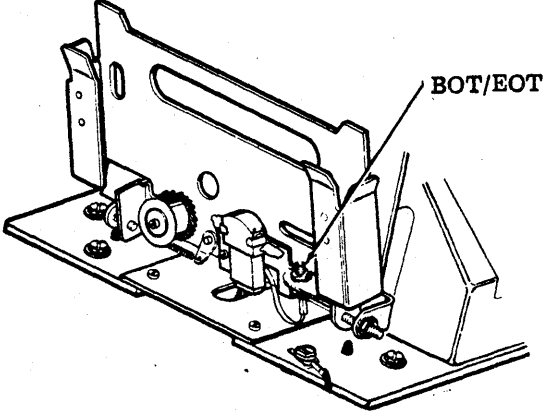
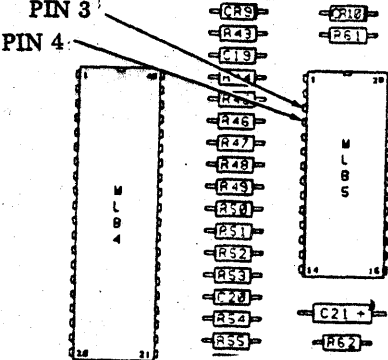
5. CIRCUIT CARD ANALYSIS (410764) (Contd)

ANALYSIS QUESTION	YES, NO RESPONSE DIRECTIVE
<p><u>Step 22.</u> Check MLB1 pin 2 for waveform.</p>  <p>Replace MLB1 with 404239. Replace R4 with 328767.</p> <p>Vert .5V/Div. Horz 10us/Div.</p>	<p>Yes Go to 23.</p> <p>No</p>
<p><u>Step 23.</u> Check MLB4 pin 11 for waveform.</p>  <p>Replace R5 with 315957. Replace R6 with 315957.</p> <p>Vert .5V/Div. Horz 10us/Div.</p>	<p>Yes Go to 24.</p> <p>No</p>

ANALYSIS QUESTION	YES, NO RESPONSE DIRECTIVE
<p><b>Step 24.</b> Check J2 pin 1 for waveform.</p>  <p>Replace 408598 SSI/AC Distribution Assembly. Refer to 3. <u>COMPONENT ANALYSIS.</u></p>  <p>Vert .2V/Div. Horz 10us/Div.</p>	<p>Yes Go to 25.</p> <p>No</p>
<p><b>Step 25.</b> Check MLB4 pin 9 for waveform.</p>  <p>Replace R7 with 315957. Replace R8 with 320275.</p>  <p>Vert .5V/Div. Horz 10us/Div.</p>	<p>Yes Go to 26.</p> <p>No</p>
<p><b>Step 26.</b> Check J2 pin 6 for waveform.</p>  <p>Replace 408598 SSI/AC Distribution Assembly. Refer to 3. <u>COMPONENT ANALYSIS.</u></p>  <p>Vert .2V/Div. Horz 10us/Div.</p>	<p>Yes Go to 27.</p> <p>No</p>

D. TROUBLESHOOTING (Contd)

5. CIRCUIT CARD ANALYSIS (410764) (Contd)

ANALYSIS QUESTION	YES, NO RESPONSE DIRECTIVE
<p><u>Step 27.</u> Check MLB4 pin 10 for waveform.</p>  <p>PIN 10</p> <p>Replace R9 with 315957. Replace R8 with 320275.</p> <p>Vert .5V/Div. Horz 10us/Div.</p>	<p>Yes Go to 28.</p> <p>No</p>
<p><u>Step 28.</u> Check to see if BOT/EOT lamp is lit.</p>  <p>Replace 406123 cable assembly. Replace R75 with 300255. Refer to 3. <u>COMPONENT ANALYSIS.</u></p>	<p>Yes Go to 29.</p> <p>No</p>
<p>"SELF-TEST" <u>Step 29.</u> Perform self-test by latching cassette into cassette drive. MLB5 pin 3 should be +12 V dc, and MLB5 pin 4 should be 0 V dc.</p>  <p>PIN 3</p> <p>PIN 4</p> <p>Replace cassette in place switch with 406111. Refer to 3. <u>COMPONENT ANALYSIS.</u></p>	<p>Yes Go to 30.</p> <p>No</p>

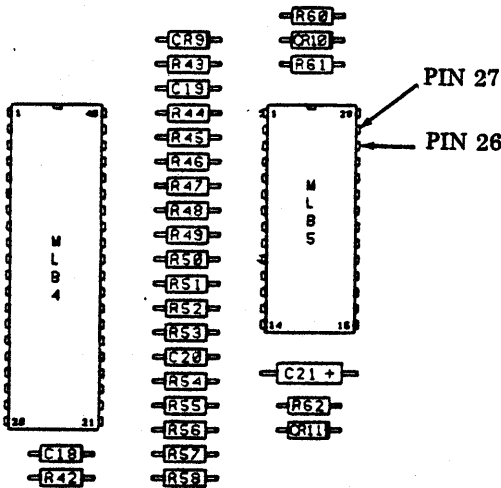
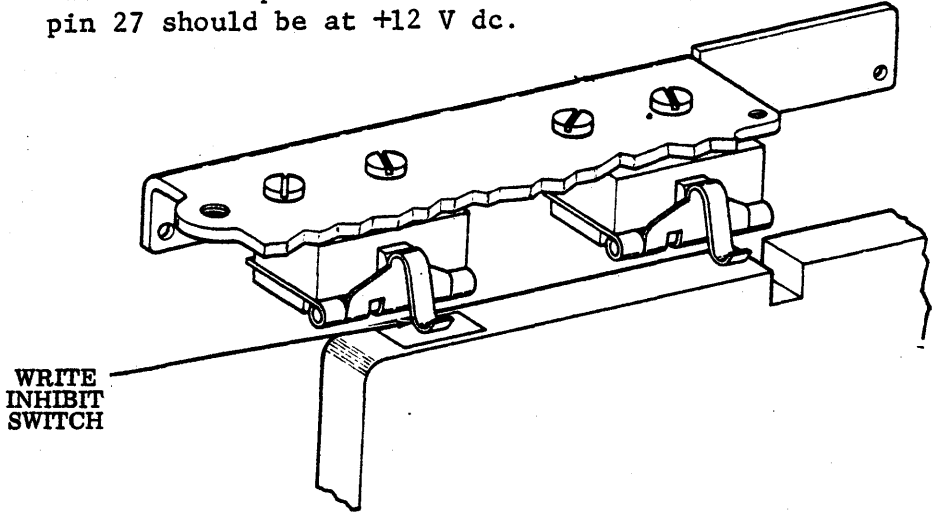


ANALYSIS QUESTION

YES, NO  
RESPONSE  
DIRECTIVE

Step 30. Unlatch cassette and manually activate write inhibit switch. MLB5 pin 26 should be at 0 V dc, and MLB5 pin 27 should be at +12 V dc.

Yes  
Go to 31.

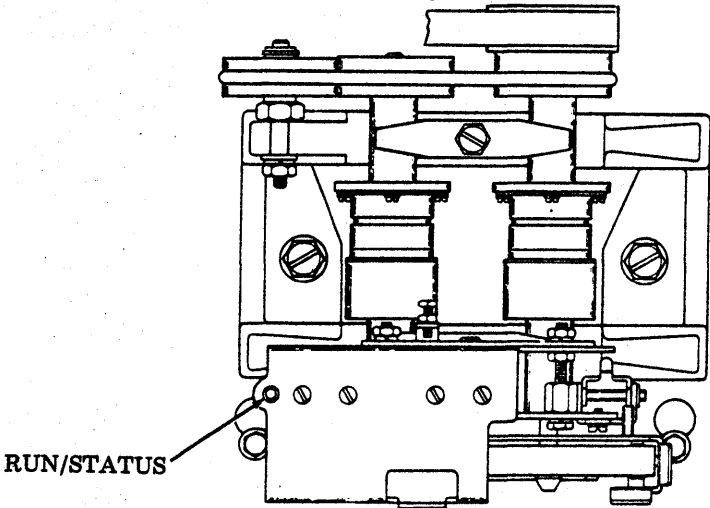
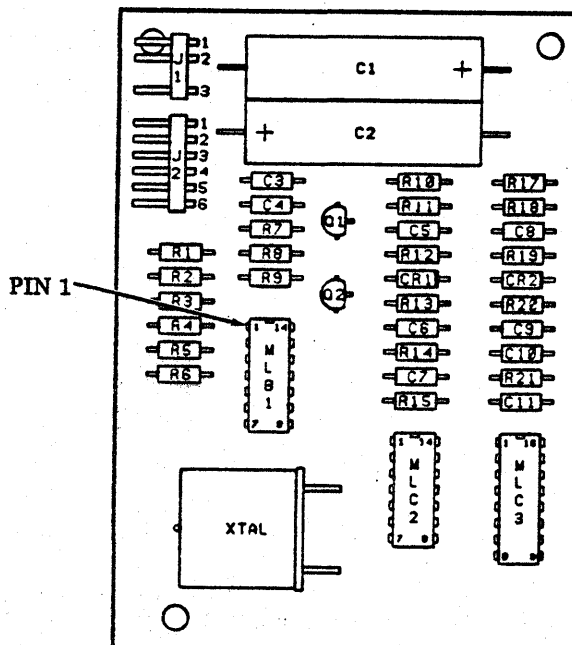


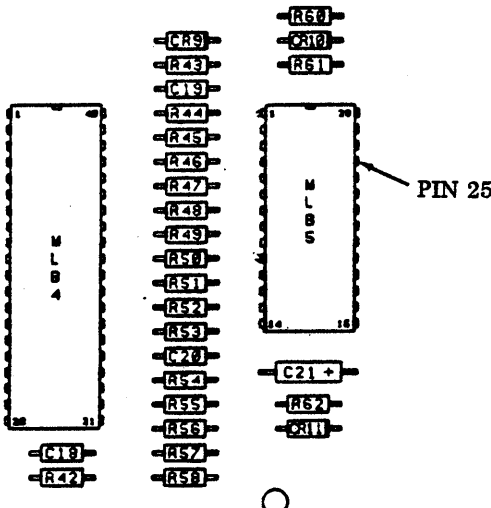
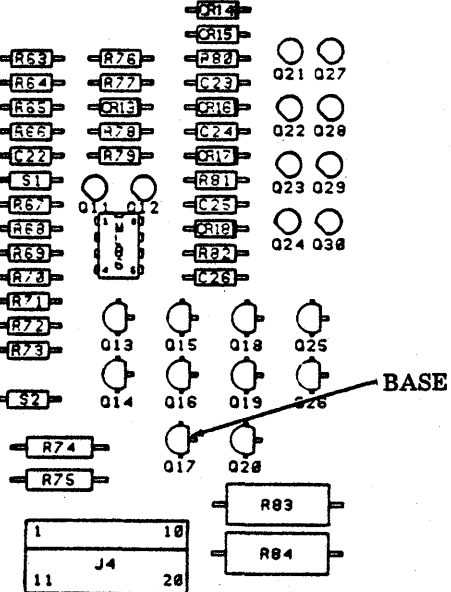
Replace write inhibit switch with 406111. Refer to 3. COMPONENT ANALYSIS.

No

D. TROUBLESHOOTING (Contd)

5. CIRCUIT CARD ANALYSIS (410764) (Contd)

ANALYSIS QUESTION	YES, NO RESPONSE DIRECTIVE
<p><u>Step 31.</u> During self-test does RUN/STATUS lamp turn on?</p> 	<p>Yes Go to 37.</p> <p>No Go to 32.</p>
<p><u>Step 32.</u> Check MLB1 pin 1 for -12 V dc when lamp is on, and +12 V dc when lamp is off.</p>  <p>Replace MLB1 with 404239. Replace 406123 cable assembly.</p>	<p>Yes Go to 33.</p> <p>No</p>

ANALYSIS QUESTION	YES, NO RESPONSE DIRECTIVE
<p><b>Step 33.</b> Check MLB5 pin 25 for +12 V dc when lamp is on, and -12 V dc when lamp is off.</p>  <p>Replace MLB5 with 405683.</p>	<p>Yes Go to 34.</p> <p>No</p>
<p><b>Step 34.</b> Check base of Q17 for -11 V dc when lamp is on, and -12 V dc when lamp is off.</p>  <p>Replace R64 with 315989. Replace R63 with 315989.</p>	<p>Yes Go to 35.</p> <p>No</p>

D. TROUBLESHOOTING (Contd)

5. CIRCUIT CARD ANALYSIS (410764) (Contd)

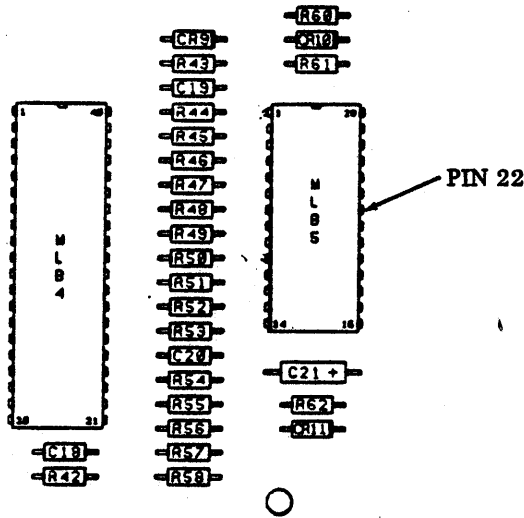
ANALYSIS QUESTION	YES, NO RESPONSE DIRECTIVE
<p><b>Step 35.</b> Check collector of Q17 for -12 V dc when lamp is on, and 0 V dc when lamp is off.</p> <p>Replace Q17 with 315930. Replace Q20 with 341091.</p>	<p>Yes Go to 36.</p> <p>No</p>
<p><b>Step 36.</b> Check left side of R74 for -5 V dc when lamp is on, and 0 V dc when lamp is off.</p> <p>Replace R74 with 137438. Replace 406123 cable assembly.</p>	<p>Yes Go to 37.</p> <p>No</p>

ANALYSIS QUESTION

YES, NO  
RESPONSE  
DIRECTIVE

Step 37. Check MLB5 pin 22 with scope set on Vert .5V/Div. and Horz 10us/Div., signal should toggle between -12 V dc, and +12 V dc during normal operation (self-test, reading and writing), and should remain at -12 V dc during forward and reverse tape movement.

Yes  
Go to 38.

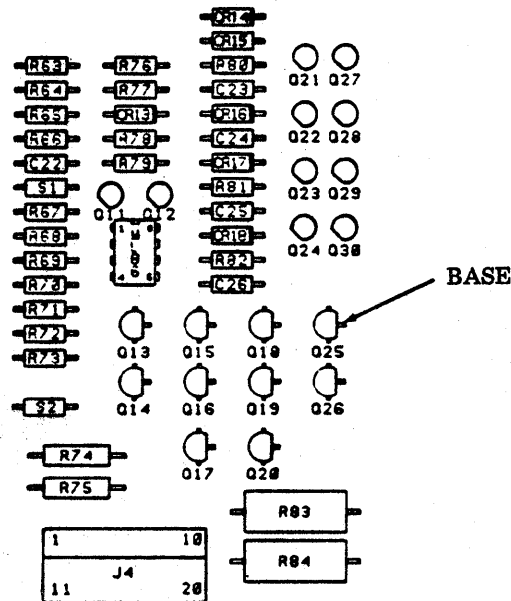


Replace MLB5 with 405683.

No

Step 38. Check base of Q25. Signal should toggle between -12 V dc and -10 V dc during normal operation, and should remain at -12 V dc during forward and reverse tape movement.

Yes  
Go to 39.

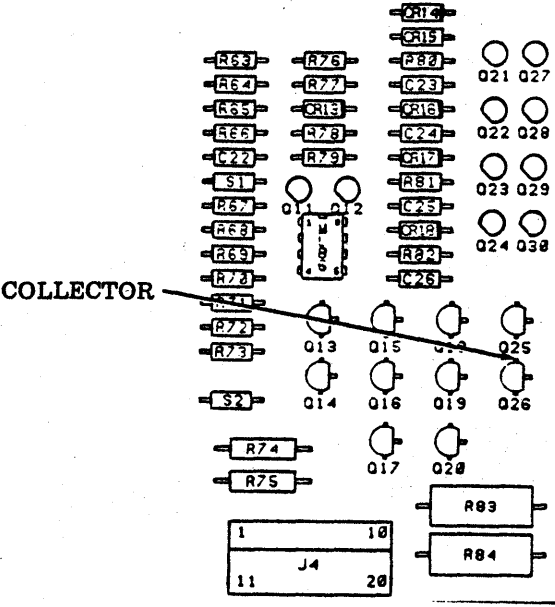
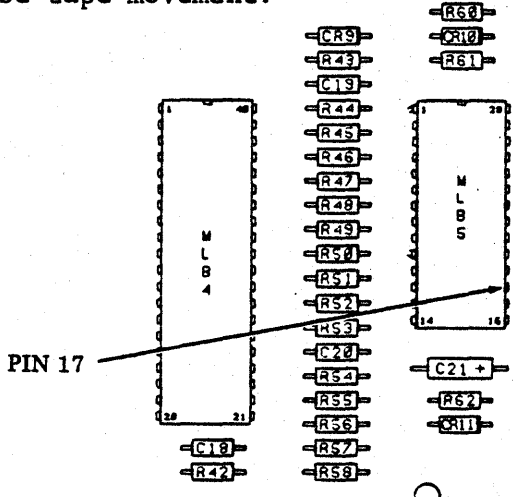


Replace R65 with 315989.  
Replace R66 with 315989.

No

D. TROUBLESHOOTING (Contd)

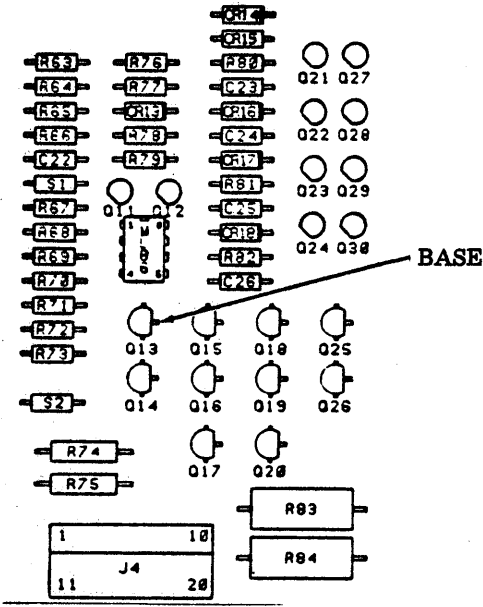
5. CIRCUIT CARD ANALYSIS (410764) (Contd)

ANALYSIS QUESTION	YES, NO RESPONSE DIRECTIVE
<p><u>Step 39.</u> Check collector of Q26. Signal should toggle between +12 V dc and -12 V dc during normal operation, and should remain at +12 V dc during forward and reverse tape movement.</p>  <p>Replace Q25 with 315930.            Replace Q26 with 341091.            Replace CR20 with 312341.            Replace CR27 with 312341.            Replace 403296 brake assembly (2).</p>	<p>Yes Go to 40.</p> <p>No</p>
<p><u>Step 40.</u> Check MLB5 pin 17. Signal should toggle between -12 V dc and +12 V dc during normal operation, should remain at -12 V dc during forward tape movement, and should remain at +12 V dc during reverse tape movement.</p>  <p>Replace MLB5 with 405683.</p>	<p>Yes Go to 41.</p> <p>No</p>

ANALYSIS QUESTION	YES, NO RESPONSE DIRECTIVE
-------------------	----------------------------

**Step 41.** Check base of Q13. Signal should toggle between -12 V dc and -10 V dc during normal operation, should remain at -12 V dc during forward tape movement, and should remain at -10 V dc during reverse tape movement.

Yes  
Go to 42.

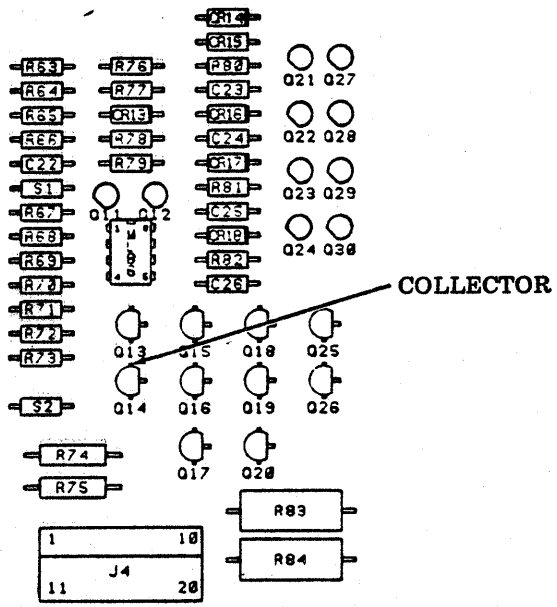


Replace R72 with 315989.  
Replace R73 with 315989.

No

**Step 42.** Check collector of Q14. Signal should toggle between 0 V dc and -12 V dc during normal operation, should remain at 0 V dc during forward tape movement, and should remain at -12 V dc during reverse tape movement.

Yes  
Go to 43.



Replace Q13 with 315930.  
Replace Q14 with 341091.

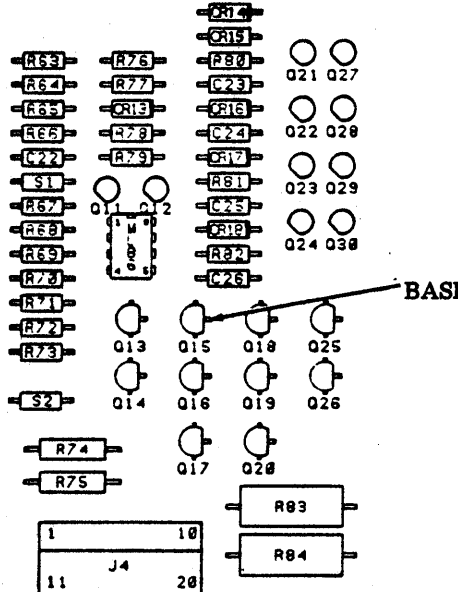
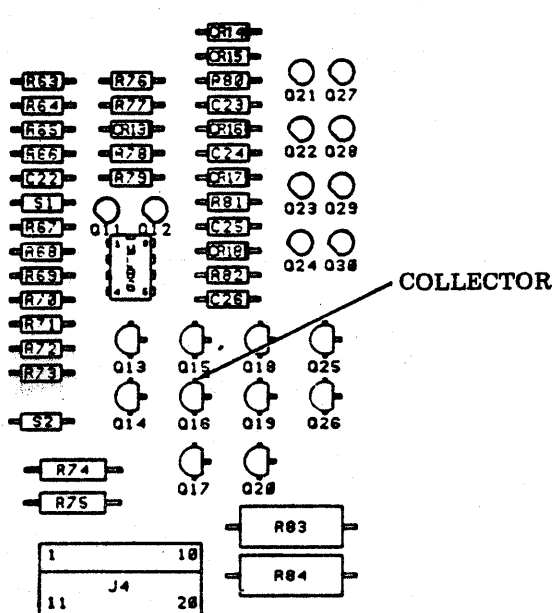
No

D. TROUBLESHOOTING (Contd)

5. CIRCUIT CARD ANALYSIS (410764) (Contd)

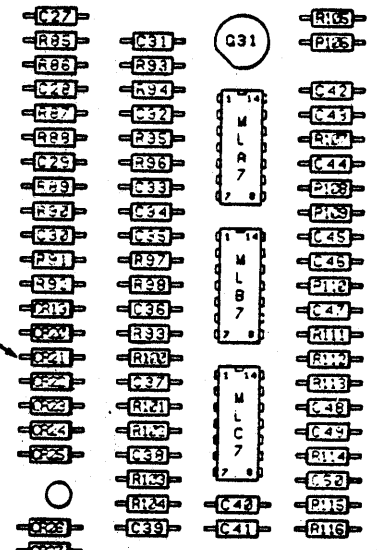
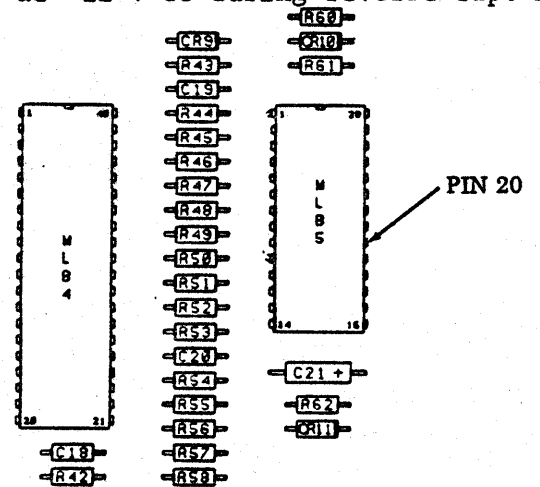
ANALYSIS QUESTION	YES, NO RESPONSE DIRECTIVE
<p><b>Step 43.</b> Check Anode of CR25. Signal should toggle between 0 V dc and -10 V dc during normal operation, should remain at 0 V dc during forward tape movement, and should remain at -10 V dc during reverse tape movement.</p> <p>Replace CR25 with 312341.                  Replace CR26 with 312341.                  Replace 403274 clutch coil                  Replace 402271 clutch assembly.</p>	<p>Yes Go to 44.</p> <p>No</p>
<p><b>Step 44.</b> Check MCB5 pin 19. Signal should toggle between -12 V dc and +12 V dc during normal operation, and should remain at -12 V dc for forward and reverse tape movement.</p> <p>Replace MCB5 with 405683.</p>	<p>Yes Go to 45.</p> <p>No</p>

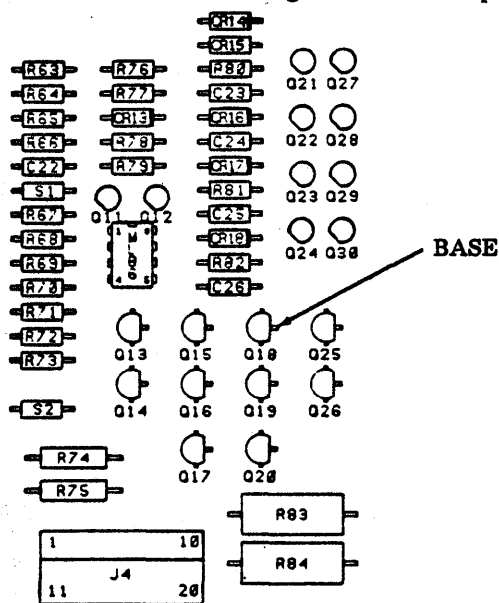
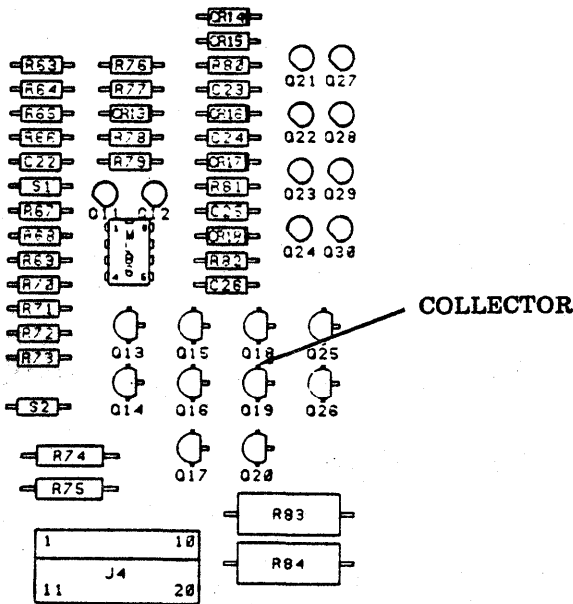


ANALYSIS QUESTION	YES, NO RESPONSE DIRECTIVE
<p><b>Step 45.</b> Check base of Q15. Signal should toggle between -12 V dc and -10 V dc during normal operation, and should remain at -12 V dc during forward and reverse tape movement.</p>  <p>Replace R69 with 315989. Replace R70 with 315989.</p>	<p>Yes Go to 46.</p> <p>No</p>
<p><b>Step 46.</b> Check collector of Q16. Signal should toggle between +12 V dc and -12 V dc during normal operation, should remain at -3 V dc during forward tape movement, and should remain at +12 V dc during reverse tape movement.</p>  <p>Replace Q15 with 315930. Replace Q16 with 341091.</p>	<p>Yes Go to 47.</p> <p>No</p>

D. TROUBLESHOOTING (Contd)

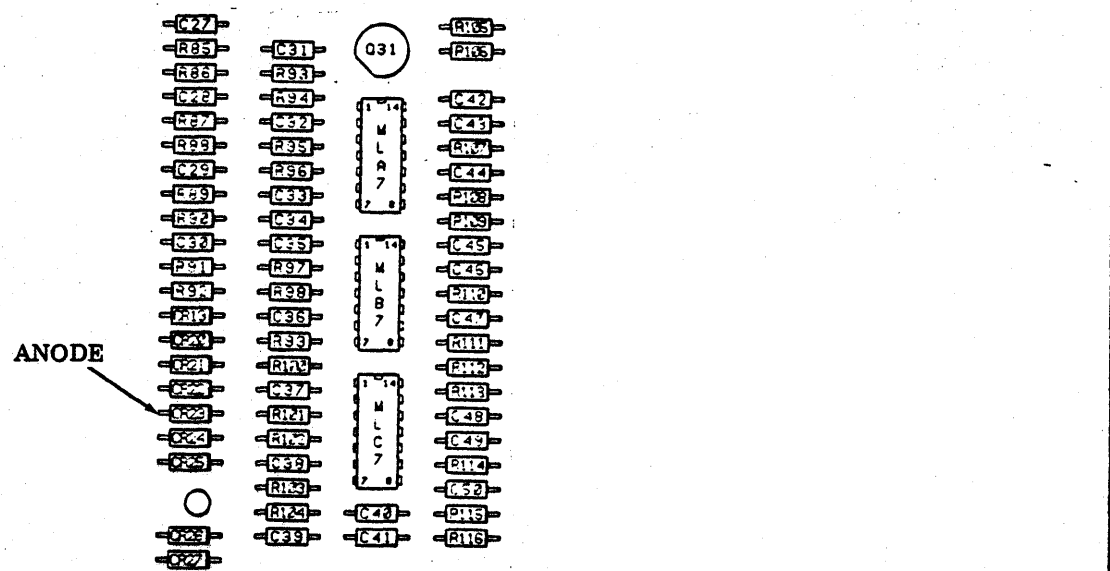
5. CIRCUIT CARD ANALYSIS (410764) (Contd)

ANALYSIS QUESTION	YES, NO RESPONSE DIRECTIVE
<p><b>Step 47.</b> Check Anode of CR21. Signal should toggle between +12 V dc and -12 V dc for normal operation, should remain at +5 V dc during forward tape movement, and should remain at +12 V dc during reverse tape movement.</p>  <p>Replace CR21 with 312341.          Replace R84 with 301767.          Replace CR20 with 312341.          Replace CR19 with 312341.          Replace 403296.brake assembly.</p>	<p>Yes Go to 48.</p> <p>No</p>
<p><b>Step 48.</b> Check MLB5 pin 20. Signal should toggle between -12 V dc and +12 V dc during normal operation, should remain at +12 V dc during forward tape movement, and should remain at -12 V dc during reverse tape movement.</p>  <p>Replace MLB5 with 405683.</p>	<p>Yes Go to 49.</p> <p>No</p>

ANALYSIS QUESTION	YES, NO RESPONSE DIRECTIVE
<p><b>Step 49.</b> Check base of Q18. Signal should toggle between -12 V dc and -10 V dc during normal operation, should remain at -10 V dc during forward tape movement, and should remain at -12 V dc during reverse tape movement.</p>  <p>Replace R67 with 315989. Replace R68 with 315989.</p>	<p>Yes Go to 50.</p> <p>No</p>
<p><b>Step 50.</b> Check collector of Q19. Signal should toggle between +12 V dc and -12 V dc during normal operation, should remain at -12 V dc during forward tape movement, and should remain at +12 V dc during reverse tape movement.</p>  <p>Replace Q18 with 315930. Replace Q19 with 341091. Replace C22 with 315976.</p> <p>Replace CR24 with 312341. Replace R83 with 301767. Replace R84 with 301767. Replace CR21 with 312341.</p>	<p>Yes Go to 51.</p> <p>No</p>

D. TROUBLESHOOTING (Contd)

5. CIRCUIT CARD ANALYSIS (410764) (Contd)

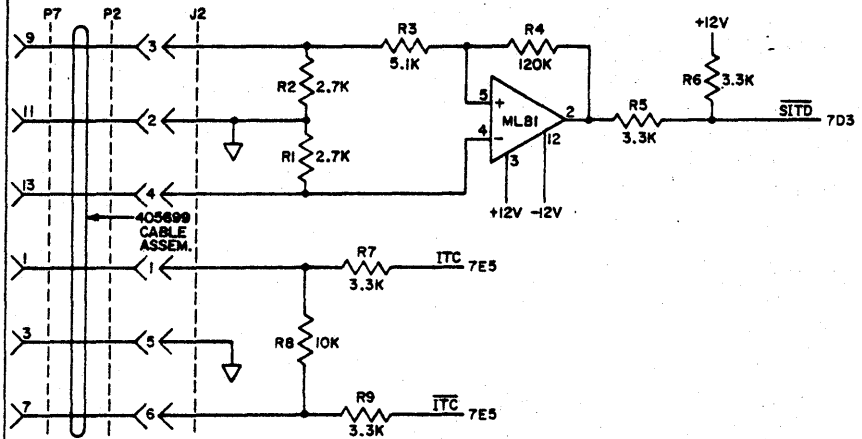
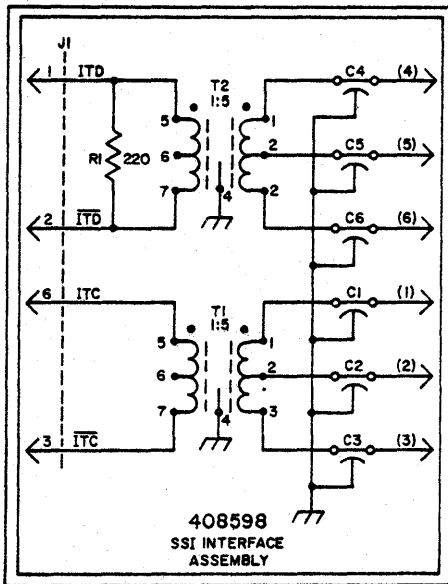
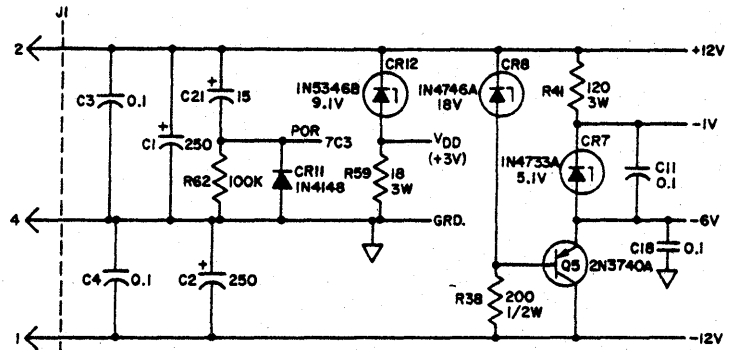
ANALYSIS QUESTION	YES, NO RESPONSE DIRECTIVE
<p><u>Step 51.</u> Check Anode of CR23. Signal should toggle between 0 V dc and -12 V dc during normal operation, should remain at -10 V dc during forward tape movement, and should remain at 0 V dc during reverse tape movement.</p>  <p>Replace CR23 with 312341.            Replace CR22 with 312341.            Replace 403274 clutch coil.            Replace 402272 clutch assembly.</p>	<p>Yes Go to 52.</p> <p>No</p>

ANALYSIS QUESTION	YES, NO RESPONSE DIRECTIVE
<p><u>Step 52.</u> Analysis Steps 1-51 should be sufficient to repair a defective 410764 circuit card. If problems are still encountered at this point, the following steps may be undertaken:</p> <ol style="list-style-type: none"> <li>1. Replace MLB4 with 402279.</li> <li>2. Replace MLB5 with 405683.</li> <li>3. Refer to functional schematics at end of section for further analysis.</li> </ol> <p>If problems are still encountered during write operations, the following steps may be undertaken:</p> <ol style="list-style-type: none"> <li>1. Replace MLB8 with 404239.</li> <li>2. Replace Q31 with 315931.</li> <li>3. Replace Q32 with 341091.</li> <li>4. Replace Q33 with 341091.</li> <li>5. Replace CR28 with 197464.</li> <li>6. Replace CR29 with 197464.</li> <li>7. Refer to functional schematics at end of section for further analysis.</li> </ol> <p>If problems are still encountered during read operations, the following steps may be undertaken:</p> <ol style="list-style-type: none"> <li>1. Replace MLA7 with 337347.</li> <li>2. Replace MLC7 with 337347.</li> <li>3. Replace MLB7 with 337347.</li> <li>4. Replace Q21 with 323934.</li> <li>5. Replace Q22 with 323934.</li> <li>6. Replace Q23 with 323934.</li> <li>7. Replace Q24 with 323934.</li> <li>8. Replace Q27 with 323934.</li> <li>9. Replace Q28 with 323934.</li> <li>10. Replace Q29 with 323934.</li> <li>11. Replace Q30 with 323934.</li> <li>12. Replace CR9 with 197464.</li> <li>13. Replace CR10 with 197464.</li> <li>14. Replace CR15 with 197464.</li> <li>15. Replace CR16 with 197464.</li> <li>16. Replace CR17 with 197464.</li> <li>17. Replace CR18 with 197464.</li> <li>18. Refer to functional schematics at end of section for further analysis.</li> </ol>	

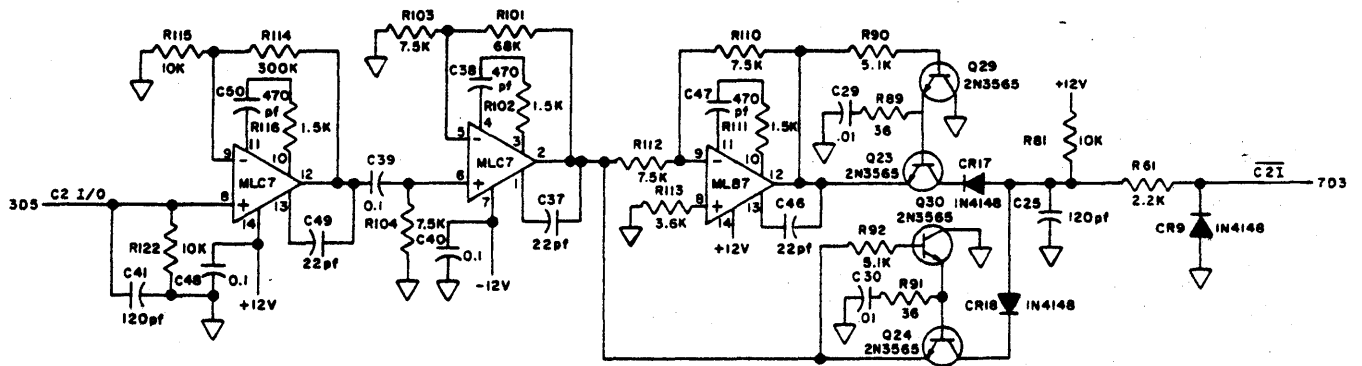
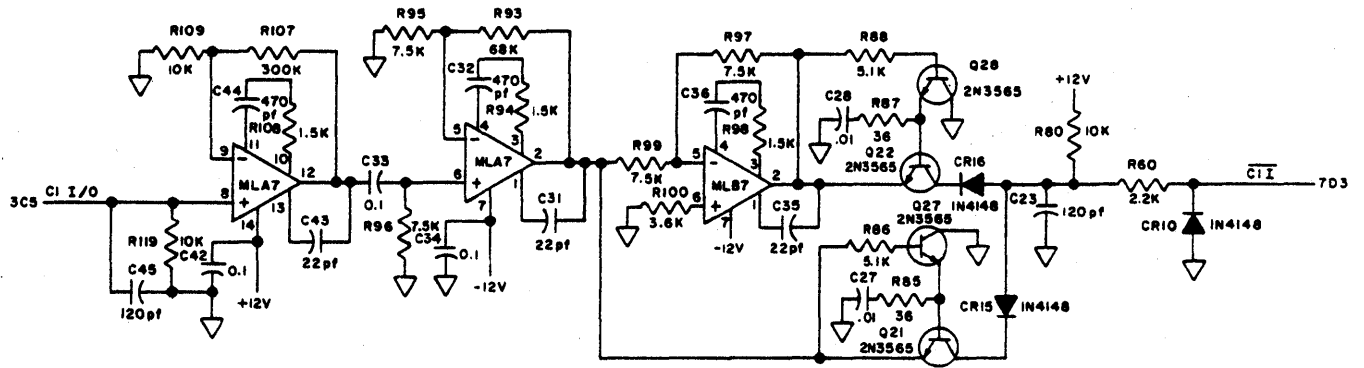
D. TROUBLESHOOTING (Contd)

6. FUNCTIONAL SCHEMATICS

POWER INPUT, REGULATORS, POR  
AND SSI INTERFACE CIRCUITS



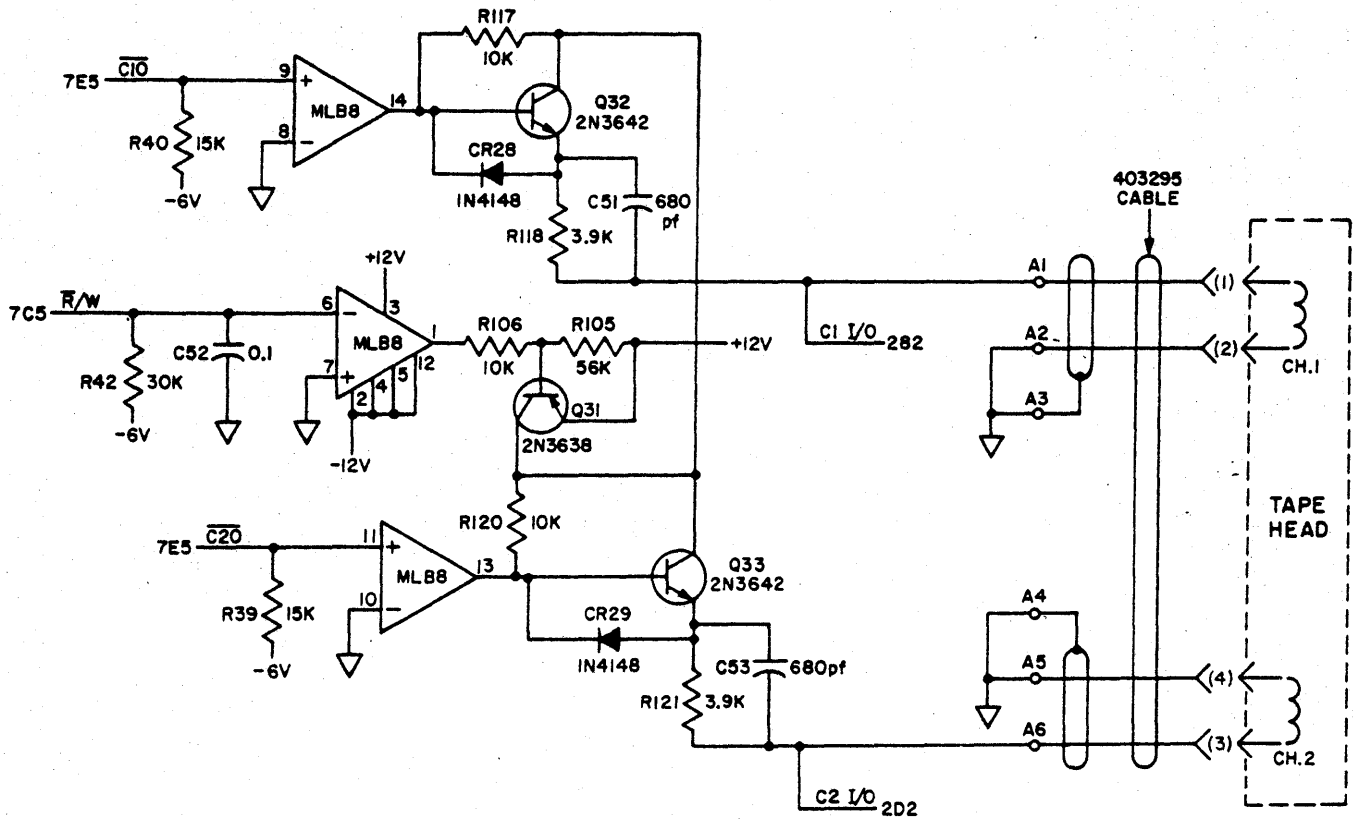
PEAK DETECTOR CIRCUITS



D. TROUBLESHOOTING (Contd)

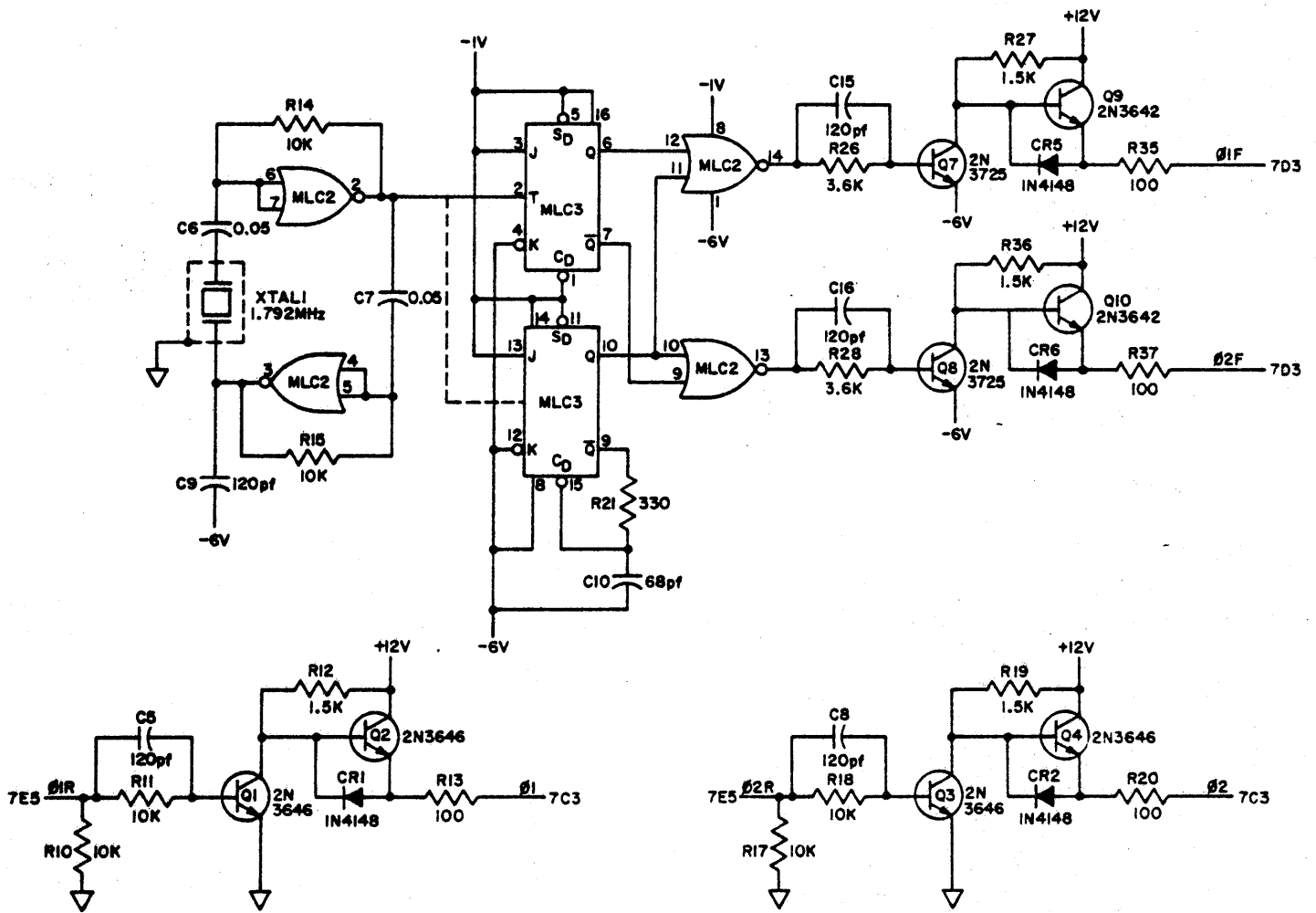
6. FUNCTIONAL SCHEMATICS (Contd)

WRITE AMPLIFIERS





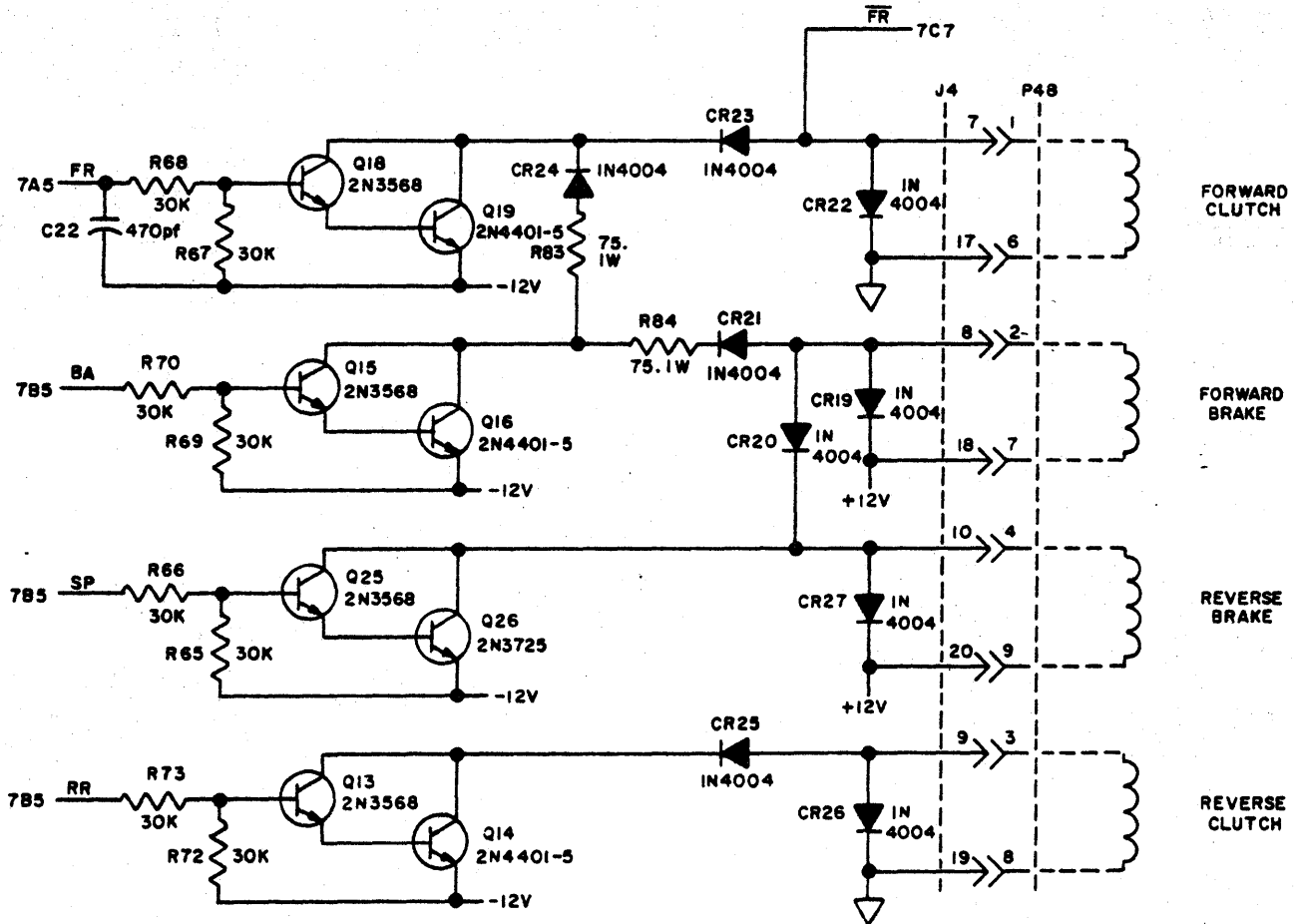
OSCILLATOR AND CLOCK DRIVERS



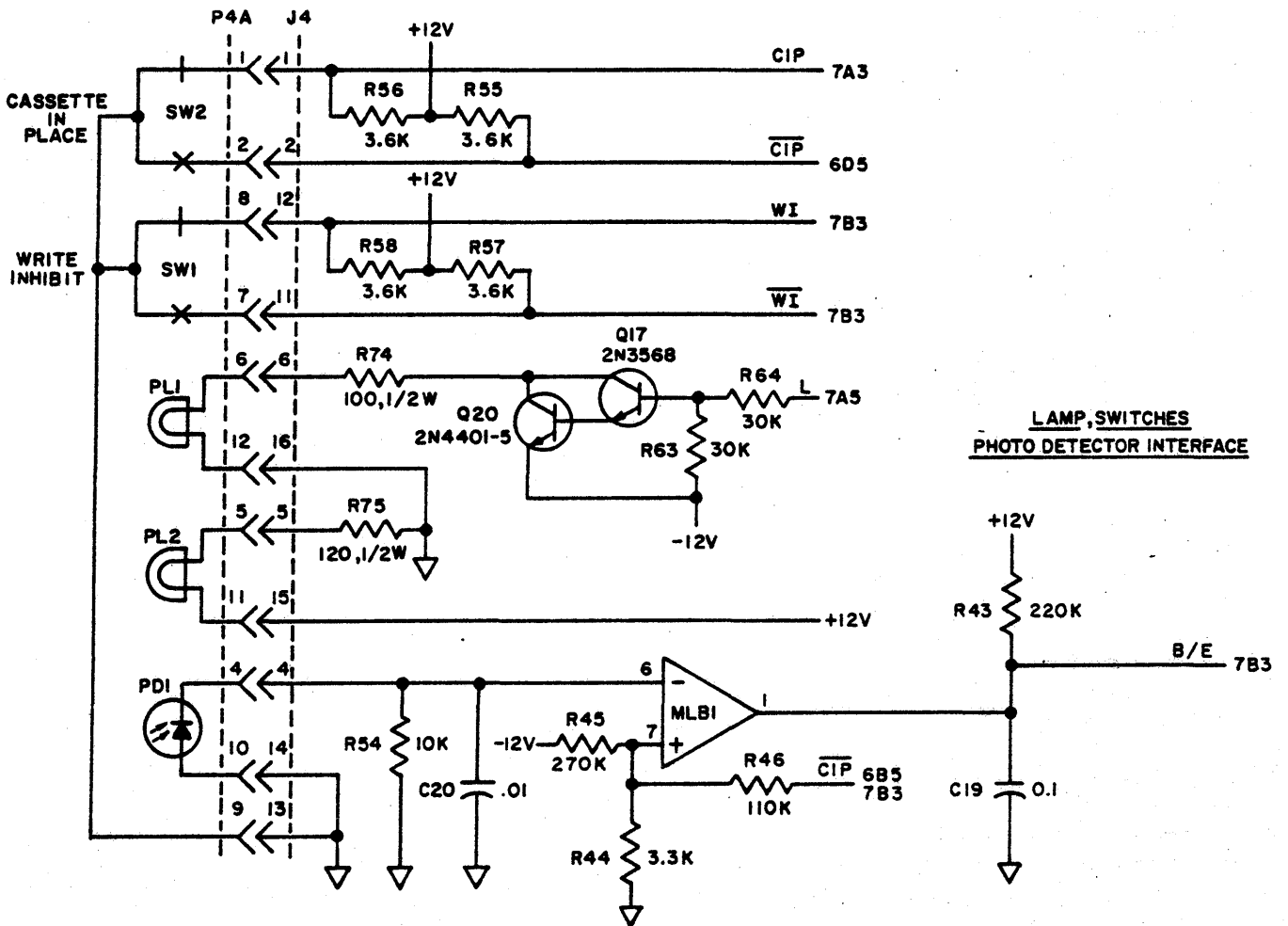
D. TROUBLESHOOTING (Contd)

6. FUNCTIONAL SCHEMATICS (Contd)

CLUTCH AND BRAKE DRIVERS



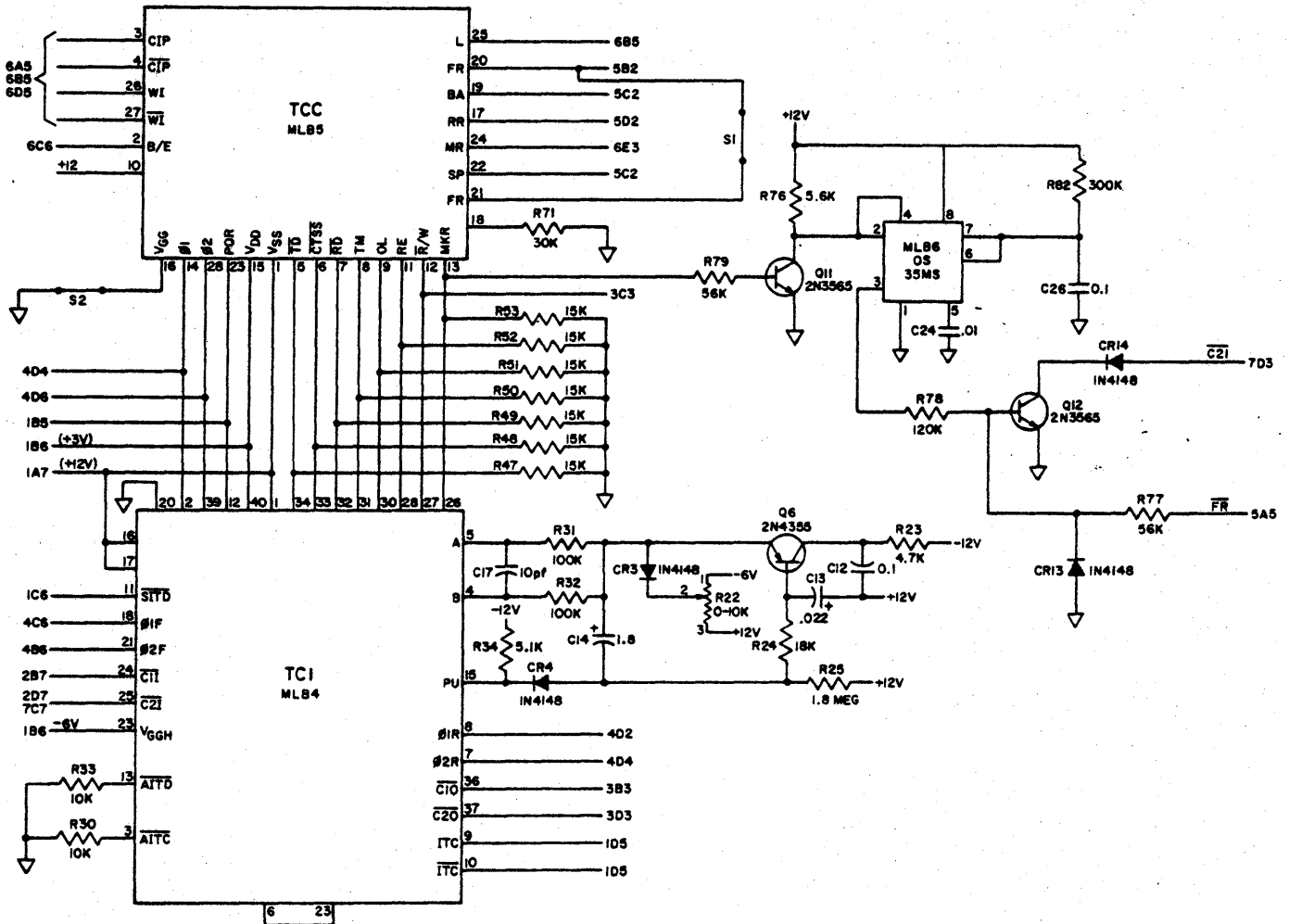
LAMP, SWITCHES, PHOTO DETECTOR INTERFACE,  
MOTOR AND MOTOR CONTROL



D. TROUBLESHOOTING (Contd)

6. FUNCTIONAL SCHEMATICS (Contd)

MOS CIRCUIT, PLL CONTROL AND MARKER BLIND



E. ADJUSTMENTS AND LUBRICATION1. GENERAL

Adjustments that require major disassembly of the cassette drive are not covered in this manual at this time.

Adjustments are grouped according to the mechanism (cassette holder or drive mechanism), and in the sequence recommended for a comprehensive "in-the-field" adjustment. One electrical adjustment of the 410764 card "Open Line Frequency" is shown.

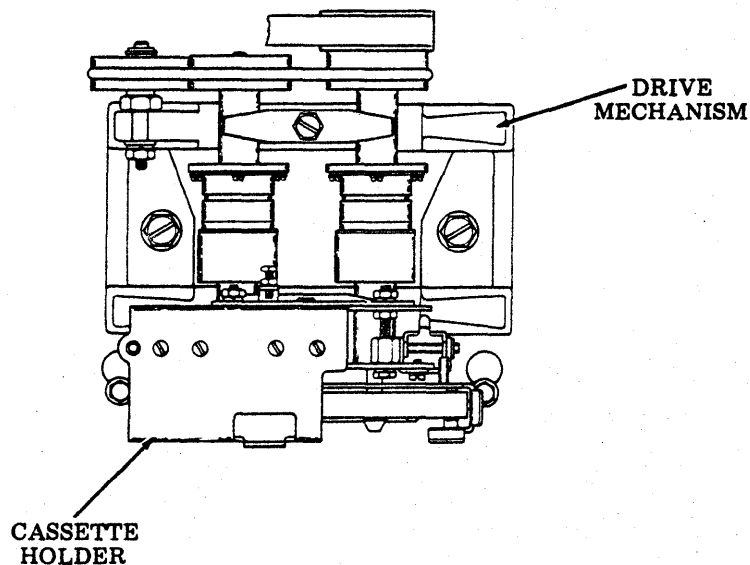
Identification drawings and tables are included to locate the mechanisms and list the adjustments related to these mechanisms.

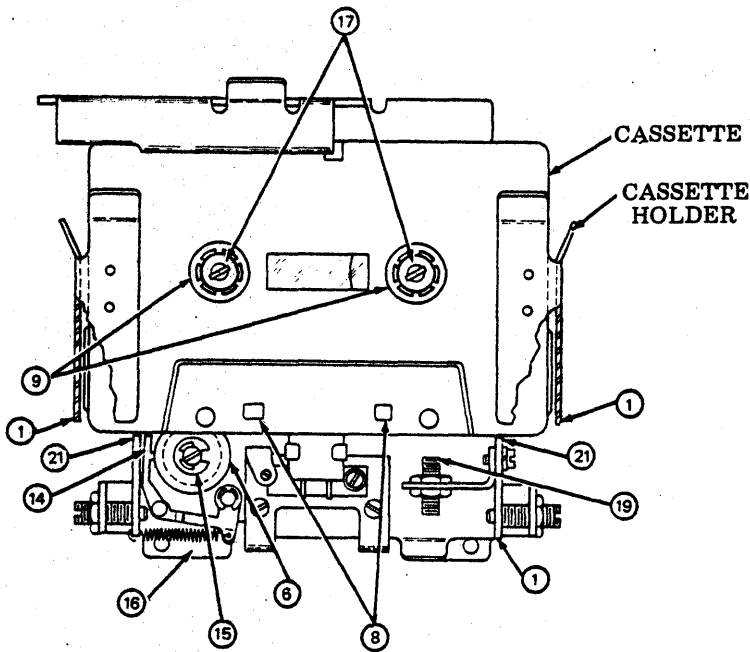
The instruction "friction tight" means to tighten to the point where friction keeps the parts from moving, but they are still loose enough to move for adjustment purposes.

Spring or belt tensions are checked with a spring scale held at the angle shown in the adjustment illustration. Springs that do not meet requirements, and for which no adjustment procedure is given, should be replaced.

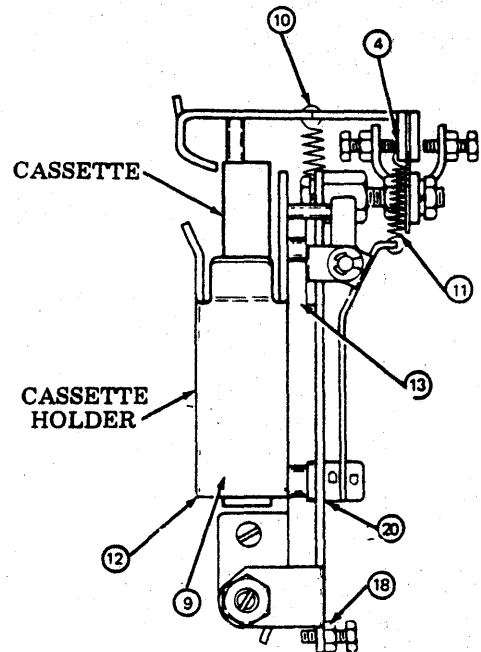
After adjustment is complete, tighten any screws or nuts loosened to make the adjustment.

Tools Required: 406131 Gauge (Brake and Clutch Gap)  
406130 Wrench, Driver (402274/402275 Drive Hubs)

2. ASSEMBLIES

E. ADJUSTMENTS AND LUBRICATION (Contd)2. ASSEMBLIES (Contd)Cassette Holder

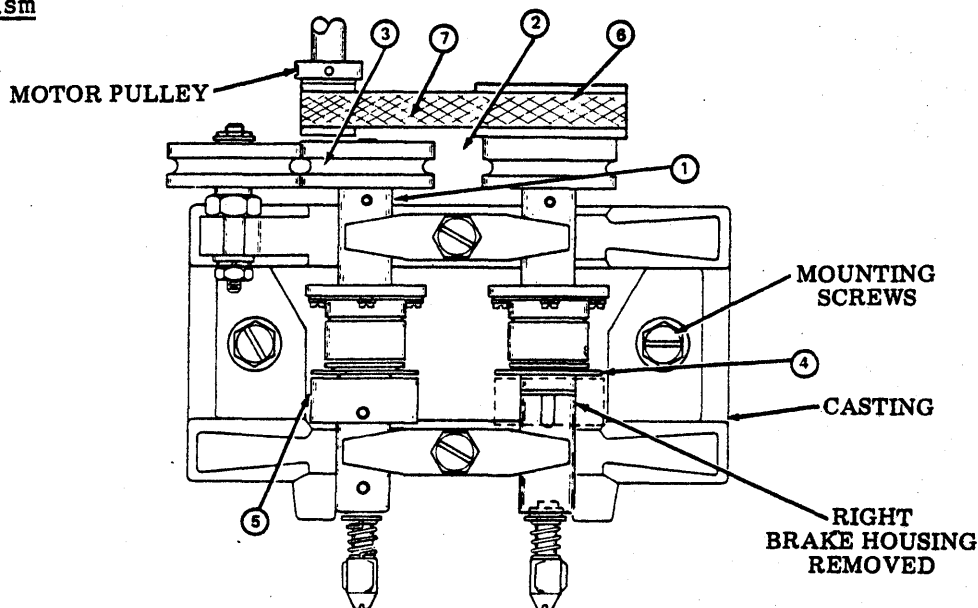
(Front View)



(Right Side View)

CASSETTE HOLDER ADJUSTMENTS	ADJUSTMENT REFERENCE PAGES
① Cassette Holder	2-95
② Latch (Preliminary and Final)	2-96
③ Latch Stop Screw (Rear)	2-97
④ Latch Stop Screw (Front)	2-97
⑤ Switch Height	2-98
⑥ Tape Cleaner	2-99
⑦ Run Lamp Mounting	2-99
⑧ Head	2-100
⑨ Plate With Cassette Holder	2-100
⑩ Cassette Latch Spring	2-101
⑪ Sensing Bail Spring	2-101
⑫ Cassette Pressure Spring	2-101
⑬ Cassette Holder Pressure Spring	2-102
⑭ Bobbin Latch Spring	2-102
⑮ Bobbin Spring	2-102
⑯ Stepper Spring	2-105
⑰ Drive Hub Spring	2-105
⑱ Cassette Holder Stop	2-103
⑲ BOT-EOT Lamp Mounting	2-103
⑳ BOT-EOT Sensor Tube	2-104
㉑ Cassette Downstop	2-104

Drive Mechanism



DRIVE MECHANISM ADJUSTMENTS	ADJUSTMENT REFERENCE PAGES
① Pulley and Shaft Endplay	2-106
② Pulley Alignment	2-106
③ Belt ("O" Ring)	2-106
④ Clutch	2-107
⑤ Brake	2-107
⑥ Motor Pulley	2-108
⑦ Motor Drive Belt	2-108

3. CASSETTE HOLDER ADJUSTMENTS

Cassette Holder

(1) Requirement

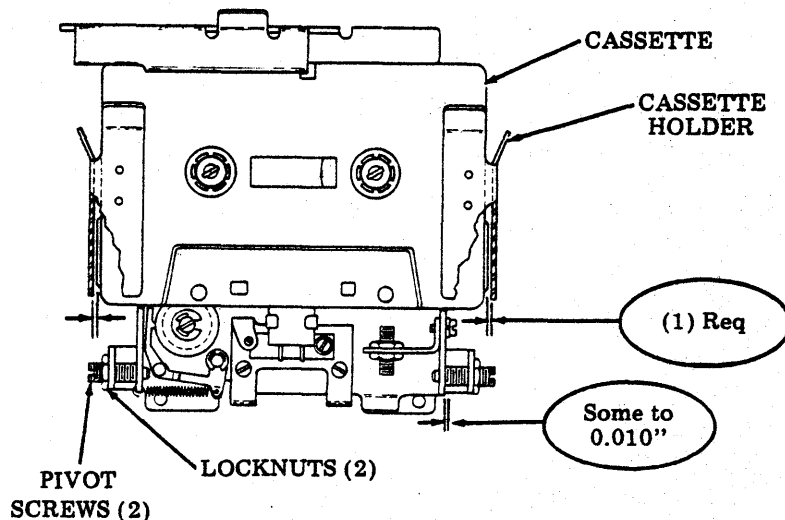
With a standard cassette latched in position, there should be equal clearance (as gauged by eye) between both sides of the cassette and the cassette holder.

(2) Requirement

Endplay between the cassette holder and the pivot screws  
Min Some---Max 0.010 inch.

To Adjust

With the locknuts friction tight, adjust pivot screws until the requirements are met. Tighten locknuts.



E. ADJUSTMENTS AND LUBRICATION (Contd)3. CASSETTE HOLDER ADJUSTMENTS (Cont)Latch (Preliminary)

## (1) Requirement

With a standard cassette in place and the cassette latched, the clearance between the cassette holder and the stop post should be

Min 0.005 inch---Max 0.015 inch.

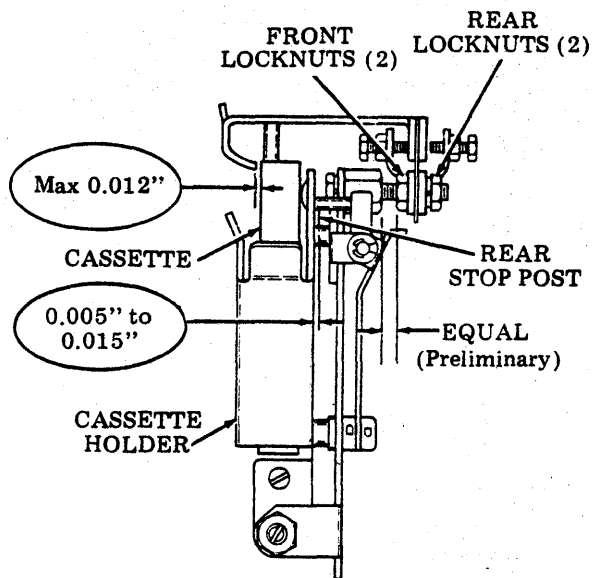
## (2) Requirement

With a standard cassette in place and the cassette holder latched, the clearance between any point and the latch should be

Max 0.012 inch.

## To Adjust

With the rear locknuts loosened, adjust the two front stop nuts equally (preliminary) until the requirement is met. Tighten locknuts.

Latch (Final)

## (1) Requirement

With a standard cassette placed (wrong side out) in the cassette holder and the cassette holder rotated until the latch is resting on the cassette, clearance between the cassette and either end of the latch should be

Min Some---Max 0.015 inch.

## (2) Requirement

The two switch actuators should be centered with their respective hole or slot, as gauged by eye.

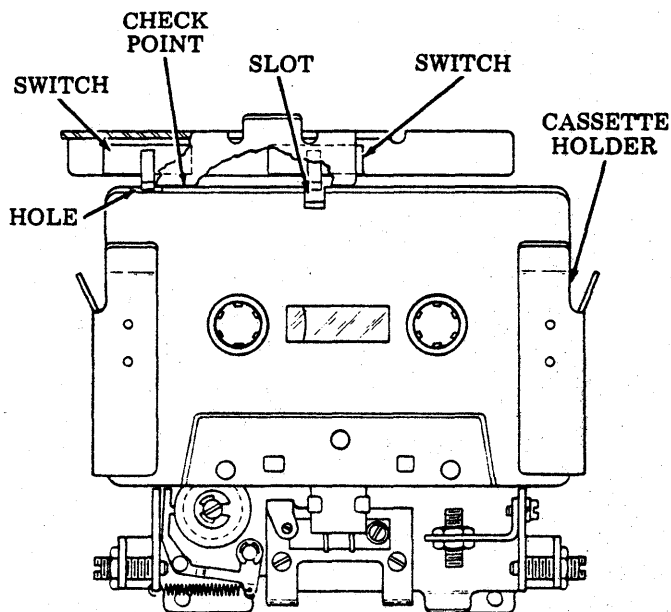
## (3) Requirement

With the cassette removed, the write inhibit switch actuator should clear the cassette holder when it is moved in and out.

## To Adjust

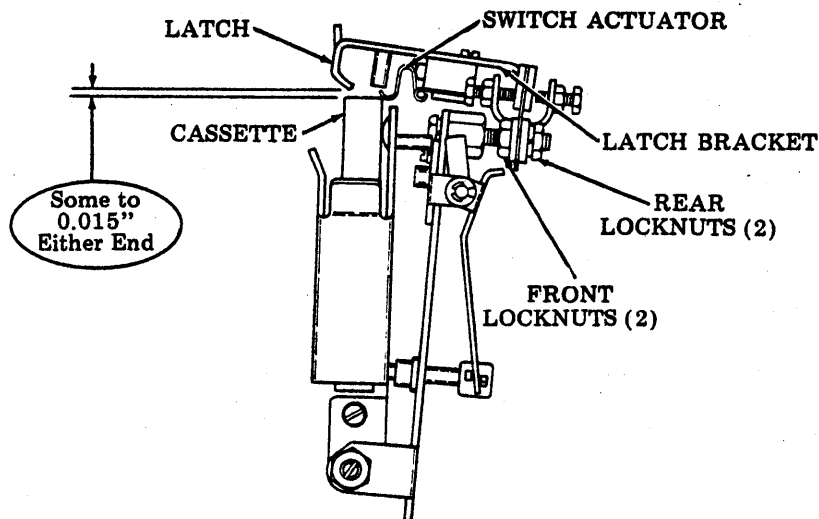
Maintain front locknuts position, loosen the rear locknuts, position the latch and switch to meet the requirements. Tighten locknuts.

## WRONG SIDE



NOTE: Recheck PRELIMINARY LATCH adjustment. Refine if necessary.

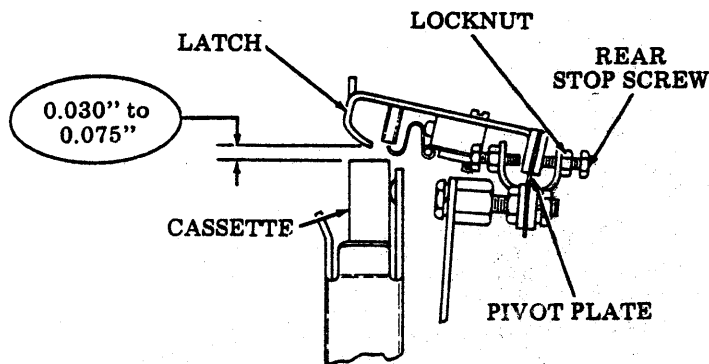




**Latch Stop Screw (Rear)**

**Requirement**

With the latch raised to its uppermost position, there should be clearance between the latch and a standard cassette of  
 Min 0.030 inch---Max 0.075 inch.



**To Adjust**

With locknut loose, position rear stop screw until the requirement is met. Tighten locknut.

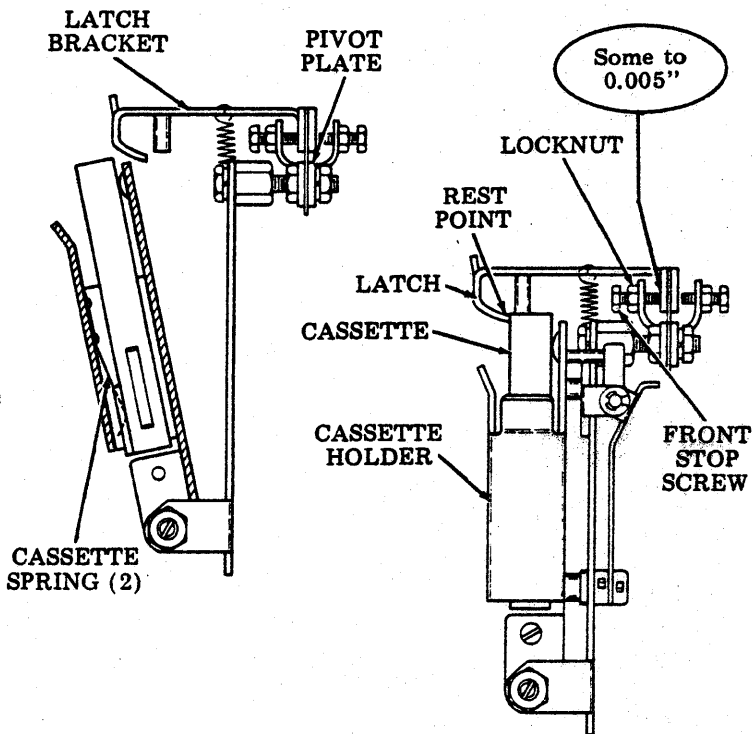
**Latch Stop Screw (Front)**

**(1) Requirement**

As the cassette holder with a standard cassette installed is pivoting toward the latched position, the cassette should strike the latch and cam the latch upward.

**(2) Requirement**

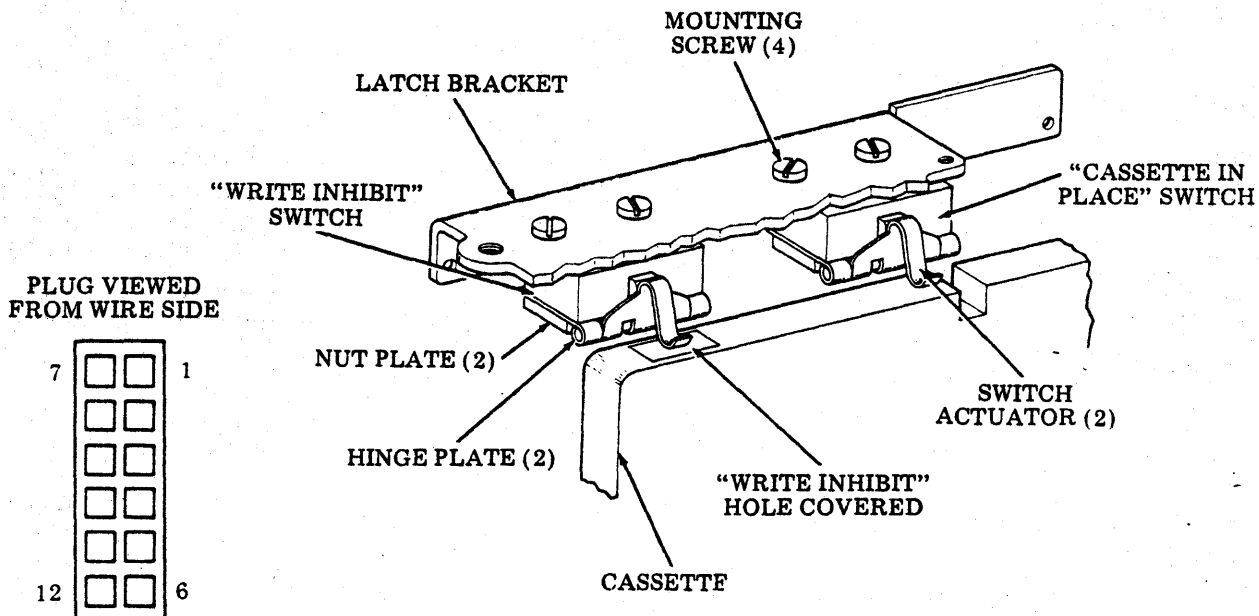
In the latched position, the latch should rest on the cassette and there should be clearance between the front stop screw and the latch bracket of  
 Min Some---Max 0.005 inch.



**To Adjust**

With the locknut loose, position the front stop screw until the requirement is met. Tighten locknut.

**NOTE:** Requirements (1) and (2) have to be checked with cassette spring holding cassette in place against the rear of the cassette holder.

E. ADJUSTMENTS AND LUBRICATION (Contd)3. CASSETTE HOLDER ADJUSTMENTS (Contd)Switch Height

## (1) Requirement

As a standard cassette (right side out) is loaded and unloaded into position, the two switches should operate at approximately the same time.

## To Check

Operation may be determined by the audible "click" of switches or by use of a continuity checking device, on terminals 7 and 8, ("Write Inhibit" switch) and terminals 1 and 2 ("Cassette in Place" switch) to indicate contact closure.

## (2) Requirement

There should be some overtravel left on the two switch actuators.

## To Check

Check for some clearance between the switch actuator and the cassette, without bottoming the actuator against the switch.

## To Adjust

With the switch mounting screws friction tight, position the hinge plate until the requirements are met. Tighten mounting screws.

NOTE: Power must be removed from unit when this measurement is taken. Recheck LATCH adjustment, refine if necessary.

Tape Cleaner

(1) Requirement

With a standard cassette in the loaded position, the magnetic tape should be in contact with the cleaning fabric.

(2) Requirement

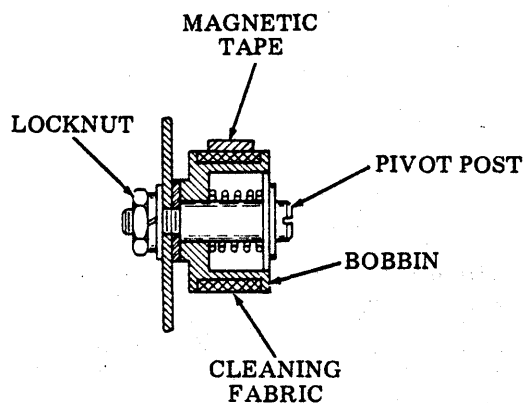
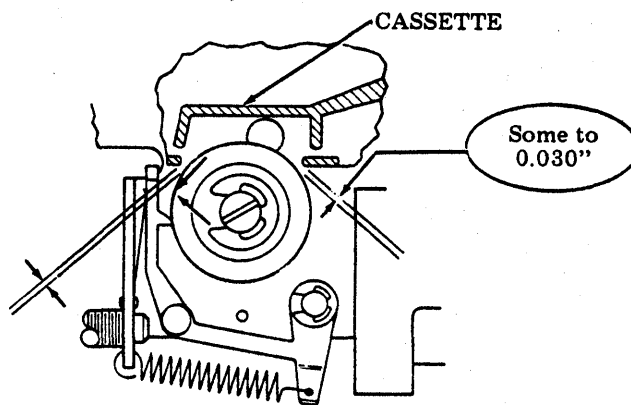
There should be  
Min Some---Max 0.030 inch  
clearance between cassette and bobbin on the side with least clearance.

(3) Requirement

The bobbin should step at least every second time the cassette is inserted.

To Adjust

With the locknut friction tight, position the bobbin vertically to meet the requirement. Tighten locknut.



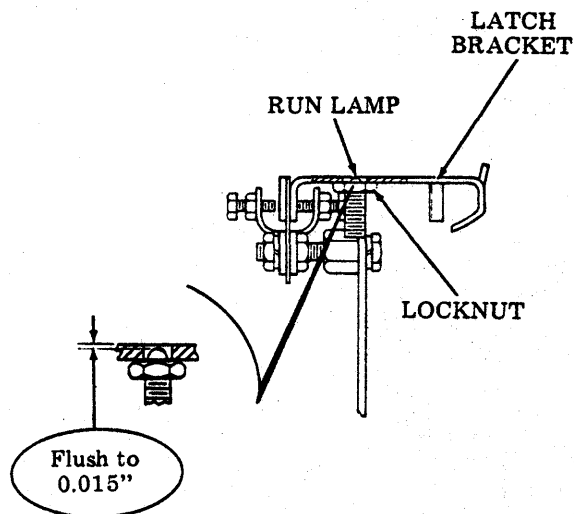
Run Lamp Mounting

Requirement

The tip of the run lamp should be  
Min Flush---Max 0.015 inch  
underflush with the top surface of the latch bracket.

To Adjust

With the locknut loose, position the lamp. Tighten the locknut.

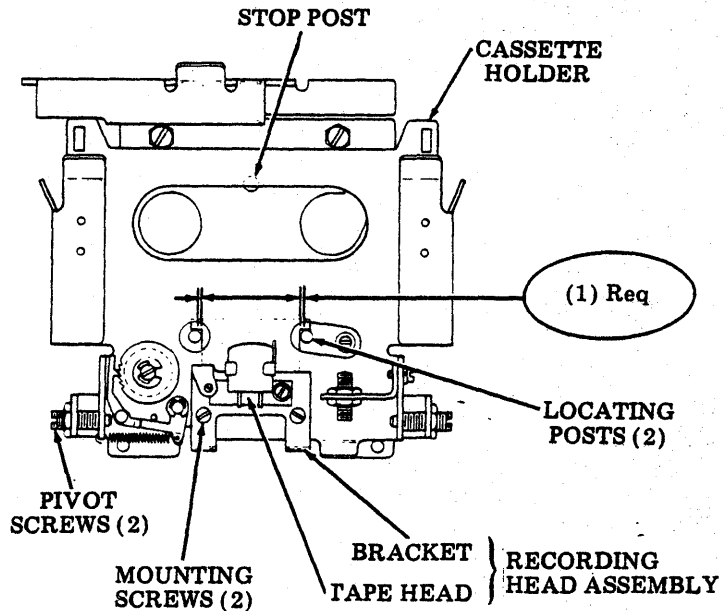


E. ADJUSTMENTS AND LUBRICATION (Contd)3. CASSETTE HOLDER ADJUSTMENTS (Contd)Head Adjustment**(1) Requirement**

With the cassette holder biased rearward against the stop post, recording head assembly should rest on the locating posts and should be centered with equal clearance, as gauged by eye, between the locating posts.

**(2) Requirement**

The recording head assembly should not bind on the locating pins when cassette holder is pivoted outward. Check that the endplay between the cassette holder and pivot screws is taken up, first to the left and then to the right.

**To Adjust**

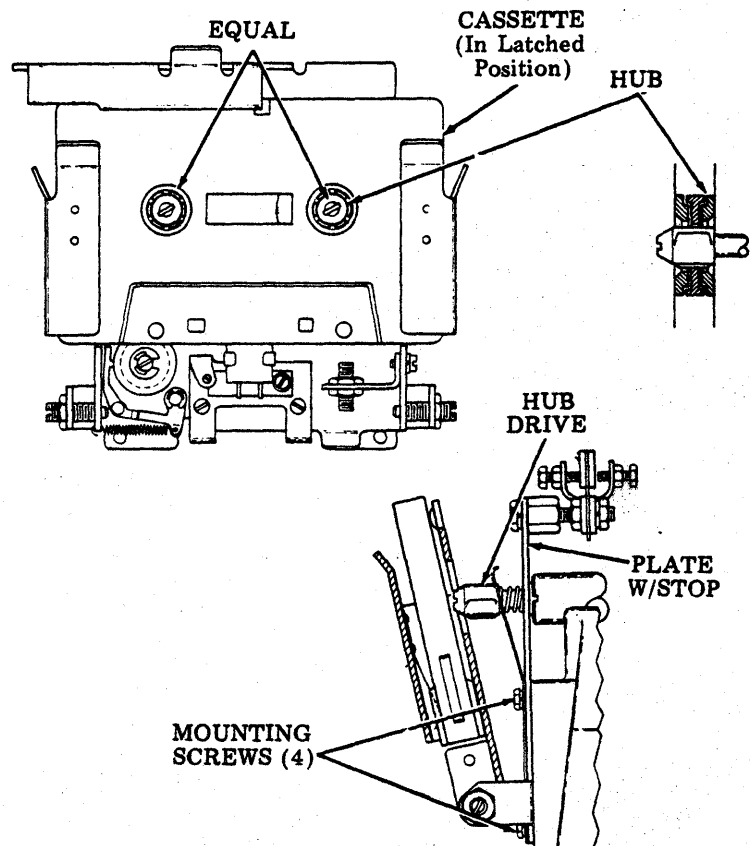
With the cassette holder biased rearward against the stop post and the mounting screws friction tight, slide recording head assembly against locating posts and the clearance on both sides should be equal. Tighten mounting screws.

Plate With Cassette Holder**Requirement**

With a standard cassette loaded in its latched position, the radial distance between the drive hub (less driving teeth) and the cassette case should be equal, as gauged by eye. Check requirement on both hubs.

**To Adjust**

With the mounting screws friction tight, position plate with stop to meet this requirement. Tighten mounting screws.



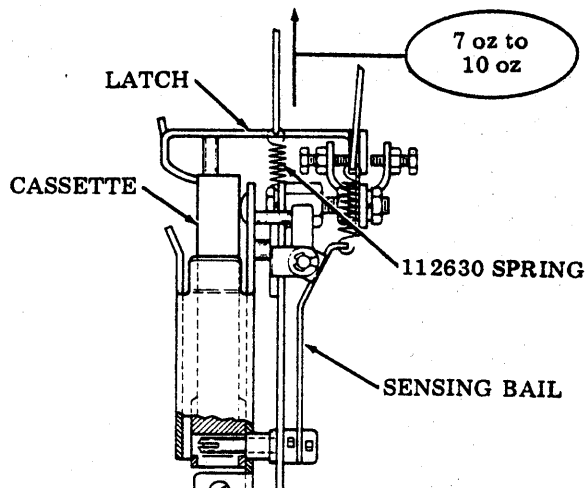
**NOTE:** The flat portion of the driving teeth of the drive hubs must drive the reel clockwise on the left (rewind) shaft and counterclockwise on the right (wind) shaft.

Cassette Latch Spring

Requirement

With a standard cassette in the latched position, it should take  
 Min 7 ounces---Max 10 ounces  
 to start spring moving from the installed length.

NOTE: If spring does not meet requirement, it should be replaced.

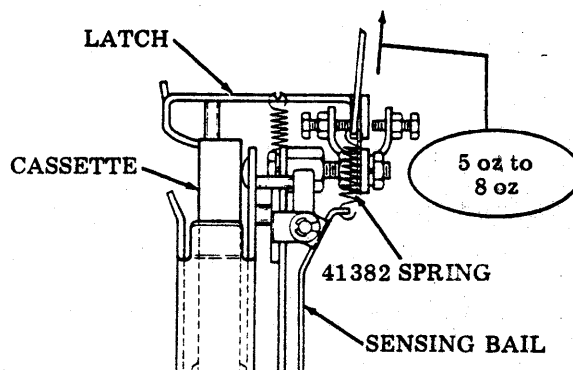


Sensing Bail Spring

Requirement

With a standard cassette in the latched position, it should take  
 Min 5 ounces---Max 8 ounces  
 to start spring moving from the installed length.

NOTE: If spring does not meet requirement, it should be replaced.



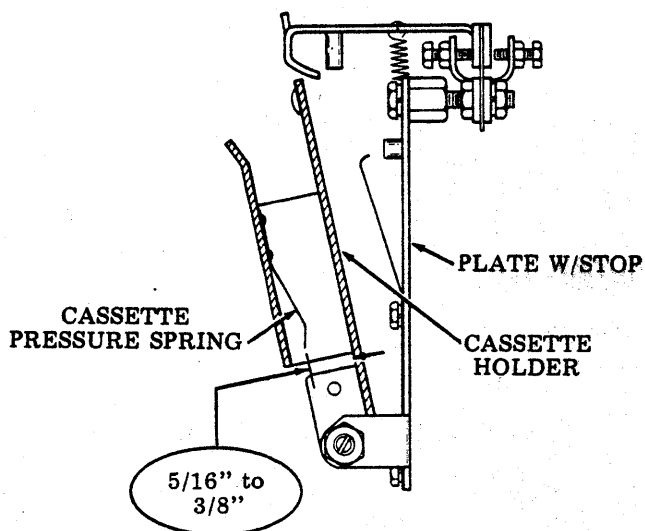
Cassette Pressure Spring

Requirement

With an unloaded cassette holder, the clearance between the tip of the pressure spring and the cassette holder should be  
 Min 5/16 inch---Max 3/8 inch.

To Adjust

Bend spring to meet requirement.



E. ADJUSTMENTS AND LUBRICATION (Contd)

3. CASSETTE HOLDER ADJUSTMENTS (Contd)

Cassette Holder Pressure Spring

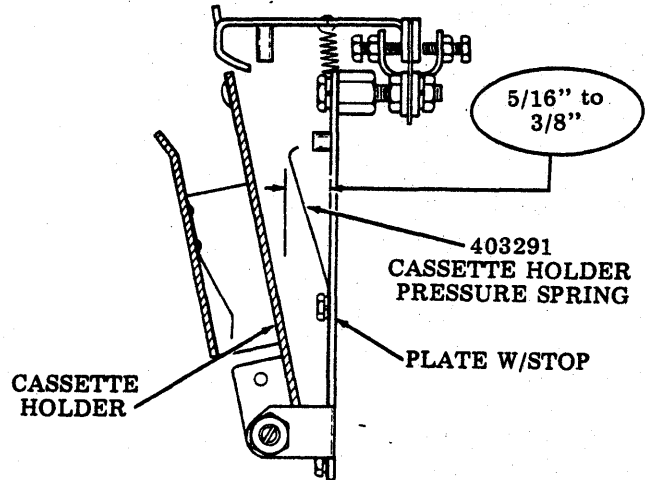
Requirement

With the cassette holder in the unlatched position, the distance between the outside edge of the upper form of the spring and the plate with stop should be

Min 5/16 inch---Max 3/8 inch.

To Adjust

Bend spring to meet this requirement.



Bobbin Latch Spring

Requirement

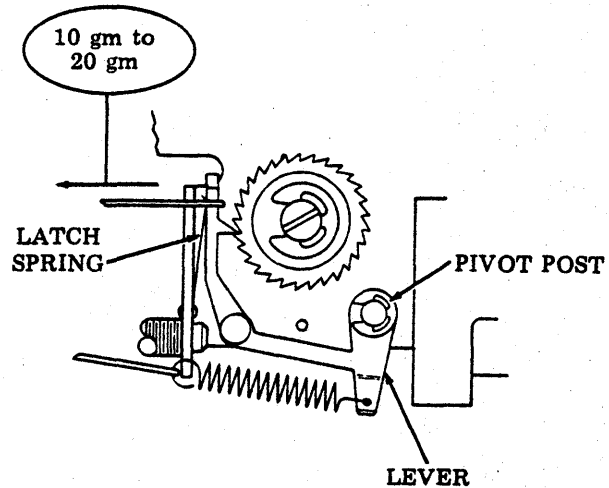
It should take

Min 10 grams---Max 20 grams to start latch moving.

To Adjust

Bend spring to meet his requirement.

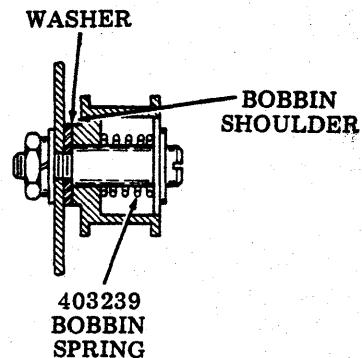
**NOTE:** While checking, hand rotate ratchet wheel 1/2 tooth travel.



Bobbin Spring

Requirement

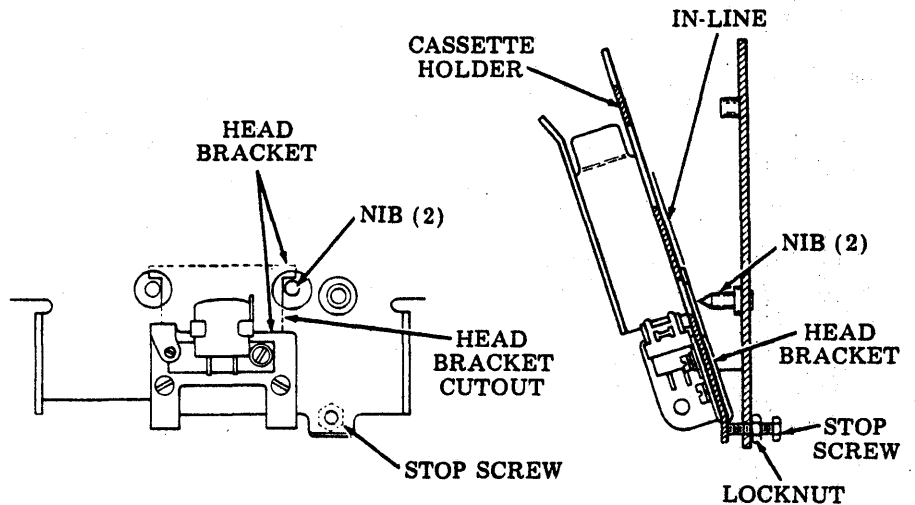
The bobbin spring should bias the bobbin shoulder against the washer.



**Cassette Holder Stop**

**Requirement**

With cassette holder in unlatched (forward) position, rear side of head bracket should be in line with the tip of the NIB (as gauged by eye at cutout of head bracket).



**To Adjust**

With locknut friction tight, adjust stop screw until requirement is met. Tighten locknut.

**BOT-EOT Lamp Mounting**

**(1) Requirement**

With cassette holder in its rearmost position (against stop post), tip of lamp should be

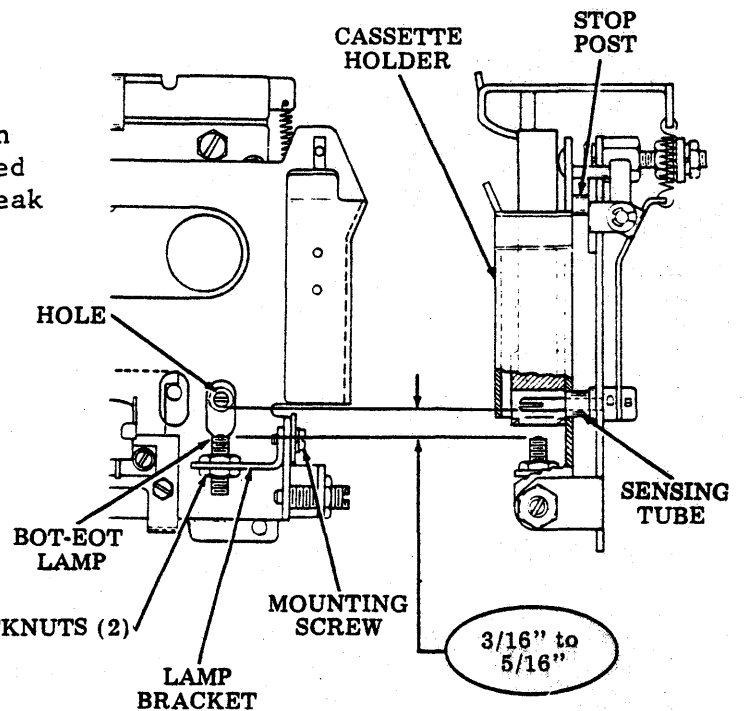
Min 3/16 inch---Max 5/16 inch from bottom of sensing tube.

**(2) Requirement**

Lamp should be in line with hole in underside of sensing tube, as gauged by eye. Lamp should be aimed for peak photo-cell output. (A minimum of -200 millivolts.)

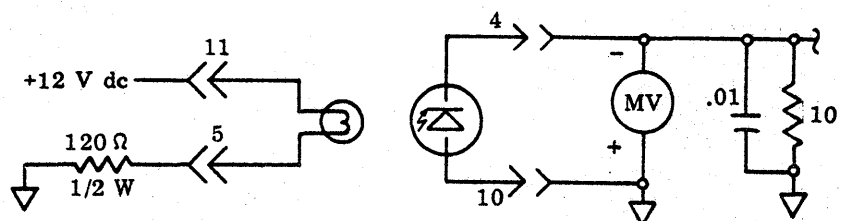
**To Adjust**

Loosen locknuts and mounting screw which secures lamp bracket to cassette holder. To meet requirement, adjust light source in the following sequence (to produce a minimum output of -200 millivolts between pins 4 and 10 (to 410764 circuit card).



- (a) Vertical (up and down)
- (b) Vertical Rotation
- (c) Horizontal Position (within mounting hole)

Tighten locknuts and mounting screws.



E. ADJUSTMENTS AND LUBRICATION (Contd)3. CASSETTE HOLDER ADJUSTMENTS (Contd)BOT-EOT Sensor TubeRequirement

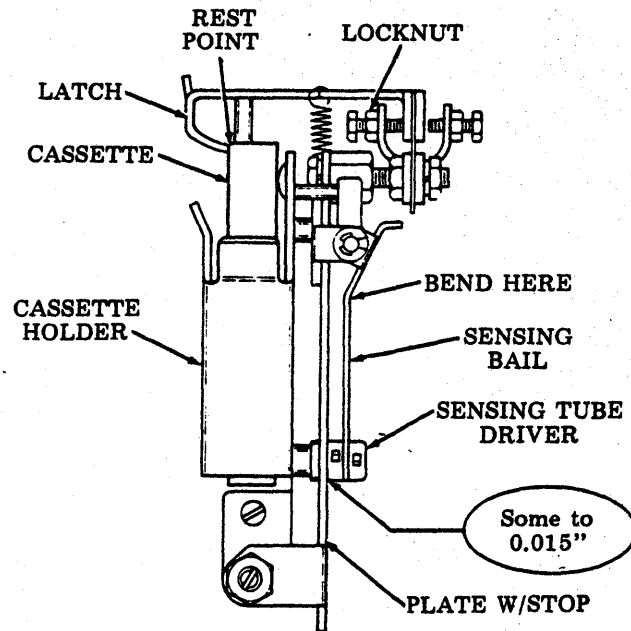
With the cassette in the latched position, the clearance between the sensing tube driver and the plate with stop should be

Min: Touch without binding.

Max: Not to exceed 0.015 inch at the point of least clearance when the sensing tube is biased lightly to the rear to take up play.

To Adjust

Bend sensing bail as required to meet requirement.

Cassette DownstopRequirement

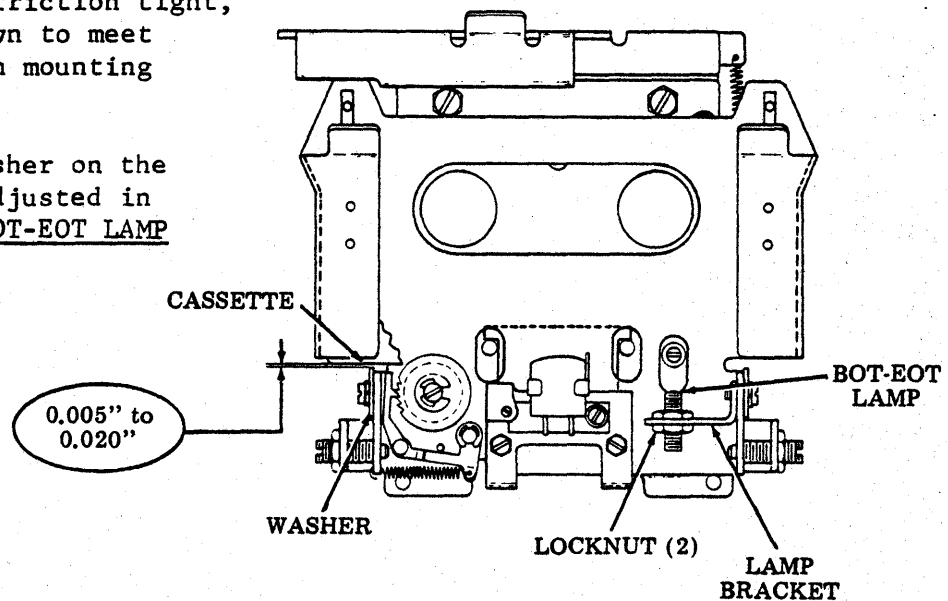
With a cassette latched in place, the clearance between the cassette and the top of the washer should be

Min 0.005 inch---Max 0.020 inch on both sides.

To Adjust

With mounting screw friction tight, move washer up or down to meet requirement. Tighten mounting screw.

NOTE: The downstop washer on the right side should be adjusted in conjunction with the BOT-EOT LAMP MOUNTING adjustment.



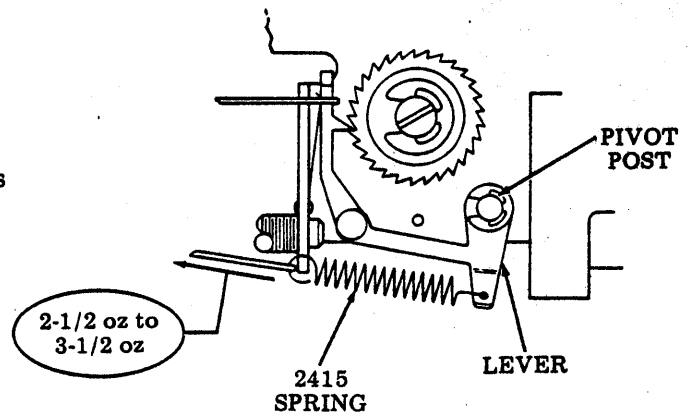


Stepper Spring

**Requirement**

With the cassette removed, it should take  
 Min 2-1/2 ounces---Max 3-1/2 ounces  
 to start spring moving at the  
 installed length.

**NOTE:** If spring does not meet  
 requirement, it should be replaced.

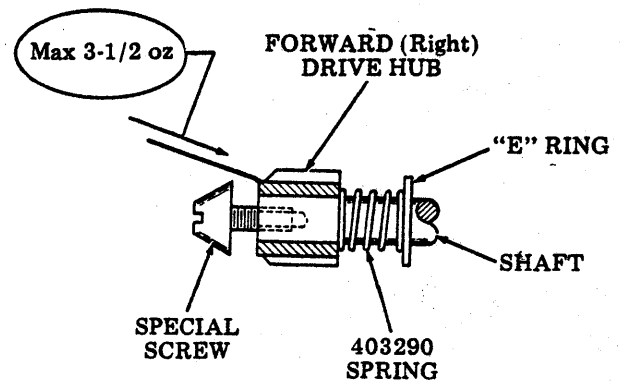


Drive Hub Spring -- Forward (Right)

**Requirement**

The drive hub should contact the special  
 screw. It should require  
 Max 3-1/2 ounces  
 to start drive hub moving rearward.

**NOTE:** It may be necessary to remove the  
 special screw to check this requirement,  
 however, the check is made with the drive  
 hub at the normal rest position. If  
 spring does not meet requirement, replace  
 spring.



Drive Hub Yield Spring -- Reverse (Left)

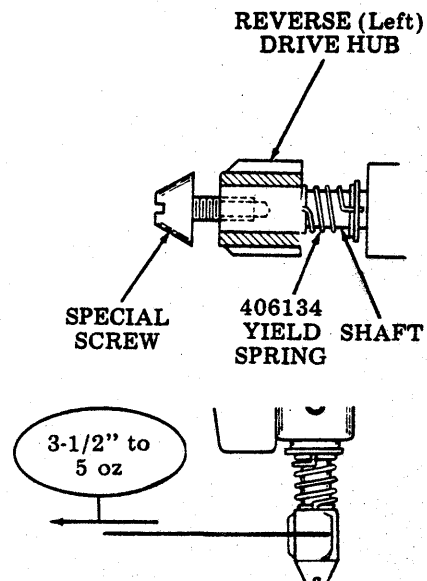
(1) **Requirement**

Restrain the shaft from turning; it  
 should require  
 Min 3-1/2 ounces---Max 7 ounces  
 applied to the outer edge of the drive  
 hub to start the hub moving counter-  
 clockwise.

(2) **Requirement**

When the drive hub is moved all the way  
 to the rear and let snap forward, the  
 drive hub should contact the special  
 screw.

**NOTE:** If the spring does not meet the  
 requirement, replace spring.



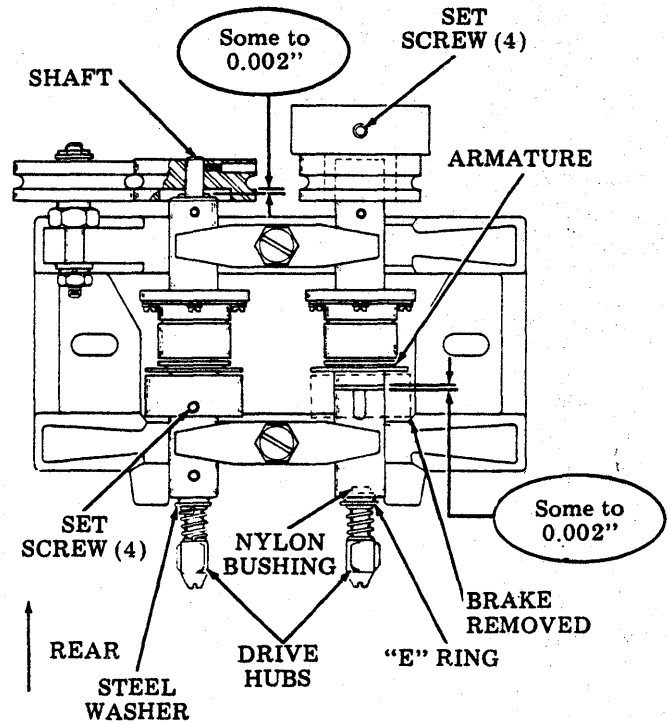
E. ADJUSTMENTS AND LUBRICATION (Contd)4. DRIVE MECHANISM ADJUSTMENTSPulley and Shaft Endplay**Requirement**

There should be

Min Some---Max 0.002 inch perceptible endplay, as gauged by eye, on each shaft.

**To Adjust**

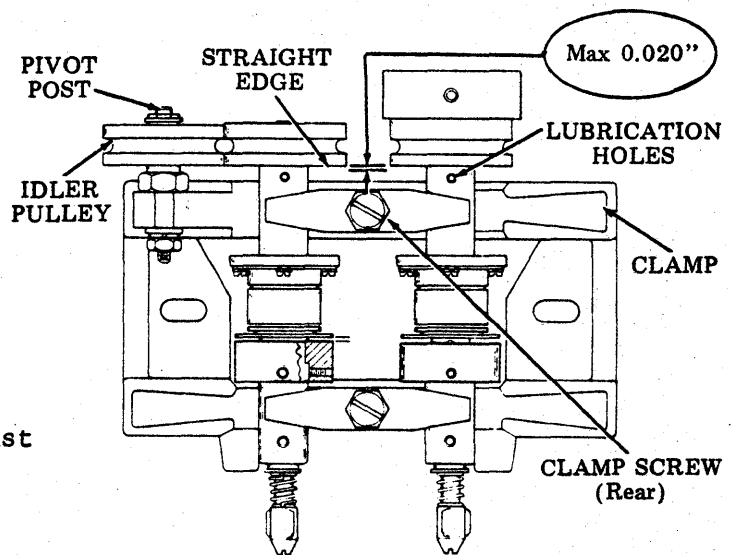
- Position each armature on its shaft with two set screws loosened.
- Insert a 0.002 inch gauge between friction washer and armature.
- Apply enough rearward pressure on the drive hubs to force the steel washer against the nylon bushing and overcome any play between the "E" ring and the shaft "E" ring groove.
- Tighten (very securely, both set screws for each assembly).

Pulley Alignment**Requirement**

With lubrication holes upward, the front face of all three pulleys should be in line within Max 0.020 inch as gauged against a straight edge. (Bias idler pulley toward rear.)

**To Adjust**

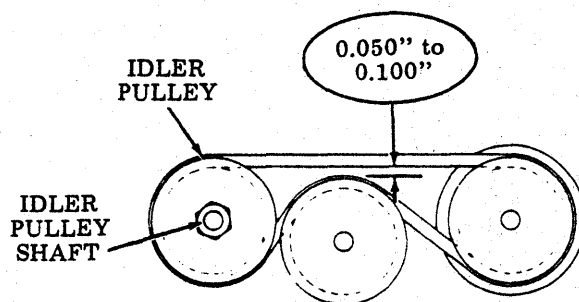
With the rear clamp screw friction tight and the "O" ring removed, adjust the shafts with pulleys until the requirement is met. Tighten clamp screw.

Belt ("O" Ring)**Requirement**

The gap in the reversing belt should be Min 0.050 inch---Max 0.100 inch.

**To Adjust**

With the idler pulley shaft friction tight, adjust up or down until the requirement is met. Tighten shaft nut.



**Clutch**

**Requirement**

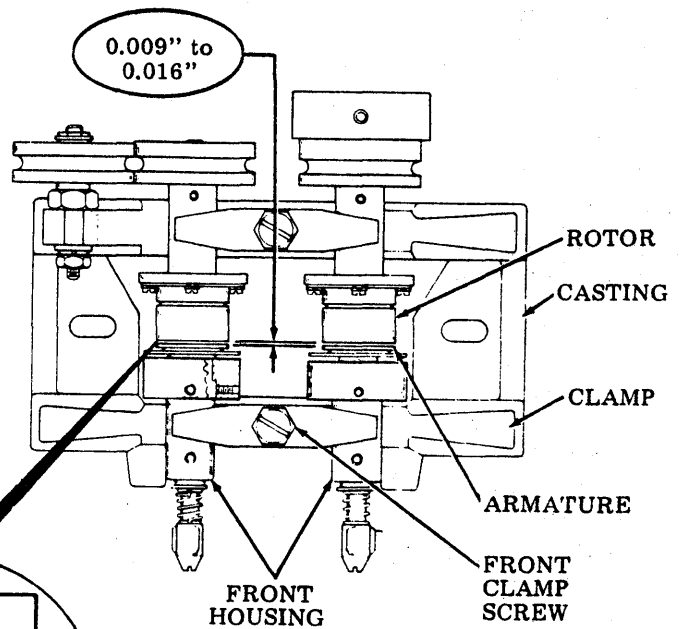
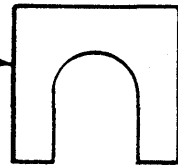
With lubrication holes upward and each shaft biased toward the center, the air gap between the rotor and armature of each clutch should, at the point of least clearance, be

Min 0.009 inch---Max 0.016 inch.

**To Adjust**

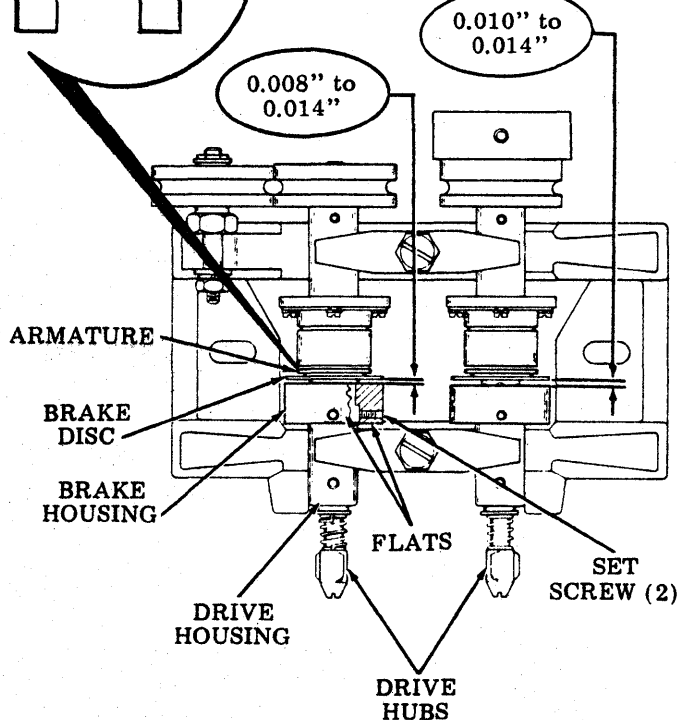
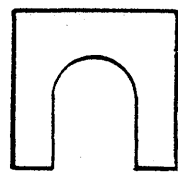
With the front clamp screw friction tight, and the 406131 0.012 inch gauge between the rotor and armature, slide front housing rearward until the requirement is met. Tighten clamp screw.

406131 0.012"  
GAUGE  
(Insert in Air Gap)



**Brake**

406131 0.012" GAUGE  
(Insert Between Brake  
Disc and Brake Housing)



**Requirement**

With the armature biased toward the front (by means of pulling slightly on the drive hub), the air gap between the brake disc and the brake housing should, at the point of least clearance, be

Min 0.010 inch---Max 0.014 inch  
(Forward Brake)

Min 0.008 inch---Max 0.014 inch  
(Reverse Brake)

**To Adjust**

Loosen the two sets screws. Insert the 406131 0.012 inch gauge between the brake disc and the brake housing. With the set screws over the mounting flats on the drive housing, slightly tighten the right set screw until friction tight. Adjust brake coil housing until the requirement is met. Tighten two set screws.

E. ADJUSTMENTS AND LUBRICATION (Contd)

4. DRIVE MECHANISM ADJUSTMENTS (Contd)

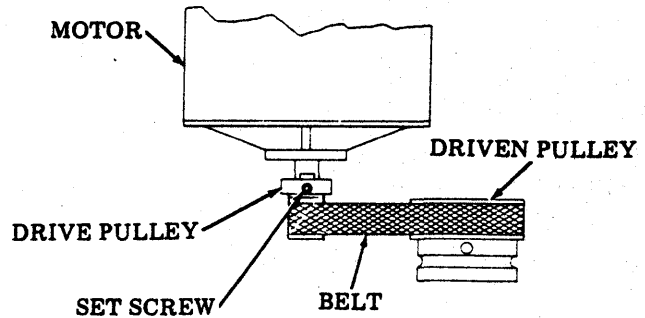
Motor Pulley

Requirement

The flat belt should be approximately centered on both the motor drive pulley and driven pulley.

To Adjust

With the set screw loose, position the drive pulley to meet the requirement.



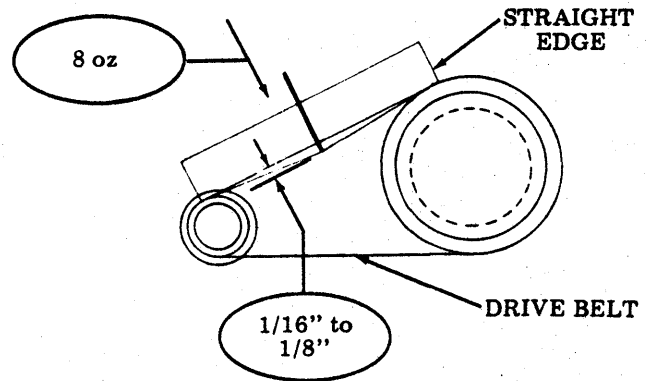
Motor Drive Belt

(1) Requirement

With a force of 8 ounces applied perpendicular to the drive belt, approximately midway along its free length, the belt should deflect  
Min 1/16 inch---Max 1/8 inch  
from a line tangent to both pulleys.

(2) Requirement

While the belt is motor driven (motor on), the belt should maintain its center position on the large pulley and should not walk to the edge of the pulley.



To Adjust

With the casting mounting screws friction tight, move casting, left or right with a slight pivot, to meet the requirements.

Base Plate Height (Early Design Only - See Note)

## (1) Requirement

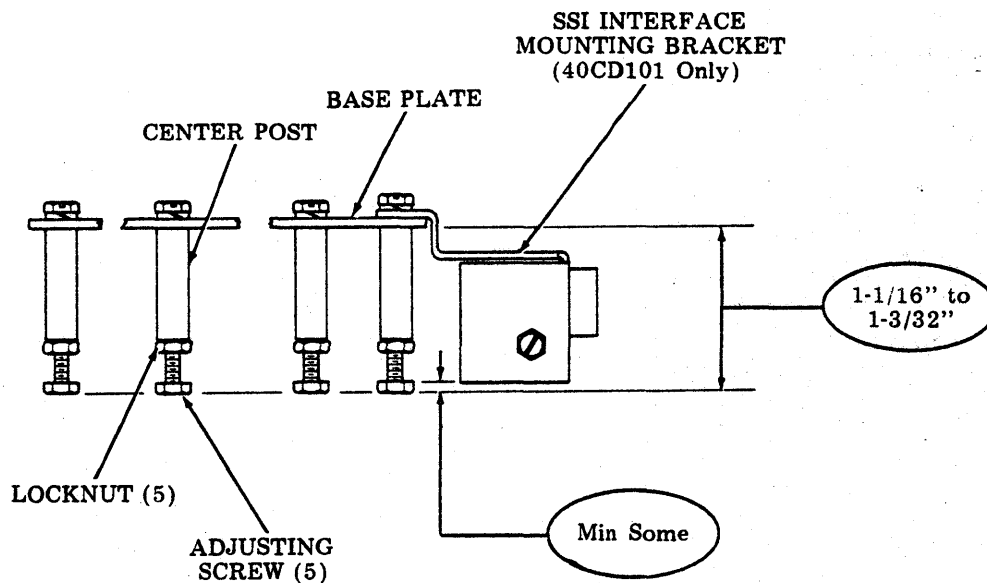
The five posts and adjusting screws should support and maintain a level balance of the unit when removed from the cover base.

## (2) Requirement

The distance between the tops of the adjusting screws and base plate should be Min 1-1/16 inch---Max 1-3/32 inch.

## To Adjust

With the locknuts friction tight, adjust the four corner posts to meet the requirement. Tighten locknuts. With the aid of a flat surface, adjust the center post until the tip of the adjusting screw is parallel to the four outer posts. Tighten locknut.



**NOTE:** Early design 40CD102 were supplied with five posts and five adjusting screws. Later design units are supplied with screws replacing the posts and adjusting screws and do not require adjusting.

E. ADJUSTMENTS AND LUBRICATION (Contd)5. 410764 CIRCUIT CARD ADJUSTMENTOpen Line FrequencyRequirement

The open line frequency of the 405681 TCI chip must be 50 kilohertz  $\pm 1$  kilohertz. The adjustment must be accurate to within  $\pm .4$  microseconds.

To Adjust

With dc power applied to the 410764 circuit card and the SSI signal line disconnected, adjust R22 to meet the above requirement.

NOTE 1: To adjust variable resistor (R22), connect oscilloscope common to board common (negative end of C1) and oscilloscope probe to the phase 1 clock output (either end of R13).

Set the scope:

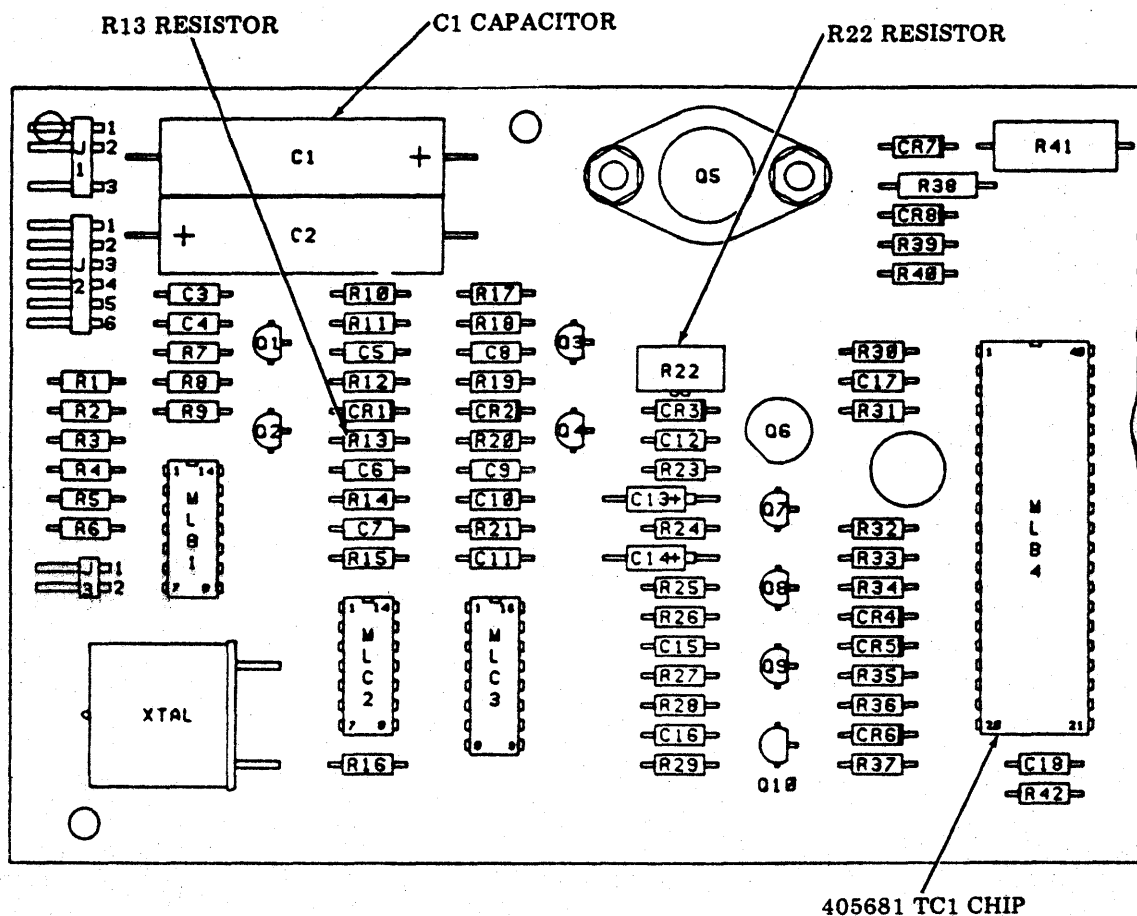
X10 probe to 0.5 V per division

2 microseconds per division

Center the trace

Adjust R22 to obtain one complete cycle in 10 divisions.

NOTE 2: With the exception of this adjustment on the 410764 circuit card assembly, all other adjustments are related to the mechanical portion of the 40CD102.



## 6. CASSETTE DRIVE LUBRICATION

Lubricate the cassette drive just prior to placing in service or before putting it in storage. The cassette drive should be relubricated after it has been in service a few weeks. Thereafter, relubricate every 2000 hours of running time or 6 months, whichever occurs first.

Apply lubricants to points as indicated.

On small parts, a minimum amount of lubricant should be applied so that the lubricant remains on the parts and does not run off.

Excessive lubricant should be removed with a dry, lint-free cloth.

The following areas must be kept dry, free of all lubricant:

All electrical components, including terminals.

All parts normally touched by the operator, including exposed surfaces in the cassette holder area and all large flat areas.

Reading head.

Surfaces of the tape cleaner which contact the magnetic tape.

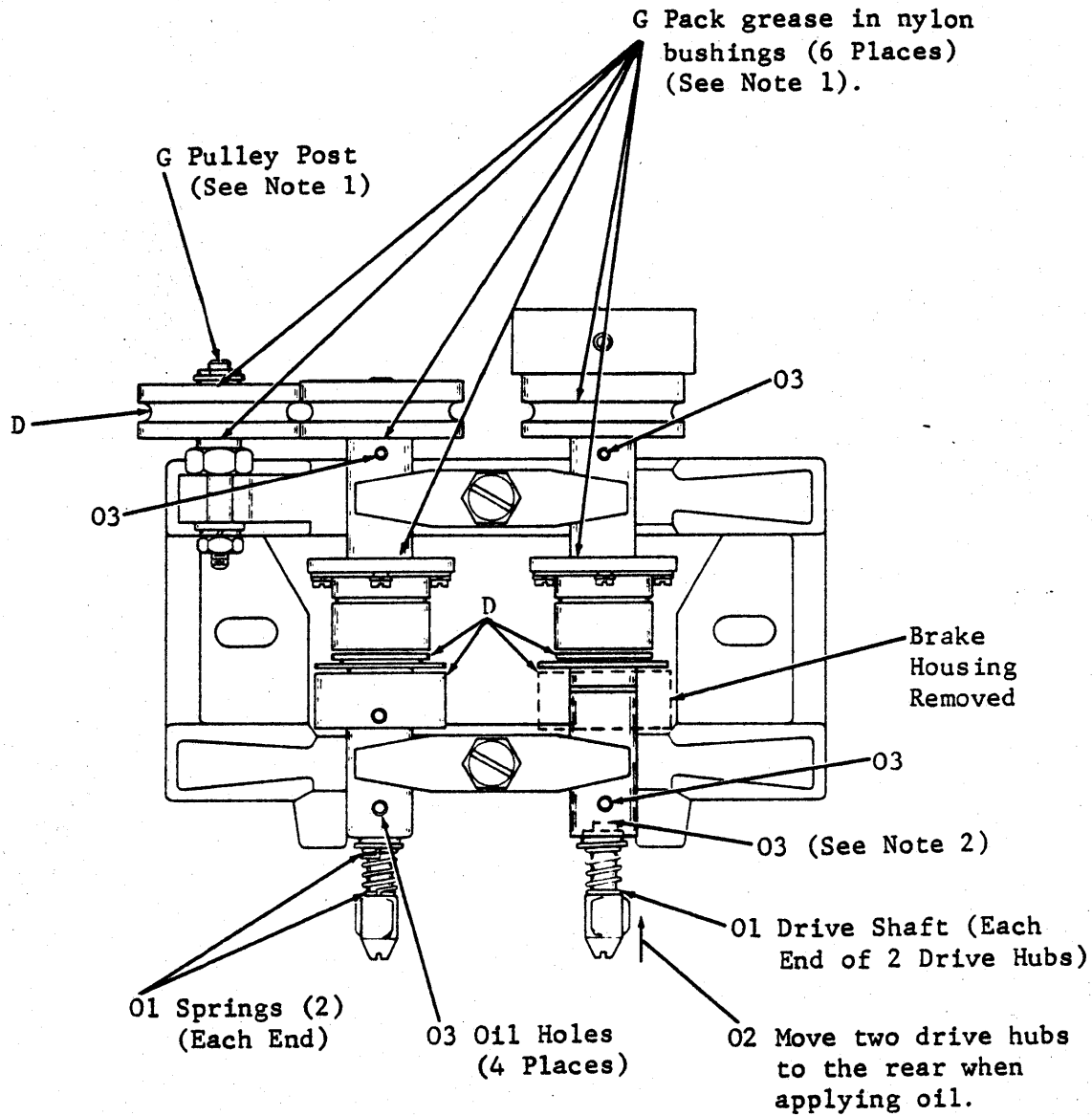
Friction surfaces of the magnetic clutches.

The following symbols indicate the quantity of lubricant to be used on a specified area: Symbols 01, 02, 03, etc., refer to 1, 2, 3, etc., drops of oil. The following list of symbols applies to the lubrication instructions and the type of lubricant to be used:

O Oil (88970)

G Pack grease between nylon bushings (143484--one pound can or 145867 4-ounce tube)

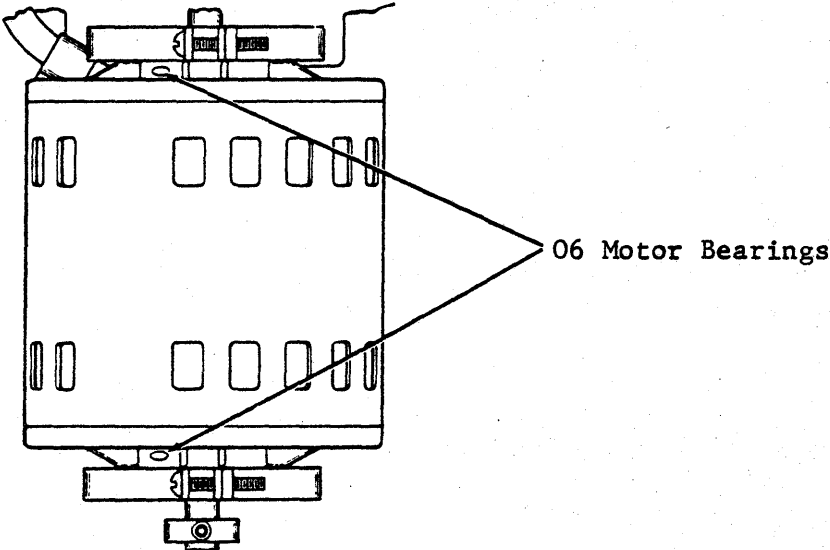
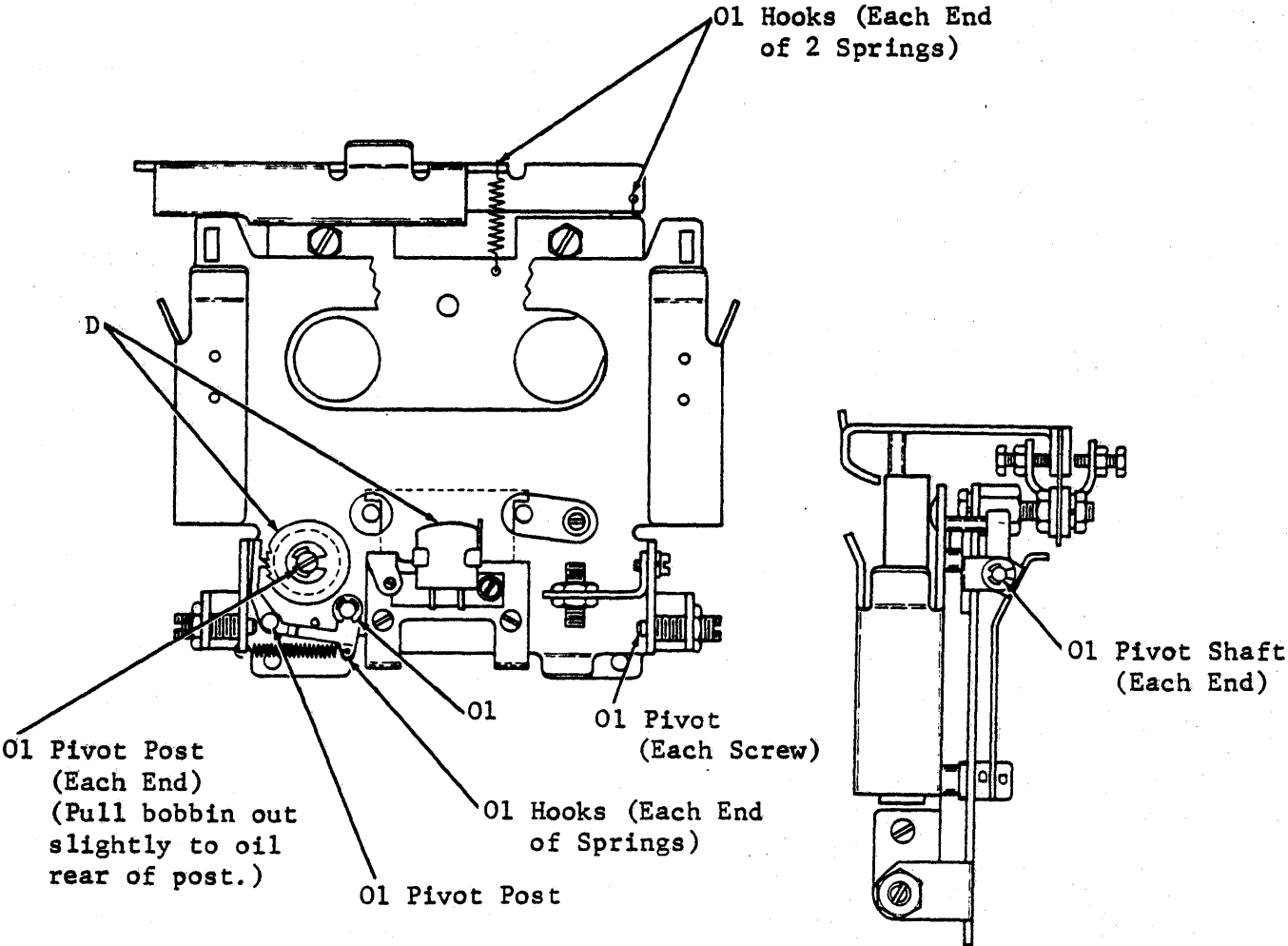
D Keep dry, no lubricant permitted.

E. ADJUSTMENTS AND LUBRICATION (Contd)6. CASSETTE DRIVE LUBRICATION (Contd)

NOTE 1: These nylon bushings should be greased only when the unit is reassembled.

NOTE 2: These nylon bushings (4) and fiber friction washer (4) should be oiled (03 drops), whenever a nylon bushing or a friction washer is replaced.





F. DISASSEMBLY/REASSEMBLY AND PARTS

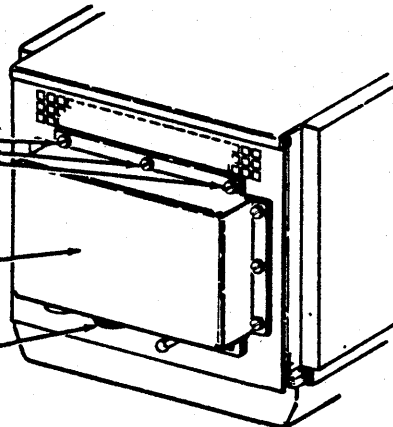
1. REMOVAL AND REPLACEMENT OF UPPER CABINET ASSEMBLY

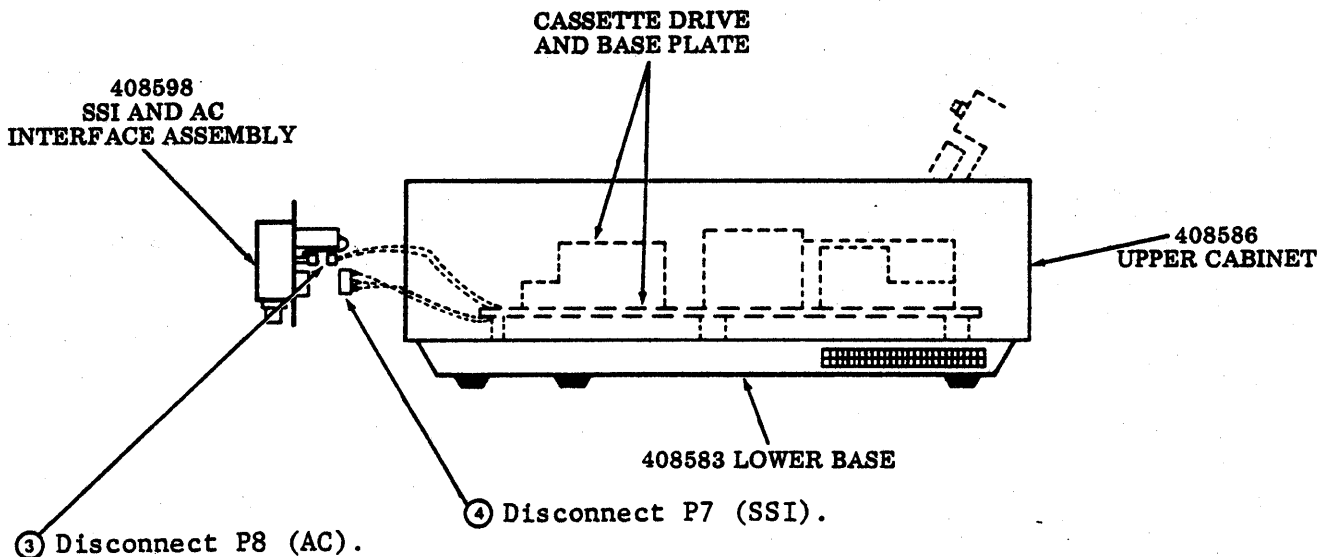
To remove cover.

① Remove 12 181242 screws with washers which mount the 408598 SSI/AC interface assembly.

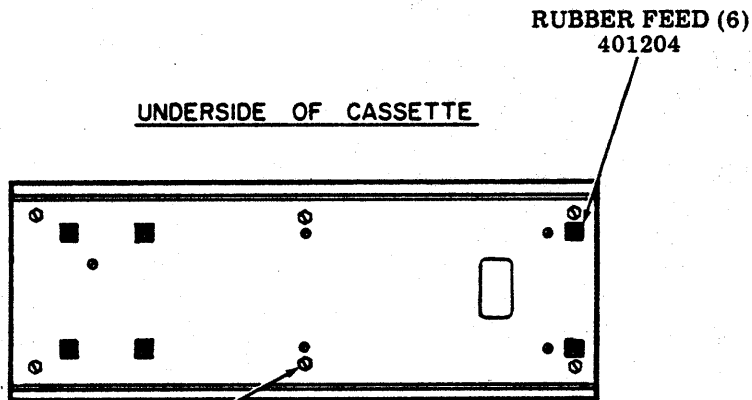
② Move the 408598 SSI/AC interface assembly to the rear slightly.

NOTE: Disconnect cables from controller (if mounted).





⑤ Lay cassette drive on its side for access to the underside of drive.



⑥ Loosen six 408584 head shoulder screws which mount cover.

⑦ Holding the base and cover firmly together, return the cassette drive to its upright position.

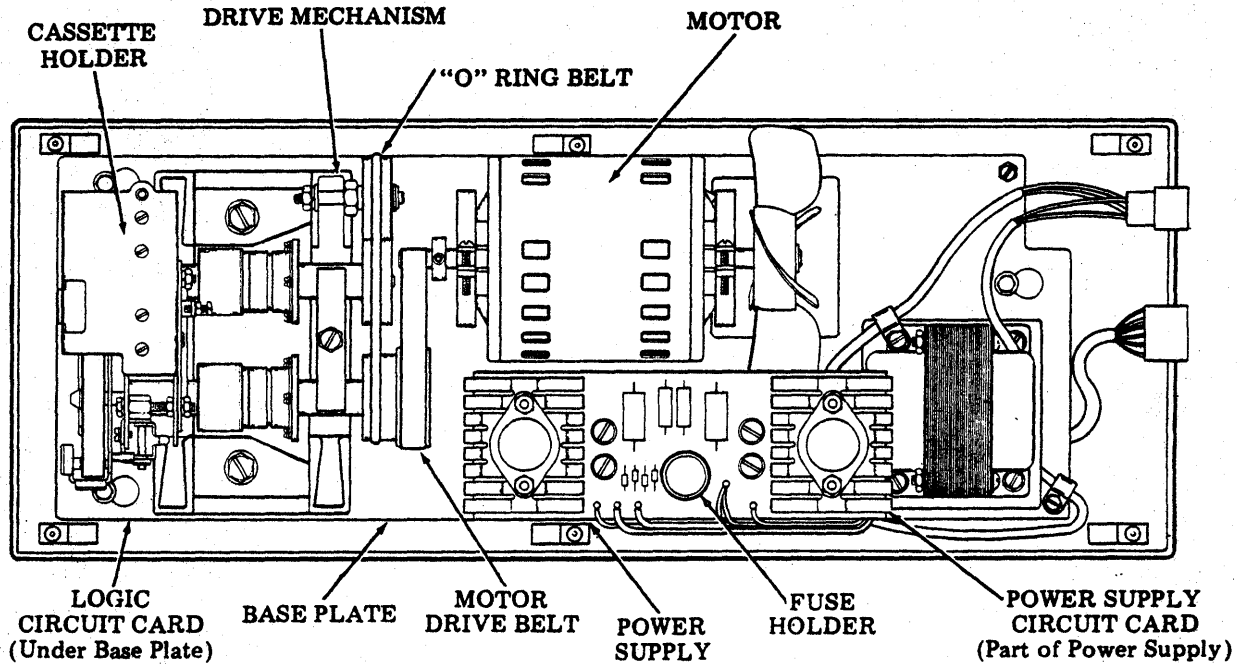
⑧ Remove the cover from the base with cassette drive by lifting the cover straight up.

To replace the cover, reverse the removal procedure.

**WARNING:** DO NOT OVERTIGHTEN THE SIX 408584 CAPTIVE SCREWS WHICH MOUNT THE COVER.

F. DISASSEMBLY/REASSEMBLY AND PARTS (Contd)

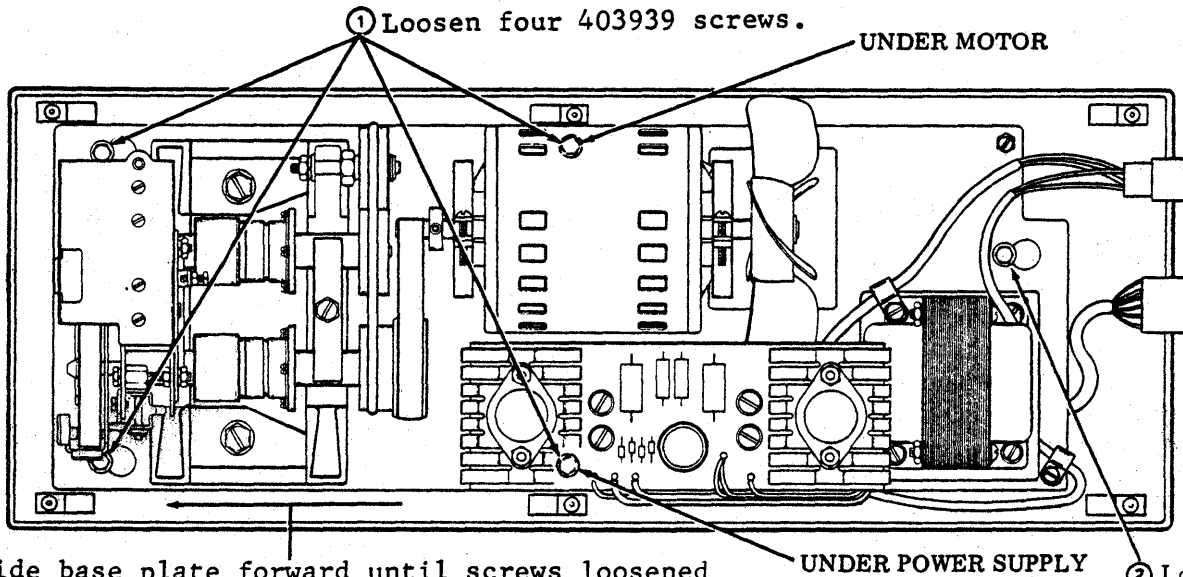
2. SUBASSEMBLY IDENTIFICATION



3. DISASSEMBLY/REASSEMBLY DIRVE

40CD102 Cassette Drive (From Cabinet Base)

- Remove cabinet.

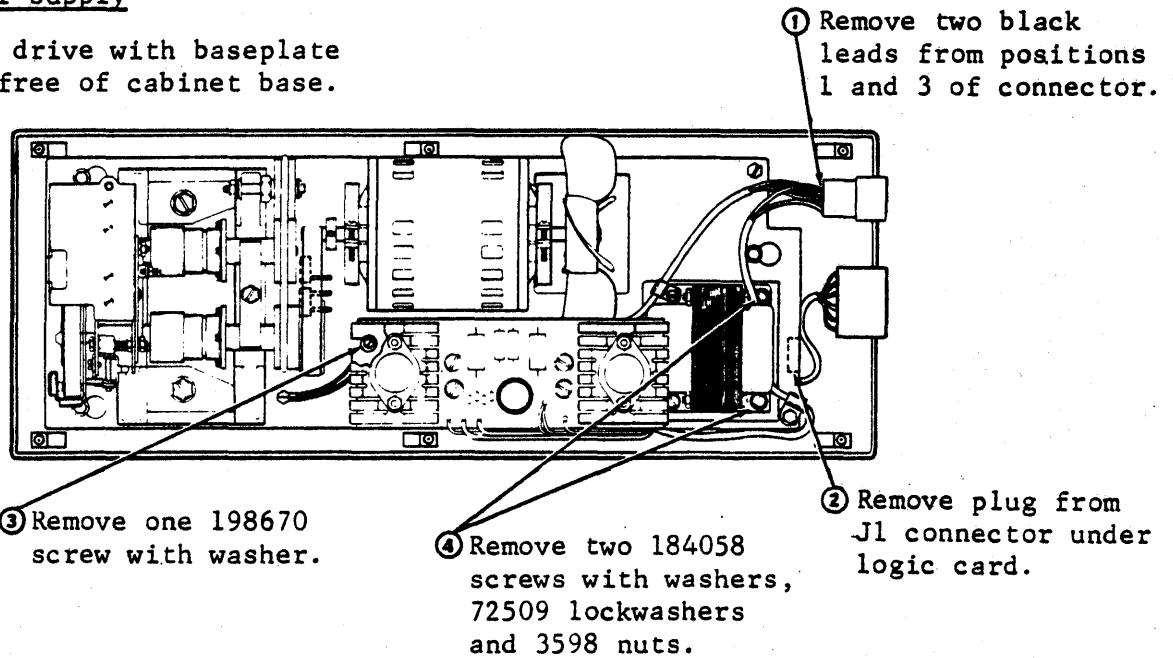


Slide base plate forward until screws loosened in Steps 1 and 2 are centered in circular holes and lift off.

To install cassette drive with base plate, reverse removal procedures. Before sliding cassette drive rearward, screws must be centered in circular holes located under power supply and motor.

406101 Power Supply

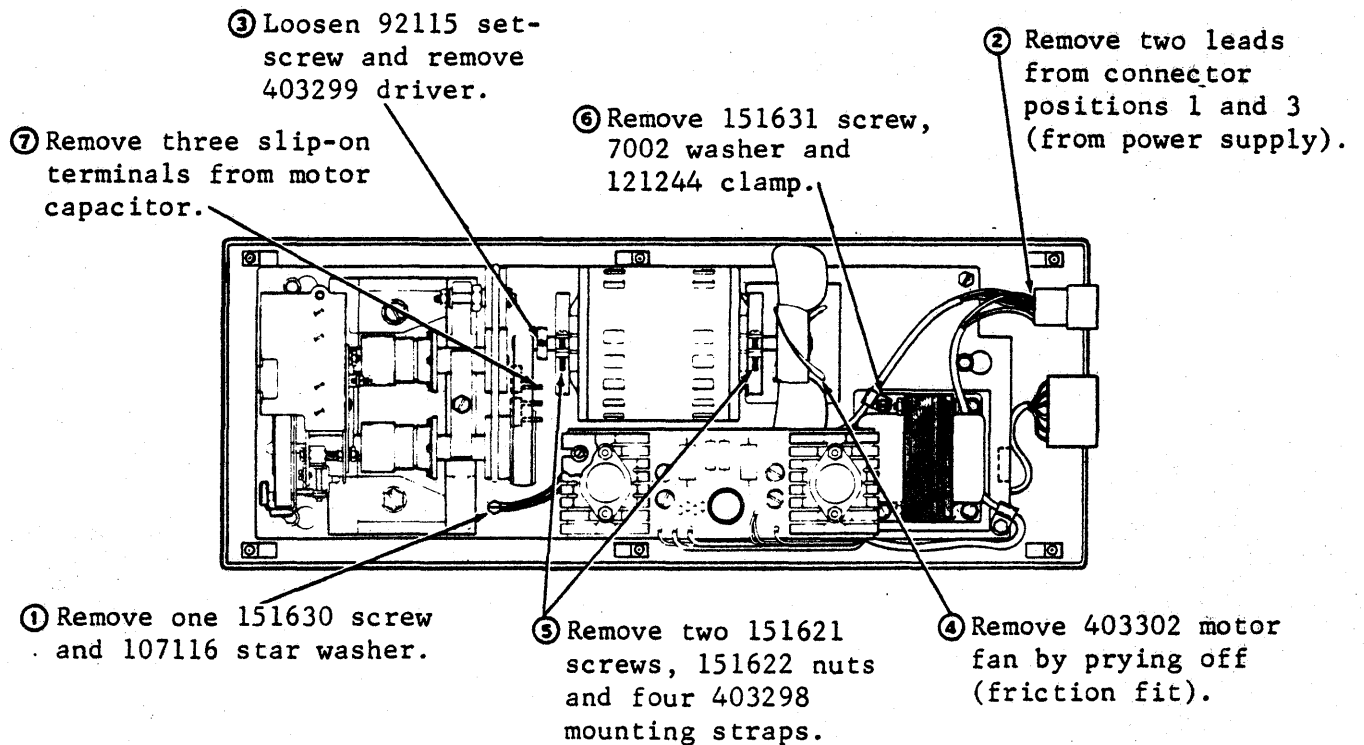
- Cassette drive with baseplate must be free of cabinet base.



To install power supply, reverse procedures.

403303 Motor Assembly

- Remove 403300 belt drive.



To install motor, reverse procedures.

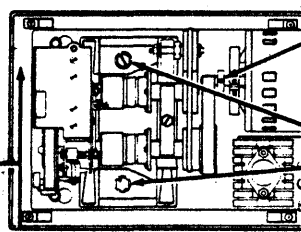
F. DISASSEMBLY/REASSEMBLY AND PARTS (Contd)

3. DISASSEMBLY/REASSEMBLY DRIVE (Contd)

403300 Drive Belt

•Remove cabinet.

② Move drive assembly in direction shown to loosen drive belt.



③ Remove 403300 drive belt.

① Loosen two mounting screws.

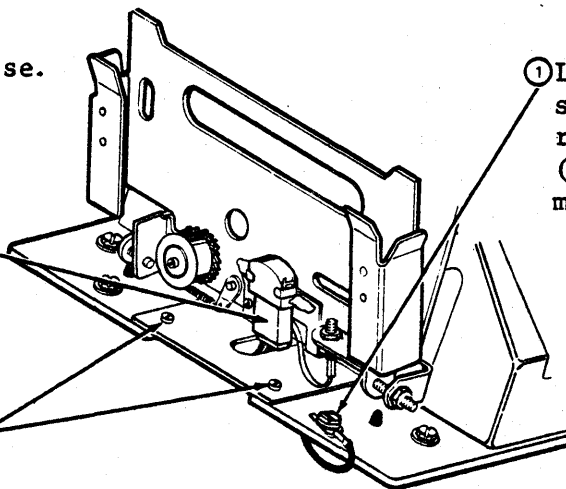
To install drive belt, reverse procedures. Recheck Motor Drive Belt and Motor Pulley adjustments (2-108).

410764 Logic Circuit Card

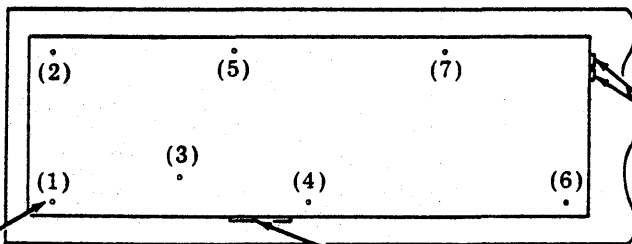
•Remove cassette drive with base.

③ Remove tape head connector.

① Loosen 403939 screw and remove terminal. (On early design models only.)



② Remove two 110434 screws and 110743 lockwashers. Remove 403301 cover with slot.

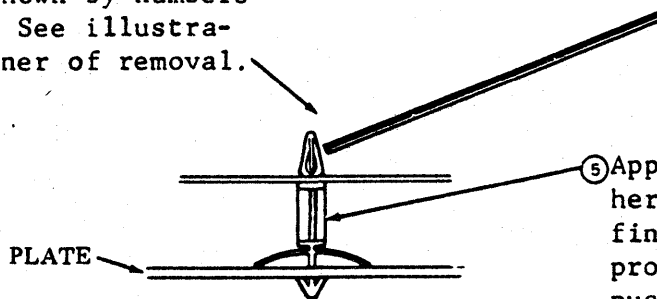


⑦ Remove P1 and P2 connectors.

⑥ Pry card off of 403586 plastic studs in order shown by numbers in parentheses. See illustration showing manner of removal.

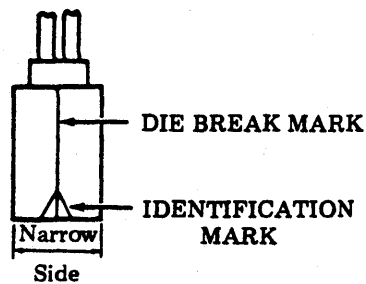
⑧ Remove P4A and P4B connectors.

④ Push projection in with orange stick (or equivalent).



⑤ Apply pressure upward here with thumb or fingers at same time projection is being pushed inward.

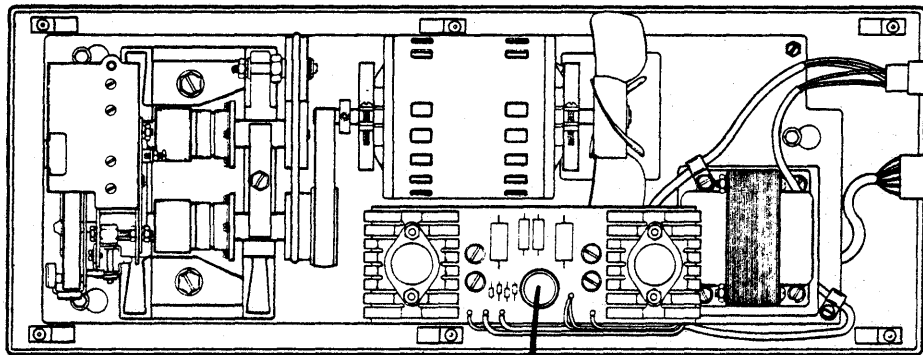
Manner of Prying Circuit Card From Plastic Studs



To install 410764 logic circuit card, reverse removal procedures. Circuit card must be installed with component side toward baseplate. Projections or 403586 plastic studs must secure circuit board. The tape head connector must be assembled to the tape head so that the identification mark is to the right as viewed from the front of the cassette drive.

### 143307 Fuse

- Remove cover.



- ① Push down and rotate fuse cap (counterclockwise). Lift fuse cap and fuse out.



- ② Pull 143307 fuse from fuse cap.

To install fuse, reverse removal procedures.

NOTE: Replace with 143307 0.6 amp Slow-Blow fuse.

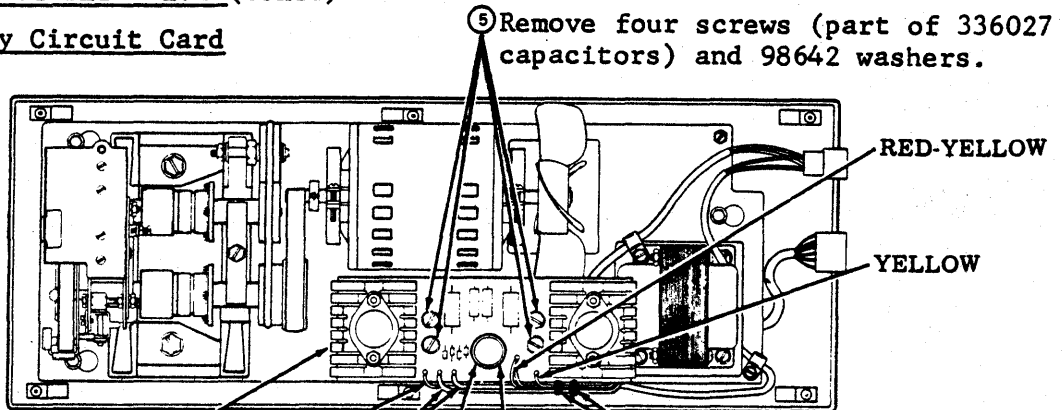
F. DISASSEMBLY/REASSEMBLY AND PARTS (Contd)

3. DISASSEMBLY/REASSEMBLY DRIVE (Contd)

410043 Power Supply Circuit Card

•Remove cover.

① Unsolder six leads shown in illustration.



⑥ Remove 410043 power supply card.

BLUE RED

④ Cut two cable ties.

② Remove heat shrink tubing and unsolder two black leads.

③ Remove 116783 fuse holder.

To install circuit card, reverse procedures. Cover lower portion of fuse holder with suitable heat shrink tubing after black leads are soldered in place. Secure cable assembly to power supply circuit board with two RM43679 cable ties.

406103 Transformer

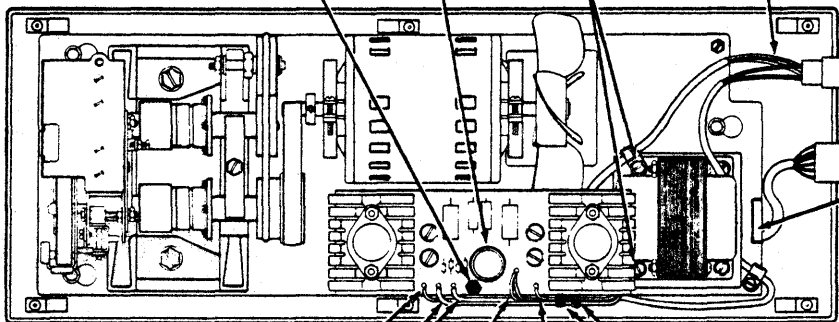
① Cassette drive with base-plate must be free of cabinet base.

⑤ Remove one 151630 screw, 99260 lockwasher and terminal connected to two red-yellow leads.

④ Remove heat shrink tubing from fuse holder. Unsolder two leads.

⑦ Remove two 184056 screws.

⑥ Remove two black leads from positions 1 and 3 of connector.



⑧ Remove plug from J1 connector on logic circuit card.

BLUE RED RED-YELLOW YELLOW

② Cut two cable ties. Remove lacing twine.

③ Unsolder leads.

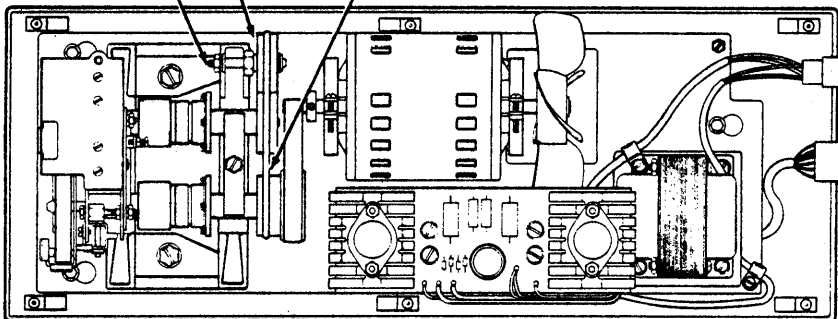
To install 406103 transformer, reverse removal procedures. Cover lower portion of fuse holder with suitable heat shrink tubing after leads are soldered in place. Secure cable assembly to power supply circuit board with two RM43679 cable ties.



**403289 "O" Ring Belt**

- Remove 403300 drive belt.

- ① Loosen nut.
- ② Lift idler pulley assembly out of slot in casting.
- ③ Remove 403289 "O" ring belt.

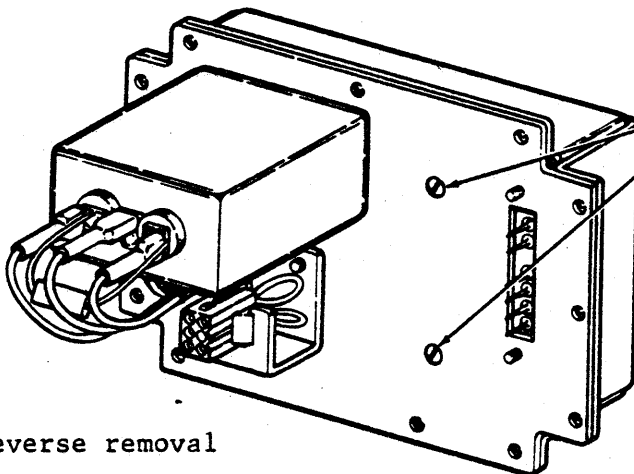


To install, reverse procedures. Recheck Belt ("O" Ring) adjustment (2-106).

**4. DISASSEMBLY/REASSEMBLY SSI/AC INTERFACE**

- Remove 408597 rear enclosure assembly.

- ① Remove 408598 SSI/AC interface assembly from cover.



- ② Remove two 97799 flat head screws.

- ③ Carefully remove 408597 rear enclosure assembly. Wires are connected inside.

To replace, reverse removal procedures.

F. DISASSEMBLY/REASSEMBLY AND PARTS (Contd)

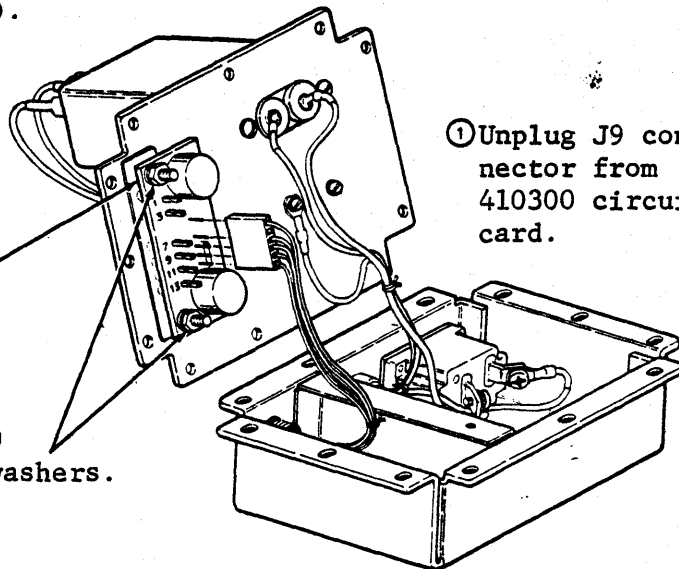
4. DISASSEMBLY/REASSEMBLY SSI/AC INTERFACE (Contd)

410300 Circuit Card

- Remove upper cabinet assembly (2-114).
- Remove SSI/AC interface from cabinet assembly (2-121).
- Remove rear enclosure assembly from interface assembly (2-128).

③ Remove 410300 circuit card.

② Remove two 3606 nuts, 92260 lockwashers and 7002 flat washers.



① Unplug J9 connector from 410300 circuit card.

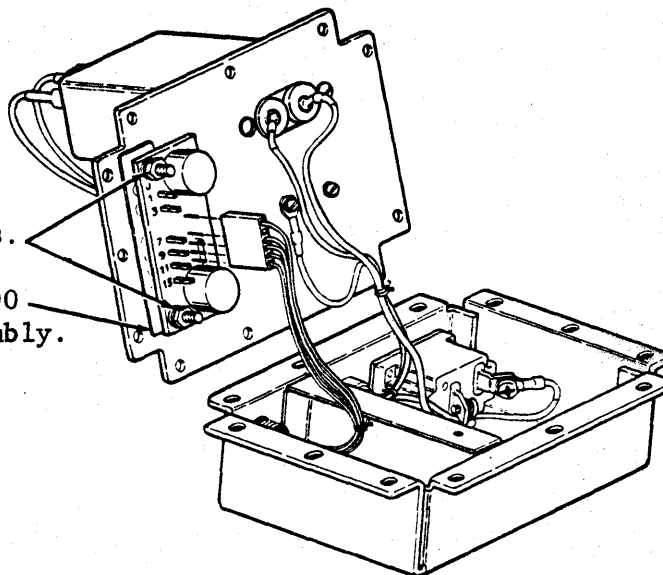
To install a new 410300 circuit card, reverse removal procedure.

408590 Filter Assembly Removal

- Remove upper cabinet assembly (2-114).
- Remove SSI/AC interface assembly (2-121).
- Remove rear enclosure assembly from interface assembly (2-128).
- Remove 410300 SSI from circuit card (2-129).

① Remove two 403616 posts and two 92260 lockwashers.

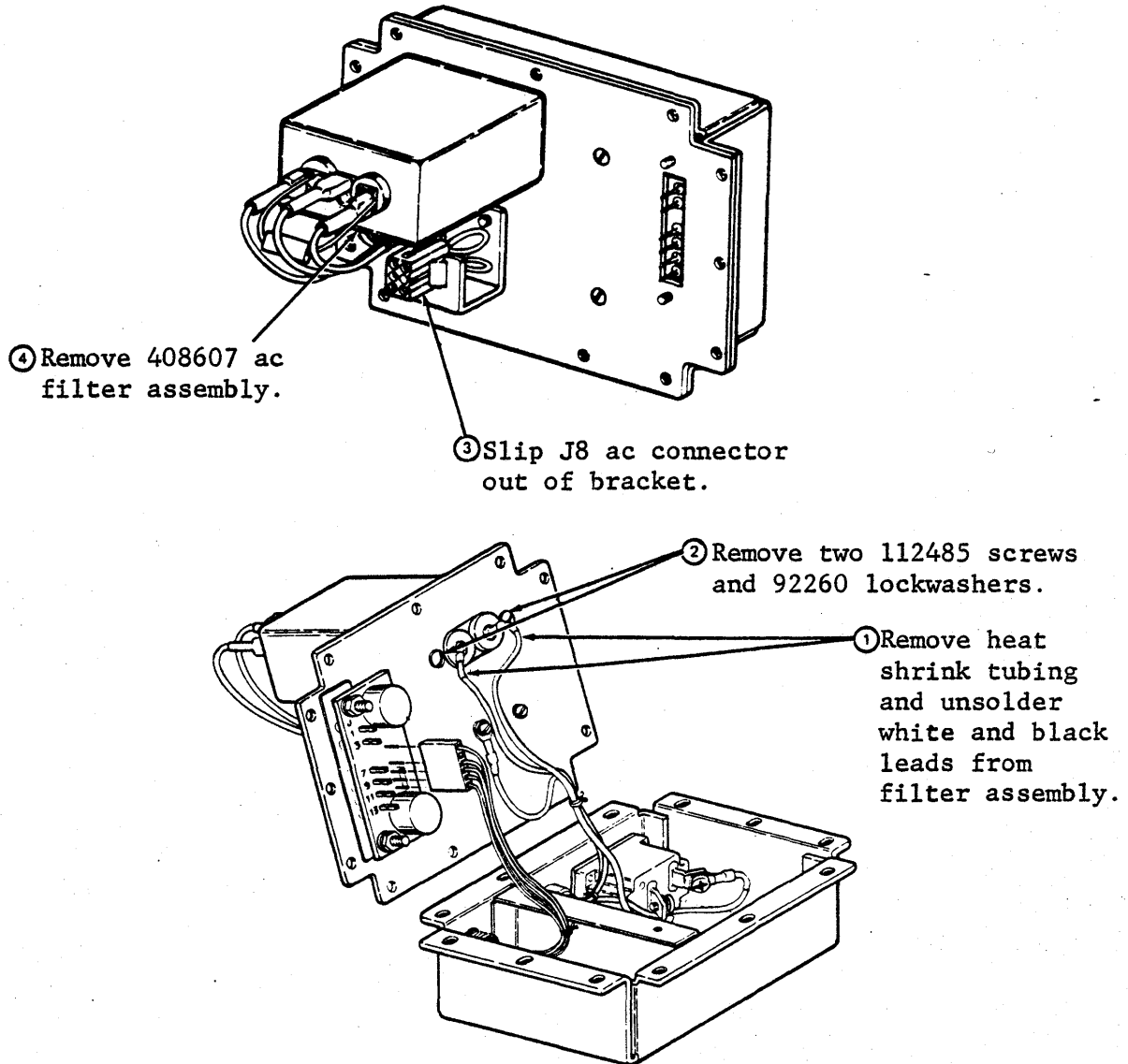
② Remove 408590 filter assembly.



To install new 408590 filter assembly, reverse removal procedure.

408607 AC Filter Assembly Removal

- Remove upper cabinet assembly (2-114).
- Remove SSI/AC interface assembly from upper cabinet assembly (2-114).
- Remove Rear enclosure assembly from interface assembly (2-128).



To install the ac filter assembly, reverse the removal procedure. When resoldering leads to line side of filter, solder black lead to terminal 5 and white lead to terminal 4. Leads should be covered with heat shrink tubing after soldering.

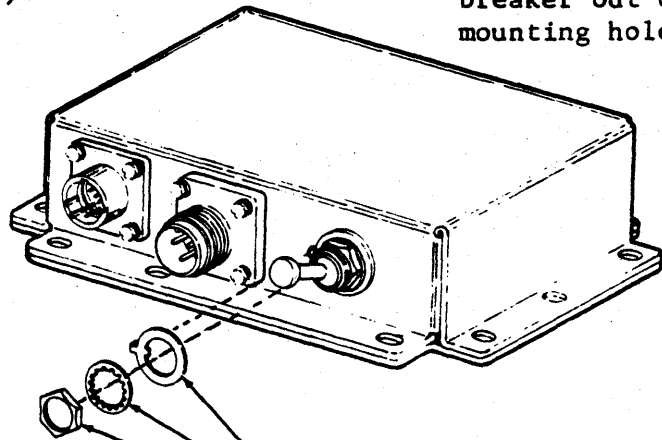
F. DISASSEMBLY/REASSEMBLY AND PARTS (Contd)

4. DISASSEMBLY/REASSEMBLY SSI/AC INTERFACE (Contd)

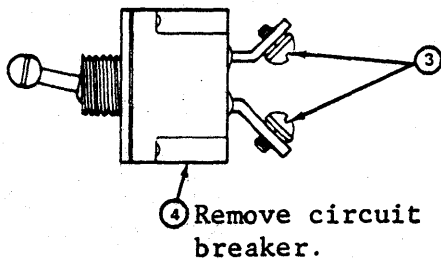
408594 Circuit Breaker Removal

- Remove upper cabinet assembly (2-115).
- Remove rear enclosure assembly from interface assembly (2-129).

② Slip circuit breaker out of mounting hole.



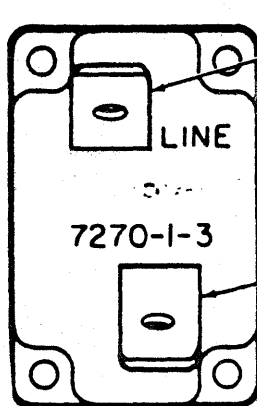
① Remove nut, lockwasher and keyway washer which mount circuit breaker to enclosure.



③ Remove the two black leads from circuit breaker. (Phillips head screwdriver.)

④ Remove circuit breaker.

To install a new 408594 circuit breaker, reverse removal procedure. When connecting the black leads, proceed as indicated below.



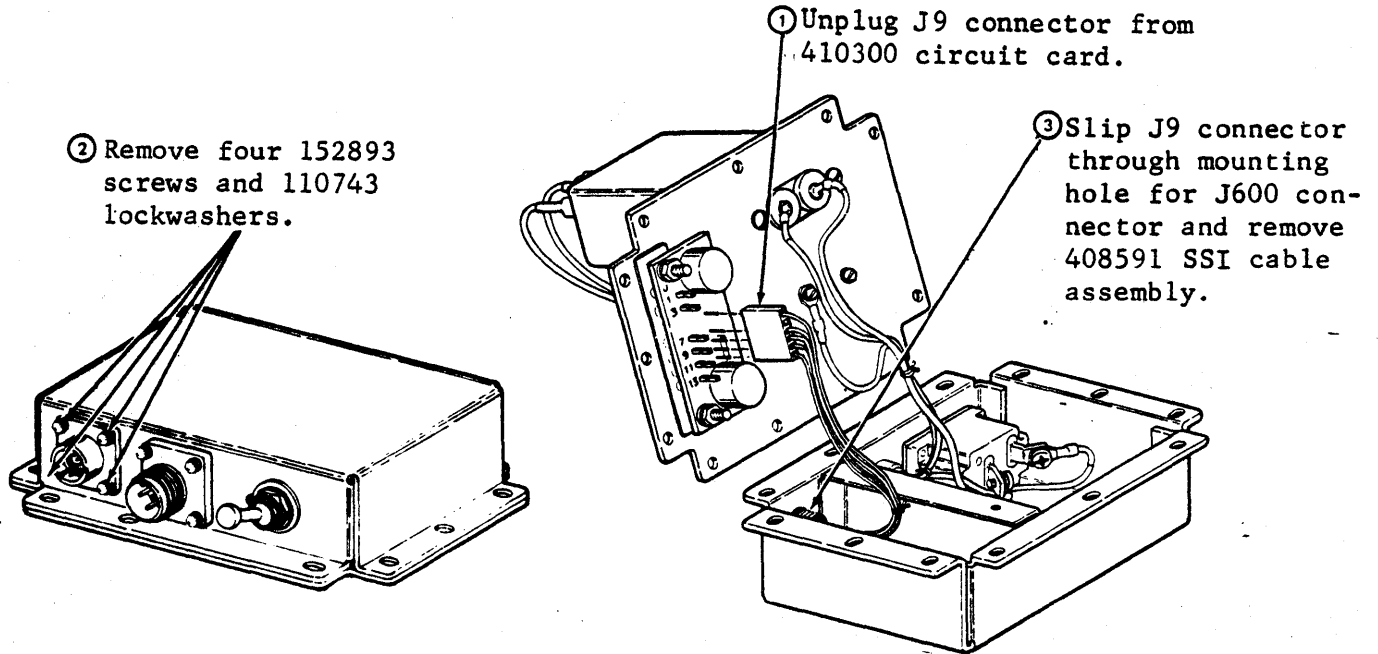
⑤ Connect black lead from terminal B of J601 connector to terminal marked line on circuit breaker.

⑥ Connect black lead from terminal 5 of ac filter assembly to unmarked terminal on circuit breaker.

When mounting circuit breaker in rear enclosure, orientate circuit breaker so that keyway is pointing toward small hole next to circuit breaker mounting hole.

408591 SSI Cable Assembly Removal

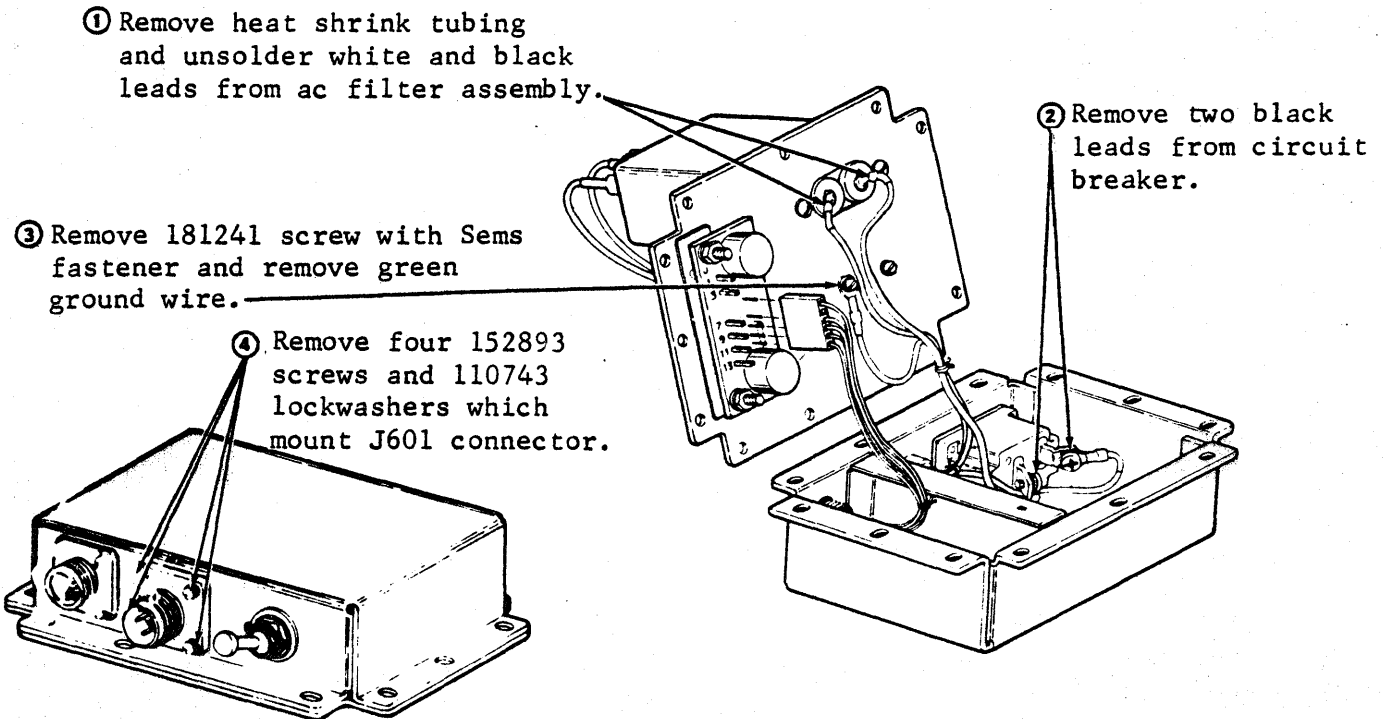
- Remove upper cabinet assembly (2-114).
- Remove rear enclosure assembly from the interface assembly (2-128).



To install SSI cable assembly, reverse removal procedure.

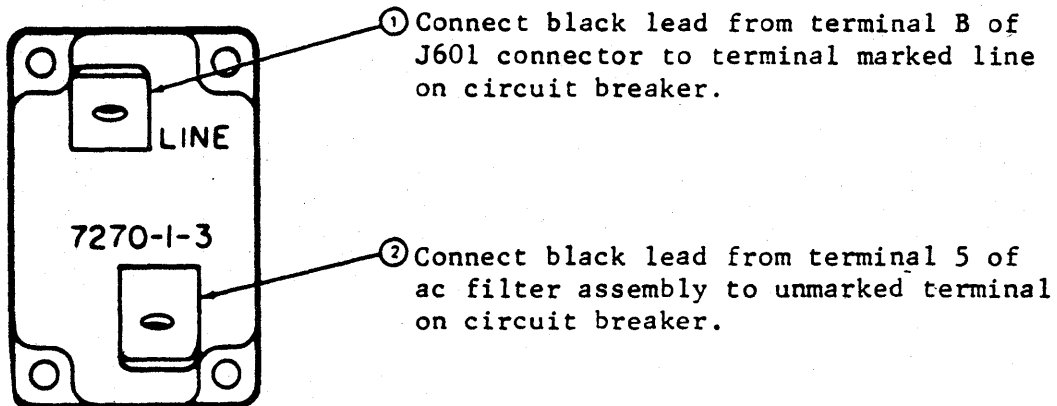
408592 AC Cable Assembly Removal

- Remove the upper cabinet assembly (2-114).
- Remove the rear enclosure assembly from the interface assembly (2-128).



F. DISASSEMBLY/REASSEMBLY AND PARTS (Contd)4. DISASSEMBLY/REASSEMBLY SSI/AC INTERFACE (Contd)

To install the 408592 ac cable assembly, reverse the removal procedure. When connecting the black leads to the circuit breaker, proceed as indicated below:



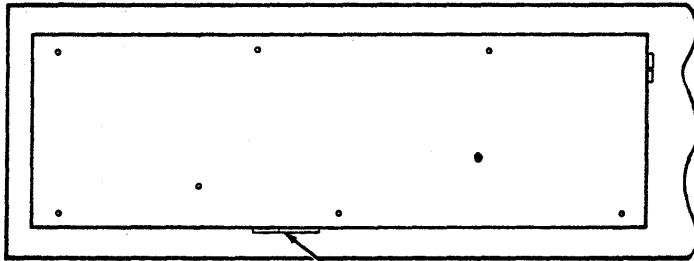
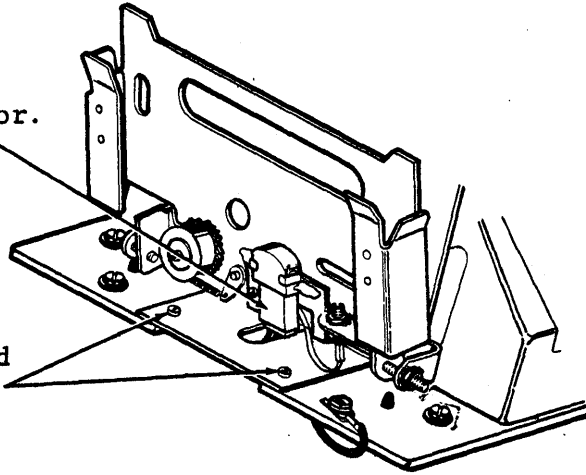
- ③ When connecting the white and black leads to the ac filter assembly, solder the black lead from circuit breaker to terminal 5 of the ac filter assembly. Solder the white lead from terminal A of J601 connector to terminal 4 of the ac filter assembly. The leads should be covered with heat shrink tubing after soldering.

Drive Mechanism

- Remove cassette drive with base from lower cabinet.
- Remove 403300 drive belt.

② Remove tape head connector.

① Remove two 110434 screws and 110743 lockwashers. Remove 403301 cover with slot.

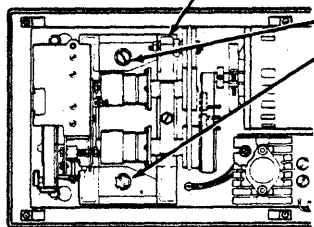


③ Remove P4A and P4B connectors.

④ Check if plastic strap securing cables to casting also straps casting to base. If it does, cut strap.

⑤ Remove two mounting screws, lockwashers and flat washers.

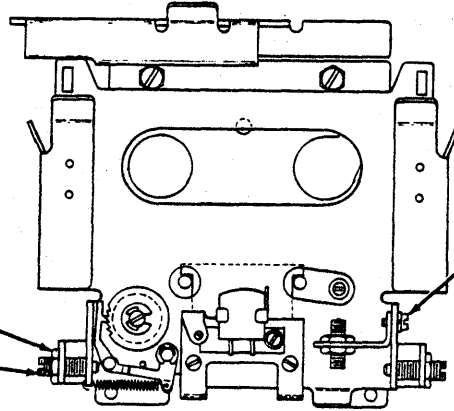
⑥ Remove drive mechanism.



F. DISASSEMBLY/REASSEMBLY AND PARTS (Contd)

4. DISASSEMBLY/REASSEMBLY SSI/AC INTERFACE (Contd)

① Remove the 110434 screw, 107116 lock-washer and 125015 flat washer which mount the BOT lamp bracket. Remove the BOT lamp and bracket.



② Loosen pivot screw locknuts both ends.

③ Loosen pivot screws both ends.

④ Remove cassette holder assembly.

To install cassette holder assembly, reverse removal procedure. The tape head connector must be assembled to the tape head so that the identification mark is to the right as viewed from the front of the cassette drive.

Recheck adjustments:

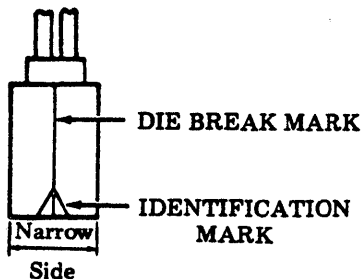
Cassette Holder Page 2-95 and BOT-EOT Sensor Tube Page 2-104 and BOT-EOT Lamp Mounting Page 2-103.

Front Plate Assembly

- Remove cassette drive with base from lower cabinet.
- Remove drive mechanism from base.
- Remove cassette holder assembly.



To install drive mechanism, reverse removal procedures. The tape head connector must be assembled to the tape head so that the identification mark is to the right as viewed from the front of the cassette drive. If plastic strap was cut, secure cabling to left rear of casting with a new plastic strap or lacing twine. Recheck Motor Drive Belt and Motor Pulley adjustments (2-108).

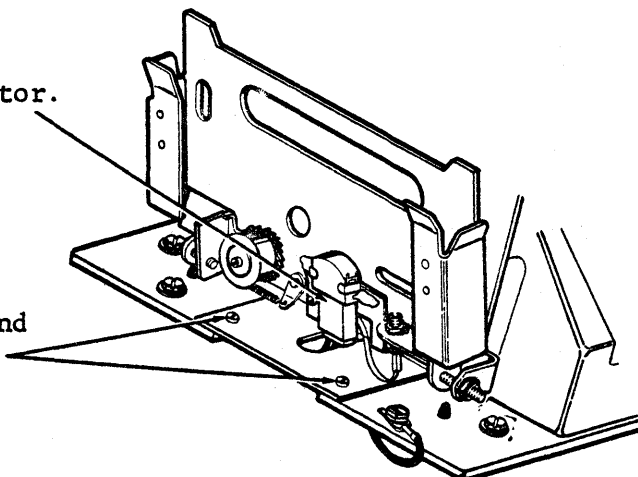


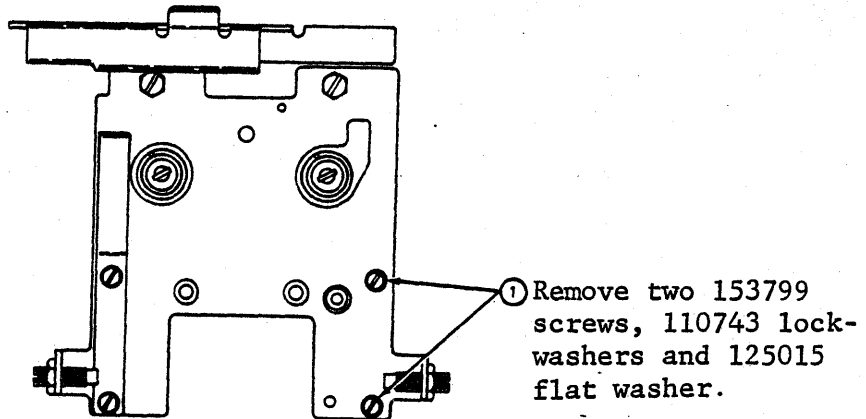
### Cassette Holder Assembly

- Remove cassette drive with base from lower cabinet.
- Remove drive mechanism.

② Remove tape head connector.

① Remove two 110434 screws and 110743 lockwashers. Remove 403301 cover with slot.



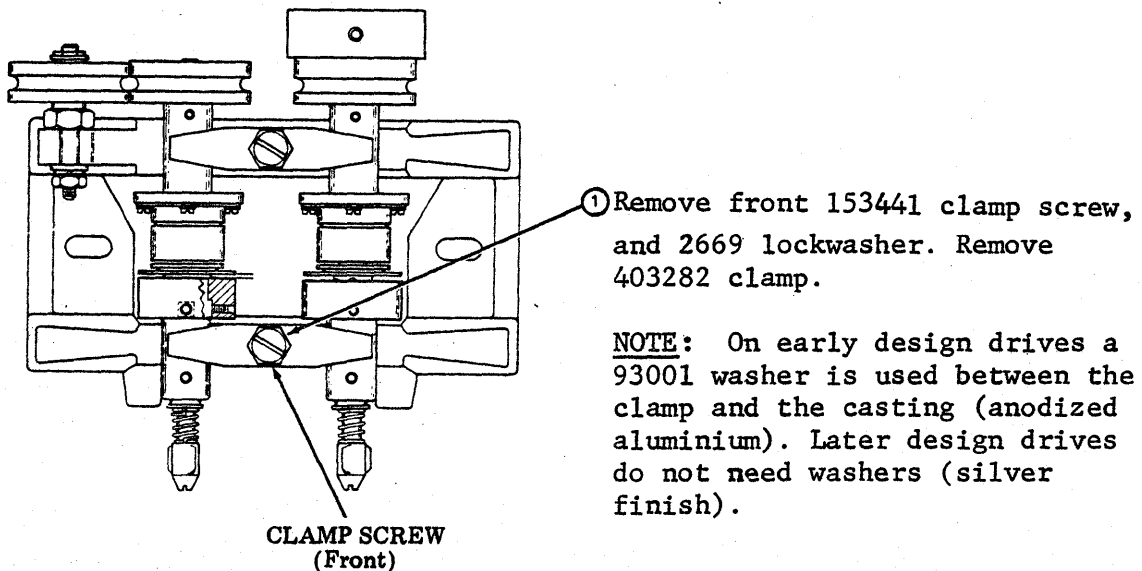
F. DISASSEMBLY/REASSEMBLY AND PARTS (Contd)4. DISASSEMBLY/REASSEMBLY SSI/AC INTERFACE (Contd)

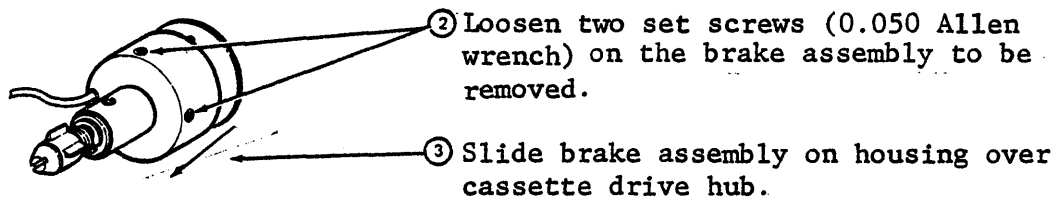
- ② Remove two 153799 screw and 110743 lockwasher and 403291 cassette holder pressure spring.
- ③ Carefully route cable through casting.
- ④ Remove front plate assembly.

To install the front plate, reverse removal procedure.  
Check Plate With Cassette Holder adjustment Page 2-100.

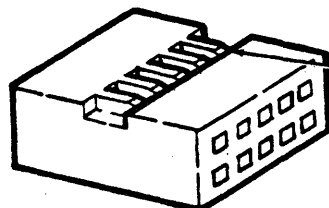
Brake Assembly

- Remove cassette drive with base from lower cabinet.
- Remove drive mechanism from base.
- Remove cassette holder assembly.
- Remove front plate assembly.





④ Trace the pair of wires from the brake assembly removed to the P4B connector.

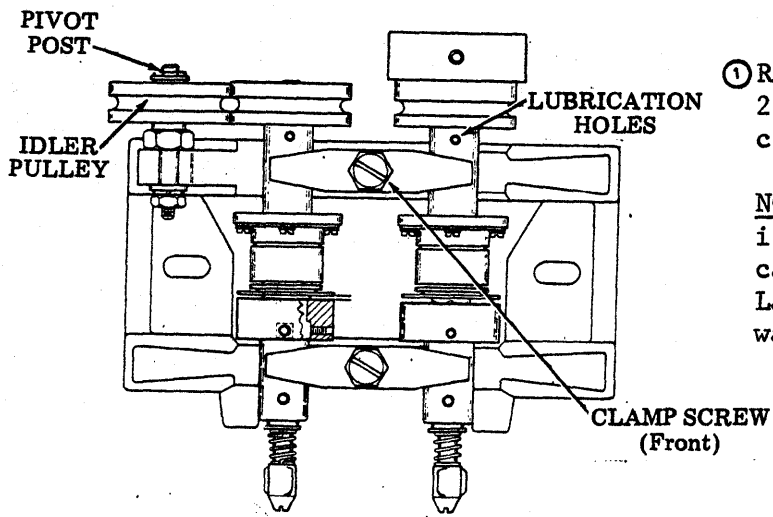


To install a brake assembly, reverse the removal procedure. Refer to WDP 0501 for connections to P4B connector.

Check adjustment, Clutch, Page 2-107 and Brake, Page 2-107.

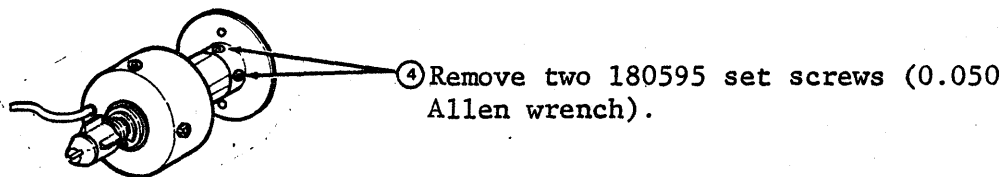
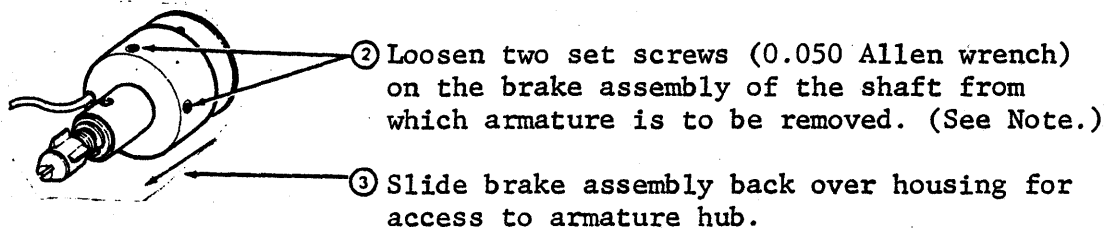
#### Armature Assembly

- Remove cassette drive with base from lower cabinet.
- Remove drive mechanism from base.
- Remove cassette holder assembly.
- Remove front plate assembly.

F. DISASSEMBLY/REASSEMBLY AND PARTS (Contd)4. DISASSEMBLY/REASSEMBLY SSI/AC INTERFACE (Contd)

- ① Remove front 153441 clamp screw and 2669 lockwasher. Remove the 403282 clamp.

**NOTE:** On early design drives, a 93001 is used between the clamp and the casting (anodized aluminium casting). Later design drives do not need washers (silver finish casting).

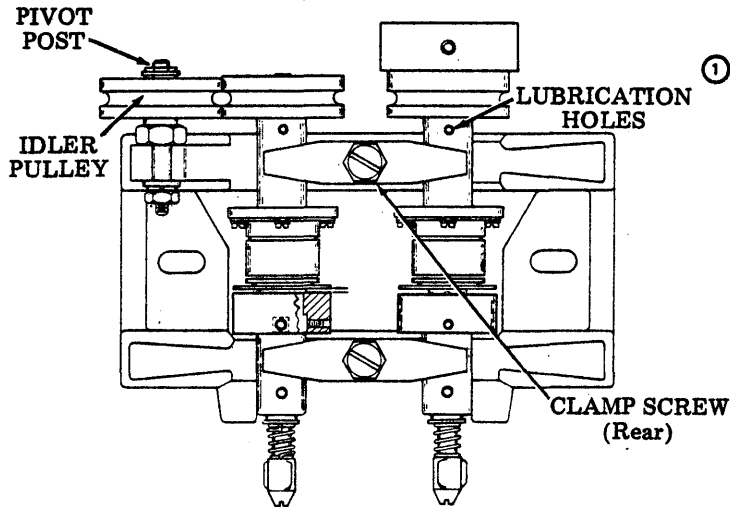


To install armature assembly, reverse the removal procedure.  
Check adjustments: Pulley and Shaft End Play Page 2-106.

**NOTE:** Armature assemblies with clutch assemblies should be replaced as mated pairs.

Clutch Assembly

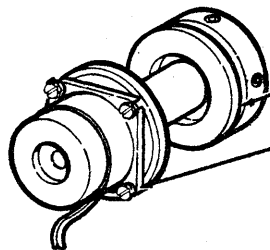
- Remove cassette drive with base from lower cabinet.
- Remove drive mechanism from base.
- Remove cassette holder assembly.
- Remove front plate assembly.



- ① Remove rear 153441 clamp screw and 2669 lockwasher. Remove rear clamp.

NOTE: On early design drives, a 93001 is used between the clamp and the casting (anodized aluminium casting). Later design drives do not need washer (silver finish casting).

- ② Loosen two set screws (0.050 Allen wrench) on pulley of shaft from which clutch is to be removed. (See Note 1.)

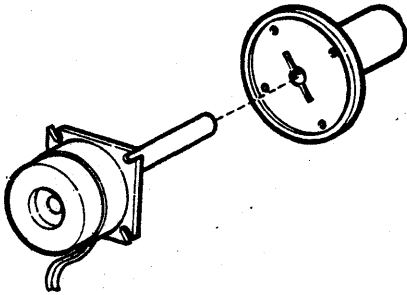


- ③ Remove pulley from shaft.
- ④ Remove four 111640 screws and 130663 lockwashers.

NOTE 1: Clutch assemblies with armature assemblies should be replaced as mated pairs.

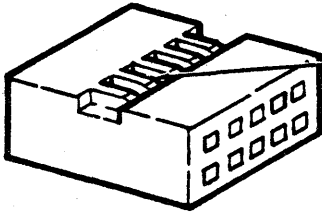
F. DISASSEMBLY/REASSEMBLY AND PARTS (Contd)

4. DISASSEMBLY/REASSEMBLY SSI/AC INTERFACE (Contd)



- ⑤ Remove clutch with shaft assembly from housing.  
Forward clutch assembly (long)-402272.  
Reverse clutch assembly (short)-402271.

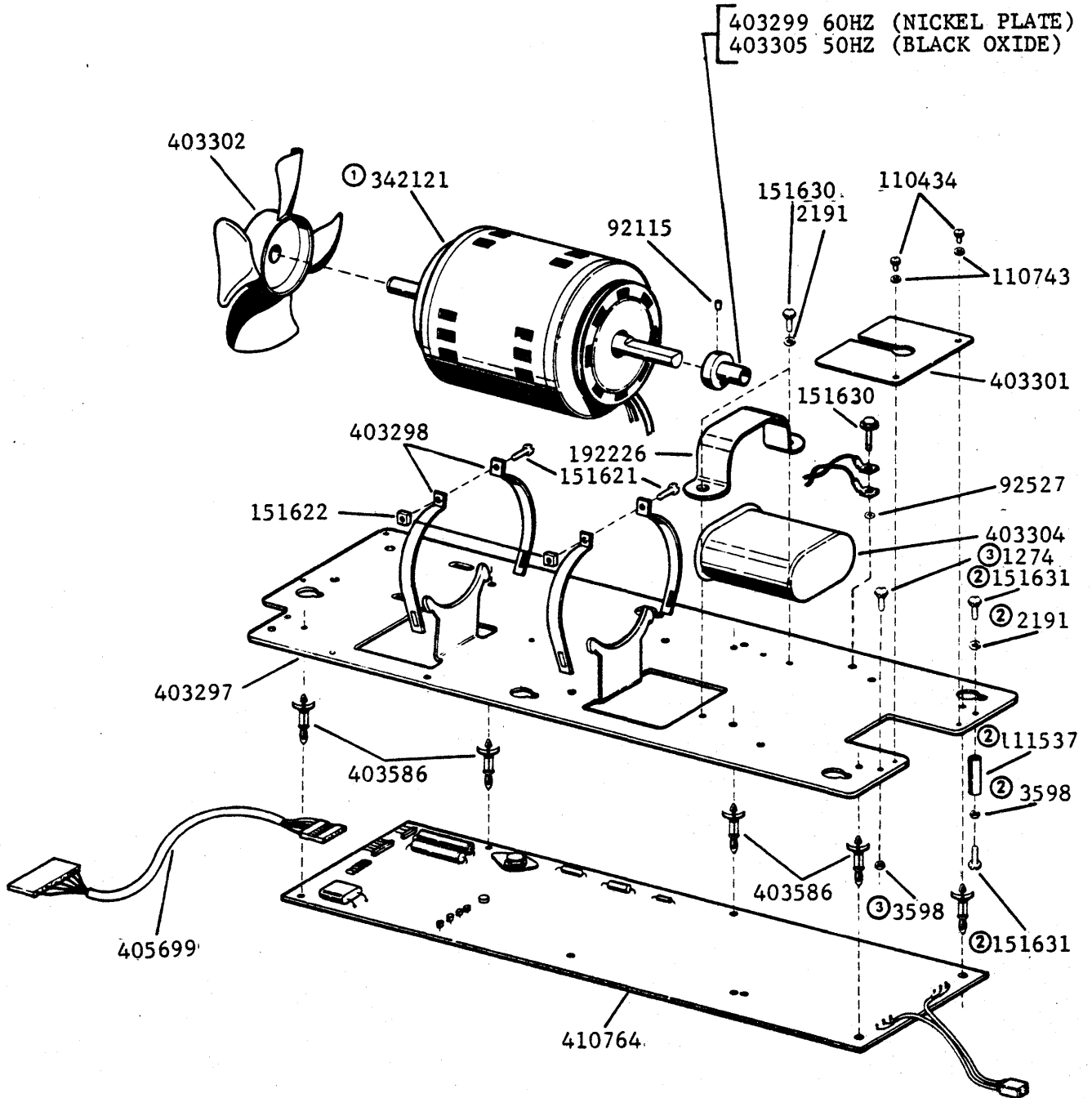
NOTE: Field coil, rotor and shaft are replaced as mated pairs.



- ⑥ Trace wires from clutch assembly being removed to connector P4B.  
⑦ With a pick, raise the locking tab of the connector and carefully pull the wire to be removed. Repeat for other lead from the clutch assembly.

To install clutch assembly, reverse the removal procedure. Refer to WDP 0501 for connections to P4B. Check adjustments: Clutch Shaft End Play Page 2-106 Pulley Alignment Page 2-106 and Clutch Gap, Page 2-107.

5. PARTS

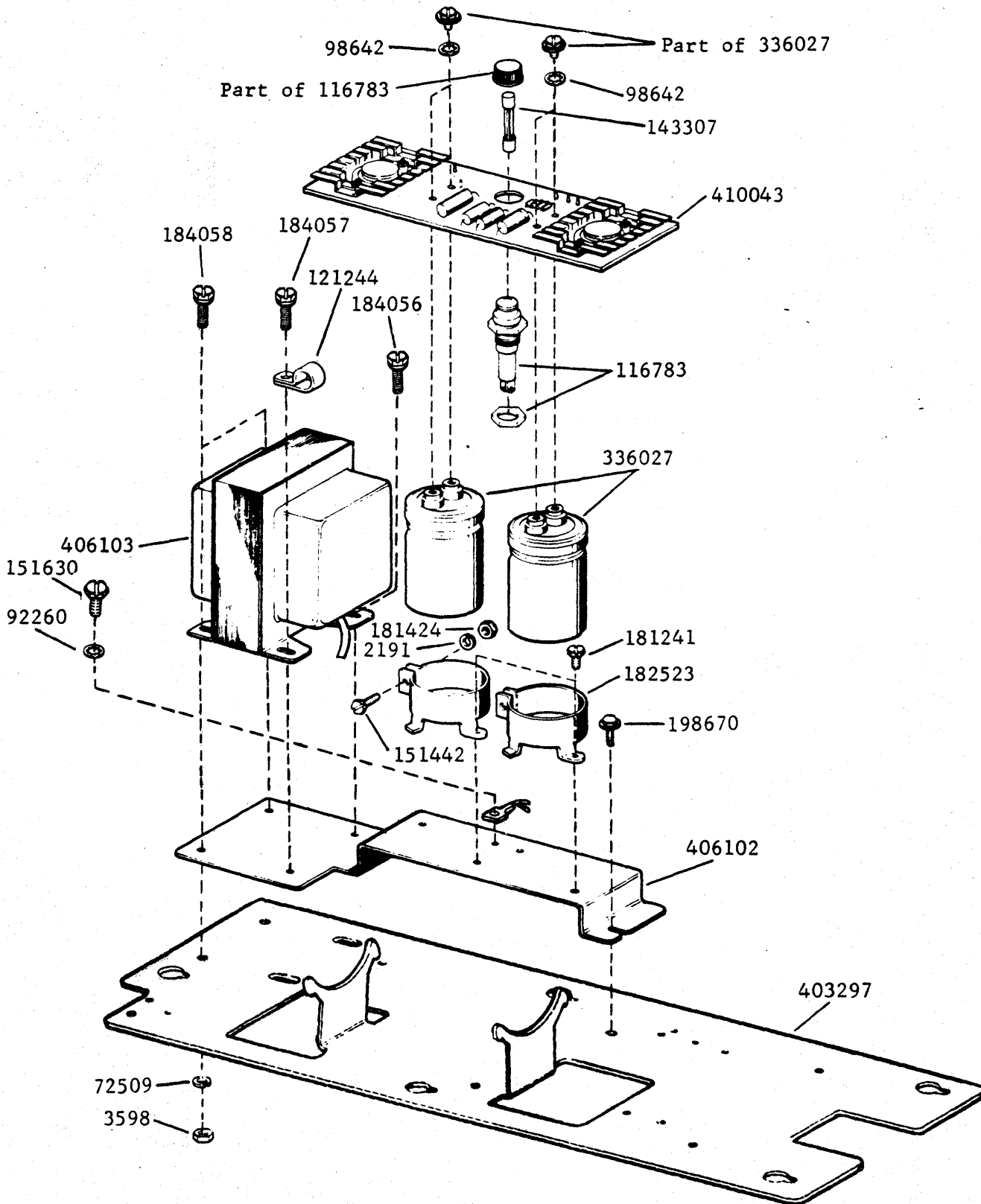


- ① Part of 403303 motor assembly.
- ② Early design units were supplied with five posts and adjusting screws.
- ③ Late design units are supplied with five screws and nuts.

Base Plate and Motor Assembly

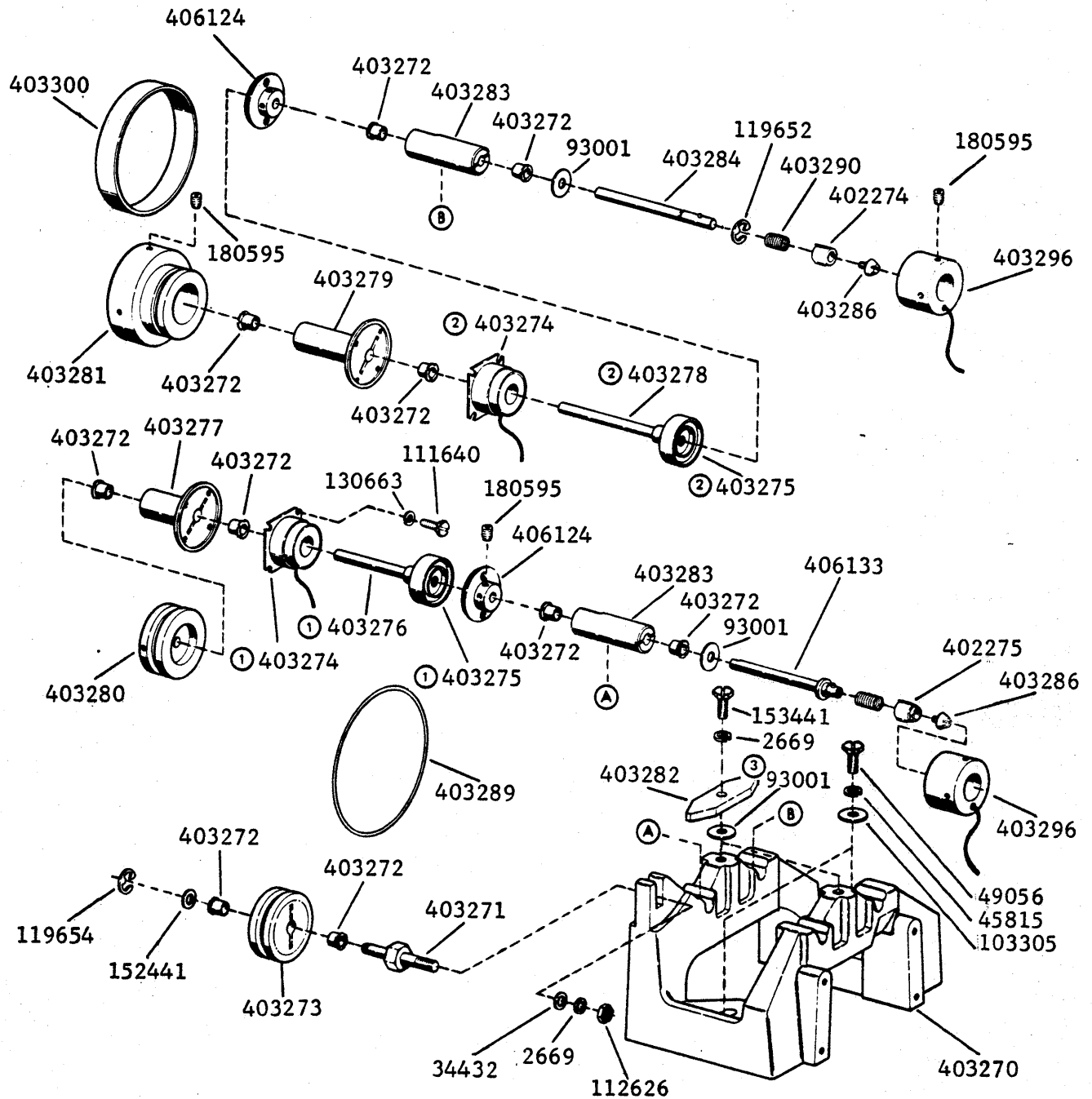
F. DISASSEMBLY/REASSEMBLY AND PARTS (Contd)

5. PARTS (Contd)



Power Supply Assembly



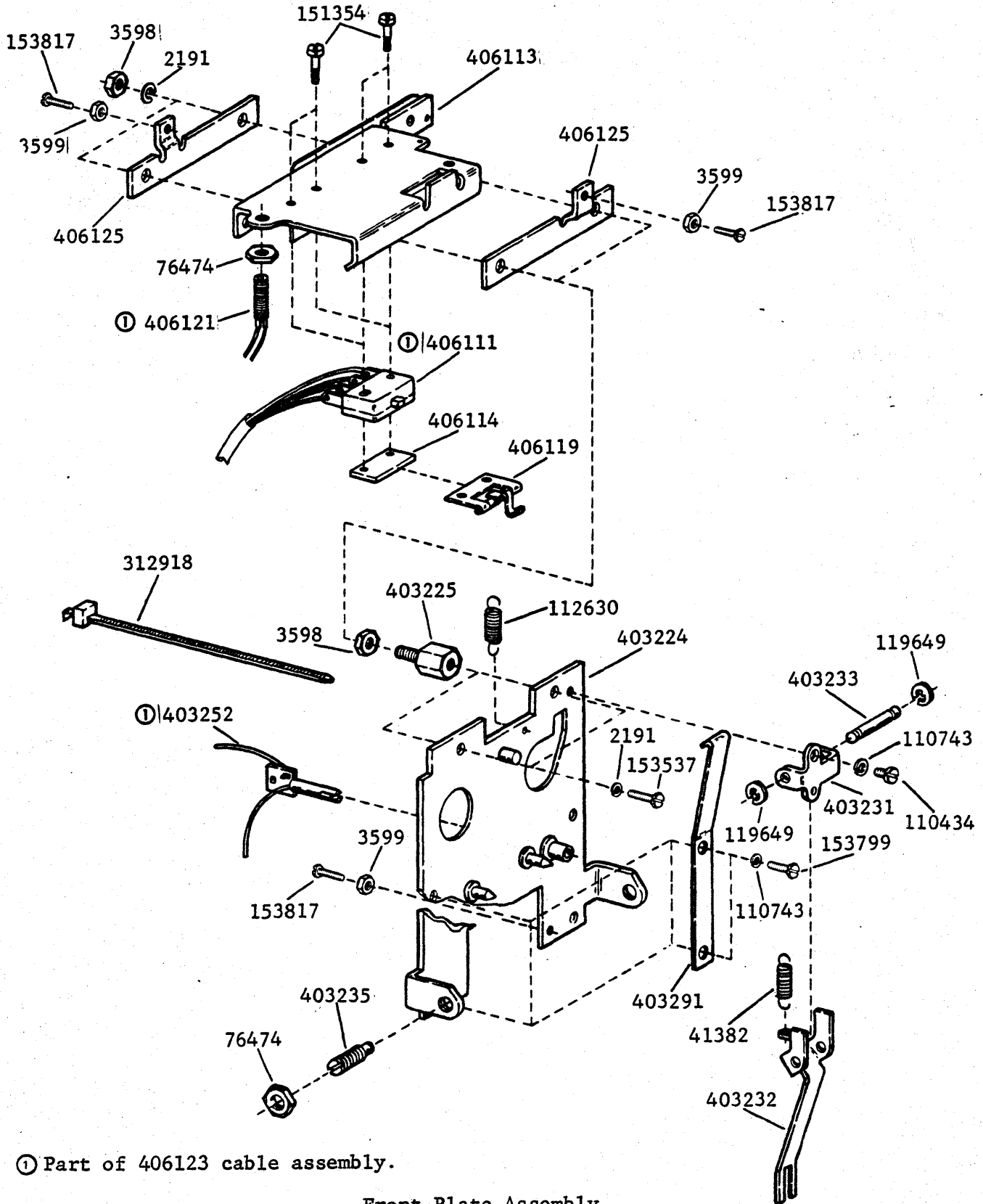


- ① Part of 402271 clutch assembly (short shaft).
- ② Part of 402272 clutch assembly (long shaft).
- ③ 93001 washers not required if 403270 casting has silver finish (not anodized).

Casting Assembly

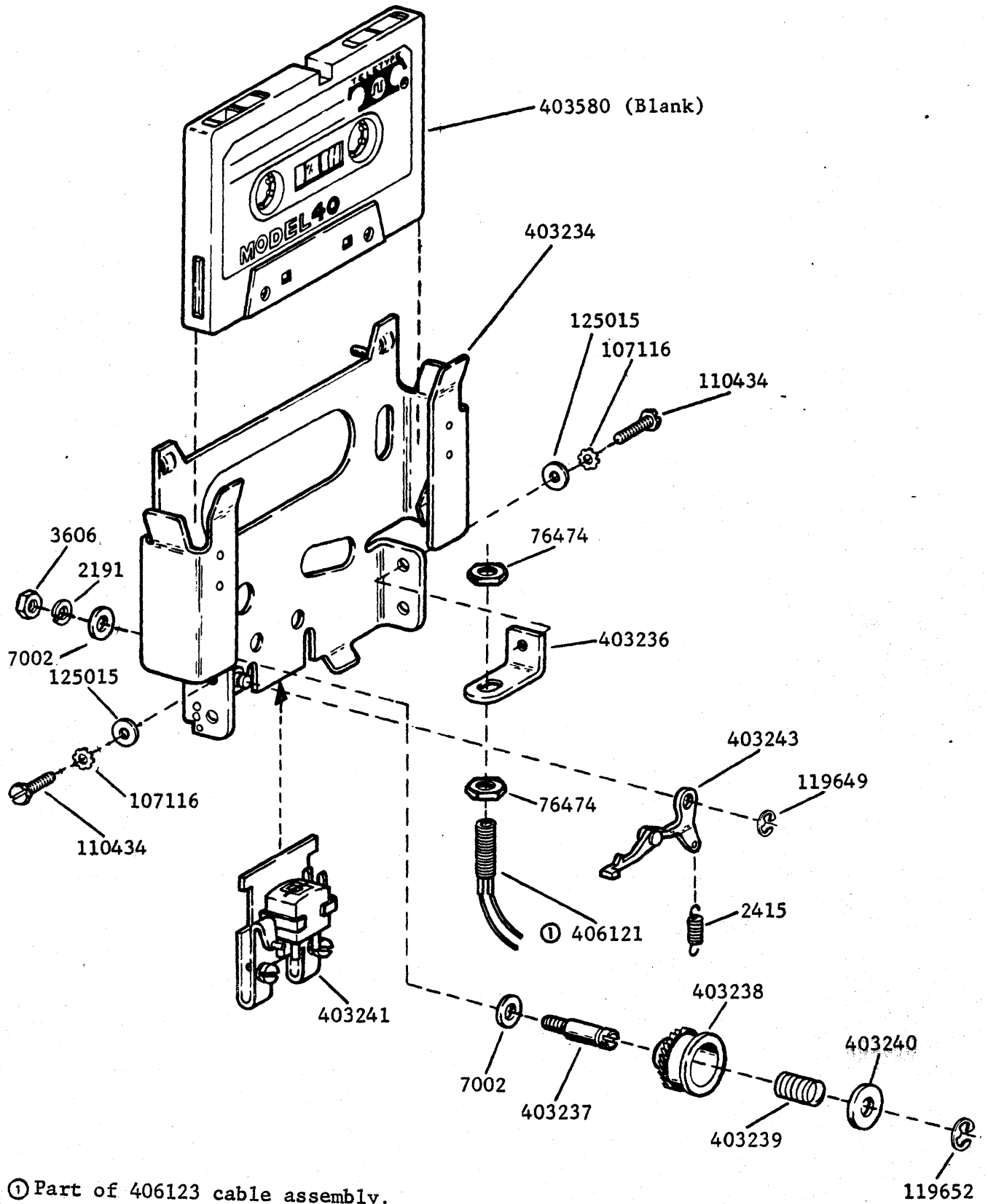
F. DISASSEMBLY/REASSEMBLY AND PARTS (Contd)

5. PARTS (Contd)



① Part of 406123 cable assembly.

Front Plate Assembly

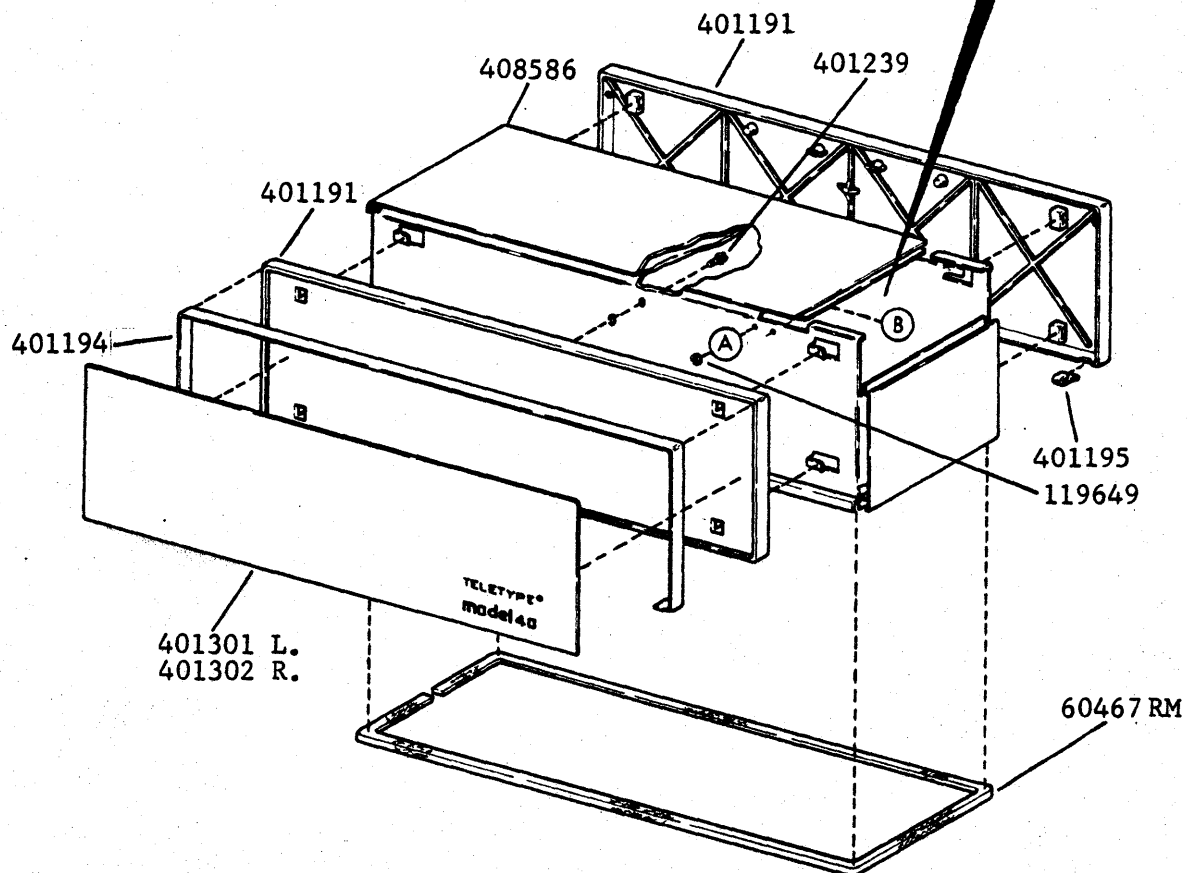
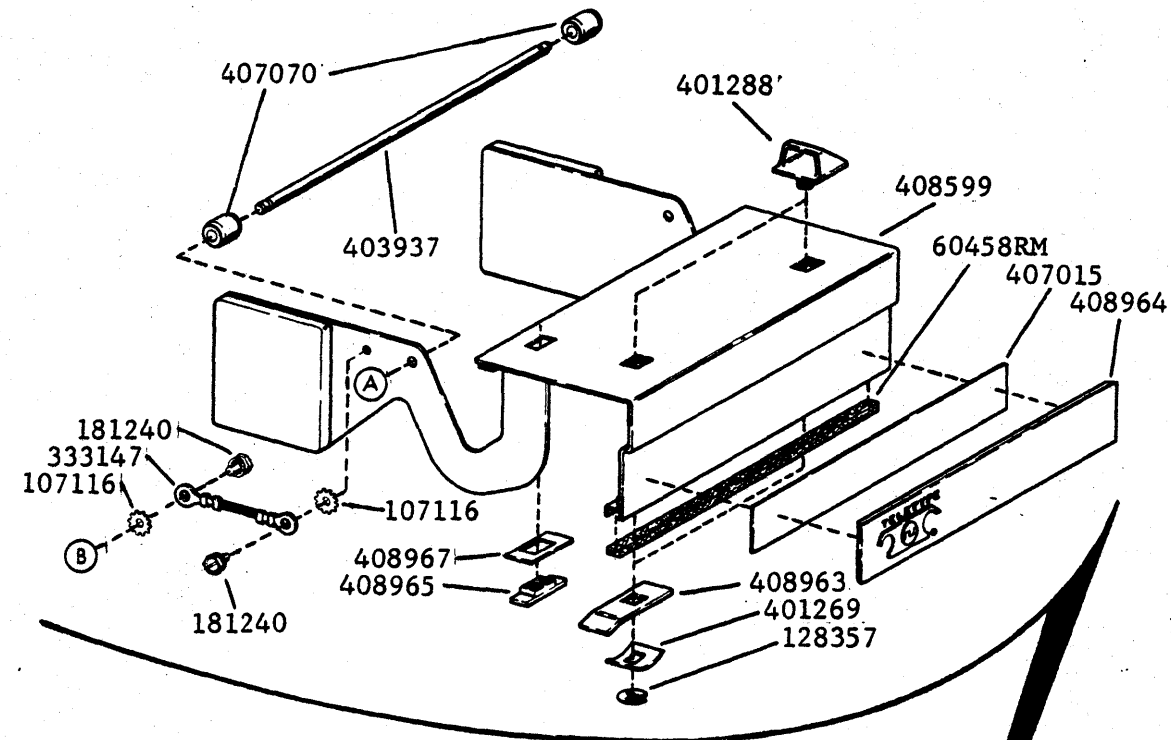


① Part of 406123 cable assembly.

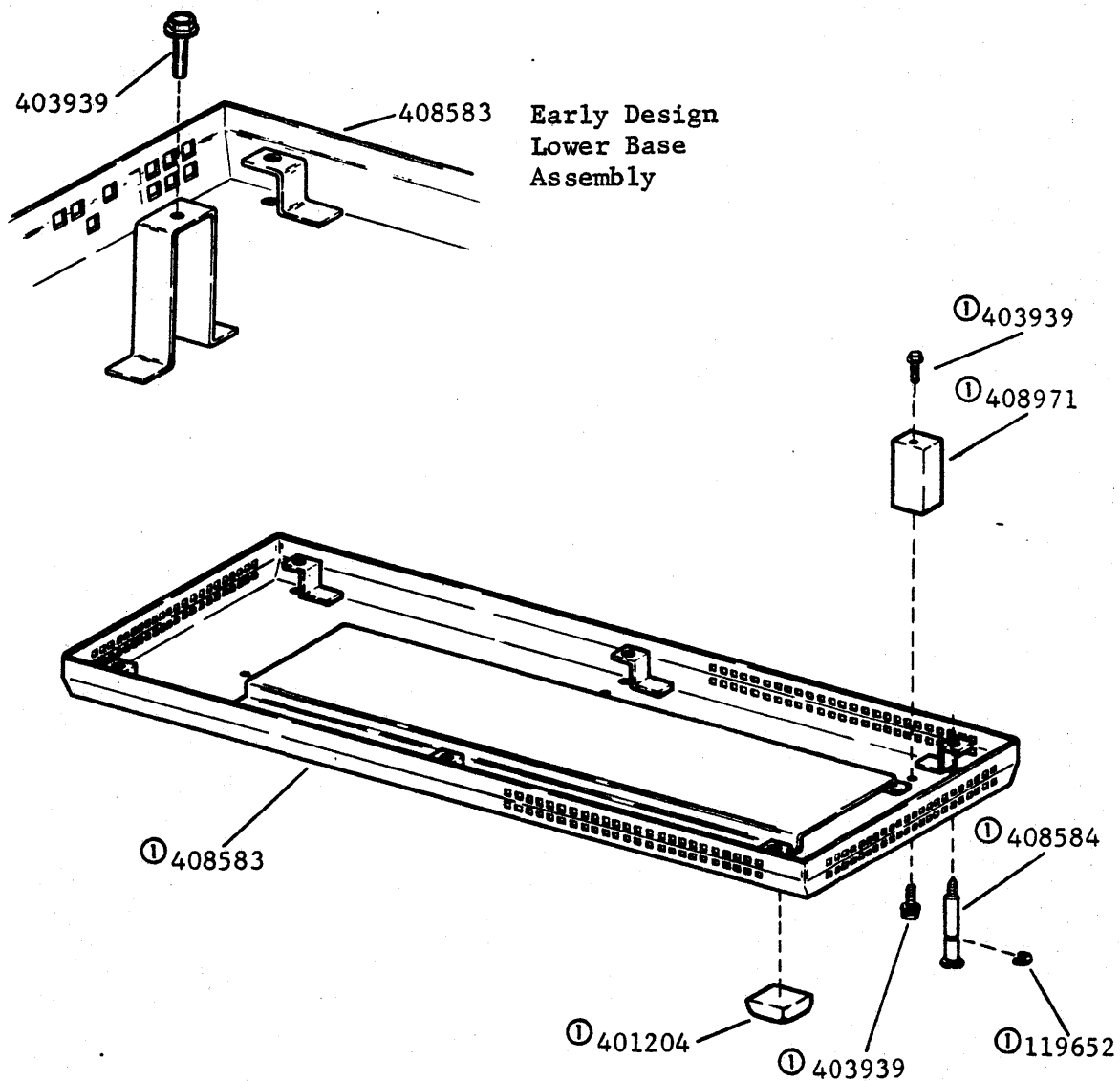
Cassette Holder Assembly

F. DISASSEMBLY/REASSEMBLY AND PARTS (Contd)

5. PARTS (Contd)

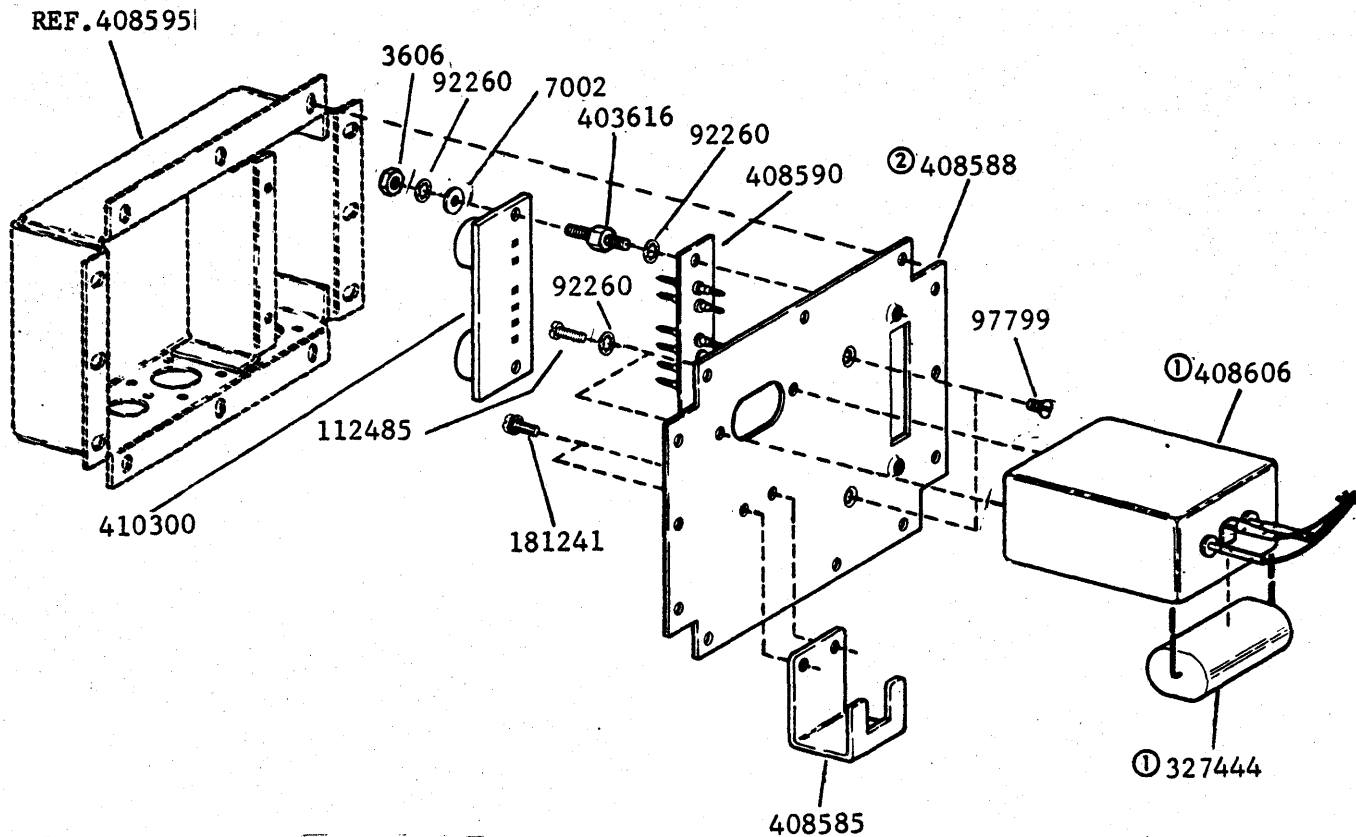


40CAB102 -- Upper Cabinet Assembly



① Part of 408613 lower base assembly.

40CAB102 - Lower Base Assembly

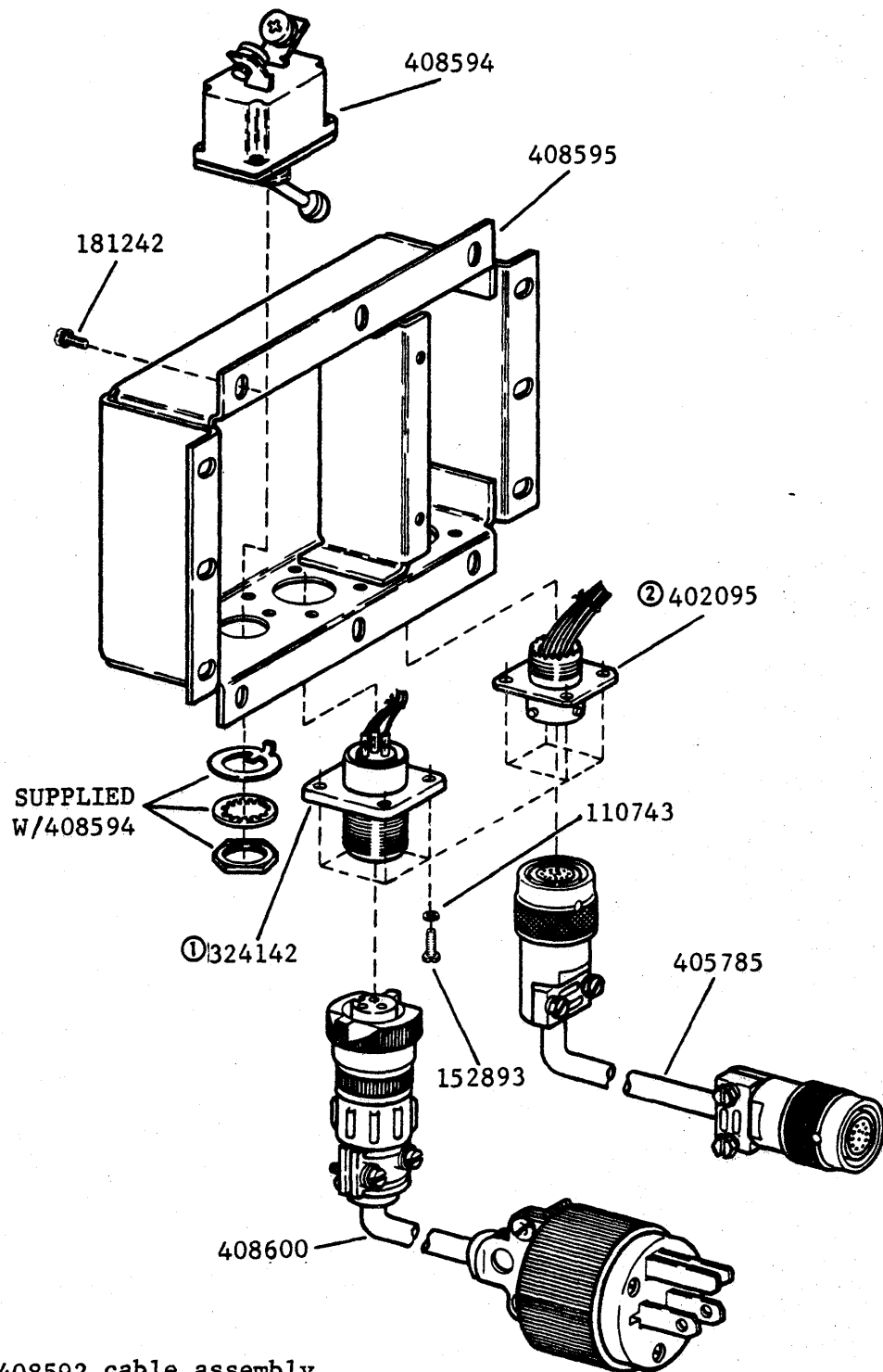
F. DISASSEMBLY/REASSEMBLY AND PARTS (Contd)5. PARTS (Contd)

① Part of 408607 filter assembly.

② Early design 408588 had shelf below filter assembly.

③ Later design 408588 shelf was eliminated as it was not needed.

Chassis Assembly of 408598 SSI/AC Interface Assembly



- ① Part of 408592 cable assembly.
- ② Part of 408591 cable assembly.

408597 Rear Enclosure Assembly of the 408598 SSI/AC Interface Assembly

F. DISASSEMBLY/REASSEMBLY AND PARTS (Contd)

## 5. PARTS (Contd)

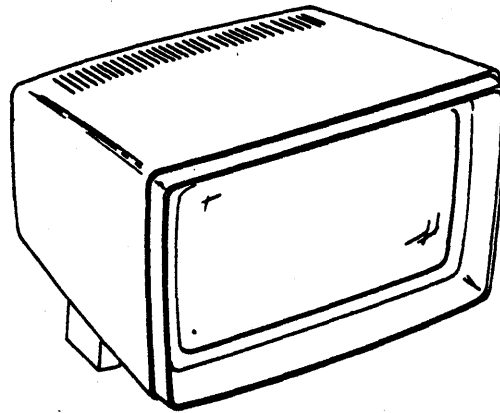
<u>PART NO.</u>	<u>DESCRIPTION AND PAGE NO.</u>	<u>PART NO.</u>	<u>DESCRIPTION AND PAGE NO.</u>
1274	Screw, 6-40 x 1-1/8 FIL 135	151631	Screw, 6-40 x 5/16 Hex 135
2191	Lockwasher 135, 136, 138, 139	152441	Washer, Flat 137
2415	Spring 139	152893	Screw, 4-40 x 1/4 Hex 143
2669	Lockwasher 137	153441	Screw, 10-32 x 7/16 Hex 137
3598	Nut, 6-40 Hex 135, 136, 138	153537	Screw, 6-40 x 9/32 Hex 138
3599	Nut, 4-40 Hex 138	153799	Screw, 4-40 x 21/64 Hex 138
3606	Nut, 6-40 Hex 139, 142	153817	Screw, 4-40 x 3/8 Hex 138
7002	Washer, Flat 139, 142	180595	Setscrew, 4-40 137
34432	Washer, Flat 137	181240	Screw w/Lockwasher, 6-40 x 3/16 Hex 140
41382	Spring 138	181241	Screw w/Lockwasher, 6-40 x 1/4 Hex 136, 142
45815	Lockwasher 137	181242	Screw w/Lockwasher, 6-40 x 5/16 Hex 143
49056	Screw, 10-32 x 7/8 Hex 137	181424	Nut, 6-40 SQ 136
60458	Gasket 140	182523	Clamp, 1-38 in ID Mounting 136
72509	Lockwasher 136	184056	Screw w/Lockwasher, 6-40 x 1/4 Hex 136
76474	Nut, 10-32 Hex 138, 139	184057	Screw w/Lockwasher, 6-40 x 3/8 Hex 136
92115	Setscrew, 8-32 135	184058	Screw w/Lockwasher, 6-40 x 7/16 Hex 136
92260	Lockwasher 136, 142	192226	Bracket, Capacitor Mounting 135
92527	Lockwasher 135	198670	Screw w/Lockwasher, 6-40 x 5/16 Hex 136
93001	Washer, Flat 137	312918	Strap 138
97799	Screw, 6-40 x 9/64 Flat 142	324142	Connector, 3 PT Plug 143
98642	Lockwasher 136	327444	Capacitor, 2 MFD 142
103305	Washer, Flat 137	333147	Jumper, 1-3/4 in Braided 140
107116	Lockwasher 139, 140	336027	Capacitor, 2500 MFD 136
110434	Screw, 4-40 x 3/16 FIL 135, 138, 139	342121	Motor 135
110743	Lockwasher 135, 138, 143	401191	Panel, End 140
111537	Post 135	401194	Band, Trim 140
111640	Screw, 2-56 x 7/32 FIL 137	401195	Clip 140
112485	Screw, 6-32 x 1/4 FIL 142	401204	Bumper 141
112626	Nut, 10-32 Hex 137	401239	Screw, 8-18 SPL 140
112630	Spring 138	401269	Washer, Spring 140
116783	Holder, Fuse 136	401288	Handle 140
119649	Ring, Retaining 138, 139, 140	401301	Plate 140
119652	Ring, Retaining 137, 139, 141	401302	Plate 140
119654	Ring, Retaining 137	402095	Receptacle 143
121244	Clamp, 1/4 ID Cable 126	402271	Clutch Assembly 137
125015	Washer, Flat 139	402274	Hub, Right Drive 137
128357	Ring, Retaining 140	402275	Hub, Left Drive 137
130663	Lockwasher 137	403224	Plate w/Stop 138
143307	Fuse, .6 AMP 136	403225	Post 138
151354	Screw, 2-56 x 15/32 FIL 138	403231	Bracket 138
151442	Screw, 6-40 x 1/2 Hex 136		
151621	Screw, 6-32 x 3/4 RD 135		
151622	Nut, 6-32 SQ 135		
151630	Screw, 6-40 x 1/4 Hex 135, 136		



<u>PART NO.</u>	<u>DESCRIPTION AND PAGE NO.</u>	<u>PART NO.</u>	<u>DESCRIPTION AND PAGE NO.</u>
403232	Bail, Sensor 138	403616	Post 142
403233	Shaft 138	403937	Shaft 140
403234	Holder, Cassette 139	403939	Screw, 8-32 Spl 141
403235	Screw, 10-32 Pilot 138	405699	Cable Assembly 135
403236	Bracket 139	405785	Cable Assembly 143
403237	Post, Bobbin 139	406102	Bracket 136
403238	Bobbin w/Tape 139	406103	Transformer 136
403239	Spring, Compression 139	406111	Switch 138
403240	Bearing, Retaining 139	406113	Bracket 138
403241	Head Assembly 139	406114	Plate, Nut 138
403243	Latch, Feed 139	406119	Actuator 138
403252	Tube, Sensing 138	406121	Lamp w/Terminals 138, 139
403270	Casting 137	406123	Cable Assembly 138, 139
403271	Stud 137	406124	Armature 137
403272	Bearing 137	406125	Blade 138
403273	Pulley 137	406133	Shaft 137
403274	Coil 137	407015	Adhesive 140
403275	Rotor 137	407070	Spacer 140
403276	Shaft 137	408583	Base 141
403277	Housing 137	408584	Screw, 6-40 Shoulder 141
403278	Shaft 137	408585	Bracket 142
403279	Housing 137	408586	Cabinet 140
403280	Pulley 137	408588	Plate 142
403281	Pulley 137	408590	Filter Assembly 142
403282	Clamp 137	408591	Cable Assembly 143
403283	Housing 137	408592	Cable Assembly 143
403284	Shaft, Drive 137	408594	Breaker, Circuit 142
403286	Screw, 4-40 Spl 137	408595	Enclosure, Rear 143
403289	Ring, O 137	408597	Enclosure Assembly, Rear 143
403290	Spring 137	408598	Interface Assembly 142
403291	Spring, Flat 138	408599	Door w/Hinge 140
403296	Brake 137	408600	Cable Assembly 143
403297	Plate 135, 136	408606	Filter 142
403298	Strap, Mounting 135	408607	Filter Assembly 142
403299	Driver 135	408613	Base Assembly 141
403300	Belt, Drive 137	408963	Latch 140
403301	Cover 135	408964	Plate, Trim 140
403302	Fan, Motor 135	408965	Lens 140
403304	Capacitor, 8MF 135	408967	Adhesive 140
403305	Driver 135	408971	Standoff 141
403580	Cassette 139	410043	Card, Circuit 136
403586	Support, Circuit Card 135	410300	Card, Circuit 142
		410764	Card, Circuit 135



PART 4 — TEMPEST MODEL 40 DISPLAY MONITOR 40MN202/RA



	<u>INDEX</u>	<u>PAGE</u>
A.	GENERAL	
	1. DESCRIPTION . . . . .	2
	2. TOOLS, TEST EQUIPMENT, AND MISCELLANEOUS . . . . .	2
B.	SHOP PROCEDURES	
	1. GENERAL . . . . .	3
	2. CLEANING . . . . .	3
	3. INSPECTION . . . . .	5
	4. MARKING AND PACKING . . . . .	7
	5. CRT DISPOSAL . . . . .	11
C.	TESTING	
	1. GENERAL . . . . .	13
	2. HIGH VOLTAGE BREAKDOWN TEST . . . . .	15
	3. FUNCTIONAL TESTS . . . . .	17
D.	TROUBLESHOOTING	
	1. GENERAL . . . . .	22
	2. HIGH VOLTAGE BREAKDOWN FAILURE . . . . .	23
	3. TROUBLE ISOLATION . . . . .	24
	4. DETAILED TROUBLE ANALYSIS . . . . .	30
	5. REFERENCE MATERIAL . . . . .	65
E.	ADJUSTMENTS AND LUBRICATION	
	1. ADJUSTMENTS . . . . .	68
	2. LUBRICATION . . . . .	75
F.	DISASSEMBLY/REASSEMBLY AND PARTS	
	1. GENERAL . . . . .	76
	2. DISASSEMBLY/REASSEMBLY . . . . .	79
	3. PARTS . . . . .	111
	4. COMPONENT PARTS LIST . . . . .	124

PART 4 -- TEMPEST MODEL 40 DISPLAY MONITOR 40MN202/RAA. GENERAL1. DESCRIPTION

The function of the Tempest Model 40 Display Monitor (standard Teletype Tempest treated) is to provide a visual display on a cathode ray tube of the data stored by the Tempest Model 40 display logic. Characters are displayed in dot pattern form within a matrix of 720 horizontal dots by 336 vertical dots, over an area 11-1/4 inches wide by 5-1/4 inches high, centered on the CRT face. Adjustments are provided within the monitor for horizontal size and linearity, brightness, focus and centering. Operator controls include a power (ON-OFF) switch, brightness control, and tube tilt to minimize reflected glare. Indicator lamps are provided within the monitor for use in checking operation of major subsystems. Under control of the display logic, the monitor is capable of displaying characters, singly or in groups, at half intensity. The ac power is routed to the display monitor via a connector in the left support leg. Logic signals are routed to the display monitor via a cable through an opening in the rear of the housing assembly.

Refer to Page 4-65, 5. REFERENCE MATERIAL for a general circuit description with block diagram and for further details of the major components functions.

The display monitor is designed for operation with a supply voltage of 115 V ac (+10 percent) at 60 or 50 Hz. Operating power is 115 watts and heat generation is 400 BTU/Hr.

2. TOOLS, TEST EQUIPMENT, AND MISCELLANEOUSTools

The tools listed below are supplementary to common types such as pliers, screwdrivers, etc, and may be procured locally or ordered from Teletype Corporation.

NOTE: When ordering replaceable components, unless otherwise specified, prefix each part number with the letters "TP" (ie, TP410055).

<u>Description</u>	<u>Part No.</u>
• Pull Spring Hook	75765
• Nut Driver Wrench 1/4 Inch	89954
• Nut Driver Wrench 5/16 Inch	89955
• Nut Driver Wrench 3/16 Inch	125752
• Terminal Extractor	182697
• Adjusting Tool	405992
• Scale, 6 Inch L. S. Starrett No. 338 or equivalent (procure locally)	
• Soldering Iron, Weller Model W-MCP-750 with MP2C Tip, or equivalent (procure locally)	
• Desoldering Tool, EDSYN Model MMS005 Soldapullt <sup>®</sup> , or equivalent (procure locally)	

Test Equipment

The following equipment or equivalent is required for testing, troubleshooting, and adjusting the display monitor.

- Volt-Ohm-Milliameter, Triplet Model 630 APL
- Digital Multimeter, Fluke Model 8100A
- Oscilloscope, Tektronix Model 7904 e/w:
  - 2 -- 7A16A Single Trace Amplifiers
  - 1 -- 7B70 Time Base Unit
- High Voltage DC Breakdown Tester, Slaughter Co. Model 108-2.5MW
- Tempest Model 40 KD Set, Full Edit or
- Display Monitor Test Set -- CP10.010.000

Supplied by: Teletype Corporation  
 Custom Product Division  
 5555 Touhy Avenue  
 Skokie, Illinois 60077  
 (312) 982-2499

Miscellaneous

The following items should be procured locally:

- Glyptol® , General Electric, Type 1201, Red
- Brush, 1/2 Inch Soft-Bristle
- Thermal Joint Compound

B. SHOP PROCEDURES1. GENERAL

This section details the cleaning, refinishing, and inspection procedures to be followed prior to testing and troubleshooting the display monitor. In many cases, careful inspection will save later troubleshooting by revealing broken or loose connections, damaged components, possible short circuits, etc.

Refer to Page 4-76, F. DISASSEMBLY/REASSEMBLY AND PARTS whenever detailed information on removing display monitor components is required.

The packing materials detailed in this section are designed for protection against damage from rough handling in shipping.

2. CLEANING

Immersion type cleaning is NOT recommended for the display monitor.

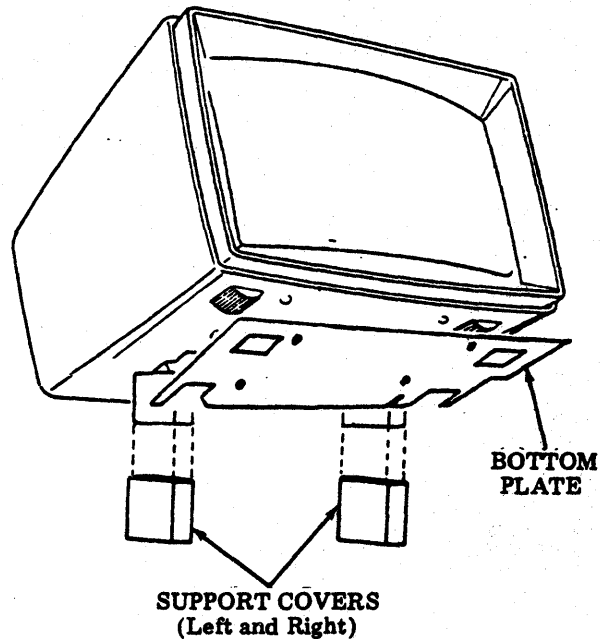
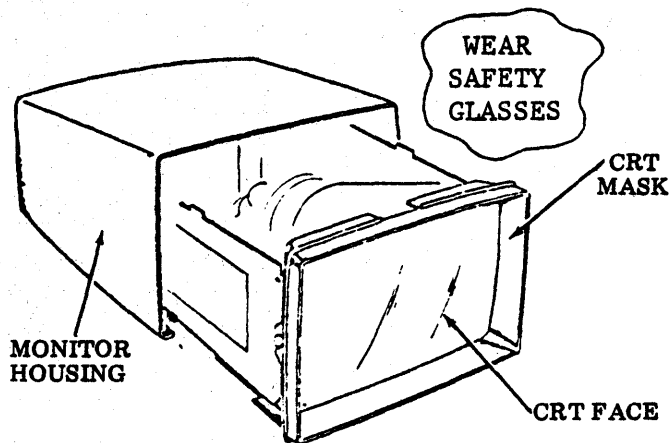
**CAUTION:** AVOID THE USE OF HARSH OR ABRASIVE CLEANING AGENTS OR SOLVENTS WHICH COULD SCRATCH OR DAMAGE THE EXTERIOR PLASTIC SURFACES OF THE MONITOR HOUSING OR THE FACE OF THE CATHODE RAY TUBE (CRT) OR CRT MASK.

Exterior

**CAUTION:** WEAR SAFETY GLASSES AND USE CARE IN HANDLING.

B. SHOP PROCEDURES (Cont)2. CLEANING, Exterior (Cont)

- (1) Remove housing (bottom latch).
- (2) Set display monitor on the rear, display tube face up, and pull off bottom cover and support covers.
- (3) Restore unit to its normal position.



Clean all indicated surfaces as follows:

- a. Wash with mild detergent solution
- b. Rinse with damp cloth
- c. Buff dry with soft cloth

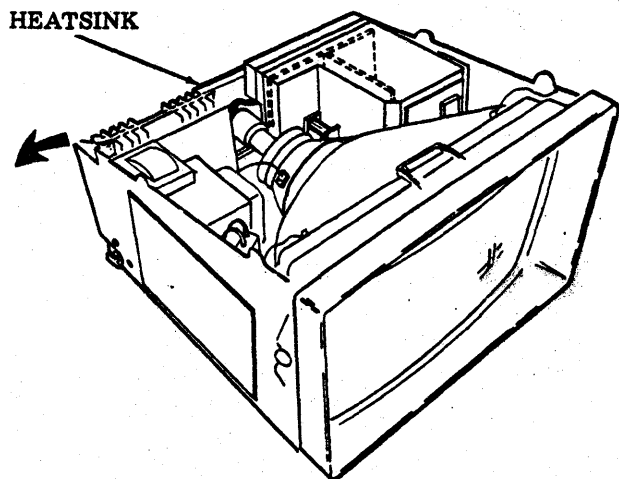
Interior

**CAUTION 1:** WEAR SAFETY GLASSES, AND BE CAREFUL NOT TO STRIKE OR DAMAGE THE FRAGILE NECK OF THE CRT.

Rotate heatsink back if necessary for easier access.

Clean chassis and components, particularly heatsink area, by lightly brushing with a clean dry 1/2 inch brush followed by air blowing.

**CAUTION 2:** THE AIR SUPPLY SHOULD NOT EXCEED 20 PSI. HIGHER AIR PRESSURES MAY DAMAGE SMALL COMPONENTS.

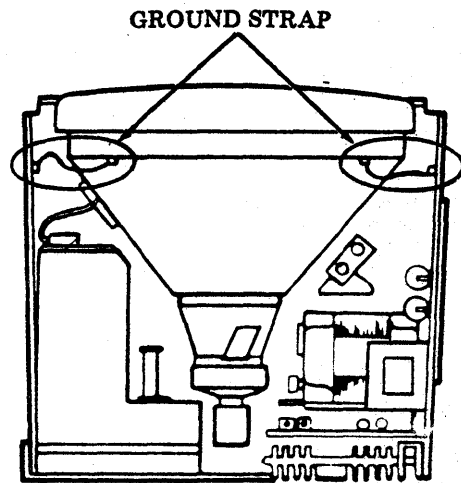
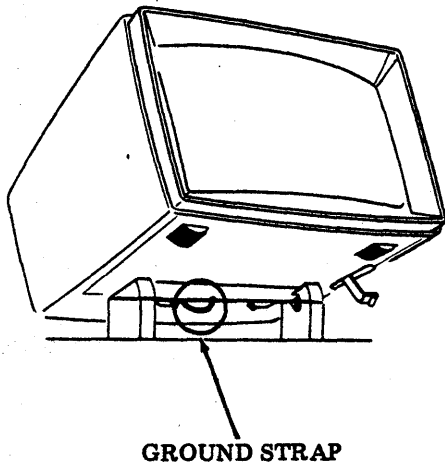


3. INSPECTION

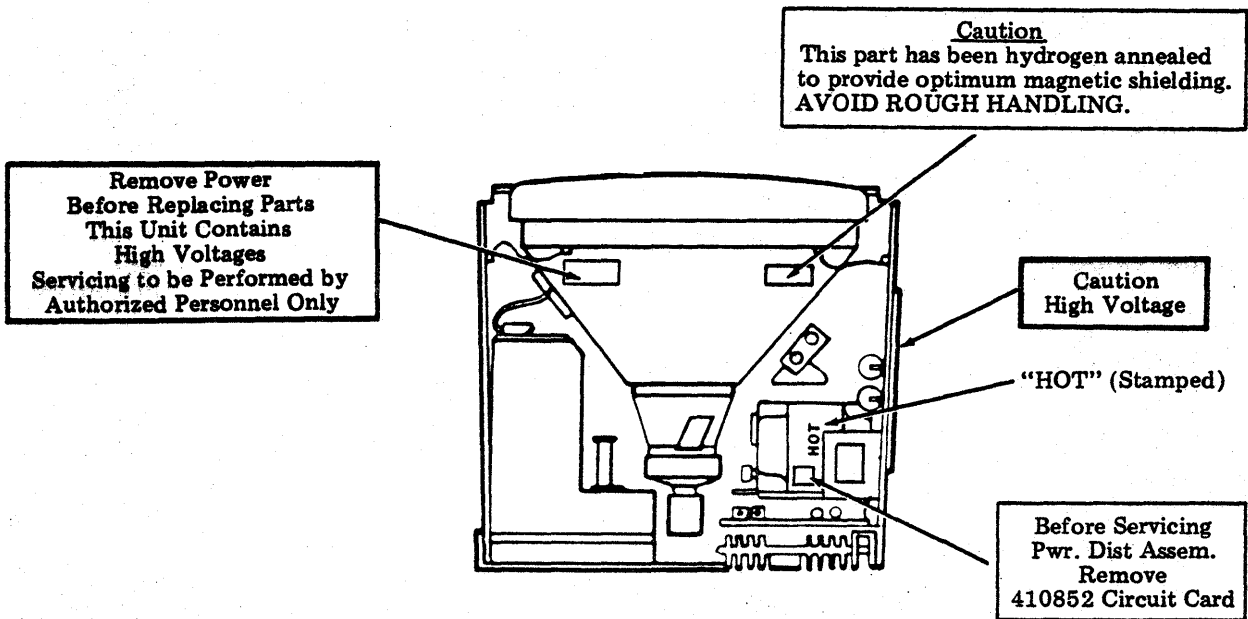
Interior

**CAUTION:** WEAR SAFETY GLASSES, AND BE CAREFUL AROUND SUCH FRAGILE AREAS AS THE DISPLAY TUBE NECK, YOKE, AND SOCKET.

- a. Rotate heatsink to the rear and check the condition of wiring and components. Verify that various connectors are in place and fully seated.
- b. Check for the presence and proper connection of grounding straps. Make sure these connections are tight.

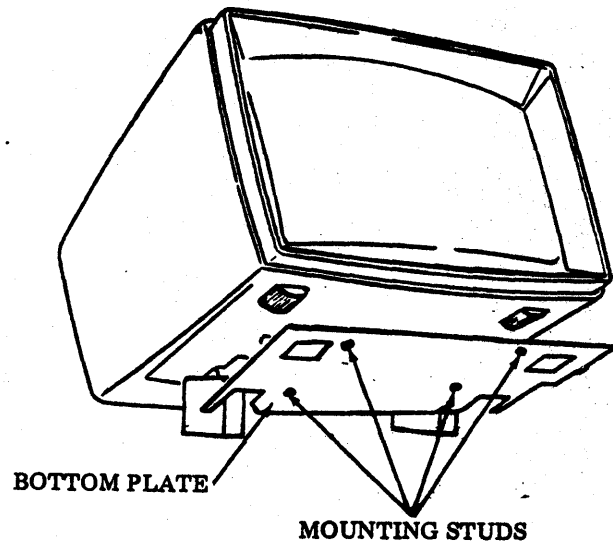


- c. Check for the presence and legibility of all warning labels.

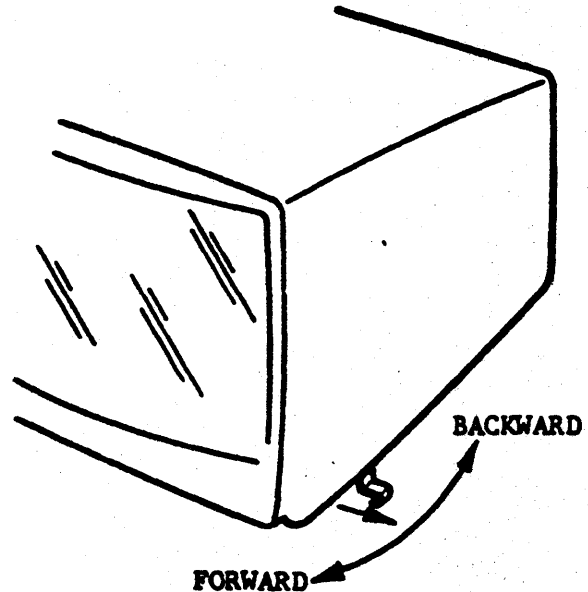


B. SHOP PROCEDURES (Cont)3. INSPECTION (Cont)External

- a. Examine the face of the display tube for chips, scratches, or severe discolorations.
- b. Check that housing, bottom plate and support bracket shields are not cracked, severely scratched, discolored, etc.
- c. Verify that all four studs associated with bottom plate are present and not broken or mutilated.
- d. Reinstall bottom plate and support bracket shields which were removed prior to cleaning. Note the differences in the right and left support shields to accommodate the support bracket's hinge.

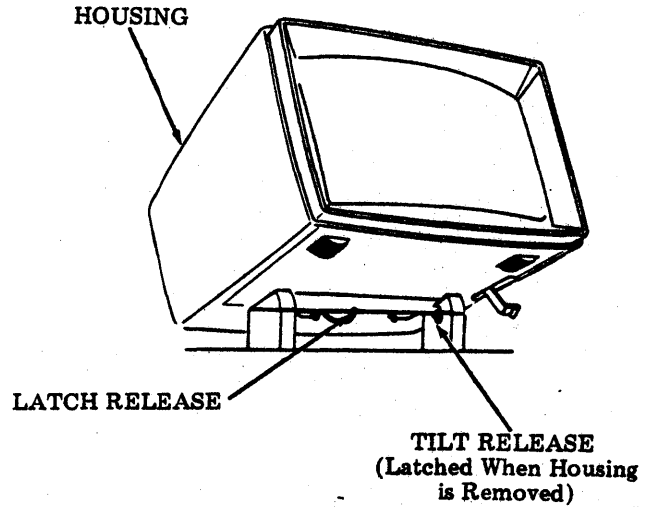
Mechanical Checks

- a. Check tube tilt control for proper detenting throughout the entire range of tilt, so that the tube will remain positioned at any desired tilt angle in the range. Move adjusting lever to the right to disengage from rack teeth. Move lever forward or backward to obtain desired position. Release lever to lock in place.





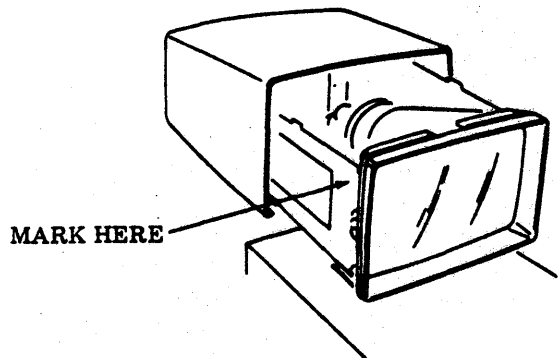
- b. With monitor housing removed, the monitor tilt release mechanism should latch to prevent monitor from tilting back on support brackets. Check this feature by attempting to tilt monitor from the horizontal.
- c. Replace housing. Observe that housing latch operates to securely lock housing to monitor and that monitor is now capable of being tilted back on support brackets.



4. MARKING AND PACKING

Marking

For record keeping purposes, repair date may be marked on monitor chassis as shown.



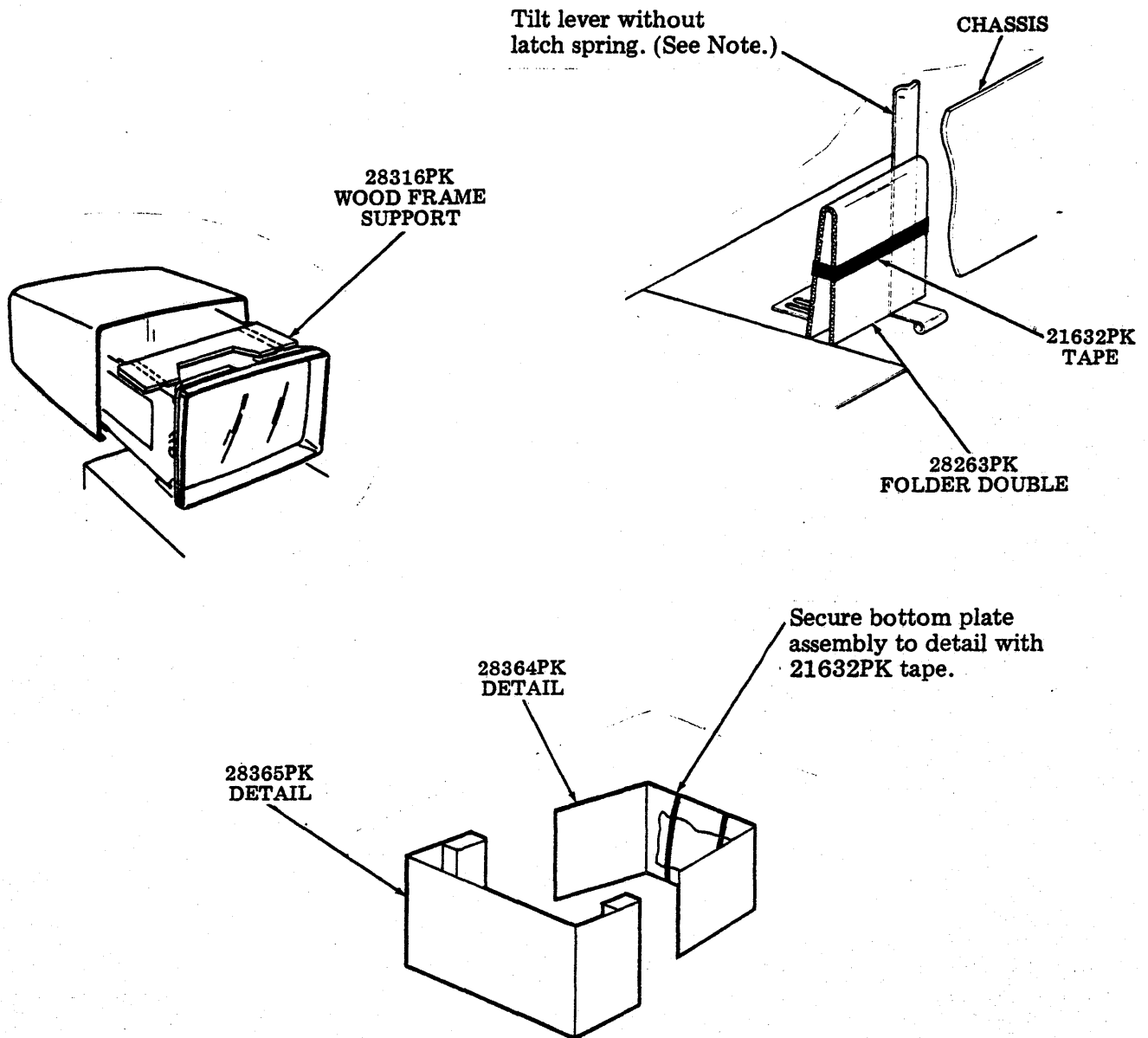
B. SHOP PROCEDURES (Cont)4. MARKING AND PACKING (Cont)Packing

Factory-type packing may be duplicated by ordering material shown below and applying as follows. PK designated items should be ordered from Teletype Corporation. The screws, washers, and lockwashers should be procured locally.

<u>Qty</u>	<u>Materials Required</u>	<u>Qty</u>	<u>Materials Required</u>
1	11322PK Corrugated Carton	4	1/4-20 by 2 Inch RH Steel
1	10603PK Corrugated Carton		Machine Screws
1	28381PK Wood Pallet	4	Steel Compression Lockwashers for
1	28364PK Corrugated Detail		1/4 Inch Screws
1	28365PK Corrugated Detail	4	Flat Iron Washers for 1/4 Inch
2	28051PK Metal Spacers		Screws
8	27442PK Plastic Corners	-	21719PK Tape (as required)
2	27542PK Labels	-	21632PK Tape (as required)
1	23457PK Plastic Bag	-	21298PK Tissue Paper (as required)
1	28316PK Wood Frame	1	28263PK Corrugated Detail

- a. Preassemble all parts to bottom of main frame. Mount assembly to a 28381PK pallet with two 28051PK spacers, four 1/4-20 by 2 inch right-hand steel machine screws, four steel compression lockwashers for 1/4-inch screws and four flat iron washers for 1/4-inch screws. Tighten screws securely.
- b. Complete assembly of monitor with cover removed. Invert monitor.
- c. Secure each of the two support covers in place with a strip of 21632PK tape. Return unit to an upright position.
- d. Carefully disconnect CRT cable. Tape the video cable to inside of left frame with 21632PK tape.
- e. Mount one 28316PK wood frame support to the two side frames at the top of unit. The side frames must fit inside the slots of the wood detail. The cut out portion of the wood detail must be facing in the direction of the front face of the tube. Move detail to rear so it is positioned just in front of the round projections on frames.
- f. Tape the wood frame support tightly in position on the frames with three complete bands of 21632PK tape over the front and rear of the support and the underside of the monitor.
- g. Mount cover and latch securely.
- h. Release monitor and bottom plate assembly to the packing area.
- i. Form a 10603PK carton. Close and seal bottom flaps with a strip of 21719PK tape applied along the center seam. The tape should extend approximately three inches down the ends of the carton.
- j. Place unit in carton. Place a 23457PK plastic bag around unit.
- k. Form a 28365PK detail and place in carton at front of unit as illustrated.
- l. Wrap the bottom plate assembly in a sheet of 21298PK tissue paper. Form a 28364PK detail and secure the wrapped bottom plate to the detail with two bands of 21632PK tape.
- m. Position the detail and bottom plate in the carton.
- n. Close and seal the top flaps of the carton as outlined in operation 9.
- o. Moisten and apply a 27542PK label to upper left-hand portion of top of carton.

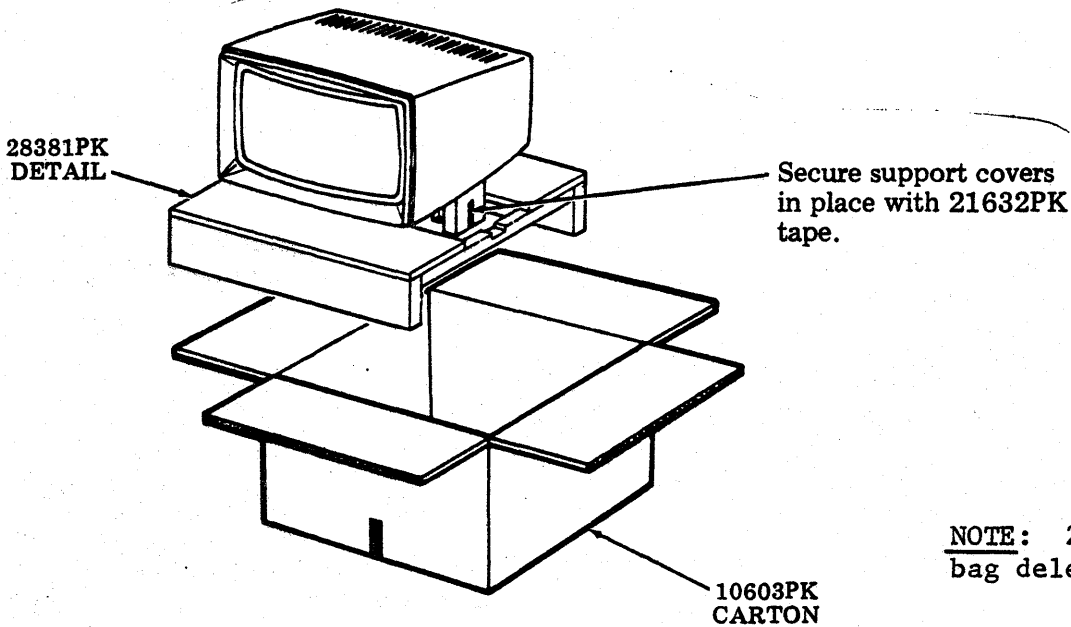
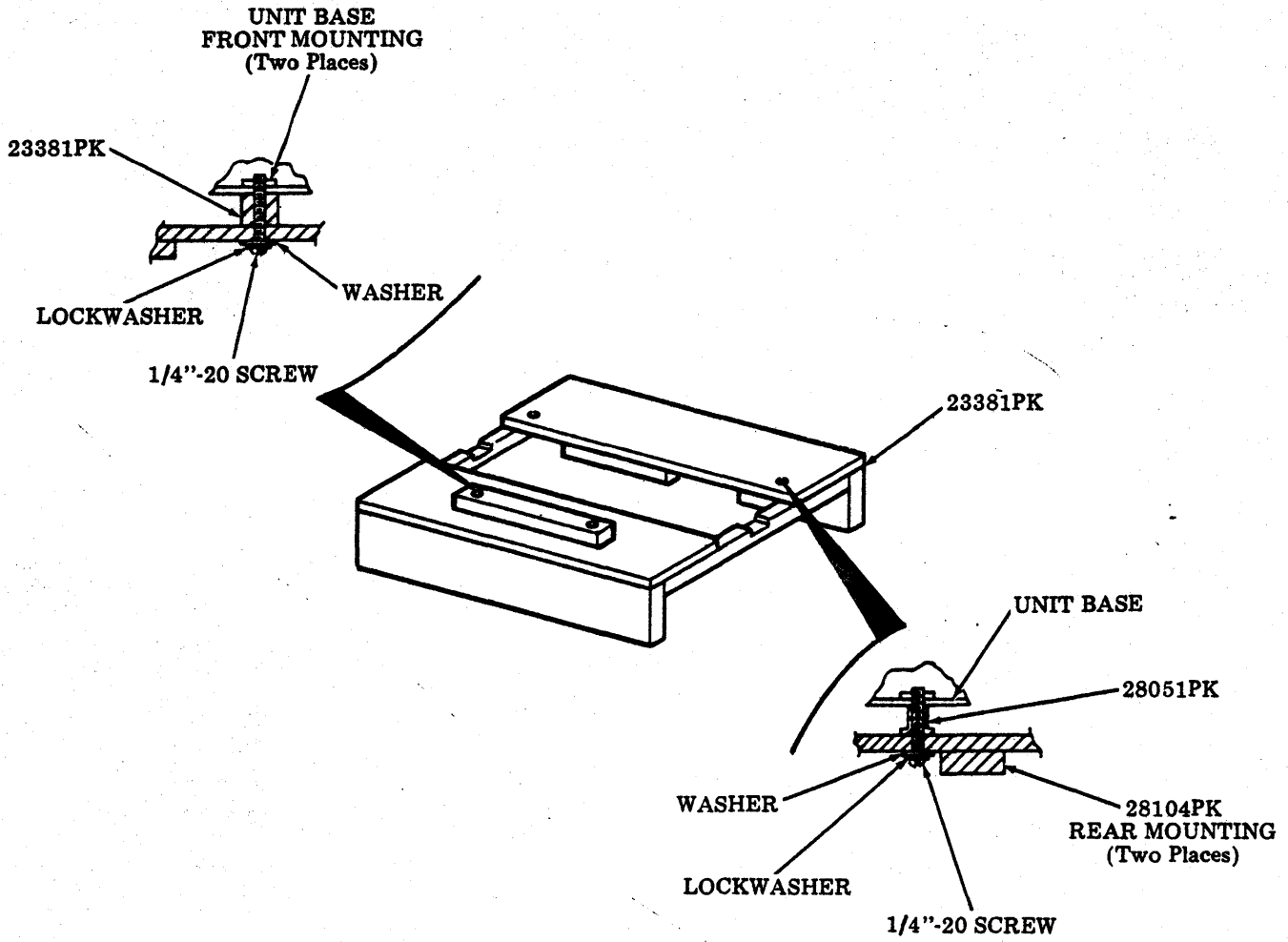
- p. Form a 11322PK carton and with bottom flaps down and outward, place around the inner carton.
- q. Position a 27442PK plastic corner on each of the four corners of the inner carton.
- r. Close and seal the top flaps of the carton with 21719PK tape as outlined in operation 9.
- s. Moisten and apply a 27542PK label to upper left-hand portion of top of carton.
- t. Carefully invert carton and contents. Position a 27442PK plastic corner on each of the four corners of the inner carton.
- u. Close and seal bottom flaps of carton as outlined in operation 9. Invert carton.



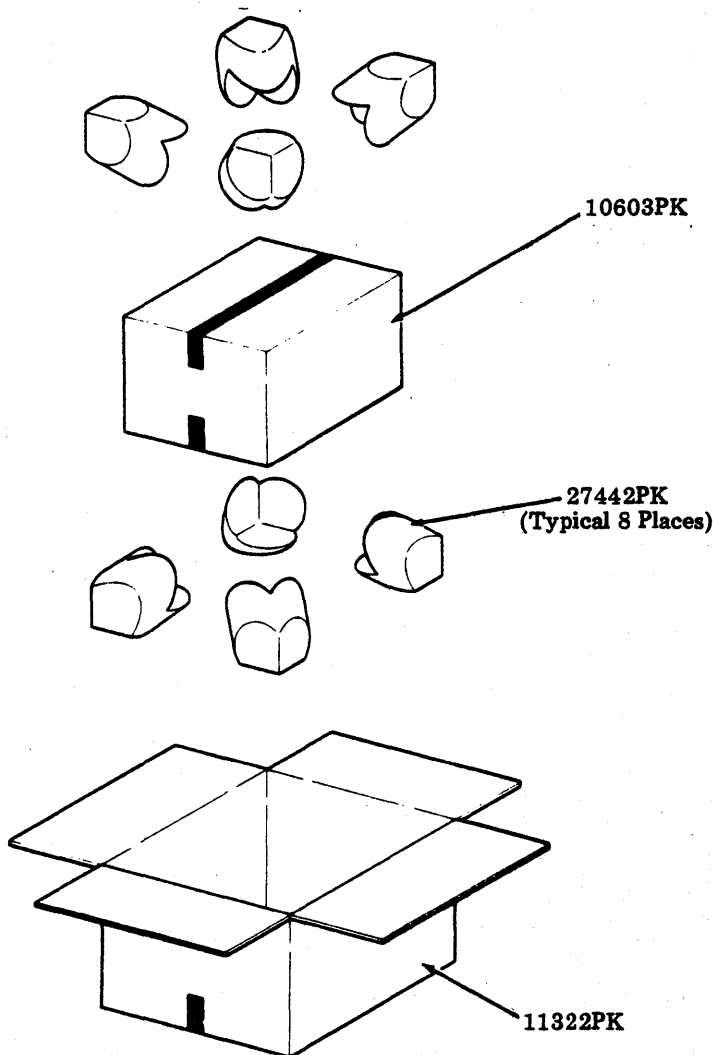
**NOTE:** If tilt lever is equipped with 406152 latch spring (late design), 28263PK detail is not required. Move lever to front detent position and latch will engage when monitor bottom plate is removed.

B. SHOP PROCEDURES (Cont)

4. MARKING AND PACKING, Packing (Cont)



NOTE: 23457PK plastic bag deleted for clarity.



## 5. CRT DISPOSAL

Because cathode ray tubes are highly evacuated the glass shell may collapse if dropped, scratched, or struck sharply. The sudden inrush of air displacing the vacuum may exert sufficient force to dangerously propel shattered glass. To eliminate this accidental possibility, air must be allowed to enter the tube under controlled conditions prior to disposal of defective or worn out CRT tubes. Once the air pressure is equalized, standard glass disposal methods can be followed. Either of the methods illustrated can be used to allow air into the tube.

**DANGER:** ALWAYS WEAR SAFETY GLASSES (PREFERABLY SAFETY GOGGLES OR GLASSES WITH SIDE SHIELDS) WHEN HANDLING OR WORKING IN THE AREA OF EXPOSED CATHODE RAY TUBES.

WEAR LEATHER GLOVES WHEN HANDLING EXPOSED CRT.

EXTREME CAUTION MUST BE OBSERVED TO AVOID CONTACT BETWEEN SKIN ABRASIONS OR OPEN WOUNDS AND BROKEN FRAGMENTS OF THE CRT.

IF A CUT IS RECEIVED FROM CRT GLASS OBTAIN MEDICAL TREATMENT IMMEDIATELY.

DO NOT PICK UP THE TUBE BY ITS NECK. CARRY THE TUBE WITH BOTH HANDS NEAR ITS FACE. DO NOT TOUCH THE ANODE TERMINAL (RING SHAPED) ON SIDE OF TUBE.

B. SHOP PROCEDURES (Cont)

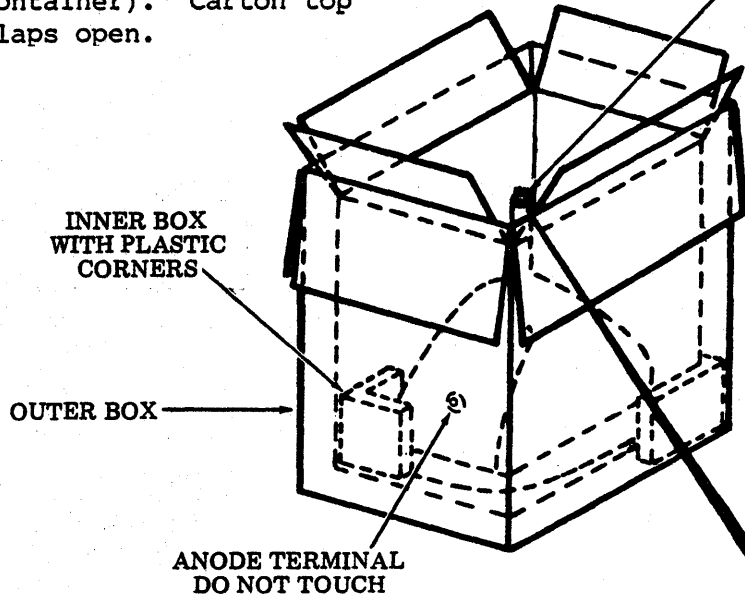
5. CRT DISPOSAL (Cont)

Method 1:

- ① Place CRT in packing cartons retained from replacement tube (or equivalent strong container). Carton top flaps open.

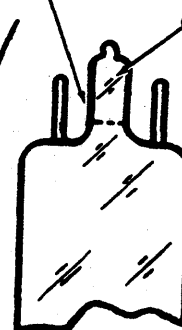
WEAR SAFETY GLASSES AND LEATHER GLOVES

- ② Pull (or carefully pry with screwdriver) the plastic ring off of the terminal pins at end of neck.



- ③ Score base of pointed head with metal file. Do not file completely through glass.

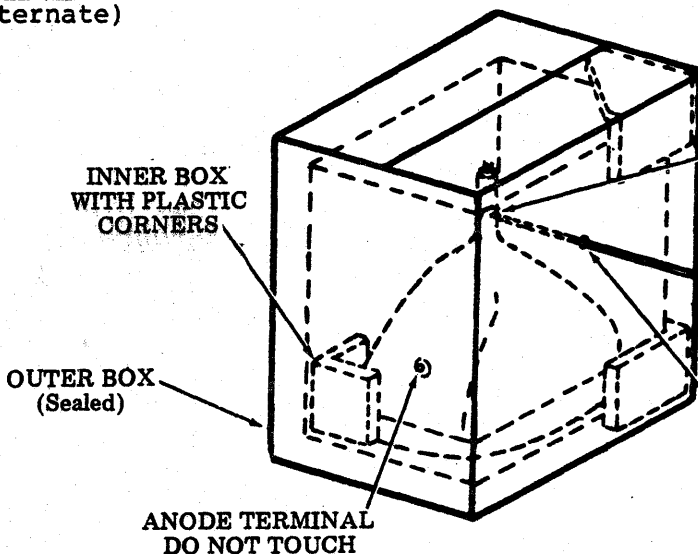
- ④ Break off tip of bead with gas pliers to allow air into tube.



Method 2:  
(Alternate)

WEAR SAFETY GLASSES AND LEATHER GLOVES

- ① Place CRT in packing cartons retained from replacement tube (or equivalent strong container). Seal cartons.



NECK OF CRT

- ② Insert steel rod through side of container.
- ③ Strike rod with hammer to break tube near top of the neck.
- ④ Seal opening for steel rod. Mark box "BROKEN GLASS". Dispose with glass refuse.

## C. TESTING

### 1. GENERAL

Functional testing of the display monitor is accomplished with the use of a full edit Tempest Model 40 KD Set or Display Monitor Test Set.

Functional testing provides a means for verifying operational requirements of the display monitor unit. The test procedure should be performed from start to finish without omissions. Possible causes of trouble are listed with the tests to provide aid in correcting the trouble.

Whenever the display monitor fails a particular test, refer to D. TROUBLESHOOTING to locate the trouble. After the trouble has been corrected, repeat the test that disclosed the trouble and if found satisfactory, resume testing from that point.

CAUTION: TURN OFF ALL AC POWER AND SIGNAL SOURCES WHEN INSTALLING THE DISPLAY MONITOR ON THE TEST SET OR WHEN REMOVING IT. SIMILARLY, TURN OFF ALL POWER AND SIGNAL SOURCES WHEN REMOVING OR REPLACING COMPONENTS.

**NOTES**

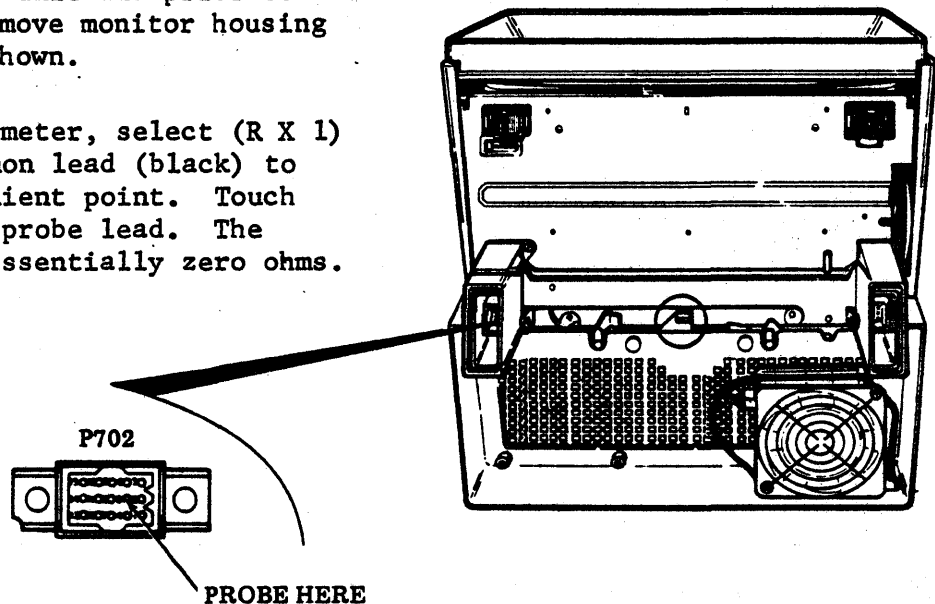


## 2. HIGH VOLTAGE BREAKDOWN TEST

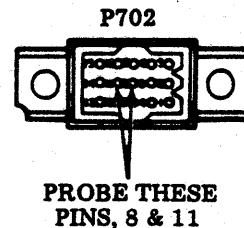
### Resistance Checks

These checks are to be made prior to connecting power to unit and prior to breakdown test. Remove monitor housing and place unit as shown.

Using digital multimeter, select (R X 1) scale and clip common lead (black) to chassis at a convenient point. Touch pin 5 of P702 with probe lead. The meter should read essentially zero ohms.



Select (R X 1 K) scale of multimeter. Operate monitor ON/OFF switch to ON. Leave meter common lead on chassis and touch pin 8, and then pin 11 of P702. The multimeter should indicate infinite ( $\infty$ ) resistance at both pins. Any reading indicates a leak to ground in cabling or power distribution circuitry.



**NOTE:** If any of these tests fail DO NOT perform the high voltage breakdown test. The trouble must be corrected first. Proceed to D. TROUBLESHOOTING for the appropriate procedure to correct the trouble.

### Precautions

**CAUTION:** EXTREME CARE SHOULD BE TAKEN WHEN TESTING AS HIGH VOLTAGE IS PRESENT WHEN POWER SWITCH IS ON. OPERATOR SHOULD OBSERVE THE FOLLOWING PRECAUTIONS.

- a. AVOID BODILY CONTACT WITH CHASSIS WHEN PROBING.
- b. PROBE ONLY THE POINTS SPECIFIED BY THIS SECTION.

C. TESTING (Cont)2. HIGH VOLTAGE BREAKDOWN TEST (Cont)Equipment Preparation

Verify that breakdown tester power switch is OFF and that probe tips are retracted. Connect breakdown tester to 115 V ac power source.

Operate breakdown tester power switch to ON and adjust for 500 V output.

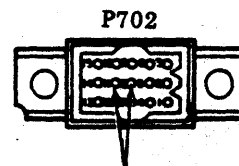
Extend both probe tips and touch together momentarily to verify that breakdown indicator is functioning.

Retract probe tips and proceed.

Breakdown Test Procedure

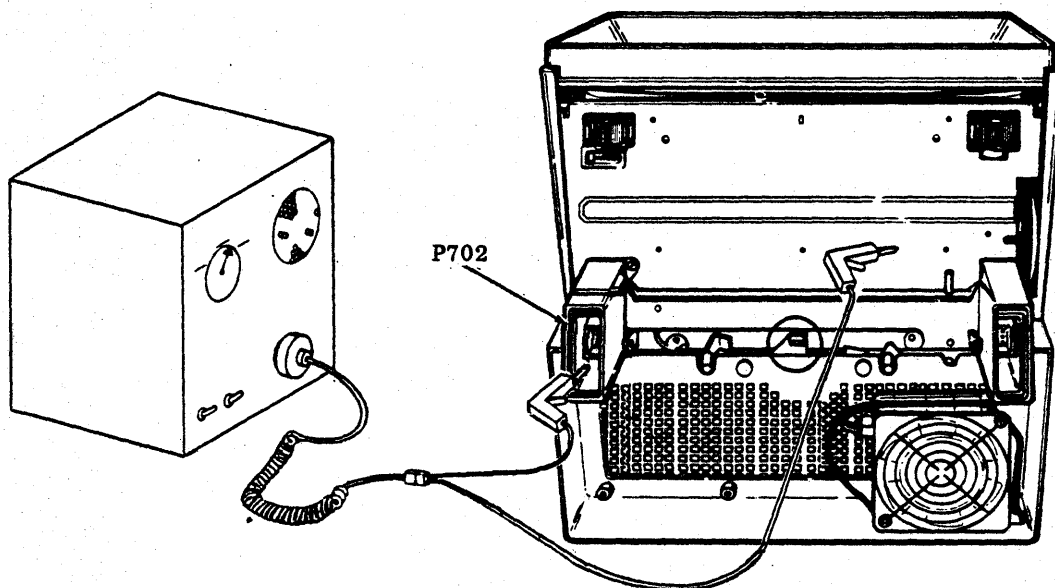
With the breakdown tester turned ON, set the breakdown voltage to 0 V dc.

Hold one extended probe tip of the breakdown tester on bottom of monitor chassis.



Use the other extended probe tip to touch pin 8. Increase the breakdown test set output voltage to 500 V dc and hold for one second. Repeat the procedure probing pin 11. The test set should NOT signal a breakdown.

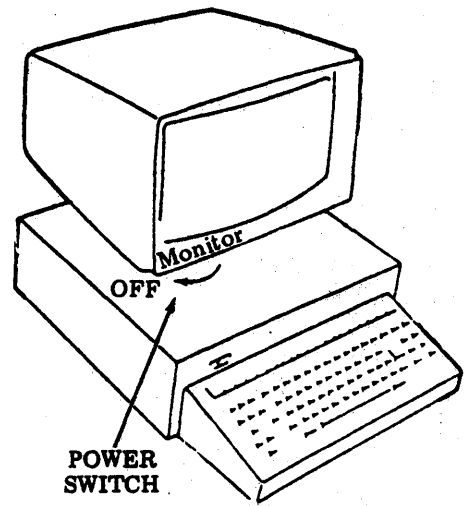
If a breakdown failure occurs, refer to D., 2. HIGH VOLTAGE BREAKDOWN FAILURE for detailed troubleshooting methods. If the breakdown test was successful, operate display monitor power switch to OFF and proceed to 3. FUNCTIONAL TESTS.



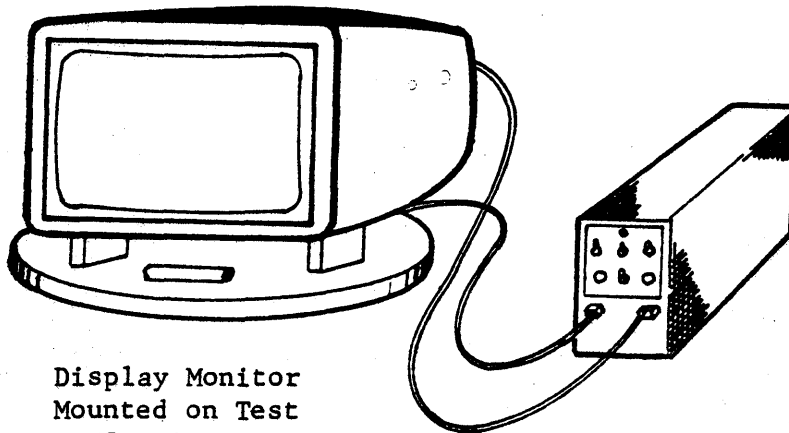
3. FUNCTIONAL TESTS

Preliminary

Check that 115 V ac power switch of KD set or display monitor test set, whichever used, is in the OFF position. The display monitor power switch should also be switched to OFF. Mount display monitor as shown, either on the KD set or on the circular base supplied with test set.



Display Monitor Mounted on KD Set



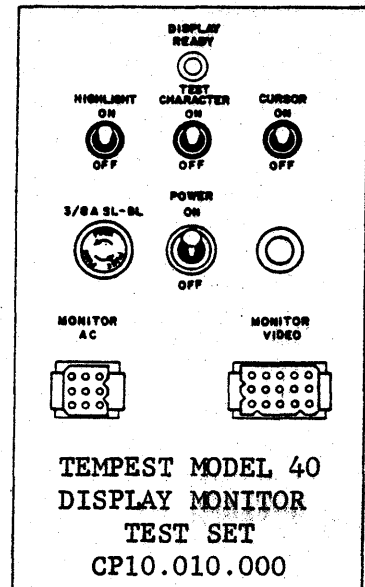
Display Monitor Mounted on Test Set Base

Certain differences in the displayed information are present when using the display monitor test set in lieu of KD set for performing the functional tests.

Operating the TEST CHARACTER switch to ON, causes 24 lines of 80 test characters per line, or, 1920 test characters to be generated. These characters are displayed as white on a dark background and are rectangular with a central dot:

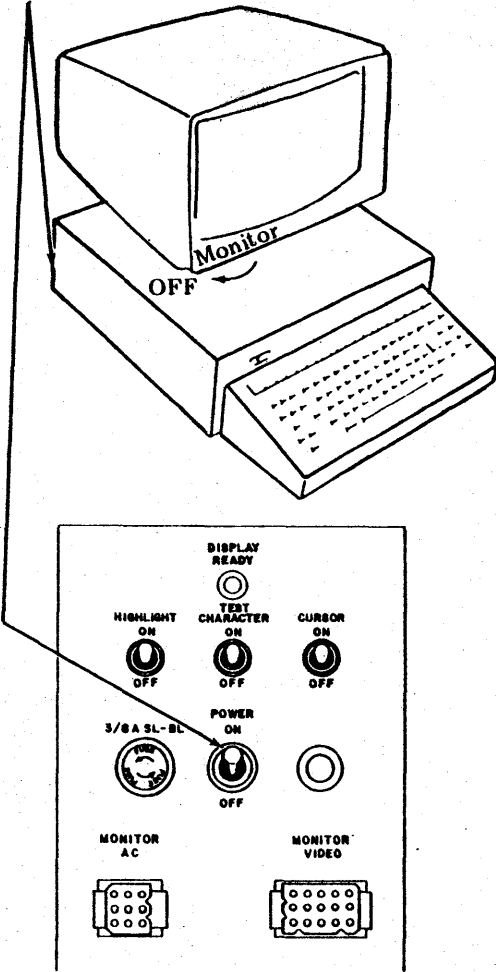
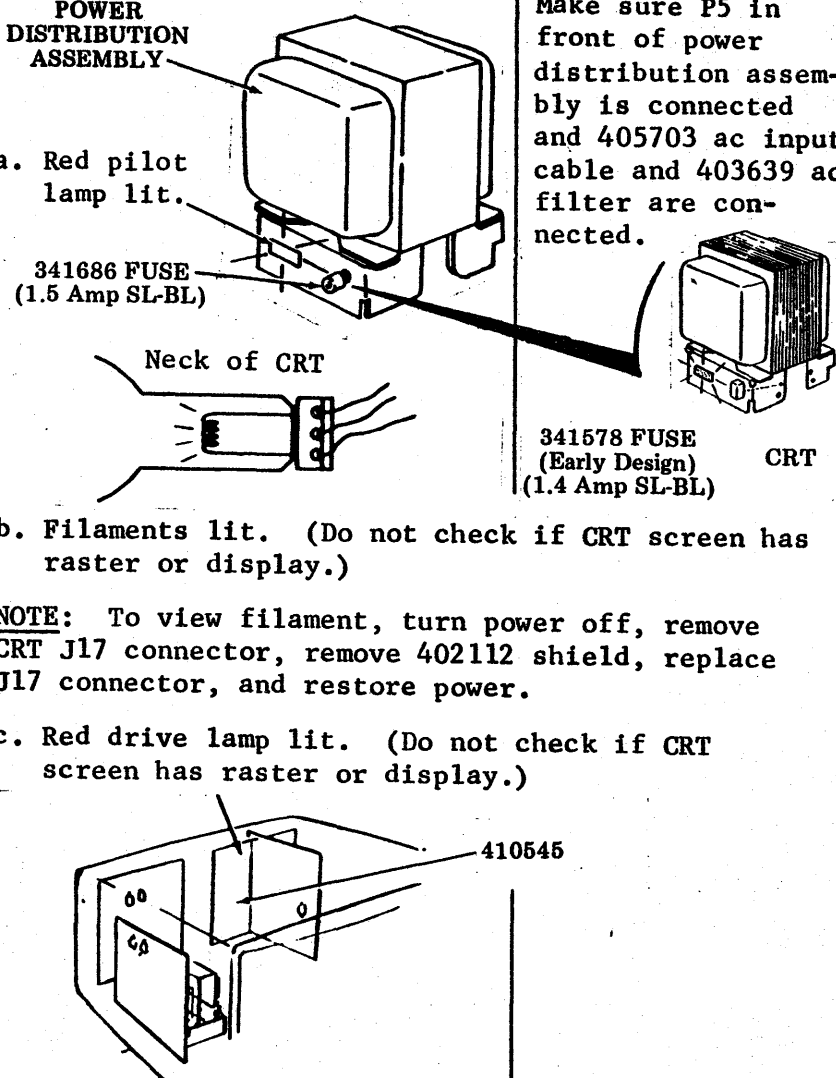
The CURSOR ON switch operated, produces a uniformly bright screen by illuminating all 1920 character positions (cursor in all character positions).

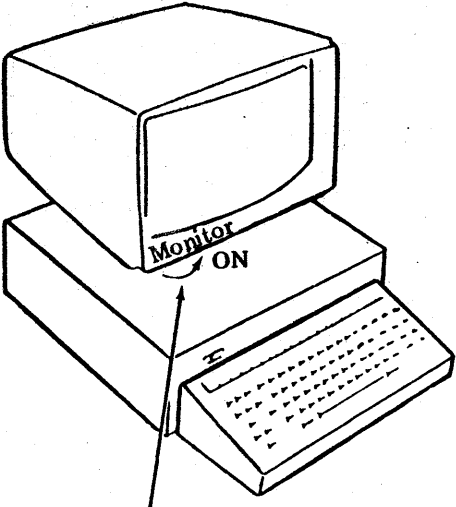
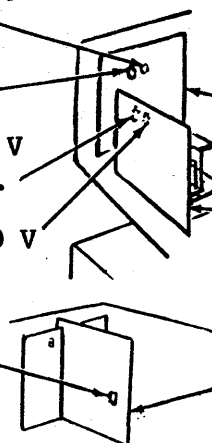
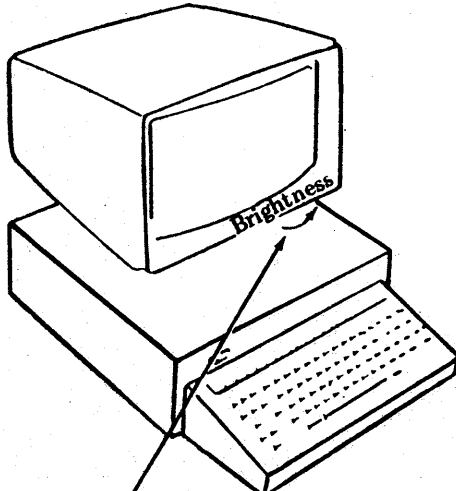
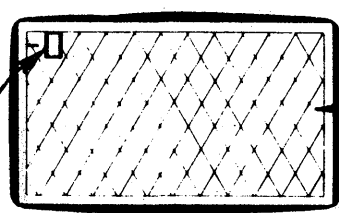
The HIGHLIGHT switch operated in conjunction with the CURSOR ON or TEST CHARACTER switch causes the display to alternate from full to half intensity at intervals of approximately one second.

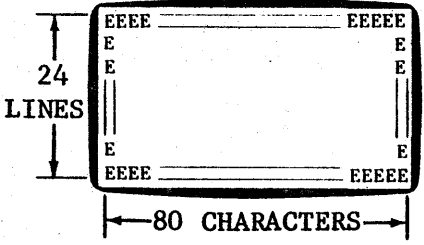
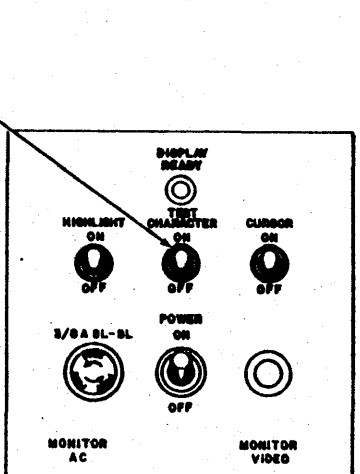
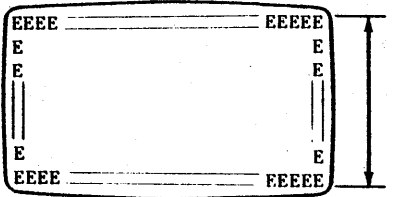
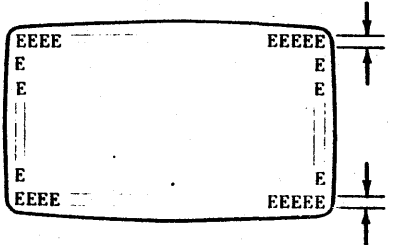
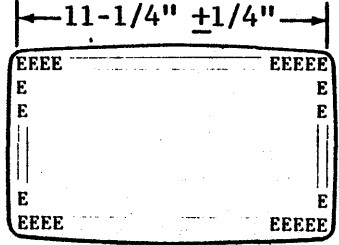


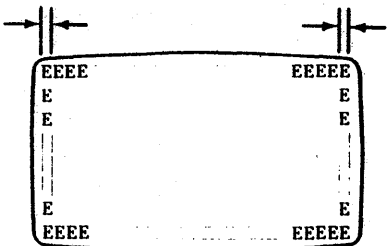
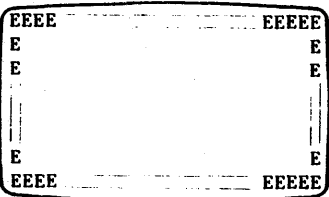
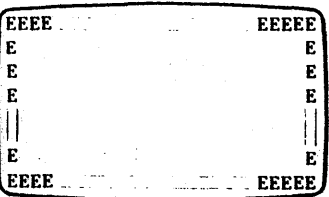
Residual Images

Residual images on the display monitor screen shall be considered permissible subject to local appearance standards so long as the images are not apparent when the monitor is in operation and are not objectionable in nature when the monitor is turned off. Refer to F. DISASSEMBLY/REASSEMBLY AND PARTS for CRT replacement and B. SHOP PROCEDURES for CRT disposal.

TEST NO.	PROCEDURE	RESPONSE	POSSIBLE CAUSE OF TROUBLE	ADDITIONAL ANALYSIS
1	<p>Apply ac power to KD or test set. Turn ac switch on.</p>  <p><b>NOTE:</b> All other test set switches should be OFF.</p>	<p><b>POWER DISTRIBUTION ASSEMBLY</b></p> <p>a. Red pilot lamp lit.</p> <p><b>341686 FUSE (1.5 Amp SL-BL)</b></p> <p><b>Neck of CRT</b></p> <p><b>341578 FUSE (Early Design) (1.4 Amp SL-BL)</b> CRT</p> <p>b. Filaments lit. (Do not check if CRT screen has raster or display.)</p> <p><b>NOTE:</b> To view filament, turn power off, remove CRT J17 connector, remove 402112 shield, replace J17 connector, and restore power.</p> <p>c. Red drive lamp lit. (Do not check if CRT screen has raster or display.)</p>  <p><b>NOTE:</b> To view red drive lamp, turn power off and remove 405873 front enclosure from 402254 high voltage and video assembly. Connect P3 directly to J6 on 410545 circuit card by passing the 410547 filter assembly. Reconnect all other connectors and restore power.</p>	<p>Make sure P5 in front of power distribution assembly is connected and 405703 ac input cable and 403639 ac filter are connected.</p>	<p>4-24, 1.a.</p> <p>4-24, 1.b.</p> <p>4-25, 1.c.</p>

TEST NO.	PROCEDURE	RESPONSE	POSSIBLE CAUSE OF TROUBLE	ADDITIONAL ANALYSIS
2	 <p>Monitor ac power switch on.</p>	<p>c. Overvoltage lamp extinguished.</p> <p>b. Normal lamp lit.</p> <p>a. Unreg 65 V lamp lit. Unreg 130 V lamp lit.</p> <p>d. High voltage lamp lit. (Do not check if CRT screen has raster or display.)</p>  <p>NOTE: If all lamps remain extinguished.</p>	<p>410853</p> <p>410852</p> <p>410546</p> <p>Check red pilot lamp.</p>	<p>4-25, 2.c.</p> <p>4-25, 2.b.</p> <p>4-25, 2.a.</p> <p>4-26, 2.d.</p> <p>4-24, 1.a.</p>
3	 <p>Operator brightness to maximum intensity.</p>	<p>a. Raster clearly visible (not brilliant).</p>  <p>b. Cursor and segment marker present when using KDP set.</p>	<p>Master Brightness Adjustment</p> <p>410545</p> <p>410547 Regulator Filter</p>	<p>4-69</p> <p>4-26, 3.</p>

TEST NO.	PROCEDURE	RESPONSE	POSSIBLE CAUSE OF TROUBLE	ADDITIONAL ANALYSIS
4	<p>Generate the following test pattern on screen from the KD keyboard, or</p>  <p>Operate test set TEST CHARACTER switch to ON. See Page 4-13, <u>Preliminary</u> for discussion of test pattern.</p> 	<p>a. Characters well defined.</p> <p>b. Vertical size 5-1/4 inches <math>\pm 1/8</math> inch.</p>  <p>c. Equal character height.</p>  <p>d. Horizontal size.</p> 	<p><u>Focus</u> adjustment</p> <p><u>Vertical Size</u> adjustment</p> <p><u>Vertical Linearity</u> adjustment</p> <p><u>Horizontal Size</u> adjustment</p>	<p>4-69</p> <p>4-70</p> <p>4-70</p> <p>4-70</p>

TEST NO.	PROCEDURE	RESPONSE	POSSIBLE CAUSE OF TROUBLE	ADDITIONAL ANALYSIS
4 (Cont)		<p>e. Equal character width.</p>  <p>f. Lines across display appear parallel to horizontal plane.</p>  <p>g. Test pattern centered.</p> 	<p><u>Horizontal Linearity</u> adjustment</p> <p><u>Yoke Orientation</u> adjustment</p> <p><u>Display Centering</u> adjustment</p>	<p>4-73</p> <p>4-74</p> <p>4-74</p>
5	<p>Generate one line of highlighted characters or operate test set HIGHLIGHT and TEST CHARACTER switches to ON.</p>	<p>Characters shall alternate full to half intensity at approximately one second intervals as gauged by eye.</p>	<p>410545</p>	<p>4-28, 4.</p>

## D. TROUBLESHOOTING

### 1. GENERAL

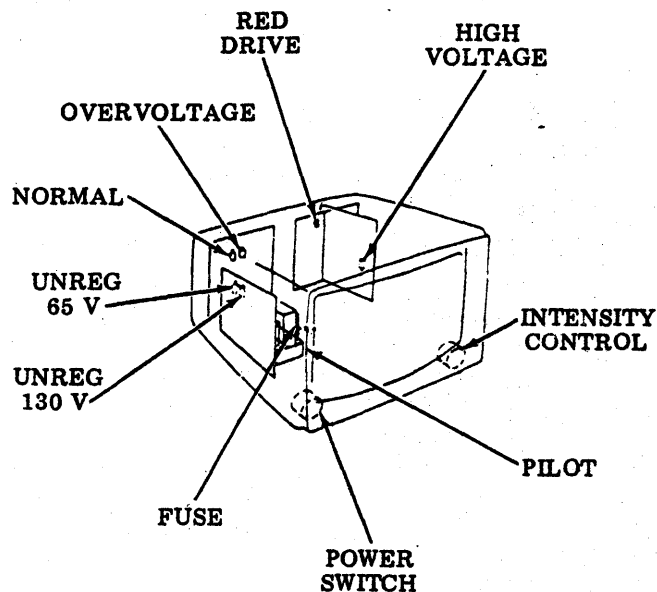
This section provides necessary information for locating and clearing troubles encountered in testing the display monitor per C. TESTING. Proceed directly to the additional analysis of this section that is referenced in C. TESTING.

Troubleshooting of breakdown test failures are provided completely in 2. HIGH VOLTAGE BREAKDOWN FAILURE. For other problems, 3. TROUBLE ISOLATION should always be consulted first. Proceed, when necessary, to the referenced in depth information of 4. DETAILED TROUBLE ANALYSIS which contains voltage levels, oscilloscope waveforms, and step-by-step instructions required for circuit analysis.

Supplementary information such as circuit descriptions and block diagrams is provided in 5. REFERENCE MATERIAL.

The display monitor contains a number of circuit status lamps as an aid to locating trouble. The sketch details the location of these lamps.

To view the red drive lamp on the 410545 circuit card or the high voltage lamp on the 410546 circuit card, it is necessary to remove the 405873 front enclosure from 402254 high voltage and video assembly. See F. DISASSEMBLY/REASSEMBLY AND PARTS for procedures. With the enclosure removed, connect P3 (from 410853 circuit card) directly to J6 on 410545 circuit card bypassing the 410547 filter assembly. Reconnect all other connectors and restore power.



Resistance checks are to be made with the digital multimeter.

Signal waveforms and voltage levels indicated at the test points of the trouble analysis procedure are to be checked with the oscilloscope.

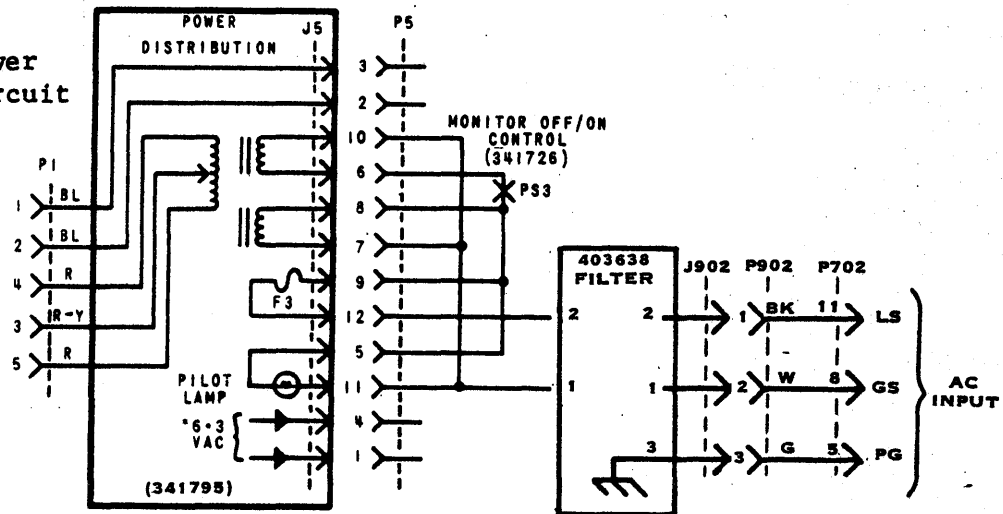
Refer to F. DISASSEMBLY/REASSEMBLY AND PARTS for procedures.



## 2. HIGH VOLTAGE BREAKDOWN FAILURE

Select the (R X 1) scale of the digital multimeter and check resistance between P702(5) and chassis. If not zero ohms, check for a loose chassis connection or green wire broken off at P702(5). The P702(5) MUST have continuity to the chassis.

Display Monitor  
AC Input and Power  
Distribution Circuit



Unplug P902 leads from the top of the 403638 ac filter. Use the breakdown tester as in C. TESTING, holding one prod on the chassis. Use the other prod to probe P702 pins 8 and 11. If a failure occurs, check 405703 ac input cable.

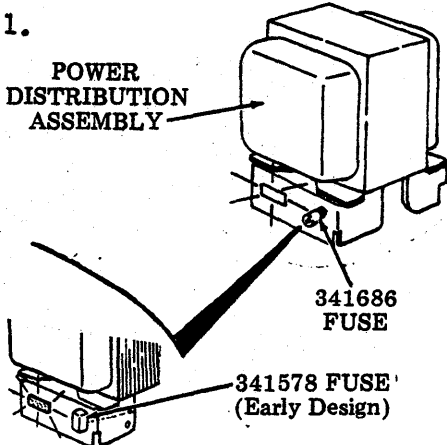
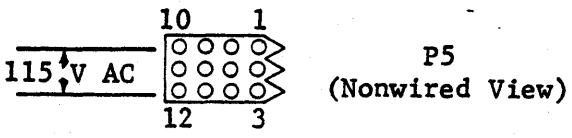
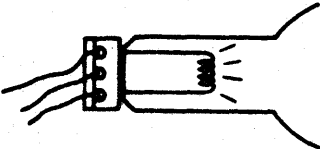
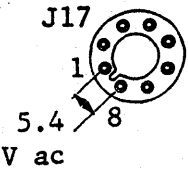
If P902 checked satisfactorily, unplug J5 and P5. Use breakdown tester in C. TESTING, holding one prod on the chassis. Use the other prod and progressively probe J5, pins 5 through 12. If a failure occurs on any pin, remove 341795 power distribution assembly and examine components and wiring associated with the pin (see circuit). Also check for signs of arcing at J5. Replace any defective wiring or components.

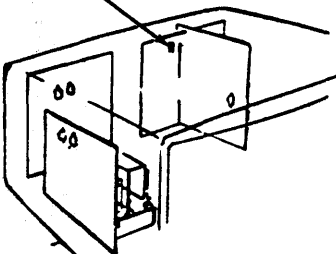
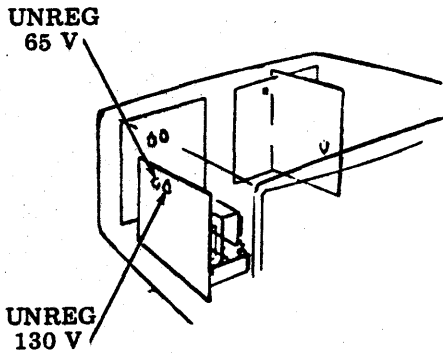
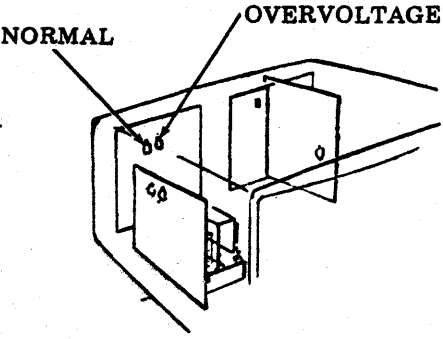
If J5 checked satisfactory, repeat the above procedure on P5, pins 5 through 12. Carefully examine wiring associated with failure indication for signs of arcing. Note that certain P5 pins are connected together by wiring. Disconnect switch PS3 and check separately if cabling appears in good order. Replace any defective wiring, 403638 ac filter, or components.

D. TROUBLESHOOTING (Cont)

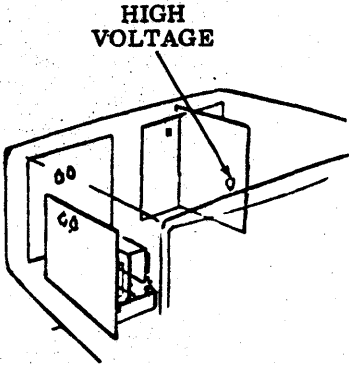


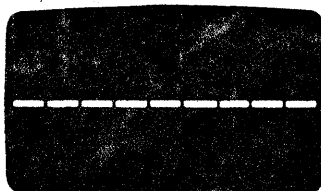
3. TROUBLE ISOLATION

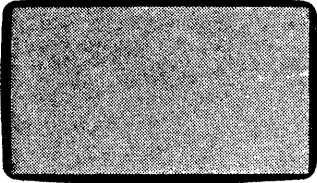
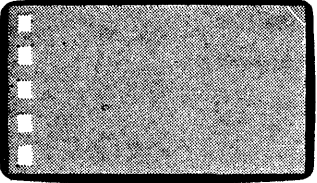
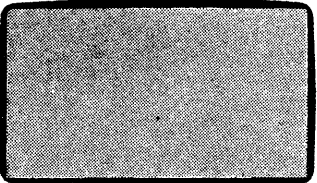
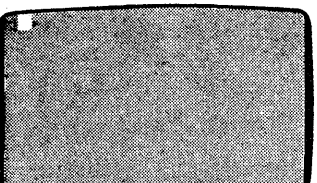
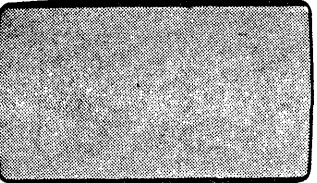
**CAUTION:** TURN OFF ALL POWER OR SIGNAL SOURCES BEFORE DISCONNECTING OR CONNECTING ELECTRICAL COMPONENTS IN THE DISPLAY MONITOR.

TROUBLE SYMPTOM	TROUBLE ISOLATION AND CORRECTION	DETAILED TROUBLE ANALYSIS
<p>1.</p>  <p>a. Red pilot lamp OFF.</p>	<p>Check fuse for continuity -- early design 341578 (1.4A SL-BL). Current design 341686 (1.5A SL-BL).</p> <p>Fuse good, but pilot lamp not lit. Check 115 V ac <math>\pm 10\%</math> at connector P5 (10, 12).</p>  <p>No 115 V ac -- Replace 405703 cable assembly or 403639 ac filter assembly.</p> <p>115 V ac OK -- Replace 341795 power distribution assembly.</p> <p>Fuse continues to fail -- Replace: 410852 circuit card assembly, 410853 circuit card assembly, 402254 high voltage and video assembly, Q1 and Q2 on heatsink.</p>	<p>4-67</p>
<p>b. CRT filaments OFF.</p>  <p><b>NOTE:</b> To view CRT filaments remove the 402112 shield.</p>	<p>Pilot lamp ON -- Power distribution assembly. Disconnect J17 from CRT. Check 5.4 V ac <math>\pm 10\%</math> at connector J17 (1, 8).</p>  <p>5.4 V ac OK -- Replace CRT.</p> <p>No 5.4 V ac. Remove power. Disconnect P5. Check continuity P5(1) to J17(8). Check continuity P5(4) to J17(1). Check continuity P20(1) and (2) to J17(8) and (1).</p> <p>No continuity -- Replace or repair 405863 cable assembly or 405861 rear cover assembly.</p> <p>Continuity OK -- Replace 341795 power distribution assembly.</p>	<p>4-67</p> <p>4-67</p>

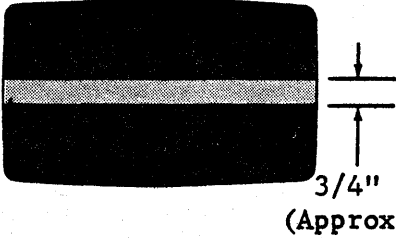

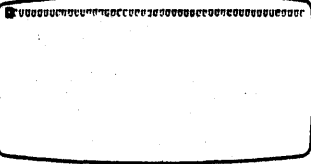

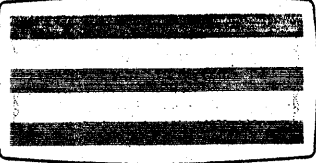
TROUBLE SYMPTOM	TROUBLE ISOLATION AND CORRECTION	DETAILED TROUBLE ANALYSIS
<p>1. (Cont)</p> <p>c. Red drive lamp OFF.</p> 	<p>Check Test Point 4 on 410545.</p> <p><b>NOTE:</b> To view red drive lamp, remove 405873 front enclosure from the 402254 high voltage and video assembly.</p>	<p>4-36</p>
<p>2.</p> <p>a. Unreg 65 V or 130 V lamp is OFF.</p> 	<p>Check Test Point 1 on 410852. Remove power and remove the 410852 card.</p> <p>Apply power and check for 135 V ac +10% at P1 (4, 5). If 135 V ac not present, replace 341795 power distribution assembly.</p>	<p>4-46</p>
<p>b. Normal lamp OFF.</p> 	<p>Check Test Point 19 on 410853.</p>	<p>4-54</p>
<p>c. Overvoltage lamp ON.</p>	<p>Check Test Point 20 on 410853.</p>	<p>4-54</p>

D. TROUBLESHOOTING (Cont)3. TROUBLE ISOLATION (Cont)

TROUBLE SYMPTOM	TROUBLE ISOLATION AND CORRECTION	DETAILED TROUBLE ANALYSIS
<p>2. (Cont)</p> <p>d. High voltage lamp OFF.</p> 	<p>Check Test Point 1 on 410545.</p>	<p>4-36</p>
<p>3.</p> <p>a. No display.</p> 	<p>Normal lamp OFF -- 410853. Check 130 volt regulator.</p> <p>Normal lamp ON -- 410853. High voltage lamp OFF -- 410546. Check horizontal driver.</p> <p>High voltage lamp ON -- 410546. Check connector P10, 405858 cable assembly, and 405859 high voltage plate assembly.</p>	<p>4-54</p> <p>4-36</p> <p>4-67</p>
<p>b. Bright horizontal line.</p> 	<p>Decrease operator brightness. Depress Test Switch No. 3 on 410001 circuit card in KD test set display logic or switch test set test character ON. If horizontal line appears <u>dashed</u>, go to 3.c.</p> <p>Check 65 volt regulator.</p>	<p>4-52</p>
<p>c. Bright horizontal dashed line.</p> 	<p>Check connector J4 and 410559 vertical deflection assembly.</p> <p>Check vertical control.</p> <p>Check for open C3 capacitor on 410852 rectifier assembly.</p>	<p>4-30</p> <p>4-48</p> <p>4-45</p>

TROUBLE SYMPTOM	TROUBLE ISOLATION AND CORRECTION	DETAILED TROUBLE ANALYSIS
<p>3. (Cont)</p> <p>d. Raster, but no cursor or character.</p> 	<p>Check dot amplifier.</p>	<p>4-39</p>
<p>e. Rolling (vertical).</p> 	<p>Check vertical control.</p> <p>Check vertical receiver.</p> <p><u>NOTE:</u> Rectifier assembly can cause vertical rolling and linearity problems without failure of indicator lamps.</p>	<p>4-48</p> <p>4-38</p> <p>4-45</p>
<p>f. No brightness control.</p> 	<p>Check connector P13.</p> <p>Check highlight amplifier.</p>	<p>4-31</p> <p>4-42</p>
<p>g. Expanded vertical.</p> 	<p>Check 65 volt regulator.</p>	<p>4-51</p>
<p>h. Expanded horizontal.</p> 	<p>Overvoltage lamp ON -- 410853.</p> <p>Check 130 volt regulator.</p>	<p>4-54</p>

D. TROUBLESHOOTING (Cont)3. TROUBLE ISOLATION (Cont)

TROUBLE SYMPTOM	TROUBLE ISOLATION AND CORRECTION	DETAILED TROUBLE ANALYSIS
<p>3. (Cont)</p> <p>i. Reduced display.</p>  <p>3/4" (Approx)</p>	<p>Check Test Point 5 on 410853.</p>	<p>4-48</p>
<p>j. Dim vertical line.</p> 	<p>Check connector P10, 405858 cable assembly, and 405859 high voltage plate assembly.</p> <p>Replace 410546 circuit card.</p>	<p>4-31</p>
<p>4. No highlight.</p> 	<p>Check highlight amplifier.</p>	<p>4-42</p>
<p>5.</p> <p>ROLLING SLOWLY</p>  <p>Display distorted between indentations.</p>	<p>Check for open C1 capacitor on 410852 rectifier assembly.</p>	<p>4-45</p>
<p>6.</p> <p>ROLLING SLOWLY</p>  <p>Some faint oversized characters visible.</p>	<p>Check for open C2 capacitor on 410852 rectifier assembly.</p>	<p>4-45</p>

TROUBLE SYMPTOM	TROUBLE ISOLATION AND CORRECTION	DETAILED TROUBLE ANALYSIS
7. a. Snowy, fuzzy display random flickering of dots. b. Blooming, oversize display. c. Gradual decrease in intensity over periods up to 1/2 hour. d. Entire display flickers brighter or dimmer randomly or for extended periods of time. e. Parts of characters dim or fading over entire or part of display. f. Entire display out of focus.	Check highlight (R-13)	<u>4-42</u>
	High voltage (410546)	4-57
	Check CRT (402110)	
	Check CRT (402110)	
	Check CRT (402110)	
	Check focus adjustment Check CRT (402110)	<u>4-69</u>

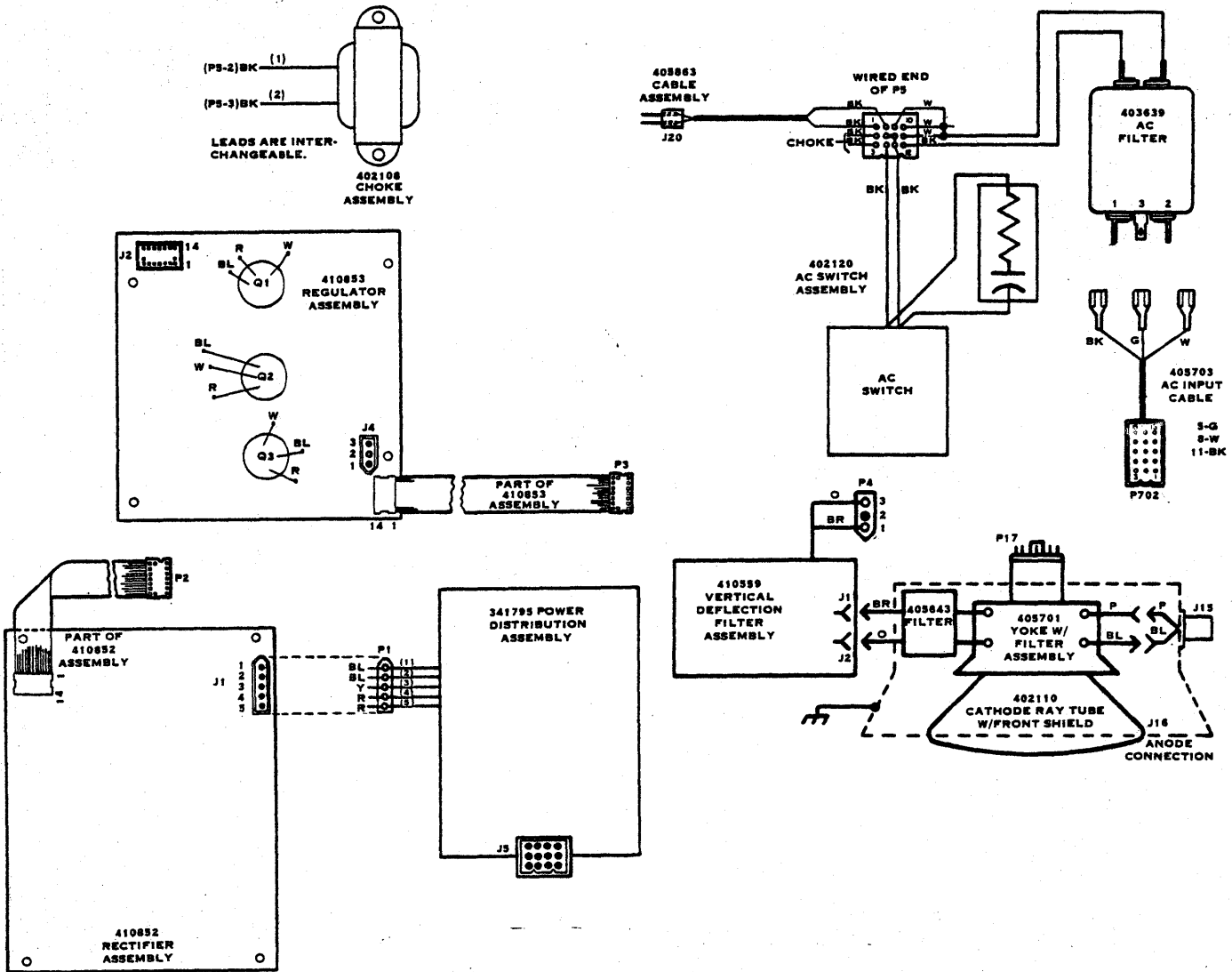
D. TROUBLESHOOTING (Cont)

4. DETAILED TROUBLE ANALYSIS

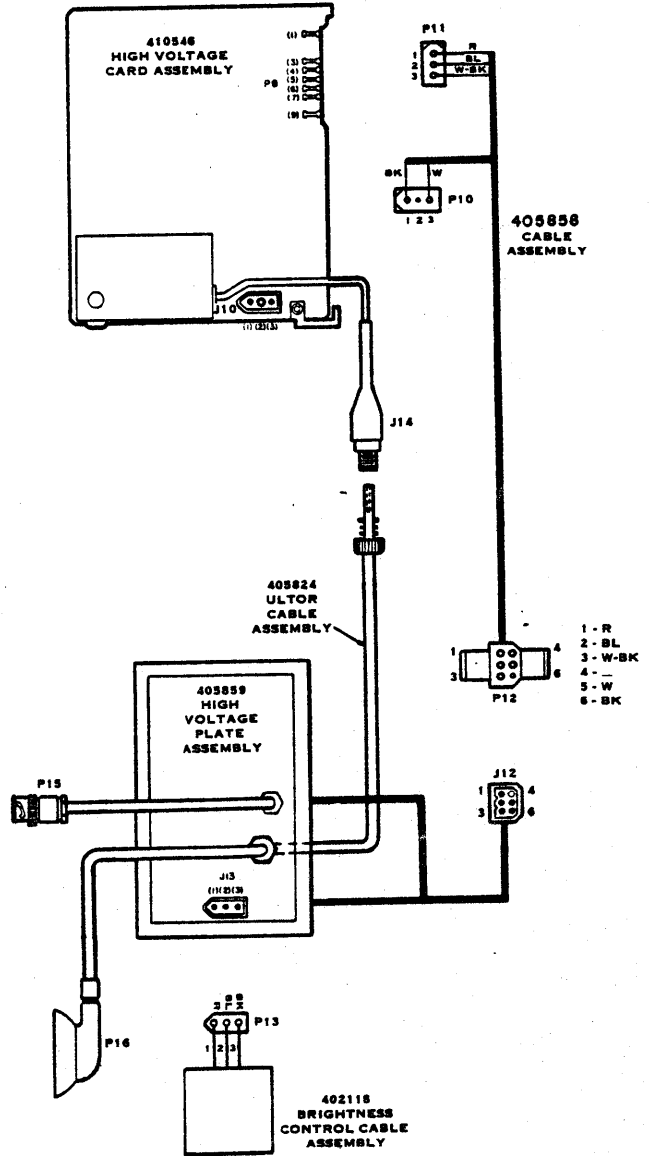
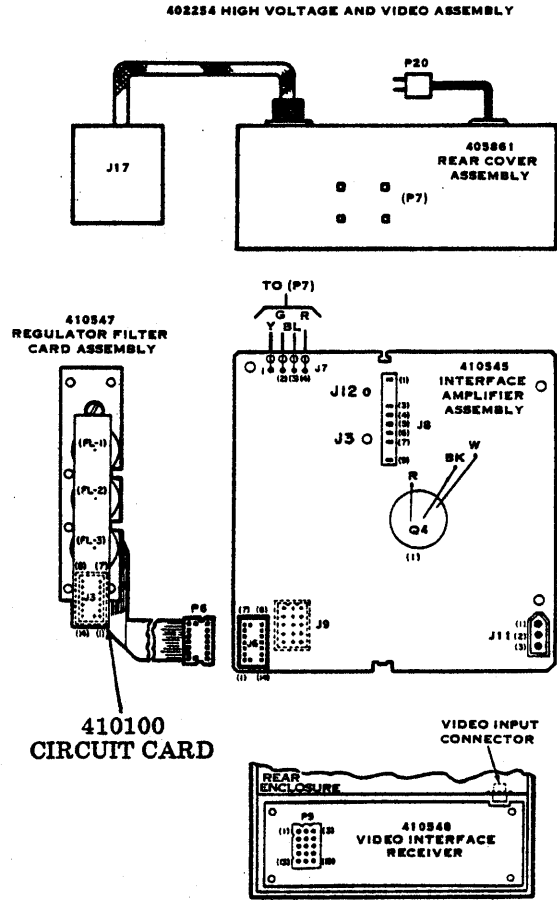
NOTE: The circled numbers on the schematic and pictorial diagrams designate the test points referenced in the associated troubleshooting sequences.

Actual Wiring Diagram

NOTE: Transistors Q1, Q2 and Q3 are mounted on heatsink. Transistor Q4 is mounted on the rear enclosure of the 402254 high voltage and video assembly.



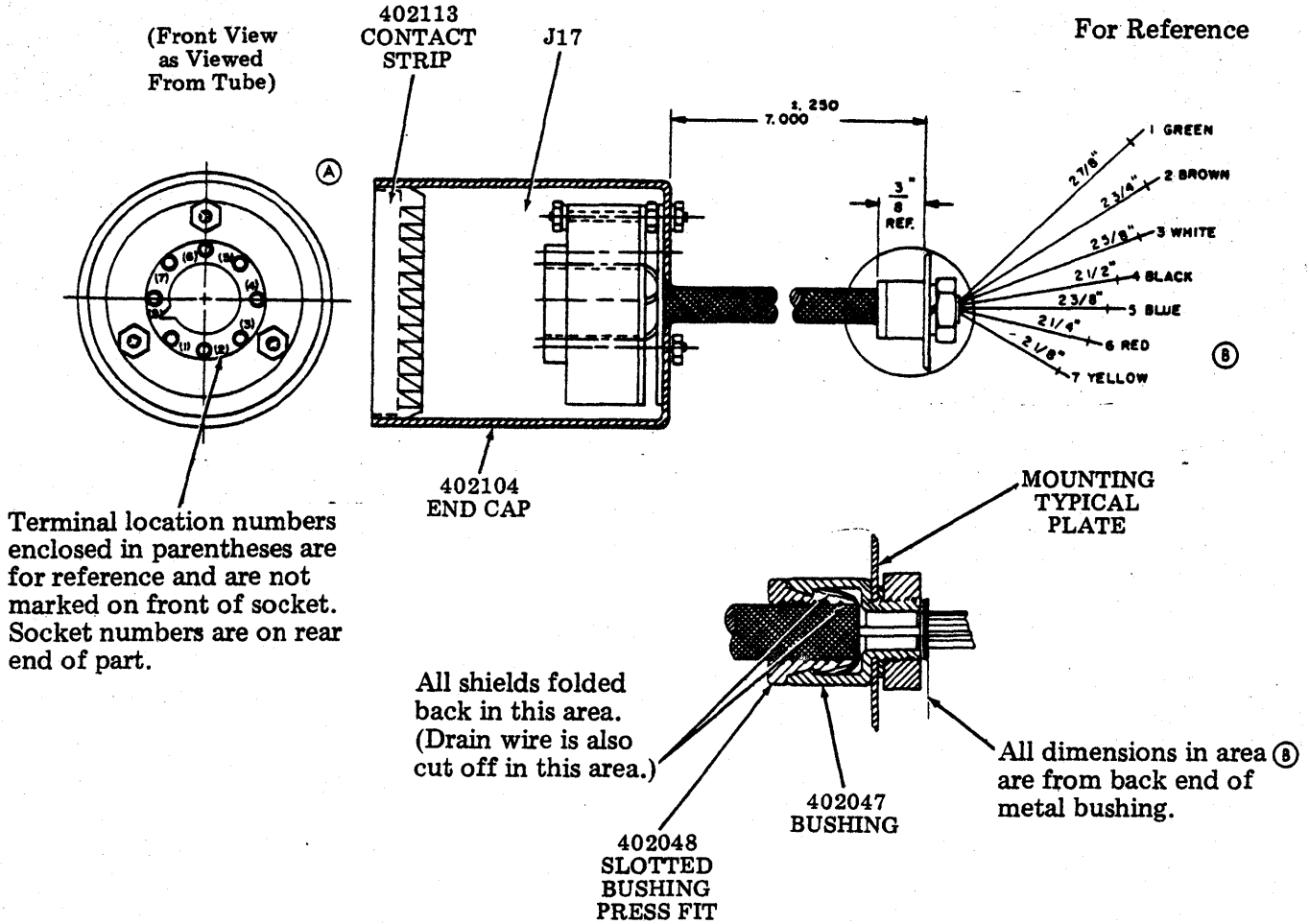




D. TROUBLESHOOTING (Cont)

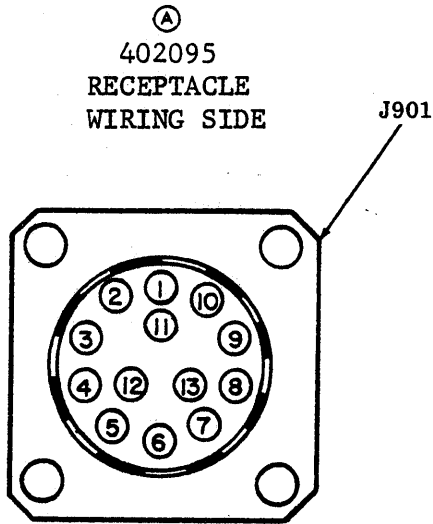
4. DETAILED TROUBLE ANALYSIS (Cont)

402117 CRT Cable Assembly

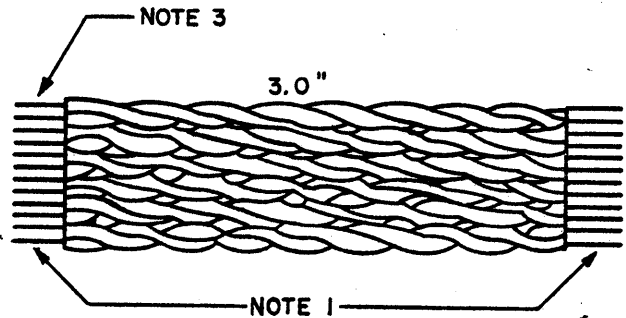


RUNNING LIST		
24 AWG. TEFLON WIRE, VOLTAGE RATING 1000V		
FROM	COLOR	TO
A1	BROWN	B2
A3	RED	B6
A4	BLUE	B5
A5	GREEN	B1
A8	YELLOW	B7
24 AWG. DOUBLE SHIELDED CABLE		
A2	BLACK	B4
A7	WHITE	B3

402246 Video Cable Assembly



Ⓑ  
400574  
TERMINAL  
(12 Places)



7 TWISTED PAIR 26 AWG. 31194 RM		
FROM	COLOR	TO
A1	ORANGE	B
A2	WHITE-ORANGE	B
A3	WHITE-YELLOW	B
A4	WHITE-BROWN	B
A5	GREEN	B
A6	YELLOW	B
A8	WHITE-GREEN	B
A9	BLACK	B
A10	SLATE	B
A11	VIOLET	B
A12	BLUE	B
A13	BROWN	B

NOTE 1: Prepare for crimping (24 places).

NOTE 2: Remove twisted pair, namely red and white/red.

NOTE 3: In area Ⓐ use 402097 male pins (12 places).

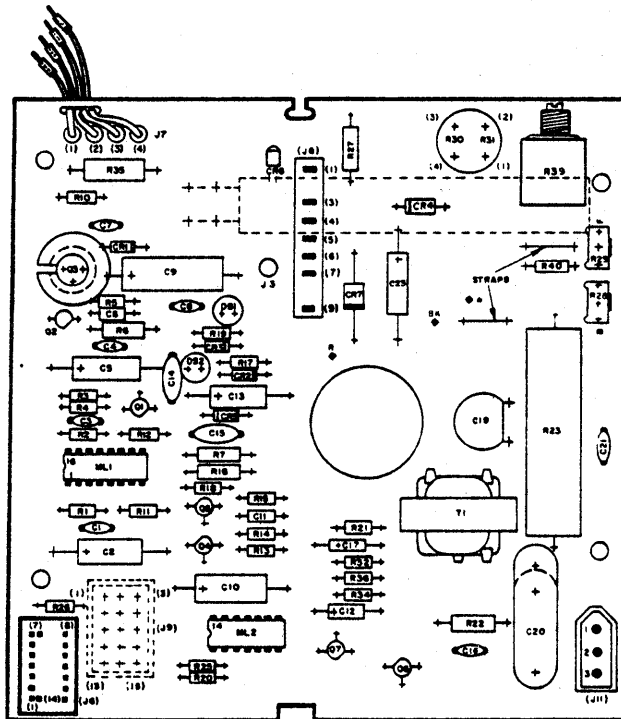
NOTE 4: In area Ⓑ cover terminals with suitable heat shrink tubing (12 places).

D. TROUBLESHOOTING (Cont)

4. DETAILED TROUBLE ANALYSIS (Cont)

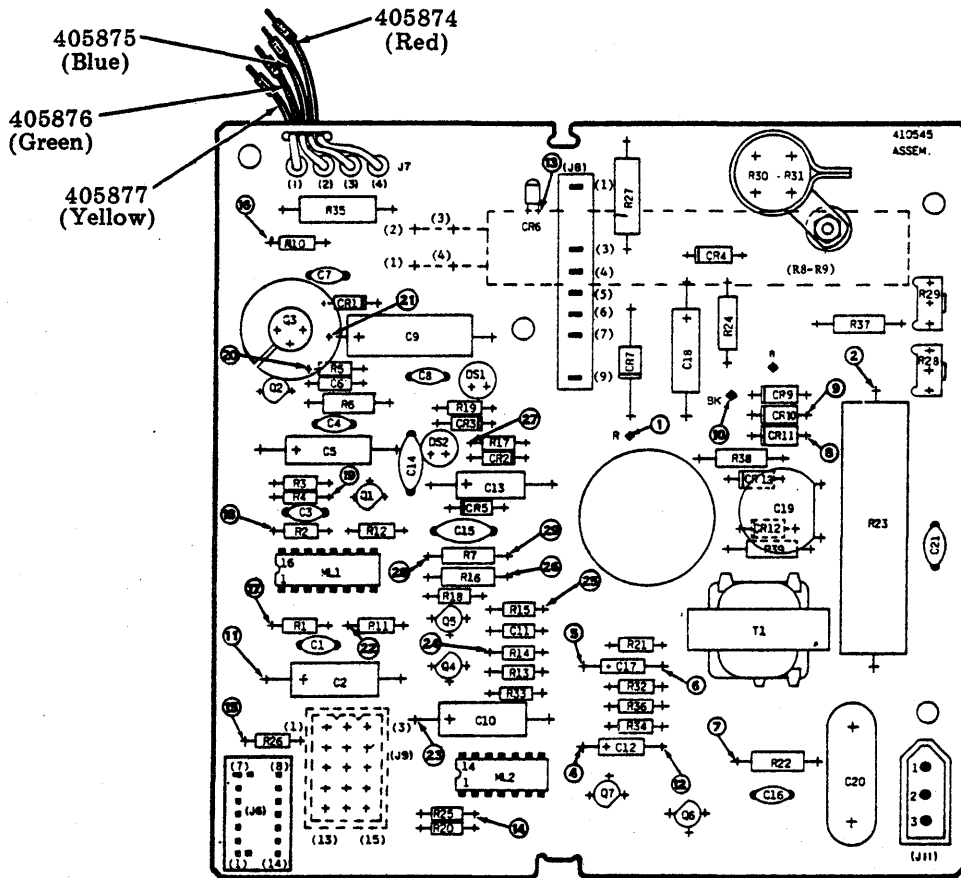
410545 Horizontal Driver

Issue 6A



REF DESIGN	DESCRIPTION	PART NO.	REF DESIGN	DESCRIPTION	PART NO.
C1	0.1 MFD 25 W Vdc	305821	R8	300 ohm, 20 W, 5%	341634
C2	.47 MFD 20 W Vdc	310931	R9	600 ohm, 5 W, 5%	
C3	0.01 MFD 100 W Vdc	319999	R10	150 ohm	330640
C6	.220 MFD 200 W Vdc	335803	R13	2.7 K	315956
C9	.50 MFD 50 W Vdc	192711	R16	470 ohm, 1/2 W, 5%	137602
C12	0.22 MFD 35 W Vdc	300089	R17	4.7 ohm	341575
C13	0.10 MFD 20 W Vdc	403016	R18	270 ohm	328784
C14	0.01 MFD 1.4 K Vdc	336377	R19	22 meg	324855
C16	0.27 MFD 1 K Vdc	325035	R22	2.7 K, 1/2 W, 5%	118144
C20	0.22 MFD 400 W Vdc	341637	R23	1200 ohm, 15 W, 5%	341631
C21	0.002 MFD 1 K Vdc	328794	R26	330 ohm, 1/4 W, 5%	328785
C23	0.47 MFD 35 Vdc	323139	R27	6.8 meg, 1/2 W	147028
R1	.120 ohm	333405	R28	Variable 1 meg, 1/2 W	341567
R2	1000 ohm	321213	R29	Variable 5 meg, 1/2 W	341668
R3	4.7 K	315959	R30	50 ohm, 15 W, 5%	341635
R4	220 ohm	318802	R31	25 ohm, 10 W, 5%	
R5	470 ohm	320276	R34	1.5 K	315954
R39	200 ohm, pot.	406292	J6	Guide, Connector	341751
R40	1.3 M, .25 W	330642		Connector, Pin .025	341618
CR1	Diode 1N4148	197464	J9	Plug, 15 Circuit	341645
CR3	Diode 1N4007	335880		Terminal	341644
CR4	Diode	430605	J8	Connector, 9 Pin Male	341700
CR5	Diode, 1N4740 ZENER 10 V	336019	J11	Plug, 3 Pin	341692
CR6	Diode, LED	341636	R	Connector, Pin .025	341618
CR7	Diode, Damper	341539		Heat Sink, Snap On	341660
Q1	Transistor, 2N4275	335774		Pad, Transistor Mounting	144495
Q3	Transistor, 2N3725	341638		.027 Dia. Wire (Strap)	39550RM
Q6	Transistor, Horz. Driver	341639	J7(1)	Lead, Elect. (Yellow)	405877
Q7	Transistor, 2N3569	324656	J7(2)	Lead, Elect. (Green)	405876
ML1	Integrated Circuit	339716	J7(3)	Lead, Elect. (Blue)	405875
ML2	Integrated Circuit	339002	J7(4)	Lead, Elect. (Red)	405874
DS1	Bulb, NEON (Orange Dot)	341590	T1	Transformer	341521

410545 Horizontal Driver



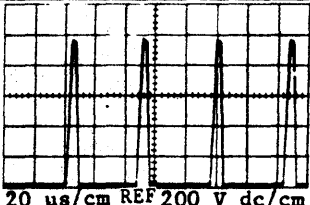
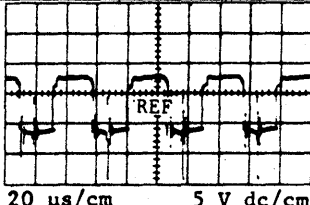
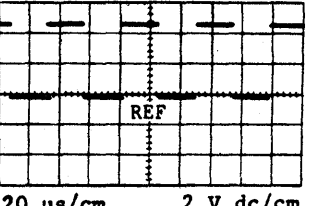
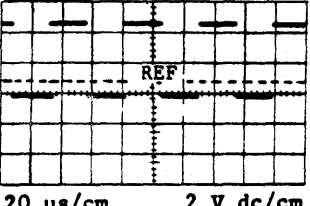
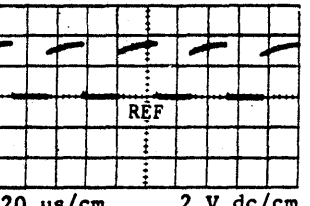
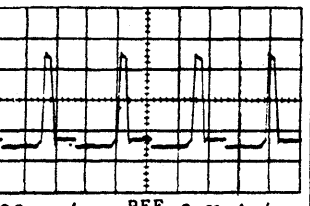
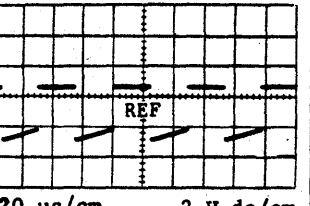
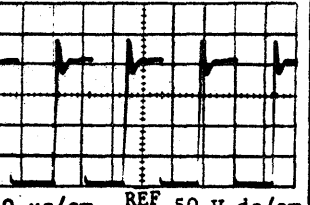
REF DESIGN	DESCRIPTION	PART NO.	REF DESIGN	DESCRIPTION	PART NO.
C1	0.1 MFD 25 W V dc	305821	R21	470 ohm, 1/4 W, 5%	320276
C2	47 MFD 20 W V dc	310931	R22	2.7 K, 1/2 W, 5%	118144
C12	0.22 MFD 35 W V dc	300089	R23	1200 ohm, 15 W, 5%	341631
C16	270 PFD 1000 W V dc	325035	R24	6.8 ohm, 1/2 W, 5%	177101
C17	0.22 MFD 35 W V dc	300089	R30	50 ohm, 15 W, 5%	341635
C18	100 MFD 10 W V dc	181665	R31	25 ohm, 10 W, 5%	341635
C20	0.22 MFD 400 W V dc	341637	R32	4.7 K ohm, 1/4 W, 5%	315959
C21	0.002 MFD 1000 W V dc	328794	R33*	1 K ohm, 1/4 W, 5%	321213
ML2	Integrated Circuit	339002	R34	1.5 K ohm, 1/4 W, 5%	315954
CR6	Diode, LED	341636	R36	180 ohm, 1/4 W, 5%	328783
CR7	Diode	341539	R38	120 K ohm, 1/2 W	118184
CR8	Diode Network	402282	R39	120 K ohm, 1/2 W	118184
CR9	Diode	341732	Q6	Transistor	341639
CR10	Diode	341732	Q7	2N 3569	324656
CR11	Diode	341732	Q4	(Heatsink) Transistor	341570
			Q4	(Heatsink) Transistor (See Note)	406306
			F1	No. 18 ga wire strap**	
			T1	Transformer	341521

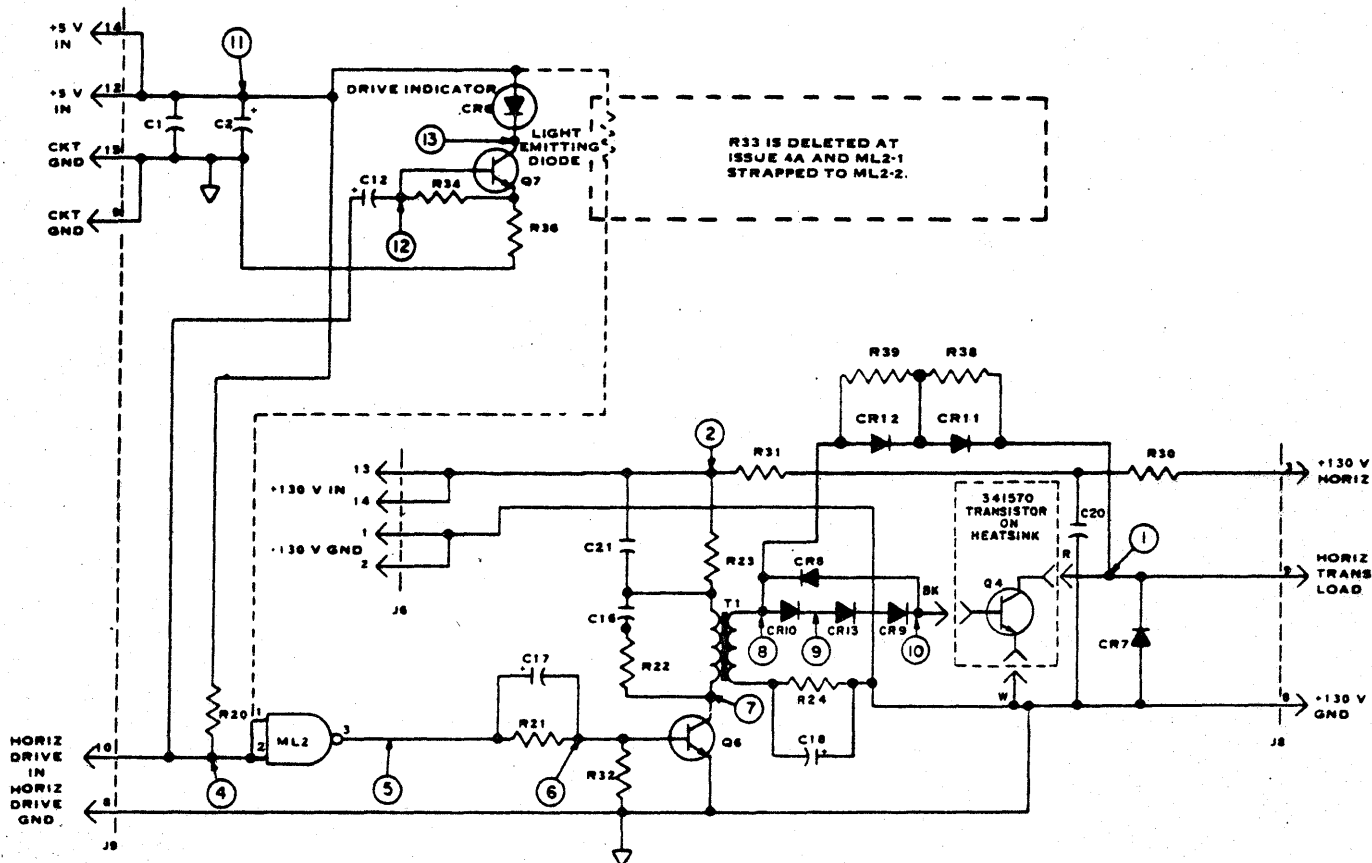
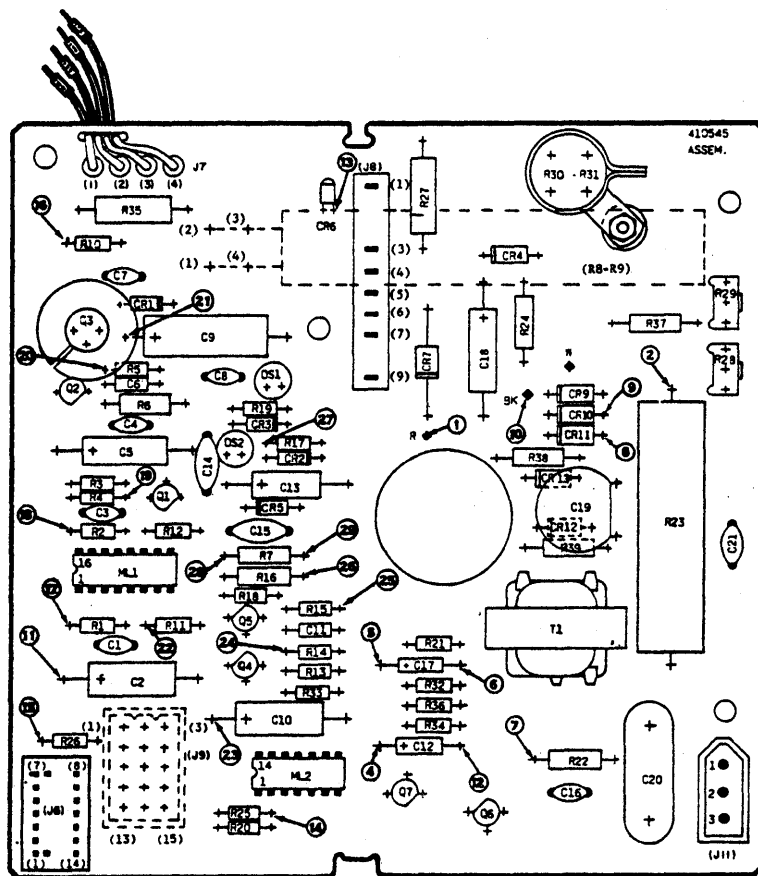
NOTE: Transistor Q4, 406306, can only be used with Issue 6A or later, 410545 circuit card. Transistor Q4, 341570, can be used with any issue of 410656 card.

\*Deleted at Issue 4A.

D. TROUBLESHOOTING (Cont)

4. DETAILED TROUBLE ANALYSIS, 410545 Horizontal Driver (Cont)

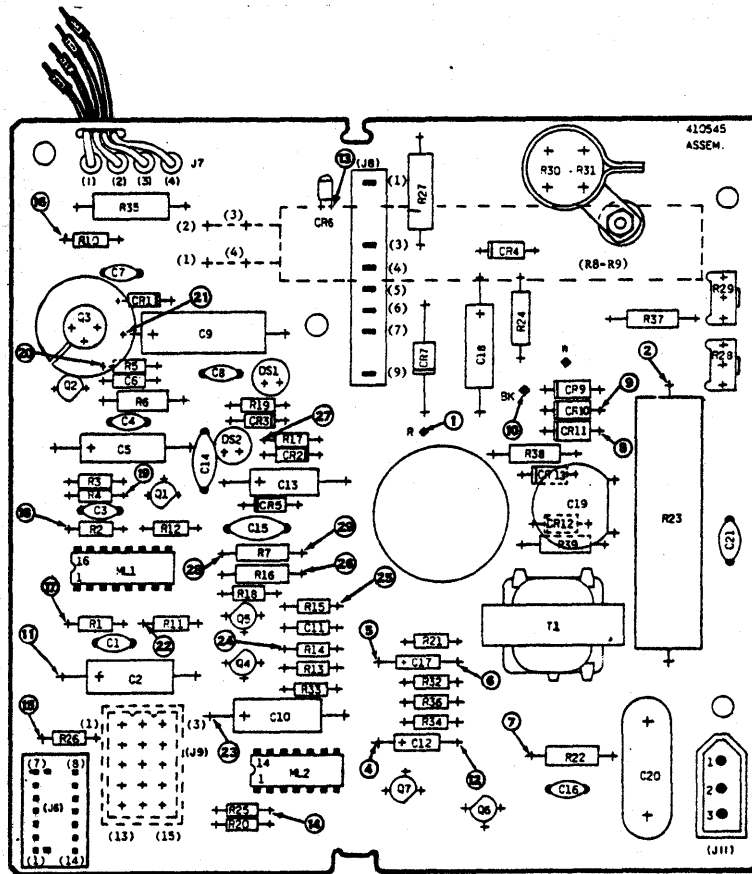
TEST POINT	VOLTAGE OR WAVEFORM	COMPONENT ANALYSIS	TEST POINT	VOLTAGE OR WAVEFORM	COMPONENT ANALYSIS
1		No display. Replace Q4. If Test Points 3 and 10 are good and signal good, see Note 1.	8 9 10		No signal. Replace respectively: T1 CR11 CR10 NOTE 3
2	130 V dc	No voltage. Check J6. Check J3 and 410547 regulator filter (4-53).	11	5 V dc	No voltage: Check J9 and 410548 video interface receiver and video input cable.
	No Test Point 3.				
4		No signal. Check J9 and 410548 video interface receiver (4-57) and video input cable.	12		No signal. Replace C12. NOTE 3
5		No signal. Replace ML2.	13		No signal. Replace CR6 and Q7. NOTE 3
6		No signal. Replace C17.	<p><b>NOTE 1:</b> If high voltage lamp remains extinguished with a good signal at Test Point 1, replace 410546 circuit card.</p> <p><b>NOTE 2:</b> Most failures isolated under Test Points 1 through 10 will result in no raster.</p> <p><b>NOTE 3:</b> The above waveforms may appear different in the new Issue <u>6A</u> or higher 410545 circuit cards. It may be necessary to adjust the <u>R39</u> variable resistor for the correct waveforms.</p>		
7		Incorrect signal. Replace Q6.			



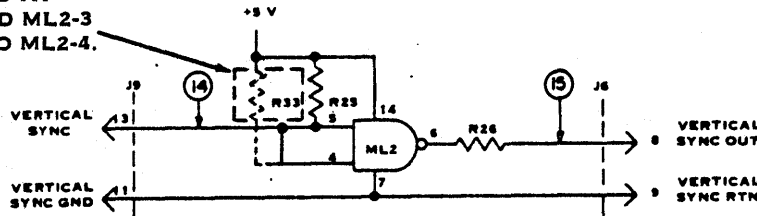
D. TROUBLESHOOTING (Cont)

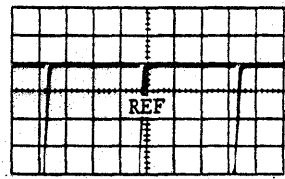
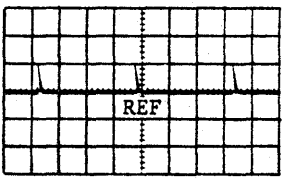
4. DETAILED TROUBLE ANALYSIS (Cont)

410545 Vertical Receiver



\*R33 DELETED AT ISSUE 4A AND ML2-3 STRAPPED TO ML2-4.



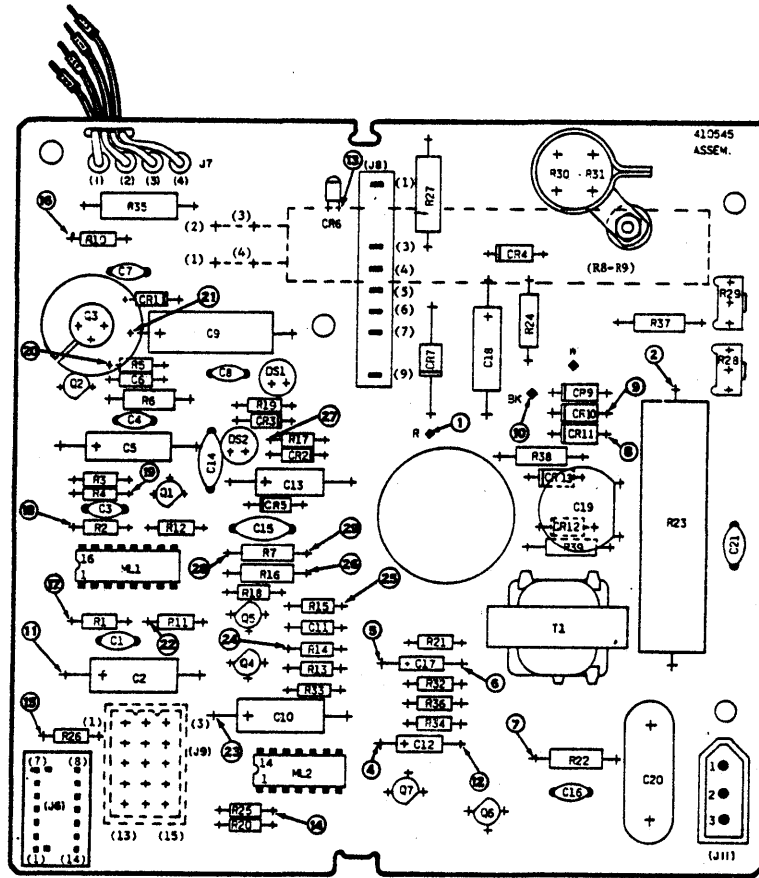
TEST POINT	VOLTAGE OR WAVEFORM	COMPONENT ANALYSIS	TEST POINT	VOLTAGE OR WAVEFORM	COMPONENT ANALYSIS
14		Rolling. No signal. Check J9.	15		Rolling. No signal. Replace ML2.  Rolling. Signal good. Go to 4-43. Test Point 2.

**NOTE:** Problem in this circuit will result in a rolling display.

REF DESIGN	DESCRIPTION	PART NO.
R25	120 ohm, 1/4 W, 5%	333405
R26	330 ohm, 1/4 W, 5%	328785
R33*	1 K ohm, 1/4 W, 5%	321213
ML2	Integrated Circuit	339002



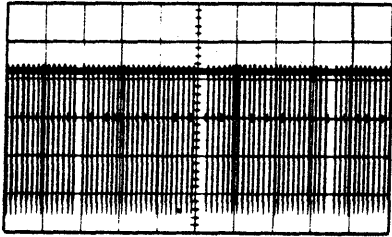
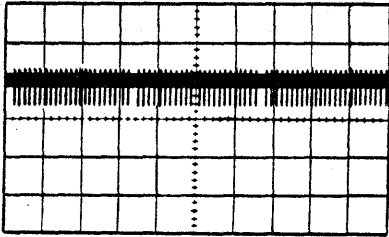
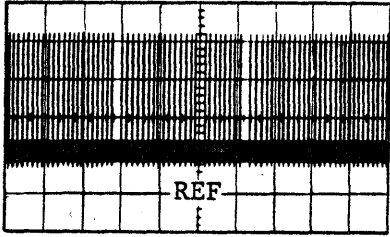
410545 Dot Amplifier



REF DESIGN	DESCRIPTION	PART NO.	REF DESIGN	DESCRIPTION	PART NO.
R1	120 ohm, 1/4 W, 5%	333405	C3	0.01 MFD 100 W V dc	319999
R2	1 K ohm, 1/4 W, 5%	321213	C4	0.1 MFD 25 W V dc	305821
R3	4.7 K ohm, 1/4 W, 5%	315959	C5	47 MFD 20 W V dc	310931
R4	220 ohm, 1/4 W, 5%	318802	C6	220 PFD 200 W V dc	335803
R5	470 ohm, 1/4 W, 5%	320276	C7	0.01 MFD 100 W V dc	319999
R6	51 ohm, 1/2 W, 5%	143656	C8	0.01 MFD 100 W V dc	319999
R8	300 ohm, 20 W, 5%	341634	C9	50 MFD 50 W V dc	192711
R9	600 ohm, 5 W, 5%	341634			
R10	150 ohm, 1/4 W, 5%	330640	CR1	1N4148	197464
R35	15 K ohm, 1 W, 10%	120210			
			DS1	NEON, (Orange Dot)	341590
Q1	2N4275	335774			
Q2	2N4275	335774			
Q3	2N3725	341638			

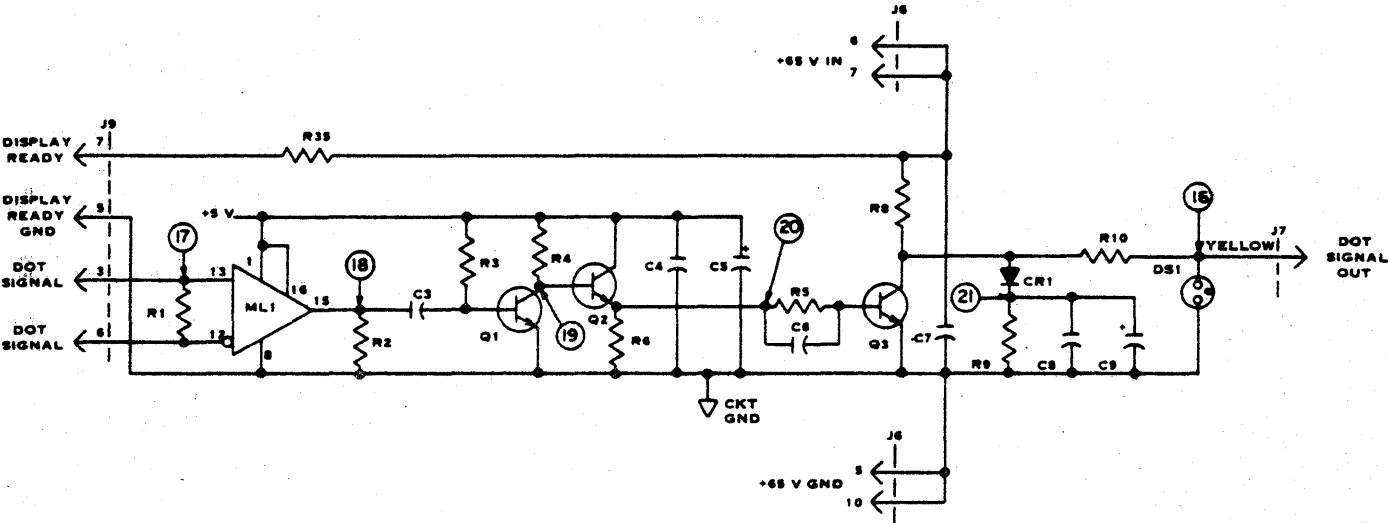
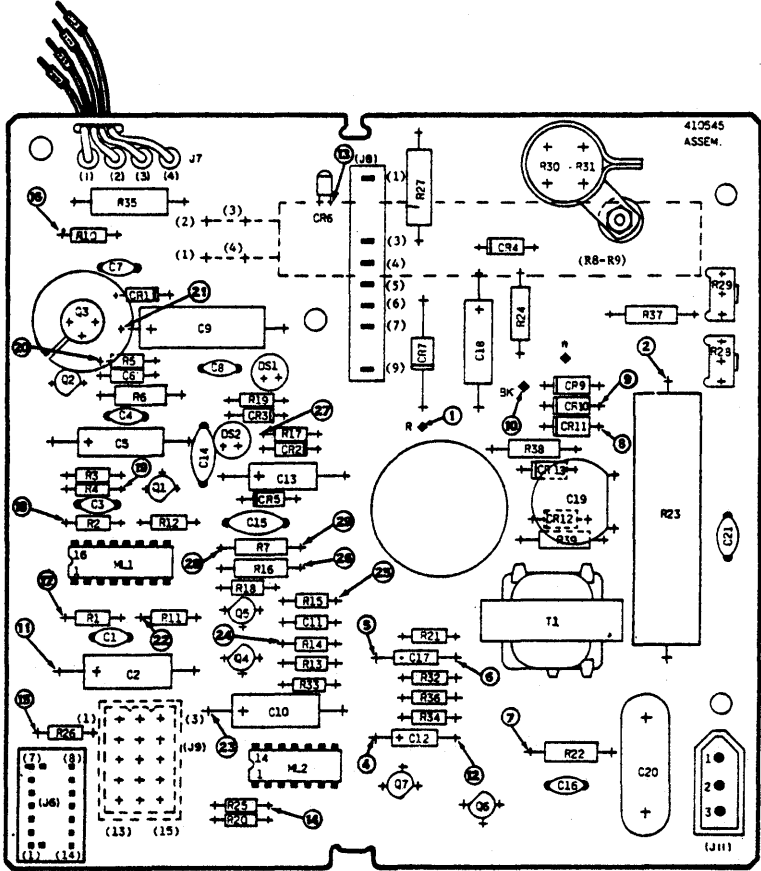
## D. TROUBLESHOOTING (Cont)

## 4. DETAILED TROUBLE ANALYSIS, 410545 Dot Amplifier (Cont)

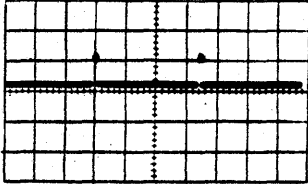
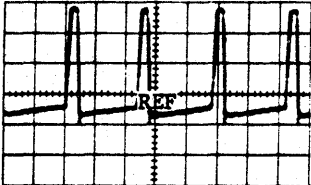
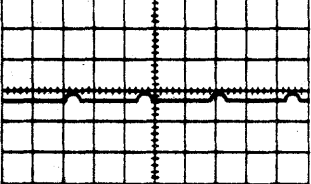
TEST POINT	VOLTAGE OR WAVEFORM	COMPONENT ANALYSIS
16	 <p>5 ms/cm REF 10 V dc/cm</p>	No signal. Test Point 20. Replace Q3. Signal good. No characters. Check J7 and 405861 rear cover assembly including CRT cable. Replace CRT.
17 18	 <p>5 ms/cm REF 1 V dc/cm</p>	No signal. Check J9 and 410548 video interface receiver and video input cable. Replace ML1.
19 20	 <p>5 ms/cm REF 1 V dc/cm</p>	No signal. Replace respectively:  Q1  Q2
21	42 V dc	No voltage. Replace CR1.

NOTE 1: The signals above are developed by entering characters on the display.

NOTE 2: Failure here will result in no cursor or any characters.



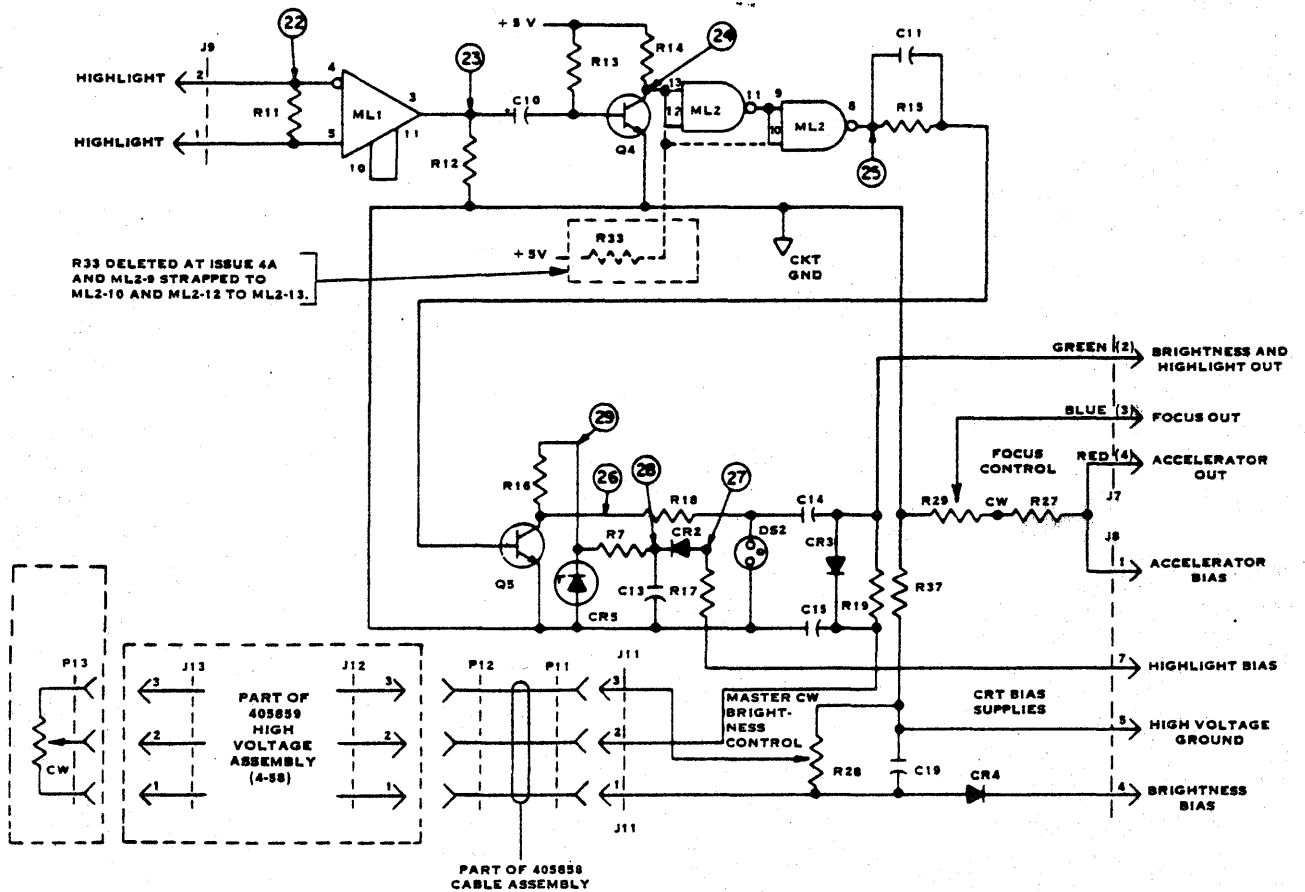
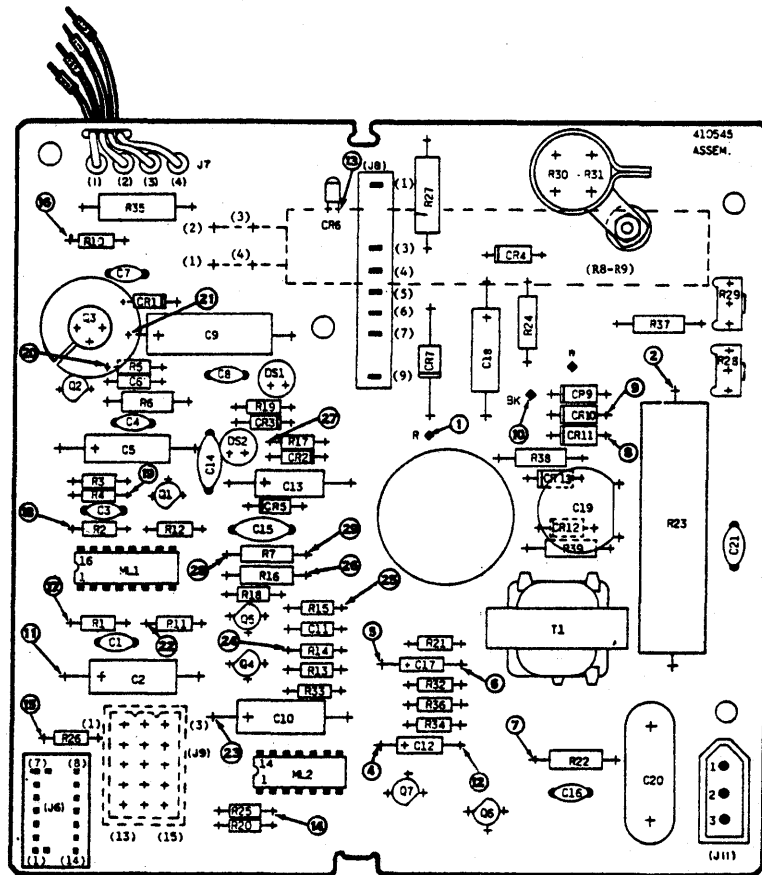
D. TROUBLESHOOTING (Cont)4. DETAILED TROUBLE ANALYSIS (Cont)410545 Highlight Amplifier

TEST POINT	VOLTAGE OR WAVEFORM	COMPONENT ANALYSIS
22	 <p>5 ms/cm REF 1 V dc/cm</p>	No signal. Check J9, 410548 video interface receiver, and video input cable.
	Test Points 23-26 look similar to Test Point 22 - changes indicated below.	
23	Level 4.2 V dc Neg. Pulse.	No signal. Replace ML1.
24	Level .2 V dc +5 V dc Pulse.	No signal. Replace Q4.
25	Level 0 V dc +3.5 V dc Pulse.	No signal. Replace ML2.
26	Level 10 V dc Neg. Pulse.	No signal. Replace Q5. Signal good. Check J7 and 405861 rear cover assembly. Replace 410546. Replace CRT.
27	 <p>20 μs/cm REF 5 V dc/cm</p>	No signal. Check J8.
28	 <p>20 μs/cm REF 5 V dc/cm</p>	No signal. Replace CR2.
29	10 V dc	No voltage. Replace CR5.

NOTE 1: The signals shown are developed by placing 80 highlighted \*s on line one of display. The rest of display is blank and cursor is home. If monitor test set is used, turn HIGHLIGHT and TEST CHARACTER ON. The signal at test point 22 will appear similar to that illustrated but inverted.

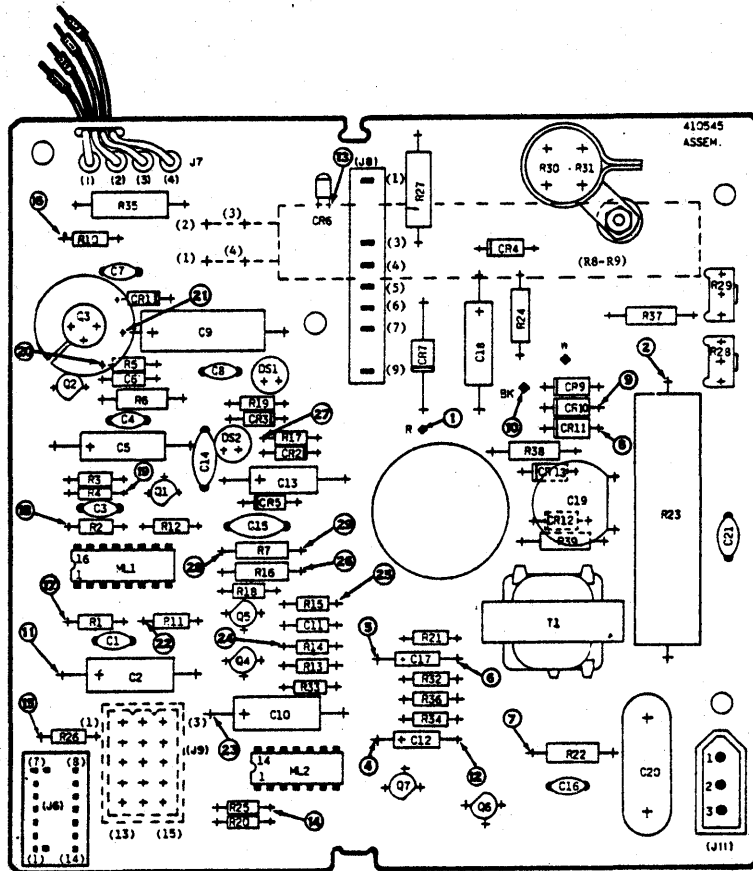
NOTE 2: Failure will result in no highlight or protected information.

CAUTION: PROBE ONLY DESIGNATED TEST POINT AREAS ON THIS CIRCUIT CARD AS DAMAGE TO MONITOR OR TEST EQUIPMENT COULD RESULT.



## D. TROUBLESHOOTING (Cont)

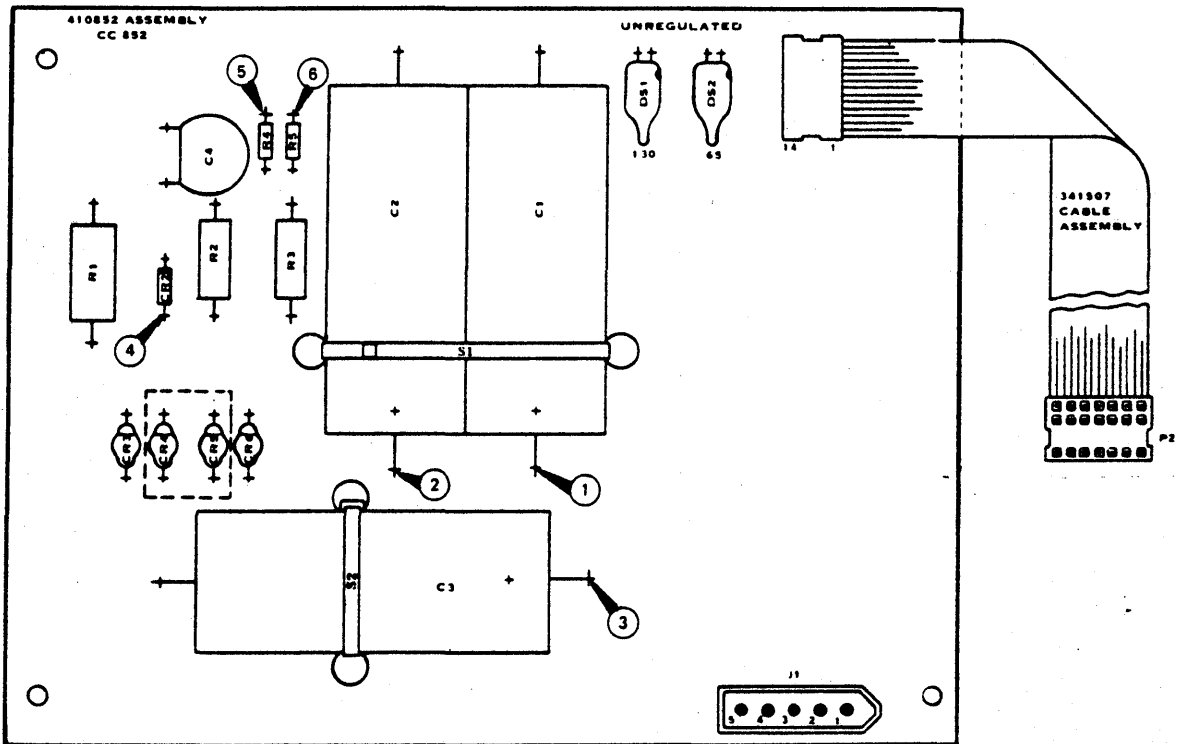
## 4. DETAILED TROUBLE ANALYSIS, 410545 Highlight Amplifier (Cont)



REF DESIGN	DESCRIPTION	PART NO.	REF DESIGN	DESCRIPTION	PART NO.
R7	100 ohm, 1/2 W, 5%	137438	C10	47 MFD 20 W V dc	310931
R11	120 ohm, 1/4 W, 5%	333405	C11	220 PFD 200 W V dc	335803
R12	1 K ohm, 1/4 W, 5%	321213	C13	10 MFD 25 W V dc	321976
R13	2.7 K ohm, 1/4 W, 5%	315956	C14	0.01 MFD 1.4 K V dc	336377
R14	220 ohm, 1/4 W, 5%	308802	C15	0.1 MFD 500 W V dc	315942
R15	470 ohm, 1/4 W, 5%	320276	C19	0.1 MFD 500 W V dc	315942
R16	470 ohm, 1/2 W, 5%	137602	C20	0.01 MFD 1.4 K V dc	336377
R17	4.7 ohm, 1/4 W, 5%	341575			
R18	270 ohm, 1/4 W, 5%	328784	CR2	1N4148	197464
R19	22 meg, 1/4 W, 5%	324855	CR3	1N4007	335880
R27	6.8 meg, 1/2 W, 5%	147028	CR4	1N4004	312341
R28	RES Variable	341667	CR5	1N4740 ZENER 10 V	336019
R29	RES Variable	341668			
R33*	1 K ohm, 1/4 W, 5%	321213	ML1	Integrated Circuit	339716
R37	27 K ohm, 1/2 W, 5%	118187	ML2	Integrated Circuit	339002
Q4	2N4275	335774			
Q5	2N4275	335774	DS2	NEON, (Orange Dot)	341590

\*Deleted at Issue 4A.

410852 Rectifier Assembly

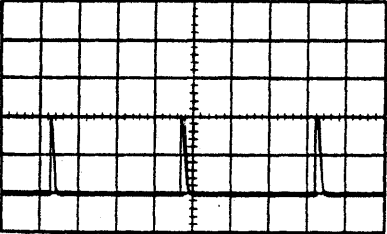


REF DESIGN	DESCRIPTION	PART NO.	REF DESIGN	DESCRIPTION	PART NO.
C1	200 MFD 250 V	341504	DS1	NEON, (Orange Dot)	341590
C2	300 MFD 150 V	341505	DS2	NEON, (Green Dot)	341589
C3	1000 MFD 75 V	341506			
C4	0.01 MFD 1000 V	341550			
CR1*	Bridge, 2A, 400 V	341503	R1	39 K, 2 W	341572
CR2	1N4004	312341	R2	20 K, 1 W	120211
CR3	Diode	408307	R3	10, 1 W	178862
CR4	Diode	408307	R4	330 K, 1/4 W	333415
CR5	Diode	408307	R5	82 K, 1/4 W	333411
CR6	Diode	408307			

\*Deleted at Issue 1B; replaced by CR3, CR4, CR5, and CR6.

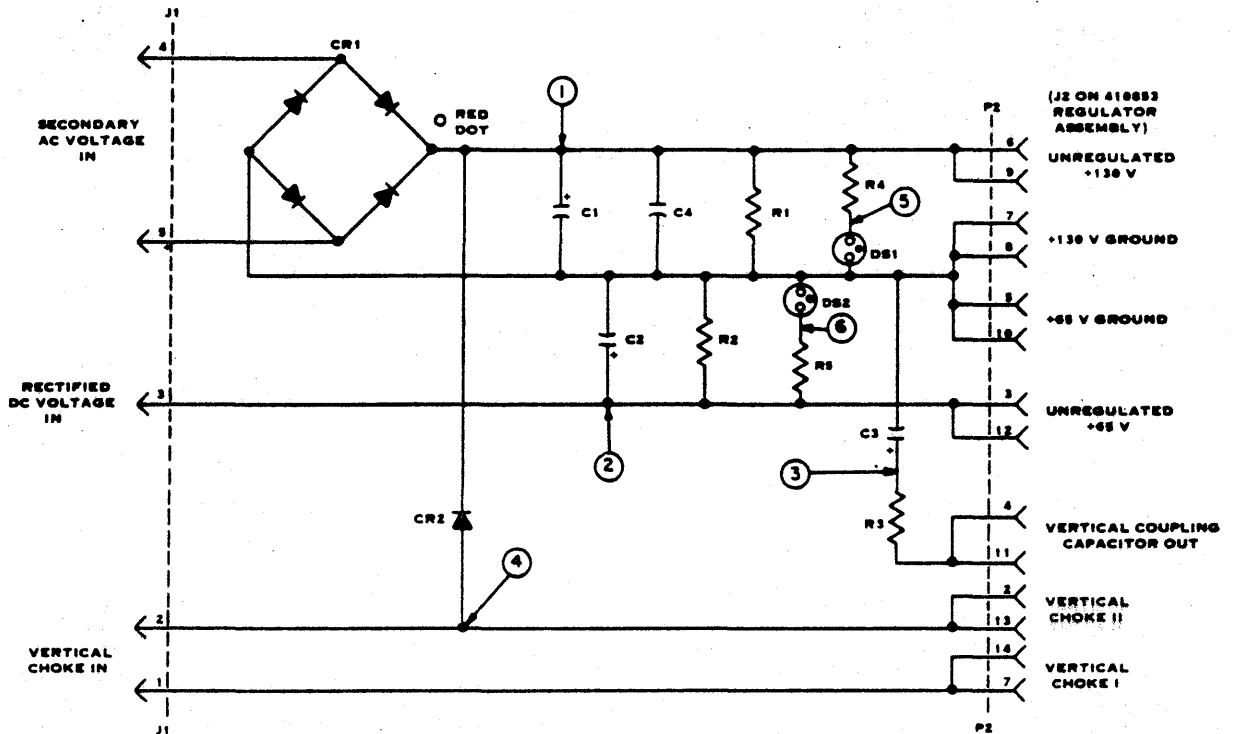
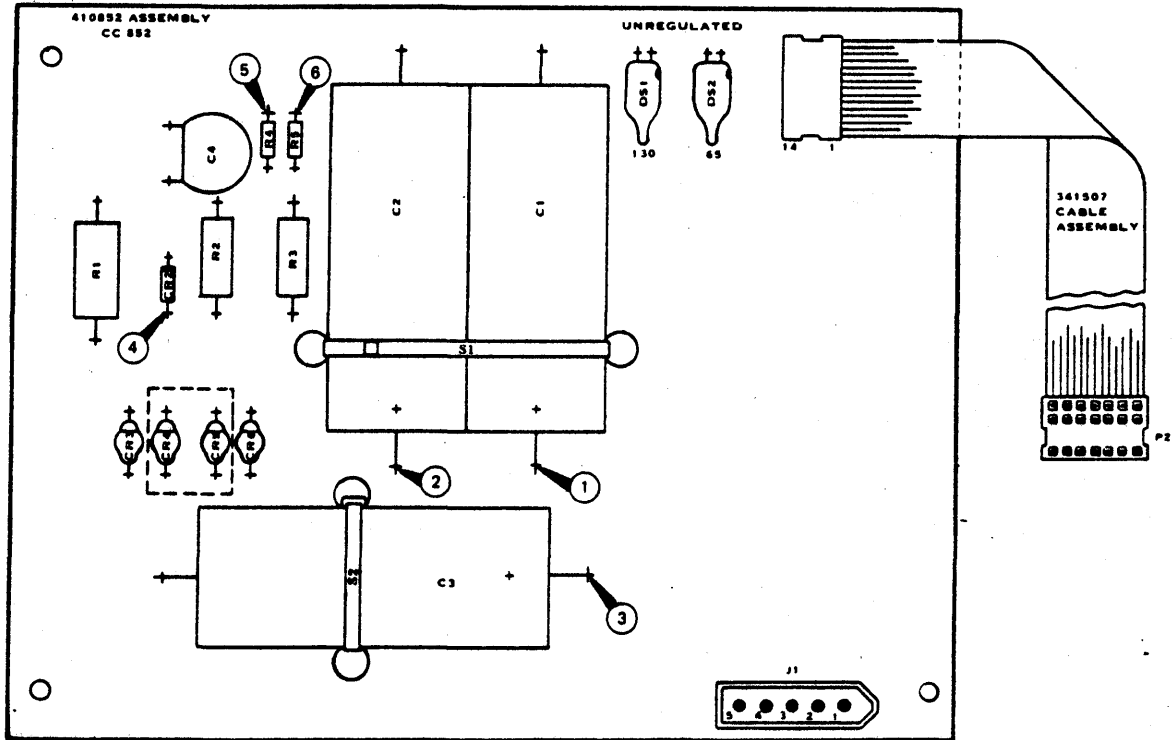
## D. TROUBLESHOOTING (Cont)

## 4. DETAILED TROUBLE ANALYSIS, 410852 Rectifier Assembly (Cont)

TEST POINT	VOLTAGE OR WAVEFORM	COMPONENT ANALYSIS
1	190 V dc $\pm 10\%$	No voltage. Replace CR1.
2	90 V dc $\pm 10\%$	No voltage. Check J1.
3	55 V dc $\pm 10\%$	No voltage. Check yoke.
4	 <p>5 ms/cm      50 V dc/cm</p>	Incorrect signal. Replace CR2.
5	60 V dc $\pm 10\%$	High voltage. Replace DS1.
6	55 V dc $\pm 10\%$	High voltage. Replace DS2.

**NOTE:** Troubles on this card will usually result in no display.

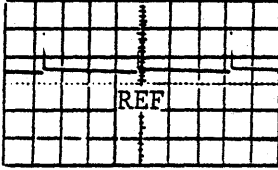
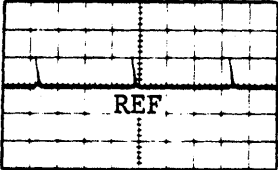

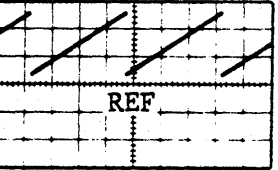
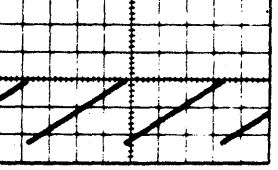
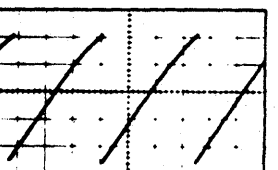


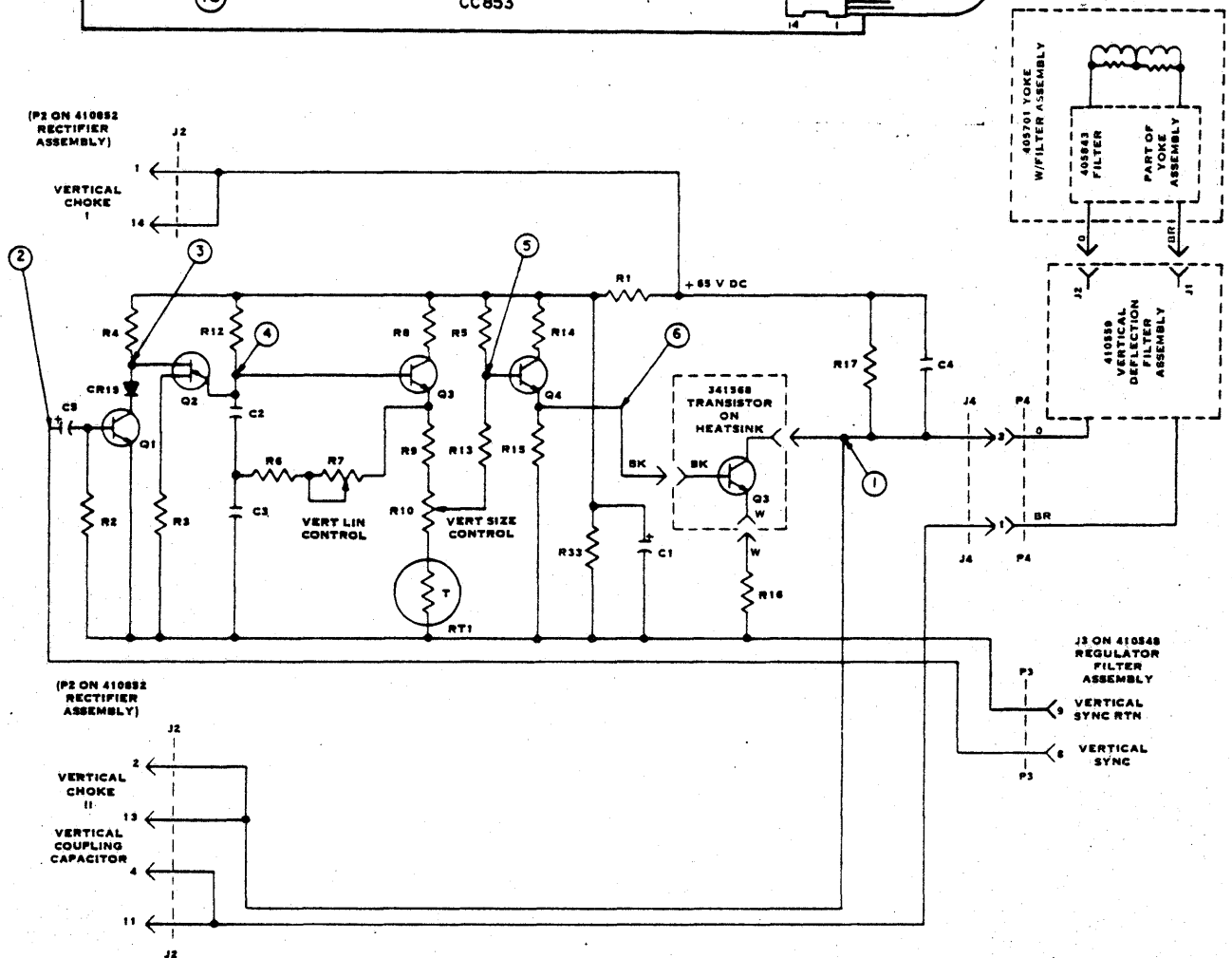
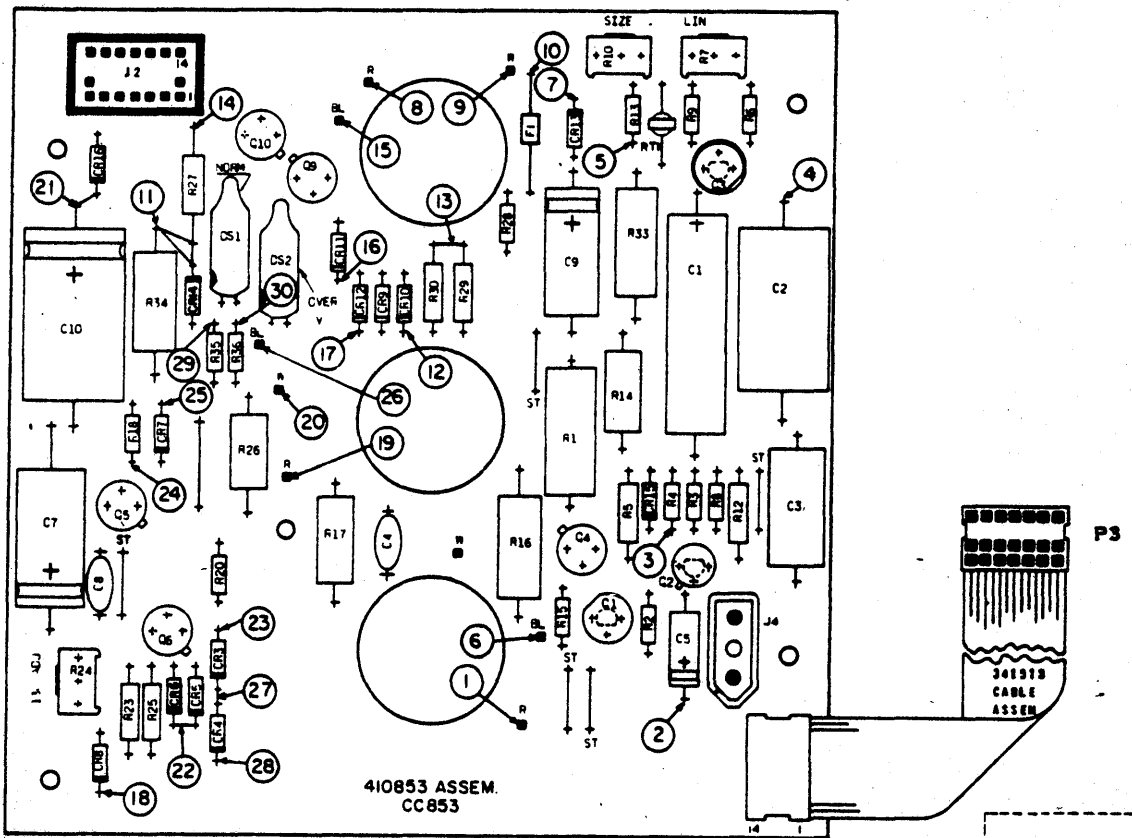


D. TROUBLESHOOTING (Cont)

4. DETAILED TROUBLE ANALYSIS (Cont)

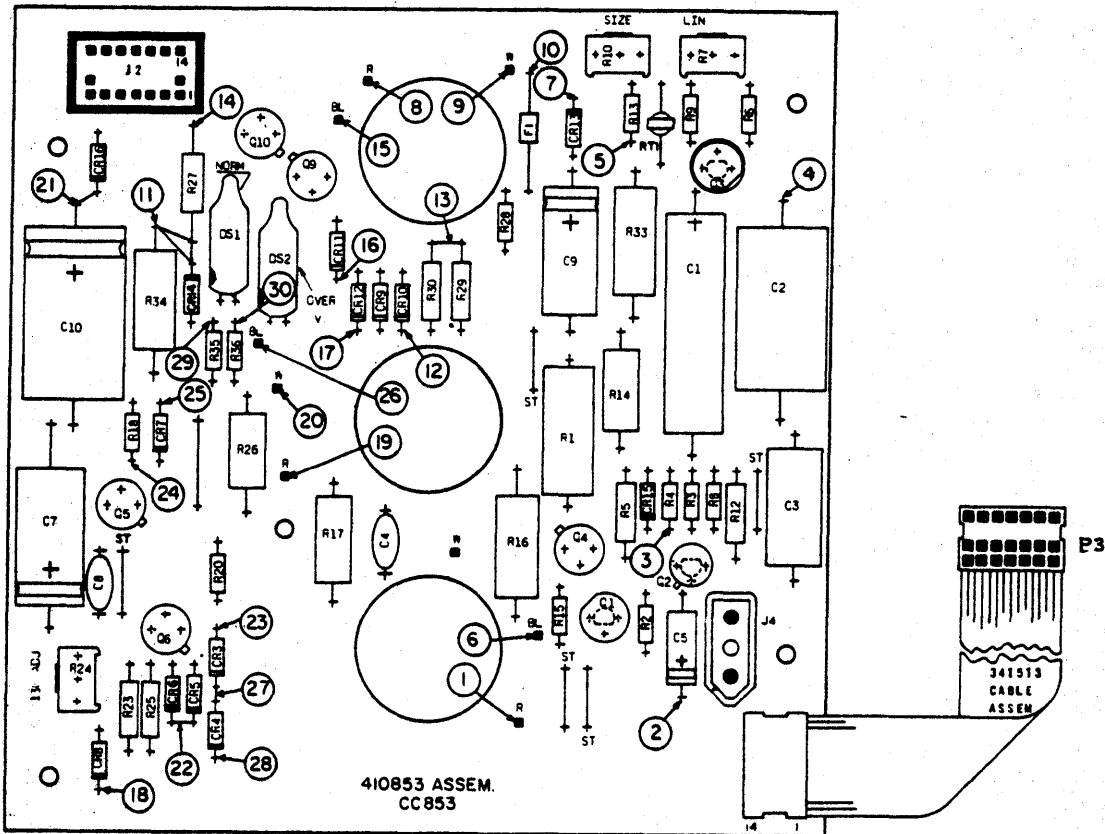
410853 Vertical Control

TEST POINT	VOLTAGE OR WAVEFORM	COMPONENT ANALYSIS
1	 <p>5 ms/cm      100 V dc/cm</p>	<p>Signal good. No trouble here. Horizontal dashed line. Check Test Points 4 and 6. Replace Q3 (Heatsink).</p>
2	 <p>5 ms/cm      1 V dc/cm</p>	<p>Rolling. Incorrect signal. Problem on 410545. No signal. Check 410547 regulator filter circuit card assembly.</p>
3	 <p>5 ms/cm      REF      5 V dc/cm</p>	<p>Rolling. Incorrect signal. Replace CR15 or Q1.</p>
4	 <p>5 ms/cm      5 V dc/cm</p>	<p>Horizontal dashed line. Incorrect signal. Replace Q2.</p>
5	 <p>5 ms/cm      REF      2 V dc/cm</p>	<p>Reduced display. Incorrect signal. Replace Q3.</p>
6	 <p>5 ms/cm      1 V dc/cm</p>	<p>Horizontal dashed line. No signal. Replace Q4.</p>



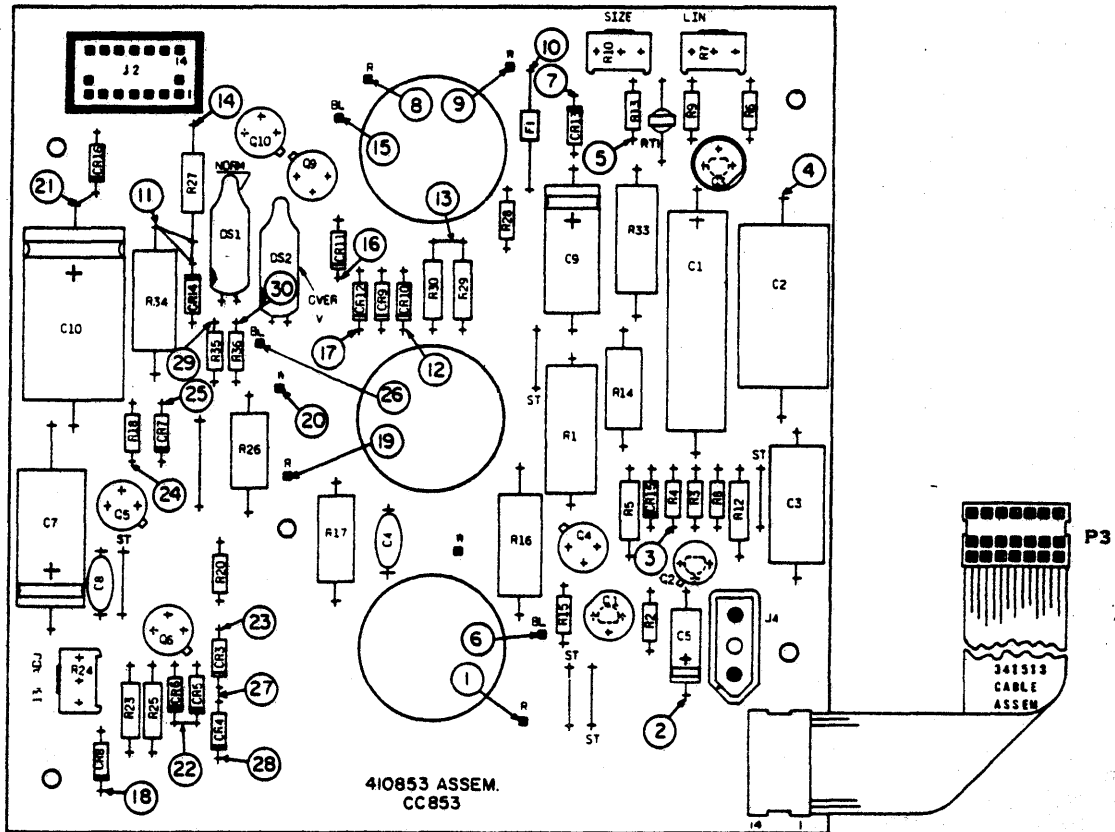
D. TROUBLESHOOTING (Cont)

4. DETAILED TROUBLE ANALYSIS, 410853 Vertical Control (Cont)



REF DESIGN	DESCRIPTION	PART NO.	REF DESIGN	DESCRIPTION	PART NO.
R1	1.5 K ohm, 5 W, 5%	341551	C1	100 MFD 50 W V dc	327668
R2	15 K ohm, 1/4 W, 5%	333408	C2	2 MFD 200 W V dc	341609
R3	51 ohm, 1/4 W, 5%	315947	C3	47 MFD 200 W V dc	341617
R4	2.2 K ohm, 1/4 W, 5%	315955	C4	0.01 MFD 1000 V	341550
R5	75 K ohm, 1/4 W, 1%	341592	C5	2 MFD 25 W V dc	320290
R6	2.2 K ohm, 1/4 W, 5%	315955			
R7	Resistor, Variable	341666	Q1	2N3568	315930
R8	1.5 K ohm, 1/4 W, 5%	315954	Q2	Transistor, UNLJ	341511
R9	1 K ohm, 1/4 W, 5%	321213	Q3	2N3569	324656
R10	Resistor, Variable	341665	Q4	2N2218	325083
R12	75 K ohm, 1/4 W, 1%	341592			
R13	2.2 K ohm, 1/4 W, 5%	315955	Q3	(Heatsink) Transistor	341568
R14	1.5 K ohm, 1 W, 5%	341597			
R15	1 K ohm, 1/4 W, 5%	321213	RT1	Thermistor	341606
R16	15 ohm, 2 W, 5%	332764			
R17	1.5 K ohm, 1 W, 5%	341597	CR15	Diode	300102
R33	2 K ohm, 2 W, 5%	321155			

410853 -- 65 Volt Regulator

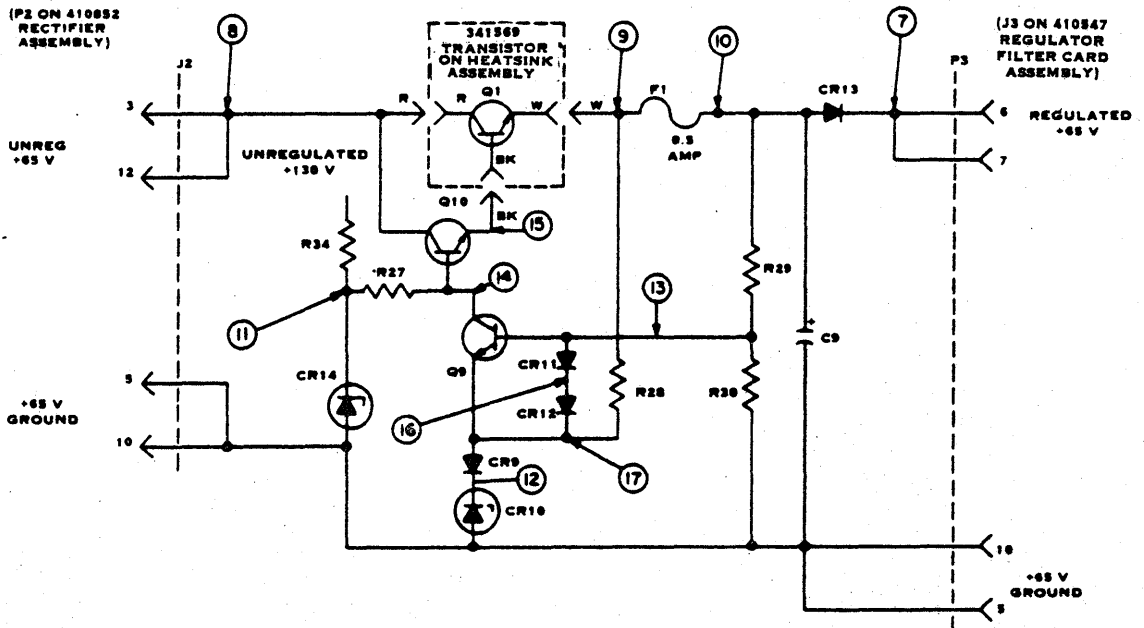
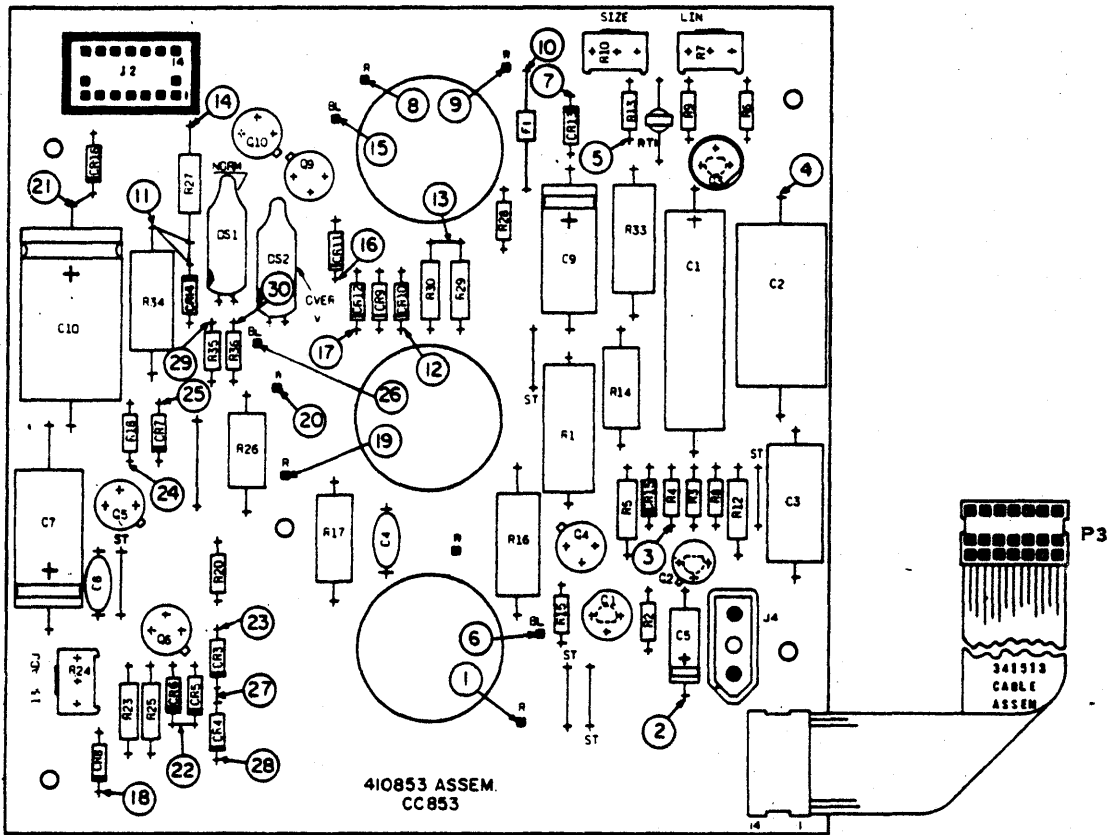


REF DESIGN	DESCRIPTION	PART NO.	REF DESIGN	DESCRIPTION	PART NO.
R27	18 K ohm, 1/2 W, 5%	118151	CR9	1N4004	312341
R28	68 K ohm, 1/4 W, 5%	333410	CR10	1N5235 B	341510
R29	28.7 K ohm, 1/2 W, 1%	341595	CR11	1N4004	312341
R30	4.02 K ohm, 1/4 W, 1%	324900	CR12	1N4004	312341
R34	27 K ohm, 2 W, 5%	341603	CR13	1N4007	335880
			CR14	1N5268 A	341571
Q9	2N3440	341508			
Q10	2N3440	341508	C9	4 MFD 150 W V dc	341602
Q1	(Heat Sink) Transistor	341569	F1	Fuse (0.5 Amp)	341752

D. TROUBLESHOOTING (Cont)4. DETAILED TROUBLE ANALYSIS, 410853 -- 65 Volt Regulator (Cont)

TEST POINT	VOLTAGE OR WAVEFORM	COMPONENT ANALYSIS
7	+65 V dc <u>+10%</u>	Horizontal line. Test Point 10 CR13.
8	90 V dc	No signal. Check J2.
9	65 V dc	Horizontal line. Replace Q1 (Heatsink).
10	65 V dc	Horizontal line. Replace F1.
11	82 V dc	High voltage. Replace CR14.
12	6.8 V dc	Expanded vertical. Replace CR9, CR10.
13	8 V dc	No signal. Replace R29.
14	65 V dc	Expanded vertical. If high, replace Q9.
15	65 V dc	Horizontal line. If zero, replace Q10.
16	7.6 V dc	No signal. Replace CR11.
17	7.4 V dc	No signal. Replace CR12.

NOTE: Components listed in Trouble Analysis column should be replaced if symptom specified exists.

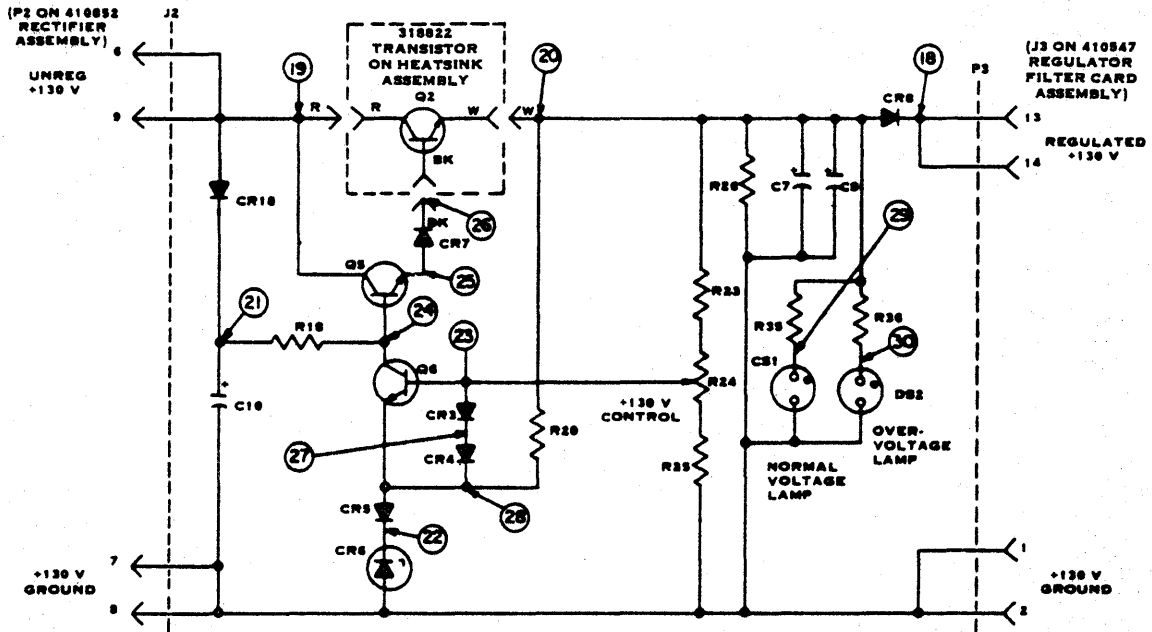
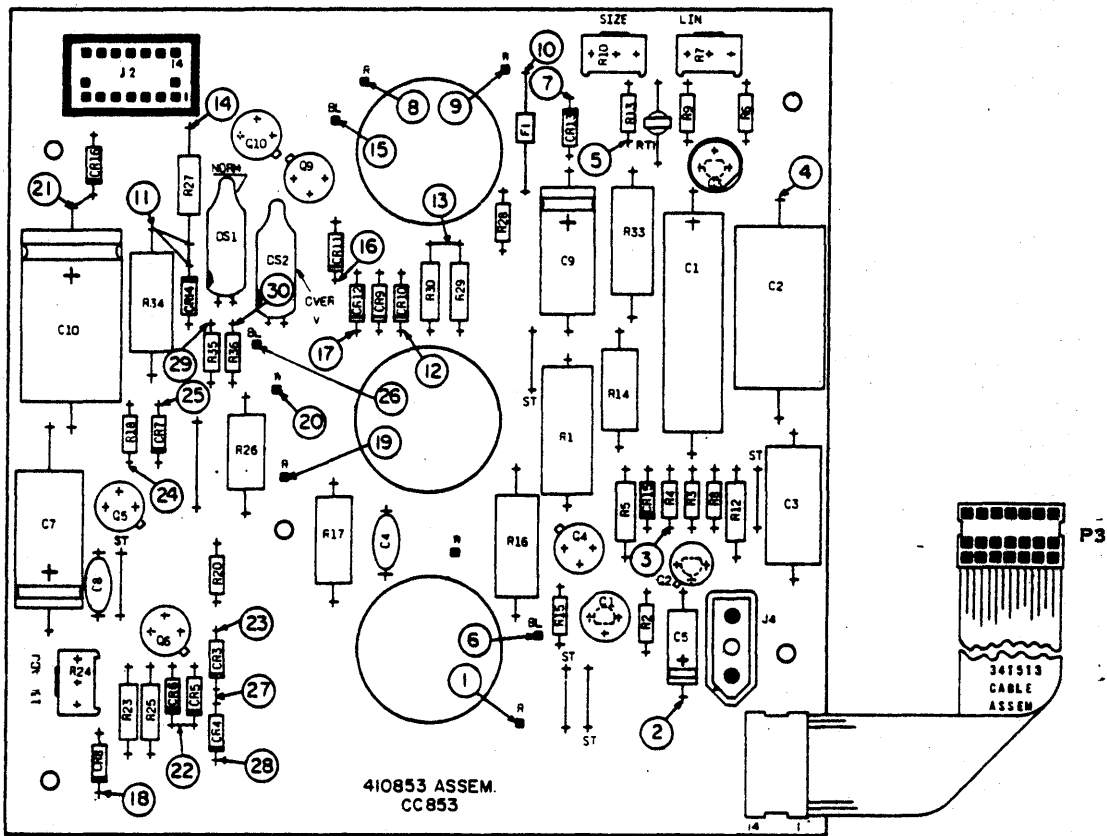


D. TROUBLESHOOTING (Cont)4. DETAILED TROUBLE ANALYSIS (Cont)410853 -- 130 Volt Regulator

TEST POINT	VOLTAGE OR WAVEFORM	COMPONENT ANALYSIS
18	130 $\pm$ 1.3 V dc	No display. Replace CR8.
19	190 V dc	No signal. Check connector J2.
20	130 V dc	No display. Replace Q2 on heat-sink.
21	190 V dc	No display. Replace CR16.
22	6.8 V dc	Expanded horizontal. Replace CR6, CR5.
23	8 V dc	No signal. Replace R24.
24	130 V dc	Expanded horizontal. Replace Q6.
25	130 V dc	No display. Replace Q5.
26	130 V dc	No display. Replace CR7.
27	7.8 V dc	No signal. Replace CR5.
28	7.6 V dc	No signal. Replace CR4.
29	55 V dc	No signal. Replace DS1.
30	130 V dc	No signal. Replace DS2

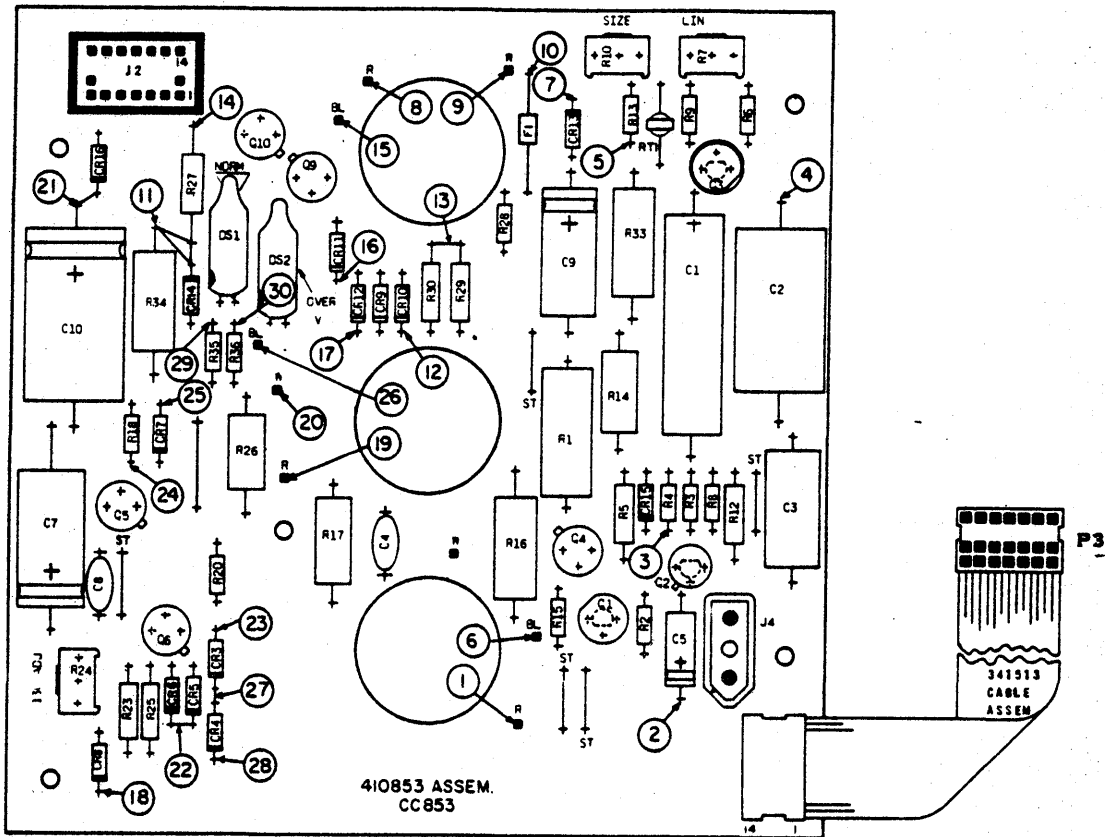
**NOTE:** The components listed in Component Analysis column should be replaced if no signal is found at test point.





D. TROUBLESHOOTING (Cont)

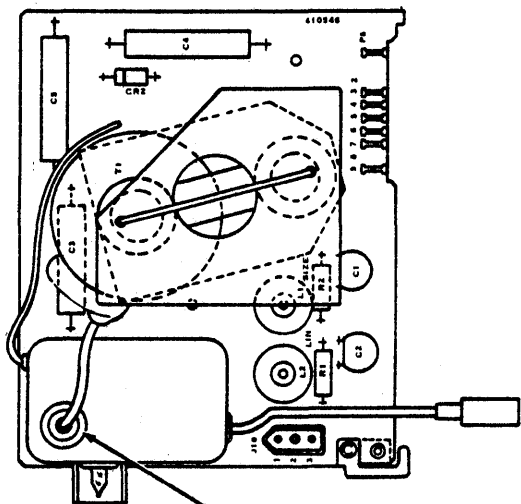
4. DETAILED TROUBLE ANALYSIS, 410853 -- 130 Volt Regulator (Cont)



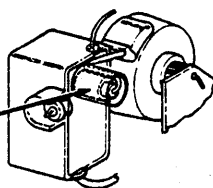
REF DESIGN	DESCRIPTION	PART NO.	REF DESIGN	DESCRIPTION	PART NO.
R18	100 K	321508	CR3	1N4004	312341
R20	180 K	333412	CR4	1N4004	312341
R23	121 K, 1%	341596	CR5	1N4004	312341
R24	2 K, 1/2 W, Var.	341665	CR6	1N5235 B	341510
R25	7.15 K, 1%	341594	CR7	1N4004	312341
R26	56 K, 1 W	118198	CR8	1N4007	335880
R35	180 K	333412	CR16	1N4004	312341
R36	47 K	318801			
			Q5	2N3440	341508
C7	4 MFD 250 W V dc	341600	Q6	2N3440	341508
C8	0.01 MFD 1000 V	341550			
C10	10 MFD 250 W V dc	341601	Q2	(Heatsink) Transistor	318822
DS1	NEON (Orange Dot)	341590			
DS2	NEON (Black Dot)	341591			

410546 High Voltage Assembly

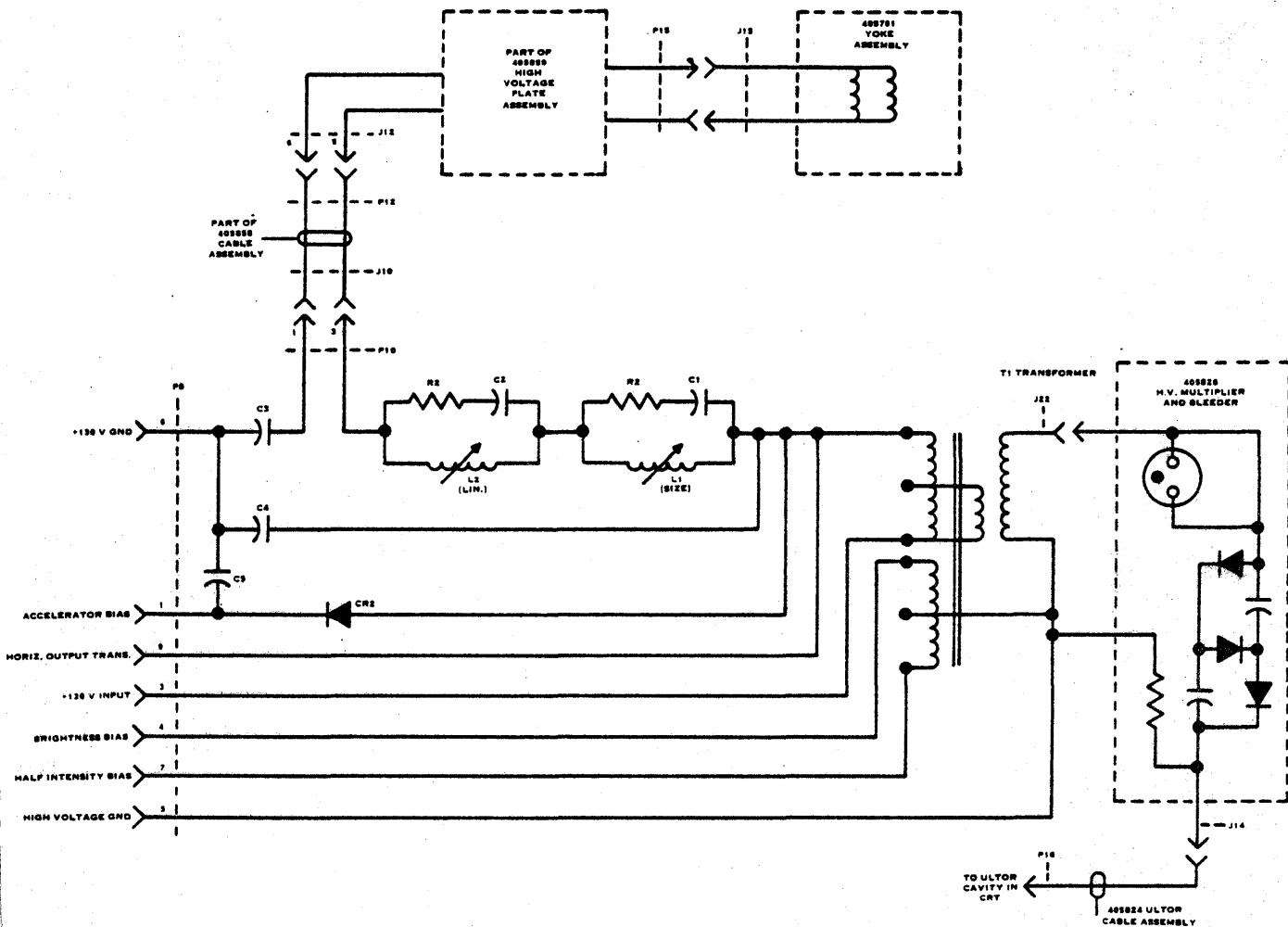
**WARNING: DO NOT USE OSCILLOSCOPE TO PROBE HIGH VOLTAGE ASSEMBLY.**



REF DESIGN	DESCRIPTION	PART NO.	REF DESIGN	DESCRIPTION	PART NO.
C1	0.0047 MFD 1 KV	341622	CR2	Di Diode 2 KV	341554
C2	0.0068 MFD 1 KV	341623	L1	Size Control	341530
C3	0.47 MFD 400 V 5%	405951	L2	Linearity Control	341531
C4	0.0033 MFD 1600 V 5%	341625	T1	Trans. Asm., Horiz. Out.	341528
C5	0.1 MFD 1000 V 10%	341547			
R1	220 ohm 1W 5%	144464	H. V. Multiplier & Bleeder	405826	
R2	680 ohm 1W 5%	182763			



406614 COVER

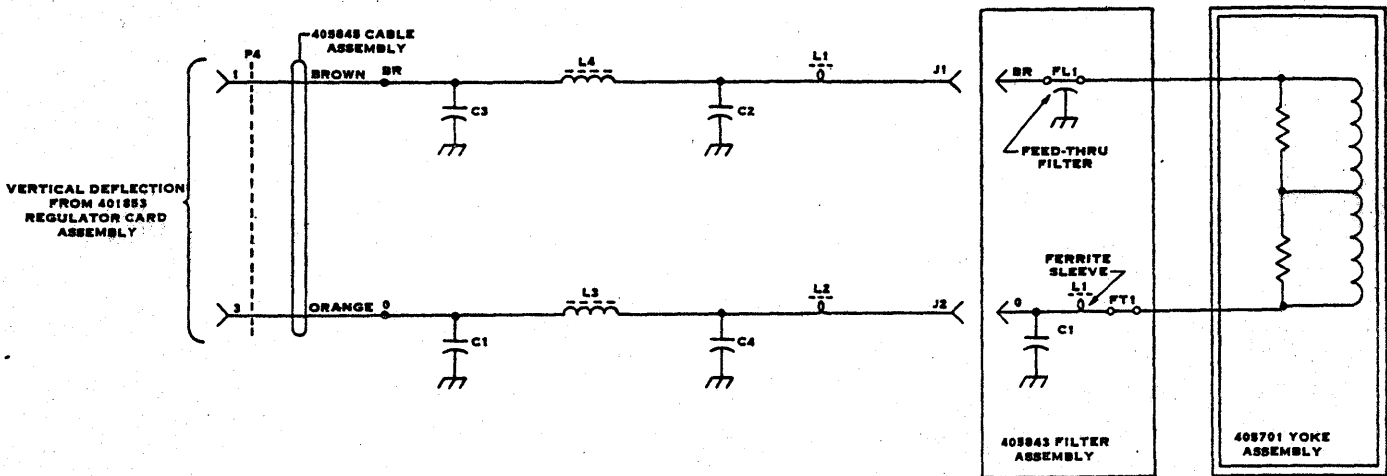
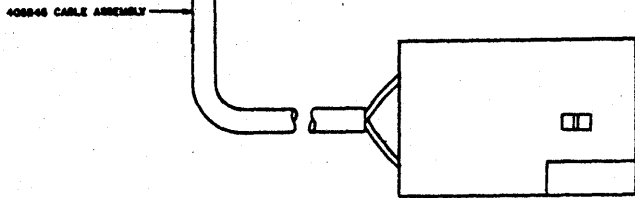
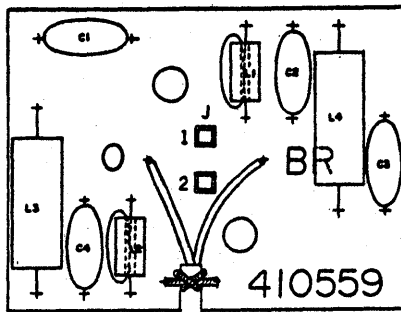


D. TROUBLESHOOTING (Cont)

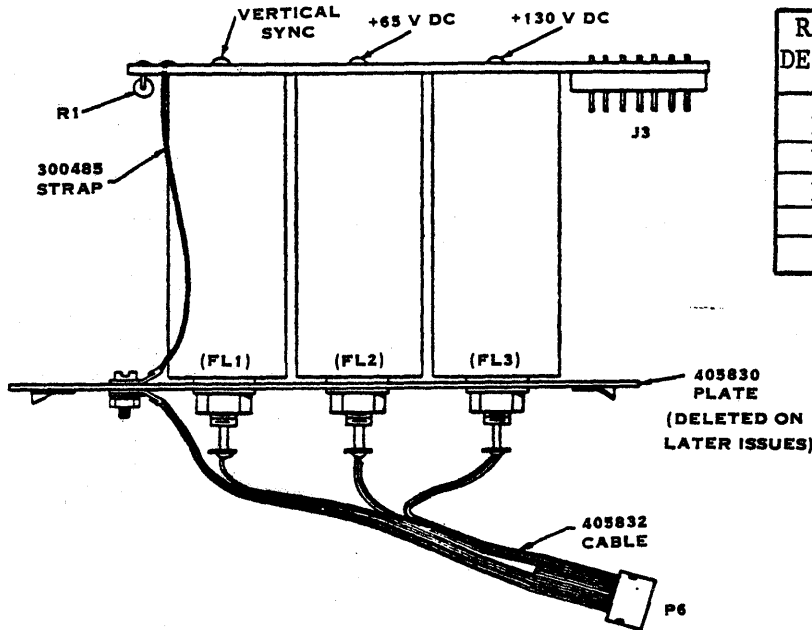
4. DETAILED TROUBLE ANALYSIS (Cont)

410559 Vertical Deflection Filter Circuit Card Assembly

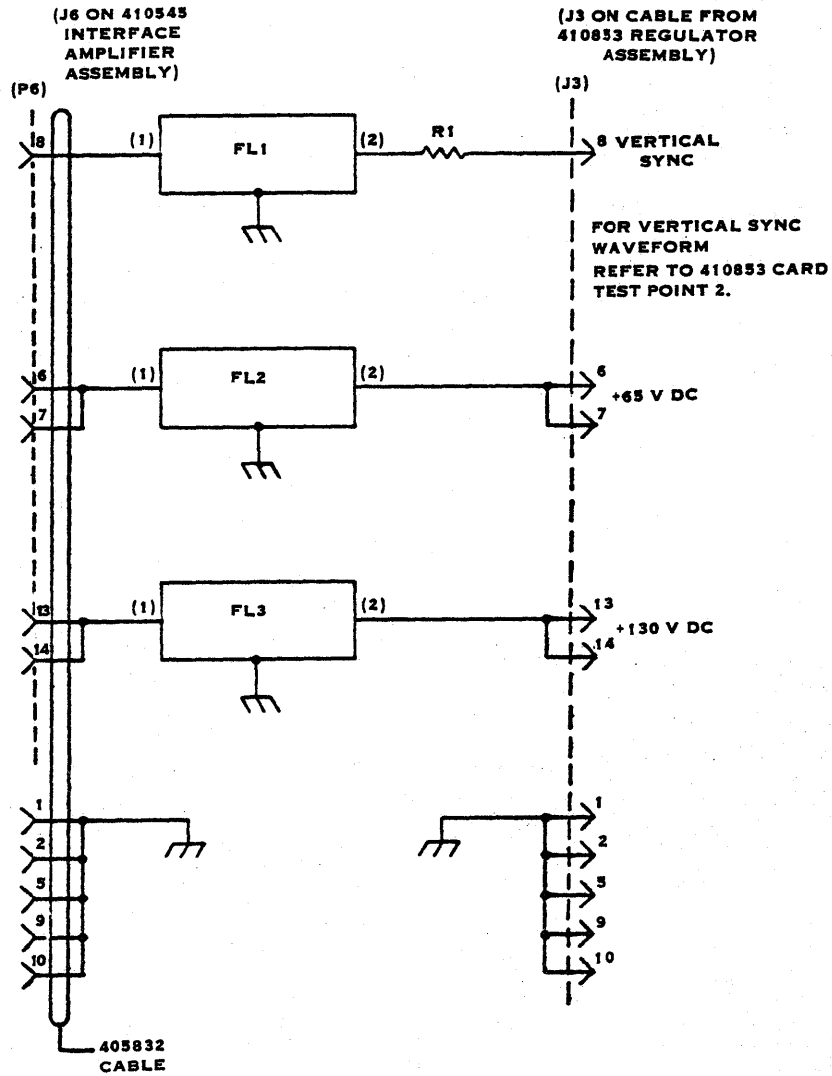
REF DESIGN	DESCRIPTION	PART NO.
C1	0.01 UF $\pm 20\%$	341550
C2	0.01 UF $\pm 20\%$	341550
C3	0.01 UF $\pm 20\%$	341550
C4	0.0047 UF $\pm 20\%$	341622
L1	R. F. Choke	405849
L2	R. F. Choke	405849
L3	R. F. Choke 39 UH $\pm 10\%$	321159
L4	R. F. Choke 39 UH $\pm 10\%$	321159
J1 & J2	Receptacle	403611



410547 Regulator Filter Circuit Card Assembly



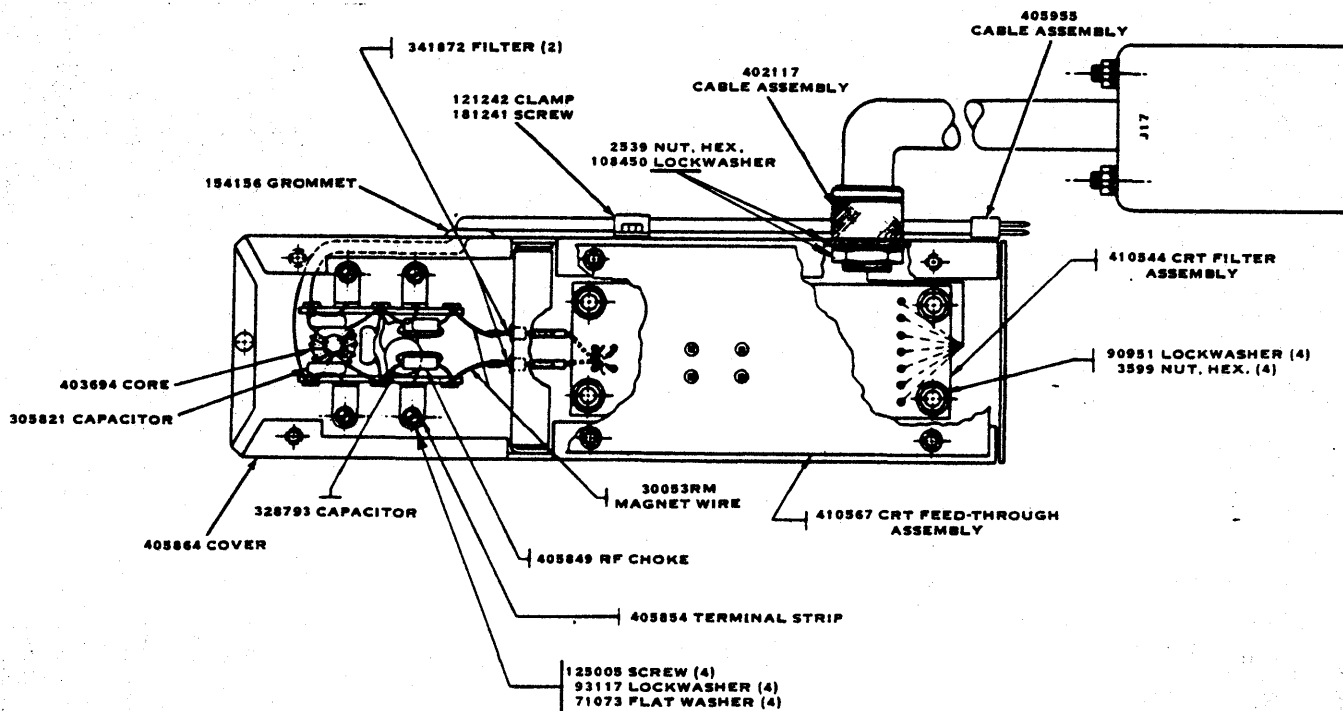
REF DESIGN	DESCRIPTION	PART NO.
FL1	LP Filter	405860
FL2	LP Filter	405860
FL3	LP Filter	405860
R1	680 Ohm, 1/4 W	315971



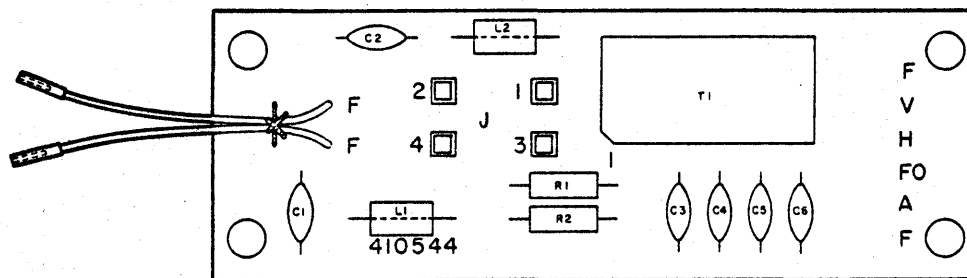
D. TROUBLESHOOTING (Cont)

4. DETAILED TROUBLE ANALYSIS (Cont)

405861 Rear Cover Assembly

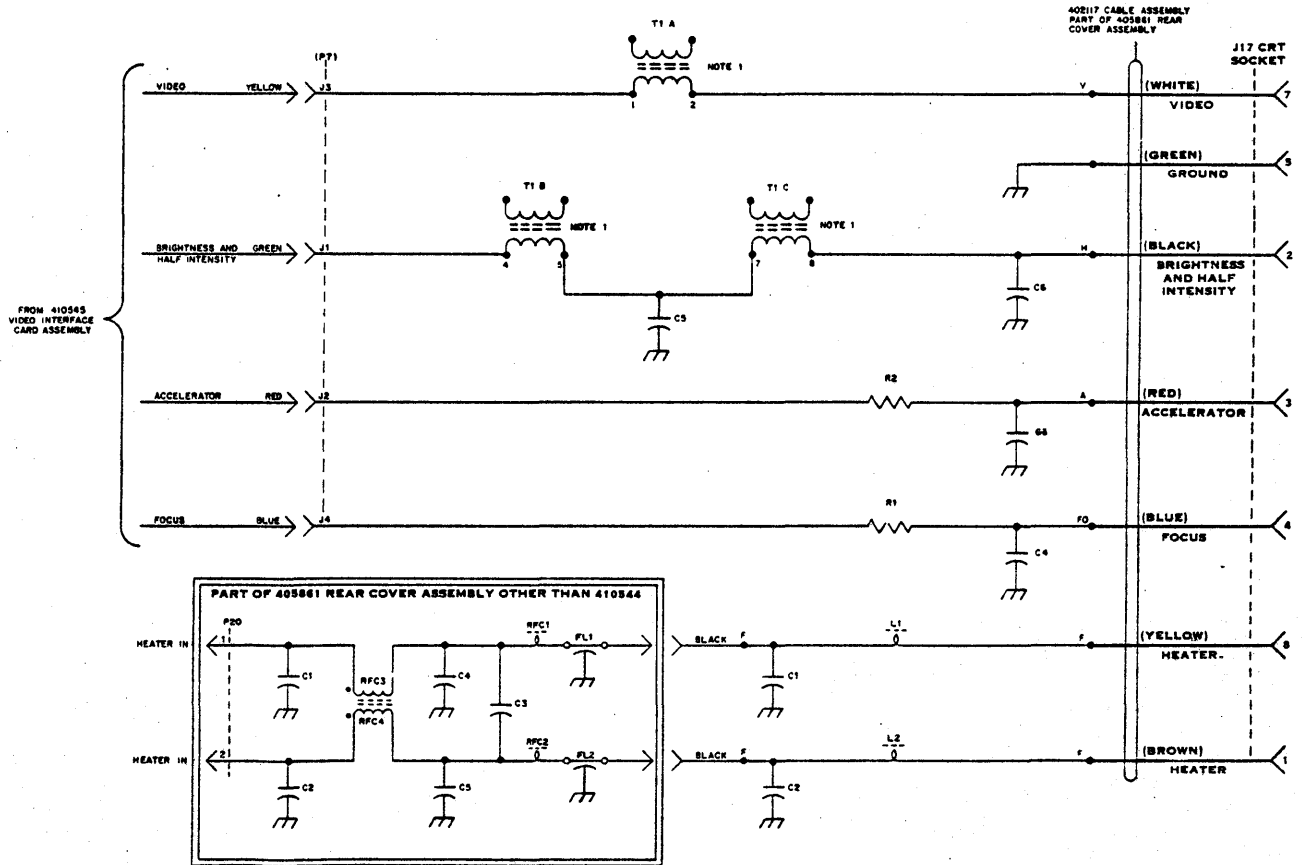


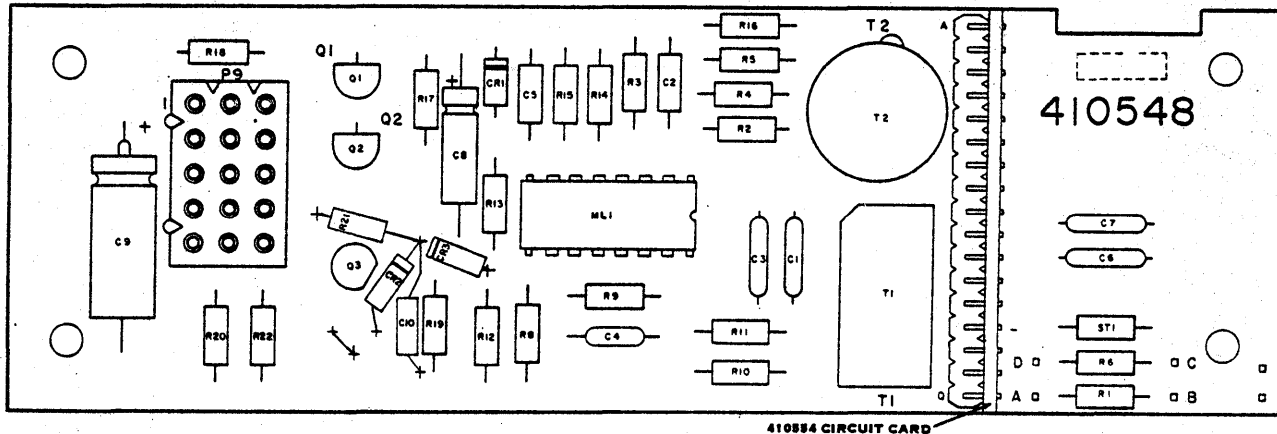
410544 CRT Filter Assembly (Used Above)



REF DESIGN	DESCRIPTION	PART NO.	REF DESIGN	DESCRIPTION	PART NO.
C1	0.1 MFD, 25 V DC	305821	R1	1.5K Ohm 1/4 W	315954
C2	0.1 MFD, 25 V DC	305821	R2	1.5K Ohm 1/4 W	315954
C3	200 PF, 1000 V DC	325011	T1	Transformer Assem.	403659
C4	200 PF, 1000 V DC	325011	J1-J4	Vert. PV Receptacle	403611
C5	22 PF, 1000 V DC	325007	L1	Ferrite Sleeve	343619
C6	22 PF, 1000 V DC	325007	L2	Ferrite Sleeve	343619

405861 Rear Cover Assembly (Includes 410544)

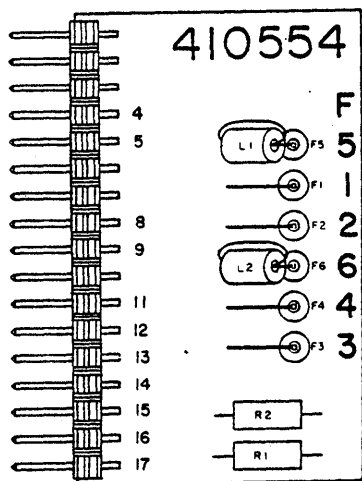


D. TROUBLESHOOTING (Cont)4. DETAILED TROUBLE ANALYSIS (Cont)410548 Video Interface Receiver

REF DESIGN	DESCRIPTION	PART NO.	REF DESIGN	DESCRIPTION	PART NO.
C1	0.1 MFD	305821	R12	560 Ohm 1/4 W	315951
C2	22 PF	335801	R13	220 Ohm 1/4 W	318802
C3	0.1 MFD	305821	R14	220 Ohm 1/4 W	318802
C4	0.001 MFD	328793	R15	470 Ohm 1/4 W	320276
C5	0.01 MFD	300057	R16	1.2K Ohm 1/4 W	315953
C6	0.1 MFD	305821	R17	3.6K Ohm 1/4 W	315958
C7	0.1 MFD	305821	R18	820 Ohm 1/4 W	315952
C8	10 MFD	137312	R19	430 Ohm 1/4 W	336697
C9	47 MFD	310931	R20	2.2K Ohm 1/4 W	315955
C10	0.002 MFD	328794	R21	4.7K Ohm 1/4 W	315959
R1	1200 Ohm 1/4 W	333405	R22	4.7K Ohm 1/4 W	315959
R2	1000 Ohm 1/4 W	321213	T1	Transformer Assem.	403659
R3	100 Ohm 1/4 W	315948	T2	Transformer	403658
R4	220 Ohm 1/4 W	318802	Q1	2N4410 Transistor	334133
R5	220 Ohm 1/4 W	318802	Q2	2N3646 Transistor	325076
R6	1200 Ohm 1/4 W	333405	Q3	2N4275 Transistor	335774
R8	560 Ohm 1/4 W	315951	CR1	1N4178 Diode	197464
R9	220 Ohm 1/4 W	318802	CR2	1N4148 Diode	197464
R10	220 Ohm 1/4 W	318802	CR3	1N4148 Diode	197464
R11	220 Ohm 1/4 W	318802	ML1	I.C. Line Receiver	339716

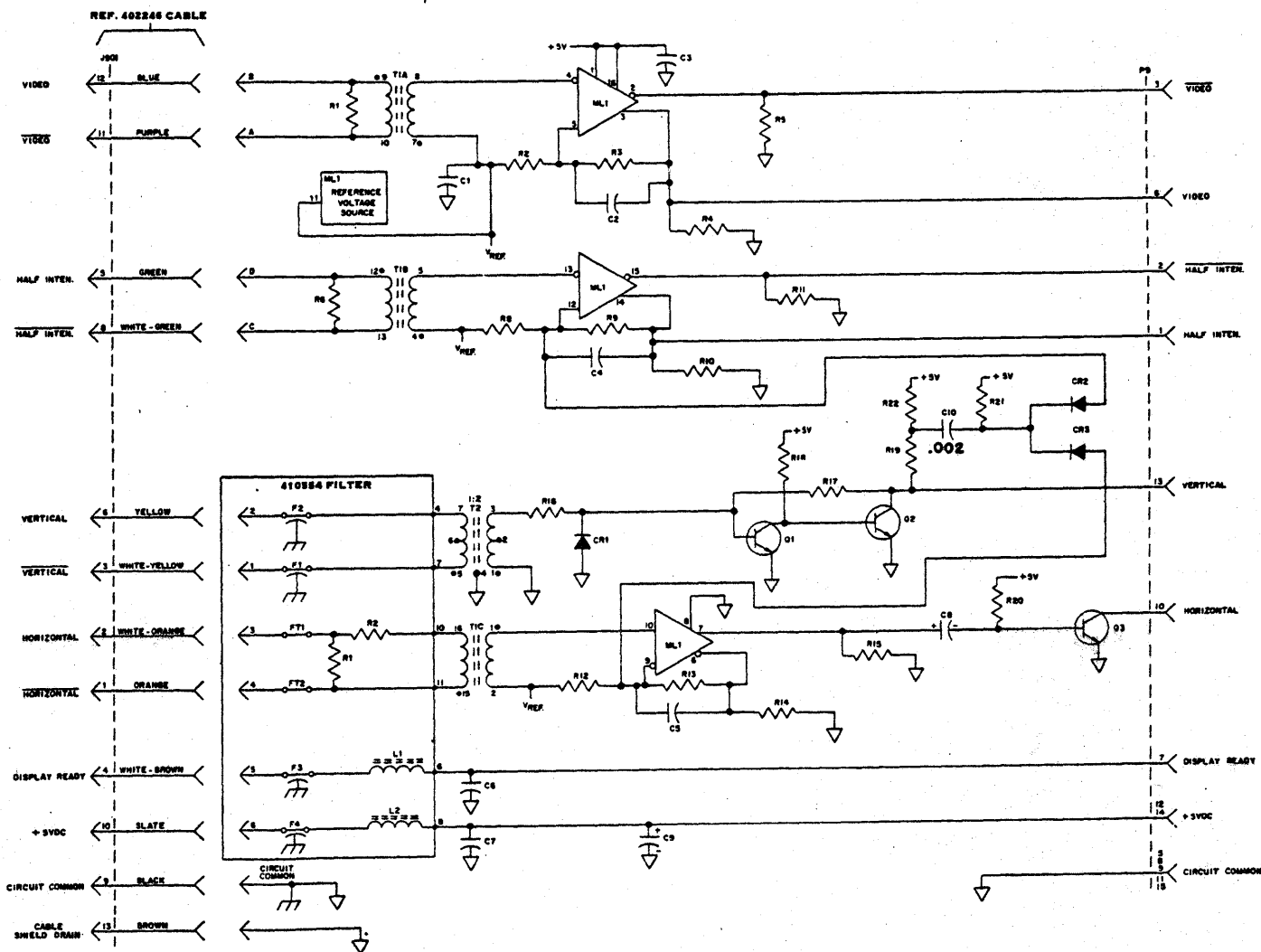


410554 Filter Circuit Card Assembly



REF DESIGN	DESCRIPTION	PART NO.
F1	Filter	341872
F2	Filter	341872
F3	Filter	402087
F4	Filter	402087
F5	Filter	341872
F6	Filter	341872
L1	R.F. Choke	405849
L2	R.F. Choke	405849
R1	120 Ohm 1/4 W	333405
R2	15 Ohm 1/4 W	335635

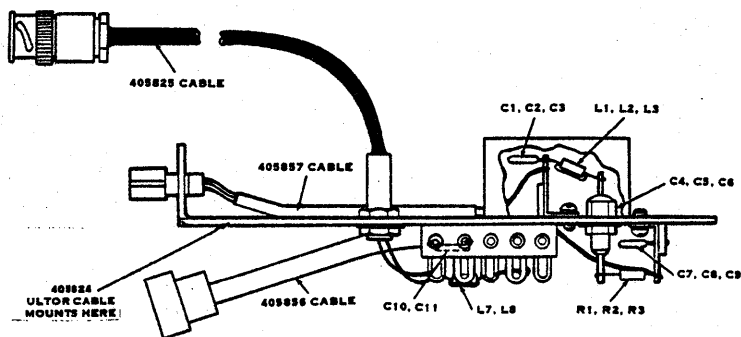
410548 Video Interface Receiver and 410554 Filter



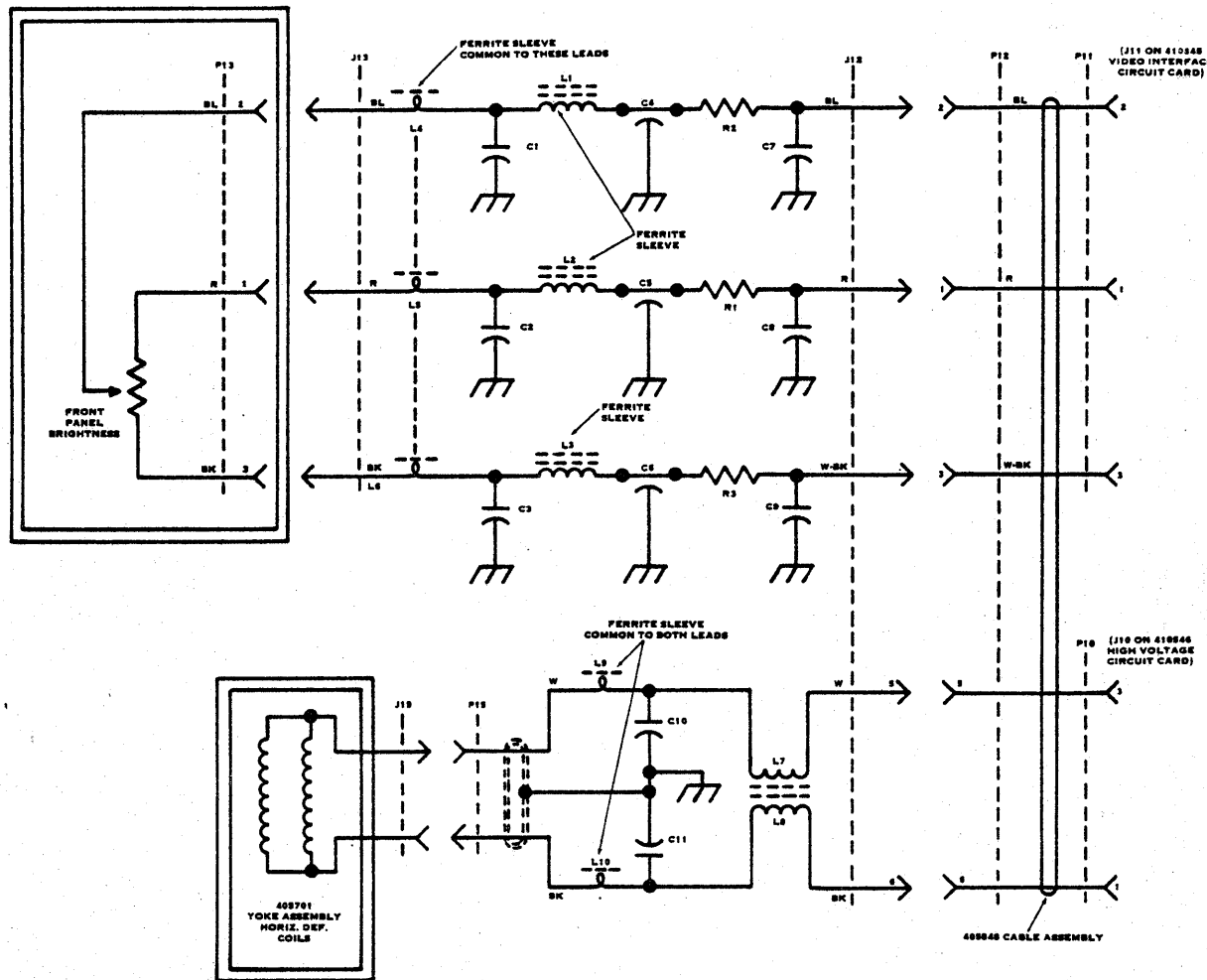
D. TROUBLESHOOTING (Cont)

4. DETAILED TROUBLE ANALYSIS (Cont)

405859 High Voltage Plate Assembly



REF DESIGN	DESCRIPTION	TP NO.	REF DESIGN	DESCRIPTION	TP NO.
C1,2,3	0.001 MFD, 1K V	328793	L1,2,3	R.F. Choke	405849
C4,5,6	0.001 MFD, 1K V Feed-Thru	338801	L7,8	R.F. Choke	405849
C7,8,9	500 PF, 1K V	321157			
C10,11	500 PF, 1K V	325036	R1,2,3	10K Ohm	320275



5. REFERENCE MATERIALMajor Component Function and Position

Interface/Amplifier Circuit Card -- Contains interface circuits necessary to receive and process the horizontal drive, vertical synchronization, and dot signals used to control the deflection and modulation of the electron beam in the CRT. The interface/amplifier circuit card is used in conjunction with the regulator and vertical deflection circuit card and with the high voltage and horizontal deflection assembly.

Regulator and Vertical Deflection Circuit Card -- Contains vertical sweep generator, +130 volt and +65 volt regulator. This circuit card is used in conjunction with the rectifier assembly and interface/amplifier circuit card.

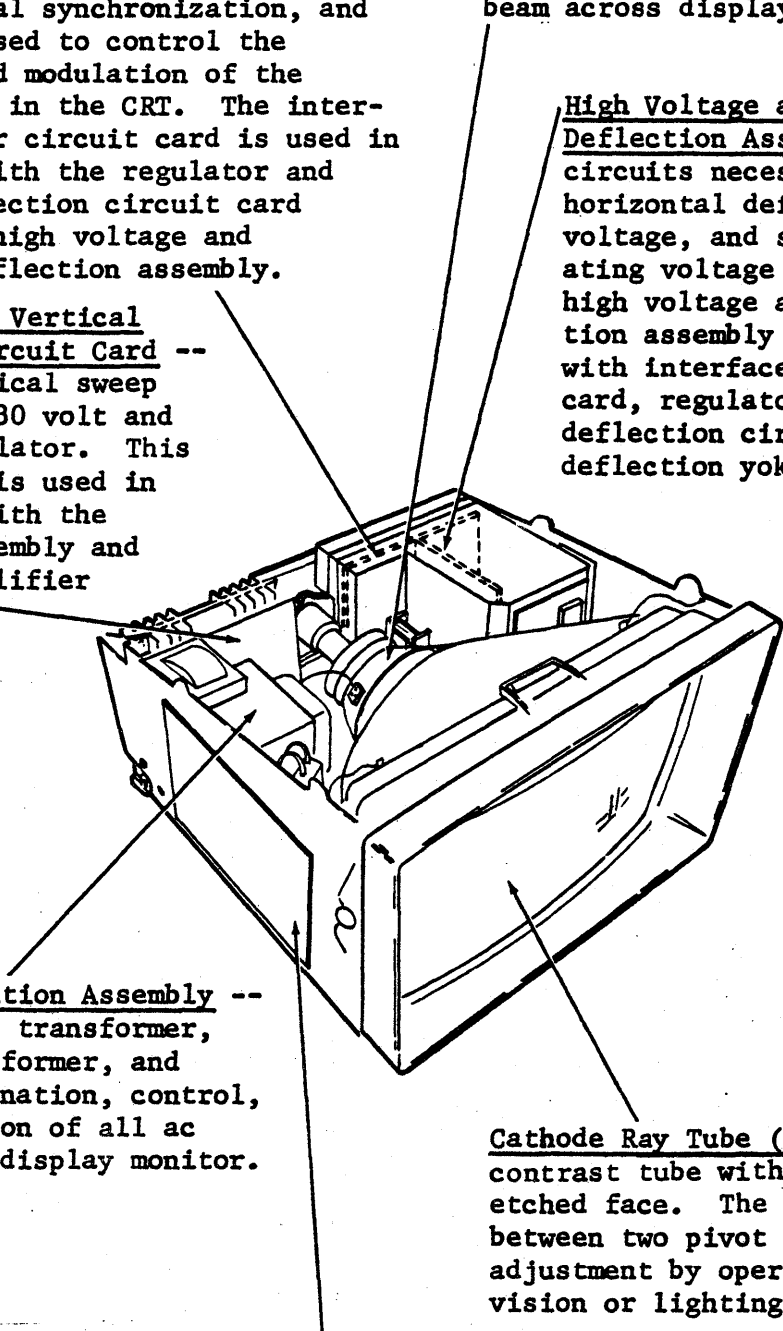
Deflection Yoke Assembly -- Contains horizontal and vertical coil windings that control the sweep of the electron beam across display screen.

High Voltage and Horizontal Deflection Assembly -- Contains circuits necessary to generate horizontal deflection, CRT bias voltage, and second anode accelerating voltage for the CRT. The high voltage and horizontal deflection assembly is used in conjunction with interface/amplifier circuit card, regulator and vertical deflection circuit card, and deflection yoke assembly.

Power Distribution Assembly -- Contains power transformer, filament transformer, and provides termination, control, and distribution of all ac power for the display monitor.

Cathode Ray Tube (CRT) -- Is a high contrast tube with a glare reducing etched face. The CRT is mounted between two pivot points to allow adjustment by operator for line of vision or lighting conditions.

Rectifier Assembly -- Contains rectifier circuit to provide unregulated +130 volts and +65 volts, vertical coupling capacitor, and interconnection to vertical choke. The rectifier assembly interfaces with power distribution assembly and regulator and vertical deflection circuit card.



D. TROUBLESHOOTING (Cont)5. REFERENCE MATERIAL (Cont)General Circuit DescriptionPower

Ac power is applied to power distribution assembly through the left support leg of display monitor and through the ac line filter assembly. At this time the pilot lamp lights and half power is supplied to the CRT filaments. By turning on display monitor control, full ac power is supplied to power distribution assembly where voltage is stepped up and applied to rectifier assembly. Normal filament voltage is now provided for CRT.

The rectifier assembly provides two filtered dc voltages for use on regulator assembly, unregulated +65 V and unregulated +130 V. The two indicator lamps on the circuit card indicate the presence of both dc voltages.

The regulator assembly has two regulators which provide +130 V and +65 V to the interface/amplifier assembly. The norm lamp on the circuit card should be on indicating regulated 130 volt power.

The voltages needed to bias CRT are processed and controlled by the interface/amplifier assembly. These voltages as well as the horizontal deflection current are generated by high voltage assembly.

The high voltage assembly also generates 17,000 V accelerating voltage for CRT. An indicator lamp on the circuit card indicates the presence of high voltage during normal operation.

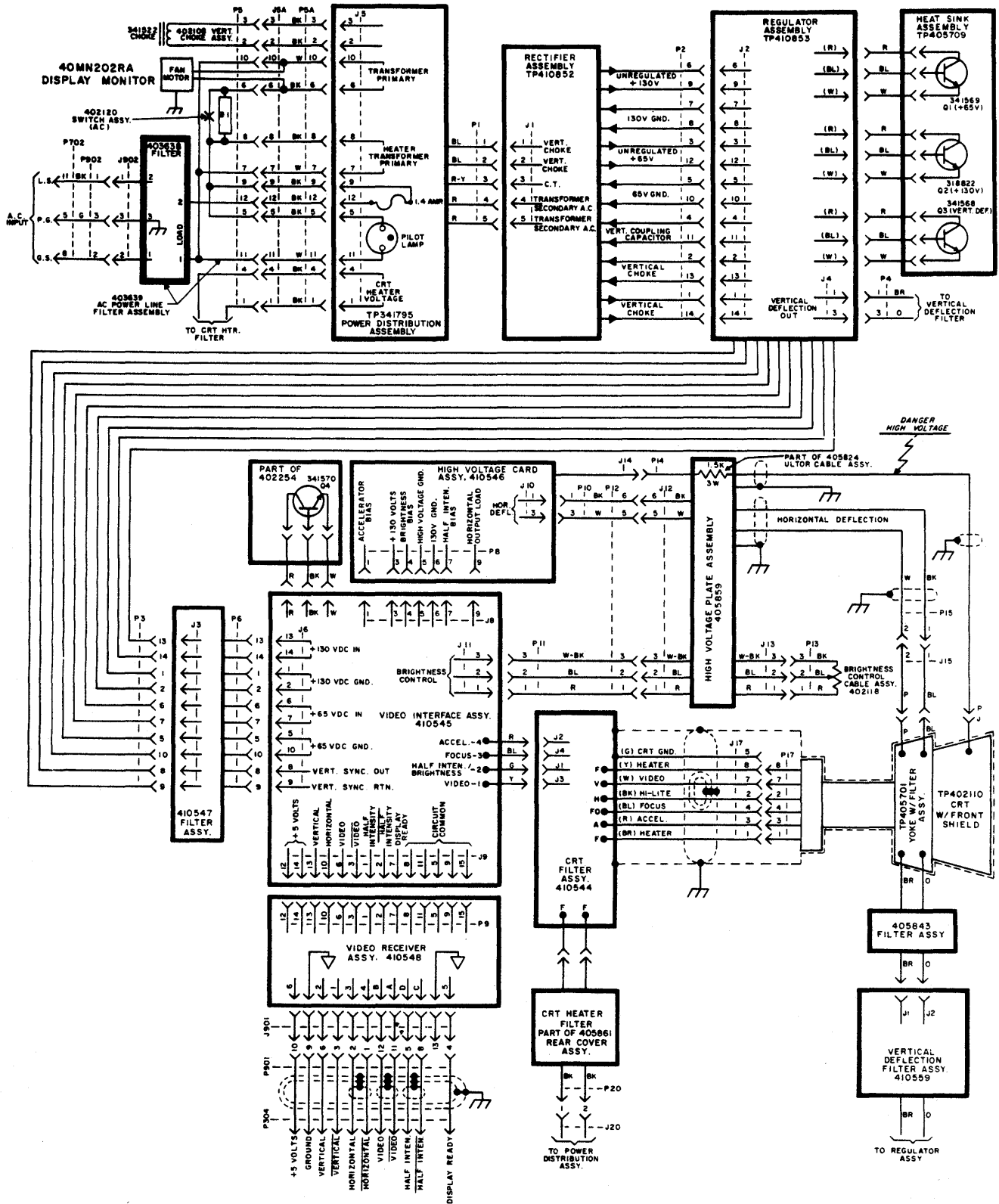
Deflection

In order to form characters, numbers, or symbols on the CRT screen, the CRT electron beam must be positioned from up to down, and from left to right across screen in successive sweeps.

This is done by generating two independent ramps of current coupled to the deflection yoke vertical and horizontal coils. One ramp of current is generated by the vertical sweep generator of the regulator assembly at a 60 Hz rate. The other ramp generated by the high voltage assembly sweeps the electron beam from left to right and back again at a 21,000 Hz rate.

Since horizontal rate is much faster than vertical rate, the electron beam will travel across the CRT screen 350 times during one vertical cycle, thereby, creating a uniform lighted area called the raster. Video signals from the display logic to CRT grid element turn the electron beam on or off at proper times during vertical raster deflection to accomplish writing of a character on display screen.

40MN202/RA Display Monitor



E. ADJUSTMENTS AND LUBRICATION

1. ADJUSTMENTS

Preliminary

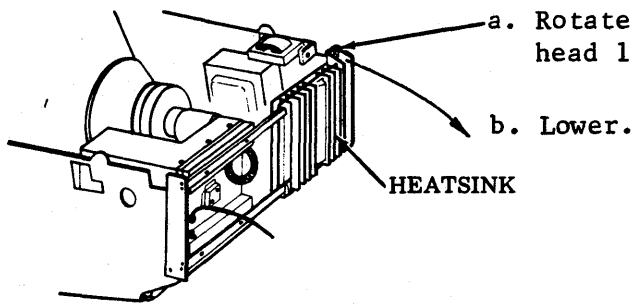
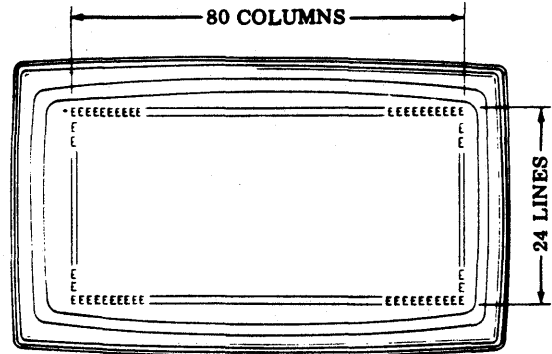
Display monitor electrical adjustments are made in conjunction with a full edit Tempest Model 40 KD Set or a Display Monitor Test Set as described on Page 4-13,

C. TESTING.

Before making any of the following electrical adjustments allow approximately 10 minutes of warmup time.

The majority of electrical adjustments require a displayed test pattern consisting of "E" characters derived from the KD set, or "□" characters derived from the test set, in all positions around the perimeter of the display.

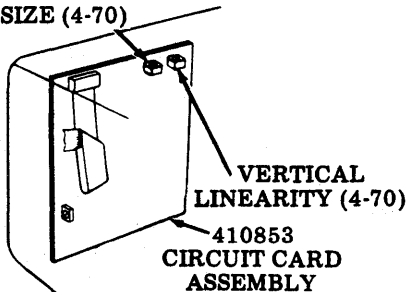
Electrical adjustments are made with monitor housing removed and rear heatsink lowered to a horizontal position.



**CAUTION:** WEAR SAFETY GLASSES WHEN MONITOR HOUSING IS REMOVED, AND OBSERVE ALL SAFETY PRECAUTIONS TO AVOID ACCIDENTAL ELECTRICAL SHOCK OR BREAKAGE OF THE CATHODE RAY TUBE.

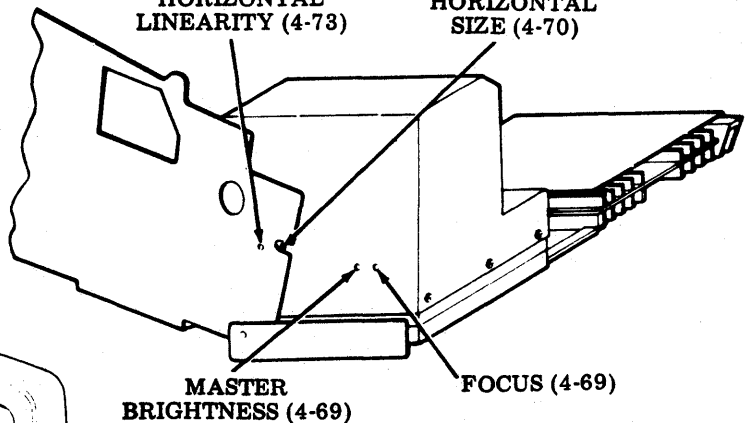
The number indicated in parentheses after each adjustment title designates the page covering the adjustment requirements and procedure.

VERTICAL SIZE (4-70)

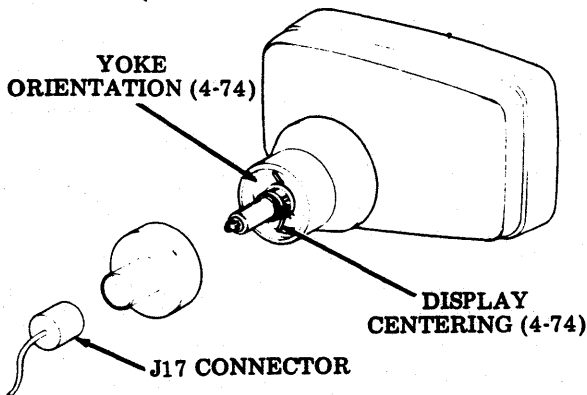


HORIZONTAL LINEARITY (4-73)

HORIZONTAL SIZE (4-70)



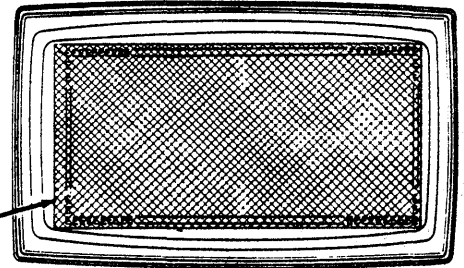
YOKE ORIENTATION (4-74)



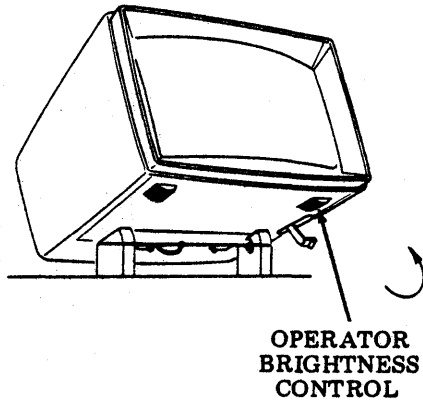
Master Brightness

Requirement: After a 3 minute warmup, the raster (lighted rectangular background) shall be just visible (not brilliant) with operator brightness control turned full counterclockwise to maximum intensity.

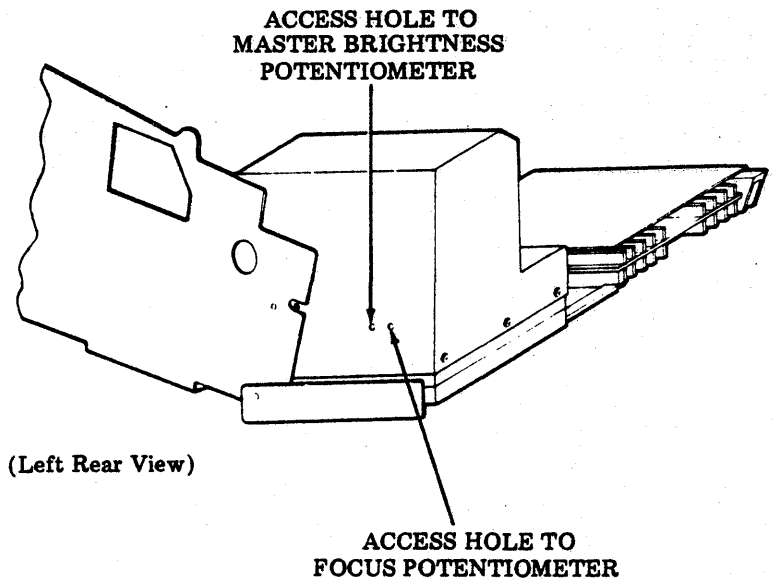
To Adjust: Rotate operator brightness control full counterclockwise for maximum intensity. Rotate master brightness potentiometer clockwise for darker; counterclockwise for brighter. Adjust for clearly visible raster.



RASTER (Lighted rectangular background area — shown as crosshatched area)



OPERATOR BRIGHTNESS CONTROL



(Left Rear View)

Focus Adjustment

Requirement: The display characters shall be well defined.

To Adjust: Rotate focus potentiometer to position giving sharpest display characters. For 410545 Issue 6A and later, if focus is unobtainable and sharpest setting of potentiometer is at counterclockwise extreme, remove cover from high voltage and video assembly. Cut strap ST (DANGER: POWER DOWN FIRST), immediately behind R29. Repeat Master Brightness and Focus adjustments. Replace cover from high voltage and video assembly.

E. ADJUSTMENTS AND LUBRICATION (Cont)

1. ADJUSTMENTS (Cont)

Vertical Size

Requirement: The height of the 24 lines shall be 5-1/4 inches  $\pm 1/8$  inch.

To Adjust: Rotate vertical size potentiometer clockwise to decrease; counter-clockwise to increase.

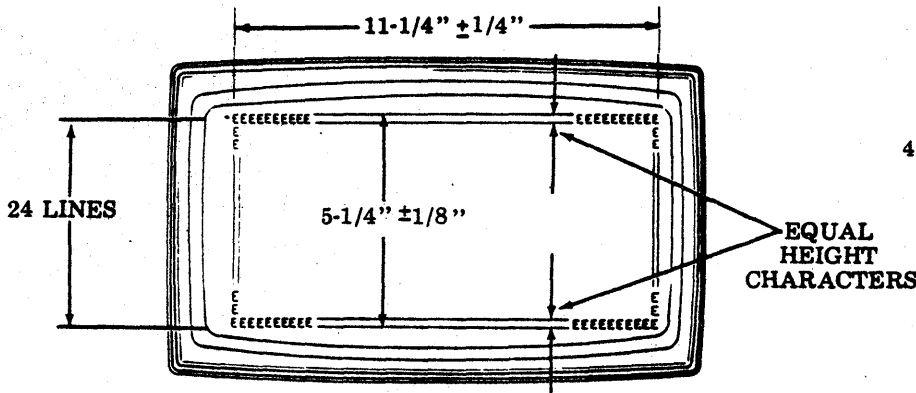
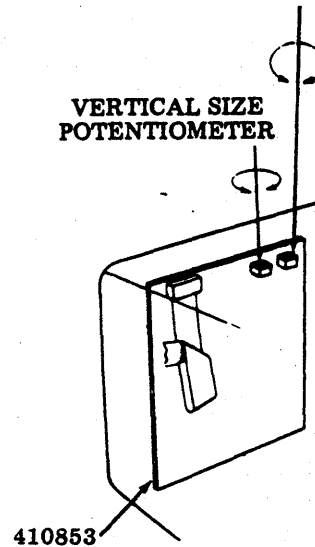
Vertical Linearity

Requirement: Character height shall be uniform throughout the display.

To Adjust: Rotate vertical linearity potentiometer clockwise to decrease top row; counterclockwise to decrease bottom.

VERTICAL LINEARITY  
POTENTIOMETER

VERTICAL SIZE  
POTENTIOMETER

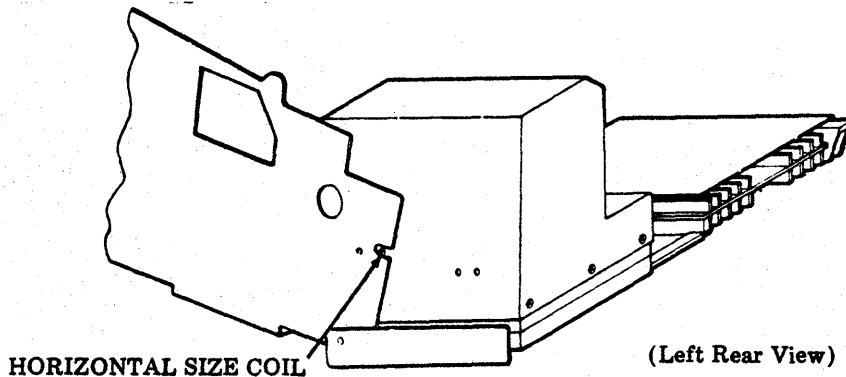


Horizontal Size

NOTE: Use 405992 monitor adjusting tool to perform this adjustment.

Requirement: The width of 80 characters shall be 11-1/4 inches  $\pm 1/4$  inch.

To Adjust: Rotate horizontal size coil clockwise to decrease width; counterclockwise to increase width.



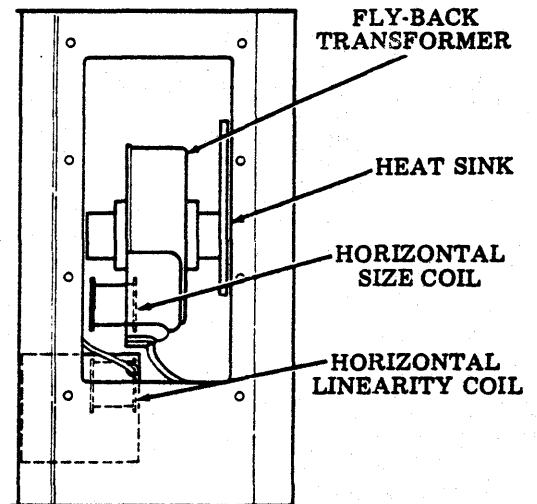
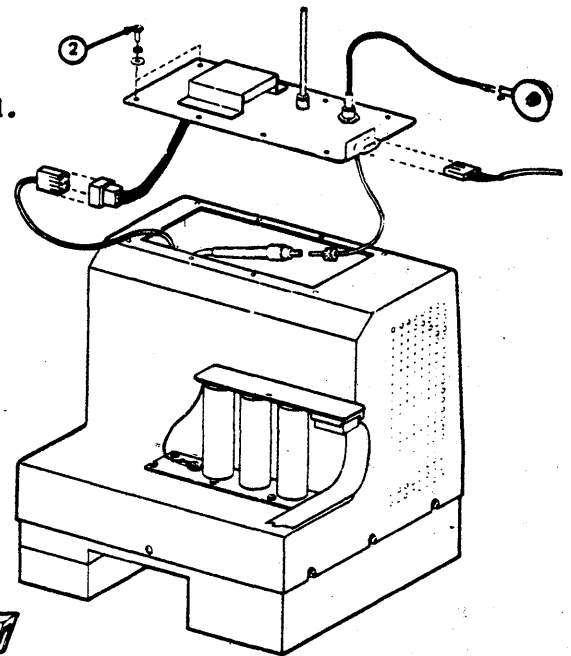
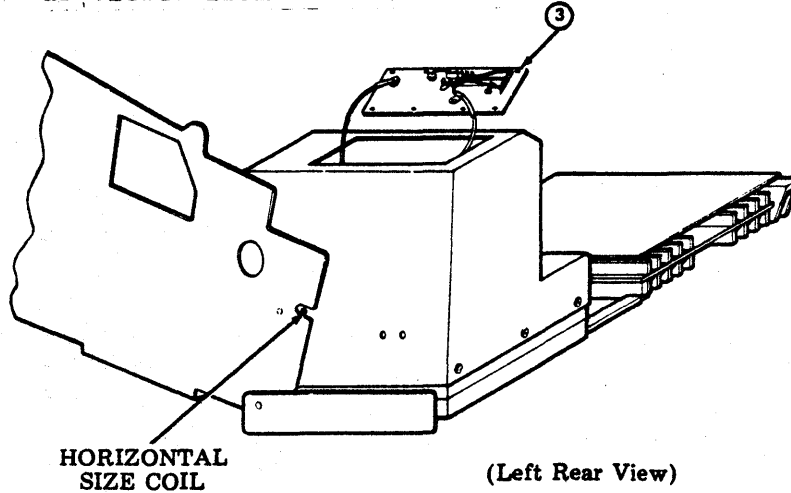


- ① Turn off main power switch.
- ② Remove eight 152893 screws, 110743 lock-washers and 125011 flat washers from 405859 high voltage plate assembly.
- ③ Position high voltage plate so that there is an unobstructed view of the horizontal size and linearity coils on the 410546 circuit card.

**NOTE:** On later design monitors, the horizontal drive cable is clamped to the high voltage plate assembly.

**WARNING:** BE SURE THAT TERMINALS AND/OR FEED THROUGH FILTERS ON THE HIGH VOLTAGE PLATE ASSEMBLY ARE NOT TOUCHING THE COPPER ENCLOSURE.

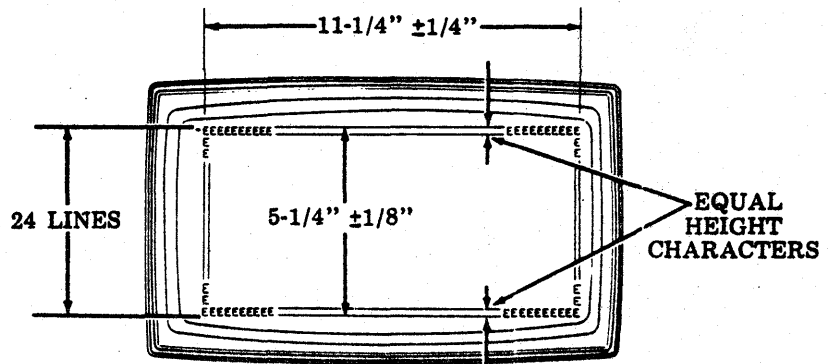
- ④ Turn on main power switch.
- ⑤ Insert the 405992 adjusting tool through the access hole on the left side of the enclosure as viewed from back of monitor.



While viewing through the top opening of the enclosure, route the 405992 past the heat sink on the fly-back transformer and into the horizontal size coil.

**DANGER:** DO NOT PUT FINGERS INSIDE THE ENCLOSURE AND DO NOT TOUCH COMPONENTS ON HIGH VOLTAGE PLATE ASSEMBLY.

- ⑥ Adjust horizontal size of display to 11-1/4 inches  $\pm 1/4$  inch.
- ⑦ Turn off main power switch.
- ⑧ Reassemble 405859 high voltage plate assembly by reversing the removal procedure.



Horizontal Size

E. ADJUSTMENTS AND LUBRICATION (Cont)

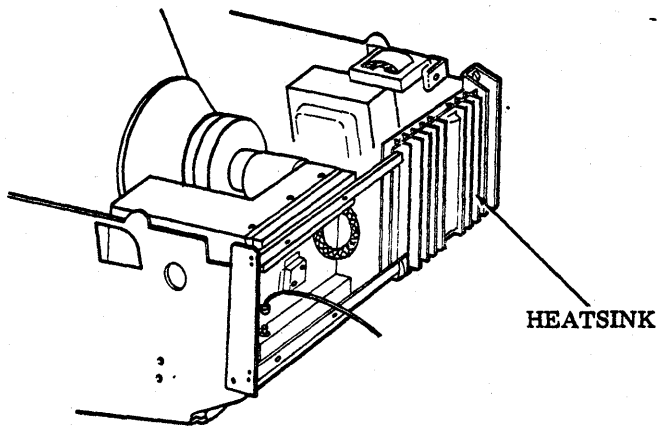
1. ADJUSTMENTS (Cont)

Horizontal Centering Adjustment (New)

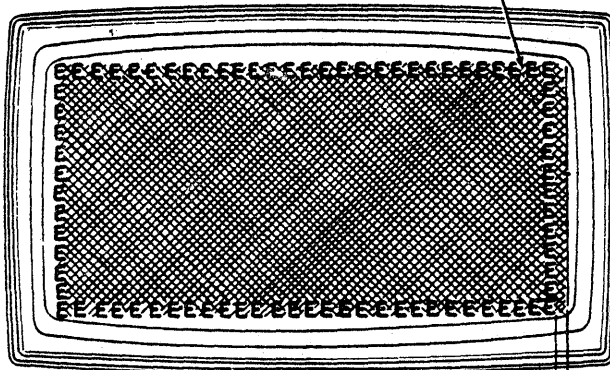
Requirement: (410545 Issue 6A and later), the space between the 80th character and the right edge of the raster should be 1 to 1-1/2 character width (gauged by eye) after a three minute warm-up.

To Adjust: Rotate horizontal centering potentiometer.

HORIZONTAL CENTERING  
POTENTIOMETER



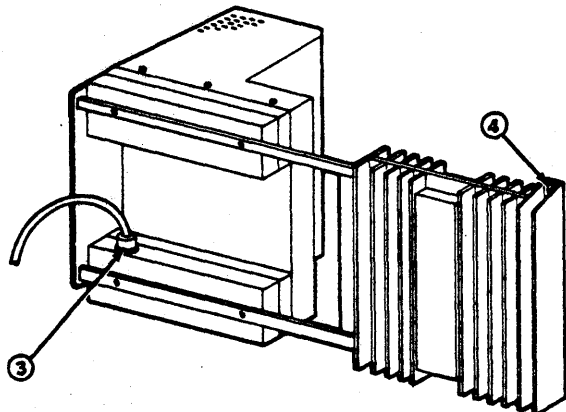
RASTER (Lighted rectangular  
background area shown as  
crosshatched area.)



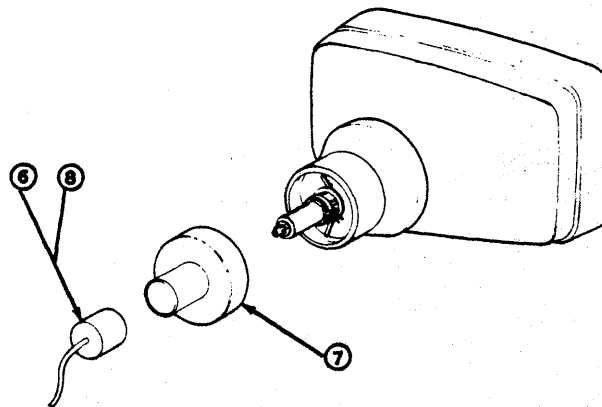
1 TO 1-1/2 CHARACTER WIDTH

Procedure for Access to Monitor Yoke and Centering Rings

- ① Turn main power switch off.
- ② Remove monitor cover.
- ③ Remove monitor P901 connector.
- ④ Release 1/4-turn fastener securing heat sink assembly and tilt heat sink assembly rearward.
- ⑤ Using tube tilt mechanism, tilt tube face downward.
- ⑥ Carefully remove CRT J17 connector.
- ⑦ Carefully remove 402112 shield assembly.
- ⑧ Replace CRT J17 connector.
- ⑨ Turn main power switch on.



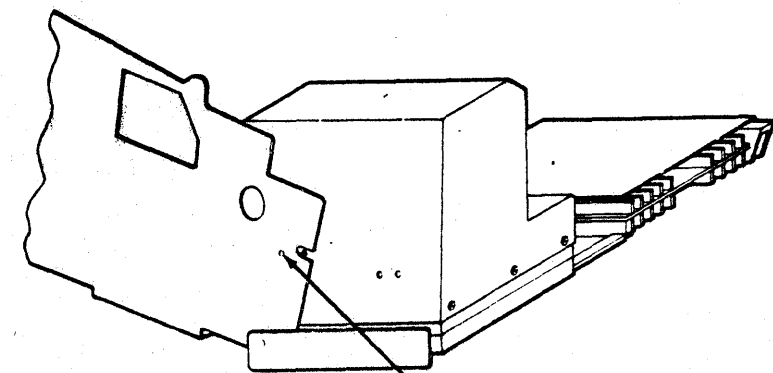
•To reinstall 402112 shield assembly reverse above procedure.



Horizontal Linearity

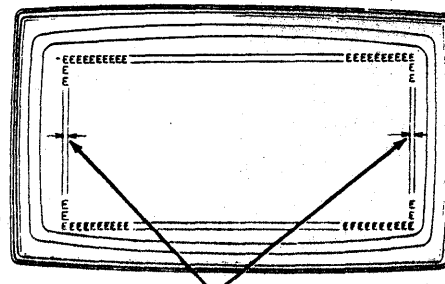
Requirement: Character width shall be uniform throughout the display as gauged by eye.

To Adjust: Rotate horizontal linearity coil for uniform width characters. Check and refine (if necessary) Horizontal Size adjustment.



(Left Rear View)

ACCESS HOLE TO HORIZONTAL LINEARITY COIL (In side frame and high voltage shield)

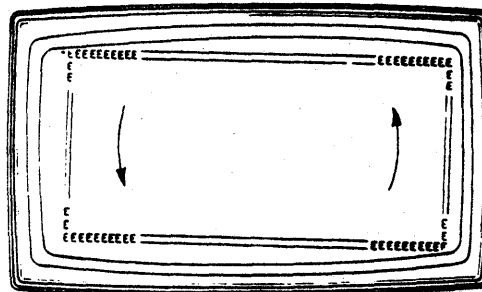


EQUAL WIDTH CHARACTERS (Gauged by eye)

E. ADJUSTMENTS AND LUBRICATION (Cont)1. ADJUSTMENTS (Cont)Yoke Orientation

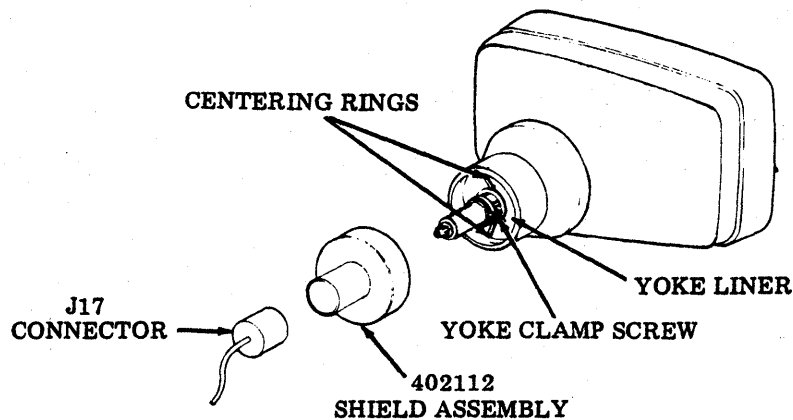
**Requirement:** The rectangular display area shall be aligned (rotationally) to the CRT face.

**CAUTION:** HIGH VOLTAGES ARE PRESENT AT YOKE. HANDLE ONLY BY YOKE LINER. THE NECK OF CRT IS FRAGILE. BE CAREFUL NOT TO STRIKE GLASS WITH SCREWDRIVERS, ETC. DO NOT OVERTIGHTEN YOKE CLAMP SCREW.



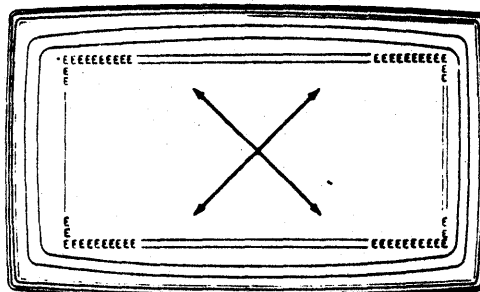
Rotate yoke to align display.

**To Adjust:** Loosen yoke clamp screw. Rotate yoke to align display with CRT face. Do not overtighten yoke clamp screw.

Display Centering

**Requirement:** The display (80 character by 24 lines) shall be centered on CRT face as gauged by eye.

**To Adjust:** Rotate two display centering rings by tabs.



Display movement as centering rings are rotated.

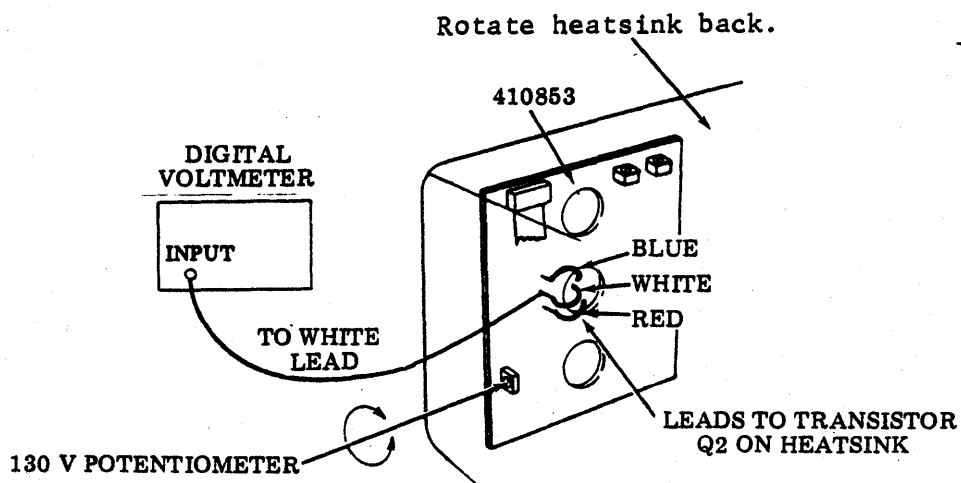
**130 VOLT ADJUSTMENT**

**NOTE:** The 130 V adjustment is preset at the factory, and should not be remade unless:

- There is definite indication that adjustment is not correct. Refer to Test and Troubleshooting Sections C and D.
- Components on 410853 circuit card have been replaced during repair.

**Requirement:** The voltage at the emitter of transistor Q2 (318822) on heatsink shall be 130 V dc  $\pm 1.3$  V.

**To Adjust:** Connect voltmeter input to white lead going to emitter of Q2 on heatsink. Rotate 130 V potentiometer to adjust measured voltage to 130 V dc. Apply small amount of Glyptal to 130 V potentiometer adjusting screw.

**2. LUBRICATION**

None required.

## F. DISASSEMBLY/REASSEMBLY AND PARTS

### 1. GENERAL

This section provides removal and disassembly procedures of various display monitor assemblies. For identification and removal of soldered-in circuit card components, refer to Page 4-30, 4. DETAILED TROUBLE ANALYSIS or wiring diagram package WDPO460.

Included in this section are exploded assembly views detailing individual part numbers and a numerical listing of parts referenced to page numbers of the exploded views. This information will be found on Page 4-111, 3. PARTS.

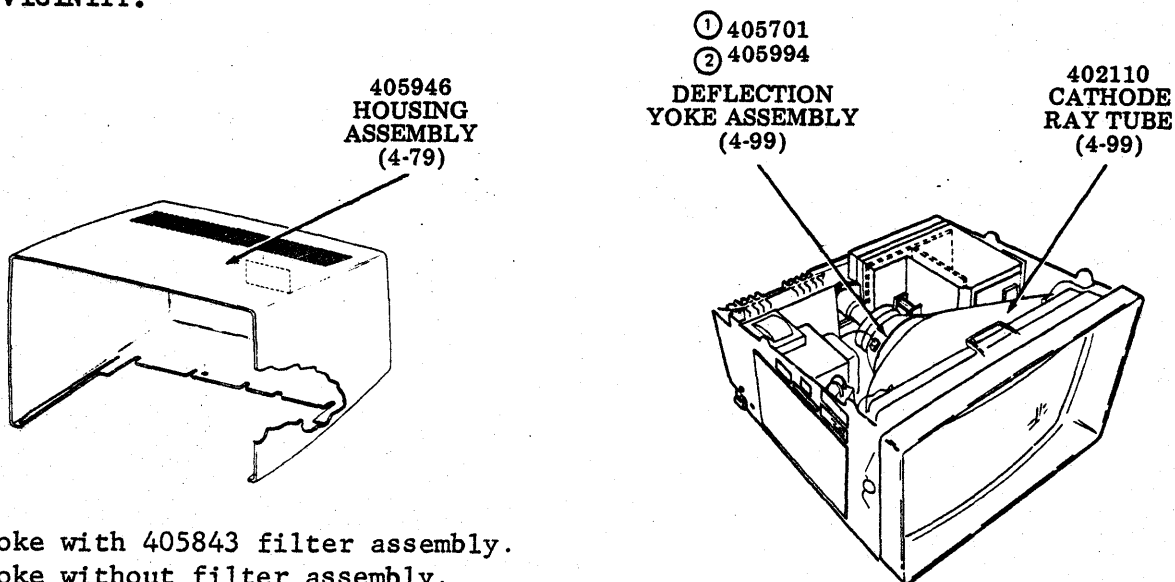
When removing a subassembly or part, follow the order of removal as indicated by the circled numbers, such as ①, ②, etc. Do NOT force or pry any parts to provide clearance for removal.

Refer to Page 4-2, 2. TOOLS, TEST EQUIPMENT, AND MISCELLANEOUS for a listing of tools required to disassemble or reassemble the display monitor unit.

After disassembly and reassembly of a subassembly or component are performed, the associated adjustments shall be checked, and relubrication (if applicable) shall be performed. For adjustments and lubrication of the monitor refer to Page 4-70, E. ADJUSTMENTS AND LUBRICATION.

For all disassembly or reassembly procedures or when disconnecting or reconnecting any electrical components of the display monitor, all power and video signals to the monitor shall be turned OFF to avoid safety hazards and prevent electrical component damage. A recommended safety practice is to unplug all ac input power cords.

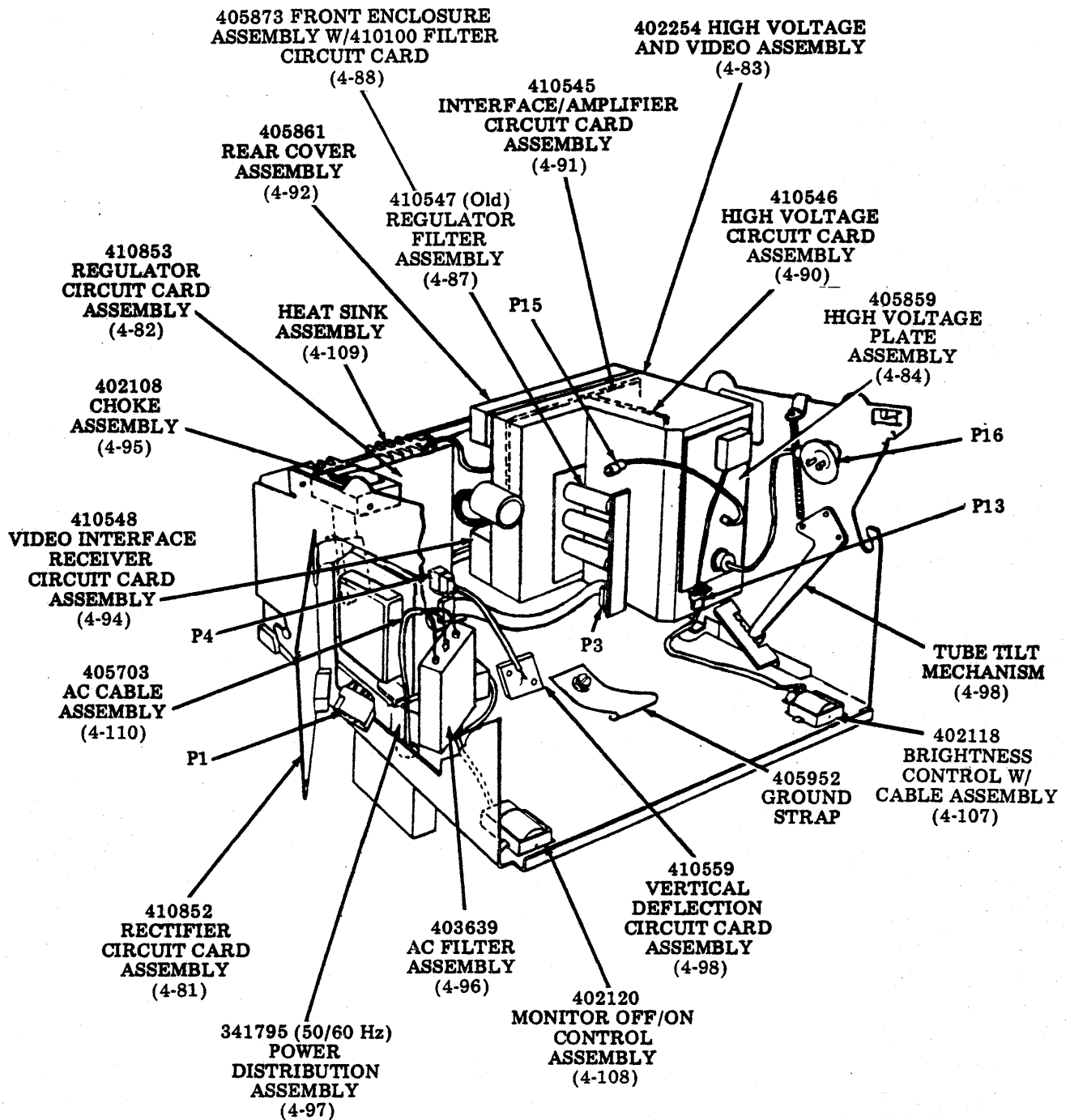
**CAUTION:** WEAR APPROVED SAFETY GLASSES WHEN THE MONITOR HOUSING IS REMOVED, AS THE DISPLAY TUBE IS FRAGILE IN THE NECK AREA AND IS SUBJECT TO IMPLOSION IF BROKEN. BE CAREFUL NOT TO STRIKE THE GLASS TUBE WITH TOOLS OR COMPONENTS WHEN WORKING IN ITS VICINITY.



- ① Yoke with 405843 filter assembly.
- ② Yoke without filter assembly.

**NOTE:** To remove a subassembly or individual part, follow the procedure on page referenced in parentheses.

**NOTE:** The number indicated in parentheses after each assembly designates the page covering the disassembly/reassembly procedures.



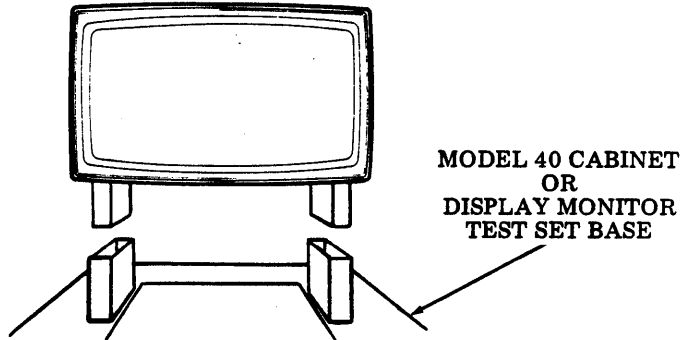
NOTES



2. DISASSEMBLY/REASSEMBLY

The disassembly/reassembly procedures are based upon the following initial conditions unless otherwise specified:

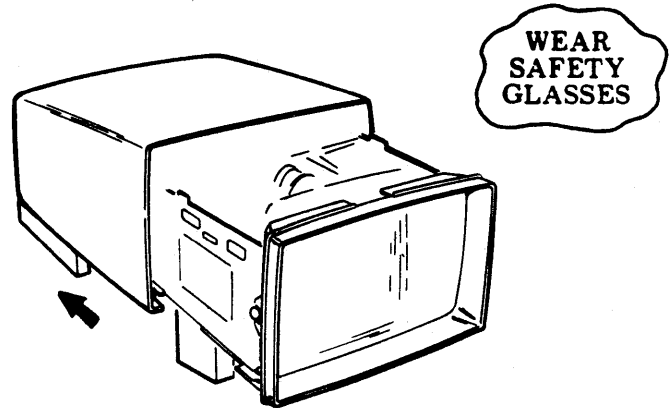
The display monitor shall be placed on a suitable holding fixture.



405946 Housing Assembly

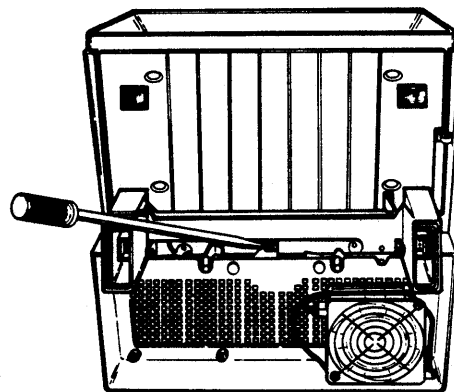
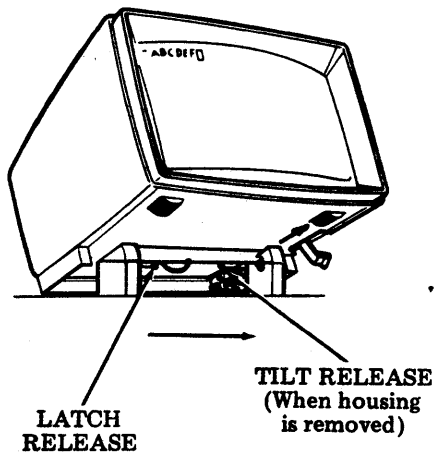
② Removal of monitor housing:

Disconnect the fan cable and ground strap and route cable out of cover through opening in rear of the shroud assembly.



③ Disengage latch. New cover latch has rectangular hole to accept a tool (small screwdriver) to unlatch display cover.

④ Move housing back.



(Bottom View)  
(Late Design)

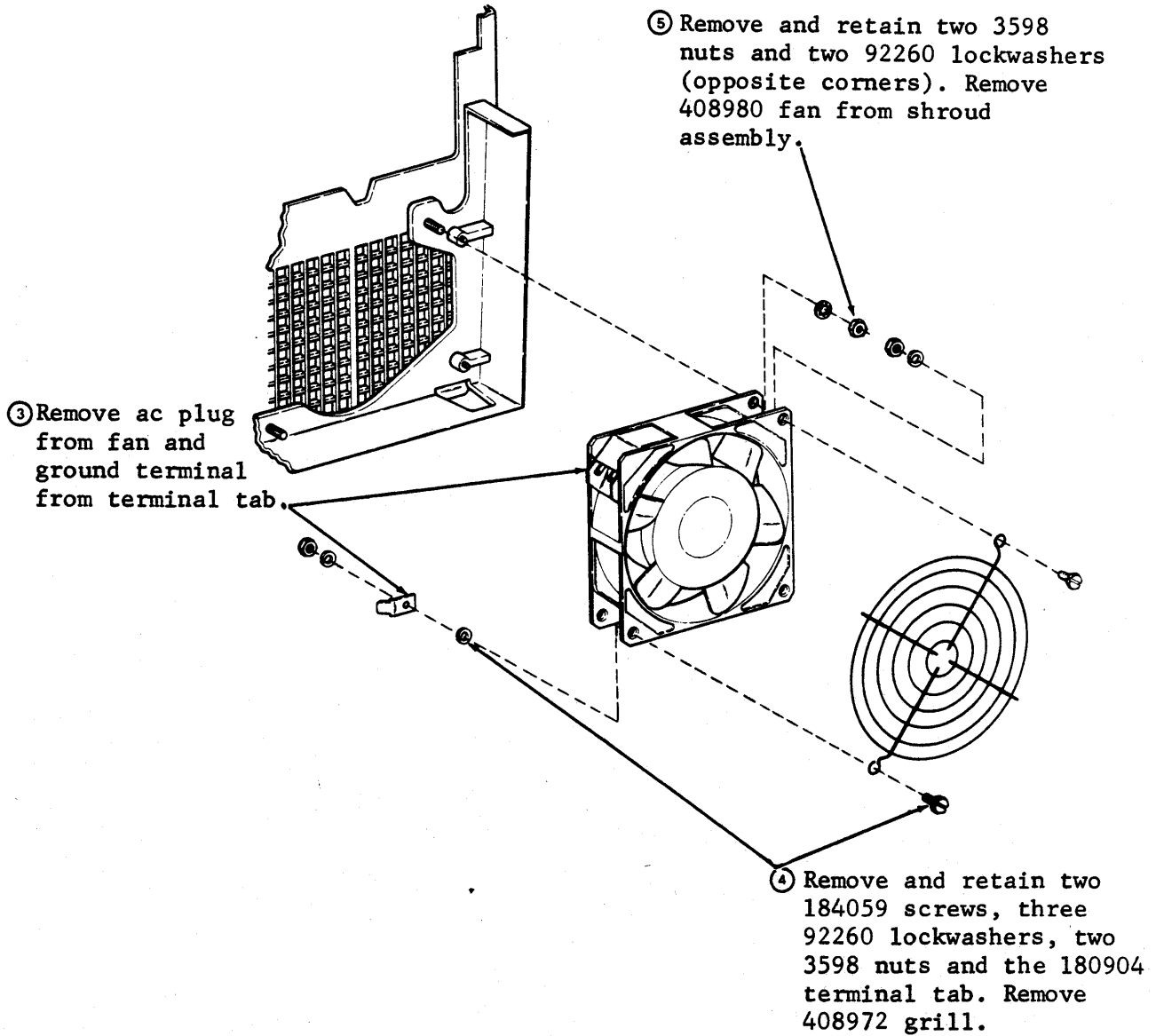
New cover latch has rectangular hole to accept a tool (small screwdriver) to unlatch monitor cover.

F. DISASSEMBLY/REASSEMBLY AND PARTS (Cont)

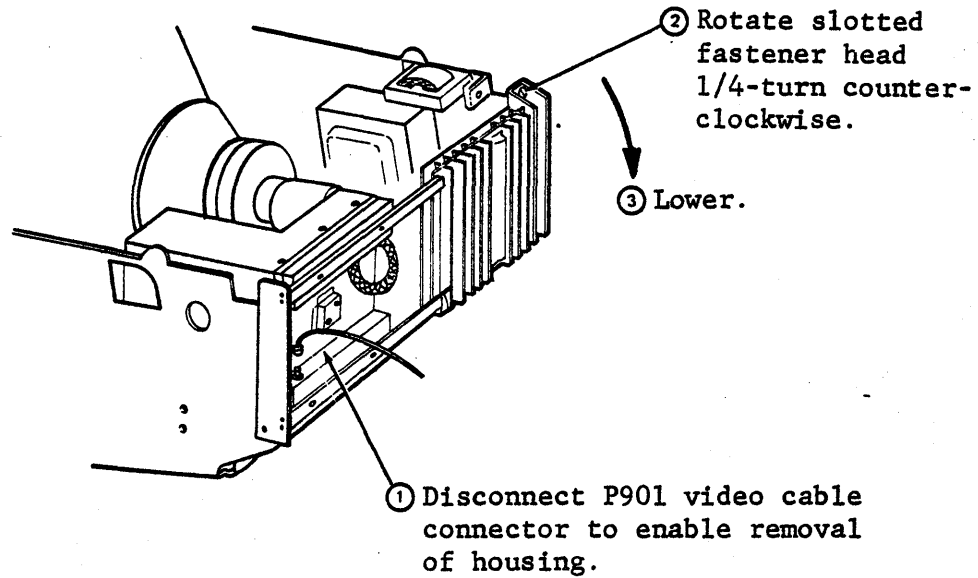
2. DISASSEMBLY/REASSEMBLY (Cont)

408980 Fan Assembly

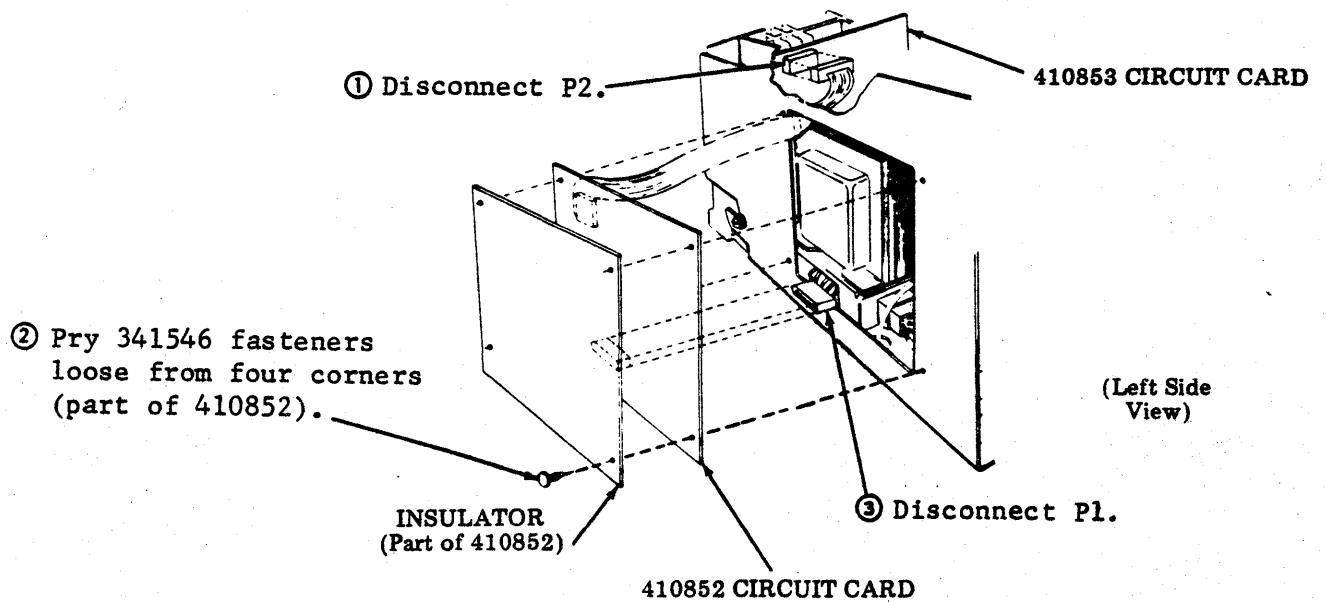
- ① Remove monitor and place on end for access to shroud assembly with fan.
- ② Remove the six self-threading screws and flat washers that hold the shroud assembly to the cover. Remove the shroud assembly from the cover assembly.



Heat Sink to Lowered Position



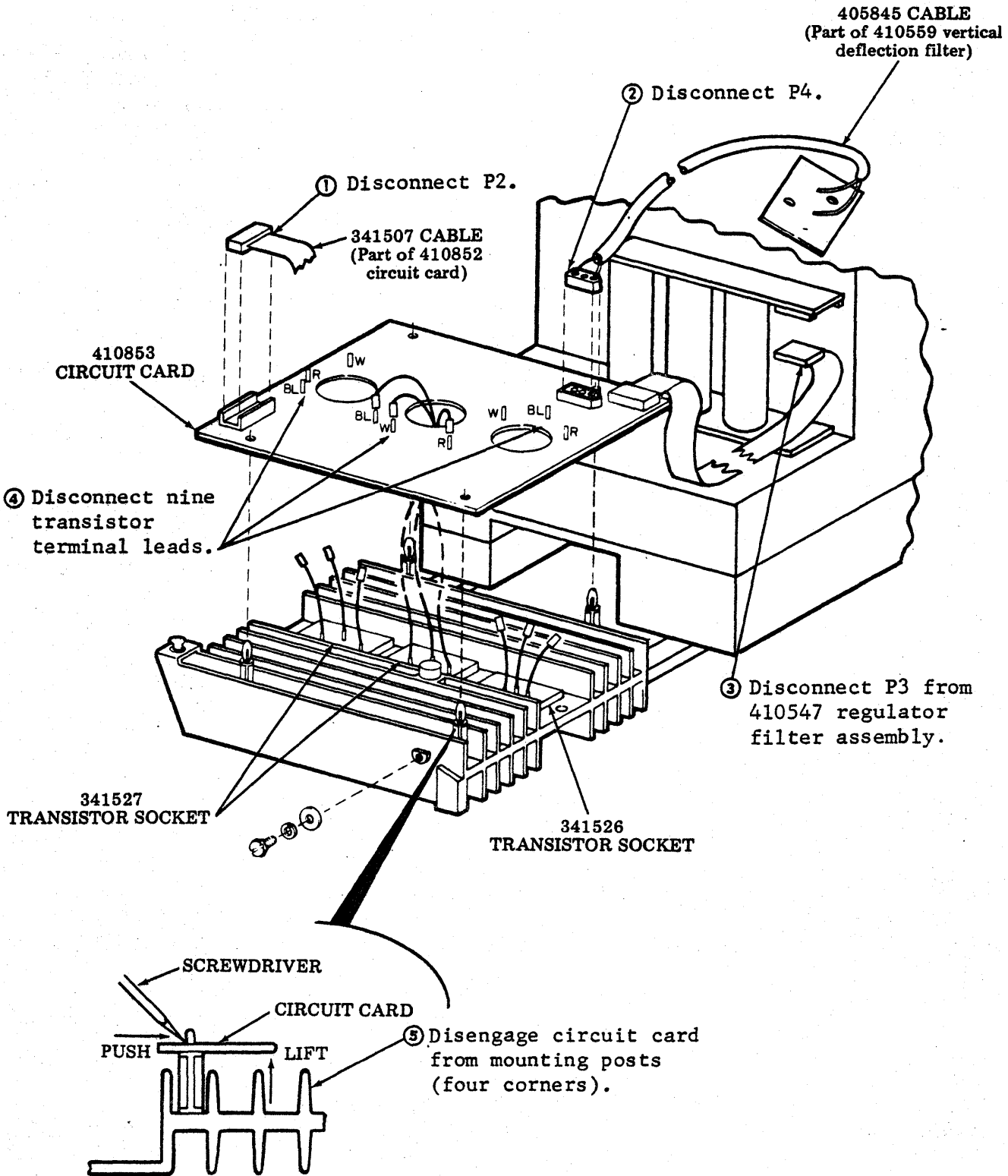
410852 Rectifier Circuit Card Assembly



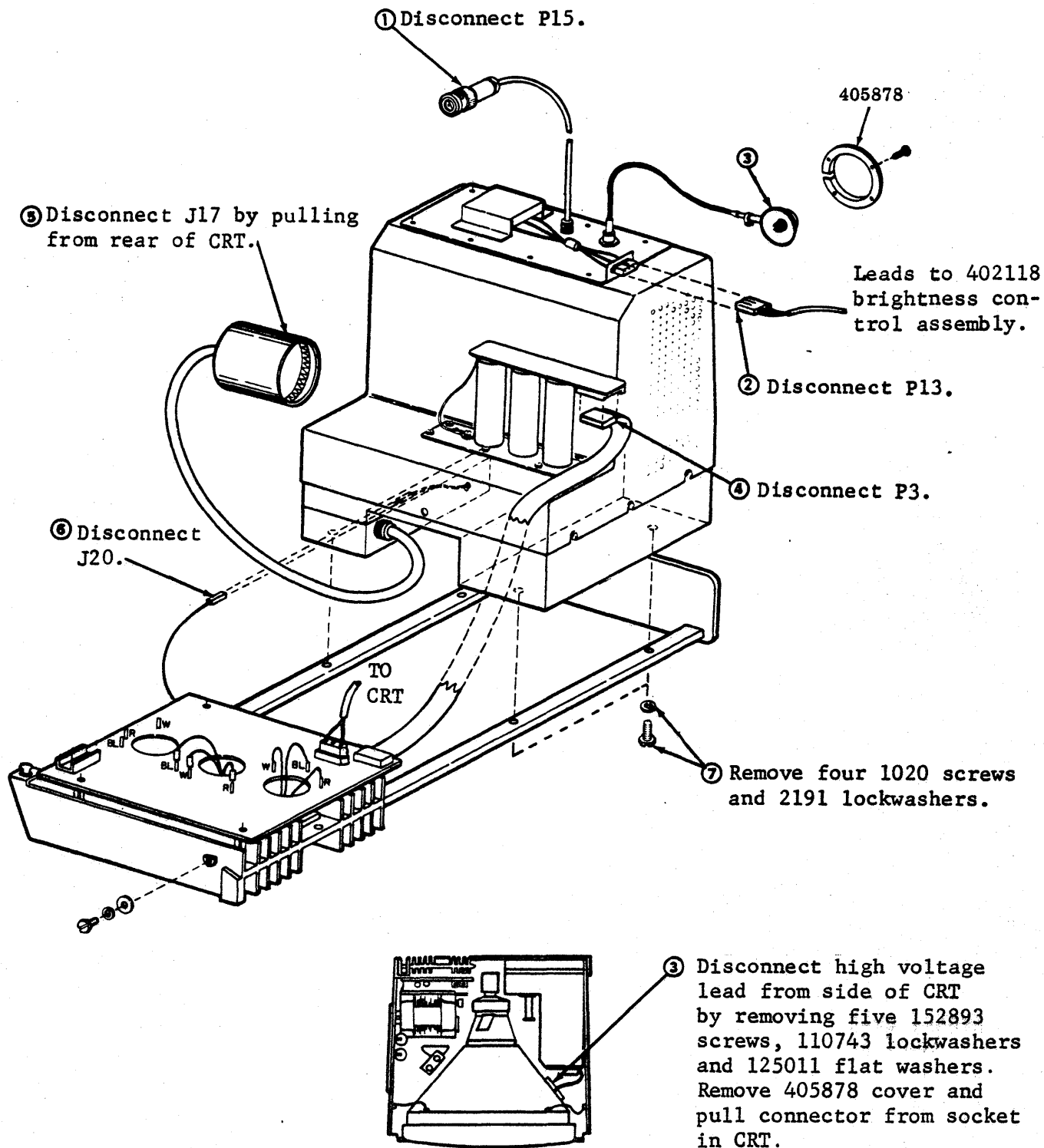
F. DISASSEMBLY/REASSEMBLY AND PARTS (Cont)

2. DISASSEMBLY/REASSEMBLY (Cont)

410853 Regulator Circuit Card Assembly



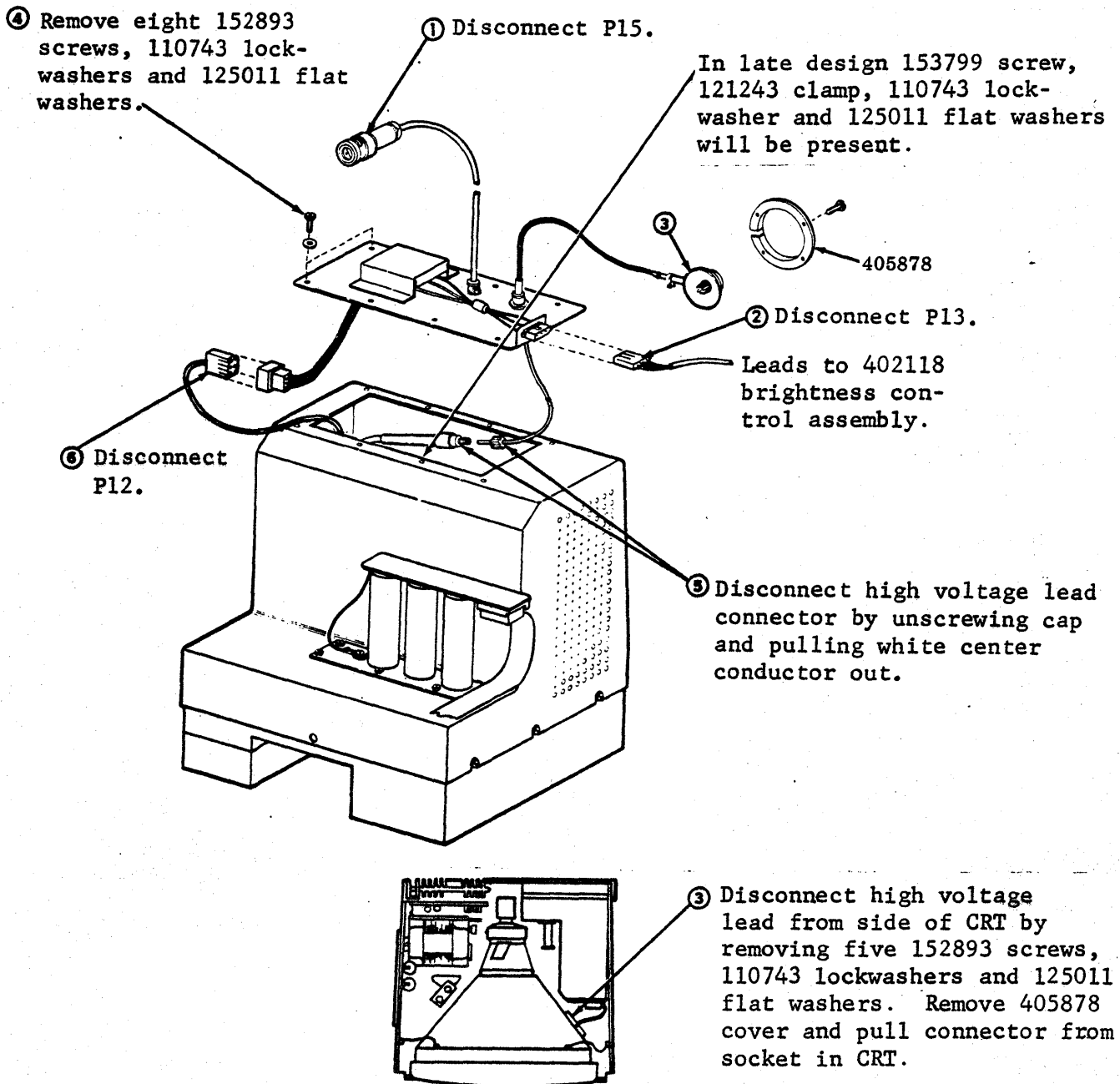
402254 High Voltage and Video Assembly



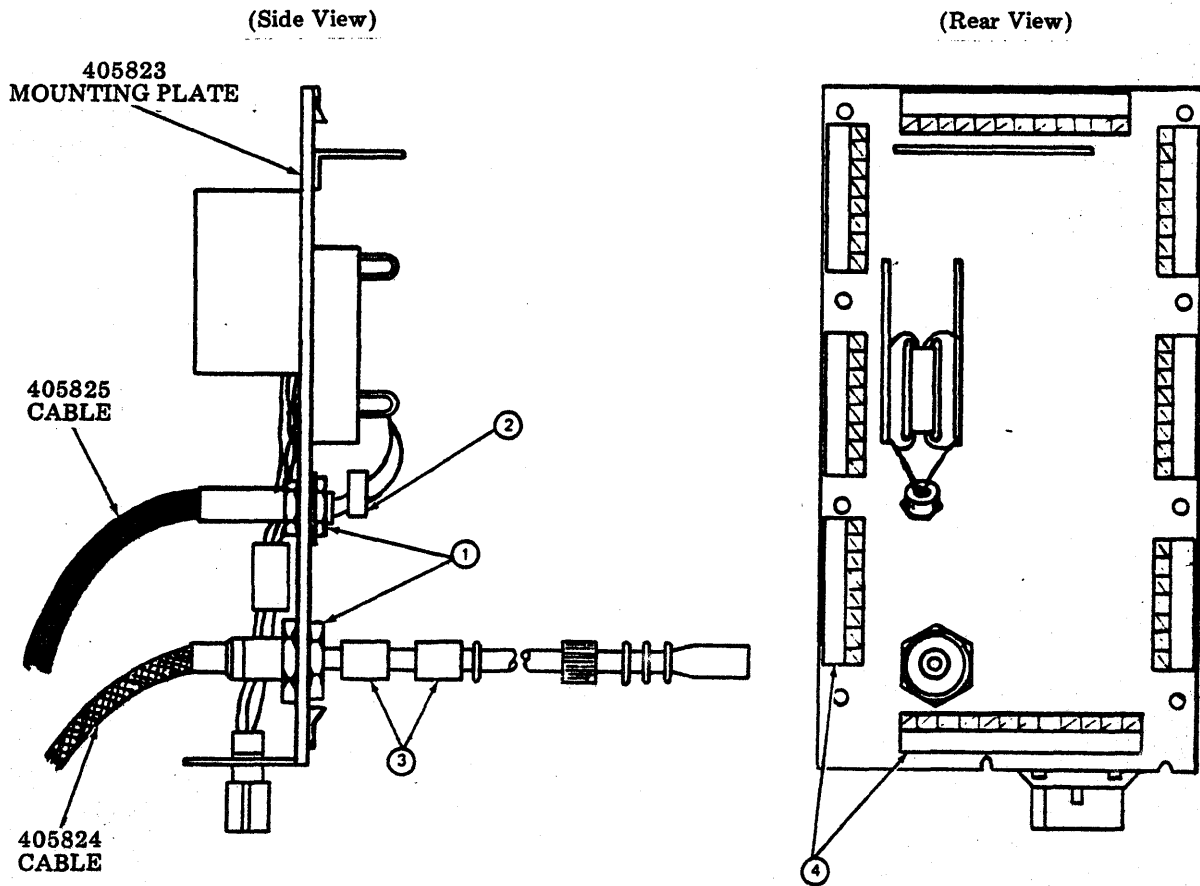
F. DISASSEMBLY/REASSEMBLY AND PARTS (Cont)

2. DISASSEMBLY/REASSEMBLY (Cont)

405859 High Voltage Plate Assembly



**NOTE:** During reassembly of 405859 high voltage plate assembly, the requirements specified on the following pages should be checked and met to insure proper operation of the monitor.

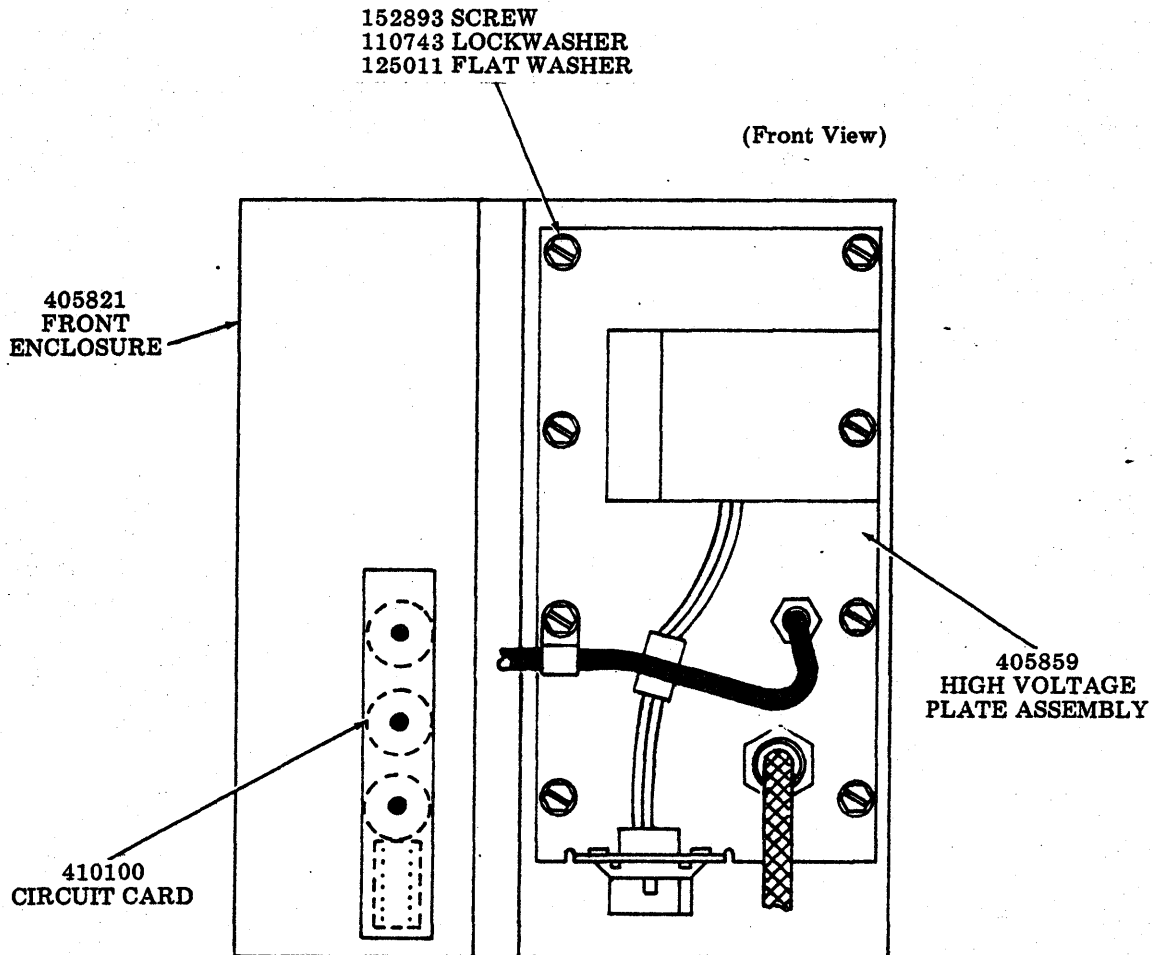
High Voltage Plate Assembly

- ① The hex nuts that mount the two 405824 and 405825 cable assemblies must be tight and secure to the 405823 mounting plate.
- ② The 403694 ferrite sleeve must be on the 405825 cable assembly when mounted to the 405823 high voltage plate.
- ③ The 408974 ferrite sleeve (two required) must be on the 405824 cable assembly when mounted to the 405823 high voltage plate.
- ④ The presence of eight segments of 39628RM contact strip must be around the perimeter and between the 405823 mounting plate and the 405821 front housing when assembled.

F. DISASSEMBLY/REASSEMBLY AND PARTS (Cont)

2. DISASSEMBLY/REASSEMBLY (Cont)

Front Enclosure With High Voltage Plate Assembly

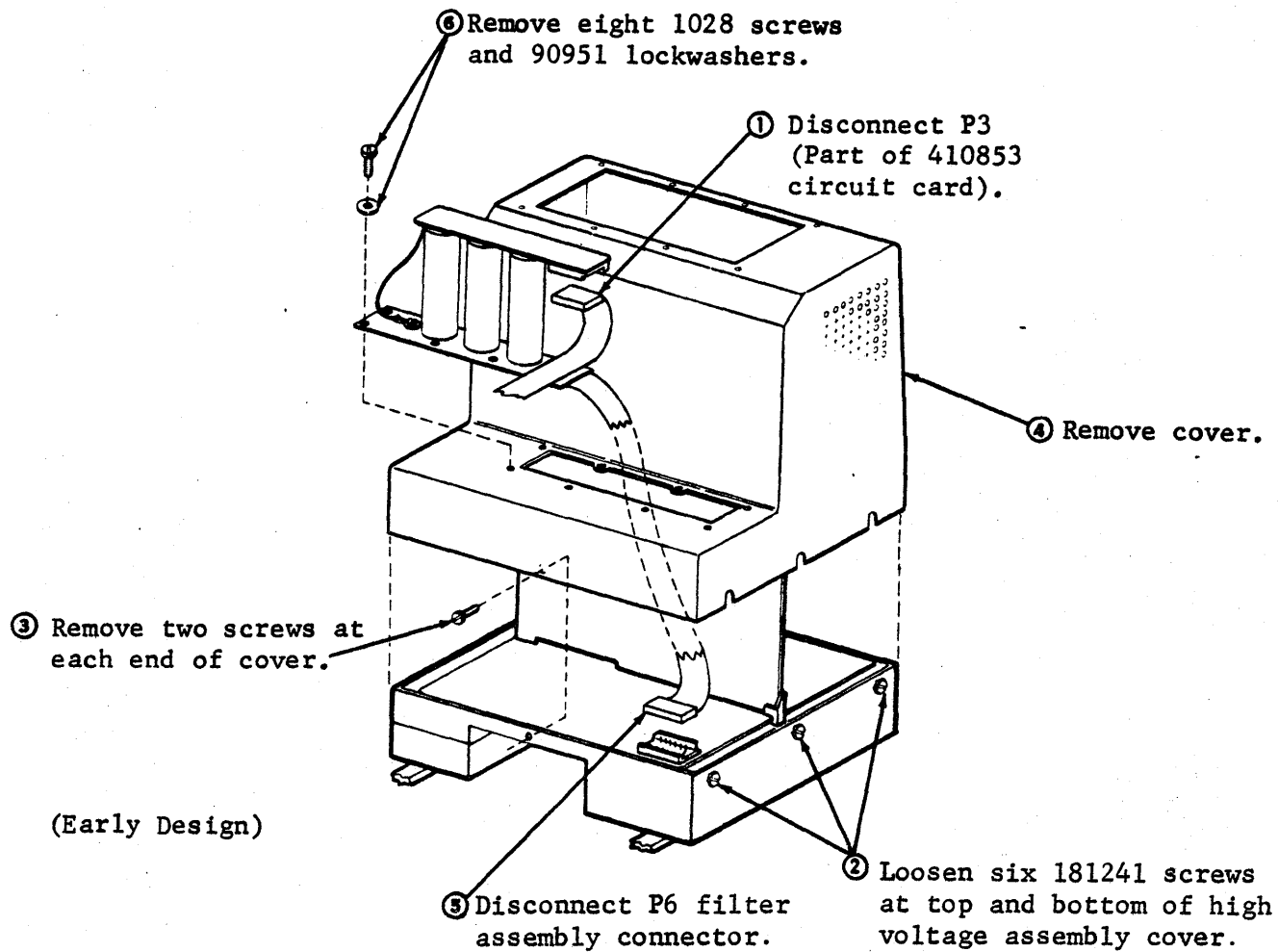


The eight 152893 hex head screws, 110743 lockwashers and 125011 flat washers must be tight and secure when 405859 high voltage plate assembly is mounted to 405821 front housing.



410547 Regulator Filter Assembly

- Remove 405859 high voltage plate assembly (4-87).

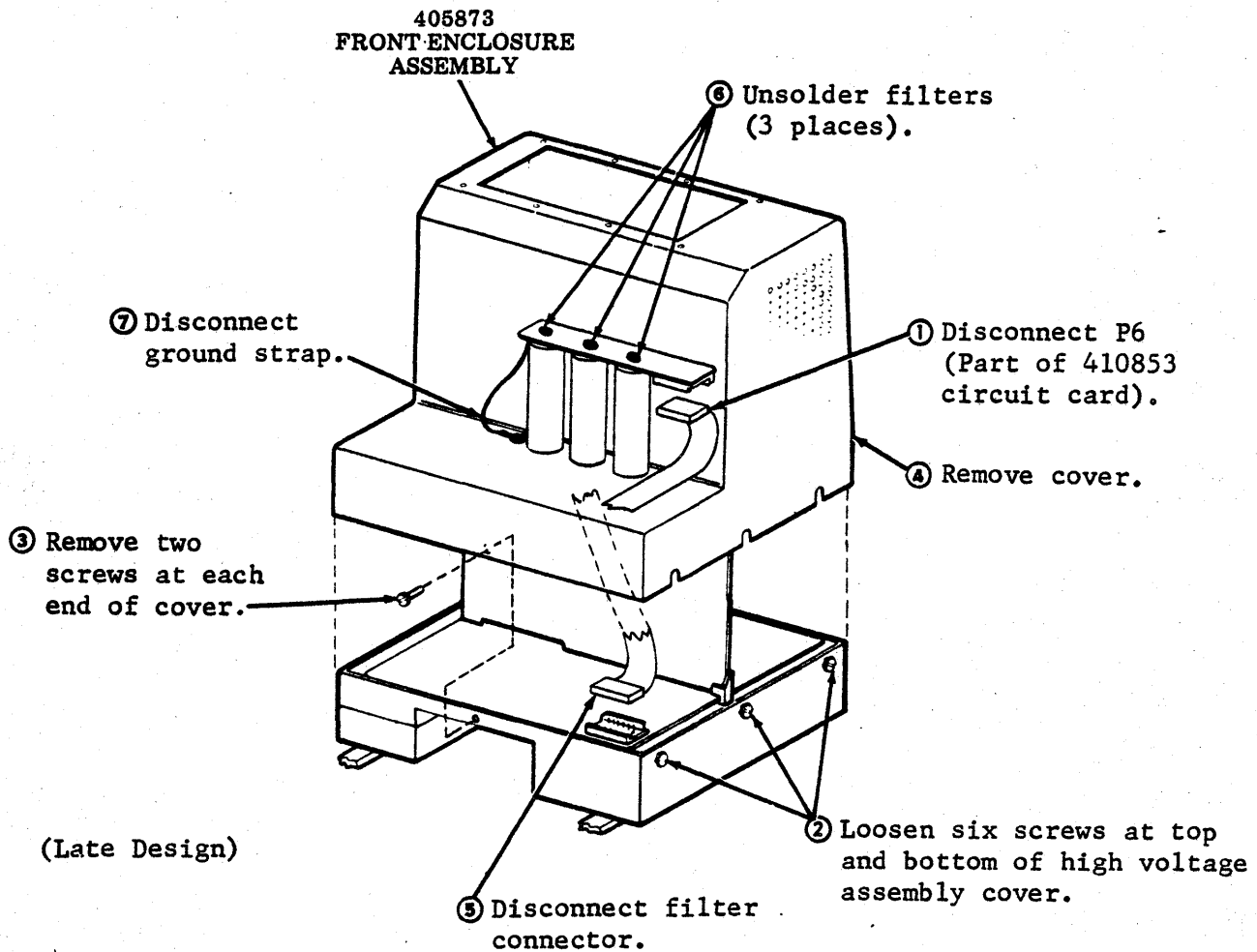


F. DISASSEMBLY/REASSEMBLY AND PARTS (Cont)

2. DISASSEMBLY/REASSEMBLY (Cont)

410100 Circuit Card Assembly

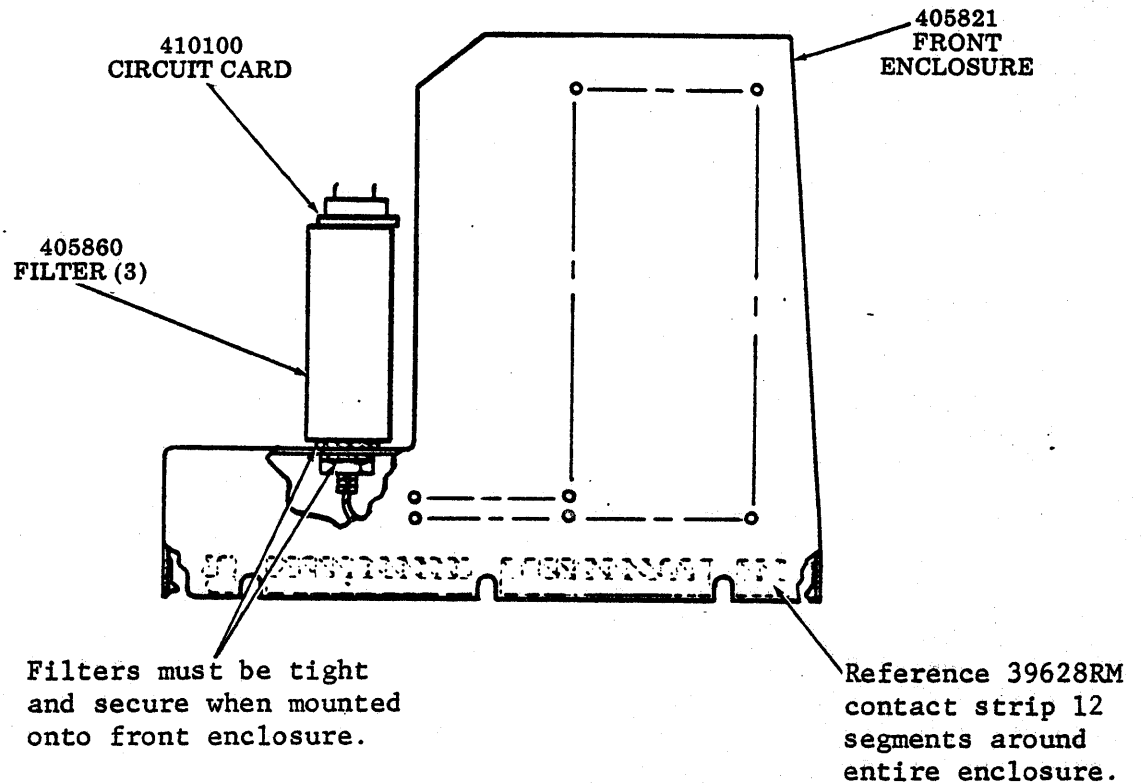
- Remove 405859 high voltage plate assembly (4-88).



**NOTE:** During reassembly, the requirements specified on the following page should be checked and met to insure proper operation of the monitor.

405873 Regulator Filter Assembly

(Top View)



The three 405860 tubular filter cartridges must be tight and secure when mounted onto the 405821 front housing.

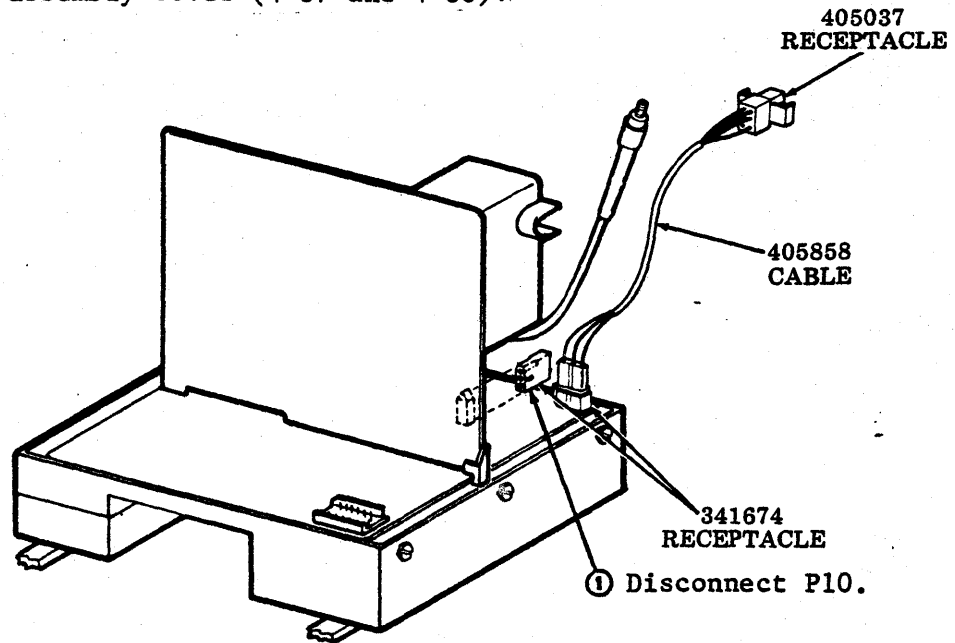
At the lower edge of the 405821 front housing, check for the presence of (12) segments of 39628RM contact strip around entire opening and make sure that they are parallel to the lower edge.

F. DISASSEMBLY/REASSEMBLY AND PARTS (Cont)

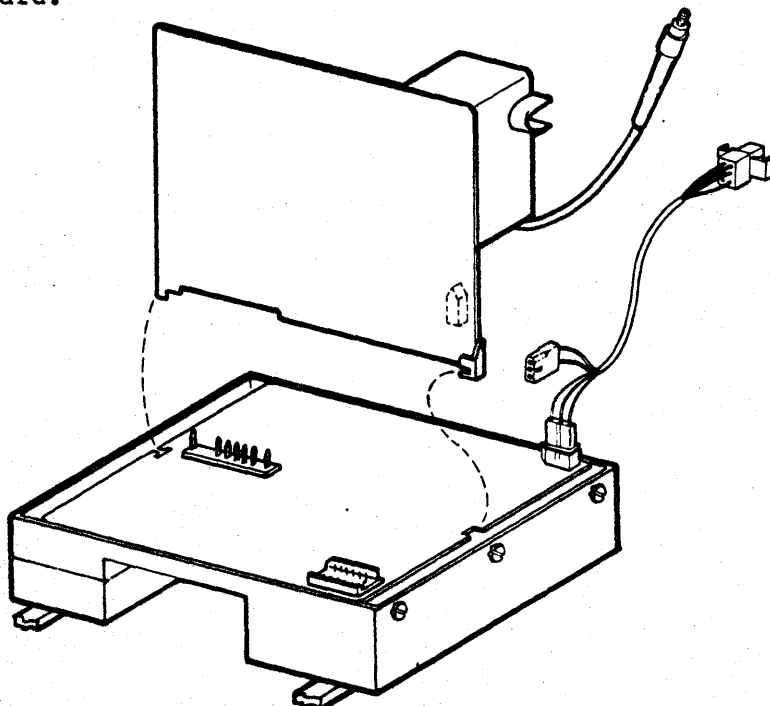
2. DISASSEMBLY/REASSEMBLY (Cont)

410546 High Voltage Circuit Card Assembly

- Remove 405859 high voltage plate assembly (4-84).
- Remove high voltage assembly cover (4-87 and 4-88).

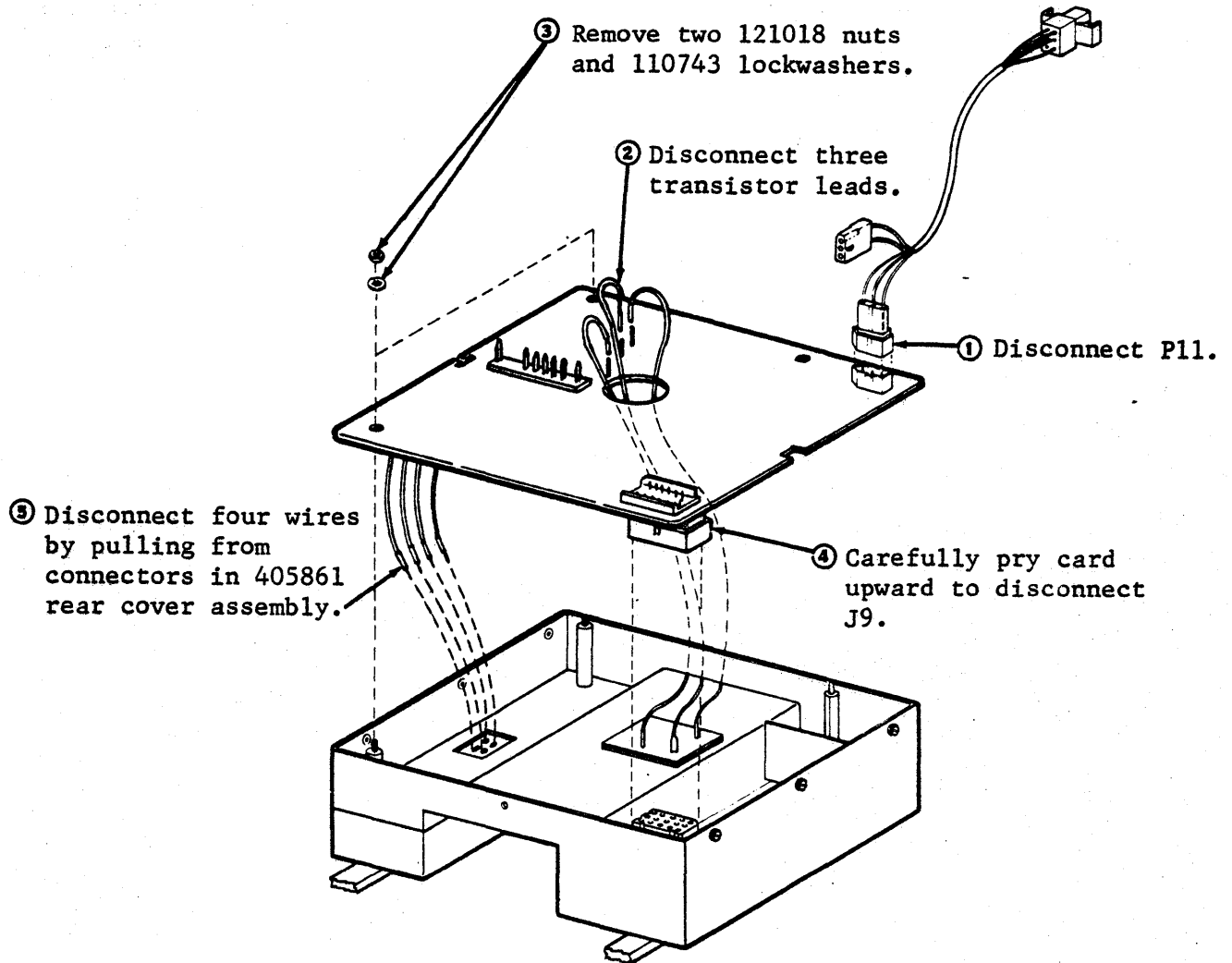


- ② Rotate and unhook 410546 circuit card.



410545 Interface/Amplifier Circuit Card Assembly

- Remove 405859 high voltage plate assembly (4-84).
- Remove high voltage assembly cover (4-87 and 4-88).
- Remove 410546 high voltage circuit card assembly (4-90).

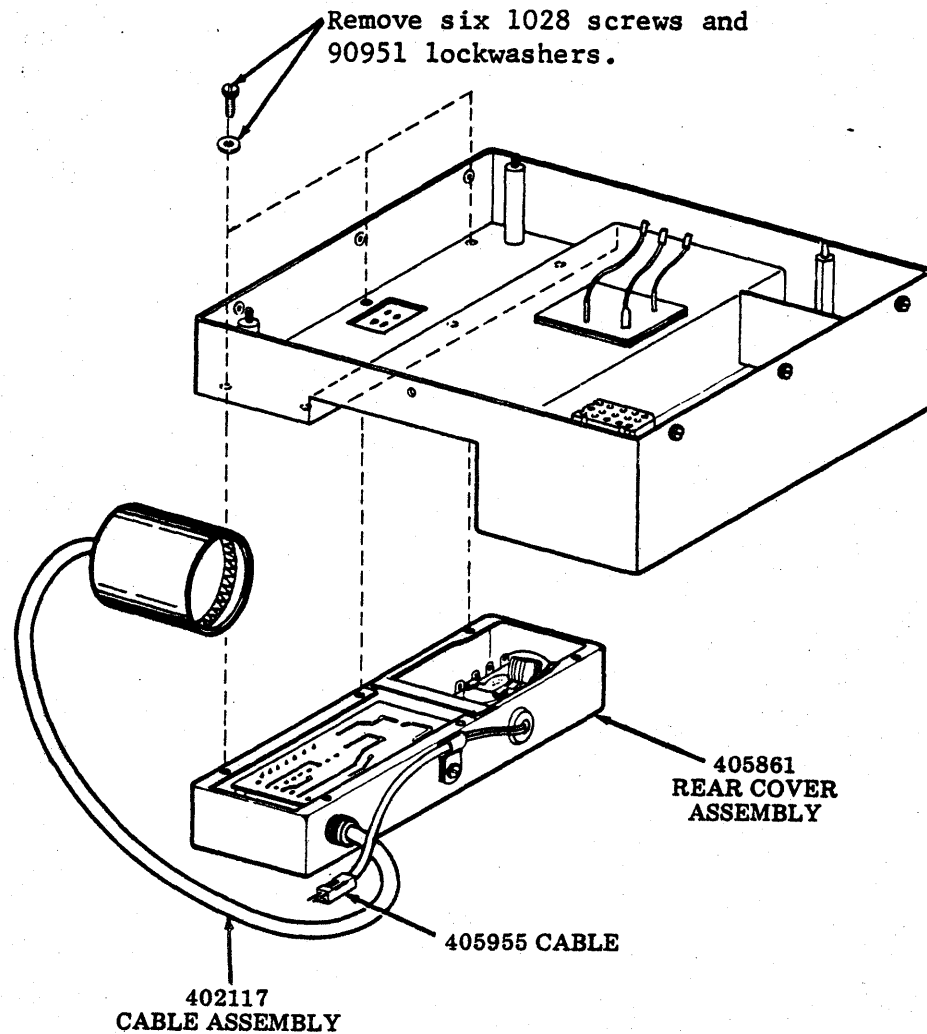


F. DISASSEMBLY/REASSEMBLY AND PARTS (Cont)

2. DISASSEMBLY/REASSEMBLY (Cont)

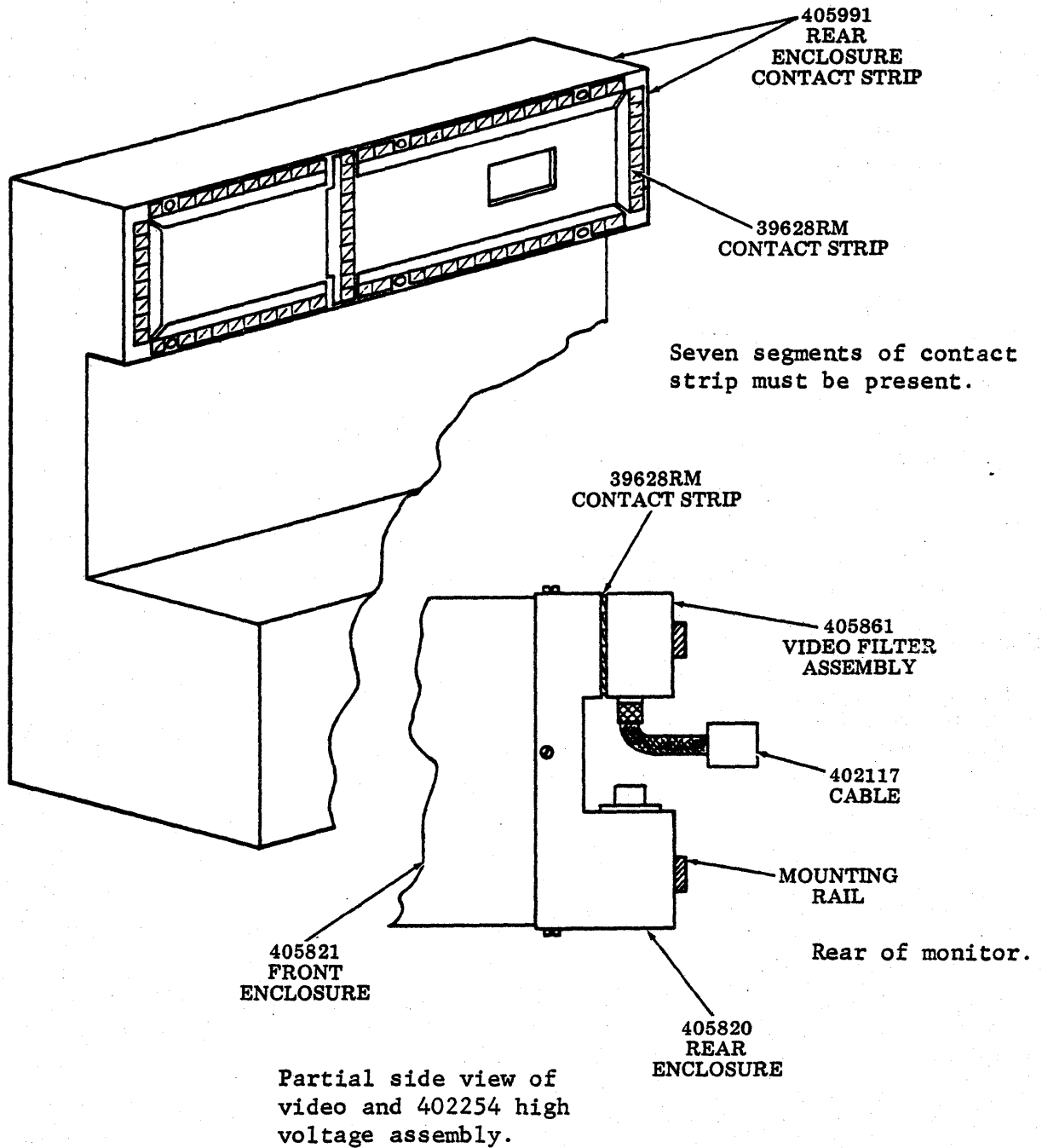
405861 Rear Cover Assembly

- Remove 402254 high voltage and video assembly (4-83) from heat sink.
- Remove 405859 high voltage plate assembly (4-84).
- Remove high voltage assembly cover (4-87 and 4-88).
- Remove 410546 high voltage circuit card assembly (4-90).
- Remove 410545 interface/amplifier circuit card assembly (4-91).



**NOTE:** During reassembly of the 405861 rear cover assembly, the requirements specified on the following page should be checked and met to insure proper operation of the monitor.

For location of contact strip see 405991 rear enclosure contact strip.



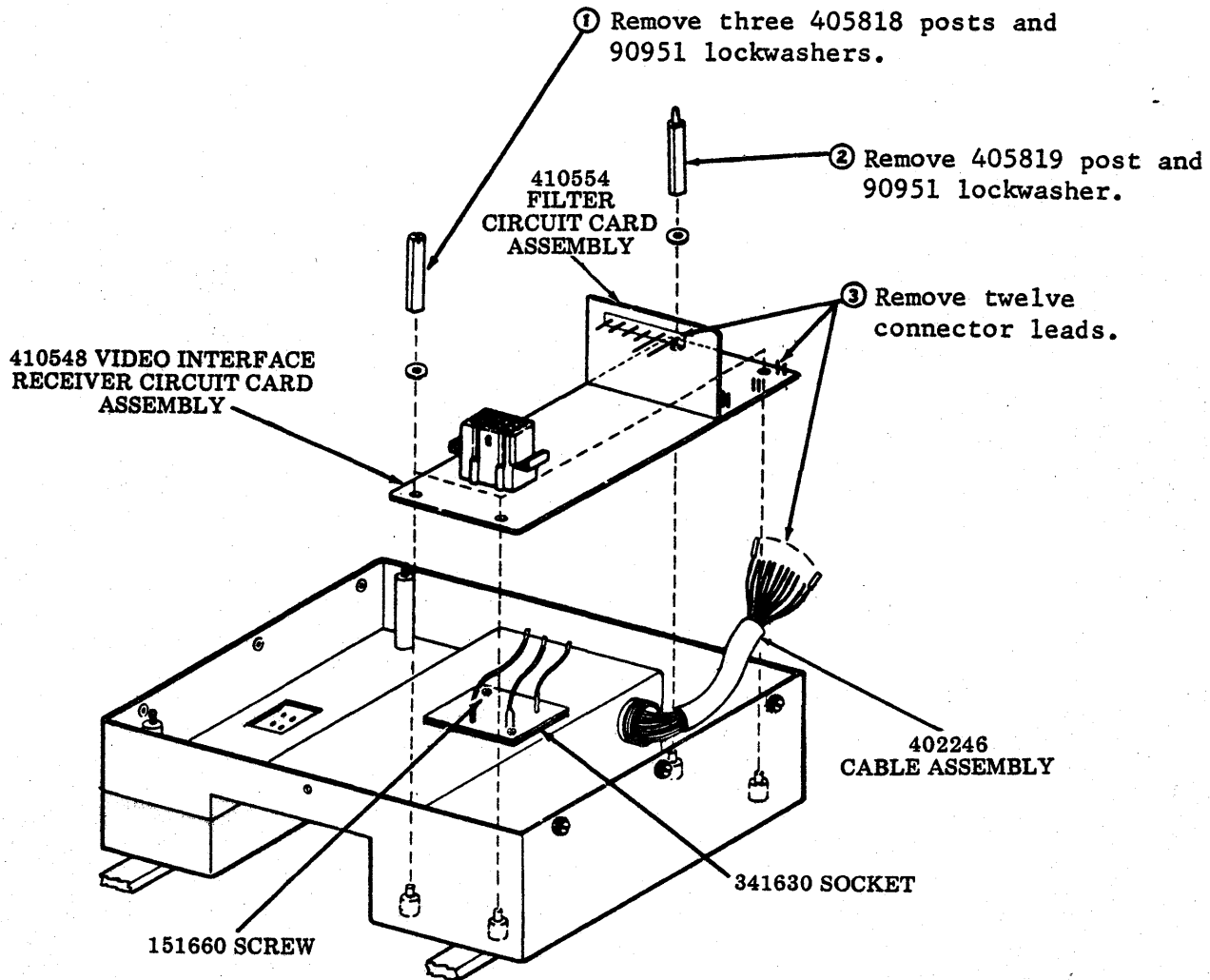
The presence of seven segments of 39628RM contact strip must be between the 405861 video filter assembly and the 405820 rear housing.

F. DISASSEMBLY/REASSEMBLY AND PARTS (Cont)

2. DISASSEMBLY/REASSEMBLY (Cont)

410548 Video Interface Receiver Circuit Card Assembly

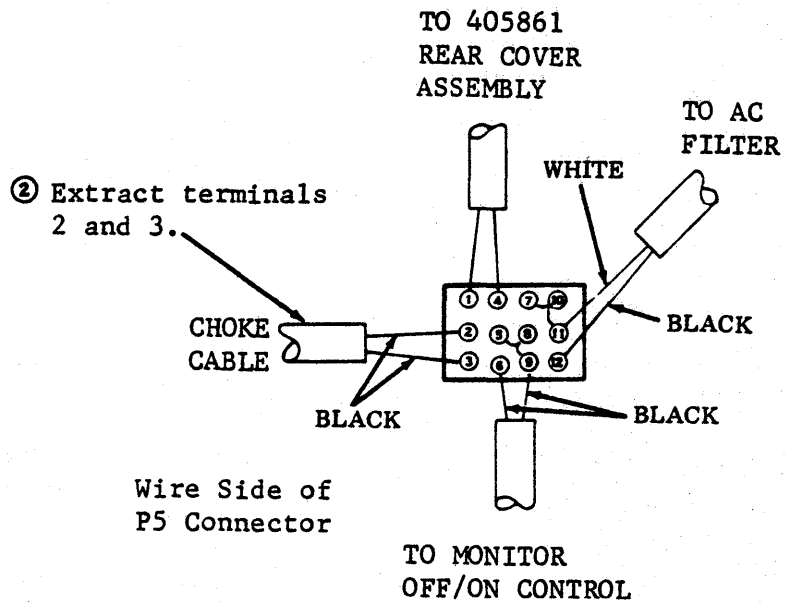
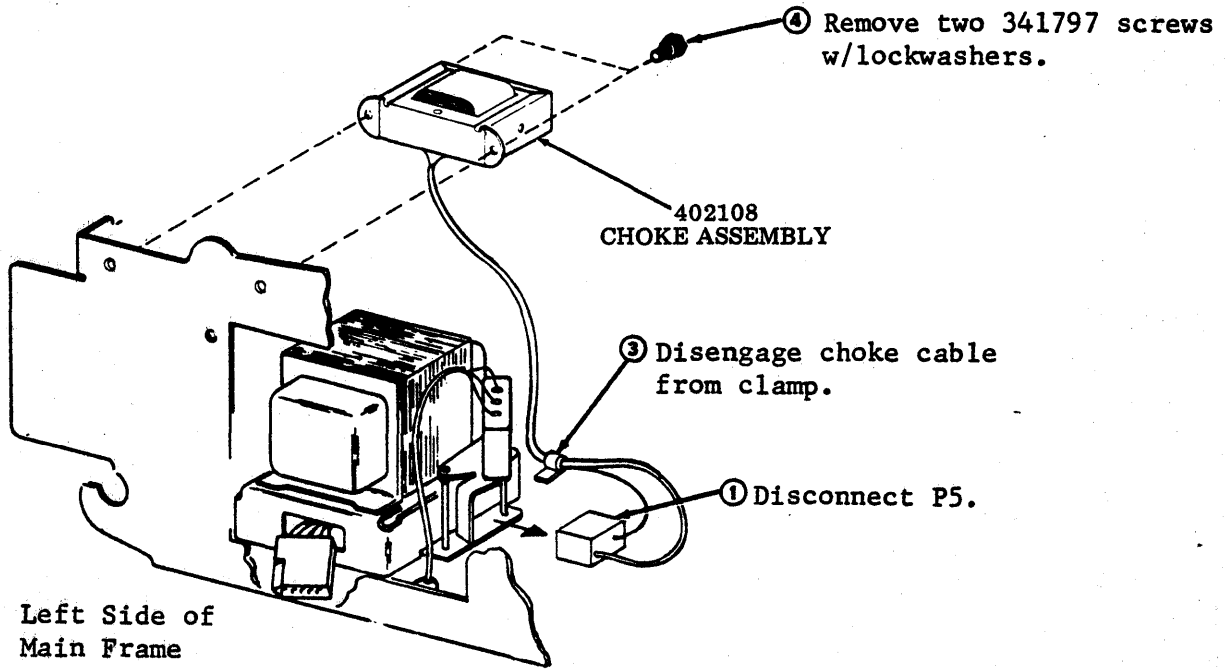
- Remove 405859 high voltage plate assembly (4-84).
- Remove high voltage assembly cover (4-87 and 4-88).
- Remove 410546 high voltage circuit card assembly (4-90).
- Remove 410545 interface/amplifier circuit card assembly (4-91).





402108 Choke Assembly

- Remove 410852 rectifier circuit card assembly (4-81).

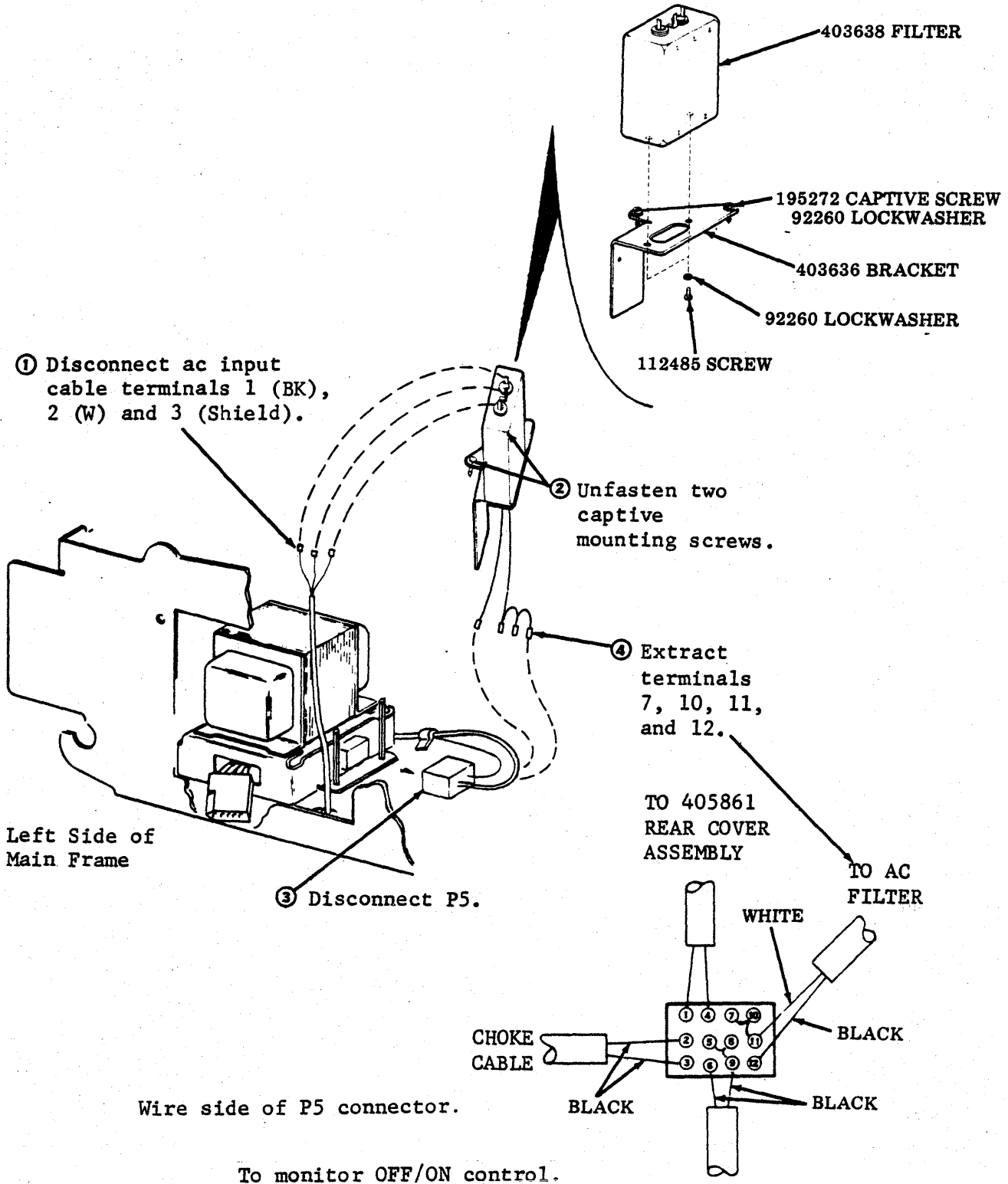


F. DISASSEMBLY/REASSEMBLY AND PARTS (Cont)

2. DISASSEMBLY/REASSEMBLY (Cont)

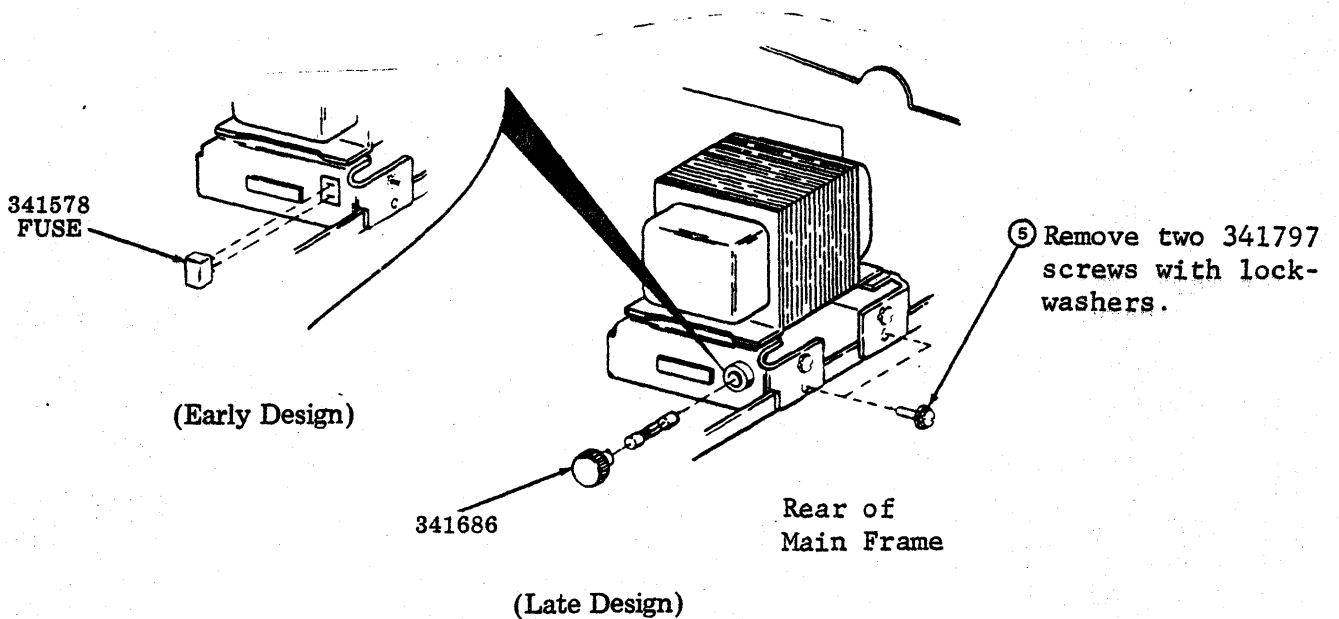
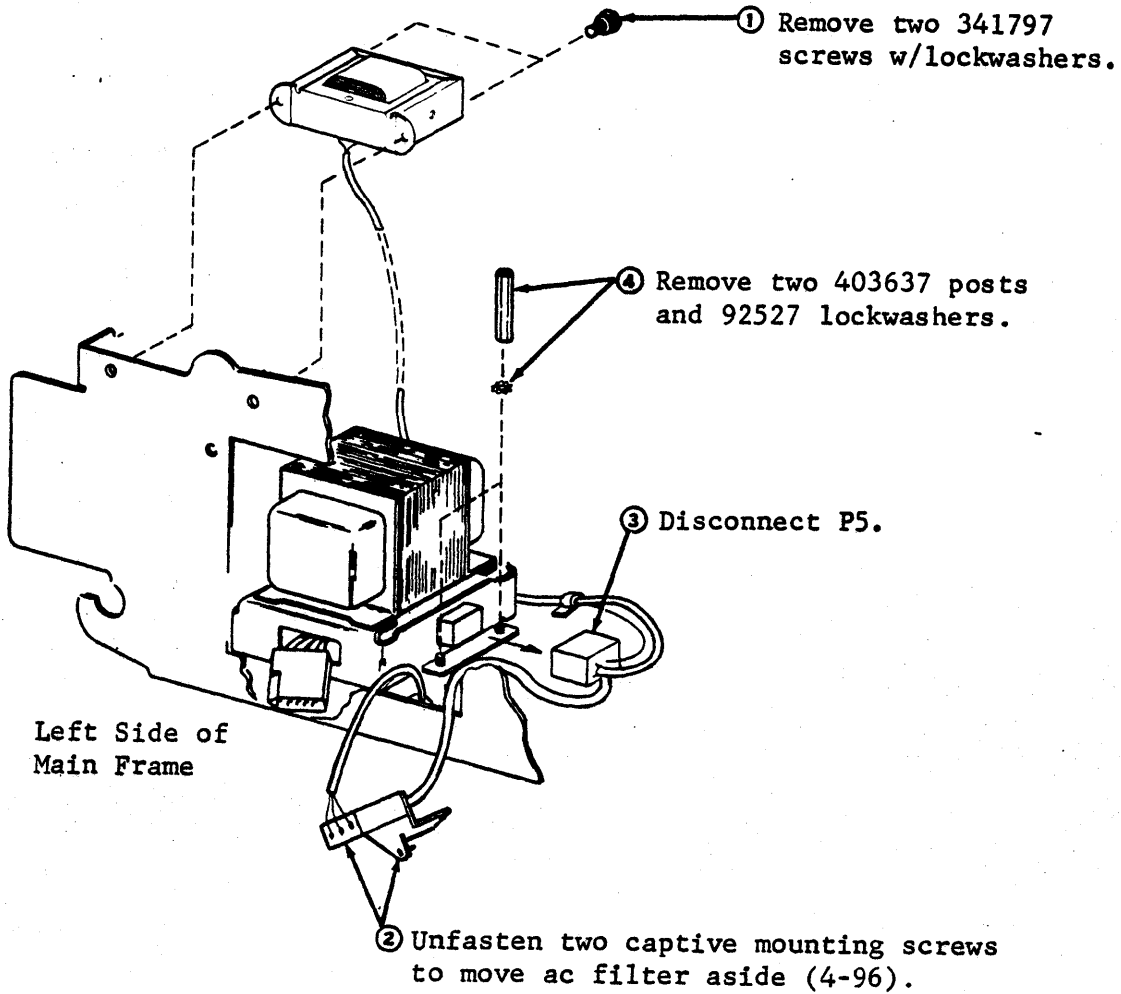
403639 AC Filter Assembly

- Remove 410852 rectifier circuit card assembly (4-81).



341795 (50/60 Hz) Power Distribution Assembly

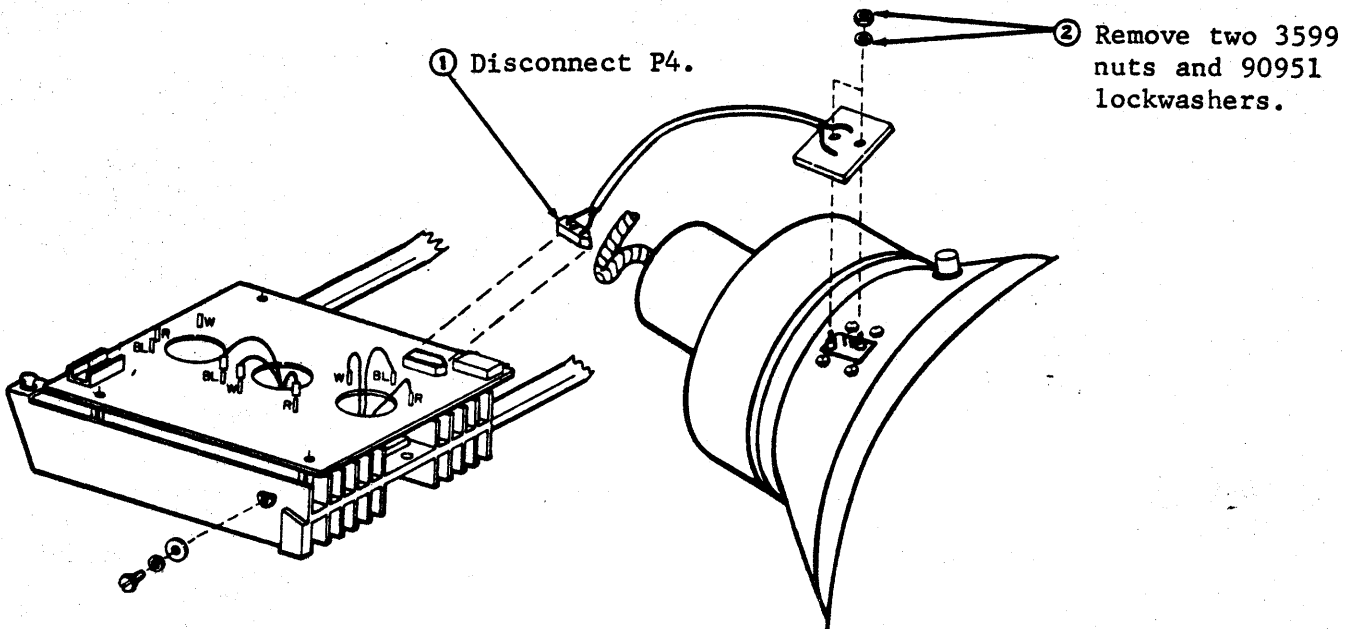
- Remove 410852 rectifier circuit card assembly (4-81).



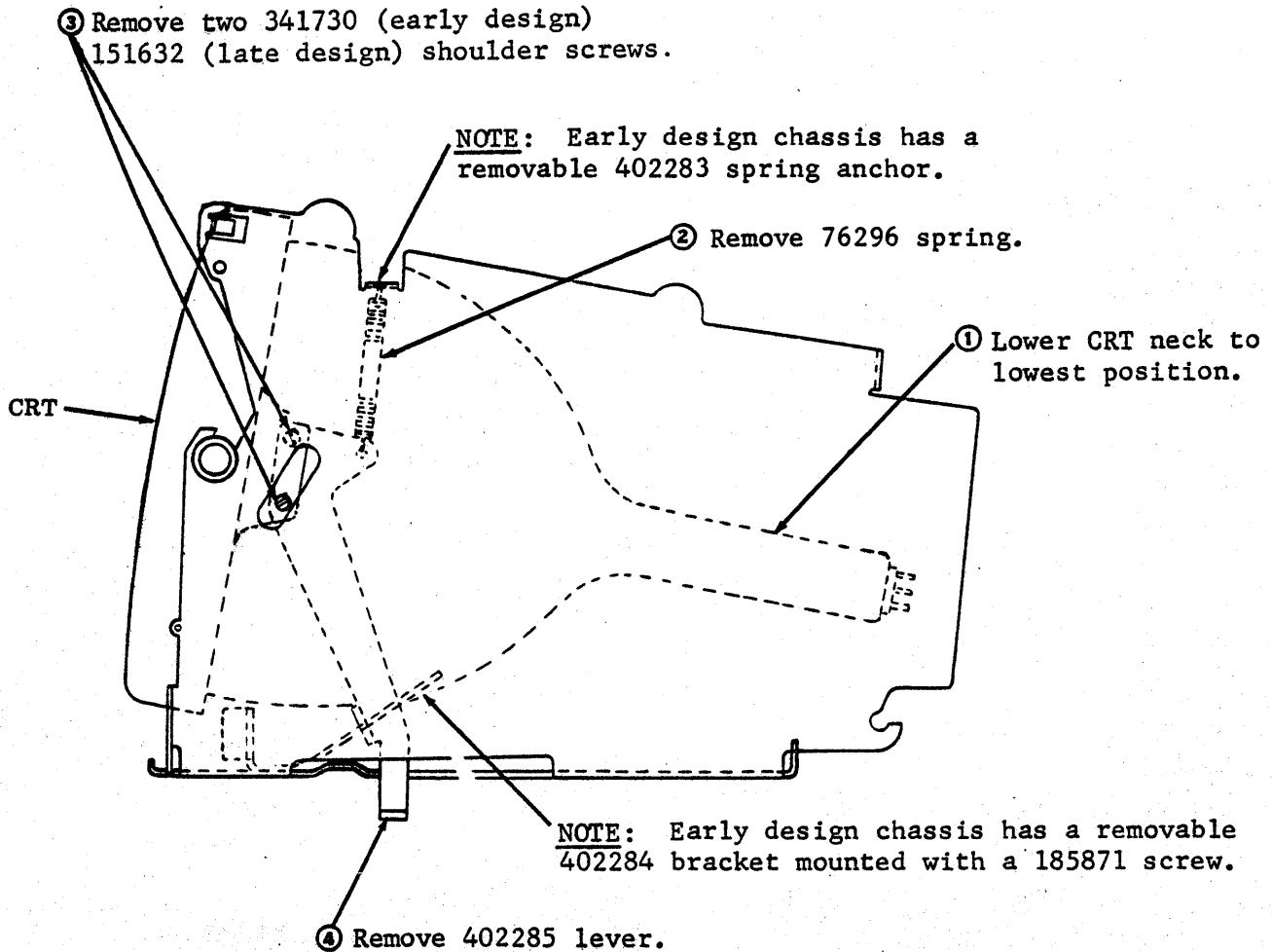
F. DISASSEMBLY/REASSEMBLY AND PARTS (Cont)

2. DISASSEMBLY/REASSEMBLY (Cont)

410559 Vertical Deflection Circuit Card Assembly



Tube Tilt Mechanism



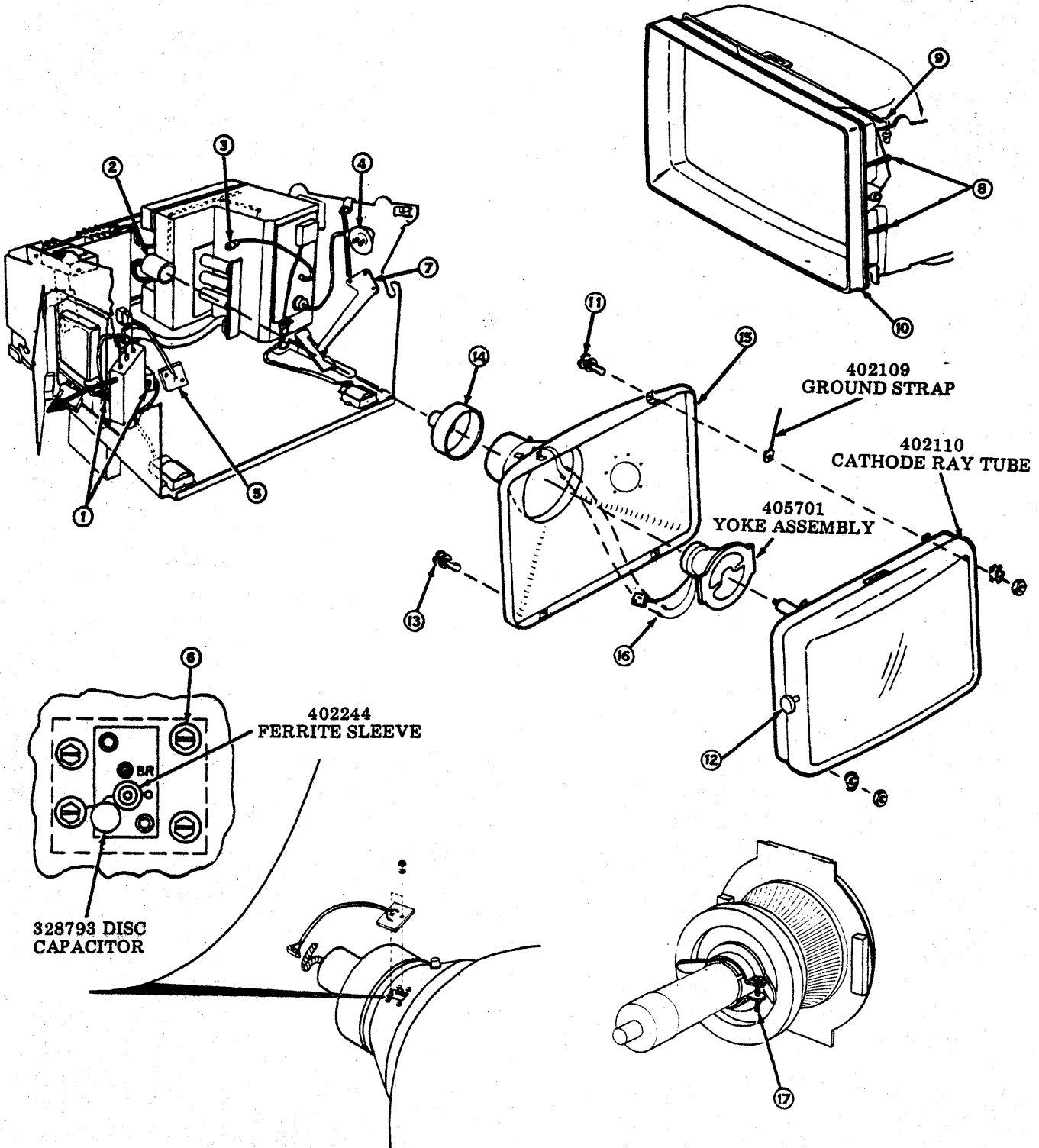
402110 Cathode Ray Tube  
405701 or 405994 Deflection Yoke Assembly (See Page 4-100 for location of parts.)

- Remove 410852 rectifier circuit card assembly (4-81).
- ① Disengage captive mounting screws and move ac filter assembly aside.
- ② Disconnect J17.
- ③ Disconnect P15.
- ④ Disconnect high voltage lead from side of CRT by removing five 152893 screws, 110743 lockwashers and 125011 flat washers. Remove 405878 cover and pull connector from socket in CRT.
- ⑤ Disengage 410559 vertical deflection circuit card assembly from CRT (see 4-98).
- ⑥ Remove four 152893 screws, 110743 lockwashers, 125011 flat washers.  
  
NOTE: Insert 402244 ferrite sleeve on filter marked "0". Above ferrite sleeve, solder one end of 328793 disc capacitor to portion of filter leg that is round. Other end of disc capacitor to be between shield and washer of screw as shown. Both leads of capacitor to be as short as possible.
- ⑦ Remove 402285 tube tilt lever (see 4-98).
- ⑧ Remove four 181523 springs.
- ⑨ Rotate rod rearward and remove by disengaging from holes in chassis.
- ⑩ Remove mask.
- ⑪ Remove top two 181243 screws w/lockwashers, 107116 lockwashers, and 3598 nuts to disengage ground straps.
- ⑫ Rotate neck of CRT toward vertical and lift to disengage pivot points from chassis.
- ⑬ Remove bottom two 181243 screws w/lockwashers, 107116 lockwashers, and 3598 nuts.
- ⑭ Remove 402112 intermediate shield.
- ⑮ Carefully remove 402101 shield from CRT.
- ⑯ Disconnect two leads.
- ⑰ Loosen yoke clamp screw. Slide yoke rearward off CRT neck. In reassembly, do not overtighten yoke clamp screw.

F. DISASSEMBLY/REASSEMBLY AND PARTS (Cont)

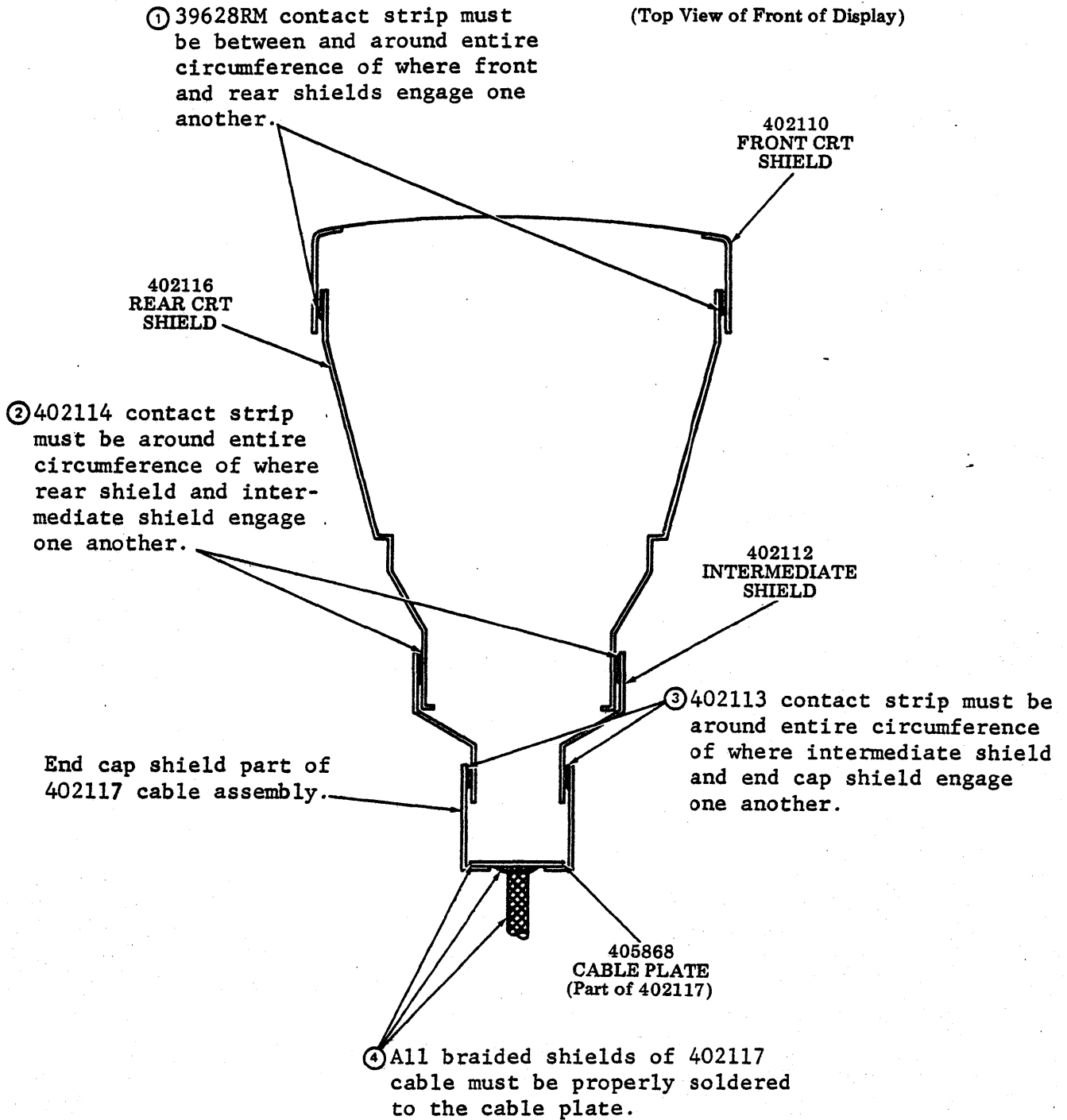
2. DISASSEMBLY/REASSEMBLY (Cont)

402110 Cathode Ray Tube, 405701 Deflection Yoke Assembly (Cont)



**NOTE:** During reassembly, the requirements specified on the following pages should be checked and met to insure proper operation of the monitor. These recommended checks are to be performed by qualified service personnel.

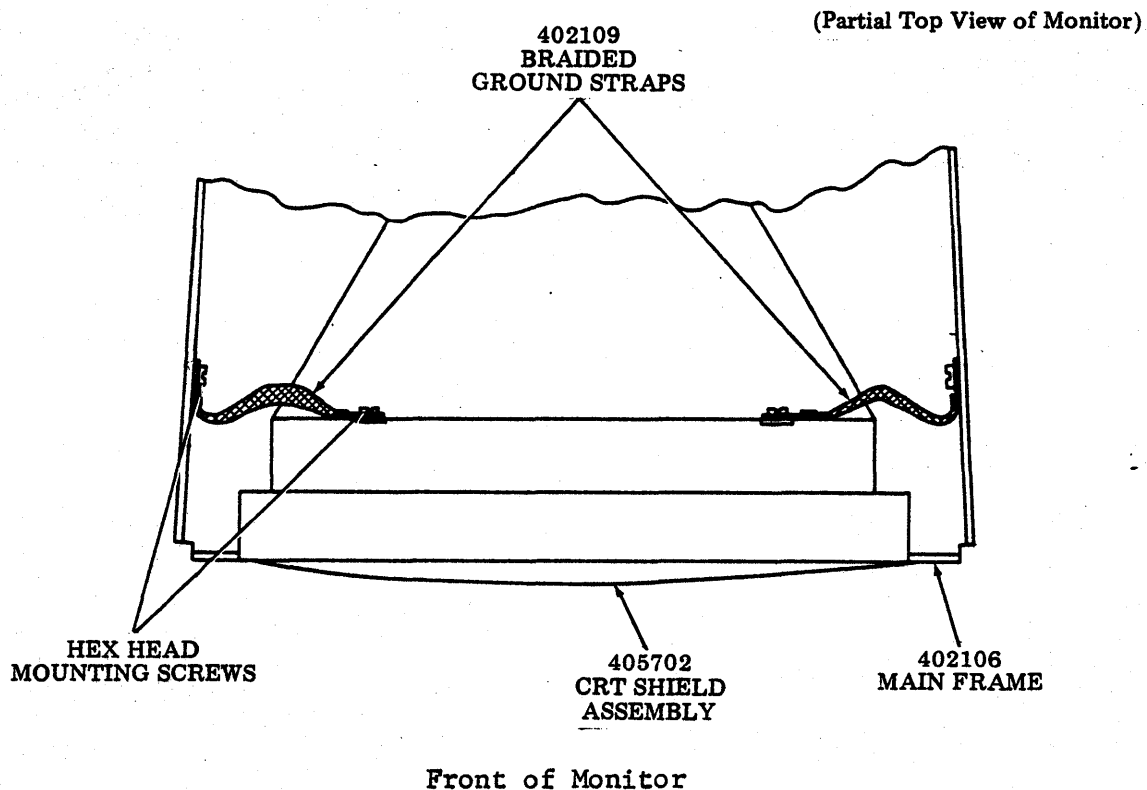
This figure shows all the shield assemblies that enclose the CRT.



F. DISASSEMBLY/REASSEMBLY AND PARTS (Cont)

2. DISASSEMBLY/REASSEMBLY (Cont)

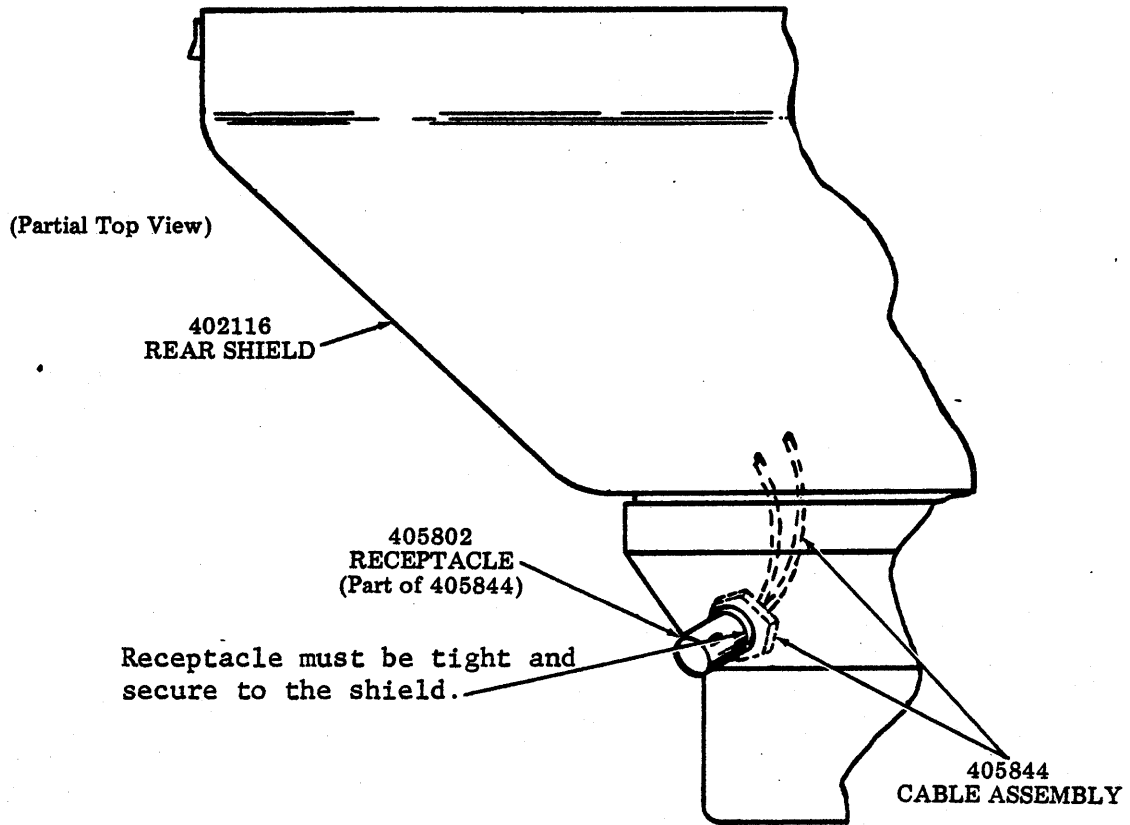
402110 Cathode Ray Tube, 405701 Deflection Yoke Assembly (Cont)



Check that the 402109 braided ground straps are properly mounted from the upper right and upper left side of the CRT tube shield assembly to the right and left sidewalls of the 402106 main frame.



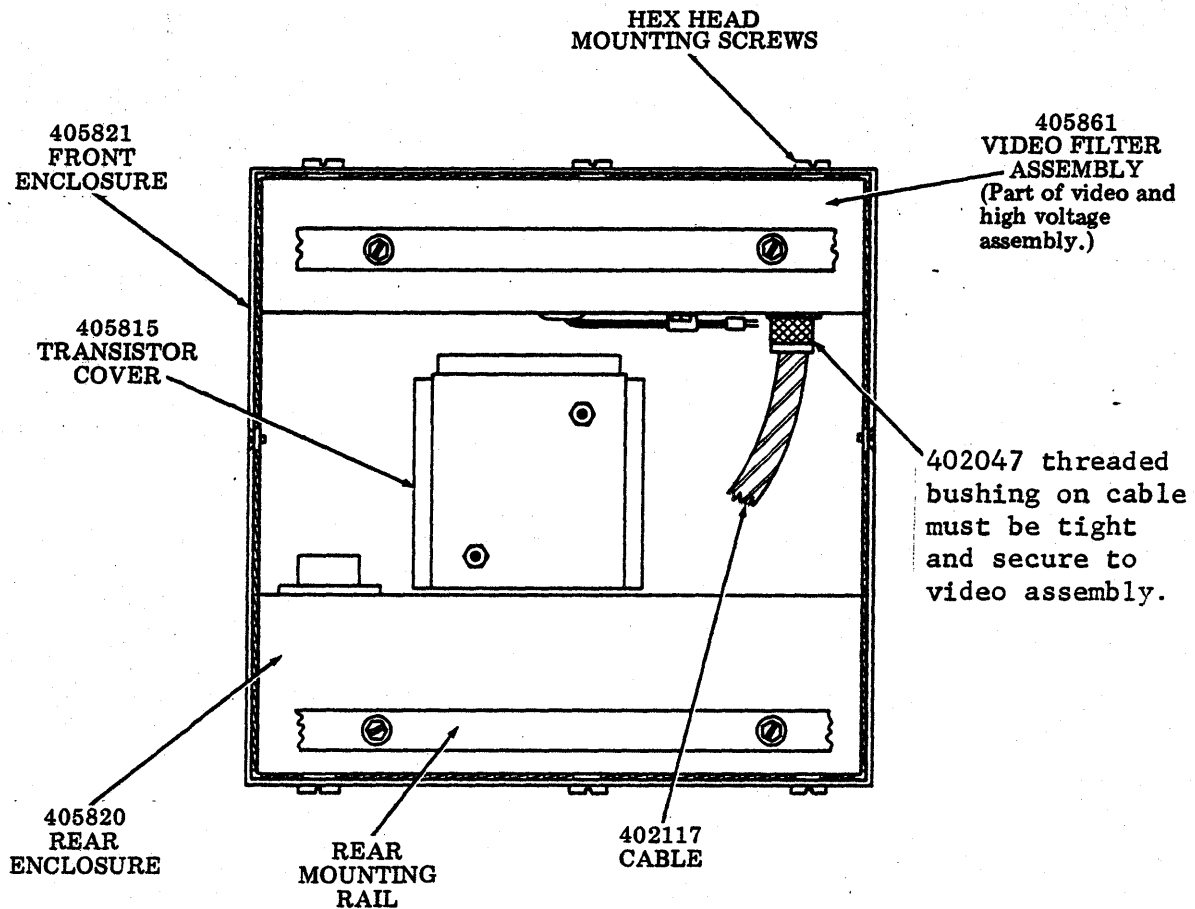
Rear 402116 CRT Shield Assembly



Check that the 405802 "twin-ax" connector that mounts on the rear 402116 CRT shield is tight and secure to the shield.

F. DISASSEMBLY/REASSEMBLY AND PARTS (Cont)2. DISASSEMBLY/REASSEMBLY (Cont)Video and High Voltage Assembly

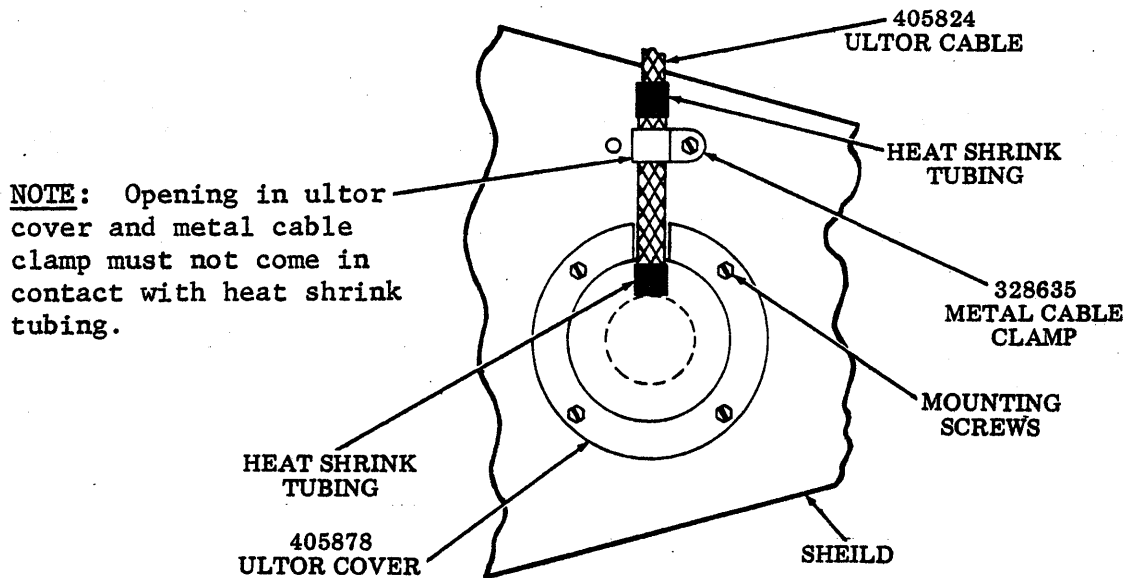
As viewed from rear of monitor.



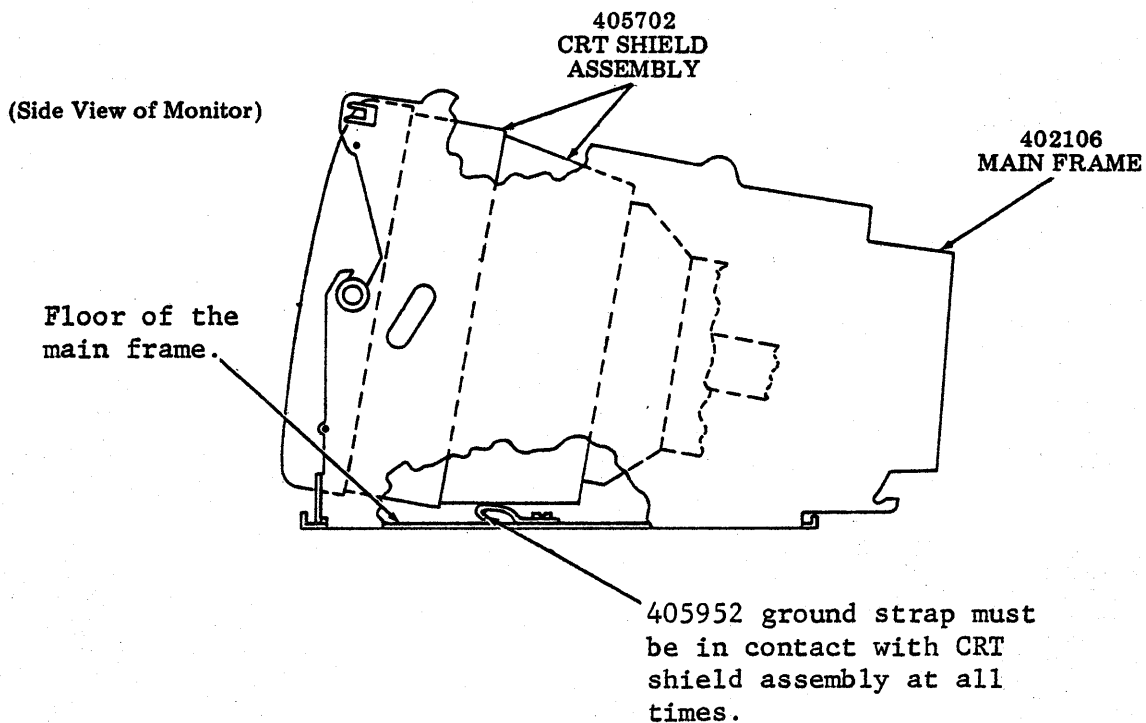
Check that the 402047 threaded metallic bushing on the 402117 CRT cable assembly is tight and secure at the point of entry to the 405861 video filter assembly.

Left Side of Shielded Tube

As viewed from rear of monitor.



Check that the 328635 metal cable clamp is in total metallic contact with the braid of the 405824 ultor cable assembly and that the braid of the 405824 ultor cable assembly is in metallic contact with the edges of the slot in the 405878 ultor cover shield that covers the connection to the CRT. The shrink tubing on the cable should not prevent metallic contact as indicated above.



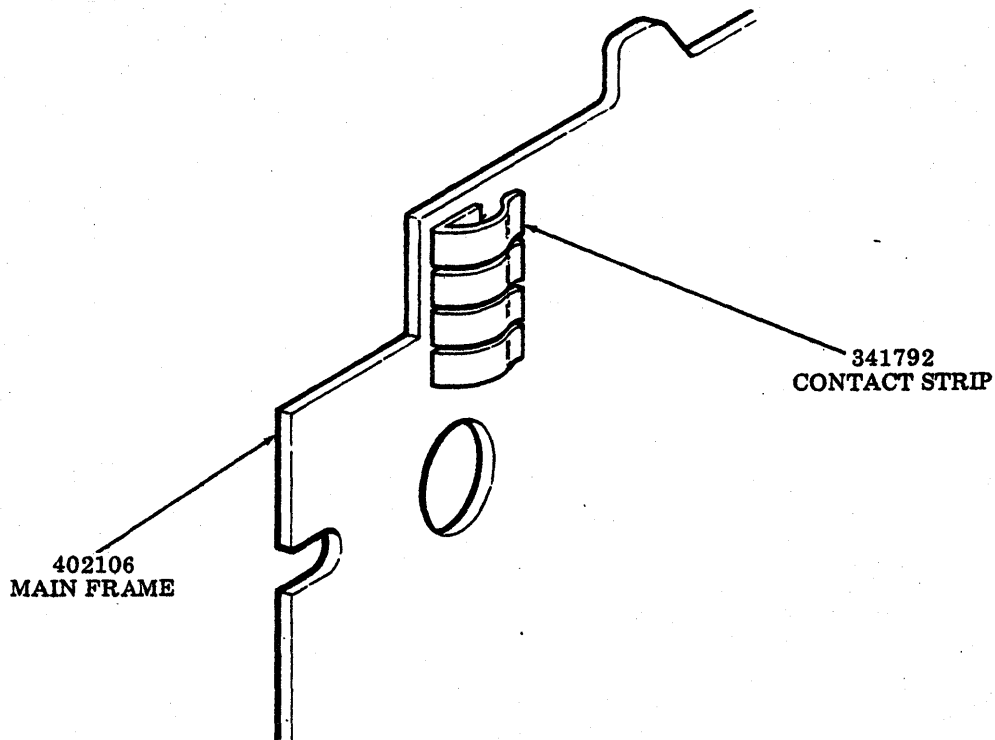
Check that the ground strap which is centrally located and mounts to the floor of the 402106 main frame is in direct contact with the 405702 CRT shield assembly at all times.

F. DISASSEMBLY/REASSEMBLY AND PARTS (Cont)

2. DISASSEMBLY/REASSEMBLY (Cont)

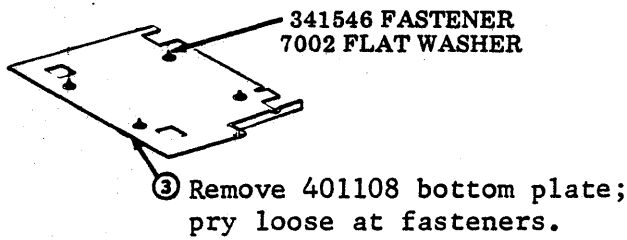
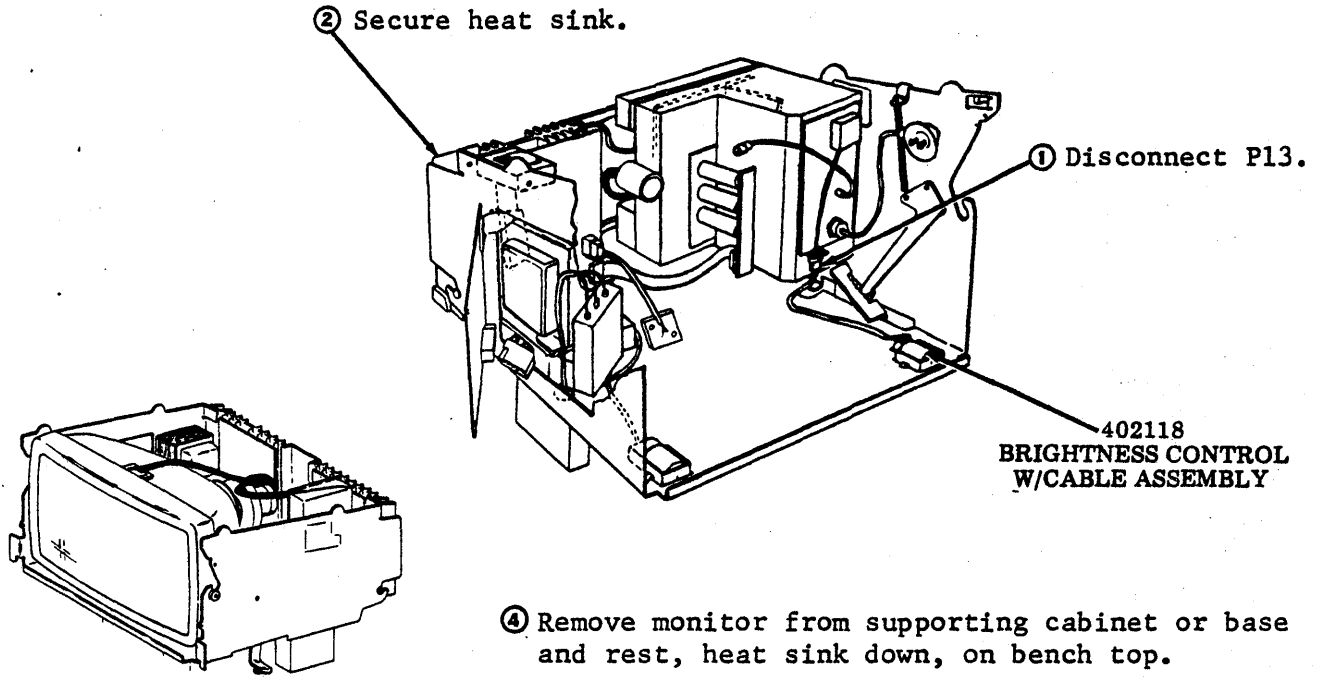
Upper Rear Corner of the Right Sidewall of the Main Frame

As viewed from rear of monitor.

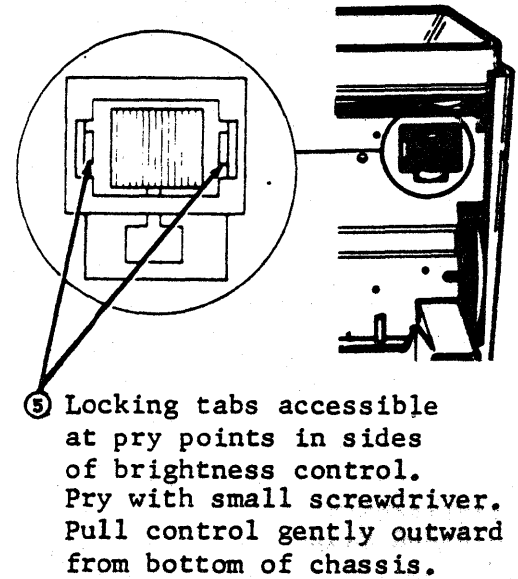
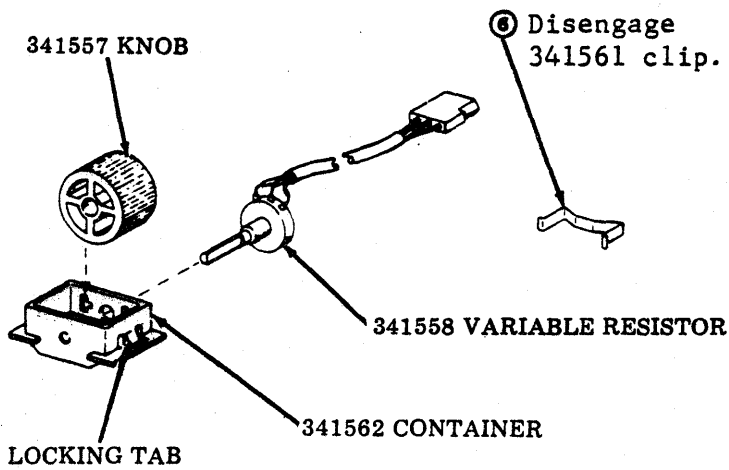


Check for presence of the 341792 contact strip which should be mounted on the inside surface in the upper rear area of the right sidewall of the 402106 main frame.

402118 Brightness Control W/Cable Assembly



402118 Brightness Control  
W/Cable Assembly

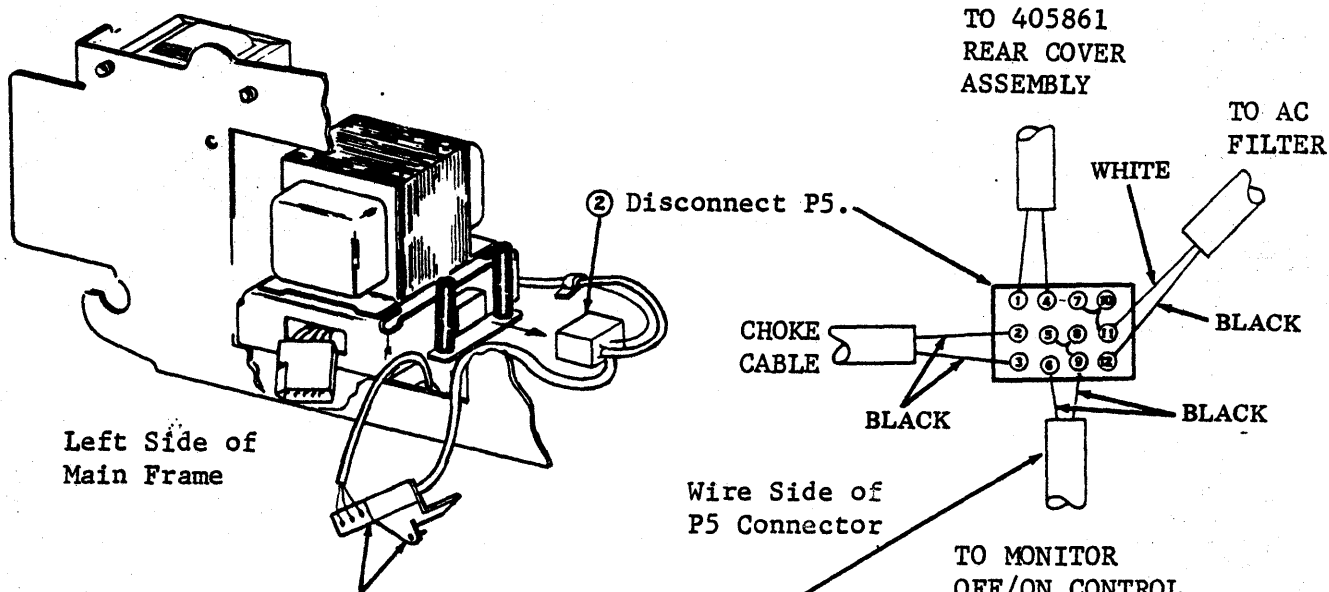


F. DISASSEMBLY/REASSEMBLY AND PARTS (Cont)

2. DISASSEMBLY/REASSEMBLY (Cont)

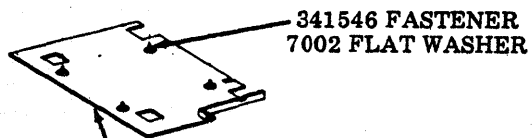
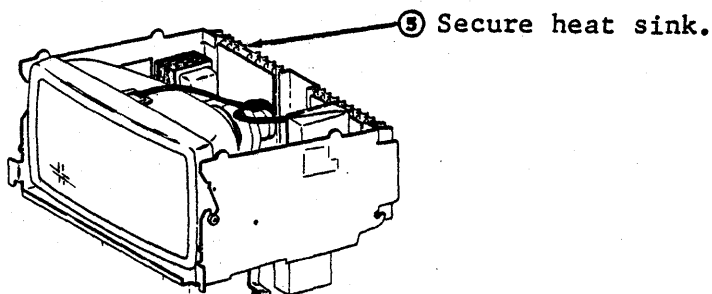
402120 Monitor Off/On Control Assembly

- Remove 410852 rectifier circuit card assembly (4-81).

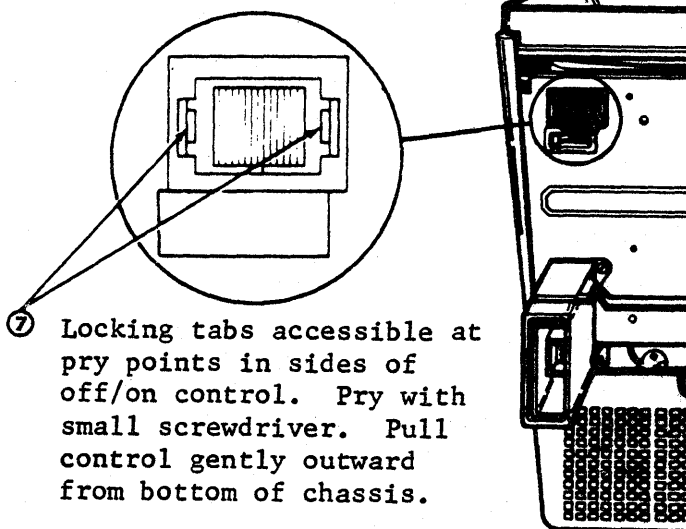


① Unfasten two captive mounting screws to move ac filter aside (see 4-96).

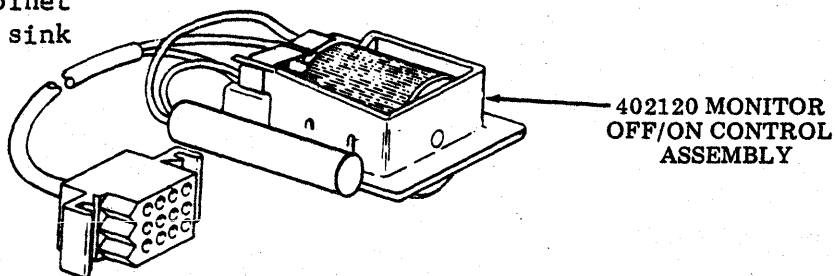
③ Extract terminals 5, 6, 8, and 9.



④ Remove 401108 bottom plate; pry loose at fasteners.

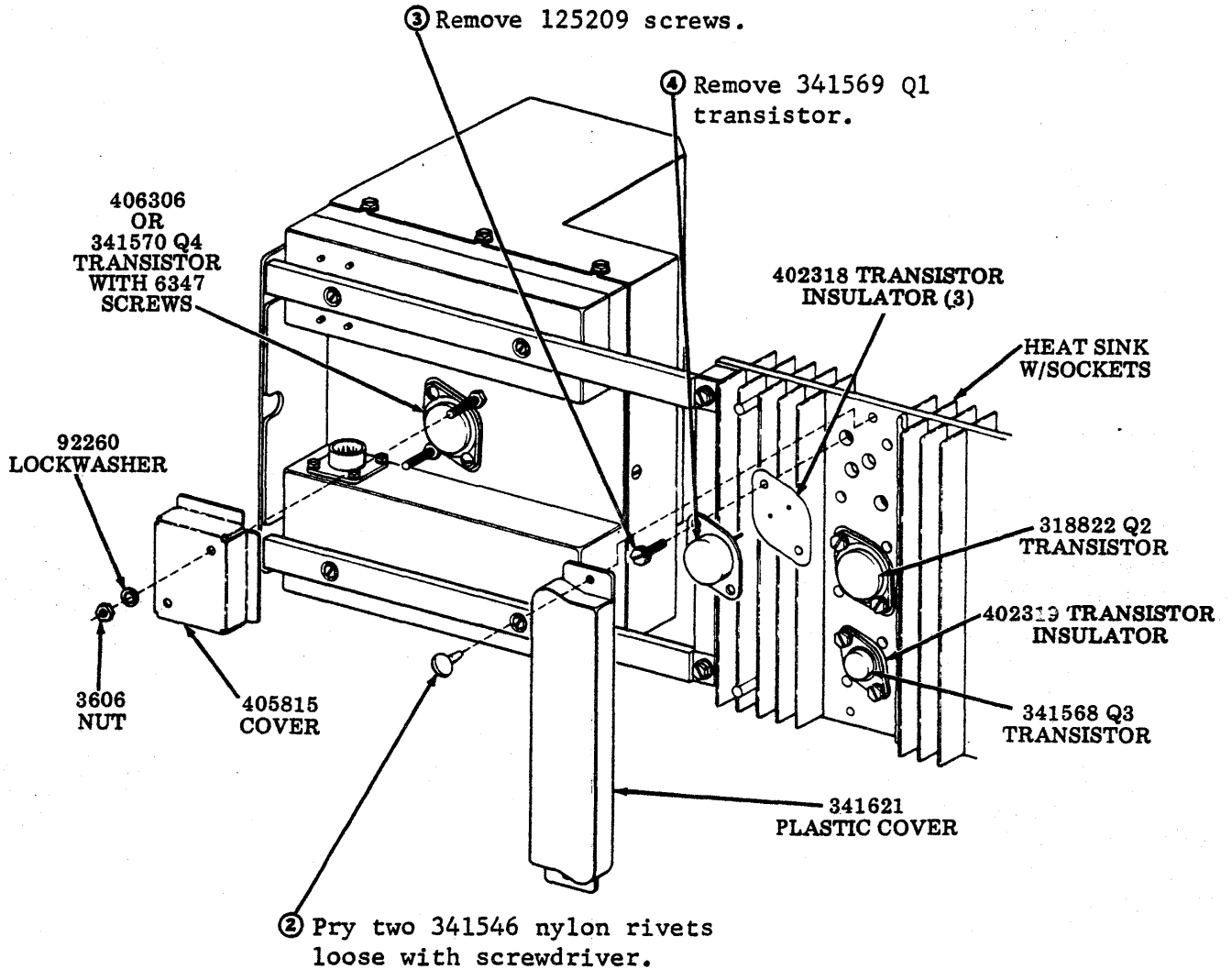


⑥ Remove monitor from cabinet or base and rest, heat sink down, on bench top.



Heat Sink Transistors

① Secure heat sink in upright position.



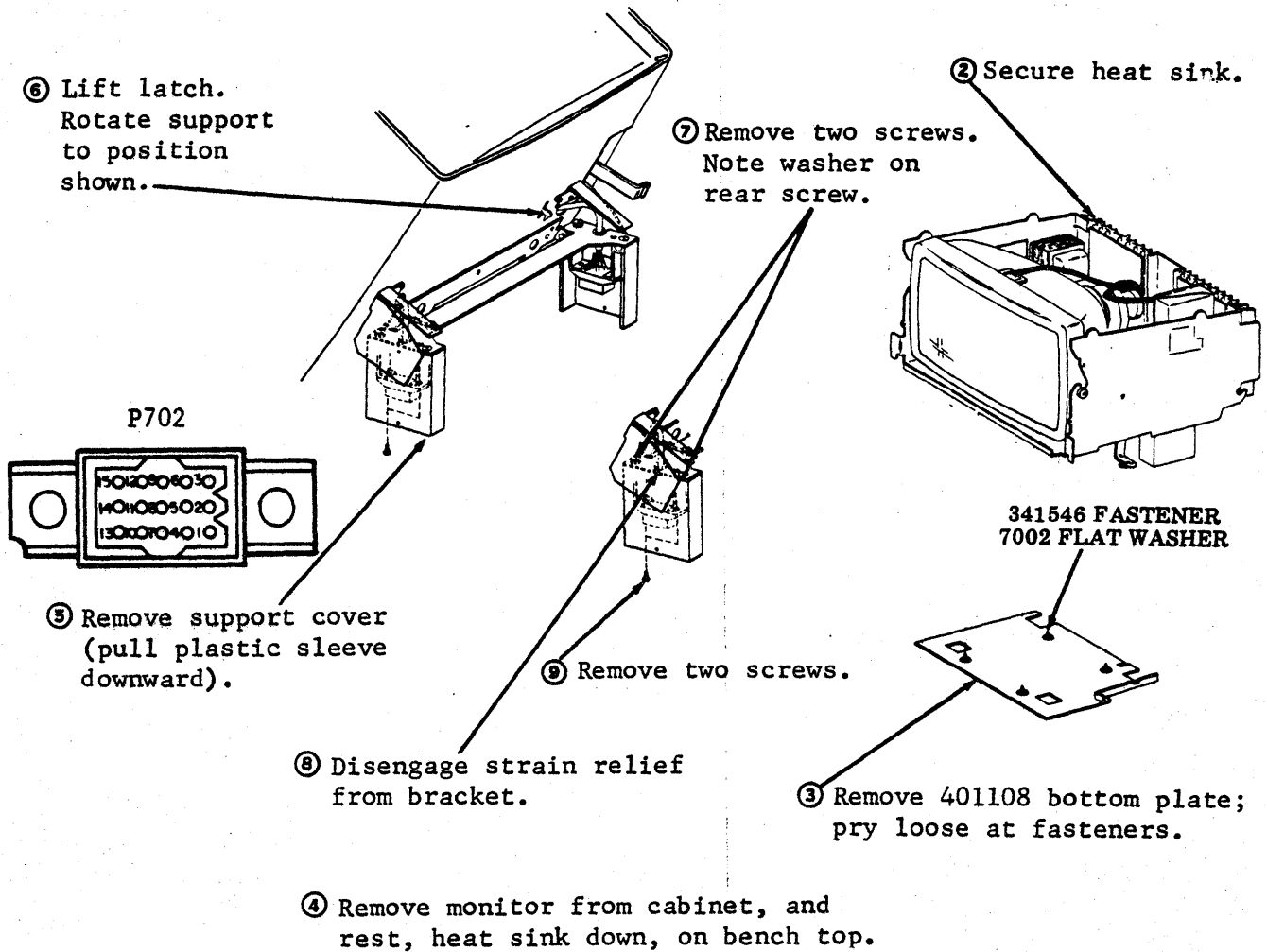
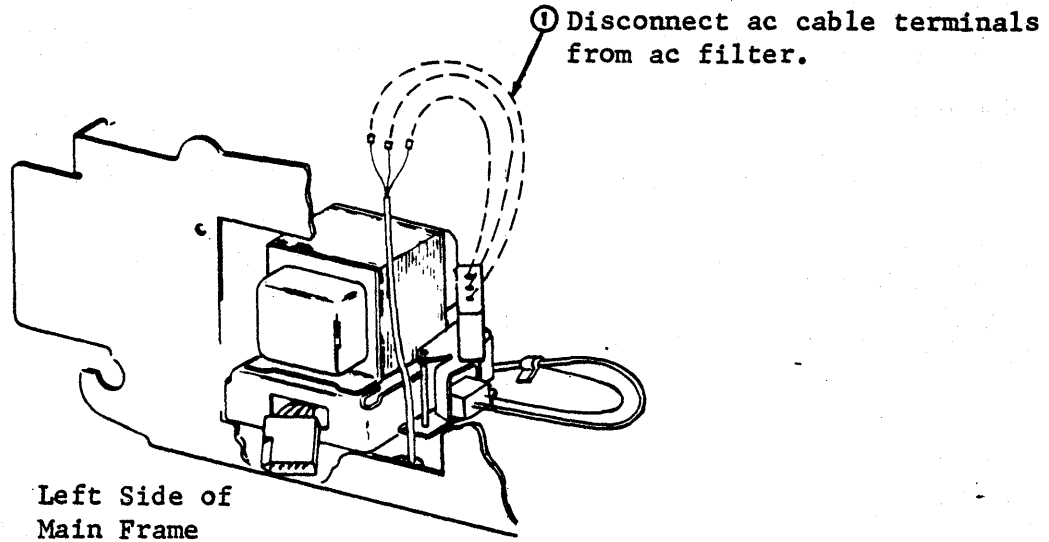
**NOTE 1:** On heat sink assembly, 402319 insulator associated with transistor (Q3) is replaced by 402319 (new) using mica (muscovite) material. The mica insulator requires thermal joint compound (heat conducting paste) applied to the rear side of the transistor and on the heat sink surface. The 402318 insulator associated with transistors (Q1, Q2 and Q4) remains unchanged. The insulator material used is fiberglass reinforced silicone rubber and does not require thermal joint compound.

**NOTE 2:** Transistor Q4 part number 406306 can only be used with 410656 Issue 6A or later, incorporating R39 part number 406292 horizontal centering control. Transistor Q4 part number 341570 can be used with any issue of 410656 circuit card.

F. DISASSEMBLY/REASSEMBLY AND PARTS (Cont)

2. DISASSEMBLY/REASSEMBLY (Cont)

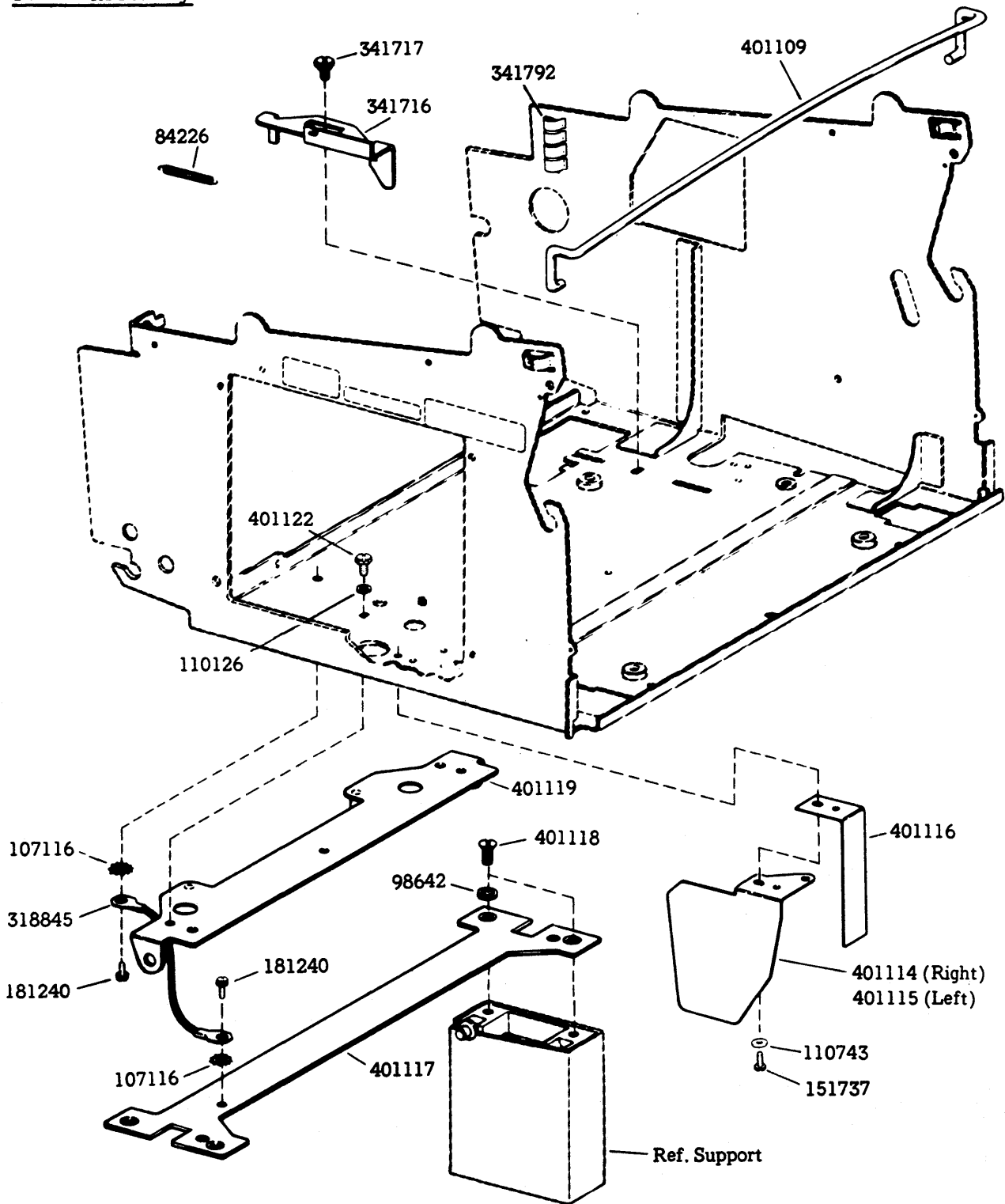
405703 AC Cable Assembly





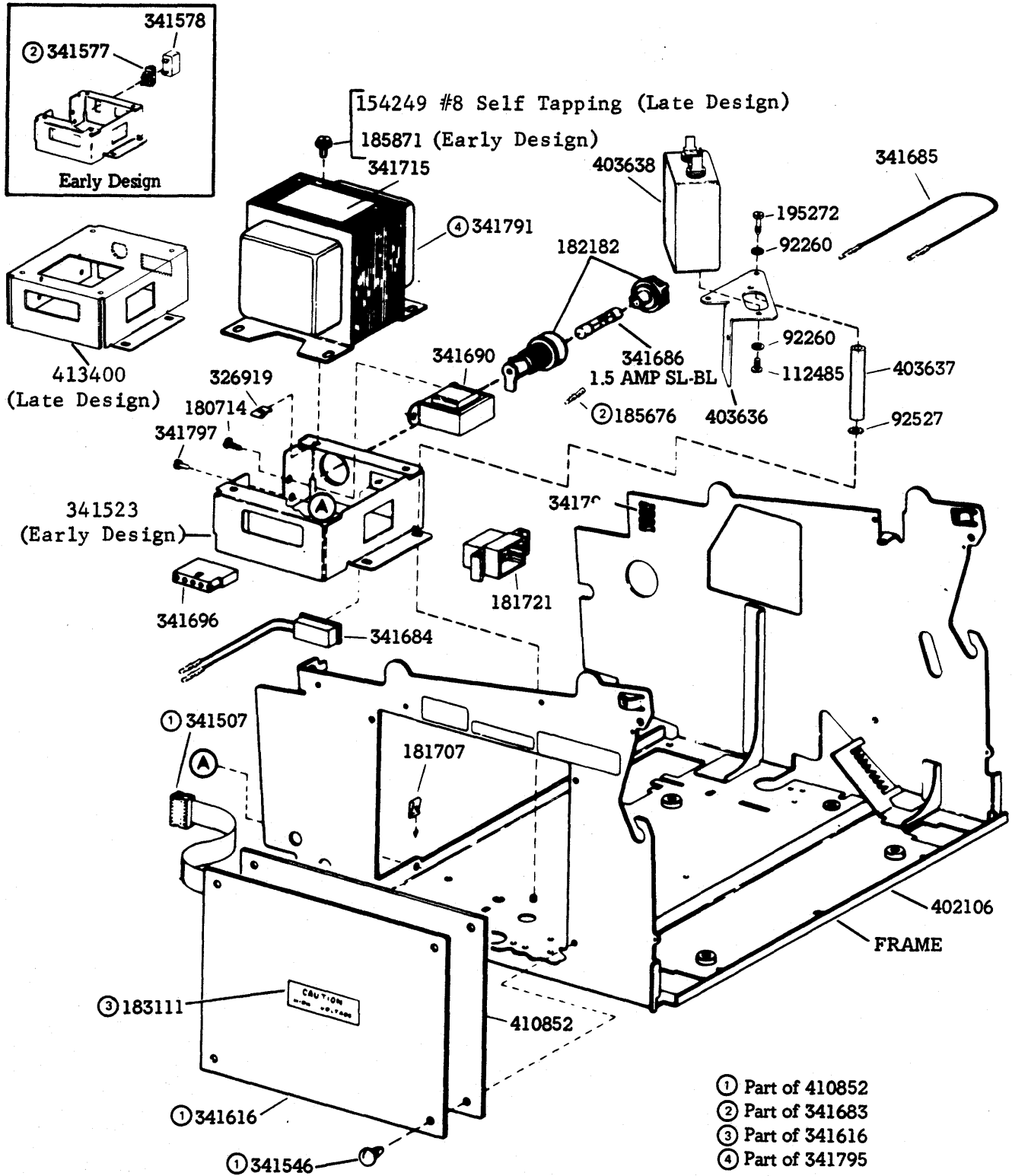
3. PARTS

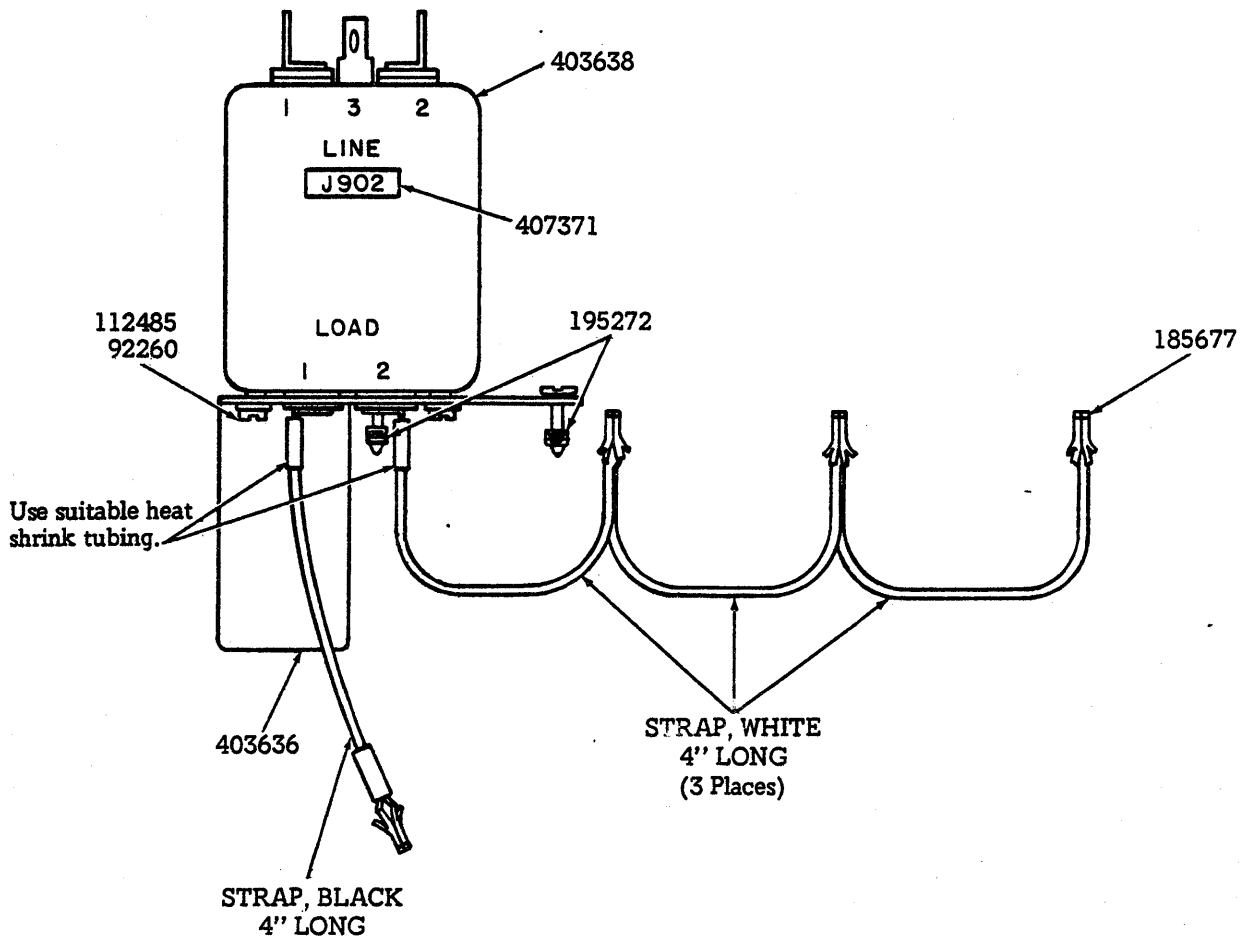
Frame Assembly



F. DISASSEMBLY/REASSEMBLY AND PARTS (Cont)

3. PARTS, Frame Assembly (Cont)

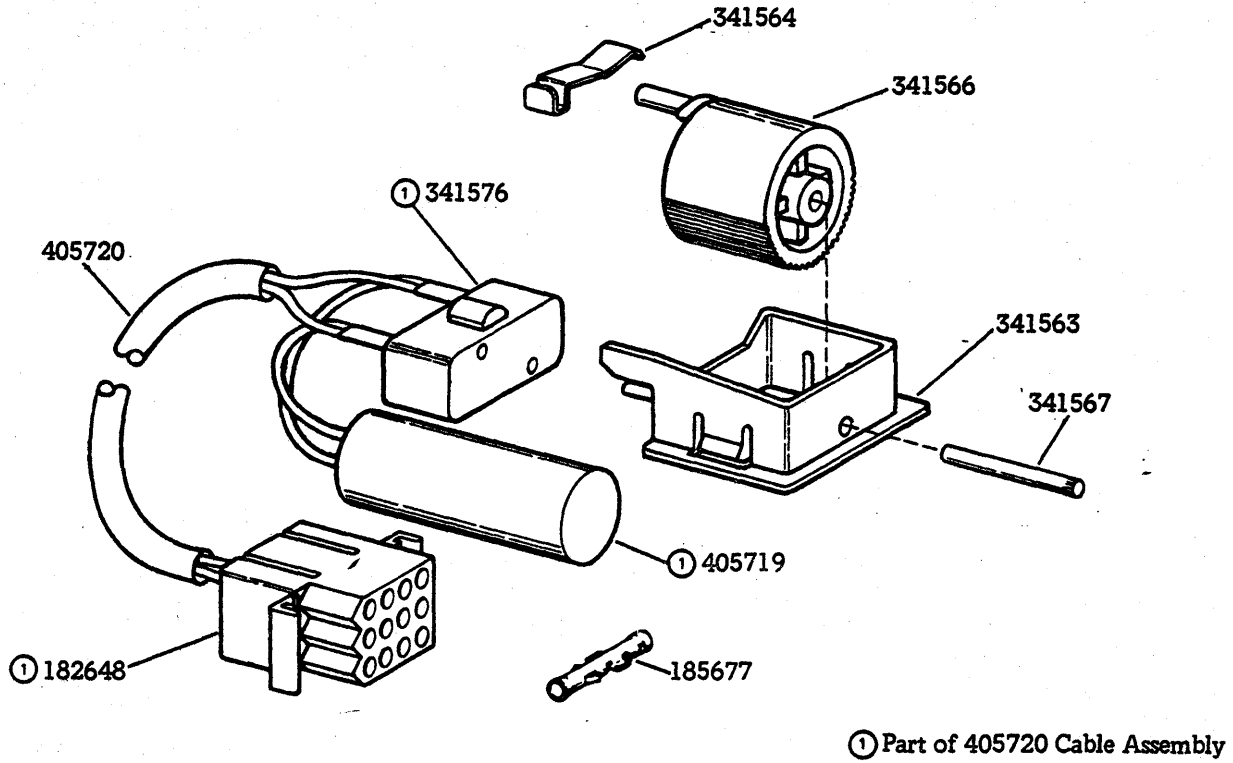




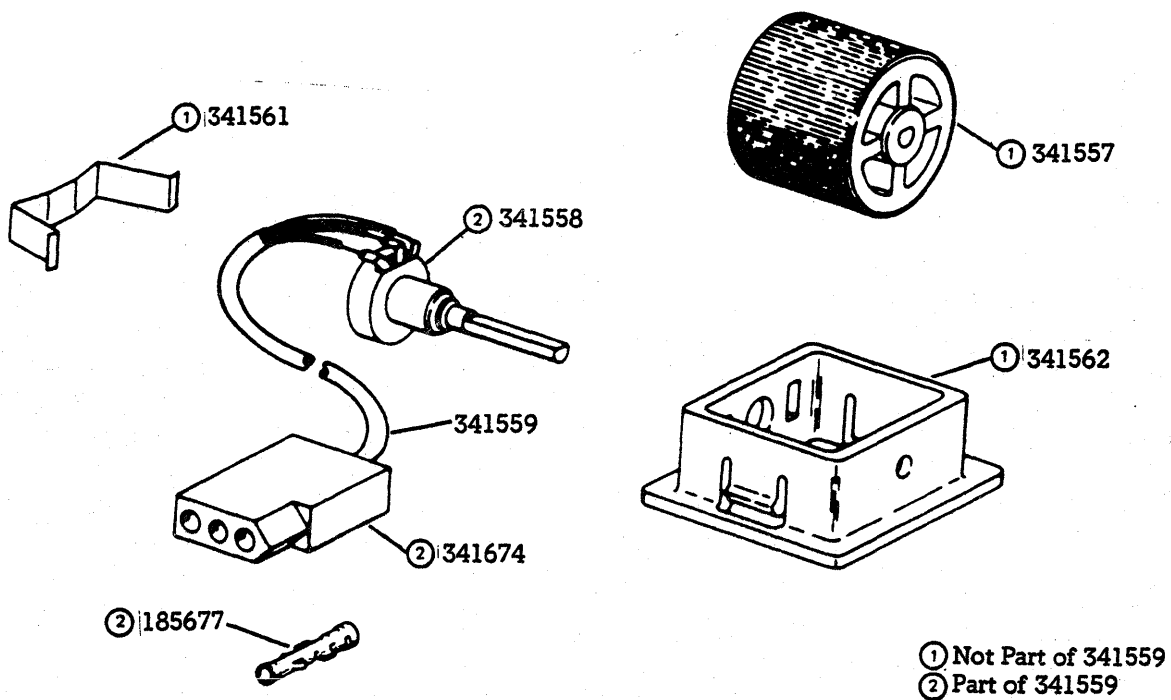
F. DISASSEMBLY/REASSEMBLY AND PARTS (Cont)

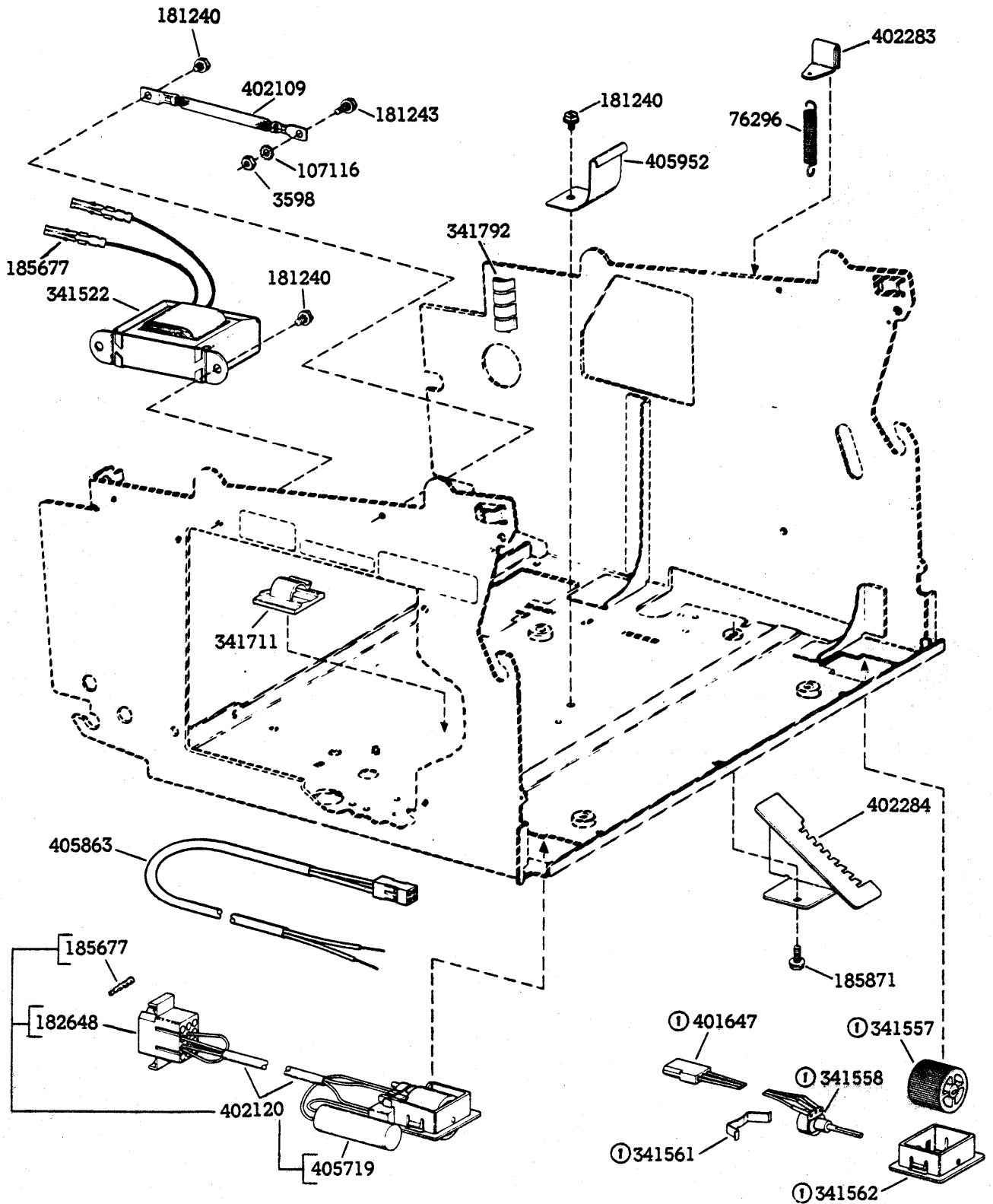
3. PARTS (Cont)

402120 Monitor Control Switch (On-Off) Assembly



402118 Brightness Control Switch Assembly



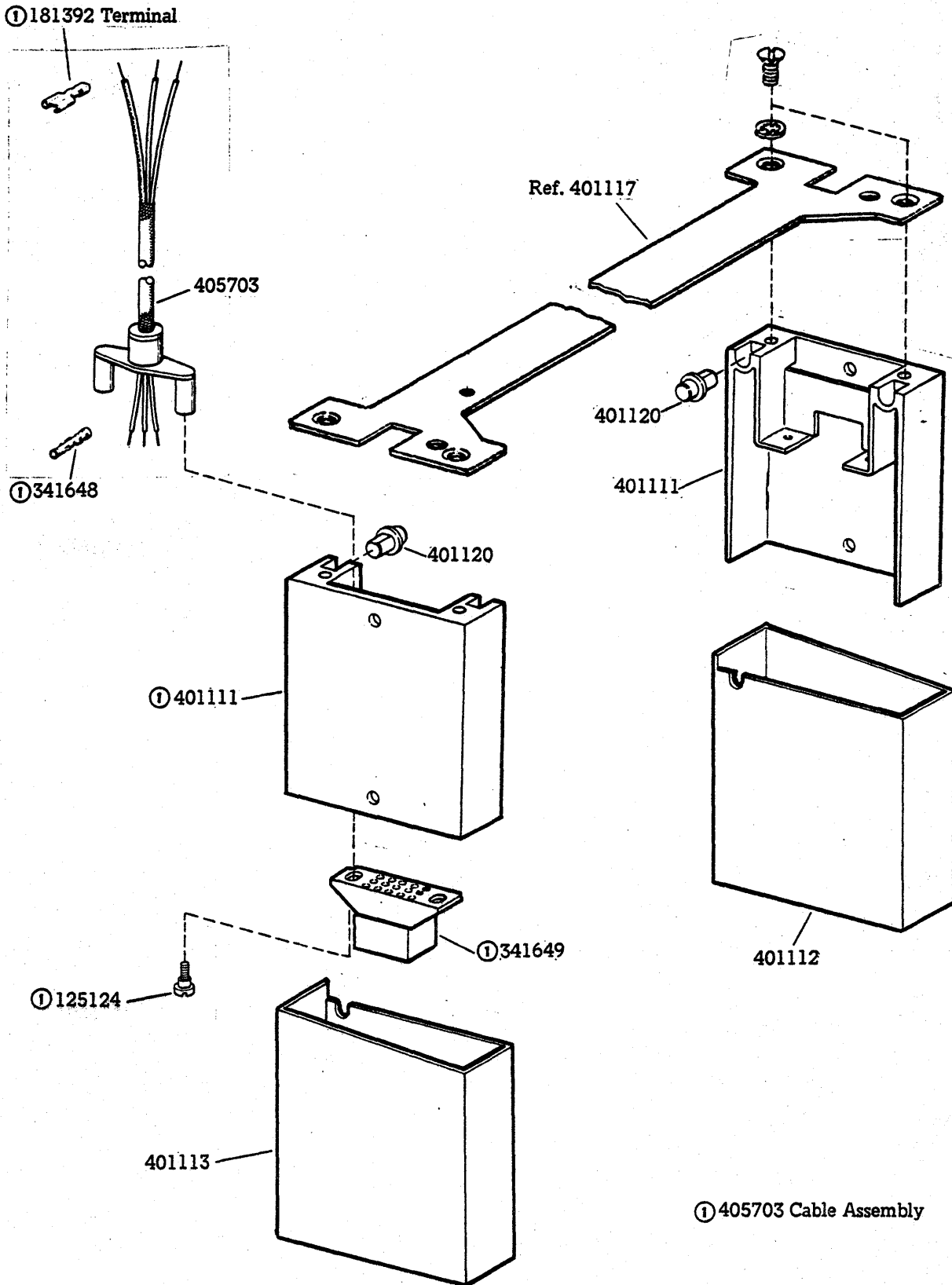


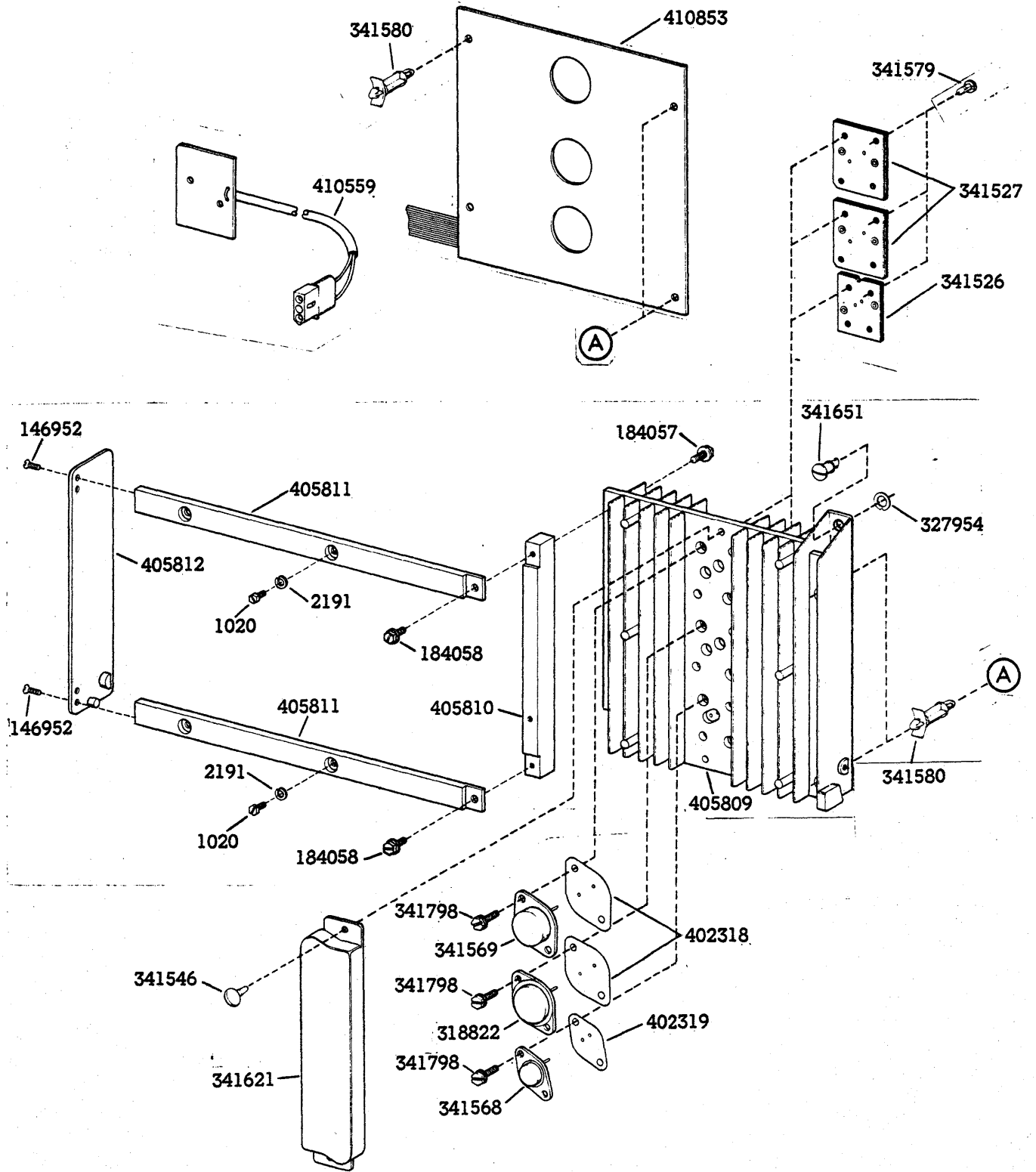
① 402118 Cable Assembly

402286 MK

F. DISASSEMBLY/REASSEMBLY AND PARTS (Cont)

3. PARTS (Cont)

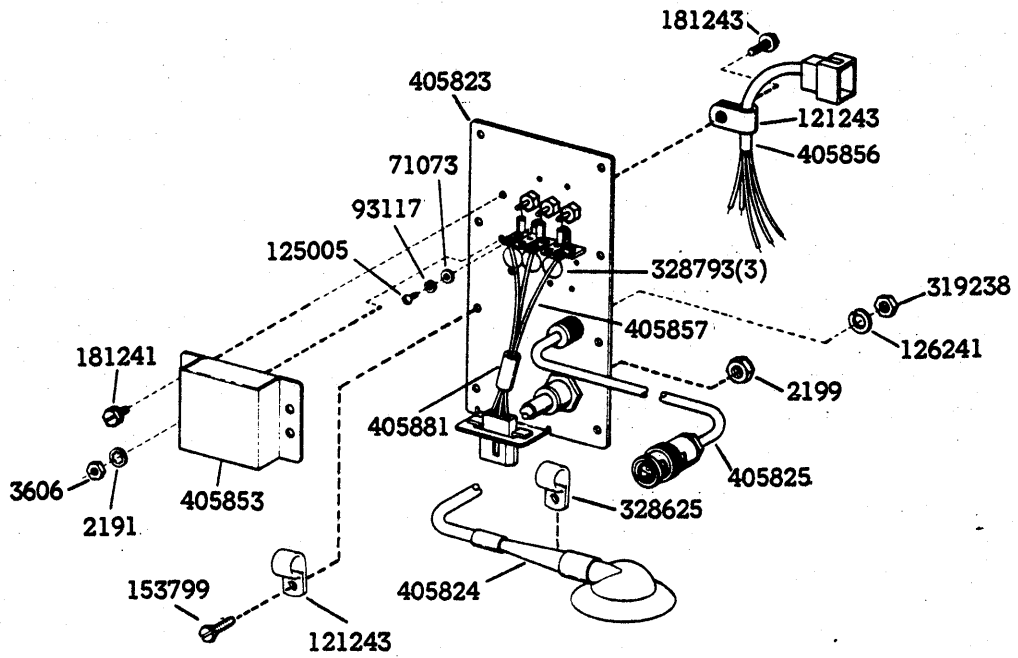




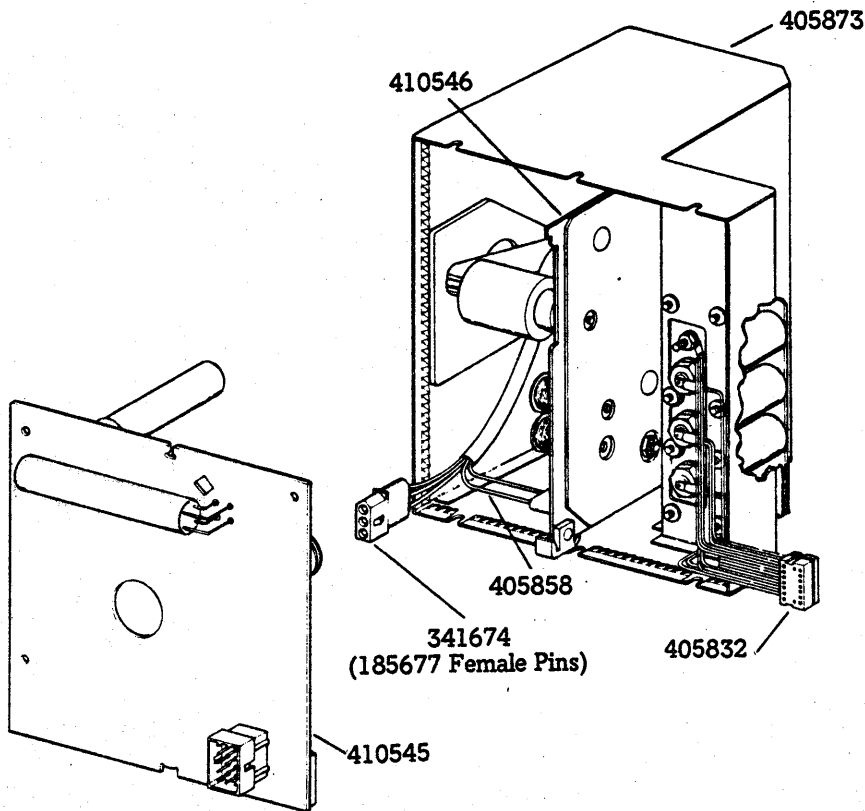
HEAT SINK ASSEMBLY

F. DISASSEMBLY/REASSEMBLY AND PARTS (Cont)

3. PARTS (Cont)

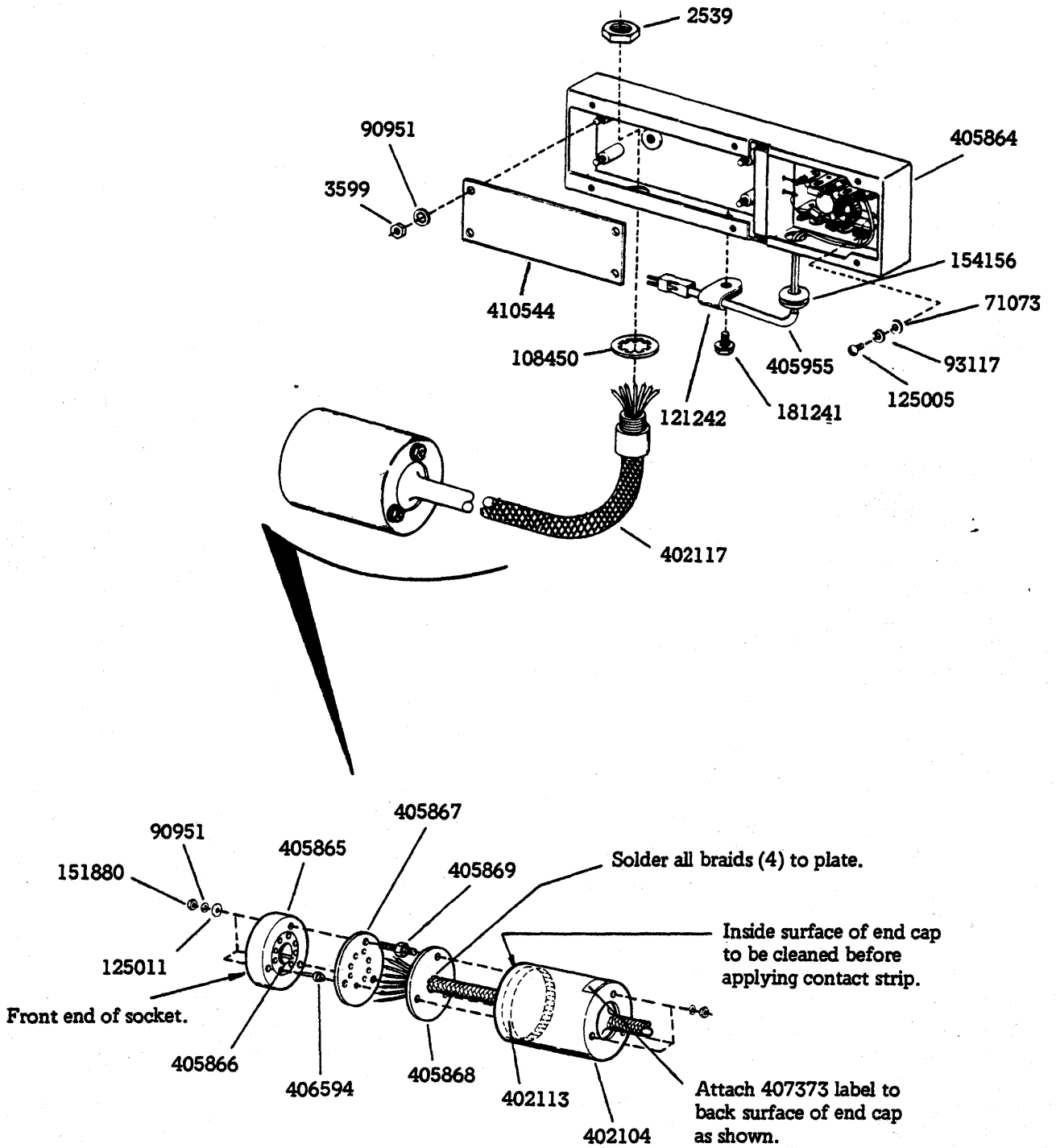


HIGH VOLTAGE PLATE ASSEMBLY (405859)



FRONT ENCLOSURE ASSEMBLY (405873)

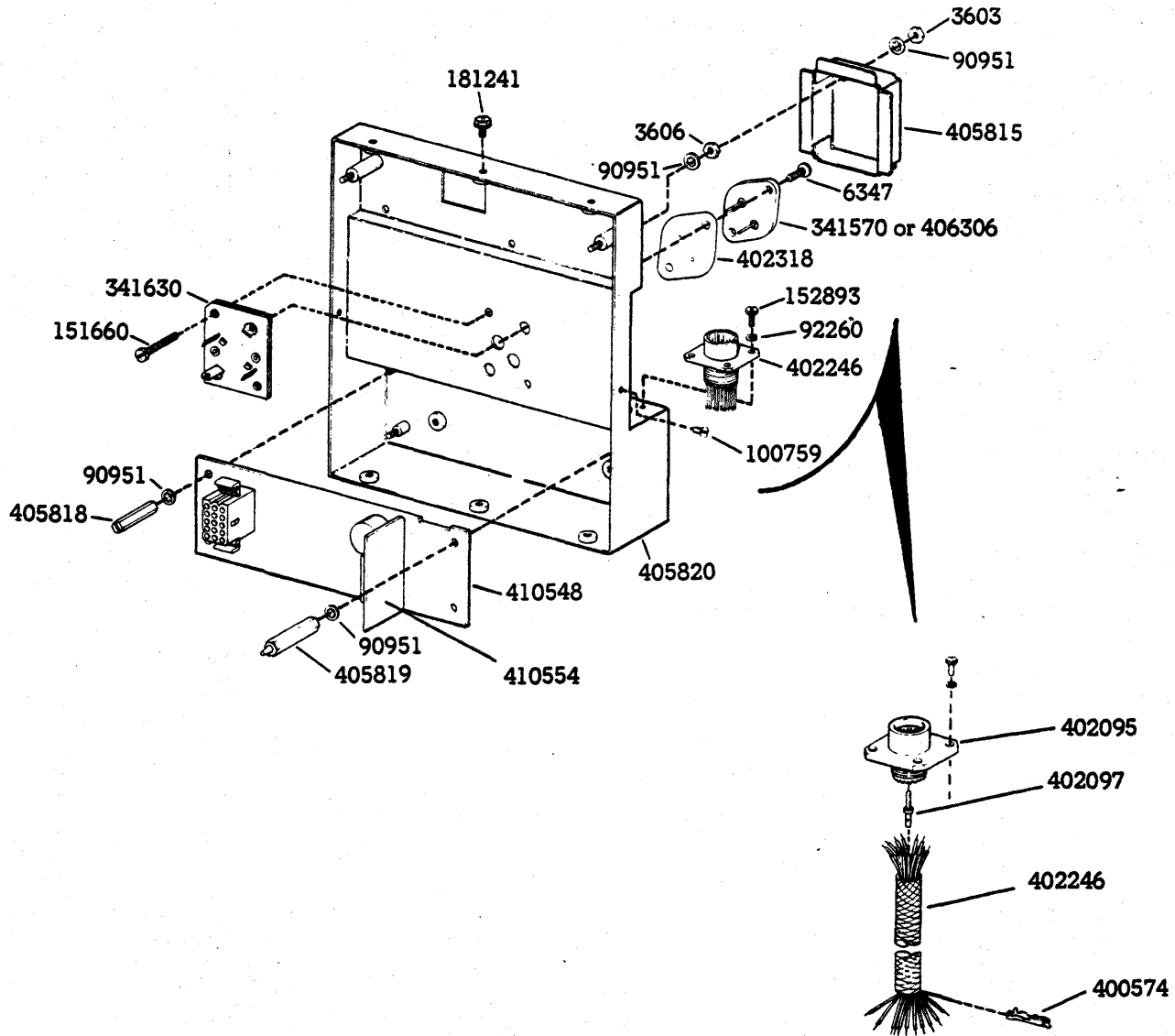




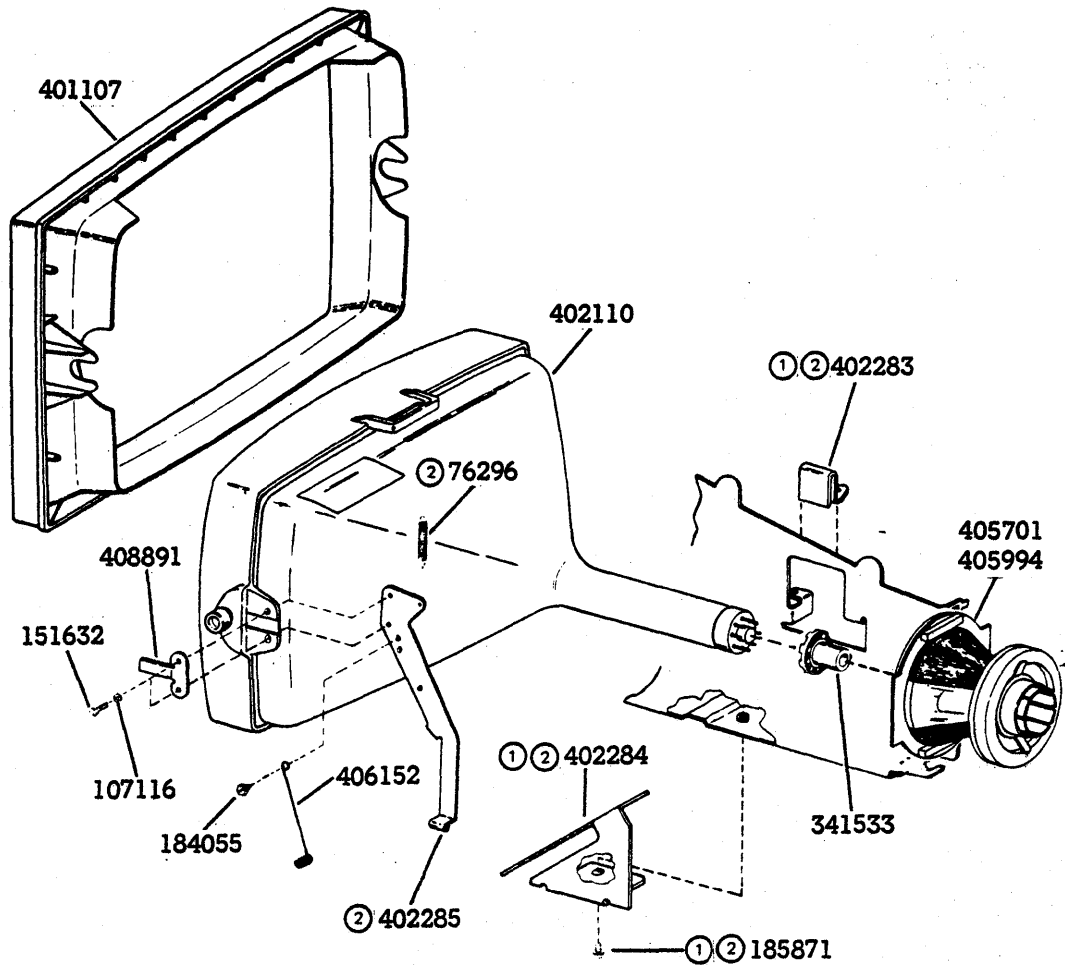
REAR COVER ASSEMBLY (405861)

F. DISASSEMBLY/REASSEMBLY AND PARTS (Cont)

3. PARTS (Cont)

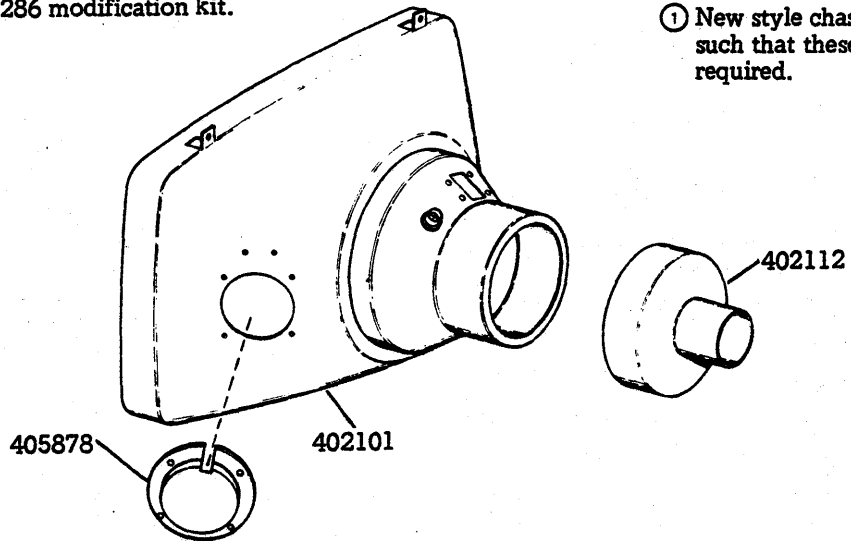
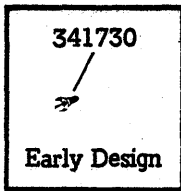


REAR ENCLOSURE ASSEMBLY



② Part of 402286 modification kit.

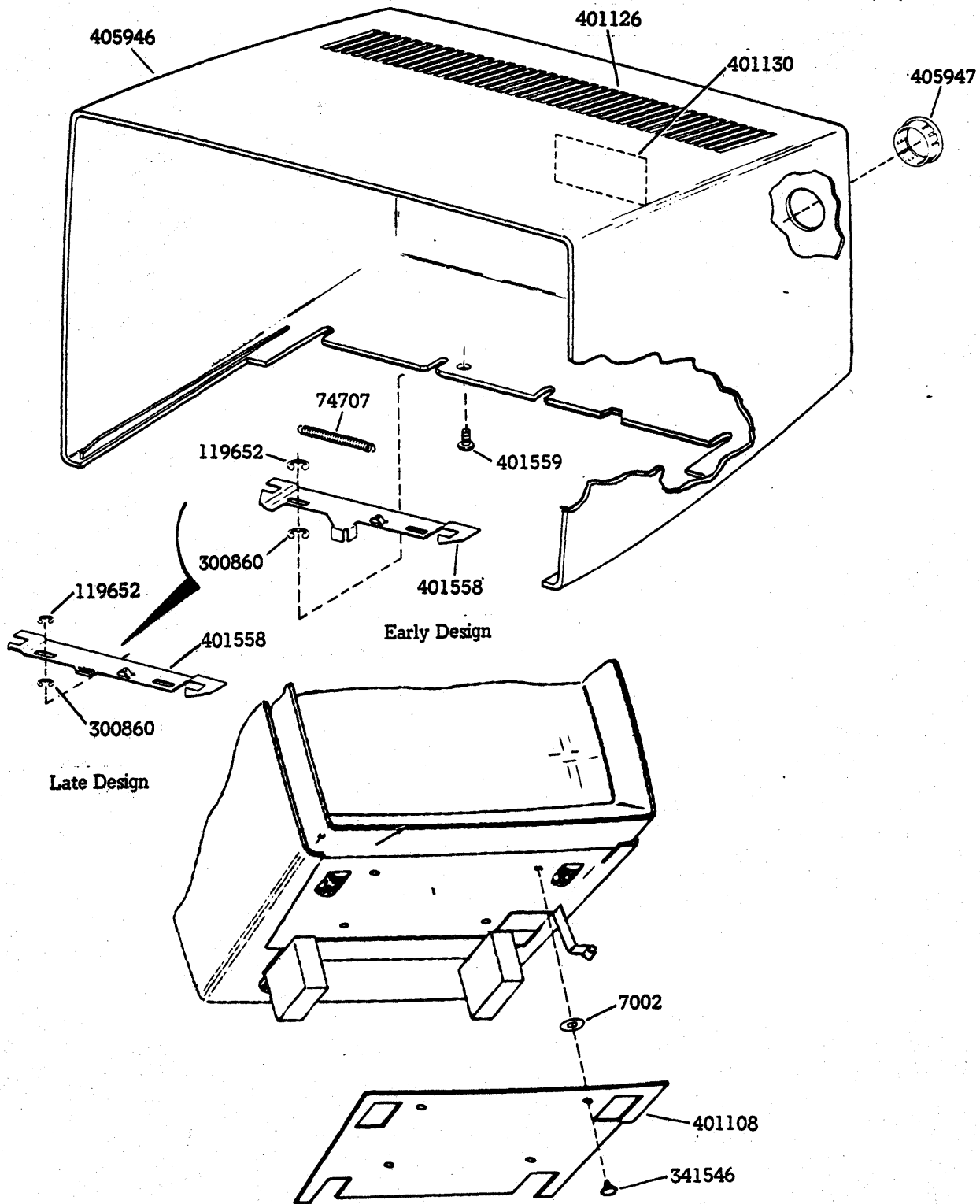
① New style chassis is redesigned such that these parts are not required.

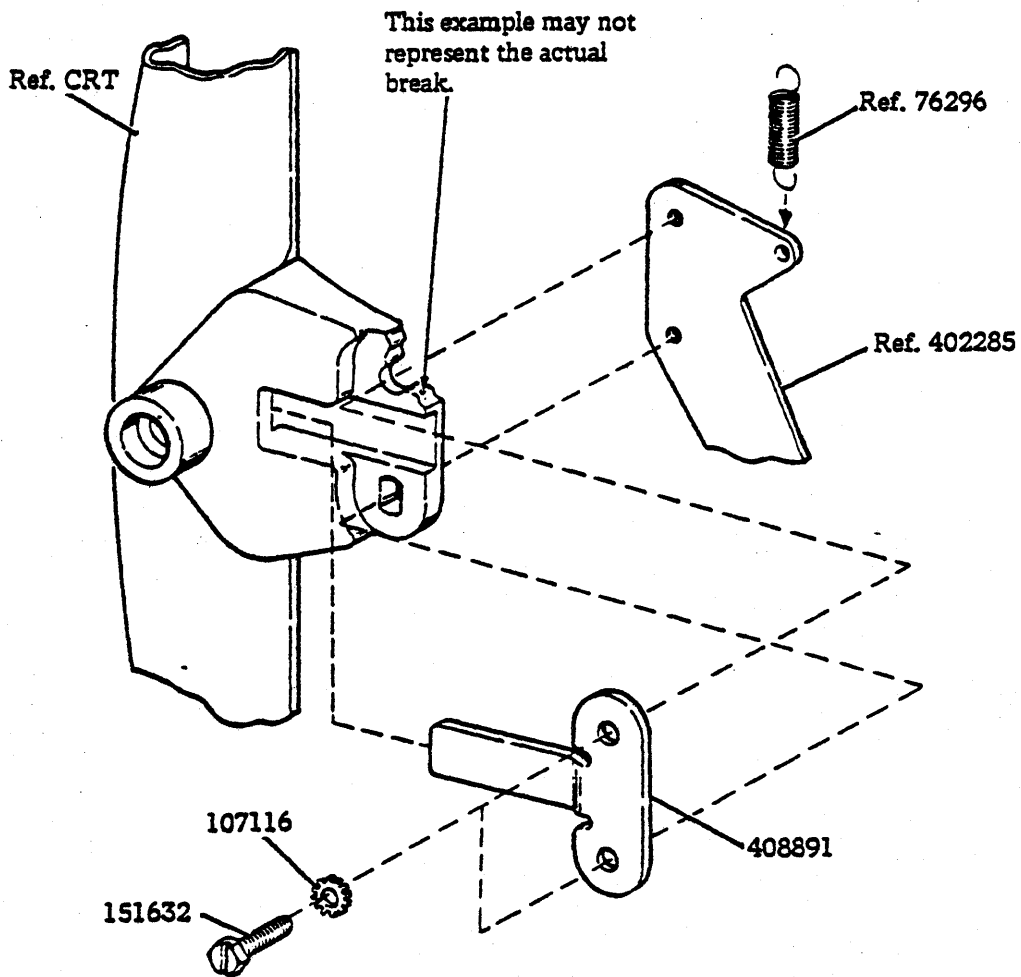


**402286 MODIFICATION KIT TO REPLACE WHEEL-TYPE  
TUBE TILT MECHANISM WITH LEVER-TYPE**

F. DISASSEMBLY/REASSEMBLY AND PARTS (Cont)

3. PARTS (Cont)





**408892 MODIFICATION KIT TO REPAIR 40-TYPE DISPLAY MONITOR CRT WITH BROKEN TILT LEVER MOUNTING TAB**

F. DISASSEMBLY/REASSEMBLY AND PARTS (Cont)4. COMPONENT PARTS LIST

**NOTE:** When ordering replaceable parts or components, unless otherwise specified, prefix each part number with the letters "TP" (ie, TP410055).

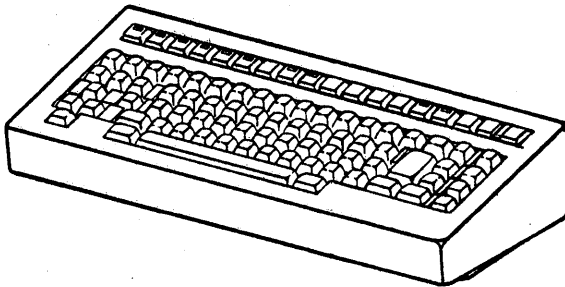
Part Number	Description and Page Number	Part Number	Description and Page Number	Part Number	Description and Page Number
1020	Screw, 6-40 x 1/4 Hex 117	180714	Screw, #6 Self-Tapping 112	341559	Cable Assembly 114
2191	Lockwasher 118	181240	Screw w/Lockwasher, 6-40 x 3/18 Hex 111, 115	341561	Retainer, Spring 114, 115
2199	Nut, 7/16-32 Hex 118	181241	Screw w/Lockwasher, 6-40 x 1/4 Hex 118, 119, 120	341562	Container 114, 115
2539	Nut, 3/8-32 Hex 119	181243	Screw w/Lockwasher, 6-40 x 3/8 Hex 115, 118	341563	Container 114
3598	Nut, 6-40 Hex 115	181392	Terminal, Tab Type 116	341564	Retainer, Spring 114
3599	Nut, 4-40 Hex 119	181707	Nut, Speed 112	341566	Wheel 114
3603	Nut, 1/4-32 Hex 120	181721	Connector, 12 Pt Plug Type 112	341567	Shaft 114
3606	Nut, 6-40 Hex 118, 120	182182	Holder, Fuse 112	341568	Transistor 117
6347	Screw, 6-32 x 3/8 RD 120	182648	Connector, 12 Pt Receptacle Type 114, 115	341569	Transistor 117
7002	Washer, Flat 122	183111	Label 112	341570	Transistor 120
71073	Washer, Flat 118, 119	184055	Screw w/Lockwasher, 6-40 x 3/16 Hex 121	341576	Switch 114
74707	Spring 122	184057	Screw w/Lockwasher, 6-40 x 3/8 Hex 117	341577	Socket, Fuse 112
76296	Spring 115, 121, 123	184058	Screw w/Lockwasher, 6-40 x 7/16 Hex 117	341578	Fuse, 1.4A SL-BL 112
84226	Spring 111	185676	Terminal, Plug Type 112	341579	Fastener 117
90951	Lockwasher 119, 120	185677	Terminal, Receptacle Type 113, 114, 115, 118	341580	Support, Circuit Card 117
92260	Lockwasher 112, 113, 120	185871	Screw w/Lockwasher, 8-32 x 3/8 Hex 112, 115, 121	341616	Insulator 112
92527	Lockwasher 112	195272	Screw, 6-40 Spl 112, 113	341621	Cover 117
93117	Lockwasher 118, 119	300860	Ring, Retaining 122	341630	Socket Assembly 120
98642	Lockwasher 111	318822	Transistor 117	341648	Terminal, Plug Type 116
100759	Screw, 4-40 x 3/16 Flat 120	318845	Jumper 111	341649	Connector 116
107116	Lockwasher 111, 115, 121, 123	319238	Nut, 12-32 Hex 118	341651	Stud 117
108450	Lockwasher 119	326919	Nut, Speed 112	341674	Connector, 3 Pt Receptacle 114, 118
110126	Lockwasher 111	327954	Retainer, Split Ring 117	341683	Socket, Fuse 112
110743	Lockwasher 111	328625	Cable Assembly 118	341684	Lamp Assembly, Neon 112
112485	Screw, 6-32 x 1/4 Fil 112, 113	328793	Capacitor, .001 MFD 118	341685	Strap 112
119652	Ring, Retainer 122	341507	Cable Assembly 112	341686	Fuse, 1.5A SL-BL 112
121242	Clamp, 8/8 ID Cable 119	341522	Choke 115	341690	Transformer 112
121243	Clamp, 3/16 ID Cable 118	341523	Bracket 112	341696	Connector, 5 Pt Receptacle 112
125005	Screw, 2-56 x 3/16 RD 118, 119	341526	Socket Assembly 117	341711	Clamp, Cable 115
125011	Washer, Flat 119	341527	Socket Assembly 117	341715	Lable 112
125124	Screw, 4-40 Shoulder 116	341533	Base, CRT 121	341716	Latch 111
126241	Lockwasher 118	341546	Fastener, Drive 112, 117, 122	341717	Screw, 8-32 Shoulder 111
146952	Screw, 4-40 x 3/8 Flat 117	341557	Wheel 114, 115	341717	Screw, 6-40 Shoulder 121
151632	Screw, 6-40 x 3/8 Hex 121, 123	341558	Potentiometer 114, 115	341730	Transformer 112
151660	Screw, 6-40 x 7/8 Fil 120			341792	Finger 111, 112, 115
151737	Screw, 4-40 x 11/64 Hex 111			341795	Distribution Assembly, Power 112
151880	Nut, 4-40 Hex 119			341797	Screw w/Lockwasher, 6-32 x 5/16 Hex 112
152893	Screw, 4-40 x 1/4 Hex 120			341798	Screw w/Lockwasher, 6-32 x 9/16 Hex 117
153799	Screw, 4-40 x 21/64 Hex 118			400574	Terminal, Plug Type 120
154156	Grommet, Rubber 119			401107	Mask, Monitor 121
				401108	Plate, Bottom 122

Part Number	Description and Page Number	Part Number	Description and Page Number	Part Number	Description and Page Number
401109	Rod, Support 111	402246	Cable Assembly 120	405861	Cover Assembly, Rear 119
401111	Support 116	402283	Clip, Spring 115, 121	405863	Cable Assembly 115
401112	Cover, Right Support 116	402284	Bracket 115, 121	405864	Cover 119
401113	Cover, Left Support 116	402285	Lever 121, 123	405865	Socket 119
401114	Shield, Right Side 111	402286	Modification Kit 115, 121	405866	Ring 119
401115	Shield, Left Side 111	402318	Insulator 117, 120	405867	Cover, End 119
401116	Shield, Front 111	402319	Insulator 117	405868	Plate 119
401117	Bracket 111, 116	403636	Bracket 112, 113	405869	Post 119
401118	Screw, 10-32 x 1/2 Flat 111	403637	Post 112	405873	Enclosure Assembly, Front 118
401119	Bracket, Hinge 111	403638	Filter 112, 113	405878	Cover 121
401120	Post 116	405701	Yoke Assembly 121	405881	Sleeve 118
401122	Screw, 8-32 x 7/32 Hex 111	405703	Cable Assembly 116	405946	Cover, Monitor 122
401126	Screen 122	405719	Network 114, 115	405947	Bushing 122
401130	Plate 122	405720	Cable Assembly 114	405952	Strap 115
401558	Bracket, Latch 122	405809	Sink, Heat 117	405955	Cable Assembly 119
401559	Post 122	405810	Bar 117	405994	Yoke Assembly 121
401647	Connector, 3 Pt Receptacle 115	405811	Rail 117	406152	Latch, Spring 121
402095	Receptacle 120	405812	Plate 117	406306	Transistor 120
402097	Pin 120	405815	Cover 120	406594	Terminal 119
402101	Shield 121	405818	Nut, 4-40 Slotted 120	407371	Label 113
402104	Cap, Rear 119	405819	Post 120	407373	Label 119
402106	Frame 112	405820	Enclosure, Rear 120	408891	Bracket 121, 123
402109	Strap, 3" Braided 115	405823	Plate 118	408892	Modification Kit 123
402110	Shield Assembly, CRT Front 121	405824	Cable Assembly 118	410544	Card, Circuit 119
402112	Shield 121	405825	Cable Assembly 118	410545	Card, Circuit 118
402113	Strip, Contact 119	405832	Cable Assembly 118	410546	Card, Circuit 118
402117	Cable Assembly 119	405853	Cover 118	410548	Card, Circuit 120
402118	Cable Assembly 114, 115	405856	Cable Assembly 118	410554	Card, Circuit 120
402120	Switch Assembly 114, 115	405857	Cable Assembly 118	410559	Card, Circuit 117
		405858	Cable Assembly 118	410852	Card, Circuit 112
		405859	Plate Assembly, High Voltage 118	410853	Card, Circuit 117

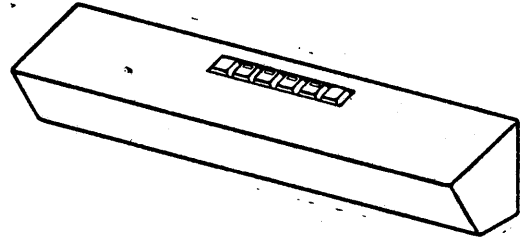




PART 5 -- TEMPEST MODEL 40 OPCONS



40K103 and 40K108 KD Opcons  
(With Keyboard)



40K002 RO Opcon  
(Without Keyboard)

	<u>INDEX</u>	<u>PAGE</u>
<b>A. GENERAL</b>		
1. DESCRIPTION . . . . .		5-2
2. TOOLS AND TEST EQUIPMENT. . . . .		5-2
<b>B. SHOP PROCEDURES</b>		
1. GENERAL INFORMATION . . . . .		5-3
2. CLEANING AND REFINISHING. . . . .		5-3
3. INSPECTION. . . . .		5-5
4. CONVERSIONS . . . . .		5-6
5. MARKING AND PACKING . . . . .		5-11
<b>C. TESTING</b>		
1. GENERAL . . . . .		5-14
2. PRELIMINARY . . . . .		5-14
3. FUNCTIONAL TESTS -- 40K103 OPCON. . . . .		5-14
4. FUNCTIONAL TESTS -- 40K108/RDE/RDH OPCONS . . . . .		5-26
5. FUNCTIONAL TESTS -- 40K108/RDG OPCON. . . . .		5-33
6. FUNCTIONAL TESTS -- 40K108/RDF. . . . .		5-41
7. FUNCTIONAL TESTS -- 40K002 OPCON. . . . .		5-49
<b>D. TROUBLESHOOTING</b>		
1. GENERAL . . . . .		5-50
2. PRELIMINARY . . . . .		5-50
3. TROUBLESHOOTING CHARTS. . . . .		5-51
4. REFERENCE MATERIAL. . . . .		5-94
<b>E. ADJUSTMENTS AND LUBRICATION</b>		
1. ADJUSTMENTS . . . . .		5-121
2. LUBRICATION . . . . .		5-121
<b>F. DISASSEMBLY/REASSEMBLY AND PARTS</b>		
1. GENERAL . . . . .		5-121
2. REMOVAL AND REPLACEMENT -- KD AND RO. . . . .		5-123
3. SUBASSEMBLY IDENTIFICATION -- KD. . . . .		5-123
4. DISASSEMBLY/REASSEMBLY -- KD. . . . .		5-124
5. PARTS -- KD . . . . .		5-130
6. SUBASSEMBLY IDENTIFICATION -- RO. . . . .		5-140
7. DISASSEMBLY/REASSEMBLY -- RO. . . . .		5-141
8. PARTS -- RO . . . . .		5-143
9. COMPONENT PARTS LIST -- KD AND RO . . . . .		5-144

PART 5 -- TEMPEST MODEL 40 OPCONSA. GENERAL1. DESCRIPTIONKD Opcon

The KD Opcon is a keytop actuated device for manually generating data and operational mode information in the form of coded signals. The KD opcon also functions to receive and indicate (lighted keytops) status codes or sound (internal tone generator) alarm codes. Interface with other Model 40 components is by means of separate controller logic.

The KD Opcon consists of one or two circuit cards mounting the integrated and discrete component logic, keytop associated keyswitches, tone generator and necessary cabling, hardware and covers. A 9-pin connector is provided for interfacing with the Model 40 controller.

RO Opcon

The 40K002 RO Opcon is a keytop actuated device for manually selecting certain operating modes of receive-only printer sets. Selection is by direct keyswitch make-break operation in contrast to the keyswitch code generating capabilities of the KD opcon. Status of the various modes is indicated by lighted keytops.

The RO opcon consists of a frame mounting the keytop associated keyswitches, necessary hardware and covers, and cabling terminated by a 9-pin connector for interfacing with the Model 40 controller.

2. TOOLS AND TEST EQUIPMENTTools

The tools listed below are supplementary to common types such as pliers, screwdrivers, etc, and may be ordered from Teletype Corporation using the part number shown. Tools listed without a Teletype part number may be procured locally.

NOTE: When ordering parts, prefix each number with the letters "TP" unless specified otherwise.

<u>Description</u>	<u>Part No.</u>
• Spring Hook (Pull)	75765
• 1/4 Inch Nut Driver Wrench	89954
• Keyswitch Extractor Tool	346257
• Keytop Extractor Tool	346260
• Cable Assembly (Interface and Bell Card Extractor) (2 required)	346274
• Static Discharge Strap	346392
• Cable Extender (Opcon Extender -- 6 Ft)	401641
• Terminal Extractor Tool	402840
• Terminal Insertion Tool, Molex HT-1807, or equivalent (procure locally)	
• Soldering Iron, Weller Model W-MCP-750 with MP2C Tip, or equivalent (procure locally)	
• Desoldering Tool, EDSYN Model MMS005 Soldapullt <sup>®</sup> , or equivalent (procure locally)	

Test Equipment

The following equipment is required for testing and troubleshooting the KD Opcon. This equipment, or equivalent substitutes, should be procured locally.

- Triplett Model 630APL Multimeter
- Tektronix Model 7904 Oscilloscope e/w:
  - 2 -- 7A16A Single Trace Amplifiers
  - 1 -- 7B70 Time Base Unit

Miscellaneous

Items a. through d. may be procured locally. Item e. should be ordered from Teletype Corporation.

- a. Refined Mineral Spirits
- b. Wiping Cloths, Soft, Lint-Free
- c. 1/2-Inch Nylon-Bristle Paint Brush
- d. Thermal Joint Compound, Wakefield Engineering No. 340, or equivalent
- e. Grease, 4-Ounce Tube 97116

B. SHOP PROCEDURES1. GENERAL INFORMATION

This section details the cleaning, refinishing and inspection procedures to be followed prior to testing and troubleshooting the opcon unit. In many cases careful inspection, in particular, will save later troubleshooting by revealing broken or loose connections, damaged components, possible short circuits, etc.

Refer to Page 5-121, F. DISASSEMBLY/REASSEMBLY AND PARTS whenever detailed information on removing opcon components is required.

CAUTION: TO AVOID POSSIBLE INTERNAL DAMAGE TO THE MOS DEVICES OR CIRCUIT CARDS WITH MOS DEVICES DUE TO ELECTRICAL STATIC DISCHARGE BY SERVICE PERSONNEL, FOLLOW THE HANDLING AND GROUNDING PROCEDURES ON PAGE 5-64, 1. GENERAL.

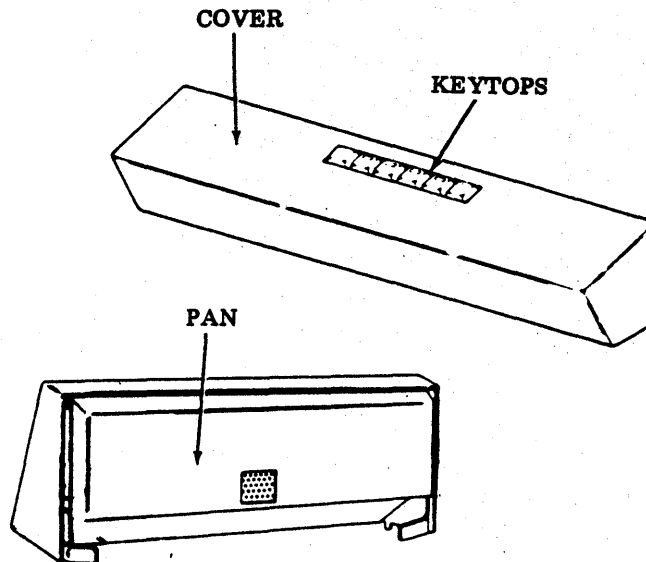
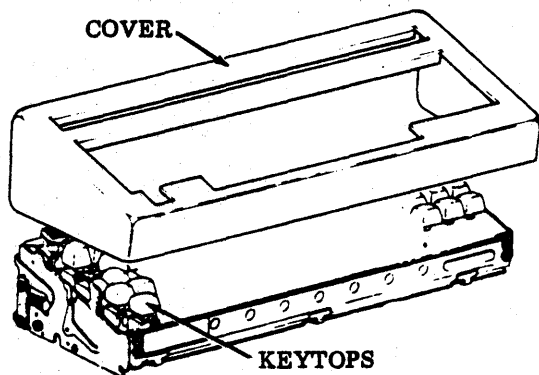
Refer to Page 5-6, 4. CONVERSIONS for keytop locations and part numbers when a change from one standard keytop arrangement to another is desired.

The packing materials detailed in this section are designed for protection against damage from rough handling in shipping.

2. CLEANING AND REFINISHING

Immersion type cleaning is not recommended for the KD or RO opcon units.

CAUTION: AVOID THE USE OF HARSH OR ABRASIVE CLEANING AGENTS, OR SOLVENTS WHICH COULD SCRATCH OR DAMAGE THE EXTERIOR PLASTIC COVER OR KEYTOPS.

B. SHOP PROCEDURES (Cont)2. CLEANING AND REFINISHING (Cont)Exterior

Clean all indicated surfaces as follows:

Cover (Removed From Opcon)

Wash with mild detergent solution.

Rinse with damp cloth.

Buff dry with soft cloth.

Keytops (Removed From Opcon)

Place keytops in dipping basket or other mesh container.

Immerse basket in mild detergent solution and agitate for 1 or 2 minutes.

Rinse keytops with clean hot water (140°F).

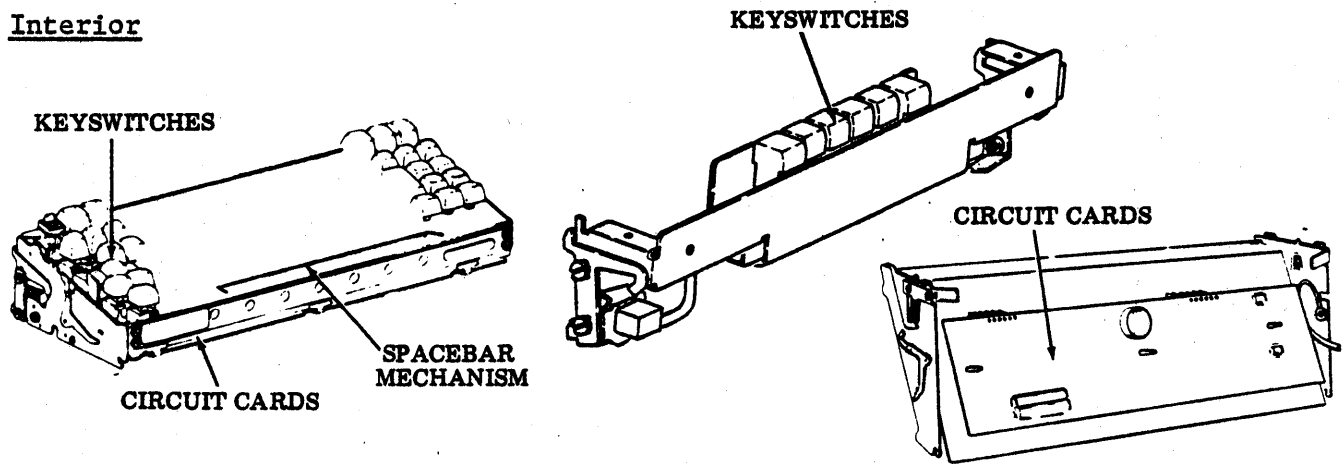
Remove keytops from basket and air dry or buff dry with clean soft cloth.

Before keytops are reinstalled, clean the opcon interior as specified on Page 5-5, Interior.

Pan (Removed From Opcon)

Wipe off metal pan with a soft cloth dampened with refined mineral spirits.

Interior



Clean the interior area, keyswitches, circuit cards, and other components by lightly brushing with a clean dry 1/2-inch paint brush followed by air blowing.

**CAUTION:** THE AIR SUPPLY SHOULD NOT EXCEED 20 P.S.I. HIGHER AIR PRESURES MAY DAMAGE SMALL COMPONENTS.

Reinstall the keytops in accordance with the arrangements detailed on Page 5-6, 4. CONVERSIONS of this section. Replace any damaged or illegible keytops. Leave the cover and pan off at this time to facilitate inspection.

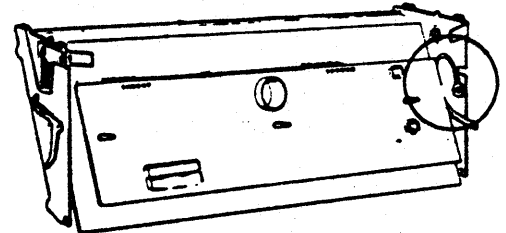
3. INSPECTION

Internal Inspection

Remove the cover and pan, if not already removed, and visually check general condition of opcon, replacing any damaged components.

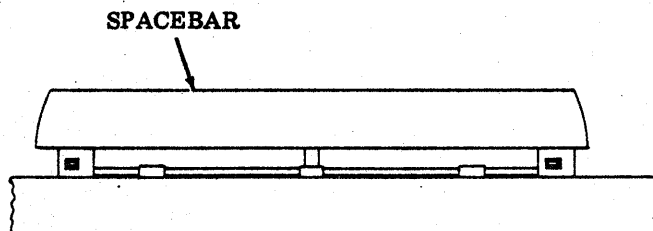
Verify continuity of green ground strap between opcon connector pin 9 and the opcon frame.

Examine the 9-pin connector located at the left rear side of the opcon for dirty, loose, bent, broken, or missing pins.



Check for presence of audible click when each key is depressed (except CAPS LOCK) and when each key is released. A second click should be heard when repeat keys are depressed fully and click again when released.

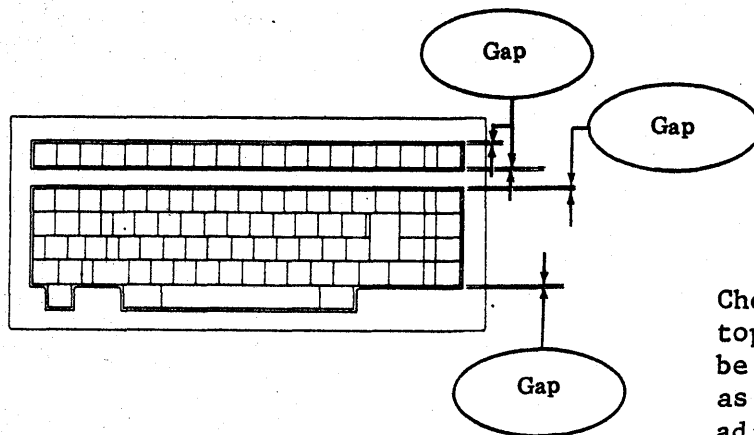
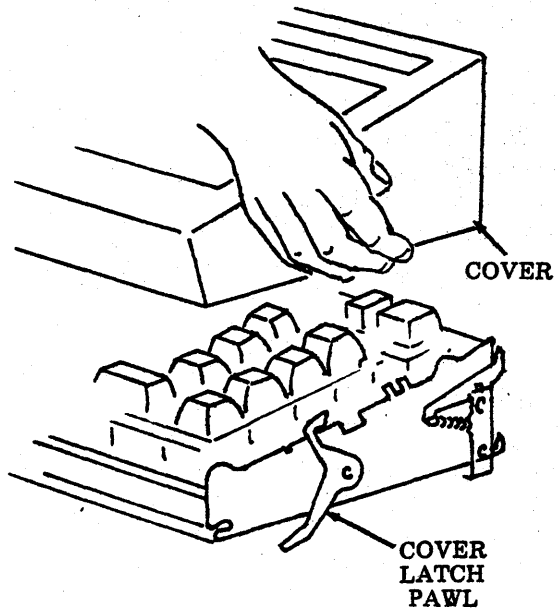
Check mechanical operation of the CAPS LOCK key. This key should latch down when depressed and release when depressed again. (Remove blocking keytop, if present, to check.)



Check mechanical operation of spacebar mechanism. The spacebar should return to its unoperated position freely when depressed and released slowly. Replace cover and pan.

B. SHOP PROCEDURES (Cont)3. INSPECTION (Cont)External Inspection

Replace the KD opcon cover. The cover latch pawls should operate freely and when latched should securely hold cover to console frame.



Check clearance between cover and keytop on the KD opcon. The gap should be approximately equal in four places as shown. Make Cover-to-Keytop adjustment (Page 5-121) if any keytops are found rubbing against cover.

4. CONVERSIONS

Conversions from one KD opcon keyboard arrangement to another is accomplished in the following ways:

- a. Disabling certain mode selection by substituting blank blocking keytops for keytops having descriptive designations.
- b. Enabling certain mode selection by substituting keytops with descriptive designations for blank blocking keytops.

Keyboard arrangements are directly related to the various Model 40 set arrangements relative to selectable controller and/or printer options. The variable keytops involved are shown and described.

Arrangements for 40K103 Opcon

RCA

SEND	REC	LOCAL	S/R	INTRPT	FORM SEND	OPT II	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	PARITY ERROR	TERM READY	KBD OVRN	CLEAR TO SEND	HIGH LIGHT	FORM ENTER	TAB SET	TAB CLEAR	<input checked="" type="checkbox"/>	CLEAR
------	-----	-------	-----	--------	-----------	--------	-------------------------------------	-------------------------------------	--------------	------------	----------	---------------	------------	------------	---------	-----------	-------------------------------------	-------

This arrangement used on Tempest KD Sets.

RCB

SEND	REC	LOCAL	S/R	INTRPT	FORM SEND	OPT II	PRINT ON LINE	PRINT LOCAL	PARITY ERROR	TERM READY	KBD OVRN	CLEAR TO SEND	HIGH LIGHT	FORM ENTER	TAB SET	TAB CLEAR	<input checked="" type="checkbox"/>	CLEAR
------	-----	-------	-----	--------	-----------	--------	---------------	-------------	--------------	------------	----------	---------------	------------	------------	---------	-----------	-------------------------------------	-------

This arrangement used on asynchronous or isochronous Tempest KDP Sets.

RCC

SEND	REC	LOCAL	OPT II	PARITY ERROR	TERM READY	<input checked="" type="checkbox"/>	KBD OVRN	CLEAR TO SEND	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CLEAR
------	-----	-------	--------	--------------	------------	-------------------------------------	----------	---------------	-------------------------------------	-------------------------------------	-------------------------------------	-------------------------------------	-------------------------------------	-------------------------------------	-------------------------------------	-------------------------------------	-------------------------------------	-------------------------------------	-------

This arrangement used on Tempest KP Sets.

RCD

SEND	REC	LOCAL	MSG WTG	INTRPT	FORM SEND	<input checked="" type="checkbox"/>	PRINT ON LINE	PRINT LOCAL	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	HIGH LIGHT	FORM ENTER	TAB SET	TAB CLEAR	<input checked="" type="checkbox"/>	CLEAR
------	-----	-------	---------	--------	-----------	-------------------------------------	---------------	-------------	-------------------------------------	-------------------------------------	-------------------------------------	-------------------------------------	------------	------------	---------	-----------	-------------------------------------	-------

This arrangement used on synchronous Tempest KDP Sets.

HOME	SCROL UP	SEGMT ADV	!	@	#	\$	%	^	&	*	(	)	-	]	TAB	~	S	Y	N	LINE INSRT	
CURSR RETRN	SCROL DOWN	CURSR TAB	DC1	ETB	ENQ	DC2	DC4	EM	SUB	US	SI	ESC	[	]	NEW LINE		A	C	K	LINE DELETE	
<input type="checkbox"/>	<input type="checkbox"/>	CAPS LOCK	SOH	DC3	EOT	DLE	BEL	GS	RS	VT	FF	:	;	"/	(	)	N	A	K	CHAR INSRT	
<input type="checkbox"/>	<input type="checkbox"/>	SHIFT	NUL	CAN	ETX	DEL	STX	SO	FS	<	>	?	/	SHIFT	RETURN					CHAR DELETE	
<input type="checkbox"/>	<input type="checkbox"/>	CONTROL	SPACE										CONTROL								

Indicates 340701 blocking keytop.

All 40K103 KD Opcons have the same typewriter field, cursor controls and editing features keytop arrangement.

B. SHOP PROCEDURES (Cont)4. CONVERSIONS (Cont)

## 40C103 -- CONTROL KEYTOPS

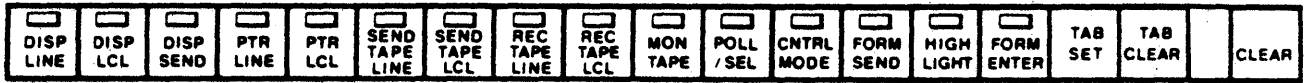
KEYTOP	TP PART NUMBER	USED ON KEYBOARD ARRANGEMENT			
		RCA	RCB	RCC	RCD
SEND	346100	X	X	X	X
REC	346101	X	X	X	X
LOCAL	346102	X	X	X	X
S/R	346103	X	X		
INTRPT	346106	X	X		X
FORM SEND	346121	X	X		X
OPT II	346124	X	X	X	
PRINT ON LINE	346104		X		X
PRINT LOCAL	346105		X		X
PARITY ERROR	346126	X	X	X	
TERM READY	346127	X	X	X	
KBD OVRN	346159	X	X	X	
CLEAR TO SEND	346158	X	X	X	
HIGH LIGHT	346107	X	X		X
FORM ENTER	346108	X	X		X
TAB SET	346110	X	X		X
TAB CLEAR	346111	X	X		X
CLEAR (TST)	405933	X	X		X
BLANK (TST)	405935			X	
MSG WTG	346123				X



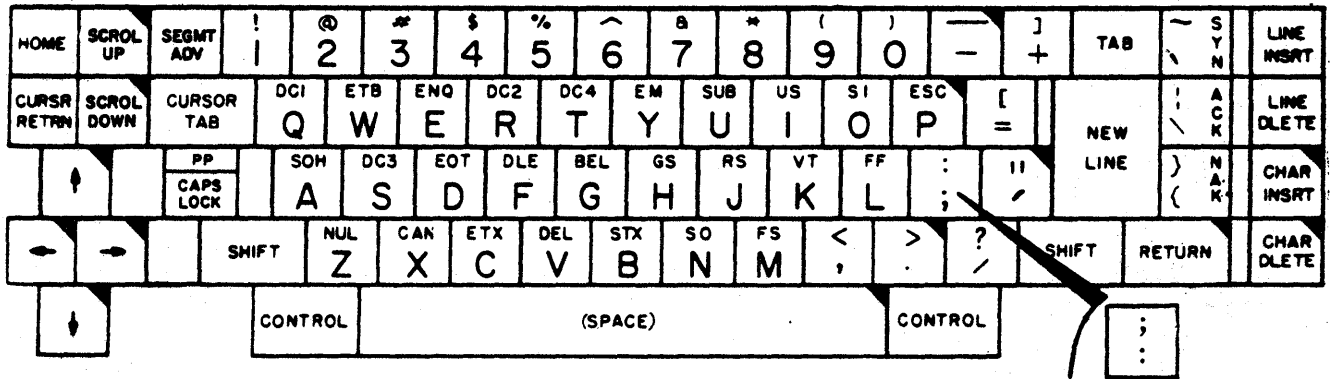
Arrangements for 40K108 Opcon

40K108/RDE or 40K108/RDH Opcon Layout

Have the same typewriter field, cursor controls and editing controls as a 40K108/RDF.

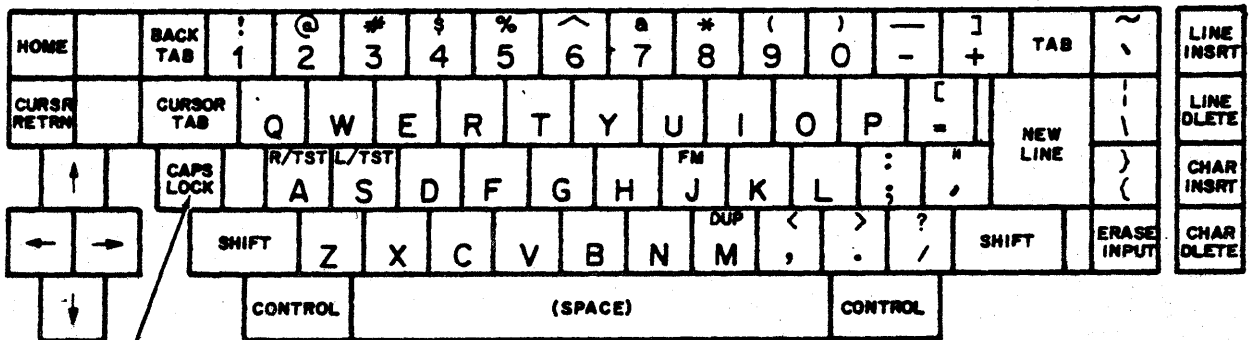


40K108/RDF Opcon Layout



Only on RDH

40K108/RDG Opcon Layout -- ASCII (Factory Installed)



EBCDIC (Field Substitution)

CAPS LOCK -- 340894  
BLOCKING -- 405918

INDICATOR LIGHT

REPEAT KEYS



341027

341028

341029

B. SHOP PROCEDURES (Cont)4. CONVERSIONS (Cont)

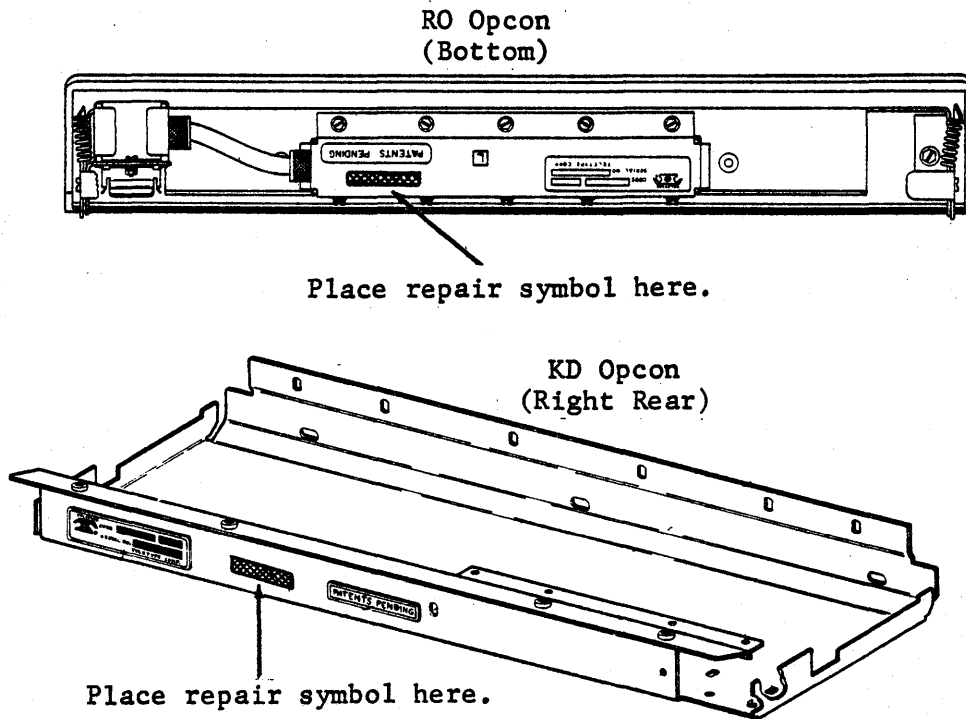
## 40C108 -- CONTROL KEYTOPS

KEYTOP	TP PART NUMBER	USED ON KEYBOARD ARRANGEMENT			
		RDE	RDF	RDG	RDH
SEND	346100		X		
LOCAL	346102		X	X	
S/R	346103			X	
FORM SEND	346121	X			X
PRINT LOCAL	346105			X	
HIGH LIGHT	346107	X			X
FORM ENTER	346108	X			X
TAB SET	346110	X	X		X
TAB CLEAR	346111	X	X		X
DISP LINE	346170	X			X
DISP LCL	346171	X			X
DISP SEND	346172	X			X
PTR LINE	346173	X			X
PTR LCL	346174	X			X
SEND TAPE LINE	346175	X			X
SEND TAP LCL	346176	X			X
REC TAPE LINE	346177	X			X
REC TAPE LCL	346178	X			X
MON TAPE	346179	X			X
POLL/SEL	346180	X			X
CNTRL MODE	346181	X			X
CMND	346182		X		
NEXT OUTGO	346183		X		
FRMT	346184		X		
NEXT INCOM	346185		X		
DEFEC	346186		X		
PRINT A	346187		X		
PRINT B	346188		X		
PA1	346863			X	
PA2	346864			X	
PF1 -- PF10	346865-874			X	
PF11	346877			X	
PF12	346878			X	
CLEAR (TST)	405933	X	X	X	X

5. MARKING AND PACKING

Marking

For record keeping purposes, the repair date may be marked on the opcon frame in a manner similar to that detailed below.



Packing

Factory-type packing may be duplicated by ordering the required PK materials from Teletype Corporation and applying, as follows.

Materials Required for KD Opcon

<u>Qty</u>		<u>Qty</u>	
1	9526PK Corrugated Carton	1	21307PK Muslin Bag
1	28164PK Set of Polystyrene Details		21719PK Tape (as required)
1	TC-135 Instruction Sheet		21632PK Tape (as required)
1	23456PK Plastic Bag		21480PK Tape (as required)
1	27643PK Label		

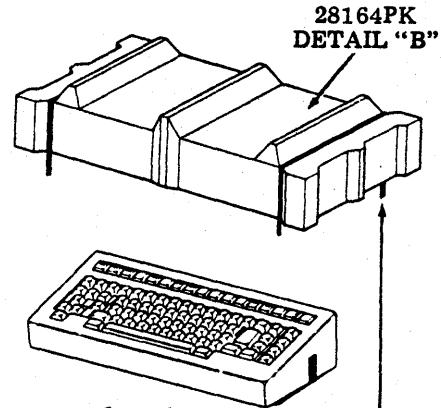
- (1) Place spare keytops in a 21307PK muslin bag and set aside.
- (2) Place a 28164PK detail "A" base on work bench. Place muslin bag containing keytops in cavity provided.
- (3) Remove KD opcon cover, if late design 28164PK packing details are used.
- (4) Place unit in a 23456PK plastic bag. Place a TC-135 instruction sheet in bag on top of keytops. Close open end of bag and secure with a strip of 21480PK tape.

B. SHOP PROCEDURES (Contd)

5. MARKING AND PACKING, Packing (Contd)

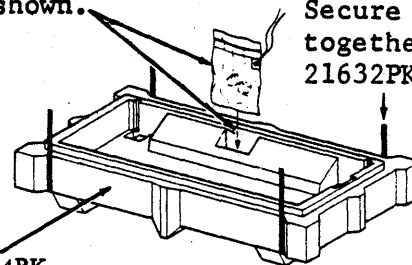
- (5) Place a 28164PK detail "B" cover over keyboard and place KD keyboard cover in cavity provided in late design 28164PK detail "B".
- (6) Secure 28164PK detail "A" base to detail "B" cover with a band of 21632PK tape applied girthwise around each end of plastic details.
- (7) Form a 9526PK carton. Close bottom flaps and seal center seam with a strip of 21719PK tape. The tape should extend approximately three inches down ends of carton.
- (8) Place prepacked unit in carton. Close top flaps of carton and seal as outlined in (7).
- (9) Moisten and apply a 27643PK label to upper left-hand portion of top of carton.

Early Design Packing Detail

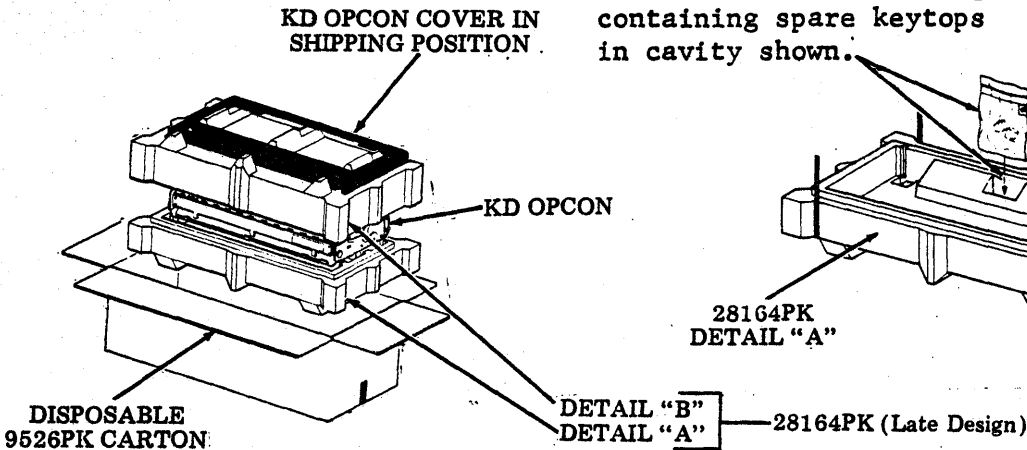


Place 21307PK muslin bag containing spare keytops in cavity shown.

Secure details together with 21632PK tape.



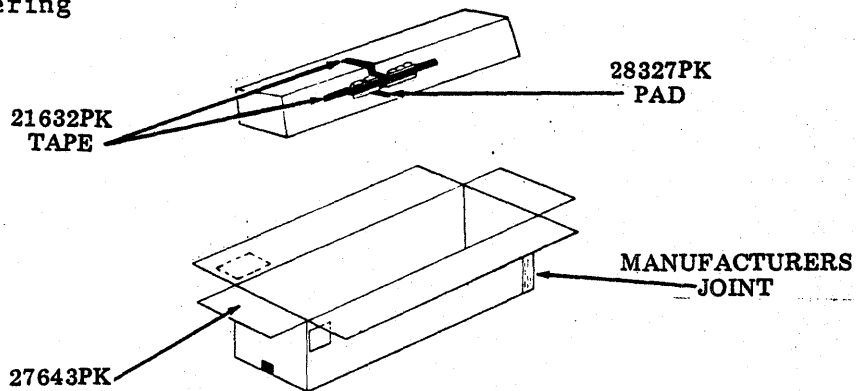
Late Design Packing Details



Material Required for RO Opcon

- |              |   |                          |
|--------------|---|--------------------------|
| 21632PK Tape | 1 | 28327PK Pad              |
| 12719PK Tape | 1 | 27643PK Carton           |
| 21480PK Tape |   | 27952PK Air Cap Covering |

NOTE: 23456PK plastic bag not shown.



- (1) Form an 8762PK carton. Close and seal bottom flaps with a strip of 21719PK tape applied to the center seam and extending three inches down the ends of the carton.
- (2) Place one 28327PK corrugated pad on top of the keytops. Tape securely to keyboard with two pieces of 21632PK tape (one piece across the length and one piece across the width of the pad).
- (3) Cut a seventy six inch long piece of 27952PK air cap and place on bench.
- (4) Place unit with open end down lengthwise on center of air cap approximately six inches from the end.
- (5) Wrap the unit lengthwise and tape end of air cap with a strip of 21480PK tape.
- (6) With manufacturers joint on the carton to the right side, place the unit into the carton with the keytops to the side of the carton.
- (7) Close and seal top flaps of carton as indicated in Step 1.

NOTE: 27952PK air cap deleted for clarity.

C. TESTING

1. GENERAL

Functional testing of the 40K103 or 40K108 KD Opcon is accomplished with the use of a full edit Model 40 KD Set. The 40K002 RO Opcon is tested in conjunction with a Model 40 ROP Set.

Functional testing provides a means for verifying the operational requirements of the KD or RO opcon units. The test procedure should be performed from start to finish without omissions. Possible causes of trouble are listed with the tests to provide aid in making the trouble correction.

Whenever the opcon fails a particular test, refer to Page 5-50, D. TROUBLESHOOTING to locate the trouble. After the trouble has been corrected, repeat the test that disclosed the trouble and if found ok, resume testing from that point.

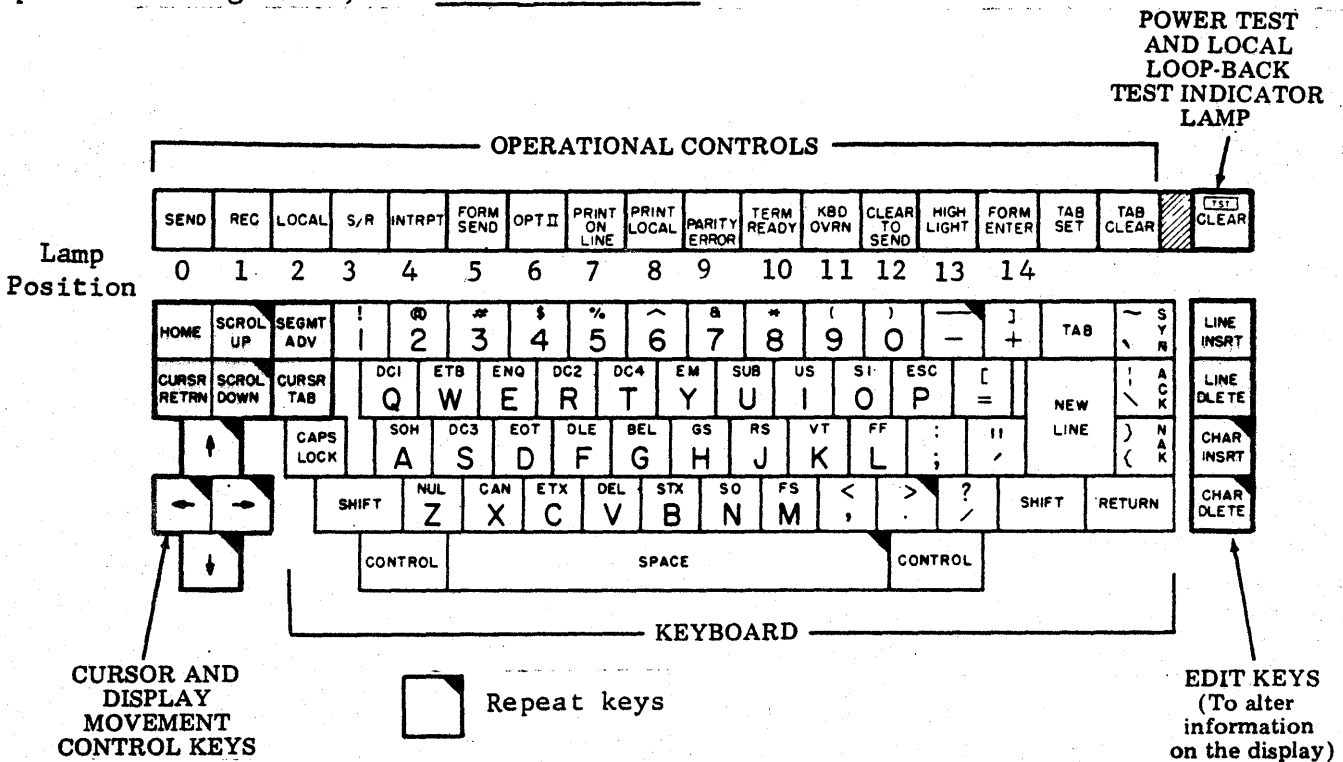
2. PRELIMINARY

With power off, install the opcon to be tested to the Model 40 KD or ROP Set serving as a test set. Then proceed with either:

3. FUNCTIONAL TESTS -- 40K103 Opcons
4. FUNCTIONAL TESTS -- 40K108/RDE/RDH OPCONS
5. FUNCTIONAL TESTS -- 40K108/RDG OPCON
6. FUNCTIONAL TESTS -- 40K108/RDF
7. FUNCTIONAL TESTS -- 40K002 OPCON

3. FUNCTIONAL TESTS -- 40K103 OPCONS

Remove all blocking keytops, if present. The location of the various control and data keys referred to in the KD opcon test are shown below. Apply power and proceed to Page 5-15, 3. FUNCTIONAL TESTS.



**NOTE:** The REC lamp lights immediately when power to the set is turned on. When using 40C430/AAT/017 controller, LOCAL lamp lights on power turn on.

STEP	PROCEDURE	RESPONSE	POSSIBLE CAUSE OF TROUBLE	SECTION D TROUBLE ANALYSIS
<b>KD OPCON TEST</b>				
1	Depress RETURN and ESC P simultaneously with additional force, and then release (Power Test).	TST CLEAR lamp lights (brightly) momentarily indicating power to opcon.	Dirty or broken connector pins.  Dirty or broken connection in feed-through box.  410074 interface and bell card.	Page 5-24
2	Depress RETURN and <span style="border: 1px solid black; padding: 2px;">"/</span> simultaneously with additional force, and then release (Loop-Back Test).  a. Place opcon into the caps mode by depressing and latching CAPS LOCK.  b. Depress the following keys while observing lamps for proper indication.	TST CLEAR lamp lights (brightly) and remains lit indicating the loop-back test mode is activated.  <b>NOTE:</b> Occasionally the operational lamps may flash on and then off, or the alarm bell may sound when the loop-back test mode is activated. If this occurs, clear the test by depressing RETURN and ESC P keys beyond their normal stop, and re-enter the test mode.	Check <span style="border: 1px solid black; padding: 2px;">"/</span> keyswitch.	Page 5-38, 5-47

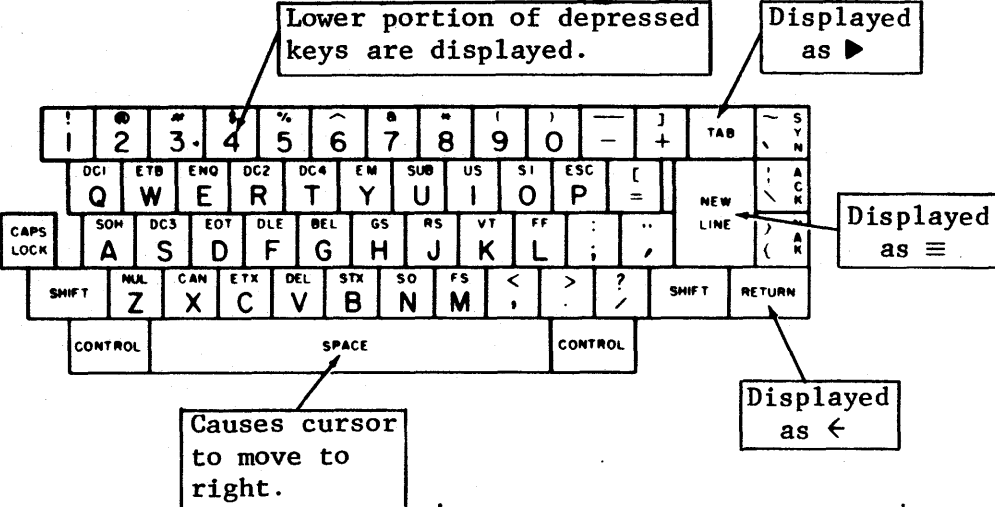
3. FUNCTIONAL TESTS -- 40K103 OPCONS (Contd)

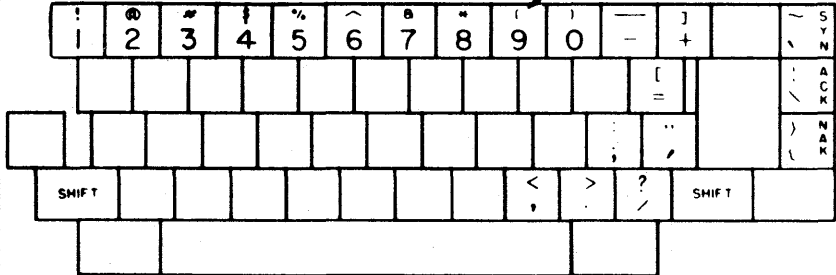
C. TESTING (Contd)

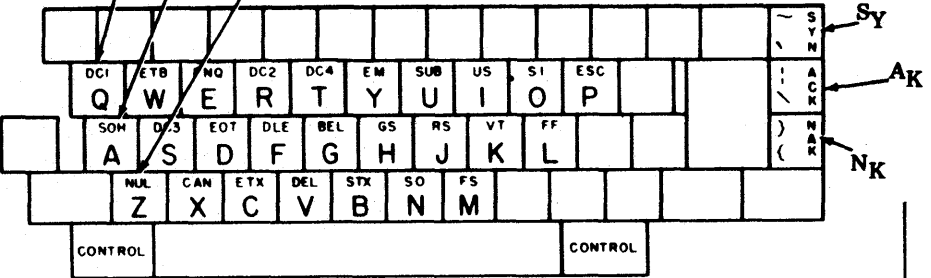


STEP	PROCEDURE	RESPONSE	POSSIBLE CAUSE OF TROUBLE	SECTION D TROUBLE ANALYSIS
2b. (Cont)	<div style="text-align: center; margin-bottom: 10px;"> <span style="border: 1px solid black; padding: 2px;">Depress Keys</span> </div> <div style="display: flex; justify-content: space-between; margin-bottom: 10px;"> <span style="border: 1px solid black; padding: 2px;">Function</span> <span style="border: 1px solid black; padding: 2px;">Lamp Position</span> <span style="border: 1px solid black; padding: 2px;">Lamp Condition</span> </div> <p>A - - - - -&gt; SEND (0) - - - - -&gt; ON</p> <p>CONTROL and A (SOH) SEND (0) OFF</p> <p>C REC (1) ON</p> <p>CONTROL and C (ETX) REC (1) OFF</p> <p>D LOCAL (2) ON</p> <p>CONTROL and D (EOT) LOCAL (2) OFF</p> <p>G S/R (3) ON</p> <p>CONTROL and G (BEL) S/R (3) OFF</p> <p>F INTRPT (4) ON</p> <p>CONTROL and ACK INTRPT (4) OFF</p> <p>E FORM SEND (5) ON</p> <p>CONTROL and E (ENQ) FORM SEND (5) OFF</p> <p>B OPT II (6) ON</p> <p>CONTROL and B (STX) OPT II (6) OFF</p> <p>J PRINT ON LINE (7) ON</p> <p>NEW LINE PRINT ON LINE (7) OFF</p> <p>O PRINT LOCAL (8) ON</p> <p>CONTROL and O (SI) PRINT LOCAL (8) OFF</p> <p>N PARITY ERROR (9) ON</p> <p>CONTROL and N (SO) PARITY ERROR (9) OFF</p> <p>M TERM READY (10) ON</p> <p>RETURN TERM READY (10) OFF</p> <p>L KBD OVRN (11) ON</p> <p>CONTROL and L (FF) KBD OVRN (11) OFF</p> <p>K CLEAR TO SEND (12) ON</p> <p>CONTROL and K (VT) CLEAR TO SEND (12) OFF</p> <p>I HIGH LIGHT (13) ON</p> <p>TAB HIGH LIGHT (13) OFF</p> <p>H FORM ENTER (14) ON</p> <p>← (Cursor Left) FORM ENTER (14) OFF</p> <p>→ (Cursor Right) REC (1)</p> <p style="text-align: center;">≥FLASH≤</p>			<p>Page 5-52</p>

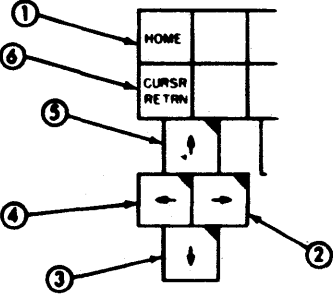
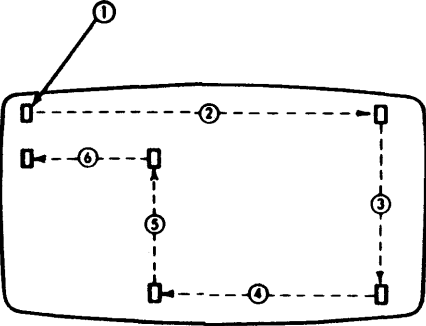


STEP	PROCEDURE	RESPONSE	POSSIBLE CAUSE OF TROUBLE	SECTION D TROUBLE ANALYSIS
2b. (Cont)	<p style="text-align: center;">Depress Keys</p> <p>CONTROL and C (ETX) CURSR RETRN CONTROL and G (BEL) ↓ (Cursor Down) CONTROL and B (STX) CLEAR NEW LINE LINE DLETE RETURN LINE INSRT CONTROL and L (FF) HOME ← (Cursor Left)</p>	<p style="text-align: center;">Function</p> <p style="text-align: center;">Lamp Position</p> <p>REC (1) S/R (3) S/R (3) OPT II (6) OPT II (6) PRINT ON LINE (7) PRINT ON LINE (7) TERM READY (10) TERM READY (10) KBD OVRN (11) KBD OVRN (11) FORM ENTER (14) FORM ENTER (14)</p>	<p style="text-align: center;">Lamp Condition</p> <p>OFF ≥FLASH≤ OFF ≥FLASH≤ OFF ≥FLASH≤ OFF ≥FLASH≤ OFF ≥FLASH≤ OFF ≥FLASH≤</p>	
c.	Depress RETURN and ESC P simultaneously with additional force, and then release.	TST CLEAR lamp extinguishes and returns opcon to normal operating mode.		

STEP	PROCEDURE	RESPONSE	POSSIBLE CAUSE OF TROUBLE	SECTION D TROUBLE ANALYSIS
3	<p>Depress each key on keyboard portion of opcon four or five times.</p> 			<p>Page 5-56, 5-64</p>
4	<p>Disengage CAPS LOCK by depressing it again momentarily. Again depress each key on keyboard portion of opcon four or five times.</p>	<p>The alpha characters described in Step 3 are displayed in lower case (ie, abcdef, etc).  Numerical 0-9 are displayed as numerals 0-9.</p>	<p>Check mechanical operation of CAPS LOCK key.</p>	<p>Page 5-56, 5-64</p>

STEP	PROCEDURE	RESPONSE	POSSIBLE CAUSE OF TROUBLE	SECTION D TROUBLE ANALYSIS
5	Depress left SHIFT together with each nonalpha key (ie, !@#\$, etc) on keyboard portion of opcon.	<p>Upper portion of depressed keys are displayed.</p> 		Page 5-56, 5-64
6	Depress right SHIFT together with one of the keys depressed in Step 5.	The character on upper portion of depressed key is displayed.	Check operation of right SHIFT key-switch.	

STEP	PROCEDURE	RESPONSE	POSSIBLE CAUSE OF TROUBLE	SECTION D TROUBLE ANALYSIS
7	Depress left CONTROL together with keys containing control characters four or five times each.	<p style="text-align: center;">Displayed as</p> <p style="text-align: center;">D<sub>1</sub> E<sub>B</sub> E<sub>Q</sub> D<sub>2</sub> D<sub>4</sub> E<sub>M</sub> S<sub>B</sub> U<sub>S</sub> S<sub>I</sub> E<sub>C</sub>                      S<sub>H</sub> D<sub>3</sub> E<sub>T</sub> D<sub>L</sub> B<sub>L</sub> G<sub>S</sub> R<sub>S</sub> V<sub>T</sub> F<sub>F</sub>                      N<sub>U</sub> C<sub>N</sub> E<sub>X</sub> % S<sub>X</sub> S<sub>O</sub> F<sub>S</sub></p> 	Check operation of left CONTROL keyswitch.	NOTE: On opcon being tested with a 40C430/AAT/017 controller, ENQ, US, SYN, ACK, EOT, DLE and NAK cannot be generated from the opcon.
8	Depress right CONTROL together with one of the keys depressed in Step 7.	The corresponding control character is displayed.	Check operation of right CONTROL keyswitch.	
9	Depress the  ,  and SPACE with additional force than is normally required.	----- ..... The SPACE key repeatedly moves the cursor.	Another key may be stuck in the partially depressed condition (check mechanical operation of that keyswitch).	Page 5-55

STEP	PROCEDURE	RESPONSE	POSSIBLE CAUSE OF TROUBLE	SECTION D TROUBLE ANALYSIS
10	<p>Depress HOME. Then in sequence depress momentarily with more force than normally required, each cursor movement key shown.</p> 			Page 5-55
11	<p>Home the cursor and type alpha characters A through J on the display. Place cursor over character E and depress CHAR INSRT momentarily; then depress it fully -- releasing it after characters stop moving.</p>	<pre> <input type="checkbox"/> ABCDEF GHIJ <input type="checkbox"/> ABCD <input checked="" type="checkbox"/> EFGHIJ ABCD <input type="checkbox"/> EFGHIJ ABCD <input type="checkbox"/>     EFGHIJ </pre>		Page 5-55
12	<p>Depress CHAR DLETE momentarily; then depress it fully.</p>	<pre> ABCD <input type="checkbox"/>     EFGHIJ ABCD <input type="checkbox"/>     EFGHIJ ABCD <input checked="" type="checkbox"/> EFGHIJ ABCD <input checked="" type="checkbox"/> FGH IJ ABCD <input checked="" type="checkbox"/> GHIJ </pre>		Page 5-55
13	<p>Depress LINE INSRT once.</p>	<p>Cursor moves to beginning of line, and line of data moves down one line.</p>	<p>Check operation of LINE INSRT keyswitch.</p>	

3. FUNCTIONAL TESTS -- 40K103 OPCONS (Contd)

STEP	PROCEDURE	RESPONSE	POSSIBLE CAUSE OF TROUBLE	SECTION D TROUBLE ANALYSIS
14	Depress LINE DLETE once; then depress CLEAR.	The line of data moves up, and then display is cleared of all characters.	Check operation of LINE DLETE keyswitch.	
15	Depress SEND, REC and LOCAL in sequence as shown.	<p>SEND lamp lights when key is depressed (LOCAL lamp extinguishes).</p> <p>REC lamp lights when key is depressed (SEND lamp extinguishes).</p> <p>LOCAL lamp lights when key is depressed (REC lamp extinguishes).</p>		Page 5-55
<div> </div> <p><b>NOTE:</b> The following steps provide test procedures for the opcon to be used on KD or KDP Sets. As a reminder, any blocking keytops should be removed.</p>				
16	Depress HOME and numeric 1.	Numeric 1 is displayed in home position.		
17	Depress NEW LINE 24 times.	Cursor moves down display, displaying new line character at 1st position of each line. On the 24th depression of NEW LINE, the numeric 1 will disappear from display.		

STEP	PROCEDURE	RESPONSE	POSSIBLE CAUSE OF TROUBLE	SECTION D TROUBLE ANALYSIS
18	Type a numeric 2 and depress NEW LINE 24 times.	The numeric 2 will move up one line each time NEW LINE is depressed. On the 24th depression of the NEW LINE, the numeric 2 will disappear from screen.		
19	Type a numeric 3.	A numeric 3 is displayed.		
20	Depress HOME.	The cursor moves to the home position and a 1 is displayed under the cursor.		
21	Depress SEGMT ADV.	Cursor does not move, a 2 is displayed under cursor.		
22	Depress SEGMT ADV again.	The cursor does not move, the 2 is replaced by the 3 under the cursor.		
23	Depress SEGMT ADV again.	The cursor does not move, the 3 is replaced by the 1 under the cursor.		
24	Depress SCROL UP once.	The 1 disappears from the display and the 2 appears at bottom left of display.		
25	Depress SCROL UP fully.	The 2, then the 3 move up the display. Scrolling stops when the 3 reaches top of display.		

## C. TESTING (Contd)

## 3. FUNCTIONAL TESTS -- 40K103 OPCONS (Contd)

STEP	PROCEDURE	RESPONSE	POSSIBLE CAUSE OF TROUBLE	SECTION D TROUBLE ANALYSIS
26	Depress SCROL DOWN once, then fully.	The 3 moves down one line, then moves down continuously and disappears as the 2 appears at top of display. Scrolling continues until the 1 appears at top of display.		
27	Place cursor away from home position and depress TAB SET. Depress CURSR TAB twice.	Cursor moves to the same position on the next line. (Next tab mark -- not displayed.)	Check operation of TAB SET and CURSR TAB keyswitches.	
28	Home the cursor and depress TAB CLEAR.	Cursor returns to home position, and all tab marks are cleared.	Check operation of TAB CLEAR keyswitch.	Page 5-55
29	Depress INTRPT, FORM SEND, PRINT ON LINE, HIGH LIGHT and FORM ENTER each twice.	Lamp lights when key is depressed; extinguishes when key is depressed again.  <b>NOTE:</b> When HIGH LIGHT and FORM ENTER are turned on and off, cursor will move one character position on display.		
30	Depress S/R, PRINT LOCAL and LOCAL in sequence as shown.	S/R lamp lights when key is depressed.  PRINT LOCAL lamp lights when key is depressed (S/R remains on).  LOCAL lamp lights when key is depressed.		Page 5-55



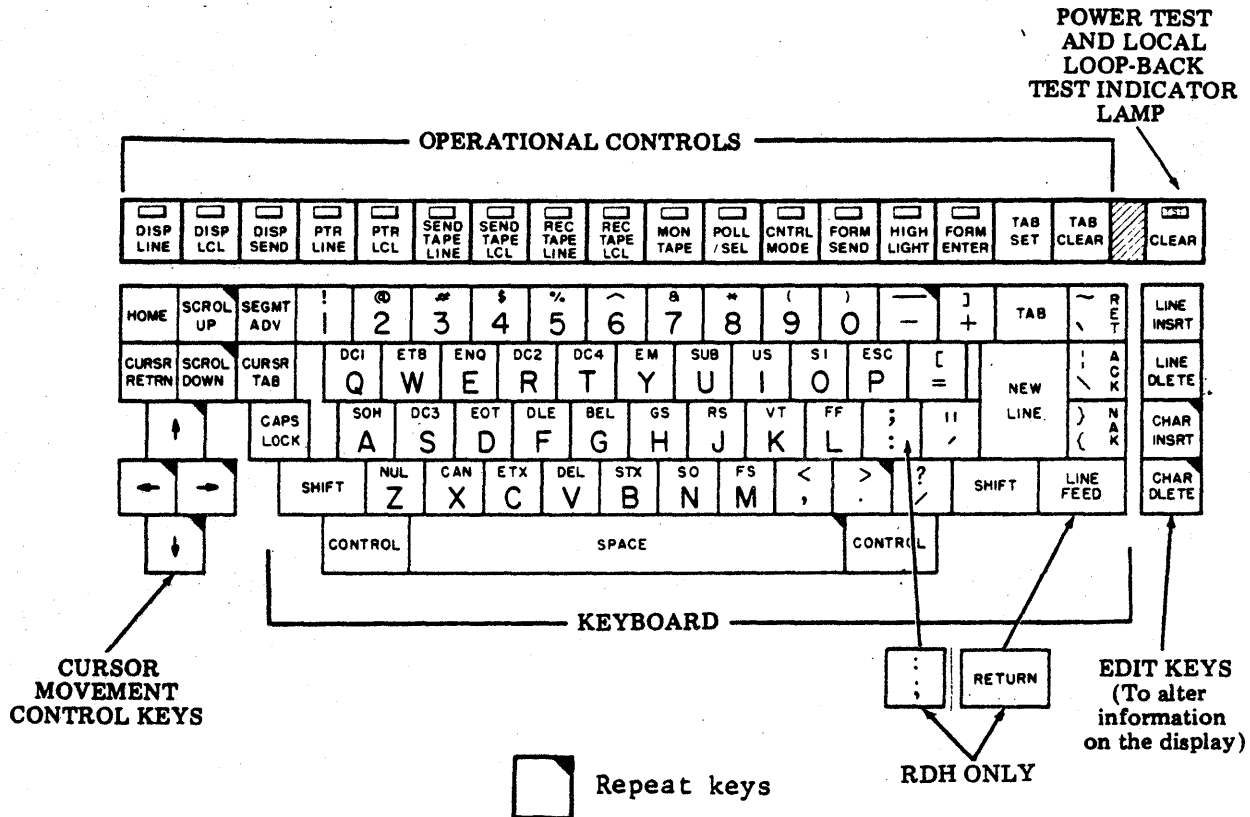
NOTES

### C. TESTING (Contd)

#### 4. FUNCTIONAL TESTS -- 40K108/RDE/RDH OPCONS

##### Keypop Layout

The location of the various control and data keys referred to in the checkout procedures can be found in the following illustration.




##### Preliminary Instructions

Follow these preliminary instructions before testing of the opcon is started using a Tempest Model 40 set. The operational checks are to be performed in the order presented.

- (a) Cassettes are in unlatched position; turn power on to cassette drive (if present).
- (b) Turn on power to the set or station.
- (c) Turn on power to the display and adjust brightness.
- (d) Perform Erase function on each of the cassettes, if not previously preformatted. Refer to How To Operate Manual 405 for procedure.

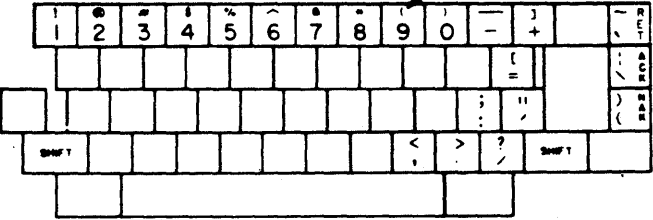
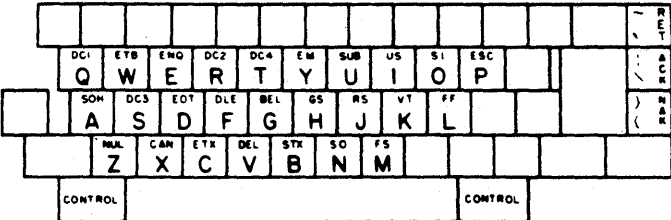
**NOTE:** Immediately when power is turned on, the poll/sel and mon tape (if monitor tape is present) lamps will light. PTR line lamp will light after approximately 14 seconds.

STEP	PROCEDURE	RESULTS	TROUBLE ANALYSIS																																																																					
1	<p>Depress RETURN or LINE FEED and  simultaneously with additional force and then release.</p> <p>a. Place opcon into the caps mode by depressing and latching CAPS LOCK.</p> <p>b. Depress the following keys while observing lamps for proper indication.</p> <table border="1"> <thead> <tr> <th>Depress Keys</th> <th>Function</th> <th>Lamp Condition</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>DISP LINE</td> <td>ON</td> </tr> <tr> <td>CONTROL and A (SOH)</td> <td>DISP LINE</td> <td>OFF</td> </tr> <tr> <td>C</td> <td>DISP LCL</td> <td>ON</td> </tr> <tr> <td>CONTROL and C (ETX)</td> <td>DISP LCL</td> <td>OFF</td> </tr> <tr> <td>D</td> <td>DISP SEND</td> <td>ON</td> </tr> <tr> <td>CONTROL and D (EOT)</td> <td>DISP SEND</td> <td>OFF</td> </tr> <tr> <td>G</td> <td>PTR LINE</td> <td>ON</td> </tr> <tr> <td>CONTROL and G (BEL)</td> <td>PTR LINE</td> <td>OFF</td> </tr> <tr> <td>F</td> <td>PTR LCL</td> <td>ON</td> </tr> <tr> <td>CONTROL and ACK</td> <td>PTR LCL</td> <td>OFF</td> </tr> <tr> <td>E</td> <td>SEND TAPE LINE</td> <td>ON</td> </tr> <tr> <td>CONTROL and E (ENQ)</td> <td>SEND TAPE LINE</td> <td>OFF</td> </tr> <tr> <td>B</td> <td>SEND TAPE LCL</td> <td>ON</td> </tr> <tr> <td>CONTROL and B (STX)</td> <td>SEND TAPE LCL</td> <td>OFF</td> </tr> <tr> <td>J</td> <td>REC TAPE LINE</td> <td>ON</td> </tr> <tr> <td>NEW LINE</td> <td>REC TAPE LINE</td> <td>OFF</td> </tr> <tr> <td>O</td> <td>REC TAPE LCL</td> <td>ON</td> </tr> <tr> <td>CONTROL and O (SI)</td> <td>REC TAPE LCL</td> <td>OFF</td> </tr> <tr> <td>N</td> <td>MON TAPE</td> <td>ON</td> </tr> <tr> <td>CONTROL and N (SO)</td> <td>MON TAPE</td> <td>OFF</td> </tr> <tr> <td>M</td> <td>POLL/SEL</td> <td>ON</td> </tr> <tr> <td>LINE FEED</td> <td>POLL/SEL</td> <td>OFF</td> </tr> </tbody> </table>	Depress Keys	Function	Lamp Condition	A	DISP LINE	ON	CONTROL and A (SOH)	DISP LINE	OFF	C	DISP LCL	ON	CONTROL and C (ETX)	DISP LCL	OFF	D	DISP SEND	ON	CONTROL and D (EOT)	DISP SEND	OFF	G	PTR LINE	ON	CONTROL and G (BEL)	PTR LINE	OFF	F	PTR LCL	ON	CONTROL and ACK	PTR LCL	OFF	E	SEND TAPE LINE	ON	CONTROL and E (ENQ)	SEND TAPE LINE	OFF	B	SEND TAPE LCL	ON	CONTROL and B (STX)	SEND TAPE LCL	OFF	J	REC TAPE LINE	ON	NEW LINE	REC TAPE LINE	OFF	O	REC TAPE LCL	ON	CONTROL and O (SI)	REC TAPE LCL	OFF	N	MON TAPE	ON	CONTROL and N (SO)	MON TAPE	OFF	M	POLL/SEL	ON	LINE FEED	POLL/SEL	OFF	<p>TST CLEAR lamp lights (brightly) and remains lit indicating loopback test mode is activated and power is being supplied to opcon.</p> <p><b>NOTE:</b> Occasionally the operational lamps may flash on and then off, when loopback test mode is activated. If this occurs, clear the test by depressing LINE FEED and ESC P beyond their normal stop, and re-enter test mode.</p>	<p>Page 5-73 and 5-88</p> <p>Page 5-76</p> <p>Check operation of keyswitches.</p>
Depress Keys	Function	Lamp Condition																																																																						
A	DISP LINE	ON																																																																						
CONTROL and A (SOH)	DISP LINE	OFF																																																																						
C	DISP LCL	ON																																																																						
CONTROL and C (ETX)	DISP LCL	OFF																																																																						
D	DISP SEND	ON																																																																						
CONTROL and D (EOT)	DISP SEND	OFF																																																																						
G	PTR LINE	ON																																																																						
CONTROL and G (BEL)	PTR LINE	OFF																																																																						
F	PTR LCL	ON																																																																						
CONTROL and ACK	PTR LCL	OFF																																																																						
E	SEND TAPE LINE	ON																																																																						
CONTROL and E (ENQ)	SEND TAPE LINE	OFF																																																																						
B	SEND TAPE LCL	ON																																																																						
CONTROL and B (STX)	SEND TAPE LCL	OFF																																																																						
J	REC TAPE LINE	ON																																																																						
NEW LINE	REC TAPE LINE	OFF																																																																						
O	REC TAPE LCL	ON																																																																						
CONTROL and O (SI)	REC TAPE LCL	OFF																																																																						
N	MON TAPE	ON																																																																						
CONTROL and N (SO)	MON TAPE	OFF																																																																						
M	POLL/SEL	ON																																																																						
LINE FEED	POLL/SEL	OFF																																																																						

C. TESTING (Contd)



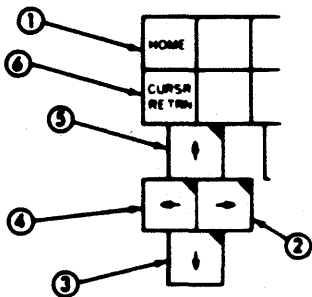
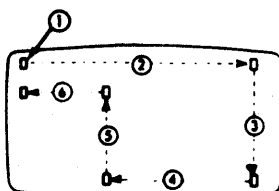
4. FUNCTIONAL TESTS -- 40K108/RDE/RDH OPCONS (Contd)

STEP	PROCEDURE	RESULTS	TROUBLE ANALYSIS
<p>1b. (Cont)</p>	<p>L CONTROL and L (FF) K CONTROL and K (VT) I TAB H ←(Cursor Left) →(Cursor Right) CONTROL and C (ETX) CURSR RETRN CONTROL and G (BEL) ↓(Cursor Down) CONTROL and B (STX) CLEAR NEW LINE LINE DLETE LINE FEED LINE INSRT CONTROL and L (FF) HOME ←(Cursor Left)</p>	<p>CNTRL MODE ON CNTRL MODE OFF FORM SEND ON FORM SEND OFF HIGH LIGHT ON HIGH LIGHT OFF FORM ENTER ON FORM ENTER OFF DISP LCL ≡FLASH≡ DISP LCL OFF PTR LINE ≡FLASH≡ PTR LINE OFF SEND TAPE LCL ≡FLASH≡ SEND TAPE LCL OFF REC TAPE LINE ≡FLASH≡ REC TAPE LINE OFF POLL/SEL ≡FLASH≡ POLL/SEL OFF CNTRL MODE ≡FLASH≡ CNTRL MODE OFF FORM ENTER ≡FLASH≡ FORM ENTER OFF</p>	
<p>c.</p>	<p>Depress LINE FEED and ESC P simultaneously with additional force, and then release.</p>	<p>TST CLEAR lamp extinguishes and returns opcon to normal operating mode.</p>	<p>Page 5-73</p>
<p>2</p>	<p>Home the cursor, enter opcon -- Display mode (DISP LINE, DISP LCL, DISP SEND lamp out). Then depress each key on the keyboard portion of the opcon four or five times. Check monitor for character or function.</p>	<p>Lower portion of depressed keys are displayed. Displayed as ≡ Transmitted as ←←≡ Displayed as ← Displayed as ↓ Causes cursor to move to right.</p>	<p>Pages 5-81 and 5-83</p>

STEP	PROCEDURE	RESULTS	TROUBLE ANALYSIS
3	Disengage CAPS LOCK by depressing it again momentarily. Again depress each key on keyboard portion of opcon four or five times.	Alpha characters described in Step 2 are displayed in lower case (ie, abcdef, etc).	Pages 5-81 and 5-83.
4	Depress left SHIFT together with each nonalpha key (ie, !@#\$, etc) on keyboard portion of opcon.	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">Upper portion of depressed keys are displayed.</div> 	Pages 5-81 and 5-83
5	Depress right SHIFT together with one of the keys depressed in Step 4.	The character on upper portion of depressed key is displayed.	Pages 5-81 and 5-83
6	Depress left CONTROL together with keys containing control characters four or five times each.		Page 5-89

C. TESTING (Contd)



4. FUNCTIONAL TESTS -- 40K108/RDE/RDH OPCONS (Contd)

STEP	PROCEDURE	RESULTS	TROUBLE ANALYSIS
7	Depress right CONTROL together with one of the keys depressed in Step 7.	The corresponding control character is displayed.	
8	Depress  ,  and SPACE with additional force than is normally required.	----- ..... The SPACE key repeatedly moves the cursor.	Page 5-78
9	Depress HOME. Then in sequence depress momentarily with more force than normally required, each cursor movement key shown.  		Page 5-89
10	Home the cursor and type alpha characters A through J on the display. Place the cursor over character E and depress CHAR INSRT momentarily; then depress it fully -- releasing it after characters stop moving.	<pre> ABCDEFGHIJ□ ABCD EFGHIJ ABCD□ EFGHIJ ABCD□ EFGHIJ                     </pre>	Page 5-78
11	Depress CHAR DLETE momentarily; then depress it fully.	<pre> ABCD□ EFGHIJ ABCD□ EFGHIJ ABCD EFGHIJ ABCD EFGHIJ ABCD GHIJ                     </pre>	Page 5-78
12	Depress LINE INSRT once.	Cursor moves to beginning of line, and the line of data moves down one line.	Page 5-78

STEP	PROCEDURE	RESULTS	TROUBLE ANALYSIS
13	Depress LINE DELETE once; then depress CLEAR.	The line of data moves up, and then display is cleared of all characters.	Page 5-78
14	Place the cursor away from home position and depress CURSOR TAB.	Cursor moves to first character position of next line (unformatted display).	Page 5-89
15	Place the cursor away from home position and depress TAB.	Cursor moves to first character position of next line (unformatted display).	Page 5-89
16	Depress HOME and numeric 1.	Numeric 1 is displayed in home position.	Pages 5-81 and 5-89
17	Depress NEW LINE 24 times.	Cursor moves down display, displaying new line character at 1st position of each line. On the 24th depression of NEW LINE, the numeric 1 will disappear from display.	Pages 5-81 and 5-89
18	Type a numeric 2 and depress NEW LINE 24 times.	The numeric 2 will move up one line each time NEW LINE is depressed. On the 24th depression of the NEW LINE, the numeric 2 will disappear from screen.	Pages 5-81 and 5-89
19	Type a numeric 3.	A numeric 3 is displayed.	
20	Depress HOME.	The cursor moves to the home position and a 1 is displayed under the cursor.	Page 5-89
21	Depress SEGMENT ADV.	Cursor does not move, a 2 is displayed under cursor.	Page 5-89
22	Depress SEGMENT ADV again.	The cursor does not move, the 2 is replaced by the 3 under the cursor.	
23	Depress SEGMENT ADV again.	The cursor does not move, the 3 is replaced by the 1 under the cursor.	
24	Depress SCROLL UP once.	The 1 disappears from the display and the 2 appears at bottom left of display.	Page 5-89

## C. TESTING (Contd)

## 4. FUNCTIONAL TESTS -- 40K108/RDE/RDH OPCONS (Contd)

STEP	PROCEDURE	RESULTS	TROUBLE ANALYSIS
25	Depress SCROL UP fully.	The 2, then the 3 move up the display. Scrolling stops when the 3 reaches top of display.	Page 5-89
26	Depress SCROL DOWN once, then fully.	The 3 moves down one line, then moves down continuously and disappears as the 2 appears at top of display. Scrolling continues until the 1 appears at top of display.	Page 5-78
27	Depress SEGMENT ADV twice.	First the 2 then the 3 appear at top of display.	Page 5-89
28	Position cursor by means of the  and  to next to the last line of display. Type some Us on this line.	Cursor moves under direction of cursor control key. Us are displayed.	Page 5-78
29	Depress LINE INSRT once.	The Us move to last line of display. The cursor moves to the 1st character position of the line next to last line of display.	Page 5-78
30	Depress LINE INSRT several times.	Display does not change.	
31	Home cursor and depress TAB CLEAR.	All tabs (on all segments) are cleared.	Page 5-89
32	Depress HIGH LIGHT.	HIGH LIGHT lamp lights.	
33	Enter a full line of *s at top of display.	*s are displayed as intensified. Alarm sounds at 73rd and 80th character positions. Cursor remains at right end of line. <u>NOTE:</u> If option X1 is installed, the cursor will wrap to the beginning of the next line.	



STEP	PROCEDURE	RESULTS	TROUBLE ANALYSIS
34	Depress HIGH LIGHT again.	HIGH LIGHT lamp extinguishes.	Page 5-89
35	Place cursor away from home position and depress TAB SET. Depress CURSR TAB twice.	Cursor moves to the same position on the next line. (Next tab mark -- not displayed.)	
36	Home the cursor and depress TAB CLEAR.	Cursor returns to home position, and all tab marks are cleared.	

5. FUNCTIONAL TESTS -- 40K108/RDG OPCON

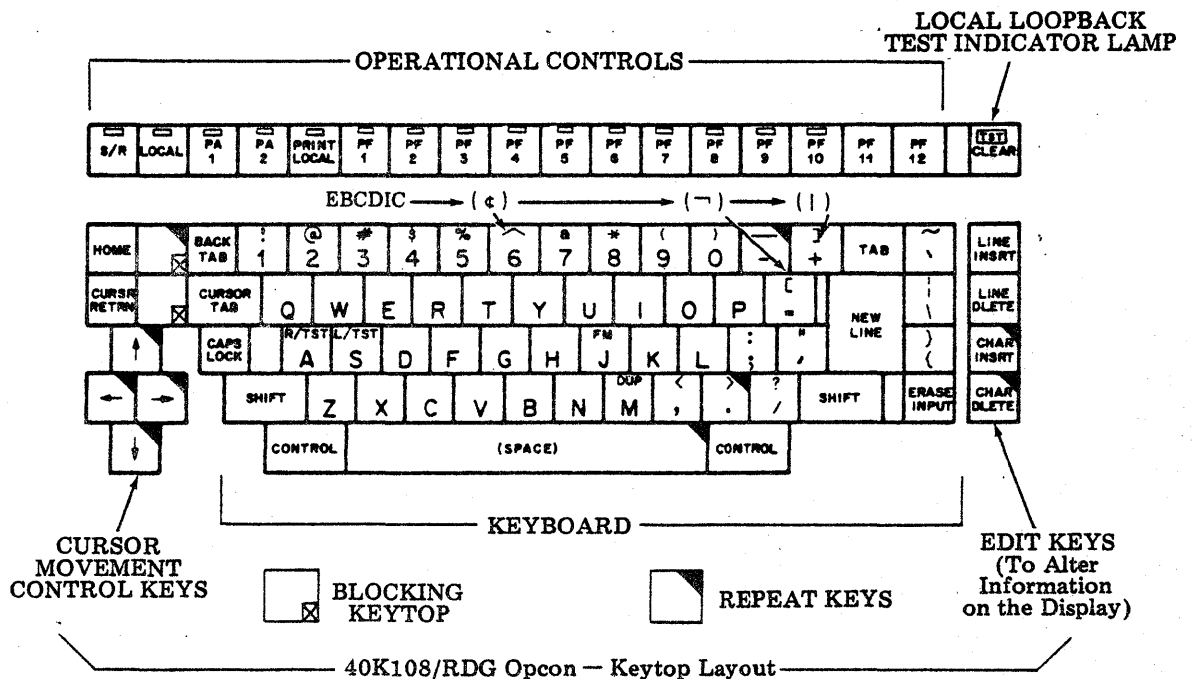
The location of the various control and data keys referred to in the checkout procedures can be found in the following illustration.

Preliminary Instructions

Follow these preliminary instructions before testing of the opcon is started using a Tempest Model 40 Set. The operational checks are to be performed in the order presented.

- (a) Turn on power to the set or station (LOCAL indicator lights on each opcon).
- (b) Turn on power to the display and adjust brightness.
- (c) Perform Steps 1 through 19.

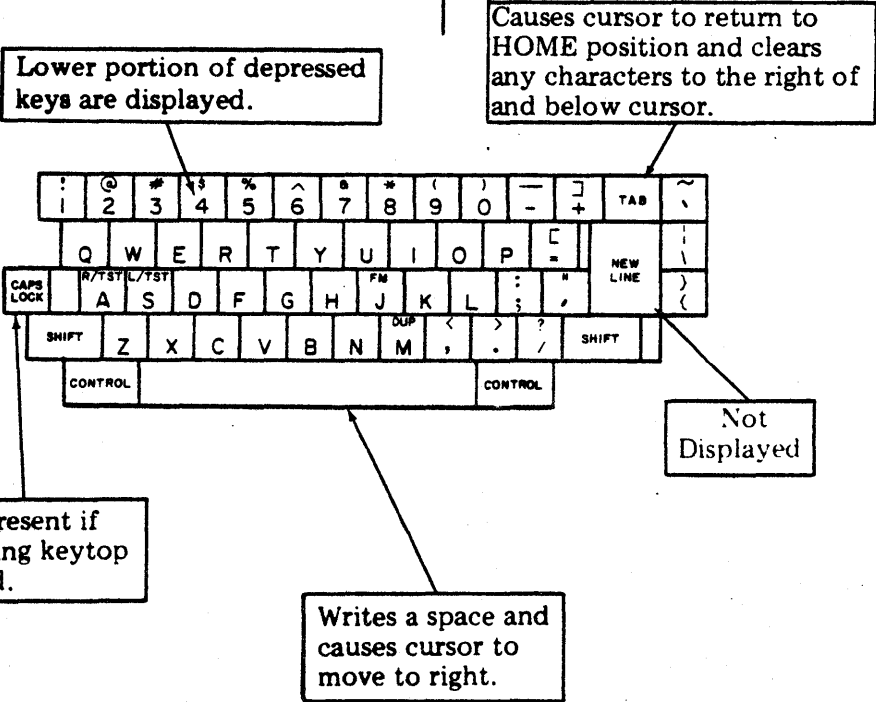

NOTE: Immediately when power is turned on, the POLL/SEL and MON TAPE (if monitor tape is present) lamps will light. PTR line lamp will light after approximately 14 seconds.



C. TESTING (Contd)

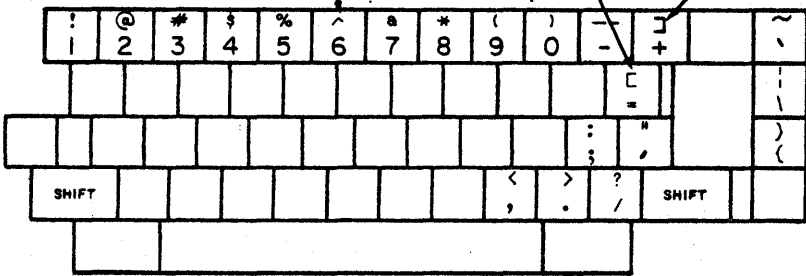
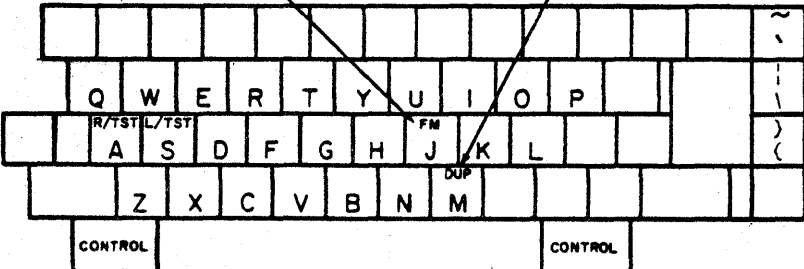
5. FUNCTIONAL TESTS -- 40K108/RDG OPCON (Contd)

STEP	PROCEDURE	RESULTS	TROUBLE ANALYSIS																																																																																													
1	<p>Depress ERASE INPUT and <span style="border: 1px solid black; padding: 2px;">" ,</span> simultaneously with additional force and then release.</p> <p>a. Place opcon into the caps mode by depressing and latching CAPS LOCK.</p> <p>b. Depress the following keys while observing lamps for proper indication.</p> <table border="1"> <thead> <tr> <th>Depress Keys</th> <th>Function</th> <th>Lamp Condition</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>S/R</td> <td>ON</td> </tr> <tr> <td>CONTROL and A (SOH)</td> <td>S/R</td> <td>OFF</td> </tr> <tr> <td>C</td> <td>LOCAL</td> <td>ON</td> </tr> <tr> <td>CONTROL and C (ETX)</td> <td>LOCAL</td> <td>OFF</td> </tr> <tr> <td>D</td> <td>PA1</td> <td>ON</td> </tr> <tr> <td>CONTROL and D (EOT)</td> <td>PA1</td> <td>OFF</td> </tr> <tr> <td>G</td> <td>PA2</td> <td>ON</td> </tr> <tr> <td>CONTROL and G (BEL)</td> <td>PA2</td> <td>OFF</td> </tr> <tr> <td>F</td> <td>PRINT LOCAL</td> <td>ON</td> </tr> <tr> <td>CONTROL and ACK</td> <td>PRINT LOCAL</td> <td>OFF</td> </tr> <tr> <td>E</td> <td>PF1</td> <td>ON</td> </tr> <tr> <td>CONTROL and E (ENQ)</td> <td>PF1</td> <td>OFF</td> </tr> <tr> <td>B</td> <td>PF2</td> <td>ON</td> </tr> <tr> <td>CONTROL and B (STX)</td> <td>PF2</td> <td>OFF</td> </tr> <tr> <td>J</td> <td>PF3</td> <td>ON</td> </tr> <tr> <td>NEW LINE</td> <td>PF3</td> <td>OFF</td> </tr> <tr> <td>O</td> <td>PF4</td> <td>ON</td> </tr> <tr> <td>CONTROL and O (SI)</td> <td>PF4</td> <td>OFF</td> </tr> <tr> <td>N</td> <td>PF5</td> <td>ON</td> </tr> <tr> <td>CONTROL and N (SO)</td> <td>PF5</td> <td>OFF</td> </tr> <tr> <td>M</td> <td>PF6</td> <td>ON</td> </tr> <tr> <td>ERASE INPUT</td> <td>PF6</td> <td>OFF</td> </tr> <tr> <td>L</td> <td>PF7</td> <td>ON</td> </tr> <tr> <td>CONTROL and L (FF)</td> <td>PF7</td> <td>OFF</td> </tr> <tr> <td>K</td> <td>PF8</td> <td>ON</td> </tr> <tr> <td>CONTROL and K (VT)</td> <td>PF8</td> <td>OFF</td> </tr> <tr> <td>I</td> <td>PF9</td> <td>ON</td> </tr> <tr> <td>TAB</td> <td>PF9</td> <td>OFF</td> </tr> <tr> <td>H</td> <td>PF10</td> <td>ON</td> </tr> <tr> <td>← (Cursor Left)</td> <td>PF10</td> <td>OFF</td> </tr> </tbody> </table>	Depress Keys	Function	Lamp Condition	A	S/R	ON	CONTROL and A (SOH)	S/R	OFF	C	LOCAL	ON	CONTROL and C (ETX)	LOCAL	OFF	D	PA1	ON	CONTROL and D (EOT)	PA1	OFF	G	PA2	ON	CONTROL and G (BEL)	PA2	OFF	F	PRINT LOCAL	ON	CONTROL and ACK	PRINT LOCAL	OFF	E	PF1	ON	CONTROL and E (ENQ)	PF1	OFF	B	PF2	ON	CONTROL and B (STX)	PF2	OFF	J	PF3	ON	NEW LINE	PF3	OFF	O	PF4	ON	CONTROL and O (SI)	PF4	OFF	N	PF5	ON	CONTROL and N (SO)	PF5	OFF	M	PF6	ON	ERASE INPUT	PF6	OFF	L	PF7	ON	CONTROL and L (FF)	PF7	OFF	K	PF8	ON	CONTROL and K (VT)	PF8	OFF	I	PF9	ON	TAB	PF9	OFF	H	PF10	ON	← (Cursor Left)	PF10	OFF	<p>TST CLEAR lamp lights (brightly) and remains lit indicating loopback test mode is activated and power is being supplied to opcon.</p> <p>NOTE: Occasionally the operational lamps may flash on and then off, when loopback test mode is activated. If this occurs, clear the test by depressing LINE FEED and ESC P beyond their normal stop, and re-enter test mode.</p>	<p>Page 5-73 and 5-88.</p> <p>Check operation of key-switches.</p>
Depress Keys	Function	Lamp Condition																																																																																														
A	S/R	ON																																																																																														
CONTROL and A (SOH)	S/R	OFF																																																																																														
C	LOCAL	ON																																																																																														
CONTROL and C (ETX)	LOCAL	OFF																																																																																														
D	PA1	ON																																																																																														
CONTROL and D (EOT)	PA1	OFF																																																																																														
G	PA2	ON																																																																																														
CONTROL and G (BEL)	PA2	OFF																																																																																														
F	PRINT LOCAL	ON																																																																																														
CONTROL and ACK	PRINT LOCAL	OFF																																																																																														
E	PF1	ON																																																																																														
CONTROL and E (ENQ)	PF1	OFF																																																																																														
B	PF2	ON																																																																																														
CONTROL and B (STX)	PF2	OFF																																																																																														
J	PF3	ON																																																																																														
NEW LINE	PF3	OFF																																																																																														
O	PF4	ON																																																																																														
CONTROL and O (SI)	PF4	OFF																																																																																														
N	PF5	ON																																																																																														
CONTROL and N (SO)	PF5	OFF																																																																																														
M	PF6	ON																																																																																														
ERASE INPUT	PF6	OFF																																																																																														
L	PF7	ON																																																																																														
CONTROL and L (FF)	PF7	OFF																																																																																														
K	PF8	ON																																																																																														
CONTROL and K (VT)	PF8	OFF																																																																																														
I	PF9	ON																																																																																														
TAB	PF9	OFF																																																																																														
H	PF10	ON																																																																																														
← (Cursor Left)	PF10	OFF																																																																																														
c.	<p>Depress ERASE INPUT and ESCP simultaneously. TST lamp extinguishes.</p>		<p>Page 5-73.</p>																																																																																													

STEP	PROCEDURE	RESULTS	TROUBLE ANALYSIS
2	<p>Home the cursor and depress a few keys on the keyboard portion of the opcon.</p>	<p><i>Note:</i> Each keytop need not be checked except for a trouble call. Each keytop shall function each time it is depressed.</p> <p>Causes cursor to return to HOME position and clears any characters to the right of and below cursor.</p> <p>Lower portion of depressed keys are displayed.</p> 	<p>Pages 5-81 and 5-83.</p>
3	<p>Disengage the  key by depressing it again momentarily. Again depress a couple of keys on the keyboard portion of the opcon. (Opcons with no CAPS LOCK key require no action; go to Step 4.)</p>	<p>The alpha characters described in Step 2 are displayed in lower case (ie, abcdef, etc).</p>	<p>Pages 5-81 and 5-83.</p>

C. TESTING (Contd)

5. FUNCTIONAL TESTS -- 40K108/RDG OPCON (Contd)

STEP	PROCEDURE	RESULTS	TROUBLE ANALYSIS
4	<p>Depress the left then the right <span style="border: 1px solid black; padding: 2px;">SHIFT</span> key while depressing and checking operation of one of the following alpha keys (ie, !@#\$, etc).</p> <p style="text-align: center;">(Or c )</p>	<p>Upper portion of the depressed keys are displayed.</p> <p style="text-align: center;">(Or -) (Or  )</p>  <p style="text-align: right;">See Note following Step 5.</p>	<p>Pages 5-81 and 5-83.</p>
5	<p>Depress the <span style="border: 1px solid black; padding: 2px;">CONTROL</span> key together with the <span style="border: 1px solid black; padding: 2px;">FM J</span> key; then depress the <span style="border: 1px solid black; padding: 2px;">CONTROL</span> key together with the <span style="border: 1px solid black; padding: 2px;">DUP M</span> key.</p>	<p>See Note following Step 5.</p> <div style="display: flex; justify-content: space-around; margin-bottom: 10px;"> <div style="border: 1px solid black; padding: 5px;">May be displayed as FS or &lt;</div> <div style="border: 1px solid black; padding: 5px;">May be displayed as D<sub>L</sub> or Ø</div> </div> 	

STEP	PROCEDURE	RESULTS	TROUBLE ANALYSIS
------	-----------	---------	------------------

*Note:* Some characters may not be displayed or may be displayed as a character other than the character received on-line or entered from the opcon. See the table below which also provides printer actions for applicable characters.

Type of 40K108 Opcon		ASCII or EBCDIC					ASCII			EBCDIC			ASCII or EBCDIC	
Character Received From LCU or Entered on 40K108 Type Opcon		~	\		{	}	^	]	[	↓		¬	D <sub>U</sub>	FM
Character Displayed Using D I/O:	410431 ASCII UP-LO	~	\		{	}	^	]	[	^	]	[	DL	FS
	410434 ASCII MONO	^	⊘	\			^	]	[	^	]	[	∅	/
	410435 EBCDIC UP-LO	~	\		{	}	↓		¬	↓		¬	DL	FS
	410436 EBCDIC MONO	⊘	⊘	\	¬		↓		¬	↓		¬	∅	<
	410432 ASCII LINE-DRAW	+	⌈		+	⌊	^	]	[	^	]	[	DL	FS
Character Printed Using Type Carrier:	400629 80C ASCII UP-LO	~	\		{	}	^	]	[	^		[	SP	SP
	400645 80C ASCII MONO	^	⊘	\	[	]	^	]	[	^	]	[	SP	SP
	400775 80C ASCII LINE-DRAW	+	⌈		+	⌊	^	]	[	^	]	[	SP	SP
	400777 132C ASCII UP-LO	~	\		{	}	^	]	[	^	]	[	SP	SP
	400780 132C ASCII MONO	^	⊘	\	[	]	^	]	[	^	]	[	SP	SP
	400783 132C EBCDIC UP-LO	~	\		{	}	↓		¬	↓		¬	SP	SP
	400784 80C EBCDIC UP-LO	~	\		{	}	↓		¬	↓		¬	SP	SP
	400785 80C EBCDIC MONO	⊘	⊘	\	¬		↓		¬	↓		¬	SP	SP
	400887 132C EBCDIC MONO	↓	⊘	\	¬		↓		¬	↓		¬	SP	SP

**LEGEND:**





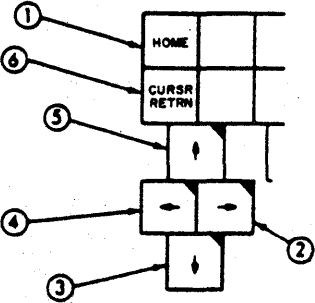
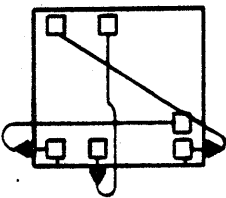
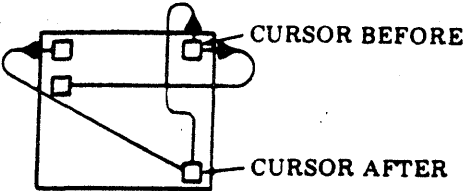
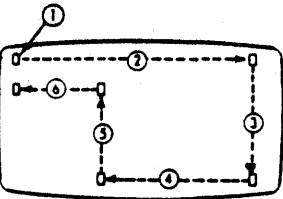















Will print with fold-over option in printer enabled. Error symbol will print if fold-over option is not enabled.

*Note:* ∅ is displayed as 0 but printed as ∅.

C. TESTING (Contd)











5. FUNCTIONAL TESTS -- 40K108/RDG OPCON (Contd)

STEP	PROCEDURE	RESULTS	TROUBLE ANALYSIS
6	Depress one of the following keys with additional force,    (SPACE)	----- ..... The space key repeatedly moves the cursor.	Page 5-78.
7	Depress the  key. Then in sequence depress momentarily with more force than normally required, each cursor movement key shown.   	 Note: In local opcon operation, attempts to move the cursor off the display will result as shown:	Page 5-89.
8	Depress ERASE INPUT key.	Display clears and cursor goes to home position. LOCAL indicator remains lit.	Pages 5-76 and 5-89.
9	Type the alpha characters A through J on the display. Place the cursor over the character E and depress the  key once, then depress it fully — releasing it after the characters move to the next line.	① ABCD  FGHIJ ② ABCD  EFGHIJ ③ ABCD  EFGHIJ Note: CHAR INSRT and CHAR DLETE affect all 24 lines on a DCC KD. CHAR INSRT and CHAR DLETE affect only 4 lines including the line with the cursor on MCC KD. Characters move slowly.	Page 5-78.

STEP	PROCEDURE	RESULTS	TROUBLE ANALYSIS
10	Depress the  key momentarily, then depress it fully.	ABCD  EFGHIJ ABCD  EFGHIJ Characters delete one at a time or repeatedly when key is held depressed. See Note in Step 9.	Page 5-78.
11	Depress the  key three times.	The cursor remains at its present location, and the line of data moves down three lines.	Page 5-78.
12	Depress the  key once, then depress it fully.	The line of data moves up one line, then stops on the first line.	Page 5-78.
13	Depress  key, (if printer is not provided, go to Step 14).	LOCAL indicator extinguishes, PRINT LOCAL indicator lights and then goes off when printer buffer receives the message; LOCAL indicator lights.  Printer copies entire display (24 lines):	• Flashing PRINT LOCAL indicator indicates printer: a. is not print local. b. cabinet lid is open. c. form-out or paper-out condition. d. ac power is off. e. defective printer cable.
14	Place the cursor away from home position and depress the  key.	The cursor returns to home position.  <i>Note:</i> Displayed data is not affected by CURSOR TAB and BACK TAB keys.	Page 5-89.
15	Place the cursor away from home position and depress the  key.	The cursor returns to home position.	Page 5-89.
16	Place the cursor away from home position and depress the  key.	Cursor returns to home position. Any characters to the right of and below cursor will be cleared.	Page 5-89.

## C. TESTING (Contd)

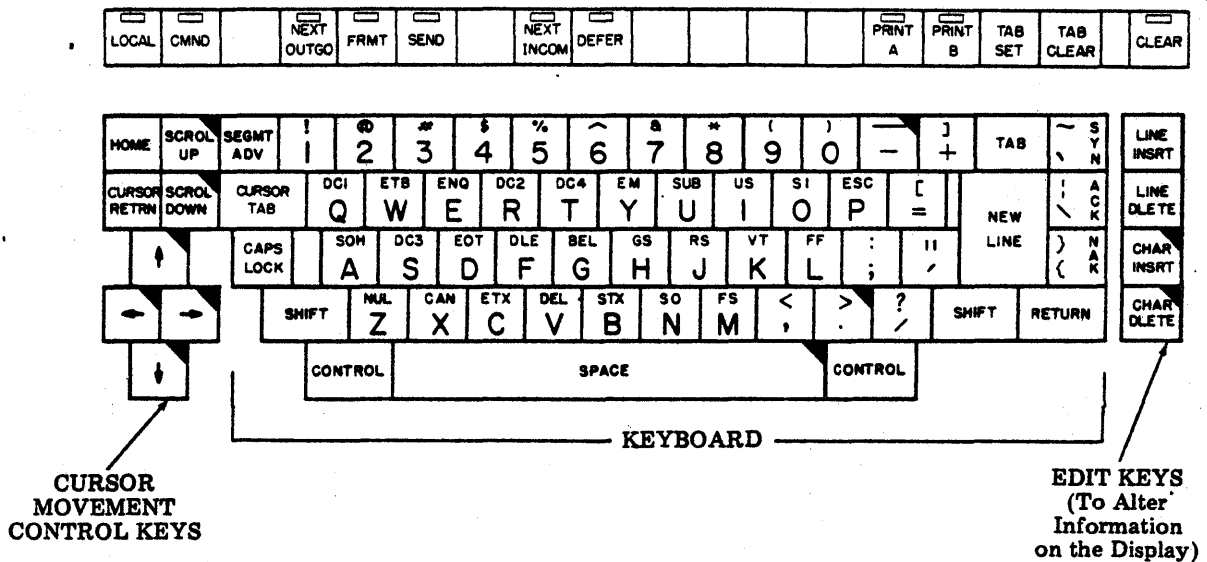
## 5. FUNCTIONAL TESTS -- 40K108/RDG OPCON (Contd)

STEP	PROCEDURE	RESULTS	TROUBLE ANALYSIS
17	Type some text on the opcon and then depress  . Attempt to type some text on the opcon.	Text is displayed. LOCAL indicator extinguishes when S/R is depressed.  Attention bell sounds each time a key is depressed.	Page 5-89.
18	Alternately depress LOCAL then depress  key, then  key and  ,  ,  through  ,  and  keys in the same manner.	 is lit and extinguishes when a key is depressed (same for each key). Data on display remains unchanged, except when CLEAR key is depressed; all data clears from display and cursor goes to home position.	Page 5-76.
19	This step applies only to monospace opcons (blocking keytop over CAPS LOCK position).  a. Depress ERASE INPUT and QUOTES keys together with additional force.  b. Depress A (do <u>not</u> depress SHIFT).  c. Depress ERASE INPUT and P keys together with additional force.	TST indicator lights and remains lit.  S/R key lights.  TST indicator light goes out.	Page 5-76.  •Remove blocking keytop, check that plunger is in lower position. •Replace opcon.  Page 5-76.



6. FUNCTIONAL TESTS -- 40K108/RDF

The location of the various control and data keys referred to in the checkout procedures can be found in the following illustration.



Preliminary Instructions

Follow these preliminary instructions before testing of the keyboard is started. The steps are to be performed in the order presented.

(a) Power-up sequence:

- (1) Turn power on to memory system.
- (2) Insert properly formatted diskette into drive 3.
- (3) Turn power on to KD1 (with controller in pedestal).
- (4) Turn power on to KD2.
- (5) Turn power on to Intr 2 (in Printer A pedestal).
- (6) Turn monitor power switches on.
- (7) Turn printer cabinet power switches on.

(b) When the power is turned on:

- LOCAL indicator lights.
- Monitor displays raster, cursor, time and date.
- Diskette drives are initialized with lamps in door release latch dimly lit.
- NEXT INCOM indicator may be lit.
- Controller fans are on.
- Power supply indicators light.
- Input line is enabled and output line disabled.

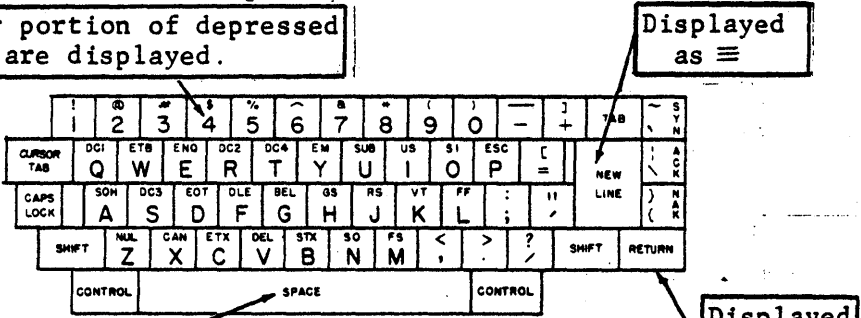

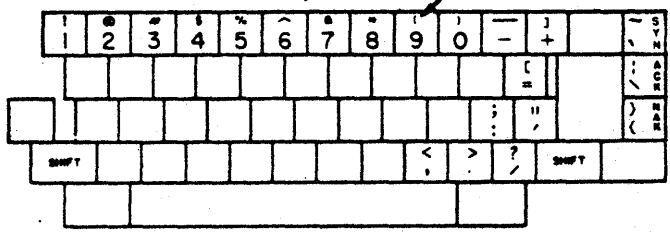
(c) Insert blank 407640 diskettes at drive 1 and drive 2, refer to Manual 434 for instructions.

C. TESTING (Contd)

6. FUNCTIONAL TESTS -- 40K108/RDF (Contd)

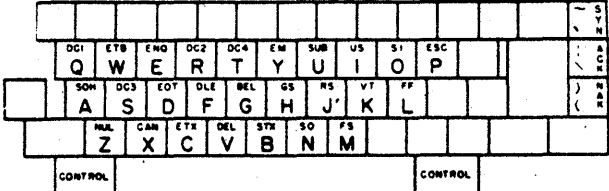


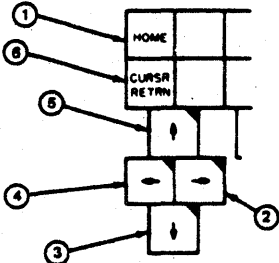
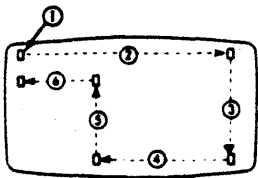
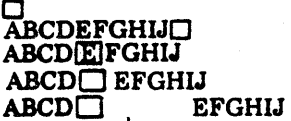
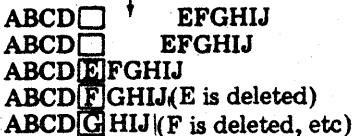
(d) Insert properly preformatted diskette in drive 3. Variable system information can be entered on diskette 3 (if required), by use of CMD SOH  
A procedure.

STEP	PROCEDURE	RESULTS	TROUBLE ANALYSIS																																																									
1	<p>Depress RETURN and <span style="border: 1px solid black; padding: 2px;">"</span> simultaneously with additional force and then release.</p> <p>a. Place opcon into the caps mode by depressing and latching CAPS LOCK.</p> <p>b. Depress the following keys while observing lamps for proper indication.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="border: 1px solid black; padding: 2px;">Depress Keys</th> <th style="border: 1px solid black; padding: 2px;">Function</th> <th style="border: 1px solid black; padding: 2px;">Lamp Condition</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">A</td> <td style="text-align: center;">LOCAL</td> <td style="text-align: center;">ON</td> </tr> <tr> <td>CONTROL and A (SOH)</td> <td>LOCAL</td> <td>OFF</td> </tr> <tr> <td style="text-align: center;">C</td> <td style="text-align: center;">CMND</td> <td style="text-align: center;">ON</td> </tr> <tr> <td>CONTROL and C (ETX)</td> <td>CMND</td> <td>OFF</td> </tr> <tr> <td style="text-align: center;">G</td> <td style="text-align: center;">NEXT OUTGO</td> <td style="text-align: center;">ON</td> </tr> <tr> <td>CONTROL and G (BEL)</td> <td>NEXT OUTGO</td> <td>OFF</td> </tr> <tr> <td style="text-align: center;">F</td> <td style="text-align: center;">FRMT</td> <td style="text-align: center;">ON</td> </tr> <tr> <td>CONTROL and ACK</td> <td>FRMT</td> <td>OFF</td> </tr> <tr> <td style="text-align: center;">E</td> <td style="text-align: center;">SEND</td> <td style="text-align: center;">ON</td> </tr> <tr> <td>CONTROL and E (ENQ)</td> <td>NEXT INCOM</td> <td>OFF</td> </tr> <tr> <td style="text-align: center;">J</td> <td style="text-align: center;">NEXT INCOM</td> <td style="text-align: center;">ON</td> </tr> <tr> <td style="text-align: center;">NEW LINE</td> <td style="text-align: center;">DEFER</td> <td style="text-align: center;">OFF</td> </tr> <tr> <td style="text-align: center;">O</td> <td style="text-align: center;">DEFER</td> <td style="text-align: center;">ON</td> </tr> <tr> <td>CONTROL and O (SI)</td> <td>HIGH LIGHT</td> <td>OFF</td> </tr> <tr> <td style="text-align: center;">I</td> <td style="text-align: center;">HIGH LIGHT</td> <td style="text-align: center;">ON</td> </tr> <tr> <td style="text-align: center;">TAB</td> <td style="text-align: center;">FORM ENTER</td> <td style="text-align: center;">OFF</td> </tr> <tr> <td style="text-align: center;">H</td> <td style="text-align: center;">FORM ENTER</td> <td style="text-align: center;">ON</td> </tr> <tr> <td style="text-align: center;">← (Cursor Left)</td> <td style="text-align: center;">FORM ENTER</td> <td style="text-align: center;">OFF</td> </tr> </tbody> </table>	Depress Keys	Function	Lamp Condition	A	LOCAL	ON	CONTROL and A (SOH)	LOCAL	OFF	C	CMND	ON	CONTROL and C (ETX)	CMND	OFF	G	NEXT OUTGO	ON	CONTROL and G (BEL)	NEXT OUTGO	OFF	F	FRMT	ON	CONTROL and ACK	FRMT	OFF	E	SEND	ON	CONTROL and E (ENQ)	NEXT INCOM	OFF	J	NEXT INCOM	ON	NEW LINE	DEFER	OFF	O	DEFER	ON	CONTROL and O (SI)	HIGH LIGHT	OFF	I	HIGH LIGHT	ON	TAB	FORM ENTER	OFF	H	FORM ENTER	ON	← (Cursor Left)	FORM ENTER	OFF	<p>TST CLEAR lamp lights (brightly) and remains lit indicating loopback test mode is activated and power is being supplied to opcon.</p> <p>NOTE: Occasionally the operational lamps may flash on and then off, when loopback test mode is activated. If this occurs, clear the test by depressing LINE FEED and ESC p beyond their normal stop, and re-enter test mode.</p>	<p>Page 5-73 and 5-88.</p> <p>Page 5-76.</p> <p>Check operation of key-switches.</p> <p>Page 5-73.</p>
Depress Keys	Function	Lamp Condition																																																										
A	LOCAL	ON																																																										
CONTROL and A (SOH)	LOCAL	OFF																																																										
C	CMND	ON																																																										
CONTROL and C (ETX)	CMND	OFF																																																										
G	NEXT OUTGO	ON																																																										
CONTROL and G (BEL)	NEXT OUTGO	OFF																																																										
F	FRMT	ON																																																										
CONTROL and ACK	FRMT	OFF																																																										
E	SEND	ON																																																										
CONTROL and E (ENQ)	NEXT INCOM	OFF																																																										
J	NEXT INCOM	ON																																																										
NEW LINE	DEFER	OFF																																																										
O	DEFER	ON																																																										
CONTROL and O (SI)	HIGH LIGHT	OFF																																																										
I	HIGH LIGHT	ON																																																										
TAB	FORM ENTER	OFF																																																										
H	FORM ENTER	ON																																																										
← (Cursor Left)	FORM ENTER	OFF																																																										
c.	Depress RETURN and P keys.	TST indicator goes out.	Page 5-73.																																																									

STEP	PROCEDURE	RESULTS	TERMINAL ANALYSIS
<p>1. (d) (Contd)</p>	<p>Depress LOCAL (if indicator is not lit), HOME, and CLEAR. LOCAL indicator lights, cursor at home position, and no characters displayed. Then depress each key on opcon four or five times. Check monitor for character.</p> <p>Lower portion of depressed keys are displayed.</p>  <p>Displayed as ≡</p> <p>Causes cursor to move to right.</p> <p>Displayed as ←</p>		<p>Page 5-81 and 5-83.</p>
<p>2</p>	<p>Depress CAPS LOCK (if present). Depress each alpha key on opcon four or five times. Depress RETURN and/or NEW LINE when required.</p>	<p>Character on each key is displayed.</p> 	<p>Page 5-81 and 5-83.</p>
<p>3</p>	<p>Depress and hold left SHIFT, then each nonalpha key (ie, !@#\$, etc) on opcon.</p>	<p>Upper portion of depressed keys are displayed.</p> 	<p>Page 5-81 and 5-83.</p>
<p>4</p>	<p>Depress and hold right SHIFT. Depress one of the keys depressed in Step 3.</p>	<p>The character on upper portion of depressed key is displayed.</p>	<p>Page 5-81 and 5-83.</p>

C. TESTING (Contd)



6. FUNCTIONAL TESTS -- 40K108/RDF OPCON (Contd)

STEP	PROCEDURE	RESULTS	TERMINAL ANALYSIS
5	Depress and hold left CONTROL. Depress keys containing control characters a few times each. 	The corresponding control character is displayed.	Page 5-89.
6	Depress and hold right CONTROL. Depress one of the keys depressed in Step 5.	The corresponding control character is displayed.	
7	Depress  ,  and SPACE with additional force than is normally required.	..... The SPACE key repeatedly moves the cursor.	Page 5-78.
8	Depress HOME. Then in sequence depress momentarily with more force than normally required, each cursor movement key shown. 		Page 5-89.
9	Home the cursor (depress HOME) and type alpha characters A through J on the display. Place the cursor over character E and depress CHAR INSRT momentarily; then depress it fully -- releasing it after characters stop moving.		Page 5-78.
10	Depress CHAR DLETE momentarily; then depress it fully.		Page 5-78.

STEP	PROCEDURE	RESULTS	TERMINAL ANALYSIS
11	Depress LINE INSRT once.	Cursor moves to beginning of line, and the line of data moves down one line.	Page 5-78.
12	Depress LINE DELETE once; then depress CLEAR.	The line of data moves up, and then display is cleared of all characters.	Page 5-78.
13	Place the cursor away from home position and depress CURSOR TAB.	Cursor moves to first character position of next line (unformatted display).	Page 5-89.
14	Place the cursor away from home position and depress TAB.	Cursor moves to first character position of next line (unformatted display).	Page 5-89.
15	Depress HOME and numeric 1.	Numeric 1 is displayed in home position.	Page 5-81 and 5-89.
16	Depress NEW LINE 24 times.	Cursor moves down display, displaying new line character at 1st position of each line. On the 24th depression of NEW LINE, the numeric 1 will disappear from display.	Page 5-81 and 5-89.
17	Type a numeric 2 and depress NEW LINE 24 times.	The numeric 2 will move up one line each time NEW LINE is depressed. On the 24th depression of the NEW LINE, the numeric 2 will disappear from screen.	Page 5-81 and 5-89.
18	Repeat Steps 16 and 17 for numeric 3, 4 and 5.	A numeric 3, 4 or 5 is displayed at the 1st line of each segment.	
19	Depress HOME.	The cursor moves to the home position and a 1 is displayed under the cursor.	
20	Depress SEGMENT ADV.	Cursor does not move; a 2 is displayed under cursor.	Page 5-89.

## C. TESTING (Contd)

## 6. FUNCTIONAL TESTS -- 40K108/RDF (Contd)

STEP	PROCEDURE	RESULTS	TROUBLE ANALYSIS
21	Depress SEGMENT ADV three times more to advance the segments.	The cursor does not move; the 2 is replaced by a 3 under the cursor, 4 replaces the 3, and 5 replaces the 4.	Page 5-89.
22	Depress SEGMENT ADV again.	The cursor does not move; the 5 is replaced by a 1 under the cursor.	
23	Depress SCROLL UP once.	The 1 disappears from the display and a 2 appears at bottom left of display.	Page 5-89.
24	Depress SCROLL UP fully and hold.	The 2 is replaced by a 3, then the 3 moves up the display. Then a 4 appears followed by a 5. Scrolling stops when the 5 reaches top of display.	
25	Depress SCROLL DOWN once, then fully.	The 5 moves down one line, then moves down continuously and disappears followed by 4, 3 and 2. Scrolling continues until the 1 appears at top of display.	Page 5-78.
26	Depress SEGMENT ADV four times.	The 5 appears at top of display.	Page 5-89.
27	Position cursor by means of the  and  to next to the last line of display. Type some Us on this line.	Cursor moves under direction of cursor control key. The Us are displayed.	Page 5-78.
28	Depress LINE INSERT once.	The Us move to last line of display. The cursor moves to the 1st character position of the line next to last line of display.	Page 5-78.
29	Depress LINE INSERT several times.	Display does not change.	
30	Depress HOME and TAB CLEAR.	All tabs and data (on all segments) are cleared.	Page 5-89.

STEP	PROCEDURE	RESULTS	TERMINAL ANALYSIS
31	Enter a full line of dashes (-) at top of display.	Dashes (-) are displayed.  Alarm sounds at 70th through 80th character positions.  Cursor remains at right end of line.	Page 5-78.
32	Depress RETURN.	Cursor moves to left margin. No characters altered in any way.	Page 5-89.
33	Depress NEW LINE.	Cursor drops one line.	Page 5-89.
34	Enter a full line of periods (.) on the display.	Periods (.) are displayed across monitor.  Alarm sounds at 70th and 80th character positions.  Cursor remains at right end of line.	Page 5-78.
35	Depress NEW LINE.	Cursor moves to left margin and moves down one line (≡ is not added over 80th character).	
36	Depress HOME and CLEAR.	Cursor to home position. Screen is cleared (data in all segments is cleared).	
37	Type QUICK Depress SPACE (5 times) Depress TAB SET Depress HOME	Word QUICK appears on line 1. Cursor moves. No change (stop is set). Cursor to home position.	Page 5-89.
38	Depress CHAR INSRT fully and hold until movement stops.	Word QUICK moves to right and off display.	Page 5-89.
39	Depress CHAR DLETE twice.	Word QUICK in line 1 moves two positions left.	Page 5-89.

C. TESTING (Contd)6. FUNCTIONAL TESTS -- 40K108/RDF OPCON (Contd)

STEP	PROCEDURE	RESULTS	TERMINAL ANALYSIS
40	Depress CURSOR TAB.	Cursor moves to tab column. No data is altered along the way.	Page 5-89.
41	Depress TAB.	Tab symbol ( ▶ ) appears at original position of cursor. Cursor moves one space to the right. Tabs are not sent on-line.	Page 5-89.
42	Depress HOME, CLEAR, then TAB CLEAR.	Cursor goes to home position.  All characters and tab columns are cleared from screen and on all segments.	Page 5-89.



STEP	PROCEDURE	RESPONSE	POSSIBLE CAUSE OF TROUBLE	SECTION D TROUBLE ANALYSIS
RO OPCON TEST				
1	Depress OPT II once.  Depress OPT II again.	Key should latch down and lamp should light.  Key should unlatch and come up, lamp should extinguish.	Wiring to keyswitch.  Open keyswitch.  Defective lamp.	Page 5-83 and 5-89.
2	Depress TEST once.  Depress TEST again.	Key should latch down and lamp should light.  Key should unlatch and come up, lamp should extinguish.	Wiring to keyswitch.  Open keyswitch.  Defective lamp.	Page 5-83 and 5-89.
3	TERM READY is normally lit during operation. Depress key twice.	On the first depression, lamp should extinguish. On the second depression, lamp should relight.	Wiring to keyswitch.  Open keyswitch.  Defective lamp.	Page 5-76.

D. TROUBLESHOOTING

1. GENERAL

This section provides the necessary information for locating and clearing troubles encountered in testing the 40K103 and 40K108 KD or 40K002 ROP opcon units per 5-14.

The detailed troubleshooting charts include voltage levels, oscilloscope waveforms, abbreviated schematics and step-by-step instructions for trouble diagnosis. Supplementary information such as block diagrams, functional schematics and keyswitch assignments and coding is provided on Page 5-92 REFERENCE MATERIAL.

2. PRELIMINARY

KD Opcon

**CAUTION:** TO AVOID POSSIBLE INTERNAL DAMAGE TO THE MOS DEVICES OR CIRCUIT CARDS WITH MOS DEVICES DUE TO ELECTRICAL STATIC DISCHARGE BY SERVICE PERSONNEL, FOLLOW THE HANDLING AND GROUNDING PROCEDURES ON PAGES 5-120 AND 5-121.

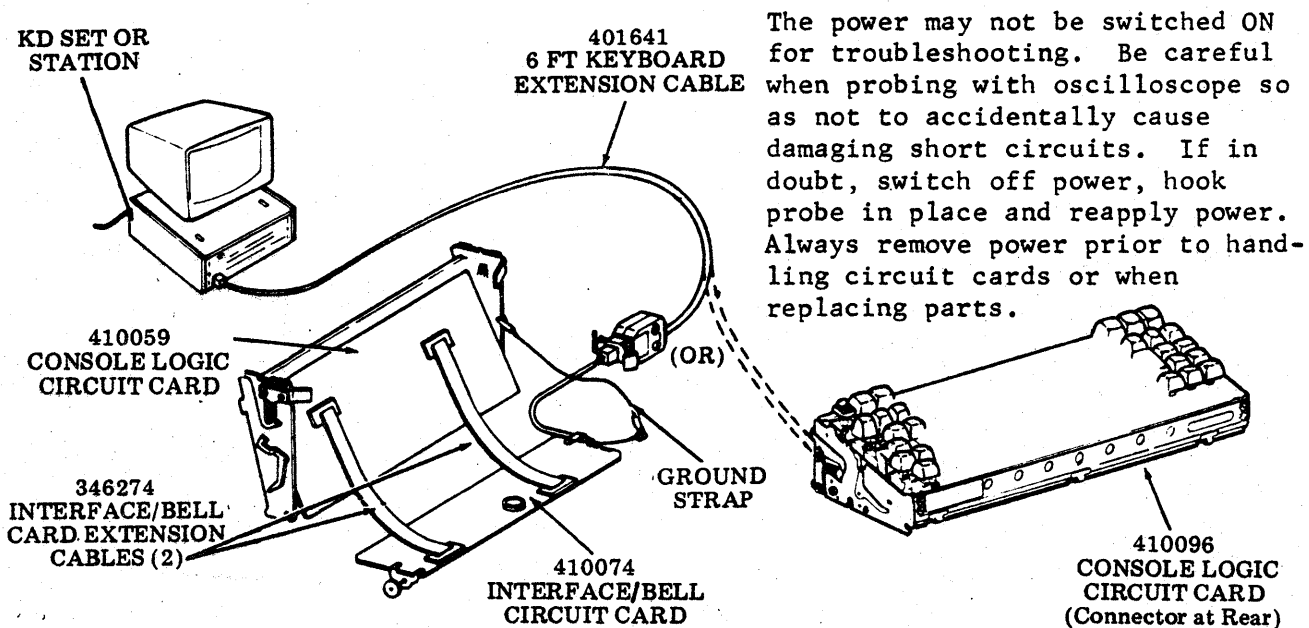
Arrange the KD opcon on the bench as illustrated, following with cover, bottom pan, interface/bell card and coverplate removed.

Connect a ground strap having an alligator clip at each end from opcon side plate to green ground lead terminal as shown. Connect oscilloscope ground to keyboard side plate in the same manner.

Using two 346274 interface/bell card extender cables, connect card to console logic as shown; if the 410074 circuit card is present.

With power off, connect keyboard to KD set or station using a 401641 keyboard extension cable.

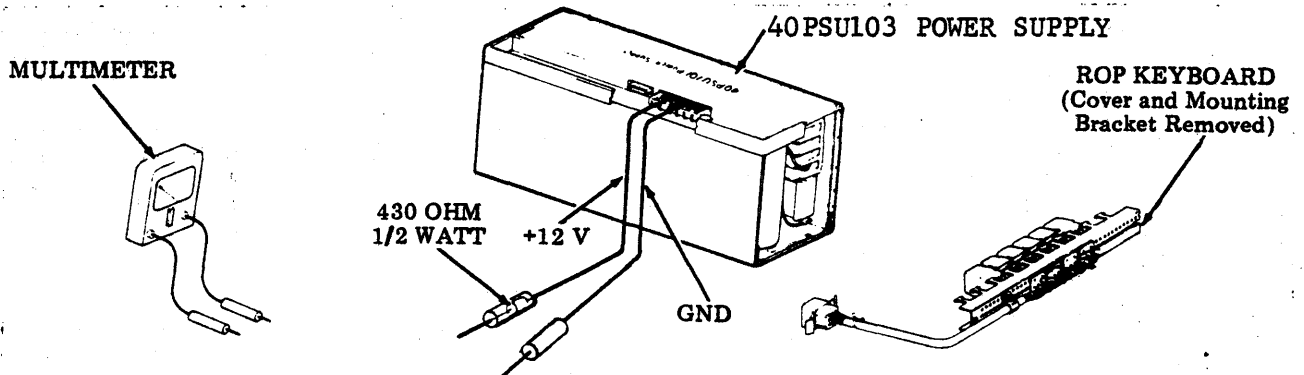
**CAUTION:** MAKE SURE THE NONCOMPONENT SIDE OF EITHER CIRCUIT CARD DOES NOT REST ON OR AGAINST ANYTHING THAT WILL CAUSE SHORTING DURING TROUBLESHOOTING OPERATIONS.



ROP Opcon

ROP opcon troubleshooting consists solely of checking keyswitch operation and indicator lighting. Remove power, disconnect ROP opcon from ROP set and remove opcon cover and mounting bracket. Arrange opcon as shown below.

Connect two test leads with probes to +12 (terminal 6) and GND (terminal 6) of a 40PSU103 power supply. The +12 test lead MUST include a series connected 430 ohm, 1/2 watt resistor most conveniently placed in the probe.



Use the multimeter (R X 1 scale) to check opcon keyswitch operation and the power supply and probes to check opcon indicator lamps per troubleshooting of this section.

3. TROUBLESHOOTING CHARTS

The following charts pertain to the early design 40K103 (410059 and 410054 or 410074 circuit cards) or 40K108 (410096 circuit card) opcon:

- Chart 1 Power Test Fails (Page 5-53)
- Chart 2 Control Row Indicator Fails to Light (Page 5-54)
- Chart 3 No Repeat Characters Output From the Opcon (Page 5-56)
- Chart 4 Incorrect Characters From the Opcon (Page 5-57)
- Chart 5 No Data Output From the Opcon and "Loopback Test Mode" Does Not Function (Page 5-65)
- Chart 6 No Alarm (Page 5-69)
- Chart 7 Delay in Repeat (Page 5-71)
- Chart 8 All Control Row Indicators Flash (Page 5-73)

The following charts pertain to the late design 40K108 (410096) opcons:

- Chart 9 "TST" or "Console Test" Indicator Fails to Light (Page 5-74)
- Chart 10 Control Row Indicator Fails to Light (Page 5-77)
- Chart 11 No Repeat (Page 5-79)
- Chart 12 Incorrect Characters From the Opcon (Page 5-82)
- Chart 13 No Data Output From the Opcon (Page 5-84)
- Chart 14 No Alarm (Page 5-88)
- Chart 15 "Loopback" Test Does Not Work (Page 5-89)
- Chart 16 Single Key Failure (Page 5-90)

The following chart pertains to the 40K002 ROP opcons.

- Chart 17 ROP Opcon Troubleshooting Using 40PSU101 or Equivalent (Page 5-18)

NOTES

CHART I

POWER TEST FAILS

STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
1	<p>Check to see that supply voltages are present at B1, A12 (V<sub>SS</sub>) and B2, A7 (V<sub>DD</sub>) on 410074 card.</p>	<div style="display: flex; flex-direction: column; align-items: center;"> <div style="display: flex; align-items: center; margin-bottom: 20px;"> <div style="text-align: center;"> <p>① B1 and A12</p> </div> <div style="border: 1px solid black; padding: 5px; margin: 0 10px;">10 V dc/cm</div> <div style="text-align: center;"> <p>VSS</p> <p>0</p> </div> </div> <div style="display: flex; align-items: center;"> <div style="text-align: center;"> <p>② B2 and A7</p> </div> <div style="border: 1px solid black; padding: 5px; margin: 0 10px;">10 V dc/cm</div> <div style="text-align: center;"> <p>0</p> <p>VDD</p> </div> </div> </div> <p>If voltages are not present, check for dirty or broken connector pins, open lands, cut leads, etc.</p> <p>If voltages are present, go to Step 2.</p>
2	<p>Check for correct voltages on terminals of 405925 TST indicator assembly when lamp should be lit.</p> <p style="text-align: center;">Terminal Side of Indicator Keyswitch</p>	<div style="display: flex; flex-direction: column; align-items: center;"> <div style="display: flex; align-items: center; margin-bottom: 20px;"> <div style="text-align: center;"> <p>③ Pin 3</p> </div> <div style="border: 1px solid black; padding: 5px; margin: 0 10px;">10 V dc/cm</div> <div style="text-align: center;"> <p>VSS</p> <p>0</p> </div> </div> <div style="display: flex; align-items: center;"> <div style="text-align: center;"> <p>④ Pin 4</p> </div> <div style="border: 1px solid black; padding: 5px; margin: 0 10px;">10 V dc/cm</div> <div style="text-align: center;"> <p>0</p> <p>VDD</p> </div> </div> </div>

D. TROUBLESHOOTING (Contd)

3. TROUBLESHOOTING CHARTS (Contd)

CHART I (Contd)

POWER TEST FAILS

STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
2 (Cont)		<p>If voltages are correct, replace defective 405925 TST indicator assembly.</p> <p>If voltages are incorrect, check for open CR15 diode, open emitter to collector on Q7 transistor or shorted emitter to collector on Q6 transistor on 410059 circuit card.</p>
<p><b>NOTE:</b> Refer to Pages 5-98 and 5-101, Functional Schematics FS-1 and FS-4 (410059 circuit card) and Page 5-107, Functional Schematic FS-10 (410074 circuit card).</p>		

CHART 2

CONTROL ROW INDICATOR FAILS TO LIGHT

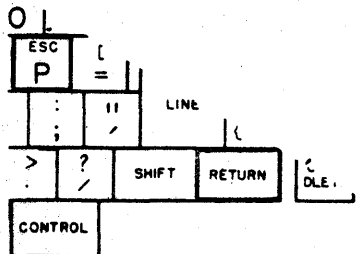

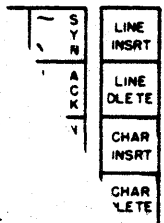
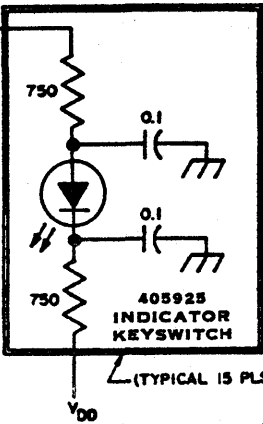
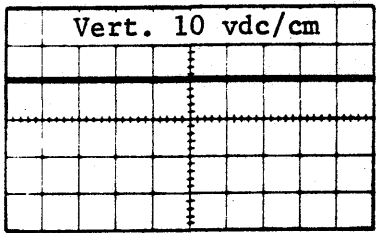
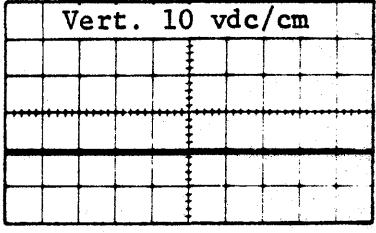
STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
1	<p>Depress RETURN and ESC P fully and check to see that TST CLEAR lamp lights.</p> 	<p>If TST CLEAR lamp fails to light, go to Page 5-53.</p>  <p>If TST CLEAR lamp lights, go to Step 2.</p> 
2	<p>Enter loop-back test mode and perform test. Refer to Page 5-15, 3. FUNCTIONAL TESTS, Step 2.</p>	<p>If failing lamp fails to light in test mode, go to Step 3.</p> <p>If failing lamp lights in test mode, check for defective keyswitch with failing lamp (refer to Pages 5-56 and 5-57, Steps 1 and 2).</p>

CHART 2 (Contd)

CONTROL ROW INDICATOR FAILS TO LIGHT

STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
3	<p>Check to see that associated lamp driver output voltage is correct at MLB5-2, 3, 4, 8, 9, 10, 11, 31, 32, 33, 34, 35, 37, or 38 (SSI) on 410059 card when lamp should be lit.</p> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 5px; margin-right: 10px;"> <p style="text-align: center; margin: 0;">MLB5 SERIAL INTERFACE AND LAMP DRIVER</p> </div> <div style="margin-right: 10px;"> <p>L1 11 (L0) SEND</p> <p>L3 9 (L1) REC ---</p> <p>L4 8 (L2) LOCAL</p> <p>L7 2 (L3) S/R</p> <p>L6 3 (L4) INTRPT ---</p> <p>L5 4 (L5) FORM SEND</p> <p>L2 10 (L6) OPT II</p> <p>L10 37 (L7) PRINT ON LINE</p> <p>L15 31 (L8) PRINT LOCAL</p> <p>L14 32 (L9) PARITY ERROR</p> <p>L13 33 (L10) TERM READY</p> <p>L12 34 (L11) KBD OVRN</p> <p>L11 35 (L12) CLEAR TO SEND</p> <p>L9 38 (L13) HIGH LIGHT</p> <p>L8 39 (L14) FORM ENTER</p> <p>L0 12 (L15) NOT USED</p> </div> <div style="border: 1px solid black; padding: 5px;">  </div> </div>	<div style="text-align: center;"> <p>Indicator "ON"</p>  <p>Indicator "OFF"</p>  </div> <p>If voltage output on lamp driver goes to V<sub>SS</sub> when lamp should be lit, replace defective indicator key-switch.</p> <p>If voltage output on lamp driver remains at V<sub>DD</sub> when lamp should be lit, replace defective MLB5.</p>

D. TROUBLESHOOTING (Contd)

3. TROUBLESHOOTING CHARTS (Contd)

CHART 3

NO REPEAT CHARACTERS OUTPUT FROM THE OPCON

• Place opcon in local mode.

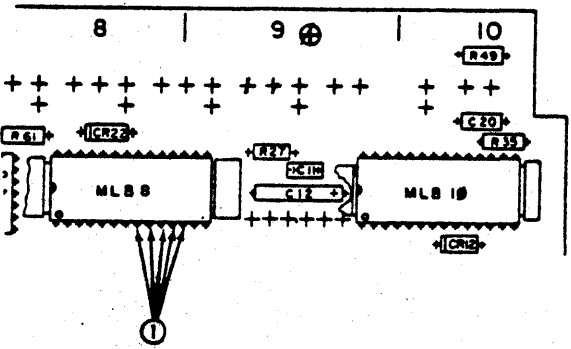
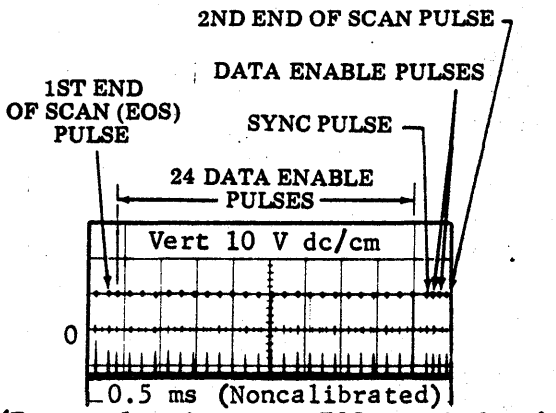
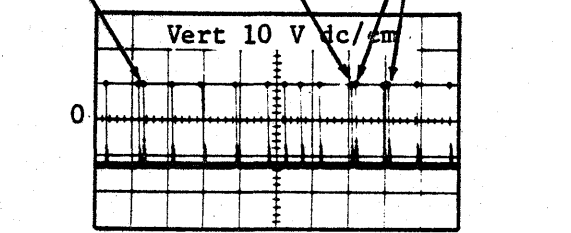
STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
1	<p>Depress a repeatable key fully. Hold and check I/O signals on MLB8-8 through 12 (KL) on 410059 card.</p> 	<p>NORMAL INDICATION AND CORRECTIVE PROCEDURE</p>  <p>① I/O signal of one scan period (4.57 ms) from any sense amplifier with no depressed keyswitches.*</p>
	<p>NORMAL DEPRESSION OF REPEAT KEYSWITCH (1 pulse)</p> <p>REPEAT KEYSWITCH DEPRESSED FULLY (2 pulses)</p> <p>UNWANTED PULSE DEPRESSION (Go to Step 2.)</p>  <p>I/O signal of one scan period from any sense amplifier with a repeatable key depressed fully.</p>	<p>*When depressed, CAPS LOCK key will cause a depression pulse in I/O signal at MLB8-10. This pulse has no effect on any repeatable key.</p> <p>If there are <u>no</u> other keyswitch depressions besides the desired repeat keyswitch depressions, replace MLB8 on 410059 card.</p> <p>If there <u>are</u> other unwanted keyswitch depressions present in the I/O signal, go to Step 2.</p>



CHART 3 (Contd)

NO REPEAT CHARACTER OUTPUT FROM THE OPCON

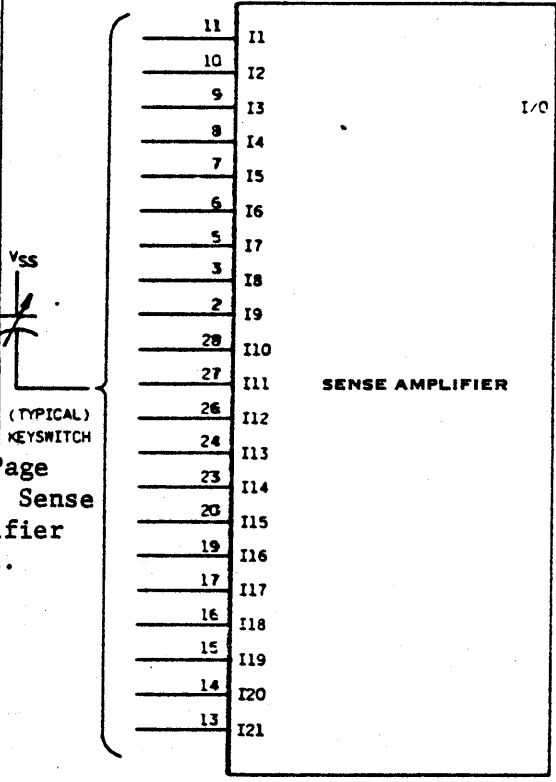
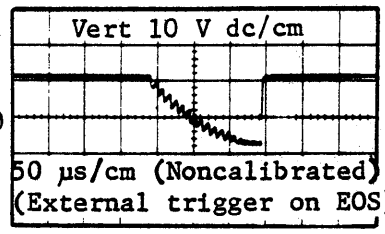
STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
2	<p>Release depressed repeat keyswitch and check inputs of sense amplifier associated with unwanted keyswitch depression.</p>  <p>See Page 5-98, Sense Amplifier Chart.</p>	<p>If inputs to sense amplifier <u>do not</u> indicate a keyswitch depression, replace sense amplifier associated with false depression.</p>  <p>Signal of Sense Amplifier Input Having a Keyswitch Depression</p> <p>If input to sense amplifier <u>does</u> indicate a keyswitch depression:</p> <ol style="list-style-type: none"> <li>Check for open connection to keyswitch associated with sense amplifier input having depression indicated.</li> <li>Check for cold solder connections at terminals of keyswitch.</li> <li>If above results show no difficulties, replace defective keyswitch.</li> </ol>
<p><b>NOTE:</b> Refer to Pages 5-98 and 5-99, Functional Schematics FS-1 and FS-2 (410059 circuit card).</p>		

CHART 4

INCORRECT CHARACTERS FROM THE OPCON

•Place opcon in local mode.

STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
1	<p>Check that all switch address signals which are sent from MLB8-17 through 25 to MLB6 (ROM) on 410059 card are correct (external trigger on AE -- MLB8-3).</p>	

D. TROUBLESHOOTING (Contd)

3. TROUBLESHOOTING CHARTS (Contd)

CHART 4 (Contd)

INCORRECT CHARACTERS FROM THE OPCON

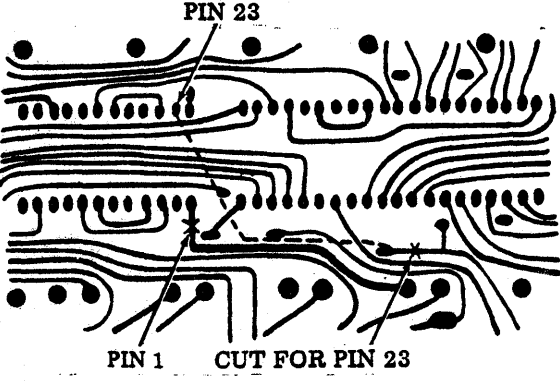
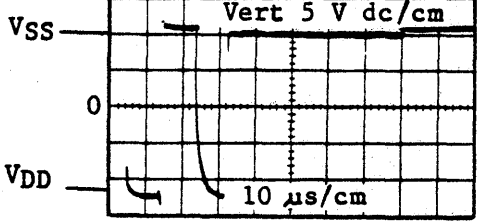
STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
<p>1 (Cont)</p>		<p>① MLB8-22 ↑ key depressed fully and held.</p> <p>SWITCH ADDRESS TO MLB6</p> <p>DATA BITS SENT FROM MLB6 TO MLB8 (ASCII)</p> <p>1 = SPACE</p> <p>0 = MARK</p> <p>Vert 5 V dc/cm</p> <p>10 μs/cm</p> <p>(External trigger on AE)</p> <p>If switch address signal is not correct on MLB8-17 through 25 and the signal on each data level toggles, replace defective MLB8.</p> <p>If switch address signal is incorrect on MLB8-17 through 25 and the signal on each data level <u>does not</u> toggle, go to Step 2.</p> <p>If switch address signal sent to MLB6 on MLB8-17 through 25 is correct, go to Step 3.</p>

**NOTE 1:** Depress a repeatable key fully and hold to view signals required in chart (ie, cursor ↑).

**NOTE 2:** Refer to Page 5-99, Functional Schematic FS-2 (410059 circuit card) and Pages 5-102 and 5-103, Functional Schematics FS-5 and FS-6 (410074 circuit card).

CHART 4 (Contd)

INCORRECT CHARACTERS FROM THE OPCODE

STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
<p>2</p> <p>a.</p>	<p>If one of the data levels is held at near <math>V_{SS}</math> voltage, the defective MOS package can be found by the following technique.</p> <p>Cut the conductors on noncomponent side of 410059 card which go to <math>V_{SS}</math> on MLB6-1 and to <math>V_{REF}</math> on MLB6-23.</p>  <p>PIN 23</p> <p>PIN 1 CUT FOR PIN 23</p> <p>b.</p>	<p>If lead which was held at near <math>V_{SS}</math> goes to <math>V_{DD}</math> the defective package may be either MLB8 or MLB5, go to Step 2b.</p>  <p>Vert 5 V dc/cm</p> <p>10 <math>\mu</math>s/cm</p> <p>If data level goes to <math>V_{DD}</math>, replace defective package MLB5; if it does not, replace defective package MLB8.</p>
<p><b>NOTE:</b> Replace package and make certain that all conductors that were cut are repaired by soldering a piece of wire in place where conductors were cut.</p>		
<p>3</p>	<p>Check that all data bits which are sent from MLB6-6 through 10 and 16 through 19 to MLB8 on 410059 card are correct (external trigger on -- OE MLB6-11).</p>	

D. TROUBLESHOOTING (Contd)

3. TROUBLESHOOTING CHARTS

CHART 4 (Contd)

INCORRECT CHARACTERS FROM THE OPCON

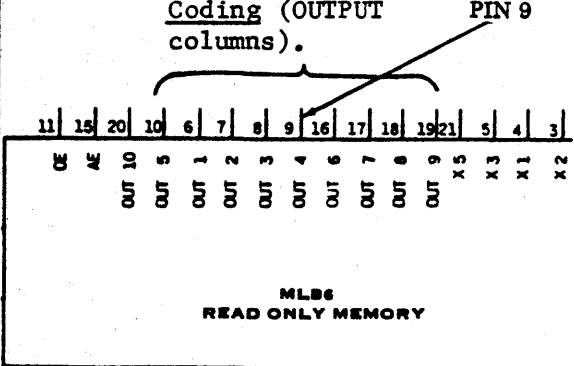
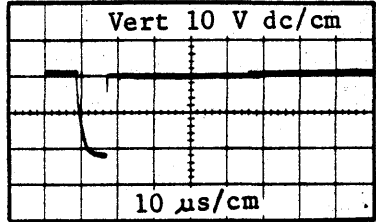

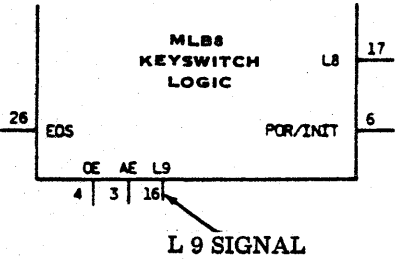
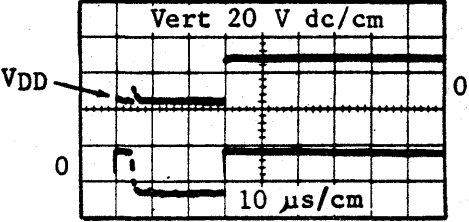
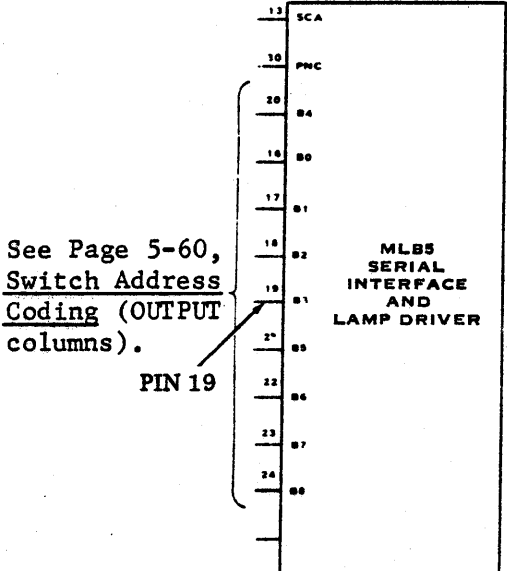

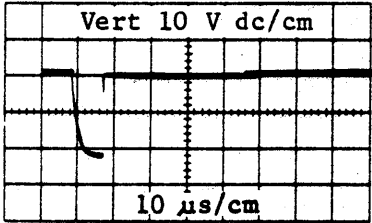
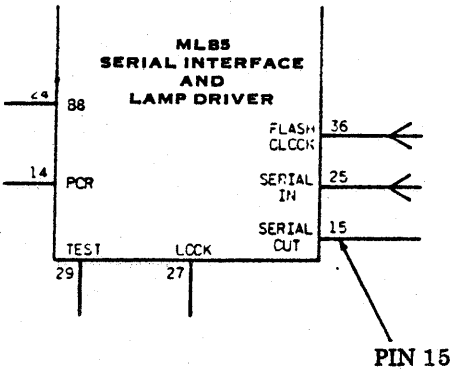

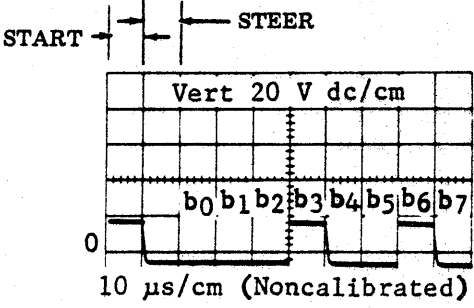
STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
<p>3 (Cont)</p>	<p>See Page 5-60, <u>Switch Address Coding</u> (OUTPUT columns).</p>  <p>MLB6 READ ONLY MEMORY</p>	<p>NORMAL INDICATION AND CORRECTIVE PROCEDURE</p> <p>DATA BIT 3 1 = SPACE</p>  <p>MLB6-9 waveform, with  key depressed fully and held.</p> <p>If any data bit (ASCII -- American National Standard Code for Information Interchange) is incorrect on MLB6-6 through 10 and 16 through 19 and the signal on each data level toggles, replace defective MLB6.</p> <p>If any data bit (ASCII) is incorrect on MLB6-6 through 10 and 16 through 19 and the signal on each data level <u>does not</u> toggle, go to Step 2.</p> <p>If all data bits sent to MLB8 on MLB6-6 through 10 and 16 through 19 are correct, go to Step 4.</p>
<p>4</p>	<p>Check that L9 signal on MLB8-16 remains near VDD during output enable for a valid character generated.</p>  <p>MLB8 KEYSWITCH LOGIC</p> <p>L9 SIGNAL</p>	<p>Top Signal -- L9 signal at VDD during output of data bit -- see bottom signal.</p>  <p>If L9 signal remains near VSS, check for shorted emitter to collector on Q9 transistor.</p>

CHART 4 (Contd)

INCORRECT CHARACTERS FROM THE OPCON

STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
4 (Cont)		If L9 signal remains near V <sub>DD</sub> during output enable for a valid character generated, go to Step 5.
5	<p>Check that all ASCII character input signals on MLB5-16 through 24 on 410059 card are correct.</p> 	<p>MLB5-19 waveform, with  key depressed fully and held.</p>  <p>If any data bit (ASCII) is incorrect on MLB5-16 through 24 and the signal on each data level toggles, replace defective MLB5 on 410059 card.</p> <p>If any data bit (ASCII) is incorrect on MLB5-16 through 24 and the signal on each data level <u>does not</u> toggle, go to Step 2.</p> <p>If all data bits are correct on MLB5-16 through 24, go to Step 6.</p>
6	<p>Check that serial out signal on MLB5-15 on 410059 card is correct. Trigger oscilloscope internally to view this signal.</p> 	<p><u>NOTE:</u> This signal consists of an 18 bit character having a start bit, steer bit, and 16 data bits (only ASCII b<sub>0</sub> through b<sub>7</sub> are shown in waveform).</p> <p>MLB5-15 waveform, with  key depressed fully and held.</p>  <p>If serial out signal is incorrect, replace defective MLB5 on 410059 card.</p> <p>If serial out signal is correct, go to Step 7.</p>

D. TROUBLESHOOTING (Contd)

3. TROUBLESHOOTING CHARTS (Contd)

CHART 4 (Contd)

INCORRECT CHARACTERS FROM THE OPCON

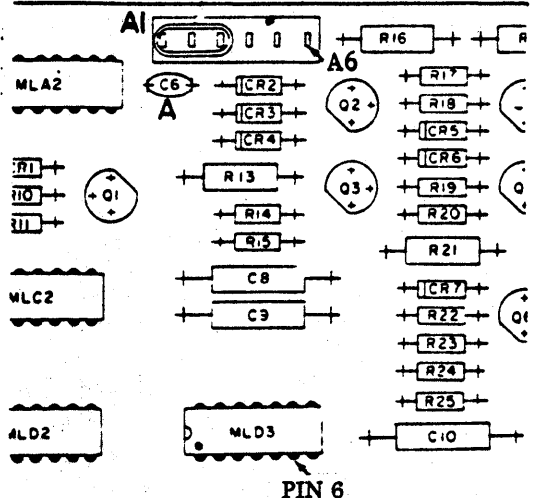
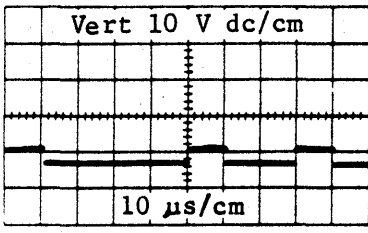
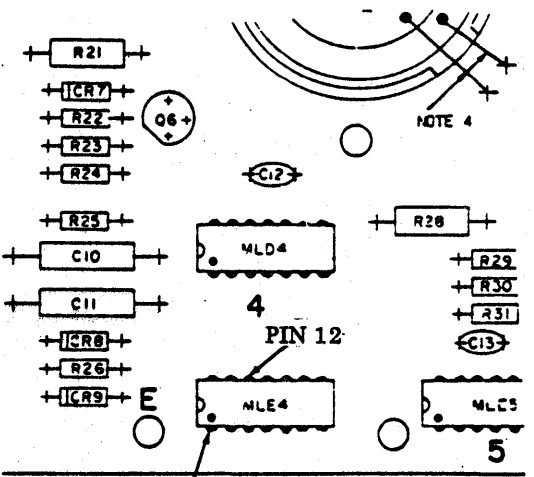
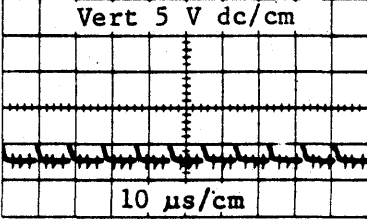

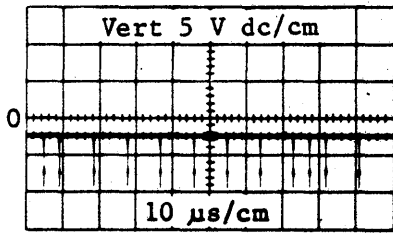
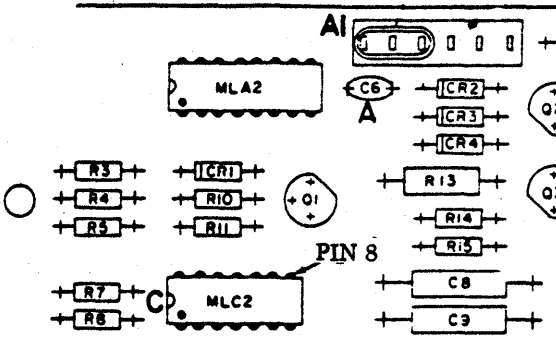

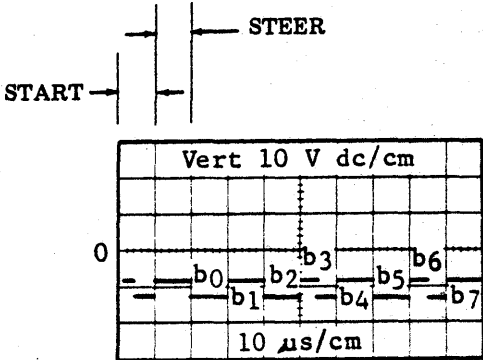
STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
7	<p>Check output data signal on MLD3-6 on 410074 card. Trigger oscilloscope externally on serial out data pin A6.</p>  <p style="text-align: center;">PIN 6</p>	<p>MLD3-6 waveform, with key depressed fully and held.</p>  <p style="text-align: center;">(Noncalibrated)</p> <p>If signal is incorrect or not present, check for open CR7 diode, replace MLD3.</p> <p>If signal is present and correct, go to Step 8.</p>
8	<p>Check space bit timing signal on MLE4-1 on 410074 card. Trigger internally.</p>  <p style="text-align: center;">PIN 12</p> <p style="text-align: center;">PIN 1</p>	<p>MLE4-1 waveform, Continual signal</p>  <p style="text-align: center;">(Noncalibrated)</p> <p>If signal is incorrect or not present, check for open CR8 diode, shorted C11 capacitor, replace MLE3.</p> <p>If signal is present and correct, go to Step 9.</p>

CHART 4 (Contd)

INCORRECT CHARACTERS FROM THE OPCON

STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
9	Check output data signal on MLE4-12 on 410074 card. External trigger on pin A6 (see step 12 for location of MLE4-12.)	<p>MLE4-12 waveform, with  key depressed fully and held.</p>  <p>(Noncalibrated)</p> <p>If signal is not present, replace MLE4.</p> <p>If signal is present, go to Step 10.</p>
10	<p>Check output data signal on MLC2-8 on 410074 card. External trigger on pin A6.</p> 	<p><b>NOTE:</b> This signal consists of an 18 bit character having a start bit, steer bit and 16 bits (only ASCII b0 through b7 are shown in waveform).</p> <p>MLC2-8 waveform, with  key depressed fully and held.</p>  <p>(Noncalibrated)</p> <p>If signal is not present, replace MLC2.</p> <p>If signal is correct, go to Step 11.</p>

D. TROUBLESHOOTING (Contd)

3. TROUBLESHOOTING CHARTS (Contd)

CHART 4 (Contd)

INCORRECT CHARACTERS FROM THE OPCON

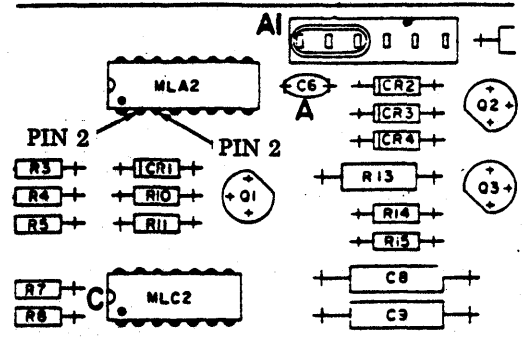
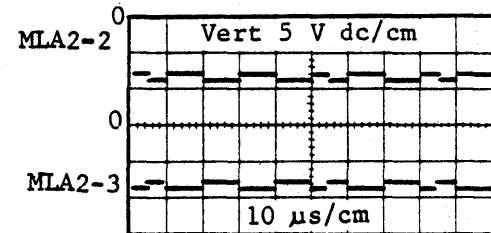
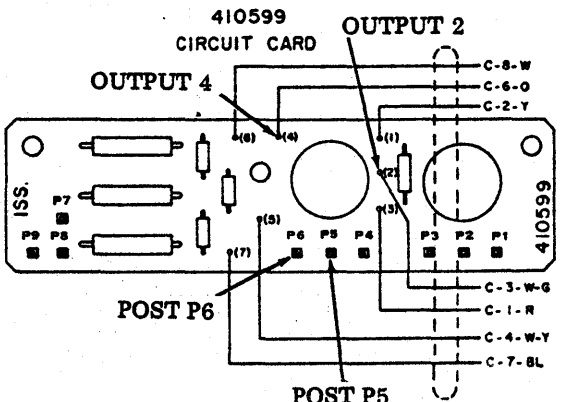
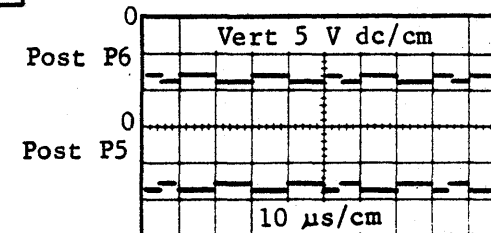
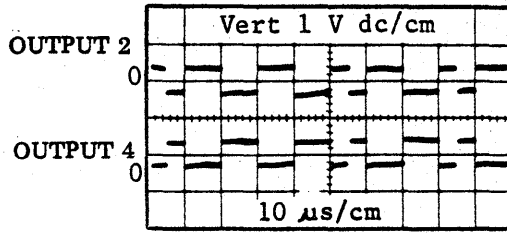
STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
11	<p>Check output data signal on MLA2-2 and 3 on 410074 card. External trigger on pin A6.</p> 	<p>↑ key depressed fully and held.</p>  <p>(Noncalibrated)</p> <p>If signal is not present, replace MLA2.</p> <p>If signal is correct, go to Step 12.</p>
12	<p>Check output data signal at posts P5 and P6 of 410599 card. External trigger on pin A6.</p> 	<p>↑ key depressed fully and held.</p>  <p>(Noncalibrated)</p> <p>If signal is not present, check for open wiring to 410074 card. Check continuity of feed-through filter.</p>
13	<p>Check output data signal at outputs (2) and (4) of 410599 card. External trigger on pin A6.</p>	<p>↑ key depressed fully and held.</p>  <p>(Noncalibrated)</p>



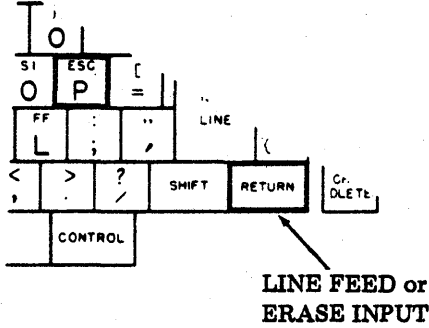
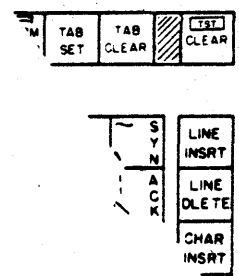
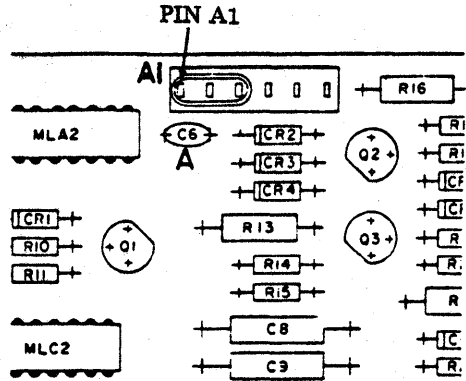
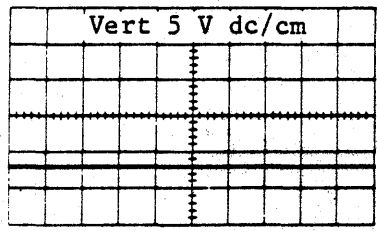
CHART 4 (Contd)

INCORRECT CHARACTERS FROM THE OPCON

STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
13 (Cont)		If signal is not present, check for open output winding in T1 transformer, poor solder connections.  If signal is present, opcon is good, check associated controller logic.

CHART 5

NO DATA OUTPUT FROM OPCON AND LOOP-BACK TEST MODE DOES NOT FUNCTION

STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
1	Depress RETURN, LINE FEED or ERASE INPUT to see that TST CLEAR lamp lights.  	If TST CLEAR lamp fails to light, go to Page 5-53.  If TST CLEAR lamp lights, go to Step 2.  
2	Check to see that $V_{CC}$ voltage is present on pin A1 of 410074 card.  	Pin A1 $V_{CC}$ Voltage    If $V_{CC}$ voltage is not present, check switching regulator. (Refer to Page 5-103, Functional Schematic FS-11).  If $V_{CC}$ voltage is present, go to Step 3.

D. TROUBLESHOOTING (Contd)

3. TROUBLESHOOTING CHARTS (Contd)

CHART 5 (Contd)

NO DATA OUTPUT FROM OPCON AND LOOP-BACK TEST MODE DOES NOT FUNCTION

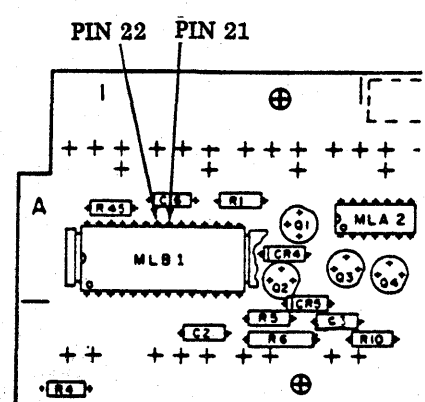
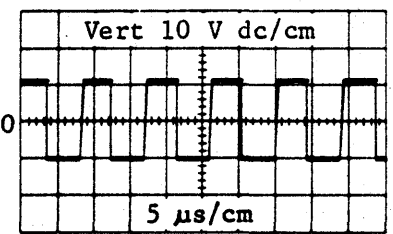
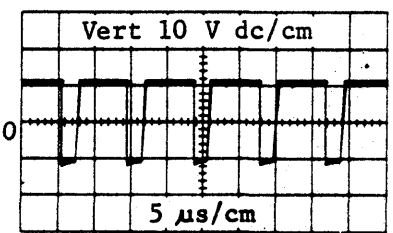
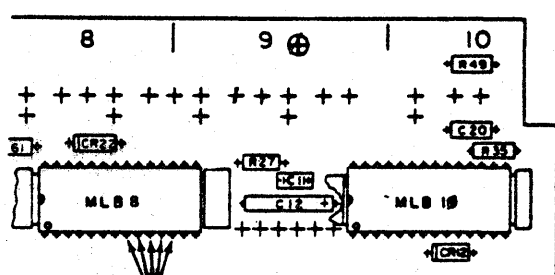
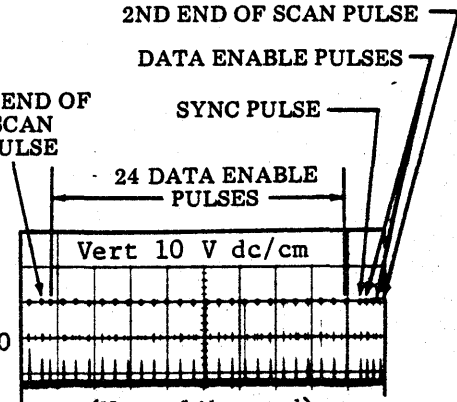
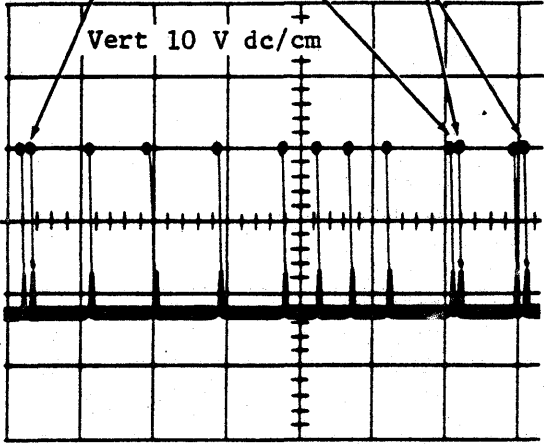
STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
3	<p>Check to see that <math>\emptyset 1H</math> and <math>\emptyset 2H</math> clocks are present on MLB1-22 and 21, respectively on 410059 card.</p> 	<p>Pin 22 <math>\emptyset 1H</math> Clock Signal</p>  <p>Pin 21 <math>\emptyset 2H</math> Clock Signal</p>  <p>If <math>\emptyset 1H</math> and <math>\emptyset 2H</math> clocks are not present, check high frequency clock and drivers. (Refer to Page 5-100, Functional Schematic FS-3).</p> <p>If <math>\emptyset 1H</math> and <math>\emptyset 2H</math> clocks are present, go to Step 4.</p>
4	<p>Depress a repeatable key fully -- hold -- and check I/O signals on MLB8-8 through 12 on 410059 card.</p>  <p>PIN 8 THRU PIN 12</p>	 <p>(Noncalibrated) (External trigger on EOS)</p> <p>Pin 8 thru Pin 12, I/O signal of one scan period (4.57 ms) from any sense amplifier with no depressed keyswitches.*</p> <p>*When depressed, the CAPS LOCK key will cause a depression pulse in</p>

CHART 5 (Contd)

NO DATA OUTPUT FROM OPCON AND LOOP-BACK TEST MODE DOES NOT FUNCTION

STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
<p>4 (Cont)</p>		<p>I/O signal at MLB8-10. This pulse has no effect on any repeatable key.</p> <p>NORMAL DEPRESSION OF REPEATABLE KEYSWITCH (1 pulse)</p> <p>UNWANTED PULSE DEPRESSION (Go to Step 2.)</p> <p>REPEATABLE KEYSWITCH DEPRESSED FULLY (2 pulses)</p>  <p>④ I/O signal of one scan period from any sense amplifier with a repeatable key depressed fully.</p> <p>If there <u>are</u> other unwanted key-switch depressions present in the I/O signal, refer to Page 5-57, Step 2.</p> <p>If there are <u>no</u> other keyswitch depressions besides the desired repeat keyswitch depressions, go to Step 5.</p>
<p>5</p>	<p>Check that all switch address signals on MLB8-17 through 25 are correct on 410059 card. (Refer to Page 5-58, Step 1).</p>	<p>If switch address signal is not correct and the signal on each data level toggles, replace defective MLB8.</p> <p>If switch address signal is not correct and the signal on each data level does not toggle, go to Page 5-59, Step 2.</p> <p>If switch address signal is correct, go to Step 6.</p>

D. TROUBLESHOOTING (Contd)

3. TROUBLESHOOTING CHARTS (Contd)

CHART 5 (Contd)

NO DATA OUTPUT FROM OPCON AND LOOP-BACK TEST MODE DOES NOT FUNCTION

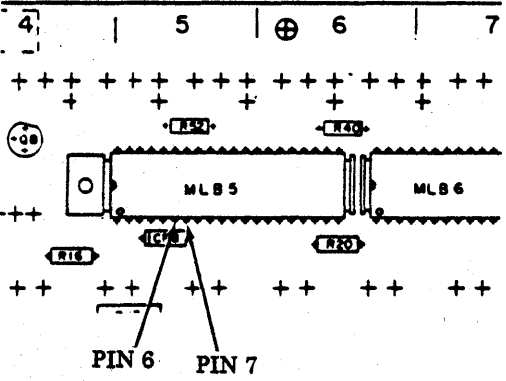
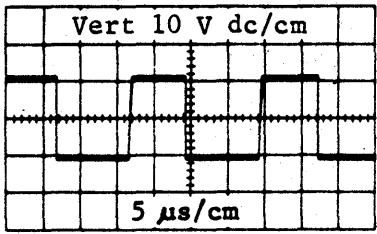
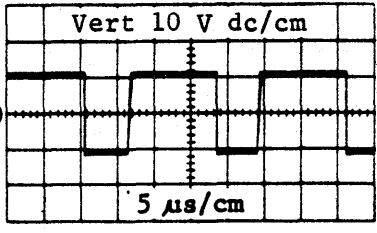
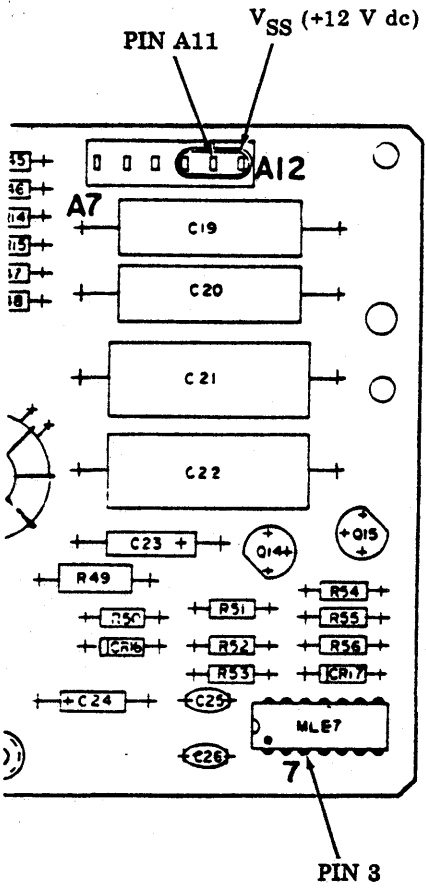
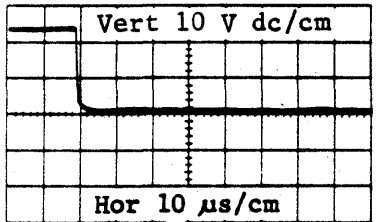
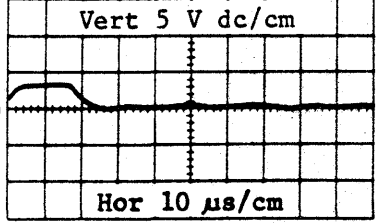
STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
6	Check that serial out signal on MLB5-15 on 410059 card is correct. (Refer to Page 5-61, Step 6).	<p>If serial out signal is not present, go to Step 7.</p> <p>If serial out signal is present, go to Page 5-62, Step 7.</p>
7	<p>Check to see that <math>\emptyset 1L</math> and <math>\emptyset 2L</math> clocks are present on MLB5-7 and 6, respectively on 410059 card.</p> 	<p>Pin 7 <math>\emptyset 1L</math> Clock Signal</p>  <p>Pin 6 <math>\emptyset 2L</math> Clock Signal</p>  <p>If <math>\emptyset 1L</math> and <math>\emptyset 2L</math> clocks are not present, check the low frequency clock drivers. (Refer to Page 5-105, Functional Schematic FS-8).</p> <p>If <math>\emptyset 1L</math> and <math>\emptyset 2L</math> clocks are present, replace defective MLB5 on 410059 card.</p>

CHART 6

NO ALARM

STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
1	<p>Check for alarm signal on pin A11 of 410074 card (see Page 5-72, Notes 1 through 4.)</p> 	<p>Pin A11 Alarm Signal</p>  <p>If waveform is <u>not</u> present, momentarily jump pin A12 to A11.</p> <p>If alarm sounds, replace defective 342553 TSS1 (MLB5), 410059 card.</p> <p>If waveform is present, and alarm does not sound, go to Step 2.</p>
2	<p>Check for alarm signal on MLE7-3 on 410074 card (see Page 5-71, Note 3).</p>	<p>Pin 3 Alarm Signal</p>  <p>If waveform is <u>not</u> present, check for shorted C25 capacitor or shorted input on MLE7 on 410074 card.</p>

D. TROUBLESHOOTING (Contd)

3. TRoubleshooting Charts (Contd)

CHART 6 (Contd)

NO ALARM

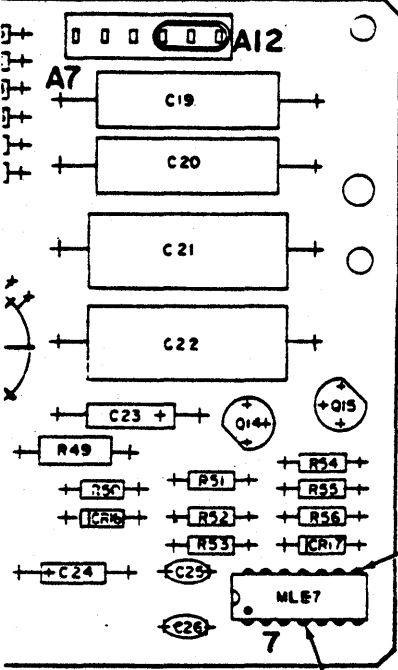
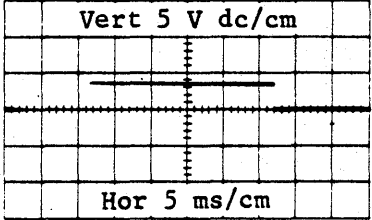
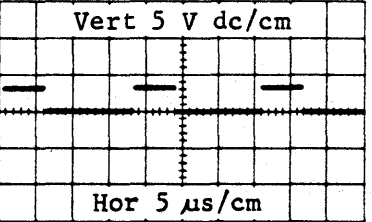
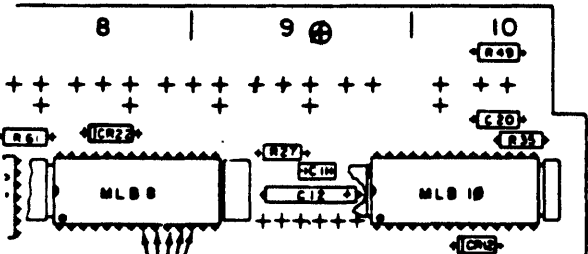
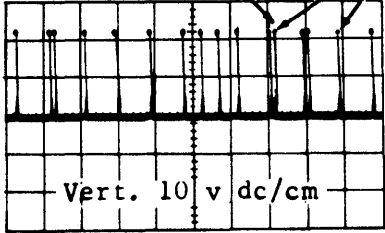
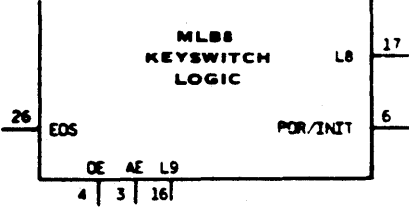
STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
2 (Cont)		If the waveform is present and alarm does not sound, go to Step 3.
3	<p>Check for alarm signal on MLE7-8 on 410074 card (see Page 5-72, Note 3).</p> 	<p>If waveform is present, and alarm does not sound, go to Step 4.</p> <p>Pin 8 Alarm Signal</p>  <p>If waveform is <u>not</u> present, check for Ø2L predrive signal on MLE7-4 on 410074 card.</p> <p>Pin 4 Ø2L Pre-drive Signal</p>  <p>If Ø2L predrive signal is present, replace MLE7 on 410074 card.</p> <p>If Ø2L predrive signal is <u>not</u> present, replace MLD3 on 410074 card.</p>

CHART 7

DELAY IN REPEAT

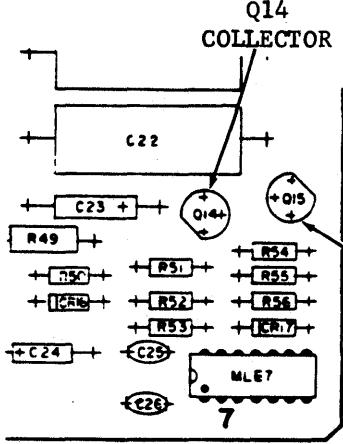
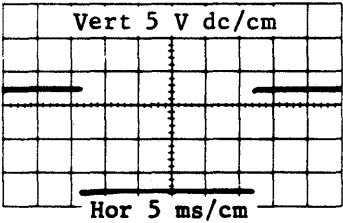
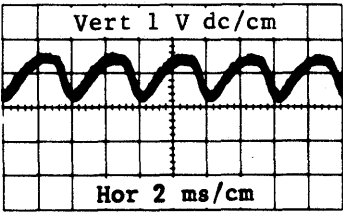
STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
<p>1 Depress a repeatable key fully. Hold and check I/O signals on Pins 8, 9, 10, 11 and 12 of MLB8 on 410059 card.</p>  <p>PIN 8 THROUGH PIN 12</p> <p>Note: Signal appears when key is depressed.</p>	<p>NORMAL DEPRESSION OF REPEAT (or Test) KEYSWITCH (1 Pulse)</p> <p>REPEAT (Or Test) KEYSWITCH DEPRESSED FULLY (2 Pulses)</p>  <p>Vert. 10 v dc/cm</p> <p>Trigger on EOS</p> <p>I/O signal of one scan period from any sense amplifier with a repeatable key depressed fully.</p> <p>If signal is incorrect go to page 5-29. If signal is correct go to Step 2.</p>	
<p>2 Check address enable (AE) on MLB8 Pin 3 as a repeatable key is fully depressed.</p> 	<p>If the same delay exists in this signal, that appear in cursor response, replace MLB8.</p>	

D. TROUBLESHOOTING (Contd)

3. TROUBLESHOOTING CHARTS (Contd)

CHART 7 (Contd)

DELAY IN REPEAT

STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
4	<p>Check for alarm signal on collector of Q14 transistor on 410074 card (see Note 3).</p> 	<p>Q14 Alarm Signal</p>  <p>If waveform is <u>not</u> present, replace defective Q14 transistor.</p> <p>If waveform is present and alarm does not sound, go to Step 5.</p>
5	<p>Check for alarm signal on emitter of Q15 transistor on 410074 card (see Q15 transistor (shown in Step 4) on 410074 card (see Note 3).</p>	<p>Q15 Alarm Signal</p>  <p>If waveform is <u>not</u> present, check for shorted C21, C22 or C23 capacitors, or shorted emitter to collector on Q15 transistor, etc on 410074 card.</p> <p>If waveform is present, alarm should sound.</p>
<p><b>NOTE 1:</b> Controller must have an alarm detect circuit.</p> <p><b>NOTE 2:</b> Generating a bell code at the opcon will not cause the alarm to sound.</p> <p><b>NOTE 3:</b> Depress the spacebar fully and hold to view signals required in chart.</p> <p><b>NOTE 4:</b> Refer to Page 5-105, Functional Schematic FS-9 (410074 circuit card).</p>		

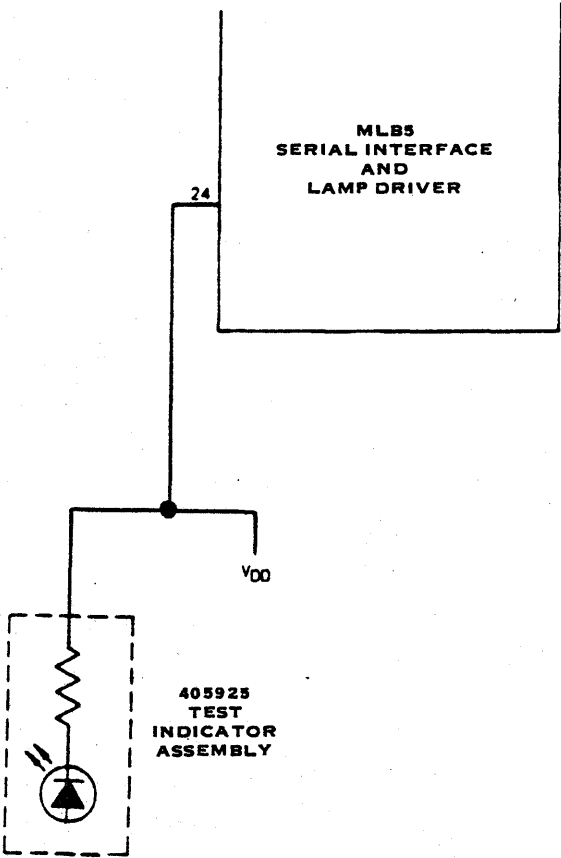


All Control Row Indicators Flash-in Local Loopback Test Mode When a Character Having the Eight Bit Spacing is Generated

NOTE 1: Place opcon in local loopback test mode.

NOTE 2: Depress PERIOD fully and hold to view signals required in chart.

CHART 8

ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
<p>Check voltage at MLB5-24 on 410059 card when lamps are flashing (see Note 2).</p> 	<p>If this level remains at <math>V_{DD}</math> while lamps flash, replace defective MLB5.</p>

D. TROUBLESHOOTING (Contd)

3. TROUBLESHOOTING CHARTS (Contd)

CHART 9

"TST" INDICATOR FAILS TO LIGHT

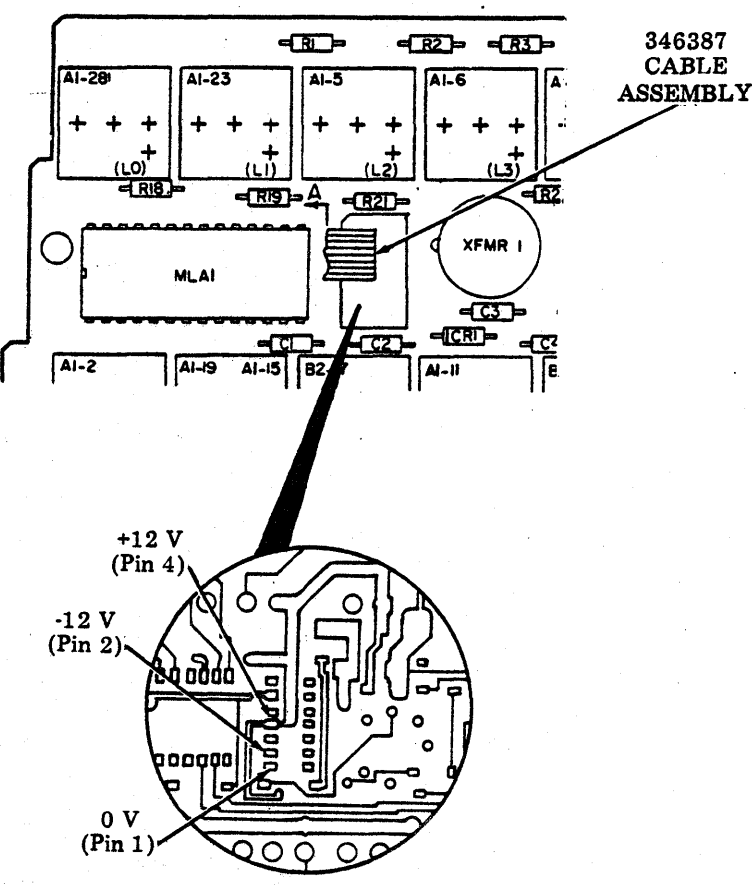
STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
<p>1</p> <p>Check to see that supply voltages are present at Pin 1 (0 V), Pin 2 (-12 V) and Pin 4 (+12 V) of the dip connector on 346387 cable assembly.</p>  <p>Bottom View of Dip Connector on 410096 Card.</p>		<p>If voltages are not present, check for dirty or broken connector pins, open lands, cut cable, etc.</p> <p>If voltages are present, go to Step 2.</p>

CHART 9 (Contd)

"TST" INDICATOR FAILS TO LIGHT

STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
<p>2</p> <p>Check for correct voltage at Pin 23 of MLA3 when "TST" lamp should be on.</p> <div style="text-align: center;"> </div>	<p>"TST" or "CONSOL TEST" lamp "ON"</p> <div> <p style="text-align: center;">10 V dc/cm</p> </div> <p>"TST" or "CONSOL TEST" lamp "OFF"</p> <div> <p style="text-align: center;">10 V dc/cm</p> </div>	
<p>3</p> <p>Check to see that <math>\phi 1</math> and <math>\phi 2</math> clocks are present on Pins 22 and 21, respectively, of ML1 on 410096 card.</p>	<p>Pin 22 <math>\phi 1</math> Clock Signal</p> <div> </div> <p>Pin 21 <math>\phi 2</math> Clock Signal</p> <div> </div>	

D. TROUBLESHOOTING (Contd)3. TROUBLESHOOTING CHARTS (Contd)


## CHART 9 (Contd)

"TST INDICATOR FAILS TO LIGHT

STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
3 (Cont)		<p>If <math>\phi 1</math> and <math>\phi 2</math> clocks are not present, go to Chart 11, Step 3.</p> <p>If <math>\phi 1</math> and <math>\phi 2</math> clocks are present, go to Step 4.</p>
4	Check I/O signal at Pin 14 of MLA3 for depression of "RETURN" and "QUOTES" keys when depressed fully.	If I/O signal indicates the desired keyswitch depressions and "TST" indicator fails to light, replace MLA3 or MLA5 respectively.
5	Depress "RETURN" and "QUOTES" keys fully, hold and check inputs of MLB3 associated with depressed keyswitches.	<p>If inputs to sense amplifier do not indicate the desired keyswitch depressions, replace defective keyswitch(es).</p> <p>If inputs to sense amplifier do indicate the desired keyswitch depressions, replace MLB3 or MLA6.</p>

CHART 10

CONTROL ROW INDICATOR FAILS TO LIGHT

STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE											
<p>1 Place keyboard in local loopback test mode per table below and check to see that test indicator lights and remains on.</p> <p style="text-align: center;">LOCAL LOOPBACK TEST TABLE</p> <table border="1"> <thead> <tr> <th>OPCON TEST</th> <th>RDF-RDH</th> <th>RDG</th> <th>RDE</th> </tr> </thead> <tbody> <tr> <td>IN</td> <td>RETURN AND "</td> <td>ERASE INPUT AND "</td> <td>LINE FEED AND "</td> </tr> <tr> <td>INDICATOR</td> <td>TST</td> <td>TST</td> <td>TST</td> </tr> </tbody> </table>	OPCON TEST	RDF-RDH	RDG	RDE	IN	RETURN AND "	ERASE INPUT AND "	LINE FEED AND "	INDICATOR	TST	TST	TST	<p>If "TST" lamp fails to light, go to Chart 8.</p>  <p>If "TST" lamp lights, go to Step 2.</p>
OPCON TEST	RDF-RDH	RDG	RDE										
IN	RETURN AND "	ERASE INPUT AND "	LINE FEED AND "										
INDICATOR	TST	TST	TST										
<p>2 Perform "Loopback" test. Refer to Section C, Part 4. Testing for Functional Tests -- 40K108 Opcons.</p>	<p>If failing lamp fails to light in test mode, go to Step 3.</p> <p>If failing lamp lights in test mode, check for defective keyswitch with failing lamp (refer to Chart 8, Steps 1 and 2).</p>												

D. TROUBLESHOOTING (Contd)

3. TROUBLESHOOTING CHARTS (Contd)

CHART 10 (Contd)

CONTROL ROW INDICATOR FAILS TO LIGHT

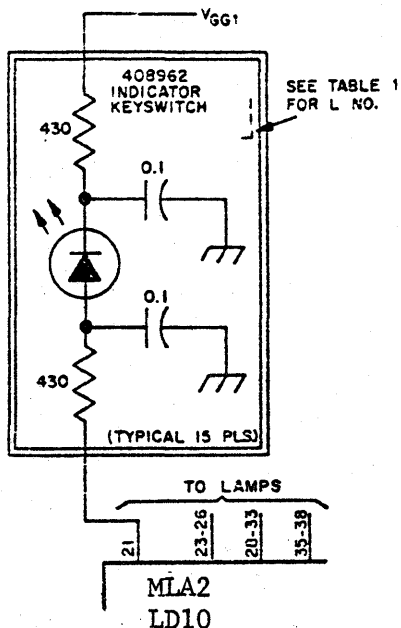
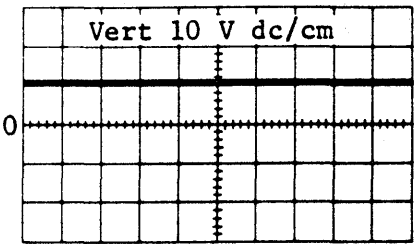
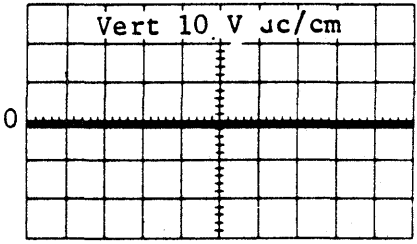
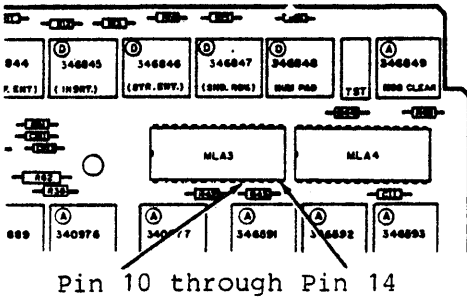
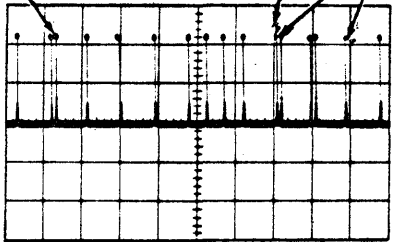
STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE																																				
3	<p>Check to see that associated lamp driver output voltage is correct at pin numbers per table below when the associated indicators should be on.</p> <p style="text-align: center;"><b>LAMP DRIVER TABLE</b></p> <table border="1"> <thead> <tr> <th>LAMP NO.</th> <th>PIN NO. ON LD10 CHIP</th> <th>LAMP NO.</th> <th>PIN NO. ON LD10 CHIP</th> </tr> </thead> <tbody> <tr><td>L0</td><td>33</td><td>L8</td><td>29</td></tr> <tr><td>L1</td><td>35</td><td>L9</td><td>28</td></tr> <tr><td>L2</td><td>37</td><td>L10</td><td>24</td></tr> <tr><td>L3</td><td>38</td><td>L11</td><td>23</td></tr> <tr><td>L4</td><td>36</td><td>L12</td><td>21</td></tr> <tr><td>L5</td><td>32</td><td>L13</td><td>25</td></tr> <tr><td>L6</td><td>31</td><td>L14</td><td>26</td></tr> <tr><td>L7</td><td>30</td><td>NOT USED</td><td>22</td></tr> </tbody> </table> 	LAMP NO.	PIN NO. ON LD10 CHIP	LAMP NO.	PIN NO. ON LD10 CHIP	L0	33	L8	29	L1	35	L9	28	L2	37	L10	24	L3	38	L11	23	L4	36	L12	21	L5	32	L13	25	L6	31	L14	26	L7	30	NOT USED	22	<p style="text-align: center;">Indicator "ON"</p>  <p style="text-align: center;">Indicator "OFF"</p>  <p>If voltage on the lamp driver output is correct when lamp should be on, check resistance of associated current limiting resistor and replace if necessary. If resistor checks OK, replace defective indicator keyswitch.</p> <p>If voltage on the lamp driver output remains at an off state when lamp should be on, replace defective MLA2.</p> <p>Note: V<sub>gg 1</sub> = 0 V dc. V<sub>ss</sub> = +12 V dc.</p>
LAMP NO.	PIN NO. ON LD10 CHIP	LAMP NO.	PIN NO. ON LD10 CHIP																																			
L0	33	L8	29																																			
L1	35	L9	28																																			
L2	37	L10	24																																			
L3	38	L11	23																																			
L4	36	L12	21																																			
L5	32	L13	25																																			
L6	31	L14	26																																			
L7	30	NOT USED	22																																			

CHART 11

NO REPEAT

- Place opcon in local mode.

STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
<p>1 Depress a repeatable key fully. Hold and check I/O signals on Pins 10 through 14 of MLA3 on 410096 card.</p>  <p>Pin 10 through Pin 14</p>	<p>If there are <u>no</u> other keyswitch depressions besides the desired repeat keyswitch depressions, replace MLA3.</p> <p>If there <u>are</u> other unwanted keyswitch depressions present in the I/O signal, go to Step 2.</p> <p>NORMAL DEPRESSION OF REPEAT (or Test) KEYSWITCH (1 Pulse)</p> <p>REPEAT (Or Test) KEYSWITCH DEPRESSED FULLY (2 Pulses)</p> <p>UNWANTED PULSE (Depression) — Go to Step 2</p>  <p>Vert 5 V dc/cm.</p> <p>I/O signal of one scan period from any sense amplifier with a repeatable key depressed fully.</p> <p>I/O signal of one scan period (4.57 ms) from any sense amplifier with no depressed keyswitches.*</p> <p>*The "CAPS LOCK" key when depressed will cause a depression pulse in I/O signal at Pin 12 of MLA3. This pulse has no effect on any repeatable key.</p>	

D. TROUBLESHOOTING (Contd)

3. TROUBLESHOOTING CHARTS (Contd)

CHART 11 (Contd)

NO REPEAT


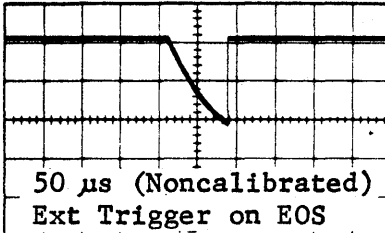
STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE																																										
<p>2</p> <p>Release depressed repeat keyswitch and check inputs of sense amplifier associated with unwanted keyswitch depression.</p> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">PIN NO.</p> <table style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 15px; text-align: center;">11</td><td style="width: 15px; text-align: center;">11</td><td rowspan="21" style="width: 100px; vertical-align: middle; text-align: center;">SENSE AMP</td></tr> <tr><td style="text-align: center;">10</td><td style="text-align: center;">12</td></tr> <tr><td style="text-align: center;">9</td><td style="text-align: center;">13</td></tr> <tr><td style="text-align: center;">8</td><td style="text-align: center;">14</td></tr> <tr><td style="text-align: center;">7</td><td style="text-align: center;">15</td></tr> <tr><td style="text-align: center;">6</td><td style="text-align: center;">16</td></tr> <tr><td style="text-align: center;">5</td><td style="text-align: center;">17</td></tr> <tr><td style="text-align: center;">3</td><td style="text-align: center;">18</td></tr> <tr><td style="text-align: center;">2</td><td style="text-align: center;">19</td></tr> <tr><td style="text-align: center;">28</td><td style="text-align: center;">110</td></tr> <tr><td style="text-align: center;">27</td><td style="text-align: center;">111</td></tr> <tr><td style="text-align: center;">26</td><td style="text-align: center;">112</td></tr> <tr><td style="text-align: center;">24</td><td style="text-align: center;">113</td></tr> <tr><td style="text-align: center;">23</td><td style="text-align: center;">114</td></tr> <tr><td style="text-align: center;">20</td><td style="text-align: center;">118</td></tr> <tr><td style="text-align: center;">19</td><td style="text-align: center;">116</td></tr> <tr><td style="text-align: center;">17</td><td style="text-align: center;">117</td></tr> <tr><td style="text-align: center;">16</td><td style="text-align: center;">118</td></tr> <tr><td style="text-align: center;">15</td><td style="text-align: center;">119</td></tr> <tr><td style="text-align: center;">14</td><td style="text-align: center;">120</td></tr> <tr><td style="text-align: center;">13</td><td style="text-align: center;">121</td></tr> </table> <p style="text-align: right; margin-top: 10px;">I/O 28</p> </div> <div style="margin-top: 10px;"> <p>V<sub>SS</sub></p>  <p>(TYPICAL) KEYSWITCH (SEE SENSE AMP TABLE NEXT PAGE)</p> </div>	11	11	SENSE AMP	10	12	9	13	8	14	7	15	6	16	5	17	3	18	2	19	28	110	27	111	26	112	24	113	23	114	20	118	19	116	17	117	16	118	15	119	14	120	13	121	<p>If inputs to sense amplifier, <u>do not</u> indicate a keyswitch depression, replace sense amplifier associated with false depression.</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p>Vert 5 V dc/cm</p>  <p>0</p> <p>50 μs (Noncalibrated) Ext Trigger on EOS</p> </div> <p>Signal of Sense Amplifier Input Having a Keyswitch Depression</p> <p>If input to sense amplifier <u>does</u> indicate a keyswitch depression:</p> <ol style="list-style-type: none"> <li>a. Check for open connection to keyswitch associated with sense amplifier input having depression indicated.</li> <li>b. Check for cold solder connections at terminals of keyswitch.</li> <li>c. If above results show no difficulties, replace defective keyswitch.</li> </ol>
11	11	SENSE AMP																																										
10	12																																											
9	13																																											
8	14																																											
7	15																																											
6	16																																											
5	17																																											
3	18																																											
2	19																																											
28	110																																											
27	111																																											
26	112																																											
24	113																																											
23	114																																											
20	118																																											
19	116																																											
17	117																																											
16	118																																											
15	119																																											
14	120																																											
13	121																																											

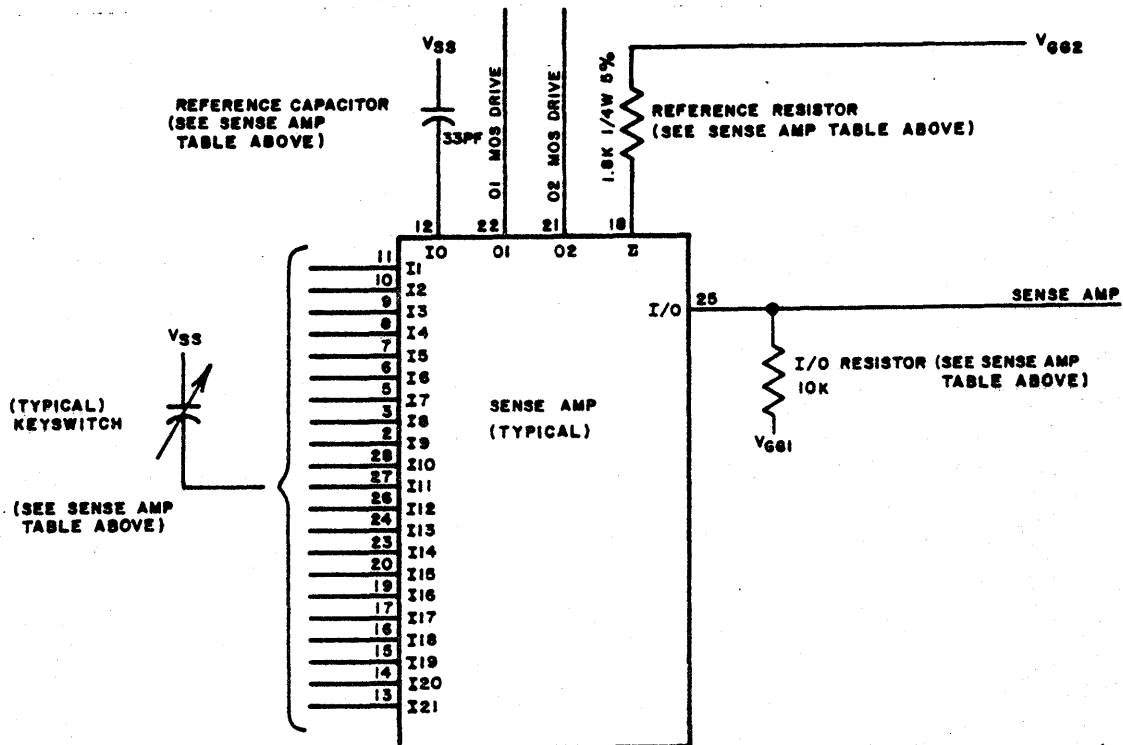


CHART 11 (Contd)

NO REPEAT

SENSE AMP TABLE

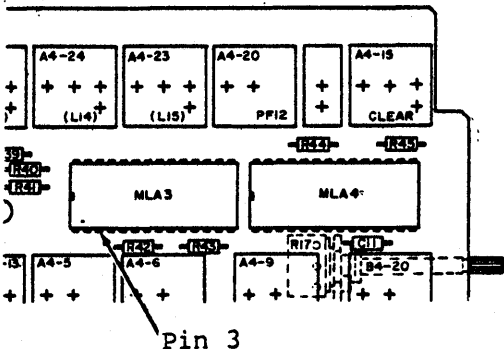
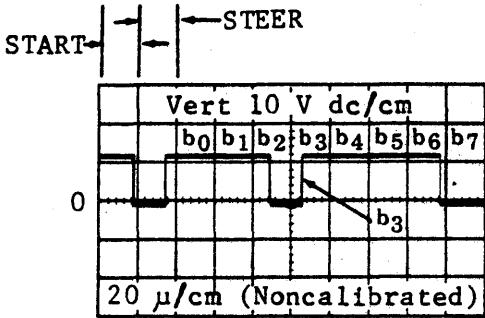
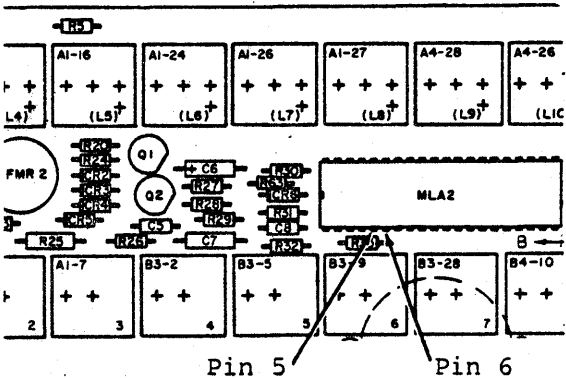
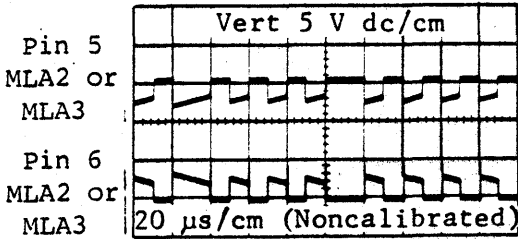
SENSE AMP PIN NO	SENSE AMP 1 (MLA4)	SENSE AMP 2 (MLB4)	SENSE AMP 3 (MLB2)	SENSE AMP 4 (MLA1)	SENSE AMP 5 (MLB3)
KEYTOP CHARACTER					
11	<	XTRA (Vss)	E	I	Y
10	\	B	B	→	N
9	/	I	F	↑	G
8	P (TEST)	L	Z	←	T
7	P	U	V	3	N
6	TAB	/	W	(L3)	G
5	+	K	Q	(L2)	S
3	-	.	D	CURSOR RET.	R
2	0 (ZERO)	.	C	HOME	4
28	(L9)	0	Z	(L0)	7
27	=	;	A	(L8)	M
26	(L10)	9	S	(L7)	J
24	(L14)	/	X	(L6)	SPACE
23	TAB SET	RETURN	SHIFT (LEFT)	(L1)	CONTROL (LEFT)
20	TAB CLEAR	LINE INSERT	CAPS LOCK	SCROL DOWN	SHIFT (RIGHT)
19	(L13)	LINE DELETE	CURSR. TAB	SCROL UP	NEW LINE
17	(L12)	CHAR. INSRT.	SEGMT. ADV.	(L4)	" (TEST)
16	(L11)	CHAR. DELETE	↓	(L5)	CONTROL (RIGHT)
15	CLEAR	CHAR. DELETE - RPT	→ REPEAT	SCROL UP - RPT	> . - REPEAT
14	CHAR. INSRT - RPT	OPTION - RPT (Vss)	← REPEAT	SCROL DOWN - RPT	SPACE - RPT
13	≡ RPT	NEW LINE - RPT (Vss)	↑ REPEAT	↓ REPEAT	RETURN (TEST)
REFERENCE RESISTOR					
18	R45	R57	R55	R19	R56
I/O RESISTOR					
25	R44	R42	R49	R18	R43
KEYSWITCH LOGIC (MLA3) INPUT PIN NO.					
	10	11	12	13	14
REFERENCE CAPACITOR					
12	C11	C15	C13	C1	C14



NOTES

CHART 12

INCORRECT CHARACTERS FROM THE KEYBOARD

STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
<p>1</p> <p>Check that Serial Send Data signal on Pin 3 of MLA3 is correct.</p>  <p>Pin 3</p> <p>Trigger oscilloscope internally to view this signal. See Note 1 and 2 below.</p>	<p><b>NOTE:</b> This signal consists of an 18 bit character having a start bit, a steer bit and 16 data bits (only ASCII <math>b_0</math> through <math>b_7</math> are shown in waveform).</p> <p>← Key Depressed Fully and Held</p>  <p>If Serial Send Data signal is incorrect, replace defective MLA3.</p> <p>If Serial Send Data signal is correct, go to Step 2.</p>	
<p><b>NOTE 1:</b> Depress a repeatable key fully and hold to view signals required in chart (ie, cursor ←).</p> <p><b>NOTE 2:</b> Refer to Functional Schematics.</p>		
<p>2</p> <p>Check that SSI data signal (ITC) on Pins 5 or 6 of MLA2 is correct.</p>  <p>Pin 5</p> <p>Pin 6</p> <p>External trigger on Pin 3 of MLA3.</p>	<p>← Key Depressed Fully and Held</p>  <p>If signal is not correct, replace MLA2.</p> <p>If signal is correct, go to Step 3.</p>	

D. TROUBLESHOOTING (Contd)

3. TROUBLESHOOTING CHARTS (Contd)

CHART 12 (Contd)

INCORRECT CHARACTERS FROM THE KEYBOARD

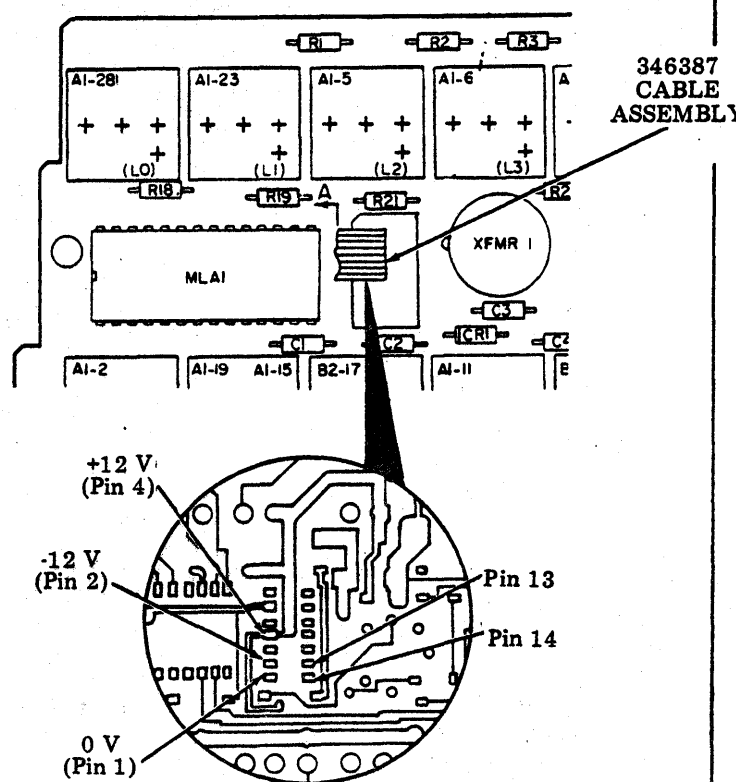
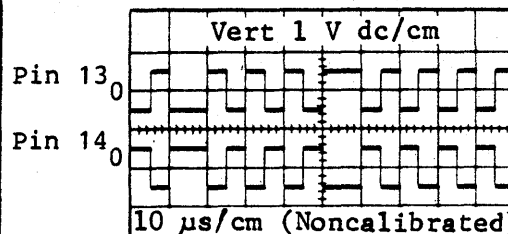
STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
3	<p>Check that SSI data signal is correct at Pin 13 and Pin 14 of the dip connector on 346387 cable assembly.</p>  <p style="text-align: center;">Bottom View of Dip Connector</p>	<p>← Key Depressed Fully and Held</p>  <p>If signal is not present, check for open output winding on XFMR1 transformer or poor solder connections, etc.</p> <p>If signal is present, opcon is good, check associated controller logic.</p>

CHART 13

NO DATA OUTPUT FROM THE KEYBOARD

STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE																
1	Place keyboard in local loopback test mode (see table below) and check to see that "TST" indicator lights and remains on. (See Note below.)	If "TST" indicator fails to light in local loopback mode, go to Chart 9.																
<p>LOCAL LOOPBACK TEST MODE TABLE</p> <table border="1"> <thead> <tr> <th>OPCON STATE \</th> <th>RDF RDH</th> <th>RDG</th> <th>RDE</th> </tr> </thead> <tbody> <tr> <td>IN</td> <td>RETURN AND "</td> <td>ERASE INPUT AND "</td> <td>LINE FEED AND "</td> </tr> <tr> <td>OUT</td> <td>RETURN AND P</td> <td>ERASE INPUT AND P</td> <td>LINE FEED AND P</td> </tr> <tr> <td>TEST INDICATOR</td> <td>TST</td> <td>TST</td> <td>TST</td> </tr> </tbody> </table>		OPCON STATE \	RDF RDH	RDG	RDE	IN	RETURN AND "	ERASE INPUT AND "	LINE FEED AND "	OUT	RETURN AND P	ERASE INPUT AND P	LINE FEED AND P	TEST INDICATOR	TST	TST	TST	<p>If "TST" indicator lights, place opcon out of local loopback test mode to extinguish "TST" indicator and go to Step 8. (See Table).</p>
OPCON STATE \	RDF RDH	RDG	RDE															
IN	RETURN AND "	ERASE INPUT AND "	LINE FEED AND "															
OUT	RETURN AND P	ERASE INPUT AND P	LINE FEED AND P															
TEST INDICATOR	TST	TST	TST															
<p>NOTE: If "TST" indicator is lighted after power is on, go to Step 2.</p>																		

2 Check to see that  $\emptyset 1L$  and  $\emptyset 2L$  clocks are present at MLA2, MLA3 and  $\emptyset 1$  and  $\emptyset 2$  clocks at all sense amplifiers (See D. 4. REFERENCE MATERIAL).

$\emptyset 1L$  Clock Signal

$\emptyset 2L$  Clock Signal

Pin 22 of any sense amp  $\emptyset 1$  Clock Signal

Pin 21 of any sense amp  $\emptyset 2$  Clock Signal

If  $\emptyset 1$  and  $\emptyset 2$  clocks are not present, go to Step 3.

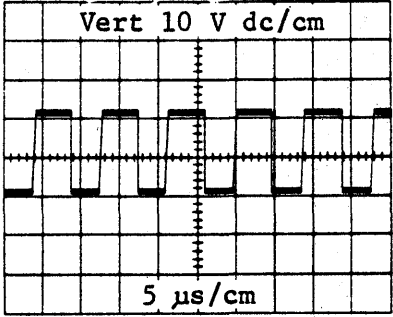
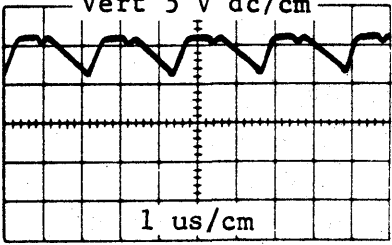
If  $\emptyset 1$  and  $\emptyset 2$  clocks are present, go to Step 8.

## D. TROUBLESHOOTING (Contd)

## 3. TROUBLESHOOTING CHARTS (Contd)

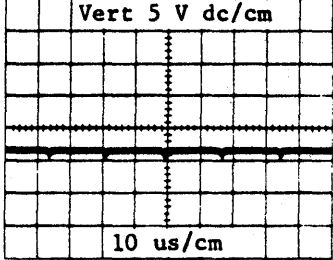
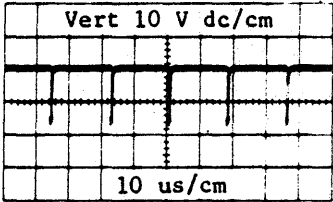
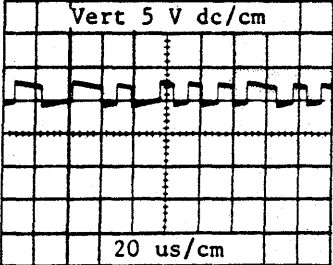
## CHART 13 (Contd)

NO DATA OUTPUT FROM THE KEYBOARD

STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
3	<p>Check to see that <math>\phi 1</math> and <math>\phi 2</math> clock predrives are present at Pins 18 and 19 respectively, of MLA2.</p>	<p>Pin 18 <math>\phi 1</math> PRE Clock Signal</p>  <p>Vert 10 V dc/cm</p> <p>5 <math>\mu</math>s/cm</p> <p>If <math>\phi 1</math> PRE and <math>\phi 2</math> PRE clocks are present, replace MLB1.</p> <p>If <math>\phi 1</math> PRE and <math>\phi 2</math> PRE are not present, go to Step 4.</p>
4	<p>Check signal at timing Pins 2 and 3 of MLA2.</p> <p>NOTE: The timing pins are very sensitive to stray capacitance. Many oscilloscope probes will cause improper operation of the phase-locked loop if they are attached to either Pin 2 or Pin 3 of MLA2.</p>	<p>Pin 2 or 3 of MLA2</p>  <p>Vert 5 V dc/cm</p> <p>1 <math>\mu</math>s/cm</p> <p>If signal is not present, go to Step 5.</p> <p>If signal is present, go to Step 7.</p>

## CHART 13 (Contd)

NO DATA OUTPUT FROM THE KEYBOARD

STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
5	Check for correct signal at emitter of Q2.	Emitter of Q2  <p>If signal is present, check the timing components R31, R32 and C8.</p> <p>If signal is not present, go to Step 6.</p>
6	Check for correct PU signal at Pin 8 of MLA2.	Pin 8 of MLA2  <p>If signal is present, check associated PU filter components (C6, C7, R27, R29, and Q2).</p> <p>If signal is not present, go to Step 7.</p>
7	Check to see that ITD signal is present at Pins 39 or 40 of MLA2.	Pin 39 or 40 of MLA2  <p>If signal is present, replace MLA2 or MLA3. If signal is not present, check for open output winding on XFMR2 transformer, check R22, SSI cable, etc.</p>

D. TROUBLESHOOTING (Contd)

3. TROUBLESHOOTING CHARTS (Contd)

CHART 13 (Contd)

NO DATA OUTPUT FROM THE KEYBOARD

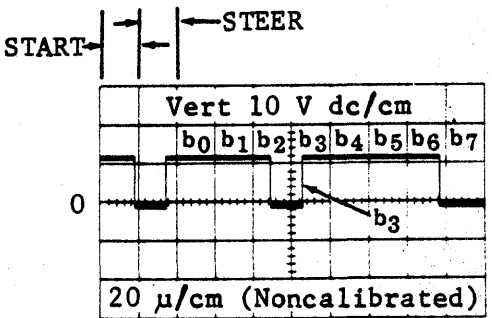
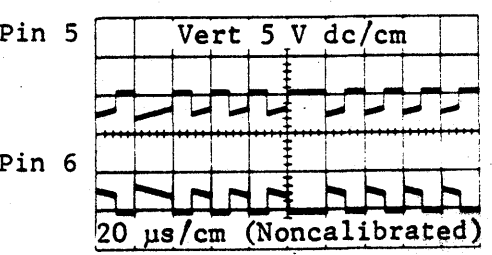
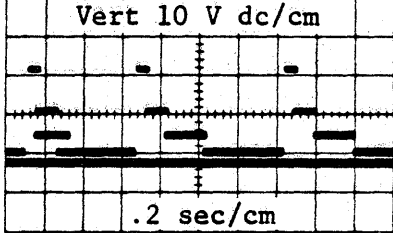
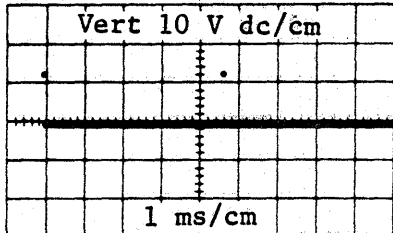
STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
8	<p>Check that <u>Serial Send Data</u> signal is present on Pin 3 of MLA3.</p>	<p>NOTE: This signal consists of an 18 bit character having a start bit, a steer bit and 16 data bits (only ASCII <math>b_0</math> thru <math>b_7</math> are shown in waveform).</p> <p>← Key Depressed Fully and Held</p>  <p>If <u>Serial Send Data</u> Signal is incorrect, replace defective MLA3.</p> <p>If <u>Serial Send Data</u> signal is correct, go to Step 2.</p>
9	<p>Check that ITC signal is present at Pin 5 and Pin 6 of MLA2.</p>	<p>← Key Depressed Fully and Held</p>  <p>If signal is not correct, replace MLA2.</p> <p>If signal is correct, go to Step 3.</p>



CHART 14

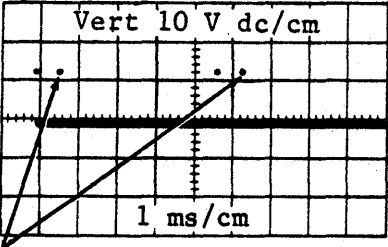
NO ALARM

STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
1	<p>With alarm volume turned up, enter the loopback test mode, then depress the "RETURN" or "ERASE INPUT" or "LINE FEED" key fully. (See Notes 1, 2 and 3.)</p> <p><u>NOTE 1:</u> Controller must have an alarm detect circuit.</p> <p><u>NOTE 2:</u> Generating a bell code at the opcon will not cause the alarm to sound locally.</p> <p><u>NOTE 3:</u> Refer to Functional Schematic.</p>	<p>The "TST" indicator lights and remains lighted and the alarm sounds as long as the "RETURN", "ERASE INPUT" or "LINE FEED" key is fully depressed.</p> <p>If alarm sounds, alarm circuit is working. Go to Step 3.</p> <p>If alarm does not sound, go to Step 2.</p>
2	<p>With keyboard in loopback test mode and the specified key in Step 1 is fully depressed, check alarm signal at Pin 21 of MLA3.</p>	<p>Pin 21 of MLA3</p>  <p>If signal is present and alarm does not sound, check R17 and 346370 crystal assembly.</p> <p>If signal is not present, replace MLA3 or MLA5.</p>
3	<p>Clear the loopback test mode, then depress the space bar fully and hold. Check for alarm signal at Pin 14 of MLA2.</p>	<p>Pin 14 of MLA2</p> <p>Without Alarm Signal</p> 

D. TROUBLESHOOTING (Contd)3. TROUBLESHOOTING CHARTS (Contd)

## CHART 14 (Contd)

NO ALARM

STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
3 (Cont)		<p>Pin 14 of MLA2</p>  <p>With Alarm Signal</p> <p>ALARM SIGNAL</p> <p>If alarm signal is present and alarm does not sound, replace MLA3.</p> <p>If alarm signal is not present when alarm should sound, replace MLA2.</p>

## CHART 15

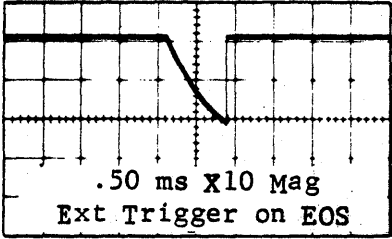
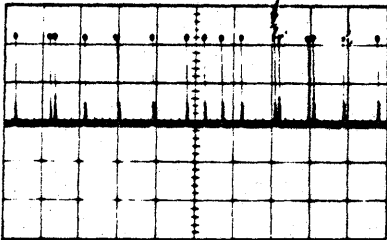
LOOPBACK TEST DOES NOT WORK

STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
1	Depress "RETURN" "LINE FEED" or "ERASE INPUT" and "QUOTES" keys fully and check to see that "TST" indicator lights and remains on.	<p>If "TST" indicator fails to light, go to Chart 9.</p> <p>If "TST" indicator lights, go to Step 2.</p>
2	Check to see that L-LPBK/HALT lead (Pin 22 of MLA3) is high (approximately +11 V dc) when "TST" is lighted.	<p>If L-LPBK/HALT lead remains at approximately 0 V dc, replace MLA3.</p> <p>If L-LPBK/HALT lead is at approximately +11 V dc, and loopback test does not work, replace MLA2.</p>

CHART 16

SINGLE KEY FAILURE

•Place opcon in local mode.

STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
1.	Depress key in question several times.	<p>Check fo proper tactile feel. If key feels sluggish or clicks are not heard, replace keyswitch.</p> <p>If key feels normal; go to Step 2.</p>
2.	Check input of sense amplifier associated with key in question, while depressing key.	<div style="text-align: center;"> <p>Vert 5 V dc/cm</p>  <p>0</p> <p>.50 ms X10 Mag</p> <p>Ext Trigger on EOS</p> </div> <p>Signal of Sense Amplifier Input Having a Keyswitch Depression</p> <p>If signal is not present, replace keyswitch.</p> <p>If signal is present, go to Step 3.</p>
3.	Check output of sense amplifier (pin 25) associated with key in question, while depressing key.	<div style="text-align: center;"> <p>NORMAL DEPRESSION OF KEYSWITCH (1 Pulse)</p> <p>Vert 5 V dc/cm</p>  </div> <p>I/O Signal of One Scan Period From Any Sense Amplifier With a Key Depressed</p> <p>If signal is not present, replace sense amplifier.</p> <p>If signal is present, go to Step 4.</p>

D. TROUBLESHOOTING (Contd)

3. TROUBLESHOOTING CHARTS (Contd)

CHART 16 (Contd)

SINGLE KEY FAILURE

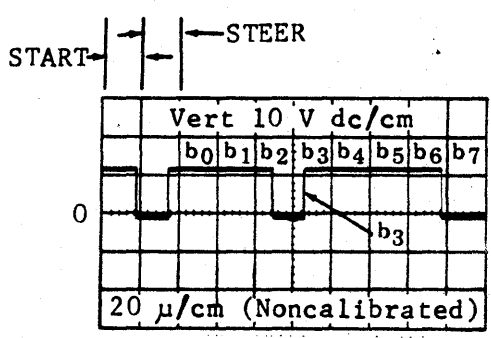
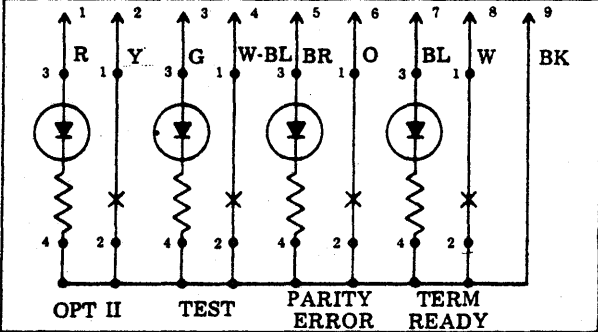
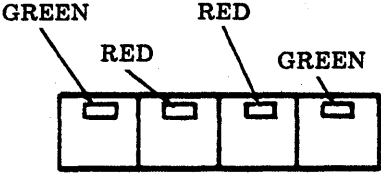

STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
4	Check <u>Serial Send Data (Pin 3)</u> of TKL for proper signal when key is depressed.	<p>This signal consists of an 18 bit character having a start bit, a steer bit and 16 character bits (only ASCII b<sub>0</sub> through b<sub>7</sub> are shown in waveform).</p> <p>← Key Depressed Fully and Held</p>  <p>Vert 10 V dc/cm</p> <p>0</p> <p>20 μ/cm (Noncalibrated)</p> <p>If <u>Serial Send Data</u> signal is incorrect, replace defective MLA3.</p>

CHART 17

RO OPCON TROUBLESHOOTING

STEP	ACTION	NORMAL INDICATION AND CORRECTIVE PROCEDURE
<p>1</p>	<p>Using the equipment arrangement detailed on Page 5-49, <u>RO Opcon</u>, hold GND probe on pin 9 of opcon connector. Apply +12 probe with 430 ohms resistor progressively to pins 1, 3, 5 and 7 of opcon connector. All blocking keytops should be temporarily removed.</p>  <p style="text-align: center;">RO Opcon Schematic</p>	 <p>The corresponding lamps should light in the color indicated.</p> <p>If all lamps fail to light, check for open ground lead. (Refer to schematic.)</p> <p>If one lamp fails to light, check wiring to failing lamp or replace keyswitch.</p> <p>If all lamps light as indicated, go to Step 2.</p>
<p>2</p>	<p>Using the multimeter as a continuity checker, hold the common probe on pin 9 of the opcon connector. Hold OHMS probe on pin 2 of the opcon connector and depress OPT II. Repeat with TEST, PARITY ERROR, and TERM READY, moving the OHMS probe to pins 4, 6 and 8, respectively.</p> 	<p>Each keyswitch, when operated, should register continuity on the multimeter.</p> <p>If a keyswitch fails the continuity check, check wiring to failing keyswitch, or replace open keyswitch.</p> <p>Replace any blocking keytops removed.</p>

D. TROUBLESHOOTING (Contd)

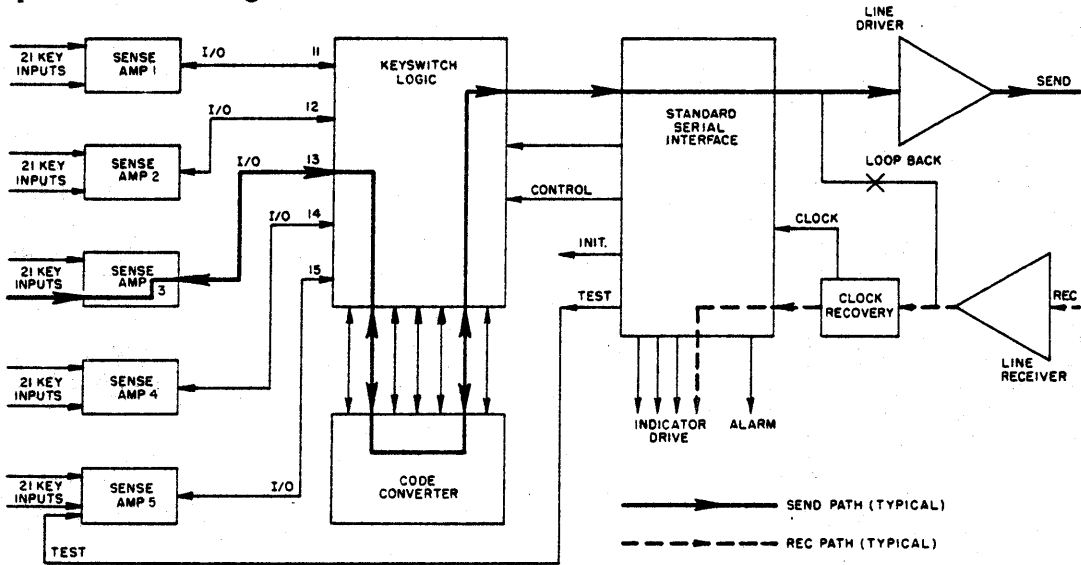
4. REFERENCE MATERIAL

The opcon diagrams, functional schematics and keyswitch assignment tables are provided as aids in locating and clearing troubles encountered while testing and troubleshooting.

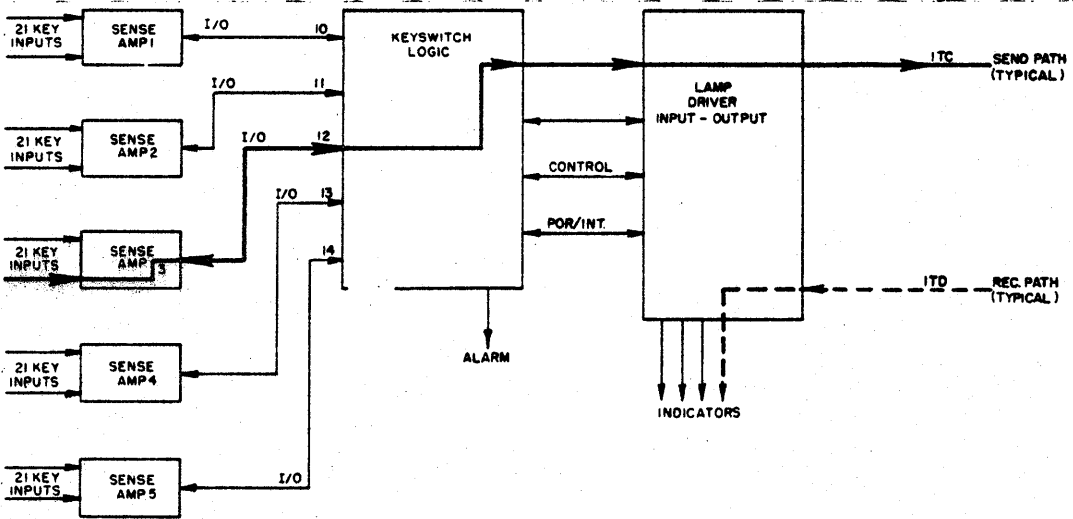
- A. OPCON DIAGRAMS. . . . . 5-92
- B. FUNCTIONAL SCHEMATICS . . . . . 5-93

A. OPCON DIAGRAMS

40K103 Opcon Block Diagram



40K108 Opcon Block Diagram



**B. FUNCTIONAL SCHEMATICS**

The following functional schematics support the troubleshooting analysis contained in D. 3. TROUBLESHOOTING CHARTS (refer to Page 5-51).

- FS-1     Keyswitches and Sense Amplifiers (410059 Circuit Card)
- FS-2     Keyswitch and Interface Logic (410059 Circuit Card)
- FS-3     High Frequency Clock and Drivers (410059 Circuit Card)
- FS-4     Power Distribution (410059 Circuit Card)
- FS-5     Di-Phase Logic (410074 Circuit Card)
- FS-6     Serial Data Driver and Receiver (410074 Circuit Card)
- FS-7     Loopback Test (410074 Circuit Card)
- FS-8     Low Frequency Clock Drivers (410074 Circuit Card)
- FS-9     Flash Timer and Alarm (410074 Circuit Card)
- FS-10    Power Distribution (410074 Circuit Card)
- FS-11    Switching Regulator (410074 Circuit Card)
- FS-12    Keyswitches and Sense Amplifiers (410096 Circuit Card)
- FS-13    Keyswitch and Interface Logic (410096 Circuit Card)
- FS-14    Power Distribution (410096 Circuit Card)

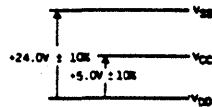
D. TROUBLESHOOTING (Contd)4. REFERENCE MATERIAL (Contd)Functional Schematics

The following functional schematics support the troubleshooting analysis beginning on Page 5-24, 3. TROUBLESHOOTING CHARTS.

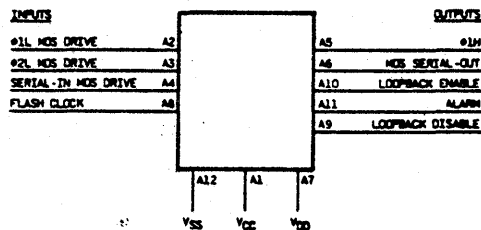
For detailed circuit descriptions and/or complete data interchange and clock and interface timing diagrams, refer to Wiring Diagram Package 0458WDP which may be ordered from Teletype Corporation.

Functional Schematic NotesCIRCUIT NOTES

1. SUPPLY VOLTAGES:  
THE FOLLOWING VOLTAGES ARE MEASURED IN RESPECT TO  $V_{DD}$ .



2. SIGNAL VOLTAGES:  
THE INPUT VOLTAGES FOR PIN NUMBERS A2, A3, A4, A8 AND THE OUTPUT VOLTAGES FOR PIN NUMBERS A6, A9, A10, A11, ALL SWING BETWEEN  $V_{SS}$  AND  $V_{DD}$ . THE OUTPUT VOLTAGE FOR PIN NUMBER A5 SWINGS BETWEEN  $V_{CC}$  AND  $V_{DD}$ .

INFORMATION NOTES

1. TERMINALS DESIGNATIONS ENCLOSED IN PARENTHESES ARE FOR REFERENCE AND ARE NOT MARKED ON COMPONENTS.
2. ALL RESISTANCE VALUES IN OHMS UNLESS OTHERWISE SPECIFIED.
3. ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SHOWN.

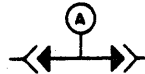
4. ALL CAPACITANCE IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
5. SYMBOLS:



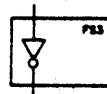
SIGNAL GROUND



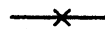
FRAME OR CHASSIS GROUND



LETTER OR TITLE IN CIRCLE INDICATES PRESENCE OF AN OPTION WHICH THE CUSTOMER CAN ARRANGE TO SUIT HIS CHOICE OR REQUIREMENT WITHIN THE POSSIBILITIES SHOWN.



CIRCUITRY WITHIN SINGLE SOLID LINE ENCLOSURE IS SHOWN FOR REFERENCE ONLY. IT IS SHOWN IN DETAIL ELSEWHERE IN THE SAME SD.



NORMALLY OPEN CONTACT



TEST POINT



SUMMATION

EQUIPMENT NOTES

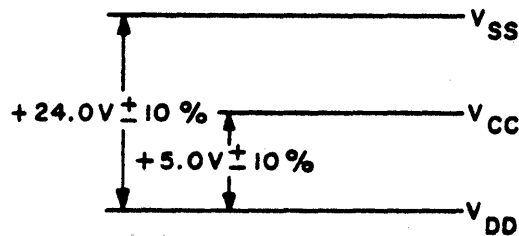
THE 410059 CIRCUIT CARD ASSEMBLY IS MANUFACTURED FOR CAPS LOCK MODE OF OPERATION.



Circuit Notes -- 40K108 Opcon

1. Supply Voltages:

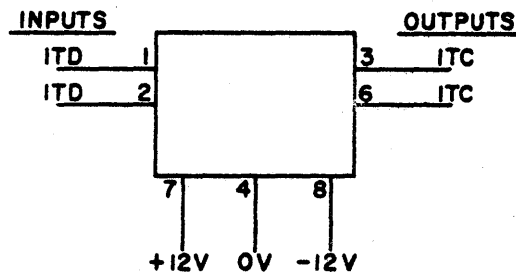
The following voltages are measured in respect to V<sub>GG1</sub> (0V).



2. Signal Voltages:

The input signal for pins 1 and 2 is a differential voltage of 1.4 V ±.8 V P-P.

The output signal for pins 3 and 6 is a differential voltage of 1.6 V ±.6 V P-P.



Information Notes -- All 40KXXX KD Opcons

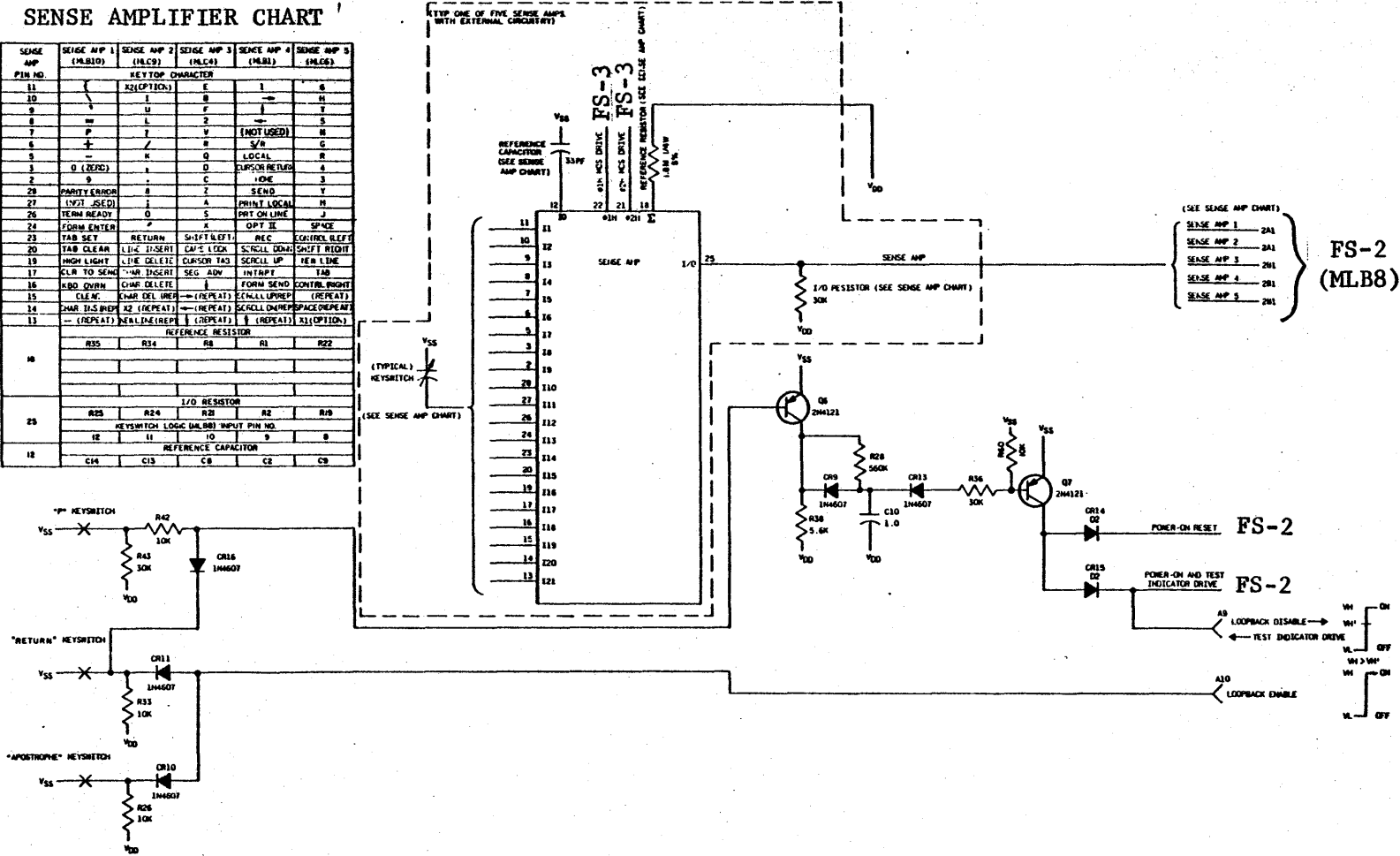
ABBREVIATIONS:

- |           |                           |         |                             |
|-----------|---------------------------|---------|-----------------------------|
| AE --     | ASSRESS ENABLE            | MOS --  | METAL-OXIDE SILICON CIRCUIT |
| CREF --   | REFERENCE CAPACITOR       |         | PACK                        |
| DE --     | DATA ENABLE               | MR --   | MASTER RESET                |
| DEP --    | DEPRESSION                | NUM --  | NUMERIC CLUSTER             |
| EOS --    | END OF SCAN               | OE --   | OUTPUT ENABLE               |
| I --      | INPUT                     | P-P --  | PEAK TO PEAK                |
| I/O --    | INPUT/OUTPUT              | PNC --  | PRESENT NEXT CHARACTER      |
| INIT --   | INITIALIZE                | POR --  | POWER ON RESET              |
| ITC --    | INFORMATION TO CONTROLLER | ROM --  | READ ONLY MEMORY            |
| ITD --    | INFORMATION TO DEVICE     | RREF -- | REFERENCE RESISTOR          |
| KL --     | KEYSWITCH LOGIC           | SCA --  | SEND CHARACTER AVAILABLE    |
| LDIO --   | LAMP DRIVER INPUT OUTPUT  | SI --   | SERIAL INTERFACE            |
| L.LPBK -- | LOCAL LOOPBACK            | ST --   | STRAP, WIRE                 |
|           |                           |         | -- SUMMATION                |
|           |                           | TKL --  | TELETYPE KEYSWITCH LOGIC    |

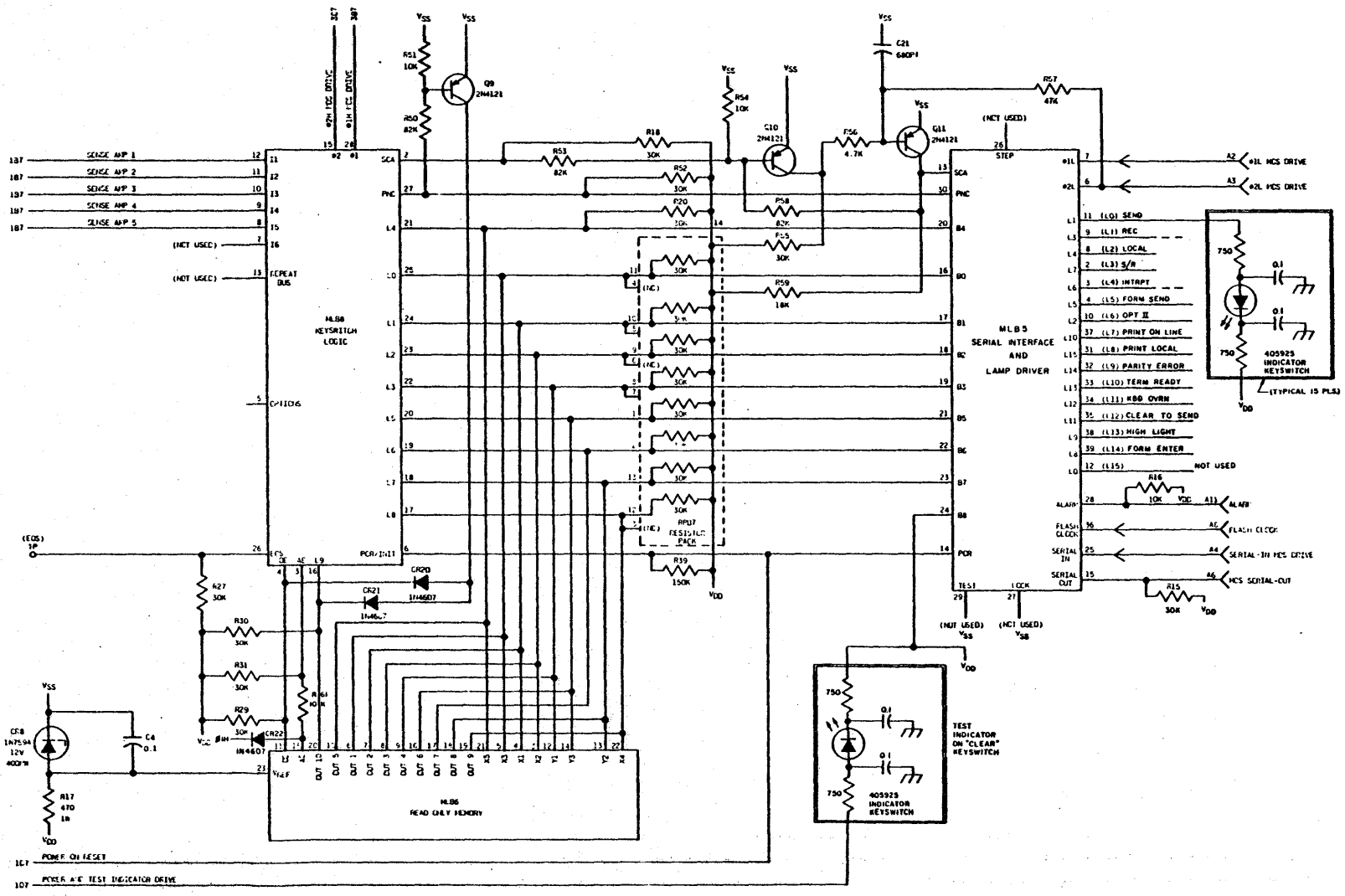
D. TROUBLESHOOTING (Contd)

4. REFERENCE MATERIAL, Functional Schematics (Contd)

Keyswitches and Sense Amplifiers (410059 Circuit Card) (FS-1)



Keyswitch and Serial Interface Logic (410059 Circuit Card) (FS-2)

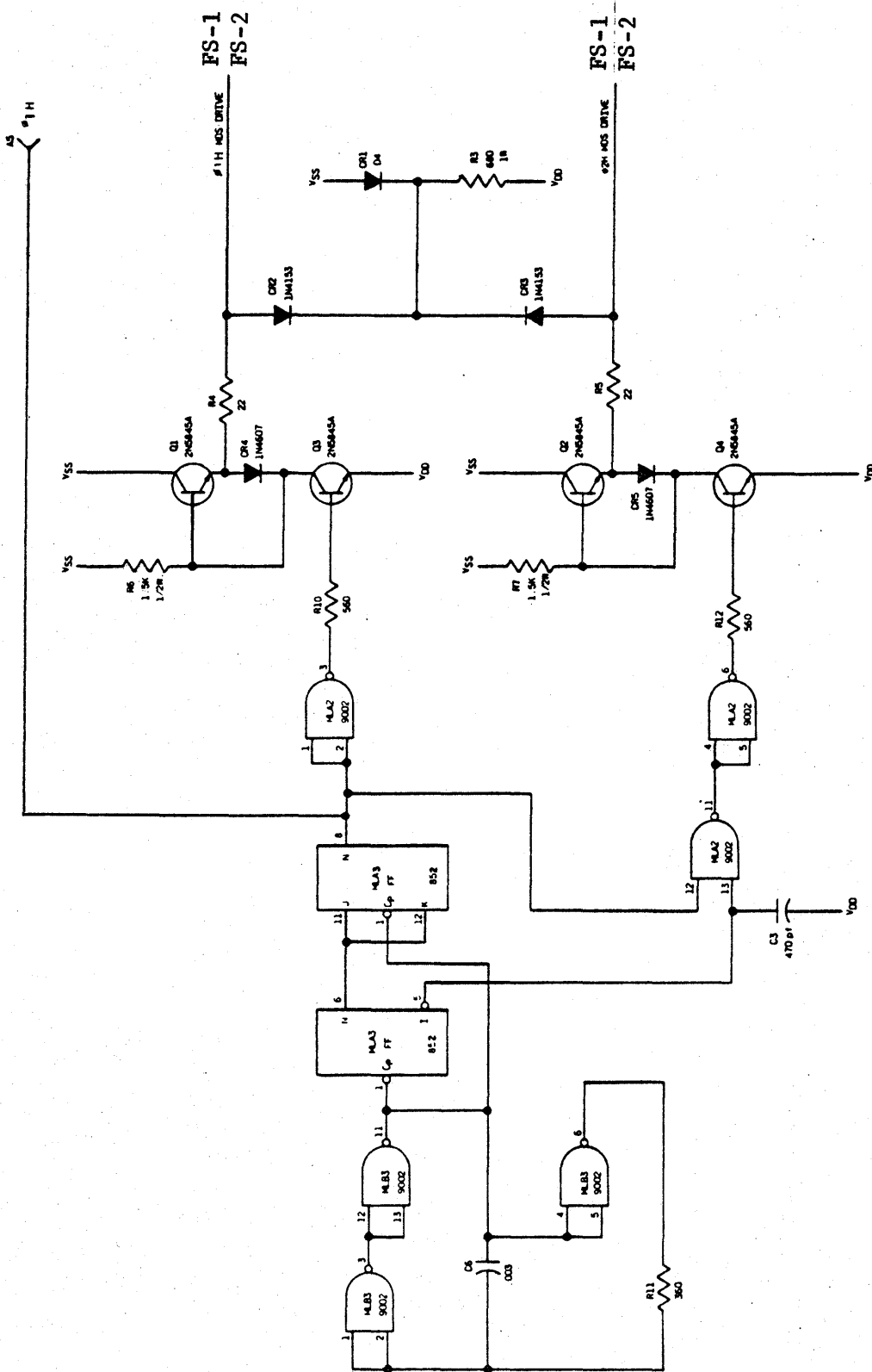


167 POWER ON RESET  
 107 POWER A-C TEST INDICATOR DRIVE

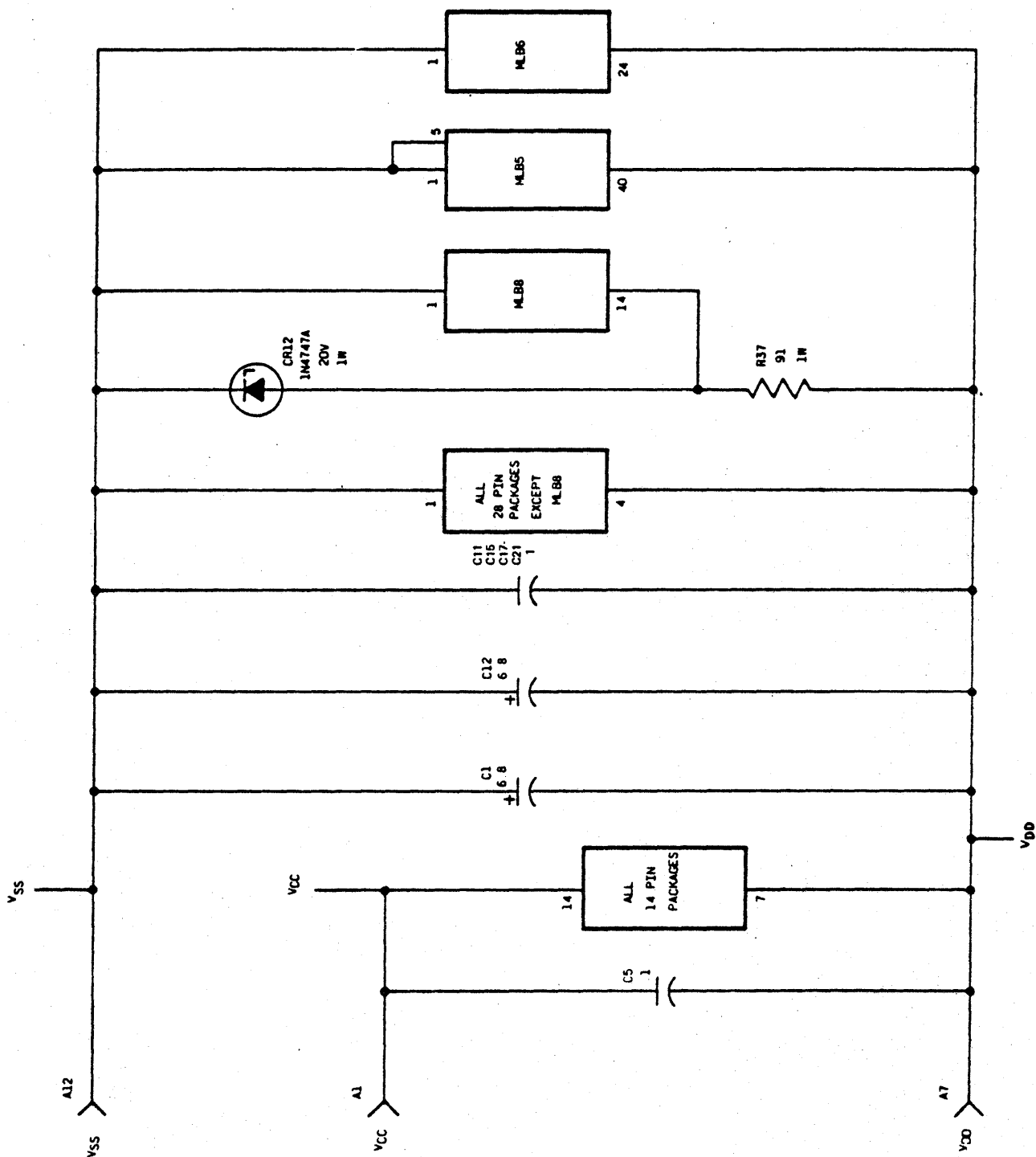
D. TROUBLESHOOTING (Contd)

4. REFERENCE MATERIAL, Functional Schematics (Contd)

High Frequency Clock and Drivers (410059 Circuit Card) (FS-3)



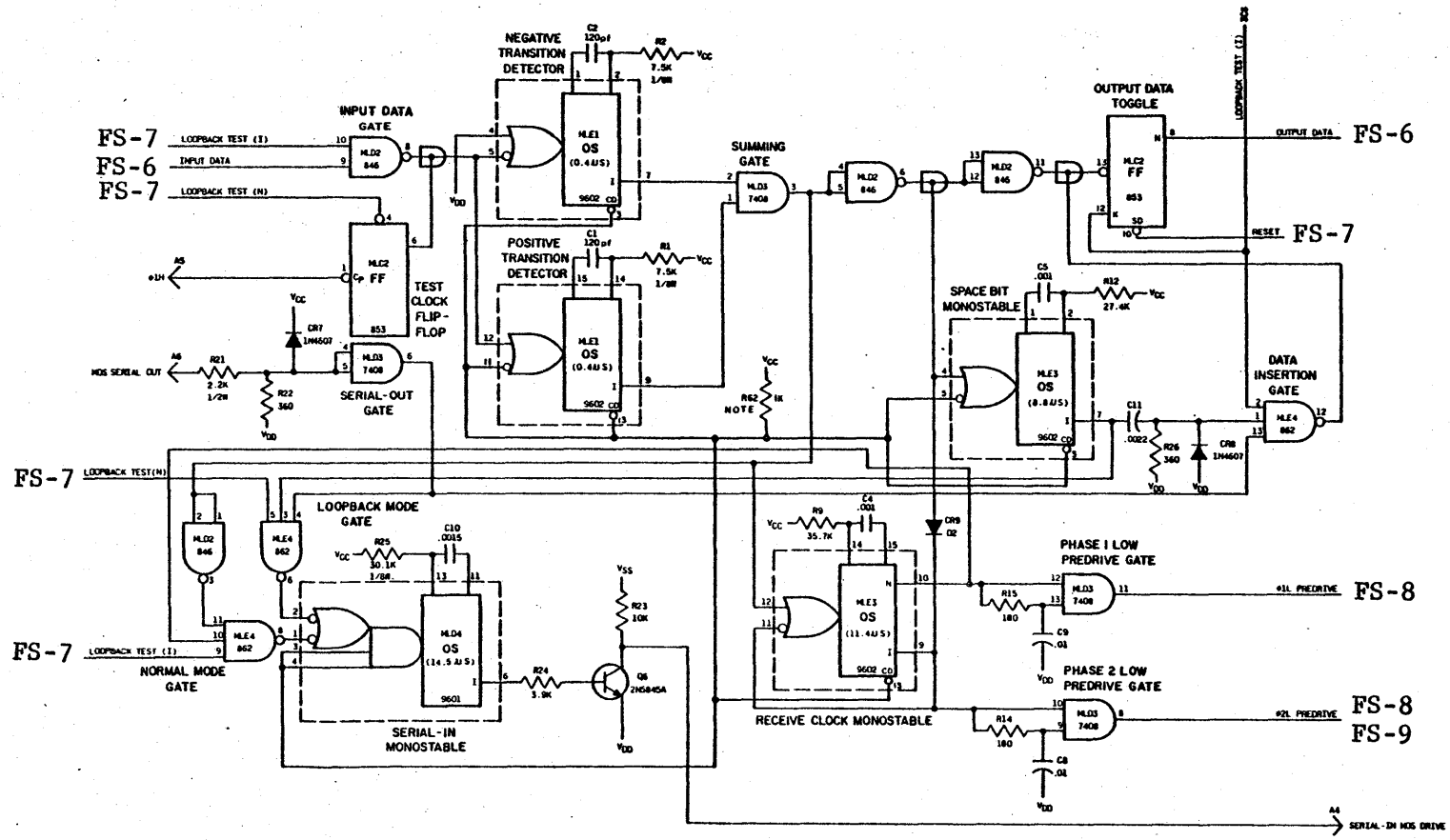
Power Distribution (410059 Circuit Card) (FS-4)



D. TROUBLESHOOTING (Contd)

4. REFERENCE MATERIAL, Functional Schematics (Contd)

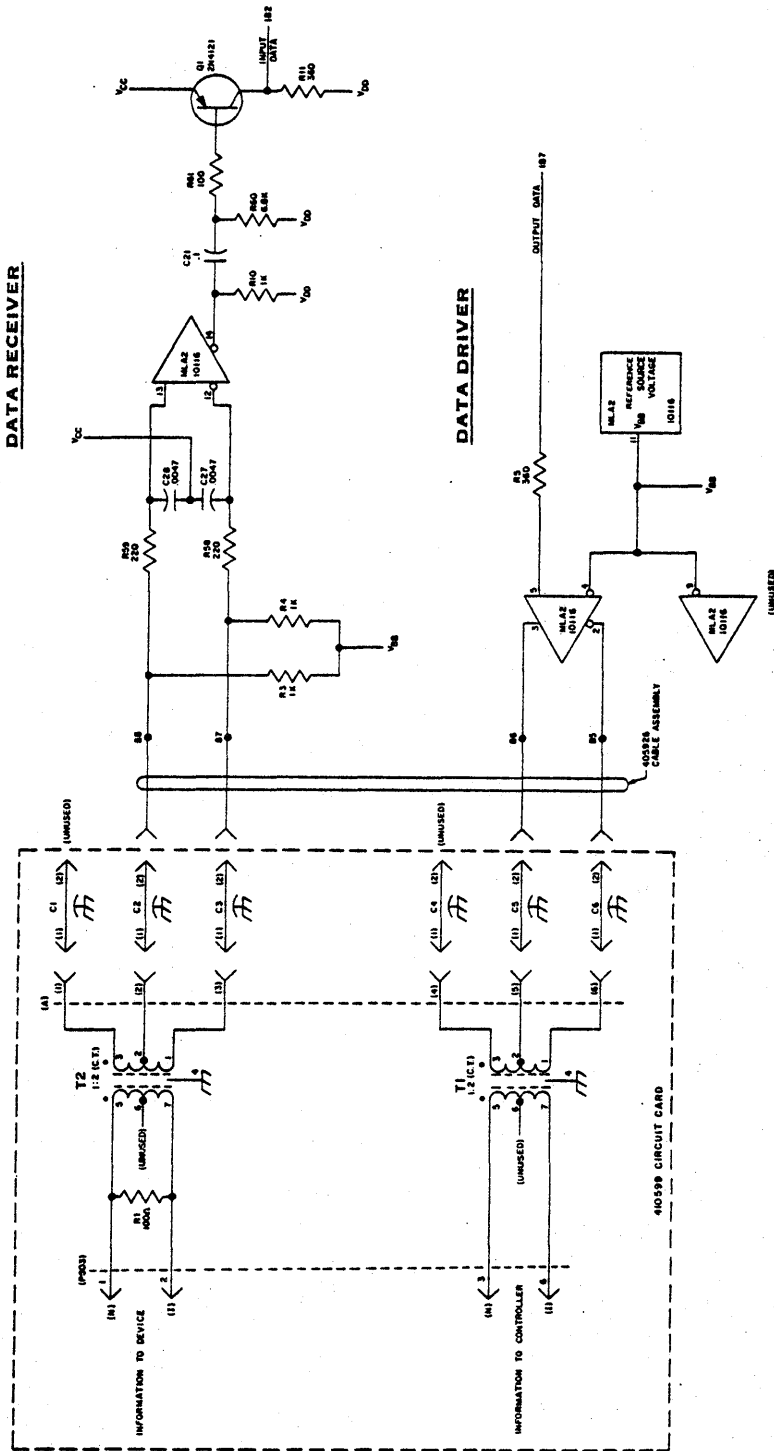
Di-Phase Logic (410074 Circuit Card) (FS-5)



NOTE: At customer identification issue 1B, R16 and associated connections added.

Serial Data Driver and Receiver (410074 Circuit Card) (FS-6)

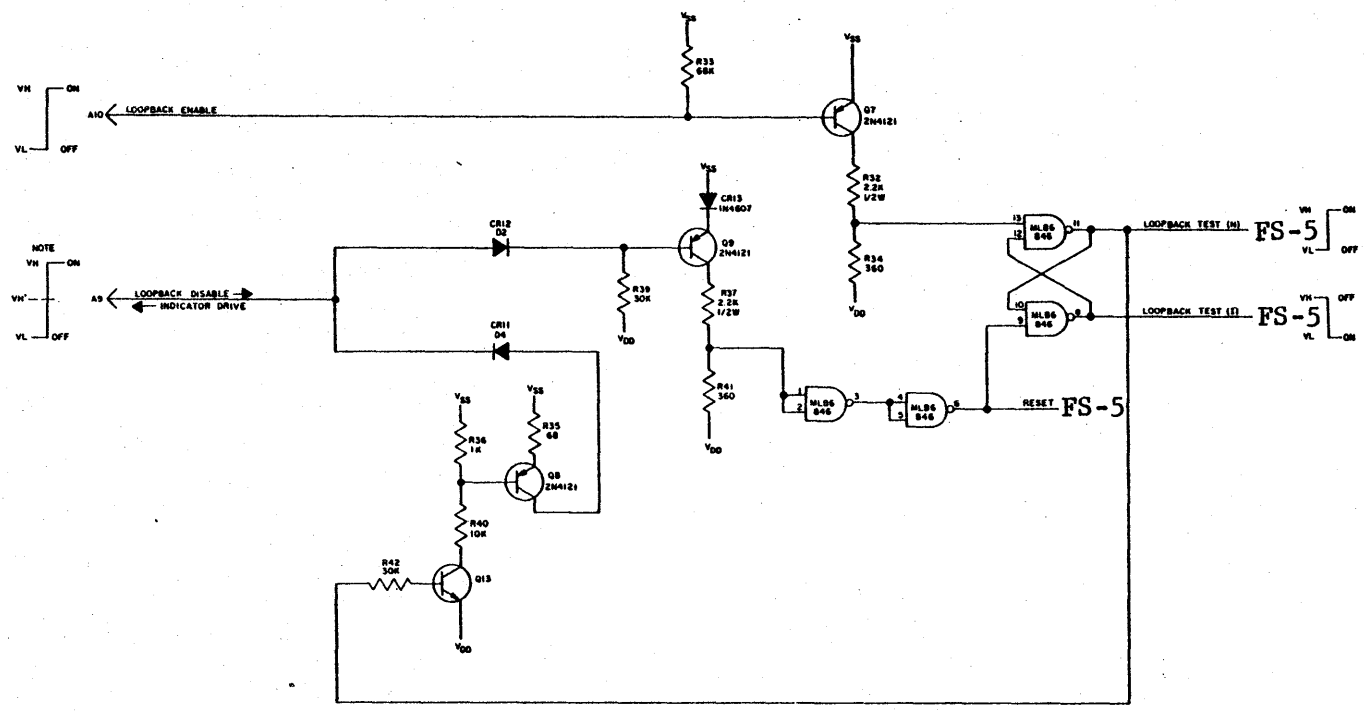
SERIAL DATA DRIVER AND RECEIVER



D. TROUBLESHOOTING (Contd)

4. REFERENCE MATERIAL, Functional Schematics (Contd)

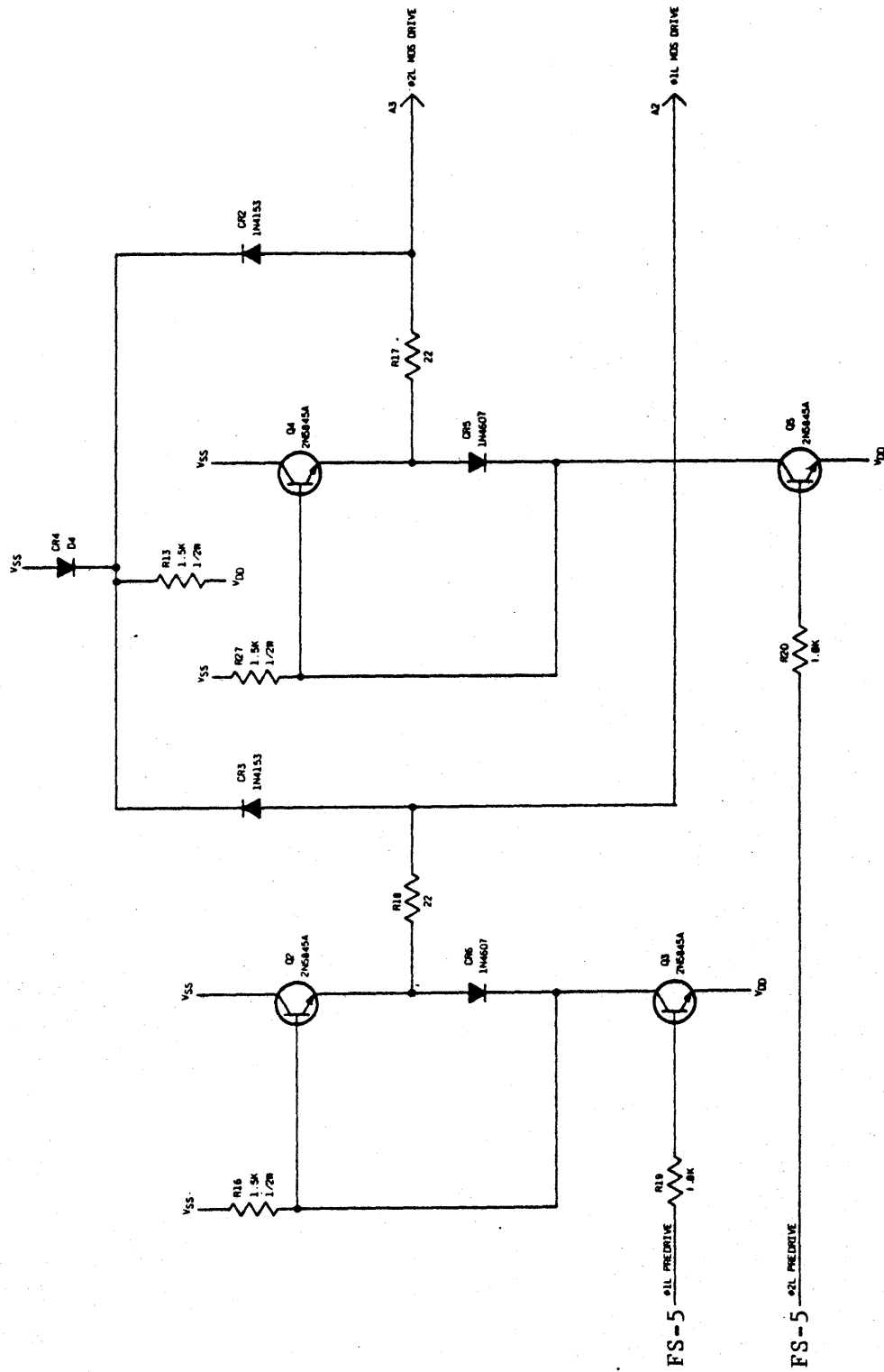
Loop-Back Test (410074 Circuit Card) (FS-7)



**NOTE:** This signal is both an input and an output with loop-back disable being active at VH and indicator drive being active at VH'.



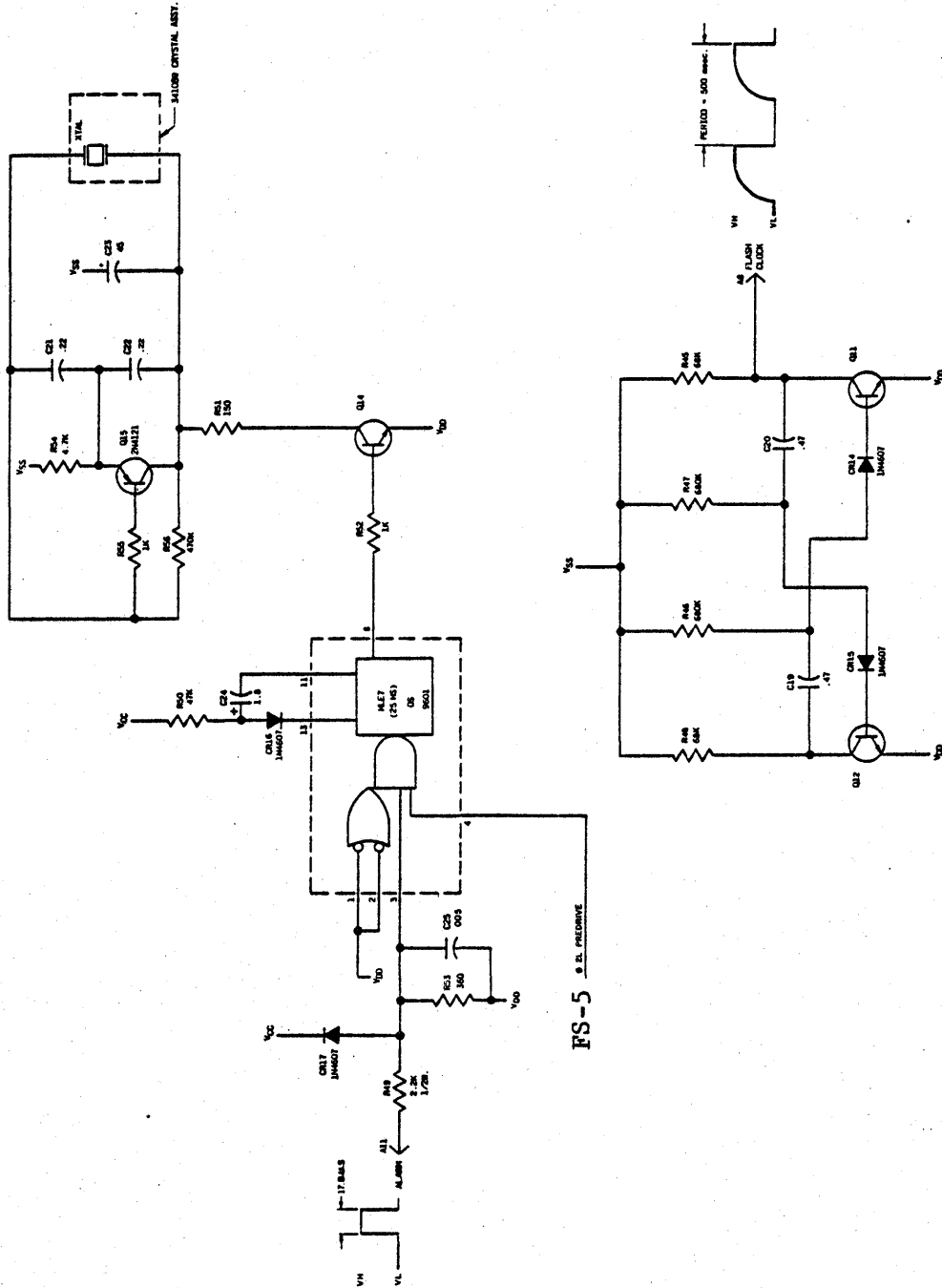
Low Frequency Clock Drivers (410074 Circuit Card) (FS-8)



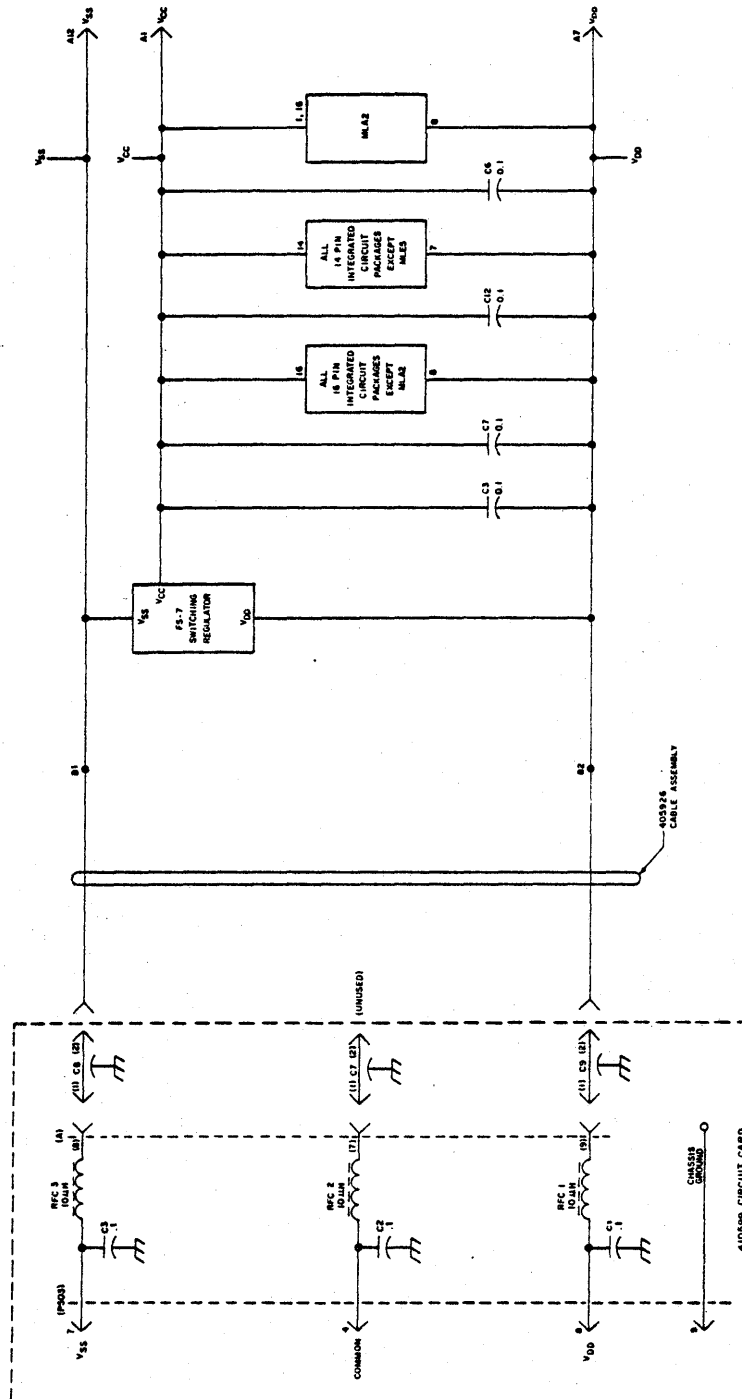
D. TROUBLESHOOTING (Contd)

4. REFERENCE MATERIAL, Functional Schematics (Contd)

Flash Timer and Alarm (410074 Circuit Card) (FS-9)



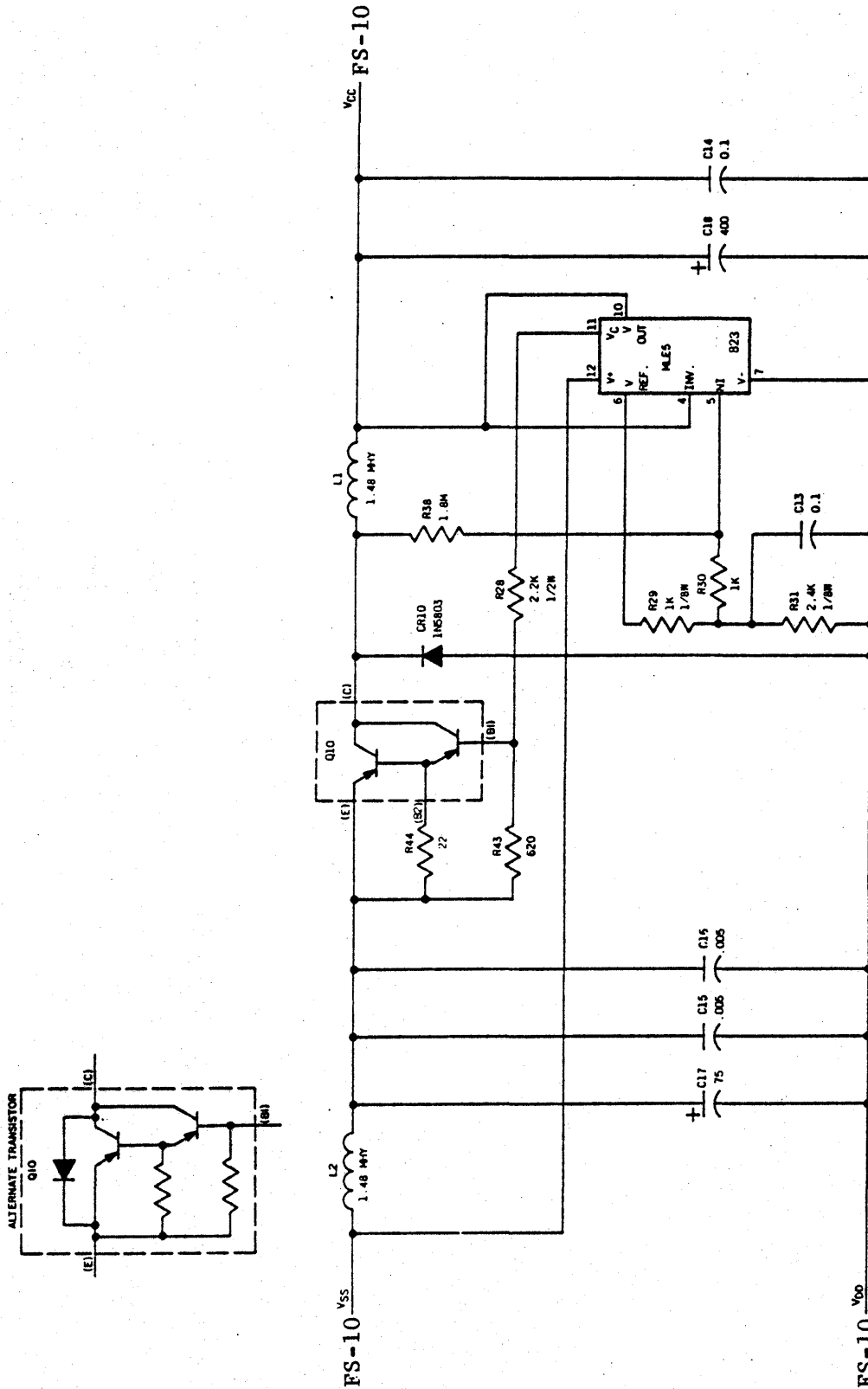
Power Distribution (410074 Circuit Card) (FS-10)



D. TROUBLESHOOTING (Contd)

4. REFERENCE MATERIAL, Functional Schematics (Contd)

Switching Regulator (410074 Circuit Card) (FS-11)



NOTE: Alternate configuration of Q10 transistor.

KD Opcon Keyswitch Assignments

Sense Amplifier Keyswitch Assignments

SENSE AMPLIFIER		SENSE AMPLIFIER TO KEYSWITCH LOGIC INPUT				
INPUT	PIN	SA1-I1 (MLB10)	SA2-I2 (MLC9)	SA3-I3 (MLC4)	SA4-I4 (MLB1)	SA5-I5 (MLC6)
I1	11	{	(X <sub>2</sub> )	E	1	6
I2	10	\	I	B	→	H
I3	9	,	U	F	↑	T
I4	8	=	L	2	←	5
I5	7	P	7	V	(TEST)	N
I6	6	+	/	W	S/R	G
I7	5	-	K	Q	LOCAL	R
I8	3	0 (ZERO)	,	D	CURSOR RETURN	4
I9	2	9	.	C	HOME	3
I10	28	PARITY ERR	8	Z	SEND	Y
I11	27	(NOT USED)	;	A	PRINT LOCAL	M
I12	26	TERM READY	0	S	PRINT ON LINE	J
I13	24	FORM ENTER	/	X	OPT II	SPACE
I14	23	TAB SET	RETURN	SHIFT L	RECEIVE	CONTROL L
I15	20	TAB CLEAR	LINE INSERT	CAPS LOCK	SCROL DOWN	SHIFT R
I16	19	HIGH LIGHT	LINE DELETE	CURSOR TAB	SCROL UP	NEW LINE
I17	17	CLR TO SEND	CHAR INSERT	SEG ADV	INTRPT	TAB
I18	16	KBD OVRN	CHAR DELETE	CURSOR DOWN	FORM SEND	CONTROL R
I19	15	CLEAR	REPEAT CHAR DELETE	REPEAT →	REPEAT SCROL UP	REPEAT •
I20	14	REPEAT CHAR INSERT	REPEAT (X <sub>2</sub> )	REPEAT ←	REPEAT SCROL DOWN	REPEAT SPACE
I21	13	REPEAT -	REPEAT NEW LINE	REPEAT ↓	REPEAT ↑	(X <sub>1</sub> )

SCANNING ORDER

NOTE 1: Unshift keytop symbols shown only.

NOTE 2: RCB arrangement shown.



SENSE AMP.			INPUTS							UNSHIFT OUTPUT									SHIFT OUTPUT									CONTROL OUTPUT																	
SENSE AMP NO.	PIN NO.	IN PUT NO.	TKL TROM TSSI	SWITCH ADDRESS							BIT 7 (Y <sub>2</sub> ) = 1, BIT 8 (X <sub>4</sub> ) = 1									BIT 7 (Y <sub>2</sub> ) = 0, BIT 8 (X <sub>4</sub> ) = 1									BIT 7 (Y <sub>2</sub> ) = 1, BIT 8 (X <sub>4</sub> ) = 0																
				0	1	2	3	4	5	7	8	0	1	2	3	4	5	6	7	8	9	CHAR.	0	1	2	3	4	5	6	7	8	9	CHAR.	0	1	2	3	4	5	6	7	8	9	CHAR.	
↑	2	9	SA 40	1	1	1	0	1	0	X	X	0	1	1	0	0	0	1	1	1	0	9	1	1	1	0	1	0	1	1	0	0	{	0	0	0	0	0	0	0	0	0	1	ETX	
	2	9	SA 41	0	1	1	0	1	0			1	0	0	0	1	0	1	1	1	0	.	1	0	0	0	0	1	1	0	0	0	>	0	0	0	0	0	0	0	0	0	1		
	2	9	SA 42	1	0	1	0	1	0			0	0	1	1	0	0	1	1	0	0	c	0	0	1	1	0	1	1	0	0	0	C	0	0	1	1	1	1	1	1	1	0		
	2	9	SA 43	0	0	1	0	1	0			1	1	1	0	1	0	0	1	0	0	HOME	0	0	0	0	0	0	0	0	0	1	HOME	0	0	0	0	0	0	0	0	0	0		
	2	9	SA 44	1	1	0	0	1	0			0	0	1	1	0	0	1	1	0	0	3	0	0	1	1	0	1	1	0	0	0	#	0	0	0	0	0	0	0	0	0	0		
	28	10	SA 45	0	1	0	0	1	0			1	0	1	0	1	0	0	1	0	0	PARITY ERROR	0	0	0	0	0	0	0	0	0	1	PARITY ERROR	0	0	0	0	0	0	0	0	0	0		
	28	10	SA 46	1	0	0	0	1	0			1	1	1	0	0	0	1	1	0	0	8	1	0	1	0	1	0	1	0	0	0	*	0	0	0	0	0	0	0	0	0	0		
	28	10	SA 47	0	0	0	0	1	0			1	0	1	0	0	0	1	1	0	0	z	1	0	1	0	1	0	1	0	0	0	Z	1	1	1	1	1	1	1	1	1	0		NUL
↑	28	10	SA 48	1	1	1	1	0	0			1	0	0	1	1	0	0	0	1	0	SEND	0	0	0	0	0	0	0	0	0	1	SEND	0	0	0	0	0	0	0	0	0	1	EM	
	28	10	SA 49	0	1	1	1	0	0			0	1	1	0	0	0	1	0	0	y	0	1	1	0	0	1	0	1	0	0	Y	0	1	1	0	0	1	1	0	0	0			
	27	11	SA 50	1	0	1	1	0	0			0	0	0	0	0	0	0	0	0	1	(NOT USED)	0	0	0	0	0	0	0	0	0	1	(NOT USED)	0	0	0	0	0	0	0	0	0	1		
	27	11	SA 51	0	0	1	1	0	0			0	0	1	0	0	0	1	1	0	0	:	1	0	1	0	0	0	1	1	0	0	:	0	0	0	0	0	0	0	0	0	1		
	27	11	SA 52	1	1	0	1	0	0			0	1	1	1	0	0	1	0	0	0	a	0	1	1	1	0	0	1	0	0	0	A	0	1	1	1	1	1	1	1	1	0		
	27	11	SA 53	0	1	0	1	0	0			0	1	1	1	0	0	0	0	0	0	PRINT LOCAL	0	0	0	0	0	0	0	0	0	1	PRINT LOCAL	0	0	0	0	0	0	0	0	0	1		
	27	11	SA 54	1	0	0	1	0	0			0	1	0	0	1	0	0	0	0	0	m	0	1	0	0	1	0	1	0	0	0	M	1	1	0	0	0	1	1	0	0	0		
	26	12	SA 55	0	0	0	1	0	0			0	0	1	0	0	0	0	0	0	0	TERM READY	0	0	0	0	0	0	0	0	0	1	TERM READY	0	0	0	0	0	0	0	0	0	1		
↑	26	12	SA 56	1	1	1	0	0	0			0	0	0	0	1	0	0	1	0	0	o (ALPHA)	0	0	0	0	1	0	1	0	0	0	O (ALPHA)	0	0	0	0	1	1	1	1	1	0	SI	
	26	12	SA 57	0	1	1	0	0	0			0	0	1	0	0	0	1	0	0	0	s	0	0	1	0	1	0	1	0	0	0	S	0	0	1	0	1	1	1	1	1	0		DC3
	26	12	SA 58	1	0	1	0	0	0			0	0	1	1	0	0	0	1	0	0	PRINT ON LINE	0	0	0	0	0	0	0	0	0	1	PRINT ON LINE	0	0	0	0	0	0	0	0	0	1		
	26	12	SA 59	0	0	1	0	0	0			1	0	1	0	1	0	0	1	0	0	j	1	0	1	0	1	0	1	0	0	0	J	1	0	0	0	1	1	1	1	1	0		RS
	24	13	SA 60	1	1	0	0	0	0			0	0	0	1	0	0	0	0	0	0	FORM ENTER	0	0	0	0	0	0	0	0	0	1	FORM ENTER	0	0	0	0	0	0	0	0	0	1		
	24	13	SA 61	0	1	0	0	0	0			0	0	0	1	0	1	1	1	0	0	p	1	0	1	1	0	1	1	1	0	0	"	0	0	0	0	0	0	0	0	0	1		
	24	13	SA 62	1	0	0	0	0	0			1	1	1	0	0	0	1	1	0	0	x	1	1	1	0	0	1	0	1	0	0	X	1	1	1	0	0	1	1	1	1	0		CAN
	24	13	SA 63	0	0	0	0	0	0			0	1	1	0	1	0	0	0	1	0	OPT II	0	0	0	0	0	0	0	0	0	1	OPT II	0	0	0	0	0	0	0	0	0	1		
↑	24	13	SA 64	1	1	1	1	1	0	0			1	1	1	1	0	1	1	0	0	SPACE																							
	23	14	SA 65	0	1	1	1	1	1	0			0	1	1	1	0	0	1	0	0	TAB SET																							
	23	14	SA 66	1	0	1	1	1	1	0			0	1	0	0	1	1	1	0	0	RETURN																							
	23	14	SA 67	0	0	1	1	1	1	0			0	0	0	0	0	0	0	0	0	1	SHIFT (L)																						
	23	14	SA 68	1	1	0	1	1	1	0			0	1	0	1	1	0	0	0	1	0	RECEIVE																						
	23	14	SA 69	0	1	0	1	1	1	0			0	0	0	0	0	0	0	0	0	0	1	CONTROL (L)																					
	20	15	SA 70	1	0	0	1	1	1	0			1	0	1	1	0	0	1	0	0	0	TAB CLEAR																						
	20	15	SA 71	0	0	0	1	1	1	0			1	1	0	0	1	0	0	0	0	0	LINE INSERT																						
↑	20	15	SA 72	1	1	1	0	1	1	0			0	0	0	0	0	0	0	0	0	1	CAPS LOCK																						
	20	15	SA 73	0	1	1	0	1	1	0			1	1	0	1	0	0	0	0	0	SCROL DOWN																							
	20	15	SA 74	1	0	1	0	1	1	0			0	0	0	0	0	0	0	0	0	1	SHIFT (R)																						
	19	16	SA 75	0	0	1	0	1	1	0			0	0	1	0	0	1	0	1	0	0	HIGH LIGHT																						
	19	16	SA 76	1	1	0	0	1	1	0			0	1	0	0	1	0	0	1	0	0	LINE DELETE																						
	19	16	SA 77	0	1	0	0	1	1	0			1	1	1	1	1	0	0	0	0	0	CURSOR TAB																						
	19	16	SA 78	1	0	0	0	1	1	0			0	0	1	0	1	0	0	1	0	0	SCROL UP																						
	19	16	SA 79	0	0	0	0	1	1	0			1	0	1	0	1	1	1	0	0	0	NEW LINE																						

NOTE: CODING: POS. LOGIC  
 1 = 0 V (SPACE)  
 0 = -24 V (MARK)

7th BIT = EXTENDED  
 8th BIT = HAS NO MEANING  
 9th BIT = NO CHAR.

D. TROUBLESHOOTING (Contd)

4. REFERENCE MATERIAL (Contd)

40K103 Keyswitch Codes -- Switch Address Coding (Contd)

SENSE AMP	INPUTS		UNSHIFT OUTPUT									
	TKL FROM TSSI	SWITCH ADDRESS	BIT 7 (V <sub>2</sub> ) = 0, BIT 8 (X <sub>4</sub> ) = 0									
	TKL FROM TSSI	0 1 2 3 4 5 7 8 X <sub>3</sub> X <sub>1</sub> X <sub>2</sub> V <sub>1</sub> X <sub>5</sub> V <sub>3</sub> V <sub>2</sub> X <sub>4</sub>	0	1	2	3	4	5	6	7	8	9
	SA 120	1 1 1 0 0 0 0 0 0	0	1	2	3	4	5	6	7	8	9
	SA 121	0 1 1 0 0 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 122	1 0 1 0 0 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 123	0 0 1 0 0 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 124	1 1 0 0 0 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 125	1 1 0 0 0 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 126	1 0 0 0 0 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 127	0 0 0 0 0 0 0 0 0	0	0	0	0	0	0	0	0	0	1

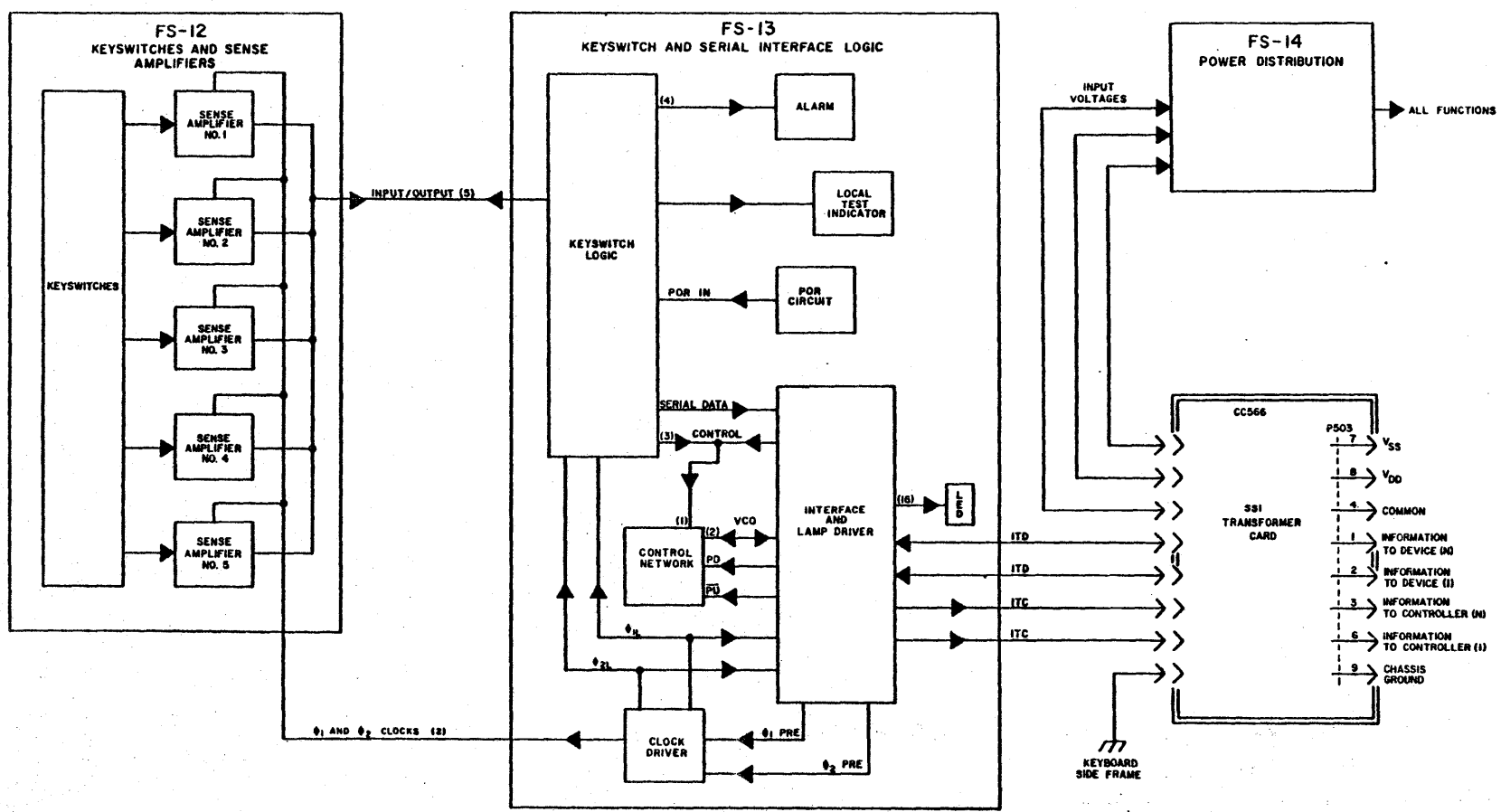
SENSE AMP	INPUTS		UNSHIFT OUTPUT									
	TKL FROM TSSI	SWITCH ADDRESS	BIT 7 (V <sub>2</sub> ) = 0, BIT 8 (X <sub>4</sub> ) = 0									
	TKL FROM TSSI	0 1 2 3 4 5 7 8 X <sub>3</sub> X <sub>1</sub> X <sub>2</sub> V <sub>1</sub> X <sub>5</sub> V <sub>3</sub> V <sub>2</sub> X <sub>4</sub>	0	1	2	3	4	5	6	7	8	9
	SA 80	1 1 1 0 1 0 0 0 0	0	1	0	0	1	0	0	0	0	0
	SA 81	0 1 1 0 1 0 0 0 0	1	0	0	0	1	0	0	0	0	0
	SA 82	1 0 1 0 1 0 0 0 0	0	1	0	1	0	0	0	0	1	0
	SA 83	0 0 1 0 1 0 0 0 0	0	0	0	1	1	0	0	0	0	0
	SA 84	1 1 0 1 1 1 1 1 0	0	1	1	1	1	1	1	1	0	0
	SA 85	0 1 0 1 0 1 0 0 0	1	1	0	1	0	0	0	0	1	0
	SA 86	1 1 1 0 1 0 0 0 0	1	1	1	0	1	0	0	0	1	0
	SA 87	0 0 0 1 0 1 0 0 0	1	0	1	1	1	0	0	0	1	0
	SA 88	1 1 1 0 1 0 0 0 0	1	1	1	0	1	0	0	0	0	0
	SA 89	0 1 1 0 1 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 90	1 0 1 0 1 0 0 0 0	1	0	1	0	1	0	0	0	0	0
	SA 91	0 0 1 0 1 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 92	1 1 0 0 1 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 93	1 1 0 0 1 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 94	1 0 0 0 1 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 95	0 0 0 0 1 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 96	1 1 1 1 0 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 97	0 1 1 1 0 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 98	1 0 1 1 0 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 99	0 0 1 1 0 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 100	1 1 0 1 0 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 101	0 1 0 1 0 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 102	1 0 0 1 0 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 103	0 0 0 1 0 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 104	1 1 1 0 1 0 0 0 0	0	0	0	0	1	0	0	0	1	0
	SA 105	0 1 1 0 1 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 106	1 0 1 0 1 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 107	0 0 1 0 1 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 108	1 1 0 0 1 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 109	1 1 0 0 1 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 110	1 0 0 0 1 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 111	0 0 0 0 1 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 112	1 1 1 0 0 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 113	0 1 1 0 0 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 114	1 0 1 0 0 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 115	0 0 1 0 0 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 116	1 1 0 1 0 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 117	0 1 0 1 0 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 118	1 0 0 1 0 0 0 0 0	0	0	0	0	0	0	0	0	0	1
	SA 119	0 0 0 1 0 0 0 0 0	0	0	0	0	0	0	0	0	0	1

7th BIT = EXTENDED  
8th BIT = HAS NO MEANING  
9th BIT = NO CHAR.

NOTE: CODING: POS. LOGIC  
1 = 0 V (SPACE)  
0 = -24 V (MARK)



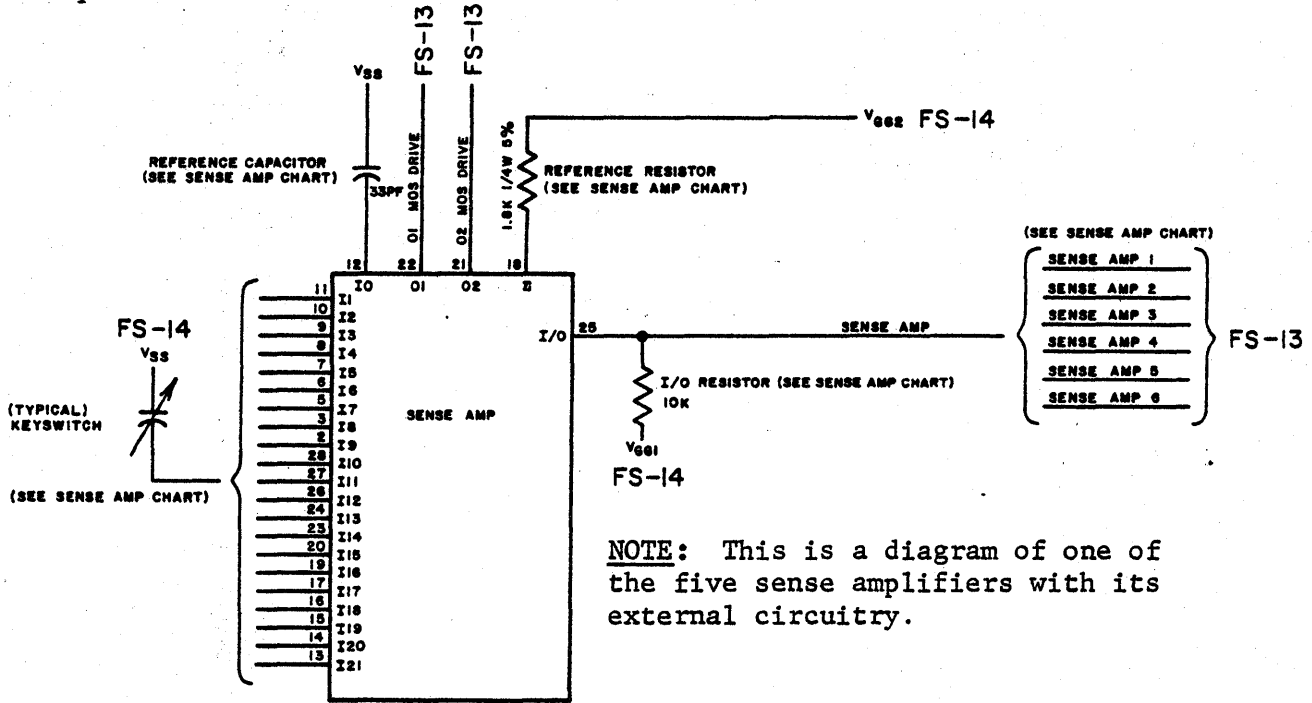
BD-1  
CIRCUIT BLOCK DIAGRAM



D. TROUBLESHOOTING (Contd)

4. REFERENCE MATERIAL (Contd)

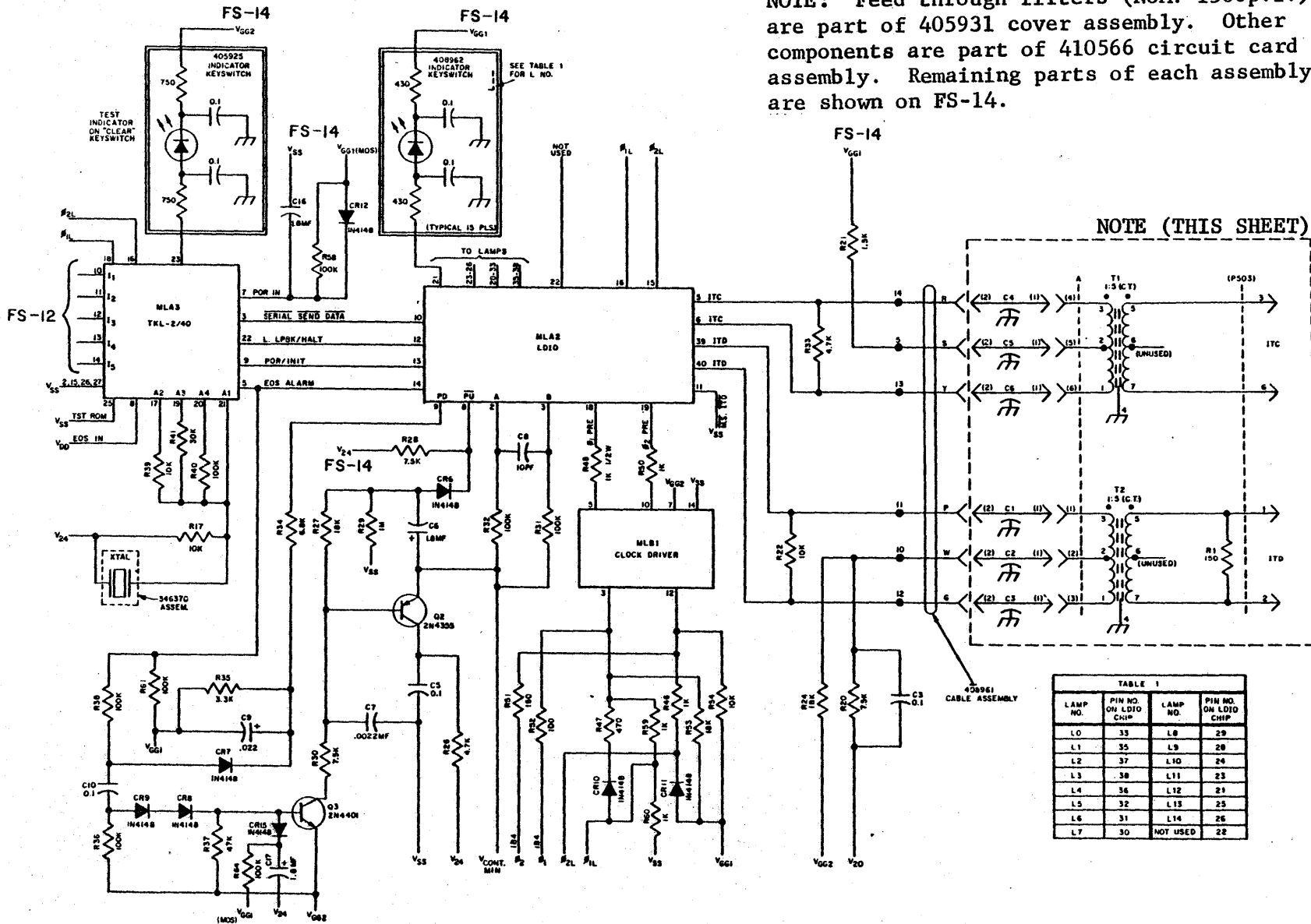
Keyswitches and Sense Amplifiers (410096 Circuit Card) (FS-12)



NOTE: This is a diagram of one of the five sense amplifiers with its external circuitry.

SENSE AMP TABLE

SENSE AMP PIN NO	SENSE AMP 1 (MLA4)	SENSE AMP 2 (MLB4)	SENSE AMP 3 (MLB2)	SENSE AMP 4 (MLA1)	SENSE AMP 5 (MLB3)
KEYTOP CHARACTER					
11	(	XTRA (V <sub>SS</sub> )	C	I	Y
10	\	B	B	→	M
9	∩	I	F	↓	G
8	P (TEST)	L	Z	←	T
7	P	U	V	3	N
6	TAB	/	W	(L3)	G
5	+	K	Q	(L2)	S
3	-	.	D	CURSOR RET.	R
2	O (ZERO)	.	C	HOME	4
28	(L9)	O	Z	(L0)	7
27	=	;	A	(L8)	M
26	(L10)	9	S	(L7)	J
24	(L18)	/	X	(L6)	SPACE
23	TAB SET	RETURN	SHFT (LEFT)	(L1)	CONTROL (LEFT)
20	TAB CLEAR	LINE INSERT	CAPS LOCK	SCROL DOWN	SHFT (RIGHT)
19	(L13)	LINE DELETE	CURSR. TAB	SCROL UP	NEW LINE
17	(L12)	CHAR. INSERT.	SEGMT. ADV.	(L4)	° (TEST)
16	(L11)	CHAR. DELETE	↓	(L5)	CONTROL (RIGHT)
15	CLEAR	CHAR. DELETE - RPT	→ REPEAT	SCROL UP - RPT	> . - REPEAT
14	CHAR. INSERT - RPT	OPTION - RPT (V <sub>SS</sub> )	→ REPEAT	SCROL DOWN - RPT	SPACE - RPT
13	← RPT	NEW LINE - RPT (V <sub>SS</sub> )	↑ REPEAT	↑ REPEAT	RETURN (TEST)
REFERENCE RESISTOR					
18	R45	R57	R55	R19	R56
I/O RESISTOR					
25	R44	R42	R49	R18	R43
KEYSWITCH LOGIC (MLA5) INPUT PIN NO.					
10	11	12	13	14	
REFERENCE CAPACITOR					
13	C11	C15	C13	C1	C14



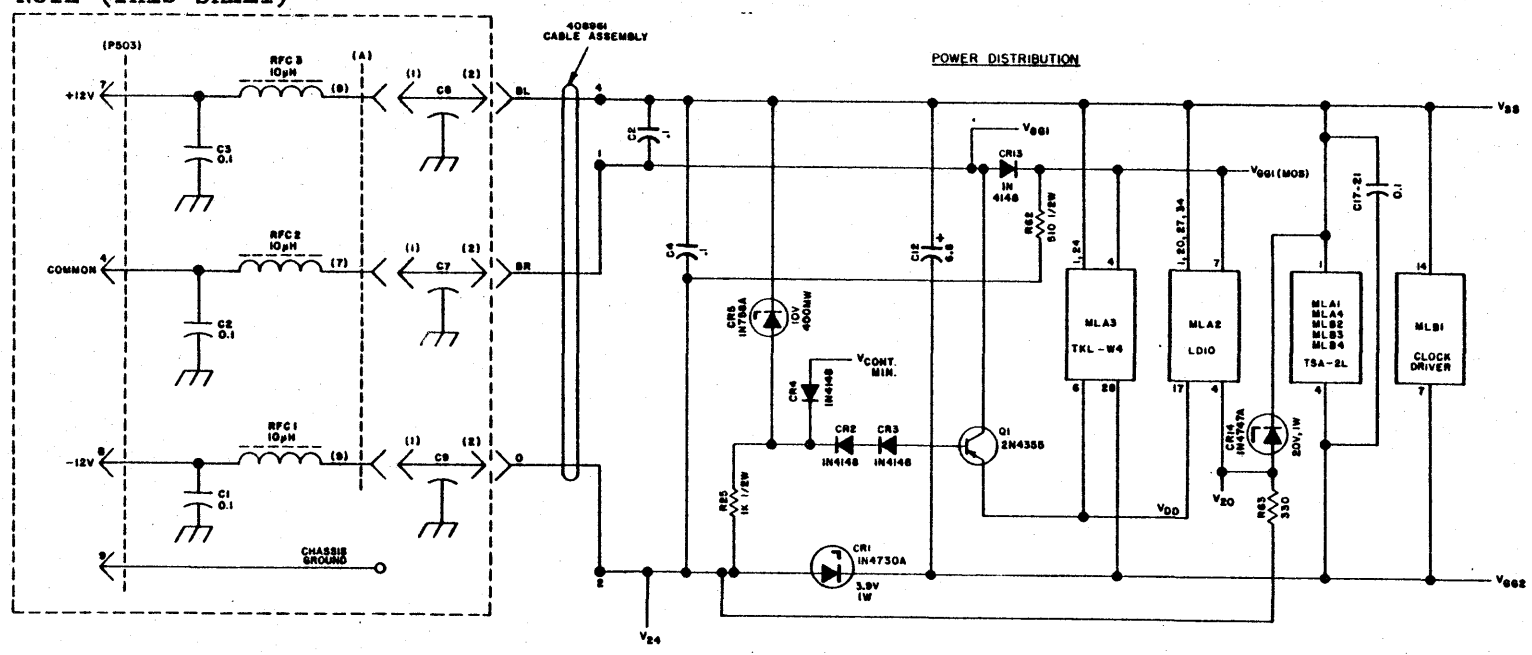
NOTE: Feed through filters (NOM. 1500p.f.) are part of 405931 cover assembly. Other components are part of 410566 circuit card assembly. Remaining parts of each assembly are shown on FS-14.

D. TROUBLESHOOTING (Contd)

4. REFERENCE MATERIAL (Contd)

Power Distribution (410096 Circuit Card) (FS-14)

NOTE (THIS SHEET)



NOTE: Feed through filters (NOM. 1500p.f.) are part of 405931 cover assembly. Other components are part of 410566 circuit card assembly. Remaining parts of each assembly are shown on FS-13.

SENSE AMPS			Switch Addresses	UNSHIFT		SHIFT		CONTROL	
Sense Amp Pin No.	Sense Amp No.	Data Enable No.		B <sub>0</sub> B <sub>1</sub> B <sub>2</sub> B <sub>3</sub> B <sub>4</sub> B <sub>5</sub> B <sub>6</sub> B <sub>7</sub> B <sub>8</sub> B <sub>9</sub>	Character	B <sub>0</sub> B <sub>1</sub> B <sub>2</sub> B <sub>3</sub> B <sub>4</sub> B <sub>5</sub> B <sub>6</sub> B <sub>7</sub> B <sub>8</sub> B <sub>9</sub>	Character	B <sub>0</sub> B <sub>1</sub> B <sub>2</sub> B <sub>3</sub> B <sub>4</sub> B <sub>5</sub> B <sub>6</sub> B <sub>7</sub> B <sub>8</sub> B <sub>9</sub>	Character
				0123456789		0123456789		0123456789	
11 11 11 11 10 10 10	1 2 3 4 5 2 2 3	1 1 1 1 2 2 2	0 1 2 3 4 5 6 7	00100000110 10001000000 01011000111 01110001100 01100000101 11000101110 11100001100 10111000101	{ X - e l y \ s b	01000000110 10001000000 01011101010 01111011110 01100101111 11000001000 10101011100 10111101111	} X - E I Y : + B	01010111100 10001000000 01011111111 00000000001 01100111101 10011111110 00000000001 10111111101	NAK X ENQ  EM ACK  STX
10 10 9 9 9 9 9 9 8	4 5 1 2 3 4 5 1	2 2 3 3 3 3 3 4	8 9 10 11 12 13 14 15	00111110000 11101000101 11111000110 01101000111 10011000111 00010010000 10010011110 NON-SEND	→ h ' i r t 6 P(TEST)	00111110000 11101101111 10000000110 01101101010 10011101010 00010010000 10000101010 NON-SEND	→ H ~ I P ↑ P(TEST)	00111110000 01000111111 10010111100 00000111101 11110111101 00010010000 00000000001 NON-SEND	→  GS SYN US DLE ↑ P(TEST)
8 8 8 8 7 7 7 7	2 3 4 5 1 2 3 4	4 4 4 5 5 5 5	16 17 18 19 20 21 22 23	11001000111 10110001100 11101111100 11010000111 11110000101 01010000101 10010000101 00110001110	1 2 ← t p u v 3	11001101010 11111101010 11101111100 11010101010 11110101111 01010101111 10010101111 00111011100	L @ ← T P U V #	11001111111 00000000001 11101111100 11010111111 00100111111 10100111101 0000000101 00000000001	FF  ← DCA ESC SUB DEL
7 6 6 6 6 6 5 5	5 1 2 3 4 5 1 2	5 6 6 6 6 6 7 7	24 25 26 27 28 29 30 31	10001000101 01101111110 00001011100 00010000111 10111000000 00011000101 00101011110 00101000101	n TAB / w (L3) s/r g + k	10001101111 01101111110 00000011110 00010101010 10111000000 00011101111 01000101000 00101101111	N TAB T W (L3) G J K	10001111101 01101111110 00000000001 00010111111 10111000000 00011111101 00000000001 00101111101	SO TAB  ETB (L3) REL  VT
5 5 5 3 3 3 3	3 4 5 1 2 3 4 5	7 7 8 8 8 8 8	32 33 34 35 36 37 38 39	01110000111 11011000000 01010001110 01001011110 11001011100 11011000101 00011100101 10110000111	(L2) LOCAL 4 5 - ↑ ↓ CURSOR RETURN r	01110101010 11011000000 01011011100 00000101110 11000001110 11011101111 00011100101 10110101010	Q (L2) %   V D CURSOR RETURN R	01110111111 11011000000 00000000001 00000000001 00000000001 11011111101 00011100101 10110111111	DC1 (L2)   ROT CURSOR RETURN DC2

D. TROUBLESHOOTING (Cont'd)

4. REFERENCE MATERIAL (Cont'd)

40K108 Keyswitch Codes -- Switch Address Coding (Cont'd)

SENSE AMPS			UNSHIFT				SHIFT				CONTROL			
Sense Asp Pin No.	Sense Asp No.	Data Enable No.	Switch Addresses	B <sub>0</sub> B <sub>1</sub> B <sub>2</sub> B <sub>3</sub> B <sub>4</sub> B <sub>5</sub> B <sub>6</sub> B <sub>7</sub> B <sub>8</sub> B <sub>9</sub>	Character	B <sub>0</sub> B <sub>1</sub> B <sub>2</sub> B <sub>3</sub> B <sub>4</sub> B <sub>5</sub> B <sub>6</sub> B <sub>7</sub> B <sub>8</sub> B <sub>9</sub>	Character	B <sub>0</sub> B <sub>1</sub> B <sub>2</sub> B <sub>3</sub> B <sub>4</sub> B <sub>5</sub> B <sub>6</sub> B <sub>7</sub> B <sub>8</sub> B <sub>9</sub>	Character					
2	1	9	40	1111001110	0(Zero)	01101011100	)	0000000001						
2	2	9	41	1000101110	.	10000011100	>	0000000001						
2	3	9	42	0011100111	c	00111101010	c	0011111111	STX					
2	4	9	43	1110110010	HOME	1110110010	HOME	1110110010	HOME					
2	5	9	44	1101001100	^	1101101110	\$	0000000001						
28	1	10	45	1010100010	(L9)	1010100010	(L9)	1010100010	(L9)					
28	2	10	46	0000100111	o(Alpha)	0000110101	o	0000111111	SI					
28	3	10	47	1010000101	z	1010010111	z	1111111111	MUL					
28	4	10	48	1001100010	(L0) SEND	1001100010	(L0)	1001100010	(L0)					
28	5	10	49	0001001100	7	1001101100	&	0000000001						
27	1	11	50	0100001100	-	0010010100	[	0000000001						
27	2	11	51	0010001100	!	1010001110	:	0000000001						
27	3	11	52	0111100101	@	0111110111	A	0111111101	SOH					
27	4	11	53	0111100000	(L8)PRINT LOCAL	0111100000	(L8)	0111100000	(L8)					
27	5	11	54	0100100101	#	0100110111	N	1100011101	FS					
26	1	12	55	0010100000	(L10)	0010100000	(L10)	0010100000	(L10)					
26	2	12	56	0110001110	9	1110101110	(	0000000001						
26	3	12	57	0011000101	8	0011010111	S	0011011101	DC3					
26	4	12	58	0011100010	(L7)PRINTRONLINE	0011100010	(L7)	0011100010	(L7)					
26	5	12	59	1010100111	J	1010110101	J	1000011111	ES					
24	1	13	60	0001010000	(L14)FORM ENTER	0001010000	(L14)	0001010000	(L14)					
24	2	13	61	0001101110	.	1011101110	-	0000000001						
24	3	13	62	1110000111	x	1110010101	X	1110011111	CAN					
24	4	13	63	0110100010	(L6)	0110100010	(L6)	0110100010	(L6)					
24	5	13	64	1111101100	SPACE									
23	1	14	65	0111001000	(L15)TAB SET									
23	2	14	66	0100111100	RETURN									
23	3	14	67	NON-SEND	SHIFT (LEFT)									
23	4	14	68	0101100010	(L1)RBC									
23	5	14	69	NON-SEND	CONTROL (LEFT)									
20	1	15	70	1011001000	(L16)TAB CLEAR									
20	2	15	71	1100110000	LINE INSERT									
20	3	15	72	NON-SEND	CAPS LOCK									
20	4	15	73	1101010000	SCROL DOWN									
20	5	15	74	NON-SEND	SHIFT RIGHT									
19	1	16	75	0011001010	(L13)HIGHLIGHT									
19	2	16	76	0100110010	LINE DELETE									
19	3	16	77	1111110000	CURSCR TAB									
19	4	16	78	0011010010	SCROL UP									
19	5	16	79	1010111110	NEW LINE									

SENSE AMPS			UNSHIFT		SENSE AMP			UNSHIFT		
Sense Amp Pin No.	Sense Amp No.	Data Enable No.	Switch Addresses	B <sub>0</sub> B <sub>1</sub> B <sub>2</sub> B <sub>3</sub> B <sub>4</sub> B <sub>5</sub> B <sub>6</sub> B <sub>7</sub> B <sub>8</sub> B <sub>9</sub>	Character	Sense Amp No.	Data Enable No.	Switch Addresses	B <sub>0</sub> B <sub>1</sub> B <sub>2</sub> B <sub>3</sub> B <sub>4</sub> B <sub>5</sub> B <sub>6</sub> B <sub>7</sub> B <sub>8</sub> B <sub>9</sub>	Character
17	1	17	80	0100100000	(L12)	1	25	120	NON-SEND	
17	2	17	81	1000010000	CHAR INSRT.	2	25	121		
17	3	17	82	0101010010	SEGMT ADV	3	25	122		
17	4	17	83	0001100000	(L4) INTRPT	4	25	123		
17	5	17	84	NON-SEND	“(TEST)	5	25	124		
16	1	18	85	1100100010	(L11)	1	26	125		
16	2	18	86	1111010010	CHAR DLETE	2	26	126		
16	3	18	87	1011110010	↓	3	26	127		
16	4	18	88	1110100000	(L5)FORM SEND					
16	5	18	89	NON-SEND	CONTROL(RIGHT)					
15	1	19	90	1010110000	CLEAR					
15	2	19	91	NON-SEND	CHAR DLETE REPEAT					
15	3	19	92	↓	→ REPEAT					
15	4	19	93	↓	SCROL UP-REPEAT					
15	5	19	94	↓	. REPEAT					
14	1	20	95	↓	CHAR INSRT-REPEAT					
14	2	20	96	NON-SEND	I REPEAT					
14	3	20	97	↓	← REPEAT					
14	4	20	98	↓	SCROL DOWN REPEAT					
14	5	20	99	↓	SPACE REPEAT					
13	1	21	100	↓	- REPEAT					
13	2	21	101	↓	NEW LINE REPEAT					
13	3	21	102	↓	↓ REPEAT					
13	4	21	103	↓	↑ REPEAT					
13	5	21	104	NON-SEND	RSTURN-(TEST)					
	1	22	105	↓						
	2	22	106	↓						
	3	22	107	↓						
	4	22	108	↓						
	5	22	109	↓						
	1	23	110	↓						
	2	23	111	↓						
	3	23	112	NON-SEND						
	4	23	113	↓						
	5	23	114	↓						
	1	24	115	↓						
	2	24	116	↓						
	3	24	117	↓						
	4	24	118	↓						
	5	24	119	↓						

NOTES



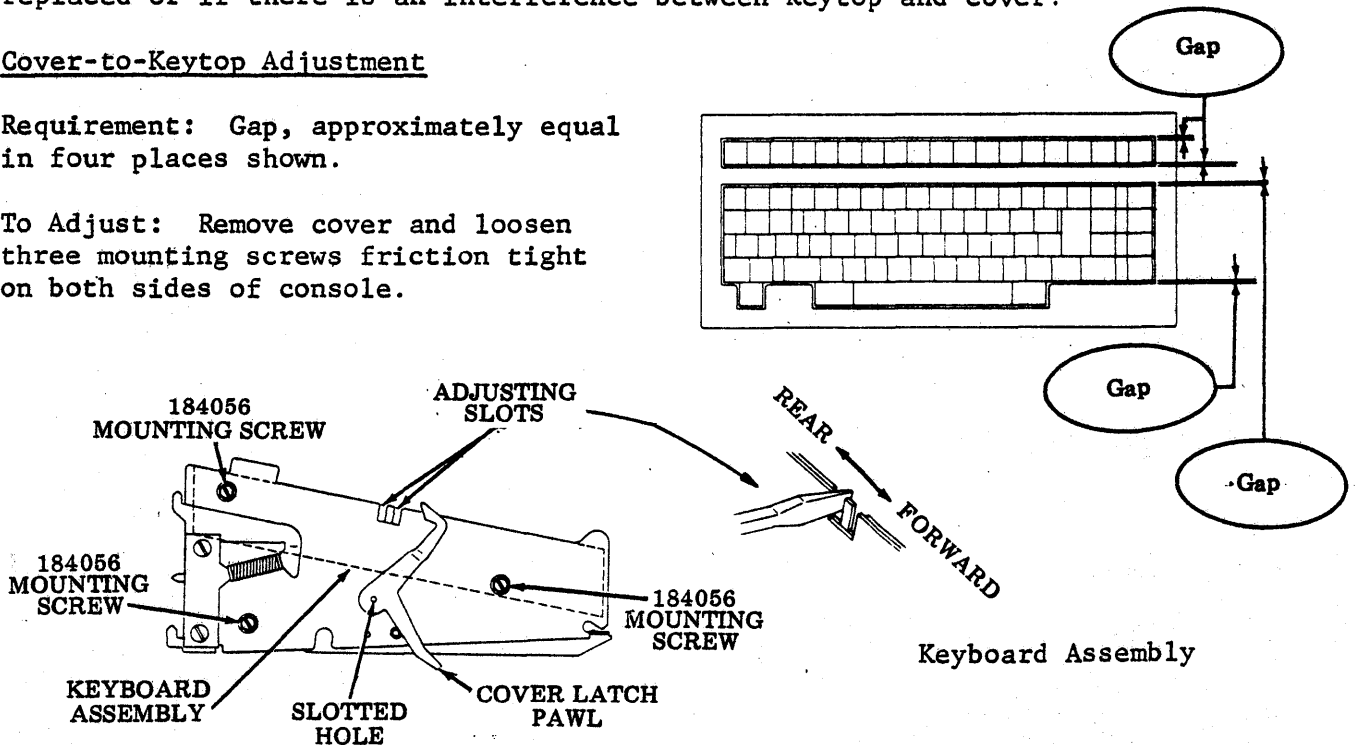
E. ADJUSTMENTS AND LUBRICATION1. ADJUSTMENTS

**NOTE:** The clearance between the cover and keytop is the only adjustment provided on the KD opcon. Normally, readjustment is not necessary unless the cover is replaced or if there is an interference between keytop and cover.

Cover-to-Keytop Adjustment

**Requirement:** Gap, approximately equal in four places shown.

**To Adjust:** Remove cover and loosen three mounting screws friction tight on both sides of console.



Insert screwdriver blade into adjusting slot and move keyboard assembly forward or to the rear to gain "gap" clearance. Tighten screws, replace cover and check gaps. If the gaps are not approximately equal after reassembly, remove cover and repeat the adjustment.

2. LUBRICATION

**NOTE:** Only the side frame slotted holes as detailed require occasional lubrication -- and then sparingly. Lubrication of any other part, assembly, keyswitch or the opcon as a whole is NOT required and MUST be avoided.

Lubricate the slotted holes on each side sparingly only with 97116 grease. Oil is NOT permissible.

F. DISASSEMBLY/REASSEMBLY AND PARTS1. GENERAL

This section covers KD or RO opcon removal from an assembly to an associated set and disassembly or reassembly of either opcon down to or up from basic components.

## F. DISASSEMBLY/REASSEMBLY AND PARTS (Contd)

### 1. GENERAL (Contd)

Precautions should be taken to assure that the opcon is disassembled and reassembled under clean conditions. No oil, grease, or other liquids should be allowed on unassembled parts, subassemblies, keyswitches, or the complete opcon.

The locations of major subassemblies and parts are shown on Page 5-123, 3. SUBASSEMBLY IDENTIFICATION -- KD and Page 5-140, 6. SUBASSEMBLY IDENTIFICATION -- RO with references to applicable disassembly/reassembly procedures.

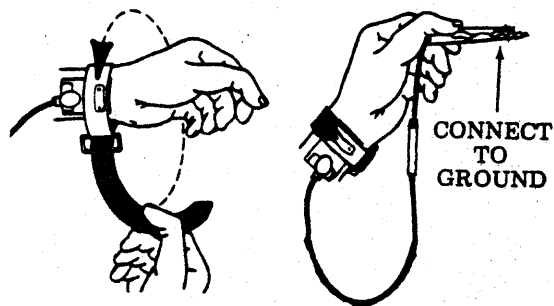
Reference in the procedures to left or right and up or down and top or bottom, etc, refer to the opcon in its normal operating position.

When removing a subassembly or part from the opcon, follow the removal procedures and note how each part is removed and the sequence of its removal. For reassembly, reverse the removal procedure except where different instructions are given.

**CAUTION:** TO AVOID POSSIBLE INTERNAL DAMAGE TO THE MOS DEVICES, OR CARD WITH MOS DEVICES, DUE TO ELECTRICAL STATIC DISCHARGE BY SERVICE PERSONNEL, THE DETAILED PROCEDURES LISTED SHOULD BE FOLLOWED.

- (1) ALL MOS DEVICES SHOULD BE DELIVERED AND STORED IN CONDUCTIVE CARRIERS SUCH AS FOAM PADS OR ALUMINUM TUBES.
- (2) ALL HANDLING OF MOS DEVICES, OR CARDS WITH MOS DEVICES, SHOULD BE DONE AT A GROUNDED BENCH WITH A CONDUCTIVE FOAM PAD OR AT A LOCATION WHERE THE SERVICE PERSONNEL CAN BE MAINTAINED AT GROUND POTENTIAL.\*
- (3) ALL PERSONNEL HANDLING MOS DEVICES, OR CIRCUIT CARDS WITH MOS DEVICES, MUST WEAR A STATIC PROTECTION GROUNDING STRAP ADJUSTED TO MAKE FIRM CONTACT WITH THE SKIN AT ALL TIMES.\*
- (4) MOS DEVICES DELIVERED IN ALUMINUM TUBES OR FOAM PADS MAY BE TRANSFERRED TO WORK AREA PAD BY TOUCHING CARRIER OR PAD FIRST AND REMOVING DEVICE BY THEIR PACKAGE (BODY), RATHER THAN BY THE LEADS, IF AT ALL POSSIBLE. HOWEVER, THESE DEVICES SHOULD ALWAYS BE POSITIONED SO THAT THE LEGS ARE IN CONTACT WITH THE FOAM AT ALL TIMES.
- (5) SOLDERING IRONS, TEST AND INSERTION EQUIPMENT MUST BE GROUNDED.

\*Service personnel are never to be connected directly to ground but rather through a high resistance discharge path of a minimum of one megohm where 115 V ac is present.



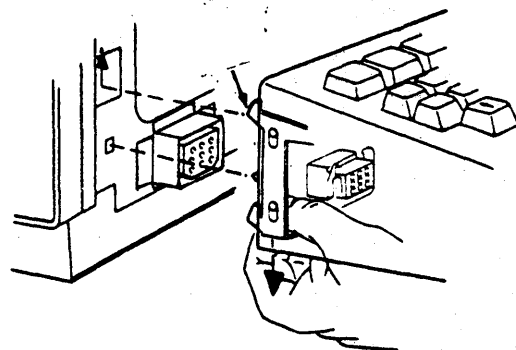
A separate listing of part numbers, Page 5-144, 9. COMPONENT PARTS LIST -- KD AND RO, is included to facilitate ordering of replacement parts.

Refer to Page 5-2, Tools for a listing of the necessary tools.

2. REMOVAL AND REPLACEMENT -- KD AND RO

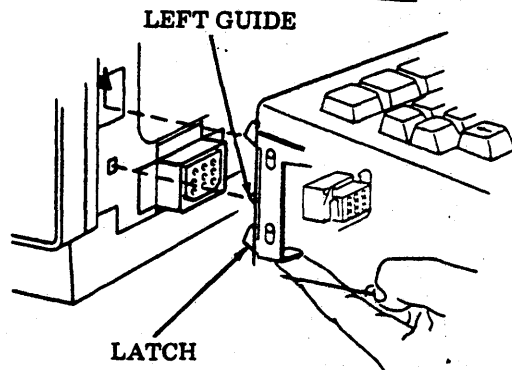
Removal

- ① Place thumb on inward tab of left latch and press downward to unlatched position.
- ② Hold opcon firmly with left hand. With right hand place thumb on right latch tab and press downward to unlatched position.
- ③ Carefully pull opcon forward to disengage from cabinet.



Replacement

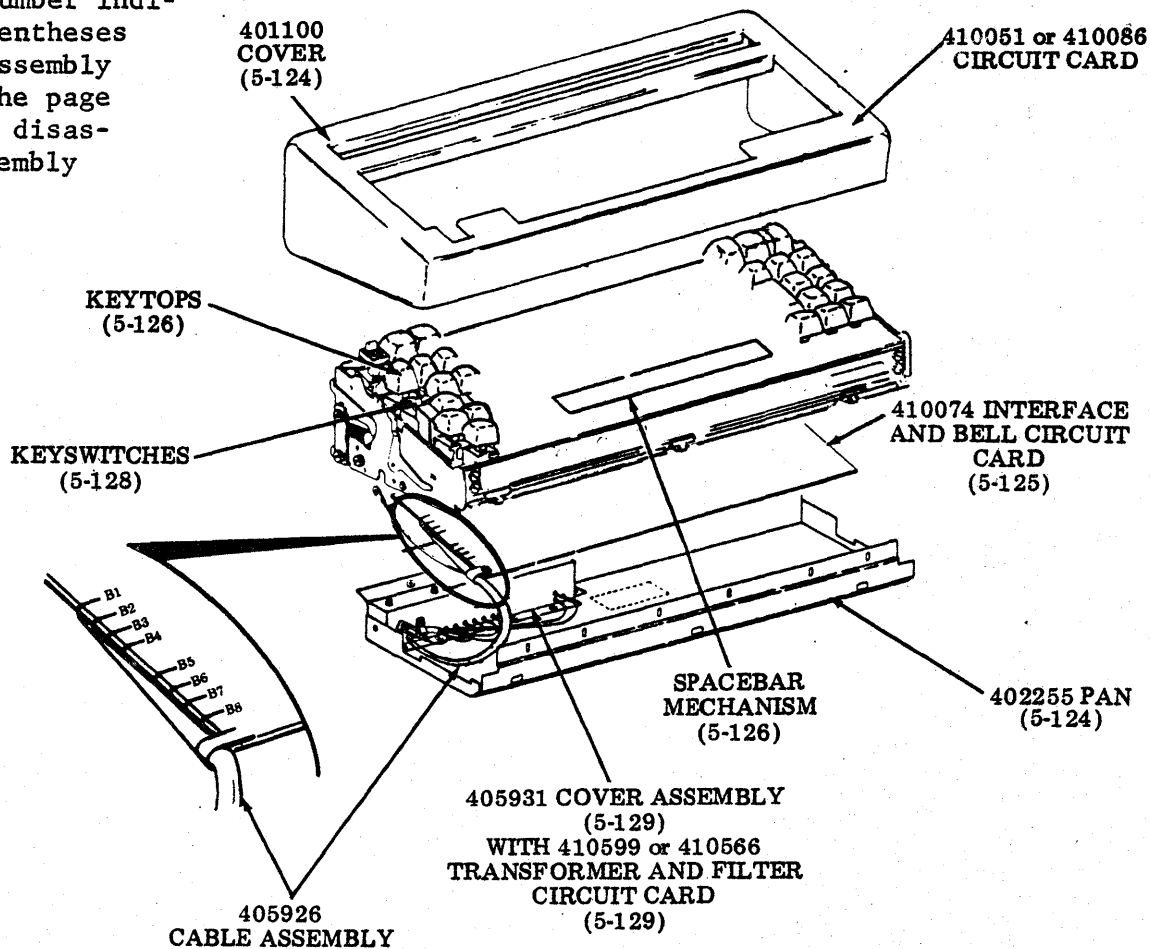
- ① Slide left and right latches down.
- ② Engage connectors and left and right guides into the slots.
- ③ Slide left and right latches upward to latched position.



**CAUTION:** CHECK THAT OPCON IS FIRMLY ATTACHED ON BOTH SIDES BEFORE RELEASING HOLD.

3. SUBASSEMBLY IDENTIFICATION -- KD

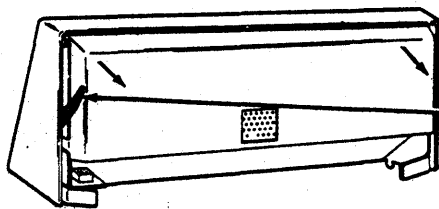
**NOTE:** The number indicated in parentheses after each assembly designates the page covering the disassembly/reassembly procedures.



F. DISASSEMBLY/REASSEMBLY AND PARTS (Contd)

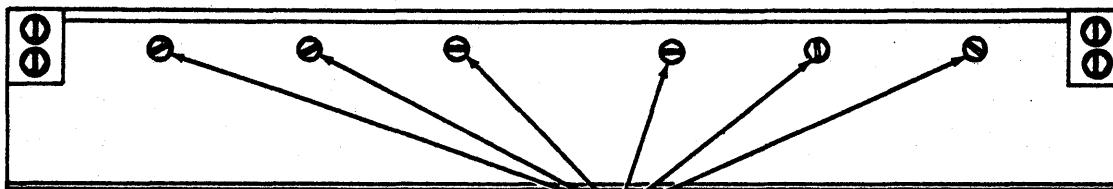
4. DISASSEMBLY/REASSEMBLY -- KD

401100 Cover



- ① Stand opcon upright on back side as shown.
- ② Use a thin bladed screwdriver or orange stick and pry left and right levers down. Remove cover.

402255 Pan

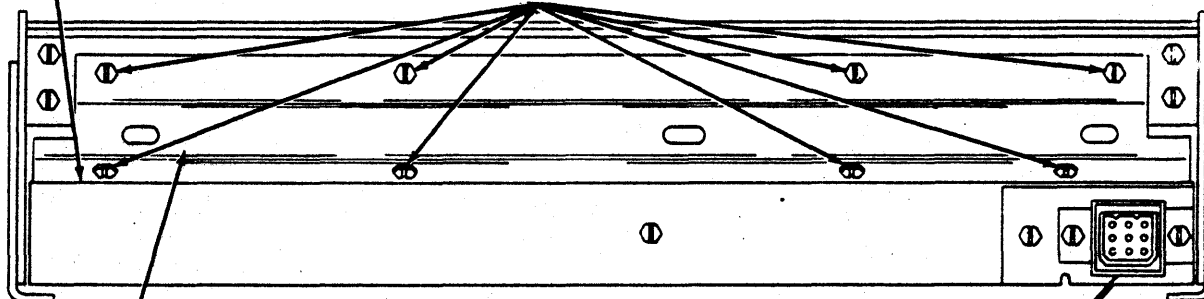


(Front View of Opcon)

- ① Remove six 152893 screws, 110743 lockwashers and 125011 flat washers.

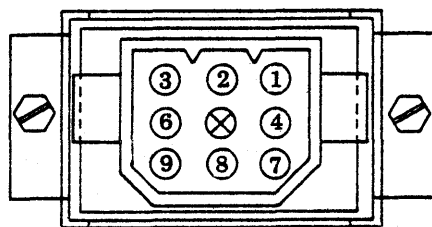
- ② Remove eight 152893 screws, 110743 lockwashers and 125011 flat washers.

402255 PAN

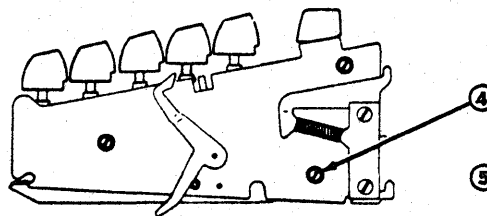
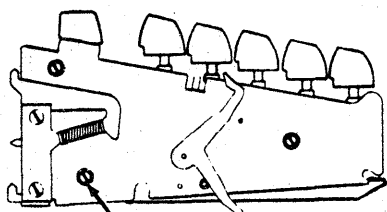


(Rear View of Opcon)

- ③ Remove 402256 plate.



SSI Connector Orientation



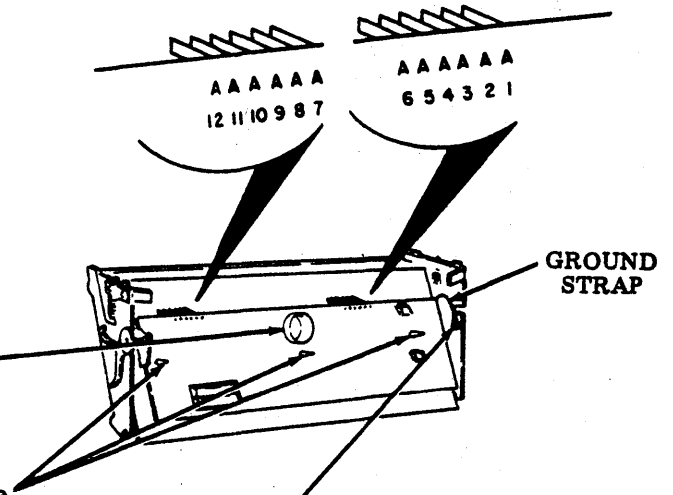
- ④ Remove two 184056 screws; one from each side of frame.

- ⑤ Remove pan.

410074 Interface and Bell Circuit Card

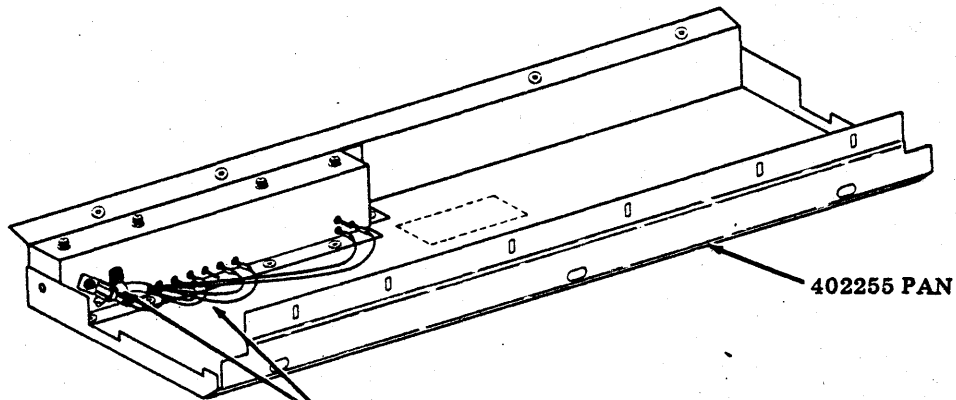
**CAUTION 1:** DURING REASSEMBLY, CAREFULLY SEAT PINS OF CIRCUIT CARD INTO RECEPTACLES BEFORE APPLYING PRESSURE.

**CAUTION 2:** DURING DISASSEMBLY AND REASSEMBLY, AVOID HANDLING OF CRYSTAL IN TUNED HOLDER, AS DAMAGE MAY OCCUR.



② Using long nose pliers, compress three locking tabs on plastic standoffs one at a time while applying upward pressure to circuit card.

① Remove 151722 screw and 107116 lockwasher securing ground strap to left side frame.

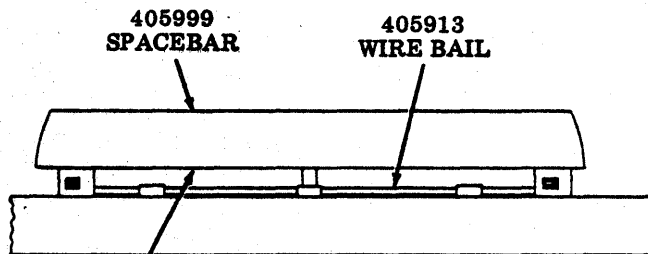


③ Remove push on terminals of 405926 cable assembly.

④ Remove circuit card.

F. DISASSEMBLY/REASSEMBLY AND PARTS (Contd)4. DISASSEMBLY/REASSEMBLY -- KD (Contd)Spacebar Mechanism

- Remove 401100 cover (5-124).
- Remove both control keytops (5-126).



- ① Disengage 405913 wire bail from two snap clips formed out of top shield using a small screwdriver. Push bail to rear.

- ② With wire bail removed, push spacebar to right and upward to release spacebar from guides keyswitch assembly.

Keytops

To remove data keytops:

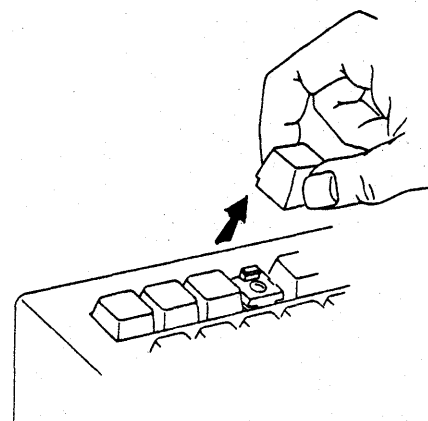
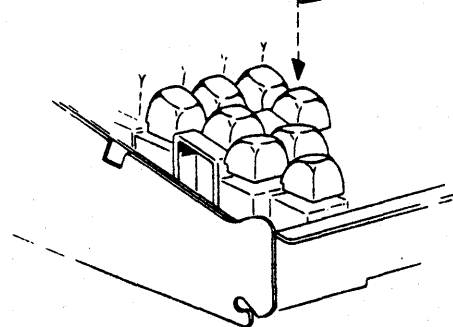
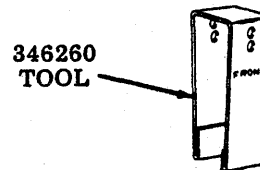
Place 346260 tool over the keytop and pull up to remove.

**CAUTION 1:** THE CAPS LOCK KEYTOP MUST BE IN THE FULLY EXTENDED, UNLATCHED POSITION BEFORE ATTEMPTING TO REMOVE THE KEYTOP. FAILURE TO OBSERVE THIS PRECAUTION WILL RESULT IN A DAMAGED KEYSWITCH.

To remove control keytops and blocking keytops:

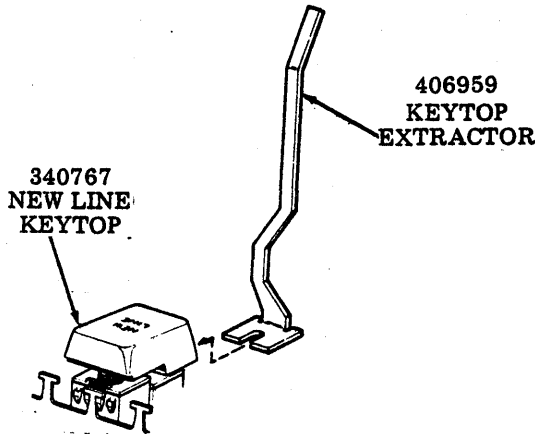
- ① Grasp keytop using thumb and index finger.
- ② Exert upward force until keytop releases.

In reassembly of the blocking keytop for the CAPS LOCK switch only, operate the switch to the latched (down) position. For all other blocking keytops, position keytop over switch housing and snap down until ridges are retained by notches in switch body.



To remove new line keytop.

- ① Remove TAB keytop directly above the NEW LINE keytop.



- ② Insert the fork portion of the 406959 keytop extractor under the top edge of the keytop so that the tines of the extractor tool are around the metal post at the top of the keytop and the 340764 spring is depressed under the extractor tool.

- ③ Pry up with the extractor tool being sure the tines of the extractor tool pry against the metal plate embedded in the keytop. Pry up until keytop pops loose.

**CAUTION 2:** CONTROL ROW BLOCKING KEYTOPS ARE NOT THE SAME ON THE FRONT AND REAR SIDE AND MUST BE ASSEMBLED WITH THE PROPER ORIENTATION.



Profile of Control Row Blocking Keytop

405906 Keytop Shield

③ Remove two screws. Remove 405919 bars.

④ Remove seven screws. Remove 405927 bar.

① Remove all keytops in rows 1 through 5.

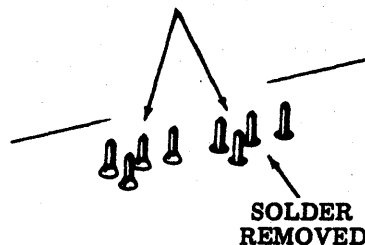
Labels in diagram: 405919 BAR, INTERBOARD CONNECTOR (Under bar), 405927 BAR, EOS TEST POINT (Under bar), TKL (MLB8) (Under bar), INTERBOARD CONNECTOR (Under bar), 405919 BAR, ROWS 1-5, 405906 KEYPAD SHIELD.

HOME	SCROL UP	SEGMT ADV	1	2	3	4	5	6	7	8	9	0	-	+	TAB	SYN	LINE INSRT
CURSR RETRN	SCROL DOWN	CURSOR TAB	Q	W	E	R	T	Y	U	I	O	P	=	NEW LINE	ACK	LINE DELETE	
↑			A	S	D	F	G	H	J	K	L	:	"	NEW LINE	NACK	CHAR INSRT	
←	→	SHIFT	Z	X	C	V	B	N	M	,	.	/	SHIFT			CHAR DELETE	
↓		CONTROL												CONTROL			

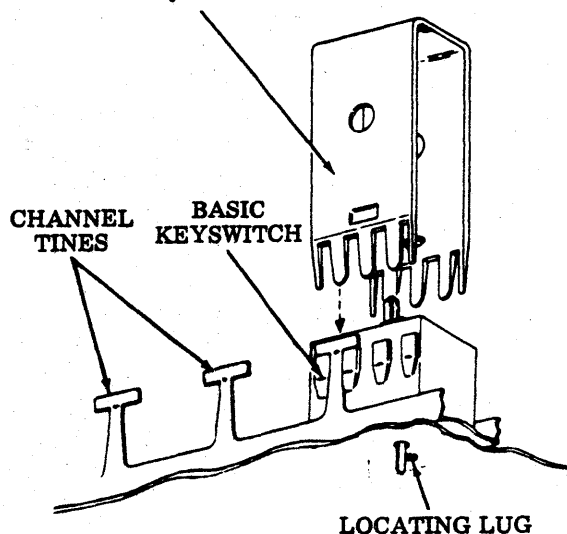
F. DISASSEMBLY/REASSEMBLY AND PARTS (Contd)4. DISASSEMBLY/REASSEMBLY -- KD (Contd)Keyswitches

- Remove 401100 cover(5-124).
- Remove 402255 pan (5-124).
- Remove 410074 interface and bell circuit card (5-125) (if present).
- Remove keytops (5-126).
- Remove 405906 keytop shield (5-127).

- ① Remove solder from around terminal pins of keyswitch to be removed.



- ② Place 346257 tool over keyswitch and press downward. When tool bottoms and embossed projections snap into notches on keyswitch, squeeze and pull back on tool to lift keyswitch out.



**CAUTION:** USE A LOW WATTAGE SOLDERING IRON (AVOID PROLONGED CONTACT WITH PINS) ALONG WITH A DESOLDERING TOOL TO PREVENT DAMAGE TO KEYSWITCH CARD CIRCUITS AND COMPONENTS.

**NOTE:** The tool tines must pass between keyswitch housing and inside of channel tines.

In reassembly, insert new keyswitch, observe position of locating lug, and press keyswitch into channel. Switch must snap fully into front and rear channel tines. Hold keyswitch in place and resolder.

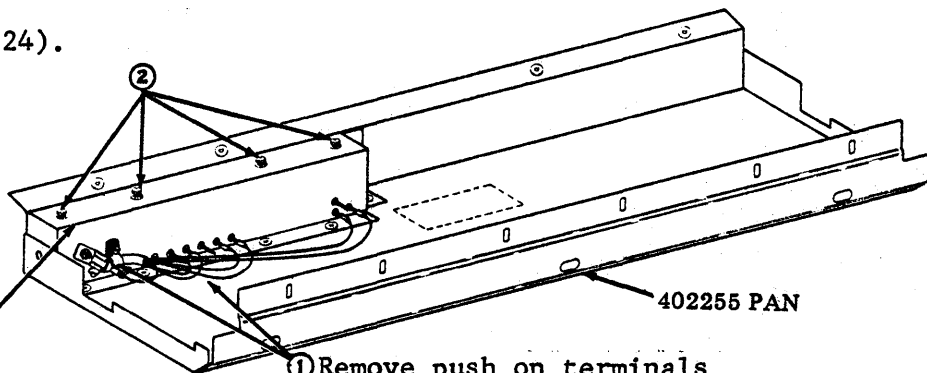


405931 Cover Assembly

•Remove 402255 pan (5-124).

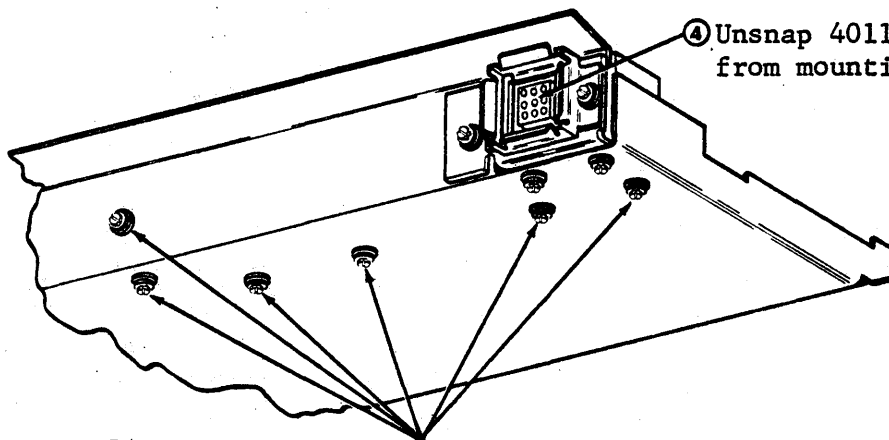
② Remove four 152893 screws, 110743 lock-washers and 125011 flat washers.

⑤ Remove 405931 cover assembly.



① Remove push on terminals of 405926 cable assembly.

④ Unsnap 401149 connector from mounting bracket.

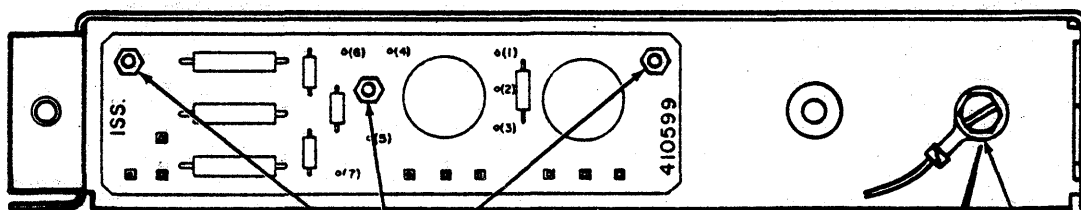


③ Remove six 152893 screws, 110743 lock-washers and 125011 flat washers.

410599 or 410566 Transformer and Filter Circuit Card

•Remove 402255 pan (5-124).

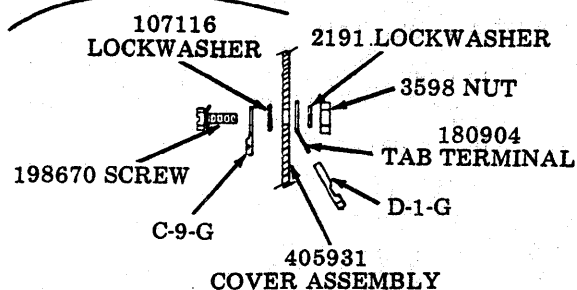
•Remove 405931 cover assembly (5-129).



① Remove three 3599 nuts and 110743 lockwashers.

② Remove 198670 screw.

③ Remove circuit card.



F. DISASSEMBLY/REASSEMBLY AND PARTS (Contd)

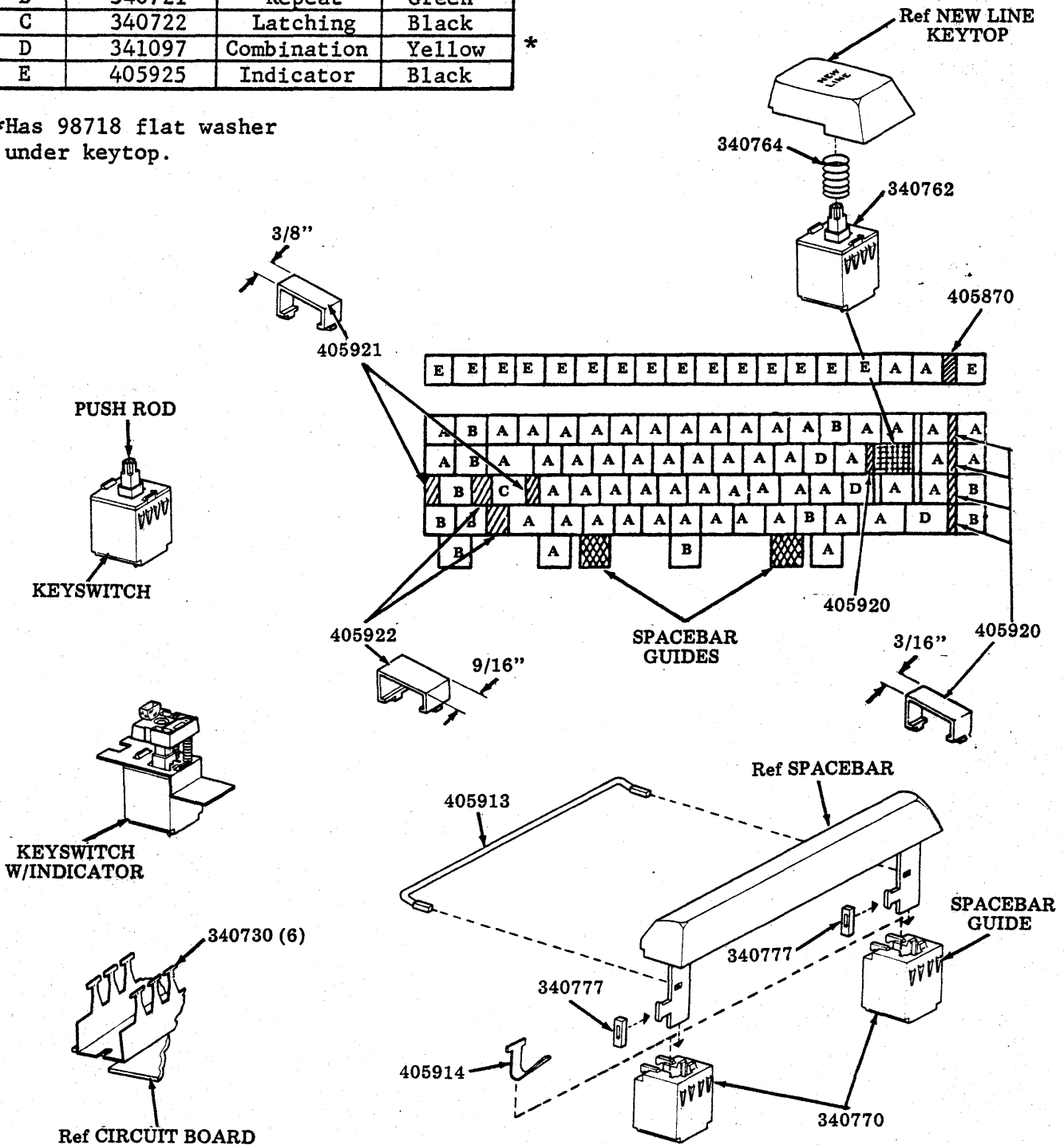
5. PARTS -- KD

410051 Console Logic Circuit Card

POS	KEYSWITCH NO.	TYPES	PUSH ROD COLOR
A	340720	Basic	White
B	340721	Repeat	Green
C	340722	Latching	Black
D	341097	Combination	Yellow
E	405925	Indicator	Black

NOTE: Early design keyswitches have the part number stamped on the keyswitch housing.

\*Has 98718 flat washer under keytop.

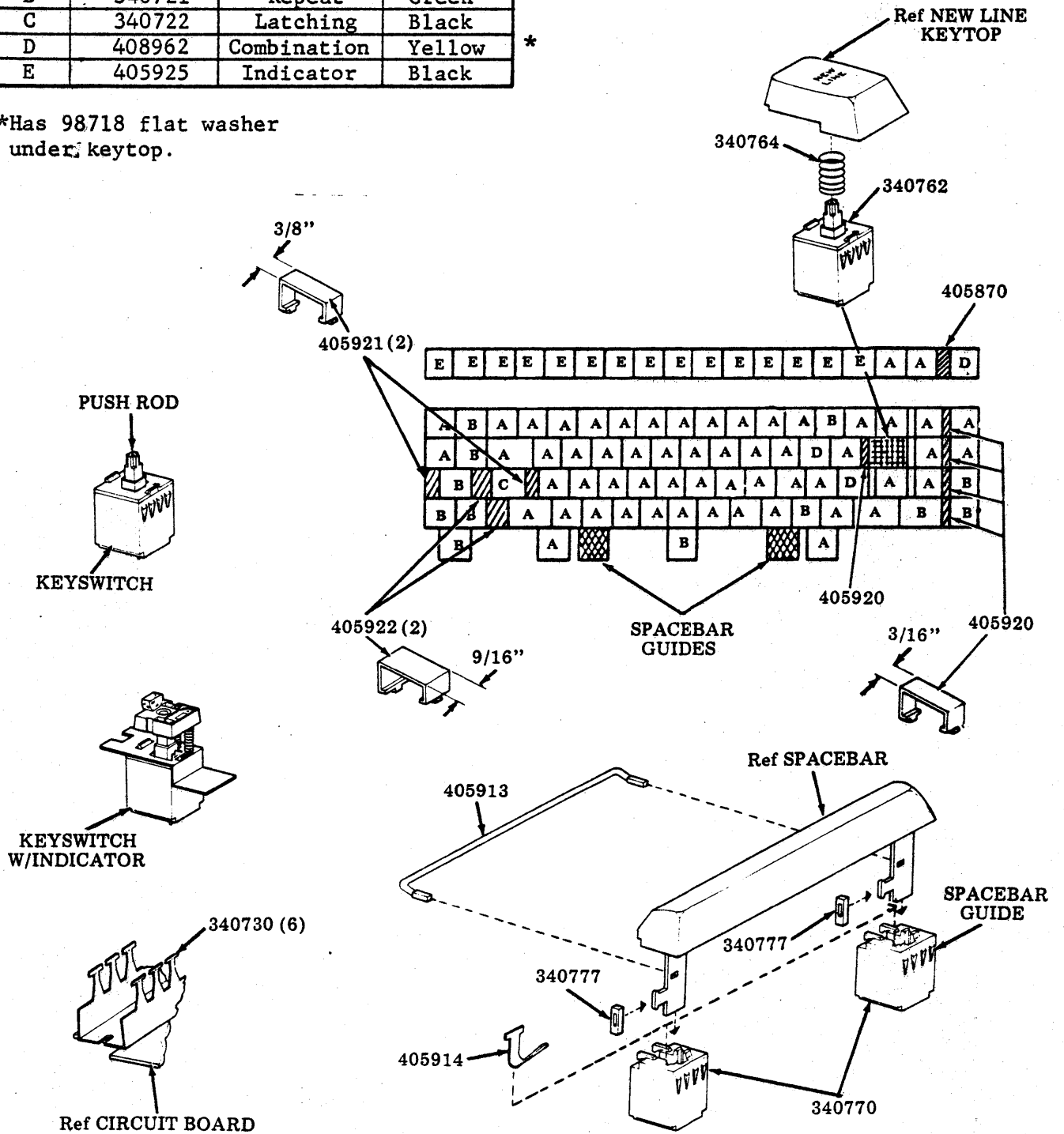


410096 Console Logic Circuit Card

POS	KEYSWITCH NO.	TYPES	PUSH ROD COLOR
A	340720	Basic	White
B	340721	Repeat	Green
C	340722	Latching	Black
D	408962	Combination	Yellow
E	405925	Indicator	Black

NOTE: Early design keyswitches have the part number stamped on the keyswitch housing.

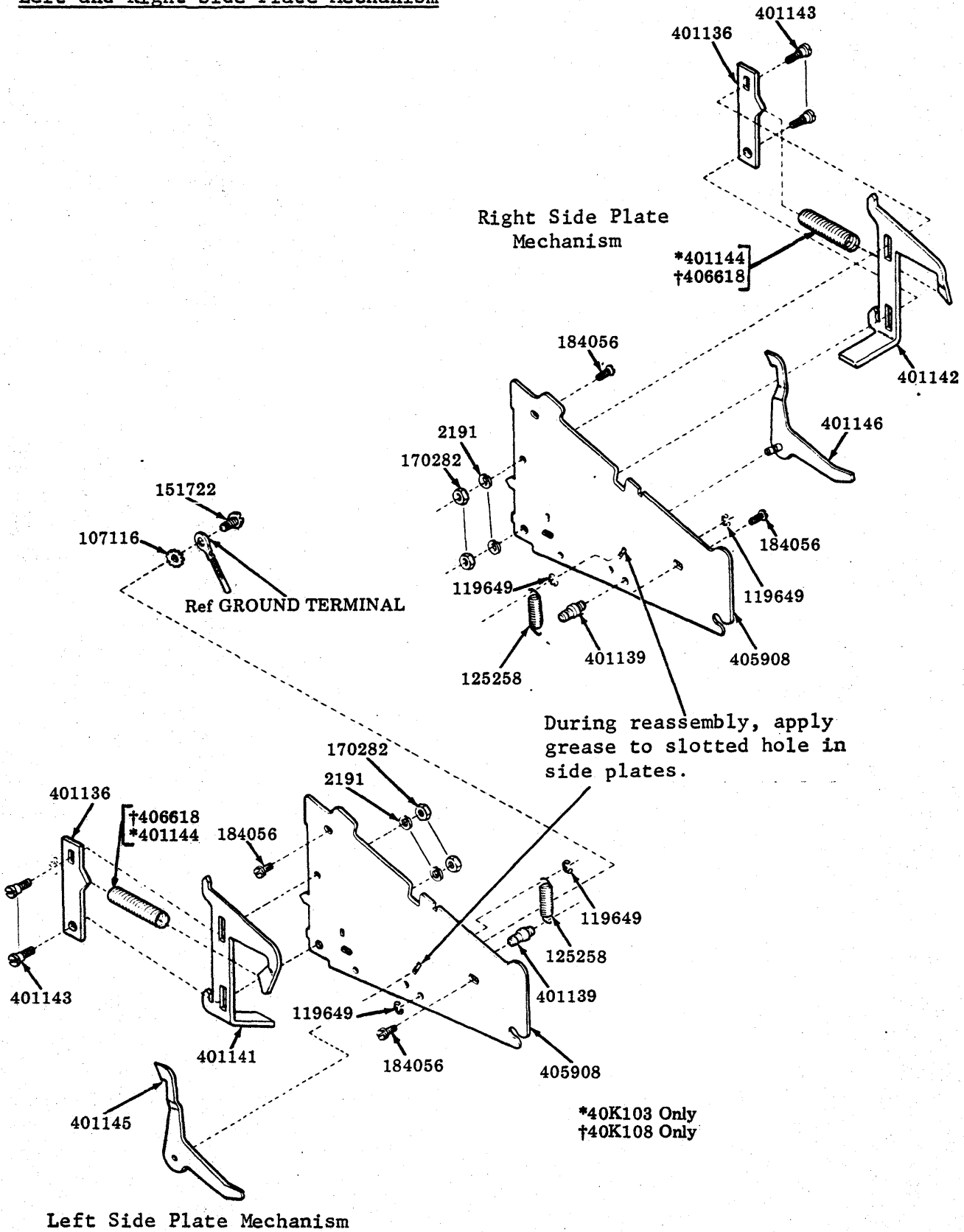
\*Has 98718 flat washer under keytop.

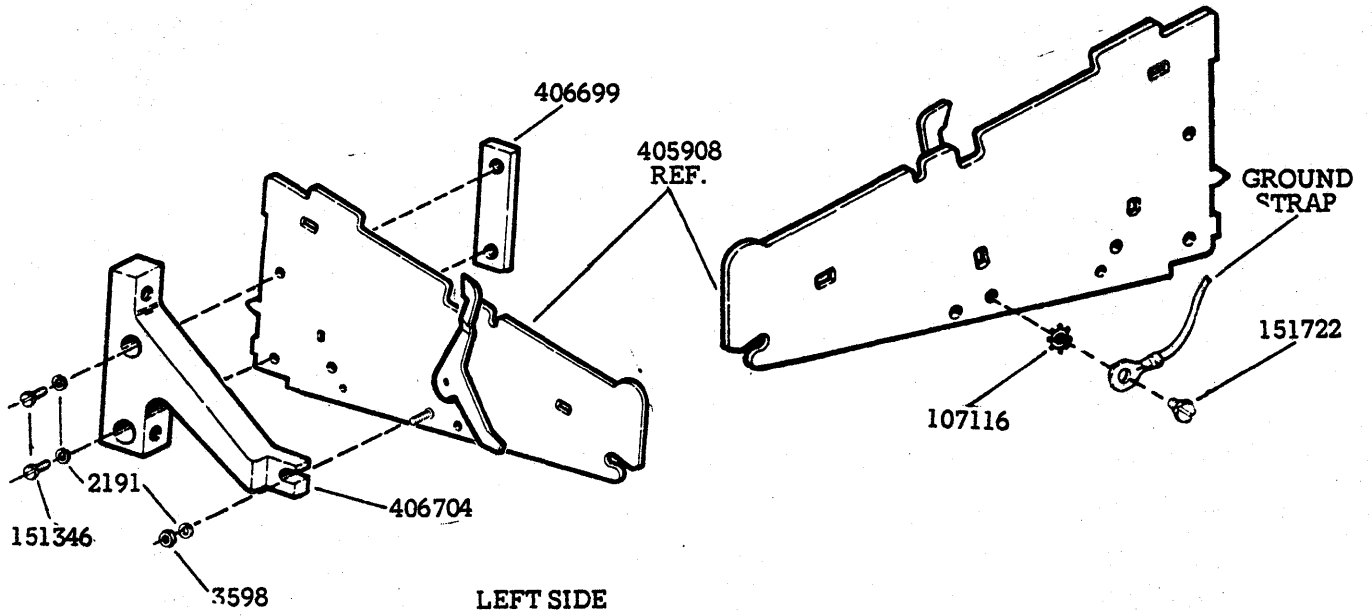
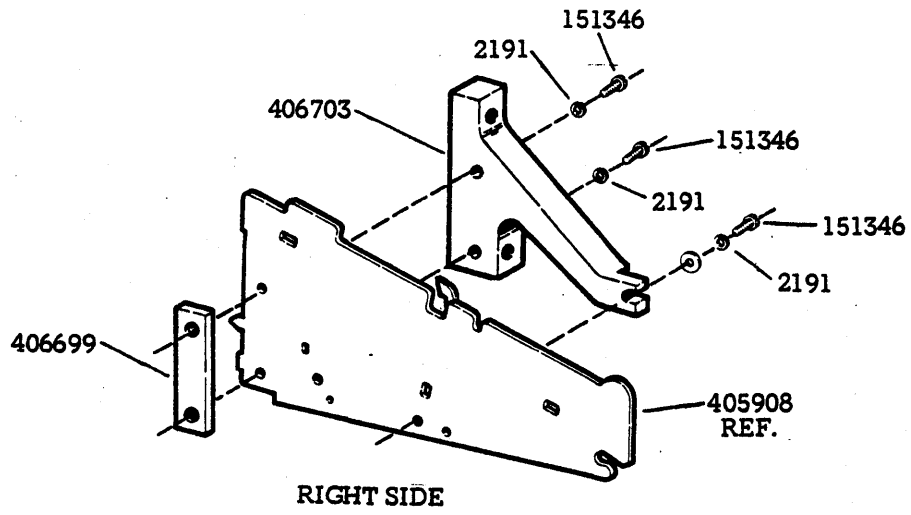


F. DISASSEMBLY/REASSEMBLY AND PARTS (Contd)

5. PARTS -- KD (Contd)

Left and Right Side Plate Mechanism



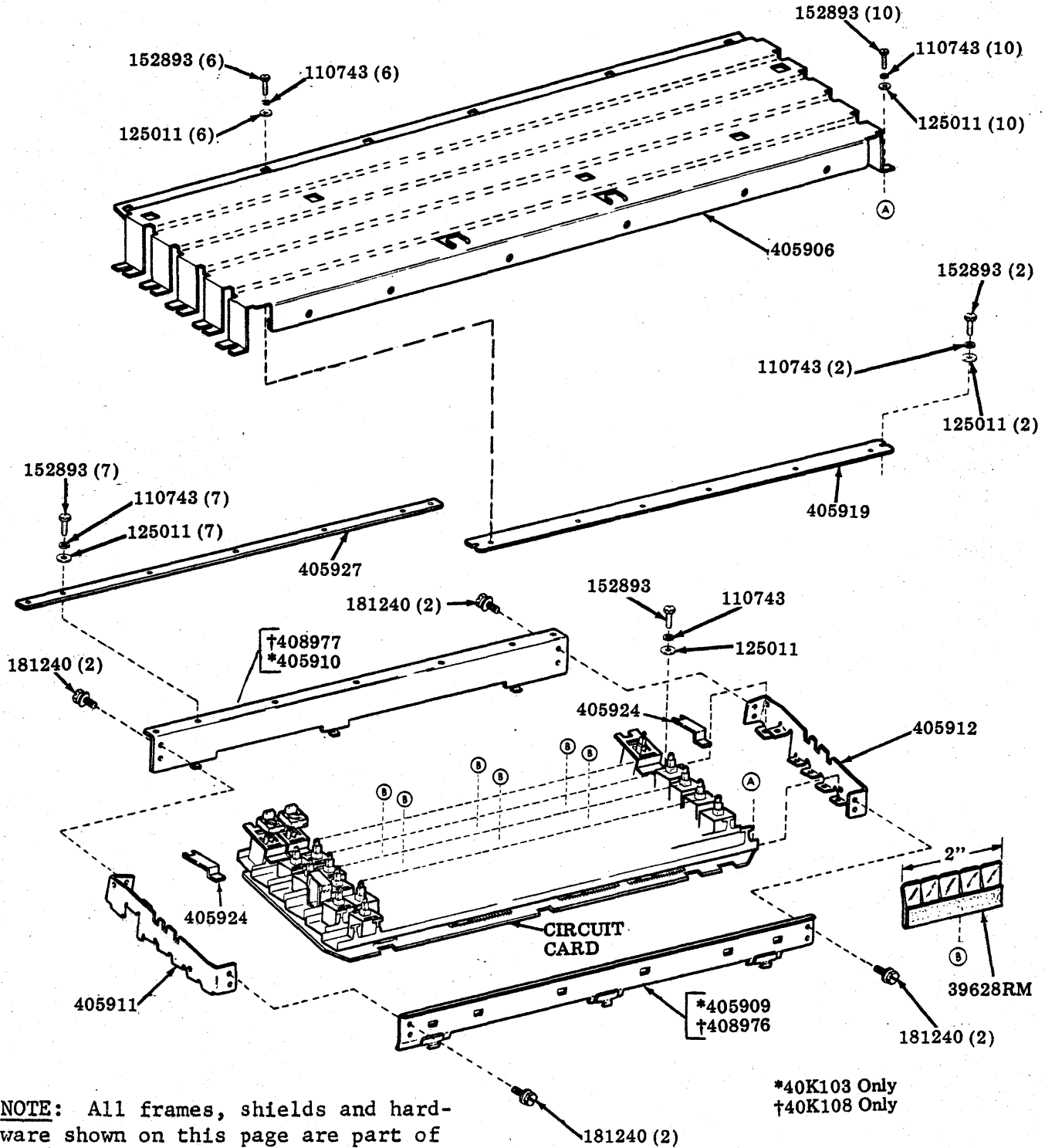


Opcons With Modification Kit 406715 Installed

F. DISASSEMBLY/REASSEMBLY AND PARTS (Cont)

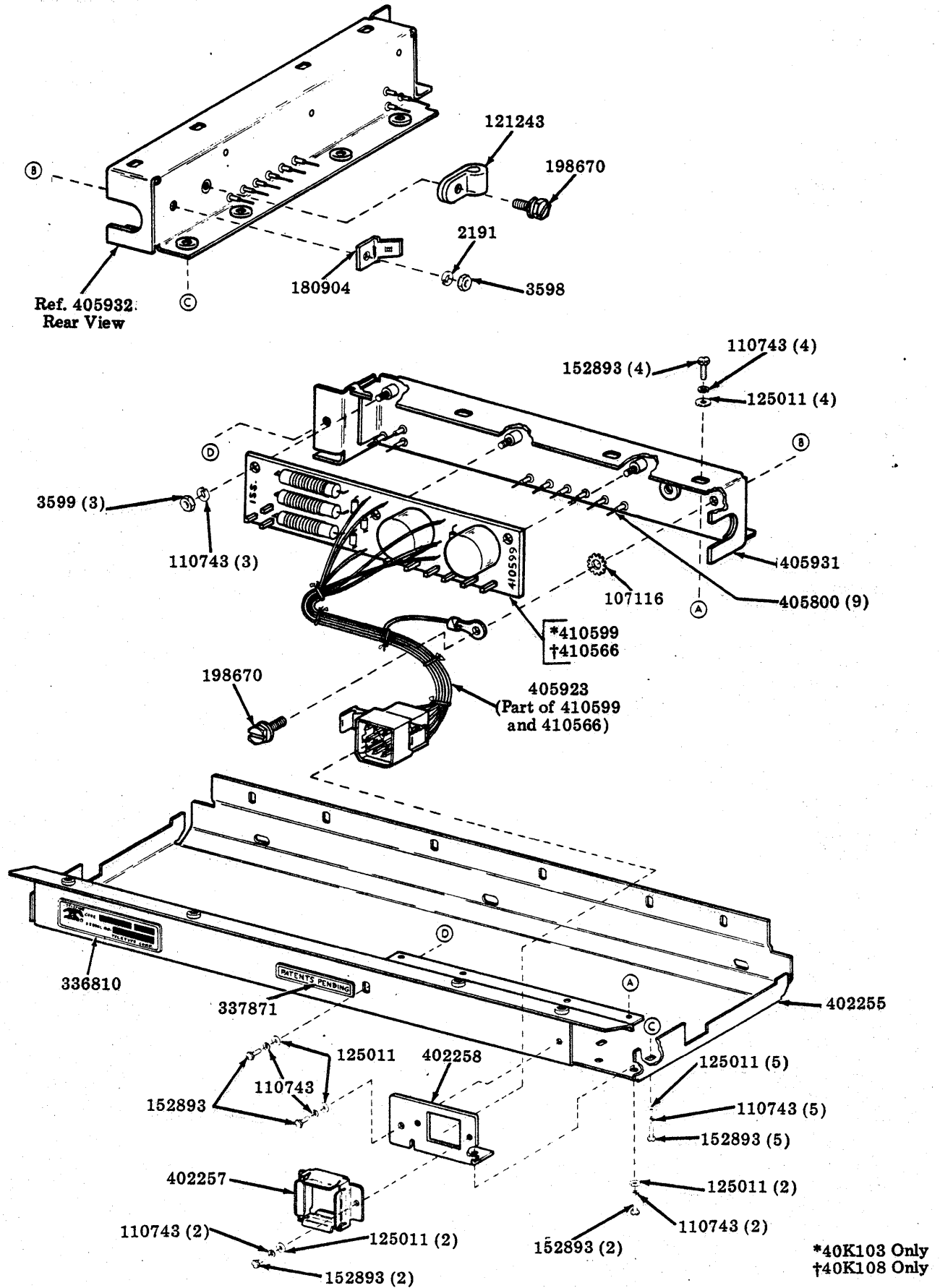
5. PARTS -- KD (Cont)

Keytop Shield and Opcon Frame



**NOTE:** All frames, shields and hardware shown on this page are part of the 410059 or 410096 circuit cards.

405931 Cover Assembly

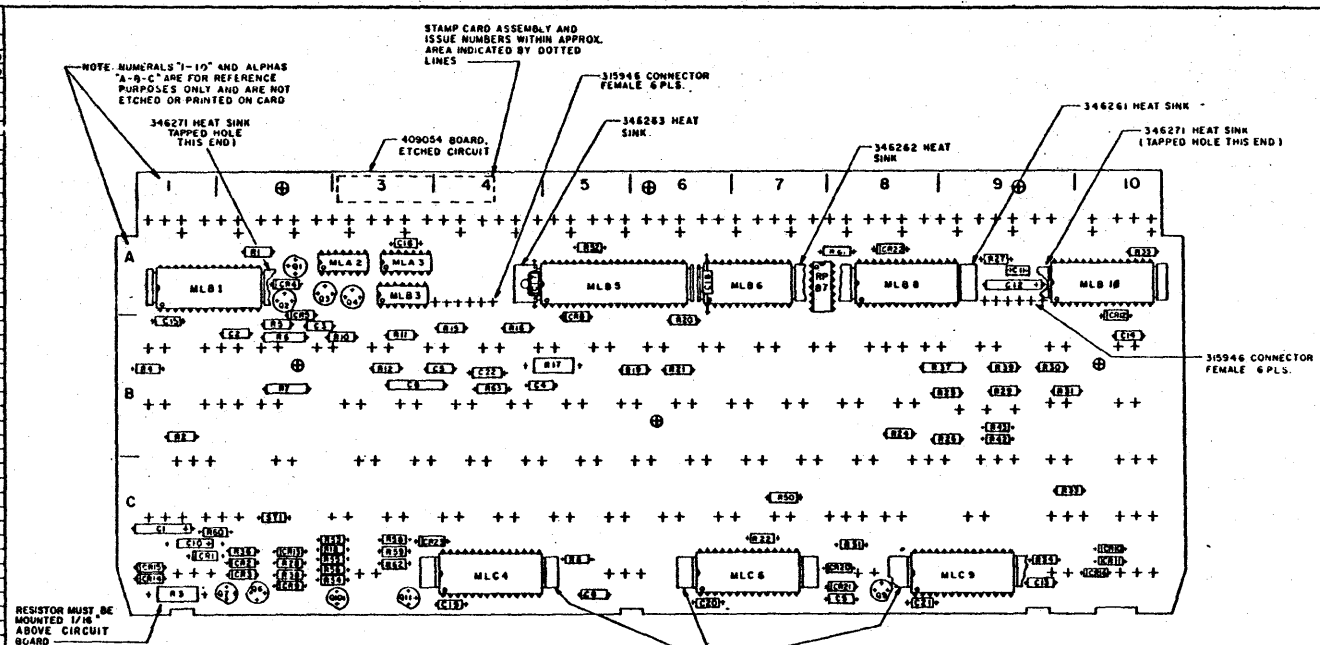


F. DISASSEMBLY/REASSEMBLY AND PARTS (Contd)

5. PARTS -- KD (Contd)

410059 Circuit Card

REF. DESIG.	PART NO	REQ	QTY	DESCRIPTION
MLB1	342289	5		SEALC APPL
MLA2	339072	2		QUAD 2 INPUT GATE (9002)
MLA3	326852	1		QUAD 3 K FLIP FLOP (852)
MLB3				SAVE AS MLB2
MLC4				SAVE AS MLB1
MLB5	342553	1		INTAF 1.5" P DRIVE
MLB6	342506	1		OPCON ROD 4
MLC6				SAVE AS MLB1
MLB8	342288	1		KEYER LOGIC 4
MLC9				SAVE AS MLB1
MLB10				SAVE AS MLB1
RPB7	341075	1		RESISTOR PACK 3GM
R1	326573	5		RESISTOR, 1.0M 1/4W
R2	315889	17		RESISTOR, 30K 1/4W
R3	184043	1		RESISTOR, 800 OHM 3W
R4	326751	2		RESISTOR, 22 OHM 1/4W
R5				SAVE AS R4
R6	131442	2		RESISTOR, 1.5K 1/2W
R7				SAVE AS R6
R8				SAVE AS R1
R10	315951	2		RESISTOR, 560 OHM 1/4W
R11	328785	1		RESISTOR, 330 OHM 1/4W
R12				SAVE AS R10
F15				SAVE AS R2
R16	320275	8		RESISTOR, 10K 1/4W
R18	171580	1		RESISTOR, 470 OHM 1/8
F18-R21				SAVE AS R2
R22				SAVE AS R1
R24-R25				SAVE AS R2
R26				SAVE AS R1M
R27				SAVE AS R2
R28	330645	1		RESISTOR, 560K 1/4W
R29-R31				SAVE AS R2
R33				SAVE AS R1M
R34-R35				SAVE AS R1
R36				SAVE AS R2
R37	182516	1		RESISTOR, 91 OHM 1/8
R38	315960	1		RESISTOR, 5.6K 1/4W
R39				SAVE AS R2

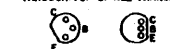


REF. DESIG.	PART NO	REQ	QTY	DESCRIPTION	REF. DESIG.	PART NO	REQ	QTY	DESCRIPTION
CR1	3001C2	1		DICKE, L4	NOTE 1	340720	57		KEYSWITCH, BASIC
CR2-CR3	333735	2		DICKE, 1M4153	NOTE 1	340721	11		KEYSWITCH, REPEAT
CR4-CR5	197454	1		DICKE, 1M4607 CR 11/914	NOTE 1	340722	1		KEYSWITCH, LATCHING
R43				SAVE AS R42	NOTE 1	405925	16		KEYSWITCH, INDICATING
				SAVE AS R2	NOTE 1	341097	3		KEYSWITCH, COMBINATION
R50	333411	3		RESISTOR, 82K 1/4W	CR9-11				
R51				SAVE AS R16	CR12	323622	1		DICKE, ZENER 1M4747A
R52				SAVE AS R2	CR13				SAVE AS CR4
R53				SAVE AS R50	CR14	1771C3	2		DICKE, C2
R54				SAVE AS R16	CR15				SAVE AS CR14
R55				SAVE AS R2	CR16				SAVE AS CR4
R56	315959	1		RESISTOR 4.7K 1/4W	CR20				SAVE AS CR4
				SAVE AS R50	CR21-23				SAVE AS CR4
R58	323148	1		RESISTOR 18K 1/4W					NOTE 1, 3 405920 8 SPACER
R60-61				SAVE AS R16					NOTE 1, 3 405921 2 SPACER
R62	321213	1		RESISTOR 1K 1/4W					NOTE 1, 3 405922 2 SPACER
R63	315961	1		RESISTOR .2K 1/4W					NOTE 5 739470H THERMAL JOINT COMP'D
C1	333727	2		CAPACITOR 6.8 MFD, 35V	NOTE 2	398288M 271			CONTACT STRIP
C2	346238	5		CAPACITOR 33PF 100V	NOTE 3	340764	1		SPRING COMPRESSION
C3	315976	1		CAPACITOR 47PF 200V		405913	1		BAIL
C4-C5	305821	2		CAPACITOR .1 MFD, 25V		405914	2		SPRING, FLAT
C6	137302	1		CAPACITOR .025 MFD 100V		340777	2		BLASPER
CR8-C9				SAVE AS C2		407-B	1		WASHER, FLAT
C10	336648	1		CAPACITOR 1MFD, 35V					NOTE 6 346261 1 HEAT SINK #/INSULATOR
C11	337330	1		CAPACITOR .1 MFD 50V					NOTE 6 346262 1 HEAT SINK #/INSULATOR
C12				SAVE AS C1					NOTE 6 346263 1 HEAT SINK #/INSULATOR
C13-C14				SAVE AS C2					NOTE 6 346264 3 HEAT SINK #/INSULATOR
C15-C21	405324	7		CAPACITOR, .1 MFD 50V	NOTE 7	405904	1		SCREW, ETCHED CIRCUIT
C22	335800	1		CAPACITOR 330PF		405910	1		FRAME, FRONT
SY1	336470	1		STRAP		405910	1		FRAME, REAR
						405911	1		FRAME, LEFT
						405912	1		FRAME, RIGHT
						181240	8		SCREW
						152293	27		SCREW
						110743	27		WASHER, LOCK
						128011	27		WASHER, FLAT

SIMILAR TO: 410084

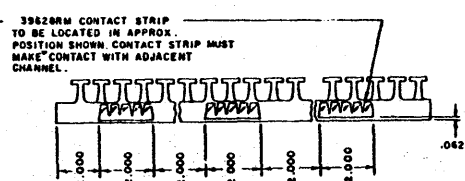
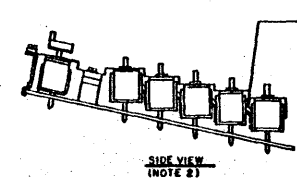
MANUFACTURING NOTES

- REFER TO 405790 ARRANGMENT DWG FOR POSITION AND PART NUMBER OF COMPONENTS AND CHANNELS.
- SEE SIDE VIEW BELOW FOR CONTACT STRIP LOCATION.
- PLACE IN MUSLIN BAG AND TIE TO ASSEMBLY.
- VIEW OF CIRCUIT CARD CONNECTIONS LOOKING THROUGH TOP OF ALL TRANSISTORS.



INFORMATION NOTES

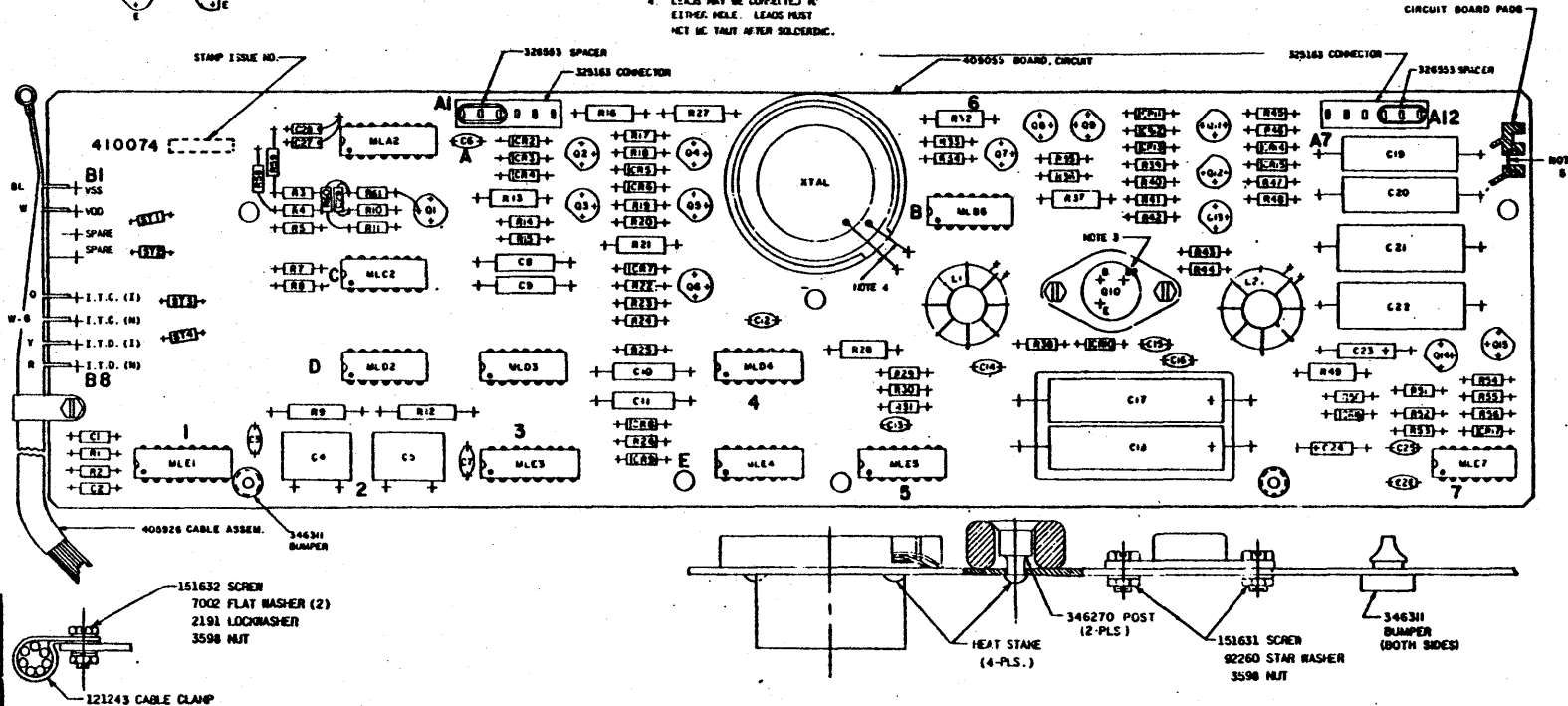
101. R11 CHANGED FROM 560 OHMS TO 330 OHMS.
102. RESISTOR R3 CHANGED FROM 600 OHM 1W TO 800 OHM 3W AT ISSUE 2A.





NOTES:

1. CARD CONNECTIONS OF TRANSISTORS VIEWED THROUGH TOP.
2. COMPONENT TOLERANCES UNLESS OTHERWISE SPECIFIED.  
RESISTORS 1%  
CAPACITORS 10%
3. HOLE NOT TO BE FILLED WITH SOLDER WHEN LEAD IS OMITTED.
4. LEADS MAY BE CONNECTED TO EITHER HOLE. LEADS MUST NOT BE TAUT AFTER SOLDERING.
5. STRAP RECTANGULAR PADS IN THIS AREA WITH 24 AWG TINNED SOLID COPPER WIRE.



REF. DESIG.	PART NO	REQ	QTY	DESCRIPTION	REF. DESIG.	PART NO	REQ	QTY	DESCRIPTION	REF. DESIG.	PART NO	REQ	QTY	DESCRIPTION	REF. DESIG.	PART NO	REQ	QTY	DESCRIPTION																
ML1	339602	2		DUAL MONOSTABLE 9602	R24	320026	1		RESISTOR 3.9K 1/4W	R54	315959	1		RESISTOR 4.7K 1/4W																					
ML2	339716	1		TRIPLE LINE REC'R 10116	CR2-3	333736	2		DIODE 1N4153	R25	324908	1		RESISTOR 30.1K 1/8W 1%	R55					LI-2	401737	2		INDUCTOR 1.48 MH											
MLC2	326853	1		DUAL J-K FLIP FLOP 853	CR4	300102	2		DIODE D4	R26				SAME AS R5	R56	333416	1		RESISTOR 470K 1/4W	XTAL	341089	1		CRYSTAL ASSEMBLY											
MLD2	326846	2		QUAD NAND GATE 846	CR5-8	197464	9		DIODE 1N4148	R27				SAME AS R13	R50-59	318002	2		RESISTOR 220Ω 1/4W																
MLD3	339408	1		QUAD AND GATE 7408	CR9	177108	2		DIODE D2	R28				SAME AS R21	R60	300092	1		RESISTOR 6.8K 1/4W																
MLE3				SAME AS MLE1	CR10	401734	1		DIODE 1N6803	R29	401066	1		RESISTOR 1K 1/8W 5%	R61	315948	1		RESISTOR 100Ω 1/4W						409055	1	BOARD, CIRCUIT								
MLD4	339601	2		SINGLE MONOSTABLE 9601	CR11				SAME AS CR4	R30				SAME AS R3																					
MLE4	326852	1		TRIPLE NAND GATE 862	CR12				SAME AS CR9	R31	401067	1		RESISTOR 2.4K 1/8W 5%																					
MLE5	326823	1		VOLTAGE REGULATOR	CR13-17				SAME AS CR5	R32				SAME AS R21	C1-2	325034	2		CAPACITOR, 120 PFD																
MLB6				SAME AS MLD4						R33	333410	3		RESISTOR 68K 1/4W	C3	305821	7		CAPACITOR .1 MFD								325163	2	POST, CONNECTOR						
MLE7				SAME AS MLD4						R34				SAME AS R5	C4-5	300256	2		CAPACITOR .001 MFD 5%									326553	2	SPACER					
										R35	335622	1		RESISTOR 68Ω 1/4W	C6-7				SAME AS C3																
										R36				SAME AS R3	C8-9	181618	2		CAPACITOR .01 MFD.																
										R37				SAME AS R21	C10	333481	1		CAPACITOR .0015 MFD.																
										R38	326573	1		RESISTOR 1.8M 1/4W	C11	333482	1		CAPACITOR .0022 MFD.																
Q1	324144	5		TRANSISTOR 2N4121	R7-8	330640	3		RESISTOR 150Ω 1/4W	R40				SAME AS R23	C12-14				SAME AS C3																
Q2-6	341091	5		TRANSISTOR 2N5845A	R9	305876	1		RESISTOR 35.7K 1/4W 1%	R41				SAME AS R5	C15-16	171567	3		CAPACITOR .005 MFD .90%																
Q7-9				SAME AS Q1	R10				SAME AS R3	R42				SAME AS R39	C17	401733	1		CAPACITOR 75 MFD.																
Q10	401735	1		TRANSISTOR, DARLINGTON	R11				SAME AS R3	R43	333407	1		RESISTOR 620Ω 1/4W	C18	401000	1		CAPACITOR 400 MFD.																
Q11-14	335241	4		TRANSISTOR	R12	323725	1		RESISTOR 27 K 1/4W 1%	R44				SAME AS R17	C19-20	148832	2		CAPACITOR 47 MFD 5%																
										R45				SAME AS R33	C21-22	199015	2		CAPACITOR .22 MFD.																
										R46	337442	3		RESISTOR 1.5K 1/2W	C23	337336	1		CAPACITOR 45 MFD																
Q15				SAME AS Q1	R14-15	328783	2		RESISTOR 180Ω 1/4W	R46-47	333417	2		RESISTOR 680K 1/4W	C24	310929	1		CAPACITOR 1.8 MFD.																
										R48				SAME AS R13	C25				SAME AS C15																
										R49	326751	3		RESISTOR 220 1/4W 10%	C2F				SAME AS C3																
										R50	321507	2		RESISTOR 1.0K 1/4W	ST1-ST4	336470	4		STRAP																
										R51	129852	5		RESISTOR 2.2K 1/2W	C27-28	341622	2		CAPACITOR 0047 MFD.																
										R52				SAME AS R7	C29	405324	1		CAPACITOR .1 MFD																
										R53	320275	2		RESISTOR 10K 1/4W																					
														SAME AS R5																					

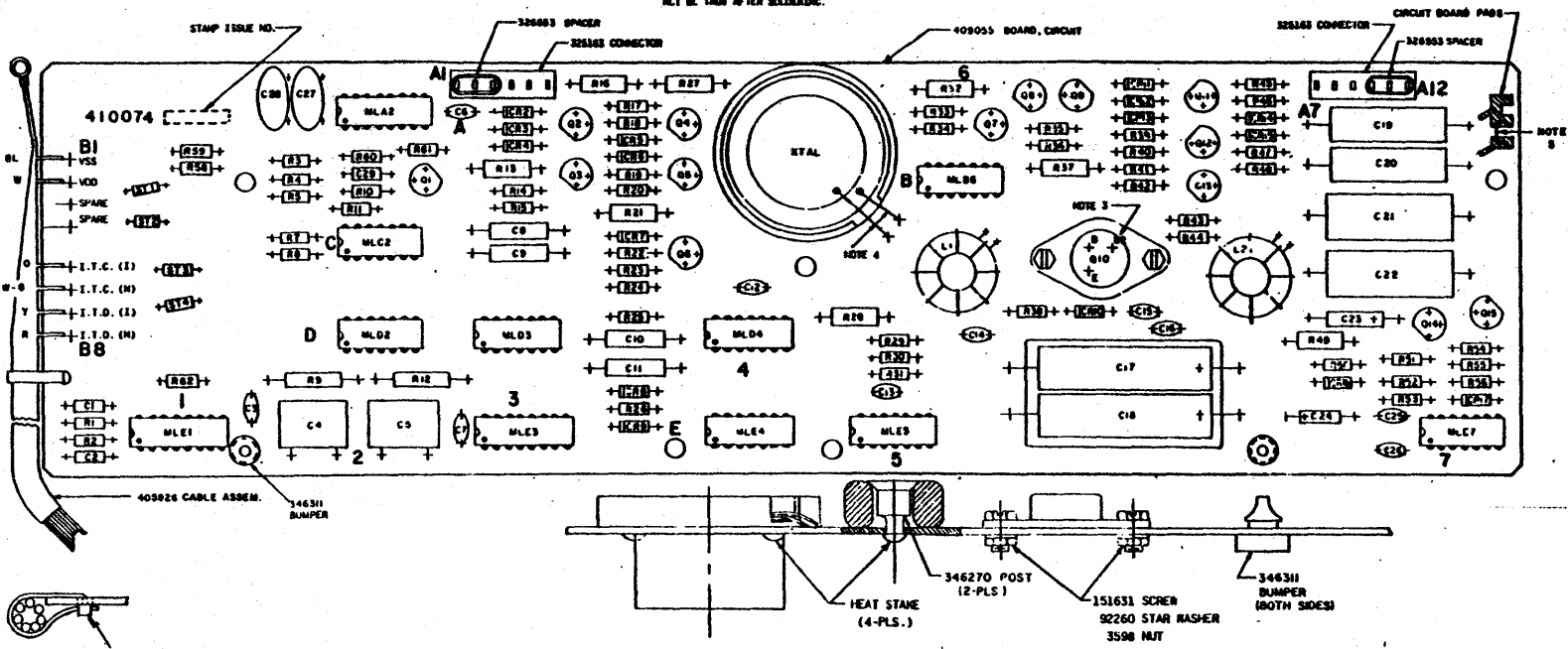
F. DISASSEMBLY/REASSEMBLY AND PARTS (Cont'd)

5. PARTS -- KD (Cont'd)

410074 Circuit Card (Late Design)

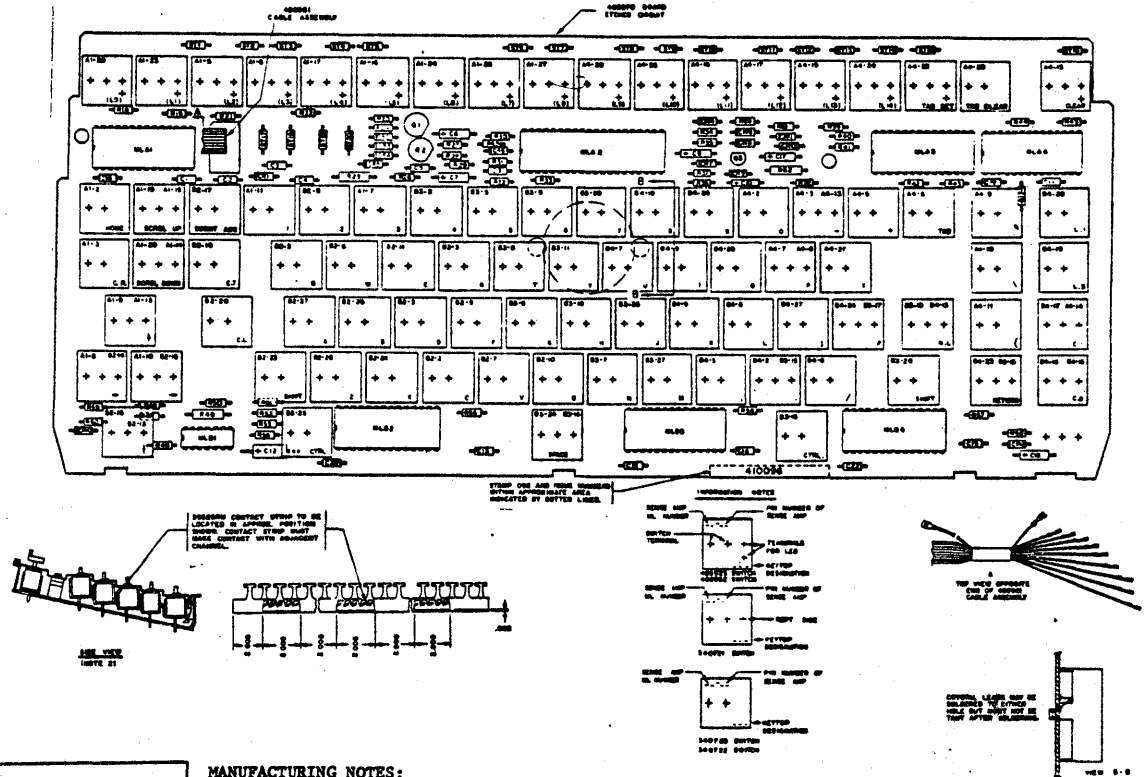
NOTES:

1. CARD CONNECTIONS OF TRANSISTORS VIEWED THROUGH TOP.
2. COMPONENT TOLERANCES UNLESS OTHERWISE SPECIFIED.  
RESISTORS 1%  
CAPACITORS 10%
3. HOLE NOT TO BE FILLED WITH SOLDER WHEN LEAD IS OMITTED.
4. LEADS MAY BE CONNECTED TO EITHER HOLE. LEADS MUST NOT BE TAUP AFTER SOLDERING.
5. STRAP RECTANGULAR PADS IN THIS AREA WITH 24 AWG TINNED SOLID COPPER WIRE.



REF. DESIG.	PART NO. REQ.	QTY	DESCRIPTION	REF. DESIG.	PART NO. REQ.	QTY	DESCRIPTION	REF. DESIG.	PART NO. REQ.	QTY	DESCRIPTION	REF. DESIG.	PART NO. REQ.	QTY	DESCRIPTION			
MLE1	339602	2	QUAL MONOSTABLE 9602	R24	320026	1	RESISTOR 3.9K 1/4W	R54	315959	1	RESISTOR 4.7K 1/4W							
MLA2	339716	1	TRIPLE LINE REC'R 10116	R25	324908	1	RESISTOR 30.1K 1/8W 1%	R55			SAME AS R3	L1-2	401737	2	INDUCTOR 1.48 MH			
MLC2	326853	1	QUAL J-K FLIP FLOP 853	CR4	300102	2	DIODE D4	R56	333416	1	RESISTOR 470K 1/4W	XTAL	341069	1	CRYSTAL ASSEMBLY			
MLD2	326846	2	QUAD NAND GATE 846	CR5-8	197464	9	DIODE 1N4148	R27			SAME AS R13	R58-59	318802	2	RESISTOR 220Ω 1/4W			
MLD3	339408	1	QUAD AND GATE 7408	CR9	177108	2	DIODE D2	R28			SAME AS R21	R60	300092	1	RESISTOR 6.8K 1/4W			
MLE3			SAME AS MLE1	CR10	401734	1	DIODE 1N5803	R29	401066	1	RESISTOR 1K 1/2W 5%	R61	315948	1	RESISTOR 100Ω 1/4W			
MLD4	339601	2	SINGLE MONOSTABLE 9601	CR11			SAME AS CR4	R30			SAME AS R3	R62			SAME AS R3			
MLE4	326862	1	TRIPLE NAND GATE 862	CR12			SAME AS CR9	R31	401067	1	RESISTOR 2.4K 1/8W 5%					346270	2	POST
MLE5	326823	1	VOLTAGE REGULATOR	CR13-17			SAME AS CR5	R32			SAME AS R21	C1-2	325034	2	CAPACITOR .12C PFD			
MLB6			SAME AS MLD2					R33	333410	3	RESISTOR 68K 1/4W	C3	305821	7	CAPACITOR .1 MFD			
MLE7			SAME AS MLD4					R34			SAME AS P5	C4-5	300256	2	CAPACITOR .001 MFD 5%			
								R35	335622	1	RESISTOR 60Ω 1/4W	C6-7			SAME AS C3			
								R36			SAME AS R3	CR-9	181618	2	CAPACITOR .01 MFD.			
								R37			SAME AS R21	C10	333481	1	CAPACITOR .0015 MFD.			
								R38	326573	1	RESISTOR 1.8M 1/4W	C11	333482	1	CAPACITOR .0022 MFD.			
								R39	315989	2	RESISTOR 30K 1/4W	C12-14			SAME AS C3			
								R40			SAME AS R23	C15-16	171567	3	CAPACITOR .005 MFD. 100%			
Q1	324144	5	TRANSISTOR 2N4121	R7-8	330640	3	RESISTOR 150Ω 1/4W	R41			SAME AS R5	C17	401733	1	CAPACITOR 75 MFD.			
Q2-6	341091	5	TRANSISTOR 2N5845A	R9	305876	1	RESISTOR 35.7K 1/4W 1%	R42			SAME AS R39	C18	401000	1	CAPACITOR 400 MFD.			
Q7-9			SAME AS Q1	R10			SAME AS R3	R43	333407	1	RESISTOR 620Ω 1/4W	C19-20	149832	2	CAPACITOR 47 MFD 5%			
Q10	401735	1	TRANSISTOR, DARLINGTON	R11			SAME AS R5	R44			SAME AS R17	C21-22	199015	2	CAPACITOR .22 MFD.			
Q11-14	333241	4	TRANSISTOR	R12	323725	1	RESISTOR 27.4K 1/4W 1%	R45			SAME AS R33	C23	337336	1	CAPACITOR 45 MFD			
								R46-47	333417	2	RESISTOR 680K 1/4W	C24	310929	1	CAPACITOR 1.8 MFD.			
Q15			SAME AS Q1	R14-15	328783	2	RESISTOR 180Ω 1/4W	R48			SAME AS R33	C25			SAME AS C15			
								R49			SAME AS R21	C2E			SAME AS C3			
								R50	319801	1	RESISTOR 47K 1/4W	ST1-ST4	336470	4	STRAP			
								R51			SAME AS R7	C27-28	341622	2	CAPACITOR .0047 MFD.			
								R52			SAME AS R3	C29	405324	1	CAPACITOR .1 MFD			
								R53			SAME AS R5				92260	2	WASHER, STAR	
															3598	2	NUT, HEX.	
															346311	2	BUMPER	

410096 Circuit Card



REF. DESIG.	PART NO.	QTY.	DESCRIPTION
MLA1	342280	5	SENSE AMP. TSA -2L
MLA4			Same as MLA1
MLA2	342236	1	LD10
MLA3	342244	1	TKL - 2/40
MLB1	404027	1	Clock Driver
MLB2-4			Same as MLA1
R64			Same as R31
R17			Same as R18
R18	320275	9	Resistor, 10K OHM 1/4W
R19	328573	5	Resistor, 1.8K OHM 1/4W
R20	320273	3	Resistor, 7.5K OHM 1/4W
R21	315954	1	Resistor, 1.5K OHM 1/4W
R22			Same as R18
R24	323148	3	Resistor, 18K OHM 1/4W
R25	137440	2	Resistor, 1K OHM 1/2W
R26	315959	2	Resistor, 4.7K OHM 1/4W
R27			Same as R24
R28			" " R20
R29	330641	1	Resistor, 1M OHM 1/4W
R30			Same as R20
R31-32	321508	8	Resistor, 100K OHM 1/4W
R33			Same as R26
R34	300092	1	Resistor, 6.8K OHM 1/4W
R35	315957	1	Resistor, 3.3K OHM 1/4W
R36			Same as R31
R37	318801	1	Resistor, 4.7K OHM 1/4W
R38			Same as R31
R39			" " R18
R40			" " R31
R41	315989	1	Resistor, 30K OHM 1/4W
R42-44			Same as R18
R45			" " R19
R46	321213	4	Resistor, 1K OHM 1/4W
R47	320276	1	Resistor, 470 OHM 1/4W
R48			Same as R25
R49			" " R18
R50			" " R46
R52	315948	1	Resistor, 100 OHM 1/4W
R53			Same as R24
R55-57			" " R19
R58			Same as R31

MANUFACTURING NOTES:

1. Refer to 40K108-AC Analysis Chart for position B part number of components and channel assembly information.
2. See side view for contact strip location.
3. Place in Muslin bag and tie to assembly.
4. Etched circuit board to be issue 4A or higher.
5. Refer to 40K/MC for label location.

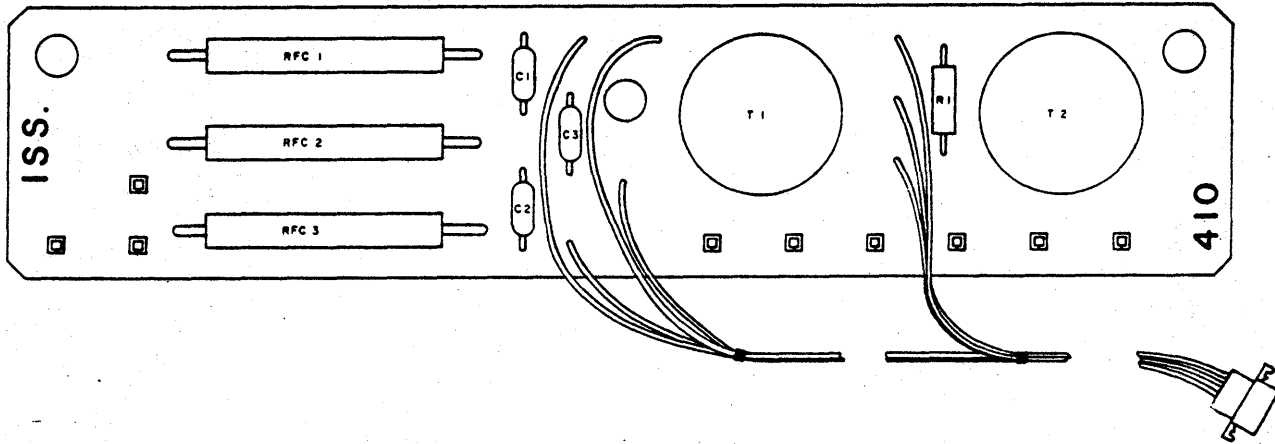
REF. DESIG.	PART NO.	QTY.	DESCRIPTION
R59-60			Same as R46
R61			Same as R31
R62	137603	1	Resistor, 510 OHM 1/2W
R63	328785	1	Resistor, 330 OHM 1/4W
R64			Same as R18
CR1	346894	1	Diode, Zener IN4730A
CR2-4	197464	12	Diode, IN4148
CR5	405688	1	Diode, IN756A
CR6-13			Same as CR2
CR14	323606	1	Diode, Zener IN4747A
CR15			Same as CR2
C1	346325	5	Capacitor, 33PF
C2-5	406324	10	Capacitor, 0.1 MFD
C6	310929	3	Capacitor, 1.5 MFD
C7	315939	1	Capacitor, .0022 MFD
C8	346831	1	Capacitor, 10 PF
C9	310921	1	Capacitor, .022 MFD
C10			Same as C2
C11			" " C1
C12	333727	1	Capacitor, 6.8 MFD
C13-15			Same as C1
C16, C17			" " C8
C18-22			Same as C2
Q1-2	325077	2	Transistor, 2N4355
Q3	333241	1	Transistor, 2N4401
ST1-30	336470	20	Strip, Wire
	340730	6	Channel
	405915	2	Shield
	405906	1	Shield, Keypop
	405919	1	Bar
	405927	1	Bar

REF. DESIG.	PART NO.	QTY.	DESCRIPTION
	405924	2	Filler
Note 1	405970	1	Cap. Filler
Note 1,3	405920	5	Spacer
Note 1,3	405921	3	Spacer
Note 1,3	405925	2	Spacer
Note 1	340730	67	Keyswitch, Basic
Note 1	340731	14	Keyswitch, Repeat
Note 1	340732	1	Keyswitch, Latch
Note 1	405963	15	Keyswitch, Indicator
Note 1	405926	1	Keyswitch, Indicator
Note 4	409070	1	Etched Circuit Board
	408976	1	Frame, Front
	408977	1	Frame, Rear
	406911	1	Frame, Left
	406912	1	Frame, Right
	181240	8	Screw W/Washer
Note 1	340762	1	Housing Assembly
Note 1	340770	2	Guide, Space Bar
	405999	1	Bar Assm. Space
Note 2	398258M	2 Ft.	Contact Strip
Note 3	340764	1	Spring, Compression
	405913	1	Ball
	405914	2	Spring, Flat
	340777	2	Bumper
	98718	1	Washer, Flat
	346370	1	Crystal Assembly
	408961	1	Cable Assembly
	152893	27	Screw
	110743	27	Washer, Lock
	125011	27	Washer, Flat

F. DISASSEMBLY/REASSEMBLY AND PARTS (Contd)

5. PARTS -- KD (Contd)

410566 and 410599 Circuit Card



410566 Circuit Card

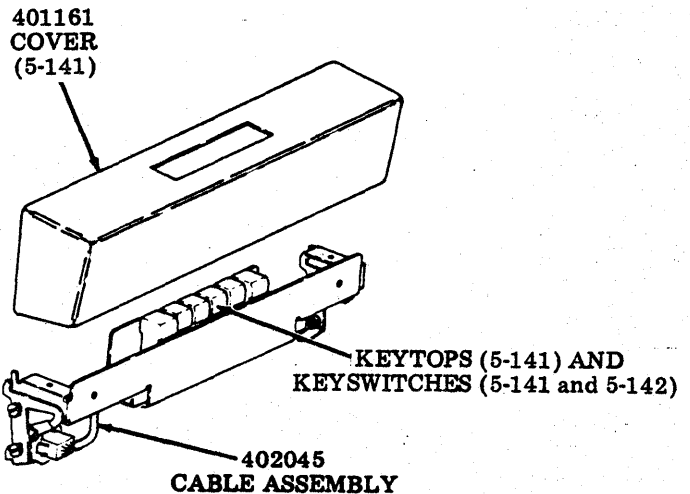
REF DESIG.	PART NO REQ	QTY	DESCRIPTION
R1	315948	1	RESISTOR, 100Ω 1/4 W
C1	405324	3	CAPACITOR, .1MFD 50V
C2			SAME AS C1
C3			SAME AS C1
T1	403658	2	TRANSFORMER
T2			SAME AS T1
RFC 1	405930	3	CHOKE, R. F.
RFC 2			SAME AS RFC 1
RFC 3			SAME AS RFC 1
	403611	9	RECEPTACLE
	405923	1	CABLE ASSEMBLY
	409599	1	CIRCUIT BOARD

410590 Circuit Card

REF DESIG.	PART NO REQ	QTY	DESCRIPTION
R1	315948	1	RESISTOR, 100Ω 1/4 W
C1	405324	3	CAPACITOR, .1MFD 50V
C2			SAME AS C1
C3			SAME AS C1
T1	403658	2	TRANSFORMER
T2			SAME AS T1
RFC 1	405930	3	CHOKE, R. F.
RFC 2			SAME AS RFC 1
RFC 3			SAME AS RFC 1
	403611	9	RECEPTACLE
	405923	1	CABLE ASSEMBLY
	409599	1	CIRCUIT BOARD

6. SUBASSEMBLY IDENTIFICATION -- RO

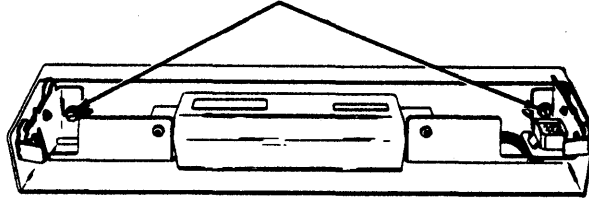
**NOTE:** The number indicated in parentheses after each assembly designates the page covering the disassembly/reassembly procedures.



7. DISASSEMBLY/REASSEMBLY -- RO

401161 Cover

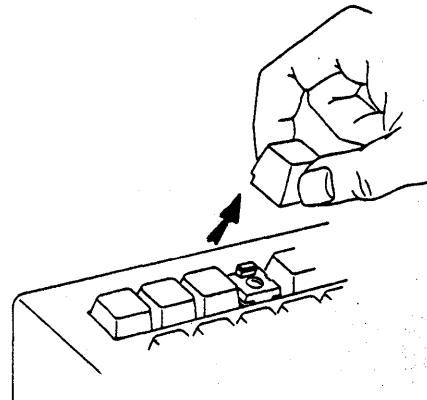
Remove two 184056 screws w/lockwashers mounting cover to keyswitch bracket.



Keytops

- ① Grasp keytop using thumb and index finger.
- ② Exert upward force until keytop releases.

**CAUTION:** BLOCKING KEYTOPS ARE NOT THE SAME ON THE FRONT AND REAR SIDE AND MUST BE ASSEMBLED WITH THE PROPER ORIENTATION.

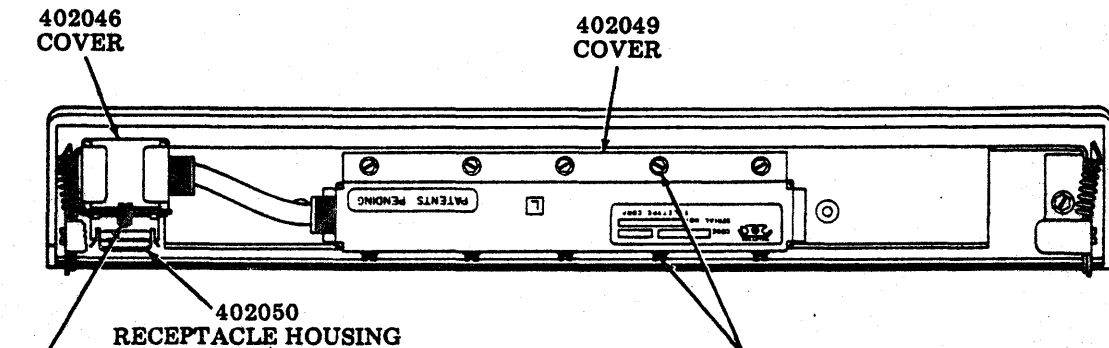


Profile of Blocking Keytop

In reassembly of blocking keytops, position blocking keytop over switch housing until ridges are retained by notches in switch body.

Keyswitches

- Remove 401161 cover (see above).
- Remove keytops (see above).



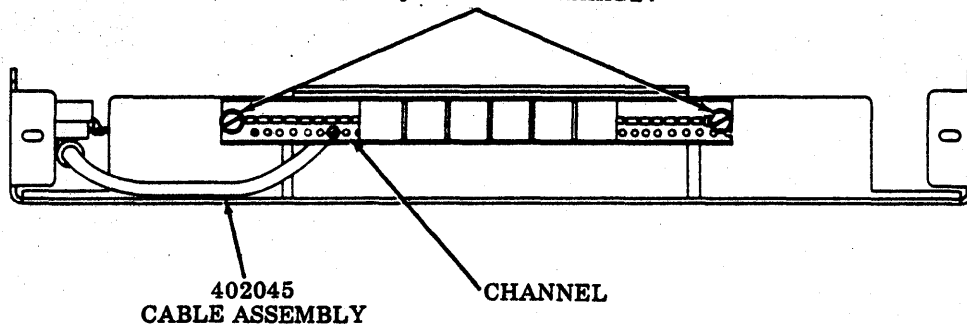
- ② Remove two 152893 screws, 110743 lockwashers and 3599 nuts. Remove 402050 receptacle housing and 402046 cover. Unsnap 401149 connector from bracket.

- ① Remove ten 151152 screws, 110743 lockwashers and 125011 flat washers. Remove 402049 cover.

F. DISASSEMBLY/REASSEMBLY AND PARTS (Contd)

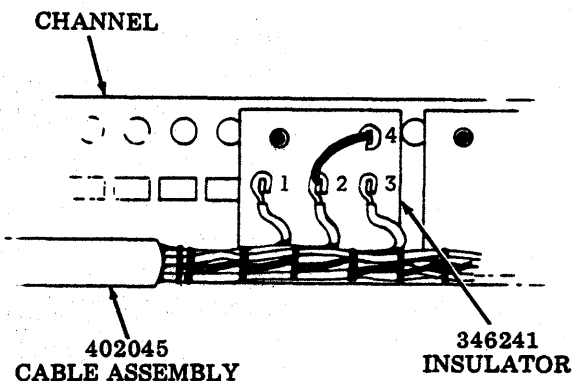
7. DISASSEMBLY/REASSEMBLY -- RO (Contd)

- ③ Remove two 184056 screws w/lockwashers securing keyswitch channel.



- ④ Remove solder from terminal pins securing cable leads and jumpers, and remove insulator.

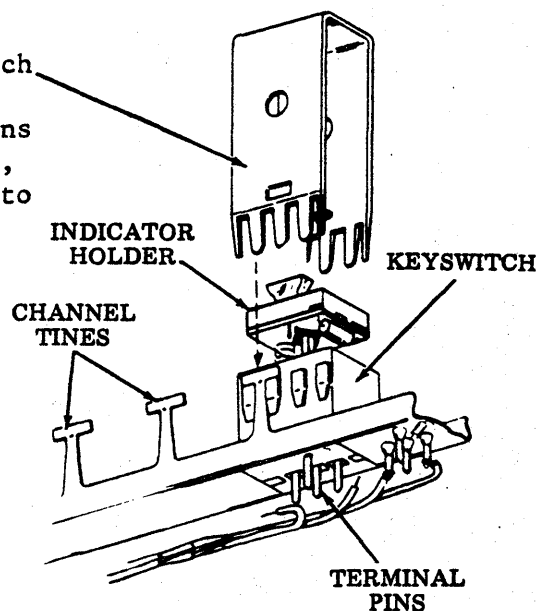
**CAUTION:** USE A LOW WATTAGE SOLDERING IRON (AVOID PROLONGED CONTACT WITH PINS) ALONG WITH A DESOLDERING TOOL TO PREVENT DAMAGE TO CABLE LEADS.



- ⑤ Place 346257 tool over keyswitch and press downward. When tool bottoms and embossed projections snap into notches on keyswitch, squeeze and pull back on tool to lift keyswitch out.

**NOTE:** The tool tines must pass between keyswitch housing and inside of channel tines.

In reassembly, insert new keyswitch, observe position of locating lug, and press keyswitch into channel. Switch must snap fully into front and rear channel tines. Before resoldering, replace insulator, hold keyswitch in place and resolder.

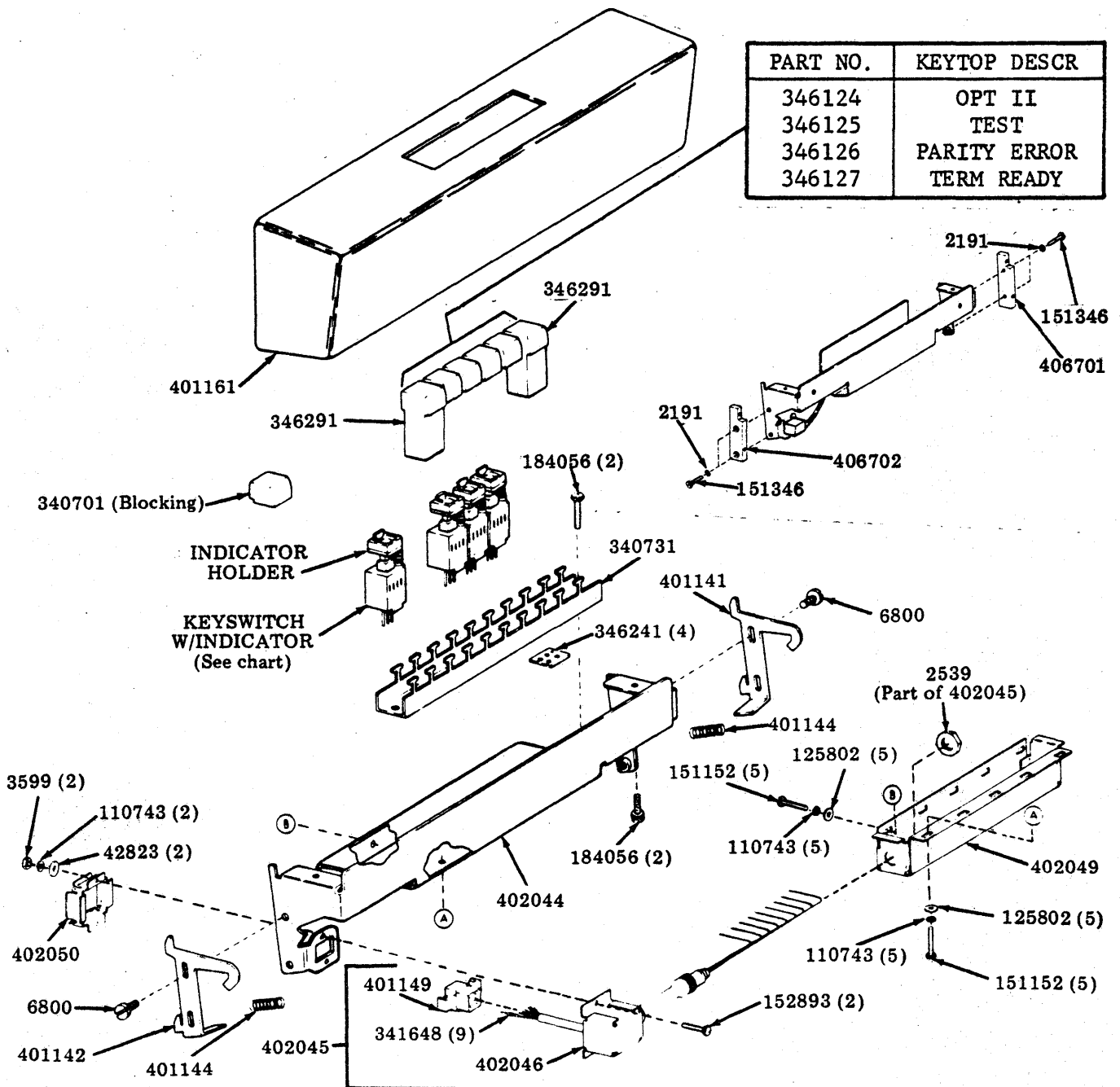


8. PARTS -- RO

PIN	
1	R
2	Y
3	G
4	W-BL
5	BR
6	O
7	BL
8	W
9	BK

KEYTOP DESCR	SWITCH NO.	INDICATOR HOLDER COLOR	PUSH ROD COLOR
OPT II	346214	White	PURPLE
TEST	346215	Light Gray	PURPLE
PARITY ERROR	346213	Light Gray	BLUE
TERM READY	346212	White	BLUE

**NOTE:** Early design key-switches have the part number stamped on the keyswitch housing.



PART NO.	KEYTOP DESCR
346124	OPT II
346125	TEST
346126	PARITY ERROR
346127	TERM READY

F. DISASSEMBLY/REASSEMBLY AND PARTS (Contd)9. COMPONENT PARTS LIST -- KD AND RO

NOTE: When ordering parts, prefix each number with the letters "TP".

Part Number	Description and Page Number	Part Number	Description and Page Number	Part Number	Description and Page Number
2191	Lockwasher 129,132, 133,135,137,143	171567	Capacitor, .005 MFD 137,138	315961	Resistor 8.2K OHM 136
2539	Nut, 3/8-32 Hex 143	171580	Resistor, 470 OHM 136	315976	Capacitor, 470 PF 136
3598	Nut, 6-40 Hex 129, 133,135,137,138	177108	Diode 136,137,138	315989	Resistor 136,137, 138,139
3599	Nut, 4-40 Hex 129, 133,141,143	180904	Tab, Terminal 129,135	318801	Resistor, 47000 OHM 137,138,139
6800	Screw, 6-40 Shoulder 143	181240	Screw w/Lockwasher, 6-40 x 3/16 Hex 134, 136,139	318802	Resistor, 220 OHM 137,138
7002	Washer, Flat 137	181618	Capacitor, .01 MFD 137,138	320026	Resistor, 3.9K OHM 137,138
42823	Washer, Flat 143	182516	Resistor, 91 OHM 136	320273	Resistor, 7.5 OHM 139
92260	Washer, Lock 137,138	184043	Resistor, 800 OHM 136	320275	Resistor, 10000 OHM 136,137,138,139
98718	Washer, Flat 130,131, 139	184056	Screw w/Lockwasher 6-40 x 1/4 Hex 124, 132,141,142,143	320276	Resistor, 10K OHM 139
107116	Lockwasher 125,129, 132,133,135	197464	Diode 136,137,138, 139	321213	Resistor 136,137, 138,139
110743	Lockwasher 124,129, 134,135,136,139,141, 143	198670	Screw w/Lockwasher, 6-40 x 5/16 Hex 129, 135	321507	Resistor, 1.8K OHM 137,138
119649	Ring, Retaining 132	199015	Capacitor, .22 MFD 137,138	321508	Resistor, 100000 OHM 139
121243	Clamp, 3/16 ID Cable 135,137	300092	Resistor 6.8K OHM 137,138,139	323148	Resistor, 18,000 OHM 136,139
125011	Washer, Flat 124,129, 133,135,136,139,141	300102	Diode 136,137,138	323606	Diode 136,139
125258	Spring 132	300256	Capacitor, .001 MFD 137,138	323725	Resistor, 27.4K OHM 137,138
125802	Washer, Flat 143	305821	Capacitor, .1 MFD 136,137,138	324144	Transistor 136,137,138
129852	Resistor, 2,200 OHM 137,138	305876	Resistor, 35.7K OHM 137,138	324903	Resistor, 7.5K OHM 137,138
137302	Capacitor 136	310921	Capacitor, .022 MFD 139	324908	Resistor, 30.1K OHM 137,138
137440	Resistor, 1,000 OHM 139	310923	Capacitor, .39 MFD 139	325034	Capacitor 137,138
137442	Resistor, 1500 OHM 136,137,138	310929	Capacitor, 1.8 MFD 137,138	325077	Transistor 139
137603	Resistor, 510 OHM 139	310929	Capacitor, 1.8 MFD 137,138	325163	Connector 137,138
148832	Capacitor, .47 MFD 137,138	315939	Capacitor, .002 MFD 139	326553	Spacer 137,138
151152	Screw, 6-40 x 3/16 Hex 141,143	315946	Connector 136	326573	Resistor 136,137,138, 139
151346	Screw, 6-40 x 3/8 Fil 133,143	315948	Resistor, 100 OHM 137,138,139,140	326602	Resistor, 360 OHM 137,138
151631	Screw, 6-40 x 5/16 Hex 137,138	315951	Resistor, 560 OHM 136	326751	Resistor, 22 OHM 136,137,138
151632	Screw, 6-40 x 3/8 Hex 137	315954	Resistor 139	326823	Circuit, Integrated 137,138
151722	Screw, 6-40 x 3/16 Hex 125,132,133	315957	Resistor, 3300 OHM 139	326846	Circuit, Integrated 137,138
152893	Screw, 6-40 x 1/4 Hex 124,129,134, 135,136,139,141, 143	315959	Resistor, 4700 OHM 136,137,138,139	326852	Circuit, Integrated 136,137
170282	Nut, 6-40 Hex 132			326853	Circuit, Integrated 137,138



Part Number	Description and Page Number	Part Number	Description and Page Number	Part Number	Description and Page Number
328783	Resistor 137,138	340777	Bumper 130,131, 136,139	401145	Latch, Left Cover 132
328785	Resistor 136,139	341075	Resistor 136	401146	Latch, Right Cover 132
330640	Resistor, 150 OHM 137,138,139	341089	Crystal 137,138	401149	Connector 129,141, 143
330641	Resistor 139	341091	Transistor 136,137, 138	401161	Cover 140,141,143
330645	Resistor, 560, 000 OHM 136	341097	Keyswitch, Combina- tion 130,136	401733	Capacitor 137,138
333241	Transistor 137,138, 139	341622	Capacitor 137,138	401734	Diode 137,138
333407	Resistor, 620 OHM 137,138	341648	Terminal 143	401735	Transistor 137,138
333410	Resistor 137,140	342236	Circuit, Integrated 139	401737	Inductor 137
333411	Resistor 136	342244	Circuit, Integrated 139	402044	Bracket 143
333416	Resistor 137,138	342280	Circuit, Integrated 139	402045	Cable Assembly 140,142,143
333417	Resistor 137,138	342288	Logic Assembly 136	402046	Cover 141,143
333481	Capacitor 137,138	342289	Amplifier 136	402049	Cover 141,143
333482	Capacitor 137,138	342506	Logic Assembly 136	402050	Housing, Receptacle 141,143
333727	Capacitor 136,139	342553	Logic Assembly 136	402255	Pan 123,124,125, 128,129,135
333736	Diode 136,137,138	346124	Keytop 143	402256	Plate 124
334665	Diode 136	346125	Keytop 143	402257	Housing, Receptacle 135
335622	Resistor 137,138	346126	Keytop 143	402258	Bracket 135
335800	Capacitor 136	346127	Keytop 143	403611	Receptacle 140
336470	Strap 136,137,138, 139	346212	Keytop 143	403658	Transformer 140
336810	Plate, Identification 135	346213	Keytop 143	404027	Driver 139
336948	Capacitor 136	346214	Keytop 143	405324	Capacitor 136,137, 138,139,140
337330	Capacitor 136	346215	Keytop 143	405688	Diode 139
337336	Capacitor 137,138	346238	Capacitor 136,139	405800	Filter 135
337871	Plate, Identification 135	346241	Insulator 142,143	405870	Cap 130,131,136, 139
339002	Circuit, Integrated 136	346257	Extractor, Keyswitch 128,142	405906	Shield, Keytop 127, 128,134,136,139
339408	Circuit, Integrated 137,138	346260	Extractor, Keytop 126	405908	Plate 132,133
339601	Circuit, Integrated 137,138	346261	Sink, Heat 136	405909	Frame, Front 134, 136
339602	Circuit, Integrated 137,138	346262	Sink, Heat 136	405910	Frame, Rear 134,136
339716	Circuit, Integrated 137,138	346263	Sink, Heat 136	405911	Frame, Left 134,136, 139
340701	Keytop 143	346264	Sink, Heat 136	405912	Frame, Right 134, 136,139
340720	Keyswitch, Basic 130, 131,136,139	346266	Post 137,138	405913	Bail 126,130,131, 136,139
340721	Keyswitch, Repeat 130,131,136,139	346270	Sink, Heat 136	405914	Spring 130,131, 136,139
340722	Keyswitch, Latching 130,131,136,139	346271	Spacer 143	405915	Shield 139
340730	Channel 130,131, 136,139	346291	Bumper 137,138	405919	Bar 127,134,136, 139
340731	Channel 143	346311	Capacitor 139	405920	Spacer 130,131, 134,136,139
340762	Housing 130,131, 136,139	346351	Crystal 139	405921	Spacer 130, 131, 136,139
340764	Spring, Compression 127,130,131,136,139	346370	Diode 139	405922	Spacer 130,131, 136,139
340767	Keytop Assembly 127	401000	Capacitor 137,138	405923	Cable Assembly 135,140
340770	Guide 130,131,136, 139	401066	Resistor 137,138		
		401067	Resistor 137,138		
		401100	Cover 123,124, 126,128		
		401136	Plate, Spring 132		
		401139	Post, Spring 132		
		401141	Latch, Left Plate 132,143		
		401142	Latch, Right Plate 132,143		
		401143	Screw, 6-40 x 11/32		
		401144	Shoulder 132		
			Spring 132,143		

F. DISASSEMBLY/REASSEMBLY AND PARTS (Contd)

9. COMPONENT PARTS LIST -- KD AND RO (Contd)

Part Number	Description and Page Number	Part Number	Description and Page Number	Part Number	Description and Page Number
405924	Filler 136,139	406703	Support, Right 133	410051	Card, Circuit 123, 130
405925	Keyswitch, Indicator 130,131,136,139	406704	Support, Left 133	410059	Card, Circuit 134, 136
405926	Cable Assembly 123, 125,129,137,138	406959	Extractor 127	410074	Card, Circuit 123, 128,137,138
405927	Bar 127,134,136, 139	408961	Cable Assembly 139	410086	Card Circuit 123
405930	Choke, R.F. 140	408962	Keyswitch 131,139	410096	Card, Circuit 131, 134,139
405931	Cover Assembly 123,129,135	408976	Frame, Front 134, 139	410566	Card, Circuit 123, 129,140
405999	Spacebar 126,139	408977	Frame, Rear 134, 139	410590	Card, Circuit 140
406618	Spring 132	409054	Board, Circuit 136	410599	Card, Circuit 123, 129,135,140
406699	Plate, Nut 133	409055	Board, Circuit 137, 138		
406701	Support, Right 143	409070	Board, Circuit 139		
406702	Support, Left 143	409599	Board, Circuit 140		





**TELETYPE CORPORATION**  
5555 Touhy Avenue, Skokie, Illinois 60077  
Telephone: (312) 982-2000

**MANUAL 359**  
Issue 2, February 1982  
T.O. 31W4-4-300-1