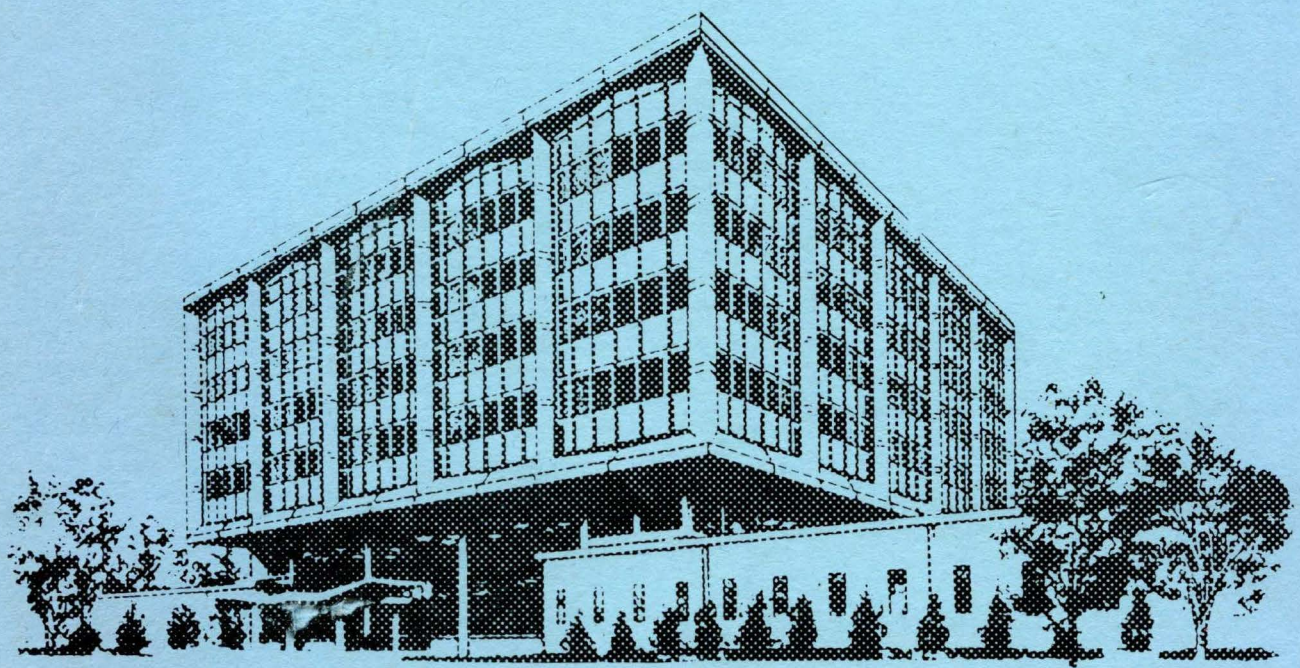
SANDERS DATA SYSTEMS

MAINTENANCE MANUAL

3720 MAGNETIC TAPE TRANSPORT AND CONTROLLER



SANDERS DATA SYSTEMS, INC.

A Subsidiary of Sanders Associates, Inc.

PUBLICATION NO. 7013417H005
(8000 SERIES)

*T.M. Sanders Associates, Inc.

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MAINTENANCE MANUAL

3720 MAGNETIC TAPE TRANSPORT AND CONTROLLER

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A Subsidiary of Sanders Associates, Inc.

Daniel Webster Highway, South — Nashua, New Hampshire 03060

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LIST OF EFFECTIVE PAGES

Total number of pages in this publication is 185.

TABLE OF CONTENTS

PART 1 MAGNETIC TAPE TRANSPORT MAINTENANCE

SECTION 1

INTRODUCTION

SECTION 2

INSTALLATION

TABLE OF CONTENTS (Cont.)

TABLE OF CONTENTS (Cont.)

TABLE OF CONTENTS (Cont.)

TABLE OF CONTENTS (Cont.)

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS

LIST OF TABLES

PART 2 CONTROLLER INTERFACE MAINTENANCE

SECTION 1

INTRODUCTION

SECTION 2

INSTALLATION

TABLE OF CONTENTS (Cont.)

TABLE OF CONTENTS (Cont.)

LIST OF ILLUSTRATIONS

LIST OF TABLES

PART 1
MAGNETIC TAPE TRANSPORT MAINTENANCE

SECTION 1

INTRODUCTION

1.1 GENERAL

This manual contains material required to service and maintain the Sanders Model 3720 Magnetic Tape Transport (tape transport), and includes installation, operational procedures, troubleshooting procedures and other maintenance aids.

In the 8090 Magnetic Tape Pooler System (pooler) configuration, external control of the tape transport is accomplished at the keyboard under control of the Pooler Applications program.

Interface requirements between the tape transport and pooler microprocessor are established in the controller interface, hereafter referred to as the controller.

The controller consists of 4 printed circuit cards, located in the pooler microprocessor assembly. Maintenance support of the controller is provided in Attachment I of this manual.

1.2 TAPE TRANSPORT DESCRIPTION

The tape transport shown in figure 1-1 includes the electro-mechanical components and circuitry required to move the tape and record data.

The tape transport contains four basic functional circuits: 1) motor control circuits, 2) write logic, 3) read logic, and 4) power supply.

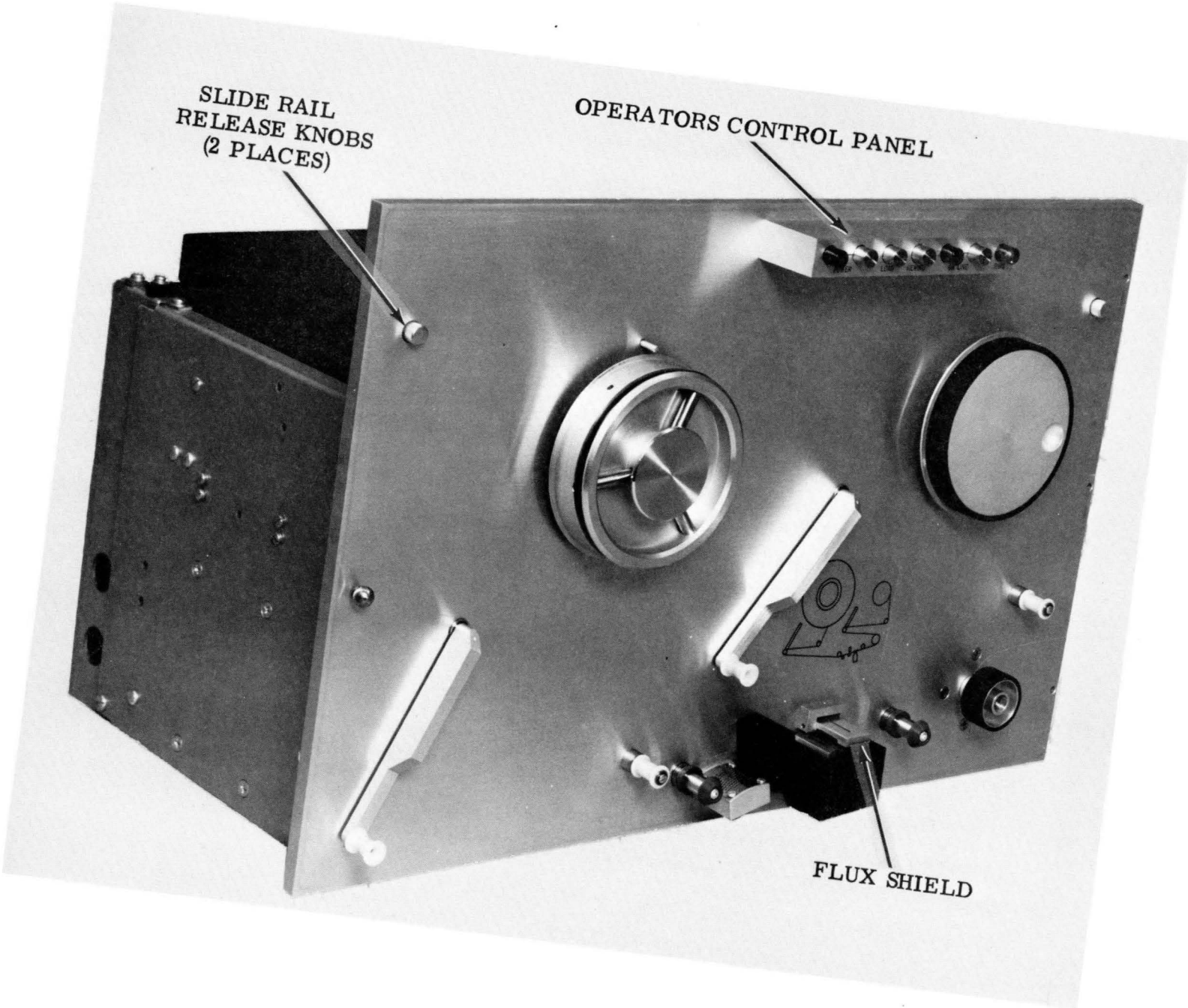

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Figure 1-1. Model 3720 Magnetic Tape Transport.

1.3 SPECIFICATIONS

	MODEL 3720
REEL DIAMETER	8.5 in.----------21.59 cm
TAPE CAPACITY	1200 ft.----------365.76 cm
TAPE SPEED	25 ips----------63.5 cm/s
REWIND SPEED	100 ips----------250 cm/s
START/STOP TIME	15 ±1 msec----------15 ±1 msec.
START/STOP DISTANCE	0.19 ±0.02 in-----.4826 ± cm
PANEL WIDTH	19.00 in----------48.36 cm
PANEL HEIGHT	12.25 in----------31.12 cm
DEPTH (BEHIND PANEL)	11.25 in----------28.58 cm
DEPTH (TOTAL)	13.25 in----------33.66 cm
WEIGHT	45 lbs.----------20.39 kg
TAPE SPECIFICATIONS	0.5 in. wide, 1.5 mil thick, computer grade
SPEED VARIATION (LONG TERM)	±1%
SPEED VARIATION (INSTANTANEOUS)	±3%
TAPE TENSION	7 ±1 oz.----------198.45 ±28.35g
NUMBER OF TRACKS	9, IBM compatible spacing
TAPE PATH	Head and guide spacing IBM compatible
RECORDING MODE	NRZ1 (IBM compatible)
DATA DENSITY	9 Track NRZ1------800 CPI
INTERCHANNEL DISPLACEMENT ERROR	150 micro inches max.
ERASE HEAD	Full width DC, IBM compatible
ELECTRONICS	Solid State, All silicon
POWER	100/115/235 VAC, 48-62 Hz. 250 Watts
OPERATING TEMPERATURE	60°F (15°C) to 90°F (32°C) Humidity---20% to 80% without condensation
STORAGE TEMPERATURE	-30°F (1°C) to +120°F (49°C)
ALTITUDE	Operating--Up to 10,000 feet Storage----Up to 50,000 feet

1.4 MAINTENANCE PHILOSOPHY

The maintenance philosophy associated with the tape transport, requires that a malfunction be isolated to a major field replaceable assembly. All field replaceable assemblies are supplied as part of the standard serviceman's maintenance kit #7013425K001. Additional spare parts are available in the district level kit #7013425K002. Refer to paragraph 5.7 for a complete list of all spare assemblies included in both maintenance kits.

Three printed circuit boards are located in the tape transport; MC-17, RC-11, and the RP-16. Each of the three boards are field replaceable, however the replacement of the RP-16 board is not recommended.

The four (4) printed circuit boards in the processor assembly can be easily replaced and require no special adjustment or jumper configuration.

The RP-16 card includes several components that may be plugged in or easily replaced; these parts are included in the 7013425K001 (serviceman's) parts list. The MP-17 and RC-11 cards are replaceable at the customer's location but require some alignment. In any event, less than one hour should be necessary for repair at the customer level before another tape transport is installed. Replacement tape transports are available at the district level.

If, in the course of responding to a specific complaint where a particular symptom suggests the replacement of a component listed in the District level parts list (7013425K002), that component may be taken from the district office to the customer's site for potential replacement. Most of the items on the 7013425K002 parts list can be replaced on site by trained personnel with the recommended equipment. However,

unless there is sufficient reason to determine that one or two of the higher level items are defective, there is no reason to carry more than 7013425K001 spares.

It is important to attach a repairable tag immediately following removal of a defective assembly. Defective units which are not easily field repairable must be returned to the factory. For proper packaging instructions, refer to Section 6.

Tools and equipment required for servicing at the customer level are listed in table 1-1.

1.5 RELATED DOCUMENTATION

The following is a list of various documents which relate to the tape transport.

- Model 8090 Installation Manual Publication #7013417H004
- Model 8090 Operator's Manual Publication #7014282H003
- Model 8090 Software Manual Publication #7014282H002
- Model 810 Systems Reference Manual, Publication #72003021001
- Selftest Diagnostic Users Manual, Publication #7013172H005
- PDS 800/3000 Schematic Diagrams, Publication #SDS-800-15

TABLE 1-1

TOOLS AND EQUIPMENT

Item	Description
1	Standard Tool Kit
2	PDS Supplemental Tools
3	Meter, Digital, 3-1/2 digits
4	Test Card, TC-12 Exerciser
5	Gauge, spring, one-pound
6	Tape (two required) a. "Scratch" tape 8.5 - inch reel, 0.5 - inch wide, 1.5 - mil thick, computer grade b. Master Skew Tape, IBM P/N 432640
7	Isopropyl alcohol, lab grade with cotton swabs and lint-free cloth for applying and wiping.
8	Oscilloscope, Tektronix 422/432/453 (included as item 1 on standard tool kit)
9	Volt Ohm Meter, Triplett 310 or equivalent (included as item 2 on standard tool kit)
10	SELFTEST Diagnostic Program for Mag Tape. 7013950 through 7013953 with user's guide.
11	Spare Parts Kit #7013425K001/7013425K002

SECTION 2

INSTALLATION

2.1 GENERAL

This section provides a general description of the installation requirements associated with the tape transport when installed in the pooler configuration. Additional information is available in the System 8090 Installation Manual, publication #7013417H004.

In the pooler configuration, the tape transport is normally packaged and shipped in a separate cardboard container as detailed below.

2.2 UNPACKING

Prior to unpacking the shipping container, it is advisable to inspect the exterior for any visible damage. If there is visible damage to the exterior of the container it is likely that the internal equipment is damaged. When unpacking the tape transport, closely inspect the unit in the damaged area. If the tape transport is damaged, promptly notify both the carrier and Corporate Traffic Department, Sanders Associates, Inc., for immediate attention.

One of two packing methods is used in preparing the tape transport for shipment. Therefore, two procedures for unpacking the unit are presented here. To unpack the tape transport select the applicable procedure.

2.2.1 PROCEDURE 1

Refer to figure 2-1 while performing the following procedure:

1. Cut lengthwise along the center of the container, cutting through both the reinforced nylon bands and binding tape.

2. Open cardboard container flaps and remove four corner cushions.

3. Remove inner container.

4. Open inner container and remove cardboard spacers.

5. Remove the tape transport.

6. Remove polyethylene film from the unit.

7. Install slide rail mounting brackets (see figure 6-1).

2.2.2 PROCEDURE 2

Refer to figure 2-2 while performing the following procedure.

1. Cut lengthwise along the center of the container, cutting through both the reinforced nylon bands and binding tape.

2. Open cardboard container flaps.

3. Remove top half of foam cushion and 4-mil polyethylene film.

4. Remove the tape transport.

5. Remove 4-mil polyethylene film from the unit.

IMPORTANT

Save all shipping material for reshipment of defective units to the factory for repair and refurbish.

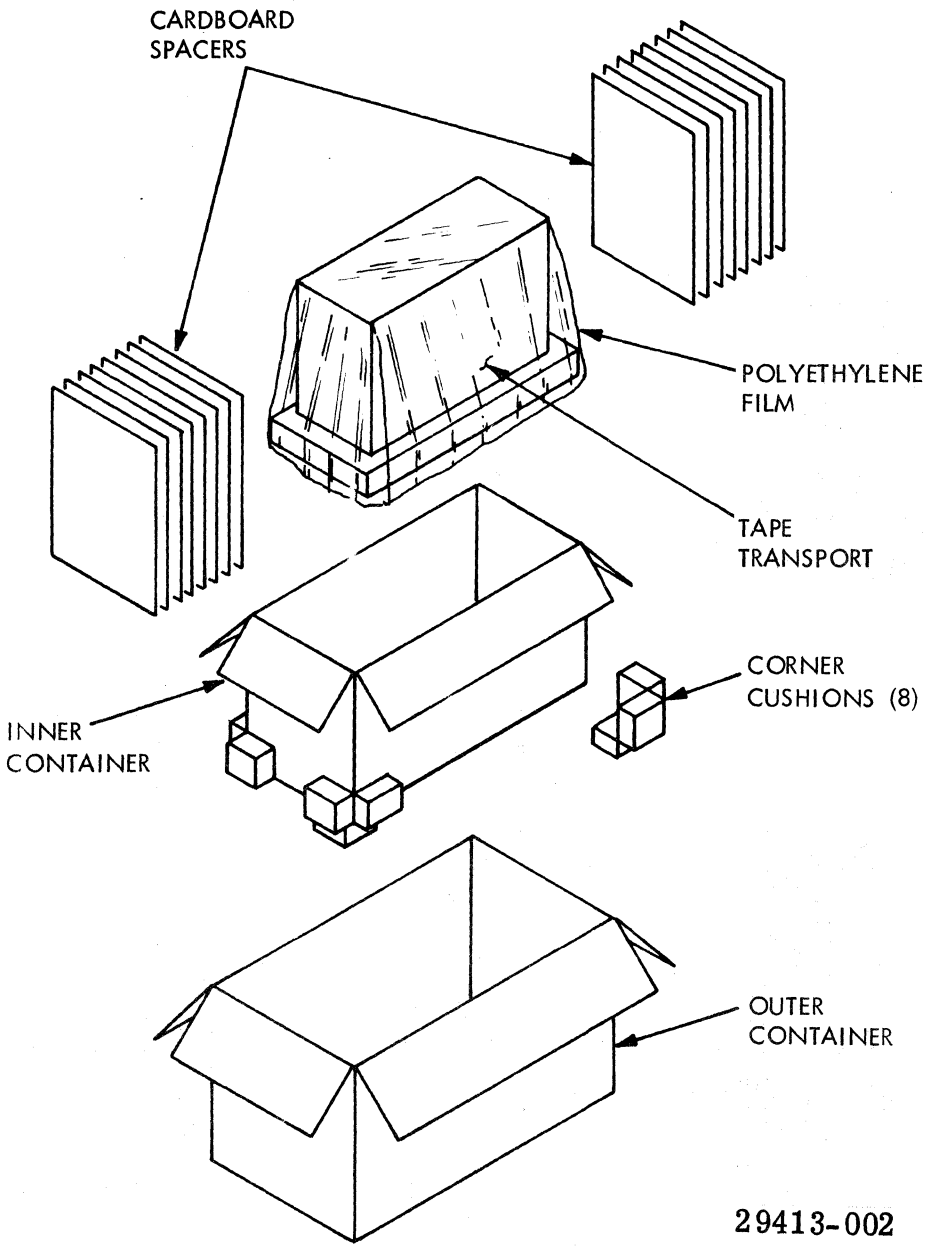


Figure 2-1. Transport Shipping Configuration.

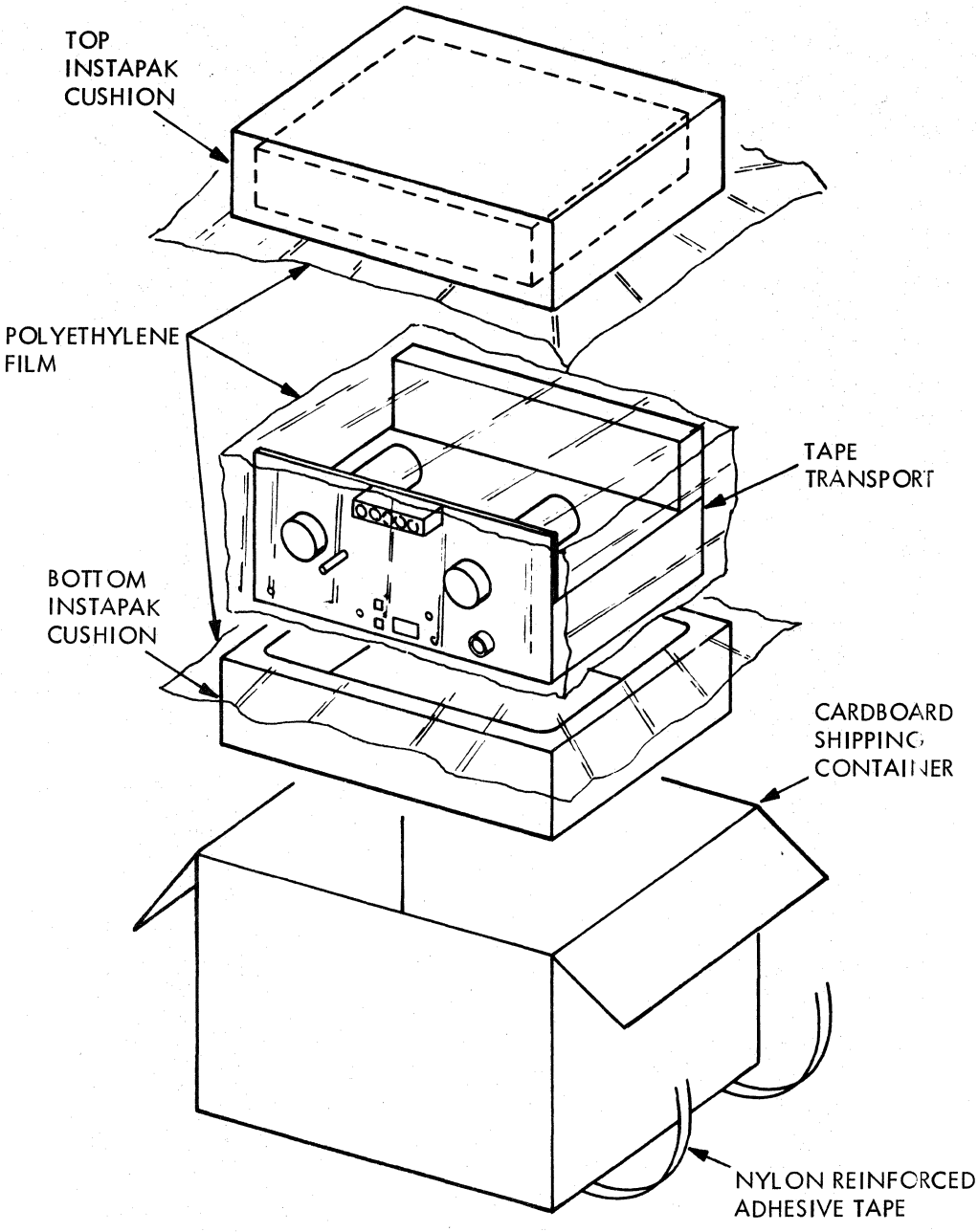


Figure 2-2. Alternate Shipping Configuration.

2.3 ENVIRONMENT

The tape transport is designed to operate in the following environment.

Operating Temperature--------60°F (15°C) to 90°F (32°C)*

Humidity----------20% to 80% without condensation

Altitude----------10,000 feet

Noise Level----------60 dba (MAX)

* Magnetic tape will not tolerate temperatures in excess of 90°F (32°C). The tape transport however, can be shipped and stored (without tape mounted) at temperatures of -49°F (-45°C) to 158°F (70°C), at a relative humidity between 15% and 95%.

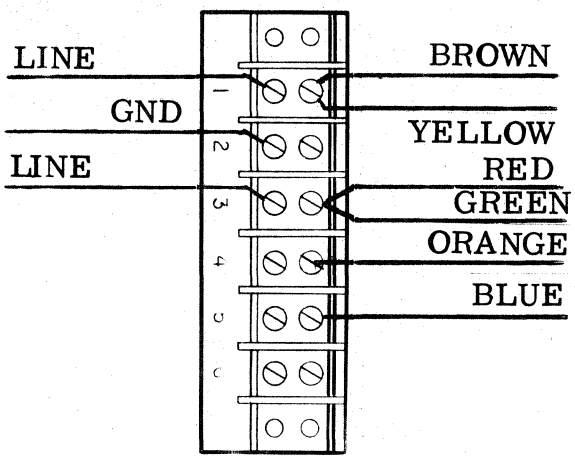
2 4 POWER REQUIREMENTS

2.4.1 INPUT AC POWER

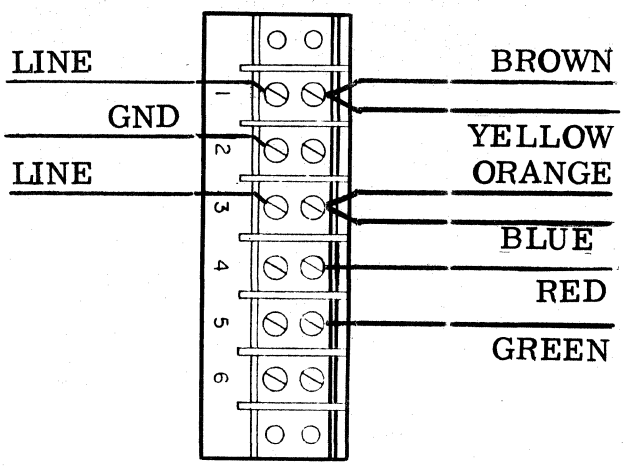
The tape transport is capable of operating on both domestic and foreign single phase power, 100, 115 or 235 VAC (other operating voltage may be obtained from the factory), 48 to 62 Hz. Selection of the input voltage range is predetermined at the time of purchase and wired accordingly. Selection is made by appropriately connecting the power transformer leads to the terminal board (TB-1) located on the inside left side plate of the tape transport. Refer to figure 2-3 for detailed connections. Prior to powering up the tape transport, it is advisable to verify that TB-1 is properly wired for the particular configuration.

The input AC line is fused according to the input power requirements.

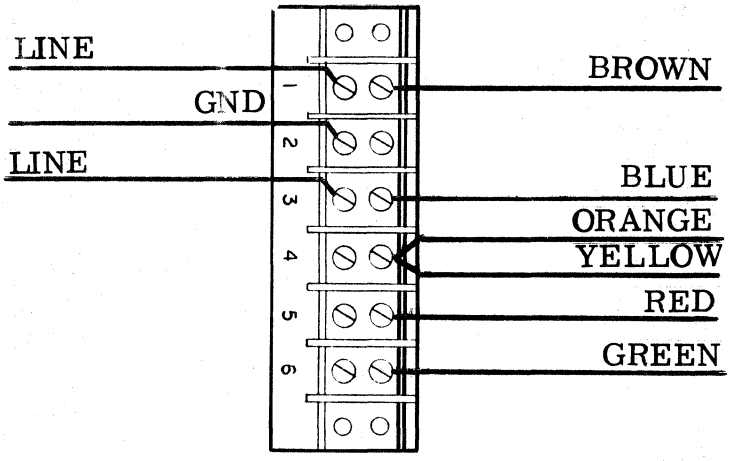
Nominal Input Voltage	Fuse	Amps	Type	Part Number
100 VAC	F1	3.0A	SLO-BLO	7528001P105
115 VAC	F1	3.0A	SLO-BLO	7528001P105
235 VAC	F1	1.5A	SLO-BLO	7528001P149



100 ± 10 VAC



115 ± 10 VAC



235 ± 20 VAC

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Figure 2-3. Input Power Connections (TB-1).

2.4.2 INTERNAL DC POWER

The tape transport contains power supply circuits that provide the following internal DC outputs. Refer to figure 5-2 for DC power distribution.

Output	Fuse	Amps	Type	Part Number
+12 VDC	F2	7.5A	3AG	7528001P005
-12 VDC	F3	3.0A	3AG	7528001P055
+5 VDC	NOT FUSED	----	---	
+5 (S)	NOT FUSED	----	---	

2.5 DIMENSIONS AND WEIGHT

The dimensions of the tape transport in both standard and metric units are shown in figure 2-4. The unit weighs 45 lbs (20.39 kg).

The dimensions of the tape transport cabinet in both standard and metric units are shown in figure 2-5. The tape transport cabinet weighs 60 lbs (28.52 kg).

2.6 INSTALLATION

The tape transport is mounted in a low boy cabinet on slide rails. When used in the pooler configuration, the tape transport cabinet is placed on top of, and attached to, the matching pooler microprocessor cabinet (see figure 2-6). If intended for use with other than the pooler, (stand alone) the tape transport and cabinet assembly may be placed in any convenient location provided that the air intake is not obstructed and the tape transport cabinet is within 25 cable feet of the microprocessor.

2.7 TAPE TRANSPORT INTERFACE CABLING

Figure 2-7 illustrates the cabling required to connect the tape transport to the microprocessor assembly. In the pooler configuration, a 9-foot cable (assembly 7013416G001)

is used to connect the tape transport interface connector board PC-4 (J101, J102 and J103) to connector J2 of the distributor card (card location XA20 of the microprocessor assembly). For detailed signal functions and pin connections refer to Input/Output Interface Signals of Section 5.

DIMENSIONS

	INCHES	CENTIMETERS
A	12.25	31.01
B	9.75	27.77
C	19.0	48.26
D	5.0	12.7
E	2.125	5.4

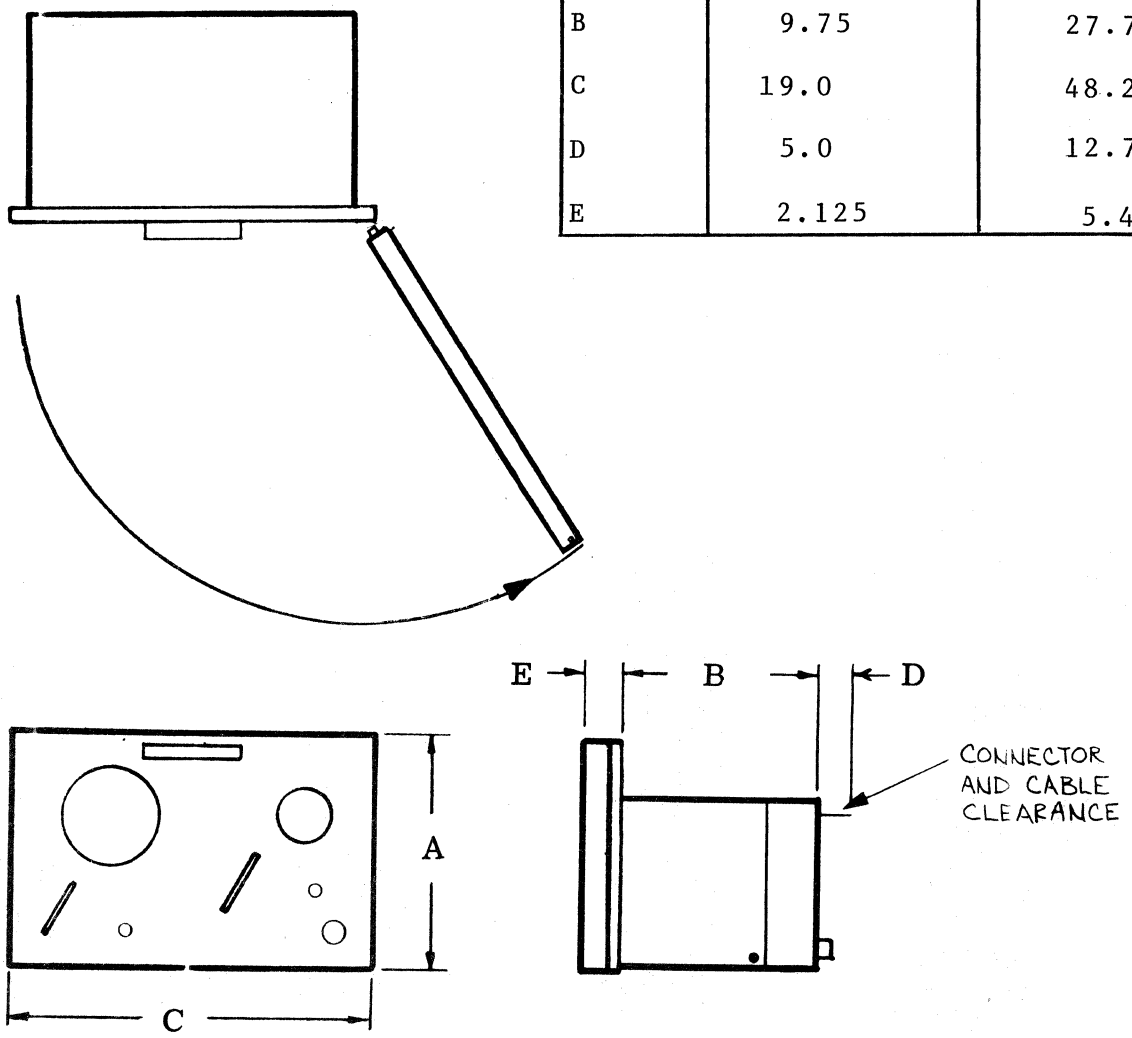

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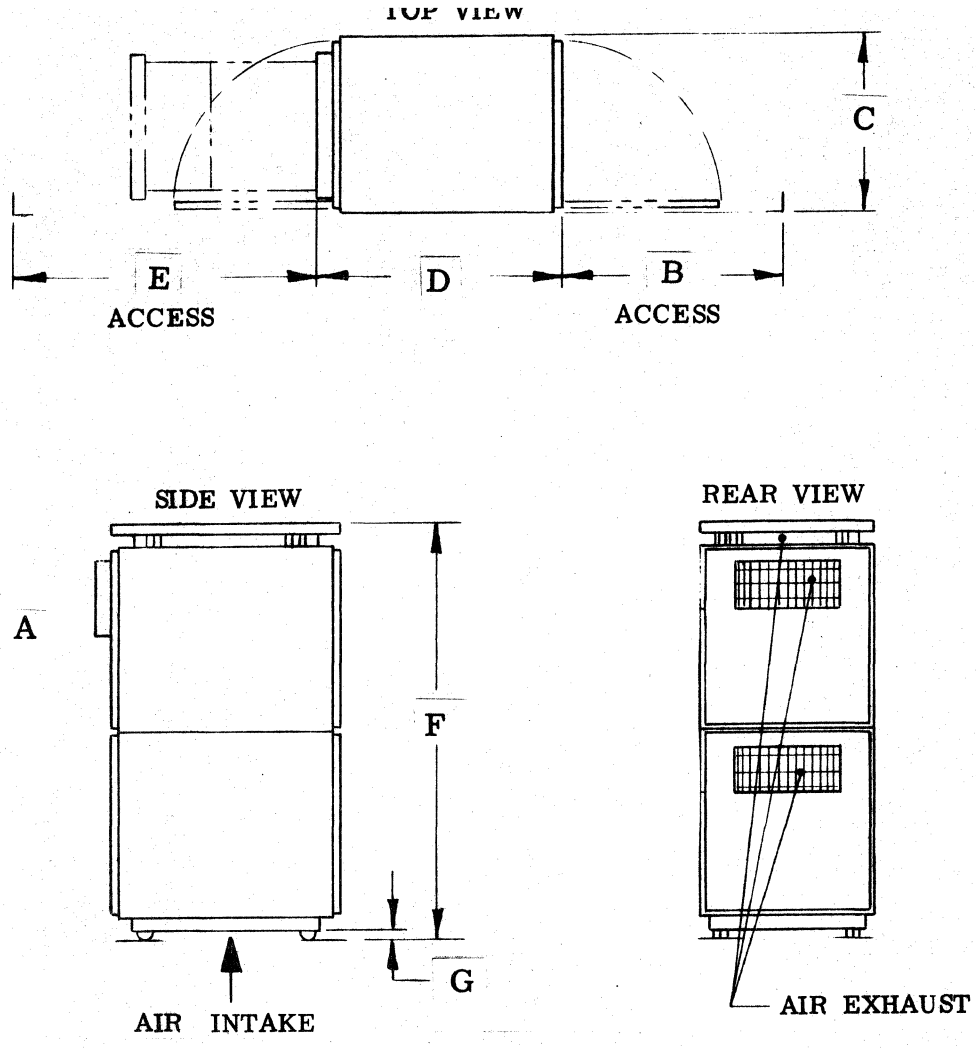
Figure 2-4. Tape Transport Dimensions.



DIMENSIONS

	INCHES	CENTIMETERS
A	30.0	76.20
B	30.0	76.20
C	23.0	58.42
D	32.0	81.28
E	50.0	127.00
F	54.0	137.16
D	1.75	4.45

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Figure 2-5. Processor/Tape Transport Cabinet Dimensions.

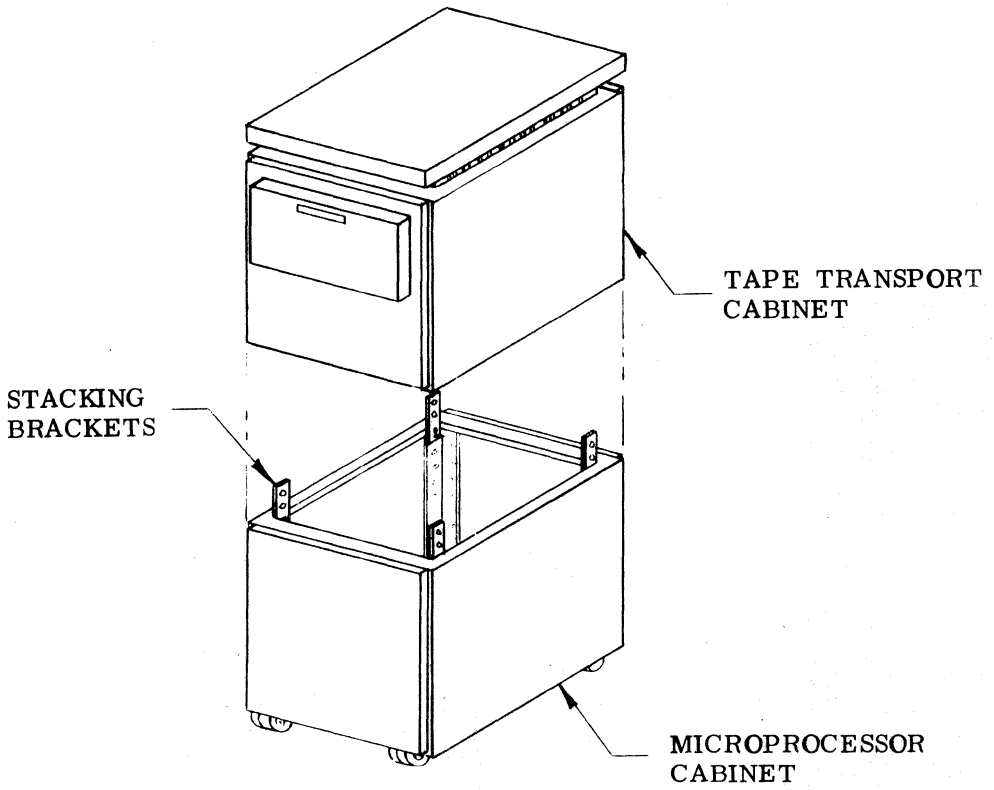

Figure 2-6. Tape Transport Cabinet Stack Mounting.

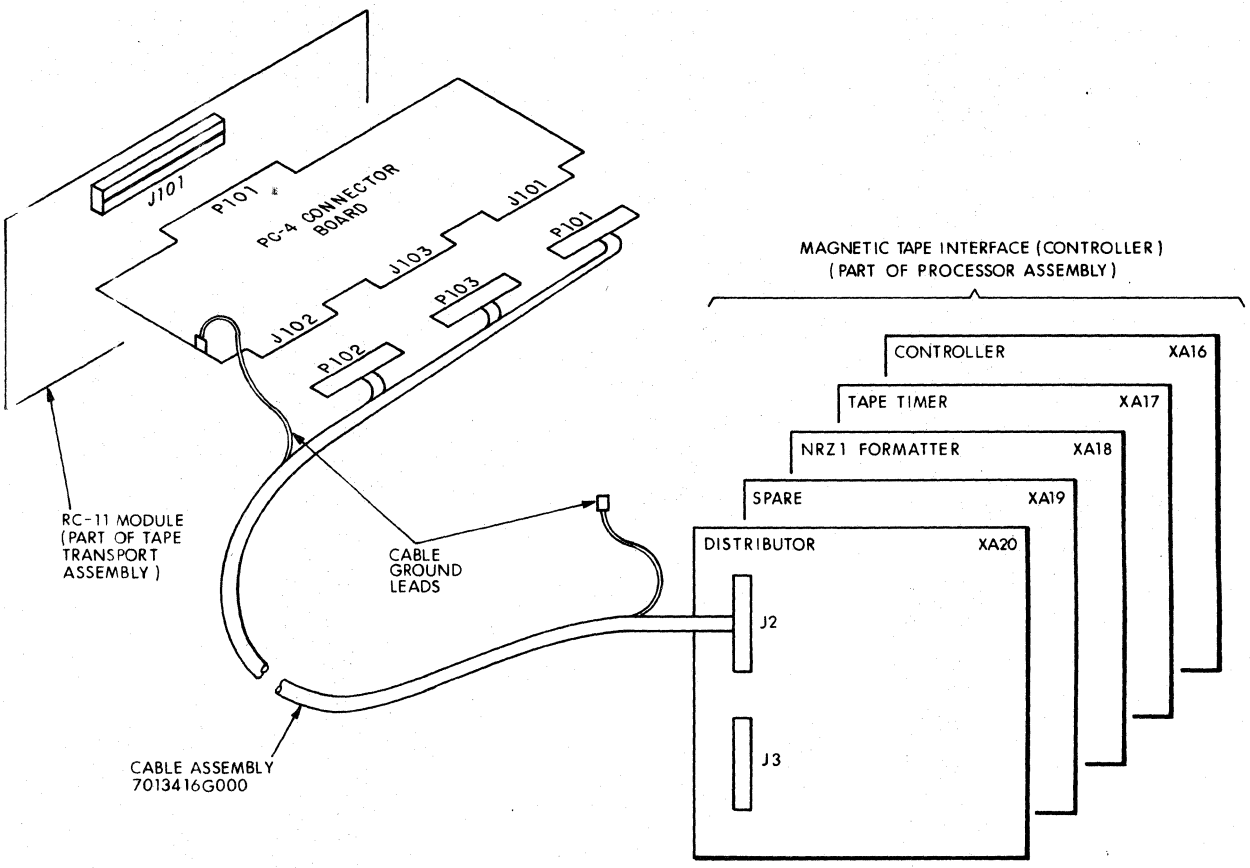

Figure 2-7. Tape Transport/Controller Interface Cabling (Model 8090 MTPS).

SECTION 3

OPERATING INSTRUCTIONS

3.1 GENERAL

The section contains a description of the tape transport controls/indicators and proper methods of loading and unloading magnetic tape.

Operating characteristics relative to specific operations both on-line and stand-alone are presented in Sections 4 and 5.

3.2 CONTROLS AND INDICATORS

The operator control panel on the tape transport is located on the top front portion of the assembly as illustrated in figure 1-1 and detailed in figure 3-1.

3.2.1 CONTROLS

POWER — A pushbutton latch switch that applies power to the tape transport.

LOAD — A pushbutton switch that initiates the tape loading sequence. Pressing the switch causes the reels to apply tension to the tape. The tape then advances to the beginning of tape (BOT) marker and stops.

REWIND — A pushbutton switch that initiates the rewind operation. Pressing the switch places the tape transport off-line, rewinding the tape to BOT. Pressing the switch when tape is at BOT causes tape to unload from the take-up reel at low speed.

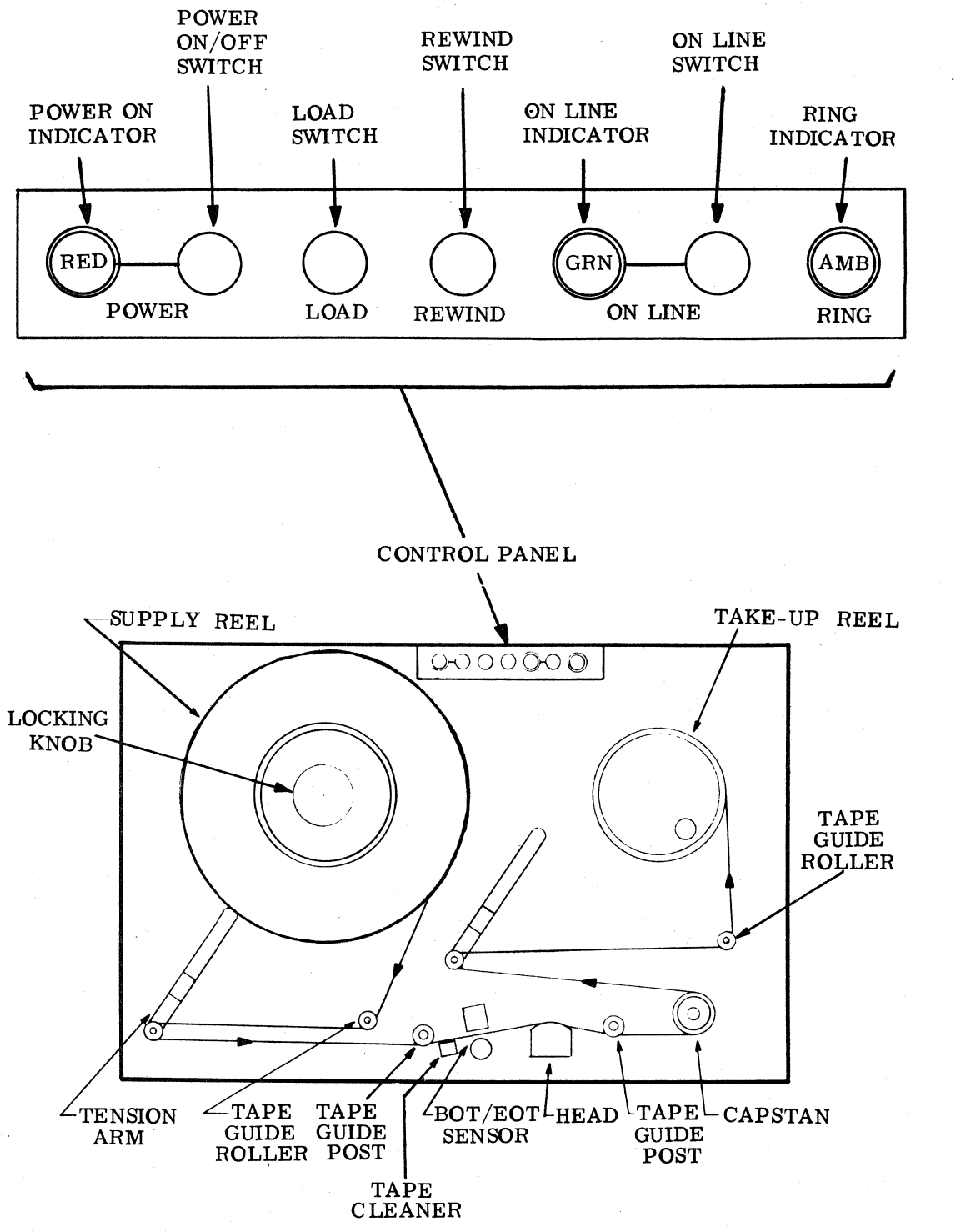

Figure 3-1. Tape Transport Front Panel Hardware.

ON LINE — A pushbutton switch that places the tape transport in the on-line mode (enabling remote control) if tape is loaded and LOAD button pressed. The tape transport may be placed off-line at any time by pressing the switch again.

3.2.2 INDICATORS

POWER — This indicator lights red when power is applied to the tape transport.

ON LINE — This indicator lights green when the tape transport is on-line and under remote control of an external device.

RING — This indicator lights amber when a write ring is on the supply reel and the LOAD button is pressed. If the indicator is not lighted writing or erasing data is disabled.

3.3 OPERATING PROCEDURES

3.3.1 TURN-ON

Press the POWER button at the control panel. Power indicator should light, indicating power up status.

3.3.2 LOADING TAPE (PROGRAM OR BLANK TAPE)

1. If recording is intended, check tape reel to ensure that the plastic write ring is installed on the rear flange of the reel. When reading tapes, write ring should be removed to protect the contents of each tape from an accidental write or erasure.

2. Remove protective plastic snap-on seal ring from tape reel.

3. Open tape transport dust cover door.

4. Pull locking knob out to the release position,mount tape reel onto supply hub. Mount reel so that tape unwinds when reel is rotated clockwise. Mounting pressure should be concentrated around the hub area to prevent wear on the tape edges. Seat the reel tightly against the hub rim and push the locking knob in to secure the reel in place.

5. Thread tape along tape path exactly as shown in figure 3-2.

6. Hold the end of tape onto the take-up reel and rotate counterclockwise several turns until the pressure holds the tape in place. Gently release the take-up reel to avoid any slack along the tape path.

7. Check to ensure that the tape is properly seated on the rollers and guides.

8. Close the tape transport dust cover door.

9. Press the LOAD button. Tension arms should move as the reels take up the slack. Tape advances to the beginning of tape (BOT) marker and stops. The unit is now loaded and ready to be placed on-line (external control). Off-line manual operations are limited to exercising tape motion with the use of the service switch.

10. If write ring is installed, ring indicator will illuminate.

3.3.3 ON-LINE MODE

Press the ON LINE button. The ON LINE indicator should light. Placing the tape transport on line transfers operational control to an external device. In the pooler configuration, control is transferred to the keyboard under control of the Magnetic Tape Management System (MTMS) applications program.

3.3.4 UNLOADING TAPE REELS

1. Press REWIND button. Tape rewinds to the BOT marker and stops.

2. Press the REWIND button again. Tape rewinds at a slower rate until tape path is clear. Tension arms will relax during this mode.

3. Open tape transport dust cover door.

4. Manually rewind remaining tape onto supply reel.

5. Pull locking knob outward and remove tape reel.

6. Place and secure plastic snap-on seal ring onto the reel.

3.3.5 RELOADING FROM END OF TAPE

If all of the tape is unwound from the supply reel (EOT marker missing or defective EOT sensing circuits) the tape must be rethreaded (in reverse) and rewound onto the supply reel. It is difficult to place the end of the tape onto the rim of the supply reel due to interference from the reel flanges. Because of this, it is impossible to hold the tape end on the rim. Wetting the tape end provides a temporary adhesive for starting the tape onto the rim.

1. Rethread (in reverse) tape as shown in figure 3-2.

2. Lightly moisten the tape end and insert between the supply reel flanges, onto the rim. Gently rotate reel counterclockwise several turns until the pressure holds the tape in place.

3. Continue to rotate several turns checking to ensure that the EOT reflective marker is present (about 10 turns in from tape end). If missing, replace EOT marker to the shiny side of the tape along the edge nearest the front panel.

4. Rotate take-up reel counterclockwise removing tape slack.

5. Ensure that tape is properly seated on all rollers and guides.

6. Close tape transport dust cover door.

7. Press the LOAD button, immediately followed by the REWIND button and hold until tape begins to rewind.

3.3.6 POWER FAILURE RECOVERY

In the event of a power failure, the tape transport will stop smoothly with no damage to the tape. When power is restored, the tape may be rewound or re-started.

To rewind the tape after a power failure, press the LOAD and REWIND buttons and hold until the machine starts rewinding.

To restart the tape at its present position, press and hold the LOAD button followed by the ON LINE button. The transport will apply tension to the tape and go on line. Since the tape will not be at precisely the same position as it was when the power failure occurred, the tape may have to be rewound a few inches to locate the original position.

SECTION 4

MAINTENANCE

4.1 GENERAL

This section details the requirements necessary to support preventive maintenance, parts replacement and adjustments on the tape transport. In addition to this material, other maintenance aids such as interface signals and distribution, troubleshooting diagrams, wiring diagrams and spare parts list are contained in Section 5. Logic and assembly diagrams associated with the tape transport are contained in Section 7, others are contained in the PDS 800/8000 Schematic Diagrams, publication #SDS-800-15.

The estimated mean time between failures (MTBF) for the tape transport electronics is 2400 hours under normal usage and periodic maintenance. Life expectancy of the motors and read/write head however, is 5,000 normal operating hours.

4.2 PREVENTIVE MAINTENANCE

To insure maximum operational reliability of the tape transport, it must be kept clean and free from any accumulation of dust, tape oxides or other foreign particles. Any small particle between the tape and head is capable of causing dropouts resulting in hundreds of lost data bits. Such dropouts are by far the most common cause of tape errors.

4.2.1 CLEANING

4.2.1.1 Daily

Clean read/write head and all other tape bearing surfaces as indicated in table 4-1, item 1 (see figure 3-1) using a

clean cotton swab moistened with isopropyl alcohol. Wipe all surfaces with a clean, dry, lint free cloth.

4.2.1.2 Semi-Annual

Clean, inspect, check and make necessary adjustments as indicated in table 4-1.

TABLE 4-1

PREVENTIVE MAINTENANCE CHART

Action	Notes/References
1. Daily Cleaning	
(a) Head	Apply isopropyl alcohol with cotton swab and dry with lint free cloth. Do NOT mar, or scratch or touch any of the surfaces.
(b) Tension Arm Rollers	Rotate while cleaning
(c) Rotating Tape Guide Rollers	Rotate while cleaning
(d) Fixed Tape Guide	Rotate inner flange while cleaning
(e) Capstan	Clean surface of rubber drive wheel.
2. Semi-Annual Cleaning	
(a) Fixed Tape Guide	(1) Loosen outer flange hex screw. (2) Rotate flange to provide a new wear surface (3) Tighten hex screw after cleaning
(b) BOT/EOT Reflective Surface	Wipe with dry, clean, lint free cloth. Do NOT use any type of cleaning liquid as this will dissolve the adhesive, securing the reflective surface.

TABLE 4-1

PREVENTIVE MAINTENANCE CHART (Cont)

Action	Notes/References
2. Semi-Annual Cleaning (continued)	
(c) Dust Cover Door	Clean inside and outside surfaces with a non-abrasive cleaner such as Windex and wipe with dry, lint free cloth.
3. Inspection	
(a) Head	Replace when head is worn to the depth of the flat gutters on each side of the head. Return worn head to the district office. Refer to paragraph 4.3.2.10
(b) Tape Guides	Replace tape guide whenever it is found to be worn out of round or the tape edges have cut into the guide flanges. Refer to paragraph 4.3.2.15
4. Checks and Adjustments	Each of the following items must be checked to insure that the limits of the adjustment are satisfactory. In most cases, minor adjustments may be sufficient to maintain optimum operating parameters.

(a) Power Supply

Output	Assembly	Test Points	Adjustment	Criteria	Reference Paragraph
+12VDC	MC-17	+12V BUS	R163	+12.00±0.06V	4.4.2.1
+ 5VDC	MC-17	+ 5S BUS	N/A	5.0±0.5V	4.4.2.1
+ 5VDC	MC-17	+ 5V BUS	N/A	5.00±0.25V	4.4.2.1
-12VDC	MC-17	-12V BUS	N/A	-12.0 ±0.6V	4.4.2.1

TABLE 4-1

PREVENTIVE MAINTENANCE CHART (Cont)

Action	Notes/References

(b) Capstan Servo (use TC-12 Card, VOM and Oscilloscope)

	Assembly	Test Points	Adjustment	Criteria	Reference Paragraph
Zero Adjust	MC-17	TP-15	R138	0±0.005V	4.4.2.4
Requirements: (1) BOT/EOT sensor inhibited (2) Supply tension arm at center position (3) Capstan motor stopped (LOAD and ON LINE buttons pressed)					
Forward Speed	MC-17	TP-5	R126	F=(round label)	4.4.2.4
Reverse Speed	MC-17	TP-5	R125	R=(round label)	4.4.2.4
Rewind Speed	MC-17	TP-5	R127	RWD=(Round label)	4.4.2.4
Start/Stop	MC-17	TP-5	R106	13.5±0.5 ms at 90%	4.4.2.4

(c) Reel Servo (tension arms)

Insure that each tension arm maintains an arc limited by the maximum positions forward and reverse when the tape transport is exercised in each direction. When there is no tape motion, each tension arm should be at the center position.

	Assembly	Test Points	Adjustment	Criteria	Reference Paragraph
Supply Tension Arm	MC-17	See fig.4-22	R194	Arc	4.4.2.3
	MC-17	See fig.4-22	R198	Center	4.4.2.3
Take-Up Tension Arm	MC-17	See fig.4-22	R230	Arc	4.4.2.3
	MC-17	See fig.4-22	R234	Center	4.4.2.3

(d) BOT/EOT sensor (must use brown tape between sensor and reflector)

	Assembly	Test Points	Adjustment	Criteria	Reference Paragraph
BOT	RC-11	TP-8(BOT)	R1046	2.5±0.1V	4.4.2.5
EOT	RC-11	TP-9(EOT)	R1048	2.5±0.1V	4.4.2.5

TABLE 4-1

PREVENTIVE MAINTENANCE CHART (Cont)

Action	Notes/References

(e) Read Amplifier Output (write all "ones" using TC-12 Card and read back)

Output	Assembly	Test Points	Adjustment	Criteria	Reference Paragraph
Track P	RC-11	TP-P	R101	6.0±0.3V P-P	4.4.2.6
Track 0	RC-11	TP-0	R201	6.0±0.3V P-P	4.4.2.6
Track 1	RC-11	TP-1	R301	6.0±0.3V P-P	4.4.2.6
Track 2	RC-11	TP-2	R401	6.0±0.3V P-P	4.4.2.6
Track 3	RC-11	TP-3	R501	6.0±0.3V P-P	4.4.2.6
Track 4	RC-11	TP-4	R601	6.0±0.3V P-P	4.4.2.6
Track 5	RC-11	TP-5	R701	6.0±0.3V P-P	4.4.2.6
Track 6	RC-11	TP-6	R801	6.0±0.3V P-P	4.4.2.6
Track 7	RC-11	TP-7	R901	6.0±0.3V P-P	4.4.2.6

(f) Read Skew

	Assembly	Test Points	Adjustment	Criteria	Reference Paragraph
Skew Adjust	RC-11	STP	See Ref. Paragraph	6.0 µs max.	4.4.2.9

(g) Flux Gate

	Assembly	Test Points	Adjustment	Criteria	Reference Paragraph
Flux Gate Adjust	RC-11	Anode CR105	See Ref. Paragraph	1.5V P-P max.	4.4.2.7

(h) Tape Tension (use spring gauge as detailed in paragraph 4.4.2.7)

	Assembly	Test Points	Adjustment	Criteria	Reference Paragraph
Tape Tension Adjust	0A0543-B	--	--	7±1 oz.	4.4.2.8

4.2.2 LUBRICATION

The tape transport is equipped with sealed, self lubricating reel and capstan motors. Periodic lubrication is NOT required.

4.2.3 HANDLING TAPE REEL

4.2.3.1 Handling

The 8090 Pooler Application Program tape and data tapes require special care; being careful to avoid contamination with fingerprints, dust or any other foreign material. It is very important to handle all tape reels by the hub area or plastic side flanges. The tape transport dust cover door must be kept closed whenever possible.

4.2.3.2 Storage

Each tape reel includes a plastic, snap-on, seal ring which fits around the reel sealing the tape from contaminants. The seal ring must be attached to the reel and snapped firmly in place whenever reels are not in use. Also each reel of tape must be stored in a controlled environment not to exceed the temperature range of $50^{o}F$ ($10^{o}C$) to $90^{o}F$ ($32^{o}C$) with less than 85% relative humidity. Strong magnetic fields must also be avoided to prevent the destruction of recorded data.

4.3 PARTS REPLACEMENT

4.3.1 GENERAL

This section contains detailed parts replacement procedures for each of the major field replaceable assemblies in the tape transport. Defective assemblies that are NOT field replaceable, requires that the tape transport be replaced with a spare from the district office and that the defective tape transport be returned to the factory for repair. Refer to Section 6 of the manual for detailed repackaging and shipping instructions.

4.3.2 PROCEDURES

Table 4-2 lists all of the procedures required for field replacement and the source of parts availability.

Each procedure includes a general description of the procedure, tools required and specific removal/replacement instructions.

TABLE 4-2

FIELD REPLACEABLE PART/PROCEDURES

Paragraph	Title	Assembly Part Number	Availability		Page
			Field Kit	District Kit	
4.3.2.1	Tape Transport	7013315P003		x	4-9
4.3.2.2	MC-17 Card	7013844P019	x	x	4-10
4.3.2.3	RC-11 Card	7013844P020	x	x	4-13
4.3.2.4	BOT/EOT Sensor	7013844P005	x	x	4-16
4.3.2.5	Tension Arm Servo Sensor	7013844P026		x	4-18
4.3.2.6	Control Relay (K1)	7013844P023	x	x	4-22
4.3.2.7	Fuse Replacement	* 7528001P105	x	x	4-23
		7528001P005	x	x	
		7528001P055	x	x	
4.3.2.8	Filter Capacitors	7013844P024		x	4-24
		7013844P025		x	
4.3.2.9	Power Rectifiers	7013844P022		x	4-25
4.3.2.10	Tape Head (write/read)	7013844P001		x	4-27
4.3.2.11	Capstan Motor	7013844P011		x	4-30
4.3.2.12	Reel Motor	7013844P012		x	4-32
4.3.2.13	Indicator Lamps	7532008P004	x	x	4-34
4.3.2.14	Tape Guides	7013844P002		x	4-34
		7013844P003		x	
4.3.2.15	Tension Arm Servo Lamps	7013844P017	x	x	4-36

* Use 7528001P149 for 230 VDC applications.

4.3.2.1

REPLACEMENT PROCEDURE	ASSEMBLY PART NUMBER	TOOLS REQUIRED
TAPE TRANSPORT ASSEMBLY	7013315P003	Phillips Head Screwdriver

DESCRIPTION The tape transport assembly must be shipped to the factory whenever a malfunction is NOT field repairable or at every 5,000 operating hour interval.

PROCEDURE

Steps:

1. Power down tape transport assembly.
2. Open tape transport dust cover door.
3. Release both front panel slide latches (left and right knurled knobs see figure 1-1).
4. Pull tape transport assembly outward to the lock position.
5. Disconnect the three I/O connectors at the rear of the tape transport (J101, J102, and J103). **Also disconnect ground lead.**
6. Remove cable clamp from slide rail (see figure 4-4).
7. Disconnect power cord from cabinet outlet.
8. Press lock latches on slide rail to release slide from lock position (see figure 4-4) and remove tape transport from cabinet.
9. Remove slide rail assembly from the defective tape transport side panels by removing four (two each side) phillips head screws and associated hardware.
10. Install slide rail assembly on the replacement tape transport using the original mounting hardware.

    NOTE

    Make certain that the top set of holes on each side panel of the tape transport are used to install the slide rails.

11. Install the tape transport into the cabinet, inserting the slide rails into the slide rail tracks.
12. Push the tape transport into the cabinet to the lock position.
13. **Connect the three I/O connectors (J101,J102 and J103)and ground lead to the tape transport PC-4 card.**
14. Replace the cable clamp removed in step 6 (see figure 4-4).
15. Route tape transport power cord through the left-side cable retaining brackets and connect it to the AC power distribution strip (Waber).
16. Release slide lock and push tape transport into the cabinet.
17. Secure slide latches released in step 3. Close tape transport door.

4.3.2.2

REPLACEMENT PROCEDURE	ASSEMBLY PART NUMBER	TOOLS REQUIRED
MC-17 CARD	7013844P019	Common Head Screwdriver

DESCRIPTION The MC-17 printed circuit card occupies card position #1, mating with connectors J1 and J2. Refer to figure 4-1 for relative location.

The MC-17 card contains the power supply regulator and motor control circuitry. All of the adjustments associated with this card must be realigned whenever the MC-17 card is replaced. Refer to the adjustment procedures in this section.

PROCEDURE

Steps:

1. If tape is mounted on transport, rewind (manually if necessary) and remove.
2. Power down transport assembly.
3. Open transport dust cover door and release both slide rail latches (left and right knurled knobs, see figure 1-1).
4. Pull transport assembly outward from rack assembly to access rear of unit.

NOTE

To facilitate adjustments, the tape transport may be removed from the rack assembly, placed on a work surface and exercised using the TC-12 Exerciser card and/or service switch.

5. Remove the two MC-17 mounting screws securing the module to the card cage assembly and pull defective module out.
6. Adjust both capstan and reel servo adjustments of the replacement module (four each) to the approximate center of their range. Total of eight adjustments, R126, R125, R106, R107, R230, R234, R198 and R194 (see figure 4-2).
7. Insert replacement module into the card slot (components facing to the front) and firmly seat into the mating connectors J1 and J2. Secure with two mounting screws.
8. Remove the card cage hinge release hardware (two screws, see figure 4-1) and swing card cage assembly down to access MC-17 adjustments.
9. Press POWER ON button. Insure that transport is powered on. Perform Power Supply Checks and Adjustments (paragraph 4.4.2.1).
10. Perform Preliminary Reel Servo Setup (paragraph 4.4.2.2).
11. Perform Reel Servo Adjustments (paragraph 4.4.2.3).
12. Perform Capstan Servo Adjustments (paragraph 4.4.2.4).

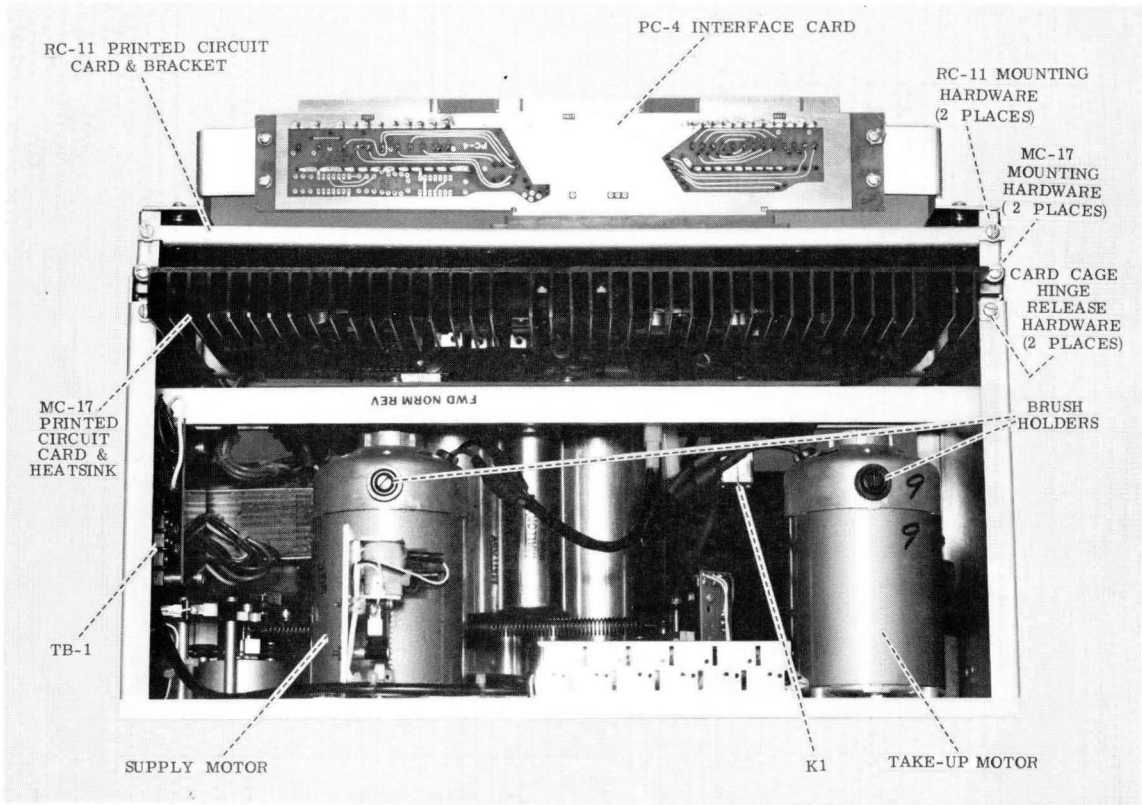

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Figure 4-1. MC-17 Disassembly/Removal.

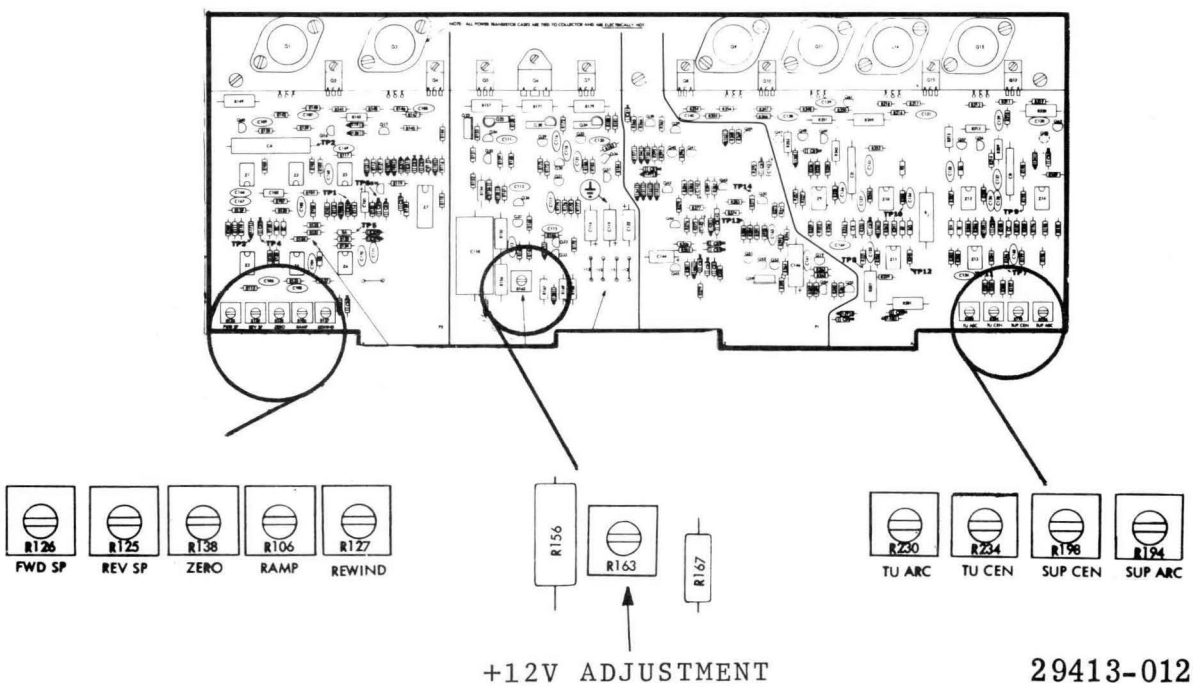

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Figure 4-2. MC-17 Adjustment Locations.

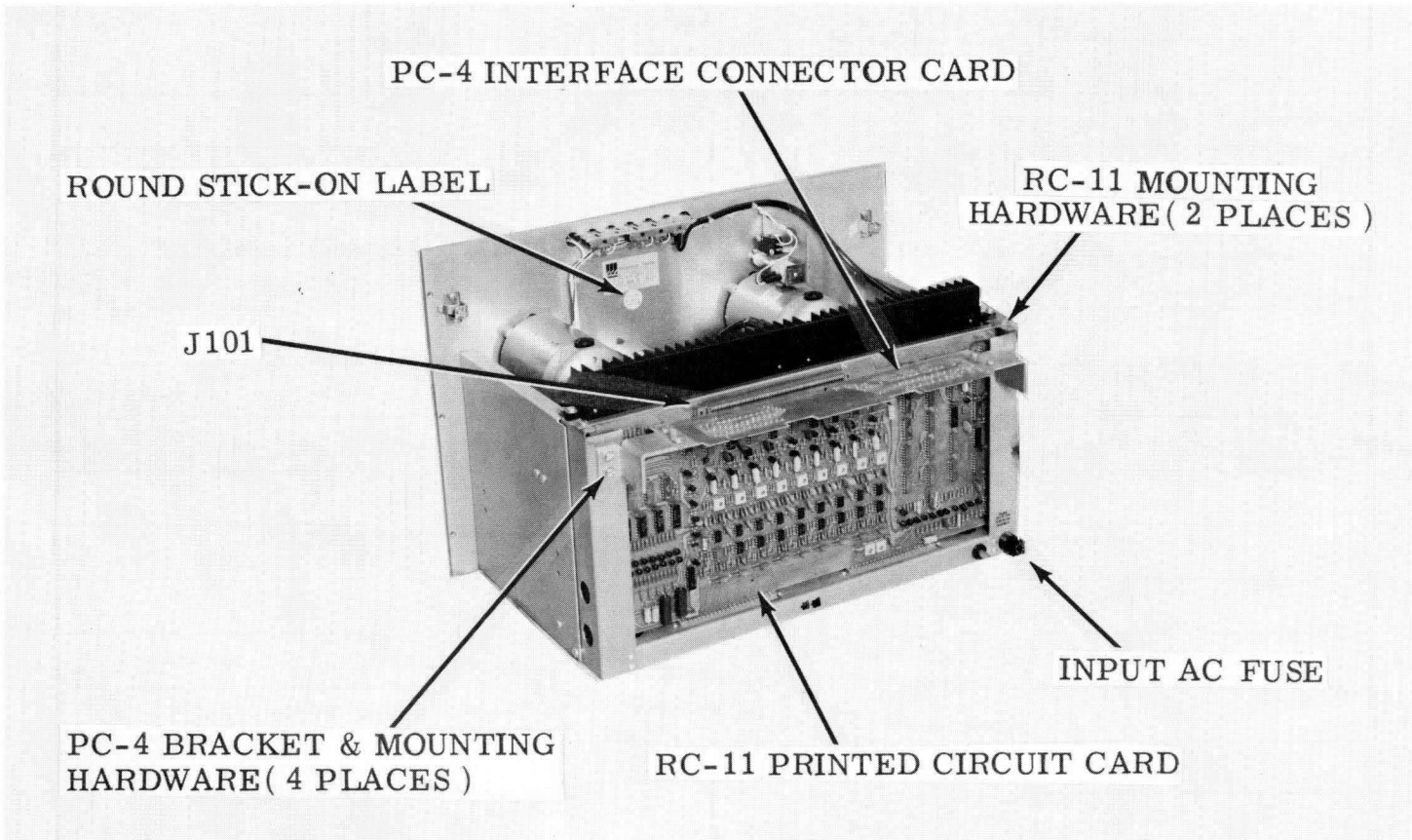

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Figure 4-3. RC-11 Disassembly/Removal.

4.3.2.3

REPLACEMENT PROCEDURE	ASSEMBLY PART NUMBER	TOOLS REQUIRED
RC-11 CARD	7013844P020	Common Head Screwdriver

DESCRIPTION The RC-11 printed circuit card occupies card position #2, mating with connectors J3 and J4. Refer to figure 4-1 for relative location.

The RC-11 card contains both the read and write amplifier circuits and input/output (I/O) control. All of the adjustments associated with this card must be realigned whenever replacement is necessary. Refer to adjustment procedures in this section.

PROCEDURE

Preliminary:

Rewind and remove tape,if installed.

Steps:

1. Power down transport assembly.
2. Open transport dust cover door and release both slide latches (left and right knurled knobs, see figure 1-1).
3. Pull transport assembly outward from rack assembly to access the rear of unit.
4. Remove four mounting screws securing I/O Connector card and bracket (PC-4) to the main frame (see figure 4-3).
5. Disconnect the PC-4 connector card from the RC-11 card.
6. Remove the two mounting screws securing the RC-11 card to the card cage assembly and remove defective module (refer to figure 4-1).
7. Insert replacement module into the card slot (components to the rear) and firmly seat into connectors J3 and J4. Secure with two mounting screws.
8. Replace and secure PC-4 connector card and bracket.
9. The adjustments on the RC-11 card are accessible when the card cage is in the normal position. Perform the BOT/EOT Sensor adjustment (paragraph 4.4.2.5) and Read Amplifier Output adjustment (paragraph 4.4.2.6).

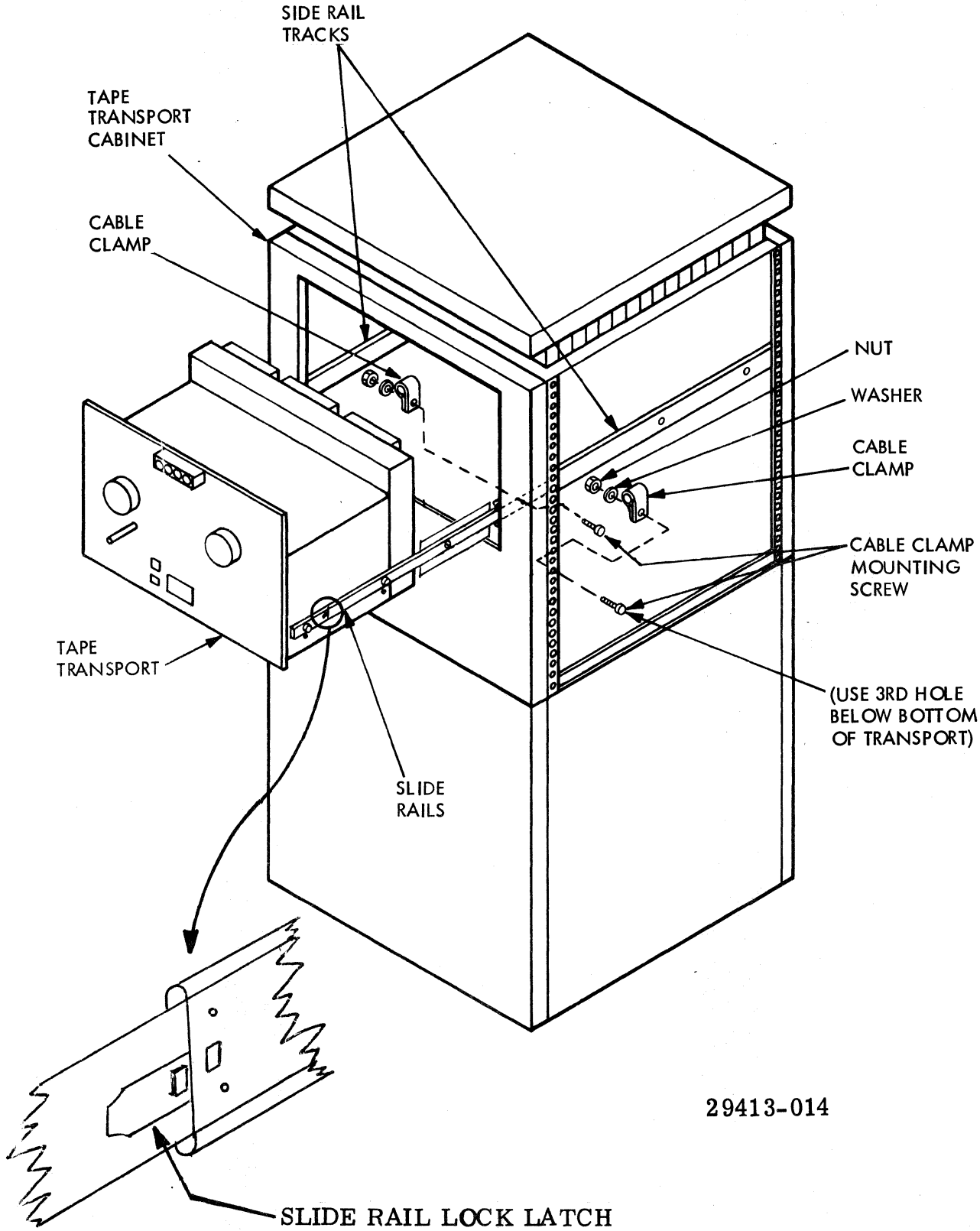

Figure 4-4. Tape Transport Slide Rail/Removal.

4.3.2.4

REPLACEMENT PROCEDURE	ASSEMBLY PART NUMBER	TOOLS REQUIRED
BOT/EOT SENSOR	7013844P005	Common Head Screwdriver, Soldering Iron and Plastic Cable Ties

DESCRIPTION The BOT/EOT sensor assembly contains two phototransistors and lamp. If any of these components fail, the sensor assembly must be replaced.

PROCEDURE

Steps:

1. If tape is mounted on transport, rewind and remove.
2. Power down transport assembly.
3. Open transport dust cover door and release both slide rail latches (left and right knurled knobs, see figure 1-1).
4. Pull transport assembly outward from rack assembly to lock position.
5. Disconnect power cord and interface cable and remove cable clamp (see paragraph 4.3.2.1). Remove transport from rack and place transport on a work surface with the bottom facing upward.
6. Unsolder the four sensor wires from the J2 and J4 printed circuit connector pins (see figure 4-5 for relative connector location and figure 4-6 for details). Also cut the cable ties which secure leads to cable harness.
7. Remove sensor assembly mounting screw located immediately below the sensor leads at the rear of the front panel and remove sensor assembly.
8. Insert the four wires of the replacement unit through the front panel access hole.
9. Position the sensor assembly facing down towards the mirror post and secure with mounting screw.
10. Solder the sensor leads to the appropriate pins as shown in figure 4-6.
11. Resecure the sensor leads to the main cable assembly with spare plastic cable ties.
12. Replace the transport into the rack assembly, connecting the power cord and interface cable.
13. Following replacement of the sensor assembly, perform the BOT/EOT sensor adjustment (paragraph 4.4.2.5).

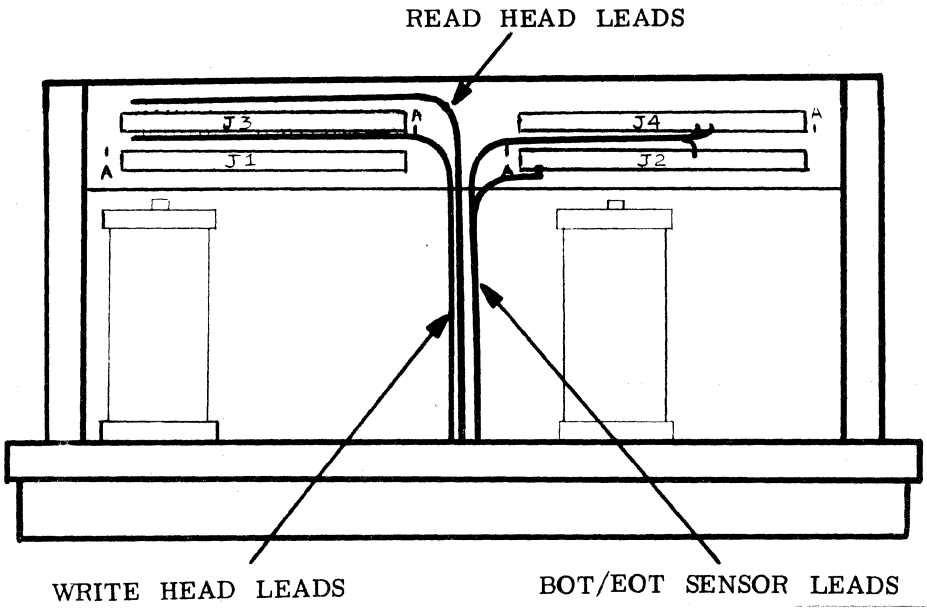

Figure 4-5. Tape Transport, Bottom View.

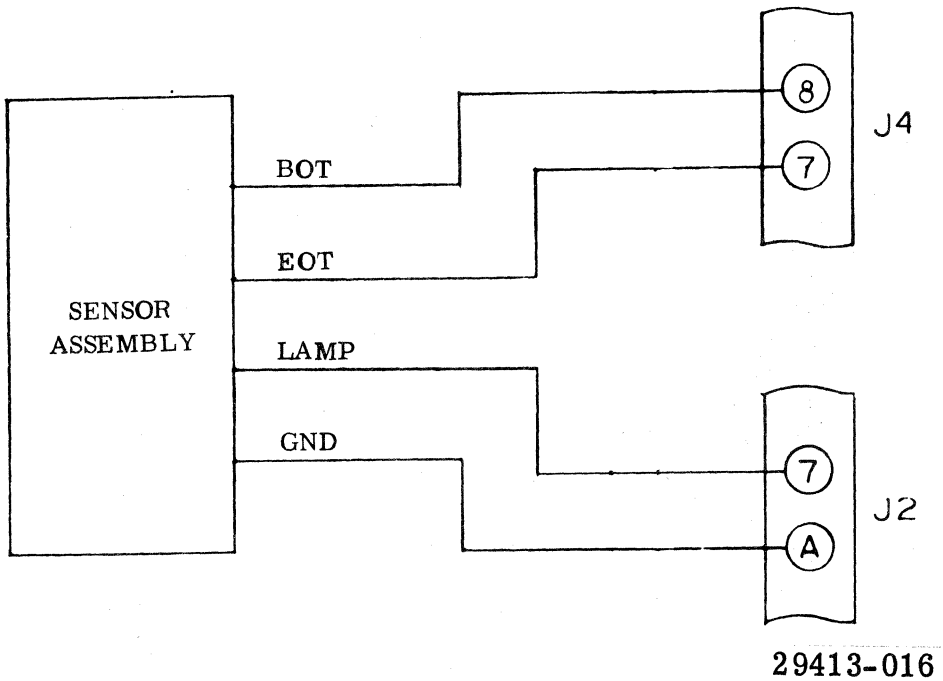

Figure 4-6. BOT/EOT Sensor Wiring Diagram.

4.3.2.5

REPLACEMENT PROCEDURE	ASSEMBLY PART NUMBER	TOOLS REQUIRED
TENSION ARM SERVO SENSOR	7013844P026	Small Screwdriver, Soldering Iron, 3/32-inch Allen Wrench, Adhesive Tape

DESCRIPTION Both tension arm assemblies are equipped with a position sensor and lamp assembly that senses the position of each tension arm. Do not replace this assembly if only the lamp is defective. The sensor lamp in each assembly is connected in series, therefore each must be checked if any or both are defective (refer to paragraph 4.3.2.15 for lamp replacement instructions).

PROCEDURE

Steps:

1. If tape is mounted on transport, rewind (manually if necessary) and remove.

2. Power down transport assembly.

3. Open transport dust cover door and release both slide rail latches (left and right knurled knobs, see figure 1-1).

4. Pull transport assembly outward from rack assembly to lock position.

NOTE

The servo assembly contains a photocell, lamp and small printed circuit card (PS-1). The assembly is removed by first unsoldering the connections to PS-1 and then removing the two mounting screws securing the assembly to the tension arm bearing block.

5. Unsolder wires from PS-1 (five on take-up PS-1, four on supply PS-1). Refer to figure 4-8 for details.

6. Remove the dark plastic shield which fits under the lamp spring clip if one is installed.

7. Place a piece of adhesive tape on the slotted disk to mark its relative position.

8. Remove black slotted servo disk from tension arm shaft (rear) by removing the 3/32" allen head cap screw. Refer to figure 4-7.

9. Using a small screwdriver, remove the assembly by removing two mounting screws. Access to the mounting screws is difficult and requires offsetting the screwdriver. This is especially true when removing the servo assembly from the supply tension arm bearing block (refer to figure 4-7).

10. Position replacement assembly in place and secure with two mounting screws (see figure 4-7).

11. Install slotted disk onto tension arm shaft and secure with 3/32" allen head cap screw.

NOTE

Reassembly of the slotted disk is very important. Notice that the slot in the disk is eccentric. Facing the rear of the transport assembly, mount the disk exactly as shown in figure 4-9. Position disk with adhesive tape in the same position as in step 7.

12. Replace plastic light shield.

13. Resolder the leads to PS-1. Refer to figure 4-8 for detail connections.

14. Following replacement of this assembly, perform the tension arm sensor adjustment (see paragraph 4.4.2.10).

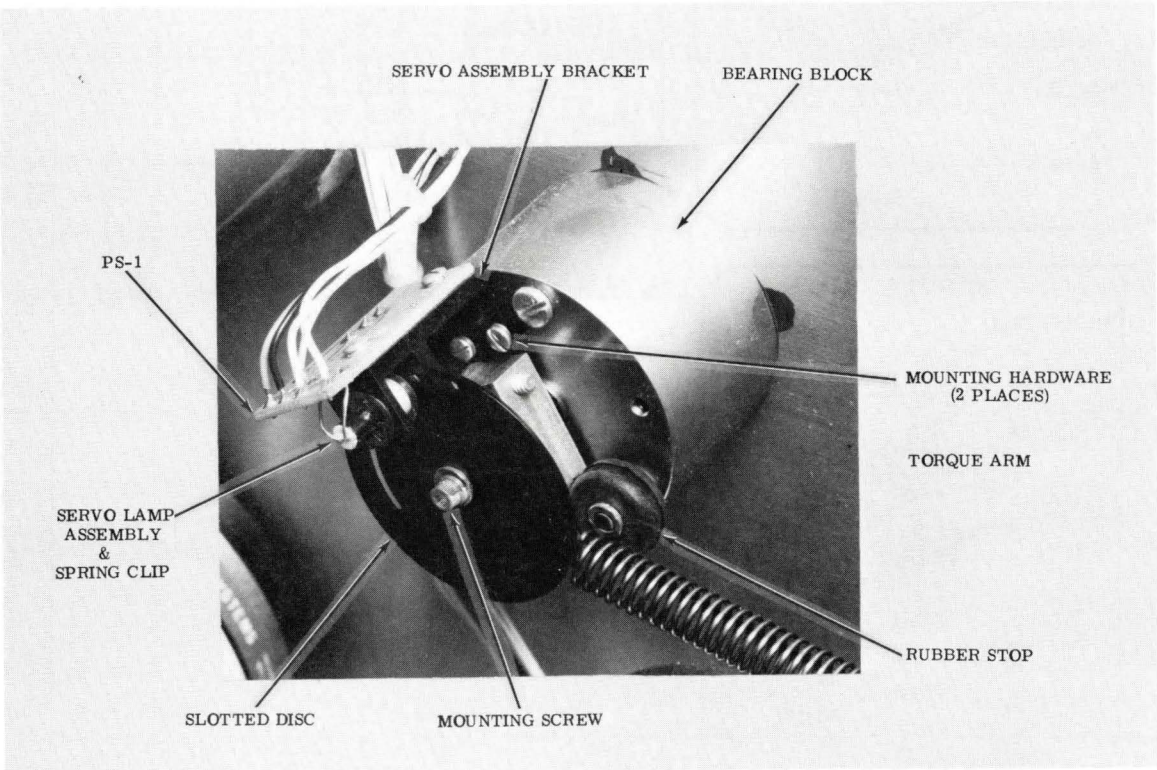

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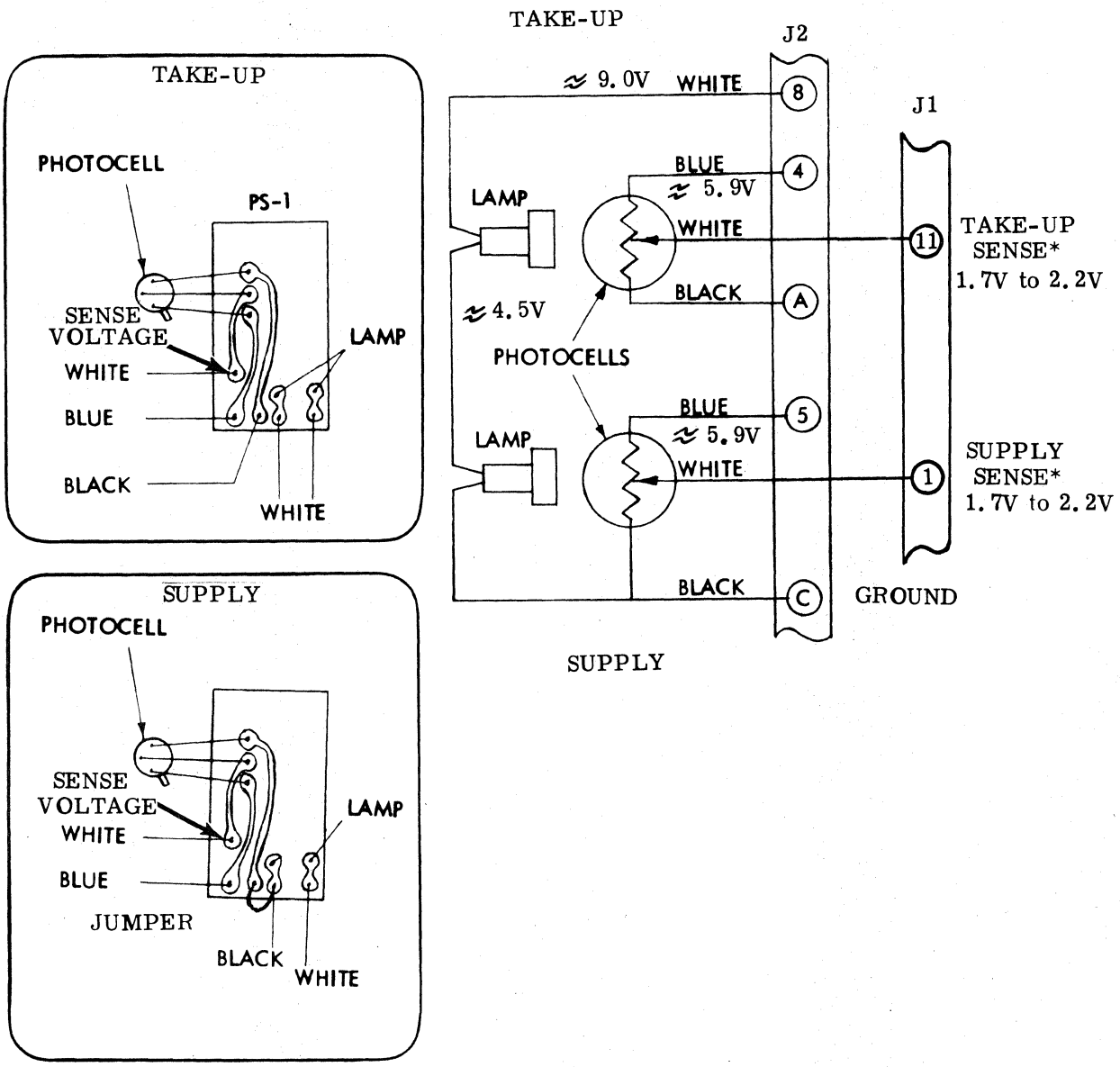
Figure 4-7. Tension Arm Servo Sensor Disassembly.



* SENSE VOLTAGES ARE DETERMINED BY ARM AND SHUTTER POSITIONS(REFER TO PARAGRAPH 4.4.2.10).THE INDICATED VOLTAGES ARE ACCEPTABLE WHEN THE TENSION ARM IS AT REST. OTHER VOLTAGES ARE APPROXMATE AND MAY VARY DEPENDING UPON TOLERANCES OF COMPONENTS . 29413-018

Figure 4-8. Tension Arm Servo Sensor Wiring/Schematic.

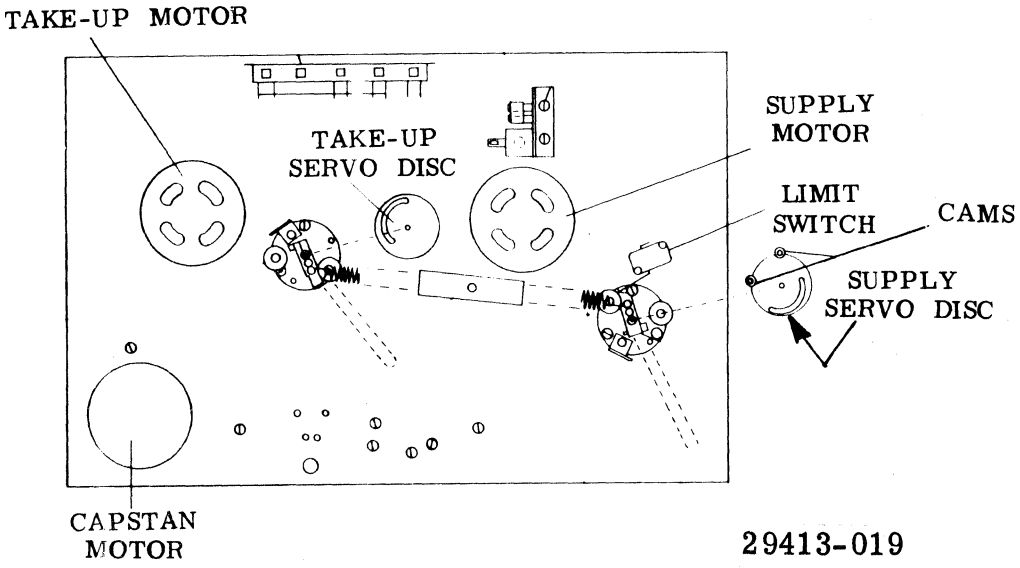


Figure 4-9. Slotted Disk Orientation.

4.3.2.6

REPLACEMENT PROCEDURE	ASSEMBLY PART NUMBER	TOOLS REQUIRED
CONTROL RELAY (K1)	7013844P023	Common Head Screwdriver

DESCRIPTION Relay K1 is activated when the LOAD button is pressed, and the arm limit switch is in the run position (supply arm off rest position). This relay is located on the RP-16 card (figure 4-10) and is easily replaceable.

PROCEDURE

Steps:

1. Power down tape transport assembly.
2. Open tape transport dust cover door and release both slide rail latches (left and right knurled knobs, see figure 1-1).
3. Pull tape transport assembly outward from rack assembly to lock position.
4. Using the screwdriver, lift and remove K1 retainer clip from relay housing.
5. Unplug and remove defective relay.
6. Insert spare K1 relay, replacing the retainer clip.

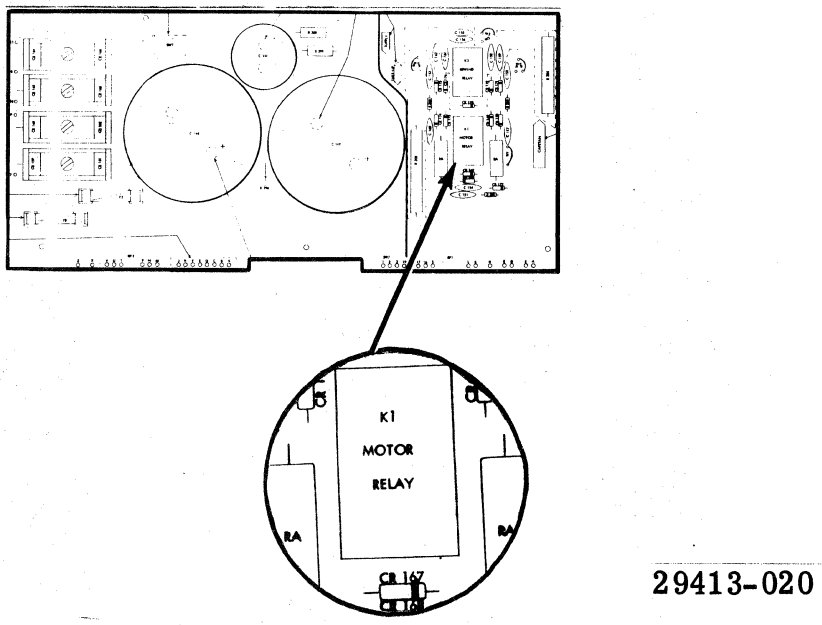


Figure 4-10. Relay K1 Replacement.

4.3.2.7

REPLACEMENT PROCEDURE	ASSEMBLY PART NUMBER	TOOLS REQUIRED
FUSE REPLACEMENT	7528001P105 7528001P005 7528001P055	

DESCRIPTION Checking all fuses and replacing those which are defective should be the first step in any maintenance activity.

PROCEDURE

Steps:

a. F1 Replacement

1. Power down tape transport assembly.

2. Fuse F1 is easily accessible from the fuse holder on the rear panel of the tape transport assembly. Remove and replace if necessary.

b. F2 F3 Replacements

1. Open tape transport dust cover door and release both slide rail latches (left and right knurled knobs, see figure 1-1).

2. Pull tape transport assembly outward from rack assembly to lock position.

3. From the bottom of the tape transport assembly, pry the faulty fuse (F2 or F3) from the fuse clip on the RP-16 card (see figure 4-11).

4. Insert spare fuse by snapping into clip holder.

5. Secure tape transport in normal rack mounted position.

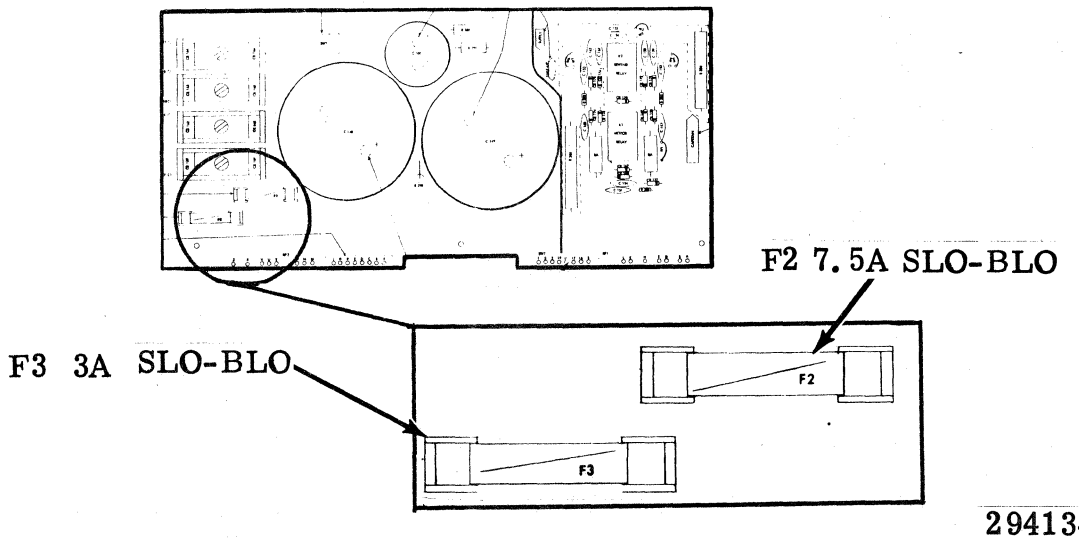


Figure 4-11. Location of Fuses F2 and F3.

4.3.2.8

REPLACEMENT PROCEDURE	ASSEMBLY PART NUMBER	TOOLS REQUIRED
FILTER CAPACITORS	7013844P024 7013844P025	Common Head Screwdriver

DESCRIPTION All three filter capacitors (C148, C149 and C150) are easily accessible by placing the transport assembly on its side with the bottom facing outward and the card cage assembly in the hinged down position.

PROCEDURE

Steps:

1. Power down tape transport assembly.
2. Open tape transport dust cover door and release both slide rail latches (left and right knurled knobs, see figure 1-1).
3. Pull tape transport outward from the rack assembly to the lock position.
4. Disconnect power cord and interface cable and remove cable clamp (see paragraph 4.3.2.1). Remove transport from rack.
5. Remove the MC-17 and RC-11 printed circuit cards. Refer to respective replacement procedures for removal.
6. Place tape transport on a work surface on its side with the bottom facing outward.
7. From the backplane of the RP-16 card, remove the two mounting screws while holding the defective capacitor. Two fiber spacers are used (one for each terminal) to provide mounting stability (C148 and C149 only). Refer to figure 4-12 for capacitor location and polarity orientation.
8. Insert spacers onto replacement capacitor and position capacitor in place. If there is difficulty in keeping the spacers in place while positioning C148 and/or C149, secure spacers with tape or adhesive.

CAUTION

Polarity is extremely important when installing the replacement capacitor. Positive (+) polarity is indicated on the bottom of the capacitor in addition to a RED mark on the capacitor case. Make absolutely sure that the positive capacitor terminal is connected to the positive plane of the RP-16 card (etched into back-plane).

9. Secure capacitor with mounting hardware.

4.3.2.9

REPLACEMENT PROCEDURE	ASSEMBLY PART NUMBER	TOOLS REQUIRED Common Head Screwdriver, Soldering Iron, Nut Driver Set, Desoldering Tool
POWER RECTIFIERS	7013844P022	

DESCRIPTION The four power rectifier assemblies located on the RP-16 card are not easily accessible. In some cases the defective rectifier leads may have to be cut rather than unsoldered. If cut, remove remaining leads by unsoldering and pulling leads through the backplane of the card. Refer to figure 4-12 for rectifier assembly location.

PROCEDURE

Steps:

1. Power down tape transport assembly.
2. Open tape transport dust cover door and release both slide rail latches (left and right knurled knobs, see figure 1-1).
3. Pull tape transport outward from the rack assembly to the lock position.
4. Disconnect power cord and interface cable and remove cable clamp (see paragraph 4.3.2.1). Press both spring loaded lock latches (see figure 4-4) and remove transport from rack. Place tape transport on a work surface with the top facing upward.
5. Remove MC-17 and RC-11 printed circuit cards. Refer to respective replacement procedures for removal.
6. Remove all three filter capacitors from the RP-16 card (refer to paragraph 4.3.2.8).
7. Disconnect all three motor connectors from the RP-16 card.
8. Remove the top three mounting screws securing the RP-16 card to the upper bracket.

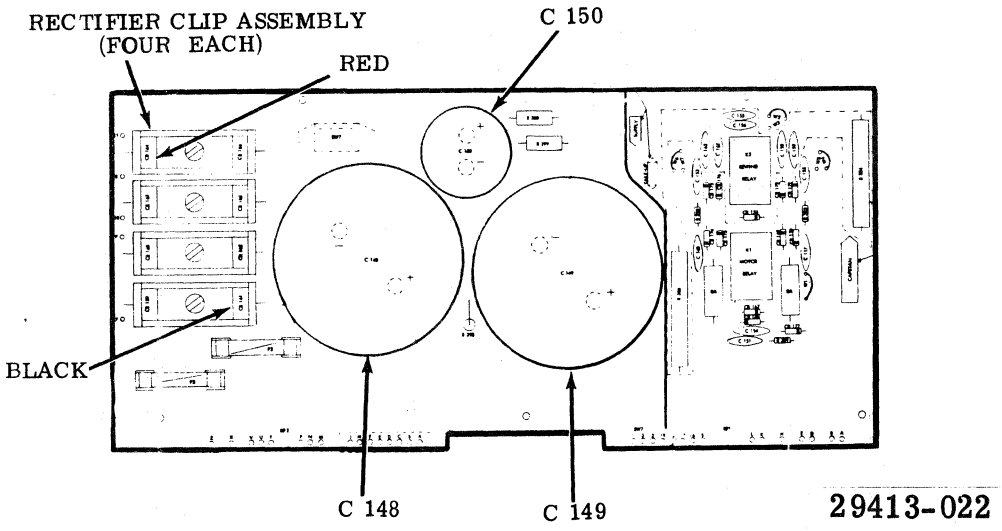


Figure 4-12. RP-16 Rectifier and Filter Capacitor Replacement.

IMPORTANT

Notice the fibre washer on the left hand mounting screw (viewed from rear of transport). It is important that the fibre washer be reinstalled at this location to eliminate the possibility of a short circuit between the screw head and printed circuit.

9. Loosen lower bracket side panel mounting screws (one each side of transport).

10. Swing RP-16 card downward using the lower bracket as a hinge.

11. Unsolder (cut if necessary) leads of defective rectifier assembly. If necessary, use the desoldering tool.

12. Remove 10-32 mounting hardware securing the rectifier clip assembly to the RP-16 card (backplane) and remove rectifier clip assembly.

13. Install replacement rectifier clip assembly, secure with mounting hardware and solder rectifier leads.

CAUTION

The rectifier clip assemblies are polarized for replacement purposes. Diodes CR159, CR160, CR163 and CR164 (formerly Delco, lettered in red) are type 1N3492R and must be installed nearest to the edge of the RP-16 card. The other end of the assembly, diodes CR161, CR162, CR165 and CR166 (formerly Delco, lettered in black) are type 1N3492 and must be installed nearest to capacitor C148.

14. Secure RP-16 card in its normal position (fiber washer in top left hand mounting hole).

15. Tighten lower bracket side panel hardware.

16. Connect all three motor connectors (observe proper connections).

17. Replace all three filter capacitors (observe proper polarity, refer to paragraph 4.3.2.8).

18. Replace MC-17 and RC-11 printed circuit cards. (MC-17 components facing inward, RC-11 components facing to the rear).

19. Replace transport into the rack assembly connecting power cord and interface cable. Secure interface cable with the cable clamps removed in step 4.

20. Return transport to normal service and verify proper operation.

4.3.2.10

REPLACEMENT PROCEDURE	ASSEMBLY PART NUMBER	TOOLS REQUIRED
TAPE HEAD (WRITE/READ)	7013844P001	Common Head Screwdriver, Soldering Iron and Plastic Cable Ties

DESCRIPTION The tape head may require replacement after prolonged use or in the event of an internal wiring problem. The head should be inspected occasionally for signs of wear. If the head crown is worn to the depth of the side gutters, the head should be replaced.

Replacement heads are factory tested and all wiring is properly shielded, stripped and tinned prior to shipping.

PROCEDURE

Steps:

1. If tape is mounted on tape transport, rewind and remove.
2. Power down tape transport assembly.
3. Open tape transport dust cover door and release both slide latches (left and right knurled knobs, see figure 1-1).
4. Pull tape transport assembly outward from rack assembly to the lock position. Disconnect the power cord and interface cable. Remove interface cable clamp (see paragraph 4.3.2.1). Press both spring loaded lock latches (left and right slide rails, see figure 4-4) and remove tape transport from rack. Place tape transport on a work surface with the bottom facing upward.
5. Unsolder all head leads from J3 connector pins. Refer to figure 4-13 for detailed connections.
6. Remove the two head mounting screws from the rear of the front panel, just above the leads.
7. Cut the cable ties that secure both the read and write head leads to the main cable harness.
8. Remove the head assembly, pulling leads through the front panel access hole.
9. Insert the leads of the replacement unit through the front panel access hole and secure the head assembly with the mounting screws and associated hardware.
10. Dress the leads along the same path as the original unit, securing the leads to the main cable harness with plastic cable ties.
11. Solder leads to J3 connector pins as illustrated in figure 4-13.

NOTE

The write head cable is distinguishable by the light gauge (#26) white and black wire at the end of the cable. The bulk of the head leads fan out of the shielding (in pairs, 1 blue and 1 red) in the proper sequence for connection to J3 beginning with a blue lead and continuing with alternate red and blue leads.

12. Replace the transport assembly on its slide mount and reconnect the interface cable and power cord. Also replace cable clamp.

13. Clean head assembly using isopropyl alcohol, cotton swab and clean, lint free cloth.

14. Following head replacement, perform the following adjustments;

    (a) Read Amplifier Output (paragraph 4.4.2.6).

    (b) Flux Gate Shield (paragraph 4.4.2.7).

    (c) Read Skew (paragraph 4.4.2.9).

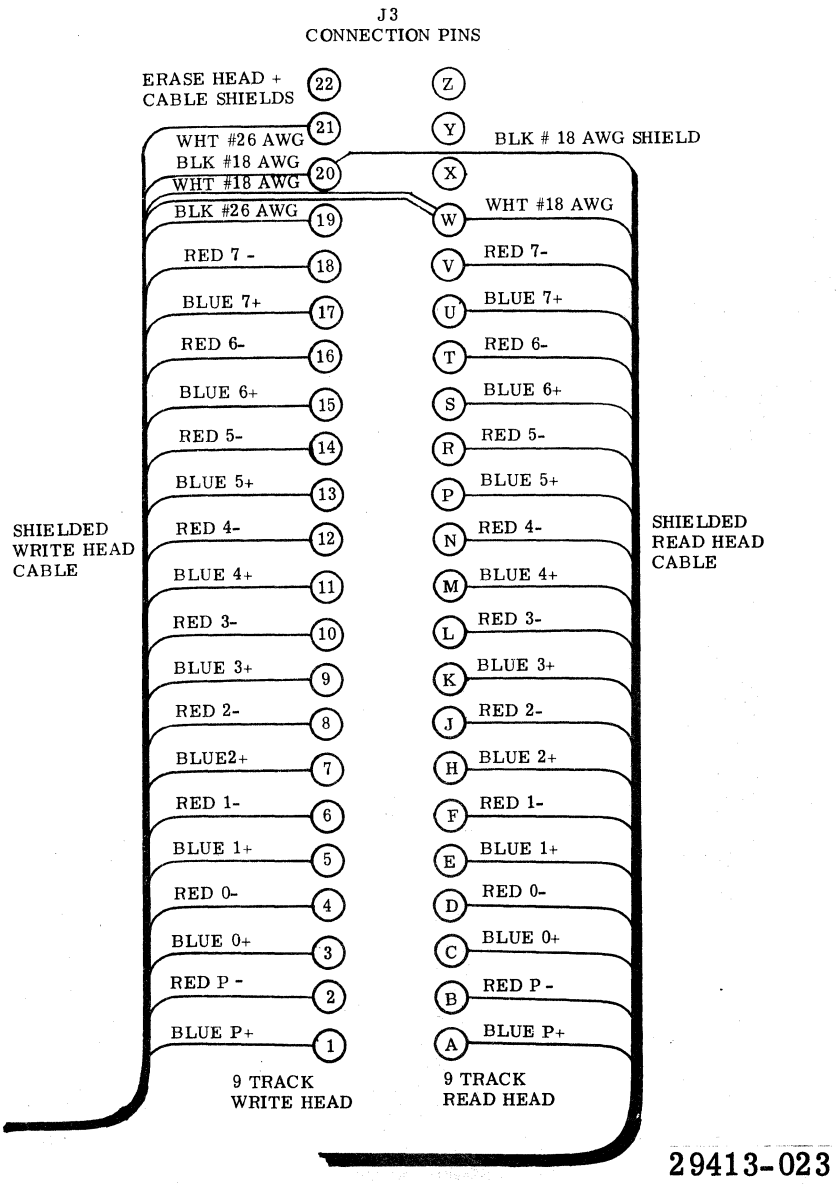


Figure 4-13. Tape Head Wiring Diagram.

REPLACEMENT PROCEDURE	ASSEMBLY PART NUMBER	TOOLS REQUIRED Common
CAPSTAN MOTOR	7013844P011	Head Screwdriver, Phillips Head Screwdriver, 1/16" Allen Wrench

DESCRIPTION If the capstan motor fails to operate, first check the motor brushes and replace, if necessary, before attempting to replace the motor.

PROCEDURE

Steps:

1. If tape is mounted on tape transport, rewind (manually if necessary) and remove.
2. Power down tape transport assembly.
3. Open tape transport dust cover door and release both slide rail latches (left and right knurled knobs, see figure 1-1).
4. Pull tape transport assembly outward from rack assembly to lock position.
5. Accurately measure and record distance between front panel and inside edge of drive wheel for future reference (see figure 4-14 which shows similar measurement on the supply reel hub).
6. The capstan drive wheel is secured to the motor shaft with a set screw. Loosen set screw and remove drive wheel from shaft.
7. Disconnect capstan motor connector from RP-16 card. Refer to figure 4-15 for connector location.
8. Remove four phillips head mounting screws that secure capstan motor to the front panel.
9. Install and secure replacement capstan motor with phillips head screws.

NOTE

When installing replacement motor, check to insure that both mounting surfaces (front panel and motor mounting surface)are clean and free of any foreign material so that motor will mount perpendicular to the front panel and tape path.

10. Connect motor connector to power board receptacle.
11. Replace capstan drive wheel onto motor shaft. Position wheel to the same distance measured in step 5 and secure with set screw.
12. Following replacement of capstan motor, perform the following adjustments;
    (a) Capstan Servo (paragraph 4.4.2.4).
    (b) Read Skew (paragraph 4.4.2.9).

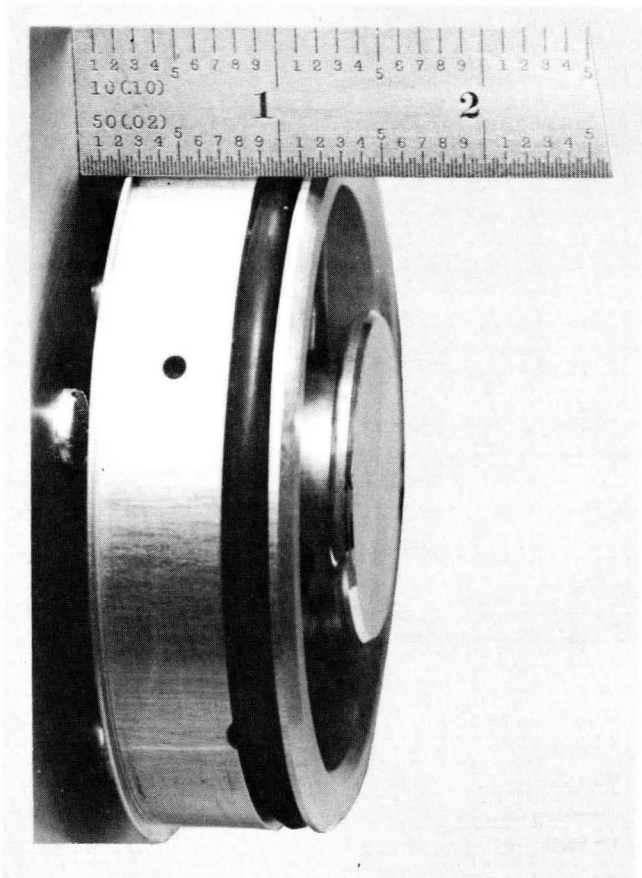


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Figure 4-14. Face Plate,Side View.

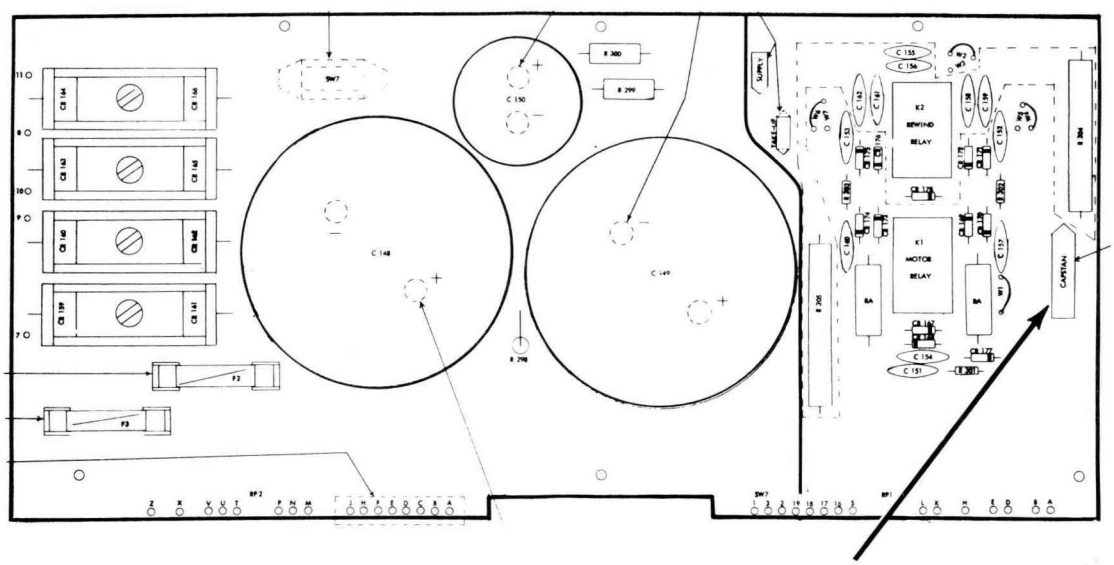

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Figure 4-15. Capstan Motor Connector Location.

4.3.2.12

REPLACEMENT PROCEDURE	ASSEMBLY PART NUMBER	TOOLS REQUIRED
REEL MOTORS	7013844P012	Common Head Screwdriver, 3/32" & 5/64" Allen Wrenches, Machinist Rule

DESCRIPTION If either reel motor fails to operate, first check the motor brushes and replace, if necessary, before attempting to replace the motor.

PROCEDURE

Steps:

1. If tape is mounted on tape transport, rewind (manually if necessary) and remove.
2. Power down tape transport assembly.
3. Open tape transport dust cover door and release both slide rail latches (left and right knurled knobs, see figure 1-1).
4. Pull tape transport assembly outward from rack assembly to lock position.
5. Accurately measure the distance between the front panel and inside edge of reel hub of defective motor (either supply hub or take-up hub) for future reference (see figure 4-14).
6. Both reel hubs are secured to the respective motor shaft with an allen head set screw (3/32-inch for supply reel, 5/64-inch for take-up reel). Loosen set screw and remove appropriate reel hub.

   NOTE

   The rubber covering on the take-up hub must be removed to access the set screw. Simply pull rubber covering off.

7. Disconnect motor connector from RP-16 card (figure 4-16).
8. After removing hub, remove four common head front panel mounting screws securing defective reel motor and remove.
9. Install and secure replacement motor, insuring that mounting surface is clean and free from foreign material.
10. Reconnect motor connector to power board receptacle.
11. Replace reel hub onto motor shaft. Position hub to the same distance measured in step 5 and secure with set screw. If take-up motor is replaced, be sure to replace rubber hub covering.
12. Following replacement of either reel motor, perform the Reel Servo adjustments (paragraph 4.4.2.3).

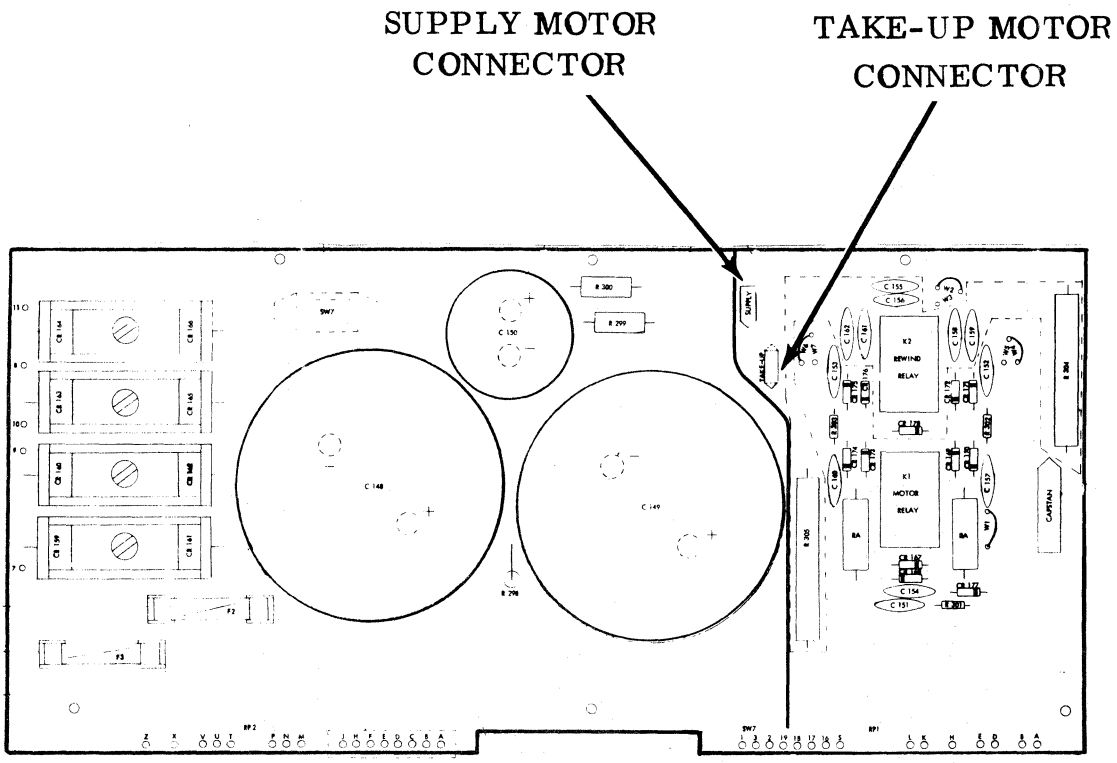

Figure 4-16. Supply/Take-Up Reel Motor Connector Location.

4.3.2.13

REPLACEMENT PROCEDURE	ASSEMBLY PART NUMBER	TOOLS REQUIRED
INDICATOR LAMPS	7532008P004	N/A

DESCRIPTION Indicator bulbs located on the tape transport control panel (figure 3-1) should immediately be replaced when found to be defective.

PROCEDURE

Steps:

1. Power down tape transport assembly.
2. Remove indicator lens assembly by turning counter-clockwise several turns.
3. Remove and replace lamp (type 382).
4. Replace indicator lens assembly, power up tape transport and verify operation of indicator lamp.

4.3.2.14

REPLACEMENT PROCEDURE	ASSEMBLY PART NUMBER	TOOLS REQUIRED
TAPE GUIDES	7013844P002 7013844P003	Common Head Screwdriver

DESCRIPTION There are two types of tape guide assemblies; fixed and rotating. Both types are easily accessible for replacement.

PROCEDURE

Steps:

1. Power down tape transport assembly.
2. Open tape transport dust cover door and release both slide rail latches (left and right knurled knobs see figure 1-1).
3. Pull tape transport assembly outward from the rack.
4. Remove tape guide mounting hardware from the rear of the front panel (see figure 4-17).
5. Install replacement tape guide and secure with mounting hardware.

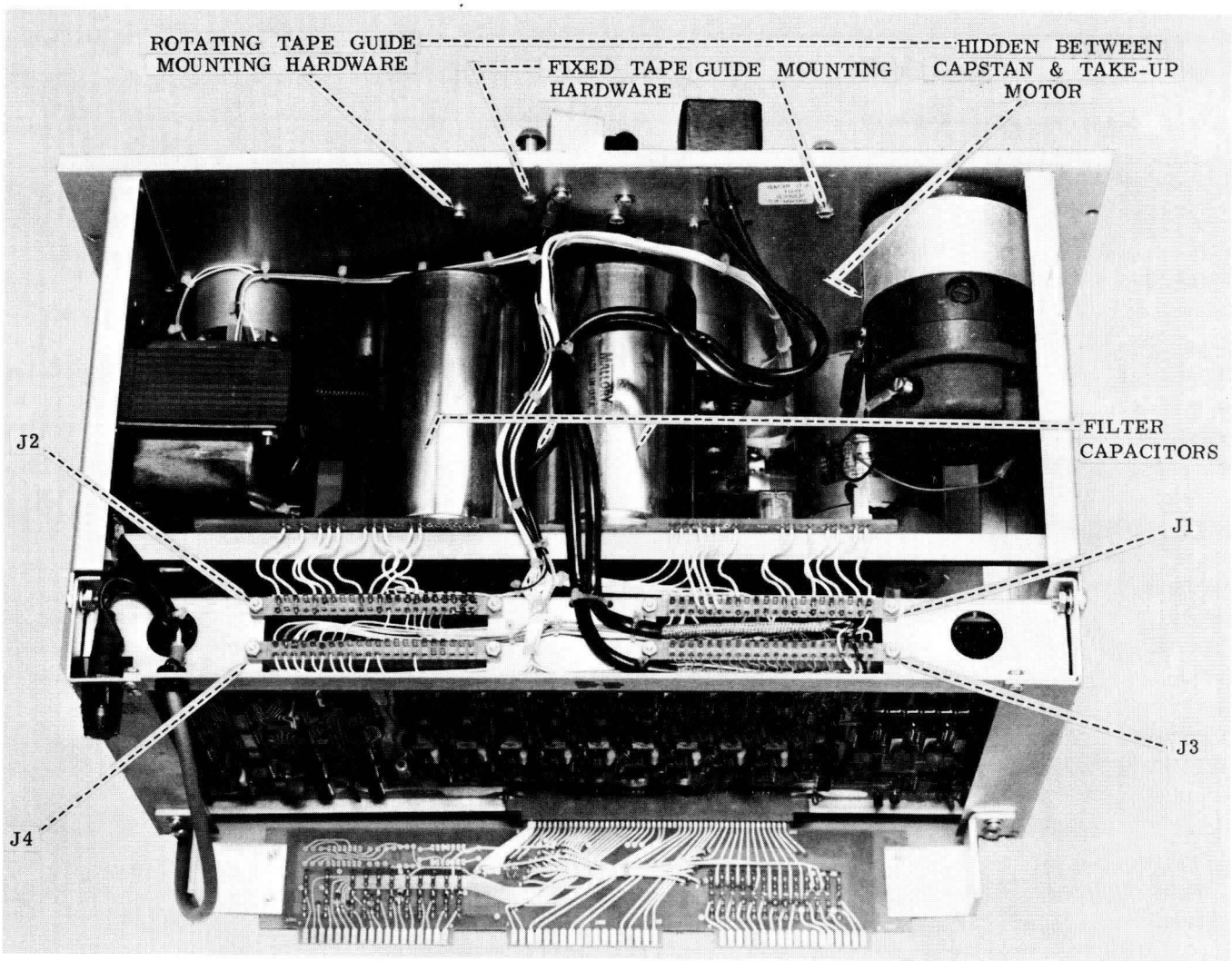

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Figure 4-17. Tape Guide Disassembly/Replacement.

4.3.2.15

REPLACEMENT PROCEDURE	ASSEMBLY PART NUMBER	TOOLS REQUIRED
TENSION ARM SERVO LAMPS	7013844P017	Small Common Head Screwdriver, Soldering Iron, Triplett Model 310 VOM

DESCRIPTION The supply and take-up tension arm servo sensor lamp assemblies are connected in series. Failure of one lamp causes both lamps to go out. Determine which lamp is defective (open) by using the VOM. Check both lamps; it is possible for both lamps to be defective. Refer to figure 4-8 for location and schematic drawing of sensor assembly.

PROCEDURE

Steps:

1. Remove black plastic light shield if one is installed.
2. Unsolder both leads of the defective lamp(s).
3. Using a small screwdriver, pry loose the spring clip that secures the lamp to the black mounting bracket. Do not remove clip, just loosen.
4. The end of the black mounting bracket is slotted as shown in figure 4-18. To remove the take-up servo lamp, slide lamp down and remove. The supply servo sensor is mounted differently. The lamp must be lifted upward to remove.
5. Remove spring clip and insert on replacement bulb.
6. Position replacement lamp in place and push spring clip tightly against bracket to secure lamp.
7. Resolder lamp leads.
8. Replace plastic light shield.
9. Check to insure that the sense voltages at the center lead of each photocell is between 1.7 to 2.2V DC with each respective tension arm at the rest position. If the sense voltage is not satisfactory perform the Tension Arm Servo Sensor adjustment (see paragraph 4.4.2.10).

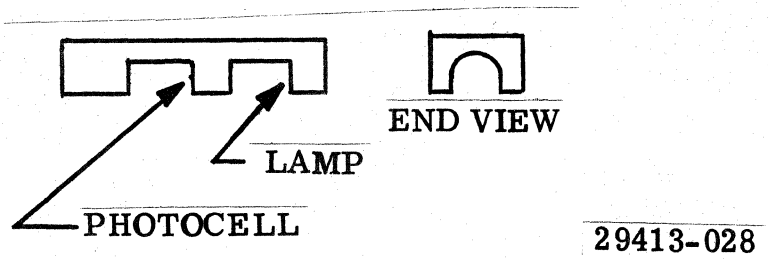


Figure 4-18. Mounting Bracket, Servo Lamp.

4.4 ADJUSTMENT PROCEDURES

4.4.1 GENERAL

The following adjustment procedures are provided to insure satisfactory operation of the tape transport following replacement of a major assembly.

These adjustments are preset at the factory and only require readjustment following replacement of a major assembly.

The adjustments located on the MC-17 card are not readily accessible, therefore, all of the adjustment procedures relative to the MC-17 card must be performed with the card cage assembly in the hinged down position.

4.4.2 PROCEDURES

The adjustment procedures are grouped into electrical and mechanical adjustments as listed in table 4-3. Each procedure provides a general description of the adjustment, in addition to recommended test equipment, tools required and specific instructions.

It is important to note that all potentiometer adjustments and mechanical adjustments are coated with glyptal (or equivalent) to secure the original setting. Following readjustment, it is necessary to apply glyptal or equivalent to secure the new setting.

TABLE 4-3

ADJUSTMENT PROCEDURES

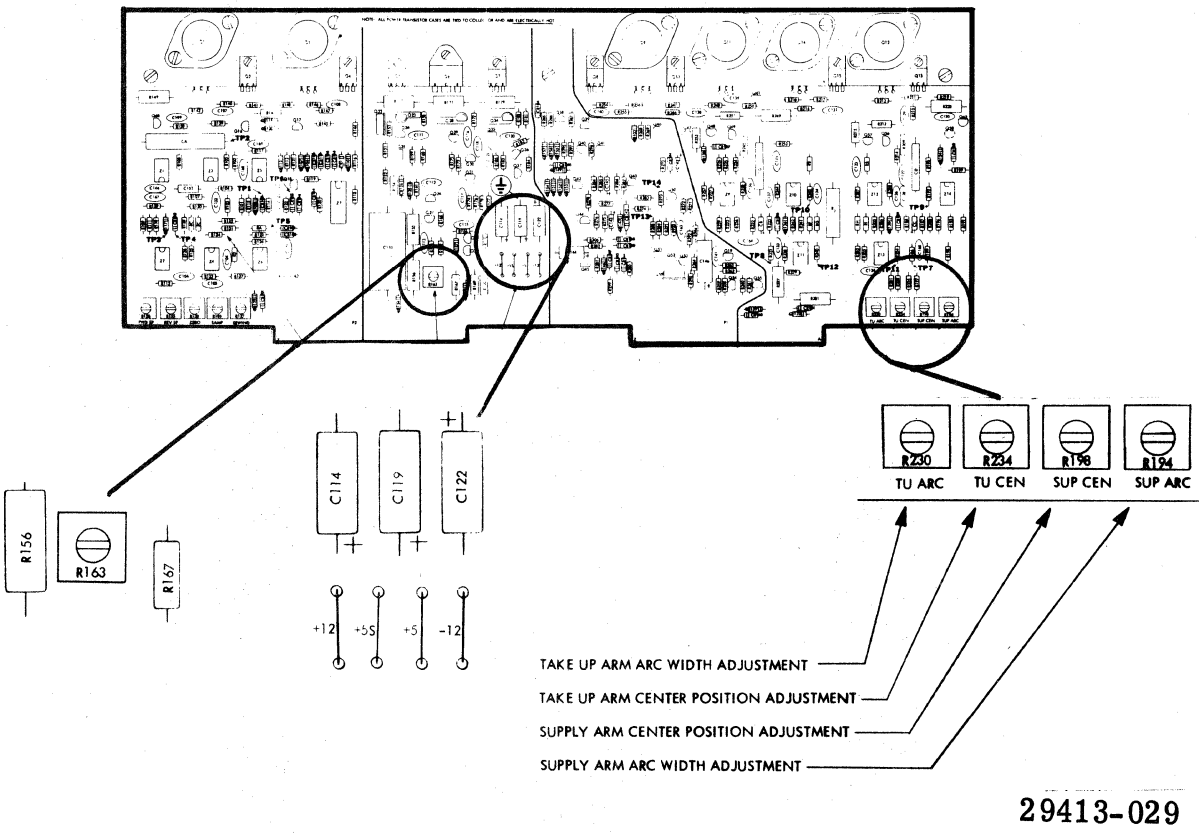


Figure 4-19. Power Supply and Reel Servo Adjustment Locations.

4.4.2.1

ADJUSTMENT	COMPONENT REFERENCE
POWER SUPPLY OUTPUT	R163
ASSEMBLY NAME	**ASSEMBLY PART NUMBER**
MC-17 Card	7013844P019
RECOMMENDED TEST EQUIPMENT	**TOOLS REQUIRED**
Digital Voltmeter	Common Head Screwdriver

DESCRIPTION The +5 volt and -12 volt regulator circuits are referenced to the +12 volt output. The adjustment of +12V (R-163) simultaneously sets all three outputs to the proper voltages. Refer to figure 4-19 for location of test points and adjustments.

PROCEDURE

NOTE

The +12 volt output is factory set and is not normally adjusted in the field. If the MC-17 card is replaced, the +12 volt output should be monitored and adjusted if necessary.

Steps:

1. Attach digital voltmeter to +12V test bus or + side of C114.
2. If necessary, adjust R163 to obtain an output of +12.00 ± 0.06 VDC.
3. Verify that the outputs listed below are satisfactory.

-12	Test Point	-12.0 ± 0.6 VDC
+5	Test Point	+5.00 ± 0.25 VDC
+5S	Test Point	+5.0 ± 0.5 VDC

If the +12V output is adjusted, the adjustment procedures listed below must be checked and readjusted if necessary.

(a) Reel Servo (paragraph 4.4.2.3)

(b) Capstan Servo (paragraph 4.4.2.4)

(c) BOT/EOT Sensor (paragraph 4.4.2.5)

4.4.2.2

ADJUSTMENT	COMPONENT REFERENCE
PRELIMINARY REEL SERVO SET UP	R198 and R234
ASSEMBLY NAME	**ASSEMBLY PART NUMBER**
MC-17 Card	7013844P019
RECOMMENDED TEST EQUIPMENT	**TOOLS REQUIRED**
None	Common Head Screwdriver

DESCRIPTION The preliminary reel servo set up is required to provide a course centering adjustment of the supply and take-up tension arms.

PROCEDURE

Preliminary:

1. Tape transport must be removed from the rack assembly and placed on a work surface (see Transport Replacement Procedure paragraph 4.3.2.1).

2. Card cage assembly must be in the hinged down position. Remove the two hinge release screws (see figure 4-1) and pull card cage down.

Steps:

1. If tape reel is installed, rewind and remove.

2. Adjust capstan and reel servo adjustments to the approximate center of their range (see figure 4-2).

3. Cut a 2-inch piece of scrap tape and place it between the sensor and mirror post to inhibit the BOT/EOT circuits.

4. Place the supply tension arm at the approximate center of its arc and hold.

5. Press and hold the LOAD button. Take-up reel, supply reel and capstan motor should rotate.

6. Press LOAD and ON LINE buttons simultaneously (simulates BOT). Capstan motor should stop.

7. While supply and take-up motors are operating, and with the supply tension arm held at the exact center (point C, figure 4-21). Adjust the S CEN (R-198) until supply motor stops.

8. Secure the supply tension arm so that it is off the stop position (not necessarily in the center). This is required to maintain rotation of take-up motor for centering adjustment. A write ring, looped around the arm roller and the nearby tape guide is a convenient method. A large screwdriver or other device wedged between the work surface and supply tension arm roller is an alternate method.

PROCEDURE(Cont.) PRELIMINARY REEL SERVO SET UP ADJUSTMENT

NOTE

If the supply arm is accidentally moved to either extreme of the operating arc, it will trip a microswitch which shuts down all motors. If this occurs, resecure the supply arm, press LOAD button to start the motors, then press LOAD and ON-LINE to halt the capstan motor. The capstan motor must be halted in this manner to perform the preliminary arm centering adjustment properly.

9. Position the take-up tension arm at the exact center of its arc (point H, figure 4-21) and hold. Adjust the T CEN (R-234) until take-up motor stops.

10. Do not reassemble the card cage assembly in the normal position. Assembly must be in the hinged down position to access additional adjustments.

11. Perform Reel Servo Adjustment (paragraph 4.4.2.3).

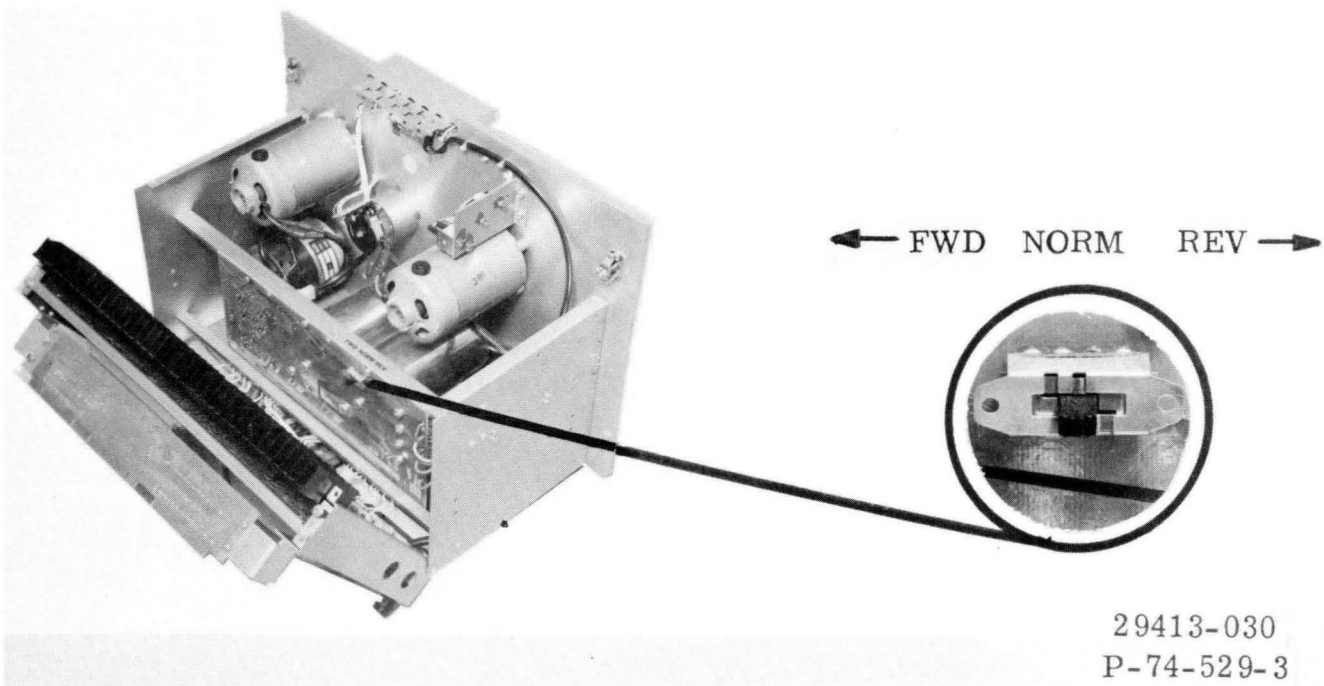


Figure 4-20. Service Switch Location.

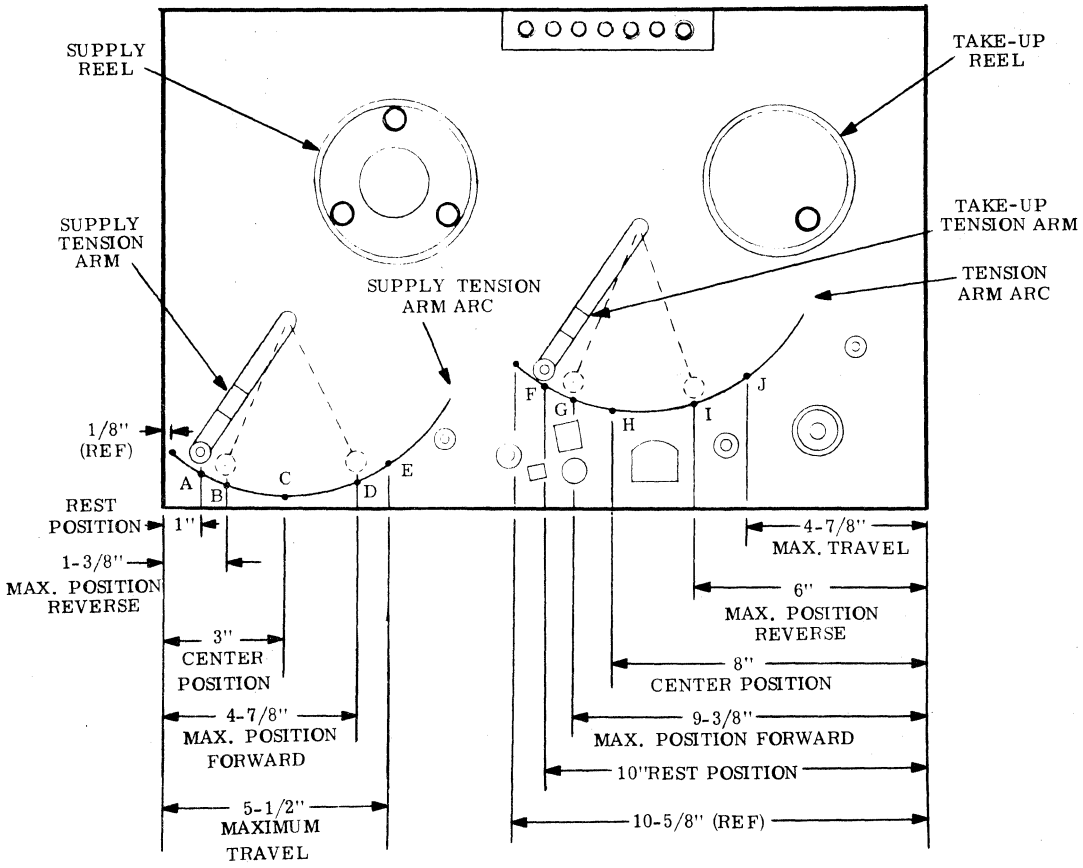


Figure 4-21. Location of Tension Arm Operating Positions.

4.4.2.3

ADJUSTMENT	COMPONENT REFERENCE
REEL SERVO	R194 and R230
ASSEMBLY NAME	**ASSEMBLY PART NUMBER**
MC-17 Card	7013844P019
RECOMMENDED TEST EQUIPMENT	**TOOLS REQUIRED**
Reel of Test Tape	Common Head Screwdriver

DESCRIPTION These adjustments are required to set the proper operating range of both tension arms. Refer to figure 4-19 for adjustment locations and figure 4-21 for the appropriate reference point locations.

PROCEDURE

Steps:

1. Place a 2-inch piece of scrap tape between the BOT/EOT sensor and mirror post.
2. Position the supply tension arm off its rest position and hold.
3. Press the LOAD button to start all motors. Capstan motor must be rotating to perform this adjustment.

   IMPORTANT

   Do not release supply tension arm.

4. Place the service switch in the FWD (forward) position. Refer to figure 4-20 for location of service switch.
5. Move the supply tension arm to point D as illustrated in figure 4-21 and hold.
6. Adjust SUP ARC (R194) until the supply reel motor stops.
7. Secure the supply tension arm so that it is off the rest position (see step 8 of the Preliminary Reel Servo Set Up).
8. Move the take-up tension arm to point G as illustrated in figure 4-21 and hold.
9. If take-up reel motor does not stop rotating, adjust TU ARC (R-230) until the take-up reel stops.
10. Place the service switch in the REV (reverse) position.
11. Position the supply tension arm to point B as illustrated in figure 4-21 and hold.
12. Adjust SUP ARC (R194) until supply reel stops (should be a very slight adjustment).
13. Secure the supply tension arm off of the rest position (refer to step 7).
14. Place the take-up tension arm to point I (figure 4-21) and hold.

15. Adjust TU ARC (R-230) until take-up reel stops (should be a very slight adjustment).

16. Mount and load a reel of test tape using the standard procedure.

17. Exercise both forward and reverse directions using the service switch. If reel servos are properly adjusted, the transport will continue to operate in a normal manner. If improperly adjusted, the transport will shut down as a result of activating the supply tension arm limit switch. If this occurs repeat the Preliminary Reel Servo Set Up (paragraph 4.4.2.2) except for step 2. Then repeat this entire procedure.

18. If the transport continues to operate normally, check to insure that the forward and reverse operating positions of both tension arms are within 1/4-inch of their specified reference points illustrated in figure 4-21. If necessary, make repeated fine adjustments of both the SUP ARC and TU ARC in both directions to adjust the tension arm operating positions to within 1/4-inch. Also readjust both center positions if necessary (see table below).

Component	Function	Description
R-230	TU ARC	Controls the extremes of the take-up tension arm arc.
R-234	TU CEN	Controls the take-up tension arm center position. Must be adjusted without tape motion; i.e., loaded and on-line.
R-194	SUP ARC	Controls the extremes of the supply tension arm arc.
R-198	SUP CEN	Controls the supply tension arm center position. Must be adjusted without tape motion; i.e., loaded and on-line.

4.4.2.4

ADJUSTMENT	COMPONENT REFERENCE
CAPSTAN SERVO	R138, R126, R127 and R106
ASSEMBLY NAME	**ASSEMBLY PART NUMBER**
MC-17 Card	7013844P019
RECOMMENDED TEST EQUIPMENT	**TOOLS REQUIRED**
Reel of Test Tape, Tektronix Oscilloscope Model 422, 432 or 453, Digital Voltmeter and TC-12 Exerciser Card	Common Head Screwdriver

DESCRIPTION The following adjustments must be performed whenever the MC-17 card or capstan motor-tachometer is replaced. These adjustments set the forward, reverse and rewind speed in addition to the capstan zero and ramp adjustment. Refer to figures 4-22 and 4-23 for location of test points and adjustments.

PROCEDURE

NOTE

Card cage assembly must be in the hinged down position.

Steps:

a. Capstan Zero Adjustment (figure 4-22)

1. Connect voltmeter to test point TP-15.
2. Place a piece of magnetic tape between the BOT/EOT sensor and mirror post.
3. Secure supply tension arm away from the rest position (approximate center).
4. Press the POWER ON button.
5. Press the LOAD button.
6. Press the LOAD and ON LINE buttons simultaneously. Capstan motor should stop.
7. Adjust ZERO pot (R138) for 0.0 $\pm$ 0.005V at TP-15.

b. Forward Speed Adjustment (figure 4-23)

1. Mount and thread test tape. Refer to loading procedure in Section 3.
2. Press LOAD button. Tape should advance to BOT and stop.
3. Attach the digital voltmeter to TP-5.
4. Place the service switch in the FWD position.

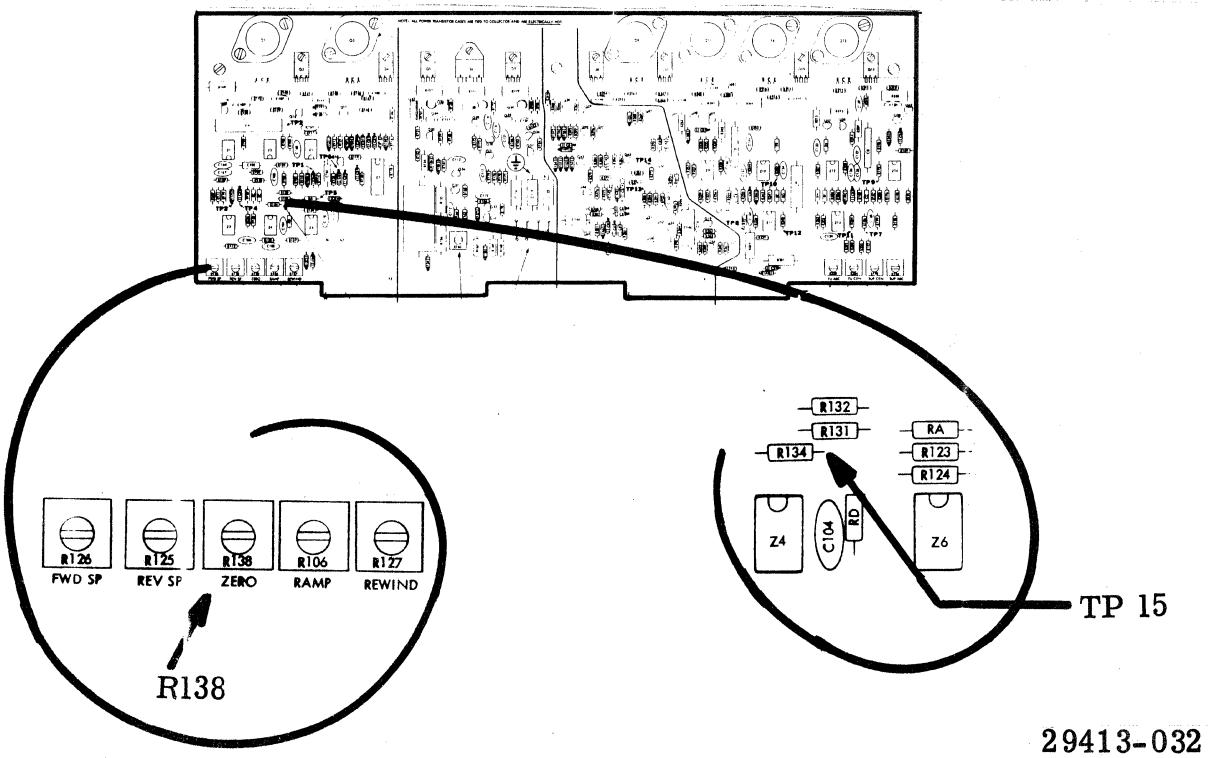


Figure 4-22. Capstan Servo Adjustments/Test Point Locations.

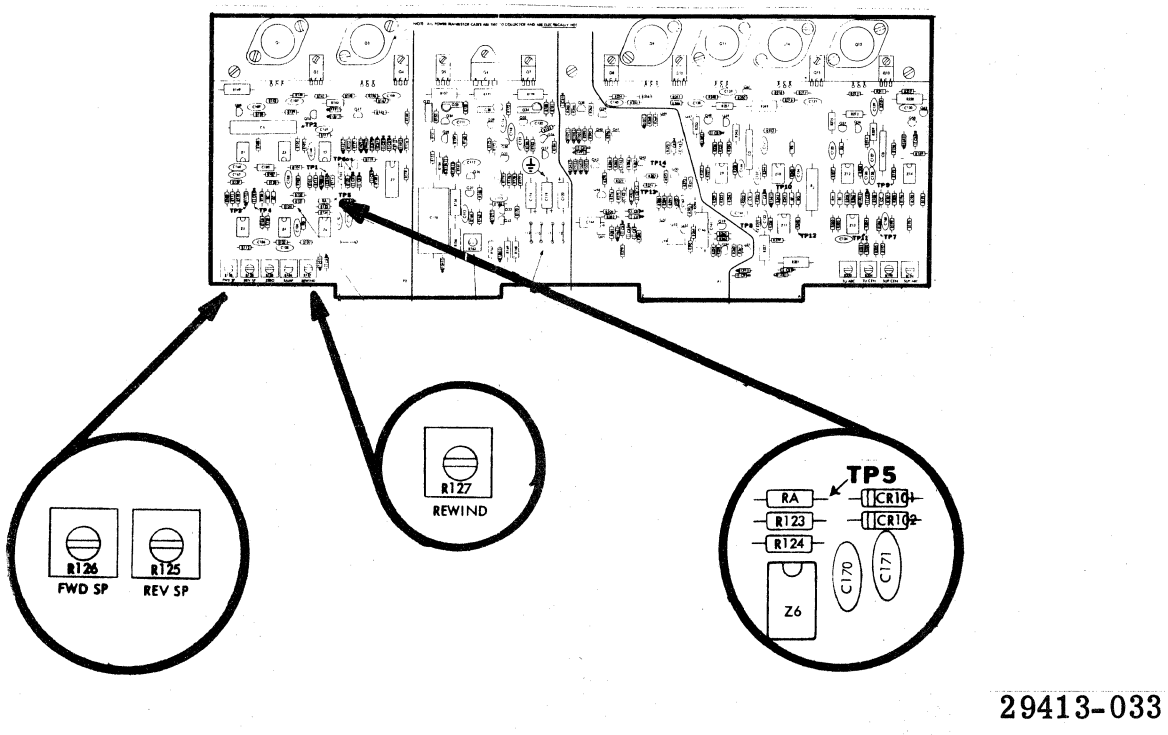


Figure 4-23. Forward Speed Adjustment/Test Point Location.

NOTE

A round stick-on label located on the rear of the front panel, lists the proper voltage corresponding to the recorder's forward (F=1.XXX), reverse (R=1.XXX) and rewind (RWD=4.XXX) speeds (see figure 4-3. These measurements are taken at TP-5 on the MC-17 card. The speed adjustments are adjusted to duplicate these measurements by monitoring TP-5 with a digital voltmeter.

5. If necessary, adjust FWD SP pot (R-126) to duplicate F=1.XXX ± 0.002V measurement.

c. Reverse Speed Adjustment (figure 4-23)

1. Place the service switch in the REV position.

2. If necessary, adjust REV SP pot (R-125) to duplicate R=1.XXX ± 0.002V measurement at TP-5 as indicated on the stick-on label.

d. Rewind Speed Adjustment (figure 4-23)

1. Place the service switch in the FWD position and let run to accumulate enough tape on the take-up reel to allow for a rewind adjustment (approximately 1 minute).

2. Press the REWIND button. Tape should rewind.

3. If necessary, adjust RWD pot (R-127) to duplicate RWD=4.XXX ± 0.10V measurement at TP-5 as indicated on the stick-on label.

e. Capstan Start/Stop Ramp Adjustment (figure 4-24)

1. Remove PC-4 Interface Connector if attached.

2. Install TC-12 Exerciser card into connector J101.

3. Place the function switches on the TC-12 card to the following positions:

S1 -- PULSE/DC ---- PULSE
S2 -- FORWARD/REVERSE ---- FORWARD
S3 -- OFF/SHUT ---- OFF
S4 -- WRITE/READ ---- WRITE

4. Attach the oscilloscope probe to TP-5.

5. Set the oscilloscope to external trigger and trigger from TP-1.

6. Press the LOAD button followed by the ON LINE button.

7. Adjust external trigger so that the waveform illustrated below appears on the scope. The RAMP adjustment (R-106) should be set to place the 90% amplitude start or stop time at 13.5 ± 0.5 msec. (see figure 4-25) or ramps of approximately 14.8 ± 0.5 msec. in total duration.

   If the capstan servo system is operating properly, the start and stop times in both the forward and reverse directions will be equal (± 0.5 msec.). Any greater difference indicates a defective component in the ramp generator circuitry.

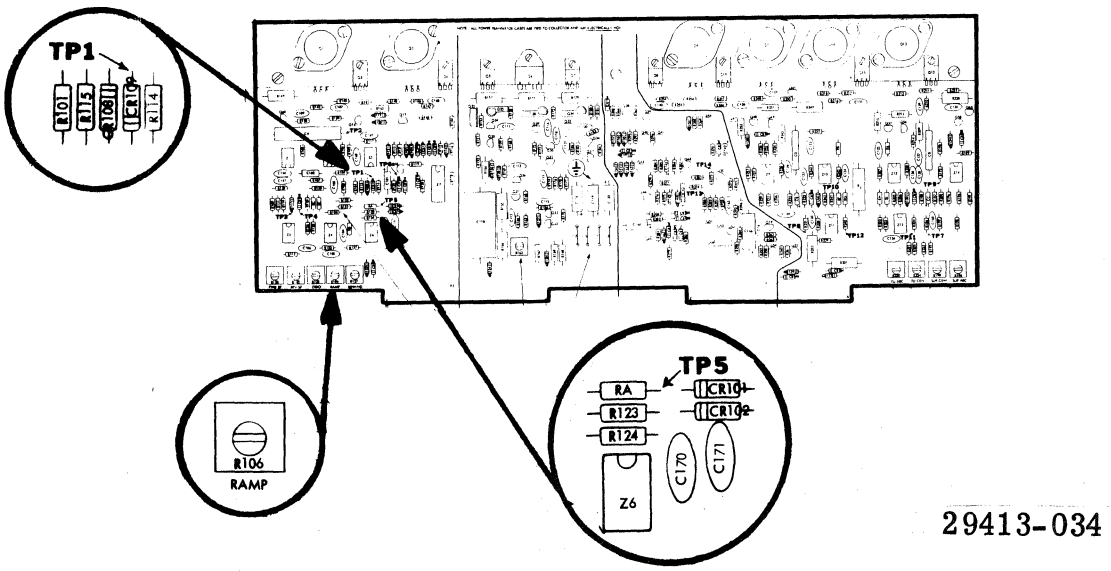
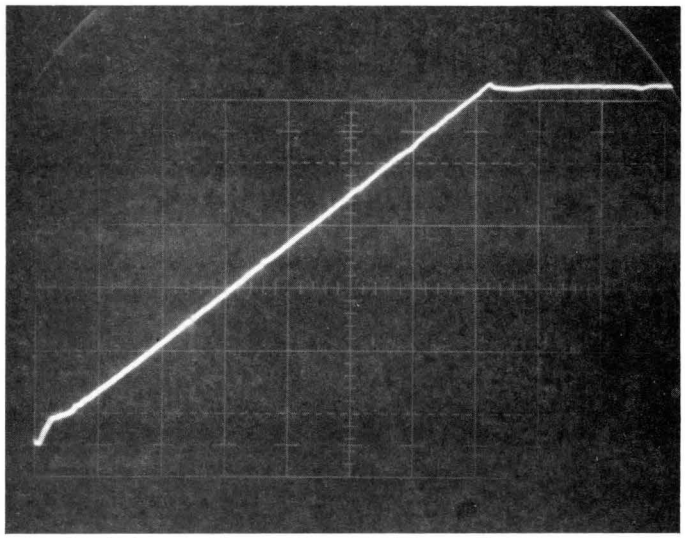
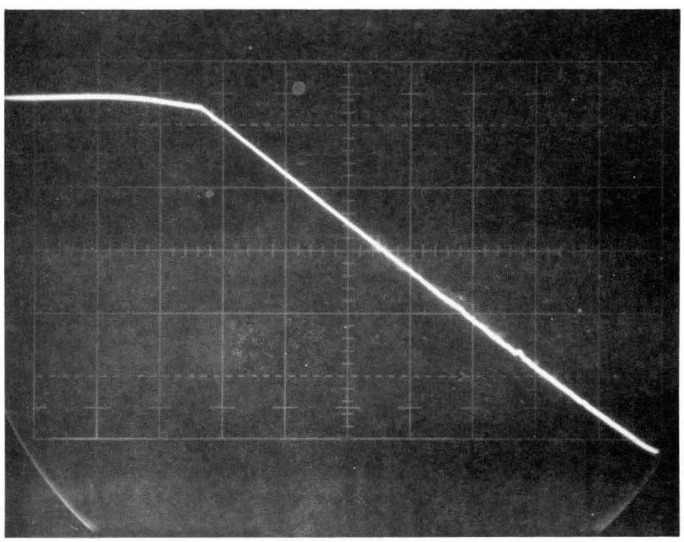


Figure 4-24. Start/Stop Adjustment/Test Point Locations.



EXT. TRIGGER
SLOPE (-)
SWEEP: 2ms/cm
VERT. GAIN: 0.2v/cm

START



EXT. TRIGGER
SLOPE (+)
SWEEP: 2ms/cm
VERT. GAIN: 0.2v/cm

STOP

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Figure 4-25. Start/Stop Waveforms.

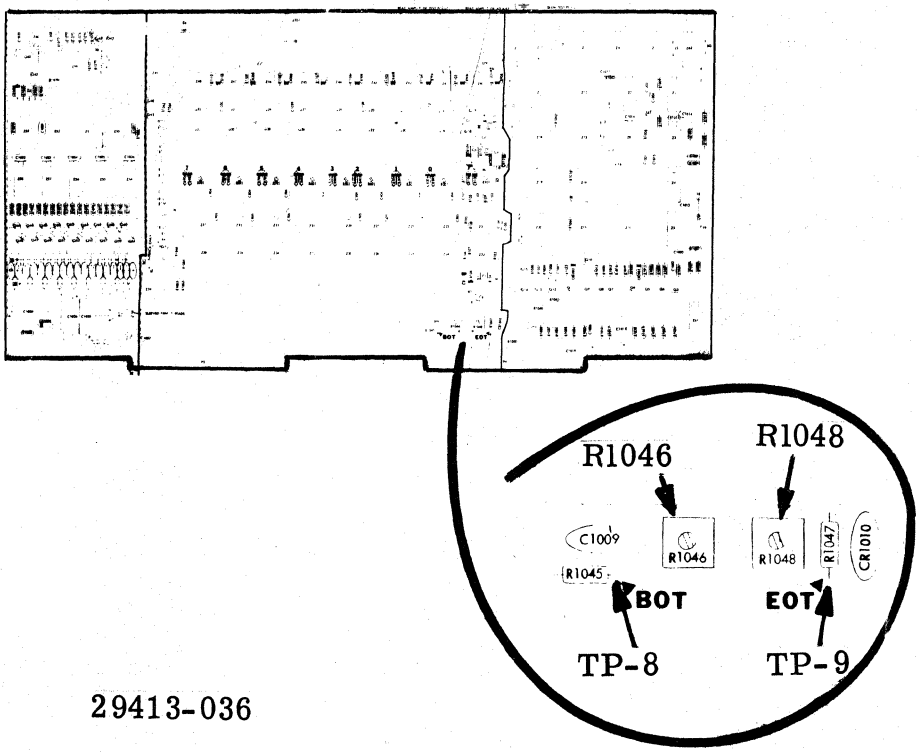


Figure 4-26. BOT/EOT Adjustments/Test Point Locations.

4.4.2.5

ADJUSTMENT	COMPONENT REFERENCE
BOT/EOT SENSOR	R1046 and R1048
ASSEMBLY NAME	**ASSEMBLY PART NUMBER**
RC-11 Card	7013844P020
RECOMMENDED TEST EQUIPMENT	**TOOLS REQUIRED**
Reel of Test Tape*, Digital Voltmeter or Triplett Model 310 VOM or Equivalent	Common Head Screwdriver

DESCRIPTION The adjustments of R-1046 and R-1048 set the normal (quiescent) operating level of the BOT and EOT sensing circuit.

NOTE

* Brown test tape is preferred, however, black tape is acceptable if brown is not available.

PROCEDURE

Steps:

1. Mount and thread test tape. Refer to loading procedure in Section 3.
2. Press the LOAD button. Tape should advance to the BOT marker and stop.
3. Momentarily place the service switch to the FWD position to advance the tape beyond the BOT marker.
4. Attach voltmeter to TP-8 (BOT) on the RC-11 card (see figure 4-26).
5. If necessary, adjust R-1046 to obtain +2.5V $\pm$ 0.1V on the digital voltmeter. If the VOM is used, set the VOM to the 10 or 15 volt scales. The lower range (2.5 or 3 volt scale) loads the circuit resulting in erroneous measurements.
6. Attach voltmeter to TP-9 (EOT) on the RC-11 card.
7. If necessary, adjust R-1048 to obtain 2.5 $\pm$ 0.1V on the voltmeter.

NOTE

The operation of the sensors may be checked by inserting a reflective surface between the sensor housing and the tape. If the BOT and EOT are sensed properly, the tension arms will completely relax.

4.4.2.6

ADJUSTMENT	COMPONENT REFERENCE
READ AMPLIFIER OUTPUT	R101, R201, R301, R401, R501, R601, R701, R801 and R901
ASSEMBLY NAME	**ASSEMBLY PART NUMBER**
RC-11 Card	7013844P020
RECOMMENDED TEST EQUIPMENT	**TOOLS REQUIRED**
Reel of Blank (Brown) Test Tape, TC-12 Exerciser Card and Tektronix Oscilloscope Model 422, 432 or 453	Common Head Screwdriver

DESCRIPTION The gain of each of 9 read amplifiers must be adjusted following replacement of the tape head or RC11 board module. Test points and adjustment locations are illustrated in figure 4-27 and are accessible from the rear of the transport.

PROCEDURE

Preliminary:

1. Place the function switches on the TC-12 card as follows:

   S1 - PULSE/DC ---------- DC
   S2 - FORWARD/REVERSE --- FORWARD
   S3 - OFF/SHUT ---------- OFF
   S4 - WRITE/READ -------- WRITE

2. Connect TC-12 card to J101 of the RC-11 card.

Steps:

1. Mount and thread blank test tape. Refer to loading procedure in Section 3.

2. Press the LOAD button. RING indicator should light.

3. Press the ON LINE button. ON LINE indicator should light. Allow tape transport to record (ONE's) for several minutes.

4. Press the REWIND button and allow tape to rewind to the BOT marker.

5. Set the WRITE/READ function switch on the TC-12 card to the READ position.

6. Set the scope vertical gain to 1V/cm and the sweep to 20 μs/cm.

7. Monitor each of the following test points (figure 4-27) and adjust each respective pot to obtain a 6.0 $\pm$ 0.3V P-P output for each track while operating in the read mode. Pressing the ON LINE button places the tape transport in the read back mode. Pressing the ON LINE button again, stops the read operation. Alternate use of the ON LINE button controls the start/stop of the read operation and is convenient for conserving recorded data while changing test points. Refer to figure 4-28 for a typical read amplifier output waveform.

TP-P----TRACK P----R-101
TP-0----TRACK 0----R-201
TP-1----TRACK 1----R-301
TP-2----TRACK 2----R-401
TP-3----TRACK 3----R-501
TP-4----TRACK 4----R-601
TP-5----TRACK 5----R-701
TP-6----TRACK 6----R-801
TP-7----TRACK 7----R-901

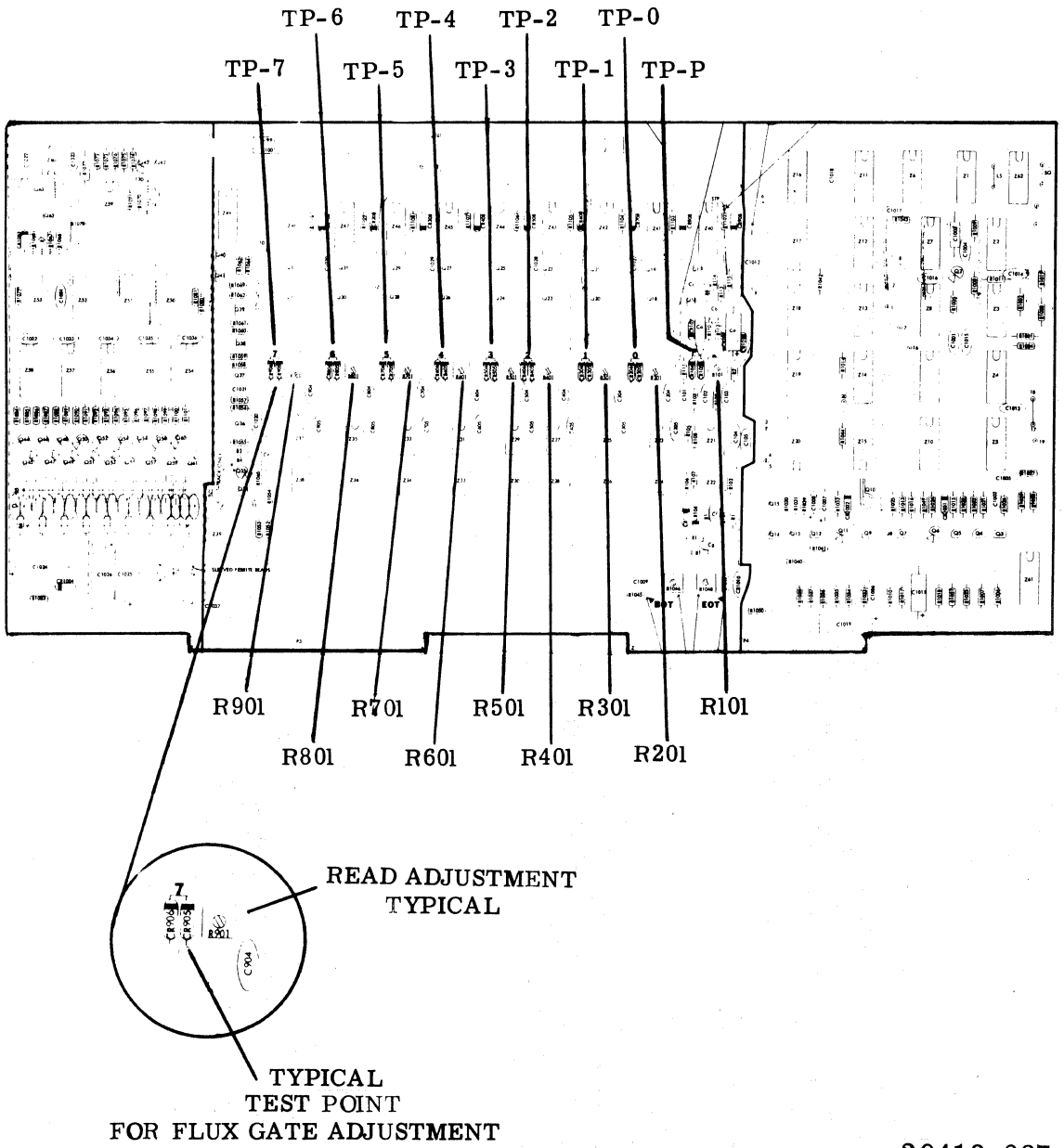
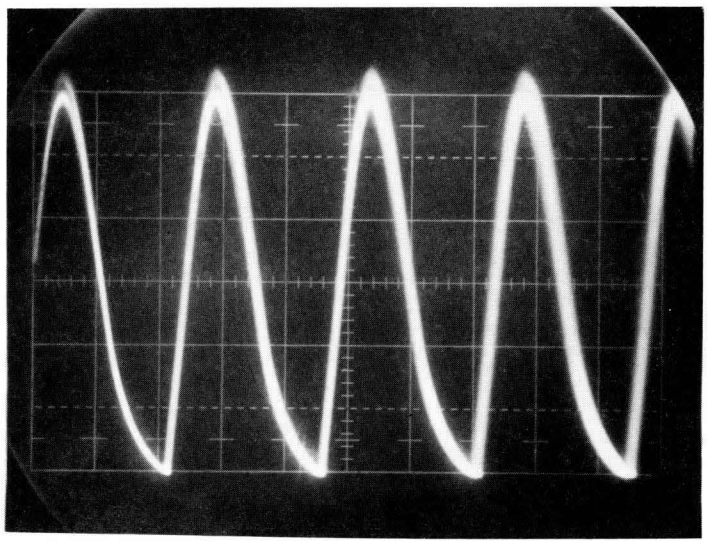


Figure 4-27. Read Amplifier Adjustments/Test Point Locations.



SWEEP: 20ms/cm
VERT. GAIN: 1v/cm

29413-038

Figure 4-28. Read Amplifier Output Waveform (Typical).

4.4.2.7

ADJUSTMENT	COMPONENT REFERENCE
FLUX GATE SHIELD	N/A
ASSEMBLY NAME	**ASSEMBLY PART NUMBER**
Flux Shield	APO 125
RECOMMENDED TEST EQUIPMENT	**TOOLS REQUIRED**
Reel of Blank (Brown) Test Tape, TC-12 Exerciser Card and Tektronix Oscilloscope, Models 422, 432 or 453	Common Head Screwdriver

DESCRIPTION The flux gate is a hinged shield located directly on top of the head assembly. Its function is to provide magnetic shielding between the write and read head gaps. Proper operation should be verified whenever the head is replaced or if error conditions occur in the read-after-write mode.

PROCEDURE

NOTE

This test and adjustment is performed by writing logical "1's".

Steps:

1. To generate an all ones pattern, remove PC-4 Interface Connector board and install TC-12 Exerciser card to connector J101.

2. Place the TC-12 card function switches to the following positions

   S1 -- PULSE/DC ---------- DC
   S2 -- FORWARD/REVERSE --- FORWARD
   S3 -- OFF/SHUTTLE ------- OFF
   S4 -- WRITE/READ -------- WRITE

3. Mount and thread test tape. Refer to loading procedure in Section 3.

4. Press the LOAD button. Tape should advance to BOT and stop.

5. Carefully remove tape from capstan drive wheel and allow to wrap around tape guide instead of the capstan.

6. Attach oscilloscope probe to anode of any diodes CR 105, CR 205, etc. through CR 905 on the RC-11 card (see figure 4-27).

7. Press the ON LINE button. Capstan motor and write circuits are activated. Since the tape is not threaded around the capstan, the tape should NOT move.

8. Observe the waveform at the test point chosen in step 6. It should measure less than 1.5 volts peak-to-peak.

9. If adjustment is necessary (greater than 1.5V P/P) loosen the two flux gate mounting screws (just above head mounting screws, rear of front panel) and readjust the position of the flux gate to obtain the lowest possible measurement.

10. Tighten mounting screws and verify that flux gate is still at the optimum position.

4.4.2.8

ADJUSTMENT	COMPONENT REFERENCE
TAPE TENSION	N/A
ASSEMBLY NAME	**ASSEMBLY PART NUMBER**
Torque Arm	0A0460-J
RECOMMENDED TEST EQUIPMENT	**TOOLS REQUIRED**
1 Pound Spring Force Gauge	7/64-inch Allen Wrench

DESCRIPTION The tape tension is controlled by the spring attached to the two torque arms mounted on the tension arm shafts. This spring is a precision unit and should not be replaced with a commercial stock unit.

PROCEDURE

Steps:

a. Take-Up Tension Arm

1. Attach string to tape guide post closest to take-up tension arm and thread as shown in figure 4-29.
2. Attach spring force gauge to other end of string.
3. Pull gauge in the direction shown until tension arm is positioned in the center of its arc. Gauge should measure 7 ±1 ounces (198 ±28 grams).
4. If tension is incorrect, check the position of the arm when resting against the stop. The tension arms should be within 1/8-inch of the rest position dimensions shown in figure 4-21.
5. The tension may be adjusted by loosening the 7/64 allen set screw, positioning the torque arm to the desired position and securing the set screw.
6. Let the tension arm snap against the stop several times to insure that the torque arm is tight enough to prevent slippage.
7. Again check the tension of the gauge. If measurement is not correct, repeat steps 5 through 7 for correct measurement.

b. Supply Tension Arm

1. Attach a string to the tape guide post closest to the supply tension arm and thread as shown in figure 4-30.
2. Attach spring force gauge to other end of string.
3. Pull gauge in the direction shown until tension arm is positioned in the center of its arc. Gauge should measure 7 ±1 ounces (198 ±28 grams).
4. If tension is incorrect, check the position of the arm when resting against the stop. The tension arm should be within 1/8-inch of the rest position dimensions shown in figure 4-21.

5. The tension may be adjusted by loosening the 7/64-inch allen set screw, positioning the torque arm to the desired position and securing the set screw.

6. Let the tension arm snap against the stop several times to insure that the torque arm is tight enough to prevent slippage.

7. Again check the tension of the gauge. If measurement is not correct, repeat steps 5 through 7 for correct measurement.

NOTE

If any tape tension adjustment is made, perform the Tension Arm Sensor adjustment (paragraph 4.4.2.10).

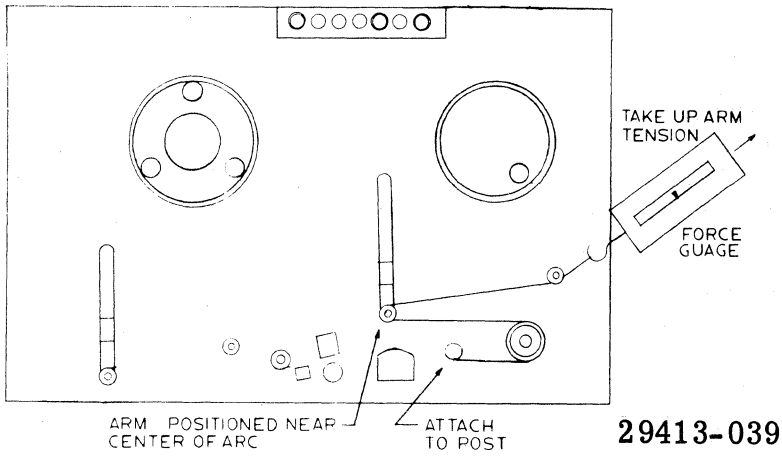


Figure 4-29. Take-Up Arm Tension Measurement.

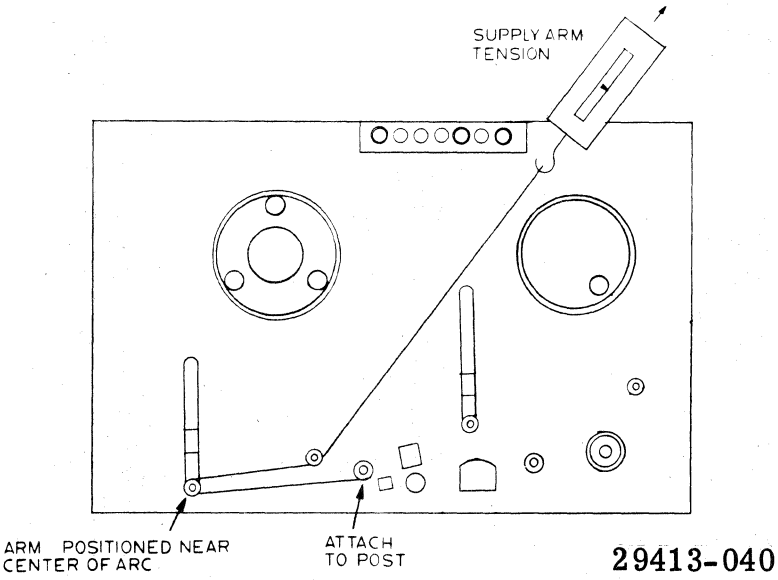


Figure 4-30. Supply Arm Tension Measurement.

4.4.2.9

ADJUSTMENT	COMPONENT REFERENCE
READ SKEW	N/A
ASSEMBLY NAME	**ASSEMBLY PART NUMBER**
Tape Guide (Fixed)	7013844P002
RECOMMENDED TEST EQUIPMENT	**TOOLS REQUIRED**
Master Skew Tape (IBM) Tektronix Oscilloscope, Models 422, 432 or 453 and TC-12 Exerciser Card.	Common Head Screwdriver

DESCRIPTION Skew occurs if the tape is not exactly perpendicular to the head. The skew must be checked and corrected, if necessary, following replacement of the tape head or tape guides. A master skew tape is read and the tape path adjusted so that all bits of a character will be read simultaneously.

PROCEDURE

Steps:

NOTE

This adjustment, if necessary, requires shimming the tape guide which corrects the problem. Only one tape guide need be shimmed.

1. Remove PC-4 Interface Connector board and install TC-12 Exerciser card to connector J101.

2. Attach oscilloscope probe to Skew Test Point (STP) on the RC-11 card (refer to figure 4-31 for location).

3. Mount and thread master skew tape. Refer to loading procedure in Section 3.

4. Place the TC-12 function switches to the following positions.

   S1 -- PULSE/DC ---------- DC
   S2 -- FORWARD/REVERSE --- FORWARD
   S3 -- OFF/SHUTTLE ------- OFF
   S4 -- WRITE/READ -------- READ

5. Press the LOAD button, followed by the ON LINE button.

6. Observe waveform at STP. It should approximate that shown in figure 4-32.

7. If the skew time exceeds 6.0 μ seconds (at 25 IPS) determine which tape guide requires shimming by lightly pushing the edge of the tape against the spring loaded flange of each guide. The guide which increases the skew reading must be shimmed.

8. Remove tape guide by removing mounting screw from rear of face plate. Place the .0005" shim between the tape guide and face plate. Tighten mounting screw and recheck skew measurement. Spare shims are included with the replacement head.

NOTE

One .0005" shim changes the skew measurement by approximately 1.5 μ seconds.

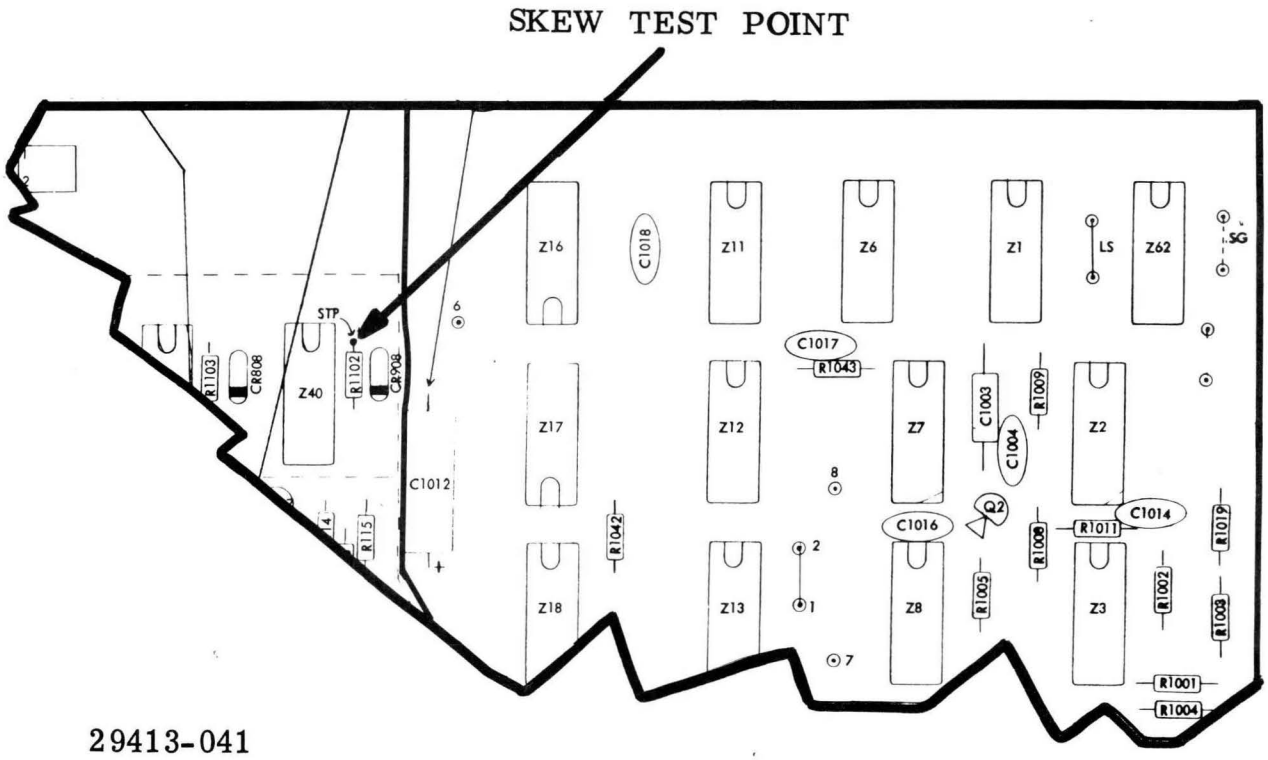
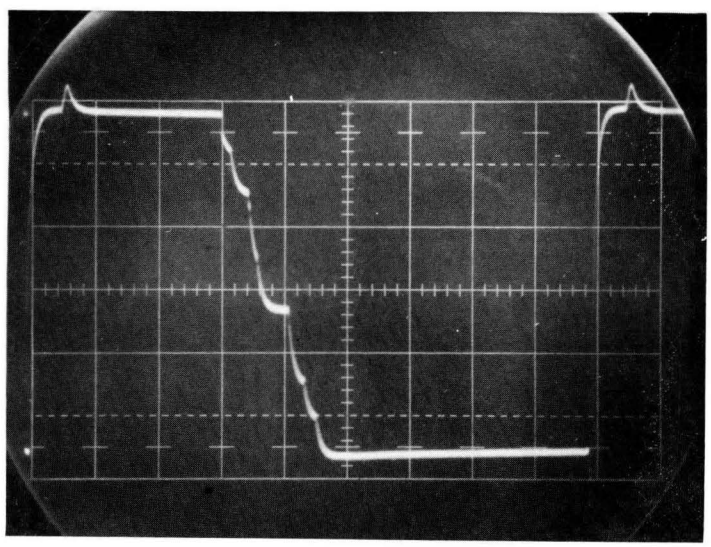


Figure 4-31. Read Skew Test Point.



SWEEP: 2μs/cm
VERT. GAIN: 1v/cm

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Figure 4-32. Skew Waveform.

4.4.2.10

ADJUSTMENT	COMPONENT REFERENCE
TENSION ARM SERVO SENSOR	N/A
ASSEMBLY NAME	**ASSEMBLY PART NUMBER**
Servo Disk	0A0499-J
RECOMMENDED TEST EQUIPMENT	**TOOLS REQUIRED**
Triplett Model 310 VOM or equivalent	3/32-inch Allen Wrench

DESCRIPTION The purpose of this adjustment is to insure that the servo disc is oriented properly on the tension arm shaft. This must be performed whenever the tension servo sensor assembly is replaced. Orientation of the supply servo disc must also be compatible with the operation of the limit switch cams.

PROCEDURE

Steps:

1. If tape reel is mounted, rewind and remove.
2. Loosen servo sensor disc center mounting screw (see figure 4-7).
3. Measure the sense voltage at the center lead of each respective photocell (white wire, see figure 4-8).
4. Voltage should measure approximately 1.8 VDC with the tension arm at rest position. If adjustment is necessary, rotate servo disc to obtain 1.8 VDC.
5. Carefully tighten servo disc center mounting screw without moving the servo disc or tension arm. When screw is tight, sense voltage should measure between 1.7V to 2.2VDC. If sense voltage is not within tolerance, readjust servo disc.
6. Swing tension arm slowly to its maximum travel point and observe that the sense voltage increases gradually to approximately 4.0 $\pm$ 0.5VDC.
7. If sense voltage is satisfactory, secure center screw with a daub of glyptol.

NOTE

Steps 8 through 12 apply only to the supply servo assembly.

8. Inhibit the BOT/EOT sensor with a piece of scrap tape.
9. Position the supply tension arm to the approximate center position and press the LOAD button.
10. Slowly move the supply tension arm towards the rest position. At the rest position, one of the supply tension arm cams should engage the limit switch causing the supply reel motor to shut down. If this does not occur, repeat all previous steps and adjust the sense voltage output obtained in step 4 for a lower measurement but still within tolerance specified in step 5.

11. Position the supply tension arm to the approximate center position and press the LOAD button.

12. Slowly advance the supply tension arm to the maximum travel position. The other cam on the supply servo disc should engage the limit switch causing the supply reel motor to shut down. If this does not occur repeat all previous steps and adjust the sense voltage output obtained in step 4 for a higher measurement but still within tolerance specified in step 5.

13. Mount and thread test tape.

14. Press the LOAD button and the ON LINE button.

15. Using either the TC-12 Exerciser card or the service switch, run the transport in the forward and reverse directions.

16. Check to insure that all tension arm operating positions illustrated in figure 4-21 are satisfactory. Minor adjustments (MC-17) may be necessary (see table below)

Component	Function	Description
R-230	TU ARC	Controls the extremes of the take-up tension arm arc.
R-234	TU CEN	Controls the take-up tension arm center position. Must be adjusted without tape motion; i.e., loaded and on-line.
R-194	SUP ARC	Controls the extremes of the supply tension arm arc.
R-198	SUP CEN	Controls the supply tension arm center position. Must be adjusted without tape motion; i.e., loaded and on-line.

SECTION 5

MAINTENANCE AIDS

5.1 GENERAL

This section contains several different types of maintenance aids designed to quickly isolate defective assemblies in the tape transport.

It is recommended that troubleshooting and field replacement be limited to the assembly level. Field replaceable spares are listed in the field and district level maintenance kits (see paragraph 5.7). Additional spare parts are available through the Sanders Data Systems logistics.

Malfunctions associated with other assemblies which are not field replaceable requires repackaging of the faulty transport for shipment to Sanders Associates. Refer to Section 6 for detail instructions.

5.2 TROUBLESHOOTING

This section provides the user with a systematic approach to quickly isolate the cause of failure and take the necessary corrective action.

Basically, malfunctions of the tape transport assembly relate to one of three major operations listed below:

1. Tape Drive/and Control Electronics
2. Write Electronics
3. Read Electronics

Since the internal tape transport power supply drives each of these functions it is recommended that the power supply be

completely checked for proper operation. Furthermore in the event of a failure, it would be advisable to perform a general visual inspection of the tape transport assembly for more obvious failure characteristics such as faulty cable and printed circuit connections, blown fuses, frayed wires, shorted connector pins and charred areas.

5.2.1 POWER SUPPLY CHECKOUT

If the tape transport is malfunctioning, the following tests should be performed to check for proper behavior of all power supplies.

1. Check the rectified DC outputs

   J2 pin 11: +20VDC (14 to 23 V range)

   J2 pin 13: -20VDC (14 to 23 V range)

   J2 pin 12: +8VDC (8 to 12 V range)

2. Regulators

   The +12, +5, and -12 VDC outputs can be measured at the load isolation jumpers on the MC-17 card or at connector J1 pins T, R, and N respectively. A reading greater than 5% off the nominal indicates a malfunction.

   NOTE

   The +12VDC output is used as a reference voltage for the remaining outputs. The +12VDC output should be checked first in the event of a power supply malfunction.

If any power supply output is abnormal, isolate the faulty assembly (MC-17 or RP-16) with DC voltage measurements. The MC-17 card is field replaceable. Replacement of the RP-16 is not recommended, however, certain components are field replaceable (refer to Section 4).

Each regulator includes a protective current limiter which reduces the output voltage in case of severe overload. To check

for this possibility, the loads may be removed from each supply by opening the associated jumper on the MC-17 card.

If the DC fuses are blown, check the respective power transistors for collector to emitter short circuits before replacing the fuses. Replace MC-17 card if any are found to be defective.

5.2.2 TROUBLESHOOTING DIAGRAMS

The first requirement in fault isolation is to identify the failure characteristic to one of the three major functions listed in paragraph 5.2. By selecting the appropriate trouble-shooting diagram and following the procedures outlined, the exact source of the malfunction can be determined.

If the tape transport controller interface is suspected of being faulty, refer to Part 2 of this manual for maintenance information.

The following troubleshooting diagram illustrate a general approach to fault isolation. Each diagram consists of blocks containing statements, actions, reactions and questions relating to system operations. Questions are answered with either a YES of NO decision. Each decision leads to subsequent actions which ultimately results in taking some form of corrective action.

Each diagram assumes that power is applied and the power supply is functioning properly.

Figure 5-1 illustrates a routine to exercise the various tape drive and motion control hardware. Motion commands may be issued by the pooler display/keyboard (using the 8090 Application Program) or manually, at the tape transport (stand-alone operation via TC-12 Exerciser card and control panel).

The magnetic tape debug aids program may also be used to exercise the tape transport. Refer to the Diagnostic Selftest User's Manual, Publication #7013393H002.

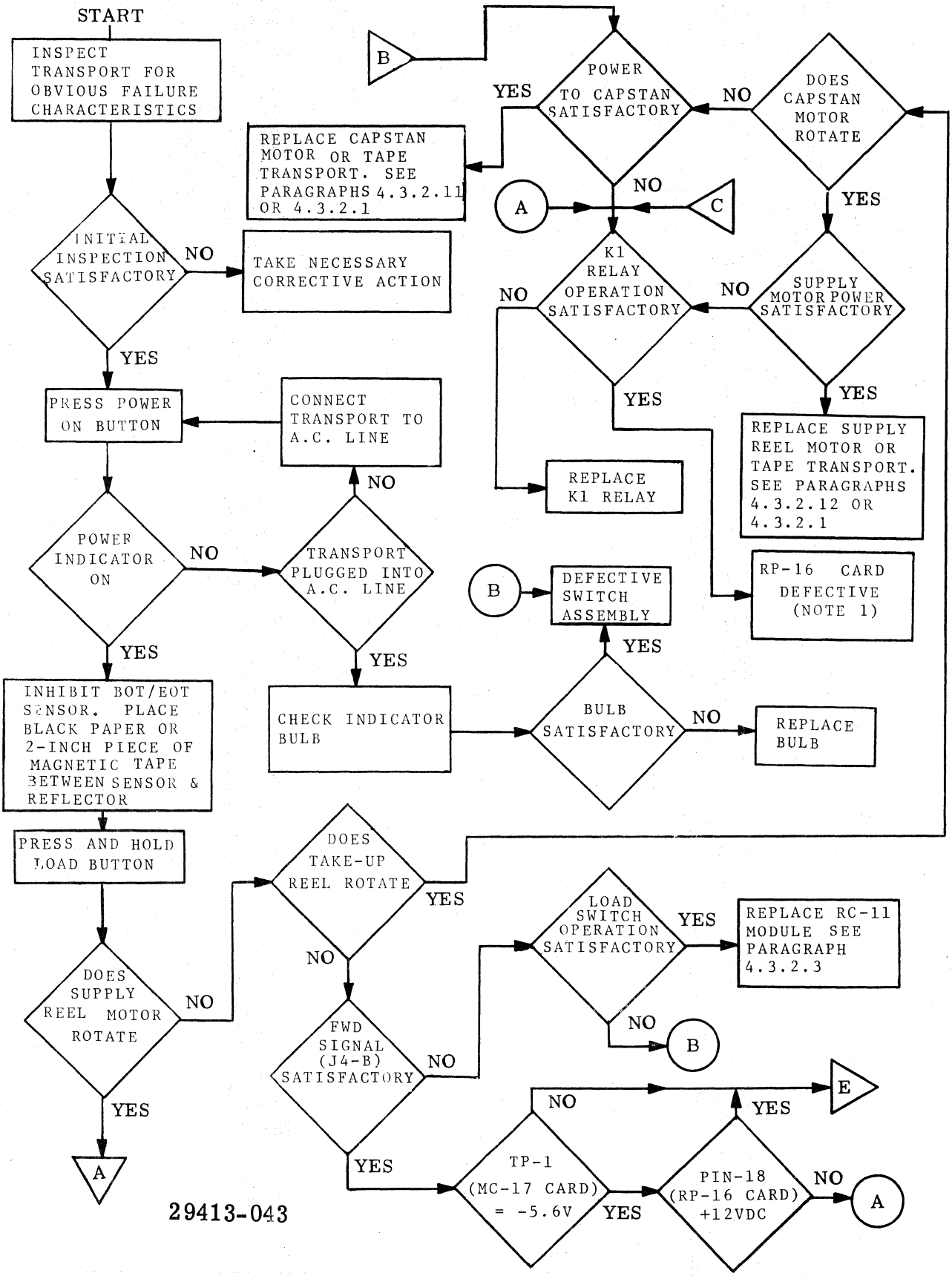


Figure 5-1. Troubleshooting Diagram, Preliminary Checkout, Load Sequence and Test Write/Read Sheet 1 of 4

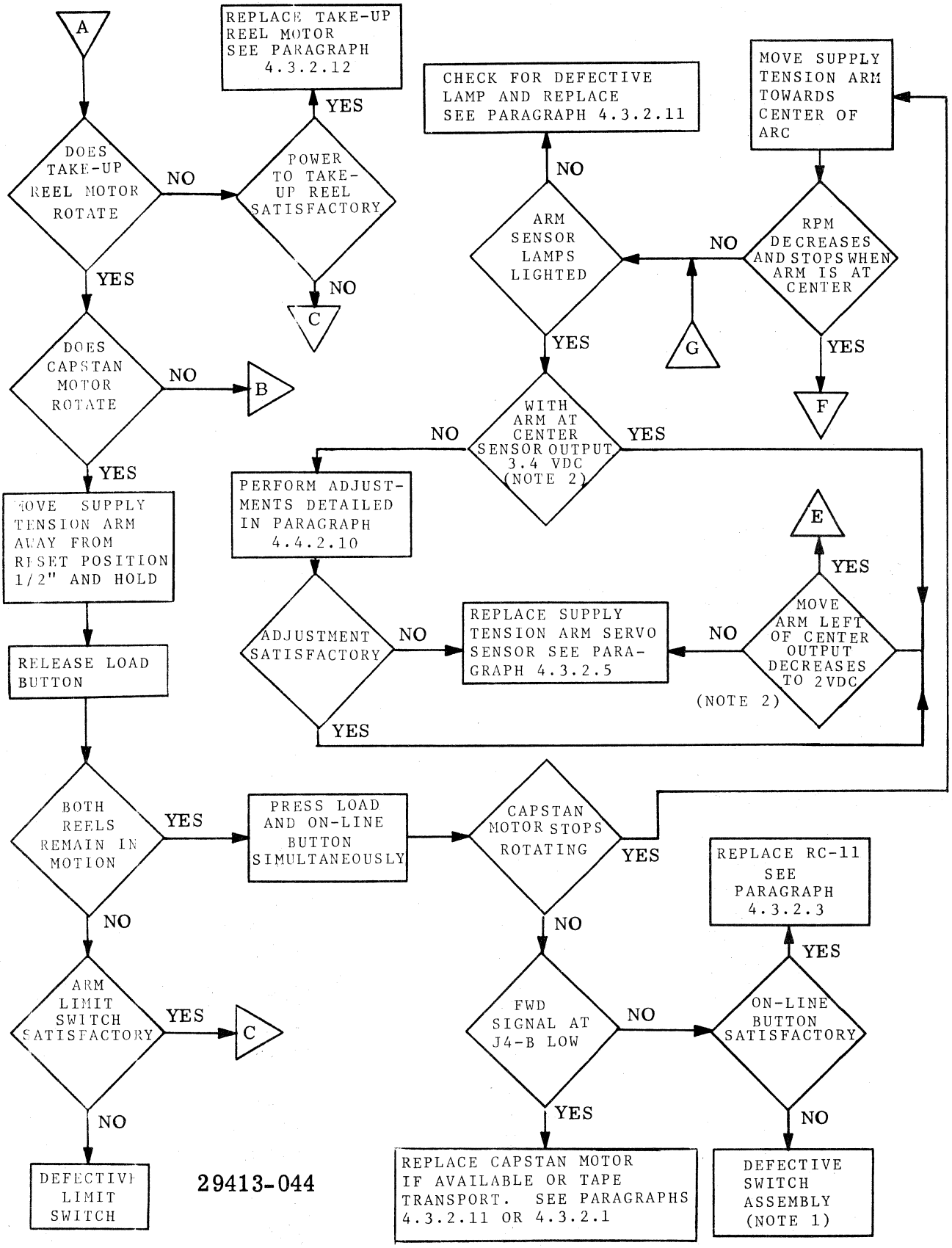


Figure 5-1. Troubleshooting Diagram, Preliminary Checkout, Load Sequence and Test Write/Read Sheet 2 of 4

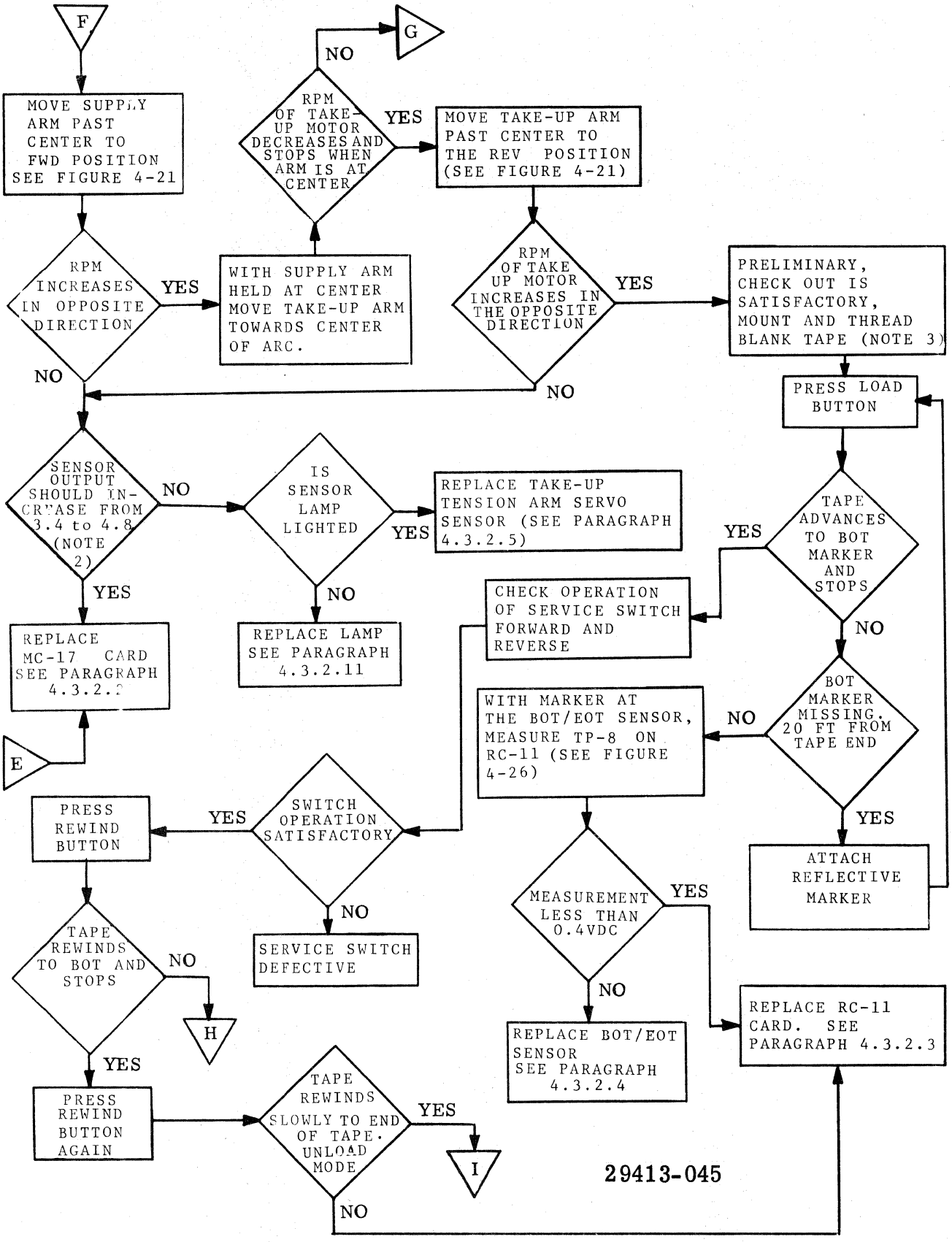


Figure 5-1. Troubleshooting Diagram, Preliminary Checkout, Load Sequence and Test Write/Read Sheet 3 of 4

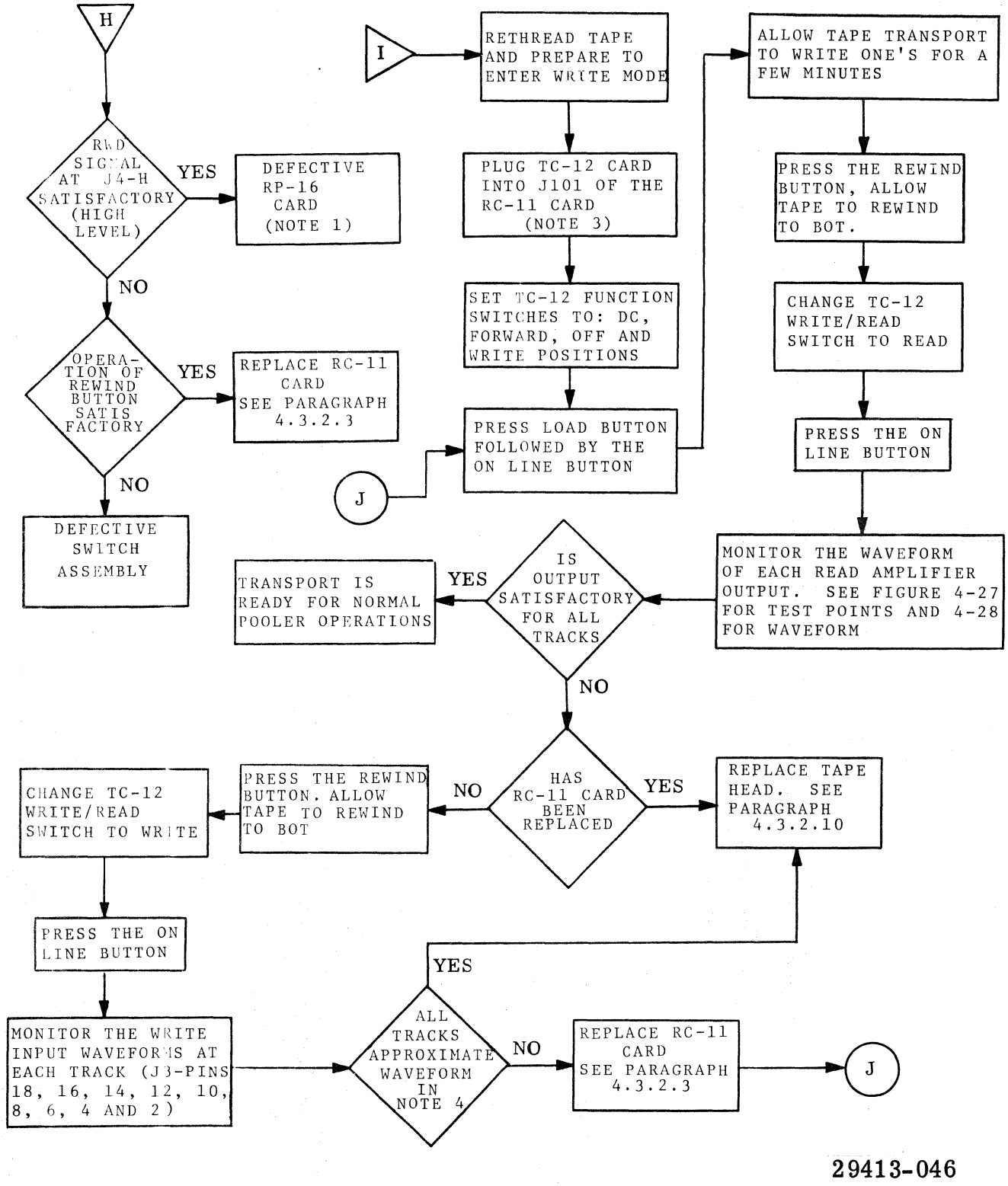
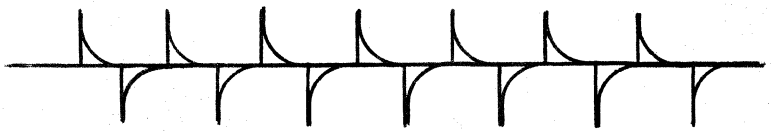


Figure 5-1. Troubleshooting Diagram, Preliminary Checkout, Load Sequence and Test Write/Read Sheet 4 of 4

Notes for figure 5-1

NOTES:

1. Assembly is not field replaceable. Repackage tape transport assembly for shipment to Sanders Associates (See Section 6).
2. Supply tension arm servo output at TP-7 (MC-17 card). Take-up tension arm servo output at TP-8 (MC-17 card).
3. Refer to tape mounting procedures in Section 3.
4. Service switch not required for normal operation. Replace tape transport when convenient.
5. Waveform should approximate figure below.



5.3 INPUT/OUTPUT INTERFACE SIGNALS

Tables 5-1 and 5-2 list the input/output (I/O) signals associated with the tape transport assembly. Each table lists the I/O source and destination of each signal, signal mnemonic, description and type.

Input signals to the tape transport originate at the 8090 Pooler and distributed by the controller interface. Each signal is buffered at the distributor card (assembly 7100608G000, part of the interface) and transferred to the RC-11 card (connector J101) through the PC-4 interface connector board.

Output signals generated by the tape transport and supplied to the 8090 Pooler are also buffered at the distributor card.

5.4 INTERNAL WIRING

The wiring diagram of figure 5-2 illustrates the internal interconnections of the tape transport assembly. The circled connection points indicate the origin (output) of each signal function, while those that are not circled signify inputs.

This diagram, in addition to the I/O interface data contained in tables 5-1 and 5-2 provides sufficient information to trace specific functions relative to troubleshooting and maintenance.

5.5 MAGNETIC TAPE DEBUG AIDS PROGRAM

Refer to the Diagnostic Selftest User's Manual, Publication #7013393H002.

TABLE 5-1

INPUT INTERFACE SIGNALS

Distributor Card P/O Controller Interface				PC-4 Card
Connector (From)	Signal Name	Description	Signal Type	Connector (To)
J2-E	Select (SLT)	This input gates all tape transport inputs and outputs. A false SELECT line will immediately terminate any tape motion except rewind.	Level	J101-J
J2-7	Set Write Status (SWS)	This input must go true concurrently with the forward command, and remain true for a period of at least 20 microseconds following initiation of a SYNCHRONOUS FORWARD or REVERSE command to energize the tape transport write and erase circuitry. The circuitry will remain energized until initiation of a SYNCHRONOUS FORWARD or REVERSE command with the SET WRITE STATUS input held false or until receipt of a REWIND or Off-Line command. The tape transport will not write unless a write ring is installed on the tape reel.	Level or Pulse	J101-K
J2-J	Synchronous Forward Command (SFC)	The tape transport moves in the forward direction as long as this input is true. The command is blocked if the tape transport is not in READY status.	Level	J101-C
J2-15	Rewind Command (RWC)	This input causes the tape transport to move in the reverse direction at high speed until reaching the BOT mark. At the completion of a rewind the tape transport will move the tape forward to the BOT mark and stop. The WRITE function is disabled. A REWIND COMMAND will be ignored if the tape transport is already at BOT.	Pulse	J101-H

TABLE 5-1

INPUT INTERFACE SIGNALS (Cont)

Distributor Card P/O Controller Interface				PC-4 Card
Connector (From)	Signal Name	Description	Signal Type	Connector (To)
J2-R	Off-Line Command (OFFC)	This input will place the tape transport off-line, disabling remote control and turning off the front panel ON LINE indicator. The tape transport will remain off-line until the operator presses the ON LINE button. This input is gated only by Select, permitting the tape transport to accept an Off-Line Command while rewinding.	Pulse	J101-L
J2-14	Write Data Strobe (WDS)	The Write Data Strobe input strobes the information on the Write Data lines into the tape transport write circuitry. A pulse width of approximately 2 microseconds is recommended. The frequency is determined by tape speed and density and should be 20.0 KHz for 25 ips, 800 bpi operation.	Pulse	J101-A
J2-8	Synchronous Reverse Command (SRC)	The tape transport moves in the reverse direction at normal speed when this input is true. The command is blocked if the tape transport is not in READY status. If the BOT marker is sensed while in Reverse, the tape transport will halt with the marker positioned approximately 0.6 inch closer to the head than the normal load point.	Level	J101-E
J2-L	Write Amplifier Reset (WARS)	This input will reset the tape transport NRZI flip-flops. This automatically writes the LRCC character on the tape. The character should be written in the eighth character position after the last data character of a record. No Write Data Strobe should be supplied when writing the LRC.	Pulse	J102-C

TABLE 5-1

INPUT INTERFACE SIGNALS (Cont)

Distributor Card P.O Controller Interface				PC-4 Card
Connector (From)	Signal Name	Description	Signal Type	Connector (To)
J2-P	Write Data BIT 2^0	A true level spanning the Write Data Strobe pulse causes a "ONE" to be recorded on the tape in the associated track. The data character should be present prior to the Write Data Strobe leading edge and remain stable until the trailing edge.	Level	J102-V
J2-13	BIT 2^1			J102-U
J2-N	BIT 2^2			J102-T
J2-12	BIT 2^3			J102-S
J2-11	BIT 2^4			J102-R
J2-M	BIT 2^5			J102-P
J2-K	BIT 2^6			J102-N
J2-9	BIT 2^7			J102-M
J2-10	BIT 2^P			J102-L

TABLE 5-2

OUTPUT INTERFACE SIGNALS

PC-4 Card				Distributor Card
Connector (From)	Signal Name	Description	Signal Type	Connector (To)
J101-M	On-Line (ONL)	A true output that indicates the operator has placed the tape transport under remote control.	Level	J2-20
J101-T	Ready	When this line is true, the tape transport is on-line, selected, loaded with tape and not rewinding. Motion commands will be ignored if Ready is false.	Level	J2-X
J101-R	Load Point (LDP)	A true output that indicates the the tape is positioned at the BOT marker.	Level	J2-Z
J101-U	End Of Tape (EOT)	A true output that indicates the EOT marker is being sensed. This output may be noisy if the tape transport stops at the edge of the marker.	Level	J2-5
J101-P	File Protect (FPT)	A true output that indicates the write ring is not installed on the reel. The tape transport will not write when this output is true.	Level	J2-22
J101-N	Rewinding (RWD)	A true output that indicates the tape transport is in the rewind or advance to load point mode following BOT.	Level	J2-21
J103-2	Read Data Strobe (RDS)	A true, 2 microsecond pulse that occurs when a character has been assembled in the read register	Level	J2-Y
	READ DATA OUTPUT	A true level during the Read Data Strobe pulse indicating	Level	
J103-18	BIT 2^0	that a "ONE" bit was read in the		J2-W
J103-17	BIT 2^1	associated track. The Read Data		J2-19
J103-15	BIT 2^2	outputs will appear prior to the		J2-18
J103-14	BIT 2^3	Read Data Strobe pulse and re-		J2-V
J103-9	BIT 2^4	main present until after its		J2-U
J103-8	BIT 2^5	trailing edge.		J2-S
J103-4	BIT 2^6			J2-T
J103-3	BIT 2^7			J2-16
J103-1	BIT 2^P			J2-17

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED

POWER ON SW1 — F1 — TERMINAL BD (TB1) — SEE NOTE 2

CC-1 (RP-16 BOARD) — RP-1 (RP-16 BOARD) — J1 (MC-17 BOARD) — J2 (MC-17 BOARD) — CHASSIS GROUND — J3 (RC-11 BOARD) — J4 (RC-11 MODULE)

SERVICE SW: REV / NORM / FWD

REWIND: NC / NO / NO / NC

16				
M	+12 VDC		U	
P	-20 VDC UNREG	TO REGULATOR	M 11 P	
X	+20 VDC UNREG	TO CAPSTAN SERVO	13 X	
Z	-20 VDC UNREG	TO CAPSTAN SERVO	20 Z	
			22	
B	+20 VDC UNREG	TO REEL SERVO	B	
E	GND TO REEL	SERVO	2 E	
H	-20 VDC UNREG	TO REEL SERVO	5 H	
			7	
			T	+12 VDC
			12	-12 VDC
			13	+5 VDC
			14	+5 VDC
			Z	FORWARD FWD
			X	REVERSE REV
			Y	REWIND RWD
			W	REELS ON
			20	SET BROKEN TAP
19	AC SENSE		19	
D		SUPPLY SERVO OUT +	D 4	
A	(RETURN)	SUPPLY SERVO OUT -	A	
K		TAKE-UP SERVO OUT +	K 9	
L	(RETURN)	TAKE-UP SERVO OUT -	L 10	
S			S 15	
			H	
J	GND		J	
N	+8 VDC UNREG	TO REGULATOR	N	
V	CAPSTAN SERVO OUT +		V	
18	K1 COIL		18	
17	K2 COIL		17	
U	TACH + TO CAPSTAN	SERVO	U	
T	TACH - TO CAPSTAN	SERVO	T	
			21	
	LIMIT SW		22	
			A GND	1
			7 BULB +12VDC	4
	1 SENSOR I			
	1 SENSOR II	PHOTOCELL 2 +5VDC	5	
	3 GND		3 H	
	2 PHOTOCELL +5VDC		4	
	5 SENSOR BULB +12VDC		8	
	4 SENSOR BULB +12VDC		5	
			10 L	

1	TRK P+	ON-LINE	BLU
2	P-		RED
3	0+		BLU
4	0-		RED
5	1+		BLU
6	1-		RED
7	2+		BLU
8	2-		RED
9	3+		BLU
10	3-		RED
11	4+		BLU
12	4-		RED
13	5+		BLU
14	5-		RED
15	6+		BLU
16	TRK 6-		RED
Y	ON-LINE LAMP		M
X			
Z	RING SW		K
			C
			B
			E
			H
			J
			N
20	CABLE SHIELDS		
19			5
17	TRK 7+		BLU
18	TRK 7-		RED
	LOAD BOTTOM		3
22	WHITE POWER		6
A	TRK P+		BLU
B	P-		RED
C	0+		BLU
D	0-		RED
E	1+		BLU
F	1-		RED
H	2+		BLU
J	2-		RED
K	3+		BLU
L	3-		RED
M	4+		BLU
N	4-		RED
P	5+		BLU
R	5-		RED
S	6+		BLU
T	6-		RED
U	7+		BLU
V	TRK 7-		RED
W	COMMON		
21	ERASE		

2	EOT		7
3	BOT		8
	SOLENOID ON		4

WRITE HEAD — ERASE HEAD — READ HEAD

TUS — SS — SEE NOTE 1

BOT/EOT SENSOR

2. FOR POWER TRANSFORMER CONNECTIONS TO TB-1, REFER TO FIGUEE 2-3.

1. TUS SIGNIFIES TAKE-UP SENSOR PRINTED CIRCUIT CARD PS-1 AND SS SIGNIFIES SUPPLY SENSOR PRINTED CIRCUIT CARD PS-1.

NOTES

SA-14-164 The Drafthoard, Inc.

G6	G5	G4	G3	G2	G1	ITEM	SIZE	PART OR IDENTIFYING NO.	DESCRIPTION
QTY PER ASSY									PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES
.XX DECIMAL ± .XXX DECIMAL ±
ANGLES ± SURFACE QUALITY √ MAX
INTERPRET DRAWING PER 81S002

NEXT ASSY | USED ON
APPLICATION
MFG

CONT NO.
DRAFTG: DR DATE; APPD; CHK
ENGRG: DEV; E/M; PROJ

SANDERS DATA SYSTEMS, INC. — A Subsidiary of Sanders Associates, Inc — NASHUA, NEW HAMPSHIRE

WIRING DIAGRAM, TRANSPORT ASSY

SIZE	CODE IDENT NO.	DWG NO.
D	94117	

SCALE | SHEET OF

DO NOT SCALE PRINT

Figure 5-2. Wiring Diagram, Tape Transport.

5.6 TC-12 EXERCISER CARD

The TC-12 Exerciser Card is a maintenance tool designed to perform various on-line type operations to facilitate testing, troubleshooting and adjustments.

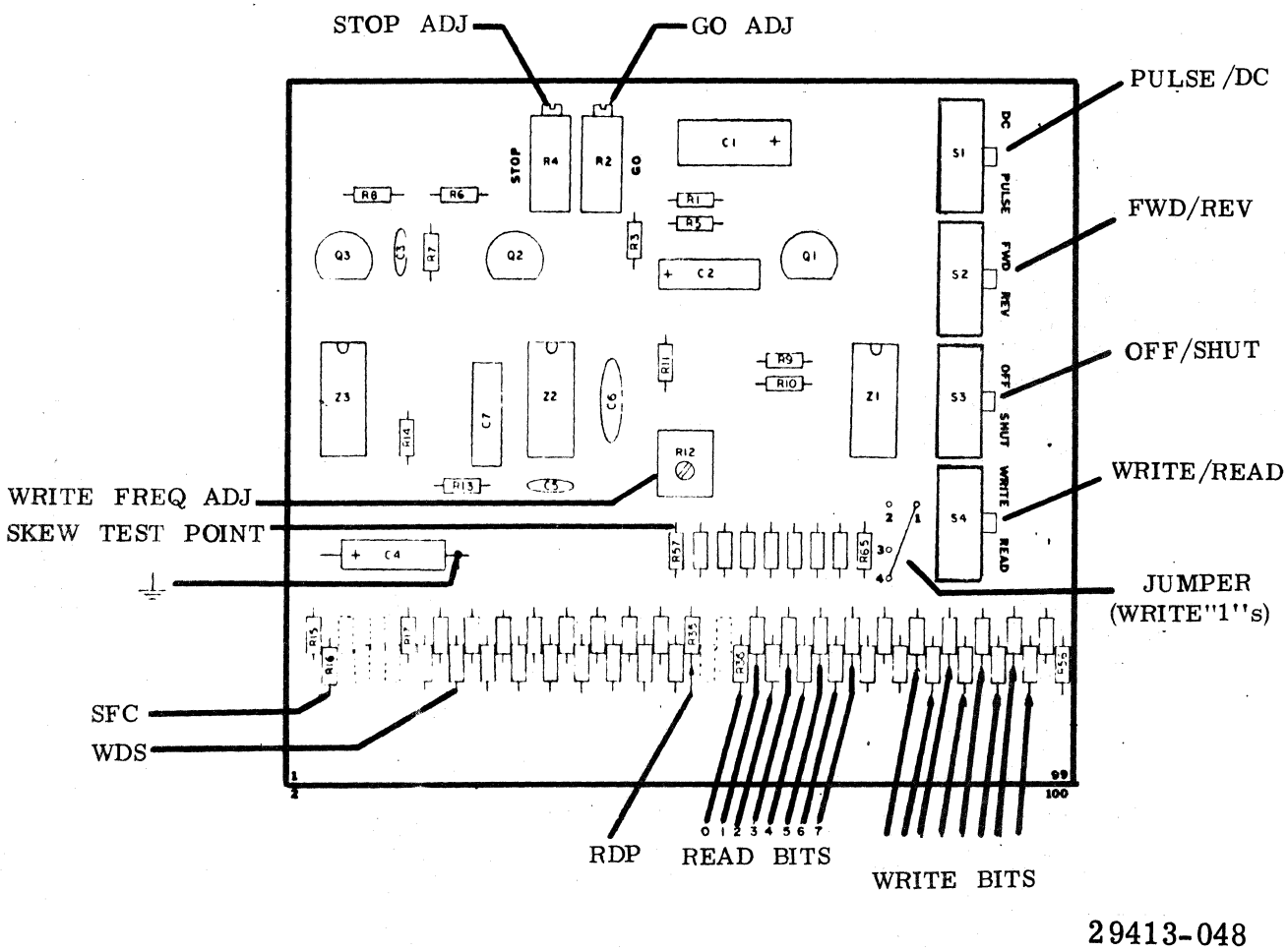


Figure 5-3. TC-12 Exerciser Card, Component Layout.

The TC-12 card is designed to plug into the interface connector J101 located on the RC-11 card (rear of tape transport). To access J101, the universal interface board (PC-4) and mounting bracket must be removed.

5.6.1 FUNCTION SWITCHES

The TC-12 card includes 4 function switches and supporting circuits to perform the following operations (see figure 5-3).

SWITCH	FUNCTION	DESCRIPTION
S1	PULSE/DC	Selects continuous or start/stop tape motion. DC = continuous motion; PULSE = start/stop motion. The duration of the start/stop is variable and controlled by the STOP and GO adjustments.
S2	FORWARD/ REVERSE	Selects direction of tape motion.
S3	OFF/SHUT	Selects alternate forward/reverse motion (back and forth) when placed in the SHUT (Shuttle) position. S1 must be in the PULSE mode for the shuttle operation.
S4	WRITE/READ	Selects WRITE or READ mode. In the WRITE mode, the tape transport writes logical "1's" in each track providing that the jumper option is properly connected (see figure 5-3). In the READ mode, the write circuits are disabled and data is read from tape. Tape must be rewound to the beginning of data. Write ring must be installed for a write operation.

5.6.2 ADJUSTMENTS

STOP/GO	These two adjustments (R2, R4) control the duration of the start/stop action in the PULSE mode. This feature also affects the forward/reverse duration of the shuttle mode.
WRITE FREQUENCY	The write frequency adjustment (R12) must be set to 20,000 Hz to insure recording at the proper bit density; i.e., 800 BPI at 25 IPS.

5.6.3 TEST POINTS

Each signal at the tape transport interface connector is connected to a terminating resistor. The resistors terminate the open-collector output drivers in the tape transport to permit voltage measurements. The abbreviations, signal names and the expected behavior of each key interface line is listed below. The tape transport must have tape mounted and be on-line to observe these signals.

RC	Rewind Command input line. Normally high level. Pulses low at EOT for automatic rewind.
OC	Off Line Command input line. Normally high level.
WP, 0-7	Write Data input lines. Normally low level, causing binary ones to be written.
DS	Data Density Select input line. Normally high level.
RS	Read Data Strobe output line. Normally high with low-going 2 microsecond pulses occurring for each character read.

RP, 0-7 Read Data output lines.
Normally high with low-going pulses occurring for each logical "one" read. Each pulse lasts approximately half of the normal bit period.

RY Ready output line.
Low when tape has been mounted and the tape transport is on-line. Goes high during rewind or when off-line.

OL On Line output line. Low when on-line.

RD Rewinding output line. Low during rewind.

FP File Protect output line. Low if no write ring installed.

LP Low Point output line. Normally high.
Low while BOT reflective marker is sensed.

ET End Of Tape output line. Normally high.
Low while EOT reflective marker is sensed.
Causes automatic rewind.

ST Select input line. Normally low to enable tape transport.

SW Set Write Status input line. Controlled by WRITE-READ switch on TC-12 card. Write is low, read is high.

WRS Write Amplifier Reset input line. Normally high.
Grounding this line during a write will stop the write pulses at each track.

WS Write Data Strobe input line. Normally high with low-going 2 microsecond pulses from the TC-12 write oscillator.

OV — Overwrite input line. Normally high. If grounded prior to starting tape motion in continuous write mode then grounding WRS will turn off tape transport's write power.

SF — Synchronous Forward Command input line. Low level that causes forward tape motion. Controlled by TC-12 switches.

SR — Synchronous Reverse Command input line. Low level that causes reverse tape motion. Controlled by TC-12 switches.

5.7 MAINTENANCE KIT

The spare parts listed in table 5-3 represent those items which are field replaceable and contained in the serviceman's standard maintenance kit #7013425K001. Table 5-4 lists those spare parts which are also field replaceable, but are only stocked at the district office level.

TABLE 5-3

FIELD MAINTENANCE KIT #7013425K001

Item No.	Quantity	Part No.	Description
1	1	7013844P019	Power/Servo PCB (MC-17)
2	1	7013844P020	Data Control PCB (RC-11)
3	1	7013844P005	Sensor, EOT/BOT
4	2	7532008P004	Lamp, Type 382
5	1	7013844P017	Lamp, Arm Sensor
6	5	7528001P105	Fuse, SB, 3A
7*	5	7528001P149	Fuse, SB, Ceramic 1.5A
8	5	7528001P005	Fuse, MB, 7.5A
9	5	7528001P055	Fuse, MB, 3A
10	1	7013844P023	Relay, 4PDT, 12VDC
11	1	7100605G001	Tape Controller PCB
12	1	7100606G001	Tape Timer PCB
13	1	7100608G001	Tape Distributor PCB
14	1	7100607G001	Tape Formatter (NRZ1) PCB
15	1	7013844P022	Rectifier Assembly

* For 235 VAC Application Only

TABLE 5-4

DISTRICT LEVEL MAINTENANCE KIT #7013425K002

Item No.	Quantity**	Part No.	Description
1	1-4	7013844P019	Power Servo PCB (MC-17)
2	1-4	7013844P020	Data Control PCB (RC-11)
3	2-8	7013844P005	Sensor, EOT/BOT
4	2-8	7532008P004	Lamp, Type 382
5	1-2	7013844P026	Servo Assembly
6	5-20	7528001P105	Fuse, SB, 3A
7*	5-20	7528001P149	Fuse, SB, Ceramic 1.5A
8	5-20	7528001P005	Fuse, MB, 7.5A
9	5-20	7528001P055	Fuse, MB, 3A
10	1-4	7013844P023	Relay, 4 PDT
11	1-4	7100605G001	Tape Controller, PCB
12	1-4	7100606G001	Tape Timer PCB
13	1-4	7100608G001	Tape Distributor PCB
14	1-4	7100607G001	Tape Formatter (NRZ1) PCB
15	1	7013844P022	Rectifier Assembly
16	1	7013844P023	Power Relay Control PCB (RP-16)
17	1	7013844P001	Tape Head
18	1	7013844P002	Tape Guide, Fixed
19	1	7013844P003	Tape Guide, Rotating
20	0	7013844P011	Motor, Capstan
21	0	7013844P012	Motor, Reel
22	2	7013844P017	Lamp, Arm Sensor
23	1	7013844P018	Photocell, Arm Sensor
24	1	7013844P024	Capacitor, 110,000 µf, 25V
25	1	7013844P025	Capacitor, 25,000 µf, 10V
26	1	7013315P003	Tape Transport Assembly
27	1	7013416G001	Cable Assembly

* For 235 VAC Application Only

** Quantity depends on the density of units in a given district.

SECTION 6

REPACKAGING AND RESHIPMENT

6.1 GENERAL

The tape transport assembly must be returned to the factory for repair or refurbish whenever a malfunction is NOT field repairable or at every 5,000 operating hour intervals.

The tape transport assembly and/or defective printed circuit card must be properly packaged for reshipment to avoid the possibility of irrepairable damage during transit. The following procedures are recommended.

6.2 TRANSPORT PACKING REQUIREMENTS

The transport assembly is packaged in heavy duty cardboard containers with proper spacers and protective pieces. The shipping material used to ship the original or replacement unit, is reused to ship the defective assembly back to the factory.

A description and use of each piece of shipping material is illustrated in figures 2-1 and 2-2.

6.2.1 PROCEDURE

6.2.1.1 Removal From Cabinet

Refer to Tape Transport Replacement Procedure (paragraph 4.3.2.1).

6.2.1.2 Slide Rail Disassembly

1. Remove slide rail assembly from the defective tape transport side panels by removing four (two each side) phillips head screws and associated hardware (see figure 6-1).

2. Install slide rail assembly on replacement tape transport if available (see paragraph 4.3.2.1).

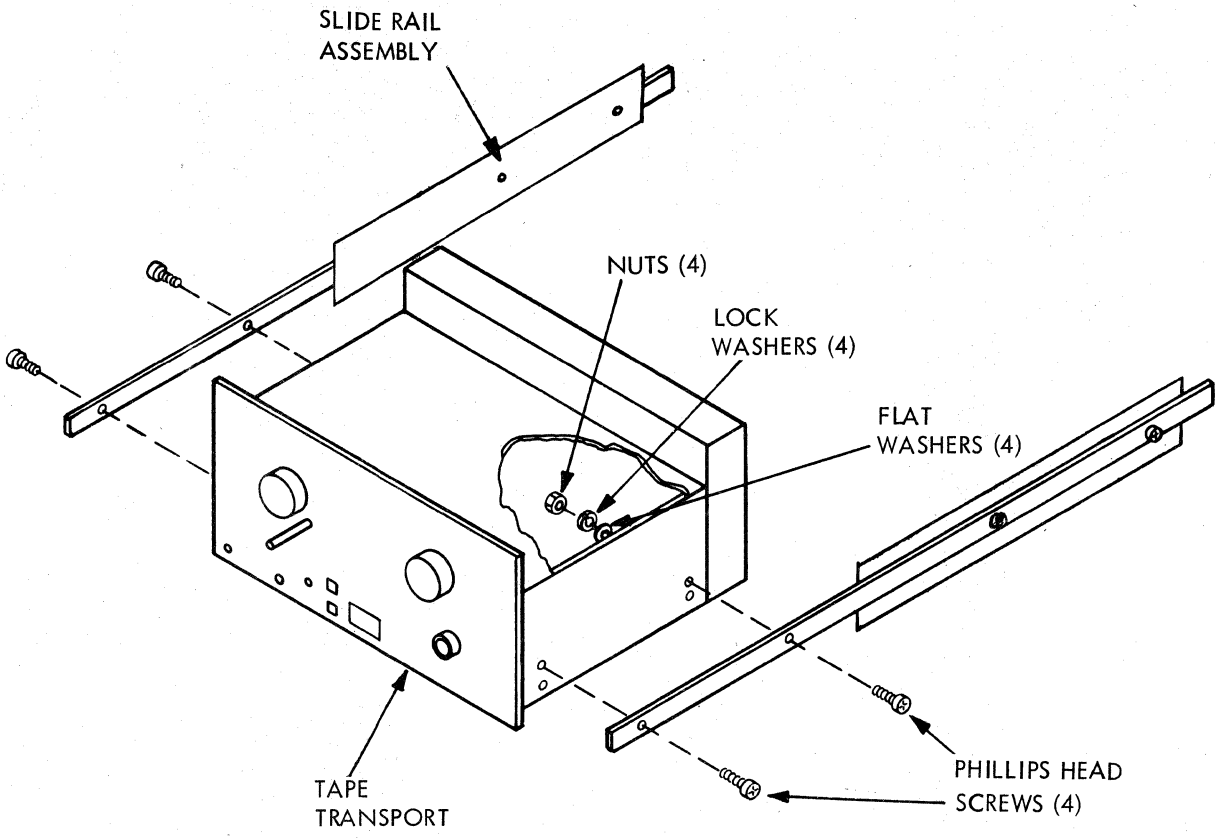


Figure 6-1. Tape Transport Slide Rail Disassembly.

6.2.1.3 Packing

6.2.1.3.1 Standard Method

1. Place the tape transport face down inside the inner container.

2. Insert cardboard side spacers.

3. Close inner container flaps and secure with adhesive binding tape.

4. Place corner cushions at bottom corners of primary container placing inner container inside, such that the inner container is supported by cushions.

5. Insert top corner cushions in place.

6. Close and secure primary container flaps with adhesive binding tape.

7. Wrap reinforced nylon tape around the primary container as shown in figure 2-1.

6.2.1.3.2 Alternate Method

Some tape transports are shipped in containers protected by preformed Instapac* foam molds.

1. Place bottom half of foam mold on the bottom of the cardboard container.

2. Place the tape transport inside of the foam mold.

3. Insert the top half of the mold over the top of the tape transport.

4. Close and secure container flaps with adhesive binding tape.

5. Wrap reinforced nylon tape around the container as shown in figure 2-2.

6.3 PRINTED CIRCUIT BOARD PACKING REQUIREMENTS

It is recommended that defective printed circuit boards be shipped back to the factory as soon as possible following removal from any of the major system components. It is further recommended that each printed circuit board be packaged for shipment according to the procedures provided below.

6.3.1 PROCEDURE

1. Wrap the defective printed circuit board with bubble plastic, kempac, foam rubber or any other acceptable packing material.

* T.M. Instapak Corporation

2. Using a scrap piece of cardboard, form a secondary folder to fit the wrapped printed circuit board as shown in step 1 of figure 6-2. Fold with the rib grain of the cardboard.

3. Place the wrapped printed circuit board in the secondary folder and secure flaps with adhesive tape. See step 2, figure 6-2.

4. Using another scrap piece of cardboard, form a primary folder to fit secondary folder as shown in step 3, figure 6-2.

5. Place secondary folder in the primary folder with the taped flaps facing down and in a direction opposite to the fold of the primary folder. See step 4 of figure 6-2.

6. Secure primary flaps with adhesive tape as shown in figure 6-2,step 5.

6.4 SHIPPING INSTRUCTIONS

The method of shipping is left to the descretion of the sender. Many factors are of prime importance in selecting the method of shipment as detailed below.

The instructions below apply from, to or between any field office within the continental United States.

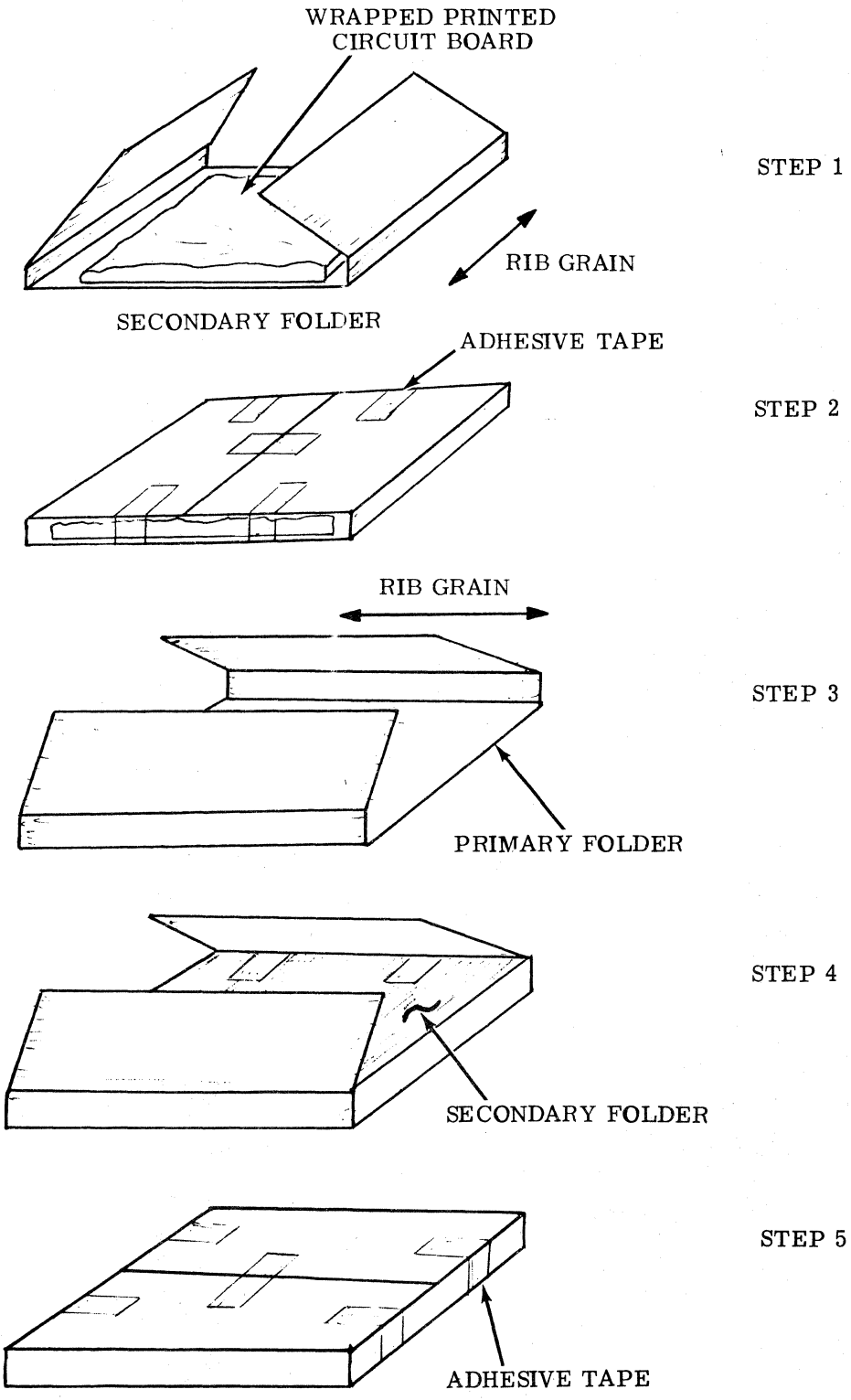


Figure 6-2. Printed Circuit Board Shipping Configuration.

SURFACE

If shipping:	then	Ship Via:
1-40 lbs.		Parcel Post
41-500 lbs.		REA Express
500-over		Call Corporate Traffic Department for instructions

AIR

If Weight of Shipment is:	DISTANCE IN MILES							
	1-350	351-850	851-1000	1001-1300	1301-1500	1501-1700	1701-2400	2401-over
1-25	Air X	Air X	AFF	Air X	AFF	Air X	Air X	AFF
26-35	Air X	Air X	AFF	Comm'l	AFF	Comm'l	Air X	AFF
36-50	Air X	Air X	AFF	Comm'l	AFF	Comm'l	Comm'l	AFF
51-100	Air X	Comm'l	Comm'l	Comm'l	Comm'l	Comm'l	Comm'l	Comm'l
100-over	Comm'l	Comm'l	Comm'l	Comm'l	Comm'l	Comm'l	Comm'l	Comm'l

Legend:
- Air X - Air Express (Air Division of REA Express, Inc.)
- AFF - Air Freight Forwarder viz: Domestic Air Express, Airborne Freight Corp., WTC Air Freight
- Comm'l - Any scheduled commercial passenger airline that goes to city of destination

GENERAL INSTRUCTIONS

1. Show Return Authorization Numbers on all shipping documents and containers.
2. Do not declare a value on Air or Express shipments in value block.
3. Show N.V.D. (No Value Declared).
4. Describe as: Electrical or Electronic Equipment.
5. Do not return material to Nashua via Air Freight unless an urgency exists, if so: mark shipping papers "HOLD AT LOGAN FOR SANDERS PICKUP".
6. Do not ship via Emery Air Freight.

SECTION 7

TAPE TRANSPORT SCHEMATIC AND LOGIC DIAGRAMS

7.1 GENERAL

The schematic and logic diagrams listed below and contained in this section apply only to the tape transport electronics. Diagrams relative to other pooler system components including the tape transport controller interface are included in the PDS 800/8000 Schematic Diagrams, publication #SDS-800-15.

TABLE 7-1

ENGINEERING DIAGRAMS

Title		Drawing Number
MC-17	Component Layout	CD-0035
	Power Supply Schematic	SC-0146
	Capstan Servo Schematic	SC-0147
	Reel Servo Amplifier Schematic	SC-0159
	Reel Servo and Relay Control	LD-0011
RC-11	Component Layout	CD-0037
	Write Logic Diagram	SC-0153
	Read Logic Diagram	SC-0154
	Control Logic Diagram	LD-0002
RP-16	Component Layout	CD-0036

NOTE: ALL POWER TRANSISTOR CASES ARE TIED TO COLLECTOR AND ARE ELECTRICALLY HOT

TEST POINT FOR ZERO ADJUSTMENT

REWIND SPEED ADJUSTMENT

CAPSTAN RAMP ADJUSTMENT

CAPSTAN SERVO ZERO ADJUSTMENT

REVERSE SPEED ADJUSTMENT

FORWARD SPEED ADJUSTMENT

+12V ADJUSTMENT

REGULATOR OUTPUT TEST POINTS

TAKE UP ARM ARC WIDTH ADJUSTMENT

TAKE UP ARM CENTER POSITION ADJUSTMENT

SUPPLY ARM CENTER POSITION ADJUSTMENT

SUPPLY ARM ARC WIDTH ADJUSTMENT

TP1 – RAMP GENERATOR INPUT
TP2 – RAMP GENERATOR OUTPUT
TP3 – FORWARD RAMP
TP4 – REVERSE RAMP
TP5 – TACHOMETER
TP6 – REWIND RAMP

TP13 – POWER FAIL ONE SHOT
TP14 – POWER FAIL TO CAPSTAN

TP7 – SUPPLY ARM PHOTOCELL
TP8 – TAKE UP ARM PHOTOCELL
TP 9 – SUPPLY ARM SERVO RAMP
TP10 – TAKE UP ARM SERVO RAMP
TP11 – SUPPLY MOTOR CURRENT
TP12 – TAKE UP MOTOR CURRENT

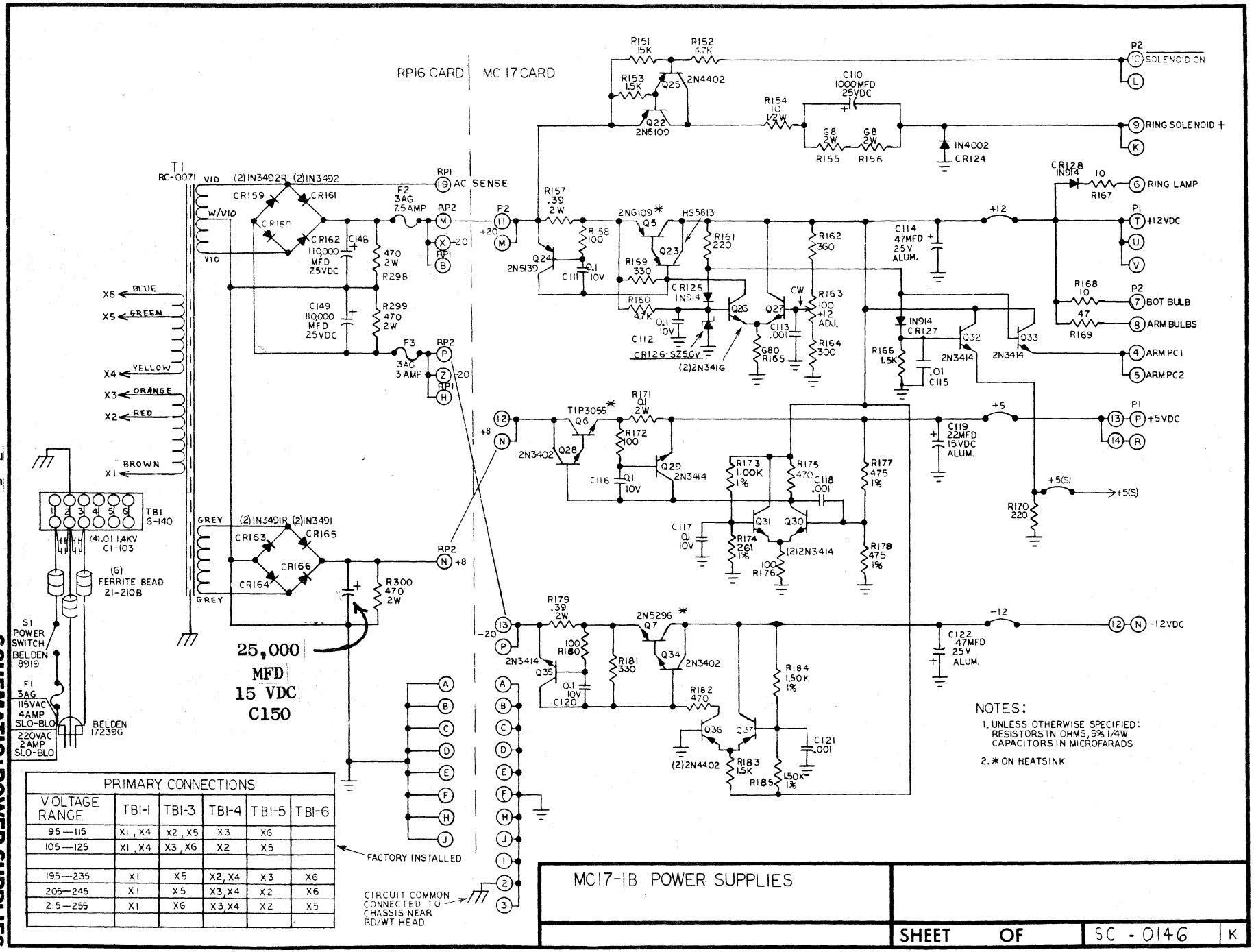
CAPSTAN SERVO | **POWER SUPPLIES** | **REEL SERVO AND RELAY CONTROL** | **REEL SERVOS**

REF. DESIG	LAST USED
R306	
C163	
CR178	
Q62	
Z14	

DELETED
C147
Q47
Q58

MC-17 CARD **CD-0035**

SCHEMATIC: POWER SUPPLIES

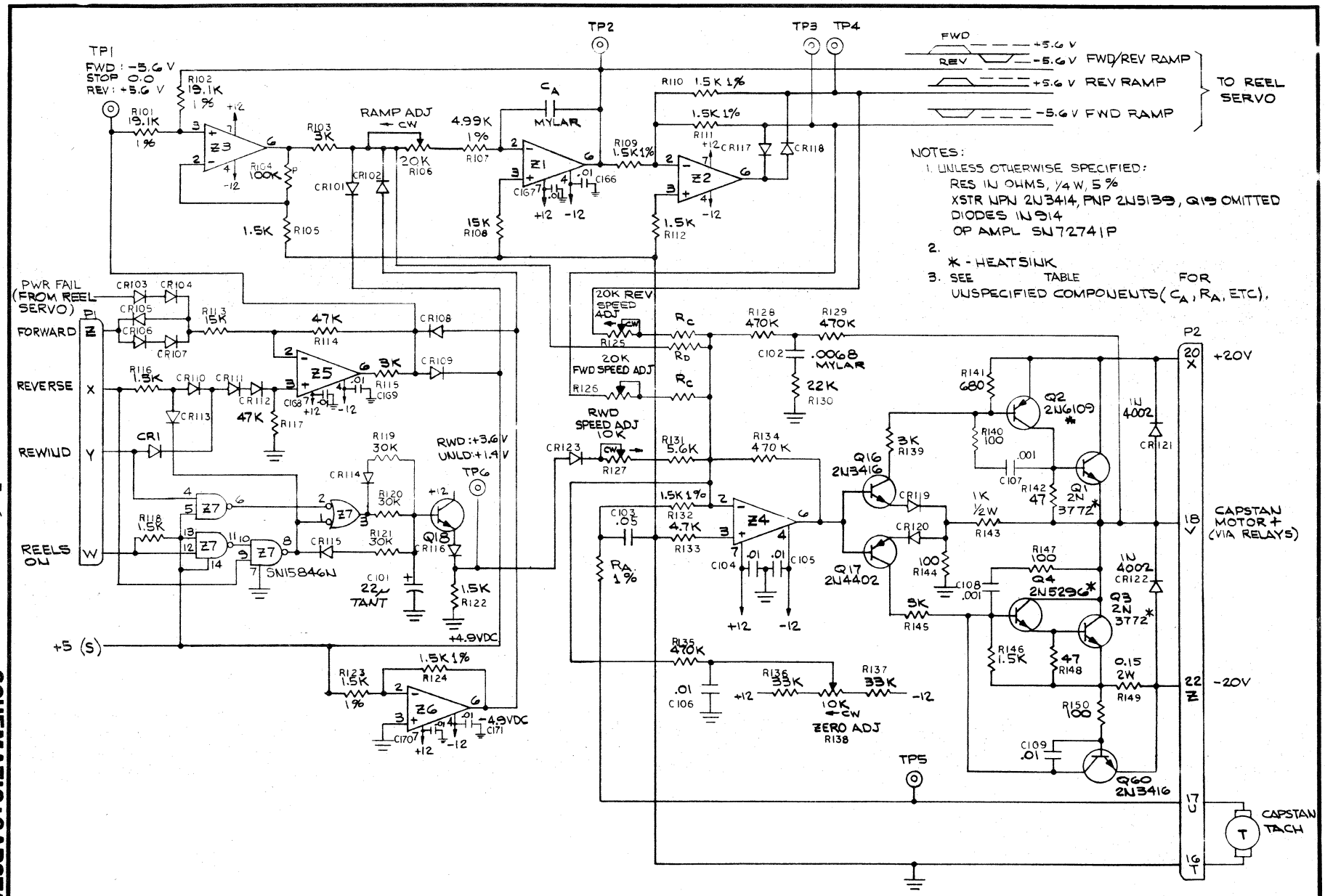


PRIMARY CONNECTIONS					
VOLTAGE RANGE	TBI-1	TBI-3	TBI-4	TBI-5	TBI-6
95—115	X1, X4	X2, X5	X3	X6	
105—125	X1, X4	X3, X6	X2	X5	
195—235	X1	X5	X2, X4	X3	X6
205—245	X1	X5	X3, X4	X2	X6
215—255	X1	X6	X3, X4	X2	X5

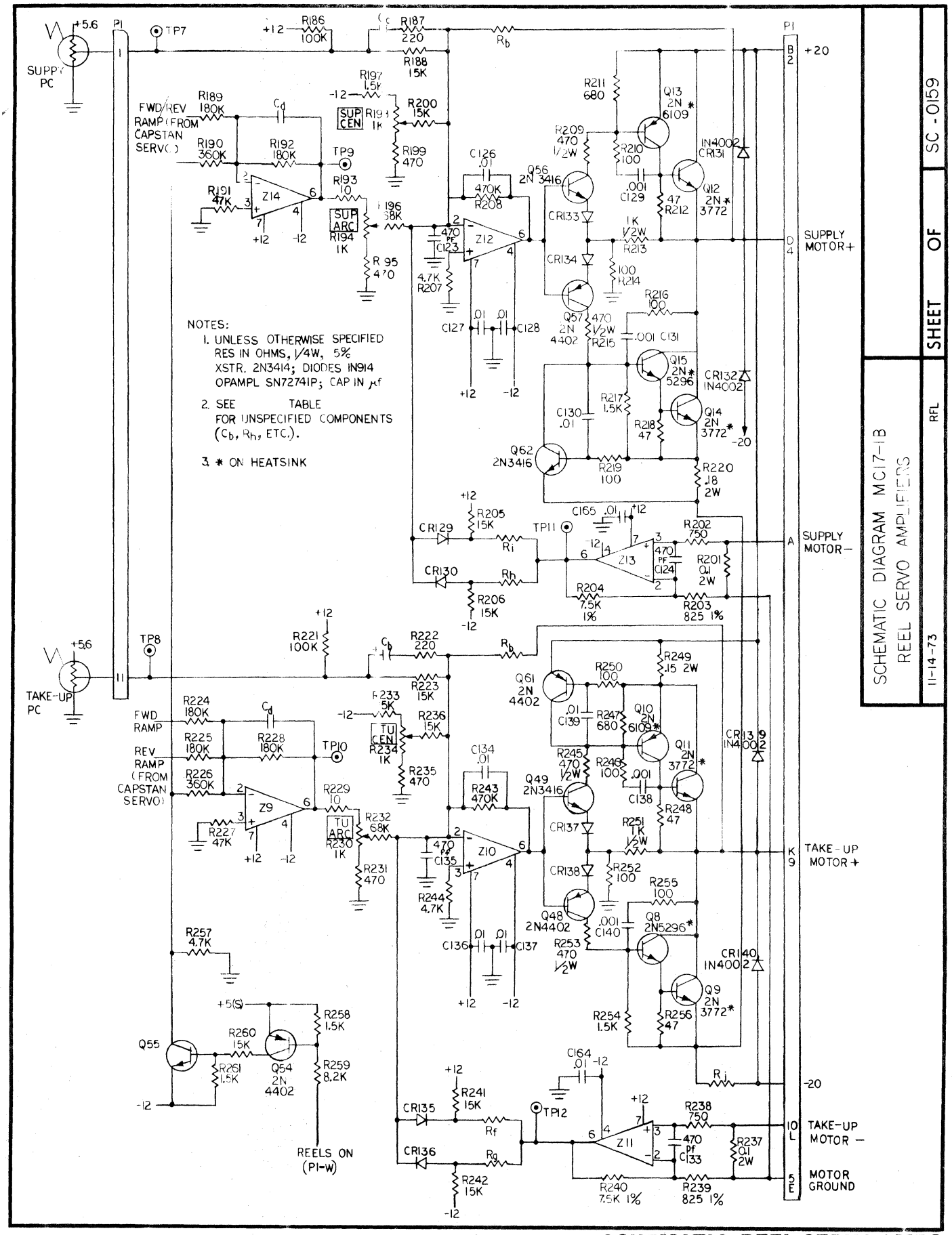
NOTES:

1. UNLESS OTHERWISE SPECIFIED: RESISTORS IN OHMS, 5% 1/4W CAPACITORS IN MICROFARADS
2. * ON HEATSINK

MC17-1B POWER SUPPLIES		
	SHEET OF	SC - 0146 K



SCHEMATIC DIAGRAM MC17-1B CAPSTAN SERVO			
6-22-72	SHEET OF	SC - 0147	K



SCHEMATIC DIAGRAM MC17-1B
REEL SERVO AMPLIFIERS
11-14-73 RFL

SC-0159 SHEET OF

7-7/7-8 **SCHEMATIC: REEL SERVO AMPS**

NOTES:

1. UNLESS OTHERWISE SPECIFIED
   RES IN OHMS, 1/4 W, 5% XSTR. 2N3414;
   DIODES IN914;
   CAPS IN µf
2. CAPS C151 THROUGH C162 ARE .01µf 500V

CAPSTAN SERVO
SEE SC-0147

SUPPY MOTOR SERVO
SEE SC-0159

TAKE-UP MOTOR SERVO
SEE SC-0159

P2 RP2
17 U
16 T
V

PI RPI
4 D
A
9 K
10 L
15 S
18
17
16

C154 7 KI 6
C151 .01 500V
R301 220
CRI67 IN4002 +20(R)
CRI68 IN4002 -20(R)
W2
MPI
TACH
CAPSTAN MOTOR

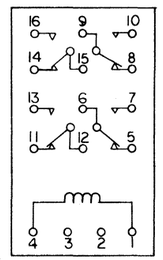
8 NC KI 9
10
C160
CRI73 IN4002 +20(R)
CRI74 IN4002 -20(R)
CRI75 IN4002
R303 220
C153
W6
MP2
SUPPLY REEL MOTOR

33 2W
33 2W
14 KI 15
16
C157
CRI76 IN4002 +20(R)
CRI69 IN4002
CRI70 IN4002 -20(R)
CRI71 IN4002
CRI72 IN4002 +20(R)
R302 220
C152
W4
MP3
TAKE-UP REEL MOTOR

4
K1
CRI77 IN4002

K1: P&B RIO-EI-X4-V185(12V)

K2: P&B RIO-EI-X2-V700 (24V)
(MODEL 1700)



RELAY BASE
(BOTTOM VIEW)

PI
AC SENSE 19
SET BT 20
TO P4-3
LOAD P.B.
ARM LIMIT SW
N.O.
21
22

+20
R277 4.7K
Q44 2N3416
CRI42 SZ10.0
CRI43
R275 15K
R278 15K
R274 15K
C143 10 35V
R276 47K
CRI44

+5(S)
R279 15K
CRI45
R306 47
C144 22 16V
CRI46
CRI47
R280 47K
R281 47K
Q45 2N3416
R282 15K
+20

FORWARD
REVERSE
REELS ON
REWIND

R285 4.7K
CRI48
R286 68K
R287 4.7K
TPI3
Q42
CRI49
C145 10 20V
Q43
R284 15K
R288 4.7K
CRI50
CR 151
CR 152
CR 153
CR 154

+20
Q51 2N3416
R290 15K
Q59 2N6109
R289 15K
Q53 2N3416
Q52 2N3416
5.6K R294
C146 47µf 25V
R291 47K
R293 15K
R292 150
.01 C163

CRI55
CRI57
CRI56
CRI58
R295 15K
Q40 2N3416
Q41 2N3416
R296 15K
R297 47K

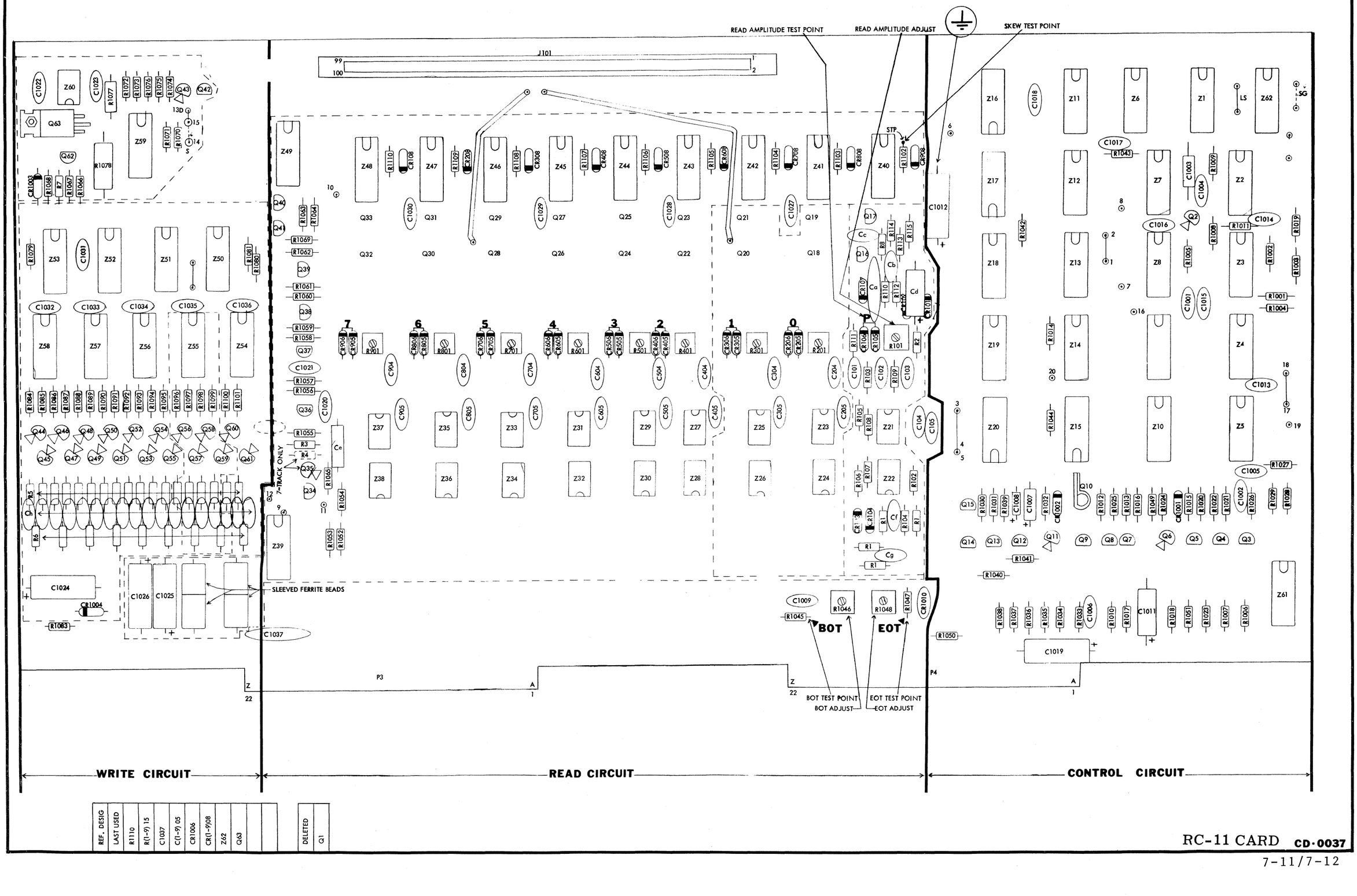
+5(S)
R262 47K
R264 4.7K
R283 15K
Q19
C141 .01
R263 15K

+12
Q38 2N3416
R265 15K
R268 15K
R269 15K
Q46
Q39 2N3416
R266 47K
R267 15K
R270 15K
TPI4
R273 100K
POWER FAIL TO CAPSTAN
CRI41
C142 33 15V
R271 100K
R272 47K
Q50

MC-17 PWA REEL SERVO & RELAY CONTROL

RP-16 PWA MOTOR RELAY SECTION

TOLERANCES UNLESS OTHERWISE NOTED	FINISH	
FRACT ± 1/64		
DEC ± .005	DRAWN	LD-0011
ANG ± 1°		RELAY CONTROL
		7-9/7-10

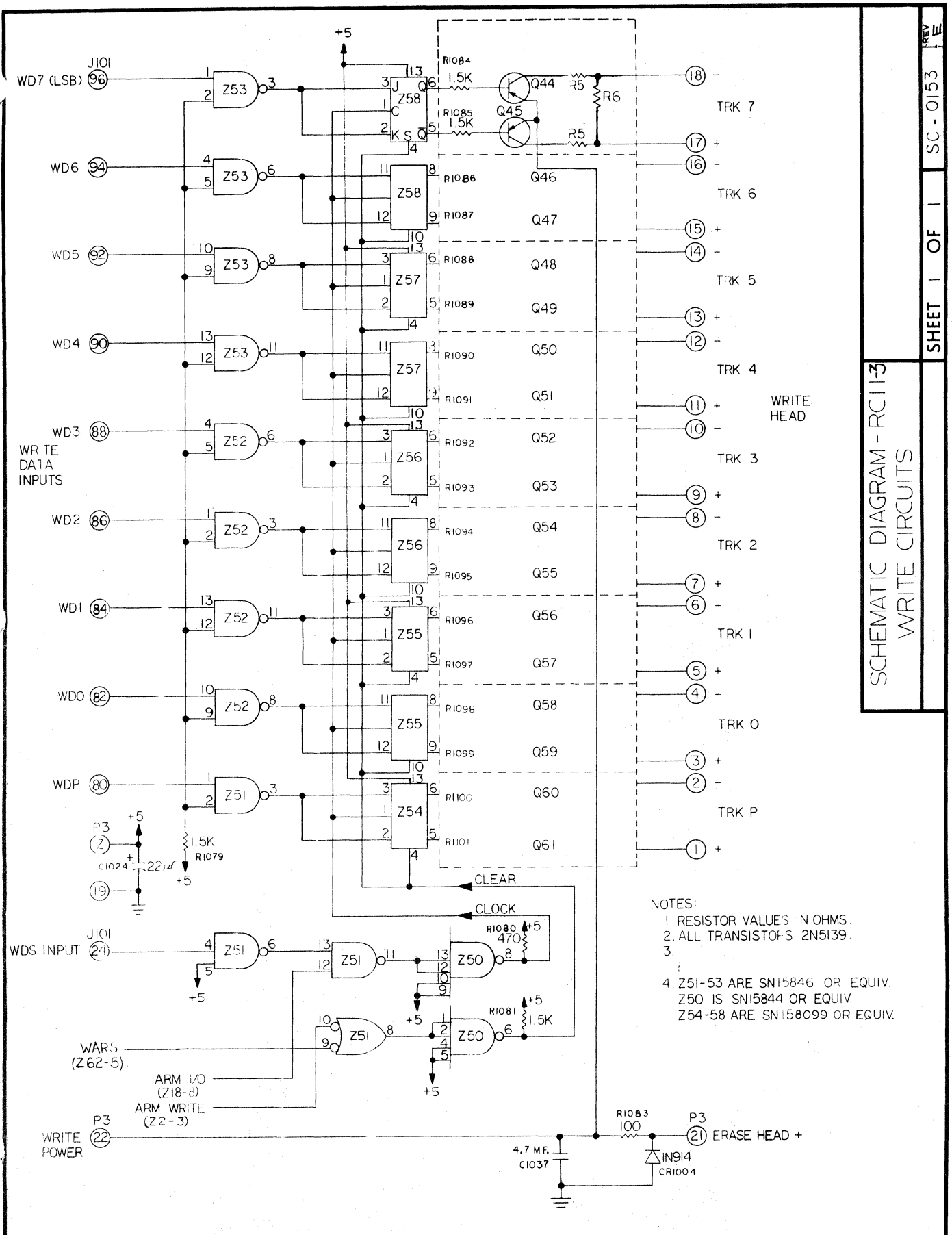


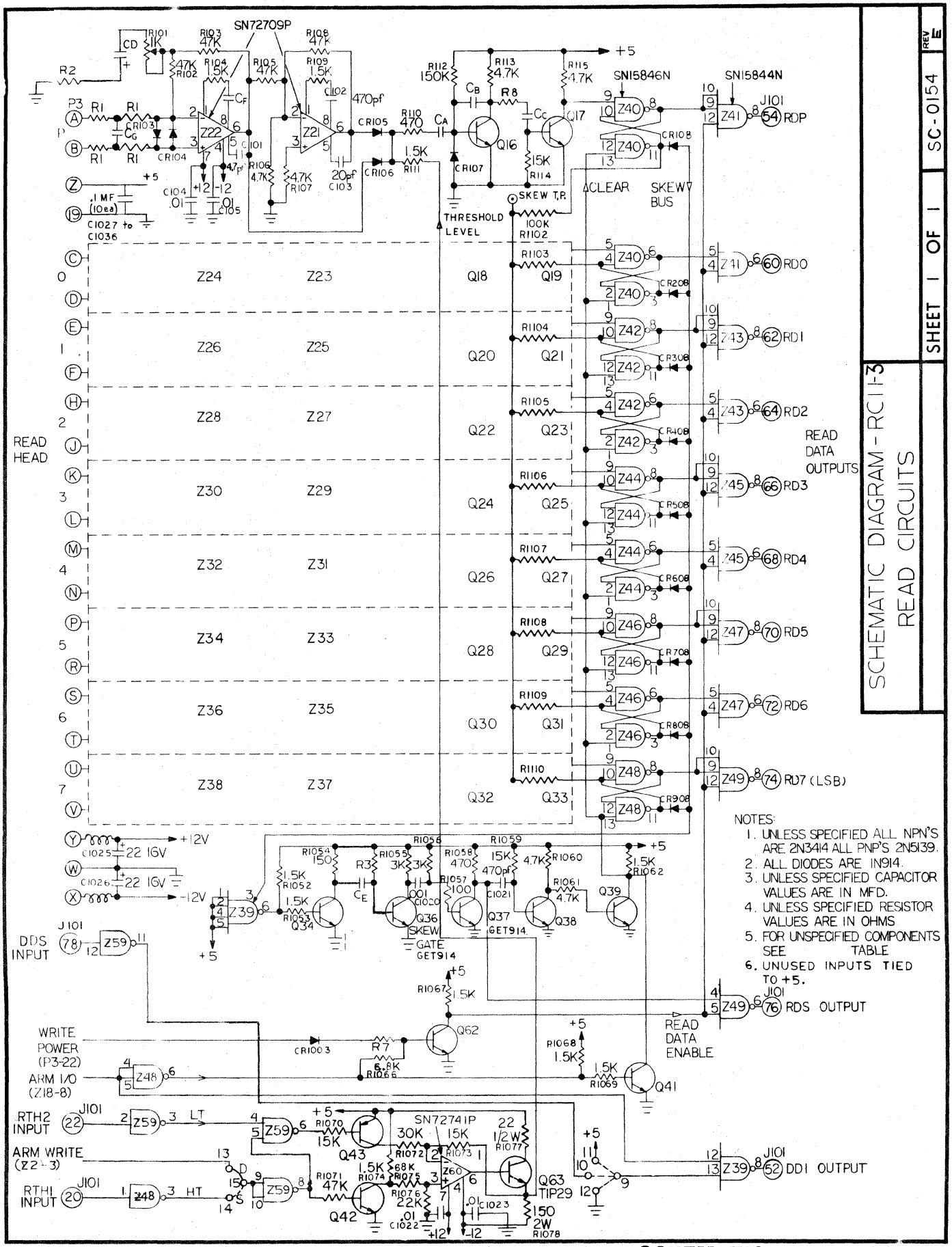
REF. DESIG	LAST USED
R1110	
R(1-9) 15	
C1037	
C(1-9) 05	
CR1006	
CR(1-9)08	
Z62	
Q63	

DELETED
Q1

RC-11 CARD **CD-0037**

7-11/7-12


SCHEMATIC DIAGRAM - RC11-3
WRITE CIRCUITS
SHEET 1 OF 1
SC-0153
REV E
WD7 (LSB)
WD6
WD5
WD4
WD3
WR TE DATA INPUTS
WD2
WD1
WD0
WDP
WDS INPUT
WARS (Z62-5)
ARM I/O (Z18-8)
ARM WRITE (Z2-3)
WRITE POWER
TRK 7
TRK 6
TRK 5
TRK 4
TRK 3
TRK 2
TRK 1
TRK 0
TRK P
WRITE HEAD
ERASE HEAD +
CLEAR
CLOCK
NOTES:
1. RESISTOR VALUES IN OHMS.
2. ALL TRANSISTORS 2N5139.
3.
4. Z51-53 ARE SN15846 OR EQUIV.
Z50 IS SN15844 OR EQUIV.
Z54-58 ARE SN158099 OR EQUIV.



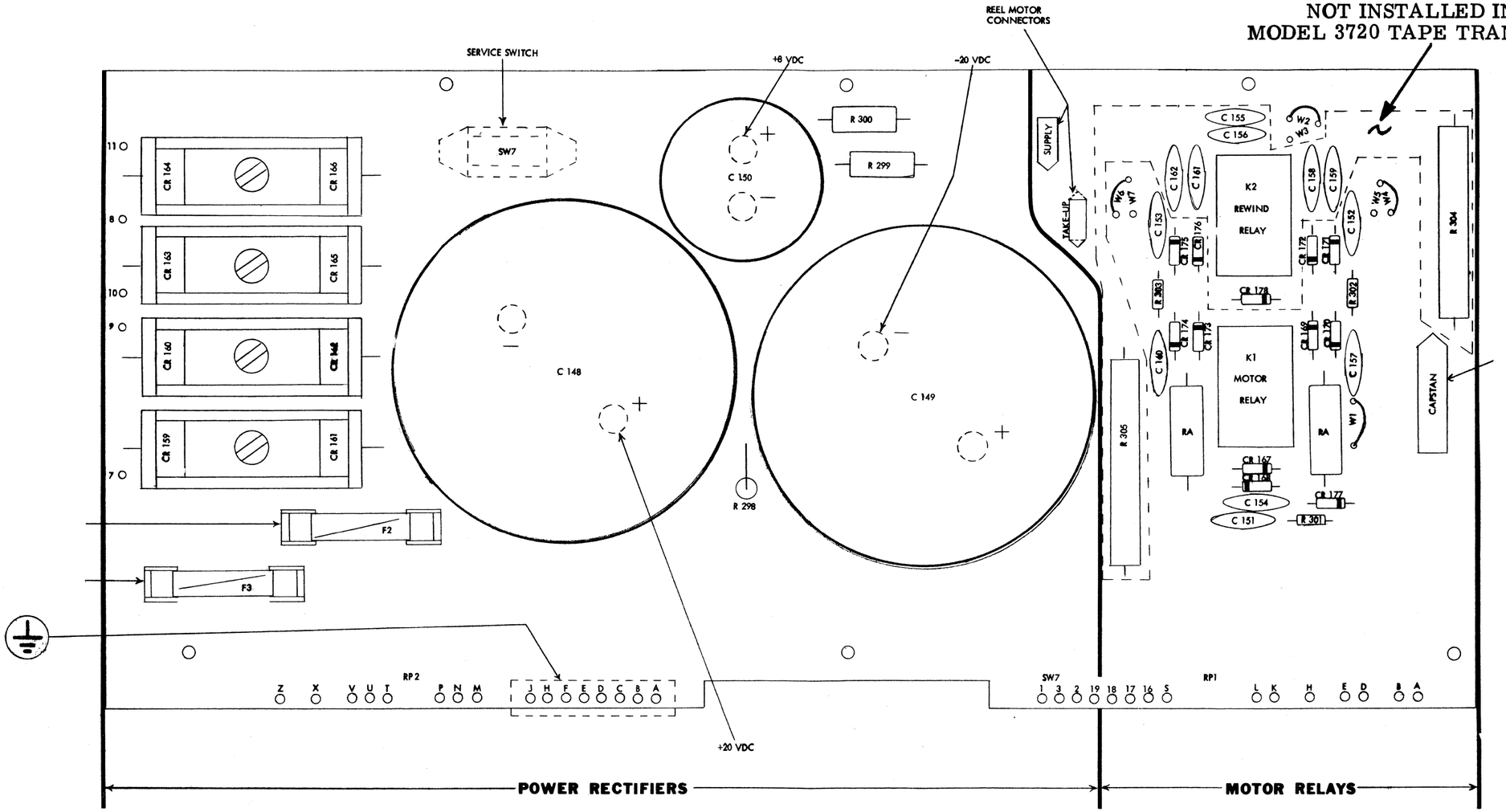
SCHEMATIC: READ CIRCUITS

NOTES:
1. UNLESS OTHERWISE NOTED:
   DIODES : 1N914
   XSTR NPN : 2N3414
   XSTR PNP : 2N5139
   2-IN GATES : SN15846N
   4-IN GATES : SN15844N
   Z4 : SN7474N
   Z8 : SN15809SN
   Z62 : SN7406N

FINISH		SCHEMATIC RCII-3 RECORDER CONTROL LOGIC	REV E
SCALE			
DRAWN PK	11 MAY 76	LD-0002	
APPR.			

LD-0002
SCHEMATIC: CONTROL LOGIC
7-15/7-16

NOT INSTALLED IN
MODEL 3720 TAPE TRANSPORT



RP-16 CARD CD-0036

7-17/7-18

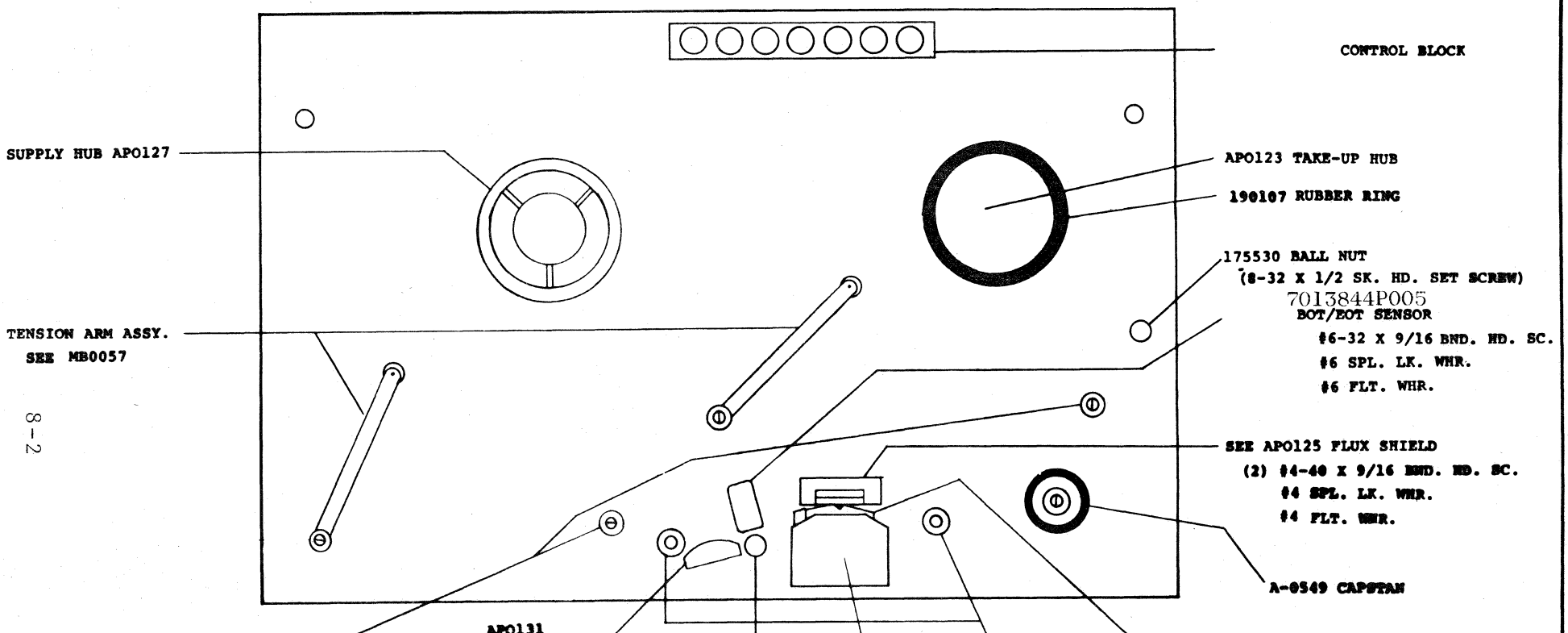
SECTION 8

ILLUSTRATED PARTS

BREAKDOWN

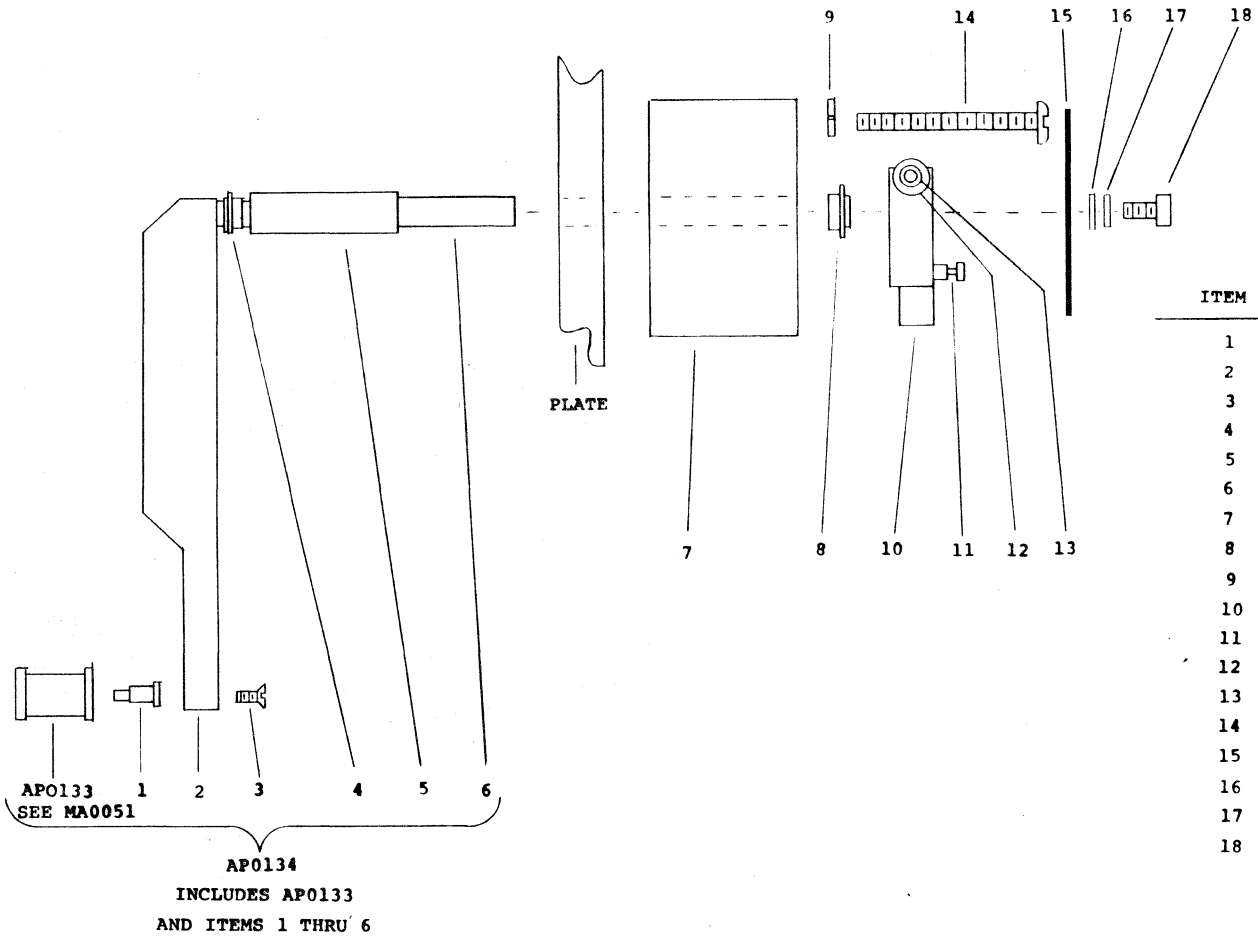
TAPE TRANSPORT PARTS LIST

	Drawing or Part List No.
Front Plate - Front View	MB-0059
Tension Arms (AP0134)	MB-0057
Tension Arm Roller (AP0133)	MA-0051
Rotating Tape Guide (AP0121)	MA-0050
Fixed Tape Guide (AP0120)	MA-0048
Tape Cleaner (AP0131)	MA-0049
Flux Shield (AP0125)	MA-0047
Front Plate - Rear View	MB-0053
File Protect Unit (AP0124)	MB-0055
Servo Sensor (AP0136)	7013844P026
Limit Switch	MA-0044



8-2

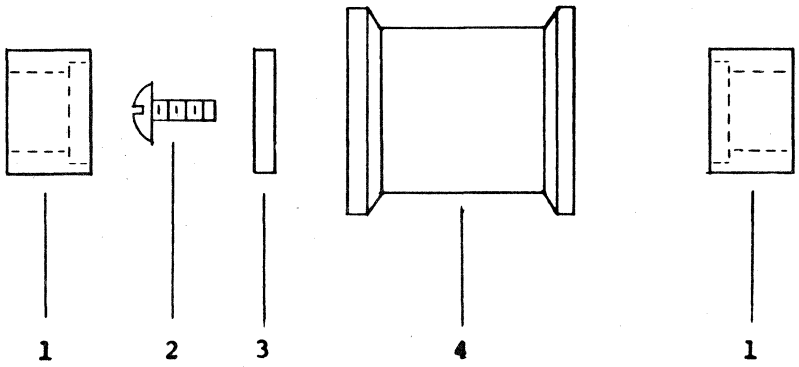
ASSY. - FRONT PLATE FRONT VIEW		
	SHEET OF	MB-0059



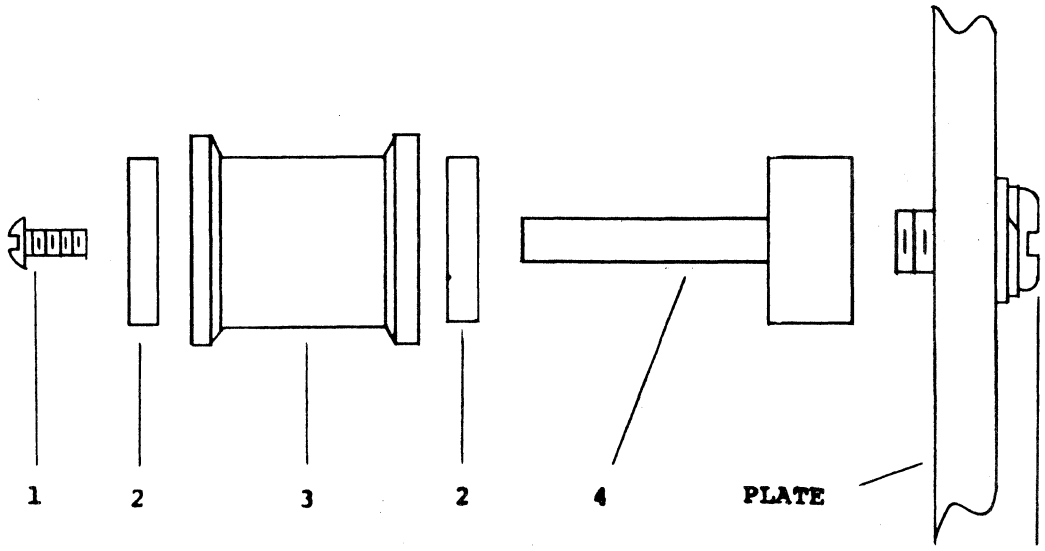
ITEM	QUANTITY	DESCRIPTION	PART NO.
1	1	STANDOFF	OA0267-E
2	1	TENSION ARM	OA0543-B
3	1	#2-56x3/8 FLT HD SLT SCREW	
4	1	BEARING	170614
5	1	COLLAR	OA0570
6	1	SHAFT	OA0569-B
7	1	BEARING BLOCK	OA0558-B
8	1	SEE ITEM 4	
9	3	#6 SPL LK WHR	
10	1	TORQUE ARM	OA0460-J
11	1	PIN 3/16x5/8 TYPE G	160102
12	1	#6 FLT WHR	
13	1	#6-32x1/2 SKT HD CAP SCREW	
14	3	#6-32 X 1 1/2 BHD HD SCREW	
15	1	SERVO DISC	OA0499-J
16	1	#4 FLT WHR	
17	1	#4 SPL LK WHR	
18	1	#4-40x1/4 SKT HD CAP SCREW	

TENSION ARM ASSY.		
	SHEET OF	MB-0057

TENSION ARM ROLLER ASSY.
7015811P901



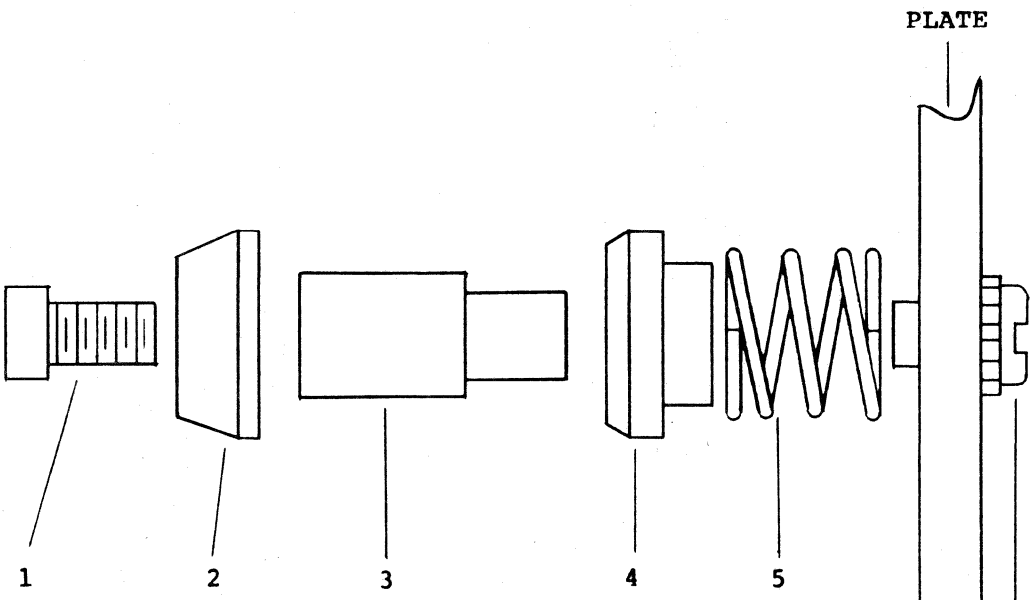
ITEM	QUANTITY	DESCRIPTION	PART NO.
1	2	PLUG	OA0289-A
2	1	#2-56x3/16 BND HD SCREW	
3	1	BEARING	170418-2
4	1	TAPE GUIDE	OA0266



ROTATING TAPE GUIDE ASSY.
7015841P405

SHEET OF MA-0050

ITEM	QUANTITY	DESCRIPTION	PART NO.
1	1	2-56x3/16 BND HD SCREW	
2	2	BEARING SSIF-418-ZZEE	170418-1
3	1	TAPE GUIDE	OA0266
4	1	POST, IDLING ROLLER	OA0378-2



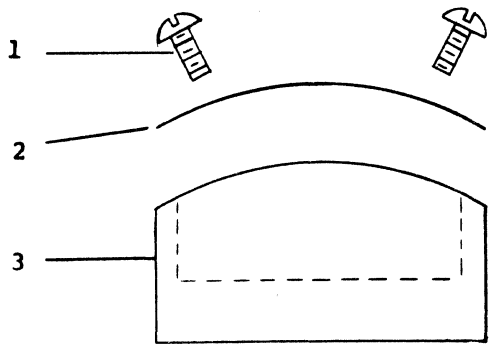
SEE FRONT PLATE
ASSY. DWG. MB-0050

FIXED TAPE GUIDE ASSY.
70158[illegible]002

SHEET OF MA-0048

ITEM	QUANTITY	DESCRIPTION	PART NO.
1	1	#6-32x1/4 SKT HD CAP SCREW	
2	1	RETAINER, TAPE GUIDE CAP	OA0429
3	1	SUPPORT, TAPE GUIDE	OA0347
4	1	CAP, TAPE GUIDE	OA0394
5	1	SPRING, TAPE GUIDE	OA0345

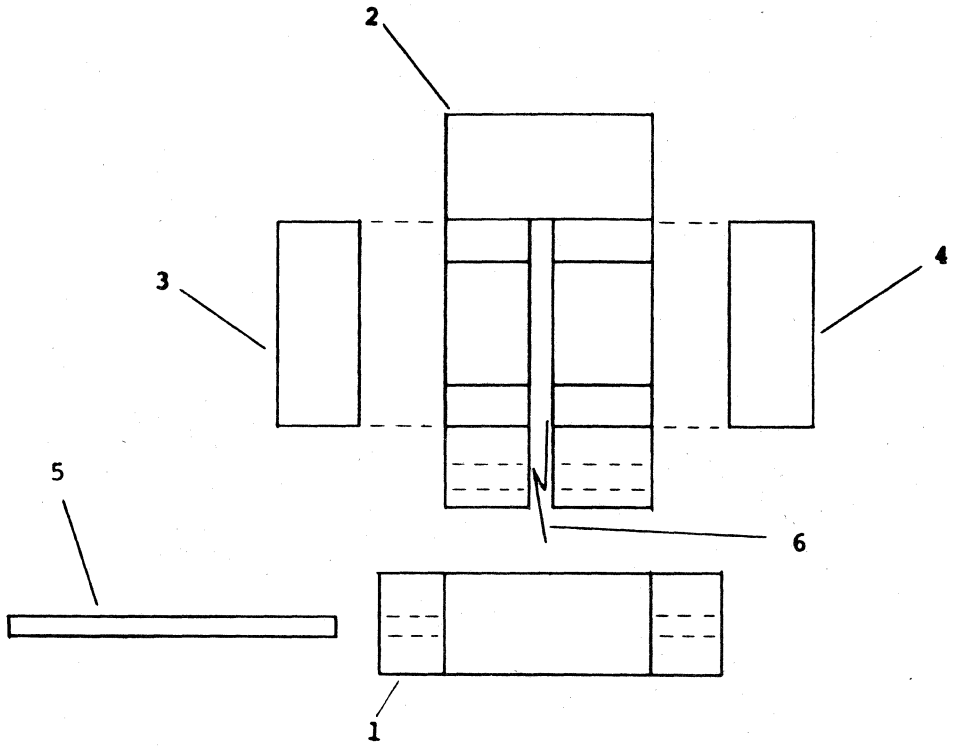
TAPE CLEANER ASSY.
AP0131



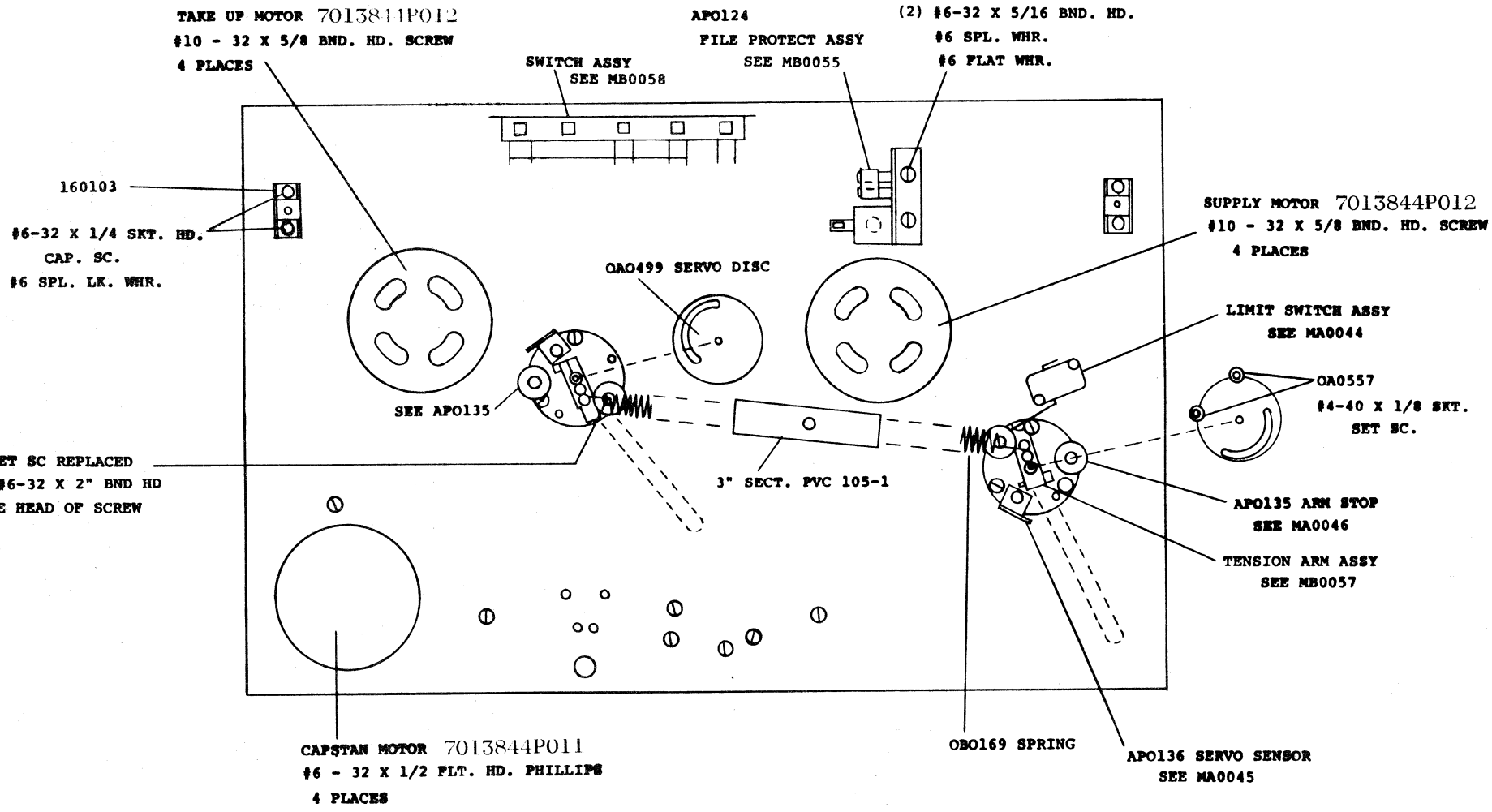
FRONT VIEW

ITEM	QUANTITY	DESCRIPTION	PART NO.
1	4	#2-56x3/16 BND HD SCREW	
2	1	SCREEN	172449
3	1	PILLAR TAPE CLEANER	0A0600

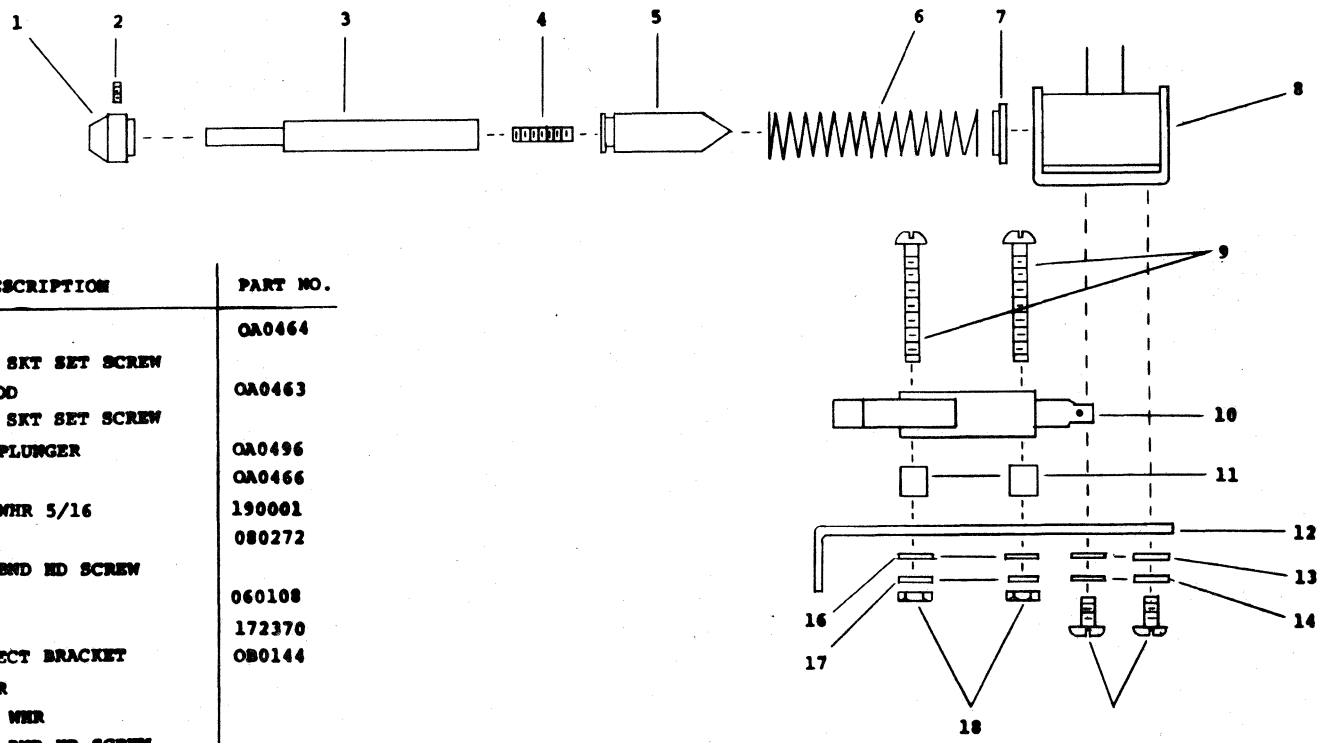
FLUX SHIELD ASSY.
AP0125



ITEM	QUANTITY	DESCRIPTION	PART NO.
1	1	BRACKET, FLUX SHIELD	OA0462-F
2	1	CAP, FLUX SHIELD	OA0461-F
3	1	INSERT, COPPER	OA0365-2
4	1	INSERT, FERRITE	OA0365-1
5	1	PIN	161819
6	1	SPRING	OA0469



ASSEMBLY - FRONT PLATE REAR VIEW		
	SHEET OF	MB-0053

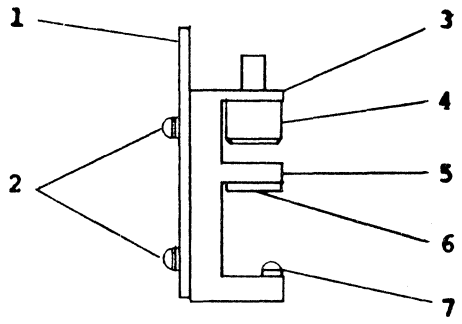


ITEM	QUANTITY	DESCRIPTION	PART NO.
1	1	ACTUATOR	OA0464
2	1	#4-40x1/8 SKT SET SCREW	
3	1	SENSING ROD	OA0463
4	1	#4-40x1/2 SKT SET SCREW	
5	1	SOLENOID PLUNGER	OA0496
6	1	SPRING	OA0466
7	1	SHOULDER WHR 5/16	190001
8	1	SOLENOID	080272
9	2	#4-40x1" BND HD SCREW	
10	1	SWITCH	060108
11	2	STANDOFF	172370
12	1	FILE PROJECT BRACKET	OB0144
13	2	#6 FLT WHR	
14	2	#6 SPL LK WHR	
15	2	#6-32x1/4 BND HD SCREW	
16	2	#4 FLTWHR	
17	2	#4 SPL LK WHR	
18	2	#4-40 HEX NUT	

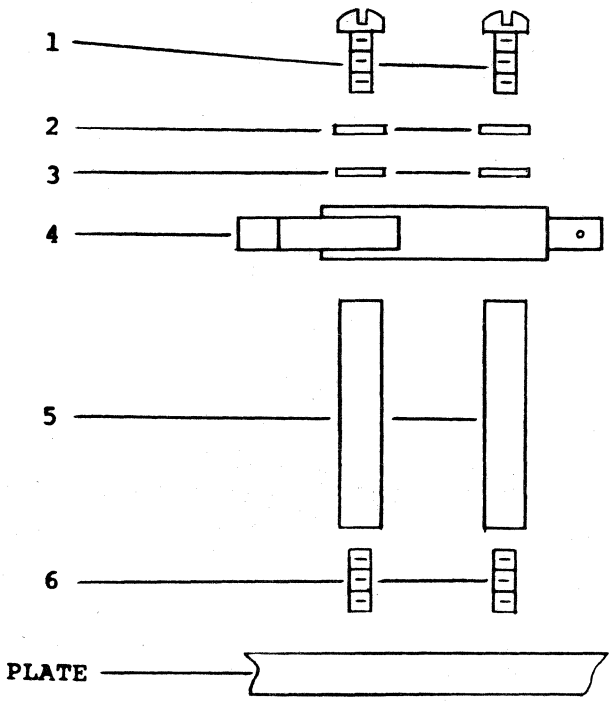
FILE PROTECT ASSY.
AP0124

SHEET OF MB-0055

SERVO ASS'Y
[illegible]



ITEM	QUANTITY	DESCRIPTION	PART NO.
1	1	PRINTED CIRCUIT BOARD	PS-1
2	2	#2-56 X 3/16 BND. HD.	
	2	#2 SPL. LK. WHR.	
	2	#2 FLAT WHR.	
3	1	LAMP RETAINING RING	
4	1	ALCO LAMP	050680
5	1	PHOTO SENSOR BLOCK	0A0500
6	1	PHOTO CELL, VACTEC	720301
7	2	#2-56 X 1/4" BND. HD.	
	2	#2 SPL. LK. WHR.	



LIMIT SWITCH ASS'Y DETAIL

SHEET OF MA-0044

ITEM	QUANTITY	DESCRIPTION	PART NO.
1	2	#4-40 X 5/8 BND. HD. SCREW	
2	2	#4 SPL. LK. WHR.	
3	2	#4 FLAT WHR.	
4	1	SWITCH	060108
5	2	MICRO SWITCH STANDOFF	0A0542
6	2	#6-32 X 3/8 SKT SET SCREW	

PART 2
CONTROLLER MAINTENANCE

SYSTEM 8090 MAGNETIC TAPE CONTROLLER INTERFACE MAINTENANCE

SECTION 1

INTRODUCTION

1.1 GENERAL

The following information is provided to aid maintenance personnel in performing field maintenance on the magnetic tape controller interface. Installation instructions and repackaging and reshipment instructions not appearing herein can be found in the appropriate sections of the Model 3720 Magnetic Tape Transport Maintenance Manual (Part 1).

1.2 PHYSICAL DESCRIPTION

The system 8090 Magnetic Tape controller interface consists of four printed circuit boards (PCB's). The four PCB's and their slot locations in the microprocessor card cage are as follows (see figure 1-1):

a. Magnetic Tape Controller or Controller (XA 16)
b. Magnetic Tape Timer or Timer (XA 17)
c. Magnetic Tape Formatter or Formatter (XA 18)
d. Magnetic Tape Distributor or Distributor (XA 20)

1.3 FUNCTIONAL DESCRIPTION

1.3.1 CONTROLLER

The controller interfaces with the distributor, the timer, the formatter and the general purpose buffer channel (GPBC). The controller performs the following functions:

- Selection Register and Jumper Straps
- Record Counter
- Address Counter
- Controller Data Multiplexor
- Decode Logic
- Command Register
- Data Multiplexor and Register
- Maintenance Switch

1.3.2 DISTRIBUTOR

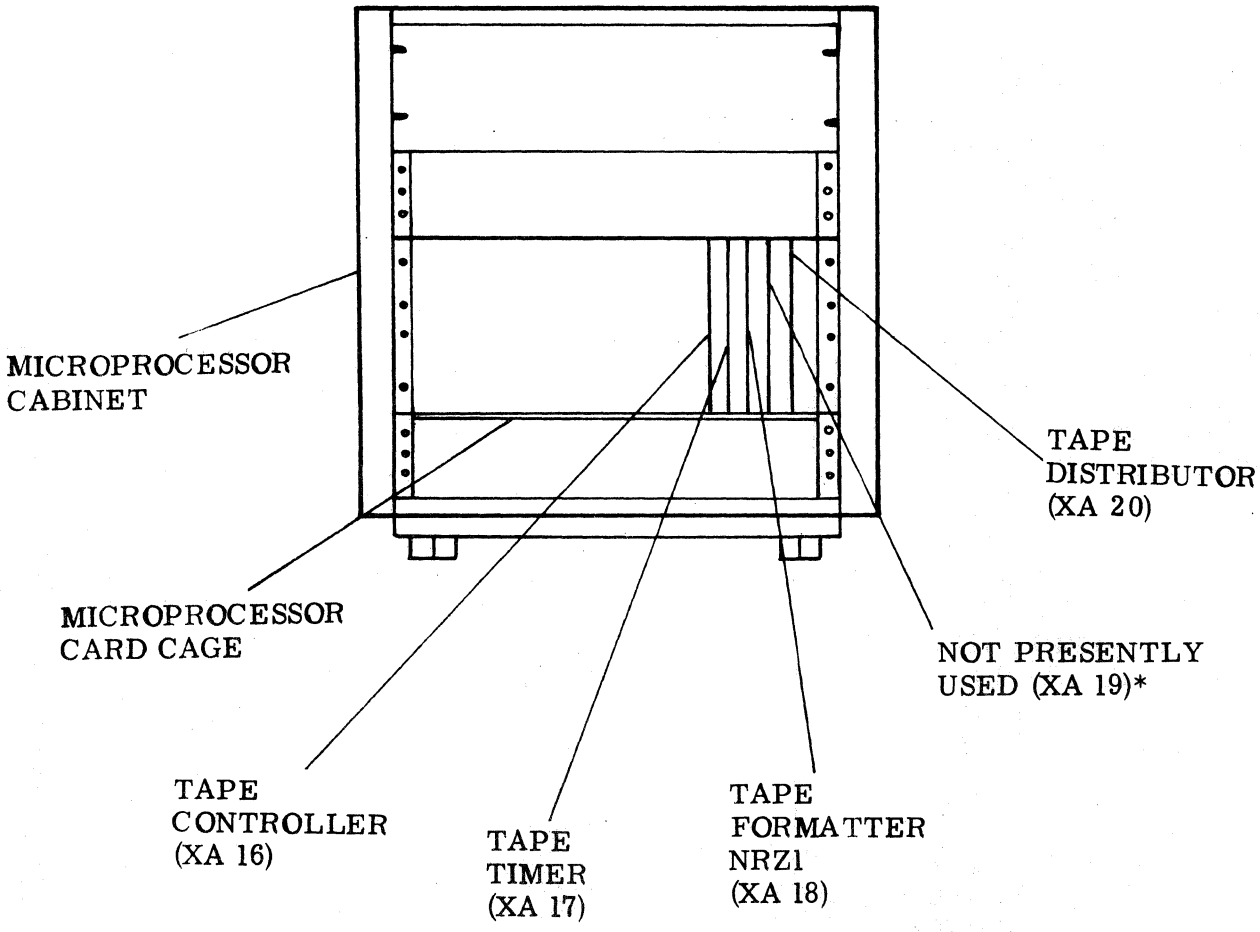
The distributor interfaces with the controller, the formatter, the timer and two NRZ1 or two phase encoded, 9-track tape drives. The distributor handles all data and status lines to and from the tape drives. Neither drive will be on the lines unless selected. Only one drive may be selected at any one time. All lines leaving the distributor are buffered and go to one drive.

The distributor contains the following registers and latches:

- First Character Write Latch
- Read Data Multiplexor
- Motion Register
- End of Tape Mark

1.3.3 TIMER

The timer interfaces with the controller, formatter and distributor. The timer PCB performs the following functions:



* LATER CONFIGURATIONS MAY USE TAPE FORMATTER (PE) IN SLOTS XA18 AND XA 19.

Figure 1-1. Controller Interface PCB Locations

Oscillator
Basic Timer
Delay Request
Test Bus
Command Detect and Busy
Illegal Command
File Mark Search
Termination Logic
Operation Complete
Interrupt
Error Flag
Rewind Error

1.3.4 FORMATTER

The formatter interfaces with the timer and the distributor. This PCB is used for NRZ1 recording and performs the following functions:

Data Transfer Request
Tape Motion Command Set-Up Logic
Tape Gap Detection Logic
Write Control Logic
File Mark Detection Logic
Error Checking Logic
CRC Generation Logic

1.4 MAINTENANCE PHILOSOPHY

The maintenance philosophy requires that: (1) a malfunction be isolated to a major field replaceable assembly and (2) that the major field replaceable assembly be replaced with an operational spare. All field replaceable assemblies are supplied as part of the maintenance kit #7013425K001. Refer to tables 5-3 and 5-4 in Section 5 of Part 1 for maintenance kit components.

To eliminate the possibility of reusing a defective assembly as a replacement spare, it is important to properly identify the assembly as defective by attaching a repairable tag immediately following its removal.

Malfunctions resulting from defective assemblies that are not field replaceable requires that the assembly be repackaged and shipped to Sanders Associates. All defective parts must also be properly packaged for shipment to the factory.

Assemblies returned to the factory are repaired, refurbished and returned to the original site. Defective parts are also repaired (where practical) and used to restock maintenance kits.

1.5 RELATED DOCUMENTATION

The following is a list of various documents which relate to the controller interface.

Magnetic Tape Controller Card Description (7100605H001)
Magnetic Tape Timer Card Description (7100606H001)
Magnetic Tape Distributor Card Description (7100608H001)
Magnetic Tape Formatter Card Description (7100607H001)

SECTION 2

INSTALLATION

2.1 GENERAL

The four controller interface boards are located as shown in figure 1-1. Before installing or removing these boards insure that the power is off. Also, when replacing boards, insure that the component side of the boards being replaced faces to the right.

In the present configuration slot XA 18 is occupied by the NRZ1 formatter. In future installations slots XA 18 and XA 19 may be occupied by the phase encoded (PE) formatter.

SECTION 3

MAINTENANCE

3.1 GENERAL

Maintenance activity associated with the controller interface includes fault isolation or troubleshooting and parts replacement. This section details the requirements necessary to support these functions.

This section is a guide to prompt isolation of a faulty field replaceable PCB. It enables maintenance personnel to isolate a faulty PCB with a minimum of repetitious testing. Certain non-standard failures; i.e., motherboard problems, software problems, operator errors, etc., is beyond the scope of this section and is not covered here.

3.2 FAULT ISOLATION

This section provides the user with a systematic approach to isolate the cause of a failure and take the necessary corrective action. The most important factor in the repair of the controller interface is the effective use of the diagnostic selftests to isolate a defective PCB.

If a malfunction occurs, it is recommended that the Microprocessor low voltage power supply (LVPS) be checked first for proper operation. Furthermore, it is advisable to perform a general visual inspection of the LVPS and the controller interface for obvious failure characteristics such as faulty printed circuit connections and shorted or bent connector pins.

If the visual inspection does not result in any significant findings it is first necessary to check the power supply voltages and then to make use of the diagnostic selftests to isolate a fault.

3.2.1 LVPS CHECK

Perform the steps given in the following procedure to check the power supply voltages.

NOTE

The following checks are made on terminal board TB1 (located on the rear panel of the LVPS) using a volt-ohm meter (VOM) Triplett Model 310 or equivalent .

1. Check the -12V terminals. Voltage should be -12 $\pm$ 0.5V. If not, see the -12VDC adjustment procedure.
2. Check the +12V terminals. Voltage should be +12 $\pm$ 0.5V. If not, see the +12VDC adjustment procedure.
3. Check the 5V terminals. Voltage should be 5 $\pm$ 0.1V. If not, see the +5VDC adjustment procedure.

3.2.1.1

ADJUSTMENT	COMPONENT REFERENCE
-12VDC	R16
ASSEMBLY NAME	**ASSEMBLY PART NUMBER**
Low Voltage Power Supply (LVPS)	7013361G001
RECOMMENDED TEST EQUIPMENT	**TOOLS REQUIRED**
Triplett Model 310 or Equivalent	Non-conducting Adjustment Tool

DESCRIPTION

Adjust R16 to obtain the voltage measurement to within the tolerance given below.

PROCEDURE

1. Insure that the LVPS power ON/OFF switch is ON and all the circuit breakers on the status panel are in the UP position.
2. Connect the VOM to the -12V terminal on terminal board TB1.
3. Adjust potentiometer R16 on LVPS regulator board XA 2 (7100364G001) so that VOM measures -12 $\pm$ 0.5VDC.
4. If voltage output cannot be adjusted to the tolerance given in step 3, disconnect the leads from the -12V terminal on terminal board TB1 and repeat step 3.
5. If voltage output cannot be adjusted within tolerance given in step 3, replace regulator board XA 2, and repeat steps 1 through 3.
6. If voltage still cannot be adjusted within tolerance given in step 3, replace LVPS.

3.2.1.2

ADJUSTMENT	COMPONENT REFERENCE
+12VDC	R5
ASSEMBLY NAME	**ASSEMBLY PART NUMBER**
Low Voltage Power Supply (LVPS)	7013361G001
RECOMMENDED TEST EQUIPMENT	**TOOLS REQUIRED**
Triplett Model 310 VOM or Equivalent	Non-conducting Adjustment Tool

DESCRIPTION

Adjust R5 to obtain the voltage measurement to within the tolerance given below.

PROCEDURE

1. Insure that the LVPS power ON/OFF switch is ON and that all circuit breakers on the status panel are in the UP position.
2. Connect the VOM to the +12V terminal on terminal board TB1.
3. Adjust potentiometer R5 on LVPS regulator board XA 2 (7100364G001) so that VOM measures +12 $\pm$ 0.5VDC.
4. If voltage output cannot be adjusted to the tolerance given in step 3, disconnect the leads from the +12 terminal on terminal board TB1 and repeat step 3.
5. If voltage output cannot be adjusted within tolerance given in step 3, replace regulator board XA 2 and repeat steps 1 through 3.
6. If voltage output still cannot be adjusted within tolerance given in step 3, replace LVPS.

3.2.1.3

ADJUSTMENT	COMPONENT REFERENCE
+5VDC	R20
ASSEMBLY NAME	**ASSEMBLY PART NUMBER**
Low Voltage Power Supply (LVPS)	7013361G001
RECOMMENDED TEST EQUIPMENT	**TOOLS REQUIRED**
Triplett Model 310 VOM or Equivalent	Non-conducting Adjustment Tool

DESCRIPTION

Adjust R20 to obtain the voltage measurement to within the tolerance given below.

PROCEDURE

1. Insure that the LVPS power ON/OFF switch is in the ON position and that all circuit breakers on the status panel are in the UP position.
2. Connect the VOM to the +5V terminal on terminal board TB1.
3. Adjust potentiometer R20 on LVPS regulator board XA 1 (7100363G001) so that VOM measures +5 $\pm$ 0.1VDC.
4. If voltage output cannot be adjusted to the tolerance given in step 3, disconnect the leads from the +5V terminal on terminal board TB1 and repeat step 3.
5. If voltage output cannot be adjusted within tolerance given in step 3, replace regulator board XA 1 and repeat steps 1 through 3.
6. If voltage output still cannot be adjusted for proper measurement replace LVPS.

3.2.2 CONTROLLER INTERFACE CHECK

Four diagnostic selftest programs are used to isolate a controller interface malfunction to a particular printed circuit board. Once the defective board has been located using the selftest, the maintenance philosophy is to replace the defective board with operational board from the maintenance kit.

To isolate a malfunction in the controller interface using the portable tester (7013014G001) with perforated mylar or paper tapes, follow the diagnostic selftest loading sequence presented in table 3-1. Diagnostic Selftest User's manuals are available for each selftest given in the table. The part numbers of the manuals correspond with the part numbers for the tapes except that the last four digits of the part numbers are "H002" instead of "R003".

Use table 3-1 and the appropriate Diagnostic Selftest User's Manual to isolate a defective controller interface assembly.

TABLE 3-1

DIAGNOSTIC SELFTEST LOADING SEQUENCE

Selftests	Part Number
810 INITIAL SLFTST	7013396R003
810 KD SLFTST MON	7013183R003
PDS MEM SLFTST	7013191R003
810 KD DISPLAY SLFTST	7014032R003
810 KYBD SLFTST	7014033R003
810 PROC SLFTST	7013933R003
PDS ROM SLFTST	7013188R003
MAG TAPE ROM TM	7012016R010
PDS GPBC SLFTST	7013942R003
MAG TAPE SLFTST PT 1	7013950R003
MAG TAPE SLFTST PT 2	7013951R003
MAG TAPE SLFTST PT 3	7013952R003
MAG TAPE SLFTST PT 4	7013953R003

SECTION 4

MAINTENANCE AIDS

4.1 GENERAL

Maintenance aids for the controller interface consist of test point function descriptions, block diagrams, and timing diagrams. Refer to the appropriate card description as required for these items. See table 4-1 below.

TABLE 4-1

CONTROLLER INTERFACE CARD DESCRIPTIONS

Title	Part Number
Card Description Magnetic Tape Controller	7100605H001
Card Description Magnetic Tape Timer	7100606H001
Card Description Magnetic Tape Formatter	7100607H001
Card Description Magnetic Tape Distributor	7100608H001

SECTION 5

PREVENTIVE MAINTENANCE

5.1 GENERAL

Preventive maintenance on the interface controller consists of proper handling of the printed circuit cards. When removing or inserting cards insure that:

1. Power is OFF.
2. Cards are properly oriented.
3. Cards are inserted in correct slot.
4. Card connectors and card cage mating connectors are serviceable.

SECTION 6

REPACKAGING AND RESHIPMENT

6.1 GENERAL

For repackaging and reshipment instructions refer to section 6 of the Model 3720 Tape Transport Maintenance Manual (Part 1).

SECTION 7

DRAWINGS AND PARTS LISTS

7.1 GENERAL

The parts listing for the controller interface is provided in table 7-1 below. Drawings (schematic diagrams, wiring diagrams, component location diagrams, etc.) are provided in PDS 800/3000 Schematic Diagrams Manual (PDS-800-15).

TABLE 7-1

PARTS LISTING FOR THE CONTROLLER INTERFACE

Component	Part Number
Magnetic Tape Controller	7100605G001
Magnetic Tape Timer	7100606G001
Magnetic Tape Formatter (NRZ1)*	7100607G001
Magnetic Tape Distributor	7100608G001

* Option: Phase Encoded (PE) Tape Formatter part number is to be assigned.

PUBLICATION CHANGE REQUEST

PUBLICATION TITLE: _____

PUBLICATION NUMBER: _____ EDITION: _____
NUMBER/DATE

REVISION: _____ DATE: _____
DATE

REQUESTED BY: _____ COMPANY: _____
NAME

ADDRESS: _____ STATE: _____ ZIP: _____

COMMENTS: IDENTIFY PROBLEM AREA BY PAGE, PARAGRAPH, FIGURE OR TABLE NUMBER.

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