B 9495 (5E)
MAGNETIC TAPE SUBSYSTEM

TECHNICAL MANUAL
VOLUME 1:

OPERATION and MAINTENANCE

Burroughs

FIELD ENGINEERING

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FUNCTION AND OPERATION

INTRODUCTION

This book provides information required to install, operate, and maintain the Burroughs B 9495 (5E) Magnetic Tape Subsystem. The function and operation section is written for the education of the field engineer and operator in their responsibilities for the tape subsystem operation and maintenance. The following is a list of related literature:

B 9495 (MEC) Master Electronics Control Illustrated Parts Catalog, form no. 1099835
B 9495 (5E) Magnetic Tape Transport Illustrated Parts Catalog, form no. 1094109
B 9495 (5E) Magnetic Tape Subsystem Theory of Operation, form no. 1095619
B 9495 (5E) Magnetic Tape Subsystem Test and Field Documentation (see section 3)
B 3500/B 6700 9-Track Magnetic Tape Control Manual, form no. 1034204
B 9495 (4A/5A) Magnetic Tape Subsystem, form no. 1062254 (for 6A I/O Control material)

GENERAL DESCRIPTION

The B 9495 (5E) Magnetic Tape Subsystem consists of Master Electronics Control Unit (MEC) (figure 1-1) and one to sixteen tape drive units (figure 1-2). The MEC contains one to four input/output channels and one to eight exchanges housed in a main and auxiliary cabinet. The subsystem is capable of operating in the NRZ or phase encoding mode of recording or a combination of both depending upon the options installed in the MEC and tape units. Table 1-1 lists information on the subsystem characteristics.

Table 1-1. B 9495 (5E) Subsystem Characteristics

Item	Characteristics		
Information packing Density	800 bpi — NRZ 1600 bpi — Phase Encoding		
Tape Speed	25, 50, 75 or 125 in./sec		
Rewind Speed	450 inches per second		
Rewind Time	85 to 110 seconds		
Transfer Rates		800 bpi	1600 bpi
	25 ips	20 kB/s	40 kB/s
	50 ips	40 kB/s	80 kB/s
	75 ips	60 kB/s	120 kB/s
	125 ips	100 kB/s	200 kB/s
Reel Size	Up to 10.5 inch reel radius, containing up to 2400 feet of tape.		
Leaders	Refer to "Tape Cartridges" in this section.		
Cartridge Bands	Easy Load I or II bands for 10.5 inch reels.		

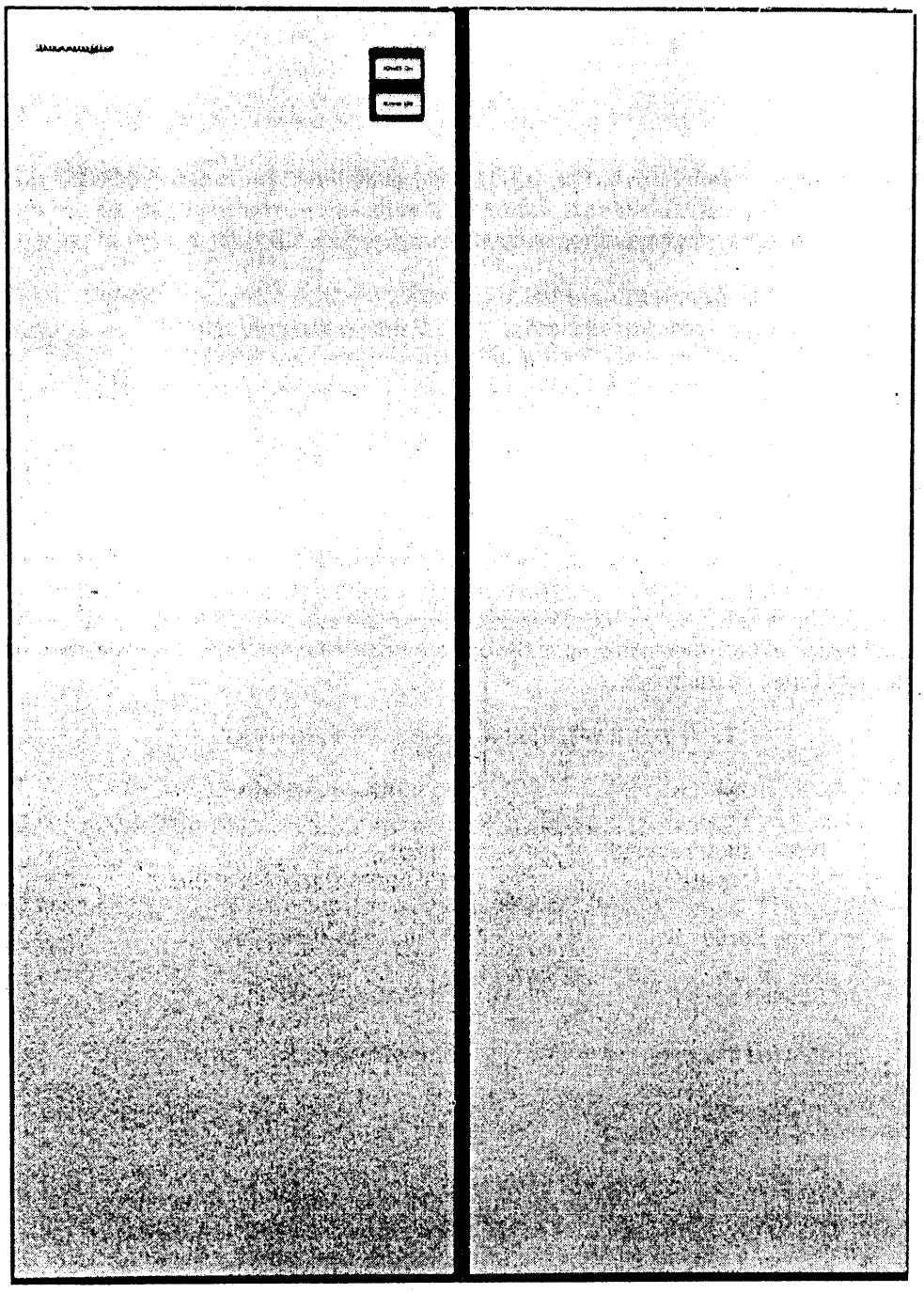

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Figure 1-1. MEC (Main and Auxiliary Cabinets)

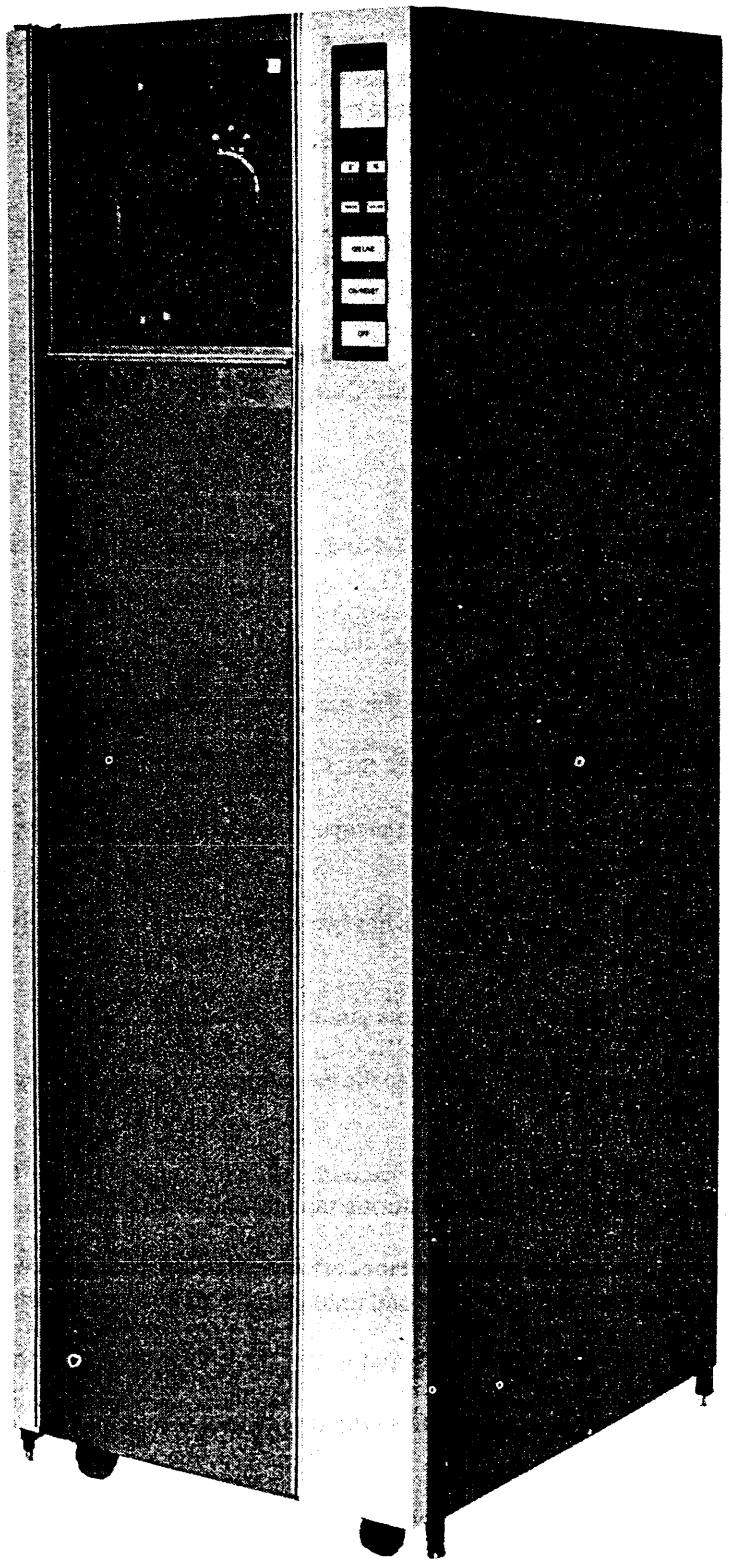

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Figure 1-2. Tape Unit

The tape unit features automatic loading of tape when using 10.5 inch full reels of tape with or without a cartridge band. Semi-automatic loading is provided by the tape unit when using incomplete reels or smaller reels of tape. Semi-automatic loading requires the operator to set a switch in the tape unit and place the leading edge of the tape in an area beyond the first air threading guide prior to pressing the load button. For complete loading information see the tape loading procedure in this section.

The subsystem configuration can be comprised of from one to four controls, and from one to sixteen tape units. The subsystem configuration depends on the customer requirements. Four controls give the system the ability to do tape operations on four drives at the same time (see figure 1-3).

The recording mode of the subsystem is phase encoding (PE) (1600 bpi), or a combination of phase encoding and NRZ (800 bpi). The NRZ capabilities are options installed in the MEC and tape unit when ordered by the customer. These options can be installed in the field.

TAPE DRIVE DECK COMPONENTS

The tape drive deck components are illustrated in figure 1-4 and are described in the following paragraphs.

a. Load Chute. This is the tape entrance to the vacuum columns from the supply reel. During a manual load cycle, the tape leader must be manually inserted into this chute.

b. Supply Hub. The supply reel of tape is put on this hub for tape unit operation.

c. Hub Latch. Pressing this latch locks or releases the supply reel of tape from the supply hub.

d. Cartridge Guide Notches. These notches guide the tape reel cartridge for correct positioning on the servo deck during load operations.

e. Take-up-Reel. This reel receives the tape which has been unwound from the supply reel. The take-up reel is not removable by an operator.

f. Air Bearing. This bearing provides a frictionless guide in the vacuum column.

g. Vacuum Column Door. This door gives access to the vacuum columns for cleaning. This door must not be opened during the operation of the tape unit.

h. Vacuum Columns. The tape is pulled into the vacuum columns to provide tape tension across the read/write head and to prevent tape damage during tape direction changes.

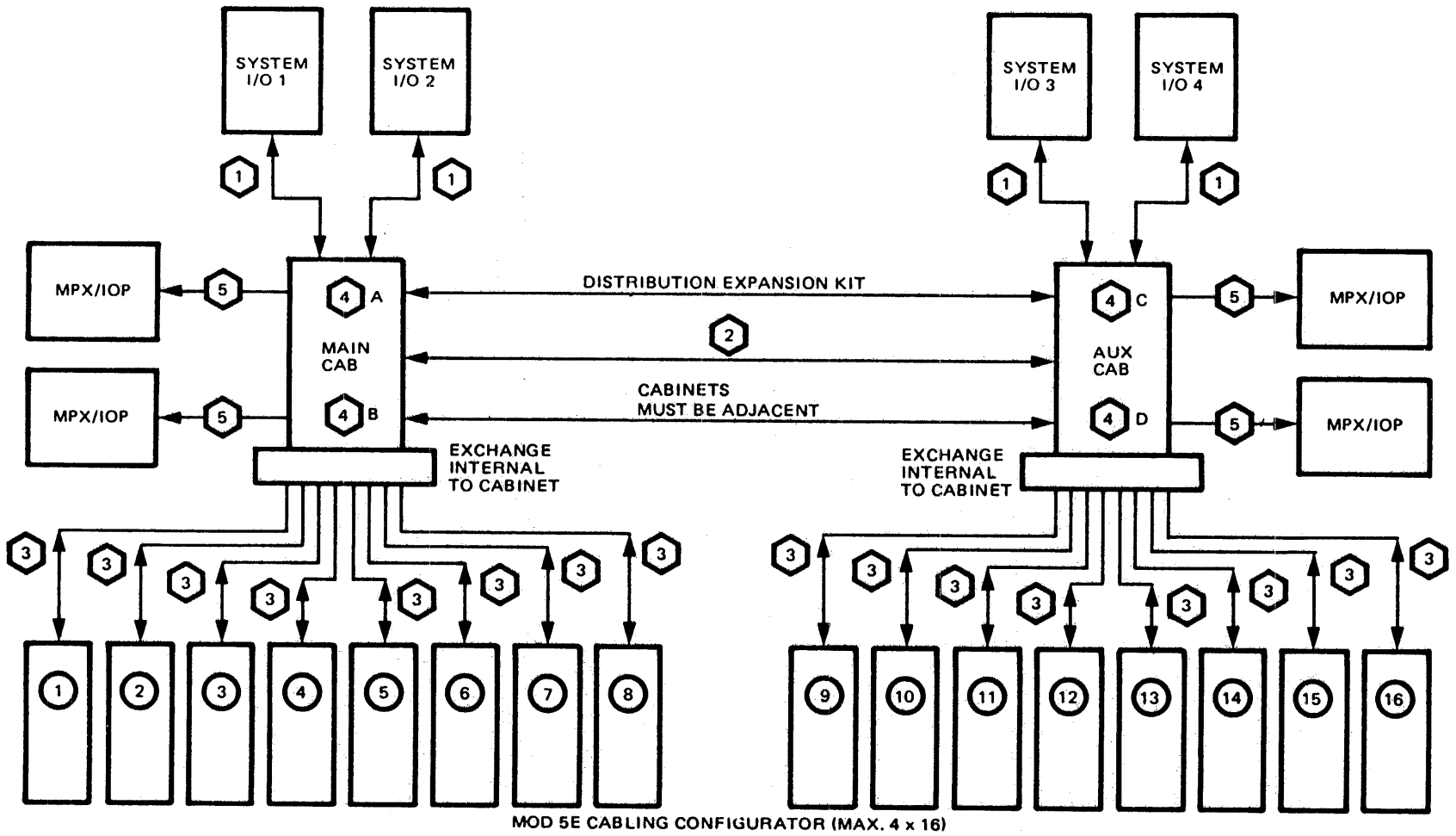
i. Cartridge Opening Arm. This arm engages the tape cartridge opening latch when the cartridge is put on the supply hub. The arm rotates during the load and unload cycle to open and close the cartridge.

j. Read/Write Head. The read/write head reads and writes the information onto the tape.

k. Tape Guide. The tape guide guides the tape from the supply reel across the read/write head and onto the take-up reel.

l. BOT/EOT Sensor. This sensor detects the end of tape (EOT), and the beginning of tape (BOT) markers on the tape during load, rewind, and normal tape operations.

m. Capstan. The capstan is a motor driven disk which maintains tape movements at a constant speed across the read/write head. The capstan is constructed of very light materials which allow it to stop and change directions at a very high speed.



MOD 5E CABLING CONFIGURATOR (MAX. 4 x 16)

NOTE: ONLY ONE CABLE IS REQUIRED BETWEEN THE MEC AND EACH SYSTEM I/O CONTROL, EXCEPT 2 CABLES FOR NRZ, AND ONE BETWEEN MEC AND EACH SLAVE UNIT. TWO CABLES RUN BETWEEN THE MAIN AND AUXILIARY CABINET FOR EACH CONTROL AND ARE PROVIDED AS A PART OF THE DISTRIBUTION EXPANSION KIT.

1. LENGTHS OF 25, 35 AND 50 FEET. 1 PER PE CONTROL 6A, 2 PER NRZ CONTROL 4A.
2. REQUIRE DISTRIBUTION EXPANSION KIT - (1 KIT PER MOTHERBOARD - 2 CABLES PER KIT).
3. LENGTHS OF 15, 25 AND 50 FEET.
4. CONTROL MODULE - REQUIRES AN X KIT, 1X, 2X, 3X, 4X DEPENDING ON CONTROL LOCATION.
5. READY STATUS CABLE - 1 PER MPX/IOP.

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Figure 1-3. Subsystem Configuration

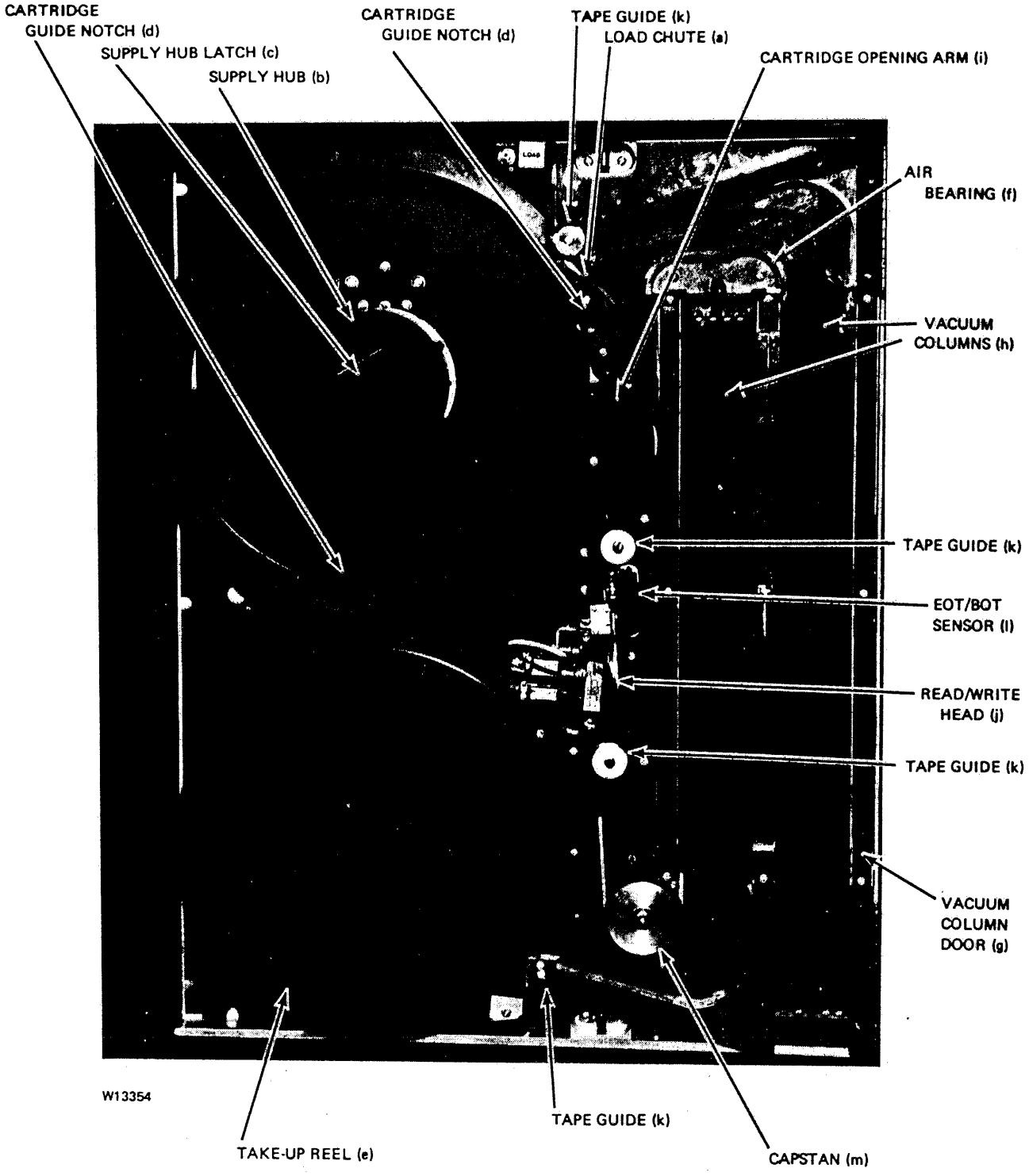


Figure 1-4. Tape Deck Components

TAPE CARTRIDGES

The use of tape cartridges (figure 1-5) eliminates the need to handle the magnetic tape when unloading and loading the tape reel. To install a tape reel into a cartridge, follow the steps outlined below:

a. Inspect the tape leader for damage (bent or cut). If necessary, replace or repair the leader. Use the tape crimping tool (P/N 75-9000-508, available from field engineering sales) to correctly trim the end of the leader (see figure 1-6).

b. Open the cartridge latch and expand the cartridge size so that it will fit over the tape reel.

c. Put the tape reel into the cartridge so that the write-ring groove faces the reel stops on the cartridge.

NOTE

For correct cartridge operation, enough tape must be loaded on the supply reel to fill the reel to within 5/8 inch of its edge, but no closer that 1/4 inch. More or less tape will cause loading problems.

d. Close the cartridge latch.

OPERATING PROCEDURES

The following operating procedures apply to the tape units and master electronics control (MEC). The operator must be familiar with this portion of the manual before operating the subsystem.

APPLYING POWER

The following procedure must be used for applying power to the MEC and tape units. The failure of the MEC or tape unit to power-on must be reported to the field engineer as soon as possible.

MEC POWER

Power to the MEC is applied by pressing the POWER ON button on the main cabinet which will be illuminated when power is on. To power off the MEC, press the POWER OFF button. Power can be applied to the MEC with the front door open.

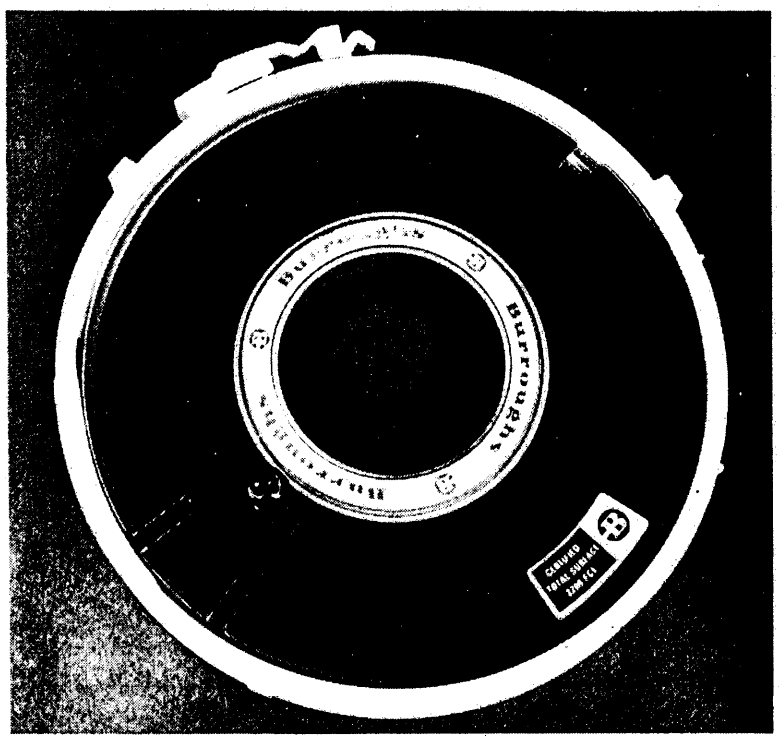
An optional auxiliary power supply is available in the MEC configuration which includes an auxiliary cabinet. When this power supply is installed, power can be turned on from either the main or auxiliary cabinet, depending on the configuration determined by the field engineer. This configuration can be changed by the field engineer to permit power to be applied from the alternate cabinet in the event of a failure in the primary power source.

TAPE UNIT POWER

Power to the tape unit is applied by pressing the ON/RESET button which will be illuminated when power is on. To power off the tape unit, press the POWER OFF button. Power can be applied to the tape unit with the front door open.

TAPE LOADING

The following procedures apply both to open reels and to reels with automatic cartridge bands. The autoload feature of the tape unit will work with all 10.5 inch full reels of tape, with or without the autoload cartridge band. Mini-reels and 10.5 inch reels without a full reel of tape must be loaded using the Manual Load Procedure in this section.



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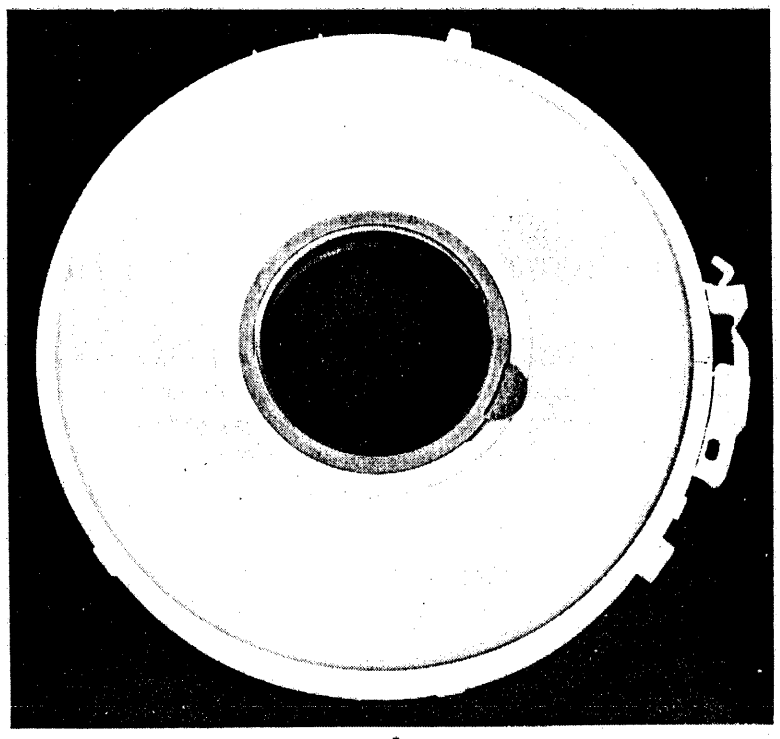

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Figure 1-5. Tape Cartridge Container

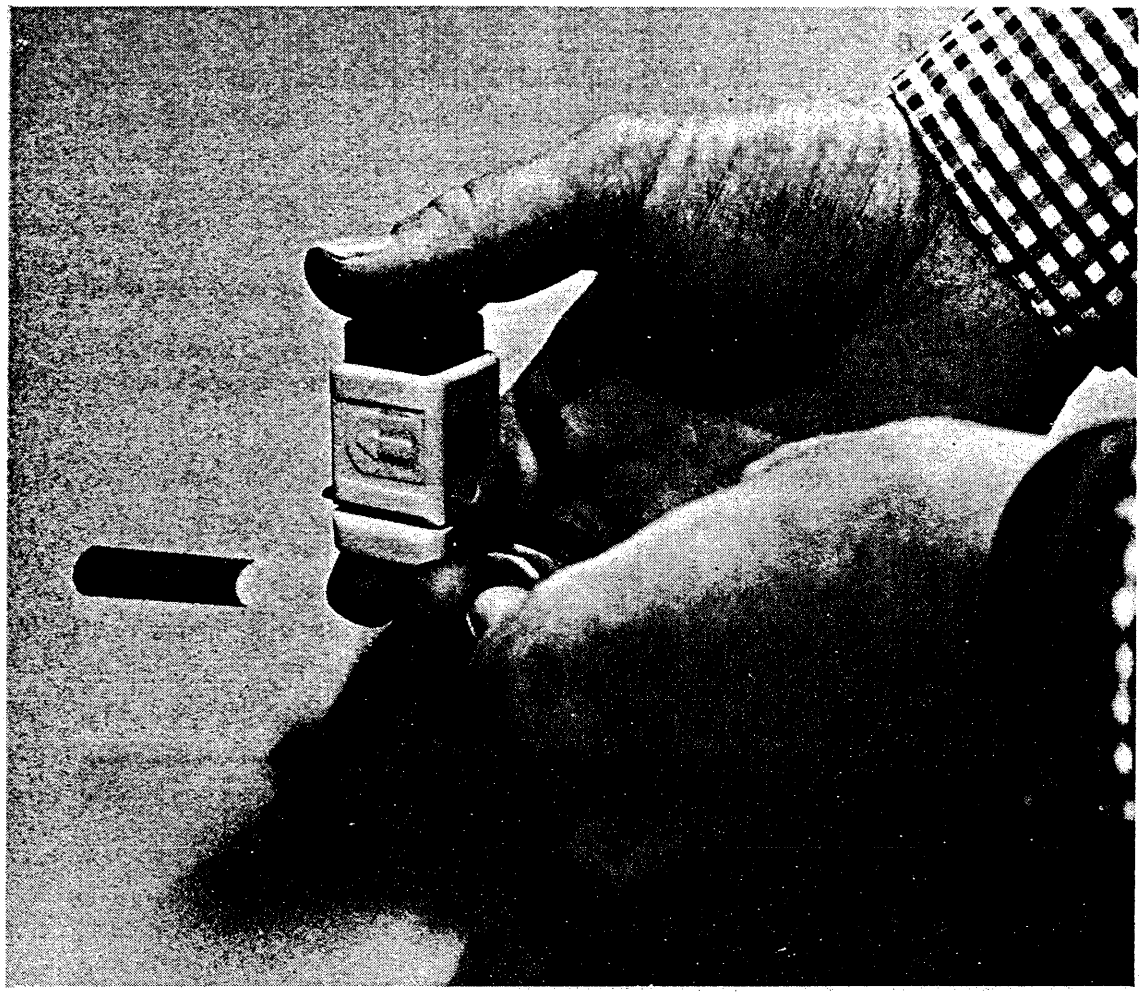

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Figure 1-6. Tape Leader Crimping

AUTO LOAD PROCEDURE

a. Press the RESET button on the control panel.

b. Select AUTO by using the AUTO/MANUAL switch (see figure 1-7).

c. Select the desired density, 800 or 1600, by pressing the appropriate button on the control panel.

d. Press the hub latch, if necessary, so that the word OPEN is visible at the center of the hub.

e Put the reel of tape on the supply hub, pushing the reel on as far as it will go. If the reel is equipped with an automatic cartridge, make sure that when putting the reel on the hub, the two guides on the cartridge are aligned with the guide slots on the tape unit (see figure 1-8).

f. Press the supply hub latch and then release it. This will lock the reel on the hub, and the word OPEN will no longer be seen on the hub.

g. Press the LOAD button. The unit will complete the load operation.

h. Press the ON LINE button. The unit will go online when the load operation is complete, and the READY and ON LINE buttons will be illuminated.

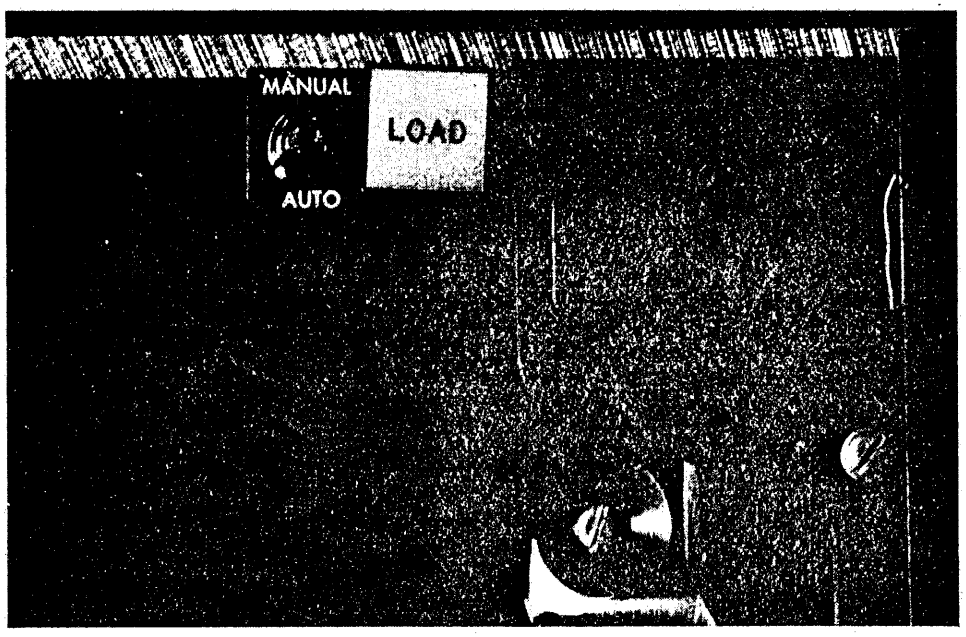

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Figure 1-7. AUTO/MANUAL Switch

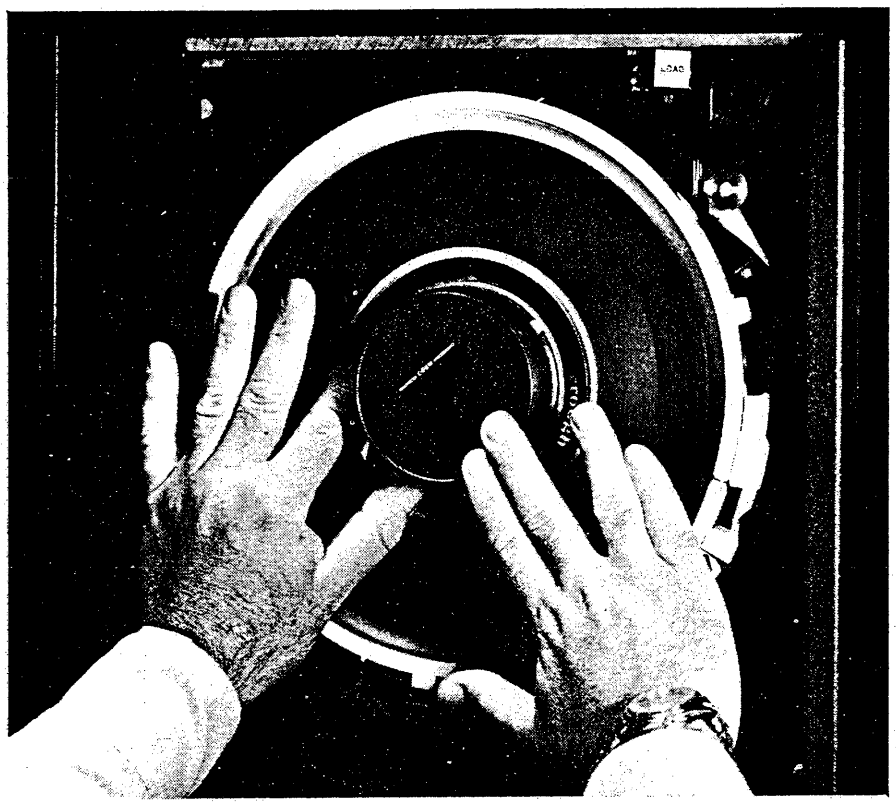

Figure 1-8. Tape Reel Loading

MANUAL LOAD PROCEDURE

The following instructions and figures 1-9 through 1-12 describe the proper method for loading mini-reels (any reel less than 10.5 inches in diameter), and 10.5 inch reels that are not completely full of tape. The figures show a Burroughs male leader, but the procedures apply to any tape crimped with the Burroughs tape crimper or equivalent.

a. Press the ON/RESET button.

b. Select MANUAL by using the AUTO/MANUAL switch.

c. Select the desired density, 800 or 1600, by pressing the appropriate button the control panel.

d. Press the hub latch, if necessary, so that the word OPEN is visible at the center of the hub.

e. Put the reel on the supply hub, pushing the reel on as far as it will go.

f. Press the supply hub latch and then release it. This will lock the reel on the hub, and the word OPEN will no longer be visible on the hub.

g. Grasp the reel with the left hand as shown in figure 1-9. Place the left index finger on outer layer of tape as shown to prevent the tape from unwrapping.

h. Insert the right hand between the leader and the outer reel flange as shown in figure 1-10. Maintain a grip on the tape.

i. Rotate the supply reel counter-clockwise, keeping the right hand positioned as shown in figure 1-11. Stop the rotation when the leader is in position to enter the load chute.

j. Rotate the supply reel clockwise, maintaining the pressure with the left index finger. Rotate the reel until the leader is positioned about 1-1/2 to 2 inches (4 to 5 cm) into the load chute (see figure 1-12).

k. Remove both hands and press the LOAD button.

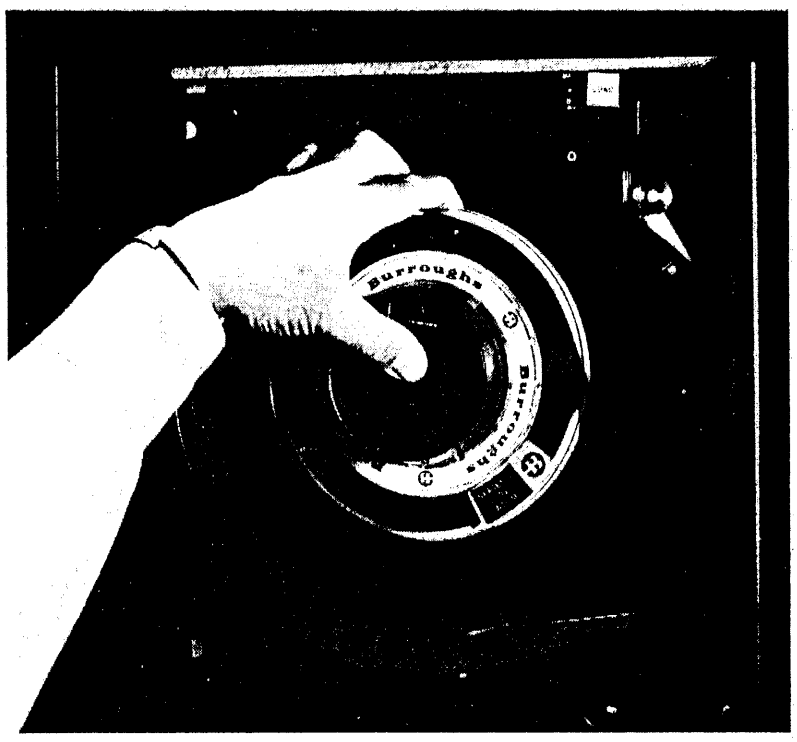

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Figure 1-9. Manual Loading Procedure

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Figure 1-10. Manual Load Leader Guidance

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Figure 1-11. Manual Load Leader Entry

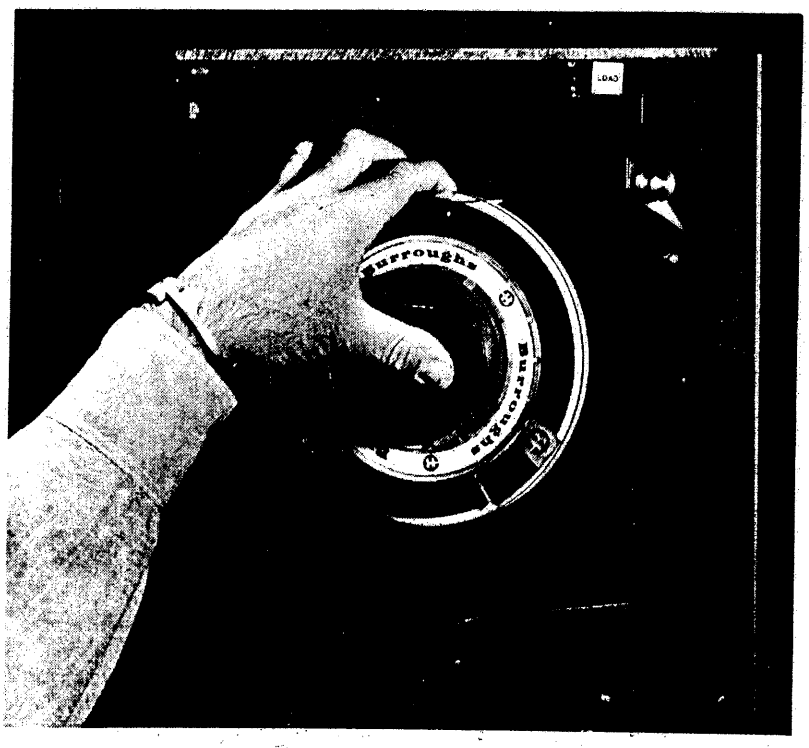


Figure 1-12. Tape Leader in Chute

MID-REEL LOAD

A mid-reel load is necessary when the following occurs:

a. Power is lost with the tape loaded.

b. Tape bottoms out in the vacuum column.

c. Tape pulls out of the vacuum column.

The following procedures apply for a mid-reel load:

a. Press the ON/RESET button.

b. Manually rotate the supply reel counterclockwise one-half turn. This will position the tape loop above the center of the supply column.

c. Press the LOAD button. If the unit does not load, repeat steps a and b. If the unit loads, press ON LINE, REWIND or UNLOAD as desired.

REWINDING A TAPE

Press the REWIND button. If the tape unit is online, the ON/RESET button must be pressed before pressing the REWIND button. The rewind indicator will light and the tape will rewind at high speed until the low-tape sensor is activated by the low amount of tape left on the take-up reel. At the time the low tape sensor is activated, the rewind speed will slow to the normal tape speed of the tape unit and stop at the beginning of tape (BOT) marker.

UNLOADING A TAPE

Press the ON/RESET button and then the UNLOAD button. The unit will begin to unload the tape. If the tape is not positioned at the BOT marker, the tape unit will rewind the tape before the unload operation begins. At the completion of the unload operation the window will open. Press the supply hub latch until it locks in the open position, with the word OPEN visible at the center of the hub. Remove the tape reel, and close the window.

POWER-OFF PROCEDURE

Unload the tape from the tape unit. Press the POWER OFF button, raise window, and latch it closed.

LOAD FAILURES

Load failures and their causes are described in the following paragraphs. The field engineer must be informed of tape units with repeating load failures.

a. The tape fails to go through tape path and onto take-up reel and may retry if 10.5 inch reels or cartridges are used.

   1. Cause. Improper placement of leader, or tape leader damaged.

   2. Correction. Cut off the end with a Burroughs tape crimper or install a new male leader.

b. The unit aborts early in cycle.

   1. Cause. Tape does not cross the EOT/BOT sensor due to poor condition of the leader.

   2. Correction. Cut off the end with a Burroughs tape crimper or install a new male leader.

c. The tape pulls off the take-up reel when dumping tape into the vacuum columns.

   1. Cause. The BOT marker is too close to the leader end of tape. The marker must be 16 feet from the leader end of the tape.

   2. Correction. Cut off and install the marker correctly.

d. The tape fails to dump into the vacuum column, and the load cycle stops.

   1. Cause. BOT marker missing.

   2. Correction. Install a BOT marker strip 16 feet from the leader end of the tape.

e. The unit fails to start the load operation.

   1. Cause. The leader is too far down into the load chute and is covering the EOT/BOT sensor.

   2. Correction. Pull the leader out of the chute.

OPERATOR DUTIES

In addition to performing the proper operating procedures described previously, the operator is required to ensure the proper handling of the magnetic tape reels, and maintain the cleanliness of the tape unit components. The operator schedule for cleaning the tape unit is described below.

Use a lint-free cloth, cotton swabs, and the recommended cleaning solution (Burroughs tape path cleaner) to wipe clean the tape unit components. Maintain a cleaning record to ensure proper cleaning intervals. For component locations see figure 1-4.

a. Capstan. Wipe clean every 8 hours of operation.

b. Read/Write Head. Wipe clean every 8 hours of operation.

c. Tape Guides. Wipe clean every 8 hours of operation.

d. Supply Hub. Wipe clean every 8 hours of operation; also clean the rubber tire which is part of the supply hub.

e. Vacuum Columns. Wipe clean every 40 hours of operation.

f. Tape Path. Wipe clean every 40 hours of operation.

OPERATOR CONTROLS AND INDICATORS

Operator controls and indicators are located in the upper right-hand corner of the tape unit and on the tape deck behind the front door (see figures 1-7 and 1-13). The functions of the controls and indicators on the tape unit are described below.

a. UNIT IDENTIFICATION Indicator. This is a label displaying the unit designation symbol (number 1 through 16 inclusive). This indicator is illuminated when the unit is ready or flashes to indicate a load failure.

b. DENSITY Switch/Indicator. Two pushbutton switches are used to select the density at which the unit is to operate. The available densities are 800 bits per inch NRZ, and 1600 bits per inch PE.

c. MANUAL/AUTO Switch. The AUTO position is selected when using 10.5 inch full reels. This position will cause the supply reel to automatically move in the reverse direction to put the tape leader in the proper position before the automatic thread cycle.

   The MANUAL position is selected when using incomplete 10.5 inch reels or smaller reels. The operator must manually put the tape leader into the tape path before the LOAD button is pressed.

d. WRITE RING Indicator. This indicator will be illuminated when a write-ring is installed on the tape reel which has been loaded on the tape unit.

e. REWIND Switch/Indicator. This switch activates the high speed rewind function. The indicator is illuminated when the tape unit is rewinding. The REWIND switch is disabled when the tape unit is online.

f. UNLOAD Switch/Indicator. This switch activates the tape unload cycle. If the UNLOAD switch is pressed and the tape is not at BOT, the tape unit will rewind to BOT and then unload. During the rewind time, the REWIND indicator will be illuminated. The UNLOAD indicator is illuminated when the unit is waiting to unload (rewind), or is actually in the unload cycle. The UNLOAD switch is disabled when the tape unit is online. At the end of the unload cycle the window will open for operator access.

g. ON LINE Switch/Indicator. The ON LINE switch puts the unit in an online condition if the unit achieves a ready condition. The indicator is illuminated to indicate that the tape unit is capable of system (remote) operation. When the indicator is off (local), the tape unit cannot be used by the system. In the local mode,

maintenance operation can be done without affecting the system operation. The ON LINE switch allows remote operation and disables the REWIND and UNLOAD switches.

h. LOAD Switch. If a tape reel has been put on the supply hub and the LOAD switch is pressed, the tape will be automatically loaded onto the take-up reel, and the tape unit will illuminate the READY indicator.

i. ON/RESET Switch/Indicator. The ON/RESET switch, when pressed with ac power off, will power-on the tape unit and its internal dc power supplies. If the tape unit power is on and the ON/RESET switch is pressed, the following will take place:

1. All of the tape unit logic will be cleared to a beginning state.

2. The tape unit will go to the offline mode.

3. If a rewind is in process, the tape speed will slow to the normal unit speed and complete the rewind operation. A second pressing of the switch will cause the tape movement to stop.

4. If the unit is rewinding due to the pressing of the UNLOAD button, the tape speed will slow down to the normal reverse speed and will stop at BOT and not complete the unload cycle.

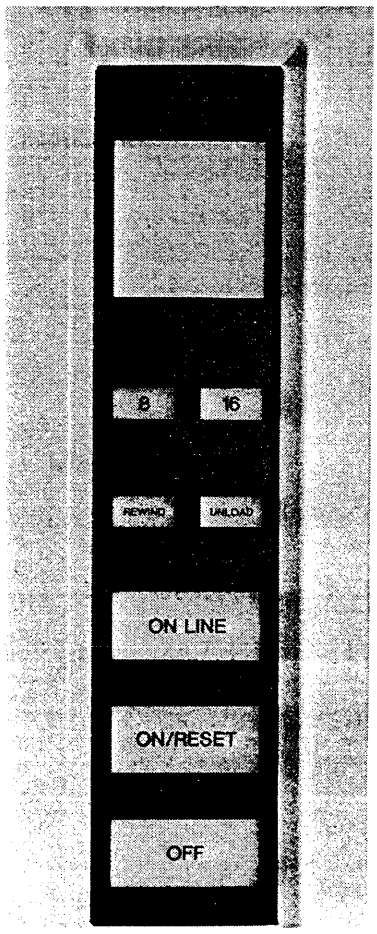


Figure 1-13. Operator Controls and Indicators

SECTION 2
INSTALLATION

INTRODUCTION

This section contains information necessary to install the B 9495 (5E) Magnetic Tape Subsystem.

INSTALLATION REQUIREMENTS

The following paragraphs describe the environment and power input requirements that are necessary for the proper installation and operation of the subsystems.

ENVIRONMENT

The recommended operation conditions for magnetic tape are class-C, which are as follows:

a. Temperature: 65 to 80 degrees F (18 to 27 degrees C). Changes in temperature while operating should be minimized. Changes of no more than 20 percent should occur over a four hour period.

b. Relative Humidity: 40 to 60 percent. Wet bulb must be less than 80 degrees. Relative humidity and temperature are dependent upon each other. Twenty-four hours of stabilization time must be allowed before operating any part of the subsystem which has been moved from a non-operating to the operating environment. Humidity changes between 40 percent and 60 percent must not take place in less than four hours. Raw water humidifiers are prohibited.

c. Storage: 65 to 80 degrees F (18 to 27 degrees C). If the magnetic tape is stored in an environment that is not in the recommended range, it must be permitted to stabilize for 24 hours in the recommended environment before it is used. Exposure to an environment that is not in the recommended range must be followed by a stabilization period equal to or greater than the time of exposure.

d. Atmospheric Pollutants. All air conditioning must filter out pollutants so that air meets the National Bureau of Standards Blackness test with a minimum rating of 50 percent efficiency.

e. Cleanliness. The following requirements for cleanliness are mandatory for reliable subsystem operation:

   1. There must be a minimum amount of dust and flaking from ceilings and walls.

   2. The floor should be rubber, or vinyl tile. Asphalt tile should be avoided.

   3. Damp mopping or specially filtered vacuum cleaners must be used to clean the computer room. No broom sweeping is allowed.

   4. No smoking is permitted.

   5. For dust limitations see "Atmospheric Pollutants" in this section.

POWER REQUIREMENTS

The B 9495 (5E) subsystem power requirements are given in table 2-1, along with related information. The input power specifications are class B.

Table 2-1. Power Requirements

Voltage System-Domestic (single-phase, 3 wire)	208 Vac ± 10% at 60 Hz 230 Vac ± 10% at 60 Hz			
Voltage System-Int'l (single-phase, 3 wire)	220 Vac ± 10% at 50 Hz 230 Vac ± 10% at 50 Hz 240 Vac + 5 − 10% at 50 Hz			
Power — MEC:				
Amps	10 (5A surge)			
Watts	1000			
Power Factor	0.80			
KVA (L1 and L2)	1.11			
BTU (per hour)	2700			
Power — Tape Unit (per unit):	**High Duty**	**Low Duty**	**Idle**	**Surge**
Amps	13.9	7.1	6.9	16.0
Watts	2600	1350	1300	—
Power Factor	0.9	0.9	0.9	—
KVA (L1 and L2)	2.9	1.5	1.4	—
BTU (per hour)	9000	4600	4400	—
Circuit Breaker:				
MEC	10 A			
Tape Unit	15 A			
Frequency Variation	+1, −2%			
Line Noise	3 times the line supply voltage for 5 ms.			
Power Connector:				
MEC	Hubbel 5664 (15A)			
Tape Unit	Hubbel 2711 (20A)			

INSTALLATION PROCEDURES

The following procedures for installing both the MEC and tape units must be followed in the order given.

a. Move the MEC and tape units into position. Refer to MEC AND TAPE UNIT PLACEMENT in this section.

b. Measure the input voltage at the plug of the power source for the MEC and tape units. These measurements must be used to correctly set up the tape units in step c. Verify correct voltage and ground wiring of the plug.

c. Make the necessary voltage and frequency modifications to the MEC and tape units. Refer to the MEC FREQUENCY AND VOLTAGE MODIFICATIONS and the TAPE UNIT FREQUENCY AND VOLTAGE CONVERSION in this section.

d. Connect the subsystem power cables as described in CABLE REQUIREMENTS AND INSTALLATION in this section. Do not connect the signal cable at this time.

e. Power on the MEC and tape units, and verify a normal power on.

f. Load tapes on all of the tape units, and operate the tapes using the local maintenance drive card and the control panel. Verify all functions: LOAD, UNLOAD, BOT/EOT, DETECTION, REWIND, READ, and WRITE.

g. Power off the MEC and all tape units, and connect the signal cables and ready status cables as described in CABLE REQUIREMENTS AND INSTALLATION in this section.

h. Power on the MEC and all tape units.

i. Refer to MEC MAINTENANCE PANEL in section 4, and operate the tape units from the maintenance panel to check the local subsystem operation.

j. Rewind all of the tape units, put the maintenance panel in the remote state, and put all of the tape units in the online state.

k. Perform an online sytem test under MCP control using online confidence routines or user programs.

MEC AND TAPE UNIT PLACEMENT

The MEC must be located no more than 40 feet (12.2 meters) from the I/O control cabinet. The longest distance allowed from the MEC to a tape unit is 40 feet. All distances are measured from the cable opening in the floor under the MEC to the cable opening in the floor under the I/O control cabinet or tape unit.

Figure 2-1 shows the floor dimensions of the MEC and tape unit. A minimum clearance of 36 inches must be allowed the front and rear of the MEC and tape units for operation and maintenance.

MEC FREQUENCY AND VOLTAGE MODIFICATION

The MEC will operate from input voltages of 208 to 240 Vac, at 50 or 60 hertz. The input transformer must be wired to match the input voltage. Measure the input voltage at the MEC power source and connect the input wires from PDK1-6 to T1E1, as shown in figure 2-2.

TAPE UNIT FREQUENCY AND VOLTAGE CONVERSIONS

The tape unit will operate from input voltages of 208 to 240 Vac, at frequencies of 50 or 60 hertz. The modifications required for the tape unit to match the input frequency and voltage are described in the following paragraphs.

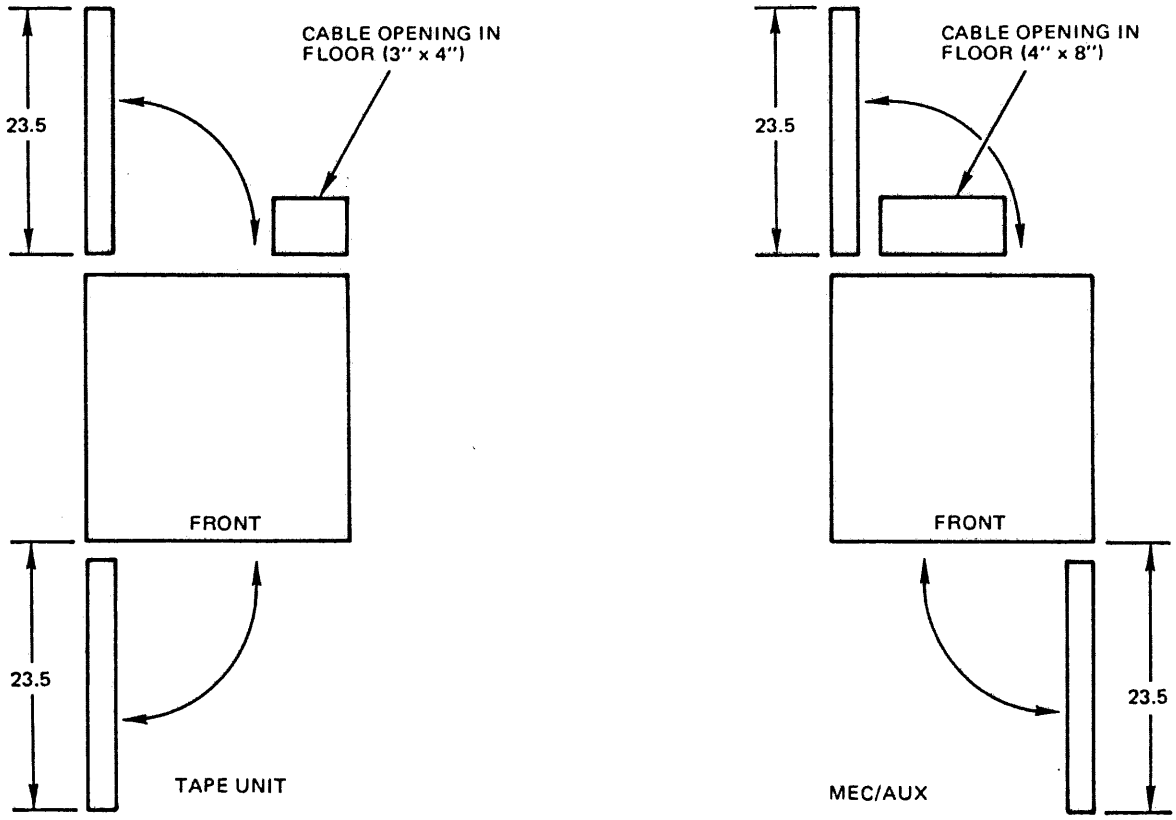
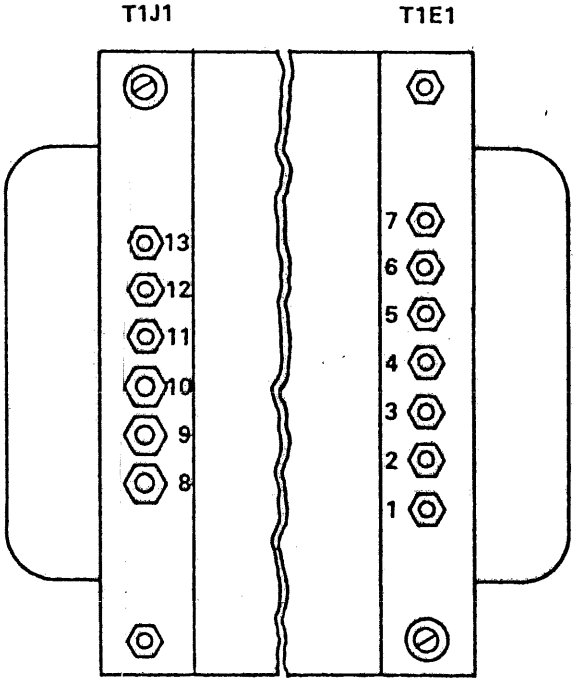


Figure 2-1. MEC and Tape Unit Floor Dimensions



INPUT VOLTS	CONNECT THE WIRE	
	FROM	TO
208	*PDK1-6	T1E1-3
220	*PDK1-6	T1E1-4
230	*PDK1-6	T1E1-5
240	*PDK1-6	T1E1-6

*PDK1-6 IS TERMINAL 6 OF THE POWER RELAY IN THE POWER SUPPLY.

Figure 2-2. MEC Input Voltage Modifications

FREQUENCY CONVERSION

The blower motor in the tape unit is frequency sensitive and must be modified when converting between 50 and 60 hertz input power.

The drive pulley on the blower motor has two diameters, and can be reversed on the motor shaft (see figure 2-3). For 60 cycle operation, position the driving pulley on the motor so that the smaller diameter is nearest to the face of the air system chassis. For 50 cycle operation, position the driving pulley on the motor so that the larger diameter is nearest to the face of the air system chassis.

If the pulley has been moved on the shaft, the BLOWER BELT TENSION AND TRACKING must be adjusted (see section 8).

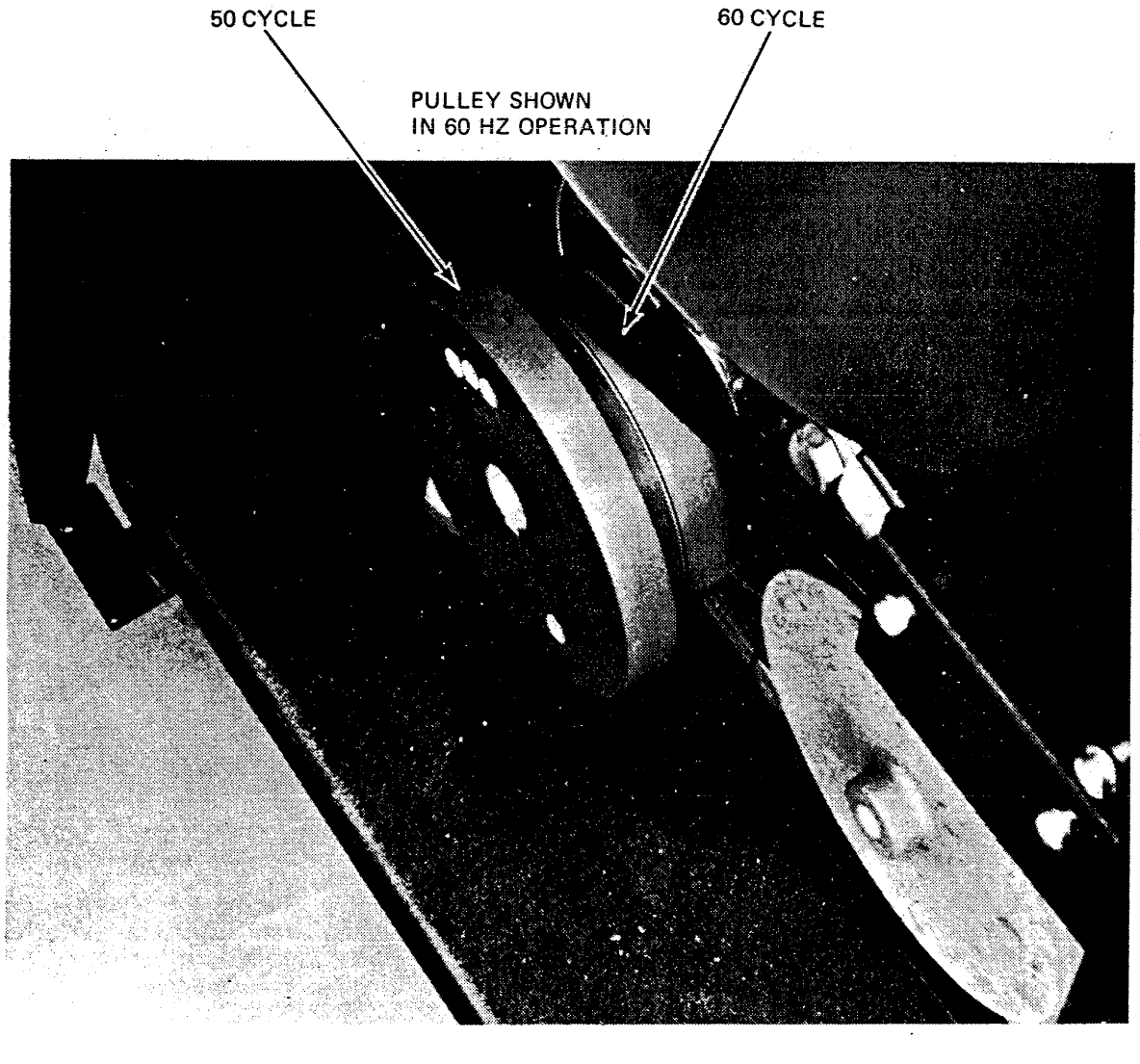


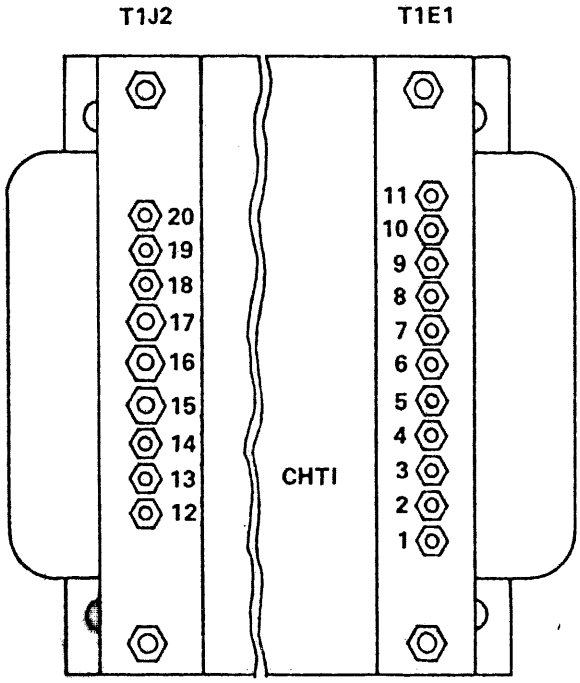
Figure 2-3. Blower Motor Pulley Positioning

ALTITUDE CONVERSION

When the unit is installed above 5000 feet (1524 meters) altitude, the belt is moved to the smaller step of the blower pulley (away from the air system chassis). Reposition the motor pulley as required for proper tracking.

INPUT VOLTAGE CONVERSION

For the tape unit to operate correctly, the input transformer must be wired to match the input voltage. Figure 2-4 shows the input transformer and the tap numbering. Measure the input voltage at the source for the tape unit, and connect the input wires from PDK1-6 and T1L1-5 to the correct tapes on the transformer.



INPUT VOLTS	CONNECT THE WIRE	
	FROM	TO
208	PDK1-6	T1E1-4
	T1J1-5	T1E1-4
220	PDK1-6	T1E1-5
	T1J1-5	T1E1-5
230/240	PDK1-6	T1E1-6
	T1J1-5	T1E1-6

Figure 2-4. Tape Unit Voltage Conversion

CABLE REQUIREMENTS AND INSTALLATION

The cables necessary to install the B 9495 (5E) tape subsystems are listed in table 2-2 and illustrated in figure 1-3. The length of the cables chosen depends on the distances between the I/O control and MEC, and between the MEC and tape units. Cables must be ordered on form 1903812.

Table 2-2. B 9495 (5E) Tape Subsystem Cable Requirements

*Key	Part Number	Length	Recording Mode	From	To	Required
Power Cables						
	2048 3095	15'	NRZ or PE	MTU	Panel	Provided with unit
	2047 8236	15'	NRZ or PE	MEC	Panel	Provided with MEC
Signal Cables						
1	1145 7645	25'	NRZ or PE	I/O	MEC	1 per PE control
1	1147 8369	35'	NRZ or PE	I/O	MEC	or
1	1147 8377	50'	NRZ or PE	I/O	MEC	2 per NRZ control
3	2028 0707	15'	NRZ or PE	MEC	MTU	
3	2028 0715	25'	NRZ or PE	MEC	MTU	1 per tape unit (MTU)
3	2028 0723	50'	NRZ or PE	MEC	MTU	
Ready Status Cables**						
5	2048 2576	75'	NRZ or PE	MEC	MPX	1 per control
5	2048 2594	100'	NRZ or PE	MEC	MPX	

*Key numbers see figure 1-3.

**Part numbers provided for ready status cables are for the B 6700. Part numbers for the ready status cables for the B 7700 should be obtained from the corresponding mainframe documentation. System configurations require one ready status cable per control (PE or NRZ) unless multiple controls access the same unit numbers. Systems with "splitting" capabilities require a ready status cable for all controls even when more than one control accesses the same unit number.

The following is the procedure for attaching the signal cable assembly in the tape unit and the MEC. Figure 2-5 illustrates the signal cable assembly.

a. Plug the connect board of one end of the signal cable into the tape unit logic backplane location at LBBC2 (both ends of the cable have identically wired connect boards).

b. Attach the signal cable ground lug to the logic gate as indicated in figure 10-1, using the existing mounting screw.

CAUTION

The signal cable must clear the air system motor and the pulleys and have sufficient slack to be able to service the logic backplane without strain to the cable.

c. Feed the signal cable through the cutout provided in the power input panel and fasten the cable with the strain relief bracket (P/N 1103 7462) furnished with the unit.

d. Connect the other end of the signal cable to the MEC exchange backplane, odd numbered units at EBHB4 and even numbered units at EBHB1, (see figure 2-6).

e. Connect the ground lug of the signal cable to the exchange backplane chassis using the nearest existing mounting screw.

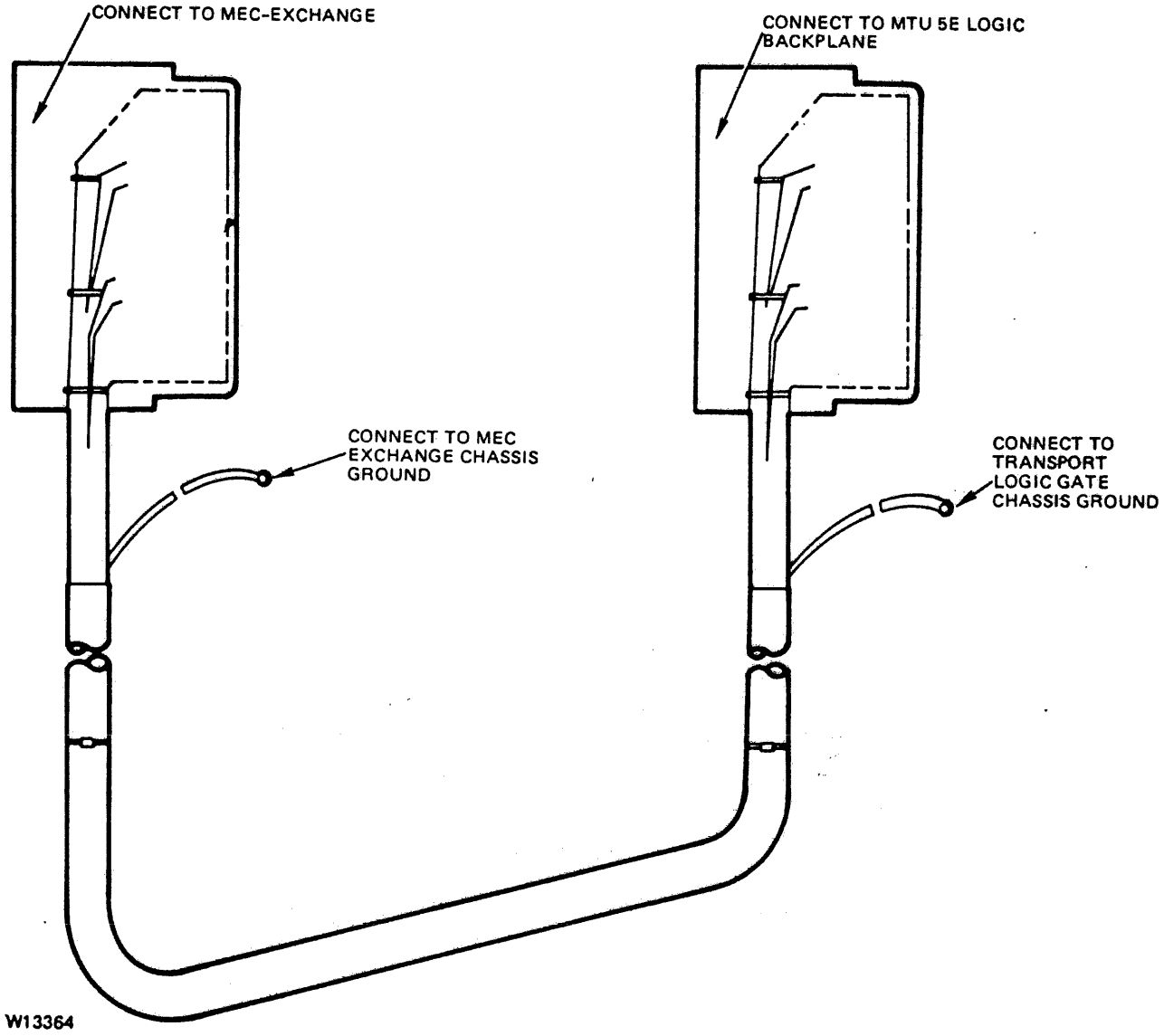
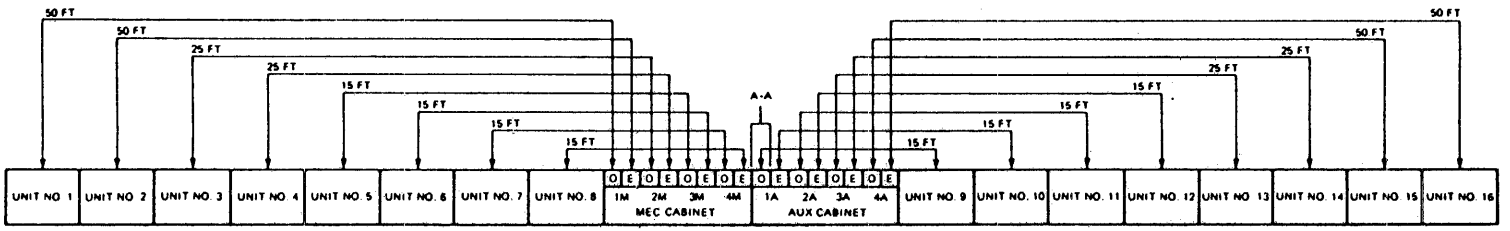


Figure 2-5. MEC to MTU Signal Cable Assembly



TYPICAL CONFIGURATION - NOT LIMITED TO NOR TO BE CONSTRUED AS ONLY METHOD OF CABLING THE SUBSYSTEM

SLAVE UNIT DESIGNATIONS COME FROM ODD OR EVEN CONNECTION AND EXCHANGE CONNECTION INTO MOTHER BOARD

a) MEC CABINETS MUST BE CONNECTED WITH THE MEC ON THE LEFT AND AUX. ON THE RIGHT.

b) EXCHANGE DESIGNATIONS WILL BE:
EXC (M) FOR MEC CABINET
EXC (A) FOR AUX CABINET

UNIT NUMBER	CABINET	EXCHANGE	POST	CARD CONNECTOR
1	MEC	1M	ODD	EBHB4
2	MEC	1M	EVEN	EBHB1
3	MEC	2M	ODD	EBHB4
4	MEC	2M	EVEN	EBHB1
5	MEC	3M	ODD	EBHB4
6	MEC	3M	EVEN	EBHB1
7	MEC	4M	ODD	EBHB4
8	MEC	4M	EVEN	EBHB1
9	AUX	1A	ODD	EBHB4
10	AUX	1A	EVEN	EBHB1
11	AUX	2A	ODD	EBHB4
12	AUX	2A	EVEN	EBHB1
13	AUX	3A	ODD	EBHB4
14	AUX	3A	EVEN	EBHB1
15	AUX	4A	ODD	EBHB4
16	AUX	4A	EVEN	EBHB1

NOTE: 1. DESIGNATE AND BUS CABLES ARE PART OF 1X, 2X, 3X OR 4X CABLE KIT.

2. THE CONTROLS ARE IDENTICAL AND LOCATION IN THE MEC DETERMINE WHICH CABLE KIT IS REQUIRED (SEE ILLUSTRATION). CONTROLS ARE DESIGNATED AS "A" OR "B", "C" OR "D". CABLE KIT WILL CONTAIN THE APPROPRIATE BUS AND DESIGNATE CABLE AND TERMINATOR CARDS.

PE CONTROL MODULE 25/50	P/N 2028 9849
PE CONTROL MODULE 75/125	P/N 2042 2408
1X CABLE KIT - I/O CONTROL "A"	P/N 2041 7580
2X CABLE KIT - I/O CONTROL "B"	P/N 2040 2586
3X CABLE KIT - I/O CONTROL "C"	P/N 2040 2574
4X CABLE KIT - I/O CONTROL "D"	P/N 2040 2582
MOTHER MODULE 1 THRU 8	P/N 2014 9589
DISTRIBUTION EXPANSION KIT	P/N 2040 2590
EXCHANGE EXPANSION KIT	P/N 2041 9701

RULE OF THUMB - ALLOW 3-1/2 FT. OF CABLE FOR EACH UNIT AWAY FROM THE MEC CABINET.

EX.: FOURTH UNIT AWAY FROM MEC (M) 4 x 3.5 FT. = 14.0 FT. USE 15 FT. CABLE - SIXTH UNIT AWAY FROM MEC (A) 6 x 3.5 = 21.0 FT. USE 25 FT. CABLE. THE ABOVE HOLDS TRUE FOR 3# POWER DISTRIBUTION SYSTEM CABLES.

NOTE: J2/J3 ON M8 ARE WIRED PARALLEL SO THAT BUS CABLE CAN GO INTO EITHER LOCATION.

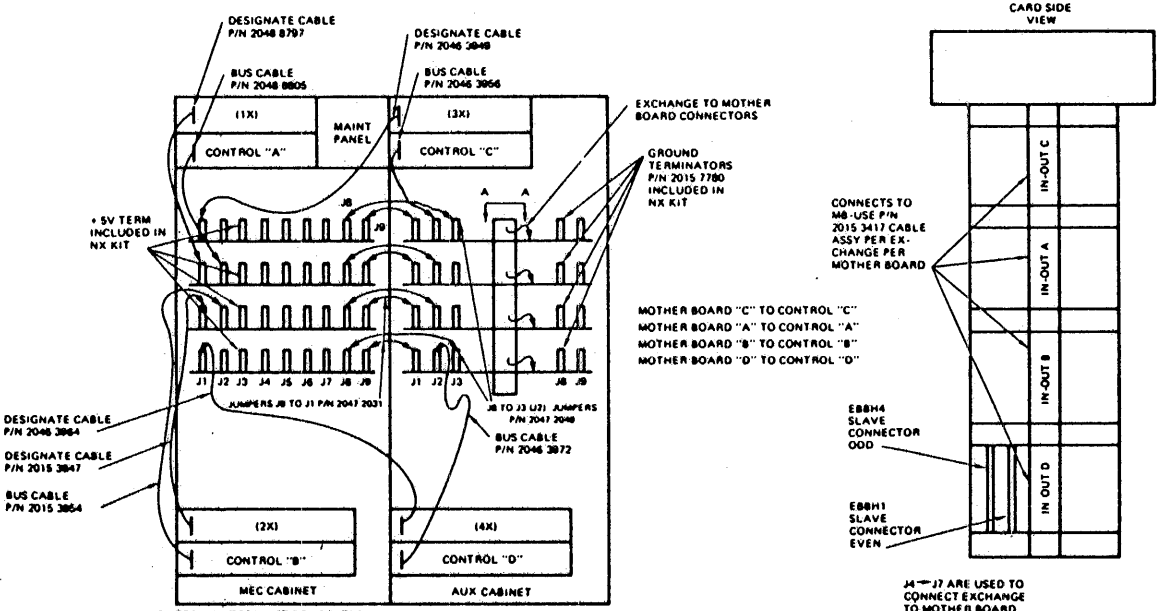
CONTROL DESIGNATE CABLES MUST GO INTO J1 LOCATION ON MAIN MEC MOTHER BOARD.

QTY	LENGTH	USE	FROM	TO	P/N
1/UNIT*	15 FT.	POWER	SLAVE	WALL OUT	2041 3217
1/UNIT	15 FT.	SIGNAL	SLAVE	MEC XCH	2028 0707
1/UNIT	25 FT.	SIGNAL	SLAVE	MEC XCH	2028 0715
1/UNIT	50 FT.	SIGNAL	SLAVE	MEC XCH	2028 0723
1/UNIT	25 FT.	SIGNAL	MEC CNTL	PCC I/O	1146 7846
1/UNIT	35 FT.	SIGNAL	MEC CNTL	PCC I/O	1147 8389
1/UNIT	50 FT.	SIGNAL	MEC CNTL	PCC I/O	1147 8377

*ONLY ONE OF THESE PER SLAVE UNIT.

MEC(S) MAY BE PLACED ANYWHERE IN THE STRING OR AWAY FROM THE STRING. THE ONLY REQUIREMENT BEING 50 FT. MAXIMUM ON SIGNAL CABLE LENGTH. THE MEC AND AUX. MEC MUST BE ADJACENT. WHEN EXPANDING TO MORE THAN 8 UNITS OR BEYOND THE 2X CONFIGURATION, THE AUX CABINET MUST BE INSTALLED. THE AUX. CABINET WILL REQUIRE THE DISTRIBUTION EXPANSION KIT FOR EACH MOTHER BOARD INSTALLED IN THE MEC CABINET.

UNITS MAY BE CONFIGURED AS FOLLOWS: ALL EVEN UNITS ON LEFT, AND ALL ODD UNITS ON RIGHT, OR VICE VERSA. ONLY RESTRICTION IS 50 FT. MAXIMUM CABLE LENGTH FROM SLAVE TO EXCHANGE, AND 50 FT. CABLE LENGTH FROM CONTROL MODULE TO I/O.



+5V TERMINATOR MUST BE LOCATED IN J3.
GROUND TERMINATOR MUST BE LOCATED IN J8 OF THE ENDING MOTHER BOARD.
THIS WILL REQUIRE MOVING THE TERMINATOR TO THE EXTENSION MODULE LOCATED IN THE AUX. MEC SHOULD THE EXTENSION BE REQUIRED. ALSO ADD GND, PILL AND +5 HOOKUP TO AUX. IN 3X AND 4X ADDITION.

J4 — J7 ARE USED TO CONNECT EXCHANGE TO MOTHER BOARD

J8 TO J1 CABLES ARE IN THE DISTRIBUTION
J8 TO J2 EXPANSION KIT P/N 2047 2031 (DCS)
P/N 2047 2048 (BUS)

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Figure 2-6. Subsystem Cable Configuration

TAPE SUBSYSTEM CHECK

With the signal cable installed, the following tape unit checks can be performed using the maintenance panel of the MEC.

a. Load a scratch reel of tape on the unit.

b. Designate the unit from the MEC maintenance panel.

NOTE

The unit must be offline and the MEC in local.

c. Perform various operations from the MEC maintenance panel program selectors varying the patterns and record sizes.

d. Set the HALT ON ERROR switch. There must be no read errors.

e. Check the CERTIFY option for proper operation on that unit.

f. Move the maintenance panel cable to another MEC, if available, and repeat step c. through e.

SYSTEM TEST

The system test for a unit must use the MEC, consequently the system test for two units and two controls can be tested in approximately the same number of hours. The system test time will double with each two additional units. With the addition of a MEC auxiliary cabinet, the system test of both MEC's and four units can be tested in the same time period. The test time will double with each additional four units.

The system test is considered to be under operating system (MCP), using online confidence routines (MTPDNO, SCR, B 1700 MAGTAPE TEST) or user programs (SORT, SYCOPY, DUMPALL).

STANDARD INSTALLATION TIME

Unit unpack and unit test .....8 hours

System test .....4 hours

---

12 hours/unit

INSTALLATION REPORTING

Fill out form no. WES 2500, "ARRIVAL QUALITY REPORT" and form no. 900057 for CARES or EARLY UNIT REPORTING, as applicable.

SECTION 3
DOCUMENTATION AND COMPONENTS

INTRODUCTION

This section contains information related to the component location, and documentation on the B 9495 (5E) Magnetic Tape Subsystem. Refer to section 1 for a list of additional books and documents that are related to this subsystem.

B 9459 (5E) TEST AND FIELD DOCUMENTATION

Test and Field Documentation is shipped with each MEC and tape unit. The MEC documentation consists of one book which is included in the container with the MEC cables. The tape unit documentation consists of one book which is included in the container with the tape unit cables. All of the cable containers are marked with the accompanying unit serial number to ensure that the documents they contain are at the same level of revision as the unit.

The content of the tape unit Test and Field Documentation is as follows:

Section One:

- Index
- Glossary of Terms
- Card Schematics
- Circuit Lists
- Connector Schematics
- General Schematics
- Card Locator Chart
- Rack and Panel Chart
- Component Location Instructions
- Card Assembly Drawings

Section Two:

- Logic Flow Schematics
- Load Timing Flows
- Unload Timing Flows
- Load Decision Flow Chart

The content of the MEC test and field documentation is as follows:

General:

- MEC Flow Chart
- Glossary of Terms
- Logical Diagrams of Chips Used

MEC PE Control:

- Card Locator
- Change History
- Term and Card Cross Reference
- Card Schematics
- Circuit Lists, Card and Voltage

MEC Exchange

- Card Locator
- Change History
- Term and Card Cross Reference
- Card Schematics
- Circuit Lists, Card and Voltage

MEC Maintenance Panel:

- Card Locator
- Card History
- Term and Card Cross Reference
- Maintenance Panel Schematics
- Maintenance Panel Circuit Lists
- Card Schematics
- Circuit Lists, Card and Voltage

MEC NRZ Control:

- Card Locator
- Change History
- Term and Card Cross Reference
- Card Schematics
- Circuit Lists, Card and Voltage

Power Supply:

- Schematic
- Assembly Drawing

CARD COMPONENT LOCATIONS

Figures 3-1 and 3-2 show the method of matching the component locations with the coordinates, given on the schematics in the test and field documentation, next to each component. Note that there are two methods used to identify the chip location on the logic card. Both of these methods are used in the test and field doumentation. Each method is described separately in the following paragraphs.

BURROUGHS SPECIAL CARDS

The Burroughs special card component locations are shown in figure 3-1. Looking at the component side of the card as shown, the discrete component locations are read horizontally from right to left. The first component of a particular type will be designated number 1 of that type. Continuing from left to right, the next component of that same type will be number 2. For example, capacitor C1 appears in the upper right-hand corner; continuing to the left, the capacitor C2 is found in the left-hand corner.

BURROUGHS STANDARD CARDS

The Burroughs standard card component locations are shown in figure 3-2. Looking at the component side of the card as shown, the vertically mounted components are designated in the same manner as the special card format. The horizontally mounted components are located using the column and row coordinates shown in figure 3-2. Note that the chip locations use a different set of coordinates than the discrete componets.

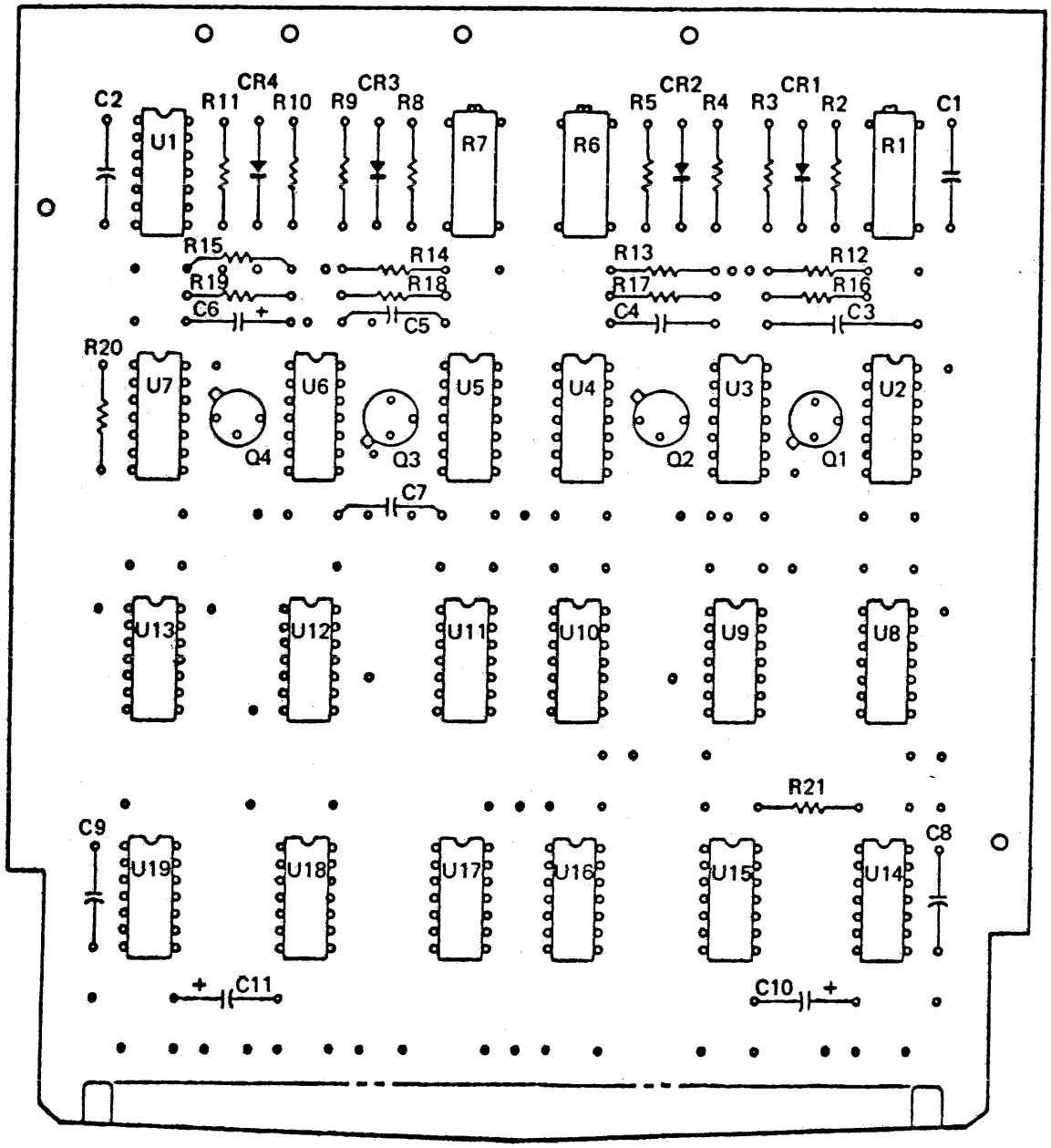

Figure 3-1. Special Card Component Locations

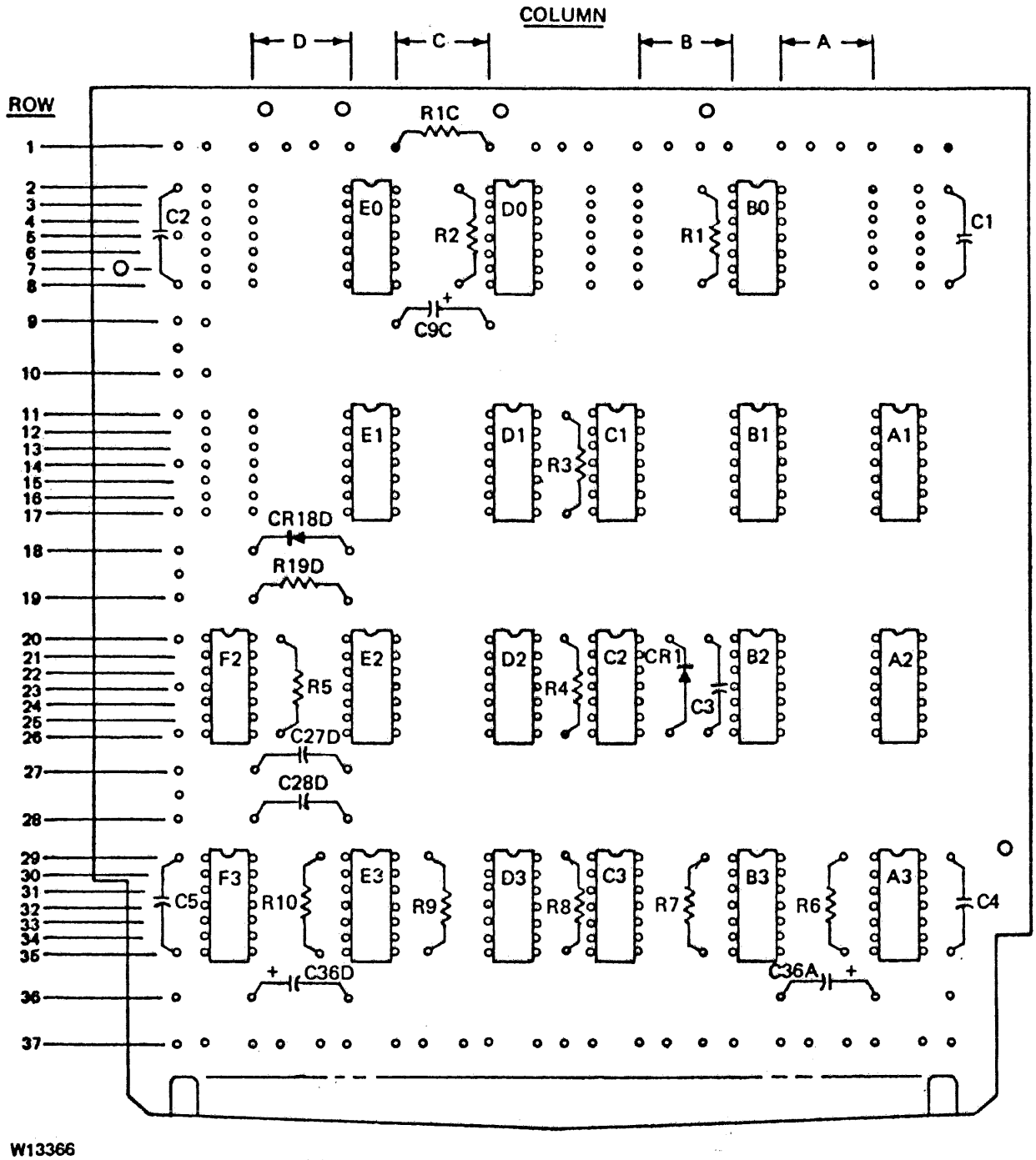

Figure 3-2. Standard Card Component Locations

CARD LOADING

Figures 3-3 through 3-8 show the card loading for the MEC and tape unit. The maintenance indicators are not shown for the MEC control in figure 3-3, but are shown in figure 4-10.

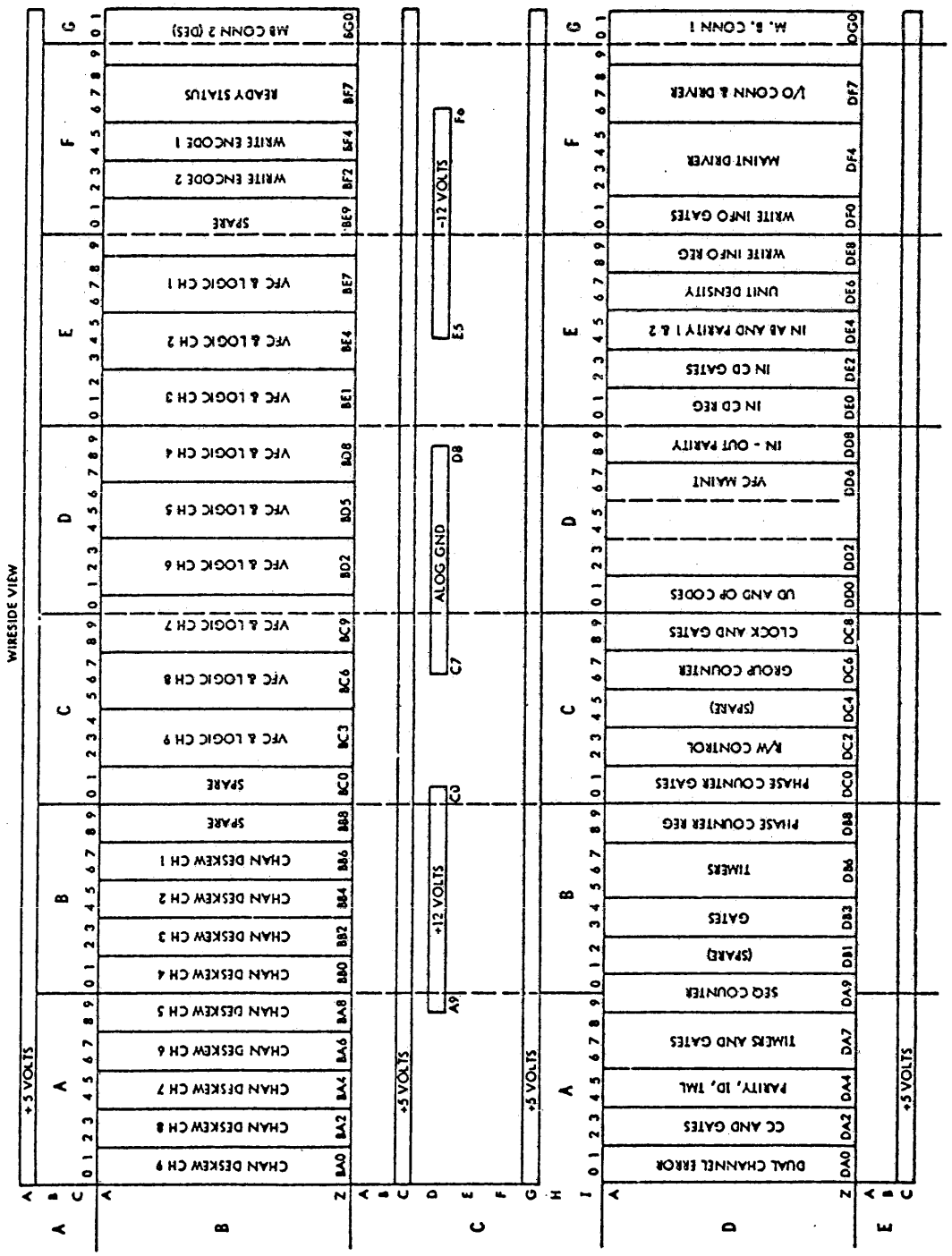

Figure 3-3. MEC PE Control Card Loading (Wire Side)

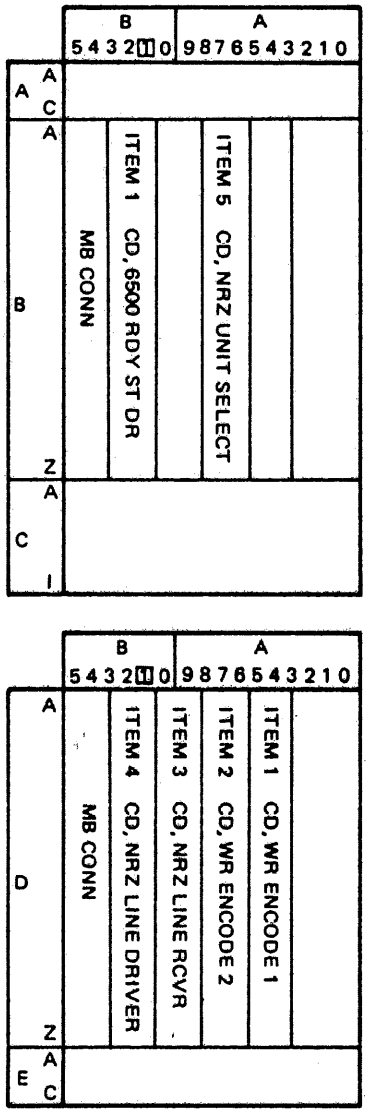

Figure 3-4. MEC NRZ Control Card Loading (Card Side)

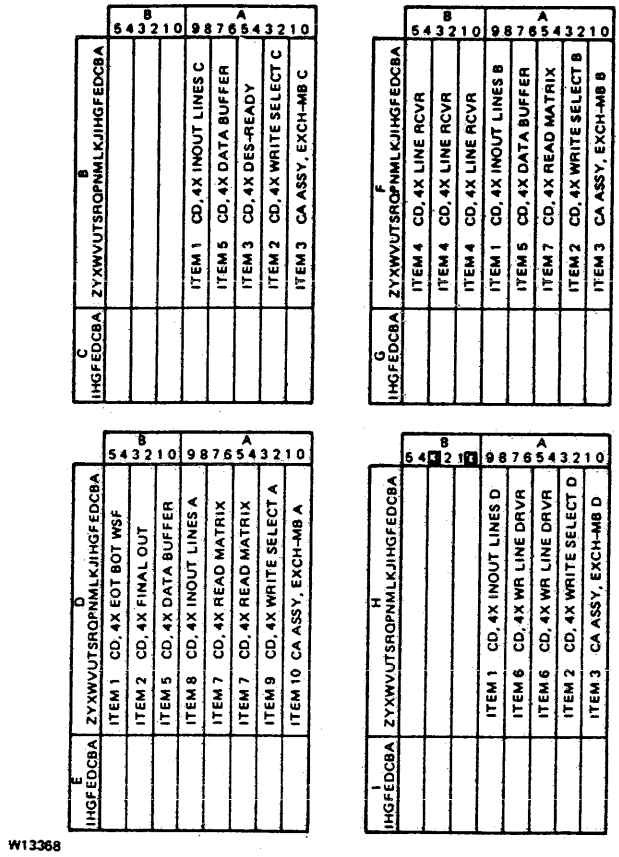

Figure 3-5. Card Locator Exchange

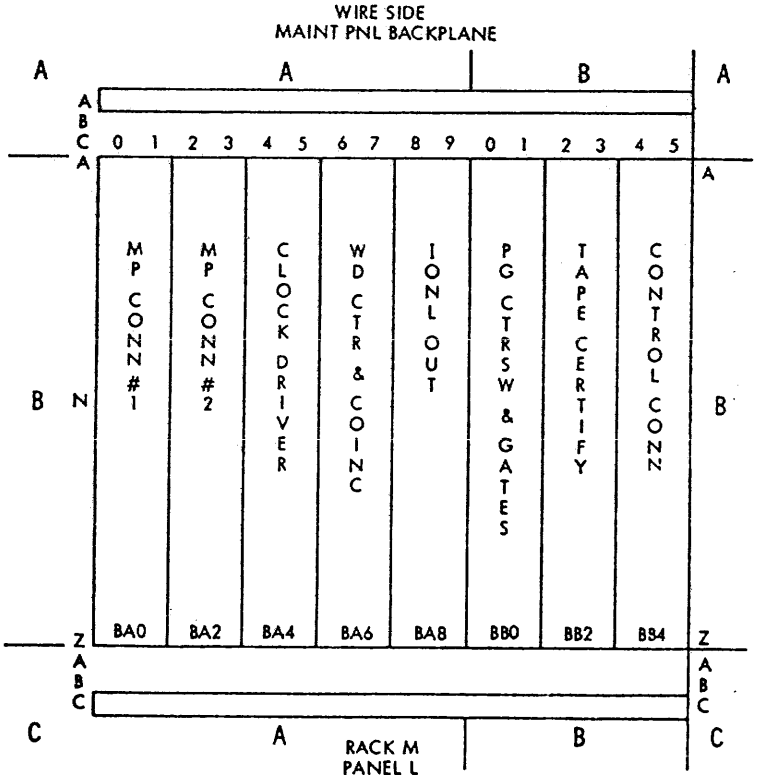

Figure 3-6. Card Loading Maintenance Logic

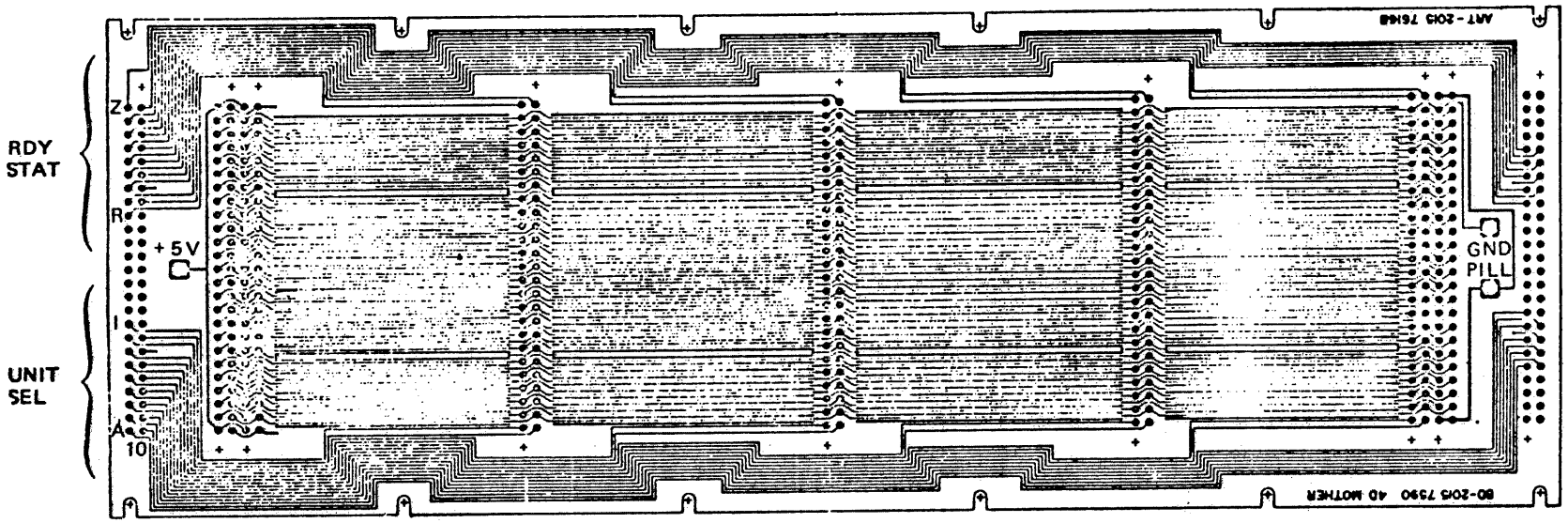

Figure 3-7. Mother Board

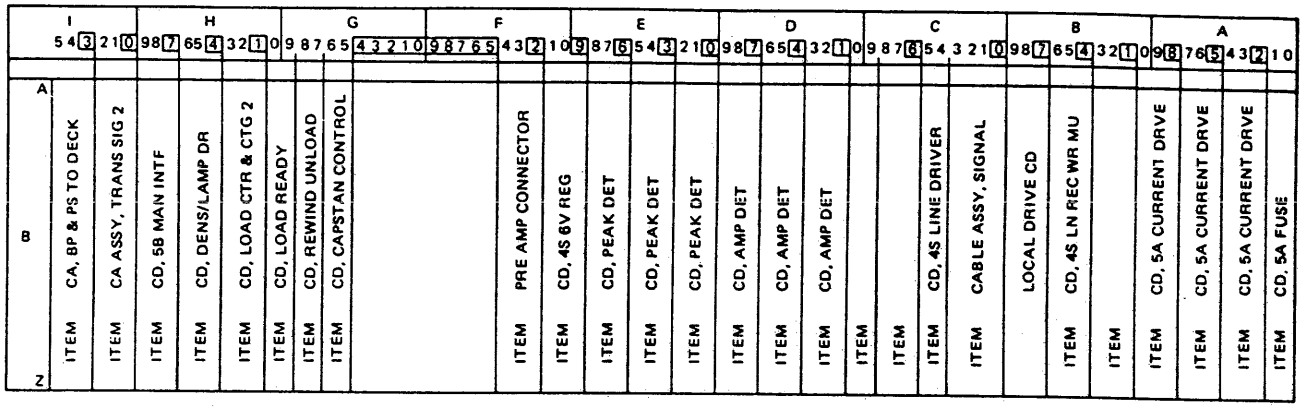

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Figure 3-8. Tape Unit Logic Backplane

MEC AND TAPE UNIT MODULE LOCATIONS

Figures 3-9 through 3-11 show the locations of the major modules in the MEC and tape unit.

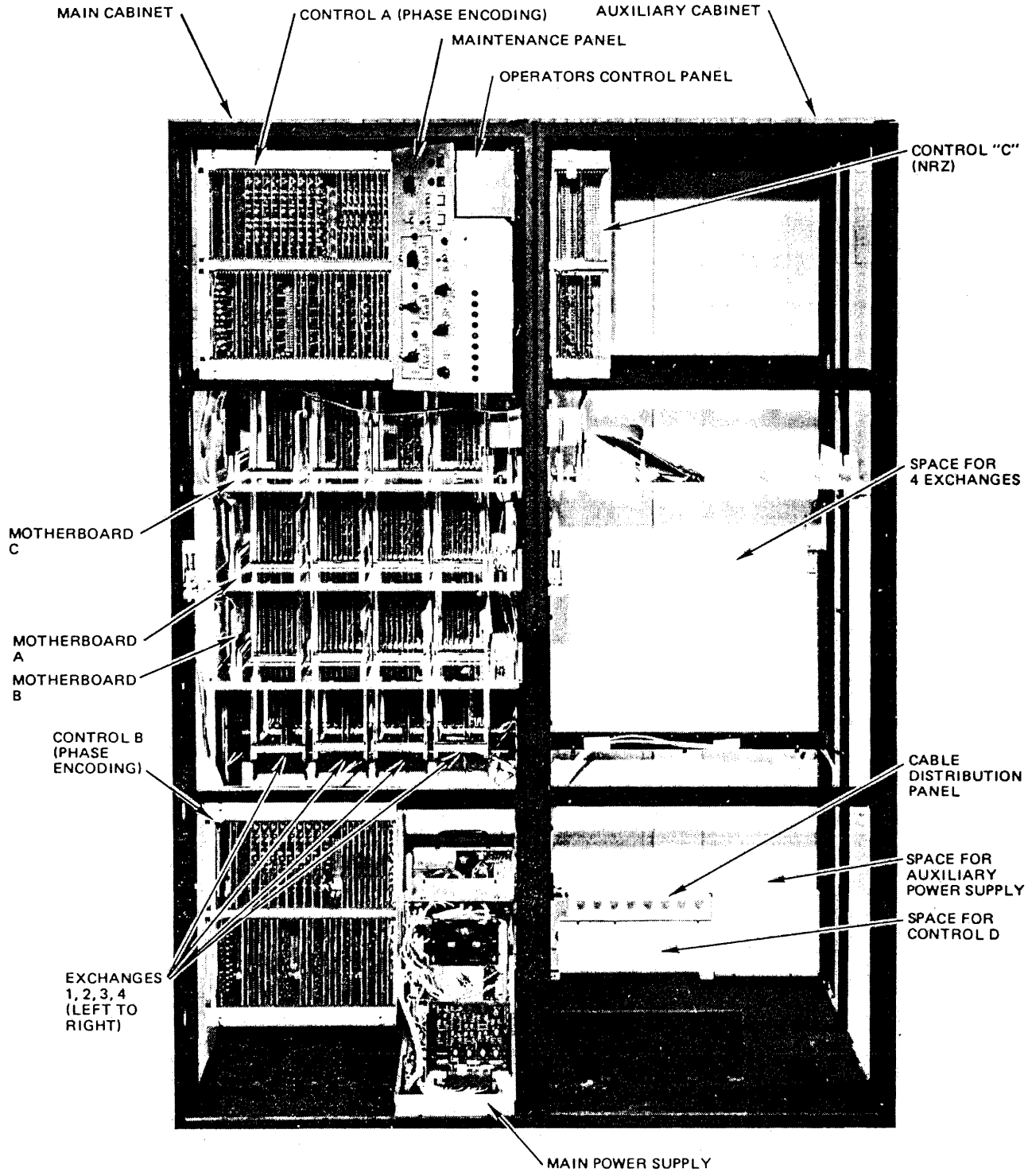


Figure 3-9. MEC Module Locations (sheet 1 of 2)

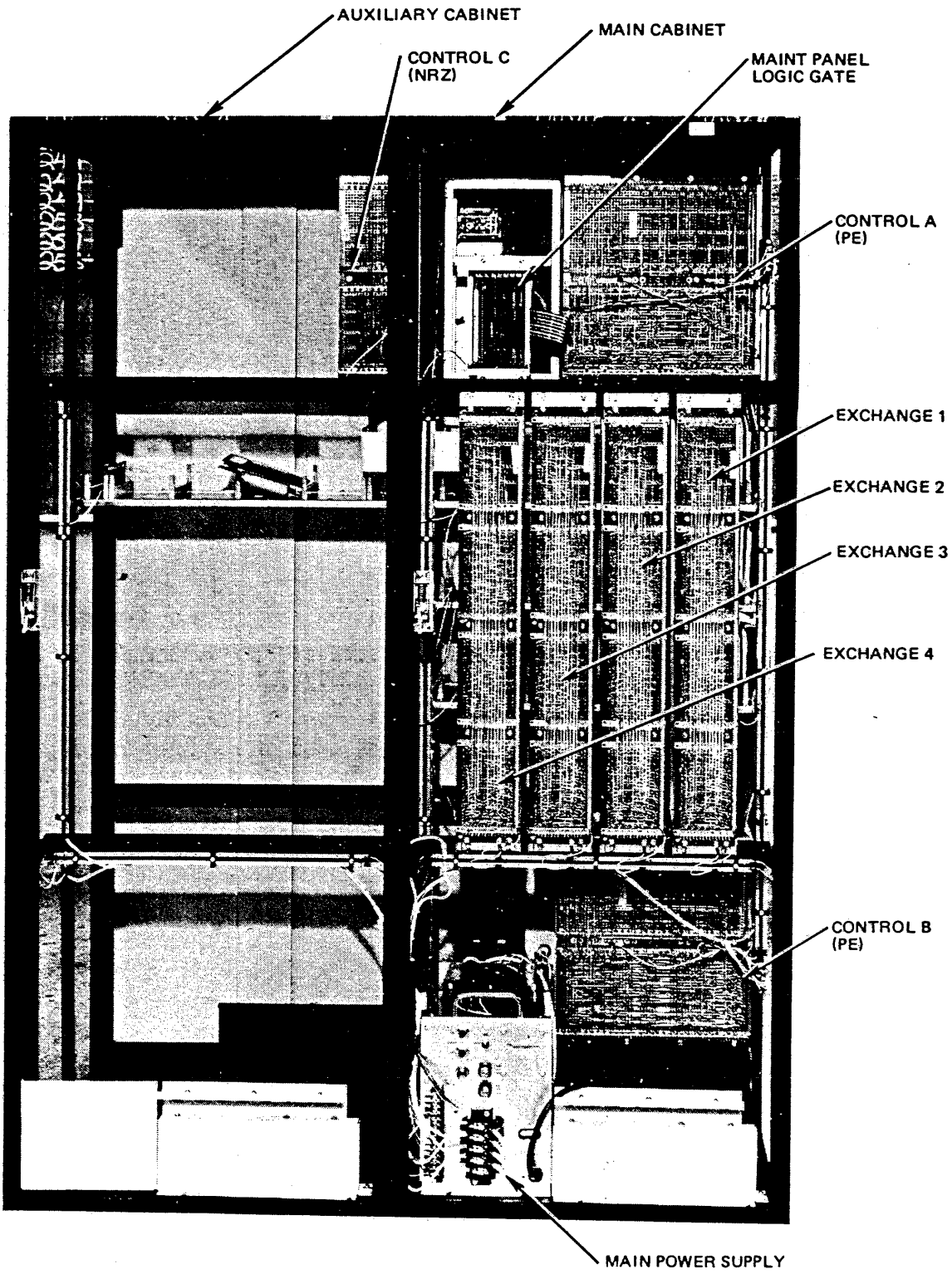


Figure 3-9. MEC Module Locations (sheet 2 of 2)

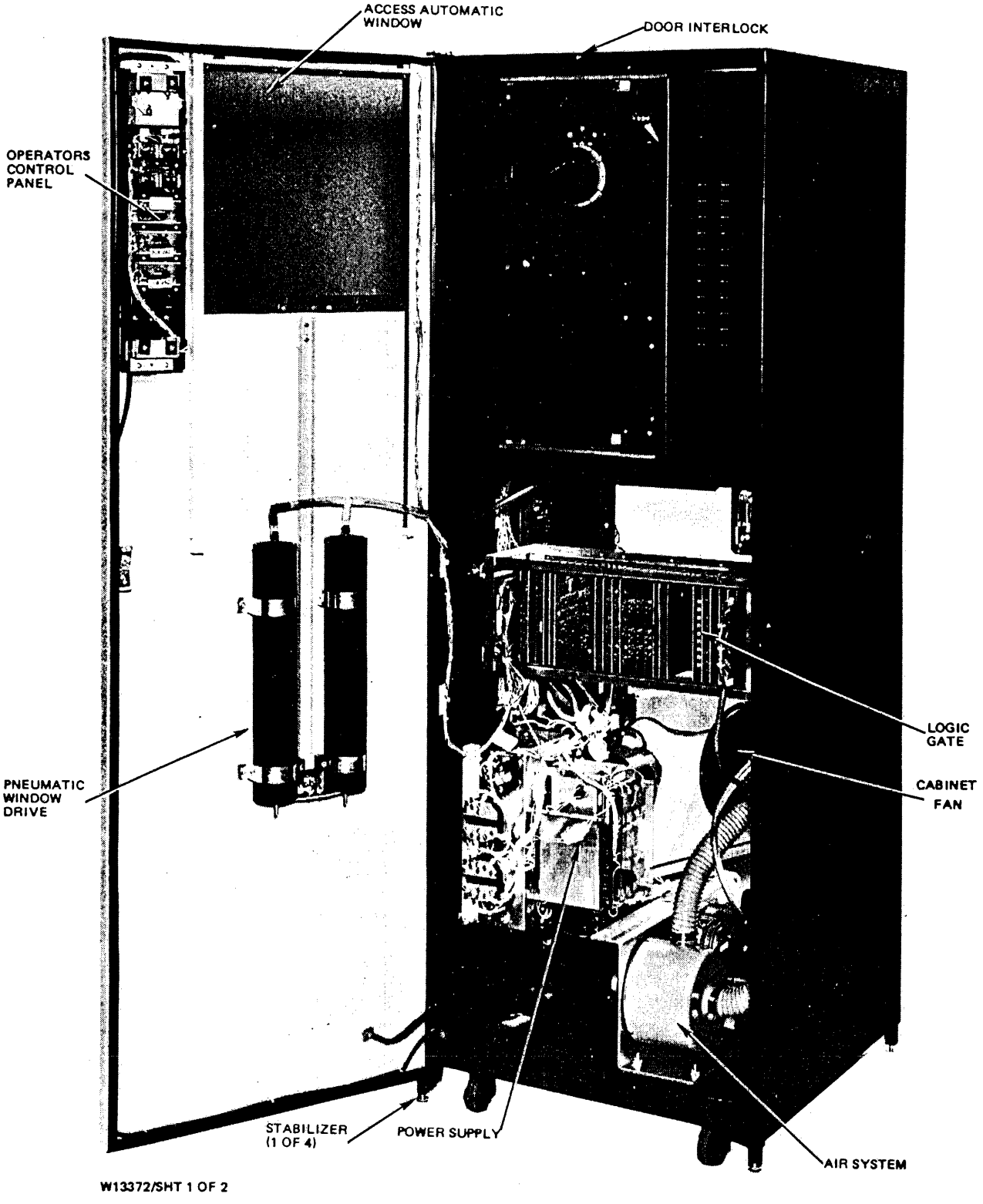


Figure 3-10. Tape Unit Module Locations (sheet 1 of 2)

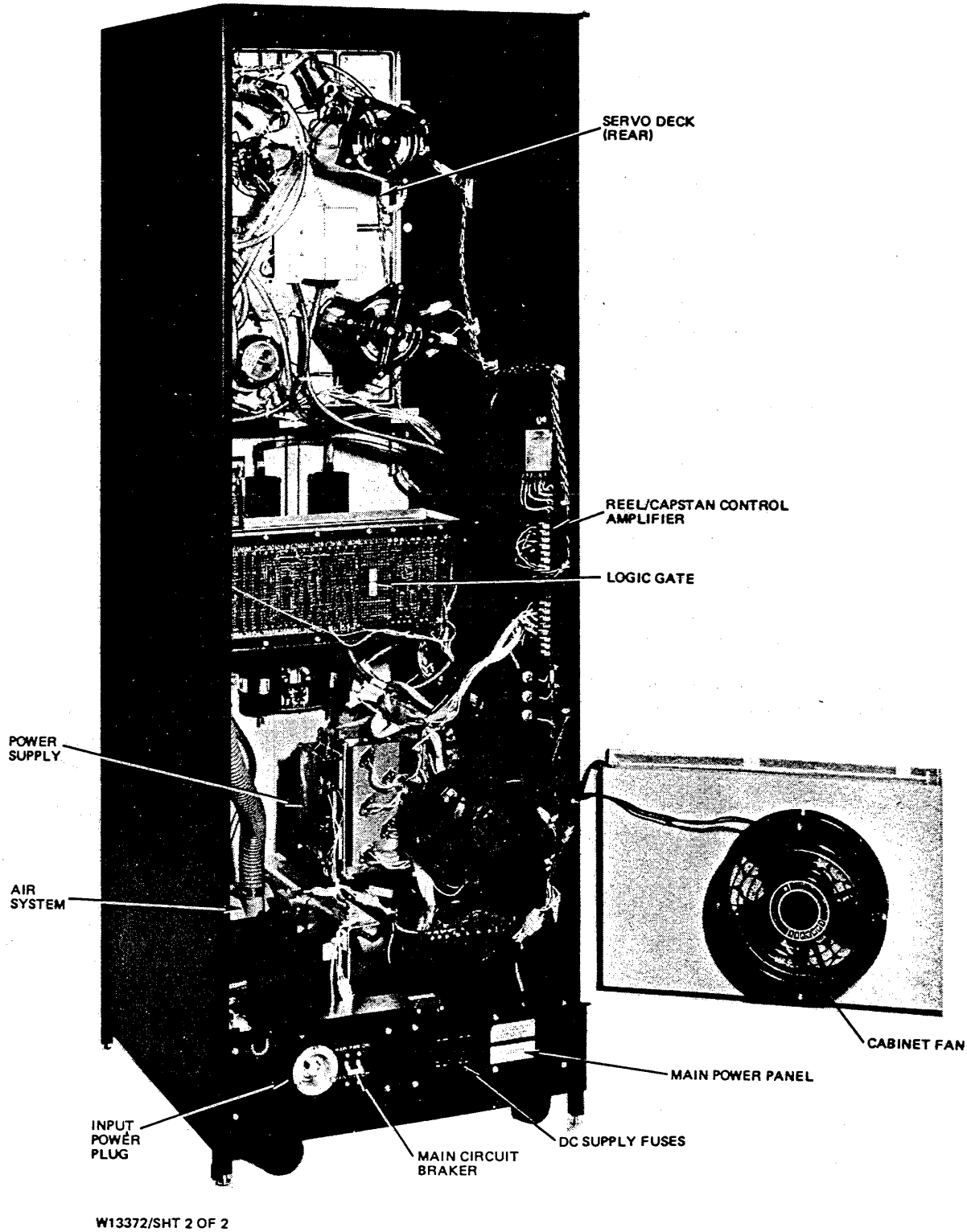


Figure 3-10. Tape Unit Module Locations (sheet 2 of 2)

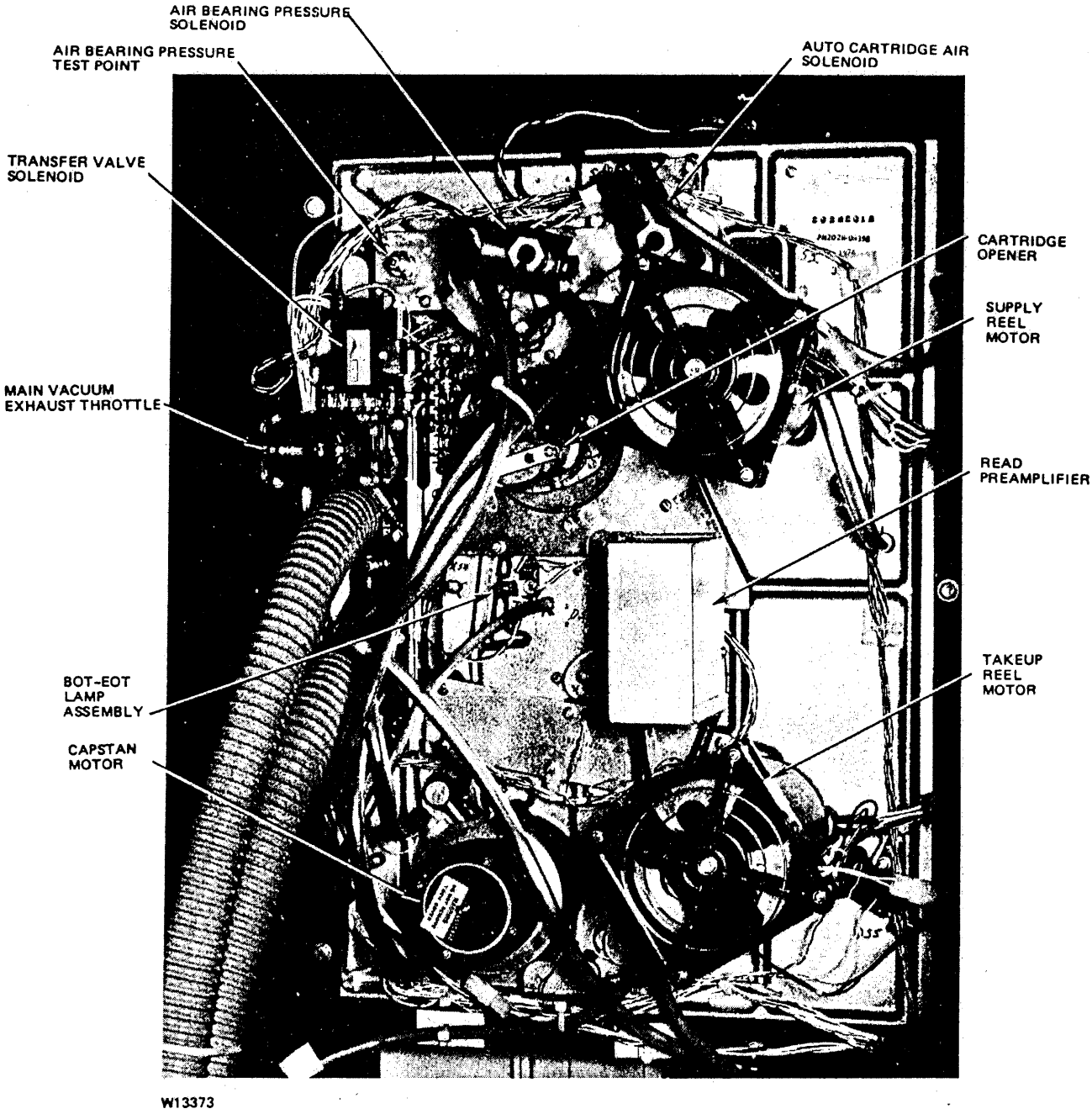


Figure 3-11. Servo Deck

SECTION 4
SYSTEM MAINTENANCE TECHNIQUES

INTRODUCTION

The performance and reliability of the B 9495 (5E) Magnetic Tape Subsystem depend upon the preventive maintenance (PM) it receives. The procedures described in this section of the manual include all scheduled checks and maintenance steps necessary for reliable subsystem operation. This section is also concerned with the maintenance and troubleshooting of the subsystem as a whole. The use of all special tools and subsystem diagnostic procedures is also covered in this section.

The maintenance, trouble-shooting, and adjustment of individual parts of the subsystem are discussed in subsequent sections of this manual, as follows:

Subject Covered	Section
Master Electronics Control (MEC)	5
Reel Servo System	6
Capstan Servo System	7
Vacuum/Pressure System	8
Read/Write System	9
Power Supplies	10

B 9495 (5E) PREVENTIVE MAINTENANCE

The following procedures describe the minimum recommended PM necessary to maintain the subsystem. The procedures apply to all subsystem configurations. The time intervals are in actual-on-time (A.O.T.), which is power-on time but not necessarily in-use time. The calendar intervals are the A.O.T. figures computed on a 6-day, 3-shift operation and should be re-evaluated for each customers usage. The required times are estimates and do not include repair or replacement time. The subsystem check time is based on the time necessary to check each unit in a subsystem of eight units, and does not include the time required to correct or fine-tune the subsystem as a result of the check. The check list provided in figure 4-1 should be used to maintain PM records.

NOTE

Make copies of the PM chart and place one on each unit or system log book for scheduling PM. Check off items as they are accomplished.

8-HOUR PM (ONCE PER SHIFT)

This procedure must be performed by the operator and requires approximately five minutes per tape unit. For details see OPERATOR DUTIES in section 1.

150 HOR PM (WEEKLY)

This procedure is a field engineer function and requires approximately 20 minutes for each tape unit.

a. Clean and inspect the vacuum columns, light rail, prism rails and air bearings. Check the tank lamps for discoloration.

b. Clean the tape deck sensors (BOT/EOT, take-up path, and low-tape) using a swab dampened in tape path cleaner.

A.O.T. HOURS/CALENDER INTERVALS

ITEM	150	300	450	600	750	900	1050	1200	1350	1500	1650	1800	1950	2100	2250	2400	2550	2700	2850	3000	3150	3300	3450	3600	3750	3900	4050	4200	4350	4500	4650	4800	4950	5100
CLN/CHK CLMNS/BRGS/BLKS																																		
CLEAN SENSORS																																		
CLEAN SUPPLY TIRE																																		
CLEAN FURNACE FILTER																																		
CHECK VAC. PRESS				■				■				■				■				■				■				■				■		
CHECK AIR PRESSES				■				■				■				■				■				■				■				■		
CHECK BOT-EOT				■				■				■				■				■				■				■				■		
CHECK WRITE RING				■				■				■				■				■				■				■				■		
CHECK AIR BEARINGS/BLOCKS				■				■				■				■				■				■				■				■		
CLN POS AIR FILTER				■				■				■				■				■				■				■				■		
CHK LOAD/UNLOAD/RUN/RWD				■				■				■				■				■				■				■				■		
CLN CAPSTAN FILTER				■				■				■				■				■				■				■				■		
SUBSYSTEM VERIFICATION							■							■													■						■	
CHK READ/WRITE HEAD WEAR							■							■						■							■						■	
CHK CAPSTAN SPEED/START/STOP														■													■							
CHK FOR MAGNETIZED HEAD														■													■							
CHK ANALOG GAIN														■													■							
CHK SKEW (NRZ)														■													■							
CHK BRUSHES/MICRON FILTER														■													■							
REPLACE SERVO LAMPS														■													■							
CHECK SERVO ADJUSTMENT														■													■							
REPLACE BRUSHES																																		■

W13374

Figure 4-1. B 9495 (5E) Preventive Maintenance Checklist

c. Check scotchlite tape in the vacuum columns and on the thread blocks for wear, tear, separation or dirt buildup.

d. Clean the supply hub rubber insert (tire) using the tape path cleaner (TP35).

e. Clean or replace the furnace filter located in the rear door of the unit.

600-HOUR PM (MONTHLY)

This procedure is a field engineer function, and requires approximately 30 minutes for each tape unit.

a. Check the COLUMN AIR VACUUM ADJUSTMENT (section 8).

b. Check the AIR BEARING PRESSURE ADJUSTMENT (section 8).

c. Check the BOT AND EOT SENSOR ADJUSTMENTS (section 6).

d. Check that the air holes in the air bearings and slots in the thread blocks are clear of dirt. Clean as required.

e. Verify the reel motor speeds, cartridge operation, servo action, and loop positioning by performing load and unload operations.

f. Drive tape forward, reverse, and full rewind while verifying the servo action and tape loop positioning.

g. Clean or replace the fiber filter inside the glass bowl on the positive air pump.

h. Vacuum the capstan motor filters.

i. Perform appropriate test routines.

1000-HOUR PM (EVERY SIX WEEKS)

This is a field engineer function and will require an estimated time of 1 hour and 30 minutes.

a. Perform subsystem verification as follows:

   1. Verify the VFC adjustment of one MEC control (sections 4 and 5).

   2. Select one tape unit in the subsystem and verify the speed and start/stop phase encoded read gain adjustments (sections 7 and 9).

   3. Perform the unit signature verification (section 4),on the selected unit.

   4. Using the tape created in step 3, verify unit signatures on each unit and MEC control in the subsystem by performing a READ FWD, READ REV, READ FWD with the maintenance panel. Optimize unit and MEC adjustments to obtain a set of signatures as close to each other as possible.

b. Perform appropriate test routines.

c. Check read/write head for wear.

2000-HOUR PM (EVERY THREE MONTHS)

The following procedure is a field engineer function and requires approximately one hour per tape unit.

a. Replace both lamps in the vacuum column light rail.

b. Remove and clean the inner air bearings, tape cleaner and thread blocks. Inspect pressure and vacuum holes in deck plate, clean if necessary. Reinstall parts using gauge P/N 2027 0708 to position tape cleaner as described in section 9.

c. Perform check for MAGNETIZED HEAD CHECK (see section 9).

d. Verify the CAPSTAN ELECTRICAL ADJUSTMENTS (see section 7).

e. Verify the SERVO ADJUSTMENTS (section 6).

f. Verify the NRZ and PHASE ENCODING READ GAIN ADJUSTMENTS (section 9).

g. Verify the NRZ READ SKEW ADJUSTMENTS (section 9).

h. Check servo motor brushes. These brushes must be replaced at 5,000 hour A.O.T. Do not remove the capstan motor tachometer brushes for inspection because they are extremely difficult to re-install.

i. Perform appropriate test routines.

REQUIRED MAINTENANCE TOOLS

The following list of tools are the tools required to properly maintain the subsystem. This list is also found in the equipment installation guide for the subsystem. The uses for each of the tools are described in this section and in the adjustment procedures.

Part Number	Description	Quantity
1622 1806	Tool, Thin Wall Socket Wrench	1
1622 4420	Jaquets Indicator (Tach.)	1
1622 9890	Degausser, Bulk	1
1631 2415	Alignment Tape, 9 Track	1
2027 1326	Tool, Tape Cleaner Alignment	1
2027 0807	Capstan Depth Gauge	1*
2027 1417	Tool, Cartridge Guide	1
2027 1664	Tool, Supply Motor Alignment	1*
2027 4066	Labels, Indicator	1
2027 6721	Gauge, Spring	1*
2041 4140	Plug-on Indicators	10
2042 3406	Extender Card	1
2045 8659	Vacuum Gauge	1
2045 9566	Labels, Indicator	1
2047 6313	VFC Maintenance Card	1
2026 4263	Maintenance Drive Card	1
2048 1420	Transponder Card	1
2048 5140	Tool, Supply Hub Alignment	1*
2048 5165	Fixture, Upper JHUB Holding	1*

Part Number	Description	Quantity
2048 5223	Fixture, Lower Hub Holding	1*
2048 5231	Tool, Take-up Hub Alignment	1*
75-110-51	Cleaning Kit	1**
	Oscilloscope, Meter and Standard Tool Kit	1

* Branch stock only; need not be kept on site.
** Sales item.

MEC MAINTENANCE PANEL

The MEC maintenance panel (figure 4-2) is a subsystem exercising tool, designed to exercise all functions of the subsystem that could be done by the system input/output control.

The MEC maintenance panel commands enter the PE control electronics using the same command bites that the I/O control uses. Read and write information is handled in the same manner as in normal system operation.

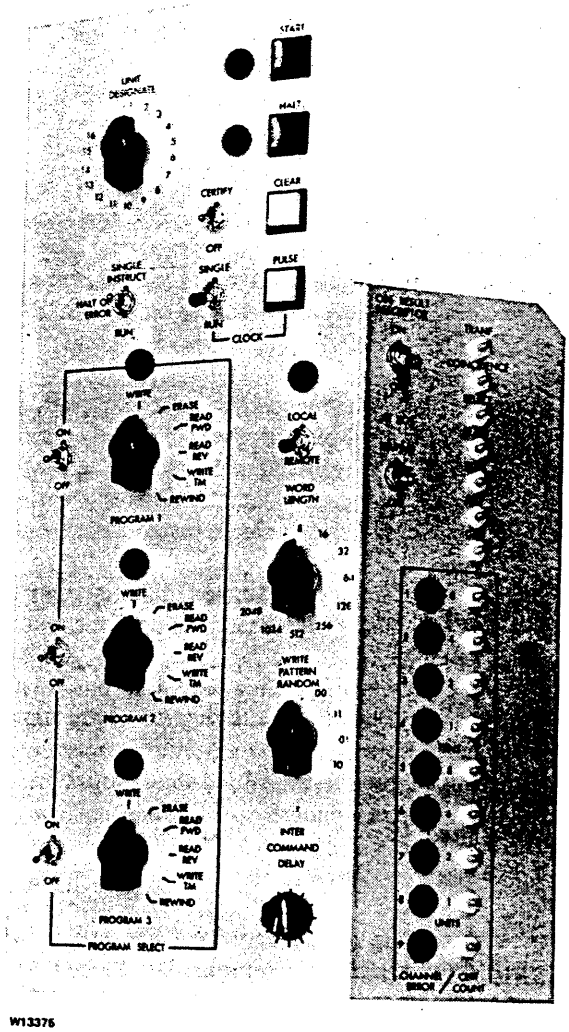


Figure 4-2. Maintenance Panel

The MEC maintenance panel can be connected to any of the subsystem PE controls with the 6-foot flat cable to enable maintenance or troubleshooting capabilities through that control to any tape unit desired.

SWITCHES, TEST POINTS, INDICATORS

The following information provides detailed descriptions of the maintenance panel switches, buttons, and test points. All functions are active only with the MEC in the local mode, except as noted.

a. UNIT DESIGNATE. This switch is a 16-position, 4-level wafer switch, used to represent a 4-bit binary coded decimal (BCD) output with values of 0 through 15, which are gated with BUSY/onto the IONL 5, 6, 7, and 8 information lines.

b. RUN/HALT ON ERROR/SINGLE INSTRUCT. This is a 3-position toggle switch with positions as follows:

RUN	The maintenance panel will cycle through the program steps as selected by the program select switches, until the HALT or CLEAR buttons are pressed.
HALT ON ERROR	The maintenance panel will cycle through the program steps until a read or write error is detected. When an error is detected, the operation will halt.
SINGLE INSTRUCT	The program sequence will unconditionally halt at the conclusion of each step. Pressing the START button again will step the program to the next instruction.

c. CLEAR. This button, when pressed, will unconditionally and immediately clear all functions.

d. REWIND AT EOT/OFF. Because the maintenance panel is soft connected to the control, the only time action can be taken after sensing EOT is at the end of each operation. The action of this switch is as follows:

OFF	With the switch in this position, the operation, upon completion, will halt after the EOT marker is sensed. Read or write operations may be continued beyond the EOT marker by pressing the START button for each additional operation cycle desired (single instruct type mode). Read reverse in the area beyond the EOT marker will be on a single instruct basis until the EOT marker is passed.
REWIND AT EOT	When the EOT marker is sensed, and that operation is completed, the unit will rewind. When BOT is sensed, operations will resume.

e. OBS RD/OFF. The observe result descriptor switch is active in remote and local. This switch is of the locking type and has a red cap. It must remain in the down position for normal remote operations. When active (up), this switch will prevent the control from completing an operation, enabling the observation of the result status bits in the input/output register, if plug-on indicators are used. It will also enable observation of the result descriptor in the I/O channel so that a comparison can be made between the two.

NOTE

This switch will interrupt the system activity if left active (switch up) when the maintenance panel is in remote and plugged into any online MEC control.

f. WORD LENGTH. This 9-position rotary switch is active during a maintenance panel write or erase command. One word is equal to 2 characters on tape. The selectable word lengths are 8, 16, 32, 64, 128, 256, 512, 1024, and 2048.

g. WRITE PATTERN. This 5-position rotary switch selects the information pattern to be written. The information is written in the proper format because the preamble and postamble are generated by the subsystem control electronics. The switch positions are as follows:

RANDOM	Writes the word length counter outputs.
00	Writes all zeros on tape.
11	Writes all ones on tape.
01	Writes alternate zeros and ones on tape.
10	Writes alternate ones and zeros on tape.

h. INT COM DEL (Intercommand Delay). This potentiometer selects the time spent between commands, and the time between the pressing of the START button and the first command execution. This delay ranges from 4 milliseconds to 1.5 seconds.

NOTE

When operation in the single instruct mode, the intercommand delay must be set at the minimum time.

i. LOCAL/REMOTE. This toggle switch is of the locking type and has a red cap. It must remain in the down position during remote operations.

The maintenance panel functions can be performed only when the maintenance panel is in the local mode and the START button has been pressed for the first time. The following functions are exceptions, and are active anytime the maintenance panel is connected to a control:

1. Testpoints
2. OBS RD/OFF (observe result descriptor)
3. CLOCK switch (This switch is active even when the maintenance panel is not plugged into a control.)

j. PROGRAM SWITCHES. The program switches consist of three 6-position rotary switches, and three associated toggle switches. Each rotary switch will decode to give the following program steps: WRITE, ERASE, READ FORWARD, READ REVERSE, WRITE TAPE MARK, and REWIND. The maintenance panel transfers the functions to the control in the same way that the I/O channel does. There is an ON/OFF toggle switch associated with each program switch to bypass that step if desired. A space operation can also be initiated as described under "MAINTENANCE PANEL USES" in this section.

k. CERTIFY. This toggle switch, when active (up), writes a continuous record full length of tape, while counting dropouts on the amplitude dropout lines. The data pattern written is dependent upon the position of the Write Pattern switch, which is normally set at the all ones (11) position. When a dropout is encountered in any channel, a blanking multi is fired to span a normal length tape flaw to prevent multiple counts on one tape flaw.

l. RUN/SINGLE. This toggle switch is of the locking type, and has a red cap. It will affect the subsystem operation if activated either in the local or remote mode. It must be in the down position during normal operations. The RUN/SINGLE switch selects either a continuous train of clock pulses, or single clock pulses when the PULSE button is pressed. In the single pulse position, it is necessary to press the START button first.

NOTE

This switch, when active (up), disables the clock to all MEC PE controls in the subsystem, not just the one the maintenance panel is plugged into.

m. HALT. This button inhibits the continuing of local operations, but will allow the operation in progress to complete.

n. START. This button starts the intercommand delay, and moves the program pointer to the next program step. The START button also initializes the maintenance panel if it is in local mode to gain control of the MEC control.

o. CHANNEL ERROR Indicators. The channel error indicators are active in local and remote. These indicators monitor the channel error flip-flops in the deskewing section of the control, and light to indicate the error being detected (amplitude dropout, skew, etc.). If an error is detected, the indicators will remain on until the next operation is initiated.

NOTE

One or two channel indicators lighted following an operation means that those channels are in error. All but one or two indicators on, means that the indicators that are off reflect the channel in error.

When in the CERTIFY mode of operation, these indicators are used as a decimal counter to count the detected tape errors.

p. Program Indicators. When the maintenance panel is running, these indicators are lit when their associated instruction is being executed. When the maintenance panel is halted, they indicate the last operation executed.

q. LOCAL Indicator. This indicator will be illuminated when the maintenance panel is in LOCAL.

r. HALT Indicator. This indicator is located beside the HALT button. It is lit when the maintenance panel has been halted.

s. Channel Error Testpoints. These test points are active in both the local and remote modes, and are connected as follows:

TRANF	This test point is connected to the word transfer clock which is used to communicate with the I/O channel. TRANSF is generated by the MEC.
COINCIDENCE	Coincidence is true when the word counter and word length are equal. It is used on the maintenance panel only to reset the select latch and to terminate a write or erase operation.
SELECT/	This level puts the control into action. It comes from the I/O channel or maintenance panel (see figure 4-3).
READY/	This level is the control's response to the SELECT level (see figure 4-3). It is used by both the I/O and the maintenance panel.

BUSY/	This level is used to determine the end of an operation. SELECT/, READY, and BUSY/ = the end of the operation (see figure 4-4).
TELF/	This level is the tape error flip-flop in the MEC control. It is false when any error is detected by the control.
GRD	This test point is the MEC logic ground.

MAINTENANCE PANEL TIMING

Figures 4-3 and 4-4 illustrate the timing relationships initiated by the MEC maintenance panel.

MAINTENANCE PANEL USES

The following information concerns the use of the maintenance panel for maintaining and troubleshooting the tape subsystems.

TAPE CERTIFICATION

The field engineer or operator can verify scratch tapes and obtain counts of tape flaws by using the CERTIFY option and the following procedure:

a. Plug the maintenance panel into an available MEC control, and designate the tape unit which has the tape to be certified. The tape unit must be ready and offline.

b. Select a WRITE operation on PROGRAM switch 1, and turn PROGRAM switches 2 and 3 off.

c. Set WRITE PATTERN to all ones (11).

d. Set REWIND AT EOT/OFF switch to OFF (down).

e. Put the CERTIFY switch to CERTIFY (up).

f. Set the run switch to RUN (or HALT ON ERROR, for a visual inspection of the tape).

g. Press the START button. The designated tape unit will write on the entire length of tape counting the errors. The CHANNEL ERROR indicators now become a counter that will count the errors on tape up to decimal 99. To reset the count, the CLEAR button must be pressed.

ALL BIT TAPE CREATION

The maintenance panel can be used to create "all bits" tapes for analog gain, tape speed and start/stop adjustments. Use the CERTIFY option as described above to create "all bits" tapes of 1600 or 3200 FCI (set the WRITE PATTERN switch to 10 or 01 for 1600 FPI, or 00 or 11 for 3200 FCI). (This method is preferred to the maintenance drive card because the MEC write clock is crystal controlled ensuring correct density.)

SPECIAL RECORDS

Long records can be created for servo current limiting adjustment or servo action testing. Use the CERTIFY function to write a record of any desired length anywhere on tape by pressing the START and HALT button, with the tape positioned where the record is desired. The record length is dependent upon the time between START and HALT.

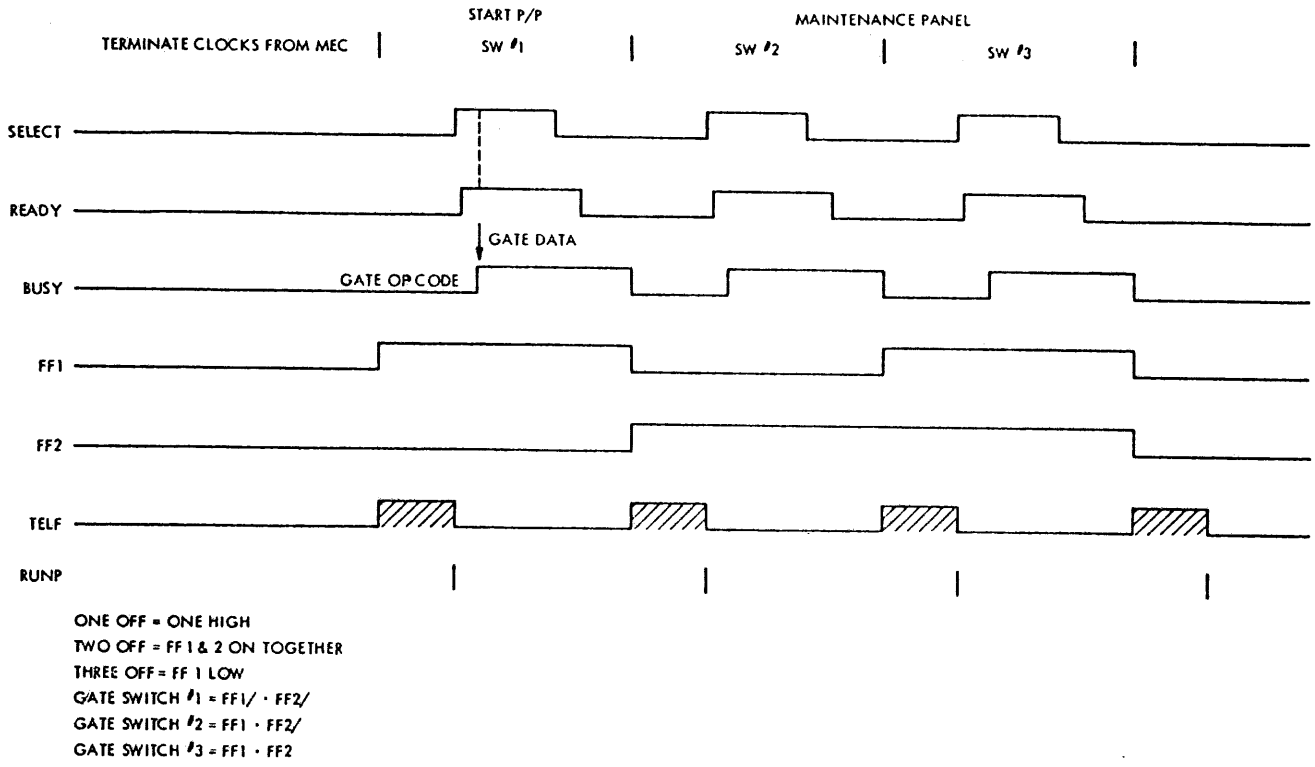


Figure 4-3. MEC Maintenance Panel Program Timing

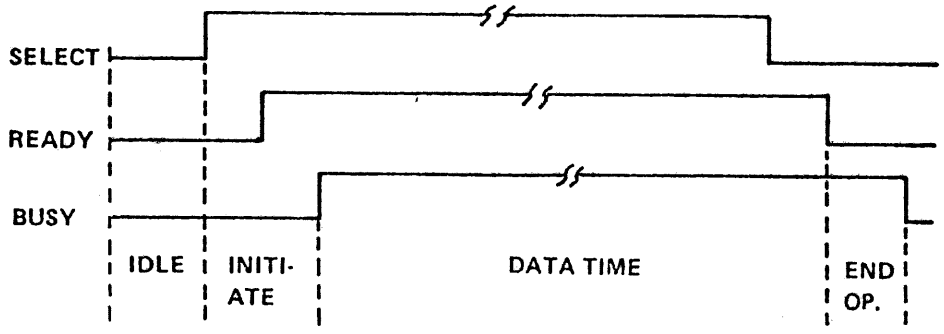


Figure 4-4. Timing for SELECT, READY, and BUSY for a Write Operation

MEC TIMER ADJUSTMENTS

To adjust the MEC timers, set up maintenance panel according to the instructions in section 5 for the multi needing adjustment. Substituting a transponder card for a transport further simplifies these adjustments by eliminating all unit-related jitter from the oscilloscope display.

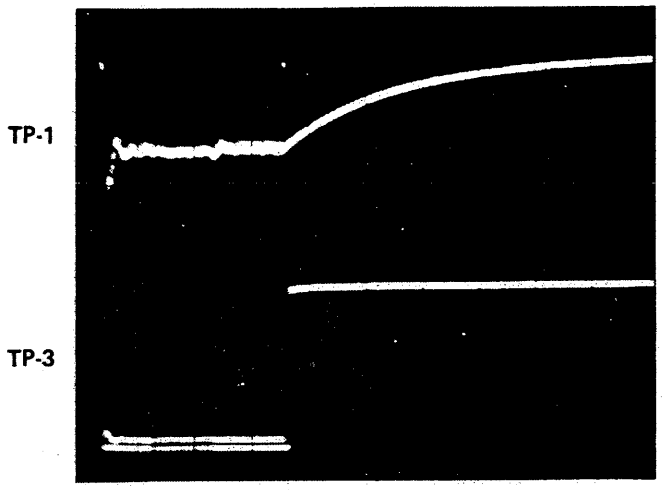


Figure 4-5. Reference Unit Signature

UNIT SIGNATURE VERIFICATION

The unit signature verification procedure is used to determine if a tape unit is performing correctly and is compatible with other tape units. The "signature" is observed in the MEC at TP1 of any VFC card. TP1 is the error correction voltage (EROV) generated by the VFC to correct for variations in the rate of data transfer from the tape unit during read and read-after-write operations. Because this error correction voltage (TP1) is a direct reflection of the data transfer rate, it can be used to monitor start/stop and run speed characteristics of a tape unit.

A properly adjusted and operational VFC produces a characteristic waveshape at TP1 as shown in figure 4-5. The waveshape in figure 4-5 was recorded using the transponder card in place of the tape unit to eliminate any corrective voltage resulting from tape unit read variations. The maintenance panel was used to write 16 word blocks of all ones. The lower waveshape (TP3 — decoded ones) is displayed to provide a reference to the actual data block.

Procedure to View Unit Signature

a. Connect the oscilloscope as follows:

   1. Connect channel-A to TP1 of any VFC card. Select 0.2 volts/cm and ac.

   2. Connect channel-B to TP3 of the same VFC card. Select 2.0 volts/cm and dc.

   3. Trigger external positive on VRL/. (Pin 1Y of any VFC card.)

   4. Set the main sweep speed to 100 microseconds/cm.

b. Set up the maintenance panel as follows:

   1. Set the PROGRAM SELECT switch 1 on; 2 and 3 off.

   2. Turn the PROGRAM 1 rotary switch to WRITE.

   3. Put the WORD LENGTH switch to 16.

4. Put the WRITE PATTERN switch to 10.

5. Put the UNIT DESIGNATE switch to the tape transport desired or to the tape unit number corresponding to the location of the transponder card.

6. Put the maintenance panel in LOCAL and press START.

c. Position the A-trace on the oscilloscope screen so that the ac ground reference is positioned on a grid marker. It is necessary to select ac because the static dc potential at TP1 is approximately 6 volts.

Explanation of Observed Waveforms

Observe that the error correction voltage on the A-trace goes no more than 0.5 volt negative and then returns to approximately −0.3 volt for the duration of the data block. The initial 0.5 volt negative transition is the result of the VFC synchronizing on the first data bits in the block. Once the VFC is locked, the error voltage level should remain at approximately 0.3 volt negative, in respect to the static potential throughout the block. This 0.3 volt offset is a result of the current VFC adjustment procedure which sets the sawtooth ramp (TP2) to a natural frequency slightly slower than the nominal data rate. This is done to obtain equal overspeed and underspeed tolerances. At the end of the block, the error correction voltage should return to its static potential of 0.0V (ac) as data is no longer present.

Figure 4-6 shows a unit signature recorded while writing on an operational tape unit (125) instead of the transponder card as shown in figure 4-5. The error correction voltage (TP1) is more erratic than in figure 4-5, owing to normal tape speed variations which occur during start and run modes of tape motion. As variations in start profiles or run speeds increase, the correction voltage at TP1 will also increase. Overspeed conditions result in a more negative error correction voltage.

Underspeed conditions result in a less negative (possibly even positive-going) error correction voltage. Poor start time is usually indicated by initial negative transitions much larger than the 0.5 volt expected, because the tape appears to be traveling too fast as a result of being written during an underspeed condition (the tape was moving too slowly at write time, causing the data to be packed at a higher density). When this high density portion of tape passes the read head at the correct speed, the data transfer rate is excessive, indicating an overspeed condition to the VFC circuits.

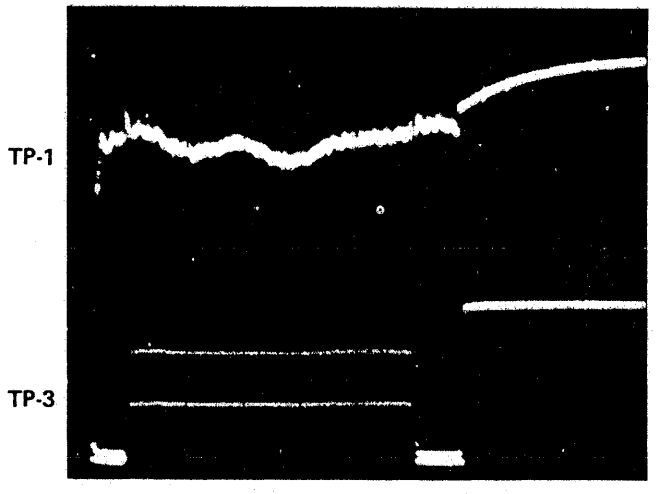


Figure 4-6. Actual Unit Signature

The error correction voltage can vary only through a certain limited range and yet be able to correct the VFC tracking. If a tape speed deviation generates an error correction voltage great enough to exceed this range, the VFC will fail to synchronize, or break synchronization, and an error condition will result in that channel(s). The overspeed limit is approximately 1.3 volts negative (from the 0.0 Vac reference). The underspeed limit is approximately 0.8 volt positive (from the 0.0 Vac reference). If any portion of the generated error correction voltage exceeds these approximate limits, the VFC will be unable to sychronize or remain in synchronization with the data which will result in an error condition.

The degree of operational margin increases as unit signatures appear more and more like the reference signature shown in figure 4-5. Unnecessary unit signature deviations should be corrected by adjusting or repairing the tape unit involved. The VFC adjustment, or the MEC, should not be considered as the problem area unless the reference signature (using a transponder card) is incorrect, or there are substantial differences in the signatures noted on different VFC's while exercising one tape unit.

The unit signature verification procedure can be expanded to include checking read operations by selecting WRITE, READ REV, READ FWD with the maintenance panel and setting the oscilloscope main-sweep to show three blocks of data on the screen. Use the delayed sweep to observe the signature for each block.

The unit signature verification procedure is also very useful in checking subsystem compatibility and in analyzing tapes with read errors. Tapes created on one tape unit or tapes with read errors, can be read on other tape units while observing the signatures for discrepancies. Permanent read errors can be analyzed by performing repetitive forward and reverse reads over the block in error and observing the signature.

VFC MARGINS

Use the maintenance panel in conjunction with the VFC maintenance card to establish working margins of each VFC card. For procedure, refer to VFC MAINTENANCE CARD.

TRANSPORT EXERCISER

By selecting appropriate operations, record size, data pattern, and intercommand delay, almost any valid sequence of operations (up to 3) can be executed in a repetitive manner. Most common is WRITE, READ REVERSE, READ FORWARD of varying record size and pattern. But other patterns using REWIND, WRITE TAPE MARK, ERASE, and SPACE may be used to exercise specific functions.

MEC TROUBLESHOOTING

The SINGLE INSTRUCT, OBS RD, and SINGLE PULSE switches on the maintenance panel, in conjunction with the transponder card, make it possible to troubleshoot almost any MEC logic problem, including the deskew circuits.

READ/WRITE ERROR ANALYSIS

Read/write error analysis is perhaps the most important and useful application of the maintenance panel. The most effective ways to avoid and correct equipment problems are to analyze maintenance logs for possible problems, to isolate media problems from equipment failures, and to analyze bad tapes for actual problems.

All tape errors have a cause, and quick determination of that cause will reduce the number of times it can affect system operation. All tapes which experience fatal read or write errors and, if possible, even those with high retry error rates should be analyzed with the maintenance panel. Arrangements should be made to obtain both the reels and sufficient subsystem time from the customer.

Figure 4-7 is a flow chart of the procedure recommended to analyze tapes with permanent errors or high retry counts. The flow chart can be used by the field engineer as a guide to assist in determining the cause of tape errors.

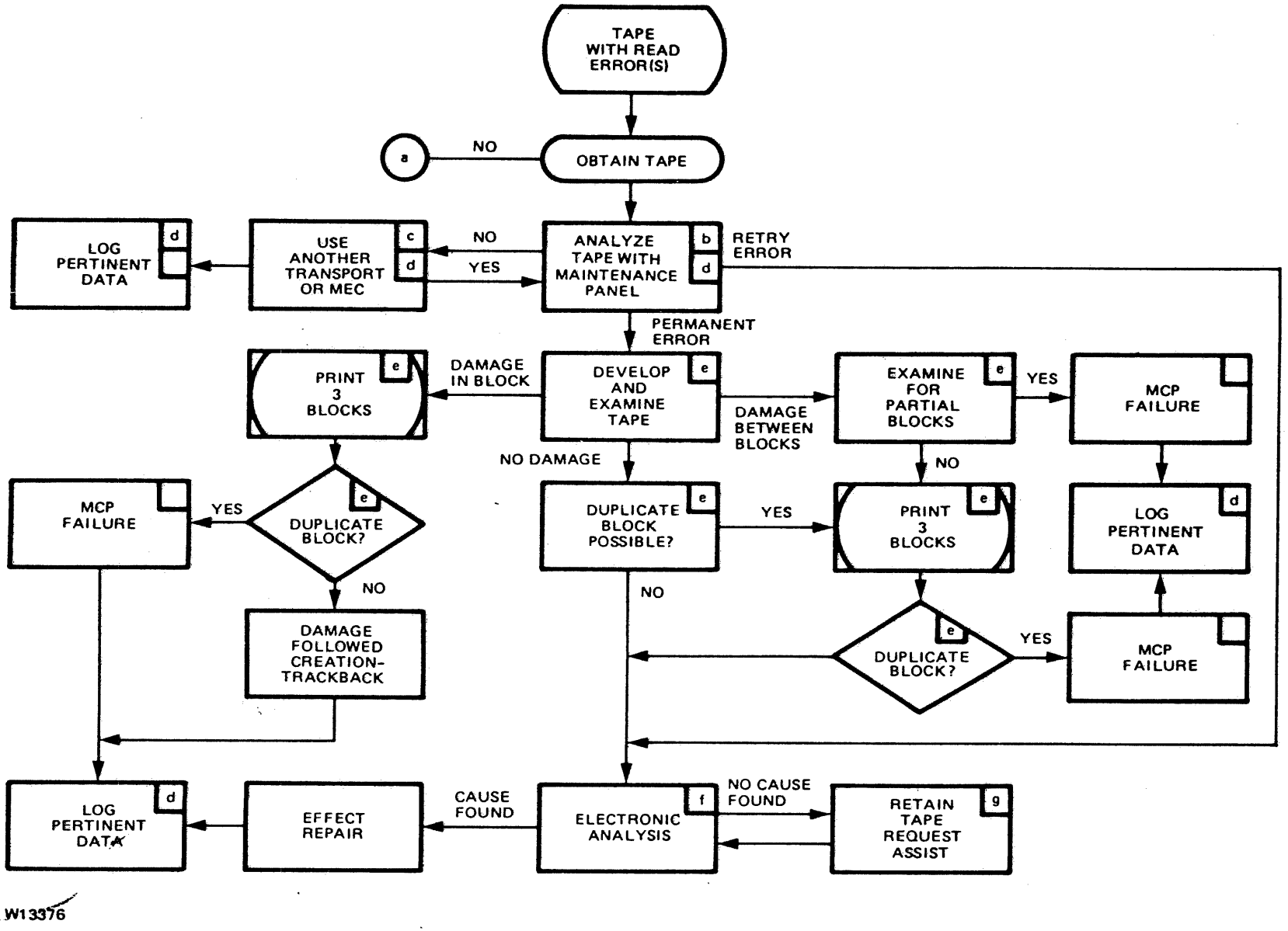


Figure 4-7. Tape Error Analysis Flow

An explanation of each block in the flow chart is included in the following paragraphs. The lower case letter in the upper right corner of each block matches the lower case letter in the following paragraphs.

a. Request customer to furnish the following:

   1. Failing tape (with reel marked at approximate area of failure).

   2. Address of tape unit on which tape was written.

   3. Address of tape unit or units on which tape failed to read.

   4. Job on which failure occurred, time, and date of failure.

   5. Sufficient tape subsystem offline availability to permit analysis of the error.

b. Analyze the suspect tape using the maintenance panel. Install all indicators on the control and select HALT ON ERROR. Read the tape in the following modes:

   1. Continuous forward.

   2. Continuous reverse.

   3. Alternate forward and reverse while varying the INTERCOMMAND DELAY.

Failure modes and number of failures should be noted. For example, one channel error indicator always illuminated, only FWD errors, only turn-around errors (FWD to REV, or REV to FWD), intermittent retries, solid error on one record only.

NOTE

There will usually be one solid read error on most input tapes. This bad record is a partial record which is old data left on tape at the completion of the last write command during creation of the input file. An error of this type will immediately follow the trailer label. Developing the tape to locate the trailer lable or listening to the start/stop sound of the capstan for a change in frequency, which indicates a different block size, are other methods of locating the end of a file.

Attempt to diagnose observed symptoms. Often, no further testing is required. For example, a tape that fails to read only in the forward direction was very likely written on a unit which had a poor start time producing a bad preamble. This preamble becomes a postamble during reverse read operations and does not affect the VFC's as seriously.

Another example that may require no further testing would be constant failures in one channel (indicated by the same channel indicator being lit each time). Troubleshooting would then be directed toward repairing that channel.

c. In some cases it is desireable to re-analyze the same tape on a different unit and/or MEC control to aid in determining the cause.

   Try the tape on a unit other than the one it was created on. If the tape reads successfully on the unit it was created on but not on other units, a compatibility problem exists and the creating unit should be checked.

Try the tape on the unit on which the user experienced problems. A failure on only one unit indicates a problem in that unit.

Try a third unit if symptoms are contradictory or still not apparent. If still unsuccessful in defining the failure, try a different MEC channel. If no error can be found, re-execute the failing program, if possible, using the failing tape on the same unit the original execution utilized. If all efforts to reproduce the failure are unsuccessful, the incident should be permanently recorded in a tape error log for possible future reference.

d. Maintain a tape error log of all tape errors experienced by the user. The following information should be included for each failure.

1. Date of failure.

2. System message defining the failure.

3. Unit number on which the failure occurred.

4. Physical tape reel number.

5. Tape and file name of failing reel.

6. Unit number on which the tape was created.

7. Date of creation.

8. Results of F.E. analysis. Include unit numbers involved, symptoms, causes and corrective action taken. Attach pertinent console logs or maintenance logs if considered helpful.

This log can be useful in determining common failure modes, defective tapes, defective hardware or programmatic problems.

e. Examine the tape for damage and/or develop the tape. First, be sure the portion of tape with the error is in the area of the read/write head, and, if possible, know the exact location with respect to the head (on which side of the head the failing block is located). Exact positioning can be maintained by marking the back side of the tape with a felt marker at the point of contact with read head.

Handling and developing tape must be done with extreme caution to prevent additional damage or failure symptoms. This makes effective analysis more difficult and can render the tape useless in the future.

To develop the tape, dip the portion to be viewed, oxide side up, all the way into a well-shaken can of MAGNA-SEE[1] or other developing agent. Develop a sufficient length of tape to include at least two records on either side of the failing record. If a permanent record of the developed area is wanted, it can be transferred to white paper by lifting off the developed pattern with a piece of clear cellophane tape.

Check the tape for physical damage, such as creases, nicks, scratches, and edge damage. Damage is defined as oxide voids or tape deformaties sufficient to cause the tape surface not to contact the surface of the head in one or more data tracks.

[1] A SOUNDCRAFT product of CBS RECORDS a division of Columbia Broadcasting System, Inc., Danbury, Conn. 06810

If the tape is physically damaged and the damage lies within a valid record, it can be assumed the damage occurred after the tape was created. Incidents of this type of damage should be investigated, checking the usage between the time it was created and when it first failed to read in an attempt to locate the mode of damage, such as a specific unit, operator damage.

If the damage is between records and/or evidence of write retry is present (extended erased areas), it can be assumed that the damage was present prior to tape creation, but was bad enough to result in some failure in the write retry routine such as misindexing or incomplete erasure of the flawed area. The current write retry procedure of double-backspace method is capable of detecting, erasing, and by-passing tape flaws up to 0.4 inch in length, but electronic analysis of the damage area for residual flux changes or programmatic analysis of the adjacent blocks for duplication of data is advisable. The possibility of a duplicate or partial block must always be considered and eliminated. Analyzing why a block has a fatal error is not necessay if it was left on tape due to a write retry deficiency. Corrective action in such cases must be toward implementing proper error recovery. Burroughs utility programs such as DUMPALL or online diagnostics such as SCR, can be used as well as locally written routines, to print the data contained in the failing and several adjacent blocks. This data should then be compared for duplication.

Also, consider the possibility of a hardware failure during write which caused the write error to go undetected.

Incidents of problems relating to tape damage can be reduced by encouraging the user to dispose of bad tapes but it should be remembered that well adjusted equipment complemented by good programming should run with no permanent read errors, even on damaged tape. Throughput can be greatly reduced, but failures should be of the write recoverable type.

Verify size of IBG and completeness of erasure. Gap should be 0.6 inch nominal (gaps may be larger, up to 25 feet, depending on erasures generated for write retries or in special instances such as initial gap or tape marks). Gaps shorter than the nominal are often caused by tape slippage. Gaps should be totally erased. There should be no signs of any flux reversals of discernable tracks in the gap. Erase head operation, especially its positioning, is usually the cause of problems in the IBG.

Verify track alignment to see that the 9 tracks are equally spaced on the tape. Tracking problems can show up as tracks 1 or 9 overlapping the physical edge of the tape.

If possible, compare length of the failing block to adjacent good blocks. If blocks are of a programmatically fixed length, disparity in physical length indicates tape speed variations or partial blocks.

When physical analysis is completed, remove all remaining "MAGNA-SEE", dirt, fingerprints, etc., with tape path cleaner and lint free cloths, and carefully re-thread the tape.

f. If the preceding procedures have not disclosed the cause of failure, it will be necessary to electronically analyze the failing block. There are several test points and logic levels in the unit, MEC and controls which can be observed. A few of the most helpful are:

1. Unit signature — The VFC error voltage at TP1 of each VFC. This test point is ideal for verifying Start/Stop and tape speed characteristics.

2. Analog information — At TP1, 4 and 7 of the unit peak detectors. Useful for verifying gains, initial read skew, possibility of dropout and other head and media related problems.

3. Digitalized data at several points in the data chain; from the peak detectors, through the amplitude detectors, skew cards (NRZ), line drivers, into the MEC at the input to the VFC's or channel deskew cards or into the NRZ control at the skew gate. These points are useful in verifying skew and data integrity.

4. The error level generated by the failure condition (TELF on the MEC) maintenance panel. Viewing this in conjunction with one or more of the preceding testpoints provides an exact time reference to where the failure occurred which will make determining the actual cause much simpler. The oscilloscope should be triggered externally on such levels as BUSY, drive commands ((FDL/BDL) or VRL (Valid Record Level) to stabilize the signals, while reading forward and reverse over the bad block. Intercommand delay should be maximum to reduce tape wear.

Analysis of fatal write errors is somewhat more difficult as operating systems (MCP's) do not always leave the failing block or failing area of tape in the same state it was at the time the failure occurred. Additionally, MCP's can rewind and purge such a tape. This may result in an additional parity error at the point where the "purge" completed. An attempt should first be made to analyze the tape in its initial state as described earlier. If successful, the maintenance panel should be used in a WRITE only or WRITE, READ REV, READ FWD mode to check the suspect unit or area of tape. Use any or all of the indications described previously to locate failures, such as failure modes, developing tape, physical inspection, electronic analysis.

Take appropriate corrective action, based on the cause of the failure.

g. If the cause of the failure cannot be determined, retain the tape and any information gathered. Collaborate with other field engineers or support personnel to resolve the problem. There should be no unexplainable read errors.

SPACE OPERATIONS

The space operation is used to move the tape from its record position over a specified number of records and then stop. The maximum number of records that can be spaced over is 100.

a. Set all PROGRAM switches off.

b. Insert the space OP code (8 for forward, 9 for reverse) into the INA register using the plug-on indicators.

c. Insert the number of records to be spaced into the INC and IND registers using the plug-on indicators. For example, to space 13 records, insert "1" in INC and "3" in IND; to space 100 records insert "0" in INC and IND.

d. Press the START button. Only one operation will be executed.

e. If OBS RD was active (up), the result descriptor will be displayed in the IN register.

f. To execute another operation, press CLEAR and repeat steps a. to e.

VFC MAINTENANCE CARD

The VFC maintenance card is designed to aid the field engineer in troubleshooting and determining operating margins of the VFC's. The card funishes blocks of data (RIM 1 through 9) to the VFC cards and allows repetitive start up and run of the VFC's. Potentiometer R1 is used to vary the frequency of data pulses, simulating speed variations that might occur in the transport (nominal data read is 3200 FCI). Switch S1 allows VFL/-M and RIM 1 through 9 to be

gated to the backplane. There are two test points on the card that can be used as observation points or for sync. The following is the VFC check procedure for margins.

a. Ensure VFC's and dc voltages are adjusted correctly.

b. Put the MEC control to be checked in local by plugging the maintenance panel driver card into CBDF4, and putting the local remote switch to LOCAL.

c. Put the VFC maintenance card into MEC control location CBDD6, and turn switch S1 of the VFC maintenance card off.

d. Monitor TP3 on the VFC maintenance card, and adjust the square wave output (with potentiometer R1) for the nominal frequency (3200 FCI) as indicated in figure 4-8 and table 4-1. The times given in table 4-1 are in microseconds, measured leading edge to leading edge of the waveform.

e. Move the A probe to TP2 of a VFC card (amplitude 1 volts/cm, trigger internal auto sweep 1 microseconds/cm).

f. Set switch S1 on VFC maintenance card ON, and adjust the oscilloscope trigger. The trace should appear as two ramps per nominal time division "T" (table 4-1 and figure 4-9). The trace must be stable, indicating that the VFC is locked.

Table 4-1. VFC Margins (Values of "T" in Microseconds)

Speed	+20%	+15%	+10%	+5%	Nominal	−5%	−10%	−15%	−20%
25 ips	30.00	28.75	27.50	26.25	25.00	23.75	22.50	21.25	20.00
50 ips	15.00	14.37	13.75	13.12	12.50	11.87	11.25	10.62	10.00
75 ips	9.99	9.58	9.16	8.75	8.33	7.91	7.50	7.08	6.67
125 ips	6.00	5.75	5.50	5.25	5.00	4.75	4.50	4.25	4.00

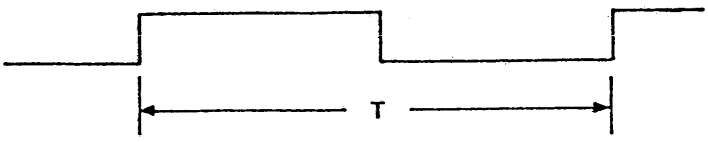


Figure 4-8. VFC Card Adjustment

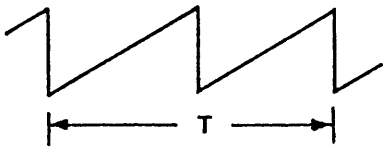


Figure 4-9. VFC Ramp

g. Increase the duration of "T" (simulating decreasing data rate with potentiometer R1 in 5 percent increments (see figure 4-9). The oscilloscope signal should increase in width but remain stable. Ideally, the VFC should remain locked until a 20 percent deviation from nominal is induced with R1. At this point, the VFC will not be able to lock. This will be noted by the ramps becoming very unstable; possibly doubling in frequency. A slight decrease in the frequency deviation with potentiometer R1 should result in the VFC locking again.

h. Restore the duration of "T" to nominal with R1.

i. Continue to decrease the duration of "T" (simulating an increase in data rate) in 5 percent increments. The VFC should ideally remain locked until a 20 percent deviation from nominal is reached. At this point the ramps will become unstable.

j. Verify each VFC using steps e. through i.

TRANSPONDER CARD

The transponder card was designed to permit single pulsing of the MEC for general troubleshooting purposes, but especially the deskewing circuits. The card simulates an actual transport without any of the skew and jitter which result from actual tape motion, and offers clean, jitter-free signals for troubleshooting. Use of the card also makes adjusting the MEC timer (section 5) easier and more exact.

a. Plug the transponder card into any one of the exchanges Slave Connector Ports (EBFB1 or EBFB4). Disconnect a slave logic cable if necessary.

b. Connect a backplane jumper from the +5 volts buss to EBFB2Z or EBFB5Z (depending on which slot the transponder card is installed in). This action is required to provide +5 volts to the transponder circuits.

c. Plug the maintenance panel cable driver into an available MEC control and set it to LOCAL.

d. Set unit designate switch to correspond to the tape unit port selected in step a.

e. Proceed to use the maintenance panel as if it were operating with an actual tape unit. When the maintenance procedure is completed, be sure to remove the transponder card and the +5 volts jumper installed in step b above. Reconnect the slave logic if removed in step a.

PLUG ON INDICATORS

The MEC PE control indicators (P/N 2041 4140) can be used only on the cards shown in figure 4-10. The labels shown are available under part numbers 2041 4066, and 2045 9566, and can be permanently attached to the indicator blocks. Figure 4-10 may be used to reference a blank indicator block which will reduce the number of blocks required. The blocks have individual manual SET and general CLEAR capabilities.

MAINTENANCE DRIVE CARD

The maintenance drive card enables local read and write operations in the continuous or start/stop mode at the tape unit. The card is plugged into the logic backplane at LBBB8. When plugged in, the transport is logically forced into an offline condition and cannot be accessed from the MEC.

The switch, test point and potentiometer functions are as follows (see figure 4-11 for component locations):

a. FWD/OFF/REV Switch. This switch controls the direction of the tape motion, or will stop all motion if in the center position.

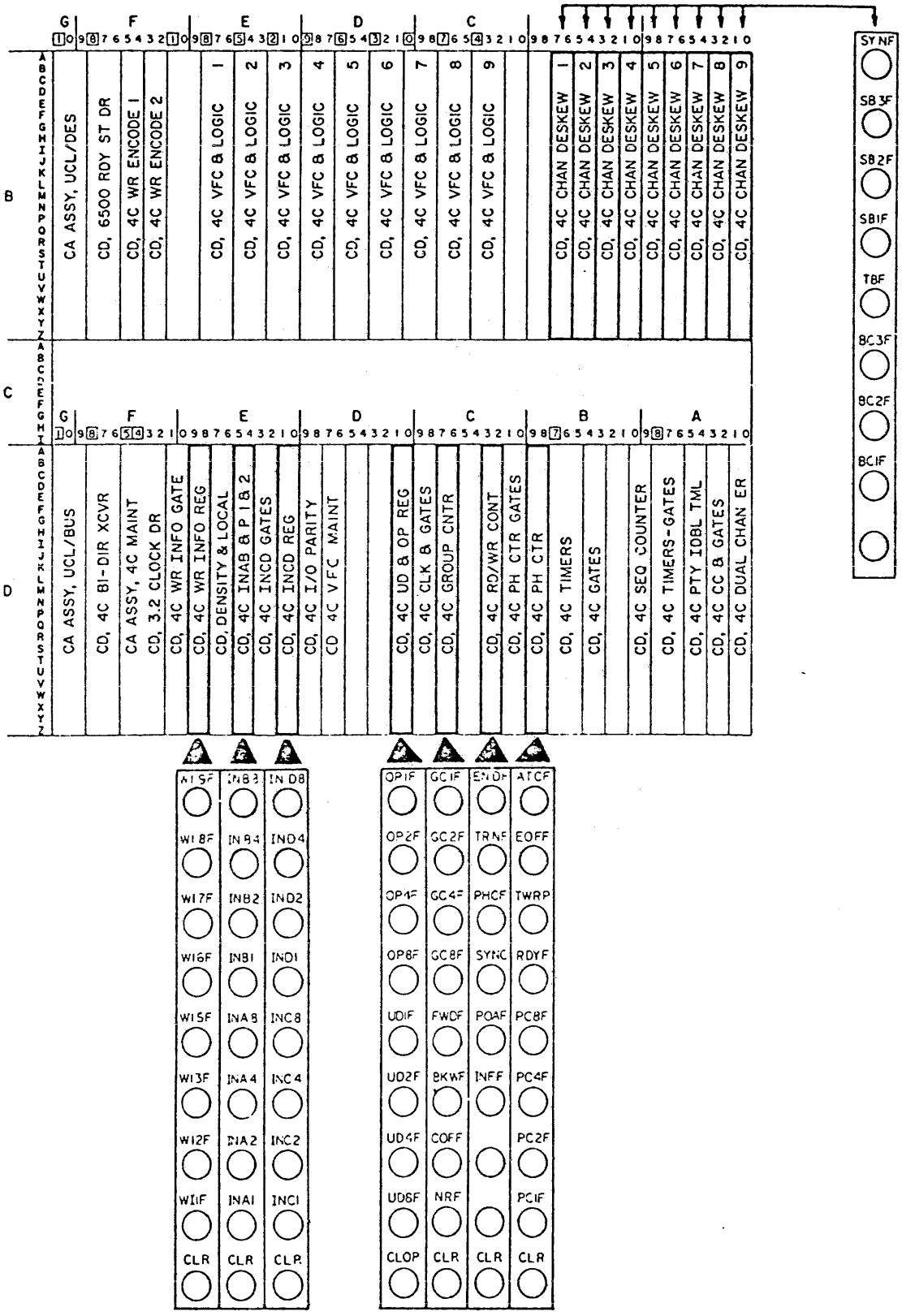


Figure 4-10. Maintenance Indicator Labels on MEC Control

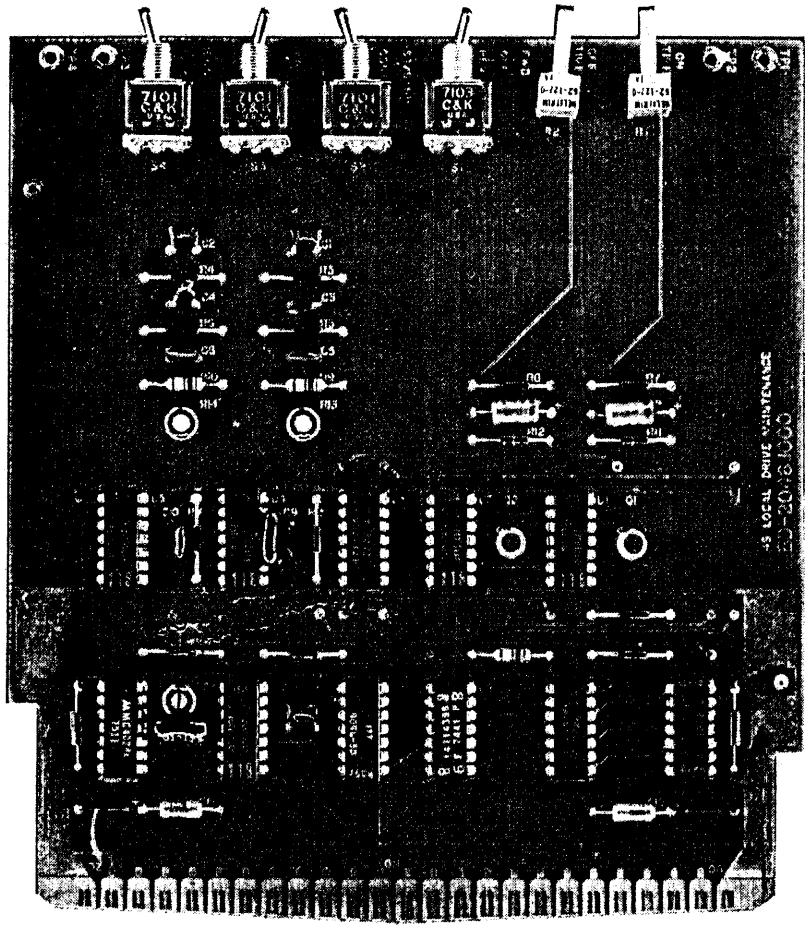


Figure 4-11. Tape Unit Maintenance Drive Card

b. ST/STOP — CONT Switch. This switch controls the mode of tape motion. It will drive tape continuously, or in a start/stop mode (on and off time are dependent upon setting of R1 and R2).

c. WRITE Switch. This switch selects either the read or write operation. A write ring must be installed to perform a write operation.

d. 1600/3200 Switch. This switch selects the density (in FCI) at which a tape will be written. If the operator control panel is set to 1600, this switch is active and will select 1600 or 3200 FCI. If the operator's panel is set to 800, this switch is inactive, and 800 FCI will be written. The exact frequency is adjusted by potentiometer R22, WRITE CLOCK ADJ.

e. TP1. This test point is the FWD/ drive level. It will be false when tape is driving forward.

f. TP2. This test point is the REV/ drive level. It will be false when tape is driving backward.

g. TP3. This test point is the tape speed discriminator. It presents a linear representation of actual tape motion by discriminating peak pulses from the channel 5 peak detector. For this reason, it is an excellent point to observe when checking for tape slippage or other motion-related problems.

h. TP4. (Active only when used on B9495-5/6 transports). This test point is the capstan speed discriminator. It presents a linear representation of actual capstan motion by discriminating tachometer pulses from the capstan tachometer circuit.

i. R1, ON TIME. This potentiometer controls the on time of the start/stop oscillator. It determines the no tape motion period during start/stop operation.

j. R2, OFF TIME. This potentiometer controls the off time of the start/stop oscillator. It determines the tape-motion period during start/stop operation.

k. R13, Tape Speed Calibrate. This potentiometer permits the field engineer to adjust the linear representation of tape speed (at TP3) to any desired reference voltage. These reference voltages are called out in applicable adjustment procedures.

To adjust R13, install the maintenance drive card, on an extender, into LBBB8 of the tape unit. Using the card, drive tape in the desired direction. Monitor TP3 and adjust R13 for required reference.

l. R22, Write Clock Adjustment. The write clock oscillator on the maintenance drive card must be adjusted to produce an output frequency exactly equal to the subsystem write clock frequency so that tapes created with the maintenance drive card have the same data packing density (FCI) as system created tapes. This is very important, as analog gains and the tape speed discriminator (TP3) are density sensitive. Tapes created at the wrong density, because of an incorrectly adjusted write clock or speed errors, will produce erroneous voltages at TP3 of this card, and on the analog test points of the peak detectors.

The procedure for adjusting the write clock frequency on the maintenance drive card is as follows:

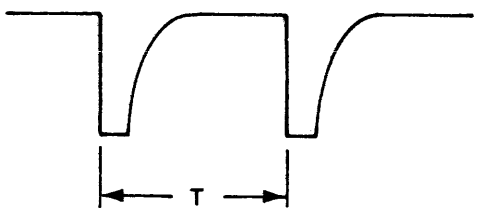
1. Put the maintenance drive card on an extender and plug into backplane location LBBB8.

2. Load an output tape on the tape unit and press the LOAD button.

3. Select 1600 on the operators control panel.

4. Select FWD, CONT, WRITE, and 3200 with the four toggle switches on the maintenance drive card.

5. Monitor backplane pin 1L of the maintenance drive card with an oscilloscope. The write clock will appear as shown in Figure 4-12. Adjust R22 for time T in accordance with figure 4-12.



TRANSPORT SPEED	T (time)
25 ips	12.50 μS
50 ips	6.25 μS
75 ips	4.16 μS
125 ips	2.50 μS

W13378

Figure 4-12. Maintenance Card Frequency Adjustment

SECTION 5
MEC MAINTENANCE

INTRODUCTION

This section describes the adjustments required for the master electronics control (MEC). There is no specified sequence for the adjustments unless otherwise stated in the procedures. The procedures are to be used for checking the adjustments also.

Prior to making any adjustments, the power supply must be checked to be within specification and adjusted as required (refer to section 10 of this manaul).

TIMER SETTINGS

The one-shot timers in the MEC cabinet are adjusted using the MEC maintenance panel and one of the tape units. Table 5-1 lists the one-shot timers, potentiometers, and test points for each of the timer adjustments. Following table 5-1 is a preliminary set-up procedure for setting up the MEC maintenance panel to make the timer adjustments. The preliminary procedure will be used to make all the MEC timer adjustments, with minor changes for the adjustment of the RH1M, RH2M, and SP HOLD timers. The changes are described in the adjustment procedures following the preliminary set-up.

Table 5-1. MEC Timer Settings

Timer Name	Card Location	TP	Pot Adj*	Timer Setting *** 25 ips	50 ips	75 ips	125 ips
IDBM	CBDA7	7	R1	150	75	50	30
WIDT	CBDB6	2	R1	220	110	73	44
RH1M**	CBDA7	8	R2	2.32	1.16	820us	470us
RH2M	CBDA7	9	R3	1	500us	330us	200us
WGNT	CBDB6	3	R7	18	9	6	4
WIGT	CBDB6	1	R6	43	21.5	13	8.8
SP HOLD	CBDA7	5	R13	16	8	5.3	3.2
OCTOT	CBDB6	4	R22	12.2sec	6.1sec	4.06sec	2.44sec

*See figure 5-1 for potentiometer locations.

**With WORD LENGTH switch set to 8 and WRITE PATTERN switch set to 00. This is a preliminary setting.

***Unless otherwise specified timer settings are measured in milliseconds.

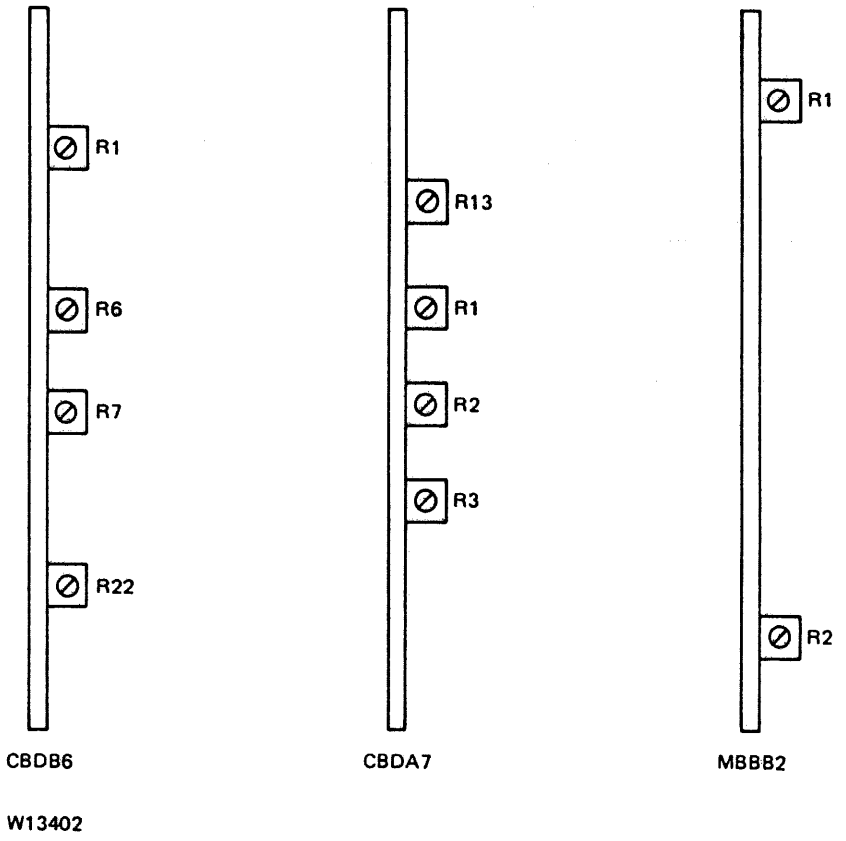


Figure 5-1. Potentiometer Locations

PRELIMINARY SET-UP PROCEDURE

The preliminary set-up procedure must be followed to set-up the MEC maintenance panel and the tape unit for the adjustment of the MEC timers.

a. Put the PROGRAM SELECT toggle switch 3 to OFF.

b. Put the PROGRAM SELECT toggle switches 1, 2 to ON.

c. Put the PROGRAM SELECT switch 1 to WRITE.

d. Put the PROGRAM SELECT switch 2 to REWIND.

e. Put the WORD LENGTH switch to 8.

f. Put the WRITE PATTERN switch to 00.

g. Put the SINGLE INSTRUCTION/HALT ON ERROR/RUN switch to RUN.

h. Put the CLOCK-SINGLE/RUN switch to RUN.

i. Put the UNIT DESIGNATE switch to the unit to be used.

j. Turn the INTER COMMAND DELAY potentiometer fully clockwise.

k. Put the LOCAL/REMOTE switch to LOCAL.

l. Put the CERTIFY/OFF switch to OFF.

m. Put the OBS R/D switch to OFF.

n. Load a reel of tape (with a write-ring on it) on the tape unit. Put the tape unit in local (not online).

IDBM ADJUSTMENT

a. Connect the oscilloscope to test point 7 of the card at CBDA7.

b. Set the oscilloscope controls as follows:

SYNC — Internal
SLOPE — Negative (−)
SWEEP — Normal

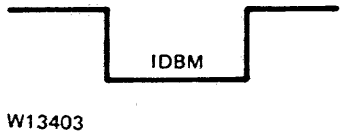


Figure 5-2. IDBM Adjustment

c. Press the START button on the maintenance panel. The lights above PROGRAM SELECT switches 1 and 2 will blink.

d. Adjust potentiometer R1 on the card at CBDA7 for a negative pulse duration stated in table 5-1.

WIDT, WGNT, AND WIGT ADJUSTMENTS

a. Connect the oscilloscope as shown in table 5-1.

b. Set the oscilloscope controls as follows:

SYNC — Internal
SLOPE — Positive (+)
SWEEP — Normal

Figure 5-3. WIDT, WIGNT, and WIGT Adjustments

c. Press the CLEAR and then the START buttons on the maintenance panel. The lights above PROGRAM SELECT switches 1 and 2 will blink.

d. Adjust each timer for their positive pulse duration as stated in table 5-1.

RH1M, RH2M, AND SP HOLD ADJUSTMENTS

a. Put the PROGRAM SELECT switch 2 to the OFF position.

b. Connect the oscilloscope to adjust RH1M as shown in table 5-1.

c. Set the oscilloscope controls for sync-internal positive (+).

d. Press the CLEAR and then the START buttons on the maintenance panel.

e. Adjust the RH1M timer for a positive pulse duration according to table 5-1.

f. Change the oscilloscope to sync-internal negative and check test point 3 of the VFC card at CBBD3 for the correct timing of RH1M, as shown in figure 5-4. Fine adjustment as required.

g. Change the oscilloscope to sync-external negative at TP8 (RH1M). Monitor and adjust RH2M and SP HOLD for a positive pulse duration as shown in table 5-1.

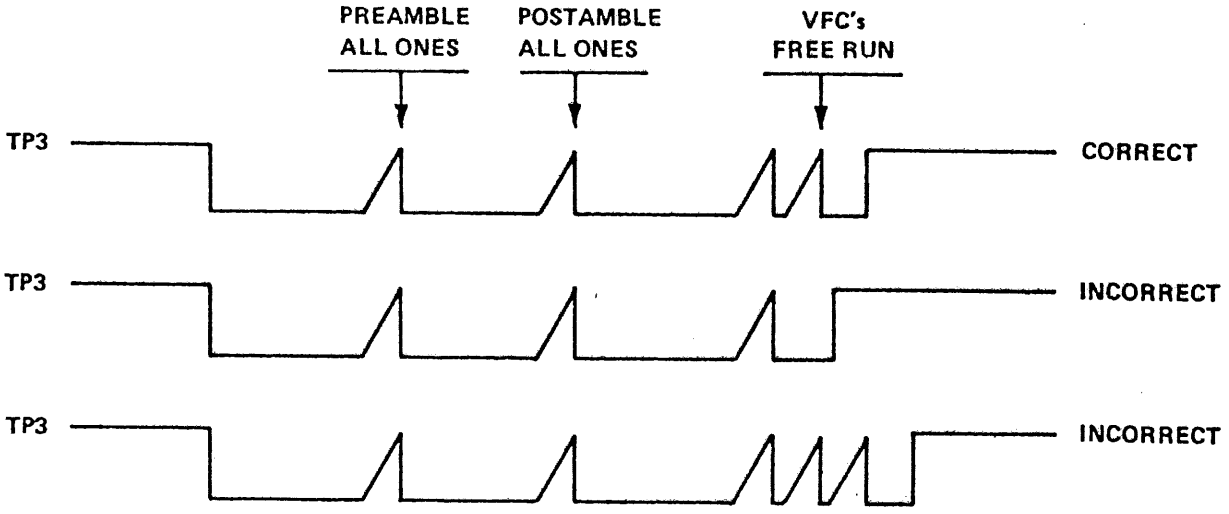


Figure 5-4. RH1M at Testpoint 3 of the VFC Card at CBBD3

Figure 5-5. RH1M, RH2M, and SP HOLD Adjustments

OCTOT ADJUSTMENTS

a. Set the oscilloscope as follows:

   1. INT POS on monitoring probe — Monitor TP4 of CBDB6 (4C Timers).

   2. Time base — as required and will vary depending on speed.

b. Set the maintenance panel as follows:

   1. Program Switch — 1 on; 2 and 3 off.

   2. Program Select — Erase or Write.

   3. Certify Switch — On.

   4. Unit — as desired.

c. Press START and write or erase enough tape to allow timer to time out. After creating a sufficient amount of tape, rewind tape, then change maintenance panel to the following:

   1. Program knob 1 to READ FWD

   2. Program knob 2 to READ REV

   3. Both program switches — On

d. Observe timer and adjust according to table 5-1.

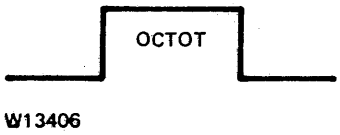


Figure 5-6. OCTOT Adjustment

NOTE

These timer settings give 25 feet of tape travel to correspond to ANSI maximum gap (IBG) size.

CERTIFY OPTION TIMER SETTINGS

If the CERTIFY option is installed, the FWTR and CTTR timers (see table 5-2) must be adjusted to the tape speed of the slave units being used. The following is the procedure for adjusting the CERTIFY option timers.

a. Put the CERTIFY SWITCH on the maintenance panel to the on position.

b. Remove the channel 9 Deskew card from card position CBBAO.

c. Connect a jumper between pins CBDF4T (MPSELECT) and CBBA1R (CE9F).

d. Turn the INTER COMMAND DELAY potentiometer on the maintenance panel fully clockwise.

e. Connect the oscilloscope as follows:

SYNC	Internal
SWEEP	Normal
SLOPE	Positive (+)
MONITOR	As indicated in table 5-2

f. Press the START button on the maintenance panel. The CHANNEL ERROR/CERTIFY COUNT lights on the maintenance panel will count from 1 through 99 and then stop.

g. Press the HALT button and the CLEAR button on the maintenance panel. The CHANNEL ERROR/CERTIFY COUNT counter on the maintenance panel should reset.

h. Turn the INTER COMMAND DELAY potentiometer on the maintenance panel fully counterclockwise.

i. Adjust the FWTR timer (table 5-2).

j. Change the oscilloscope SLOPE to Negative (−).

k. Adjust the CTTR timer (table 5-2).

Table 5-2. Certify Option Timer Settings

Timer Name	Card Location	TP	Pot Adj*	Timer Settings 25 ips	50 ips	75 ips	125 ips
FWTR	MBBB2	3	R1	5.0 ms	2.5 ms	1.67 ms	1.0 ms
CTTR	MBBB2	8	R2	5.5 us	2.8 us	1.8 us	1.1 us

*See figure 5-1 for potentiometer locations.

VFC CARD ADJUSTMENT

The VFC card adjustment is done only on MEC's with phase encoding capabilities. The VFC circuitry uses the MEC power supplies for reference voltages and is therefore dependent upon the accuracy of these supplies. No attempt should be made to make the VFC adjustments until the power supplies have been checked for the proper voltages as instructed in section 10 of this manual. The following is the procedure for adjusting the VFC cards.

a. Mount a scratch reel of tape on one of the tape units in the subsystem, or use the transponder card (see section 4).

b. Select the tape unit from the MEC maintenance panel and do a write certify (any information pattern).

c. Connect a grounded wire to pin CBBC7X (or pin IX) of any VFC card (VRL-M). This will permit the VFC ramp to run free.

d. Connect a grounded wire to pin CBDC9E (ATCF/). This will permit the write clock pulses to run free.

e. Connect the A probe of the oscilloscope to pin CBDC8B (TWLD). Put the trace amplitude at 2 volts/cm.

f. Connect the B probe of the oscilloscope to TP2 of the VFC card at CBBE7. Put the trace amplitude at 1 volt per cm.

g. Press the START button. The tape will move forward. The write clock and VFC ramps will appear on the oscilloscope.

h. Press the clear button. The tape will stop moving, but the write clock and VFC ramps will continue to appear on the oscilloscope.

i. Set the oscilloscope to trigger internal negative and select a sweep speed to display two write clock pulses (see figure 5-7).

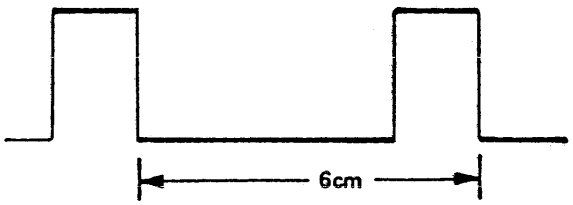


Figure 5-7. Write Clock Pulses

j. Decalibrate the main sweep so that the distance from trailing edge to trailing edge of the write clock pulses is six divisions (centimeters) on the oscilloscope face.

k. Select the B-trace (adjust the trigger level if necessary) and look at the free-running VFC ramp. Do not re-adjust the oscilloscope main sweep calibration.

l. Adjust potentiometer R7 on the VFC card being checked to obtain rise time on the oscilloscope (see figure 5-8).

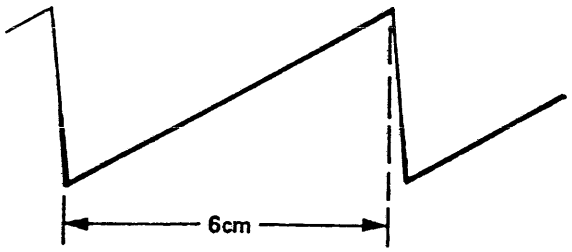


Figure 5-8. VFC Ramp Adjustment

m. Move the B probe to TP2 of each of the remaining eight VFC cards, repeating step l. for each card.

n. Remove the grounding wires that were installed in steps c and d.

o. Verify the tape unit operation by doing a write, read reverse, and read forward using various data patterns and word lengths from the MEC mantenance panel. Also, make certain that the tape unit can read the tapes that were created before the VFC adjustments were made.

SECTION 6
REEL SERVO SYSTEM MAINTENANCE

INTRODUCTION

This section provides instructions for the maintenance of the reel servo system. This section also includes information on the maintenance and adjustment of the autoload cartridge handling hardware. The adjustment procedures are used to check, and adjust the reel servo system. No specific sequence must be followed unless otherwise specified in the procedures.

MAINTENANCE TESTS

The maintenance tests for the reel servo system consist of verifying all the adjustments and exercising the reel servos using the maintenance drive card, the MEC maintenance panel and test routines.

THERMISTOR CHECK

To check for proper connection and operation of the tank thermistors, use the following procedure:

a. With no tape in vacuum columns and the column door closed, power on unit.

b. Turn potentiometers SU, SL, TU and TL fully counterclockwise.

c. Monitor test point SNS and adjust potentiometer OAS for 1.0 volts.

d. Pull plug P6. Test point SNS must drop to about 0.9 volts.

e. Plug P6 back into jack J6.

f. Monitor test point TNS and adjust potentiometer OAT for 1.0 volts.

g. Pull plug P6. Test point TNS must drop to about 0.9 volts.

h. Plug P6 back into J6.

i. Perform initial and final servo adjustments.

SERVO ADJUSTMENTS

The following adjustments are presented in two parts. The first part is the initial set-up, used when a card replacement has been made in the servo logic and precedes the final adjustments. The final adjustments are performed when aligning a previously operational servo, as in the case of a failure and replacement of individual components within the servo system.

INITIAL SERVO ADJUSTMENTS

The following adjustments are made with no tape loaded on the tape unit.

a. Turn potentiometers SU, SL, TU, and TL to their counterclockwise limit (see figure 6-1).

b. Monitor test point SNS and adjust potentiometer OAS for +2.5 volts.

c. Adjust potentiometer SL for 0.0 (zero) volts.

d. Adjust potentiometer SU for −2.5 volts.

e. Monitor test point TNS and adjust potentiometer OAT for +2.5 volts.

f. Adjust potentiometer TL for 0.0 (zero) volts.

g. Adjust potentiometer TU for −2.5 volts.

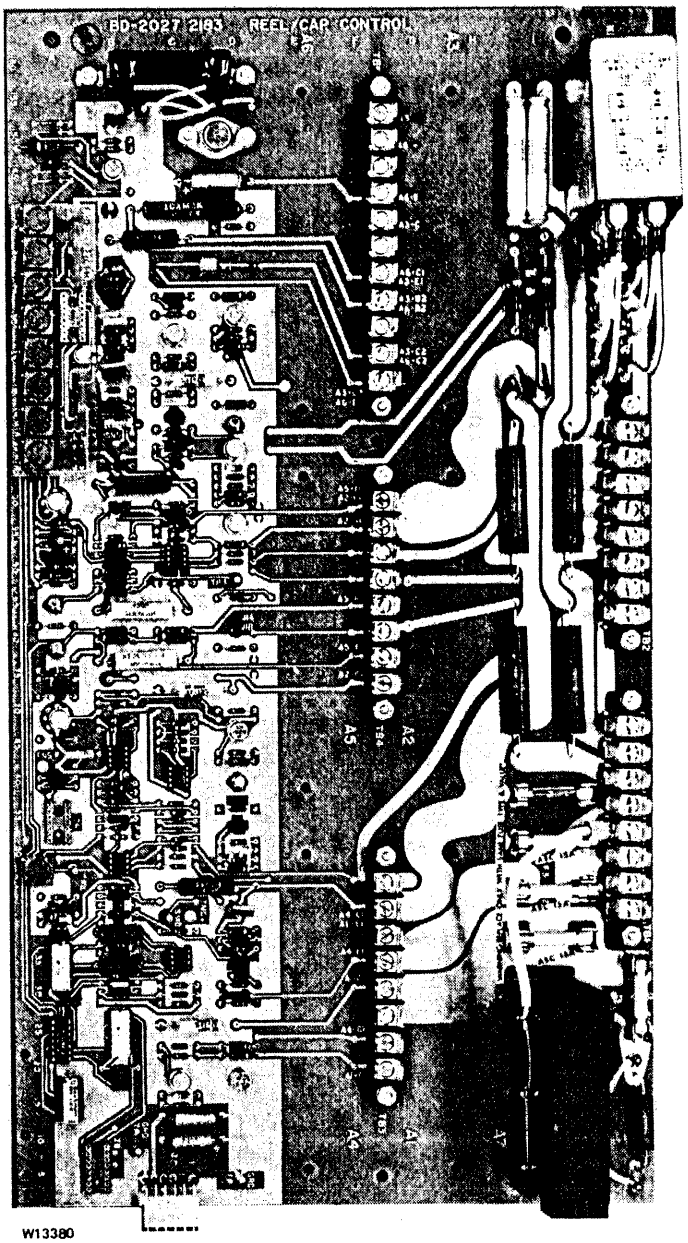


Figure 6-1. Reel/Capstan Control Board

FINAL SERVO ADJUSTMENTS

The final servo adjustments are made when aligning previously operational servo, as in the case of a failure and replacement of individual components within the servo system. If a card replacement has been made, the initial servo adjustments must be made before making the final servo adjustments.

a. Load a reel of tape on the unit.

b. Open the front door and disable the door interlock switch by pulling on the plunger located above the supply reel on the frame.

c. Press the LOAD button and allow the tape to thread and load into the columns. Both tape loops must be close to the center position (see figure 6-2).

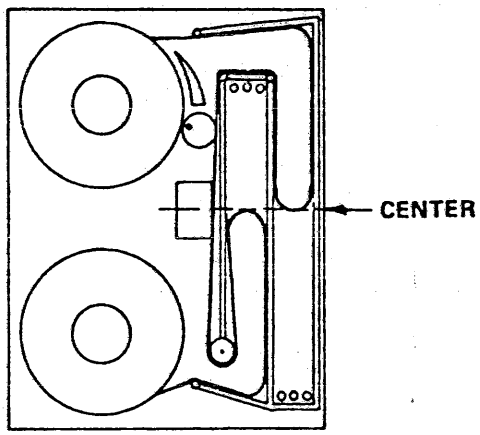


Figure 6-2. Tape Loop in Center Position

Supply Column:

d. Readjust potentiometer SL to position the supply tape loop at the "0" inch mark in the supply column.

e. Monitor test point SNS, while manually rotating the supply reel to line up the tape loop with the lower 4-inch mark. The change at SNS should be 1.2 volts from the "0" inch voltage reading.

f. Adjust potentiometer OAS to obtain the 1.2 volts change.

g. Repeat steps d. through f. until both conditions are met.

h. Manually rotate the supply reel to line up the tape loop with the upper 4-inch mark. Adjust potentiometer SU for a change of 1.2 volts from the "0" inch voltage reading.

Take-up Column:

i. Readjust potentiometer TL to position the take up loop at the "0" inch mark in the take up column.

j. Monitor test point TNS while manually rotating the take-up reel to line up the tape loop with the lower 4-inch mark.

k. Adjust potentiometer OAT for a change of 1.2 volts from the "0" inch voltage reading.

l. Repeat steps i. through k. until both conditions are met.

m. Manually rotate the take up reel to line up the tape loop with the upper 4-inch mark.

n. Adjust potentiometer TU for a change of 1.2 volts from the "0" inch voltage reading.

NOTE

If the adjustments cannot be made as described, something in the light rail, prism rails, or sensors is at fault and must be corrected before the adjustments can be made. Do not try to compensate for mechanical problems or failures with the servo adjustment because this will lead to additional failures.

SERVO NULL CHECK

Load a reel of tape on the tape unit. Upon completion of the load operation, the tape loops in the vacuum columns must be positioned within one inch of the center-line of the columns.

CURRENT LIMITING ADJUSTMENT

This adjustment need only be performed on units operating at 75 or 125 ips. The adjustment range is too narrow to affect the 25 and 50 ips operations.

a. Power ON.

b. Measure test point TP6. Adjust potentiometer CLA for +0.540 volts (see figure 6-1).

CURRENT LIMITING CHECK

Check proper operation of current limiting as follows:

a. Mount a full 10.5 inch reel on the unit.

b. Press the LOAD button and allow the tape to thread and load into the columns.

c. Adjust tape speed (FWD and REV) to 125 ips (refer to section 7).

d. Drive tape to the middle of the reel.

e. Write a record approximately 30 inches long by using the CERTIFY option on the maintenance panel, and pressing the START and HALT buttons each once in rapid order (250 milliseconds).

f. Read forward and reverse (SHOE SHINE) over the record using the maintenance panel program 1 and 2 switches (see MAINTENANCE PANEL in section 5 for instructions).

g. Monitor test point TP3 (SU MTR CUR) with the oscilloscope (see figure 6-1). The peak voltage of the positive and negative peaks must be 464 to 537 millivolts.

h. Monitor test point TP7 (TU MTR CUR) with oscilloscope. The peak voltage of the positive and negative peaks must be 464 to 537 millivolts.

i. Check tape performance in SHOE SHINE mode close to EOT and close to BOT according to steps e. and f. The tape loops must stay in the columns.

j. When proper tape speed for the unit under test differs from 125 ips, adjust to proper tape speed.

TAPE THREAD SENSOR ADJUSTMENT

The tape thread sensor is located in the area of the take-up reel. During the tape threading cycle, this sensor is used to indicate the presence of tape in the take-up reel area after the start of the thread cycle.

a. Unload the tape unit. This adjustment is made without tape on the take-up reel.

b. Monitor test point TTPX on the capstan control card at LBBG5 with a voltmeter or oscilloscope.

c. Adjust potentiometer TPP on the capstan control card (LBBG5) for −4.0 volts.

BOT AND EOT SENSOR ADJUSTMENT

The BOT and EOT sensors are used to indicate that the tape is positioned in the data area or in the leader area.

a. Initial mechanical adjustment.

1. Remove the center thread block and verify that the reflector mirror is centered in the tape path (not the center of the block). If necessary, peel off and relocate the reflector mirror.

2. Mount the thread block so that the left edge and bottom edge are flush with the edges of the tank plate.

3. Monitor EOTX and BOTX on the capstan control card (LBBG5) with an oscilloscope.

4. Turn the EOT and BOT potentiometers fully clockwise.

5. Adjust the position of the EOT/BOT lamp until both sensors generate the same maximum negative output (balanced output). Tighten the mounting screw securely.

b. Final electrical adjustment.

1. Monitor EOTX and BOTX with a meter or an oscilloscope. Remove any tape from the tape path. the tape path.

2. Adjust the EOT and BOT potentiometers for −3.5 volts.

3. Load a reel of tape and position it so that there is no reflective EOT or BOT strip in front of the EOT/BOT sensor. The amplitude of the level at EOTX and BOTX must be no more negative that −1.0 volts. If the amplitude is more negative than −1.0 volts, repeat the initial mechanical alignment.

LOW TAPE SENSOR ADJUSTMENT

To allow the maximum amount of time for the servos to slow down between sensing low tape and BOT, the sensor/lamp block located on the deck casting beneath the take-up hub must be moved as far away from the center of the take-up hub as its mounting holes will allow.

a. Position one of the two reflective strips located on the take-up reel over the low tape sensor. This sensor is located on the deck plate behind the take-up reel.

b. Monitor test point LTPX on the capstan control card at LBBG5 with a meter or oscilloscope, and adjust potentiometer LTP on that same card for −4.0 volts.

c. Monitor test point LTP/ and rotate the take-up reel by hand, ensuring that the voltage level at the test point switches from not more than +0.4 volt when the reflective strip is lined up with the sensor, to not less than +2.5 volts when the reflective strip is not lined up with the sensor.

REEL MOTOR SPEED ADJUSTMENT

The reel motor speed adjustment is done with no tape loaded on the tape unit.

a. Put the tape unit power off.

b. Disconnect the take-up motor plug J28.

c. Put the tape unit power on.

d. Manually rotate the take-up reel for four revolutions. The supply motor will begin to turn.

e. Adjust the SU MTR potentiometer on the sensor preamp board (see figure 6-1) for a supply motor speed of 40 rpm if the tape unit is cold (48 rpm if it is warm) using a hand held tachometer for the measurement.

f. Put the tape unit power off, and connect the take-up motor plug J28.

g. Connect a jumper from test point LTP/ on the capstan control card, to ground.

h. Put the tape unit power on, and press the LOAD button. The take-up reel will begin to turn.

i. Adjust potentiometer TU MTR on the sensor preamp board for 110 rpm if the tape unit is cold (130 rpm if it is warm) using a hand held tachometer for the measurement.

j. Put the tape unit power off and remove the jumper from the capstan control card.

TAPE CARTRIDGE HARDWARE ALIGNMENT

The following alignments are necessary for the proper functioning of the cartridge handling mechanism. The supply motor alignment must be checked if the cartridge retainer alignment can not be properly performed.

SUPPLY MOTOR ALIGNMENT

This procedure uses the motor alignment tool, part number 2027 1664, to center the supply reel motor with respect to its mounting holes in the deck casting. The supply hub must be removed from the supply motor shaft, two of the motor mounting bolts (diagonal to each other) must be removed, and the other two loosened.

To align the motor position, slide the motor alignment tool over the supply motor shaft and at the same time position the motor so that the posts on the tool can be pushed into the empty (diagonal) motor mounting bolt holes. With the supply motor now aligned, tighten the remaining two mounting bolts. Remove the tool, and install and tighten the remaining two mounting bolts. Install the supply hub on the motor shaft.

CARTRIDGE OPENER ALIGNMENT

This procedure adjusts the position of the cartridge opening motor so that the opening pin contacts the cartridge and opens it correctly.

a. Put the cartridge alignment tool, part number 2027 1417, on the supply hub as if it were a reel of tape.

b. Rotate the aligment tool so that the cartridge opening pin contacts the detent in the tool outer rim (see figure 6-3). If adjustment of the cartridge opening pin is required, loosen the cartridge opener motor mounting screws as shown in figure 6-3 and shift the motor into position.

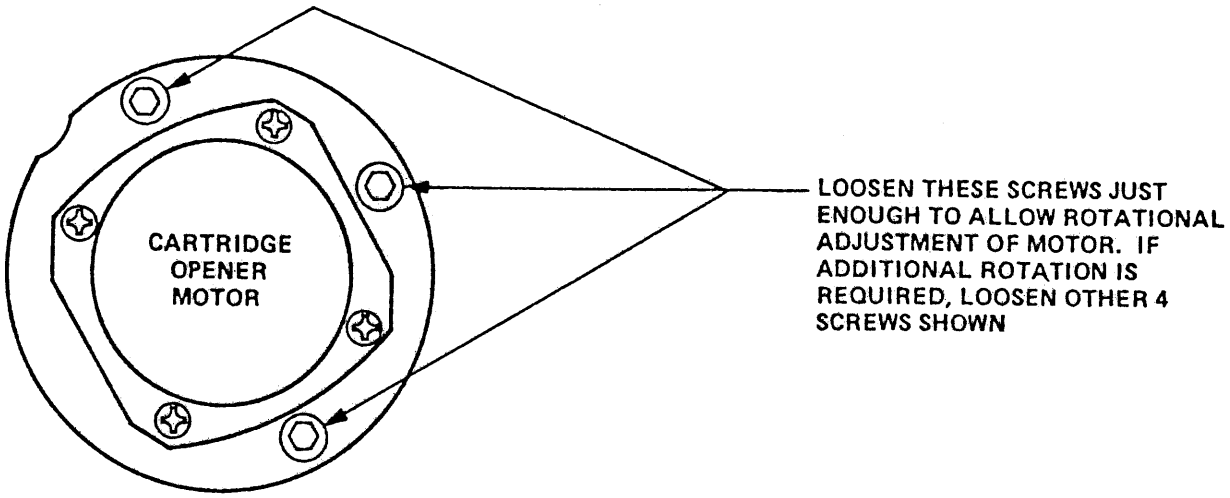
CARTRIDGE RETAINER ALIGNMENT

The following procedure adjusts the upper and lower cartridge retainers and the thread block to correctly receive and hold the cartridge band.

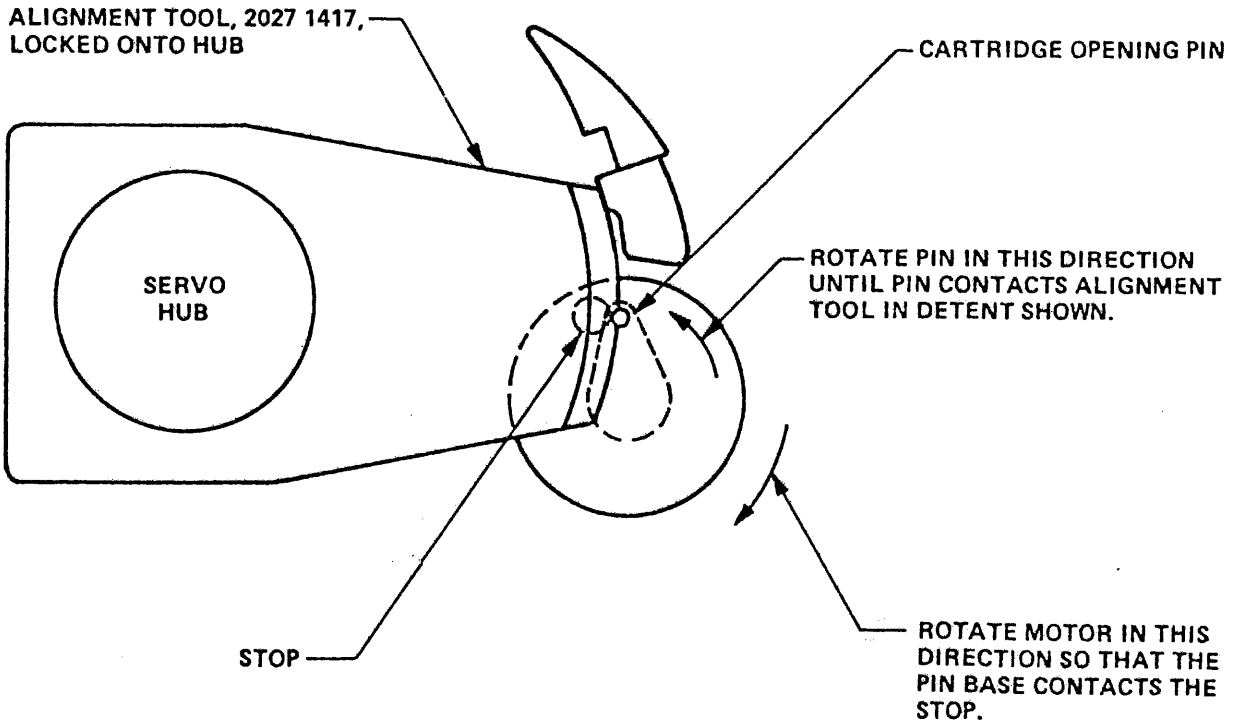
a. Put the cartridge alignment tool, part number 2027 1417, on the supply hub as if it were a reel of tape.

b. Loosen the upper and lower retainer and threading block mounting screws.

c. Rotate the tool, align the retainers and threading block, as shown in figure 6-4, and tighten the mounting screws.

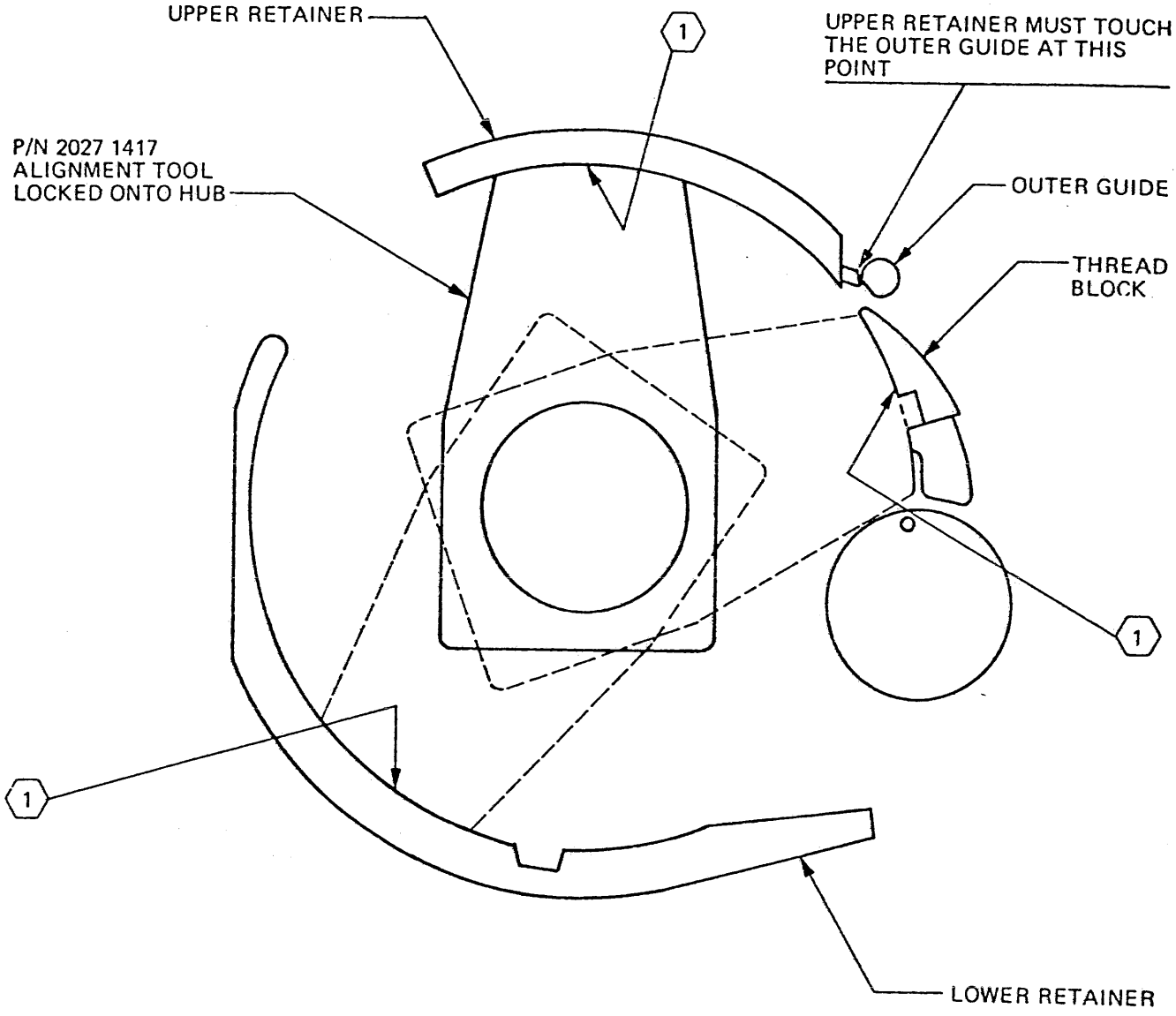


REAR VIEW



FRONT VIEW

Figure 6-3. Cartridge Opener Adjustment



1 FOR CORRECT ALIGNMENT THE INSIDE CURVED SURFACES OF THE RETAINERS AND THREAD BLOCK MUST BE IN LIGHT CONTACT WITH THE ALIGNMENT TOOL.

Figure 6-4. Alignment of Cartridge Retainer Parts

SUPPLY REEL HUB DISASSEMBLY, REASSEMBLY, AND ALIGNMENT

The following procedure and figures 6-5 through 6-7 describe the disassembly, assembly, and alignment of the supply reel hub.

SUPPLY HUB DISASSEMBLY

To disassemble the supply reel hub, perform the procedures shown in figure 6-5.

SUPPLY HUB ASSEMBLY AND ALIGNMENT

To assemble and align the supply reel hub, proceed as follows:

a. Put the bushings, spacer, and nut on the hub and carefully slide the hub onto the supply motor shaft. The clamping nut must be loose.

b. Remove the thread block assembly from the deck. This must be done to allow the alignment tool to be placed properly.

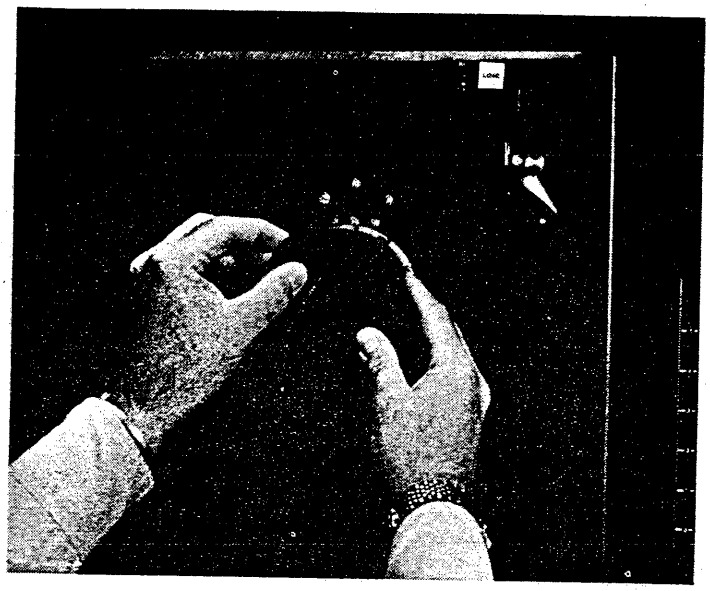
c. Put the supply hub alignment tool, part number 2048 5140, in position (see figure 6-6). The plastic ring must be in position on the hub before using the alignment tool. Position the supply hub so that it is flush against the back of the alignment tool.

d. Hold the hub holding tool so that the hub will not move on the shaft, and tighten the clamping nut to 420 pound-inches. Reposition the supply hub alignment tool to make sure that the alignment is correct.

e. Reassemble the hub using the reverse of the disassembly procedure (steps 1 through 8 of figure 6-5).

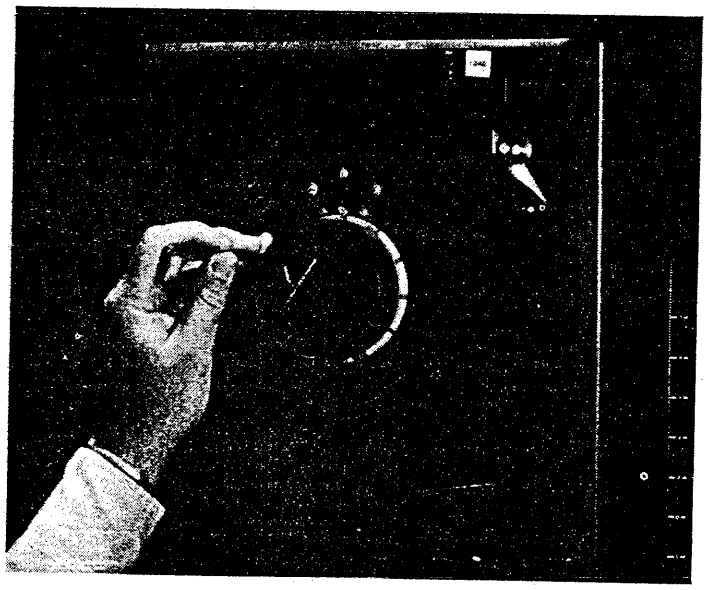
f. Adjust hub according to HUB ADJUSTMENT PROCEDURE in this section.

g. Load a reel of tape on the tape unit and do a load operation to check that the tape positions itself correctly in the load throat.



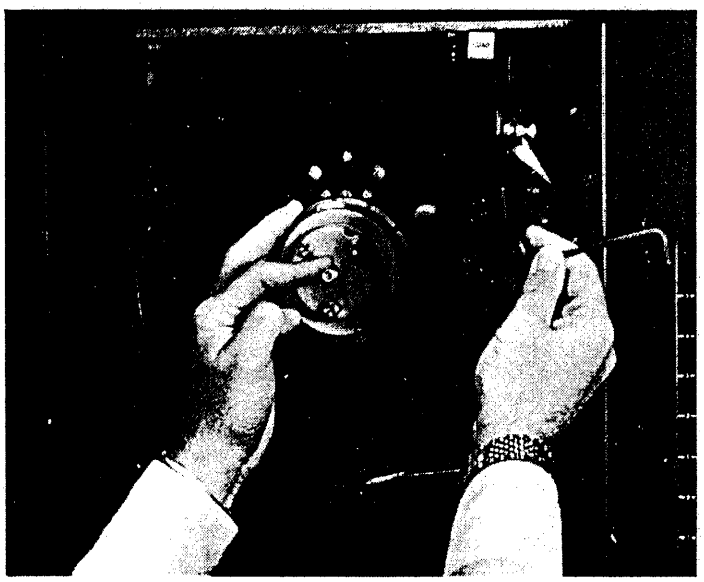
W13381

1. PUT THE REEL LATCH IN THE UNLATCHED POSITION AND REMOVE THE HUB COVER PLATE. THE MECHANISM IS SPRING LOADED AND IT IS BETTER TO DISASSEMBLE WITH LATCH IN THE UNLATCHED POSITION.



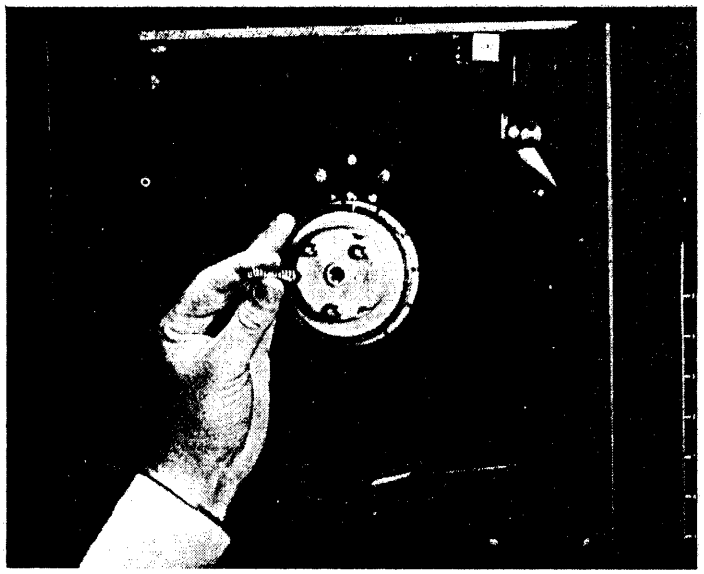
2. REMOVE THE THREE BRISTOL SCREWS THAT SECURE THE SUPPLY REEL HUB.

Figure 6-5. Supply Hub Disassembly, Sheet 1 of 4



W13383

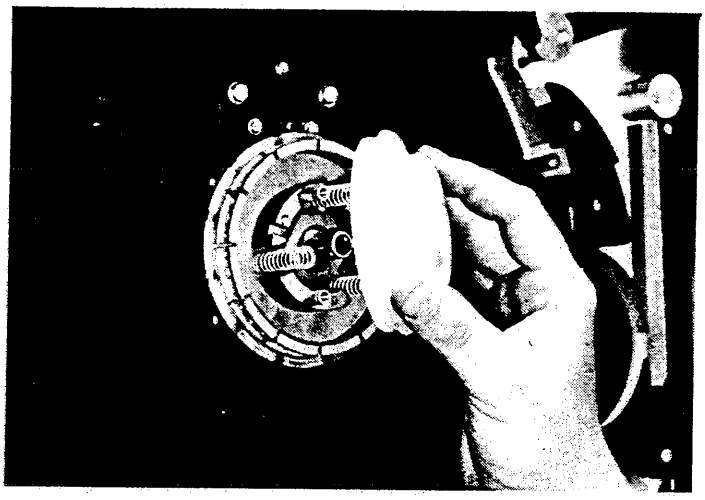
3. REMOVE THE SUPPLY REEL HUB FROM THE HUB BASE HOUSING ASSEMBLY.



W13384

4. REMOVE THE COMPRESSION SPRING FROM THE CENTER OF THE HUB BASE.

Figure 6-5. Supply Hub Disassembly, Sheet 2 of 4



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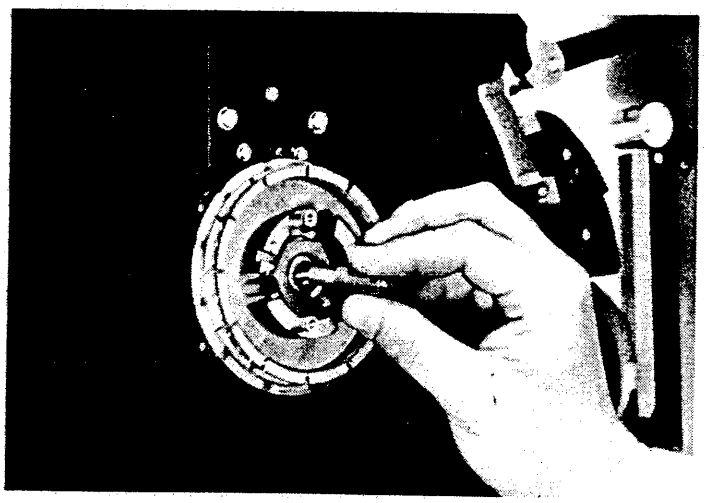
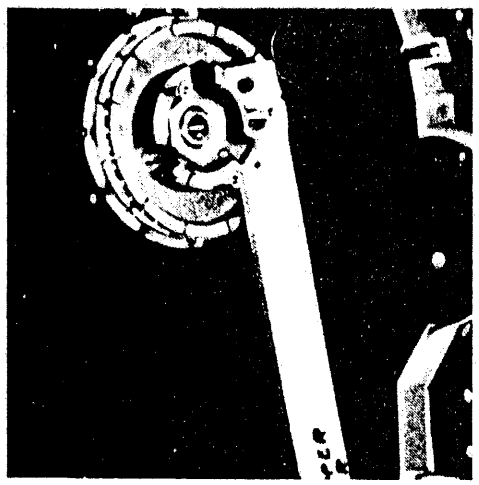
5. REMOVE THE 3 C-CLIPS THAT SECURE THE LARGE NYLON PISTON. REMOVE THE PISTON AND THE 3 COMPRESSION SPRINGS.



W13386

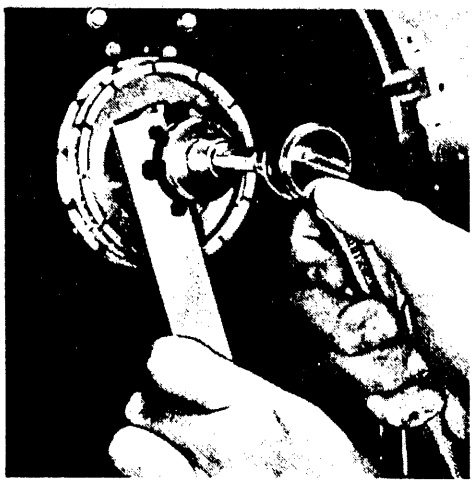
6. REMOVE THE PISTON GUIDE STUD FROM THE CENTER SHAFT.

Figure 6-5. Supply Hub Disassembly, Sheet 3 of 4



W13387

7. SECURE THE UPPER HUB HOLDING TOOL (2048 5165) TO THE HUB USING 2 OF THE ALLEN SCREWS REMOVED IN STEP 2.



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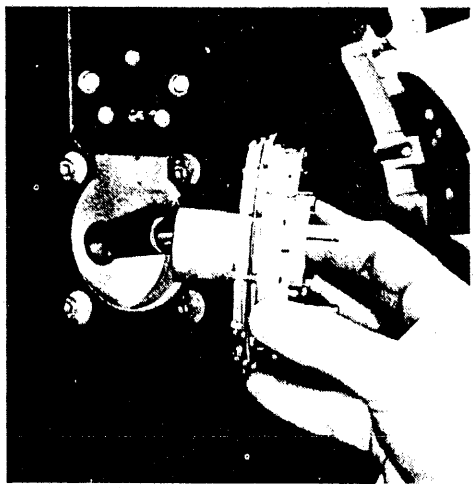
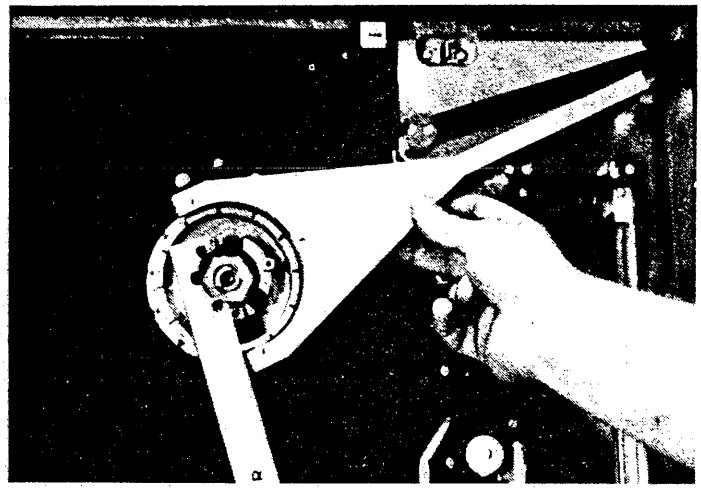
8. LOOSEN THE CLAMPING NUT USING A 1-1/8 INCH SOCKET WRENCH (1622 1802) WHILE SECURELY HOLDING THE UPPER HUB HOLDING TOOL.



W13389

9. TAP THE HUB SHARPLY WITH A NEOPRENE HAMMER TO LOOSEN THE COMPRESSION BUSHINGS ON THE SHAFT AND REMOVE THE HUB. INSPECT THE MOTOR SHAFT, BUSHINGS, AND SPACER FOR EXCESS WEAR.

Figure 6-5. Supply Hub Disassembly, Sheet 4 of 4



W10056

Figure 6-6. Supply Hub Alignment

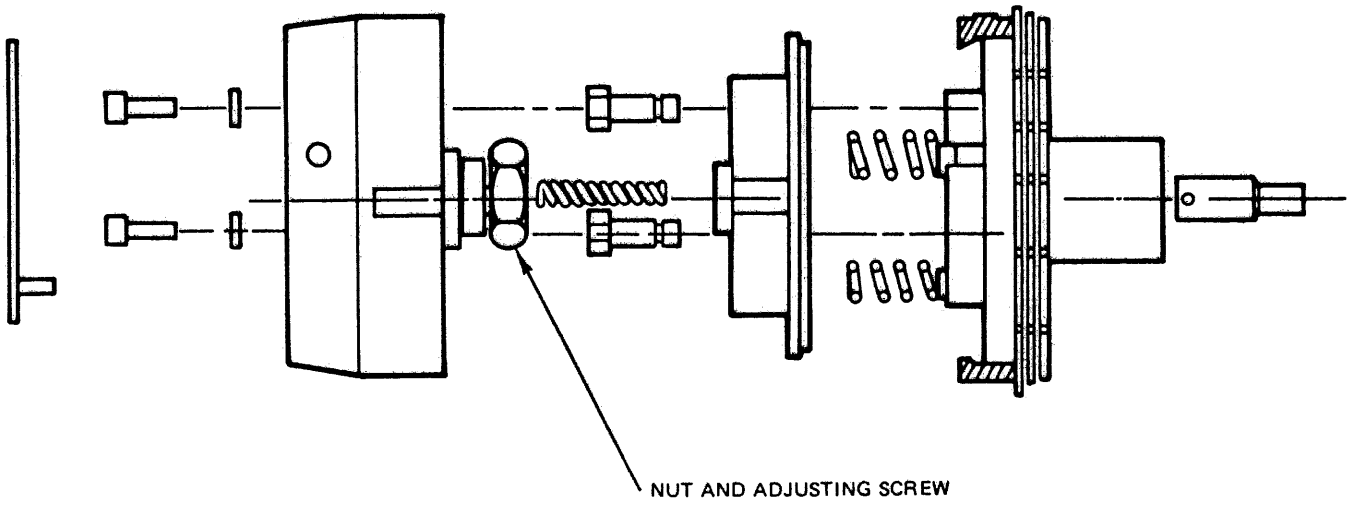
HUB ADJUSTMENT PROCEDURE

a. With no reel mounted, lock hub (lever out). Press lever several times with light pressure to feel play in lever before the heavy force of the piston is contacted.

b. Turn adjusting screw (use a small screw driver or similar tool) under the hub lever out until all play is removed (see figure 6-7).

c. Unlock hub and mount a cartridge alignment tool, P/N 2027 1417, onto the hub. If the tool will not go onto the hub, turn adjusting screw out approximately one-quarter turn at a time until reel will go onto lock hub.

d. With tool locked onto hub, the amount of play at the end of the lever must be adjusted to 0.08 to 0.10 inch by turning adjusting screw.



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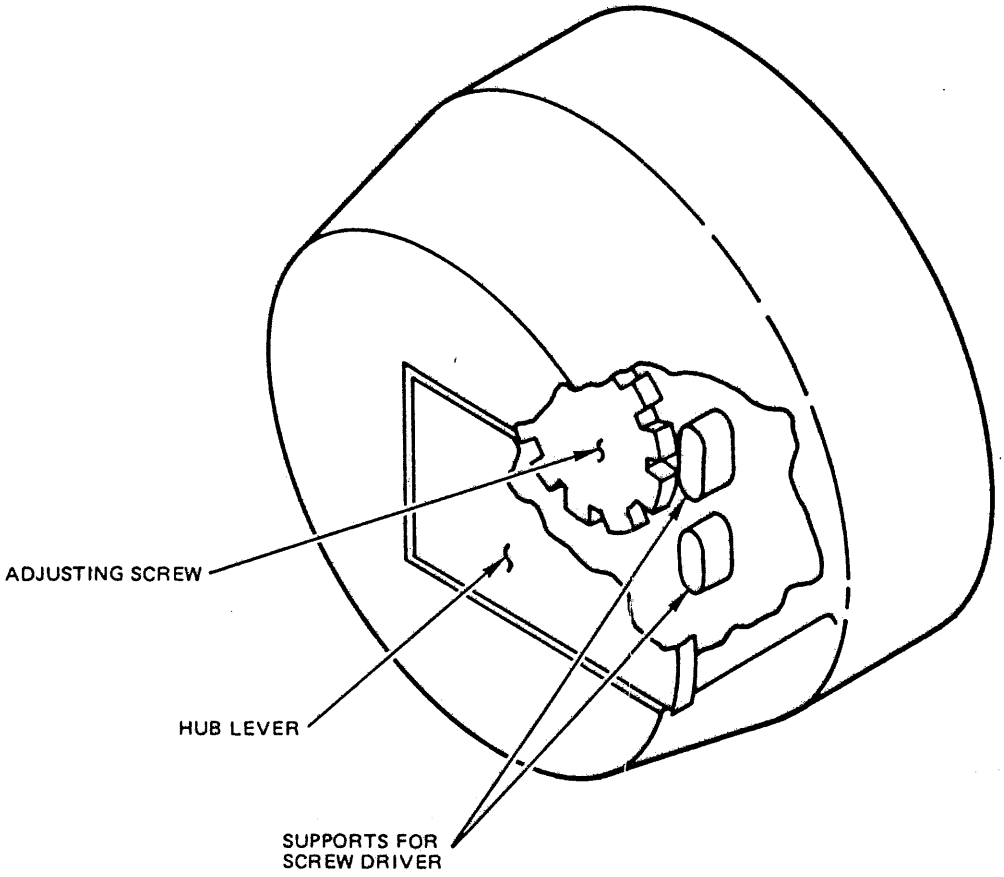


W13391

Figure 6-7. Supply Hub Adjusting Screw

TAKE-UP HUB DISASSEMBLY, ASSEMBLY, AND ALIGNMENT

The following procedure and figures 6-8 and 6-9 describe the disassembly, assembly, and alignment of the take-up hub.

a. To disassemble the take-up hub, proceed as follows:

1. Remove the six phillips-head screws which secure the outer flange of the take-up reel to the hub, and remove the outer flange.

2. Put the lower hub holder tool, part number 2048 5223, into position as shown in figure 6-8, and using a 1-1/8 inch socket wrench, loosen the hub clamping nut.

3. Tap the hub sharply with a neoprene hammer to loosen the bushings on the shaft and remove the hub. Inspect the motor shaft, bushings, and spacer for excessive wear.

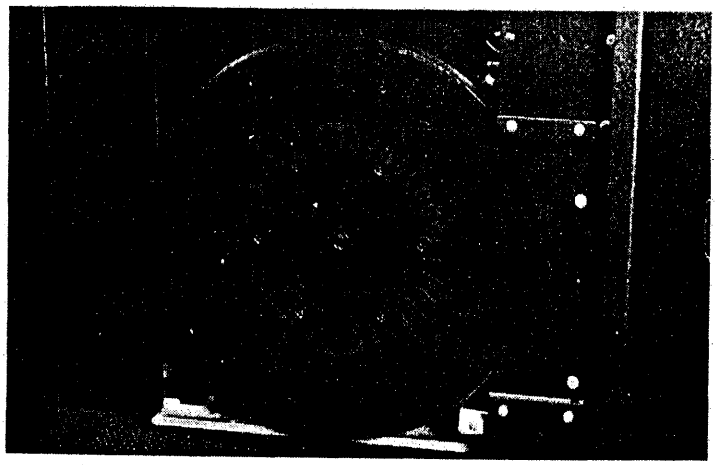
b. To assemble and align the take-up hub, proceed as follows:

1. Put the take-up hub on the take-up motor shaft and position the lower lub alignment tool, part number 2048 5231, as shown in figure 6-9. Be sure that the rear of the tool is flush on the rear flange, and that the bar is flush on the deck casting.

2. Hold the lower hub holding tool in place so as not to allow the hub to slip on the shaft, and tighten the clamping nut to 420 pound-inches. Reposition the lower hub alignment tool and check that the alignment is correct.

3. Reassemble the outer flange on the take-up hub and tighten the six phillips-head screws which hold it.

4. Load a reel of tape on the tape unit and do a load operation to check that the tape tracks correctly onto the take-up reel, and that the tape does not rub against the take-up reel flanges.



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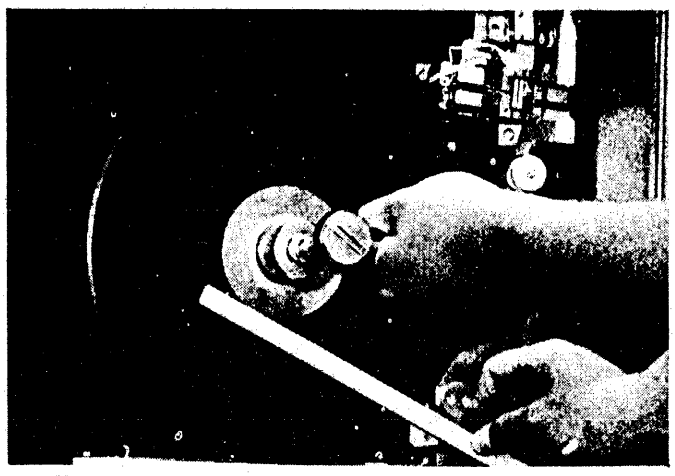

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Figure 6-8. Tape-Up Hub Disassembly

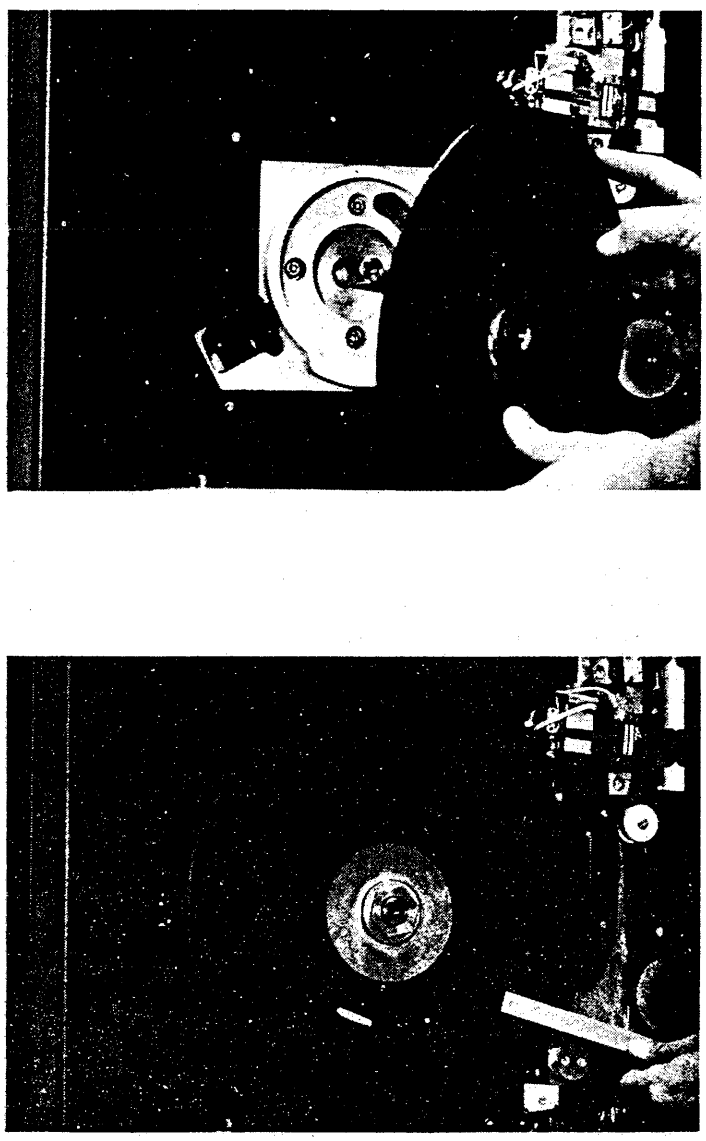

Figure 6-9. Tape-Up Hub Assembly

SECTION 7
CAPSTAN SERVO SYSTEM

INTRODUCTION

This section provides instructions for the maintenance of the capstan servo system. The adjustment procedures are used to check and adjust the capstan servo system. No specific sequence must be followed unless otherwise specified in the procedures.

CAPSTAN MECHANICAL ALIGNMENTS

The following alignments position the capstan with respect to the deck casting and tape guide blocks. The capstan mechanical alignment must be correct before making any other capstan adjustments.

CAPSTAN CLEARANCE

With no tape in the vacuum column, the clearance between the outside diameter of the capstan and the vacuum column wall and guide block must be between 0.005 and 0.009 inch. A tab-card should be used to measure this clearance because it bends freely and will not damage the capstan (see figure 7-1).

CAPSTAN TRACKING (DYNAMIC ALIGNMENT CHECK)

During consecutive forward and reverse drive operations, the tape must move so that there is no visible front-to-back motion of the tape on the capstan, and the tape must just touch the back plate (shown in figure 7-1) without any creasing, distortion or wrinkles at this point. Check the capstan dynamic tracking as follows:

a. Load a reel of tape on the tape unit.

b. Remove the capstan cover plate from the vacuum column door assembly.

c. Drive tape forward and reverse using the maintenance drive card at LBBB8. Check that the tape moves in the center of the capstan without lateral motion. If the tape does not track properly, the capstan or motor may require replacement. Before replacing the capstan motor, check for burrs or scratches on the capstan motor mounting plate or on the machined surface of the deck.

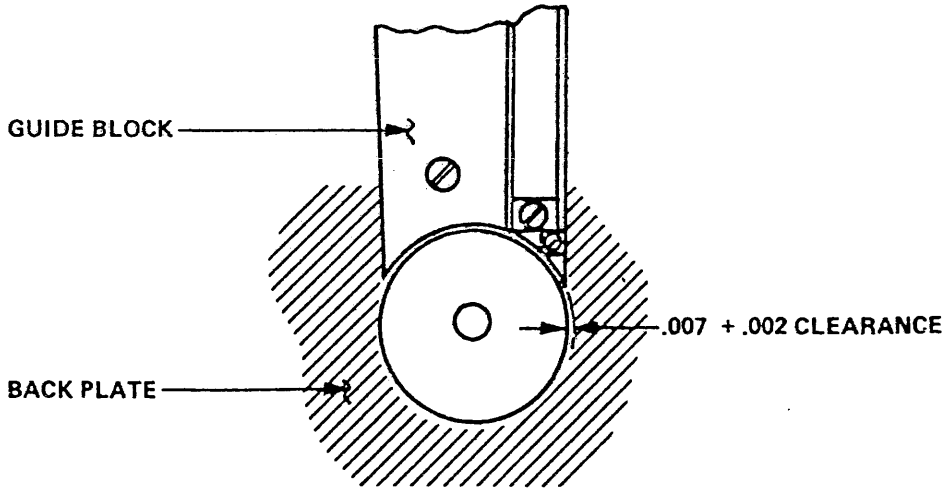

Figure 7-1. Capstan Clearance

CAPSTAN ELECTRICAL ADJUSTMENTS

All capstan adjustments are done with the tape unit in local. Use the maintenance drive card at LBBB8 for these adjustments.

Prior to making any adjustments, the power supply must be checked to be within specification and adjusted as required (refer to section 10 of manual).

NULL

With the tape in the columns and no tape motion, adjust NULL potentiometer on the capstan control card at LBBG5 for zero volts at backplane pin LBBG6E of that same card.

FORWARD SPEED

a. Hold a hand tachometer (Jacquets indicator) on the shaft extension at the rear of the capstan motor.

b. Using the maintenance drive card (position LBBB8), drive the tape forward in the continuous mode.

c. Adjust potentiometer "FWD" on the capstan control card at LBBG5 for the correct rpm reading as in table 7-1.

Table 7-1. Capstan Speed and Start/Stop Ramp

Tape Speed (ips)	Capstan Speed (rpm)	Rewind Speed (rpm)	Start Time (ms)	Stop Time (ms)	WNGT (Ref only) (ms)
25	240 ± 3	4020 ± 10	16.0 ± 0.5	27.0 ± 1.0	18.0 ± 0.5
50	480 ± 5	4020 ± 10	6.5 ± 0.25	6.5 ± 0.25	9.0 ± 0.25
75	720 ± 7	4020 ± 10	5.0 ± 0.2	5.0 ± 0.2	6.0 ± 0.2
125	1200 ± 12	4020 ± 10	3.5 ± 0.2	3.0 ± 0.2	4.0 ± 0.2

REVERSE SPEED

a. Drive tape in the reverse continuous mode with the maintenance drive card.

b. Adjust potentiometer "REV" on the capstan control card, at LBBG5 for the correct rpm reading as in table 7-1.

REWIND SPEED

a. Press the REWIND button, and allow the tape to rewind for 30 seconds.

b. Insert the tachometer on the shaft extension on the capstan motor.

c. Adjust the "RWD" potentiometer on the capstan control card for a reading of 4020 rpm on the tachometer.

START/STOP ADJUSTMENT

a. Refer to table 7-1 for the correct start/stop times.

b. Load a scratch reel of tape and write all "1's" (3200 fci) for the full length of tape, using the maintenance panel CERTIFY option or a properly adjusted maintenance drive card (see section 4).

c. Rewind the tape.

d. Using the maintenance drive card (LBBB8), drive tape in the forward start/stop mode.

e. Connect an oscilloscope as follows:

1. Trigger external negative (−) on TP1 of the maintenance drive card.

2. With "A" probe, monitor test point RMP on the capstan control card at position LBBG5. See figures 7-2 through 7-5 and adjust the ACC potentiometer for the start time given in table 7-1. The tach feedback (TFB) test point should be monitored on "B" probe (inverted) to check the waveforms as shown in figures 7-2 through 7-5.

3. Change the trigger slope to positive (+).

4. See figures 7-2 through 7-5, and adjust the DEC potentiometer on the capstan control card at position LBBG5 for the stop time given in table 7-1.

f. After this adjustment is made, compare it to TP3 of a properly adjusted maintenance drive card to ensure that no tape slippage is occurring.

NOTE

Using an "all bits" tape and monitoring the analog signal at TP1, TP4, or TP7 of any peak detector will provide a good illustration of tape motion.

g. To check for a correct IBG, proceed as follows:

1. Using the maintenance panel, create a tape with eight character blocks and intercommand delay at maximum.

2. Read the tape forward or reverse with the maintenance drive card in continuous mode (on the fly) and monitor the analog signal (TP1 on any peak detector) for an interblock gap according to table 7-2.

Table 7-2. Interblock Gap (IBG)

Speed	IBG Size	IBG Time
25 ips	0.625 ± 0.03 in.	25 ± 1.2 ms
50 ips	0.625 ± 0.03 in.	12.5 ± 0.6 ms
75 ips	0.625 ± 0.03 in.	8.3 ± 0.4 ms
125 ips	0.630 ± 0.05 in.	5.0 ± 0.4 ms

SECTION 8
VACUUM AND PRESSURE SYSTEM

INTRODUCTION

This section provides procedures for the maintenance of the vacuum and pressure system. The adjustment procedures are used to check and adjust the vacuum and pressure system. No specific sequence must be followed unless otherwise specified in the procedures.

BLOWER BELT TENSION AND TRACKING ADJUSTMENT

The following adjustment requires the use of the spring gauge tool part number 2027 6721.

BELT TENSION

The belt tension is adjusted by loosening the three blower mounting bolts (see figure 8-1), and pulling on the blower shaft with a spring gauge to a force of 21 pounds. Holding the pulling force at 21 pounds, tighten the mounting bolts. Upon completion of this adjustment, check the belt tracking.

COMPRESSOR PULLEY CLEARANCE

The pulley on the compressor must be adjusted for close running clearance with its own base at 0.035 ±0.010 inch (0.089 ±0.025 cm).

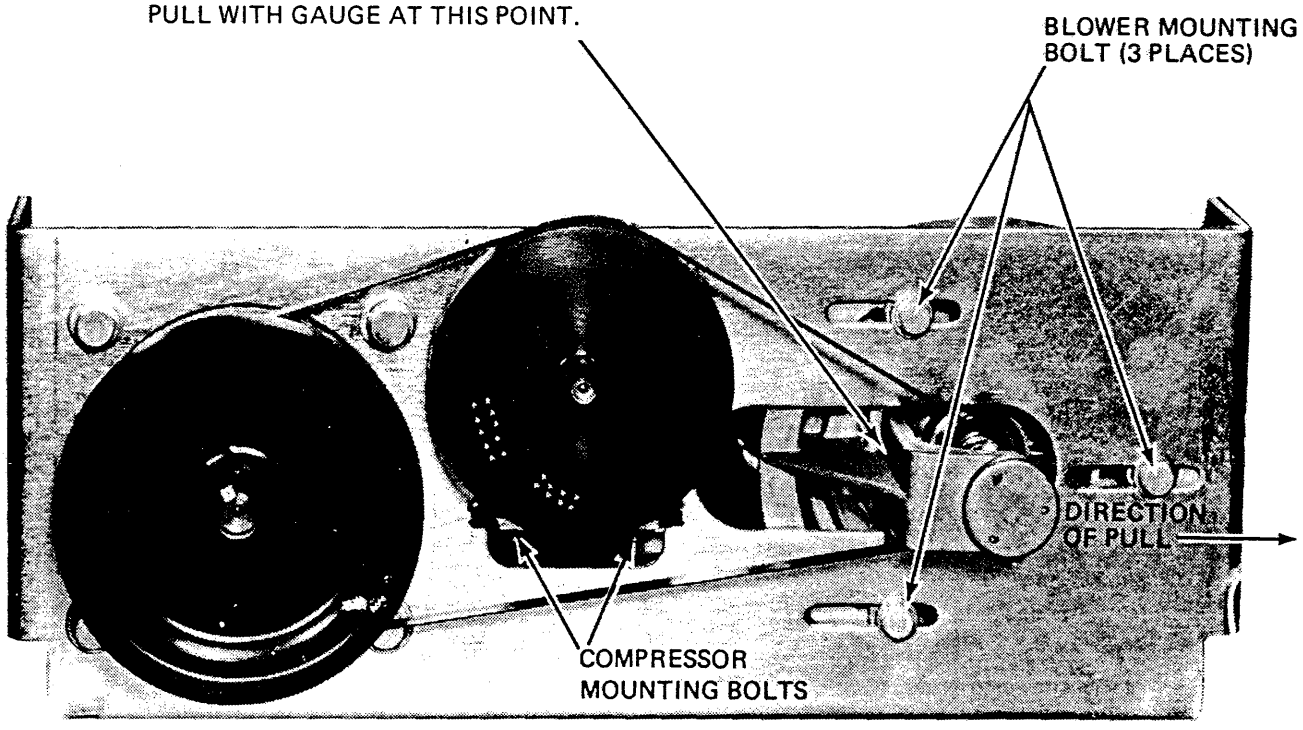

Figure 8-1. Blower Belt Tension and Tracking

BELT TRACKING

Adjust the belt tracking by loosening the compressor mounting bolts (see figure 8-1) and adjusting its position so that the belt tracks in the center of all the pulleys while turning the motor pulley in the clockwise direction.

For altitudes 5000 feet (1524 meters) and above, the belt must be repositioned on the smaller diameter pulley of the blower. Readjust belt tracking; this can require repositioning of the motor pulley to achieve proper tracking.

MAIN AND THREAD AIR PRESSURE ADJUSTMENT

This adjustment adjusts the air pressure at the tape threading blocks which guide the tape leader through the tape path and onto the take-up reel during an autoload cycle. This adjustment is made during a load cycle. Ground LT PX on capstan control and depress LOAD.

a. Monitor the main pressure test point with a pressure gauge (figure 8-2).

b. Adjust the main pressure bleed plate over the main pressure bleed hole for 30.0 inches of water pressure (1.08 pounds per square inch).

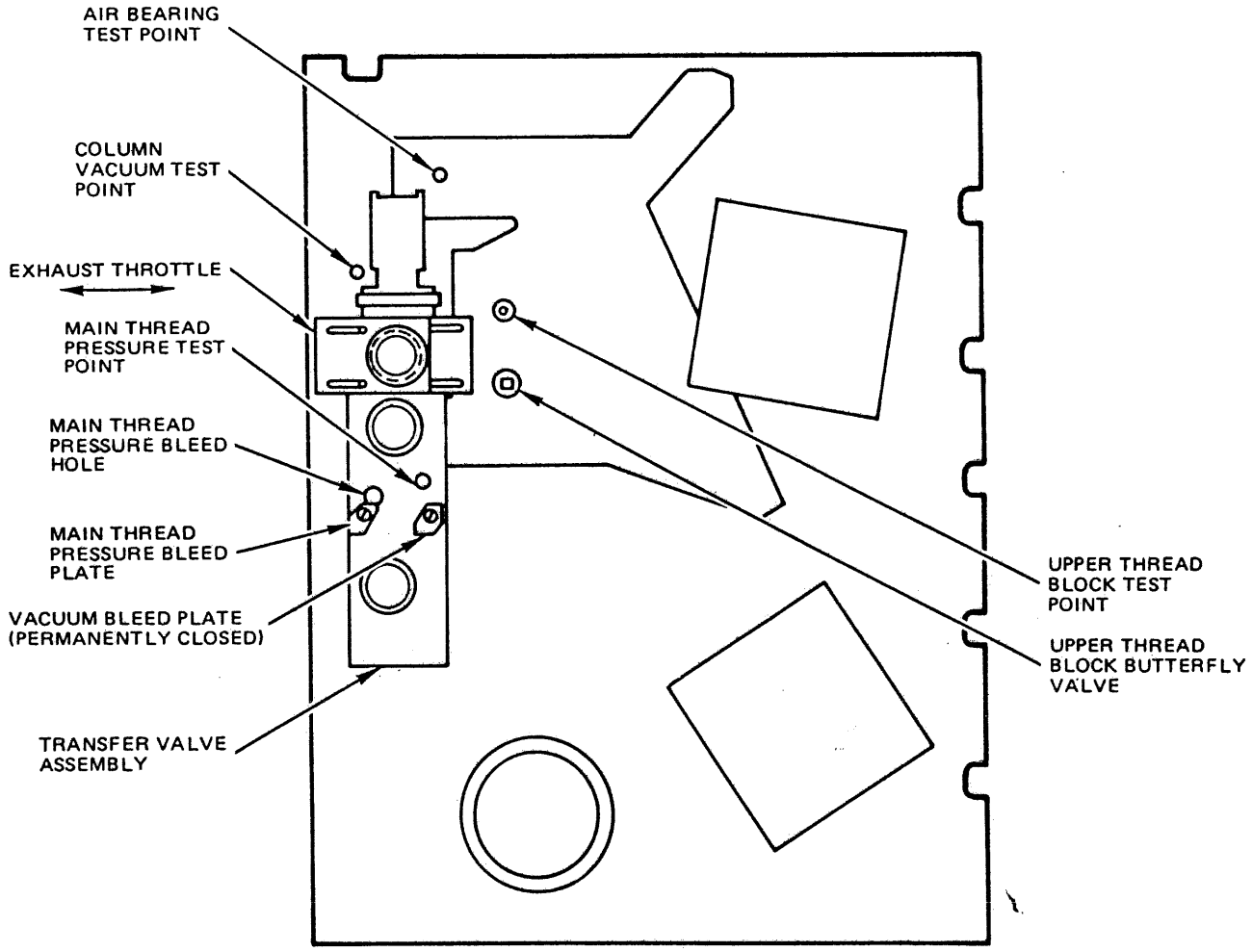

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Figure 8-2. Rear View of Deck Assembly

c. Monitor the upper thread block test point with a pressure gauge and adjust the upper thread block needle-valve for 10 ±1 inches of water pressure (0.36 ±0.036 pounds per square inch).

COLUMN AIR VACUUM ADJUSTMENT

This adjustment adjusts the vacuum pressure in the tape vacuum columns so that the proper tape tension is applied across the read/write head.

a. Mount a reel of tape on the tape unit, and perform a load operation so that tape is in the vacuum columns.

b. Monitor the column vacuum test point to have 30 ±2 inches of water (IOW).

c. Adjust the exhaust throttle as required to obtain 30 inches of water (IOW) vacuum (1.08 pounds per square inch (PSI). Loosen the two screws that secure the throttle to the transfer valve assembly and slide the throttle to the right or left.

AIR BEARING PRESSURE

The air bearing pressure is not adjustable. With a tape loaded, the pressure at the air bearing pressure test point must be 33 to 66 IOW (1.2 to 2.4 PSI).

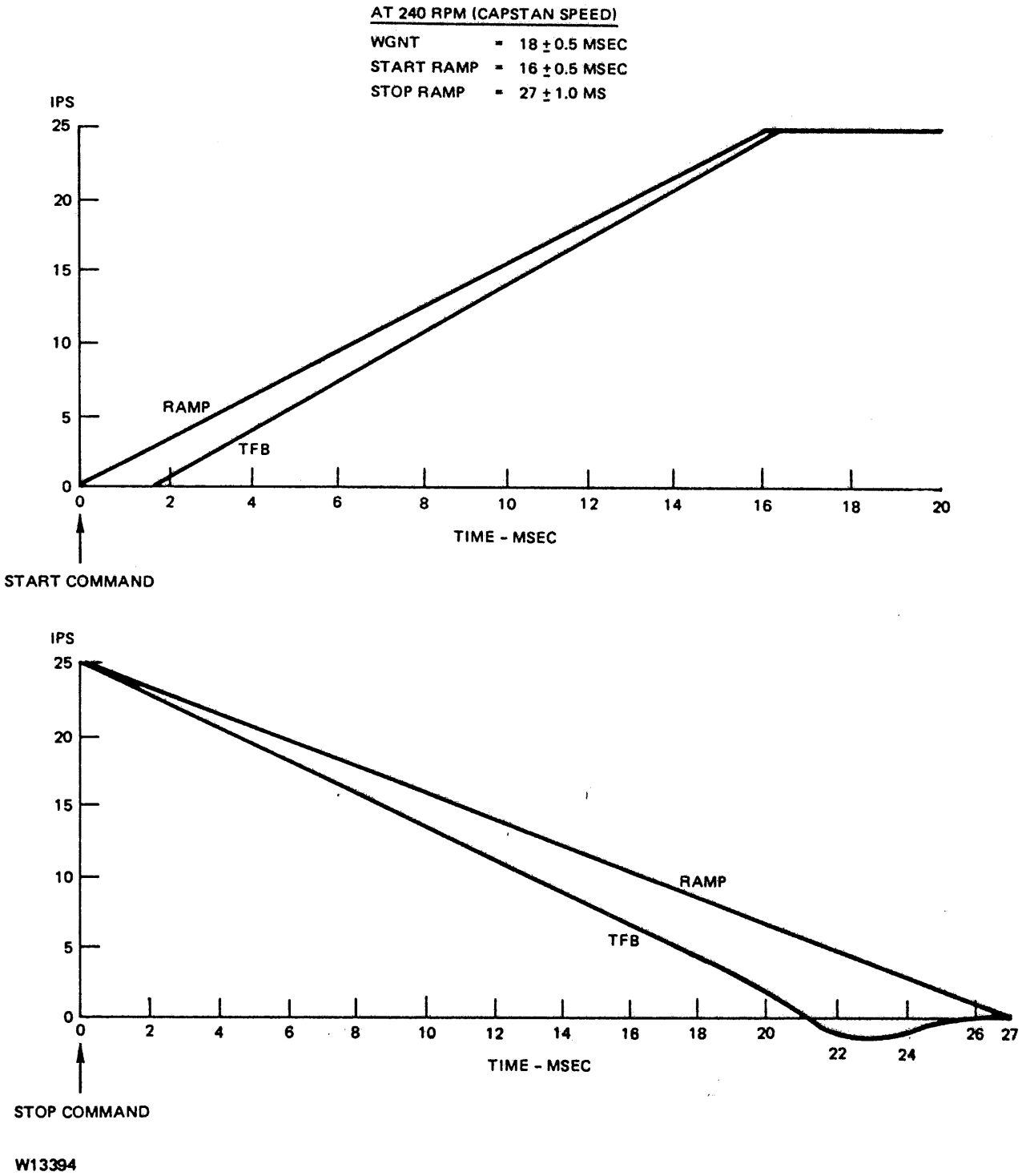

Figure 7-2. Start/Stop Time and Profile (25 ips)

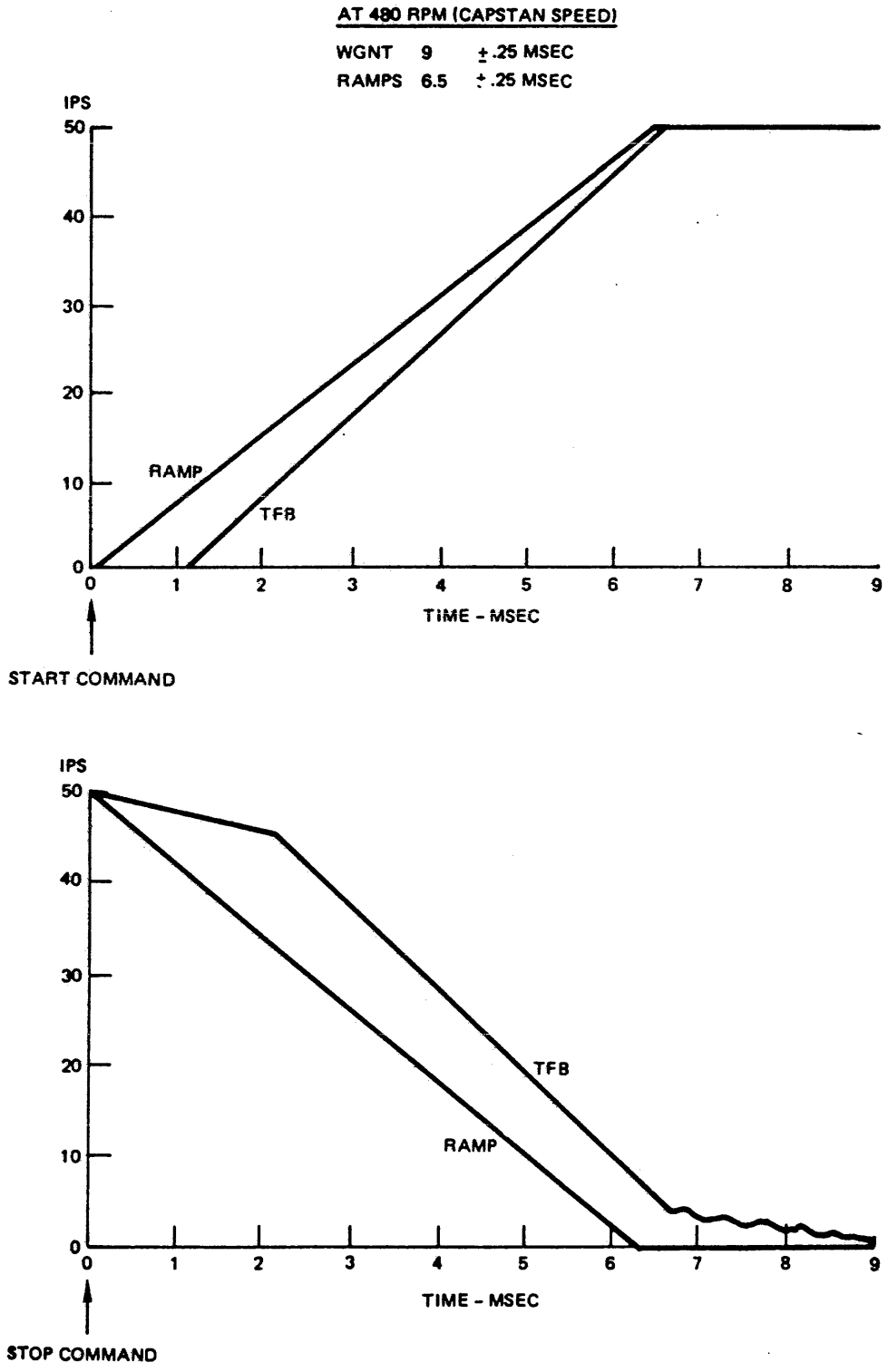

Figure 7-3. Start/Stop Time and Profile (50 ips)

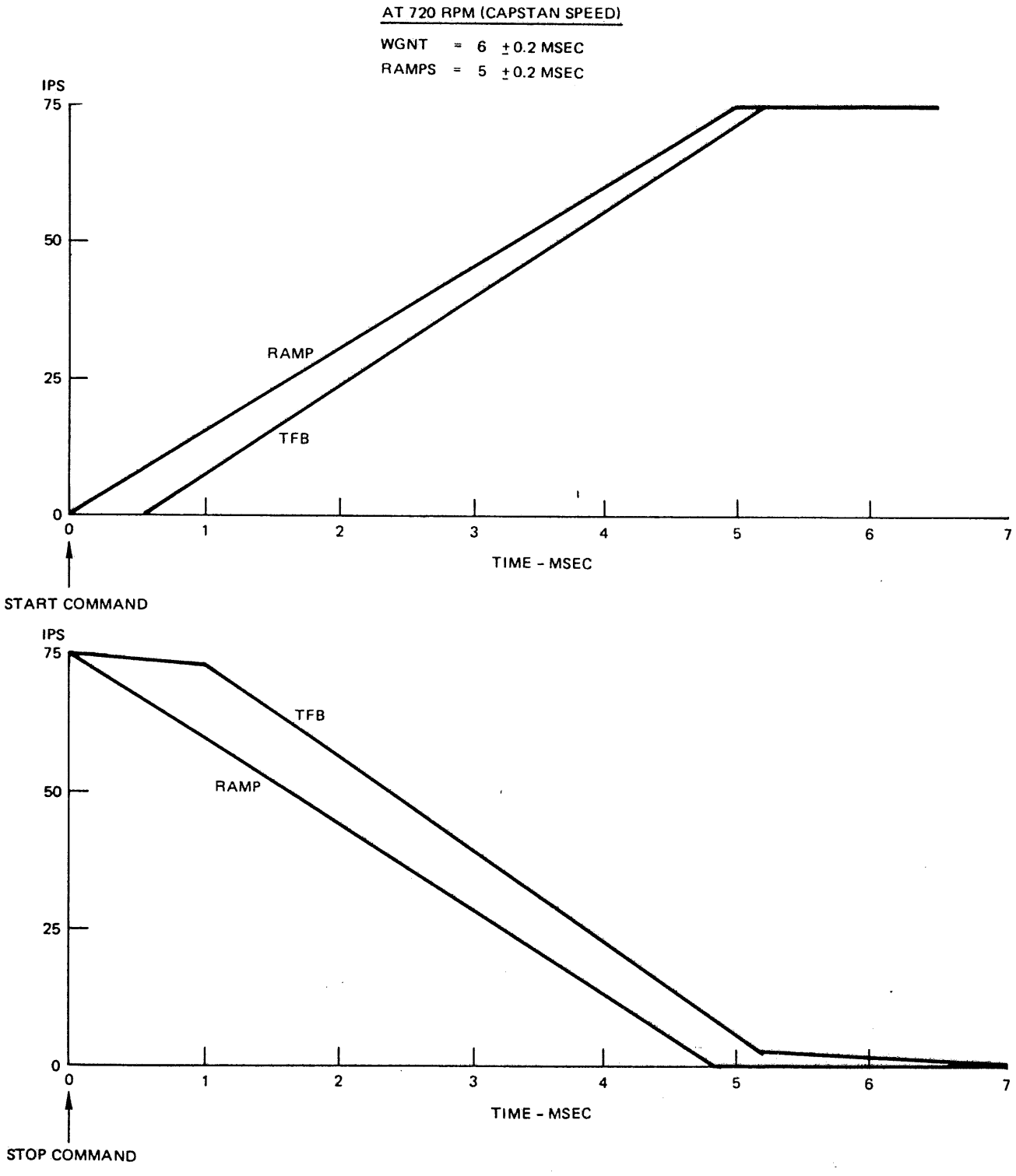

Figure 7-4. Start/Stop Time and Profile (75 ips)

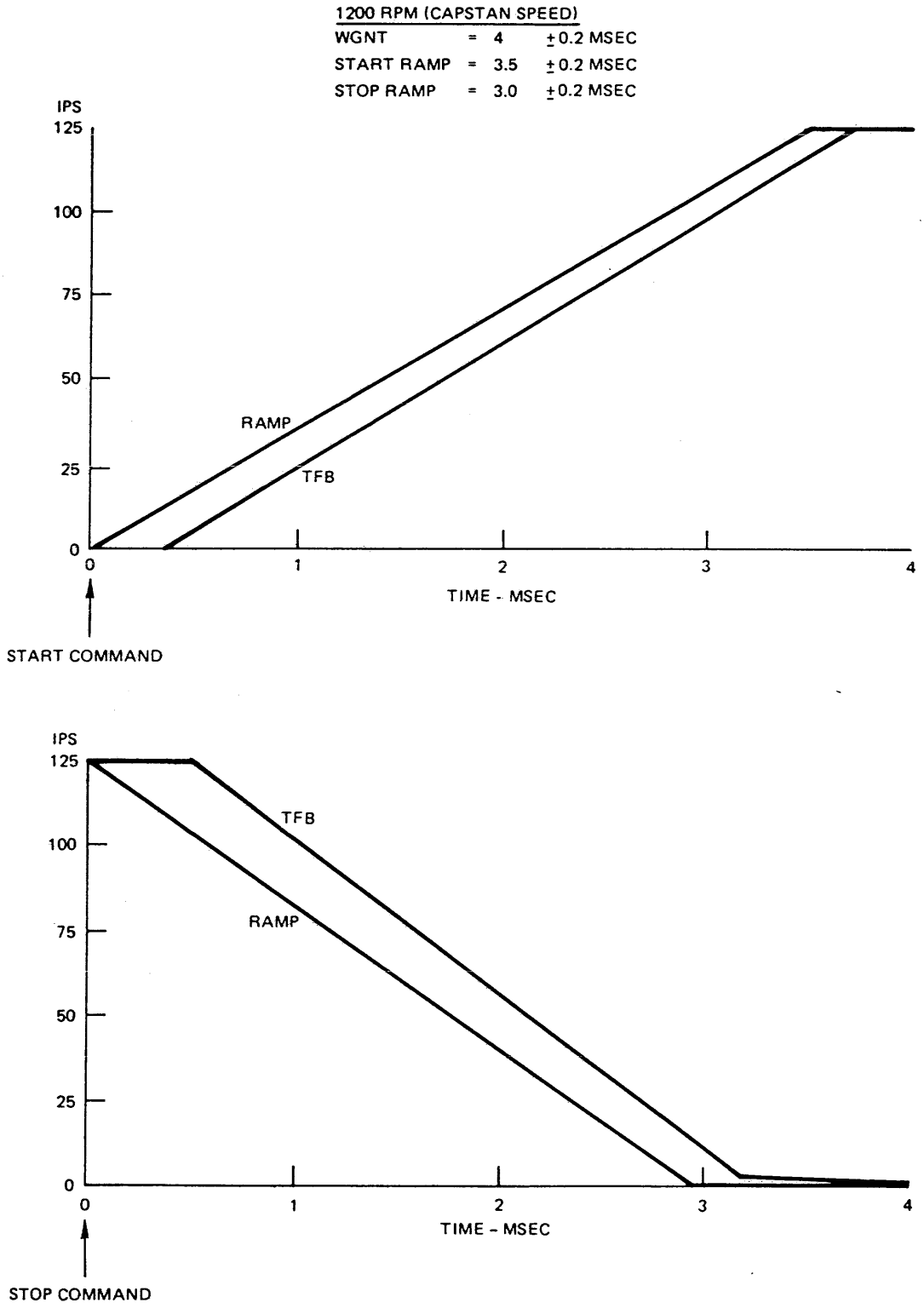

Figure 7-5. Start/Stop Time and Profile (125 ips)

SECTION 9
READ/WRITE SYSTEM MAINTENANCE

INTRODUCTION

This section provides procedures for the maintenance of the read/write system. The adjustment procedures are used to check and adjust the read/write system. All adjustments except the ERASE HEAD EFFECTIVENESS CHECK must be done in sequence.

Prior to making any adjustments, the power supply must be checked to be within specification and adjusted as required (refer to section 10 of this manual).

ERASE HEAD EFFECTIVENESS CHECK

This procedure checks the erase head for correct operation and alignment. The erase head is not adjustable, and it cannot be replaced as an individual part. If the erase head is found to be defective, the complete read/write and erase head assembly must be replaced.

a. Load a reel of tape on the tape unit.

b. Connect an oscilloscope to TP1 on LBBE7 (Channel 1) and TP7 on LBBE1 (Channel 9).

c. Write an all bits tape using the maintenance drive card while verifying analog gains in Channel 1 and Channel 9. Rewind the tape after the write operation.

CAUTION

Do not remove write current drivers or write head connector with power on.

d. Turn power off and remove the current driver cards at positions LBBA3 and LBBA9. This will prevent the writing of information in tracks 1, 2, 3, 7, 8, and 9.

e. Write all bits from the beginning of the tape using the maintenance drive card and verify Channel 1 and Channel 9 gain. If the erase head is working correctly, the amplitude of the analog signals will not exceed 100 millivolts. If one of the two channels is greater than 100 millivolts, check the tape cleaner position as follows (see figure 9-1):

1. Open the front door, and the vacuum column door.

2. Remove the tape guide block above the tape cleaner.

3. Loosen the tape cleaner mounting screw, and clamp the alignment tool (P/N 2027 1326) to the tape cleaner.

4. Align the tool so that it contacts three points on the read/write, and erase heads as shown. Hold the tool in place and tighten the tape cleaner mounting screw.

5. Remove the alignment tool from the tape cleaner.

6. Re-install the tape guide block. When installing the guide block, the reference-A corner must line up with the cleaner or it will allow the tape to hit the cleaner during load operations.

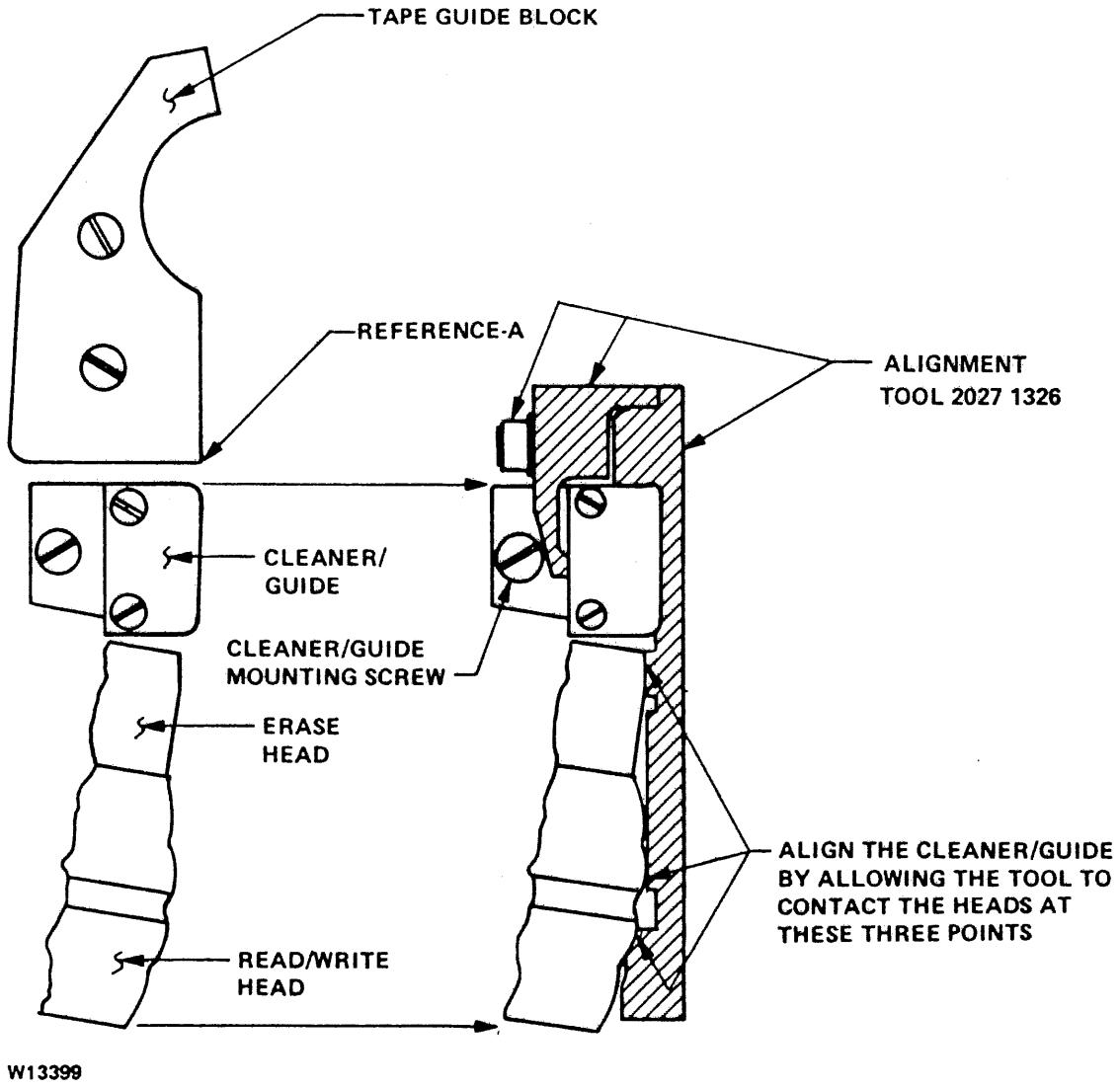

Figure 9-1. Tape Cleaner/Guide Positioning

TAPE SKEW AND AZIMUTH ADJUSTMENT

a. Load a skew alignment tape on the tape unit.

b. Drive the tape forward in the READ mode, using the maintenance drive switch.

c. Monitor the read signals (analog) with channels "A" and "B" of an oscilloscope at TP1 of LBBE7 (channel 1) and TP7 of LBBE1 (channel 9), respectively. Sync on channel 1 and select alternate. The peaks of the two signals as seen on the oscilloscope should coincide to within ±0.3 microsecond. If not, adjust the head azimuth adjust screw (figure 9-2) so that the two signals coincide.

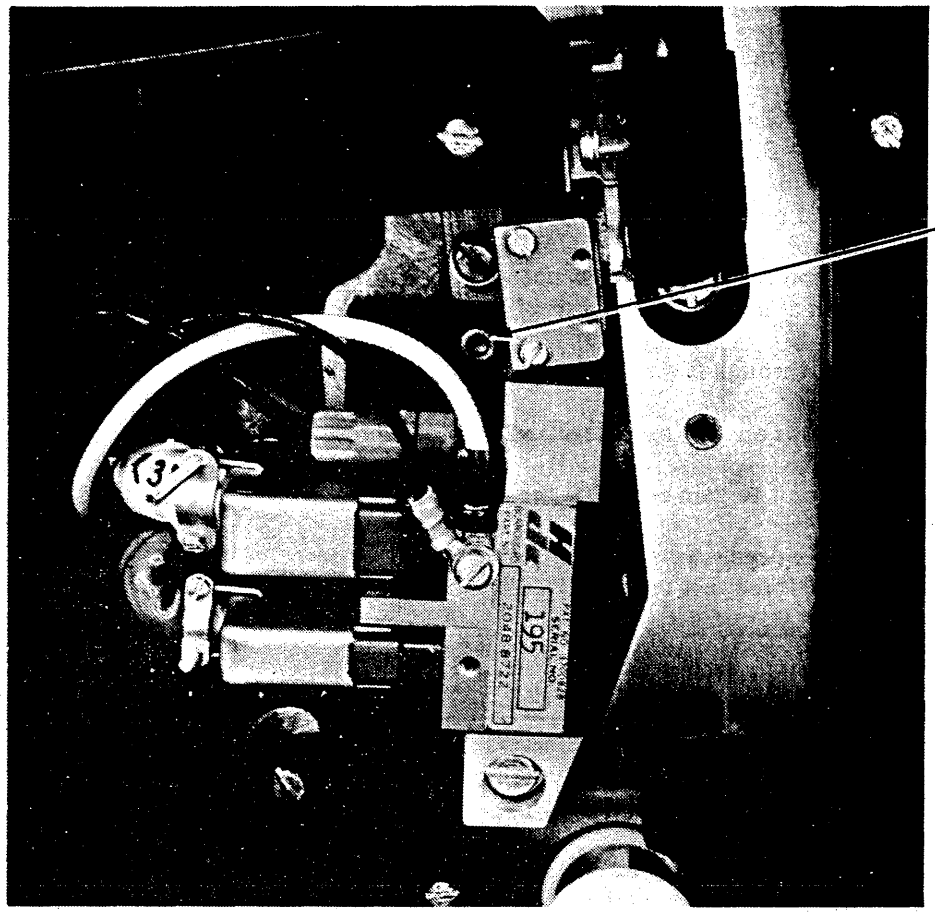

Figure 9-2. Head Azimuth Adjustment

NOTE

To ensure that alignment is not off by one or more full analog peaks, move trace-B to channel 4 (TP1 of LBBE4) and verify that it is in alignment with channel 1.

d. Drive tape in the REVERSE mode and observe the two signals. They should still be within ±0.3 microsecond of each other. If so, the procedure is completed at this point. If not, readjust the head azimuth skew to split the error equally between forward and reverse drive.

MAGNETIZED HEAD CHECK

This procedure is to be used after making head resistance or scheduled preventive maintenance checks.

a. Mount an approved tape and write 800 or 1600 fci continuously using the maintenance drive card.

b. Note the read amplitude of Channel 1; it should be 4 to 8.5 volts peak-to-peak while writing.

c. Switch to read and reverse and note the amplitude of the first read pass.

d. Read forward and note that the amplitude is over 96 percent of reading in step b.

   8 V x 0.96 = 7.68 V
   4 V x 0.96 = 3.84 V

e. Read reverse and note that the amplitude is over 95 percent of the reading in step c.

f. Read forward and reverse again and note that amplitude is no more than 1 percent (0.08 V on 8 V) lower than at step d. and e. respectively.

g. Repeat steps b. through f. on each of the other channels.

h. If these conditions are not met, degauss the head as follows:

   1. Open the unit to gain access to the read/write head.

   2. Turn on the degausser and rotate in a circular pattern, moving toward the head from a distance of three feet (approximately one meter).

   3. Place the degausser as close to the head as possible.

   4. Move the degausser in the same circular pattern, moving away from the head a distance of three feet (approximately one meter).

   5. Turn the degausser off.

i. Retest according to steps a. through g. Several degauss cycles may be required.

WRITE-STEP ADJUSTMENT

The write-step adjustment improves the electrical characteristics of the write head and normally requires readjustment only when the read/write head is replaced. Readjusting the write-step will affect the read gains, so the read gains must be checked after making the write-step adjustment.

The read and write adjustments are made while driving at a constant speed (not start/stop), and are best accomplished off-line with the aid of the local drive maintenance card.

The read gain is defined at 3200 fci on a standard reference tape.

The write step adjustment will affect the 3200 fci amplitude while having little effect on the peak-to-peak amplitude at 1600 fci. For this reason, initial write-step and read gain adjustments are made to ensure no clipping of the read signal while adjusting the write-step.

a. Load a reel of tape (write ring installed) on the tape unit.

b. Write 1600 fci (not start/stop) with the aid of local drive card and ensure that the gains at the analog test point on peak detector cards are below 9 volts peak-to-peak. This can be done by adjusting peak detector potentiometers. This ensures no clipping of the read signal prior to adjusting write-step.

c. Turn LINE RECV WRITE MULTI POTENTIOMETERS fully counterclockwise. Check the test points on the same card. Each should be between 100 to 120 nanoseconds.

d. Refer to table 9-1. While switching the local drive maintenance card rapidly between forward and reverse, scope test points 2 on the peak detector card for each channel. Signal will look somewhat like B. (See figure 9-3.)

e. While turning the corresponding LINE RECV MULTI POTENTIOMETERS slowly clockwise, look for symmetry similar to that shown in A (figure 9-3); as soon as this symmetry is achieved, stop further adjusting. Note that in some cases (due to head characteristics and different speed drives), achievement of the symmetry as shown in A may not be possible.

   In such cases only, continue to adjust the potentiometer clockwise until symmetry as shown in C (figure 9-3) is achieved. Do not turn the potentiometers any further clockwise.

   Repeat steps 1d and 1e for the rest of the tracks (peak detector TP's 2, 5 and 8).

PHASE ENCODING READ GAIN ADJUSTMENT

The phase encoding read gain adjustment is made while writing all "1" or all "0" on the tape (3200 fci). The maintenance drive card can be used to do this adjustment if the write clock on the card is adjusted to the correct frequency (see section 4 "MAINTENANCE DRIVE CARD"), and the density switch is set to 3200 bpi.

a. Load a reel of tape on the tape unit.

b. Write on the tape at 3200 fci using either the maintenance panel or the maintenance drive card (with correctly adjusted write clock).

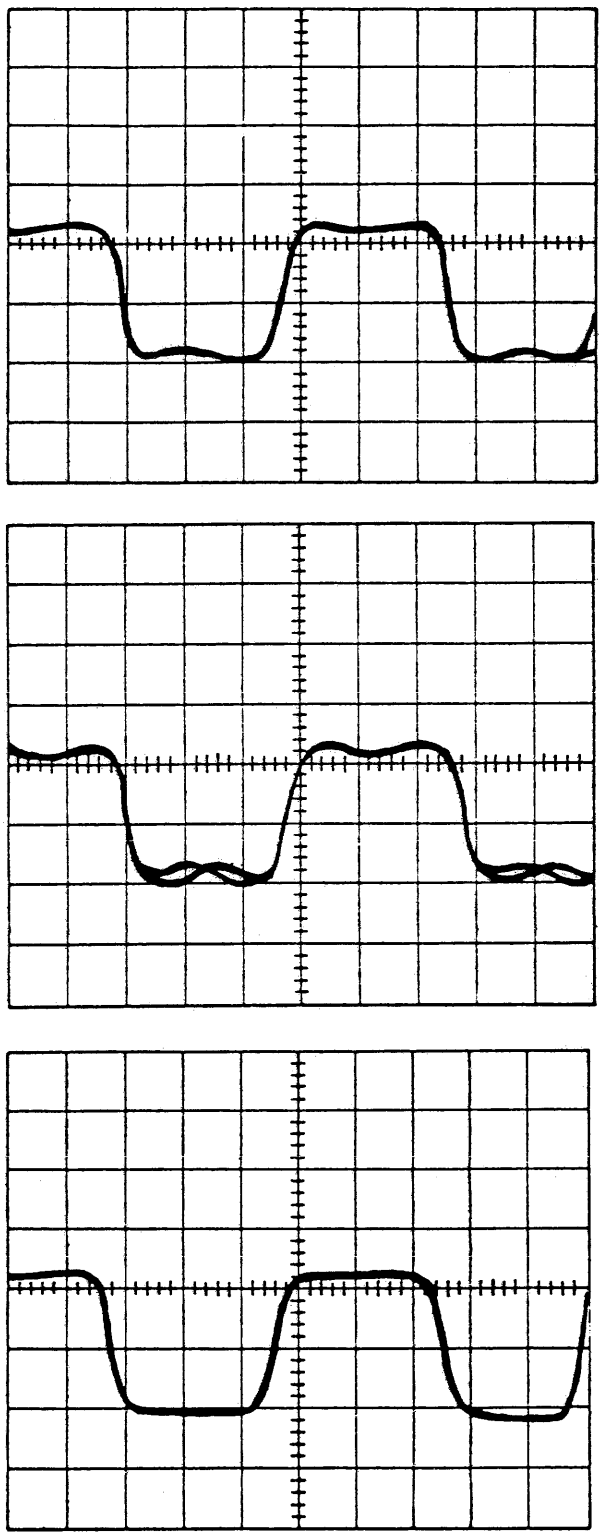

Figure 9-3. Write-step Profiles

Table 9-1. Phase Encoding Write-Step Adjustment

Channel	Testpoint	Adjust
1	LBBE7, TP2	LBBB5, R1
2	LBBE7, TP5	LBBB5, R2
3	LBBE7, TP8	LBBB5, R3
4	LBBE4, TP2	LBBB5, R4
5	LBBE4, TP5	LBBB5, R5
6	LBBE4, TP8	LBBB5, R6
7	LBBE1, TP2	LBBB5, R7
8	LBBE1, TP5	LBBB5, R8
9	LBBE1, TP8	LBBB5, R9

c. Connect the oscilloscope to the test points, and adjust the potentiometers listed in table 9-2 for a 6-volt peak-to-peak analog signal.

d. Change the writing density to 1600 bpi and note that the peak-to-peak signal amplitude is approximately 8 to 10-volts, but do not make any further adjustments.

Table 9-2. Phase Encoding Read Gain Adjustment

Channel	Card Location	Testpoint	Potentiometer
1	LBBE7	1	R79
2	LBBE7	4	R80
3	LBBE7	7	R81
4	LBBE4	1	R79
5	LBBE4	4	R80
6	LBBE4	7	R81
7	LBBE1	1	R79
8	LBBE1	4	R80
9	LBBE1	7	R81

NRZ READ GAIN ADJUSTMENTS

The NRZ gain adjustments are made with the nine potentiometers in the preamp assembly (figure 9-4). The test points are the same as for the phase encoding read gain adjustments. Before doing this adjustment, the phase encoding read gains and write-step adjustments must be correct.

a. Remove the preamp cover.

b. Load a reel of tape on the tape unit.

c. Press the 800 bpi density button on the tape unit control panel.

d. Write the tape in the continuous mode using the maintenance drive card.

e. Connect an oscilloscope to the test points and adjust the potentiometers indicated in figure 9-4 for a peak-to-peak analog signal of eight volts. Do not adjust the peak detector potentiometers to achieve the required amplitude.

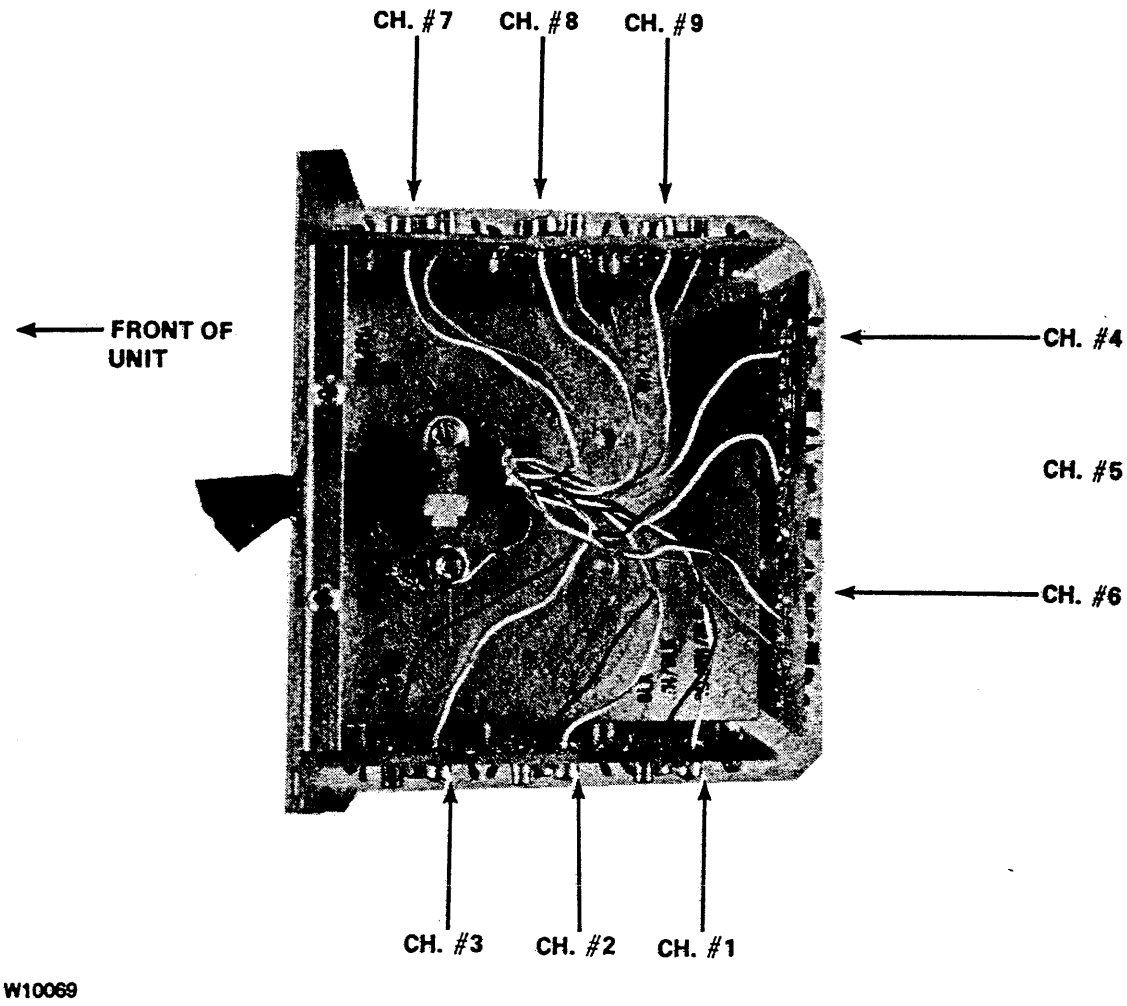

Figure 9-4. Preamplifier Assembly

NRZ READ SKEW ADJUSTMENTS

Read and write skew adjustments are required on tape units on which the NRZ capabilities are used. The skew adjustments must follow the order in which they are listed.

a. Verify TAPE SKEW AND AZIMUTH ADJUSTMENT prior to this adjustment.

b. Turn the 18 potentiometers on the read skew control card (Location LBBC7) to their full counterclockwise limit.

c. Load an 800 bpi skew-free tape on the tape unit and press the 800 bpi button on the tape unit control panel.

d. Connect an oscilloscope probe to test point 1 (channel 1 skew multi output) of the NRZ read skew card at LBBC9 and trigger internal.

e. Connect the other probe of the oscilloscope to each of the remaining eight test points (channels) at LBBC 9 to determine which of the channels has the most natural electrical delay. Move the internally triggered probe to the channel (test point) with the most natural delay.

NOTE

It is a good maintenance practice to put a gummed label in the tape unit, and mark it with the reference channel (step d) for future use (see figure 9-5).

Direction	Ref. Channel
FWD READ	CH. NO. _____
WRITE	CH. NO. _____
REV READ	CH. NO. _____

Figure 9-5. Skew Reference Channel Label

f. Look at each of the remaining 8 channels with the other probe, using the oscilloscope algebraic add function, and adjust each of the forward read potentiometers (table 9-3) so that the trailing edges align to within 0.2 microsecond of the reference channel (step e).

g. Rewind the tape and load a scratch reel of tape on the tape unit. Write all bits using the maintenance drive card.

h. Repeat steps c and d, while writing the tape, to determine the reference channel for the write circuits. Move the internally triggered probe to the reference channel.

i. Look at each of the remaining 8 channels with the other probe, using the oscilloscope algebraic add function, and adjust each of the write skew adjust potentiometers (table 9-3) so that the trailing edges align to within 0.2 microsecond of the reference channel (step e).

j. Rewind the tape, and then write "all bits" to the middle of the tape.

k. Stop the write operation, and do a reverse read over the information that was just written.

l. Repeat steps c and d while reading in the reverse direction, to determine the reverse reference channel. Move the internally triggered probe to the reference channel.

m. Look at each of the remaining 8 channels with the other probe, using the oscilloscope algebraic add function, and adjust each of the reverse read skew potentiometers (table 9-3) so that the trailing edges align to within 0.2 microseconds of the reference channel (step e) (see figure 9-6).

n. Check the forward and reverse read skew, using the NRZ I/O control to read the tape forward and reverse, and looking at the PCC I/O common ORed test point BABC9I (on the I/O control). The tape read pulses must be gathered into the skew gate period as shown in figure 9-6.

Table 9-3. Read/Write Skew Adjustments

Channel	Monitor LBBC9	READ Adjust LBBC7 REV	FWD	Write Adjust LBBB2
1	TP1	R3	R4	R1
2	TP2	R9	R10	R2
3	TP3	R15	R16	R3
4	TP4	R21	R22	R4
5	TP5	R27	R28	R5
6	TP6	R33	R34	R6
7	TP7	R39	R40	R7
8	TP8	R45	R46	R8
9	TP9	R51	R52	R9

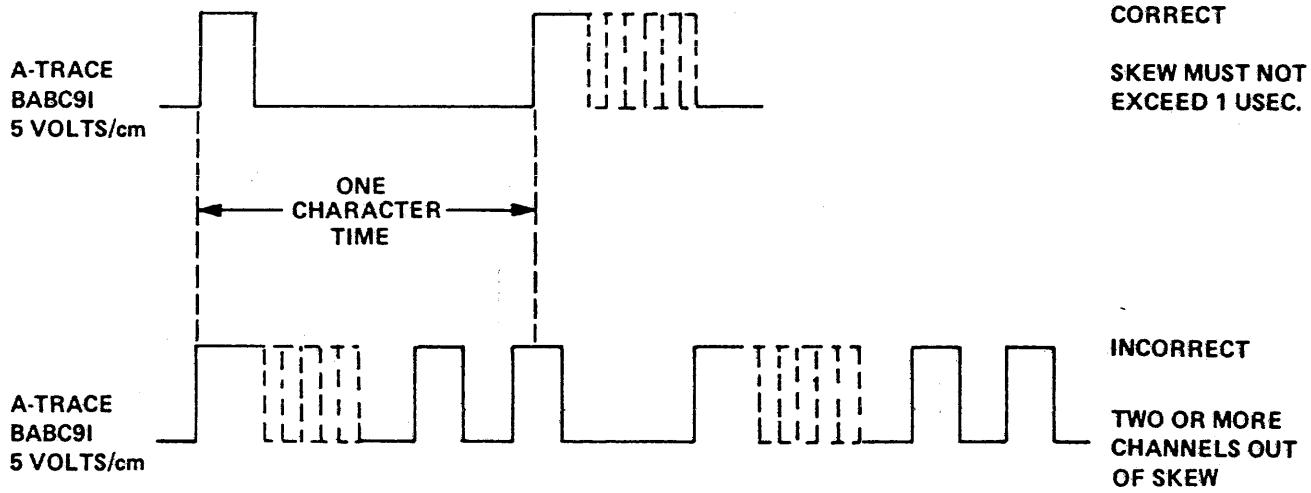

Figure 9-6. NRZ Skew Check

SECTION 10
POWER SUPPLIES MAINTENANCE

MEC AND TAPE UNIT POWER SUPPLY ADJUSTMENTS

The only adjustments made to the MEC or tape unit power supplies are made to the +12.0 and the −12.0 volt regulators.

MEC POWER SUPPLY ADJUSTMENT

a. Measure the voltage on the +12.0 volt buss (see figure 3-3) and adjust potentiometer R1 on the power supply regulator card for +12.0 volts.

b. Measure the voltage on the −12.0 volt buss (see figure 3-3) and adjust potentiometer R2 on the power supply regulator card for −12.0 volts.

TAPE UNIT POWER SUPPLY ADJUSTMENT

a. Measure the voltage on the +12.0 volt buss (see figure 10-1) and adjust potentiometer R1 on the power supply regulator card (figure 10-2) for +12.0 volts.

b. Measure the voltage on the −12.0 volt buss (see figure 10-1) and adjust potentiometer R2 on the power supply regulator card (figure 10-2) for −12.0 volts.

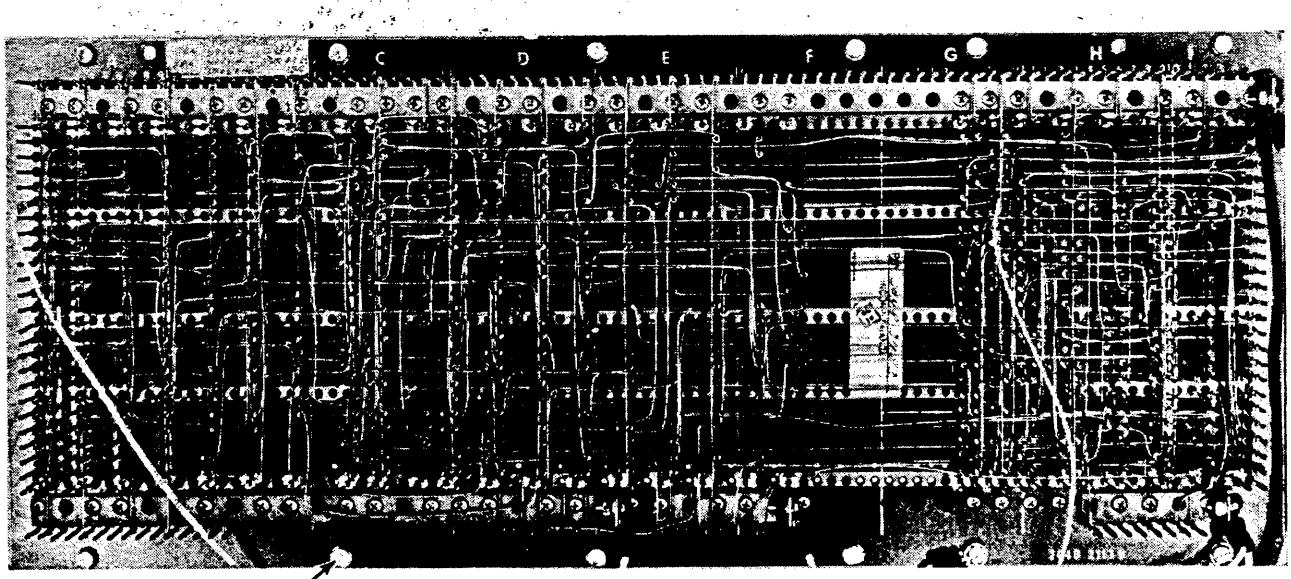

Figure 10-1. Tape Unit Voltage Measurement Points

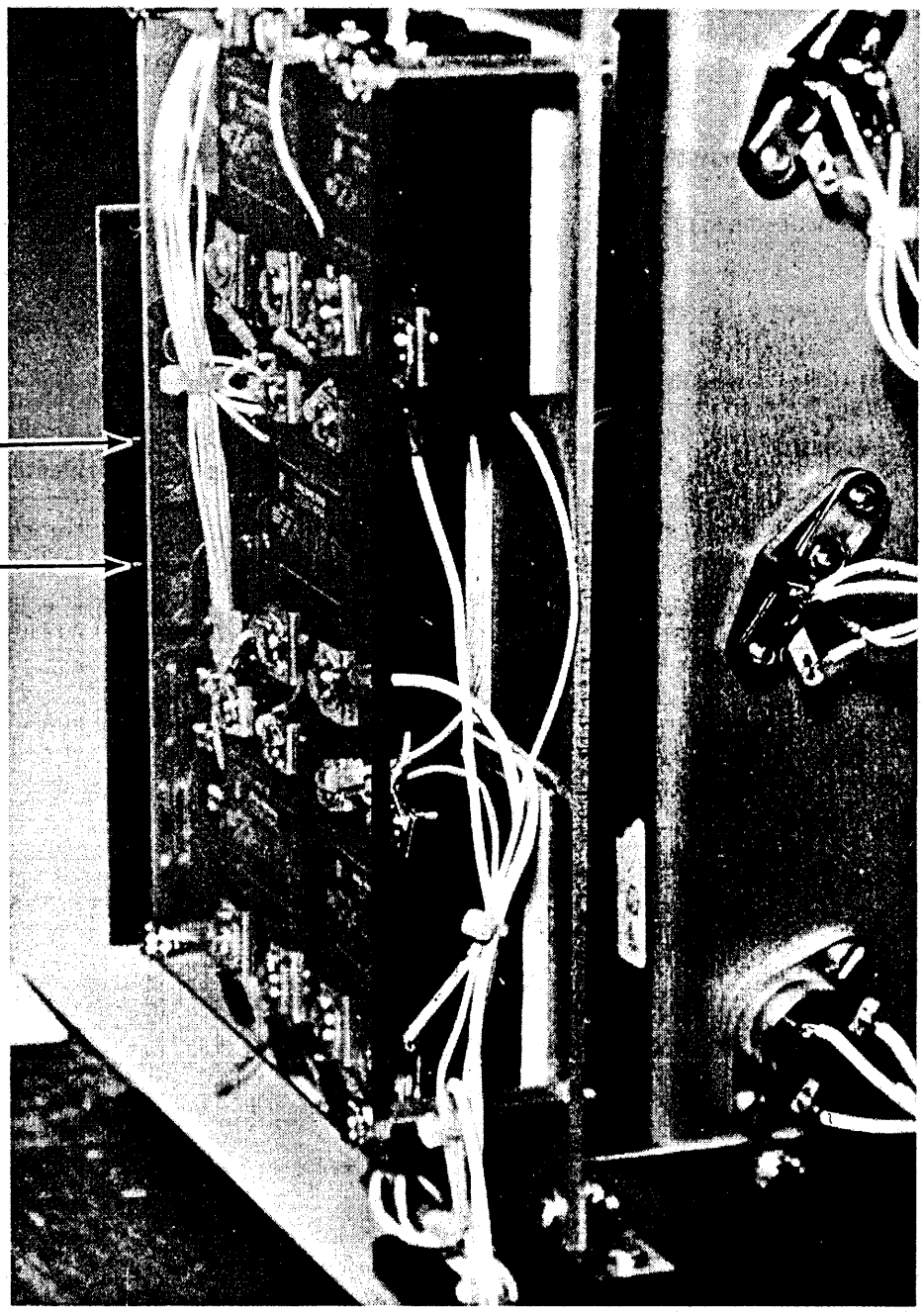

Figure 10-2. Tape Unit Power Supply Regulator Card Location