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REPORT NUMBER CCCC00 REPORT DATE 04DEC74

VOL 002 M/T 3411 SERIAL 51051905

EC846311

LOGIC SYSTEMS DIAGRAMS	NUMBER	DESCRIPTION	PART NUMBER	EC NUMBER	FEATURE RM
	XJ0010	VOL 2 TABLE OF CONTENTS	0001845991	000734852	
	XN0100	3410/11 INSTALL CHECKSHEET	0001846000	000736672	
	XN0200	STABILIZER L BRACKET INSTALLA	0001846001	000734732	
	XN0300	TAPE UNIT SIGNAL CABLE PLUGGI	0001846002	000736672	
	XQ0020	CARRL TABLE OF CONTENTS	0001846003	000734864	
	XQ0050	GENERAL LOCATIONS	0001845977	000734732	
	XQ0100	POWER ON/OFF PROCEDURES	0001846004	000734864	
	XQ0200	TAPE LOOP CHECK	0001846005	000736672	
	XQ0300	TOP COVER REMOVAL & REPLACEME	0001846006	000734852	
	XQ0400	SLIDING DOOR REMOVL & REPLACE	0001846007	000734864	
	XQ0500	OP PANEL LAMP REMOVL.& REPLA	0001846008	000734852	
	XQ0600	USAGE MTR CD REMOVL & REPLACE	0001846009	000734864	
	XQ0700	USAGE MTR TRFMR REMOVL & REPL	0001846010	000734864	
	XQ0800	FILE PROTECT SW REMOVL & REPL	0001846011	000734864	
	XQ0900	TERMINAL BOARD & FUSE LOCATIO	0001846012	000734864	
	XQ1000	NOTION CTRL BD REMOVL REMPLAC	0001846013	000736672	
	XQ1100	REEL MTR FUSES REMOVL REMPLAC	0001846014	000734864	
	XQ1200	TAPE IDLER ASSY-REM,REPL ADJU	0001846015	000736672	

REPORT NUMBER 0CC000 REPORT DATE 04DEC74

VOL D02 M/T 3411 SERIAL 51051905

LOGIC SYSTEMS DIAGRAMS	NUMBER	DESCRIPTION	PART NUMBER	EC NUMBER	FEATURE	3M
	XQ1250		0001846042	000736672		
	XQ13C0	BOT/EOT ASSY-REM,REPL & ADJUS	0001846016	000735117		
	XQ1400	VACUUM CHECK PROCEDURES	0001846017	000734864		
	R E A S	0005118589				
	XQ1450	TAPE LOAD CHECK AND ADJUSTMENT	0001846043	000734861		
	XQ1475	VACUUM COLUMN REMOVAL/REPLACEMENT	0001846046	000736672		
	XQ1500	VACUUM PUMP	0001846018	000734852		
	XQ1600	VACUUM PUMP REM & REPL	0001846019	000734864		
	XQ1700	VACUUM MOTOR ASSY REM & REPL	0001846020	000734852		
	XQ1800	CAPSTAN MOTOR ASSY REM & REPL	0001846021	000734852		
	XQ1900	TAPE TRACKING CHECK & ADJUSTM	0001846022	000734852		
	XQ2000	REEL LATCH ASSY REM & REPL	0001846023	000736672		
	XQ2100	REEL HUB ALIGNMENT	0001846024	000734864		
	XQ2150	R/W HEAD CARD	0001846051	000734864		
	XQ2200	3411 EXHAUST FAN ASSY REM REP	0001846025	000734852		
	XQ2300	DC POWER SUPPLY COLING FAN A	0001846026	000734852		
	XQ2400	CP1,CP2 & CP3 CIRCUIT PROTECT	0001846027	000734852		
	XQ2500	4-VOLT ASSY REM & REPL	0001846028	000734940		

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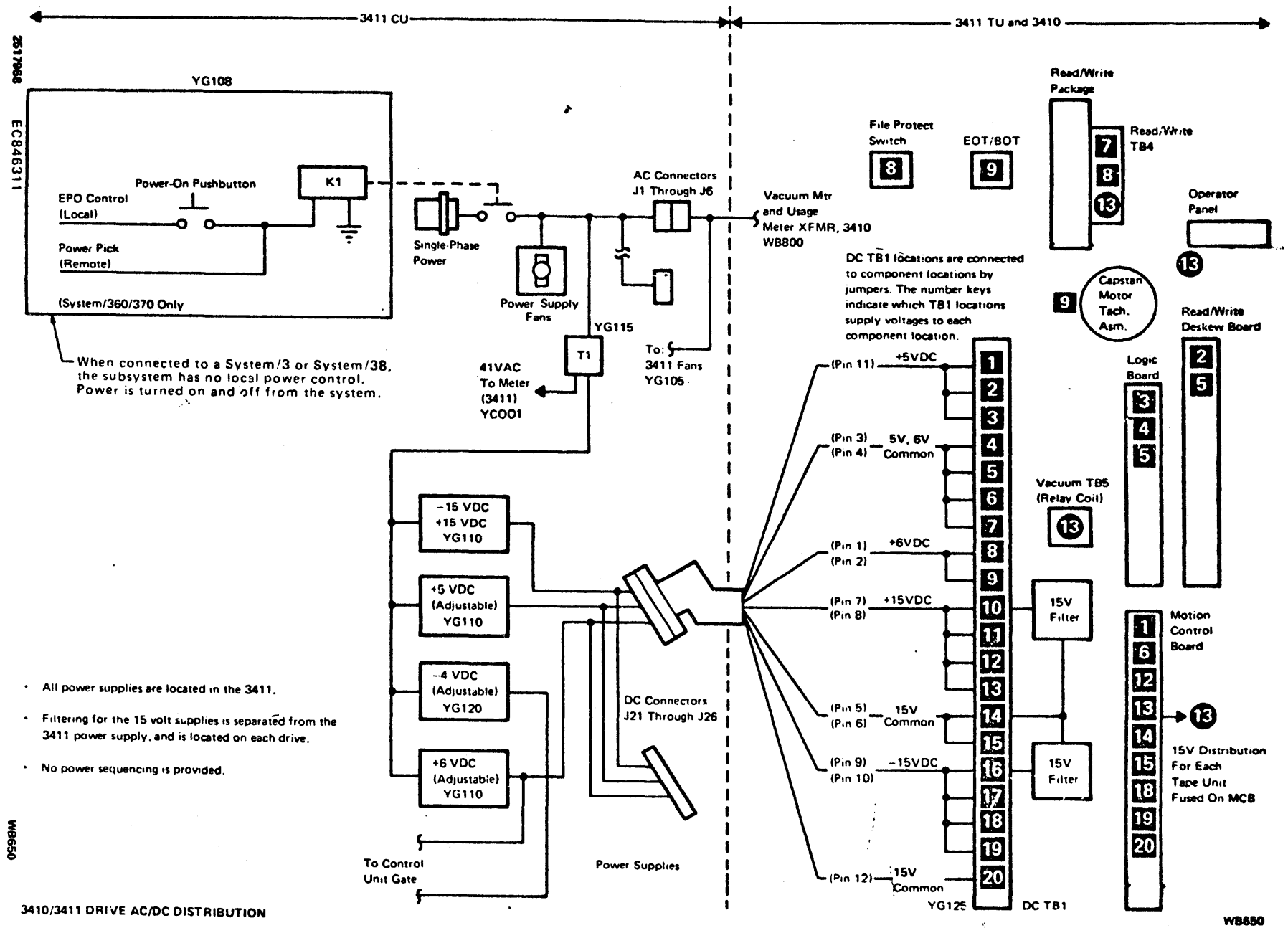
VOL 002 M/T 3411 SERIAL 51051905



- All power supplies are located in the 3411.
- Filtering for the 15 volt supplies is separated from the 3411 power supply, and is located on each drive.
- No power sequencing is provided.

3410/3411 DRIVE AC/DC DISTRIBUTION

IBM Maintenance Library

Volume 1	Volume 2
PLAN	DIAG System/3 User's Guide
INTRO duction	INSTAL lation
MAP Plan	CARRL Checks, Adjustments, Removal/Replacements, Locations
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3410 / 3411

Magnetic Tape Subsystem Maintenance Manual

XJ0010	1845991	734556	734556A	734852		
Seq 1 of 2	Part Number	1 Sept 72	20 Oct 72	26 Feb 73		

The *IBM 3410/3411 Diagnostic User's Guide (System/3)* is being shipped from Boca Raton, Florida for domestic use and from Vimercate, Italy for World Trade Corporation, with the diagnostic routines. Insert the System/3 User's Guide following this page.

XJ0010	1845991
Seq. 2 of 2	Part Number

734556	734556A	734852		
1 Sept 72	20 Oct 72	26 Feb 73		

Note: See **INSTAL 2A** for 3750 installation checksheet.

ITEM	NOTES	TC	TU0	TU1	TU2	TU3	TU4	TU5
Placement of Units	1. Install stabilizer "L" brackets. See Figure 2. 2. Lower rear stabilizer "L" brackets until they just touch the floor, and then tighten the mounting screws. 3. Mount the side covers loosely, in proper configuration. See "Side Covers" in this chart. 4. Position units according to customer requirements. **Note:** Due to the length of the 3410 cables, not more than three 3410s can be installed on either side of the 3411. 5. After machines are in place, snug front stabilizer "L" bracket mounting screws. 6. Insert large screwdriver through center hole of bracket and pry downward until bracket firmly but just contacts the floor. Do not raise casters off the floor. 7. Finish tightening front stabilizer "L" bracket mounting screws. **Note:** Do not raise transport until all four stabilizer "L" brackets are firmly in place.							
Shipping Brackets	1. Turn vacuum system hold-down bracket approximately 270 degrees clockwise around the frame screw. See altitude setting next section. See also "CARRL" Figure D-1, Item 28. 2. With front cover off, remove the screws located near each front corner of the transport casting that fasten the transport hold-down brackets to the side frame. See "CARRL" Figure D-1, Item 29. For World Trade only, remove only the right hand screw. The left hand screw must be left in place. **Note:** Do not remove transport hold-down brackets from transport casting. Leave them in place for reshipment. 3. Remove filament tape from the 3411 gate latch. 4. Remove filament tape from all cables.							
Altitude Setting	For operation at altitudes above 3,000 feet (914, 4m), move vacuum supply drive pulley so belt is driven by large sheave of drive pulley. See "CARRL" Figure D-32, "Vacuum Pump Removal and Replacement Procedure."							
Model Numbers	Verify that all 3410 tape units in the subsystem are the same model number as the 3411. Refer to Figure 3 to verify model number plugging.							
Tape Unit Features	Jumpers for the tape unit features are factory-plugged on the logic board. See Figure 3 if the diagnostic printouts indicate possible plugging errors in this area. **Note:** Tape units must not be plugged for a feature unless both they and the tape control to which they are attached have this feature installed.							
Side Covers	1. Open the sliding door. **CAUTION** To prevent top cover damage, always use the lifting bar to raise the transport assembly. Be sure both support brackets latch; one bracket may require manual latching. 2. Raise transport by grasping the lifting bar located under the transport and lifting. 3. Secure the side covers. (Install side covers without oval cutouts at exposed ends of subsystem.)							
Flexible Conduits and Ground Straps	Install between units as shown in Figure 4. Ensure on System/3 and System/38 only, both ends of I/O cable ground are installed.							

*CARRL - "Checks, Adjustments, Removals, Replacements, and Locations" section of this manual.

ITEM	NOTES	TC	TU0	TU1	TU2	TU3	TU4	TU5
Power Cables	1. Route all 3410 power cables through the flexible conduits. **ROUTE ALL DC CABLES FIRST.** 2. Plug dc power cables (black) into dc (red) sockets J21 - J26 in 3411 power supply. 3. Plug ac power cables (gray) into ac sockets J1 - J6 (white) in 3411 ac box. For servicing convenience, plug cables from TU0 into sockets J1 and J21 and those from TU1 into sockets J2 and J22, etc. **Note:** Any tape unit power cable may be connected to any socket within the appropriate group. See CARRL D-56.							
TU Addressing	1. Verify that 9142 card in A-A1D2 has jumper from P34—Q34. (TU addresses 0—3) 2. Verify that 9142 card in A-A1E2 has jumper from Q34—R34. (TU addresses 4,5). See ALD pages JA101 and JA201. See "CARRL" Figure D-58. See "INSTAL 2," "PE ID Burst Check."							
Signal Cables	Route all 3410 signal cables through flexible conduits, Figure 4. Plug as shown in Installation Manual Figures 5 & 6, using cable holder, part 819410, on each bus out cable. Remove the "E" card for ease of installation of bus out cables on subsystems with the Additional Tape Unit Feature (#9001). (Customer's addressing scheme determines plugging sequence.) Captivate all cables under the cable clamp bar at the left side of the controller gate, viewing from the card side.							
Cable Channels	After plugging power and signal cables, place power cables in the rear cable channel of each unit. Place signal cables in the front channel of each unit. (The front channel is the one with a foam pad in the bottom.)							
"Select Out" Priority (System/360 and System/370 only)	Machines are wired at the factory for "high" priority. To wire for "low" priority, change wires as shown: **Note:** Does not apply to System 370/115, or 370/125. "High" Priority: A1B4B08 — A1A4B08; A1A4D09 — A1F2P09; A1F2P11 — A1B4D09 "Low" Priority: A1B4B08 — A1F2P09; A1A4D09 — A1B4D09; A1F2P11 — A1A4B08							
3411 Model Identification	Verify that cards in A1H2, A1J2, and A1K2 are plugged according to Tape Controller ALD page A6001.							
CU Address (System/360 and System/370 only)	Jumper card 01A-A1M2 according to ALD page A6002. **Note:** Does not apply to System 370, Models 115 and 125 MTA. It does apply if MPX attached.							
CU Busy	System/3 and System/38 - Jumper 01A-A1G2 S49 to T49. 370/115 or 370/125 only, Jumper 01A-A1G2 U49 to T49.							
Metering	System/3 and System/38 - Jumper 01A-A1G2 S51 to T51. 370/115 or 370/125 only, Jumper 01A-A1G2 T51 to U5l.							

*CARRL - "Checks, Adjustments, Removals, Replacements, and Locations" section of this manual.

ITEM	NOTES	TC	TU0	TU1	TU2	TU3	TU4	TU5
PE ID Burst Check	**System/3 and System/38**: Jumper card A-A1L2 E34-F34 for card type 9135 (PE only) or H46-J46 for card type 9132 (NRZI) to enable PE ID burst checking. **System/360, System/370**: Jumper card A-A1L2 H46-J46 (9132) (DD) or A-A1L2 E34-F34 (9135) to enable PE ID burst checking if your system uses OS21 or DOS27, VS1 Release 2, VS2 Release 1 or later versions. Jumper card A-A1L2 J46-K46 (9132) or A-A1L2 F34-G34 (9135) to disable PE ID burst checking if your system uses OS20 or DOS 26, VS1 Release 1 or earlier versions. See ALD page GA014 with DD or ALD page GA107 with PE only.							
Interface Cables	Install as shown in Figure 6. Route all power, EPO, and I/O Cables through the cutout in the machine base. Install cables so that the ends with the red labels attach to the 3411, and the ends with the white labels attach to the System/360 or System/370 channel or the System 3 and System/38 attachment. See Note 3. **CAUTION** Do not kink these cables.							

Interface Cable Routing

System/3, System/38, 370/115, 370/125			System/360, System/370		
From	To	Group	From	To	Group
3411	5203	3-17	3411	Mplx. Chan.	150
3411	5421	3-17	3411	Sel. Chan.	151
3411	EPO	(Note 1)	3411	Control Unit	152
370/115, 125		3036 (2)	3411	Channel EPO (Note 2)	153
	3125 or	3037	3411	Chan. to Chan Adapter	154
3411	3115	Also See Note 3			
3411 Sys/38 3411	EPO YYYY 01D 84				

Note 1: Plugs into socket J7 in ac power box.
Note 2: Plugs into socket J7 in 24 volt supply. On 370/115 and 370/125 the 24 volt P.S. is not present in the 3411. An EPO Control Circuit Card is mounted in the A.C. box door. The -24 volt service originates in the 3115 and 3125. See CARRL D-46. If System 370/115 or 125 and MPX attached, cable interface and EPO are the same as System 360 MPX channel.
Note 3: For System/3 cable routing, see Chapter 7C2 in the System/3 Installation Manual.
For System 38 cable routing, see System/38 installation manual.

Pluggable Units	Check that all pluggable units, cables and voltage lines are securely seated. ALD page YC001 shows dc cabling for the 3411.							

*CARRL - "Checks, Adjustments, Removals, Replacements, and Locations" section of this manual.

ITEM	NOTES	TC	TU0	TU1	TU2	TU3	TU4	TU5
AC Power	Check that customer's supply voltage corresponds to the voltage rating label on the 3411 ac power supply cover. To connect a machine for operation at a different input voltage, refer to the following logic pages. (Alter the rating label if you change machine connections.) See "CARRL" Figure D-17.							

3410-3411 Models	Used With	3411 AC Distrib. YG105	System Power Sequence YG108	Tape Unit Pneumatic & Metering WB800
1,2,3 (60 Hz) 1 (50 Hz)	S/360 S/370 - Models 115 and 125 MPX channel	2524786	2524783	2518074
2,3 (50 Hz)		2524804	2524783	2518074
1,2,3 (60 Hz) 1 (50 Hz)	370/115 370/125	2524879		2518074
2,3 (50 Hz)	370/115 370/125	2524859		2518074
1,2,3 (60 Hz) 1 (50 Hz)	Sys/3 Sys/38	2524787		2518074
2,3 (50 Hz)	Sys/3 Sys/38	2524803		2518074

Power-On Checks	1. Turn on tape subsystem power. See "CARRL" Figure D-2 for power-on/power-off procedures. 2. Check that all fans are operating. 3. If all fans are not operating, go to MAP AC010 (Power Supply Entry). 4. If loading problems are encountered, go to MAP AB010. **System 38** 1. Insure 3411 power cord is inserted in customer power source. 2. Insure CB1 is on (see 3411 MLM for location). 3. Run good machine path. Power will be turned on by System/38.							
Configuration	**UDT—System/3** "Verify" configuration when installing new system. Reconfiguration is necessary when connecting to existing system. See "Diagnostic User's Guide, Diagnostic Control Program, Unit Definition Card," in 5410 MDM Program Description Volume 1, (shipped with machine logic). **CDS—System/360 - System/370** See "On Line Test Configuration Data Set Guide," Form D99-CDSG-1 **System/38** See program product installation manual.							
Skew/ Tracking	For System/3, run Section 70A Routine 2. Follow the procedure given in MAP AD047, Entry 01. For System/360 or System/370, run T3410 "P" Routine 1. Follow the procedure given in MAP AA070, Entry 01. Refer to "CARRL"* Figure D-36 (Tape Tracking Check and Adjustment) **only** if the diagnostic you run indicates that tracking adjustment is necessary. For System/3, run Section 70A Routine 1. For System/360 or System/370, run T3410 "P" Routine 2. For System/38, run MAP 6420.							

*CARRL - "Checks, Adjustments, Removals, Replacements, and Locations" section of this manual.

ITEM	NOTES	TC	TU0	TU1	TU2	TU3	TU4	TU5
Diagnostics	Refer to User's Guide sections of this manual for instructions to run these diagnostics. System/3. Go to User's Guide and run diagnostics 704, 702, 708, 70F. Set SSW14 ON for sense data printout for diagnostics 701 and 702. Go to appropriate entry on MAP AA010 if problem occurs. **THIS IS A MINIMUM REQUIREMENT.** System/360, System/370. Go to User's Guide and run T3410 Sections "M," "N," and "O." Go to appropriate entry on MAP AA035 if problem occurs. **THIS IS A MINIMUM REQUIREMENT.** System/38. Run good machine path MAP.							
Trim	1. Affix address labels to each tape unit. 2. Affix front and rear cover labels to each tape unit, using IBM cleaner P/N 450608 to moisten adhesive back on labels. (The shielded covers are to be installed on the 3411.) 3. Mount tape racks on each tape unit. 4. Install front and rear covers. For subsystems with above-the-floor entry of "external" cables, cut 3411 rear cover as shown in Figure 7. See "CARRL" Figure D-4.							
Finish	System/3. Go to System/3 Installation Instructions, Chapter 10, "System Testing." Run System/3 Diag. 715 to clear disk. System/360 and System/370. Finish running diagnostics and turn system over to customer. System/38. Go to system installation instructions.							

Figure 1A. 3750 Installation Check Sheet

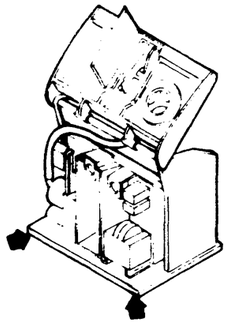
ITEM	NOTES	TC
Placement of Units	1. Install stabilizer "L" brackets. See Figure 2. 2. Lower rear stabilizer "L" brackets until they just touch the floor and then tighten the mounting screws. 3. Mount the side covers loosely, in proper configuration. See "Side Covers" in this chart. 4. Position units according to customer requirements. Note: Due to the length of the 3410 cables, not more than three 3410s can be installed on either side of the 3411. 5. After machines are in place, snug front stabilizer "L" bracket mounting screws. 6. Insert large screwdriver through center hole of bracket and pry downward until bracket firmly but just contacts the floor. Do not raise casters off the floor.* 7. Finish tightening front stabilizer "L" bracket mounting screws. **Note:** do not raise transport until all four stabilizer "L" brackets are firmly in place.	
Shipping Brackets	1. Turn vacuum system hold-down bracket approximately 270 degrees clockwise around the frame screw. See altitude setting next section. See also "CARRL" Figure D-1, Item 28. 2. With front cover off, remove the screws located near each front corner of the transport casting that fasten the transport hold-down brackets to the side frame. See "CARRL" Figure D-1, Item 29. For World Trade only, remove only the right hand screw. The left hand screw must be left in place. **Note:** Do not remove transport hold-down brackets from transport casting. Leave them in place for reshipment. 3. Remove filament tape from the 3411 gate latch. 4. Remove filament tape from all cables.	
Altitude Setting	For operation at altitudes above 3,000 feet (914.4m), move vacuum supply drive pully so belt is driven by large sheave of drive pulley. See "CARRL" Figure D-32, "Vacuum Pump Removal and Replacement Procedure."	
Side Covers	1. Open the sliding door. **CAUTION** To prevent top cover damage, always use the lifting bar to raise the transport assembly. Be sure both support brackets latch; one bracket may require manual latching. 2. Raise transport by grasping the lifting bar located under the transport and lifting. 3. Secure the side covers. (Install side covers without oval cutouts at exposed ends of subsystem.)	
3411 Model Identification	Verify that cards in A1H2, A1J2, and A1K2 are plugged according to Tape Controller ALD page A6001.	
Power Cables	Plug ac power cable (gray) into ac socket J1 of I/O frame.	
Interface Cables	Install as shown in Figure 6. Route all power, EPO, and I/O Cables through the cutout in the machine base. Install cables so that the ends with the red labels attach to the 3411, and the ends with the white labels attach to the 3750 MTA on the 2PA1. **CAUTION** Do not kink these cables.	

*CARRL - "Checks, Adjustments, Removals, Replacements, and Locations" section of this manual.

ITEM	NOTES	TC
AC Power	Check that customer's supply voltage corresponds to the voltage rating label on the 3411 ac power supply cover. To connect a machine for operation at a different input voltage, refer to the following logic pages. (Alter the rating label if you change machine connections.) See "CARRL" Figure D-17. Plug ac cables on socket J1 of I/O frame.	

3410-3411 Model	Used With	3411-AC Distrib. YG105	System Power Sequence YG108	Tape Unit Pneumatic & Metering WB800
1 (50 Hz)	3750	2524786	2524783	2518074

Diagnostics	Refer to I/O 610 in the 3750 documentation for instructions on how to run D1C diagnostics. Go to the appropriate entry on MAP I/O 610 if a problem occurs. This is a minimum requirement.	
Trim	1. Affix front and rear cover labels to each tape unit, using IBM cleaner P/N 450608 to moisten adhesive back on labels. (The shielded covers are to be installed on the 3411.) 2. Mount tape racks on each tape unit. 3. Install front and rear covers. For subsystems with above-the-floor entry of "external" cables, cut 3411 rear cover as shown in Figure 7. See "CARRL" Figure D-4.	



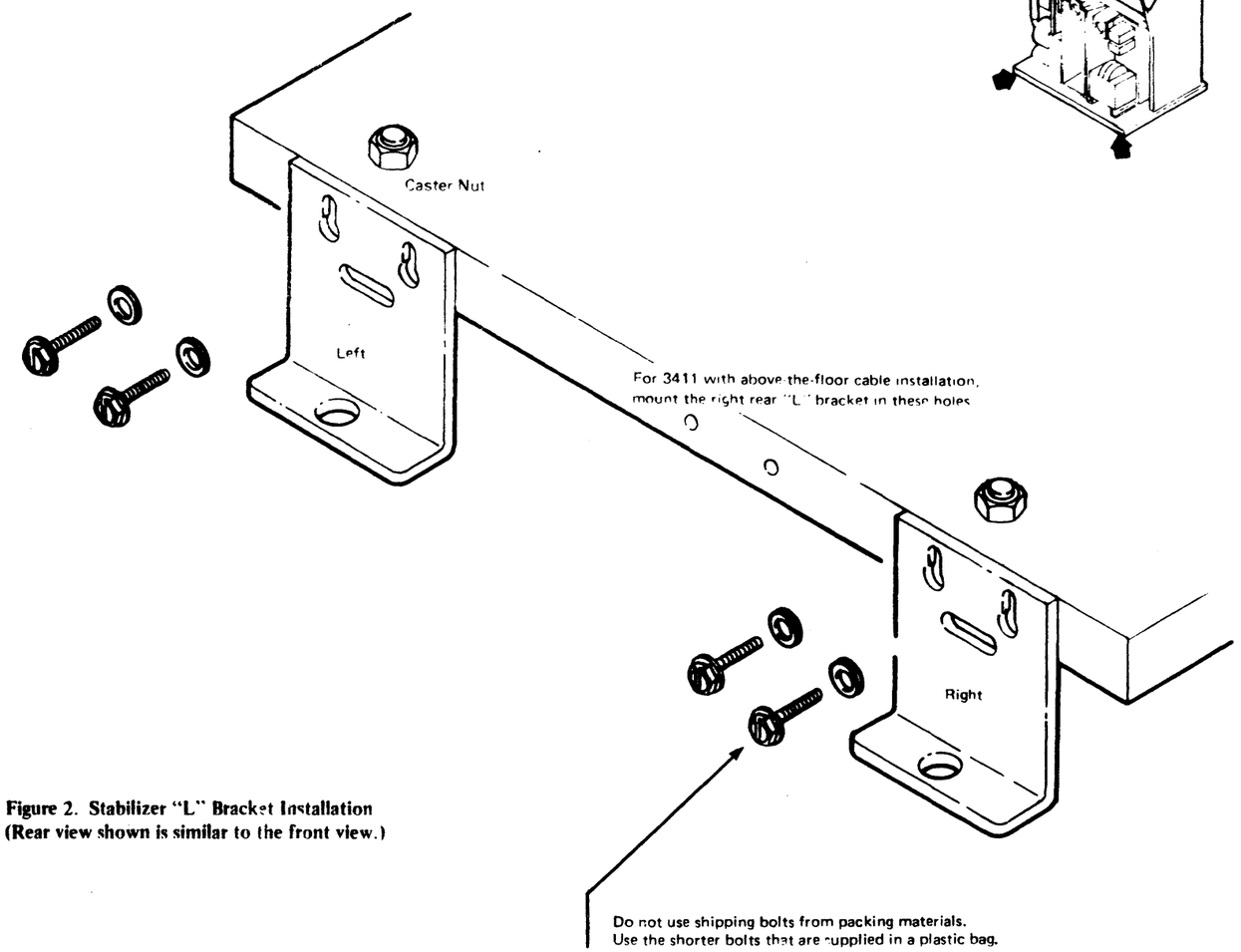
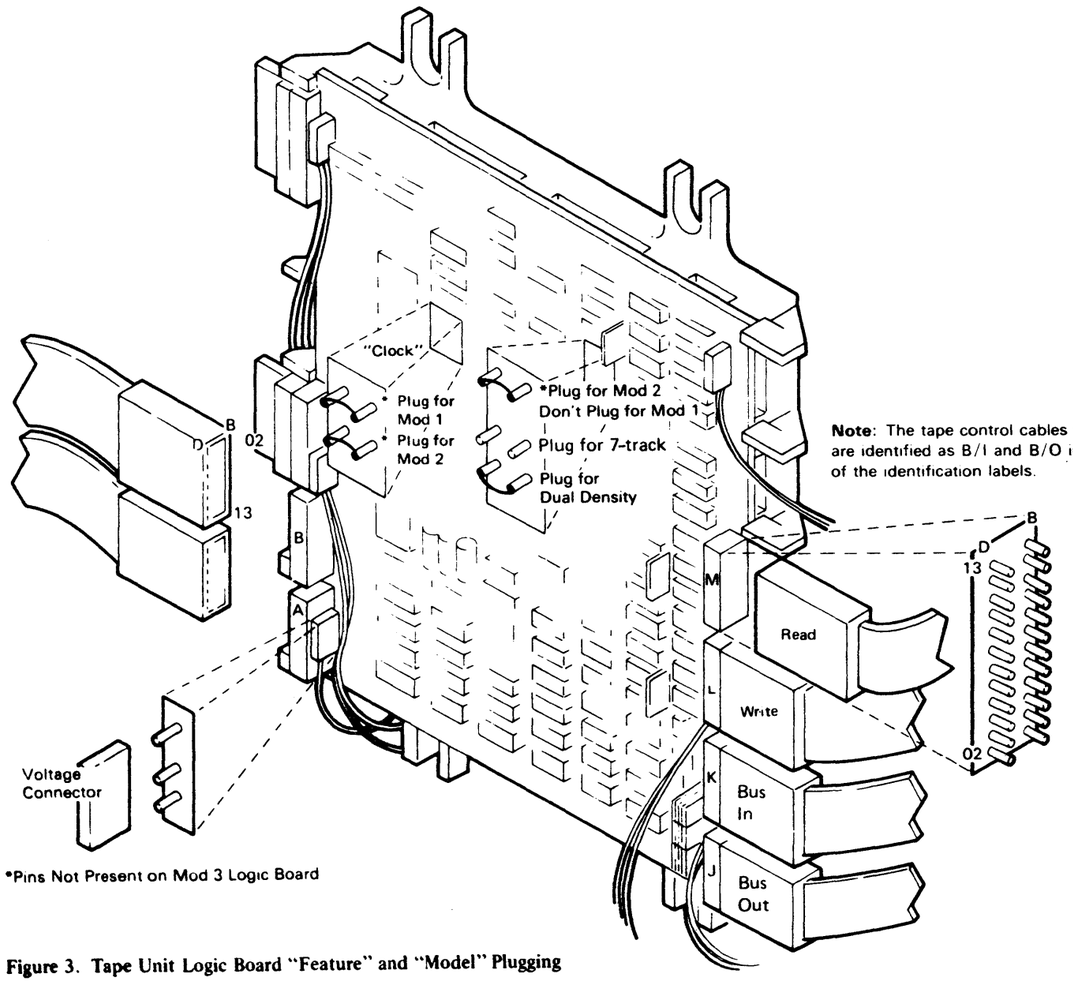


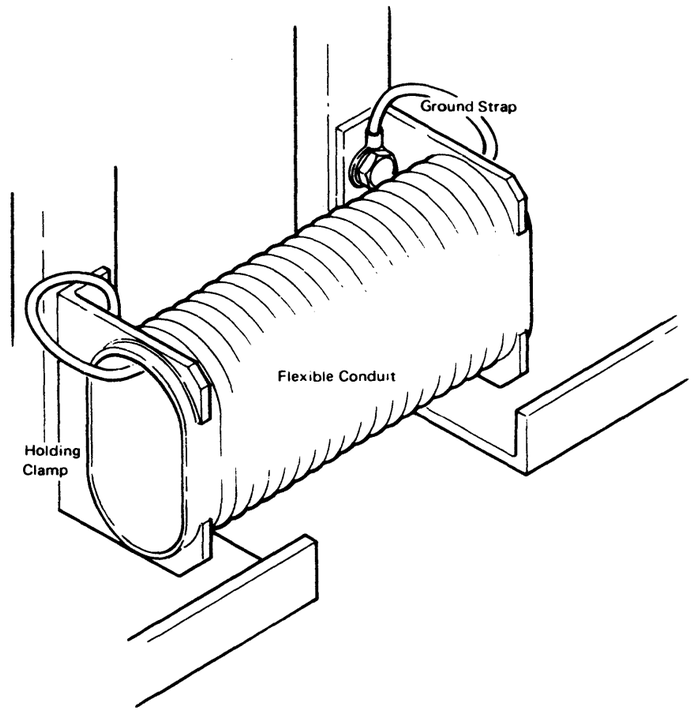
Figure 2. Stabilizer "L" Bracket Installation
(Rear view shown is similar to the front view.)



*Pins Not Present on Mod 3 Logic Board

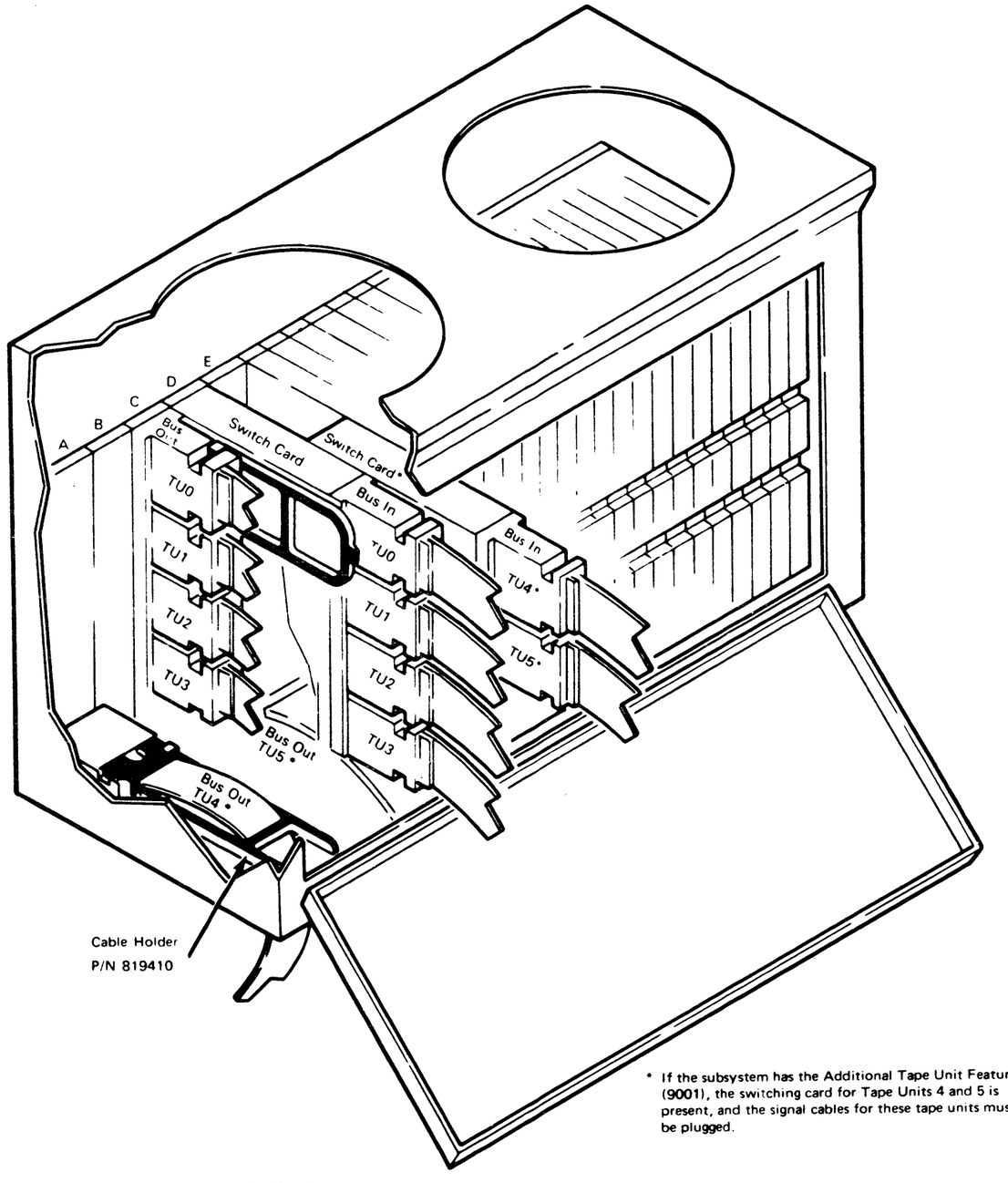
Figure 3. Tape Unit Logic Board "Feature" and "Model" Plugging

Note: The tape control cables to the tape unit interface are identified as B/I and B/O in the upper right corner of the identification labels.



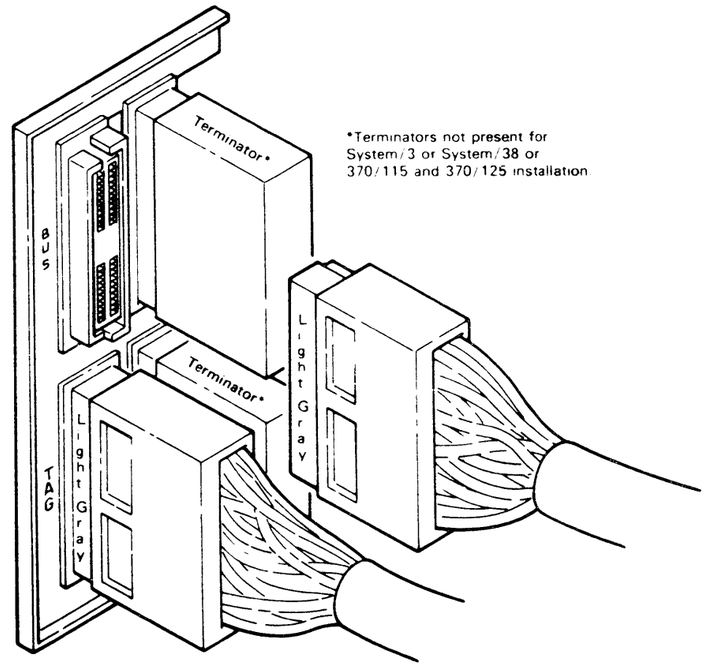
1. Insert conduit between frames.
2. Route ground strap through conduit and secure to mounting screws.
3. Using a twisting motion, insert conduit in holding clamps so the conduit ends extend two or three spirals beyond each clamp.
4. Cable threading is permissible with conduit outside machine and may be advisable in right angle physical planning.

Figure 4. Flexible Conduit and Ground Strap Installation



* If the subsystem has the Additional Tape Unit Feature (9001), the switching card for Tape Units 4 and 5 is present, and the signal cables for these tape units must be plugged.

Figure 5. Tape Unit Signal Cable Plugging



*Terminators not present for System/3 or System/38 or 370/115 and 370/125 installation.

Figure 6. Interface Cable Plugging

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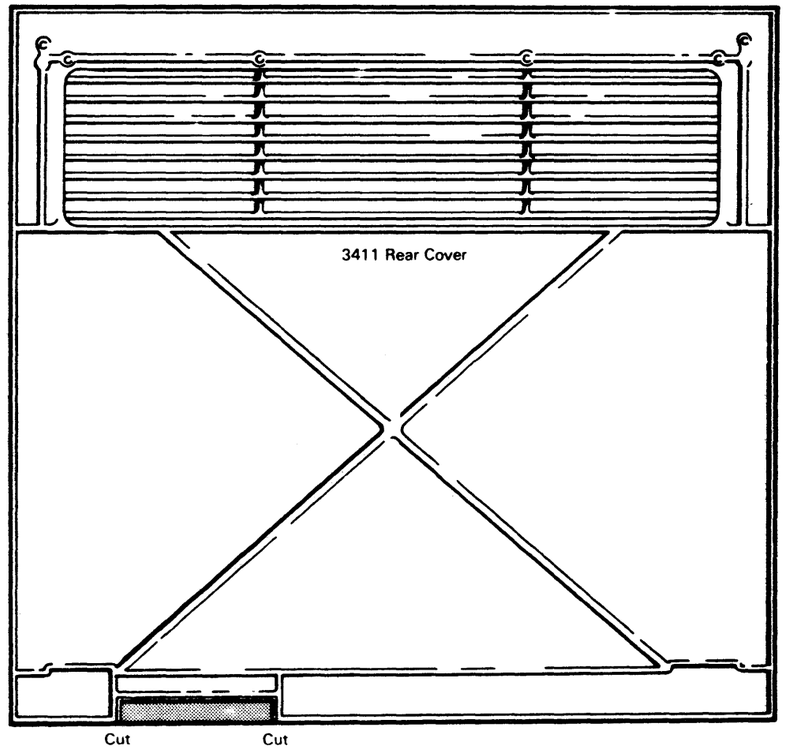

1. Using a hacksaw, cut two one-inch slots where indicated.
2. Using adjustable wrench or pliers to grasp cover, bend area between slots back-and-forth to break out material in shaded area.
3. File the edges of the opening to remove sharp edges.

Note: 3411 cover contains metal shielding.

Figure 7. 3411 Cover Modification for Above-the-Floor Cable Entry

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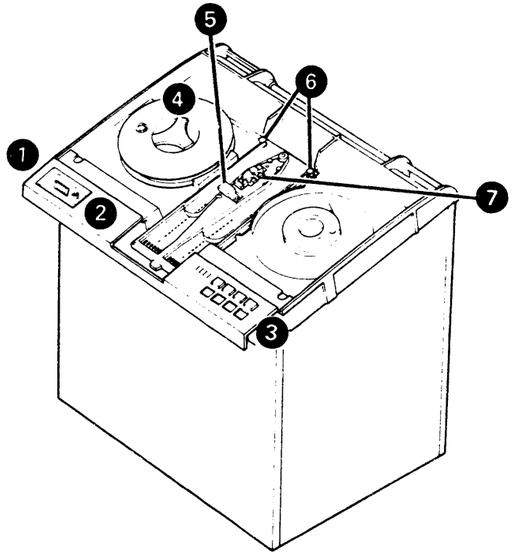
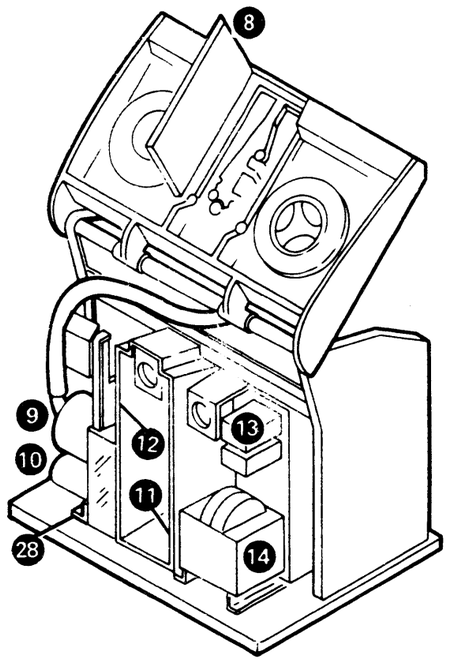
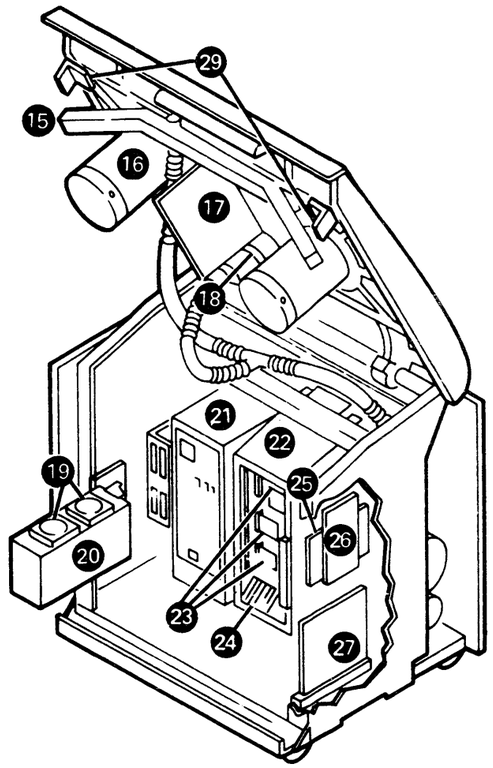
Figure D-1. General Locations

Note: For a specific location of a terminal board or a fuse, see Figure D-17, "Terminal Board and Fuse Locations."

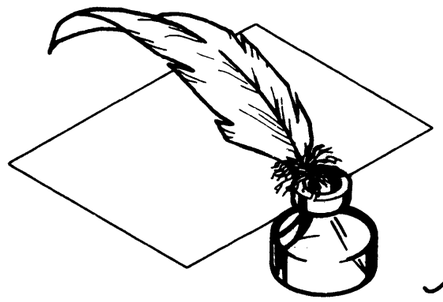
1. Usage Meter
2. Enable/Disable Switch
3. Operator Panel
4. Reel Latch
5. BOT/EOT Assembly
6. Tape Idlers
7. Read/Write Head
8. Vacuum Column Cover
9. Vacuum Pump
10. Vacuum Motor
11. A2 Board
12. A3 Board
13. AC Ferro Capacitors
14. Main Transformer
15. Lifting Bar
16. Reel Motors
17. Read/Write Head and Card Assembly
18. Capstan Motor
19. Control Unit Cooling Fans
20. Control Unit Gate
21. AC Box
22. DC Box
23. DC Voltage Regulator Cards
24. A5 Board
25. Logic Board
26. Deskew Board
27. Motion Control Board
28. Pneumatic Shipping Bracket
29. Transport Hold Down Bracket







XQ0050 Seq 1 of 2	1845977 Part Number	734556 1 Sept 72	734732 5 Dec 72			



Notes

XQ0050	1845977	734556	734732			
Seq 2 of 2	Part Number	1 Sept 72	5 Dec 72			

Figure D-2. Power On/Off Procedures

System/3, 370/115, and 370/125 Power On/Off

Machines attached to System/3, 370/115, and 370/125 can only be powered on and off through the system. See the system operating instructions.

System/38

Machines attached to System 38 are powered on and off under system control. The Good Machine Path MAP will power up the sub-system while running, power down is a CE option.

System/360 and System/370 Power On/Off

Note: This does not apply to System/3 MTA, 370/115, or 370/125.

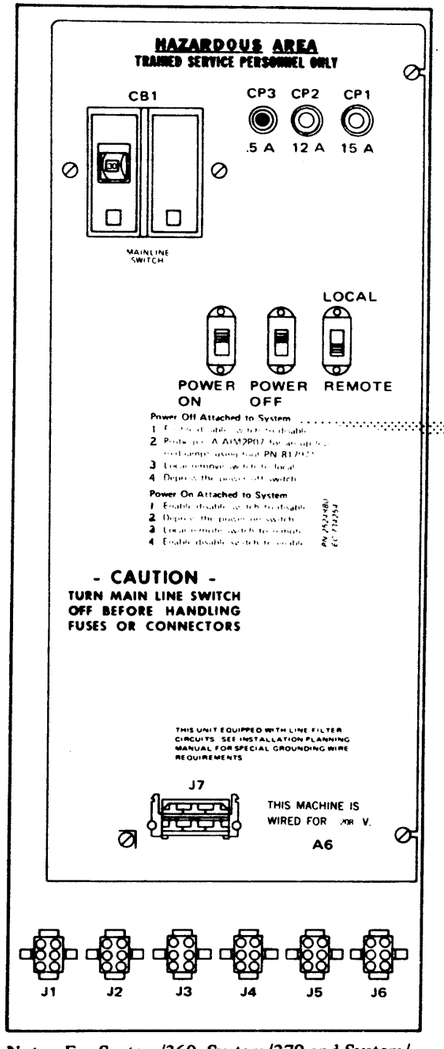
Normal power on/off sequencing for the tape control and tape units is controlled by system power interlock circuits. Maintenance activities may necessitate dropping power in the tape control. Because voltage transients, caused by dropping or bringing up tape control power during system operation, can cause erroneous system interrupts, use the following procedures when dropping or bringing up tape control power.

Power Off:

Note: The channel to which the tape control is attached must complete all operations and have no pending interrupts before you turn off the tape control power.

1. Vary the subsystem offline. See System/360 and System/370 operating instructions.
2. Set the ENABLE/DISABLE switch to DISABLE. This allows the subsystem to go offline when the CPU reaches "wait state."

   Note: An optional way to force the CPU into a "halt" or "wait state" is to press STOP at the CPU.
3. Using your probe box, probe M2P07 on 01A. Wait until you get a plus before going to Step 4.
4. Set the LOCAL/REMOTE switch to LOCAL.
5. Turn power off at the ac box.



Note: For System/360, System/370 and System/370 Models 115 and 125 MPX attached only. Does not apply to System/3 MTA or System/370 Models 115 and 125 that are not MPX attached.

Power On:

1. Set the ENABLE/DISABLE switch to DISABLE.
2. Turn power on at the ac box.
3. Set the LOCAL/REMOTE switch to REMOTE.
4. Set the ENABLE/DISABLE switch to ENABLE. This allows the subsystem to go online when the CPU reaches "wait state."

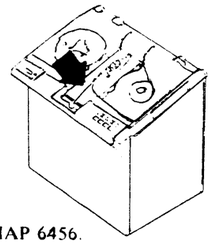
   Note: An optional way to force the CPU into a "halt" or "wait state" is to press STOP at the CPU.

Power Off—Attached to System
1 Enable/disable switch to disable
2 Probe pin A-A1M2P07 for an up level (red lamp) using tool PN817971
3 Local/remote switch to local
4 Depress the power off switch

Power On—Attached to System
1 Enable/disable switch to disable
2 Depress the power on switch
3 Local/remote switch to remote
4 Enable/disable switch to enable

PN 2524880
EC 734254

Figure D-3. Tape Loop Check



Note: On System/38, go to hard copy MAP 6456.

1. This test assumes that the LOAD/UNLOAD test has run successfully. If the test hasn't been run, go to MAP AB100.

2. This test checks out the vacuum switches, reel, capstan, and capactive sense unit on the following three operations:

   Forward Search
   Reset or Stop
   Rewind

Note: This writeup is for normal operation. If an abnormal operation occurs, go to the designated MAP page.

3. Remove tape reel from transport.

4. Setup: Cut an eight-foot length of scratch tape and position it as shown in Part 1 of this figure. After positioning the tape, install the half-column door and bypass the sliding door interlock switch.

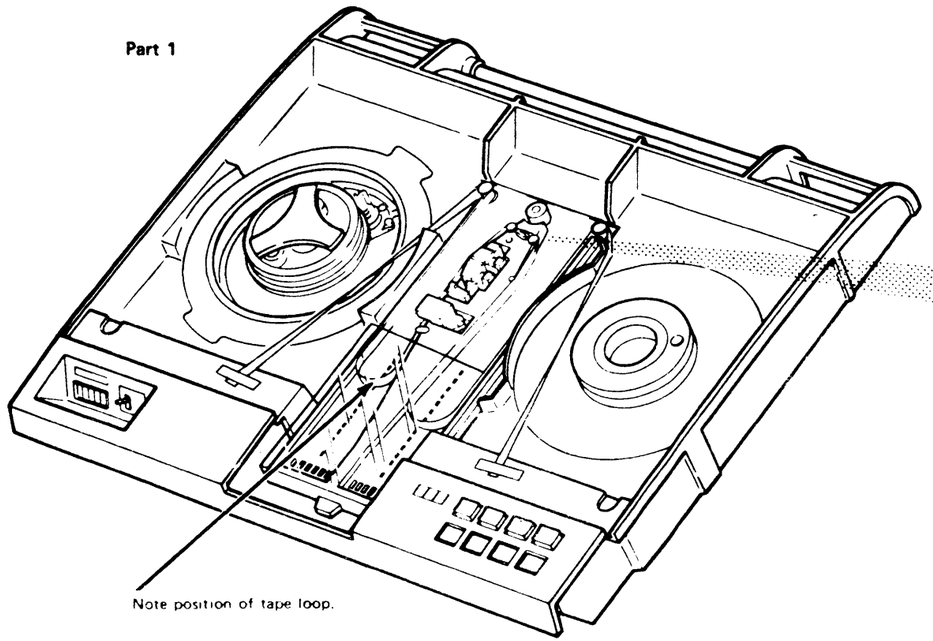
5. Forward Search:

   A. Press LOAD/REWIND:

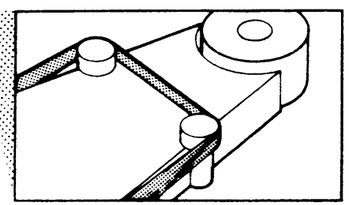
      1. Vacuum system should not time out (MAP AB132).
      2. Capstan should move clockwise (MAP AB133).
      3. Left reel should move counterclockwise (MAP AB134).
      4. Right reel should move clockwise (MAP AB134).

   B. Vary the loop in the left column, as shown in Part 2 of this figure. The left reel should go from maximum counterclockwise to forward null, to maximum clockwise (MAP AB134).

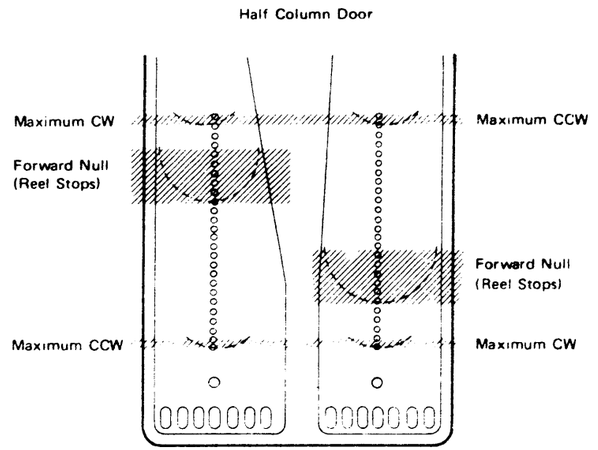
Part 1



Note: Carefully fold the tape and secure it over the guides.



Part 2



XQ0100 Seq 2 of 2	1846004 Part Number	734556 1 Sept 72	734556A 20 Oct 72	734556B 10 Nov [illegible]	734864 1 Aug [illegible]	443751 [illegible] Sept 74	846311 1 Feb 73	

Figure D-3. Tape Loop Check

6. Stop or Reset Null Condition:

   A. Press RESET. The capstan motor stops.

   B. Vary the loop in the left column as shown in Part 3 of this figure. The left reel should go from maximum counterclockwise to stop null, to maximum clockwise (MAP AB134).

   C. Vary the loop in the right column, as shown in Part 3 of this figure. The right reel should go from maximum clockwise, to stop null, to maximum counterclockwise (MAP AB134).

7. Rewind Operation:

   A. Press LOAD/REWIND:

      1. Capstan turns counterclockwise at rewind speed (MAP AB136).
      2. Left reel turns counterclockwise at high speed (MAP AB136).
      3. Right reel turns counterclockwise or doesn't turn (MAP AB136).

   B. Vary the loop in the left column, as shown in Part 4 of this figure. The left reel speed should go from maximum counterclockwise to minimum counterclockwise or stopped (MAP AB136).

   C. Vary the loop in the right column as shown in Part 4 of this figure. The right reel speed should go from maximum counterclockwise to stopped (MAP AB136).

8. End Load Rewind Operation.

   A. Position each loop in the stop null position as shown in Part 3 of this figure.

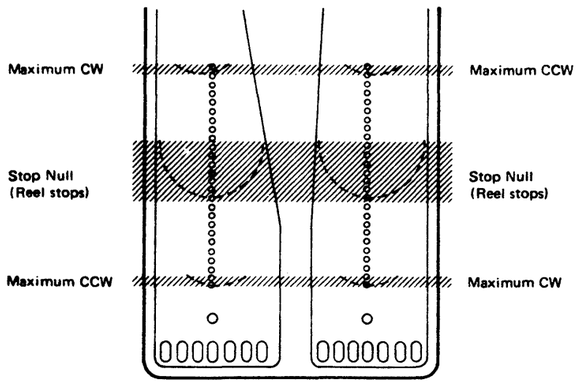
   B. Press RESET. Both reels should stop immediately (MAP AB140).

   C. Press UNLOAD/REWIND.

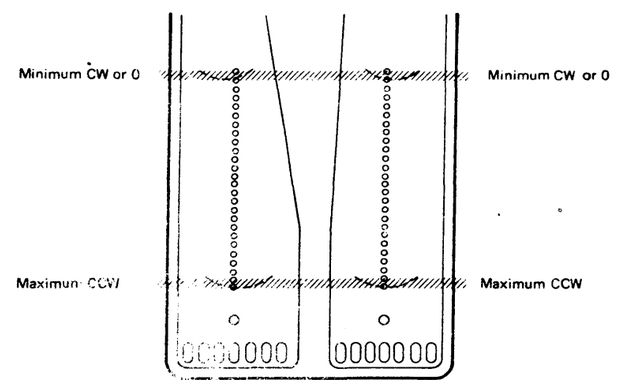
   D. Press RESET.

   E. The vacuum motor and reels should stop (MAP AB180). End of tape loop check.

Part 3



Part 4



XQ0200	1846005	734556	734556A	734556B	735101	736672
Seq. 1 of 2	Part Number	1 Sept 72	20 Oct 72	20 Nov 72	9 Apr 73	26 Oct 73

Figure D-4. Front and Rear Cover Removal and Replacement

Functional Code 000-31

Note: See the *IBM 3410/3411 Illustrated Parts Catalog*, order number S132-0006, for part numbers.

Procedure A – US Only

1. Grasp the cover sides near the top and lift, to unhook the retaining connectors, then pull outward.

2. Lift the cover to unhook the bottom tabs.

   Note: Some machines may have magnetic latches on bottom of cover.

3. Assemble in reverse order.

Procedure B – World Trade Only

The front and rear covers on World Trade machines must be unlatched before removing the cover. The cover is latched at the top left and top right corners.

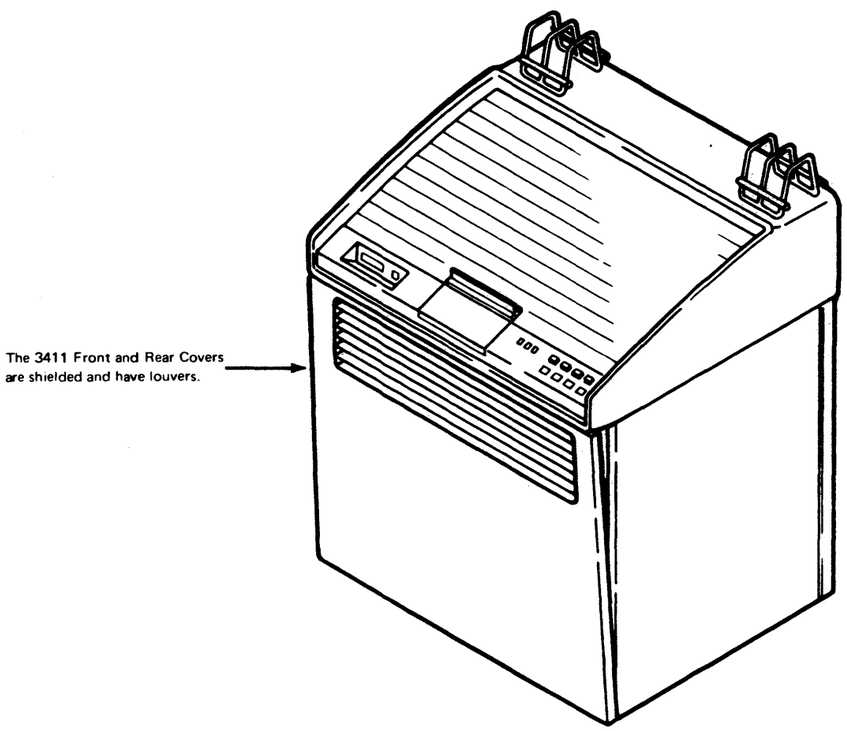
1. Slide a screwdriver or flat tool along the top edge of the cover until the latch arms in top left and top right corners are unhooked.

2. Grasp the cover sides near the top and lift, to unhook the retaining connectors, and then pull outward.

   Note: If the machines are installed close together, it may be necessary to raise the transport assembly to unlatch the rear cover.

3. Lift the cover to unhook the bottom tabs.

4. Assemble in the reverse order. Be sure the cover is latched when it is in place.



The 3411 Front and Rear Covers are shielded and have louvers.

Figure D-5. Top Cover (Part 2517716) Removal and Replacement

Functional Code 000-31

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.

2. Remove the front cover.

3. Open the sliding door.

CAUTION
To prevent top cover damage, always use the lifting bar to raise the transport assembly. Be sure both support brackets latch. One bracket may require manual latching.

World Trade Machines Only.

Remove transport hold down screw located on the left front corner of side frame before lifting transport.

This screw must be replaced when servicing is finished.

4. Raise the transport assembly.

5. Remove the four horizontal screws located under the front of the top cover.

6. Remove the two screws, one on each side, that secure the cover brackets to the frame. The brackets are located towards the rear on each side.

7. Lower the transport assembly *carefully* to prevent damage.

8. Close the sliding door.

9. Holding the top cover at the rear, lift up and forward to remove the cover.

Note: When assembling the top cover, make sure the sliding door opens and closes without binding.

10. Assemble in reverse order.

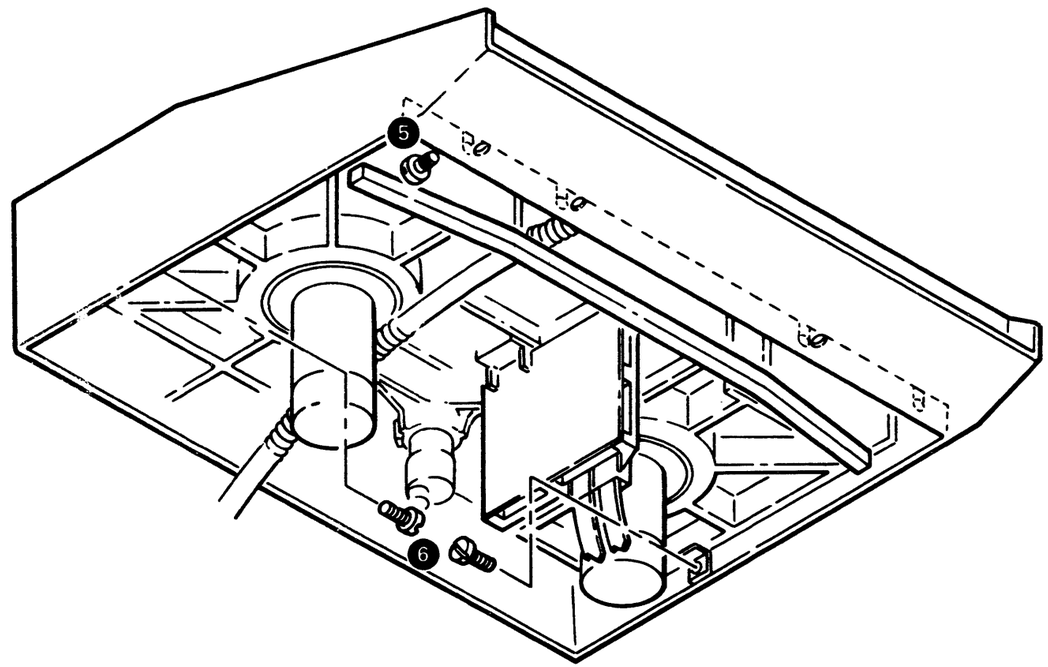
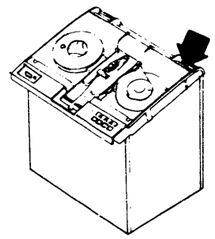


Figure D-6. Sliding Door Interlock Switch (Part 526088) Removal, Replacement, and Adjustment

Functional Code 000-34



1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.

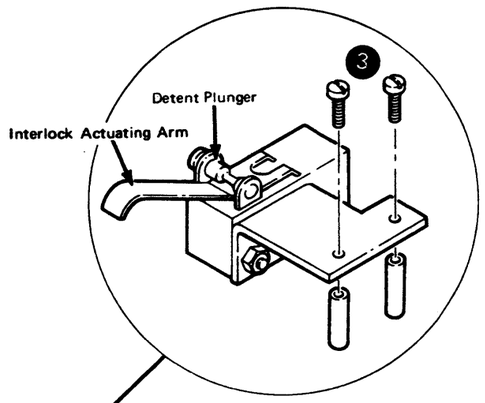
2. Remove the top cover.

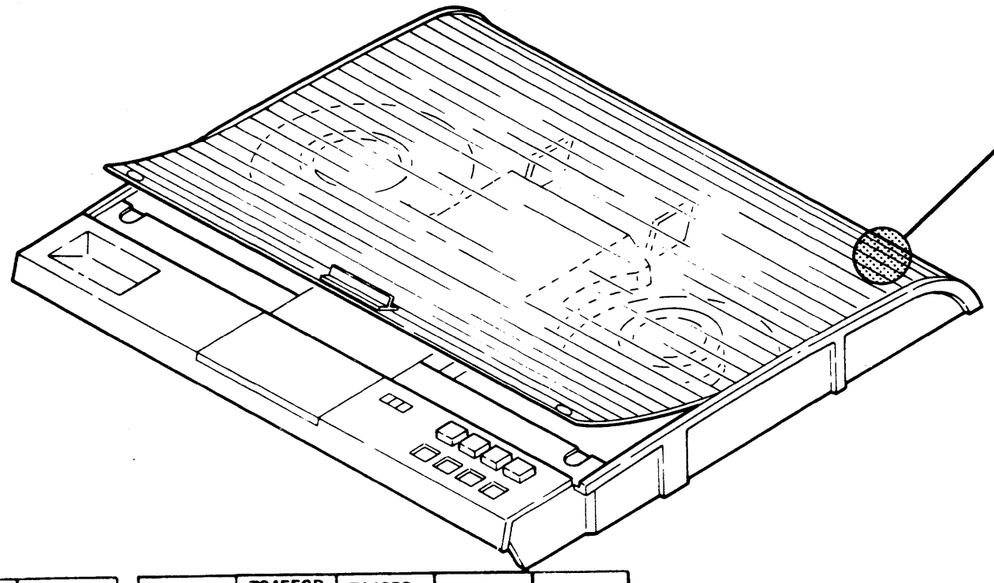
Note: The top cover must be removed carefully. Please review Figure D-5, "Top Cover Removal and Replacement," before beginning.

3. Remove the two switch mounting screws, and then remove the switch from the machine.

4. Remove the two wires from the switch and transfer them, one for one, to the new switch.

5. Attach the new switch to the machine.





6. Adjust the switch as follows:

   A. Position the switch so that the back screw is down in the slot.

   B. Tighten the screw enough to hold position while adjusting the switch.

   C. Replace and guide the sliding door as if the top cover was mounted.

   D. Move the switch actuator arm up until the switch transfers with sufficient overtravel to meet the the following conditions:

      1. The actuating arm doesn't scrape against the sliding door when the door is closed.

      2. The actuating arm doesn't slide off the sliding door when the door is closed.

      3. When the switch is manually bypassed, the closing of the sliding door must reset the switch.

Note: To manually bypass the interlock switch, remove the front cover and raise the transport assembly. Reach up through the machine casting and push the interlock detent plunger to the right.

7. Assemble in reverse order.

XO0300 Seq 2 of 2	1846006 Part Number	734556 1 Sept 72	734556B 20 Nov 72	734852 26 Feb 73		

Figure D-7. Sliding Door (Part 2517665)* Removal and Replacement

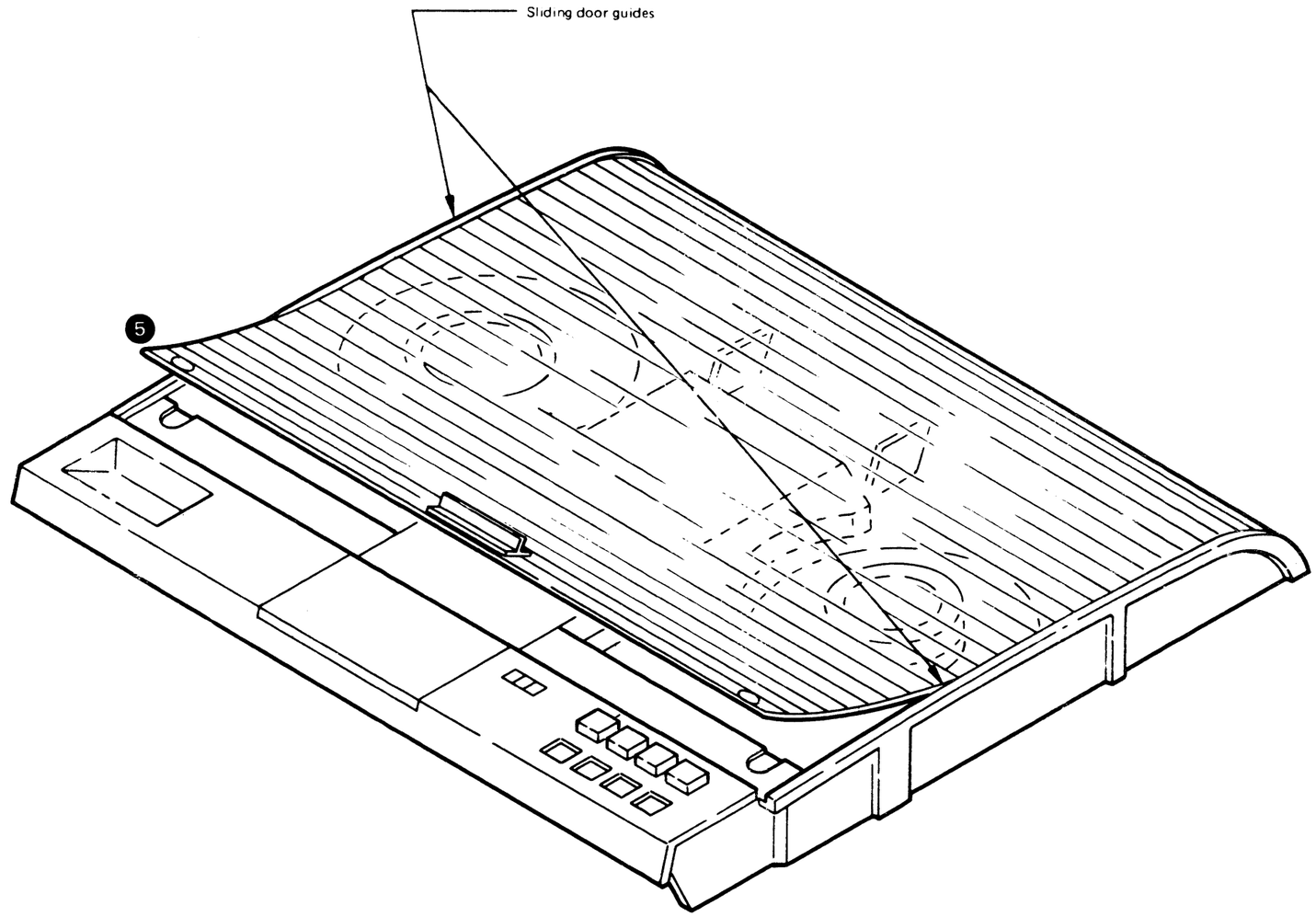
Functional Code 000-32

1. Turn off subsystem power. See Figure D-2 "Power On Off Procedures," for reference.

Note: The top cover must be removed carefully. Please review Figure D-5, "Top Cover Removal and Replacement," before beginning.

2. Remove the top cover.
3. Remove the rear cover.
4. Unhook the sliding door retaining strap from the rear support bar.
5. Lift the sliding door out of its track.
6. Place the new door in the track.
7. Make sure the sliding door opens and closes without binding.
8. Check the adjustment of the sliding door interlock switch. See Figure D-6, "Sliding Door Interlock Switch Assembly Removal, Replacement, and Adjustment," for reference.
9. Replace the top cover.

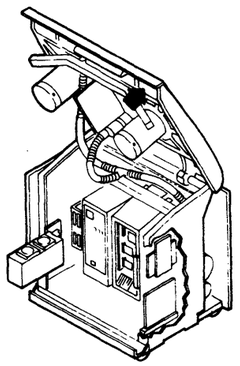
*Order substitute part number 2517910 if the transport has white plastic sliding door guides.

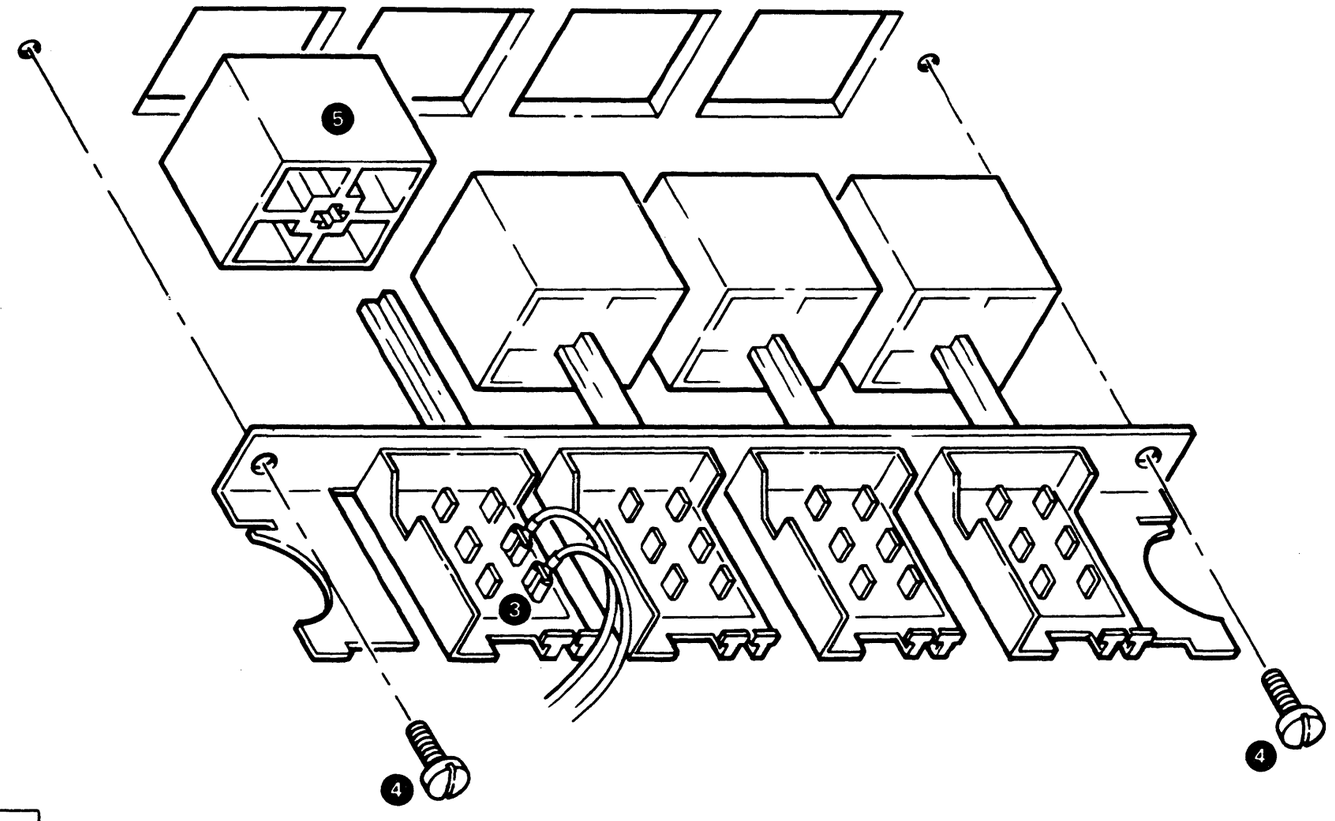


XQ0400	1846007	734556	734864	734864		
Seq. 1 of 2	Part Number	1 Sept 72	1 Aug 73	1 Aug 73		

Figure D-8. Operator Switch Assembly (Part 2517620) Removal and Replacement

Functional Code 006-11





Note: The entire assembly must be replaced if any individual switch needs replacement.

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.

2. Remove the top cover.

Note: The top cover must be removed carefully. Please review Figure D-5, "Top Cover Removal and Replacement," before beginning.

3. Remove and transfer the wires, one for one, to the new switch assembly.

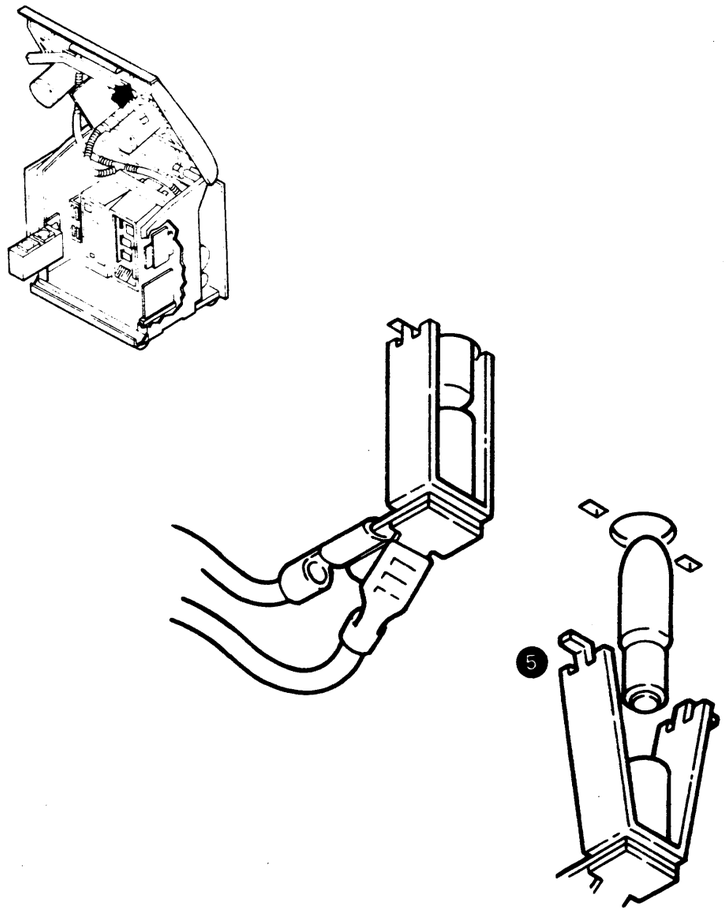
4. Remove the two screws that hold the assembly in place. The assembly can now be removed from the machine.

5. Transfer the operator pushbuttons to the new assembly.

6. Assemble in reverse order.

Figure D-9. Operator Panel Lamp (Part 2518063) Removal and Replacement

Functional Code 006-10



Note: If you have a piece of tubing that you normally use to replace bad lamps, remove the plastic lamp cover to gain access to the lamps. If you don't have this piece of tubing, follow this procedure:

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.
2. Remove the front cover.
3. Open the sliding door.

CAUTION
To prevent top cover damage, always use the lifting bar to raise the transport assembly. Be sure both support brackets latch. One bracket may require manual latching.

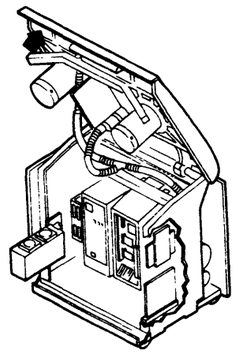
World Trade Machines Only.

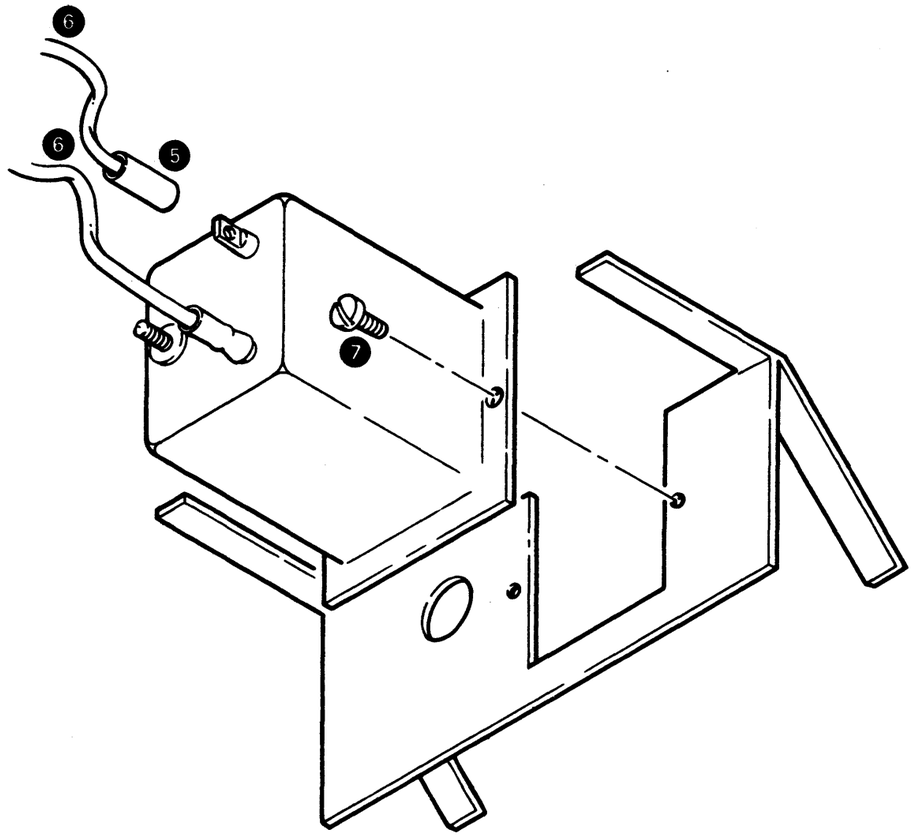
Remove transport hold down screw located on the left front corner of side frame before lifting transport.

This screw must be replaced when servicing is finished.

4. Raise the transport assembly.
5. Squeeze the springs on each side of the lamp socket. Then pull the socket down and out of the machine.
6. Remove the bad lamp, and install a new one.
7. Assemble in reverse order.

Figure D-10. Usage Meter Removal and Replacement





Functional Code 770-07

60 Hz Part 740503
50 Hz Part 740608

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.

2. Remove the front cover.

3. Open the sliding door.

CAUTION
To prevent top cover damage, always use the lifting bar to raise the transport assembly. Be sure both support brackets latch. One bracket may require manual latching.

World Trade Machines Only.

Remove transport hold down screw located on the left front corner of side frame before lifting transport.

This screw must be replaced when servicing is finished.

4. Raise the transport assembly.

5. Remove the heat-shrink material from the two meter wires.

6. Unsolder the two meter wires.

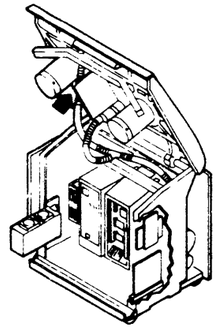
7. Remove the two meter mounting screws. Pull the meter down and out of the machine.

8. Install the new meter in reverse order.

Note: Be sure to install new heat-shrink material on the two meter wires.

Figure D-11. Usage Meter Card (Part 372688) Removal and Replacement

Functional Code 770-03



1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.

2. Remove the front cover.

3. Open the sliding door

CAUTION
To prevent top cover damage, always use the lifting bar to raise the transport assembly. Be sure both support brackets latch. One bracket may require manual latching.

World Trade Machines Only:

Remove transport hold down screw located on the left front corner of side frame before lifting transport.

This screw must be replaced when servicing is finished.

4. Raise the transport assembly.

5. Break and remove the tamper-proof plugs.

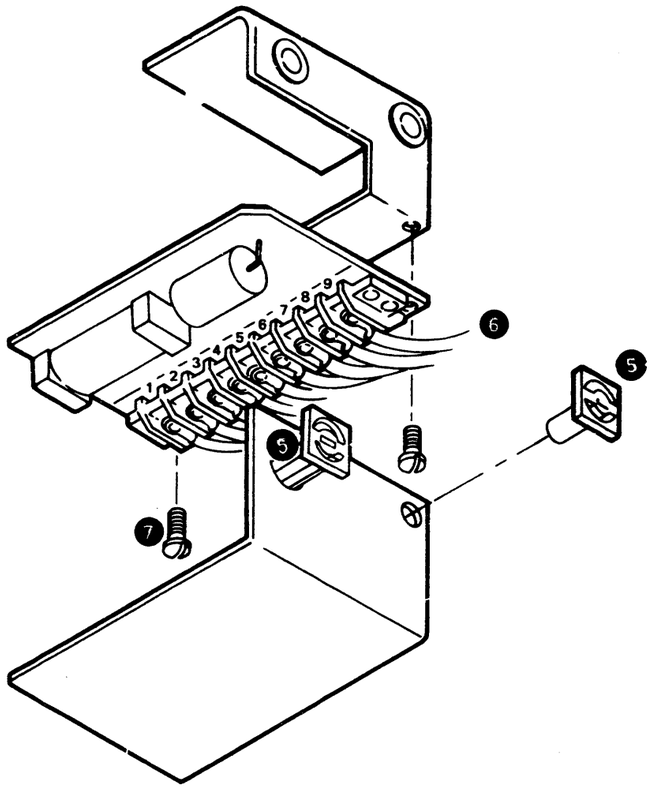
Note: 3410 machines manufactured after EC 443769 do not have tamper-proof plugs.

6. Disconnect and transfer the wires, one by one, to the new card.

7. Remove the two card mounting screws, then remove the card from the machine.

8. Position the new card in the machine, and replace the two card mounting screws.

Note: It is not necessary to replace tamper-proof plugs or shield on 3410s when the card is replaced. The shield is required on all 3411 machines.

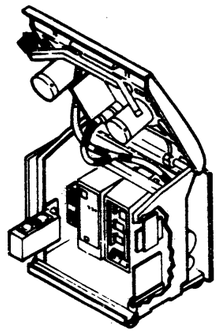


XQ0600	1846009
Sec 1 of 2	Part Number

See EC History	734864	443751	443800	
	1 Aug 73	20 Sept 74	31 Oct 75	

Figure D-12. Usage Motor Enable/Dissble Switch (Part 725347) Removal and Replacement

Functional Code 770-11



1. **Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.**
2. **Remove the front cover.**
3. **Open the sliding door.**

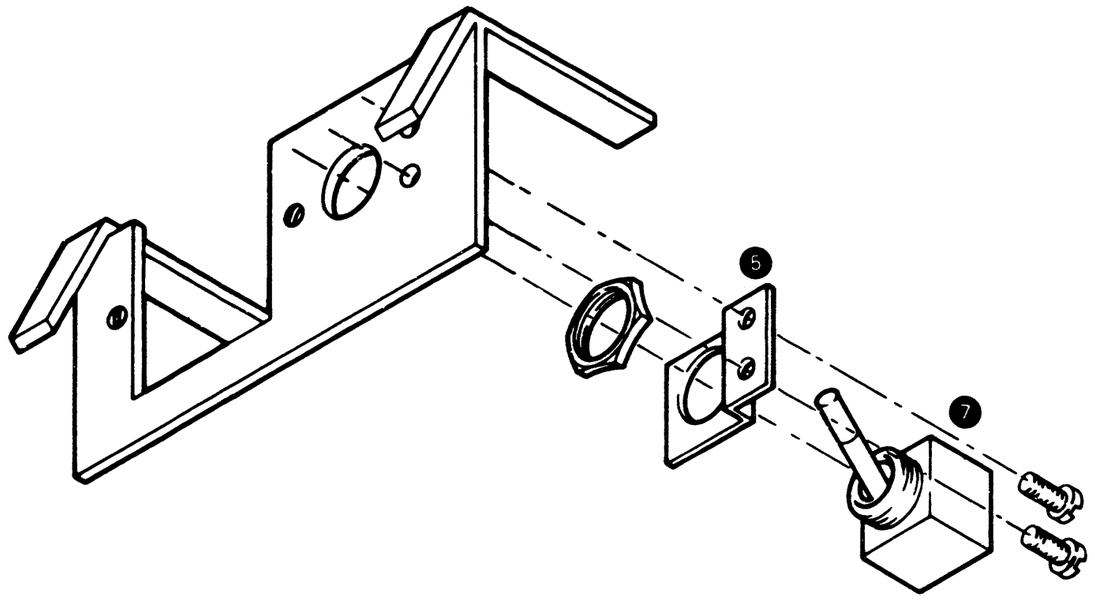
CAUTION
To prevent top cover damage, always use the lifting bar to raise the transport assembly. Be sure both support brackets latch. One bracket may require manual latching.

World Trade Machines Only.

Remove transport hold down screw located on the left front corner of side frame before lifting transport.

This screw must be replaced when servicing is finished.

4. **Raise the transport assembly.**
5. **Remove the switch bracket from the meter bracket.**
6. Remove the wires connected to the switch.
7. **Remove switch from switch bracket.**
8. Install new switch in reverse order.



XQ0600	1846009
Seq 2 of 2	Part Number

See EC History	734864 1 Aug 73	443751 20 Sept 74	443800 31 Oct 75	

Figure D-13. Usage Meter Transformer Removal and Replacement

Functional Code 770-xx

60 Hz Part 740560
50 Hz Part 740562

Note: The 3411 doesn't have a usage meter transformer.

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.

2. Open the sliding door.

3. Remove the front cover.

CAUTION
To prevent top cover damage, always use the lifting bar to raise the transport assembly. Be sure both support brackets latch. One bracket may require manual latching.

World Trade Machines Only.

Remove transport hold down screw located on the left front corner of side frame before lifting transport.

This screw must be replaced when servicing is finished.

4. Raise the transport assembly.

5. Loosen the screws that secure the terminal shield, then remove the shield.

6. Disconnect and label the wiring to the transformer.

7. Remove the transformer mounting screws, then remove the transformer from the machine.

8. Install the new transformer in reverse order.

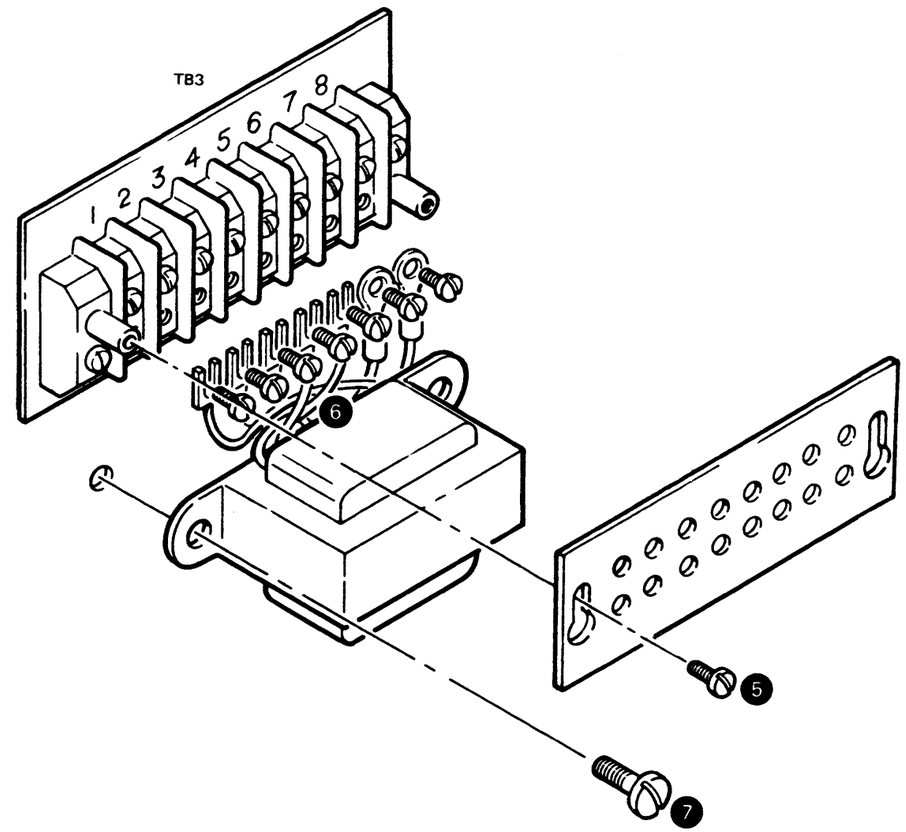


Figure D-14. Usage Meter Circuit Fuse (Part 78998) Removal and Replacement

Functional Code 770-18

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures."

2. Replace the fuse with part 78998.

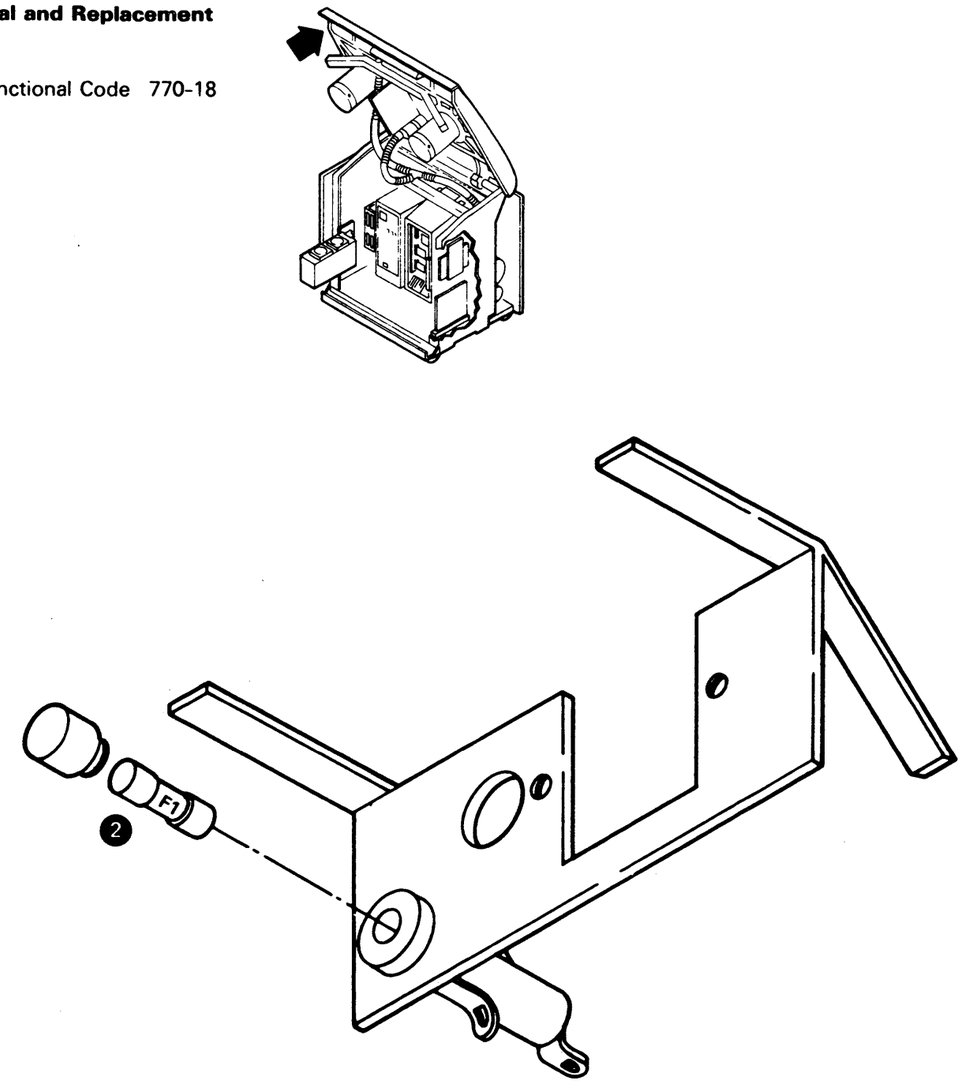


Figure D-15. File Protect Switch Assembly (Part 2517715) Removal and Replacement

Functional Code 005-37

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.
2. Open the sliding door.
3. Remove the filler ring.

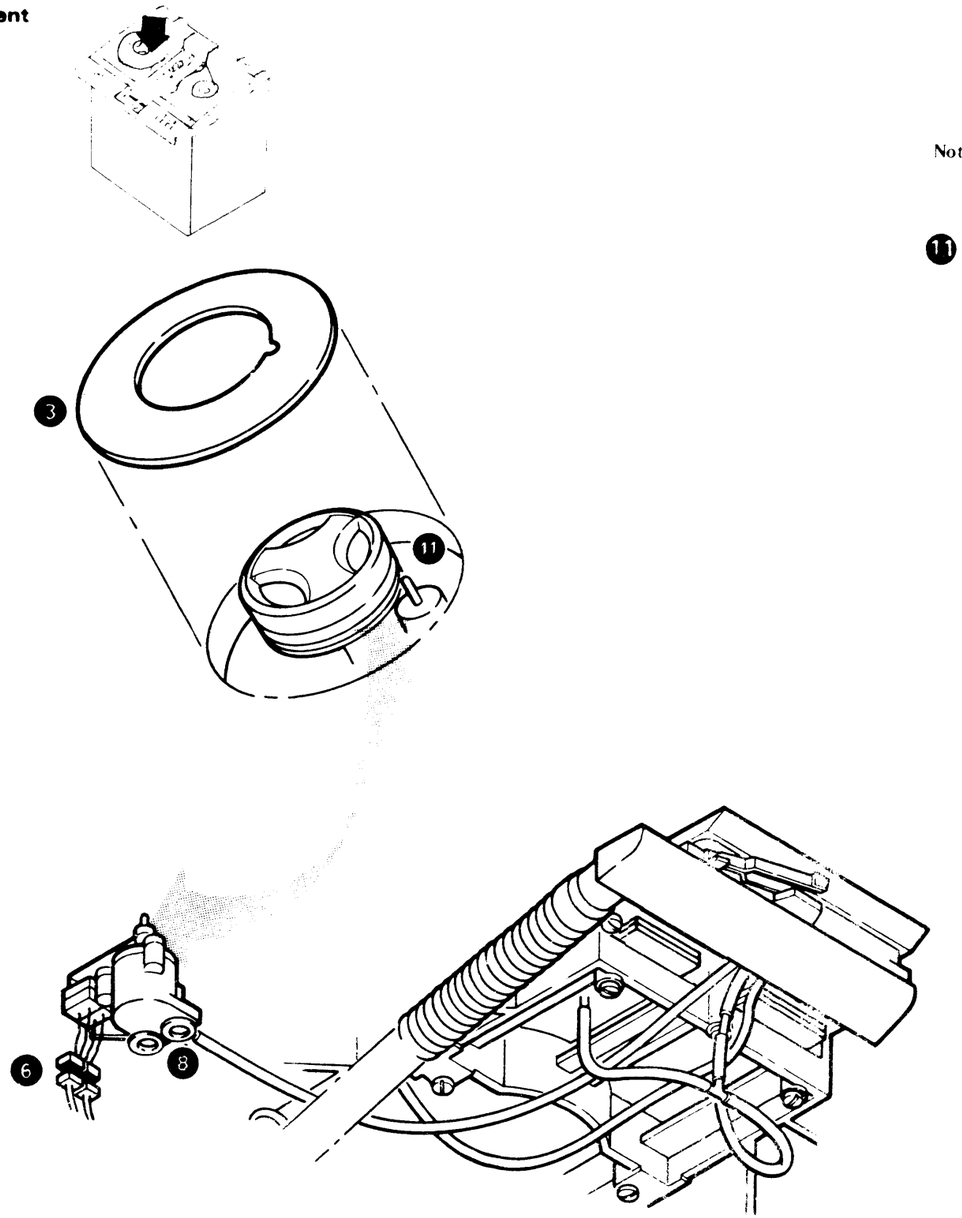
   Note: The filler ring is held in place by adhesive. Insert a thin object under the ring and *carefully* pry it loose. The filler ring is reusable if it isn't bent or broken during removal. If you need a new filler ring, order P/N 2517769. If double backed tape is not reusable, position filler ring with rubber cement P/N 450521.
4. Remove the front cover.

   CAUTION
   To prevent top cover damage, always use the lifting bar to raise the transport assembly. Be sure both support brackets latch. One bracket may require manual latching.

   World Trade Machines Only.

   Remove transport hold down screw located on the left front corner of side frame before lifting transport.

   This screw must be replaced when servicing is finished.
5. Raise the transport assembly.
6. Unplug the two cables that go to the switch.
7. Remove the two mounting screws.
8. Remove the vacuum hose from the file protect assembly.
10. Install the new assembly in reverse order.



Note: Use a # 10 washer, if required, between the plunger housing and the motor plate to meet the conditions stated in 11 (b) and (c).

11 (a) Make sure that the file protect plunger fits in the file protect groove without rubbing against the tape reel.

(b) Check that the file protect plunger extends a minimum of .125 inches (3,17 mm) above the reel hub flange. Insert the # 10 washer if this minimum cannot be met.

(c) With the plunger retracted, check that the plunger is a minimum of .010 inches (0,25 mm) below the reel hub flange. Remove the # 10 washer if this minimum cannot be met.

(d) Be sure both micro switches transfer before applying vacuum.

Figure D-16. Logic Board Removal and Replacement

Functional Code xxx-02

Models 1 and 2	8529050 or 8529060 or 8529070 or 8529080
Model 3	8529051 or 8529061 or 8529071 or 8529081

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.

2. Remove the front cover.

3. Open the sliding door.

CAUTION
To prevent top cover damage, always use the lifting bar to raise the transport assembly. Be sure both support brackets latch. One bracket may require manual latching.

World Trade Machines Only.

Remove transport hold down screw located on the left front corner of side frame before lifting transport.

This screw must be replaced when servicing is finished.

4. Raise the transport assembly.

5. Remove the six voltage connectors.

6. Unplug and label the six logic board cables and the two jumper cards so they can be plugged into the same sockets on the new board. Transfer the two jumper cards (P/N 5861451) to the new board.

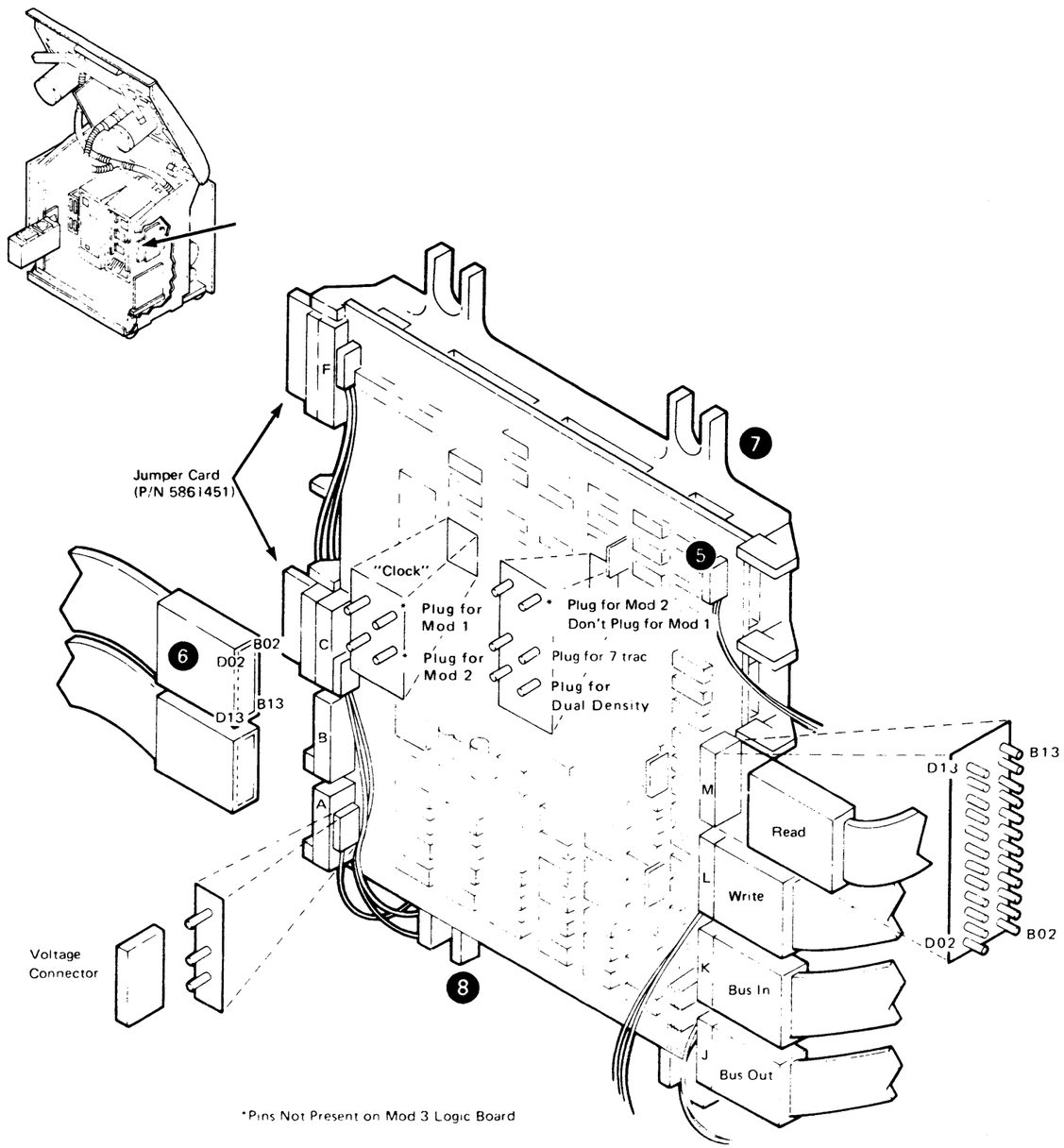
7. Remove the top two mounting screws.

8. Loosen the bottom two mounting screws.

9. Remove the board from the machine.

10. Identify the jumpers that define model and features, and transfer them to the new board.

11. Install the new board in reverse order.



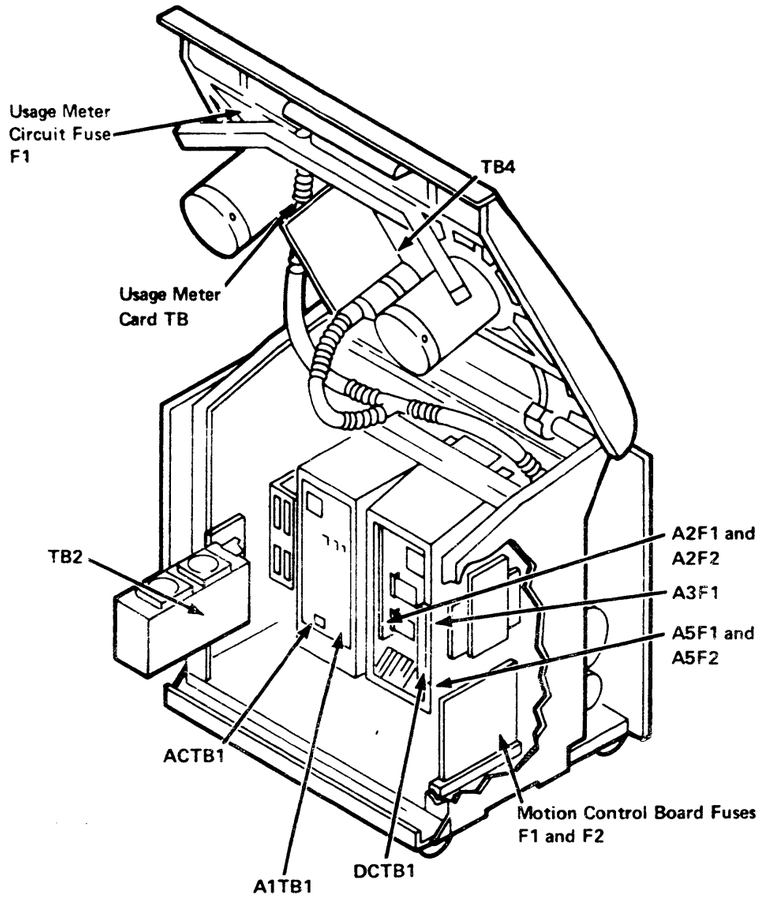
*Pins Not Present on Mod 3 Logic Board

Socket Designation	Socket Pin Numbers	Logic Converts To
A	D02 thru D13 B02 thru B13	A02 thru A13 A22 thru A33
B	D02 thru D13 B02 thru B13	B02 thru B13 B22 thru B33
C	D02 thru D13 B02 thru B13	C02 thru C13 C22 thru C33
F	D02 thru D13 B02 thru B13	F02 thru F13 F22 thru F33
J	D13 thru D02 B13 thru B02	J13 thru J02 J33 thru J22
K	D13 thru D02 B13 thru B02	K13 thru K02 K33 thru K22
L	D13 thru D02 B13 thru B02	L13 thru L02 L33 thru L22
M	D13 thru D02 B13 thru B02	M13 thru M02 M33 thru M22

Figure D-17. Terminal Board and Fuse Locations

Terminal Board Name	Location
ACTB1	Located inside the AC Box. See Figure D-54.
ACTB2	50 Hz only. Located inside the AC Box, at the top rear.
DCTB1	Located on the right front of the DC Box in the 3411. Located in front of the C4 and C5 capacitors in the 3410. See Figure D-51.
TB2	Located on the 3411 control unit gate.
TB3	Present in 3410 only. Located on left side frame. See Figure D-13.
TB4	Located to the right of the Read/Write Head and Card Assembly.
TB5	Located in the pneumatic supply. See Figure D-33.
A2TB1	Located on the A2 board in the DC Box. See Figure D-48.
A3TB1	Located on the A3 board in the DC Box. See Figure D-47.
A1TB1	Located on the back of the AC Box front cover. System 360/370. See Figure D-46.
Usage Meter Card TB	Located on the usage meter card. See Figure D-11.

Fuse Name	Location
Motion Control Board Fuses F1 and F2	Located on the Motion Control Board. See Figure D-21.
Usage Meter Circuit Fuse F1	Located on meter bracket. See Figure D-14.
A2F1 and A2F2	Located on the A2 board in the DC Box. See Figure D-52.
A3F1	Located on the A3 board in the DC Box. See Figure D-52.
A5F1 and A5F2	Located on the A5 board in the DC Box. See Figure D-52.



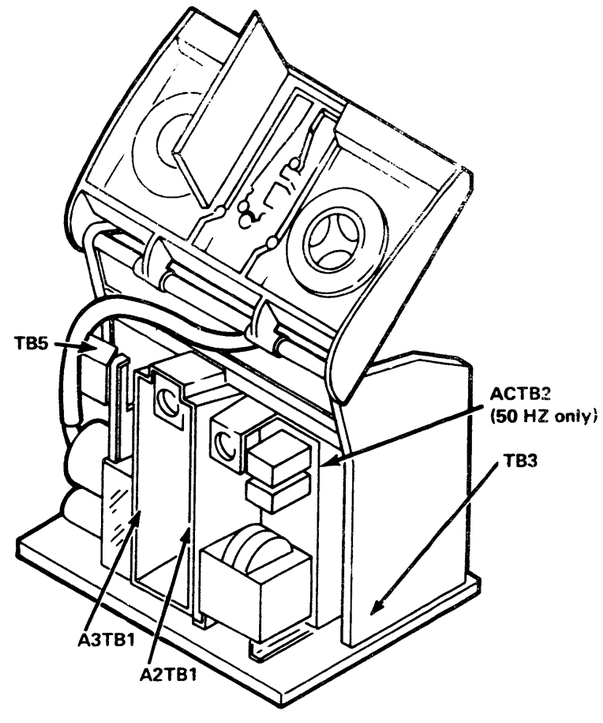


Figure D-18. Deskew Board Removal and Replacement

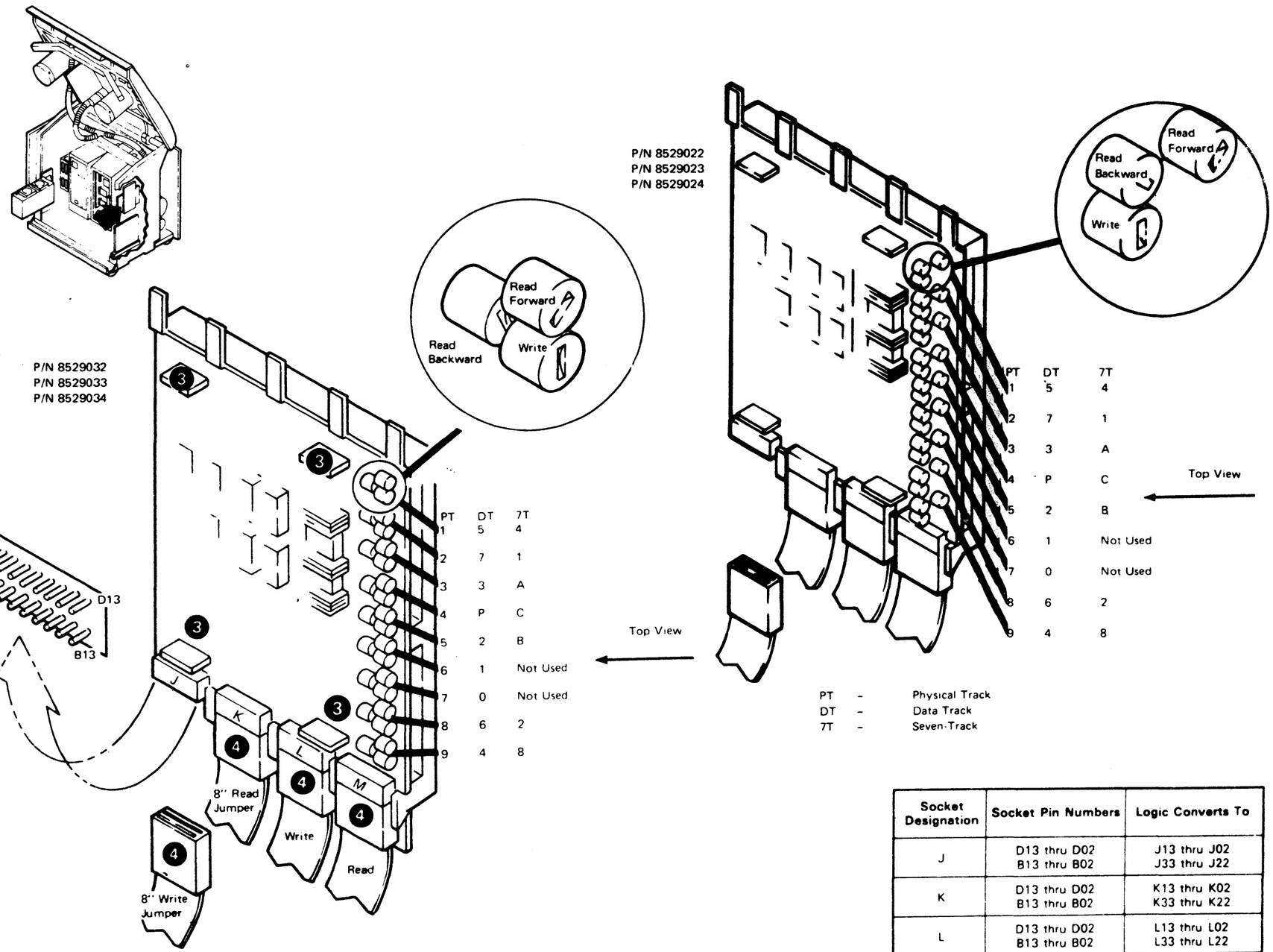
Functional Code 009-46

Model 1	8529022 or 8529032
Model 2	8529023 or 8529033
Model 3	8529024 or 8529034

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.
2. Remove the logic board. See Figure D-16, "Logic Board Removal and Replacement," for reference.
3. Remove the four voltage connectors.
4. Label and remove the four flat cables.
5. Loosen the two back mounting screws.
6. Remove the two front mounting screws.
7. Remove the board from the machine.
8. Install new board in reverse order.
9. Install the logic board that was removed in Step 2.

Note: After installing a new deskew board, you must run the skew diagnostics and adjust the skew. On System/360 and System/370, run OLT T3410P. On System/3, run diagnostic section 70A, routine 02.

On System/38, run MAP 6420 and Good Machine Path to verify.



Socket Designation	Socket Pin Numbers	Logic Converts To
J	D13 thru D02 B13 thru B02	J13 thru J02 J33 thru J22
K	D13 thru D02 B13 thru B02	K13 thru K02 K33 thru K22
L	D13 thru D02 B13 thru B02	L13 thru L02 L33 thru L22
M	D13 thru D02 B13 thru B02	M13 thru M02 M33 thru M22

Figure D-19. Motion Control Board Removal and Replacement

Functional Code xxx-05

Models 1 and 2	Part 373577 Figure A, or 373581 Figure B
Model 3	Part 373578 Figure A, or 373582 Figure B

Note: Before replacing a board, check the contacts and sockets on the old board to make sure that they are clean. If they are dirty, clean them, reseat the board, and then retry the failing operation.

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.

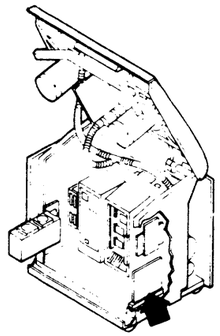
2. Remove the front cover.

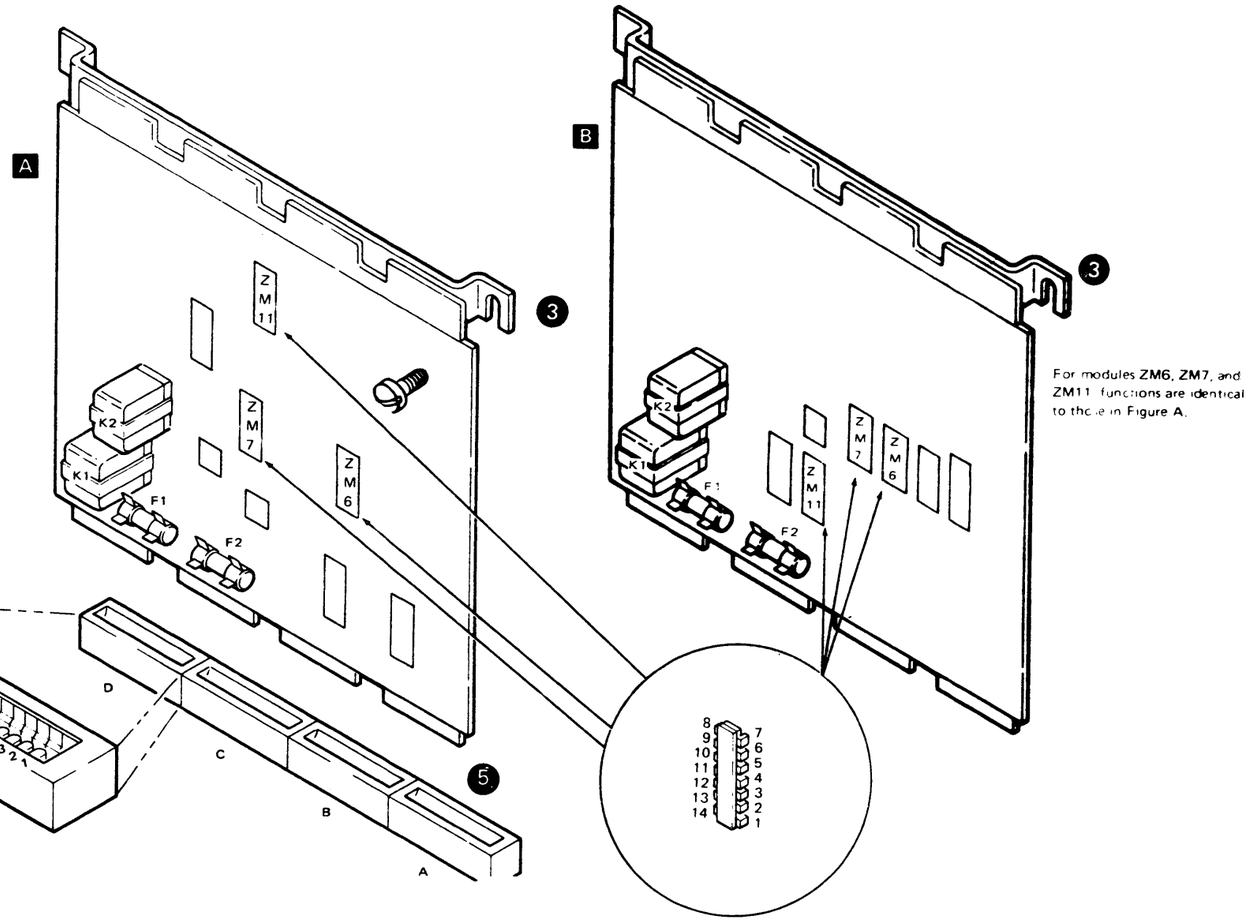
3. Loosen the front mounting screw on the motion control board bracket. The rear screw is a shoulder screw and doesn't need loosening.

4. Lift the board straight up to remove it from its socket. It may be necessary to *carefully* rock the board back and forth to loosen it from the socket.

5. Insert the new board firmly in the socket. Don't flex the board when applying pressure to seat it.

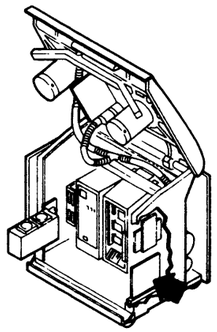
6. Tighten the bracket mounting screw.

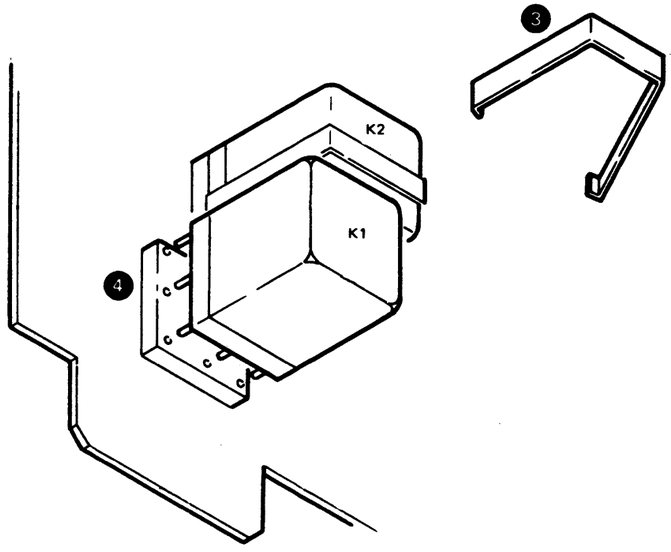




For modules ZM6, ZM7, and ZM11 functions are identical to those in Figure A.

Figure D-20. Motion Control Board Relays (Part 2517831) Removal and Replacement



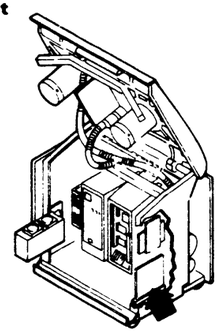


Functional Code xxx-06

Note: The K1 and K2 relays are located at the lower rear of the motion control board.

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.
2. Remove the front cover.
3. Unsnap the relay holding clip.
4. Remove the relay by pulling it straight out from the motion control board.
5. Install the new relay.
6. Replace the relay holding clip.

Figure D-21. Motion Control Board Fuses Removal and Replacement

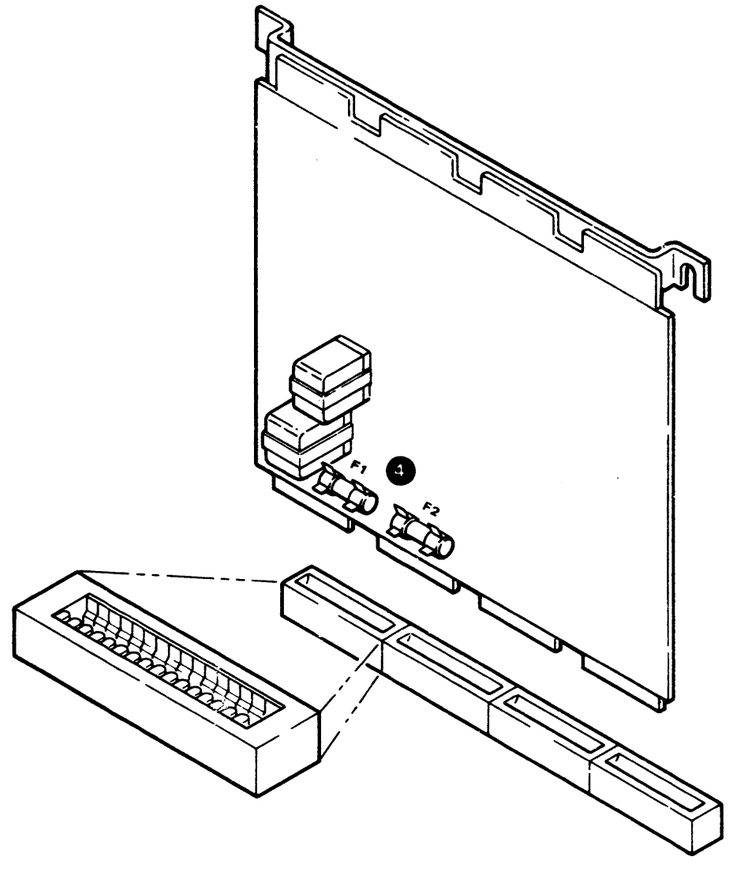


Functional Code 010-18

5 Amp. (Models 1 and 2)Part 123786
10 Amp. (Model 3) Part 511063

Note: F1 is for -15 volts; F2 is for +15 volts.

1. **Remove the front cover.**
2. Check which light emitting diode (LED) is lit. This indicates which fuse is blown.
3. **Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.**
4. **Remove the blown fuse.**
5. **Replace with the proper size fuse.**



XQ1100 Seq. 1 of 2	1846014 Part Number

See EC History	734864 1 Aug 73	443751 20 Sept 74	443800 31 Oct 75	

Figure D-22. Capacitive Sense Assembly (Part 2517555) Removal and Replacement

Functional Code 010-43

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.

2. Remove the front cover.

3. Open the sliding door.

CAUTION
To prevent top cover damage, always use the lifting bar to raise the transport assembly. Be sure both support brackets latch. One bracket may require manual latching.

World Trade Machines Only.

Remove transport hold down screw located on the left front corner of side frame before lifting transport.

This screw must be replaced when servicing is finished.

4. Raise the transport assembly.

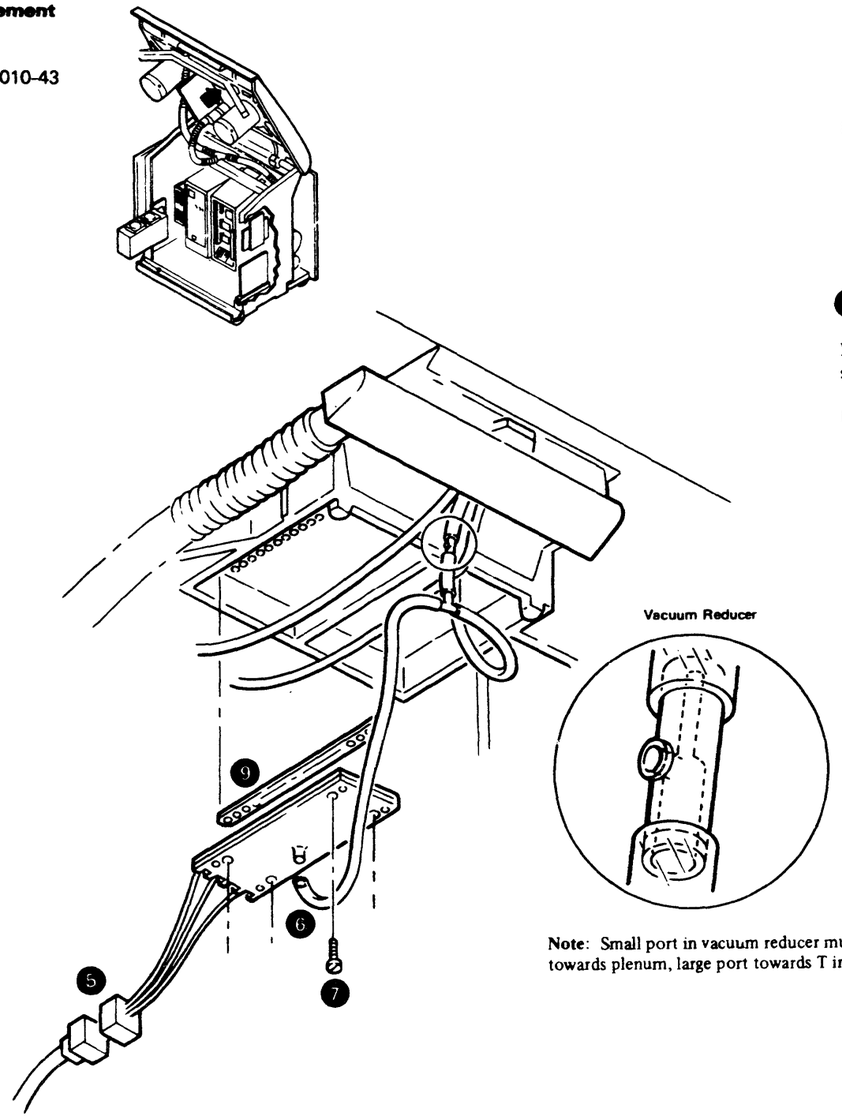
5. Use a broad blade screwdriver to *carefully* unplug the three-pronged signal connector, because it is difficult to unplug by hand.

6. Remove the vacuum hose from the capacitive sense assembly.

CAUTION
Do not pull hard too on hose because the port on the back of the capacitor sensor will break. Pry hose off with a screwdriver.

7. Remove the four mounting screws. These are the screws with the larger heads.

CAUTION
Over tightening these screws during replacement will strip the holes in the column.



Note: Small port in vacuum reducer must be towards plenum, large port towards T in hose.

8. Carefully remove the capacitive sense assembly. You should be able to work it out without disconnecting the file protect and BOT/EOT vacuum hoses. If you do have trouble removing the assembly, remove these vacuum hoses *carefully* to prevent damage to the tips, and then remove the capacitive sense unit.

9. Make sure the rubber seal is removed.

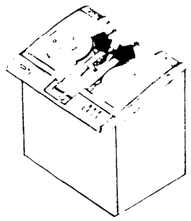
Note: While the assembly is out, inspect the column sensing ports to make sure they are open.

10. Install the new capacitive sense assembly in reverse order. Make sure you install the rubber seal.

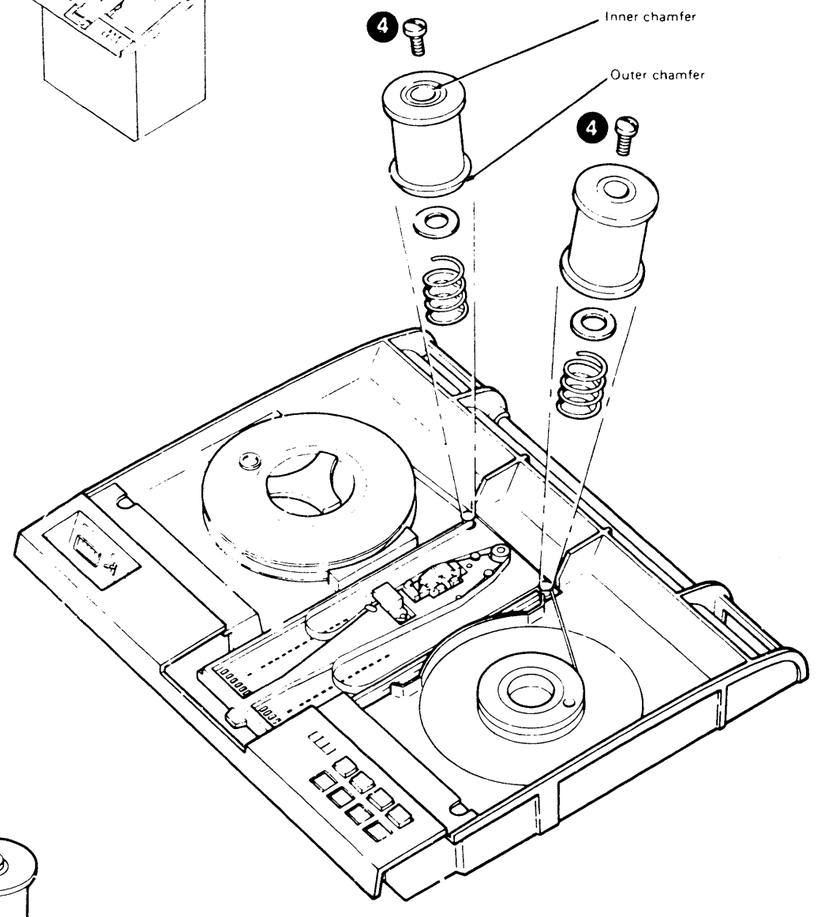
XQ1100 Sers 2 of 2	1846014 Part Number

See EC History	734864 1 Aug 73	443751 20 Sept 74	443800 31 Oct 75	

Figure D-23. Tape Idler Assembly Removal, Replacement, and Adjustment



Functional Code 011-25



Left Tape Idler	Part 2518334
Right Tape Idler	Part 2517636

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.
2. Open the sliding door
3. Open the vacuum column cover.
4. Remove the adjusting screw located in the center of the idler.
5. Lift the idler assembly off the shaft.
6. Install new idler on the shaft.

   Note: The left idler must be installed so that the inner chamfer is on the top. The left and right idlers are not interchangeable.
7. Replace the center adjusting screw.
8. To raise or lower the idler, turn the center adjusting screw.
9. Verify proper alignment to the tape column by checking your adjustment with the go/no-go gauge, part 2518029.

   Note: When using the go/no-go gauge, make sure that the entire bottom of the gauge is in firm contact with the back surface of the vacuum column. The go side of the gauge must not contact the underside of the upper flange. The no-go side of the gauge should contact the underside of the upper flange.
10. Depress the idler to check for binding. The spring should return freely.
11. Check tape tracking. See Figure D-36, "Tape Tracking Check and Adjustment," for reference.

    On System/38, run MAP 6420 and then Good Machine Path to verify.

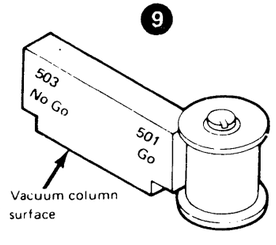


Figure D-24. Tape Guide Assembly Removal and Replacement

Functional Code 011-25

Note: See the *IBM 3410/3411 Illustrated Parts Catalog*, order number S132-0006, for part numbers.

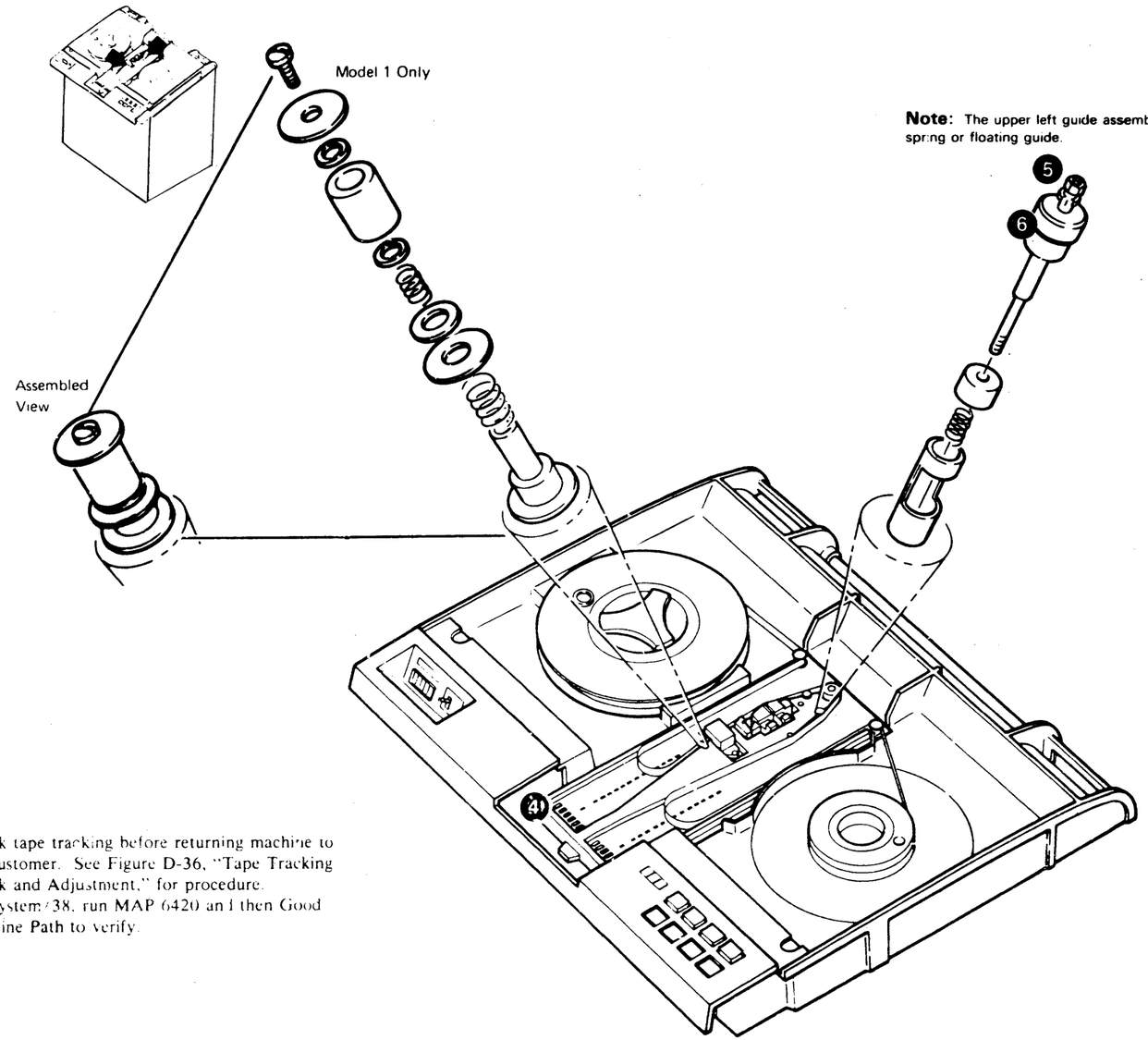
1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.
2. Open the sliding door.
3. Open the vacuum column cover.
4. Cover the holes at the bottom of the vacuum columns with masking tape. This prevents the loss of small parts.
5. Remove the nut and the washer from the top of the tape guide.
6. Remove the cap.
7. Using your fingers, unscrew the tape guide assembly, then remove it from the machine.

   Note: Be careful not to lose the spring from the two floating guides.
8. Reuse all parts not being replaced.
9. Assemble all parts before inserting the new tape guide assembly in the machine. The polished side of the ceramic guide should face the tape.

   Note: Later level upper guides have a circular indentation on back side for identification purposes.
10. Using the cap, screw the complete tape guide assembly in place.

CAUTION
Insure that lower ceramic guide is seated properly on the mounting shaft shoulder before tightening. Check for compliant action.

11. The lower left guide roller on Model 1 must turn freely.
12. Check tape tracking before returning machine to the customer. See Figure D-36, "Tape Tracking Check and Adjustment," for procedure. On System/38, run MAP 6420 an I then Good Machine Path to verify.



XQ1200 Seq 2 of 2	1846015 Part Number	734556B 20 Nov 72	734852 26 Feb 73	734847 29 Mar 73	734864 1 Aug 73	736672 26 Oct 73	846311 1 Feb 74	

Figure D-24A. Subplate and Guide Adjustments

1. Open the sliding door.

2. Open the vacuum column door.

3. Measure the guides using subplate adjusting tool, part 2518029.

   Note: When using the go no-go gauge, make sure that the entire bottom of the gauge is in contact with the vacuum column surface and the top go side is under the ceramic guide.

4. If guides do not need adjustment, proceed no further. Return to CARRL D-36.

5. If the guides need adjustment, turn off subsystem power. See CARRL D-2, "Power On Off Procedures for reference."

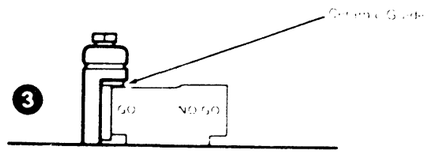
6. Remove the front cover.

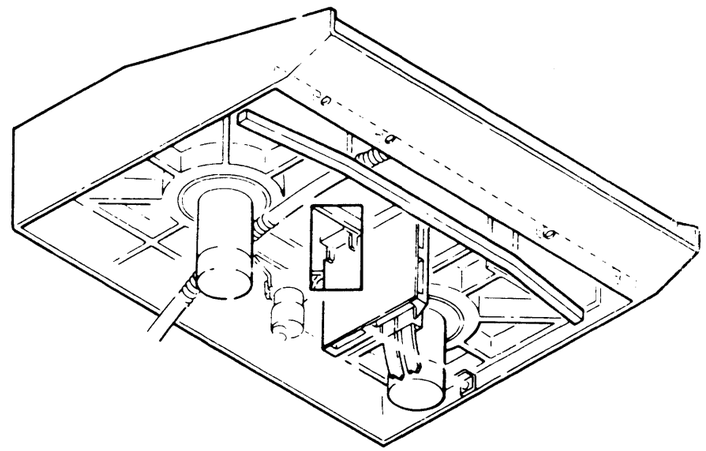
7. Remove plastic covers from subplate mounting screw heads. Adjust the guides by turning the subplate mounting screws. Do this adjustment with the transport down. Turn the screws clockwise to raise the guides; counterclockwise to lower the guides.

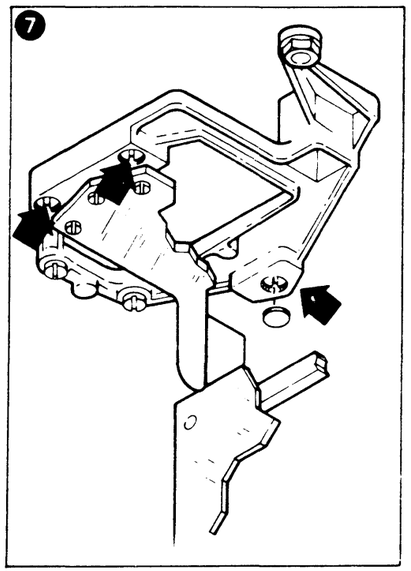
CAUTION

A small adjustment of the screws will move the guide a large amount and shift the other guides out of adjustment. Turn the screws only 5 to 10 degrees at a time.

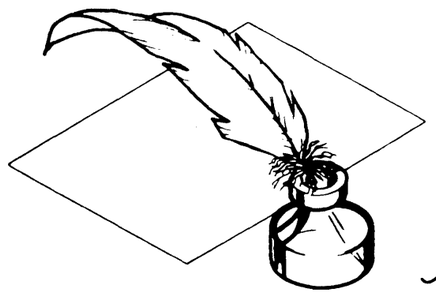
8. When adjustment is completed, reinstall plastic covers over subplate mounting screw heads, turn power on and return to CARRL D-36.







XQ1250	1846042	734852	735109	736672		
Seq 1 of 2	Part Number	26 Feb 73	17 May 73	26 Oct 73		



Notes

XQ1250	1846042
Sht 2 of 2	Part Number

734852	735109	736672		
26 Feb 73	17 May 73	26 Oct 73		

Figure D-25. BOT/EOT Assembly (Part 2517564) Removal, Replacement, and Adjustment

Functional Code xxx-15

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.
2. Remove the front cover.
3. Open the sliding door.

CAUTION
To prevent top cover damage, always use the lifting bar to raise the transport assembly. Be sure both support brackets latch. One bracket may require manual latching.

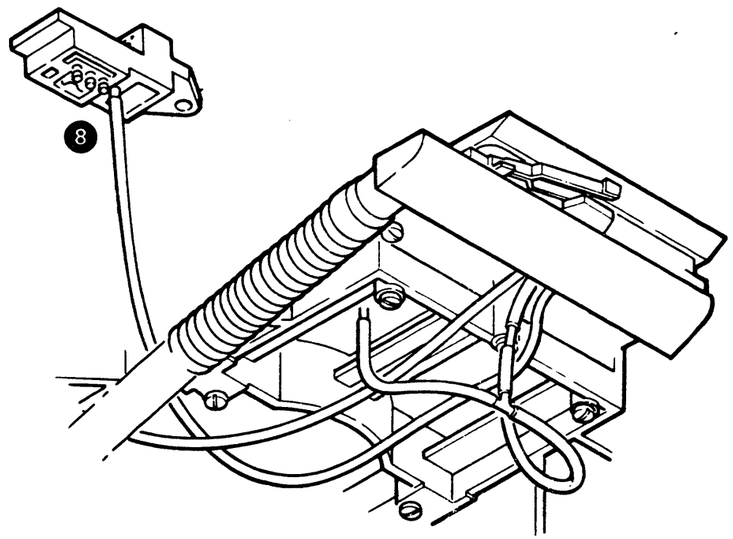
World Trade Machines Only.

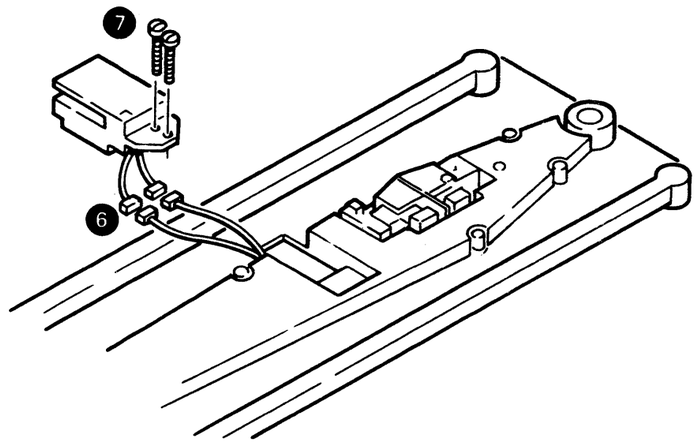
Remove transport hold down screw located on the left front corner of side frame before lifting transport.

This screw must be replaced when servicing is finished.

4. Raise the transport assembly.
5. Open the vacuum column cover.
6. Unplug the BOT/EOT cables.
7. Remove the two screws that secure the assembly to the base.
8. Remove the vacuum tube that goes to the BOT/EOT assembly. Use care in removing the vacuum tube as the tip is plastic and breaks easily.
9. Remove the assembly from the machine.
10. Install the new assembly in reverse order, however, *don't* fully tighten the two base mounting screws.

CAUTION
When installing the new assembly, make sure the assembly is all the way to the right.





11. Horizontally adjust the assembly.

Note: Adjust the assembly for a tape to erase head clearance of .002 to .004 inch (0,05 to 0,10 mm). For complete adjustment procedure, see below:

A. Tool part 2517647 is needed for this adjustment.

B. Make sure the base mounting screws are loose enough to permit the assembly to slide freely.

C. Slide the tool between the top and bottom blocks of the assembly, with open side of tool facing up and the three buttons on the bottom of the tool in firm contact with the column surface.

D. Vertically position the tool so the center projection on the right side of the tool is in line with the erase head.

E. Set the tool solidly against the read/write and erase heads while maintaining contact with the column surface. Don't distort the cleaner blade with excessive pressure.

F. Holding the tool as described in Step E, slide the assembly to the left until the cleaner blade contacts the tool.

G. Tighten the assembly mounting screws while holding this position.

12. Power up the tape unit.
13. Install the half column door, part 2517722, and then load a tape, loop. See Figure D-3.
14. Visually check the tape to erase head gap carefully to see that a clearance exists. If there isn't clearance, recheck your adjustment.

CAUTION
BOT sense unit cover snaps in place. To remove, lift up and out on rear of cover.

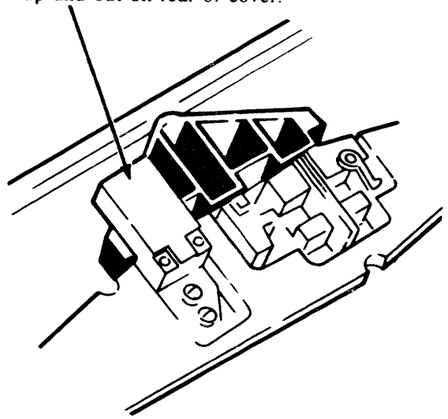
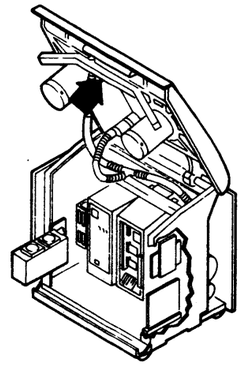
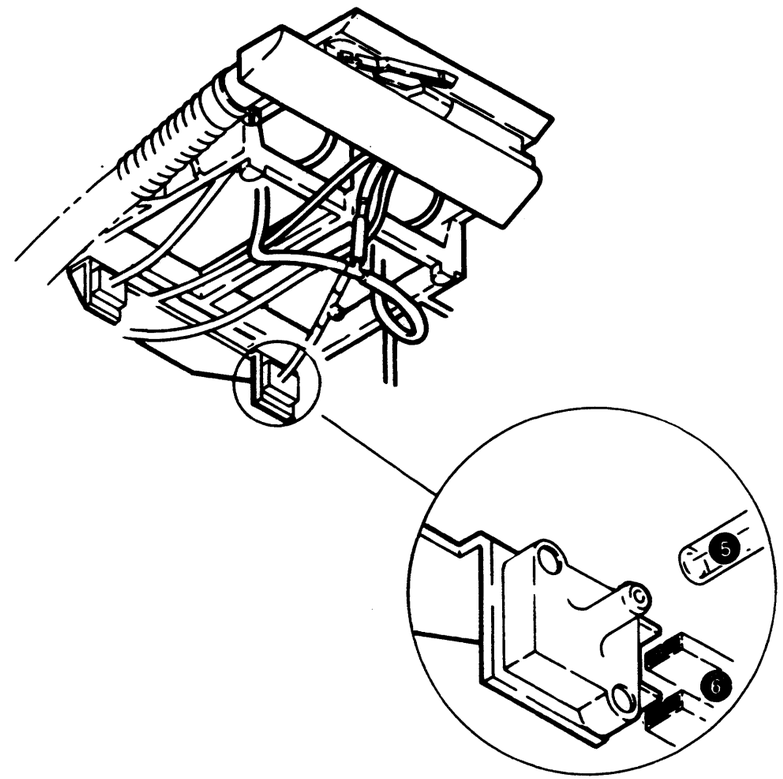


Figure D-26. Tape-In-Column Vacuum Switch Assembly Removal and Replacement





Functional Code 008-21

Right column switch Part 2517780
Left column switch Part 2517780

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.
2. Remove the front cover.
3. Open the sliding door.

CAUTION
To prevent top cover damage, always use the lifting bar to raise the transport assembly. Be sure both support brackets latch. One bracket may require manual latching.

World Trade Machines Only.

Remove transport hold down screw located on the left front corner of side frame before lifting transport.

This screw must be replaced when servicing is finished.

4. Raise the transport assembly.
5. Carefully remove the vacuum hose from the switch, as the tips are plastic and break easily.
6. Remove the two slip-on connectors.
7. Remove the two screws that secure the switch to the mounting bracket.
8. Install the new switch in reverse order.

XQ1300 Seq. 2 of 2	1846016 Part Number

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Figure D-27. Vacuum Check Procedures

Functional Code 008-00

There are three ways to check vacuum—with a water manometer, with a pneumatic pressure gauge, or with a gram gauge.

Manometer/Pressure Gauge Method

1. Obtain a 30-inch (762 mm) water manometer, part 453500, or a pneumatic pressure gauge, BM 5495384.

2. When using the manometer, fill with tap water, maintaining the water level near the zero position on the scale. Zero the manometer by sliding the scale up or down until the zero mark lines up within 0.2 inch (5,1 mm) of the bottom of the meniscus in both columns.

3. Remove the cap from the tee in the hose to the right side tape-in-column switch.

4. Attach the manometer or pressure gauge hose to the tee.

5. Load the tape unit in a normal manner.

6. Read the vacuum level. The vacuum level should read between 17 inches (431,8 mm) and 24 inches (609,6 mm).

Note: (Manometer only) The vacuum level is the sum of the displacement of the water level in each column. Both legs must be read and added together.

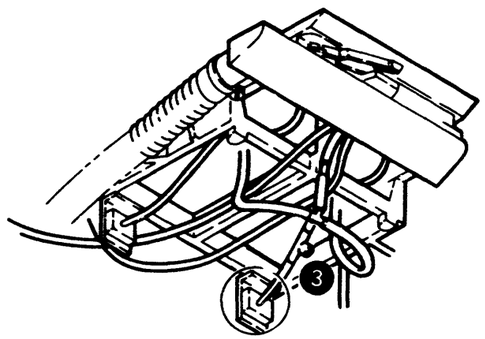
7. If the vacuum level is below 17 inches (431,8 mm):

   A. Check the vacuum pump drive belt for proper belt tension (See D-31).

   B. Check for leaks in the vacuum system.

   C. Check the drive belt to make sure it is on the proper pulley step (See D-31).

Note: Low vacuum can cause intermittent read/write errors and loading problems. High vacuum can cause premature head wear, but is a less frequent condition. If high vacuum is indicated, recheck your vacuum readings. Check that the drive belt is on the proper pulley step.



Gram Gauge Method

1. Obtain a gram gauge with a times ten blade, part 450459.

2. Obtain a eight-foot length of half-inch magnetic tape and some masking tape or cellophane tape. Position the tape as shown in Part 1 of Figure D-3, "Tape Loop Check."

3. Install the half column door.

4. Push RESET, and then LOAD/REWIND.

5. When the capstan starts to turn, push RESET again. The capstan will stop turning, and you can release the tape.

> **DANGER**
> **One or both of the reel hubs will turn depending on the position of the tape in the columns. Be careful not to get your fingers or clothing caught in the turning hubs.**

6. Make sure the right column tape loop is positioned low enough so that it is at the wide part of the column.

Note: Moving the loop up in the left column will cause the loop in the right column to descend. If either loop moves below the bottom of the sensing ports, vacuum will drop. Return to Step 6 and reload.

7. Fasten a paper clip to the tape at the right of the right column idler.

8. Insert the tip of the gram gauge blade in the paper clip loop. Measure the tape tension by pulling the gram gauge to the right and parallel to the tape path. The tension should read between 174 and 245 grams.

9. If the tension reads below 174 grams, the vacuum level is too low. Check the following:

   A. The vacuum pump drive belt for proper belt tension.

   B. For leaks in the vacuum system.

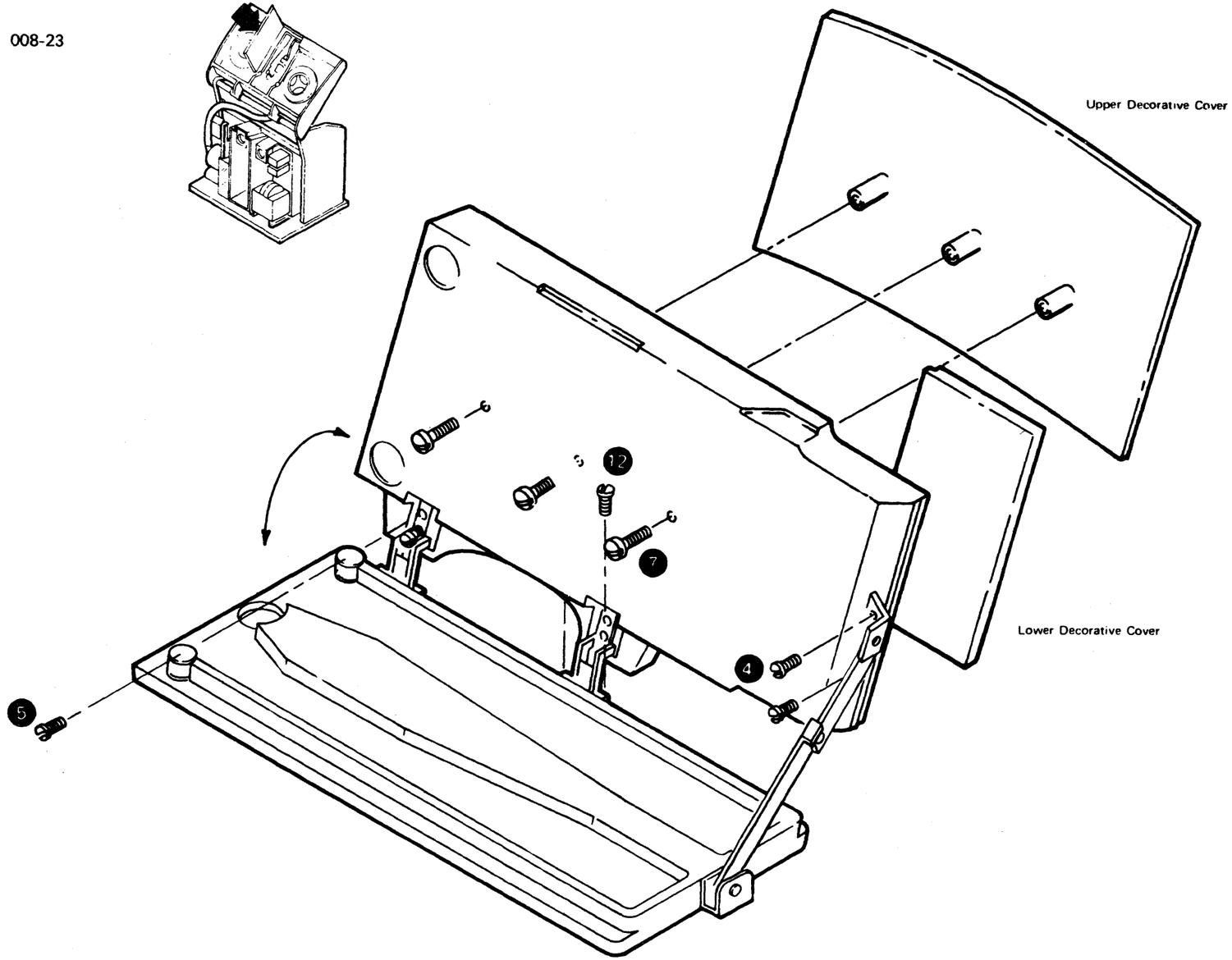
   C. The drive belt to make sure it is on the proper pulley step.

Note: Low vacuum can cause intermittent read/write errors and loading problems. High vacuum can cause premature head wear, but is a less frequent condition. If high vacuum is indicated, recheck your vacuum readings. Check that the drive belt is on the proper pulley step.

Figure D-28. Vacuum Column Cover (Part 2517577) Removal, Replacement, and Adjustment

Functional Code 008-23

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures."
2. Open the sliding door.
3. Open the vacuum column cover.
4. Remove the two stay brace mounting screws that secure the brace to the vacuum column cover.
5. On each hinge, remove the upper two screws that secure the cover to the hinges. Remove upper hinge.
6. Remove cover.
7. Remove the three mounting screws from the upper decorative cover and remove the cover.
8. Remove lower decorative cover.
9. Install decorative covers in reverse order on the new vacuum column cover.
10. Install the new vacuum column cover, reversing steps 1 to 6.
11. Check the cover to see that it opens and closes without interfering with the main plate or operator's panel.
12. To adjust the cover clearance, loosen the lower hinge mounting screws and then reseat them.



XQ1400 Sec 2 of 2	1846017 Part Number	734556 1 Sept 72	734556A 20 Oct 72	734739 11 Jan 73	734864 1 Aug 73	443751 20 Sept 74

Figure D-28A. Tape Load Check and Adjustment

This procedure assumes that the tape unit cannot load tape.

Note: Tape loading reliability can be affected by transport cleaning frequency, especially in the capstan area. The cleaning procedure outlined in the 3410/11 Operators Guide (Form G222-004-X), should be performed at least once every eight hours to ensure proper tape loading.

1. Remove the front cover.

2. Open the sliding door.

CAUTION
To prevent top cover damage, always use lifting bar to raise the transport assembly. Be sure both support brackets latch. One bracket may require manual latching.

3. Raise the transport assembly.

4. Bypass the sliding door interlock switch. See CARRL Figure D-6 for the switch location.

5. Lower the transport assembly.

6. Check that the column door hinges are not binding or preventing the cover from closing properly.

7. Open the vacuum column door and check the tape path and seals in the head area. See CARRL D-28A, Part 2 of 2, for an illustration of the head cavity area. The tape guides and idler rollers must be aligned (CARRL D-23) to ensure good loading reliability. The seals on the erase head should contact the lower head seal. The lower head seal should not have any large openings. The head seal in the cover should not prevent the cover from closing.

8. Remove the upper decorative cover from the column door. See CARRL D-28 for the removal procedure.

9. Close the column cover and mount a CE work tape.

10. Press LOAD-REWIND and watch the tape-load sequence. The left reel will turn first and tape should enter the left column. About one second later, the right reel turns and tape should enter the right column. When properly loaded, the capstan moves tape to search for the BOT marker.

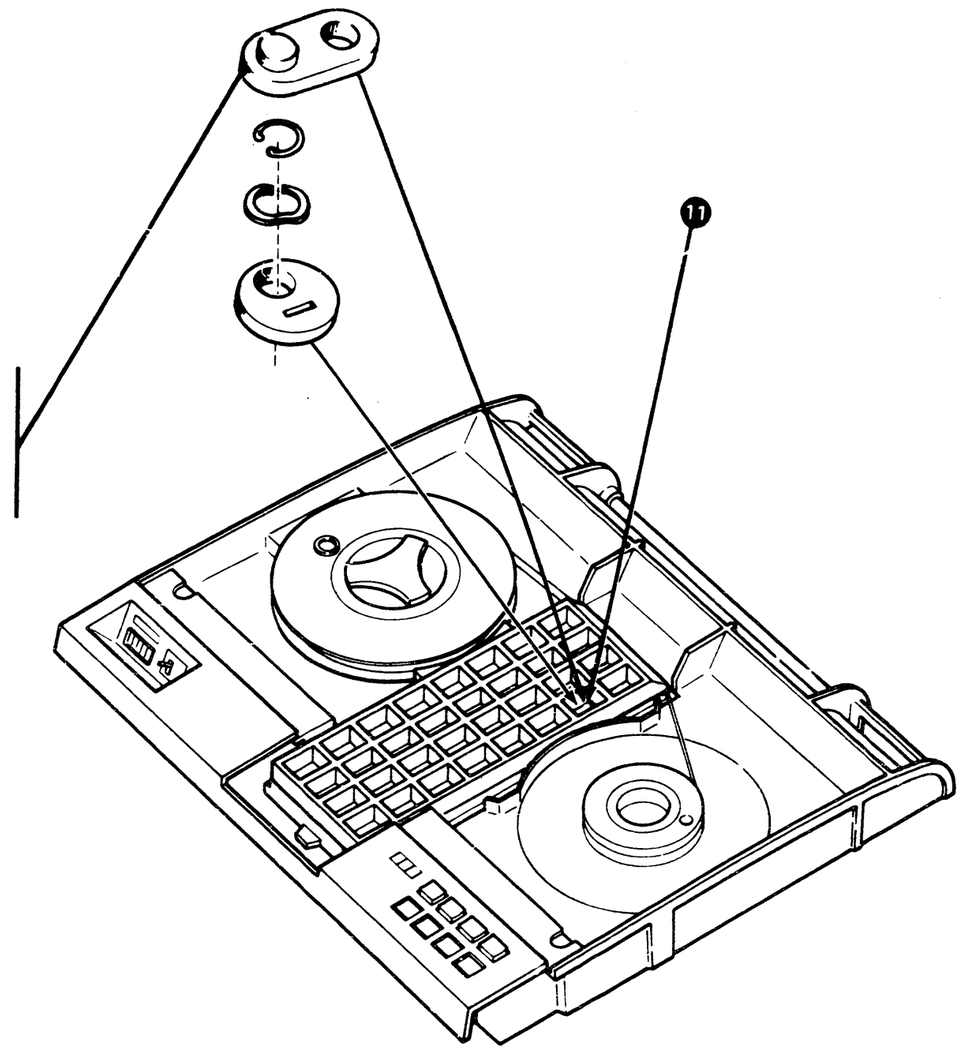
11. Tape failing to load in the left column is indicated by tape flutter at the top of the columns. The flutter occurs when the tape bottoms in the column(s). Press RESET. The tape will wind back on the reel. Turn the air bleed valve to allow about 25% more air through the opening. (The bleed valve is located in the upper right of the column cover.) Repeat Step 10.

Note: Some column covers have a factory-installed plug to adjust the air bleed. This plug can be changed to the closed or half-open position, or can be removed for full air bleed. If the plug is changed, use rubber cement, part 104774, to hold the plug in position. If the plug is removed, clean off any adhesive residue on the cover.

12. Tape failing to load in the right column is indicated when the left reel starts turning CCW and the vacuum system turns off. If this occurs, turn the air bleed valve to allow about 25% less air through the opening. Repeat Step 10.

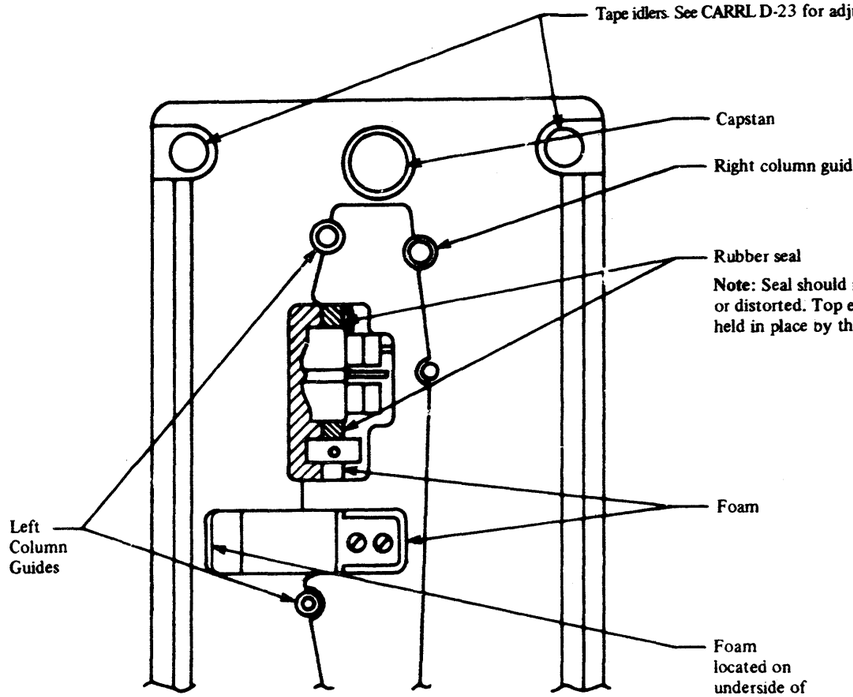
13. After the air bleed adjustment has been made, load and unload tape at least 25 times to ensure proper operation. Open and close the column door every third or fourth time. If a load failure occurs, repeat the air bleed adjustment.

Note: During this test, the vacuum motor may stop because of overheating. If this occurs, wait for the motor to cool before proceeding.



XQ1450	1846043
Seq 1 of 2	Part Number

734861	443751	443800		
19 Feb 73	20 Sept 74	31 Oct 75		



XQ1450 Seq. 2 of 2	1846043 Part Number	734861 19 Feb 73	443751 20 Sept 74	443800 31 Oct 75		

Figure D-28B. Vacuum Column Removal and Replacement

Functional Code 008-23

Model 1	Part 2518553
Model 2 and 3	Part 2518554

1. Remove the Read/Write Head and Card assembly. See CARRL D-40, Steps 1-12.

2. Remove the Head Card Support Bracket.

3. Disconnect the BOT/EOT cables.

4. Use a broad-blade screwdriver to *carefully* unplug the three-pronged signal connectors of the capacitive sense units. Tag the connectors for identification.

5. Disconnect the three ground wires from the main casting.

6. Disconnect the two hoses from the tape in column ports on the lower vacuum column.

7. Disconnect the two hoses from capacitive sense units and from the plenum.

8. Disconnect the file protect hose from the vacuum plenum.

9. Disconnect the vacuum hose from the BOT/EOT assembly. Use care in removing the vacuum hose as the tip is plastic and breaks easily.

10. Disconnect the flexible hose from the vacuum plenum.

11. Remove the vacuum column cover. See CARRL D-28.

12. Remove the two cover hinges and stay brace assembly from the vacuum column.

13. Remove the head card support plate and vacuum switch bracket.

14. Remove the screws holding the vacuum column to the main casting.

15. Lift the vacuum column straight up from main casting. Be very careful not to damage the capstan when removing the column.

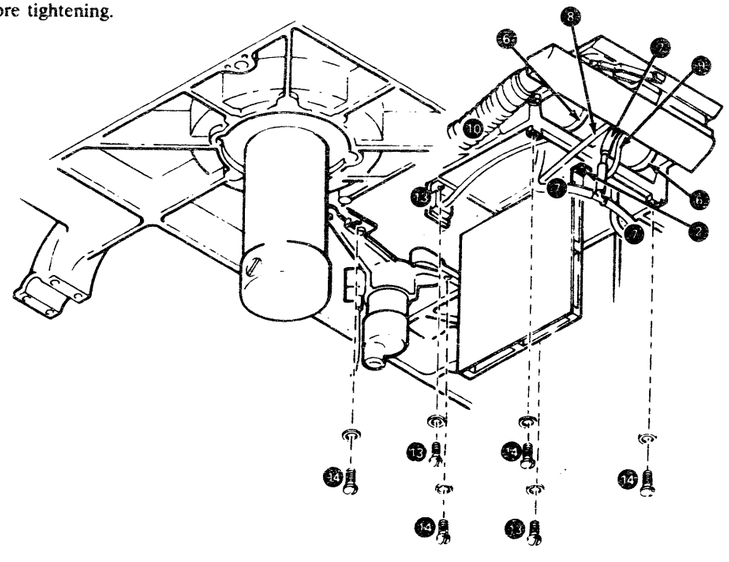
16. Remove the BOT/EOT assembly from the old column and put aside.

Note: Some columns have shims cemented to the column mounting pads. Do not remove them. Install the new columns as received.

17. Position the bottom of the new column onto the main casting first. Then, very carefully, lower the column without touching the capstan. Guide the ground wires through the holes in main casting as the column is lowered.

18. Fasten the new column to the main casting with the screws removed in Step 14.

Note: The length of the screws vary as required for mounting other hardware. Check their length before installing. Position the capstan stay bracket so that both sides lock against the capstan motor leg before tightening.



19. Install the head card casting support and vacuum switch brackets.

20. Make sure the column is securely fastened. But DO NOT overtighten the screws.

21. Mount the BOT/EOT assembly on the new column.

22. Connect the three ground wires to the main casting.

23. Connect the vacuum hose to the BOT/EOT assembly.

24. Connect the file protect hose to the vacuum plenum.

25. Connect the two hoses to the capacitive sense units and to the plenum.

26. Connect the two hoses to the lower vacuum column ports and connect the flexible hose to the vacuum plenum.

27. Install the two cover hinges and stay brace assembly on the vacuum column.

28. Install the vacuum column cover. See CARRL D-28.

29. Connect the two capacitive sense cables.

30. Connect the BOT/EOT cables.

31. Install the head card support bracket. Leave the mounting screw loose.

32. Install the Read/Write Head and Card assembly. See CARRL D-40.

33. Adjust the BOT/EOT assembly. See CARRL D-25.

34. Adjust the Tape Idlers. See Carrl D-23.

35. Adjust the Tape Guide Assemblies. See Carrl D-24 and D-24A. Return here to Step 36.

36. Perform the Tape Tracking Check and Adjustment. See CARRL D-36.

    Note: On System/38, run MAP 6420.

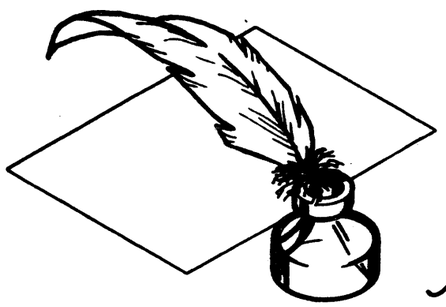
37. Perform the Mechanical and Electrical Skew Adjustments. See CARRL D-57.

    Note: On System/38, run MAP 6420.

38. Run all remaining diagnostics to check tape unit operation.

    Note: On System/38, run Good Machine Path.

39. If any failures occur, go to the appropriate MAP.
    World Trade Machines Only.
    Remove transport hold down screw located on the left front corner of side frame before lifting transport.
    This screw must be replaced when servicing is finished.



Notes

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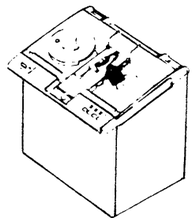
Figure D-29. Vacuum Column Guide Pin (Part 2517607) Removal and Replacement



Functional Code 011-25

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.

2. Open the sliding door.

3. Remove the front cover.

CAUTION
To prevent top cover damage, always use the lifting bar to raise the transport assembly. Be sure both support brackets latch. One bracket may require manual latching.

World Trade Machines Only.

Remove transport hold down screw located on the left front corner of side frame before lifting transport.

This screw must be replaced when servicing is finished.

4. Raise the transport assembly.

5. Open the vacuum column cover.

6. Remove the nut that holds the guide pin in place. This nut is located on the underside of the transport assembly.

7. Remove the guide pin from the top of the transport assembly.

8. Install the new guide pin in reverse order.

9. Check tape tracking. See Figure D-36, "Tape Tracking Check and Adjustment."

Note: On System/38, run MAP 6420 and then Good Machine Path to verify.

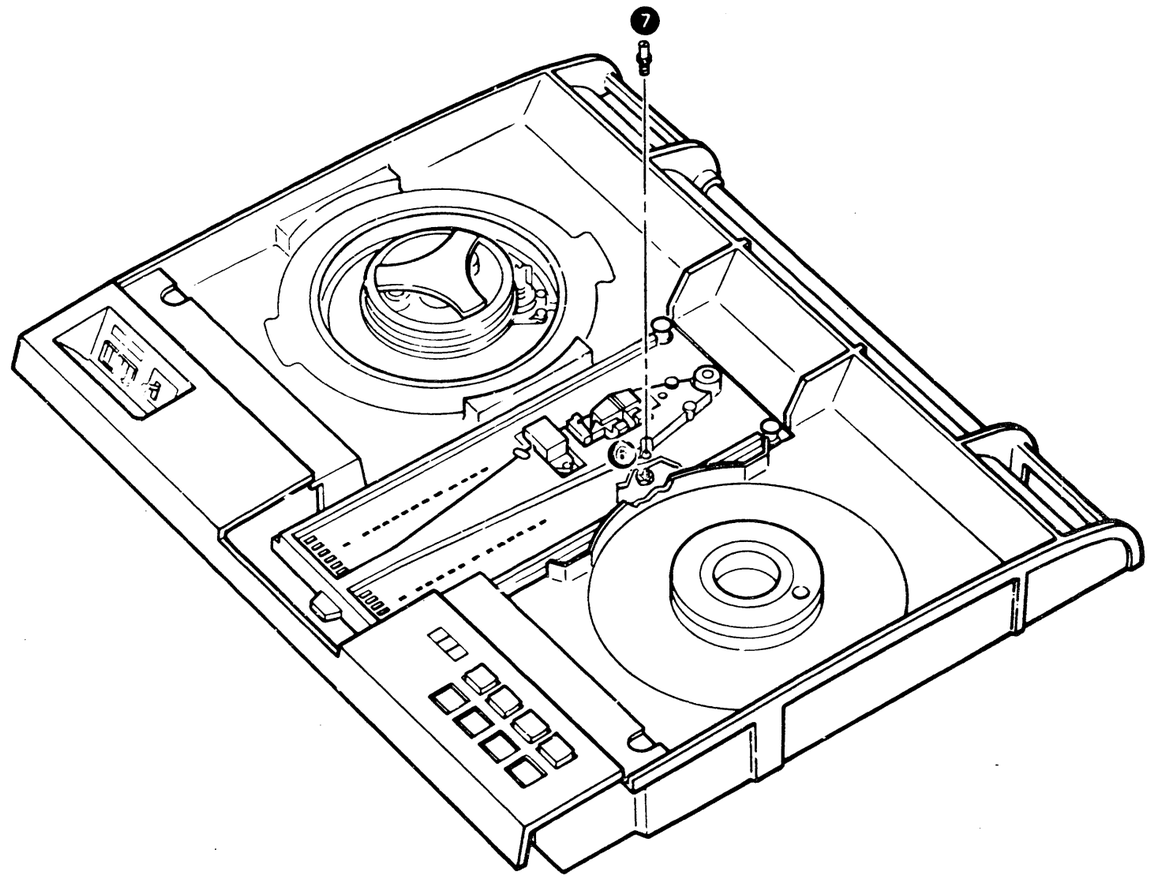


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Figure D-30. Vacuum-Up-Switch Assembly (Part 2517780) Removal and Replacement

Functional Code 008-21

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.
2. Remove the front cover.
3. Open the sliding door.

CAUTION
To prevent top cover damage, always use the lifting bar to raise the transport assembly. Be sure both support brackets latch. One bracket may require manual latching.

World Trade Machines Only.

Remove transport hold down screw located on the left front corner of side frame before lifting transport.

This screw must be replaced when servicing is finished.

4. Raise the transport assembly.
5. Remove the plastic cover from the motor relay.
6. Remove the vacuum hose.
7. Remove the two wires from the assembly.
8. Remove the two mounting screws.
9. Lift the assembly from the machine.
10. Install the new assembly in reverse order.

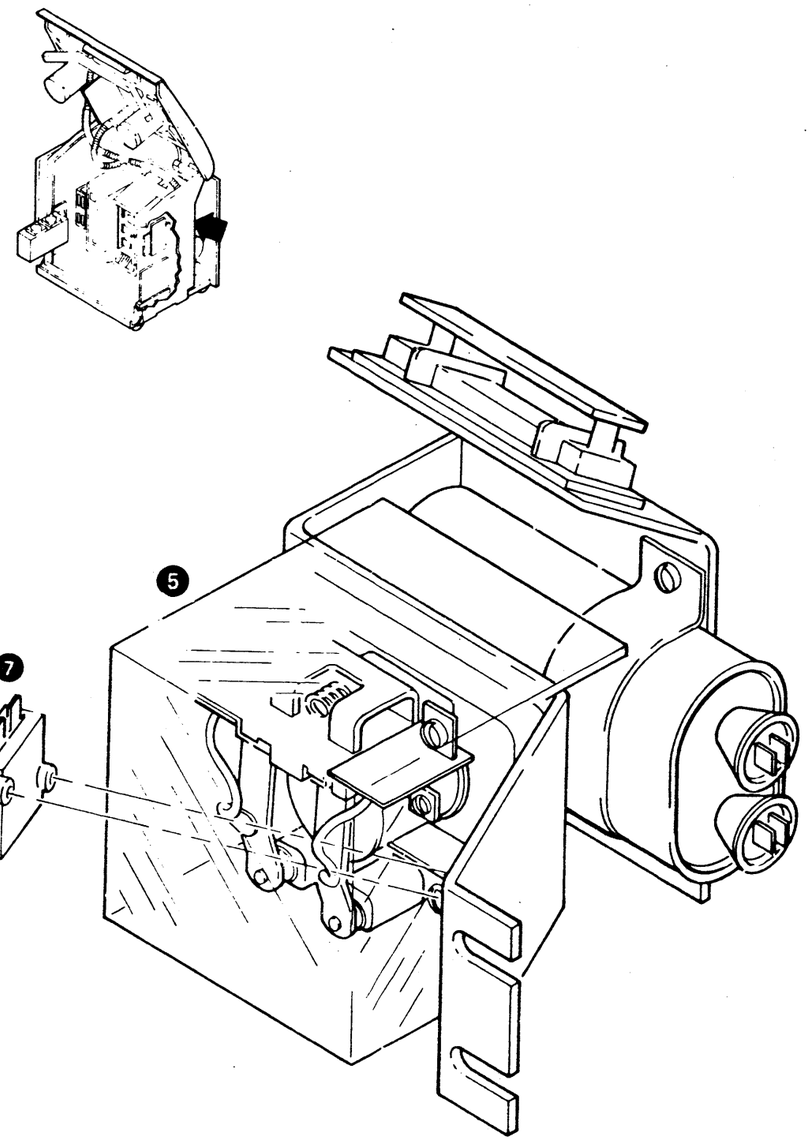

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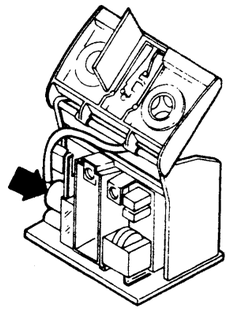
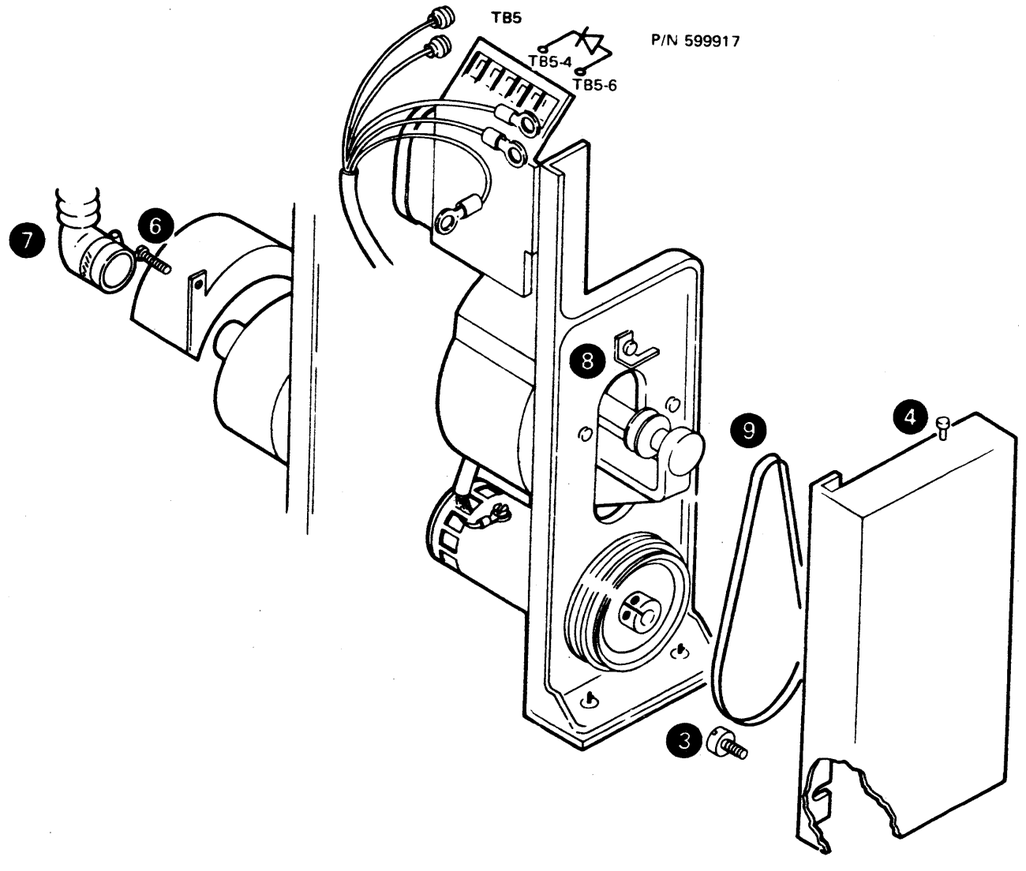
Figure D-31. Vacuum Pump (Part 2522879) Removal and Replacement

Functional Code 008-24





1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.
2. Remove the rear cover.
3. Loosen the belt guard holding screw.
4. Pull the latch on top of the belt guard and slide the belt guard off.
5. Remove the entire pneumatic assembly from the machine. The wires don't have to be disconnected.
6. Loosen the two muffler holding screws.
7. Remove the plastic elbow that connects the hose to the pump.
8. Remove the three vacuum pump mounting screws.
9. Remove the drive belt.
10. Lift the pump from the machine.
11. Install the new vacuum pump in reverse order. Don't fully tighten the three pump mounting screws until you adjust the drive belt tension.
12. When tightening the muffler, make sure it is adjusted so that it seals all around the vacuum pump. Do not tighten muffler until drive belt has been adjusted.

CAUTION
When installing the drive belt, move the pump down so you won't have to force the drive belt over the pulley.

13. Install the drive belt on:
    - the small pulley step for an altitude under 3000 feet (914,4 m),
    - the large pulley step for an altitude over 3000 feet (914,4 m).
14. Tighten the drive belt by raising the vacuum pump.

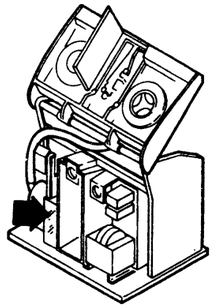
Note: The drive belt is properly adjusted when you have a deflection of approximately one-quarter inch (6,35 mm) when you apply four pounds (1,814 kg) of pressure to the middle of the drive belt.

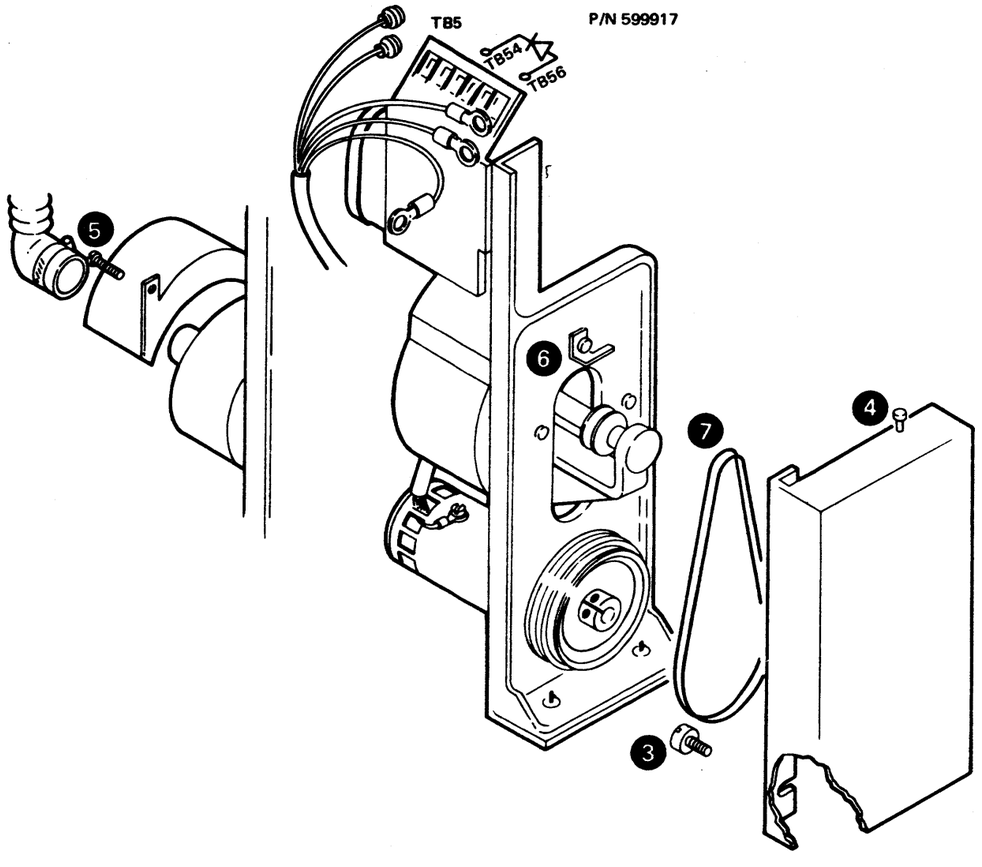
CAUTION
Too much tension on the drive belt can cause load failures.

15. Fully tighten the three vacuum pump mounting screws after adjusting the drive belt tension.

Figure D-32. Vacuum System Drive Belt Removal, Replacement, and Adjustment

Functional Code 008-35





60 Hz Part 2517804
50 Hz Part 2517858

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.
2. Remove rear cover.
3. Loosen the belt guard holding screw.
4. Pull the latch on top of the belt guard and slide the belt guard off.
5. Loosen the two muffler holding screws.
6. Loosen the three vacuum pump mounting screws.
7. Remove the drive belt.

CAUTION
When installing the new drive belt, move the pump down so you won't have to force the belt over the pulley.

8. Install the new drive belt on:
   - the small pulley step for an altitude under 3000 feet (914,4 m),
   - the large pulley step for an altitude over 3000 feet (914,4 m).

Note: There are two screw holes in the motor shaft. When you move the motor pulley, align the set screws with the screw holes before tightening.

9. Tighten the new drive belt by raising the pump.

Note: The drive belt is properly adjusted when you have a deflection of approximately one-quarter inch (6,35 mm) when you apply four pounds (1,814 kg) of pressure to the middle of the drive belt.

CAUTION
Too much tension on the drive belt can cause load failures.

10. Tighten the three vacuum pump mounting screws.
11. Tighten the two muffler holding screws. Make sure the muffler is adjusted so that it seals around the vacuum pump.
12. Replace the belt guard.

Figure D-33. Vacuum Motor Assembly Removal and Replacement

Functional Code 008-20

60 Hz Part 2517786
50 Hz Part 2517787

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.
2. Remove the rear cover.
3. Loosen the belt guard holding screw.
4. Pull the latch on top of the belt guard and slide the belt guard off.

(5) Remove the pneumatic assembly from the machine.

6. Remove the wires that go to the vacuum motor from TB5.

(7) Remove the red and blue wires from the motor capacitor. These are slip-on connectors.

(8) Remove the ground wire.

9. Loosen the two muffler holding screws.

(10) Loosen the three vacuum pump mounting screws.

11. Remove the drive belt.

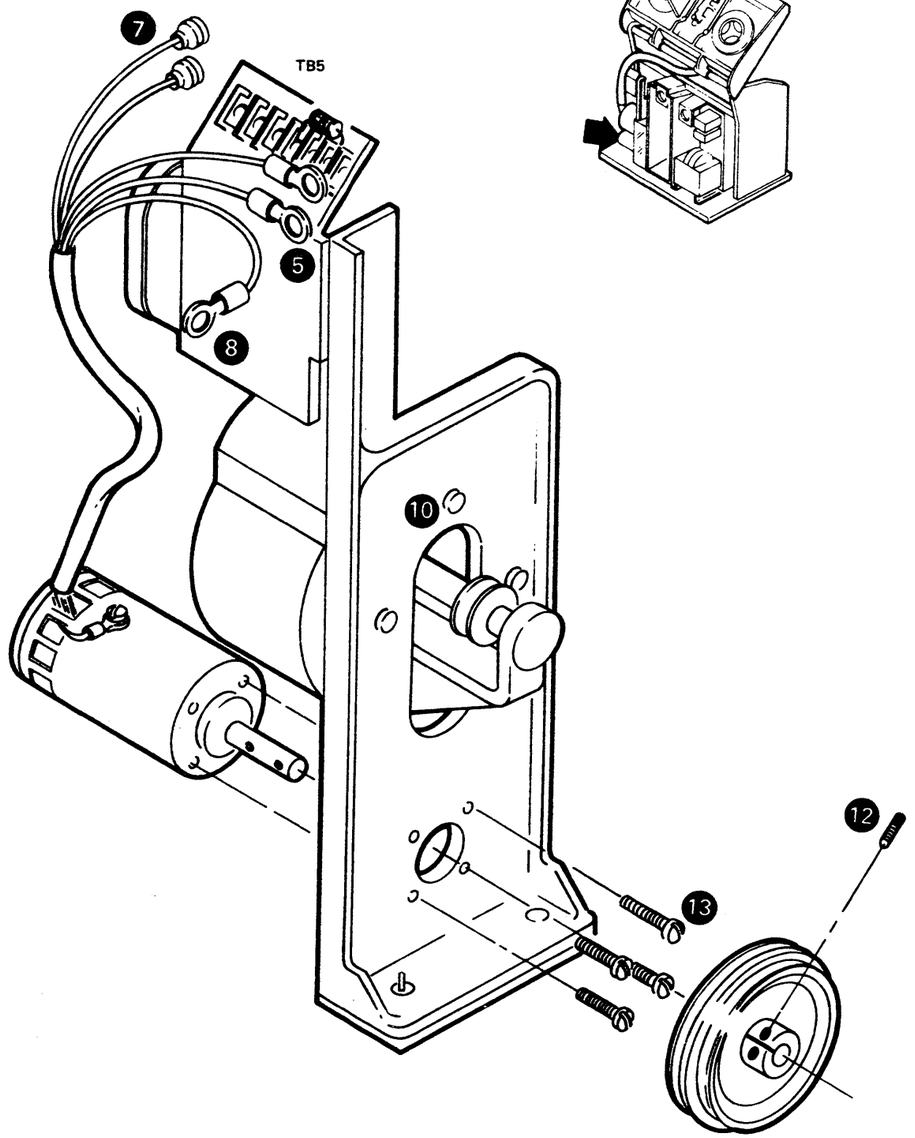
(12) Loosen the adjustable set screw. Loosen the motor pulley tightening screw, then remove the pulley from the shaft.

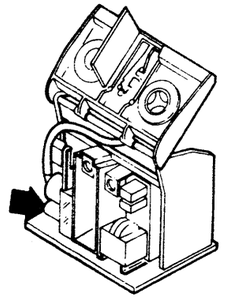
Note: There are two screw holes in the motor shaft. When you replace the motor pulley, the set screw goes into:

- the back hole for an altitude under 3000 feet (914,4 m).
- the front hole for an altitude over 3000 feet (914,4 m).

(13) Remove the four motor mounting screws.

14. Lift the motor from the machine.





15. Install the new motor in reverse order. Don't fully tighten the three vacuum pump mounting screws until you adjust the drive belt tension

CAUTION
When installing the drive belt, move the pump down so you won't have to force the drive belt over the pulley.

16. Install the drive belt on:
    - the small pulley step for an altitude under 3000 feet (914,4 m),
    - the large pulley step for an altitude over 3000 feet (914,4 m).
17. Tighten the drive belt by raising the pump.

Note: The drive belt is properly adjusted when you have a deflection of approximately one-quarter inch (6,35 mm) when you apply four pounds (1,814 kg) of pressure to the middle of the drive belt.

CAUTION
Too much tension on the drive belt can cause load failures.

18. Fully tighten the three vacuum pump mounting screws after adjusting the drive belt tension.

Note: Motor wire connections are:

Blue wire	to top capacitor terminal
Red wire	to lower capacitor terminal
Yellow wire	to TB5-2
White wire	to TB5-1

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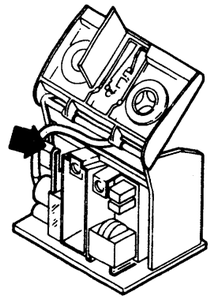
Figure D-34. Vacuum Motor Relay (Part 589091) Removal and Replacement



Functional Code 008-06

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.
2. Remove the front and rear covers.
3. Open the sliding door.

CAUTION
To prevent top cover damage, always use the lifting bar to raise the transport assembly. Be sure both support brackets latch. One bracket may require manual latching.

World Trade Machines Only.

Remove transport hold down screw located on the left front corner of side frame before lifting transport.

This screw must be replaced when servicing is finished.

4. Raise the transport assembly.
5. Remove the relay cover.
6. Remove and label the wires attached to the relay.
7. Remove the two mounting screws.
8. Lift the relay from the machine.
9. Install the new relay in reverse order.

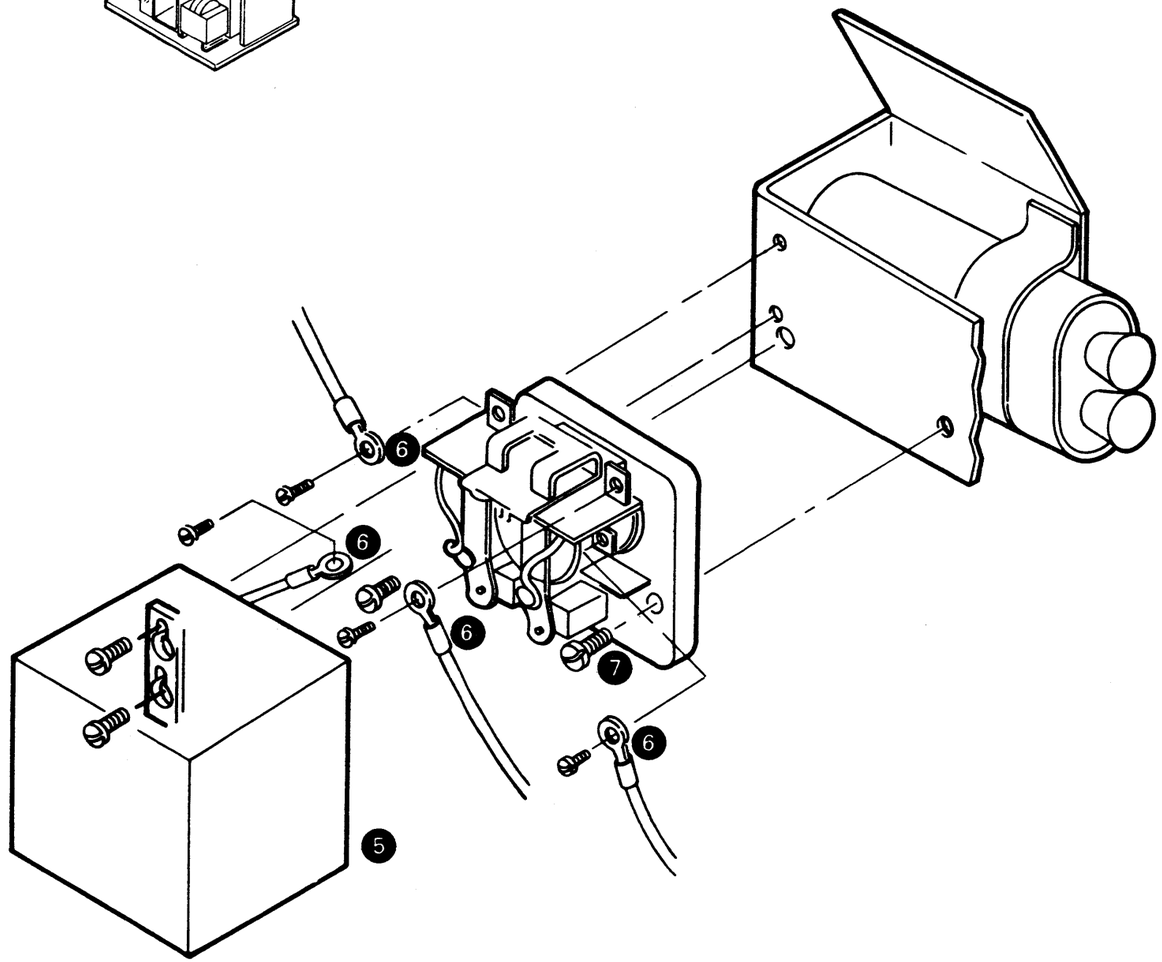


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Figure D-35. Capstan Motor Assembly (Part 2523227) Removal and Replacement
Functional Code 001-20

1. Turn off subsystem power. See Figure D-2. "Power On/Off Procedures."

2. Remove the front cover.

3. Open the sliding door.

CAUTION
To prevent top cover damage, always use the lifting bar to raise the transport assembly. Be sure both support brackets latch. One bracket may require manual latching.

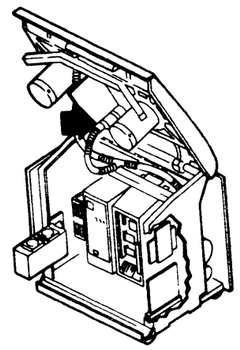
World Trade Machines Only.

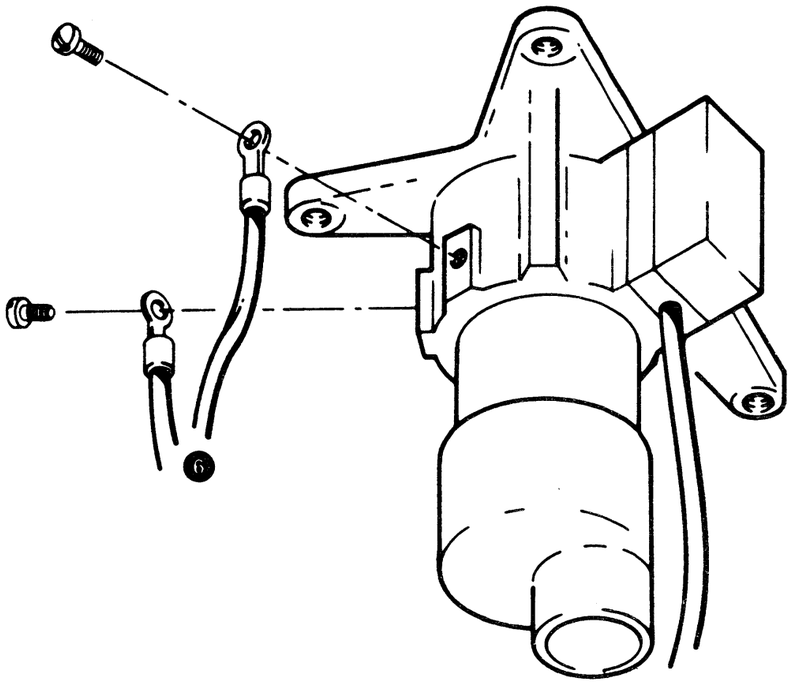
Remove transport hold down screw located on the left front corner of side frame before lifting transport.

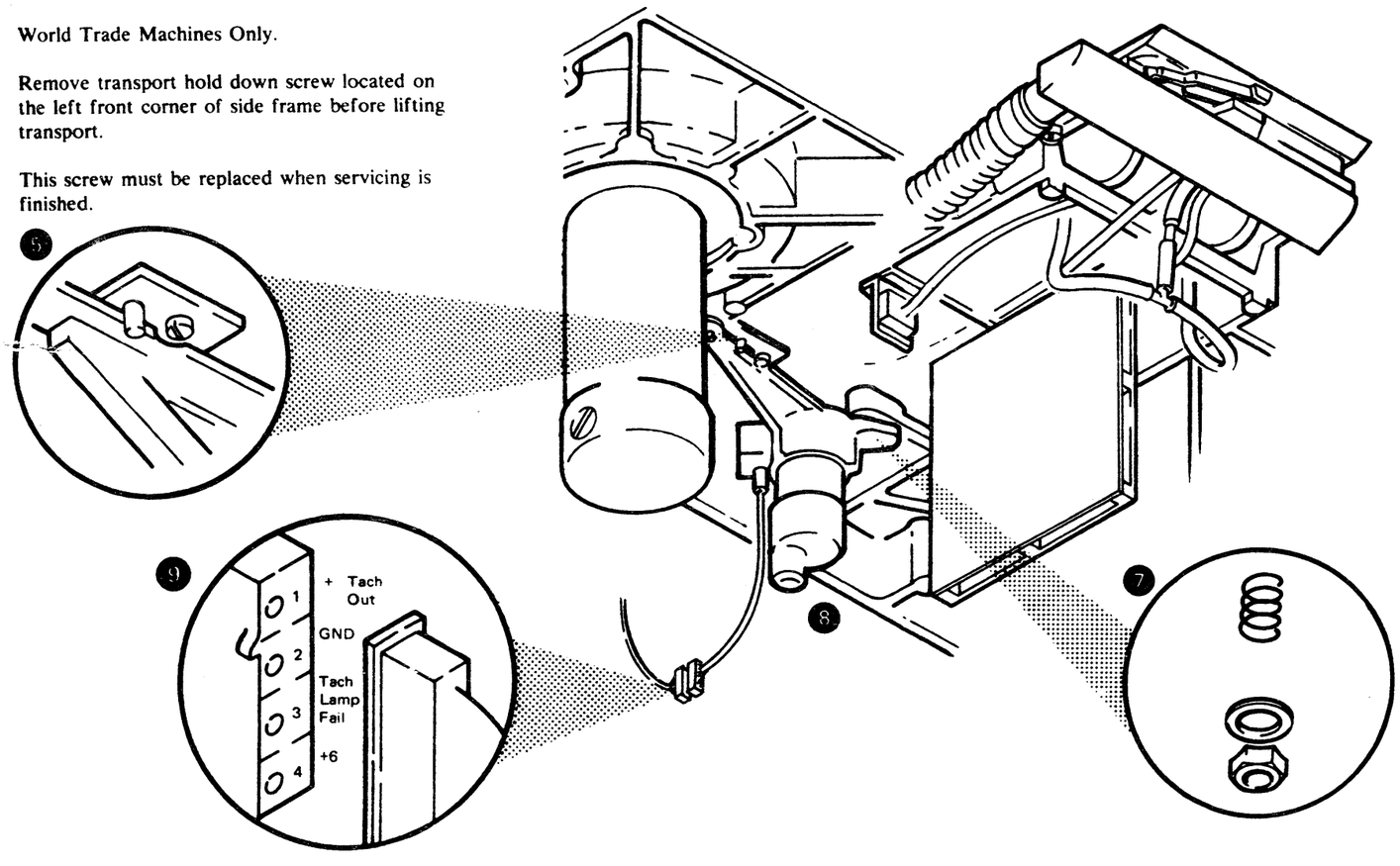
This screw must be replaced when servicing is finished.

4. Raise the transport assembly.

5. Loosen the screw that secures the capstan stay bracket.







CAUTION
Be sure to label the wires so you can attach them to the same terminals on the new motor. Reversing the wires will reverse the rotation of the capstan. Don't bump the head circuit board when working in this area.

6. Remove the two wires from the motor.

7. Remove the nut, the washer, and the spring from the capstan motor locator stud located on the right underside of the motor. The motor is still held in place by the top two mounting screws.

8. For Model 3 tape units only, disconnect the vacuum hose.

9. Carefully, disconnect the tachometer cable plug.

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Figure D-35. Capstan Motor Assembly (Part 2523227) Removal and Replacement

Page 2 of 2

10 Holding the motor securely, loosen the top two mounting screws. Don't remove the screws completely as the grommet and spring will fall out.

CAUTION
Alternate loosening of the two screws. Don't wedge the capstan tip against the column as this will further damage the capstan motor assembly.

Note: Access to the top mounting screws is through the holes in the decorative cover. One hole is above and to the right of the capstan. The other hole is to the left of the capstan and just outside the left tape column.

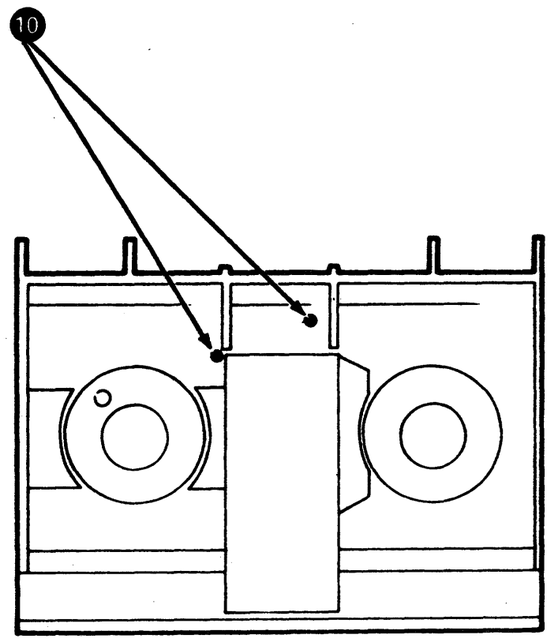
11. Remove the motor assembly.

Note: Use caution in steps 11 through 16 to prevent damage to the capstan.

12. Make certain that the support springs are in place between the capstan motor and the tape deck on the two adjustable mounting screws.

13. Guide the capstan motor into place on the locator stud. Keep the capstan motor level. While holding the capstan motor, tighten each of the two mounting screws, a little at a time. During the tightening process, rotate the capstan to make sure it is not damaged by binding against the column.

CAUTION
The capstan can be severely damaged if it binds against the column when you are tightening the mounting screws.



14. When the two mounting screws are bottomed, back each one off one and one-half turns.

15. Install the spring, the washer, and the nut on the locator stud on the underside of the capstan motor.

16. Tighten the nut, and when it is bottomed, back it off one half turn. This ensures shoulder-to-shoulder contact between the capstan front support and the locator stud shoulder.

17. Make sure the capstan rotates freely. If it binds, loosen and retighten the mounting screws and the nut on the underside.

18. Connect the tachometer plug.

19. Connect the motor wires.

20. If this is a Model 3 tape unit, connect the vacuum hose.

21. Lower the transport assembly *slowly and carefully* to prevent damage.

22. Turn on subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.

23. Check tape tracking. See Figure D-36, "Tape Tracking Check and Adjustment," for reference.

24. Position the capstan stay bracket so that both sides lock against the capstan motor leg. Tighten the stay bracket mounting screw.

25. Check skew. See Figure D-57, "Electrical and Mechancial Skew Adjustments," for reference.

Note: On System/38, run MAP 6420 and Good Machine Path to verify.

Figure D-36. Tape Tracking Check and Adjustment

Functional Code 001-20

Note: Before starting this procedure, see CARRL D-24A, Steps 1 through 5, for check procedure.

Note: On System/38, if referred to this page, run MAP 6420.

1. Remove the front cover.
2. Open the sliding door.

CAUTION

To prevent top cover damage, always use the lifting bar to raise the transport assembly. Be sure both support brackets latch. One bracket may require manual latching.

World Trade Machines Only.

Remove transport hold down screw located on the left front corner of side frame before lifting transport.

This screw must be replaced when servicing is finished.

3. Raise the transport assembly.
4. Bypass the sliding door interlock switch. See Figure D-6, "Sliding Door Interlock Switch Removal, Replacement, and Adjustment."
5. Lower the transport assembly.
6. Install the half column door, part 2517722.
7. Manually load the tape loops in the tape unit with a scratch tape that has no edge damage.
8. Press LOAD/REWIND, holding reels until vacuum comes up, then release reels to column control.
9. Get the scratch tape moving in a forward/backward *shoeshine* motion.
10. On Model 1 units, insure that the lower left guide roller turns freely.

    Note: To get the *shoeshine* motion on **System/360** and **System/370**, use On Line Test (OLT) T3410P, routine 02.

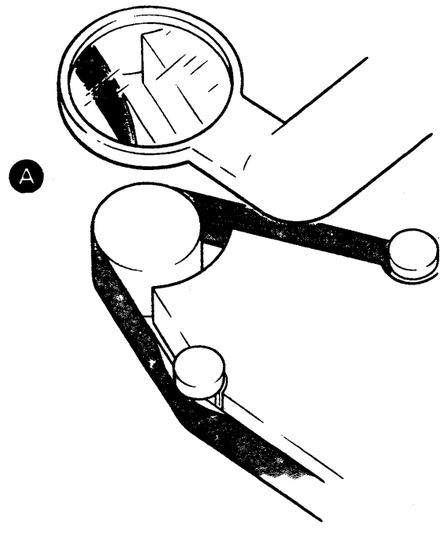
    On **System/3**, use diagnostic section 70A, routine 01. To get this routine, set sense switch 18 ON and push RESET HALT.

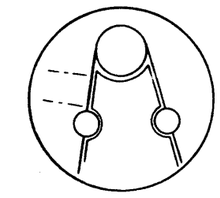
11. Check tape tracking at the upper left guide. The tape must move in either direction without distortion, flatter, or front-to-back movement while tracking against the guide. Use a dental mirror and magnifying light (part 452642) to check tracking. It may be difficult to see the small changes in the movement of the tape when looking directly at the upper left guide. To assist you in checking tracking, it will help you to use one or more of the following service aids:

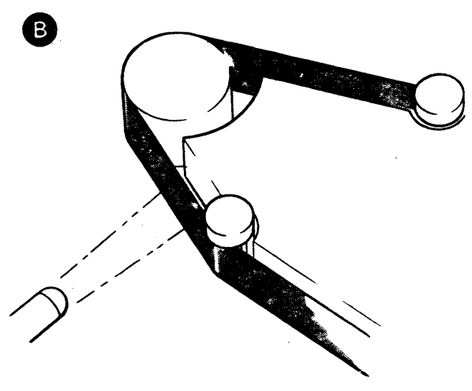
    A Using the magnifying light, look down at the edge of the tape in the area between the upper left guide and the drive capstan. If the tape is riding heavily against the guide, the tape line will change and show a buckle. This condition can be seen with the tape moving in either direction. Go to Step B.

    B Shine the light under the edge of tape on the back column wall. Look at the light beam between the tape and the column wall. The beam of light will change if there is any movement of tape away from the guide. Go to Step C.

    It is possible to have tracking look good but still have the tape away from the top of the guide. Using your dental mirror and light, you can see the reflection of the guide shaft when the tape is away from the top of the guide. Go to Step 12.







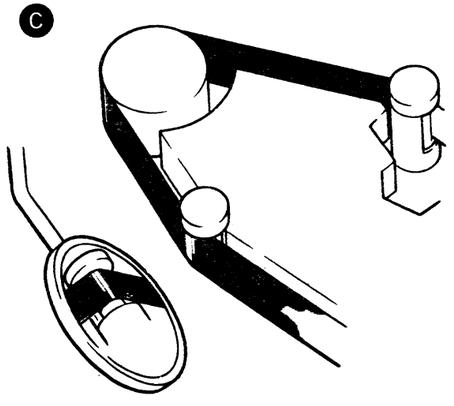


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Figure D-36. Tape Tracking Check and Adjustment
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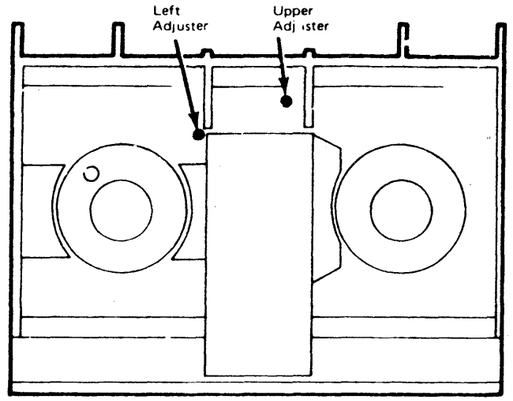
D. If, after using the above three service aids, you are still not sure whether tracking is good, a maladjustment may be used as a last resort. Insert your adjusting wrench in the upper tracking adjusting screw. Note the position of the wrench handle. Looking at the tape at the upper left guide, turn the adjusting wrench counterclockwise one-quarter to onehalf turn. This moves the tape away from the guide. Slowly, turn the wrench clockwise until the tape contacts the guide. Go to Step 12.

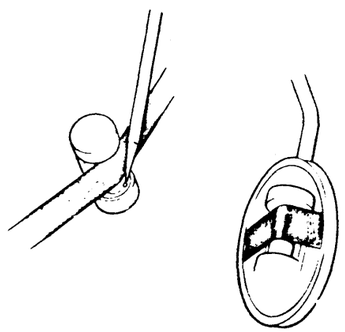
12. If tape is tracking correctly, go to Step 17. If tape is not tracking correctly, identify the condition in the tracking chart.



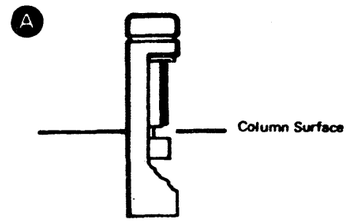
Tracking Adjustment Chart					
CONDITIONS					
Tracking is the same in forward and backward but the tape is		Tracking is different in forward and backward and the tape is in			
		FORWARD		BACKWARD	
Away from the top of the guide	Heavily against the top of the guide	Away from the top of the guide	Heavily against the top of the guide	Away from the top of the guide	Heavily against the top of the guide
ADJUSTMENTS					
Turn upper adjuster clockwise	Turn upper adjuster counter clockwise	Turn left adjuster counter clockwise	Turn left adjuster clockwise	Turn left adjuster clockwise	Turn left adjuster counter clockwise
Note: The guide referenced in this chart is the upper left guide. Adjusters are capstan mounting Cap screws.					

13. Adjust left guide tracking as shown in the tracking adjustment chart.

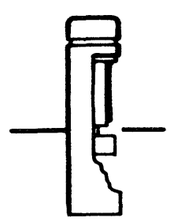
14. Check tracking at the right tape guide. Any tape flick seen during reversal can be ignored. If there is a buckle in the tape, depress the spring-loaded guide flange and look for one of the following conditions:



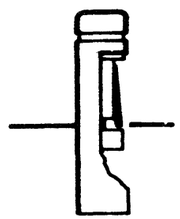
A If the buckle disappears and the tape is still tracking against the top of the right guide, the buckle is being caused by the pressure of the spring and can be ignored. Go to Step 15.



B If the buckle remains, tracking at the upper left guide needs further adjustment. Go back to Step 11.



C If the buckle travels to the column surface, or if you can see where the tape has pulled away from the top of the guide, tracking at the upper left guide needs further adjustment. Go back to Step 11.



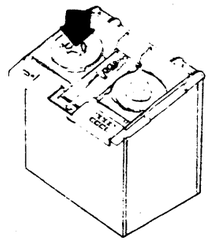
15. If the tape is tracking correctly, unload the tape unit. If this is a System/3, set sense switch 18 OFF.

16. Remove the half column door.

17. If your entry to this procedure was from MAP page AD047, AD049, AA070, or AA072 return to that page, otherwise check skew. See Figure D-57, "Mechanical and Electrical Skew Adjustments."

Figure D-37. Reel Latch Assembly (Part 2517850) Removal and Replacement

Functional Code 010-49



1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.
2. Open the sliding door.
3. Remove the three mounting screws from the center of the hub.
4. Remove the assembly from the machine.
5. Install the new reel latch assembly in reverse order.

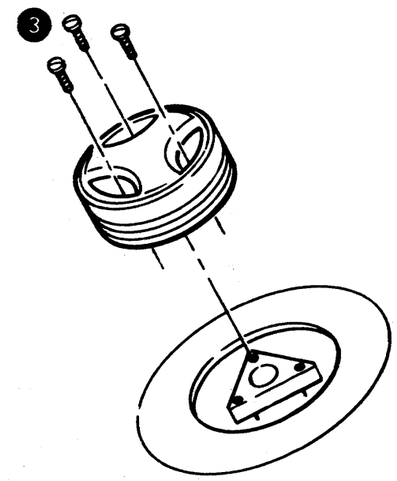
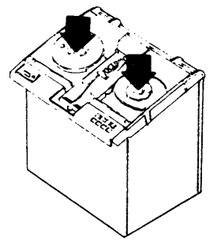


Figure D-38. Reel Motor Removal and Replacement



Functional Code 010-20

Models 1 and 2	Part 2517838
Model 3	Part 2517826

Note: Some Model 1 and 2 reel motors require 8-32 screws, part 0234320 or 10-32 screw part 0234331.

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures."

2. Remove the reel hub.

   Left side: Remove the three screws from the center of the hub, and carefully remove the filler ring (part 2517769).

   Right side: Carefully remove the trim disc (part 2523727) to gain access to the three mounting screws. Remove the three mounting screws.

   Note: The trim disc and filler ring are held in place by adhesive. Insert a thin object under the disc or ring and carefully pry it loose. The disc and ring are reusable only if they aren't bent or broken during removal. See CARRL D-15, Item 3.

3. On the left side, remove the file protect switch assembly. See Figure D-15, "File Protect Switch Assembly Removal and Replacement."

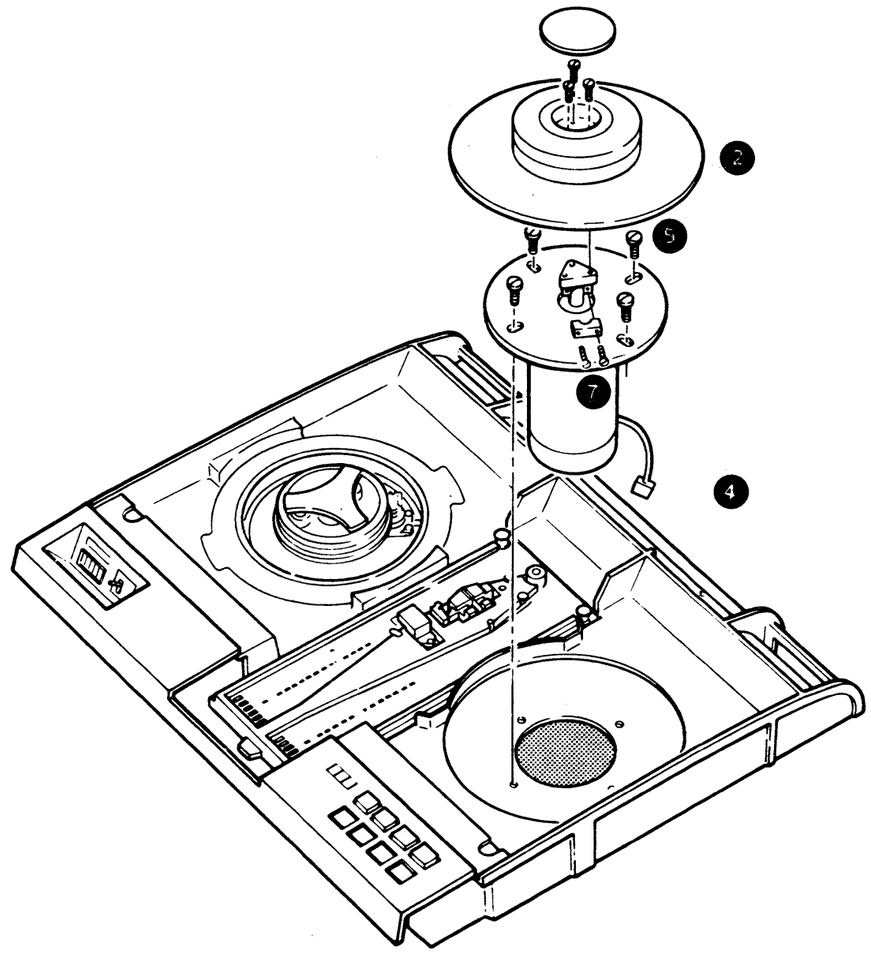
4. Disconnect the reel motor plug.

5. Remove the four flange mounting screws.

6. From the top, remove the motor from the machine.

7. Remove the flange and the split collar.

8. Install the split collar and the flange on the new motor.



9. Install the new motor. Use a tape reel to help you center the mounting plate on the left side casting. Be sure the file protect switch mounting holes are aligned. On the right side, use the machine reel flange to center the motor.

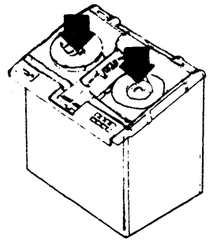
10. Connect the motor plug.

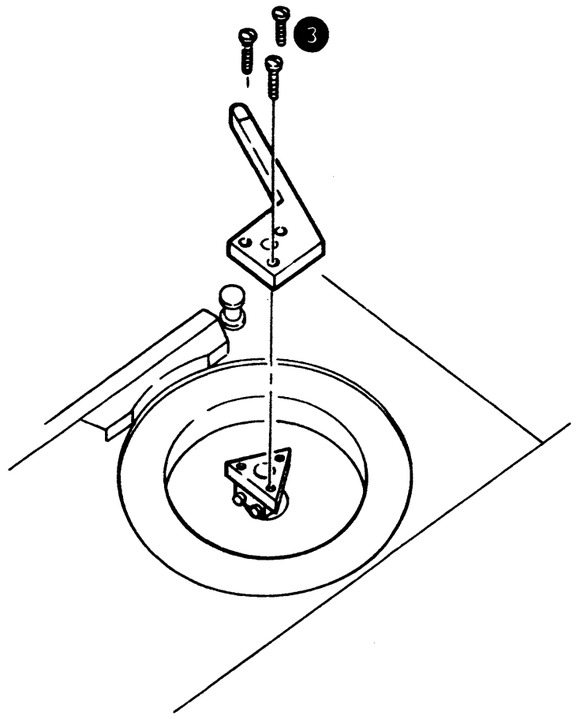
11. Reinstall the file protect switch assembly if removed in Step 3. See Figure D-15, "File Protect Switch Assembly Removal and Replacement."

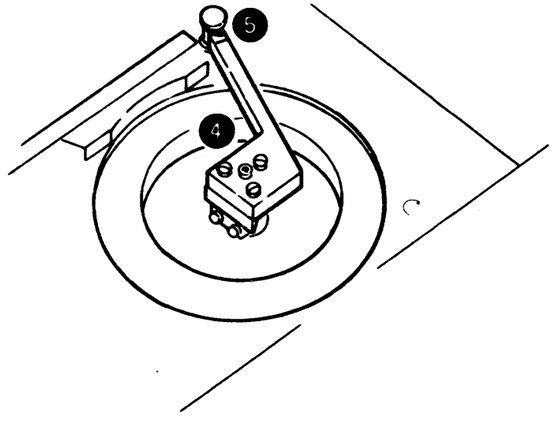
12. Make sure the idler is adjusted properly. See Figure D-23, "Tape Idler Assembly Removal, Replacement, and Adjustment."

13. Perform reel hub alignment procedure. See Figure D-39, "Reel Hub Alignment."

Figure D-39. Reel Hub Alignment







Functional Code 010-00

CAUTION
Don't align reel hub unless idler is in proper adjustment. See Figure D-23, "Tape Idler Assemblies Removal, Replacement, and Adjustment," for procedure.

CAUTION
Special tool part 2517735 is needed for reel hub alignment. Handle this tool carefully because it is easily damaged.

1. Remove reel hub.

   Left side: Remove the three screws from the center of the hub, and carefully remove the filler ring (part 2517769).

   Right side: Carefully remove the trim disc (part 2523727) to gain access to the three mounting screws.Remove the screws.

Note: The trim disc and filler ring are held in place by adhesive. Insert a thin object under the disc or ring and carefully pry it loose. The disc and ring are reusable only if they aren't bent or broken during removal. See CARRL D-15, item 3.

2. Rotate the split collar so the holding screws are facing the front of the machine.

3. Attach the special tool to the hub by using the three mounting screws supplied. As you tighten the screws, make sure the arm of the tool is *not* in contact with the machine base or the idler.

4. Insert the supplied adjusting screw into the center threaded hole of the tool. This screw exerts pressure against the motor shaft and is used to position the collar on the shaft.

CAUTION
Be careful not to nick or score the idler with the end of the tool. A damaged idler can cause severe tape damage.

5. Check to see if the end of the special tool fits freely between the flanges of the idler. If it doesn't fit freely:

   A. Loosen the split collar holding screws.

   B. Use the adjusting screw to raise the collar and tool so that the end of the tool fits freely between the flanges of the idler. Always make this adjustment by raising the collar and tool.

   C. When the tool is centered in the idler, tighten the plit collar holding screws. Tighten the two screws evenly to prevent the split collar from cocking on the shaft. Make sure that the tool arm doesn't contact any part of the machine while tightening the split collar holding screws.

   D. Recheck the adjustment.

6. Remove the special tool.

7. Install the filler ring. Align the filler ring cutout with the file protect switch plunger. Make sure that the plunger doesn't bind on the filler ring.

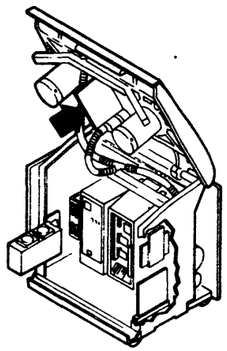
8. Replace the reel hub.

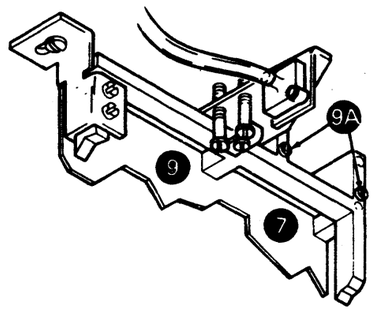
9. If the idler adjustments were changed, go to Figure D-36, "Tape Tracking Check and Adjustment." Readjust idlers before proceeding as shown in Figure D-23.

Note: On System 38, run MAP 6420.

Figure D-40. Read/Write Head and Card Assembly Removal and Replacement

Functional Code 009-45





Compare the head card frame supports with Carrl illustrations below and Carrl D-40A for correct method of removal and replacement.

Model 1, PE	Part 2517574 or 2518011
Model 2, PE	Part 2517790 or 2518012
Model 3, PE	Part 2517794 or 2518013
Model 1, DD	Part 2517800 or 2518014
Model 2, DD	Part 2517801 or 2518015
Model 3, DD	Part 2517802 or 2518016
Model 1, 7-Trk	Part 2517797
Model 2, 7-Trk	Part 2517798
Model 3, 7-Trk	Part 2517799

1. Turn subsystem power off. See Figure D-2, "Power On/Off Procedures."
2. Remove the front cover.
3. Open the sliding door.

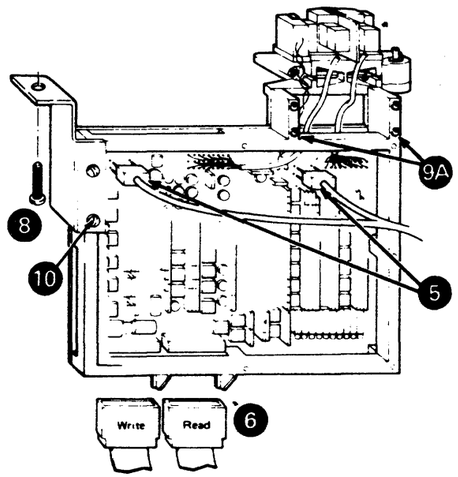
CAUTION
To prevent top cover damage, always use the lifting bar to raise the transport assembly. Be sure both support brackets latch. One bracket may require manual latching.

World Trade Machines Only.

Remove transport hold down screw located on the left front corner of side frame before lifting transport.

This screw must be replaced when servicing is finished.

4. Raise the transport assembly.
5. Unplug the two voltage cables.
6. Unplug the read and write flat cables.
7. Loosen the card frame clamp screw.
8. Loosen the support bracket mounting screw.
9. Move the card frame against the skew block. Using the two screws stored on the vacuum switch support bracket (9), fasten the card frame to the skew block.
10. Slide the frame clamp off the card and loosen the two head card frame mounting screws.



11. Remove the three skew block mounting screws.
12. Remove the head and card assembly from the machine. Continue with the next step for installation.
13. To avoid damage to the assembly, perform this step carefully. Insert the read/write head up through the opening in the vacuum column until the skew plate is located on the sub-plate dowel pins. At the same time, make sure that the card frame is inserted in the channel of the support bracket.

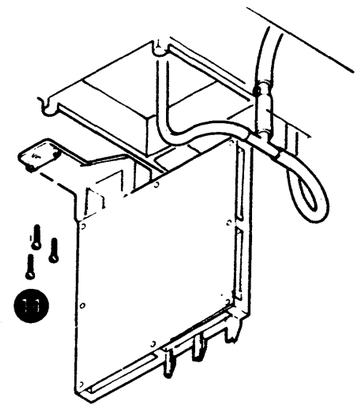
    Note: *Some replacement card assemblies have a plastic shield covering the head and cables. Do not remove this cover until after the assembly has been installed in the machine.*

14. Thread the three skew block mounting screws through the skew plate and into the sub-plate. Tighten these screws just enough to hold the head and card assembly in place. Be sure the head seal is located correctly in the vacuum column opening. Be sure the BOT/EOT vacuum hose isn't pinched between the head and card bracket and the main plate.
15. Tighten the skew block mounting screws.
16. A. Clamp the card frame to the vacuum switch support bracket.

    B. Position the support bracket on the head card frame. Tighten the two head card frame mounting screws (10) to clamp the head card in the bracket. (Do not put any stress on the head card frame.)

    C. With the support bracket loose, remove the two screws (9A) holding the card frame to the skew block and store them on the vacuum switch support bracket.

    D. Loosen the frame clamp and move the head card about an eighth of an inch (3,17 mm) from the skew block. Tighten the clamp screw.
17. Fully tighten the support bracket mounting screw (8).



18. Plug in the read and write flat cables. Dress cable lay in cable retainers to prevent interference with the top of the tape controller gate assembly.

CAUTION
Make sure that the voltage connectors are plugged correctly before turning on power. Incorrect plugging will cause severe damage to the assembly.

19. Plug in the two voltage cables. Remove the plastic protective cover if present on the replacement assembly. Install the cover on the assembly to be returned.
20. Turn on subsystem power. See Figure D-2, "Power On/Off Procedures."
21. Reset the BOT/EOT assembly position. See Figure D-25.
22. Check tape tracking. See Figure D-36, "Tape Tracking Check and Adjustment."

    Note: On System/38, run MAP 6420.
23. Check skew. See Figure D-57, "Mechanical and Electrical Skew Adjustments."

    Note: On System/38, run MAP 6420.
24. Run Diagnostics 701, 702, and 704 for System/3, and T3410A, B, C, and P for System/360 and System/370.

    Note: On System/38, run Good Machine Path.

XQ2100	1846024	See EC	734864	443751	846311			
Seq 2 of 2	Part Number	History	1 Aug 73	20 Sept 74	1 Feb 79			

Figure D-40A. Read/Write Head and Card Assembly Removal and Replacement-(Early Model)

Compare the head card frame supports with Carrl illustrations below and Carrl D-40 for correct method of removal and replacement.

1. Turn subsystem power off. See Figure D-2, "Power On/Off Procedures."
2. Remove the front cover.
3. Open the sliding door.

CAUTION

To prevent top cover damage, always use the lifting bar to raise the transport assembly. Be sure both support brackets latch. One bracket may require manual latching.

World Trade Machines Only.

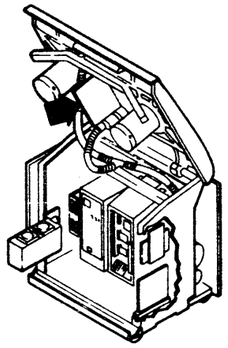
Remove transport hold down screw located on the left front corner of side frame before lifting transport.

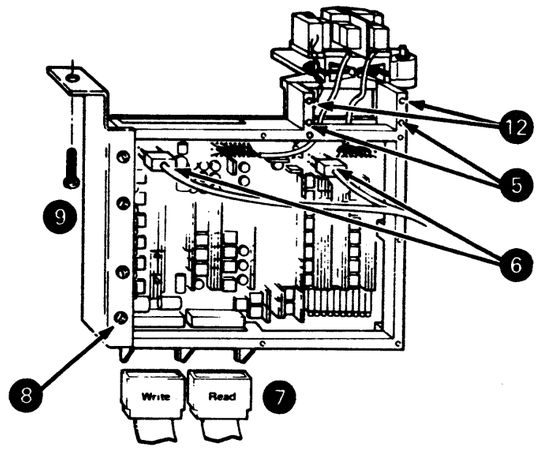
This screw must be replaced when servicing is finished.

4. Raise the transport assembly.
5. Tighten the two lower flat-head holding screws that secure the head assembly to the skew block. These screws are located on the right side of the head assembly.
6. Unplug the two voltage cables.
7. Unplug the read and write flat cables.
8. Loosen the four head card frame mounting screws.
9. Loosen the support bracket mounting screw.
10. Remove the three skew block mounting screws.
11. Remove the head and card assembly from the machine. Continue with the next step for installation.
12. In the new head and card assembly transfer the two upper binding head screws #12 from the assembly removed. Bottom these screws in the casting and there should be a minimum of .020" clearance between the card frame and the top of the binding head screws.

Functional Code 009-45

Model 1, PE	Part 2517574
Model 2, PE	Part 2517790
Model 3, PE	Part 2517794
Model 1, NRZI	Part 2517800
Model 2, NRZI	Part 2517801
Model 3, NRZI	Part 2517802
Model 1, 7-Trk	Part 2517797
Model 2, 7-Trk	Part 2517798
Model 3, 7-Trk	Part 2517799





13. To avoid damage to the assembly, perform this step carefully. Insert the read/write head up through the opening in the vacuum column until the skew plate is located on the sub-plate dowel pins. At the same time, make sure that the card frame is inserted in the channel of the support bracket.

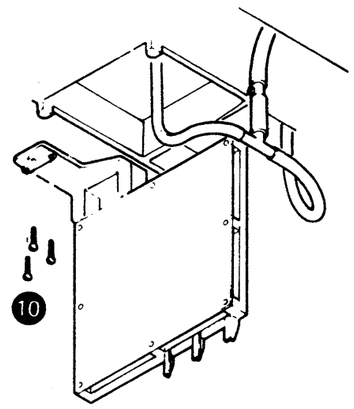
Note: *Some replacement card assemblies have a plastic shield covering the head and cables. Do not remove this cover until after the assembly has been installed in the machine.*

14. Thread the three skew block mounting screws through the skew plate and into the sub-plate. Tighten these screws just enough to hold the head and card assembly in place. Be sure the head seal is located correctly in the vacuum column opening. Be sure the BOT/EOT vacuum hose isn't pinched between the head and card bracket and the main plate.
15. Tighten the skew block mounting screws.
16. Position support bracket on the head card frame. Mount the bracket to the main casting loosely with the screw and washer. Tighten the four screws that hold the head card frame in the bracket. Make sure there isn't any stress on the assembly.
17. Fully tighten the support bracket mounting screw.
18. Plug in the read and write flat cables.

CAUTION

Make sure that the voltage connectors are plugged correctly before turning on power. Incorrect plugging will cause severe damage to the assembly.

19. Plug in the two voltage cables.
20. Loosen the two holding screws two full turns. **These are the same screws you tightened in Step 5.**
21. Be sure the card and frame assembly is floating, that is, completely separated from the skew block and the four frame-to-block mounting screws, and that no pressure is being applied to the skew block. If the assembly is not floating,



loosen the four head card frame mounting screws, reposition card frame, and tighten screws. Remove the plastic protective cover if present on the replacement assembly. Install the cover on the assembly to be returned.

22. Turn on subsystem power. See Figure D-2, "Power On/Off Procedures."
23. Reset the BOT/EOT assembly position. See Figure D-25.
24. Check tape tracking. See Figure D-36, "Tape Tracking Check and Adjustment."

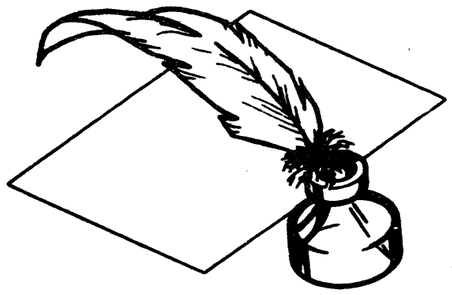
    Note: On System 38, run MAP 6420.

25. Check skew. See Figure D-57, "Mechanical and Electrical Skew Adjustments."

    Note: On System 38, run MAP 6420.

26. Run Diagnostics 701, 702, and 70A for System/3, and T3410A, B, C, and P for System/360 and System/370.

    Note: On System/38, run Good Machine Path.



Notes

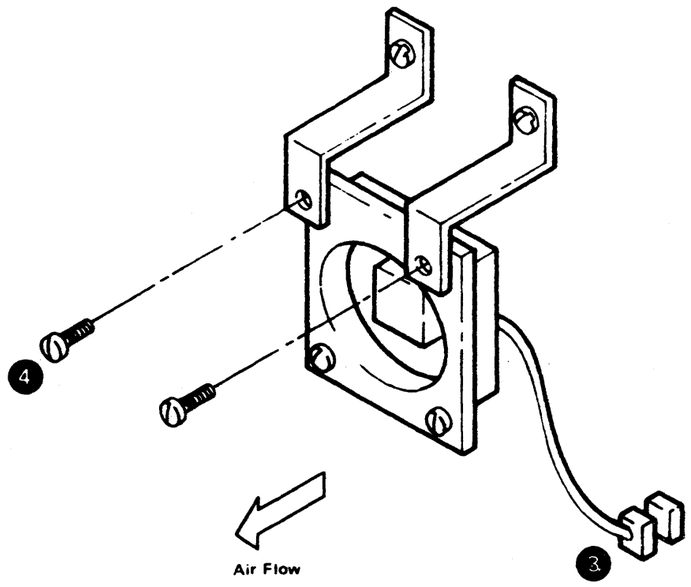
XQ2150 Seq 2 of 2	1846051 Part Number	734864 1 Aug 73	443751 20 Sept 74	846311 1 Feb 79				

Figure D-41. 3411 Exhaust Fan Assembly Removal and Replacement

Functional Code 009-33

60 Hz Part 2503537
50 Hz/60 Hz Part 8036618

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.
2. Remove the rear cover.
3. Unplug the ac power cable.
4. Remove the two screws that secure the fan to the mounting brackets.
5. Install the new assembly in reverse order.
6. Turn on power and check the air flow.



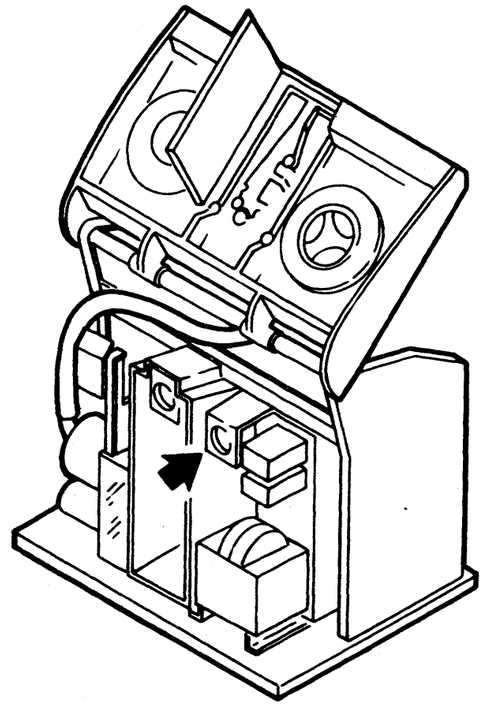
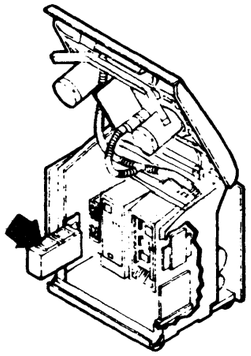
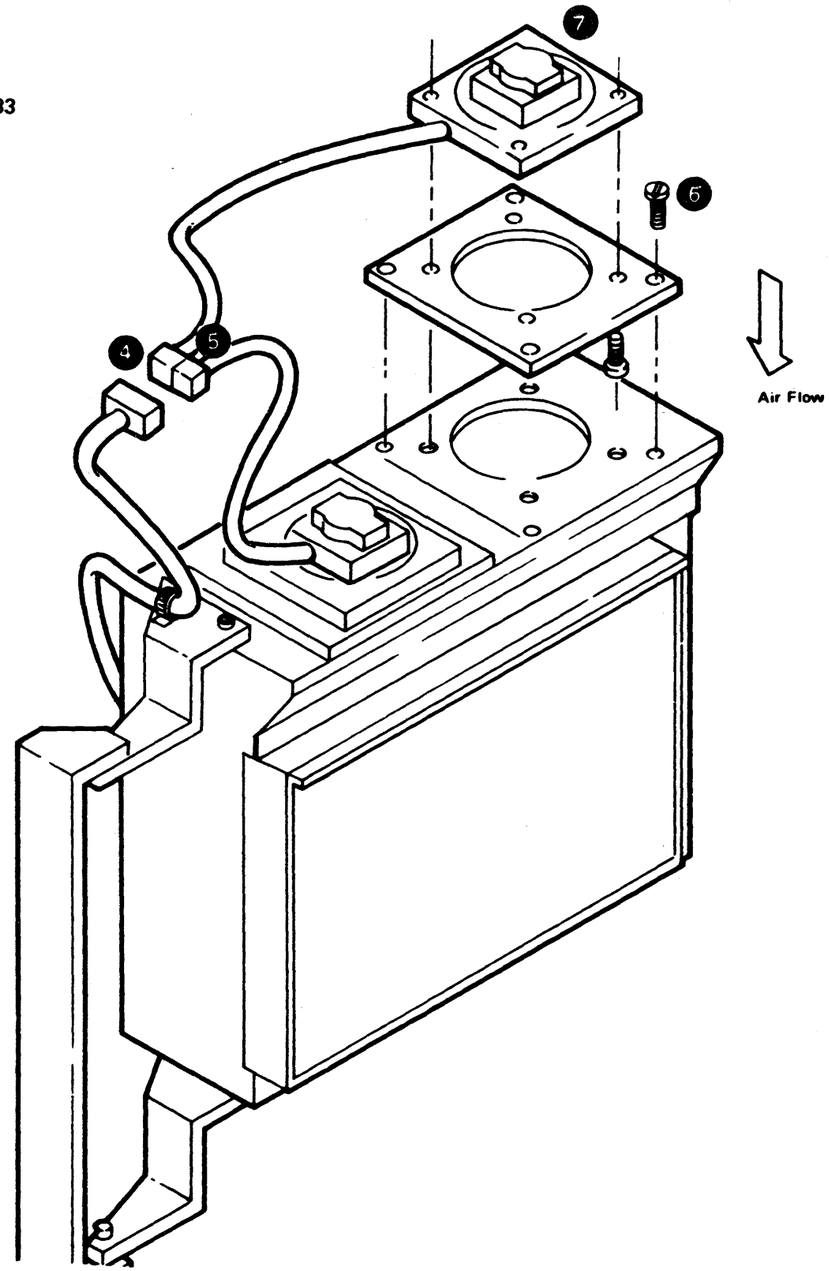


Figure D-42. Control Unit Cooling Fan Assemblies Removal and Replacement

Functional Code 003-33





60 Hz Part 2503537
50 Hz/60 Hz Part 8036618

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.
2. Remove the front cover.
3. Swing the tape control unit gate out.
4. Unplug the ac power cable.
5. Separate the cable assembly at the plug.
6. Remove the four mounting plate screws.
7. Remove the cooling fan assembly and the plate from the machine.
8. Remove the fan assembly from the plate.
9. Install the new assembly in reverse order.
10. 'Power On' and check air flow.

XQ2200	1846025	734556	734556A	734852	443751	
Seq 2 of 2	Part Number	1 Sept 72	20 Oct 72	26 Feb 73	20 Sept 74	

Figure D-43. DC Power Supply Cooling Fan Assemblies Removal and Replacement

Functional Code 600-33

Bottom Fan		Top Fan	
60 Hz	Part 2524837	60 Hz	2503537
50 Hz/60 Hz	Part 4241435	50 Hz/60 Hz	8036618

Bottom Fan Assembly Removal and Replacement

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.

DANGER
The primary power cable (ac input) must be disconnected at its source and identified to prevent accidental reconnection.

2. Remove the front cover.
3. Open the sliding door.

CAUTION

To prevent top cover damage, always use the lifting bar to raise the transport assembly. Be sure both support brackets latch. One bracket may require manual latching.

World Trade Machines Only.

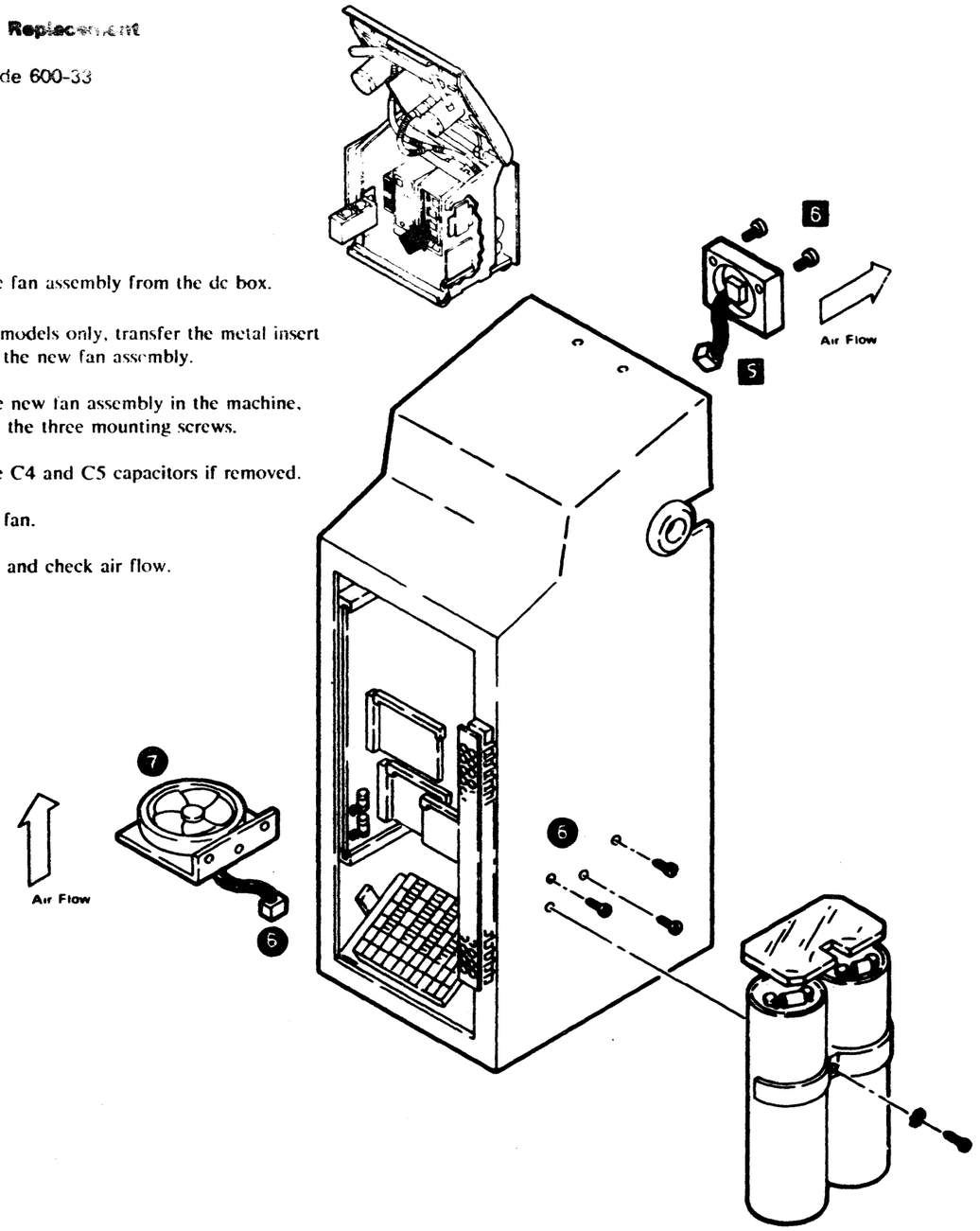
Remove transport hold down screw located on the left front corner of side frame before lifting transport.

This screw must be replaced when servicing is finished.

4. Raise the transport assembly.
5. Unplug the fan.
6. Remove the three fan mounting screws from the right side.

Note: It may be necessary to remove the C4 and C5 capacitors to gain access to these three screws. See Figure D-51, "Power Supply C4 and C5 Capacitors Removal and Replacement," Step 5 for procedure.

7. Remove the fan assembly from the dc box.
8. For 60 Hz models only, transfer the metal insert bracket to the new fan assembly.
9. Position the new fan assembly in the machine, and replace the three mounting screws.
10. Replace the C4 and C5 capacitors if removed.
11. Plug in the fan.
12. 'Power On' and check air flow.



Top Fan Assembly Removal and Replacement

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.

DANGER
The primary power cable (ac input) must be disconnected at its source and labeled to prevent accidental reconnection.

2. Remove the rear cover.
3. Open the sliding door.

CAUTION

To prevent top cover damage, always use the lifting bar to raise the transport assembly. Be sure both support brackets latch. One bracket may require manual latching.

4. Raise the transport assembly.
5. Unplug the fan.
6. Remove the two mounting screws that secure the fan. Remove the fan assembly from the dc box.
7. Transfer the fan guard from the old fan to the new fan.
8. Position the new fan assembly, and replace the two mounting screws.
9. Plug in the fan.
10. 'Power On' and check air flow.

Figure D-44. CB1 Circuit Breaker Removal and Replacement

Functional Code 600-18

Note: See the *IBM 3410/3411 Illustrated Parts Catalog*, order number S132-0006, for part numbers.

1. Turn off subsystem power. See Figure D-2. "Power On/Off Procedures."

DANGER
The primary power cable (ac input) must be disconnected at its source and labeled to prevent accidental reconnection.

2. Remove the front cover.
3. Open the sliding door.

CAUTION

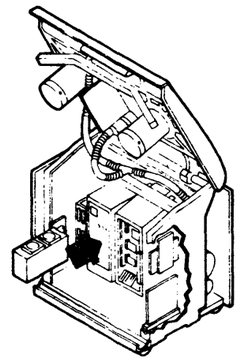
To prevent top cover damage, always use the lifting bar to raise the transport assembly. Be sure both support brackets latch. One bracket may require manual latching.

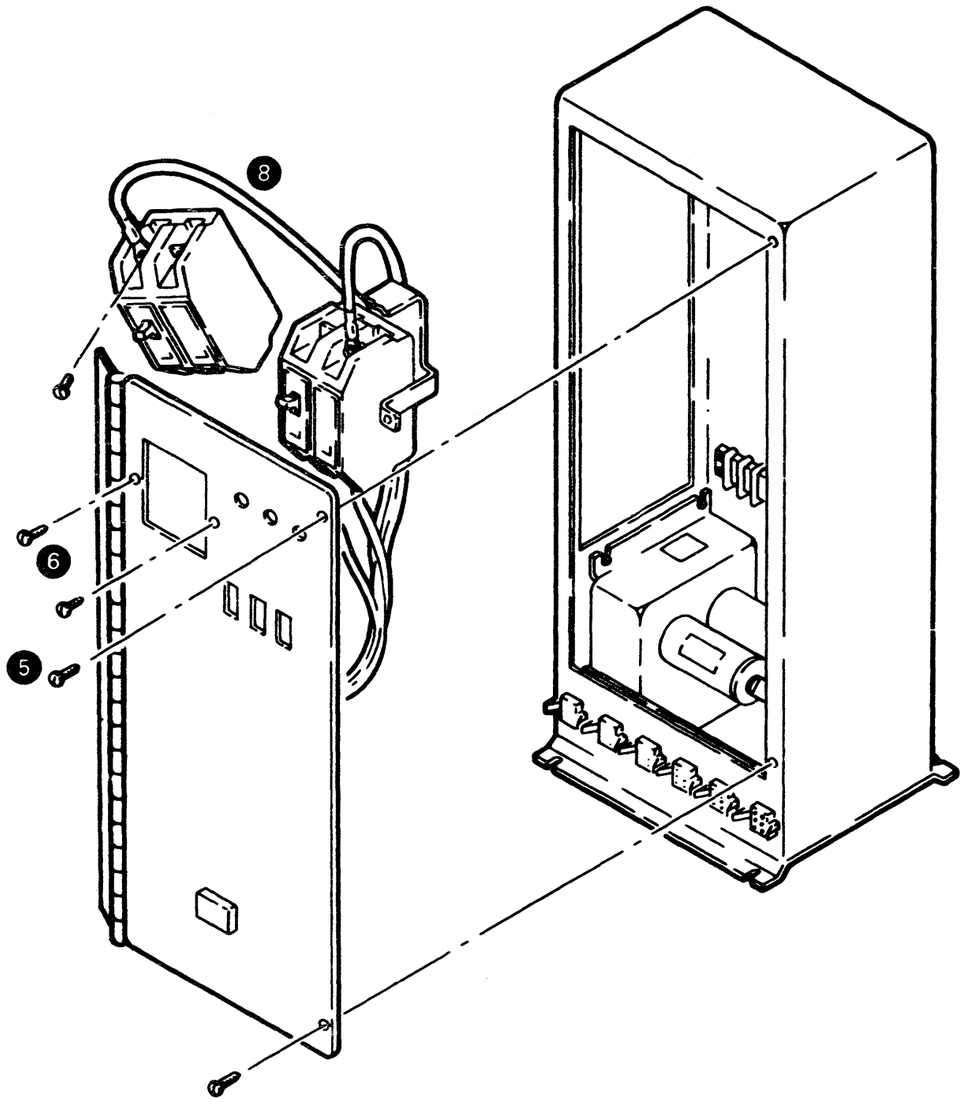
World Trade Machines Only.

Remove transport hold down screw located on the left front corner of side frame before lifting transport.

This screw must be replaced when servicing is finished.

4. Raise the transport assembly.
5. Remove the two screws securing the hinged cover of the ac box.
6. Remove the two circuit breaker mounting screws.
7. Remove the breaker.
8. Transfer the wiring, terminal for terminal, to the new breaker.
9. Position the new breaker, and replace the two mounting screws.
10. Secure the ac box cover.



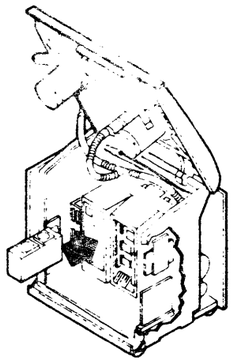


XQ2300 Seq. 2 of 2	1846026 Part Number

734556 1 Sept 72	734556A 20 Oct 72	734556B 20 Nov 72	734852 26 Feb 73	443751 20 Sept 74

Figure D-45. CP1, CP2, and CP3 Circuit Protectors Removal and Replacement

Functional Code 600-18



Note: See the *IBM 3410/3411 Illustrated Parts Catalog*, order number S132-0006, for part numbers.

Note: CP3 is present only if the machine is attached to System/360 and System/370, Attachment feature only.

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.

DANGER
The primary power cable (ac input) must be disconnected at its source and labeled to prevent accidental reconnection.

2. Remove the front cover.
3. Open the sliding door.

CAUTION
To prevent top cover damage, always use the lifting bar to raise the transport assembly. Be sure both support brackets latch. One bracket may require manual latching.

World Trade Machines Only.

Remove transport hold down screw located on the left front corner of side frame before lifting transport.

This screw must be replaced when servicing is finished.

4. Raise the transport assembly.
5. Remove the two screws securing the front hinged cover of the ac box.
6. Disconnect the wiring to the circuit protector that you want to change. Transfer the wires, one by one, to the new circuit protector.
7. Remove the nut and the lock washer that secure the circuit protector to the front panel.
8. Position the new circuit protector and replace the nut and lock washer.
9. Secure the ac box cover.

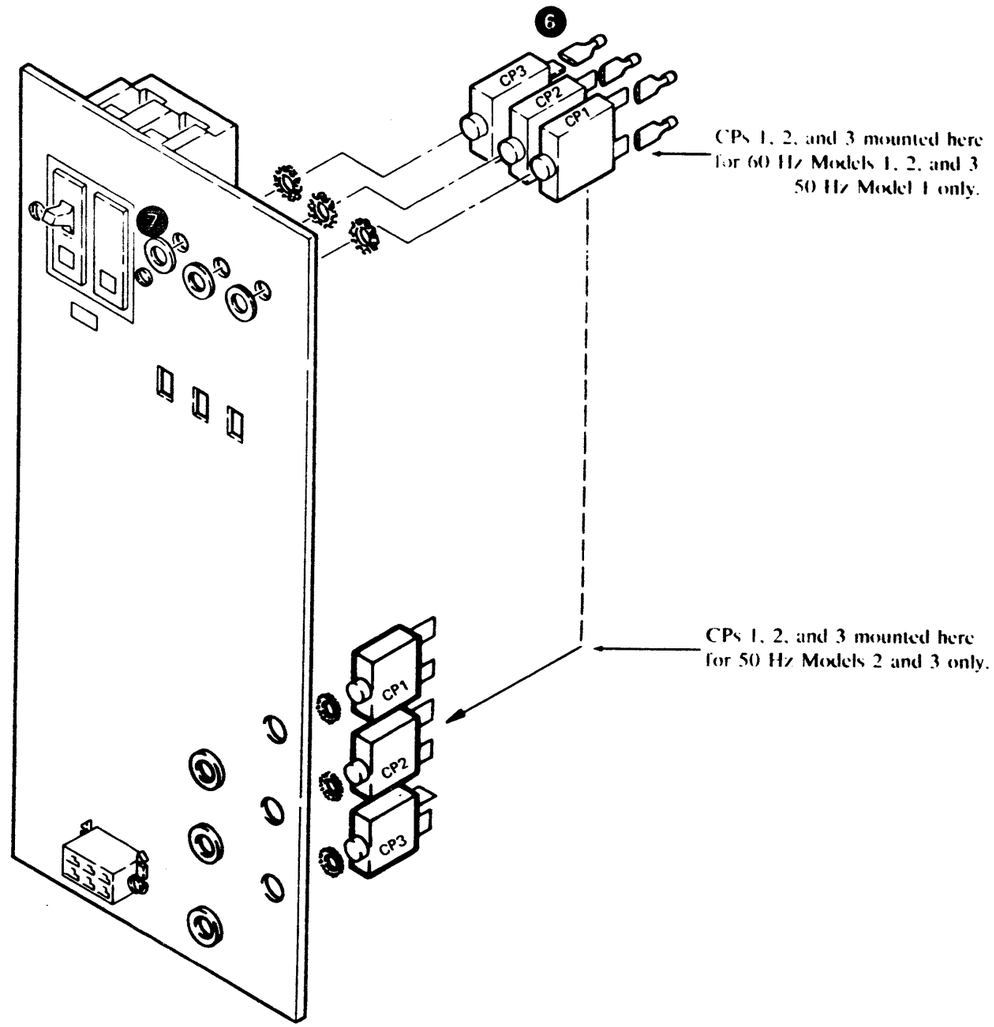
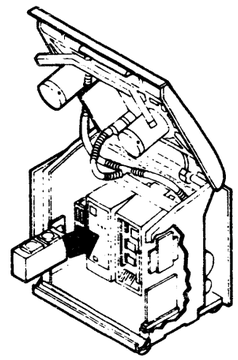
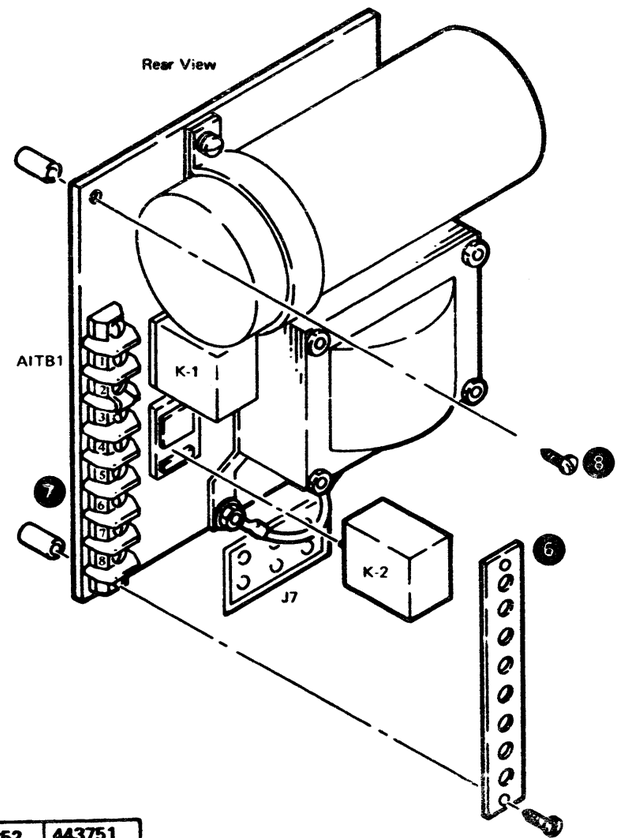
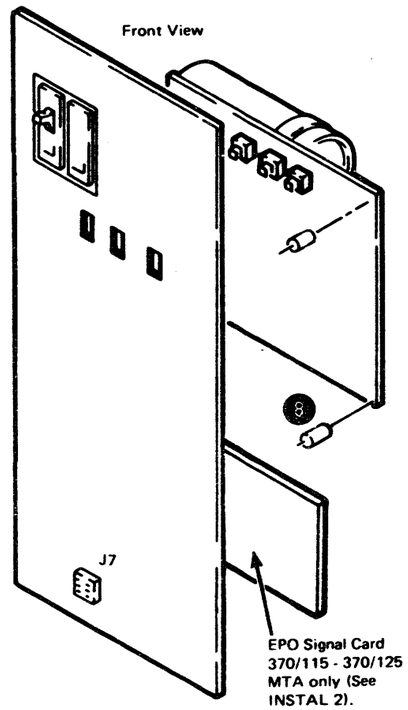


Figure D-46. 24-Volt AC Sequencing Assembly Removal and Replacement

Functional Code 600-00







Note: See the *IBM 3410/3411 Illustrated Parts Catalog*, order number S132-0006, for part numbers.

Note: This sequencing assembly is present only if the machine is attached to System/360 or System/370 Attachment feature only.

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.

DANGER
The primary power cable (ac input) must be disconnected at its source and labeled to prevent accidental reconnection.

2. Remove the front cover.
3. Open the sliding door.

CAUTION
To prevent top cover damage, always use the lifting bar to raise the transport assembly. Be sure both support brackets latch. One bracket may require manual latching.

World Trade Machines Only.

Remove transport hold down screw located on the left front corner of side frame before lifting transport.

This screw must be replaced when servicing is finished.

4. Raise the transport assembly.
5. Remove the two screws securing the hinged cover of the ac box.

6. Remove the TB shield.

DANGER
The capacitor, located on the sequencing assembly, can retain a charge. Discharge the capacitor before handling the sequencing assembly.

7. Disconnect and label all the wiring to the assembly, except those wires that come from J7. The wires running to J7 must be removed at the plug.

8. Remove the four assembly mounting screws and standoffs.

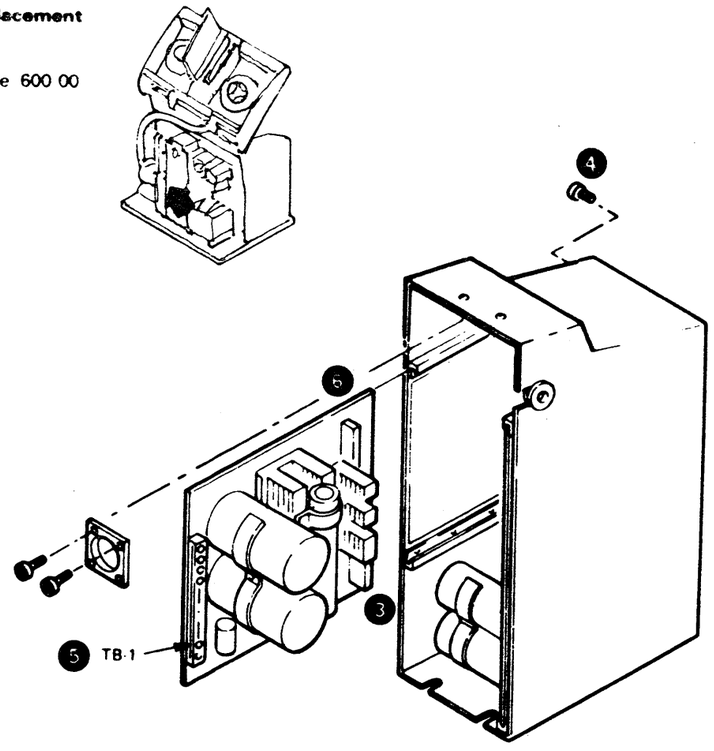
9. Position the new assembly, then replace the four mounting screws and standoffs.
10. Reconnect all wiring to the assembly and the J7 plug.
11. Secure the ac box cover.

XQ2400 Sec 2 of 2	1846027 Part Number

734556 1 Sept 72	734556A 20 Oct 72	734556B 20 Nov 72	734852 26 Feb 73	443751 20 Sept 74

Figure D-47. 4-Volt Assembly (Part 2524747) Removal and Replacement

Functional Code 600 00



Note: *The 4-volt assembly is the shorter of the two boards located in the dc box and is labeled A3.*

1 Turn off subsystem power. See Figure D-2. "Power On/Off Procedures." for reference.

DANGER
The primary power cable (ac input) must be disconnected at its source and labeled to prevent accidental reconnection.

2 Remove the front and rear covers.

3 Remove the 4-volt dc regulator card and its retaining clip.

4 Remove the assembly retaining screw, which is located at the front of the dc box, on the top right side.

5 Disconnect and label the wiring from the 18-position terminal board (TB1).

6 Slide the 4-volt assembly out the rear of the machine

DANGER
Capacitors on the board assembly may retain a charge. Discharge before handling.

7. Note EC level of board removed.

8. Note EC level of replacement board.

9. Slide the new board in from the rear of the machine.

Note: *It may be necessary to remove the rear dc power supply cooling fan. See Figure D-43. "DC Power Supply Cooling Fan Assemblies Removal and Replacement."*

10. **Reconnect the wires to the 18-position terminal board. To aid you in connecting these wires, it is helpful to have the logic (VG120) on hand.**

Note: *This circuit board is EC level sensitive.*

For U.S.:

Install EC 734294B if circuit board removed is at an EC level previous to 734294.

For World Trade.

If board removed is at an EC level previous to 734294, remove one end of jumper P/N 5759069, installed by EC 734294C, from A3-TB1, position 17 and attach to A2-TB1, position 17 of +5V. 6V regulator board located on other side of power supply.

If board removed is at same EC level as replacement board, wire TB1 in same positions as removed from in step 5.

11. **Replace the 4-volt dc regulator card and its retaining clip.**

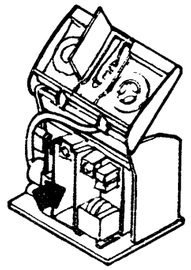
12. **Replace the assembly retaining screw that you removed in Step 4**

13. **Check the dc power supply voltages. See Figure D-53 "DC Power Supply Regulator Cards Removal, Replacement, and Adjustment."**

XQ2500 Seq 1 of 2	1846028 Part Number

734556 1 Sept 72	734556A 20 Oct 72	734852 26 Feb 73	734294C 7 Aug 74	

Figure D-48. 5- and 6-Volt Assembly Removal and Replacement



Functional Code 600-00

Model 1	Part 2524808
Model 2	Part 2524740
Model 3	Part 2524800

Note: The 5- and 6-volt assembly is the longer of the two boards located in the dc box and is labeled A2.

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.

DANGER
The primary power cable (ac input) must be disconnected at its source and labeled to prevent accidental reconnection.

2. Remove the front and rear covers.

3. Remove the 4-volt assembly. See Figure D-47, "4-Volt Assembly Removal and Replacement," for procedure.

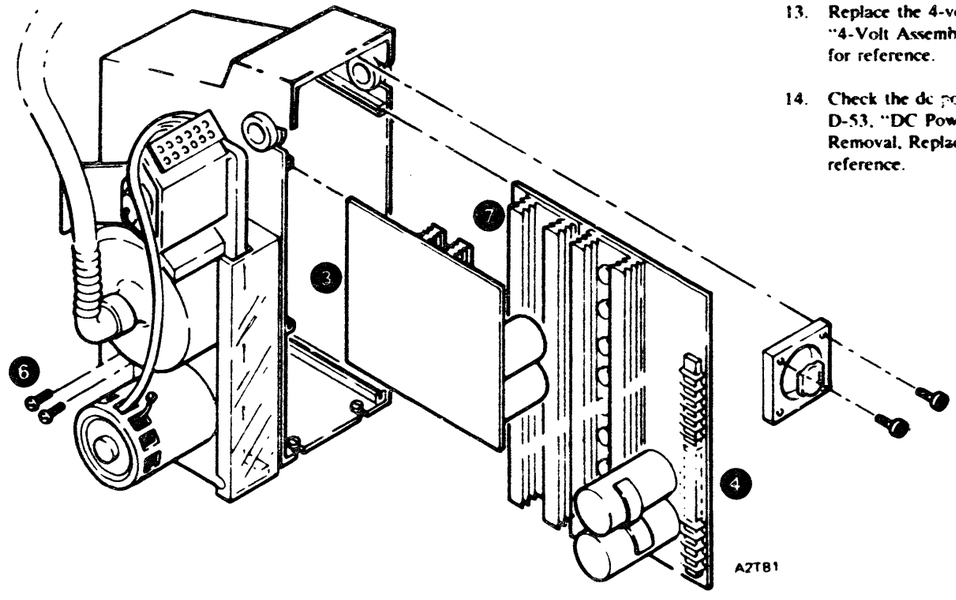
4. **Disconnect and label the wiring to the 18-position terminal board on the 5- and 6-volt assembly.**

5. Remove the cables connected to J21-J26.

6. Remove the two board mounting screws. These screws are located at the front right hand side of the dc distribution board. It may be necessary to remove the C4 and C5 capacitors to gain access to the screws. See Figure D-51. "Power Supply C4 and C5 Capacitors Removal and Replacement." Step 5 for procedure.

7. Slide the 5-and 6-volt assembly out the rear of the machine. Be careful not to damage the two SMS dc regulator cards.

DANGER
Capacitors on the board assembly may retain a charge. Discharge before handling.



8. Slide the new assembly in from the rear.

9. Replace the mounting screws.

10. Replace the capacitors if removed in Step 6.

11. **Reconnect all wiring to the 5- and 6-volt assembly. Because of the numerous connections, it is helpful to have the logic (YG110) on hand to aid you in connecting these wires.**

12. **Transfer the two SMS dc regulator cards and their retaining clips from the old board to the new board**

13. **Replace the 4-volt assembly. See Figure D-47, "4-Volt Assembly Removal and Replacement," for reference.**

14. **Check the dc power supply voltages. See Figure D-53, "DC Power Supply Regulator Cards Removal, Replacement, and Adjustment," for reference.**

Figure D-49. Main Transformer Removal and Replacement

Functional Code 600-00

Models 1 and 2, 60 Hz	Part 2524734
Model 3, 60 Hz	Part 2524735
Models 1 and 2, 50 Hz	Part 4119318
Model 3, 50 Hz	Part 4119319

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures."

DANGER
The primary power cable (ac input) must be disconnected at its source and labeled to prevent accidental reconnection.

2. Remove the front and rear covers.

3. Open the sliding door.

CAUTION
To prevent top cover damage, always use the lifting bar to raise the transport assembly. Be sure both support brackets latch. One bracket may require manual latching.

World Trade Machines Only.

Remove transport hold down screw located on the left front corner of side frame before lifting transport.

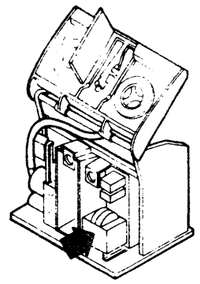
This screw must be replaced when servicing is finished.

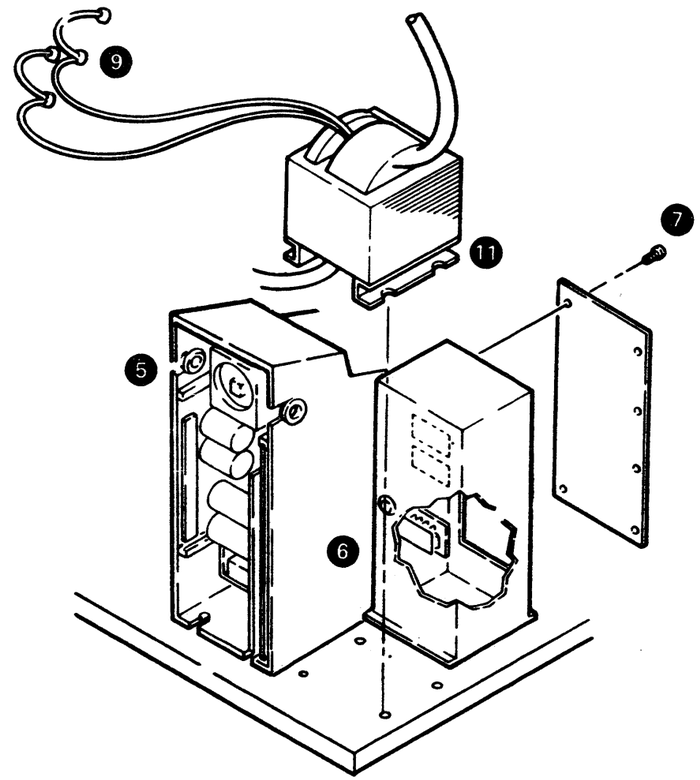
4. Raise the transport assembly.

5. Remove only the transformer wires that go to A3TB1 on the 4-volt assembly.

6. Remove only the transformer wires that go to A2TB1 on the 5- and 6-volt assembly.

7. Remove the two screws securing the hinged cover of the ac box.





8. Disconnect the following wires inside the ac box:
   - the transformer wires labeled 1, 2, 3, and 4 at A6TB1.
   - the transformer wires labeled 7 and 8 at the connector.

9. Disconnect the red wires that connect the transformer to the ac ferro capacitors. These capacitors are mounted on the rear of the ac box. To disconnect the wires, remove the heat-shrink material that covers them, and then remove the slip-on connectors. New heat-shrink material must be used when reconnecting these wires.

10. Remove the three screws that secure the transformer to the machine frame.

Note: Some machines have four screws securing the transformer.

11. The transformer can now be removed from the machine.

CAUTION
It takes two people to lift the transformer from the machine. Depending on the model, the transformer weighs from 60 to 120 pounds (27 to 54 kg).

12. Install the new transformer in reverse order.

DANGER
Miswired capacitors, or capacitors with a long shelf life, can expel their contents when power is turned on. Stand clear of the capacitors before turning on subsystem power.

13. Transfer "High Temperature" label to new transformer.

14. Check the power supply voltages. See Figure D-53, "DC Power Supply Regulator Cards Removal, Replacement, and Adjustment."

Figure D-50. Power Supply K1 and K2 Relays Removal and Replacement

Functional Code 600-06

Modeis 1, 2, and 3, 60 Hz,
Model 1, 50 Hz Part 2524713

Models 2 and 3, 50 Hz Part 2588425

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures."

DANGER
The primary power cable (ac input) must be disconnected at its source and labeled to prevent accidental reconnection.

2. Remove the front cover.

3. Open the sliding door.

CAUTION
To prevent top cover damage, always use the lifting bar to raise the transport assembly. Be sure both support brackets latch. One bracket may require manual latching.

World Trade Machines Only.

Remove transport hold down screw located on the left front corner of side frame before lifting transport.

This screw must be replaced when servicing is finished.

4. Raise the transport assembly.

5. Remove the two screws securing the hinged cover of the ac box.

6. For 50 Hz models, remove the relay cover.

7. Remove the relay mounting screws.

8. Transfer the wires, one by one, to the new relay.

9. For 60 Hz models only, add heat-shrink tubing over the two center contacts of the new relay.

10. Mount new relay.

11. Replace relay cover if 50 Hz.

12. Secure the ac box cover.

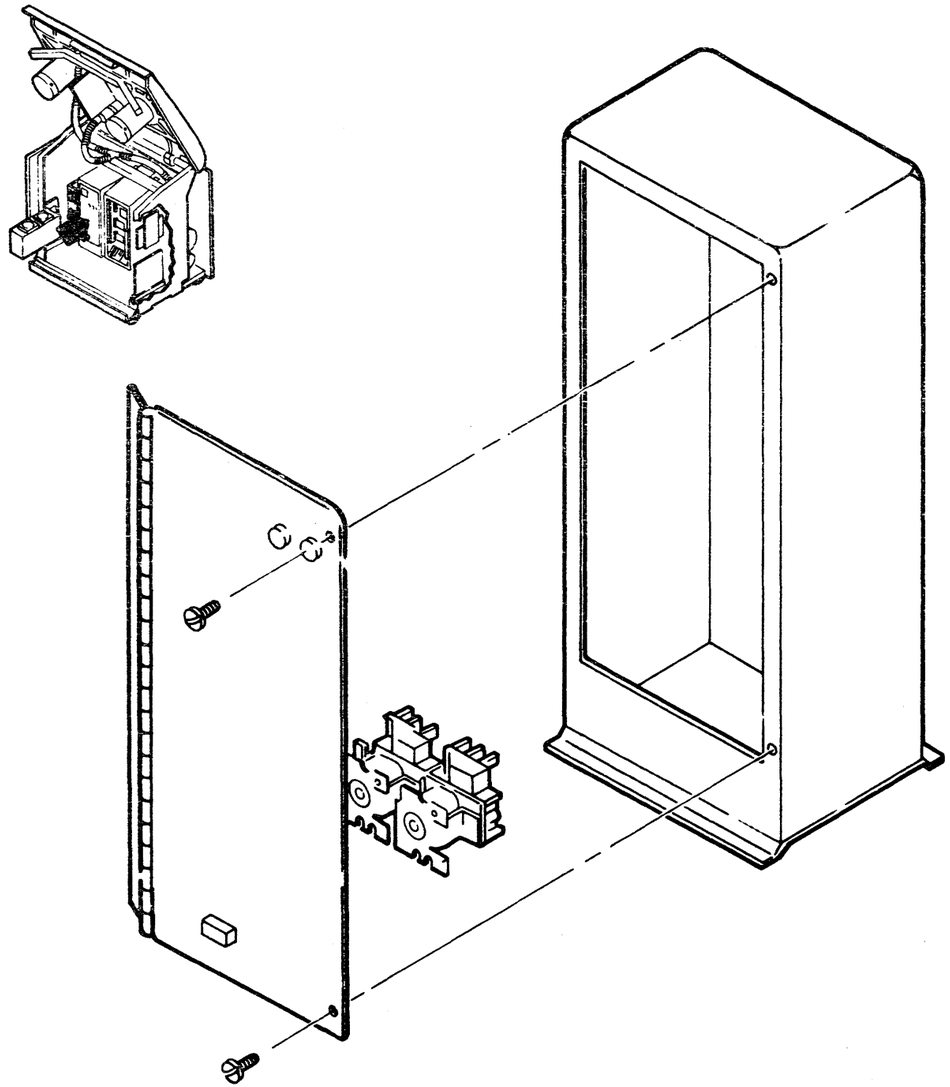


Figure D-51. Power Supply C4 and C5 Capacitors Removal and Replacement

Functional Code 600-09

Model 1	Part 2524764
Model 2	Part 2524792
Model 3	Part 2524760

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.

DANGER
The primary power cable (ac input) must be disconnected at its source and labeled to prevent accidental reconnection.

2. Remove the front cover.

3. Open the sliding door.

CAUTION
To prevent top cover damage, always use the lifting bar to raise the transport assembly. Be sure both support brackets latch. One bracket may require manual latching.

World Trade Machines Only.

Remove transport hold down screw located on the left front corner of side frame before lifting transport.

This screw must be replaced when servieing is finished.

4. Raise the transport assembly.

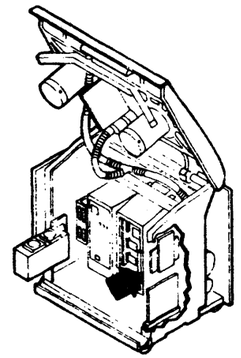
DANGER
The capacitors retain a hazardous charge for approximately 10 seconds after power is turned off.

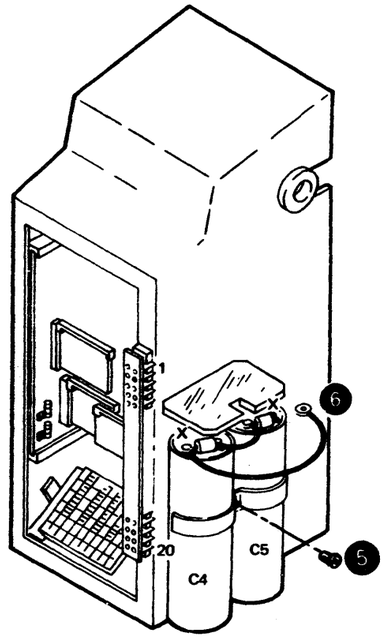
5. Remove the holding clamp mounting screw. Some models have wing nuts located inside D.C. box in the 3411.

6. Transfer the jumpers and resistors, one by one, to the new capacitor. Be sure to maintain correct polarity. See YG125 and YG135.

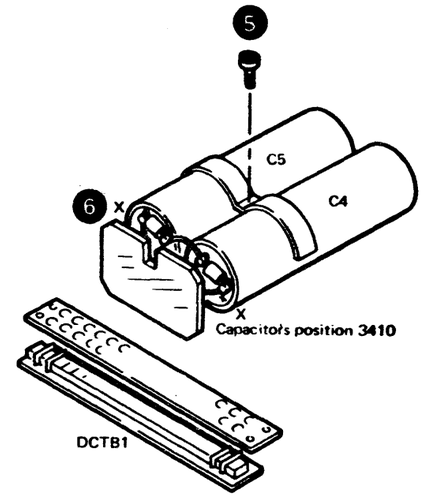
7. Position the capacitor and replace the holding clamp mounting screw.

DANGER
Miswired capacitors can expel their contents when power is turned on. Stand clear of the capacitors before turning on subsystem power.





Capacitors position 3411



XQ2700 Seq 1 of 2	1846030 Part Number	See EC History	736672 26 Oct 73	443751 20 Sept 74		

Figure D-52. Power Supply Fuses Removal and Replacement

Functional Code o00-18

1 A2F1 and A2F2 (Part 2524719) Removal and Replacement

Note: These fuses are located on the 5- and 6-volt (A2 board) assembly, and are held in place by clips.

1. Remove the front cover.
2. Check the indicator lamp to see which fuse is bad.
3. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures."
4. Install a new fuse.

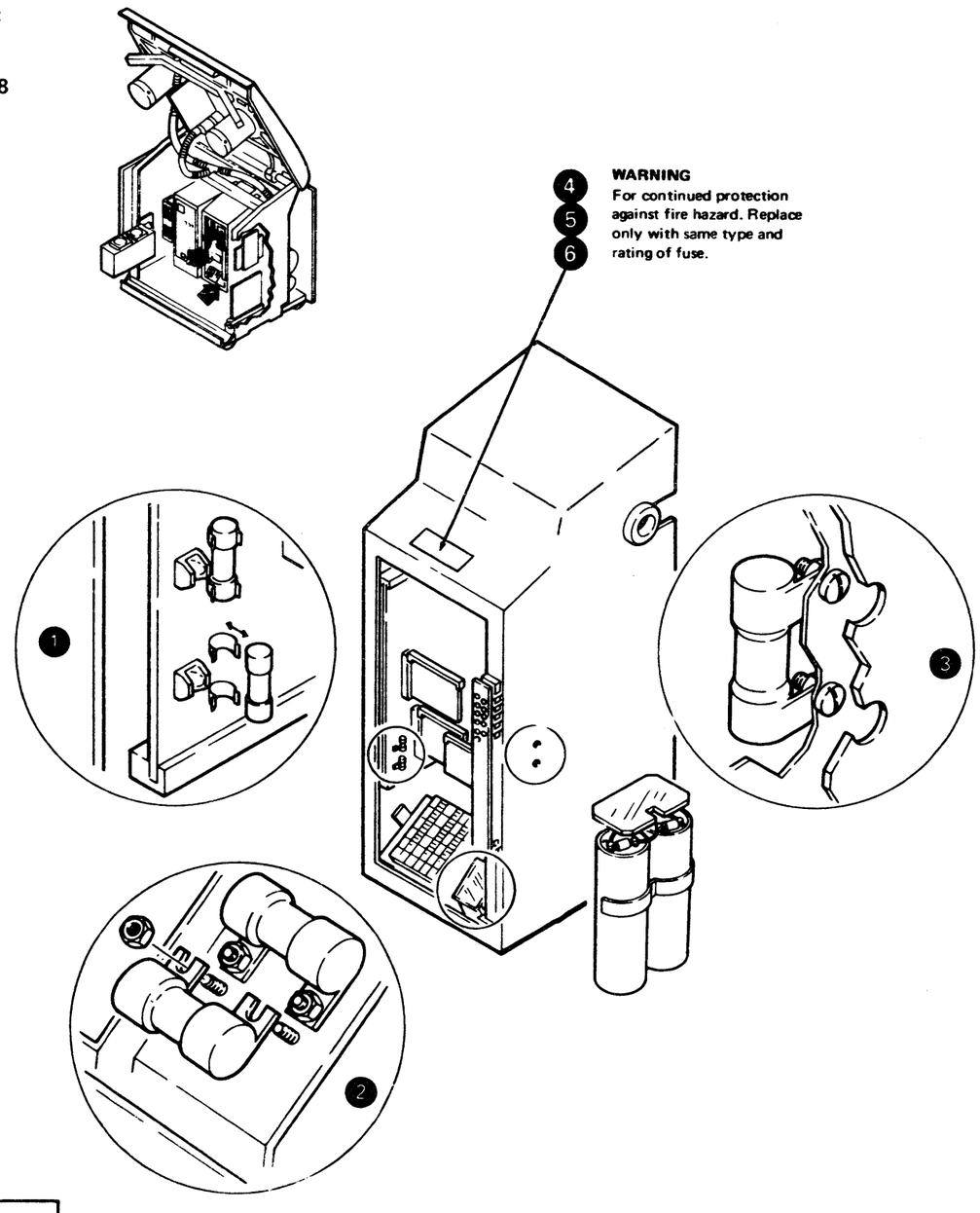
2 A5F1 and A5F2 (Part 2524739) Removal and Replacement

Note: These fuses are located on the A5 board. This board is located at the bottom right front of the dc box.

1. Remove the front cover.
2. Check the indicator lamps to see which fuse is bad.

   Note: The left lamp is the indicator for the top fuse (F1 for +15 volts), and the right lamp is the indicator for the bottom fuse (F2 for -15 volts).

3. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures."
4. Remove the plastic cover to gain access to the fuses.
5. Loosen the nuts that secure the fuse to the board.
6. Install a new fuse.



3 A3F1 (Part 2524739) Removal and Replacement

Note: This fuse is located on the 4-volt (A3 board) assembly.

1. Remove the front cover.
2. Check the indicator lamp to see if the fuse is bad.
3. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures."
4. Loosen the screws that secure the fuse to the board. It may be necessary to remove the capacitors and one of the regulator cards to gain access to the screws. Refer CARRL D-51.
5. Install a new fuse.
6. Replace the capacitors and the regulator card if removed in Step 4.

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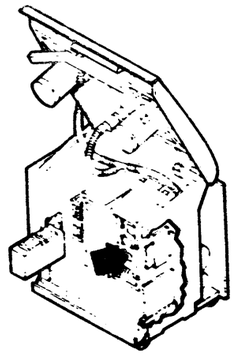
Figure D-53. DC Power Supply Regulator Cards (Part 375455) Removal, Replacement, and Adjustment

Functional Code 600-42



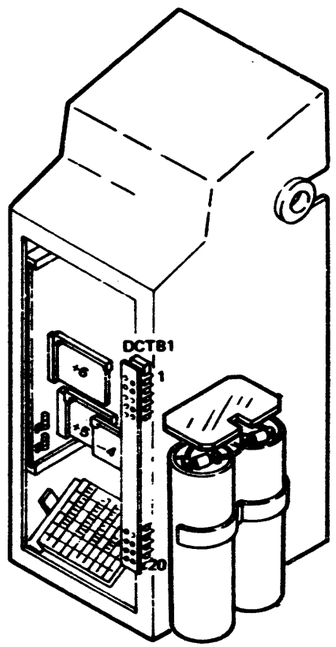
Removal and Replacement

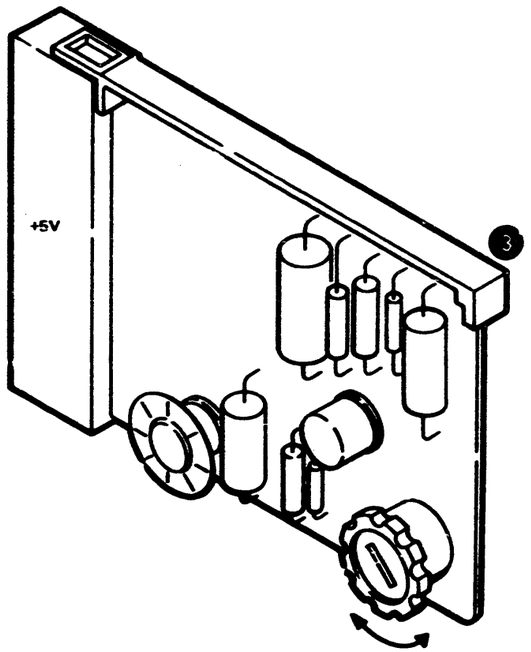
Note: The three regulator cards are interchangable.

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures," for reference.

Note: Removal of the 5-volt card requires removal of the 6-volt card first.

2. Remove the front cover.
3. Lift up on the card retainer.
4. Remove the cards by pulling straight out from the connectors.
5. When installing a new card, make sure it is firmly seated.





Voltage Check and Adjustment

1. Remove the front cover.
2. Use a voltmeter with +0.25% accuracy to measure the power supply output voltages at DCTB1 at the following test points:

Voltage	Measure At	Tolerance
+5	TB1-1(+) To TB1-4(-)	+4.90 to +5.10
+6	TB1-9(+) To TB1-4(-)	+5.99 to +6.01
+15	TB1-11(+) To TB1-14(-)	+13.5 to +17.15
-15	TB1-17(-) To TB1-14(+)	-13.5 to -17.15

Note: -4 is measured at the tape control logic gate. 01A-A1Q4B06(-) to 01A-A1Q4D08(+). The allowable range is -3.99 to -4.01 volts. See Figure D-58, "Tape Control Board Pin Layout and Card Numbering," for reference.

3. For a missing dc voltage, go to the following MAP:

Voltage	MAP	System/38 MAP
-4	AC110	6478
+5	AC090	6476
+6	AC100	6477
+15	AC130	6479
-15	AC130	6479

Note: For -4, +5, or +6 out of tolerance go to MAP AC120. For +15 or -15 out of tolerance go to MAP AC134.

4. If the above checks and adjustments have been made and are okay, but a problem with the −4 V, +5 V, or +6 V supply is still suspected, check these voltages for ripple. Use an oscilloscope grounded to dc common and check for ripple or noise with all tape units loaded. It should not exceed ±2.5% or a total of 5%. If the ripple exceeds tolerance, replace the power supply (See CARRL D-47 and D-48).

Figure D-54. AC Box Assembly Removal and Replacement

Functional Code 600-00

Note: See the *IBM 3410/3411 Illustrated Parts Catalog*, order number S132-0006, for part numbers.

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures."

DANGER
The primary power cable (ac input) must be disconnected at its source and labeled to prevent accidental reconnection.

2. Remove the front and rear covers.

3. Open the sliding door.

CAUTION
To prevent top cover damage, always use the lifting bar to raise the transport assembly. Be sure both support brackets latch. One bracket may require manual latching.

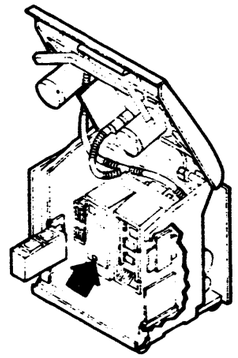
World Trade Machines Only.

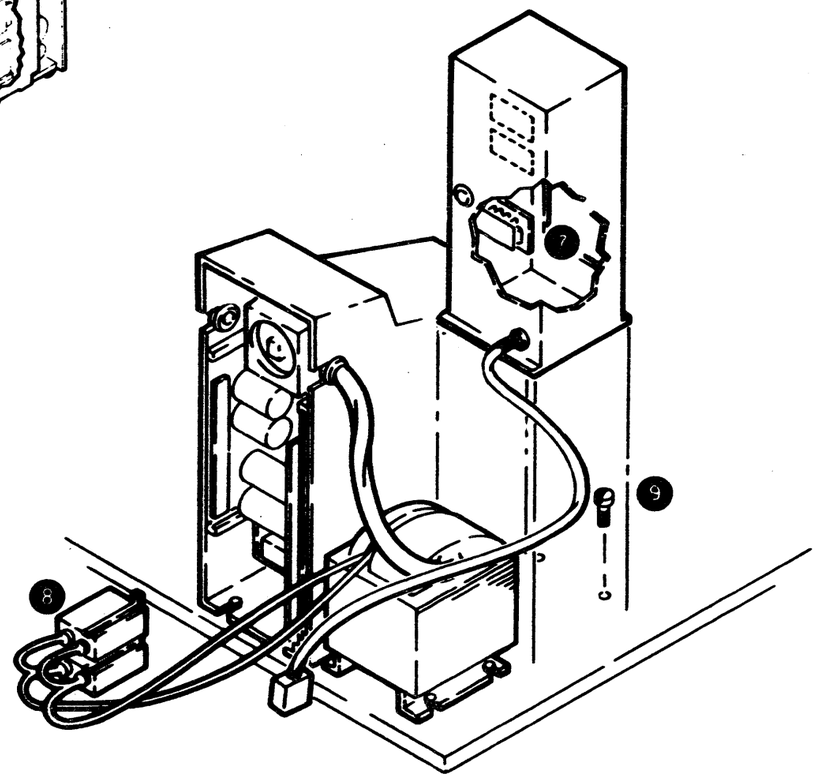
Remove transport hold down screw located on the left front corner of side frame before lifting transport.

This screw must be replaced when servicing is finished.

4. Raise the transport assembly.

5. Outside the ac box, disconnect:
   - The dc power supply fan assemblies, at connectors.
   - The tape control fan assemblies, at connectors.
   - The cables to J1 - J7 at front of ac box.





   - The cable from ac box to dc box at A3TB1 and/or A2TB1 (see logic YG110, YG120).

     Note: This cable is present when the machine is attached to a System 360 or System 370. It may not be present when the machine is attached to System 3.

   - The meter cable at the usage meter card. See Figure D-11, "Usage Meter Card Removal and Replacement."

6. Remove the two screws securing the front hinged cover of the ac box.

7. Inside the ac box, disconnect and label, (where necessary):
   - The wires labeled 1, 2, 3, and 4, which connect to A1TB1.
   - The wires labeled 7 and 8 at the plug.

8. Leaving the wires connected for installation on the new ac box, remove the ac ferro capacitors, which are mounted on the back of the ac box. See Figure D-55, "AC Ferro Capacitors Removal and Replacement," for procedure.

9. Remove the three ac box mounting screws.

10. Free those cables that will be removed with the ac box from cable clamps.

11. *Carefully* maneuver the ac box out the front of the machine.

12. Install the new ac box assembly in reverse order.

DANGER
Miswired capacitors, or capacitors with a long shelf life, can expel their contents when power is turned on. Stand clear of the capacitors before turning on subsystem power.

Figure D-55. AC Ferro Capacitors Removal and Replacement

Functional Code 600-09

Note: See the *IBM 3410/3411 Illustrated Parts Catalog*, order number S132-0006, for part numbers.

1. Turn off subsystem power. See Figure D-2, "Power On/Off Procedures."

DANGER
The primary power cable (ac input) must be disconnected at its source and labeled to prevent accidental reconnection.

2. Remove the front and rear covers.

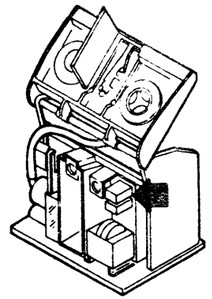
3. Disconnect the wires that connect to the capacitor. To disconnect, remove the heat-shrink material that cover them, and then remove the slip-on connectors.

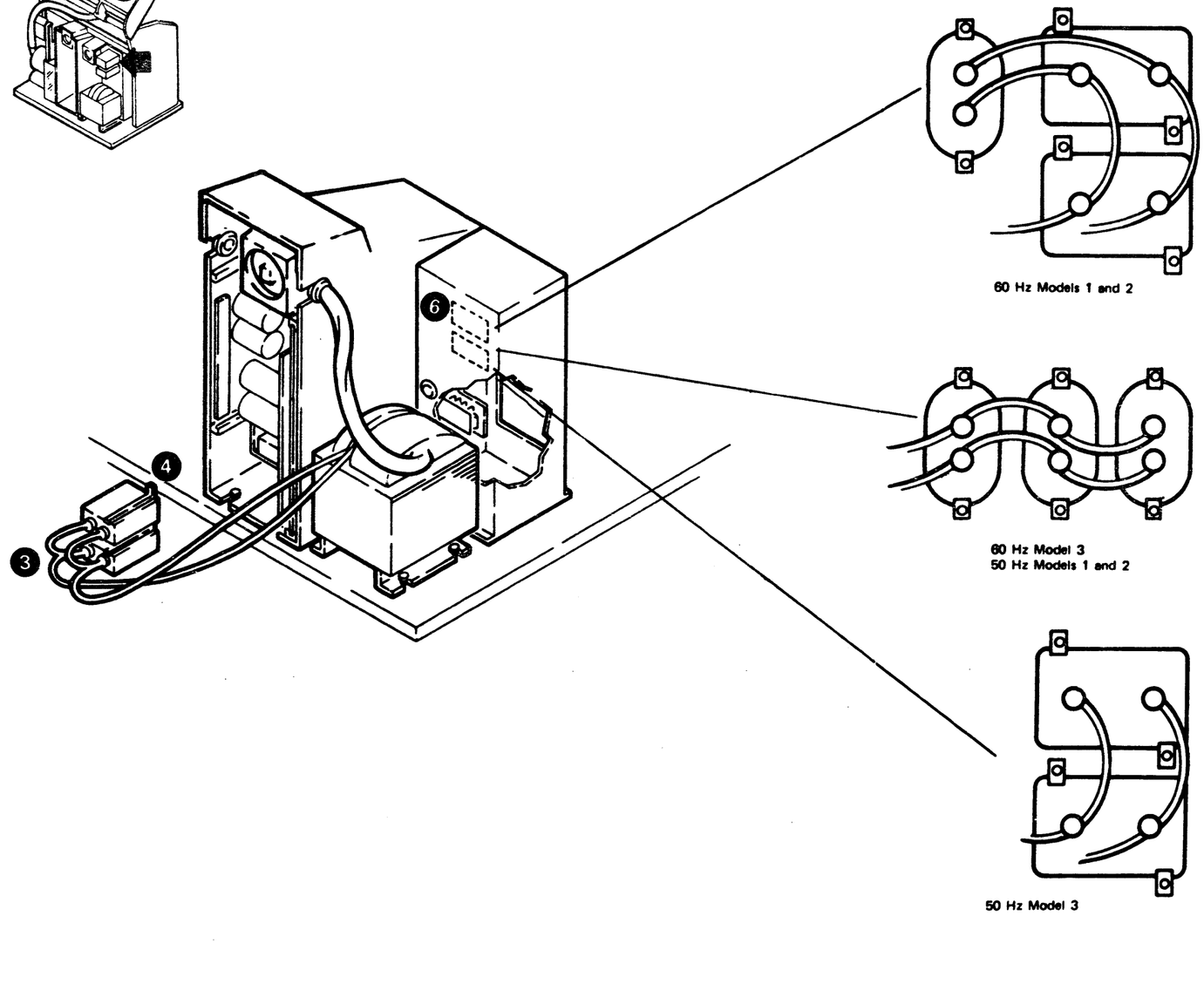
4. Remove the two capacitor supporting braces.

5. Transfer the wires, one by one, to the new capacitor. Install new heat-shrink material on the connectors.

6. Position the new capacitor, then replace the supporting braces.

DANGER
Miswired capacitors, or capacitors with a long shelf life, can expel their contents when power is turned on. Stand clear of the capacitors before turning on subsystem power.





60 Hz Models 1 and 2

60 Hz Model 3
50 Hz Models 1 and 2

50 Hz Model 3

Figure D-56. J Plug Locations and Numbering

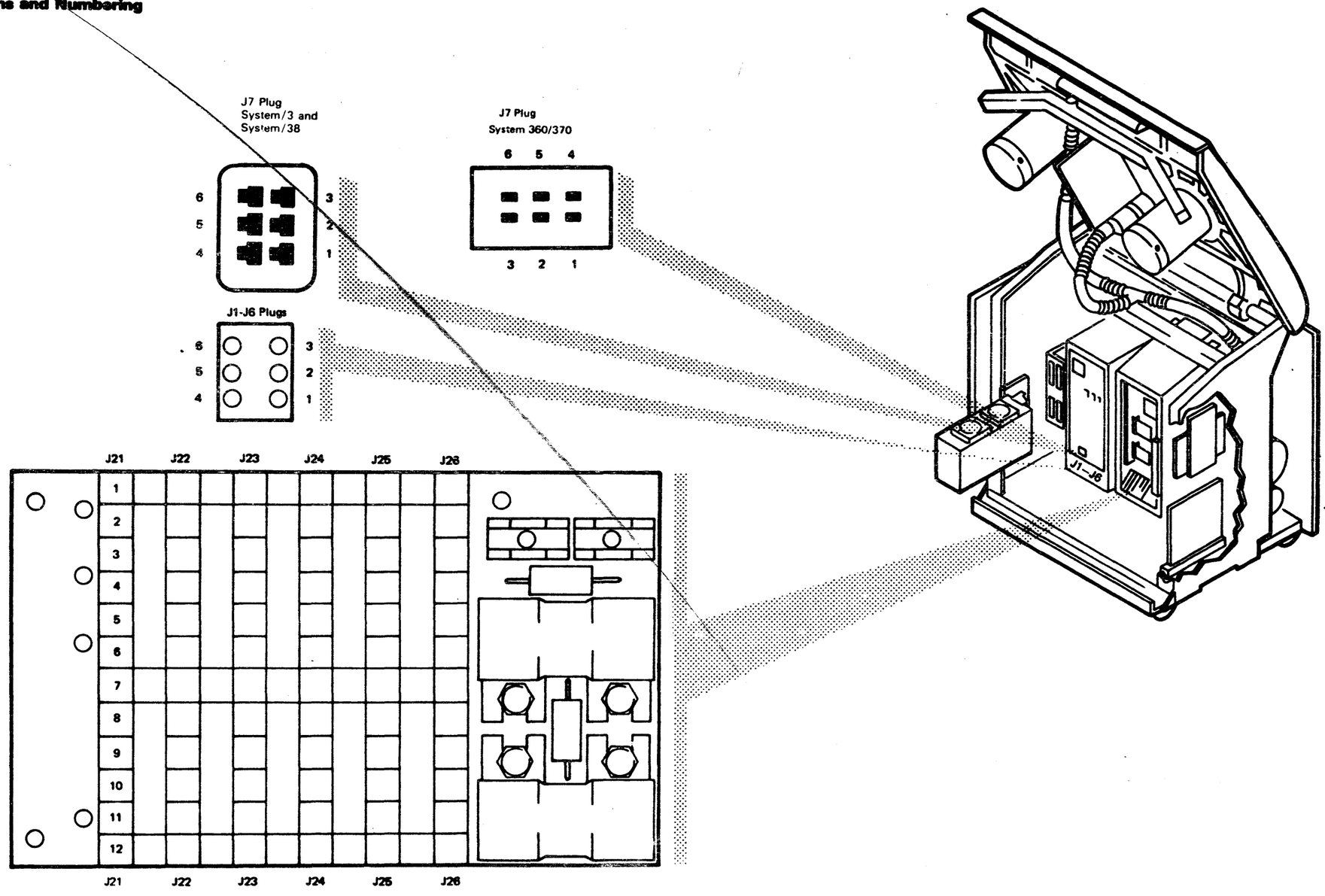


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Figure D-57. Mechanical and Electrical Skew Adjustments

Note: *If a hardware error intermittently occurs during the running of any adjustment test, ignore it and rerun the program.*

Note: On System/38, run MAP 6420 to make and test adjustments. No graphs will be printed. The MAP uses the console display to indicate the adjustments.

Functional Codes:

Mechanical Skew Adjustment - xxx-01
Electrical Skew Adjustment - xxx-02

System/3 Mechanical Skew Adjustment

1. Manually bypass the sliding door interlock switch. See Figure D-6, "Sliding Door Interlock Switch Assembly Removal, Replacement, and Adjustment."

2. If your entry to this figure was from MAP AD047, go to Step 10.

3. Clean the tape path and vacuum columns.

4. Make sure tape tracking is correct before adjusting mechanical skew. See CARRL D-36, "Tape Tracking Check and Adjustment." Read Note 2.

5. Load the master skew tape on the tape unit to be checked. Make the tape unit READY.

Note: Do not use the half column cover while running Skew Diagnostics.

6. Load the Diagnostic Control Program (DCP) and diagnostic 70A.

7. When an HA Halt occurs on diagnostic 70A, set the following sense switches ON:

   A. 10, 11, 12, or 13 (selects the tape unit to be checked).

   B. 16.

   C. 19 for 7 track.

8. If this is a dual density tape unit, remove the dual density jumper from the logic board. See CARRL D-16, "Logic Board Removal and Replacement."

   CAUTION
   Faulty skew adjustment can cause a dead track indication and runaway symptoms, or a true dead track situation exists.

   Note: If 7-track Tape Unit, turn all deskew pots full CW (minimum). See CARRL D-18. Proceed to Step 9.

9. Reset the Halt. The tape moves forward and a message is printed.

10. Compare the printout with Parts 1, 2, and 3 on CARRL D-57, page 5. If 7 track, refer to CARRL D-57A, Part 3.

    A. If the printout is similar to Part 1 (all tracks are within limits), go to Step 19.

    B. If the printout is similar to Parts 2 or 3 (tracks are scattered, and on or beyond the limits), draw a line on the printout starting at the track 4 position and going through the track 6 position to the base line. See Parts 2 and 3 for an illustration of how to draw the line. The side of the base line that the line intersects determines the direction you turn the mechanical skew adjusting screw. Save the printout and go to Step 11.

    C. If tracks 4 and 6 are vertically aligned as shown in Part 4 of this figure, draw a line from track 4 through track 0, to the base line. The side of the base line the line intersects determines the direction you turn the mechanical skew adjusting screw. Save the printout and go to Step 11.

11. SYSTEM RESET.

12. Set sense switch 14 ON and sense switch 16 OFF. If 7 track set sense switch 19 OFF, also.

13. Reset the Halt.

14. Observe the tape movement. The tape will be moving in either a start and stop motion (go to Step 14A), or a continuous motion (go to Step 14B).

    A. If the tape starts and stops at approximately one second intervals, slowly turn the mechanical skew adjusting screw (through the hole on top of the vacuum column cover) in the direction indicated on the base line in the printout saved from Step 10. Turn in this direction until the tape moves continuously (with no start and stop motion). When this point is reached, continue turning the adjusting skew in the same direction until the tape again starts and stops at approximately one second intervals. At this point go to Step 15.

    B. If the tape moves continuously (with no start and stop motion), slowly turn the mechanical skew adjusting screw (through the hole on top of the vacuum column cover) in the direction indicated on the base line in the printout saved from Step 10. Continue turning in this direction until the tape starts and stops at approximately one second intervals. When this is accomplished go to Step 15.

15. Press the STOP key and then SYSTEM RESET.

16. Set sense switch 14 OFF and sense switch 16 ON. If 7 track set sense switch 19 ON, also.

17. Reset the Halt and a message is printed.

18. Compare the printout to the originals printed in Step 10:

    A. If the printout shows mechanical skew to be within limits, as shown in Part 1 of this figure, continue to Step 19.

    B. If the printout shows that mechanical skew is still out of adjustment, return to Step 10A or 10B and repeat the mechanical skew adjustment.

19. Go to MAP AD049 to recheck tape tracking. This is the checkpoint for bidirectional tracking deviations. See CARRL D-57, Page 7. If 7-track, go to MAP AD049, Entry 2.

    Note: No further mechanical skew adjustment is needed.

20. If this is a dual density tape unit, replace the dual density jumper that you removed in Step 8.

21. If you got to this procedure from MAP AD047H3, return to that page, otherwise go to CARRL D-57, page 2 and make electrical skew adjustments. See Note 1.

Note 1: If the tape unit you have just adjusted is not a dual density unit, skew adjustments for the tape unit are completed.

Note 2: If tape unit is 7-track, set all read forward, read backward and write deskew pots fully CW (minimum) before making tracking adjustments.

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Figure D-57. Mechanical and Electrical Skew Adjustments
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System/3 Electrical Skew Adjustments

Note: *If a hardware error intermittently occurs during the running of any adjustment test, ignore it and rerun the program.*

Electrical skew must be adjusted in the following sequence:

Read forward
Read backward
Write

1. If entry to this adjustment procedure was from MAP AD047E1, go to Step 7. If entry was from MAP AD048, go to step 13.

2. If mechanical skew adjustments have been done, press system reset and go to Step 8.

3. Clean the tape path and vacuum columns.

4. Check mechanical skew. See System/3 Mechanical Skew Adjustment for procedure.

5. Load the master skew tape on the tape unit to be checked. Make the tape unit READY.

Note: Do not use the half column cover while running the Skew Diagnostics.

6. If you are doing this adjustment procedure because the deskew board or the read/write head assembly has been replaced, set all the skew pots to midrange for 9-track NRZI or full CW (minimum) for 7-track NRZI.

7. Load the Diagnostic Control Program (DCP) and diagnostic 70A.

8. When an HA Halt occurs on diagnostic 70A, set the following sense switches ON:

   A. 10, 11, 12, or 13 (selects the tape unit to be checked).

   B. 16.

CAUTION
Faulty skew adjustment can cause a dead track indication and runaway symptoms, or a true dead track situation exists.

9. If this is a dual density tape unit, make sure the dual density jumper is installed on the logic board. See CARRL D-16, "Logic Board Removal and Replacement."

   Note: If 7-track, proceed to Step 10.

10. Reset the Halt.

    The tape moves forward and a message is printed.

11. Compare the read forward skew printout to Parts 1 and 5 of CARRL D-57, Page 5. If 7 track, refer to CARRL D-57A, Page 2.

    A. If the printout is similar to Part 1 (all tracks are within limits), go to Step 12. See CARRL D-57, Page 5.

    B. If only one or two tracks are outside the skew limits, adjust the corresponding skew pots as indicated by the examples and text on Part 5 of this figure. If 7-track and a mechanical replacement has taken place, in the tape path or deskew, go to Step 11D. See CARRL D-18.

    C. If more than two tracks are outside the skew limits, follow this procedure:

       1. Check to see if the skew pots are set at midrange for 9-track NRZI or full CW (minimum) for 7-track NRZI. If they aren't, set them at this time.

       2. Do a System Reset and Reset the Halt. This will cause a new skew printout.

       3. Compare the new printout to Parts 1 and 5 of this figure. If all tracks are within limits, go to Step 12. If some tracks require adjustment, go to Step 11D.

    D. The pots are to be adjusted in the direction indicated in the text on Part 5 for 9-track NRZI. For 7-track NRZI, select the extreme leftmost track on the printout as the reference track. Adjust all other track pots CW, until alignment agrees with Part 1. Do not adjust the pot corresponding to the selected reference track. Continue the adjustments until all the tracks are within limits.

12. Check read backward skew by doing the following:

    A. System Reset and set sense switch 17 ON.

    B. Repeat Steps 10 and 11 until all tracks are within limits, then go to Step 13.

13. Check write skew by doing the following:

    A. System Reset and set sense switch 15 ON and sense switch 17 OFF.

    B. Remove the master skew tape and replace it with a good scratch tape with the write enable ring inserted.

    C. Make the tape unit READY.

    D. Repeat Steps 10 and 11 until all tracks are within limits, then go to Step 14. See System/3 User's Guide for "01" Halt.

14. This completes all electrical skew adjustments. If entry to this procedure was from MAP AD048, return to MAP AD048D1.

Figure D-57. Mechanical and Electrical Skew Adjustments
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System/360 and System/370 Mechanical Skew Adjustment

Note: *If a hardware error intermittently occurs during the running of any adjustment test, ignore it and rerun the program.*

1. Manually bypass the sliding door interlock switch. See CARRL D-6, "Sliding Door Interlock Switch Assembly Removal, Replacement, and Adjustment."

2. If your entry to this procedure was from MAP AA070, go to Step 10.

3. Clean the tape path and vacuum columns.

4. Don't adjust mechanical skew unless tape tracking is correct. See CARRL D-36, "Tape Tracking Check and Adjustment."

5. Load the master skew tape on the tape unit to be checked. Make the tape unit READY.

6. If this is a dual density tape unit, remove the dual density jumper from the logic board. See CARRL D-16, "Logic Board Removal and Replacement."

7. Load OLTEP/OLTSEP and diagnostic T3410P. Select the external option desired by entering EXT=M.

   The external options are:

   M = Forward Mechanical Skew, All Tracks
   F = Forward Electrical Skew
   B = Backward Electrical Skew
   W = Write Skew
   A = Automatic Mode
   T = Mechanical Tracking

CAUTION
Faulty skew adjustment can cause a dead track indication and runaway symptoms, or a true dead track situation exists.

Note: *If a printer isn't available on the system to use as an output device, you must also specify the option "PP" to get the output DPRINTS from the console typewriter.*

8. When the message "UNREADABLE TAPE LABEL ON OXXX" or "INT REQ OXXX" is printed on the console typewriter, reply "P" and then make the tape unit READY. The tape moves forward and a message is printed.

9. Compare the printout to Parts 6, 7, and 8 of this figure. If 7 track, refer to CARRL D-57A, Part 3.

   A. If the printout is similar to Part 6 (all tracks are within limits), go to Step 14.

   B. If the printout is similar to Parts 7 or 8 (tracks are scattered on or beyond the limits), draw a line on the printout starting at the track 4 position and going through the track 6 position to the base line. See Parts 7 and 8 for an illustration of how to draw the line. The side of the base line that the line intersects determines the direction you turn the mechanical skew adjusting screw. Save the printout and go to Step 10.

   C. If tracks 4 and 6 are vertically aligned as in Part 9 of this figure, draw a line from track 4 through track 0 to the base line. The side of the base line the line intersects determines the direction you turn the mechanical skew adjusting screw. Save the printout and go to Step 10.

10. Press REQUEST on the console typewriter. This allows you to restart T3410P. Use the external option "A."

11. Observe the tape movement. When the tape moves for approximately 10 seconds and then stops, the null or correct starting point has been reached.

    If tape is moving with a start and stop motion, with vibration after the stop, go to Step 11A.

    If tape is moving forward continuously, go to Step 11B.

    A. If the tape starts and stops, then vibrates backward and forward, at approximately one second intervals, slowly turn the mechanical skew adjusting screw (through the hole on top of the vacuum column cover) in the direction indicated on the base line in the printout saved from Step 9. Turn in this direction until the tape moves continuously (with no start and stop motion). When this point is reached, continue turning the adjusting screw in the same direction until the tape again starts and stops, then vibrates backward and forward, in one second intervals. When this is accomplished, go to Step 12.

    B. If the tape moves with a continuous forward motion, slowly turn the mechanical skew adjusting screw (through the hole on top of the vacuum column cover) in the direction indicated on the base line in the printout saved from Step 9. Continue turning in this direction until the tape starts and stops, then vibrates backward and forward, at approximately one second intervals. When this is accomplished, go to Step 12.

Note: To terminate T3410P with the EXT=A option on a DOS system, a 'Cancel BG' command must be issued and OLT job reinitiated.

12. Restart T3410P with the external option "M" This will cause a new printout to be printed.

13. Compare this printout to the originals saved from Step 9:

    A. If the printout shows mechanical skew within limits, as shown in Part 6 of this figure, continue to Step 14.

    B. If the printout shows that mechanical skew is still out of adjustment return to Step 9 and repeat the mechanical skew adjustment.

14. Go to MAP AA072 to recheck tape tracking. This is the checkpoint for bidirectional tracking deviations. See CARRL D-57, Page 7. If 7 track, refer to CARRL D-57A, Page 1.

    Note: No further mechanical skew adjustment is needed.

15. If this is a dual density tape unit, replace the dual density jumper that you removed in Step 6.

16. If you got here from MAP AA070, return to that page, otherwise continue with electrical skew adjustments.

Figure D-57. Mechanical and Electrical Skew Adjustments
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System/360 and System/370 Electrical Skew Adjustments

Note: *If a hardware error intermittently occurs during the running of any adjustment test, ignore it and rerun the program.*

Electrical skew must be adjusted in the following sequence:

1. Read forward
2. Read backward
3. Write

1. If entry to this adjustment procedure was from MAP AA070 or AA071 to to Step 7.

2. If mechanical skew adjustment has been made, go to Step 7.

3. Clean the tape path and vacuum columns.

4. Check mechanical skew. See System/360 and System/370 Mechanical Skew Adjustment.

5. Load the master skew tape on the tape unit to be checked. Make the tape unit READY.

6. If you are doing this adjustment procedure because the deskew board or the read/write head assembly has been replaced, set all skew pots to midrange.

7. Load OLTEP/OLTSEP and diagnostic T3410P. Select the external option desired by entering EXT=F.

   The external options are:

   M = Forward Mechanical Skew, All Tracks
   F = Forward Electrical Skew
   B = Backward Electrical Skew
   W = Write Skew
   A = Automatic Mode
   T = Mechanical Tracking

CAUTION
Faulty skew adjustment can cause a dead track indication and runaway symptoms, or a true dead track situation exists.

Note: *If a printer isn't available on the system to use as an output device, you must specify the option "PP" to get the output (DPRINTS) from the console typewriter.*

8. If the message "UNREADABLE TAPE LABEL ON OXXX" or "INT REQ OXXX" appears on the console typewriter, reply "P" and then READY the tape unit. The tape moves forward and a message is printed.

9. If this is a dual density tape unit, check to make sure the dual density jumper is installed on the logic board. See CARRL D-16, "Logic Board Removal and Replacement."

10. Compare the printout to Parts 6 and 10 of this figure.

    A. If the printout is similar to Part 6 (all tracks are within limits), go to Step 11.

    B. If only one or two tracks are outside the skew limits, adjust the corresponding skew pots as indicated by the text on Part 10. See Figure D-18.

    C. If more than two tracks are outside the skew limits, check to see that the skew pots are set at midrange. If the skew pots aren't at midrange, set them there now. Rerun selected external option and compare the new printout to Parts 6 and 9. If all tracks are within limits, go to Step 11. If some tracks require adjustment, go to Step 10D.

    D. Adjust the skew pots for those tracks still on or outside the limits. The pots are to be adjusted in the direction indicated by the text in Part 10. When all tracks are within limits, go to Step 11.

11. Check read backward skew by doing the following:

    A. Press REQUEST on the console typewriter and restart T3410P, with external option 'EXT=B' if not previously selected.

    B. Repeat Step 10 until all tracks are within limits.

12. Check write skew by doing the following:

    A. Remove the master skew tape and replace it with a good scratch tape with the write enable ring inserted.

    B. Press REQUEST on the console typewriter and restart T3410P with external option 'EXT=W', if not previously selected.

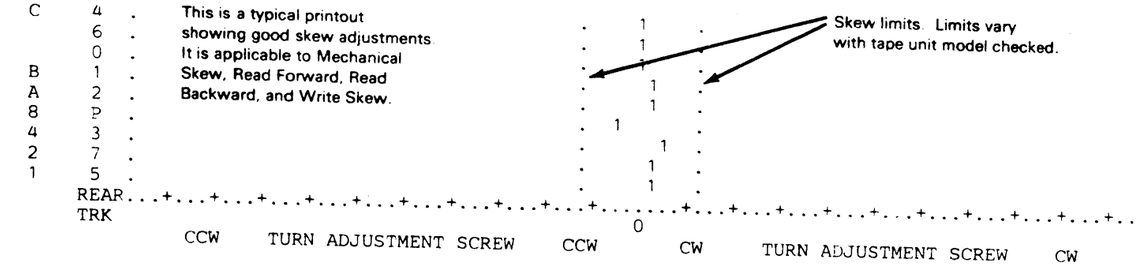
    C. READY the tape unit and repeat Step 10 until all tracks are within limits.

13. This completes all electrical skew adjustments. If entry to this procedure was from MAP AA071, return to that page.

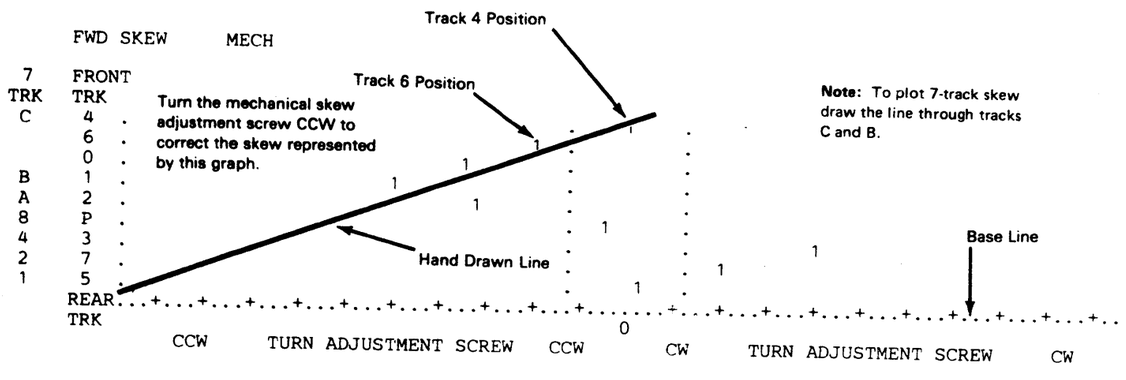
Figure D-57. Mechanical and Electrical Skew Adjustments

System/3 Skew Printouts

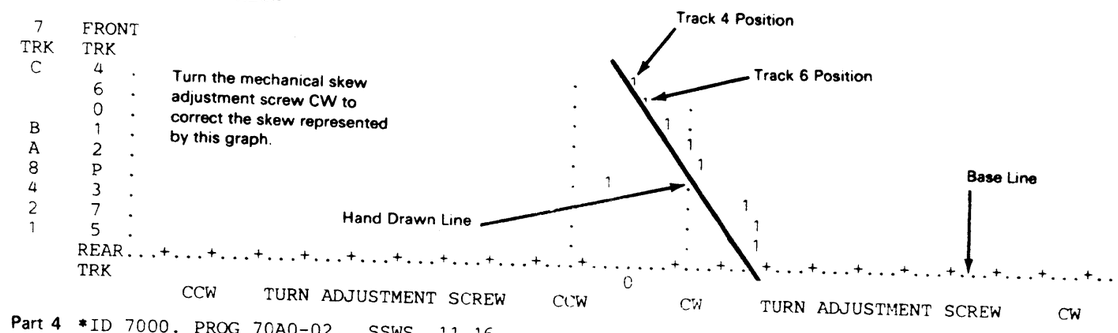
Part 1 *ID 7001. PROG 70A0-02. SSWS 11,16
UNIT 68 MODE P.E.



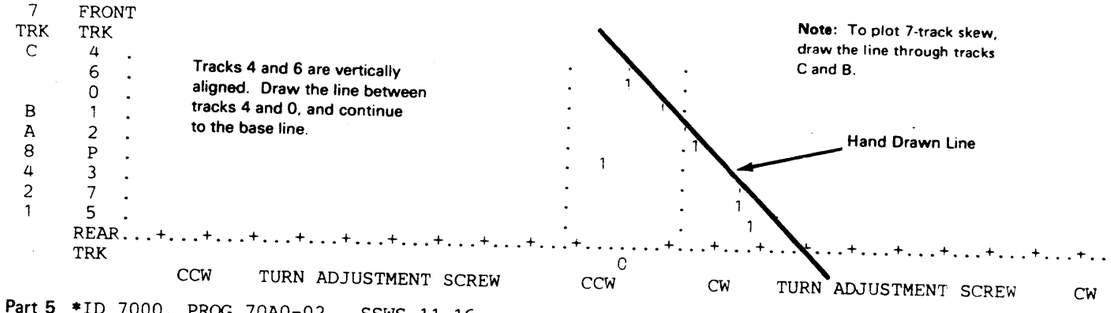
Part 2 *ID 7000. PROG 70A0-02. SSWS 11,16
UNIT 68 MODE P.E.



Part 3 *ID 7000. PROG 70A0-02. SSWS 11,16
UNIT 68 MODE P.E.



Part 4 *ID 7000. PROG 70A0-02. SSWS 11,16
UNIT 68 MODE P.E.



Part 5 *ID 7000. PROG 70A0-02. SSWS 11,16
UNIT 68 NRZI

Skew is out of limits.

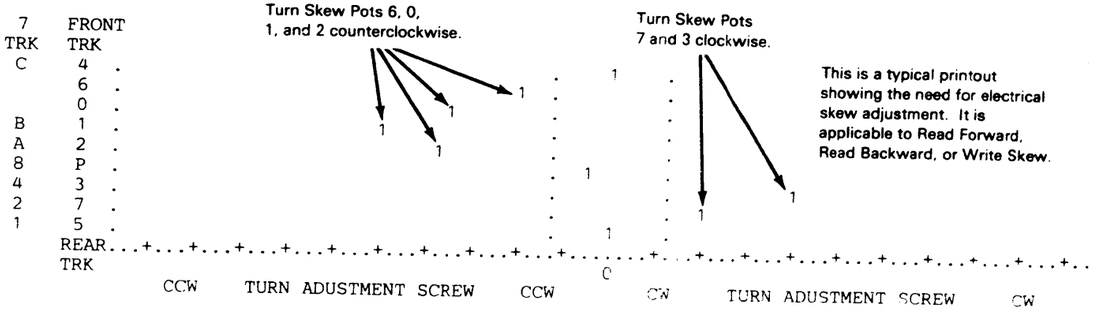


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Figure D-57. Mechanical and Electrical Skew Adjustments

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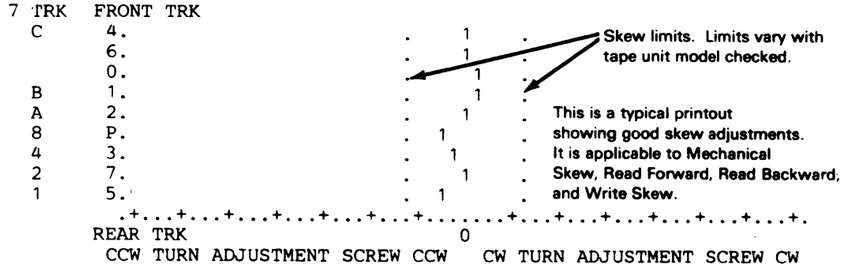
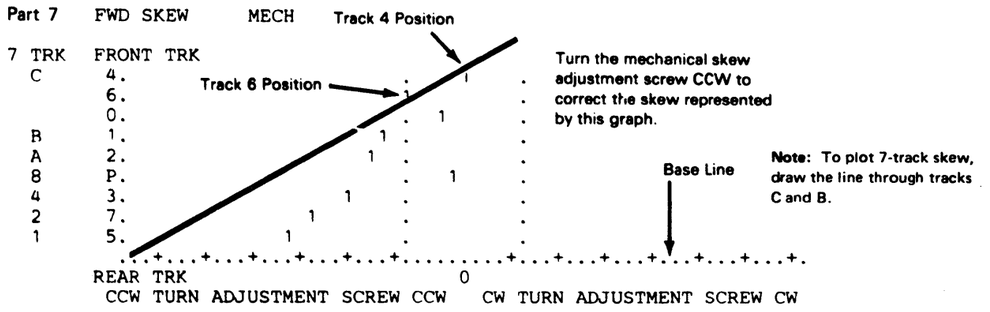
System/360 and System/370 Skew Printouts

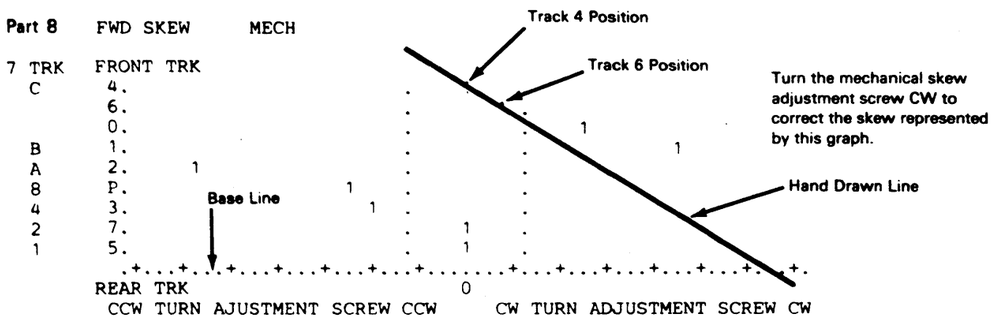
Part 6



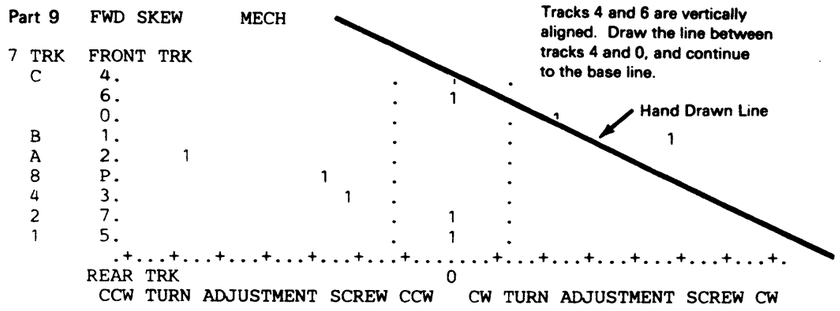
Part 7



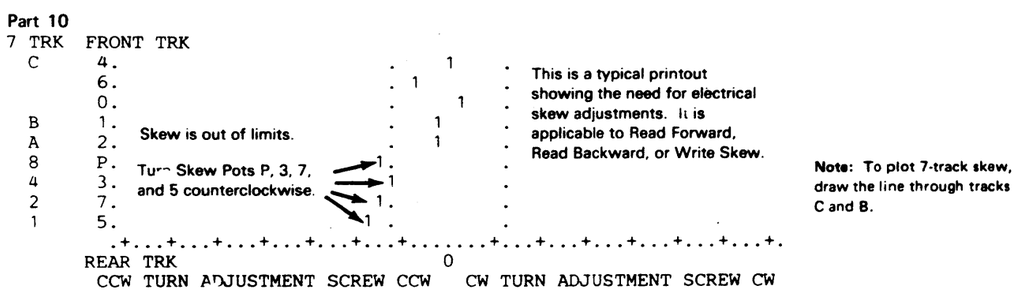
Part 8



Part 9



Part 10



XQ3200 Seq 2 of 2	1846035 Part Number	734556 1 Sept 72	734842 8 Dec 72	734852 26 Feb 73		

Figure D-57. Mechanical and Electrical Skew Adjustments

Mechanical Tape Tracking

The printouts (Parts 11, 12, and 13 of this Figure) represent the tracking situation by showing the relationship between track 4 and track 5. Track 4 is always shown centered, and is used as a reference point. Track 5 can be shown centered, to the left of center, or to the right of center.

Good tracking is interpreted in two ways, using the graphs. If track 5 is within the vertical dotted lines on both the forward and backward graphs, tracking is good (Part 11). Tracking is also good if track 5 is shown off center an equal amount in opposite directions on the two graphs. That is, if track 5 is off center to the left x number of divisions on the forward graph, it should be off center to the right approximately an equal amount on the backward graph. In essence, if the algebraic sum of the deviation left and right is within the vertical dotted lines, as measured along the horizontal axis from the "0" reference, tracking is acceptable.

Bad tracking is interpreted from the printouts when track 5 is not off center an equal and opposite amount on the two graphs and the difference is greater than half the distance between the two vertical dotted lines.

If bad tracking is indicated, see Figure D-36, "Capstan Alignment and Tape Tracking Adjustment."

If the tracking boundaries meet the above requirements, it is acceptable. *Do not* attempt to correct excursions beyond the vertical dotted lines by adjusting tracking. Return to Figure D-57 Mechanical and Electrical Skew Adjustments (Page 1 for System/3, and Page 3 for System/360 and System/370) for recheck.

Note: The tracking check printouts shown here and on Figure D-57, Page 8 are applicable to System/3 Diagnostic 70A and to System/360 and System/370 Diagnostic T3410P.

Tracking Check Printouts

Part 11

```
ID 7000. PROG 70A0-02.  SSWS  10
  UNIT 60  MODE P.E.


      FWD TRACKING CHECK

      FRONT
7 TRK TRK
  C    4  .                                .    1    .
       6  .                                .         .
       0  .                                .         .
  B    1  .                                .         .
  A    2  .                                .         .
  8    P  .                                .         .
  4    3  .                                .         .
  2    7  .                                .         .
  1    5  .                                .    1    .
      REAR...+...+...+...+...+...+...+...+...+.......+...+...+...+...+...+...+...+..
      TRK                                          0

      ID 7000. PROG 70A0-02.  SSWS  10,17
        UNIT 60  MODE P.E.


      BKD TRACKING CHECK

      FRONT
7 TRK TRK
  C    4  .                                .    1    .
       6  .                                .         .
       0  .                                .         .
  B    1  .                                .         .
  A    2  .                                .         .
  8    P  .                                .         .
  4    3  .                                .         .
  2    7  .                                .         .
  1    5  .                                .    1    .
      REAR...+...+...+...+...+...+...+...+...+.......+...+...+...+...+...+...+...+..
      TRK                                          0
```

Figure D-57. Mechanical and Electrical Skew Adjustments
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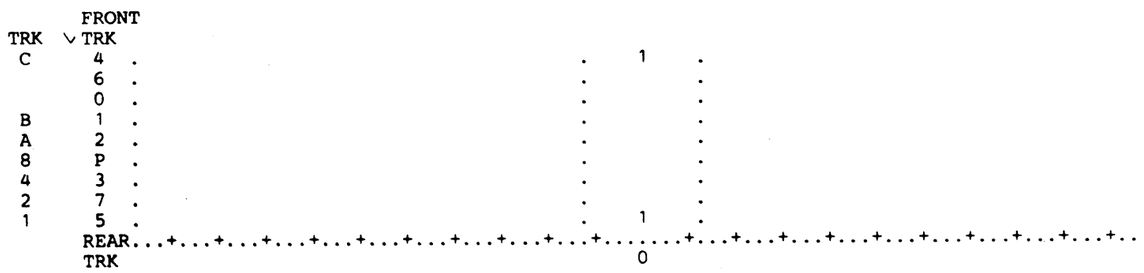
Tracking Check Printouts

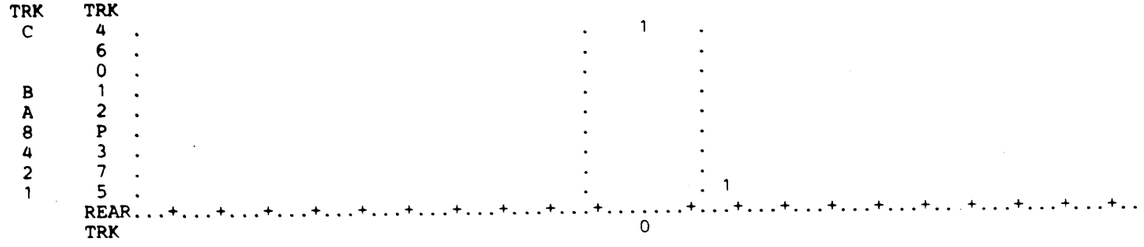
Part 12 ID 7000. PROG 70A0-02. SSWS 10
UNIT 60 MODE P.E.

FWD TRACKING CHECK



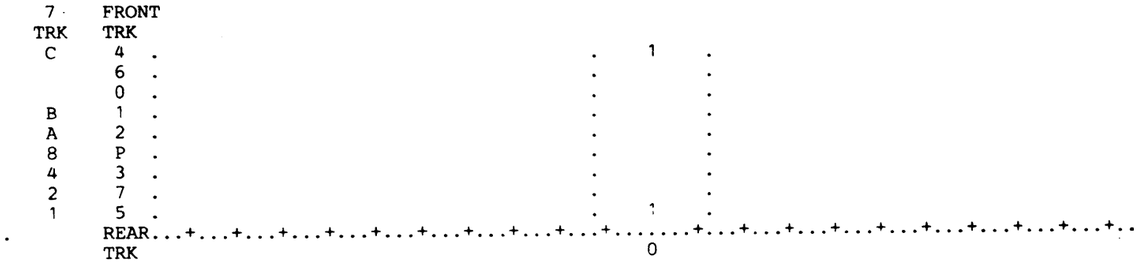
ID 7000. PROG 70A0-02. SSWS 10,17
UNIT 60 MODE P.E.

BKD TRACKING CHECK



Part 13 ID 7000. PROG 70A0-02. SSWS 10
UNIT 60 MODE P.E.

FWD TRACKING CHECK



ID 7000. PROG 70A0-02. SSWS 10,17
UNIT 60 MODE P.E.

BKD TRACKING CHECK

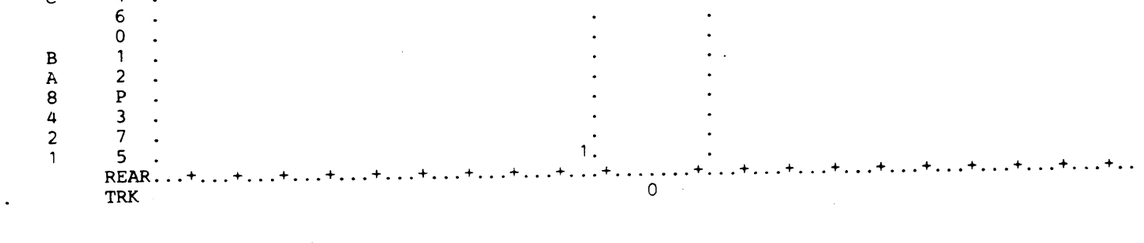


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Figure D-57. Mechanical and Electrical Skew Adjustments

Manual Mechanical Skew Adjustment

This procedure assumes that tracking meets specifications.

The microprocessor tester kit, part 2518291, is used in the following adjustment. The kit consists of an indicator card, a tester panel, and a ROS Test card.

To set up the tester, plug the indicator card in socket A-A1R2, plug the tester panel cables in sockets A1Z4 and A1Z5, and plug the ROS test card in socket A-A1S2.

This test is made in PE Mode.

For Dual Density machines, remove the Dual Density jumper on logic board to force PE mode.

1. Mount a master skew tape, part 432641 or 432640, on the tape unit and make the unit READY.
2. Set control word '096X' (X=tape unit address) in the microinstruction (B address) switches.
3. Set control switch A to 1 and control switch B to 1.
4. Set the SNGCYC/NORMAL switch to SNGCYC.
5. Press RESET.
6. Press START.

   If this is a seven-track tape unit, you must make the necessary track conversions. Use the same control words as specified for dual density.

   Note: The seven-track physical reference is as follows:

Physical Track	1	2	3	4	5	6	7
Data Track	1	2	4	8	A	B	C

7. To read the tape forward, set '7802' in the microinstruction (B address) switches.
8. Press the reset button.
9. Press START.
10. Turn switch B to 0.
11. Set SNGCYC/NORMAL switch to NORMAL.
12. Set 1805 in STOP ADDRESS switches.
13. Press START (tape moves forward).

Note: Each depression of the START key will reverse tape direction.

The read data can be observed by scoping the following points on the tape control logic gate (observe negative transitions).

Tie Byte	Data Trk	Physical Trk	7-Trk	Tape Control Gate Pin
04	5	1	4	K2U10
01	7	2	1	J2U10
10	3	3	A	H2U06
00	P	4	C	K2U02
20	2	5	B	J2U02
40	1	6	NU*	H2U02
80	0	7	NU*	K2U06
02	6	8	2	J2U06
08	4	9	8	H2U10

***Not Used–Before setting or measuring skew on 7 track, set track 0 & 1 deskew pots to mid-range or minimum delay (clockwise). See Carrl D-18.**

To adjust mechanical skew, sync the scope on data track 4 or 5 (most lagging) and observe the opposite outside track. Adjust the head to zero mechanical skew. On 7 track, sync on track C or 1 (most lagging) and observe the opposite outside track.

Note: Ensure that the data bits aligned by this procedure are part of the same data byte. If they are not, scoping the other data tracks should reveal the error. Sync the scope on data track 2.

Maximum Allowable Skew

	Model 1	Model 2	Model 3
Fwd	0.00 usec	0.00 usec	0.00 usec
Bkwd	6.00 usec	3.00 usec	1.50 usec

Allowable jitter is 10.00 usec for Model 1, 5.00 usec for Model 2, and 3.50 usec for Model 3.

To read tape backward, press START to reverse direction.

If forward skew meets specifications and backward skew does not, recheck the tracking adjustments. Do not compensate for tracking problems with the skew adjustments.

Manual Electrical Read Forward Skew Setup

The microprocessor tester kit, part 2518291, is used in the following adjustment. The kit consists of an indicator card, a tester panel, and a ROS test card.

To set up the tester, plug the indicator card in socket A-A1R2, plug the tester panel cables in sockets A1Z4 and A1Z5, and plug the ROS test card in socket A-A1S2.

NRZI electrical skew is adjusted in this order:

1 Read forward.
2 Read backward.
3 Write.

This test is made in NRZI mode. For Dual Density machines, install the Dual Density jumper on the logic board

1. Mount a master skew tape, part 432641 or 432640, on the tape unit and make it READY.
2. Set control word '092X' (X=tape unit address) in the microinstruction (B address) switches.
3. Set control switch A to 1 and control switch B to 1.
4. Set the SNGCYC/NORMAL switch to SNGCYC.
5. Press RESET.
6. Press START.
7. To read the tape forward, set "7802" in the microinstruction (B address) switches.
8. Press RESET.
9. Press START.
10. Set the SNGCYC/NORMAL switch to NORMAL.
11. Set 1805 in the STOP ADDRESS switches. Turn control switch B to 0.
12. Press START.
13. Tape will move until START is pressed again. Press START again to move tape in the opposite direction.
14. Follow adjustment procedure.

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Figure D-57. Mechanical and Electrical Skew Adjustments

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Manual Electrical Read Backward Skew Setup

1. Mount a master skew tape, part 432641 or 432640, on the tape unit and make it READY.
2. Set control word '092X' (X=tape unit address) in the microinstruction (B address) switches.
3. Set control switch A to 1 and control switch B to 1.
4. Set the SNGCYC/NORMAL switch to SNGCYC.
5. Press RESET.
6. Press START.
7. To read the tape backward, set "7802" in the microinstruction (B address) switches.
8. Press RESET.
9. Press START.
10. Turn control switch B to 0.
11. Set the SNGCYC/NORMAL switch to NORMAL.
12. Set 1805 in STOP ADDRESS switches.
13. Press START twice (see note).
14. Follow adjustment procedure.

Note: This procedure is the same as "Manual Electrical Read Forward Skew Setup," except START must be depressed twice to execute backward.

Adjustment Procedure

The read data can be observed by scoping the following points on the tape control logic gate.

Tie Byte	Data Trk	Physical Trk	7-Trk	Tape Control Gate Pin
04	5	1	4	K2U10
01	7	2	1	J2U10
10	3	3	A	H2U06
00	P	4	C	K2U02
20	2	5	B	J2U02
40	1	6	NU*	H2U02
80	0	7	NU*	K2U06
02	6	8	2	J2U06
08	4	9	8	H2U10

***Not Used–Before setting or measuring skew on 7 track, set track 0 & 1 deskew pots to mid-range or minimum delay (clockwise). See Carrl D-18.**

Note: Ensure that the data bits aligned by this procedure are all part of the same data byte. Comparing the relative positions of the data tracks should reveal if they are not.

1. Set scope to sync on NEGATIVE INTERNAL.
2. Use data track 2 as a scope sync and adjust scope to display only one bit of track 2 read data.
3. If reading forward, adjust the track 2 forward read deskew pot to midrange. The pulse width is 18.00 usec for Model 1, 14.00 usec for Model 2, and 7.00 usec for Model 3.
4. If reading backward, adjust the track 2 backward read deskew pot to midrange. The pulse width is identical to read forward pulse width (Step 3).
5. Scope and adjust the remaining tracks, aligning the positive transition of each one with the positive transition of track 2.

Allowable jitter is 10.00 usec for Model 1, 5.00 usec for Model 2, and 3.50 usec for Model 3. Measure jitter between data tracks 4 and 5 (outside tracks).

Manual Electrical Write Skew Adjustment

Ensure that read skew adjustments are correct before proceeding with write skew adjustments.

This adjustment is done while continuously writing all ones in all tracks, NRZI mode (800 bpi). Use a work tape that is known to be good.

1. Set control word '09AX' (X=tape unit address) in the microinstruction (B address) switches.
2. Set switch A to zero and switch B to one.
3. Set the SNGCYC/NORMAL switch to SNGCYC.
4. Press RESET.
5. Press START.
6. Set '7800' in the microinstruction (B address) switches.
7. Press RESET.
8. Press START.
9. Set the SNGCYC/NORMAL switch to NORMAL.
10. Press START.

The read data can be observed by scoping the following points on the tape control logic gate.

Tie Byte	Data Trk	Physical Trk	7-Trk	Tape Control Gate Pin
04	5	1	4	K2U10
01	7	2	1	J2U10
10	3	3	A	H2U06
00	P	4	C	K2U02
20	2	5	B	J2U02
40	1	6	NU*	H2U02
80	0	7	NU*	K2U06
02	6	8	2	J2U06
08	4	9	8	H2U10

***Not Used–Before setting or measuring skew on 7 track, set track 0 & 1 deskew pots to mid-range or minimum delay (clockwise). See Carrl D-18.**

1. Turn all the write deskew pots clockwise all the way (minimum setting).
2. Determine the most lagging track and sync the scope on it.
3. Scope and adjust the remaining tracks, aligning the positive transition of each one to the positive transition of the most lagging track.

Typical VTL Characteristics:

Supply Voltages = + 5.0 volt and ground
Logical "0" output volt = + 0.2 volt to ground
Logical "1" output volt = + 3.0 volt to + 5.0 volt

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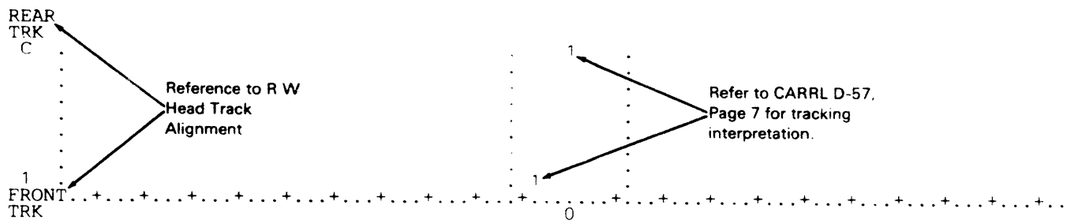
Figure D-57A. Mechanical and Electrical Skew Adjustments—7 Track

PART 1

ID 7000. PROG 70A0-02. SSWS 10,19
UNIT 60 MODE NRZI MODEL 2 7TK

FWD TRACKING CHECK



PART 2
ID 7001. PROG 70A0-02. SSWS 10,17,19
UNIT 60 MODE NRZI MODEL 2 7TK

BKD TRACKING CHECK

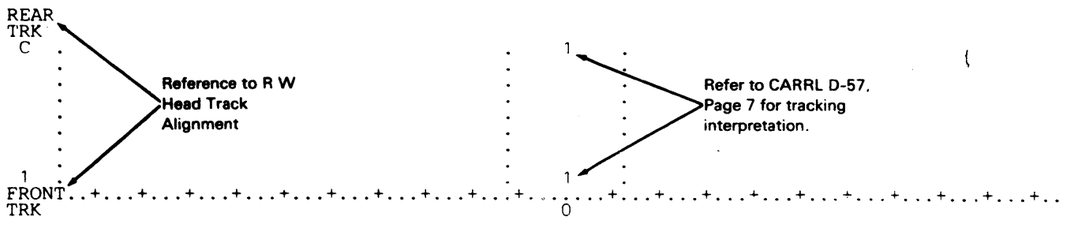


Figure D-57A. Mechanical and Electrical Skew Adjustments—7 Track

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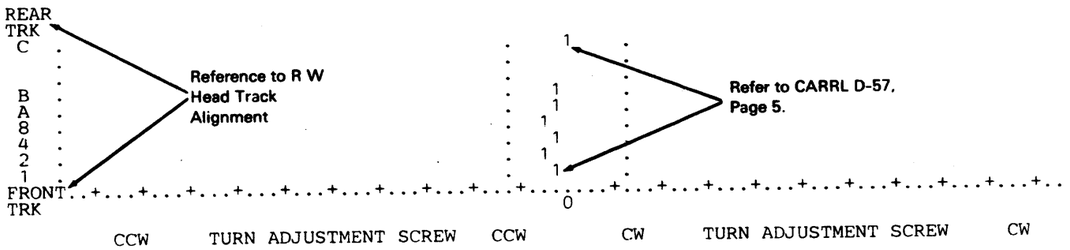
PART 3

ID 7001. PROG 70A0-02. SSWS 10,16,19
UNIT 60 MODE NRZI MODEL 2 7TK

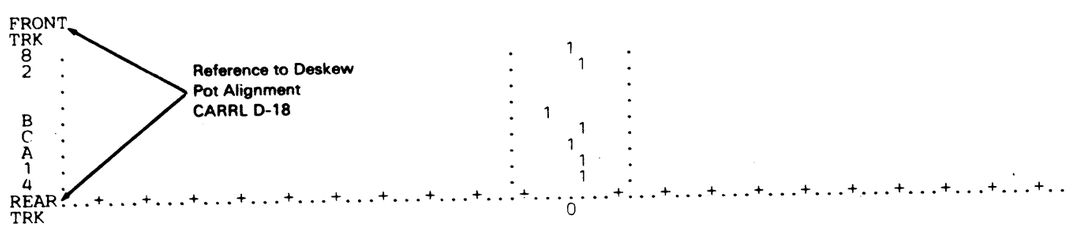
FWD SKEW MECH



PART 4

ID 7001. PROG 70A0-02. SSWS 10,16
UNIT 60 MODE NRZI MODEL 2 7TK

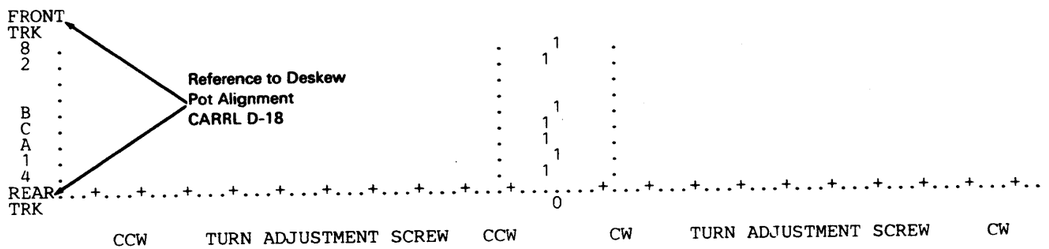
FWD SKEW



PART 5

ID 7001. PROG 70A0-02. SSWS 10,16,17
UNIT 60 MODE NRZI MODEL 2 7TK

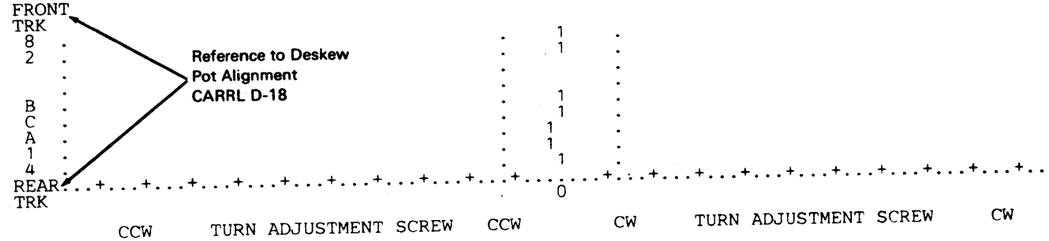
BKD SKEW



PART 6

ID 7001. PROG 70A0-02. SSWS 10,15,16
UNIT 60 MODE NRZI MODEL 2 7TK

WRT SKEW



XQ3450 Seq. 2 of 2	1846045 Part Number	734852 26 Feb 73				

Figure D-58. Tape Control Unit Board Pin Layout and Card Numbering

Page 1 of 2

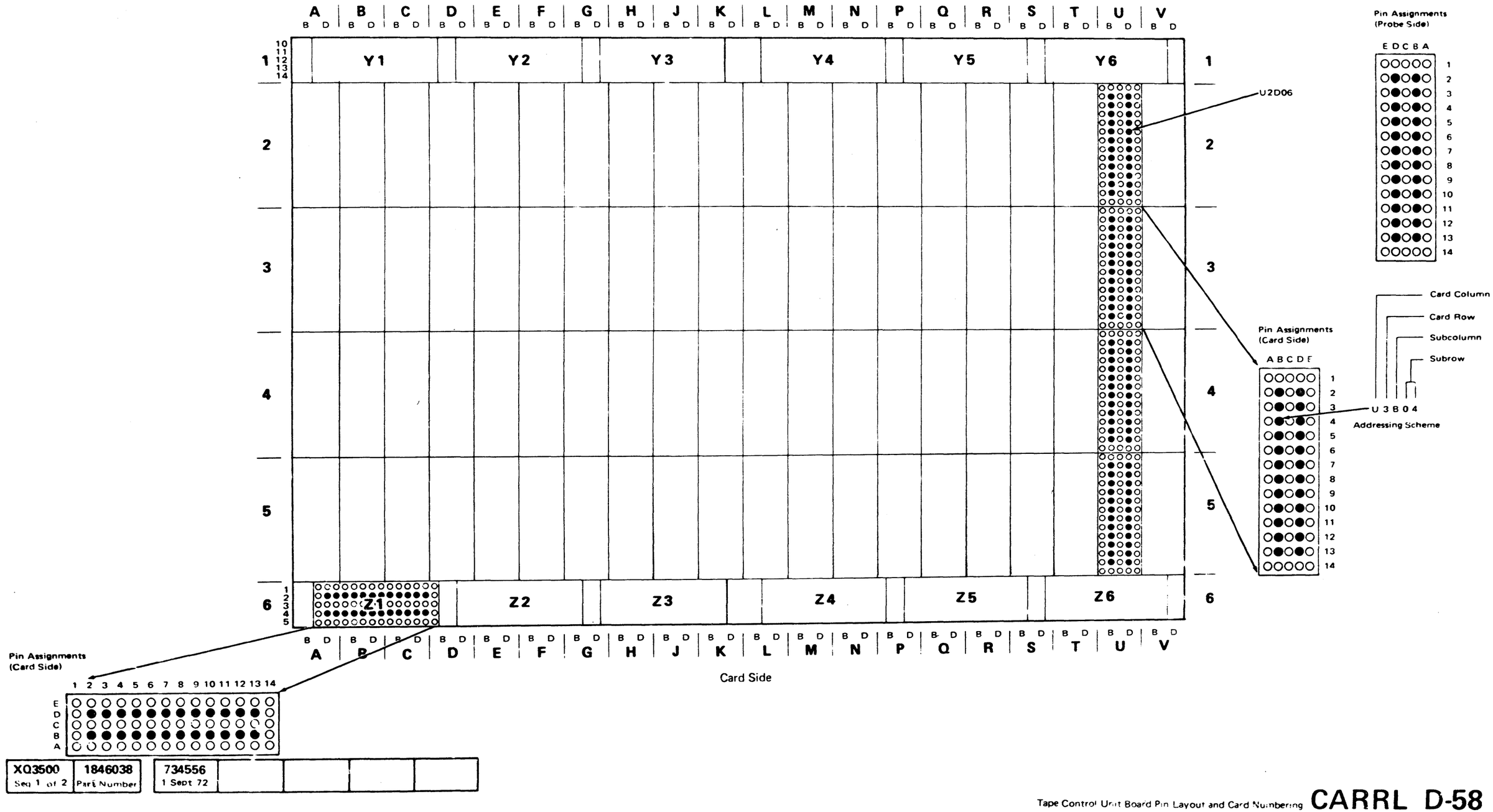
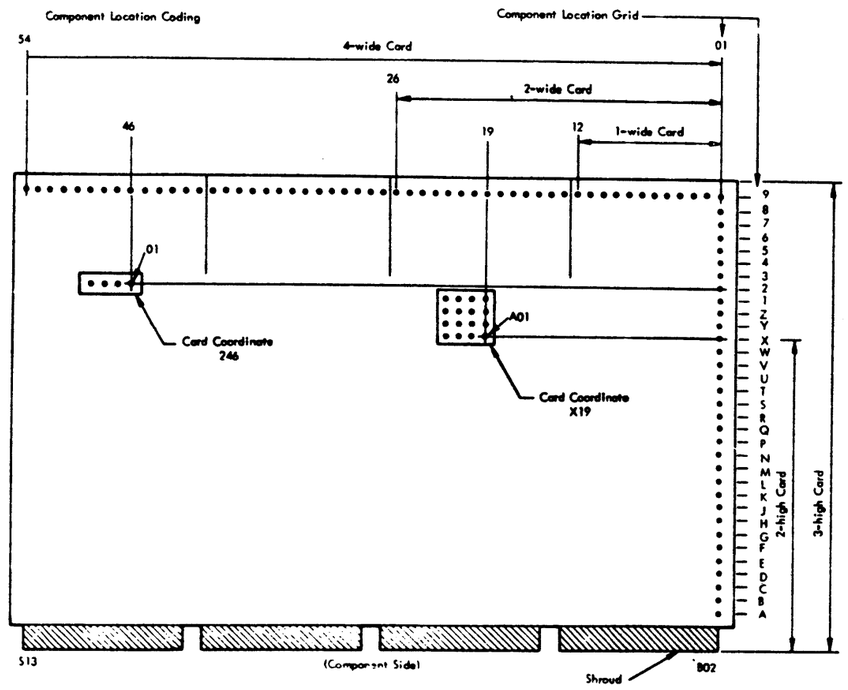
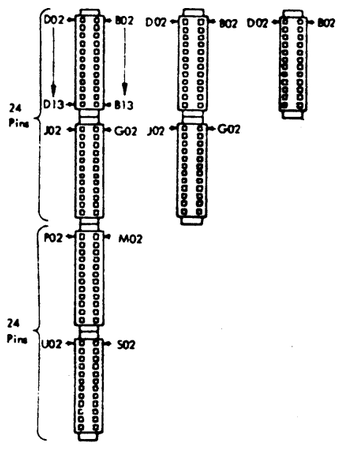


Figure D-58. Tape Control Unit Board Pin Layout and Card Numbering

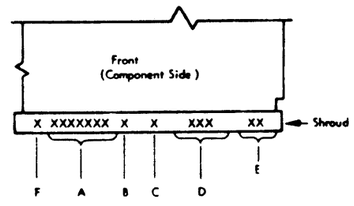
Page 2 of 2



Contact Assignments



Card Identification



A - Seven digits of assembly part number.

B - Major code. Alpha character indicates number of EC release/changes processed on that particular part number, changed when an EC is installed. (A = initial release, B = first EC, C = second EC, etc.)

C, D, E, F } Manufacturing Data

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When an error occurs, obtain and analyze attachment sense bytes 0 and 1 before analyzing sense bytes.

When the 'sense valid' bit is active, request sense bytes 2-3, 4-5, and 6-7, in that order. When sense is, or has become valid, successive sense instructions must be executed within 30ms of each other or the sense information in bytes 2-7 may be invalid due to normal subsystem activity.

Bit	0	1	2	3	4	5	6	7
Hardware Detected Errors (Bit 7 OFF)								
	Spare	Instruction Counter Error	XFR Error	ALU Error	Spare	ROS Parity Error	Spare	Microprogram Detected Error
Microprogram Detected Errors (Bit 7 ON)								
	ALU FRU Error	Instruction Counter Error	ABO Parity Error	Attachment Control Tag Error	Instruction Tag Error	Spare	Spare	Microprogram Detected Error
Attachment Sense Byte "0"								
	Spare	ABI Parity Error	ABO Parity Error	Tape Control Disabled	Two Tag Error	Subsystem Busy	Out of Sequence Error	Sense Valid
Attachment Sense Byte "1"								
	Address Out Response Error	Service Out Response Error	Command Out Response Error	Address In Error	Service In Error	Command In Error	Status In Error	Spare

Figure E-1. Hardware/Microprogram Detected Errors and Attachment Sense (System/3)

Sense Bytes								
Bit / Byte	0	1	2	3	4	5	6	7
0	Noise	Wrong Length Block	Unit Exception ‡	Data Check †	Diagnostic Track Error	NOP §	Equipment Check #	Sense Valid
1	Data § † Converter Check (DCC)	Command Reject §	Backward At Load Point §	Start Velocity Check † §	Illegal Command §	Tape Unit Status Changed	Word Count Zero §	Not Capable
2	Backward Status	Not File Protected	End of Tape ‡	Beginning of Tape	Write Status	Start Pushbutton	Tape Unit Check * §	Not Busy
3	Tape Mark Check #	End Velocity Check †	Tape Unit Positioning Check #	Reject Tape Unit #	Write Feedthru Check	No Readback Data #	Tach Check #	Overrun †
4	Seven-Track	Short Gap Mode	Dual Density Feature	NRZI Mode	Tape Unit Model			
5	Bus Out Check †	Multi-Track Error (MTE) or LRC Error †	Data Timing Error †	End Data/CRC †	Envelope/ Phase Error †	False End Marker †	PE ID Burst Check †	VRC Error †
6	Lamp Check *	Left Column Check *	Right Column Check *	Reset Key *	Data Security Erase	Spare	Spare	Spare
7	CE Aids and Diagnostic Commands							

‡ Sets Unit Exception
† Sets Data Check
§ Sets NOP
# Sets Equipment Check
* Sets Unit Check

NOP: Present when a command is accepted but cannot be executed

Sense Valid: Always active for subsystem sens byte 0. Used to differentiate between attachment sense bytes and subsystem sense bytes.

Figure E-2. System/3 Sense Bytes

Status and Sense Bytes: System/360 and System/370								
Bit	0	1	2	3	4	5	6	7
Byte								
Status	Attention	Status Modifier	Control Unit End	Busy	Channel End	Device End	Unit Check	Unit Exception
0	Command Reject *	Intervention Required *	Bus Out Check *	Equipment Check *	Data Check *	Overrun *	Word Count Zero *	Data Converter Check *
1	Noise †	Tape Unit Status A	Tape Unit Status B	Seven-Track Tape Unit	Load Point	Write Status	File Protected	Not Capable *
2	Track in Error							
3	Read/Write VRC †	Multiple Track Error or LRC Error †	Skew Error †	End Data Checkor CRC †	Envelope Check †	1600 BPI Set	Backward	Spare
4	Tape Unit Positioning Check #	Tape Unit Reject #	Tape Indicate	Spare	Spare	Diagnostic Track Check †	Tape Unit Check	Illegal Command *
5	New Subsystem	New Subsystem	Write Tape Mark Check #	PE ID Burst Check *	Parity Compare †	Tach Check #	False End Mark †	Reserved for RPQ
6	Seven-Track Tape Unit	Short Gap Mode	Dual Density	NRZI Density	Tape Unit Model Identification			
7	Lamp Check ¤	Left Column Check ¤	Right Column Check ¤	Ready Reset	Data Security Erase	Spare	Spare	Spare
8	Spare	Feedthrough Check	Spare	End Velocity Check †	Readback Data not Detected #	Start Velocity Check †	Spare	Spare

† Sets Data Check
# Sets Equipment Check
* Sets Unit Check
¤ Sets Tape Unit Check

Figure E-3. Sense and Status Byte Summary–System 360 and System 370

Sense Data (DSTAT) System/38

When an error occurs, the 3411 Adapter will immediately obtain and store the DSTAT. When a Read Sense command is issued, the stored DSTAT is sent to the IOM and the storage area cleared.

DSTAT Byte	Desc.	Data Store Location	Bit 0	1	2	3	4	5	6	7
0	Prev. BSTAT0	32	Reserved.	Reserved.	Halt	Chan Error	I/O Except	Cmd. Reject	I/O Error	Cmd. Comp.
1	Prev. BSTAT1; BSTAT0= I/O Exc	33	End of tape	Wrong length record	Tape mark sensed	-	-	-	-	-
1	Prev. BSTAT1; BSTAT0= Cmd Rej	33	FOB error	Sense Req'd	Cmd. with 0 ops	Unit not avail.	Byte count 0 or invalid offset	Unit not ready	-	Unit busy
1	Prev. BSTAT1; Cmd was clear pend post event and BSTAT0= cmd cmplt	33								No post even was pending
2	Last post event	34	ICC DBI parity	IOC intf parity	Not valid xfer	SCA check reset	-	-	0= error cond	0= single OU
2			00=post event 01=data erase 10=rewind 11=rwnd unld		00=tape unit0 01=tape unit1 10=tape unit2 11=tape unit3		Op failed	-	1= req to IOM	0= single OU
3	Error type	35	3411 I/O check	Tag error	ABI/ ABO parity	3411 Det'd error	Chan. status reg error	Chan over run	3411 Disable switch	Subsys power off
4	Status update or intl. error	36							Status update	Init. error
5	Interfc seq	37	SIO	LIO	SNS	Init tag check	Addr seq	Cmd seq	Data xfer seq	End tag check
6	ABI/ABO parity	38	-	-	3411 ABI parity	3411 ABO parity	Attach ABI parity	-	-	-
7	3411 Detectd error	39	-	Instr cntr	Xfer error	ALU error	-	ROS parity	-	0= Hdware det'd
7			ALU error	Instr cntr	ABO parity	Cntrl tag	Instr Tag	-	-	1= microcode det'd
8	3411 Sense byte0	40	Noise	Wrong length record	Unit except	Data Check	Diag. track check	NOP	Equip. check	Sense valid
9	3411 Sense Byte1	41	-	Cmd reject	Bkwd at BOT	Start vel check	Illegal cmd	Tape unit status change	Word count zero	Not capable
10	3411 Sense byte2	42	Backward	Not file prot	End of tape	Begin of tape	Write status	Start button	Tape unit check	Not busy
11	3411 sense byte3	43	Tape mark check	End vel check	Tape pos. check	Rej. tape unit	Write feed check	Read back check	Tach check	Overrun
12	3411 sense byte4	44	-	Short gap	Dual density	Alt. density	Model 1 = 0000 Model 2 = 0001 Model 3 = 0010			

DSTAT Byte	Desc.	Data Store Location	Bit 0	1	2	3	4	5	6	7
13	3411 sense byte5	45	Bus out check	MTE/ LRCR	Data timing error	End data check	Env. check	False end mark	PEID burst error	VRC error
14	3411 sense byte6	46	Lamp check	Left col check	Right col check	Ready reset	Data erase	-	-	-
15	3411 sense byte7	47	Track in error or diagnostic data							
16	Tape unit 0	48	01=DSE 10=Rewind 11=Rwnd/Unld		Subsys power off	3411 hdwe error	3411 disable switch	Not start	Post event ready	Busy
17	Tape unit 1	49	01=DSE 10=Rewind 11=Rwnd/Unld		Subsys power off	3411 Hdwe error	3411 Disable switch	Not start	Post event ready	Busy
18	Tape unit 2	50	01=DSE 10=Rewind 11=Rwnd/Unld		Subsys power off	3411 hdwe error	3411 disable switch	Not start	Post event ready	Busy
19	Tape unit 3	51	01=DSE 10=Rewind 11=Rwnd/unld		Subsys power off	3411 hdwe error	3411 Disable switch	Not start	Post event ready	Busy
20	Residual op count	52	Residual operations count							
21	Chan status reg	53	Halt	Disc	Chan parity	Dev adr ready	Req status xfer	Req read	Req write	I/ working
22 23	Actual Length Count	54 55	Actual length count							
24 25	–	56 57	Number of successful read operations							
26 27	–	58 59	Number of successful write operations							
28 29 30 31	–	60 61 62 63	Not currently used							

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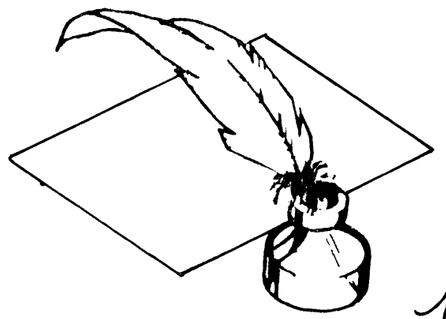
REF 2A



Notes

XT0150 Seq 2 of 2	4416313 Job Number	646311 Time Job						

Procedures For Running EREP (System/360 and System/370)

This section contains only the operational information required to print Environmental Recording, Editing and Printing (EREP). For additional information on this topic, read "Appendix C" of the *3410/3411 Magnetic Tape Subsystems Theory Diagrams Manual*, Order Number SY32-5028. Use of the following procedures result in a detailed printout and a summary printout.

DOS

The following statements execute EREP through the system console (SYSLOG). The first statement calls for the execution of EREP; the second statement, SEND, is the response to a message that EREP issues to establish where the instructions are coming from (which in this case is the console).

All Volumes:

```
//EXEC␣EREP
S␣END
OPTION␣TES,NOTAPE,PRINT,SUM,VOL
```

Specific Volumes:

```
//EXEC␣EREP
S␣END
OPTION␣TES,NOTAPE,PRINT,SUM,VOL
SELECT␣VOLUME=nnnnnn
```

All 3410 Tape Units:

```
//EXEC␣EREP
S␣END
OPTION␣TES,NOTAPE,PRINT,SUM
SELECT␣DEVICE=3410*
```

***This SELECT statement is only required if the system has a mixture of tape units, for example, 3420s and 3410s.**

Specific Drives:

```
//EXEC␣EREP
S␣end
OPTIONS␣TES,NOTAPE,PRINT,SUM
SELECT␣CUA=nnnn
```

OS

In OS, IFCEREP0 must be executed through job control statements (JCL). The following JCL prints the necessary statistical information. The job card, //JOB, is not complete as shown, it must be completed according to the customer's procedure.

All Volumes:

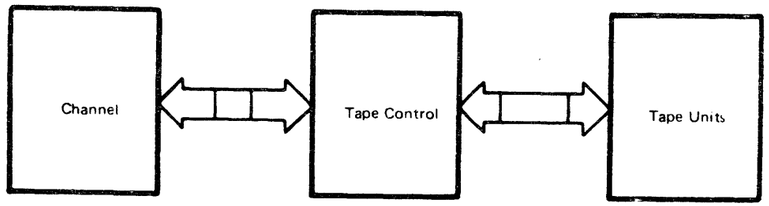
```
//JOB      ...
//         EXEC PGM=IFCEREP0,PARM='TYPE=0,MFS=Y'
//EREPPT   DD SYSOUT=A
/*
```

Specific Volumes:

```
//JOB      ...
//         EXEC PGM=IFCEREP0,PARM='TYPE=0,MFS=Y,VOLID=nnnnnn'
//EREPPT   DD SYSOUT=A
/*
```

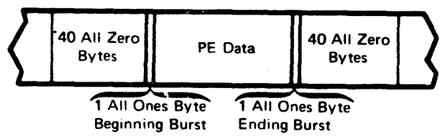
All 3410 Tape Units:

```
//JOB      ...
//         EXEC PGM=IFCEREP0,PARM='TYPE=0,MFS=Y,DEVICE=3410'
//EREPPT   DD SYSOUT=A
/*
```

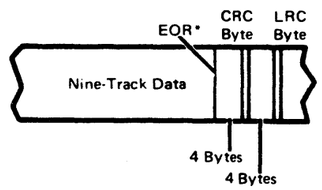


Block transferred between channel and tape control.

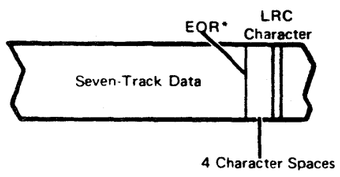
PE block transferred between tape control and tape unit.



NRZI block transferred between tape control and tape unit.



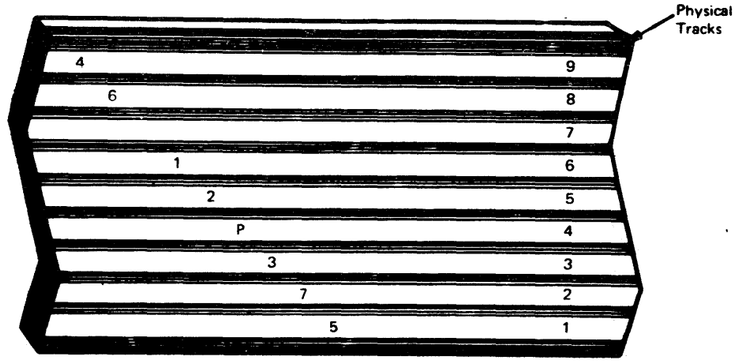
NRZI block transferred between tape control and tape unit

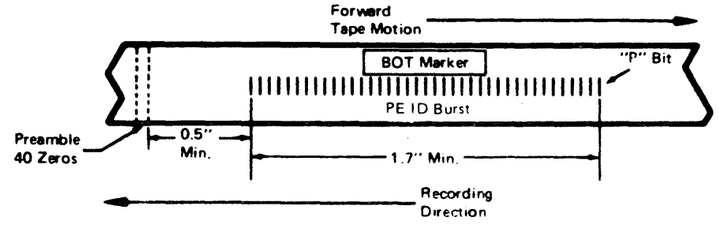


*End of Record

Data Block Format

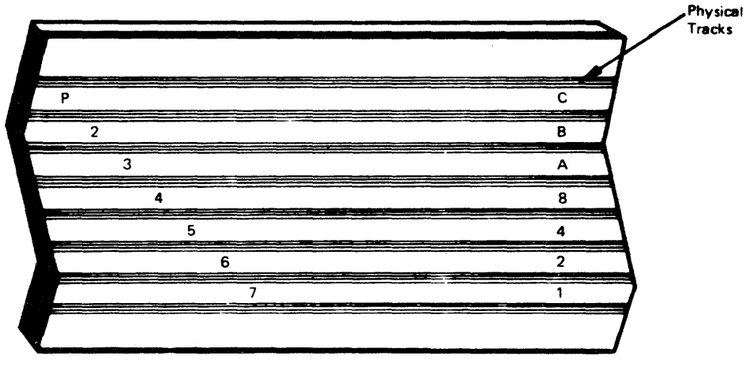
Recording Format—Nine-Track PE and NRZI





Phase Encode I.D. Format

Recording Format—Seven-Track NRZI



XT0200	1846092	734556	734556B	734864		
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CARD FUNCTION

*Cards D2 and E2 are interchangeable.

**Cards H2, J2, and K2 are interchangeable.
See A6001 for jumpers.

A	B	C	D		E		F	G	H	J	K	L	M	N	P	Q	R	S	T	U	V
System Interface WC00X	360/370 System Interface Not for 115/125 WC00X	Cable TU 0 Bus Out JA104	Cable TU 0 Bus In		Cable TU 4 Bus In		360/370 Interface Driver/ Receiver Not for 115/125 HD001 - HD006	Sys/3 115/125 3750 Sys/38 Interface Driver/ Receiver HN001 - HN005	Read Detect Zone 3 Tracks 1, 3, 4 GB301 - GB319	Read Detect Zone 2 Tracks 2, 6, 7 GB201 - GB219	Read Detect Zone 1 Tracks P, 0, 5 GB101 - GB119	RIC/ROC Compare SDC Registers 1 and 2 SDC Register 3 (DD) Write Clock IBG-B0B PEID Burst Tape Mark Detecr PE GA101 - GA107 DD GA001 - GA014	360/370 Not for 115/125 Interface Address Select Sel Out Bypass HC001 - HC008	Adapter Tag In Bus In TU Tags TU Bus Out Transfer Decode Power On Reset System Reset FB001 - FB010	ROS Reg A-Reg B-Reg B-Bus LSR ALU Page Bit Reg BOC Decode FA001 - FA013	Master OSC Clock OP Decode Clock Gating ROS Reg Instruc-tion Counter FC001 - FC011	CE Indicator Card TA001 - TA014	ROS Patch Card Pages 18-1F FQ401 - FQ409	ROS Patch Card Pages 10-17 FQ301 - FQ309	ROS Card Pages 08-0F FQ201 - FQ209	ROS Card Pages 00-07 FQ101 - FQ111
		Cable TU 1 Bus Out JA104	Cable TU 1 Bus In		Cable TU 5 Bus In																
		Cable TU 2 Bus Out JA105	Cable TU 2 Bus In	TU Address register and switch select TU 0 – 3	Cable TU 4 Bus In	TU Address register and switch select TU 4 and 5															
		Cable TU 3 Bus Out JA105	Cable TU 3 Bus In	* JA101 – 107		* JA201 – 207			**	**	**										

Z1	Z2	Z3	Z4	Z5	Z6
TU 4 Bus Out JA203	TU 5 Bus Out JA203	Not used	Tester TA018	Tester TA017	Not used

XT0300	1703107	443751	846311					
Seq 1 of 1	Part Number	20 Sept 74	1 Feb 79					

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Service Techniques

This section describes the following CE tools and service techniques:

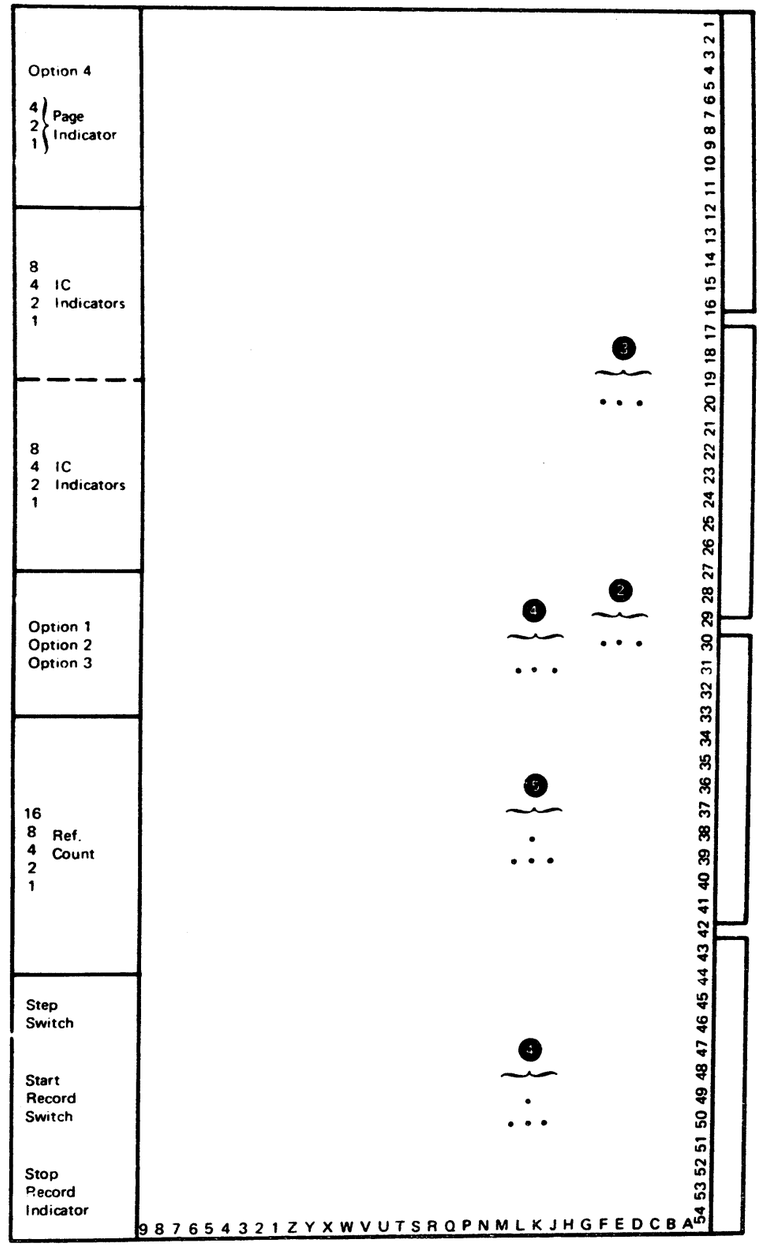
- ROS Address Tracer
- CE Diagnostic Probe
- Developing Tape
- Master Skew Tape Handling and Use
- Microprocessor Tester
- Patch Card

ROS Address Tracer Card Part No. 8216729

The ROS Address Tracer card stores 32 Instruction Counter (IC) addresses with 4 optional inputs for recording 32 microinstruction cycles. With pluggable jumpers, you can designate the trace addresses as consecutive or alternate (every other one, which equals 64). The tracer card stores the IC addresses in one of 32 locations (0-31). After the IC processes 32 addresses, all storage positions are full. Any additional addresses that are stored will overlay the old addresses. There is one indicator for each IC address and one indicator for each of the optional inputs. A five-position Reference Counter and its associated indicators are also located on this card. The indicators are used to determine the 32 stored addresses.

Recording of addresses is initiated manually by the Start Record switch or automatically by an optional input. The Start Record switch provides the only reset capability on the card and resets the Stop Record latch. Recording can be stopped manually by the Step Switch when the microprogram is in a continuous loop or automatically from an optional input. The Step switch also advances the five-position Reference Counter. The Stop Record indicator turns on when tracing ceases. Since optional inputs are provided for both starting and stopping, maximum flexibility is achieved, which facilitates the tracing of one or more microinstructions.

Optional Inputs 1 and 2 are used for tracing tape control lines. Both inputs are recorded like the IC addresses and reflect the status of those lines for the previous 32 or 64 microprogram instructions. Optional Inputs 3 and 4 record Page bits 3 and 4 respectively. The input polarity of Page bit positions 3 and 4 of the IC varies. Therefore, these particular inputs must be variable by polarity to facilitate proper monitoring of each ROS location. This is accomplished by plug wiring on the card. Optional indicators 1 and 2 require a negative input to the card to turn them on. When the input becomes positive, the indicator turns off.



Optional Inputs 1 and 2 can be traced by jumpering the following card pins:

Input	Polarity
Optional 1 B02	Minus (See Note)
Optional 2 M04	Minus

Note: Optional Input ! is used only if automatic tracing is not required. Refer to Step 5 of the plugging instructions for polarity requirements when Optional Input 1 is used for starting the trace.

The tape control has four locations that are capable of handling the tracer card. These same locations are used for the 3411 ROS card. Plug the tracer card into one of the unused locations.

CAUTION
A fifth ROS card location, R2, is reserved for the Microprocessor Tester. It will not accommodate the tracer card because of wiring differences.

Five jumpers must be plugged for correct monitoring of the 3411 IC by the ROS address tracer. This figure illustrates the ROS Tracer card. The circled numbers point to the card coordinates that are plugged to achieve particular functions which are discussed as follows:

1. Jumper +6 vdc to pin B11 of the socket used. This applies voltage to the tracer card indicators.

❷. Jumper E30 to F30

❸. a) Jumper E20 to D20 for consecutive tracing of ROS addresses (32).

b) Jumper E20 to F20 for alternate tracing of ROS addresses (64).

❹. a) If the tracer card is in locations U2 or S2, jumper K50 to L50.

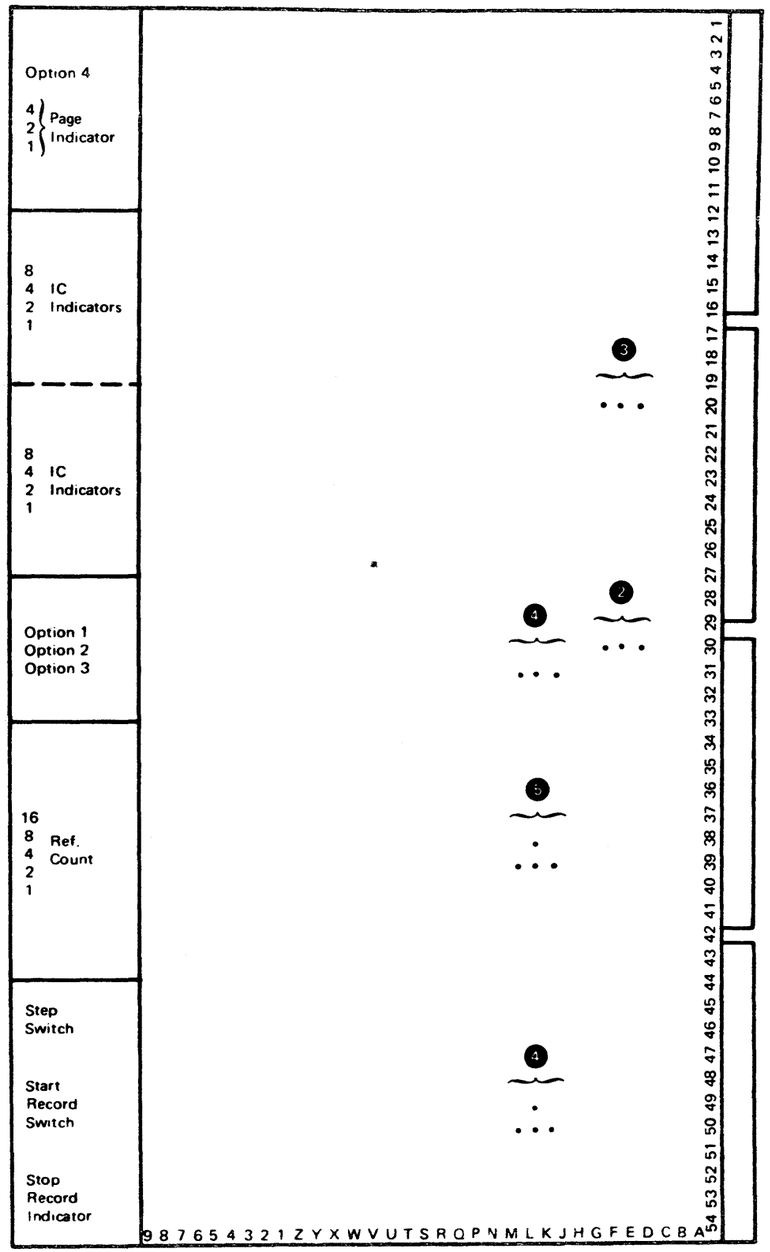
b) If the tracer card is in location T2, jumper K50 to K49.

c) If the tracer card is in locations T2 or S2, jumper K31 to L31.

d) If the tracer card is in location U2, jumper K31 to J31.

❺. a) To start address recording with Optional Input 1, jumper K39 to J39 (applies negative input to B02), or jumper K39 to L39 (applies positive input to B02).

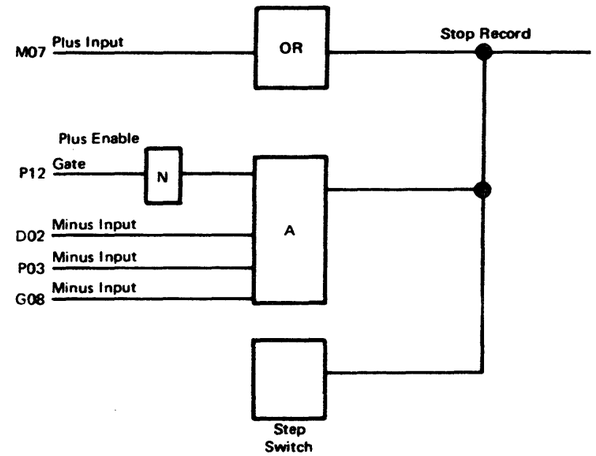
b) To manually start address recording, jumper K39 to K38.



Stop Record Inputs

The Stop Record inputs and polarities are shown on the circuit diagram. The plus input at P12 (Enable Gate) alone will allow the circuit to function as a four legged AND.

However, a narrow pulse width may fail because the circuit is designed to expect at least one negative input in conjunction with the Enable Gate. Therefore, use at least two inputs. If only one input is needed, use a plus input at M07. One other input to the Stop Record circuit is the Step switch.



Execute the following procedure to determine the trapped addresses when tracing ceased.

1. Record the address in the five-position Reference Counter indicators.
2. Record the address displayed in the IC indicators (include Page bits). Also record the indicators of any optional inputs that are wired.

Note: If this is the first address displayed after tracing stopped, this record is the address trapped 32 or 64 microinstructions prior to the termination of the tracing.

3. Repeat steps 2 and 3 thirty one times. (Press the Step switch to advance the Reference counter.)

Note: When 32 readouts have been completed, the Reference Counter will match the address recorded in Step 1.

CE Diagnostic Probe

This probe is a substitute for the oscilloscope in normal system diagnostic techniques.

The diagnostic probe has two probe tips: one is for probing MST-I signals; and the other is for probing SLD (SLT) 100/700 signals. Only one tip is used at a time. This tip slips over the signal pin being tested and supports the probe.

Two lamps indicate the status of the line being probed — either up level or down level. A pulse is indicated by a flash of one light (depending upon the polarity). A series of pulses is indicated either by both lights on at the same time or on alternately, depending on the pulse frequency.

Each light has its own sampling circuits and operates independently of the other light. If a line is active when probed, the appropriate light is turned on for approximately 75 milliseconds. After this time, the light goes off and the line is immediately sampled again. If the line is still active, the light is turned on for another 75 milliseconds, otherwise it stays off until the line again becomes active.

The probe is powered by –4 volts dc and ground through a 42-inch power cable. The end of the cable has a four pin socket which plugs onto the power cross–over connectors on the MST boards, or at other similar locations where –4 volts and ground have been provided in the proper pin configuration. Always keep the side of the power plug labeled UP in the up direction.

The probe has two MST input terminals for gating. When a jumper wire is connected from one of these gates to an MST signal pin, operation of the indicator lamps is inhibited (both lights off) until the gate receives the correct polarity signal. The (+) gate requires an MST UP level to start sampling and the (–) gate requires an MST DOWN level. These gates work for MST only. However, an SLD signal at the SLD probe tip may be gated with an MST signal at the gate. Always use the shortest lead possible when jumpering a signal to the probe gates.

Noise Rejection: The probe input sensitivity is compatible with either MST or SLD circuit families Probe circuits can be affected by stray electrical noise from switching appliances such as drills, fluorescent lights from electrostatic discharges. The probe power cord can give erroneous indications when hanging close to the memory and its associated magnetic field. The following are probe operating specifications (in-between levels are not defined and vary from probe to probe):

A. MST Specifications for MST Probe Tip

Up Level:	–0.55 volts to –0.98 volts
Down Level:	–1.52 volts to –2.18 volts
Protection:	+24 volts dc to –30 volts dc
Response:	30 nanosecond pulse width
Inhibit Range:	–0.5 volts dc to +24 volts dc, –3.98 volts dc to –30 volts dc, and on open pins

B. SLD Specifications for SLD Probe Tip

Up Level:	+2.7 volts dc to +60 volts dc
Down Level:	–.01 volts dc to +0.45 volts dc
Protection:	–12 volts dc to +60 volts dc
Response:	200 nanoseconds (worse case) pulse width
Inhibit Range:	–3.0 volts to –12.0 volts and on open pins

C. Specifications for MST Gates

1. (+) Gate:
   - Active Range: –1.01 volts to –0.613 volts
   - Inhibit Range: –1.55 volts to –4.48 volts
2. (–) Gate:
   - Active Range: –1.55 volts to –4 48 volts
   - Inhibit Range: –0.613 volts to –1.01 volts
3. Protection: –4 volts dc to +6 volts dc
4. Response: Same as MST

D. Power Requirements: –4 volts dc +/– 12% at 265 milliamps (maximum)

E. Power Dissipation: 1.95 watts (worse case)

F. Lamps: 2 each – Part 454612 (Field Replaceable)

G. Tips: 2 each – Part 453163 (Field Replaceable)

Developing Tape

Errors such as short interblock gaps or noise in the gap may be identified by developing the tape. Dip the tape in tape development solution. Agitate the solution and move the desired tape area through the solution several times to attract the powdered iron to the bit locations. Remove the tape from the solution and dry.

After the tape has dried, place transparent tape over the developed area and lift. Bit patterns of powdered iron stick to the transparent tape, and they may be viewed either on a Microfiche viewer (place the tape on clear plastic such as a blank Microfiche card) or on white paper.

CAUTION

1. Using transparent tape to lift the bit pattern may remove oxide and damage tape.
2. Development solution can be used on IBM Heavy Duty, IBM Series 500, or Dynexcel ® tape. Itseffect on other manufacturer's tape is unpredictable.

After examination, perform the following steps to place the suspected tape area near the read/write head:

1. Use a clean, dry, lint–free cloth to wipe development solution off tape.
2. Remount tape on the tape unit.
3. Position suspected area of tape in the read/write head area (tape still unloaded).

Correcting Tape Defects

Some minor tape defects can be corrected as follows:

1. An oxide clump may be removed with a sharp nonmagnetic knife. Use a shaving action so the tape underside does not pull out.
2. Remove an edge crease by ironing tape between a pencil eraser and a hard surface.
3. Erase (remove) bits in the IBG with the tip of a small magnetized screwdriver after developing the tape. Do not disturb the good data blocks on either side of the IBG.

Master Skew Tape Handling and Use

Master skew and master signal level tapes are used to check tape unit performance. Master skew tapes have a density of 800 flux changes per inch (fci), and they are written with bits extending across the entire tape width. Total skew is held to within 0.375 microsecond at 112.5 inches per second.

When written to complete saturation, master signal level tapes produce read signal amplitude within 2% of the IBM standard.

Tape part numbers are:

	1200–foot Reel	600–foot Reel
Master skew tape	432641	
*Master signal level tape	432152	461108

*All new master signal level tapes will be checked at 3200 fci, and the suffix "A" added to the part number of checked tapes.

Observe the following to keep master skew and master signal level tapes in good condition:

1. Always handle tapes with extreme care.
2. Use master tapes only for their intended purpose.
3. Make full reel passes to ensure even wear.
4. Never rewind a master tape at high-speed.
5. Fully identify master tapes stored in customer's working area.
6. Label reels "Make Full Passes Only/Do Not High-Speed Rewind."

Microprocessor Tester Kit

The Microprocessor Tester kit, B/M 2518291, is a branch office tool used to analyze microprocessor problems which cannot be corrected through on-line test analysis. Because of the time required to set up and use this tester, it is recommended only in cases where other methods have failed to correct the problem. (See Note.)

The kit consists of three parts and a carrying case:

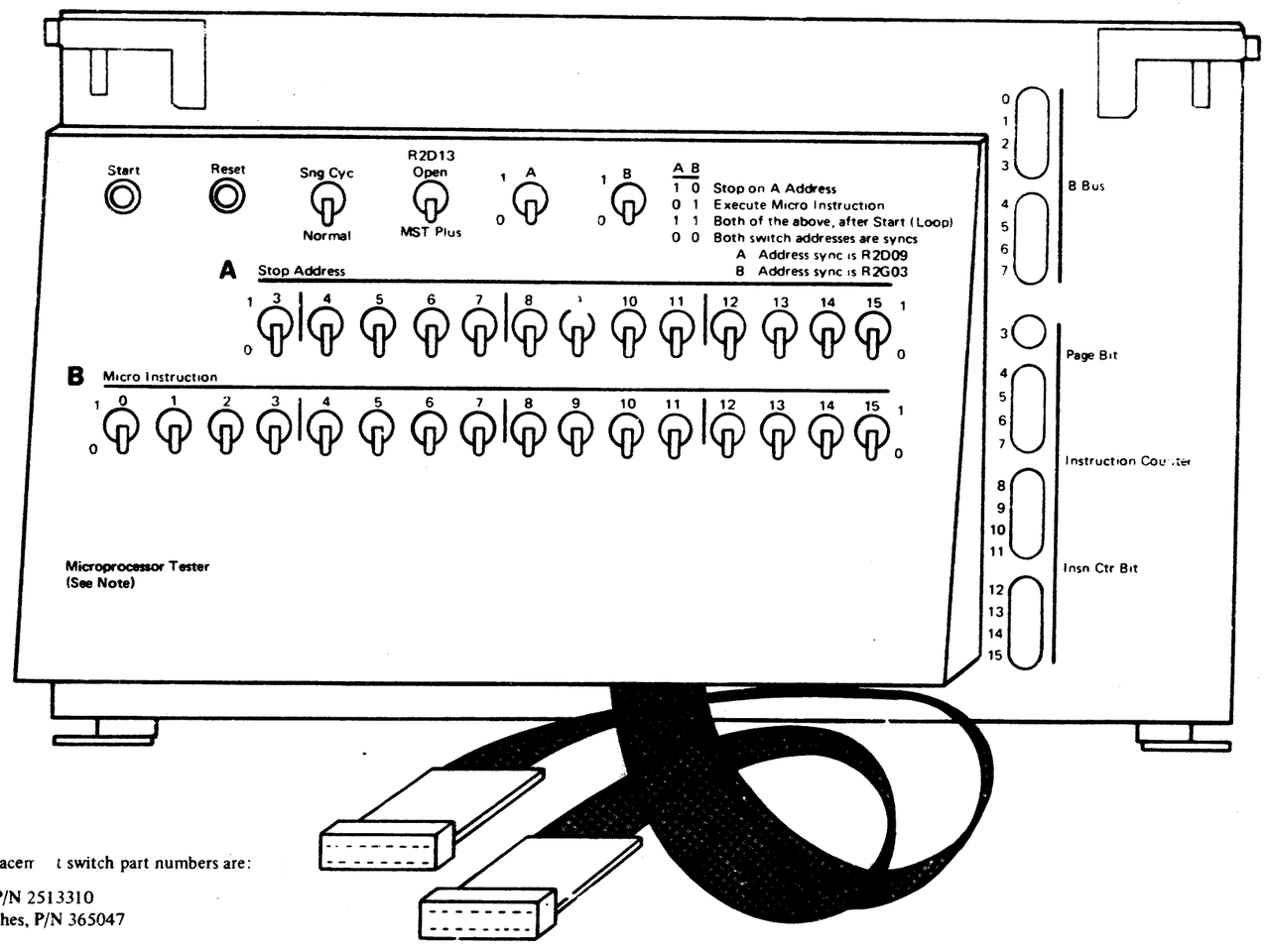
- Indicator Card (part 2517730)
- Tester Panel (part 2517725)
- ROS Test Card (part 5857347)

With the tester kit, you can:

- Observe the selected subsystem microprogram (ROS) address.
- Read the contents of the LSR.
- Branch to a selected starting address in the microprogram.
- Stop on a selected microprogram address.
- Loop a particular routine in the microprogram.
- Determine the location in ROS where a microprogram hang or stop occurs.
- Generate a sync pulse, for triggering other instrumentation, whenever the selected microprogram location is addressed.

When the ROS Test Card is used, you can:

- Read back and forth over a PE or NRZI written block.
- Perform a phase encoded loop-write-to-read operation.
- Cause tape to move back and forth (shoeshine) in a manner suitable for offline tracking and skew adjustment or verification.



Note: Tester replacement switch part numbers are:

Toggle switches, P/N 2513310
Push button switches, P/N 365047

XW0300	1846095
Seq 1 of 2	Part Number

734556	734556A	734852	443800	
1 Sept 72	20 Oct 72	26 Feb 73	31 Oct 75	

Hardware Description

Indicator Card

Indicators are mounted on an MST card plugged into 01A-A1R2. The indicators display the contents of the B Bus, Instruction Counter, and the Page Register. The B Bus displays the LSR contents at the end of the last completed instruction cycle.

If the Address Display jumper is in positions Z46-146 of the Indicator card, the Instruction Counter and Page Register indicators display the address of the next ROS word to be fetched.

If the Address Display jumper is in 146-246, the Instruction Counter and Page Register indicators display as follows:

1. The address previous to the one entered in the STOP ADDRESS switches. Use indicators 3-15.
2. The address just completed when using the SNGCYC/NORMAL switch in the SNGCYC position. Use indicators 4-15. Bit 3 is part of next address.
3. The address just completed when a hardware detected hardware error occurs. Use indicators 4-15. Bit 3 is part of next address.

Note: In Steps 2 and 3, if the completed instruction was a BU to a different ROS Page, bit 3 is not valid.

Tester Panel Switches

Start

Starts the microprogram when SNGCYC is off. Used to step through the microprogram when SNGCYC is on.

Reset

Initiates a system reset and should be used only when the subsystem is off-line. Also, when in SNGCYC mode, the RESET pushbutton initiates the instruction placed in the MICRO INSTRUCTION switches.

SNGCYC/NORMAL

When turned to the SNGCYC position, it stops the tape control at the end of the current instruction cycle. In this position, each time the START pushbutton is pressed, the tape control executes each instruction as it occurs within the microprogram. If a BU or a BOC (with condition met) is encountered, the branch is executed and single cycling resumed from the 'branched to' address.

In NORMAL, the START pushbutton must be pressed to return the subsystem to normal.

R2D13 OPEN/MST PLUS

This switch does not affect the operation of the tester, and it serves only as a convenience for the Customer Engineer.

When in the OPEN position, the switch causes tape control backpanel pin R2D13 to be floated (neither signal nor ground is applied). When the switch is in the MST PLUS position, an MST up level (-0.9 volts) is present at R2D13.

Pin R2D13 may be jumpered to other backpanel pins allowing selective turn on or turn off of various tape control circuits when using the switch.

A and B

The two switches function together as follows:

Switch		
A	B	Result
0	0	The subsystem operates normally. A sync pulse is generated when the microprogram address compares to either the address in the STOP ADDRESS switches or to the address in the MICRO INSTRUCTION switches.
0	1	The program executes the instruction in the MICRO INSTRUCTION switches.
1	0	The program stops at the address entered in the STOP ADDRESS switches.
1	1	When the address entered in the STOP ADDRESS switches is selected, instead of stopping, the instruction in the MICRO INSTRUCTION switches is executed. If the instruction is a branch, a loop may be created.

STOP ADDRESS

With switch A on, the program stops at the address entered.

MICRO INSTRUCTION

With switch B on, pressing the START pushbutton executes the instruction entered. When used with SNGCYC and the START pushbutton, a single ROS instruction can be entered and executed.

Operating Instructions

Initial Set Up

Power down the subsystem, then plug the indicator card into 01A-A1R2 and the tester panel cables into the connectors at 01A-A1Z4 and 01A-A1Z5 on the card side. These connectors are located at the bottom of the tape control logic gate. Numbering starts at the hinged side of the logic gate. The tester panel will not operate unless the indicator card is plugged.

To start at a selected microprogram address:

1. Set SNGCYC/NORMAL to SNGCYC to stop the tape control.
2. In the MICRO INSTRUCTION switches, place a BU (branch unconditional) to the desired starting address.
3. Set Switch A to 0, Switch B to 1.
4. Press RESET.
5. Press START.
6. Set SNGCYC/NORMAL switch back to NORMAL.
7. Press START.

To stop at a selected microprogram address:

1. In the STOP ADDRESS switches, place the microprogram address at which you want to stop.
2. Set Switch A to 1, Switch B to 0. The microprocessor will stop whenever the address in the STOP ADDRESS switches compares with the address in the Instruction Counter.
3. Press START to continue from this STOP ADDRESS.

To loop on a portion of either the subsystem microprogram, or the ROS Test Card microprogram:

1. Set the SNGCYC/NORMAL switch to SNGCYC.
2. In the MICRO INSTRUCTION switches, place a BU instruction to the starting address of the desired loop.
3. In the STOP ADDRESS switches, place the last address of the desired loop.
4. Set both Switch A and Switch B to 1.
5. Press RESET.
6. Press START.
7. Set SNGCYC/NORMAL switch to NORMAL.
8. Press START.

Single Cycle (From a Selectable Address)

1. Set SNGCYC/NORMAL switch to SNGCYC.
2. In the MICRO INSTRUCTION switches, place a BU (branch unconditional) to a starting microprogram address.
3. Set Switch A to 0, Switch B to 1.
4. Press RESET.
5. Press START.

Note: If the address display jumper is in location 146-246 when the RESET pushbutton is pressed, the microprogram is reset to location 0. Press RESET again to execute the BU instruction.

6. Set Switch B to 0.
7. Press START (one instruction will be executed). Each time START is pressed, the next sequential microprogram instruction is executed. If a BU or BOC (with condition met) is encountered, the branch is executed and single-step continues from the 'branched to' address.

Generate Sync Pulses

Sync Point 1

A scope sync point (minus Sync Address 1) is available at 01A-A1R2D09. The sync address is set into the STOP ADDRESS switches. The Sync 1 latch is set by '0-50 nsec' and 'Stop Addr Compare.' The sync pulse width is the length of the compared instruction cycle.

Sync Point 2

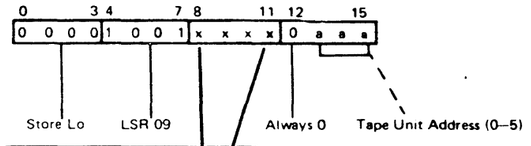
A second sync point (minus Sync Address 2) is available at 01A-A1R2G03. The sync address is set into the MICRO INSTRUCTION switches. The Sync 2 latch is set by '0-50 nsec' and 'Start Addr Compare.' The sync pulse width is the length of the compared instruction cycle.

To Display LSR Contents – Using Microprocessor Tester and Indicator card

1. Set the SNGCYC/NORMAL switch to SNGCYC.
2. Set switch A to 0, switch B to 1.
3. Press RESET.
4. Select either the low or high LSRs by entering one of the following XFER instructions into the MICRO INSTRUCTION switches:
   4005 – (Low LSRs 0 to 15)
   5005 – (High LSRs 16 to 31)
5. Press RESET, press START.
6. In the MICRO INSTRUCTION switches, enter on ORM instruction. 9x00 where x = desired LSR number 0 – F.
7. Press START. The B-Bus indicators now display the contents of the selected LSR.

How to Use the ROS Test Card

1. Plug the ROS Test Card in location 01A-A1S2.
2. Set the control word for the desired operation in the MICRO INSTRUCTION switches.



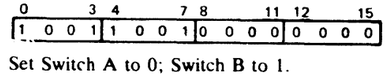
9-Track PE – Alt. Dir.	0110
9-Track NRZI – Alt. Dir.	0010
7-Track NRZI – Alt. Dir.	0011
Tape motion for tracking adjustment	
PE –	1100
NRZI –	1000
Write all ones	
NRZI –	1010
PE –	1110
9-Track PE LWR –	0100
7-Track NRZI LWR –	0001
9-Track NRZI LWR –	0000

Note: The System 360/370 interface must be disabled to operate with ROS Test Card when channel cables are not installed.

3. Set Switch A to 0; Switch B to 1.
4. Set the SNGCYC/NORMAL switch to SNGCYC.
5. Press RESET and START (stores the control word in the MICRO INSTRUCTION switches in LSR-09).
6. Place a 7800 (Unconditional Branch), or 7802 if in Mechanical Skew, in the MICRO INSTRUCTION switches.
7. Press RESET
7a. Press START
8. Set the SNGCYC/NORMAL switch to NORMAL.
8a. Set 1805 in the STOP ADDRESS switches and turn switch "A" to 1.
9. Press START. The selected operation will start and continue until RESET is pressed.

To verify the contents of LSR-09:

1. Set the SNGCYC/NORMAL switch to SNGCYC.
2. In the MICRO INSTRUCTION switches, enter an ORM instruction using LSR-09.



3. Set Switch A to 0; Switch B to 1.
4. Press RESET/START. The B BUS indicators now display the contents of LSR-09.

ROS Test Card Programs

Certain operations contain macro-instructions and require use of the ROS Test Card. These are: read shoeshine, loop-write-to-read, tape motion for tracking adjustments, and write all ones for skew adjustments. Read "How to Use ROS Test Card," Ser 7 page.

Read Shoeshine

One PE or NRZI written block on tape is read repetitively in alternating directions. The block is first read forward, then backward, then forward, etc., with a minimum go-down-time between reads. Read errors are stored as in normal on-line operation and no data errors will interrupt tape motion. However, improper status conditions that occur before data is read can cause the instruction counter to hang at location 180E, and the operation be aborted.
Tape marks are skipped and have no effect during the PE read operations.

Phase Encoded Shoeshine (6x)

Errors can be monitored in the following manner:

1. Place address 1806 in the STOP ADDRESS switches. Set switch B to 0 when program stops. Single cycle to 1806. Set Control switch A to 1.
   a. The phase errors by data track are stored in R13 and are displayed by the B BUS indicators.
   b. Bit positions 0-7 correspond to data tracks 0-7. Track P is not logged.
2. When the program stops, single cycle to address 1807. R14 is displayed, but not used.
3. Single cycle to address 1808.
   a. R15 is displayed by the B BUS indicators.
   b. Bits 0-7 equal:
      0 Abnormal ending
      1 Phase error parity even
      2 Envelope loss
      3 Multi-track error
      4 Data timing error
      5 False end of data
      6 False beginning of block
      7 Not used

Notes

a. The direction of tape is not recorded.
b. Tape might run away if the RESET or SNGCYC/NORMAL switches are used to stop the program.
c. Use CPU to position the data block in front of the read head.
d. Error conditions are cleared whenever the program is restarted.

Nine-Track NRZI Shoeshine (2x)

Errors can be monitored in the following manner:

1. Place address 1806 in the STOP ADDRESS switches. Set Control switch A to 1.
2. When the program stops, single cycle to address 1807.
   The contents of R14 are displayed by the B BUS indicators. Disregard for this operation.
3. Single cycle to address 180B. R15 is displayed by the B BUS indicators.
   a. Bit 0 on indicates a parity error.
   b. Bit 2 on indicates a missing bit.
4. The parity bit can be synced on by placing 180A (odd parity) or 180C (even parity) in the STOP ADDRESS switches.

Notes

a. The CRC and LRC characters are not parity checked.
b. The direction of tape motion is not recorded.
c. Tape might run away if the program is stopped by the RESET or SNGCYC/NORMAL switches.
d. Use CPU to position the data block in front of the read head.
e. Error conditions are cleared whenever the program is restarted.

Seven-Track NRZI Shoeshine (3x)

Refer to Nine Track NRZI Shoeshine for error monitoring procedures.

Loop-Write-To-Read

A random data pattern is sent to the selected tape unit and returned to the tape control via the normal read data path.
Read errors are stored as in normal on-line operation. No tape motion results from a Loop-Write-to-Read operation, and no data is written on tape. The operation is executed repetitively with 40 milliseconds between operations.

Loop-Write-To-Read Phase Encoded (4x)

Errors can be monitored as follows:

1. Place address 1806 in the STOP ADDRESS switches. Set Control switch A to 1.
2. Single cycle to address 1807.
   a. The data track phase errors stored in R14 are displayed by the B BUS indicators. B BUS 0-7 corresponds to Data Track 0-7. The P track is not logged.
3. Single cycle to address 1808.
   a. The errors stored in R15 are displayed by the B BUS indicators.
      Bit 0 Read Data Parity
      Bit 1 Phase Error
      Bit 2 Envelope Loss
      Bit 3 Multi-track Error
      Bits 4-7 Not Used

Note: Refer to the following MAPs for Loop-Write-to-Read card:
System/3 MAP AD073
System/360 or System/370 MAP AA052

Loop-Write-To-Read Seven-Track (1x)

Errors can be monitored as follows:

1. Place address 1806 in the STOP ADDRESS. Set Control switch A to 1.
2. Single cycle to address 1807. The contents (if any) of R14 are displayed by the B BUS indicators. Disregard for this operation.
3. Single cycle to address 1808. The contents of R15 are displayed by the B BUS indicators.
   Bit 0 Read Data Parity
   Bits 1-7 Not Used

Note: Refer to the following MAPs for the Loop-Write-to-Read card:
System/3 MAP AD073
System/360 or System/370 MAP AA052

Tape Motion (8x)

The selected tape unit moves tape approximately eight feet back and forth through the transport. This motion can be used in tracking adjustments, or where close examination of tape motion is required.

Write All Ones (Ax)

This program is used for skew adjustments and verification. The program writes ones in all tracks continuously.

Mechanical Skew

1. Load the Master Skew tape on the tape unit.
2. Remove DD jumper from TU logic board.
3. Set switches A and B to 1.
4. Place SNGCYC/NORMAL switch to SNGCYC.
5. Place control word 096x in MICRO INSTRUCTION switches.
6. Press RESET.
7. Press START.
8. Place 7802 in the MICRO INSTRUCTION switches.
9. Press RESET, then START.
10. Turn B to 0.
11. Place SNGCYC/NORMAL switch to NORMAL.
12. Place address 1805 in the STOP ADDRESS switches. Do not turn on Switch A.
13. Press START (tape moves forward).
    Note: Each depression of START will reverse the tape direction.
14. Replace the DD jumper on the TU logic board.

Read Forward Electrical Skew

Refer to "CARRL" Figure D-57, page 9.

Read Backward Electrical Skew

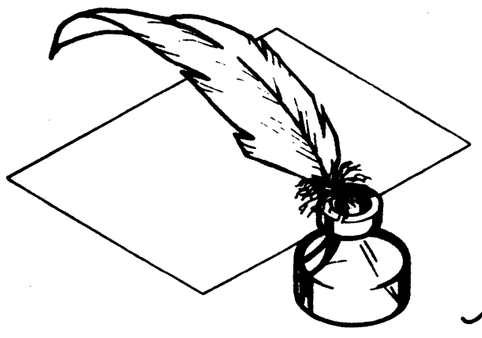
Refer to "CARRL" Figure D-57, page 10.

Write Skew

1. Load a good scratch tape at load point.
2. Place control word 09Ax in the MICRO INSTRUCTION switches.
3. Ensure that the dual density jumper is installed on the tape unit logic board.
4. Place 7800 in the MICRO INSTRUCTION switches.

Operating Hints

1. Do not use the RESET pushbutton when executing a Tester program. Pressing RESET causes a trap to address 0000. The subsystem microprogram will then branch into the IDLE (System/3 and System/38) or IDLESCAN (System/360/370) routines.
2. The ROS card in location 01A-A1V2 must always be plugged to ensure proper loading for all ROS cards and the Microprocessor Tester.
3. A stop address for incorrect control word set-up is 180E. Some examples are: tape unit not ready, invalid tape unit address, or invalid operation.



Notes

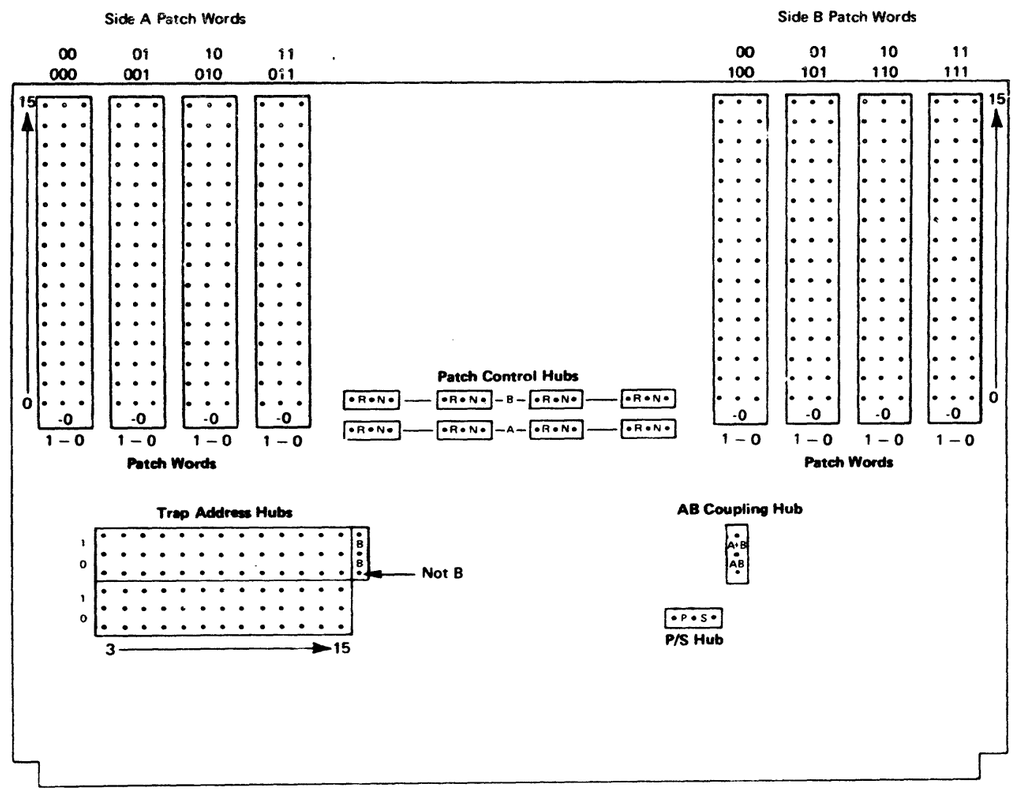
ROS Patch Card

The purpose of the ROS Patch Card, part 8215414, is to:

- Allow emergency repair of defective ROS words.
- Allow application of an emergency REA to the microcode, until a new MST-A card can support a field bill of material.

The patch card can substitute new microprocessor words for existing ROS words. One patch card can produce one 8-word patch (the contents of up to 8 consecutive ROS locations may be replaced), or two 4-word patches.

The ROS Patch Card plugs into any unused location between 01A-A1R2 and 01A1-A1V2. Location T2 is preferred because it is not used for other special tools. Multiple patch cards may be used if several patches are required. The number of patch cards which may be installed is restricted only by the number of vacant card positions between 01A-A1R2 and 01A1-A1V2. The trap address for a patch (address of the first ROS word to be replaced) is identified by plugging the actual ROS address on the patch card. Patch word(s) (the word, or words, you want to substitute for ROS) are also plugged on the patch card in the order they are to appear in the microprogram. Up to eight patch words may be plugged on a patch card. They are divided into two groups called side A and side B. Separate trap addresses may be plugged for each side, allowing two independent patches from one patch card. If a patch longer than four words is needed, the side A and side B patch words can be coupled to form one 5-8 word patch. In this case, only the trap address for side A is used.



Once a patch has started (the ROS address requested by the microprocessor matches the trap address plugged on the patch card), the first patch word executed is determined by tape control instruction counter (IC) bits. Each subsequent step of the IC causes another patch word to read out until the patch is ended. Patch Control hubs are plugged to identify the last word of a patch. When the Patch Control hub identifies the last word of a patch, the microprogram resumes processing.

During a patch sequence, patch words are normally read out from left to right on the patch card. This is because the IC is increased by one with each instruction cycle.

Sync Pulse Generation

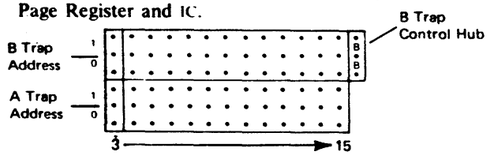
The patch card produces a positive (+) sync pulse at pin D09 whenever the ROS address from the microprocessor matches the A trap address. This condition will cause a patch to begin even though you may only require the sync pulse. To use the sync pulse feature, you must patch at least one word. This can be done with a one word patch that replaces the ROS address used for syncing with its original contents.

Parity Generation

The patch card generates good parity for all patch words before they are sent to the microprocessor. For this reason, a parity error does not result from a failure to correctly read out a patch word.

Trap Address Hubs

Two sets of hubs each contain 13 bits (3-15), which correspond to the combined bits of the tape control Page Register and IC.



The A Trap Address hubs are always active and must be plugged with the ROS address where your patch is to begin.

In normal operation, the microprocessor selects a ROS word to be read out by placing an address in the Page Register and IC. The ROS word specified by this address is read into the microprocessor. With the patch card installed, the address specified by the microprocessor is compared with the A Trap Address. When they are equal, the word sent to the microprocessor comes from the patch card instead of from ROS.

The patch has now begun. Subsequent instruction cycles cause patch words, rather than ROS words, to be sent to the microprocessor until a patch word is addressed for which the associated patch control hub is plugged R.

The B Trap Address is used when two separate 4-word patches are desired. These hubs are effective only if the B Trap Control hub is plugged B. When plugged B, the B Trap Control hub prevents a patch from starting on the B Trap Address.

The B Trap Address operates the same as the A Trap Address, comparing the trap address and the ROS address on each instruction cycle. When the two are equal, a patch is started using the B side patch words. The patch then continues until a patch word is addressed for which the patch control hub is plugged R.

3411 ROS Addressing

3411 Card Locations	Page Bits 3	4	5	6	7	ROS Address 8	9	10	11	12	13	14	15	See Note
A1V2	0	0	0	0	0	0	0	0	0	0	0	0	0	(000) ROS Pages 0–7
	0	0	1	1	1	1	1	1	1	1	1	1	1	07FF
A1U2	0	1	0	0	0	0	0	0	0	0	0	0	0	(800) ROS Pages 8–15
	0	1	1	1	1	1	1	1	1	1	1	1	1	0FFF
A1T2	1	0	0	0	0	0	0	0	0	0	0	0	0	(1000) ROS Pages 16–23
	1	0	1	1	1	1	1	1	1	1	1	1	1	17FF
A1S2	1	1	0	0	0	0	0	0	0	0	0	0	0	(1800) ROS Pages 24–31
	1	1	1	1	1	1	1	1	1	1	1	1	1	1FFF
A1R2	Special ROS card location Used for Tester Indicator Card and ROS Patch Card													

XW0600	1846098	734556	734556A			
Sec 1 of 2	Part Number	1 Sept 72	20 Oct 72			

Note: Any unused ROS location (S2, T2, U2, V2) may be used for:

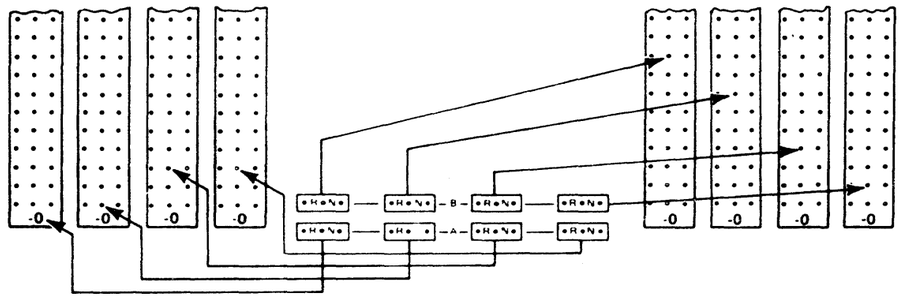
1. ROS Patch Card
2. ROS Address Tracer Card

The ROS Test Card is functional only in card location S2.

Page bit positions 3 and 4 will complement depending where the card is plugged:

N=Normal
C=Complement

Location	3	4
A1V2	No Complement	
A1U2	N	C
A1T2	C	N
A1S2	C	C



Patch Control Hubs

These hubs control the operation of the patch once it has begun. One of these hubs is associated with each patch word. The upper row of hubs applies to Side B Patch Words, and the lower row applies to the Side A Patch Words.

Each of the hubs is plugged either for N (normal) or R (return). When a patch word is executed, and the associated patch control hub is plugged N, the patch continues and another patch word is addressed at the end of the current instruction cycle. If the hub is plugged R, the patch ends on the current instruction cycle, and the next word read into the microprocessor is from normal ROS.

When ending a patch, you must ensure that ROS is reentered at the correct address. Problems can arise if:

1. The number of patch words used in your patch is different than the number of ROS words replaced.
2. Your patch contains a BOC instruction.

In either case, the patch should end with a BU instruction to the correct ROS address and the associated Patch Control hub plugged R. A BU instruction loads IC with the desired address, and where it had stepped during the patch does not matter. Examples 3 and 4 show each of these cases.

P/S Hub

Always plug P, which allows all card functions to operate. S is not used.

Patch Words

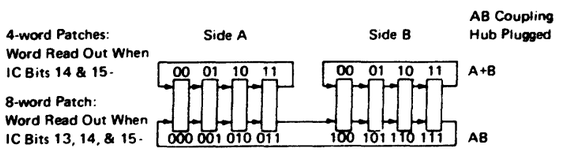
Eight patch words are divided into two groups of four words each. The four words on the left side of the card are Side A Patch Words, and the four on the right are Side B Patch Words.

Each patch word contains 16 bits (0-15), which correspond to the bits of a standard ROS word. A patch word is read into the microprocessor when the tape control instruction counter (IC) equals the trap address. When this compare occurs, the patch word to be read out is selected by IC bits 14 and 15, in a 4-word patch, or IC bits 13, 14, and 15 in an 8-word patch. The selected patch word is read out and executed. As the IC steps normally at the end of the instruction cycle, another patch word is selected, read out, and executed. This process continues until the patch is completed (see "Patch Control Hubs") and normal ROS addressing is resumed.

AB Coupling Hub

Plug A+B to cause independent operation of sides A and B. This allows either one or two 4-word patches to be performed. IC bits 14 and 15 select the patch word to be executed.

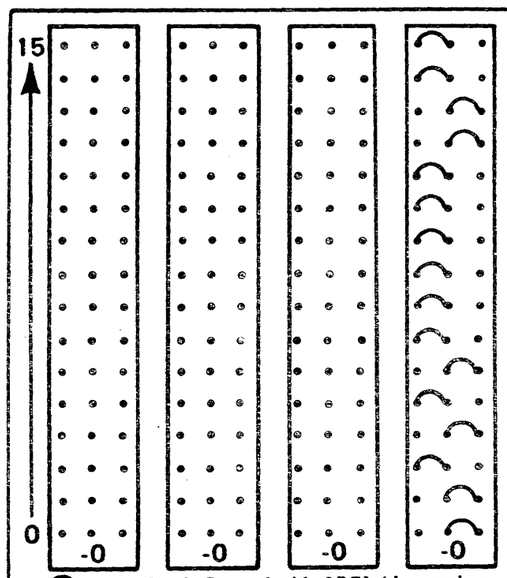
Plug AB when one patch of 5 to 8 words is desired. Side B is coupled to side A to form one patch. IC bits 13, 14, and 15 select the patch word to be executed.



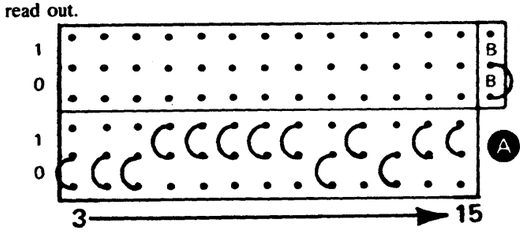
Examples

1. To replace a single ROS word:

Example: Replace the contents of ROS location 3EB with *2BF3*.



B Patch Word: Plugged with *2BF3* (the word you want to substitute for the contents of ROS location 3EB). This patch word reads out first because bits 14 and 15 of the trap address are *1,1*. When the trap occurs, bits 14 and 15 of IC will also equal *1,1* selecting this patch word for read out.

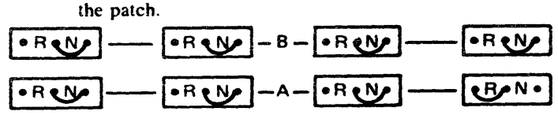


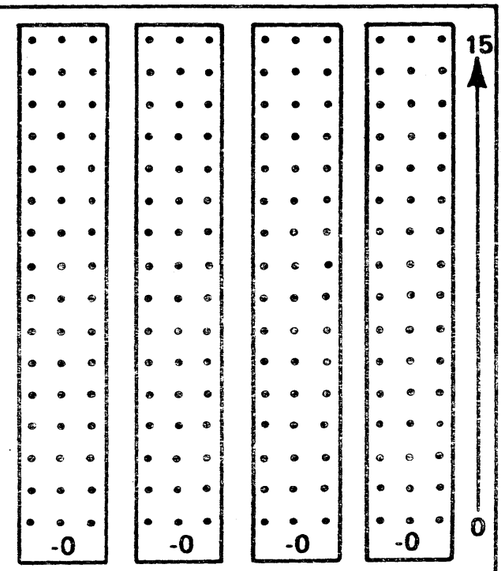
E B Trap Control Hub: Plugged B to disable the B Trap Address. The B Trap Address is not used when only one patch is plugged on the patch card.

A A Trap Address: Plugged with the address of the ROS location you want to replace (3EB).

C Patch Control Hub: Plugging this hub R causes the patch to end on the associated patch word. Since the patch word to which this hub applies is the first patch word to read out, a one word patch is produced.

All other patch control hubs are plugged N. This is not absolutely necessary in this example; however, it is a good practice to plug all hubs N except those on which you actually want to end the patch.

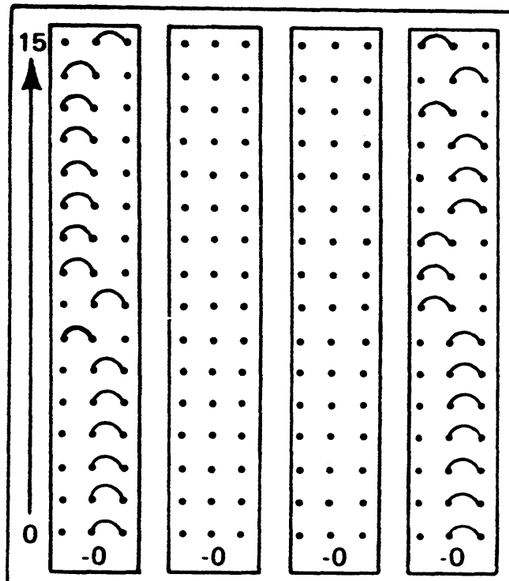




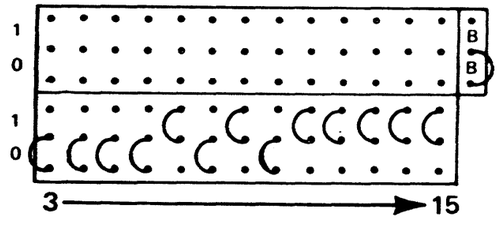
D AB Coupling Hub: Plugged A+B since the patch is less than five words long and coupling of Side A to Side B is not required.

2. To replace the contents of two consecutive ROS locations (2-word patch):

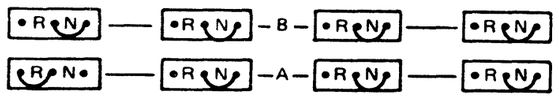
Example: Replace the contents of ROS location 15F with *01C5*, and ROS location 160 with *02FE*:

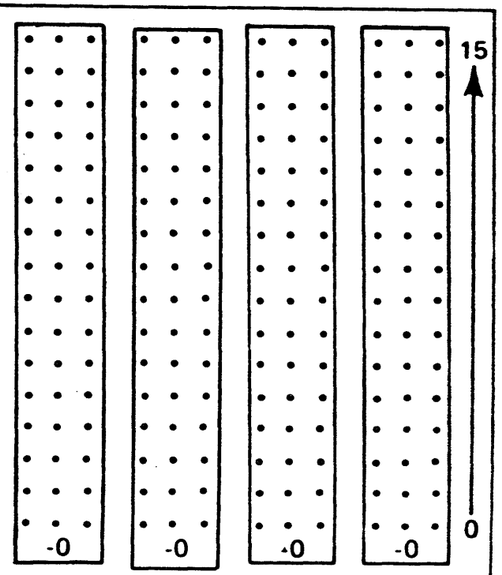


B Patch Word: Plugged with *01C5* (the word you want to substitute for the contents of ROS location 15F). This patch word is read out first because IC bits 14 and 15 = *1,1* when the trap occurs.

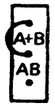


C Patch Control Hub: Plugging this hub R causes the patch to end on the associated patch word. Remember, this is a two word patch. The first word read out was the rightmost of the side A patch words. The patch control hub for that word is plugged N causing the patch to continue. When IC stepped from 15F to 160, bits 14 and 15 selected the leftmost patch word to read out. The patch control hub for this word is plugged R so the patch ends on this patch word.
The IC has stepped to 161, and the microprogram is reentered at that address.





E B Trap Control Hub: Plugged B to disable the B Trap Address. The B Trap Address is not used when only one patch is plugged on the patch card.



D AB Coupling Hub: Plugged A+B since the patch is less than five words long and coupling of side A to side B patch words is not required.

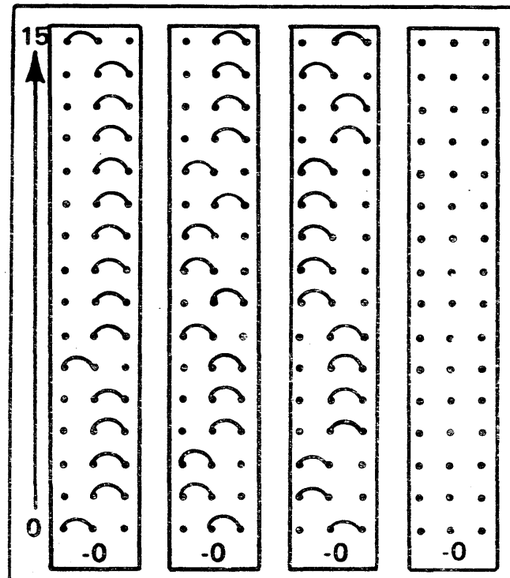
A A Trap Address: Plugged with the starting address of the patch. This is the address of the first ROS location to be replaced (15F).

3. To modify the microprogram with a patch of greater than four words:

Example: Replace the contents of ROS locations 1EC-1F1 (six locations) with a seven word patch. The patch will be:

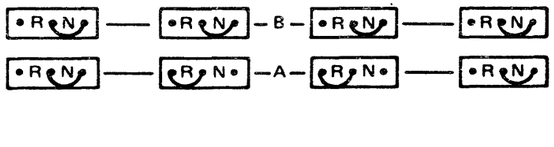
1EC	1508	STO 08,LSR 21
1ED	4360	XFR LSR 03,ABI
1EE	D340	ANDM LSR 03,40
1EF	2002	BOC ALU0,02(in patch)*
1F0	8401	ORI LSR 04,01
1F1	62D0	BU 2D0
1F2	61F2	BU 1F2

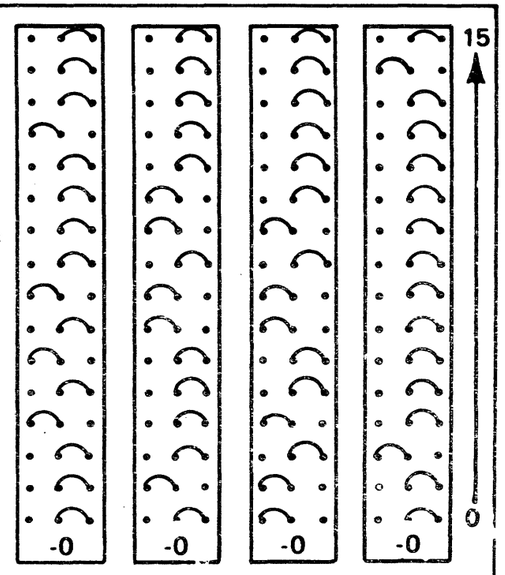
* Since the patch control hub for this BOC is plugged N, the patch will not end on the instruction (whether or not the branch condition is met). Therefore, only bits 13, 14, and 15 of IC are necessary to select the next patch word. In the example, if the branch condition is met when the BOC is executed, a value of *02* is loaded into IC. Since the patch is to continue, IC bits 13, 14, and 15 *(0,1,0)* select the last word in the patch to be read out next.
If the branch condition is not met when the BOC is executed, IC steps normally and the next sequential patch word (ORI) is selected to read out.

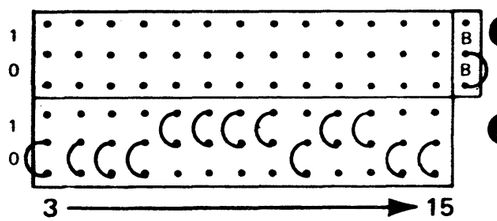


B Patch Word: This is the first patch word read out when the patch begins. It is plugged *1508* (the word you want to substitute for the contents of ROS location 1EC). This patch word is read out first because IC bits 13, 14, and 15 = *1,0,0* when the trap occurs. Since this is a patch of greater than four words, the side A and side B patch words are coupled by plugging the AB Coupling hub. When the patch words are coupled, bits 13, 14, and 15 of IC select the patch word for readout.

C Patch Control Hub: Plugging these hubs R causes the patch to end on either of the two associated patch words. Each of these patch words contain a BU instruction. When either word is read out and executed, IC is loaded with a ROS address by the BU instruction. Because the patch control hub for each instruction is plugged R, the patch will end and the microprogram will resume from ROS at the address loaded into IC (2D0 or 1F2).







E B Trap Control Hub: Plugged B to disable the B Trap Address. The B Trap Address is not used when only one patch is plugged on the patch card.

A A Trap Address: Plugged with the starting address of the patch. This is the address of the first ROS location to be replaced (1EC).

D AB Coupling hub: Plugged AB to couple the side A and side B patch words for one patch. This must be done for any patch of more than four words.

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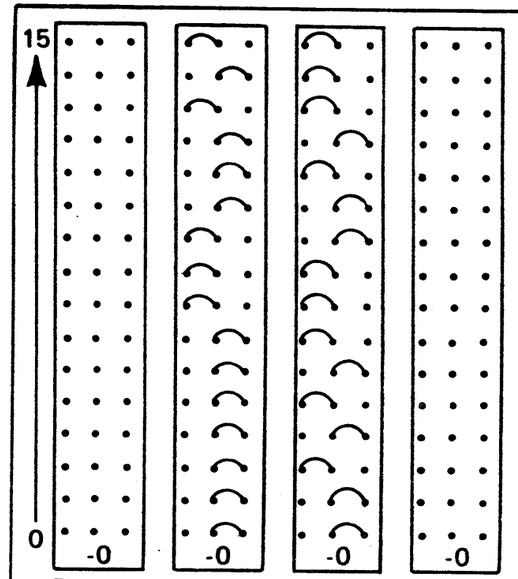
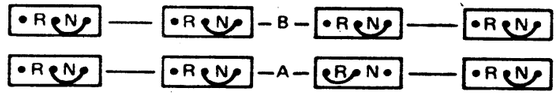
4. To modify the microcode with a patch ending with a BOC instruction:

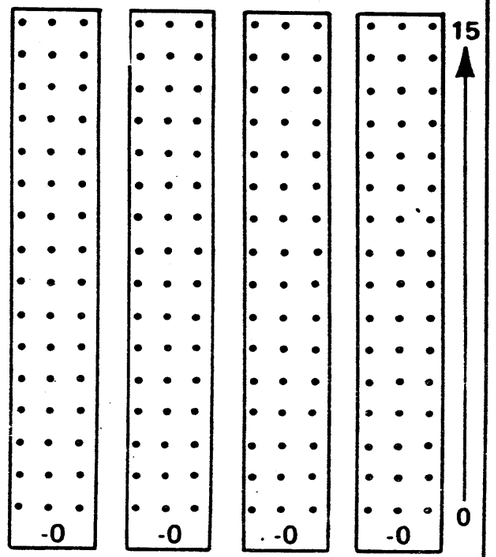
Example: Replace the contents of ROS locations 101 and 102 with *01C5* and *2E07 (BOC)*, respectively.

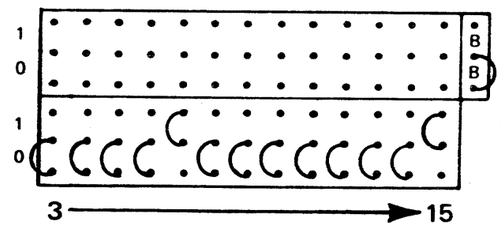


B Patch Word: This is the first patch word read out when the trap occurs (selected by IC bits 14 and 15 = *0,1*).

C Patch Control Hub: Plugging this hub R causes the patch to end on the associated patch word which is a BOC instruction. When the patch control hub for a BOC instruction is plugged R, the ROS microprogram is reentered whether or not the branch condition is met.
If the branch condition is met, IC is loaded with a ROS address and the microprogram resumes from ROS at that address (in this example, address 197).
If the condition is not met, IC steps normally and the microprogram resumes from whatever address IC contains (in this example, address 103). To end a patch on a BOC, you must 1) plug the full address portion of the instruction, bits 8-15; and 2) ensure that the page register contents have not been altered by the patch. Patch instructions that may change the page register are Branch Unconditional and Transfer to IC.

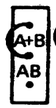






E B Trap Control Hub: Plugged B to disable the B Trap Address. The B Trap Address is not used when only one patch is plugged on the patch card.

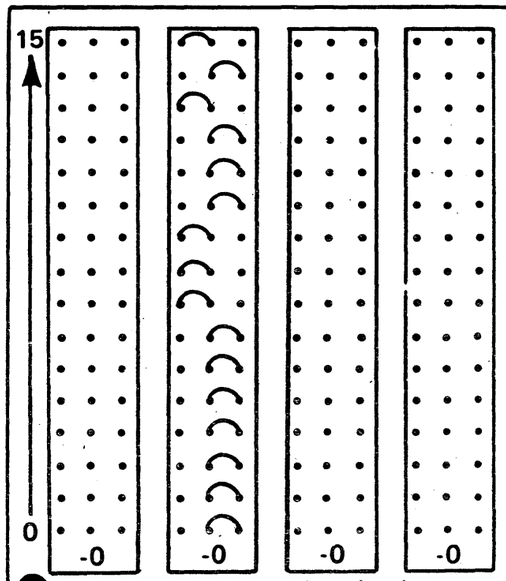
A A Trap Address: Plugged with the starting address of the patch (101). This is the address of the first ROS location to be replaced.



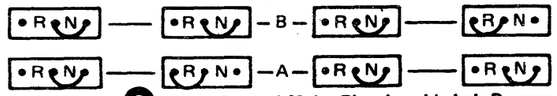
D AB Coupling Hub: Plugged A+B since the patch is less than five words long and coupling of side Aand side B patch words is not required.

5. To execute two 1-word patches:

Example: Replace the contents of ROS location 1A1 with *01C5*, and the contents of ROS location 2B3 with *8401*.

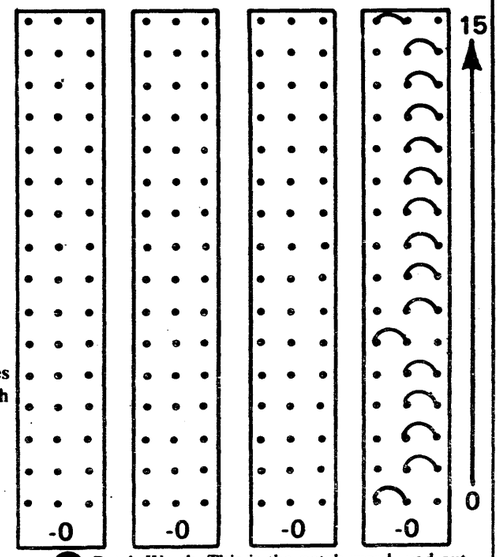


B Patch Word: This is the patch word read out when IC matches the A trap address (IC bits 14 and 15 = *0,1*).



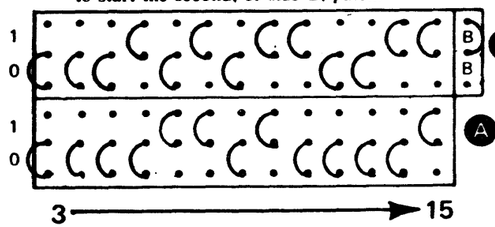
H Patch Control Hub: Plugging this hub R causes the side B patch to end on the associated patch word. Since this hub applies to the first patch word of the side B patch, a one word patch results.

C Patch Control Hub: Plugging this hub R causes the side A patch to end on the associated patch word. Since the patch word to which this hub applies is the first side A patch word read out, a one word patch results.



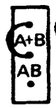
G Patch Word: This is the patch word read out when IC matches the B trap address (IC bits 14 and 15 = *1,1*).

E B Trap Control Hub: Plugged B which activates the B Trap Address. The B trap address is used to start the second, or side B, patch.



F B Trap Address: Plugged with the starting address of the second patch (2B3).

A A Trap Address: Plugged with the starting address of the first of two patches (1A1).



D AB Coupling Hub: Plugged A+B because for two independent patches, the side A and side B patch words cannot be coupled.

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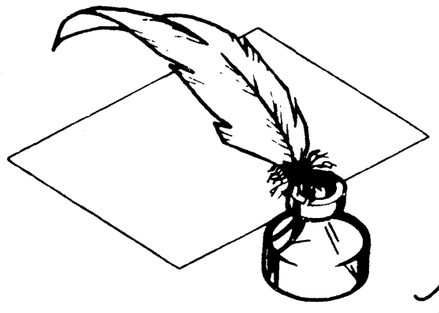

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