SERVICE AIDS - TAPE UNLOADED

TEST	AREA TESTED	PREREQUISITES	RESULTS	TP's
Self	ROM, RAM, CTC DAC, Z80	Power on	All lamps on for 1 sec. then UNLOAD lamp on, all others off.	
1,1	Supply and Take-up reels		Exercise both motors CW and CCW	TP 0 TP 61
	Activates Q5 and Q6	Press LOAD switch	Turn on HIGH VOLTAGE RAIL	Sh. 4
	Deactivate Q5 and Q6	Press UNLOAD Switch	Turn off HIGH VOLTAGE RAIL	
1,2	Write 1 Character Record	GND. LSTWRD U12W-5	Allows Troubleshooting of Write Circuits	Sync U12W-9 Sh. 6
		Press LOAD switch	Simulates 100 IPS Data Rate	R251
		Press Unload sw.	Simulates 25 IPS Data Rate	
1,3	Filemark	Same as 1,2	:Allows Troubleshooting of Write Filemark CKTS	Same
1,4	Tach Phase Quadrature		Displays Phase Shift 8 = 90 deg. Nominal 3 = 30 deg. Minimum	A0 TP 72 B0
	8 Qudratures	Press LOAD sw.	Pressing LOAD causes next Quadrature	TP 70 Sht. 3
2,1	ONL (TP 81), RWD (TP 87) 6 Output Status Ports	Disconnect from Daisy chain	Toggled in binary Sequences Repeats each 10 Msec.	TP 77 to 87 Sht. 3
2,2	BOT Sensor	Tape W/O BOT	Binary Count X .16 = output Voltage No Tape =GT .9 Volts Tape LT .3 Volts Marker =GT 1.0 Volts	R207 (IMBD) Sht. 5
2,3	EOT Sensor	Tape W/WO EOT	Same as Test 2,2	R292 (IMBD)
2,4	Tension Arm Transducer Voltage. Seq. Display from Hi to Low Order Nybble	Toggle LOAD Sw. to Sequence display. Press UNLOAD with ARM against Fwd Stop	8 Bits = -.46 to +4.96V (40 mV/ count) HIDEN on=bits 7,6,5,4 HIDEN off=bits 3,2,1,0 Absolute output of ARM: 00h = 0 Volts HHh = +10 Volts	TP64 Sht 5
	ARM voltage Delta (2.6 V to 3.6V)	Press LOAD Sw. again.		

TEST	AREA TESTED	PREREQUISITES	RESULTS	TP's
3,1	File Protect, Reel Seat & Tape in Path Sensors	Reel & FPT Ring Reel & FPT Ring Reel & FPT TIP TIP	 UNLOAD Lamp = 1 Flash, > .4V UNLOAD Lamp = 2 Flash-es, > .1V. 0.0V to 0.1V LOAD Lamp on = 0.25 to 2.2V.	TP 71 R302 (OUTBD) TP 69 (INBD) Sht 5
3,2	Hub & Door Lock	Doors Closed Doors Open	Momentary Lock ON LINE Lamp on	TP 74 TP 75
3,3	Door/Inter-	Enter Diagnostics	Disables Interlocks	
3,4	Blower Cycle	Press LOAD sw.	LOAD Lamp & Blower on	r275

DIAGNOSTIC TEST ROUTINES - TAPE LOADED

TEST	AREA TESTED	PREREQUISITES	RESULTS	TP's
1,1	Inject Read Noise	Enter Diagnostic	Approx. .2VPP, .5 MHZ Noise	TP 57
1,2	Disables 1,1			
1,3	Inject +5V Ripple	Enter Diagnostic	Approx. +/- .25V AC Ripple to +5VDC	TP 89 Sht. 5
1,4	Disables 1,3			
2,1	Read Threshold	Install Write Enable Ring Adjust R115	LOAD & UNLOAD Lamps Flashing Equally	TP 94 Sht. 7
2,2	Servo Exer-cise, Arm Limit Display	Enter Diagnostic	Servos 25%/100IPS/Rev. 75%/25IPSFwd, Arm Tension = Binary Flashing Display = >5, EOT/RWD	Sht. 4
2,3	Write 1 Block or Read 1 Block if FPT	LOAD sw. = 25IPS UNLOAD = 100IPS HIDEN & SPEED = Reverse	Gnd. LSTWRD (U12W-5) = Preamble, 1 char., Postamble.	TP 40

PREVENTIVE MAINTENANCE ********FREON for Tape Path & Head*********

WRITE CONTROL INSTRUCTIONS See IOU 49 Section.

STATUS IN See IOU 49 Section.

CIPHER DATA STREAMING TAPE TRANSPORT

$\boxed{45335}$

Disable cover
Latch Switches

Runs on IOU 49

Vendor Code #45

Model #5241

Requirements for Streaming Mode

~~Req~~ Mem - was 500k
Now 350 K - 408.1.13

Cipher Tape Drive (IOU49)

IOU52 Disc

Q30 or Q64

ATP - STAPE

OP SYS - *Tapex

Tape Speed	100 ips, 50 ips (3200 bpi only), 25 ips		
Low-Speed Variations (LSV)	±1% of nominal		
Instantaneous Speed Variation (ISV)	±4% of long-term speed		
Write Skew	300 microinches, maximum		
Rewind Speed	175 ips, average (10 1/2 -inch reel)		
Nominal Access Time (ms)	<u>25 ips</u>	<u>100 ips</u>	<u>50 ips</u>
Read	40	260	120
Write	40	260	120
Nominal Reposition Time (ms)			
Read	120	780	350
Write	120	780	350
Nominal Reinstruct Time (ms)			
Read	15	4	8
Write	12	3	6
Character Rate (Hz)			
1600 bpi	40,000	160,000	N/A
3200 bpi	N/A	N/A	160,000
Data Density	1600 bpi (PE) or 3200 bpi		
Tape (Computer grade)	ANSI X3.40-1976		
Width	0.5 inch		
Thickness	1.5 mil		
Reel Size	10 1/2 inches max. 7 inches min.		
Tape Tension	7 oz., nominal		
Net Weight	80 pounds (36.0 kg)		
Shipping Weight	98 pounds (44.5 kg)		

Table 1-1. Mechanical and Electrical Specifications

Dimensions	
Height	8.75 inches (22.2 cm)
Width	17.0 inches (43.2 cm)
Depth (from mounting surface)	22.0 inches (55.9 cm)
Mounting (standard 19-inch RETMA rack; slide mounting provided)	EIA Specifications
Power	100, 120, 220, 240 Vac (+10%, -15%); 230 Vac (±10%) 48 - 61 Hz; 270 watts, max.
Data Reliability:	
Write (certified tape)	1 error in 10^8 bytes
Read Recoverable	1 error in 10^9 bytes
Read Permanent	1 error in 10^{10} bytes
Operating Temperature	13-40 degrees Centigrade
Relative Humidity	20-85% noncondensing
Altitude	7,500 feet (10,000 feet optional)
Interface Impedance	130 ohms at 3 Vdc
Sink Current	25 ma, max.
Logic Low	0.4 Vdc, max.
Logic High	2.4 Vdc, min.
Rise/Fall Time	100 nanoseconds, max.
Daisy-Chain Capabilities	Eight dual-speed tape drives or four dual-speed tape drives plus one formatted drive, 25 feet maximum total if active repeaters not used.
Cable Characteristics	28 AWG flat ribbon, 22 or 24 AWG twisted pair.
MTBF	5500 hours
MTTR	30 minutes (to isolate and replace major subassemblies)

Table 1-1. Mechanical and Electrical Specifications (Continued)

INTRODUCTION TO STREAMING TAPE OPERATION

Streaming tape operation is simply writing data to tape without stopping and starting between each record block. Interblock gaps, as required in the ANSI format, are inserted automatically "on the fly". This concept, although not new, was focused on in IBM's Model 8809 in late 1978. All tape drives currently being manufactured have the capability of streaming.

So what is so special about the Cipher Model F880 Microstreamer? It is manufactured **specifically** for streaming tape operation under a design concept in which a severe design constraint, that of start/stop time, has been greatly relaxed. As shown in Figure 5, a typical 125 ips, vacuum column tape drive is capable of starting and stopping in 3.5 milliseconds, within the 0.6-inch inter-record gap, while the Microstreamer takes up to 240 milliseconds to ramp up to a speed of 100 ips.

Obviously, the streaming tape drive does not generate standard interblock gaps in the usual manner, with its 240-millisecond ramp-up time (at 100 ips). The manner in which the Microstreamer generates the standard interblock gap is explained on page 8 in the Repositioning section.

The relaxation of the previously vital tape-access time constraint has made possible numerous design changes:

- Capstan servo is no longer required.
- Reel servos are simplified.
- Lower power and less expensive motors are required.
- Tape is loaded and unloaded automatically.
- Less expensive tape buffering is required.

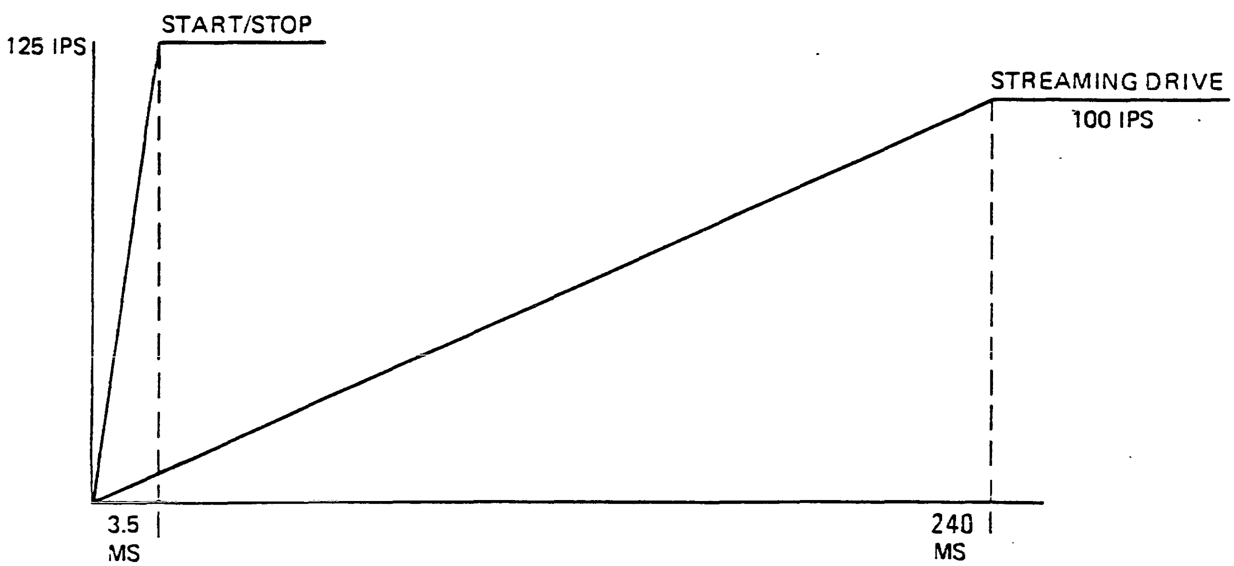


Figure 5. Tape Access Time

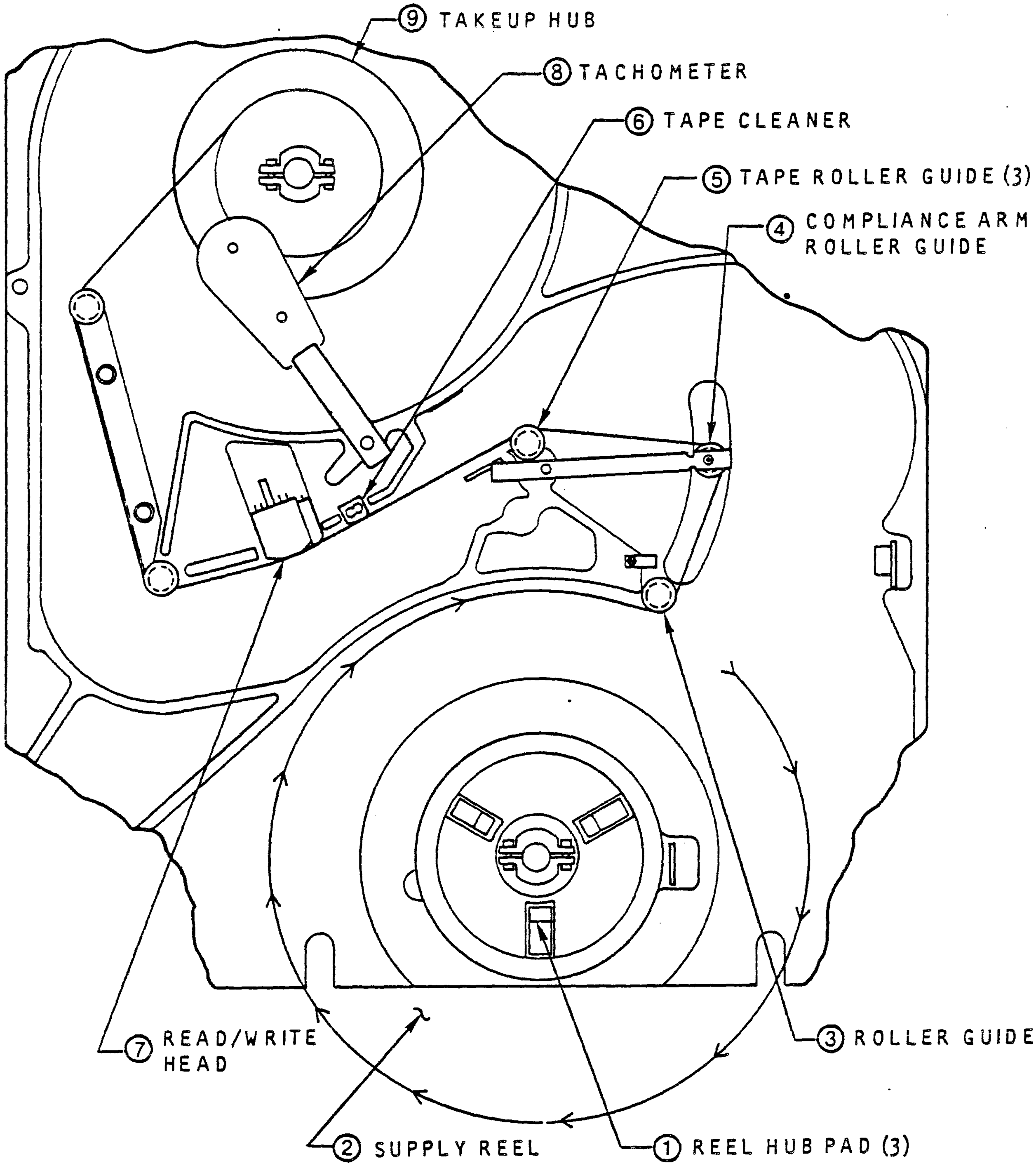


Figure 1. Tape Path

BACKUP TIME FOR VARIOUS DISK CAPACITIES

The total time required for the operator to complete the task of backup for a given disk capacity is given in Tables 8 and 9. These calculations are based on a write speed of 100 ips and a rewind speed of 200 ips. Additionally, 1 minute is added for each tape load function.

DISK SIZE MBYTES	BLOCK SIZE IN BYTES					
	8192	4096	2048	1024	512	256
20	3.9	4.4	5.3	7.4	10.7	18.0
40	8.0	9.0	10.7	13.9	21.3	36.0
60	12.3	13.1	16.4	21.3	31.9	54.1
80	15.6	18.0	21.3	28.7	43.5	72.2
100	19.7	22.1	27.1	36.0	54.1	89.4
160	32.0	35.3	42.6	56.6	86.1	144.3
200	40.2	44.3	53.3	71.3	108.2	179.5

Table 8. Time in Minutes for Various Capacity and Block Size at 1600 bpi

DISK SIZE MBYTES	BLOCK SIZE IN BYTES					
	8192	4096	2048	1024	512	256
20	2.5	2.5	3.3	4.9	9.0	16.6
40	4.1	4.9	7.4	10.7	17.2	31.2
60	6.6	8.2	10.7	15.6	25.4	46.7
80	8.2	10.7	13.9	20.5	34.4	62.3
100	11.5	13.3	18.0	26.2	43.5	77.9
160	18.0	21.3	28.7	41.8	69.7	124.6
200	22.1	26.2	35.2	53.3	86.1	155.8

Table 9. Time in Minutes for Various Capacity and Block Size at 3200 bpi

Tables 10 and 11 show the number of 10.5-inch reels of 1.5-mil. (standard 2400-foot) tape Required to back up a specific disk size. The figures shown include all formatting characters and record gaps.

DISK SIZE MBYTES	BLOCK SIZE IN BYTES					
	8192	4096	2048	1024	512	256
20	0.48	0.54	0.65	0.9	1.3	2.2
40	0.97	1.1	1.30	1.7	2.6	4.4
60	1.50	1.6	2.00	2.6	3.9	6.6
80	1.90	2.2	2.60	3.5	5.3	8.8
100	2.40	2.7	3.30	4.4	6.6	10.9
160	3.90	4.3	5.20	6.9	10.5	17.6
200	4.90	5.4	6.50	8.7	13.2	21.9

Table 10. Number of Reels of Tape for Various Capacity and Block Size at 1600 bpi (2400' Reel)

DISK SIZE MBYTES	BLOCK SIZE IN BYTES					
	8192	4096	2048	1024	512	256
20	0.3	0.3	0.4	0.6	1.1	1.9
40	0.5	0.6	0.9	1.3	2.1	3.8
60	0.8	1.0	1.3	1.9	3.1	5.7
80	1.0	1.3	1.7	2.5	4.2	7.6
100	1.4	1.6	2.2	3.2	5.3	9.5
160	2.2	2.6	3.5	5.1	8.5	15.2
200	2.7	3.2	4.3	6.5	10.5	19.0

Table 11. Number of Reels of Tape for Various Capacity and Block Size at 3200 bpi (2400' Reel)

TAPE CAPACITY

The total number of bytes to be stored in a single reel of tape varies with the block size.

Figure 29 gives an idea of the capacity achievable for various block lengths. The chart allows for a standard gap size of 0.6 inch and takes into account the preamble and postamble characters required for each block of data recorded in PE format.

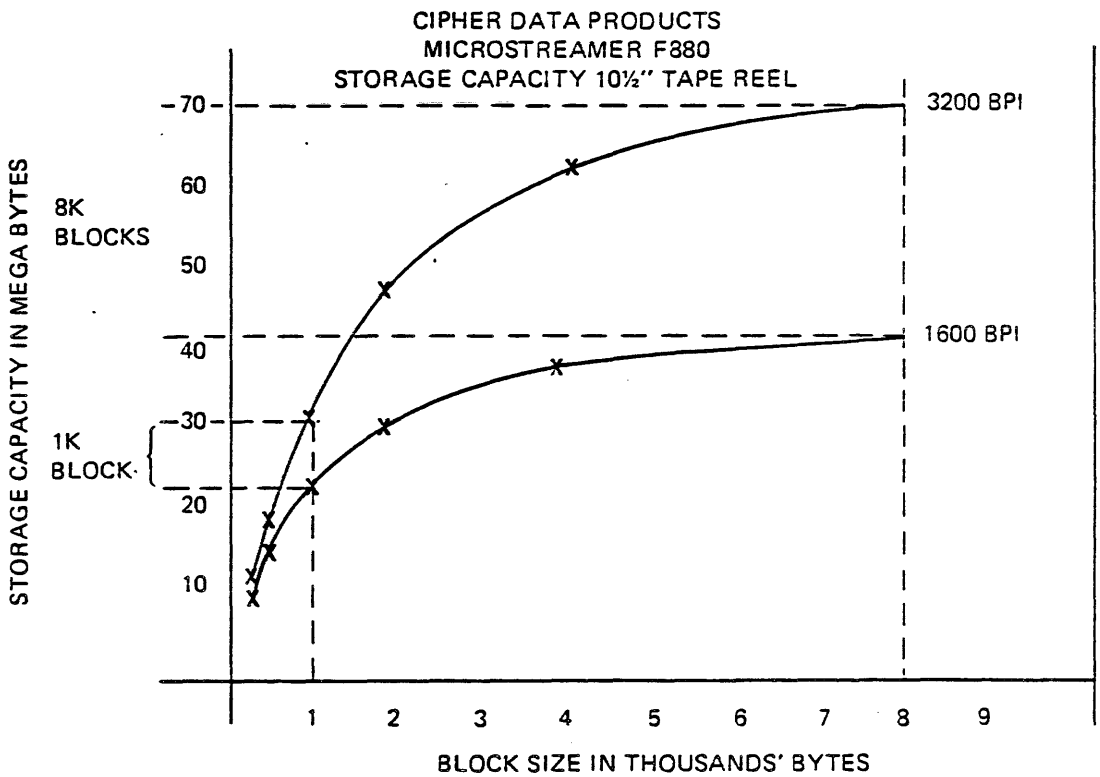
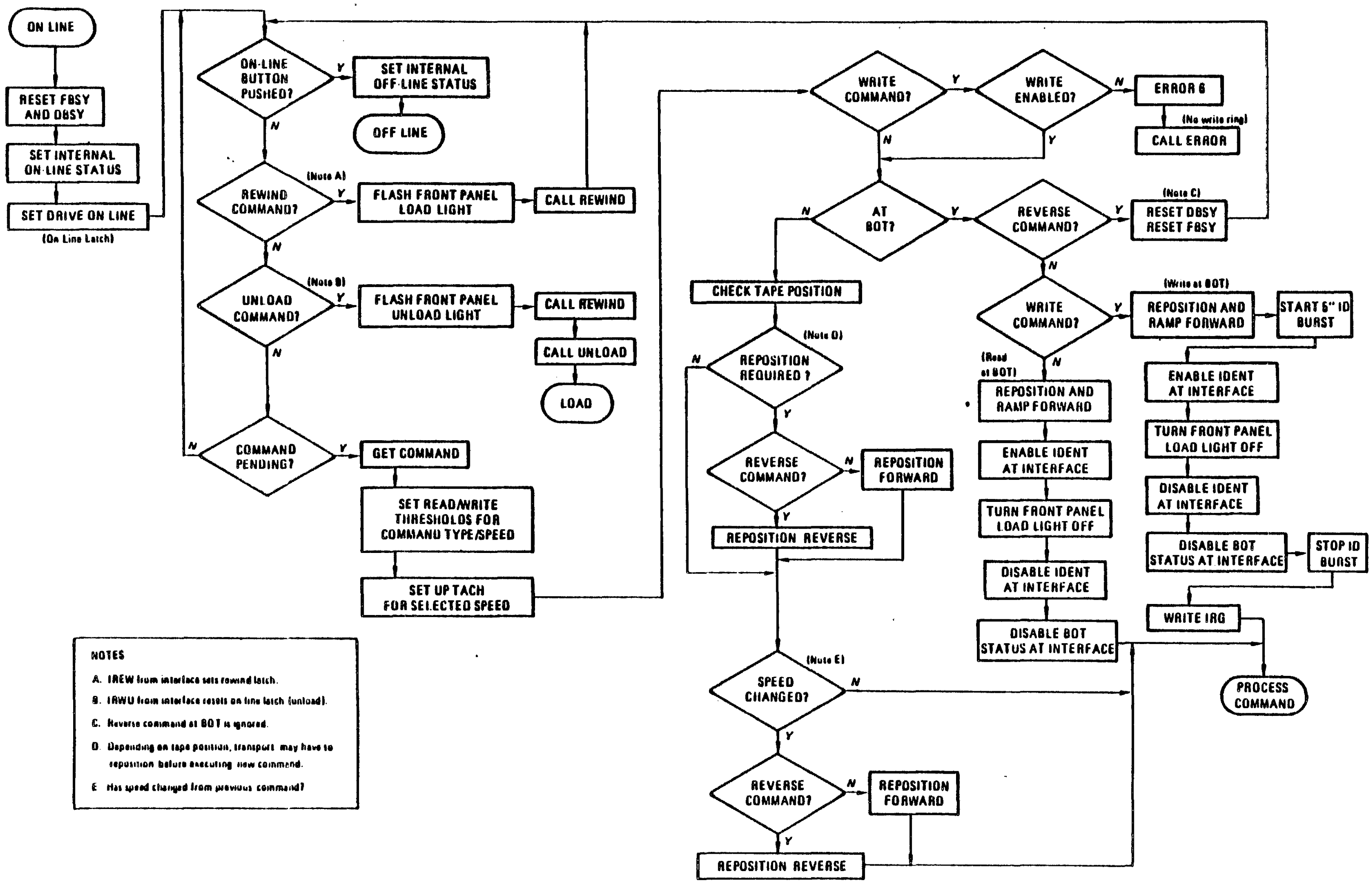


Figure 29. Storage Capacity vs Block Size



380-204

Figure 2-45. On Line Sequence

4-9

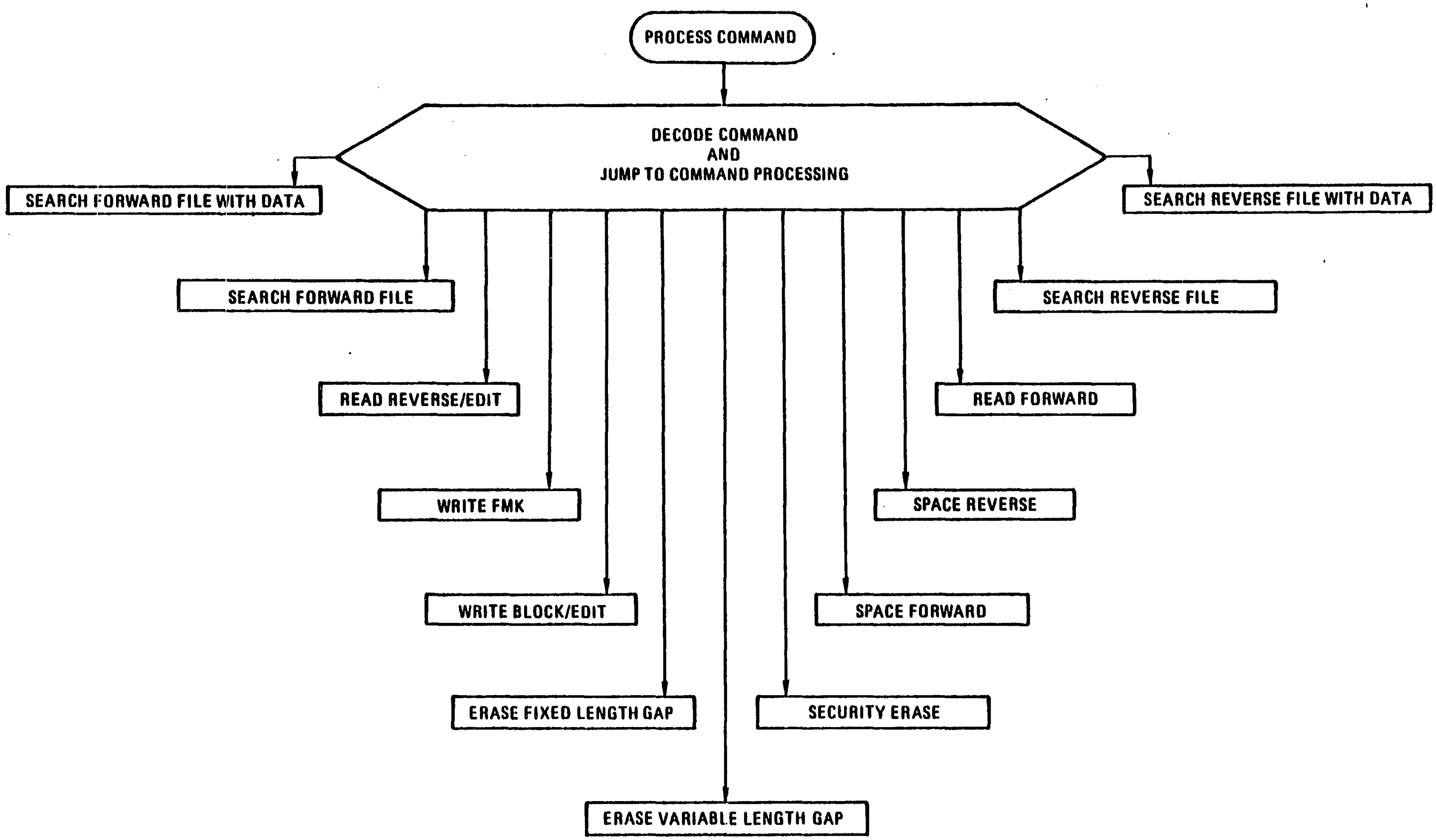


Figure 2-46. Process Command Sequence

Refere to 4-22 thru 4-26

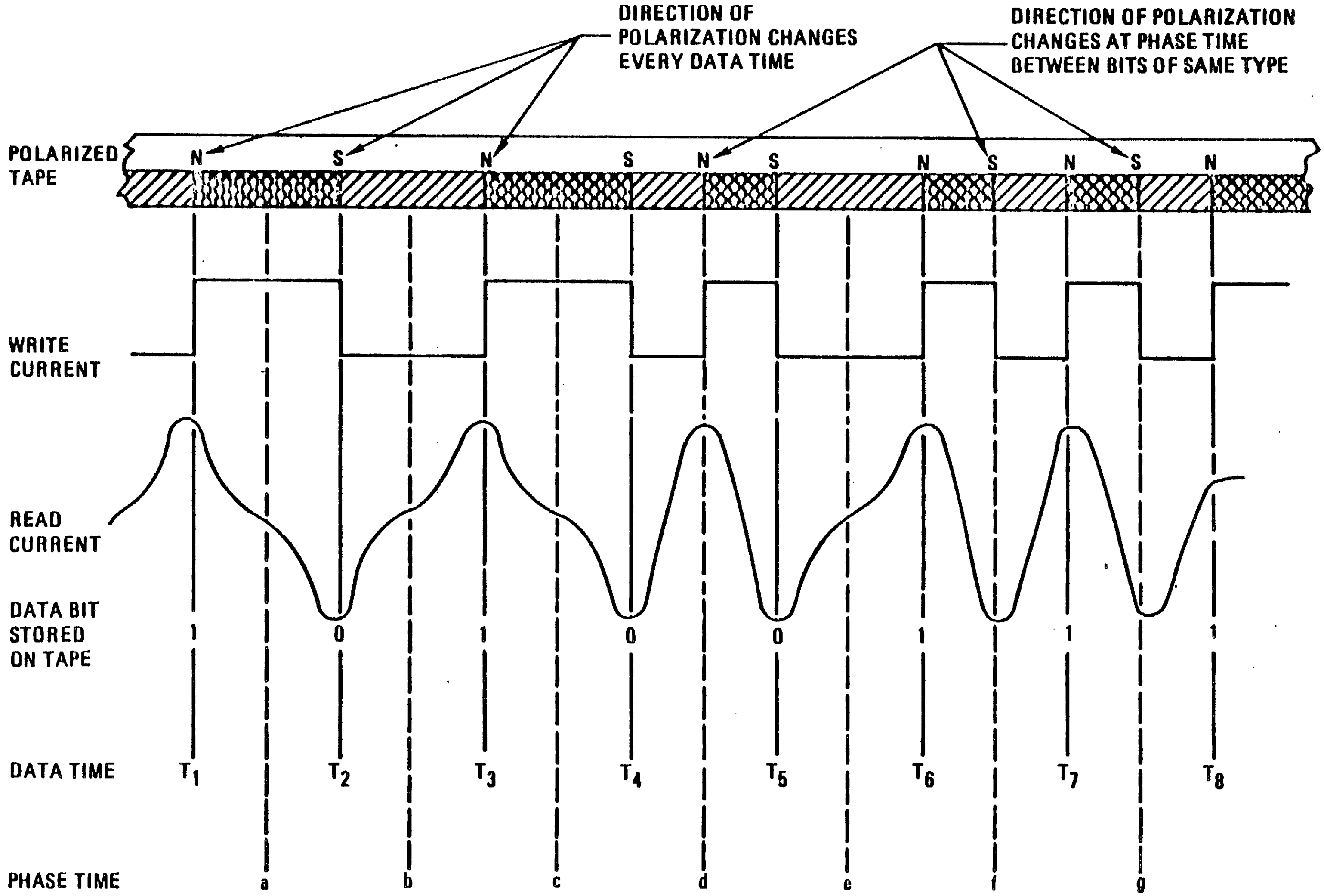


Figure 2-1. Phase-Encoded Tape Magnetization

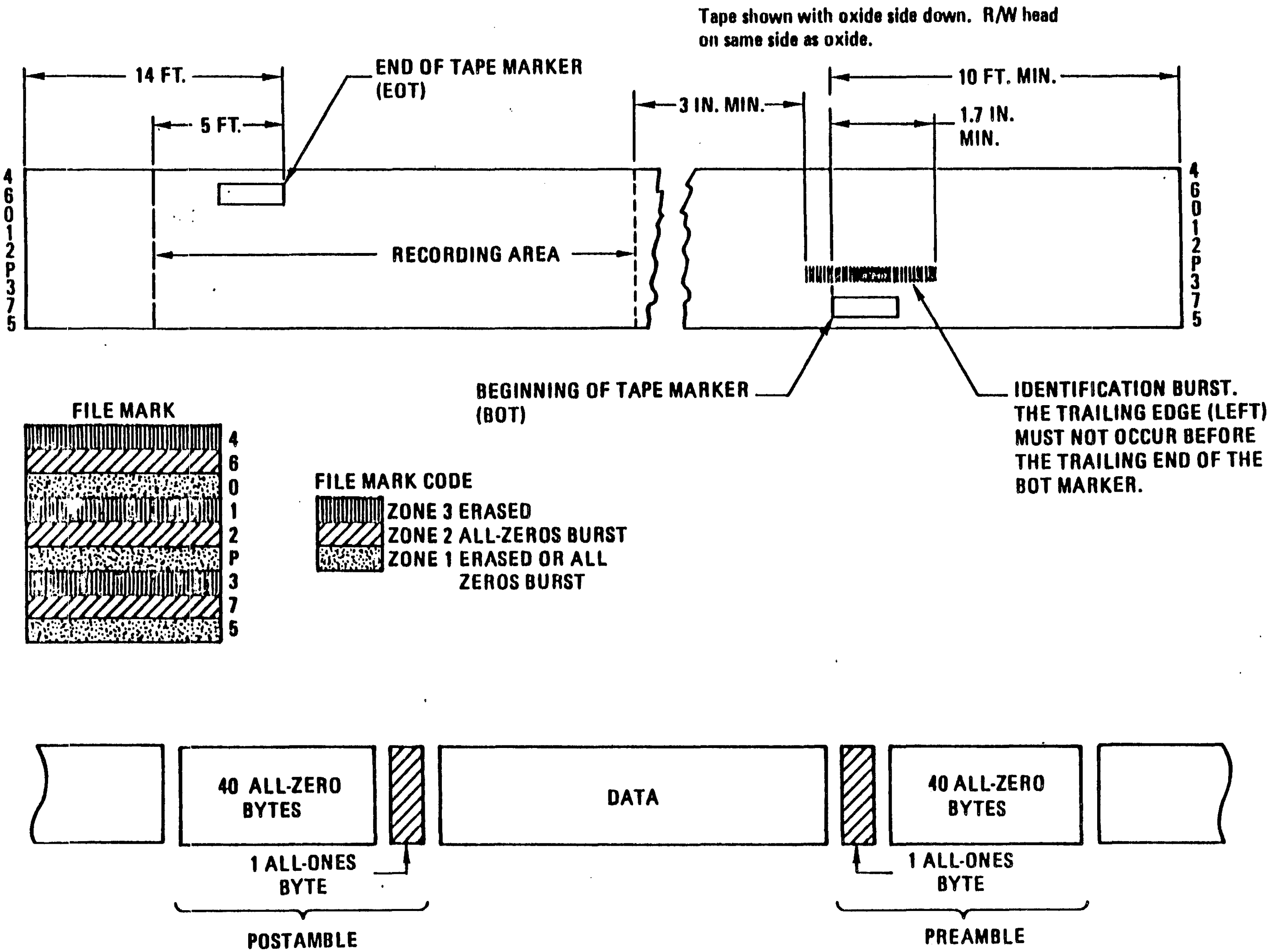


Figure 2-2. Nine-track PE Data Format

880-151

STREAMING-TAPE OPERATION

2-10. Streaming-tape operation is simply writing data to tape without stopping and starting between each record block. Interblock gaps, as required in the ANSI format, are inserted automatically "on the fly". Figure 2-3 illustrates in the simplest form what a streaming drive will automatically perform if for any reason the unit must start and stop after each block. As can be seen in the diagram, there is a period of time called Command Reinstruct Time. This is the time after reading or writing the last character of the last block in which the system must instruct the tape drive to continue or after reaching point B, the tape drive will enter what is known as a repositioning cycle. If the command to continue reading or writing is not received by the time normal forward velocity reaches point B, the drive automatically decelerates, coming to rest at point E. This sequence is called repositioning. After coming to rest at point E, the unit waits for the next command to read or write. The time from point E to point F is defined as access time. This repositioning and access time may be thought of as latency time which will vary depending upon when the next command is issued with respect to the last read or write character. Each leg at 100 ips takes about 240 ms, B-C = 240 ms, D-E = 240 ms. Total repositioning plus access time equals 1025 ms at 100 ips and 150 ms at 25 ips.

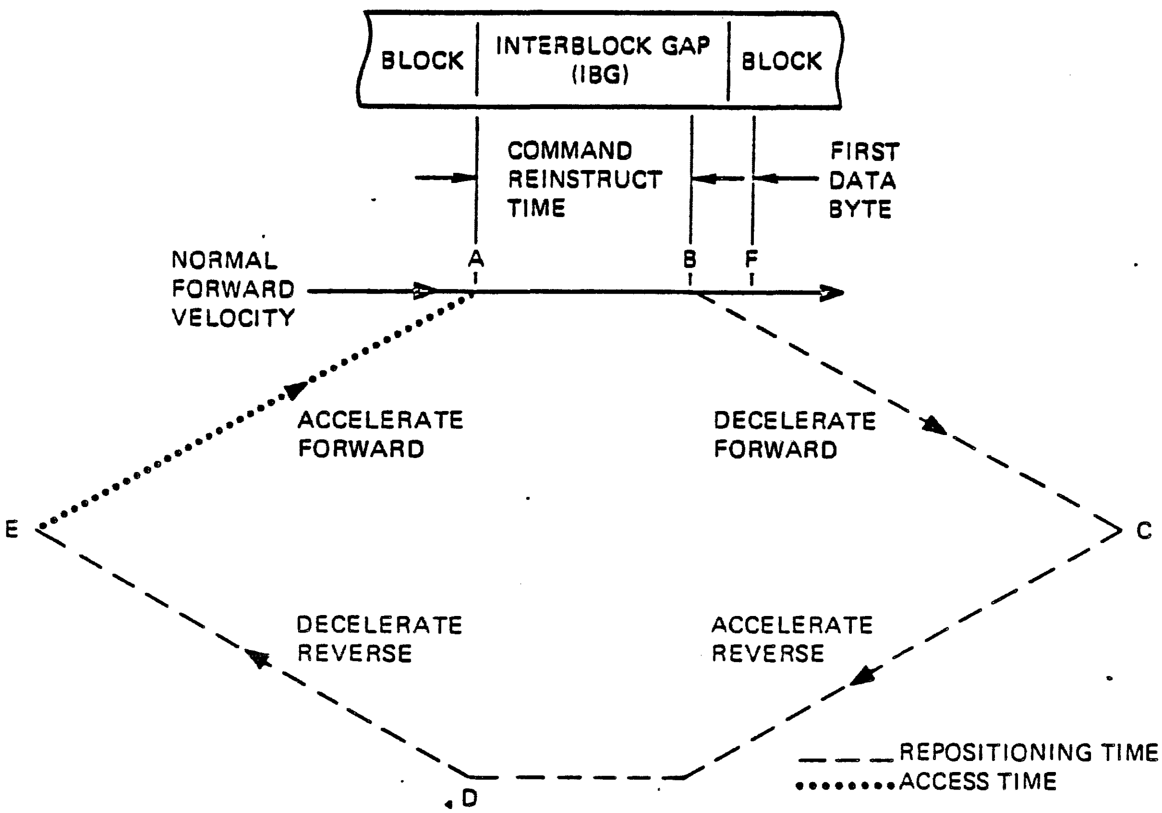


Figure 2-3. Repositioning Cycle

880-152

forward direction than in the reverse direction and slightly more time is required to accelerate in the reverse direction than in the forward direction. This causes the graph to become distorted, as shown in Figure 2-4 E.

2-14. To allow for minor variations in acceleration and deceleration rates, the tape is allowed to run at speed for short distances during repositioning. This provides an offset, which is shown as points C and C' in Figures 2-4 D and E. After repositioning, the record head might be left several data blocks in front of the point at which the next write or read operation is to take place. If one command is followed by another in the opposite direction, it becomes necessary to perform an additional repositioning to allow the required distance for tape acceleration, as illustrated in Figure 2-5. This illustration represents a reverse read following a write forward. It can be seen that the second reposition is a retrace of the first. It is shown offset in time for clarity only. The double repositioning can be partially prevented if the new command is issued somewhere along segments AB or BC, in which case that segment will be completed and the command executed in the normal manner. If point C has been reached, however, the entire repositioning must be completed. Repositioning may be required when a high-speed operation follows a low-speed operation, even if they are of the same category and in the same direction and the new command is issued within the reinstruct time. This is necessary to allow the tape ample time to accelerate to record speed. Figure 2-6 illustrates this and represents a high-speed space file forward following a low-speed read. Repositioning will also occur at other times, for example, prior to rewinding.

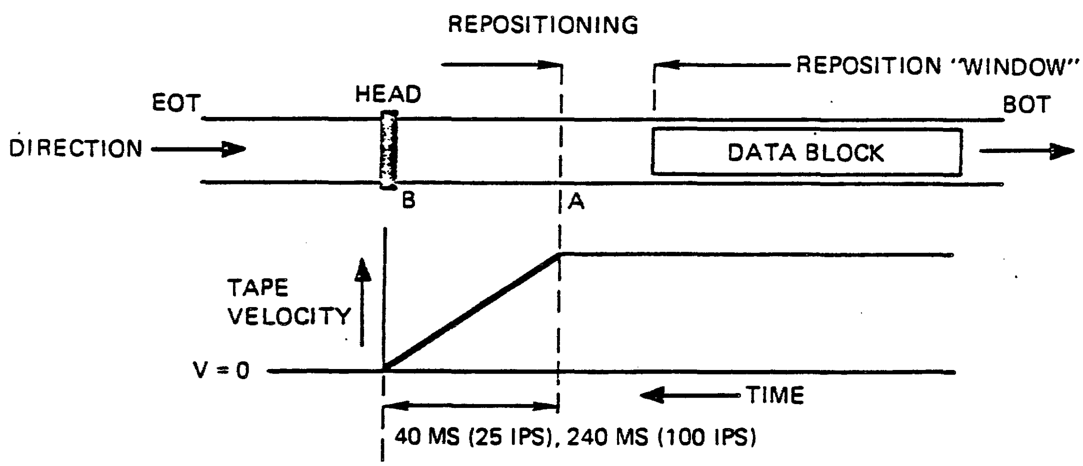


Figure 2-4A. Ramp Down (FWD)

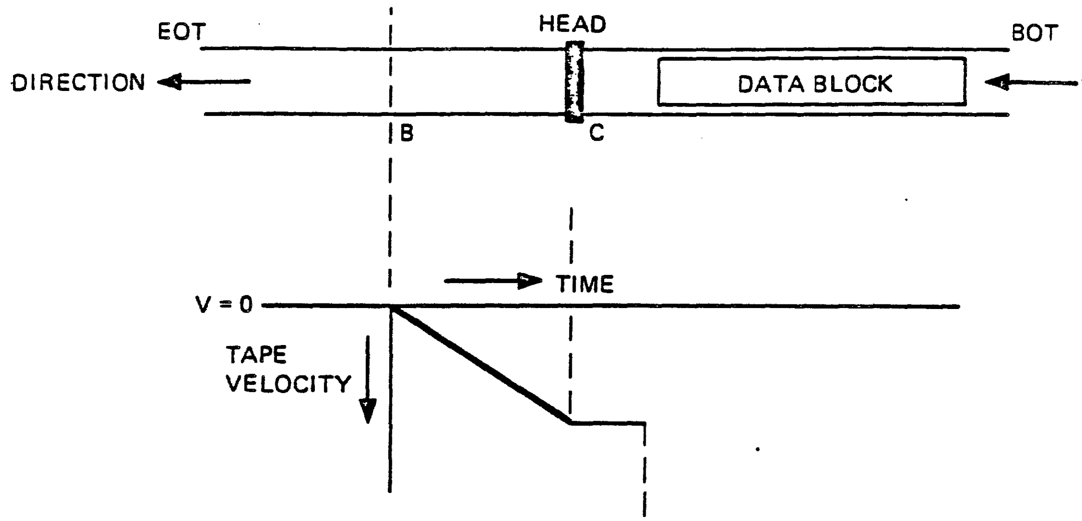


Figure 2-4B. Ramp Up (REV)

880-154

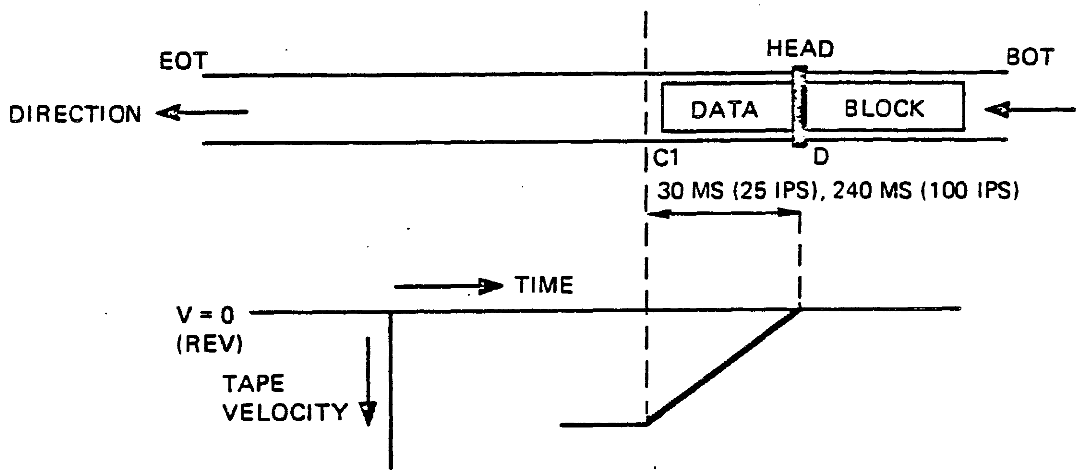


Figure 2-4C. Ramp Down (REV)

880-155

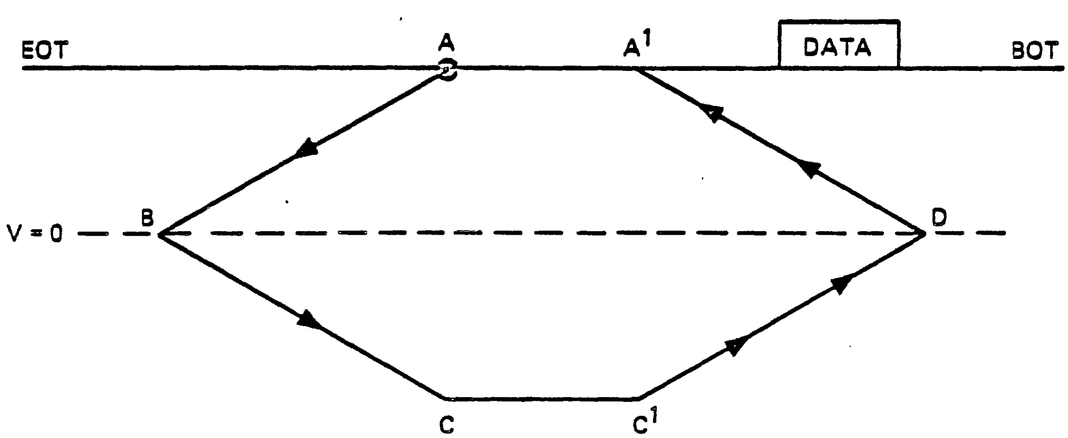
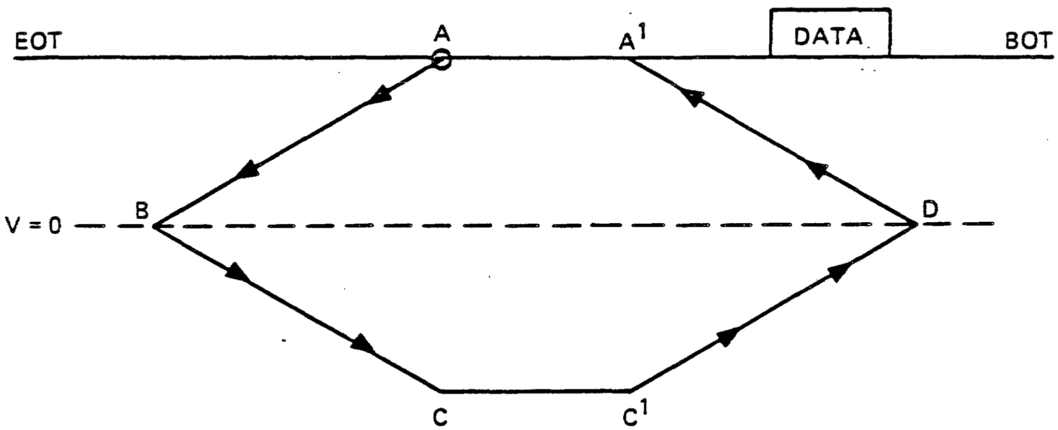


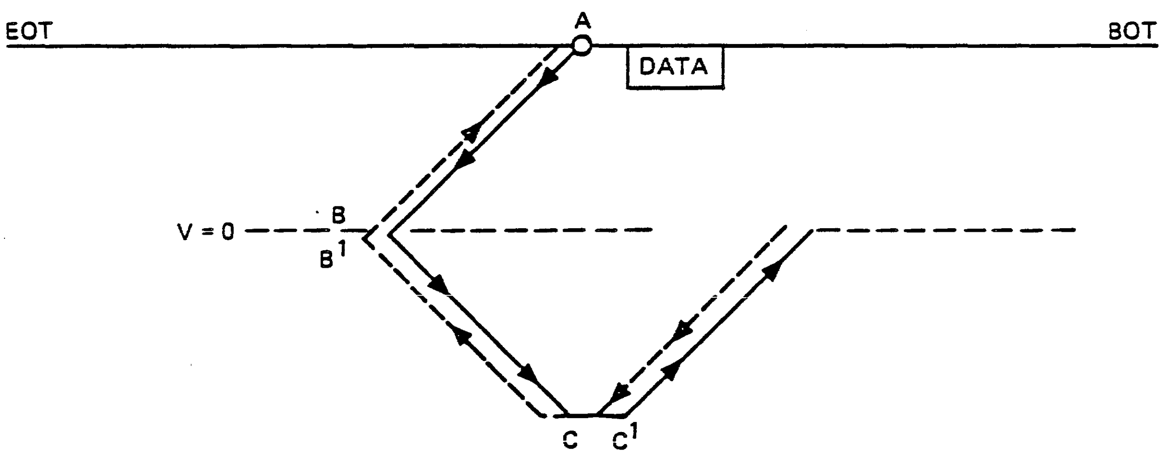
Figure 2-4D. Composite Ramps at 100 ips

880-156



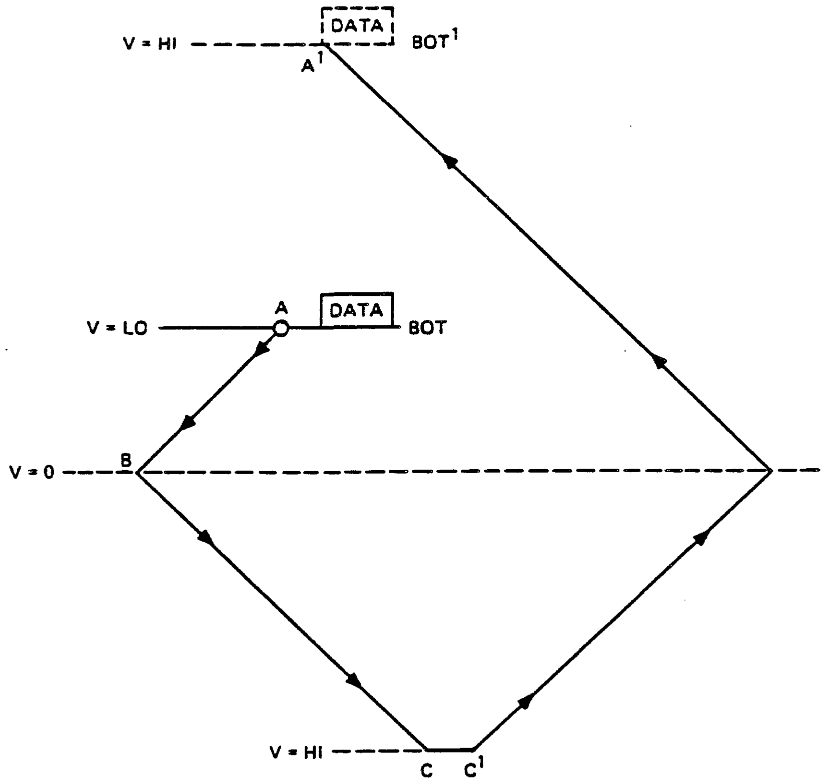
880-157

Figure 2-4E. Composite Ramps at 25 ips



880-158

Figure 2-5. Reverse Direction Repositioning



880-159

Figure 2-6. Low Speed to High Speed Repositioning

MAJOR TRANSPORT COMPONENTS

2-15. The Cipher Model F880 MTSU transport is composed of three main assemblies: the drive assembly, which includes the tape drive components and the compliance arm system; the power supply system, which consists of a transformer and a power supply assembly mounted on the bottom of the top plate; and the formatter printed wiring board (PWB), which contains the voltage regulation circuitry, servo control logic circuitry, reel motor servos, sensor circuits, write and read circuits, and input/output (I/O) interface circuits.

2-16. **Power Supply/System Failure Detect Circuit.** The power supply assembly consists of a RFI line filter, ac line fuse, and rectifier circuits. The voltage regulators and system failure detect circuits are located on the formatter PWB. The system failure detect circuitry removes the drive voltage from the servo motors in the event of a power failure or microprocessor failure.

2-17. **Control Logic Circuitry.** A Z80 microprocessor with associated I/O chips, serves as the primary control element in the F880 MTSU. The program is stored in 8K of on-board programmable read-only memory (PROM) circuits.

2-18. **Takeup/Supply Servo Circuits.** Both takeup and supply servos incorporate voltage and current feedback lines which are used to control the speed and torque of the reel motors. These feedback lines are also used by the microprocessor to select either the voltage drive or current drive signal for servo control.

COMMAND	REVERSE	WRITE	WRITE FILEMARK	EDIT	ERASE
Read Forward	0	0	0	0	0
Read Reverse	1	0	0	0	0
Read Reverse Edit	1	0	0	1	0
Write	0	1	0	0	0
Write Edit	0	1	0	1	0
Write File Mark	0	1	1	0	0
Erase Variable Length	0	1	0	0	1
Erase Fixed Length	0	1	1	0	1
Security Erase	0	1	1	1	1
Space Forward	0	0	0	0	1
Space Reverse	1	0	0	0	1
File Search Forward	0	0	1	0	0
File Search Forward (Ignore Data)	0	0	1	0	1
File Search Reverse	1	0	1	0	0
File Search Reverse (Ignore Data)	1	0	1	0	1
No Operation Decode	0	0	0	1	1
3200 bpi*	1	0	1	1	1
1600 bpi (PE)*	0	0	1	1	1
Diagnostic Routine	0	0	1	1	0
Cycle Servos Exit Test 22 Any Command	0	0	0	0	0
Read Logic Margin Test	1	0	0	0	0
+5 Vcc Circuit Margin Test	0	1	0	0	0
Reset Margin Tests	1	1	0	0	0
Extended Status	0	0	1	0	0

*Microstreamer 2 only

Table 3. Command Decoding

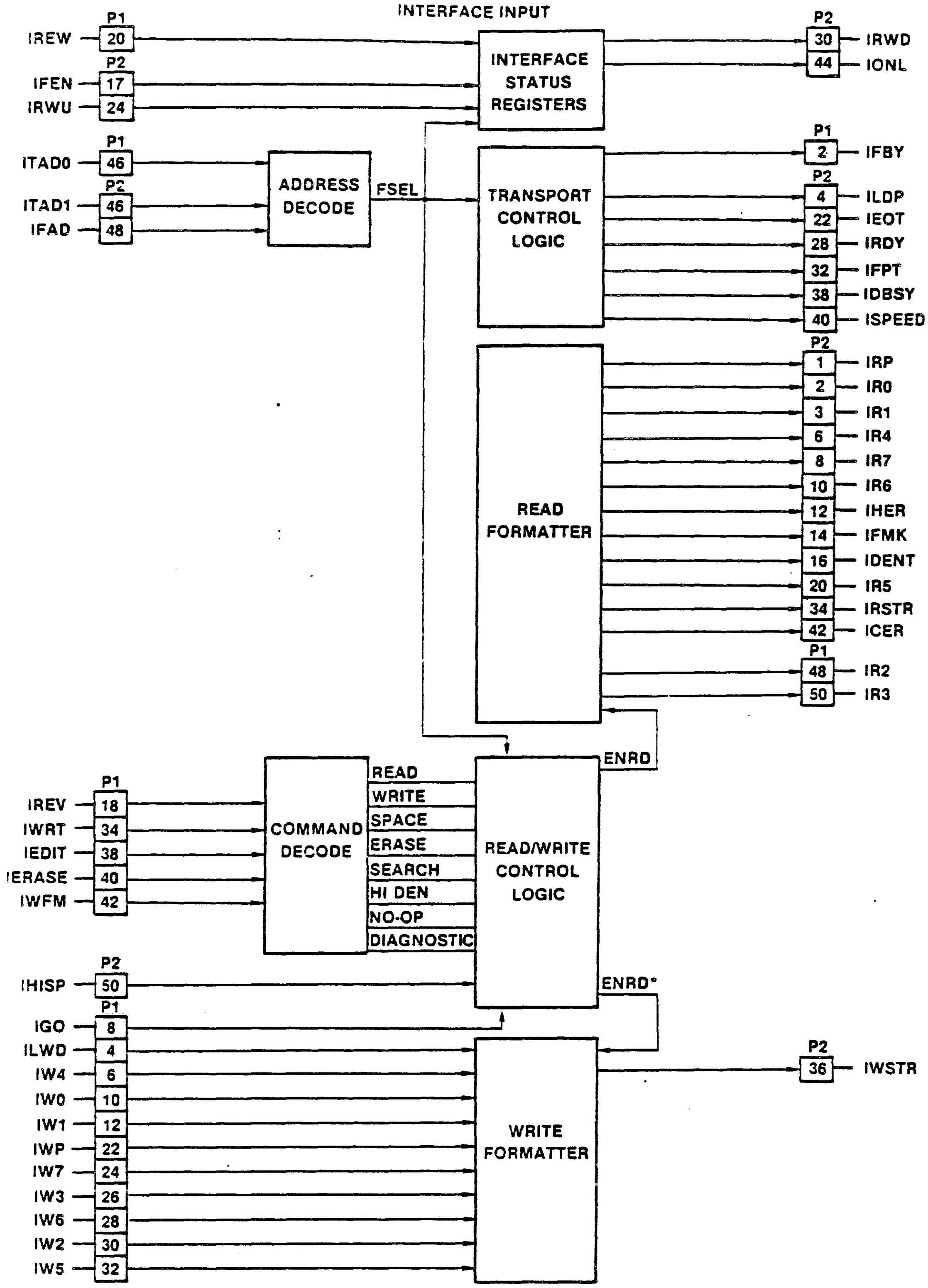


Figure 10. Transport Interface Diagram

880-43

IRWD. This 1-microsecond (minimum) pulse initiates REWIND in the selected, ready (not at load point) transport. If the selected transport is at load point, the command is ignored. The REWIND command does not assert the IFBSY or IDBSY status line. The IRWD status will go true within less than 1 microsecond, and the IRDY will go false. A new command to this drive should be delayed until the status IRDY is true and IRWD is false. Other daisy-chained transports may be addressed while the transport is rewinding. The physical operation of a rewind involves running at 25 ips for about 20 inches in the forward direction before the reverse motion occurs. The average rewind speed is approximately 175 ips. When the tape reaches BOT, the drive ramps down and returns to BOT, where it stops, setting the ILDP and IRDY and resetting the IRWD status.

IRWU. This pulse (1 microsecond minimum) modifies the standard rewind command by resetting the ON LINE status flip/flop and initiating an unload sequence when the transport encounters BOT.

IFEN. This signal, which must be asserted by the controller, may be pulsed high (2 microseconds, minimum) to reset a READ, SEARCH, or WRITE command runaway during DBSY. It is ignored when DBSY is false. Command termination occurs within 50 milliseconds with a normal sequence: IDBSY drops, then IFBSY drops. This command cannot be used to terminate REWIND, UNLOAD, ERASE FIXED, WRITE FILE MARK, or extended status commands, since these commands cannot "run away". By limiting the IFEN in this way, all runaways can be terminated in an orderly manner with no loss of tape information.

IHISP. When asserted, the Model F880 transport operates at 100 ips. This line must be set up a minimum of 1 microsecond ahead of the trailing edge of IGO. Since it is latched in the transport, there is no hold time requirement. Repositioning when switching speed is automatic but delays the first command by about 1.2 seconds. There is no restriction as to when speed may be changed from 25 to 100, or 100 to 25 ips. Thus the user may initiate a high-speed file search followed by low-speed data transfers, if this system is not able to utilize the full, high-speed, streaming data modes. All repositioning during speed switching is automatic and transparent to the user.

IFBY. This signal goes true within 1 microsecond following the trailing edge of IGO and goes false following command completion. It is not desirable to wait for IFBY to be reset before issuing additional commands. The use of the trailing edge of IDBSY is recommended.

IDBSY. This signal goes true after any repositioning, staying true during the active execution of all commands initiated by the IGO. On the trailing edge of this signal, another command of any type, direction, or speed may be given. IDBSY goes true as soon as the tape has reached operating speed. IDBSY will go true at least 100 microseconds before any data transfer, end of file, or block detection.

IDENT. This is a level which goes true to identify 1600 bpi phase-encoded (PE) tapes. When reading forward from the BOT, the formatter monitors the parity channel for the presence of the identification burst. If an identification burst is detected, this line is set true for a short period of time as the BOT passes over the read head. An identification mark is not generated during 3200 bpi operation. An ID burst is detected by the presence of more than 80 character periods where only the parity channel is recorded, with the other channels erased. The absence of an ID burst will not prevent the transport from reading an otherwise valid 1600 bpi tape.

IHER. This signal is pulsed when the record being written/read contains an uncorrectable error. The line goes low when an error is detected before IDBSY goes false. Error conditions asserting this line include the following:

a. Mutiple-track dropout: Two or more tracks have analog envelopes dropping below the operating threshold before passing through the postamble. This is the most common type of hard error and can be distinguished from the others since it always occurs more than 25 microseconds after a correctable error.

b. Uncorrectable parity error: All tracks have valid envelopes, but the parity is even and the postamble has not yet been detected. This error can be detected by the absence of ICER while IHER is set, together with parity error on the transmitted data. An ICER may occur later, since the postamble is unlikely to be detected. This error can be caused by writing of incorrect parity when the external write parity option is selected. It may also indicate excessive write-to-read crosstalk or high noise between chassis and signal ground (if local grounding wire inside the transport is removed).

c. Non-0 character in postamble: The only allowable character in the postamble is a 0 (with even parity). This is checked during the first 20 postamble character intervals.

d. Excessive skew: This error detection is indirect. A character bit will be lost, causing an unavoidable postamble detection failure and a consequent parity error when the postamble is entered.

e. Loss of data envelope after postamble detection: 20 character intervals after the postamble provide time for the postamble to end and envelope detectors to decay. At the end of this time there must be at least eight quiescent data channels, or an error will be reported.

ICER. This signal is pulsed when a signal-track dropout is detected and error correction is in process. This will occur before IDBSY goes false. These pulses occur throughout the rest of the data block, and they must be latched to be sensed at the IDBSY transition.

NOTE

> To ensure IBM/ANSI compatibility, the system must rewrite records containing hard or corrected errors on a read-after-write verification.

IFMK. This line is pulsed on a write verification or read operation when an IBM/ANSI compatible file mark is detected. This occurs prior to a false-going IDBSY. If a file mark is not detected during a file mark write operation, the bad file mark should be backspaced with a SPACE REVERSE command, and the file mark should be rewritten. For maximum data reliability, a file mark is detected using majority logic. A file mark is sensed when any two of the three tracks (channels 2, 6, and 7) which must be present are present for at least 15 characters periods, and all three of the erased channels (channel 1, 3, and 4) are absent. This technique provides automatic dead track recovery of file marks, which is essential, as error handling of file marks is notoriously poor in most computer tape systems.

IRDY. This level indicates that tape is tensioned and is not rewinding, off line, loading, or unloading. In the event of a hard fault shutdown, the drive goes off line and not ready. This line should be used to precondition any tape drive command.

IONL. This level indicates that transport on-line flip-flop is set. The transport may be placed on line during or after tape load whenever the drive was off line. This will go false within 1 microsecond of the reception of an UNLOAD command. When IONL is false, IRDY will be false.

IRWD. This level indicates that the transport is in rewind to beginning of tape sequence. The status goes true within 1 microsecond of the REWIND command and stays true until the tape returns to BOT. IRDY is false while the drive is rewinding.

IFPT. This level indicates that the loaded reel has no write permit ring, hence the write electronics are disabled, and write commands are prohibited. This status goes true during the tape-load sequence before the transport goes ready. This status is valid at all times when tape is loaded.

ILDP. This level is true when the load-point reflective marker is logically at the sensor. Since normal operation of the transport requires long ramps and repositions, when a command is executed at BOT, the ILDP status will remain true during the repositions. This is especially noticeable at 100 ips, when ILDP will remain true for 0.5 seconds after a command. If a REVERSE command runs into BOT, a command reset occurs with ILDP being set. If an illegal reverse command occurs at BOT, ILDP will remain true, but IFBY and IDBSY will sequence quickly (in less than 10 milliseconds) in order to retain compatibility with other commands. In order to erase Model F880 interface design, ILDP goes true only at the end of a REWIND and is not set even when crossed over physically by the transport if it is "repositioning" and is not logically at the BOT marker.

IEOT. This level indicates that the end-of-tape marker is past the read/write head. This signal will go false either on a rewind or by backing up over the EOT marker. This signal should be considered accurate only to a few inches.

ISPEED. This signal is asserted when the transport is operating in the high-speed mode. It is valid after IDBY goes true for the associated command and is latched until the next IGO command.

COMMAND DECODE

Basic transport commands are derived by decoding the REVERSE, WRITE, WRITE FILE MARK, EDIT, and ERASE interface lines. When a command is issued to the transport from the controller, the transport asserts the IFBY line and performs all timing and control functions necessary for the execution of the command.

The command lines are transferred to the command registers on the trailing edge of the IGO pulse. Any errors occurring during the execution of the command are reported to the controller via the IHER or ICER interface lines. Upon completion of the command, the IDBSY interface line goes false, notifying the controller that it may issue another command. All legal combinations of the interface lines are listed in Table 3. The interface lines used for command decoding are defined as follows:

a. REVERSE (IREV). This is a level which, when true, specifies reverse tape motion and when false, specifies forward tape motion.

b. WRITE (IWRT). This is a level which, when true, specifies the write mode of operation and when false, specifies the read mode of operation.

c. WRITE FILE MARK (IWFM). This is a level which, when true and IWRT is also true, causes a file mark to be written on the tape.

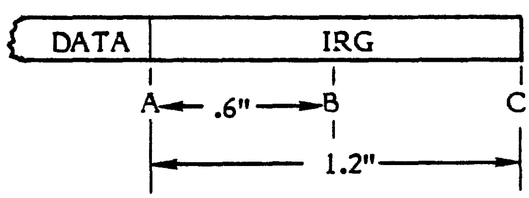
d. EDIT (IEDIT). When this level is true and IWRT is true, the transport operates in the edit mode.

e. ERASE (IERASE). This is a level which when true in conjunction with a true level on the IWRT line, causes the transport to execute an erase variable length command. The transport will be conditioned to execute a normal write command but no data will be recorded. A length of tape, as defined by ILWD, will be erased. Alternately, if IERASE, IWRT, and IWFM command lines are true, the transport is conditioned to execute a dummy write file mark command. A fixed length of tape of approximately 3.75 inches will be erased. When command lines IWRT, IWFM, IEDIT, and IERASE are true the transport is conditioned to execute a security erase operation. A length of tape, from the point where the command was issued to 5 feet beyond EOT, will be erased.

IGO. This is a pulse with a minimum duration of 1 microsecond. The trailing edge initiates tape motion of the selected ready transport, and latches the command into the formatting register. The formatter address lines must be held constant from the leading edge of IGO until IFBY goes false.

EXTENDED INTER-RECORD GAPS. During the write operation, if successive write commands cannot be issued within the normal reinstruct times, the Microstreamer may be commanded to continue running forward at the selected speed and not enter a repositioning cycle. This is accomplished by setting up the command lines for a normal write operation and asserting and holding the IGO interface signal in the true state until data is available at the interface. The IRG will be extended to no more than 100 inches; otherwise, the original gap will reposition automatically. If an IRG extension must be cancelled without a new WRITE command, a NO-OP command should be placed on the command lines before IGO is dropped. This will sequence IFBY and IDBSY but will not generate a tape command.

A second method is available to extend the Inter-Record Gap. When switch S1-3 is in the "ON" position, the drive will generate IRGs up to 1.2 inches in length.



The above figure shows how this option works. While streaming, if the next command is sent between points A and B the drive will generate the standard .6-inch IRG. If the next command is received between points B and C, the drive will begin writing the next record shortly after the command is received, generating an IRG length between 0.6 and 1.2 inches. If the next command is received after point C, the drive will reposition, then generate a standard 0.6-inch IRG.

The following are the basic commands that can be executed by the Model F880 tape transport. These commands are strobed by IGO:

READ. The Model F880 tape transport reads data records of file marks in either a forward or reverse direction, generating output data (eight lines plus parity) and data strobes to the controller. A read reverse into load point clears the formatter in the same way as does an IFEN reset. A read forward operation will be terminated if it occurs more than 15 feet beyond EOT. This prevents transport operation, which could cause the tape to run off the end of the supply hub. Recovery threshold is automatically lowered during a read operation in order to provide additional reliability. The write threshold is approximately 25%, while the read threshold drops to 10%. The beginning of a data block is detected by the presence of two or more data channel envelopes which exceed the threshold for 15 to 20 consecutive character intervals. For purposes of End-of-Block detection, the presence of less than two channels for 15 to 20 consecutive character intervals generates Gap Detect and drops IDBSY. During the read operation, error detection, data transfer, and file mark search occur. These IDBSY lines may be strobed by the trailing edge of IDBSY. They remain valid for at least 1 and no longer than 100 microseconds.

SPACE (Forward and Reverse). This operation is identical to a standard Read, except that Read Strobe and error flags are not generated.

FILE SEARCH. This signal initiates a space operation in either the forward or the reverse direction. The read data lines may be deactivated during file search operation, thereby ignoring any data that is written on the tape. The File Search command is terminated when:

a. A file mark is encountered.

b. Load point is encountered in a reverse direction.

c. The formatter is externally cleared.

d. The tape is past EOT by 15 feet or more.

WRITE (Forward only). The Microstreamer tape transport starts tape and generates the proper delay before transferring the data character, ensuring the generation of compatible inter-record gaps. When writing from load point, the dual-speed tape drive always generates the required PE identification burst. When IDBSY goes true, it indicates that the first IWSTR (write strobe) will occur no sooner than 40 character intervals later. The write operation continues until ILWD (Last Word) is received by the transport, which indicates the last character in the data block.

True write operations (not erase) generate an automatic read verification with the signals activated as in read commands, except that signal thresholds are higher (25%).

COMMAND	REVERSE	WRITE	WRITE FILEMARK	EDIT	ERASE
Read Forward	0	0	0	0	0
Read Reverse	1	0	0	0	0
Read Reverse Edit	1	0	0	1	0
Write	0	1	0	0	0
Write Edit	0	1	0	1	0
Write File Mark	0	1	1	0	0
Erase Variable Length	0	1	0	0	1
Erase Fixed Length	0	1	1	0	1
Security Erase	0	1	1	1	1
Space Forward	0	0	0	0	1
Space Reverse	1	0	0	0	1
File Search Forward	0	0	1	0	0
File Search Forward (Ignore Data)	0	0	1	0	1
File Search Reverse	1	0	1	0	0
File Search Reverse (Ignore Data)	1	0	1	0	1
No Operation Decode	0	0	0	1	1
3200 bpi*	1	0	1	1	1
1600 bpi (PE)*	0	0	1	1	1
Diagnostic Routine	0	0	1	1	0
Cycle Servos Exit Test 22 Any Command	0	0	0	0	0
Read Logic Margin Test	1	0	0	0	0
+5 Vcc Circuit Margin Test	0	1	0	0	0
Reset Margin Tests	1	1	0	0	0
Extended Status	0	0	1	0	0
*Microstreamer 2 only					

Table 3. Command Decoding

There are several variations to the basic write operation, as explained in the following subparagraphs.

EDIT. This signal is identical to basic write operation (or its variations), except that erase and write head currents are sequenced on to overlap the record being rewritten. This operation should be preceded by a read reverse or read reverse edit command to position in front of the block being edited. A block should be edited no more than three times to ensure proper gap spacing.

WRITE FILE MARK. This signal generates the compatible file mark and produces a (4.0-inch) IRG gap. The read file mark circuitry is activated. If a file mark status is not returned, the file mark should be backspaced and rewritten. File mark identification is reliable, since it is recovered by means of majority gating. All required and optional tracks are being written with 80 transitions (40 characters) of 0's. Channels 1, 3, and 4 are dc erased.

ERASE. This signal produces an erase field at the head with no data flux transitions. There are three variations to this command, as follows:

ERASE FIXED LENGTH: erases a fixed length of tape (4 inches).

ERASE VARIABLE LENGTH: continuous erasure until terminated by the controller. Length is determined by the last character flag used in a normal write operation.

SECURITY ERASE: erase forward to EOT and 5 feet beyond. No status lines are activated; other transports may be selected while a SECURITY ERASE is occurring. It is not necessary to wait for IFBSY to drop before selection of another transport, but it is preferable to wait for IDBSY. The transport may also be commanded to rewind after completion of SECURITY ERASE simply by issuing a REWIND. The transport will indicate an immediate rewinding status, dropping the IDBSY, IRDY, and IFBSY, but will complete SECURITY ERASE and a REWIND automatically. Other transports may be selected and used during execution of these commands.

NO-OPERATION DECODE. This command specifies no operation of the transport, and may be used to stabilize the command lines during extended inter-record gap operation.

3200 BPI. This is a command which, when initiated while at the BOT marker, specifies the 3200 bpi mode of operation. This option is available only on the Microstreamer 2.

1600 BPI. This is a command which, when initiated while at the BOT marker, specifies the PE mode of operation.

DIAGNOSTIC ROUTINE. This is a command which, when initiated, redefines the command coding to allow the selection of internal diagnostic routines while the transport is in the on-line mode. The subsequent command, which selects the specific diagnostic, must be available within 1 second of the ON-LINE DIAGNOSTIC command.

a. Cycle Servos: (Identical to Service Aid 22)

b. Read Logic Margin Test: (Identical to Service Aid 11)

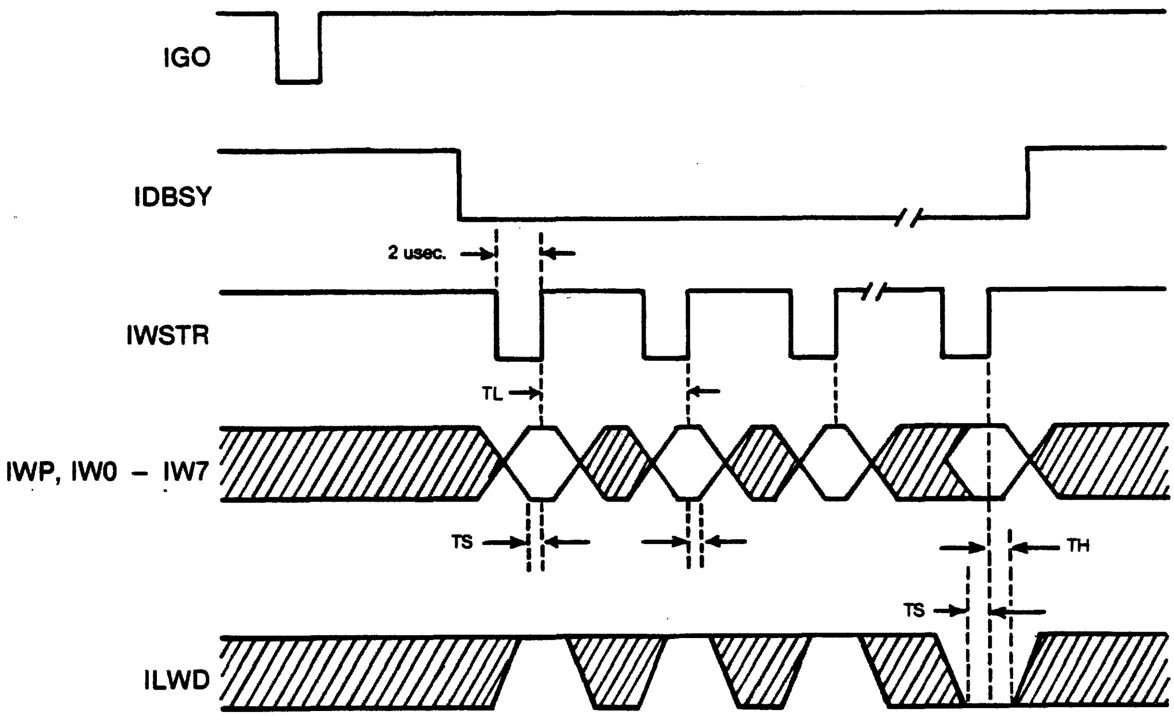
c. +5 Vcc Circuit Margin Test: (Identical to Service Aid 13)

d. Reset Margin Tests: (Identical to Service Aid 12)

e. Extended Status: The transport will output 128 bytes of information in the form of 256 nybbles (half-bytes) with the low nybble of each byte first. The user must pack the nybbles to restore the byte information.

READ/WRITE DATA LINES

IWSTR. This is a pulse indicating (trailing edge) that the character on the data lines has been written on tape and the next character is needed. The next-character and last-word flag must have a set-up time of at least 300 nanoseconds ahead of the trailing edge of the IWSTR. This timing is illustrated in Figure 11. The frequency of the WSTR pulse is proportional to tape speed multiplied by bit density. The width of IWSTR is 2.0 (±0.1)



TS = 300 NANOSECONDS (MINIMUM)

TH = 0 NANOSECONDS (MAXIMUM)

TL = 25.00 MICROSECONDS @ 25 IPS
= 6.25 MICROSECONDS @ 100 IPS

Figure 11. Write Strobe Timing

microseconds. The following equation represents the relationship WSTR frequency to tape speed and bit density:

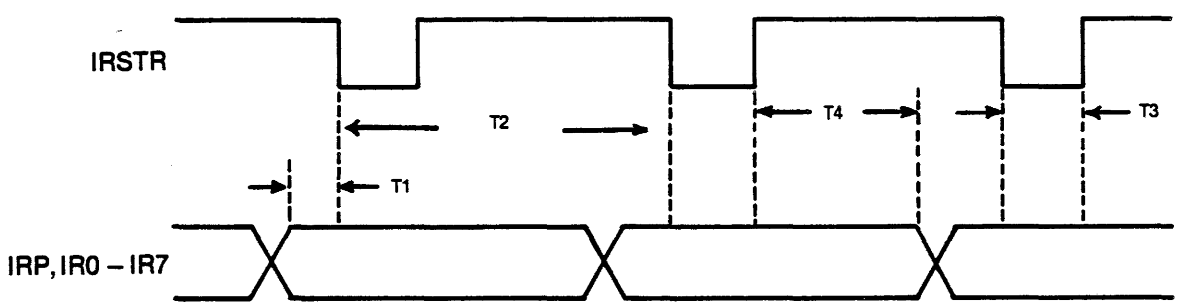
$$f_w = (v) \times (bpi)$$
e.g.: @ 100 ips PE
$$f_w = 160{,}000 \text{ bytes/second}$$

ILWD. This is a flag associated with the last write data character. The set-up time must be at least 300 nanoseconds ahead of the trailing edge of IWSTR. There is no hold time requirement. This flag is also used to terminate the WRITE command and Erase Variable Length command.

IWP, IW0-7. These are Write Data Lines. They must be set up with the same timing as ILWD.

IRSTR. This is a pulse which indicates that a read character is present on the controller interface. Note that although average long term transfer rate is the same as for write data, due to skew and velocity change, the instantaneous rate can be almost twice that of the write data. The fall of IDBSY should be used to indicate the end of the command, since not all read and write commands will produce read strobes. Figure 12 illustrates IRSTR timings.

IRP, IRO-7. These are read data lines to the controller. Timing is indicated in Figure 12. The read data lines overlap the IRSTR by at least 500 nanoseconds.



T1 (MINIMUM)	= 100 NANOSECONDS
T2 (MINIMUM)	= 3.5 MICROSECONDS @ 100 IPS = 14 MICROSECONDS @ 25 IPS
T2 (AVERAGE)	= 6 MICROSECONDS @ 100 IPS = 25 MICROSECONDS @ 25 IPS
T3 (NOMINAL)	= 1.5 MICROSECONDS (1.5 MS)
T4 (MINIMUM)	= 500 NANOSECONDS

Figure 12. Read Strobe Timing

PLUG NO.	LIVE PIN	GRD PIN	SIGNAL	TYPE	FUNCTION
PI	4	3	Last Word (ILWD)	Level	When true, during write, indicates that the character to be strobed into the formatter is the last character of the record.
PI	6	5	Write Data 4 (IW4)	Level	-
PI	8	7	Initiate Command (IGO)	Pulse	With MTSU ready and on line, the command specified on the command lines is initiated on the trailing edge of IGO.
PI	10	9	Write Data 0 (IW0)	Level	-
PI	12	11	Write Data I (IWI)	Level	-
PI	18	17	Reverse (IREV)	Level	When true, with MTSU ready and online, causes tape to move in the reverse direction, and when false, causes tape to move in the forward direction.
PI	20	19	Rewind (IREW)	Pulse	With MTSU ready, online, and not at BOT, this pulse causes tape to rewind in reverse direction.
PI	22	21	Write Data Parity (IWP)	Level	-

Table I-2. Interface Input Connections

PLUG NO.	LIVE PIN	GRD PIN	SIGNAL	TYPE	FUNCTION
P1	24	23	Write Data 7 (WD7)	Level	-
P1	26	25	Write Data 3 (IWD3)	Level	-
P1	28	27	Write Data 6 (IWD6)	Level	-
P1	30	29	Write Data 2 (IWD2)	Level	-
P1	32	31	Write Data 5 (IWD5)	Level	-
P1	34	33	Write (IWRT)	Level	When true, specifies the write mode of operation, and when false, specifies the read mode of operation.
P1	40	39	Erase (IERASE)	Level	When true, with MTSU on line, specifies the erase mode of operation
P1	42	41	Write File Mark (IWFM)	Level	When true, and IWRT is also true, causes a file mark to be written on the tape.
P2	18	17	Formatter Enable (IFEN)	Pulse	With MTSU, on line, and IDBSY true, the pulse will reset a command "runaway" condition.

Table 1-2. Interface Input Connections (Continued)

PLUG NO.	LIVE PIN	GRD PIN	SIGNAL	TYPE	FUNCTION
P2	24	23	Rewind/Unload (IREW)	Pulse	When true, with MTSU on line, causes the selected unit to go off line and rewind tape to the BOT marker. The MTSU will unload the tape when BOT marker is detected.
P2	50	49	High Speed Select (IHISP)	Level	When asserted 1 microsecond ahead of the trailing of IGO, causes the transport to operate at 100 ips.
P1	46	45	Transport Address 0 (ITAD0)	Level	The MTSU is selected by a combination of the levels on the ITAD0, ITAD1, and IFAD lines and the position of switches S1, S2, and S4. Refer to Volume I, Section II.
P2	46	45	Transport Address 1 (ITAD1)	Level	–
P2	48	47	Formatter Address (IFAD)	Level	–
P1	38	37	Edit (IEDIT)	Level	When true, with IWRT true, causes the MTSU to operate in the edit mode.

Table 1-2. Interface Input Connections (Continued)

PLUG NO.	LIVE PIN	GRD PIN	SIGNAL	TYPE	FUNCTION
P1	2	1	Formatter Busy (IFBY)	Level	Goes true on trailing edge of IGO, when a command is received by the MTSU, and remains true for duration of the command.
P1	48	47	Read Data 2 (IR2)	-	-
P1	50	49	Read Data 3 (IR3)	-	-
P2	1	-	Read Data Parity (IRP)	-	-
P2	2	-	Read Data 0 (IR0)	-	-
P2	3	-	Read Data (IR1)	-	-
P2	4	-	Load Point (ILDP)	Level	True when BOT marker is positioned in front of photosensor.
P2	6	5	Read Data 4 (IR4)	-	-
P2	8	7	Read Data 7 (IR7)	-	-
P2	10	9	Read Data 6 (IR6)	-	-

Table 1-3. Interface Output Connections

PLUG NO.	LIVE PIN	GRD PIN	SIGNAL	TYPE	FUNCTION
P2	12	11	Hard Error (IHER)	Pulse or Level	When true, indicates that an uncorrectable read error has been detected by the MTSU.
P2	14	13	File Mark (IFMK)	Pulse	When true indicates that the MTSU has detected a file mark.
P2	16	15	Indentification (IIDENT)	Level	Goes true, when the BOT marker passes over the read head, to identify 1600 bpi (PE) tapes.
P2	20	19	Read Data 5 (IR5)	-	-
P2	22	21	End of Tape (IEOT)	Level	When true, indicates that the EOT marker has been detected. IEOT remains true until the EOT marker is sensed in the reverse direction.
P2	28	27	Ready (IRDY)	Level	True when load sequence is complete and MTSU is on line and not rewinding. (MTSU is ready to receive a remote command.)

Table 1-3. Interface Output Connections (Continued)

PLUG NO.	LIVE PIN	GRD PIN	SIGNAL	TYPE	FUNCTION
P2	30	29	Rewinding (IRWD)	Level	True when MTSU is selected and a reel of tape without a write-enable ring is mounted on the MTSU.
P2	34	33	Read Strobe (IRSTR)	Pulse	Goes true for each data character read from the tape.
P2	36	35	Write Strobe (IWSTR)	Pulse	When true (trailing edge), indicates that the character on the data lines has been written on tape and the next character is needed.
P2	38	37	Data Busy (IDBSY)	Level	True when the tape on the selected transport has reached operating speed.
P2	40	39	High Speed Status (ISPEED)	Level	When true, indicates that the MTSU is operating in the high-speed mode. (It is also true during 3200 bpi operation.)
P2	42	41	Corrected Error (ICER)	Pulse	When true indicates that a single-track dropout has been detected, and the MTSU is performing error correction.
P2	44	43	On Line (IONL)	Level	When true, indicates that the selected MTSU is under remote control. When false, MTSU is under manual control.

Table I-3. Interface Output Corrections (Continued)

The Model F880 transport incorporates several different diagnostics tests and service aids. These diagnostic aids are designed to protect (during certain fault conditions) the tape from damage and also provide alignment and test states for preventive maintenance.

The diagnostic and service aids are designed to be used by experienced service technicians and, therefore, a special code must be keyed in through the front panel control switches to allow access to the various test functions.

As shown in Figure 22, the front panel switches are assigned numeric values of one through five and the corresponding indicators are assigned binary numbers to display results of the various tests.

The code to access the various tests routines is divided into the following parts: An ID Code, a Service Aid Number, and an Execution Command.

The ID code (4,5) is the same for all Service Aids and entered by depressing switch 4 (WRTEN/TEST) followed by switch 5 (HI DEN).

After entering the ID code, the Service Aid Number must be keyed in. Service Aids are always two digit codes.

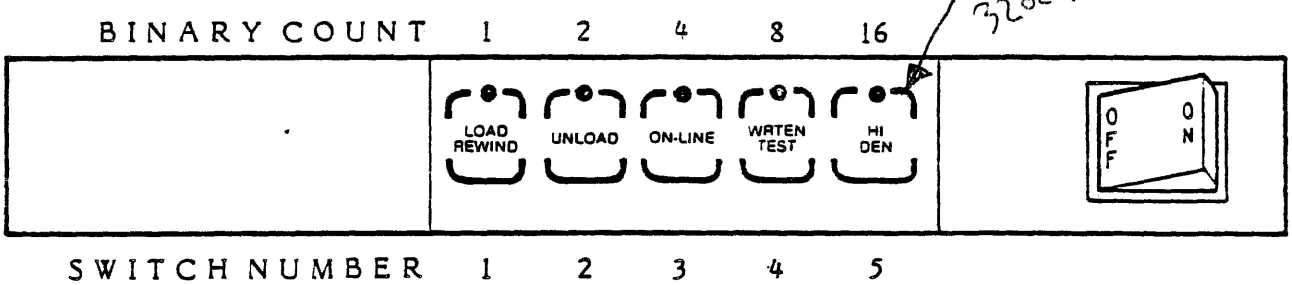
After entering the two-digit Service Aid Number, the Execution Command, switch 5 (HI DEN) must be depressed.

An example:

To call for Service Aid 11 the switch sequence would be:

ID Code	...Depress WRTEN/TEST	(4)
	Depress HI DEN	(5)
Service Aid Number	...Depress LOAD/REWIND	(1)
	Depress LOAD/REWIND	(1) (2nd time)
Execute	...Depress HI DEN	(5)

on for 3200 B.P.I



3 4 2 for Interlock
4 5 Lock out

Figure 22. Front Panel Switches

Hi Dens + Load to Take up tension

OPERATOR FAULT INDICATORS

The front panel indicators also provide fault status information to the operator.

There are two groups of fault indications.

a. Those which are normally caused by the operator and can be avoided by following the proper operating procedure.

b. Those which generally are machine malfunctions and require correction by an experienced service technician.

The following fault indications require operator intervention:

INDICATION	ERROR CONDITION
All indicators flashing	After four automatic retrys the transport did not successfully complete the load sequence. The tape leader should be checked for excessive damage. If a second attempt at loading fails the unit must be manually loaded.
All indicators except LOAD flashing	The BOT marker was not detected within the first 35 feet of tape.
All indicators except UNLOAD flashing	Tape reel was inserted upside-down. Write ring must be down.
All indicators except ON-LINE flashing	A load operation was attempted with the front-panel door or top cover in the open position.
All indicators except TEST flashing	A load operation was attempted without a reel of tape inserted in the unit.

Table 6. Operator Fault Codes

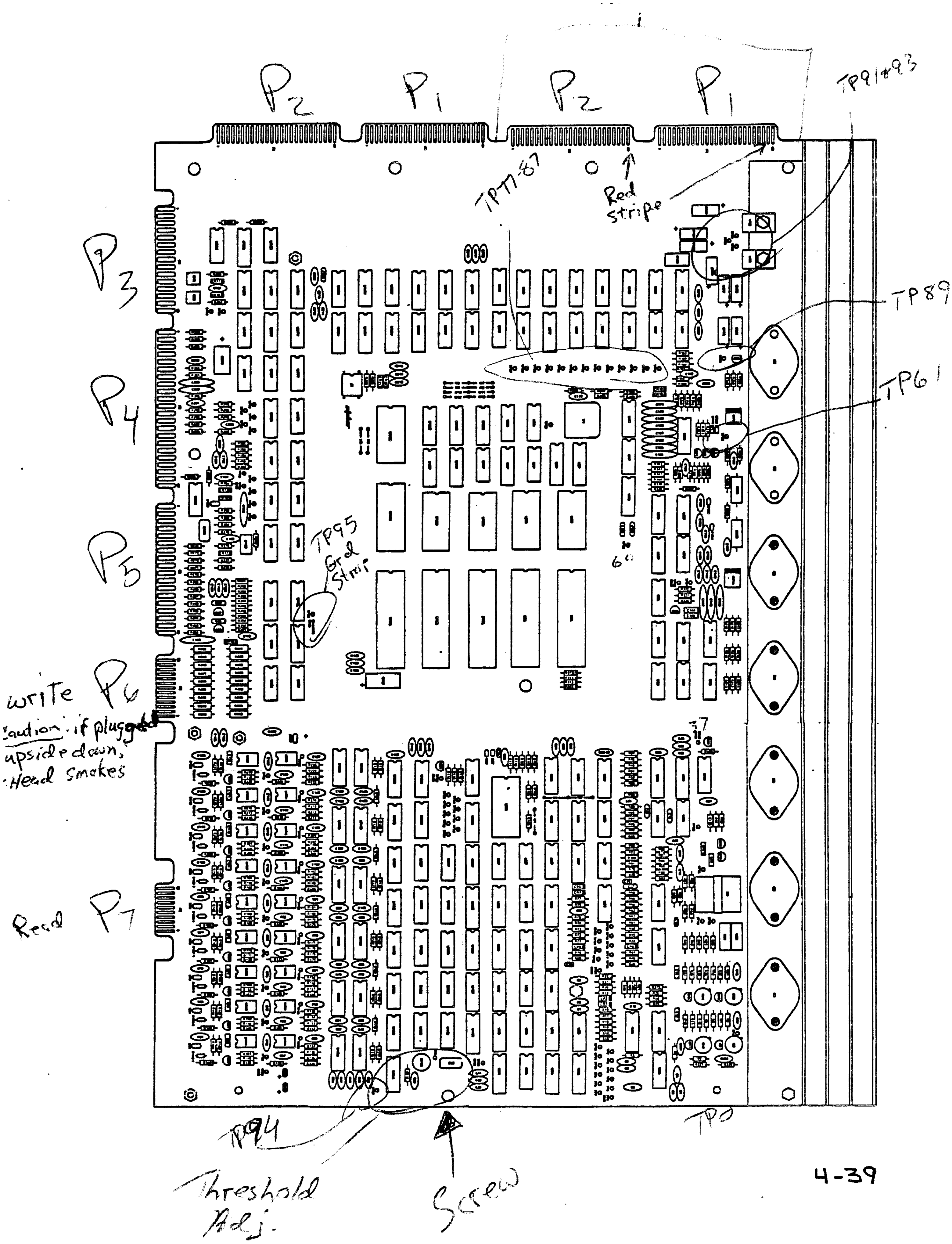
The following error conditions require intervention by an experienced service technician:

INDICATION	CONDITIONS
LOAD indicator flashing	Not Used
UNLOAD indicator flashing	Not Used
LOAD and UNLOAD indicators flashing	The Model F880 detected more than 3700 feet of tape beyond the BOT marker.
ON-LINE indicator flashing	The tension arm swing exceeded the range of normal operation during the load sequence.
LOAD and ON-LINE indicators flashing	The Model F880 received an interface command prior to completion of the previous command.
UNLOAD and ON-LINE indicators flashing	The Model F880 received a write command with a write-protected reel of tape loaded on the transport.
LOAD, UNLOAD, and ON-LINE indicators flashing	An illegal or undefined command was received by the Model F880.
TEST indicator flashing	A failure of the supply hub locking mechanism occurred.
LOAD and TEST indicators flashing	Not Used
UNLOAD and TEST indicators flashing	The auto-zero function of the digital-to-analog converter failed during the power-up sequence.
LOAD, UNLOAD, and TEST indicators flashing	Not Used
ON-LINE and TEST indicators flashing	Supply reel was not seated on hub, or a failure of the file protect circuit occurred.
LOAD, ON-LINE, and TEST indicators flashing	Supply reel did not remain unlocked during tape unload operation.

Table 7. System Fault Codes

INDICATION	CONDITIONS
UNLOAD, ON-LINE, and TEST indicators flashing	Because of a controller error, tape travel beyond the EOT marker exceeded 18 feet.
LOAD, UNLOAD, ON-LINE, and TEST indicators flashing	Not Used
HI DEN indicator flashing	Not Used
LOAD and HI DEN indicators flashing	The supply servo tension arm has exceeded its free travel limits during any operation except those functions of the load and unload sequence where tape tension is not under arm control.
UNLOAD and HI DEN indicators flashing	Tape speed variations in excess of the ANSI maximum of ±10% deviation from the normal operating speed occurred. This test is also performed as part of the power-up diagnostic routine and may be bypassed to allow access to other diagnostic tests by depressing the TEST switch for 5 seconds during power up.

Table 7. System Fault Codes (continued)


P2
P1
P2
P1
TP91 & 93
TP77-87
Red stripe
TP89
TP61
P3
P4
P5
TP95
Grd Strip
write
P6
Caution: if plugged upside down, Head smokes
Read
P7
TP94
Threshold Adj.
Screw
TP0

CIPHER DATA PRODUCTS DIP SWITCH SETTINGS FOR U8W

SWITCH	SH	OPEN	CLOSED	FUNCTION
1-16	3		XX	FORMATTER ADDRESS (SEE TABLE)
2-15	3		XX	TRANSPORT ADDRESS (SEE TABLE)
3-14	2	XX		RESERVED
4-13	3		XX	TRANSPORT ADDRESS (SEE TABLE)
5-12	6	XX		C = EXTERNAL PARITY SELECT (S6 OPEN)
6-11	6		XX	C = INTERNAL PARITY GENERATION (S5 OPEN)
7-1Ø		XX		RESERVED
8-Ø9		XX		RESERVED

C = CLOSED

ADDRESS LINE DECODING TABLE

IFAD	ITAD Ø	ITAD 1	S1	S2	S4	ADDRESS
Ø	Ø	Ø	1	1	1	Ø
Ø	Ø	1	1	1	Ø	1
Ø	1	Ø	1	Ø	1	2
Ø	1	1	1	Ø	Ø	3
1	Ø	Ø	Ø	1	1	4
1	Ø	1	Ø	1	Ø	5
1	1	Ø	Ø	Ø	1	6
1	1	1	Ø	Ø	Ø	7

Ø = FALSE INTERFACE LEVEL Ø = OPEN
1 = TRUE INTERFACE LEVEL 1 = CLOSED

W PATCH LIST

PATCH	IN	LOC	SHEET	PATCH	IN	LOC	SHEET
W 1	*		9	W 2		U6G	9/F
W 3		U7G	9/F	W 4		U14P	6/F
W 5		U14P	6/F	W 6	*	U11T	6
W 7		U1ØT	6	W 8	*	U11T	6
W 9		U1ØT	6	W1Ø	*	U11T	6
W11		U1ØT	6	W12	*	U11T	6
W13		U1ØT	6	W14		U8N	2
W15	XX	U8N	2	W16	XX	U9T	2
W17		U8T	2	W18		U8T	2
W19	XX	U9T	2	W2Ø	**		3
W21	*		3				

* NO PATCH / CONTINUITY
** NO PATCH / NO CONTINUITY

CIPHER DATA PRODUCTS TEST POINTS

TP	SH	LOC	NAME	TP	SH	LOC	NAME	TP	SH	LOC	NAME
0.	(4)	Q6	V20P	1.	(5)		GND	2.	(8)	U11F6	CLR
3.	(8)	U11C6	DCLK 1	4.	(8)	U11C3	CLR	5.	(8)	U12E11	CLR
6.	(4)	U3A12	T1DR	7.	(8)	U11B11	CLR	8.	(8)	U11B3	CLR
9.	(8)	U11E6	CLR	10.	(8)	U12E3	DCLK 2	11.	(8)	U11E11	CLR
12.	(4)	U3A3	VIN 7	13.	(4)	Q3-Q4	SMDH	14.	(4)	Q1-Q2	TMDH
15.	(5)	Q17	V20P	16.	(4)	U3A4	T1DR	17.	(4)	U3E3	VT
18.	(4)	U3E12	IS	19.	(4)	U3E10	VS	20.	(4)	U5E12	VOUT1
21.	(5)		GND	22.	(4)	U3A10	T1DR	23.	(4)	U3E4	IT
24.	(4)	U3D3	S1DR	25.	(4)	U3D10	S1DR	26.	(5)		GND
27.	(8)	U13B7	CHDROP 0	28.	(8)	U13F9	CHDROP 2	29.	(8)	U13F7	CHDROP 3
30.	(8)	U13E9	CHDROP P	31.	(8)	U13B9	CHDROP 6	32.	(8)	U13E7	CHDROP 1
33.	(8)	U13H9	CHDROP 5	31.	(8)	U13C7	CHDROP 4	35.	(8)	U13H7	CHDROP 7
36.	(5)		GND	37.	(5)		GND	38.	(5)		GND
39.	(7)	U19A6	HEAD 4	40.	(7)	U17A7	RDATA4	41.	(7)	U19B6	HEAD 6
42.	(7)	U17B7	RDATA6	43.	(7)	U19C6	HEAD 0	44.	(7)	U17C7	RDATA0
45.	(7)	U19D6	HEAD 1	46.	(7)	U17D7	RDATA1	47.	(7)	U19E6	HEAD 2
48.	(7)	U17E7	RDATA2	49.	(7)	U19F6	HEAD P	50.	(7)	U17F7	RDATAP
51.	(7)	U19G6	HEAD 3	52.	(7)	U17G7	RDATA3	53.	(7)	U19H6	HEAD 7
54.	(7)	U17H7	RDATA7	55.	(7)	U19I6	HEAD 5	56.	(7)	U17I7	RDATA5
57.	(7)		RNOISE	58.	(5)	U3L10	RES*	59.	(5)		GND
60.	(3)	U4R8	RD	61.	(4)	Q5	V20M	62.	(2)	U8R4	CLK8M
63.	(5)	Q20	+5R	64.	(5)	U20N10	V1N 2	65.	(5)	U20N12	P4-20
66.	(5)		GND	67.	(5)	U18T6	LOAD/CLR	68.	(5)	U20N3	P4-6
69.	(5)	U19T14	P2A0	70.	(5)	U19T1	P1B0 (B0)	71.	(5)	U19T13	P2A1
72.	(5)	U19T2	P1B1 (A0)	73.	(5)	U18R10	ET/EP	74.	(5)	Q39	HUB LOCK
75.	(5)	Q40	DOOR LOCK	76.	(5)		GND	77.	(3)	U3V4	P0ARDY

CIPHER DATA PRODUCTS TEST POINTS

TP	SH	LOC	NAME	TP	SH	LOC	NAME	TP	SH	LOC	NAME
78.	(3)	U7V5	ILDP	79.	(3)	U6V2	W21	8Ø.	(3)	U6V12	ONLSEL
81.	(3)	U2V6	IONL	82.	(3)	U7V7	IRDY	83.	(3)	U7V12	IFPT
84.	(3)	U7V1Ø	IFBY	85.	(3)	U7V2	IEOT	86.	(3)	U7V15	IDBSY
87.	(3)	U1ØV8	IRWD	88.	(5)		GND	89.	(5)	Q7	+5V
9Ø.	(5)	VR1	-12V	91.	(5)		GND	92.	(5)	VR2	+12V
93.	(9)	U9F8	PECLK	94.	(7)	R115	VOUTØ	95.	( )	CHASSIS	GND

PLUG PIN NUMBERING CIPHER

PLUG 1		PLUG 2	
PIN #	SIGNAL NAME	PIN #	SIGNAL NAME
1	*NOTE	1	IRDP
2	IFBY	2	IRDØ
3		3	IRD1
4	ILWD	4	ILDP
6	IW4	6	IRD4
8	IGO	8	IRD7
1Ø	IWØ	1Ø	IRD6
12	IW1	12	IHER
14	RESERVED	14	IFMK
16	RESERVED	16	IDENT
18	IREV	18	IFEN
2Ø	IREW	2Ø	IRD5
22	IWP	22	IEOT
24	IW7	24	IRWU
26	IW3	26	
28	IW6	28	IRDY
3Ø	IW2	3Ø	IRWD
32	IW5	32	IFPT
34	IWRT	34	IRSTR
36		36	IWSTR
38	IEDIT	38	IDBSY
4Ø	IERASE	4Ø	IONL
42	IWFM	42	ICER
44	BLANK	44	
46	ITADO	46	ITADI
48	IRD2	48	IFAD
5Ø	IRD3	5Ø	IHISP

*NOTE Odd numbered pins are ground unless specified otherwise.

PLUG 3

PIN #	SIGNAL NAME
1	GND RTN
2	-2ØVDC
3	GND RTN
4	+2ØVDC
5	GND RTN
6	+9VDC
7	GND RTN
8	VDC (V3OM)
9	GND RTN
1Ø	VDC (V3ØP)
11	
12	7VAC
13	LOCK 2Ø
14	DOORLOCK
15	HUBLOCK

PLUG 4

PIN #	SIGNAL NAME
1	FPT RING SENSOR
2	FPT RING SENSOR (+5)
3	OPTICAL TACH
4	OPTICAL TACH (+5)
5	GND
6	SERVO POSITION (?)
7	FPT RING SENSOR
8	OPTICAL TACH
9	TAPE IN PATH SENSOR
1Ø	OPTICAL TACH
11	TAPE IN PATH SENSOR
12	TAPE IN PATH SENSOR (+5)
13	DOOR SENSE
14	DOOR SENSE
15	BOT EOT SENSOR (+5)
16	BOT EOR SENSOR
17	BOT EOT SENSOR (VINØ)
18	BOT EOT SENSOR (VIN1)
19	GND
2Ø	SERVO POSITION (?)
21	GND
22	GND

PLUG 5		PLUG 6	
PIN #	SIGNAL NAME	PIN #	SIGNAL NAME
1	TO SSR BLOWER CONTROL	1	WHEADCT
2	" "	2	CHAN 4
3	TUMH	3	CHAN 4
4	SUML	4	CHAN 6
5	TUML	5	CHAN 6
6	SUMH	6	CHAN Ø
7	GND	7	CHAN Ø
8	TACTILE SWITCHES	8	CHAN 1
9	" "	9	CHAN 1
1Ø	" "	1Ø	CHAN 2
11	" "	11	CHAN 2
12	" "	12	CHAN P
13	" "	13	CHAN P
14	" "	14	CHAN 3
15	" "	15	CHAN 3
16	" "	16	CHAN 7
17	" "	17	CHAN 7
18	+5V	18	CHAN 5
19		19	CHAN 5
		2Ø	WHEADCT
		21	ERASE RTN (GND)
		22	ERASE DRV
		23	
		24	
		25	

PLUG 7

PIN #	SIGNAL NAME
1	RP HEAD 4
2	GND
3	RP HEAD 6
4	RM HEAD 4
5	RP HEAD Ø
6	RM HEAD 6
7	RP HEAD 1
8	RM HEAD Ø
9	RP HEAD 2
1Ø	RM HEAD 1
11	RP HEAD P
12	RM HEAD 2
13	RP HEAD 3
14	RM HEAD P
15	RP HEAD 7
16	RM HEAD 3
17	RP HEAD 5
18	RM HEAD 7
19	GND

CIPHER_DATA_PRODUCTS

F5880_MTSU_LAB

A. Refer to section 3 in Cipher Technical Manual for exercising the following Diagnostic routines with Tape Unloaded. (NOTE: 4 diasbles Service Aid)

Tape Unloaded

1. Defeat Interlocks with Service Aid 33 (4-5-3-3-5)

2. Exercise Service Aid 11 (4-5-1-1-5) while refering to Statement Numbers beginning with SE1000 - p. 3-20.

~~3.~~ Exercise Service Aid 12 (4-5-1-2-5) and Service Aid 13 (4-5-1-3--5) while refering to Statement Number beginning with WR1000 - p. 3-28.

4. Exercise Service Aid 14 (4-5-1-4-5) while refering to Statement Numbers beginning with TA1000 - p. 3-31.

~~5.~~ Exercise Service Aid 21 (4-5-2-1-5) while refering to Statement Numbers beginning with TI1000 - p. 3-34.

6. Exercise Service Aid 22 (4-5-2-2-5) and Service Aid 23 (4-5-2-3-5) while refering to Statement Numbers beginning with BE1000 - p. 3-37.

7. Exercise Service Aid 24 (4-5-2-4-5) while refering to Statement Numbers beginning with CA1000 - p. 3-38.

8. Exercise Service Aid 31 (4-5-3-1-5) while refering to Statement Numbers beginning with HS1000 - p. 3-40.

9. Exercise Service Aid 32 (4-5-3-2-5) while refering to Statement Numbers beginning with HD1000 - p. 3-43.

~~10.~~ Exercise Service Aid 33 (4-5-3-3-5) while refering to Statement Numbers beginning with LD1000 - p. 3-18.

11. Exercise Service Aid 34 (4-5-3-4-5) while refering to Statement Numbers beginning with BL1000 - p. 3-44.

B. The following Diagnostics are run with Tape Loaded.

1. Exercise Service Aid 11 (4-5-1-1-5) Probably used with contoller generated commands.

2. Exercise Service Aid 12 (4-5-1-2-5) to disable Service Aid 11.

3. Exercise Service Aid 13 (4-5-1-3-5) Probably used with contoller generated commands.

4. Exercise Service Aid 14 (4-5-1-4-5) to disable Service Aid 13.

5. Exercise Service Aid 22 (4-5-2-2-5)
   (Does this enable 100 IPS mode?)

3. Exercise Service Aid 23 (4-5-2-3-5) while refering to Statement Numbers beginning with RF1000 - p. 3-48. This also enables 25 IPS mode.

C. Adjustments

1. Exercise Service Aid 21 (4-5-2-1-5) while refering to paragraph 4-12 on p. 4-9 Read Threshold Adjustment.
2. Supply Hub - p. 4-~~?~~. 19
3. Takeup Hub - p. 4-~~?~~. 27
4. Compliance Arm - p. 4-28.
5. Takeup Motor - Note what is required to replace - p. 4-39.
6. Head Azimuth - p. 4-~~?~~. 52

STAPE tests the IOU-49 STREAMING TAPE DRIVE CONTROLLER.

SUBJECT DEVICE : IOU-49

ROM-version: -

CONTROLLER : -
Board-ver. : -
ROM-version: -

SYSTEM REQUIRED
CPU-type : Q29Q64
Min. memory: 32K bytes

This program tests the IOU-49 streaming tape drive controller. One or more Cipher tape drives may be configured for this test, each with its own IOU-49.

Load the program using the standard ATP loading procedure, with the name STAPE.

The program will ask for the devices to be tested. Each device will be checked to verify that it is an IOU-49 and is operational. The IOU-49 rom date and version will be displayed for each device entered.

Next the question "SINGLE TEST ?" will be asked. Answer using Flag 2 (yes) or Flag 3 (no). If the selection is yes, the following list will be displayed:

TEST BLOCK NAMES ARE:

UNL	WRITE PROTECT AND UNLOAD TEST	(MANUAL)
END	END OF TAPE TEST	(MANUAL)
PRE	PRELIMINARY FUNCTIONAL TEST	(AUTO)
PH1	WRITE ENTIRE TAPE TEST	(AUTO)
PH2	READ ENTIRE TAPE TEST	(AUTO)
PH3	STREAMING TEST	(AUTO)

Enter the desired test name and the program will continue. If the single test option is not selected the program will execute all the automatic tests in order. Next enter the iteration count. This is the number of times the test will be executed for each controller. Specify whether to halt after an error by answering "yes" or "no" (f2 or f3) to the question "HALT AFTER ERROR".

The program will now ask "OUTPUT DEVICE:". Enter a valid printer address to record test names, iteration counts and error messages as they occur. The terminal will also display this information.

Finally a "TEST MESSAGE" may be recorded on the printer at the beginning of the test (as well as the control line of a VT3). Answer "yes", as before, to allow entry of this message.
A description of all the tests follows, first the MANUAL tests (executed only by specifing "SINGLE TEST"), and then the AUTOMATIC section will be described.

A. MANUAL SECTION

1. WRITE PROTECT AND UNLOAD TEST
   a. A write is attempted with the tape write protected, this causes an automatic unload.
   b. The tape is manually reloaded with a write ring.
   c. An Unload command is executed.
   d. The tape is manually reloaded.

2. END OF TAPE TEST
   a. Maximum length blocks are written to the end of tape mark. The total block count is displayed. This also serves as a test of overall tape quality.

B. AUTOMATIC SECTION

1. PRELIMINARY TEST
   a. Write 10 maximun length blocks of channel-test data in IPL mode. Channel test data consists of the following 26 byte pattern:

      $0102040810204080C0E0F0F8FC
      FEFDFBF7EFDFBF7F3F1F0F0703

   b. Rewind, read and verify each block in IPL mode.
   c. Rewind and do a Read Check of each block.
   d. Backspace and Erase the 10th block.
   e. Backspace and rewrite the 10th block and 2 end of file marks.
   f. Rewind and search for 2 file marks.
   g. Rewind, read and verify each block in IPL mode.
   h. Rewind and write 10 maximum length blocks of worst-case data in Buffer mode (with interrupts enabled). Worst-case data is the pattern $B6DB6D.
   i. Rewind, read and verify each block in Buffer mode (with interrupts enabled).
   j. Rewind, Stream write 10 maximum length blocks of worst-case data.
   k. Do a reverse backup check.
   l. Do a forward backup check.
   m. Repeat the above sequence at 50ips and then at 100ips, (the first sequence is at 25ips).

2. PHASE 1 - IPL MODE WRITE
   a. Write incremental block lengths. Each block 1 byte greater than the preceding. The data pattern is increased by 1 each block, from all $00's to all FF's.
   b. Write 26 blocks of increasing length, each block more than the last by the amount of the next value in the 26 byte channel test pattern (previous page). The last block written is the maximum length of 16k ($4000). The data pattern is the channel test pattern repeated.
   c. Write decremental block lengths to the end of tape mark. Data written is the worst-case pattern, $B6DB6D, repeated.

3. PHASE 2 - IPL MODE READ
   a. Data written in Phase 1 are read back and verified.

3. PHASE 3 - STREAM MODE WRITE
   a. Write 512 maximum length blocks of worst-case data.
   b. Do a reverse backup check.

At the end of the test sequence the iteration count is incremented and displayed along with the number of the device just tested. When the count entered at the start of the test is reached, and the last device has been tested, the test is complete.

Errors are reported either by a simple message, in the case of a data miscompare or timeout of some kind, or by the display of the controller's Read Id bytes, with their interpretation, in the case of a status error. Examples are shown on the next page.

Examples:

```
ERROR #01
INCORRECT READ DATA

ERROR #02  TST:PRE  ITR:01  BLK:0001  CTL:20  SPD:025
 MODE:IPL  STO:84   EXT 15:80 16:00 17:00 18:00 19:00
TAPE INOPERABLE
```

In the first example, above, no status error has occurred, but the data read back from the tape did not agree with what was written. The second example is an error reported by the controller. The fields displayed are as follows:

1. Error number.
2. Test Block in progress.
3. Test iteration number.
4. Last block written or read.
5. Last control command sent to controller.
6. The current speed in inches per second.
7. The mode of operation (Ipl, Buffer or Streaming).
8. Status 0.
9. External status bytes.
10. A message (or messages) derived from the external status bytes.

All errors are numbered and a device is aborted should the limit of 9 errors be reached in any one test sequence. After an error, the test in which it occured is restarted from the beginning.

The first line of the terminal's screen indicates program information as follows:

1. The block number of the current read or write.
2. The address of the device being tested.
3. The name of the test block being run.
4. The number of the test iteration with the count entered at the beginning of the test - seperated by a slash.
5. An "h" in the right corner, if the halt on error option was selected.

Example:

```
BLK=1234  ADR=4  TST=PRE  ITR=02/04h
```