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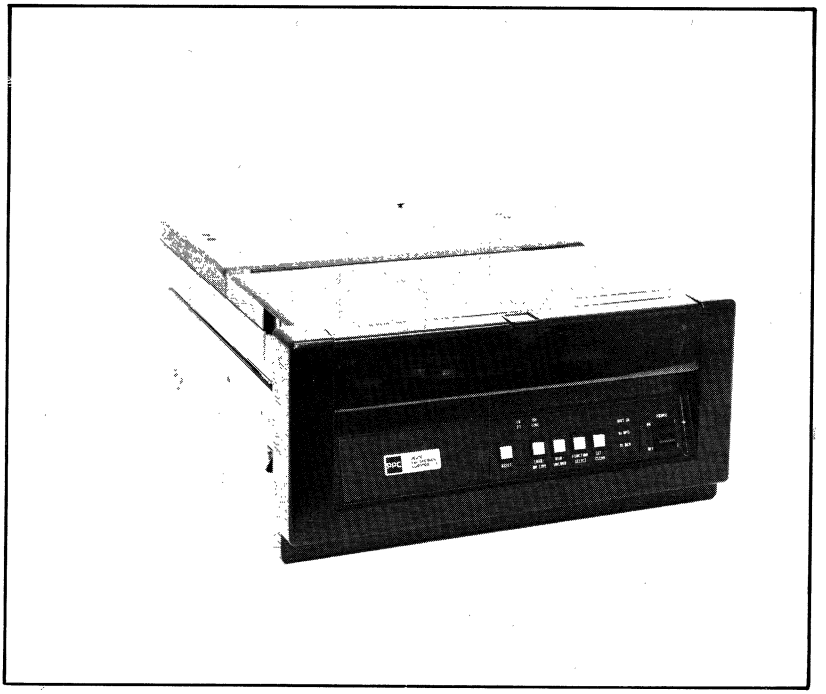

# MODEL FS1000 FORMATTED TAPE DRIVE
# INSTALLATION AND OPERATION MANUAL NO. 111311

Revision E, August 1985

## FOREWORD

This manual provides operating instructions for the Formatted Tape Drive, Model FS1000, manufactured by Pertec Peripherals Corporation (PPC™), Chatsworth, California.

The contents include a general description of the drive, specifications, installation, and operating instructions.


### WARNING

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for Class A computing devices pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

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# SECTION I
# GENERAL DESCRIPTION AND SPECIFICATIONS

## 1.1 INTRODUCTION

This section provides a physical description, functional description, and specifications for the Formatted Tape Drive, Model FS1000, manufactured by Pertec Peripherals Corporation (PPC™), Chatsworth, California.

## 1.2 PURPOSE OF EQUIPMENT

The tape drive has the capability of recording digital data on 9-track magnetic tape. The unit provides two operating modes. In the streaming mode, tape is continuously moving at speeds of 0.635 m/s or 2.54 m/s (25 or 100 ips) and data is recorded in 63 c/mm (1600 cpi) Phase Encoded ANSI/IBM-compatible format. An additional speed of 1.27 m/s (50 ips) records at 126 c/mm (3200 cpi). The drive can also be used in a start/stop mode, utilizing tape repositioning to achieve compatible interblock gaps. Data recorded in the 63 c/mm (1600 cpi) mode of operation can be recovered when the tape is played back on an IBM digital tape drive or its equivalent.

The drive can also read data from magnetic tape that has been recorded in 9-track, Phase Encoded, ANSI/IBM-compatible format. Data can be read in either the streaming or start/stop modes at tape speeds of 0.635 or 2.54 m/s (25 or 100 ips) as specified in the preceding paragraph.

The drive is equipped with a dual-stack head that has the read and write gaps separated by 7.6 mm (0.3 inch). The dual-stack head configuration allows simultaneous write and read operations to be performed. Data recorded by the write head can be read by the read head after the tape has moved approximately 7.6 mm (0.3 inch). This head configuration allows data to be read for verification immediately after being written.

The drive operates directly from 100, 120, 220, or 240v single phase power with a frequency between 48 and 62 Hz.

## 1.3 MODEL IDENTIFICATION

The FS1000 tape drive is supplied in a single configuration identified as Model FS1511-19. This drive is equipped with the following standard features.

- 63 c/mm and 126 c/mm (1600 cpi and 3200 cpi) dual density (operator selectable)
- 9-track read-after-write head
- Pertec® standard interface
- Selectable start/stop operation without repositioning (0.635 m/s [25 ips] 63 c/mm [1600 cpi] write mode)
- Variable extended gap (streaming mode)
- Multi-level diagnostics
- Reel sizes 177.8, 215.9 and 266.7 mm (7, 8.5, and 10.5 inches)
- Tape thickness 0.0381 and 0.0254 mm (1.5 and 1.0 mil)

## 1.4 MECHANICAL AND ELECTRICAL SPECIFICATIONS

Mechanical and electrical specifications for the FS1000 Formatted Tape Drive are provided in Table 1-1.

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Table 1-1
Mechanical and Electrical Specifications

| | | | |
|---|---|---|---|
| Tape Tension | 2.502N ± 0.278N (9 ounces ± 1 ounce) | | |
| Tape Creepage | None | | |
| Tape (computer grade)<br>Width<br>Thickness | Conforming to ANSI X3.40-1976<br>12.6492 ± 0.0508 mm (0.498 ± 0.002 inch)<br>0.0381 mm (1.5 mil) (nominal) or<br>0.0254 mm (1.0 mil) (nominal) | | |
| Reel Sizes | 177.8, 215.9, and 266.7 mm<br>(7, 8.5, and 10.5 inches) | | |
| Autothread Reliability | 95% including retries (tape leader to be free of creases or folds; tape to be from media vendors approved by PPC) | | |
| Rewind Time, 731.52 m (2400 feet) of tape | 3 minutes (nominal) | | |
| Tape Speed (nominal) | **Low Speed**<br>0.635 m/s<br>(25 ips) | **High Speed**<br>1.27 m/s<br>(50 ips) | <br>2.54 m/s<br>(100 ips) |
| Record Density | 63 c/mm<br>(1600 cpi) | 126 c/mm<br>(3200 cpi) | 63 c/mm<br>(1600 cpi) |
| Access Time (nominal)<br>Read with 15.24 mm (0.6 inch) IBG<br>Write with 15.24 mm (0.6 inch) IBG | <br>55 ms<br>67 ms | <br>105 ms<br>111 ms | <br>225 ms<br>228 ms |
| Command Reinstruct Time with 15.24 mm (0.6 inch) IBG | 10 ms | 5 ms | 2.5 ms |
| Repositioning Time (nominal) | 150 ms | 290 ms | 675 ms |
| Recording Characteristics | Records and reads data consistent with ANSI X3.39-1973 | | |
| Power (nominal) | 350 watts | | |
| Input Voltages | 100v, 120v, 220v, or 240v (+ 10, − 15%) 250v maximum | | |
| Line Frequency | 48 Hz— 62 Hz | | |
| Temperature<br>Operating<br><br><br>Non-Operating<br>Shipping | <br>4.4°C to 40°C (40°F to 104°F) (Maximum operating ambient may not exceed maximum operating temperature specified by the tape media vendor.)<br>− 28.9°C to 71°C (− 20°F to 160°F)<br>− 28.9°C to 71°C (− 20°F to 160°F) | | |
| Humidity<br>Operating<br><br><br>Non-Operating | <br>15%—95% relative humidity without condensation (May not exceed operating humidity specified for tape.)<br>5%—95% without condensation | | |
| Altitude<br>Operating<br>Non-Operating<br>Shipping | <br>0 to 2,438 m (0 to 8,000 feet)<br>0 to 15,240 m (0 to 50,000 feet)<br>0 to 15,240 m (0 to 50,000 feet) | | |

Note: In 25 ips Start/Stop Mode only, Write Access Time = 45 ms, nominal.
Command Re-Instruct Time, Write 2.5 ms, nominal.

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## 1.5 PHYSICAL DESCRIPTION

Physically, the drive consists of two subassemblies. These are the base and the chassis; see Figure 1-1. All of the tape handling components, the PCBAs (except for the Control/Write PCBA), and the power supply components (except for the ac input connector assembly and line filter), are mounted on the base. The chassis contains the hinges for the base, the gas spring, the Control/Write PCBA and the ac input components. The complete assembly is designed for slide mounting in a standard 482.6 mm (19-inch) EIA equipment rack and requires 222.25 mm (8.75 inches) of vertical space. Power is supplied through a standard domestic or international cord set, depending on equipment configuration.

Access to the tape path area of the drive is via a door in the front bezel and two hinged doors on top. The front panel door is for tape loading and the top doors provide service access. The doors are equipped with interlocks that prevent tape motion when they are open. The interlocks can be defeated by function code when necessary, to allow service access with the equipment in operation. However, the doors should remain closed during normal usage to protect the magnetic tape, heads, and other components from dust. This will help ensure maximum data reliability.

All operator controls and indicators are located on the front panel of the drive.

For access to the tape path components and the Formatter PCBA (mounted on the inside of the top door), the drive must be extended on its mounting slides and the top doors opened. For access to the remaining PCBAs, the unit must be extended, the top doors opened, and the captive screws that secure the base subassembly to the chassis must be loosened. The base subassembly then hinges upwards to provide access to the PCBAs and the components mounted on the underside of the base casting. The power supply components are located within the housing that also encloses the takeup reel motor. For access to these components, the drive must be extended and opened as for access to the PCBAs. The housing can then be opened by removing the two flat-head screws that secure the cover.

## 1.6 FUNCTIONAL DESCRIPTION

Drive operation depends on a combination of functions, as shown in the simplified block diagram, Figure 1-2.

(1) Formatter
(2) Internal Interface
(3) System Control
(4) Write Data Processing
(5) Read Data Processing
(6) Tape Handling
(7) Power Supply

The formatter function receives data to be written on tape and commands from the controller, and data read from the tape and status from the drive. It performs the required format conversions in each direction and outputs write data and commands to the internal interface, and read data and status to the controller. The formatter function is contained on the Formatter PCBA.

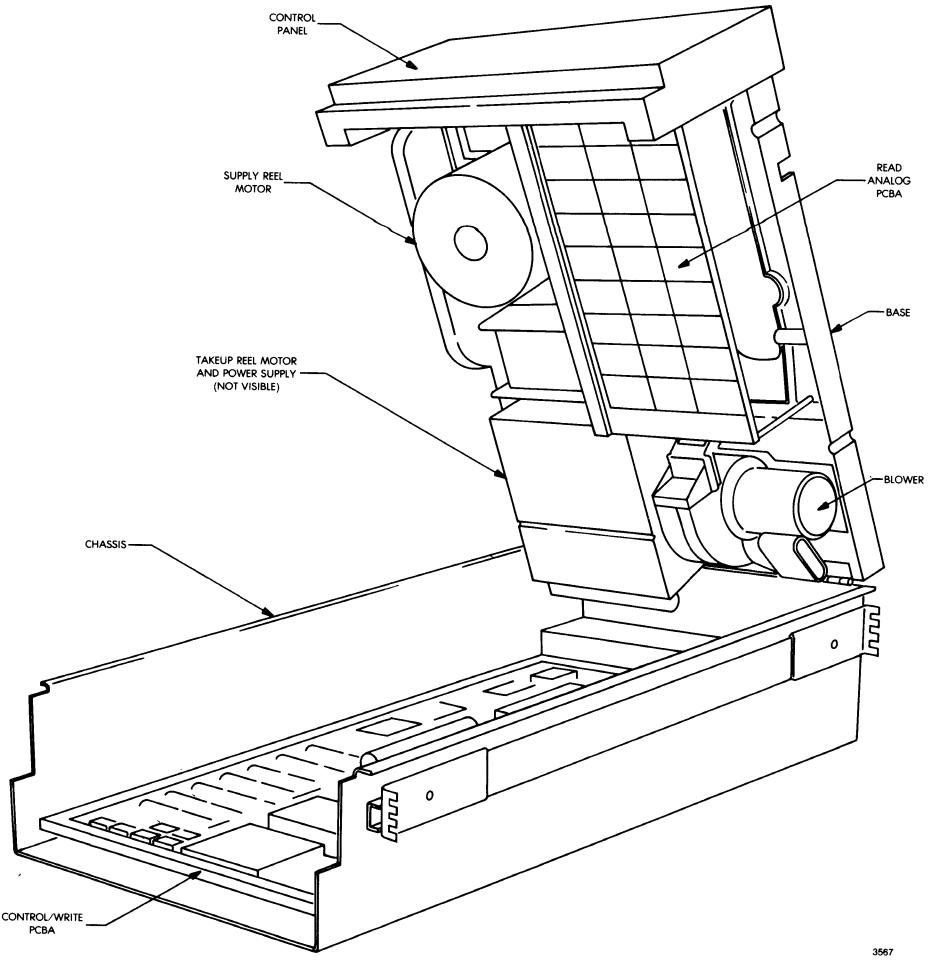


Figure 1-1. FS1000 Major Subassemblies

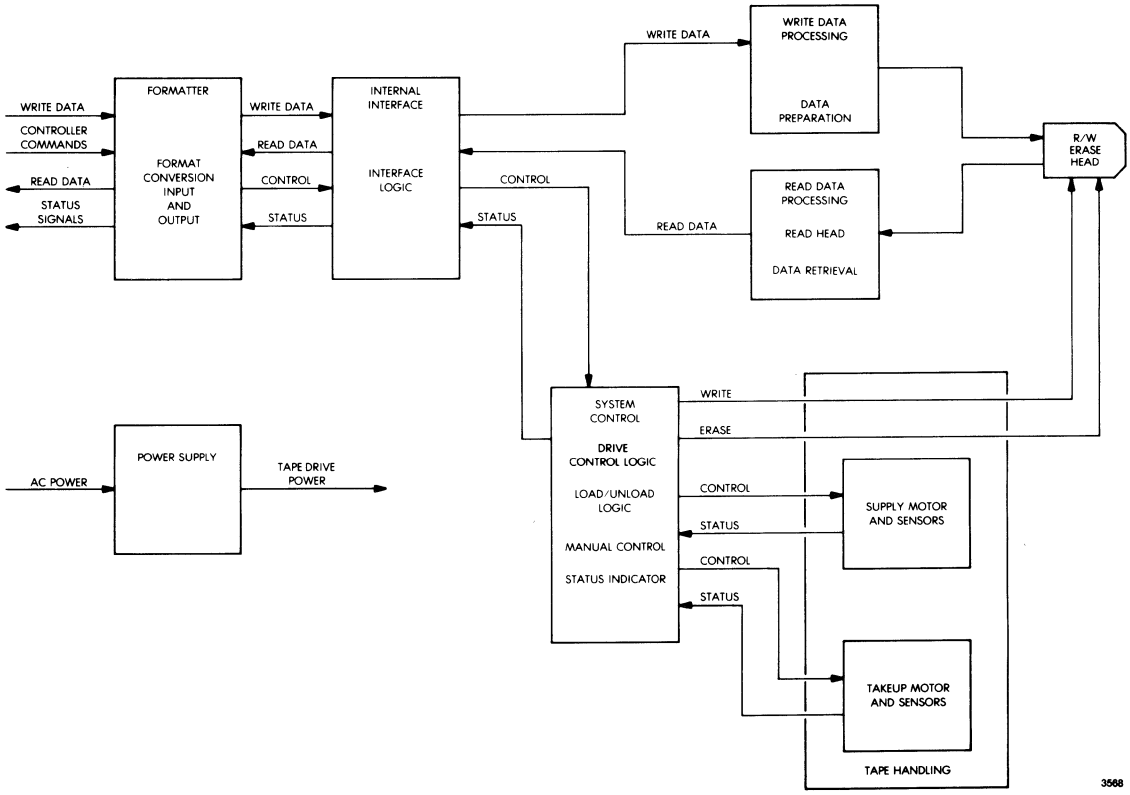


Figure 1-2. FS1000 Simplified Block Diagram

The internal interface function directs and coordinates the flow of data, status, and control signals between the other functions. The internal interface function is located partially on the Formatter PCBA and partially on the Control/Write PCBA.

The system control function processes the controller and manual commands in order to efficiently write and read data on the tape. Tape handling and status reporting is also provided by the system control function. This function is located on the Control/Write PCBA.

Write data processing function prepares the incoming data for recording and supplies the information to the write head. The write data function is located on the Control/Write PCBA.

The read data processing function processes data retrieved from the tape by the read head and supplies the data to the internal interface function. The function includes the read-after-write capability that permits the controller to verify the execution of a write command while writing is in progress. This function is located on the Read Analog PCBA.

The tape handling function includes the takeup and supply reel motors, the tension arm, tachometer, tape-in-path sensors, BOT and EOT sensors, and the air loading system. The tape handling components are located on the base assembly.

The power supply function includes transforming, rectifying, regulating and distributing input power as required to supply the electrical needs of the other functions. The power supply components are located on the base assembly and on the chassis.

## SECTION II
## INSTALLATION AND INITIAL CHECKOUT

### 2.1 INTRODUCTION

This section contains instructions for uncrating and mounting the FS1000 drive as well as procedures for electrically connecting the drive and performing the initial checkout. This section also contains a summary of interface information.

### 2.2 UNCRATING

The drive is shipped in a protective container that meets the National Safe Transit Specification (Project 1A). The container is designed to minimize the possibility of damage during shipment. The following procedure is to be used for uncrating the unit. Refer to Figure 2-1 in conjunction with the procedure.

(1) Place the shipping container on a low, flat surface. Ensure that the carton is positioned so that the model and serial number information are visible on the entrance surface of the carton.

(2) Remove or cut tape from around top of carton and open flaps (see Figure 2-1).

(3) Remove upper foam inserts from carton.

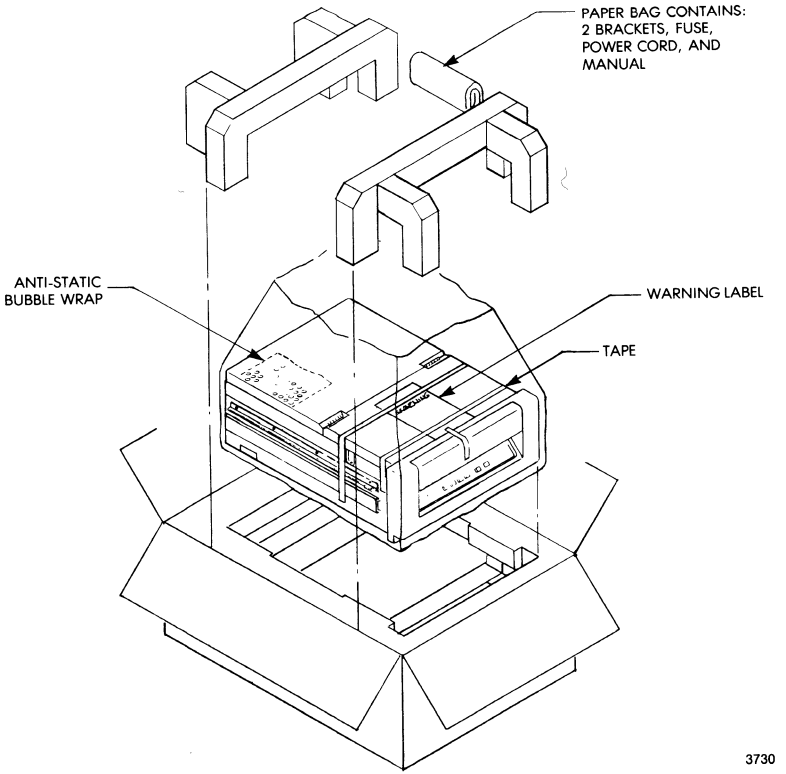


Figure 2-1A. Uncrating Rack-Mounted Units

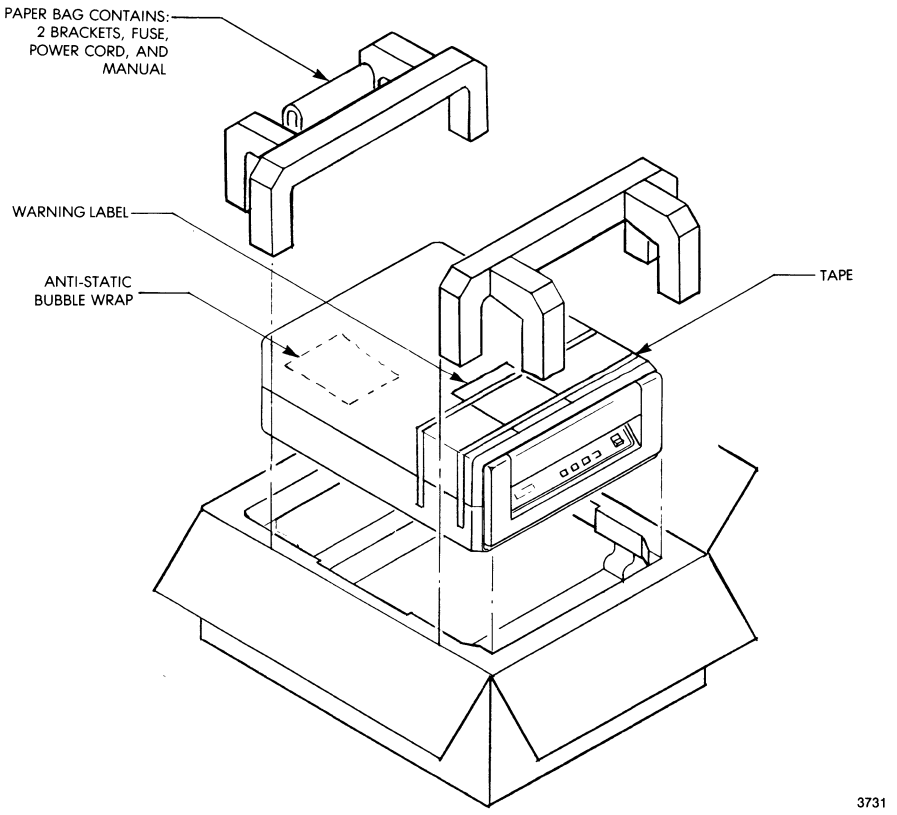


Figure 2-1B. Uncrating Enclosure Units

(4) Remove paper bag on right side of unit (at rear of units supplied with enclosures) that contains mounting brackets, fuse, power cord, and Installation and Operation manual.

***WARNING***

***THE DRIVE AND PACKING MATERIAL WEIGH IN EXCESS OF 52 KG (115 POUNDS). EXERCISE CARE WHEN LIFTING TO PREVENT PERSONNEL INJURY AND EQUIPMENT DAMAGE.***

(5) Grasp the unit (in poly bag) and lift it out of the lower foam insert. Place the unit on a convenient work surface.

(6) Cut open the poly bag containing the unit and remove the bag.

(7) On enclosure mounted units, open the enclosure. On units without enclosure, proceed to Step (8).

(8) Remove the tape securing the top cover of the unit, and the packaging warning label secured to the cover by the tape. Open the top cover and remove the anti-static bubble wrap between the Formatter PCBA and the takeup reel.

(9) Check the contents of the shipping container against the packing slip and inspect the contents for any visible damage. Notify the carrier immediately if the contents are incomplete or any damage is noted.

(10) Check the identification label for the correct model number and line voltage requirements.

(11) Retain all packaging material to use for reshipment if necessary.

## 2.3 PACKAGING FOR RESHIPMENT

When it is necessary to reship the tape drive, perform the following steps.

(1) Remove all power from the tape drive.

(2) Disconnect all external connectors and cables from the unit.

***WARNING***

***THE DRIVE AND PACKING MATERIAL WEIGH IN EXCESS OF 52 KG (115 POUNDS). EXERCISE CARE WHEN LIFTING TO PREVENT PERSONNEL INJURY AND EQUIPMENT DAMAGE***

(3) Open the top cover of the drive, and place the anti-static bubble wrap (retained in Paragraph 2.2.[11]) on top of the take up reel.

(4) Tape the packaging warning label (retained in Paragraph 2.2[11]) in the center of the top cover (see Figure 2-1) and tape the top cover.

(5) Place the tape drive in the poly bag retained in Paragraph 2.2(11).

(6) Position the tape drive in the lower foam packing insert within the shipping carton (retained in Paragraph 2.2[11]).

(7) Position the upper foam packing inserts (retained in Paragraph 2.2.[11]) over the drive in the shipping carton.

(8) Close the flaps of the shipping carton and seal them with a strong adhesive shipping tape.

## 2.4 POWER CONNECTIONS

A quick change power cord set is supplied for use with all FS1000 drives. The 100/120v units are supplied with a standard domestic power cord. The 220/240v units are supplied with an international 220v power cord. Table 2-1 lists (in several languages) the color code for the power cord supplied. The female connector on the power cord mates with the male fuse holder/power connector on the rear of the drive. Connection to the power source is by the male connector of the power cord.

Drive operating voltage is selected by orienting the Line Voltage Configuration PCB in the fuse holder/power connector on the rear of the drive; see Figure 2-2. The ac input voltage and line fuse requirements are listed in Table 2-2.

## 2.5 INITIAL CHECKOUT PROCEDURE

A detailed description of the operator controls and indicators is contained in Section III. The procedures to be followed during visual inspection, learn procedure, and initial checkout of the drive are given in Paragraphs 2.5.1, 2.5.2, and 2.5.3, respectively.

### 2.5.1 VISUAL INSPECTION

Prior to applying power to the drive, perform the following visual inspection procedure.

(1) Visually examine the unit for any evidence of physical damage that may have occurred during shipment.

Table 2-1
Power Cord Color Code

| | | | | |
|---|---|---|---|---|
| **Black or Brown**<br>AC 'Hot'<br>(Live) | **Nero o Marrone**<br>(Vivo) | **Noir ou Brun**<br>(haut Voltage) | **Negro o Moreno**<br>(Vivo) | **Schwarz oder Braun**<br>(Heiss) |
| **White or Blue**<br>AC Return<br>(Neutral)<br>(Common) | **Bianco o Blue**<br>AC Ritorno<br>(Neutro)<br>(Comune) | **Blanc ou Blue**<br>AC Retour<br>(Neutre)<br>(Commun) | **Blanco o Azul**<br>AC Neutro<br>(Neutro)<br>(Comun) | **Weiss oder Blau**<br>AC Zuruck<br>(Neutral)<br>(Gemeinsamer) |
| **Green or Green with Yellow Stripes**<br>Chassis<br>(Ground) | **Verde o Verde con le Righe Gialle**<br>Telaio<br>(Terra o massa) | **Vert ou Vert avec Rayure Jaune**<br>Chassis<br>(Terre) | **Verde o Verde con Rayas Amarillas**<br>Chasis<br>(Tierra) | **Grün oder Grün mit Gelben Streifen**<br>Chassis<br>(Grund) |

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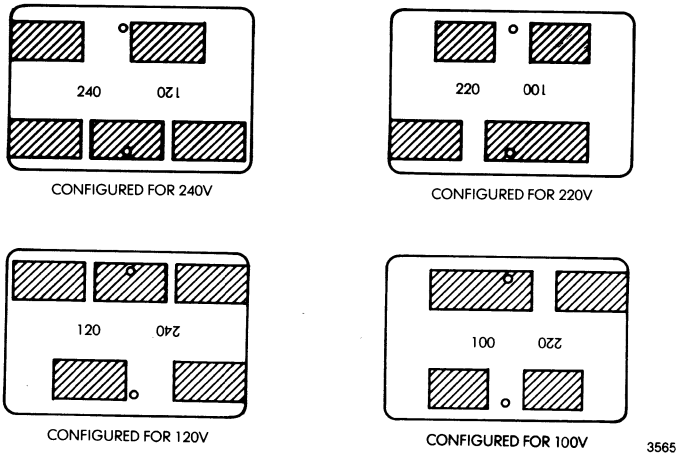


Figure 2-2. Line Voltage Configuration PCB Orientation

Table 2-2
AC Input Voltage and Fuse Requirements

| Input Voltage | Fuse |
|---|---|
| 100v ac | 4A Slow-Blow |
| 120v ac | 4A Slow-Blow |
| 220v ac | 2A Slow-Blow |
| 240v ac | 2A Slow-Blow |

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(2) Check the orientation of the Line Voltage Configuration PCB (see Figure 2-2), located under the sliding fuse cover next to the power connector on the rear of the drive. Verify that a line fuse of the correct rating is installed (refer to Table 2-2).

*CAUTION*

*ENSURE THAT BASE CASTING IS RAISED HIGH ENOUGH TO ALLOW SAFETY BRACKET ON THE GAS SPRING TO FALL INTO PLACE.*

(3) Loosen two socket head captive screws that secure the base casting to the chassis and swing the base casting up to its service position.

(4) Check for any loose cable connectors, screws or mounting hardware.

(5) Disengage the gas spring safety bracket and close and secure the base assembly with the two socket-head captive screws.

(6) Open the tape path access doors on top of the unit and the tape loading door in the front of the unit. Ensure that doors operate properly and show no signs of damage.

(7) Visually inspect the tape path area for cleanliness, loose or damaged hardware, or obstructions (packing materials, etc.).

(8) Close the tape path access doors and the tape loading door.

(9) Connect the power plug to the appropriate power source.

### 2.5.2 CHECKOUT

Perform the initial checkout of the drive as follows. Refer to Section III of this manual for descriptions of the control and indicator functions.

(1) Toggle the POWER switch to the ON position. The power indicator should light. Performance of the CPU/RAM test is shown by the front panel indicators lighting in sequence starting with left-most. Test failure is shown by the sequence stopping with one of the indicators lighted. The five horizontal indicators point to a probable CPU fault. The three vertical indicators suggest a probable RAM failure. During the following lamp test, all indicators will light simultaneously and the 7-segment displays will display the number 88. The lamps and displays will remain on for approximately 1 second. On completion of the tests, the indicators will go out, and the 7-segment displays will display the default unit number – 0.

(2) Enter the function select mode by pressing and holding the FUNCTION SELECT switch for at least 3 seconds.

(3) Step through the function codes by holding the FUNCTION SELECT switch depressed. Verify that the function codes are correct for your system. (Function codes are listed in Table 3-1.)

*NOTE*

*Optional operating modes are included in the function codes. Function code configuration is stored in non-volatile RAM and need be set only once. Codes selected are stored when power is removed.*

(4) Open the tape loading door in the front bezel of the drive.

(5) Position a tape reel, with write enable ring installed, on the supply hub in such a way that the tape will unwind if the reel is turned clockwise (write enable ring down).

(6) Close the tape loading door (door interlock prevents operation with the door open).

(7) Press the LOAD/ON LINE switch once. Tape will automtically thread and advance to load point. The LD PT indicator should flash during the load cycle and illuminate steadily when tape reaches load point. The WRT EN indicator should also light.

(8) Press the LOAD/ON LINE switch again.

(9) Verify that the ON LINE indicator lights. Additional depressions of the LOAD/ON LINE switch should alternately extinguish and relight the ON LINE indicator.

*NOTE*

*The speed and density indicators will also show the presently selected state.*

(10) With the drive on line, verify that all front panel switches except POWER and LOAD/ON LINE are disabled.

(11) Depress LOAD/ON LINE switch and verify the ON LINE indicator is extinguished.

(12) Depress the REW/UNLOAD switch. Tape will run slowly in reverse and unload. Verify that the REW/UNLOAD indicator flashes during unloading.

(13) When unloading is complete (REW/UNLOAD indicator extinguishes), open tape loading door, remove the tape reel, remove the write enable ring from the reel, and replace the tape reel on the supply hub.

(14) Close the tape loading door and depress the LOAD/ON LINE switch once. Tape will automatically thread and advance to load point. The LD PT indicator will flash during the load cycle and illuminate steadily when tape reaches load point.

(15) Verify that WRT EN indicator is extinguished.

(16) Perform system diagnostics to check remaining controls and indicators. Refer to operating instructions in Section III.

## 2.6 RACK MOUNTING THE DRIVE

The FS1000 drive is designed to be mounted either in a standard 482.6 mm (19 inch) EIA equipment rack or the specially designed desk top enclosure. For rack mounting, a vertical panel opening of 222.25 mm (8.75 inches) is required and the depth behind the mounting surface must be a minimum of 568.2 mm (22.37 inches). The drive is available with either detachable or non-detachable slides, and the mounting procedures are slightly different. Refer to Paragraph 2.6.1 for mounting drives equipped with non-detachable slides and Paragraph 2.6.2 for units equipped with detachable slides.

### 2.6.1 NON-DETACHABLE SLIDE MOUNTING PROCEDURE

Figure 2-3 shows the critical dimensions of the drive. Figure 2-4 shows the mounting hole pattern and dimensions for the non-detachable slide mounting brackets and should be referred to in conjunction with the following procedure when rack mounting the drive. Refer to Paragraph 2.7 for enclosure mounting procedures.

***WARNING***

***THE RACK IN WHICH THE DRIVE IS TO BE MOUNTED MUST BE SUFFICIENTLY WEIGHTED OR ANCHORED TO SAFELY ACCOMMODATE THE HIGH CENTER OF GRAVITY THAT IS PRESENT WITH THE DRIVE EXTENDED ON ITS MOUNTING SLIDES.***

(1) Place the drive on a convenient work surface.

(2) Remove the mounting slides from each side of the drive chassis. Retain all hardware for reinstallation. Do not remove the nuts from the threaded studs at the front of the chassis. Loosen the nuts sufficiently to allow the studs to slide out of the V-shaped slots in the mounting slides.

(3) Remove the front and rear slide mounting brackets and the attaching hardware from the mounting hardware package.

(4) Secure the front and rear slide mounting brackets to the mounting slides.

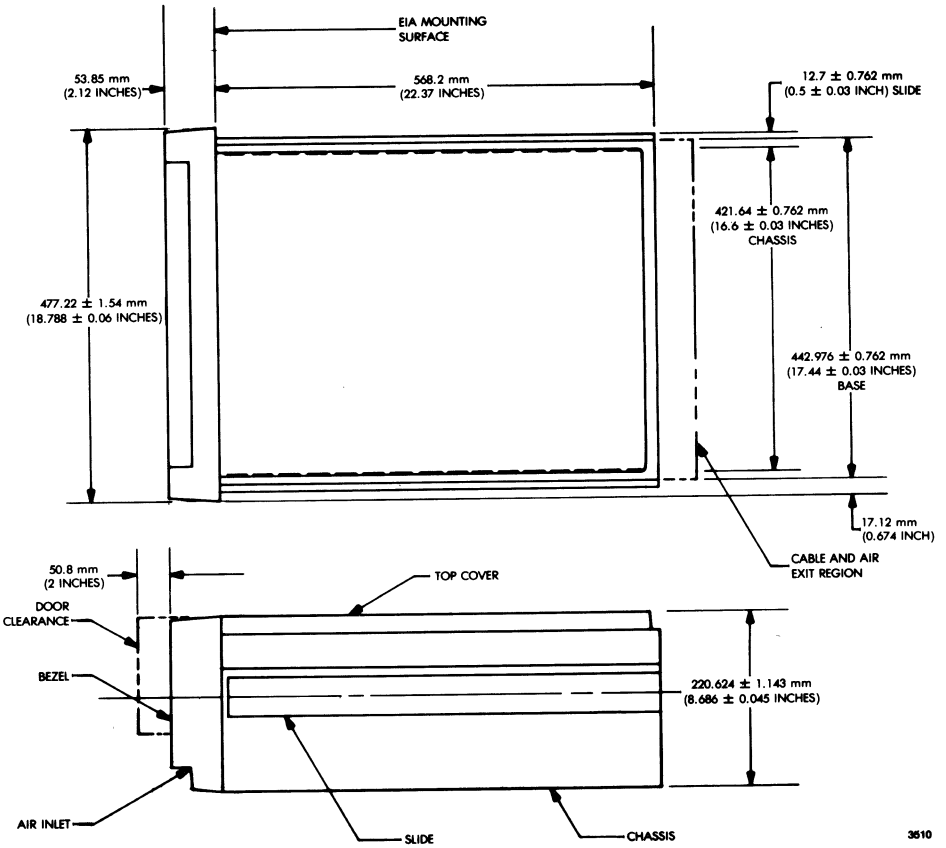



Figure 2-3. Physical Dimensions

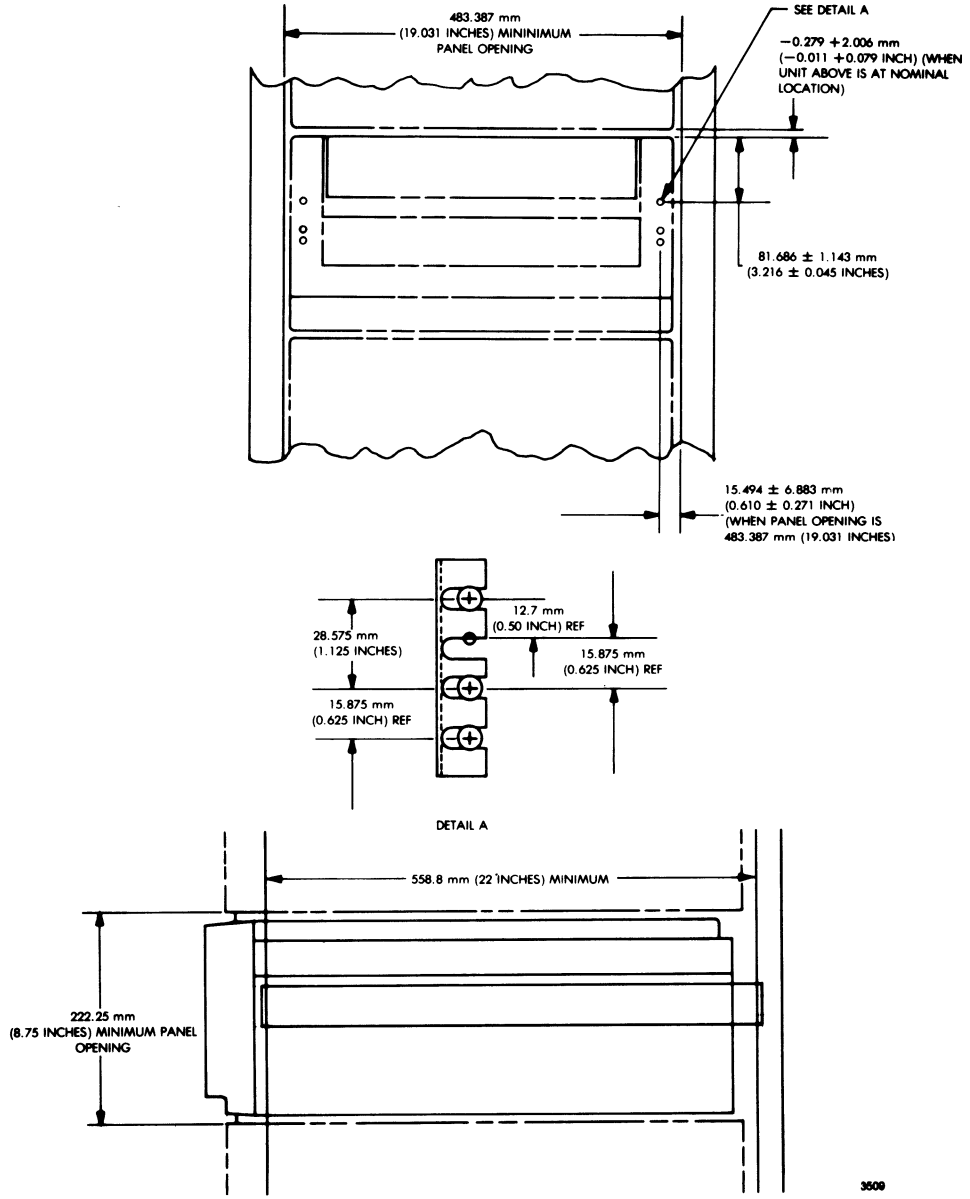



Figure 2-4. EIA Mounting Hole Pattern, Non-Detachable Slides

(5) One at a time, place the mounting slides in position and secure the front and rear mounting brackets to the mounting rails. Use three 10-32 x 3/8-inch buttonhead Phillips screws for each bracket and place a star lockwasher and a 10-32 nut on each screw to secure it.

(6) Fully extend the mounting slides out of the mounting rails until they lock.

***WARNING***

***THE DRIVE WEIGHS APPROXIMATELY 50KG (110 LBS). EXERCISE CARE WHEN LIFTING TO PREVENT PERSONNEL INJURY AND EQUIPMENT DAMAGE.***

(7) Lift the drive (using either sufficient personnel or mechanical means) and place it in position on the mounting slides with the forward studs approximately 1 inch in front of the V-shaped slot in the slide. The lip of the chassis will rest on the support lip on the slides.

(8) Slide the unit back so that the tapered slot in the end of the slide engages the threaded stud at the front of the chassis. Also ensure that the mounting holes in the slides line up with those in the chassis.

(9) Using the hardware removed in Step (2), secure the mounting slides to the drive chassis.

(10) If an adjustable dolly or other mechanical device was used to position the drive for mounting, remove it and slide the drive into the mounting rack.

### 2.6.2 DETACHABLE SLIDE MOUNTING PROCEDURE

Figure 2-3 shows the critical dimensions of the drive. Figure 2-5 shows the mounting hole pattern and dimensions for the detachable slide mounting brackets and should be referred to in conjunction with the following procedure when rack mounting the drive. Refer to Paragraph 2.7 for enclosure mounting procedures.

***WARNING***

***THE RACK IN WHICH THE DRIVE IS TO BE MOUNTED MUST BE SUFFICIENTLY WEIGHTED OR ANCHORED TO SAFELY ACCOMMODATE THE HIGH CENTER OF GRAVITY THAT IS PRESENT WITH THE DRIVE EXTENDED ON ITS MOUNTING SLIDES.***

(1) Place the drive on a convenient work surface.

(2) Remove the mounting slides from each side of the drive chassis. Retain all hardware for reinstallation.

(3) Remove the front and rear slide mounting brackets and the attaching hardware from the mounting hardware package.

(4) Secure the front and rear slide mounting brackets to the mounting slides.

(5) One at a time, place the mounting slides in position (refer to Figure 2-5), and secure the front and rear mounting brackets to the mounting rails. Use four 10-32 x 3/8-inch pan-head Phillips screws for each bracket and place a flat washer, a lock washer, and a 10-32 nut on each screw to secure it.

(6) Fully extend the mounting slides out of the mounting rails until they lock.

***WARNING***

***THE DRIVE WEIGHS APPROXIMATELY 50 KG (110 LBS). EXERCISE CARE WHEN LIFTING TO PREVENT PERSONNEL INJURY AND EQUIPMENT DAMAGE.***

(7) Lift the drive (using either sufficient personnel or mechanical means) and place it in position with the mounting rail (connected to the chassis) on the slide lip. The forward stud should be approximately 2 inches in front of the V-shaped slot in the slide.

(8) Slide the unit back so that the front of the slide lip is positioned completely inside the mounting rail wraparound (Figure 2-5). Also ensure that the mounting rail block is positioned inside the receiving slot in the slide.

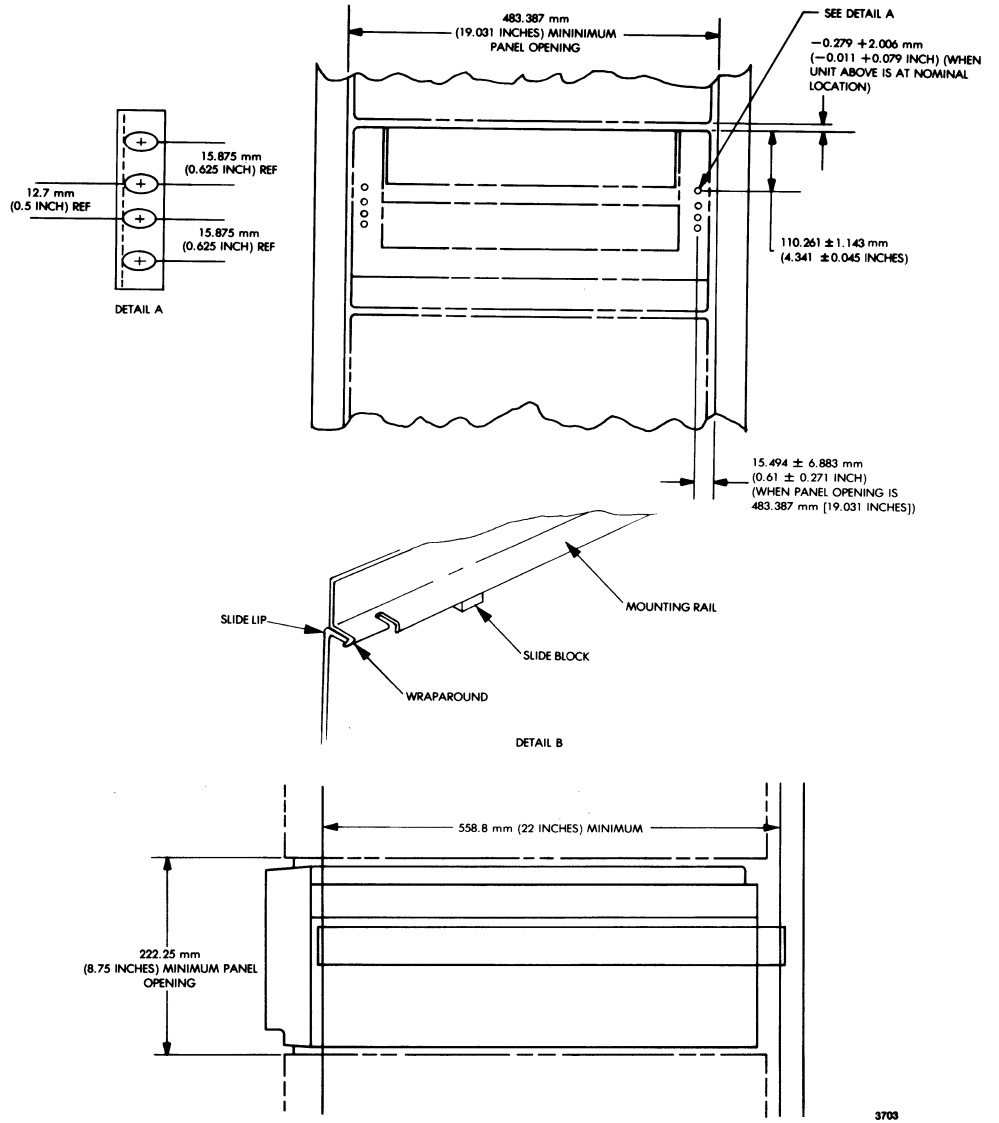



Figure 2-5. EIA Mounting Hole Pattern, Detachable Slides

(9) Using the hardware removed in Step (2), secure the mounting slides to the drive chassis.

(10) Remove any device used to position the drive for mounting and slide the drive into the mounting rack.

## 2.7 ENCLOSURE MOUNTING THE DRIVE

The FS1000 drive may be mounted in a specially designed desk-top enclosure for installations where rack mounting is not possible or desirable. Perform the following procedure to mount the drive in the desk-top enclosure.

(1) Open the top front cover on the drive and locate the two socket head captive screws that secure the base assembly to the chassis assembly.

(2) Loosen the two socket head captive screws and raise the base to the locked position. Ensure that the base is raised high enough to allow the safety bracket on the gas spring to fall into place.

(3) Remove the slide assemblies and spring latches from each side of the chassis.

(4) Disengage the gas spring safety bracket, lower the base assembly, and secure it using the two captive socket head screws.

***WARNING***

***THE DRIVE WEIGHS APPROXIMATELY 50 KG (110 LBS). EXERCISE CARE WHEN LIFTING TO PREVENT PERSONNEL INJURY AND EQUIPMENT DAMAGE.***

(5) Lift the drive (using either sufficient personnel or mechanical means), and place it inside the enclosure.

(6) Loosen the two socket head captive screws and raise the base to the locked position. Ensure that the base is raised high enough to allow the safety bracket on the gas spring to fall into place.

(7) Carefully position the chassis so that the four holes in the bottom of the chassis line up with the four tapped holes in the enclosure.

(8) Secure the drive to the enclosure using the hardware provided.

(9) Disengage the gas spring safety bracket, lower the base assembly, and secure it using the two captive socket head screws.

## 2.8 INTERFACE SPECIFICATIONS AND INFORMATION

The following paragraphs contain a summary of the physical and electrical interface specifications for the FS1000 Formatted Tape Drive. The interface driver/receiver configuration is shown in Figure 2-6.

### 2.8.1 INTERFACE CABLES

Two 50-lead flat cables, 28 AWG (3M Part No. 3365-50 or equivalent [not included]) provide the interconnection between the FS1000 and the host controller. Interface connectors are 3415-0001 or equivalent. An Interface Kit (Part No. 112622-01) including cables and connectors can be ordered from PPC. Maximum length for a cable connecting a controller to a single formatted drive is 6.1 metres (20 feet). Longer cable lengths can be achieved by using active repeaters in series with the line. Interface connectors on the Formatter PCBA are accessible through slots in the rear edge of the drive's top door.

### 2.8.2 DAISY-CHAIN REQUIREMENTS

A maximum of eight FS1000 drives can be connected in a daisy-chain configuration. An alternate configuration allows a maximum of four FS1000s and one standard formatted start/stop unit to be daisy-chained. The start/stop unit may in turn have up to three unformatted start/stop drives connected to it in a daisy-chain configuration.

The maximum total length, for a cable connecting two or more units to a formatter in a daisy-chain configuration is 6.1 metres (20 feet). Longer cable lengths can be achieved by using active repeaters in series with the line.

When connecting the FS1000 in a daisy-chain configuration, ensure that only the last drive in the chain contains terminators for the P1 and P2 interface connectors. The terminators consist of IC resistor packs installed in DIP sockets on the formatter PCBA. They are mounted in socket locations U150 and U152. Also ensure that no two units in the daisy chain are configured for the same drive address.

### 2.8.3 INTERFACE CHARACTERISTICS

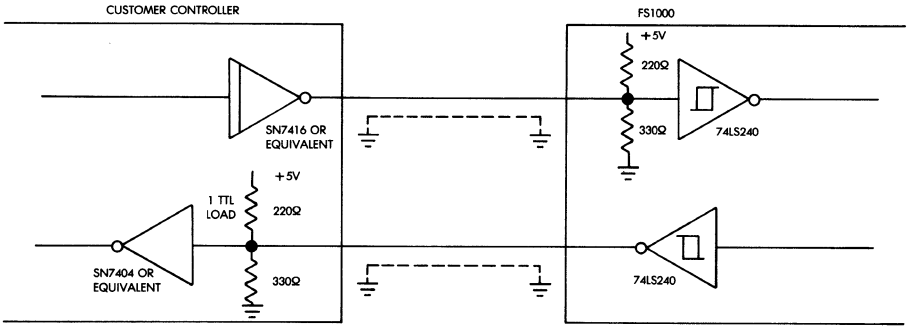
Interface lines to and from the formatter are TTL compatible, single ended. Terminator circuits consist of a 220 ohm resistor to +5v and a 330 ohm resistor to ground (as shown in Figure 2-6).

All interface signal mnemonics are designated by the prefix I. Signal levels and pulsewidths are as follows.

Levels: True = Low = 0 to 0.5v (approximately)
False = High = 2.5 to 5v (approximately)

Pulses: Pulse levels are as previously stated, pulsewidth 200 nanoseconds or greater.

The interface circuits are designed so that any disconnected interface line is interpreted as a logical false signal by the formatter logic.




NOTES:
1. NO MORE THAN 1 TTL LOAD SHOULD BE DRIVEN BY INTERFACE SIGNALS FROM THE CONTROLLER.
2. IMPROVED NOISE MARGIN WILL BE ACHIEVED IF THE RECEIVER IN THE CUSTOMER CONTROLLER SHOWN ABOVE IS REPLACED WITH AN SN74LS14 SCHMITT TRIGGER INPUT CHARACTERISTICS. THIS IMPROVEMENT IN SIGNAL-TO-NOISE RATIO BECOMES MORE SIGNIFICANT AS CABLE LENGTHS INCREASE TO THE MAXIMUM ALLOWABLE SIZE.

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Figure 2-6. Interface Configuration

## SECTION III
## OPERATION

### 3.1 INTRODUCTION

This section provides specific information pertaining to operation of the FS1000 Formatted Tape Drive. The material provided includes loading and unloading procedures, detailed descriptions of the controls and indicators, interface signal and timing information, and diagnostic operating procedures

### 3.2 PRELOADING INFORMATION

Perform the following procedure, as applicable, before loading tape.

***WARNING***

***ENSURE THAT THE MOUNTING FRAME IS SUFFICIENTLY WEIGHTED OR ANCHORED TO SAFELY ACCOMMODATE THE HIGH CENTER OF GRAVITY THAT IS PRESENT WITH THE DRIVE EXTENDED.***

(1) Extend the drive out of the mounting frame and open the top cover to gain access to the tape path components.

(2) Check the tape path area for dirt, dust, etc. Clean the tape path area daily (or as necessary) as specified in the following steps.

*CAUTION*

*DO NOT USE ROUGH OR ABRASIVE CLOTHS TO CLEAN HEAD OR TAPE GUIDES. USE ONLY 91 PERCENT ISOPROPYL ALCOHOL. USE OF OTHER SOLVENTS MAY DAMAGE HEAD LAMINATION ADHESIVE.*

(3) Moisten a cotton swab or foam applicator with isopropyl alcohol. The applicator should be moist, not dripping wet. Shake off any excess solvent.

*CAUTION*

*AN EXCESSIVE AMOUNT OF SOLVENT MAY CAUSE SEEPAGE INTO THE BEARINGS AND CONTAMINATION OR BREAKDOWN OF THE BEARING LUBRICANT.*

(4) Wipe the tape contact surface of the head with the moistened applicator. Use only light pressure (do not scrub) and wipe in the direction of tape travel. Be sure that fibers from the applicator do not stick to any part of the head.

(5) Wipe the surface dry using a lintless wiper or dry applicator and light pressure. Once again, wipe in the direction of tape motion.

(6) Clean the tape guides and remaining tape path components using the same technique specified in Steps (4) and (5).

(7) Using a hand-held magnifier, examine the head and tape path components to ensure that all accumulated oxide and dirt has been removed.

(8) Close the top cover and slide the drive into the mounting frame.

(9) If the task requires recording data on the tape, install a write enable ring on the supply reel.

*CAUTION*

*DO NOT HANDLE TAPE REELS SUCH THAT THE FLANGES WILL BE SQUEEZED TOGETHER. IF THE FLANGES ARE FORCED AGAINST THE TAPE, EDGE DAMAGE MAY RESULT. WHEN THE REEL IS MOUNTED ON THE DRIVE, APPLY PRESSURE ONLY TO THE HUB; NEVER TO THE REEL FLANGE. EXERCISE CARE DURING REMOVAL OR REPLACEMENT OF TAPE REEL COLLARS. IT IS EASY TO INADVERTANTLY SQUEEZE THE REEL FLANGES DURING THIS OPERATION.*

(10) Ensure that the tape is free to run, i.e., tape leader is not secured by tape or other retaining material, and that tape leader is not damaged or creased. To ensure proper automatic loading, the end of the tape must be trimmed. A tape crimper (IBM Part No. 2512063) can be used to trim the tape.

(11) Ensure that the unit is properly connected and, if the unit is being loaded for the first time, that the initial checkout procedure in Section II has been performed.

## 3.3 LOADING AND UNLOADING TAPE

The following paragraphs provide procedures for loading and unloading tape. These procedures assume that an industry standard tape reel (177.8, 215.9, or 266.7 mm [7, 8.5, or 10.5 inch]) is being used. The tape leader must be free of creases or folds (trim the leader using a tape crimper, IBM Part No. 2512063, as required). The supply reel must be positioned horizontally in such a way that the tape will unwind if the reel is turned clockwise as viewed from above.

### 3.3.1 AUTOLOAD PROCEDURE

(1) Toggle the POWER switch to the ON position.

(2) Lower the tape loading door in the front bezel of the drive.

(3) Position the tape reel on the supply hub in such a way that the tape will unwind if the reel is turned clockwise (write enable ring, if installed, should be down).

*CAUTION*

*HANDLE TAPE REELS BY THE HUB WHENEVER POSSIBLE. IF TAPE REEL FLANGES ARE FORCED AGAINST THE TAPE, EDGE DAMAGE MAY RESULT.*

(4) Close the tape loading door.

(5) Press the LOAD/ON LINE switch once.

The supply hub will automatically lock the tape reel in place. The reel will turn backwards a few turns and then turn forward (clockwise), ejecting the tape into the tape path. Figure 3-1 illustrates the tape routing. Tape is threaded through the tape path by the drive air system. The LD PT indicator will flash during the load operation, and remain illuminated to indicate successful completion (i.e., tape at load point). If the tape fails to load the first time, the supply reel backwinds all of the tape and tries to load a second, and if necessary, a third time. If the tape fails to load on the third attempt, the 7-segment displays flash the load fault code until RESET is depressed or POWER is switched to OFF. (Operator troubleshooting information, including a list of fault codes, is presented in Paragraph 3.9.)

### 3.3.2 MANUAL LOADING PROCEDURE

(1) Extend the drive out of the mounting frame on its slides.

(2) Open the top covers of the drive to gain access to the tape path.

(3) Lower the tape loading door in the front bezel of the drive.

(4) Position the tape reel on the supply hub in such a way that the tape will unwind if the reel is turned clockwise (write enable ring, if installed, should be down).

*CAUTION*

*HANDLE TAPE REELS BY THE HUB WHENEVER POSSIBLE. IF TAPE REEL FLANGES ARE FORCED AGAINST THE TAPE, EDGE DAMAGE MAY RESULT.*

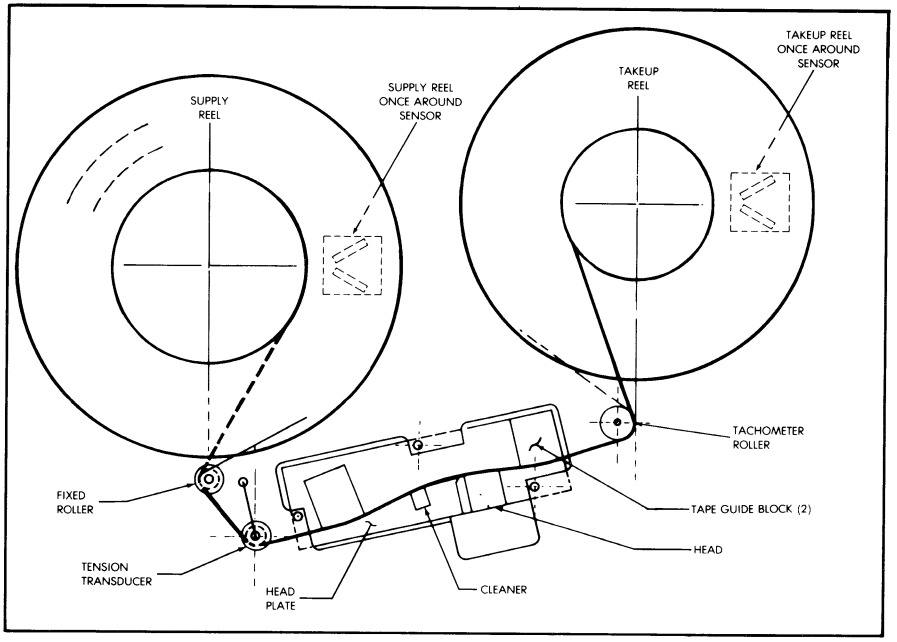


Figure 3-1. Tape Path

(5) Depress the Autoload Override button located at the lower left side of the tape loading door, press the tape reel hub down and turn it CCW to the lock position. Then release the Manual Override button.

(6) Toggle the POWER switch to the ON position.

(7) Manually thread the tape through the tape path (see Figure 3-1) by slowly winding both reels clockwise until at least four turns of tape have been wound onto the takeup reel.

(8) Close the top cover and the tape loading door on the drive and push the drive back into the mounting frame.

(9) Press the LOAD/ON LINE switch once to tension the tape and bring it to load point (LD PT indicator remains illuminated).

### 3.3.3 UNLOADING PROCEDURE

The following procedure assumes that tape is loaded and is at or beyond load point, and that the drive is off line.

(1) Press the REW/UNLOAD switch once. Tape will rewind to load point and stop.

(2) Press the REW/UNLOAD switch a second time. The tape will rewind onto the supply reel and the supply reel will automatically be released from the hub.

(3) Open the tape loading door in the front bezel and remove the supply reel.

*CAUTION*

*HANDLE TAPE REELS BY THE HUB WHENEVER POSSIBLE. IF TAPE REEL FLANGES ARE FORCED AGAINST THE TAPE, EDGE DAMAGE MAY RESULT.*

*NOTE*

*If the supply reel hub does not automatically release, depress and hold the Autoload Override button located at the lower left side of the tape loading door and turn supply hub clockwise to release the supply reel.*

## 3.4 CONTROLS AND INDICATORS

All controls and indicators, with the exception of the Autoload Override (hub lock) button, are located on the control panel of the drive. The following paragraphs describe the control and indicator functions. The control and indicator locations are shown in Figure 3-2.

### 3.4.1 POWER ON/OFF SWITCH

The POWER ON/OFF switch is a two-position rocker switch that controls the application of ac power to the drive. Powerup diagnostics are also initiated with the POWER ON/OFF switch.

### 3.4.2 POWER INDICATOR

This indicator is illuminated when secondary ac power is present.

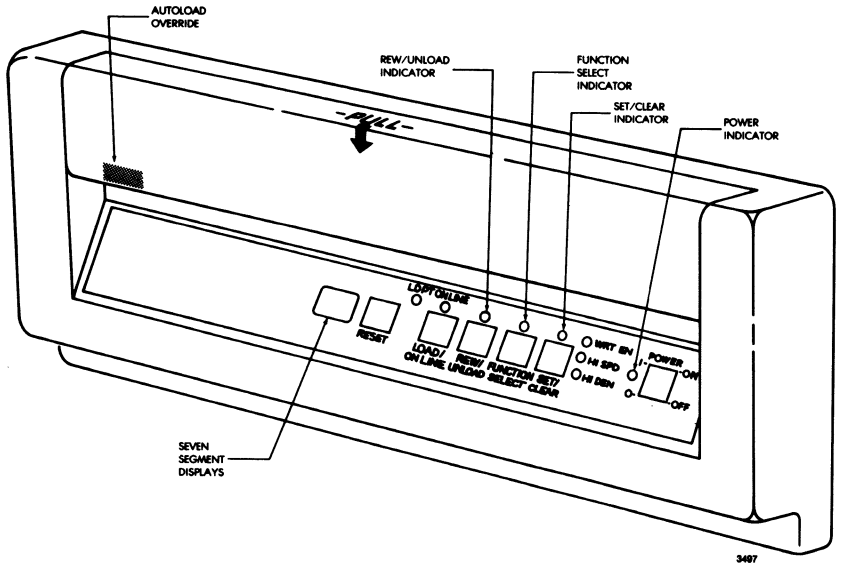


Figure 3-2. Control Switches and Indicators

### 3.4.3 LOAD/ON LINE SWITCH

When depressed once, with tape not tensioned, auto load begins. The switch is depressed a second time, after the tape reaches load point, to place the drive on line. In the on line mode, the unit will only respond to commands sent via the host interface (front panel switches, except LOAD/ON LINE will be ignored). All host interface command, data, and status lines are active in the on line mode. In the off line mode, all host interface command lines (except Load/On-Line) are disabled. Status lines are not disabled.

If the front panel Load/On-Line function selection option is set, two consecutive depressions of the switch result in the unit automatically going on line when load point is reached. Subsequent depressions of the switch will cause the drive to toggle between the on line and off line states. The unit is never allowed on line prior to the tape reaching load point.

### 3.4.4 LD PT (LOAD POINT) INDICATOR

This indicator flashes during a load operation and is steadily illuminated when the tape is at load point.

### 3.4.5 ON LINE INDICATOR

When the LOAD/ON LINE switch has been depressed twice and function code 31 (refer to Table 3-1) is true, the indicator flashes during a load operation, and lights continuously when load point is reached. If function code 31 is false, the indicator remains off until load point is reached and the LOAD/ON LINE switch is depressed for the second time. The indicator then lights continuously.

### 3.4.6 REW/UNLOAD SWITCH

When depressed once, with the unit off line and beyond load point, a rewind to load point is initiated. When load point is reached, the switch is depressed a second time to unload the tape. Two consecutive depressions of the switch with the unit off line and beyond load point, will result in the tape automatically being unloaded at the end of the rewind operation.

When the unit is in the Function Select mode, with function code 12 displayed, the switch allows selection of a 126 c/mm (3200 cpi) recording format either with or without identification burst, refer to Paragraph 3.4.7.

### 3.4.7 REW/UNLOAD INDICATOR

If the REW/UNLOAD switch is depressed twice while the unit is off line and loaded, the indicator will flash as tape is rewound and unloaded. If the REW/UNLOAD switch is depressed once, the indicator will illuminate during the rewind and go out when the tape stops at BOT. When the switch is depressed again, the indicator will flash as the tape is unloaded.

When the unit is in the Function Select mode, with function code 12 displayed, the indicator will be illuminated to indicate that the 126 c/mm (3200 cpi) recording format without identification burst has been selected. If the indicator is not illuminated, the recording format with identification burst has been selected.

### 3.4.8 FUNCTION SELECT SWITCH

When the FUNCTION SELECT switch is depressed and held for at least 3 seconds, with the drive off line and tape not in motion, the 7-segment display will switch to a display of 00 and the FUNCTION SELECT indicator will light. The drive is now in the Function Select mode. If the switch is held down, the display will step through the function codes (listed in Table 3-1) at the rate of one per second. Rapid repeated

depressions of the switch can be used to step through the function codes at a faster rate. The LOAD/ON LINE and REW/UNLOAD switches are disabled when function selection is in process. The exception to this is that when function code 12 is displayed, the REW/UNLOAD switch is used to select between two alternate recording formats (refer to Paragraphs 3.4.6 and 3.4.7). The RESET switch is used to enable a selected function code and to exit the Function Select mode. An example of a function selection sequence to set the unit address is as follows:

(1) Depress and hold FUNCTION SELECT switch for 3 seconds (7-segment display goes to 00 and FUNCTION SELECT indicator lights).

(2) Depress and release FUNCTION SELECT switch four times to step display to 04 (unit address to be set).

(3) Depress and release SET/CLEAR switch, SET/CLEAR indicator should light (unit address is set).

(4) Depress and release RESET switch, FUNCTION SELECT indicator should go out and 7-segment display goes to – 4 (new unit address is enabled).

### 3.4.9 FUNCTION SELECT INDICATOR

This indicator is illuminated when the unit is in the Function Select mode. Depressing the RESET switch causes the indicator to go off.

### 3.4.10 SET/CLEAR SWITCH

Pressing this switch while in the Function Select mode will cause the selected function to be set or cleared if it's a true/false function. If it's a multiple choice function, only one choice can be set, which will clear the previous choice in that group.

When in normal operation, depressing the SET/CLEAR switch toggles the 7 segment displays between two functions; unit number display, and tape footage counter. The tape footage counter displays the distance tape has traveled from BOT in 100 foot increments. The tape footage counter is functional in both the on-line and off-line conditions.

### 3.4.11 SET/CLEAR INDICATOR

This indicator is illuminated when the unit is in the Function Select mode, and the displayed function code is true (set).

### 3.4.12 RESET SWITCH

Depressing the RESET switch with the unit off line, terminates the last command in process, clears a load fault and terminates the function selection operation. Depressing the switch again has no effect.

### 3.4.13 WRT EN INDICATOR

Indicates that a reel of tape with a write enable ring is loaded on the supply hub.

### 3.4.14 HI SPD INDICATOR

Indicates that the high operating speed has been selected.

### 3.4.15 HI DEN INDICATOR

Indicates that the high recording density has been selected.

Table 3-1
Function Selection Codes

| Code | Operational Codes | | Notes |
|---|---|---|---|
| | Code Set (LED On) | Code Cleared (LED Off) | |
| –0 | Unit address 0 selected | Unit address 0 deselected | |
| –1 | Unit address 1 selected | Unit address 1 deselected | |
| –2 | Unit address 2 selected | Unit address 2 deselected | |
| –3 | Unit address 3 selected | Unit address 3 deselected | |
| –4 | Unit address 4 selected | Unit address 4 deselected | 1 |
| –5 | Unit address 5 selected | Unit address 5 deselected | |
| –6 | Unit address 6 selected | Unit address 6 deselected | |
| –7 | Unit address 7 selected | Unit address 7 deselected | |
| 10 | Local speed select. Function codes 11, 12, and 13 enabled. | Speed selection accomplished via interface. Function codes 11, 12, and 13 disabled. | |
| 11 | Speed = 0.635 m/s (25 ips)<br>Density = 63 c/mm (1600 cpi) selected | Deselected | 1 |
| 12 | Speed = 1.27 m/s (50 ips)<br>Density = 126 c/mm (3200 cpi) selected | Deselected | 5 |
| | REW/UNLOAD LED on — recording format without identification burst selected | REW/UNLOAD LED off — recording format with identification burst selected | |
| 13 | Speed = 2.54 m/s (100 ips)<br>Density = 63 c/mm (1600 cpi) selected | Deselected | |
| 20 | Start/stop mode selected. Unit will function as a start/stop drive while writing at 0.635 m/s (25 ips). Unit will reposition for all other commands and speeds. | Streaming mode selected. Unit will reposition if next command not received during reinstruct period. | |
| 21 | Gap length selected by codes 22—29. Extended gap command from I/O (IRTH1) is ignored. | If extended gap is not selected via I/O (IRTH1 high), default to 0.6 inch gap. If extended gap is selected via I/O (IRTH1 low), gap length is as indicated by codes 22—29. | |
| 22 | 0.6 inch gap selected | Deselected | 1 |
| 23 | 0.9 inch gap selected | Deselected | |
| 24 | 1.2 inch gap selected | Deselected | |
| 25 | 2.4 inch gap selected | Deselected | |
| 26 | 4.8 inch gap selected | Deselected | |
| 27 | 6.0 inch gap selected | Deselected | |
| 28 | 8.0 inch gap selected | Deselected | |
| 29 | 10.0 inch gap selected | Deselected | |
| 30 | Tape is automatically tensioned and brought to BOT, and (if unit was previously on line) unit is placed on line. If unit was not previously on line, tape is tensioned and brought to BOT, unit then idles. Occurs when tape is in path immediately after primary power is applied. | No autoload function; if tape is in path, it will sit idle. | 3 |

NOTES:
1. Only one code within this group can be set at a time. Setting a code clears the previously set code within the group. The individual codes within the group cannot be cleared independently.
2. Diagnostic use only.
3. Autoload function (code 30) must be set before tape is tensioned.
4. If RESET switch is pressed, unit will return to Function Select mode with code 50 displayed. To return to normal operation, set mode 50 and depress RESET.
5. Code 12 is used to select two separate functions, speed/density and recording format. Only the speed/density function interacts with codes 10—13.

Continued

Table 3-1

Function Selection Codes (Continued)

| Code | Operational Codes (Cont.) | | Notes |
|---|---|---|---|
| | Code Set (LED On) | Code Cleared (LED Off) | |
| 31 | Tape is loaded and brought to BOT with single depression of LOAD/ON LINE switch. Second switch depression after tape reaches BOT is required to place drive on line. | Tape is loaded and brought to BOT with single depression of LOAD/ON LINE switch. Second switch depression prior to tape reaching BOT causes drive to automatically go on line when tape reaches BOT. | |
| 32 | External write data parity bit is selected — controller generates odd parity | Return to normal operation — internal parity generation | |
| | **Diagnostic Codes** | | |
| | ***WARNING*** | | |
| | ***THIS CODE(*) IS INTENDED FOR USE DURING SERVICING BY QUALIFIED TECHNICIANS ONLY. IMPROPER USE CAN RESULT IN INJURY TO PERSONNEL AND EQUIPMENT DAMAGE.*** | | |
| 50 | Normal operation selected — default code for diagnostic routines. | Diagnostic routine selected | 1 |
| ***51** | Manual control of tape motion functions is provided by front panel controls. Refer to Paragraph 3.7.14. | Diagnostic mode 51 deselected | 4 |
| ***52** | Manual control of tape shuttle function is provided by front panel controls. Refer to Paragraph 3.7.14. | Diagnostic mode 52 deselected | 4 |
| 53 | *NOTE*<br>*This code is intended for use by qualified technicians only.*<br>Provides front panel monitoring of tension and velocity encoders and various sensors. Refer to Paragraph 3.7.14. | Diagnostic mode 53 deselected | 4 |
| ***54** | Provides front panel control of self-adjustment diagnostics. Refer to Paragraph 3.7.14. | Diagnostic mode 54 deselected | 4 |
| 55 | *NOTE*<br>*This code is intended for use by qualified technicians only.*<br>Provides front panel examination and display of various data from the Control Write PCBA. Refer to Paragraph 3.7.14. | Diagnostic mode 55 deselected | 4 |
| ***60** | Provides manual override of various safety interlocks. Refer to Paragraph 3.7.14. | Diagnostic mode 60 deselected | 4 |
| 61 | *CAUTION*<br>*THIS CODE IS INTENDED FOR USE DURING SERVICING BY QUALIFIED TECHNICIANS ONLY. IMPROPER USE CAN RESULT IN EQUIPMENT DAMAGE.*<br>Provides manual override of various motion control corrections. Refer to Paragraph 3.7.14. | Diagnostic mode 61 deselected | 4 |

NOTES:
1. Only one code within this group can be set at a time. Setting a code clears the previously set code within the group. The individual codes within the group cannot be cleared independently.
2. Diagnostic use only.
3. Autoload function (code 30) must be set before tape is tensioned.
4. If RESET switch is pressed, unit will return to Function Select mode with code 50 displayed. To return to normal operation, set code 50 and depress RESET.

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### 3.4.16 SEVEN SEGMENT DISPLAYS

Two 7-segment displays are located on the front panel as illustrated in Figure 3-2. These displays indicate the drive's unit address, distance tape has traveled from BOT, function select codes when in the function select mode, and diagnostic codes (refer to Table 3-1).

A continually illuminated code indicates that diagnostic checks are in process. If a fault is identified, the displays flash the fault code until power is switched off or RESET is depressed.

### 3.4.17 AUTOLOAD OVERRIDE

The Autoload Override is a mechanical linkage accessible with the tape loading door opened. Depressing this switch unlatches the supply reel hub locking mechanism when the hub is turned CW, and latches the locking mechanism when the hub is turned CCW.

## 3.5 INTERFACE SIGNALS — CONTROLLER TO FORMATTER

All signal names are chosen to correspond to the logical true condition. Drivers and receivers belong to the TTL family where the true level is between +0.05v and +0.5v and the false level is between +2.5v and +5v. Interface signal mnemonics are identified by the prefix I. Interface signals are described in the following paragraphs and the signal configuration on the interface connectors is shown in Figure 3-3.

### 3.5.1 FORMATTER ADDRESS (IFAD) AND TRANSPORT ADDRESS (ITAD0, ITAD1)

These three lines in combination, allow the controller to select one of several drives connected to the controller. The maximum number of drives that may be connected in a daisy-chain configuration is as follows:

P1

| | | | |
|---|---|---|---|
| IFBY | 2 | 1 | GND |
| ILWD | 4 | 3 | GND |
| IW4 | 6 | 5 | GND |
| IGO | 8 | 7 | GND |
| IW0 | 10 | 9 | GND |
| IW1 | 12 | 11 | GND |
| ISGL | 14 | 13 | GND |
| ILOL | 16 | 15 | GND |
| IREV | 18 | 17 | GND |
| IREW | 20 | 19 | GND |
| IWP | 22 | 21 | GND |
| IW7 | 24 | 23 | GND |
| IW3 | 26 | 25 | GND |
| IW6 | 28 | 27 | GND |
| IW2 | 30 | 29 | GND |
| IW5 | 32 | 31 | GND |
| IWRT | 34 | 33 | GND |
| IRTH2 | 36 | 35 | GND |
| IEDIT | 38 | 37 | GND |
| IERASE | 40 | 39 | GND |
| IWFM | 42 | 41 | GND |
| IRTH1 | 44 | 43 | GND |
| ITAD0 | 46 | 45 | GND |
| IR2 | 48 | 47 | GND |
| IR3 | 50 | 49 | GND |

P2

| | | | |
|---|---|---|---|
| IR0 | 2 | 1 | IRP |
| ILDP | 4 | 3 | IRI |
| IR4 | 6 | 5 | GND |
| IR7 | 8 | 7 | GND |
| IR6 | 10 | 9 | GND |
| IHER | 12 | 11 | GND |
| IFMK | 14 | 13 | GND |
| IDENT | 16 | 15 | GND |
| IFEN | 18 | 17 | GND |
| IR5 | 20 | 19 | GND |
| IEOT | 22 | 21 | GND |
| IOFL | 24 | 23 | GND |
| INRZ | 26 | 25 | GND |
| IRDY | 28 | 27 | GND |
| IRWD | 30 | 29 | GND |
| IFPT | 32 | 31 | GND |
| IRSTR | 34 | 33 | GND |
| IWSTR | 36 | 35 | GND |
| IDBY | 38 | 37 | GND |
| ISPEED | 40 | 39 | GND |
| ICER | 42 | 41 | GND |
| IONL | 44 | 43 | GND |
| ITAD1 | 46 | 45 | GND |
| IFAD | 48 | 47 | GND |
| IDEN | 50 | 49 | GND |

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Figure 3-3. Formatter/Controller Interface Connector

(1) Eight FS1000 drives, or

(2) Four FS1000 drives and one standard formatted start/stop drive. The standard formatted start/stop drive may in turn have up to three unformatted start/stop drives connected in the standard daisy-chain configuration.

Signal levels and the resulting address selection are listed in Table 3-2.

### 3.5.2 INITIATE COMMAND (IGO)

This pulse initiates the commands listed in Table 3-3 (refer to Paragraph 3.7 for command descriptions). The trailing edge of IGO strobes the signals described in Paragraphs 3.5.3—3.5.8 into the formatter. At the same time, the Formatter Busy signal (IFBY) is set low.

Table 3-2
Drive Address Selection

| Address | IFAD | ITAD0 | ITAD1 |
|---|---|---|---|
| 0 | H | H | H |
| 1 | H | H | L |
| 2 | H | L | H |
| 3 | H | L | L |
| 4 | L | H | H |
| 5 | L | H | L |
| 6 | L | L | H |
| 7 | L | L | L |

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Table 3-3
Formatter Commands Initiated by IGO Pulse

| Command | IREV | IWRT | IWFM | IEDIT | IERASE | Para. Ref. |
|---|---|---|---|---|---|---|
| Read Forward | H | H | H | H | H | 3.7.1 |
| Read Reverse (Normal) | L | H | H | H | H | 3.7.2 |
| Read Reverse (Edit) | L | H | H | L | H | 3.7.2 |
| Write | H | L | H | H | H | 3.7.3 |
| Edit | H | L | H | L | H | 3.7.4 |
| Write File Mark | H | L | L | H | H | 3.7.5 |
| Variabe Length Erase | H | L | H | H | L | 3.7.6 |
| Fixed Length Erase | H | L | L | H | L | 3.7.7 |
| Space Forward | H | H | H | H | L | 3.7.8 |
| Space Reverse | L | H | H | H | L | 3.7.9 |
| File Mark Search Forward — With Data | H | H | L | H | H | 3.7.12 |
| File Mark Search Reverse — With Data | L | H | L | H | H | 3.7.13 |
| File Mark Search Forward — Without Data | H | H | L | H | L | 3.7.10 |
| File Mark Search Reverse — Without Data | L | H | L | H | L | 3.7.11 |
| Diagnostic | H | H | L | L | H | 3.7.14 |
| Data Security Erase | H | L | L | L | L | 3.7.15 |
| Select 126 c/mm (3200 cpi)/ 1.27 m/s (50 ips) | L | H | L | L | L | 3.7.16 |

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### 3.5.3 REVERSE/FORWARD (IREV)

This signal specifies forward or reverse tape motion.

Low = Reverse
High = Forward

### 3.5.4 WRITE/READ (IWRT)

This signal specifies the operating mode of the system.

Low = Write
High = Read

### 3.5.5 WRITE FILE MARK (IWFM)

This signal causes a Write File Mark to be written on the tape, if IWRT is also low during this time.

### 3.5.6 EDIT (IEDIT)

This is an additional command line used in conjunction with IREV, IWRT, IWFM, and IERASE to edit a record on tape, initiate diagnostics or data security erase, and select the high density mode (alternate to use of IRTH2 and IDEN).

### 3.5.7 ERASE (IERASE)

This is an additional command line used during erase and file mark search operations.

### 3.5.8 DENSITY SELECT (IRTH2)

The IRTH2 signal specifies the data density during a write command. Selection is accomplished at BOT during a write operation.

Low = 126 c/mm (3200 cpi) (PE)
High = 63 c/mm (1600 cpi) (PE)

### 3.5.9 SPEED SELECT (IDEN)

IDEN is used to select tape speed.

High = 0.635 m/s (25 ips)
Low = 2.54 m/s (100 ips)

This line is inactive if 1.27 m/s (50 ips) 126 c/mm (3200 cpi) is selected.

### 3.5.10 REWIND (IREW)

IREW is a pulse (200 nanoseconds minimum) that causes the tape to rewind to Load Point, providing the drive is Ready and On-line. The pulse does not cause the formatter to become busy.

### 3.5.11 OFF-LINE (IOFL)

This pulse (200 nanoseconds minimum) causes the drive to be placed in the Off-line mode of operation and to perform a rewind/unload operation. IOFL does not cause the formatter to become busy.

### 3.5.12 LOAD-ON-LINE (ILOL)

This pulse (200 nanoseconds minimum) causes the drive to be placed on line and to rewind to BOT if the tape was loaded. If the tape was not loaded, it will be loaded, rewound to BOT (if necessary) and the drive placed on line.

### 3.5.13 FORMATTER ENABLE (IFEN)

This is a level which, when low, enables the formatter interface. A high level disables the FS1000 interface, and stops tape motion in the drive.

### 3.5.14 WRITE DATA LINES (IW0—IW7)

These eight lines transmit write data from the controller to the formatter. The eight data bits on the Write Data lines are written onto the corresponding tracks on tape. IW7 corresponds to the least significant bit of the character.

The first character of the data record should be available on these lines within forty character periods after Data Busy goes true and should remain true until after the trailing edge of the first Write Strobe pulse issued by the formatter; see Figure 3-4. The next character must then be set up a minimum of 100 nanoseconds before the next trailing edge (low to high) of IWSTR. Subsequent characters will be processed in this way until Last Word is set low, indicating that the last character is being transferred. Table 3-4 identifies the Write Data lines with regard to interface identification. ANSI track number and binary weight.

### 3.5.15 WRITE DATA PARITY (IWP)

This line is used only when external parity generation is selected via the front panel function codes. External parity generation requires the controller to generate odd parity on the Write Data lines and apply this parity bit to IWP. Setup timing requirements for this line are consistent with requirements for IW0—IW7.

### 3.5.16 LAST WORD (ILWD)

During the execution of a Write command or an Erase (Variable Length) command, this pulse is used to indicate that the next character to be strobed into the formatter is the last character of the record. The line will be set low by the controller a minimum of 50 nanoseconds before the next trailing edge (low to high) of IWSTR.

### 3.5.17 GAP LENGTH (IRTH1)

This signal is used to control the length of the interblock gap written at the end of a write command. IRTH1 is tested during the time that the IGO signal goes low to transfer a write command to the FS1000. If IRTH1 is high at this time, the length of the interblock gap will be 15.24 mm (0.6 inch). If IRTH1 is low, the interblock gap will be determined by function select codes.

## 3.6 INTERFACE SIGNALS — FORMATTER TO CONTROLLER

### 3.6.1 FORMATTER BUSY (IFBY)

When a command is issued to the drive, IFBY goes low at the trailing edge of IGO and remains low until the command is executed and the drive is repositioning.

### 3.6.2 DATA BUSY (IDBY)

The IDBY signal is set low in the following modes.

(1) Write: Tape has reached operating speed and traversed the defined Interblock Gap.

(2) Read: Tape has reached operating speed.

IDBY is reset when the read head has just read the record. For on-the-fly operation, a new command must be given right after IDBY is reset and must occur before IFBY is reset. This signal should be used by the controller to inhibit further commands.

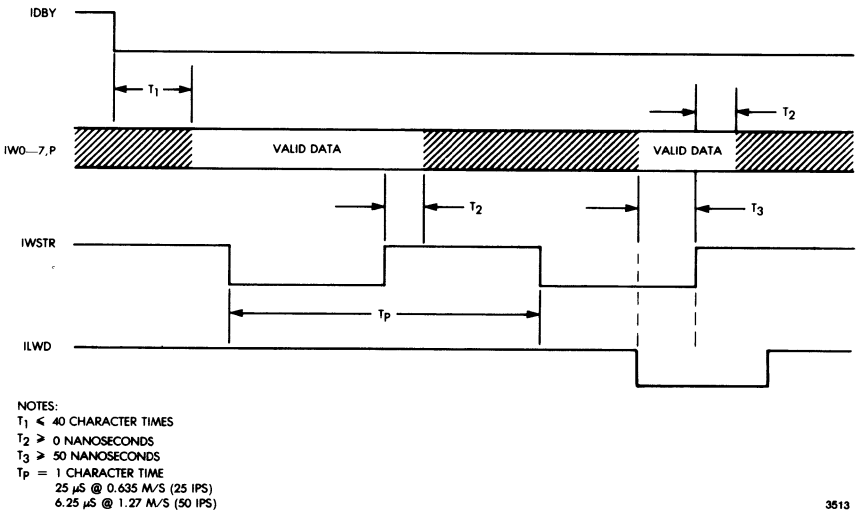


Figure 3-4. Write Data Timing

Table 3-4
Data Binary Weight Identification

| Write Line | Binary Weight | Pertec Interface Channel | ANSI Track |
|---|---|---|---|
| IW7 | 0 | 7 | 2 |
| IW6 | 1 | 6 | 8 |
| IW5 | 2 | 5 | 1 |
| IW4 | 3 | 4 | 9 |
| IW3 | 4 | 3 | 3 |
| IW2 | 5 | 2 | 5 |
| IW1 | 6 | 1 | 6 |
| IW0 | 7 | 0 | 7 |
| IWP | P | P | 4 |

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### 3.6.3 IDENTIFICATION (IDENT)

The signal is low when a PE ID burst is read from tape in 63 cp/m (1600 cpi) data density.

### 3.6.4 HARD ERROR (IHER)

The IHER signal is set low if a read error is detected by the formatter. All error information is reported to the controller before IDBY goes false.

IHER is set by one of the following.

(1) More than one channel error.
(2) Parity error without any channel error indication.
(3) A false postamble is detected.
(4) A format error is detected.

### 3.6.5 CORRECTED ERROR (ICER)

This signal is set low by a single track error during a read or read-after-write operation. ICER in a read-after-write operation indicates that the record should be rewritten.

### 3.6.6 FILE MARK (IFMK)

This signal is low when a file mark is read from tape. The formatter will recognize a file mark if there are flux reversals in Channels 0, 5, and 1, with Channels 6, 3, and 4 dc-erased.

### 3.6.7 DRIVE STATUS AND CONFIGURATION LINES

The listed lines are used to indicate the status and configuration of the selected drive and are defined in the following paragraphs.

Status: IRDY, IONL, IRWD, IFPT, ILDP, IEOT

Configuration: ISPEED

#### 3.6.7.1 Ready (IRDY)

This is a level which is true only when the drive is ready to receive commands through the interface lines.

#### 3.6.7.2 On-Line (IONL)

This is a level which is low when the on line mode is set.

#### 3.6.7.3 Rewinding (IRWD)

This is a level which is true when any rewind operation is in progress. A true IRWD causes IRDY to go false.

#### 3.6.7.4 File Protect (IFPT)

This level goes true when the write enable ring is removed from the supply reel of the selected unit and remains true until tape is unloaded.

#### 3.6.7.5 Load Point (ILDP)

This level goes true when the drive is ready and the BOT marker is detected. The signal goes false after the BOT marker moves forward passing the read head.

#### 3.6.7.6 End Of Tape (IEOT)

This signal is set low when the EOT marker is detected during a forward motion and reset when the EOT marker is detected during a reverse motion.

### 3.6.7.7 Tape Speed (ISPEED)

This signal indicates operating tape speeds of the selected drive. When true, the signal indicates operation in the high speed mode (2.54 m/s [100 ips] if 63 c/mm [1600 cpi] is selected, 1.27 m/s [50 ips] if 126 c/mm [3200 cpi] is selected); when false, the signal indicates operation in the low speed mode (0.635 m/s [25 ips] if 63 c/mm [1600 cpi] is selected).

### 3.6.8 WRITE STROBE (IWSTR)

The trailing edge (low to high) of this signal is used to strobe write data from the controller to the formatter. (See Figure 3-4 for timing data.)

### 3.6.9 READ STROBE (IRSTR)

This signal is used to strobe read data to the controller (pulsewidth 200 nanoseconds minimum).

### 3.6.10 READ DATA (IR0—IR7,P)

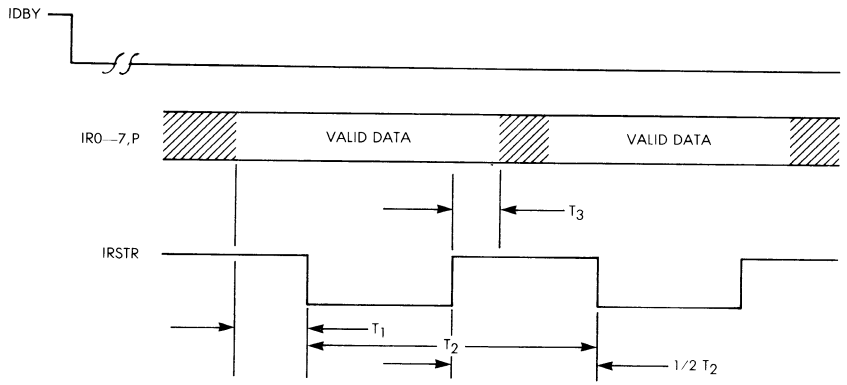
These eight lines transmit read data from the formatter to the controller. The eight data bits on the Read Data lines are read from the corresponding track on the tape. IR7 corresponds to the least significant bit. Binary weight of the Read Data lines is the same for the corresponding number Write Data line given in Table 3-4 (i.e., IR5 and IW5 both have a binary weight of 2). Timing requirements for read data are shown in Figure 3-5.

### 3.6.11 UNIT CHECK (ISGL)

This signal is used to report that the selected drive is malfunctioning.

### 3.6.12 DIAGNOSTIC ACKNOWLEDGE (INRZ)

This level, when true, indicates that the formatter is executing the diagnostic command.




NOTES:
$T_1 \geq$ 1.8 µS @ 1.27 AND 2.54 M/S (50 AND 100 IPS)
7.5 µS @ 0.635 M/S (25 IPS)
$T_2$ (AVERAGE) = 6.25 µS @ 1.27 AND 2.54 M/S (50 AND 100 IPS)
25 µS @ 0.635 M/S (25 IPS)
$T_3 \geq$ 0.9 µS @ 1.27 AND 2.54 M/S (50 AND 100 IPS)
3.8 µS @ 0.635 M/S (25 IPS)

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Figure 3-5. Read Data Timing

## 3.7 BASIC COMMANDS

(The basic formatter commands are listed in Table 3-3.) As previously mentioned in Paragraph 3.5.2, these commands are initiated when the IGO pulse strobes the proper combination of signals into the formatter (also shown in Table 3-3). The following paragraphs provide a brief description of each command and the resultant modes of operation.

### 3.7.1 READ FORWARD

The Read Forward command causes tape to be accelerated to operating speed. The drive reads the first record encountered. The formatter generates the delays necessary for proper tape positioning under the read head. The next record on tape can be read by supplying a new Read Forward command during the reinstruct time delay, thereby improving the access time to the next record. This is referred to as on-the-fly operation. Refer to repositioning characteristics in Paragraph 3.8. If the next command is not issued within the reinstruct time delay period, the FS1000 will go through the repositioning sequence.

### 3.7.2 READ REVERSE (NORMAL AND EDIT)

The Read Reverse command is similar to a Read Forward command except that tape motion is in reverse. Records may also be read in reverse on-the-fly. During any reverse operation, the formatter always resets to the quiescent state when the BOT is detected.

A Read Reverse command may be modified to position the head further back in the gap after reading a record. The change in position of the head facilitates editing of a record, and is done by the formatter in response to an Edit command. Details of the Edit command are contained in Paragraph 3.7.4.

### 3.7.3 WRITE

When executing a Write command, the FS1000 accelerates tape to operating speed and, after the appropriate pre-record delay time, begins to transfer data from the controller to the drive. The process continues until a Last Word (ILWD) command is received from the controller. The tape will continue to move forward until the record has been read by the read head, then tape will go through the reinstruct time delay. Consecutive records may be written on-the-fly, by issuing commands during the reinstruct time. If the next command is not issued within the reinstruct time delay period, the FS1000 will go through the repositioning sequence.

### 3.7.4 EDIT

Edit operations are similar to Write operations except the write current is switched off slowly at the end of an edit sequence to minimize the possibility of recording a *glitch*. For proper head positioning, an Edit command should be preceded by a Read Reverse (Edit) command.

### 3.7.5 WRITE FILE MARK

The Write File Mark command causes a file mark gap of approximately 102 mm (4 inches) to be generated, followed by a file mark consisting of 80 flux reversals. The file mark is written on the tape in Channels P, 0, 2, 5, 1, and 7. Channels 6, 3, and 4 are dc-erased.

### 3.7.6 ERASE (VARIABLE LENGTH)

The Erase (Variable Length) command causes tape to be moved in the forward direction with erase current on. An ILWD signal from the controller terminates the erase operation. Note that in the PE mode, the ID burst will not be erased when an Erase command is given from BOT.

### 3.7.7 ERASE (FIXED LENGTH)

The Erase (Fixed Length) command causes a 102 mm (4 inch) length of tape to be erased. This command is always executed while moving tape in the forward direction.

### 3.7.8 SPACE FORWARD

The Space Forward command is similar to a Read Forward command except that no Read Strobe (IRSTR) signals are supplied to the controller. Although error checking is not performed, a test is made to determine if the record spaced over was a File Mark.

### 3.7.9 SPACE REVERSE

The Space Reverse command is similar to a Read Reverse command except that no IRSTR signals are supplied to the controller. Although error checking is not performed, a test is made to determine if the record spaced over was a File Mark.

### 3.7.10 FILE MARK SEARCH FORWARD

A File Mark Search Forward command causes the drive to execute a series of Read Forward commands while on-the-fly at the speed and density previously selected. This series is terminated when either a File Mark character or the EOT marker is located. Tape is stopped when the File Mark is read as in a normal Read operation. If the EOT marker is detected during a File Mark Search, the operation is terminated and tape is stopped at the end of the record currently being processed. The File Mark Search Forward command inhibits presentation of IRSTR, ICER and IHER signals at the formatter-to-controller interface.

### 3.7.11 FILE MARK SEARCH REVERSE

A File Mark Search Reverse command causes the drive to execute a series of Read Reverse commands while on-the-fly at the speed and density previously selected. This series is terminated when either a File Mark character or the BOT marker is located. Tape is stopped when the File Mark is read as in a normal Read operation. If the BOT tab is detected during a File Mark Search, the operation is terminated. The File Mark Search Reverse command inhibits presentation of IRSTR, ICER and IHER signals at the formatter-to-controller interface.

### 3.7.12 FILE MARK SEARCH FORWARD WITH DATA

This command is the same as the File Mark Search Forward command described in Paragraph 3.7.10 except the data circuitry is enabled and presentation of IRSTR, ICSR, and IHER is not inhibited.

### 3.7.13 FILE MARK SEARCH REVERSE WITH DATA

This command is the same as the File Mark Search Reverse command described in Paragraph 3.7.11 except the data circuitry is enabled and presentation of IRSTR, ICER, and IHER is not inhibited.

### 3.7.14 DIAGNOSTIC

Various diagnostic codes (Table 3-1) can be selected via the FUNCTION SELECT switch on the drive front panel. Each of these codes, when enabled, changes the functions of the front panel controls and indicators. The purposes of each of these codes and the resultant switch and indicator functions are given in the subsequent paragraphs.

In general, the switch sequence to enable any diagnostic is

(1) Use FUNCTION SELECT switch to enter Function Select mode and step through codes to desired diagnostic.

(2) Use SET/CLEAR switch to set desired diagnostic.
(3) Use RESET switch to exit Function Select mode and enable diagnostic.
(4) Use RESET switch again to exit diagnostic back to Function Select mode at code 50.

A detailed example of an operating sequence using several diagnostic codes, is given in Paragraph 3.11.

3.7.14.1 Code 51

***WARNING***

***THIS CODE IS INTENDED FOR USE DURING SERVICING BY QUALIFIED TECHNICIANS ONLY. IMPROPER USE CAN RESULT IN PERSONNEL INJURY AND EQUIPMENT DAMAGE.***

When code 51 is set, the functions of the front panel controls and indicators are changed to provide manual control of tape motion. Functions available are Load, Forward, Reverse, Stop, and EOT/BOT Cycle. Tape motion will be at the speed preselected by the operator using Function Select codes 11, 12, and 13. Functions of the front panel controls and indicators with code 51 set, are shown in Figure 3-6.

With a tape reel in place on the supply hub but tape not loaded, depressing the Load/Cycle switch will initiate a tape load cycle. The Forward, Reverse, and Stop functions are self-explanatory. The EOT/BOT Cycle function interacts with Forward and Reverse. With EOT/BOT Cycle off, the drive will move tape in the selected direction and stop when either the EOT or BOT marker is detected.

With EOT/BOT Cycle on, tape motion will automatically reverse when either marker is detected, and tape will cycle continuously until stopped by the operator. Depressing the RESET switch will cause the drive to exit code 51 and revert to Function Select mode with code 50 displayed.

3.7.14.2 Code 52

***WARNING***

***THIS CODE IS INTENDED FOR USE DURING SERVICING BY QUALIFIED TECHNICIANS ONLY. IMPROPER USE CAN RESULT IN PERSONNEL INJURY AND EQUIPMENT DAMAGE.***

Selection of code 52, with tape loaded, provides a shuttle function at the speed preselected by the operator using Function Select codes 11, 12, and 13. Functions of the front panel controls and indicators, with code 52 set, are shown in Figure 3-7.

The switches, as indicated in the figure, are dual purpose. The forward or reverse shuttle length is displayed by pressing the appropriate switch. Depressing the LOAD/DECREMENT LENGTH switch with a tape reel in place on the supply hub but tape not threaded will initiate a tape load cycle. To change the shuttle length, press and hold the Forward or Reverse Length display switch, and simultaneously press and hold the Increment Length or Decrement Length switch until the desired shuttle length is displayed. Length is displayed in hexadecimal tach lines after ramp-up, most significant byte first (for 1 second), then the least significant byte. When incrementing or decrementing, each time the LSB goes to 0, the MSB will be displayed for 1 second. Shuttling is started and stopped by depressing the Shuttle/Stop switch. If EOT is detected during forward motion, the tape will rewind to BOT and shuttling will restart. Depressing the RESET switch will cause the drive to exit code 52 and revert to Function Select mode with code 50 displayed.

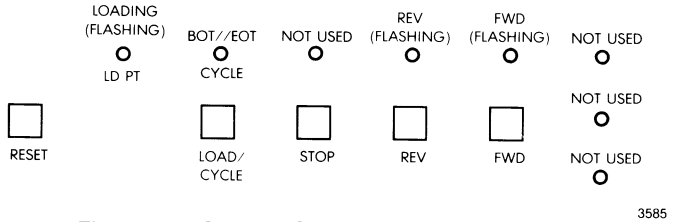



Figure 3-6. Code 51 Control/Indicator Functions

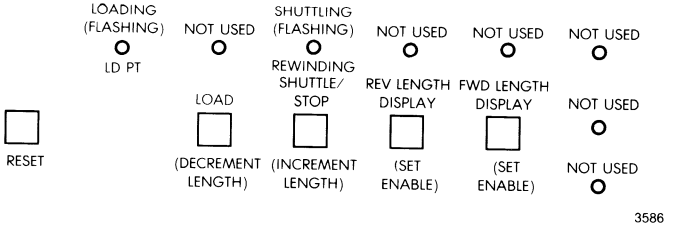



Figure 3-7. Code 52 Control/Indicator Functions

3.7.14.3 Code 53

*NOTE*

*This code is intended for use by qualified technicians only.*

Selection of code 53 provides front panel monitoring of the tension or velocity encoder. The front panel indicators allow monitoring of the drive sensors. Functions of the front panel controls and indicators, with code 53 set, are shown in Figure 3-8.

The indicators are all dual purpose as shown in the figure. When Tension Look is depressed, the tension encoder count is shown on the 7-segment display, and the sensor functions shown over the indicators (Figure 3-8) are displayed on the indicators. When (Velocity Look) is depressed, the velocity encoder count is shown on the 7-segment display, and the sensor functions shown under the indicators (in parentheses) are displayed on the indicators. Depressing the RESET switch will cause the drive to exit code 53 and revert to Function Select mode with code 50 displayed.

3.7.14.4 Code 54

***WARNING***

***THIS CODE IS INTENDED FOR USE DURING SERVICING BY QUALIFIED TECHNICIANS ONLY. IMPROPER USE CAN RESULT IN PERSONNEL INJURY AND EQUIPMENT DAMAGE.***

Selection of code 54 provides front panel access to four adjustment diagnostic routines; the SU/TU DAC MID Self Adjustment, SU/TU Load Speed Self Adjustment, SU Load Pulse Self Adjustment, and Motor Torque Factor Self Adjustment. Performance of the SU Load Pulse Self Adjustment and the SU/TU Load Speed Self Adjustment requires a 10.5 inch reel of tape to be locked on the supply hub with the

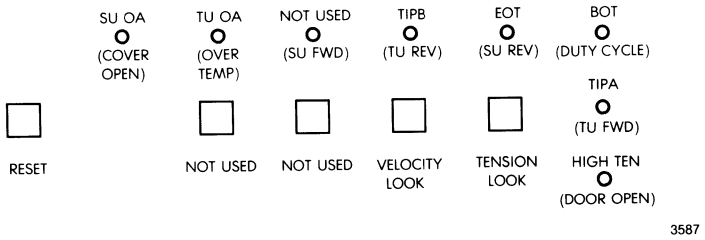



Figure 3-8. Code 53 Control/Indicator Functions

end of the tape leader secured to the tape pack. The Motor Self Adjust requires the use of an 8.5 inch reel of tape with the tape leader free to thread. Functions of the front panel controls and indicators, with code 54 set, are shown in Figure 3-9. Depressing the RESET switch will cause the drive to exit code 54 and revert to Function Select mode with code 50 displayed.

3.7.14.5 Code 55

*NOTE*

*This code is intended for use by qualified technicians only.*

Selection of code 55 provides front panel access to and display of data stored in memory that may be required during maintenance operations. Functions of the front panel controls and indicators with code 55 set are shown in Figure 3-10.

When the Prom Version Examine/Display switch is depressed, the associated indicator will flash and the PROM 0 version will be shown on the 7-segment display. The version number will be shown as four sequential bytes (e.g., first byte, 11; second byte 22; third byte, 50; fourth byte, 01: equals PROM 0 version 112250-01). Given a PROM 0 version of 112250-01, PROMs 1—3 would be 112251-01, 112252-01, and 112253-01, respectively. PROM 1—3 version numbers are not displayed.

Depressing the NOVRAM Motor Factor Examine/Display causes the associated indicator to flash while the contents of the NOVRAM motor factor table are shown on the 7-segment display. The table consists of 18 bytes which are presented sequentially. The factors displayed and their byte numbers are given in the following list. Takeup reel tension (TU TENSION), bytes 1 and 2; takeup motor drag (TU MDRAG), bytes 3 and 4; takeup motor acceleration (TU ACCEL), bytes 5 and 6; head drag (HDRAG), bytes 7 and 8; supply reel tension (SU TENSION), bytes 9 and 10; supply motor drag (SU MDRAG), bytes 11 and 12; supply motor acceleration (SU ACCEL), bytes 13 and 14; takeup reel load speed (TU LD SPD), byte 15; supply reel load speed (SU LD SPD), byte 16; supply reel load pulse, reverse (SU LD PULSE REV), byte 17; supply reel load pulse, forward (SU LD PULSE FWD), byte 18; byte 19 not used; takeup/supply digital analog converter mid value (TU/SU DACMID), byte 20. The most significant (left) nibble when added to $1F8_{16}$ will equal the TU DACMID. The least significant (right) nibble when added to $1F8_{16}$ will equal the SU DACMID. Depressing the RESET switch will cause the drive to exit code 55 and revert to Function Select mode with code 50 displayed.

Depressing the Unit Configuration Examine/Display switch causes the associated indicator to flash while the Unit Configuration is shown on the 7-segment display. The configuration will be shown as CX, where C stands for Configuration and X represents a hexadecimal (Base 16) number from 0 to F. Depressing the RESET switch will cause the drive to exit code 55 and revert to Function Select mode with code 50 displayed.

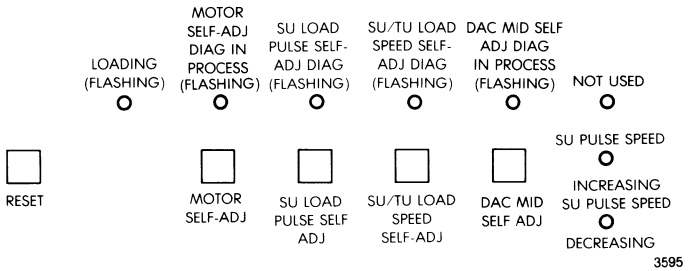



Figure 3-9. Code 54 Control/Indicator Functions

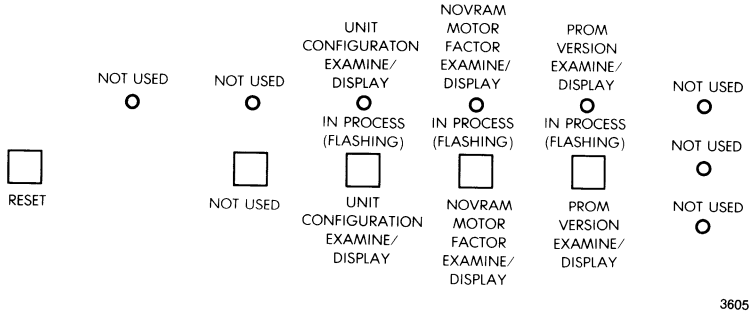



Figure 3-10. Code 55 Control/Indicator Functions

3.7.14.6 Code 60

***WARNING***

***CODE 60 OVERRIDES SAFETY FEATURES BUILT INTO THE DRIVE TO PROTECT THE OPERATOR FROM INJURY AND THE EQUIPMENT FROM DAMAGE. IT IS INTENDED FOR USE ONLY BY QUALIFIED SERVICE TECHNICIANS.***

Selection of code 60 provides manual override, via the front panel controls, of four safety interlocks designed into the drive. The front panel indicators flash to provide a display of the interlock features that have been defeated. Functions of the front panel controls and indicators, with code 60 set, are shown in Figure 3-11. Depressing the RESET switch will cause the drive to exit code 60 and revert to Function Select mode with code 50 displayed.

3.7.14.7 Code 61

*CAUTION*

*CODE 61 DISABLES CRITICAL CORRECTION FEATURES BUILT INTO THE DRIVE THAT ARE REQUIRED FOR NORMAL, SAFE, OPERATION. IF MISUSED, DAMAGE TO THE EQUIPMENT CAN OCCUR. CODE 61 IS INTENDED FOR USE ONLY BY QUALIFIED SERVICE TECHNICIANS.*

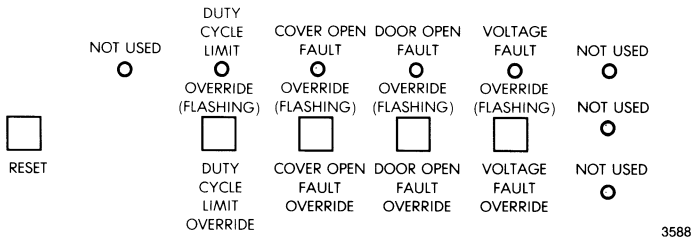



Figure 3-11. Code 60 Control/Indicator Functions

Selection of code 61 provides manual override, via the front panel controls, of four motion control correction functions designed into the drive. The front panel indicators flash to provide a display of the correction functions that have been defeated. Functions of the front panel controls and indicators with code 61 set, are shown in Figure 3-12. Depressing the RESET switch will cause the drive to exit code 61 and revert to Function Select mode with code 50 displayed.

### 3.7.15 DATA SECURITY ERASE

This command causes tape to be erased from its present position to a point 0.91 to 1.52 meters (3 to 5 feet) after EOT. Tape is then rewound to BOT.

### 3.7.16 SELECT 126 C/MM (3200 CPI)/1.27 M/S (50 IPS)

This command causes the drive to operate at a tape speed of 1.27 m/s (50 ips) and a data density of 126 c/mm (3200 cpi). (This is an alternate to the use of IRTH2 and IDEN lines for speed and density selection.)

## 3.8 TIMING REQUIREMENTS

Command re-instruct time repositioning time and access time, are defined in the following paragraphs and illustrated in Figure 3-13.

### 3.8.1 COMMAND RE-INSTRUCT TIME

With tape moving forward at nominal speed, command re-instruct time is measured from completion of the last command (A in Figure 3-13) to the point where forward deceleration begins (B in Figure 3-13). It is defined as the time, during the interblock gap, following completion of the last command and prior to the start of the repositioning cycle, when another command can be accepted. Command re-instruct time is a function of tape speed and the interblock gap length selected.

### 3.8.2 REPOSITIONING TIME

Repositioning time is measured from the end of the command re-instruct period through decelerate forward, accelerate reverse, and decelerate reverse (see Figure 3-13, B to C to D to E). Repositioning time varies with tape speed and direction and the amount of tape left on each reel. If a new command is received after the reinstruct time, the repositioning sequence is completed and the new command begins with the access time required to ramp up from E to A to B.

### 3.8.3 ACCESS TIME

With the unit stopped, access time is measured from command reception (point E in Figure 3-13) to the point where nominal velocity is attained and the first byte of data is transferred (point F). Access time varies with drive speed, prior tape speed and direction, and duty cycle.

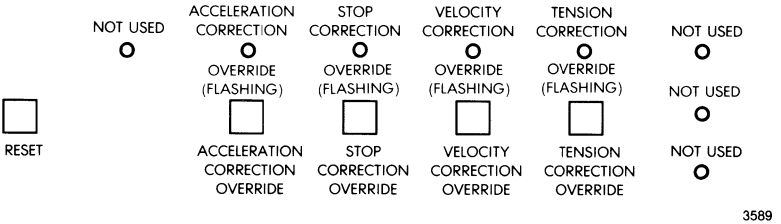
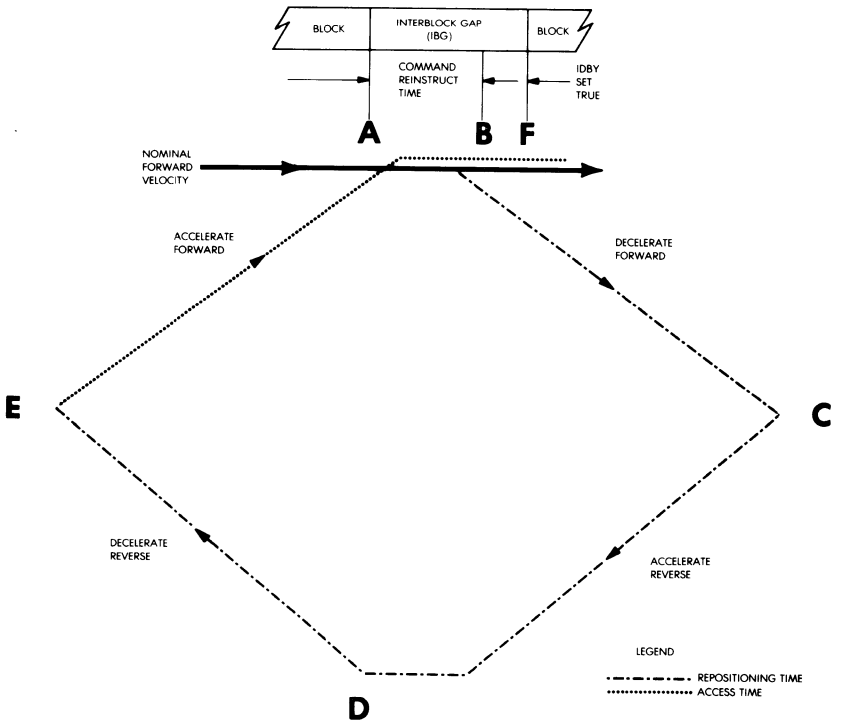



Figure 3-12. Code 61 Control/Indicator Functions




NOTES

1 COMMAND REINSTRUCT TIME (A TO B). TAPE MOTION CONTINUES AT THE NOMINAL VELOCITY IF A COMMAND IS RECEIVED BETWEEN A AND B. IF A COMMAND ARRIVES AFTER THE END OF THE REINSTRUCT TIME (B), THERE IS A COMMAND OVERRUN, AND THE TAPE UNIT AUTOMATICALLY GOES THROUGH A REPOSITIONING CYCLE

2 REPOSITIONING TIME (B TO C TO D TO E). IF A COMMAND HAS NOT BEEN RECEIVED BY THE TIME THE TAPE UNIT REACHES THE STOPPED STATE (E), THE TAPE REMAINS STOPPED AND AWAITS THE NEXT COMMAND

3 ACCESS TIME (E TO A TO F): WHEN A COMMAND IS RECEIVED WHILE THE TAPE UNIT IS IN THE STOPPED STATE, IT ACCELERATES FORWARD FROM E TO ATTAIN NOMINAL VELOCITY AND EXECUTES THE COMMAND (ACCESS TIME IS THE TIME BETWEEN THE STOPPED STATE AND THE POINT AT WHICH IDBY IS SET TRUE (LOW)

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Figure 3-13. Reinstruct and Repositioning

### 3.9 OPERATOR TROUBLESHOOTING

If the drive will not load tape or otherwise fails to function properly, perform the following operator checks prior to notifying maintenance personnel.

(1) If unit is totally inoperative, check the line fuse located under the sliding plastic cover on the rear of the unit, next to the power cord receptacle.

(2) Note any error code on the 7-segment displays and, if the problem requires calling maintenance personnel, report the fault code observed. Refer to Table 3-5 for a list of the error codes and the detected fault conditions that they represent.

(3) Ensure that supply reel is positioned such that tape will unwind if the reel is turned clockwise (as viewed from above).

(4) If tape reels turned, but tape did not thread, check tape leader for damage. Trim the leader using a tape crimper (IBM Part No. 2512063, or equivalent) as required.

(5) If tape reels do not turn, check that tape loading door and top doors of unit are securely closed. Doors are interlocked to prevent tape motion when open.

### 3.10 OPERATOR MAINTENANCE

Operator maintenance of the FS1000 Formatted Tape Drive is limited to daily cleaning of the tape path components as specified in Paragraph 3.2. Also clean the exterior of the unit as necessary using a soft cloth slightly moistened with water. Notify maintenance personnel to perform regular preventive maintenance every 6 months.

*CAUTION*

*ENSURE THAT CLEANING CLOTH IS ONLY DAMP, NOT WET. EXCESSIVE MOISTURE CAN HAVE AN ADVERSE EFFECT ON UNIT PERFORMANCE. DO NOT USE SOLVENTS ON FRONT PANEL LETTERING.*

### 3.11 DIAGNOSTIC OPERATING PROCEDURE

A sample procedure for operating the drive while using the diagnostic mode is given in Table 3-6. The procedure assumes a starting point of a fully connected unit with power off and tape reel in place, but tape not threaded. A further assumption is that it will be necessary to operate with the doors open. This condition requires that the interlocks be disabled. The diagnostic mode to be utilized is code 52; the shuttle mode. Note that in general the operating sequence consists of function code selection (FUNCTION SELECT switch), function code setting (SET/RESET switch), and function enable (RESET switch).

### 3.12 REFERENCE DOCUMENTS

An Operating and Service Manual (PPC No. 110831) containing detailed description, theory of operations, and maintenance information is available at extra cost. Contact the PPC Order Entry Department, 9600 Irondale Avenue, Chatsworth, California 91311.

Table 3-5
Fault Conditions Detected

| Error Code | Fault Condition | Error Indication Source |
|---|---|---|
| 01 | Hub unlock error — Excessive supply reel movement after hub lock solenoid has been energized* | Supply once around sensor (SUOA) |
| 02 | Slack tape error — Slack tape not removed before timeout* | Tension encoder |
| 03 | Load off EOT error — Loss of tape in path during tape slack removal* | Tape path sensor (TIPA) |
| 04 | Motion error — Inadequate forward tape motion after take-up reel hookup* | Velocity encoder |
| 05 | Forward amplifier error — Incorrect voltage at amplifier output during amplifier nulling process* | Reel amplifier forward sense circuit |
| 06 | Sense hardware error — Forward and reverse signals present concurrently during amplifier nulling process* | Reel amplifier forward and reverse sense circuits |
| 07 | Reverse out of range error — Incorrect voltage at amplifier output during amplifier nulling process* | Reel amplifier reverse sense circuit |
| 08 | Forward out of range error — Incorrect voltage at amplifier output during amplifier nulling process* | Reel amplifier forward sense circuit |
| 09 | Tension flag error — High tension indication at start of loading process* | Mid tension sensor of tension encoder |
| 10 | Tape-in-path error — Loss of tape in path before loading process* | Tape path sensor (TIPA) |
| 11 | Hub lock error — Insufficient supply reel rotation before timeout* | SUOA |
| 12 | Upside down supply reel error — Both tape-in-path signals detected together during hublock or backwrap portion of loading process* | TIPA and TIPB |
| 13 | Load speed adjust error — Supply reel speed indication incorrect after speed adjustment portion of backwrap cycle* | SUOA |
| 14 | Static on tape error — Tape not in path after spinning supply reel in reverse direction* | TIPA |
| 15 | Anti-static spin error — Supply reel activity not sensed at beginning of reverse spin* | SUOA |
| 16 | Timeout before TIPB error — Tape-in-path not sensed before timeout or excesive supply once around changes before tape-in-path is sensed* | TIPB and SUOA |
| 17 | TIPA lost error — Loss of tape-in-path signal during threading* | TIPA |
| 18 | Hookup to takeup reel error — Tape motion not sensed after TIPB sensed during threading* | Velocity encoder |

*Tape load process
**Tape unload process

Continued

Table 3-5
Fault Conditions Detected (Continued)

| Error Code | Fault Condition | Error Indication Source |
|---|---|---|
| 19 | TIPB lost error — Loss of tape-in-path signal after takeup reel motion starts during hookup* | TIPB |
| 20 | Hookup timeout error — Tape motion not sensed during hookup portion of autoload* | Velocity encoder |
| 21 | Tension timeout error — Mid tension flag not detected before timeout during tension up* | Mid tension flag |
| 22 | Mid tension range error — Mid tension flag not detected within proper encoder count from loose position during tension up* | Mid tension flag and tension encoder |
| 23 | TIPA or TIPB lost error — Tape-in-path sense signal lost after hookup and before tension up* | TIPA and TIPB |
| 24 | Supply stuck error — Supply reel speed indication incorrect** | SUOA |
| 25 | Over tension error — Excessive tape tension** | Mid tension flag |
| 26 | Unload timeout error — Tape-in-path indication after fault timer timeout** | TIPA |
| 27 | Takeup once around (TUOA) timeout error — Timeout while waiting for SUOA activity during load, after hook-up and forward motion detected | TUOA |
| 28 | Circumference calculation timeout error — Timeout during once around circumference calculation during load | SUOA<br>TUOA |
| 30 | Over travel loose error — Tension arm out of operating range in loose direction after tension up | Tension encoder |
| 31 | Over travel tight error — Tension arm out of operating range in tight direction after tension up | Tension encoder |
| 32 | TUOA out-of-range error — Excessive takeup circumferences calculated to be out of normal range between load and unload time | TUOA |
| 33 | SUOA out-of-range error — Excessive supply circumferences calculated to be out of normal range between load and unload time | SUOA |
| 60 | Voltage fault error — One or more supply voltages out of operating range | Power supply outputs |
| 61 | Over temperature error — Loss of cooling air | Thermostat |
| 62 | Cover open error — Cover open indication during tape motion | Cover interlock switch |
| 63 | Door open error — Door open indication during tape motion | Door interlock switch |

*Tape load process
**Tape unload process

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Table 3-6
Diagnostic Operating Procedure

| Step No. | Action | Display | Comments |
|---|---|---|---|
| 1 | Toggle POWER switch to ON | Power indicator lights. 7-segment displays show default unit no. – 0 | Powerup diagnostics indicated by lamp display. Refer to Paragraph 2.4.2. |
| 2 | Depress LOAD/ON LINE switch | LD PT indicator flashes as tape loads, lights steadily when tape reaches load point | |
| 3 | Depress FUNCTION SELECT switch and hold for 3 seconds | Function select indicator lights | |
| 4 | Hold FUNCTION SELECT switch depressed or use multiple depressions to step thru function codes | Diagnostic code 52 on 7-segment display | |
| 5 | Depress SET/CLEAR switch | Set/Clear indicator lights | Code 52 set |
| 6 | Depress RESET switch | Code 52 remains on display. All other indicators go out | Code 52 enabled; see Figure 3-7 for control/ indicator functions |
| 7 | Depress and hold SET/ CLEAR (FWD LENGTH DISPLAY) switch | Forward shuttle length displayed on 7-segment display | Display is hexa-decimal tach lines after rampup, most significant digit first |
| 8 | While holding SET/CLEAR switch, depress and hold REW/UNLOAD (INCRE-MENT LENGTH) switch until desired shuttle length is obtained. Release switches | $900_{16}$ displayed on 7-segment display. Most significant digit first | Display incrementing will start slowly and increase to a blur, with a momentary pause and display of the MSB each time the LSB increments to 00 |
| 9 | Depress and hold FUNCTION SELECT (REV LENGTH DISPLAY) switch | Reverse shuttle length displayed on 7-segment display | Display is in hexi-decimal tach lines after rampup, most significant digit first |
| 10 | While holding FUNCTION SELECT switch, depress and hold LOAD/ON LINE (DECREMENT LENGTH) switch until desired shuttle length is obtained. Release switches | $300_{16}$ displayed on 7-segment display. Most significant digit first | Display decrementing starts slowly and increases to a blur, with a momentary pause and display of the MSB each time the LSB decrements to 00 |
| 11 | Depress REW/UNLOAD (SHUTTLE/STOP) switch | Tape will shuttle forward $900_{16}$ tach lines and reverse $300_{16}$ tach lines | Cover and door can be opened to observe operation |

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PERTEC
PERIPHERALS
CORPORATION

P.O. Box 2198
Chatsworth, CA 91311
(818) 882-0030
TWX (910) 494-2093