MAGNETIC TAPE SYSTEM
GENERAL DESCRIPTION
3B20D MODEL 1 PROCESSOR

CONTENTS PAGE

Figures

1. GENERAL

1.01 This section provides a brief physical and functional description of the KS-22091, L2, magnetic tape system used with the 3B processor.

1.02 This section is being reissued to reflect a title change from 3B to 3B20D Model 1 processor and to delete information in paragraphs 2.01 and 4.11 relating to the KS-22091, L3, tape system. The 800-bit-per-inch, nonreturn-to-zero operation of this dual density tape unit is not supported by the 3B20D Model 1 processor. Revision arrows are used to emphasize the more significant changes.

2. CONFIGURATION

2.01 The KS-22091, L2, magnetic tape system can consist of as many as four KS-22091, L1, tape transport units and one associated formatter that reads and writes data from and to the tape in a 1600-bit-per-inch, single-density, phase-encoded format. ⧫A formatter is always required for the first tape unit on the system. Three additional units can be supported by this formatter.⧫

2.02 Tape transports (when more than one is installed) are connected to the formatter in a "daisy-chain" configuration; that is, each succeeding tape transport is connected to the preceding tape unit in a serial manner. Only the first unit in the chain is connected directly to the formatter. Figure 1 shows the standard interconnections.

3. PHYSICAL DESCRIPTION

3.01 The ♦KS-22091, L2,♦ formatter (at present, this is a Kennedy Model 9219) is 3.34 inches high, 16.76 inches wide, and 14 inches deep and weighs 20.6 pounds. The formatter is mounted on the rear of the first transport. The unit has no controls or indicators except a switch located on the rear for selection of either 115- or 230-Vac input power. Connectors J101, A10J1, and A11J1 and a power input connector are located on the rear of the unit. Figure 2 depicts a J1C134 equipment frame with tape transports and formatter installed.

3.02 The tape transport unit is also designed to fit in a standard 19-inch-wide equipment rack. It measures 24.47 inches high by 19 inches wide and is 13 inches deep. A hinged front cover provides access to the tape reels and tape heads. The tape drive motors, read-write heads, and other mechanisms are mounted on a deck plate which, in turn, may be opened to provide access to the tape drive mechanisms and electronics. Refer to Fig. 3 and 4.

3.03 A control indicator panel is located on the left side of the tape transport to provide some control capability and status information. A test panel is located under the front panel nameplate. These panels and the function of each switch and indicator are shown in Fig. 5 and 6.

3.04 Connectors A10P1 and A11P1 are located on the rear of the tape transport to provide interconnections between tape transports and the formatter (Fig. 7). A power connector which mates with a standard, detachable power cord is also located on the rear of the cabinet.

4. FUNCTIONAL DESCRIPTION

4.01 The KS-22091, L2, tape system consists of four functional areas: control logic, servo system, data electronics, and formatter. These areas are discussed in turn.

CONTROL LOGIC

4.02 The control logic generates tape system commands in response to commands from the central control (CC) and the local control panels. In addition, certain status signals are returned to the CC and to the status indicators on the control panels. Figure 8 is a block diagram of the control logic.

4.03 Initially, the control logic accepts commands from the main control panel to prepare the tape transport for operation. After power is turned on and a tape is installed, operation of the LOAD pushbutton initiates a series of signals that cause the tape to move forward to the load point. This load point is identified by a reflective marker attached to the tape which is detected by a photoelectric sensor. This prepares the tape transport to accept commands from the external system as soon as the unit is placed on-line by operation of the ON-LINE pushbutton. Once the unit is on-line, none of the local pushbutton controls have any effect until the unit is taken off-line either by a remote command or a second operation of the ON-LINE pushbutton.

SERVO SYSTEM

4.04 The servo system consists of the reel motors, the capstan drive motor, the servos to drive the motors, and electronics to control the servos. The capstan drive motor moves the tape at a precise speed, while the reel motors maintain a constant tension on the tape.

4.05 The capstan servo system includes the capstan drive motor, a servo amplifier, and a tachometer driven by the capstan motor. The servo amplifier compares the tachometer output (which is directly proportional to motor speed) with a fixed reference voltage and then controls motor speed to maintain a predefined relationship between the tachometer output and the reference voltage.

4.06 Tape tension is sensed by spring-loaded buffer arms to which are attached magnetic position sensors. If tape tension changes, the arms move, thereby causing a change in output from the position sensors. This output is amplified by the servo amplifiers, which then drive the reel motors to restore the proper tension in the tape. Refer to Fig. 9.

DATA ELECTRONICS

4.07 The data area consists of the read and write amplifiers and interface circuit cards, which provide output drivers and timing controls. A write channel and a read channel are required for each of the nine recording tracks on a tape. A write channel consists of a buffer, an adjustable deskewing circuit, a clocked flip-flop, and a write head driver. Data and control signals are accepted from the formatter and are amplified and applied to the write heads.

4.08 In principle, all bits of a data word are written simultaneously across the width of the tape,

one bit in each of the nine tracks. However, because of electrical and mechanical differences between the amplifier channels and write heads, the bits vary slightly in time. This time difference is called "skew." Each write amplifier contains deskew switches that are set at the factory, using channel P (parity) as a reference, to minimize write skew.

4.09 A read channel basically consists of a read head, amplifiers, circuits to convert tape signals into digital form, and circuits to detect excessive read skew and interrecord gaps. All nine tracks are read simultaneously. The signals are amplified, converted to digital form, and then placed on the output leads. Figures 10 and 11 are block diagrams of the write and read data circuitry, respectively.

4.10 Skew correction on the read heads is a mechanical adjustment of read head position to minimize time scatter of the signals read from tape. As previously stated, write skew is adjustable on each individual channel, while read skew is only adjustable on the nine read heads as a group.

FORMATTER

4.11 The Kennedy Model 9219 formatter is a microprocessor-controlled unit that accepts commands and data from a source (in this case the CC) and processes these signals into a form acceptable to different tape transports with different tape speeds and recording and reproducing requirements. The ◗3B20D Model 1◖ processor application uses a tape speed of 25 inches per second and a 1600-bit-per-inch, phase-encoded format.

4.12 Selection of the various options such as tape speed, signal format, and unit address is done by switches within the formatter. Figure 12 lists the options that are available, although most of them are not used in a ◗3B20D Model 1◖ processor. The ◗3B20D Model 1◖ options are noted by an X.

4.13 The formatter consists of a microprocessor, an interface circuit pack, a masterboard, and a phase-encoded read circuit pack for phase-encoded applications. The microprocessor controls data, commands, and status flow between the selected tape unit and the controller. The interface card adapts the formatter to the peripheral unit controller. The masterboard interconnects the microprocessor, the interface circuit card, and the tape transport. The phase-encoded read circuit card (when installed) permits recovery of data which has been recorded in that particular format.

5. MAINTENANCE

5.01 Maintenance should be performed on the magnetic tape system while in an off-line condition. Software diagnostics may be used to isolate a problem to a specific tape transport. Routine maintenance will be done on a scheduled basis so that individual units may be taken off-line at a time which will not cause interruptions of service.

5.02 Diagnostic tests of an off-line formatter and tape transport can be done using a Kennedy TB9219 test box. This is a self-contained unit that can be connected to a formatter. The test box writes data onto the tape and then compares what was written with what is read back. Many different data patterns may be written to insure that the formatter and tape transport are thoroughly exercised. Switches on the test box allow selection of various test programs, test modes, and data patterns. Lamps display error counts and status indications.

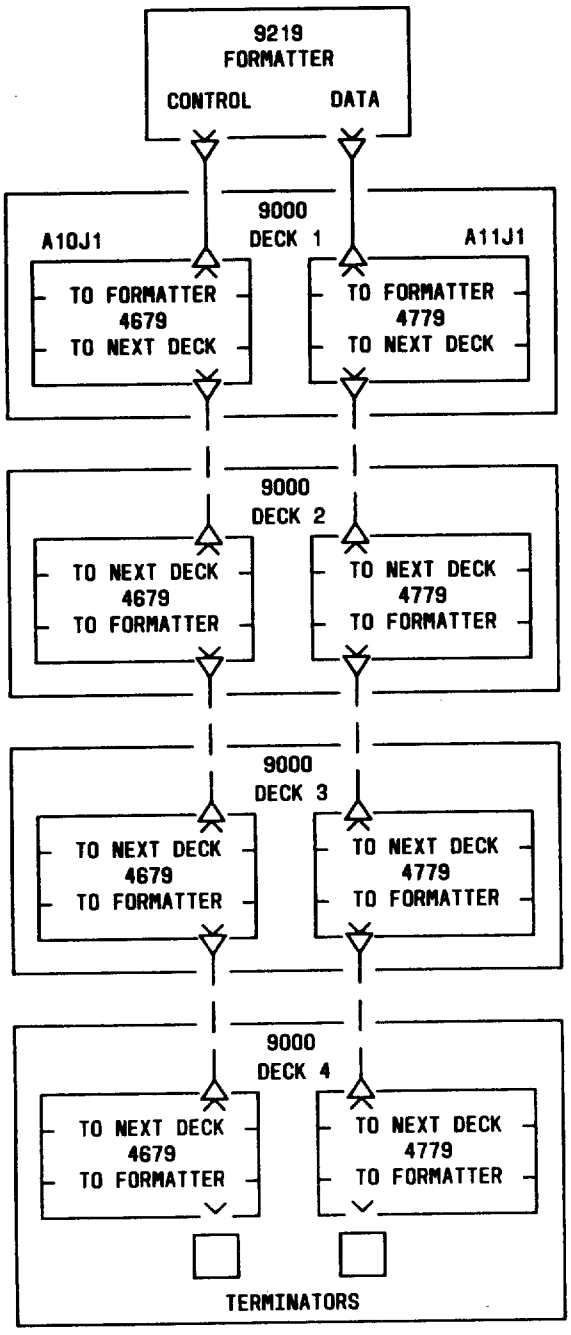
5.03 Task Oriented Practices are provided to assist craft personnel in performing routine maintenance, acceptance tests, etc. These procedures will be adequate for normal maintenance operations.

6. REFERENCES

6.01 The following Kennedy Company manuals provide detailed circuit theory and maintenance instructions:

EQUIPMENT	TITLE
Model 9219	Formatter Operation and Maintenance Manual
Model 9000	Digital Tape Transport Operation and Maintenance Manual
Model TB9219	Test Box Operation and Maintenance Manual

6.02 Refer to Section 254-301-000 for additional information relevant to the magnetic tape system.



NOTES:

1. A. DATA ADAPTER 4779 PLUGS INTO A11J1 OF DECK.
   B. CONTROL ADAPTER 4679 PLUGS INTO A10J1 OF DECK.
   C. OBSERVE A/7 KEYS OF ABOVE ADAPTER BOARDS WHEN CONNECTING TO DECK(S).
2. ALL RIBBON INTERCONNECT CABLES (FORMATTER TO ADAPTER, ADAPTER TO ADAPTER) ARE IDENTICAL.
3. OBSERVE TRIANGLE (▽) KEYS ON CABLE, FORMATTER, AND ADAPTER BOARD CONNECTORS.
4. OBSERVE "TO FORMATTER" AND "TO NEXT DECK" CONVENTION AS SHOWN ABOVE WHEN INTERCONNECTING DAISYCHAIN ONLY.
5. DATA 3860 AND CONTROL 3841 TERMINATOR CARDS ARE INSTALLED IN LAST DECK OF DAISYCHAIN ONLY.
6. DECK ADDRESS SELECT IS DETERMINED BY CONTROL MASTERBOARD SELECT PLUG OR BY OPTIONAL FRONT PANEL UNIT SELECT SWITCH.

Fig. 1—Magnetic Tape System Interconnections

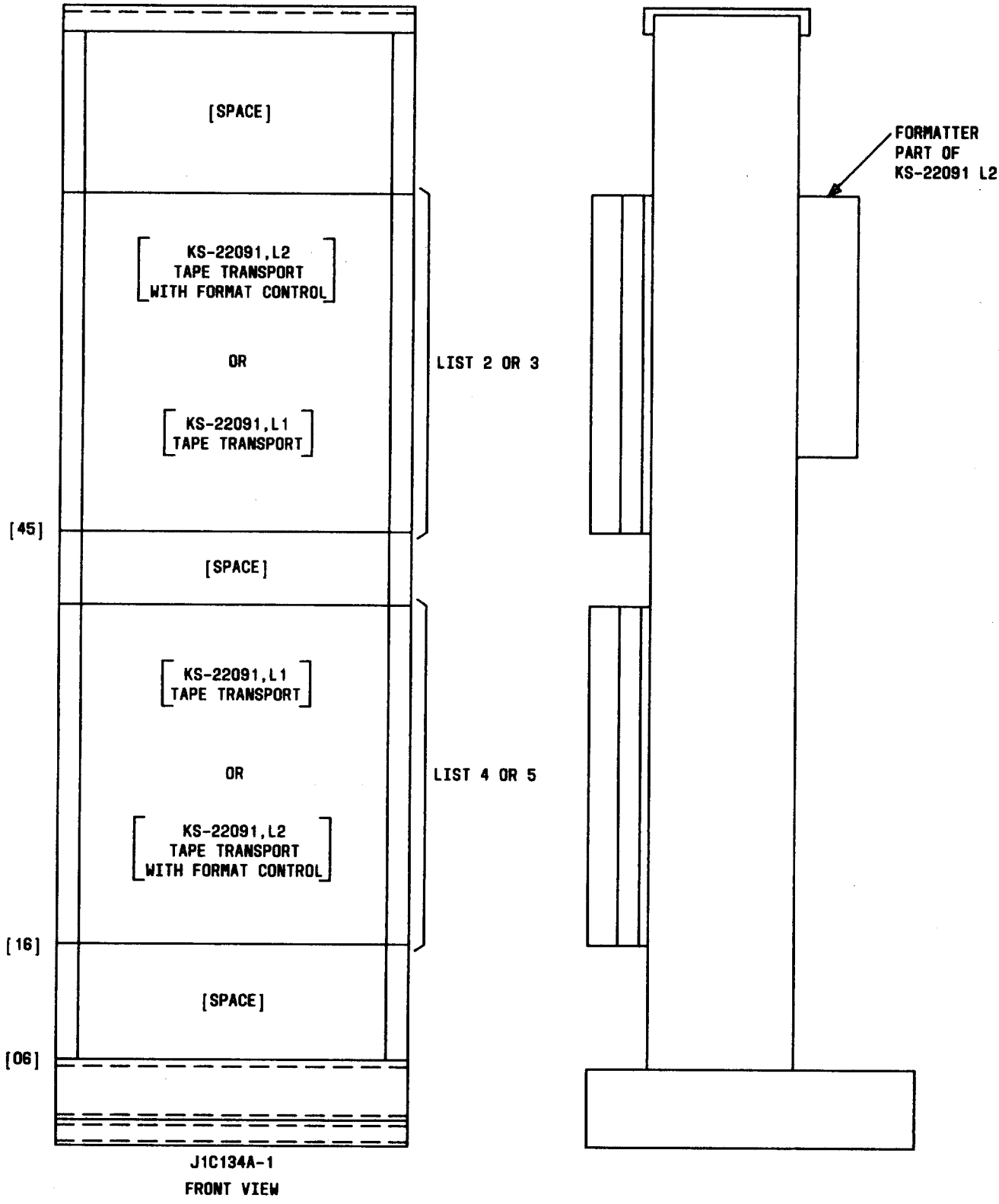


Fig. 2—Tape Transport Frame

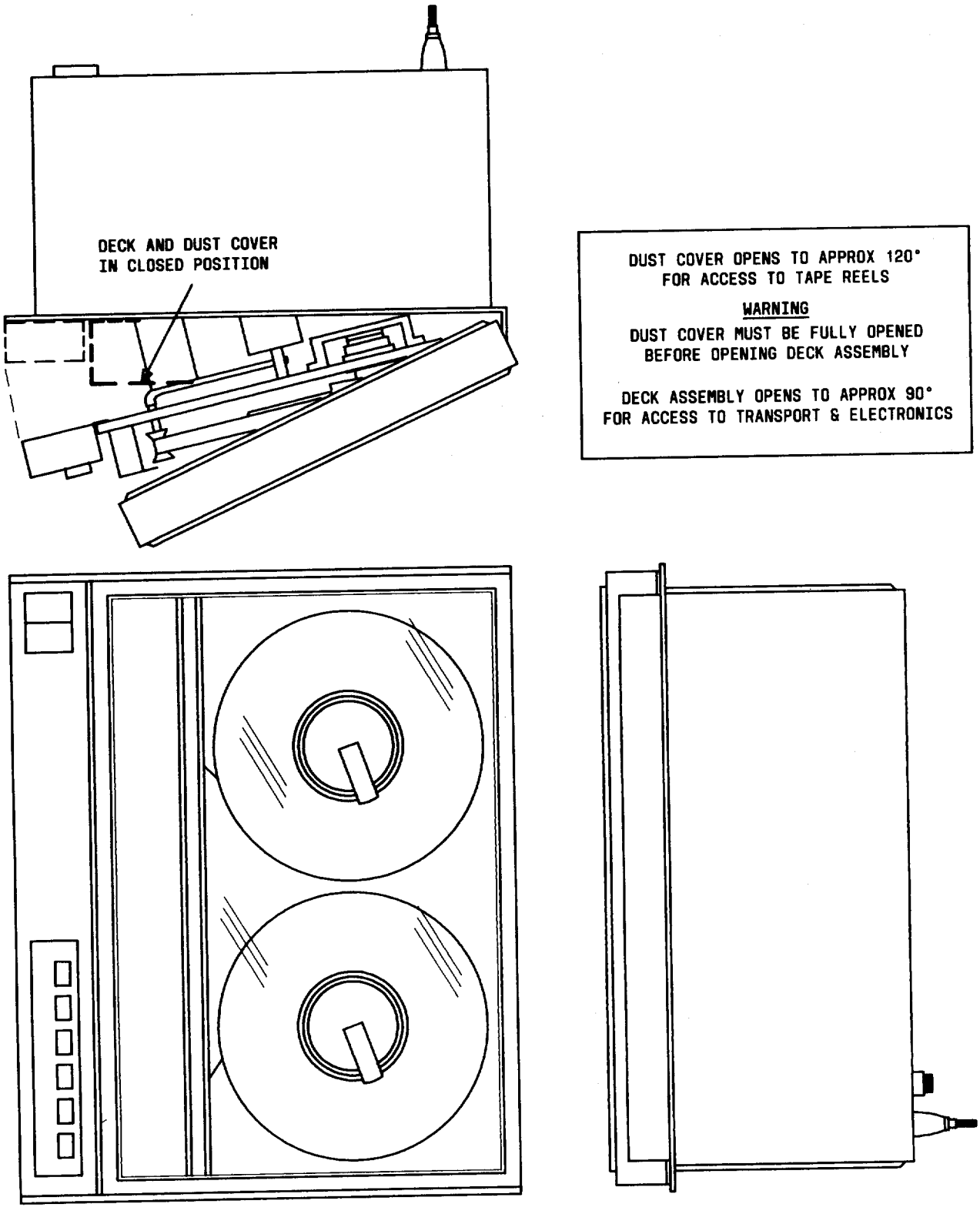


Fig. 3—KS-22091, L1, Tape Transport

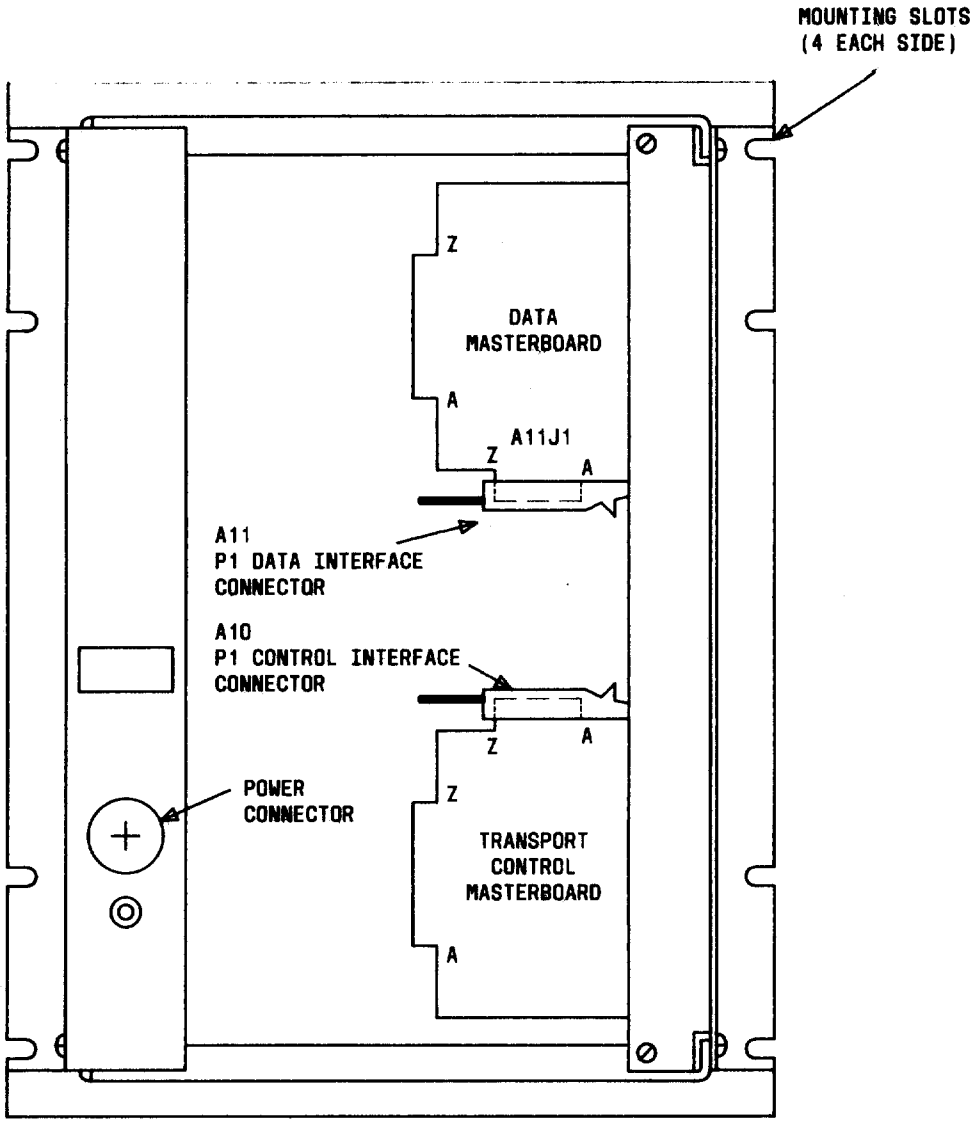
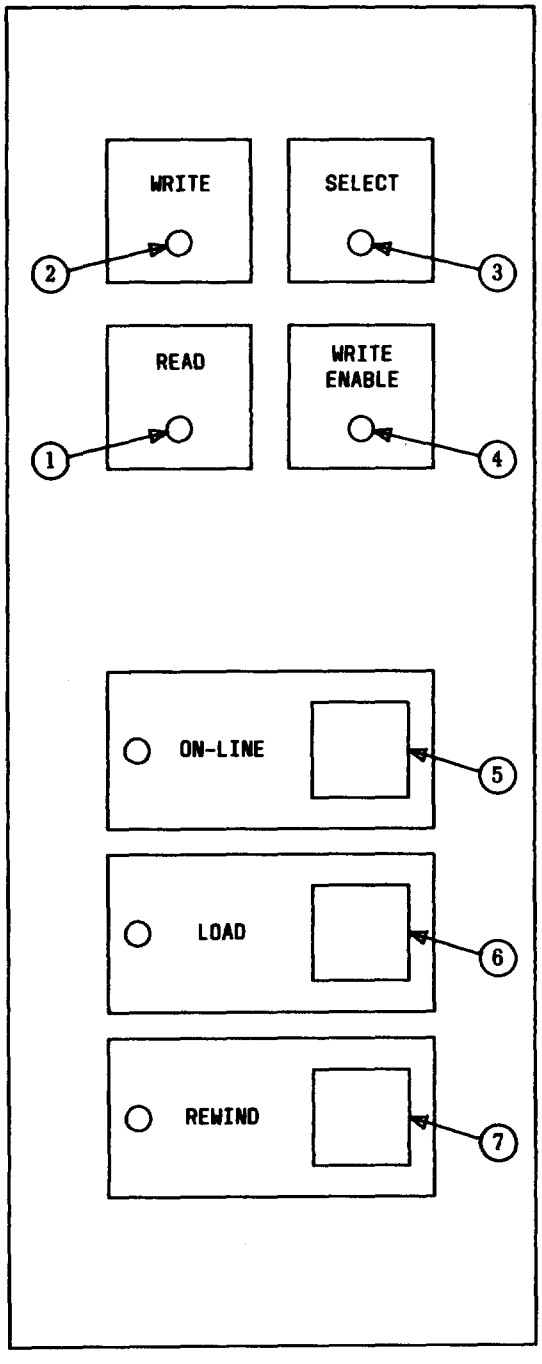


Fig. 4—KS-22091, L1, Tape Transport, Rear View



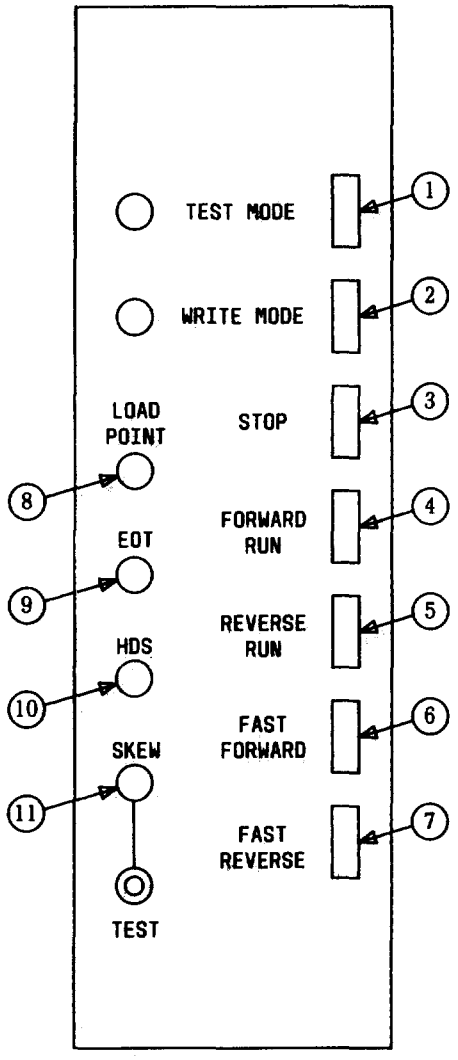
1. READ INDICATOR. Illuminated when tape unit is on-line, selected, and read status selected.
2. WRITE INDICATOR. Illuminated when tape unit is on-line, selected, and write status selected.
3. SELECT INDICATOR. Illuminated when tape unit is on-line and selected.
4. WRITE ENABLE INDICATOR. Illuminated whenever a reel with a write enable ring is mounted on the supply hub.
5. ON-LINE. A momentary pushbutton, which functions as alternate action. When first activated the tape unit is placed in an on-line condition; when the tape unit is on-line it can be remotely selected and will be ready if tape is loaded to or past the load point. When actuated again it takes the tape unit off-line. The indicator is illuminated in the on-line condition.
6. LOAD. The momentary pushbutton activates the reel servos (tension tape) and starts the load sequence. The indicator is illuminated when the reel servos are activated and tape is tensioned.
7. REWIND. The momentary pushbutton activates a rewind operation. This control is enabled only when tape is tensioned and unit is off-line. The indicator is illuminated during either a local or remote rewind operation.

   LOAD and REWIND pushbuttons are disabled when the tape unit is on-line.

Fig. 5—Main Control Panel

Note

Tape transport must be off-line and STOP pushbutton depressed before test panel can become functional.



(1) TEST MODE pushbutton and indicator. A momentary pushbutton selects test mode and activates test panel. When indicator (LED) is illuminated, test panel is active. (Tape unit must be off-line and STOP pushbutton depressed before test panel will function.)

(2) WRITE TEST pushbutton and indicator. A momentary pushbutton which programs 1's to be written on all channels in order to facilitate write skew adjustment. WRITE TEST remains active in FORWARD RUN mode only. (STOP pushbutton must be depressed and TEST MODE selected to actuate this feature.) The indicator (LED) will remain illuminated while unit is in this mode.

(3) STOP pushbutton. An interlocked pushbutton switch which terminates all tape motion.

(4) FORWARD RUN pushbutton. An interlocked pushbutton switch that allows tape unit to proceed forward at normal speed. Depressing STOP pushbutton or EOT marker will terminate this operation.

(5) REVERSE RUN pushbutton. An interlocked pushbutton switch which allows tape unit to run in reverse at normal speed. Depressing STOP pushbutton or BOT marker will terminate this operation.

(6) FAST FORWARD pushbutton. An interlocked pushbutton switch that allows tape unit to run forward at high speed. Depressing STOP pushbutton or EOT marker will terminate this operation.

(7) FAST REVERSE pushbutton. An interlocked pushbutton switch that allows tape unit to run in reverse at 150 ips. Depressing STOP pushbutton or BOT marker will terminate this operation.

(8) LOAD POINT indicator (LED). Indicates when tape is at load point.

(9) EOT indicator (LED). Indicates when tape is at EOT.

(10) HDS indicator (LED). Indicates when the transport electronics are set for high density (1600 bpi, p.e.) operation.

(11) SKEW indicator (LED) and TEST point. Indicator lights if tape skew exceeds the skew (read or write) gate setting. An oscilloscope TEST point is available for monitoring all read pulse output simultaneously, displaying total bit scatter.

Fig. 6—Test Panel Controls and Indicators

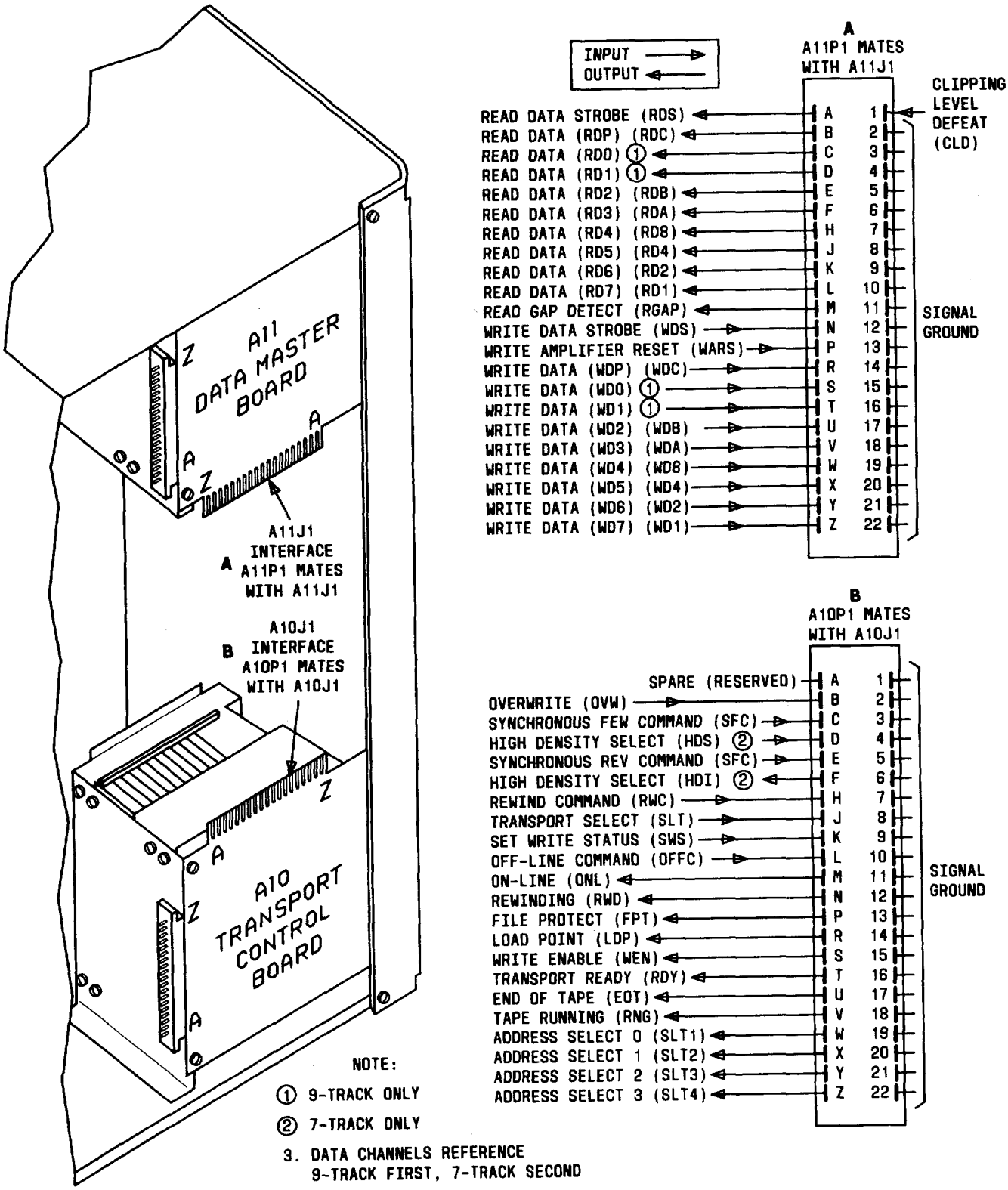


Fig. 7—Tape Transport Interface

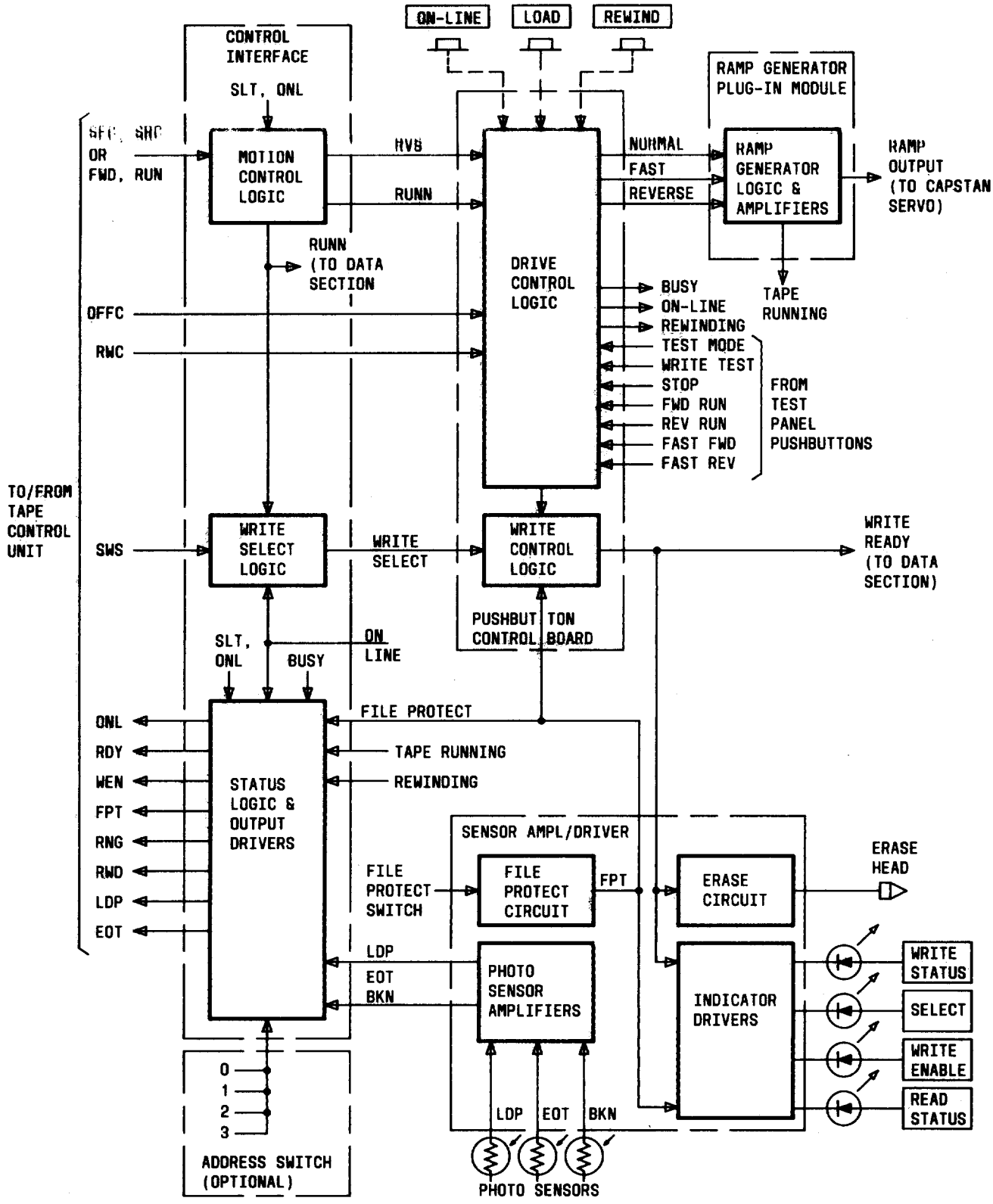


Fig. 8—Control Logic Block Diagram

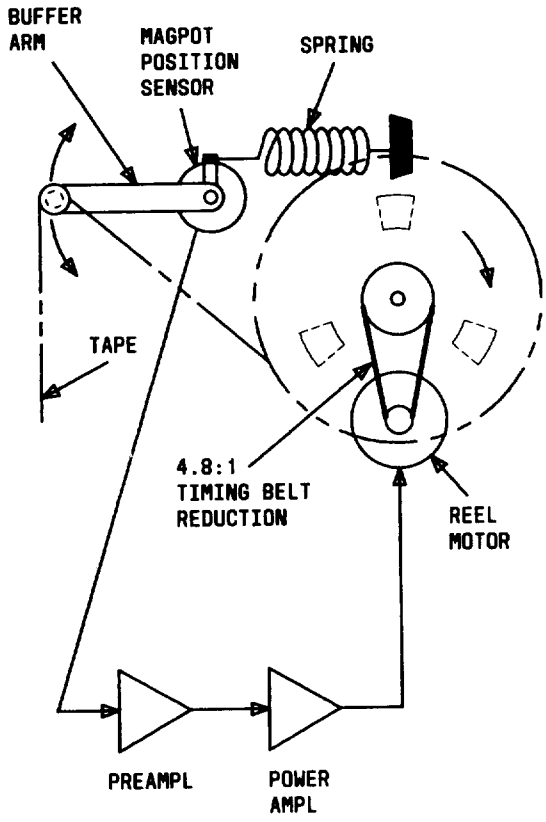
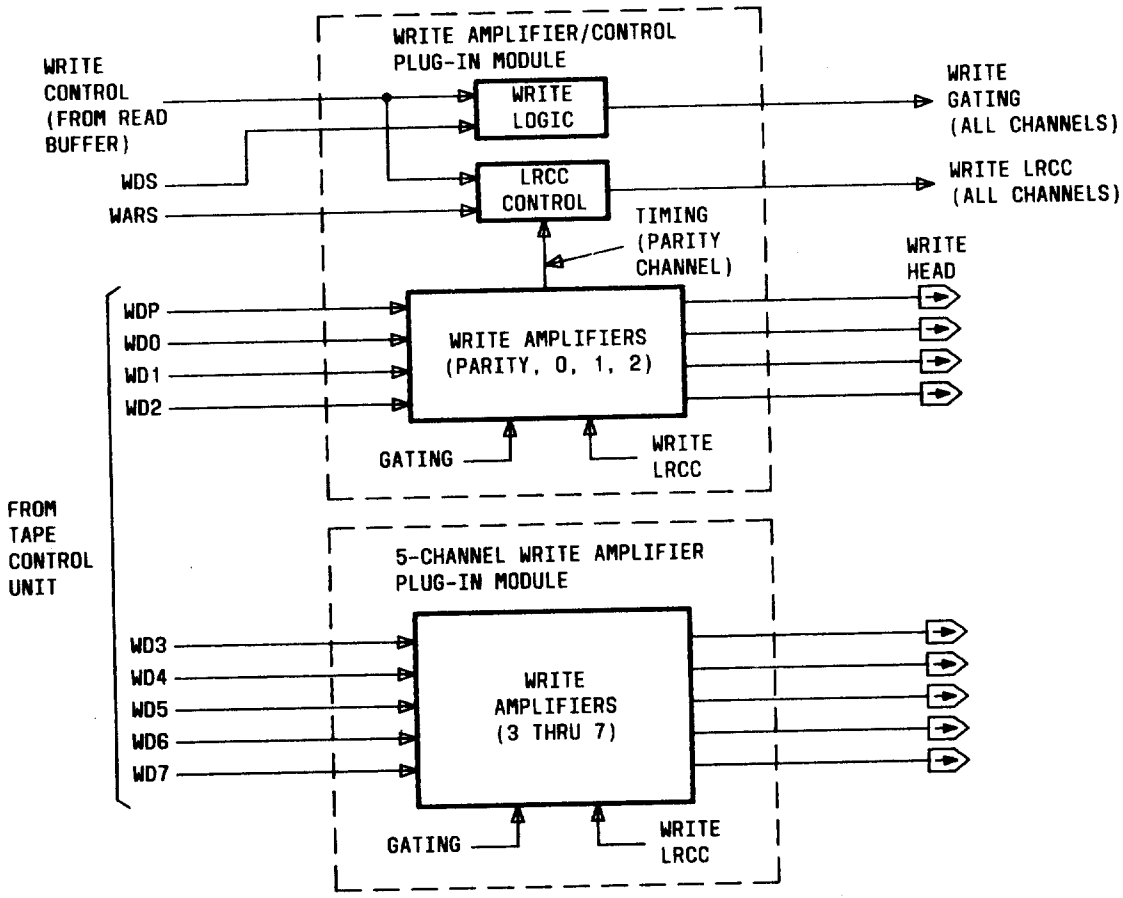


Fig. 9—Reel Motor Servo System



LRCC = LONGITUDINAL REDUNDANCY CHECK CHARACTER
WARS = WRITE AMPLIFIER RESET
WD0 = WRITE DATA 0
WDP = WRITE DATA PARITY
WDS = WRITE DATA STROBE

Fig. 10—Write Data Block Diagram

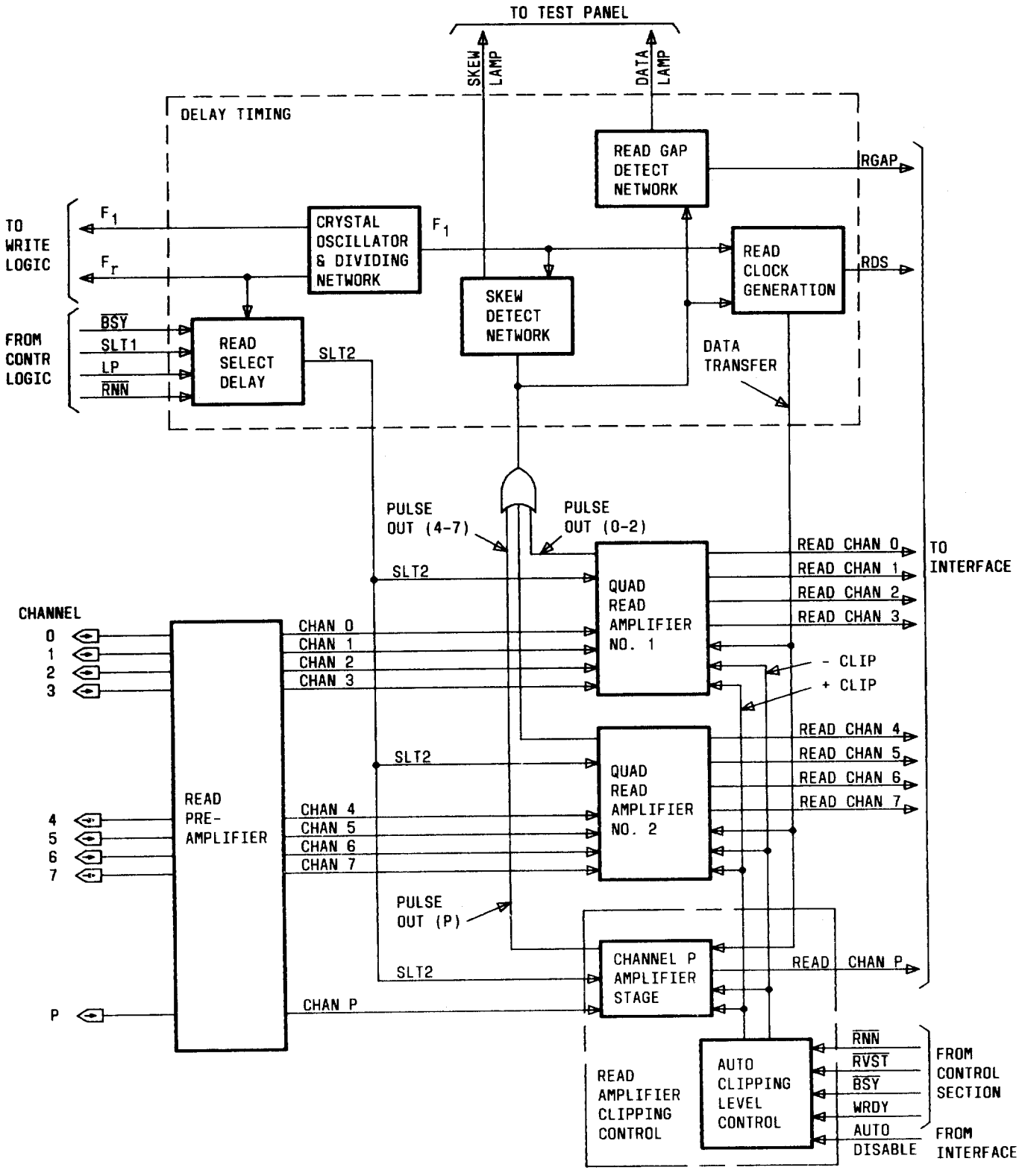
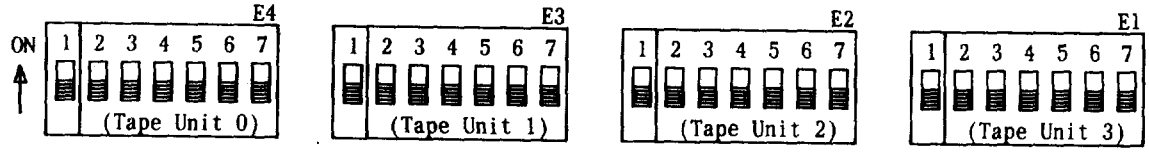


Fig. 11—Read Data Block Diagram



OPTION SETTINGS

E1-1 OFF/E2-1 ON selects Formatter Address 1 (FAD1)

E3-1 OFF/E4-1 ON: Selected Tape Unit writes internally generated parity

DENSITY SELECTION (ON = *)

	S2	S3	
9 Track 800, 1600[2] CPI		*	X
7 Track 556. 800 CPI	*		
7 Track 200, 556 CPI	*	*	

	S4	
1600 CPI low speed select	*	
1600 CPI high speed select		X

SPEED SELECTION (ON = *)

		S5	S6	S7	
NOT AVAILABLE IN 25 IPS MODELS	10 IPS (125 IPS)	*	*	*	
	12.5 IPS		*	*	
	15 IPS	*		*	
	18.75 IPS			*	
	25 IPS	*	*		X
	37.5 IPS		*		
	45 IPS	*			
	75 IPS				

NOTES

1. E1-S1 is reserved.
2. 1600 CPI density requires P.E. read recovery board.

Fig. 12—Formatter Option Selections