ARMY
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TM 11-5835-243-34
EE641-AA-MMI-010/E154MTT
TO31S3-4-110-1

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL FOR TRANSPORT, MAGNETIC TAPE AN/UYH-5 (NSN 7025-01-125-5767)

This copy is a reprint which includes current pages from Change 1.

DEPARTMENTS OF THE ARMY, THE NAVY, AND THE AIR FORCE

31 JANUARY 1983

5 SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK

1. DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL

2. IF POSSIBLE, TURN OFF THE ELECTRICAL POWER

3. IF YOU CANNOT TURN OFF THE ELECTRICAL POWER, PULL, PUSH, OR LIFT THE PERSON TO SAFETY USING A WOODEN POLE OR A ROPE OR SOME OTHER INSULATING MATERIAL

4. SEND FOR HELP AS SOON AS POSSIBLE

5. AFTER THE INJURED PERSON IS FREE OF CONTACT WITH THE SOURCE OF ELECTRICAL SHOCK, MOVE THE PERSON A SHORT DISTANCE AWAY AND IMMEDIATELY START ARTIFICIAL RESUSCITATION

CHANGE

No. 1

DEPARTMENTS OF THE ARMY,
THE NAVY, AND THE AIR FORCE
Washington, DC, 5 March 1985

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL TRANSPORT, MAGNETIC TAPE AN/UYH-5 (NSN 7025-01-125-5767)

TM 11-5835-243-34/EE641-AA-MMI-010/E154 MTT/TO 31S3-4-110-1, 31 January 1983, is changed as follows:

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Remove pages	*Insert pages*
A	A and B
i and ii	i and ii
3-17 and 3-18	3-17 and 3-18
FO-5 and FO-6	FO-5 and FO-6

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TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 92 CONSISTING OF THE FOLLOWING:

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Technical Manual
No. 11-5835-243-34
Technical Manual
EE641-AA-MMI-010/E154 MTT
Technical Order
TO 31S3-4-110-1

DEPARTMENTS OF THE ARMY
THE NAVY, AND THE AIR FORCE
Washington, DC, 31 January 1983

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL TRANSPORT, MAGNETIC TAPE AN/UYH-5 (NSN 7025-01-125-5767)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-ME-MP, Fort Monmouth, New Jersey 07703-5007.

For Air Force, submit AFTO Form 22 (Technical Order System Publication Improvement Report and Reply) in accordance with paragraph 6-5, Section VI, T.O. 00-5-1. Forward direct to prime ALC/MST.

For Navy, mail comments to the Commander, Naval Electronics Systems Command, ATTN: ELEX 8122, Washington, DC 20360.

In either case, a reply will be furnished direct to you.

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CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope

This manual describes the Magnetic Tape Transport AN/UYH-5 (hereafter called the tape transport) and the Magnetic Tape Cartridge TW-432/UYH. It contains direct support and general support maintenance instructions. Responsibilities for all levels of maintenance are specified by the Maintenance Allocation Chart (MAC) contained in TM 11-5805 -681-12-1 and TM 11-5805-683-12-1. Other publications applicable to the tape transport are listed in Appendix A of this manual. Appendix B lists expendable supplies and materials. Refer to TM 11-5835-243-20P and -34P for repair parts and special tools.

1-2. Consolidated Index of Army Publications and Blank Forms

a. Army. Refer to the latest issue of DA Pam 310-1 to determine whether there are new editions, changes or additional publications pertaining to the equipment.

b. Air Force. Use T.O. 0.1-31 Series Numerical Index and Requirements Table (NIRT).

1-3. Maintenance Forms, Records, and Reports

a. Reports of Maintenance and Unsatisfactory Equipment. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by TM 38-750, the Army Maintenance Management System. Air Force personnel will use AFR 66-1 for maintenance reporting and T.O.-00-35D54 for unsatisfactory equipment reporting. Navy personnel will report maintenance performed utilizing the Maintenance Data Collection Subsystem (MDCS) IAW OPNAVINST 4790.2, Vol 3 and unsatisfactory material/conditions (UR submissions) IAW OPNAVINST 4790.2, Vol 2, Chapter 17.

b. Report of Packaging and Handling Deficiencies. Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in AR 735-11-2/DLAR 4140.55/NAVMATINST 4355.73/AFR400-54/MCO4430.3E.

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and foward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.338/AFR 75-18/MCO P4610.19C/DLAR 4500.15.

1-4. Reporting Equipment Improvement Recommendations (EIR)

a. Army. If your tape transport needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: DRSEL-ME-MP, Fort Monmouth, NJ 07703. We'll send you a reply.

b. Air Force. Air Force personnel are encouraged to submit EIRs in accordance with AFM 900-4.

c. *Navy.* Navy personnel are encouraged to submit EIRs through their local Beneficial Suggestion Program.

1-5. Administrative Storage

Administrative storage of equipment issued to and used by Army activities will have preventive maintenance performed in accordance with the Preventive Maintenance Checks and Services (PMCS) charts (TM 11-5805 -681-12-1 or TM 11-5805-683-12-1) before storing. Do not store transport with tape cartridge installed. When removing the equipment from administrative storage, the PMCS should be performed to assure operational readiness. Disassembly and repacking of equipment for shipment or limited storage are covered in TM 740-90-1.

1-6. Destruction of Army Electronics Materiel

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

Section II. DESCRIPTION AND DATA

1-7. Description of Tape Transport

a. General. The tape transport (fig. 1-1) is a self-contained, panel-mounted unit for reading and writing digital signals on a magnetic tape cartridge. The tape transport contains the assemblies which are identified and located in figure 1-2.

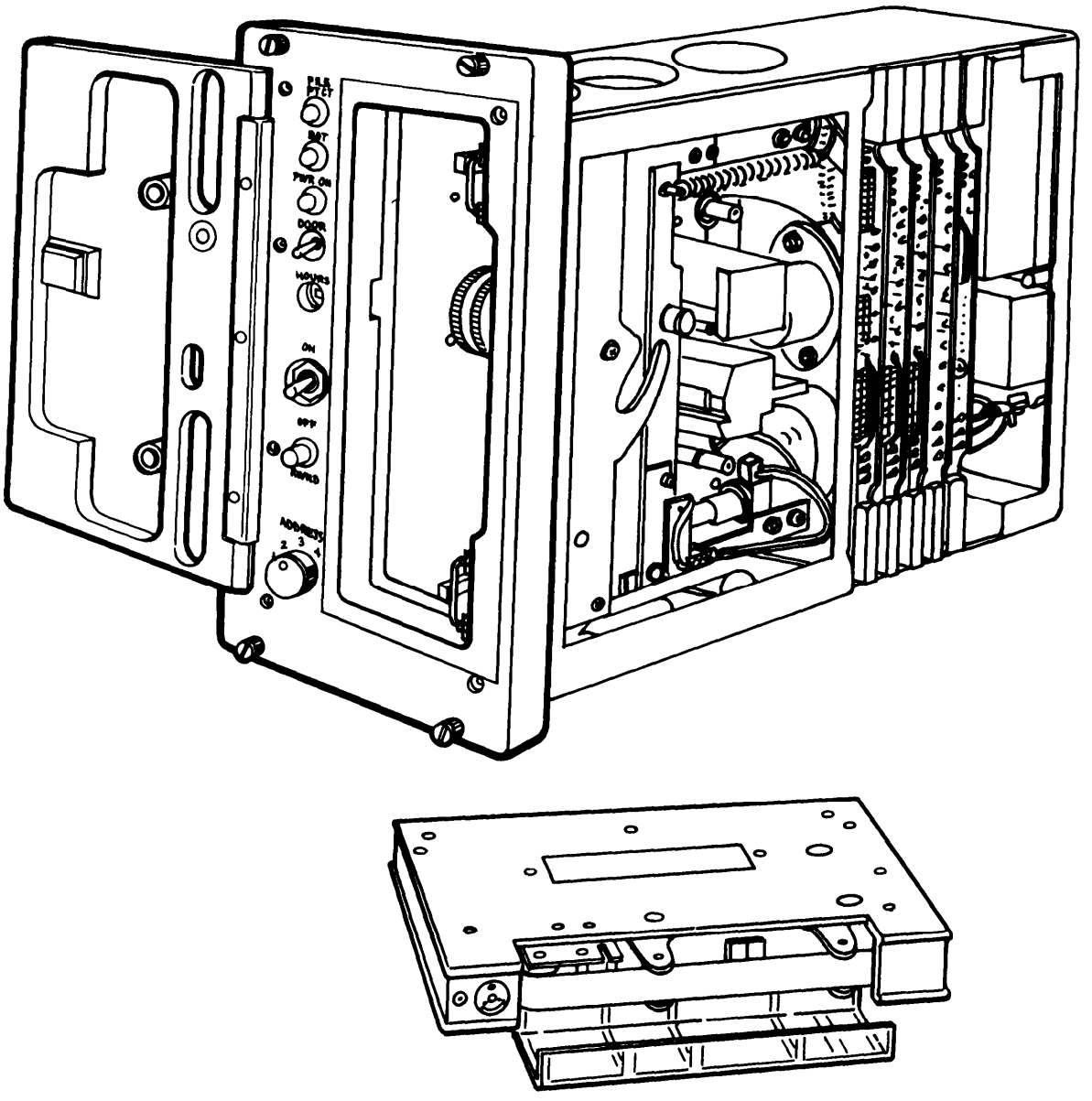

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Figure 1-1. Magnetic Tape Transport AN/UYH-5 and Magnetic Tape Cartridge TW-432/UYH.

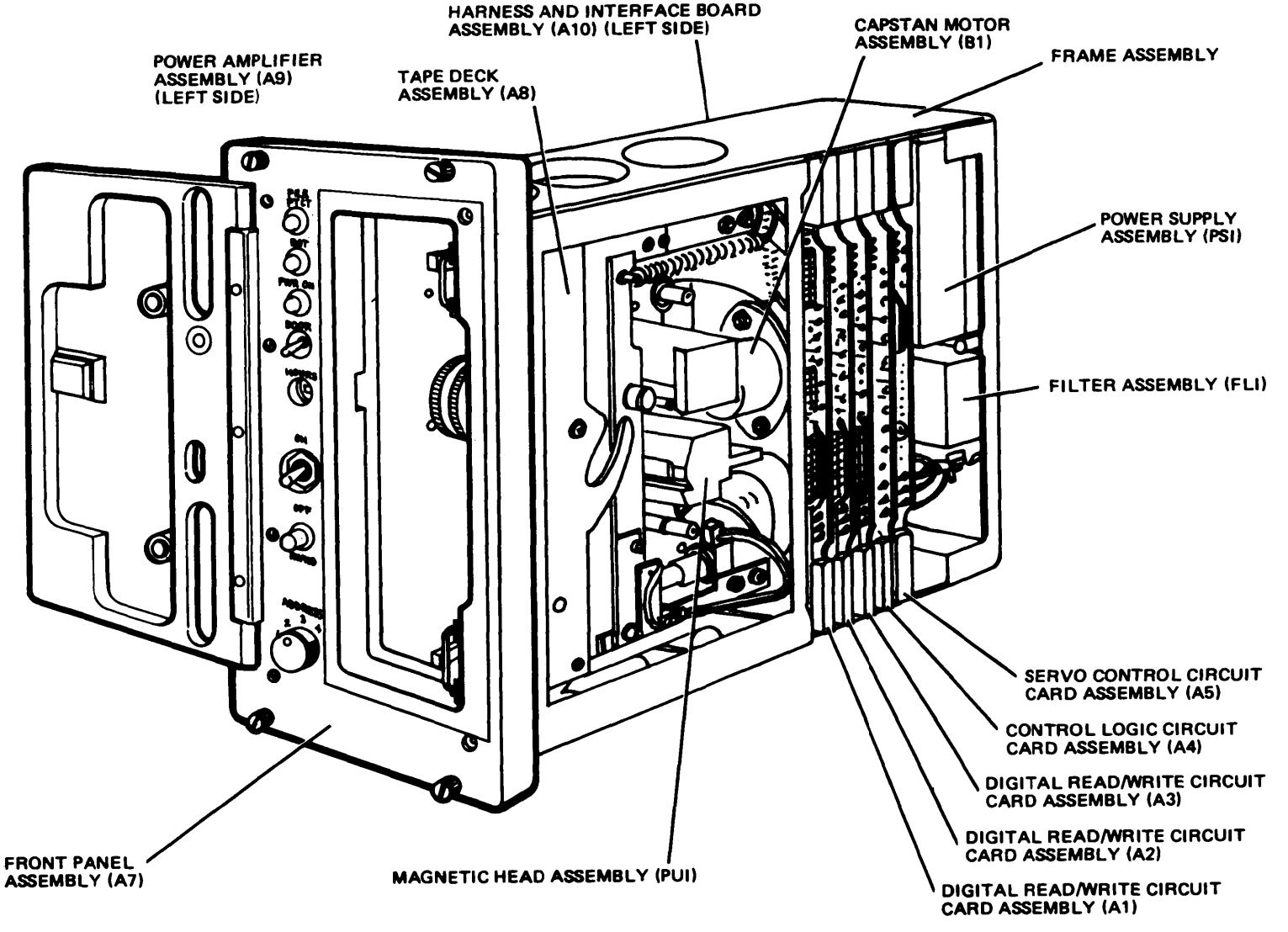


Figure 1-2. Tape Transport Assembly Locations.

b. Read/Write Electronics. The read/write electronics consists of three digital read/write circuit card assemblies (Al, A2, A3, fig. 1-2), which are plugged into the vertically-mounted harness and interface board assembly (A 10). The interface board is secured to the tape transport frame assembly. Each read/write circuit card assembly contains three read amplifiers and three write amplifiers, providing a total capability of nine-track reading and nine-track writing. This parallel nine-track 888 bpi, NRZ1 configuration is compatible with ANSI/IBM computer digital recording.

c. Control Logic. Digital parallel interface logic is controlled by the control logic circuit card assembly (A4, fig. 1-2). The control logic circuit card assembly is plugged into the same vertically-mounted harness and interface board assembly as the three read/write circuit card assemblies.

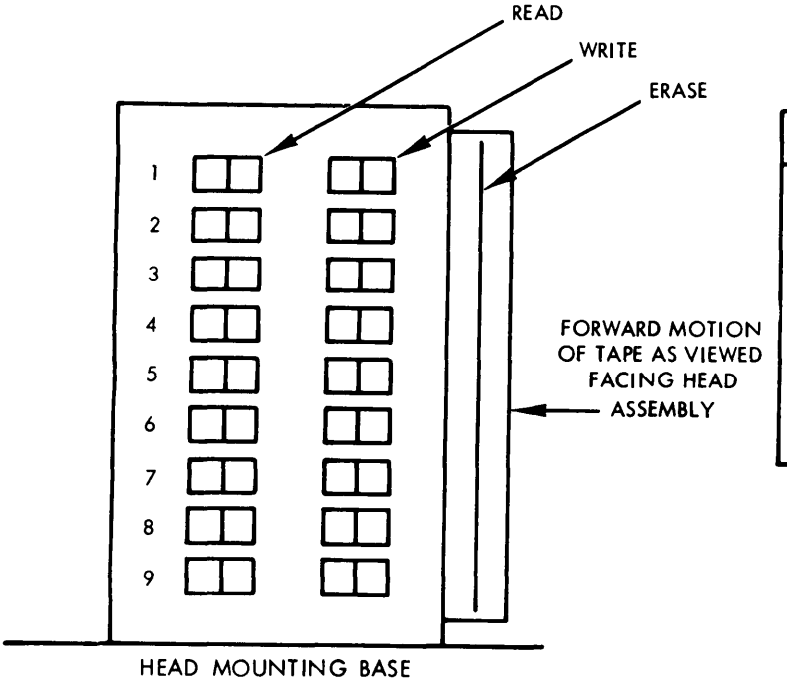
d. Servo-Control. Electronics controls for the servo system are mounted on the servo control circuit card assembly (A5, fig. 1-2). The servo system includes the capstan motor assembly (B1) and power amplifier assembly (A9). The servo control circuit card assembly is also plugged into the vertically-mounted harness and interface board assembly (A10).

e. Power Supply. The power supply assembly (PS1, fig. 1-2) is mounted inside the rear of the tape transport frame, behind the circuit card assemblies. Forced air cooling is not required. An EMI/RFI line filter assembly (FL1, fig. 1-2), is coupled to the line input of the power supply.

f. Tape Deck Assembly. The tape deck assembly (A8, fig. 1-2) is mounted on the frame assembly of the tape transport and provides a positive, spring-loaded mechanism for the insertion, retention, and removal of the tape cartridge. The tape deck serves as' a compact package for electromechanical assemblies and interconnecting wiring. The capstan motor assembly (B1); magnetic head assembly (PU1); power amplifier assembly (A9); the low tape, hole, and strip sensors; and the write permit and cartridge in place switches are all mounted on the tape deck.

g. Front Panel Assembly. The front panel assembly (A7, fig. 1-2) consists of the front panel on which the operating controls and indicators are mounted, and the access door which protects the tape deck mechanism. Controls and indicators are described in TM 11-5805-681-12-1 and TM 11-5805-683-12-1. The hinged access door contains an EMI gasket which provides a seal when the door is closed. The door is secured in the closed position by two captive wing studs. A door-operated front panel switch prevents the tape transport from operating when the door is open.

h. Tape Track Allocation. The tape transport records and reproduces digital data utilizing a nine-track parallel format on the magnetic tape contained within the magnetic tape cartridge. The nine-track parallel format is compatible with ANSI and IBM track format as shown in figure 1-3.



HEAD TRACK	ANSI TRACK	IBM TRACK
1	2	5
2	0	7
3	4	3
4	P	P
5	5	2
6	6	1
7	7	0
8	1	6
9	3	4

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Figure 1-3. Tape Track Allocation.

1-8. Description of Magnetic Tape Cartridge

a. General. The magnetic tape cartridge (fig. 1-4) consists of the enclosure, the tape tensioning and drive mechanism, and the reels which include magnetic tape and tape guides. The tape tensioning and drive mechanism and reels are housed within the enclosure to assure damage-free and contamination-free transportation and interchange of magnetic tape cartridges under operational nonditions.

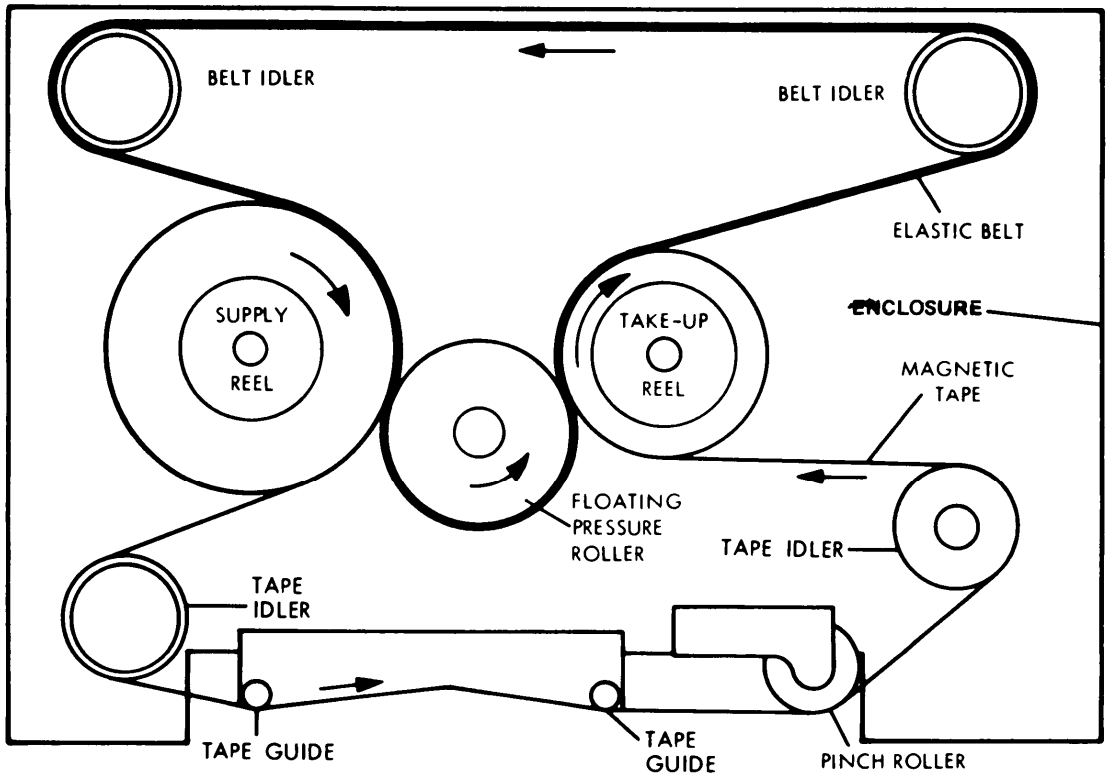

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Figure 1-4. Magnetic Tape Cartridge Subassembly Location.

b. Enclosure. The enclosure is of rylon resin construction. Its rigidity assures accurate tape guidance and minimum dynamic skew under vibration and shock environment. The access door and cover are made of translucent plastic. The access door is spring-loaded and closes automatically when the magnetic tape cartridge is removed from the tape transport. This retractable cover protects the tape from physical damage and contamination until the tape cartridge is in position within the tape transport. A rotary detent on the cartridge enclosure mechanical prevents accidental erasure or overwriting of data on the tape. When the detent is in the PROT (protected) position, write permit switch S2 on the tape deck is not actuated, and write current is inhibited.

c. Tape Tensioning. The tape tensioning mechanism consists of two freed position belt idlers, one mobile or floating pressure roller and an endless elastic belt (fig. 1-4). All idlers are made of non-magnetic stainless steel and mounted on precision, permanently lubricated ball bearings to assure fast start/stop accelerations. The elastric belt is made of special composition silicone which ensures negligible variation in the elasticity over the operating temperature range and prevents permanent damage during low temperature storage. The supply and take-up reels and the pressure roller are in nonslipping contact with the elastic belt so that tape tension is maintained while the cartridge is removed from the tape transport. The nonslipping contact is ensured by a predetermined amount of elongation of the belt at the time of installation, giving it a fixed initial tension.

d. Drive Mechanism. The magnetic tape is wound onto two flangeless aluminum alloy reel hubs and is guided between two reels by two rotating tape guides made of nonmagnetic stainless steel and the spring-loaded, polyurethane-coated pinch roller (fig. 1-4). The reels, tape guides, and pinch roller are mounted on precision, permanently lubricated ball bearings. The magnetic tape has reflective markers on the back side of the tape for beginning-of-tape (BOT) and end-of-tape (EOT) sensing, and includes three punched holes for physical end-of-tape sensing at each end of the tape.

1-9. Tabulated Data

a. Tape Transport.

(1) Physical Characteristics.

Height . . . . . .7.60 in.
Width . . . . . .4.04 in.
Depth . . . . . .15.81 in. (handle extended)
Weight . . . . . .13.51b.

(2) Electrical Characteristics.

Input Voltage . . . . . .28 ± 4 vdc
Power Consumption. . . . . .10 W max. standby
40 W max. operating
100 W max. starting
Capstan Drive . . . . . Direct drive, servo-controlled, bidirectional dc motor.

(3) Signal Characteristics.

Line Receiver Requirements:
Voltage Levels:
LOW (logic l) . . . . . 0.0 to +l.2volts
HIGH (logic 0) . . . . . .+2.5 to +4.5volts
Current Levels:
LOW (logic l) . . . . . .+0.l ma max.
HIGH (logic 0) . . . . . .- 0.l ma max.
Input Transitions. . . . . Compatible with all standard integrated circuit transition configurations. Rise and fall times limited to 1 microsecond max.
Output Driver Capabilities:
Voltage Levels:
Low (logic 1) . . . . . .0.0 to +0.5 volt
HIGH (logic 0) . . . . . .+2.5 to +4.5 volts
(5.5 volts max.)
Current Levels:
LOW (logic l), ...100 ma max.
HIGH (logic 0) . . . . . Outputs are open collector and require an external pull-up resistor (220 to 330 ohms nominal)
Output Transitions (for combined cable and load capacitance of 500 pf and line logic level):
RISE time . . . . . 0.200 microsecond max. with a 1000 ohm pull-up
FALL time . . . . . 0.300 microsecond max.

(4) Performance Characteristics.

Data Capacity:
3M Company type 890 . . . . . .46.5 megabits
Recording format. . . . . 9-track 888 bpi NRZ1 ANSI/IBM compatible
Data Transfer Rate . . . . . 12k bytes per second at 22.5 ips
Magnetic Head Assembly. . . . . 9-track read-after-write, 0.150 inch gap-to-gap, and full width erase before write in the forward direction
Tape Speed . . . . . .22.5 ips read/write; 45 ips search
Start/Stop Time . . . . . 33 milliseconds at 22.5 ips; 66 milliseconds at 45 ips
Search Speed 45ips
Instantaneous Speed Variations . . . . . 3 percent max.
Long-Term Speed Variations . .3 percent max.
Peak-to-Peak Jitter . . . . . .5 percent max.
Skew . . . . . ANSI compatible
Data Reliability . . . . . 1 unrecoverable error in 108 bits; 1 unrecoverable error in 10 bits
Status Lines (TTL Compatible). . . . . Ready (magnetic tape cartridge installed correctly and door closed), EOT marker, BOT marker, rewinding, and selected

Control Lines
(TTL Compatible). . . . . Write strobe, write permit, write reset, write enable, low-speed, high-speed, forward, reverse, run, stop, rewind and address select (four lines)
Manual Controls . . . . . Rewind to BOT, door closed, power on-off, address select 1 through 4
Automatic Controls. . . . . Stop: on detection of BOT or EOT, magnetic tape cartridge not installed properly, access door open. Record-protected magnetic tape cartridge sensing switch.

(5) Environmental Data.

Temperature: . . . . . Operating range 0°C (32°F) to 50°C (122°F). Non-operating range −40°C (−40°F) to +60°C(+140°F).
Humidity : . . . . . Circuit boards and components are conformal coated.
Shock: . . . . . operating level is 25 Gs for 11 milliseconds, half sinewave.

b. Magnetic Tape Cartridge.

(1) Physical Characteristics,

Length . . . . . *6.50* in.
Width . . . . . *5.05* in.
Height . . . . . 0.94 in.; 1.27 in. at hinges
Weight . . . . . 1.50 lb
Tape Width . . . . . 0.5 in
Usable Tape Capacity:. . . . . 3M Company tape 890,450 ft.
Tape Life at Rated Data Reliability : . . . . . 3M Company type 890; 5,000 end-to-end passes
BOT and EOT Markers: . . . . . Two 1-inch long reflective tape markers placed on back-of-tape (3M Company type 8807). Three EOT holes punched at each end-of-tape.

(2) Performance Characteristics.

Tapespeed: . . . . . 50 inches per second (ips) max.
Tape Tension: . . . . . 2.50 ounces nominal (with dynamic variations from 2.0 to 3.5 ounces). Passive elastic belt maintains tension at all times.
Dynamic Skew: . . . . . At 22.5 ips— 135 microinches
Data Reliability:. . . . . Unrecoverable error rate in specified environment is 1 in 108 bits at low speed.
File Protect: . . . . . Captive, switchable cam

CHAPTER 2

FUNCTIONING OF EQUIPMENT

Section I. SYSTEM DESCRIPTION

2-1. General

This section provides an overall, system-level fictional description of the tape transport. A functional block diagram is shown in figure 2-1.

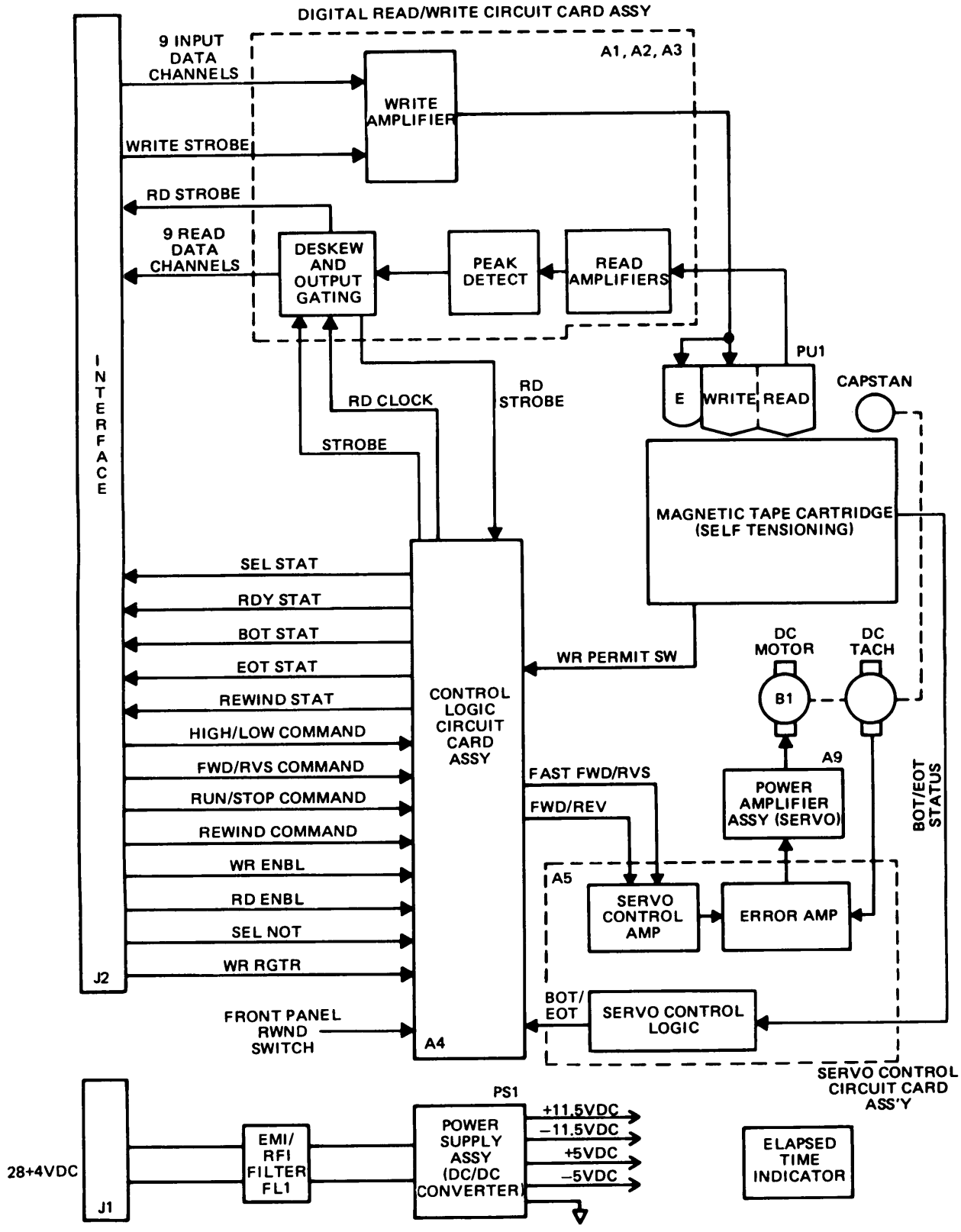


Figure 2-1. Tape Transport Functional Block Diagram.

2-2. Digital Read Write Circuit Card Assembly

The tape transport contains three identical, interchangeable digital read/write circuit cards (A1, A2, A3). Each circuit card contains three identical read/write amplifier sections, providing a total of nine digital read/write channels. The functions of the read/write circuit cards follows:

a. Buffer incoming NRZ format digital data.

b. Convert NRZ to NRZ1 format.

c. Drive the magnetic head assembly.

d. Amplify signals from the magnetic head assembly.

e. Reconstruct the signals to digital format.

f. Reconvert to NRZ format.

g. Deskew the parallel digital data.

The nine incoming channels of parallel digital data are received by the write amplifiers and converted from NRZ (non-return to zero) to NRZ1 format (para 2-7). The write head is driven by the output of the write amplifier in the prescribed format. The erase head is energized automatically when in the write mode, providing increased data reliability when writing over old data. When in the read mode, the read head senses the magnetic signals on tape. These signals are amplified, peak-detected and shaped by the read section of the read/write circuit card. A common clock, generated by the control logic circuit card, is used by the deskew circuit to desynchronize all data output channels. The tape transport can synchronously read and write at speeds up to 22.5 ips. In addition, a search speed of up to 45 ips is provided in the forward and reverse directions.

2-3. Control Logic Circuit Card Assembly

The control logic circuit card assembly (A4) receives input/output commands and provides the logic circuits to control tape motion, read/write enables, and to generate tape transport status signals.

2-4. Servo Control Circuit Card Assembly

The servo control circuit card assembly (A5), in conjunction with the power amplifier assembly (A9), and the capstan motor assembly (B1), forms a velocity servo control of the tape speed. The functions of the servo control circuit card assembly are as follows:

a. Provide a dc reference voltage for tape speed control.

b. Generate a voltage ramp for controlled tape start and stop.

c. Motor current feedback amplification.

d. Integrate tape transport sensor signals.

Upon insertion of the tape cartridge into the tape transport, the magnetic tape is automatically pressed against the read/write head, the tape guide posts, and the capstan. The capstan shaft drives the tape contained within the cartridge. Proper tape tension is maintained in either direction and at all speeds by an elastic belt in the cartridge. The capstan is driven by dc servomotor (B1) (part of the velocity servo loop). All tape motion is under direct servo control. Velocity information is a voltage generated by the dc tachometer which is directly mounted on the capstan motor shaft. This voltage is continuously compared to a fixed reference, and the difference is an error signal which is amplified and used to keep the dc motor at a constant speed. During starting and stopping, a ramp voltage is generated for the reference in order to produce controlled acceleration and deceleration of the tape. In this matter precise starting and stopping is obtained within specified inter-record gaps.

2-5. Magnetic Tape Cartridge Functional Description

a. *Forward Tape Motion*. In the tape forward mode, belt idlers rotate counterclockwise and the reels rotate clockwise. The initial tension in the elastic belt, created by the elongation of the belt at the time of assembly into the cartridge, pulls the floating pressure roller into the supply and take-up reels creating two pinch zones 'A' and 'B' (fig. 2-2). The resistance of the belt to elastic deformation at point 'A' produces a higher tension in the belt between points 'A' and 'B' than in the section from 'A' to 'D'. Additional resistance to deformation at point 'B' creates an even higher tension between 'B' and 'C' than in section 'AB.' This dual difference in actual belt tension causes the belt to be thinner in section 'BC' than it is in section 'DA'. Since there is no slippage between the belt and the magnetic tape in either section, the mass transfer rate of the belt must be equal in both. Hence, the velocity of the belt in section 'BC', where the belt is thinner, must be larger than in section 'DA', where the belt is thicker. The difference in peripheral belt velocities gives the tape on the take-up reel a higher peripheral velocity than the tape on the supply reel. Since the take-up reel is trying to wind tape faster onto the take-up reel than is unwound from the supply reel, the free length of tape between the two reels is stretched, creating a tension in this portion of the tape.

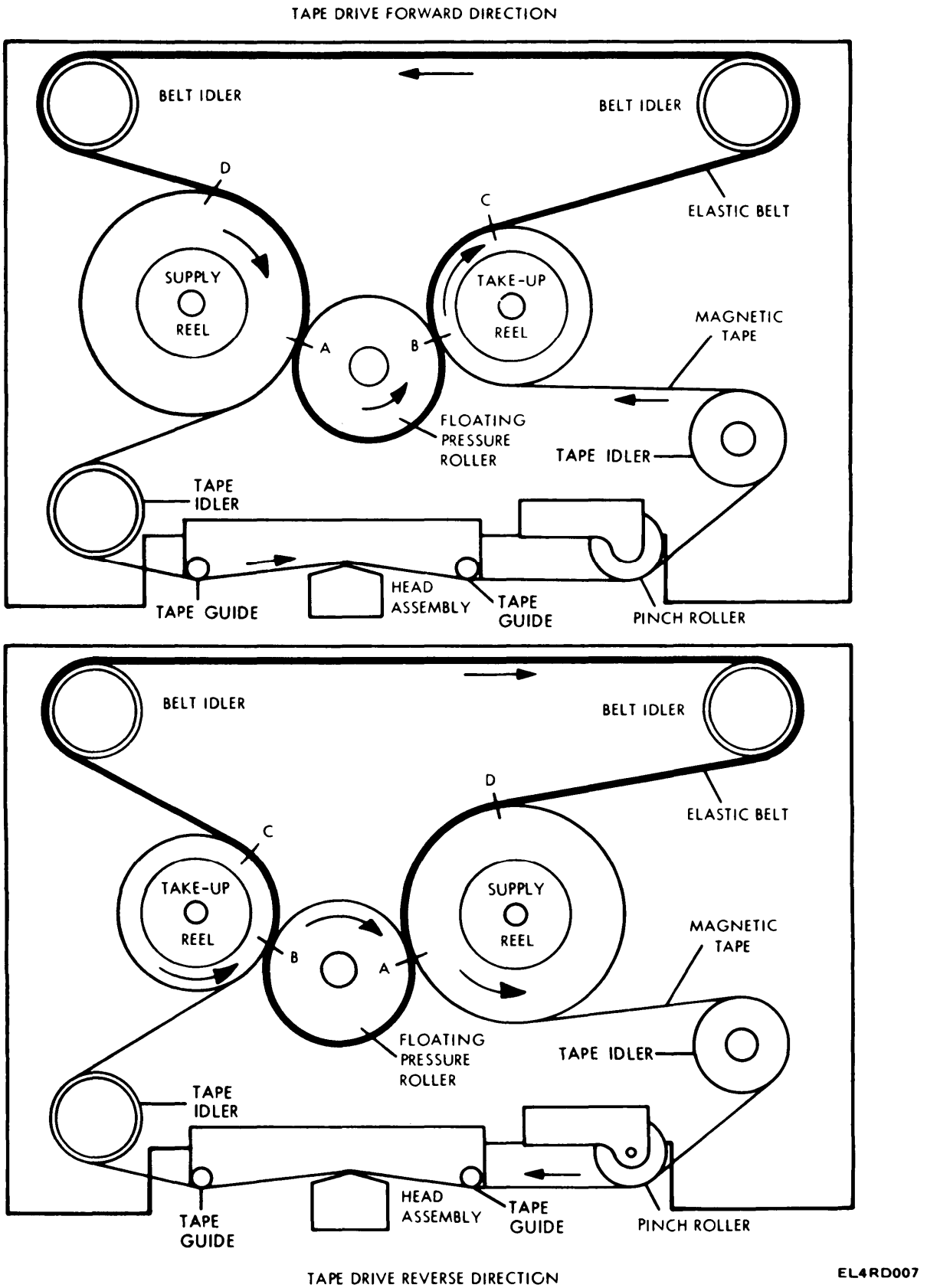


Figure 2-2. Magnetic Tape Cartridge Functional Diagram.

b. Reverse Tape Motion. In the tape reverse mode both belt idlers and the floating pressure roller are driven clockwise and the reels are driven counterclockwise (fig. 2-2). Tape tension is developed in a similar manner to that described for forward tape motion.

Section II. DETAILED FUNCTIONAL DESCRIPTION

2-6. Logic Definitions

a. Input/Output (I/O) Logic Level Definition The following logic definitions are used to describe the I/O logic requirements:

(1) LOW. Indicates the relatively low input level or pulse to the line receiver that controls the active state of that functional (logic '1').

(2) HIGH. The relatively high input level or pulse that indicates logic '0'.

(3) PULSE. A relatively low level which has a time duration of less than 10 microseconds.

(4) LEVEL. A relatively low level which has a time duration of greater than 10 microseconds.

b. Input Requirements. Input requirements for the tape transport are listed below:

(1) Standard Voltage Levels:

LOW level (logic l): . . . . . .0 to +l.2 volts
HIGH level (logic 0): . . . . . +2.5 to +4.5 volts

(2) Standard Current Levels:

LOW (logic l): . . . . . + 0.1 mA maximum (from receiver)
HIGH (logic 0): . . . . . -0.1 mA maximum (from receiver)

c. Output Driver Capabilities.

(1) Standard Voltage Levels:

LOW level (logic 1): . . . . . .0.2 to +0.5 volt
HIGH level (logic 0): . . . . . +2.5 to +4.5 volts (5.5V max.)

(2) Standard Current Levels:

Low (logic 1)". . . . . 100 mA maximum
HIGH (logic 0):. . . . . Outputs are open collector and require an external pull-up resistor 220 to 330 ohms nominal.

2-7. Digital Read Write Circuit Description

a. General. The tape transport uses three digital read/write circuit cards (A1, A2, A3). Each card contains three identical digital read/write amplifier sections, providing a total of nine read/write data channels. For example, AR1 serves as read amplifier for channels 3, 6, or 9 depending on card location (XA1, XA2, or XA3). This paragraph describes just one of the read/write amplifier sections on a circuit card, but applies equally to all nine. Use the Digital Read/Write Circuit Card Functional Block Diagram (fig. 2-3) and the schematic diagram (fig. FO-2), with the following description.

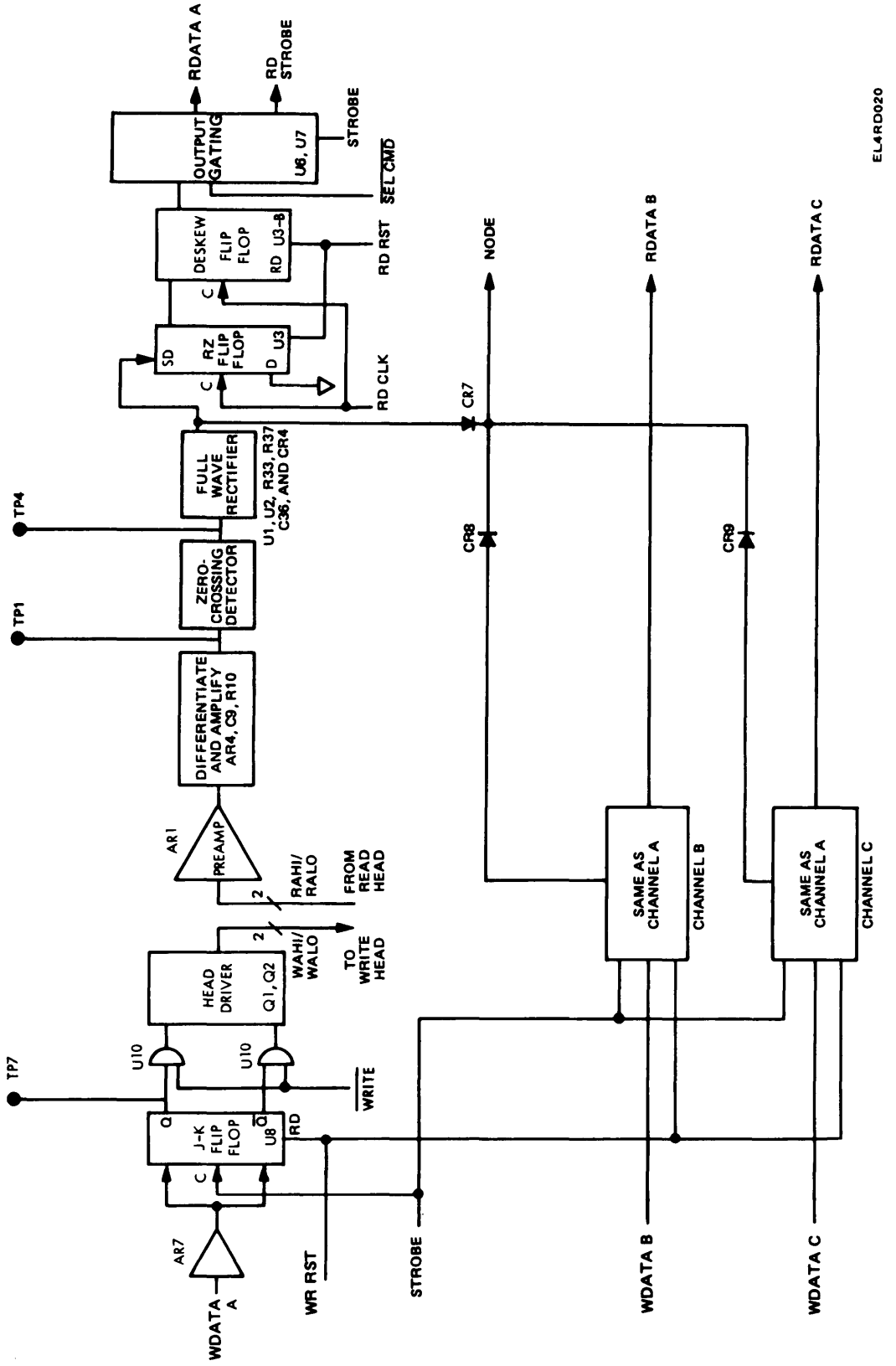


Figure 2-3. Digital Read/Write Circuit Card Functional Block Diagram.

b. Input Buffer. Line receiver AR7 is operated with a high threshold for maximum noise immunity. Resistors R40 and R41 (fig. FO-2) form the voltage source for setting the threshold voltage at approximately +1.5 vdc. NRZ format data is received from the interface as shown in waveform 1 of figure 2-4. The buffered signal is then used to drive J-K flip-flop U8. Figure 2-4 illustrates the waveforms and timing relationship of selected signals on the digital read/write card.

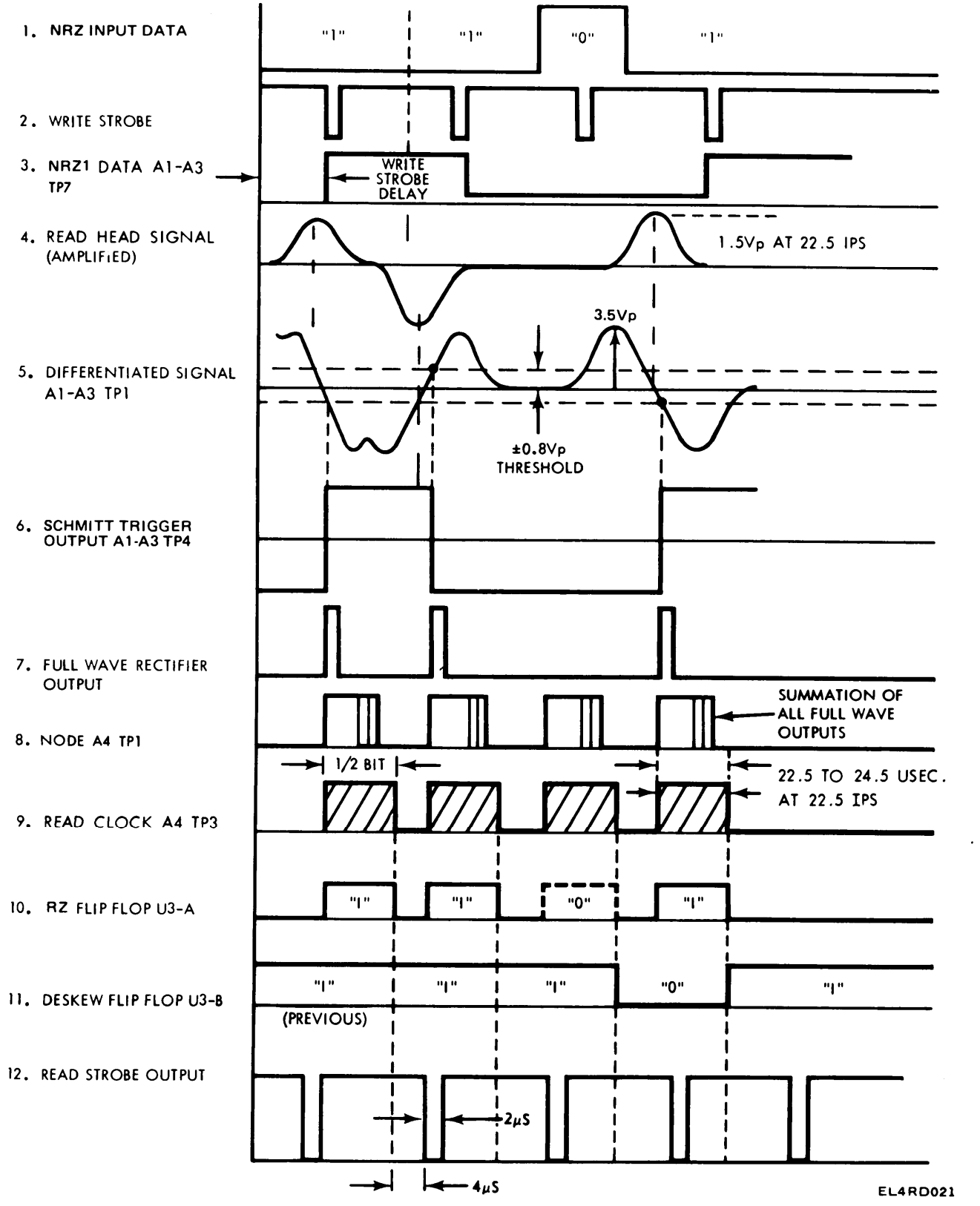


Figure 2-4. Selected Waveform Diagrams.

c. J-K Flip-Flop. Line receiver AR7 drives the J-K flip-flop U8 synchronously with the WR STROBE signal from the interface. Waveform 3 (fig. 2-4) shows that the incoming NRZ data is converted to NRZ1 format by toggling the flip-flop on each binary '1'. Write reset is accomplished by driving the reset line (RD) of flip-flop U8. This state places the write current in the proper polarity for Inter-Record Gap (IRG) and Cyclic Redundancy Check (CRC) character generation (fig. 2-6). The synchronized and converted signal is then fed to the gated head-current driver.

d. Gated Head-Current Driver. Inverter/buffer U10 and transistors Q1 and Q2 form a gated head-current driver circuit. The transistors operate in a push-pull configuration to drive the center-tapped write head which is returned to a +5 vdc via switch Q4 on control logic circuit card assembly A4. Write current is inhibited by the WR PERMIT SW command (para 2-8).

e. Read Head Preamplifier. Waveform 4 (fig. 2-4) illustrates the amplified signals derived from the read head. The signal peaks indicate the point of magnetic flux reversal on the magnetic recording tape. AR1 is an integrated linear amplifier with a gain of 200. Since the magnetic head signals are about 15 mv peak-to-peak at 22.5 ips, the output of AR1 can be expected to be approximately three volts peak-to-peak.

f. Differentiate and Amplify. Since the signal peaks of the read waveform represent magnetic flux reversals on the tape, peak detection is required to reconstruct the data. This is accomplished by differentiating and amplifying the output of the read head preamplifier AR1. Series capacitator C9 and resistor R10 differentiate the signal which is then amplified by operational amplifier AR4-B. Waveform 5 (fig. 2-4) illustrates the differentiated and amplified read head signal. Filtering of extraneous high frequency noise is provided by two filtering networks R19/C28 and R16/C21 (fig. FO-2).

g. Zero Crossing Detection. Voltage comparator AR6 in conjunction with positive feedback from R22 and R27 (fig. FO-2) functions as a zero-crossing detector (Schmitt trigger). Waveform 5 (fig. 2-4) illustrates the ±0.8 volt peak-to-peak triggering level that is fed to the detector. Waveform 6 illustrates the squared output of the detector which is, essentially, in NRZ1 format.

h. Full-wave Rectification. The output of the zero-crossing detector is applied to a full-wave rectifier consisting of U1-A, U1-D, U2-B, C36, R33, R37 and CR4 (fig. FO-2). This circuit provides a positive-going pulse for every positive- or negative-going edge from the zero-crossing detector (waveforms 6 and 7, fig. 2-4).

i. NODE Signal. The output of the full-wave rectifier circuit is impressed upon diode CR7 which is a part of the OR gate made up of CR7, CR8 and CR9. When the output pulses from the rectifier section in each of the three data channels are summed together at the outputs of diodes CR7, CR8 and CR9, the resulting signal (waveform 8, fig. 2-4) is the NODE signal. The NODE signal is routed to the control logic circuit card (A4) where it is used to generate RD CLK (read clock). RD CLK is returned to the digital read/write circuit cards to clock the RZ and deskew flip-flops. Waveform 9 (fig. 2-4) is the RD CLK signal.

j. Return to Zero (RZ). The RZ flip-flop (U3-A) converts the NRZ1 format back to RZ format. This is accomplished by setting the RZ flip-flop with the leading edge of the full-wave rectifier output (waveform 7, fig. 2-4) and resetting it with the trailing edge of RD CLK as shown in waveform 10.

k. Deskew. The deskew flip-flop (U3-B) converts the RZ format to NRZ and deskews (desynchronizes) the parallel digital data. All data stored in the RZ flip-flop in each of the data channels is synchronously shifted by the trailing edge of the RD CLK signal. The synchronous parallel digital data appears as NRZ data (waveform 11, fig. 2-4).

l. Read Strobe. RD STROBE (waveform 12, fig. 2-4) is generated by delaying RD CLK to form the two-microsecond STROBE pulse on the control logic circuit card (A4), then gating STROBE with SEL CMD via the output gating circuit on digital read/write circuit card (A3).

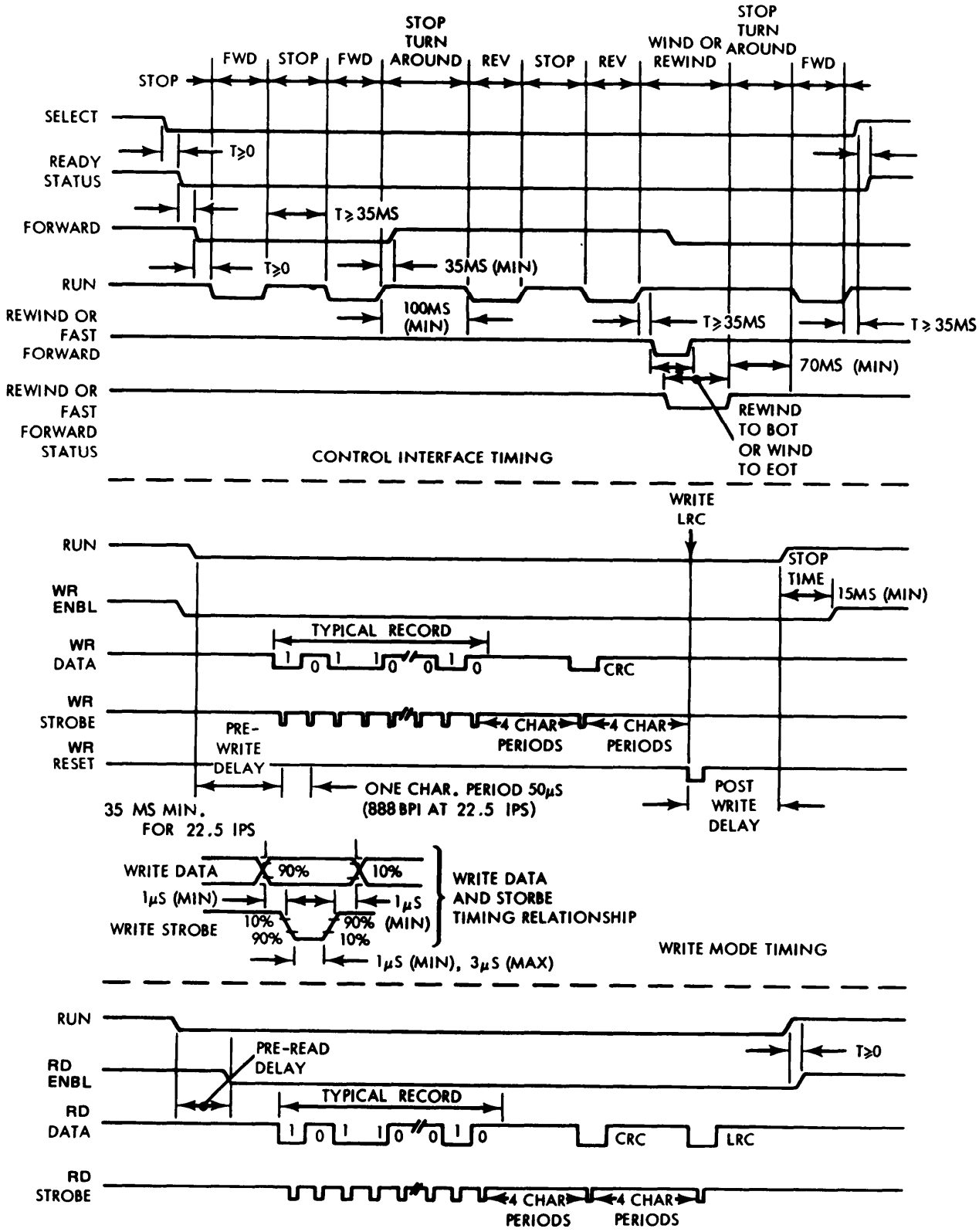
m. Variable Threshold. When in search mode (45 ips tape speed), the read output data is inhibited by imposing a higher triggering threshold on the zero-crossing detectors. This is accomplished by raising the RD RST line high at the noninverting input of voltage comparator AR6-C. Comparator AR6-C and diodes CR1, CR2 and CR3 also set the output of all zero-crossing detectors to the same state when the read mode is enabled. This is necessary to reconstruct the first bit after an IRG (Inter-Record Gap).

n. Output Gating. Read data and RD STROBE are gated out of the digital read/write circuit cards to the interface via inverters U7 and AND gates U6. The output gates are enabled when SEL CMD goes low, indicating that the tape transport has been properly addressed.

2-8. Control Logic Circuit Description

a. General. The control logic circuit card (A4) receives input/output commands and provides the

logic to control tape motion and to generate read/write enable and status signals. Use the Control Lotic Circuit card Function Block Diagram (fig. FO-3) and schematic diagram (fig. FO-4) with the following description. Figure 2-5 illustrate the timing relationship and logic level of selected signals.



EL4RD022

Figure 2-5. Timing Diagram.

b. Local Control Logic. The local control logic consists of combinational gating which decodes the DR CL INTLK (door closed interlock), CRTG IN PL INTLK (cartridge in place interlock), RWND SW (rewind switch), RWND CMD (rewind command), SEL CMD (selected command), and PRESET lines. When power is first applied, time delay Q1 and associated circuitry hold the PRESET line low. This inhibits the write logic and holds SEL-RDY (selected-ready) low for 500 ms. while the motion control and data registers are reset (RESET is low, WR RST and RD RST are high). At the end of the delay PRESET goes high, indicating that the initialization sequence is complete. When the tape transport is selected (front panel ADDRESS switch setting corresponds to tape transport address), the SEL line is high at the input to voltage comparator AR1. At the output of AR1 the inverted SEL forms SEL CMD which is used on the digital read/write logic circuit cards to enable the output gating logic (para 2-7). The low level SEL CMD is also used to enable status gating U16 and U17, and set a low level on the SEL STAT line, acknowledging that the tape transport is selected. With the SEL input high, a tape cartridge in place, and the access door closed, the CRTG IN PL INTLK, DR CL INTLK, and SEL CMD lines are high, which raises the SEL-RDY line high. The high SEL-RDY enables the write logic and the tape motion command decode logic and sets the RDY STAT line low. This indicates that the tape transport is not rewinding and is ready to receive remote commands and to transfer data. RWND SW is a local control signal initiated by the front panel RWND switch. When the switch is depressed, rewind flip-flop U11 generates the low level RWND FF signal which is output to servo control circuit card A5 as FAST RVS (para 2-9).

c. Write logic. Data can be written on tape when the external control signal WR ENBL (write enable) is low, the WR PERMIT SW line is high, and the local control logic is indicating ready status (para b, above). Voltage comparator AR1 inverts WR ENBL forming WR ENBL CMD which is gated by U12 (part of write logic) with PRESET, WR PERMIT SW, and SEL-RDY. A high level on these four lines generates a low on the output of U12 (WRITE) which is applied to ramp generator Q2, Q3. The low level on the base of Q2 turns on switch Q4 which connects the center tap of the write and erase head windings to +5 vdc. The signal WR PERMIT SW is derived from the write permit switch A8S2 located on the tape deck assembly. This switch is actuated by a rotary detent on the tape cartridge. When the detent is in the protected position (PROT), the normally closed contacts of the switch connect the WR PERMIT SW line to ground, inhibiting the write logic and turning on the front panel FILE PTCT indicator via the low FILE PTCT LT line. When the detent is not in the protected position, the contacts of switch A8S2 are open, and the write logic is enabled. A low level on the WR PERMIT line to the interface indicates that a write operation can be performed. When the W R RGT RESET line from the interface goes low, voltage comparator AR1 inverts the signal, forming WR RST CMD which is input to the write logic as a high pulse. This signal is ANDed with SEL-RDY, generating the high WR RST pulse which resets the write data registers (J-K flip-flops U8, U9) on the digital read/write circuit cards. The registers are also reset whenever WRITE goes high.

d. Read Logic. The read logic consists of one shots U4, U10 and associated gating elements which provide timing and selective output gating. Data will be read from tape when the external control signal RD ENBL is low and tape speed is 22.5 ips (FAST CMD is low). The low level RD ENBL (read enable) is inverted by voltage comparator AR1 to form RD CMD which is gated with the low FAST CMD to generate RD RST (read reset). Data output is inhibited when either RD ENBL or FAST CMD is high. This condition causes RD RST to go high, which clears the RZ and deskew flip-flops on the digital read/write circuit cards (para 2-6). High level NODE pulses from the digital read/write circuit cards are inverted and used to trigger one-shot U4. The one-shot generates high level pulses (23.4 microseconds wide) which are inverted and output as RD CLK. The clock rate is a nominal 20 kHz (50 microseconds) at the tape speed 22.5 ips. The inverted output of U4 is ORed with FST CMD to trigger dual one-shot U1O which generates the two-microsecond wide, high level STROBE pulses. At the normal tape speed of 22.5 ips STROBE is delayed 36 microseconds from the leading edge of the NODE input. When in the search mode speed of 45 ips, STROBE pulses are generated 12.5 microseconds from the leading edge of the NODE input. STROBE pulses are routed to digital read/write circuit card (A3) and used to generate the RD STROBE output to the interface.

e. Tape Motion Command Decode Logic. The taps motion command decode logic consists of BCD to decimal decoder U 13 and associated combinational gating. External control signals and tape status signals are decoded by the logic to generate tape motion commands which are used on the servo circuit card (para 2-9). Tape status signals BEG HOLE (beginning hole), BOT (beginning of tape), EOT FF (end of tape flip-flop), and END HOLE are generated on the servo control circuit card in response to signals from sensors located on the tape

deck assembly. RDY STAT, REWIND STAT, BOT STAT, and EOT STAT are generated by status gating logic U 17 and routed to the interface. Input signals asociated with the tape motion command logic are described below.

(1) HIGH/LOW (Fast/Slow Speed Select). A logic low specifies low tape speed. A logic high specifies fast tape speed.

(2) FWD/REV (Forward/Reverse). Upon receipt of a RUN CMD, the tape will be driven forward for a logic low signal and driven in reverse for a logic high signal.

(3) RUN/STOP. The tape will move in the direction specified by the FWD/REV command when the signal is at a logic low. The tape movement will stop when the signal is a logic high.

(4) END HOLE. The signal is at logic high when a hole at the end of the tape is sensed.

(5) BEG HOLE. The signal is at logic high when a hole at the beginning of tape is sensed.

(6) BOT (Beginning of Tape). The signal is at logic high when the reflective strip at the beginning of tape is sensed.

(7) EOT FF (End of Tape Flip Flop). The signal goes to logic high when the reflective strip at the end of tape is sensed. The signal remains high until the strip is again sensed after the tape motion is reversed.

(8) REWIND STAT (Rewind Status). A logic low indicates that the recorder is rewinding. The signal remains low until tape motion has stopped and the BOT marker is sensed. Rewind is initiated by either an external command (REWIND) or by the RWND switch on the front panel. Either signal sets flip-flop" (U11-A, B). The flip-flop is reset when the BOT signal becomes low.

(9) BOT STAT (Beginning of Tape Status). A low level signal indicates that the photosense assembly is sensing the BOT marker. During rewind the BOT marker may be passed in reverse. After the tape has stopped, forward motion commences and stops when the leading edge of the marker is sensed. BOT STAT remains low only as long as the BOT marker is being sensed.

(10) EOT STAT (End of Tape Status). A low level indicates that the photosense assembly has sensed the end-of-tape marker. The signal will remain low as long as the EOT marker is past the photosense assembly. The signal is reset when the EOT marker passes the photosense assembly in reverse direction. Data can be transferred past the EOT marker until an EOT hole is sensed. When an EOT hole is sensed an automatic rewind to the BOT marker occurs. The low EOT STAT signal is produced by the EOT FF input going high.

The tape motion output signals FAST FWD and REVERSE are decoded from the HIGH/LOW, FWD/REV, and RUN/STOP control signals from the interface. FAST RVS can be initiated by the above control signals or by REWIND, by the tape status signal END HOLE, and by depressing the front panel RWND switch (RWND SW signal). REWIND, END HOLE and RWND SW set the rewind flip-flop U11 which outputs RWND FF to the tape motion control rewind logic. The FWD output is either decoded directly from the interface control signals or is intiated by BEG HOLE which sets the beginning of tape flip-flop U7, U8. The tape motion output signals are high when active, and are routed to the servo control circuit card (A5, fig. 1-2). RESET is also supplied to the servo control circuit card. A low level on RESETS the end of tape flip-flop. A high level on RESET enables the flip-flop (para 2-9).

2-9. Servo Control Circuit Description

a. General. The servo control circuit card (A5, fig. 1-2) is a part of the capstan motor velocity servo loop. This card generates a dc servo error signal which controls the speed and direction of the cap stan motor. Feedback from the dc tachometer mounted on the capstan motor shaft nulls the error signal when the motor reaches the correct rotational velocity. Use the Servo Control Circuit Card Functional Block Diagram (fig. 2-6), and schematic diagram (fig. FO-5), with the following description.

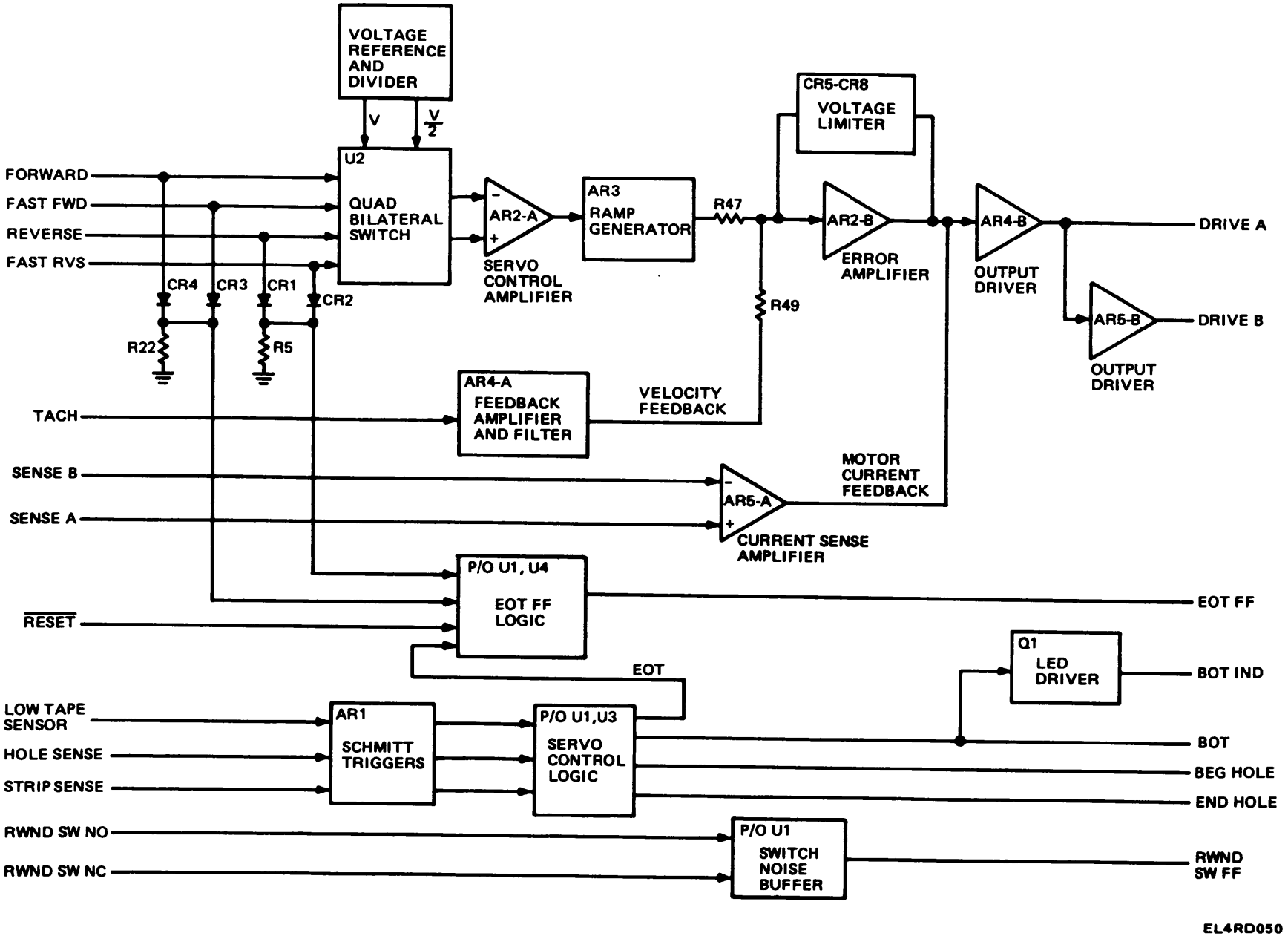


Figure 2-6. Servo Control Circuit Card Functional Block Diagram.

b. Tape Motion Command Input Switch. Tape motion commands FORWARD, FAST FWD, REVERSE, and FAST RVS are accepted on the servo control circuit card by quad bilateral switch U2. A high level from the control logic circuit card (para 2-8) on any of these command lines enables the corresponding switch section. The enabled switch section acts as a transmission gate, presenting a low impedance which connects the appropriate reference voltage to servo control amplifier AR2-A.

c. Voltage Reference. Reference voltages for use by servo control amplifier AR2-A are developed by zener diode VR1 and divider R14, R15. A logic high level on either FAST FWD or FST RVS connects the full zener voltage (V) through switch U2. A logic high level on either FORWARD or REVERSE connects half the zener voltage (V/2) to the servo control amplifier.

d. Servo Control Amplifier. The output of switch U2 is applied to operational amplifier AR2-A such that forward motion commands appear at the output of the amplifier as a negative servo reference voltage, and reverse motion commands appear as a positive servo reference voltage.

e. Ramp Generator. Operational amplifiers AR3-A, AR3-B and associated circuit components form a ramp generator with unity gain. When switch U2 commands REVERSE (a positive reference voltage), for example, the output of the ramp generator will take 18 milliseconds to reach the level of the servo reference voltage. The capstan motor voltage is, thus, a ramp function which provides controlled acceleration rather than an abrupt on-off switching.

f. Feedback Amplifier and Filter. The velocity of the capstan motor is measured by the voltage developed by a dc tachometer mounted on the capstan motor shaft. The tachometer voltage is fed into the servo control circuit card where it is filtered to suppress the ripple voltage caused by the commutator segments of the tachometer. Filtering and buffering is accomplished by feedback amplifier AR4-A and associated circuit components. The resultant signal (VELOCITY FEEDBACK) represents the motor velocity.

g. Error Amplifier. The current from ramp generator AR3 and velocity feedback amplifier AR4-A is summed at the junction of resistors R47 and R49 to generate the servo error. This error signal is the instantaneous difference between the desired capstan motor velocity (servo reference voltage) and the actual capstan motor velocity (VELOCITY FEEDBACK). The polarity of the servo error is such that the velocity of the capstan motor will increase or decrease as necessary until VELOCITY FEEDBACK is equal to the servo reference voltage. The servo error is amplified by operational amplifier AR2-B for use by output drivers AR4-B and AR5-B. Voltage swings at the output of amplifier AR2-B are limited in both directions by diodes CR5 through CR8. The output drivers AR4-B, and AR5-B form a push-pull circuit which drives the servo power amplifier assembly (A9, fig. 1-2, para 2-10). When DRIVE A is positive, tape motion is in the reverse direction. Tape motion is in the forward direction when DRIVE B is positive.

h. Current Sense Amplifier. Capstan motor drive current is sampled on the power amplifier assembly (A9) and fed back on the SENSE A and SENSE B lines to current sense amplifier AR5-A. This amplifier, and the power amplifier assembly, behave as a transconductance amplifier having a gain of 2.2 amps/volt at the output of error amplifier AR2-B. As a result of this current feedback, the current which the capstan motor can draw from drivers AR4-B and AR5-B is limited to prevent demagnetization of the motor.

i. Schmitt Triggers. Three photo transistors (sensors), hole sense A8A1, low tape sense A8A2, and strip sense A8A4, are mounted on the tape deck assembly. The sensors are activated by light emitting diodes (LEDs), also mounted on the tape deck assembly. When activated, the sensor output signal level is over 3 vdc. When not activated, the sensor output is nearly zero. The sensor signals are HOLE SENSE (holes punched at the beginning and end of the tape are sensed), STRIP SENSE (reflective tape at the beginning or end of the tape is sensed), and LOW TAPE SENSOR (the amount of tape on the supply reel has reached a low level). These signals are input to Schmitt trigger circuits AR1-A, AR1-B, and AR1-C, the triggering threshold of which is set at 2.3 vdc (0.5 vdc hysteresis). When triggered, the output is a low level pulse which is routed to the servo control logic.

j. Servo Control Logic. The servo control logic consists of combinational gating U1 and U3 which accepts the output of the Schmitt triggers and generates tape position information. The tape position signals are used on the control logic circuit card (para 2-8). When the HOLE SENSE is not present, the control logic enables BEG HOLE. With both the HOLE SENSE and LOW TAPE SENSOR signals present, BEG HOLE is inhibited and END HOLE is enabled. With a STRIP SENSE signal causing the AR1 -C to conduct and no LOW TAPE SENSOR signal, the control logic inhibits EOT and enables the BOT signal. This also outputs BOT IND

to the front panel via switch Q1. When BOT goes high on the base of Q1, the transistor is turned on, providing a path to ground for the BOT indicator. With STRIP SENSE and LOW TAPE SENSOR signals both present, BOT is inhibited and EOT is enabled.

k. EOT Flip-Flop Logic. The end of tape flip-flop logic U1 and U4 latches the EOT FF line high or low in response to inputs derived from the forward and reverse tape motion commands and the end of tape (EOT) signal generated by the servo control logic. EOT FF is initially at the logic low level with tape moving in the forward direction. When LOW TAPE SENSOR and STRIP SENSE are both high, indicating that the strip at the end of the tape has been sensed, EOT FF goes high and is latched. When HOLE SENSE then goes high, the END HOLE output line goes high and the tape motion command decode logic on control logic circuit card A4 commands fast reverse (FAST RVS). When the strip is again sensed in the reverse direction, flip-flop U4 is reset, latching EOT FF low. This conditions the logic to respond to beginning of tape (BOT) signals at the end of the rewind cycle.

l. Switch Noise Buffering. Switch contact noise generated by the front panel RWND switch is buffered by flip-flop U1. The signal RWND SW is a logic high level when the switch is depressed.

2-10. Power Amplifier Circuit Description

a. General. The power amplifier assembly (A9, fig. 1-2) is a part of the capstan motor velocity servo loop. The power amplifier is controlled by the error signal generated on the servo control circuit card A5, and provides the necessary current to drive the capstan motor at normal or fast speed in both the forward and reverse directions. As illustrated in the schematic diagram (fig. FO-6), the power amplifier is basically a bilateral bridge amplifier working in the Class B mode. While one side of the bridge is operating as a linear amplifier, the other side is cut off. Use figure 2-7 and the schematic diagram (fig. FO-6) with the following circuit description.

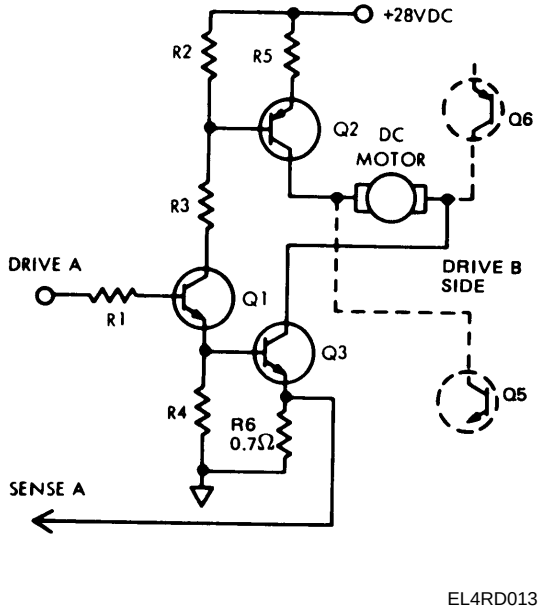


Figure 2-7. Bridge Amplifier Simplified Schematic Diagram.

b. Bridge Amplifier. When tape motion is in the reverse direction, DRIVE A receives a positive servo error signal from the servo control circuit card. DRIVE B, at this time, is a negative voltage which cuts off the opposite half of the bridge. Transistor Q1 linearly amplifies the error signal to drive transistor Q2 which, in turn, supplies current to the capstan motor. Transistor Q3 is also driven into saturation by Q1, providing a ground return for the motor current via the 0.7-ohm resistor R6. The voltage developed across R6 is fed back to the current sense amplifier on the servo control circuit card (SENSE A) in order to control the voltage to current gain (transconductance) of the power amplifier. This forms a closed current-gain loop. When

tape motion is in the forward direction, DRIVE B goes positive, and the DRIVE A side of the bridge is cut off. Operation of this side of the bridge is identical to the DRIVE A side described above. In this manner the dc motor is driven linearly in either direction without the use of relays or other else tromechanical devices.

c. *Power Turn-on.* The junction field effect transistors (JFETs) Q8 and Q9 restrict the motion of the motor during power turn-on. R18 and C4 form an RC network which controls the transistor gate voltage. At startup, the positive side of C4 is at ground. This turns Q8 and Q9 which hold the drive signal transistors Q1 and Q7 in the cut off state, inhibiting motor motion. As the charge on C4 increases, the gate voltages increase until Q8 and Q9 are turned off. In this state Q8 and Q9 present a high impedence and do not interfere with normal operation of the power amplifier circuitry.

d. Elapsed Time Meter. The elapsed time meter on the front panel is energized when the capstan motor operates. Transistor Q4 (part of the OR circuit made up of Q4, CR3 and CR4) returns the meter to ground when there is a positive voltage at either of the motor terminals..

2-11. Power Supply Description

a. General. The tape transport power supply (PSI, fig. 1-2) is a sealed replaceable unit. The power supply is a dc-to-dc converter type with isolated transformer secondaries. The + 28-vdc input power is chopped by the inverter/oscillator and transformer coupled to four regulators. Figure 2-8 is a simplified block diagram of the power supply. Figure 2-9 illustrates the tape transport power and ground system.

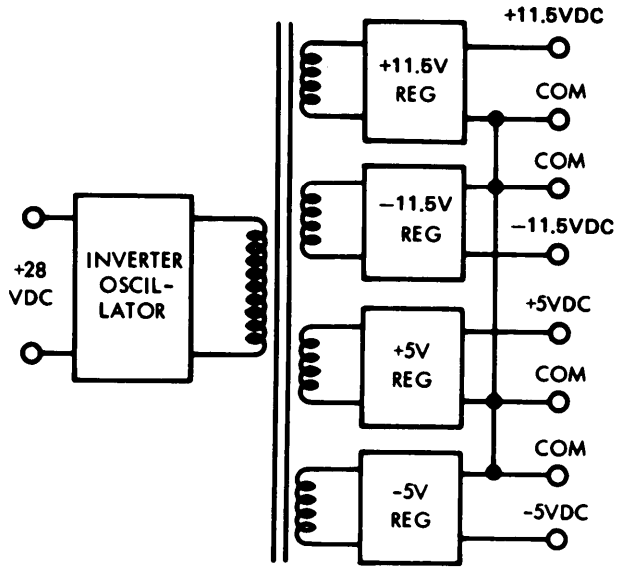


Figure 2-8. Power Supply Functional Block Diagram.

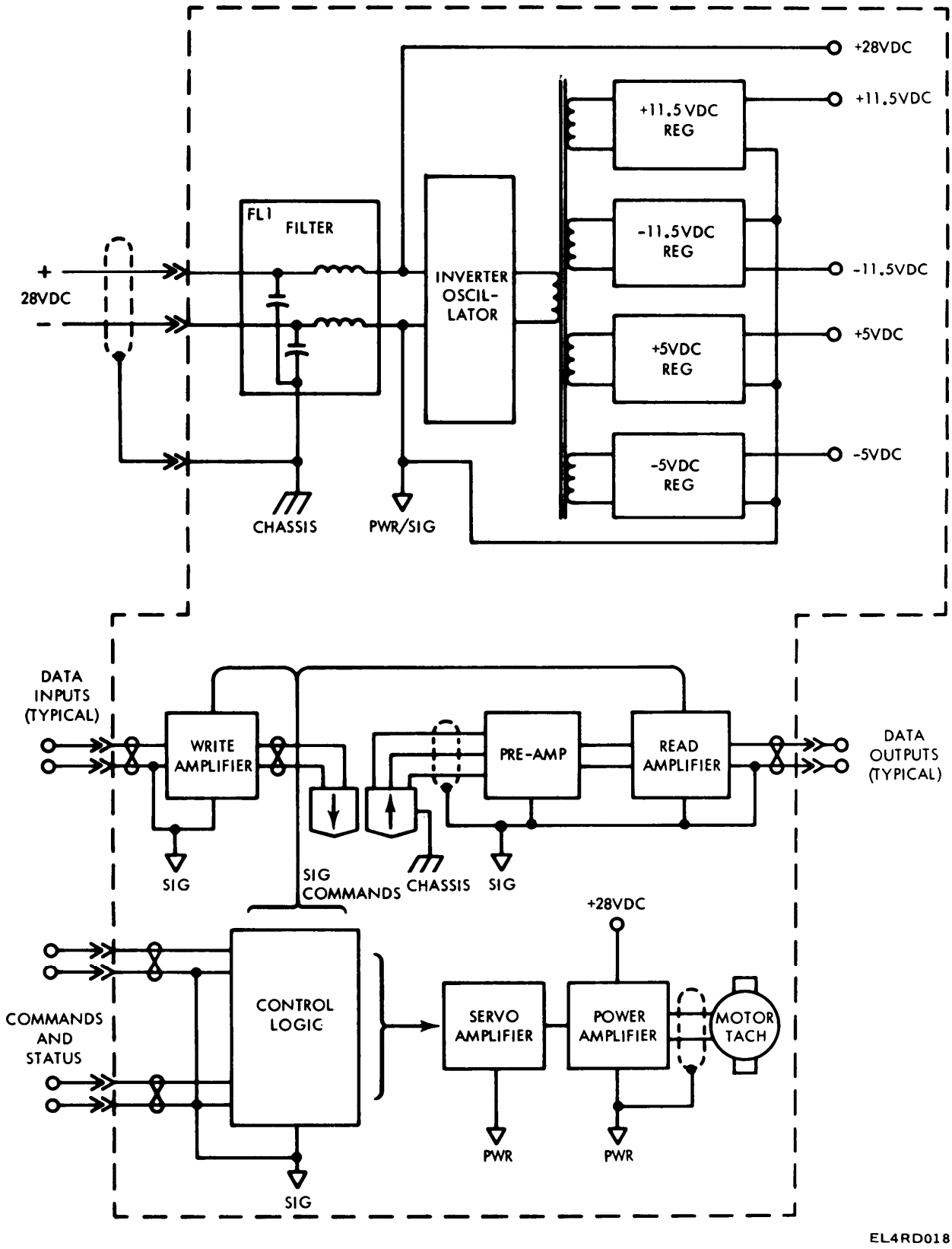


Figure 2-9. Tape Transport Power and Ground System Functional Block Diagram.

b. Output Voltage Characteristics.

(1) +11.5 ±0.35 vdc at 0.2 amp max.

(2) – 11.5 ±0.35 vdc at 0.2 amp max.

(3) +5.0 ±0.4 vdc at 1.0 amp max.

(4) –5.0 ±0.4 vdc at 0.3 amp max.

(5) +28 vdc (unregulated) from the tape transport input power, 0.5 amp continuous load, 3.0 amps for 50 milliseconds.

(6) Output voltage ripple less than 10 millivolts peak-to-peak on the 5 vdc and 11.7 vdc supplies.

c. Short Circuit Protection The shorting to ground of any output will not cause damage to the power supply.

d. Overvoltage Protection. The outputs are protected against overvoltage condition. The 5-vdc outputs will never exceed 7 vdc and the 11.5-vdc outputs will never exceed 18 vdc.

e. Undervoltage Protection. The power supply will not suffer permanent damage due to input voltages under +24 vdc.

f. Reverse Polarity Protection. The power supply will not suffer permanent damage due to reverse input voltage polarity.

CAUTION

Reversing polarity of the input power leads may damage circuitry beyond the power supply.

CHAPTER 3

DIRECT SUPPORT MAINTENANCE INSTRUCTIONS

Section I. GENERAL

3-1. Scope

This chapter provides maintenance instructions for direct support level personnel. Direct support maintenance is performed by those maintenance activities designated to support the using organization and emphasizes corrective maintenance at the equipment site. Corrective maintenance is performed on items which are identified as faulty by organizational maintenance personnel, but are beyond their capability to correct using the maintenance resources authorized at the organizational maintenance level. Direct support maintenance personnel also provide technical assistance to the using organization in all areas which require skills and training that are beyond the capabilities of the organizational maintenance personnel. Direct support maintenance activities are described below.

a. Visual inspection of components for evidence of potential failure conditions such as lack of cleanliness, improper seating of connectors, loose hardware or other items, discoloration due to excessive heat, and frayed cables or wiring. Correction of observed conditions will be accomplished as necessary at the time of observance by the maintenance personnel authorized to perform the task.

b. Replacement of an unserviceable subassembly, module, or assembly with a known good subassembly, module or assembly.

c. Performance of the repairs required to correct a specific failure or unserviceable condition and restoring the tape transport to a serviceable condition.

3-2. Voltage Measurements

Voltage, resistance, and continuity measurements are made by direct support maintenance personnel for troubleshooting faults which cannot be resolved or repaired by means of the troubleshooting charts. Normally such faults are traceable to wiring or chassis-mounted components. Generally, signal voltages are at standard TTL logic levels and measurements are made using an oscilloscope. Power supply voltages are measured with a multimeter.

3-3. Waveforms

All logic levels and waveforms are obtained at the test points located on the front edge of each card.

3-4. Verification of Repair

After a fault has been isolated and corrected, the repair must be verified before returning the tape transport or magnetic tape cartridge to the using organization. Perform the functional tests in paragraphs 3-9 through 3-17 to verify the performance of the tape transport, or paragraphs 3-18 and 3-19 to verify the performance of the magnetic tape cartridge.

Section II. TOOLS AND EQUIPMENT

3-5. Tools and Test Equipment

Tools and test equipment required to perform the maintenance procedures in this chapter are listed in the Maintenance Allocation Chart (MAC) located in TM 11-5805-681-12-1 and TM 11-5805-683-12-1. Any tools or test equipment authorized for use at the organizational level are also authorized for use by direct support.

3-6. Repair Parts

Repair parts authorized for use by direct support maintenance personnel for the tape transport and magnetic tape cartridge are listed in the Repair Parts and Special Tools List (RPSTL), TM 11-5835-243-34P. Direct support maintenance personnel are also authorized to use repair parts listed in TM 11-5835-243-20P.

Section III. TROUBLESHOOTING

3-7. Introduction

This section contains the direct support fault isolation procedures required to identify and correct a tape transport or magnetic tape cartridge malfunction. Fault isolation by direct support maintenance personnel is based on a series of functional tests using the Magnetic Tape Transport Test Set TS-4002/UYH-5 (hereafter called the exerciser). Some of the tests also use the Magnetic Tape Test Cartridge TW-433/UYH-5 (hereafter called the skew tape cartridge), while others require only a standard tape cartridge.

3-8. Fault Isolation

Isolation to a replaceable component is accomplished by using the troubleshooting charts (tables 3-2 and 3-4) in conjunction with the test procedures located in paragraphs 3-9 through 3-19. These tests are arranged in a logical order of functions and must be performed in the sequence in which they appear. If the tape transport or cartridge fails a test, stop testing immediately and refer to the appropriate troubleshooting chart for the repair procedure. When the repair has been accomplished, repeat the entire test to verify the repair. In some cases it may be necessary to trace signals with an oscilloscope or multimeter in order to isolate a fault. An extender card is provided in the IL Accessories Set for accessing the test points on circuit cards Al through A5. Use the circuit card schematic diagrams, signal interconnecting list, and interconnecting wiring diagrams, figures FO-2 through FO-11 for signal tracing. In addition, selected waveforms and timing information is illustrated in figures 2-4 and 2-5. Table 3-3 lists operating voltages for the power amplifier circuit card assembly A9.

3-9. Tape Transport Test Setup

a. Connect tape transport to exerciser shown in figure 3-1.

b. Install a standard tape cartridge in the tape transport and lock in place. Be sure write protect detent is not in PROT position.

c. Refer to TM 11-6625-3024-14 for exerciser operating instructions. Set exerciser controls as follows:

POWER ON/OFF SYSTEM	On
Depress PROCESSOR RESET (located on connector panel)	Verify STOP indicater is ON. If not, depress RESET again.
SELECT 1	On
POWER ON/OFF TRANSPORT	On

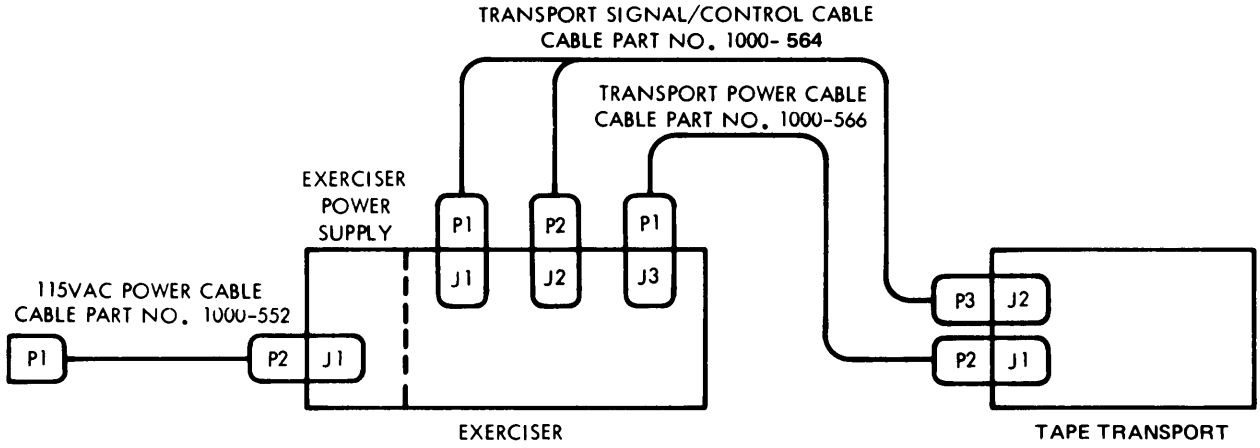


Figure 3-1. Tape Transport Test Setup.

NOTE

Ignore all indicators except as specified in each step of test procedure. If tape transport fails to perform as specified in procedure, refer to tape transport troubleshooting chart (table 3-2). After a fault has been isolated and repaired, repeat entire functional test.

3-10. Status and Control Test

a. ON/OFF Switch and PWR ON Indicator.

(1) Set ADDRESS switch on tape transport to 2.

(2) Set tape transport power ON/OFF switch to ON.

(3) Observe that PWR ON indicator lights.

b. Select Acknowledge.

NOTE

During test, tape transport access door may be open to provide access to ADDRESS switch provided door interlock switch is hand engaged.

(1) Set tape transport ADDRESS switch to position 1 and verify that SELECTED light on exerciser is on.

(2) If BOT indicators on tape transport and exerciser are not on, depress REWIND on exerciser. Verify that tape transport is rewinding by listening or observing tape. Tape should be rewound to BOT as indicated when BOT indicators light.

(3) Close tape transport door.

(4) Set the exerciser SELECT switches 2,3 and 4, in turn, depressing exerciser RUN FORWARD switch and then STOP switches for each address selected. Ensure only one exerciser SELECT switch is set at a time. For each SELECT switch verify: SELECTED, READY and BOT indicators on exerciser are off and that tape transport does not respond to a RUN command from the exerciser.

(5) Repeat step (4) for each combination of exerciser and tape transport SELECT and ADDRESS switch settings listed below, verify: the SELECTED, READY and BOT indicators on the exerciser are off, the BOT Indicator on the tape transport is on, and that the tape transport does not respond to a RUN command from the exerciser.

Exerciser SELECT	*Tape Transport ADDRESS*
1	2,3 and 4
2	1,3 and 4
3	1,2 and 4
4	1,2 and 3

c. Run/Stop Line.

(1) Remove tape cartridge. Mark end of capstan shaft with strip of tape. Reinstall tape cartridge. Close and lock access door.

(2) Set cartridge ADDRESS switch to 1. On exerciser set SELECT 1 on. Set all other SELECT switches off. Depress RUN FORWARD switch on exerciser. Observe that capstan motor rotates.

(3) Depress STOP switch on exerciser. Observe capstan motor shaft for a lo-second period to determine that it does not rotate.

(4) Cycle exerciser POWER ON/OFF TRANSPORT switch off, on, off, on at approximately two-second intervals. Verify that when cycling tape transport power does not cause capstan motor shaft to rotate.

d. Forward/Reverse.

(1) Depress exerciser RUN FORWARD switch. Observe that capstan rotates in a clockwise (CW) direction. Depress STOP switch.

(2) Depress exerciser RUN REVERSE switch. Observe that capstan rotates in a counterclockwise (CCW) direction. Depress exerciser STOP switch and remove tape from capstan shaft.

e. Write Permit.

(1) Observe that WRITE ENABLE indicator on exerciser is on.

(2) Remove tape cartridge and position write protect detent in PROT position. Install and lock cartridge in place and close tape transport access door.

(3) Observe that WRITE ENABLE indicator on exerciser is off and tape transport FILE PTCT indicator is on.

f. Ready Line.

(1) With access door closed and tape cartridge in place, observe that READY indicator on exerciser is on.

(2) Open access door. Observe that READY indicator is off.

(3) Remove cartridge, and close and lock door. Observe that READY indicator is off.

g. Beginning of Tape (BOT).

(1) Rotate tape cartridge write protect detent out of PROT position and position BOT reflective strip adjacent to cartridge mirror. Install tape cartridge in tape transport. Close and lock access door.

(2) Observe that BOT indicator on tape transport and exerciser are on, and that EOT indicator on exerciser is off.

(3) Depress RUN FORWARD switch on exerciser. Observe that BOT indicators instantly turn off. Depress STOP switch on exerciser.

h. End of Tape (EOT).

(1) Depress FAST switch on exerciser, then depress RUN FORWARD switch. Observe that EOT indicator on exerciser is off for approximately two minutes and then on momentarily prior to tape cartridge rewinding.

(2) When exerciser reports IN REWIND status, depress FAST switch and observe that EOT indicator is off.

(3) Allow tape transport to continue rewinding until tape stops at BOT, as indicated by both BOT indicators being on.

3-11. Write Test

NOTE

If exerciser reports EOT and then IN REWIND before following test is completed, allow tape to rewind to BOT. When BOT status is reported, depress RUN FORWARD switch and continue test.

a. File Protect.

(1) Remove tape cartridge and set write protect detent to PROT position. Install cartridge and verify that FILE PTCT indicator on tape transport is on. Close and lock access door.

(2) Depress WRITE DATA ALL 1 and WRITE switches on exerciser. Depress RUN FORWARD switch. Using an oscilloscope, observe signal at TP1, TP2, and TP3 of digital read/write circuit cards A1, A2, and A3.

(3) Verify that observed signal in each case is broadband noise measuring approximately 0.5v peak-to-peak.

(4) Depress REWIND switch on exerciser. when tape transport reports BOT status, remove tape cartridge and set write protect detent out of the PROT position. Reinstall tape cartridge and verify that FILE PTCT indicator on tape transport is off. Close and lock access door.

b. Write Enable.

(1) Set test oscilloscope to 50 microsec/cm and 2V/cm.

(2) Depress WRITE and WRITE DATA ALL 1 switches on exerciser. Depress RUN FORWARD switch on exerciser.

(3) Observe that the signal present at TP1, TP2, and TP3 of digital read/write circuit cards Al, A2, and A3 is 7.0 volts peak-to-peak minimum with a period of 100 ±8 microseconds (fig. 3-2). Depress STOP switch on exerciser.

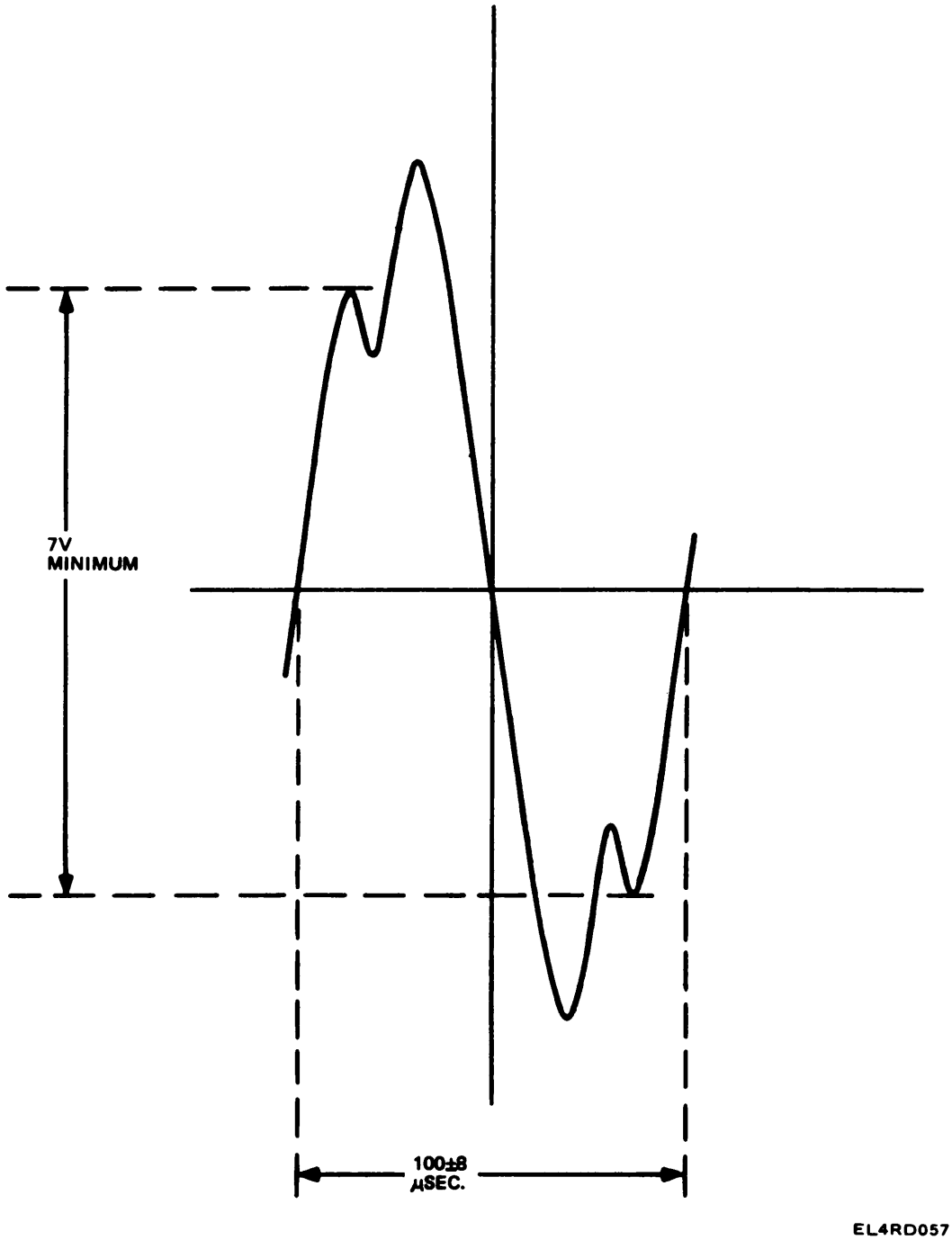


Figure 8-2. Write Test Waveform.

c. Write Reset.

(1) Depress REWIND switch on exerciser. When tape transport reports BOT status, depress RUN FORWARD switch on exerciser.

(2) Depress and hold WRITE RESET switch on exerciser while observing signal at TP1, TP2, and TP3 of digital read/write circuit cards A1, A2, and A3, in turn.

(3) Set oscilloscope to 0.1v/cm and verify that signal observed at each test point is broadband noise less than 0.5v peak-to-peak maximum.

(4) Depress REWIND switch on exerciser. Wait for BOT.

3-12. Read Test

a. Read Data Bits.

(1) Depress WRITE DATA ALL PAT switch on exerciser. Depress RUN FORWARD switch.

NOTE

WRITE DATA ALL PAT causes the WRITE DATA bits to toggle between logic one and zero states in a binary progression according to bit number (i.e., bit 1 toggles at the data rate, bit 2 toggles at 1/2 the data rate, and so on). The parity bit frequency will not be discemable.

(2) Using oscilloscope, observe signals at each of READ DATA test points on exerciser.

(3) Verify that bit 0 toggles each 50 microseconds, bit 1 each 100 microseconds, bit 2 each 200 microseconds, " etc. Allow tape to be recorded to EOT.

b. Read Strobe.

(1) When tape transport reports BOT status, depress RUN FORWARD and WRITE DATA ALL 1 switches.

(2) Using oscilloscope, observe STROBE signal at READ DATA CLK test point on exerciser.

(3) Verify that signal is a negative-going pulse having a duration of 2.0 ± 1.0 microseconds at 50% amplitude points.

(4) Using frequency counter, measure frequency of READ DATA CLK. Verify that the frequency is 20.0 ± 0.6 kHz.

(5) Depress STOP and RUN REVERSE switches on exerciser. Repeat steps (2) and (3).

(6) Depress STOP, FAST, and RUN FORWARD switches on exerciser. Repeat steps (2) and (3).

(7) Depress STOP and RUN REVERSE switches on exerciser. Repeat steps (2) and (3).

3-13. Tape Speed Test

a. Normal Speed.

(1) Replace standard cartridge with skew tape cartridge TW-433/UYH-5. Close and lock access door. Depress REWIND switch on exerciser. Wait for BOT status.

(2) Set WRITE switch on exerciser off.

(3) Connect oscilloscope to TP5 on digital read/write circuit card A2.

(4) Depress RUN FORWARD switch on exerciser.

(5) Monitor A2, TP5, triggering oscilloscope on positive-going edge of the input signal. Verify that nominal period for one complete cycle of square-wave signal observed is approximately 111 microseconds.

b. Instantaneous Speed Variation (Jitter).

(1) With oscilloscope at TP5 on digital read/write circuit card A2, oscilloscope time base such that one full cycle of the signal being displayed occupies 10 major divisions of the screen.

(2) Switch horizontal display control to x10 MAG. (Each major division of the screen now represents one percent of the total signal period.)

(3) Use HORIZONTAL POSITION control to position left-most jittered positive-going edge of the signal to the center of the reticle. Measure width (in divisions) of the jittered signal.

(4) Verify that jitter does not exceed five divisions.

c. Long-Term Speed Variation (LSV).

(1) Measure the frequency of the signal at TP5 on digital read/write circuit card A2 using frequency counter set on 1-kHz scale. Set display rate such that the frequency is sampled every 10 seconds.

(2) Record three consecutive readings and compute their average (Favg).

(3) Verify that Favg does not exceed 9 kHz ±270 Hz.

(4) Repeat steps (1) through (3) for RUN REVERSE.

(5) Repeat steps (1) and (2) above for FAST RUN FORWARD and FAST RUN REVERSE. Verify that Favg does not exceed 18 kHz ±540 Hz.

3-14. Start/Stop Time Test

a. Start Time.

(1) Ensure that FAST switch on exerciser is off. Remove skew tape cartridge and insert a write enabled standard cartridge.

(2) Set oscilloscope to trigger on the negative going edge of signal present at TP3 on servo control circuit card A5 when RUN FORWARD switch on exerciser is depressed.

(3) Display signal present at A5, TP5. Adjust signal amplitude on oscilloscope so that it is five divisions Peak-to-peak.

(4) Measure period from start of sweep to where

ramp first crosses +3 percent level (fig. 3-3). Each major division on the scale equals 20 percent.

(5) Verify that start time is within 30 to 33 ms.

(6) Depress FAST switch on exerciser. Alternately depress STOP and RUN FORWARD to display signal.

(7) Verify that start time (measured as in step (4) is within 60 to 66 ms.

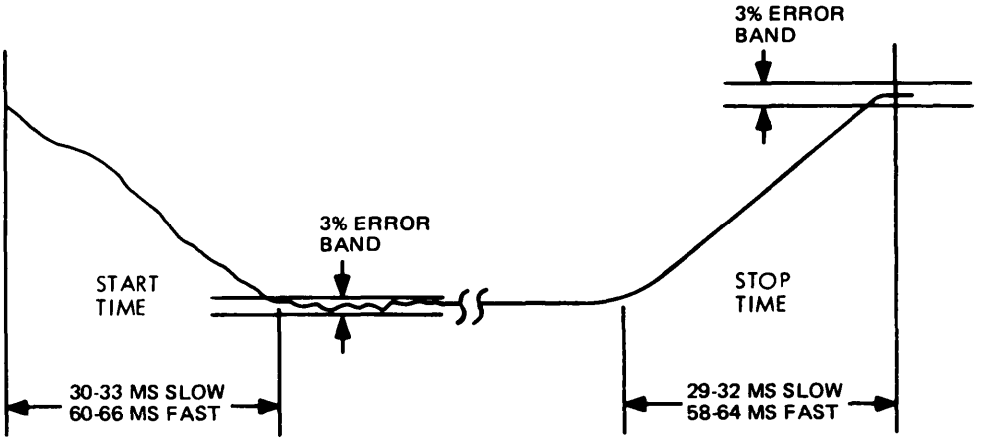


Figure 3-3. Start/Stop Time Waveforms.

b. Stop Time.

(1) Set oscilloscope to trigger on the positive edge of the external trigger signal at A5, TP3 when RUN FORWARD switch on exerciser is depressed.

(2) Display the signal present at A5, TP5. Adjust signal amplitude or oscilloscope so that it is five divisions peak-to-peak.

(3) Measure the period from start of sweep to where ramp first crosses 97 percent level (fig. 3-3). Each major division on the scale equals 20 percent.

(4) Verify that stop time is within 58 to 64 ms.

(5) Set FAST switch off. Set exerciser for RUN FORWARD, WRITE, BLOCK MODE operation.

(6) Repeat step (3) and verify that stop time is within 29 to 32 ms.

(7) Depress REWIND switch on exerciser.

3-15. Skew Test

a. Static Skew and Dynamic Skew A.

(1) On exerciser, set WRITE and FAST switches off. Insert skew tape cartridge TW-433/UYH-5. Close and lock access door. Depress REWIND switch.

(2) After BOT status is reported, depress RUN FORWARD switch.

(3) Connect CH1 of oscilloscope to TP1 of control logic circuit card A4 and set oscilloscope to trigger on the positive-going edge of the pulse. Display successively on CH2 the signal at TP4, TP5, and TP6 of digital read/write circuit cards Al, A2, A3 noting which positive signal transition is most delayed from start of sweep. Connect CH2 to this most delayed point. Refer to table 3-1 for test point/tape track number identification.

(4) Measure the period from start of sweep to center of jittered signal transition (fig. 3-4) and verify that static skew is 5.6 microseconds maximum.

(5) Depress STOP and REWIND switches on exerciser.

(6) When BOT status is reported, remove skew tape cartridge, replacing it with the write enabled standard cartridge used in previous sections of this procedure. Close and lock tape transport access door.

(7) Set WRITE switch and WRITE DATA ALL 1 switch on. Depress REWIND switch on exerciser.

(8) After BOT status is reported, depress RUN FORWARD switch.

(9) Repeat step (3).

(10) Measure the period from start of sweep to center of jittered signal transition (fig. 3-5) and verify that write/read skew is 8.89 microseconds maximum.

(11) Measure time displacement of jittered signal transition (fig. 3-5) and verify that displacement (dynamic skew A) is 6.0 microseconds maximum.

Table 3-1. Digital Read/Write Circuit Card Test Point Identification

Test point	A1 Track no.	A2 Track no.	A3 Track no.	Signal type	Waveform reference
TP1	9	6	3	Read	Fig. 3-5
TP2	8	5	2	Read	Fig. 3-5
TP3	7	4	1	Read	Fig. 3-5
TP4	9	6	3	Read	Fig. 3-5
TP5	8	5	2	Read	Fig. 3-5
TP6	7	4	1	Read	Fig. 3-5
TP7	9	6	3	Write	Fig. 3-5
TP8	8	5	2	Write	Fig. 3-5
TP9	7	4	1	Write	Fig. 3-5

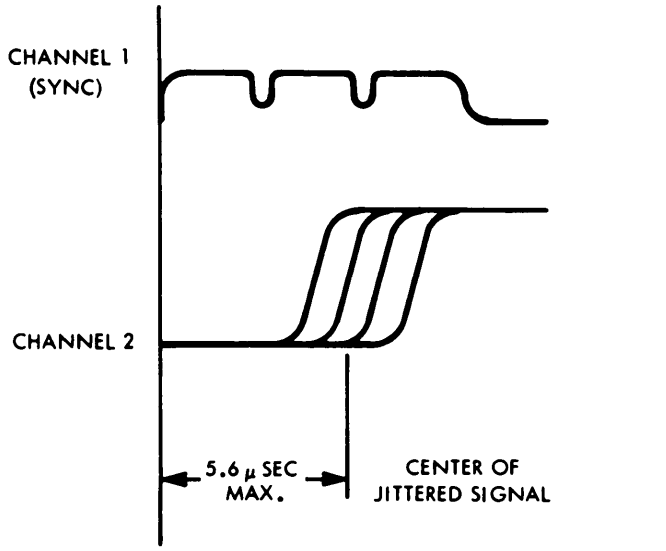


Figure 3-4. Static Skew Waveform

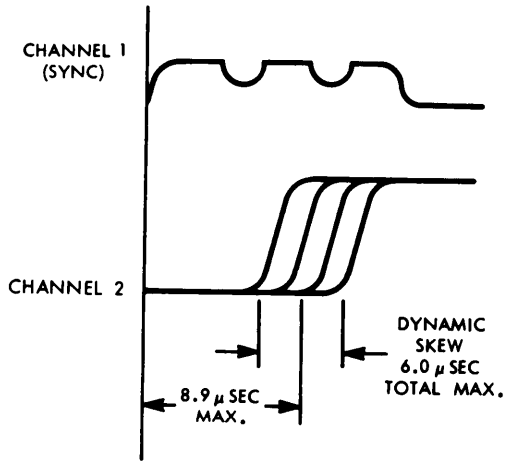


Figure 3-5. Write/Read Skew Waveform.

b. Dynamic Skew B.

(1) Using same settings as above, display signals present at TP4 of digital read/write circuit card A1 on CH1 and TP6 of digital read/write circuit card A3 on CH2 of the oscilloscope. Set oscilloscope to the chopped mode.

(2) Trigger oscilloscope on positive-going edge for the signal on Al, TP4 (CH1). Measure time displacement over which signal jitters. Make note of this time.

(3) Tigger oscilloscope on positive-going edge of signal on A3, TP6 (CH2). Measure time displacement over which the signal jitters. Make note of this time.

(4) Add the times noted in steps (2) and (3) and verify that dynamic skew B is 6.0 microseconds maximum

(5) Depress REWIND switch on exerciser. Wait for BOT to be reported.

3-16. Power Cycling Interference Test

a. Power Cycling, Write Interface.

(1) Set WRITE and WRITE DATA ALL 0 switches on exerciser on. When BOT is reported, depress exerciser PARITY ERRORS RESET and RUN FORWARD switches.

(2) Allow tape transport to perform the operation for one minute. If after that time the error counter registers zero errors, depress STOP switch, then REWIND switch on exerciser. If errors are indicated, repeat procedure (two retries maximum).

(3) When tape transport reports BOT status, set WRITE switch to off.

(4) Depress RUN FORWARD switch on exerciser. Wait 10 seconds and depress STOP switch. Cycle tape transport ON/OFF switch off, and after one second, on. Repeat five times.

(5) Depress REWIND switch on exerciser. Wait for BOT to be reported.

(6) Ensure that WRITE switch is off. Reset PARITY ERRORS counter and depress RUN FORWARD switch. Monitor error counter during first one minute of command READ operation. Verify that counter indicates zero.

(7) Depress REWIND switch on exerciser. Wait for BOT to be reported.

b. Error Test.

(1) Set WRITE switch on exerciser on. Set ALL PAT switch on. Reset PARITY ERRORS counter and depress RUN FORWARD switch.

(2) Allow tape transport to perform commanded read-after-write operation through EOT.

(3) During above operation, observe error counter during recording pass (until EOT is reported) and verify that there are no errors. If errors are indicated, repeat entire error test (two retries maximum).

(4) Wait for BOT status to be reported before continuing.

3-17. Power Consumption Test

a. Low-Speed Read While Write Mode.

(1) Connect digital multimeter (5-amp scale) at exerciser TRANSPORT CURRENT jacks.

(2) When tape transport reports BOT status, depress RUN FORWARD switch. Observe that current does not exceed 2.04 amperes.

b. High Speed.

(1) Depress STOP switch, then depress REWIND switch on exerciser. Wait for BOT status to be reported.

(2) Depress FAST and RUN FORWARD switches and observe that current does not exceed 2.04 amperes.

c. Standby.

(1) When BOT status is reported, set exerciser SELECT 1 off and SELECT 2 on.

(2) Observe that standby current does not exceed 0.65 ampere.

3-18. Magnetic Tape Cartridge Test Setup

a. Connect the exerciser to a known good tape transport as shown in figure 3-1.

b. Refer to TM 11-6625-3024-14 for exerciser operating instructions. Set exerciser controls as follows:

Power ON/OFF	
SYSTEMS	On
Depress PROCESSOR RESET	Verify that STOP indicator is ON.
(on connector panel)	If not, depress RESET again.
SELECT 1	On
Power ON/OFF TRANSPORT	On

c. Set tape transport controls as follows:

Power ON/OFF	On
ADDRESS	1 Verify that exerciser SELECTED indicator is on.

3-19. Magnetic Tape Cartridge Functional Test

NOTE

Ignore all indications except as specified in each step of this procedure. If the cartridge fails to perform as specified in this procedure, refer to tape cartridge troubleshooting chart (table 3-4). After a fault has been isolated and repaired, repeat entire functional test.

a. Beginning of Tape (BOT).

(1) Ensure that cartridge under test is not write protected (detent is not in the PROT position).

(2) Install cartridge under test in tape transport and lock in place. Close and lock tape transport access door.

(3) If BOT indicators on the tape transport and exerciser are not on, depress REWIND switch on exerciser. Verify that cartridge is rewinding. Tape should rewind to BOT as indicated when both BOT indicators light.

b. BOT Indicator and Current Measurement.

(1) Connect digital multimeter (5-amp scale) at TRANSPORT CURRENT jacks on exerciser.

(2) Depress FAST and RUN FORWARD switches on exerciser.

(3) Verify that EOT indicator on exerciser lights momentarily at EOT and cartridge rewinds to BOT. Verify that current does not exceed 2.04 amperes.

c. Forward Skew and Tape Certification.

(1) Set FAST switch off. Set WRITE DATA ALL 1 and WRITE switches on. Reset PARITY ERRORS counter to zero.

(2) Connect CH1 of oscilloscope to TP6 of digital read/write circuit card A3 and CH2 to TP4 of Al (tracks 1 and 9, respectively).

(3) Set oscilloscope vertical mode to ALTERNATE, TIME/DIV to two microseconds, and VOLTS/DIV to 10 (both channels). Set CH1 TRIGGER to POSITIVE.

(4) Depress RUN FORWARD switch on exerciser. Observe the two channels displayed on the oscilloscope and select either CH1 or CH2 TRIGGER that allows positive-going edge of both signals to be displayed.

NOTE

The skew measurements to be recorded in steps (5) and (6) are used in para e below, Forward/Reverse Skew Comparison. If the sweep is triggered by CH1, the measured period is assigned a positive (+) value. If triggered by CH2, measured period is assigned a negative (–) value.

(5) Observe time displacement of the most displaced signal. Measure and record the period from start of sweep to the center of time jittered initial signal transition (fig. 3-6). Verify that forward static skew is 0.0 ± 6.0 microseconds.

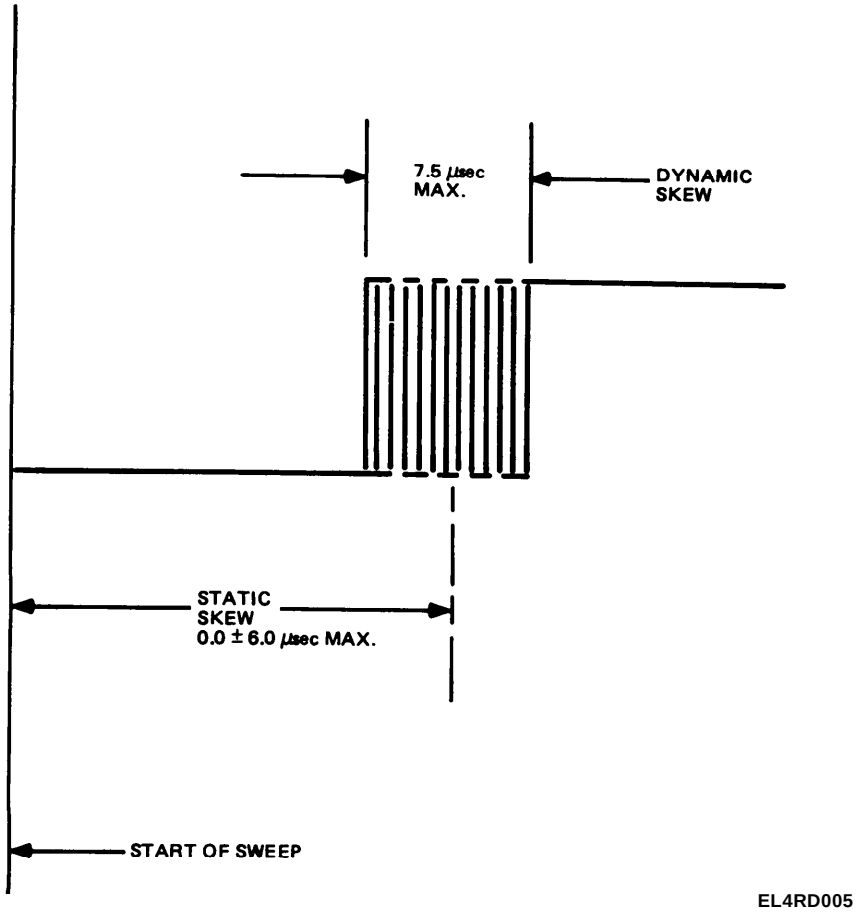


Figure 3-6. Magnetic Tape Cartridge Skew Test Waveforms.

(6) Measure record period over which initial signal transition is time jittered (fig. 3-6, dynamic skew). Verify that the dynamic skew does not exceed 7.5 microseconds.

NOTE

Do not allow tape transport to go into rewind status.

(7) When EOT status is indicated, depress STOP switch on exerciser. Observe that PARITY ERRORS counter displays zero error.

d. Reverse Skew.

(1) Depress RUN REVERSE switch on exerciser. Observe the two channels displayed on oscilloscope and select either CH1 or CH2 TRIGGER that allows the positive-going edge of both signals to be displayed.

NOTE

The skew measurement to be recorded in step (2) is used in para e below. If sweep is triggered by CH1, the measured period is assigned a positive (+) value. If triggered by CH2, measured period is assigned a negative (-) value.

(2) Observe time displacement of the most displaced signal. Measure the period from start of sweep to the center of time jittered initial signal transition (fig. 3-6) for 10 seconds minimum, at the end of tape, center of tap, and beginning of tape Record the maximum period. Verify that reverse static skew is 0.0 ± 6.0 microseconds.

e. Forward/Reverse Skew Comparison. Determine algebraic sum of forward and reverse static skew measurements taken in tests in para c and d above. Verify that total static skew does not exceed 0.0 ± 4.0 microseconds.

3-20. Tape Transport Troubleshooting

When a tape transport fails any of the functional troubleshooting tests in paragraphs 3-9 through 3-17, locate the failure in "Trouble" column of table 3-2 and take the specified action. When a repair has been completed, perform entire test to verify the repair.

CAUTION

When troubleshooting the tape transport, observe all safety precautions. Disconnect electrical power unless performing service required electromechanical or electronic actuation.

Table 3-2. Tape Transport Troubleshooting Chart

Trouble	Probable cause	Action
SELECTED status light on exerciser off.	Unit not selected.	Check SELECT switch. select line must be low.
	Control logic bad.	Replace A4 assembly.
READY status light on exerciser off.	Cartridge not installed.	Install cartridge.
	Unit not selected.	Check SELECT switch. Select line must be low.
	Cartridge in place, interlock switch bad.	Replace switch.
	Access door not closed.	Close and lock access door.
	Door closed, interlock switch bad.	Replace switch.
	Unit is rewinding.	Wait to complete rewind.
	Control logic bad.	Replace A4 assembly.
REWIND status light when RWND switch inside door is pushed.	Cartridge not installed.	Install cartridge.
	Tape in cartridge is at BOT.	Position tape away from BOT.
	RWND switch bad.	Replace switch.
	Control logic bad.	Replace A4 assembly.
REWIND status light off when commended to rewind.	Cartridge not installed.	Install cartridge.
	Tape in cartridge is at BOT.	Position tape away from BOT.
	Access door not closed.	Close and lock access door.
	Unit is in run command.	Command unit to stop.
BOT status light off after complete rewind when commanded to stop.	No BOT strip.	Install new tape in cartridge.
	Strip sensor or LED bad.	Installed new sensor and LED.
BOT status light off after complete rewind.	Servo control bad.	Replace A5 assembly.
	Control logic bad.	Replace A4 assembly.
EOT status light on exerciser off when at EOT.	No EOT strip.	Install new tape in cartridge.
	Low tape sensor or LED bad.	Install new sensor and LED.
	Strip sensor or LED bad.	
	Servo control bad.	Replace A5 assembly.
	Control logic bad.	Replace A4 assembly.
Unit goes into rewind status before given rewind command and before EOT is reached.	Servo motor has noisy brushes.	Clean commutator or replace brushes.
	Cartridge has worn tape.	Install new tape in cartridge.

Table 3-2. Tape Transport Troubleshooting Chart–Continued

Trouble	Probable cause	Action
	Servo control bad.	Replace A5 assembly.
	Control logic bad.	Replace A4 assembly.
Tape runs off end roller on cartridge.	No EOT hole on tape.	Make EOT holes in tape.
	Low tape sensor of LED bad.	Install new sensor and LED.
	Hole sensor or LED bad.	Install new sensor and LED.
	Motor turning in wrong direction,	Reverse tach and motor leads.
	Servo control bad,	Replace A5 assembly.
	Control logic bad.	Replace A4 assembly.
Tape runs off beginning roller on cartridge.	No BOT hole on tape and no BOT strip on tape	Make BOT hole in tape and install BOT strip.
	LED for hole and stip bad.	Install new LED and sensor.
	Servo control bad.	Replace A5 assembly.
	Control logic bad.	Replace A4 assembly.
Motor speed cannot be controlled (runs away).	Motor not in phase with tach.	Reverse tach or motor wires.
	Servo control bad.	Replace A5 assembly.
	Tach winding open.	Replace motor/tach.
Motor can be turned by hand with no resistante, with power on and in stop mode.	Motor winding open.	Replace motor/tach.
	Servo control bad.	Replace A5 assembly.
	Power amplifier bad.	Check A9 assembly per table 3-3; repair by replacing components.
No tape motion when in run command with cartridge in place and door closed and select line low.	Tape bunched up in cartridge.	Replace cartridge.
	Motor seized.	Check motor.
	Servo control bad.	Replace A5 assembly.
Tape bunches up in cartridge.	Cartridge worn or belt and idler wheel damaged.	Replace cartridge.
Unit does not run at correct speed (LSV too great); LSV > 3% or only one speed.	Servo control bad or not calibrated with motor/tach.	1. Adjust A5 assembly per para 3-24. 2. Replace A5 assembly. 3. Replace motor.
Unit will not read from skew cartridge tape.	Unit not commanded to read.	Read permit line must be low.
	No tape motion.	Check tape motion.
	No clocks but data is present on TP4, TP5 and TP6 of read/write circuit cards.	Check control logic assembly A4. Check read/write circuit cards by interchanging.
	No data present at read/write circuit card.	Clean head.
Unit will not write data.	Unit not commanded to write.	Write permit line must be low.
	Unit in write reset mode.	Write reset must be high.
	Dirty head.	Clean head.
	Cartridge not write enabled.	Enable cartridge,
	No tape motion.	Check tape motion trouble.
	No input signal.	Check exerciser input controls and data signals to cartridge recorder.
	Control logic bad.	Replace A4 assembly.
	Read/write circuit card(s) bad.	Check read/write circuit cards by interchanging.
Unit has excessive parity errors when reading only or when reading while writing.	Servo motor noisy,	Clean commutator or replace motor.
	Tape damaged.	Replace tape or cartridge.
	Dirty head and/or tape guides.	Clean head and guides.
	Control logic bad.	Replace A4 assembly.
Power will not come on.	ON/OFF circuit breaker bad.	Check and replace applicable item.
	Power supply bad.	
	Line filter bad.	
Steps in tape.	Tape transport tape guide springs dirty.	Clean tape guide springs, run tape cartridge to EOT and rewind.
Motor runs in one direction only.	Power amplifier bad.	Check motor drive voltages and operating voltages per table 3-3.
Excessive skew.	Guides dirty.	Clean tape guides and capstan.
	Cartridge/head out of alignment.	Reseat cartridge/align head.
	Cartridge worn.	Replace cartridge.
Noise excessive after write reset (>0.5 v peak-to-peak).	Erase function/erase head.	Perform erase verification procedure (para 3-21). If ok, trace write reset fault. If erase fails check erase signal or replace head assembly (erase fault).
	Write reset.	

Table 3-2. Tape Transport Troubleshooting Chart–Continued

Trouble	Probable cause	Action
Instantaneous speed variation excessive (ISV not within tolerance).	Motor/tach dirty.	Check tack ripple voltage (table 3-3) (should be less than 200 mV). Clean tach and/or motor commutators. Replace motor assembly.
Power cycle test failed.	Ground wire loose.	Check ground points.
Tape transport current excessive.	Short circuit.	Check power circuitry.
	Tape cartridge bad.	Replace cartridge.
Start/stop time excessive.	Capstan shaft dirty.	Clean capstan.
	Tape cartridge bad.	Replace cartridge.

Table 3-3. Power Amplifier Operating Voltages

	Reference		Speed and direction				
Signal	(Note 3)	Remarks	STOP	FWD	FAST FWD	REV.	FAST REV.
A9A1B	GROUND	Note 4 DRIVE A	–0.5	– 0.6	–0.6	+ 1.2	+1.4
A9Q7B	GROUND	Note 4 DRIVE B	+1.3	+ 1.9	+1.9	– 0.2	–0.4
A9Q5C	A9Q6C	Note 5 MOTOR DR	0.0	– 4.1	–6.3	+ 3.6	+5.7
A9Q1E	GROUND	Note 6	0.0	0.0	0.0	+ 0.9	+0.9
A9Q2B	GROUND	Note 6	+ 27.8	+27.5	+27.5	+27.1	+27.0
A9Q3E	GROUND	Note 6	0.0	0.0	0.0	+ 0.4	+0.4
A9Q7E	GROUND	Note 6	+0.7	+ 1.3	+1.3	+ 0.1	+0.0
A9Q6C	GROUND	Note 6	+0.6	+ 5.2	+7.3	+ 0.6	+0.6
A9Q5E	GROUND	Note 6	+0.1	+ 0.6	+0.6	0.0	0.0
A9Q6C	GROUND	Note 6	+0.2	+ 0.9	+1.0	+ 4.1	+6.2
TP5A5	TP6A5	Note 7 TACH DR	0.0	– 2.4	–4.7	+ 2.5	+4.8

NOTES

1. Use power amplifier schematic diagram (fig. FO-5) in conduction with this table.
2. All readings in vdc with cartridge near BOT. These voltages are approximate and only indicate general operating levels.
3. Ground is R6, pin 1.
4. If DRIVE A or DRIVE B signals are absent, check input circuitry.
5. If motor drive signal (output) is incorrect, check motor winding for short to ground or open winding. If motor is OK, refer to note 6.
6. If input signals are present but motor drive signals are incorrect, use these signal levels to isolate the fault y piece part(s). Repair by replacing faulty component(s). If necessary, components may be removed from card in order to test.
7. Tach drive voltage is shown for reference only.

CAUTION

When replacing power transistor, apply heat sync compound (Dow Corning #340 Silicone) to the base of component.

3-21. Erase Verification

a. Turn off TRANSPORT power on exerciser and remove digital read/write circuit cards A 1, A2 and A3.

b. Turn on TRANSPORT power.

c. Depress WRITE (on) and RUN FORWARD switches on exerciser. Mow tape transport to run for one minute. Depress STOP then REWIND switch on exerciser.

d. When BOT is reported, turn off TRANSPORT power and reinstall cards A1, A2 and A3.

e. Set WRITE switch on exerciser off. Depress RUN FORWARD. Observe that the signal present at TP1, 2 and 3 of A1, A2 and A3 is broadband noise at an amplitude of approximately 0.5v peak-to-peak.

3-22. Magnetic Tape Cartridge Troubleshooting

When a magnetic tape cartridge fails any of the functional troubleshooting tests in paragraph 3-19, locate failure in “Trouble” column of table 3-4 and take the specified action. When a repair has been completed, perform entire test to verify the repair.

Table 3-4. Magnetic Tape Cartridge Troubleshooting Chart

Trouble	Probable cause	Action
BOT or EOT indcator on but tape will not move.	Tape jammed.	Replace tape.
	Tape positioned between holes.	Remove cartridge cover and manually move tape so that reflective strip is opposite mirror.
Current is excessive.	Tape jammed.	Replace tape.
	Tape tension too great.	Replace cartridge.
Skew exceeds limits.	Cartridge worn.	Replace cartridge.
Tape errors.	Tape dirty.	Isolate error and inspect tape for dirt.
	Tape creased or worn.	Replace tape.
Other failures.	Tape transport faults.	Refer to troubleshooting for tape transport (table *3-2).*
Tape not under proper tension.	Taps pulled out of cartridge.	Open cartridge, remove belt and rewind manually onto supply reel.

Section IV. TAPE TRANSPORT MAINTENANCE

3-23. Introduction

This section provides detailed information for the maintenance of the tape transport by direct support level personnel. Maintenance at this level consists of the removal and replacement of authorized parts. Figures 3-7 and FO-10 are used to locate specific parts. When a part is replaced, be sure that all wires and harnesses are dressed as illustrated.

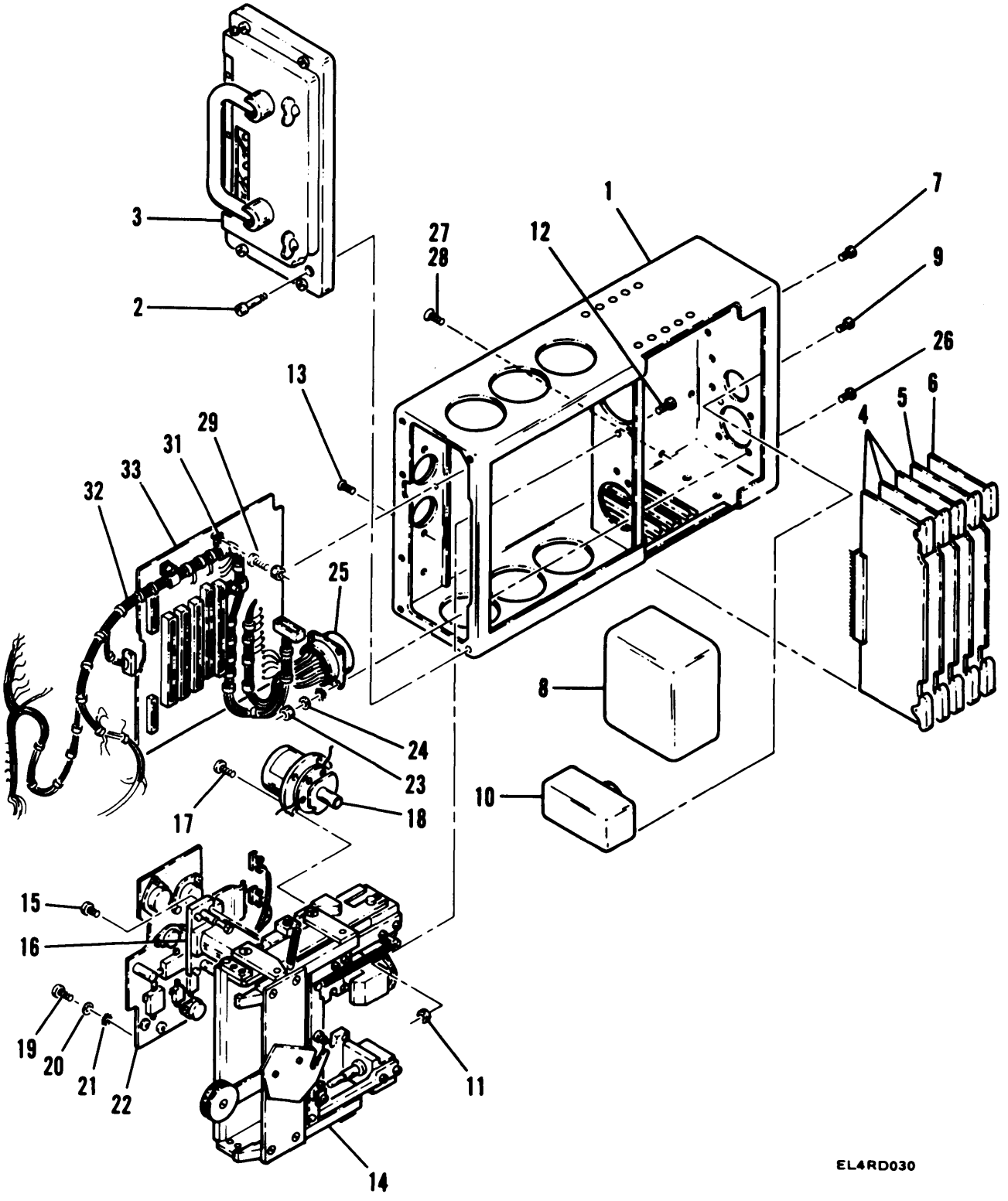


Figure 3-7. Tape Transport Parts Location.

3-24. Circuit Card Assemblies A1 Through A5

Circuit card assemblies A1 through A5 (4, 5 and 6, fig. 3-7) are plugged into the harness and interface board assembly. To remove a card, proceed as follows.

a. Removal. Lift up built-in card ejectors and carefully ease card out of the slides using a side to side rocking motion to free connector pins.

b. Replacement. Slide card into proper slot until connector guide pins mate. Push card down firmly into the connector.

3-25. Power Supply PS1

(8, fig. 3-7)

a. Removal.

(1) Remove circuit cards A1 through A5 (para 3-24).

(2) Disconnect connector A 10P1 by backing out jackscrews (gain access through two access holes in bottom of chassis).

(3) Remove cable clamp adjacent to power supply assembly on the interface board.

(4) Remove four mounting screws (7) and lift out power supply.

b. Replacement.

(1) Position power supply in chassis and secure with four mounting screws. Place a drop of sealant on screw threads before installing.

(2) Secure cable with cable clamp on interface board adjacent to power supply.

(3) secure connector A10P1 to PS1J1 (gain access through two access holes in bottom of chassis).

(4) Install circuit cards A1 through A5 (para 3-24).

3-26. Line Filter FL1

(10, fig. 3-7)

a. Removal.

(1) Remove circuit cards A1 through A5 (para 3-24).

(2) Disconnect connector A10P1 by backing out jackscrews (gain access through two access holes in bottom of chassis). Move cable out of the way.

(3) Remove four mounting screws (9), tag and disconnect electrical leads at terminal board on side of filter and remove filter assembly.

b. Replacement

(1) Position filter in chassis and secure electried leads to terminal board on filter. Secure filter to back of chassis with four mounting screws. Place a drop of sealant on screw threads.

(2) Secure connector A10P1 to PS1J1 (gain access through two access holes in bottom of chassis).

(3) Install circuit cards A1 through A5 (para 3-24).

3-27. Power Amplifier Assembly (A9)

(22, fig. 3-7)

a. Removal.

(1) Remove flat head screw on connector A8B1P1 (mates with A9J2, fig. 3-7) and remove motor cable connector A8B1P1.

CAUTION

Alternately turn connector jackscrews one to two turns each until plug separates completely from jack.

(2) Remove cable clamp adjacent to connector A10P2.

(3) Disconnect A10P2 from A9J1 by means of jackscrews.

(4) Remove mound strap) at Q6 by removing screw (19), lockwasher (20) and washer (21).

(5) Loosen three power amplifier captive mounting screws.

(6) Remove power amplifier assembly (22) from tape transport.

b. Replacement.

(1) Position assembly power amplifier in tape transport.

(2) Tighten three slot-head captive mounting screws.

(3) Apply coat of zinc chromate primer, Specification TT-P-175, to washer (20), lockwasher (21), chassis strap terminal, and terminal contact surface (fig. 3-8). Assemble with screw (19) while primer is still wet.

(4) Install cable clamp.

CAUTION

Alternately tighten connector jackscrews one to two turns each until connector is securely seated.

(5) Connect A10P2 to A9J1 and secure by means of jackscrews.

(6) Connect A8B1P1 to A9J2 and secure connector with flat head screw. Place a drop of sealant on screw threads before instilling.

3-28. Power Amplifier Assembly (A9) Repair

(fig. 3-8)

a. Genenal. The replaceable components of the power amplifier assembly are the circuit card assembly, all resistors (R3, R5, R6, R9, R10, R11, R13) and transistors (Q1, Q2, Q3, Q5, Q6) mounted on the assembly head sink plate.

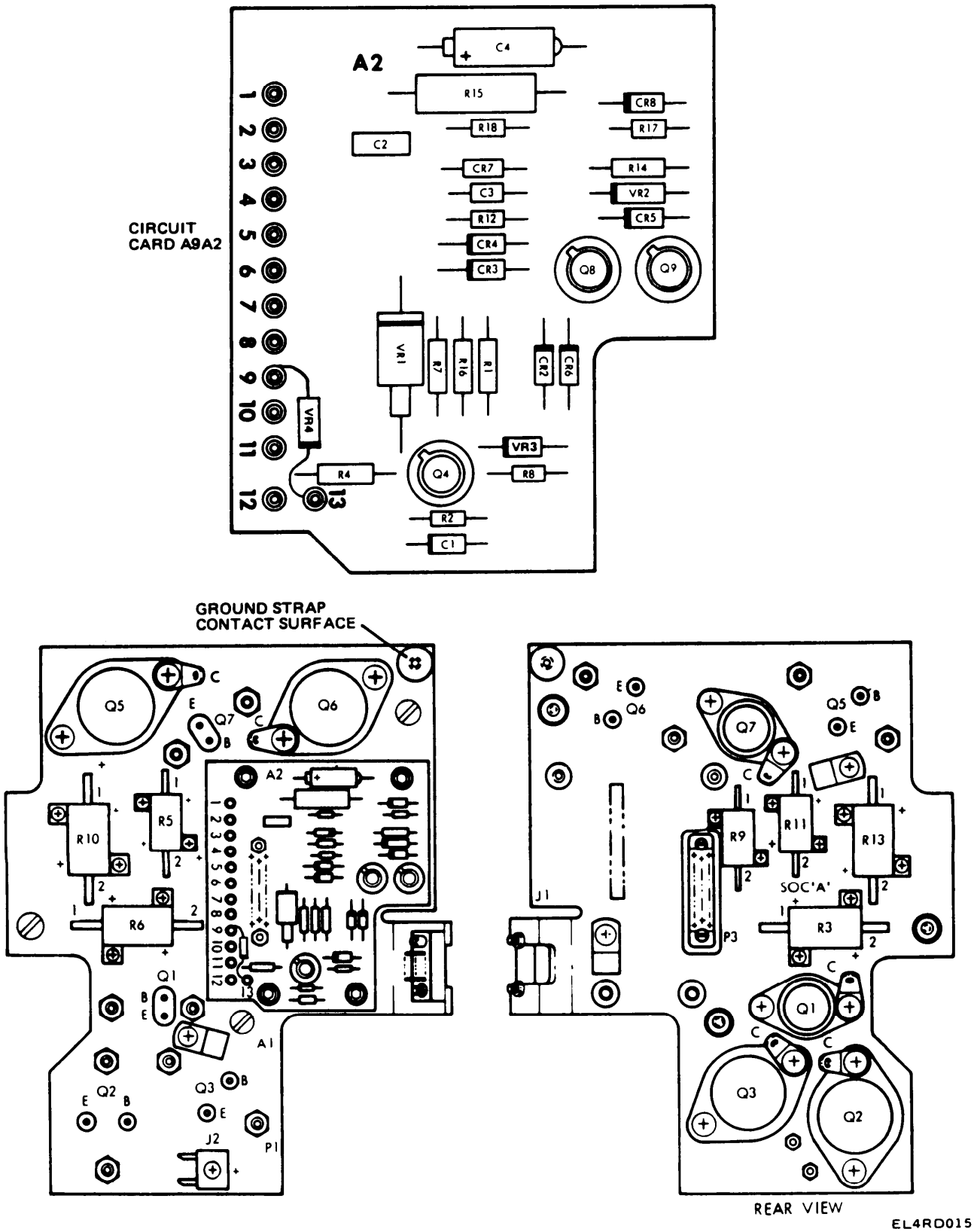


Figure 3-8. Power Amplifier Assembly Parts Location.

b. Assembly Removal. Remove the power amplifier assembly from tape transport (para 3-27).

c. Resistor Removal.

(1) Tag and unsolder wires to resistor terminals.

(2) Removal two screws and resistor from heat sink.

(3) Clean dried silicone compound from heat sink.

d. Resistor Replacement.

(1) Apply silicone compound (NSN 6850-00-927-9461) to base of resistor and place in position.

(2) Secure resistor to heat sink with two screws.

(3) Solder wires to resistor terminals.

e. Transistor Removal.

(1) Tag and unsolder wires to transistor base and emitter.

(2) Remove two screws, nuts, lock washers, flat washers and collector wire terminal.

(3) Remove transistor and insulator from heat sink.

(4) Clean dried silicone compound from heat sink and insulator.

f. Transistor Replacement.

(1) Apply silicone compound (NSN 6850-00-927-9461) to both sides of insulator and place insulator and transistor in position in heat sink.

(2) Secure transistor to heat sink with screws, lock washers, flat washers, nuts and collector wire terminal.

g. *Circuit Card (A2) Removal.*

(1) Tag and unsolder 15 wires from terminal posts.

CAUTION

Alternately turn connector jackscrews one to two turns each until plug separates completely from jack.

(2) Disconnect A9P3 from A9J3.

(3) Remove four socket head screw assemblies that secure circuit card and spacer board to the heat sink. A socket screw assembly includes a lock washer, flat washer and a fiber spacer located between the circuit card and the spacer board.

h. Circuit Card (A2) Replacement.

(1) Place spacer board in position on heat sink.

(2) Line up four fiber spacers above holes in spacer board.

(3) Place circuit card in position on four spacers.

(4) Solder the 15 tagged wires to terminal posts on circuit card.

CAUTION

Alternately tighten connector jackscrews one to two turns each until connector is securely seated.

(5) Secure connector A9P3 to A9J3 by means of jackscrews.

i. Power Amplifier Assembly Replacement. Replace power amplifier assembly in cartridge recorder (para 3-27).

3-29. Capstan Motor Assembly B1

(18, fig. 3-7)

a. Removal.

(1) Remove power amplifier assembly A9 (para 3-27).

(2) Remove harness clamp on tape deck adjacent to motor assembly.

CAUTION

Care must be taken not to damage external motor wiring when removing mounting screws.

(3) Remove four mounting screws (17) and lift out the motor assembly.

b. Replacement.

CAUTION

Care must be taken not to damage external motor wiring when replacing mounting screws.

(1) Place the motor assembly (18) on the tape deck and secure with four mounting screws (17). Place a drop of sealant on the screw threads before installing.

(2) Secure the cable clamp on the tape deck adjacent to the motor assembly.

(3) Install power amplifier assembly A9 (para 3-27).

3-30. Capstan Motor Assembly Brush

(fig. 3-9)

NOTE

The capstan motor has two brush assemblies; one for the motor and one for the integral tachometer located at rear of motor assembly. Replace both brush assemblies at the same time (para a. through d., below).

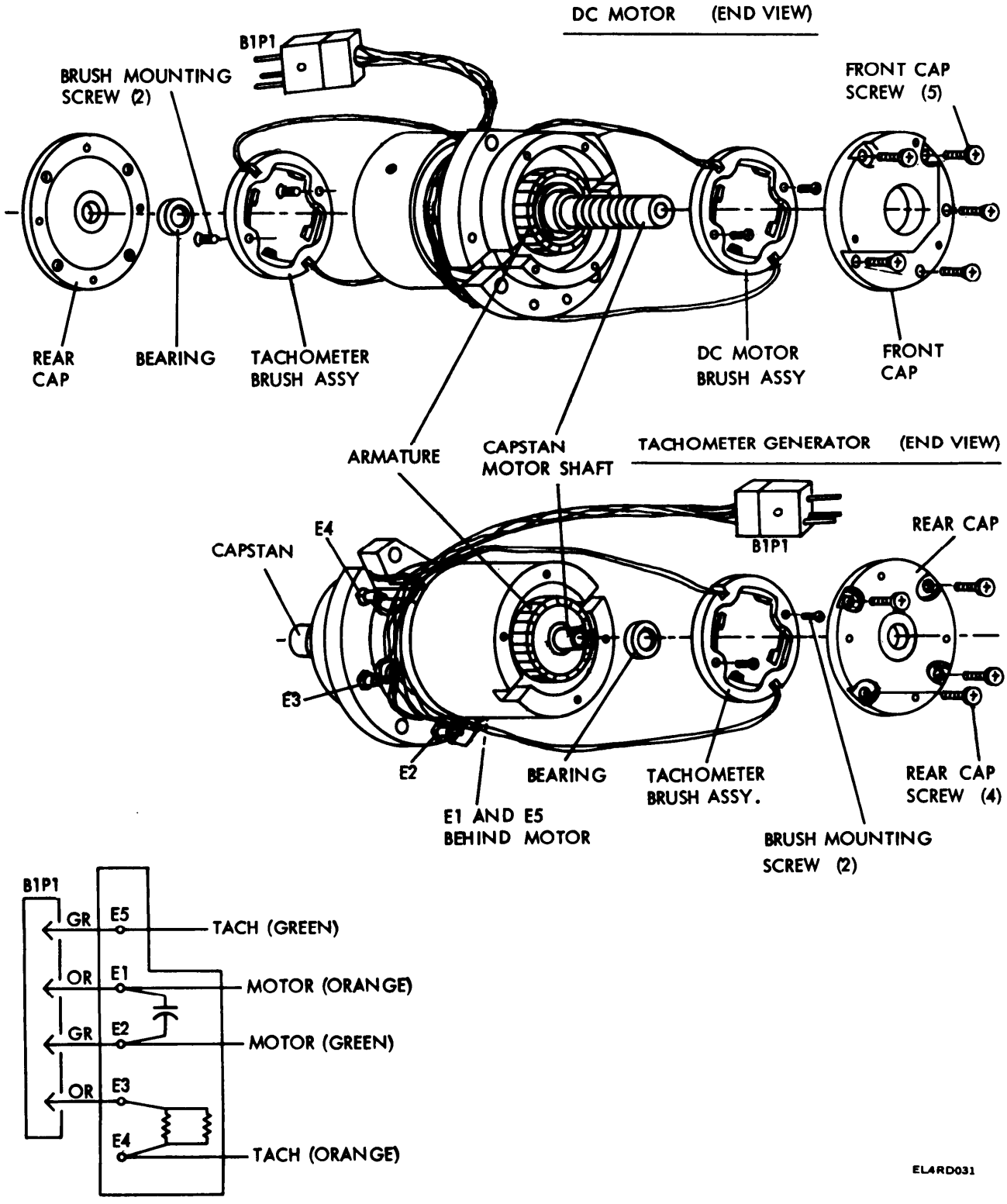


Figure 3-9. Capstan Motor Assembly Brush Installation.

a. Motor Brush Assembly Removal.

(1) Remove motor from tape transport (pan 3-29) and place on a flat, solid work surface.

NOTE

Note carefully the routing and dressing of brush assembly leads before unsoldering. Make certain that the new leads are installed correctly.

(2) Locate two orange and two green wires from each brush assembly and carefully unsolder them from motor terminals (E1, E2, E44, and ES, fig. 3-9). Remove wires from harness.

CAUTION

Hold down capstan when removing the front housing cap. This will prevent the armature from being pulled out from the stator. If armature is accidentally removed from stator, entire motor assembly must be replaced.

(3) Remove five screws (two pan head, three flat head) securing front cap to motor housing.

(4) Hold down capstan and front cap.

(5) Remove two screws securing brush assembly to motor housing.

(6) Carefully lift out brush assembly.

(7) Clean motor commutator (para 3-35).

(8) Install new motor brush assembly before removing tachometer brush assembly.

b. Motor Brush Assembly Replacement.

CAUTION

Do not remove armature assembly from stator when replacing brushes. If armature is removed from stator, entire motor must be replaced.

(1) Place brush assembly into motor housing and carefully slide brushes onto commutator.

(2) Secure brush to motor housing with two screws. Place a drop of sealant on screw threads before installing.

(3) Replace and secure front housing cap with five screws (two pan head, three flat head). Place a drop of sealant on screw threads before installing.

(4) Remove tachometer brush assembly (para c., below).

c. Tachometer Brush Assembly Removal.

CAUTION

Hold down shaft which is located in the center of the cap when removing the rear housing cap. This will prevent armature from being pulled out from stator. If armature is accidentally removed from stator, entire motor must be replaced.

(1) Remove four pan head screws securing rear cap to motor housing.

(2) Hold down shaft located in center of rear cap and carefully remove rear cap.

(3) Remove two screws securing brush assembly to motor housing.

(4) Carefully lift out brush assembly.

(5) Clean tachometer commutator (para 3-35).

d. Tachometer Brush Assembly Replacement.

CAUTION

Do not remove armature assembly from stator when replacing brushes. If armature is removed from stator, entire motor must be replaced.

(1) Place brush assembly into motor housing and carefully slide brushes onto commutator.

(2) Secure brush assembly to motor housing with two screws. Place a drop of sealant on screw threads before installing.

(3) Replace and secure rear housing cap to motor housing with four head screws. Place a drop of sealant on screw threads before installing.

(4) Assemble brush assembly leads into the harness following the routing of original leads.

(6) Form a small servce loop and solder each wire to correct motor terminal (fig. 3-9).

(6) Install motor into tape transport (para 3-29).

3-31. Magnetic Head Assembly PU1

(16, fig. 3-7)

a. Removal.

(1) Remove circuit cards A1 through A5 (para 3-24).

(2) Remove power amplifier assembly A9 (para 3-27).

(3) Remove two cable clamps holding head assembly cables to tape deck.

CAUTION

Alternately turn jackscrews one to two turns each until plug separates completely from jack.

(4) Remove connectors PU1P1 and PU1P2 from interface board jacks A10A1J1 and A10A1J2 by unscrewing two jackscrews on each connector.

(5) Remove two socket head recessed screws (15) and flat washers holding head assembly to tape deck.

(6) Lift out head assembly (16).

b. Replacement. The head assembly is aligned using a head alignment fixture, P/N T494-2311 and a head stack gage, P/N 460-1000-143. Shims are placed between the head base and tape deck nameplate to properly position the head assembly.

Shim Part Number	Thickness
493-9110-1	0.001 in.
493-9110-3	0.003 in.
493-9110-5	0.005 in.

(1) Position head assembly (16) on the tape deck and secure with two socket head screws (15) and flat washers. Do not install shims at this time.

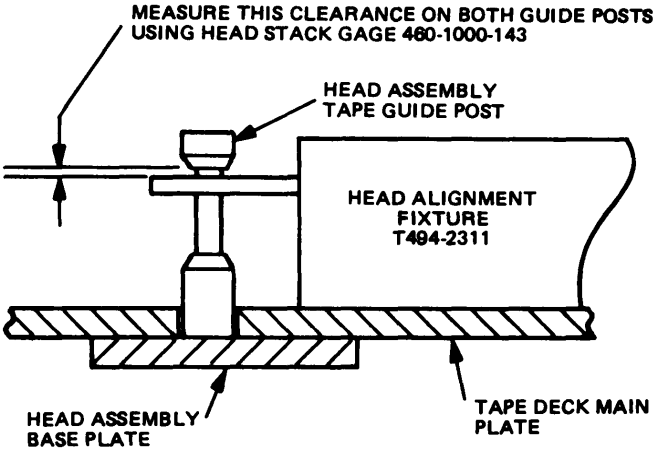
CAUTION

Alternately tighten connector jackscrews one to two turns until connector is securely seated.

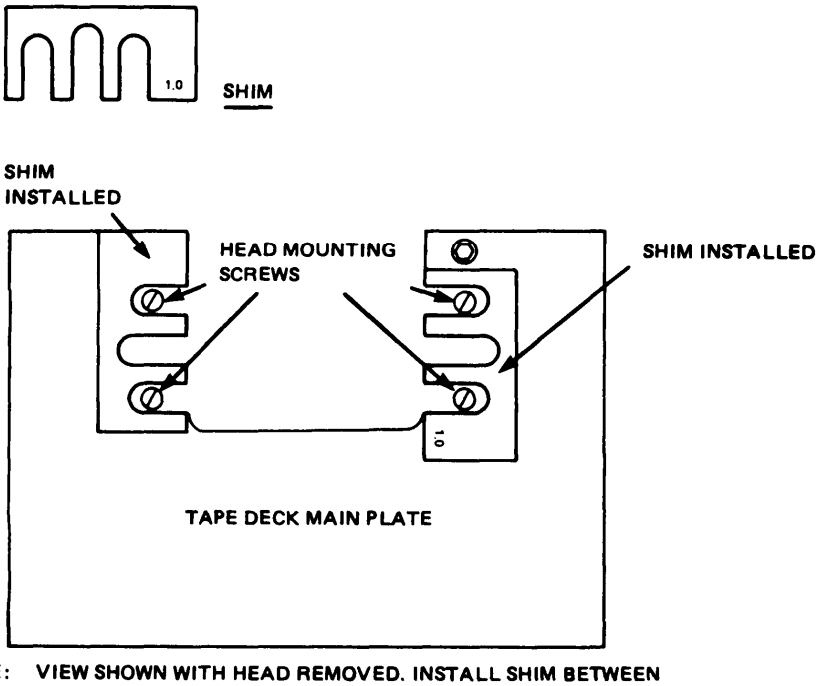
(2) Secure connector PU1P1 to A10A1J and connector PU1P2 to A10A1J2 on interface board by means of jackscrews.

(3) Insert head alignment fixture into tape transport. Ensure that the fixture is inserted correctly (fig. 3-10) and that the cartridge locking lever is in locked position.

(4) Use head stack gage to measure clearance between top of head assembly guide posts and head alignment fixture at both guide posts (fig. 3-10). Clearance at each guide post must be between 0.003 inch and 0.004 inch. If there is more than 0.001 inch difference between the guide post measurements, install new head assembly.



A. ALIGNMENT MEASUREMENT.



NOTE: VIEW SHOWN WITH HEAD REMOVED. INSTALL SHIM BETWEEN TAPE DECK MAIN PLATE AND HEAD ASSEMBLY BASE PLATE. EL4RD016

B. SHIM INSERTION.

Figure 3-10. Magnetic Head Assembly Alignment.

NOTE

Same size shims must be used on both sides of head assembly.

(5) Calculate required shim size by subtracting 0.003 inch from measured clearance for each of the guide posts.

(6) Select any combination of shims which add up to calculated shim size.

(7) Remove head alignment fixture from tape transport assembly.

NOTE

Do not attempt to insert shims with head alignment fixture inserted in tape transport.

(8) Loosen two head mounting screws (15) and insert required shims between tape deck main plate and head assembly base plate (fig. 3-10). Re-tighten head mounting screws.

(9) Insert head alignment fixture into tape transport and re-measure clearance. Ensure that fixture is inserted correctly (fig. 3-10) and that cartridge locking lever is in locked position.

(10) Repeat steps (5) to (8) as required until measured clearance is 0.003 inch to 0.004 inch with no more than 0.001 inch variation between posts.

NOTE

Ensure that shims remain in proper position.

(11) Remove one of head mounting screws and apply a drop of sealant to threads. Install and tighten screw. Repeat for remaining screw.

(12) Insert head alignment fixture into tape transport. Make certain that fixture is inserted completely and that cartridge locking level is in locked position. Check clearance with head stack gage. Verify that clearance at both tape guide posts is between 0.003 and 0.004 inch with no more than 0.001 inch variation between posts.

(13) Replace two cable clamps holding head assembly cables to tape deck.

(14) Replace power amplifier assembly A9 (para 3-27).

(15) Replace circuit cards A1 through A5 (para 3-24).

3-32. Tape Deck Assembly A8

(14, fig. 3-7)

a. Removal.

(1) Remove magnetic head assembly PU1 (para 3-31). Save head shims if any are used.

(2) Remove capstan motor assembly B1 (para 3-29).

(3) Remove three phototransistor sensor assemblies (A8A1, A8A2, A8A4) and two LED assemblies (A8A5, A8A3) from tape deck assembly (fig. FO-10).

(4) Remove three cable clamps from tape deck assembly. Cut lacing holding low tape sensor (A8A2) wires to lower anchor bar.

(5) Disconnect chassis cable connectors from tape deck main plate. Tag and unsolder harness assembly wiring from tape deck main plate.

(6) Remove interlock switch block assembly (A8S1, A8S2) by removing one screw.

(7) Remove two screws (12) and lock nuts (11) that secure tape deck rear shock mount to chassis (l). Remove two screws that secure tape deck to two shock mounts on side of chassis. Do not remove shock mounts from chassis.

(8) Remove six socket-head screws (2) securing front panel assembly (3) to chassis and swing panel out of way.

(9) Slide tape deck assembly (14) forward and out through front of chassis.

b. Replacement.

(1) Slide tape deck assembly (14) through front of chassis and secure rear shock mount to chassis with two screws (12) and locknuts (11).

(2) Secure tape deck to remaining two shock mounts on side of chassis with one screw in each mount.

(3) Install front panel (3) on chassis and secure it with six screws (2).

(4) Secure interlock switch assembly (A8S1, A8S2) with one screw.

(5) Solder tagged harness assembly wiring in place. Secure chassis cable connectors.

(6) Secure harness assembly to tape deck by means of three cable clamps. Refer to figure FO-10 for harness routing and clamp location.

(7) Secure three sensor assemblies (A8A1, A8A2, A8A4) and two LED assemblies (A8A3, A8A5) to tape deck. Refer to figure FO-10 for location. Retie low tape sensor (A8A2) wires to lower anchor bar.

(8) Replace capstan motor assembly B1 (para 3-29).

(9) Replace magentic head assembly PU1 (para 3-31).

3-33. Harness and Interface Board Assembly

(33, fig. 3-7)

a. Removal.

(1) Remove circuit card assemblies Al through A5 (para 3-24).

(2) Remove power amplifier assembly A9 (para 3-27).

(3) Remove capstan motor assembly B1 (para 3-29).

(4) Remove magnetic head assembly PU1 (para 3-31). Save head shims if any are used.

(5) Remove line filter FL1 (para 3-26).

(6) Remove interface connector J2 (25) from rear of chassis by removing four screws (26), washers (24) and nuts (23).

(7) Remove tape deck assembly A8 (para 3-32).

(8) Tag and unsolder harness wiring from phototransistor assemblies (A8A1, A8A2, A8A4) LED assemblies (A8A3, A8A5) and interlock switches (A8S1, A8S2).

(9) Unsolder harness wiring (32) from front panel components.

(10) Remove six flat head screws securing harness and interface board assembly (33) to chassis (1) and lift out assembly.

b. Replacement.

NOTE

The destination for all harness wiring is hot stamped on wire markers. If in doubt, use interconnecting wiring diagrams and signal interconnection list (figs. FO-7, FO-8 and FO-9). Use FO-10 for wire routing and dressing details.

(1) Solder harness wiring to all front panel components.

(2) Solder harness wiring to phototransistor assemblies (A8A1, A8A2, A8A4), LED assemblies (A8A3, A8A5) and interlock switches (A8S1, A8S2).

(3) Position harness and interface board (33) in chassis and secure in place with six flat head screws.

(4) Orient interface connector J2 (25) with wide key slot at top and secure connector to rear of chassis using four screws (26), washers (24) and nuts (23). Be sure that chassis ground lead to line filter FL1 is attached to connector screw.

(5) Secure line filter FL1 to chassis (para 3-26).

(6) Secure connector A10P1 to the power supply by means of connector jackscrews. Alternately tighten each screw one to two turns until connector is seated.

(7) Install tape deck assembly A8 in chassis (para 3-32).

(8) Secure front panel assembly to chassis with six socket-head screws.

(9) Replace magnetic head assembly PU1 (para 3-31).

(10) Replace capstan motor assembly B1 (para 3-29).

(11) Replace power amplifier assembly A9 (para 3-27).

(12) Replace circuit card assemblies Al through A5 (para 3-24).

3-34. Front Panel Controls and Indicators

(fig. 3-7)

a. Removal.

(1) Remove six socket-head screws (2) securing front panel assembly (3) to chassis.

(2) Carefully lay front panel assembly down flat to expose rear side.

(3) Tag and unsolder leads from components being removed.

(4) Remove component from panel as follows:

(a) LED socket is removed by unscrewing nut securing socket to panel.

(b) RWND, POWER, DOOR switches and ON/OFF circuit breaker are removed by unscrewing nut on front side of panel. When removing RWND switch, first remove white plastic knob by pulling it straight forward.

(c) ADDRESS switch is removed by first unscrewing set screw in knob and then removing nut.

(d) Elapsed time meter is removed by unscrewing two hex screws on rear of panel.

b. Replacement.

(1) Place component in panel assembly.

(2) Secure component to panel as follows:

(a) LED socket is secured by nut on rear of panel.

(b) RWND, POWER, DOOR switches and ON/OFF circuit breaker are secured by nut on front side of panel. Push white plastic knob of RWND onto switch shaft after securing nut.

(c) ADDRESS switch is secured by nut on front side of panel. Replace knob on shaft and secure it with set screw.

(d) Elapsed time meter is secured with two hex screws on rear side of panel.

(3) Solder leads to component.

(4) Secure front panel assembly (3) to frame with six socket head screws (2).

3-35. Motor and Tachometer Commutator Cleaning

(fig. 3-9)

a. Motor Commutator.

(1) Remove capstan motor assembly (para 3-29a).

(2) Remove five screws (two pan head, three flat head) securing front cap to motor housing.

CAUTION

Hold down the capstan when removing from housing cap of motor assembly. This will prevent armature from being pulled

out from stator. If armature is accidently removed from stator, entire motor assembly must be replaced.

(3) Hold down capstan and carefully remove front cap. Remove bearing from cap.

WARNING

Use isopropyl alcohol in a well-ventilated area. Avoid prolonged inhalation of fumes. Keep alcohol and fumes away from flame or sparks.

(4) Clean inside of front cap with lint-free cloth moistened with isopropyl alcohol (NSN 6810-00-753-4993).

(5) Remove two screws securing brush assembly to motor housing and carefully lift out brush assembly.

WARNING

Use isopropyl alcohol in well-ventilated area. Avoid prolonged skin contact and inhalation of fumes. Keep alcohol and fumes away from flame or sparks.

WARNING

Do not use compressed air for cleaning purposes except where reduced to less than 29 pounds per square inch (psi) and then only with effective chip guarding and personnel protective equipment. Do not use compressed air to dry parts when TRICHLOROTRIFLUOROETHANE has been used. Compressed air is dangerous and can cause serious bodily harm if protective means or methods are not observed to prevent chip or particle (or whatever size) from being blown into the eyes or unbroken skin of the operation or other personnel.

(6) Clean commutator segments using a soft-bristle brush moistened with isopropyl alcohol (NSN 6810-00-753-4993). Dry commutator by using moistur-free compressed air. Wipe commutator segments with clean lint-free cloth to remove isopropyl alcohol residue.

(7) Replace brush assembly in housing and secure with two screws.

(8) Replace bearing and front cap and secure with five screws.

b. Tachometer Commutator.

(1) Remove capstan motor (para 3-29a).

(2) Remove four screws securing rear cap to motor assembly housing.

CAUTION

Hold down shaft which is located in center of cap when removed rear housing cap of motor assembly. This will prevent armature from being pulled out of stator. If armature is accidently removed from stator, entire motor must be replaced.

(3) Hold down shaft (located in center of rear cap) and carefully remove cap. Remove bearing from cap.

(4) Remove two screws securing brush assembly to motor housing and carefully move brush assembly away from housing.

(5) Clean inside of rear plate with lint-free cloth moistened with isopropyl alcohol (NSN-6810-00-753-4993).

WARNING

Use isopropyl alcohol in a well-ventilated area. Avoid prolonged skin contact and inhalation of fumes. Keep alcohol and fumes away from flames or sparks.

WARNING

Do not use compressed air for cleaning purposes except where reduced to less than 29 pounds per square inch (psi) and then only with effective chip guarding and personnel protective equipment. Do not use compressed air to dry parts when TRICHLOROTRIFLUOROETHANE has been used. Compressed air is dangerous and can cause serious bodily harm if protective means or methods are not observed to prevent chip or particle (of whatever size) from being blown into the eyes or unbroken skin of the operator or other personnel.

(6) Clean commutator segments using a soft-bristle brush moistened with isopropyl alcohol (NSN-6810-753-4993). Dry commutator by using moisture-free compressed air. Wipe commutator segments with a clean lint-free cloth to remove isopropyl alcohol residue.

(7) Replace brush assembly in housing and secure with two screws.

(8) Replace bearing and rear cap and secure with four screws.

Section V. TAPE CARTRIDGE MAINTENANCE

3-36. Disassembly of Tape Cartridge

(fig. 3-11)

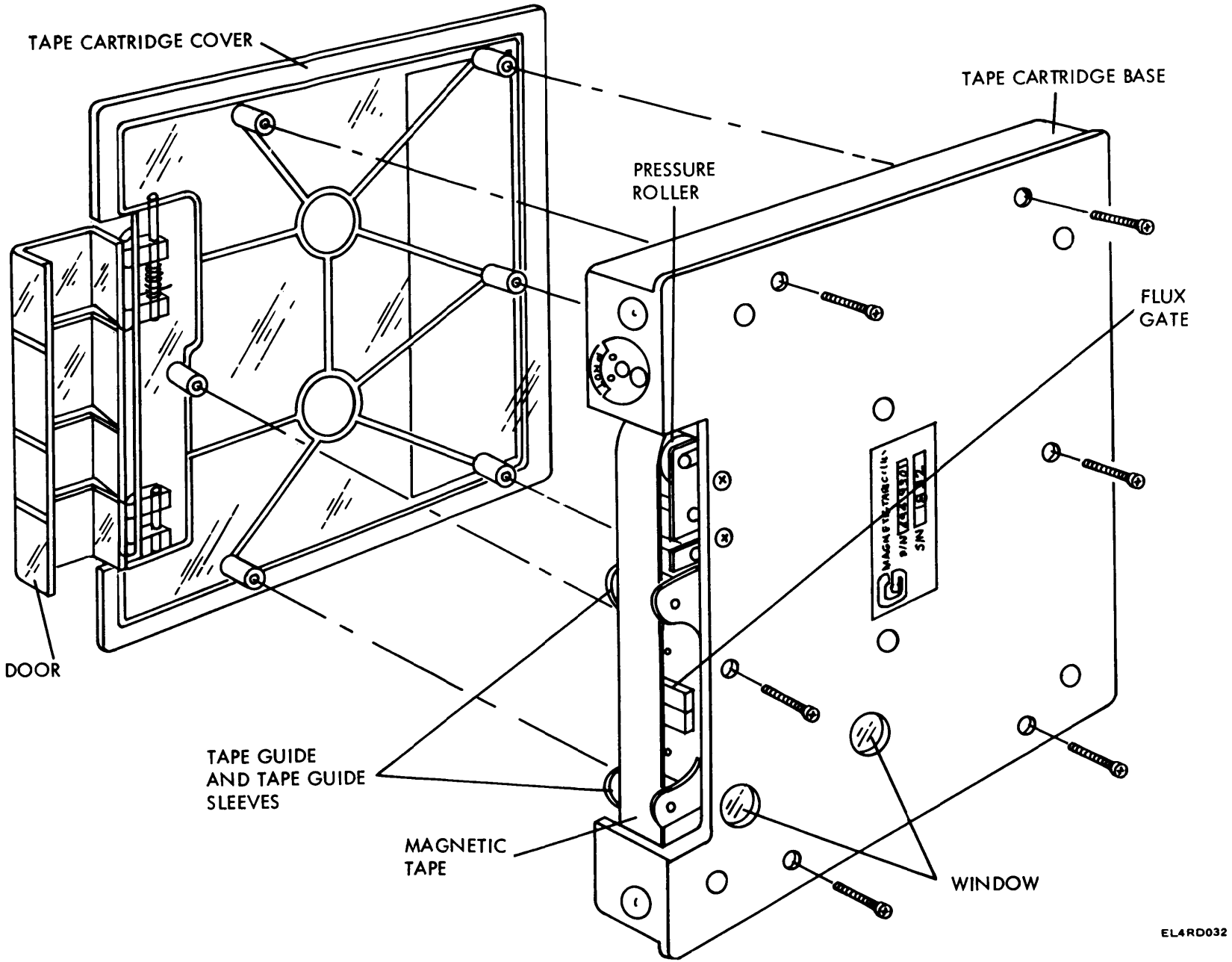


Figure 3-11. Magnetic Tape Cartridge Disassembly.

a. Remove six screws securing cartridge cover to taps cartridge.

b. Turn cartridge over, open cartridge door and lift cartridge cover away from the base.

c. Wind tape remaining on take-up hub (fig. 3-12) to supply reel hub by rotating supply hub counterclockwise. Inspect tape (para 3-38).

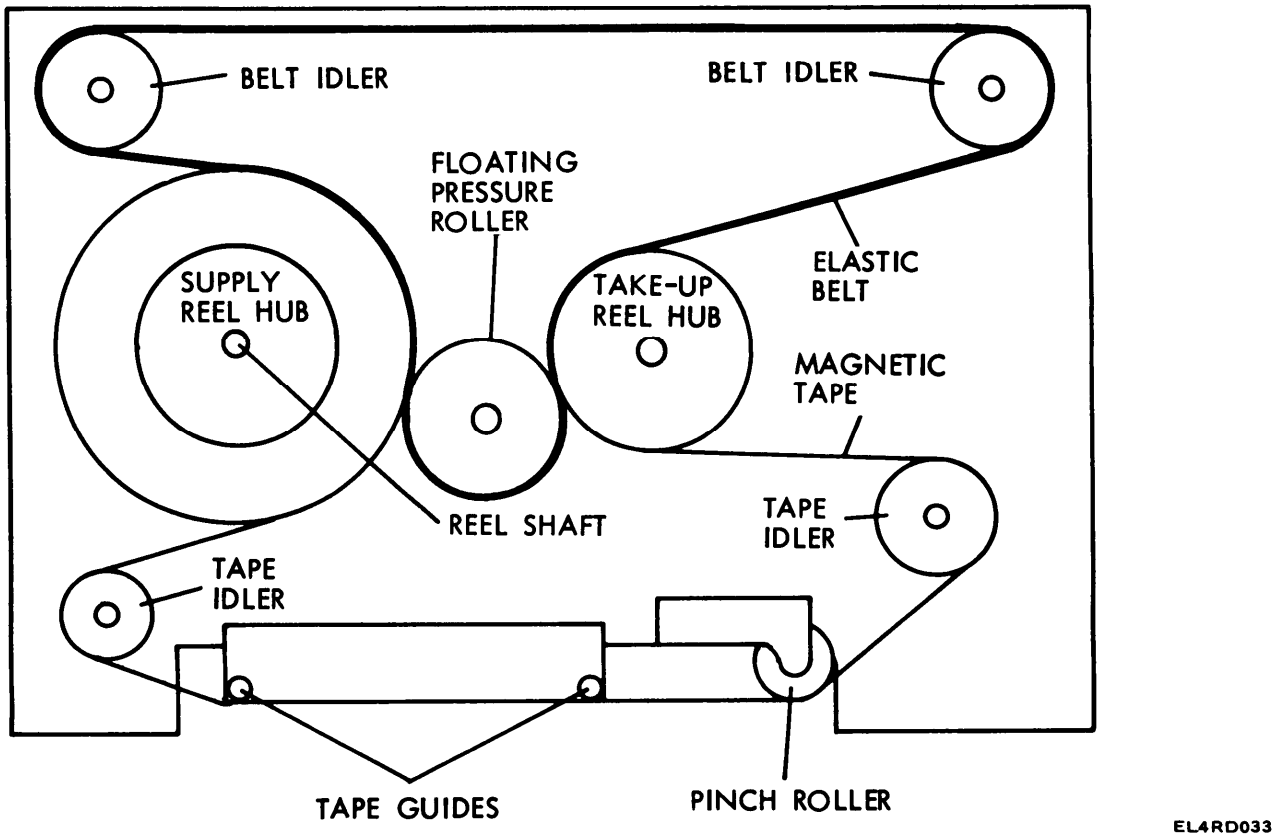


Figure 3-12. Magnetic Tape Cartridge, Tape Threading Diagram.

d. Hold floating pressure roller with thumb and carefully remove elastic belt.

e. Remove floating pressure roller.

f. Remove retaining ring that secures reel hub to cartridge base.

g. Remove shim(s) from top of reel shaft.

h. Remove reel from reel shaft ensuring that two flanged bearings remain in reel hub.

3-37. Magnetic Tape Cartridge Cleaning

a. Wash both sides of cartridge cover using clean lint-free cloth moistened with a solution of mild liquid detergent and warm water. Remove detergent residue by rinsing cartridge cover in clear warm water and drying with clean, lint-free cloth.

b. Wash inside and outside of cartridge base in a solution of mild liquid detergent and warm water. Use a soft-bristle brush to dislodge any stubborn accumulations of magnetic tape residue or grime. Rinse in clear warm water and dry using clean, lint-free cloth.

c. Wash belt and all removed plastic parts that do not contain ball bearings in a solution of mild liquid detergent and warm water. Rinse in clear warm water and allow to air dry.

d. Wipe external surfaces of plastic parts containing ball bearings using clean, lint-free cloth moistened with a solution of mild liquid detergent and warm water. Remove detergent residue by wiping with clean lint-free cloth moistened with clear warm water. Wipe exposed bearings and bearing surfaces with dry, clean, lint-free cloth to remove any residue. Allow all parts to air dry.

WARNING
USE OF CLEANING SOLVENT
Fumes of TRICHLOROTRIFLUOROETHANE are poisonous. Provide

adequate ventilation whenever you use TRICHLOROTRIFLUOROETHANE. Do not use solvent near heat or open flame. TRICHLOROTRIFLUORO-ETHANE will not burn, but heat changes the gas into poisonous, irritating fumes. DO NOT breathe the fumes or vapors. TRICHLOROTRIFLUOROETHANE dissolves natural skin oils. DO NOT get the solvent on your skin. Use gloves, sleeves and an apron which the solvent cannot penetrate. If the solvent is taken internally, see a doctor immediately.

e. Clean all removed metal parts, except mirror, using a clean, lint-free cloth and cleaning solvent (NSN 6850-00-105-3084). Use a stiff-bristle brush to dislodge any stubborn accumulations of magnetic tape residue or grime. Dry all metal parts using moisture-free compressed air at 20 psig maximum.

f. Clean mirror by wiping with clean, lint-free cloth moistened with a solution of mild liquid detergent and warm water. Remove detergent residue by wiping mirror with a clean, lint-free cloth moistened with clear warm water. Dry mirror using clean, dry, lint-free cloth.

3-38. Tape Inspection

a. When a tape cartridge is disassembled, inspect tapes for "stepping". "Stepping" is a nonuniformity of circular tape wrap or the condition of noticeable gaps between wraps of tape on the tape reel. This condition can be corrected by respooling the tape. To respond, run tape from beginning of tape (BOT) to end of tape (EOT) and back to BOT.

b. Inspect tape for creases or wear, and replace tape if found.

3-39. Magnetic Tape Replacement

NOTE

Inspect bottom of reel shaft for presence of a small shim placed on top of a larger shim. One or both may have been intentionally removed with old reel hub. Ensure that two flanged bearings are installed in center (one each side) of hub.

a. Ensure that two flanged bearings are installed in center (one each side) or reel hub.

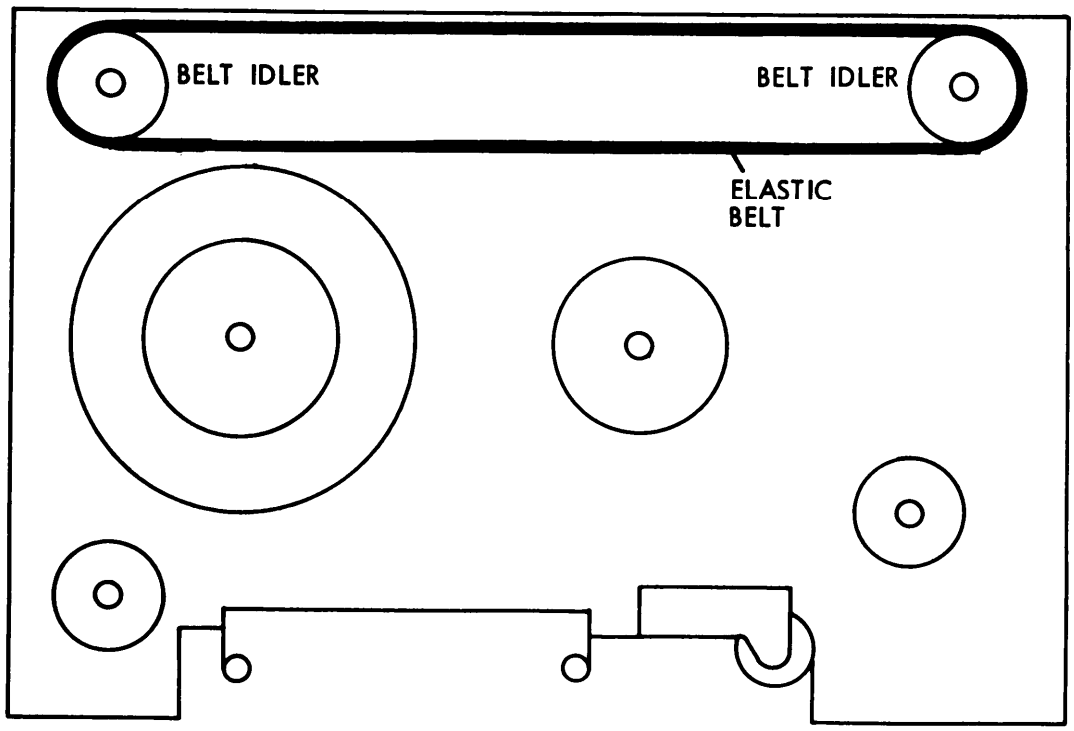
b. Place reel hub on reel shaft, then place shim on top of reel shaft and secure in position with retaining ring.

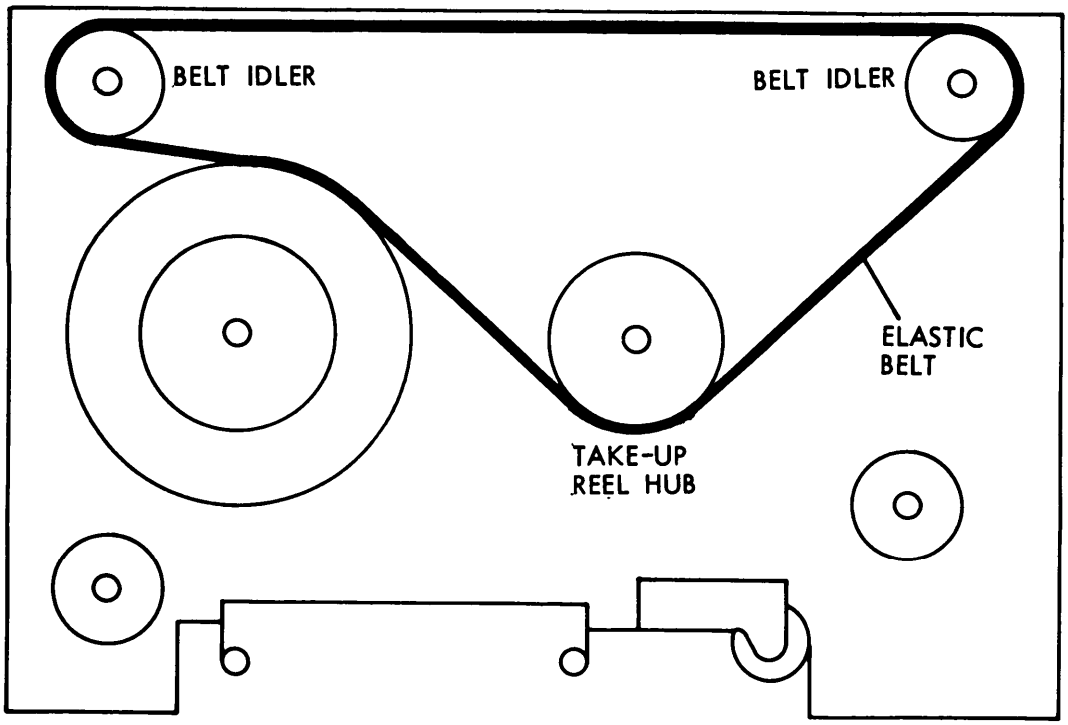
NOTE

Ensure that ridged side of elastic belt rests in grooves on belt idlers and floating pressure roller.

c. Place elastic belt around belt idlers (A, fig. 3-13).

d. Place elastic belt around take-up reel hub (B, fig. 3-13).

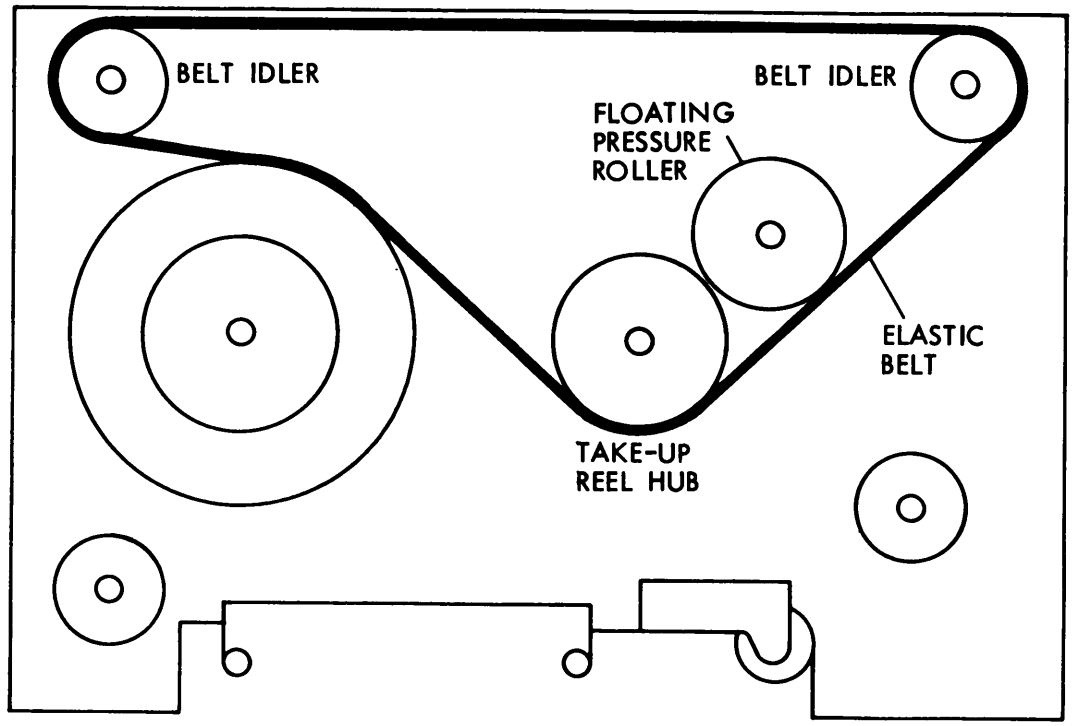


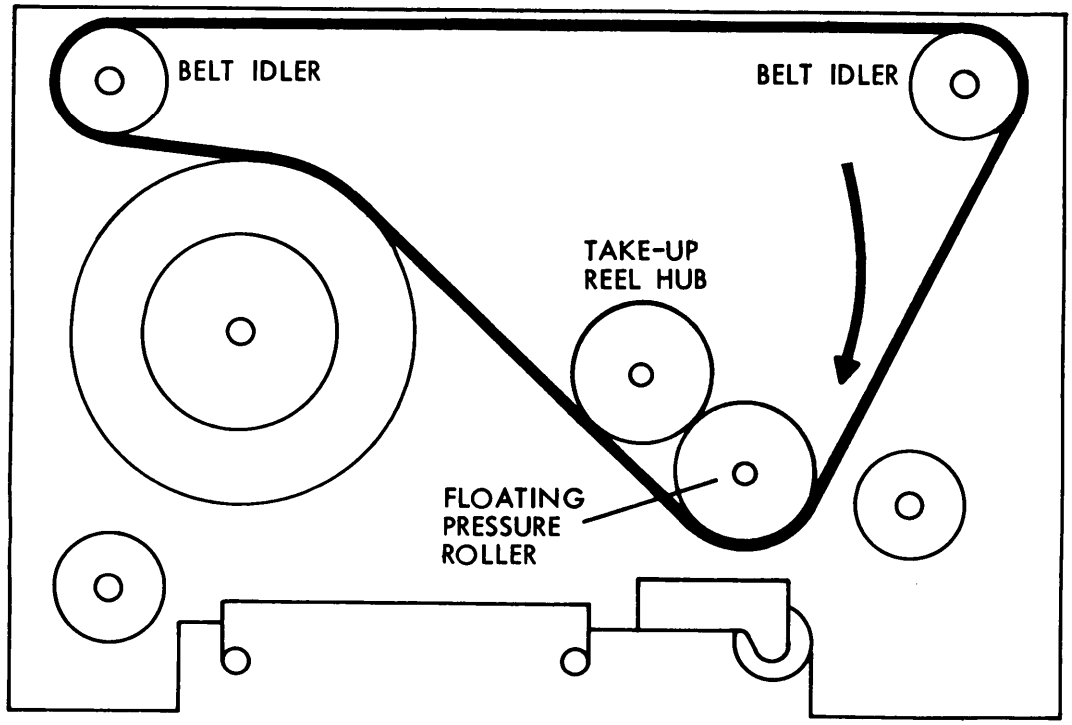


EL4RD036

Figure 3-13. Step-by-Step Tape-Threading Diagram (Sheet 1 of 5).

e. Position floating pressure roller (C, fig. 3-13).
f. Hold down floating pressure roller and slide it in direction of arrow (D, fig. 3-13). Position floating pressure roller (E, fig. 3-13).

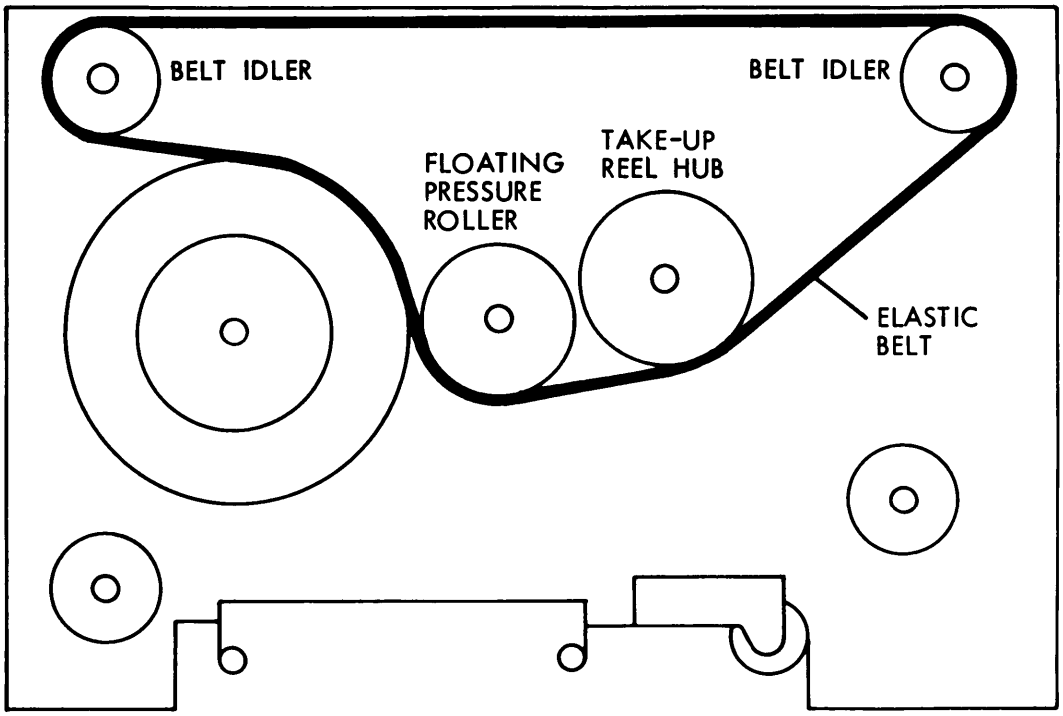


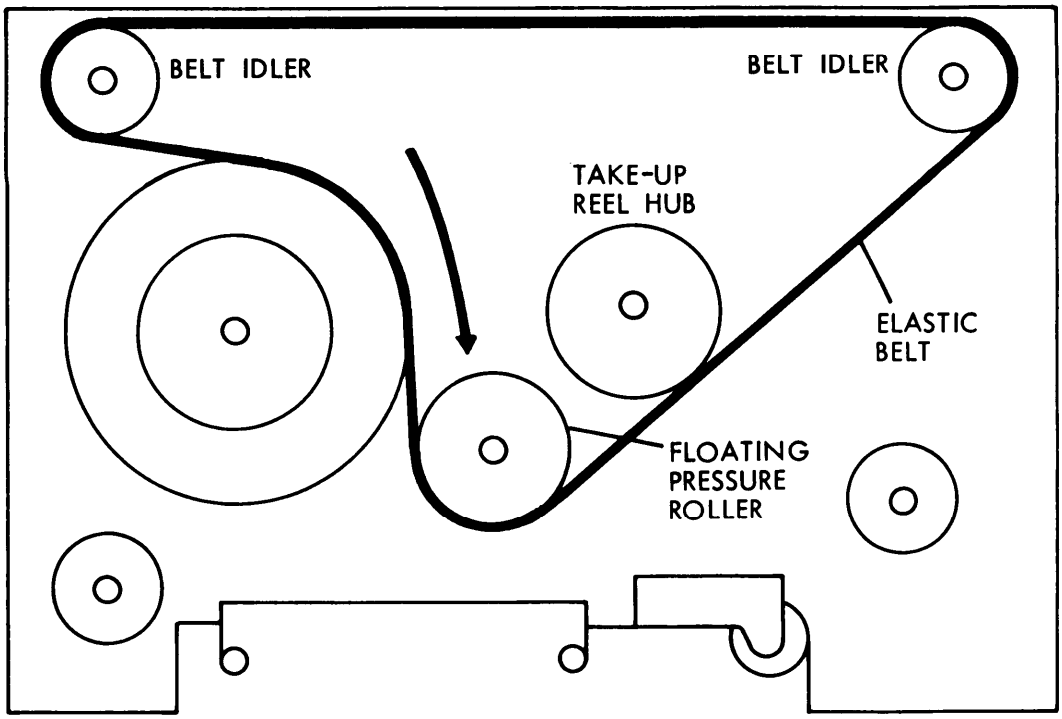


EL4RD038

Figure 3-13. Step-by-Step Tape-Threading Diagram (Sheet 2 of 5).

g. Hold down floating pressure roller and slide it in direction of arrow (F, fig. 3-13) and position elastic belt (G, fig. 3-13).

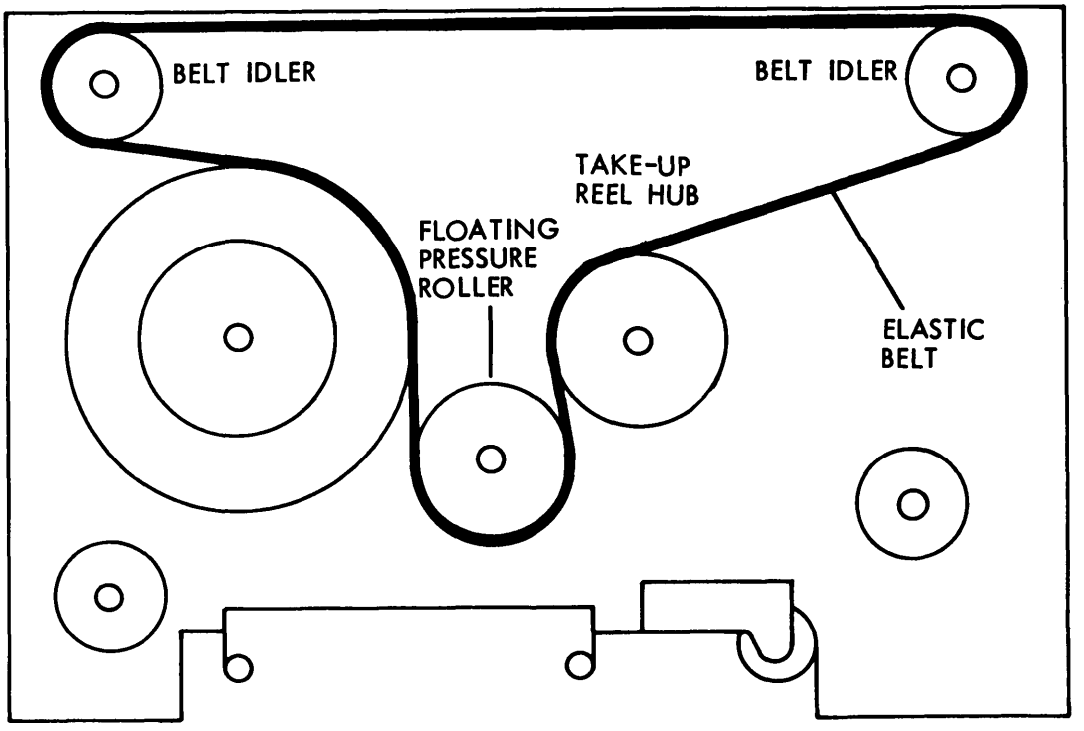


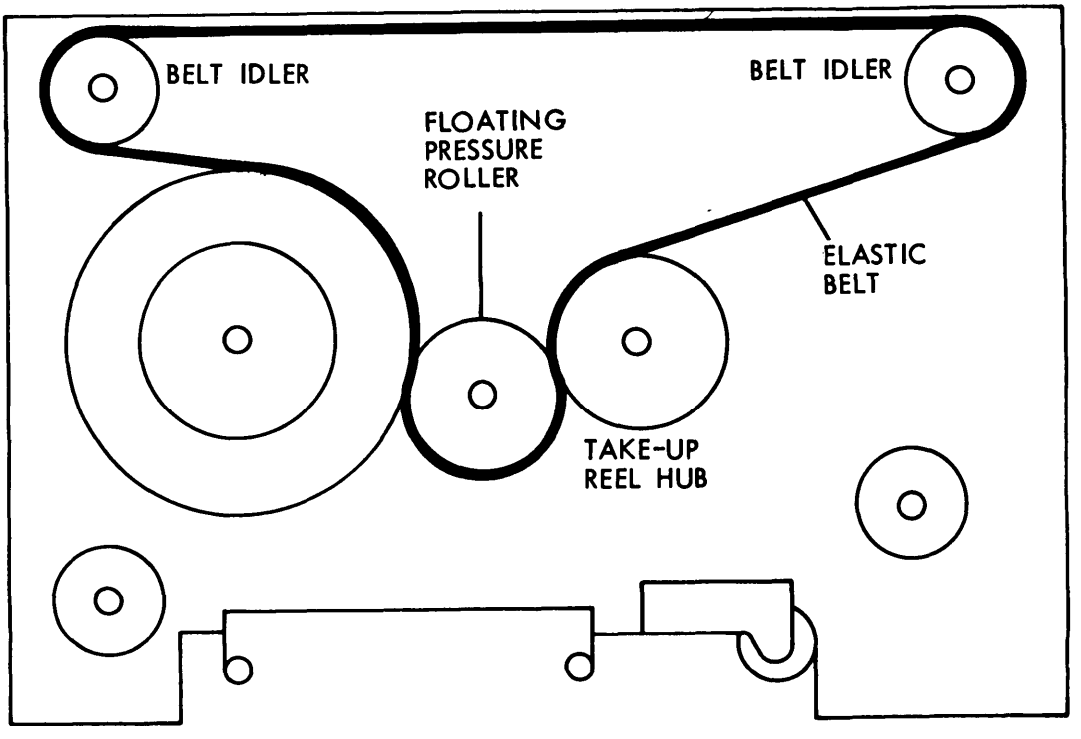


EL4RD040

Figure 3-13. Step-by-Step Tape Threading Diagram (Sheet 3 of 5).

h. Position floating pressure roller (H, fig. 3-13).





EL4RD042

Figure 3-13. Step-by-Step Tape Threading Diagram (Sheet 4 of 5).

i. Unwind tape from reel and thread through the cartridge to take-up reel (I, fig. 3-13).

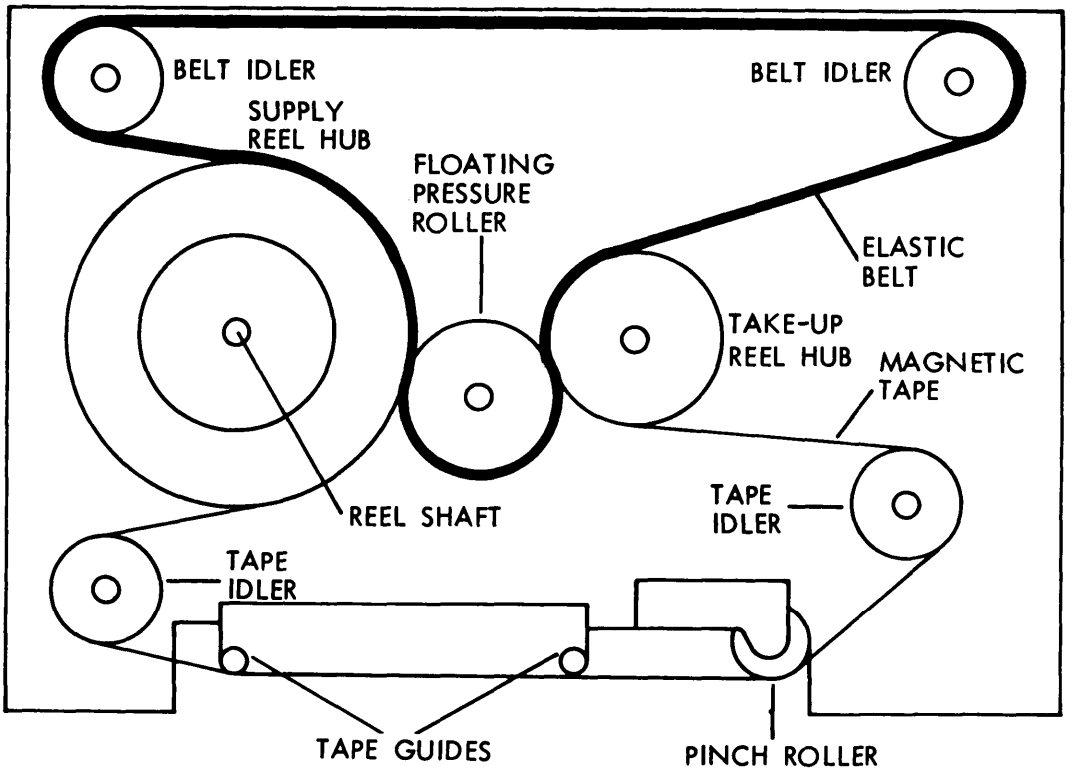


Figure 3-13. Step-by-Step Tape-Threading Diagmm (Sheet 5 of 5).

j. Lightly moisten end of tape.

CAUTION

Tape must be accurately centered on take-up reel or it will rub cartridge side causing binding and damage to tape.

k. Turn take-up reel clockwise and evenly feed tape to reel.

l. Wind tape past BOT holes in tape until reflexive strip is opposite mirror.

m. Replace and secure cover on cartridge with six screws.

CHAPTER 4

GENERAL SUPPORT MAINTENANCE MANUAL

General support maintenance consists of printed circuit card repair. Refer to the Maintenance Allocation Chart located in TM 11-5805-681-12-1 or TM 11-5805-683-12-1.

APPENDIX A

REFERENCES

DA Pam 310-1	Consolidated Index of Army Publications and Blank Forms
SB 11-573	Painting and Preservation Supplies Available for Field Use for Electronics Command Equipment
TM 11-5805-681-12-1 EE119-BA-OMI-010/E154 TTC39 T.O.31W2-2TTC39-1-1	Operator's and Organizational Maintenance Manual for Central Office Telephone, Automatic AN/TTC-39(V)2 (NSN 5805-01-122-3414) (to be published)
TM 11-5805 -683-12-1 EE119-AA-OMI-010/E154 TYC39 T.O.31W2-2TYC39-11-1	Operator's and Organizational Maintenance Manual for Central, Message Switching, Automatic AN/TYC-39(V)1 (NSN 5805-01-123-1851) (To be published)
TM 11-5835-243-20P EE64-1AA-PLO-010/E154 MTT	Organizational Repair Parts and Special Tools List for Magnetic Tape Transport AN/UYH-5 (NSN 7025-01-125-5767) (To be published)
TM 11-5835-243-34P EE641-AA-PLG-010/E154 MTT T.O.31S3-4-119-4-1	Direct Support and General Support Repair Parts and Special Tools List (Including Depot Repair Parts and Special Tools List) for Magnetic Tape Transport AN/UYH-5 (NSN 7025-01-125-5767) (To be published)
TM 11-6625-654-14	Operator's, Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools List) for Multimeter AN/USM-223
TM 11-6625-700-10	Operator's Manual Digital Readout, Electronic Counter AN/USM-207 (NSN 6625-00-911-6368)
TM 11-6625-1541-15	Operator's Organizational, Direct Support, General Support, and Depot Maintenance Manual Hewlett-Packard RMS Voltmeter Model 3400A
TM 11-6625-2953-14	Operator's, Organizational, Direct Support, and General Support Maintenance Manual Multimeter AN/USM-451 (NSN 6625-01-060-6804)
TM 11-6625-2735-14 0969-LP-170-1090 T.O.33A1-13-498-1	Operator's, Organizational, Direct Support, and General Support Maintenance Manual (Including Depot Maintenance) for Oscilloscope OS-261/U (NSN 6625-00-127-0079)
TM 11-6625-3024-14 EE641-AC-MMA-010/E154 SYSEX T.O. 33AA50-5-1-1	Operator's, Organizational, and Direct Support Maintenance Manual for Test Set, Magnetic Tape Transport TS-4002/UYH-5 (NSN 6625-01-128-2432)
TM 746-10	Field Instructions for Painting and Preserving Electronics Command Equipment
TM 740-90-1	Administrative Storage of Equipment
TM 38-750	The Army Maintenance Management System (TAMMS)

APPENDIX B

EXPENDABLE SUPPLIES AND MATERIALS LIST

B-1. Scope

This Appendix lists expendable supplies and materials you will need to maintain the AN/UYH-5. These items are authorized to you by CTA 50-970, Expendable Items (except Medical, Class V, Repair Parts, and Heraldic Items).

B-2. Explanation of Columns

a. Column 1—Level. This column identifies the lowest level of maintenance that requires the listed item.

C–Operator/Crew
O–Organizational
F—Direct Support Maintenance
H—General Support Maintenance

b. Column 2-National Stock Number. This is the National stock number assigned to the item; use it to request or requisition the item.

c. Column 3-Description. Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the Federal Supply Code for Manufacturer (FSCM).

d. Column 4-Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea., in., pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

(1) Level	(2) National Stock Number	(3) Description	(4) U/M
F	6810-00-753-4993	Alcohol, Isopropyl	8 oz
F	7920-00-924-5700	Cloth, Cleaning	EA
F	6850-00-105-3084	Trichlorotrifluoroethane	16oz
F	6850-00-927-9561	Compound, Silicone	5 oz
F		Sealant	

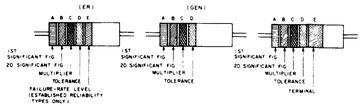
GLOSSARY

BEG HOLE	Beginning hole
BOT	Beginning of tape
BOT IND	Beginning of tape indicator
BOT STAT	Beginning of tape status
CTG IN PL INTLK	Cartridge in place interlock
DR CL INTLK	Door closed interlock
EOT FF	End of tape flip-flop
EOT STAT	End of tape status
FILE PTCT	File protect
FILE PTCT LT	File protect light
FWD	Forward
NRZ	Non return to zero
RD CLK	Read clock
RD CMD	Read command
RD ENBL	Read enable
RD RST	Read reset
RD STROBE	Read strobe
RDY STAT	Ready status
REWIND STAT	Rewind status
RWND CMD	Rewind command
RWND FF	Rewind flip-flop
RWND SW	Rewind switch
RZ	Return to zero
SEL	Selected
SEL CMD	Select command
SEL-RDY	Selected-ready
SEL STAT	Selected status
WR ENBL	Write enable
WR ENBL CMD	Write enable command
WR PERMIT SW	Write permit switch
WR RGT RESET	Write register reset
WR RST	Write reset
WR RST CMD	Write reset command
WR STROBE	Write strobe

INDEX

V

W



COLOR CODE MARKING FOR COMPOSITION TYPE RESISTORS

COLOR-CODE MARKING FOR FILM-TYPE RESISTORS

TABLE I

COLOR CODE FOR COMPOSITION TYPE AND FILM TYPE RESISTORS

BAND A		BAND B		BAND C		BAND D		BAND E	
COLOR	#FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)	COLOR	FAILURE RATE LEVEL	TERM
BLACK	0	BLACK	0	BLACK	1			BROWN	M1.0	
BROWN	1	BROWN	1	BROWN	10			RED	P0.1	
RED	2	RED	2	RED	100			ORANGE	R0.01	
ORANGE	3	ORANGE	3	ORANGE	1,000			YELLOW	S0.001	
YELLOW	4	YELLOW	4	YELLOW	10,000	SILVER	±10 (COMP. TYPE ONLY)	WHITE		SOLDERABLE
GREEN	5	GREEN	5	GREEN	100,000	GOLD	±5			
BLUE	6	BLUE	6	BLUE	1,000,000	RED	±2 (NOT APPLICABLE TO ESTABLISHED RELIABILITY)			
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7							
GRAY	8	GRAY	8	SILVER	0.01					
WHITE	9	WHITE	9	GOLD	0.1					

BAND A — THE FIRST SIGNIFICANT FIGURE OF THE RESISTANCE VALUE (BANDS A THRU D SHALL BE OF EQUAL WIDTH.)

BAND B — THE SECOND SIGNIFICANT FIGURE OF THE RESISTANCE VALUE

BAND C — THE MULTIPLIER (THE MULTIPLIER IS THE FACTOR BY WHICH THE TWO SIGNIFICANT FIGURES ARE MULTIPLIED TO YIELD THE NOMINAL RESISTANCE VALUE.)

BAND D — THE RESISTANCE TOLERANCE

BAND E — WHEN USED ON COMPOSITION RESISTORS, BAND E INDICATES ESTABLISHED RELIABILITY FAILURE-RATE LEVEL (PERCENT FAILURE PER 1000 HOURS). ON FILM RESISTORS, THIS BAND SHALL BE APPROXIMATELY 1½ TIMES THE WIDTH OF OTHER BANDS, AND INDICATES TYPE OF TERMINAL.

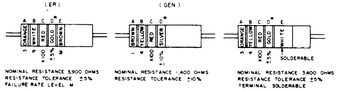
RESISTANCES IDENTIFIED BY NUMBERS AND LETTERS (THESE ARE NOT COLOR CODES.)

SOME RESISTORS ARE IDENTIFIED BY THREE OR FOUR DIGIT ALPHA NUMERIC DESIGNATORS. THE LETTER R IS USED IN PLACE OF A DECIMAL POINT WHEN FRACTIONAL VALUES OF AN OHM ARE EXPRESSED. FOR EXAMPLE

2R7 = 2.7 OHMS 10R0 = 10.0 OHMS

FOR WIRE-WOUND-TYPE RESISTORS COLOR CODING IS NOT USED. IDENTIFICATION MARKING IS SPECIFIED IN EACH OF THE APPLICABLE SPECIFICATIONS

EXAMPLES OF COLOR CODING



NOMINAL RESISTANCE 3900 OHMS
RESISTANCE TOLERANCE ±5%
FAILURE RATE LEVEL M

NOMINAL RESISTANCE 3500 OHMS
RESISTANCE TOLERANCE ±10%

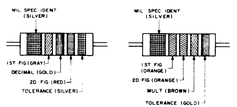
NOMINAL RESISTANCE 3400 OHMS
RESISTANCE TOLERANCE ±5%
TERMINAL SOLDERABLE

COMPOSITION-TYPE RESISTORS

FILM-TYPE RESISTORS

* IF BAND D IS OMITTED, THE RESISTOR TOLERANCE IS ±20% AND THE RESISTOR IS NOT MIL-STD

A. COLOR CODE MARKING FOR MILITARY STANDARD RESISTORS



COLOR CODING FOR TUBULAR ENCAPSULATED R F CHOKES AT A, AN EXAMPLE OF THE CODING FOR AN 82 UH CHOKE IS GIVEN. AT B, THE COLOR BANDS FOR A 330 UH INDUCTOR ARE ILLUSTRATED

TABLE 2

COLOR CODING FOR TUBULAR ENCAPSULATED R F CHOKES

COLOR	SIGNIFICANT FIGURE	MULTIPLIER	INDUCTANCE TOLERANCE (PERCENT)
BLACK	0	1	
BROWN	1	10	1
RED	2	100	2
ORANGE	3	1,000	3
YELLOW	4		
GREEN	5		
BLUE	6		
VIOLET	7		
GRAY	8		
WHITE	9		
NONE			20
SILVER			10
GOLD	DECIMAL POINT		5

MULTIPLIER IS THE FACTOR BY WHICH THE TWO COLOR FIGURES ARE MULTIPLIED TO OBTAIN THE INDUCTANCE VALUE OF THE CHOKE COIL

B. COLOR CODE MARKING FOR MILITARY STANDARD INDUCTORS

CAPACITORS, FIXED, VARIOUS-DIELECTRICS, STYLES CM, CN, CY, AND CB

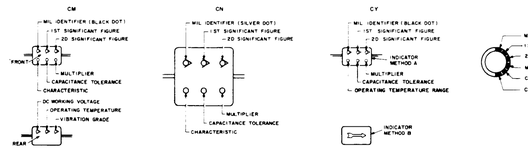


TABLE 3 — FOR USE WITH STYLES CM, CN, CY AND CB

COLOR	MIL ID	1ST SIG FIG	2D SIG FIG	MULTIPLIER	CAPACITANCE TOLERANCE			CHARACTERISTIC				AT DC WORKING VOLTAGE	OPERATING TEMP RANGE	VIBRATION GRADE
					CM	CN	CY	CB	CM	CN	CB	CM	CY CN	CM
BLACK	CM CY CB	0	0				±20%	±20%		A			-55°TO+70°C	10-55 H z
BROWN		1	1	10					B	E	B			
RED		2	2	100	±2%		±2%	±2%	C				-55°TO+85°C	
ORANGE		3	3	1,000		±30%				D	D	300		
YELLOW		4	4	10,000					E				-55°TO+125°C	10-2,000 Hz
GREEN		5	5		±5%				F			500		
BLUE		6	6										-55°TO+70°C	
PURPLE (VIOLET)		7	7											
GRAY		8	8											
WHITE		9	9											
GOLD				0.1			±5%	±5%						
SILVER	CN			0.01	±10%	±20%	±10%	±10%						

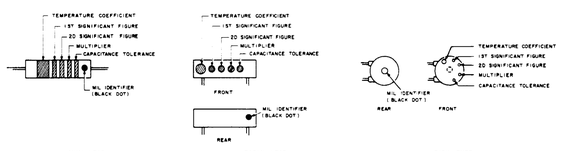


TABLE 4 — TEMPERATURE COMPENSATING, STYLE CC

COLOR	TEMPERATURE COEFFICIENT[4]	1ST SIG FIG	2D SIG FIG	MULTIPLIER	CAPACITANCE TOLERANCE		MIL ID
					CAPACITANCES OVER 10 UUF	CAPACITANCES 10 UUF OR LESS	
BLACK	0	0	0	1		±0.5 UUF	CC
BROWN	−30	1	1	10	±1%		
RED	−80	2	2	100	±2%	±0.25 UUF	
ORANGE	−150	3	3	1,000			
YELLOW	−220	4	4				
GREEN	−330	5	5		±3%	±0.5 UUF	
BLUE	−470	6	6				
PURPLE (VIOLET)	−750	7	7				
GRAY		8	8	0.01[5]			
WHITE		9	9	0.1[5]	±10%		
GOLD	+100			0.1		±1.0 UUF	
SILVER				0.01			

1. THE MULTIPLIER IS THE NUMBER BY WHICH THE TWO SIGNIFICANT (SIG) FIGURES ARE MULTIPLIED TO OBTAIN THE CAPACITANCE IN UUF.
2. LETTERS INDICATE THE CHARACTERISTICS DESIGNATED IN APPLICABLE SPECIFICATIONS MIL-C-5, MIL-C-2511, MIL-C-11272B, AND MIL-C-10950C RESPECTIVELY.
3. LETTERS INDICATE THE TEMPERATURE RANGE AND VOLTAGE-TEMPERATURE LIMITS DESIGNATED IN MIL-C-11015D.
4. TEMPERATURE COEFFICIENT IN PARTS PER MILLION PER DEGREE CENTIGRADE.
5. OPTIONAL CODING WHERE METALLIC PIGMENTS ARE UNDESIRABLE.

EL4RD051

C. COLOR CODE MARKING FOR MILITARY STANDARD CAPACITORS

Figure FO-1. Standard Color Coding Chart.

NOTES: UNLESS OTHERWISE SPECIFIED:
1. ALL CAPACITORS ARE IN MICROFARADS, ±10%, 100V
2. ALL RESISTORS ARE IN OHMS, ±2%, 1/8W
3. ALL DIODES ARE TYPE JAN1N4148
4. ALL TRANSISTORS ARE TYPE JAN2N2222A

INTEGRATED CIRCUIT TYPES	
REF DES	TYPE NO.
AR1, AR2, AR3	592
AR4, AR5	LH2101
AR6, AR7	LM139
U1, U7	4049
U2	4030
U3, U4, U5	4013
U6	55138
U8, U9	4027
U10	4502

SIG. REF.	CARD LOC./DATA CHANNEL		
	XA1	XA2	XA11
A	9	6	3
B	8	5	2
C	7	4	1

SEE SIGNAL INTERCONNECTING LIST.

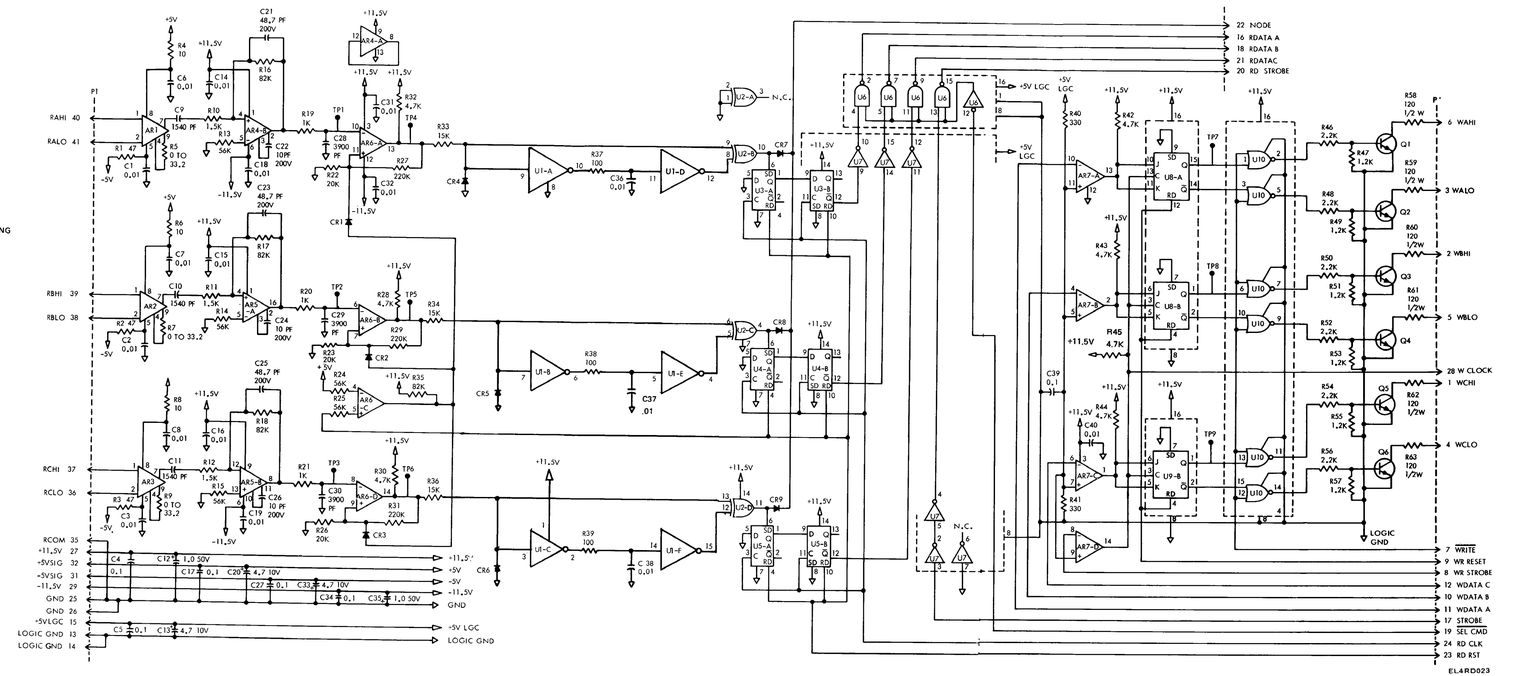


Figure FO-2. Digital Read/Write Circuit Card Schematic Diagram.

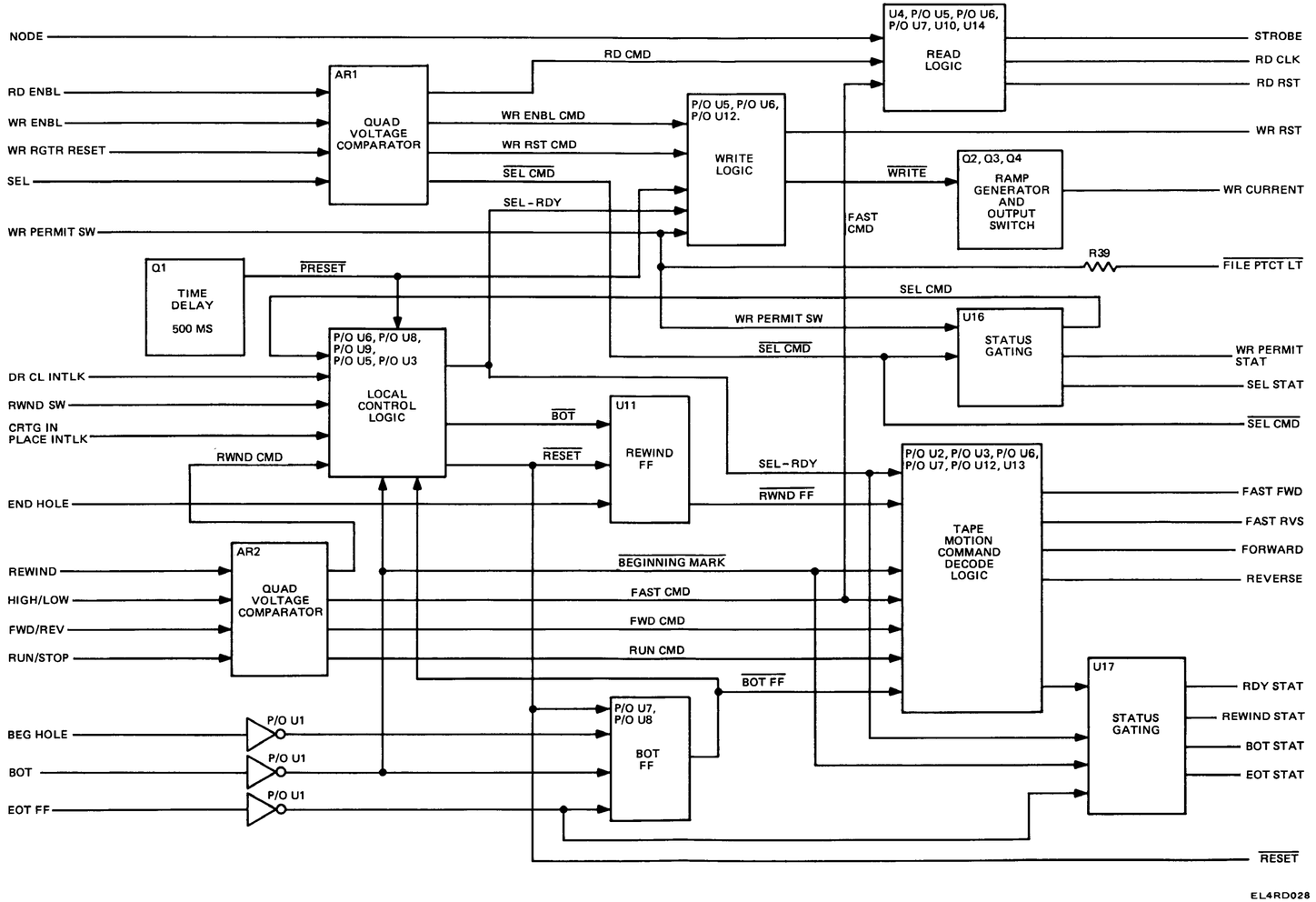
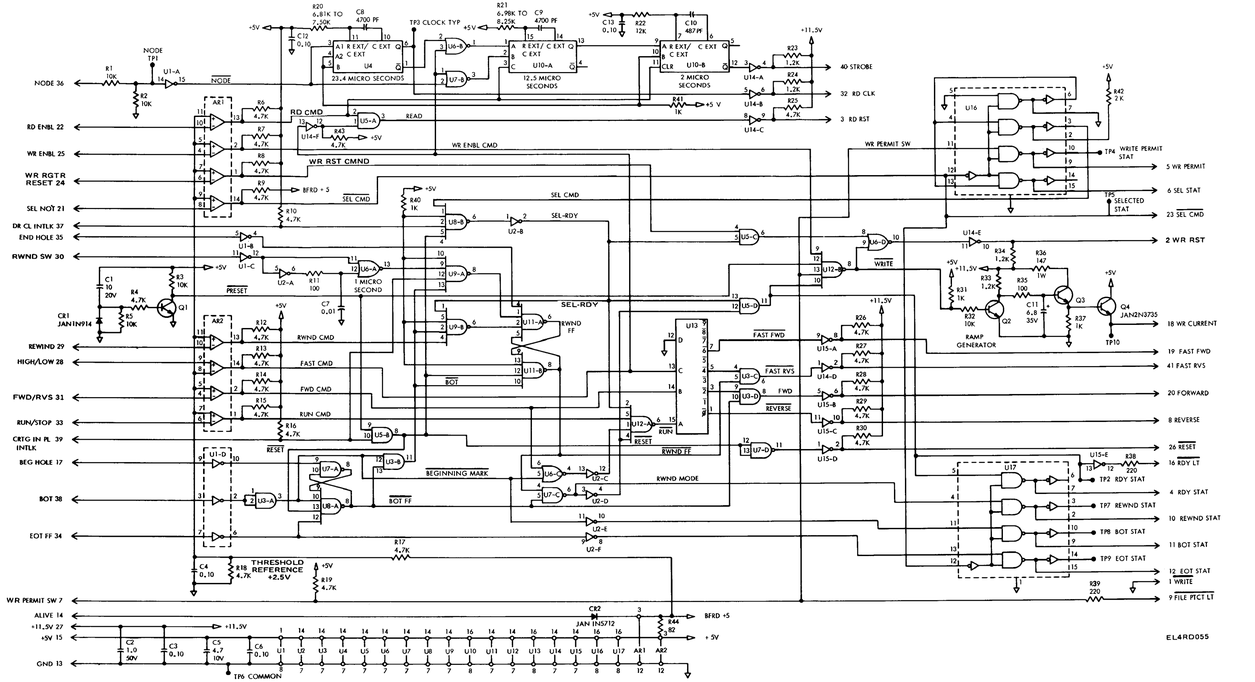


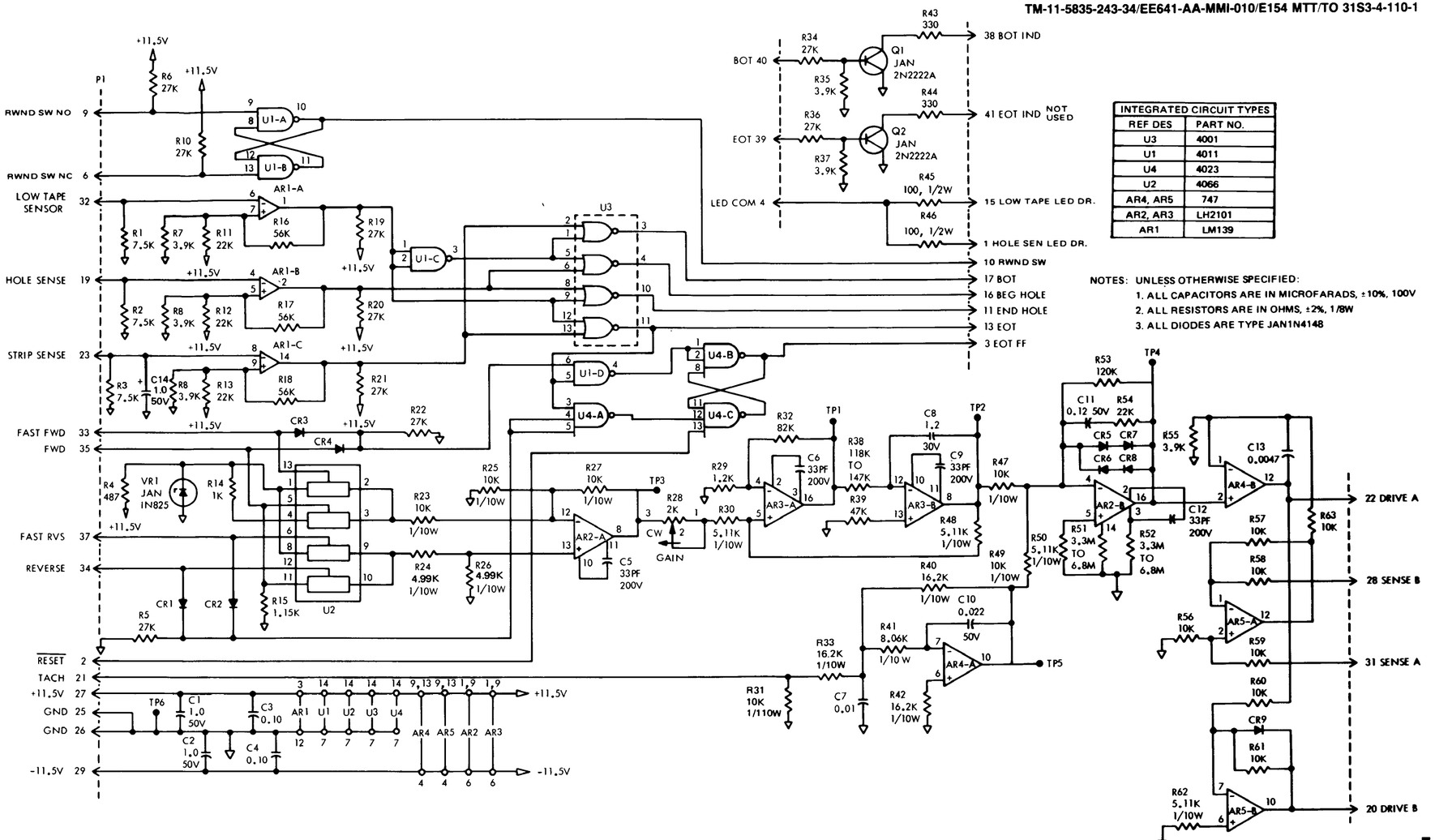
Figure FO-3. Control Logic Circuit Card Functional Block Diagram.



NOTES: UNLESS OTHERWISE SPECIFIED:
1. ALL CAPACITORS ARE IN MICROFARADS, ±10%, 100V
2. ALL RESISTORS ARE IN OHMS, ±2%, 1/8W
3. ALL TRANSISTORS ARE TYPE JAN2N2222A

INTEGRATED CIRCUIT TYPES	
REF DES	TYPE
AR1, AR2	LM139D
U1	4049
U7	5400
U6	5402
U2	5404
U14, U15	5406
U3, U5	5408
U8, U9, U11, U12	5430
U13	5442
U4	54121
U10	54123
U16, U17	55138

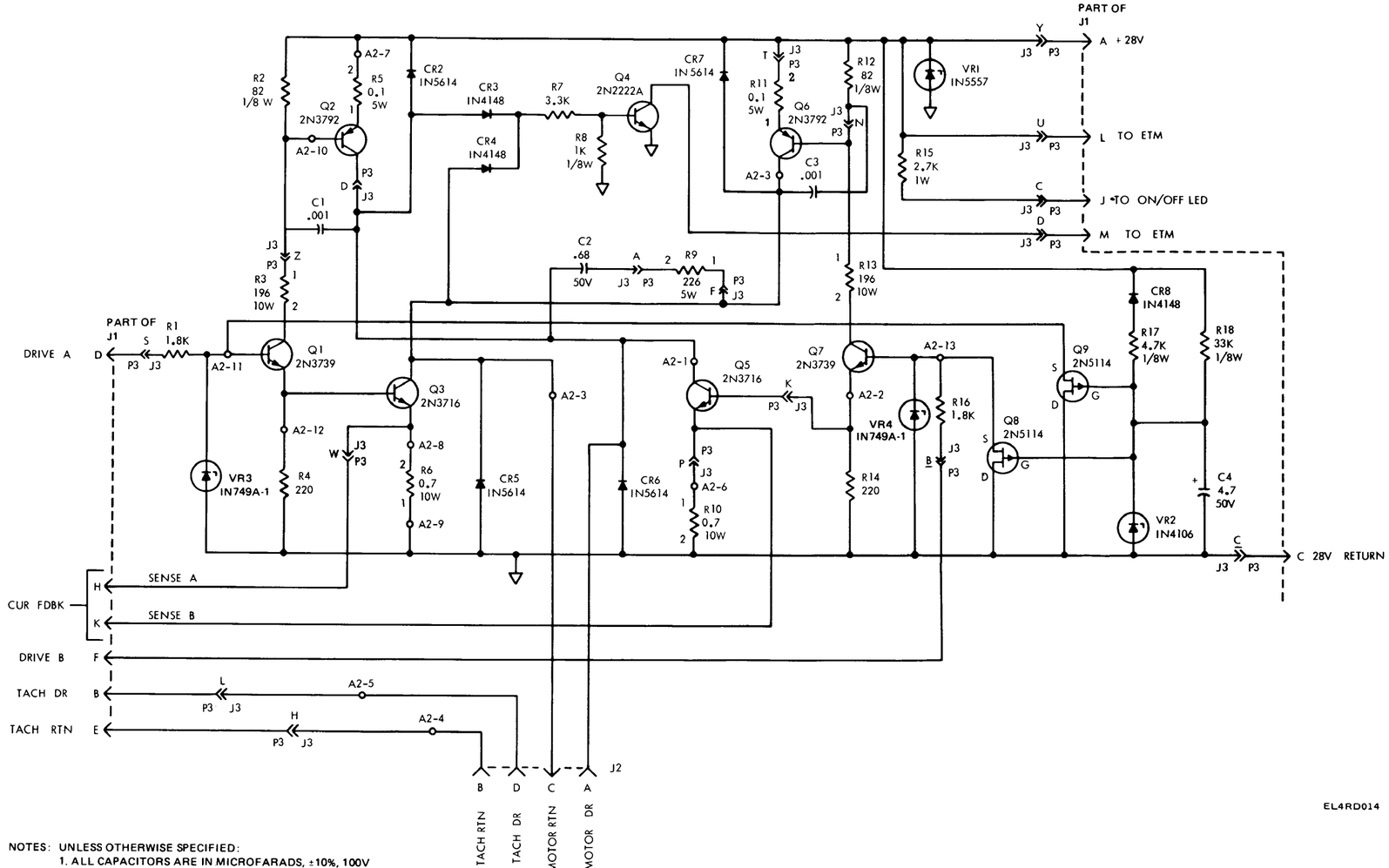
Figure FO-4. Control Logic Circuit Card Schematic Diagram.



INTEGRATED CIRCUIT TYPES	
REF DES	PART NO.
U3	4001
U1	4011
U4	4023
U2	4066
AR4, AR5	747
AR2, AR3	LH2101
AR1	LM139

NOTES: UNLESS OTHERWISE SPECIFIED:
1. ALL CAPACITORS ARE IN MICROFARADS, ±10%, 100V
2. ALL RESISTORS ARE IN OHMS, ±2%, 1/8W
3. ALL DIODES ARE TYPE JAN1N4148

Figure FO-5. Servo Control Circuit Card Schematic Diagram.



NOTES: UNLESS OTHERWISE SPECIFIED:
1. ALL CAPACITORS ARE IN MICROFARADS, ±10%, 100V
2. ALL RESISTORS ARE IN OHMS, ±2%, 1/8W
3. UNDERLINED LETTERS ARE LOWER CASE

Figure FO-6. Power Amplifier Circuit Schematic Diagram.

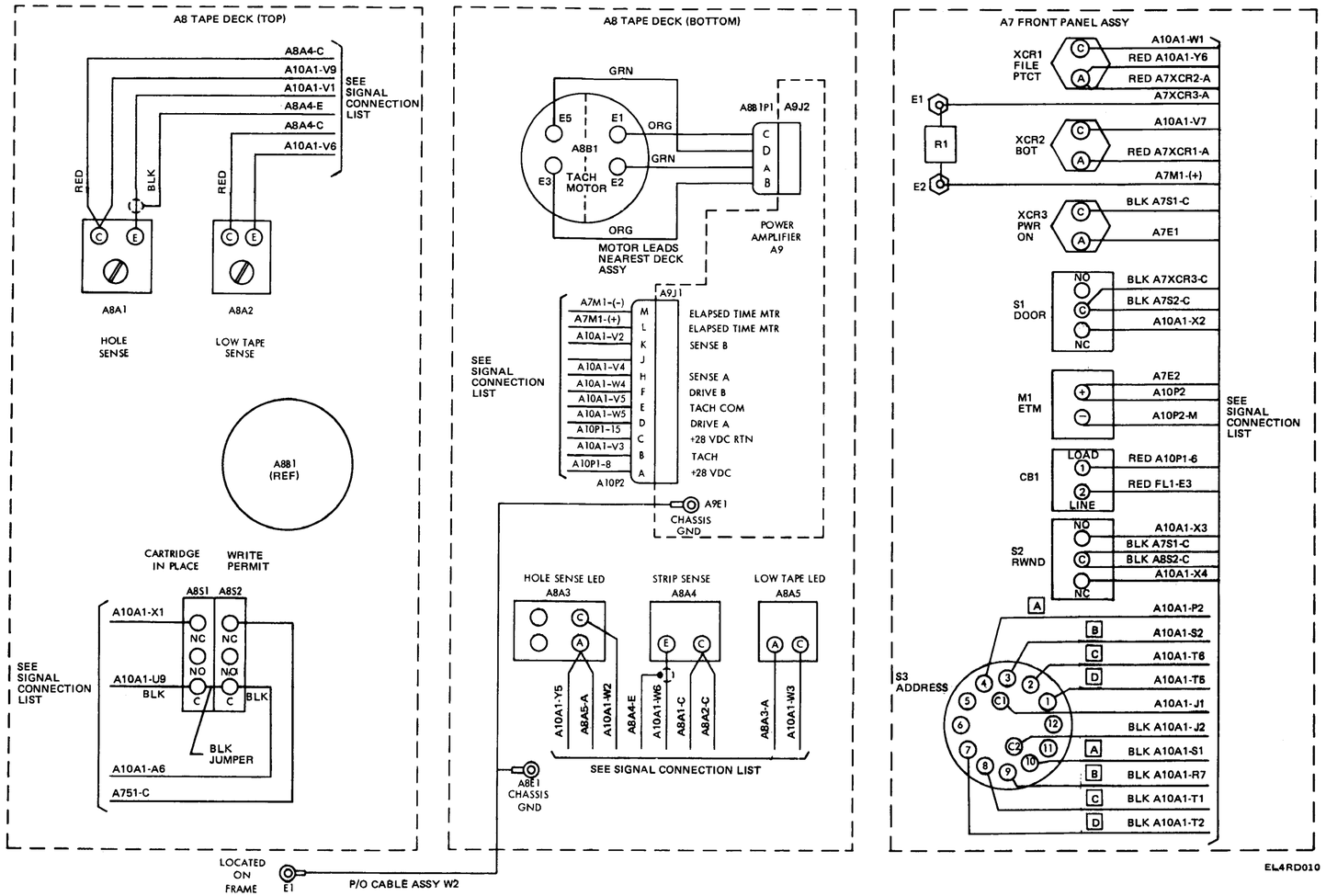


Figure FO-7. Interconnecting Wiring Diagram—Front Panel Assembly and Tape Deck.

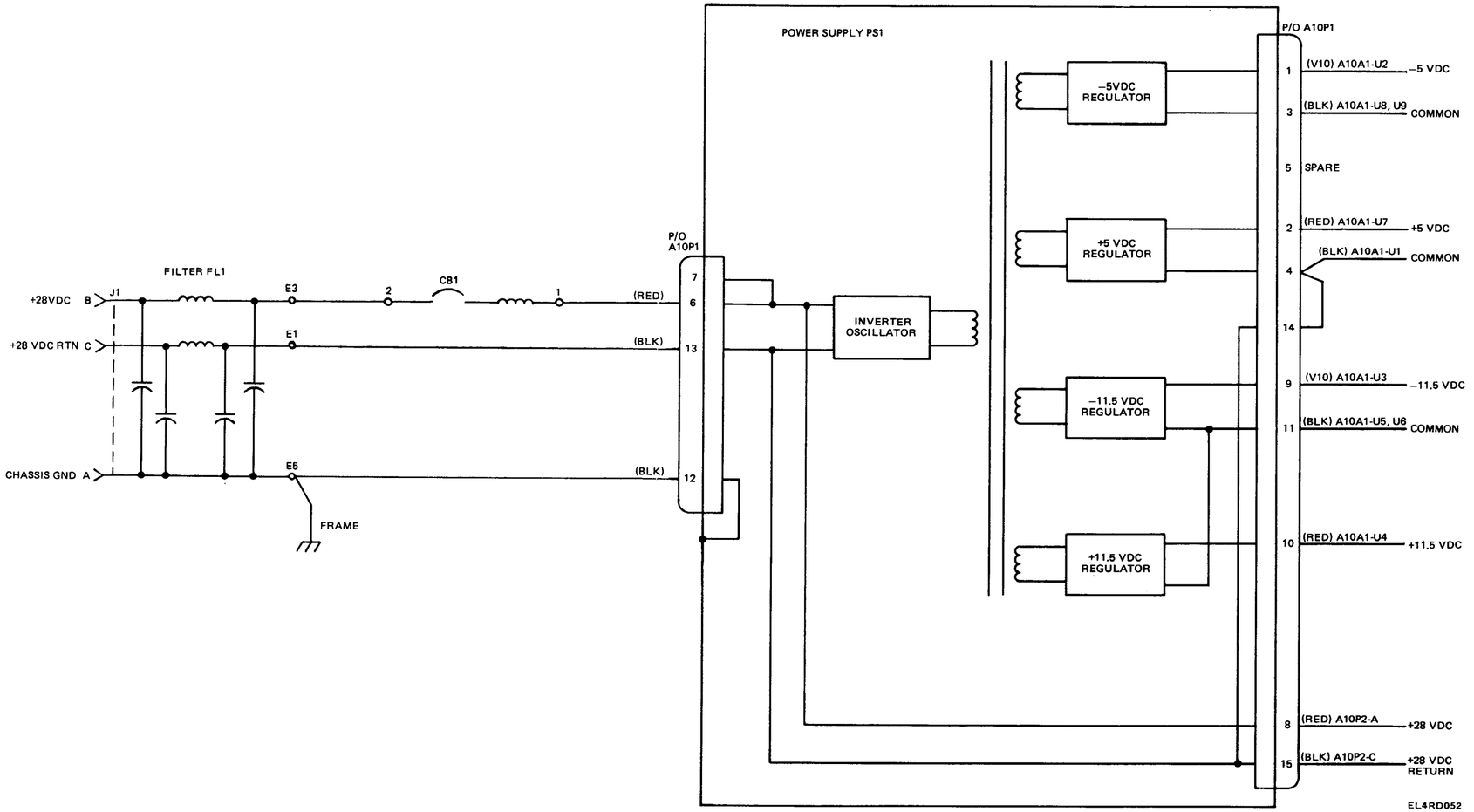


Figure FO-8. Interconnecting Wiring Diagram—Power.

HOW TO USE THE SIGNAL INTERCONNECTING LIST

Use this list by locating either the signal name in the signal column or the pin number in the appropriate connector column. All terminations where the signal is located may then be identified by reading across the row. For example, locate RD DATA PARITY in the signal column. Reading across the row, the signal is at pin 1 of connector J2, solder point C-1 on interface board A10A1, and pin 21 of digital read/write circuit card connector XA2.

SIGNAL	I/O/PUT CONNECTOR	INTERFACE BOARD	DIGITAL READ/WRITE			CONTROL LOGIC
	J2	A10A1	XA1	XA2	XA3	XA4
RD DATA PARITY	1	C- 1		21		
RD DATA PARITY RTN	2	C- 2				
RD DATA BIT 0	3	A- 1	21			
0 RTN	4	B- 2				
1	5	B- 1		16		
1 RTN	6	B- A				
2	7	C- 7		18		
2 RTN	8	B- 6				
3	9	C- 4			16	
3 RTN	10	C- 3				
4	11	A- 3	16			
4 RTN	12	B- 5				
5	13	D- 1			21	
5 RTN	14	D- 2				
6	15	A- 2	18			
6 RTN	16	B- 4				
7	17	C- 5			18	
RD DATA BIT 7 RTN	18	C- 6				
READ STROBE	19	D- 4			20	
READ STROBE RTN	20	D- 3				
READ ENABLE	21	R- 1				22
READ ENABLE RTN	22	P- 1				
SPARE	23					
SPARE	24					
WR DATA PARITY	25	M- 1			12	
WR DATA PARITY RTN	26	M- 2				
WR DATA BIT 0	27	K- 1	12			
0 RTN	28	L- 3				
1	29	L- 1			11	
1 RTN	30	L- 2				
2	31	M- 7			10	
2 RTN	32	L- 6				
3	33	M- 4				11
3 RTN	34	M- 3				
4	35	K- 3	11			
4 RTN	36	L- 5				
5	37	N- 1				12
5 RTN	38	N- 2				
6	39	K- 2	10			
WR DATA BIT 6 RTN	40	L- 4				

SIGNAL	I/O/PUT CONNECTOR	INTERFACE BOARD	DIGITAL READ/WRITE	CONTROL LOGIC	FRONT PANEL
	J2	A10A1	XA3	XA4	A7
WR DATA BIT 7	41	M- 5	10		
WR DATA BIT 7 RTN	42	M- 6			
WRITE STROBE	43	N- 4	8		
WRITE STROBE RTN	44	N- 3			
WR RGTR RESET	45	N- 5		24	
WR RGTR RESET RTN	46	N- 6			
WRITE ENABLE	47	N- 8		25	
WRITE ENABLE RTN	48	N- 7			
KEEP ALIVE	49	H- 5		14	
KEEP ALIVE RTN	50	F- 8			
RUN/STOP	51	E- 4		33	
RUN/STOP RTN	52	E- 5			
FWD/RVS	53	F- 1		31	
FWD/RVS RTN	54	E- 1			
HIGH/LOW	55	R-6, S-4		28	
HIGH/LOW RTN	56	T- 3			
REWIND	57	E- 3		29	
REWIND RTN	58	E- 7			
SEL STAT	59	R-4, S-3		6	
SEL STAT RTN	60	R- 5			
RDY STAT	61	F- 7		4	
RDY STAT RTN	62	F- 6			
BOT STAT	63	F- 2		11	
BOT STAT RTN	64	F- 3			
EOT STAT	65	F- 5		12	
EOT STAT RTN	66	F- 4			
WRITE PERMIT	67	H- 4		5	
WRITE PERMIT RTN	68	H- 3			
REWND STAT	69	H- 1		10	
REWND STAT RTN	70	H- 2			
SELECT NOT - 1	71	T- G			S3-1
SELECT NOT - 1 RTN	72	T- 2			S3-7
SELECT NOT - 2	73	T- A			S3-2
SELECT NOT - 2 RTN	74	T- 1			S3-6
SELECT NOT - 3	75	S- J			S3-3
SELECT NOT - 3 RTN	76	R- J			S3-9
SELECT NOT - 4	77	R- J			S3-4
SELECT NOT - 4 RTN	78	S- 1			S3-10
SPARE	79				

SIGNAL	INTERFACE BOARD	DIGITAL READ/WRITE			CONTROL LOGIC	SERVO CONTROL	READ HEAD	WRITE HEAD	FRONT PANEL	TAPE DECK ASSY	POWER SUPPLY	POWER AMPLIFIER
	A10A1	XA1	XA2	XA3	XA4	XA5	A10A1 J1	A10A1 J2	A7	A8	A10 P1	A10 P2
SEL NOT	J- 1				21				S3-C1			
SEL NOT RTN	J- 2								S3-C2			
FILE PTCT IND	R-8; S-2; W- G				9				CR1-C			
RCOM	U- 1	35	35	35			B, E, J				4, 14	
							M, R					
							U, X					
RCOM							A, D, H					
–5 VDC SIG	U- 2	31	31	31							1	
–11.5 VDC	U- 3	29	29	29		29					9	
+11.5 VDC	U- 4	27	27	27	27	27					10	
COMMON	U-5, 6; V-5, 10; Y-3	25, 26	25, 26	25, 26		25, 26				SHLD	3, 11	E
+5 VDC	U-7; V-9; Y-5, 6	15, 32	15, 32	15, 32	15				△	▲	2	
LOGIC GND	U- 8 ; Y- 1, 2	8, 12	8, 12	12	12	4		F1			3	
LOGIC GND	U- 9 ; Y- 4	14	14	14		14			□	■		
HOLE SENSE	V- 1					19				A1-E		
SENSE B	V- 2					28						K
TACH	V- 3					21						B
SENSE A	V- 4					31						H
LOW TAPE SENSOR	V- 6					32				A2-E		
BOT IND	V- 7					38			CR2-C			
EOT IND (NOT USED)	W- 8					41						
HOLE SEN LED DR	W- 2					1				A3-C		
LOW TAPE LED DR	W- 3					15				A5-C		
DRIVE B	W- 4					20						F
DRIVE A	W- 5					22						D
STHIP SENSE	W- 6					23				A4-E		
CRTG IN PL INTLK	X- 1				39					S1-NC		
DR CLSDED INTLK	X- 2				37				S1-NC			
RWND SW N.O.	X- 3					9			S2-NO			
RWND SW N.C.	X- 4					6			S2-NC			
READY IND (NOT USED)	X- 5				16							
WR PERMIT SW	X- 6				7					S2-NC		
WR TRK 7 HI		1						F				
8 HI		2						Y				
9 LO		3						W				
7 LO		4						C				
WR TRK 8 LO		5						B				

SIGNAL	DIGITAL READ/WRITE			CONTROL LOGIC	READ HEAD	WRITE HEAD
	XA1	XA2	XA3	XA4	A10A1 J1	A10A1 J2
WR TRK 9 HI	6					Z
WRITE	7	7	7	1		
WR RESET	9	9	9	2		
SEL CMD	19	19	19	23		
NODE	22	22	22	36		
RD RESET	23	23	23	3		
RD CLOCK	23	24	24	32		
WR CLOCK	28	28	28			
R TRK 7 LO	36				H	
7 HI	37				L	
8 LO	38				N	
8 HI	39				K	
9 HI	40				R	
R TRK 9 LO	41				Y	
WR TRK 4 HI		1				N
5 HI		2				H
6 LO		3				D
4 LO		4				K
5 LO		5				L
WR TRK 6 HI		6				A
R TRK 4 LO		36			D	
4 HI		37			A	
5 LO		38			W	
5 HI		39			Z	
6 HI		40			P	
R TRK 6 LO		41			T	
WR TRK 1 HI			1			E
2 HI			2			V
3 LO			3			P
1 LO			4			C
2 LO			5			S
WR TRK 3 HI			6			T
STROBE			17	40		
R TRK 1 LO			36		S	
1 HI			37		V	
2 LO			38		C	
2 HI			39		F	
3 HI			40		F	
R TRK 3 LO			41		C	

SIGNAL	I/O/PUT CONNECTOR	CONTROL LOGIC	SERVO CONTROL	WRITE HEAD	FRONT PANEL	TAPE DECK ASSY	POWER SUPPLY	POWER AMPLIFIER	P/R FILTER	PWR AMPL ASSEMBLY
	J2	XA4	XA5	A10A1 J2	A7	A8	A10 P1	A10 P2	FL1	A9
REVERSE		8	34							
BEGINNING HOLE		17	16							
WR CURRENT		18		B, E, J						
				M, R						
				U, X						
WR CURRENT				A, D, F						
FAST FWD		19	33							
FORWARD		20	35							
RESET		26	2							
RWND SW FF		30	10							
EOT FF		34	3, 39							
END HOLE		35	11							
BOT		38	17, 40							
FAST RVS		41	37							
+28 VDC INPUT					CB1-1		6			
+28 VDC UNREGLTD							8	A		
CHASSIS GND	E1			E1		E1	12		E5	E1
+28 VDC INPUT RTN	E1						13		E1	
+28 VDC RTN							15	C		
+28 VDC (FILTERED)					CB1-2				E3	
ET METER (+)					●			L		
ET METER (–)					M1-(–)			M		
PWR ON IND					○					

NOTES:

1. □ DENOTES INTERCONNECTION OF LOGIC GND ON GND PLANE
2. ○ DENOTES TIE POINT ONLY
3. △ CR1-A, CR2-A
4. ▲ A1-C, A2-C, A3-A, A4-C, A5-A
5. ■ S1-C, S2-C, CR3-C
6. ■ S1-C, S2-C
7. ○ E1, CR3-A
8. ● M1-(+), E2
9. UNDERLINED LETTERS DENOTE LOWER CASE

EL4RD053

Figure FO-9. Signal Interconnection List.

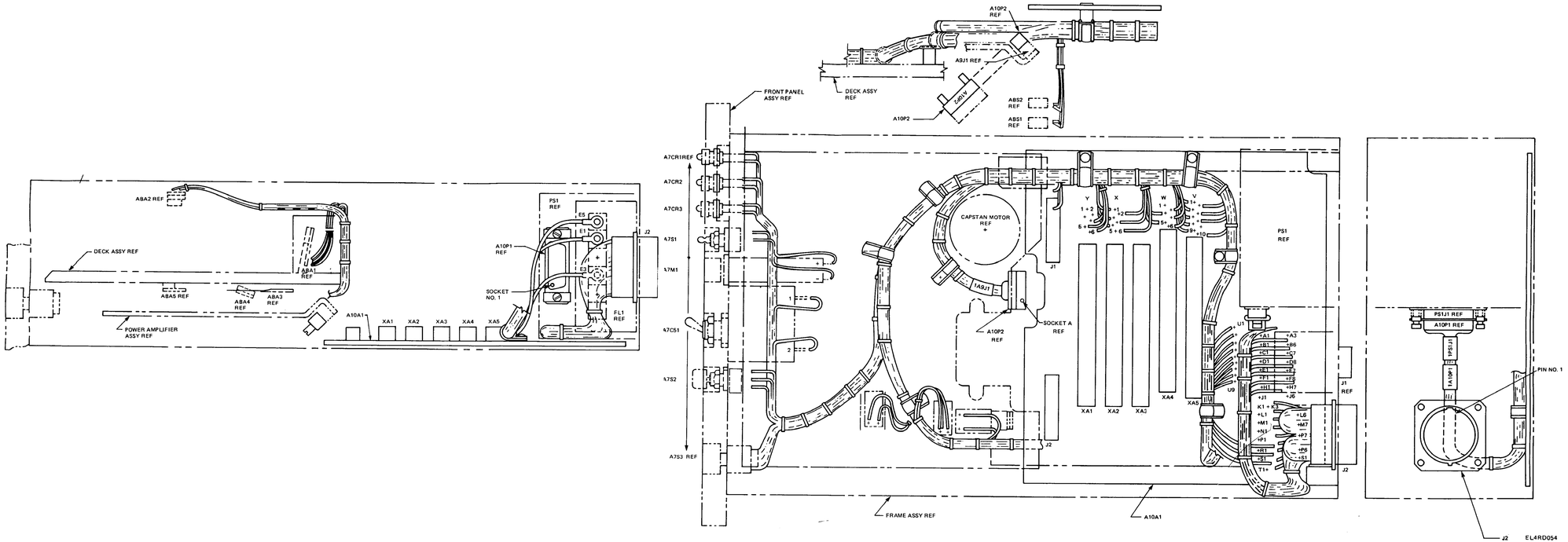


Figure FO-10. Harness and Interface Board Assembly.

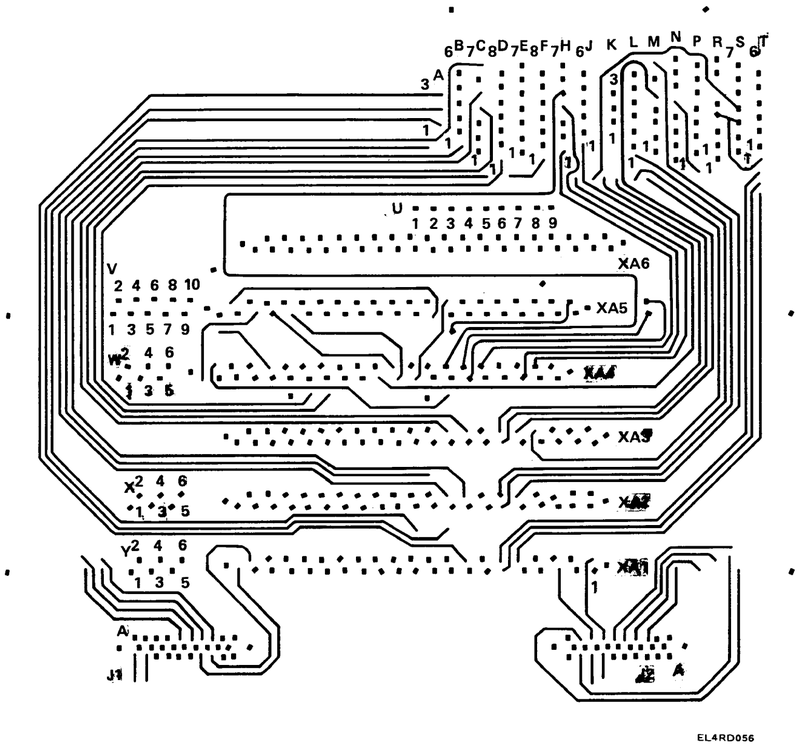


Figure FO-11. Harness and Interface Board A10A1 Wiring Layout.

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PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
2-25	2-28			Recommend that the installation antenna alignment procedure be changed throughout to specify a 2° IFF antenna lag rather than 1°. REASON: Experience has shown that with only a 1° lag, the antenna servo system is too sensitive to wind gusting in excess of 25 knots, and has a tendency to rapidly accelerate and decelerate as it hunts, causing strain to the drive train. Hunting is minimized by adjusting the lag to 2° without degradation of operation.
3-10	3-3		3-1	Item 5, Function column. Change "2 db" to "3db." REASON: The adjustment procedure the TRANS POWER FAULT indicator calls for a 3 db (500 watts) adjustment to light the TRANS POWER FAULT indicator.
5-6	5-8			Add new step f.1 to read, "Replace cover plate removed in step e.1, above." REASON: To replace the cover plate.
E-5				For item 2, change the NSN to read: 5835-00-134-9186. REASON: Accuracy.
E-8		E-3		Identify the cover on the junction box (item no. 5). REASON: It is a separate item and is not called out on figure 19.
E-9				Add the cover of the junction box as an item in the listing for figure 19. REASON: Same as above.

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