TECHNICAL MANUAL

OPERATOR, ORGANIZATIONAL, DS, AND GS MAINTENANCE MANUAL READER, PUNCHED TAPE AN/USA-34

This copy is a reprint which includes current pages from Changes 1 and 2.

HEADQUARTERS, DEPARTMENT OF THE ARMY

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Change No. 2

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WASHINGTON, DC, *1 January 1988*

Operator's, Organizational, Direct Support and General Support Maintenance Manual

READER, PUNCHED TAPE AN/USA-34 (NSN 6625-00-491-3491)

TM 11-6625-2503-14, 27 August 1971, is changed as follows:

1. Title is changed as shown above.

2. Remove old pages and insert new pages as indicated below. New or changed material is indicated by a vertical bar in the margin of the page. Added or revised illustrations are indicated by a vertical bar adjacent to the identification number.

Remove pages	*Insert pages*
6-10.13 and 6-10.14	6-10.13 and 6-10.14

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TECHNICAL MANUAL
No. 11-6625-2503-14

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 27 August 1971

READER, PUNCHED TAPE AN/USA-34

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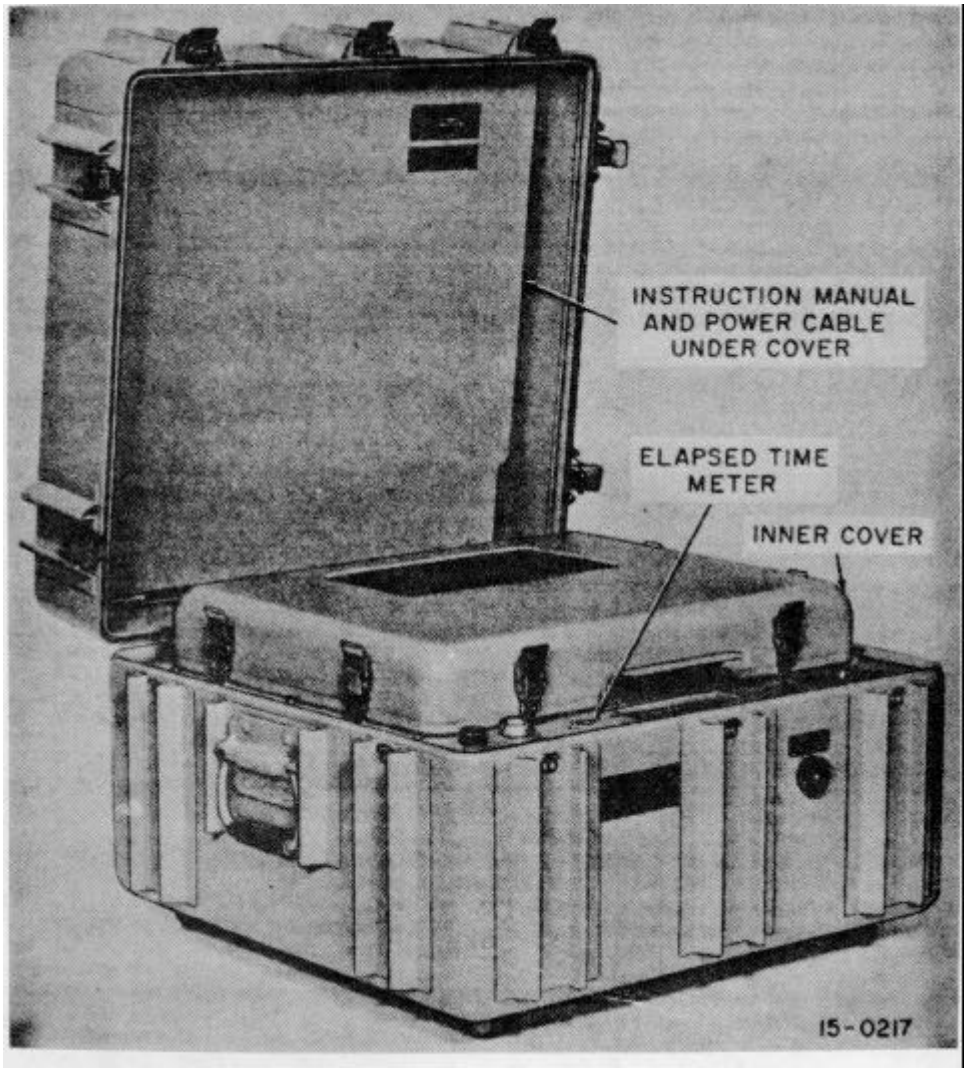


Figure 1-1. Punched Tape Reader AN/USA-34

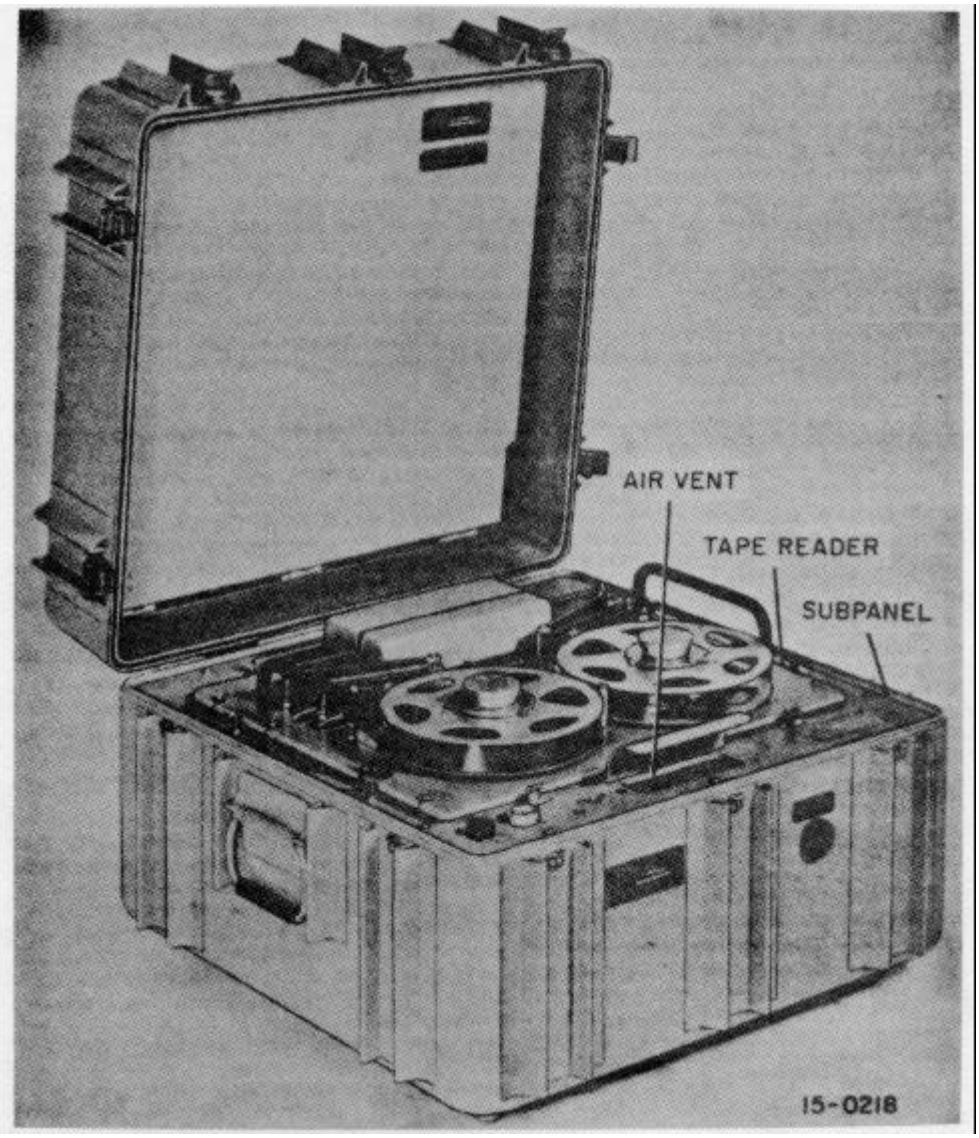


Figure 1-1.1. Punched Tape Reader Set AN/USA-34, with Inner Cover Removed

CHAPTER 1
INTRODUCTION AND DESCRIPTION

1-1. INTRODUCTION.

1-2. SCOPE OF MANUAL.
This technical manual provides operating and maintenance instructions for Reader, Punched Tape AN/USA-34 (tape reader) consisting of Punched Tape Reader RP-186/U and Punched Tape Reader Case CY-7026/USA-34. Refer to table 1-1 for characteristics and table 1-2 for reference designations assigned to the tape reader assemblies.

In addition to descriptive data, this manual includes instructions regarding special service tools, preparation for use, storage, shipment, operating instructions, periodic inspection, maintenance, and troubleshooting. An illustrated parts list is provided in Chapter 7 and schematic and signal flow diagrams are provided in Chapter 8.

1-3. INDEX OF PUBLICATIONS.

a. DA Pam 310-4. Refer to DA Pam 310-4 to determine whether there are new editions, changes, or additional publications, pertaining to the equipment.

b. DA Pam 310-7. Refer to DA Pam 310-7 to determine whether there are modification work orders (MWO's) pertaining to the equipment.

1-4. FORMS AND RECORDS.

a. Report of Maintenance and Unsatisfactory Equipment. Use equipment forms and records in accordance with instructions in TM 38-750.

b. Report of Packaging and Handling Deficiencies. Fill out and forward DD Form 6 (Report of Packaging and Handling Deficiencies) as prescribed in AR 700-58 (Army), NAVSUP Pub 378 (Navy), AFR 71-4 (Air Force), and MCO P4030.29 (Marine Corps).

c. Discrepancy in Shipment Report (DISREP) (SF361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF361) as prescribed in AR 55-38 (Army), NAVSUP Pub 459 (Navy), AFM 75-34
(Air Force), and MCO P4610.19 (Marine Corps).

d. Reporting of Equipment Manual Improvements. Reporting of errors, omissions, and recommendations for improving this manual by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications) and forwarded direct to Commanding General, U.S. Army Electronics Command, ATTN: AMSEL-MA-AD, Fort Monmouth, N.J., 07703.

1-5. DESCRIPTION.

1-6. PURPOSE OF EQUIPMENT.

1-7. The tape reader is designed to read and translate coded tape perforations into electrical signals. Either reels, strips or loops of punched tape can be read.

1-8. CAPABILITIES OF EQUIPMENT.

1-9. The tape reader is capable of reading 1 inch EIA (8-track) standard punched tape. The reels will hold up to 1000 feet of 0.0025 inch thick mylar tape. The tape reader provides a 400 character per second reading speed and an 800 character per second rewind speed in both the forward and reverse directions. Tape holes are detected during rewind for regulation of the rewind speed.

1-10. LIMITATIONS OF EQUIPMENT.

1-11. The tape reader will operate at temperatures from -40° to +65° centigrade. Maximum humidity in a non-operating condition (storage) is 95 percent at 71° centigrade. The tape reader operates at altitudes up to 10, 000 feet (20.6 inches of mercury) and will withstand altitudes up to 50, 000 feet (3. 4 inches of mercury) in a non-operating condition.

1-12. CONSTRUCTION OF EQUIPMENT
(Refer to Figure 1-1).

1-13. The punched tape reader unit is illustrated in figures 1-1 and 1-2. The tape reader is mounted in the center of the subpanel in the transit case and may be operated independently of the transit case if the physical and rfi protection of the case are not required. Duct work inside the transit case is aligned with the fan vent in the tape reader rear cover to provide the proper ventilation of the tape reader. The air intake for the duct is an opening on the upper portion of the subpanel. The air exhaust is through a vent mounted on the lower portion of the subpanel. The upper cover of the transit case provides a storage compartment for the instruction manual and the power cable.

The power cable is designed to mate with the power connector on the subpanel and connect to the associated system power source. An elapsed time meter mounted on the subpanel indicates the number of hours that the tape reader is turned on.

1-14. The unit may also be rack mounted. No accessories are provided with the tape reader except two test plugs. A rear cover panel provides access to the circuit cards for using test points and for removal and replacement. Two test plugs are located inside this panel. The tape supply and take-up reels are located on the front panel. Two handles are provided on the front panel to aid in removal, installation, and handling of the tape reader. A front cover is provided for the optic and read head assembly and capstan drive assembly. A rear cover is provided for the component plate assembly, power supply and drive mechanism. The tape reader has an explosion proof combination power on/off toggle switch and circuit breaker mounted on the front panel. A mode switch and tape feed switch are also located on the front panel. Signal and power connectors are located at the rear of the tape reader. A fan provides forced air cooling for the tape reader components.

(sc)

1-15. PRINCIPLES OF OPERATION.

1-16. The tape reader transports a punched tape past a photoelectric reading head to convert punched hole patterns into electrical output signals. The tape movement is controlled by remote forward/ reverse, start/stop, high/low speed and inhibit signals. The tape may also be manually controlled in the forward or reverse direction with the TAPE FEED switch. Reels of tape are normally read, but strips or loops of tape may be used by de-energizing the tape reel servo systems with the MODE switch. A self test mode provides for self checking of the tape reader circuits by using a specially punched test tape.

1-17. The transit case contains no operating circuits. Power and signal connections from the subpanel jacks are connected through cables to the power and signal jacks on the rear of the tape reader. One phase of the 115 Vac is fed back from the tape reader to the elapsed time meter through the interconnecting power cable. This connection allows the elapsed time meter to run whenever power is applied to the tape reader. Power jack A2J2 contains a built-in rfi filter to reduce conducted emission interference from the tape reader power leads.

Table 1-1. Leading Particulars

CHARACTERISTICS	DESCRIPTION
Input Power Requirement	
Part No. 204300-103	115 Vac, * 10% (line-to-neutral), three-phase, 4 wire,
400 Hz + 5%, 220 watts maximum	
Depth	25 inches
Width	25 inches
Height	16 inches
Weight	90 pounds
Tape Requirements	1 inch wide tape, perforated per MIL-P-9899 and EIA Standard RS-227
Reel Type	8 inch NAB
Bidirectional Character Reading Speed	400 characters per second + 10%
Fast Forward and Rewind Speed	800 characters per second + 10%
Control Inputs	Control Logic Levels Logic 0 = +0.4 Vdc at 9.0 ma (max) from tape reader Logic 1 = +4.5 $\pm$ 2 Vdc at 50 microamperes (max) to tape reader
Start/Stop Line	
Start Signal	Logic 0
Stop Signal	Logic 1
Forward/Reverse Line	
Reverse Signal	Logic 1
Forward Signal	Logic 0
Low/High Speed Signal	
High	Logic 0
Low	Logic 1
Inhibit Signal	
Inhibit	Logic 0 (selects external control of tape reader) Logic 1 (selects local control of tape reader through TAPE FEED switch)
Data Outputs	
Hole	Logic 1 = +5.5 $\pm$ 0.5 Vdc at 1.5 ma (max) from tape reader
No Hole	Logic 0 = +0.25 $\pm$ 0.25 Vdc at 10 ma (max) to tape reader

(sc)

Table 1-1. Leading Particulars (Cont)

CHARACTERISTICS	DESCRIPTION
Sprocket Hole Signal Levels	Logic 1 = Same as the data signals
Ready Output	
Ready	Logic 1 = Same as data signals
Not Ready	Logic 0 = Same as data signals
Sprocket Signal Duration	1.0 millisecond (min)
Start Time	8.5 milliseconds (max) required to reach the next character after a forward or reverse start signal
Stop Distance at Low Speed	On the same sprocket hole
Stop Distance at High Speed	Within 5 inches of stop command
Interlocks	
Power Failure or Tape Breakage	Tape drive mechanism stops
Power Removal and Reapplication in stop mode	No manual reset action required to resume operations

Table 1-2. Equipment Reference Designations

REFERENCE DESIGNATION	COMMON NAME	NOMENCLATURE
	Punched Tape Reader Unit	Punched Tape Reader AN/USA-34
A1	Tape Reader (Model 1710)	Punched Tape Reader RP-186/U
A1A1	Component Mounting Plate Assembly	-
A1A1A1	Servo Output Circuit Card Assembly	-
A1A1A2	Servo Input Circuit Card Assembly	-
A1A1A3	Servo Input Circuit Card Assembly	-
A1A1A4	Control Logic Circuit Card Assembly	-
A1A1A5	Rewind Speed Control Circuit Card Assembly	-
A1A1A6	Read Amplifier No. 1 Circuit Card Assembly	-
A1A1A7	Read Amplifier No. 1 Circuit Card Assembly	-
A1A1A8	Read Amplifier No. 2 Circuit Card Assembly	-
A1A1A9	Self Test Circuit Card Assembly	-
A1A1A10	Power Regulator Circuit Card Assembly	-
A1A2	Power Supply Assembly	-
A1A3	Read Head Circuit Card Assembly	-
A1A4	Motor Mounting Plate Assembly	-
A2	Transit Case	Punched Tape Reader Case CY-7026/USA-34
W1	Power Cable	Special Purpose Electrical Cable Assembly CX-12590/USA-34

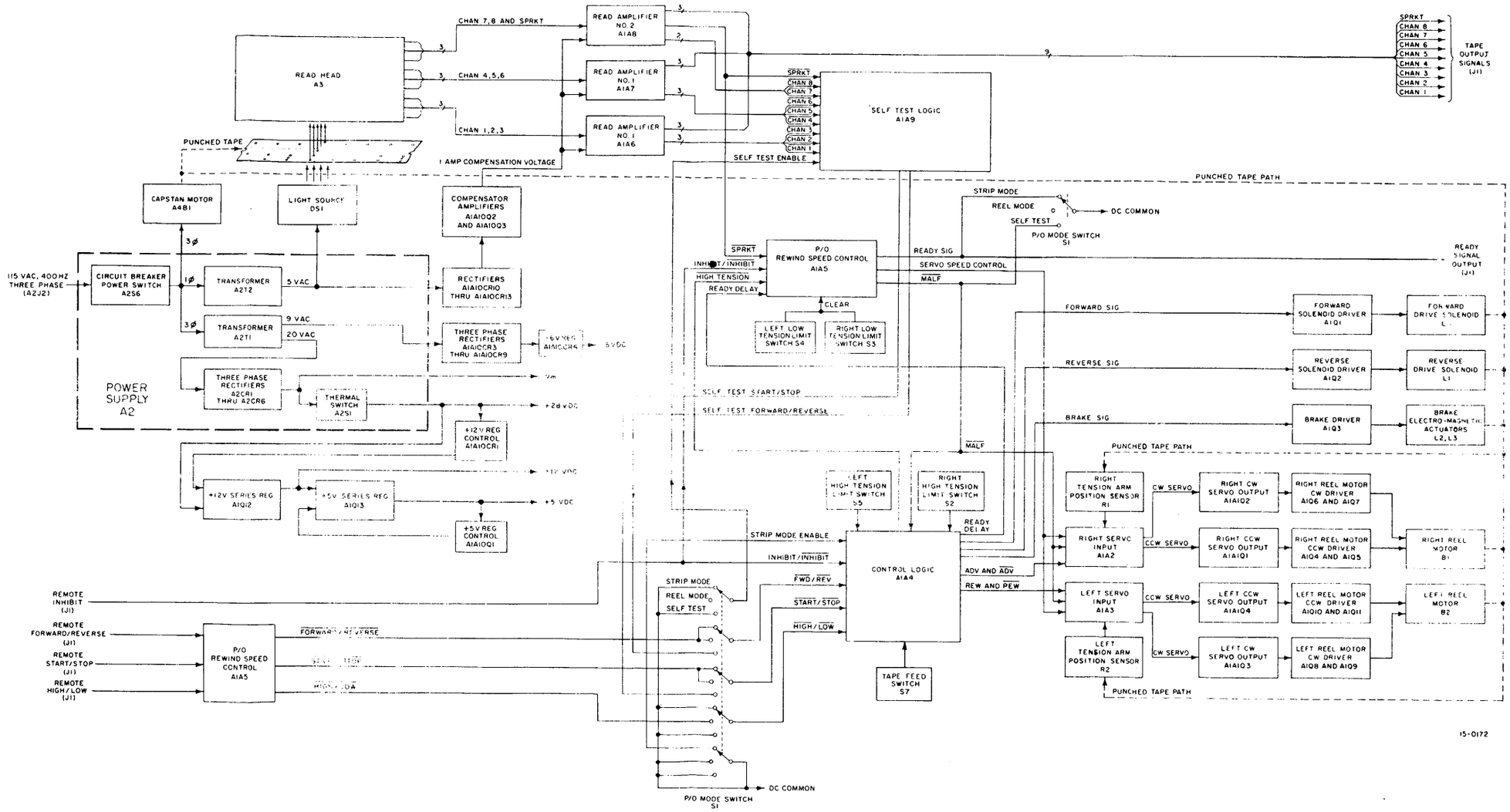


Figure 1-2. Tape Reader Block Diagram

1-18. SYSTEM OPERATION (Refer to Figure 1-2).

1-19. Functionally, the tape reader consists of the following groups of circuits:

(1) Tape data detection
(2) Tape drive
(3) Tape servo system
(4) Control logic
(5) Rewind speed control
(6) Self test logic
(7) Power supply

1-20. DATA DETECTION CIRCUITS. - The data detection circuits consist of light source DS1 and optics assembly, read head A3, read amplifiers A1A6, A1A7, and A1A8, and the lamp compensator amplifiers A1A10Q2 and A1A10Q3. Light from lamp DS1 is focused into an intense narrow beam on the tape and read head A3. The read head contains nine N/P silicon photocells, aligned with the nine possible hole positions on the tape (refer to figure 1-3). Tape passes through the light beam and acts as a shutter between the light source and the read head. An output signal is generated whenever the light passes through a hole and strikes the photocell. The tape has eight signal hole positions and one sprocket hole position for timing the location of the signal holes. Signals from the read head are amplified by the read head amplifiers A1A6, A1A7, and A1A8 (figure 1-2), and supplied to the remote equipment through jack J1. A compensation circuit generates a voltage in the cell bias chain which offsets the variations in the light source intensity due to voltage changes and variations in cell efficiency due to temperature changes. This voltage is supplied to the read amplifiers from compensator amplifiers A1A10Q2 and A1A10Q3.

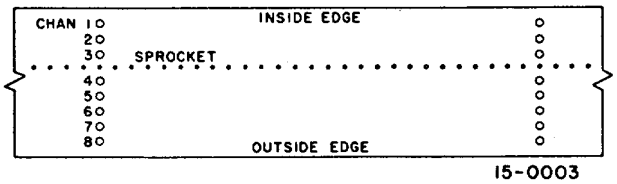


Figure 1-3. Tape Hole Details

1-21. TAPE DRIVE SYSTEM. - The tape drive system (refer to figure 1-4) consists of a single capstan motor A4B1 driving forward and reverse capstans through a belt and pulley system, two solenoid operated capstan pinch rollers L1 and L4, two electromagnetically operated tape brakes L2 and L3, and two reel motors, B1 and B2. Tape is pulled forward past the read head by the forward capstan when the tape is held against the capstan by the forward capstan pinch roller. The tape coming out of the capstan causes the right tension arm to move inward from the balanced position and thereby alters the position of the right tension arm position sensor. The change in sensor resistance turns on the servo system to increase the torque in the right tape reel motor and thereby take up the tape. At the same time the left tension arm position sensor A1R2 reacts to a change in arm position as the tape is pulled out of the left reel system. This results in a servo signal that reverses the torque in the left reel motor to aid in unreeling the tape. The reel motors are always slightly energized because of the tension provided to the tape by the tension arm springs in the balanced position. A balanced position is not an electrical null position. The tension arm spring pulls the arm just enough to cause a slight error signal which is balanced by the small amount of resulting reel motor torque. No power is applied at the electrical null of the tension arm, but this condition is attained only during transient conditions. Stopping the tape is accomplished by releasing the forward capstan and applying the tape brakes. The right tape reel motor continues to wind the tape for an instant until the tape loop shortens and the tension arm moves toward the null position. A balanced condition is again obtained and the tape stops. The left motor reel has a similar action to maintain a tape tension for the balanced condition.

1-22. A reverse tape motion is obtained by releasing the brakes and energizing the reverse capstan pinch roller. The left tension arm position sensor then develops a servo signal to increase the torque in the left tape reel motor and the tape is wound on the left reel. Reverse torque is applied to the right reel motor to aid in unwinding the tape.

1-23. When the tape is driven in the high speed mode the capstan drive solenoids are deenergized and the reel motors control the tape motion. Circuits on the control logic card A1A4 gate off position sensor control of one servo motor (B1 or B2 depending on the desired direction of high speed tape motion) and instead substitute a high speed control signal from rewind speed control card A1A5. Full current is applied to the reel motor at the start of rewind. As the tape approaches a preset speed, the motor current is reduced until the preset speed is obtained. The other servo motor has full servo control as in low speed operation.

1-24. TAPE SERVO SYSTEM. - The tape reel motors are controlled by the servo amplifier system consisting of right and left tension arm position sensors R1 and R2, right servo input card A1A2, left servo input card A1A3, right servo output buffers A1A1Q1 and A1A1Q2, left servo output buffers A1A1Q3 and A1A1Q4, right reel motor drivers A1Q4 through A1Q7, and left reel motor drivers A1Q8 through A1Q11. Dc error signals are

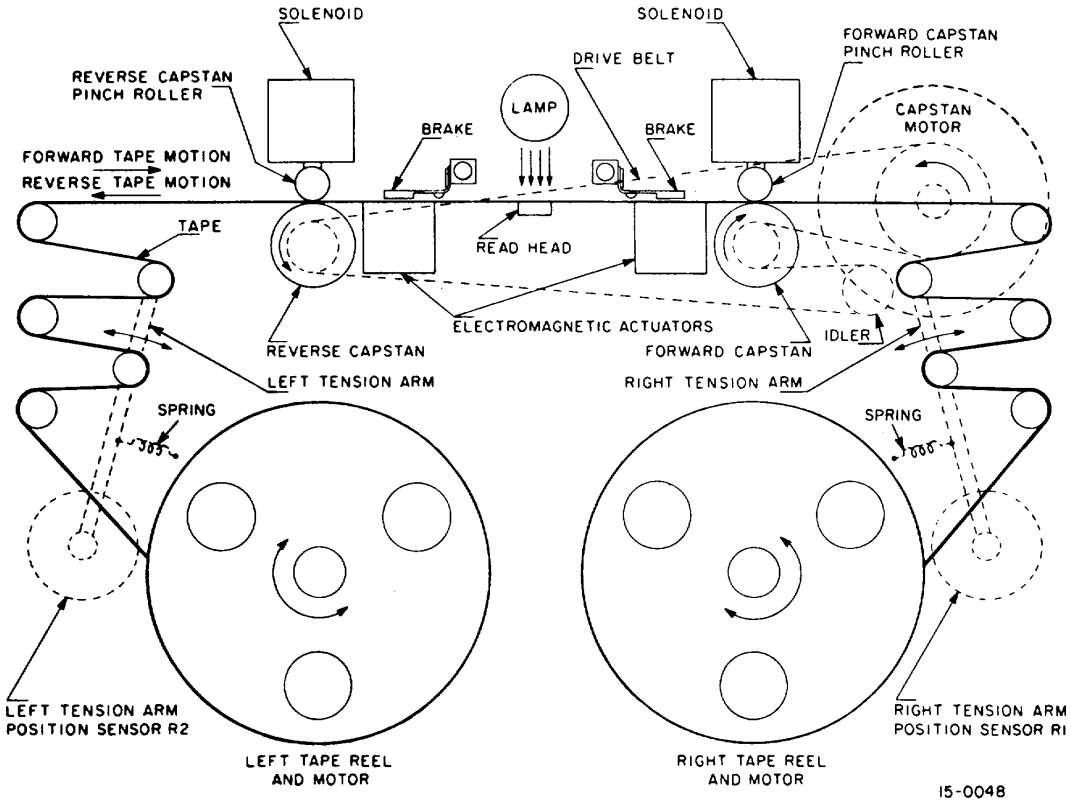


Figure 1-4. Tape Drive System

developed during low speed operation by the movement of the tension arm position sensors and recognized by comparators in the servo input circuits as right or left, clockwise or counterclockwise. The appropriate servo signals are amplified through the servo output cards and motor drivers to drive the reel motors. Servo amplifier outputs will be inhibited by the MALF (malfunction) signal due to any one of the following conditions:

a. Left (S5) or right (S2) high tension limit switches open momentarily due to a high tape tension on the tension arms.

b. Left (S4) or right (S3) low tension limit switches open due to a low (or absence) of tape tension on the tension arms.

c. Mode switch S1 set to STRIP MODE. (Tape reeling is not required when using strips or loops of tape.)

1-25. CONTROL LOGIC. - The control logic is located on control logic card A1A4 and on part of rewind speed control card A1A5. The control logic accepts local and remote control signals for controlling the tape movements as well as accepting limit switch signals. Remote control signals for forward/reverse, start/stop, and high/low speed enter the control module from jack J1 through inverting gates in the rewind speed control card and through mode switch S1 (in the REEL MODE and STRIP MODE positions). The TAPE FEED switch provides local manual forward and rewind control of the tape. However a remote "inhibit" signal on jack J1 will disable the action of the TAPE FEED switch. If the "inhibit" signal is not present then the TAPE FEED switch will be active. When the TAPE FEED switch is in either the FORWARD or REWIND position the "inhibit" signal cannot regain control until the switch is released to the AUTO position. With the mode switch in the SELF TEST position the high speed mode and external controls are disconnected. Start/stop and forward/reverse signals are then received from the self test logic board A1A5. Outputs from the control logic card control the forward and reverse solenoid drivers. the brake driver. provide a ready delay signal to the rewind speed control card, and provide a high speed mode signal (ADV and REW) to the servo amplifiers.

The logic circuits on the rewind speed control card A1A5 provide for the clearing of a high tension condition, provide for automatic tensioning of the tape after application of power, and provide a ready signal for a remote indication.

1-26. REWIND SPEED CONTROL. - In the rewind mode of operation one set of tape position sensors (either left or right) are switched out of the servo system control. The servo system is set to attempt to reach maximum speed in the desired direction by the control logic card. The sprocket hole signals are now sampled by the rewind speed control card and converted into a servo speed control signal. As the rewind speed increases from zero the sprocket hole signal will be balanced at a predetermined level, thereby holding the rewind to a speed of approximately 80 inches per second.

1-27. SELF TEST LOGIC. - Self test logic board A1A9 provides a means of checking the tape reader operation using a specially punched test tape. With the mode switch in the SELF TEST mode position, the test tape will operate the tape reader in a cycle of starts and stops in the forward direction and starts and stops in the reverse direction. This action exercises the tape reader dynamically, testing the systems listed in paragraph 1-19 except the rewind speed control. The self test logic responds to a combination of any odd numbered channel plus any even numbered channel to stop the tape on a sprocket hole. A timing circuit then resets and the tape reader starts again. Different combinations of even and odd channels are used on the test tape to test all of the channels. A hole on channels 2 and 8 actuates a forward/reverse flip-flop, changing the direction of tape motion.

1-28. - POWER SUPPLY. - The tape reader power supply A2 and regulator control board A1AO1 provide the required ac and dc voltages for the tape reader. The input power at 115 Vac, three-phase, 400 Hz

is connected from the power source through the circuit breaker A2S6 to the power transformers A2T1 and A2T2, and capstan motor A4B1.

Three-phase transformer A2T1 provides outputs of three-phase 9 Vac and three-phase 20 Vac. The 9 Vac is rectified by three-phase rectifiers A1A10CR3 through A1A10CR9 located on the regulator control board A1A10. The resulting dc output voltage is regulated by -6 volt regulator A1A10CR6 to supply -6 Vdc to the tape reader circuits.

1-29. The 20 Vac from A2T1 is rectified by three-phase rectifiers A2CR1 through A2CR6 located on the power supply. The rectifier output is the dc supply voltage for the reel drive motors (Vm), the brake electromagnetic actuators, and the drive solenoids (both +28 Vdc). The +28 Vdc transistor circuits are protected by thermal switch A2S1 which opens if the temperature inside the tape reader case becomes too high. The +28 Vdc is also used to supply the +12 volt series regulator A1Q12. The +12 volt output of A1Q12 is controlled by +12 volt regulator control A1A10CR1. The +12 volt regulated output is used to supply the various transistor circuits and also provides an input to the +5 volt series regulator A1Q13. The +5 volt output of A1Q13 is controlled by regulator control A1A10Q1 and supplies other transistor circuits.

1-30. A single phase of the three-phase input is used to supply transformer A2T2. The single-phase 5 Vac output from transformer A2T2 supplies the read head lamp DS1 and also supplies 5 Vac to rectifiers A1A10CR10 through A1A10CR13, located on the regulator control board A1A10. These rectifiers provide a dc voltage input to compensator amplifiers A1A10Q2 and A1A10Q3 which compensate the read amplifiers for variations in read head sensitivity and light source intensity.

1-31. DETAILED CIRCUIT OPERATION.

1-32. LIGHT SOURCE DS1 AND READ HEAD A3 (Refer to Figure 8-1). - Light source lamp DS1 operates directly from the 5 volt winding of transformer A2T2. The thermal constant of the lamp is relatively long, providing a very "smooth" light output at the read head with less than 5 percent ripple. The lamp is of the prefocused type and can be replaced without the need for any adjustment. An optics assembly consisting of two lenses forms an intense, long narrow beam of light on the read head cells. Shaping of the beam minimizes the cell-to-cell crosstalk. The beam is blocked by the tape except where the holes are punched. The light passing through the holes is converted to electric current pulses in the read head A3. The read head is a plug-in printed circuit board assembly consisting of nine closely matched sections of N/P silicon readout cells. Each cell generates at least 100 μA of current at nominal conditions. The cells are biased by approximately +0.45 volts from the read amplifier card to reduce cell leakage to a negligible level at high temperatures.

1-33. READ AMPLIFIER CIRCUIT CARDS A1A6, A1A7, AND A1A8 (Refer to figures 8-2 and 8-3). - Read amplifier No. 1 circuit cards are used for read head channels 1, 2, and 3 (A1A7), and read head channels 4, 5, and 6 (A1A6). Read amplifier No. 2 circuit card A1A8 is used for read head channels 7, 8, and the sprocket. Except for a change in bias resistor value for the sprocket channel, read amplifier No. 2 is identical to read amplifier No. 1, which is described in the following paragraphs.

1-34. The read amplifier circuit card consists of three identical channel amplifiers and detector circuits providing a square wave output for external circuits and for internal self test functions. One channel will be described, the others are identical.

1-35. The read head A3 supplies a negative waveform to the base bias circuit of input transistor Q1 when detecting light through a data hole punched in the tape. A dc bias for the read head of approximately 0.45 Vdc is supplied by voltage divider resistors R22 and R23. The positive base current into the base of the transistor is therefore reduced and the collector voltage rises to a minimum value of 2.7 volts. The collector voltage is then compared against a reference voltage on the non-inverting input of comparator A1. The voltage reference (approximately 2.5 volts) provides compensation for environmental temperature changes by supplying a voltage reference proportional to temperature and allow for variations in read cell efficiency. Compensations are also made for transient voltage variations and intensity variations of the light source due to ac ripple and line voltage changes.

1-36. When the collector voltage on transistor Q1 surpasses the reference voltage, the output of comparator A1 switches to a low state providing negative bias to inverter A4A. The 3.32K ohm resistor to -6 Vdc is used to provide current sinking capability for A1. The output of the inverter is therefore at a high state clamped to Vclamp through diode CR1. The high state is supplied by an internal collector resistor in A4A of 6000 ohms to +5 Vdc and an external pull up resistor of 4.64 X ohms to +12 Vdc. Positive feedback for A1 is provided by the 15.4K ohm resistor from the output to the non-inverting input. This provides hysteresis action whereby A1 will remain triggered even though the tape may have stopped close to the edge of a data hole. Data outputs to connector J1 are clamped and outputs provided to the self test card are inverted. Signal common on connector J1 is connected to dc common on the read amplifier.

1-37. SERVO INPUT CIRCUIT CARDS A1A2 AND A1A3 (Refer to Figure 8-8). - The servo input circuit card provides a pulse width modulated square wave output in response to the dc servo voltage from the tension arm potentiometer. Separate cards are used for the left and right servo signals. The servo system is enabled by a high logic level on P1-28 MALF. MALF is at a high level unless the upper or lower limit switches are actuated by a tension arm, except during the power turn on sequence. When power is turned on, MALF is low for approximately 2.0 seconds to allow the unit voltages to stabilize and then switches high for approximately 80 ms to allow the motors to create tape tension and bring up the tension arms. After this period MALF may be activated by the upper and lower limit switches. The tension arm is initially adjusted to operate in the center of the front panel cutout and at this point supplies approximately 2.6 volts on P1-18 SERVO IN. Any condition which changes the tape tension, such as initially starting, will cause the tension arm to swing from the null position. The swing causes the tap on the tension arm potentiometer to move, changing the divider resistance and de voltage on SERVO IN (approximately + 0.3 volt).

1-38. Sawtooth generator Q4 creates a sawtooth waveform by the charging and discharging of capacitor C7. The sawtooth is then current amplified by emitter follower Q3. The sawtooth is approximately 0.63 volt peak-to-peak across R18 and is impressed on two dc levels supplied by resistors R13, R21, R14, and RIB. Two reference levels are necessary to separate the sawtooth signal switching action at comparators A2 and A4. Resistor R21 is adjusted to vary the null region on which both windings of the reel motor may receive a small amount of power. The dc level shift on SERVO IN shifts the point on the sawtooth which the comparators switch. Referring to figure 1-5, a more positive servo signal switches comparator A2 on the negative peaks of the sawtooth. The width of the comparator output is dependent on where the dc level crosses the sawtooth. A higher servo voltage results in a wider pulse output. Comparator A4 produces an output when a lower servo signal voltage intercepts the positive peaks of the lower sawtooth signal. The separate outputs of the comparators are amplified and inverted to provide forward and reverse servo signals. The amount of power delivered to the reel motor depends on the width of the square wave. The direction of the reel motor depends on the winding energized by comparators A2 and A4.

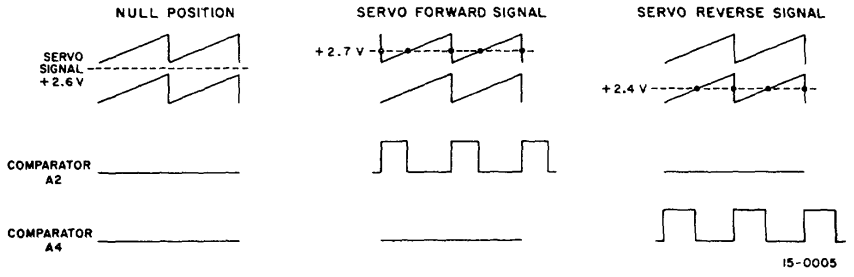


Figure 1-5. Servo Control Signal Waveforms

1-39. The SERVO IN analog signal is buffered by transistor Q1 and differentiated by capacitors C1 and C2 coupling the signal to transistor Q2. Transistor Q2 has a rc feedback network (R4 and C3) to provide high frequency attenuation of the signal coupled to comparators A2 and A4. This amplifier circuit makes the servo system responsive to the rate of change of tension arm position and provides for an anticipated acceleration of the reel motors. Capacitors C5 and C6 are used to limit the high frequency response of the system.

1-40. Gates A1C and A1B receive a low logic level from Pl-30 ADV (RE when the tape reader is in the high speed mode. This prevents the servo signal from passing through these gates since all three inputs must be at a high level in order to have an output. Only one servo input card will receive this signal, depending the desired direction of rewind. Servo input card A1A2 receives an ADV signal on P1-30 when tape is being wound on the right reel and servo input card A1A3 receives a REW signal on P1-30 when tape is being wound on the left reel. Gate A1A1 on the servo input card receiving ADV or REW also receives a high logic level from P1-34 ADV or REW. This high level and the high level from P1-36 STOP permits an output of gate A1A when high logic level is received on P1-32 REG. The REG input is derived from the sprocket signal through the rewind speed control card. During the rewind mode this signal controls the servo drive signal and the speed of the reel motors.

1-41. The servo card not receiving a high speed mode signal remains in the normal servo control mode. The tape reel motor is driven in response to the signal from the tension arm position sensor as in low speed operation. Therefore the reel motor helps to unwind the tape from the reel being emptied. A low level logic on P1-36 will stop the tape motion, while maintaining the tape reader in the high speed mode.

1-42. SERVO OUTPUT CIRCUIT CARD A1A1(Refer to Figure 8-9). - The servo output circuit card A1A1 consists of four identical emitter follower amplifiers Q1 through Q4. The emitter followers current amplify the servo signals from the servo input circuit card and supply their signal to the motor driver transistors located on component mounting plate assembly A1. The emitter follower bases are forward biased to the 28 Vdc supply, but with no servo signal a low level signal from the servo input circuit card prevents conduction. A high level servo signal on the input turns the emitter follower on. The emitter voltage is approximately 1.2 volts when loaded with the motor drive transistor.

1-43. REEL MOTOR DRIVERS (Refer to Figure 8-1). Right reel motor B1 is driven clockwise by driver Q4 and counterclockwise by driver Q5. Left reel motor B2 is driven counterclockwise by driver Q6 and clockwise by driver QT7. Diodes CR5, CR6, CR7, and CR8 aid in smoothing out the current pulses to the motor windings, as well as providing voltage transient suppression for the driver transistors. Diode CR9 provides a small amount of base-emitter bias to the driver transistors to insure non-conduction in the off condition.

1-44. CONTROL LOGIC CIRCUIT CARD A1A4 (Refer to Figure 8-5).- The control logic circuit card A1A4 accepts remote control signals, operational mode signals, high tension limit switch levels and logically combines these signals to provide forward and reverse solenoid signals, high speed signals, a brake signal, and a ready delay signal. The forward, reverse, and brake signals are coupled to their respective driver transistors located on component plate assembly A1. The ready signal is connected to the rewind speed control circuit card A1AS. The high speed signals are connected to the servo input cards. Control signals to the control logic card are switched by the mode switch. In the STRIP MODE and REEL MODE positions the signals originate from the remote equipment. In the SELF TEST mode the signals are originated in the self test card A1A9.

1-45. The forward solenoids are energized by a high level input signal at P1-29 which produces a high level output signal at P1-5 and P1-7. This is a result of three high level inputs at gate A3B. Pin 9 of A3B receives a high level through gates A1A and A1B from the high level forward signal at P1-29. Pin 10 of A3B receives a high level due to the low level start signal at P1-32. Pin 11 of A3B receives a high level signal from gate A3C. Pin 5 of A2D is a high level for reel mode operation and pin 4 receives a low level from gate ASA. Inputs to A9A are all high when monostable A2 is not triggered, the output of gate A5F is high, and P1-28, MALF is at high level. The monostable A7 is triggered when the tape reader is in the high speed mode and a stop command is received or when the tape reader is in the high speed mode and a low speed command is received while in the start condition. Gate A5F provides a high level output under the same input conditions as monostable A7. but without the delay. After the delay by monostable A7 this gate will "hold on" these conditions. MALF at P1-28 switches to a low level signal whenever a low or a high tension condition occurs, inhibiting both drive solenoids and the brakes from operating.

1-46. A reverse signal changes the level on P1-29 from high to low causing gate A3B to turn off the forward solenoid. Gate A3A then is enabled with a high level on pin 5. Pins 3 and 4 are at a high level and in parallel with gate A3B. This results in a high level at Pl-9 and P1-11 which turns on the reverse solenoid.

1-47. A stop signal is a high level at Pl-32 which places a low level at both A3A and A3B, de-energizing the forward and reverse solenoids, and places a high level at pin 1 of A3C energizing the brakes with a high level signal at P1-13 and P1-15.

Returning to the stop condition while in the high speed mode triggers the 120 ms delay monostable A7.

1-48. High speed operation is obtained with a high level signal on P1-30. Under a start command the effective "and" output of gates A5E and A5D is a high level. This high level places a low level on pin 3 of A3A and pin 11 of A3B thereby de-energizing the forward and reverse solenoids. This same high level is applied to pin 2 of gate A2A and pin 17 of gate A2B. With a forward high level signal on P1-29, pin 13 of gate A2B receives a high level signal thereby enabling gate A2B and providing a low level ADV signal to the servo system for a fast reel motor speed in the forward direction. A low level reverse signal at P1-29 enables gate A2A, providing a low level REW signal to the servo system for a fast reel motor speed in the reverse direction.

1-49. Operating in the self test or strip mode changes the high level on P1-30 to a low level, disabling gates A2A and A2B and preventing high speed operation. This low level also disables gates A5F and A9A as well as monostable A7. Gate A3C has a high level on pin 2 and receives a low level from the mode switch. The high level at pin 12 of A3C then enables gates A3A, A3B, and A3C to operate the forward solenoid, reverse solenoid, and brakes in response to self test or strip mode signals.

1-50. A high level ready-in signal is provided at P1-6 whenever gates A9B and A9C have high outputs at pins 6 and 12. These outputs will remain at a high level unless either of the following conditions exist:

a. Improper tape drive operation resulting in actuating the high tension limit switches will produce a high level at Pl-14 or P1-24 thereby enabling gates A9B or A9C.

b. A reel drive subsystem 220 ms time delay is in process thereby enabling gates A9B and A9C at pins 2 and 3.

1-51. REWIND SPEED CONTROL CIRCUIT CARD A1A5 (Refer to Figure 8-6). - The rewind speed control card contains circuits for detecting the sprocket hole signal rate during high speed operation and using these signals for servo system speed control. This card also contains additional control logic circuits for command input inhibiting, proper sequencing at power turn-on, tape reader operational status output and malfunction detection.

1-52. Low logic level sprocket pulses are received at P1-34. These pulses are inverted by gate A1A and coupled through C1 to the base of Q1. Gate A1A has an open circuit on pin 2 and is always a high level. The time constant of capacitor C1 and resistor R2 is small enough to provide a constant pulse width to transistor Q1 throughout the speed range of the tape reader. Negative pulse to Q1 back bias the base emitter junction. The collector voltage forward biases Q2. Transistor Q2 discharges capacitor C2 to approximately 0.5 volts through resistor R6 for every sprocket pulse. Capacitor C3 discharges at a slower rate thereby providing a dc level and an ac ripple to the non-inverting input, pin 2, of comparator A2. When the voltage falls below the fixed level on the inverting input, pin 3, the output of A2 switches to a low level. If the MALF signal from P1-22 is at a high level, the output of the comparator enables gates A1C and A1D providing a high level output at P1-20. This output controls the servo motor speed. Capacitor C5 across the input of comparator A2 is used for noise suppression. The ripple maintains the regulator output in the switching mode at 800 Hz.

1-53. The power turn-on sequencing circuits consist of active components Q4, A4, Q3 and A5. On power turn-on the input to the set terminal of flip-flop A4 is rising to a high level but remains at a low level for approximately 30 milliseconds due to the R13, C15 control of field effect transistor Q4. This delay assures flip-flop A4 of being set in a specific state each time the power is turned on.

1-54. At power turn-on, capacitors C11, C12, and C13 with resistor R16 present a negative pulse to the base of transistor Q3 for approximately 2 seconds. The negative pulse keeps transistor Q3 back biased with a high level collector voltage. After two seconds the set and clear terminals are at a high level enabling switching of the flip-flop A4 by the clock pulse transition from a high level to a low level. The pin 4 input is at a low level and the pin 12 input is at a high level which switches the flip-flop A4 to a cleared state (logic 0 at pin 6). When the collector of Q3 switches to a low level approximately 2 seconds after power turn-on, the negative pulse is coupled through C14 to pin 5 of gate A5D. The negative pulse forces this input of A5D to a low level for approximately 80 ms.

1-55. The output of A5D, a high level pulse $\overline{\text{MALF}}$, enables the servo system to pull up the tension arms and disengage the low tension limit switches. Disengaging the low tension limit switches place a high level on P1-15, CLEAR, resetting flip-flop A4 which maintains the high level MALF signal of P1-10 through A5A and A5B thereby permitting the tape reader to operate.

1-56. The tape reader operational status read output is a high level signal appearing at P1-5. This output will remain at a high level unless one or more of the following conditions exist:

a. A malfunction exists thereby exhibiting a high level input to the ready output gateA5Bat pin 10.

b. The reader is conditioned for self test mode. This is a wired "or" connection from the mode switch to P1-5.

c. The reader is not powered or has not completed the power turn-on sequencing.

d. The "set" terminal of flip-flop A4 has not received a high level ready-in signal from PI-9.

1-57. SELF TEST LOGIC CIRCUIT CARD A1A9 (Refer to Figure 8-4). - The self test logic circuit card provides self-programmed tape control of the tape reader start/stop, forward and reverse functions. This enables the tape reader to exercise the control circuits from a specially punched test tape. The test tape is illustrated in figure 1-6.

1-58. A change in the direction of the tape motion is initiated by a data hole appearing simultaneously in both channels 2 and 8. In the self test mode, mode switch S1 places a low level on pin 24 (SELF TEST). Gate A2A therefore puts a high level on the set terminal of flip-flop A4B enabling switching of the flip-flop by self test logic on the trigger input. Flip-flop A4B is initially set for forward tape motion. A data hole in channels 2 and 8 produces low levels at the inputs of A3B and A3C which enables gate A3D to change its output from a high to low level. The high to low level transition changes the state of the forward/reverse flip-flop A4B changing the direction to tape motion from forward to reverse. The next pair of data holes on channels 2 and 8 change the state of flip-flop A4B again to provide forward tape motion.

1-59. The tape motion is stopped by three holes appearing simultaneously; one odd numbered channel, one even numbered channel, and the sprocket. This information is stored in start/stop flip-flop A4A in such a way that the drive mechanism stops twice for any stop code. The first stop is the code itself and the second stop is on the first sprocket hole following the stop code. The two stops occur about 15 milliseconds apart and appear to be a single stop when observing the tape reader operation. Tape motion is automatically started again by a time delay circuit. A combination of any one odd numbered channel and any one even numbered channel disables gates A1A and A1B, placing a high level on pin 2 and a low level on pin 3 of the start/stop flip-flop A4A. The information is transferred by the high-to-low level transition of the leading edge of the sprocket pulse on pin 1 (trigger input). The low level sprocket signal disables gate A2B which enables gate A2C placing a low level on the base of Q1. Transistor Q1 turns off which allows capacitor C1 to charge to the point at which it triggers unijunction transistor Q2. Triggering Q2 into conduction causes a high level voltage across resistor R4 which is inverted by A2D. The low level on pin 4 of start/stop flip-flop A4A resets the flip-flop causing a low level on pin 5 which starts the tape reader again. If the tape reader does not stop on a sprocket hole, capacitor C1 does not have enough time to charge and therefore does not fire the unijunction. The flip-flop does not change states and the tape reader does not start.

1-60. POWER SUPPLY A2 (115 Vac, 400 Hz, Three-Phase) (Refer to Figure 8-10). - Three-phase 115Vac power is applied to power transformer T1 and fan B1 through CIRCUIT BREAKER POWER switch S6. The three-phase 20 Vac output of T1 is applied to three-phase rectifiers CR1 through CR6 to supply +28 Vdc. The +28 Vdc output is further applied through thermal switch S1 to series regulators A1Q12 and A1Q13 (on component mounting plate) to produce regulated outputs of +12 Vdc and +5Vdc. The regulated +5 Vdc is controlled by regulator control A10Q1. Thermal switch S1 protects the tape reader circuits from high temperature damage by opening at temperatures above 185°F and disconnecting the+28 volt supply.

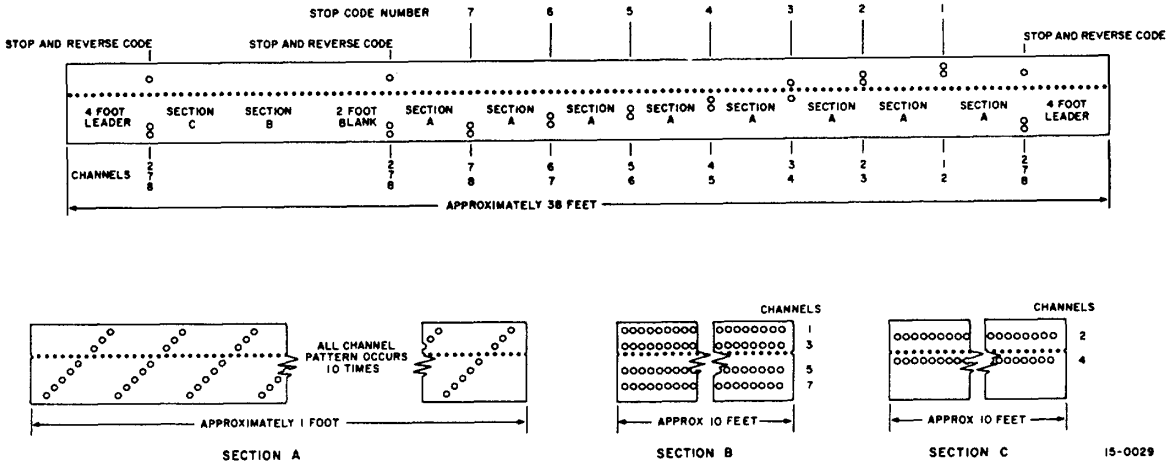


Figure 1-6. Self Test Tape

A second three-phase winding on transformer T1 supplies 9 Vac to three-phase rectifiers A1A10CR3 through A1A10CR9 producing an output of -6 Vdc. Transformer T2 is connected to one phase and the neutral of the three-phase power from S6 to supply 5 Vac to the light source DS1. The 5 Vac output also supplies rectifiers A1A10CR10 through A1A10CR13 producing a dc voltage input to compensator amplifiers A1A10Q2 and A1A10Q3. Any change in the ac output of transformer T2, which affects the light output of DS1, also changes the output of the compensator amplifiers. This lamp compensation voltage is connected to each of read amplifiers to correct for any variations in the hole signal levels due to a change in light intensity.

1-61. Deleted

1-62. Deleted

1-63. +5V REGULATOR CONTROL CIRCUIT CARD A1A10 (Refer to Figure 8-7). - Unfiltered full wave rectified +28 Vdc is supplied to the +5V regulator circuit card on pin 27. This voltage is also supplied to the collector of +12V regulator A2Q1 through resistor A2R1. It is also filtered and reduced in voltage by R1, C1, and R2 for regulation to +13 Vdc by zener diode CR1. The +13 Vdc is supplied to the base of A2Q1 for series voltage regulation. The emitter of A2Q1 is the +12 Vdc supply point for the tape reader and supplies current to Q1, used to regulate the current of +5V regulator A2Q2. Plus 5 Vdc is fed back to the base of Q1 through dividers R4, R6, and R7. High voltage levels on the +5 Vdc line increase the current into the base of Q1 reducing the base current of A2Q2 and thereby reducing the +5 Vdc output. Low voltage levels are compensated in a similar but reverse sequence.

1-64. When a three-phase power supply is used, three-phase 9 Vac is supplied on pins 28, 32, and 34. The ac is rectified by the fullwave rectifier consisting of diodes CR3, CR4, CR5, CR7, CR8, and CR9. The dc output is regulated to -6 Vdc by zener diode CR6.

1-65. Deleted

1-66. The reference voltage for the read amplifier comparators is driven by a compensation network supplied by the 5 Vac used to power lamp DS1. The ripple, time constant and phase shift of the circuit is designed to match the thermal time constant of the lamp. The compensator circuit changes the reference voltage at the same rate that the lamp output intensity changes. The absolute output voltage of the compensator increases approximately at the same percentage value that the cell output current increases as a result of increased lamp output. The amplifier reference voltage thus tracks the lamp intensity both up and down, and thereby provides reliable reading performance. The thermal coefficient of the compensating circuit increases the reference voltage as the ambient temperature rises to allow for increased cell output efficiency. The amount of ripple to the output transistors Q2 and Q3 is controlled by R11, C5 and C7 to enable the reference voltage to be in phase with the cell ripple current.

CHAPTER 2
SPECIAL TOOLS, REPAIR TOOLS, AND TEST EQUIPMENT

2-1. SPECIAL TOOLS.

2-2. Two short test point plugs are supplied with the tape reader for making measurements at the circuit card test points. They are located under the circuit card panel on the rear cover of the tape reader

CAUTION

Do not use longer plugs as they may cause a short circuit to the circuit card components under the test point.

2-3. TEST EQUIPMENT.

2-4. The test equipment listed in table 2-1 is required for the maintenance of the tape reader.

2-5. POWER SUPPLIES.

2-6. The power supplies required to operate the tape reader and the tape reader subassemblies independently are listed in table 2-2. If the listed power supplies or equivalents, are not available for the test setup of figure 6-0A, it may be possible to fabricate a cable to obtain these voltages from the associated equipment. Refer to table 3-1, table 3-2, and figure 6-0A for connection details.

2-7. TEST SETUPS AND REPAIR TOOLS.

2-8. The parts required to build the test setups in figures 6-0A through 6-0N are listed in table 2-3 through 2-11. Tape reader repair tools are listed in table 6-7.

Table 2-1. Test Equipment Required

U.S. ARMY ELECTRONICS COMMAND TYPES	COMMERCIAL EQUIVALENTS
Oscilloscope AN/USM-281	Oscilloscope, Tektronix Model 534
--	Preamplifier, Oscilloscope, Tektronix Type CA
--	Low Capacity Probe (10X Attenuation), Tektronix Type P6006
--	Banana Plug Tip (for P6006), Tektronix Type 134-0013-00
Multimeter AN/USM-223	Multimeter, Simpson Model 260
Counter, Electronic Digital AN/USM-207	Electronic Frequency Counter, Hewlett-Packard Model 5532
--	or
--	Square Wave Generator, Hewlett-Packard Model 209A
	Feeler Gauge, up to 0.025 inch
Digital Voltmeter Model X-2	--
--	Micrometer, 0-1 inch
--	Spring Scale, 0-5 pounds
--	Spring Scale, 0-2 pounds
	Spring Scale, 0-16 ounces
Took Kit, Electronic Equipment TK-105/G	--

Table 2-2. Test Setup Power Supplies Required

TEST SETUP FIGURE NO.	DESCRIPTION
6-0A 6-0C 6-0N	3-phase Ac Inverter Power Supply (115 ±2V, 400 ±8 Hz, 200-400 VA, 48V input) (Military equivalent: Motor Generator PU-545A)
6-0A 6-0C 6-0E 6-0F 6-0G 6-0J	5 Vdc Regulated Power Supply (240 mA max.)
6-0C 6-0E 6-0G 6-0J 6-0M	12 Vdc Regulated Power Supply (250 mA max.)
6-0F 6-0L 6-0M	28 Vdc Unregulated Power Supply (2 amperes max.)
6-0G 6-0J	6 Vdc Regulated Power Supply (220 mA max.)

Table 2-3. Punched Tape Reader Test Setup (Fig. 6-0A), Parts List

REF DESIG	DESCRIPTION	QTY
CR1	Diode, 1N4454	1
CR2	Diode, Zener 1N747	1
P1	Connector, multipin, MS3126F14-19S	1
P2	Connector, multipin, MS3126F16-8S	1
R1	Resistor, fixed, 560 ohm, 1/2 W	1
R2	Resistor, fixed, 10 ohm, 1/2 W	1
R3	Resistor, fixed, 10K ohm, 1/2 W	1
R4	Resistor, fixed, 500 ohm, 1 W	1
S1	Switch, 3 PST	1
S2	Switch, rotary, single pole, 10 position	1
S3	Switch, SPDT, center off	1
S4 thru S7	Switch, SPST	4
TP1 thru TP4	Jack, test point	4
-	2.5 mil, aluminum mylar tape, 30-inches long	1

Table 2-4. Read Amplifier Circuit Card Test Setup (Fig. 6-0C), Parts List

REF DESIG	DESCRIPTION	QTY
C1	Capacitor, 1000 μF, 15 V, electrolytic	1
CR1	Rectifier, full-wave, Westinghouse MP-010-ABA	1
CR2	Diode, 1N483B	1
CR3	Diode, Zener, 5 W, 1N5339B	1
J1	Connector, multipin, Elco 6303	1
R1, R3,	Resistor, fixed, 470 ohm, 1/2 W	2
R2, R4	Resistor, fixed, 10K ohm, 1/2 W	2
R5	Resistor, fixed, 120K ohm, 1/2 W	1
R6	Resistor, fixed, 56 ohm, 1 W	1
S1	Switch, rotary, 3 pole, 3 position	1
T1	Transformer, power step-down, 115-10 Vac Knight 54E4734	1
TP1 thru TP3	Jack, test point	3

Table 2-5. Self Test Logic Circuit Card Test Setup (Fig. 6-0E), Parts List

REF DESIG	DESCRIPTION	QTY
C1	Capacitor, .01 μF, 100 V	1
J1	Connector, multipin, Elco 6303	1
Q1	Transistor, unijunction, 2N2646	1
R1, R2, R3, R6	Resistor, fixed, 470 ohm, 1/2 W	4
R4	Resistor, fixed, 33K ohm, 1/2 W	1
R5	Resistor, variable, 50K ohm	1
R7	Resistor, fixed, 47 ohm, 1/2 W	1
S1	Switch, rotary, 3 pole, 7 position	1
TP1	Jack, test point	1
U1	Integrated Circuit, bistable multivibrator, type 9945	1

Table 2-6. Control Logic Circuit Card Test Setup (Fig. 6-0F), Parts List

REF DESIG	DESCRIPTION	QTY
J1	Connector, multipin, Elco 6303	1
R1 thru R6	Resistor, fixed, 470 ohm, 1/2 W	6
R7-R8	Resistor, fixed, 680 ohm, 2W	2
R9	Resistor, fixed, 300 ohm, 5 W	1
R10, R11	Resistor, fixed, 180 ohm, 1/2 W	2
R12	Resistor, fixed, 68 ohm, 2 W	1
S1 thru S3	Switch, SPST	3
S4	Switch, rotary, 2 pole, 4 position	1
TP1 thru TP10	Jack, test point	10

Table 2-7. Rewind Speed Control Circuit Card Test Setup (Fig. 6-0G), Parts List

REF DESIG	DESCRIPTION	QTY
C1	Capacitor, .01 µF, 100 V	1
CR1	Diode, 1N483B	1
J1	Connector, multipin, Elco 6303	1
Q1	Transistor, unijunction, 2N2646	1
R1, R2, R3, R6	Resistor, fixed, 470 ohm, 1/2 W	4
R4	Resistor, fixed, 33K ohm, 1/2 W	1
R5	Resistor, variable, 50K ohm	1
R7	Resistor, fixed, 47 ohm, 1/2 W	1
R8	Resistor, fixed, 10K ohm, 1/2 W	1
S1, S2	Switch, SPDT, center off	2
S3	Switch, rotary, 2 pole, 4 position	1
S4	Switch, 4 PDT	1
S5	Switch, SPST	1
TP1 thru TP4	Jack, test point	4
U1	Integrated circuit, bistable multivibrator, type 9945	1

Table 2-8. Servo Input Circuit Card Test Setup (Fig. 6-0J), Parts List

REF DESIG	DESCRIPTION	QTY
J1	Connector, multipin, Elco 6303	1
R1	Resistor, fixed, 15K ohm, 1/2 W	1
R2, R3	Resistor, fixed, 250 ohm, 1/2 W	2
R4	Resistor, fixed, 470 ohm, 1/2 W	1
R5, R6	Resistor, fixed, 47 ohm, 1/2 W	2
R7	Resistor, fixed, 220 ohm, 1/2 W	1
R8	Resistor, variable, 500 ohm	1
S1	Switch, rotary, single pole, 4 position	1
S2	Switch, rotary, 2 pole, 3 position	1
S3	Switch, SPDT, center off	1
TP1 thru TP3	Jack, test point	3

Table 2-9. Servo Output Circuit Card Test Setup (Fig. 6-0L), Parts List

REF DESIG	DESCRIPTION	QTY
CR1	Diode, 1N1124	1
J1	Connector, multipin, Elco 6303	1
R1 thru R4	Resistor, fixed, 61.9 ohm, 30 W	4
S1	Switch, rotary, single pole, 4 position	1
TP1 thru TP5	Jack, test point	5

Table 2-10. Power Regulator Circuit Card Test Setup (Fig. 6-0M), Parts List

REF DESIG	DESCRIPTION	QTY
C1	Capacitor, 1300 µF, 25 Vdc, electrolytic	1
J1	Connector, multipin, Elco 6303	1
Q1	Transistor, 2N1490	1
R1	Resistor, fixed, 25 ohm, 1/2 W	1
R2	Resistor, fixed, 100 ohm, 1/2 W	1
R3	Resistor, fixed, 820 ohm, 1/2 W	1
R4	Resistor, fixed, 1K ohm, 1/2 W	1
S1	Switch, SPDT	1
T1	Transformer, power step-down, 115-5 Vac, Triad FX7	1
T2	Transformer, power step-down, 115-9 Vac, Knight 54E4734	1
TP1 thru TP4	Jack, test point	4

Table 2-11. Power Supply Test Setup (Fig. 6-0N), Parts List

REF DESIG	DESCRIPTION	QTY
J1	Connector, multipin, Winchester MRA20P	1
P1	Connector, multipin, MS3126F16-8S	1
R1	Resistor, fixed, 30 ohm, 50 W	1
R2, R3	Resistor, fixed, 60 ohm, 30 W	2
R4 thru R6	Resistor, fixed, 90 ohm, 2W	3
R7, R8	Resistor, fixed, 5 ohm, 10 W	2
S1	Switch, rotary, 2 pole, 6 position	1
TP1 thru TP4	Jack, test point	4

CHAPTER 3
INSTALLATION

3-1. GENERAL.

3-2. The punched tape reader unit is designed for field use in the transit case, therefore installation procedures are not applicable. The power cable to connect the tape reader unit to the associated equipment is located under the upper cover of the transit case. The power cable is approximately 6 feet long.

Table 3-1. Power Connector Jack J2 Details for 400 Hz, Three-Phase

TYPE: MS3120F14-19P **MATING CONNECTOR: MS3126F14-19S**	
PIN NO.	**FUNCTION**
A	115/200 Vac, 400 Hz, Phase A
B	115/200 Vac, 400 Hz, Phase B
C	115/200 Vac, 400 Hz, Phase C
D	Spare
E	Spare
F	Spare
G	Chassis Ground
H	Neutral

Connector P1 connects to J2 on the subpanel and connector P2 connects to the power connector on the associated equipment. The signal cable and connectors are not provided with the tape reader unit. This cable will require local fabrication.

3-3. Connector pin designations, functions, and connector types for connectors J1 and J2 on the transit case subpanel are listed in tables 3-1 and 3-2. The same pin designations and functions are used in the power cable connectors and must be used in the fabricated signal cable.

3-4. POWER REQUIREMENTS.

3-5. The punched tape reader unit input power requirements are 115 Vac, 400 Hz, three-phase, 220 watts maximum.

Table 3-2. Signal Connector J1 Details

TYPE: MS3120F14-19P **MATING CONNECTOR: MS3126F14-19S**	
PIN NO.	**FUNCTION**
A	Channel 1
B	Channel 2
C	Channel 3
D	Channel 4
E	Channel 5
F	Channel 6
G	Spare
H	Shield Ground
J	Forward/Reverse (+)
K	Stop/Start (+)
L	High/Low (+)
M	Ready Output
N	Inhibit/Inhibit (+)
P	Sprocket
R	Channel 7
S	Channel 8
T	+5 Vdc Data Clamp
U	Data Clamp Voltage
V	Channel Signal Common

CHAPTER 4
OPERATING INSTRUCTIONS

4-1. INTRODUCTION.

4-2. This section contains information necessary for proper operation of the tape reader. Included in this section are equipment turn-on, equipment turnoff, tape installation, and operating procedures.

4-3. OPERATING CONTROLS.

4-4. Table 4-1 lists the tape reader and the remote control signals used in normal operation. Figure 4-1 illustrates the tape reader front panel and location of controls.

Table 4-1. Tape Reader Controls

CONTROL	REF DESIG	DESCRIPTION
Mode Switch STRIP MODE- REEL MODE- SELF TEST	S1	In STRIP MODE position, reel drive system and interlocks are disconnected. Tape reader will read strips or loops of tape. In REEL MODE position, reel drive system is powered. Tape reader will read from tape on reels. In SELF TEST position, reel drive system is powered but remote control circuits are disconnected. Tape reader will read from a test tape on reels as an exercise to test all tape reader functions.
TAPE FEED Switch	S7	Three position spring loaded toggle switch, normally in center position. In AUTO position (center) tape reader is controlled by remote circuits. In REWIND position remote circuits are disconnected and tape reader transports tape in reverse at normal speed. In FORWARD position remote circuits are also disconnected and tape reader transports tape forward at normal speed. **NOTE** **If an "inhibit" signal is present at jack J1 while the TAPE FEED switch is in the AUTO position, the REWIND and FORWARD positions of the switch are disabled.**
CIRCUIT BREAKER POWER Switch	S6 (CB)	Controls 115 Vac power for tape reader. Disconnects power if overload occurs.
Forward/Reverse (External Equipment Control)	- -	Tape reader will drive tape forward or in reverse in accordance with start/stop signals.
Stop/Start (External Equipment Control)	- -	Tape reader will start or stop driving in direction set by forward/reverse command.
High/Low (External Equipment Control	- -	Tape reader will drive tape at high or low speed in accordance with forward/reverse and start/stop signals.

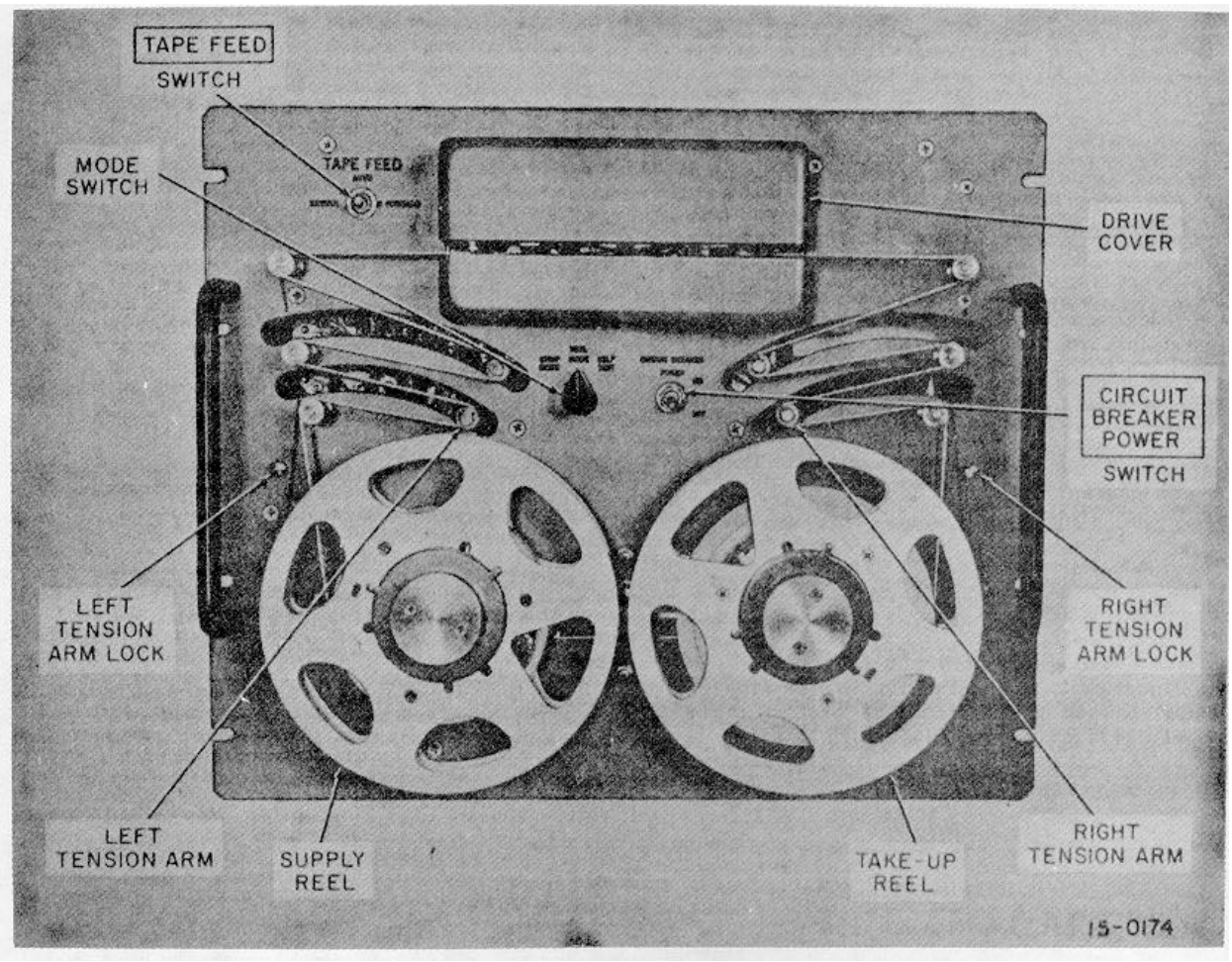


Figure 4-1. Tape Reader Front Panel

4-5. INTERLOCK CIRCUITS.

4-6. Tape tension arms actuate limit switches when tape is either significantly above or below normal tension. When either of these conditions occur the tape transport activities are stopped. A high tension limit condition is reset by eliminating the cause of the high tension and then setting the CIRCUIT BREAKER POWER switch to OFF and back to ON or by causing a momentary low tension limit condition. A low tension limit condition is reset by eliminating the cause of the low tension or by setting CIRCUIT BREAKER POWER switch to OFF and back to ON.

4-7. PRELIMINARY ADJUSTMENTS.

4-8. No preliminary adjustments are required. The tape reader is ready to operate 2 seconds after power is applied, assuming that a tape has already been installed.

4-9. EQUIPMENT STARTING AND STOPPING.

4-10. Set the CIRCUIT BREAKER POWER switch to ON to start the tape reader. Set this switch to OFF to stop the tape reader.

4-11. TAPE INSTALLATION,

4-12. TAPE REELS.

4-13. Turn CIRCUIT BREAKER POWER switch to OFF and mode switch to REEL MODE. Push left tension arm to end of panel cutout nearest the handle. Press in on left tension arm lock to lock arm in place. Lock right tension arm in a similar manner. Mount the full supply reel on the left reel hub as shown in figure 4-1 and pull off about three feet of tape. Hold a 12-inch section of tape tightly between the hands and slide the tape into the drive cover slot being sure that the tape is fully inserted

between the drive capstans, read head and brakes. Pull approximately four feet of tape through the slot and wind the tape on the take-up reel as shown in figure 4-1. Thread the tape around the left and right tension arms as shown by the front panel markings and in figure 4-1. Push left and right tension arms to end of panel cutout nearest handle to release tension arm lock; release tension arm gently to the unlocked position. Turn CIRCUIT BREAKER POWER switch to ON. Tension arms will apply tension to tape and tape brakes will be energized. The tape reader is now ready to be operated. A forward signal by the remote control will transport the tape from the supply reel to the take-up reel.

4-14. TAPE STRIPS OR LOOPS.

4-15. Turn CIRCUIT BREAKER POWER switch to OFF and mode switch to STRIP MODE. Hold a 12-inch section of the tape tightly between the hands and slide the tape into the drive cover slot as was done previously for reel stored tape. Ends of tape strips may be threaded around upper idler on each side of front panel and then allowed to fall straight down. Do not allow tape to lay on floor. Loops of tape are installed in a similar manner. Loops must be long enough to fit around drive cover without binding. Longer tape loops may be threaded around the left and right idler wheels. Turn CIRCUIT BREAKER POWER switch to ON. Tension arms are not operative in the strip mode. Tape reader is now ready to be operated. A forward signal by the remote control will transport the tape from left to right (viewing panel from front).

4-16. OPERATING THE TAPE READER.

4-17. The tape reader is normally operated by signals from remote equipment. The tape is transported in forward or reverse to read the information punched into the tape and produce corresponding electrical outputs. The mode switch is set to REEL MODE when reels of tape are to be read and set to STRIP MODE when strips or loops are to be read. The tape may be transported by local control through the use of the TAPE FEED switch. This spring loaded switch may be set to FORWARD or REVERSE disconnecting the remote signals and transporting the tape in the desired direction.

4-18. The tape reader is operated in the self test mode by setting the CIRCUIT BREAKER POWER switch to OFF and installing the test tape. Set the mode switch to REEL MODE. Set CIRCUIT BREAKER POWER switch to ON and set mode switch to SELF TEST. Results of self testing are contained in paragraph 6-54 of Chapter 6, Troubleshooting and Repair.

CHAPTER 5
PERIODIC INSPECTION, MAINTENANCE AND LUBRICATION

5-1. INSPECTION.

5-2. Inspect the tape reader for obvious signs of wear such as unusual noises, sluggish operation, or loose components. Inspection should be accomplished during the periodic cleaning described in para. 5-7.

5-3. Use the elapsed time meter to determine when to perform periodic maintenance.

5-4. Periodic maintenance is limited to the following:

a. Replacement of read head lamp after 2000 hours of tape reader operation.

b. Cleaning of tape path after 8 hours of tape reader operation.

5-5. Prepare the tape reader for maintenance and cleaning by turning the power off and removing the tape from the drive mechanism. It is not necessary 0o remove the tape from the reels.

5-6. Replacement of the read head lamp is accomplished by removing the drive mechanism cover and the lamp, installing a new lamp, and reinstalling the drive mechanism cover.

5-7. Cleaning of the tape path is accomplished by using a clean, lint free twill cloth or brush. Whenever necessary, the cloth or brush is to be moistened, not wet, with the specified cleaning solution. Use care with cleaning solutions to prevent possible damage to protective finishes. Remove the drive mechanism cover and proceed as follows:

WARNING

Most cleaners are inflammable. Do not use them near open flames or in a vicinity of unprotected electrical equipment. Make certain that ventilation is adequate.

a. Remove read head and wipe clean with a lint free cloth moistened with isopropyl alcohol, TT-I-735 or equivalent. Do not reinstall the read head until the bottom of the optic assembly has been cleaned.

CAUTION

Grasp read head by the circuit card edges to remove. Do not hold by glass photocell cover.

b. Clean brake shoes, electromagnetic actuators, and tape guides with a lint free cloth, approximately 16 inches long and 2 inches wide, moistened with isopropyl alcohol, TT-I-735 or equivalent. Insert the cloth through the drive mechanism and slide back and forth across the tape contact points until clean.

c. Clean the capstans, pressure rollers, and tape rollers with a lint free cloth, moistened with isopropyl alcohol, TT-I-735 or equivalent. In order to clean the complete tape surface of the capstans and pressure rollers, manually turn each and wipe clean.

d. Clean the top part of the optic lens and the incandescent lamp with a lint free cloth, moistened with isopropyl alcohol, TT-I-735 or equivalent. Clean the bottom part of the optic assembly with a soft brush moistened with isopropyl alcohol, TT-1-735 or equivalent.

5-8. LUBRICATION.

5-9. Periodic lubrication of this equipment is not necessary. All bearings are sell-lubricating and need no additional lubricants.

CHAPTER 6
TROUBLESHOOTING AND REPAIR

6-1. GENERAL.

6-2. This chapter contains test tables for the complete tape reader in the transit case, the tape reader out of the transit case, for the circuit cards, and for the power supply. The test table for the tape reader out of the transit case also includes troubleshooting procedures to aid in identifying defective subassemblies and front panel components. Also included in this chapter are mechanical and electrical alignment procedures.

6-3. TROUBLESHOOTING AND TEST TABLES.

6-4. The need for troubleshooting a tape reader usually arises from the notice of a system malfunction. This malfunction should be localized to some major unit. If the tape reader is indicated, then the tape reader (in transit case) can be removed from the system and tested using the procedures of table 6-1 (also see figure 6-0). The tests of table 6-1 primarily determine whether the tape reader will respond to all command signals and also if the transit case wiring and components are satisfactory. The transit case can be checked completely by continuity measurements (see figure 8-0). If the trouble does not appear in the transit case, then the tape reader should be removed and tested using the procedures of table 6-2.

6-4.1 Table 6-2 provides data to determine if the tape reader is operating properly and to provide troubleshooting data for defective components and subassemblies. When a subassembly is indicated as a fault, replace the subassembly with a unit known to be in good operating condition and repeat the test. If a spare subassembly is not available, then the subassembly must be tested using the subassembly tests, tables 6-3 through 6-5E, to determine if the subassembly is operating correctly. These tests have been written assuming a technician would start with step 1 and proceed through the table until the trouble is found. However, as a technician gains experience with the equipment, certain symptoms may be recognized as trouble in a specific area.

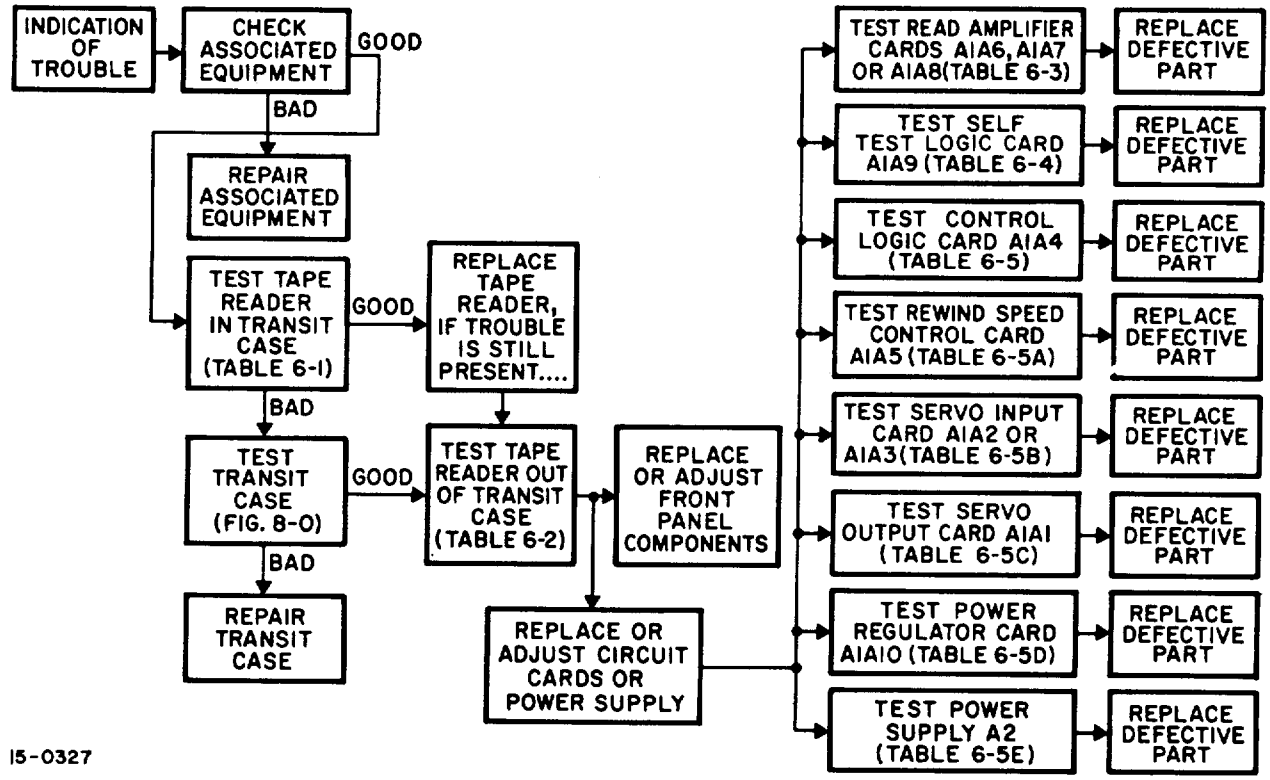


Figure 6-0. Tape Reader Troubleshooting Flow Diagram

Therefore, the tests have been arranged in the following groups to aid in this type of troubleshooting.

STEPS (TABLE 6-2)	SUBJECT
1-19	Power Distribution
20-23	Mechanical
24-31	Brakes
32-44	Servo System
45-54	Tape Drive
55-58	Tape Speed
59-60	Power Regulator
61-64	Data Outputs
(See para 6-54)	Self Test

6-4.2 Defective cards and cards that are suspected as defective are tested using the procedures of tables 6-3 through 6-5D. The power supply is tested using the procedures of table 6-5E. Troubleshooting to the individual parts must be done by obtaining a thorough understanding of the principles of operation in Chapter 1 and applying these principles to the test results of these tables. When the defective part is replaced, the subassembly should pass all the tests.

6-4.3 After repairs, when the tape reader is replaced in the transit case, the tests of table 6-1 should always be performed to insure that the equipment has been repaired and reassembled correctly.

6-4.4 These tables do not include possible operator errors considered as "failures, " such as control switches in the wrong positions or disconnected connectors. Broken wires are not listed as possible failure modes because they are applicable to almost all steps, are normally self-evident, and are easily checked by continuity.

NOTE

Test point TP1 is at the top of each circuit card.

CAUTION

Turn off tape reader power before removing or replacing cards.

6-4.5 Table 6-5F provides a summary of the voltages or waveforms that are found at the test points of circuit cards A1A1 through A1A10. These voltages or waveforms can be found when the circuit cards are operating in the tape reader or in a test setup. Specific operating conditions, if any, are indicated in the remarks column.

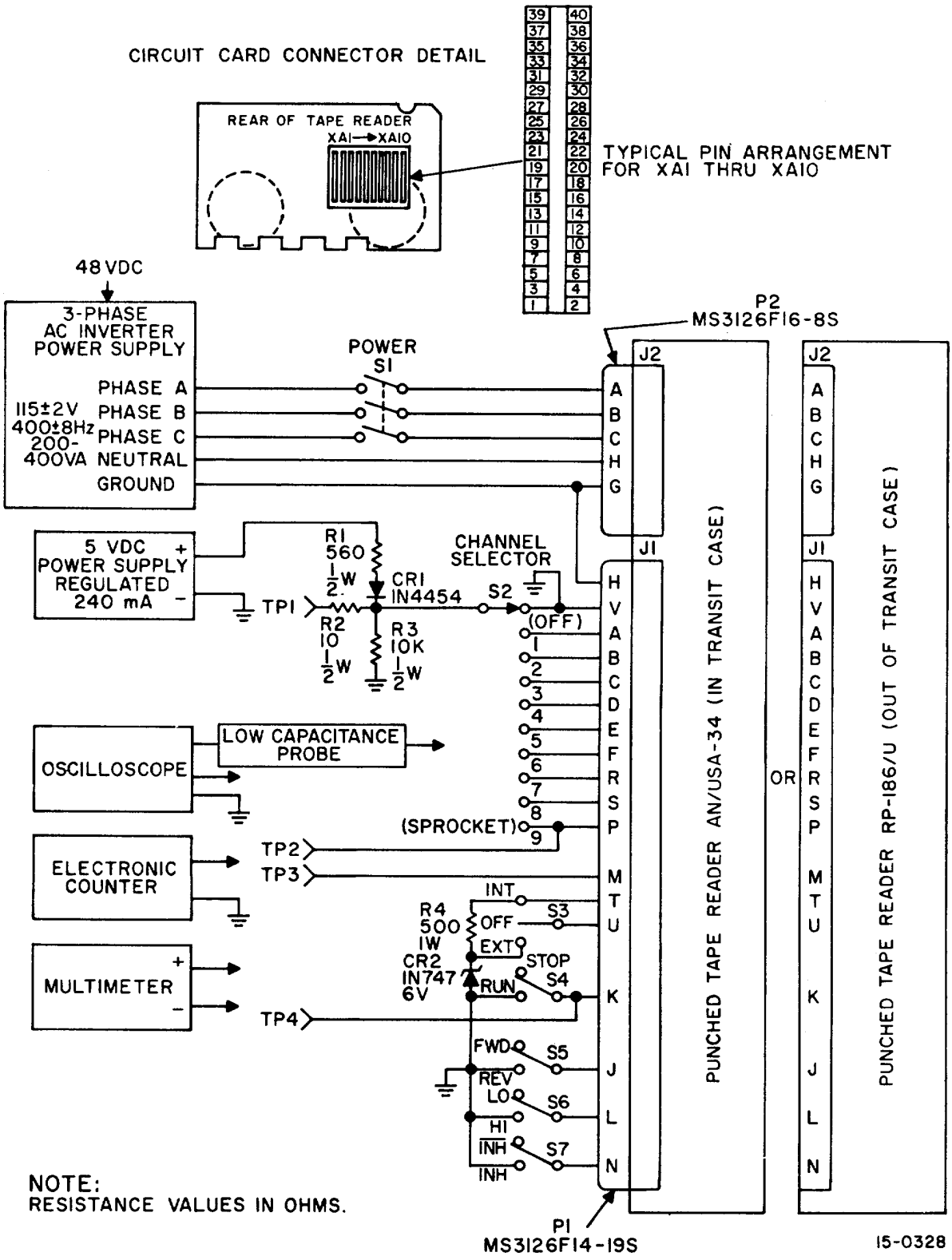


Figure 6-0A. Punched Tape Reader Test Setup

Table 6-1. Performance Test Standards, Punched Tape Reader Mounted in Transit Case

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1	Connect punched tape reader to test setup as shown in figure 6-0A. Set switches as follows: Power, S1, open Channel selector, S2, off Internal-external, S3, off Run-stop, S4, open Forward-reverse, S5, open High-low speed, S6, open Inhibit-inhibit, S7, open		Operate CIRCUIT BREAKER POWER switch to OFF and mode switch to REEL MODE.	
2	Turn on power supply and test equipment. Allow 10 minute warmup for oscilloscope.		Load test tape.	
3	Apply input power adjusted to 115 ± 2V, 400 ± 8 Hz. Close power switch S1.			
4			Operate CIRCUIT BREAKER POWER switch to ON.	Reader is in operating condition after approximately 2 seconds (tension arms move to approximate center of panel cutouts). Elapsed time meter operates. Air exhaust can be felt at front duct.
5	Set switch S4 to run and observe results. Then set switch S4 to stop.			Tape reels rotate clockwise.
6	Set switch S5 to reverse. Set switch S4 to run and observe results. Then set switch S4 to stop .			Tape reels rotate counter-clockwise.
7	Set switch S5 to forward. Set switch S6 to high speed. Set switch S4 to run and observe results. Then set switch S4 to stop .			Tape reels rotate clockwise at high speed.
8	Set switch S6 to low speed. Set switch S7 to inhibit. Set switch S4 to run and observe results. Then set switch S4 to stop and switch S7 to inhibit.			Tape reels do not rotate.

Table 6-1. Performance Test Standards, Punched Tape Reader Mounted in Transit Case (Contd)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
9	Connect electronic counter input to test point 2. Operate frequency. switch S2 to sprocket position (9). Set switch S4 to run .	TP2		Tape reels rotate clockwise. 420 ± 20 Hz output
10	Set switch S5 to reverse. clockwise. 420 ± 20 Hz output frequency .	TP2		Tape reels rotate counter-
11	Set switch S6 to high speed .	TP2		800 ± 80 Hz output frequency.
12	Set switch S4 to stop. Set switch S5 to forward. Set switch S4 to run. frequency .	TP2		Tape reel stops, tape reel rotates clockwise at high speed. 800 ±80 Hz output
13	Connect oscilloscope probe to test point 1. Set switch S3 to internal. Operate channel selector switch S2 to positions 1 through 9 .	TP1		Reel continues to run at high speed. +5.5 ± 0.5V for logic 1 level of pulse at each switch position.
14	Set switch S3 to external. Set channel selector switch S2 to positions 1 through 9 .	TP1		+4.0 ± 0.5V for logic 1 level of pulse at each switch position.
15	Set switch S3 to off. Set switch S4 to stop.		Operate CIRCUIT BREAKER POWER switch to OFF for at least 5 seconds .	Tape stops.
16	Connect oscilloscope probe to test point 3.	TP3	Operate CIRCUIT BREAKER POWER switch to ON.	+5.5 ±0.5 Vdc when tension arms come up.

Table 6-2. Punched Tape Reader Tests and Troubleshooting (Tape Reader Out of Transit Case)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1	Remove and disconnect tape reader from transit case. (Refer to para. 6-9.1.) Remove rear cover (para. 6-16a). Connect tape reader to test setup as shown in figure 6-0A. Set switches as follows: Power, S1, open Channel selector, S2, off Internal-external, S3, off U Run-stop, S4, open Forward-reverse, S5, open High-low speed, S6, open Inhibit-inhibit, S7, open		Operate CIRCUIT BREAKER POWER switch to OFF and mode switch to REEL MODE. Remove all circuit cards from the rear of the reader.	
2	Turn on power supply and test equipment. Allow 10 minute warmup for oscilloscope .			
3	Apply input power adjusted to 115 ±2V, 400 i8 Hz. Close power switch S1 .		Operate CIRCUIT BREAKER POWER switch to ON.	
4	Connect negative lead of multimeter to terminal post E18 on upper right inside corner of component plate assembly. Set multimeter for positive dc measurement. Connect positive lead to points of test .	A1XA3-16, A1XA10-27 (fig. 6-0A)		25 Vdc minimum. If unsatisfactory, proceed to step 5. If satisfactory, proceed to step 6.
5				If 25 Vdc is low or missing, measure for 115 t2 Vac between A2TB1-4 and the following terminals: A2TBl-1 (phase A) A2TB1-2 (phase B) A2TB1-3 (phase C) If any voltage is low or missing, replace CIRCUIT BREAKER POWER switch S6. If primary power is satisfac-tory, remove power supply A2 and test power supply per table 6-5E.

Table 6-2. Punched Tape Reader Tests and Troubleshooting (Tape Reader Out of Transit Case) (Contd)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
6		A1Q1 thru A1Q11 collectors (cases)		25 Vdc minimum. If unsatisfactory, check transistors.
7		A1Q12		25 Vdc minimum. If unsatisfactory, check A2R1 and transistor .
8	Close power switch S1. Connect multimeter positive lead to points of test.	A1XA2-5 A1XA3-5 A1XA5-8 A1XA6-6 A1XA7-6 A1XA8-6	With power switch S1 open, install power regulator circuit card A1A10.	+11 to +13.5 Vdc. If unsatisfactory, check A1Q12 and A1Q13. If transistors are not faulty, remove power regulator card A1A10 and test per table 6-5D. Check continuity per figure 8-13 .
9		A1XA2-40 A1XA3-40 A1XA4-40 A1XA5-40 A1XA6-40 A1XA7-40 A1XA8-40 A1XA9-40		+4.5 to +5.5 Vdc. If all readings are unsatisfactory, check A1Q13. If only last four readings are unsatisfactory, check A1L2. If transistors and A1L2 are not faulty, remove power regulator card A1A10 and test per table 6-5D. Check continuity per figure 8-13.
10		A1XA6-17 A1XA7-17 A1XA8-17		+2 to +4 Vdc. If unsatisfactory, remover power regulator card A1A10 and test per table 6-5D. Check continuity per figure 8-13.
11	Set multimeter for negative dc measurement.	A1XA2-15 A1XA3-15 A1XA5-12 A1XA6-15 A1XA7-15 A1XA8-15		-5 to -6.5 Vdc. If unsatisfactory, either power supply A2 or power regulator card A1A10 is defective. Check A2 per table 6-5E and check A1A10 per table 6-5D. Check continuity per figure 8-13.
12	Open power switch S1.		Install remainder of circuit cards with the exception of servo output circuit card A1A1.	

Table 6-2. Punched Tape Reader Tests and Troubleshooting (Tape Reader Out of Transit Case) (Contd)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
13	Close power switch S1. Connect multimeter negative lead to test point 2 on power regulator circuit card A1A10. Connect positive lead to point of test. (Multimeter set for negative dc measurement.)	A1A5TP6		-5 to -6.5 Vdc. If unsatisfactory, remove rewind speed control circuit card A1AS and test per table 6-5A.
14	Disconnect multimeter positive lead, set multimeter for positive dc measurement, and connect positive lead to point of test.	A1A10TP1		+4.5 to +5.5 Vdc. If satisfactory, proceed to step 16. If unsatisfactory, proceed to step 15 .
15	Turn power off by opening power switch S1 when circuit cards are removed or installed.			Remove circuit cards, one at a time (except A1A1 and A1A10), until reading becomes satisfactory. Then test last circuit card removed per appropriate table, 6-3 through 6-5C. Restore all circuit cards before proceeding to step 16.
16		A1A10TP3		+11 to +13 Vdc. If satisfactory, proceed to step 18. If unsatisfactory, proceed to step 17.
17	Turn power off by opening power switch S1 when circuit cards are removed or installed.			Remove circuit cards, one at a time (except A1A1, A1A4, A1A9, and A1A10) until reading becomes satisfactory. Then test last circuit card removed per appropriate table, 6-3 through 6-5B. Restore all circuit cards before proceeding to step 18.
18		A1A6TP5 A1A7TP5 A1A8TP5		2 to 4 Vdc. If satisfactory, proceed to step 20. If unsatisfactory, proceed to step 19.

Table 6-2. Punched Tape Reader Tests and Troubleshooting (Tape Reader Out of Transit Case) (Contd)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
19	Turn power off by opening power switch S1 when circuit cards are removed or installed.			Remove circuit cards A1A6, A1A7, and A1A8, one at a time, until reading becomes satisfactory. Then test last circuit card remove per appropriate table, 6-4 through 6-5D. Restore all circuit cards before proceeding to step 20.
		MECHANICAL		
20	Open power switch S1 when installing circuit cards.		Install all circuit cards. Rotate each tape roller using light finger pressure.	Tape rollers rotate freely. If unsatisfactory, disassemble roller to determine cause.
21	Remove drive mechanism cover. (See figure 6-1.)			
22	**WARNING** **Do not attempt to grasp a moving capstan. Open power switch S1, hold capstan, then close power switch S1.**		Grasp left hand capstan, turn on power switch S1. Try to prevent rotation. Turn off power switch and repeat with right hand capstan.	Left hand capstan cannot be stalled. Right hand capstan can be stalled. If unsatisfactory, adjust belt tension (para. 6-35).
23	Open power switch S1.		Move tension arms to their extreme positions and check limit switch actuation (S2 through S5). A click can be heard at each extreme position of each arm.1	Switches actuate when arms are approximately 3/16 inch from end of slots in panel and arms contact bumpers before reaching end of slots. If unsatisfactory, adjust switch positions (para. 6-21 and 6-22).
		BRAKES		
24	Close power switch S1.		Observe parallelism of brake shoes and actuators (L2 and L3) using data light source to provide a slit of light. Check to see that the mode switch is in the REEL MODE position.	**CAUTION** **Do not adjust the brakes unless a problem in operation exists.** Shoes parallel to actuators in both width and length. If unsatisfactory, adjust (para. 6-41).

Table 6-2. Punched Tape Reader Tests and Troubleshooting (Tape Reader Out of Transit Case) (Contd)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
25	Open power switch S1. Use 16 oz spring scale.		Place 30-inch strip of tape (2.5 mil thick aluminum mylar) between one brake shoe and actuator to the actuator, allowing 18 inches to extend to the side, over the tape idler. Check pull required to pull tape through brake. Repeat for other brake shoe and actuator.	3 oz maximum. If unsatisfactory, adjust (para. 6-41).
25	Use 16 oz spring scale.		Check pull required with tape extending the full length of the drive path (tape idler to tape idler).	6 oz maximum. If unsatisfactory, adjust (para. 6-41).
27	Close power switch S1. (Run-stop switch S4 remains open.) Use 2 lb spring scale.		Repeat step 26. (Actuators L2 and L3 now energized.) step 32.	32 oz pull minimum. If satisfactory, proceed to If insufficient tension, proceed to step 28.
28	Open and close power switch S1.		Observe both actuators.	Both actuators operate. If both operate, adjust brake shoe tension (para. 6-41). If one actuator does not operate, replace actuator. If both actuators do not operate, proceed to step 29.
29	Open power switch SI when removing or installing circuit card.		Remove rewind speed control circuit card A1A5 to check brake actuation.	If brakes actuate, test rewind speed control circuit card A1A5 per table 6-5A. If brakes still do not actuate, reinstall A1A5 and proceed to step 30.
30	Connect negative lead of multimeter to terminal post E18 at upper right inside corner of component plate assembly. Set multimeter for positive dc measurement. Connect positive lead to point of test.	A1Q3 collector	3 Vdc maximum.	 If satisfactory, connect TB1-5 to TB1-2. If this applies normal tension to brakes (step 27), A1R6 or A1R? is defective. If this does not apply brakes, A1C2 or A1C3 is defective. If 3 Vdc is not obtain, proceed to step 31.

Table 6-2. Punched Tape Reader Tests and Troubleshooting (Tape Reader Out of Transit Case) (Contd)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
31		A1Q3 base		1.92 to 12 Vdc. If satisfactory, A1Q3 is defective. If 1. 2 to 12 Vdc is not obtained, either resistor A1R4, diode A1CR4, or control logic circuit card A1A4 is defective. Check A1R4 and A1CR4 by continuity. Test card A1A4 per table 6-5.
		SERVO SYSTEM		
32	Close power switch S1.		Tension arms held in low tension limit position by spring action (no tape installed).	Neither reel hub rotates until tension arm is moved from low limit position. If satisfactory, proceed to step 36. If there is no power in one reel motor (B1 or B2) (one or both directions), proceed to step 38. If there is no power in both reel motors, proceed to step 41. If either or both reel hubs rotate while in low limit position, proceed to step 33.
33	Open power switch S1 when removing or installing circuit card.		Remove servo output circuit card A1A1 to observe results.	If rotation stops, proceed to step 34. If rotation does not stop, replace reel motor driver transistors as follows: A1Q6 and A1Q7 if right motor rotates cw A1Q4 and A1Q5 if right motor rotates ccw A1Q10 and A1Q11 if left motor rotates ccw A1Q8 and A1Q9 if left motor rotates cw

Table 6-2. Punched Tape Reader Tests and Troubleshooting (Tape Reader Out of Transit Case) (Contd)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
34			Reinstall circuit card A1A1. Ground test point as follows: A1A1TP3 if left hub rotates cw A1A1TP4 if left hub rotates ccw A1A1TP5 if right hub rotates cw A1A1TP6 if right hub rotates ccw	If rotation does not stop, test servo output circuit card A1A1 per table 6-5C. If rotation stops, proceed to step 35.
35			Ground test point A1A4TP3.	If rotation does not stop, test servo input circuit card A1A2 for right motor, or A1A3 for left motor per table 6-5B. If rotation stops, test control logic circuit card AiA4 per table 6-5.
36	Close power switch S1.		Individually move each tension arm away from its low limit position. Reel hubs should start to rotate (left hub counterclockwise; right hub clockwise). Move each tension arm to find the null position where reel hub rotation reverses. If satisfactory, proceed to step 42. If position of one arm is unsatisfactory, proceed to step 37 .	Null positions approximately as follows: Right tension arm 2/3 up from bottom of panel cutouts. Left tension arm 1/3 up from bottom of panel cutouts.
37	Open power switch S1 when removing or installing circuit cards.		Interchange servo input circuit cards A1A2 and A1A3.	If opposite arm now malfunctions, replace servo input circuit card (A1A2 for right side, A1A3 for left side) with a spare card. Test defective card per table 6-5B. If same arm malfunctions, adjust (para. 6-32).
38			To check right hand motor, momentarily ground collector of A1Q5 and A1Q7. To check left hand motor, momentarily ground collector of A1Q9 and A1Q11.	If reel motor does not rotate in both directions, replace motor. If reel motor rotates, proceed to step 39.

Table 6-2. Punched Tape Reader Tests and Troubleshooting (Tape Reader Out of Transit Case) (Contd)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
39	Open power switch S1 when removing or installing circuit cards.		Interchange servo input circuit cards A1A2 and A1A3.	If opposite motor now malfunctions, replace servo input circuit card (A1A2 for right side, AA3 for left side) with a spare card. Test defective card per table 6-5B. If same motor malfunctions, proceed to step 40.
40	Connect multimeter positive lead to A1A2TP2 (for right side) or A1ASTP2 (for left side) and negative lead to ground. Open power switch S1 when removing or installing circuit card.	A1A2TP2 or A1A3TP2	Move tension arm from low limit to high limit.	Voltage ranges from 2. 1 to 3.1 Vdc and shifts at least 0.4 Vdc. If satisfactory, replace servo output circuit card A1A1 with a spare card (or test per table 6-5C). If trouble persists, replace associated driver transistors: A1Q4, A1Q5 - right ccw A1Q6, A1Q7 - right cw A1Q8, A1Q9 - left cw A1Q10, A1Q11 - left ccw If unsatisfactory, adjust tension arms (para. 6-32) or replace sensor potentiometer R1 or R2 (para. 6-23).
41	Connect multimeter positive lead to test points indicated and negative lead to ground. Open power switch S1 when removing or installing circuit cards.	Test Point Logic Levels A1A4 TPS / A1A4 TP6 / A1A5 TP4 → Defective Component 1 1 0 → A1A4 0 1 0 → A1A4 0 1 1 → A1A5, S3 or S4 0 0 1 → A1A4, S2 or S5 Logic 1 = 4 ± 1.5V Logic 0 = 0 to 0.25V Check switch operation with multimeter per figure 8-1. Adjust limit switch position, if necessary (para. 6-21 and 6-22). Load test tape.	Set tension arms to centers of panel cutouts. Determine defective component as follows:	Test A1A4 per table 6-5. Test A1A5 per table 6-5A.

Table 6-2. Punched Tape Reader Tests and Troubleshooting (Tape Reader Out of Transit Case) (Contd)

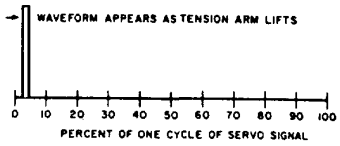
STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
42			Load test tape	
43	Connect oscilloscope dual trace inputs to test points A1A2TP1 and A1A2TP3.	A1A2TP1, A1A2TP3	Turn right tape reel slightly clockwise to cause a tension in the tape. Percentage of waveform at A1A2TP3 5% decreases and waveform just appears at A1A2TP1.	Waveforms do not exceed of total cycle time. If unsatisfactory, align servo balance control (para. 6-45).
44	Connect oscilloscope dual trace inputs to test points A1A3TP1 and A1A3TP3.	A1A3TP1, A1A3TP3	Turn left tape reel slightly counterclockwise to cause a tension in the tape and a waveform to appear at A1A3TP1	Same as step 43.
			TAPE DRIVE	
45	With power switch S1 closed and run-stop switch S4 open, observe tape.			Tape should not move. If satisfactory, proceed to step 47. If tape is moving, proceed to step 46.
46	Open power switch S1 when removing or installing circuit cards.		Remove control logic circuit card A1A4 and servo output circuit card A1A1. If tape does not move, test **CAUTION** **Circuit card A1A1 must be removed to disable the servo system and prevent tape breakage .**	If tape still moves, driver transistor A1Q1 (forward) or A1Q2 (reverse) is defective. control logic circuit card A1A4 per table 6-5.
47	Close power switch S1. Observe operation with forward-reverse switch S5 open (forward) and closed open (forward) and closed (reverse) positions.			Tape moves in both forward and reverse modes. If satisfactory, proceed to step 55. If forward drive solenoid L4 is inoperative, proceed to step 48. If reverse drive solenoid L1 is inoperative, proceed to step 51.

Table 6-2. Punched Tape Reader Tests and Troubleshooting (Tape Reader Out of Transit Case) (Contd)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
47 (Contd)				If both forward (L4) and reverse (L1) drive solenoids are inoperative (always off), proceed to step 54.
48			Connect test point A1A4TP1 to A1A4TP2.	If this energizes forward drive solenoid, test control logic card A1A4 per table 6-5. If this does not energize forward drive solenoid, proceed to step 49.
49	Connect negative lead of multimeter to terminal post E18 on upper right corner of component plate assembly. Set multimeter for positive dc measurement. Connect positive lead to point of test.	A1Q1 collector		3 Vdc maximum. If satisfactory, replace forward drive solenoid L4. If unsatisfactory, proceed to step 50.
50		A1Q1 base		If voltage is 1.2 to 12 Vdc, replace A1Q1. If voltage is less than 1.2 Vdc, test control logic circuit card A1A4 per table 6-5. Check resistor A1R2. If voltage is greater than 12 Vdc, replace A1Q1 and also test control logic circuit card A1A4 per table 6-5.
51			Connect test point A1A4TP1 to A1A4TP4.	If this energizes reverse drive solenoid L1, test control logic card A1A4 per table 6-5. If this does not energize I reverse drive solenoid L1, proceed to step 52.
52	Connect multimeter as in step 49.	A1Q2 collector		3 Vdc maximum. If satisfactory, replace reverse drive solenoid L1. If unsatisfactory, proceed to step 53.

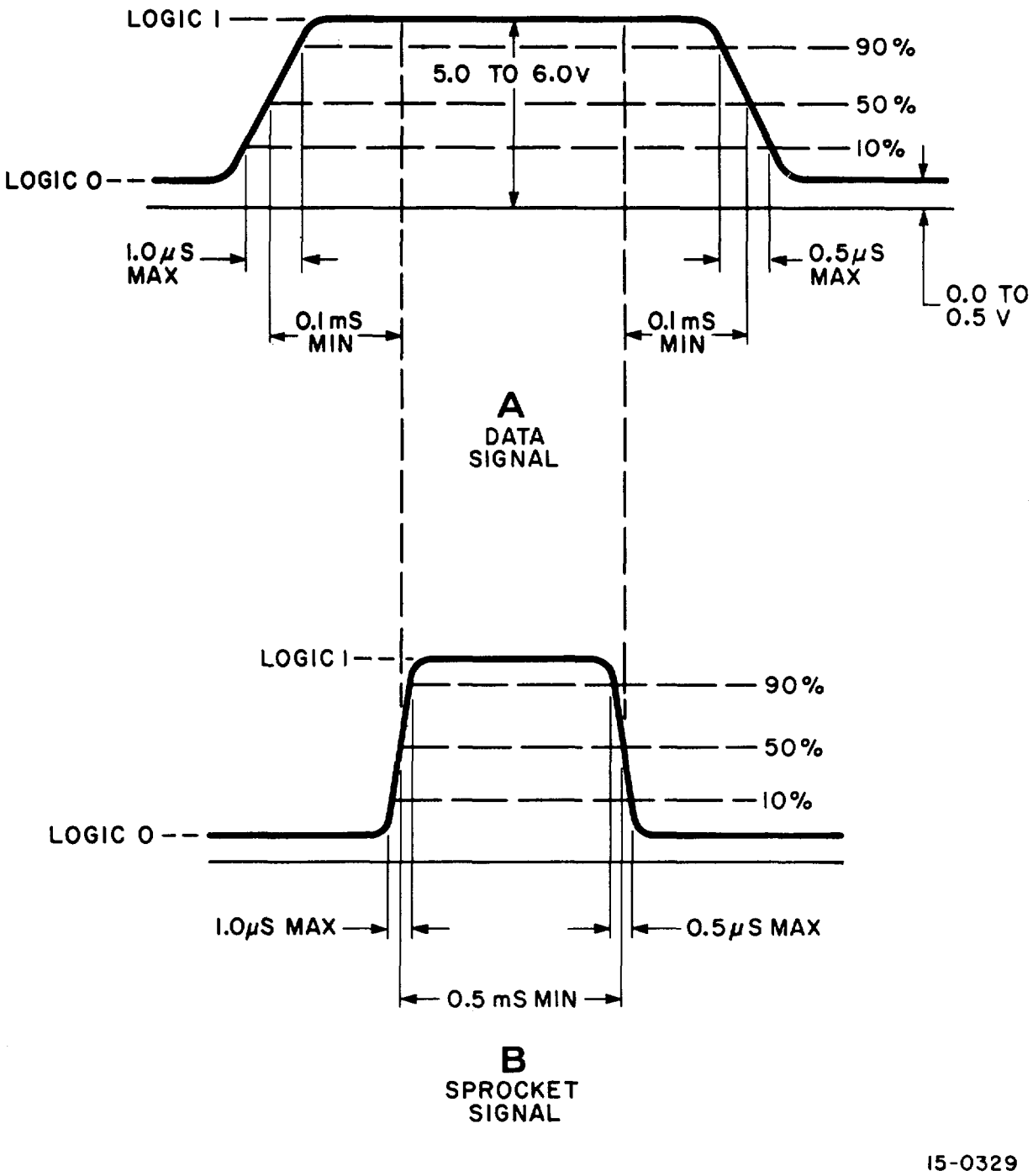


Figure 6-0B. Data and Sprocket Signal Waveforms

Table 6-2. Punched Tape Reader Tests and Troubleshooting (Tape Reader Out of Transit Case) (Contd)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
53		A1Q2 base		If voltage is 1.2 to 12 Vdc, replace A1Q2. If voltage is less than 1.2 Vdc, test control logic circuit card A1A4 per table 6-5. Check resistor A1R3. If voltage is greater than 12 Vdc, replace A1Q2 and also test control logic circuit card A1A4 per table 6-5.
54			Ground test points A1A4TP2 and A1A4TP4.	If neither solenoid is energized, check components E A1R1, A1C1, and A1C4. Test control logic circuit card A1A4 per table 6-5.
55	Connect electronic counter input to test point 2 (fig. 6-0A). Set channel selector switch S2 to off position.	TP2	Observe sprocket output frequency with high-low speed l switch S6 closed (high speed)l and forward-reverse switch, S5 open (forward) and also closed (reverse).	800 ± 80 Hz. If unsatisfactory, adjust rewind speed control A1A5 (para. 6-49). If unable to adjust, proceed to step 56.
56	Adjust oscilloscope per procedures of steps 61 and 62. Connect oscilloscope to test point 1 and set channel selector switch S2 to position 9.	TP1		See B; figure 6-OB- If waveform is satisfactory, test rewind speed control circuit card A1A5 per table 6-5A. If unsatisfactory, test card A1A8 per table 6-3. If trouble persists, replace read head.
57	Open high-low speed switch S6 (low speed). Observe sprocket output frequency with forward-reverse switch S5 open (forward) and also closed (reverse).	TP2		420 ± 20 Hz. If unsatisfactory, check capstan solenoid L4 (forward) or L1 (reverse) plunger adjustment (para. 6-37). If still unsatisfactory, replace capstan motor A4B1.
58	Close and then open high-low speed switch S6			Tension arms do not swing out of limits (actuate limit [switches and stop tape motions If tension arms do not swing out of limits, test control logic circuit card A1A4 per table 6-5. (If trouble persists, refer back to step 32.)

Table 6-2. Punched Tape Reader Tests and Troubleshooting (Tape Reader Out of Transit Case) (Contd)

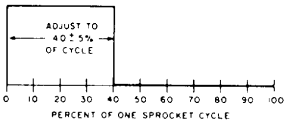
STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
		POWER REGULATOR		
59	Connect oscilloscope input to test point 1. Operate channel selector switch S2 to position 9. Open forward-reverse switch S5.	TP1		Pulse duty cycle of 35 to 45% of full sprocket cycle  If unsatisfactory, adjust power regulator A1A10R15 to obtain waveform. If waveform cannot be obtained, test A1A10 per table 6-5D.
60	Set multimeter for positive dc measurement. Connect negative lead to A1A10TP2 and positive lead to A1A10TP1.	A1A10TP1		5.1 Vdc. If unsatisfactory, adjust A1A10R6 for +5.1 Vdc reading. If voltage cannot be obtained, test A1A10 per table 6-5D.
		DATA OUTPUTS		
61	Balance the probe for the preamplifier and check the calibration of the oscilloscope.			
62	Dc couple the oscilloscope. Set the triggering mode to automatic, triggering slope to internal positive, and voltage scale to 0.1 volt/cm.			
63	Operate internal-external switch S3 to INT position. Leave oscilloscope input at test point 1 and operate channel selector switch S2 through positions 1 through 8. pulse	TP1	If all outputs are logic 0, check for burned out lamp DS 1.	(See A, figure 6-OB.) If all outputs are of short duration, remove optic assembly (36, fig. 7-2) and light source and check that all tape holes align with read head holes. If channels 7 and 8 are defective, check circuit card A1A8; for channels 4, 5, and 6, check circuit card A1A7; for channels 1, 2, and 3, check circuit card A1A6. Use table 6-3 for tests.

Table 6-2. Punched Tape Reader Tests and Troubleshooting (Tape Reader Out of Transit Case) (Contd)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
63 (Contd)				If one output is always high, test associated read amplifier circuit card per table 6-3.
64	Operate channel selector switch S2 to position 9.	TP1		(See B, figure 6-0B.) If unsatisfactory, test read amplifier circuit card A1A8 per table 6-3. If trouble persists, replace read head.
		SELF TEST		
		NOTE Perform Self Test procedure according to paragraph 6-54.		

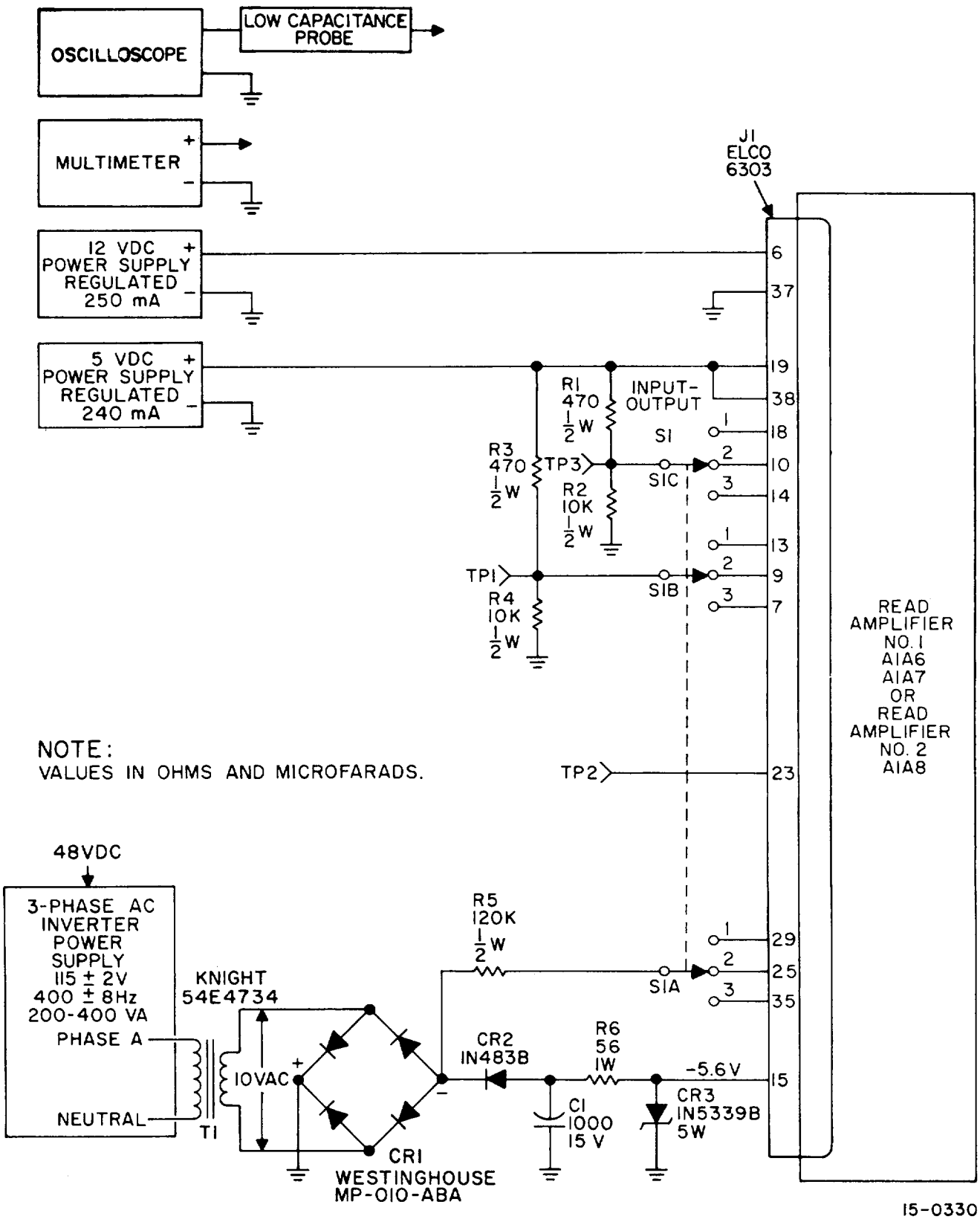


Figure 6-0C. Read Amplifier Circuit Card Test Setup

Table 6-3. Read Amplifier Circuit Card A1A6, A1A7, or A1A8 Performance Test)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1	Connect read amplifier circuit card to test setup as shown in figure 6-0C.			
2	Turn on test equipment and allow 10 minute warmup for oscilloscope. Turn on power supplies .			
3	Balance the probe for the preamplifier and check the calibration of the oscilloscope.			
4	Dc couple the oscilloscope. Set the triggering mode to ac automatic, triggering slope to internal positive, and voltage scale to 0.1 volt/cm.			
5	Operate input-output switch S1 to position 1. Connect oscilloscope to test point 3.	TP3		(See A, figure 6-0D.)
6	Operate input-output switch S1 to position 2 .	TP3		(See A, figure 6-0D.)
7	Operate input-output switch S1 to position 3 .	TPS		(See A, figure 6-0D.)
8	Connect oscilloscope to test point 1. Leave input-output switch S1 in position 3 .	TP1		(See B, figure 6-0D.)
9	Operate input-output switch S1 to position 2 .	TP1		(See B, figure 6-0D.)
10	Operate input-output switch S1 to position 1 .	TP1		(See B, figure 6-0D.)
11	Disconnect oscilloscope. Set multimeter for positive dc measurement on 2.5 volt scale. Connect multimeter to test point 2.	TP2		0.30 to 0.60 Vdc.

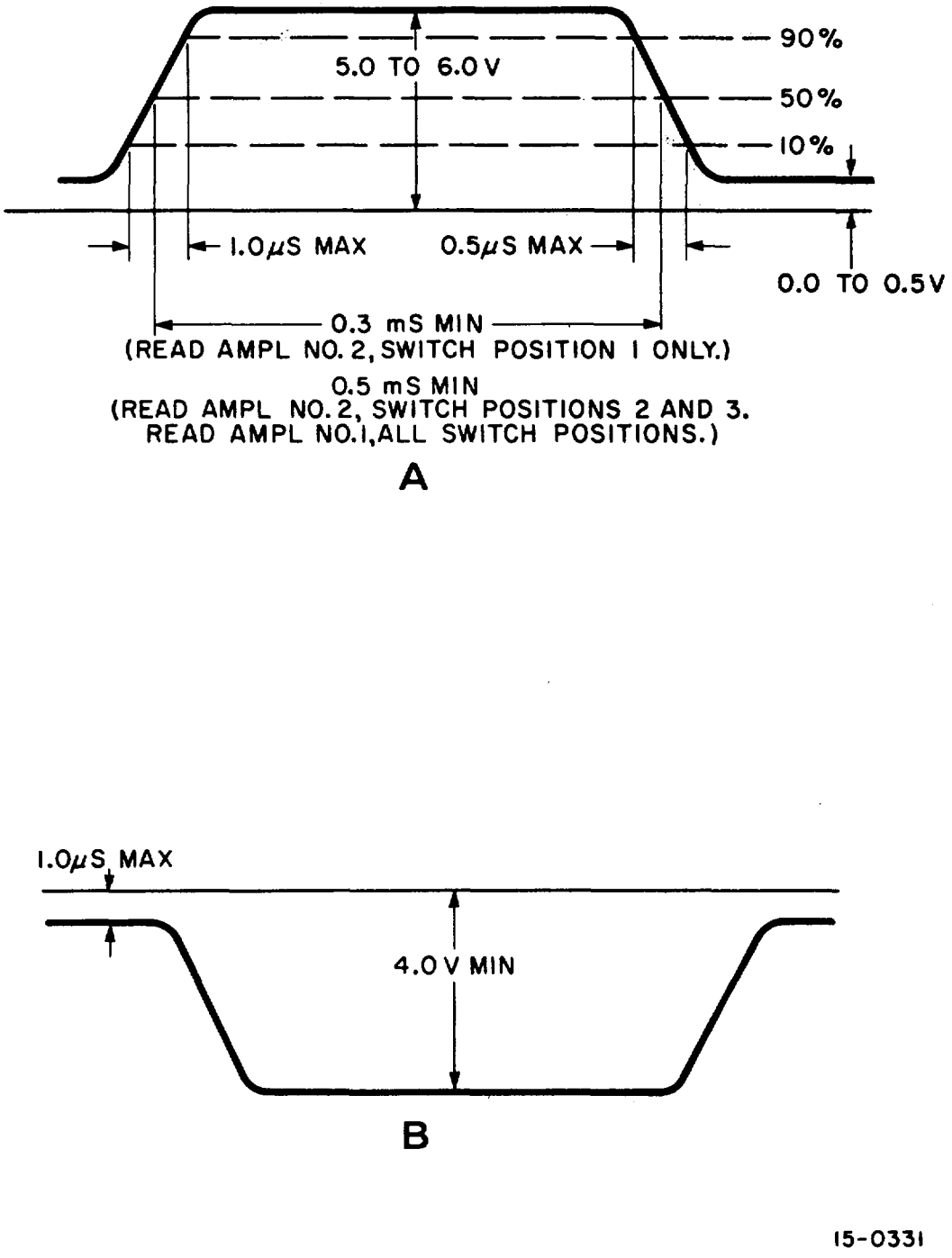


Figure 6-0D. Read Amplifier Waveforms

Table 6-4. Self Test Logic Circuit Card A1A9Performance Test

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1	Connect self test logic circuit card to test setup as shown in figure 6-0E .			
2	Turn on power supplies and test equipment .			
3	Set multimeter for positive dc measurement on 10 volt scale and connect to test point TP1. Operate channel input switch S1 to position 1 .	TP1		4.0 Vdc minimum.
4	Connect multimeter to test point 3 on the card. Operate channel input switch S1 to position 2 .	TP3 on card		4.0 Vdc minimum.
5	Operate channel input switch S1 to position 3 .	TP3 on card		4.0 Vdc minimum.
6	Operate channel input switch S1 to position 4 .	TP3 on card		4.0 Vdc minimum.
7	Operate channel input switch S1 to position 5 .	TP3 on card		4.0 Vdc minimum.
8	Operate channel input switch S1 to position 6 .	TP3 on card		4 0 Vdc minimum.
9	Observe multimeter .	TP1		1.0 Vdc maximum.
10	Operate channel input switch S1 to position 7 .	TP1		4.0 Vdc minimum.
11	Observe multimeter.	TP3 on card		1.0 Vdc maximum.

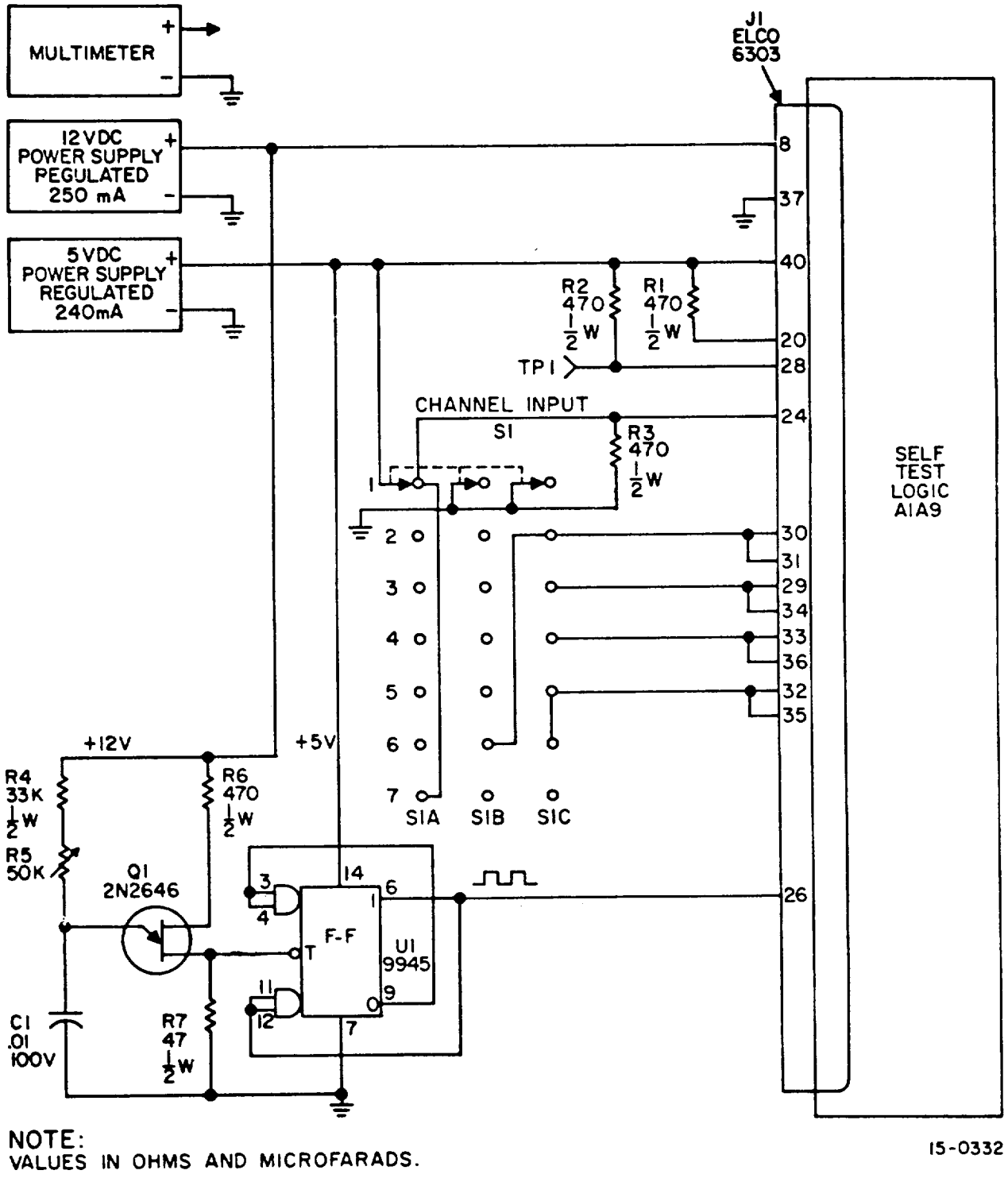


Figure 6-0E. Self Test Logic Circuit Card Test Setup

Table 6-5. Control Logic Circuit Card A1A4 Performance Test

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1	Connect control logic circuit card to test setup as shown in figure 6-0F .			
2	Turn on power supplies and test equipment and allow 10 minute warmup for oscilloscope .			
3	Set multimeter for positive dc measurement. Connect to test point indicated. Operate switches S1 through S4 as shown for each of the following steps. The functions of the switches as: S1, forward-reverse S2, high-low speed S3, run-stop S4, circuit card inputs .			
4	S1, closed S2, open S3, closed S4, -	TP3		4.0 Vdc minimum.
5	S1, open S2, closed S3, closed S4, -	TP3		0.5 Vdc maximum.
6	S1, closed S2, closed S3, closed S4, -	TP3		0.5 Vdc maximum.
7	S1, closed S2, open S3, open S4, -	TP3		0.5 Vdc maximum.
8	S1, open S2, open S3, closed S4, -	TP2		4.0 Vdc minimum.
9	S1, closed S2, open S3, open S4, -	TP2		0.5 Vdc maximum.
10	S1, open S2, closed S3, closed S4, -	TP2		0.5 Vdc maximum.

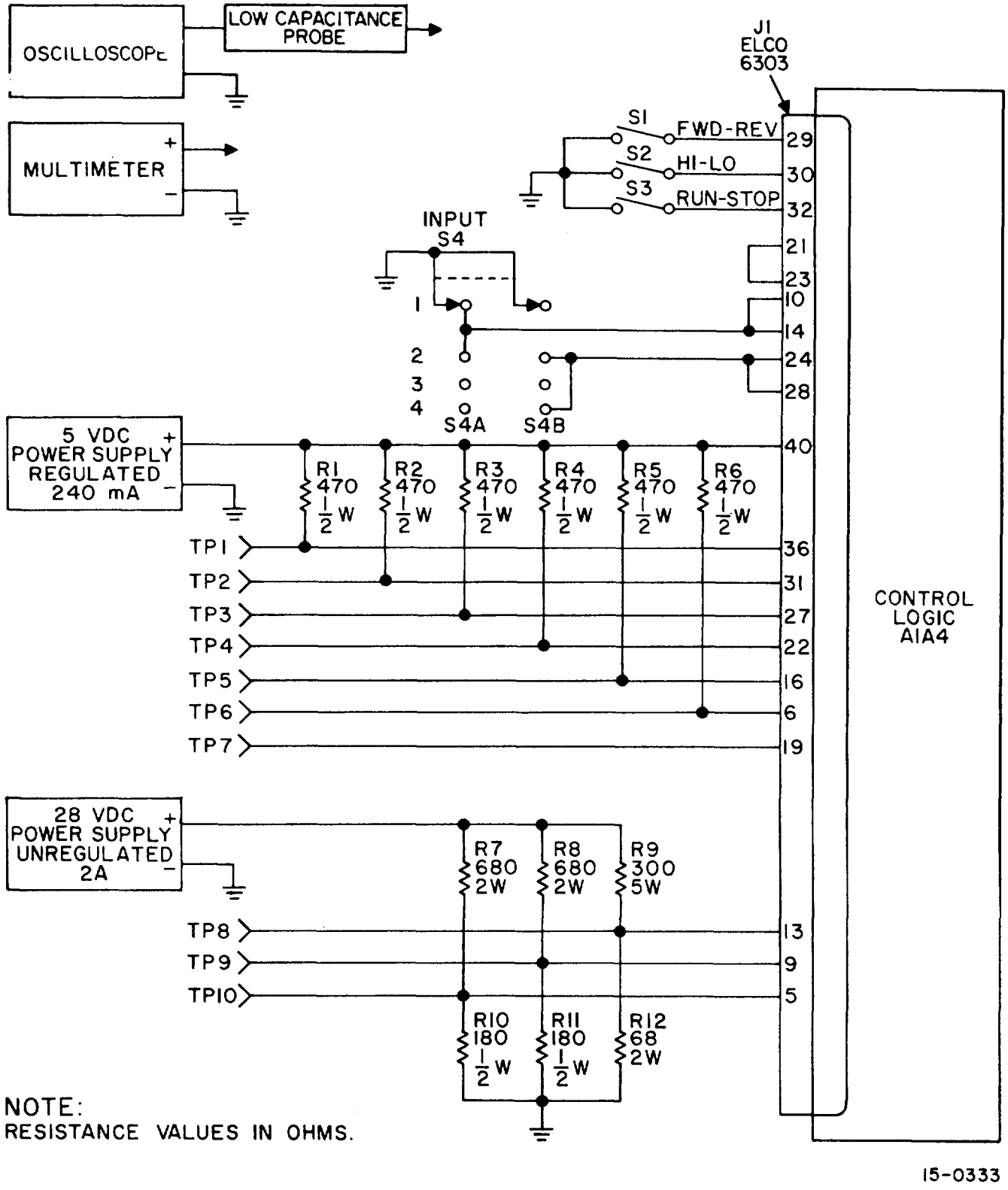


Figure 6-0F. Control Logic Circuit Card Test Setup

Table 6-5. Control Logic Circuit Card A1A4 performance Test (Contd)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
11	S1, closed S2, closed S3, closed S4, position 1	TP9		4.5 Vdc minimum.
12	S1, closed S2, closed S3, closed S4, position 3	TP9		4.5 Vdc minimum.
13	S1, closed S2, closed S3, closed S4, position 4	TP9		0.6 Vdc maximum.
14	S1, closed S2, open S3, open S4, position 3	TP9		0.6 Vdc maximum.
15	S1, closed S2, open S3, open S4, position 2	TP9		0.6 Vdc maximum.
16	S1, open S2, open S3, closed S4, position 2	TP9		0.6 Vdc maximum.
17	S1, open S2, open S3, closed S4, position 2	TP10		4.5 Vdc minimum.
18	S1, open S2, open S3, closed S4, position 4	TP10		0.6 Vdc maximum.
19	S1, open S2, closed S3, open S4, position 2	TP10		0.6 Vdc maximum.
20	S1, closed S2, closed S3, closed S4, position 2	TP10		0.6 Vdc maximum.
21	S1, closed S2, open S3, open S4, position 2	TP8		4.5 Vdc minimum

Table 6-5. Control Logic Circuit Card A1A4 performance Test (Contd)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
22	S1, closed S2, closed S3, closed S4, -	TP8		0.6 Vdc maximum.
23	S1, closed S2, open S3, open S4, position 2	TP6		4.0 Vdc minimum.
24	S1, closed S2, open S3, open S4, position 4	TP6		0.5 Vdc maximum.
25	S1, closed S2, open S3, open S4, position 1	TP6		0. 5 Vdc maximum.
26	S1, open S2, open S3, closed S4, position 3	TP6		0.5 Vdc maximum.
27	S1, closed S2, open S3, open S4, position 8	TP6		0.5 Vdc maximum.
28	Connect multimeter to test point 7. Disconnect multi-meter after this measurement.	TP7		3.0 to 3.8 Vdc.
29	Dc couple the oscilloscope. Set triggering slope to external positive, time base to 50 ms/cm, voltage scale to 0.1 volt/cm, and zero the oscilloscope .			
30	Connect oscilloscope input and external trigger to test point indicated. Operate switches S1 through S4 as follows: S1, open S2, open S3, closed S4, position 3, then close S1 and observe duration of high level pulse.	TP5		190 to 250 milliseconds.

Table 6-5. Control Logic Circuit Card A1A4 performance Test (Contd)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
31	Open S1 and observe duration of high level pulse .	TP1		190 to 250 milliseconds.
32	S1, open S2, open S3, closed S4, position 3, then close S2 and observe duration of high level pulse .	TP4		190 to 250 milliseconds.
33	S1, open S2, open S3, closed S4, position 3, then close S1 and observe duration of high level pulse .	TP6		190 to 250 milliseconds.
34	Set triggering slope to external negative. Move external trigger to test point 2. Move input to test point 8. S1, open S2, open S3, closed S4, position 3, then open S3 and observe duration of low level pulse.	TP8		190 to 250 milliseconds.

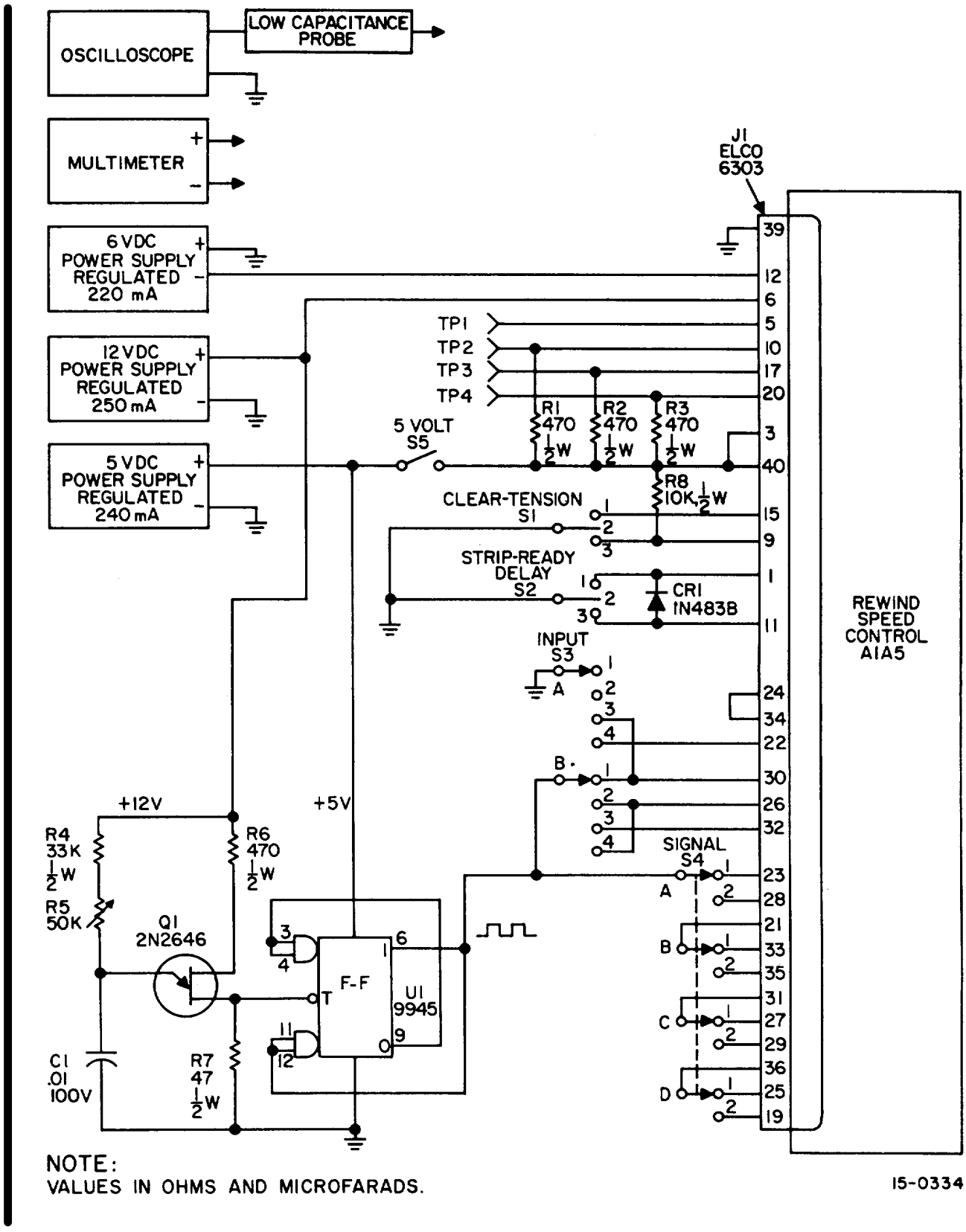


Figure 6-0G. Rewind Speed Control Circuit Card Test Setup

Table 6-5A. Rewind Speed Control Circuit Card A1A5 Performance Test)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1	Connect rewind speed control circuit card to test setup as shown in figure 6-0G .			
2	Turn on power supplies and test equipment and allow 10 minute warmup for oscillo-scope. Close 5 volt switch S5 .			
3	Connect multimeter positive lead to ground and negative lead to test point 6 on circuit card .	TP6 on card		-5.3 to -5.9 Vdc.
4	Operate input switch S3 to position 1 .			
5	Dc couple oscilloscope. Set triggering mode to ac, triggering slope to internal negative, voltage scale to 0.1 volt/cm. Zero the oscilloscope .			
6	Connect oscilloscope input to test point 4. Adjust horizontal time base so one period of the square wave falls over 10 divisions. Adjust resistor R5 on the card for a 68-71% duty cycle square wave .	TP4		(See A, figure 6-0H.)
7	Operate input switch S3 to position 2 .	TP4		(See A, figure 6-0H.)
8	Operate input switch S3 to position 3 .	TP4		(See A, figure 6-0H.)
9	Operate input switch S3 to position 4 .	TP4		Constant V1 level (A, figure 6-0H).
10	Connect oscilloscope input to test point 3. Operate signal switch S4 to position 1 .	TP3		(See A, figure 6-0H.)
11	Operate signal switch S4 to position 2 .	TP3		(See A, figure 6-0H.)
12	Connect oscilloscope input to test point 3 on the circuit card. Change time base to 1 Ms/cm, calibrated.	TP3 on card		(See B, figure 6-0H.)

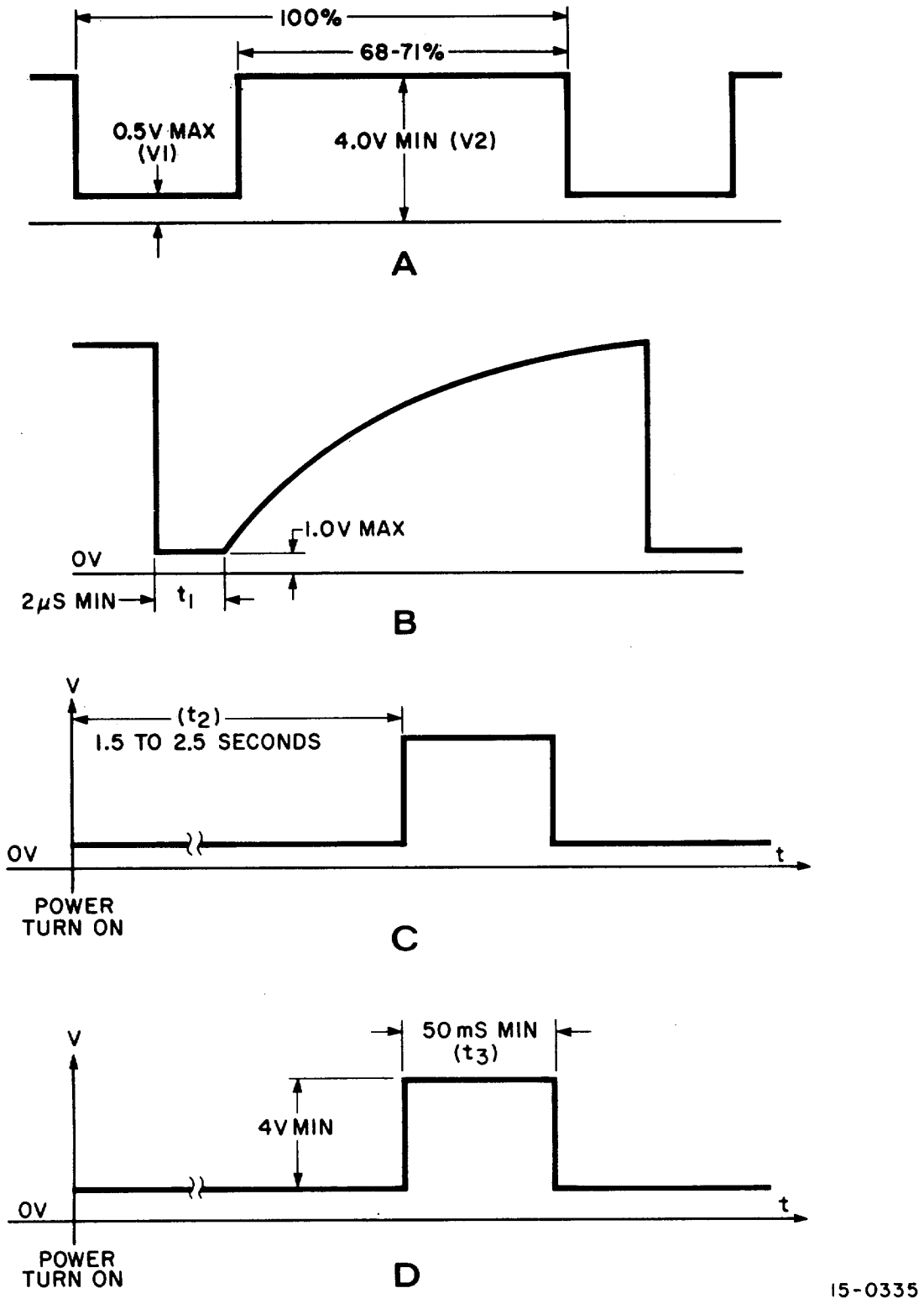


Figure 6-0H. Rewind Speed Control Waveforms

Table 6-5A. Rewind Speed Control Circuit Card A1A5 Performance Test (Contd)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
13	Set oscilloscope triggering slope to external positive and time base to 0.5 s/cm. Connect external trigger to test point 6 on the circuit card. Operate clear-tension switch S1 to position 2 and strip-ready delay switch S2 to position 3 .			
14	Connect oscilloscope input to test point 1. Open 5 volt switch S5. Close 5 volt switch S5 and observe length of time waveform is in a low level .	TP1		1.5 to 2.5 seconds.
15	Set triggering mode to ac, automatic. Operate strip-ready delay switch S2 to position 1 .	TP1		4.0 to 5.9 Vdc.
16	Operate strip-ready delay switch S2 to position 2 .	TP1		0.5 Vdc maximum.
17	Operate strip-ready delay switch S2 to position 1. Operate clear-tension switch S1 to position 1 .	TP1		4.0 to 5. 9 Vdc.
18	Operate strip-ready delay switch S2 to position 3 .	TP1		4.0 to 5.9 Vdc.
19	Operate clear-tension switch S1 to position 1 and open 5 volt switch S5. Set oscilloscope triggering to external positive, mode to ac, and time base to 0. 5 s/cm .			
20	Connect oscilloscope external trigger to test point 6 on card and connect input to test point 2 of the test setup. Close 5 volt switch S5 and observe t_2.	TP2		(See C, figure 6-0H.)
21	Open 5 volt switch S5. Set oscilloscope triggering to internal positive and time base to 10 ms/cm .			
22	Close 5 volt switch S5 and observe t_3.	TP2		(See D, figure 6-0H.)

Table 6-5A. Rewind Speed Control Circuit Card A1A5 Performance Test (Contd)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
23	Disconnect oscilloscope. Open 5 volt switch S5. Operate clear-tension switch S1 to position 2 .			
24	Connect multimeter negative lead to test point 2 and positive lead to test point 1 .	TP2 (-), TP1 (+)		0.5 to 0.9 Vdc.

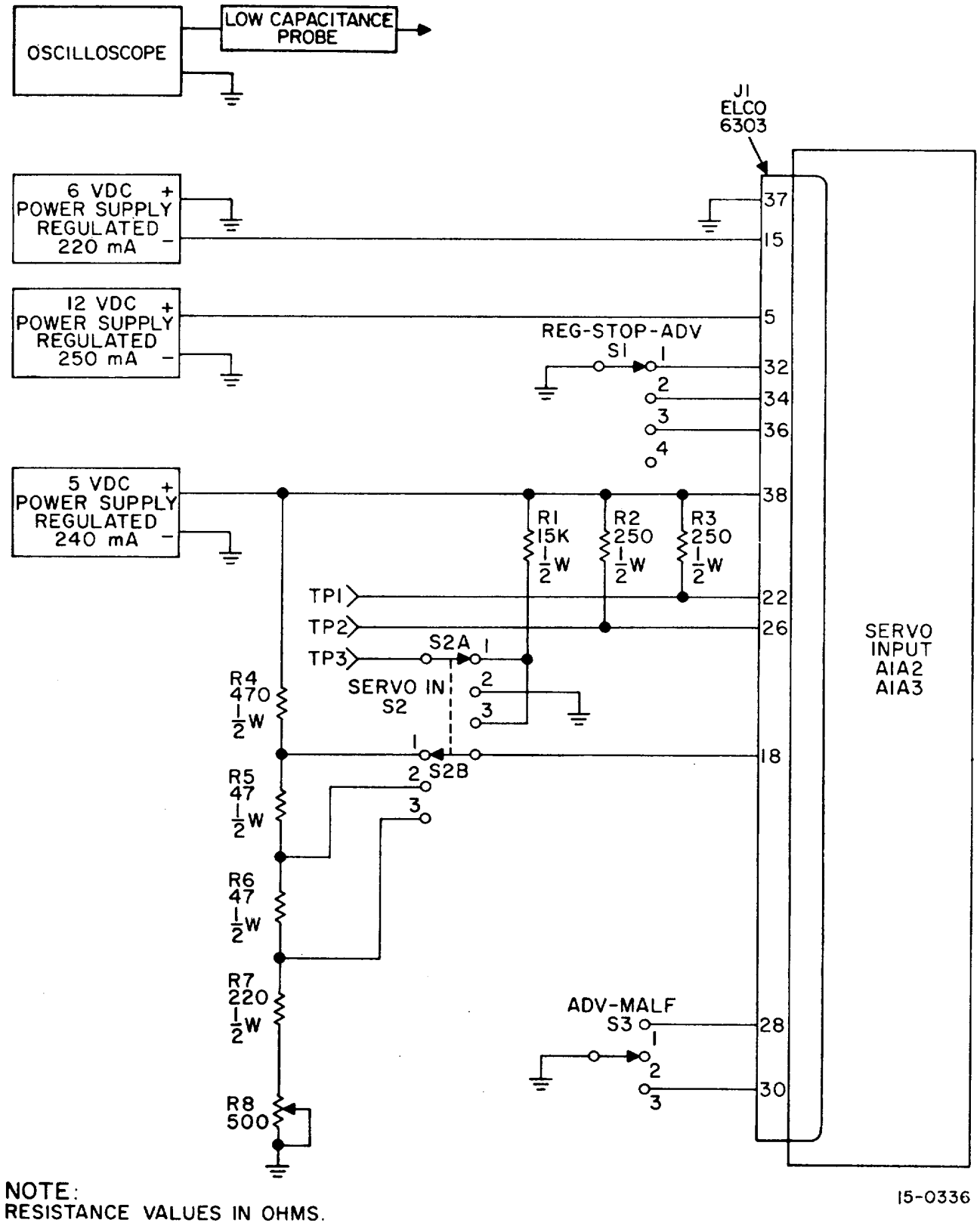


Figure 6-0J. Servo Input Circuit Card Test Setup

Table 6-5B. Servo Input Circuit Card A1A2 or A1A3 Performance Test

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1	Connect servo input circuit card to test setup and shown in figure 6-0J .			
2	Turn on power supplies and test equipment and allow 10 minute warmup for oscilloscope .			
3	Dc couple the oscilloscope. Set triggering mode to ac automatic, slope to internal positive, time base to 0.1 ms/cm, and voltage scale to 0.1 volt/cm. Zero the trace .			
4	Operate reg-stop-adv switch S1 to position 1 and adv-malf switch S3 to position 1. Connect oscilloscope input to test point 2. Observe dc level .	TP2		0 to 1 Vdc.
5	Operate reg-stop-adv switch S1 to position 2 and adv-malf switch S3 to position 3 .	TP2		0 to 1 Vdc.
6	Operate reg-stop-adv switch S1 to position 3.	TP2		0 to 1 Vdc.
7	Operate reg-stop-adv switch S1 to position 4 .	TP2		4 to 6 Vdc.
8	Operate reg-stop-adv switch S1 to position 3, adv-malf switch S3 to position 2, and servo-in switch S2 to position 2 .		Adjust R21 on circuit card fully clockwise.	
9	Adjust oscilloscope time base so one period of the square wave occupies 10 cm. Measure the data cycle TP1 and TP2. Adjust R8 on test setup for equal duty cycles .	TP1, TP2		(See A, figure 6-0K.)
10		TP1, TP2	Adjust R21 on circuit card.	Obtain 20 + 5 percent duty cycles at TP1 and TP2.
11	Connect oscilloscope input to test point 1. Operate servo-in switch S2 to position 3. Check duty cycle.	TP1		Zero percent.

Table 6-5B. Servo Input Circuit Card A1A2 0r A1A3 Performance Test (Contd)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
12	Connect oscilloscope input to test point 2. Operate servo-in switch S2 to position 1. Check duty cycle .	TP2		Zero percent.
13	Set oscilloscope triggering slope to external positive and time base to 20 ms/cm. Connect external trigger to test point 3. Operate servo-in switch S2 to position 3 .	TP2		(See B, figure 6-0K.)
14	Set oscilloscope triggering to internal positive slope and time base so one period of the square wave occupies 10 cm .	TP2		(See C, figure 6-0K.)
15	Connect oscilloscope input to test point 1. Operate servo-in switch S2 to position 2. Set triggering slope to external positive, external trigger connected to test point 3. Operate servo-in switch S2 to position 1 .	TP1		(See B, figure 6-0K.)
16	Set oscilloscope triggering to internal positive slope and time base to one period of the square wave occupies 10 cm.		**CAUTION** **Be sure to readjust R21 per para. 6-45 when card is installed in the tape reader.**	(See C, figure 6-0K.)

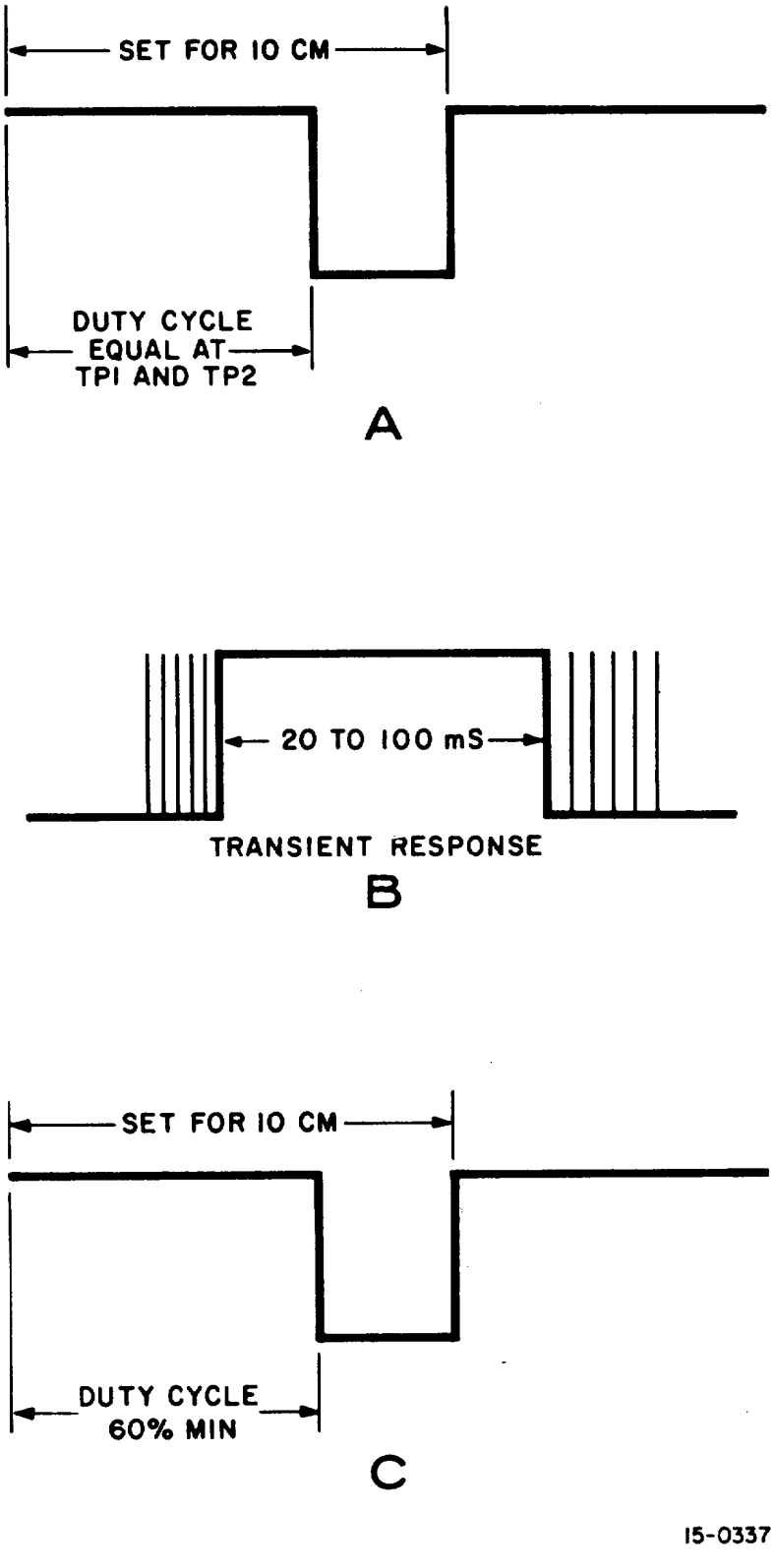


Figure 6-0K. Servo Input Waveforms

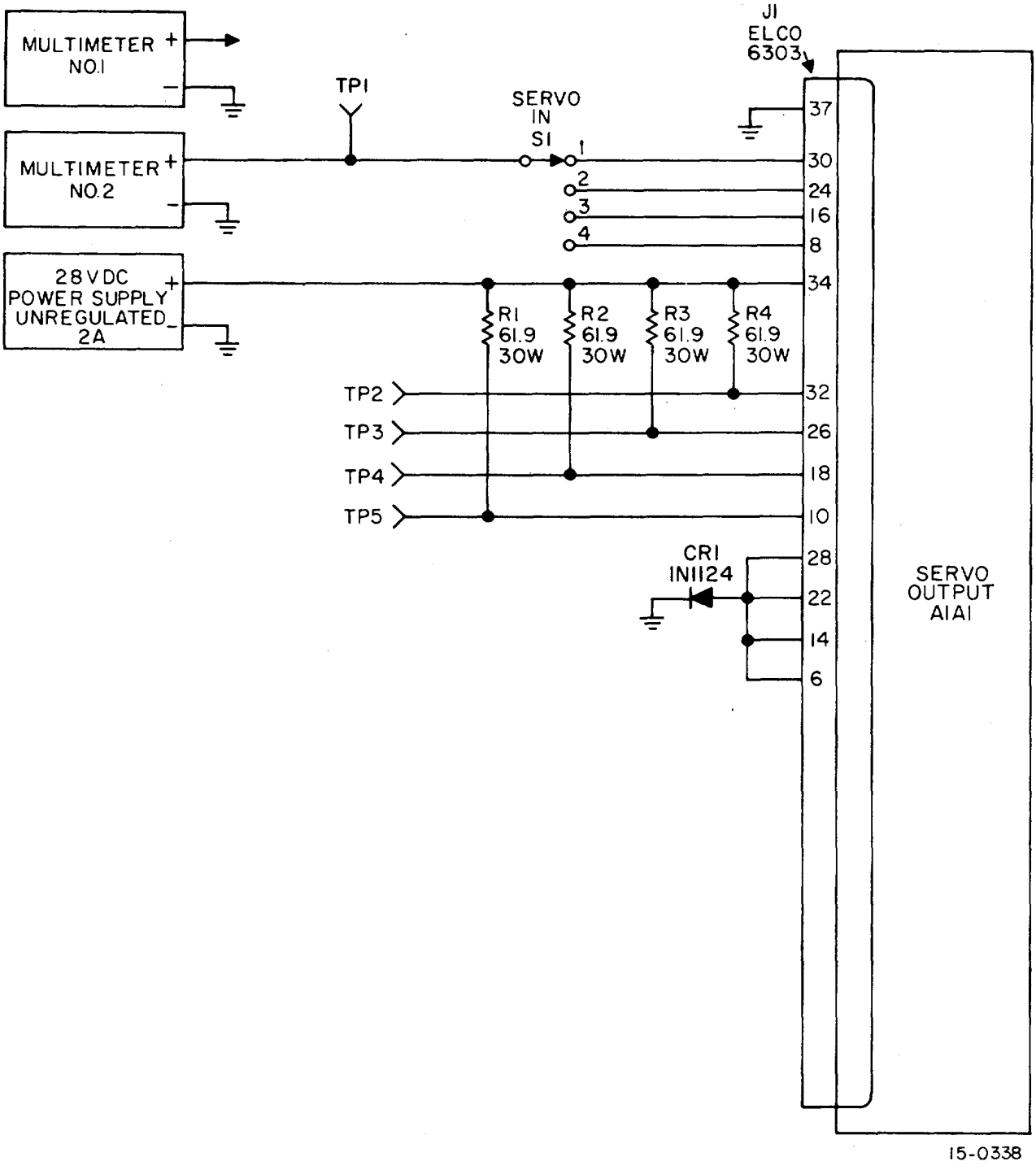


Figure 6-0L. Servo Output Circuit Card Test Setup

Table 6-5C. Servo Output Circuit Card A1A1 Performance Test

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1	Connect servo output circuit card to test setup as shown in figure 6-0L. Set multimeter No. 2 for 100 mA measurement.			
2	Turn on power supply. Operate servo-in switch S1 to position 1. Set multimeter No. 1 for positive dc measurement on 50 volt scale. Connect multimeter No. 1 to test point 2 .	TP1, TP2		25 Vdc minimum at TP2, 15 to 21 mA at TP1.
3	Operate servo-in switch S1 to position 2 .	TP2		4 Vdc maximum.
4	Connect multimeter No. 1 to test point 3 .	TP1, TP3		25 Vdc minimum at TP3, 15 to 21 mA at TP1.
5	Operate servo-in switch S1 to position 3 .	TP3		4 Vdc maximum.
6	Connect multimeter No. 1 to test point 4 .	TP1, TP4		25 Vdc minimum at TP4, 15 to 21 mA at TP1.
7	Operate servo-in switch S1 to position 4 .	TP4		4 Vdc maximum.
8	Connect multimeter No. 1 to test point 5 .	TP1, TP5		25 Vdc minimum at TP5, 15 to 21 mA at TP1.
9	Operate servo-in switch S1 to position 3.	TP5		4 Vdc maximum.

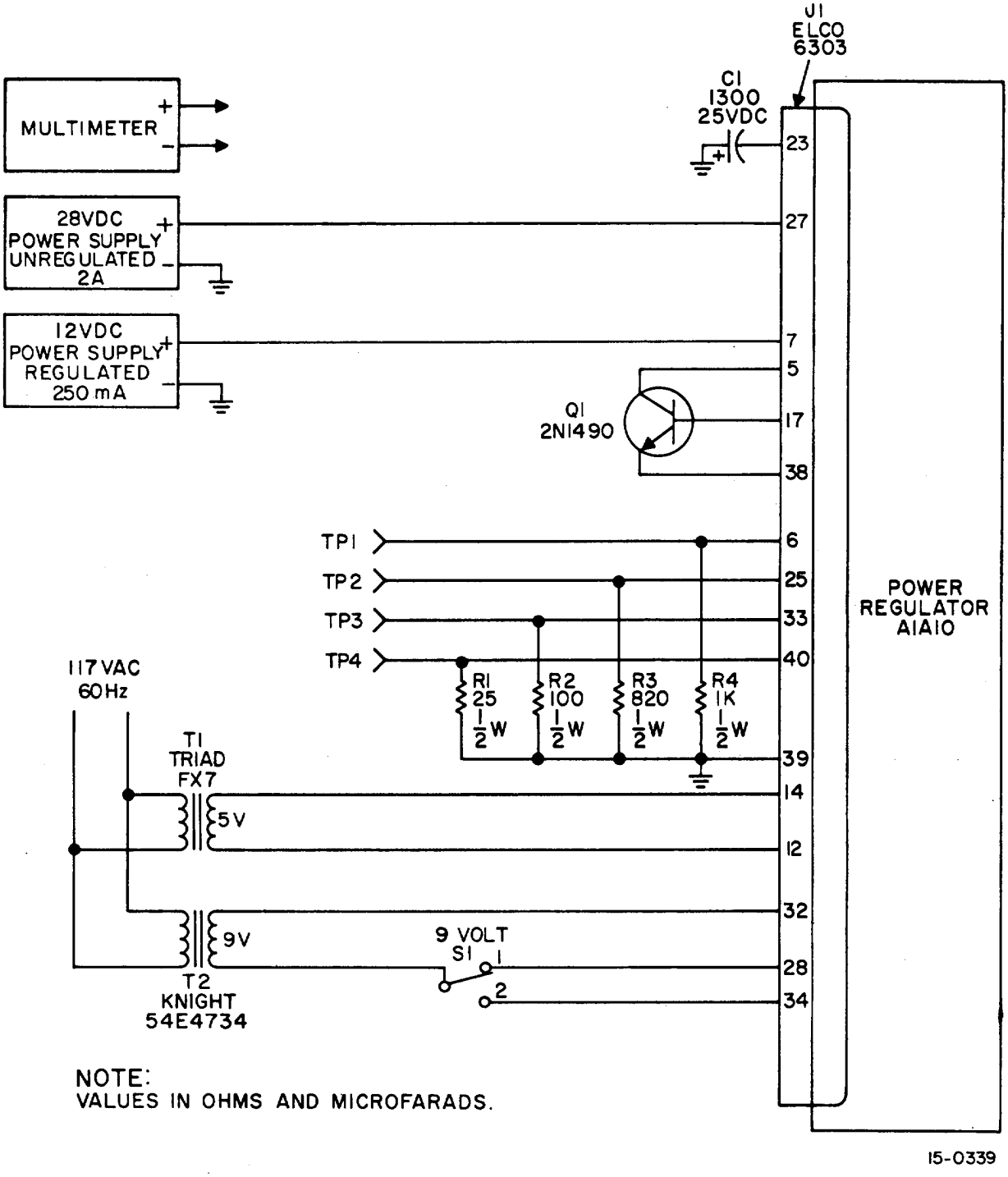


Figure 6-0M. Power Regulator Circuit Card Test Setup

Table 6-5D. Power Regulator Circuit Card A1A10 Performance Test

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1	Connect power regulator circuit card to test setup as shown in figure 6-0M .			
2	Turn on test equipment. Turn on power supplies and 117 volts, 60 Hz power source .			
3	Set multimeter for positive dc measurement on 50 volt scale. Connect negative lead to ground. Connect positive lead to test point 2 .	TP2		12 to 14 Vdc.
4	Connect multimeter positive lead to test point 4. reading .	TP4	Adjust resistor R6 on the circuit card to obtain	5.2 + 0.1 Vdc.
5	Connect multimeter positive lead to test point 1. reading .	TP1	Adjust resistor R15 on the circuit card to obtain	3.0 $\pm$ 0.1 Vdc.
6		TP1	Adjust resistor R15 on the circuit card to obtain reading .	2.7 $\pm$ 0.1 Vdc.
7	Connect multimeter positive lead to ground. Connect negative lead to test point 3. Operate 9 volt switch 1 to position 1 .	TP3		5.0 to 6.5 Vdc.
8	Operate 9 volt switch S1 to position 2.	TP3		5.0 to 6.5 Vdc.

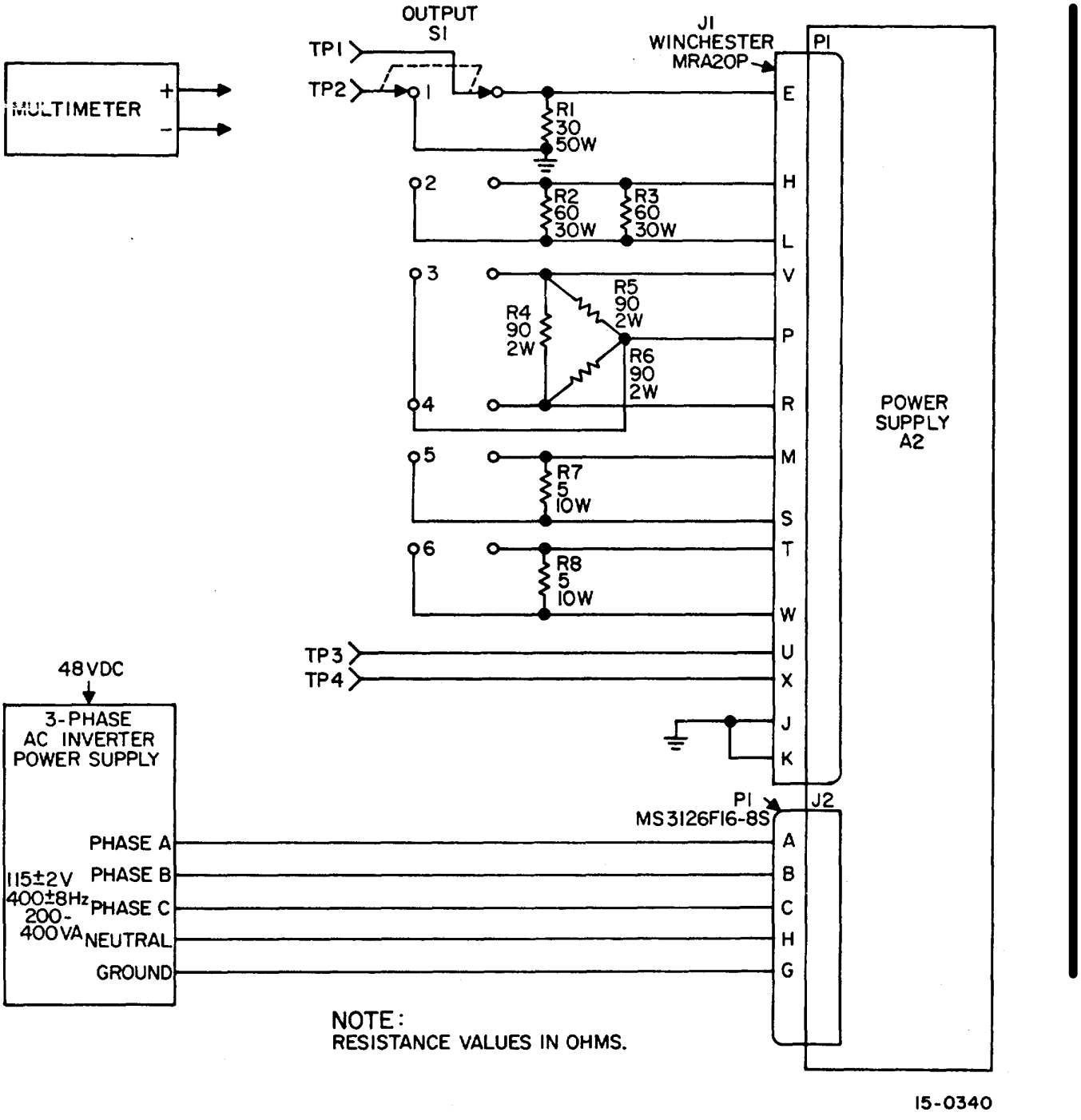


Figure 6-0N. Power Supply Test Setup

Table 6-5E. Power Supply A2 Performance Test

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1	Connect power supply to test setup as shown in figure 6-0N .			
2	Turn on test equipment and 115 volt, 400 Hz power source (adjusted to 115 ± 2 Vac). Allow 10 minute warmup .		Operate CIRCUIT BREAKER POWER switch to ON position.	
3	Set multimeter for positive dc measurement on 50 volt range. Operate output switch S1 to position 1. Connect multimeter negative lead to test point 2 and positive lead to test point 1 .	TP1		24 to 32 Vdc.
4	Operate output switch S1 to position 2 .	TP1		24 to 32 Vdc.
5	Disconnect multimeter positive lead. Set multimeter for ac measurement on 10 volt range .			
6	Operate output switch S1 to position 3. Connect multimeter positive lead to test point 1 .	TP1, TP2		8 to 12 Vac.
7	Operate output switch S1 to position 4 .	TP1, TP2		8 to 12 Vac.
8	Operate output switch S1 to position 5 .	TP1, TP2		4 to 6 Vac.
9	Operate output switch S1 to position 6 .	TP1, TP2		4 to 6 Vac.
10	Operate output switch S1 to position 1. Set multimeter for measurement on 3 volt rms range .	TP1, TP2		1. 0 to 1.8V rms.
11	Disconnect multimeter leads. Set multimeter for ohmmeter measurement. Connect multimeter to test points.	TP3, TP4		4.64 ohms + 1%.

Table 6-5F. Circuit Card Test Point Voltages and Waveforms

CIRCUIT CARD	TEST POINT	VOLTAGE OR WAVEFORM	REMARKS
A1A1 Servo Output	TP1	OV	Dc Common
	TP2	24 to 32 Vdc	
	TP3	Waveform	Step 44, Table 6-2
	TP4	Waveform	Step 44, Table 6-2
	TP5	Waveform	Step 43, Table 6-2
	TP6	Waveform	Step 43, Table 6-2
A1A2 Servo Input	TP1	Waveform	Step 43, Table 6-2
	TP2	Voltage Level and Shift	Step 40, Table 6-2
	TP3	Waveform	Step 43, Table 6-2
	TP4	Waveform	Figure 1-5
	TP5	Waveform	Figure 1-5
	TP6	0V	Dc Common
A1A3 Servo Input	TP1	Waveform	Step 44, Table 6-2
	TP2	Voltage Level and Shift	Step 40, Table 6-2
	TP3	Waveform	Step 44, Table 6-2
	TP4	Waveform	Figure 1-5
	TP5	Waveform	Figure 1-5
	TP6	0V	Dc Common
A1A4 Control Logic	TP1	0V	Dc Common
	TP2	0V/5V	Forward/Stop
	TP3	0V/5V	Strip Mode/Forward or Reverse
	TP4	0V/5V	Reverse/Stop
	TP5	0V/5V	Brake On/Brake Off
	TP6	Voltage and Waveform	Steps 23-27, 34, Table 6-5
A1A5 Rewind Speed Control	TP1	800 ± 80 Hz	High Speed
	TP2	Waveform	Step 6, Table 6-5A
	TP3	Waveform	Step 12, Table 6-5A
	TP4	0V	Tension Arms in Limits
	TP5	0V Dc Common	
	TP6	-5 to -6. 5 Vdc	
A1A6 Read Amplifier No. 1	TP1	0V	Dc Common
	TP2	Analog Data, Chan 2	Tape Moving
	TP3	Analog Data, Chan 1	Tape Moving
	TP4	Analog Data, Chan 3	Tape Moving
	TP5	2 to 4 Vdc	V Ref
A1A7 Read Amplifier No. 1	TP1	0V	Dc Common
	TP2	Analog Data, Chan 5	Tape Moving
	TP3	Analog Data, Chan 4	Tape Moving
	TP4	Analog Data, Chan 6	Tape Moving
	TP5	2 to 4 Vdc	V Ref

Table 6-5F. Circuit Card Test Point Voltages and Waveforms

CIRCUIT CARD	TEST POINT	VOLTAGE OR WAVEFORM	REMARKS
A1A8 Read Amplifier No. 2	TP1	0V	Dc Common
	TP2	Analog Data, Chan 8	Tape Moving
	TP3	Analog Data, Chan 7	Tape Moving
	TP4	Analog Data, Sprocket	Tape Moving
	TP5	2 to 4 Vdc	V Ref
A1A9 Self Test	TP1	0V	Dc Common
	TP2	Square Wave	
	TP3	7 to 15 milliseconds	High Level Pulse
	TP4	5V	Self Test Mode
A1A10	TP1	4 to 6 Vdc	
	TP2	0V	Dc Common
	TP3	11 to 13 Vdc	

Table 6-6. Motor and Transformer Winding Resistances

ITEM	REF DESIG	TERMINALS	RESISTANCE IN OHMS
Reel Motor	B1 or B2	Blk-Grn	7
		Blk-Red	7
Capstan Drive Motor	A4B1	Blk-Blue	35
		Red-Blue	35
		Red-Blk	35
Power Transformer	A2T 1	1-2	9
		2-3	9
		3-1	9
		4-5	0.15
		4-6	0.15
		5-6	0.15
		8-9	0.9
		8-10	0.9
		9-10	0.9
Lamp Transformer	A2T2	1-2	11.7
		3-5	less than 0.1
Fan	A2B1	1-2	-
		2-3	-

6-5. MOTOR AND TRANSFORMER WINDING RESISTANCE MEASUREMENTS.

6-6. The motor and transformer winding resistances in table 6-6, are provided as an aid in troubleshooting. Resistance values are nominal and may vary slightly between units.

6-7. REPAIR PROCEDURES.

6-8. GENERAL.

6-9. The following disassembly and reassembly instructions are provided for assemblies and parts of the tape reader that may require repair. Assemblies and parts not mentioned are considered to be obvious in disassembly.

6-9.1. Remove tape reader from transit case by first opening the transit case and then loosening eight toggle fasteners on the inner cover. Remove inner cover. Next remove eight machine screws from the panel mounting holes in the tape reader front panel. Lift the tape reader out of the transit case far enough to reach the cable plugs at the rear of the tape reader. Disconnect the plugs and remove the tape reader from the transit case. System cables or test cables can now be connected to jacks J1 and J2 on the rear of the tape reader.

6-10. Whenever the tape reader is disassembled for repair, perform the following additional checks.

a. Examine transistor sockets and pins for loose contacts, dirt and corrosion.

b. Inspect capacitor terminals for corrosion.

c. Resistors should be examined for blistering, discoloration, and other evidence of overheating.

d. Examine wires, cords and cables for cracked, cut or frayed insulation.

e. Examine sealed components, such as capacitors for leakage.

f. Check that the controls and switches operate freely and easily.

g. Check springs for any deformities.

h. Inspect rollers and shafts for wear, damage, and corrosion.

i. Inspect bearings for noise and roughness when turning.

6-11. During disassembly, the tape reader parts may be cleaned with a clean, lint free cloth or soft brush. Whenever necessary, the cloth or brush is to be moistened, not wet, with the specified cleaning solution. When a cleaning solution is used, care must be taken to prevent damage to protective finishes.

WARNING

Most cleaners are inflammable. Do not use them near open flames or in the vicinity of unprotected electrical equipment. Make certain that ventilation is adequate.

a. Clean solenoid rollers, brake shoes, read head, electromagnetic actuators, tape guides, capstans, pressure rollers, tape rollers, incandescent lamp and the optic lens with a lint free cloth, moistened with isopropyl alcohol, TT-I-735 or equivalent.

b. Remove all dust and grease from the exterior surfaces, chassis and subassemblies with a lint free cloth or soft brush moistened with trichloroethylene, D-T-634 or equivalent.

6-12. All bearings in the tape reader are self lubricating and need no additional lubricants.

6-13. The tools listed in table 6-7 are recommended for factory quality repair of the wiring,

Table 6-7. Repair Tools

PART NO.	FEDERAL MFR'S CODE	NOMENCLATURE	APPLICATION
107R1001	81312	Extraction tool	Extracting electrical contacts from connectors on the front panel assembly and the power supply.
11-7880-16	77820	Extraction tool	Same as above.
11-7880-20	77820	Extraction tool	Same as above.
107-1015	81312	Insertion tool	Inserting electrical contacts into connectors on the front panel assembly and the power supply.
11-7401-16	77820	Insertion tool	Same as above.
11-7401-20	77820	Insertion tool	Same as above.
MS3191-1	96906	Lug crimper	Crimping terminal lugs on the front panel assembly and the power supply.
MS3191-20B	96906	Lug crimper insert	Same as above.
46121	00779	Lug crimper	Same as above.
47386	00779	Lug crimper	Same as above.
L-1520	79136	Retaining ring pliers	Removing retaining rings on the front panel assembly.
0012	79136	Retaining ring pliers	Same as above.
0204	79136	Retaining ring pliers	Same as above.
505415	80205	Wire wrap bit	Connecting wires to the component mounting plate assembly.
507063	80205	Wire wrap bit	Same as above.
502129	80205	Wire wrap sleeve, 24 ga	Same as above.
507100	80205	Wire wrap sleeve, 30 ga	Same as above.
14R2	80205	Wire wrap tool	Same as above.
505084	80205	Wire unwrapping tool	Same as above.

connectors, and retaining rings on the tape reader. Alternate tools and methods may be used if these items are not available.

NOTE

Silicone grease specified in these procedures is type G640, manufactured by General Electric Co., Waterford, N.Y.

6-14. REMOVAL AND REPLACEMENT OF PARTS.

6-15. Removal and replacement of parts is fairly obvious and can be accomplished with minor instructions in conjunction with the exploded view details, figures 6-1 through 6-9 and figures 7-1 through 7-4. Unless otherwise stated, reassembly and replacement of parts is in reverse disassembly order.

NOTE

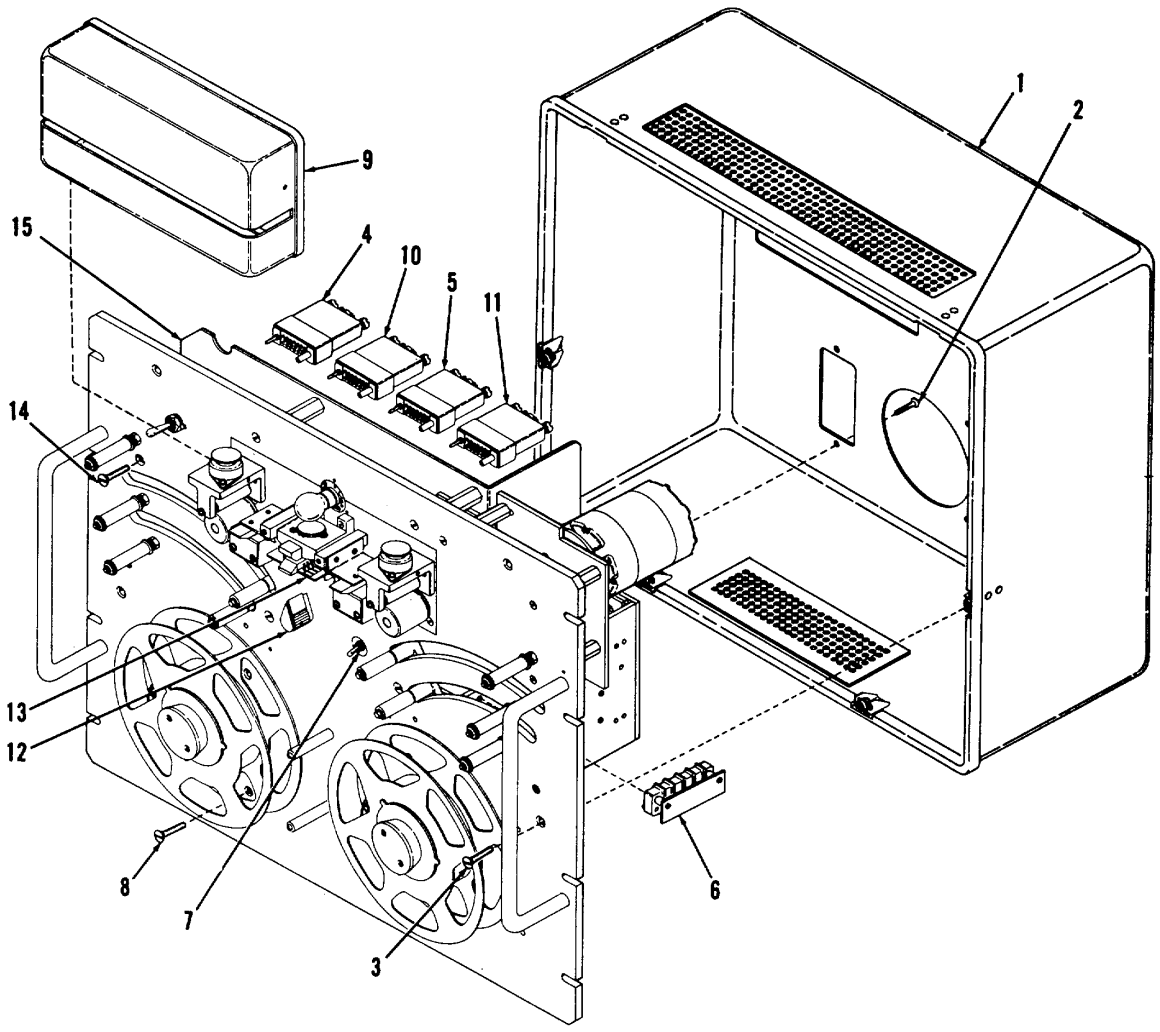
Use sealant ("Loctite," per MIL-S-40083) on the following items prior to reassembly. Front panel handle screws (67, figure 7-2), idler assembly screw (figure 6-7), capstan drive motor screws (figure 6-7), and optic assembly screws (36, figure 7-2).

NOTE

Remove tape reels when removing back cover to obtain access to the lower two front panel cover screws.

6-16. POWER SUPPLY A2 (Figure 6-1). - Removal and replacement of power supply A2 is accomplished as follows:

a. Remove rear cover (1) by removing four screws (2) from the back and six screws (3) located on the front panel.



LEGEND:

1. REAR COVER
2. SCREW (4 PLACES)
3. SCREW (6 PLACES)
4. PLUG WIPI
5. PLUG A2PI
6. TERMINAL BOARD A2TBI
7. CIRCUIT BREAKER A2S6
8. SCREW (4 PLACES)
9. DRIVE MECHANISM COVER
10. PLUG P2
11. PLUG PI
12. MODE SWITCH KNOB, NUTAND WASHER
13. READ HEAD A3
14. SCREW (5 PLACES)
15. COMPONENT MOUNTING PLATE A1

15-080

Figure 6-1. Removal of Covers, Component Mounting Plate and Power Supply

b. Disconnect plugs (4) WiP1 and A2P1 (5) by loosening two jackscrews in each plug.

c. Remove the motor leads at terminal board A2TB1 (6).

d. Remove circuit breaker A2S6 (7) by removing the nut securing the circuit breaker to the front panel.

e. Remove power supply. Remove the four screws (8) that secure the power supply to the front panel and remove the power supply.

6-17. Removal of the power supply parts is obvious. Before replacing transformers and the resistor, apply silicone grease to the mounting surfaces. Silicone grease is also applied to the mounting surfaces of the mica washers used in mounting transistors and diodes.

6-18. COMPONENT MOUNTING PLATE A1 (Figure 6-1). - Removal and replacement of the component mounting plate A1 is accomplished as follows:

a. Remove rear cover (1) by removing four screws (2) from the back and six screws (3) located on the front panel.

b. Remove all ten circuit cards.

c. Remove drive mechanism cover (9) by removing the screw located at each end of the cover.

d. Lift up the component mounting plate assembly and disconnect plugs P1, A2P1, P2, and W1P1 (11, 5, 10, 4) by loosening the two jackscrews securing each plug.

e. Remove mode switch knob, nut, and washer (12).

f. Remove read head A3 (13) by grasping the circuit card by the edges and pulling straight out from the front panel.

CAUTION

Do not hold the read head by the glass photo cell cover.

g. Remove tape guides (figure 6-2) and the read head connector A1P1 by removing the two screws, washers, and locknuts that hold the tape guides to the front panel. The connector is removed from the rear of the front panel.

h. Remove the five screws (14) holding the component mounting plate assembly (5) to the five standoffs (36, figure 7-3).

i. Remove the component mounting plate.

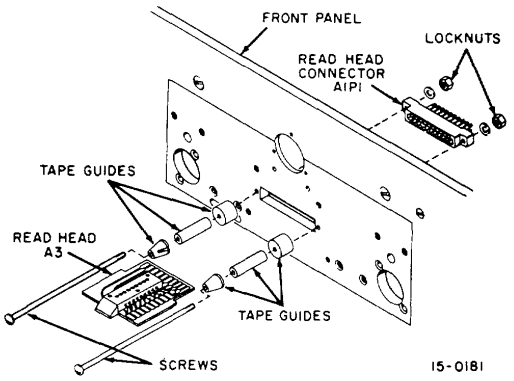


Figure 6-2. Removal of Read Head Connector A1P1

6-19. No special procedures are required to remove the component mounting plate assembly parts. No special procedures are required for replacement of parts except for the application of silicone grease to the mounting surfaces of resistors A1R1 thru A1R8. Silicone grease is also applied to the mounting surfaces of the mica washers used in mounting the transistors and diodes.

6-20. FORWARD AND REVERSE DRIVE SOLENOID ASSEMBLIES. - Removal and replacement of the forward and reverse drive solenoid assemblies L1 and/or L4 is accomplished as follows:

a. Remove drive mechanism cover (9, figure 6-1) by removing the screw located at each end of the cover.

b. Disconnect leads from solenoid assembly (figure 6-2) to terminal board TB1 (figure 6-3).

c. Remove the two socket head screws securing the solenoid assembly (figure 6-3) to the mounting bracket (figure 6-3) and remove the solenoid assembly.

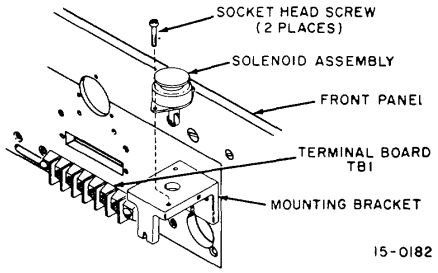


Figure 6-3. Removal of Solenoid Assemblies L1 and L4.

d. After completion of reassembly, make the adjustments specified in paragraph 6-37.

6-21. RIGHT HIGH TENSION LIMIT SWITCH S2 AND RIGHT LOW TENSION LIMIT SWITCH S3. - Removal and replacement of switches S2 and/or S3 is accomplished as follows:

a. Remove rear cover (1, figure 6-1) by removing four screws (2, figure 6-1) from the back and six screws (3, figure 6-1) located on the front panel.

b. Unsolder leads to desired switch (figure 6-4). High tension switch is nearest front panel.

c. Remove the two screws (figure 6-4) holding the switches to the switch mounting plate (figure 6-4) and remove the switches. The switch actuators (figure 6-4) are loosened in this step and must be replaced in their original position during reassembly.

d. Install new switch with the NC (normally closed) contacts toward the outside of the tape reader. This will allow the button on the switch to contact the flat spot on the actuator arm.

NOTE

If the screws holding the switch mounting plate are loosened, the plate will require readjustment after the new switch is installed.

e. Position the switch mounting plate for low tension switch actuation (listen for "click") with the tension arm 1/8-inch away from the low tension end of the panel cutout (toward center of front panel). Also align the switch case so that it is parallel to the tension arm when actuation occurs.

6-22. LEFT HIGH TENSION LIMIT SWITCH S5 AND LEFT LOW TENSION LIMIT SWITCH S4. - Removal and replacement of switches S5 and S4 is identical. to the procedures for switches S2 and S3.

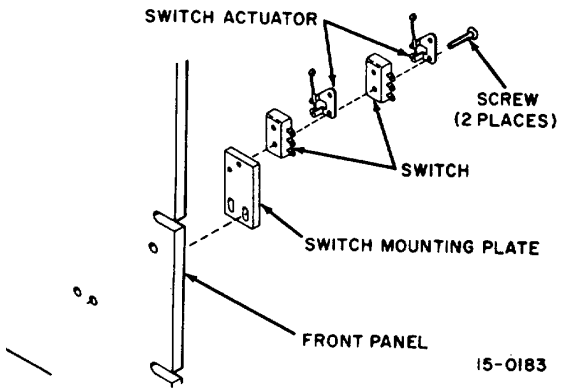


Figure 6-4. Removal of Tension Limit Switch S2, S3, S4 and S5

6-23. TENSION ARM POSITION SENSORS R1 AND R2. - Removal and replacement of variable resistors R1 and/or R2 is accomplished as follows:

a. Remove rear cover (1, figure 6-1) by removing four screws (2, figure 6-1) from the back and six screws (3, figure 6-1) located on the front panel.

b. Refer to figure 6-5. Loosen the adjusting hub on the front panel by removing the adjustment screw holding the adjusting hub to the front panel. Rotate the hub for access to the setscrew. Loosen setscrew and remove the adjusting hub.

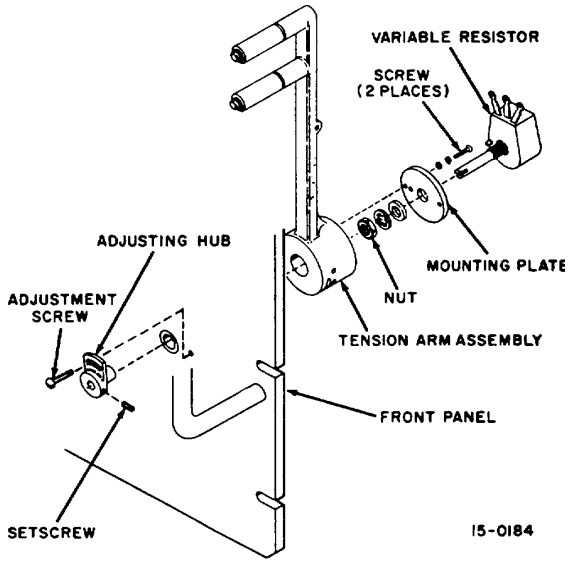


Figure 6-5. Removal of Tension Arm Position Sensors R1 and R2

c. Unsolder the three terminals on the variable resistor.

d. Remove the variable resistor and mounting plate by removing the two screws holding the mounting plate to the tension arm assembly.

e. Remove the nut securing the variable resistor to the mounting plate and remove the variable resistor.

f. While replacing the variable resistor be sure to position the adjusting hub with the setscrew contacting the flat portion of the variable resistor shaft. After completion of reassembly, adjustment of the tension arm must be accomplished as specified in paragraph 6-32.

6-24. CAPSTAN SHAFT ADAPTER ASSEMBLY. - Removal and replacement of either the left or right capstan shaft adapter assembly is accomplished as follows:

a. Remove drive mechanism cover (9, figure 6-1) by removing the screw located at each end of the cover.

b. Remove capstan (figure 6-6) by loosening two setscrews in the capstan and pulling the capstan off the shaft.

c. Remove rear cover (1, figure 6-1) by removing four screws (2, figure 6-1) from the back and six screws (3, figure 6-1) located on the front panel.

d. Remove all ten circuit cards.

e. Remove the five screws (14, figure 6-1) holding the component mounting plate assembly (15, figure 6-1) to the five standoffs and swing away from the capstan shaft adapters.

f. Refer to figure 6-6. Loosen the three screws securing the drive motor mounting plate to the three standoffs and slide toward the capstan to loosen the drive belt.

g. Remove the two screws, holding the capstan shaft adapter assembly to the front panel and remove the capstan shaft adapter assembly.

h. After completion of reassembly, adjustment of the drive belt must be accomplished as specified in paragraph 6-35.

6-25. IDLER ASSEMBLY. - Removal and replacement of the idler assembly is accomplished as follows:

a. Remove rear cover by (1, figure 6-1) removing four screws (2, figure 6-2) from the back and six screws (3, figure 6-1) located on the front panel.

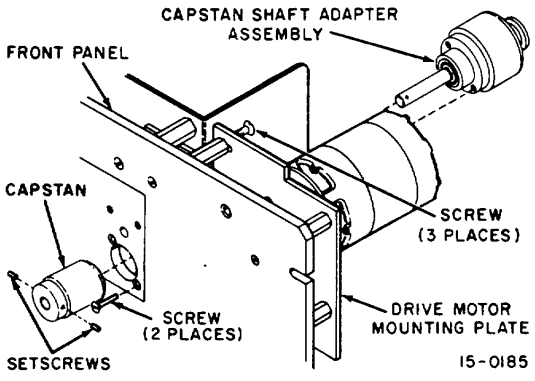


Figure 6-6. Removal of Shaft Adapter Assembly

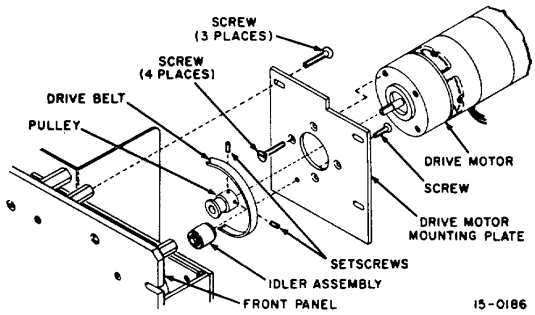


Figure 6-7. Removal of Idler Assembly, Drive Belt and Drive Motor

b. Remove all ten circuit cards.

c. Remove the five screws (14, figure 6-1) holding the component mounting plate assembly (15, figure 6-1) to the five standoffs and swing the component mounting plate assembly away from the drive motor (figure 6-7).

d. Remove the motor leads attached to terminal board A2TBl (6, figure 6-1).

e. Refer to figure 6-6. Remove the drive motor with its mounting plate by removing the three screws holding the drive motor mounting plate to the three standoffs.

f. Remove pulley (figure 6-7) from drive motor by loosening two setscrews.

g. Remove the drive motor from the mounting plate by removing the four screws.

h. Remove the idler assembly by removing one screw.

i. After completion of reassembly, adjustment of the drive belt must be accomplished as specified in paragraph 6-35.

6-26. DRIVE BELT. - Removal and replacement of the drive belt is accomplished as follows:

a. Remove rear cover (1, figure 6-1) by removing four screws (2, figure 6-1) from the back and six screws (3, figure 6-1) located on the front panel.

b. Remove all ten circuit cards.

c. Remove the five screws (14. figure 6-1) holding the component mounting plate assembly (15, figure 6-1) to the five standoffs and swing the component mounting plate assembly away from the drive motor.

d. Refer to figure 6-7. Loosen the three screws securing the drive motor mounting plate to

the three standoffs and slide the motor mounting plate towards the capstans.

e. Remove the drive belt.

f. Thread the new drive belt as illustrated in figure 1-4.

g. After reassembly, adjustment of the drive belt must be accomplished as specified in paragraph 6-35.

6-27. DRIVE MOTOR A4B1. - Removal and replacement of the drive motor A4B1 is accomplished as follows:

a. Remove rear cover (1, figure 6-1) by removing four screws from the back and six screws (2, figure 6-1) located on the front panel.

b. Remove all ten circuit cards.

c. Remove the five screws (14, figure 6-1) holding the component mounting plate assembly (15, figure 6-1) to the five standoffs and swing the component mounting plate assembly away from the drive motor (figure 6-7).

d. Remove the motor leads attached to terminal board A2TB1 (figure 6-1).

e. Refer to figure 6-7. Remove the three screws, holding the motor mounting plate to the three standoffs. Remove drive belt from pulley and remove the motor mounting plate.

f. Remove the two setscrews holding the motor pulley to the drive motor shaft and remove the pulley.

g. Remove the four screws securing the drive motor to the motor mounting plate and remove the drive motor.

h. After reassembly, adjustment of the drive belt must be accomplished as specified in paragraph 6-35.

6-28. REEL MOTORS B1 AND B2. - Removal and replacement of reel motors (including reel hub) B1 and/or B2 is accomplished as follows:

a. Remove rear cover (1, figure 6-1) by removing four screws (2, figure 6-1) from the back and six screws located on the front panel.

b. Refer to figure 6-8. Remove motor leads at motor terminal board. (Black wire-terminal 1, red wire-terminal 2, green wire-terminal 3.)

c. Remove two screws securing the reel knob and remove knob. Remove E-ring. Remove washer, spring, and pressure plate assembly.

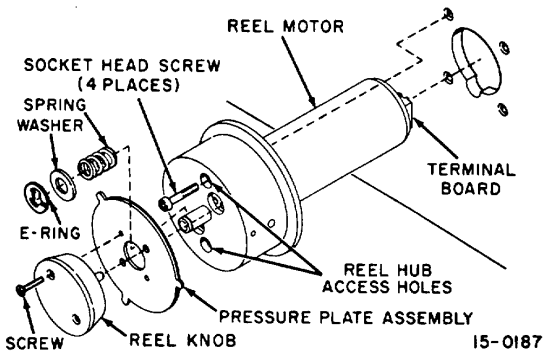


Figure 6-8. Removal of Reel Motors B1 and B2

d. Rotate the reel hub until the access holes align with two of the four socket head screws which secure the reel motor to the front panel. Remove these two screws and rotate the reel hub until the remaining two screws are visible. Remove these two screws and then remove the reel motor.

6-29. CAPSTANS AND PRESSURE ROLLER ASSEMBLY. - Removal and replacement of the capstans and pressure roller assembly is accomplished as follows:

a. Remove drive mechanism cover (9, figure 6-1) by removing the screw located at each end of the cover.

b. Refer to figure 6-9. Remove the capstan by loosening two setscrews and pulling the capstan straight out from the front panel.

c. Loosen the two screws securing the solenoid plunger assembly to the front panel just

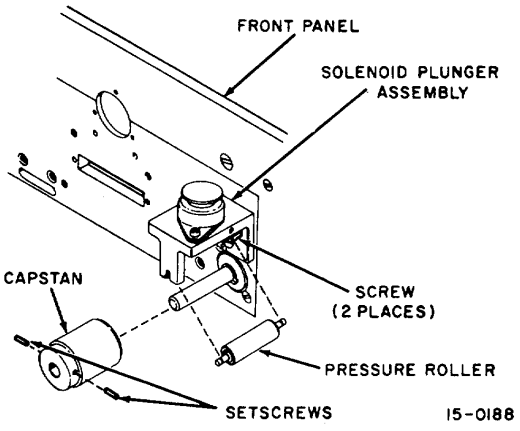


Figure 6-9. Removal of Capstan and Pressure Roller Assemblies

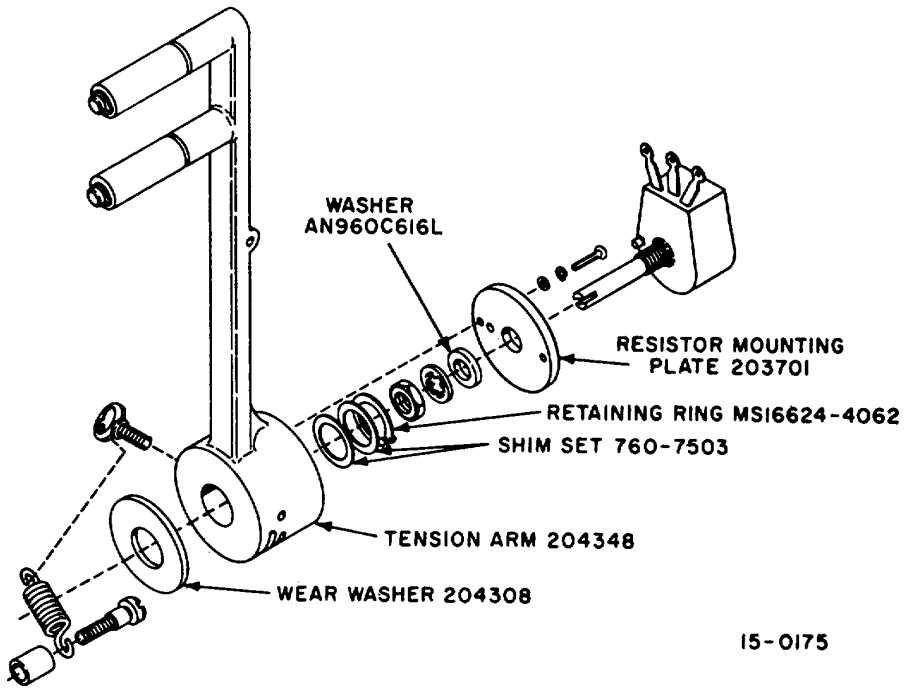


Figure 6-10. Tension Arm Shim Adjustment

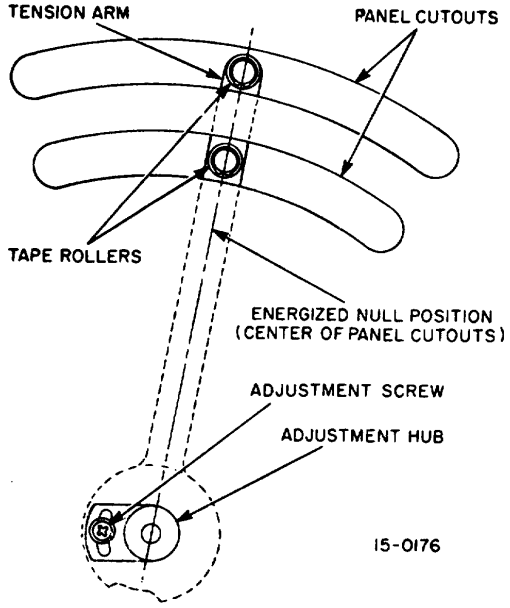


Figure 6-11. Tension Arm Position Adjustment

enough to provide clearance for the removal of the pressure roller. Remove the pressure roller.

d. After completion of assembly, adjust the solenoid plunger clearance as specified in paragraph 6-37.

6-30. MECHANICAL ALIGNMENT.

6-31. Mechanical alignments and adjustments required when assembling or installing parts in the tape reader are described in the following paragraphs.

6-32. TENSION ARMS.

6-33. Shim the tension arms (figure 6-10) to limit the axial end play to 0.005 inch (+0.000, -0.002 inch) using shim set part number 760-7503. The axial end play is measured between the wear washer and the tension arm.

6-34. Adjust tension arms (figure 6-11) with tape in its normal path and the power off, so that the null position of the right tension arm is approximately 2/3 up from bottom of cut out and the left arm is 1/3 up from bott; of cutout when tape reader is energized. This is accomplished by loosening the adjustment screw which fastens the adjustment hub to the panel and turning the hub as required to obtain the desired 8-18 position of the tension arm (refer to figure 6-11).

Retighten the adjustment screw and turn the power on. The tension arms should be positioned as stated above. Repeat process until desired position is held by the tension arms. If proper adjustment cannot be obtained, remove the two screws holding the resistor mounting plate to the tension arm (refer to figure 6-10), rotate plate to the other set of holes, replace screws and complete the tension arm adjustment.

6-35. CAPSTAN DRIVE BELT TENSION (Fig. 6-12).

6-36. To check proper capstan drive belt tension, turn power off, hold forward capstan securely, on the lower side and turn power on.

CAUTION

Do not attempt to grasp a moving capstan. Turn power off, hold capstan and then turn power on.

If belt is properly adjusted, the capstan motor will stall. If capstan motor does not stall, turn off power, loosen motor mounting plate and move plate toward the edge of the front panel. Retighten screws and retest belt tension. Check for too much belt tension by holding the reverse capstan. Capstan motor should not stall. Repeat mounting plate adjustment until the correct belt tension is obtained.

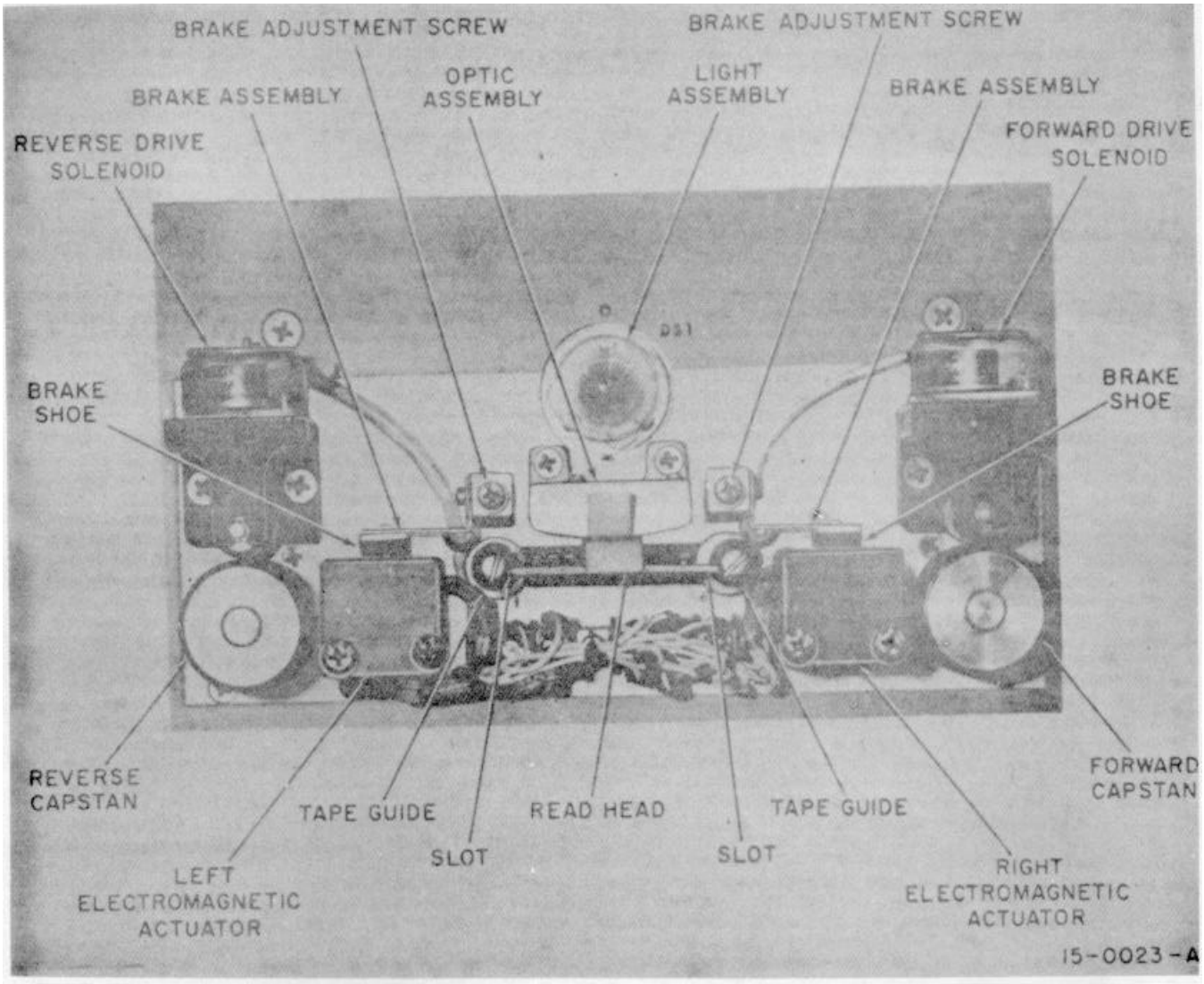


Figure 6-12. Tape Drive Mechanism Details

6-37. CAPSTAN SOLENOID (DRIVE SOLENOID) PLUNGER.

6-38. Adjust each capstan solenoid plunger for overtravel by first adding a 0.010 inch measuring shim as shown in figure 6-13. Use shim set 760-4338. Energize the tape reader and set the input signal conditions so that the solenoid is energized. Insert feeler gauge into the gap at clearance point as shown in figure 6-13. Hold feeler gauge firmly to prevent it from being pulled by the pressure roller. Check for a 0.005 inch to 0.006 inch clearance point gap with the feeler gauge. The correct gap measurement will be obtained when the feeler gauge is tangent to both the ball bearing outer race and pressure roller. Remove or add shims from the shim set to obtain correct gap. Remove the 0. 010 inch measuring shim after the proper gap measurement is obtained and tighten all screws.

6-39. TAPE GUIDE FLANGE.

6-40. Align tape guide flanges (refer to figure 6-12) so the slots are positioned horizontally with the optic assembly. This is required to allow the read head assembly to be properly aligned with its connector.

6-41. BRAKE SHOES AND ELECTROMAGNETIC ACTUATORS.

6-42. Adjustment of the brake shoes and electromagnetic actuators (EM actuator) must be made in a de-energized and an energized position. Refer to figure 6-12.

a. Test in the de-energized position by placing a strip of 0. 0025 inch thick mylar tape between a brake shoe and the EM actuator, allowing approximately 12 inches of tape to extend toward the side of the tape reader. Fasten a 5 pound spring scale to the extended part of the tape and with the EM actuators de-energized, a maximum pull of 3 + 1 ounces on the scale should move the tape. If the desired pull is not obtained, first be sure EM actuator is adjusted to just touch and be parallel to tape path. Then readjust tension of brake shoe by loosening the two screws that hold the leaf spring to the front panel post. Adjust brake shoe (with tape removed) for flat, square contact with EM actuator and retighten screws. Brake adjustment screw (fig. 6-12) may be loosened to rotate mounting post (20 max.) to obtain a square contact between brake shoe and EM actuator. Repeat the above process with the other brake shoe and EM actuator.

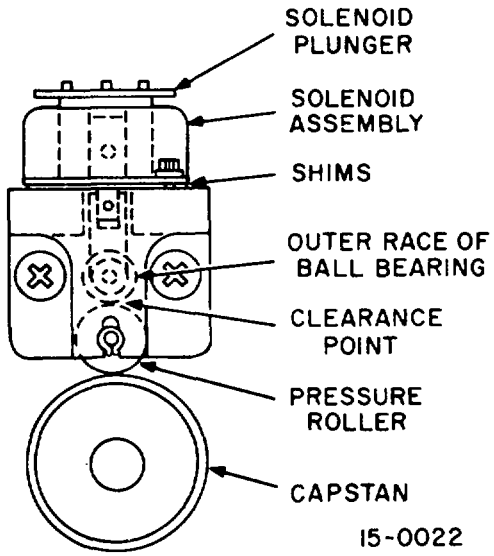


Figure 6-13. Capstan Solenoid Plunger Alignment

b. Test in the energized position by threading a strip of 0.0025 inch thick mylar tape into the tape's path between the two capstans, allowing 12 inches of tape to extend past each capstan. Fasten a 5 pound spring scale to one end of the tape and with the EM actuators energized, a minimum of 32 ounce pull should be required to move the tape. If the desired pull is not obtained, refer to table 6-2, Punched Tape Reader Tests and Troubleshooting (Brakes).

6-45. SERVO INPUT A1A2/A1A3, SERVO BALANCE CONTROL ALIGNMENT.

6-46. The servo balance control R21 is adjusted for a minimum servo signal at A1A2TP1 and A1A2TP3 when the tension arm raises due to a slack in the tape. Circuit cards A1A2 and A1A3 are adjusted separately since they control different reel motors.

6-47. To align right servo input card A1A2, connect a dual trace oscilloscope to show the waveforms at A1A2TP1 and A1A2TP3. The waveform at A1A2TP1 will appear as shown in figure 6-14. Turning the right tape reel slightly clockwise to cause a tension in the tape, and consequently allow the right tension arm to lift, will cause the waveform at A1A2TP3 to decrease and a waveform to just appear at A1A2TP1. Servo balance control A1A2R21 is adjusted to let the waveforms at A1A2TP1 and A1A2TP3 to just appear but not exceed 5 percent of the total cycle time.

6-48. Left servo input circuit card A1A3 is aligned in a similar manner. Connect oscilloscope to A1A3TP1 and A1A3TP3, and observe the waveforms. Turn the left tape reel counterclockwise to cause a tension in the tape and a waveform to appear at A1A2TP1. Adjust A1A3R21 identically to A1A2R21.

6-49. REWIND SPEED CONTROL A1A5 ADJUSTMENT.

6-50. Connect electronic frequency counter to A5TP1 (ground to A5TP5, dc common). Adjust A5R5 for 800 Hz while the tape is running in the reel mode at high speed (either forward or reverse). Clockwise rotation of A5R5 increases the frequency (and tape speed).

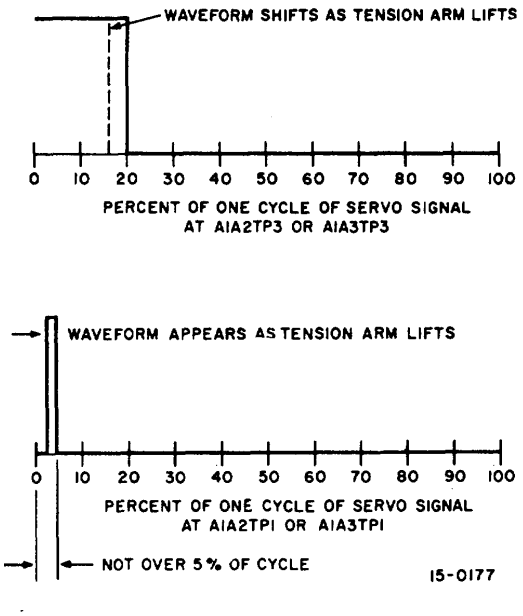


Figure 6-14. Servo Balance Control Waveforms

6-51. A less exact adjustment method may be used if an electronic frequency Counter is not available. Stop the tape and position so that no output occurs on the sprocket channel. Connect a square wave generator to A5TP1. Set the generator for 5 volts output peak-to-peak at 800 Hz. Observe the waveform at A5TP2 with an oscilloscope and adjust A5R5 for the waveform shown in figure 6-15.

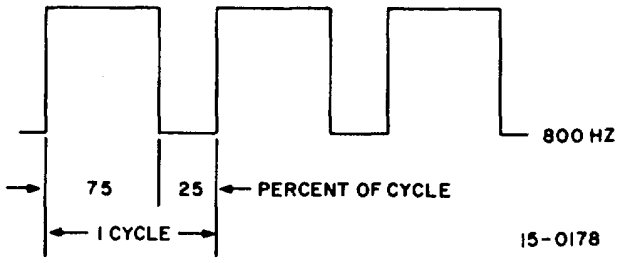


Figure 6-15. Rewind Speed Control Adjustment Waveform

6-52. POWER REGULATOR A1A10 ADJUSTMENTS. Connect an oscilloscope to the sprocket channel output at J1-P. Run the tape reader forward and observe the sprocket waveform. Adjust v ref control R15 for the waveform shown in figure 6-16.

6-53. Connect a volt-ohmmeter to A1A10TP1 and measure the +5 Vdc output. Adjust +5 Vdc regulator control R6 for +5.1 Vdc.

6-54. TEST PROCEDURE.

6-55. The tape reader is tested for reliable operation using the self test tape illustrated in figure 1-6. Install the tape on the reels according to the procedures in Chapter 4, paragraph 4-18.

CAUTION

Turn the tape reader power off before removing or replacing any circuit cards.

Move the tape to the desired test section by setting the mode switch to REEL MODE and using the TAPE FEED switch in either the FORWARD or REWIND position. Test the tape reader according to the following procedure:

a. Move to the beginning of tape where diagonal pattern is punched.

b. Set mode switch to SELF TEST.

c. Tape reader is good if the tape is stopped seven times (at equal intervals) between automatic reversing commands (which occur about 4 seconds apart).

d. If the tape stops more than seven times or if the reversing commands occur more often than every 2 seconds (not including reversing stops), proceed to paragraph 6-57 or troubleshooting tables (one or more channels failed in logic "1" state).

e. If there are less than seven stops between automatic reversing commands, proceed to paragraph 6-56 or troubleshooting tables (one or more channels failed in logic "0" state).

f. If the reversing commands are not generated, either channel 2 or channel 8 is defective, or self test circuit card A1A9 is defective. See troubleshooting tables.

g. If there are no stop commands generated, either the sprocket channel (on read amplifier No. 2 circuit card A1A8) is defective, or all channels are inoperative, or self test circuit card A1A9 is defective. See troubleshooting tables.

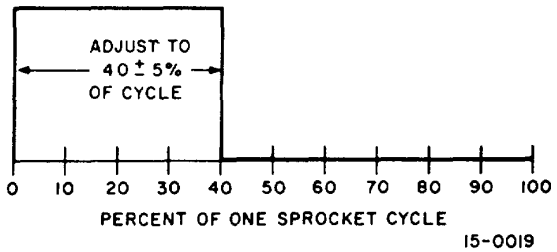


Figure 6-16. V Ref Control Adjustment Waveform

h. If the start command is not initiated when the mode switch is set to SELF TEST, board A1A9 is defective.

i. If after one or more stops the tape reader remains in stop, either the sprocket is too narrow or the brakes are malfunctioning. See troubleshooting tables.

6-56. If the reversing commands occur about every 4 seconds, channels 2 and 8 are good. If there are less than seven stops between the reversing commands, proceed as follows:

a. If there are no stops between reversing commands, either the sprocket channel is defective or the self test circuit card A1A9 is defective. See table 6-2 (data outputs) or table 6-4.

b. If some of the seven stops between reversing commands are skipped, refer to table 6-8.

Table 6-8. Stop Code Skipped vs. Bad Channel

STOP CODE NO. SKIPPED (See figure 1-6)	BAD CHANNEL
1	1
1 and 2	2
2 and 3	3
3 and 4	4
4 and 5	5
5 and 6	6
6 and 7	7
7	8

The table can be used to find more than one defective channel. For instance, if stop codes No. 2, 3 and 4 are skipped, channels 3 and 4 are defective.

6-57. If there are extra stops in section A of the tape (diagonally punched section), move to section B of the tape where channels 1, 3, 5 and 7 are punched continuously (about 10 feet), select SELF TEST mode and proceed as follows:

a. If the tape reader runs through this section of tape without stopping, proceed to step h.

b. If the tape reader stops and starts on each code, remove read amplifier No. 1 circuit card A1A6 and continue testing.

c. If the tape reader runs, then read amplifier No. 1 circuit card A1A6 is bad and should be replaced with a new circuit card.

d. If the tape reader stops and starts on each code, read amplifier No. 1 circuit card A1A6 is good and should be returned to its connector.

e. Remove read amplifier No. 1 circuit card A1A7.

f. If the tape reader runs, read amplifier No. 1 circuit card A1A7 is bad and should be replaced with a new circuit card.

g. If the tape reader stops and starts on each code, read amplifier No. 1 circuit card A1A7 is good but read amplifier No. 2 circuit card A1A8 is bad and should be replaced with a new circuit card.

h. Move to section C of the tape where channels 2 and 4 are punched continuously (about 10 feet), select SELF TEST mode.

i. If the tape reader stops and starts on each code, remove read amplifier No. 1 circuit card A1A7.

j. If the tape reader stops and starts on each code, read amplifier No. 1 circuit card A1A7 is good. Return read amplifier No. 1 circuit card A1A7 to its connector and proceed to step 1.

k. If the tape reader runs, read amplifier No. 1 circuit card A1A7 is bad and should be replaced with a new circuit card. 1. Remove read amplifier No. 1 circuit card A1A6.

m. If the unit still stops and starts on each code, read amplifier No. 1 circuit card AiA6 is good and read amplifier No. 2 circuit card A1A8 is bad. Return read amplifier No. 1 circuit card A1A6 to its connector and replace read amplifier No. 2 circuit card A1A8 with a new circuit card.

CHAPTER 7

PARTS LIST

SECTION I INTRODUCTION

7-1. GENERAL.

7-2. This illustrated parts list will assist supply and maintenance personnel in identifying and ordering parts for the model 1710 tape reader (part numbers 204300-101, 204300-103 and 204300-105).

7-3. MANUFACTURERS' IDENTIFICATION.

7-4. Items manufactured by Cook Electric Company Data-Stor Division or Government standard parts appear in the group assembly parts list without a Federal Supply Code indicated parenthetically in the description column. All other items will show the manufacturers' code in parenthesis following the item descriptions. This will be parenthetically followed by Data-Stor Division's part number. The Data-Stor Division Federal Manufacturer's Code (17597), if applicable, appears after the part number. Names and addresses of manufacturers' are as follows:

Code No.	Manufacturers' Name & Address
00141	PIC Design Corp. East Rockaway, N.Y. 11518
00779	AMP Inc. Harrisburg, Pa. 17105
03038	Long-Lok Corp. Santa Monica, Calif. 90400
05616	Cosmo Plastics Co. Cleveland, Ohio 44100
06540	Amathom Electronic Hardware Co. Inc. New Rochelle, N.Y. 10801
07388	Torotel Inc. Grandview, Mo. 64030
08289	Blinn Delbert Co. Inc. Pomona, Calif. 91766
08804	General Electric Co. Lamp Metals & Components Dept. Cleveland Wire Plant, Cleveland, Ohio 44117
13445	Cole-Hersee Co. Boston, Mass. 02127
16037	Spruce Pine Mica Co. Spruce Pine, N.C. 28777
17597	Cook Electric Co. Data-Stor Div. Morton Grove, Ill. 60053
21688	Raytheon Co. Computer Division Santa Ana Operations Santa Ana, Calif. 92704
24233	Vamistor Corp. Cedar Knolls, N.J. 07927
56289	Sprague Electric Co. North Adams, Mass. 01247
70318	Allmetal Screw Products Co. Inc. Garden City, N.Y. 11533
71279	Cambridge Rubber Co. Cambridge, Mass. 02138
71785	Cinch Mfg Co. and Howard B. Jones Div. Chicago, Ill. 60624
72928	Gudeman Division of Gulton Industries Inc. Chicago, Ill. 60610

Code No.	Manufacturers' Name & Address
73734	Federal Screw Products Inc. Chicago, Ill. 60618
75382	Kulka Electric Corp. Mt. Vernon, N.Y. 10550
81073	Grayhill Inc. La Grange, Ill. 60525
81312	Winchester Electronics Div. Litton Industries Inc. Oakville, Conn. 06779
82877	Rotron Mfg Co. inc. Woodstock, N.Y. 12498
83330	Herman H. mith Inc. Brooklyn, N.Y. 11207
84830	Lee Spring Co. Inc. Brooklyn, N.Y. 11201
84971	TA Mfg Corp. Los Angeles, Calif. 90039
87164	Michigan-Dynamics Inc. Michigan Wire Cloth Div. Detroit, Mich. 48216
88245	Litton Industries USECO Div. Van Nuys, Calif. 91401
89307	Sprague Engineering A Teledyne Co. Gardena, Calif. 90247
91929	Honeywell Inc. Micro Switch Div. Freeport, Ill. 61032
92702	IMC Magnetics Corp. Westbury, N.Y. 11591

7-5. ABBREVIATIONS.

7-6. Explanation of abbreviations used in this manual are as follows:

a. "REF" indicates the quantity has been listed elsewhere and is listed again for reference only.

b. "NHA" is an abbreviation for "next higher assembly. " This abbreviation is used when cross referencing a figure of a lower assembly to the next higher assembly.

Transit Case and Ancillary Items Parts List

REFERENCE DESIGNATION	DESCRIPTION	PART NUMBER"
A2	TRANSIT CASE	204400
A2M1	ELAPSED TIME METER	MS17322-9
A2FL1	RFI FILTER	600171
A2J1	CONNECTOR, SIGNAL	MS3120F14-19P
A2J2	CONNECTOR, POWER	MS3113H16C8P (P/o A2FL1)
-	INNER COVER	204401-201
W1	POWER CABLE	204402

7-7. REFERENCE DESIGNATION INDEX.

7-8. Table 7-5 h Section III lists the tape reader replaceable parts in reference designation order. This table is provided as an aid in identifying the item part numbers when the reference designation is known.

7-9. FIGURE CODE NUMBERS.

7-10. Code numbers (e.g. 15-0139-E) are assigned to identify the artwork for each figure. The alphabetical suffix to this code number indicates the revision level of the complete assembly part number for that figure.

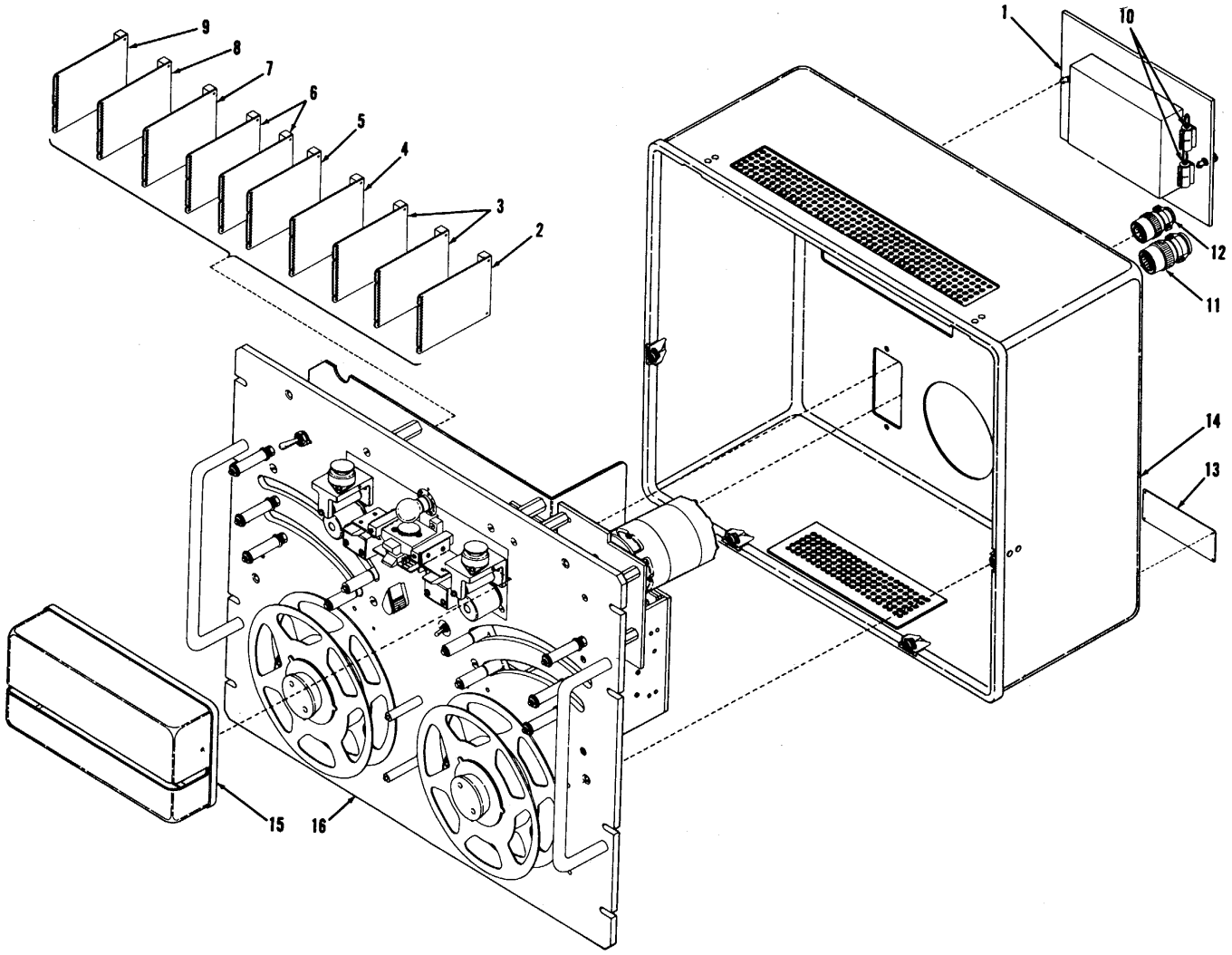


Figure 7-1. Model 1710 Tape Reader

Table 7-1. Tape Reader Parts List

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	UNIT PER ASSY
7-1-			
	204300-103	READER, PUNCHED TAPE, MODEL 1710	REF
-1	204355-201	• COVER ASSEMBLY	1
-2	203755	• CIRCUIT CARD ASSEMBLY, SERVO OUTPUT	1
-3	203746	• CIRCUIT CARD ASSEMBLY, SERVO INPUT	2
-4	203868	• CIRCUIT CARD ASSEMBLY, CONTROL LOGIC	1
-5	204381-105	• CIRCUIT CARD ASSEMBLY, REWIND CONTROL	1
-6	203740	• CIRCUIT CARD ASSEMBLY, READ AMPLIFIER No. 1	2
-7	203772	• CIRCUIT CARD ASSEMBLY, READ AMPLIFIER No. 2	1
-8	203767	• CIRCUIT CARD ASSEMBLY, SELF TEST	1
-9	203749	• CIRCUIT CARD ASSEMBLY, POWER REGULATOR	1
-10	426	• PLUG TIP (83330)(700967)(17597)	2
-11	MS3126F16-8S	• CONNECTOR, PLUG, ELECTRICAL	1
-12	MS3126F14-19S	• CONNECTOR, PLUG, ELECTRICAL	1
-13	204426	• PLATE IDENTIFICATION	1
	MS35649-224	• NUT, PLAIN, HEXAGON	4
	MS35338-134	• WASHER, LOCK	4
	NAS620-2L	• WASHER, FLAT	8
	MS51957-4	• SCREW, MACHINE	4
		----*----	
-14	204354-203	• COVER, REAR	1
		(ATTACHING PARTS)	
	MS51958-64	• SCREW, MACHINE	4
	MS15795-808	• WASHER, FLAT	4
	MS51960-67	• SCREW, MACHINE	6
		----*----	
-15	203732-201	• COVER, DRIVE	1
		(ATTACHING PARTS)	
	MS51957-26	• SCREW, MACHINE	2
	MS35338-136	• WASHER, LOCK	2
	MS15795-805	• WASHER, FLAT	2
		----*----	
-16			
	20430-103	• PANEL ASSEMBLY, TAPE READER	1

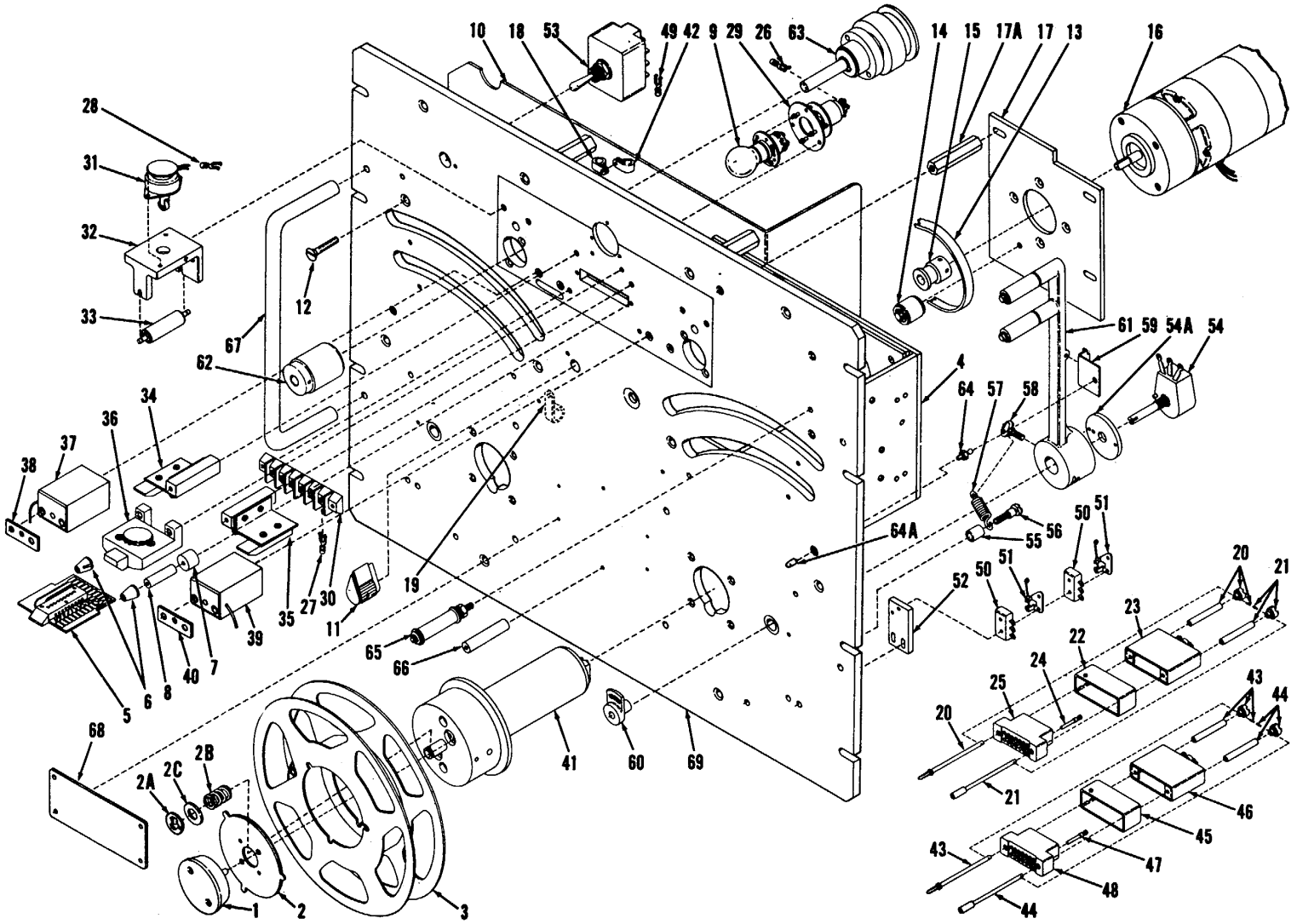


Figure 7-2. Front Panel Assembly

Table 7-2. Front Panel Parts List

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	UNIT PER ASSY
7-2-		PANEL ASSEMBLY, TAPE READER (60 Hz SINGLE PHASE)	
	204340-103	PANEL ASSEMBLY, TAPE READER (400 Hz THREE PHASE) REF	
		PANEL ASSEMBLY, TAPE READER (400 Hz SINGLE PHASE)	
-1	204303-201	• KNOB, REEL	2
		(ATTACHING PARTS)	
	MS51959-32	• SCREW, MACHINE	4
		----*----	
-2	204372	• PLATE, PRESSURE ASSEMBLY	2
		(ATTACHING PARTS)	
-2A	MS16633-1037	• RING, RETAINING	2
-2B	LC-0386-2	SPRING, COMPRESSION (84830)(752-5593-023)(17597)	2
-2C	AN960C616L	WASHER, FLAT	2
		----*----	
-3	752-5992	• REEL ASSEMBLY, TAPE READER	2
-4			
	204329	• POWER SUPPLY. 400 Hz THREE PHASE	1
		(ATTACHING PARTS)	
	MS51958-65	• SCREW, MACHINE	4
	MS15795-808	• WASHER, FLAT	4
	MS25082-7	NUT, PLAIN, HEXAGON (Supplied with item 7-4-1, 7-5-1, or 7-6-1)	1
	MS9387-06	PACKING, PREFORMED, 3/8 in. (Supplied with item 7-4-1, 7-5-1, or 7-6-1)	1
		----*----	
-5	203686	• READ HEAD ASSEMBLY	1
-6	203691	• FLANGE, TAPE, GUIDE	2
		(ATTACHING PARTS)	
	MS21083C06	• NUT, SELF-LOCKING	2
	AN960C8L	• WASHER, FLAT	2
	18-8	• SCREW, MACHINE, 6-32 x 2-5/8 (70318)(700936-003)(17597)	2
		----*----	
-7	203688	• FLANGE, TAPE, GUIDE	2
-8	203689	• POST, TAPE, GUIDE	2
-9	1630	• LAMP, INCANDESCENT (08804)(752-3316)(17597)	
-10	204319-101	• PLATE ASSEMBLY, COMPONENT MOUNTING (See Figure 7-3)	1
		(ATTACHING PARTS)	
-11	MS91528-1K2B	• KNOB	1
	MS25082-7	• NUT, PLAIN, HEXAGON (Supplied with item 7-3-1)	2
	AN960C616L	• WASHER, FLAT	2
-12	MS51960-66	• SCREW, MACHINE	5
		----*----	
	322777	• TERMINAL, LUG t00779)(700947-001)(17597)	11
-13	752-5118-068	• BELT, FLAT	1
-14	203724	• IDLER ASSEMBLY	1
		(ATTACHING PARTS)	
	MS51959-42	• SCREW, MACHINE	1
		----*----	
-15	203839	• PULLEY, MOTOR	1
		(ATTACHING PARTS)	
	LP22XF82J3	• SETSCREW (03038)(752-6592-004)(17597)	2
		----*----	
-16			
	759-0015-001	• MOTOR, ALTERNATING CURRENT	1
		(ATTACHING PARTS)	
	MS24693-C270	• SCREW, MACHINE	4
		----*----	
-17	204315	• PLATE, MOTOR, MOUNTING	1
		(ATTACHING PARTS)	
	MS51957-45	• SCREW, MACHINE	3
	MS35338-137	• WASHER, LOCK	3
	MS15795-807	• WASHER, FLAT	3
-17A	204317-201	• POST, ELECTRICAL EQUIPMENT	3
	MS51959-45	• SCREW, MACHINE	3
		----*----	

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	UNIT PER ASSY
7-2-	204352	• WIRE HARNESS, POWER	1
		(ATTACHING PARTS)	
-18	MS25281-F2	• CLAMP, WIRE SUPPORT	1
-19	MS25281-F4	• CLAMP, WIRE SUPPORT	1
	MS51957-30	• SCREW, MACHINE	1
	MS51957-29	• SCREW, MACHINE	1
	MS15795-805	• WASHER, FLAT	2
		----*----	
-20	MS18194-1	• JACKSCREW, MALE	1
-21	MS18194-2	• JACKSCREW, FEMALE	1
-22	XMRE20-1A000	• SHELL, CONNECTOR (81312)(700918-001)(17597)	1
-23	MS18192T2	• SHIELD, ELECTRICAL	1
-24	MS17804-16-20	• CONTACT, ELECTRICAL	13
-25	MS18177-1	• BLOCK, CONNECTOR	1
-26	YAE18Z2	• TERMINAL, LUG (09922)(752-9535-002)(17597)	2
-27	322777	• TERMINAL, LUG (00779)(700947-001)(17597)	5
-28	324597	• TERMINAL, LUG (00779)(700947-003)(17597)	6
-29	27428	• LIGHT, PANEL (13445)(752-5776)(17597)	1
		(ATTACHING PARTS)	
	MS51957-12	• SCREW, MACHINE	3
	MS35338-135	• WASHER, LOCK	3
	NAS620-4L	• WASHER, FLAT	3
		----*----	
-30	599D0-6S1	• TERMINAL BOARD (75382)(752-5942-006)(17597)	1
		(ATTACHING PARTS)	
	MS51957-17	SCREW, MACHINE	2
	NAS620-4L	WASHER, FLAT	2
		----*----	
-31	203717	• SOLENOID-PLUNGER ASSEMBLY	2
		(ATTACHING PARTS)	
	MS16995-10	• SCREW, MACHINE	4
	MS35338-135	• WASHER, LOCK	4
	NAS620-4L	• WASHER, FLAT	4
	760-4338	• SHIM SET	2
		----*----	
-32	203713	• BRACKET, DOUBLE ANGLE	2
		(ATTACHING PARTS)	
	MS51959-45	• SCREW, MACHINE	4
		----*----	
-33	203816	• ROLLER, PRESSURE ASSEMBLY	2
-34	203826-102	• BRAKE SHOE ASSEMBLY	1
		(ATTACHING PARTS)	
	MS51957-38	• SCREW, MACHINE	1
	MS15795-805	• WASHER, FLAT	1
		----*----	
-35	203826-101	• BRAKE SHOE ASSEMBLY I	
		(ATTACHING PARTS)	
	MS51957-38	• SCREW, MACHINE	1
	MS15795-805	• WASHER, FLAT	1
		----*----	
-36	203690	• OPTIC ASSEMBLY	1
		(ATTACHING PARTS)	
	MS51959-28	• SCREW, MACHINE	2
		----*----	
-37	203706-203	• ACTUATOR, ELECTROMAGNETIC	1
		(ATTACHING PARTS)	
	MS51957-53	• SCREW, MACHINE	2
	MS35333-72	• WASHER, LOCK	2
		----*----	
-38	204362	• STRAP, GROUNDING	1
		(ATTACHING PARTS)	
	MS51957-13	• SCREW, MACHINE	1
	MS35338-135	• WASHER, LOCK	1
	MS15795-803	• WASHER, FLAT	1
		----*----	
-39	203706-205	• ACTUATOR, ELECTROMAGNETIC	1
		(ATTACHING PARTS)	
	MS51957-53	• SCREW, MACHINE	2
	MS35333-72	• WASHER, LOCK	2
		----*----	

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	UNIT PER ASSY
7-2-40	204362	• STRAP, GROUNDING	1
		(ATTACHING PARTS)	
	MS51957-13	• SCREW, MACHINE	1
	MS35338-135	• WASHER, LOCK	1
	MS15795-803	• WASHER, FLAT	1
		----*----	
-41	204307	• MOTOR-REEL ASSEMBLY	2
		(ATTACHING PARTS)	
	MS16995-27	• SCREW, MACHINE	8
	NAS620-8L	• WASHER, FLAT	8
		----*----	
	204353	• WIRE HARNESS, CONTROL	1
		(ATTACHING PARTS)	
-42	MS25281-F3	• CLAMP, WIRE SUPPORT	5
	MS35649-264	• NUT, PLAIN, HEXAGON	2
	MS35338-136	• WASHER, LOCK	2
	MS15795-805	• WASHER, FLAT	4
	B6-11	• SPACER, SLEEVE (00141)(752-9540-011)(17597)	2
	204571-201	• BUMPER	4
	MS51957-36	• SCREW, MACHINE	2
	MS51957-49	• SCREW, MACHINE	2
	MS15795-807	• WASHER, FLAT	2
		----*----	
-43	MS18194-1	• • JACKSCREW, MALE	1
-44	MS18194-2	• • JACKSCREW, FEMALE	1
-45	XMRE20-1AOOO	• • SHELL, CONNECTOR (81312)(700918-001)(17597)	1
-46	MS18192T2	• • SHIELD, ELECTRICAL	1
-47	MS17804-16-20	• • CONTACT, ELECTRICAL	14
-48	MS18177-1	• • BLOCK, CONNECTOR	1
-49	322777	• • TERMINAL, LUG (00779)(700947-001)(17597)	6
-50	MS27216-1	• SWITCH	4
-51	JS5	• ACTUATOR, SWITCH (91925)(752-1208)(17597)	4
		(ATTACHING PARTS)	
	MS51957-9	• SCREW, MACHINE	4
	MS35338-134	• WASHER, LOCK	4
	NAS620-2	• WASHER, FLAT	4
		----*----	
-52	204314	• PLATE, SWITCH MOUNTING	2
		(ATTACHING PARTS)	
	MS51957-29	• SCREW, MACHINE	4
	MS15795-805	• WASHER, FLAT	4
		----*----	
-53	MS27406-3	• SWITCH	1
-54	600192	• POTENTIOMETER	2
		(ATTACHING PARTS)	
-54A	203701	• PLATE	2
	MS51957-15	• SCREW, MACHINE	4
	MS35338-135	• WASHER, LOCK	4
	NAS620-4L	• WASHER, FLAT	4
	AN960C616L	• WASHER, FLAT	2
		----*----	
-55	B8-14	• SPACER, SLEEVE (00141)(752-5841-014)(17597)	2
		(ATTACHING PARTS)	
-56	4331	SCREW, SHOULDER (00141)(752-5543-022)(17597)	2
		----*----	
-57	MS24586-113	• SPRING, HELICAL, EXTENSION	2
-58	NAS1300-08-8D	• THUMBSCREW	2
-59	204367	• BRACKET, DETENTION	2
		(ATTACHING PARTS)	
	MS51957-29	• SCREW, MACHINE	2
	MS35338-136	• WASHER, LOCK	2
	MS15795-805	• WASHER, FLAT	2
		----*----	
-60	204321	• HUB, ADJUSTING	2
		(ATTACHING PARTS)	
	MS51957-27	• SCREW, MACHINE	2
	MS15795-805	• WASHER, FLAT	2
	752-3512-011	• SETSCREW	4
		----*----	

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	UNIT PER ASSY
7-2-61	204348	• ARM-ROLLER ASSEMBLY, TENSION	2
		(ATTACHING PARTS)	
	MS16624-4062	• RING, RETAINING	2
	760-7503	• SHIM SET	2
	204308	• WASHER, FLAT	2
	204311	• ROLLER	2
		(ATTACHING PARTS)	
	MS16624-4031	• RING, RETAINING	2
	204312	• SHAFT, ROLLER	2
		(ATTACHING PARTS)	
	760-5120-002	• SHIM	2
	MS51957-50	• SCREW, MACHINE	2
	MS35338-138	• WASHER, LOCK	2
	MS15795-807	• WASHER, FLAT	2
		----*----	
	204310	• • ARM, TENSION	1
-62	203703-203	• CAPSTAN, TAPE READER	2
		(ATTACHING PARTS)	
	LP22XF82J3	• SETSCREW (03038)(752-6592-004)(17597)	4
		----*----	
-63	203834	• ADAPTER ASSEMBLY, CAPSTAN SHAFT	2
		(ATTACHING PARTS)	
	MS51959-29	• SCREW, MACHINE	4
		----*----	
-64	750-7942-002	• KNOB, DETENTION	2
		(ATTACHING PARTS)	
	MS16633-15	• RING, RETAINING	2
	750-7943	• SPRING, COMPRESSION	2
-64A	NO NUMBER	• SPECIAL NUT (Supplied with Item 64)	2
-65	600104	• SPINDLE, TAPE READER	6
-66	204357	• POST, ELECTRICAL EQUIPMENT	2
		(ATTACHING PARTS)	
	MS51957-52	• SCREW, MACHINE	2
	MS15795-807	• WASHER, FLAT	2
		----*----	
-67	204368	• HANDLE, BOW	2
		(ATTACHING PARTS)	
	MS51960-66	• SCREW, MACHINE	4
		----*----	
-68	204426	• PLATE, IDENTIFICATION	1
			1
		(ATTACHING PARTS)	
	MS51957-3	• SCREW, MACHINE	4
	MS35338-134	• WASHER, LOCK	4
	NAS620-2	• WASHER, FLAT	4
		----*----	
-69	204347-201	• PANEL, TAPE READER FRONT	1

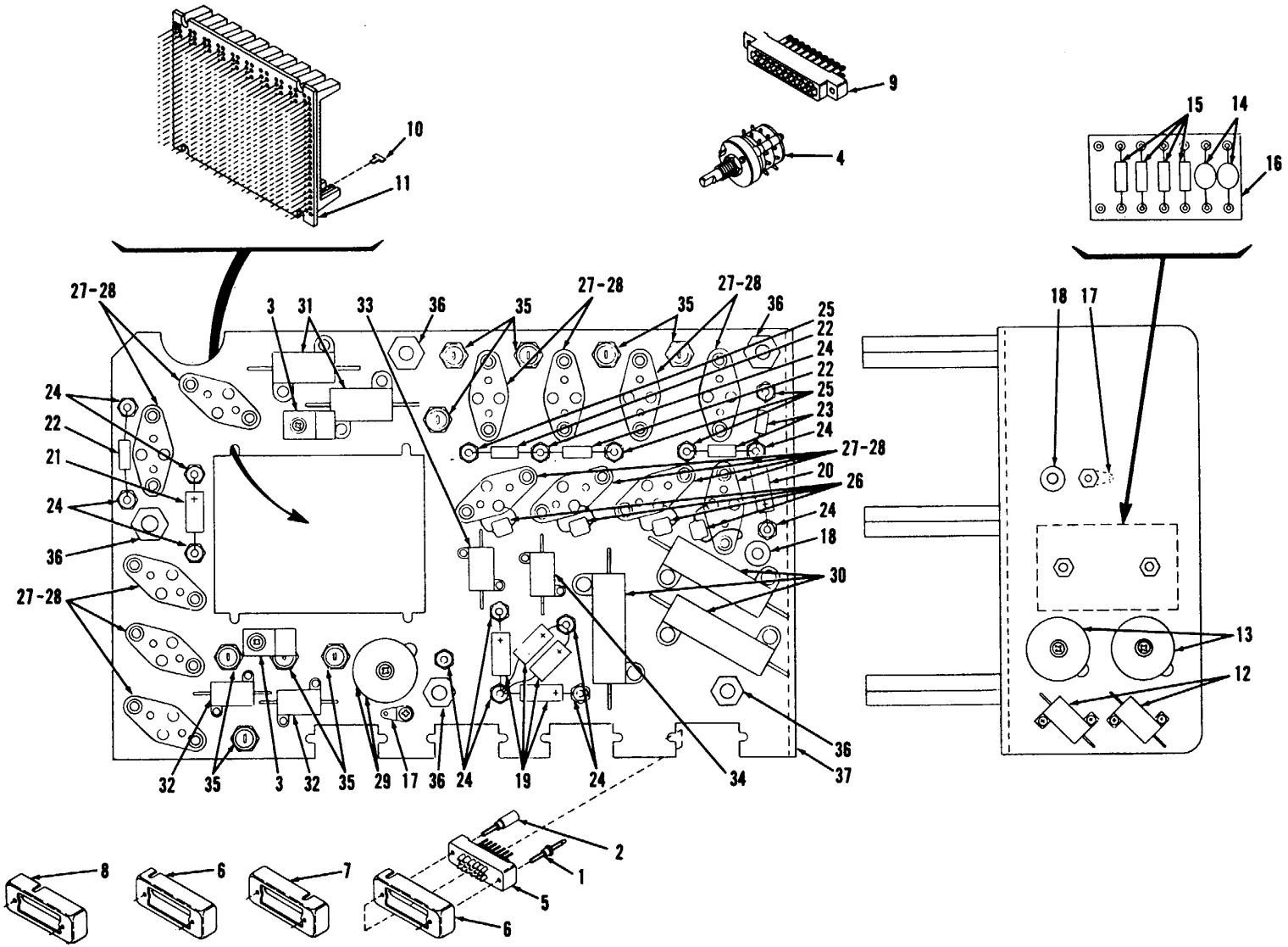


Figure 7-3. Component Mounting Plate Assembly

Table 7-3. Component Mounting Plate Assembly Parts List

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	UNIT PER ASSY
7-3-	204319-101	PLATE ASSEMBLY, COMPONENT MOUNTING (See Figure 7-2 for NHA)	REF
	204351	• WIRING HARNESS	1
		(ATTACHING PARTS)	
-1	MS18196-1	• JACKSCREW, MALE	4
-2	MS18196-2	• JACKSCREW, FEMALE	4
	MS21044C04	• NUT, SELF-LOCKING, HEXAGON (Supplied with items I and 2)	8
	NAS620C4	• WASHER, FLAT (Supplied with items 1 and 2)	8
-3	MS25281-F4	• CLAMP, WIRE SUPPORT	2
	9508	• POST, ELECTRICAL-MECHANICAL EQUIPMENT (73734)(752-9529-003) (17597)	2
	MS51957-30	• SCREW, MACHINE	4
	MS35338-136	• WASHER, LOCK	4
	MS15795-805	• WASHER, FLAT	4
		----*----	
-4	44YY23642	• • SWITCH, ROTARY (81073)(600144)(17597)	1
-5	MRA20P	• • CONNECTOR, RECEPTACLE, ELECTRICAL (81312)(700938)(17597)	4
-6	XMRE20-2A000	• • SHELL, CONNECTOR (81312)(700917-001)(17597)	2
-7	XMRE20-2D00	• • SHELL, CONNECTOR (81312)(700917-002)(17597)	1
-8	XMRE20-2E000	• • SHELL, CONNECTOR (81312)(700917-003)(17597)	1
-9	251-10-30-261	• • CONNECTOR, RECEPTACLE, ELECTRICAL (71785)(700922-001)(17597)	1
-10	531106-003	• KEY, CARD PACK (21688)(700912-002)(17597)	20
-11	204444	• WIRED CARD PACK ASSEMBLY	1
		(ATTACHING PARTS)	
	NAS671C6	• NUT, PLAIN, HEXAGON	4
	MS35338-136	• WASHER, LOCK	4
	MS15795-805	• WASHER, FLAT	4
	NAS620-6	• WASHER, FLAT	4
	MS51957-30	• SCREW, MACHINE	4
		----*----	
	MCA1-10	• CARD PACK ASSEMBLY (21688)(700912-001)(17597)	1
-12	RE65G33R2	• RESISTOR, FIXED, WIREWOUND	2
		(ATTACHING PARTS)	
	MS35649-224	• NUT, PLAIN, HEXAGON	4
	MS35338-134	• WASHER, LOCK	4
	MS15795-802	• WASHER, FLAT	4
	NAS620-2	• WASHER, FLAT	4
	MS51957-6	• SCREW, MACHINE	4
		----*----	
-13	P73-6C	• INDUCTOR, TOROIDAL (07388)(752-6385-002)(17597)	2
		(ATTACHING PARTS)	
	MS35649-264	• NUT, PLAIN, HEXAGON	2
	MS35338-136	• WASHER, LOCK	2
	MS15795-805	• WASHER, FLAT	4
	MS51957-34	• SCREW, MACHINE	2
		----*----	
-14	CM06CD472KP3	• CAPACITOR, FIXED, MICA, DIELECTRIC	2
-15	RW69V150	• RESISTOR, FIXED, WIREWOUND	4
-16	204363-201	• TERMINAL BOARD	1
		(ATTACHING PARTS)	
	MS51959-31	• SCREW, MACHINE	2
	B6-11	• SPACER, SLEEVE (00141)(752-9540-011)(17597)	2
	MS15795-805	• WASHER, FLAT	2
	MS35338-136	• WASHER, LOCK	2
	MS35649-264	• NUT, PLAIN, HEXAGON	2
		----*----	
	1724-4	• TERMINAL, STUD (71279)(752-6665-003)(17597)	4
	1406-51	• TERMINAL BOARD (71279)(701461-001)(17597)	1
-17	MS77068-2	• TERMINAL, LUG	2
		(ATTACHING PARTS)	
	MS51957-30	• SCREW, MACHINE	2
	MS35338-136	• WASHER, LOCK	2
	MS15795-805	• WASHER, FLAT	2
	MS35649-264	• NUT, PLAIN, HEXAGON	2
		----*----	
-18	MS35489-33	• GROMMET	2
-19	CL65CL560MP3	• CAPACITOR, FIXED, NONSOLID ELECTROLYTIC	4
-20	CL65CL6R8MP3	• CAPACITOR, FIXED, NONSOLID ELECTROLYTIC	1
-21	CL65CHI51MP3	• CAPACITOR, FIXED, NONSOLID ELECTROLYTIC	1
-22	CSR13C336KM	• CAPACITOR, FIXED, ELECTROLYTIC, TANTALUM, SOLID-ELECTROLYTE	1
-23	RW69V101	• RESISTOR, FIXED, WIREWOUND	4
-24	SE21XE04	• TERMINAL, STUD	12
-25	1433	• TERMINAL, FEED THRU (88245)(752-9504-011)(17597)	4
-26	CK05BX103K	• CAPACITOR, FIXED, CERAMIC DIELECTRIC	4

Table 7-3. Component Mounting Plate Assembly Parts List

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	UNIT PER ASSY
7-3-27	2N3442	• TRANSISTOR	13
		(ATTACHING PARTS)	
	MS51957-31	• SCREW, MACHINE	26
	MS35338-136	• WASHER, LOCK	26
	MS15795-805	• WASHER, FLAT	26
	DM101	• INSULATOR, TRANSISTOR (08289)(762-9525-001)(17597)	13
		----*----	
-28	8080-1G2	• SOCKET, TRANSISTOR (24233)(701407)(17597)	13
		(ATTACHING PARTS)	
	MS35649-244	• NUT, PLAIN, HEXAGON	13
	MS35338-135	• WASHER, LOCK	13
	MS15795-803	• WASHER, FLAT	13
	MS51959-18	• SCREW, MACHINE	13
		----*----	
-29	P73-1C	• INDUCTOR, TOROIDAL (07388)(752-6385-001)(17597)	2
		(ATTACHING PARTS)	
	MS35649-264	• NUT, PLAIN, HEXAGON	1
	MS35338-136	• WASHER, LOCK	1
	MS15795-805	• WASHER, FLAT	2
	MS51957-36	• SCREW, MACHINE	1
		----*----	
-30	RE75G36R5	• RESISTOR, FIXED, WIREWOUND	3
		(ATTACHING PARTS)	
	MS35649-244	• NUT, PLAIN, HEXAGON	6
	MS35338-135	• WASHER, LOCK	6
	NAS620C-4L	• WASHER, FLAT	6
	MS15795-803	• WASHER, FLAT	6
	MS51957-17	• SCREW, MACHINE	6
		----*----	
-31	RE70G1870	• RESISTOR, FIXED, WIREWOUND	2
		(ATTACHING PARTS)	
	MS35649-244	• NUT, PLAIN, HEXAGON	4
	MS35338-135	• WASHER, LOCK	4
	NAS620C-4L	• WASHER, FLAT	4
	MS15795-803	• WASHER, FLAT	4
	MS51957-17	• SCREW, MACHINE	4
		----*----	
-32	RE65G1001	• RESISTOR, FIXED, WIREWOUND	2
		(ATTACHING PARTS)	
	MS35649-224	• NUT, PLAIN, HEXAGON	4
	MS35338-134	• WASHER, LOCK	4
	MS15795-802	• WASHER, FLAT	4
	NAS620-2	• WASHER, FLAT	4
	MS51957-6	• SCREW, MACHINE	4
		----*----	
-33	RE65G3160	• RESISTOR, FIXED, WIREWOUND	1
		(ATTACHING PARTS)	
	MS35649-224	• NUT, PLAIN, HEXAGON	2
	MS35338-134	• WASHER, LOCK	2
	MS15795-802	• WASHER, FLAT	2
	NAS620-2	• WASHER, FLAT	2
	MS51957-6	• SCREW, MACHINE	2
		----*----	
-34	RE65G33R2	• RESISTOR, FIXED, WIREWOUND	1
		(ATTACHING PARTS)	
	MS35649-224	• NUT, PLAIN, HEXAGON	2
	MS35338-134	• WASHER, LOCK	2
	MS15795-802	• WASHER, FLAT	2
	NAS620-2	• WASHER, FLAT	2
	MS51957-6	• SCREW, MACHINE	2
		----*----	
-35	1N3890/JAN	• SEMICONDUCTOR DEVICE DIODE	9
		(ATTACHING PARTS)	
	MS35650-304	• NUT, PLAIN, HEXAGON	9
	MS35338-138	• WASHER, LOCK	9
	MS15795-808	• WASHER, FLAT	18
	315	• WASHER. NONMETALLIC (16037)(700659)(17597)	18
	20NC	• WASHER, NONMETALLIC (05616)(700660-002)(17597)	9
	MS77066-4	• TERMINAL, LUG	9
		----*----	
-36	204405	• POST, ELECTRICAL-MECHANICAL EQUIPMENT	5
		(ATTACHING PARTS)	
	MS24693-C272	• SCREW, MACHINE	5
		----*----	
-37	204318	• CHASSIS, ELECTRICAL EQUIPMENT	1

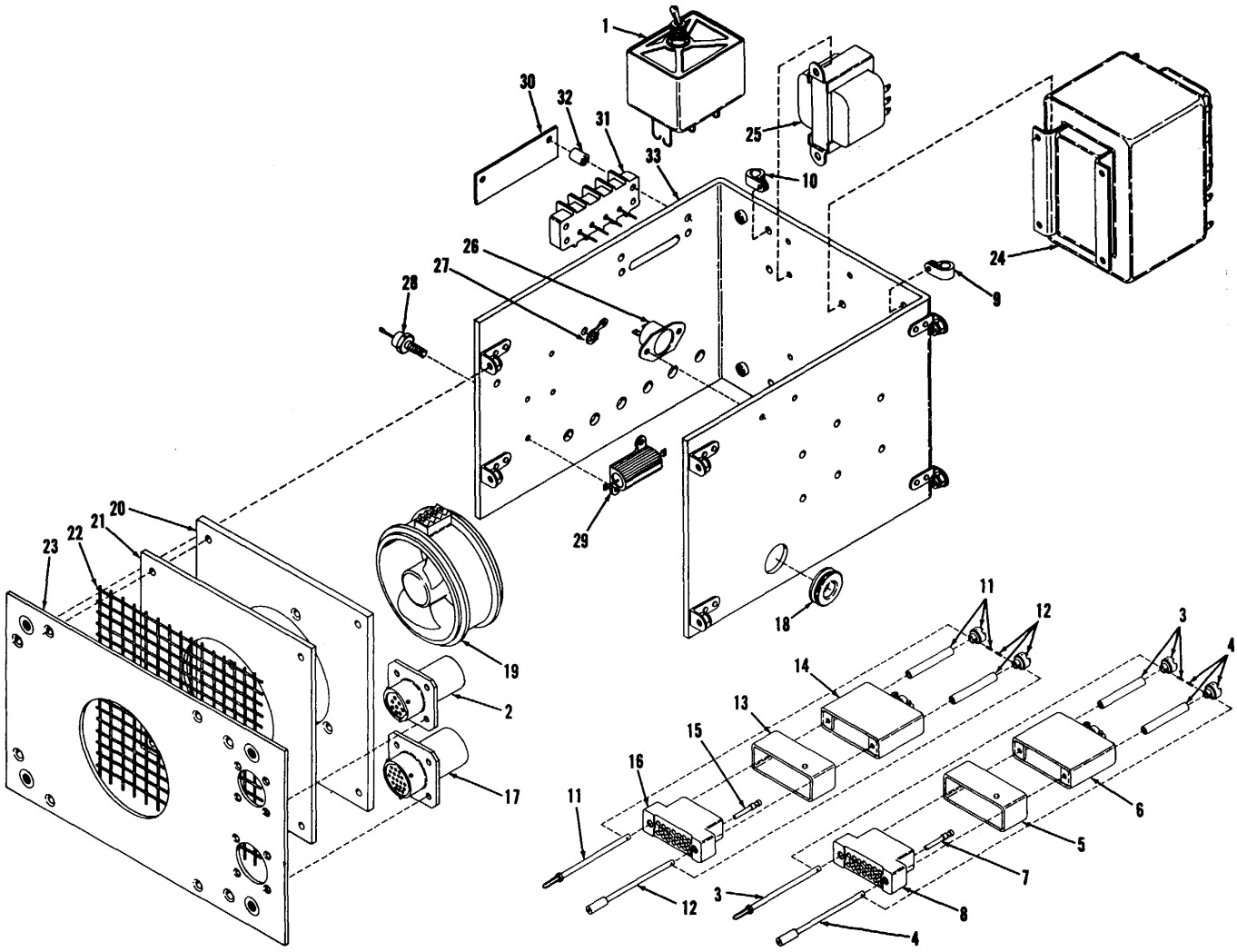


Figure 7-4. 400 Hz Three Phase Power Supply Assembly

Table 7-4. Power Supply, 400 Hz Three-Phase, Parts List

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	UNIT PER ASSY
7-4	204329	POWER SUPPLY, 400 Hz THREE-PHASE (See Figure 7-2 for NHA)	REF
-1	1411.4-17	• CIRCUIT BREAKER	1
	204350	• SIGNAL CABLE ASSEMBLY	1
		(ATTACHING PARTS)	
	MS35649-244	• NUT, PLAIN, HEXAGON	4
	MS5338-135	• WASHER, LOCK	4
	MS15795-803	• WASHER, FLAT	4
	MS51959-15	• SCREW, MACHINE	4
		----*----	
-2	MS3120E14-19P	• • CONNECTOR, RECEPTACLE, ELECTRICAL	1
-3	MS18194-1	• • JACKSCREW, MALE	1
-4	MS18194-2	• • JACKSCREW, FEMALE	1
-5	XMRE20-1E000	• • SHELL, CONNECTOR (81312)(700918-003)(17597)	1
-6	MS18192T2	• • SHIELD, ELECTRICAL, CONNECTOR	1
-7	MS17804-16-20	• CONTACT, ELECTRICAL	18
-8	MS18177-1	• BLOCK, CONNECTOR, ELECTRICAL	1
	204349	• WIRING HARNESS	1
		(ATTACHING PARTS)	
-9	MS25281-F3	• CLAMP, WIRE SUPPORT	2
-10	MS25281-F4	• CLAMP, WIRE SUPPORT	2
	MS35649-284	• NUT, PLAIN, HEXAGON	4
	MS35338-137	• WASHER, LOCK	4
	MS15795-807	• WASHER, FLAT	4
	MS51959-46	• SCREW, MACHINE	4
		----*----	
-11	MS18194-1	• • JACKSCREW, MALE	1
-12	MS18194-2	• • JACKSCREW, FEMALE	1
-13	XMRE20-1D000	• • SHELL, CONNECTOR (81312)(700918-002)(17597)	1
-14	MS18192T2	• • SHIELD, ELECTRICAL CONNECTOR	1
-15	MS17804-16-20	• • CONTACT, ELECTRICAL	13
-16	MS18177-1	• • BLOCK, CONNECTOR, ELECTRICAL	1
-17	MS3120E16-8P	• CONNECTOR, RECEPTACLE, ELECTRICAL	1
		(ATTACHING PARTS)	
	MS35649-244	• NUT, PLAIN, HEXAGON	4
	MS35338-135	• WASHER, LOCK	4
	MS15795-803	• WASHER, FLAT	4
	MS51959-15	• SCREW, MACHINE	4
		----*----	
-18	MS35489-45	• GROMMET	1
-19	704WS	• FAN, CIRCULATING, TUBE AXIAL (82877)(701460)(17597)	1
		(ATTACHING PARTS)	
	MS21044-C04	• NUT, SELF LOCKING	3
	NAS620-4L	• WASHER, FLAT	3
	L2-12	• CLEAT, MOTOR MOUNTING (00141)(752-9530-002)(17597)	3
	MS51959-18	• SCREW, MACHINE	3
		----*----	
-20	204364	• PLATE, FAN ADAPTER	1
-21	204365	• GASKET, FAN MOUNTING	1
-22	204366	• SCREEN, FAN, 4.62 inches square	
	NONE	• . SCREEN, 10 x 10 square mesh, dutch weave .025 stainless steel, market grade (87164)(701199)(17597)	A/R
		(ATTACHING PARTS)	
	MS21044-C06	• NUT, SELF LOCKING	4
	MS15795-805	• WASHER, FLAT	4
	MS51959-32	• SCREW, MACHINE	4
		----*----	
-23	204324-201	• PLATE, CONNECTOR MOUNTING	1
		(ATTACHING PARTS)	
	MS24693-C50	• SCREW, MACHINE	4
		----*----	
-24	600102	• TRANSFORMER, POWER	1
		(ATTACHING PARTS)	
	MS35649-284	• NUT, PLAIN, HEXAGON	4
	MS35338-137	• WASHER, LOCK	4
	MS15795-807	• WASHER, FLAT	4
	MS51959-45	• SCREW, MACHINE	4
		----*----	

Table 7-1. Power Supply, 400 Hz Three-Phase, Parts List

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	UNIT PER ASSY
7-4-25	600112	• TRANSFORMER, FILAMENT	1
		(ATTACHING PARTS)	
	MS35649-264	• NUT, PLAIN, HEXAGON	2
	MS35338-136	• WASHER, LOCK	2
	MS15795-805	• WASHER, FLAT	2
	MS51959-30	• SCREW, MACHINE	2
		----*----	
-26	600187	• SWITCH, THERMAL	1
		(ATTACHING PARTS)	
	MS35649-264	• NUT, PLAIN, HEXAGON	2
	MS35338-136	• WASHER, LOCK	2
	MS15795-805	• WASHER, FLAT	2
	MS51957-29	• SCREW, MACHINE	2
		----*----	
-27	MS77066-4	• TERMINAL, LUG	1
		(ATTACHING PARTS)	
	MS35650-304	• NUT, PLAIN, HEXAGON	1
	MS15795-808	• WASHER, FLAT	2
	MS51958-63	• SCREW, MACHINE	1
		----*----	
-28	IN3890/JAN	• SEMICONDUCTOR DEVICE DIODE	6
		(ATTACHING PARTS)	
	MS35650-304	• NUT, PLAIN, HEXAGON	6
	MS35338-138	• WASHER, LOCK	6
	MS15795-808	• WASHER, FLAT	12
	315	• WASHER, NONMETALLIC (16037)(700659)(17597)	12
	20NC	• WASHER, NONMETALLIC (05616)(700660-002)(17597)	6
	MS77066-4	• TERMINAL, LUG	6
		----*----	
-29	RE70G4R64	• RESISTOR, FIXED, WIREWOUND	1
		(ATTACHING PARTS)	
	MS35649-244	• NUT, PLAIN, HEXAGON	2
	MS35338-135	• WASHER, LOCK	2
	NAS620-4L	• WASHER, FLAT	2
	MS51959-16	• SCREW, MACHINE	2
		----*----	
-30	MS670-4GEE	• MARKER STRIP (75382)(700919)(17597)	1
		(ATTACHING PARTS)	
	MS51957-27	• SCREW, MACHINE	2
	MS35338-136	• WASHER, LOCK	2
	NAS620-6L	• WASHER, FLAT	2
		----*----	
-31	40TB4	• TERMINAL BOARD	1
		(ATTACHING PARTS)	
-32	9154	• POST, ELECTRICAL-MECHANICAL EQUIPMENT (73734)	
		(752-9529-010)(17597)	2
	MS15795-805	• WASHER, FLAT	6
	MS35338-136	• WASHER, LOCK	4
	MS51957-31	• SCREW, MACHINE	2
	MS35649-264	• NUT, PLAIN, HEXAGON	2
	MS51957-32	• SCREW, MACHINE	2
		----*----	
-33	204327	• CHASSIS, ELECTRICAL EQUIPMENT	1

CHAPTER 7
SECTION III REFERENCE DESIGNATION INDEX

REFERENCE DESIGNATION	FIGURE & INDEX NO.	PART NUMBER
A1	7-2-10	204319-101
A1A1	1-2	203755
A1A2	1-3	203746
A1A3	1-3	203746
A1A4	1-4	203868
A1A5	1-5	204381-105
A1A6	1-6	203740
A1A7	1-6	203740
A1A8	1-7	203772
A1A9	1-8	203767
A1A10	1-9	203749
A1CR1	3-35	1N3890/JAN
A1CR2	3-35	1N3890/JAN
A1CR3	3-35	1N3890/JAN
A1CR4	3-35	1N3890/JAN
A1CR5	3-35	1N3890/JAN
A1CR6	3-35	1N3890/JAN
A1CR7	3-35	1N3890/JAN
A1CR8	3-35	1N3890/JAN
A1CR9	3-35	1N3890/JAN
A1C1	3-19	CL65CL560MP3
A1C2	3-19	CL65CL560MP3
A1C3	3-19	CL65CL560MP3
A1C4	3-19	CL65CL560MP3
A1C5	3-20	CL65CL6R8MP3
A1C6	3-14	CM06CD472KP3
A1C7	3-14	CM06CD472KP3
A1C8	3-26	CKOSBX103K
A1C9	3-26	CK05BX103K
A1C10	3-26	CK05BX103K
A1C11	3-26	CK05BX103K
A1C12	3-21	CL65CH151MP3
A1C13	3-22	CSR13C336KM
A1J1	3-5	MRA20P
A1J2	3-5	MRA20P
A1J3	3-5	MRA20P
A1J4	3-5	MRA20P
A1L1	3-29	P73-1C
A1L2	3-29	P73-1C
A1L3	3-13	P73-6C
A1L4	3-13	P73-6C
A1P1	3-9	251-10-30-261
A1Q1	3-27	2N3442
A1Q2	3-27	2N3442
A1Q3	3-27	2N3442
A1Q4	3-27	2N3442
A1Q5	3-27	2N3442
A1Q6	3-27	2N3442
A1Q7	3-27	2N3442
A1Q8	3-27	2N3442
A1Q9	3-27	2N3442
A1Q10	3-27	2N3442
A1Q11	3-27	2N3442
A1Q12	3-27	2N3442
A1Q13	3-27	2N3442
A1R1	3-30	RE75G36R5
A1R2	3-32	RE65G1001
A1R3	3-32	RE65G1001
A1R4	3-33	RE65G3160
A1R5	3-34	RE65G33R2
A1R6	3-30	RE75G36R5
A1R7	3-30	RE75G36R5
A1R8	3-31	RE70G1870
A1R9	3-31	RE70G1870
A1R10	3-23	RW69V101
A1R11	3-23	RW69V101
A1R12	3-23	RW69V101
A1R13	3-23	RW69V101
A1R14	3-12	RE65G33R2
A1R15	3-12	RE65G33R2
A1R16	3-15	RW69V150
A1R17	3-15	RW69V150
A1R18	3-15	RW69V150
A1R19	7-3-15	RW69V150
A1S1	3-1	600144
A1TB1	3-16	204363-201
A2	2-4	204328,204329,204330
A2B1	4-19	704WS
A2CR1	4-28	1N3890/JAN
A2CR2	4-28	1N3890/JAN
A2CR	4-28	1N3890/JAN
A2CR4	4-28	1N3890/JAN
A2CR5	4-28	1N3890/JAN
A2CR6	4-28	1N3890/JAN
A2J1	4-2	MS3120E14-19P
A2J2	4-17	M3120E16-8P
A2P1	4-16	MS18177-1
A2TB1	4-31	40TB4
A2W1	4-1	204350
A2W1P1	4-8	MS18177-1
A3	2-5	203686
A4B1	2-16	600205
A4B1	2-16	759-0015-001
A4B1	2-16	600036
B1	2-41	204307
B2	2-41	204307
DS1	2-29	2720Y
L1	2-31	203717
L2	2-39	203706-205
L3	2-37	203706-203
L4	2-31	203717
P1	2-45	MS18177-1
P2	2-48	MS18177-1
R1	2-54	600192
R2	2-54	600192
S1	4-36	600187
S2	2-50	MS27216-1
S3	2-50	MS27216-1
S4	2-50	MS27216-1
S5	2-50	MS27216-1
S6		M9019/3-37
S6	4-1	1411.4-17
S6		M9019/3-39
S7	2-53	MS27406-3
TB1	2-30	599D0-6S1

CHAPTER 8
CIRCUIT DIAGRAMS

Table 8-1. Power Cable W1 Interconnections

P1 Pin No. MS3126F16-8S	P2 Pin No. Hubbel 9967	FUNCTION
A	X	115/200 Vac, 400 Hz, Phase A
B	Y	115/200 Vac, 400 Hz, Phase B
C	Z	115/200 Vac, 400 Hz, Phase C
H	W	Neutral

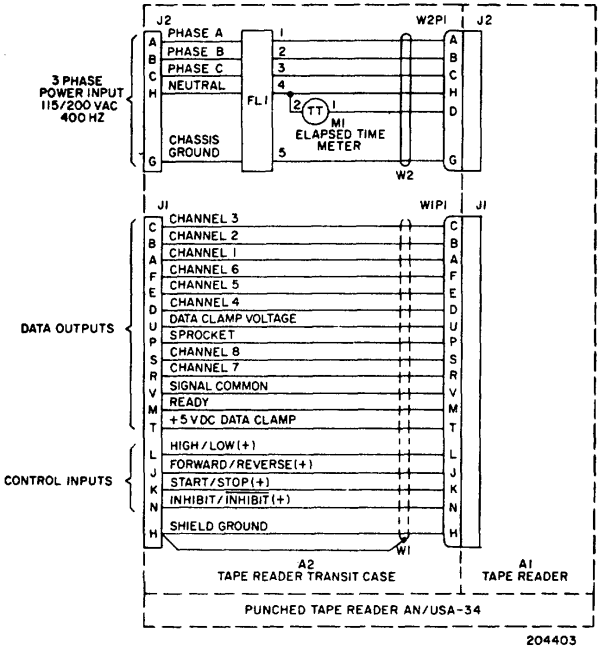


Figure 8-0. Transit Case Schematic Diagram

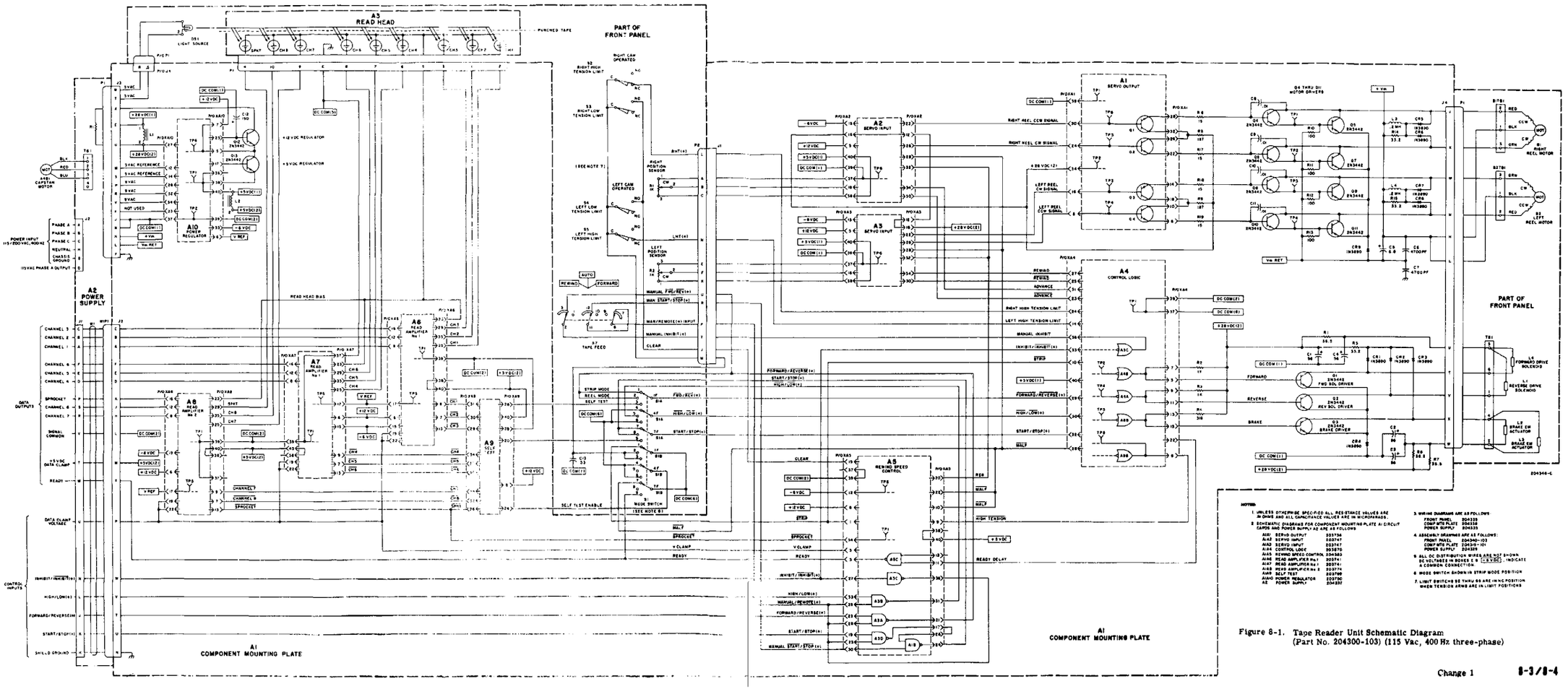


Figure 8-1. Tape Reader Unit Schematic Diagram
(Part No. 204300-103) (115 Vac, 400 Hz three-phase)

Change 1 8-3/(8-4)

Figure 8-1. Tape Reader Unit Schematic Diagram (Part No. 204300-103) (115Vac, 400 Hz three-phase)

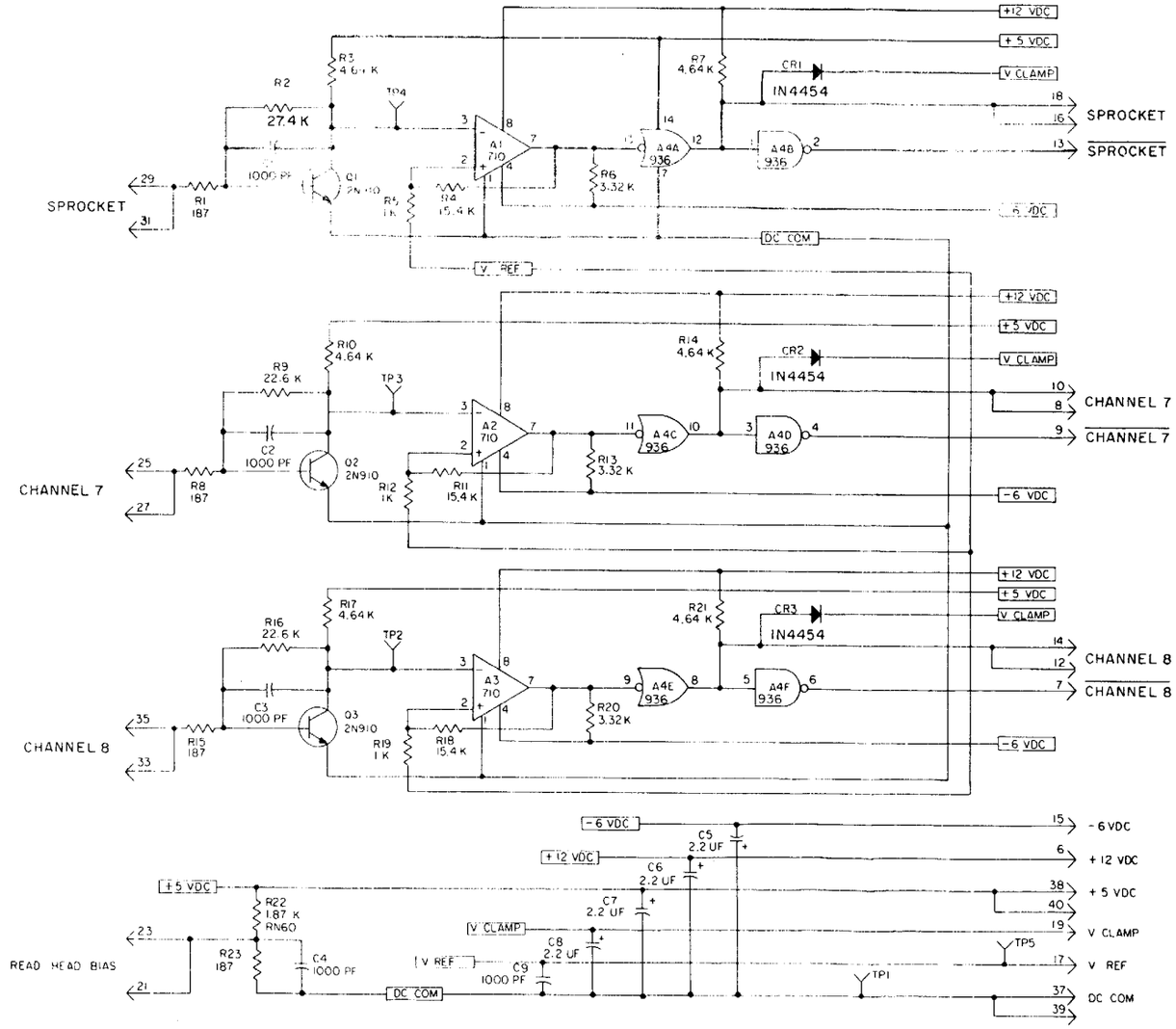


Figure 8-2. Read Amplifier No. 2 (A1A8) Schematic Diagram

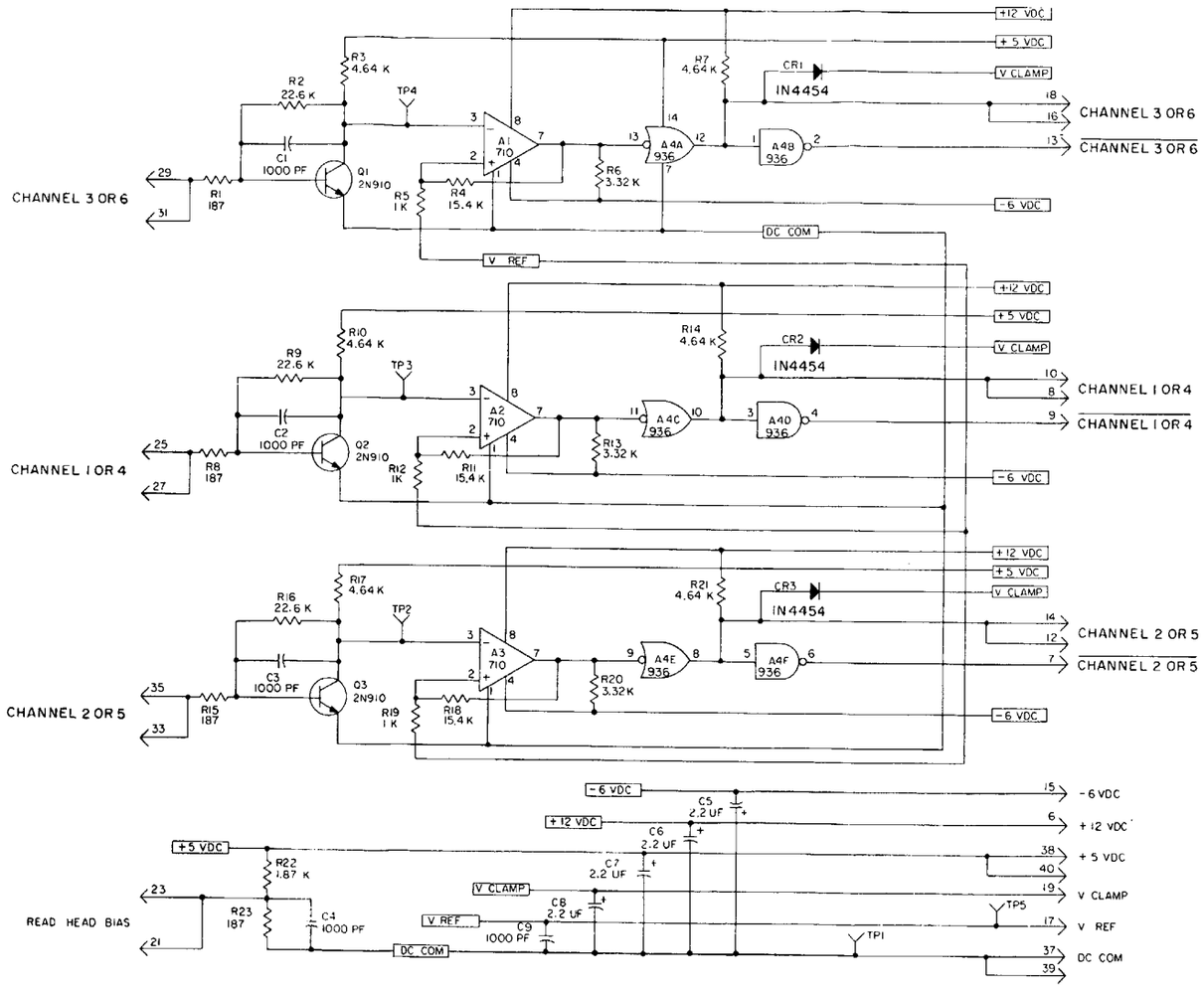


Figure 8-3. Read Amplifier No. 2 (A1A6/A1A7) Schematic Diagram

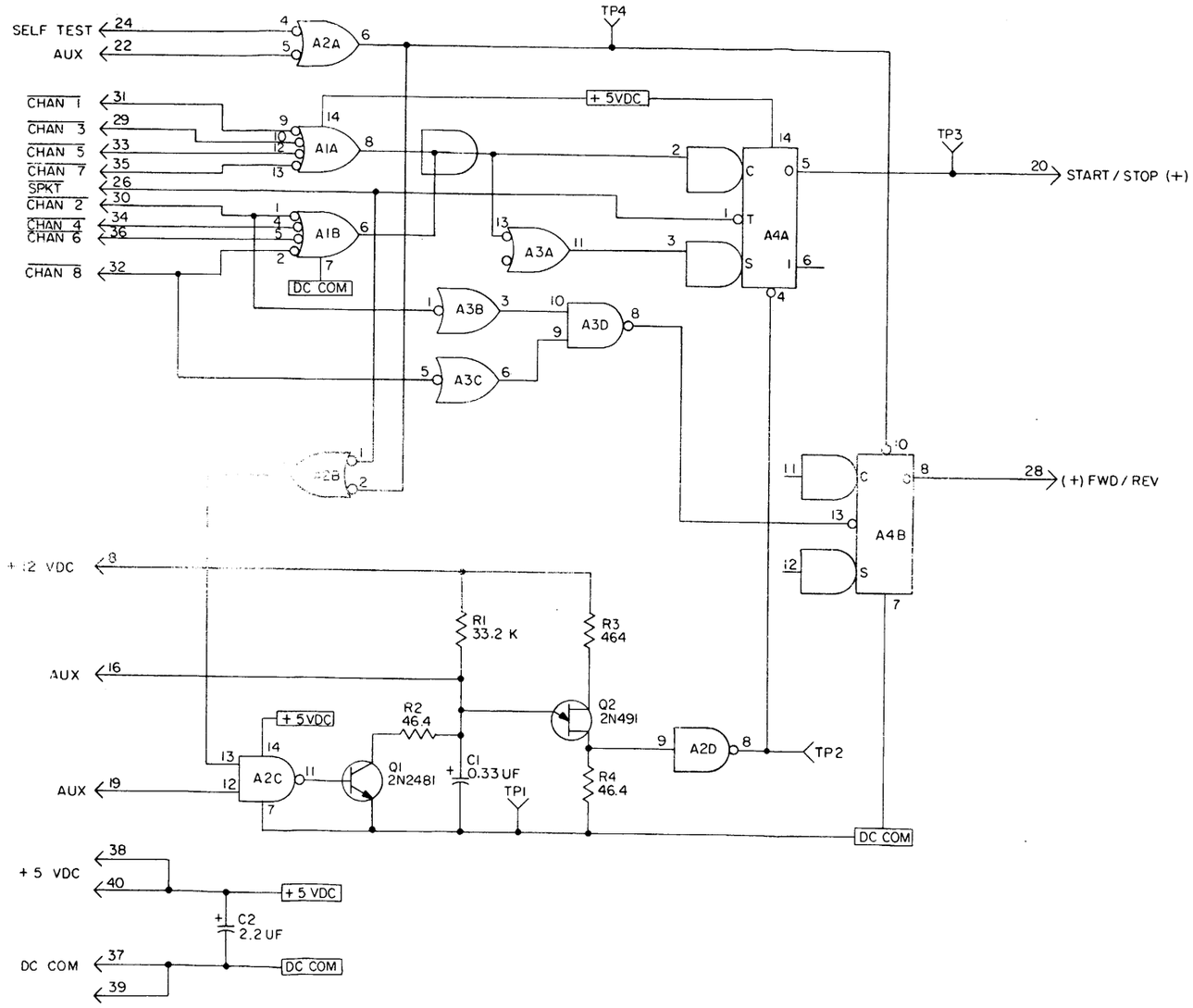


Figure 8-4. Read Amplifier No. 2 (A1A9) Schematic Diagram

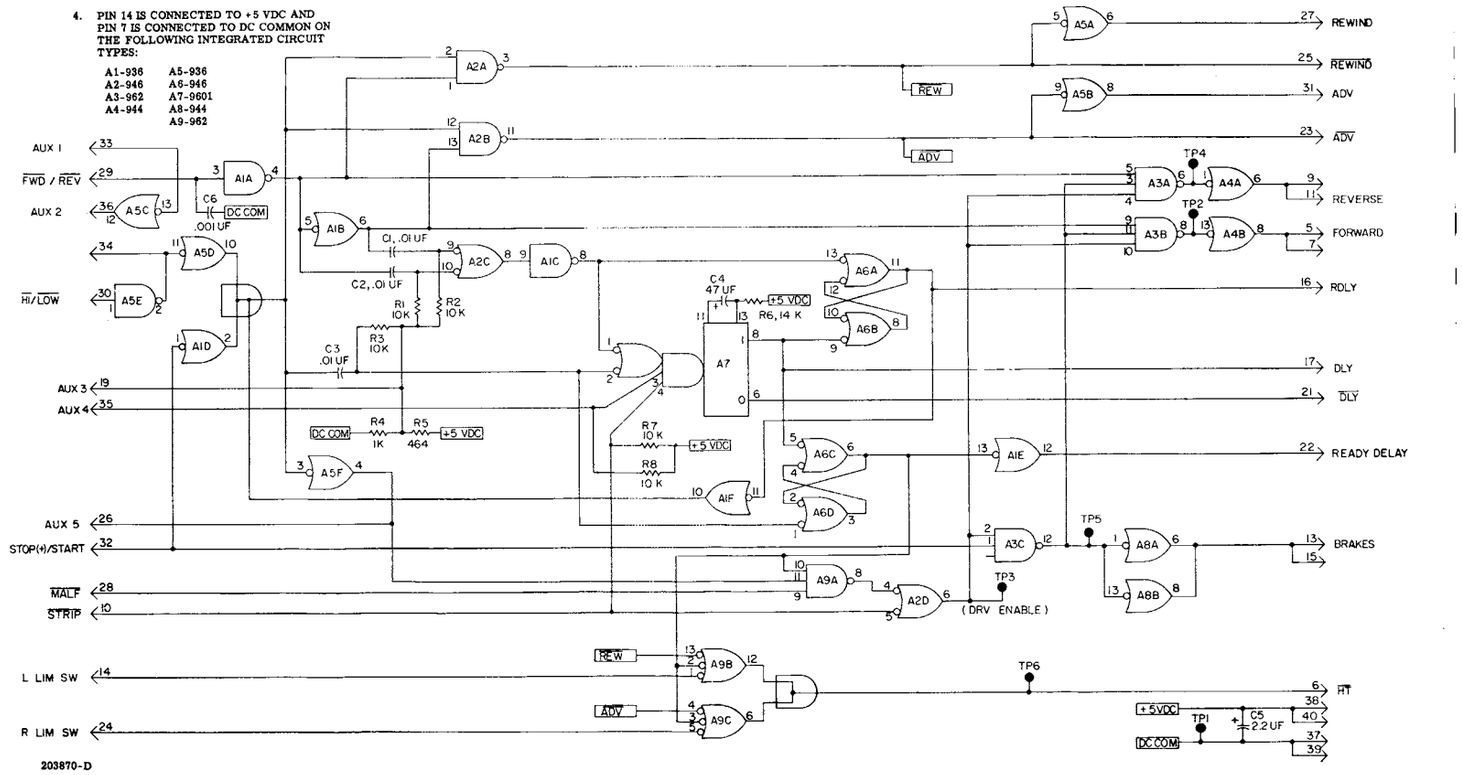


Figure 8-5. Control Logic (A1A4) Logic Diagram

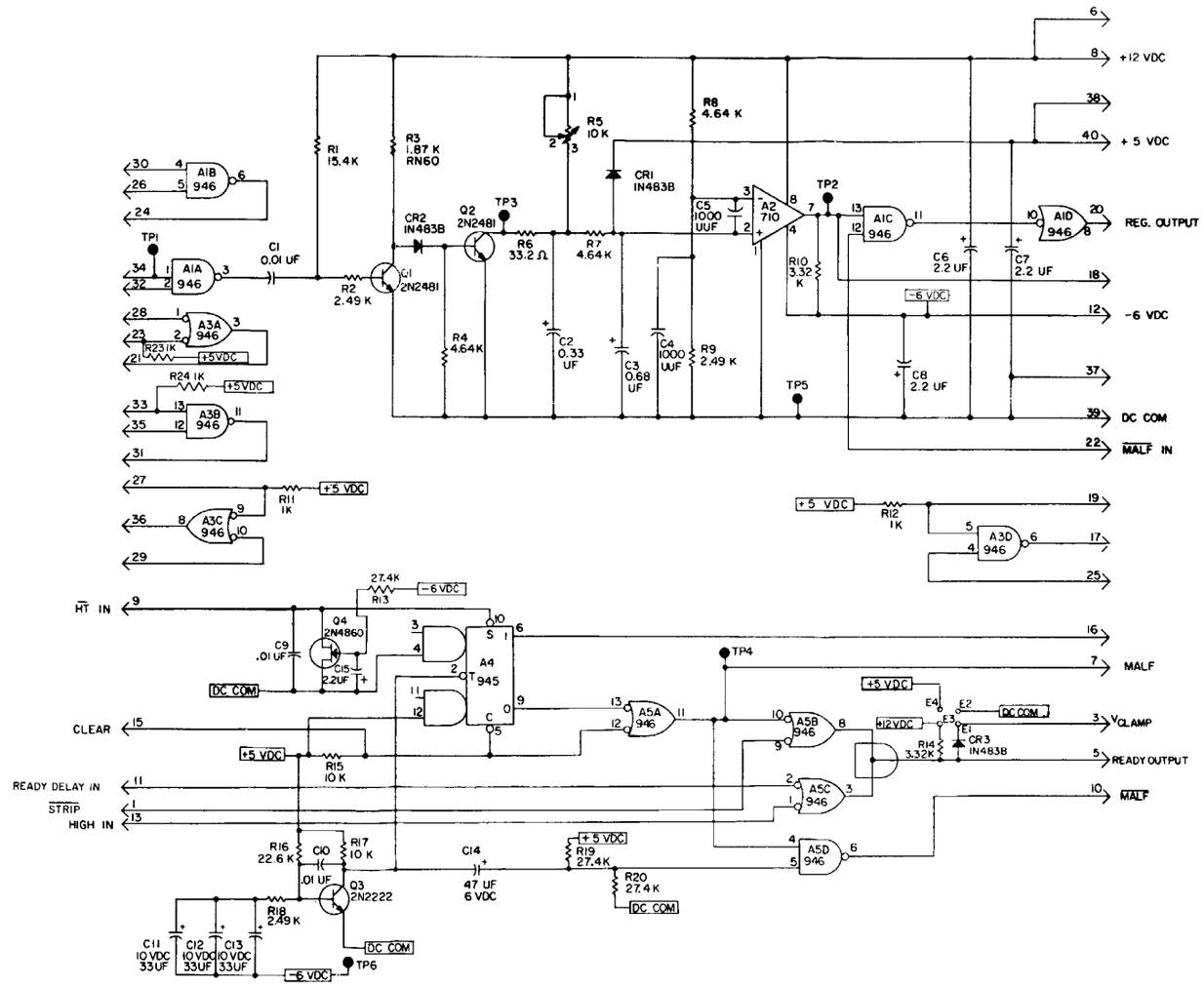


Figure 8-6. Rewind Speed Control (A1A5) Schematic Diagram

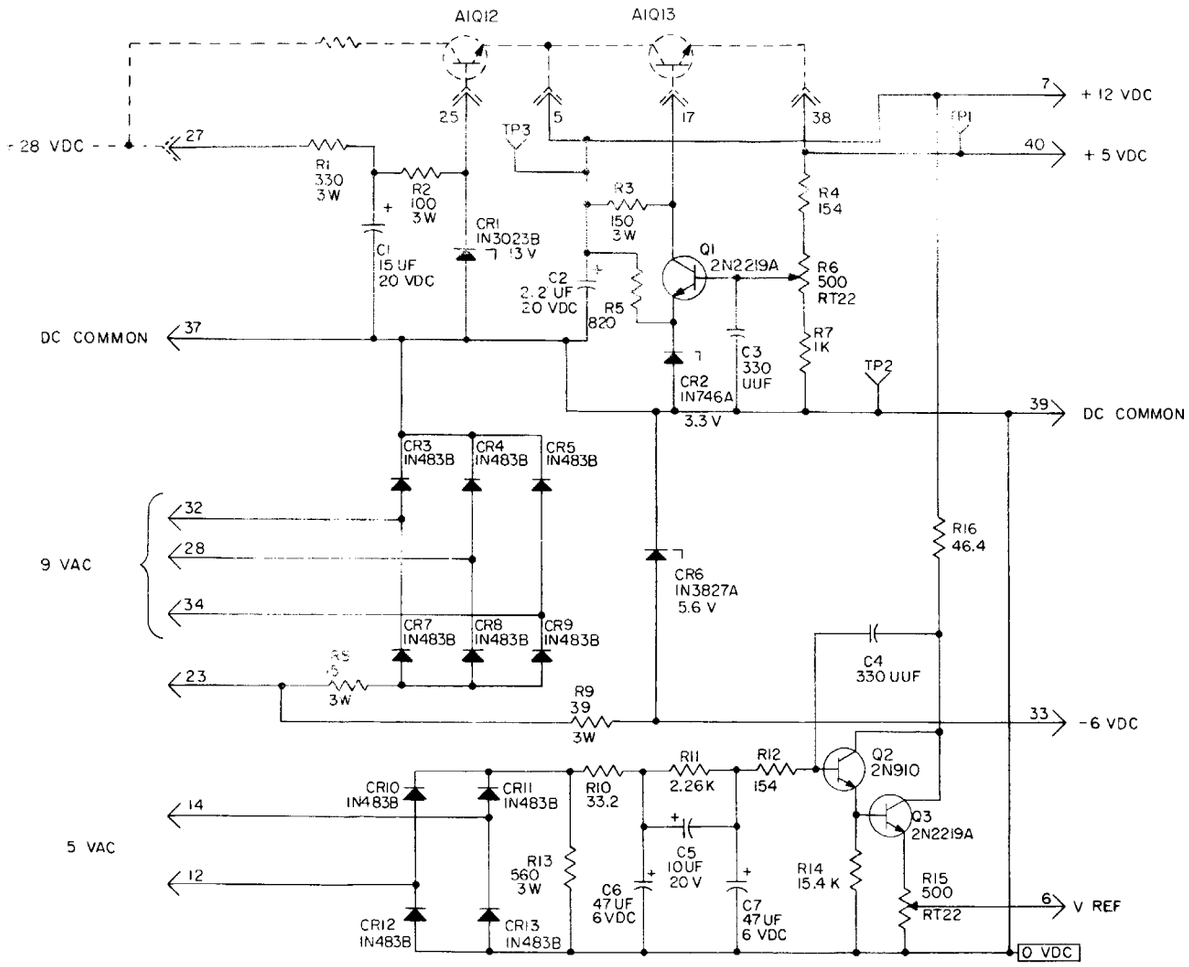


Figure 8-7. Power Regulator (A1A10) Schematic Diagram

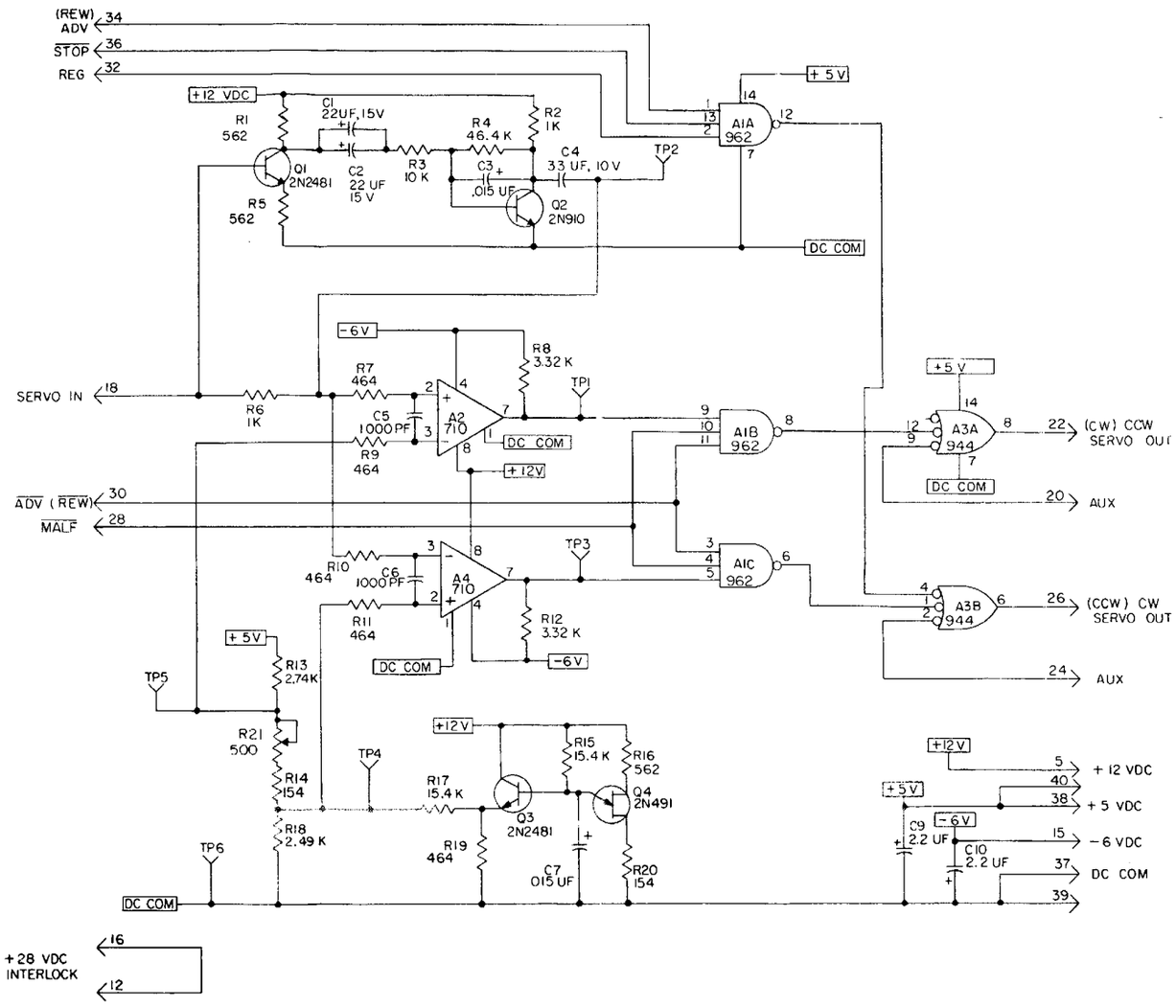


Figure 8-8. Servo Input (A1A2/A1A3) Schematic Diagram

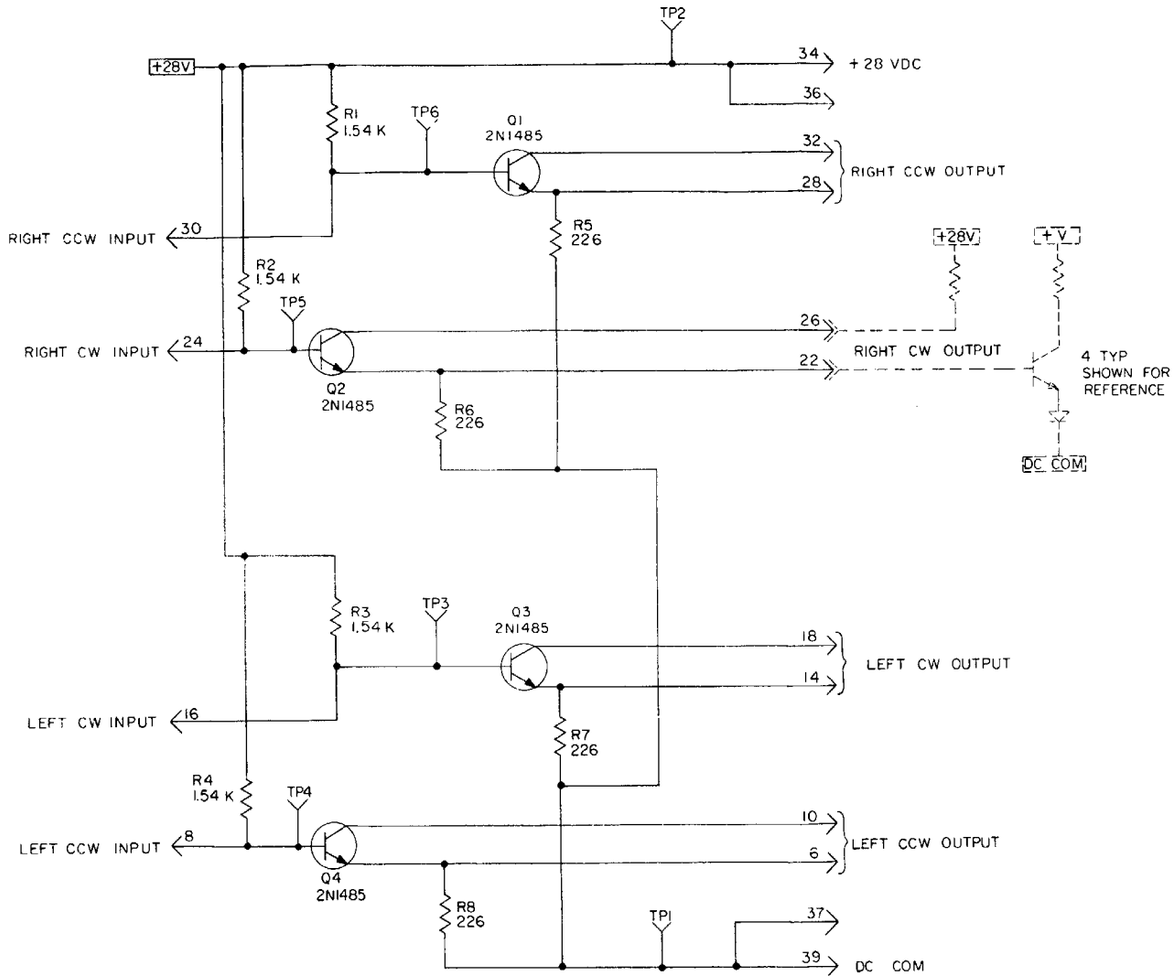


Figure 8-9. Servo Output (A1A1) Schematic Diagram

NOTES:
1. ASSEMBLY IS 204329
2. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. PREFIX WITH A2.

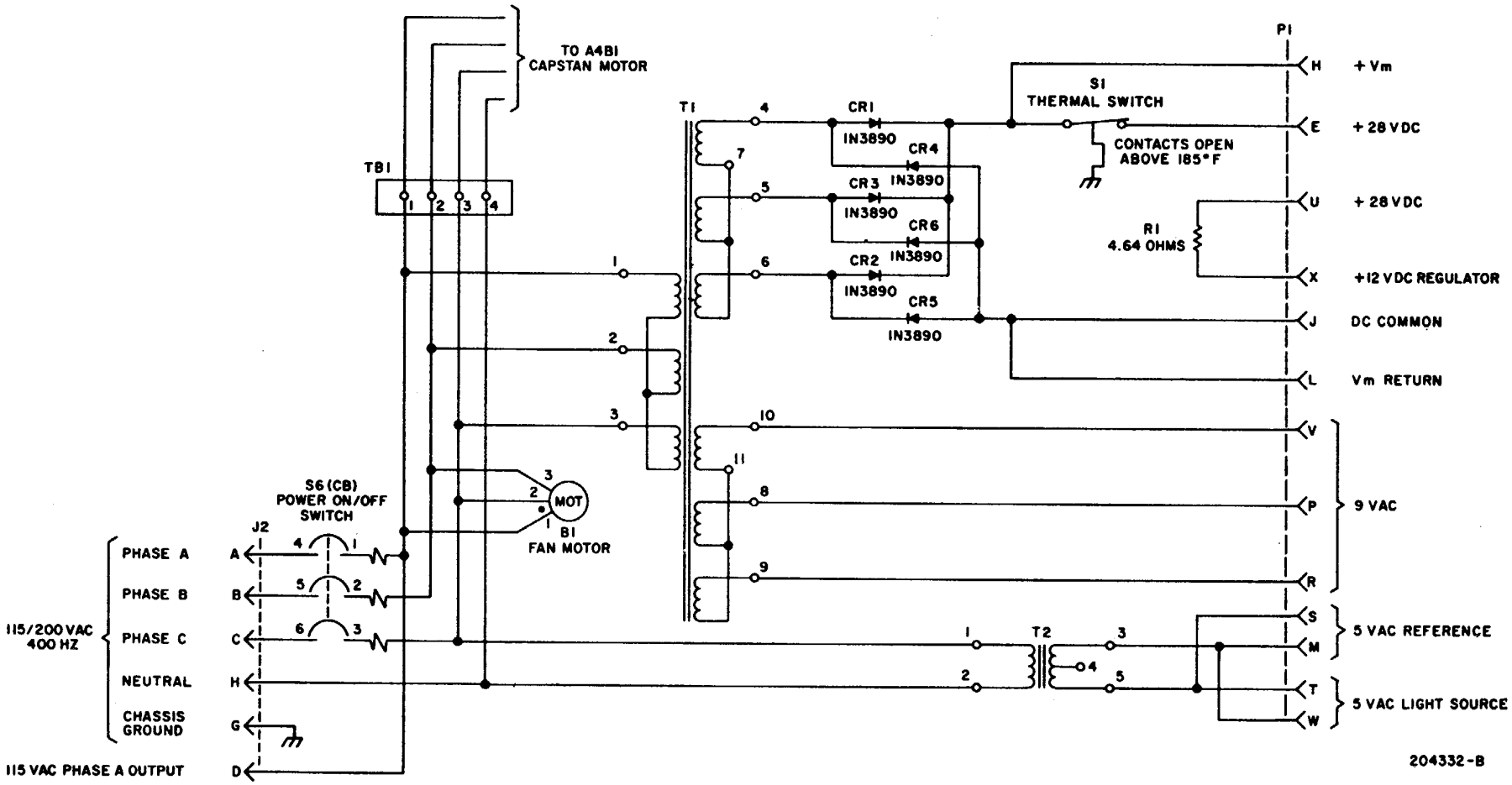


Figure 8-10. Power Supply (A2) Schematic Diagram (115 Vac, 400 Hz, three-phase)

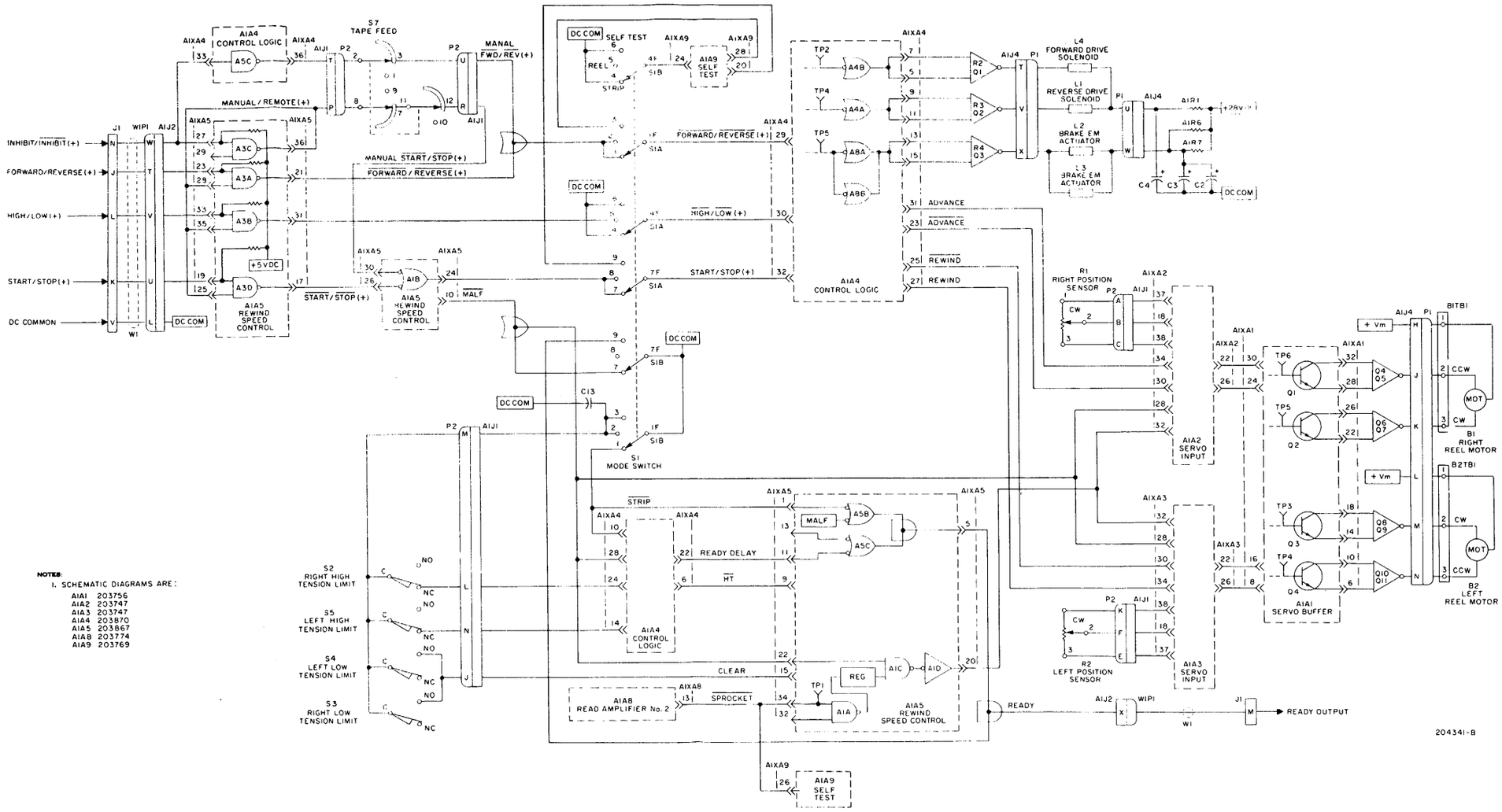


Figure 8-11. Control Flow Diagram

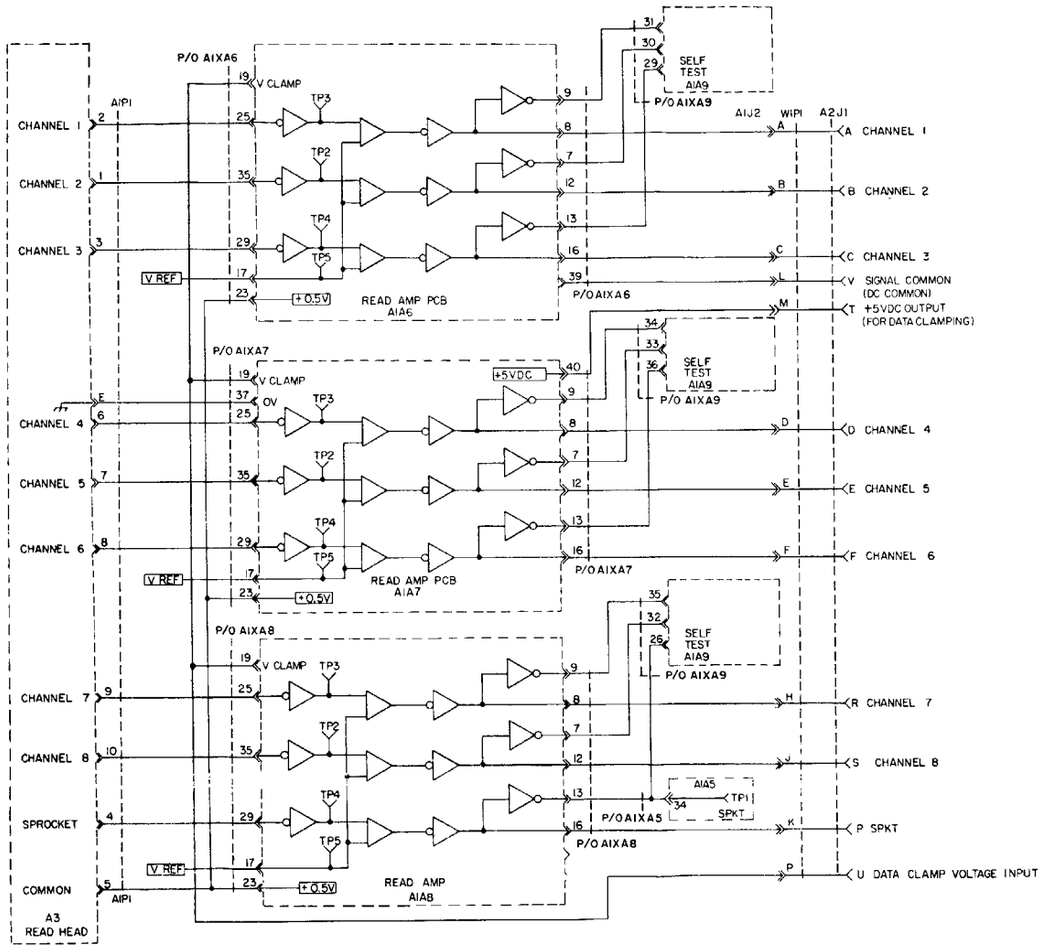


Figure 8-12. Data Flow Diagram

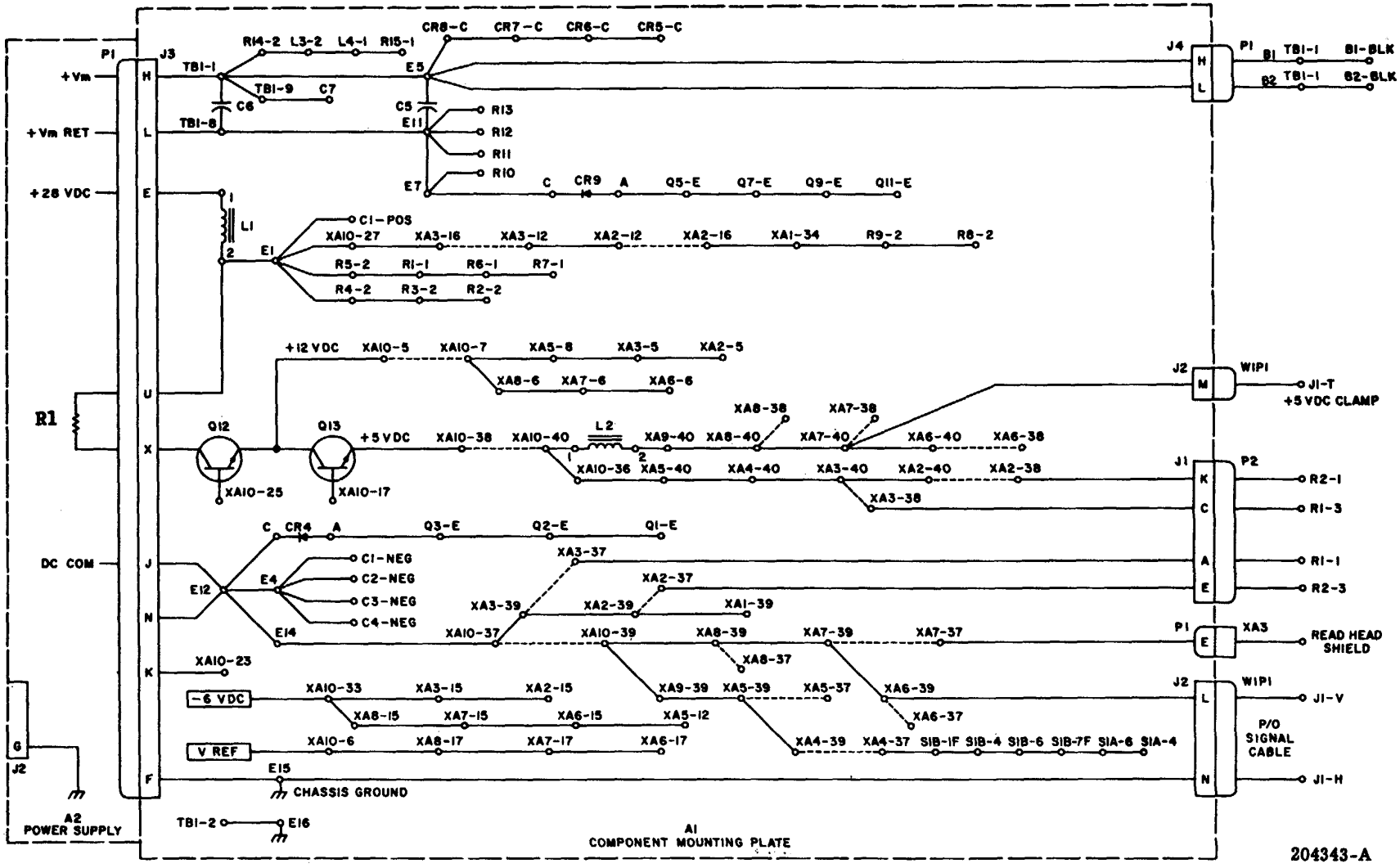


Figure 8-13. Dc Power Flow Diagram

NOTES:
1. SCHEMATIC DIAGRAMS ARE:
   A1 COMPONENT MOUNTING PLATE 204337
   A2 POWER SUPPLY 204332

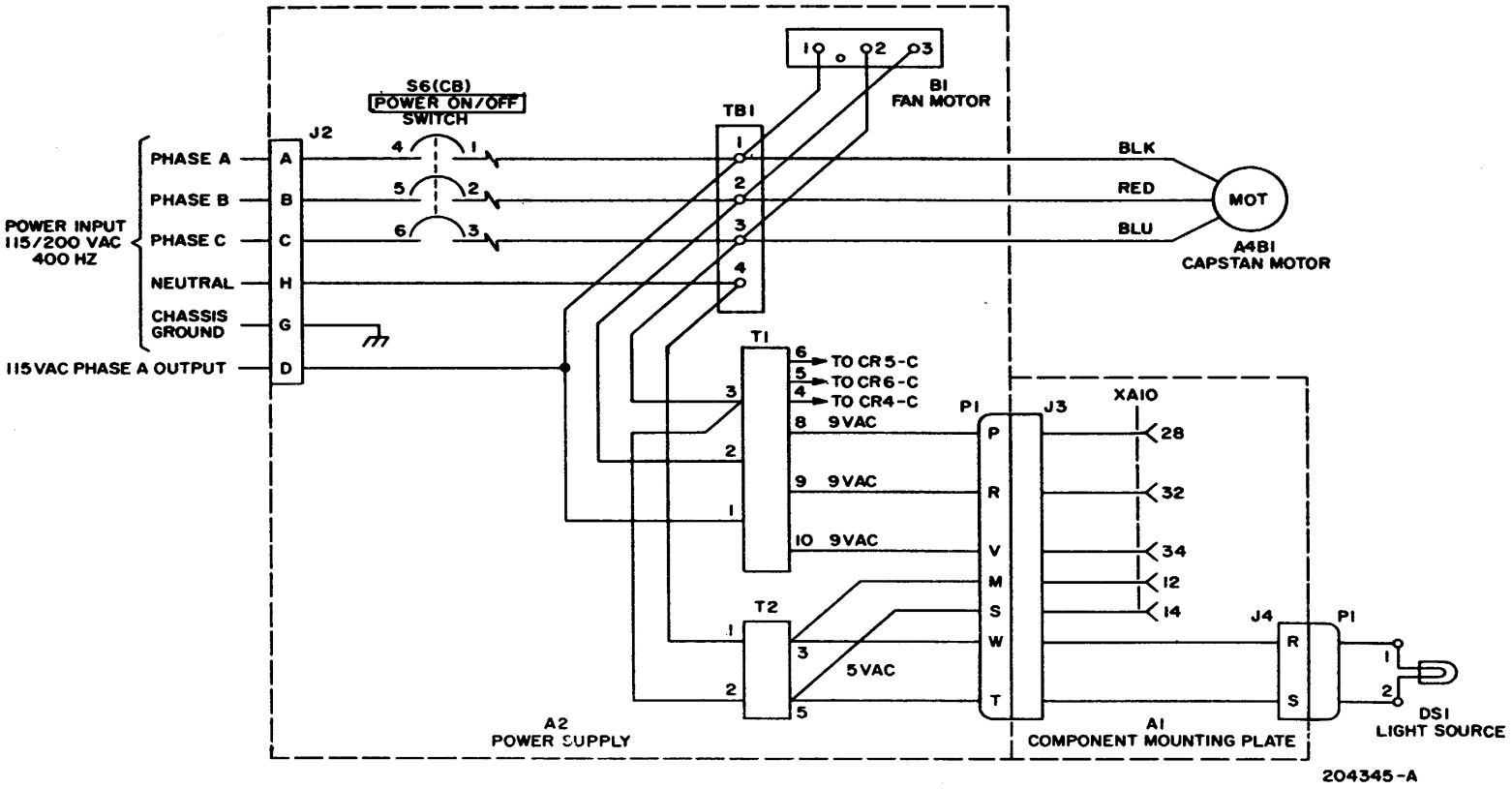


Figure 8-14. Ac Power Flow Diagram (115 Vac, 400 Hz, three-phase)

APPENDIX A
MAINTENANCE ALLOCATION

Section I. INTRODUCTION

A-1. General

This appendix provides a summary of the maintenance operations covered in the equipment literature for Reader, Punched Tape AN/USA-34. It authorizes categories of maintenance for specific maintenance functions of repairable items and components and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations.

A-2. Explanation of Format for Maintenance Allocation Chart

a. Group Number. Group numbers correspond to the reference designation prefix assigned in accordance with ASA Y32.16, *Electrical and Electronics Reference Designations.* They indicate the relation of listed items to the next higher assembly.

b. Component Assembly Nomenclature. This column lists the item names of component units, assemblies, subassemblies, and modules on which maintenance is authorized.

c. Maintenance Function. This column indicates the maintenance category which performance of the specific maintenance function is authorized. Authorization to perform a function at any category also included authorization to perform that function at higher categories. The codes used represent the various maintenance categories as follows:

Code	*Maintenance category*
C	Operator/crew
O	Organizational maintenance
F.....	Direct support maintenance
H	General support maintenance
D	Depot maintenance

d. Tools and Equipment. The numbers appearing in this column refer to specific tools and equipment which are identified by these numbers in section III.

e. Remarks. Self explanatory.

A-3. Explanation of Format for Tool and Test Equipment Requirements

The columns in the tool and test equipment requirements chart are as follows:

a. Tools and Equipment. The numbers in this column coincide with the numbers used in the tools and equipment column of the MAC. The numbers indicate the applicable tool for the maintenance function.

b. Maintenance Category. The codes in this column indicate the maintenance category normally allocated the facility.

c. Nomenclature. This column lists tools, test and maintenance equipment required to perform the maintenance functions.

d. Federal Stock Number. This column lists the Federal stock number.

e. Tool Number. Not used.

SECTIN II. MAINTENANCE ALLOC ATION CHART

(1) GROUP NUMBER	(2) FUNCTIONAL GROUP COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTIONS											(4) TOLS AND EQUIPMENT	(5) REMARKS
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
	Punched Tape Reader AN/USA-34	O												Visual Inspection
			O											Operation
				O									1	Replace read head lamps after 2000 hours and clean tape path after ? hours of tape reader operation
									O				1	Handles, Knob, lamp, and black box
			H											Operation
					P								2, 3, 4	
									H				1	All circuit card assemblies
										H			1, 5	Piece Parts
											D		1, 2, 3, 4, 5	
	All Circuit Card Assemblies		D										2, 3, 4	Test Operation
										D			1	Piece Parts

Nomenclature of End Item or Component					
SECTION III - TOOLS AND TEST EQUIPMENT REQUIREMENTS					
Tool or test Equipment Reference code	**Maintenance Category**	**Nomenclature**		**FSN**	**Tool Number**
1	O, H, D	Tool Kit	TK-105/G	5180-610-8177	
2	H, D	Multimeter	AN/USM-223	6625-999-7465	
3	H, D	Oscilloscope	AN/USM-281A	6625-228-2201	
4.	H, D	Counter, Electronic Digital	AN/USM-207	6625-911-6368	
5	H, D	Maintenance Kit	MK-693( )/A	5821-045-9695	

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