APRIL 1965

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TECHNICAL MANUAL

FOR

SIEMENS AND HALSKE

TM-2
TAPE TRANSPORT

AMPEX

AMPEX CORPORATION

Printed and Published in Reading by Ampex Electronics Ltd.

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DESCRIPTION/SPECIFICATIONS

1-1. GENERAL DESCRIPTION.

1-2. The Ampex Series TM-2 tape transport is designed for use in the digital data systems. The transport consists basically of two assemblies: a tape transport assembly and a transport electronics assembly.

1-3. SELECTIVE AND OPTIONAL FEATURES. Tape transports are available for use with ½-inch or 1-inch tape, on Ampex or IBM-compatible reels. A choice of tape speeds is also permissible. The inclusion of a transport access door, manual control panel, and photosense unit for detecting beginning or end of tape is determined by customer requirements.

1-4. TAPE TRANSPORT. (Figure 1-1.)

1-5. The function of the tape transport is to move the magnetic tape, in response to command signals, across the write and read heads so that information may be recorded on, or read from, the tape. The tape is driven by two counter-rotating capstans and capstan rollers. Rapid changes in tape speed and directions are facilitated by storing tape in vacuum chambers adjacent to the capstans. The inertia of the storage reels is thus isolated from the tape drive system, and only the mass of the tape in the drive area need be accelerated or decelerated. The vacuum chambers also provide sensing elements for a servo system which seeks to maintain a nominally constant length of tape in each chamber.

1-6. A dual-speed, hysteresis-synchronous motor is used to drive both capstans through a belt and pulley arrangement. The higher tape speed is used in the FAST FORWARD and FAST REVERSE (REWIND) modes.

1-7. Tape is guided across the write and read heads by guides integral to the head assembly. Other tape guiding elements are located at the entrances and exits of the vacuum chambers, and at the supply and take-up reels. Tape packer arms, functioning with the supply and take-up reels, ensure smooth tape packing.

1-8. A vacuum blower, mounted on the rear of the tape transport, is connected through air ducts to the vacuum chambers. This system provides proper tape tensioning, operates in conjunction with transducers to indicate the length of the tape loop within each of the chambers, and maintains a smooth tape loop configuration in the chambers, without danger of folding or kinking.

1-9. The tape transport is intended to operate with a closed access door. Transports with Ampex-supplied doors (optional) are equipped with an interlock switch to disable the transport while the door is open. A positive pressure blower, mounted on the rear of the transport maintains a slight increase over atmospheric pressure between the transport and the door to exclude dust.

1-10. Tape is threaded on the transport by means of a permanent leader, attached to the take-up reel, which is manually connected to each new reel of tape mounted on the supply reel hub. Other features of the transport include sensing devices which stop the tape motion upon contact with the beginning-of-reel or end-of-reel leaders; a write lockout switch, actuated by a ring placed on the supply reel hub and interlock circuitry to prevent tape motion when the tape threading clamp is in the closed position.

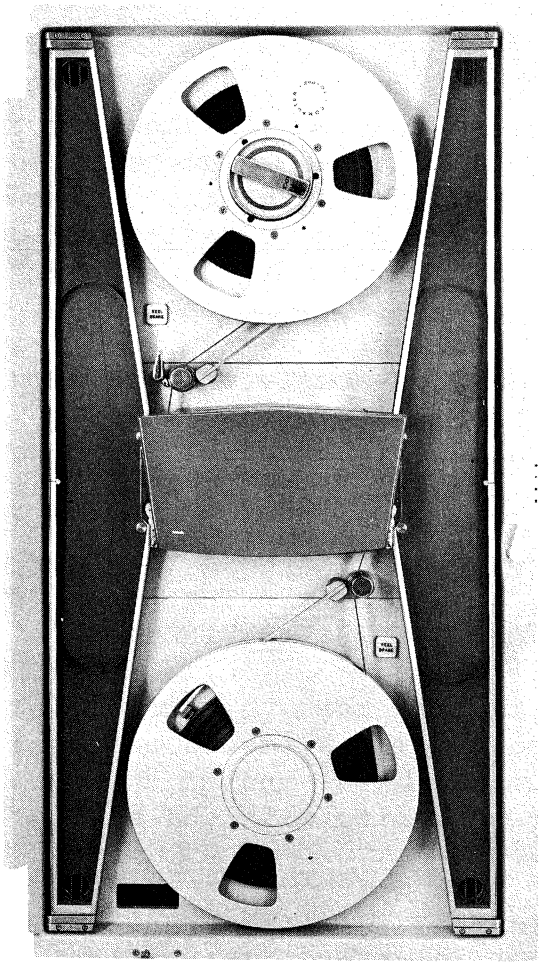

Figure 1-1. Tape Transport

1-11. The tape transport may be supplied hinge-mounted to the left side of the rack or cabinet, permitting the unit to be swung open for ease of inspection, maintenance or service.

1-12. HEAD ASSEMBLY. (Figure 1-2.)

1-13. The head assembly is mounted on the tape transport and performs the actual read and/or write function with respect to the tape. Head assemblies consist of a head mounting plate and head stacks; the exact number and configuration of stacks depends on the tape width, track arrangement, and type of head.

1-14. PHOTOSENSE.

1-15. This optional feature is accomplished by a device which detects reflective markers affixed to the mylar side of the tape. It provides signals to external control circuitry indicating the approach of the beginning or end

of the tape. The device is comprised of two units: the head, mounted on the vacuum chamber associated with the supply reel, and the electronics chassis, mounted on the rear of the tape transport.

1-16. TRANSPORT ELECTRONICS ASSEMBLY. (Figure 1-3)

1-17. The transport electronics assembly is composed of those electronic units required for operation of the tape transport. Mounted in this assembly are an actuator power supply, a servo motor (reel motor) power supply, a connector chassis, an actuator control circuit board, and a dual servo amplifier circuit board. These elements, in conjunction with transducers, switches, and circuitry mounted on the tape transport, exercise complete control over the tape unit in accordance with signals generated by the manual control panel or by external equipment.

1-18. MANUAL CONTROL PANEL. (Figure 1-4.)

1-19. The manual control panel is used when local control of the tape transport is required, or when it is desired to remove the transport from the control of external equipment for maintenance procedures. Although the manual control panel is an optional accessory, equivalent control circuitry must be provided if no manual control panel is supplied.

Figure 1-2. Head Assembly

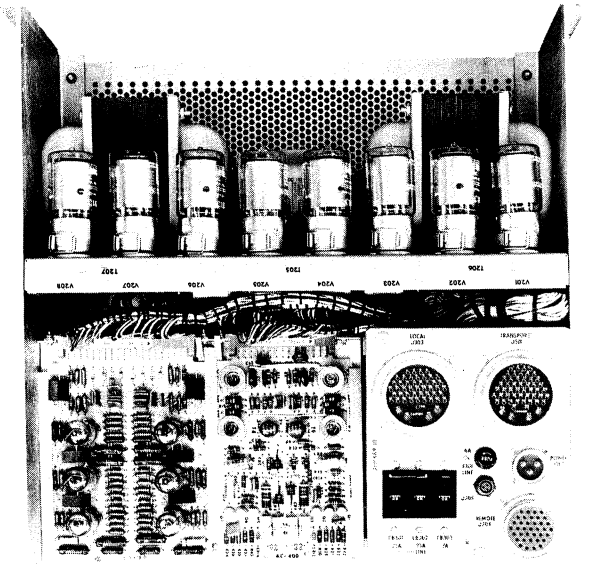

Figure 1-3.
Transport Electronics Assembly

1-20. VOLTAGE REGULATOR. (Figure 1-5.)

1-21. The voltage regulator is used to provide a stabilized ac voltage to the vacuum blower, the servo oscillator and the servo amplifier power transformer.

1-22. COOLING FAN.

1-23. Units supplied with an Ampex rack cabinet are equipped with a cooling fan mounted in the top of the cabinet. This fan exhausts heated air at the top of the cabinet, drawing cold air through louvers at the bottom to cool the tape transport.

1-24. FUNCTIONAL DESCRIPTION.

1-25. To facilitate a general discussion of machine operation, the following terminology will be used throughout this instruction manual:

Off Mode

Equipment not in operation. No commands have been given and no power applied to the equipment.

Standby Mode

Primary power (117 vac) has been applied to the equipment. All

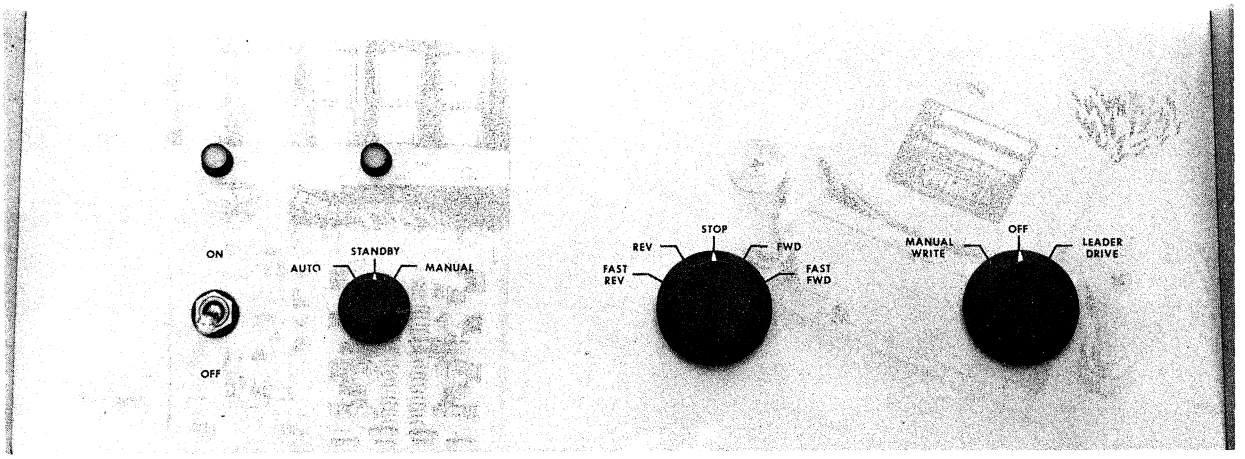

Figure 1-4. Manual Control Panel

internal or external interlocks and time delays are complete and the capstans are turning. The supply and take-up reels are locked in position by the reel brakes, and the servo systems, which seek to maintain nominally constant length loops in the vacuum chambers, are disabled. A power ON indicator on the manual control panel is illuminated.

Manual Ready Mode

Similar to the Standby mode except that the MODE SELECTOR switch on the manual control panel, or similar external switch, has been placed in the MANUAL position. The reel brakes are released and the vacuum chambers activated. Manual commands will control the tape motion.

Automatic Ready Mode

Similar to the Manual Ready mode except that the MODE SELECTOR switch on the manual control panel, or similar external switch, has been placed in the AUTO position. Tape motion may be initiated by automatic commands.

Forward Drive Mode

Equipment which was in one of the Ready modes has been given a Forward Start command. The tape has been engaged between the forward

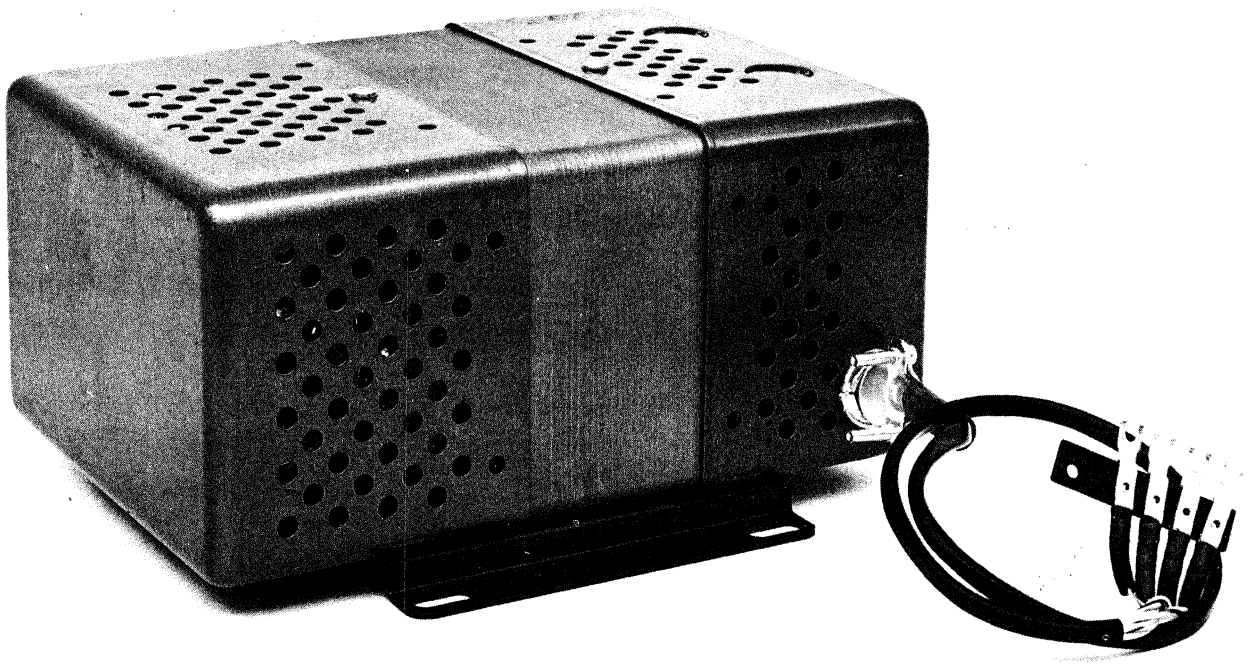

Figure 1-5. Voltage Regulator

capstan and capstan roller and is moving from the supply reel to the take-up reel at the nominal drive speed.

Reverse Drive Mode

Equipment which was in one of the Ready modes has been given a Reverse Start command. The tape has been engaged between the reverse capstan and capstan roller and is moving from the take-up reel to the file reel at the nominal drive speed.

Fast Drive Mode

Identical to the Forward and Reverse Drive modes except that the equipment has also been given a Fast command. The tape moves at twice the nominal drive speed.

Forward Start Command

This command may be effected by the following means:

1) With the system in the Manual Ready mode, place the MANUAL CONTROL switch in the FWD position.

2) When a manual control panel is not used, ground the FORWARD ON terminal through external equipment or apply a positive-going voltage to the FORWARD AUTO terminal.

3) With the system in the Automatic Ready mode, apply a positive-going voltage to the FORWARD AUTO terminal.

Reverse Start Command

This command may be effected by the following means:

1) With the system in the Manual Ready mode, operate the MANUAL CONTROL switch to the REV position.

2) When a manual control panel is not used, ground the REVERSE ON terminal through external equipment or apply a positive-going voltage to the REVERSE AUTO terminal.

3) With the system in the Automatic Ready mode, apply a positive-going voltage to the REVERSE AUTO terminal.

Fast Command

This command may be effected by the following means:

1) With the system in the Manual Ready mode, place the MANUAL CONTROL switch in the FAST FWD or FAST REV position (depending on the desired tape direction).

2) With the system in the Automatic Ready mode, or when a manual control panel is not used, connect the 24v supply to the terminal. A tape start command must also be given.

Stop Command

This command may be effected by the following means:

1) With the system operating in the Manual mode (forward or reverse, normal or fast tape speeds), place the MANUAL CONTROL switch in the STOP position. The system will now be in the Manual Ready mode.

2) With the system operating in the Automatic mode, remove any commands previously applied to the FORWARD or REVERSE AUTO terminals. Any previously applied FAST command should also be removed.

3) When a manual control panel is not used, remove any commands previously applied to the FORWARD or REVERSE AUTO terminals, remove a ground previously applied to an ON terminal, and apply a ground to a FORWARD OFF or REVERSE OFF terminal through external equipment.

When a Stop command is given during a fast mode any subsequent Start command must be delayed until the capstan speed has returned to normal.

NOTE

Programming limitations for the command signals mentioned above will be found under specifications in this section. (Refer to paragraph 1-33.)

1-26. The following description shows the application of a series of commands to the system.

1-27. Assume that the tape transport is in either the Manual Ready or Automatic Ready mode, power is applied to the system, and all interlocks and time delays are completed. The reel brakes are released and the servos activated to maintain approximately 30 inches of tape in each vacuum chamber.

1-28. The transport receives a Forward Start command. The actuator control circuitry in the electronics assembly applies a pulse to the ON winding of the forward actuator. This actuator moves the forward capstan roller to engage the tape with the forward capstan and the tape is driven past the heads at a rate determined by the capstan speed, while the reel drive servos maintain the correct length of tape in the vacuum chambers. The tape will continue to move forward until a Forward Stop command is received in the control electronics assembly. At this time the actuator control unit will pulse the actuator OFF winding, moving the capstan roller, once more, to its open position.

1-29. As the capstan roller moves away from the capstan, a tape brake mounted on the opposite end of the capstan roller assembly from the capstan roller briefly presses against the tape, which is supported by a metal brake post. This overcomes the inertia presented by the tape and aids in halting tape motion. The equipment is now ready to accept another command signal. (It should be noted that the tape motion across the heads is not stopped by the reel motors. The reel motors are stopped by dynamic braking under the control of the reel servo systems.)

1-30. When the equipment is in the Forward Drive mode, the capstan is removing tape from the supply (left) vacuum chamber and adding it to the take-up (right) vacuum chamber. The result is a tendency for the loop in the left chamber to diminish in size while the loop in the right chamber tends to grow longer. The servo system senses these changes and counteracts them by paying out tape or reeling in tape as required. The actual sensing is accomplished through slots in the base of the chambers, connected to pneumatic transducers. The tape in the vacuum chamber effectively forms a wall between the vacuum on one side of the tape and the slightly higher than atmospheric pressure (because of a positive pressure blower adding air to the space between the transport frame and the closed transport access door) on the other side of the tape. A vacuum sensing device (transducer) connected to this slot senses variations in vacuum resulting from exposure of more or less of the slot to atmosphere as the length of the loop varies within the chamber. The vacuum sensing device takes the form of a diaphragm, expansion or contraction of which moves the core of a differential transformer. The primary of this transformer is excited by a signal from an oscillator. When the core of the transformer is

equidistant from the two secondaries, the output of a demodulator, excited by the transducer is minimal. This null condition is intended to occur when the ends of the tape loops in the column are approximately 13-1/2 inches apart. Any variation in loop length results in generation of an error signal, changing the demodulator output. The demodulator output in turn controls a d-c servo amplifier, which in turn controls firing of thyratrons in the servo motor power supply. Depending upon the polarity of the demodulator signal (determined by the direction of core shift in the transducer) either the clockwise or counterclockwise thyratrons will fire, causing rotation of the reel motor. This rotation will feed more tape into the vacuum chamber if the loop size has been diminishing, or remove tape from the chamber if the loop has been growing in size. This action continues until the loop reaches its null length, at which time the core of the transformer has returned to its central position, removing the error signal from the demodulator input.

1-31. Assume that the command source signals the transport to enter a high-speed mode. The Fast command signals a relay controlling the capstan drive motor assembly to switch power from the low speed winding of the capstan drive motor to the high-speed winding. The actuator for the appropriate tape direction remains closed, and the capstan roller holds the tape against the capstan. The servo systems continue to maintain appropriate loop length in the vacuum chambers.

1-32. Assume that the tape is moving from the take-up reel to the supply reel at high speed (Fast Reverse mode). As the take-up reel is nearly emptied (determined by the angle of the lower tape packer arm) a microswitch is tripped to shift operation to the normal Reverse Drive mode.

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SECTION 1 (APPENDIX)

CUSTOMER SPECIFICATION

APRIL 1965(E)

SIEMENS AND HALSKE

TM-2
TAPE TRANSPORT

AMPEX

AMPEX CORPORATION

1. SCOPE AND CLASSIFICATION

1.1 Scope

The following specification covers major characteristics and performance of the Siemens and Halske TM-207 Magnetic Tape Transport.

1.2 Classification

1.2.1 The Siemens & Halske TM-2 Magnetic Tape Transport will use $\frac{1}{2}$-inch tape and will be composed of major sub-assemblies, such as the Tape Drive, the Reel Servo Control, the Control Electronics Unit and the Read/Write Head and Cable Assembly.

1.2.2 Features

1.2.2.1 Tape Speed

150 ips

1.2.2.2 Power

50 cycles per second, 117 volts AC

1.2.2.3 Reel Hubs

a) File Reel: NAB
b) Take-up Reel: Fixed reel flanges as per customer's supplied drawing.

1.2.2.4 Magnetic Head Assembly

Ampex $\frac{1}{2}$-inch 7-track asymmetrical head assembly.

1.2.2.5 Finish and Identification

Transport to be painted in Ampex grey with blue head cover.

1.2.2.6 Voltage Regulator Transformer Assembly

50 cycle 117 volts AC.

1.2.2.7 Write Lockout

NAB - Non-retractable

1.2.2.8 19" rack cabinet providing $66\frac{1}{2}$" rack mounting space, total height $73\frac{1}{2}$", incorporating a 400 cfm exhaust fan, motor grounded through grounding straps. Cabinet to be modified and painted as detailed in Siemens drawings: C-26324-A6-A1 (2 sheets) and C-26324-A6-B1.

1.2.2.9 Transport Access Door with Decal "TM-2"

1.2.2.10 Photosense

Output shall provide a level change of 10 + 1.5 - 1.0v. DC into 250 Ohms minimum when "off tab". The rise and fall time of the level change is less than 3 microseconds.

1.2.2.11 No cover panel.

2. APPLICABLE DOCUMENTS

The following specifications and publications of the latest issue will form a part of this specification.

2.1 The relevant selected and optional features specified on the customer's purchase order.

2.2 The SHTM-2 Handbook.

3. REQUIREMENTS

3.1 Operation

The Tape Transport will be composed of three functional units: the tape drive system, the storage reel control servos, including the buffer storage chamber and the magnetic head assembly. The tape drive system will be located centrally on the transport and will consist of forward and reverse drive capstans, driven at a constant speed through a belt and pulley system by a synchronous motor.

In the start mode, capstan rollers will press the tape against the capstans to ensure fast acceleration to normal speed. The tape will be stopped by disengaging the capstan roller. A servo system will maintain sufficient tape in the vacuum chamber to permit rapid tape acceleration on the start command.

A DC bias head will be mounted ahead of the write head to prevent spurious data in the inter-record gap.

The operation of the multi-channel magnetic head will be electrically independent of the tape control electronics.

3.2 Mounting

The Tape Transport may be mounted on a standard 19" rack and will be operated in a vertical position. The Tape Transport will be hinged for a service opening of 73° minimum.

3.3 Size

Tape Transport:	height 35",	depth 14",	width 19"
Front Access Door:	height 35",	depth 2¼",	width 19"
Control Electronics Unit:	height 18",	depth 7" ,	width 19"

3.4 Weight

Tape Transport:	190 lbs
Front Access Door:	25 lbs
Control Electronics Unit:	83 lbs

3.5 Operating Environment

The Tape Transport will be designed to operate in a fixed position, under the typical conditions for a commercial computer installation as specified below:

Ambient air temperatures	60° to 85° F.
Relative humidity	45% to 65%
Altitude	0 to 7000 ft.

3.6 Cooling

When the Tape Transport is enclosed, sufficient air must be blown over the major components in the rear of the Tape Transport to maintain maximum exhaust air temperature at less than 100° F.

The airflow requirements depend upon the additional electronics located in the rack by the customer. However, for the Tape Transport only, a flow of 400 cfm will be required at a maximum inlet temperature of 85° F. using a standard 19 inch cabinet.

3.7 Storage and Shipping Environment

Ambient air temperature	$-20^{o}F$ to $+150^{o}F$.
Relative humidity	95% maximum
Altitude	0 to 40000 ft.

Sudden temperature changes which will cause condensation will not be permitted.

3.8 Shock - Vibration

The Tape Transport will withstand normal shock and vibration encountered in air freight and van shipments and handling without damage. It will also perform satisfactorily under normal shock and vibration disturbances encountered in typical computer installations.

3.9 Tape Type

The Tape Transport will be designed to use computer grade $\frac{1}{2}$-inch mylar base (0.001 or 0.0015 inch) hard binder, oxide coated tape.

3.10 Tape Leader

A permanent tape leader should be used to facilitate replacement of tapes. The quick disconnect splice between the permanent tape leader and the file tape will be stopped adjacent to the file reel, thus permitting rapid changing of tapes.

A tape leader clamp will be provided to hold tape in position while disconnecting the file tape from the permanent leader.

A file reel may be changed by a trained operator in 30 seconds or less.

3.11 Interchangeability

Mechanical and electrical parts will be interchangeable within the preceding models of the TM-2. New spare parts will be interchangeable with the old ones, but not vice versa. If improvements are made which prevent interchangeability of spare parts, a different part number will be assigned for the newest spare part.

3.12 Power Requirements

Model:	50 cps
Frequency:	50 ± 2 cps
Voltage:	117 volts ± 7%
Standby Current:	7 Amps
Operating Current Max.:	20 Amps

4. PERFORMANCE

4.1 Start-Stop Characteristics

4.1.1 Start Time

The start time is defined as the time from the application of a "Start Command" until the tape passing over the magnetic head has maintained an instantaneous speed variation of 10% or less from nominal speed. The start time will be 2.0 ms maximum.

4.1.2 Start Distance

The start distance is the distance that the tape moves over the magnetic head during the 2 ms following a start command.

Tape Speed	Start Distance
150 ips	0.138" Min. 0.208" Max.

4.1.3 Stop Time

The stop time is defined as the time from the application of a "Stop Command", until tape motion over the magnetic head has ceased. The tape will come to rest within 1.5 m. sec. from the "Stop Command" but subsequent spurious tape movement is permissible for a further 3.0 m. sec. during which the spurious signal amplitude will not exceed 20% of the signal amplitude at nominal speed. For "ON" Times of less than 15 m. sec. the spurious signal amplitude may be 40% of the signal amplitude at nominal speed. These spurious signals are permissible only if there is recorded data on the section of tape which passes over the magnetic head during the stop time.

4.1.4 Stop Distance

The stop distance is the distance that the tape moves over the magnetic head from the time of a stop command until tape motion over the magnetic head has ceased.

Tape Speed	Stop Distance
150 ips	0.090" Min. 0.160" Max.

Comment: It is our experience that the above listed stop distance includes considerable margin on the max. side and that a distance of 0.153 max. can be achieved.

4.2 Tape Speed Characteristics

The following paragraphs related to tape speeds do not include the effects caused by variations in line frequency.

4.2.1 Instantaneous Speed Variations (ISV)

ISV is defined as the speed variation from the specified nominal speed at any instant of time. The tabulation below defines the ISV at instants of time following the start command.

Time (ms)	% Variation
2.0	10
3.0	10
3.5	10
4.0	8.5
5.0	6.0
6.0	4.0
7.0	3.0

4.2.2 Short Term Average Speed Variation

The Short Term Average Speed Variation is defined as the variation from the specified nominal speed, averaged over any interval of 10 ms occurring 7.0 ms or more after a start command. The variation will be 2% maximum.

4.2.3 Long Term Average Speed Variation

The Long Term Average Speed Variation is defined as the variation from the specified nominal speed, averaged over any interval of 30 ms or more, occurring 7.0 ms or more after a start command. This variation will be 1% maximum.

4.3 High Speed Operation

High speed operation will be provided for both the forward and reverse direction of tape motion. The speed will be 2.0 $\pm$ 5% times the nominal speed of the transport. Starting and stopping in the high speed mode will not result in relative movement of layers within the tape pack. The tape will be wound on the file reel to present a uniform surface for operator handling.

In fast reverse, the tape drive starts to return to nominal speed when the tape pack follower, associated with the take-up (lower) reel, is within .275 and .354 inches (8.0 $\pm$ 1.0 mm.) above the nominal reel hub surface.

4.3.1 Acceleration and Deceleration Between Normal and High Speeds.

Acceleration time from normal to high speed will be 8 seconds maximum. Deceleration from high speed to normal speed will be 5 seconds maximum.

Note: Programming (other than a single off command) of the capstan drive actuator is not permitted during operation above the normal speed.

4.4 Interchannel Time Displacement (ITD)

4.4.1 Definitions

4.4.1.1 ITD: The time band within which all bits of a character frame arrive at the head output when reading a tape written on the same or another TM-2 transport. Interchannel time displacement is the sum of the static skew contributed by the mechanical tolerances of the magnetic head assembly plus $\frac{1}{2}$ the dynamic skew contributed by the tape drive. ITD = Static Skew + Dynamic Skew/2

4.4.1.2 Dynamic Skew: The Dynamic skew is defined as the varying time displacement between the recorded signals of any two heads in the same stack with the tape travelling over the heads at the specified nominal speed, either direction. This time displacement is caused by random displacement of the tape as it is moved and guided across the head.

Dynamic skew is measured as the jitter band produced by the pulse output of one outside track referenced to the output of the other outside track in the same character frame.

4.4.2 ITD - Using heads mentioned in section 1.2.2.4 and specified separately.

Speed	Dynamic Skew	Static Skew	ITD
150 ips	2.5 usec.	3.6 usec.	4.9 usec. Max.

Note: These measurements do not include time displacement introduced by read/write electronics.

4.5 Tape Creepage

There shall be no evidence of improper system performance due to creepage of tape across the read/write head when the transport is stopped with the power "ON".

4.6 Programming

The minimum time between commands shall be 2.5 milliseconds. The programme shall not exceed 6 commands in any 25 m. sec. interval. The Transport shall not be programmed for data transfer purposes at speeds over 150 ips.

4.7 Tape Storage Servo Systems

. The storage servo systems will maintain the tape loop positions in the vacuum storage chambers within the specified limits provided the following "Stop Times" are inserted between commands when reversing the direction of tape motion.

There will be no stop delays required in uni-directional operation except as specified in section 4.6

Tape Speed	Bi-directional Stop Delay
150 ips	200 ms.

5. TRANSPORT CONTROL

The Tape Transport will be programmable externally through a remote connector J304. Manual control and interlock functions are through connector J303. Facilities are provided to accept the following safety interlocks controlled by compatible external circuitry.

5.1 Transport Interlocks and Safety Features

The following interlocks and safety features are available for the protection of equipment and personnel.

5.1.1 45-second Time Delay

A 45-second time delay after "Power on" must delay application of power to the reel servo motor power supply and the tape drive control circuitry, thereby inhibiting operation of the transport during this delay.

5.1.2 Safety Interlock

When a fault condition exists, the following conditions will be imposed on the tape transport:-

1) The Tape storage servo system will be rendered inoperative by removal of power from the reel servo motors.

Note: Power must not be removed from the motors for 100-150 ms to allow recovery of the servo system, should only a brief excursion over the specified tape position limits (section 5.1.3.2) occur.

2) The reel servo motor brakes will be applied.

Note: To facilitate changing tapes, push buttons will be provided near the file and take-up reels to enable disengagement of reel brakes.

3) The actuators will be programmed to the "off" position. Further programming during the fault condition will be inhibited.

Note: Removal of the fault condition will restore the transport to full operation without manual intervention in automatic mode.

5.1.3 Malfunction

A fault condition will be indicated by the removal of a -24 volt signal if any of the following circumstances exist:-

1) Transport Door: Opening the door will operate the door interlock switch, thereby rendering the transport inoperative. This switch will include over-ride capability for use during service with the door open.

2) Tape Storage Limit Switches: If the extreme limits (long or short loop) of permissible tape position are exceeded in the vacuum storage chamber, or the vacuum fails, then the safety interlock will be interrupted.

3) Power failure.

4) Tape Leader Clamp Switch: If the tape leader clamp is in the closed or engaged position, the safety interlock will be interrupted.

5.1.4 Actuator Overload

A current sensitive relay in series with the actuator power supply must temporarily interrupt actuator drive operation if the maximum programme repetition rate as specified in section 4.6 is exceeded.

5.1.5 Actuator Interlock

The actuator interlock circuit will be provided between the "forward" and "reverse" automatic input lines and the actuator drive circuitry to perform the following functions:

1) To inhibit the acceptance of an "On" command if the preceding command was an "on" command to the other actuator.

2) To inhibit actuator commands which are separated by less than 2.5 ms.

5.1.6 Servo Motor Thermal Interlock

A thermal overload switch will open the motor circuit if the temperature approaches an unsafe level. This switch will automatically reset when temperature decreases to a safe level.

6. INPUT SIGNALS TO THE TAPE TRANSPORT

Input/output signals will be connected to the transport via connectors J304 and J303.

6.1 Auto Actuator Drive

Two lines will be provided; one for the forward and one for the reverse actuator.

Application of a positive going level change of 8 to 20 volts will cause the actuator to assume the "on" position. The negative going transition of this same level will cause the actuator to return to the "off" position. The maximum level of these commands must not exceed 25v. DC with respect to ground.

The signal will have a rise time of 10 microseconds or less and be driven from a source with an impedance of 1000 Ohms or less.

6.2 High Speed

Application of a -24 volt level will cause the tape to drive at two times the normal speed. Removal of this level will return the drive to the normal speed. Maximum current required is 250 ma.

7. OUTPUTS FROM THE TAPE TRANSPORT

(Applicable parts apply only if the unit is equipped with compatible external circuitry).

7.1 Auto Ready

Opening the safety interlock circuits caused by closure of the tape leader clamp, long or short loop condition, opening of the transport access door or vacuum failure, will cause the removal of the -24 volt "Auto Ready" signal supplied to the external system in the automatic mode. Maximum permissible load on this line will be 100 ma.

7.2 Tape Leader Sensing

A conductive leader sensing post station will be located adjacent to each reel on the tape transport. Each station will consist of three rings insulated from each other.

Maximum capacity of each contact will be 60 ma. at 24 volts DC. (Arc suppression must be employed when contacts are connected to an inductive load).

7.3 Long and Short Loop Warning

A -24v. DC signal will be supplied when tape loop position in the vacuum storage chamber is within specified limits. Maximum permissible load on this circuit will be 150 ma.

8. RELIABILITY AND SERVICE ABILITY

8.1 Preventive Maintenance

Preventive maintenance will be performed in accordance with the schedule specified in the TM-2 Maintenance Manual.

8.2 Unscheduled Maintenance

A transport failure is any malfunction which requires unscheduled maintenance to restore full operational capability. The mean-time-between-failure (MTBF) will be 140 hours minimum over 1760 hours of operation. The average repair time will not exceed 1.5 hours.

8.3 Tape Wear

The average number of 100 foot passes before (permanent) drop-out of original information occurs, beyond those detected in the first pass, at 20% clipping, with peak detection, will be 3,000 using tape specified in section 3.9 (0.0015" only) at a speed up to 150 ips. A permanent drop-out is defined as one which cannot be read during a maximum of ten successive re-reads. Excessive temporary errors will not occur within 3,000 passes.

8.4 Equipment Life

The magnetic tape transport is covered by the "Ampex Standard Parts Warranty", provided no modifications have been made to the transport by the customer without a written approval from ACPC.

9. QUALITY ASSURANCE

9.1 Before the tape transport is being shipped it will be adjusted and checked in accordance with the check-out specifications prepared by the Quality Assurance Department.

SECTION II
INSTALLATION

2-1. SELECTION OF LOCATION.

2-2. The selection of a location for the tape transport should be based on the following factors:

1. The rack cabinet or rack selected must be capable of mounting and supporting the components shown in Table 2-1.

Table 2-1. Physical Dimensions

Component	Weight	Height Required	Depth From Rack Face
Tape transport	167 lbs.	35"	14"
Transport electronics assy. Vertical mounting Horizontal mounting	 70 lbs. 70 lbs.	 18" 7"	 7" 18"
Manual control panel	8 lbs.	7"	6"
Voltage regulator	24 lbs.	---	---
Transport access door	24 lbs.	---	---

2. Read and write electronics must be placed so that lengthening of the head cables beyond the 80-inch length supplied is not required. The increased capacitance associated with long head cables will impair high-frequency response.

3. The unit should be located in an area characterized by ambient temperatures between 60° and 85°F, 45% - 65% RH.

4. The unit must not be located in proximity to any strong magnetic fields.

5. A reasonably dust and dirt free environment is required.

2-3. Components of the tape transport are designed for mounting in a standard 19-inch cabinet rack. If the unit is supplied with an Ampex cabinet rack, it is shipped nearly fully assembled and cabled, and the rack need only be fastened in position.

2-4. The manual control panel, if supplied, may be mounted on the same bracket as a horizontally-mounted transport electronics assembly; this configuration requires no additional rack space for the manual control panel. The manual control panel may also be mounted directly above a vertically-mounted transport electronics assembly. In this configuration, seven inches of rack space are required for the manual control panel.

2-5. The voltage regulator is mounted on the side panel of Ampex cabinet racks. In custom installations, it may be mounted similarly or in any other convenient location which affords ample support.

2-6. The dimensions and recommended clearances for the Ampex cabinet rack are shown in Figure 2-1. In general, similar clearances will be required for all mounting schemes.

2-7. UNCRATING.

2-8. Each TM-2 tape transport is packed in a custom-built case for maximum protection in shipment. This case is designed for shipment in a horizontal attitude, and should not be handled in an upright position. In uncrating the tape transport, dismantle the shipping case carefully to avoid damage. Check the contents of the container carefully against the packing slip, and investigate the equipment for damage.

2-9. The voltage regulator transformer (shipped unmounted) must be mounted in the cabinet. Voltage regulator transformers for 60 cycle tape transports are mounted on the right side of the cabinet as viewed from the rear; voltage regulator transformers for 50 cycle tape transports are similarly mounted on the left side of the cabinet. Tapped holes are provided in the cabinet for the voltage regulator transformer and for cable clamps holding the connecting cable to TB709 on the tape transport.

2-10. A shipping lock over the transport latch inside the Ampex cabinet rack must be removed before the latch can be operated.

2-11. The transport electronics assembly is locked during shipping in the Ampex cabinet rack by angle brackets at each side. These locks must be removed before the electronics can be withdrawn from the front for servicing.

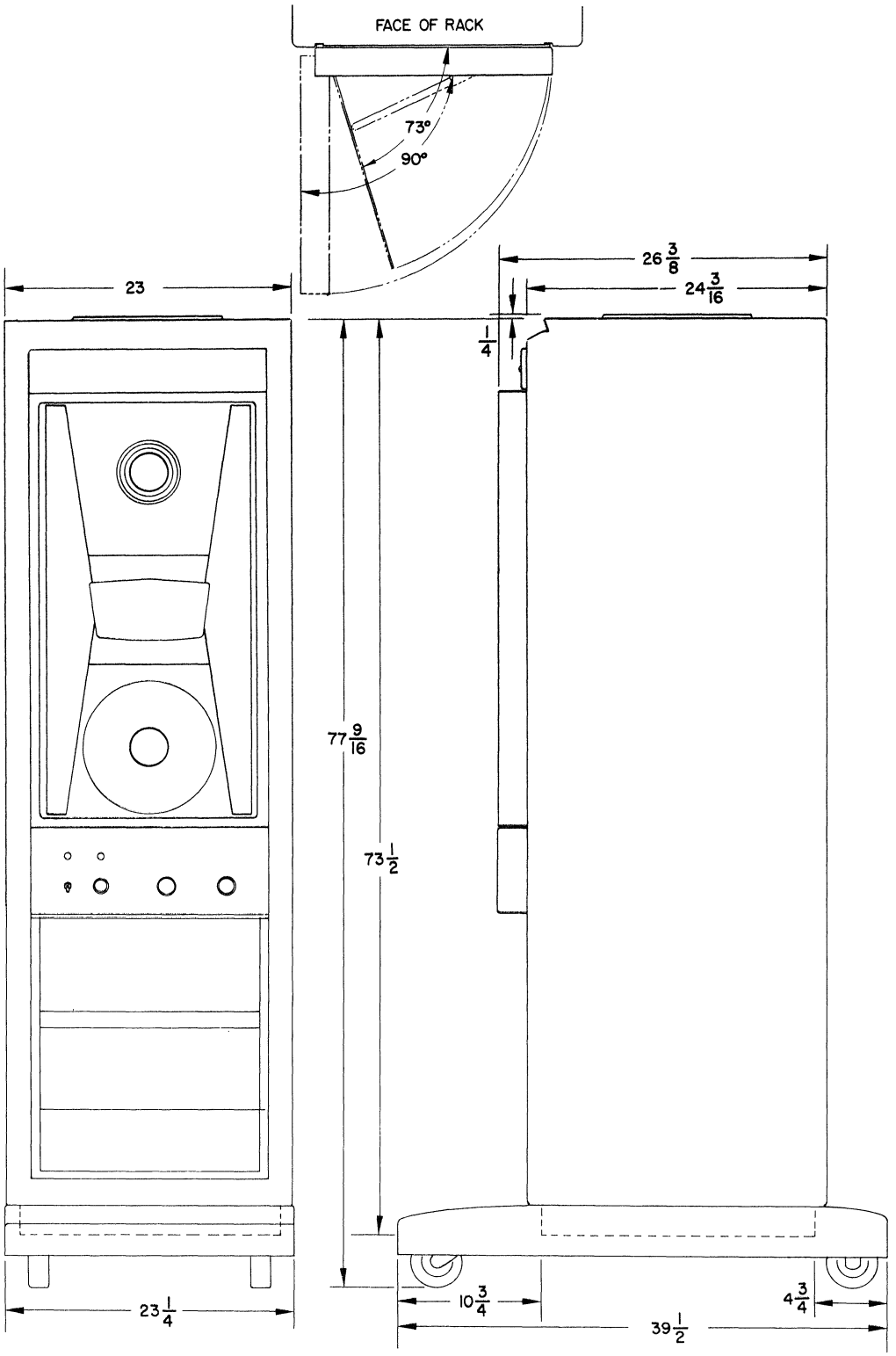


Figure 2-1
Dimensions and Clearances, Ampex Cabinet Rack

2-12. MOUNTING (CUSTOM INSTALLATIONS).

Step 1: Mount the hinge block strip to the left side rail of the rack using the 8½-inch flat head screws provided. A hole pattern for the hinge block is shown in Figure 2-2.

Step 2: Place the rack on its back on the floor.

CAUTION

The tape transport should be lifted only by the main frame casting.

Step 3: Lift the transport into position with the hinge portion of the frame between the blocks of the hinge block strip. (See Figure 2-2.)

Step 4: Insert the hinge pins through the hinge block into the hinge portion of the frame. Tighten the hinge pins securely.

Step 5: Place the transport electronics assembly in position and fasten to the side rails of the rack using the 12-24 by 3/8 inch pan head screws and #12 lock washers provided. Vertically-mounted transport electronics assemblies are fastened to the rack face with eight screws; horizontally-mounted transport electronics assemblies are fastened to the rack face with four screws. The balance of hardware supplied with the horizontally mounted transport electronics assembly may be discarded.

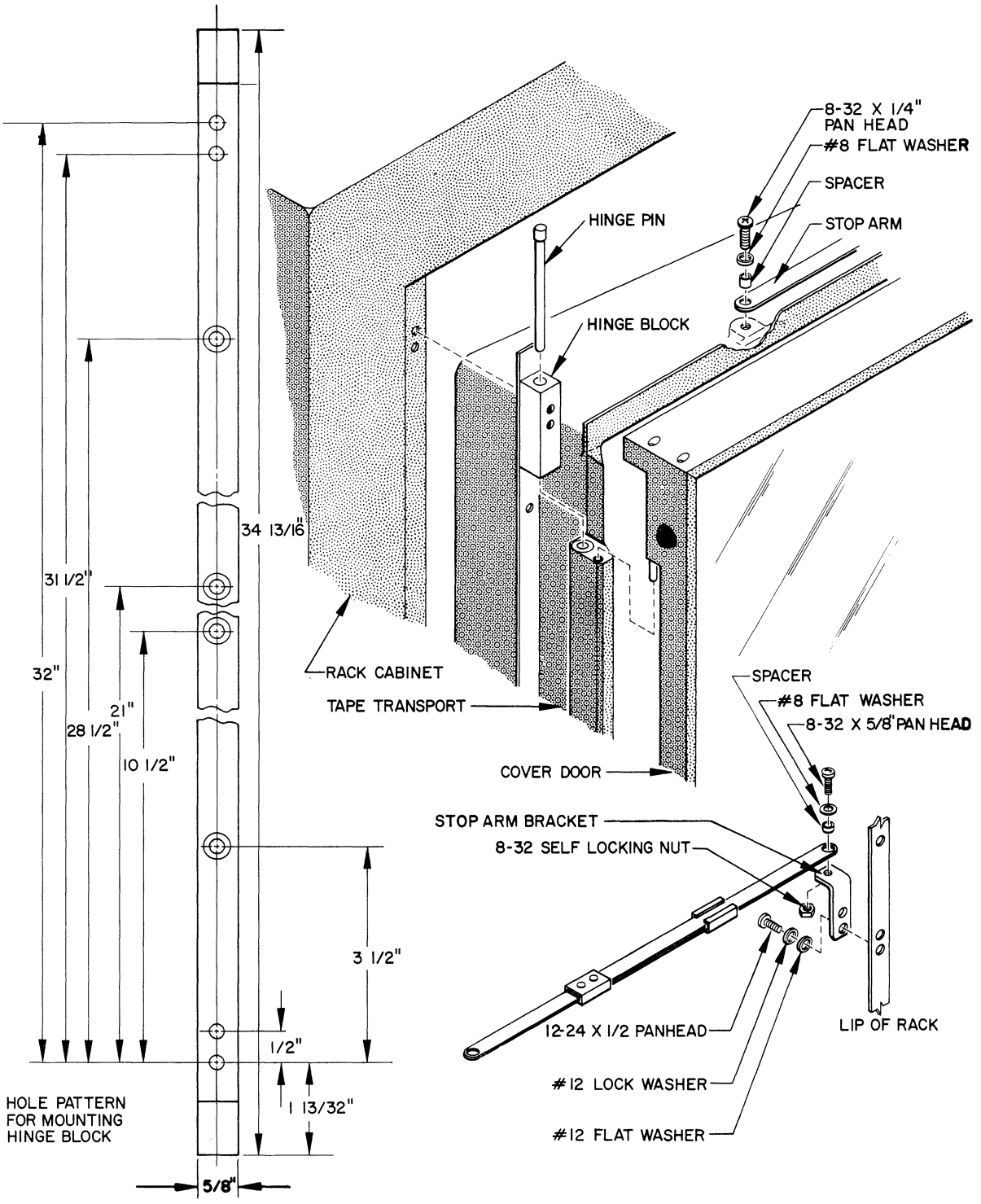


Figure 2-2. Tape Transport Mounting

NOTE

If a horizontally-mounted transport electronics assembly is used and a manual control panel is included in the system, the two brackets (supplied with the manual control panel) should be installed with the transport electronics assembly as shown in Figure 2-3. If a manual control panel is to be used with the vertically-mounted transport electronics assembly, the two brackets should be mounted separately from the transport electronics assembly.

Step 6: Fasten the manual control panel to the bracket (Figure 2-4) using the four 6-32 by 3/8-inch flat head screws supplied with the manual control panel.

CAUTION

Do not attempt to swing the transport out from the rack before the rack is secured to the floor.

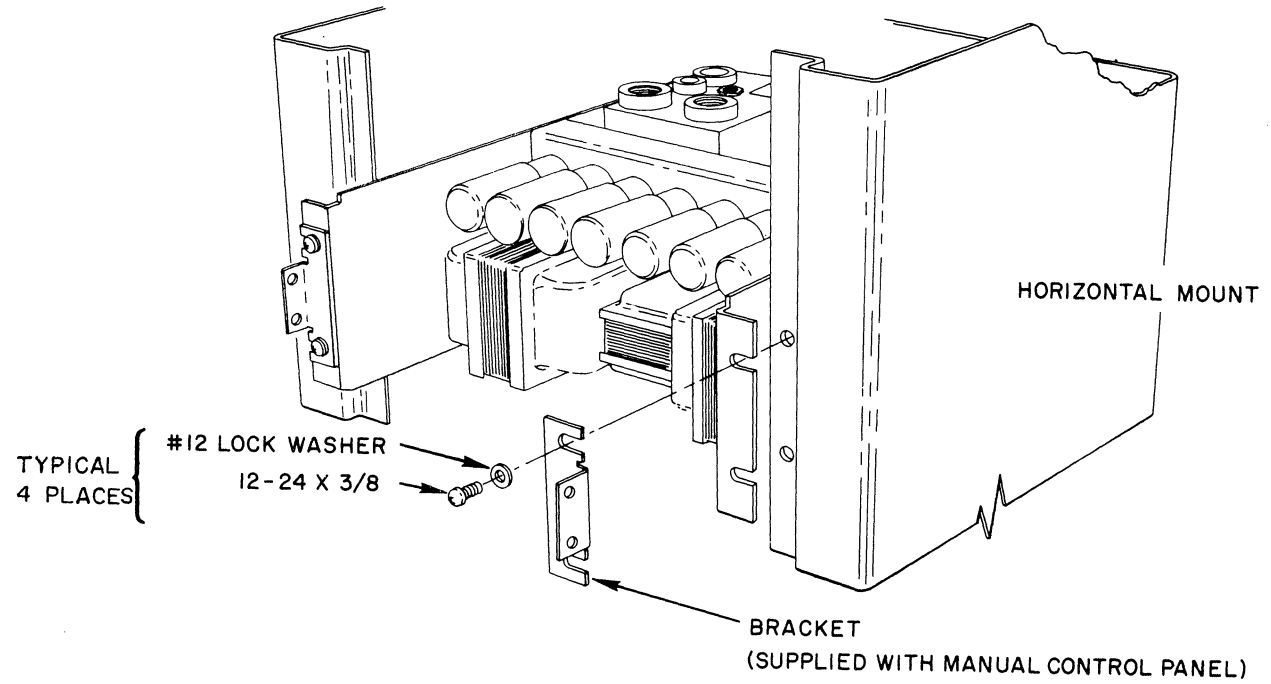
Step 7: Erect the rack and bolt it to the floor.

Step 8: Select a location for the voltage regulator. Using the dimensions and mounting details shown in Figure 2-5, mount this unit using the hardware provided.

Step 9: Fasten a ground strap from the transport to the rack.

Step 10: Mount the bracket on the back of the face of the rack cabinet using the 12-24 by ½-inch screws provided with the tape transport.

Step 11: Assemble the two stop arms provided with the tape transport as shown in Figure 2-2. Fasten the assembly to the bracket attached to Step 10 using the 8-32 by 5/8-inch screw, #8 flat washer, spacer, and #8 self-locking nut as shown in Figure 2-2. Fasten the other end of the assembly to the top of the transport using the 8-32 by ¼-inch screw, #8 flat washer, and spacer as shown in Figure 2-2.



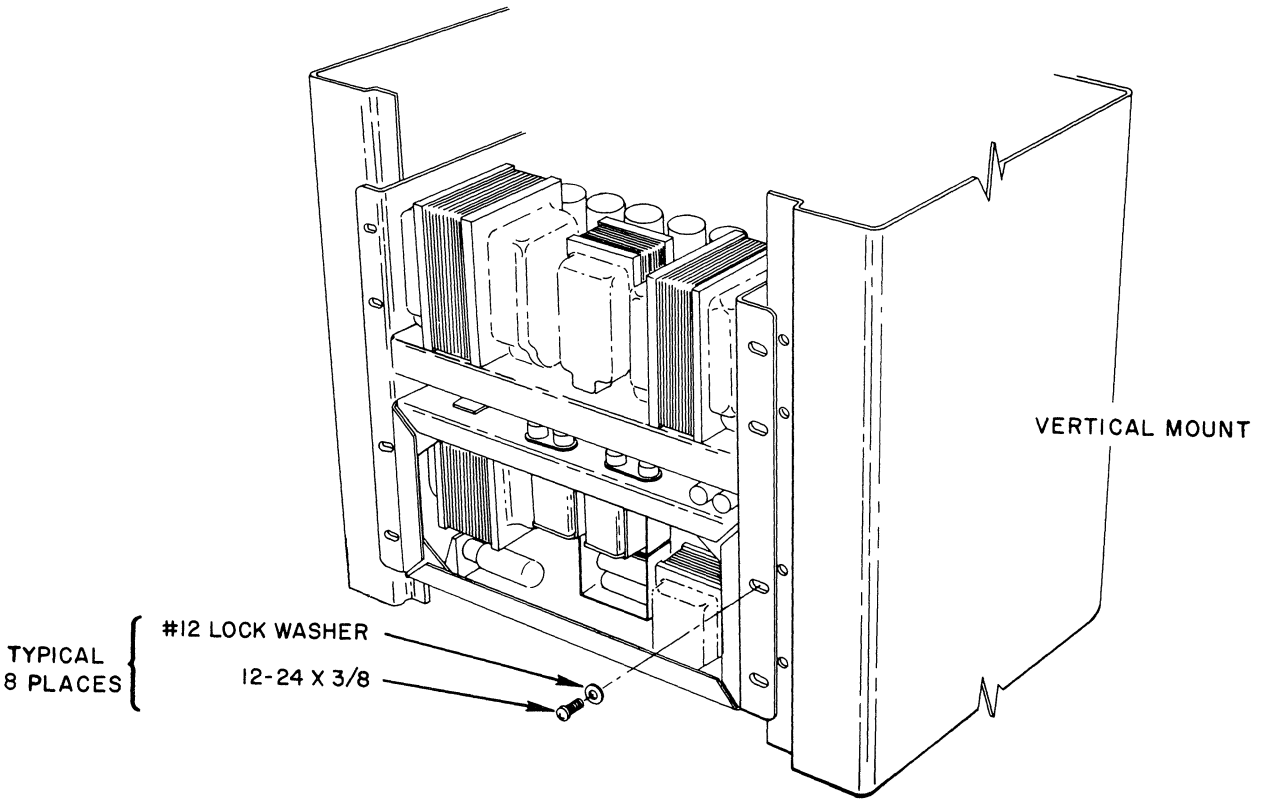


Figure 2-3
Transport Electronics Assembly Mounting

Step 12: Fasten the air filter assembly to the rack at some convenient location. Connect the hose from the air filter to the positive pressure blower inlet, using the hose clamp provided.

Step 13: Provide a source of cooling air through the rack. A minimum flow of 400 cfm over the reel motors is required. Cool air should be drawn in through louvers at the bottom of the rack and expelled at the top.

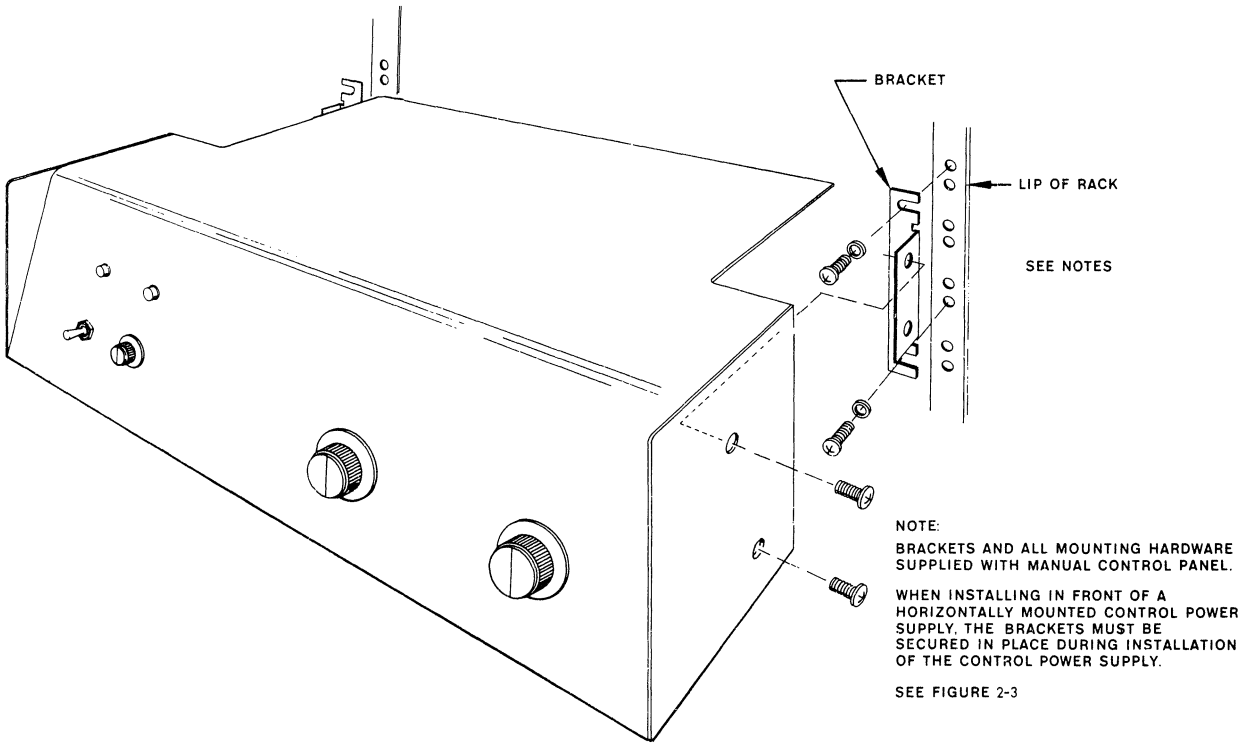


Figure 2-4. Manual Control Panel Mounting

CAUTION

If the transport is not adequately cooled, the servo motors may overheat, and programming of the transport will be restricted.

Step 14: Install cover panels over unused portion of rack.

Step 15: Mount the head assembly on the tape transport by means of the socket head cap screws and flat washers provided. Connect the head connectors to the receptacles on the tape transport, taking care to connect the write head to the write receptacle, the read head to the read receptacle. Fasten the screws which secure each connector to its receptacle.

2-13. CABLING (Figure 2-6).

2-14. All cable connections to the tape transport are made through a connector chassis on the transport electronics assembly. This

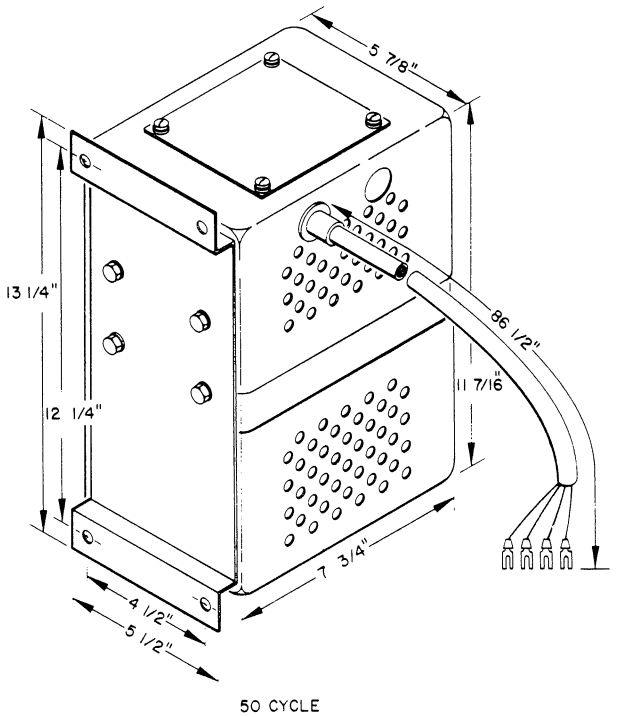


Figure 2-5. Voltage Regulator Mounting

component also serves as a central point for most connections within the tape transport.

Step 1: Connect the cable captive to the tape transport to J301 on the transport electronics assembly.

Step 2: Connect the AC power source to J302. A mating connector for this purpose is furnished with the tape transport.

Step 3: If a manual control panel is supplied, connect the cable captive to the manual control panel to J303 on the transport electronics assembly. If no manual control panel is supplied, suitable similar circuitry must be connected through J303; see Figure 2-7.

Step 4: If the tape transport is to be programmed from the tape control unit of a computer or other external source, connect this source to J304 and J305 on the transport electronics assembly. Mating connectors are supplied with the tape transport. Typical control circuitry is indicated in Figure 2-7.

Step 5: Connect the voltage regulator cable fanning strip to TB709 on the rear of the tape transport.

Step 6: Connect the cooling fan for the rack cabinet to terminals 1 and 2 on TB709, unless the power for this fan is to be supplied elsewhere.

2-15. HEAD CABLE CONNECTIONS.

2-16. The write head cables are terminated in 19-pin male Cannon connectors, one connector being used for each eight-track cable. The read head cables are terminated in similar 19-pin female Cannon connectors. Mating receptacles are provided on Ampex signal electronics assemblies; when no such electronics are provided, mating connectors must be furnished by the user.

2-17. The pin assignments of write and read head connectors are identical, and are shown in Figure 2-8. The numbers shown in parentheses in Figure 2-8 refer to track assignment on the cable for tracks 9 through 16.

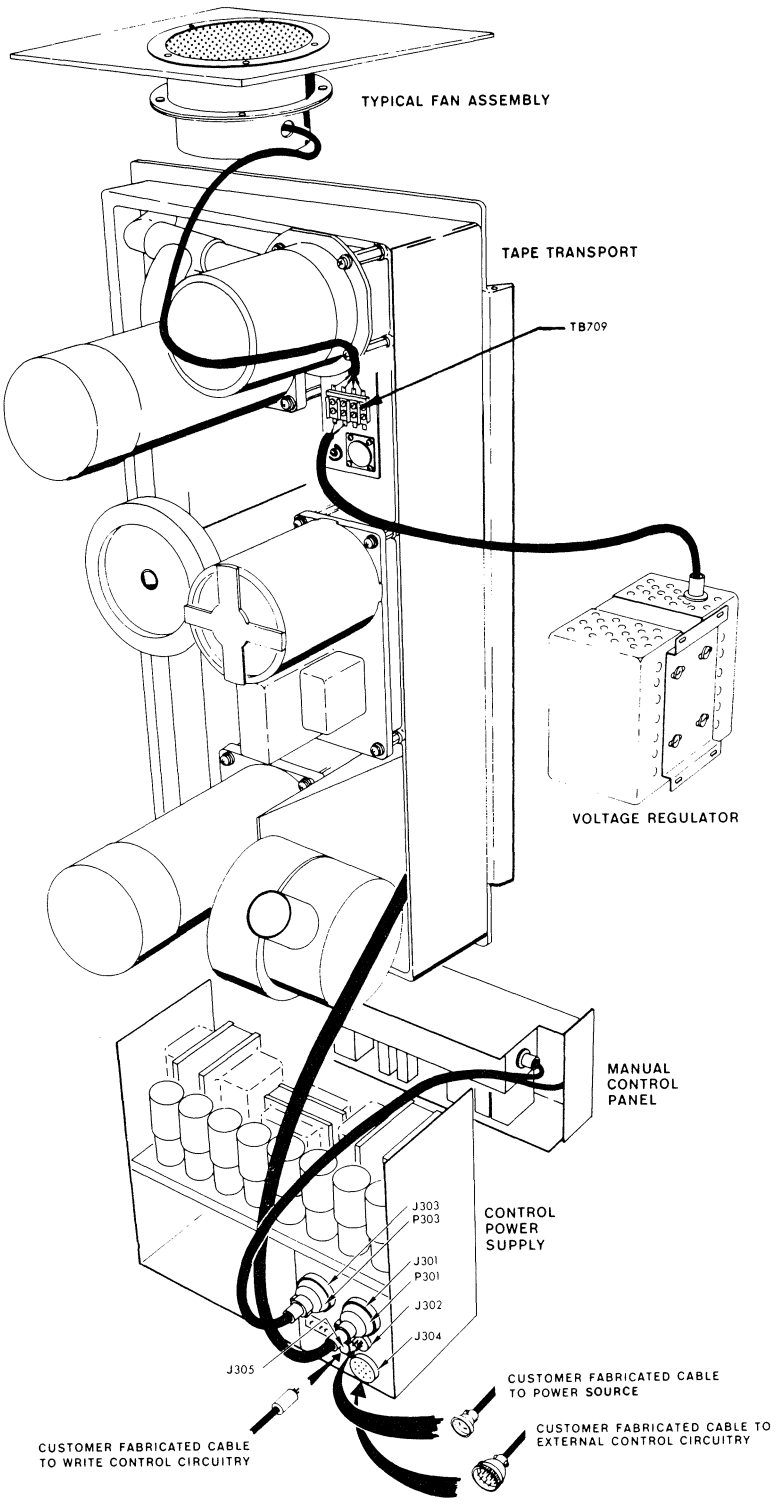


Figure 2-6. Cabling Diagram

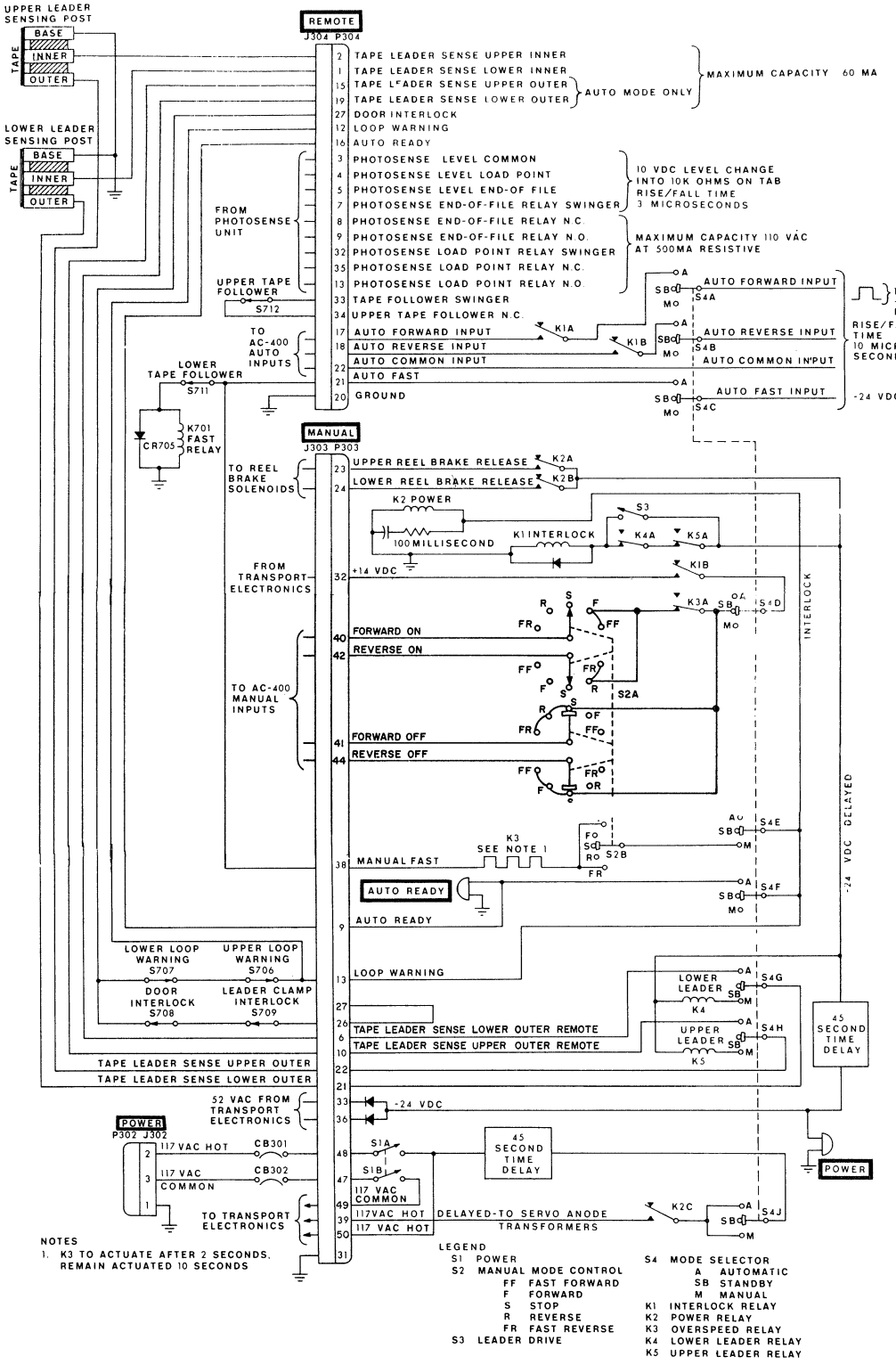


Figure 2-7. Typical Control Circuitry

2-18. PRINTED CIRCUIT CARDS.

2-19. The servo oscillator card, actuator control unit card, and servo amplifier card are not shipped in their sockets. The servo oscillator card should be placed in its housing on the rear of the tape transport, and the actuator control and servo amplifier cards in their respective positions in the transport electronics assembly. Power may now be applied to the system.

2-20. INITIAL CHECKOUT.

2-21. When the installation procedures described above have been completed, initial checkout may be performed. Thread a reel of tape on the transport as detailed in Section III of this manual.

2-22. Apply power to the equipment. Ensure that the vacuum motor is operating properly, the tape loops are formed in the vacuum chambers, and the capstans are rotating, driving the capstan rollers through the quad rings.

2-23. Operate the transport in the forward direction until all of the tape is on the take-up reel. Rewind the tape onto the supply reel.

NOTE

Irregular tape packing from a previous machine may cause faulty tape tracking. Therefore, this check should not be performed without repacking the tape on the supply reel.

CAUTION

With the actuator in the OFF position the tape should never touch the capstan roller. Contact with the roller may cause dropouts because of excessive wear on the oxide side of the tape.

Check to see that the tape is as close as possible to the capstan without touching it. If the tape touches either the capstan roller or the capstan, refer to paragraph 4-12 for adjustment procedure.

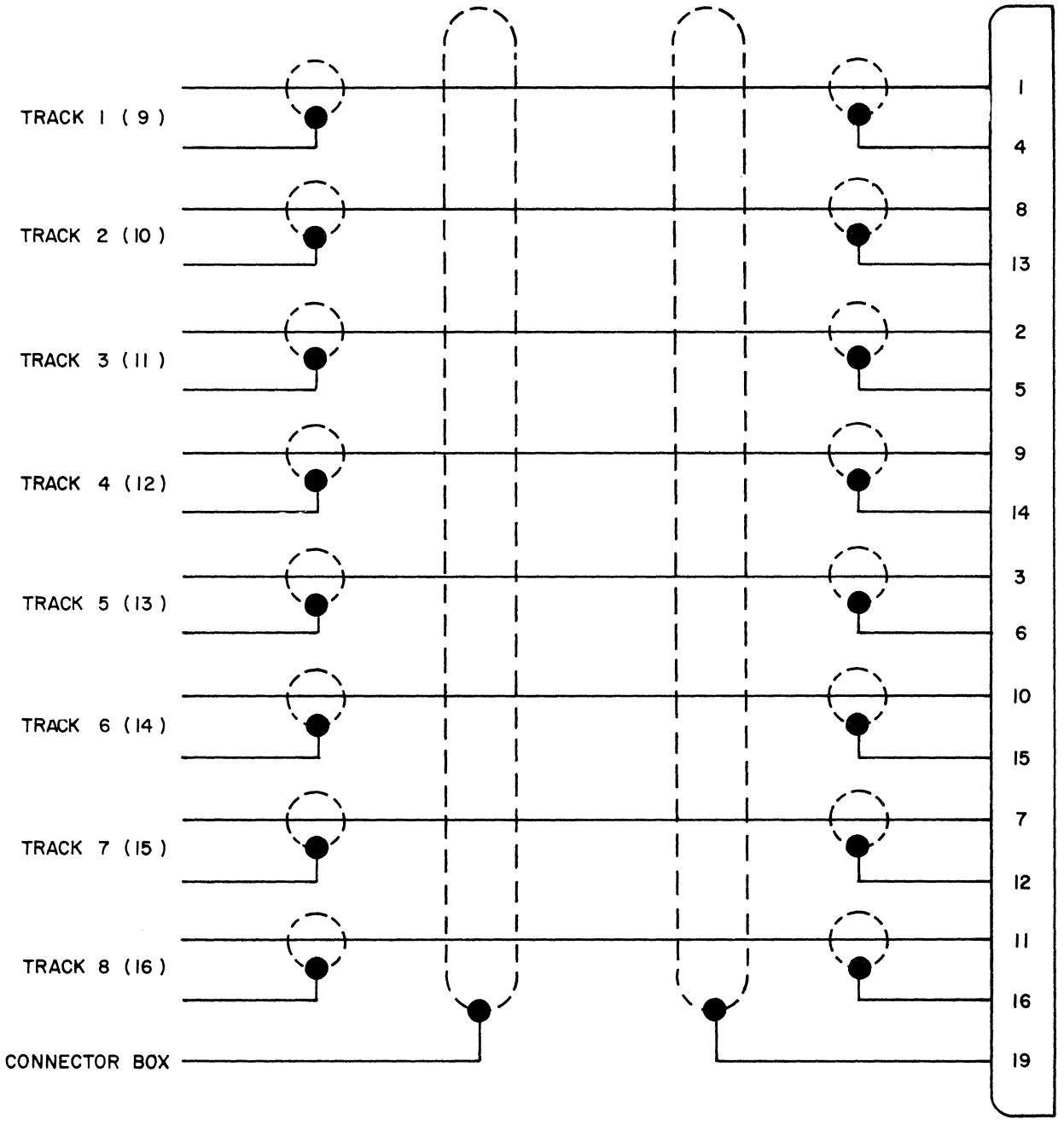


Figure 2-8. Head Cable Connections

2-24. Operate the transport from the control source in the forward and reverse directions. With the eyes at the level of the capstan rollers, observe the tape path between the capstan rollers and the vacuum chambers, between the capstan rollers and the head guides, and across the head. If any rippling, curling, or horizontal shift of the tape is evident, adjust the tape guides as described in paragraph 4-6. If the servo response appears sluggish or jittery, refer to paragraph 4-12 for adjustment procedure.

2-25. While the tape is moving in the forward and reverse directions, observe the action of the tape packer arms. The packer arm shoe must at no time touch the reel flanges. Should the shoe contact the reel, it may be adjusted as detailed in paragraph 4-9.

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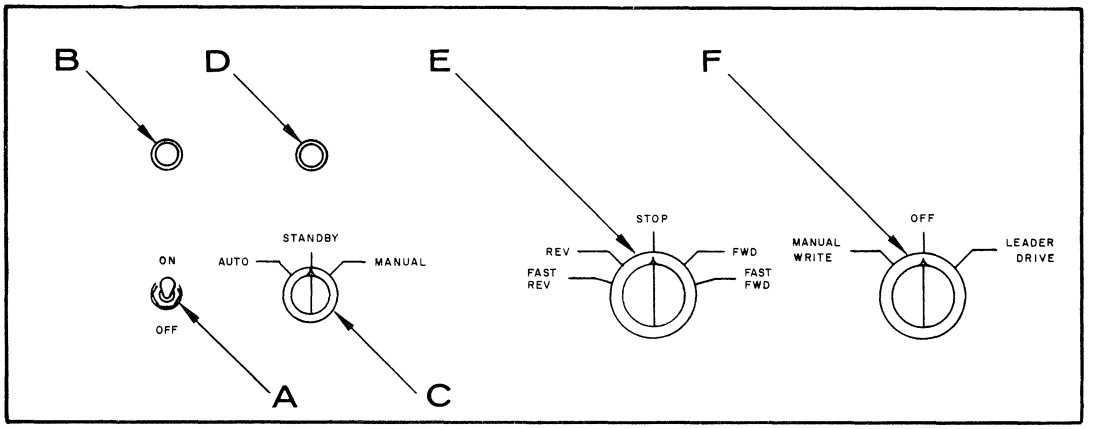
SECTION III
OPERATION

3-1. GENERAL.

3-2. The information contained in this section is based on the assumption that an Ampex manual control panel is incorporated into the tape transport. Since equivalent control circuitry must be provided by the customer if a manual control panel is not included with the tape transport, only minor differences in nomenclature should occur and no basic difference in operating procedure will be encountered.

3-3. OPERATING CONTROLS.

3-4. The operating controls for the tape transport are grouped on the front panel of the manual control panel. These controls and their functions are indicated in Figure 3-1.



CONTROL	DESCRIPTION	FUNCTION
A	POWER SWITCH	POWER ON OR OFF
B	ORANGE INDICATOR	POWER ON
C	MODE SELECTOR SWITCH	AUTO, STANDBY, OR MANUAL
D	GREEN INDICATOR	READY
E	MANUAL CONTROL SWITCH	FAST FORWARD, FORWARD, STOP, REVERSE, OR FAST REVERSE
F	MANUAL WRITE / LEADER DRIVE SWITCH	MANUAL WRITE, OFF, OR LEADER DRIVE

Figure 3-1.
Operating Controls, Manual Control Panel

3-5. THREADING TAPE LEADER.

3-6. Under normal operating conditions, the take-up reel of the transport is never removed. Successive reels of tape, or files, are placed on the supply reel hub.

3-7. The operation of re-threading the tape transport for each supply reel is avoided by attaching a permanent leader to the take-up reel. A connector tab on this leader mates with notches in the leader of each supply reel.

3-8. The machine leader is normally supplied on the take-up reel and will last for many months in normal operation. Should the leader require replacement, the following procedure is recommended.

Step 1: Remove any leader or tape from the take-up reel.

Step 2: Place the tape transport in the Standby mode. Press the lower REEL BRAKE pushbutton and starting with the plain end of the new leader, wind approximately 10 feet of leader on the reel by rotating a reel in a clockwise direction.

Step 3: Open the tape drive mechanism cover and the glass vacuum chamber doors.

Step 4: Referring to Figure 3-2, pass the tape to the left of the lower leader sensing post, over the roller guide of the vacuum chamber, and between the lower vacuum chamber guide and the chamber wall.

Step 5: Route the leader over the upper guide, between the upper guide and the chamber wall, under the buffer spring guide of the vacuum chamber, between the right-hand brake weight and brake post, and between the right-hand capstan and capstan roller.

Step 6: Pass the leader over the right-hand guide of the head assembly, between the hinged head cover and the head stack, and under the left-hand guide on the head assembly.

Step 7: Continue the threading by passing the leader between the left-hand capstan and capstan roller and the left-hand brake weight and brake post. Pass the leader between the photosense head and the buffer spring guide of the left-hand vacuum chamber. If photosense is not used, the leader is routed directly over the buffer spring guide of the left-hand vacuum chamber.

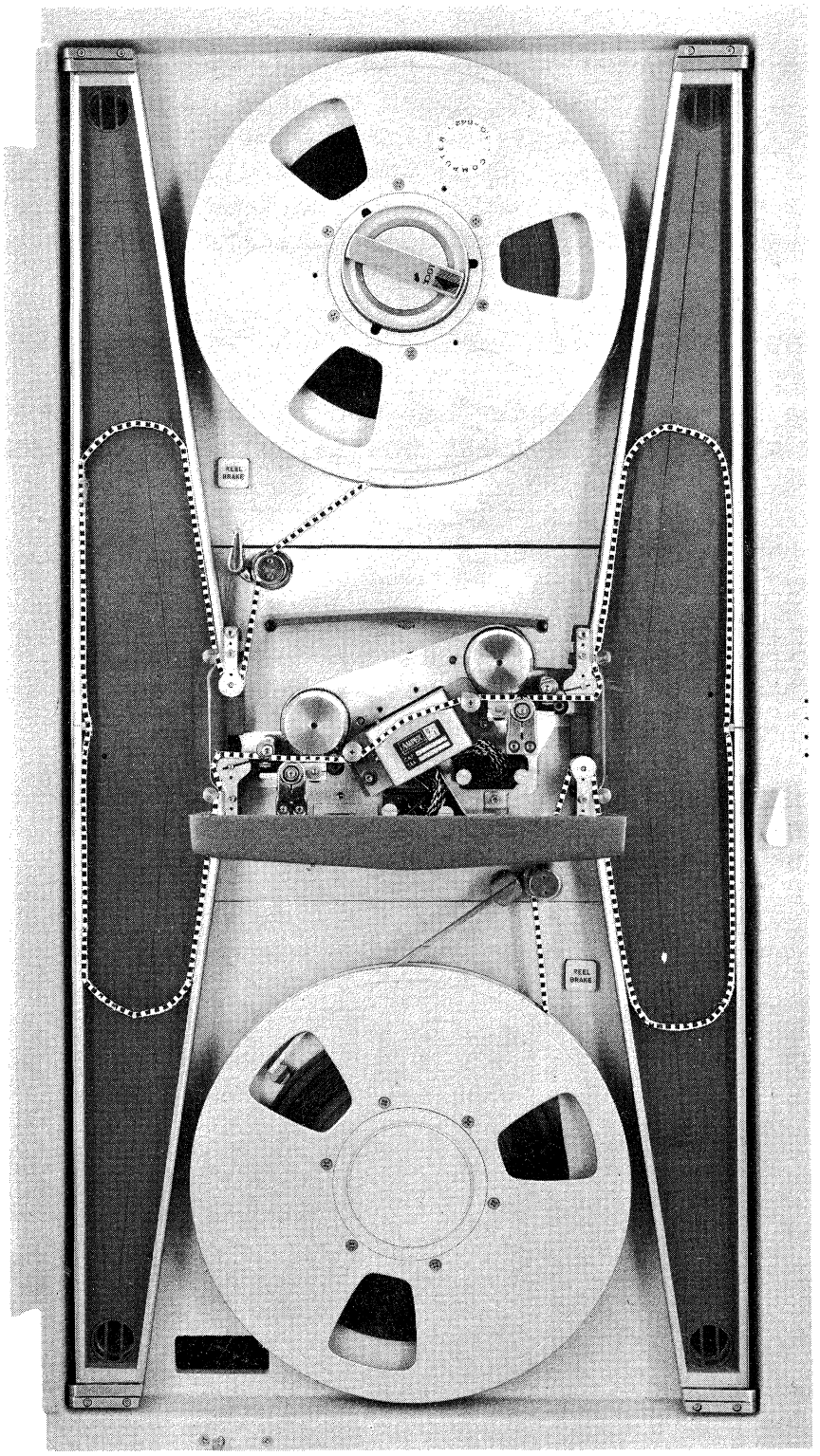


Figure 3-2. Tape Threading Path

Step 8: Thread the leader between the lower chamber guide and the chamber wall, over the upper chamber guide and between this guide and the chamber wall, and under the roller guide on the vacuum chamber. Open the leader clamp at the upper leader sensing post and clamp the leader against the post. Close the vacuum chamber doors and the tape drive mechanism cover.

3-9. INSTALLING SUPPLY REEL. (Figure 3-3)

3-10. When the permanent leader has been threaded on the tape transport as above, the supply reel may be installed by following the procedure below.

Step 1: Open the transport access door and engage the leader clamp (if not already engaged).

Step 2: (Ampex reel retainer)--Press the serrated end of the reel retainer handle. If the reel retainer has previously been locked, the lock will release.

(IBM Compatible reel retainer)--Rotate the retainer knob in a counterclockwise direction until the metal plate no longer presses against the tire.

Ampex Supply Reel

IBM File Reel

Figure 3-3. Mounting a Supply Reel

Step 3: If a write enable ring is to be used, install the ring on the back of the supply reel.

Step 4: (Ampex reel retainer)--Slip the supply reel over the reel retainer. Hold the reel firmly against the turntable surface and rotate the reel retainer handle approximately 120 degrees clockwise, at which point the reel retainer handle will lock into position. Check to see that the reel is snugly mounted on the retainer.

(IBM Compatible reel retainer)--Slip the supply reel over the reel retainer. Hold the reel firmly against the turntable surface and rotate the retainer knob in a clockwise direction until the reel is snugly mounted on the retainer.

Step 5: Press the upper REEL BRAKE pushbutton, releasing the mechanical brake on the upper reel. Pull sufficient tape from the reel to reach the end of the permanent take-up leader held in the tape clamp.

Step 6: Connect the supply leader to the take-up leader as shown in Figure 3-4. One-inch tape leaders have two sections in the quick-connect splice, one-half-inch tape leaders have a single section splice.

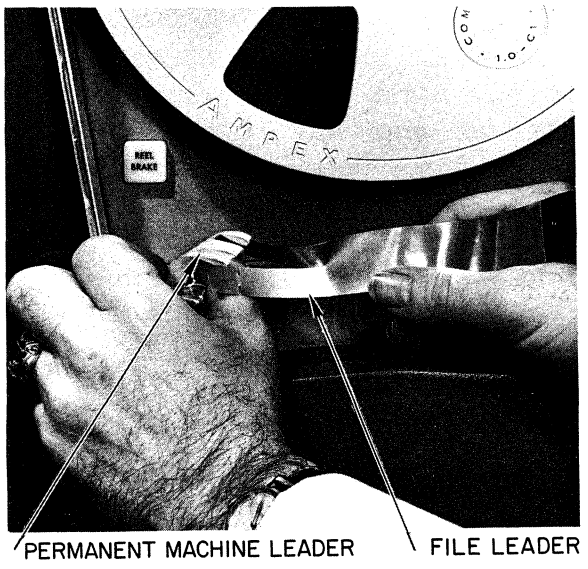


Figure 3-4.
Connecting Leaders

Step 7: Press the upper REEL BRAKE pushbutton and turn the supply reel in a counterclockwise direction to take up all slack between the supply reel and the leader clamp.

Step 8: Release the leader clamp. The upper tape packer arm will move in against the tape pack.

NOTE

The leader clamp must be opened to complete the tape transport interlock.

Step 9: Close the transport access door.

NOTE

The transport access door must be closed to complete the tape transport interlock.

Step 10: Place the MODE SELECTOR switch in the MANUAL position. Place the MANUAL CONTROL switch in the FORWARD position. Hold the MANUAL WRITE/LEADER DRIVE switch in the LEADER DRIVE position until metallized leader no longer contacts the sensing posts. When the MANUAL WRITE/LEADER drive control is released it will automatically return to OFF position. Tape will continue to move in the forward direction.

Step 11: Permit the tape to move forward until the opaque recording tape is completely threaded between the supply and take-up reels. Tape motion may now be stopped by turning the MANUAL CONTROL switch to the STOP position.

3-11. MANUAL OPERATION.

3-12. Manual operation is obtained at all times when the MODE SELECTOR switch is in the MANUAL position. Tape motion control is exclusively a function of the five-position MANUAL CONTROL switch, with writing possible when the MANUAL WRITE/LEADER DRIVE switch is in the MANUAL WRITE position.

3-13. If an entire reel of tape is to be run, the MANUAL CONTROL switch may be left in the FORWARD position. The tape transport will move tape forward until metallized leader at the end of the supply reel contacts the leader sensing post, at which time tape motion will automatically stop. Likewise, the tape may be moved in the reverse direction at normal tape drive speed by utilizing the REVERSE position of the MANUAL CONTROL switch. Tape motion will stop when the metallic leader at the beginning of the supply reel contacts the tape sensing posts.

3-14. If only certain portions of the tape are to be run, the desired section may be more rapidly reached by the use of the FAST FORWARD or FAST REVERSE positions of the MANUAL CONTROL switch. The presence of the metallic leader will stop the tape transport at the end of the reel. (FAST FORWARD and FAST REVERSE operation are locked out when the diameter of the tape pack on the take-up reel falls below a minimum point.)

3-15. If the tape motion is interrupted for any reason, such as breaking the tape transport control interlock circuitry by opening the transport access door, the MANUAL CONTROL switch must be turned to the STOP position after the interruption is cleared before tape motion can be resumed.

3-16. AUTOMATIC OPERATION.

3-17. Placing the MODE SELECTOR switch on the manual control panel in the AUTO position connects all control inputs of the tape unit to external equipment. Control of tape motion is therefore exclusively a function of the computer, and operation of the MANUAL CONTROL or MANUAL WRITE/LEADER DRIVE switches will have no effect on operation.

3-18. If tape motion is interrupted for any reason, such as breaking tape transport control interlock circuitry by opening the transport access door, tape motion is resumed as soon as the interruption is cleared. If this is not desirable, the MODE SELECTOR switch should be turned to the STANDBY position before the interruption is cleared. It will be noted that even though the operation is resumed immediately upon clearance of the interruption, the logical sequence of the programming may be destroyed.

3-19. REMOVING SUPPLY REEL.

3-20. When operating in the MANUAL mode, tape motion is automatically stopped by the presence of metallic leader across the upper leader sensing post. (Leads from this post are available for similar control in the AUTOMATIC mode.) To return the tape to the supply reel, the following procedure should be followed:

Step 1: Turn the MODE SELECTOR switch to the MANUAL position, the MANUAL CONTROL switch to the FAST REVERSE position, and the MANUAL WRITE/LEADER DRIVE switch to the LEADER DRIVE position. The tape will move at high speed from the take-up reel to the supply reel. As the rewind cycle is nearly completed the position of the take-up reel packer arm trips a switch to slow the tape transport to normal reverse speed. As the metallic leader passes over the upper leader sensing post, tape motion is automatically stopped.

Step 2: Turn the MODE SELECTOR switch to STANDBY and the MANUAL CONTROL switch to STOP.

Step 3: Open the transport access door.

Step 4: The tape will be stopped with the leader connection between the supply reel and the leader clamp. Close the leader clamp, gripping the tape.

Step 5: Disconnect the permanent machine leader from the supply leader.

Step 6: Depress the upper REEL BRAKE pushbutton and rotate the reel in a counterclockwise direction until the supply leader is completely wound on the reel.

Step 7: (Ampex reel retainer)--Depress the serrated end of the reel retainer handle to release the lock, permit the handle to rotate in a counterclockwise direction. Remove the reel from the hub.

(IBM Compatible reel retainer)--Turn the retainer knob in a counterclockwise direction until the reel can be removed from the hub.

Step 8: The equipment is now ready to be reloaded. If another supply reel is not to be installed immediately, close the transport access door.

3-21. INTERLOCKS.

WARNING

With the transport access door interlock defeated, the servo systems may be operative. The operator should avoid placing hands near the reels unless the system is in the STANDBY mode.

3-22. Interlocks are provided in the tape transport mechanism to protect the operator and tape. These interlocks should be defeated only when absolutely necessary and with full realization of potential hazards.

3-23. The transport access door interlock switch, located at the lower left front of the tape transport, permits operation of the transport only with the access door closed or when the switch has been defeated. The defeat is possible by gripping the plunger and pulling it toward the operator.

3-24. PREPARING TAPE INDICATORS.

3-25. The tape sensing posts mounted near the supply reel and the take-up reel may be used for indicators in control circuits, logic circuits, etc. Metallized leader placed on the tape backing may be used to ground either or both insulated rings of the sensing post (if the metal leader extends across the lower half of the width of the tape, the inner ring will be grounded; if the leader extends the full width of the tape, both rings will be grounded). The maximum current capacity of each sensing post is 60 milliamperes. The posts are completely available only when the transport is operating in the AUTOMATIC mode; in MANUAL operation, the outer ring of the upper leader sensing post is required to stop tape motion.

3-26. If a photosense unit is incorporated into the tape transport, a level change and/or relay operation are available for control and logic circuits. Photosense signals are not used within the tape unit. Two channels are used, one each for beginning of file and end of file. Placement of the photosense tabs on the tape is indicated in Figure 3-5.

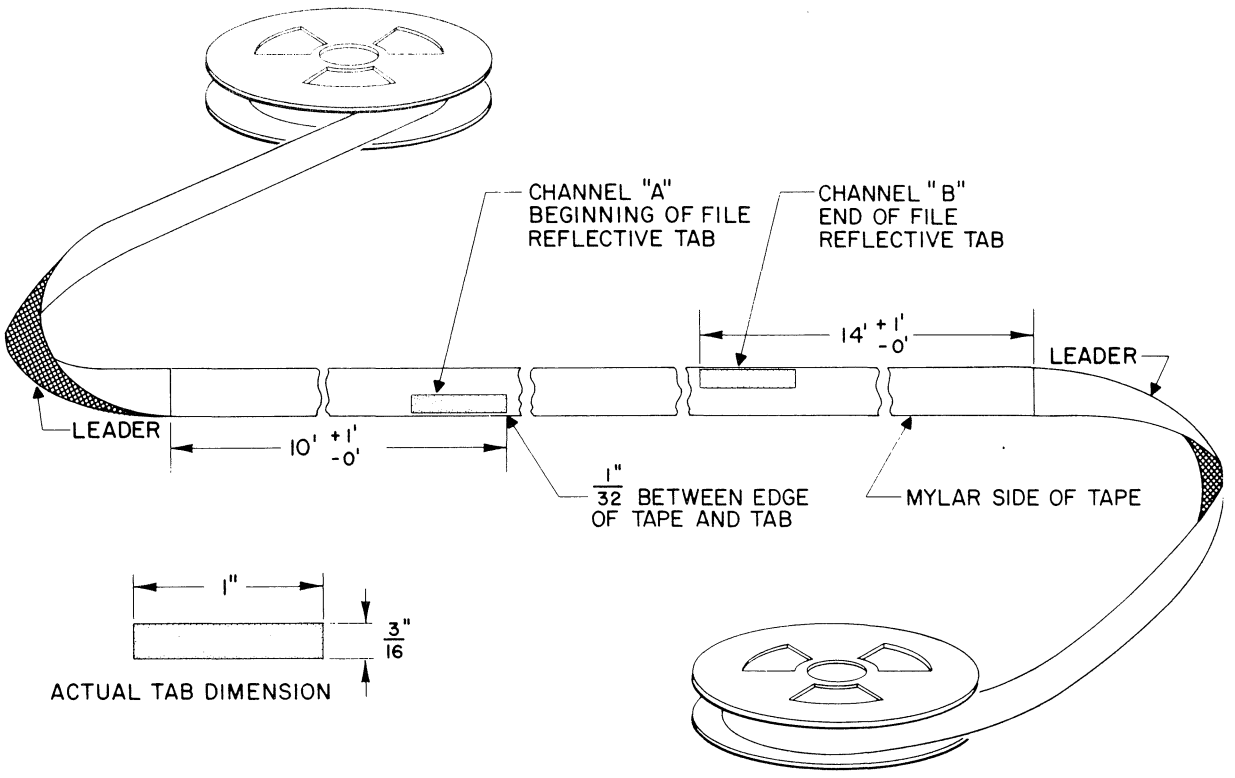


Figure 3-5. Placement of Photosense Tabs on Tape

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SECTION IV
ADJUSTMENT PROCEDURES

The information contained in this section is to be used for checking operating parameters and adjusting for optimum performance. These adjustments should also be made after major maintenance operations have been performed.

The maintenance chart in section 7 will give the recommended time interval between these operations.

4.1 Mechanical

4.2 DRIVE BELT ADJUSTMENT AND REPLACEMENT. The capstan drive belt can be changed without the removal of any assemblies from the machine. When adjusting a force of 5 lbs $\pm \frac{1}{2}$ should be applied (Figure 4.2) to the jockey pulley spindle to decrease belt tension to the point where a slowing of the reverse capstan is apparent when monitored with a stroboscope. The drive belt should track centrally and this is adjusted by aligning the pulleys.

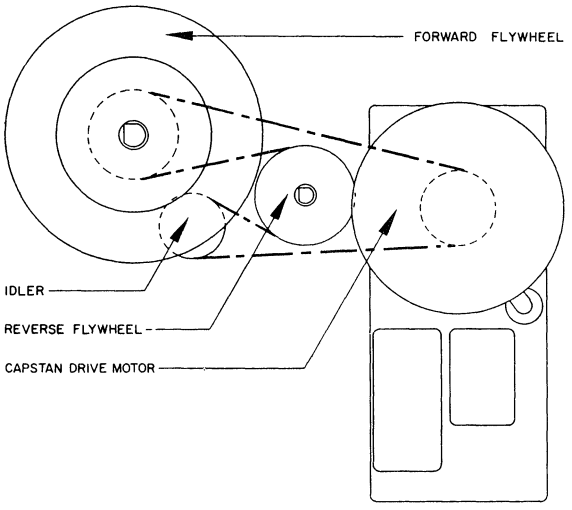


Fig. 4.1
Capstan drive belt path

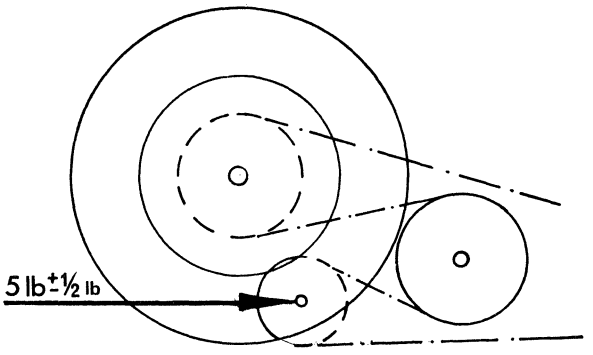


Fig. 4.2
Checking drive belt tension

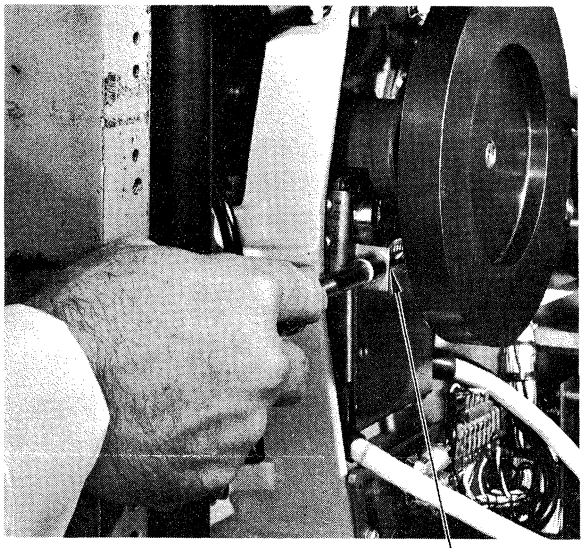


Fig. 4.3
Adjusting drive belt tension

4.3 REEL MOTOR BRAKE

The brakes are adjusted by the following procedure:

Step 1. Depress the appropriate REEL BRAKE pushbutton and note plunger travel which should be 1/16" ± 1/64".

Step 2. If the differences in positions is incorrect loosen the two screws which hold the brake solenoid, Fig 4.4, and move the solenoid to a new position. Repeat steps 1 and 2.

Step 3. Connect a spring balance to the brake solenoid arm and check brake tension which should be 7 lbs ± ½. If spring tension is not within tolerance, loosen or tighten the tensioning nut on the spade bolt to which the spring is attached.

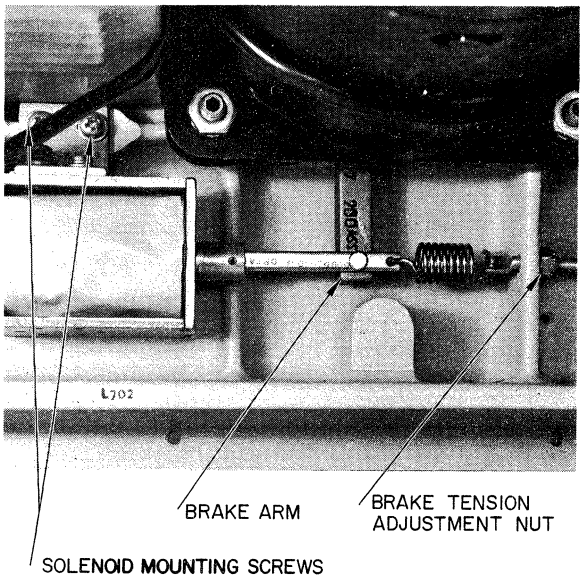


Fig. 4.4
Reel Brake adjustment

4.4 REEL RETAINER TORQUE ADJUSTMENT. The torque required to lock the hold down knob is adjusted as follows:

Step 1. Turn the hold down knob so that the operating handle points straight up and down, serrated end up, hold-down knob in released condition.

Step 2. Using a pin punch or similar device, press the spring loaded operating handle retainer at the upper left side of the operating handle so as to free the handle.

Step 3. Remove the operating handle, taking care not to lose the compression spring.

Step 4. Loosen the screw in the centre of the knob.

Step 5. Adjust the nut in the centre of the reel and tighten the lock screw.

Step 6. Re-assemble the operating handle.

Step 7. Install a reel, and using a torque wrench measure the torque required to lock a reel, which should be 25 in-lbs $\pm$ 2.

4.5 ACTUATOR ADJUSTMENT

4.5.1 CAPSTAN ROLLER ADJUSTMENT. Ensure that the actuator is in the off position, i.e. the right hand actuator in the anti-clockwise position, and the left hand actuator in the clockwise position, then set the capstan to pinch roller gap to .009 in $\pm$ .001 along its length. Set the gap as follows:

Step 1. Set gap taper to a minimum, dot and chamfer (A) on the outboard of the yoke in line with the pinch roller, being horizontal as shown in Figure 4.5, dot inwards towards the head.

Step 2. Loosen the clamping screws (B) located in the bottom of the yoke (C). Ensure that when clamping screws are loose the quad ring still runs on the metal part of the pinch roller.

Step 3. Rotate yoke on the actuator shaft until the correct head to pinch roller gap is obtained.

Step 4. Tighten clamping screws (C) tightly. NOTE It will be found that the action of tightening the screws tends to open the gap by about .002 in.

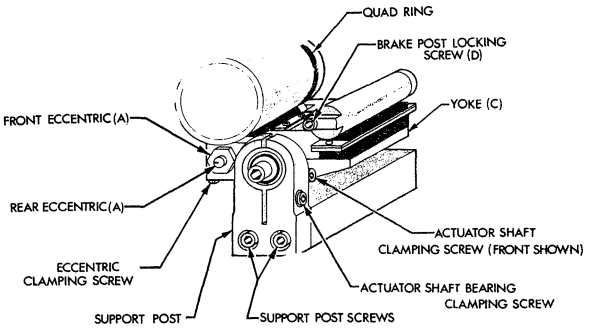


Fig 4-5
CAPSTAN & ROLLER BRAKE ADJUSTMENT

Fig. 4.5

Step 5. Correct any taper in the gap by turning the screws (A) on the eccentric. If the dot marker is turned more than about 30° some other fault is present.

4.5.2 BRAKE GAP ADJUSTMENT. The brake post to brake pad gap should be .009-.013in. and is adjusted as follows:

Step 1. Loosen socket head screw (D)

Step 2. Rotate brake post (E) until correct gap is obtained

Step 3. Whilst holding brake post in position tighten socket head screw (D)

4.6 TAPE PATH ALIGNMENT. Tape should be threaded on to the transport. The tracking is most readily checked by cycling the tape rapidly whilst observing its behaviour on the head and chamber guides. The tape should be flat with no ripple or twist, and there should be no horizontal shift anywhere in the tape path. During this operation the response of the servos may be studied. If the action is sluggish or jittery adjustments should be made as shown in paragraph 4.12.

4.6.1 TAPE PATH IN CAPSTAN AND BRAKE GAP

Step 1. Ensure that the tape is passing correctly through the capstan and brake gap. The tape should lightly touch the capstan and have a 3^{o} wrap around the brake post. (This is a special Siemens & Halske requirement.

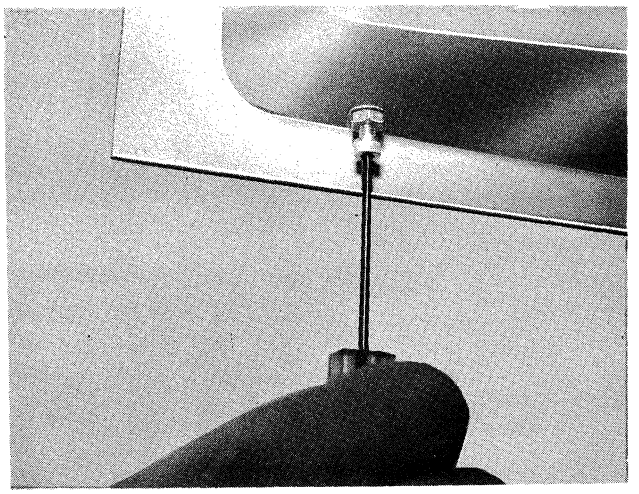


Fig. 4.6
Diagram of
Chamber adjustment

NOTE 1. This operation will not be required unless the chambers are being replaced.

2. Three fixing screws at the rear of each chamber must be slackened before Step 2.

Step 2. Adjust chamber height by a screw at the bottom of the Vacuum Chamber, see Figure 4.6. Raise or lower the chamber to obtain the correct tape alignment in the gap.

Step 3. Tighten chamber fixing screws, then unscrew adjusting screw a few turns.

4.6.2 CHAMBER GUIDE ADJUSTMENT.
The buffer spring guides are aligned by loosening the screws which secure the outboard bearing and manipulating the support with the spanner provided until proper guiding is achieved. The rotary guides are aligned by loosening the two screws which secure the outboard bearing support and manipulating the support with the spanner until guiding is correct.

Whilst adjusting this part of the tape path the tracking across the heads should be kept under observation. The tape should rest lightly against the fixed portion of the head guides and show no **tendency** to curl up on the **guide.**

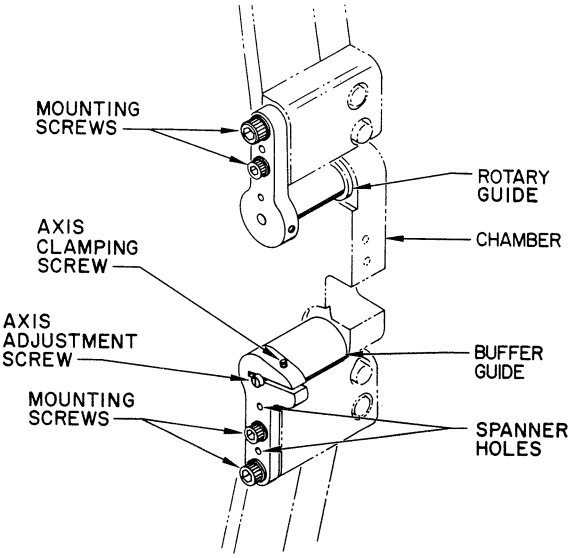


Fig. 4.7
Tape Guide Adjustment

When correcting tracking across the head in forward or reverse mode, the vacuum chamber guide leading in the tape path should be adjusted.

4.7 VACUUM AND TAPE LOOP ADJUSTMENT. Vacuum level is checked by attaching a vacuum gauge or manometer to the test points supplied. With a loop length of 14 in $\pm \frac{1}{2}$, the reading at the test point should be 16 in $\pm \frac{1}{2}$ of water. The adjustment is made by the flap over the bleeder port.

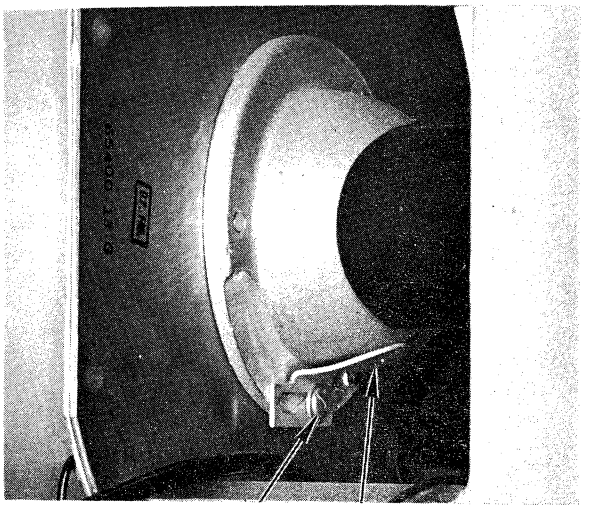


Fig. 4.8
Vacuum Level Adjustment

4.8 LEADER CLAMP ADJUSTMENT. With the leader clamp closed, rotate the switch to a point where it opens 1/16 to 1/8 in from complete closure of the clamp and tighten the hold-down nut.

4.9.1 LOWER PACKER ARM ADJUSTMENT. Ensure that there is equal clearance between the reel flanges and the packer shoe. Should the shoe require adjustment, slacken the screw clamping the arm to the shaft, move the arm axially on the shaft, taking care not to turn the arm on the shaft. Set the packer arm so that under high speed rewind conditions the packer arm switch operates at a pack thickness of 8 mm. $\pm$ 1. Tension for lower packer arm should be 71-85 grammes, with a full reel of tape (12.7 cm. radius from the centre of the hub).

4.9.2 UPPER PACKER ARM ADJUSTMENT. If an upper tape packer arm is fitted, the shoe and tension should be checked as the lower arm in 4.9.1. Tension should also be 71-85 grammes.

4.10 VACUUM SWITCH ADJUSTMENT. The operation of the vacuum switches which signal long-loop or short-loop conditions is checked as follows:

Step 1. Connect a voltmeter across the terminals of the lower loop warning switch (S707).

Step 2. Apply power to the tape unit. Place unit in the Standby mode. Make sure all interlocks are closed. The tape loops in the vacuum chamber should be at the normal 14 $\pm \frac{1}{2}$ inch length, and the vacuum switch should be closed.

Step 3. Observe the indication of the voltmeter. If a voltage is present, the switch contacts are open as they would be in the case of a long loop, short loop, or vacuum failure, and the switch must be adjusted. (see Step 9 and Figure 4.10).

Step 4. Press the lower REEL BRAKE pushbutton and elongate the tape loop until it passes over the long loop sensing port. The contact of the loop warning switch should then be open. If the closed contacts fail to open, adjustment is required. If no adjustment is required, proceed to Step 11.

Step 5. Turn off power to the tape unit and remove the screws which fasten the lower servo control assembly to the tape transport. Allow the assembly to hang by its cable.

CAUTION

Do not permit the servo control assembly leads to short on the tape transport.

Step 6. Disconnect the rubber tubing which connects the long loop sensing hold to the vacuum input port (port on side of switch with electrical connectors).

Step 7. Insert a tee fitting in the vacuum line to permit monitoring of the vacuum level with a vacuum gauge or manometer. Replace hose over the vacuum input port.

Step 8. Apply power to the transport. The transport should be in the Standby mode.

Step 9. Press the lower REEL BRAKE pushbutton and elongate the loop in the right vacuum chamber until the loop is partially across the long loop sensing hole and the monitor gauge indicates 7 inches of water vacuum. If the vacuum switch fails to open, remove the hose from the vacuum input and re-adjust the setscrew (accessible through the vacuum input port) by turning it 30 to 60 degrees counterclockwise.

NOTE

Counterclockwise rotation of the setscrew will result in an increase of differential pressure required to open the contacts.

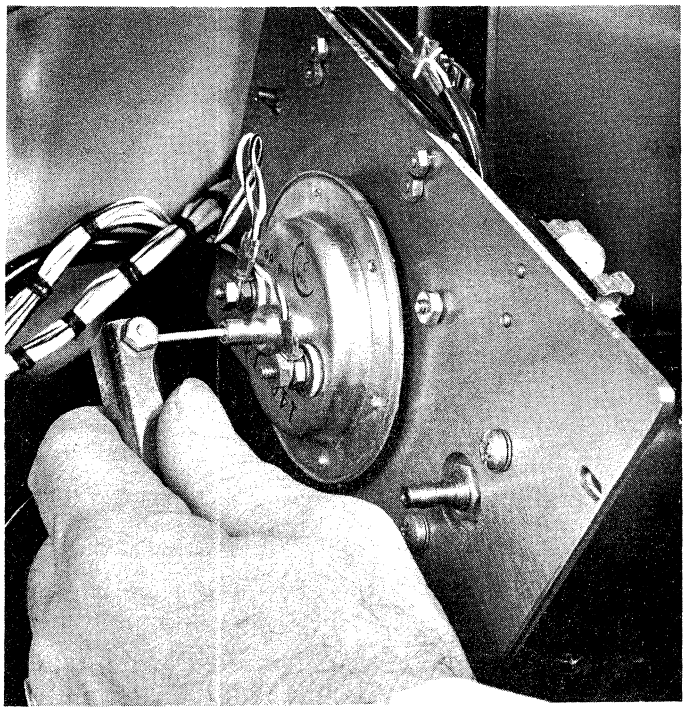


Fig. 4.9
Adjusting Loop Warning Switch

Continue adjusting the switch until the switch actuates as the loop crosses the long loop sensing hole and 7 inches of water vacuum is indicated on the monitor gauge. The switch should remain closed under normal loop conditions.

Step 10. Remount the lower servo control assembly.

Step 11. Repeat Steps 1 through 4 (and 5 through 10 if necessary) for the upper servo (left vacuum chamber).

4.11 ELECTRICAL ADJUSTMENTS.

4.12 REEL SERVO ADJUSTMENT. For optimum performance the following adjustment procedure should be used.

Step 1. Place the transport in the STANDBY mode with the tape stopped and all interlocks and time delays completed.

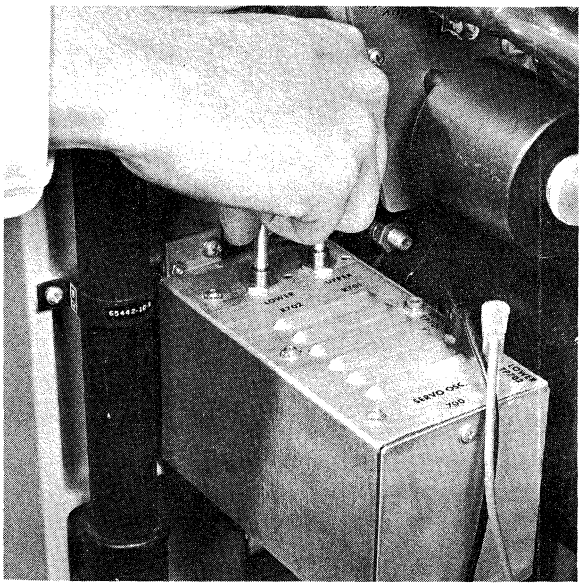
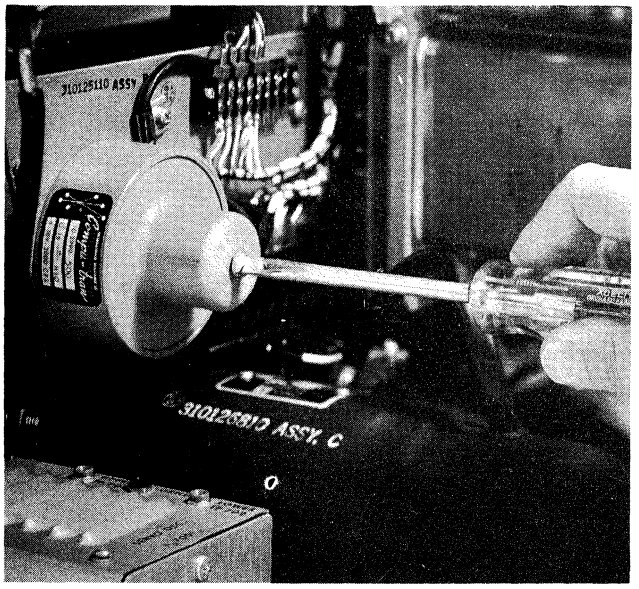
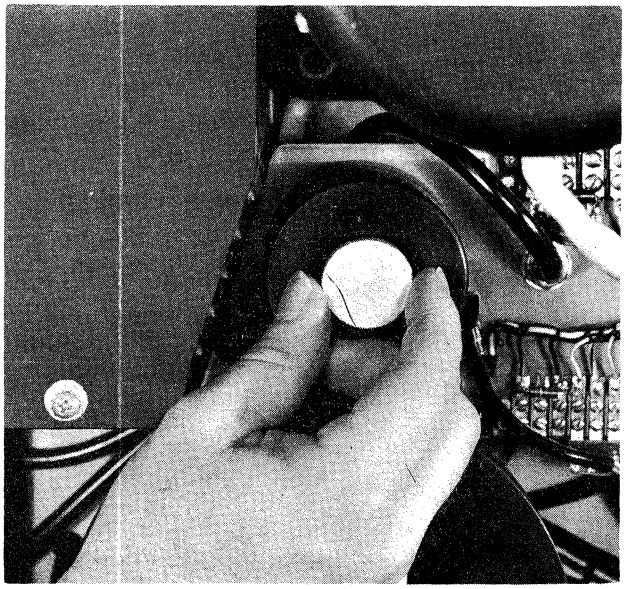


Fig. 4.10
Adjusting Servo Gain



Screw Adjustment



Knob Adjustment

Fig. 4.11
Adjusting Servo Transducer (2 types)

Step 2. Connect an ac voltmeter to TP702 and TP703 on the oscillator assembly at the rear of the transport (Figure 4.11) and adjust the LOWER servo gain control (also located on the oscillator assembly) to give a voltmeter reading of 4 v rms.

Step 3. Connect the voltmeter to TP701 and TP703 on the oscillator assembly and adjust the UPPER servo gain control to give a voltmeter reading of 4 v rms.

Step 4. Depress the reel brake pushbuttons and turn the tape storage reels to give a tape loop in each vacuum chamber 14 $\pm \frac{1}{2}$ inches long.

Step 5. Connect a dc voltmeter between pin 16 of the servo amplifier card and ground. (Pin 16 is negative with respect to ground).

Step 6. Adjust the UPPER servo transducer for a -10 $\pm$ 1 vdc meter reading. Adjustment is made with either a screw or a knob, depending on the type of transducer, as shown in Figure 4.12.

Step 7. Connect the dc voltmeter between pin 17 of the servo amplifier card and ground. Note the reading. (Pin 17 is negative with respect to ground).

Step 8. The voltmeter readings taken in Steps 6 and 7 should be within half a volt of each other. If the difference between the two readings is greater than half a volt, adjust the upper transducer for a balanced output at pins 16 and 17.

Step 9. Connect the voltmeter to pin 4 of the servo amplifier card and adjust the LOWER servo transducer to give a voltmeter reading of -10 $\pm$ 1 volts. Note the reading.

Step 10. Connect the voltmeter to pin 5 of the servo amplifier card and check that it is within half a volt of the reading taken at pin 4. If not, adjust the lower transducer for a balanced output at pins 4 and 5.

Step 11. Recheck balance across pins 16 and 17. Readjust upper transducer if necessary.

Step 12. Visually check the servo operation while the transport is operating with its normal programme. Minor adjustments of the gain controls and transducers should be made to give correct loop length and steady operation. This final adjustment will vary with each transport, depending upon the programme used and the mass of moving mechanical parts in the system. Reel weight, tape guide and adjustment, and the type of hold-down assembly, will all affect the servo operation to some extent.

4.13 CHECKING OPERATION PARAMETERS.

Note These checks should only be made when the following adjustments are known to be within specification: Vacuum level, Loop Length, Servo Setting, Oscillator Setting.

4.14 START TIME CHECKOUT.

4.15 The Start Time is defined as the time from the application of a Start Command until the instantaneous speed variations of the tape passing over the magnetic head has remained below 10% of nominal speed. The Start Time shall be 3.3 ms maximum.

4.16 The following equipment is used when checking the start time:

1) Test tape with an NRZ signal recorded at 333 bpi (master tape)

2) Read amplifier

3) Calibrated oscilloscope

4) FM discriminator

4.17 Check out the start time as follows:

Step 1. Connect equipment according to Figure 4.13.

Step 2. Thread master tape on transport.

Step 3. Adjust FM discriminator to produce zero volts output at fundamental frequency of tape read at steady state speed.

Step 4. Cycle transport to operate in Forward and Reverse Drive modes at a convenient rate. Instantaneous speed variation must fall to 10% or less within 3.3 msec from start command. A typical waveshape is shown in Figure 4.13.

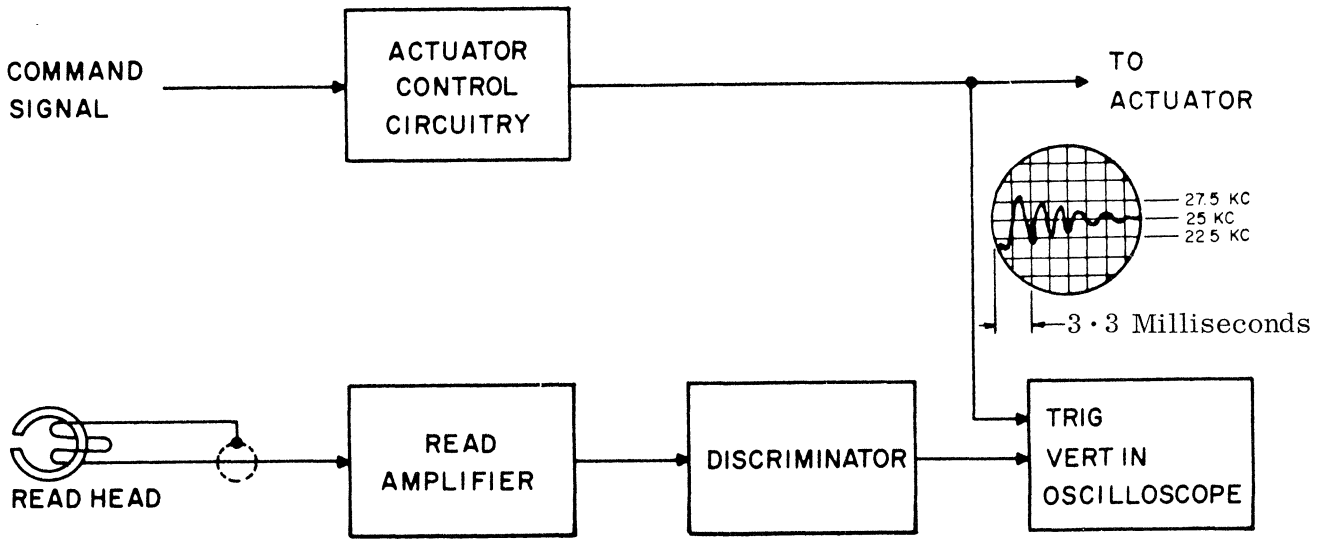


Fig. 4.12
Start Time Measurement, Test Setup

4.18 STOP TIME CHECKOUT

4.19 Stop Time is defined as the time from the application of a Stop Command until all tape motion over the head has ceased. The Stop Time shall be 1.5 ms maximum.

4.20 The following equipment is used when checking the stop time:

1) Test tape with an NRZ signal recorded at 333 bpi (master tape)
2) Read amplifier
3) Calibrated oscilloscope

4.21 Check out the stop time as follows:

Step 1. Connect test equipment as shown in Figure 4.14.

Step 2. Thread master tape on transport.

Step 3. Cycle transport at a convenient rate in Forward and Reverse drive modes.

Step 4. Observe decay time of signal displayed on oscilloscope. Decay time should be 1.5 ms or less. A typical waveshape is shown in Figure 4.14.

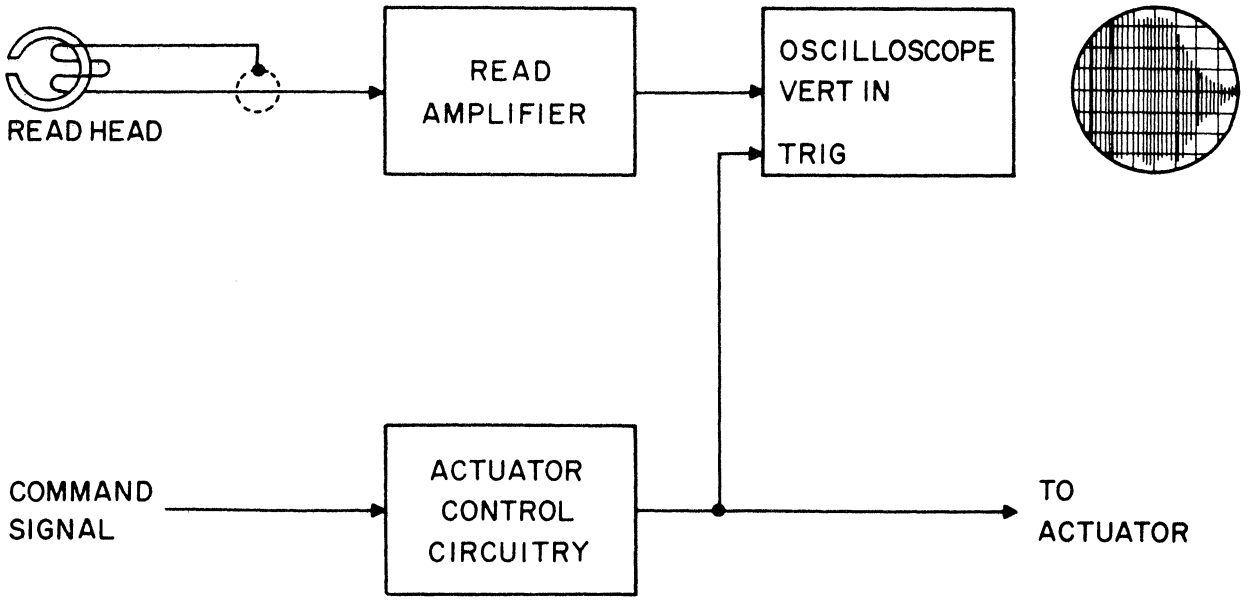


Fig. 4.13
Stop Time Measurement, Test Setup

4.22 START AND STOP DISTANCE CHECKOUT

4.23 The Start Distance is the distance that the tape moves over the magnetic head during the 3.3 ms after a Start Command. The Stop Distance is the distance that the tape moves over the magnetic head after a Stop Command.

4.24 The following equipment is used when checking the start and stop distances:

1) Test tape with an NRZ signal at 333 bpi (master tape)

2) Four waveform generators (Tektronix 162 or equivalent or a four stage programming device).

3) Read amplifier capable of developing 2.0 volts peak-to-peak output across a 600 ohm impedance, rise time 7 to 9 μSec.

4) Oscilloscope

5) Electronic counter (Hewlett Packard 523B or equivalent)

6) Pulse generator (Tektronix 161 or equivalent)

7) Power supplies as needed for the above equipment

8) Level converter

4.25 Check out the start and stop distance as follows:

Step 1. Connect test equipment as shown in Figure 4.15.

Step 2. Thread test tape on transport.

Step 3. Put all four operating MODE switches on waveform generators in triggered position.

Step 4. Put all four VERNIER controls on waveform generator in calibrated position.

Step 5. Select programme at waveform generator DURATION and MULTIPLIER controls. (example: fwd on 40 ms, fwd off 20 ms, rvs on 40 ms, rvs off 20 ms) This programme (40-20-40-20) states that the forward actuator is ON for 40 msec and OFF for 20 ms. The same is true for the reverse actuator.

Step 6. Set the GATE OUT/PULSE OUT switch to GATE OUT position.

Step 7. Start transport in automatic mode. Machine should now be programming at a 40-20-40-20 rate.

Step 8. Run equipment for a warm up period.

Step 9. Pulse generator controls are set as follows:

(a) Pulse TRIGGER SELECT in POSITIVE position.

(b) PULSE WIDTH to 1 ms.

(c) PULSE WIDTH MULTIPLIER to THREE.

(d) PULSE DELAY center scale.

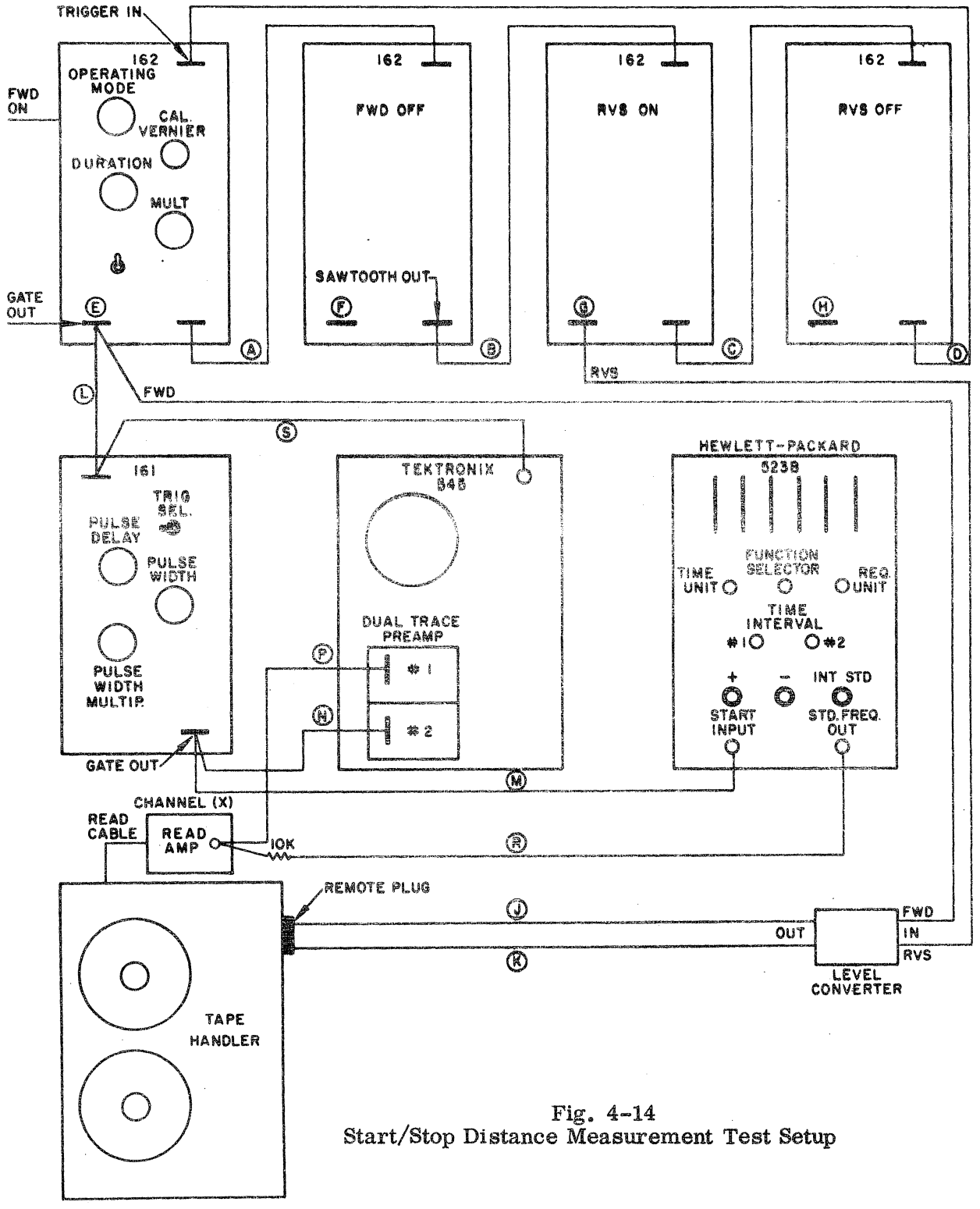


Fig. 4-14
Start/Stop Distance Measurement Test Setup

Step 10. Electronic counter 523B controls are set as follows:

(a) (a) FUNCTION SELECTOR TO TIME INTERVAL

(b) TIME UNIT to uSec (Check position)

(c) FREQUENCY UNIT to 1 second

(d) 100 KC STD to INT STD.

(e) GATE TO OPEN

(f) TIME INTERVAL No. 1 to Xl; rotate TRIGGER LEVEL until a count of near 3000 μs appears.

Step 11. Rotate PULSE WIDTH knob on 161 pulse generator until 3300 μs ± 5 (3.3 ms) appears on counter.

Step 12. Switch to pre-amp No. 2 on oscilloscope (probe N) using DC INPUT at 5 VOLTS/cm sensitivity and INTERNAL SYNC.

Step 13. Set TIME/cm to 100 ms , and put MULTIPLIER in the 2-5-1 position; then adjust for 3.3 ms gate to cover the full 10 cm oscilloscope face. Place waveform in lower half of oscilloscope face.

Step 14. Place TIME SELECTOR switch on the 523B counter to EXT. position (count position), and run tape handler in AUTOMATIC MODE.

Step 15. Place cable L in the following positions, and move cables (oscilloscope sync) with each movement.

(a) To measure forward start distance: attach cable L to E; multiply counter reading by .003-inch.

(b) To measure forward stop distance: attach cable L to F; multiply counter reading by .003-inch.

(c) To measure reverse start distance: attach cable L to G; multiply counter reading by .003-inch.

(d) To measure reverse stop distance: attach cable L to H; multiply counter reading by .003-inch.

(e) During test 1 through 4, the proper start and stop waveforms may be viewed by switching to pre-amp No. 1 (probe P), using DC INPUT at 0.2 VOLT/cm sensitivity and EXTERNAL SYNC.

NOTE

Photograph the waveforms and make an actual count of the pulses for an additional check.

4.26 LONG TERM AVERAGE SPEED VARIATION CHECKOUT

4.27 Long term average speed variation is variation from specified nominal speed, averaged over any interval of 100 ms occurring 3.3 ms or more after a run command. Maximum variation should be 2%.

4.28 The following test equipment is used to measure long term speed variation:

1) Test tape with an NRZ signal at 333 bpi (master tape)

2) Read amplifier

3) Counter

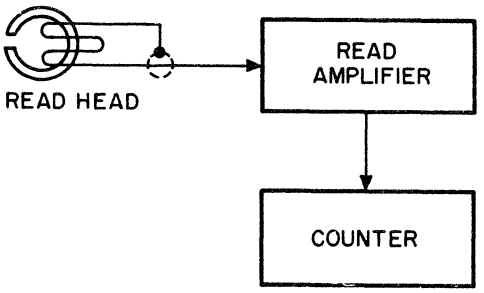


Fig. 4.15
Long Term Speed Variation Test Setup

4.29 Checkout long term speed variation as follows:

Step 1. Connect equipment as shown in Fig. 5.4 (set counter for a repetitive 100 ms count time) and thread test tape on transport.

Step 2. Run at least a half reel of tape through transport while observing count. Reading should not deviate more than $\pm$ 2% from nominal rate.

4.30 INTERCHANNEL TIME DISPLACEMENT ERROR CHECKOUT. The following procedure permits measurement of interchannel time displacement error of any data track from any other data track or reference track. The procedure does not permit separation of errors introduced by write and read electronics.

4.31 The following equipment is required to measure ITDE:

1) Test tape with an NRZ signal recorded at (333 bpi)

2) Dual trace oscilloscope

3) Read amplifiers (customer supplied)

4.32 Check out the interchannel time displacement error as follows:

Step 1. Connect the test equipment as shown in Figure 4.16

Step 2. Program tape transport to operate in Forward Drive mode. A presentation such as is shown in Figure 4.18 should appear on oscilloscope.

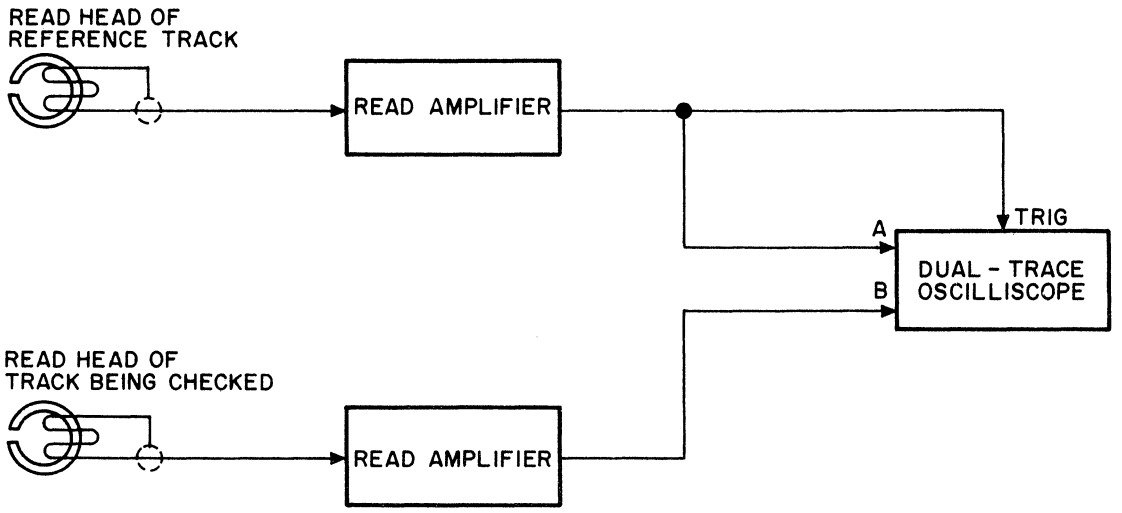


Fig. 4.16
Interchannel Time Displacement Error Test Setup

Step 3. Switch non-reference input of oscilloscope to other tracks in turn to measure ITDE of each track with respect to reference track.

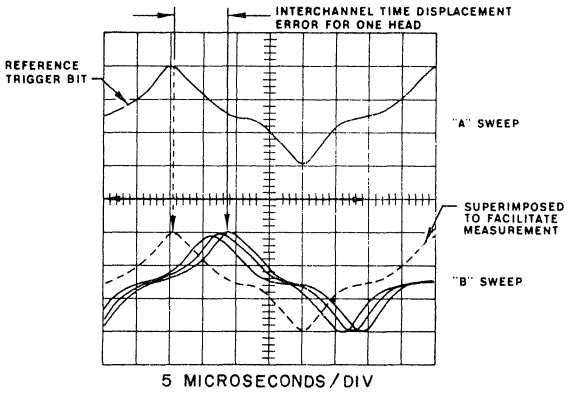


Fig. 4.17
Interchannel Time Displacement Error Waveshape

SECTION V
MECHANICAL DESCRIPTION

5-1. GENERAL.

5-2. The tape transport consists of the transport assembly, electronics assembly, access door, voltage regulator, head assembly, and head cable and box assembly. A control panel and photosense system may also be included. Schematic arrangements of tape transports showing the relationship of all connectors, terminal boards, and fanning strips used for interconnection are shown in Figure 5-1.

5-3. TAPE TRANSPORT.

5-4. The transport assembly (Figure 5-2, 5-3) consists of a tape supply and take-up system, a tape drive system, a vacuum system, a blower system, and an oscillator for excitation of the transducers. The operation of each of these systems is controlled by circuits in the electronics assembly. In this description the upper reel is referred to as the supply reel and the lower reel as the take-up reel.

5-5. The tape supply system consists of a supply reel drive assembly, a vacuum chamber, a transducer which provides signals for servo control of the reel drive, and a loop warning switch which will interrupt operation if the tape loop in the vacuum chamber becomes too large or too small.

5-6. The supply reel drive assembly is composed of a servo motor, a turntable, a reel retainer assembly, and a brake assembly. The servo motor shaft extends to the front of the tape transport where the reel turntable and retainer assembly are attached to the shaft.

5-7. The Ampex (NARTB) reel retainer assembly is a continuous contact rubber "doughnut" type, cam actuated, which provides a positive indication of a locked or unlocked condition. Turning the reel retainer handle 120° clockwise locks the reel in position; depressing the serrated end of the reel retainer handle unlocks the retainer, collapsing the retainer tire, and permitting the removal of the reel.

5-8. The IBM compatible reel retainer is a compression actuated, continuous contact rubber "doughnut" type. Turning the retainer knob clockwise compresses the retainer tire axially, causing radial expansion to lock the reel in position. Turning the knob counterclockwise allows the tire to restore, permitting removal of the reel.

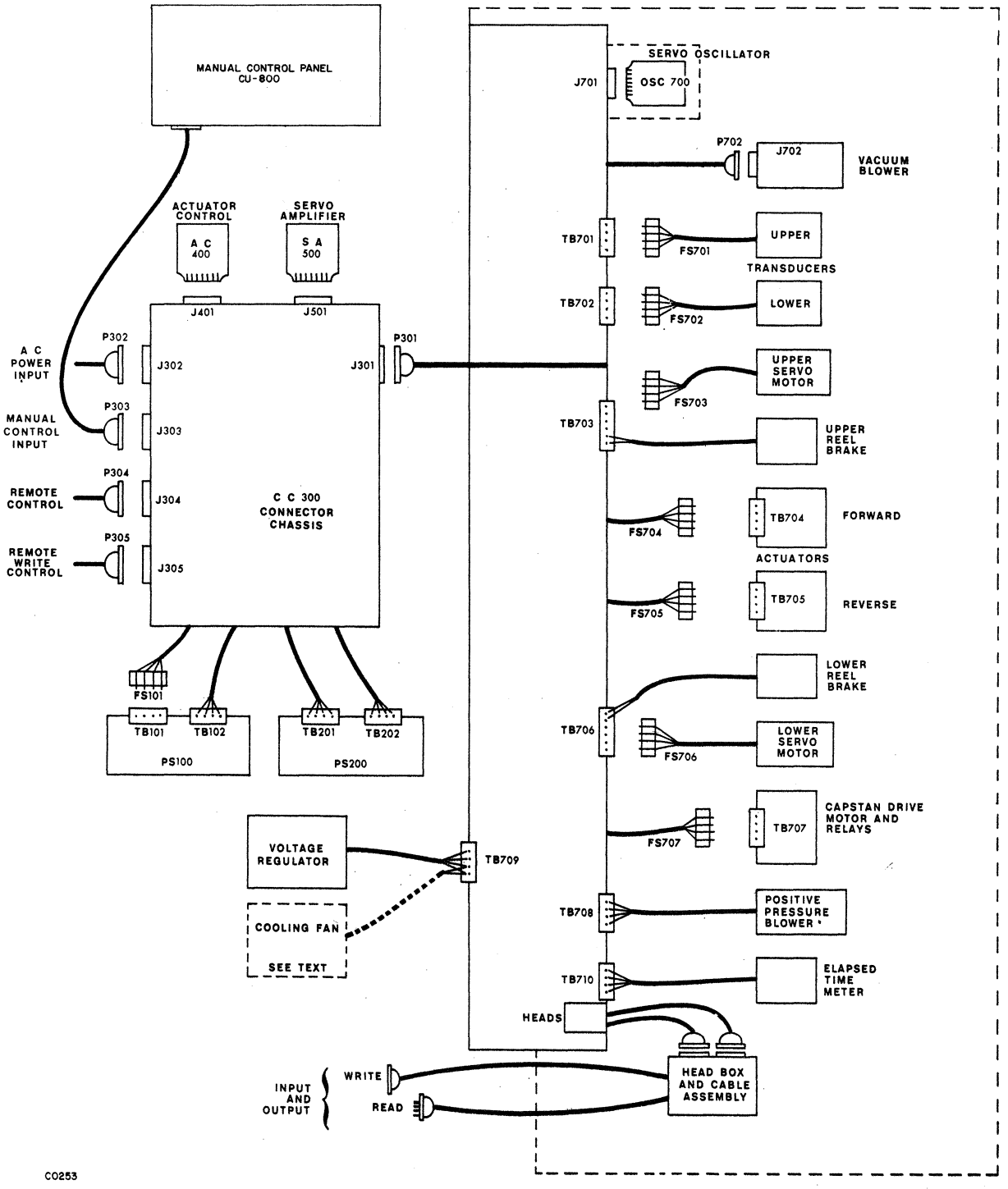


Figure 5-1. Interconnection of Units

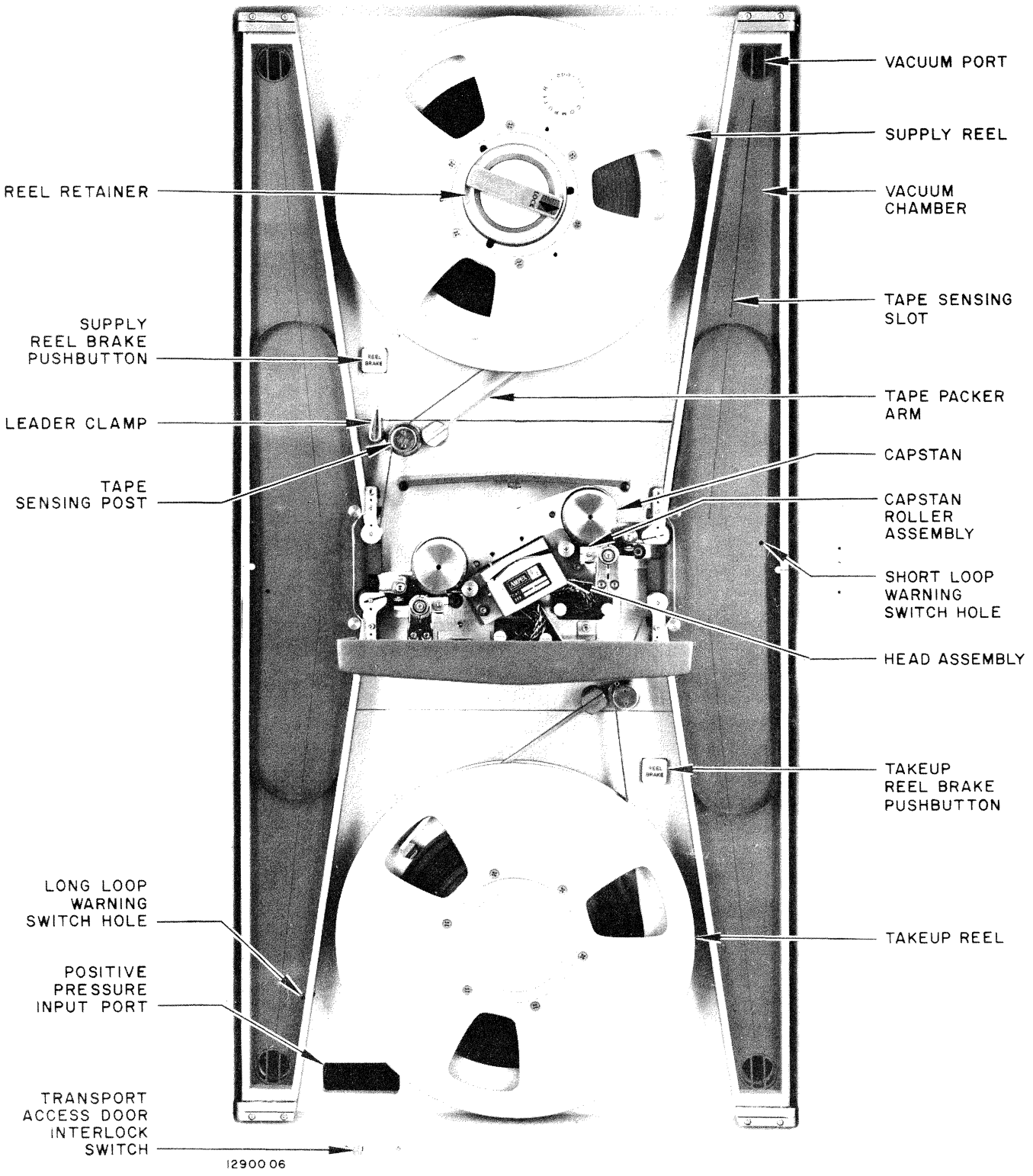


Figure 5-2. Tape Transport, Front View

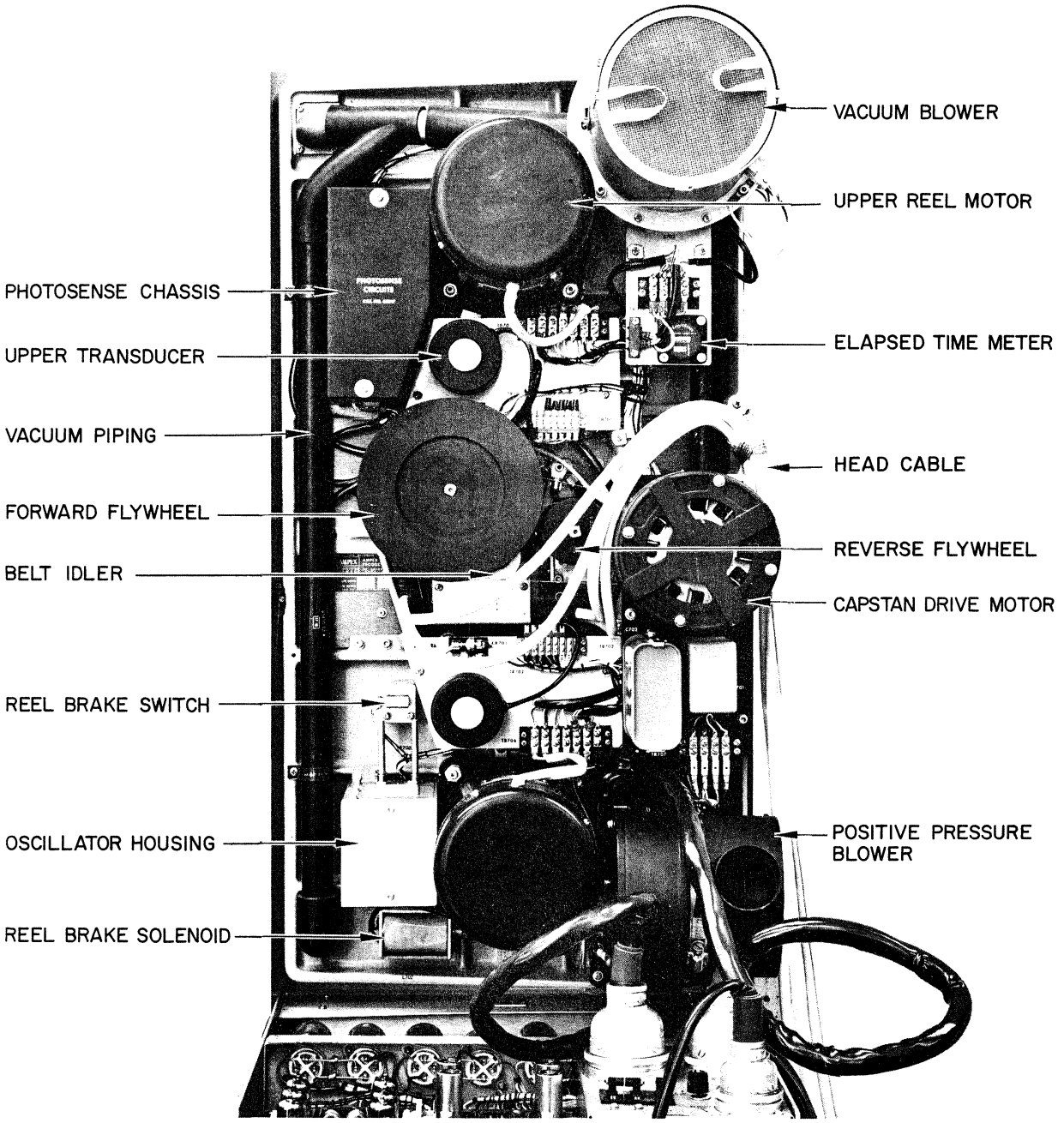


Figure 5-3. Tape Transport, Rear View

5-9. The brake assembly is mounted at the front of the servo motor and consists of a brake drum (mounted on the motor shaft), a brake shoe, a solenoid, and a loading spring. The brake is released when the solenoid is energized, as in normal operating conditions, and applied when the solenoid is de-energized (equipment in STANDBY, door interlock open, leader clamp interlock open, or vacuum lost for any reason). Brake application when the solenoid is de-energized is accomplished by a spring-loaded mechanism. The REEL BRAKE pushbutton allows the mechanical brakes to be released under non-operating conditions.

5-10. All other components of the tape supply system operate in conjunction with the vacuum system. The functioning of the entire servo control system is dictated by the vacuum chamber, a precision subassembly which forms and contains the tape loop, and isolates the reel from the tape drive system. A hinged glass cover encloses the vacuum chamber and forms a vacuum seal. Both ends of the chamber are vented to the vacuum blower assembly; tape acts as a barrier to separate the vacuum (created by the blower) from atmospheric pressure. Tape sensing slots are located in the upper and lower halves of the chamber base plate. These slots have a common junction within the base plate, and are connected through rubber tubing to the transducer.

5-11. The transducer is a diaphragm-operated differential transformer with the diaphragm pneumatically connected to the sensing slots. The core of the transformer is attached to the diaphragm and moves as the diaphragm moves. Any movement of the core from its null position produces an error signal, which is routed to the servo control electronic circuit. This circuit, in turn, causes the reel drive motor to increase or decrease the supply of tape in the chamber to eliminate the error signal.

5-12. The loop warning switch also operates on the diaphragm principle, being closed whenever a difference in air pressure exists (vacuum to atmospheric pressure), but opening when no difference exists (either vacuum-to-vacuum or atmosphere-to-atmosphere). Two holes are provided in the vacuum chamber, one opposite the opening where the tape enters and leaves the chamber, one near the end of the chamber (lower end for supply, upper end for take-up). The inside of the diaphragm is connected to the hole opposite the tape entrance opening; the outside is connected to the hole at the end of the chamber.

5-13. The tape supply system also includes the write lockout switch which may be used to prevent accidental writing over recorded information. This switch is actuated by a write lockout ring, attached to

the hub of the file reel. Normally open contacts are provided and are typically used to permit writing when closed (by completing power circuitry to write amplifiers, etc.).

5-14. The tape drive system consists of a precision plate, on which are mounted the two capstans and their associated actuators, the head assembly, the leader clamp, two tape sensing posts, and two tape packer arms. Also attached to the precision plate, but not considered part of the tape drive system, are the two vacuum chambers. The purpose of the tape drive system is to remove tape from one reservoir (typically the tape supply system), move it at a nominally constant drive speed across the magnetic heads which record or reproduce information, and deposit it in another reservoir (typically the take-up system). The tape drive system also controls the FAST REVERSE and FAST FORWARD modes of tape travel.

5-15. Two counter-rotating capstans provide bi-directional tape drive. The capstans are coupled through a belt and pulleys to the synchronous capstan drive motor. This is a dual-speed motor (1800 rpm or 3600 rpm at 60 cycles, 1500 rpm or 3000 rpm at 50 cycles) for both the normal and the fast drive speeds. The motor and both capstans operate continuously whenever power is applied to the equipment. Relay contacts select the applicable motor winding for the tape drive selected: The low-speed winding for normal operation, or the high-speed winding for the fast drives. Each capstan continuously drives its associated roller through a rubber quad-ring (at the base of the capstan); thus the rollers also are continuously rotating when power is applied.

5-16. While the speed of tape travel is determined by the capstans, the movement of the tape is controlled by the actuators which position the rollers. Two actuators are provided, one for each capstan. These assemblies are mounted on the back of the precision plate, with the actuator shaft extending through the plate to the front of the tape transport. On this shaft is mounted a rocker arm, with the roller mounted at one end, and a tape inertia brake at the other end. There are two stable positions possible for the actuator: ON, when the roller clamps the tape against the capstan to drive the tape, and OFF, when the roller is withdrawn from the capstan. At the moment of withdrawal, the brake overshoots momentarily, locking the tape between a rubber block and a metal post, quickly overcoming the small inertia of the moving tape.

5-17. A special d-c actuator drives the capstan roller assembly. The actuator is controlled by a driver circuit, in the transport electronics assembly, which in turn derives its signals from the command source.

The direction of tape motion is determined by which actuator is ON, since the two capstans rotate in opposite directions.

5-18. A typical head assembly (Figure 5-4) is composed of two tape guides, a write head stack, a read head stack, a hinged shield, base plate, and head cover. Accuracy of tape guiding across the heads is ensured by the precise machining of the base and tape guides, which are mounted at either side of the head stacks. The guide edges are accurately positioned to ensure interchangeability of tapes from machine to machine. The exact head assembly used on individual machines is shown in Section IX.

5-19. The leader clamp provides a convenient means of holding the permanent tape leader while attaching the leader to the magnetic tape. If the clamp inadvertently is left closed against the upper sensing post, the leader clamp interlock will remain open and prevent tape motion.

5-20. The two tape sensing posts, located at the top and bottom of the precision plate, provide tape sensing facilities to signal end of file, beginning of file, etc. These posts, in the tape threading path between each reel and vacuum chamber, consist of three insulated sections. The innermost section is connected to chassis ground; if contact is made between that section and the center section (by the use of metal-backed tape) a remote warning circuit may be actuated. When an end-of-tape relay is used contact across all three sections will energize the relay and stop the tape.

5-21. The tape take-up system is identical to the tape supply system previously described, except that no write lockout switch is provided on the lower reel assembly.

5-22. The vacuum for the vacuum chambers is derived from the vacuum blower assembly. The blower proper is a two-stage centrifugal fan, driven by a universal-wound a-c motor, shock-mounted into the main vacuum blower assembly. The motor is supplied with regulated power from the externally mounted voltage regulator. A bleeder port

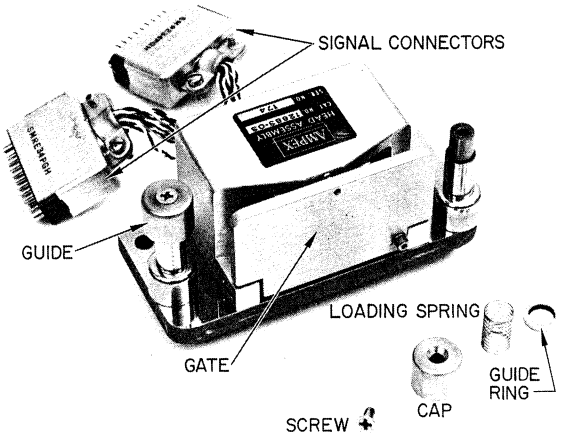


Figure 5-4. Head Assembly

is partially covered by a sliding flap, permitting adjustment of vacuum pressure; this port is on the transport side of the manifold. The vacuum manifold is formed from plastic butyrate tubing and couplings. The manifold is bonded and sealed. The air expelled from the vacuum blower is filtered to prevent dispersal of dust, etc., in the cabinet rack.

5-23. The positive pressure blower assembly is mounted at the lower right-hand side of the main tape transport frame (as viewed from the rear). Air pressure introduced by this assembly ensures that air is always leaking from the tape handling enclosure when the access door is closed. This slight pressurization of the tape handling enclosure keeps out external dust and foreign material. Intake air at the blower is filtered to ensure that it is clean and dust-free.

5-24. The servo oscillator is not part of the transport proper, being more closely associated with the transport electronics assembly. It is, however, physically located on the lower left side of the transport, as viewed from the rear.

5-25. The servo oscillator is constructed on an etched circuit board, with contacts provided at one end to form a connector. The mating connector, J701, is part of the transport wiring, as are the gain adjustment potentiometers R701 and R702. These components are mounted to the transport, shielded by a metal housing. A pair of slides on the inner walls of the housing accept the etched board and align it with J701.

5-26. A removable cover plate is provided, secured with snap-action fasteners, to permit insertion or withdrawal of the etched board. The shafts of potentiometers R701 and R702 protrude through holes provided in the housing to facilitate adjustment.

5-27. TRANSPORT ELECTRONICS ASSEMBLY. (Figure 5-5)

5-28. The transport electronics assembly consists of the electronics and servo motor power supplies (PS-100 and PS-200), the connector chassis (CC-300), the actuator control (AC-400), and the servo amplifier (SA-500).

5-29. Etched board construction and terminal board wiring are used. The two main chassis, the Electronics Power Supply (PS-100) and the Servo Motor Power Supply (PS-200) are attached to mounting brackets. The various sub-assemblies, all readily removable, are mounted on top of the Electronics Power Supply (PS-100) chassis.

5-30. The electronics power supply sub-assembly furnishes the necessary d-c and a-c voltages for operation of the servo amplifier and the actuator control unit. It also serves as the support chassis for these two units, and for the connector chassis.

5-31. The connector chassis is mounted at one end of the main chassis; the balance of the top surface is covered by a panel, hinged to provide ready access to the internal wiring. Mounted on this hinged panel are slides which accept the etched boards of the servo amplifier and actuator control unit, brackets for mating connectors for these units, and lever-operated release mechanisms to facilitate withdrawal of the boards.

5-32. When the tape transport is turned on, 117 vac is supplied to the primaries of power transformers T102, located beneath the connector chassis, and T101, located beneath the hinged panel at the opposite end of the PS-100 electronics power supply. An additional tap on the primary of T102 furnishes 135 vac to the capstan drive motor. The various secondaries of T102 furnish 6.3 vac for the filaments of the thyratrons in the actuator control unit and the tubes in the transducer oscillator. A 52 vac center-tapped winding feeds rectifiers, in the manual control panel, which supply the -24 vdc voltages to the control circuitry. Fuses for this circuit are located beneath the hinged cover. The high-voltage winding furnishes 450 vac to a

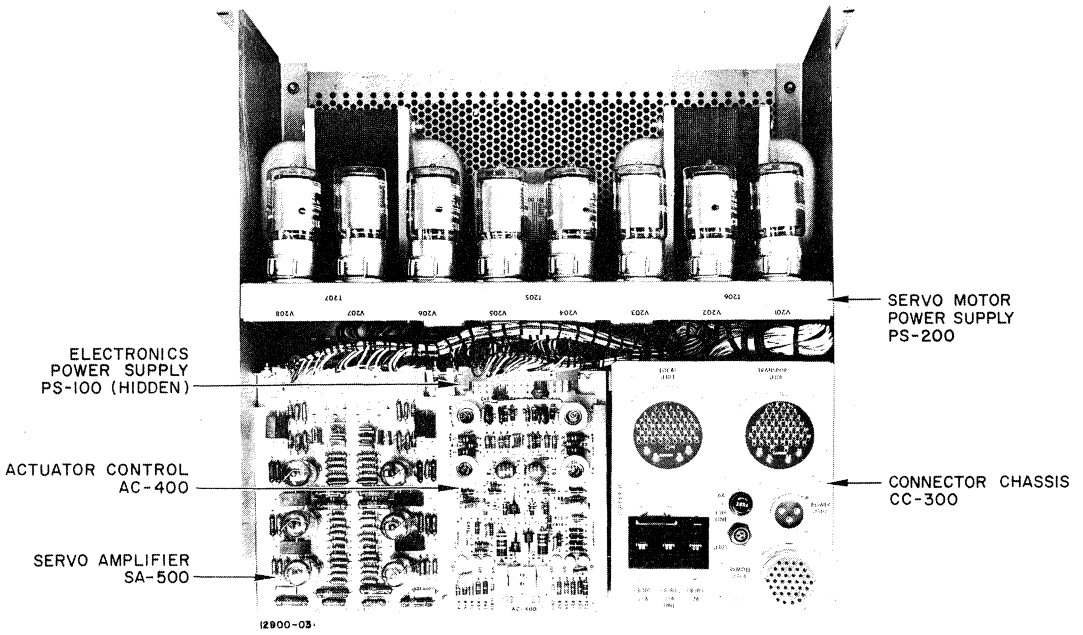


Figure 5-5. Transport Electronics Assembly

bridge rectifier, from which dc is connected to the coil and contacts of an overload relay (K101). This relay is set to operate on an overload of approximately 400 ma, and breaks the overload through its own contacts, causing the relay to drop out and re-cycle rapidly. (The output of the rectifier also furnishes, through a dropping resistor, +14 vdc to the actuator control circuitry.) From the overload relay, the high voltage is supplied to a thyratron (V104) and associated components located beneath the connector chassis which are used a "recharge electronics switch" for charging the actuator capacitors. The filament of the thyratron is supplied 2.5 vac from transformer T102.

5-33. Ground lug 101 is mounted on the PS-100 electronics power supply to provide a common grounding point for all circuits in the tape transport. A cable, part of the CC-300 connector chassis, brings ground leads for all circuits from the connector chassis to ground lug 101. Fanning strip FS101, also part of the CC-300 wiring, connects with terminal board TB101 on the electronics power supply. Separate individual leads are also provided for connection to TB102. Additional portions of the CC-300 Connector chassis wiring are brought out of the CC-300 to provide connectors J401 and J501 (mating connectors for the AC-400 and SA-500 etched boards), which are physically supported on the PS-100 chassis. Another branch of the cabling provides leads for connection to TB201 and TB202 on the servo motor power supply.

5-34. The PS-200 servo motor power supply is a thyratron power supply, used to furnish power to the windings of the servo motors as dictated by the servo amplifier and the transducers. The eight thyratrons, V201 through V208, are mounted in a line along one side of the chassis. In a row paralleling the thyratrons are transformers T205, T206, and T207. Transformer T205, mounted in the center, provides filament voltage for all of the thyratrons. Plate transformers T206 and T207 are supplied with 117 vac, delayed 45 seconds to permit filament warm-up. Below the chassis are terminal boards TB201 and TB202 and an etched circuit board assembly which contains grid biasing transformers T1 through T4 and their associated components.

5-35. The CC-300 connector chassis mounts on the electronics power supply and forms a central point for interconnection of the various units and for inputs and outputs to the power and control circuits.

5-36. On the connector chassis are located circuit breakers CB301, CB302, and CB303. Breakers CB301 and CB302 protect the power input, while CB303 protects the positive pressure and vacuum blowers, the cooling fan, and the PS-100 power transformer T101. Fuse F301 protects the PS-100 power transformer T102 and the drive motor supply

power. The top panel also mounts five connectors. J301 mates with P301, part of the transport wiring. J302 is the power input connector; J303 is the local control connector. When a manual control panel is used, P303, part of its wiring, will mate with J303. When no manual control panel is used, equivalent circuitry must be connected through J303. Receptacle J304, the REMOTE connector, provides a means of connection to external circuitry for automatic or remote controlled operation; receptacle J305 is used for connection of remote circuitry associated with the write control function.

5-37. The AC-400 actuator control is constructed entirely on an etched circuit board. This board is supported within slides mounted on the PS-100 electronics power supply, and mates with connector J401.

5-38. The SA-500 servo amplifier, like the AC-400 actuator control, is constructed entirely on an etched circuit board. It is supported by slides mounted on the PS-100 electronics power supply and mates with connector J501.

5-39. MANUAL CONTROL PANEL, CU-800.

5-40. The CU-800 manual control panel (Figure 5-6) is optional. The unit may be used to provide local primary control over the tape transport. It is intended to be rack mounted below the transport proper; its control surface is tilted for ease of operation. When the transport electronics assembly is mounted horizontally, the manual control panel may be mounted directly in front of it. The following controls and indicators are mounted on the control surface:

SWITCH	FUNCTION
POWER	Controls power to the equipment.
MODE SELECTOR	Selects automatic, standby, or manual modes.
MANUAL CONTROL	Selects tape direction and speed in manual mode.
MANUAL WRITE/ LEADER DRIVE	Selects circuitry to enable writing function or allows the operator to defeat the end-of-tape interlock.
INDICATOR	
POWER	Indicates when power is applied to equipment.
READY	Indicates when interlocks, time delays, etc., are complete and transport is ready for use.

5-41. PHOTOSENSE UNIT.

5-42. The optional photosense unit is composed of an electronic chassis which mounts on the rear of the transport frame and a photosense head which mounts on the supply reel vacuum chamber above the tape guide.

5-43. The electronics chassis, which contains all of the circuitry for photosensing, uses a combination of terminal board construction and etched boards. Terminal board TB2, located at one end of the chassis, provides connections for the signal inputs from the head and the d-c lamp power to the head. At the other end of the chassis are terminal boards TB3 and TB4 which provide connections for the outputs of the unit.

5-44. Five connectors, J1 through J5, accept the various etched boards: J1 and J2 the composite amplifier boards; J3 the 12 volt power supply board; J4 the 10 volt power supply board; and J5 the 6 volt power supply board.

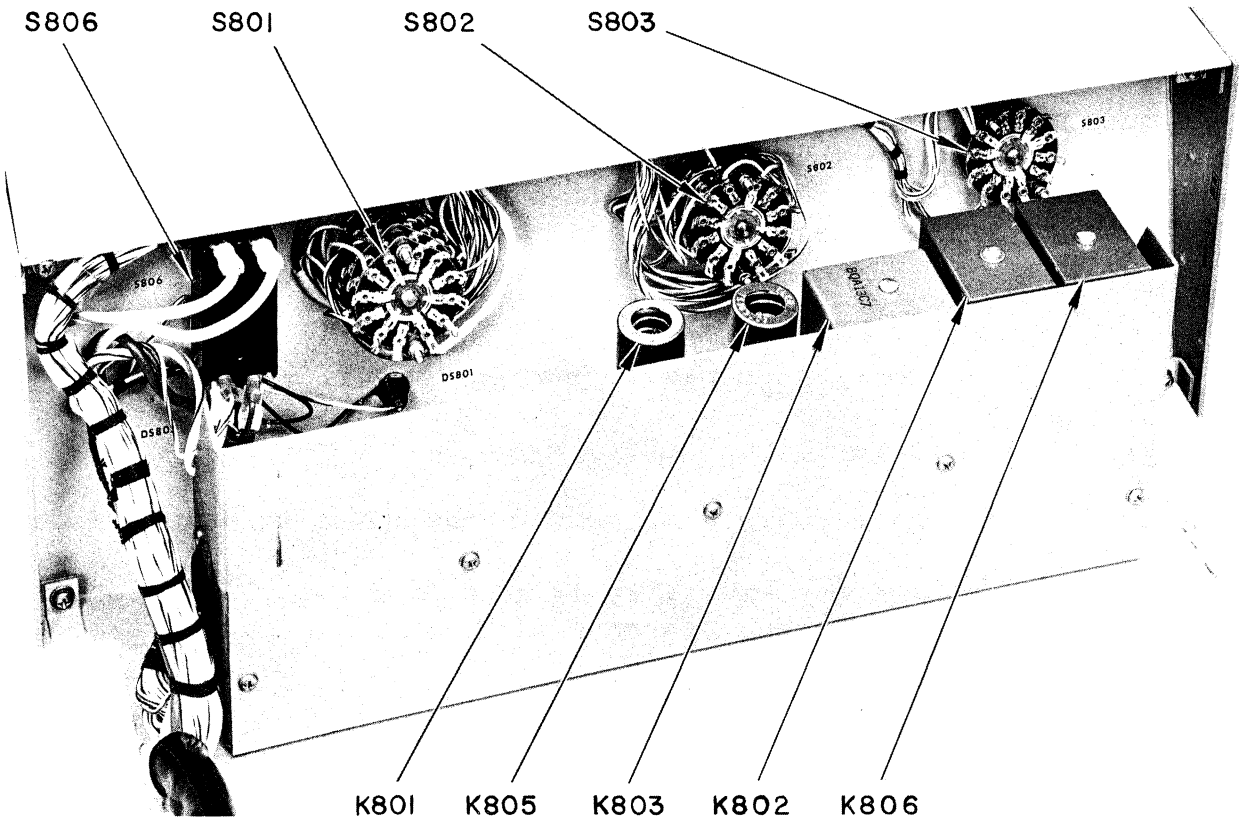


Figure 5-6. Manual Control Panel

5-45. Transformer T1 in the chassis provides 32 vac and 16 vac to the power supplies. Beside the transformer is a bracket mounting diodes CR1, CR2, and CR3, terminal board TB1, and when used, the output relays.

5-46. A cover is provided for the entire electronics unit with cutouts for access to terminal boards TB1, TB2, and TB3.

5-47. The photosense head consists of a light source and the necessary photo-electric elements to sense light from the source when reflected by markers on the tape.

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SECTION VI
ELECTRICAL OPERATION

6-1. BASIS OF DISCUSSION.

6-2. The principles of operation of the tape transport are readily divided into two main categories: control of tape motion and control of the servo mechanisms which control the length of loop in the tape storage chambers.

6-3. The explanation of circuit operation will be more clearly understood by referring to the circuit diagrams appearing in Section VIII of this instruction book.

6-4. ACTUATOR CONTROL.

6-5. The first principle to be understood with respect to the actuator is that the speed of tape motion is determined solely by the capstans. The capstan speed, in turn, is controlled by the synchronous drive motor which receives its motive force from the a-c line. The direction of tape motion is controlled by the capstan rollers, each of which engages the tape with one of the two counter-rotating capstans.

6-6. Two identical actuators for control of tape movement in the forward and reverse directions are mounted on the rear of the precision plate of the tape transport. Shafts extend to the front of the precision plate, with yokes clamped to these shafts to support the rollers and inertia brakes.

6-7. Each actuator is similar in design to a polarized relay. Two permanent magnets are used to establish the two stable conditions--ON, when the roller clamps the tape against the rotating capstan, and OFF, when the roller is pulled away from the tape and the capstan.

6-8. The actuator shaft, mounted between the two permanent magnets, has a flat reed brazed to it which serves as an armature. Flux linkage between the two magnets through this reed tends to hold it in its last set position until the opposite coil, form-wound to fit around the reed structure, is pulsed with a short burst of current to form an electromagnet. The two coils create opposing magnetic fields. Thus, one of them is always available to reverse the flux in the reed and cause the reed to flip to the other stable position. The total rotation of the reed as measured at the pole faces is only a few thousandths of an inch. The time required to shift from one position to the other is on the order of 800 microseconds.

6-9. The forward and reverse actuator circuits are identical; only the forward actuator circuit is described.

6-10. A simplified diagram of the forward actuator circuit is shown in Figure 6-1 where the common connection of the actuator ON and OFF coils is connected to a positive voltage source (C106). The other connection of each coil is taken to the anode of a thyratron, the cathode of the thyratron being returned to ground. A negative voltage source (C405) connected via the center tap of the secondary of grid input transformer T408 to the thyratron grids holds the thyratrons off.

6-11. An actuator coil is energized by firing the thyratron connected to it. Both manual and automatic inputs are used to fire the thyratrons. When the manual Forward start terminal (P303, pin 40) is grounded, capacitor C409 charges, dropping the bias voltage to V404 grid across R415, and allows V404 to fire. C106 now discharges through the actuator ON coil and V404 to switch the actuator to the ON condition. Similarly, grounding the manual Stop terminal fires thyratron V403 to switch the actuator to the OFF condition.

6-12. The automatic Forward input terminal (P303, pin 34) is connected via C408 and R413 to the primary of transformer T408. A positive-going change of voltage applied to this terminal charges C408, allows a short burst of current to flow in the transformer primary which in turn induces a voltage in the secondary to overcome the bias voltage on the

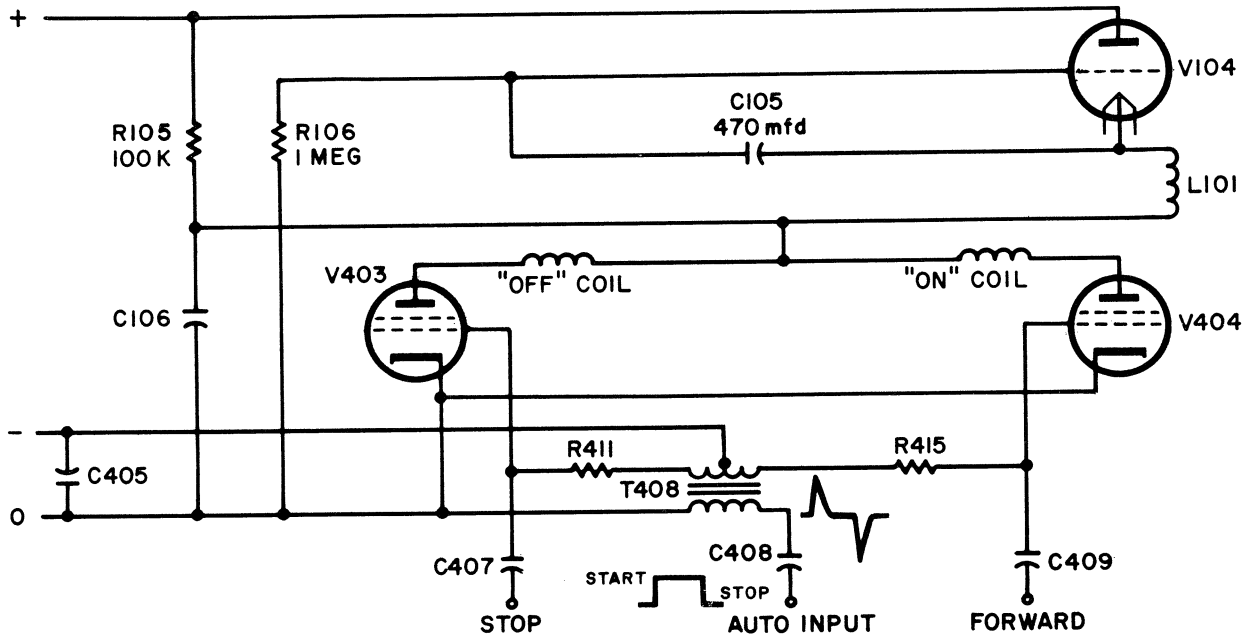


Figure 6-1. Forward Actuator Circuit (Simplified)

grid of V404 and allows it to fire. C106 now discharges through the actuator ON coil and switches the actuator to the ON condition. A negative-going voltage change at the automatic input terminal induces a voltage in the opposite direction in T408, allows V403 to fire and switches the actuator off.

6-13. A thyratron cannot be turned off by a voltage applied to its grid; the anode-cathode voltage must be removed or reversed before the grid can regain control. This is accomplished by the discharge of C106. When an actuator thyratron is fired, current flows from C106 (and continues to flow after the grid bias voltage has been restored) through the actuator coil and thyratron until C106 is discharged. The actuator coil now becomes a voltage source, due to the decaying magnetic field in the coil, and applies a reverse voltage to the anode which cuts off the thyratron and allows the grid to regain control.

6-14. The charging current to C106 is taken from a bridge rectifier power supply. When the system is first switched on, C106 charges slowly via R105. By the time the filament of V104 reaches operating temperature, C106 is fully charged, no voltage difference exists between the anode and cathode of V104 and it remains cut off. When C106 is completely discharged by an actuator operation V104 bypasses R105 to provide a fast charging circuit, ensuring a fully charged C106 when it is needed. When C106 discharges, the grid voltage of V104 is reduced beyond the point where firing becomes possible. V104, however, does not fire immediately but is delayed to allow C106 to discharge fully and allow the actuator thyratron to be cut off as described in 6-13 above. This delay is performed by a resistor and capacitor in the grid circuit (R106 and C105). As long as C106 is discharging, C105 will also be discharging through R106 and, due to the voltage drop across R106, will bias the grid negative with respect to the cathode and prevent firing. When a steady state is reached, the negative charge on V104 grid leaks away through R106 and V104 fires, charging C106 through a choke (L101). After C106 is charged to the supply voltage, a voltage induced by the decaying field around L101 drives the cathode of V104 positive with respect to its anode and grid and allows it to cut off. The circuit is now ready for the next actuator operation.

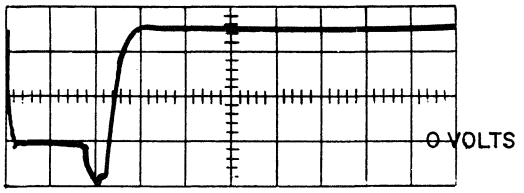
6-15. The identical reverse actuator circuit is driven from the same power supply as the forward actuator circuit (figure 8-3). Because the V104 capacitor charging circuit is common to both forward and reverse actuator circuits, isolation must be provided to prevent C106 discharging when the reverse actuator is operated and C107 discharging when the forward actuator is operated. Diodes CR107-110 provide this isolation. In the event that both C106 and C107 are discharged together (this can occur when a safety interlock switches both actuators

OFF) V104 will continue to supply charging current until both capacitors are charged before cutting off.

6-16. Figure 6-2a shows the voltage waveform seen at the anode of an actuator thyratron (V401, V402, V403, or V404) during operation. At the start of the trace the thyratron is fired by the removal of the negative bias from its grid; the anode voltage drops from 600 to approximately 10 volts, the voltage drop across the thyratron and its cathode resistor during conduction. At approximately 800 microseconds after firing C106 is completely discharged and the anode voltage begins to go negative, cutting off the thyratron. The voltage then rises rapidly as V104 fires and charges C106 (or C107).

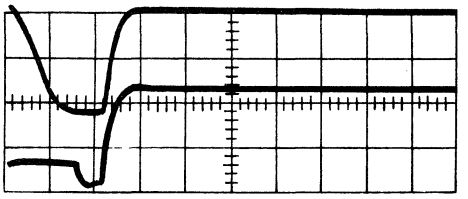
6-17. The thyratron anode voltage waveform is seen again in the lower trace of Figure 6-2b. Shown for comparison in the upper trace is the voltage across C106 or C107. The discharge and charge current in C106 or C107 is shown in Figure 6-3. This current waveform is displayed by connecting the oscilloscope across a 0.1 ohm resistor inserted in series with the capacitor. (The slight discontinuity at 200-250 microseconds is caused by the change in the actuator coil inductance as the armature moves to its new position.)

6-18. When taking measurements during actuator operation shunt loading of the actuator coils should be avoided. Excessive loading will damp the coil and reduce the negative voltage available to cut off the thyratron.



VERTICAL : 200 VOLTS / DIVISION
HORIZONTAL : 500 USEC / DIVISION

Figure 6-2a.
Waveshape, Anode of V404



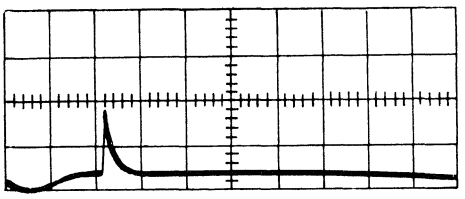
UPPER TRACE : VOLTAGE, C107
VERTICAL : 300 VOLTS / DIVISION
HORIZONTAL : 500 USEC / DIVISION
LOWER TRACE: ANODE, V404
VERTICAL : 300 VOLTS / DIVISION
HORIZONTAL : 500 USEC / DIVISION

Figure 6-2b.
Waveshapes, C107/Anode of V404

6-19. Figure 6-4 shows the waveforms seen at the cathode and grid of V104 during an operating cycle. At the start of the trace an actuator thyratron has fired and C106 or C107 starts to discharge. The cathode voltage (upper trace) follows the capacitor discharge curve while the grid voltage (lower curve) follows the discharge curve only until a steady state is reached. At this point (600 microseconds) the charge on the grid capacitor leaks off through the grid resistor until at about 1200 microseconds the grid voltage is sufficient to allow the thyratron to fire. The cathode and grid voltages now increase to the supply voltage followed by further increase in grid voltage due to the grid capacitor. The grid then returns to ground as the grid charge leaks away through the grid resistor.

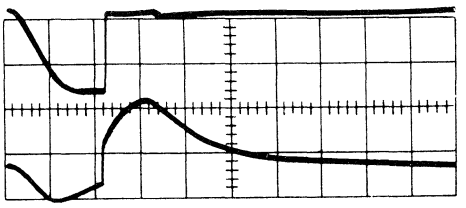
6-20. An overload relay (K101 Figure 8-3) is included in the power supply circuit to prevent damage to the bridge rectifier if severe overload occurs in the 600 vdc circuit. The overload relay coil is by-passed with a variable resistor R110 that is used to set the overload cut-out point. The rectified AC from the bridge rectifier is used to charge two large capacitors (C103 and C104). The charging current to C106 and C107 is taken from these capacitors and there is no excessive power supply load during the charging cycle.

6-21. Because of the time required for an actuator to complete one cycle, it is mandatory that the spacing of commands to the actuator be no closer than 2.5 milliseconds, regardless of the command. If for



VERTICAL : 5 AMPERES/DIVISION
HORIZONTAL : 500 USEC / DIVISION

Figure 6-3.
Waveshape, Discharge Current C107



UPPER TRACE : CATHODE, V104
VERTICAL : 300 VOLTS / DIVISION
HORIZONTAL : 500 USEC / DIVISION
LOWER TRACE : GRID, V104
VERTICAL : 300 VOLTS / DIVISION
HORIZONTAL : 500 USEC / DIVISION

Figure 6-4.
Waveshapes, Cathode/Grid V104

any reason a command signal to the system is programmed closer than 2.5 milliseconds to a previous command, two things may occur:

(1) The control thyratron associated with the previous command will not be permitted to cut off (by virtue of the second command). As a consequence, V104 will connect the power supply to ground via the thyratron and actuator coil.

(2) The grid of V104 will have insufficient time for return to ground potential after the previous command, and V104 will fire prematurely; this, in turn, will shunt the power supply across the actuator coil involved with the result that the associated control thyratron will not cut off.

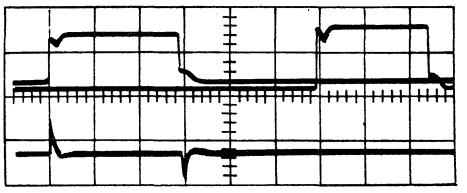
In either instance, the power supply will be overloaded, and the overload relay K101 will energize. As the contacts of K101 break the power connection, C103-C104 and either C106 or C107 will discharge rapidly through whichever control thyratron is still conducting, and by the time the relay contacts again close the power circuit, the control thyratron will be back to normal status. Thus, accidental programming of commands too close together will not damage the equipment (because of the overload safety feature), but will cause the sequential nature of the programming to be interrupted by one or more missed functions.

6-22. Two external input connections are provided at the terminals 7 and 9 of the actuator control etched board assembly AC-400; these terminals are connected to terminals 34 and 35 of J303. The input common lead is connected to terminal 8 of the etched board assembly; this common lead may be grounded if desired, but it must serve as the return for the automatic input signals. Start and stop commands must be generated by a dc voltage level change. The actuator will function on an 8 volt (+12, -0) level change, such as -10 to 0 vdc or 0 to +10 vdc for the start command, maintained at the particular voltage for the duration of the run time. Returning the command level to the original level constitutes a stop command. The level of these commands should not exceed 25 vdc. The rise time of this step function dc signal should be no greater than 10 microseconds. The top pattern of Figure 6-5 indicates such an input signal.

6-23. The dc level change is applied to current limiting resistor R413, through the parallel network of C408-R414, and thence to the primary of pulse transformer T408. (The R-C network raises the dc input impedance of the system to prevent undue loading of the external source.) The combination of the input network and the pulse transformer is such that at terminal 1 of T408 only a sharp spike remains

of the original input signal. This is illustrated by the bottom pattern of Figure 6-5. The peaked signal in the primary of T408 is stepped up and applied to the grids of V403 and V404. (See Figure 6-6.) An ON signal causes a positive spike to appear at the primary of T408; a positive spike will then appear at the grid of V404, causing V404 to conduct and shift the actuator ON. At the same time, a negative spike is applied to the grid of V403, adding to the already present fixed dc bias so that V403 does not conduct. If the input command is OFF (signal shifting from zero volts to -10 volts), a positive signal will be applied to the grid of V403 and a negative signal applied to the grid of V404.

6-24. Four external manual control connections are provided at terminals 12, 4, 6 and 10 of the etched board AC-400, corresponding to terminals 44, 41, 40 and 42 of J303. Application of a ground or a positive dc level change to these terminals will cause the indicated actuator operation to occur. For example, suppose it is desired to shift the forward actuator to ON. Applying a ground to terminal 6 of the etched board by means of an external relay or switch will cause a positive spike to appear at the grid of V404. The spike is created by the charging of .002 mfd capacitor C409 through the grid circuit of V404. When the ground is subsequently removed from terminal 6, C409 discharges via shunt resistor R417; the circuit thus is ready for the next similar command. As the ground is applied to terminal 4, a positive spike appears at the grid of V403 and the forward actuator shifts to OFF. Shunt capacitor C406B bypasses any transient impulses picked up via the external wiring. If the manual control is returned to +14 vdc instead of ground, essentially the same results are obtained, but a positive-going spike of greater amplitude is provided to the associated thyratron grid.



UPPER TRACE:	TYPICAL INPUT SIGNAL
VERTICAL:	10 VOLTS / DIVISION
HORIZONTAL:	5 MSEC / DIVISION
LOWER TRACE:	TERMINAL 1, T408
VERTICAL:	10 VOLTS / DIVISION
HORIZONTAL	5 MSEC/DIVISION

Figure 6-5.
Waveshapes, Typical AC-400
Input/Resulting Pulse

6-25. The external manual control system must be interlocked by switches and/or relays to prevent application opposed or contrary commands. For example, it should not be possible to apply a forward ON and a reverse ON command simultaneously, (or in sequence without going through an OFF command). The limitation on

spacing of commands is the same as during automatic operation: 2.5 milliseconds minimum between subsequent commands. It is also recommended that the automatic and manual inputs be interlocked so that it is impossible to apply simultaneous manual and automatic signals. Such interlocks are included in the Ampex Manual Control Panel, and are also indicated in Figure 2-7.

6-26. An actuator interlock circuit prevents one actuator being switched ON if the other actuator is already ON and thus reduces the possibility of damaged tape. Simultaneous ON conditions can arise in three ways:

(1) Start commands applied to the inputs.

(2) Start commands applied when the other actuator is already ON.

(3) Inadvertent firing of one actuator ON due to external noise when the other actuator is on the ON position.

(4) Failure of an actuator to move from the ON position to the OFF position due to a defective actuator or thyratron.

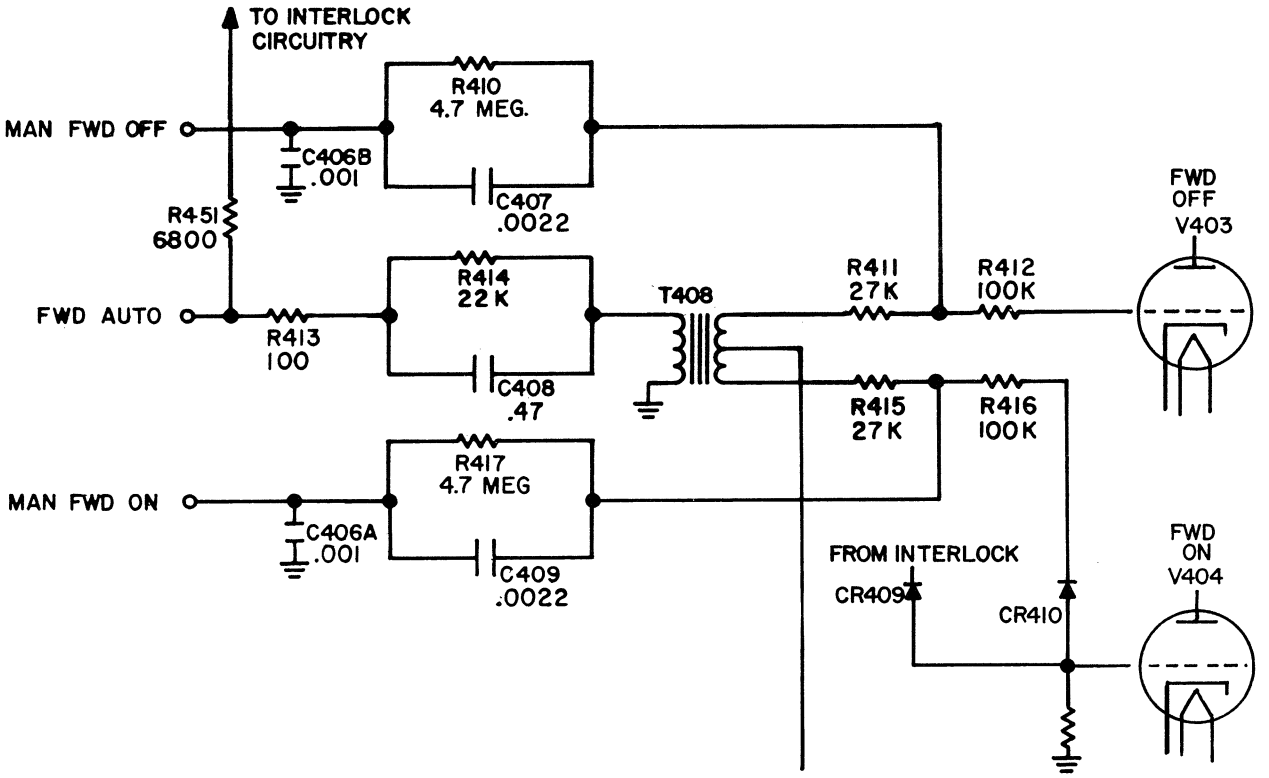


Figure 6-6. Forward Actuator Control (Partial Schematic)

The interlock circuit will prevent simultaneous ON conditions caused by the second and third conditions, but not the first or fourth.

6-27. The forward and reverse interlock circuits are identical; only the forward interlock is described.

6-28. The forward interlock circuit is shown in Figure 6-7. The circuit consists of a flip-flop with emitter-follower input, an AND gate, and an OR gate. The flip-flop is set when the reverse actuator is pulsed on and will then prevent the forward actuator ON thyratron from firing. The flip-flop is reset when the reverse actuator OFF thyratron fires and will then permit the forward ON thyratron to fire when a command is made.

6-29. The flip-flop consists of two transistors, Q404 and Q406, emitter coupled with a common emitter resistor to provide regeneration. The circuit is unbalanced to ensure that when the system is first switched on, Q404 will be conducting and Q406 will be held off; the reset state.

6-30. In the reset state Q404 is conducting due to the base current from the positive 12 volt supply via R440 and R438. The collector

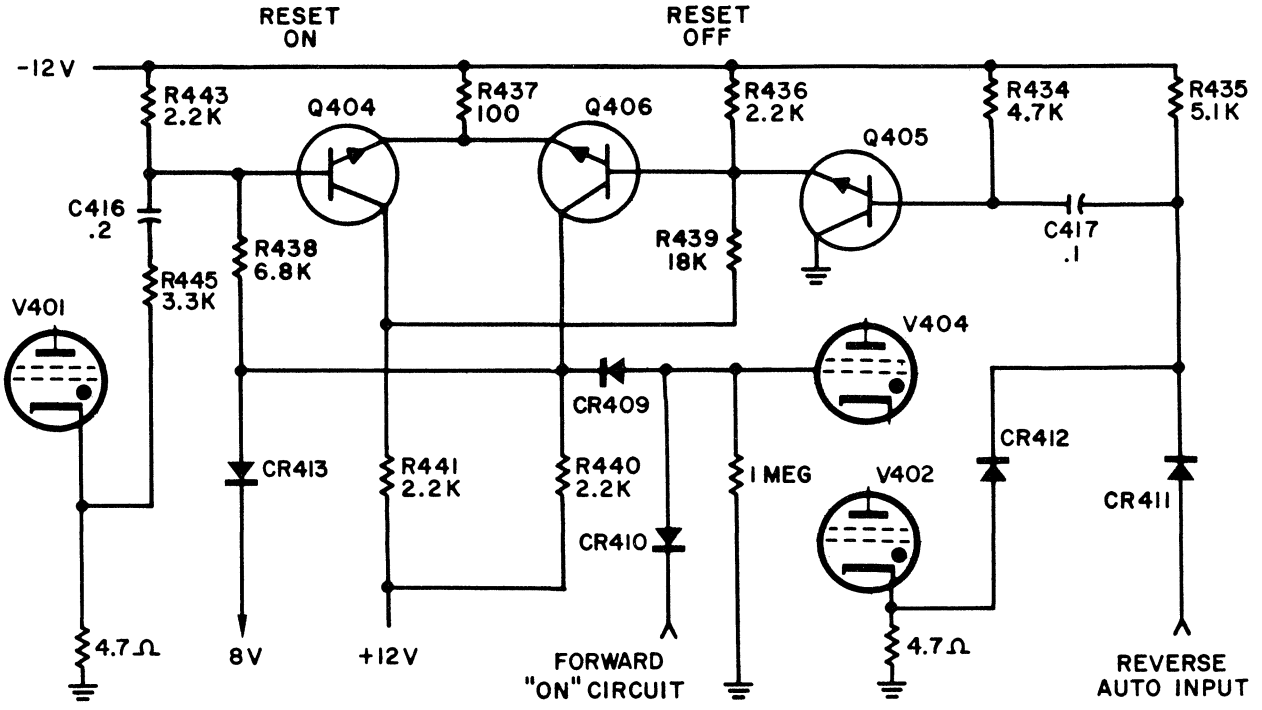


Figure 6-7. Forward Interlock Circuit (Simplified)

current is dropped across R441, preventing any base current flowing in Q406. The emitters of both transistors are tied together and, due to the current in Q404, dropped across the emitter resistor, R437, are held at 1 volt positive with respect to the negative 12 volt supply. The base of Q406 is held close to this supply by R436 and is biased off. The emitter follower input stage (Q405) is biased off, the base is held to the negative 12 volt supply while the emitter is a fraction of a volt positive to this supply, being tied to the base of Q406.

6-31. The flip-flop is set by applying a positive-going pulse to either input of the OR gate (CR411 or CR412). The input pulse applied to CR411 is from the reverse automatic input to the actuator control while the input pulse applied to CR412 is generated across the cathode resistor of V402 when that thyratron fires. Regardless of which input is used the result is that capacitor C417 charges via R434 and the base circuit of transistor Q405 in parallel. With current flowing in the base circuit Q405 switches on and causes base current to flow in Q406 which in turn switches on. As the collector current is dropped across R437 and R440, the Q404 base current is reduced and the emitter voltage increased. Transistor Q404 switches off, its collector voltage increases and base current to Q406 is supplied from the positive 12 volt supply via R441 and R439 to hold Q406 on. As this switching action is regenerative (Q406 switching on in turn switches Q404 off which in turn switches Q406 on), the circuit is quite sensitive to input pulses.

6-32. When the flip-flop is set the AND gate consisting of diodes CR409 and CR410 is inhibited and thyratron V404 cannot fire. In the set condition the junction of R440, CR409, and Q406 collector is held close to the 12 volt negative supply, the grid of V404 remains at this voltage regardless of the condition of the grid input applied via CR410.

6-33. The flip-flop is reset when thyratron V401 fires. The thyratron cathode current causes a positive-going voltage change across the cathode resistor which in turn charges C416 via the base circuit of Q404. Q404 starts to turn on and Q406 off. The circuit is regenerative as described in paragraph 6-31.

6-34. When the flip-flop is reset the AND gate controlling the firing of V404 is enabled (the negative voltage is removed from CR409 cathode) and V404 can be fired.

6-35. The operation in manual and automatic modes is similar except that the flip-flop is set by the firing of the reverse ON thyratron in the manual mode and by the automatic reverse ON pulse in the automatic mode.

6-36. Two power supplies are used for the interlock circuit. The -12 volt supply consists of rectifier CR404; filter network C412, R419, and C413; and shunt regulator Zener diode, CR415. The +12 volt supply consists of rectifier CR403; filter network C410, R418, and C441; and shunt regulator Zener diode CR416.

6-37. SERVO SYSTEM.

6-38. Two identical servo systems are used to drive the tape supply and take-up reels. The tape drive system takes the tape from the supply vacuum chamber, drives it over the head assembly, and feeds it into the take-up vacuum chamber. The servo system supplies tape to and removes tape from the vacuum chambers to maintain a constant length of tape in each vacuum chamber. The vacuum keeps the tape at the correct tension to prevent buckling or folding and allows the tape length in each chamber to be sensed by the servo system.

6-39. The loop of tape in a vacuum chamber divides the chamber into three areas, the center area is open to the atmosphere while the upper and lower areas are open to the vacuum system. Slots in the back plate of the vacuum chambers are connected by tubing to the servo transducers which are able to detect variations in air pressure. The air pressure seen by the transducer is proportional to the length of slot in each of the pressure areas in the vacuum chamber. As the length of tape loop changes the length of the sensing slot in each pressure area changes and the sum of the pressures as seen by the transducer changes. Increases in tape loop size cause the area exposed to the atmosphere to increase and the area exposed to the vacuum to decrease. The result is an increase in the pressure seen by the transducer and an output from the transducer signalling the servo system that tape must be removed from the vacuum chamber. Decreases in tape loop size decrease the area exposed to the atmosphere and increase the area exposed to the vacuum, thus causing a decrease in transducer pressure and a signal to the servo system to supply tape to the chamber. When the correct tape loop size is reached the pressure areas are such that the transducer gives no output to the servo system and the tape reels are stopped.

6-40. Figure 6-8 shows a block diagram of the servo systems. Each system includes a bi-directional series-wound d-c motor, a thyratron speed control circuit for each motor winding (forward and reverse), a three-stage vacuum tube amplifier circuit for each speed control circuit, and a demodulator circuit. Input to the system is provided from an oscillator via two transducers operated by the vacuum system.

6-41. The servo amplifier (SA-500) and the servo power supply (PS-200) form the intermediate link between the tape position error signals and

the rotation of the servo motors. It should be noted that the only moving mechanical parts of the servo system are the transducer diaphragm and core, the servo motors, the reels, and the tape itself.

6-42. The following discussion will be limited to the upper servo system (associated with supply reel and left vacuum chamber). Details of the lower servo system (take-up reel and right vacuum chamber) are identical. Note that the two servos are independent and that servo action in one vacuum chamber has no effect on the other. It is possible therefore, under certain programming sequences, for one reel to be rotating clockwise and the other counterclockwise for very short periods.

6-43. The transducer is an adjustable pnematic, diaphragm-operated linear variable differential transformer. Air pressure from the sensing slots in the vacuum chamber is connected by tubing to one side of a sensing diaphragm, which expands and contracts linearly with changes in vacuum within the plenum behind the sensing slot. The core of the transformer is rigidly attached to the diaphragm, so that movement of the diaphragm displaces the core with respect to the cylindrically wound primary and secondary windings.

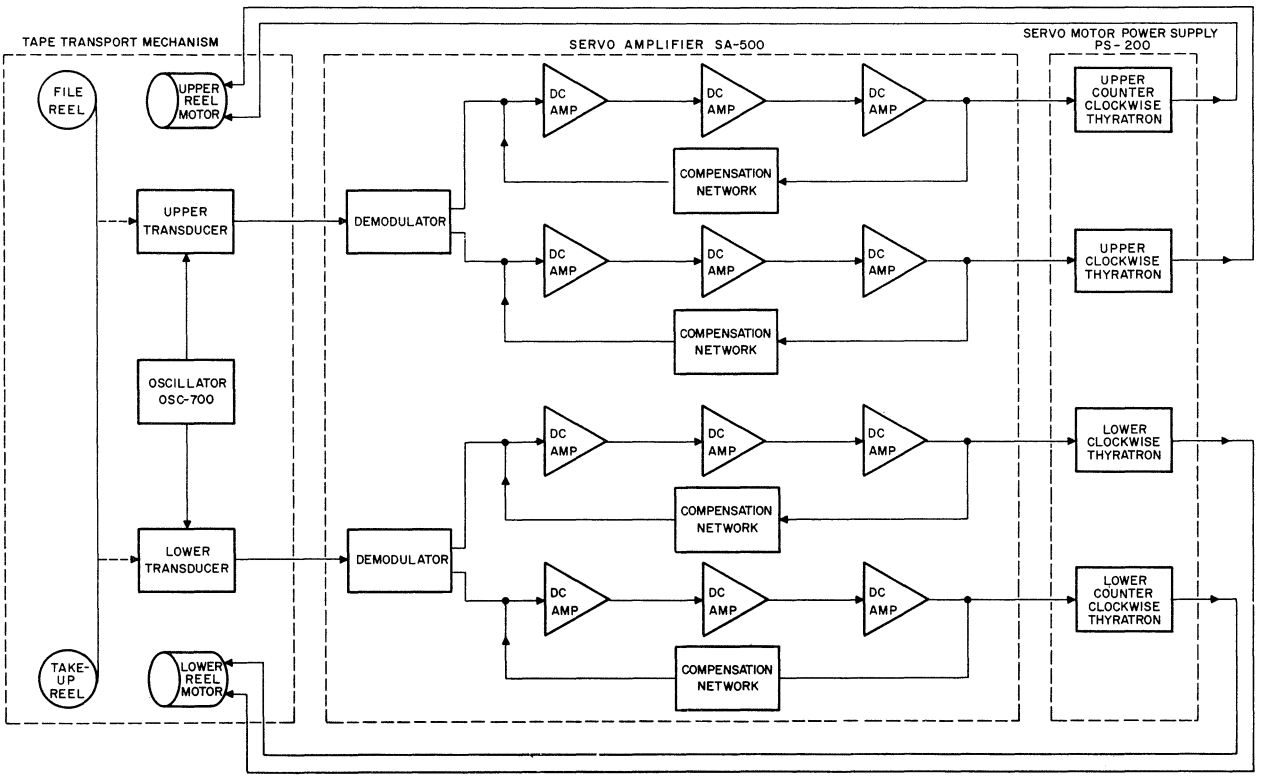


Figure 6-8. Block Diagram, Reel Servo System

6-44. The primary of the transformer is excited at nominally 2000 cps by the oscillator (OSC-700), the output amplitude of the oscillator being varied to adjust servo gain. When the core is positioned equidistant between the primary and the two secondaries, the output from the phase-opposed secondaries are equal. When the diaphragm moves the core away from the center position, unequal voltages are induced in the two secondaries.

6-45. When properly adjusted, the transducer produces a null with the ends of the tape loop approximately 14 inches apart in the vacuum chamber. Changes in length of the tape loops in either the long or short loop directions will cause a corresponding output voltage change as measured across the transformer secondaries.

6-46. These changes in secondary output voltage serve as the speed and direction sense for servo motor control. Overall sensing is such that the servo motors always try to rotate the tape reel in the direction that will return the tape loop length to the transducer null condition.

6-47. The oscillator assembly, mounted on the rear of the tape transport, is a three-stage unit, composed of oscillator, buffer stage, and push-pull power output stage. A block diagram is shown in Figure 6-9.

6-48. The B+ and filament power for operation of the oscillator is obtained from the PS-100 power supply.

6-49. Signals developed across the plate load of the oscillator are attenuated and shifted in phase by the RC networks composed of C2-R4, C3-R5, and C4-R6. (See Figure 8-6.) At the 2000 cps frequency of the oscillator, each of the frequency selective networks shifts the signal in phase by 60°, so that the signal appearing at the grid of oscillator tube V1A is 180° out of phase with the signal at the plate, thus supporting and sustaining oscillation.

6-50. The oscillator signal is applied to V1B, which functions principally as a buffer to prevent any load changes at the output from interacting with the oscillator.

6-51. The push-pull power output stage consists of the two halves of V2 in a conventional circuit, driving output transformer T1, which in turn feeds the primaries of the transducers. Potentiometers, between the secondaries of this transformer and the primaries of the transducers are used to set servo system gain. Typical oscillator output is shown in Figure 6-10.

6-52. The servo amplifier board consists of two demodulators and two d-c amplifiers. Only the demodulator and d-c amplifier relating to the upper servo will be discussed here.

6-53. The input to the servo amplifier board is the signal developed in the secondaries of the transducer differential transformers. The outputs of the servo amplifier board (Figure 8-7) are dc levels varying with the length, and rate of change of length, of tape in the vacuum chamber.

6-54. The ac output from the transducer is rectified and applied to the grids of V1 (Figure 6-11). The common terminal of the transducer secondaries is connected to the amplifier ground while the other terminals of the secondaries are each connected to a diode rectifier circuit where the dc voltages are developed across capacitors C10 to C13 inc. The positive component of one transducer output is summed with the negative component of the other output across a pair of resistors and the resulting voltage applied to one grid of V1. The other positive and negative components are summed and applied to the other grid of V1. When the transducer is in the null condition with both outputs equal, the negative component from one output exactly cancels the positive component from the other output and no error voltage is applied to the grids of V1. When the transducer is not in the null condition one output is greater than the other, one positive component will be greater than its opposing negative component and a positive voltage will be applied to that grid of V1, while the other positive component will be less than its opposing negative component and a negative voltage will

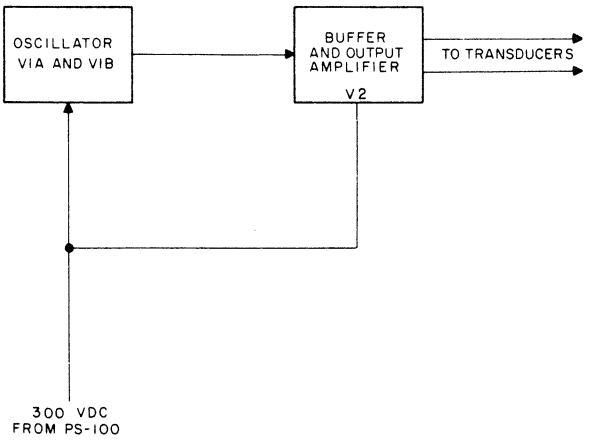
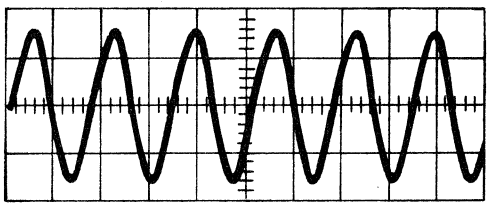


Figure 6-9.
Block Diagram,
Servo Oscillator OSC-700



VERTICAL: 10 VOLTS/DIVISION
HORIZONTAL: 10 MSEC/DIVISION

Figure 6-10.
Waveshape, Typical
Oscillator Output

be applied to that grid of V1. The result is a differential input to V1, the first stage of a d-c amplifier.

6-55. The demodulated signal applied to the grids of V1 is used to control the reel servo motor. The polarity of the voltage excursions applied to V1 is dependent on whether the tape loop is too large or too small and is used to control the direction of reel motor rotation needed to restore the correct loop size. The amplitude of the voltage excursions is dependent upon the amount of variation from the correct loop size and is used to control the reel motor speed.

6-56. The demodulated signal is amplified in a three-stage, differential d-c amplifier, frequency sensitive with negative feedback. Each stage of amplification uses an unbypassed cathode resistor that is common to the two triodes to ensure a balanced signal throughout the amplifier and minimize the effect of tube variations. The feed-back loop uses a filter network (C14-C17 and associated resistors) to bypass the high frequency component of the feedback signal. The result of this lead compensation is much greater amplification at higher frequencies, to provide rapid response to changes in loop size, and increased servo stability.

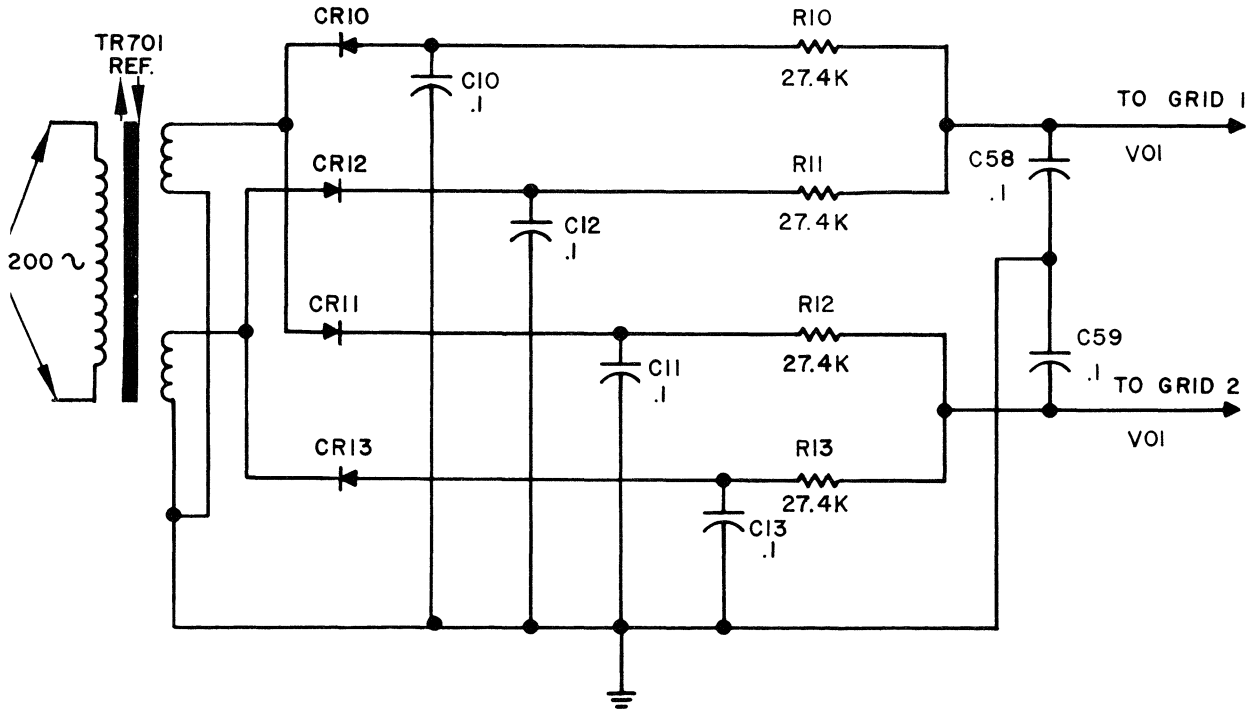


Figure 6-11.
Demodulator SA-500 (Partial Schematic)

6-57. The Servo Motor Power Supply (PS-200) provides power for the reel motors. Each reel motor has two windings, one for clockwise rotation and one for counterclockwise rotation. A simplified power supply circuit for a single motor winding is shown in Figure 6-12 where the motor winding is powered by the secondary of transformer T1 in series with a thyratron. The thyratron grid voltage is supplied from the secondary of transformer T2 in series with the control voltage. The voltage seen by the thyratron grid is the sum of the control voltage and the alternating voltage produced by T2 with a 90° phase shift, and is shown in Figure 6-12. As the thyratron is fired by the grid voltage and turned OFF by the anode voltage, the ON time is seen as the result of the alternating supply superimposed on the control voltage; the ac remains constant so the ON time becomes a function of the control voltage only.

6-58. In the actual power supply circuit (Figure 8-9) two thyratrons are used in a full wave rectifier circuit for each motor winding rather than the half-wave configuration shown in the simplified circuit. Because both negative and positive half cycles of the supply are used the motor ON time is doubled. The phase shifting networks in the grid transformer circuits permit smooth control throughout the entire anode voltage half cycle and provide ON periods in the 0 to 180 degree range

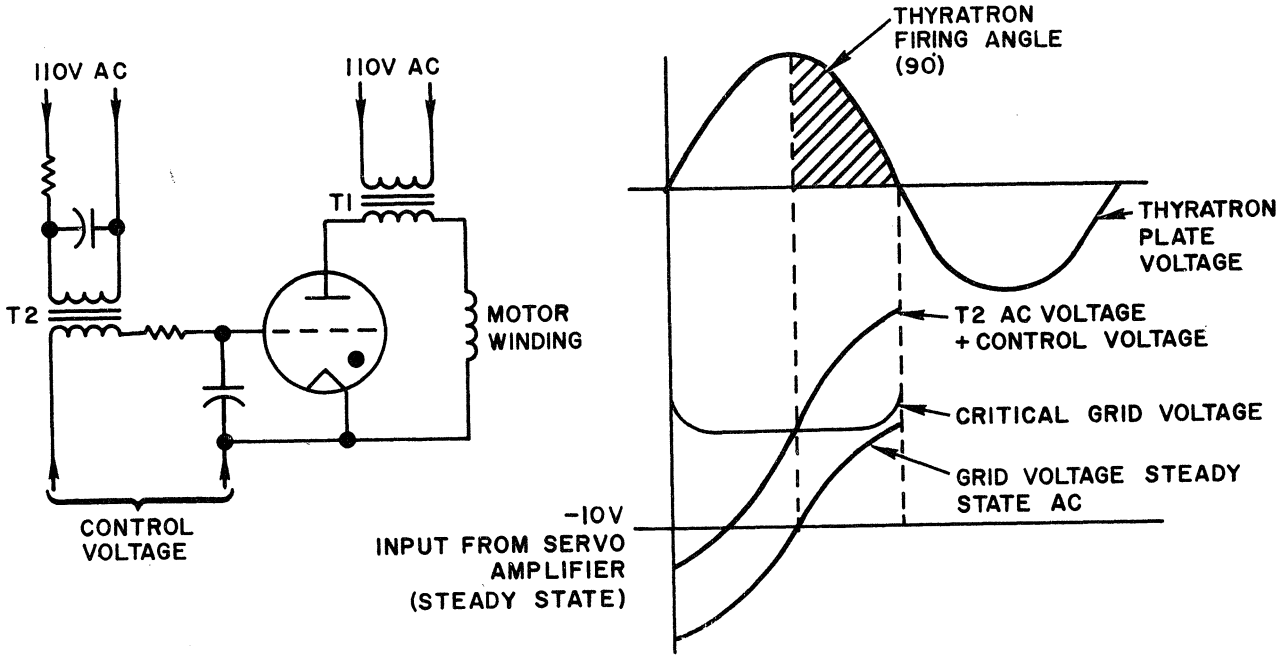


Figure 6-12. Servo Motor Power Supply (Simplified)

so that the motor current becomes a linear function of the control voltage.

6-59. The outputs of the servo amplifier are used as the control voltages for the servo motor power supply. The polarity of the output from each amplifier determines which pair of thyratrons will fire and thus determines the direction of motor rotation. The amplitude of the control voltage determines the firing angle of the thyratrons and thus determines the speed of the motor. Motor direction and speed are therefore a direct function of the size of the tape loop in the vacuum chamber and, when the correct size of the loop is obtained, the thyratrons are held off and the motor is stopped.

6-60. MANUAL CONTROL PANEL.

6-61. The manual control panel offers facilities for power control, selection of command source (manual or automatic), selection of tape motion under manual control, and a manual write/leader drive control. The control functions are so arranged that in the MANUAL mode it is impossible to present simultaneous ON signals to the two actuators.

6-62. The panel consists of four switches for control of the above functions, two time delay relays, four conventional relays, four rectifiers, and two control indicators (POWER ON and READY).

6-63. The power source is connected to pins 47 and 48 of P303 through the circuit breakers CB301 and CB302 on the connecting chassis (CC-300) of the transport electronics assembly. When S806 on the manual control panel is placed in the ON position, power is connected across thermal delay relay K805 through normally-closed contact set K806C of time delay interlock relay K806. Power is also routed through pin 50 of P303 and circuit breaker CB303 to the cooling fan, the positive pressure blower, and the primary of voltage regulator transformer T701. A connection from pin 50 of P303 also routes power through fuse F301 to power transformer T102 in the electronics power supply. If the circuit breakers are all in the ON position, the capstan drive motor will start capstan rotation, the vacuum blower motor and the cabinet cooling fan motors will start as switch S806 is closed. After a 45-second time delay, relay K805 operates. Its contact set couples 24 vdc (rectified by CR805 and CR806 from 52 vac supplied from electronics power supply PS-100) across the coil of time delay interlock relay K806. Contact set K806A provides a holding circuit for the relay, paralleling the contact set of K805. Contact set K806B connects -24 vdc to the external series circuit consisting of the leader clamp switch, interlock switch, door interlock switch, and loop

warning switches. This circuit re-enters the manual control panel at pin 13 of P303. Contact set K806C breaks the power connection to time delay relay K805 which eventually cools and reopens its contacts. The -24 vdc is also used to illuminate POWER indicator DS802.

6-64. The MODE SELECTOR switch, S801, has four decks, each deck a three-pole, three-position switch. When the MODE SELECTOR switch is placed in the AUTOMATIC position, -24 vdc from the interlock circuit is connected through contacts 1 and 2 of deck III and diode CR807 to the coil of relay K804 energizing the relay. Contact sets K804A and K804B are paralleled to connect 117 vac to terminal 39 of P303, from whence the power is routed to anode transformers T206 and T207 in the servo motor power supply (PS-200). An additional -24 vdc output, rectified by diodes CR803 and CR804 from a 52-vac source in the electronics power supply PS-100, supplies power to the brake solenoids through contact sets K804C and K804D to release the brakes on the servo motors.

6-65. If the LOOP WARNING switches are in their normally closed position, -24 vdc is also connected across the coil of interlock relay K802 through contacts 5 and 6 on deck IV of S801 and the relay is energized. Contact sets K802E and K802F are concerned solely with AUTOMATIC mode operation; in their energized position they complete the circuit from the automatic forward and reverse signal inputs to the applicable circuits in the actuator control unit (AC-400).

6-66. Contacts 1 and 2 of deck IV and contacts 9 and 10 on deck III of S801 connect the tape sensing circuits to terminals 6 and 10 on P303, where the voltage may be used for a remote AUTOMATIC READY indicator. Contacts 5 and 6 and 1 and 2 on deck I, when relay contacts K802F and K802E are closed, connect the automatic forward and reverse commands from the remote control source to the actuator control circuits in the transport.

6-67. Should the programming sequence cause a long loop or short loop to be formed in either vacuum chamber while the transport is in the AUTOMATIC mode, the -24 vdc will be removed from pin 13 of P303 (by virtue of the long loop/short loop switch opening). This, in turn, will cause K802 to de-energize until such time as the servo system recovers. There is a time delay of 20 milliseconds (supplied by R805-C801) to permit recovery of loop position. In de-energizing, K802E and K802F open the automatic input circuits; K802C and K802D apply +14 vdc to both actuator OFF circuits, supplying OFF current pulses to both actuators and causing whichever actuator is ON at that moment to switch to the OFF position. K802 will be re-energized as

soon as the long loop or short loop condition is removed by servo action, permitting programming to continue.

6-68. If the basic interlock circuit is broken while the transport is in the AUTOMATIC mode (as by power failure, door opening, vacuum failure, etc.), K802 and K804 will de-energize. These relays cannot be re-energized until the basic interlock is again completed.

6-69. When the MODE SELECTOR switch is placed in the MANUAL position, power relay K804 is energized through isolation diode CR807 and contacts 1 and 4 on deck III. (The interlock circuit must be completed in order that the power relay may be energized.) The contact sets of relay K804 perform the same functions as described above under AUTOMATIC operation.

6-70. Interlock relay K802 is energized if the short loop/long loop switches are in their normally closed positions. The energizing circuit extends from terminal 13 on P303 through contacts 5 and 8 on deck IV, the normally-closed contact set K803A, the MANUAL CONTROL switch (in its STOP position), to the relay coil. In its energized position, relay set K802A forms a holding circuit which bypasses the MANUAL CONTROL switch, permitting this switch to be turned from its STOP position.

6-71. Note that if the MODE SELECTOR switch is placed in the MANUAL position and the MANUAL CONTROL switch in any position other than STOP, relay K802 will not energize. Under these conditions, the MANUAL CONTROL switch must be placed in the STOP position once before any tape motion may be initiated.

6-72. Contact set K802B completes a circuit to +14 through contacts 5 and 8 on deck II of S801 so that manual control signals for tape motion may be selected at the MANUAL CONTROL switch. Contact sets K802C and K802D, in conjunction with contacts 9 and 12 on deck I and contacts 1 and 4 on deck II of S801 ensure that the forward actuator and reverse actuator cannot be shifted ON until the basic interlock is completed. (Contact sets K802E and K802F are applicable only to AUTOMATIC mode operation.)

6-73. Contacts 1 and 4 on deck IV and contacts 5 and 8 on deck III of S801 connect through the interlock circuit to the coil of end-of-tape relay K803. If the outer section of the upper tape sensing contact post is shorted to ground by conductive backing on the tape, the relay is energized. Contact set K803A de-energizes the holding circuit of

interlock relay K802, the contacts of the relay return to their de-energized position, stopping tape motion. Note that end-of-tape relay K803 can be energized only in the MANUAL mode. After the interlock has been completed, contacts 5 and 8 on deck III also supply -24 vdc to the MANUAL WRITE section (contacts 5 and 6 on deck I) of the MANUAL WRITE/LEADER DRIVE switch, so that when that control is placed in the MANUAL WRITE position, associated remote relays for write application may be energized.

6-74. The MANUAL CONTROL switch S802 is a three-deck control, each deck consisting of a two-pole, five-position switch. Deck I is a shorting (make-before-break) type switch; decks II and III are non-shorting. The control may be used to select any of the five tape drive conditions: FWD (Forward), FAST FWD (Fast Forward), STOP, REV (Reverse), and FAST REV (Fast Reverse or Rewind). It should be noted that the switch can select a drive condition only when the MODE SELECTOR switch S801 is at MANUAL, and that all actions previously described for that position are completed. The following discussion, therefore, assumes that the MODE SELECTOR switch is in the MANUAL position, and that relays K802, K804, and K805 have energized.

6-75. When switch S802 is placed in the FWD position, contacts 4 and 6 of deck III complete a +14 vdc circuit to the forward actuator ON circuit and the +14 vdc to the OFF line through contacts 4 and 6 on deck I is removed. The actuator will clamp the roller assembly against the rotating forward capstan, and tape motion will start. When the selector is returned to the STOP position, contacts 3 and 6 on deck I connect the +14 vdc signal to the forward OFF circuit and the +14 vdc to the ON circuit through contacts 4 and 6 on deck III is removed. The roller assembly moves away from the capstan and the tape motion is stopped with the aid of the inertia brake on the roller assembly rocker arm.

6-76. When the MANUAL CONTROL switch is placed in the REV position, contacts 12 and 8 on deck III connect the +14 vdc to the reverse ON circuit and the +14 vdc to the reverse OFF circuit through contacts 9 and 12 on deck I is removed. The reverse actuator clamps the tape against the rotating reverse capstan. When the selector is returned to the STOP position, contacts 9 and 12 on deck I connect the +14 vdc to the reverse OFF circuit. The roller moves away from the capstan, and tape motion is stopped with the aid of the inertia brake on the roller assembly arm.

6-77. When the MANUAL CONTROL switch is placed in the FAST FWD position, contacts 5 and 6 on deck III connect +14 vdc to the forward ON

circuit. Contacts 12 and 11 on deck II connect -24 vdc to thermal time delay relay K801 and, via pin 38 of P303, to rewind relay K701 on the tape transport.

The latter relay selects the fast winding of the capstan drive motor so that the capstans will be driven at higher speed. After approximately two seconds, thermal time delay relay K801 will operate to open its contact set. The contact set will remain open as long as the MANUAL CONTROL switch is in the FAST FWD position; and for approximately five seconds after the control has been switched from this position. This feature prevents the sudden application of the opposite roller assembly when using the fast winding modes as, for example, if the MANUAL CONTROL switch were suddenly moved from FAST FWD to reverse while the tape was moving at high speed. If the roller assembly were permitted to clamp the tape almost immediately, the tape would be subjected to undue stress.

NOTE

It should be remembered that once the actuator clamps the roller assembly against the capstan, it will remain in that position until the OFF signal is received. Thus, breaking the circuit by energizing K801 will not stop tape motion. The contacts of K801 are in series with both actuator ON circuits; hence, neither actuator can be shifted ON until thermal time-delay relay K801 has been allowed to cool.

Returning the selector to the STOP position results in connecting +14 vdc to the forward OFF actuator, through contacts 6 and 3 of deck I. The roller assembly is removed from contact with the forward capstan, rewind relay K701 on the transport is de-energized so that its contacts select the normal winding of the capstan drive motor, and the contacts of thermal time delay relay K801 close after approximately five seconds to close the circuit, allowing subsequent ON commands to operate the actuator circuits.

6-78. When the MANUAL control switch is placed in the FAST REV position, the action is similar to the FAST FWD discussed above. Contacts 12 and 7 on deck III connect the +14 vdc signal to the reverse capstan. Contacts 12 and 7 of deck II connect -24 vdc to K801 and K701, which perform identical functions as under FAST FWD operation.

6-79. The MANUAL WRITE/LEADER DRIVE switch S803 is a two-pole, three-position switch, with one position spring-loaded for return to the center (OFF) position. The switch appears in the circuit only when the MODE SELECTOR switch is in the MANUAL position.

6-80. The purpose of the MANUAL WRITE position is to make -24 vdc available to external controls for use in operating the write function under manual control. Contacts 5 and 6 route this control voltage to pin 25 of P303 when the switch is placed in the MANUAL WRITE position.

6-81. The purpose of the LEADER DRIVE position of the switch is to enable the operator to obtain tape motion when the end-of-tape relay K803 is energized, i.e., when the conductive backed tape is shorting the outer section of either sensing post to ground. To remove the metallized tape leader from the sensing post, contacts 1 and 4 complete the circuit for -24 vdc from terminal 13 of P303 (assuming that short loop/long loop switches are closed) to the coil of interlock relay K802. It is thus possible to energize this relay and achieve tape motion from the MODE SELECTOR switch at times when K803 is energized. The LEADER DRIVE position of the switch is spring-loaded, so that the control returns to the center (OFF) position when released.

6-82. The function of interlock relay K802 in the MANUAL mode is basically the same as for AUTOMATIC operation. However, the long loop/short loop sensing operates while the system is in the MANUAL mode, K802 will not re-energize until the MANUAL CONTROL switch is repositioned to STOP (the holding circuit to K802 will have been interrupted, and must reset via contacts 3 and 6 on deck II of the MANUAL CONTROL switch).

6-83. Interruption of the basic interlock requires re-setting of the basic interlock and return of the MANUAL CONTROL switch to STOP for a moment before subsequent tape motion can be started.

6-84. PHOTOSENSE UNIT.

6-85. The photosense unit gives an output when a reflective tab attached to the tape passes the photosense head. The output may be a relay contact transfer or a voltage level change or both depending upon the type of photosense unit. When a relay contact output is used a hold circuit is included to keep the contacts transferred for 100 milliseconds.

6-86. The photosense head contains a light source and two photosensitive diodes. When normal (brown) tape is under the head very little light from the light source is reflected from the tape to the diodes.

When a reflective tab passes under the head, light is reflected on one of the diodes and increases its reverse conductivity. Each diode is connected to the input of a transistor amplifier and a voltage is applied across it. Changes in diode conductivity due to the reflected light are thus translated into current changes and amplified. The amplifier output is taken to the input of a Schmitt trigger circuit and its output is, in turn, used as input to a two-stage driver circuit. The driver provides current to an output relay or to an external load to give a voltage level change. (See Figure 6-13.)

6-87. The electronics assemblies for a photosense channel, DC Amplifier, Schmitt Trigger, Phantastron (hold circuit), and Driver, are mounted in individual packets. These are in turn mounted on a plug-in composite base card. The complete photosense electronics unit consists of two composite base cards (one for each channel), and three plug-in power supply cards.

6-88. The DC Amplifier circuit uses a common base amplifier and an emitter follower. (See Figure 6-14.) The base of the common base amplifier (Q1) is held slightly below ground by the forward resistance of diode CR1 and resistors R1 and R2 to the -10 volt supply. The emitter voltage is determined by the emitter current and the current through R4 dropped across the photo-diode and R3 in series. Diodes CR2 and CR1 parallel the photo-diode and prevent the voltage across it becoming greater than the combined forward voltage drop of CR2 and CR1. The base of the emitter follower stage (Q2) is tied to the collector of

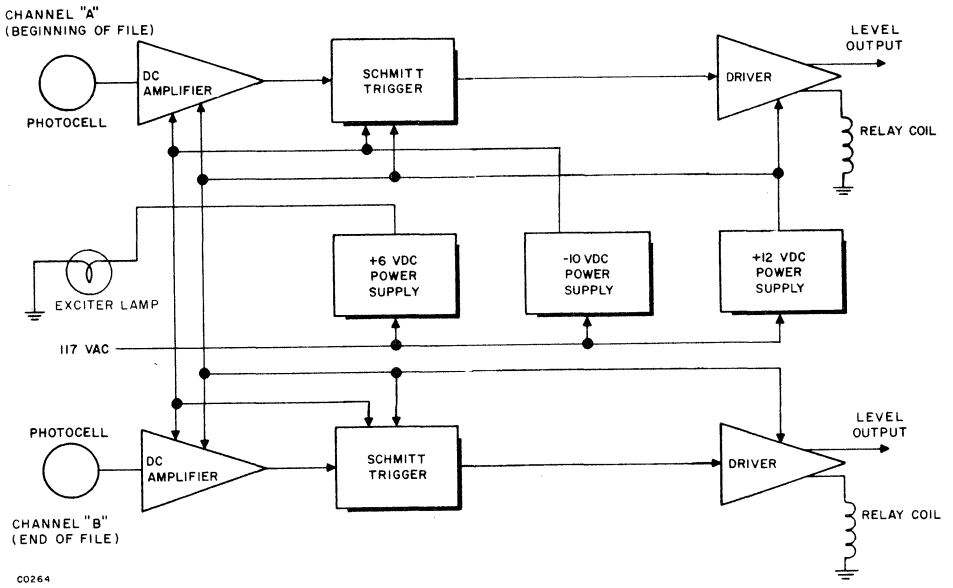


Figure 6-13. Block Diagram, Photosense Electronics

Q1 and its emitter current and output voltage is determined by the voltage drop across R5 due to the collector current in Q1. Adjustment of R4 changes the collector current in Q1 and allows the output voltage of Q2 to be set at -7.5 volts when no reflective tab is under the head.

6-89. When a reflective tab passes under the sensing head, light is reflected on the photo-diode and its resistance decreases, Q1 conducts more collector current, increasing the voltage drop across R5, and decreasing the base current in Q2. Q2 emitter current now decreases and the output voltage dropped across R6 and the load decreases to approximately -2 volts.

6-90. In its normal state Schmitt Trigger transistor Q1, (Figure 6-15) is held off by the negative voltage from the DC amplifier output. Q2 is held on by the base current due to voltage divider R1, R3, and R5. When the base of Q1 becomes less negative, due to a reflective tab being sensed, Q1 turns on, the base voltage on Q2 becomes less positive while its emitter voltage becomes more positive due to the regenerative effect of R2, and Q2 turns off. After a reflective tab has passed under the head and Q1 base becomes more negative and the Schmitt Trigger returns to its original state of Q1 off and Q2 on. The circuit output is clamped to ground by diode CR1 and gives a rectangular positive-going output pulse.

6-91. Transistor Q1 of the driver stage (Figure 6-16) is held off by the negative output from the Schmitt Trigger until a reflective tab is sensed. Q2 is held off by the +12 volt supply and no current flows in

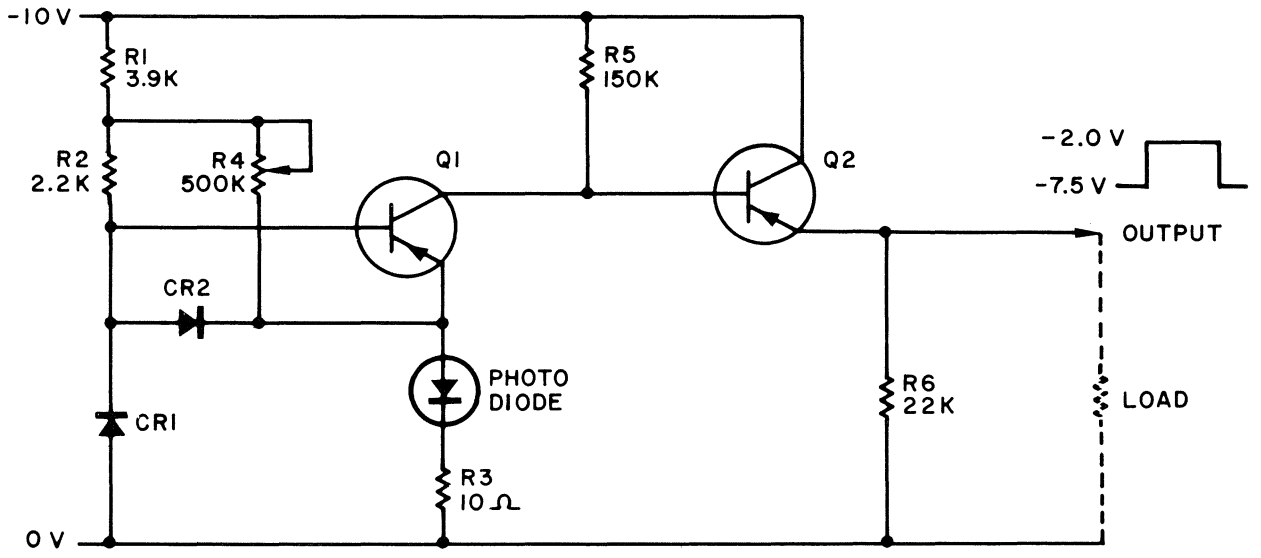


Figure 6-14. Photosense D-C Amplifier

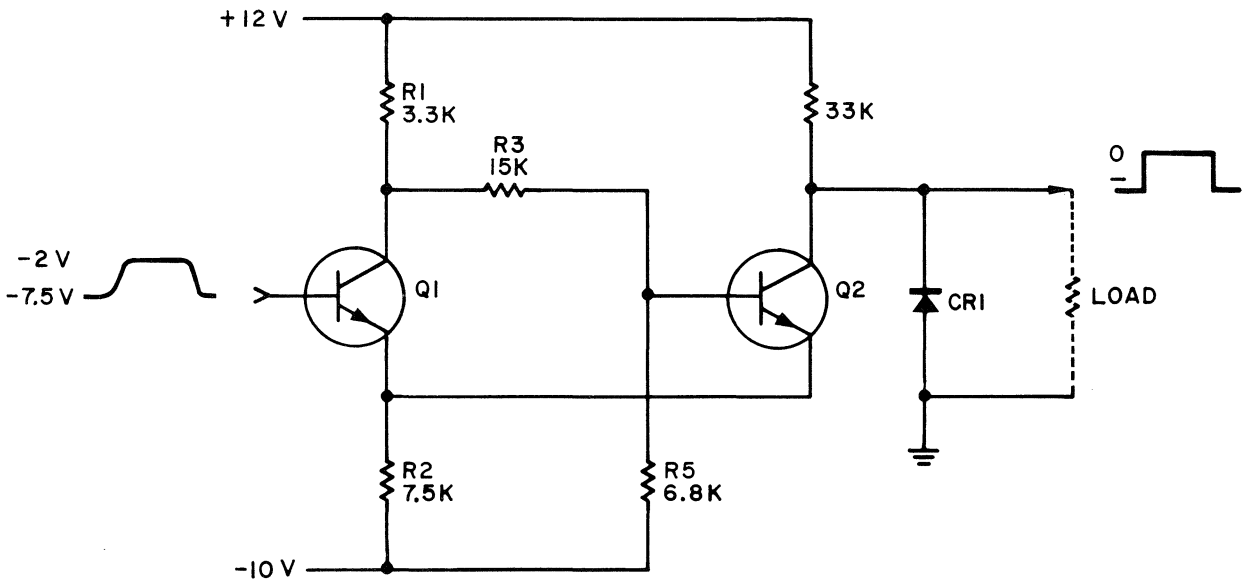


Figure 6-15. Photosense Schmitt Trigger

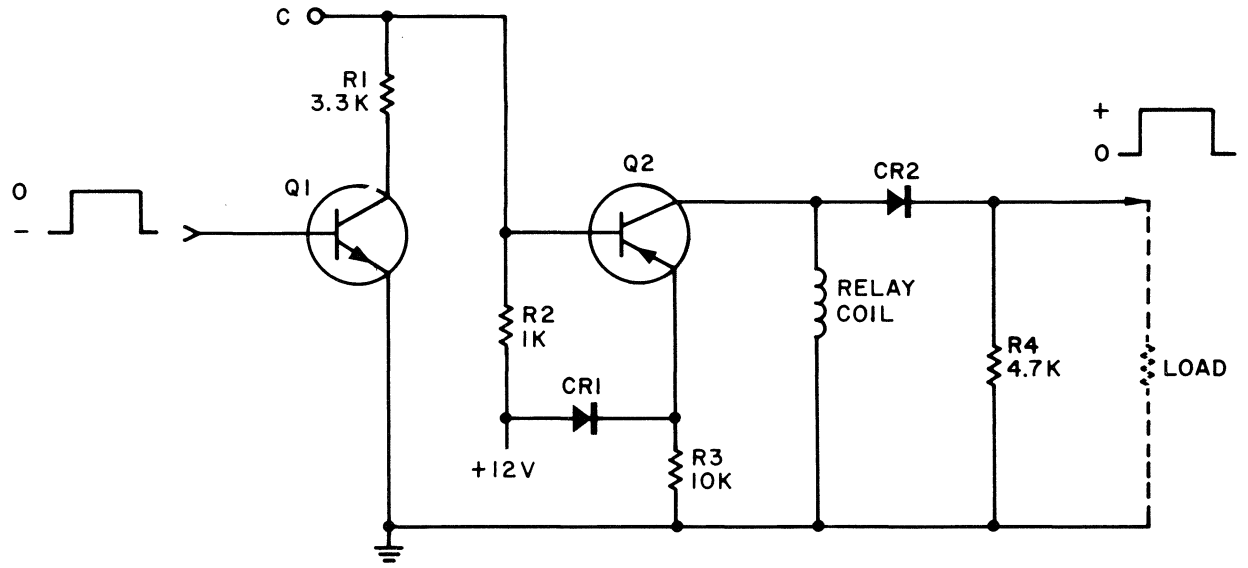


Figure 6-16. Photosense Output Circuit

the relay coil or load resistor. When a reflective tab is sensed and the input to Q1 is grounded Q1 and Q2 turn on and current flows in the relay coil and load resistor, transferring the relay contacts and raising the output level to +10 volts.

6-92. An alternate output circuit is shown in Figure 6-17. In this circuit the negative input during an off tab condition holds Q1 and Q2 on and current flows in the load resistor. When a tab is sensed Q1 and Q2 turn off and the load circuit to ground is open.

6-93. Three power supplies driven from a 32 volt output transformer are used in the photosense unit. A -10 volt supply and a +12 volt supply power the electronics while a 5-volt supply is used for the light source. Each supply is shunted by a Zener diode. Plug-in cards carry the power supply components while the transformer and Zener diodes are mounted directly on the photosense chassis.

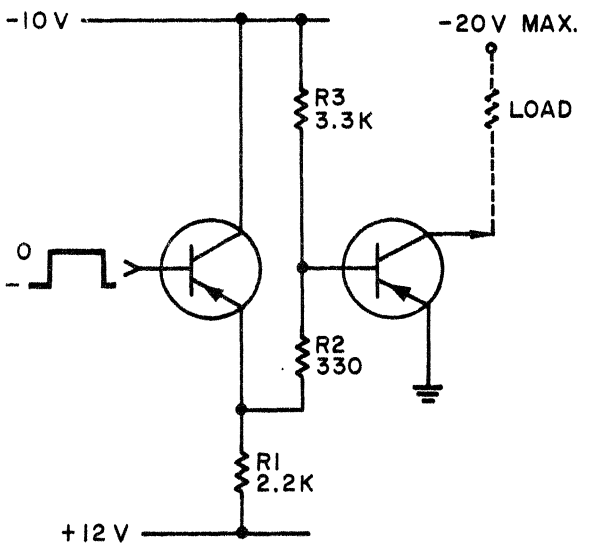


Figure 6-17.
Photosense Alternate
Output Circuit

SECTION VII
MAINTENANCE

7-1. GENERAL.

7-2. The TM-2 Tape Transport is designed to require minimum maintenance and service. Such maintenance as is required will be facilitated by a well-planned program of preventive maintenance, a systematically kept maintenance log, and carefully performed corrective maintenance as required. Adherence to such a program will ensure optimum performance of the equipment over many years.

7-3. A listing of the recommended tools and equipment used in maintenance of the tape transport will be found at the end of this section.

7-4. PREVENTIVE MAINTENANCE SCHEDULE.

7-5. A program of planned periodic maintenance is the most effective way of keeping the tape transport operating at its designed potential. A recommended schedule is shown in Table 7-1. It should be noted that these maintenance procedures are scheduled by number of eight-hour shifts, as well as by hours of running time as indicated on the elapsed time meter at the rear of the tape transport.

Table 7-1. Preventive Maintenance Schedule

Maintenance Operation	Frequency Approx.			Qty.	Total Time (Min.)	Text Paragraph Reference
	Shifts	Hours	Min. Ea.			
Check Tape Transport Tracking	1	8	1	2	2	4-6
Clean Transport	2	16	10	1	10	7-7
Check capstan roller adjustment	2	16	1	2	2	4-5-1
Check tape packer alignment	12	96	2	2	4	4-9
Adjust capstan rollers	12	96	10	2	20	4-5-1
Degauss heads and tape guides	24	192	.5	16	8	7-8

Table 7-1. Preventive Maintenance Schedule (Continued)

Maintenance Operation	Frequency Approx.			Qty.	Total Time (Min.)	Text Paragraph Reference
	Shifts	Hours	Min. Ea.			
Clean rack	24	192	5	1	5	7-9
Replace air filters	24	192	.25	4	1	7-10
Check and adjust vacuum	24	192	3	1	3	4-7
Align chamber guides if necessary	24	192	3	4	12	4-6-2
Check and adjust reel servos	24	192	6	2	12	4-12
Check hold-down operation and torque	24	192	2.5	2	5	4-4
Check Actuator Firing circuitry	24	192	7.5	2	15	7-16
Align pack follower	60	480	10	2	20	4-9
Replace thyratrons	60	480	1	13	13	7-12
Check and adjust reel servos			6	2	12	4-12
Check vacuum switch	124	992	10	2	20	4-10
Replace vacuum tubes Check and adjust reel servos	124	992	.25 6	6 2	3 12	7-13 4-12
Replace vacuum blower motor brushes Check and adjust vacuum	100	800	1 3	1 1	1 3	7-14 4-7
Check capstan drive belt tracking & tension	250	2000	1	1	1	4-2

Table 7-1. Preventive Maintenance Schedule (Continued)

Maintenance Operation	Frequency Approx.			Qty	Total Time (Min.)	Text Paragraph Reference
	Shifts	Hours	Min. Ea.			
Replace capstan rollers Reverse(incl. adj.) Forward(incl. adj.)	60	480				7-15
Replace capstan assemblies Reverse Forward Adjust capstan rollers	250	2000	 30 15 10	 1 1 2	 30 15 20	7-15 4-5
Replace actuators	250	2000	10	2	20	7-15
Replace and adjust capstan drive belt	500	4300				4-2
Replace Chamber Guides Align Guides	250	2000	10 3	4 4	40 12	7-17 4-6
Replace reel motor brushes	250	2000	15	2	30	7-18
Adjust hold down knob torque	250	2000	15	1	15	4-4
Replace positive pressure blower	625	5000	30	1	30	7-19
Replace tape packer assemblies	625	5000	45	2	90	7-20
Replace reel motors	625	5000	30	2	60	7-21
Replace capstan motor	625	5000	20	1	20	7-22
Adjust reel motor brake	625	5000	5	2	10	4-3
Replace vacuum pump	250	2000				7-14

7-6. MAINTENANCE OPERATIONS

7-7. CLEANING THE TAPE TRANSPORT.

CAUTION

Use only the indicated cleaning fluids. Use of solvents such as carbon tetrachloride may dissolve the adhesives used in the head and vacuum chamber assemblies. No alcohol should be allowed to reach the capstan roller bearings.

The read/write head assembly should be cleaned with a lint-free cloth or cotton swab moistened with Ampex Head Cleaner as shown in Figure 7-1. The head stacks and guides should be wiped carefully to remove all traces of oxide and dirt. It is not necessary to remove the head assembly from the transport for cleaning.

CAUTION

Objects extending more than 1/8" into the vacuum chamber sensing slots may cause permanent damage. Use only the Ampex cleaning tool.

The vacuum chambers and loop sensing slots should be cleaned and freed of any oxide accumulation. Primary cleaning of the loop sensing slots is accomplished by inserting the slot cleaning tool into the upper end of each sensing slot and drawing it (once only) to the lower end of the slot. (See Figure 7-2.) The vacuum chambers should then be cleaned with a Kimwipe tissue moistened with alcohol, taking care that the Scotch-Lite anti-static strip does not become saturated with alcohol. Be particularly careful to remove all traces of foreign material from the glass cover doors. The capstan roller assemblies, capstans, and fixed tape guides should be thoroughly cleaned with a Kimwipe or cotton swab moistened with isopropyl alcohol. All traces of dirt etc., should be removed. The inside of the transport access door and the face of the transport casting (especially the ledge under the take-up reel) should be wiped free of all traces of foreign material. The tape packer arm shoes should be carefully cleaned and inspected and any accumulation, especially on the lower reel packer arm shoe, should be

removed with a Kim-wipe tissue moistened with alcohol. Packer arm shoes showing signs of damage or roughness should be replaced.

7-8. DEGAUSSING HEAD ASSEMBLY. Head demagnetization is an extremely important operation, especially demagnetization of the read head. When any element in contact with the tape becomes permanently magnetized, recorded data may be partially erased. Any phenomena tending to place large unbalanced pulses through the write or read head may cause magnetization. The following precautions should be observed:

1) Do not connect or disconnect head leads while writing.
2) Do not test head continuity with an ohmmeter.
3) Do not allow any magnetized object to come into contact with any portion of the transport.

The head may be demagnetized by the following procedure:

Step 1: Remove all tape from the transport.

Step 2: Disconnect all power from the equipment.

Step 3: Plug an Ampex Model 704 Demagnetizer into a source of 117 vac power.

Step 4: Bring the tips of the demagnetizer into close proximity to, but not in contact with, the head (Figure 7-3).

Figure 7-1.
Cleaning Head Assembly

Figure 7-2.
Cleaning Sensing Slots

Step 5: With the tips of the demagnetizer straddling the head gap, run the demagnetizer slowly over the full length of the head.

Step 6: Remove the demagnetizer slowly, allowing the influence of the a-c field to die gradually.

Step 7: Repeat the process for the other head stack.

7-9. CLEANING RACK. The entire rack housing the tape transport and the tape transport itself should be thoroughly cleaned on a regular schedule.

CAUTION

Do not permit any cleaning fluid to come into contact with the capstan bearings or capstan roller bearings. Under no circumstances should the cleaning fluid be allowed to come into contact with the head assembly.

The front of the transport should be carefully wiped with a lint-free cloth moistened with ethyl alcohol.

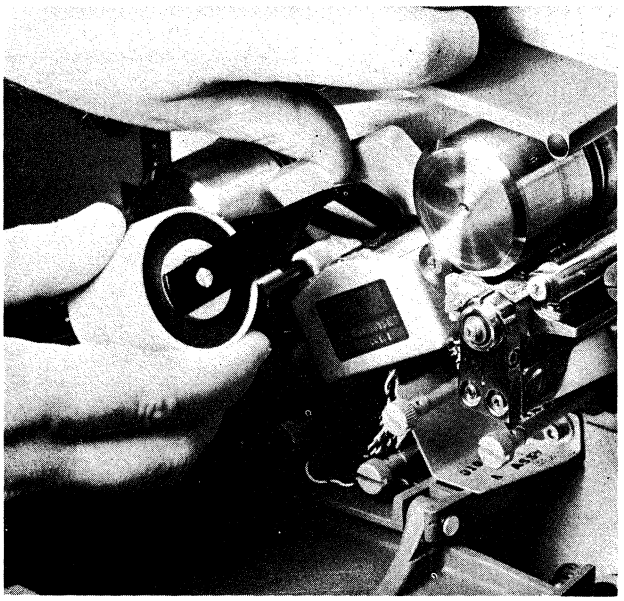


Figure 7-3.
Head Demagnetization

CAUTION

Do not use the vacuum cleaner as a blower or use compressed air to clean the transport.

A vacuum cleaner is useful in reaching otherwise inaccessible dirt on the rear of the transport, inside cabinet racks, etc. The entire rear of the transport and the cabinet housing the transport should be thoroughly cleaned.

7-10. REPLACING AIR FILTERS. The vacuum blower filter, positive

pressure blower filter, and the two filters in the rear door of the rack cabinet should be changed regularly. The vacuum blower filter is replaced by releasing the retainer and pulling the filter straight forward by means of the two loops provided. The new filter is installed by reversing the above process. The positive pressure blower filter is replaced by removing the pan head screw which holds the filter housing in its closed position. The two filters in the rear door of the rack cabinet are replaced by lifting them from their retaining slides. All filters are reusable, and may be cleaned with a vacuum cleaner.

Following this cleaning, the filters should be thoroughly washed in clear water and allowed to dry.

CAUTION

Be certain that any filter cleaned with water is allowed to dry thoroughly before being returned to service. If the filter is not completely dry, moist air may be pumped into the transport and damage the tape and the transport.

7-11. REPLACING TAPE PACKER ARM SHOES. Tape packer arm shoes may be replaced without removing the arm. A single screw holding the shoe to the arm must be removed, the new shoe fitted, and the screw replaced. If the arm must be replaced, follow the steps in paragraph 7-20 which refer to the packer arm.

7-12. REPLACING THYRATRONS. The four thyratrons on the actuator control unit AC-400, the eight thyratrons on the servo motor power supply PS-200, and the thyratron in the electronics power supply PS-100 should be replaced after each 480 hours operating time. Following replacement, the servos should be checked and adjusted as detailed in paragraph 4-12; the actuators should be checked and adjusted as detailed in paragraph 4-5 .

7-13. REPLACING VACUUM TUBES. The vacuum tubes on the oscillator (OSC-700) and servo amplifier (SA-500) printed circuit boards should be replaced each 992 hours operating time. Following the replacement, the servos should be completely adjusted as detailed in paragraph 4-12 .

7-14. VACUUM UNIT MOTOR, FILTER AND BRUSHES REMOVAL AND REPLACEMENT. See Figure 7-4 where the following steps are referenced:

CAUTION

Filter must be thoroughly dry before installation or damage to equipment may result.

Step 1: Unlatch lever arm which holds filter in motor housing assembly.

Step 2: Remove filter using the two loops attached.

Step 3: Reassemble filter by reversing Steps 1 and 2.

NOTE

Steps 4 through 9 shall be used for the removal and replacement of the vacuum unit motor.

Step 4: Disconnect power cable at vacuum unit motor assembly.

Step 5: Unsnap latches on motor housing assembly and remove this assembly from mounting bracket.

NOTE

If spare vacuum unit is available, replace old unit with spare at this point and continue maintenance procedure without affecting transport downtime.

Step 6: Loosen screws attaching vacuum unit motor to motor housing.

Step 7: Rotate vacuum unit motor until attaching hardware is clear of slotted bracket.

Step 8: Remove vacuum unit motor from motor housing assembly just far enough to take up slack in wires of chassis connector plug.

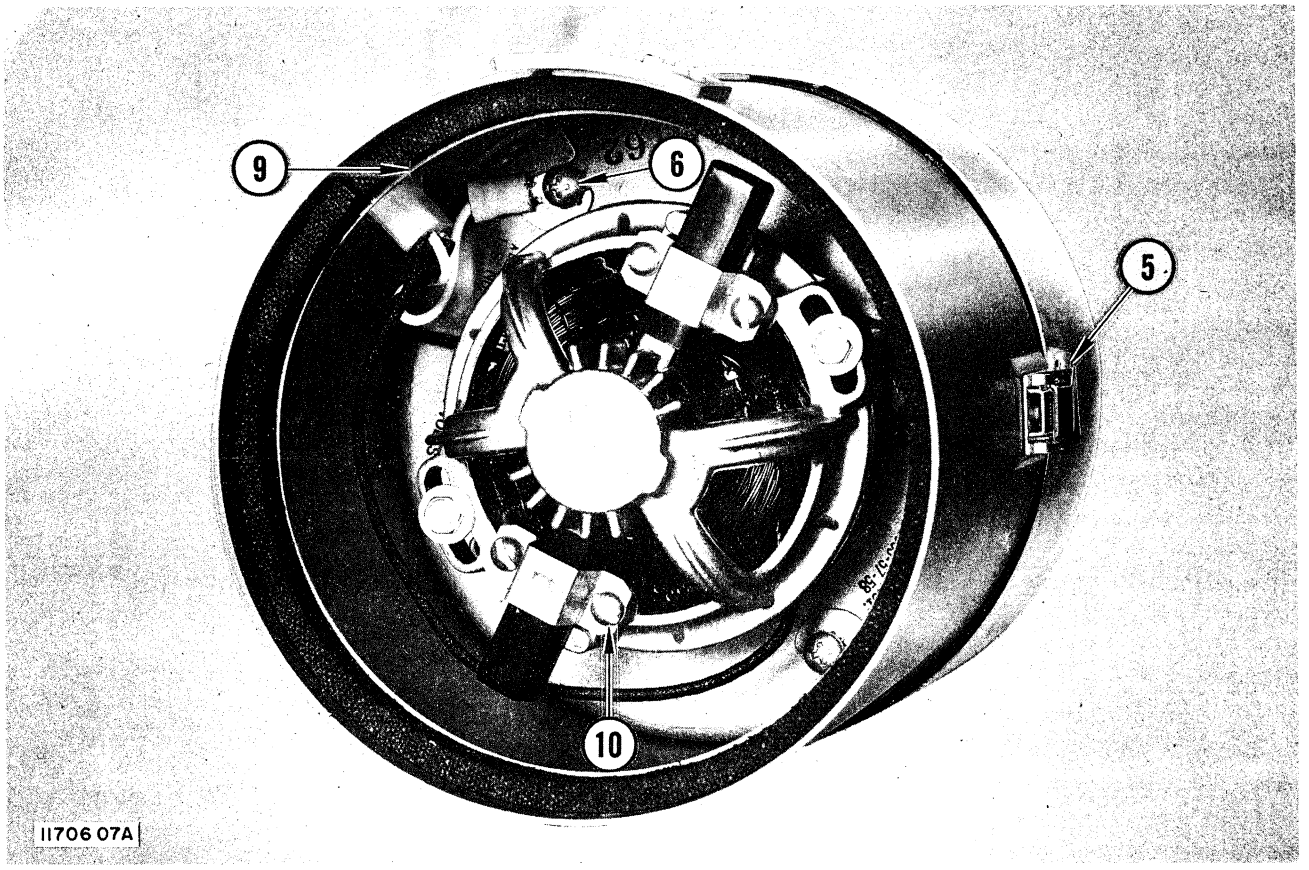


Figure 7-4a
Vacuum Unit Motor and Brushes, Removal and Replacement

Step 9: Squeeze nylon clips together and remove chassis connector plug from motor housing assembly.

NOTE

Steps 10 through 13 shall be used for removal and replacement of vacuum unit motor brushes.

Step 10: Remove attaching hardware holding brush holder to motor frame.

Step 11: (See fig. 7-4b.) Holding brush housing between thumb and forefinger, with the aid of a small screwdriver, prise out the tab, using the thumb as a fulcrum. (The plastic brush housing should not be used as a leverage point). As the stator winding wire is directly welded to the tab, care should be taken to neither damage the windings nor to break the wire at the tab.

Step 12: Insert tab into new brush housing and reassemble to motor frame.

Step 13: Repeat Steps 10 through 12 for second brush.

Step 14: Reassemble vacuum unit by reversing Steps 1 through 9.

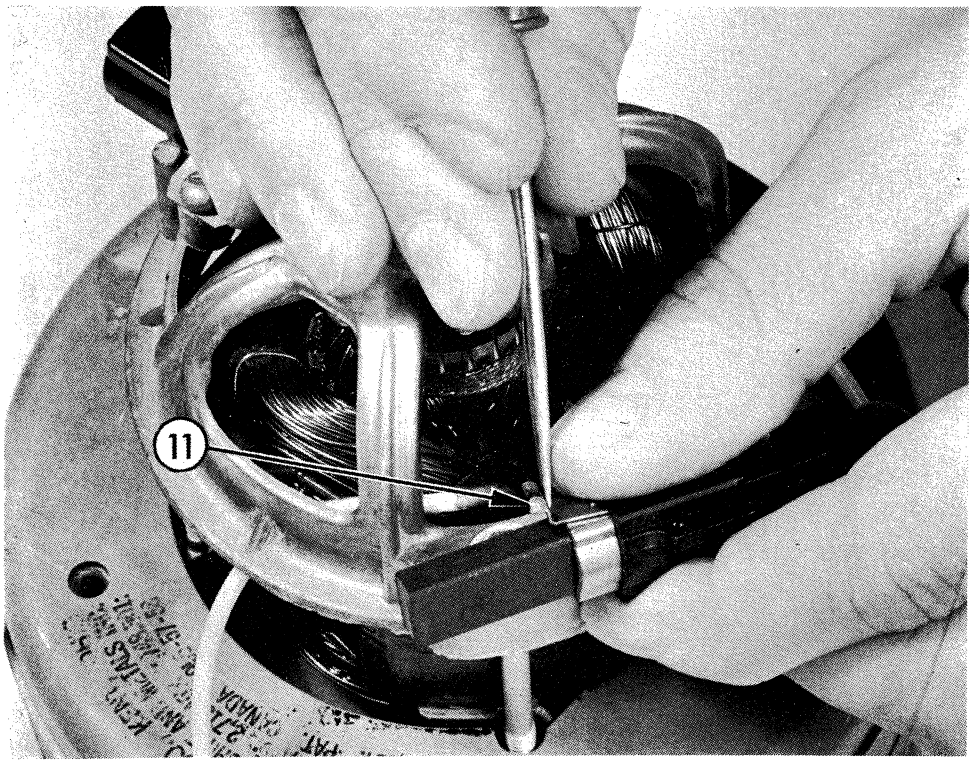


Figure 7-4b
Vacuum Unit Motor and Brushes, Removal and Replacement

7-20. REPLACING THE TAPE PACKER SWITCH ASSEMBLIES. Upper and lower assemblies are not interchangeable. For correct replacement part number refer to section IX of this manual. The following procedure describes the removal and replacement of the upper switch assembly.

Step 1: Use an Allen wrench to loosen the screw clamping the packer arm to its shaft and remove the arm.

Step 2: Remove the screw that couples the switch assembly to the tape clamp linkage.

Step 3: Disconnect the wiring harness from the switch.

Step 4: Remove the hold-down nut and lock washer from the switch assembly. These are located on the front of the transport.

Step 5: Remove the assembly by pushing the shaft through the transport casting from the front.

Step 6: Install the new switch assembly by reversing Steps 2 through 5. Do not tighten the hold-down nut.

Step 7: Adjust according to specification.

The lower packer arm switch assembly should be replaced as follows:

Step 1: Remove the capstan drive belt.

Step 2: Remove the forward capstan flywheel by loosening the two set screws which mount it to its shaft.

Step 3: Remove the two servo control assemblies by removing the fanning strips, the two screws securing each assembly to the transport, and the tubing to the vacuum chambers.

Step 4: Use an Allen wrench to loosen the screw clamping the packer arm to its shaft and remove the arm.

Step 5: Disconnect the wiring harness from the switch.

Step 6: Remove the hold-down nut and lock washer from the switch assembly, located on the front of the transport.

Step 7: Remove the assembly by pushing the shaft through the transport casting from the front.

Step 8: Adjust according to specification.

7-21. REPLACING REEL MOTORS. The replacement procedure for the reel motors is as follows:

Step 1: Snap the hub cap from the lower (fixed) reel assembly. Using an Allen wrench, remove the screws which hold the precision reel assembly to the turntable.

Step 2: Disassemble the upper hold-down knob assembly. Remove the base of the hold-down assembly from the turntable.

Step 3: Disconnect the fanning strips by which the reel motors are connected to the transport cabling.

Step 4: Remove the four nuts which hold each reel motor to its mounting studs on the transport frame.

Step 5: Install the new reel motors.

Step 6: Install the upper hold-down knob. Using a dial indicator, adjust the position of the hold-down for minimum eccentricity.

Step 7: Install the fixed lower reel assembly. Using a dial indicator, adjust the position of the assembly for minimum eccentricity.

Step 8: Connect the fanning strips from the reel motors to the appropriate terminal strips.

NOTE

If misalignment of the reel motors or turntables is evidenced by curling of the edges of the tape, etc., the offending motor or turntable must be shimmed from the transport frame until proper tape tracking is achieved.

7-22. REPLACING CAPSTAN DRIVE MOTOR. The capstan drive motor is replaced by the following procedure:

Step 1: Remove the capstan drive belt.

Step 2: Disconnect the fanning strip with which the capstan drive motor assembly is connected to the transport.

Step 3: Remove the three socket head cap screws which attach the capstan drive motor assembly to the transport standoffs; remove the assembly.

Step 4: Remove the capstan drive pulley from the drive motor by loosening the two screws which fasten it to the motor shaft.

Step 5: Remove the four cap screws which hold the capstan motor to the base plate.

Step 6: Unsolder the motor leads. Remove the capstan drive motor from the base plate.

Step 7: Install the new capstan drive motor by reversing the order of Steps 1 through 5.

7-23. REPLACING REEL BRAKES.

Step 1: Remove the reel motor (see paragraph 7-21).

Step 2: Remove the brake tension adjustment nut (see Figure 4-4).

Step 3: Disconnect the brake solenoid cable from TB703 or TB706.

Step 4: Use a Phillips screwdriver to remove the solenoid mounting screws.

Step 5: Remove the brake assembly complete.

Step 6: If required, disassemble the brake linkage by removing the cotter pin, clevis pin, and roll pin from the linkage.

Step 7: Install the brake assembly by reversing Steps 1 through 6 above.

Step 8: Adjust according to paragraph 4-3 .

7-24. REPLACING VACUUM CHAMBERS. To replace the left vacuum chamber the capstan motor assembly must be removed; otherwise the procedure is the same for left and right chambers.

Step 1: Adjust the vacuum chamber height adjusting screw under the vacuum chamber to just contact the chamber assembly. Tighten the lock nut on the height-adjusting screw.

Step 2: (Left vacuum chamber only.) Remove the capstan drive belt.

Step 3: (Left vacuum chamber only.) Disconnect the harness from the capstan motor assembly fanning strip.

Step 4: (Left vacuum chamber only.) Remove the three socket head cap screws securing the capstan motor assembly to the transport standoffs and remove the assembly.

Step 5: Loosen the tubing clamp screws securing the hard plastic vacuum tubing to the transport. This tubing runs vertically between the upper and lower vacuum chamber ports.

Step 6: Disconnect the flexible plastic tubing from the long loop, short loop, and transducer connections on the vacuum chamber.

Step 7: Use a long Allen wrench to remove the three socket head cap screws securing the vacuum chamber to the precision plate (move the vacuum tubing as required to gain access to the screws); remove the vacuum chamber.

Step 8: Check the sealing tape on the rear of the vacuum chamber for air bubbles and poor adhesion before installing the chamber.

Step 9: Position the vacuum chamber, making sure that it is resting on the height-adjusting screw, clearing the radius of the casting flange, and is parallel to the vertical flange of the transport.

Step 10: Remove all old adhesive and gasket material from chamber and casting surfaces.

Step 11: Hold chamber in position, check the gap between chamber and casting at the vacuum parts. If less than .093 in cut a counterbore in the casting to the required depth, using recessing Tool (Ampex Part No.) metal particles do not enter the transport mechanism.

Step 12: Brush the new surface with a chemical conversion agent (I.C.I. Alocrom.) Allow to dry.

Step 13: Fit an expansion cord (made from string or wire) to the new gasket (Fig. 7-5.)

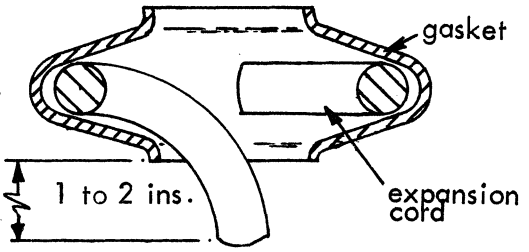
Step 14: Apply adhesive to, both mounting faces of the gasket, the casting and chamber. Allow to dry for at least 10 min.

Step 15: Fit gasket to the casting with the tail of the cord facing forward. Press firmly in position.

Step 16: Position vacuum chamber on the height adjusting screw so that it clears the radius of the casting flange and is parallel to the vertical flange of the transport.

Step 17: Press the chamber firmly against the gasket faces, ensuring contact is made between the two parts of the whole of the gasket diameter. The tail of the expansion card should enter the chamber.

Step 18: Extract the expansion cord by pulling it through the vacuum port.



Vacuum Gasket.
fig .7-5

Step 19: Reverse Steps 2 through 6 taking care that when the three mounting screws are tightened the rear of the chamber is only in contact with the precision plate, as any other contact with the transport may distort the chamber.

7-25. REPLACING READ/WRITE HEAD ASSEMBLY.

Step 1: Use an Allen wrench to loosen the long screws securing the read and write cable connectors.

Step 2: Unplug the read and write cable connectors.

Step 3: Use an Allen wrench to remove the recessed screws securing the head assembly to the precision plate.

Step 4: Pull the head assembly forward to expose the vacuum tubing attached to the rear of the tape cleaner (if used).

Step 5: Remove the plastic vacuum tubing from the head assembly (if used).

Step 6: To install head assembly reverse Steps 1 through 5 above.

7-26. REPLACING PHOTOSENSE HEAD. No attempt should be made to replace components inside the head assembly. In the event of failure a new photosense head kit should be installed as follows:

Step 1: Disconnect the photosense cable connector located at the rear of the transport behind the photosense head.

Step 2: Using an Allen wrench, remove the two screws securing the photosense head to the vacuum chamber. Remove the photosense head.

Step 3: Remove the vacuum chamber (refer to paragraph 7-24).

Step 4: Pull the photosense cable connector through the hole in the precision plate.

Step 5: To install a new photosense head, solder the new photosense cable connector (provided in the kit) to the connecting cable attached to the head. Reverse Steps 1 through 4. The face at the head must be parallel to and approximately 3/16-inch from the tape.

7-27. REPLACING PHOTOSENSE ELECTRONICS UNIT.

Step 1: Remove the two screws on the cover.

Step 2: Remove the cover.

Step 3: Disconnect the harness from the terminal strips.

Step 4: Use a long Phillips screwdriver, remove the two screws securing the chassis assembly to the transport casting and remove the assembly.

Step 5: To install the photosense unit, position the chassis assembly on the casting and reverse Steps 1 through 4.

7-28. PHOTOSENSE KIT INSTALLATION. To install a photosense unit on a tape transport not factory equipped for photosensing follow the installation procedures in paragraphs 7-26 and 7-27.

7-29. REPLACING CAPSTAN QUAD RING. To replace the capstan quad ring complete the following steps:

Step 1: Remove the socket head cap screw from the brake post adjacent to the capstan whose quad ring is to be replaced. Remove the brake post.

Step 2: Loosen the two socket head cap screws (A, Figure 4-5.) which clamp the capstan roller yoke to the actuator shaft.

Step 3: Rotate the yoke clockwise until the clearance between the capstan roller and the capstan is enough to allow the quad ring to be removed.

Step 4: Lift the quad ring out of its groove and slide it over the front of the capstan. If the ring may be removed without interference, proceed to Step 6. If the head guide is too close to the capstan to allow the quad ring to pass through, continue with Step 5.

Step 5: Remove the socket head cap screw which secures the left side of the head assembly to the precision plate.

Step 6: Loosen the screw on the right-hand side of the head assembly.

Step 7: Drop the left side of the head assembly enough to let the quad ring pass over the capstan.

Step 8: Place a new quad ring over the end of the capstan, making sure that the inside of the ring is against the capstan. Carefully slide the ring over the capstan to the groove, keeping the inside of the ring constantly in contact with the capstan.

NOTE

If the quad ring is rolled or twisted, it may fall into the groove with the inside of the ring away from the capstan. This may cause excessive wear on the quad ring.

Step 9: Reverse Steps 1 through 7.

Step 10: Adjust the capstan roller gap and brake gap as described in paragraph 4-5.

7-30. REPLACING ELAPSED TIME METER. To remove the elapsed time meter, disconnect the meter leads from TB710 on the mounting plate to which the meter is attached. Remove the retaining clip which fasten the meter to the plate and remove the meter.

7-31. REPLACING SERVO OSCILLATOR ASSEMBLY. In general, the only part of the servo oscillator assembly which may need replacing is the plug-in servo oscillator card. Remove the two fasteners which secure the servo oscillator cover plate to the chassis and pull out the servo oscillator card. If it should be necessary to remove the servo oscillator chassis, remove the two screws which secure the chassis to the transport and unsolder the leads to the P.C. connector.

7-32. REPLACING HEAD CABLE AND BOX ASSEMBLY. In order to remove the head cable and box assembly, the capstan flywheel and belt idler pulley must first be removed. The following procedure should be used:

Step 1: From the front of the transport, loosen the long screws securing the read and write head connectors.

Step 2: Disconnect the read and write head connectors from the receptacles on the head cable and box assembly.

Step 3: Remove the capstan flywheel by loosening the two Allen head set screws which mount the flywheel to its shaft.

Step 4: Detach the spring on the drive belt idler arm from the eye bolt.

Step 5: Remove the nut which secures the idler arm to the stud. Remove the idler arm.

Step 6: From the front of the transport remove the two socket head cap screws which secure the head cable and box assembly to the precision plate. (One screw is directly below the head assembly. The other is below the read head connector and holds the shield.)

Step 7: Remove the head cable and box assembly.

CAUTION

When positioning the capstan flywheel be sure that the set screws do not touch the capstan housing and that the flywheel clears the belt idler pulley.

Step 8: Install the head cable and box assembly by reversing Steps 1 through 7 above. Position the capstan flywheel for proper drive belt tracking and for clearance of all surfaces.

NOTE

When replacing the drive belt idler arm, tighten the nut enough to prevent end play but be sure that the arm is free to rotate.

7-33. REPLACING TRANSDUCERS AND LOOP WARNING SWITCHES. The servo control mounting plate must be removed in order to replace either a transducer or a loop warning switch. Therefore one procedure is given for replacement of both of these assemblies. To replace the upper transducer or loop warning switch, the capstan flywheel must first be removed. Otherwise the procedure is the same for the upper and lower servo control assemblies.

Step 1: (Upper servo control) Remove the capstan flywheel by loosening the two Allen head setscrews which mount the flywheel to its shaft.

Step 2: Disconnect the transducer fanning strip from TB701 (upper servo) or TB702 (lower servo).

Step 3: Remove the transducer cable clamp.

Step 4: Disconnect the tubing from the loop warning switch.

Step 5: Remove the two screws which secure the servo control mounting plate to the transport frame.

Step 6: Pull the mounting plate away from the transport and turn it so that the side of the plate facing the transport is accessible.

Step 7: From the transport side of the mounting plate, disconnect the leads and tubing from the transducer and the loop warning switch.

Step 8: Remove the two screws which secure the transducer to the mounting plate. Remove the transducer.

Step 9: Return the mounting plate to its original position and remove the nut which secures the loop warning switch to the plate. Remove the loop warning switch.

Step 10: To install the transducer and loop warning switch, reverse Steps 1 through 9.

7-34. REPLACING VACUUM PIPING. To replace the vacuum piping, complete the following steps:

Step 1: Remove the capstan drive motor assembly, as described in paragraph 7-22.

Step 2: On each side of the transport remove the two tube clips which hold the vacuum piping.

Step 3: Disconnect the piping from the vacuum motor.

Step 4: Pull the piping from the vacuum chamber openings and remove the piping.

Step 5: To install the vacuum piping, reverse Steps 2 through 5. Be sure that all the seals are tight.

NOTE: Wherever piping is removed, renew gasket at rear of casting.

7-35. TROUBLESHOOTING CHART.

Table 7-2. Troubleshooting Chart

SYMPTOM	POSSIBLE CAUSE	REMEDY
Parity and Bit Errors	Dirty Head	Clean Head Assembly. Paragraph 7-7.
	Edge of tape damaged	Check tape for curled edge, etc. If tape damage is found, check transport guiding with fresh roll of tape.
	Buffer guides misaligned	Align buffer guides. Paragraph 4-6-2.
	Rotary guides misaligned	Align rotary guides. Paragraph 4-6-2.
Poor Tape Pack	Insufficient tape packer tension	Replace tape packer assembly. Paragraph 7-20.
	Roughness on inside of reel flanges	Replace reel.
	Turntable out of line	Check alignment of hold-down or reel assembly.
	Reel motor worn out	Check reel motor for end play. Not more than .005" end play permissible. Replace motor if necessary. Paragraph 7-21.

Table 7-2. Troubleshooting Chart (Continued)

SYMPTOM	POSSIBLE CAUSE	REMEDY
Poor Tape Pack (Con't.)	Vacuum level improperly set	Adjust vacuum level. Paragraph 4-7 .
	Tape too loose on reel	Replace tape packer assembly. Paragraph 7-20.
Oxide accumulation in vacuum chambers	Foreign material in chambers	Clean chambers. Paragraph 7-7.
	Roughness or warpage in tape path	Check cleanliness and alignment of all elements in tape path.
	Buffer guides misaligned	Align buffer guides. Paragraph 4-6-2 .
	Rotary guides misaligned	Align rotary guides. Paragraph 4-6-2.
	Defective tape	Replace tape.
Improper loop size in vacuum chamber	Transducer misadjusted	Adjust transducer. Paragraph 4-12 .
	Sensing slot dirty	Clean sensing slot. Paragraph 7-7.
	Faulty tape	Check tape width (reels occasionally too wide or too narrow).
	Faulty transducer	Check transducer output at long and short loop and null conditions.
	Restriction in line between chamber and transducer	Check vacuum at transducer input--should be 14" to 15" of water at short loop, 5" of water at null, 0 at long loop.
Tape loops off center in chamber	Chamber out of adjustment	Adjust position of chamber on transport.
	Foreign material in chamber	Clean chamber. Paragraph 7-7.

Table 7-2. Troubleshooting Chart (Continued)

SYMPTOM	POSSIBLE CAUSE	REMEDY
	Stretched section of tape	Replace tape.
	Leaky vacuum inlet	Replace or adjust vacuum piping.
Oscillation of tape in chamber	Faulty transducer	Replace transducer Paragraph 7-33.
	Dragging reel brake	Check reel brake adjustment. Paragraph 4-3.
	Obstruction in chamber	Check for oxide buildup next to guide at chamber wall.
	Defective tape	Replace tape.
Steady oscillation of tape in chamber	Servo amplifier board loose in connector	Seat servo amplifier board firmly in connector.
	Servo gain too high	Adjust servo gain. Paragraph 4-12.
Servo inoperation	Severe misadjustment	Adjust servo. Paragraph 4-12.
	Faulty transducer	Replace transducer. Paragraph 7-33.
	Oscillator failure	Check oscillator output.
	Faulty tube in servo amplifier	Check servo amplifier tubes.
	Faulty thyratrons in servo motor supply	Check thyratrons in servo motor supply, interchanging to isolate faulty unit.

Table 7-2. Troubleshooting Chart (Continued)

SYMPTOM	POSSIBLE CAUSE	REMEDY
Servo operation poor	Dirty sensing slot	Clean sensing slot. Paragraph 7-7.
	Faulty thyratrons in servo motor supply	Interchange thyratrons to isolate faulty unit.
	Transducer out of balance	Check transducer balance at null position.
	Faulty tape	Replace tape.
	Tape path obstructed	Check for oxide buildup in tape path.
	Faulty bias in PS200	Replace bias board.
	Dragging reel brake	Check reel brake adjustment. Paragraph 4-3 .
	Defective reel motor	Replace reel motor. Paragraph 7-21.
	Faulty tubes in servo amplifier	Check servo amplifier tubes.
	Low vacuum in chambers	Check vacuum pump and check for leaks in chamber.
Reel motor "jitter"	Servo gain too high	Adjust servo gain. Paragraph 4-12.
	Varying thyratron bias in PS-200	Check stability of thyratron bias.
	Faulty tubes in servo amplifier	Check tubes in servo amplifier.
	Varying vacuum in chamber	Replace vacuum blower. Paragraph 7-14.

Table 7-2. Troubleshooting Chart (Continued)

SYMPTOM	POSSIBLE CAUSE	REMEDY
Inoperative actuator	Faulty thyratron V104 in PS-100	Replace V104.
	R110 on PS-100 open	Replace R110.
	C109 on PS-100 shorted	Replace C109.
	Insufficient actuator command signal	Check input command level.
	Faulty diode in high-voltage bridge, PS-100	Replace any faulty diodes.
	Faulty actuator	Replace actuator. Paragraph 7-15.
Actuator failure at high repetition rates (2.5 ms OFF 4.0 ON)	Faulty V104 in PS-100	Replace V104.
	Weak actuator	Replace actuator. Paragraph 7-15.

7-36. MAINTENANCE TOOLS.

7-37. The following list indicates the general nature of tools required to maintain the TM-2. Manufacturers' names and numbers are indicated only as a guide; any equivalent tool may be used.

Tool	Manufacturer and Number
Allen, wrench set, handled, .035" through 1/8"	Allen #6075
Center punch, 5/16" x 4"	Hargrove #284-5/16
Plastic hammer	Stanley #593

Ball peen hammer	Stanley #306B
Socket, 12 pt, 3/8" drive	Williams #B-1218
1/4" to 3/8" drive adaptor	Proto #5256
1/4" extension drive 14" long	Proto #4763
"T" handle, 1/4" drive	Proto #4785
Scale, 6", steel	Starrett #384
Soldering aid	Walsco #2530
Scribe	Starrett #70A
Screw starter screwdriver	Pearson #3
Scissors, 2-1/2" blade	Wiss #173E
Open end wrench set, 15° and 75°, 3/16" through 5/8"	Williams #1142PR
Spring balance, 8 oz. capacity	
Standard screwdriver set	Snap-On #SD-130-K
Stub screwdriver, small	Xcelite #R-184
Stub screwdriver, medium	Xcelite #R-3164
Stub screwdriver, large	Xcelite #R-5166
Phillips screwdriver set	Proto #9600A
Torque wrench, 0-50 in-lb.	Apco Mossberg #B50
Offset ratchet driver, Allen & Phillips	Yankee #3600-9
Pliers, extractor, external, black	Truarc #2
Pliers, extractor, internal, black	Truarc #3
Pliers, extractor, external, black, large	Truarc #4
Pliers, extractor, external, black	Truarc #015
Wrench, adjustable, 6"	Crescent #AT16
Thickness, gauge	Starrett #66
Drift punch, 1/8"	Hargrove #2868
Drift punch, 3/32"	Hargrove #2866
Drift punch, 1/16"	Hargrove #2864
Pliers, diagonal cutter	Klein #202-5
Pliers, long nose	Klein #303-6
Pliers, needle nose	Utica #777-6
Nutdriver roll	Xcelite #99SM
Nutdriver, #18	Xcelite #HS-18
File, 6" smooth cut	
File, 4" round, second cut	
Tape, steel, 8'	Lufkin #688
Inspection mirror	G.C. #5090
Wire stripper	Miller #100
Pliers, 7½"	Proto #242
Tube puller	G.C. #9130

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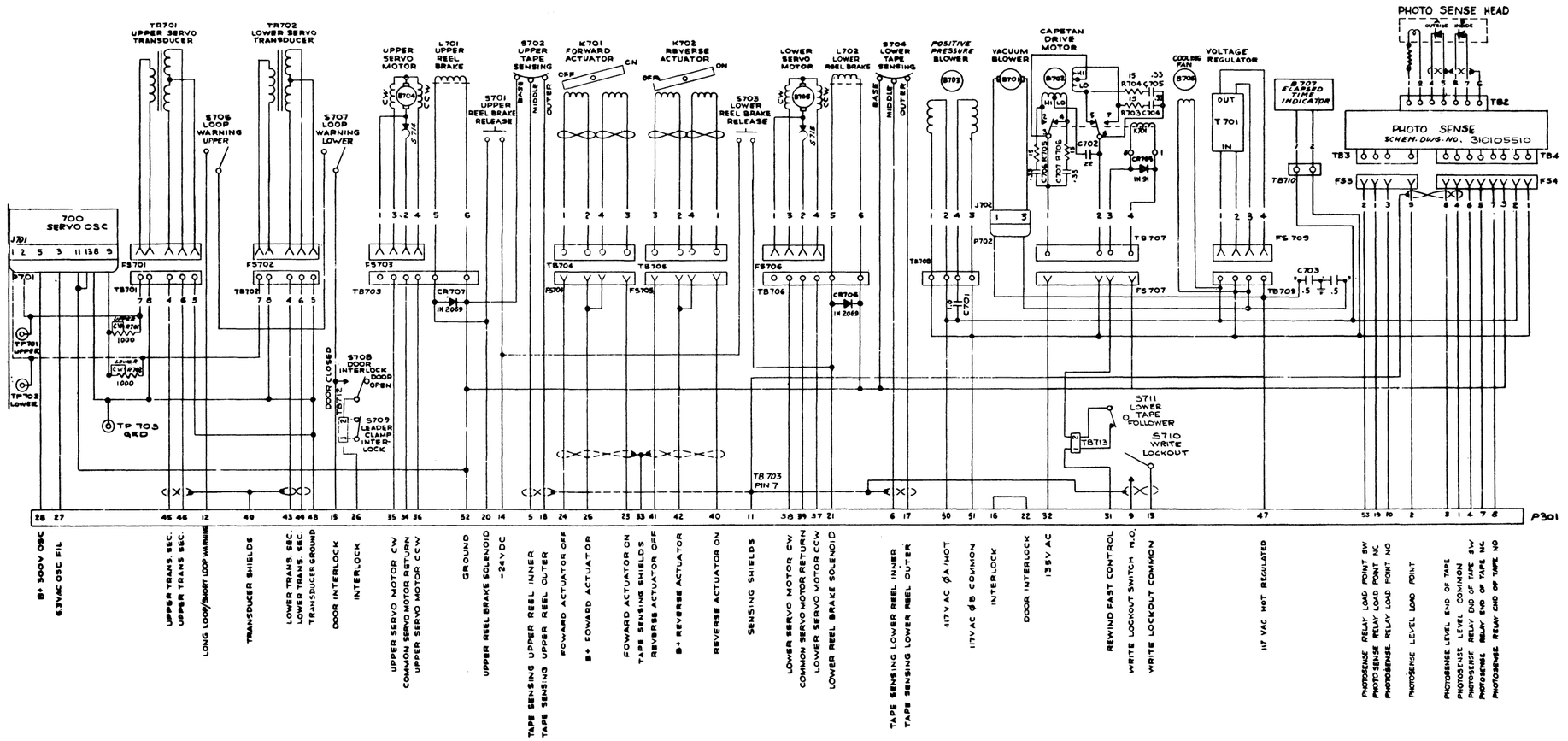


Figure 8-1
Schematic Diagram, Tape Transport
(3101098D)

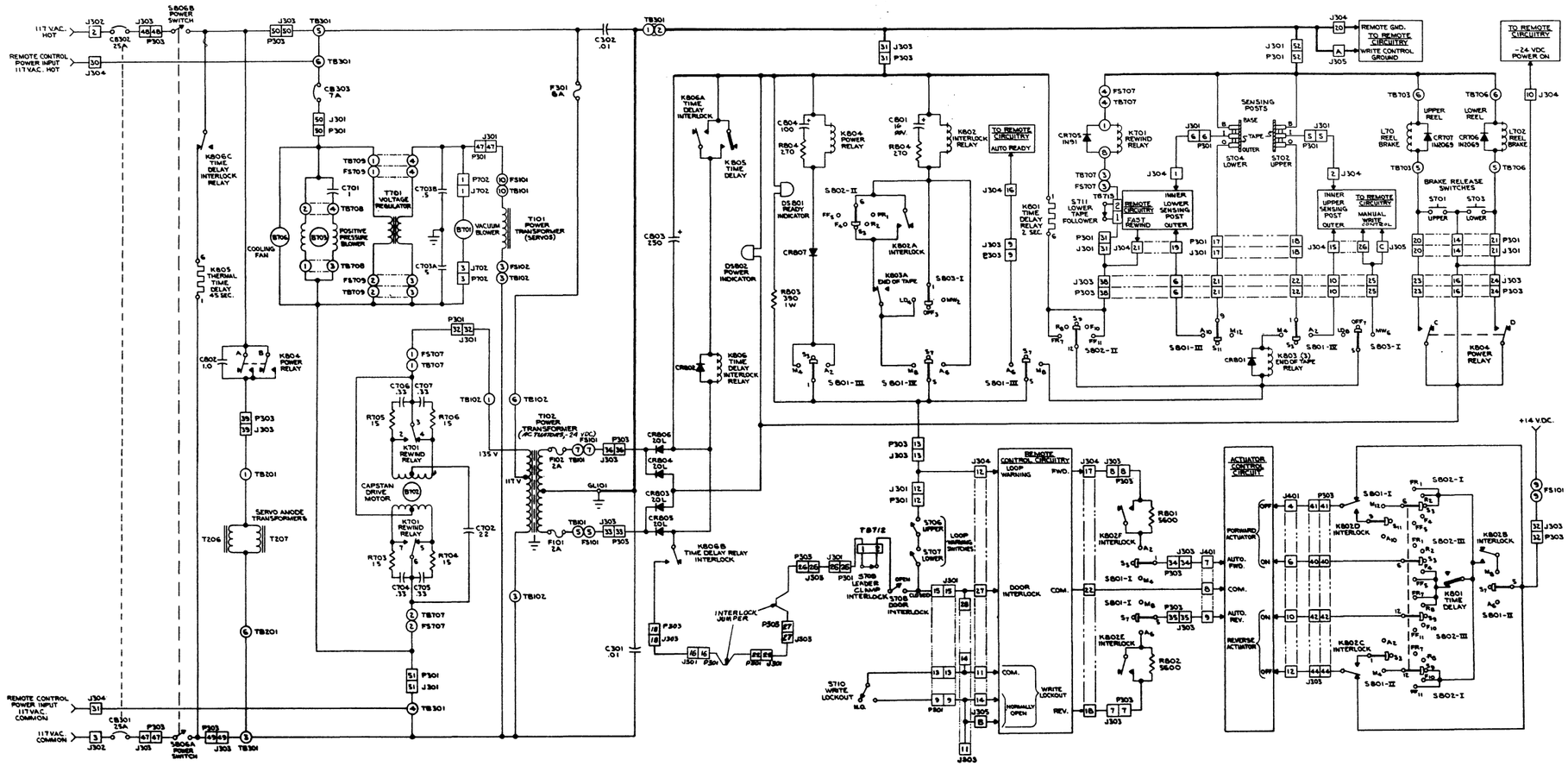


Figure 8-2
Schematic Diagram, Composite Control System
(3101003C)

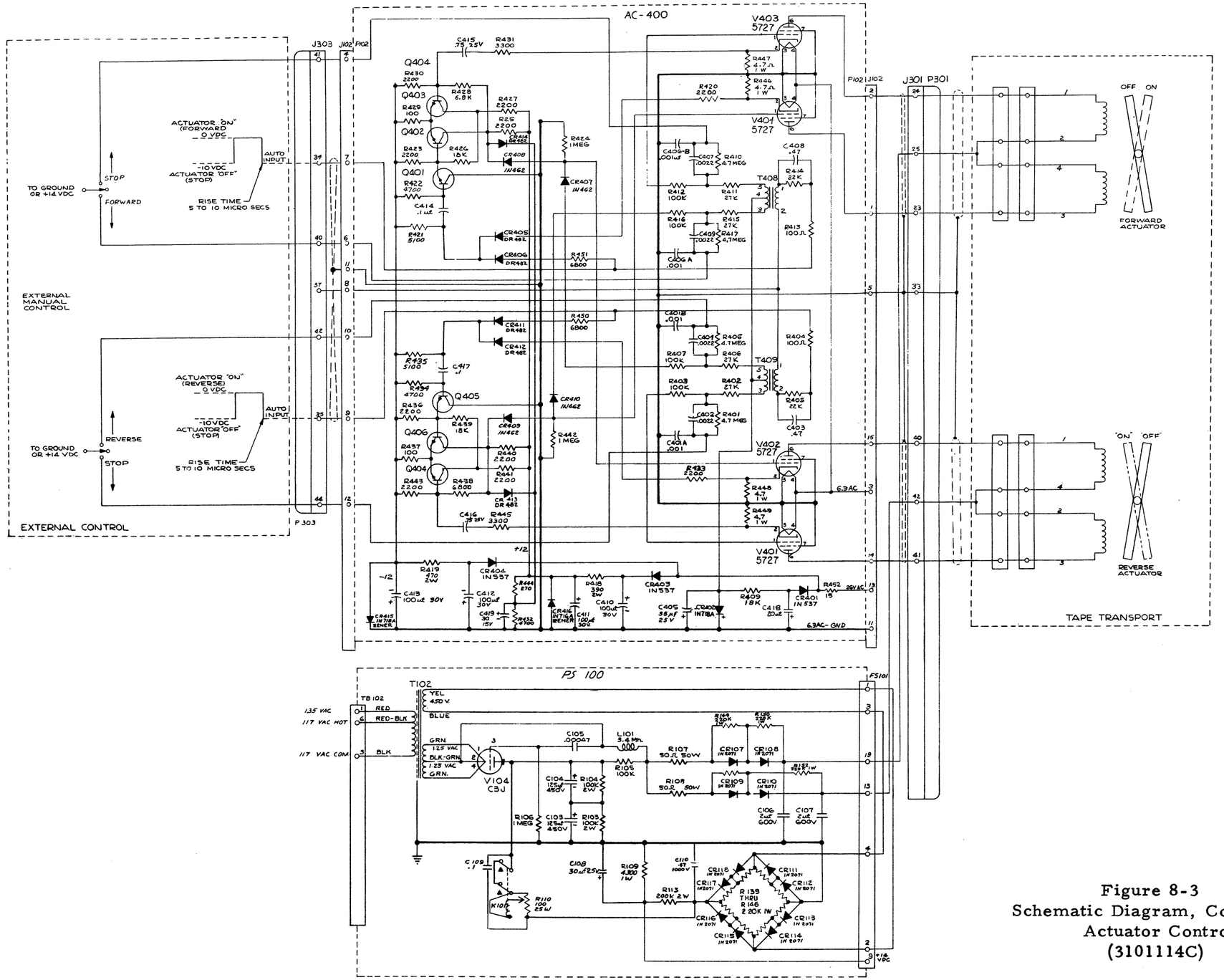


Figure 8-3
Schematic Diagram, Composite Actuator Control (3101114C)

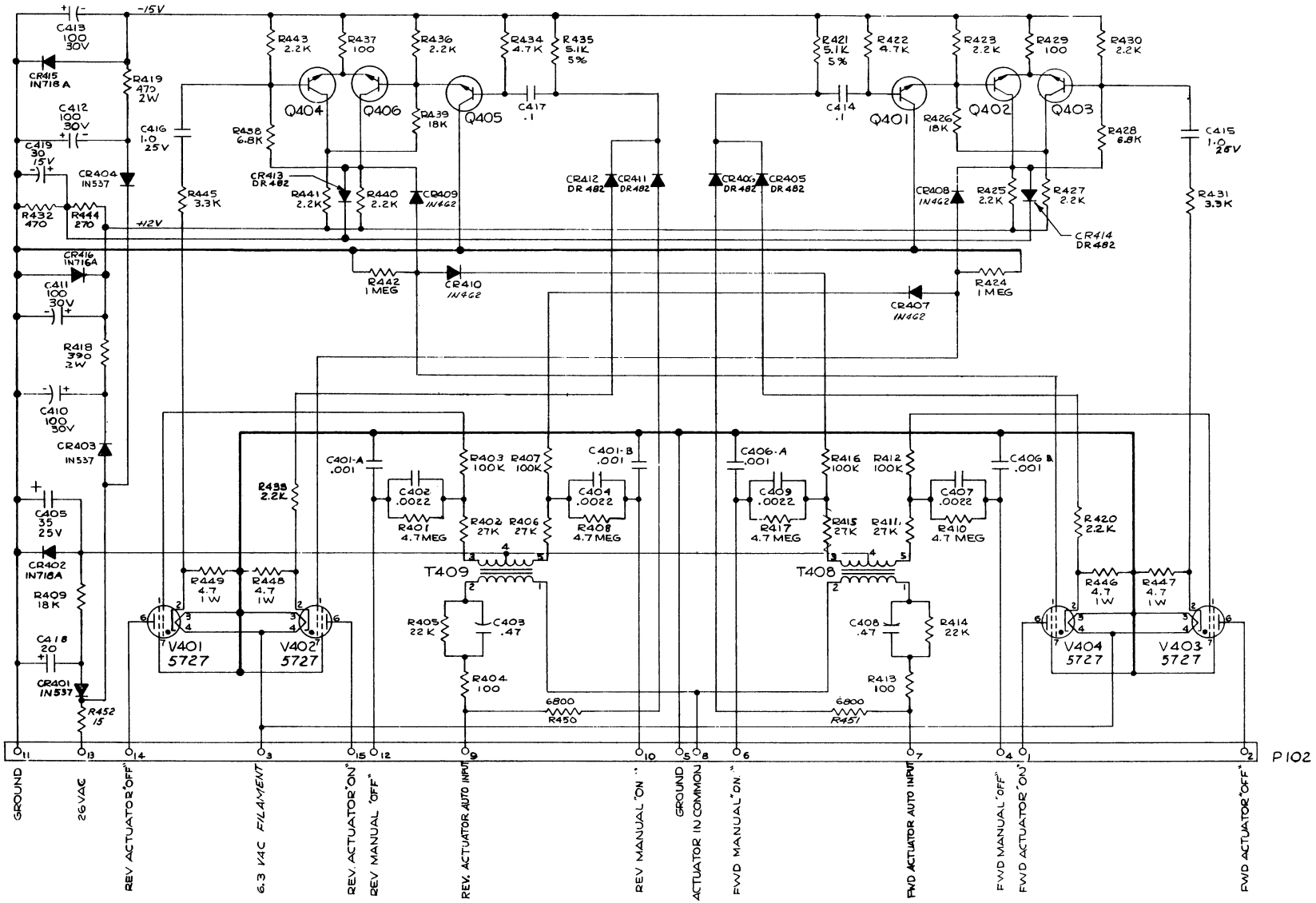


Figure 8-4
Schematic Diagram, Actuator Control
Unit AC-400 (3101347C)

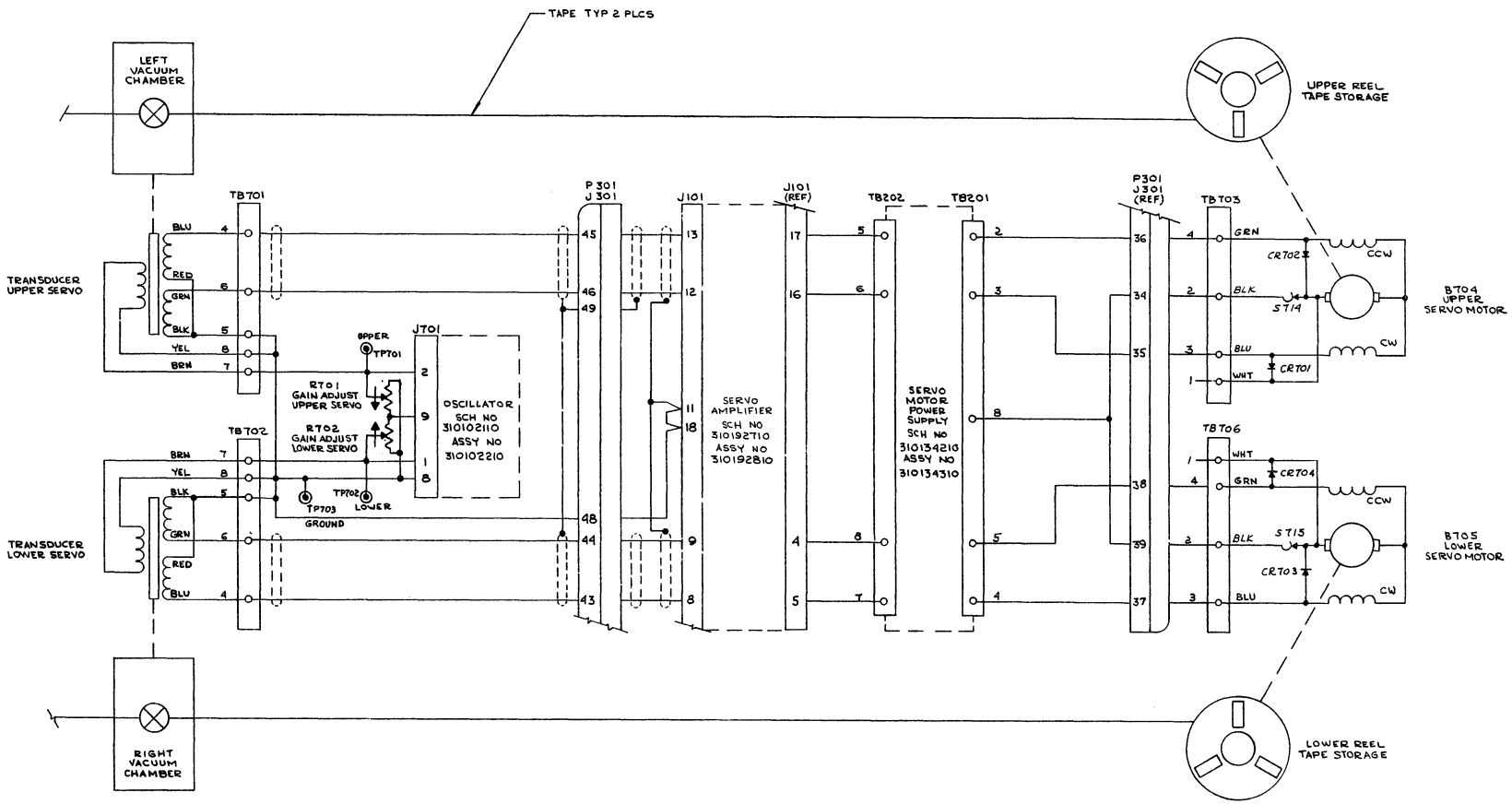


Figure 8-5
Schematic Diagram, Composite
Servo System (3102084C)

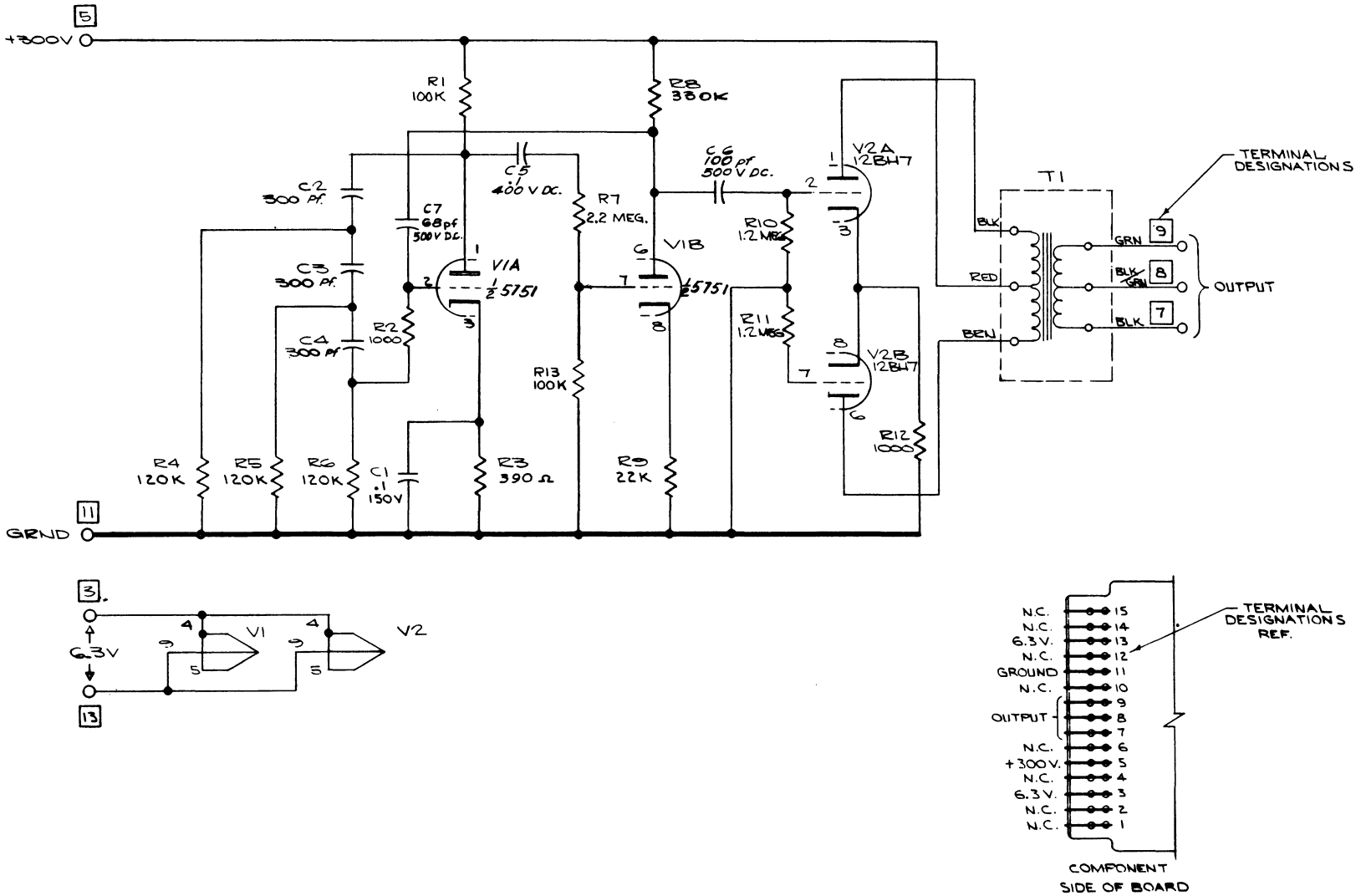


Figure 8-6
Schematic Diagram, Servo Oscillator
OSC-700 (3101021B)

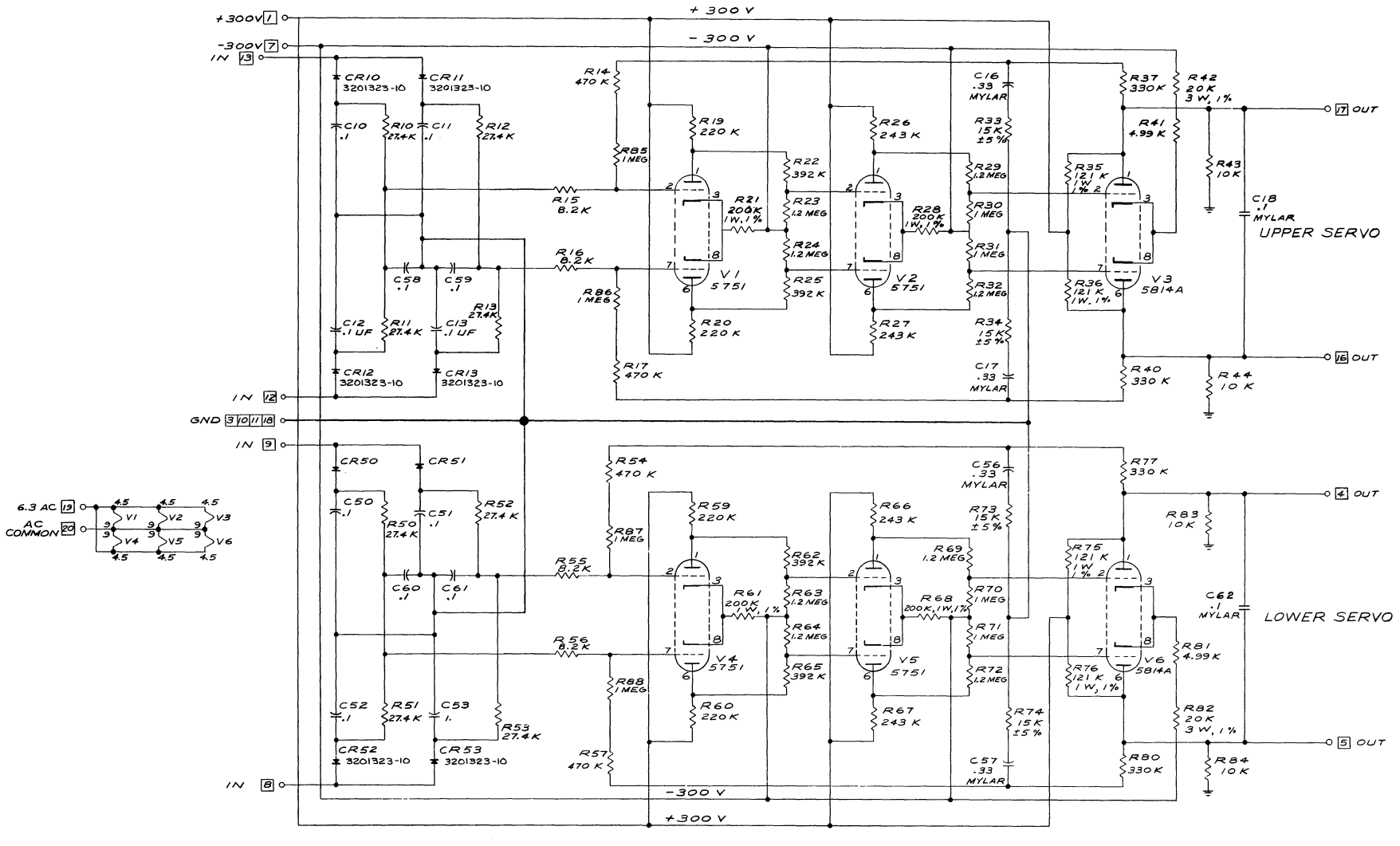


Figure 8-7
Schematic Diagram, Servo Amplifier
S. A-500 (3101927C)

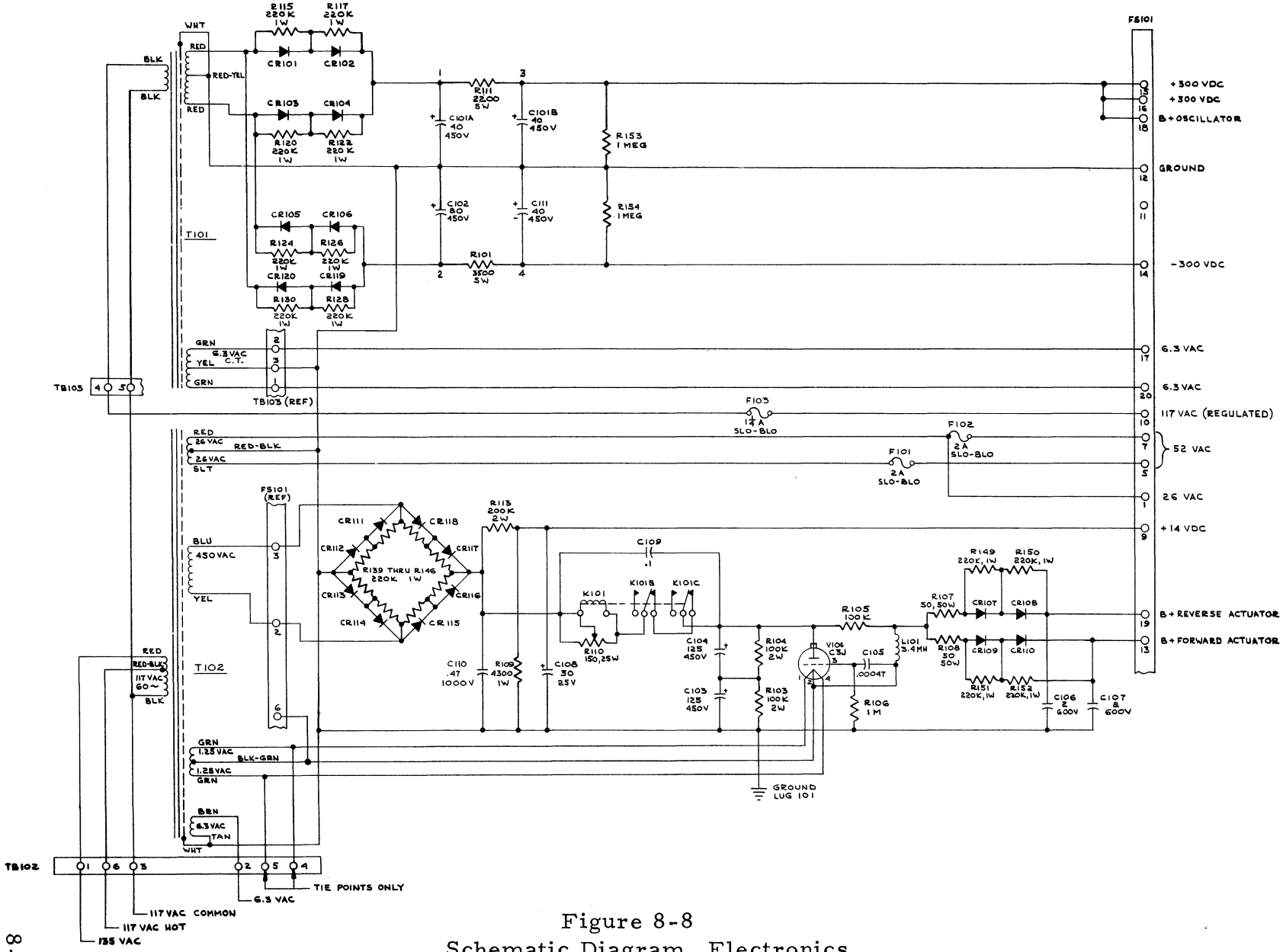


Figure 8-8
Schematic Diagram, Electronics
Power Supply P.S-100
(3101922B)

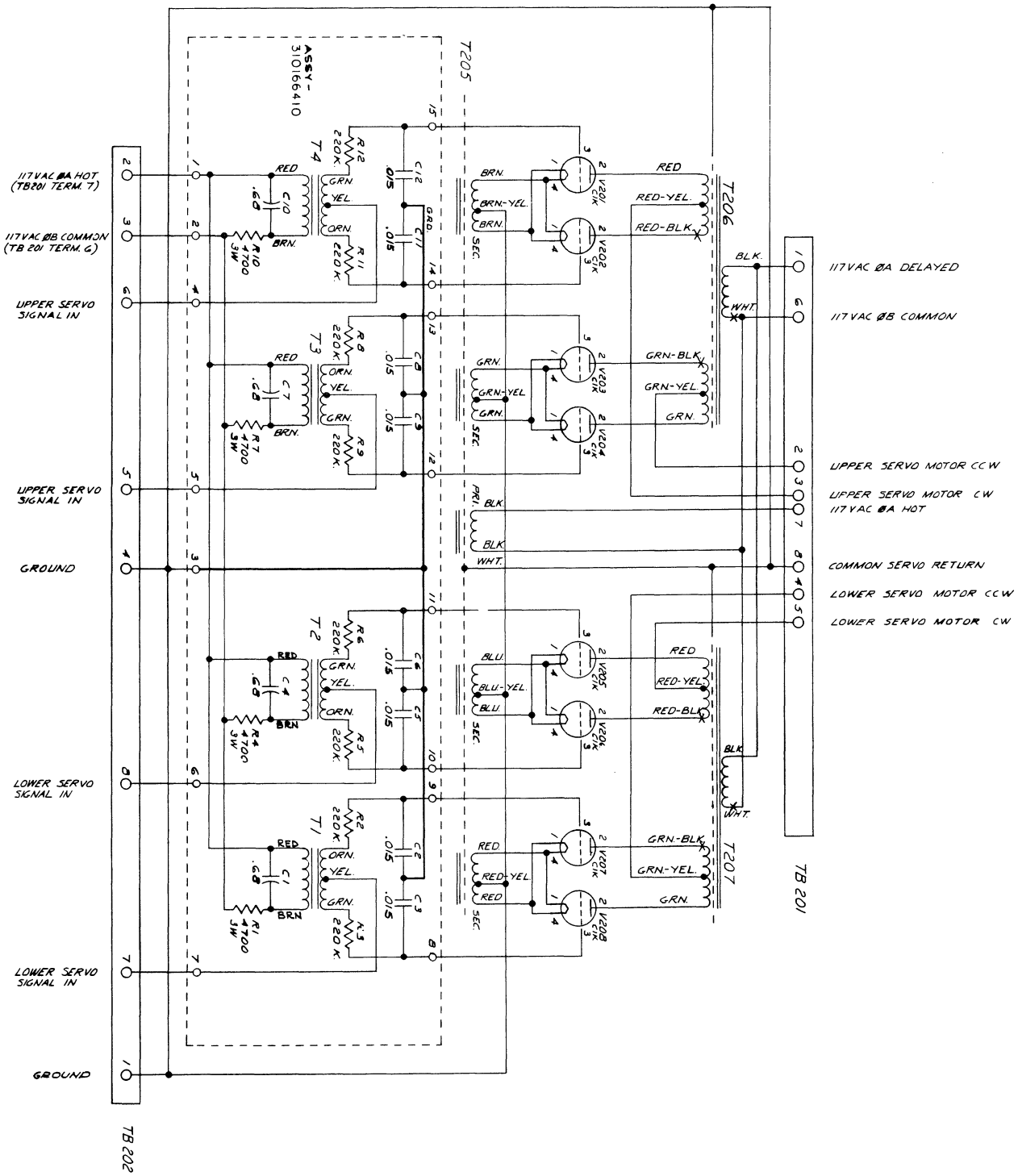


Figure 8-9
Schematic Diagram, Servo Motor
Power Supply P.S-200
(3101342B)

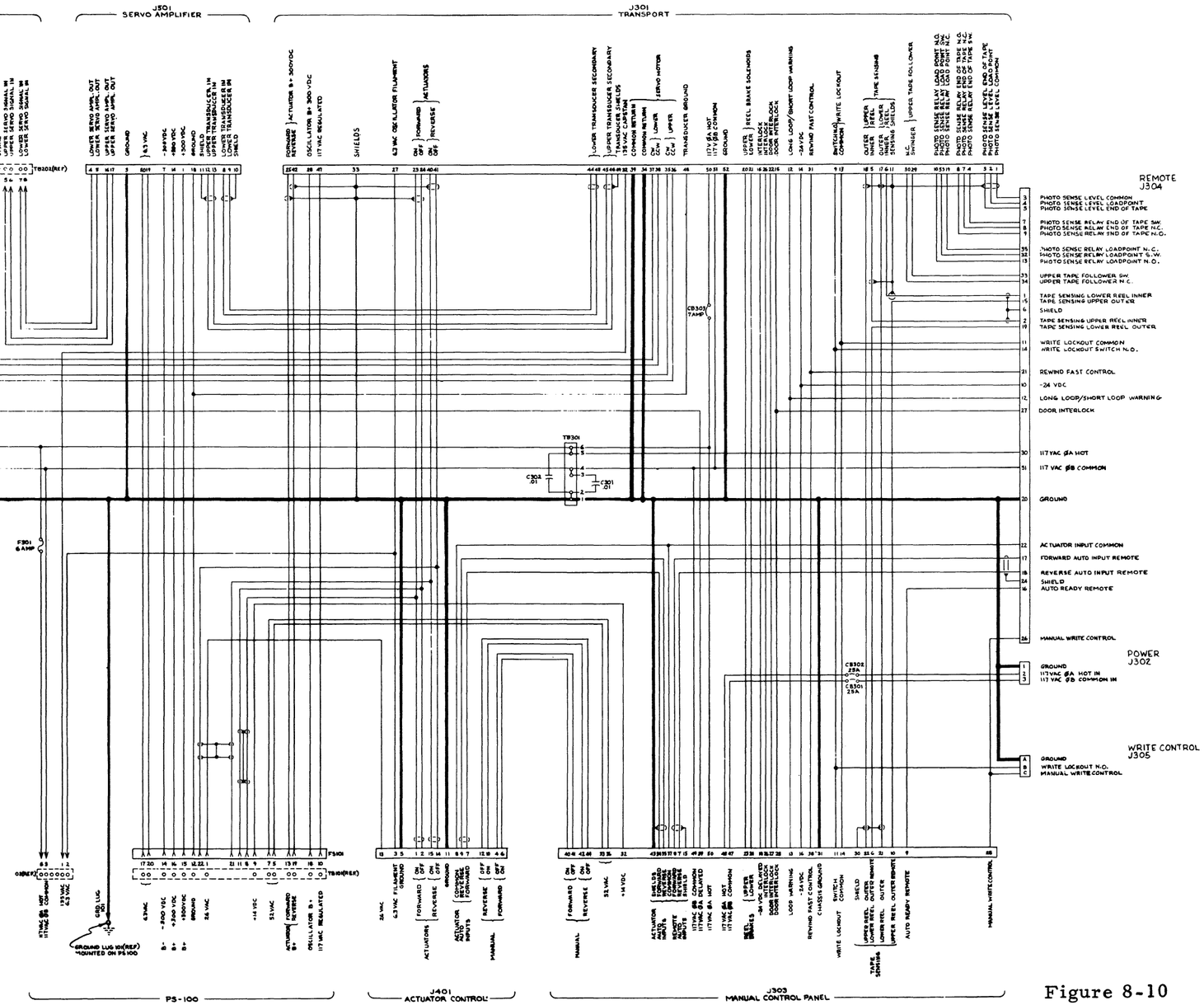


Figure 8-10
Schematic Diagram, Connector
Chassis C. C-300
(3101924B)

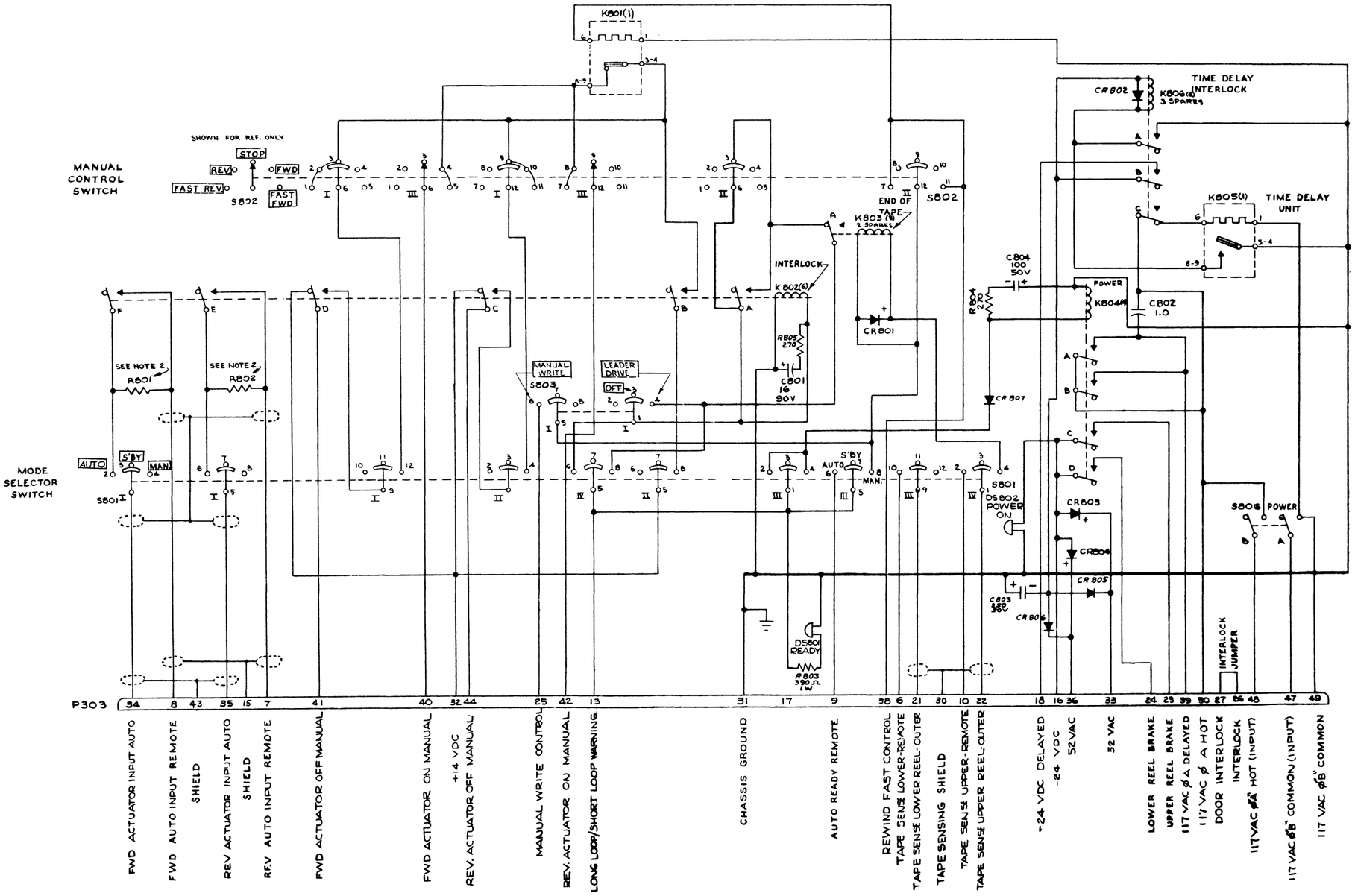


Figure 8-11
Schematic Diagram, Manual Control
Panel C, U-800
(3101065C)

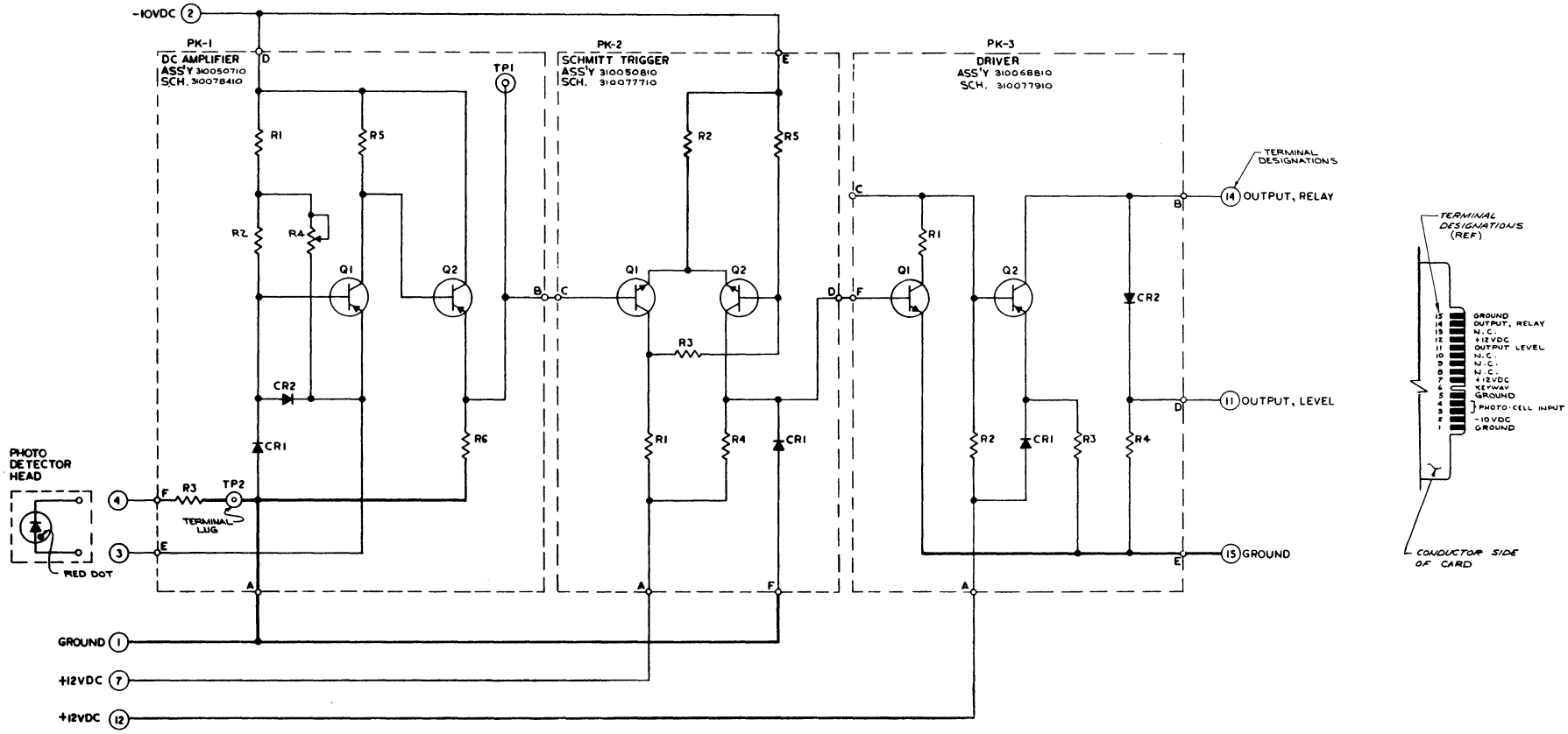
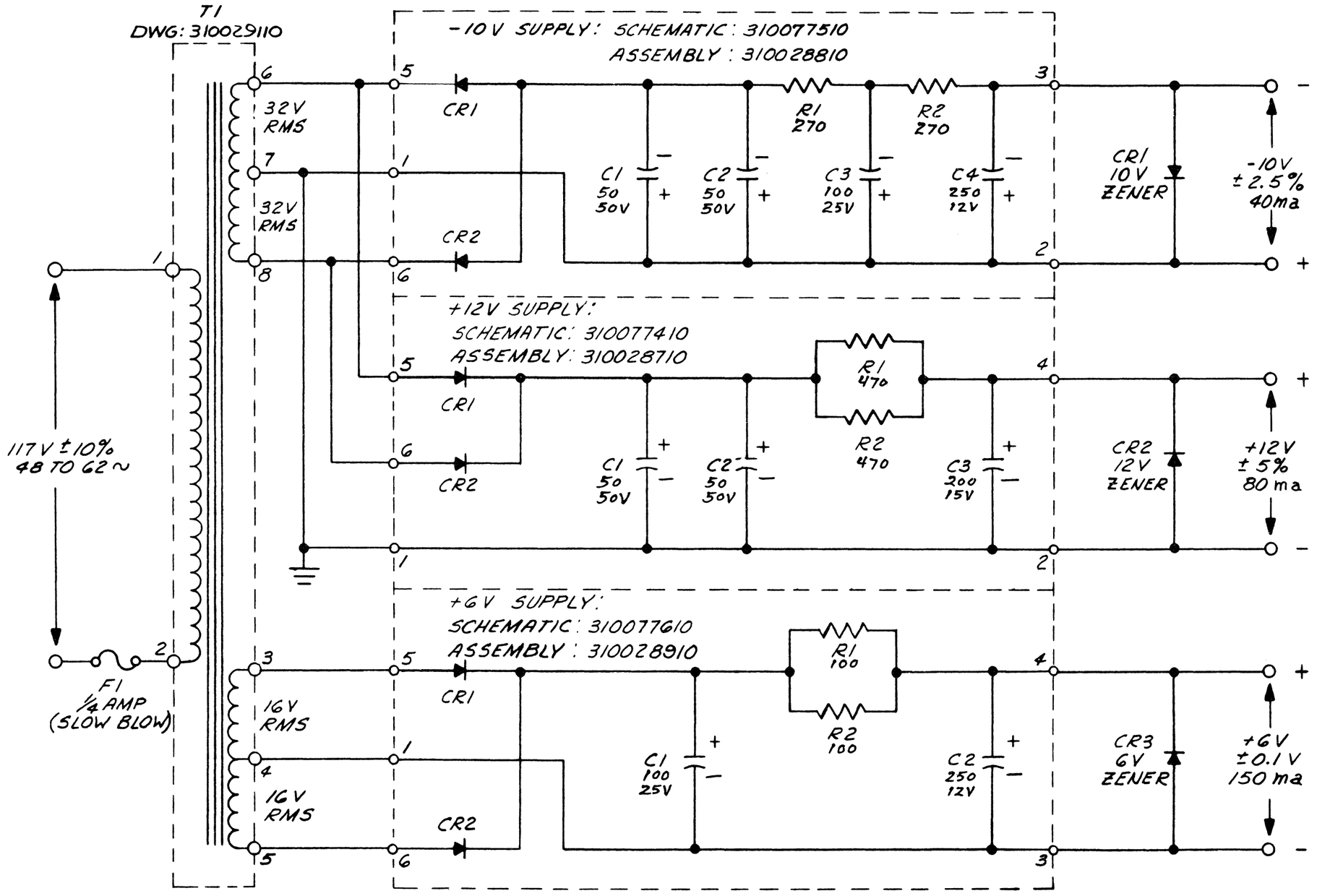


Figure 8-12
Schematic Diagram, Photosense
Base Card
(3100781A)



NOTES:

1. ALL RESISTORS IN OHMS, 3W, 3%
2. ALL CAPACITORS IN MICROFARADS

Figure 8-13
Schematic Diagram, Photosense
Power Supply

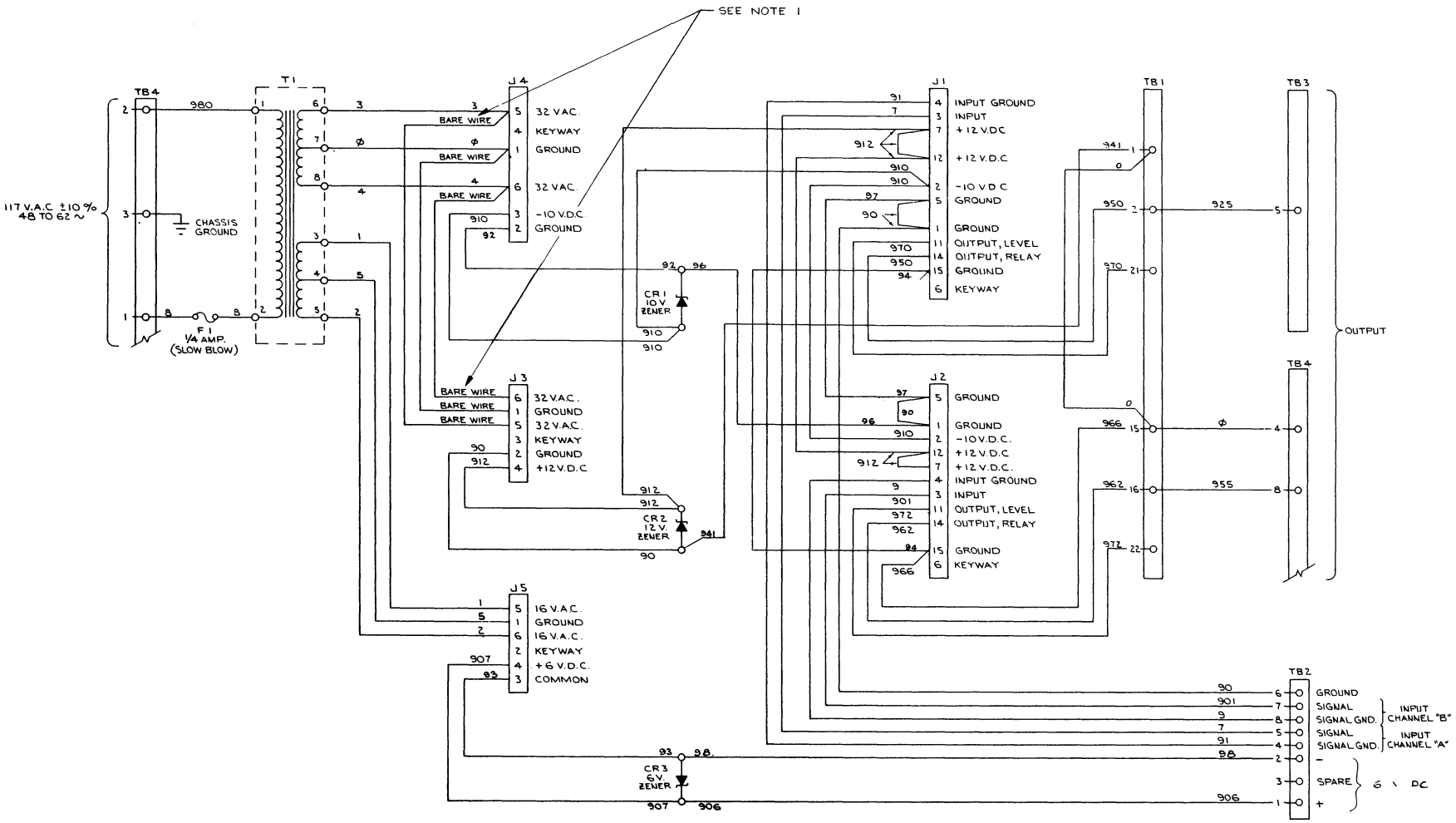


Figure 8-14
Schematic Diagram, Photosense
Chassis Wiring
(3101055C)

SECTION IX
ILLUSTRATED PARTS BREAKDOWN

9-1. INTRODUCTION.

9-2. The following pages constitute an Illustrated Parts Breakdown for the Standard TM-2 Tape Transport.

9-3. Figure 9-1 of this section contains a Feature List of basic, selective, and optional features. To show variations in selective and optional features, the USE ON CODE column is used to identify parts used on each feature.

9-4. In general, parts are listed in disassembly sequence, and indicate the maximum recommended disassembly of parts in the field. Further disassembly may require special tools and fixtures on reassembly and should not be undertaken.

9-5. An indention system is used in the DESCRIPTION column of the Illustrated Parts Breakdown to indicate parts relationship. An assembly beginning in column 1 will have its detail parts listed in column 2; a subassembly beginning in column 2 will have its detail parts listed in column 3; etc.

9-6. In correspondence with Ampex or when ordering parts for the equipment, order by Ampex Part Number. Handling of the order may also be expedited by noting the serial number of the machine for which the part is ordered.

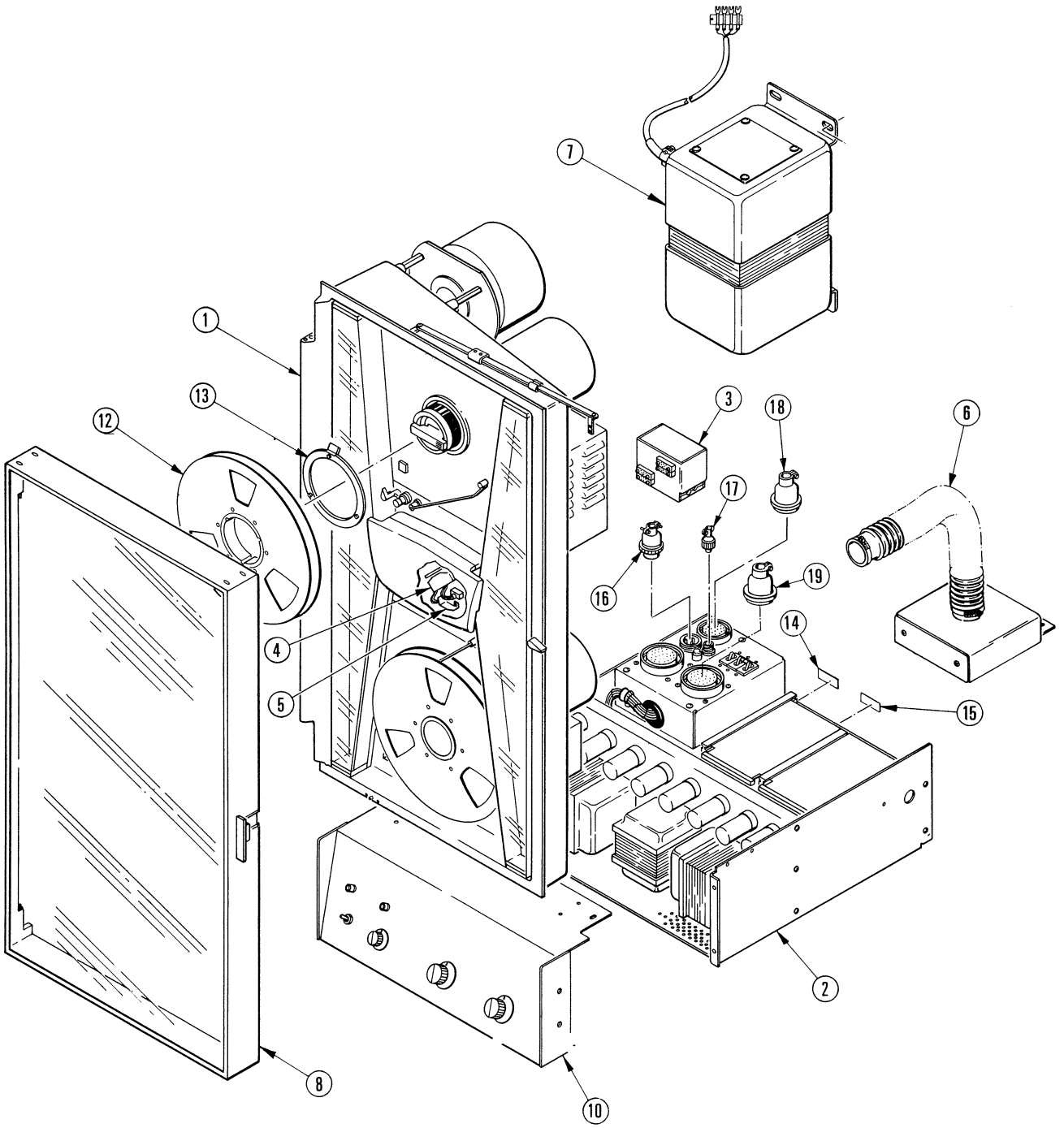


Figure 9-1
S. & H. T. M. -2(B) Tape Transport

FIG & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
		T. M. 2. TAPE TRANSPORT				
	5100558-10	Installation Drawing SHTM-2B				
	5100557-10	Final Assembly Tape Memory	1			
1	3101166-10	. Tape Transport Assembly (see figs 9-2 thru 17)	1			
2	5103005-10	. Control Assembly Power Supply (see figs 9-18 thru 9-23)	1			
3	5100856-10	. Head Box and Cable Assembly (see fig. 9-24)	1			
4	3103486-10	. Head Assembly 1/2 in., 7 channel, R/WNCT. (see fig. 9-25)	1			
5	3101095-10	. Head Cable Shield	1			
6	5100320-10	. Filter Assembly (see fig. 9-26)	1			
7	5100458-10	. Transformer and Cable Assembly (see fig. 27)	1			
8	3101077-10	. Door Assembly (see fig. 28)	1			
9	5100559-10	. Cabinet Assembly (see fig. 29)	1			
10	3101064-10	Manual Control Panel Assembly (see fig. 30) (see Note 1)				
11	3101093-10	. Transport Lock Bracket	1			
12	3101668-10	. Reel, $10\frac{1}{2}$ x 1/2 with Tape	1			
13	3101043-10	. Ring write Actuator	1			
14	3101167	. Plate, Caution, 50 cycle	1			
15	650-150	. Label, High Voltage	3			
16	144-106	. Connector, Power	1			
17	145-042	. Connector, Write	1			
18	145-127	. Connector, Remote	1			
19	145-128	. Connector, Manual	1			

FIG & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
20	471-876	. Screw, Machine, 12-24NC by 5/16 in., pan hd slotted st cad plt.	2			
21	502-049	. Washer #12 Spring Lock, st cad plt	2			
22	5104036	. Instruction Manual	1			
		NOTE 1. Although Ampex manufactured Manual Control Panel is not supplied with this machine, parts lists and operating data are included in the manual for convenience.				

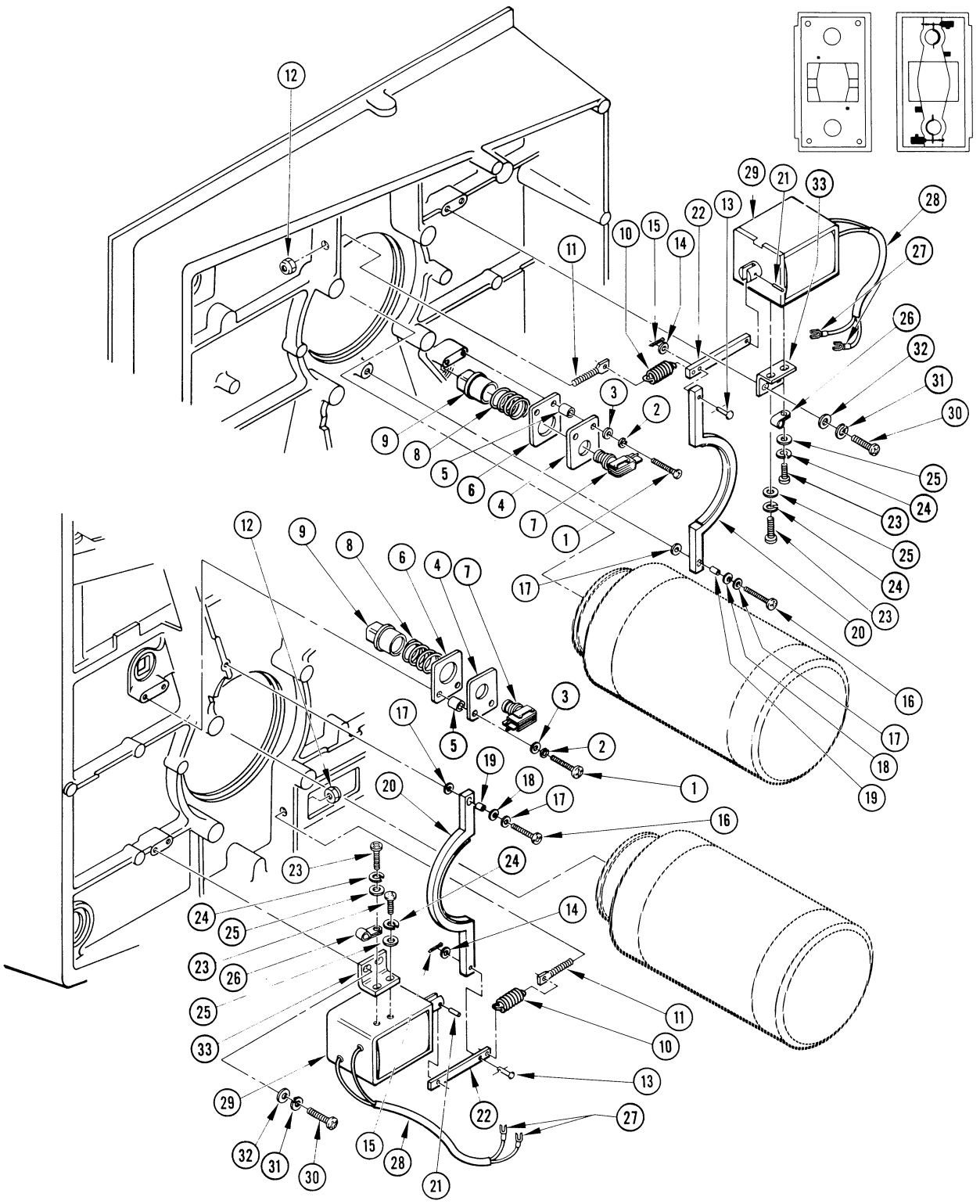


Figure 9-2
Reel Brakes

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
		REEL BRAKES				
	3101166-10	Tape Transport Assembly, basic unit, 1/2 inch (See Figure 9-1)	Ref			
1	471-074	. Screw, machine, 6-32 NC-2A by 7/8 in., pan hd Phillips, stl cad plt (MS35208-30)	4			
2	502-003	. Washer, #6 spring lock, stl cad plt (MS35338-41)	4			
3	501-009	. Washer, #6 flat, stl cad plt (MS15795-206)	4			
4	3101272-10	. Plate, switch mounting	2			
5	3101273-10	. Standoff, switch mounting	4			
6	3101271-10	. Plate, switch mounting	2			
7	120-013	. Switch, pushbutton, w/mounting hardware (Arrow Hart and Hegeman #3391EPA)	2			
8	3101270-10	. Spring, button control	2			
9	3101269-10	. Button Assembly, control	2			
10	3101295-10	. Spring, helical	2			
11	3100160-10	. Bolt, spade	2			
12	493-008	. Nut, self-locking, hex, 10-32 NF-3B, stl cad plt, nylon insert (Esna Type NM-26)	2			
13	400-009	. Pin, clevis, pan hd, stl cad plt (MS20392-1-17)	2			
14	501-008	. Washer, #4 flat, stl cad plt (MS15795-204)	2			
15	401-005	. Pin, cotter, stl cad plt, 1/16 in. dia by 1/2 in. lg	2			
16	471-082	. Screw, machine, 8-32 NC-2A by 3/4 in., pan hd Phillips, stl cad plt (MS35208-44)	2			
17	501-010	. Washer, #8 flat, stl cad plt (MS15795-207)	4			
18	506-011	. Washer, cup (Shakeproof #3502-14-17)	2			
19	3101276-10	. Spacer, brake shoe	2			
20	3100106-10	. Shoe, reel brake	2			
21	406-026	. Pin, roll, sst (Esna #79-022-094-500)	2			
22	3101275-10	. Link, solenoid	2			
23	471-076	. Screw, machine, 8-32 NC-2A by 1/4 in., pan hd Phillips, stl cad plt (MS35208-38)	4			
24	502-004	. Washer, #8 spring lock, stl cad plt (MS35338-42)	4			
25	501-010	. Washer, #8 flat, stl cad plt (MS15795-207)	4			

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
26	302-031	. Clamp, cable (Commercial Plastics #742-3)	2			
	3101233-10	. Solenoid and Cable Assembly, DC	2			
27	171-001	. . Connector, solderless (AMP #34541)	4			
28	600-010	. . Tubing, nonmetallic, #5, black (MIL-I-631)	2			
29	022-009	. . Solenoid, 24 vdc, plunger type (Philtrol #40DC-77)	2			
30	471-080	. Screw, machine, 8-32 NC-2A by 1/2 in., pan hd Phillips, stl cad plt (MS35208-42)	4			
31	502-004	. Washer, #8 spring lock, stl cad plt (MS35338-42)	4			
32	501-010	. Washer, #8 flat, stl cad plt (MS15795-207)	4			
33	3101292-10	. Bracket, mounting	2			

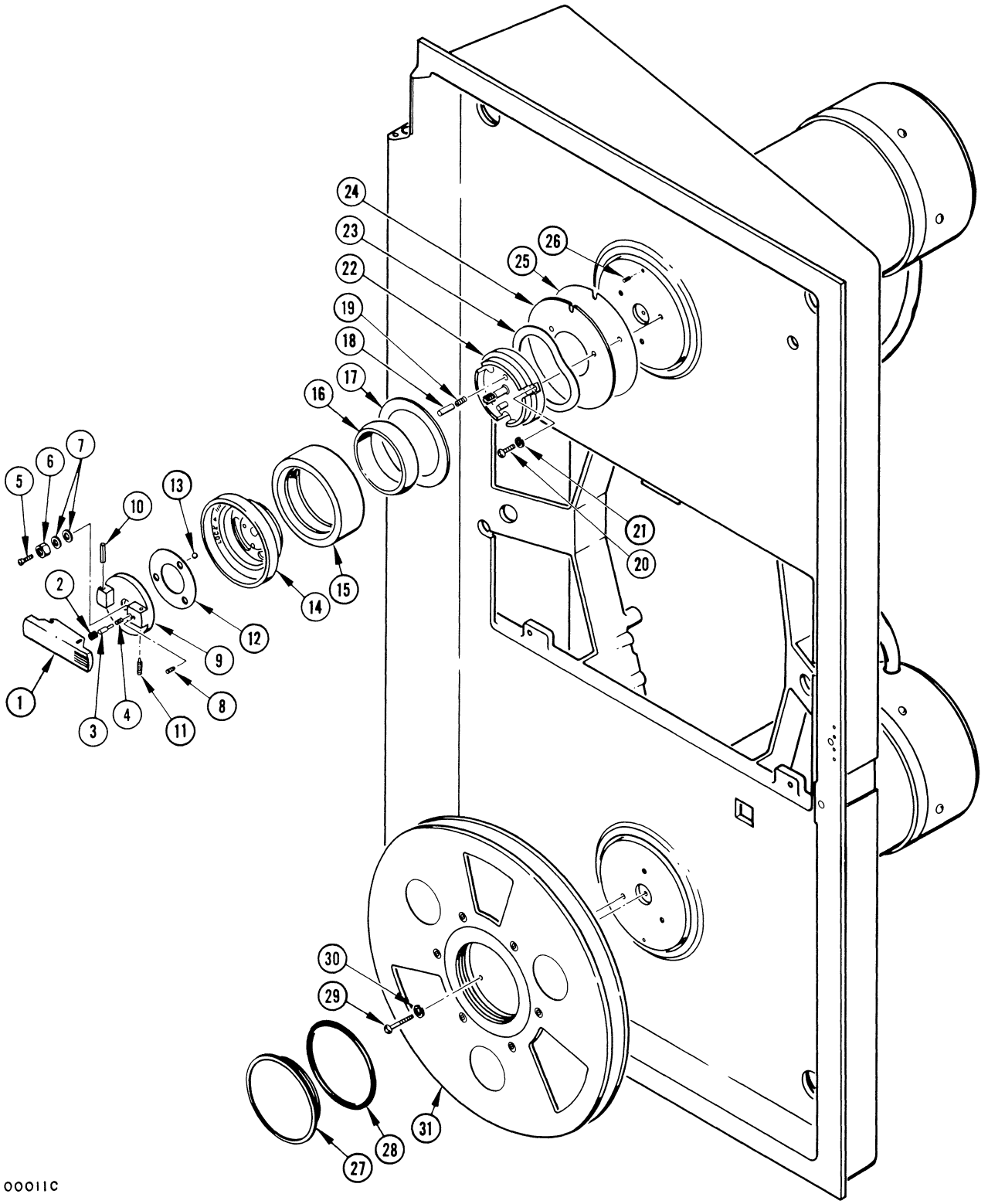


Figure 9-3
Reel Retainer and Fixed Reel

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
		REEL RETAINER AND FIXED REEL				
	3101035-10	Retainer Assembly, reel, NAB Compatible (See Figure 9-1)	Ref			
1	3101040-10	. Handle, reel retainer	1			
2	3101477-10	. Spring, helical, compression	1			
3	3101463-10	. Pin, straight, headed	1			
4	3101468-10	. Spring, reel retainer	1			
5	3101476-10	. Screw, special, reel retainer	1			
6	3101474-10	. Nut, plain hex	1			
7	3101475-10	. Washer, thrust	2			
8	477-033	. Screw, set, headless, 4-40 NC-3A by 3/8 in., cup point, stl cad plt (MS51017-13)	1			
9	3101037-10	. Reel Retainer Subassembly	1			
10	406-024	. . Pin, roll (Esna #79-012-062-0625)	1			
11	474-044	. . Pin (Vlier #S48A)	1			
12	3101464-10	. Retainer, ball	1			
13	420-020	. Bearing, ball, .250 dia (Hartford Ball Co. Grade I 440C)	3			
14	3101036-10	. Cup, reel retainer cam	1			
15	3101473-10	. Tire, reel retainer	1			
16	3101466-10	. Ring, reel retainer	1			
17	3101465-10	. Washer, flat	1			
18	3101467-10	. Pin, straight, headless	1			
19	3101469-10	. Spring, reel retainer	1			
20	471-089	. Screw, machine, 10-32 NF-3A by 1/2 in., pan hd Phillips, stl cad plt (MS24584-55)	3			
21	502-005	. Washer, #10 spring lock, stl cad plt (MS35338-43)	3			
22	3101472-10	. Reel Retainer	1			
23	3101470-10	. Washer, spring, compression	1			
24	3101478-10	. Spacer, disk	1			
25	3100196-10	. Shim, reel and turntable	A/R			
26	474-044	. Pin (Vlier #S48A)	1			
	3101170-10	Fixed Reel Assembly, inner edge guiding, 1/2 in. (See Figure 9-1)	Ref			

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
27	3100792-10	. Cap, reel hub	1			
28	432-043	. O Ring, neoprene (MS29513-139)	1			
29	471-093	. Screw, machine, 10-32 NF-2A by 1 in., pan hd Phillips, stl cad plt (MS24584-59)	3			
30	502-005	. Washer, #10 spring lock, stl cad plt (MS35338-43)	3			
31	3102099-10	. Hub and Flange Assembly, 1/2 in.	1			

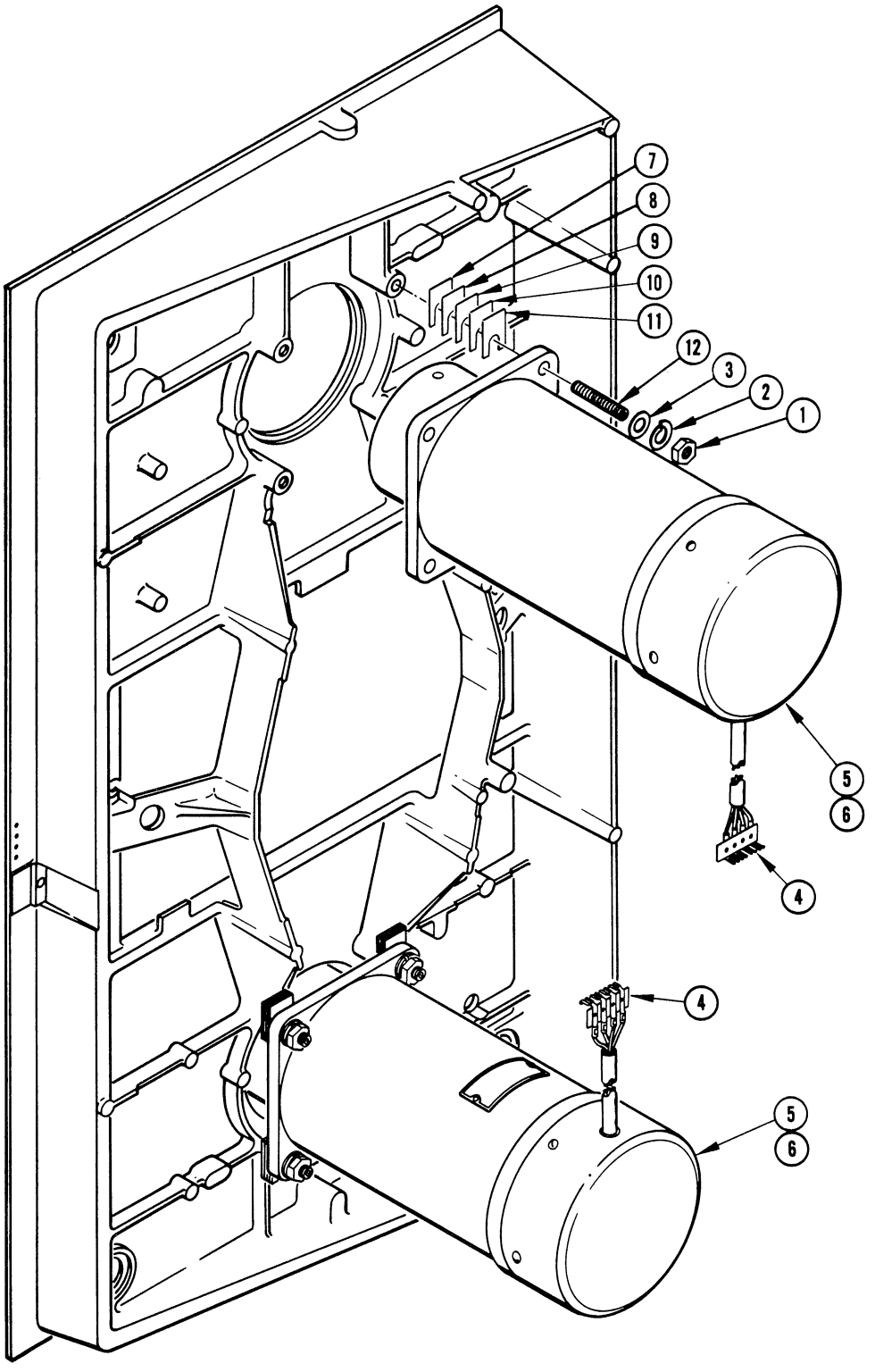


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Figure 9-4
Reel Motors

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
		REEL MOTORS				
	3101166-10	Tape Transport Assembly, basic unit, 1/2 inch (See Figure 9-1)	Ref			
1	470-120	. Screw, Cap 5/16-18 x 1 inch Hex. Soc. stl cad plt	8			
2	502-066	. Washer, 5/16 spring lock, sst (MS35338-83)	8			
3	501-030	. Washer, 5/16 flat, stl cad plt (AN960-516)	8			
	3101268-10	. Reel Motor Assembly	2			
4	180-118	. . Fanning Strip, 4 terminal (Jones #4-160-AL)	1			
5	3100618-10	. . Reel Motor	1			
6	3106019-10	. . . Brush, dc motor	4			
7	3100212-10	. Shim, 0.0015 in. thk, brass	A/R			
8	3100213-10	. Shim, 0.003 in. thk, brass	A/R			
9	3100214-10	. Shim, 0.005 in. thk, brass	A/R			
10	3100215-10	. Shim, 0.010 in. thk, brass	A/R			
11	3101312-10	. Shim, 0.020 in. thk, brass	A/R			
12	474-281	Stud, plain, stl cad plt (MS15986G P14) (detail of Frame Assembly, 3101230-10)	8			

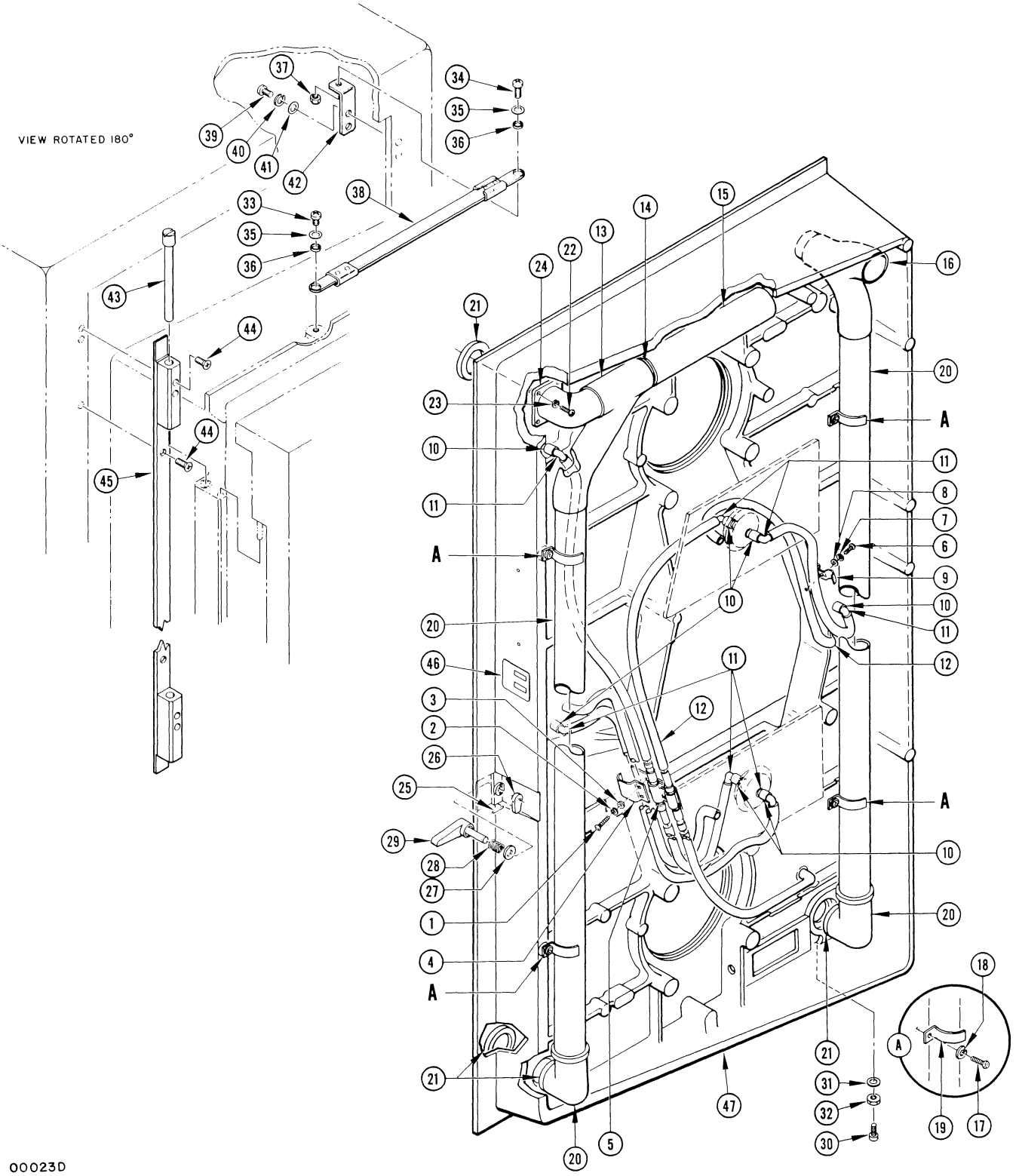


Figure 9-5
Vacuum Tubing and Main Frame

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
		VACUUM TUBING AND MAIN FRAME				
	3101166-10	Tape Transport Assembly, basic unit, 1/2 inch (See Figure 9-1)	Ref			
1	471-061	. Screw, machine, 4-40 NC-2A by 5/16 in., pan hd Phillips, stl cad plt (MS24584-13)	2			
2	502-002	. Washer, #4 spring lock, stl cad plt (MS35338-40)	2			
3	501-008	. Washer, #4 flat, stl cad plt (MS15795-204)	2			
4	3101331-10	. Clip, retainer, vacuum tubing	1			
5	3101332-10	. Vacuum Test Assembly	1			
6	471-069	. Screw, machine, 6-32 NC-2A by 3/8 in., pan hd Phillips, stl cad plt (MS24584-25)	1			
7	502-003	. Washer, #6 spring lock, stl cad plt (MS35338-41)	1			
8	501-009	. Washer, #6 flat, stl cad plt (MS15795-206)	1			
9	3101330-10	. Clip, retainer, vacuum tubing	1			
10	3101328-10	. Tubing, nonmetallic	7			
11	3101329-10	. Fitting, 90° elbow	7			
12	600-107	. Tubing, nonmetallic, 3/16 in. ID by 1/16 in. thk wall, black (Tygon #R3400)	A/R			
13	3101279-10	. Tee, rubber	1			
14	3101286-10	. Duct, straight	1			
15	3101308-10	. Tubing, tapered	1			
16	3101278-10	. Tee, rubber	1			
17	471-078	. Screw, machine, 8-32 NC-2A by 3/8 in., pan hd Phillips, stl cad plt (MS35208-40)	4			
18	502-004	. Washer, #8 spring lock, stl cad plt (MS35338-42)	4			
19	3101287-10	. Clip, tube	4			
20	3101256-10	. Piping Assembly, vacuum	2			
21	5100973-10	. Gasket, plastic foam, 1/8 in. thk	A/R			
	5100973-20	. Gasket, plastic foam, 3/16 in. thk	A/R			
	5100973-30	. Gasket, plastic foam, 1/4 in. thk	A/R			
22	471-069	. Screw, machine, 6-32 NC-2A by 3/8 in., pan hd Phillips, stl cad plt (MS24584-25)	4			
23	502-003	. Washer, #6 spring lock, stl cad plt (MS35338-41)	4			
24	3101293-10	. Duct, flanged elbow	1			
25	406-026	. Rollpin, sst (Esna #79-022-094-500)	1			

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
26	3101281-10	. Latch	1			
27	501-025	. Washer, 1/4 flat, stl cad plt (AN960-416L)	1			
28	3101291-10	. Spring, latch	1			
29	3101280-10	. Latch Handle Assembly	1			
30	470-032	. Screw, cap, 8-32 NC-3A by 7/8 in., hex soc, stl cad plt (MS35457-18)	2			
31	501-010	. Washer, #8 flat, stl cad plt (MS15795-207)	2			
32	492-010	. Nut, plain hex, 8-32 NC-2B, stl cad plt (MS35649-82)	2			
*33	471-076	. Screw, machine, 8-32 NC-2A by 1/4 in., pan hd Phillips, stl cad plt (MS35208-38)	1			
*34	471-081	. Screw, machine, 8-32 NC-2A by 5/8 in., pan hd Phillips, stl cad plt (MS35208-43)	1			
*35	501-010	. Washer, #8 flat, stl cad plt (MS15795-207)	2			
*36	3100216-10	. Washer, hinge stop	2			
*37	493-007	. Nut, self-locking, hex, 8-32 NC-3B, stl cad plt (Esna Type NM)	1			
*38	3101282-10	. Stop Arm	2			
*39	471-451	. Screw, machine, 12-24 NC-2A by 1/2 in., pan hd Phillips, stl cad plt	2			
*40	502-049	. Washer, #12 spring lock, stl cad plt	2			
*41	501-029	. Washer, #12 flat, stl cad plt	2			
*42	3101324-10	. Bracket, stop arm	1			
43	3101322-10	. Pin, hinge	2			
*44	471-735	. Screw, machine, 12-24 by 1/2 in., flat hd Phillips, stl cad plt	8			
45	3101320-10	. Hinge Block Assembly	1			
46	3100193-10	. Identification Plate	1			
47	3101230-10	. Frame Assembly	1			

*Part of Maintenance Kit 3107452-10

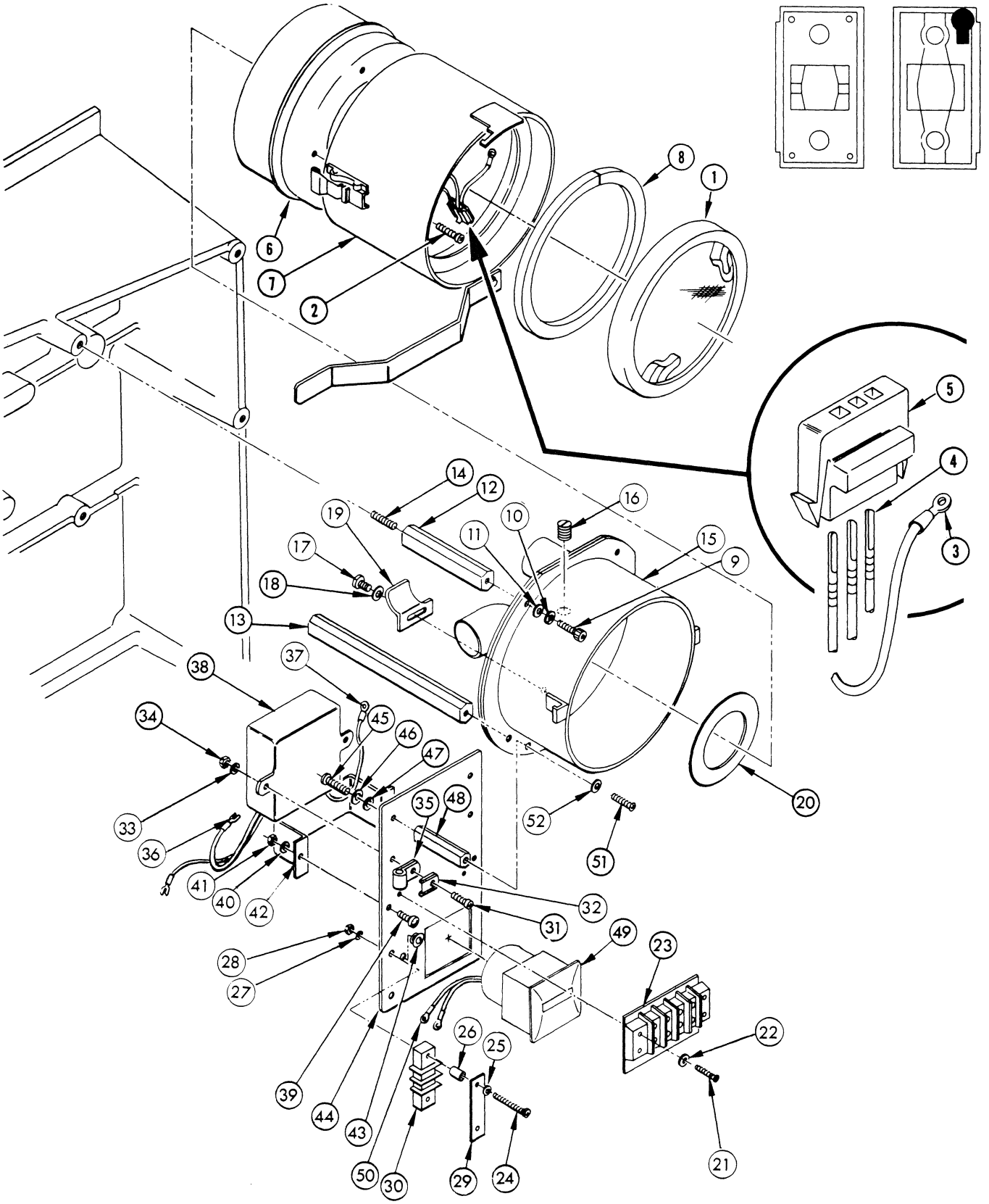


Figure 9-6
Vacuum Blower and Capacitor
Mounting Plate

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
		VACUUM BLOWER AND CAPACITOR MOUNTING PLATE				
	3101166-10	Tape Transport Assembly, basic unit, 1/2 inch (See Figure 9-1)	Ref			
	3101248-10	. Vacuum Blower Assembly	1			
1	3101533-10	. . Filter, vacuum blower	1			
2	471-087	. . Screw, machine, 10-32 NF-2A by 3/8 in., pan hd Phillips, stl cad plt (MS35209-53)	2			
3	171-069	. . Connector, solderless, ring tongue, #10 (AMP #34146)	1			
4	169-019	. . Connector, contact pin (AMP #42641-1)	3			
5	169-987	. . Connector, chassis plug, 3 pin (AMP #480177-1)	1			
6	3101534-10	. . Motor, vacuum	1			
7	3100747-10	. . Housing Assembly, vacuum motor	1			
8	269-148	. . . Gasket, foam rubber,	1			
9	470-039	. Screw, cap, 10-32 NF-3A by 5/8 in., hex soc, stl cad plt (MS35458-12)	4			
10	502-005	. Washer, #10 spring lock, stl cad plt (MS35338-43)	4			
11	501-011	. Washer, #10 flat, stl cad plt (MS15795-208)	4			
12	3101284-10	. Standoff	3			
13	3101285-10	. Standoff	1			
14	477-177	. Screw, set, headless, 10-32 by 7/8 in., hex soc, cup point, stl cad plt (Allen)	4			
15	3101247-10	. Base Assembly, vacuum blower	1			
16	440-092	. . Plug, slotted hd, brass, 1/8 in. pipe thd (Imperial Brass #117B)	1			
17	470-007	. . Screw, cap, 4-40 NC-3A by 3/16 in., hex soc, stl cad plt	1			
18	501-008	. . Washer, #4 flat, stl cad plt (MS15795-204)	1			
19	3101532-10	. . Cover, bleeder	1			
20	3101500-10	. . Gasket	1			
21	471-064	. Screw, machine, 4-40 NC-2A by 1/2 in., pan hd Phillips, stl cad plt (MS24584-16)	4			
22	502-002	. Washer, #4 spring lock, stl cad plt (MS35338-41)	4			

FIG & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
23	180-184	. Terminal Strip, barrier, 4 terminal (TB709) (Kulka Type 600-4) (See Figure 9-12)	Ref			
24	3101306-10	. Screw, machine, special	2			
25	501-009	. Washer, #6 flat, stl cad plt (MS15795-206)	2			
26	280-003	. Spacer, #6, brass cad plt (H.H. Smith #2100)	2			
27	502-003	. Washer, #6 spring lock, stl cad plt (MS35338-41)	2			
28	492-009	. Nut, plain hex, 6-32 NC-2B, stl cad plt (MS35649-62)	2			
29	3101307-10	. Cover, terminal	1			
30	180-124	. Terminal Strip, barrier (TB710) (Kulka #599-2)	1			
	5100698-10	. Capacitor Mounting Assembly	1			
31	471-071	. . Screw, machine, 6-32 NC-2A by 1/2 in., pan hd Phillips, stl cad plt (MS35208-27)	2			
32	506-013	. . Washer, #6, stl cad plt (Weckesser #D-140)	2			
33	502-003	. . Washer, #6 spring lock, stl cad plt (MS35338-41)	2			
34	492-009	. . Nut, plain hex, 6-32 NC-2B, stl cad plt (MS35649-62)	2			
35	302-037	. . Clamp, cable, plastic, 5/16 in. ID (Commercial Plastics #742-5)	2			
36	171-001	. . Connector, solderless, #6, slotted tongue (AMP #34541)	2			
37	172-003	. . Lug, soldering, #6, int tooth (Shakeproof #2104-06)	1			
38	036-055	. . Capacitor, paper, dual bathtub type, 0.5 µf 600 vdc (C703) (Sprague #BP-2506)	1			
39	471-336	. . Screw, machine, 6-32 NC-2A by 3/8 in., flat hd Phillips, stl cad plt (MS35192-25)	2			
40	502-003	. . Washer, #6 spring lock, stl cad plt (MS35338-41)	2			
41	492-009	. . Nut, plain hex, 6-32 NC-2B, stl cad plt (MS35649-62)	2			
42	3101620-10	. . Shield	1			
43	260-032	. . Grommet, elastic (Accurate Sales #GS3181)	1			
44	5100697-10	. . Plate, mounting	1			
45	471-071	. . Screw, Machine, 6-32NC-2A by 5/8 in., pan hd Phillips, stl cad plt, (MS35208-28)	2			

FIG & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
46	502-003	. . Washer, #6 Spring Lock, stl cad plt (MS35338-41)	2			
47	501-009	. . Washer #6 flat, stl cad plt (MS15795-206)	2			
48	3101619-10	. . Standoff	2			
49	000-778	. . Meter, Elapsed time	1			
50	171-010	. . Connector, Solderless, #5 Ring tongue (AMP)				
51	471-071	. Screw, Machine, 6-32NC-2A by 1/2 in., pan hd Phillips, stl cad plt, (MS35208-27)	2			
52	501-009	. Washer, #6 flat, stl cad plt, (MS15795-206)	2			

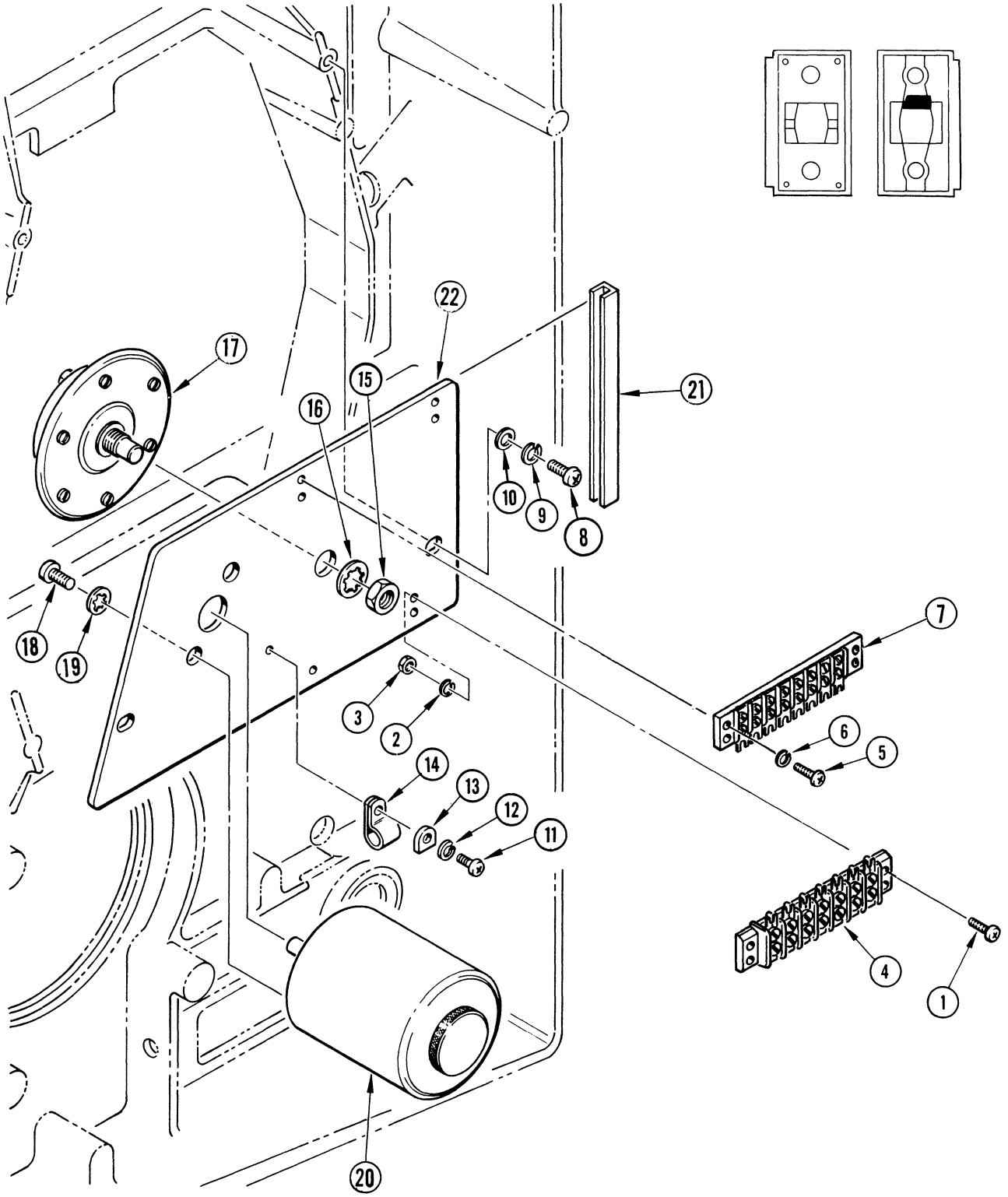


Figure 9-7
Upper Servo Control

FIG & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
		UPPER SERVO CONTROL				
	3101166-10	Tape Transport Assembly, basic unit, 1/2 inch (See Figure 9-1)				
1	471-064	. Screw, machine, 4-40 NC-2A by 1/2 in., pan hd Phillips, stl cad plt (MS24584-16)	3			
2	502-002	. Washer, #4 spring lock, stl cad plt (MS35338-40)	3			
3	492-008	. Nut, plain hex, 4-40 NC-2B, stl cad plt (MS35649-42)	3			
4	180-116	. Strip, terminal, 2-1/2 in. lg, 8 terminal, phenolic, w/marker strip (TB701) (Kulka # 410-3/4ST-8MFE) (See Figure 9-12)	Ref			
5	471-064	. Screw, machine, 4-40 NC-2A by 1/2 in., pan hd Phillips, stl cad plt (MS24584-16)	4			
6	502-002	. Washer, #4 spring lock, stl cad plt (MS35338-40)	4			
7	180-117	. Strip, terminal, 3-9/32 in. lg, 7 one sided terminals, phenolic, w/marking strip (TB703) (Kulka #600-3/4ST-7) (See Figure 9-12)	Ref			
8	471-080	. Screw, machine, 8-32 NC-2A by 1/2 in., pan hd Phillips, stl cad plt (MS35208-42)	2			
9	502-004	. Washer, # 8 spring lock, stl cad plt (MS35338-42)	2			
10	501-010	. Washer, # 8 flat, stl cad plt (MS15795-207)	2			
	3101250-10	. Control Assembly, servo, upper	1			
11	471-069	. . Screw, machine, 6-32 NC-2A by 3/8 in., pan hd Phillips, stl cad plt (MS24584-25)	1			
12	502-003	. . Washer, # 6 spring lock, stl cad plt (MS35338-41)	1			
13	506-013	. . Washer, #6 stl cad plt (Weckesser #D-140)	1			
14	302-007	. . Clamp, cable, 1/4 in. ID (Commercial Plastics #742-4)	1			
15	492-049	. . Nut, plain hex, 3/8-32 NEF-2B, stl cad plt (MS25082-7)	1			
16	502-083	. . Washer, lock, 3/8 in., internal tooth, stl cad plt (MS35333-42)	1			
17	3109238-10	. . Switch, differential vacuum (S706)	1			
18	471-086	. . Screw, machine, 10-32 NF-2A by 5/16 in., pan hd Phillips, stl cad plt (MS35209-52)	2			
19	502-027	. . Washer, # 10 lock, internal tooth, stl cad plt (MS35333-39)	2			
20	3101536-10	. . Transducer, differential vacuum (TR701)	1			
21	269-099	. . Rubber, extrusion, U-shaped (Rubbercraft #789)	A/R			
22	3101535-10	. . Plate, mounting	1			

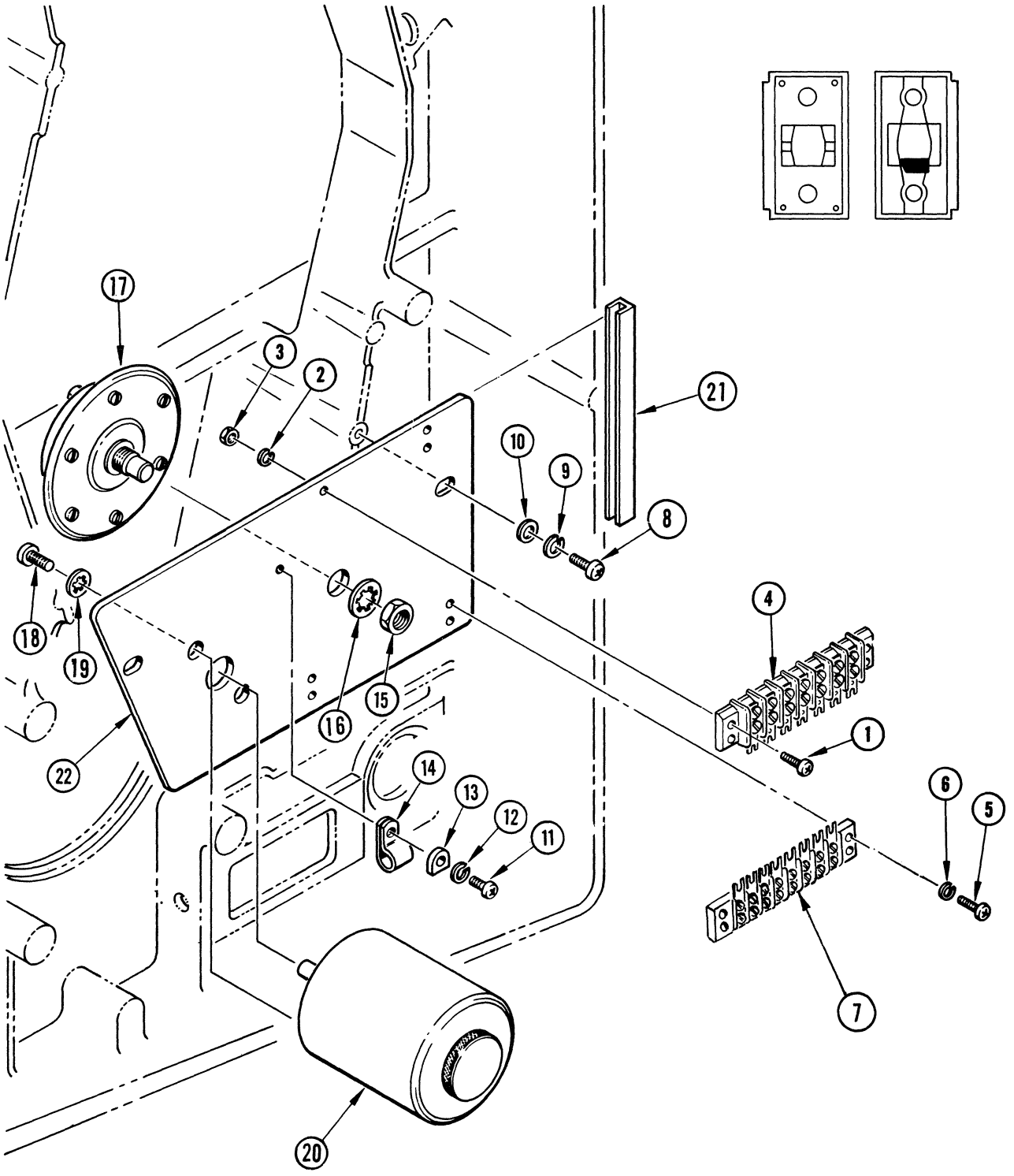


Figure 9-8
Lower Servo Control

FIG & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
		LOWER SERVO CONTROL				
	3101166-10	Tape Transport Assembly, basic unit, 1/2 inch (See Figure 9-1)	Ref			
1	471-064	. Screw, machine, 4-40 NC-2A by 1/2 in., pan hd Phillips, stl cad plt (MS24584-16)	3			
2	502-002	. Washer, #4 spring lock, stl cad plt (MS35338-40)	3			
3	492-008	. Nut, plain hex, 4-40 NC-2B, stl cad plt (MS35649-42)	3			
4	180-116	. Strip, terminal, 2-1/2 in. lg, 8 terminal, phenolic, w/marker strip (TB702) (Kulka #410-3/4ST-8MFE) (See Figure 9-12)	Ref			
5	471-064	. Screw, machine, 4-40 NC-2A by 1/2 in., pan hd Phillips, stl cad plt (MS24584-16)	4			
6	502-002	. Washer, #4 spring lock, stl cad plt (MS35338-40)	4			
7	180-117	. Strip, terminals 3-9/32 in. lg. 7 one sided terminals, phenolic, w/marking strip (TB706) (Kulka #600-3/4 ST-7) (See Figure 9-12)	Ref			
8	471-080	. Screw, machine, 8-32 NC-2A by 1/2 in., pan hd Phillips, stl cad plt (MS35208-42)	2			
9	502-004	. Washer, #8 spring lock, stl cad plt (MS35338-42)	2			
10	501-010	. Washer, #8 flat, stl cad plt (MS15795-207)	2			
	3101251-10	. Control Assembly, servo, lower	1			
11	471-069	. . Screw, machine, 6-32 NC-2A by 3/8 in., pan hd Phillips, stl cad plt (MS24584-25)	1			
12	502-003	. . Washer, #6 spring lock, stl cad plt (MS35338-41)	1			
13	506-013	. . Washer, #6, stl cad plt (Weckesser #D-140)	1			
14	302-007	. . Clamp, cable, 1/4 in. ID (Commercial Plastics #742-4)	1			
15	492-039	. . Nut, jam, hex, 3/8-32 NEF-2B (Allen-Bradley #M-1766)	1			
16	502-083	. . Washer, lock, 3/8 in., internal tooth, stl cad plt (MS35338-42)	1			
17	3109238-10	. . Switch, differential vacuum (S707)	1			
18	471-086	. . Screw, machine, 10-32 NF-2A by 5/16 in., pan hd Phillips, stl cad plt (MS35209-52)	2			
19	502-027	. . Washer, #10 lock, internal tooth, stl cad plt (MS35333-39)	2			
20	3101536-10	. . Transducer, differential vacuum (TR702)	1			
21	269-099	. . Rubber, extrusion, U-shaped (Rubbercraft #789)	A/R			
22	3101538-10	. . Plate, mounting	1			

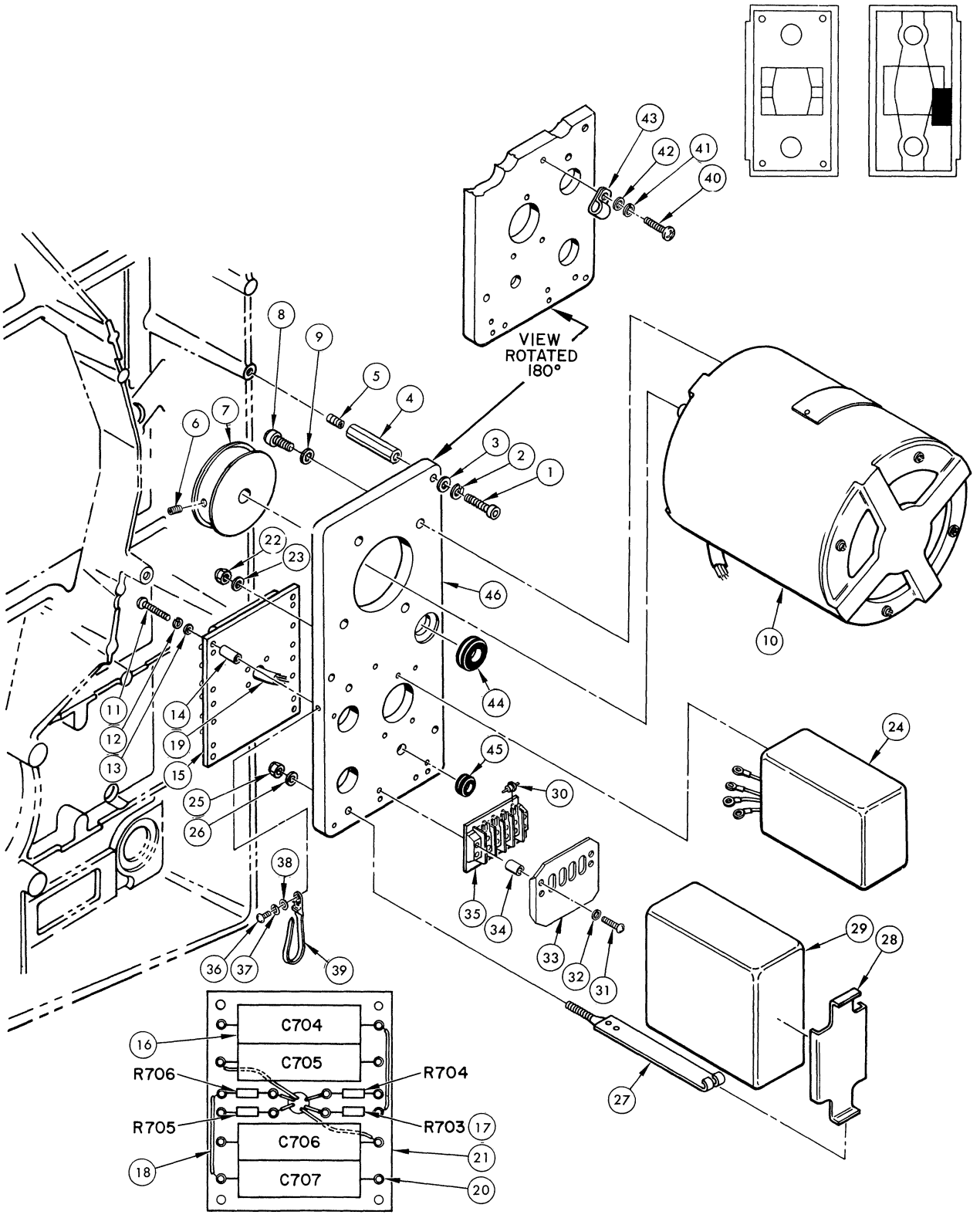


Figure 9-9
Capstan Drive Motor
and Pulley Assembly

FIG & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
		CAPSTAN DRIVE MOTOR & PULLEY ASSEMBLY				
	3101166-10	Transport Assy. (See Fig. 9-1)	Ref.			
1	470-041	. Screw, Cap, 10-32NF-3A by 7/8 in., Hex Soc, stl cad plt, (MS35458-14)	3			
2	502-005	. Washer # 10 Spring Lock, stl cad plt, (MS35338-40)	3			
3	501-011	. Washer # 10 flat, stl cad plt, (MS15795-207)	3			
4	3101283-10	. Standoff	3			
5	477-177	. Screw, Set, Headless, 10-32 by 7/8 in., Hex Soc, Cup point, stl cad plt, (Allen)	3			
	3101254-10	. Capstan drive motor assy.	1			
6	477-119	. . Screw, set, headless, cup point, sst w/nylon insert, 10-32 by 1/4 in. (Nylok)	2			
7	3101541-10	. . Pulley	1			
	3108958-10	. . Drive Motor, Capstan Sub-Assy.	1			
8	470-045	. . . Screw, Cap, 1/4-20 UNC-3A by lin., hex soc, stl cad plt, (MS35457-33)	4			
9	502-028	. . . Washer, lock, 1/4 in., int tooth, stl cad plt (MS35333-35)	4			
10	3101545-10	. . . Motor, Capstan Drive, AC, 1500/3000 RPM 50 CPS.	1			
11	471-074	. . . Screw, Machine, 6-32 NC-2A by 7/8 in., Pan hd Phillips, stl cad plt, (MS35208-30)	4			
12	502-003	. . . Washer, # 6 Spring Lock, stl cad plt, (MS35338-41)	4			
13	501-188	. . . Washer, # 6 Flat, st cad plt (NAS620-6L)	4			
14	280-009	. . . Spacer, Brass cad plt (H.H. Smith #2102)	4			
15	3101542-10	. . . Component Board Assy.	1			
16	035-346	. . . . Capacitor, Tubular, 0.33 µf, 400 Volt (C704, C705, C706, C707) (Mallory # GEM4033)				
17	041-351	. . . . Resistor, Fixed, composition, 15 ohm, 1/2 w, 10% (R703, R704, R705, R706)	4			
18	600-024	. . . . Tubing, Insulation, Electrical, # 20 Black (MIL-I-631)	A/R			

FIG & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
19	600-009	. . . . Tubing, insulation, electrical, #4, black (MIL-I-631)	A/R			
20	173-015	. . . . Terminal Lug, turret (Useco #1300B-8)	16			
21	3101748-10	. . . . Component Board	1			
22	493-002	. . . Nut, self-locking, hex, 6-32 NC-2B, brass cad plt w/nylon insert (Esna Type NM)	3			
23	501-188	. . . Washer, #6 flat, stl cad plt (NAS620-6L)	3			
24	020-113	. . . Relay, 2 pdt, 24 vdc (K701) (Comar Type AC-7954)	1			
25	493-004	. . . Nut, self-locking, hex. 10-32 NF-2B, brass cad plt w/nylon insert (Esna Type NM)	2			
26	501-192	. . . Washer, #10 flat, stl cad plt (NAS620-10L)	2			
27	290-014	. . . Bracket, capacitor, spade lug type (MIL-C-25: CP07SB3)	2			
28	3101547-10	. . . Strap, capacitor mounting	1			
29	036-052	. . . Capacitor, paper, 25 uf, 236 vac (C702) (Sprague #S49755)	1			
30	013-015	. . . Diode, germanium (CR705) (General Electric #1N91)	1			
31	471-075	. . . Screw, machine, 6-32 NC-2A by 1 in., pan hd Phillips, stl cad plt (MS35208-31)	4			
32	502-003	. . . Washer, #6 spring lock, stl cad plt (MS35338-41)	4			
33	3101747-10	. . . Shield, terminal board	1			
34	280-006	. . . Spacer, brass cad plt (H.H. Smith #2101)	4			
35	180-119	. . . Terminal Strip, barrier, 4 terminal (Kulka #600-3/4ST-4 w/marker strip)	1			
36	471-078	. . . Screw, machine, 8-32 NC-2A by 3/8 in., pan hd Phillips, stl cad plt (MS35208-40)	1			
37	502-004	. . . Washer, #8 spring lock, stl cad plt (MS35338-42)	1			
38	501-190	. . . Washer, #8 flat, stl cad plt (NASC20-8L)	1			
39	302-111	. . . Clamp, cable, plastic, adjustable (Panduit Corp #LSC-2D)	1			
40	471-072	. . . Screw, machine, 6-32 NC-2A by 5/8 in., pan hd Phillips, stl cad plt (MS35208-28)	1			
41	502-003	. . . Washer, #6 spring lock, stl cad plt (MS35338-41)	1			
42	501-188	. . . Washer, #6 flat, stl cad plt (NAS620-6L)	1			

FIG & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
43	302-036	. . . Clamp, cable, plastic, 3/8 in. dia (Commercial Plastics #742-6)	1			
44	260-016	. . . Grommet, neoprene (MS35489-98)	1			
45	260-032	. . . Grommet, neoprene (Accurate Sales # GS2181)	1			
46	3101543-10	. . . Plate, mounting	1			

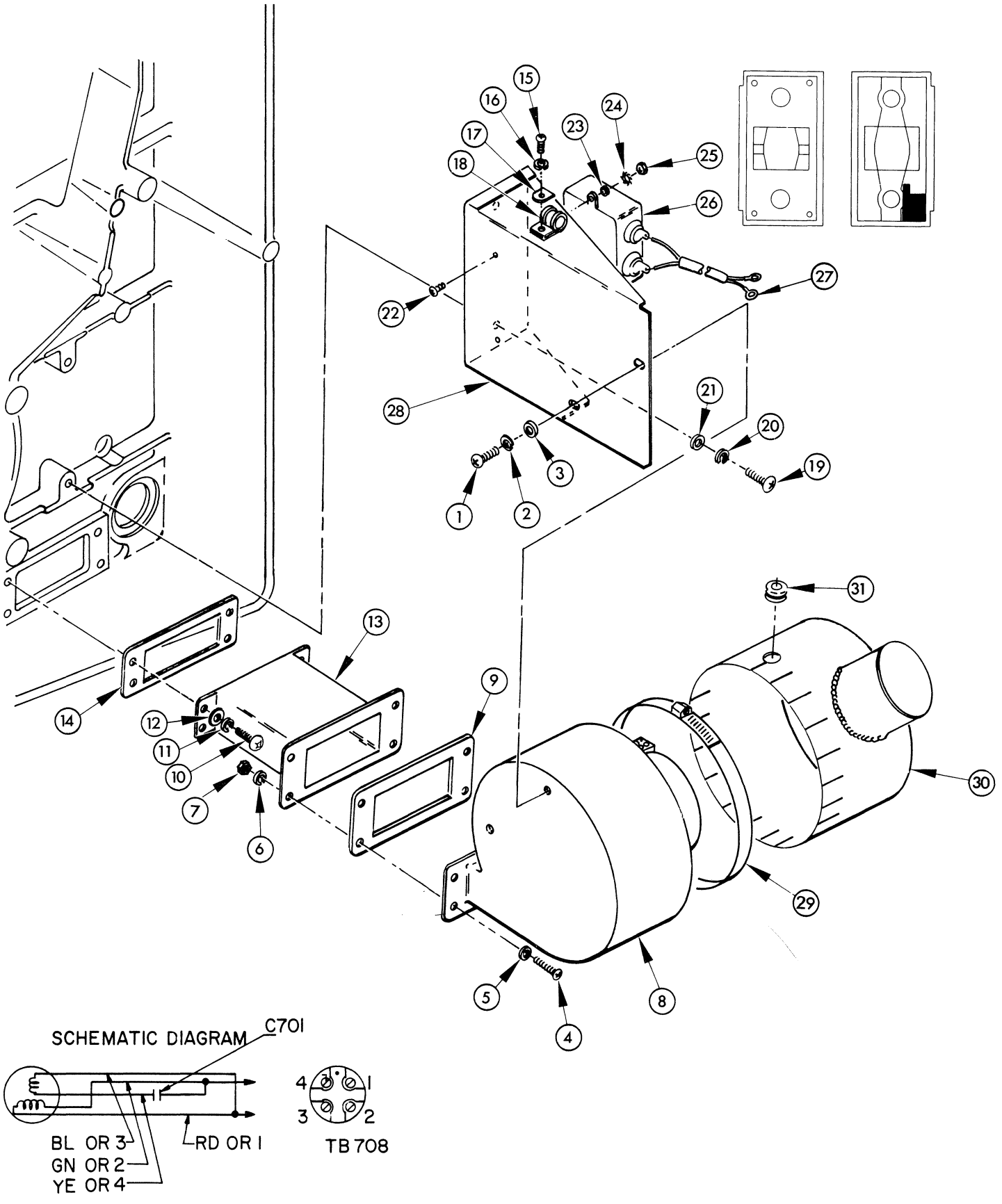


Figure 9-10
Positive Pressure Blower

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
		POSITIVE PRESSURE BLOWER				
	3101166-10	Tape Transport Assembly, basic unit, 1/2 inch (See Figure 9-1)	Ref			
1	471-078	. Screw, machine, 8-32 NC-2A by 3/8 in., pan hd Phillips, stl cad plt (MS35208-40)	2			
2	502-004	. Washer, #8 spring lock, stl cad plt (MS35338-42)	2			
3	501-010	. Washer, #8 flat, stl cad plt (MS15795-207)	2			
4	471-071	. Screw, machine, 6-32 NC-2A by 1/2 in., pan hd Phillips, stl cad plt (MS35208-27)	4			
5	501-009	. Washer, #6 flat, stl cad plt (MS15795-206)	4			
6	502-003	. Washer, #6 spring lock, stl cad plt (MS35338-41)	4			
7	492-009	. Nut, plain hex, 6-32 NC-2B, stl cad plt (MS35649-62)	4			
8	591-028	. Blower, positive pressure (Rotron Type KS409)	1			
9	3101298-10	. Gasket, rubber	1			
10	471-068	. Screw, machine, 6-32 NC-2A by 5/16 in., pan hd Phillips, stl cad plt (MS35208-24)	4			
11	502-003	. Washer, #6 spring lock, stl cad plt (MS35338-41)	4			
12	501-009	. Washer, #6 flat, stl cad plt (MS15795-206)	4			
13	3101296-10	. Adapter, blower	1			
14	3101297-10	. Gasket, rubber	1			
15	471-069	. Screw, machine, 6-32 NC-2A by 3/8 in., pan hd Phillips, stl cad plt (MS24584-25)	1			
16	502-003	. Washer, #6 spring lock, stl cad plt (MS35338-41)	1			
17	506-013	. Washer, Cable Clamp, stl, cad plt, (Weckesser #D-140)	1			
18	302-029	. Clamp, cable, (AN742D14C)	1			
19	471-078	. Screw, machine, 8-32 NC-2A by 3/8 in., pan hd Phillips, stl cad plt (MS35208-40)	2			
20	502-004	. Washer, #8 spring lock, stl cad plt (MS35338-42)	2			
21	501-010	. Washer, #8 flat, stl cad plt (MS15795-207)	2			
	3101299-10	. Bracket Assembly, blower	1			
22	471-069	. . Screw, machine, 6-32 NC-2A by 3/8 in., pan hd Phillips (MS24584-25)	2			

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
23	501-009	. . Washer, #6 flat, stl cad plt (MS15795-206)	2			
24	502-014	. . Washer, #6 lock, ext tooth, stl cad plt (MS35335-30)	2			
25	492-009	. . Nut, plain hex, 6-32 NC-2B, stl cad plt (MS35649-62)	2			
26	036-049	. . Capacitor, paper, 1 mfd, 600 vdc (C701) (Sprague #CP53B1EF105K)	1			
27	172-039	. . Solder Lug, ring tongue, for #2 screw (Zierick #101)	2			
28	3101617-10	. . Bracket, blower	1			
29	300-053	. Clamp tube (Aeroseal #200)	1			
30	3101277-10	. Housing, blower inlet	1			
31	260-004	. Grommet, elastic	1			

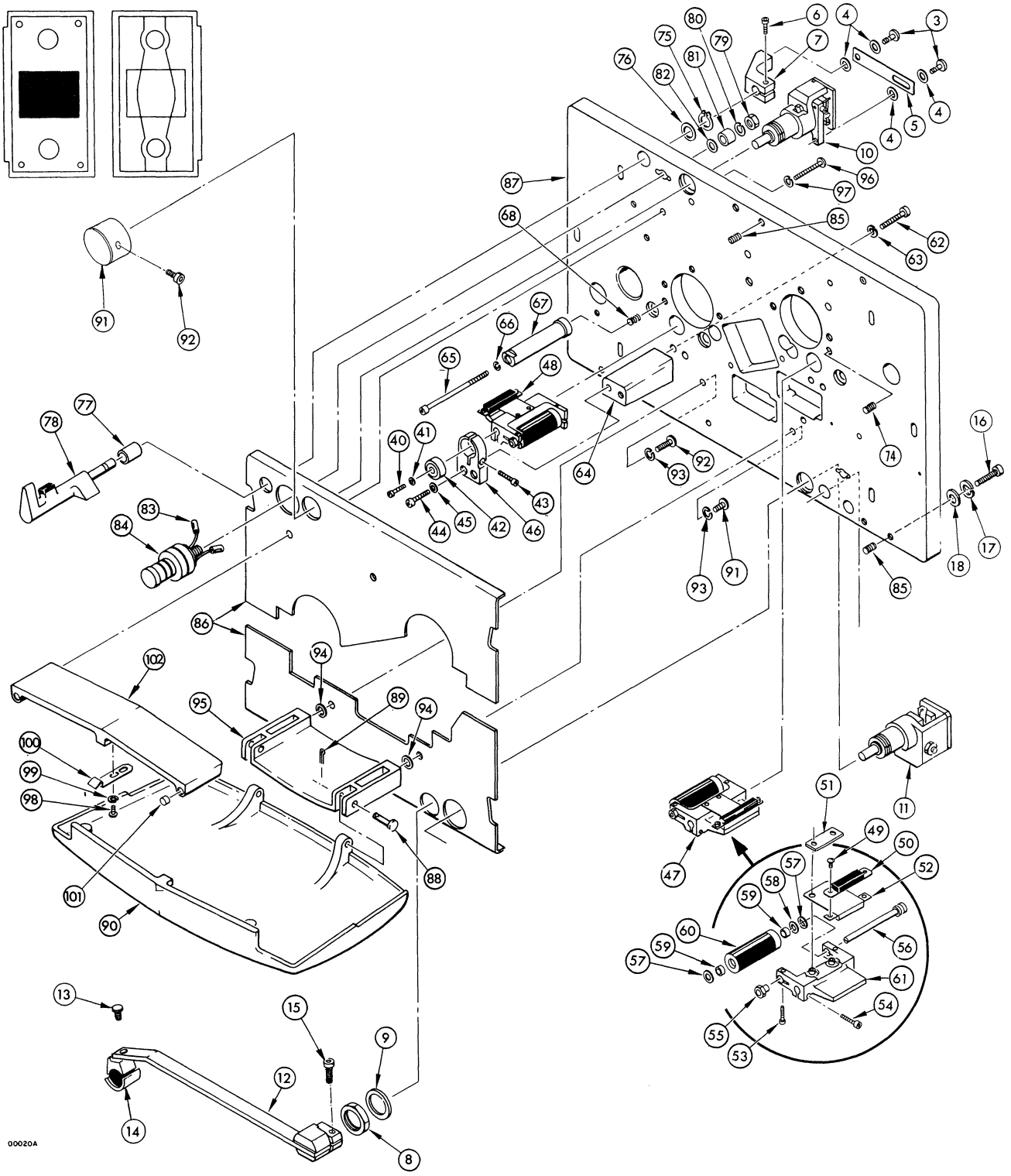


Figure 9-11
Precision Plate (Sheet 1 of 2)

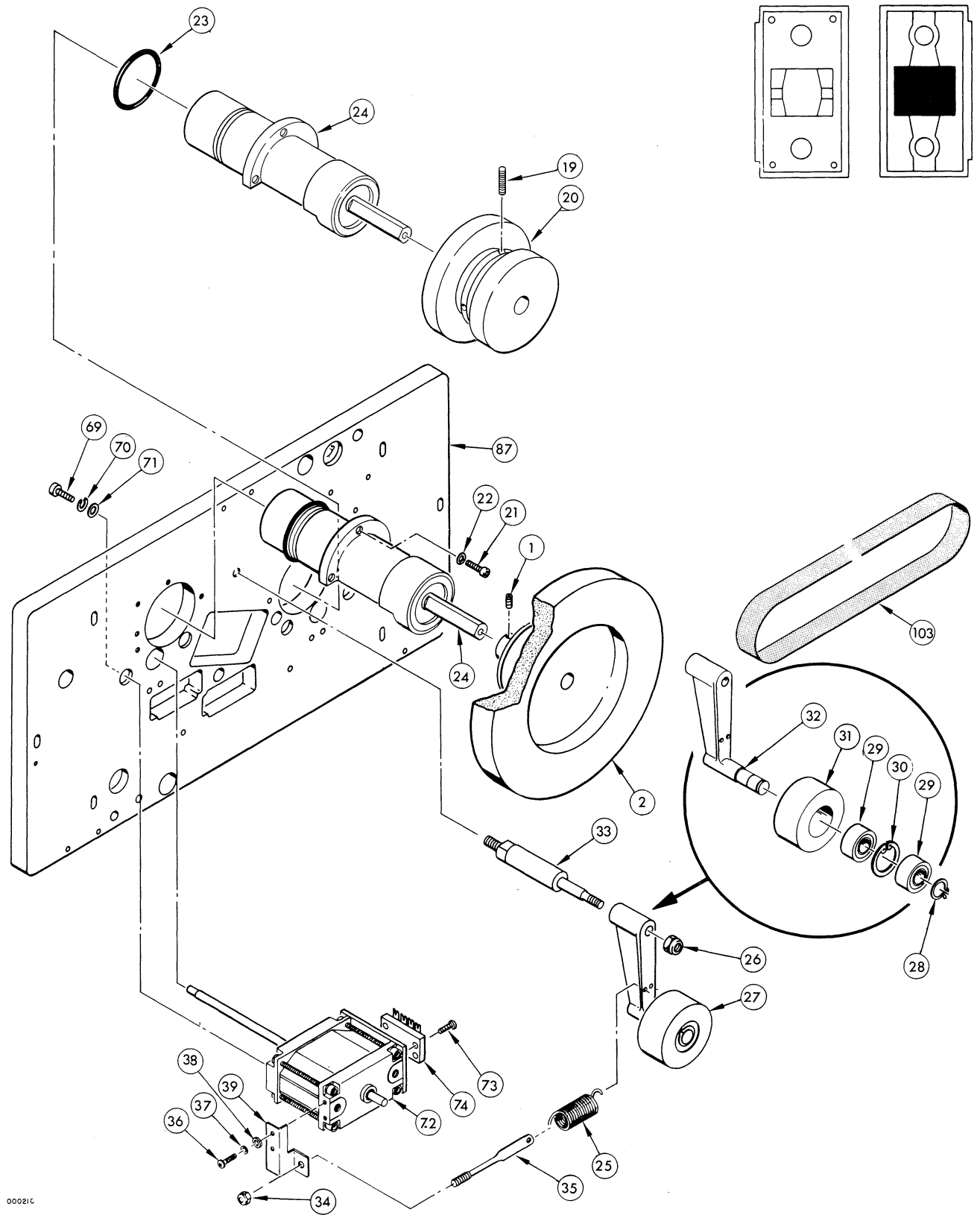


Figure 9-11
Precision Plate (Sheet 2 of 2)

FIG & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
		PRECISION PLATE				
	3101166-10	Tape Transport Assembly, basic unit, 1/2 inch (See Figure 9-1)	Ref			
1	477-174	. Screw, set, headless, 10-32 by 3/8 in., hex soc, cup point, stl cad plt (Allen)	2			
2	3101274-10	. Flywheel, capstan	1			
3	3101591-10	. Screw, shouldered	2			
4	501-009	. Washer, #6 flat, stl cad plt (MS15795-206)	4			
5	3101868-10	. Link, tape clamp	1			
6	470-012	. Screw, cap, 4-40 NC-3A by 1/2 in., hex soc, stl cad plt (MS35457-3)	1			
7	3101869-10	. Arm, tape clamp	1			
8	3101787-10	. Nut, shaft, tape packer	2			
9	3101870-10	. Washer	2			
10	5103081-10	. Tape Packer Assembly, upper, w/grounded shoe, 1/2 in.	1			
11	3109334-10	. Tape Packer Assembly, lower, w/grounded shoe, 1/2 in.	1			
12	3109331-10	. . Arm Assembly, tape packer, 1/2 in.	1			
13	471-892	. . . Screw, machine, 6-32 by 1/4 in., button hd. multiple spline, sst, passivated (Bristol)	1			
14	3109300-10	. . . Shoe, tape packer, 1/2 in.	1			
15	470-999	. . . Screw, cap, 8-32 NC-2A by 1/2 in., hex soc, stl cad plt	1			
16	470-041	. Screw, cap, 10-32 NF-3A by 7/8 in., hex soc, stl cad plt (MS35458-14)	4			
17	502-005	. Washer, #10 spring lock, stl cad plt (MS35338-43)	4			
18	501-011	. Washer, #10 flat, stl cad plt (MS15795-208)	4			

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
	3101264-10	. Precision Plate Assembly	1			
	3101574-10	. . Pulley Assembly, capstan	1			
19	477-119	. . . Screw, set, headless, 10-32 NF-2A by 1/4 in., hex soc, cup point, sst, w/nylon insert (Nylok)	2			
20	3101783-10	. . . Pulley, capstan	1			
21	470-040	. . Screw, cap, 10-32 NF-3A by 3/4 in., hex soc, stl cad plt (MS35458-13)	6			
22	502-005	. . Washer, #10 spring lock, stl cad plt (MS35338-43)	6			
23	3105408-10	. . Quad Ring	2			
24	3101554-10	. . Capstan Assembly	2			
25	3101295-10	. . Spring, helical, extension	1			
26	493-012	. . Nut, self-locking, hex, 1/4-20 NC-3B, stl cad plt w/nylon insert (Esna Type NM)	1			
27	3101560-10	. . Roller Assembly	1			
28	430-111	. . . Ring, retaining, ext, 3/8, stl cad plt (Truarc #5101-37-S-MD)	1			
29	421-070	. . . Bearing, ball, double shield (MRC #R6ZZ)	2			
30	430-085	. . . Ring, retaining, int, 7/8, stl cad plt (Truarc #N5000-87-S-MD)	1			
31	3101769-10	. . . Roller, drive belt	1			
32	3101768-10	. . . Arm, idler	1			
33	3101559-10	. . Stud, shouldered	1			
34	493-008	. . Nut, self-locking, hex, 10-32 NF-3B, stl cad plt w/nylon insert (Esna Type NM)	1			
35	3101561-10	. . Bolt, eye	1			
36	471-068	. . Screw, machine, 6-32 NC-2A by 5/16 in., pan hd Phillips, stl cad plt (MS35208-24)	2			
37	502-003	. . Washer, #6 spring lock, stl cad plt (MS35338-41)	2			
38	501-009	. . Washer, #6 flat, stl cad plt (MS15795-206)	2			
39	3101562-10	. . Bracket, anchor	1			
40	470-151	. . Screw, cap, 4-40 NC-3A by 1/4 in., hex soc, stl cad plt w/nylon insert (Unbrako)	2			
41	501-014	. . Washer, #4 flat, sst, passivated (MS15795-304)	2			
42	3101558-10	. . Bushing Assembly, rubber	2			

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
43	470-176	. . Screw, cap, 4-40 by 9/16 in., hex soc, stl cad plt w/nylon insert (Nylok #M60HS440-9C)	2			
44	470-061	. . Screw, cap 4-40 NC-3A by 3/8 in., hex soc, sst, passivated	4			
45	502-008	. . Washer, #4 spring lock, sst, passivated (MS35338-78)	4			
46	3101570-10	. . Arm, actuator shaft support	2			
47	3101556-10	. . Capstan Roller Assembly, forward	1			
48	3101557-10	. . Capstan Roller Assembly, reverse	1			
49	471-866	. . . Screw, machine, 2-56 by 1/8 in., pan hd slotted, self-locking, stl cad plt (Nylok #M37AS256-2C)	2			
50	3101760-10	. . . Pad Assembly, tape brake	1			
51	3101759-10	. . . Clamp, spring	1			
52	3101761-10	. . . Tape Brake Assembly	1			
53	470-235	. . . Screw, cap, 2-56 by 3/8 in., socket hd, sst (Nylok 1960 Series)	2			
54	470-236	. . . Screw, cap, 4-40 by 7/16 in., socket hd, sst (Nylok 1960 Series)	2			
55	3101838-10	. . . Sleeve, flanged	1			
56	3101764-10	. . . Shaft Assembly	1			
57	3101833-10	. . . Spacer, bearing	2			
58	501-119	. . . Washer, spring, #5 beryllium copper (Shakeproof #3502-05-23-2114)	1			
	3109295-10	. . . Capstan Roller Assembly	1			
59	3101782-10	. . . . Bearing	2			
60	3101765-10	. . . . Capstan Roller	1			
61	3101831-10	. . . Yoke Assembly, forward capstan roller	1			
	3101832-10	. . . Yoke Assembly, reverse capstan roller	1			
62	470-031	. . Screw, cap, 8-32 NC-3A by 3/4 in., hex soc, stl cad plt (MS35457-17)	4			
63	502-004	. . Washer, #8 spring lock, stl cad plt (MS35338-42)	4			
64	3101571-10	. . Post, actuator shaft support	2			
65	3101586-10	. . Screw, cap, soc, 8-32 NC-2A by 2-1/4 in., sst	2			
66	502-097	. . Washer, #8 spring lock, stl cad plt (AN935-8L)	2			

FIG & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
67	3101569-10	. . Post, tape brake	2			
68	495-014	. . Insert, notched, 8-32, sst (Helicoil #1185-2CNX.246)	2			
69	470-029	. . Screw, cap, 8-32 NC-3A by 1/2 in., hex soc, stl cad plt (MS.35457-15)	4			
70	502-004	. . Washer, #8 spring lock, stl cad plt (MS.35338-42)	4			
71	501-010	. . Washer, #8 flat, stl cad plt (MS15795-207)	4			
72	3101555-10	. . Actuator Assembly, capstan roller	2			
73	471-690	. . . Screw, machine, 4-40 NC-2A by 3/8 in., slotted fillister hd, brass cad plt	4			
74	180-080	. . . Terminal Strip, 4 terminals, phenolic (Kulka #410-3/4ST-4M)	1			
75	430-130	. . Ring, retaining, ext, 1/4, sst (Truarc #5101-25W)	1			
76	501-025	. . Washer, 1/4 flat, stl cad plt (AN960-416L)	1			
77	423-012	. . Bushing, plain sleeve, bronze (Bost-Bronze #B-46-4)	1			
78	3101573-10	. . Clamp, tape	1			
79	492-010	. . Nut, plain hex, 8-32 NC-2B, stl cad plt (MS35649-82)	2			
80	502-004	. . Washer, #8 spring lock, stl cad plt (MS35338-42)	2			
81	3101589-10	. . Spacer	2			
82	503-013	. . Washer, nonmetallic, #8 (General Cement #6526)	2			
83	171-009	. . Connector, solderless, corrosion resistant (AMP #320555)	4			
84	3101564-10	. . Guide Assembly, insulated	2			
85	495-010	. . Insert, notched, 10-32, sst (Helicoil #1191-3CNX.285)	4			
86	3101551-10	. . Plate, overlay	1			
87	3101549-10	. . Plate, precision	1			
88	400-024	. Pin, clevis, pan hd, stl cad plt (MS20392-21)	2			
89	401-004	. Pin, cotter, 1/16 in. dia by 3/8 in lg, sst	2			
90	5100594-10	. Cover, tape mechanism	1			
91	5100406-10	. Cap, Tape Packer, upper	1			
92	470-999	. Screw, cap, 8-32 NC-2A by 1/2 in., hex soc, stl cad plt	1			

FIG & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
91	471-072	. Screw, Machine, 6-32NC-2A by 5/8 in., Pan hd, Phillips, stl cad plt, (MS35208-28)	1			
92	471-074	. Screw, Machine, 6-32NC-2A by 7/8 in., Pan hd Phillips, stl cad plt, (MS35208-30)	1			
93	502-003	. Washer, #6 Spring lock, stl cad plt, (MS35338-41)	2			
94	501-009	. Washer, #6 Flat, stl cad plt, (MS15795-206	2			
95	3102465-10	. Bracket, Hinge	1			
96	471-074	. Screw Machine, 6-32NC-2A by 7/8 in., Pan hd, Phillips, stl cad plt, (MS35208-30)	3			
97	502-003	. Washer #6 Spring lock, stl cad plt, (MS35338-41)	3			
98	471-059	. Screw Machine, 4-40NC-2A by 3/16 in., Pan hd, Phillips, stl cad plt (MS35208-11)	2			
99	502-002	. .Washer, # 4 spring lock, stl cad plt, (MS35338-40)	2			
100	3101585-10	. Latch Spring	1			
101	3101455-10	. Bumper Head Cover	2			
102	3102467-10	. Bracket, Tape Mechanism Cover	1			
103	081-014	. Belt, Endless, Nylon, $\frac{1}{2}$ by 35 in., (Tilton #S5-TW)	1			

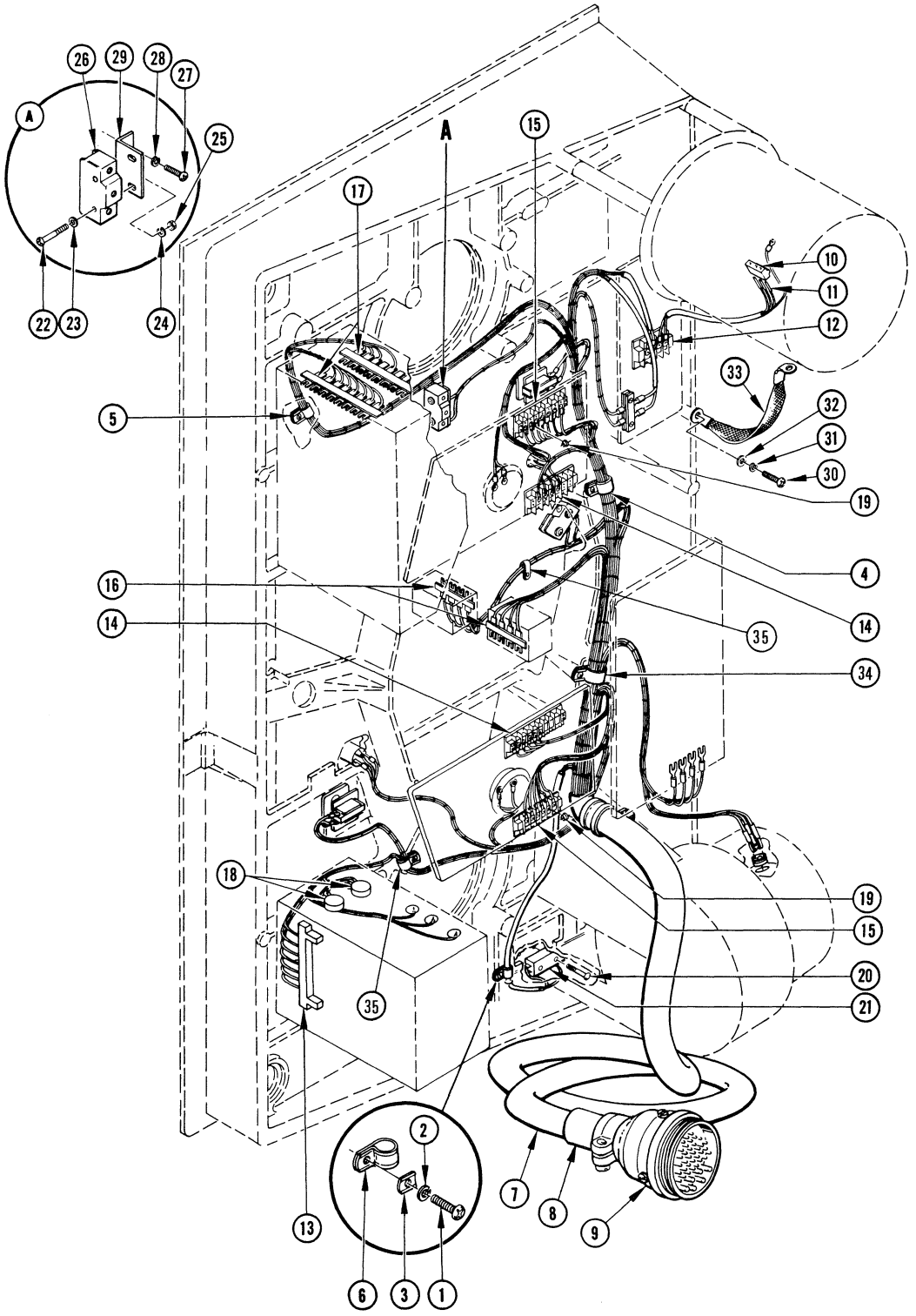


Figure 9-12
Transport Cable and Switches

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
		TRANSPORT CABLE AND SWITCHES				
	3101166-10	Tape Transport Assembly, basic unit, 1/2 inch (See Figure 9-1)	Ref			
1	471-069	. Screw, machine, 6-32 NC-3A by 3/8 in., pan hd Phillips, stl cad plt (MS24584-25)	6			
2	502-003	. Washer, #6 spring lock, stl cad plt (MS35338-41)	6			
3	506-013	. Washer, cable clamp (Weckesser #D-140)	6			
4	302-086	. Clamp, cable, 11/16 in. (Commercial Plastics #742-11)	1			
5	302-007	. Clamp, cable, 1/4 in. (Commercial Plastics #742-4)	1			
6	302-031	. Clamp, cable, 3/16 in. (Commercial Plastics #742-3)	2			
	3101257-10	. Cable Assembly, transport	1	B		
8	262-007	. . Bushing, Telescoping (AN3420-16)	1			
9	145-129	. . Connector, plug, male, 53 contact (P301) (Cannon # RLK-A53-22C-1)	1			
10	169-988	. . Connector, cable cap, 3 contact (P702) (AMP #480178-1)	1			
11	169-019	. . Connector, contact pin (AMP #42641-1)	3			
12	180-119	. . Terminal Strip, barrier, 4 terminal, w/marker strip (TB709) (Kulka #600-3/4 st-4)	1			
13	168-008	. . Connector, printed circuit board (P701) (Elco #5006-15-13-3-5-3/32)	1			
14	180-116	. . Terminal Strip, barrier strip, 8 terminals, w/marker strip (TB701, TB702) (Kulka #410-3/4ST-8MFE)	2			
15	180-117	. . Terminal Strip, barrier strip, 7 terminal, w/marker strip (TB703,TB706) (Kulka #600-3/4st-7)	2			
16	3100640-10	. . Terminal Strip, fanning strip, 4 terminal (FS704, FS705)	2			
17	3101443-10	. . Terminal Strip, fanning strip, 8 lug (FS3, FS4)	2			
18	044-297	. . Resistor, variable, wirewound, 1K, 2w, linear taper (R701, R702) (Clarostat #43-1000)	2			
19	013-139	. . Diode, silicon (CR706, CR707) (Texas Instrument #1N2069)	2			
20	471-333	. Screw, machine, 6-32 NC-2A by 3/16 in., flat hd Phillips, stl cad plt (MS35192-22)	2			

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
21	120-058	. Switch, cabinet interlock (S708) (Microswitch #3AC5)	1			
22	471-075	. Screw, machine, 6-32 NC-2A by 1 in., pan hd Phillips, stl cad plt (MS35208-31)	2			
23	501-009	. Washer, #6 flat, stl cad plt (MS15795-206)	2			
24	502-003	. Washer, #6 spring lock, stl cad plt (MS35338-41)	2			
25	492-009	. Nut, plain hex, 6-32 NC-2B, stl cad plt (MS35649-62)	2			
26	120-118	. Switch, write lockout, rigid leaf actuator (S710) (Microswitch #BZ-RW80-A2)	1			
27	471-067	. Screw, machine, 6-32 NC-2A by 1/4 in., pan hd Phillips, stl cad plt (MS35208-23)	2			
28	502-003	. Washer, #6 spring lock, stl cad plt (MS35338-41)	2			
29	3101294-10	. Bracket, mounting	1			
30	471-089	. Screw, machine, 10-32 NF-3A by 1/2 in., pan hd Phillips, stl cad plt (MS24584-55)	1			
31	502-005	. Washer, #10 spring lock, stl cad plt (MS35338-43)	1			
32	501-011	. Washer, #10 flat, stl cad plt (MS15795-208)	1			
33	3101301-10	. Strap, ground	1			
34	302-105	. Clamp, 7/8 in. black nylon	1			
35	302-036	. Clamp, 3/8 in., plastic	2			

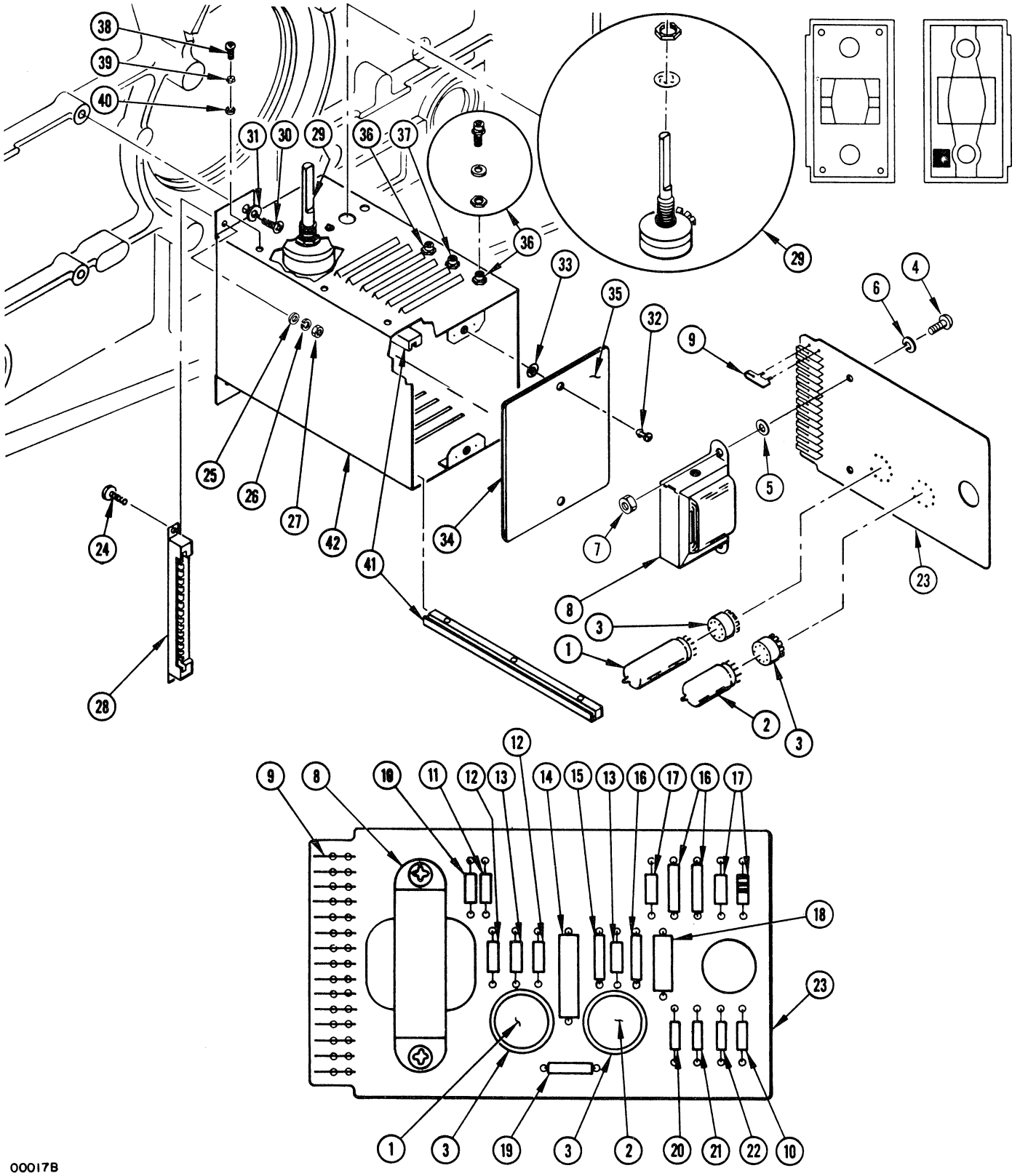


Figure 9-13
Oscillator and Housing

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
		OSCILLATOR AND HOUSING				
	3101166-10	Tape Transport Assembly, basic unit, 1/2 inch (See Figure 9-1)	Ref			
	3101265-10	. Oscillator Assembly (OSC-700)	1			
1	012-065	. . Tube, electron, 9 pin miniature (V2) (RCA #12BH7)	1			
2	012-068	. . Tube, electron, 9 pin miniature (V1) (RCA or General Electric #5751)	1			
3	150-080	. . Socket, tube, 9 pin (Cinch Type #144P24023)	2			
4	471-077	. . Screw, machine, 8-32 NC-2A by 5/16 in., pan hd Phillips, stl cad plt (MS24584-39)	2			
5	501-190	. . Washer, #8 flat, stl cad plt	2			
6	502-004	. . Washer, #8 spring lock, stl cad plt (MS35338-42)	2			
7	492-010	. . Nut, plain hex, 8-32 NC-2B, stl cad plt (MS35649-82)	2			
8	563-020	. . Transformer, cased (T1) (Triad #A53X)	1			
9	168-007	. . Contact, printed circuit board (Elco CS-60-5001.1913-.200)	15			
10	041-023	. . Resistor, fixed, composition, 100K, 1/2w, 5% (R1, R13) (MIL-R-11:RC20GF104J)	2			
11	041-028	. . Resistor, fixed, composition, 330K, 1/2w, 5% (R8) (MIL-R-11:RC20GF334J)	1			
12	041-476	. . Resistor, fixed, composition, 1.2 meg, 1/2w, 5% (R10, R11) (MIL-R-11:RC20GF125J)	2			
13	041-245	. . Resistor, fixed, composition, 1000 ohm, 1/2w, 5% (R2, R12) (MIL-R-11:RC20GF102J)	2			
14	035-356	. . Capacitor, tubular, 0.1 µf, 400 vdc, 5% (C5) (Gudeman #337E104J)	1			
15	034-184	. . Capacitor, mica, 68 pf, 500 vdc, 5% (C7) (Elmenco #DM15F680J)	1			
16	034-199	. . Capacitor, mica, 300 pf, 500 vdc, 5% (C2, C3, C4) (Elmenco #DM15F301J)	3			
17	041-318	. . Resistor, fixed, composition, 120K, 1/2w, 5% (R4, R5, R6) (MIL-R-11:RC20GF124J)	3			
18	035-355	. . Capacitor, tubular, 0.1 µf, 150 vdc, 5% (C1) (Gudeman #337Y104J)	1			
19	034-177	. . Capacitor, mica, 100 pf, 500 vdc, 5% (C6) (Elmenco #DM15F101J)	1			
20	041-344	. . Resistor, fixed, composition, 390 ohm, 1/2w, 5% (R3) (MIL-R-11:RC20GF391J)	1			

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
21	041-016	. . Resistor, fixed, composition, 22K, 1/2w, 5% (R9) (MIL-R-11:RC20GF223J)	1			
22	041-398	. . Resistor, fixed, composition, 2.2 meg, 1/2w, 5% (R7) (MIL-R-11:RC20GF225J)	1			
23	3101598-10	. . Card, printed wiring	1			
24	471-061	. Screw, machine, 4-40 NC-2A by 5/16 in., pan hd Phillips, stl cad plt (MS24584-13)	2			
25	501-008	. Washer, #4 flat, stl cad plt (MS15795-204)	2			
26	502-002	. Washer, #4 spring lock, stl cad plt (MS35338-40)	2			
27	492-008	. Nut, plain hex, 4-40 NC-2B, stl cad plt (MS35649-42)	2			
28	168-008	. Connector, printed circuit board (P701) (Elco #5006-15-13-3-5-3/32) (See Figure 9-12)	Ref			
29	044-297	. Resistor, variable, 1K, 2w, w/mounting hardware (R701, R702) (Clarostat #43-1000) (See Figure 9-11)	Ref			
30	471-078	. Screw, machine, 8-32 NC-2A by 3/8 in., pan hd Phillips, stl cad plt (MS35208-40)	3			
31	502-004	. Washer, #8 spring lock, stl cad plt (MS35338-42)	3			
	3101266-10	. Chassis Assembly, oscillator	1			
	3101605-10	. . Plate Assembly, cover	1			
32	310-068	. . . Fastener, receptacle (Southco #81-18-150-16)	2			
33	431-009	. . . Retainer, external, stl cad plt (Southco #81-32-101-15)	2			
34	3101795-10	. . . Gasket, rubber	1			
35	3101794-10	. . . Plate, cover	1			
36	148-012	. . Jack, test point, red nylon, w/mounting hardware (TP701, TP702) (Cannon #45E2, Ucinite #118930-B)	2			
37	148-013	. . Jack, test point, black nylon, w/mounting hardware (TP703) (Cannon #45E3, Ucinite #118930-C)	1			
38	471-061	. . Screw, machine, 4-40 NC-2A by 5/16 in., pan hd Phillips, stl cad plt (MS24584-13)	6			
39	502-013	. . Washer, #4 lock, ext tooth, stl cad plt (MS35335-29)	6			
40	501-008	. . Washer, #4 flat, stl cad plt (MS15795-204)	6			
41	3101606-10	. . Track, circuit board	2			
42	CHASSIS	. . Chassis Assembly, oscillator, welded	1			

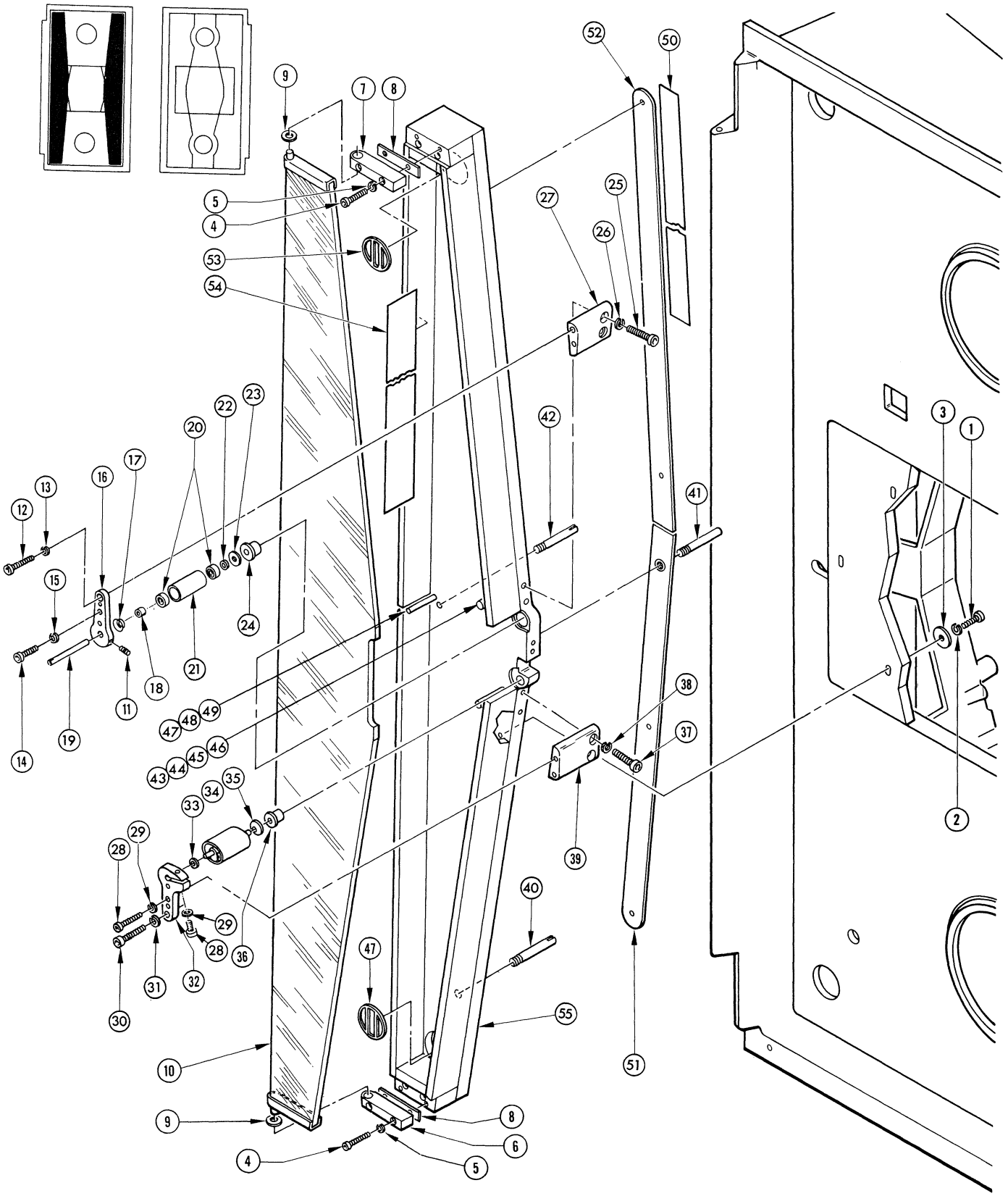


Figure 9-14
Vacuum Chambers

FIG & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
		VACUUM CHAMBERS				
	3101166-10	Tape Transport Assembly, basic unit, 1/2 inch (See Figure 9-1)	Ref			
1	470-175	. Screw, cap, 6-32 by 7/8 in., hex soc, steel, w/nylon insert (Cleveland Cap & Screw Co.)	6			
2	502-003	. Washer, #6 spring lock, stl cad plt (MS35338-40)	6			
3	3101326-10	. Washer, flat	6			
	3104019-10	. Vacuum Chamber Assembly, 1/2 in.	1			
4	470-064	. . Screw, cap, 4-40 NC-3A by 5/8 in., hex soc, sst, passivated	4			
5	502-002	. . Washer. # 4 spring lock, stl cad plt (MS35338-40)	4			
6	3101483-10	. . Hinge. chamber door	1			
7	3101484-10	. . Hinge, chamber door	1			
8	3101521-10	. . Shim, chamber door hinge	A/R			
9	501-058	. . Washer, shim, brass, 0.010 in. thk (Tilley)	A/R			
10	3101485-10	. . Door Assembly, chamber	1			
11	477-027	. . Screw, set, headless, 2-56 NC-3A by 3/16 in., hex soc, cup point, stl cad plt (MS51017-2)	1			
12	470-070	. . Screw, cap, 6-32 NC-3A by 7/16 in., hex soc, sst, passivated	1			
13	502-009	. . Washer, #6 spring lock, sst, passivated (MS35338-79)	1			
14	470-062	. . Screw, cap, 4-40 NC-3A by 7/16 in., hex soc, sst, passivated	1			
15	502-008	. . Washer, # 4 spring lock, sst, passivated (MS35338-78)	1			
16	3101513-10	. . Support, plate	1			
17	506-017	. . Washer, beryllium copper (Shakeproof # 3802-05-16-2114)	1			
18	3101524-10	. . Spacer, buffer spring	1			
	3101935-10	. . Rotary Guide Assembly, 1/2 in.	1			
19	3101519-10	. . . Shaft, rotary guide	1			
20	3101520-10	. . . Bearing, rotary guide	2			
21	3101512-10	. . . Sleeve, rotary guide	1			
22	3101514-10	. . Spacer, rotary guide	1			
23	501-034	. . Washer, flat, brass, 0.158 in. ID by 0.234 in. OD by 0.003 in. thk.	A/R			
24	3101515-10	. . Bushing, rotary guide	1			

FIG & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
25	470-088	. . Screw, cap, 10-32 NF-3A by 7/16 in., hex soc, sst, passivated	2			
26	502-011	. . Washer, #10 spring lock, sst, passivated (MS35338-81)	2			
27	3101517-10	. . Post, Support, rotary guide (used on (3104019-10)	1			
28	470-062	. . Screw, Cap, 4-40NC-3A by 7/16 in., hex soc, sst, passivated	2			
29	502-008	. . Washer, #4 springlock, sst, passivated (MS35338-78)	2			
30	470-070	. . Screw, cap, 6-32NC-3A by 7/16 in., hex soc, sst, passivated	1			
31	502-009	. . Washer #6 spring lock, sst, passivated (MS35338-79)	1			
32	3101525-10	. . Plate support, buffer guide	1			
33	3101524-10	. . Spacer, Buffer guide	1			
34	3101501-10	. . Buffer Assembly, Spring guide	1			
35	501-122	. . Washer, Spring st, (Shakeproof #3502-05-03)	1			
36	3101506-10	. . Bushing, Buffer spring	1			
37	470-088	. . Screw, cap, 10-32NF-3A by 7/16 in., hex soc, sst, passivated	2			
38	502-011	. . Washer #10 spring lock, sst, passivated (MS35338-81)	2			
39	3101527-10	. . Post, support, buffer guide	1			
40	3101492-10	. . Stud, hollow, long loop	1			
41	3102864-10	. . Stud, hollow, transducer	1			

FIG & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
42	3101509-10	. . Stud, hollow, short loop	1			
43	470-063	. . Screw, cap, 4-40NC-3A by 1/2 in., hex soc, sst, passivated	2			
44	502-002	. . Washer #4 spring lock, stl, cad plt, (MS35338-40)	2			
45	501-008	. . Washer # 4 flat, stl cad plt (MS15795-204)	2			
46	3104017-10	. . Guide, Stationary	2			
47	470-006	. . Screw, cap, 2-56NC-3A by 1/2 in., hex soc, stl cad plt	1			
48	502-001	. . Washer # 2 spring lock, stl cad plt, (MS35338-39)	1			
49	3101502-10	. . Pin, Spacer	1			
50	225-062	. . Tape, pressure sensitive, aluminized vinyl, 1 in., W(Minnesota Mining & Mfg. # 474)	A/R			
51	3101487-10	. . Plate, cover	1			
52	3101488-10	. . Plate, cover	1			
53	3101490-10	. . Grille, vacuum chamber	1			
54	3102027-10	. . Discharger, Electro-static	1			
55	Base	. . Base assy. vacuum chamber	1			

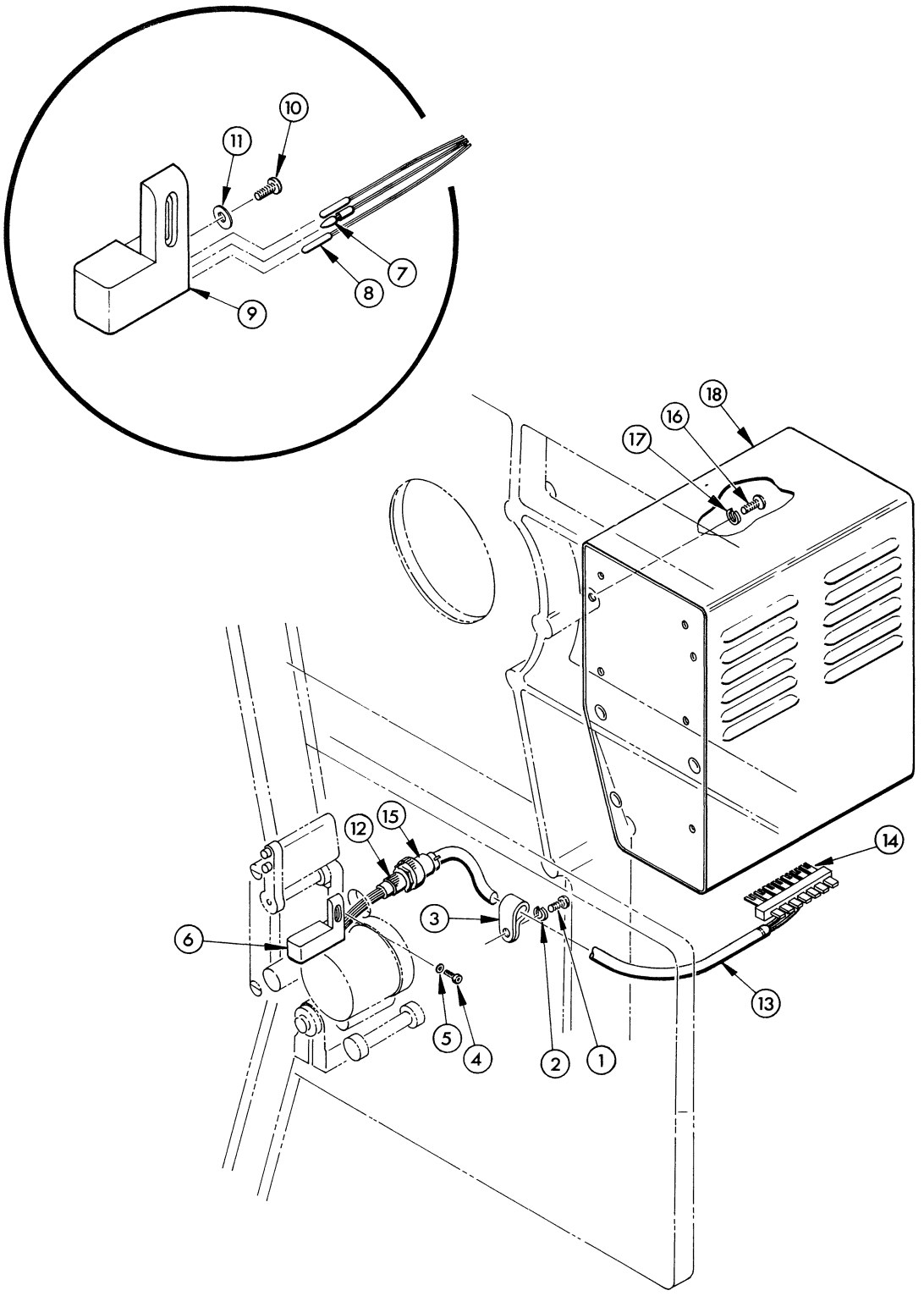


Figure 9-15
Photosense Installation

FIG & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
		PHOTOSENSE INSTALLATION				
	3101166-10	Tape Transport Assembly (See fig. 9-1)	Ref			
1	470-074	. Screw, Machine, 6-32 NC-2A by 7/8 in., pan hd Phillips, stl cad plt, (MS35208-30)	1			
2	502-003	. Washer, #6 spring lock, stl cad plt (MS35338-41)	1			
3	302-036	. Clamp, Cable, Plastic 3/8 in. ID (Commercial plastic # 742-6)	1			
4	470-061	. Screw, cap, 4-40 NC-3A by 3/8 in., hex soc, sst.	2			
5	502-002	. Washer #4 spring lock sst.	2			
6	3101930-10	. Post Assembly, Photosense	1			
7	060-059	. . Lamp, baseless, miniature	1			
8	3100594-10	. . Cell, photo electric	2			
9	3101947-10	. . Post Photosense	1			
10	471-838	. . Screw, Machine, 2-56 NC-2A by 3/16 in., pan hd slotted, stl cad plt	1			
11	503-040	. . Washer, Nylon .090 ID, 3/16 O.D., .020 thick	1			
12	145-150	. . Connector, 9 pin, male. Winchester # (M9P-LSH)	1			
13	3101596-10	. Cable Assembly	1			
14	3101443-10	. . Fanning strip	1			
15	146-170	. . Connector, 9 pin, female, Winchester #(M9S-LRH 19C)	1			
16	471-078	. Screw, Machine, 8-32 NC-2A by 3/8 in., pan hd Phillips, stl cad plt (MS35208-40)	3			
17	502-004	. Washer#8spring lock, stl cad plt, (MS35338-42)	3			
18	3101203-10	. Photosense Chassis assembly (see fig. 9-16)	1			

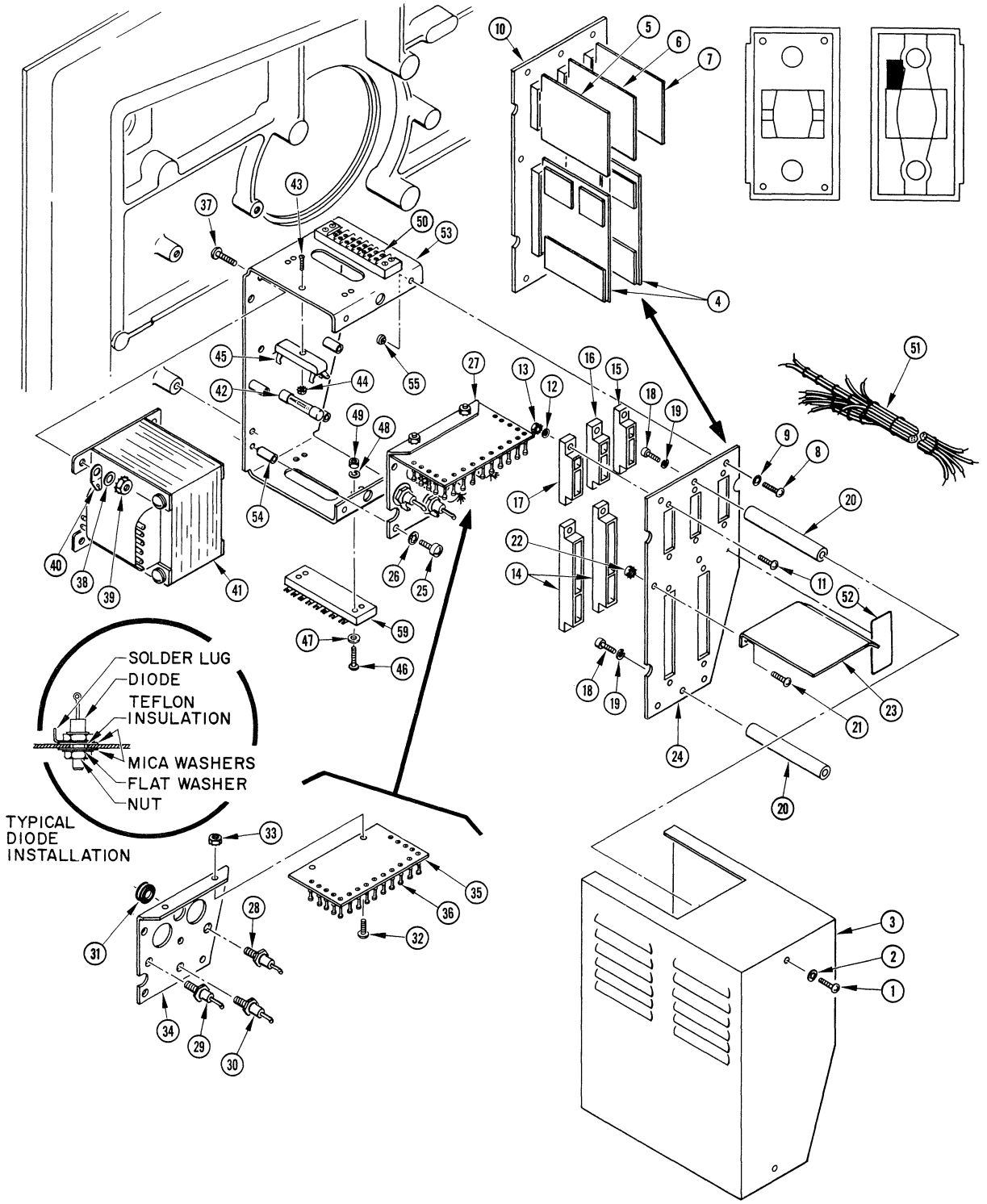
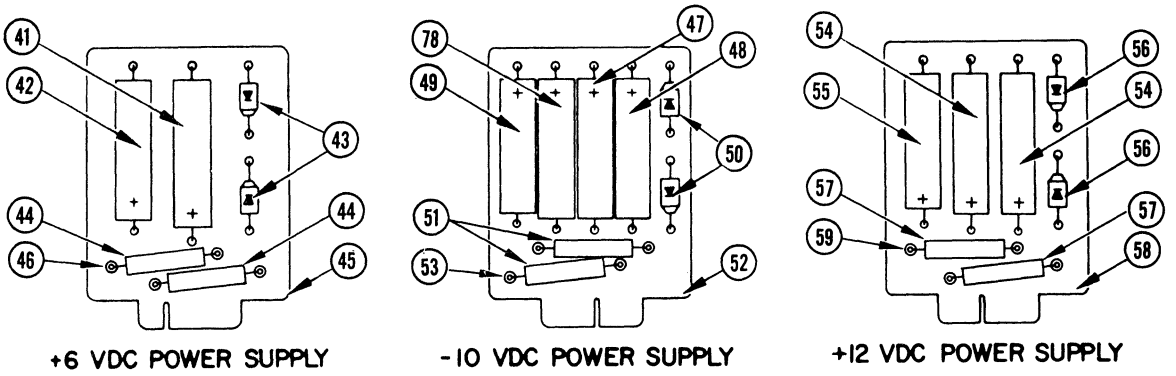


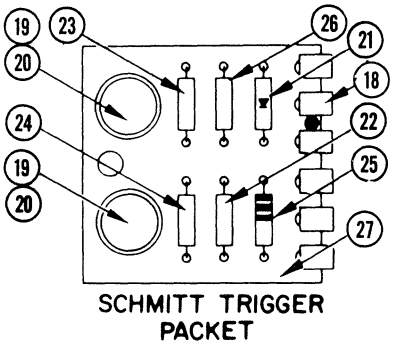
Figure 9-16
Photosense Chassis

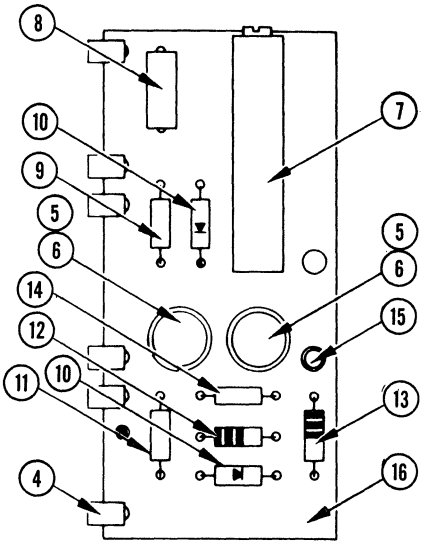
FIG & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
		PHOTOSENSE CHASSIS				
	3101203-10	Photosense Chassis Assembly, positive level output (See Figure 9-15)	Ref			
1	471-078	. Screw, machine, 8-32 NC-2A by 3/8 in., pan hd Phillips, stl cad plt (MS35208-40)	2			
2	502-026	. Washer, #8 lock, internal tooth, stl cad plt (MS35333-38)	2			
3	3101429-10	. Cover, photosense	1			
4	3100589-10	. Base Card Assembly, photosense (See Figure 9-17)	2			
5	3100289-10	. Card Assembly, power supply, +6 vdc (See Figure 9-17)	1			
6	3100288-10	. Card Assembly, power supply, -10 vdc (See Figure 9-17)	1			
7	3100287-10	. Card Assembly, power supply, +12 vdc (See Figure 9-17)	1			
8	471-060	. Screw, machine, 4-40 NC-2A by 1/4 in., pan hd Phillips, stl cad plt (MS24584-12)	4			
9	502-024	. Washer, #4 lock, int tooth, stl cad plt (MS35333-36)	4			
10	3101427-10	. Connector Plate Assembly	1			
11	471-064	. . Screw, machine, 4-40 NC-2A by 1/2 in., pan hd Phillips, stl cad plt (MS24584-16)	10			
12	501-008	. . Washer, #4 flat, stl cad plt (MS15795-204)	10			
13	496-004	. . Nut, keps, 4-40 NC-2B, ext washer, stl cad plt (Shakeproof)	10			
14	168-019	. . Connector, printed circuit board (J1, J2) (Continental Connector Corp #600-110GD-546-F6)	2			
15	168-017	. . Connector, printed circuit board (J3) (Continental Connector Corp #600-110GD-900-C3)	1			

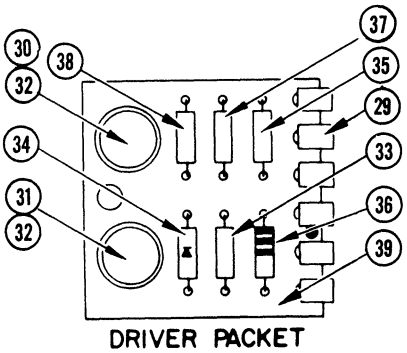
FIG & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
16	168-018	. . Connector, printed circuit board (J4) (Continental Connector Corp #600-110GD-900-D4)	1			
17	168-016	. . Connector, printed circuit board (J5) (Continental Connector Corp #600-100GD-900-B2)	1			
18	470-027	. . Screw, cap, 8-32 NC-2A by 3/8 in., hex soc, stl cad plt (MS35457-14)	2			
19	502-004	. . Washer, #8 spring lock, stl cad plt (MS35338-42)	2			
20	3101708-10	. . Spacer, sleeve	2			
21	471-060	. . Screw, machine, 4-40 NC-2A by 1/4 in., pan hd Phillips, stl cad plt (MS24584-12)	2			
22	496-004	. . Nut, keps, 4-40 NC-2B, ext washer, stl cad plt (Shakeproof)	2			
23	3101707-10	. . Deflector, air	1			
24	3101706-10	. . Connector Plate	1			
25	471-067	. Screw, machine, 6-32 NC-2A by 1/4 in., pan hd Phillips, stl cad plt (MS35208-23)	4			
26	502-025	. Washer, #6 lock, int tooth, stl cad plt (MS35333-37)	4			
27	3101426-10	. Diode Bracket Assembly	1			
28	013-145	. . Diode, zener, 10 volt, 3w, $\pm$ 2.5%, w/mounting hardware (CR1) (IRC #3Z10.V25)	1			
29	013-146	. . Diode, zener, 12 volt, 3w, $\pm$ 5%, w/mounting hardware (CR2) (IRC #3Z12.T5)	1			
30	013-156	. . Diode, zener, 6 volt, 3w, $\pm$ 0.1%, w/mounting hardware (CR3) (IRC #3Z6.0V01)	1			
31	260-005	. . Grommet, Neoprene (Rubbercraft #6)	1			
32	470-068	. . Screw, Machine, 6-32 NC-2A by 5/16 in. pan hd Phillips, stl cad plt, (MS35208-24)	2			
33	496-002	. . Nut, keps, 6-32NC-2B, ext washer, stl cad plt (shakeproof)	2			
34	3101702-10	. . Bracket Diode	1			
35	3101703-10	. . Terminal Board Assy., (TB1)	1			
36	173-024	. . . Lug, terminal (Useco #1280B) plt (Shakeproof)	18			
37	471-078	. Screw, Machine, 8-32 NC-2A by 3/8 in. pan hd, Phillips, stl, cad plt, (MS35208-40)	1			

FIG & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
38	501-010	. Washer, #8 flat, stl cad plt (MS15795-207)	4			
39	496-006	. Nut, keps, 8-32 NC-2B, ext tooth, stl cad plt (Shakeproof)	4			
40	172-001	. Lug, soldering, # 8 lock type (Shakeproof # 2104-08-00)	1			
41	3100291-10	. Transformer, power (T1)	1			
42	070-005	. Fuse, cartridge, 1/4 amp, slow blow (F1) (Littelfuse # 313. 250)	1			
43	471-327	. Screw, machine, 4-40 NC-2A by 5/16 in., flat hd Phillips, stl cad plt (MS35192-13)	1			
44	496-004	. Nut, keps, 4-40 NC-2B, ext washer, stl cad plt (Shakeproof)	1			
45	130-004	. Fuse Holder (Littelfuse # 357001)	1			
46	471-006	. Screw, machine, 2-56 NC-2A by 7/16 in., pan hd slotted, brass cad plt	12			
47	501-007	. Washer, # 2 flat, stl cad plt (MS15795-202)	12			
48	502-001	. Washer, # 2 spring lock, stl cad plt (MS35338-39)	12			
49	492-001	. Nut, plain hex, 2-56 NC-2B, brass cad plt	12			
50	180-116	. Terminal Strip, phenolic, 8 terminal (TB2, TB3, TB4) (Kulka # 410-3/4ST-8MFE)	3			
51	3101430-10	. Wiring Harness, branched	1			
52	3100249-10	. Identification Plate	1			
53	3101424-10	. Base Assembly, chassis	1			
54	280-019	. . Spacer, 6-32 thd, brass cad plt (CTC # 1246BX1/2)	4			
55	494-016	. . Nut, clinch, 4-40 NC-2B, stl cad plt (Penn Engg Co # CL-440-2)	4			









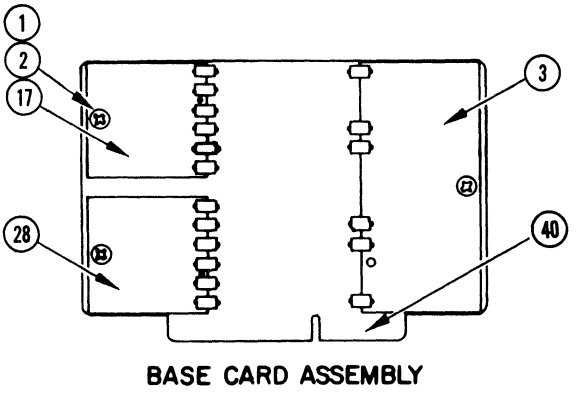


Figure 9-17
Photosense Base and
Power Supply Cards

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
		PHOTOSENSE BASE AND POWER SUPPLY CARDS				
	3100589-10	Base Card Assembly, photosense (See Figure 9-15	Ref			
1	471-059	. Screw, machine, 4-40 NC-2A by 3/16 in., pan hd Phillips, stl cad plt (MS24584-11)	3			
2	173-069	. Standoff, rivet type, 4-40 thd (Cambridge Thermionic #1300-9)	3			
3	3100507-10	. Packet Assembly, DC Amplifier	1			
4	3100670-10	. . Strap, packet	6			
5	3100671-10	. . Transistor, PNP, selected (Q1, Q2)	2			
6	280-030	. . Spacer, transistor (Milton Ross #10012)	2			
7	044-314	. . Resistor, variable, 500K, 1/4w, 10% (R4) (Allen-Bradley #RP504U)	1			
8	148-031	. . Jack, test point, yellow (TP1) (Ucinite #119437-H)	1			
9	041-406	. . Resistor, fixed, composition, 22K, 1/4w, 5% (R6) (MIL-R-11:RC07GF223J)	1			
10	013-021	. . Diode, silicon, 1N461 (CR1, CR2) (General Instrument, Hughes, Rheem)	2			
11	041-431	. . Resistor, fixed, composition, 150K, 1/4w, 5% (R5) (MIL-R-11:RC07GF154J)	1			
12	041-414	. . Resistor, fixed, composition, 2200 ohm, 1/4w, 5% (R2) (MIL-R-11:RC07GF222J)	1			
13	041-496	. . Resistor, fixed, composition, 10 ohm, 1/4w, 5% (R3) (MIL-R-11:RC07GF100J)	1			
14	041-511	. . Resistor, fixed, composition, 3900 ohm, 1/4w, 5% (R1) (MIL-R-11:RC07GF392J)	1			
15	173-012	. . Lug, terminal (TP2) (Useco #2010B2)	1			
16	3100669-10	. . Card, printed wiring	1			
17	3100508-10	. Packet Assy. Schmitt Trigger	1			
18	3100670-10	. . Strap, Packet	6			
19	014-083	. . Transistor, Germanium NPN (Q1, Q2) (General Transistor #2N444A)	2			
20	280-030	. . Spacer, Transistor (Milton Ross #10012	2			
21	013-132	. . Diode, Germanium (CR1) (Hughes # IN96A)	1			
22	041-407	. . Resistor, fixed, composition, 3300ohm, 1/4W, 5% (R1) (MIL-R-11: RC07GF332J)	1			
23	041-520	. . Resistor, fixed composition 7500ohm, 1/4W 5% (R2) (MIL-R-11: RC07GF752J)	1			

FIG & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
24	041-409	. . Resistor, fixed, composition, 15K, 1/4W 5%, (R3)(MIL-R-11: RC07GF153J)	1			
25	041-518	. . Resistor, fixed, composition, 33K, 1/4W 5%, (R4)(MIL-R-11: RCO7GF333J)	1			
26	041-413	. . Resistor fixed, composition, 6800ohm, 1/4W, 5% (R5)(MIL-R-11: RC07GF682J)	1			
27	3100672-10	. . Card, printed wiring	1			
28	3100688-10	. Packet Assy Driver	1			
29	3100670-10	. . Strap, Packet	6			
30	014-083	. . Transistor, Germanium NPN (Q1) (General transistor # ZN444A)	1			
31	014-097	. . Transistor, Germanium (Q2) (General transistor # GT1795)	1			
32	280-030	. . Spacer, Transistor (Milton Ross #10012)	2			
33	013-152	. . Diode, Germanium, Stabistor (CR1) (Transiston # S320G)	1			
34	013-153	. . Diode, Germanium (CR2)(Hughes #IN192)	1			
35	041-407	. . Resistor, fixed, composition, 3300ohm 1/4W, 5%, (R1) (MIL-R-11: RC07GF332J)	1			
36	041-410	. . Resistor, fixed, composition, 1000ohm, 1/4W, 5%, (R2) (MIL-R-11: RC07GF102J)	1			
37	041-408	. . Resistor, fixed, composition 10K, 1/4W, 5%, (R3) (MIL-R-11: RC07GF103J)	1			
38	041-412	. . Resistor, fixed, composition, 4700ohm, 1/4W, 5% (R4) (MIL-R-11: RC07GF472J)	1			
39	3100711-10	. . Card Printing	1			
40	3100578-10	. Base Card	1			
	3100289-10	Card Assy, Power Supply, +6VDC, (See Fig. 9-17)	Ref.			
41	031-186	. Capacitor, Electrolytic, 100 µf, 25volt, (C1) (Sprague # 30D188A1)	1			
42	031-220	. Capacitor, Electrolytic, 250 µf, 12volt, (C2) (Sprague #30D157A1)	1			
43	013-197	. Diode, Silicon (CR1, CR2) (RCA # IN3193)	2			

FIG & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
44	047-378	. Resistor, fixed, wirewound, 100 ohm, 3w, 3% (R1, R2) (Sage Electronics Corp Type #1250S)	2			
45	3100682-10	. Processed Board, +6 vdc	1			
46	173-036	. . Lug, terminal, hollow, brass (Useco #1390B-2)	4			
	3100288-10	Card Assembly, power supply, -10 vdc (See Figure 9-17)	REF			
47	031-187	. Capacitor, electrolytic, 50 µf, 50 volt (C1, C2) (Sprague #30D200A1)	2			
48	031-186	. Capacitor, electrolytic, 100 µf, 25 volt (C3) (Sprague #30D188A1)	1			
49	031-220	. Capacitor, electrolytic, 250 µf, 12 volt (C4) (Sprague #30D157A1)	1			
50	013-197	. Diode, silicon (CR1, CR2) (RCA #1N3193)	2			
51	047-379	. Resistor, fixed, wirewound, 270 ohm, 3w, 3% (R1, R2) (Sage Electronics Corp Type 1250S)	2			
52	3100681-10	. Processed Board, -10 vdc	1			
53	173-036	. . Lug, terminal, hollow, brass (Useco #1390B-2)	4			
	3100287-10	Card assembly, power supply, +12 vdc (See Figure 9-17)	REF			
54	031-187	. Capacitor, electrolytic, 50 µf, 50 volt (C1, C2) (Sprague #30D200A1)	2			
55	031-247	. . Capacitor, electrolytic, 200 µf, 15 volt (C3) (Sprague #30D174A1)	1			
56	013-197	. Diode, silicon (CR1, CR2) (RCA #1N3193)	2			
57	047-377	. Resistor, fixed, wirewound, 470 ohm, 3w, 3% (R1, R2) (Sage Electronics Corp Type 1250S)	2			
58	3100680-10	. Processed Board, +12 vdc	1			
59	173-036	. . Lug, terminal, hollow, brass (Useco #1390B-2)	4			

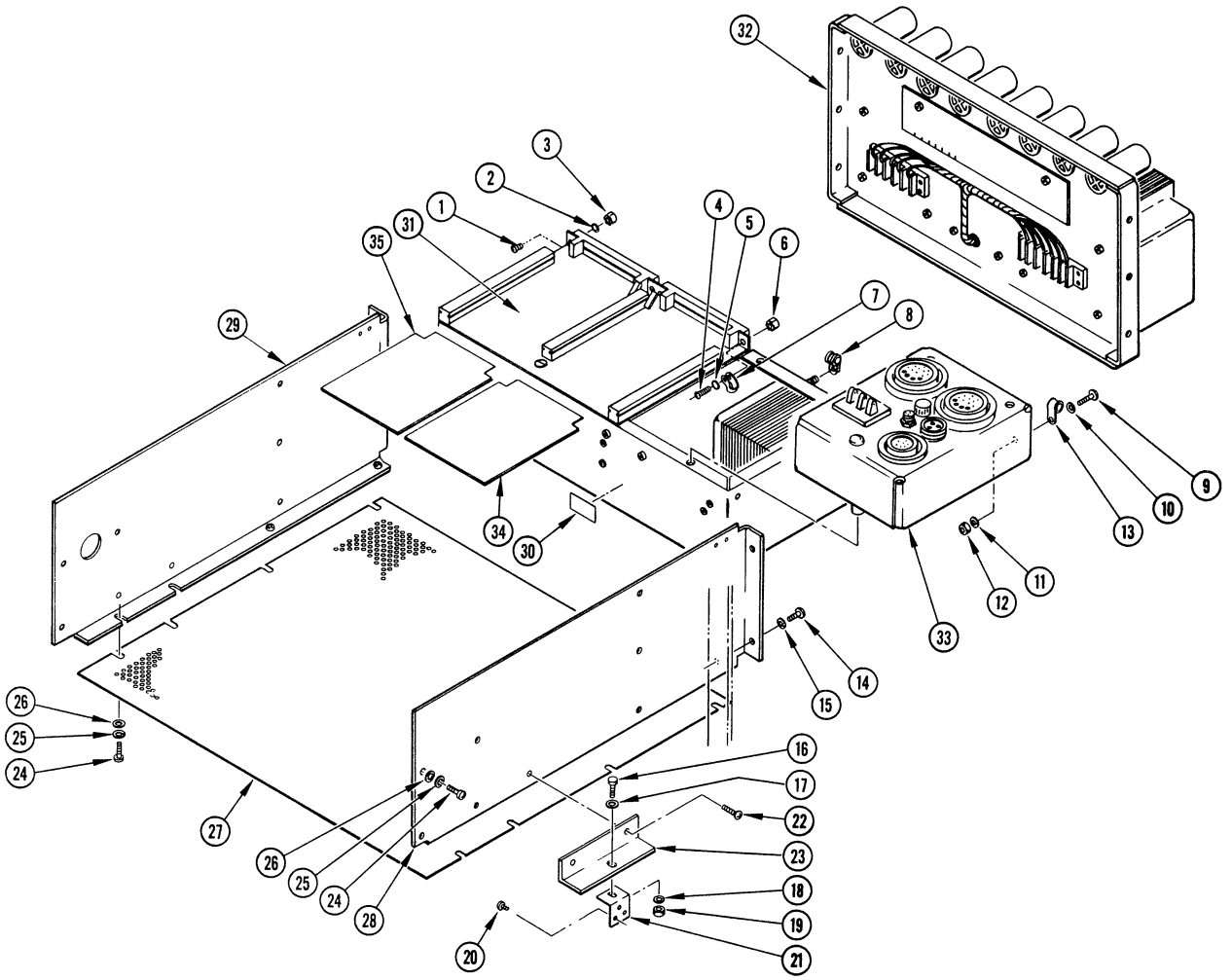


Figure 9-18
Transport Electronics

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
9-13-		TRANSPORT ELECTRONICS				
	5103005-10	Control Assembly, Power Supply (horizontal mounting) (See Figure 9-1)	Ref			
1	471-060	. Screw, machine, 4-40 NC-2A by 1/4 in., pan hd Phillips, stl cad plt (MS24584-12)	3			
2	501-086	. Washer, #4 flat, stl cad plt	3			
3	496-004	. Nut, keps, 4-40 NC-2B, ext tooth washer, stl cad plt (Shakeproof)	3			
4	471-064	. Screw, machine, 4-40 NC-2A by 1/2 in., pan hd Phillips, stl cad plt (MS24584-16)	1			
5	501-086	. Washer, #4 flat, stl cad plt	1			
6	496-004	. Nut, keps, 4-40 NC-2B, ext tooth washer, stl cad plt (Shakeproof)	1			
7	302-076	. Clamp, cable, black nylon (Weckesser Type 6)	1			
8	302-026	. Clamp, cable, loop type, w/rubber cushion (AN742D-10C)	1			
9	471-079	. Screw, machine, 8-32 NC-2A by 7/16 in., pan hd Phillips, stl cad plt (MS24584-41)	1			
10	501-010	. Washer, #8 flat, stl cad plt (MS15795-207)	1			
11	502-004	. Washer, #8 spring lock, stl cad plt (MS35338-42)	1			
12	492-010	. Nut, plain hex, 8-32 NC-2B, stl cad plt (MS35649-82)	1			
13	302-029	. Clamp, cable, loop type, w/rubber cushion (AN742D-14C)	1			
14	471-463	. Screw, machine, 12-24 NC-2A by 3/8 in., pan hd Phillips, stl cad plt	4	A		
15	502-049	. Washer, #12 spring lock, stl cad plt	4	A		
16	471-688	. Screw, machine, 1/4-20 UNC-2A by 5/8 in., hex hd, stl cad plt	2	A		
17	501-012	. Washer, 1/4 flat, stl cad plt (AN960-416)	4	A		
18	502-006	. Washer, 1/4 spring lock, stl cad plt (MS35338-44)	2	A		
19	492-012	. Nut, plain hex, 1/4-20 UNC-2B, stl cad plt (MS35690-402)	2	A		
20	476-064	. Screw, self-tapping, 10-32 by 3/8 in., binder hd Phillips, stl cad plt (Parker-Kalon)	6	A		
21	3101361-10	. Bracket, mounting	2	A		
22	471-090	. Screw, machine, 10-32 NF-2A by 5/8 in., pan hd Phillips, stl cad plt (MS35209-56)	4	A		

FIG & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
23	3101362-10	. Bracket, angle	2			
24	472-123	. Screw, machine, 10-24 NC-2A by 1/2 in., pan hd Phillips, stl cad plt (MS35206-263)	18			
25	502-005	. Washer, #10 spring lock, stl cad plt (MS35338-43)	18			
26	501-192	. Washer, #10 flat, stl cad plt (NAS620-10L)	18			
27	3101360-10	. Cover, perforated	1			
28	3101352-10	. Bracket, angle, rack mounting, horizontal	1			
29	3101353-10	. Bracket, angle, rack mounting, horizontal	1			
30	3100249-10	. Identification Plate	1			
31	3101917-10	. Power Supply Assembly (PS-100) (See Figure 9-19)	1			
32	3101341-10	. Power Supply Assembly, Servo Motor (PS-200) (See Figure 9-20)	1			
33	3102082-10	. Chassis Assembly (CC-300) (See Figure 9-21)	1			
34	5103070-10	. Actuator Board Assembly (AC-400) (See Figure 9-22)	1			
35	5103109-10	. Servo Amplifier Assembly (SA-500) (See Figure 9-23)	1			

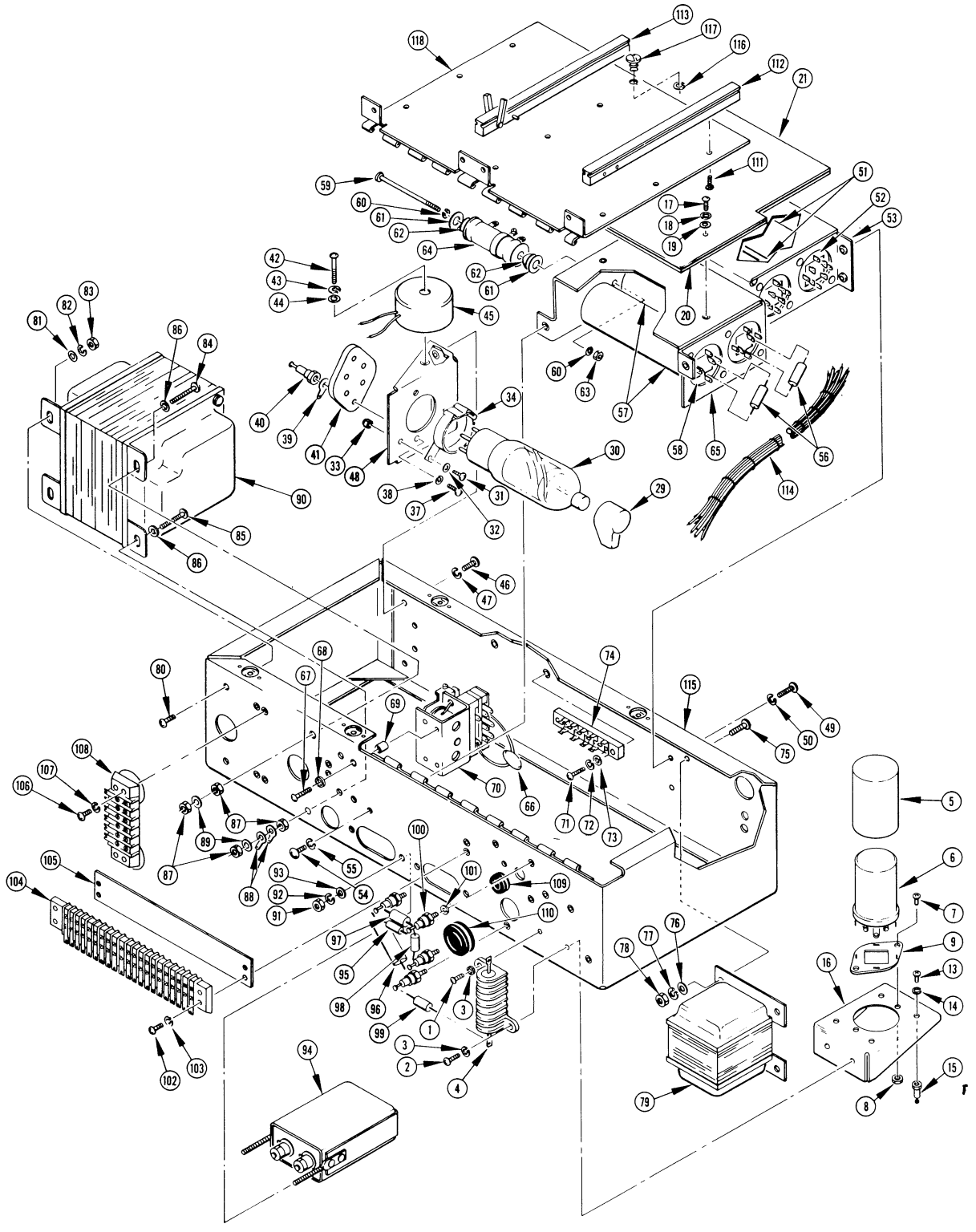
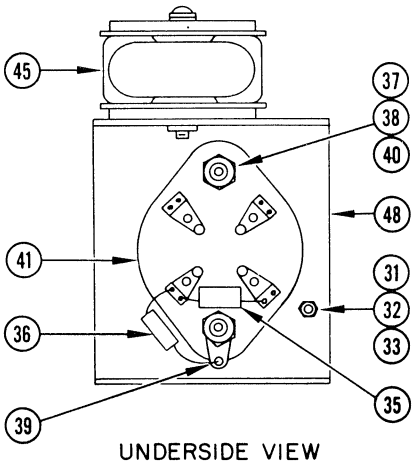
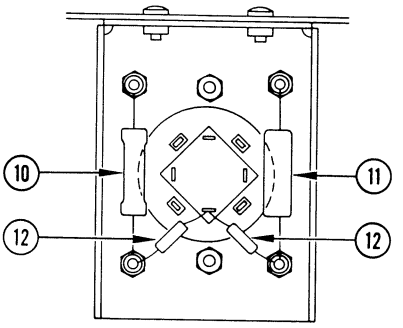


Figure 9-19
Power Supply PS-100 (Sheet 1 of 2)

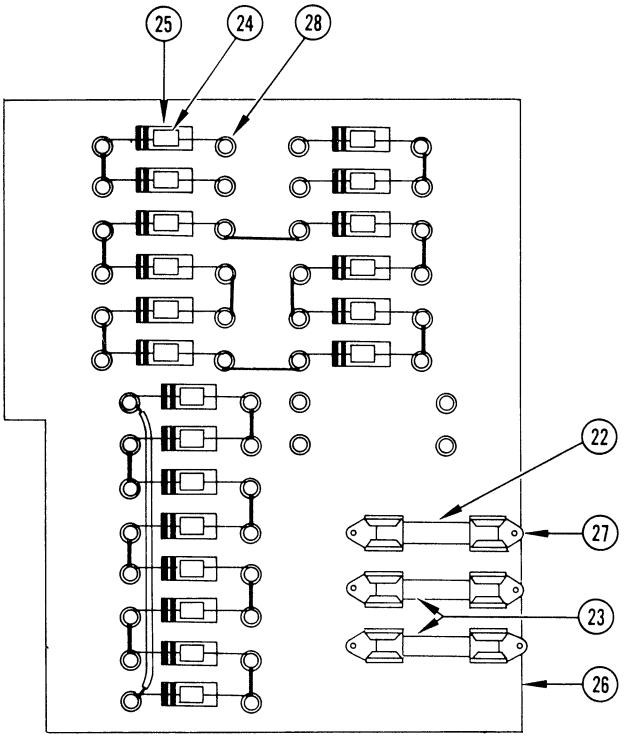
FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
		POWER SUPPLY ASSEMBLY PS-100				
	3101917-10	Power Supply Assembly PS-100 (See Figure 9-18)	Ref			
1	471-061	. Screw, machine, 4-40 NC-2A by 5/16 in., pan hd Phillips, stl cad plt (MS24584-13)	4			
2	471-062	. Screw, machine, 4-40 NC-2A by 3/8 in., pan hd Phillips, stl cad plt (MS24584-14)	1			
3	502-002	. Washer, #4 spring lock, stl cad plt (MS35338-40)	5			
4	043-280	. Resistor, fixed, wirewound, 50 ohm, 50w, 10% (R107, R108) (Dalohm Type B-50)	2			
	3101910-10	. Chassis Assembly, filter	1			
5	031-276	. . Insulator, capacitor	1			
6	031-077	. . Capacitor, electrolytic, 4 x 10 µfd, 450 volt (Mallory #FP-434)	1			
7	471-060	. . Screw, machine, 4-40 NC-2A by 1/4 in., pan hd Phillips, stl cad plt (MS24584-12)	2			
8	492-008	. . Nut, plain hex, 4-40 NC-2B, stl cad plt (MS35649-42)	2			
9	290-004	. . Bracket, mounting, fibre (Mallory #BP-6)	1			
10	043-508	. . Resistor, fixed, wirewound, 2200 ohm, 5w, 5% (R111)	1			
11	043-313	. . Resistor, fixed, wirewound, 3500 ohm, 5w, 3% (R101) (Dalohm Type #RS-5)	1			
12	041-286	. . Resistor, fixed, composition, 1 meg, 1/2w, 5% (R153, R154) (MIL-R-11:RC20GF105J)	2			
13	471-060	. . Screw, machine, 4-40 NC-2A by 1/4 in., pan hd Phillips, stl cad plt (MS24584-12)	4			
14	502-002	. . Washer, #4 spring lock, stl cad plt (MS35338-40)	4			
15	173-068	. . Terminal Lug, insulated (Lerco #6122)	4			
16	3101911-10	. . Chassis, filter	1			
17	471-068	. Screw, machine, 6-32 NC-2A by 5/16 in., pan hd Phillips, stl cad plt (MS35208-24)	2			
18	502-031	. Washer, #6 lock, int tooth, sst (MS35333-71)	2			
19	501-009	. Washer, #6 flat, stl cad plt (MS15795-206)	2			
20	3100904-10	. Board, insulation	1			
21	3100901-10	. Terminal Board Assembly, diode rectifier	1			
22	070-022	. . Fuse, cartridge, slow blow, 1-1/4 amp (F103) (Littelfuse #313125)	1			
23	070-019	. . Fuse, cartridge, slow blow, 2 amp (F101, F102) (Littelfuse #313002)	2			



UNDERSIDE VIEW
THYRATRON BRACKET



UNDERSIDE VIEW
FILTER CHASSIS



DETAIL,TERMINAL BOARD ASSEMBLY

000278

Figure 9-19
Power Supply PS-100 (Sheet 2 of 2)

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
24	3201323-10	. . Diode, silicon rectifier (CR101 thru CR120)	20			
25	041-476	. . Resistor, fixed, composition, 1.2 megohm, 1/2w, 5% (R115, R117, R120, R122, R124 R126, R128, R130, R139 thru R146, R149 thru R152) (MIL-R-11:RC20GF125J)	20			
26	3100902-10	. . Terminal Board Subassembly	1			
27	435-045	. . . Fuse Clip (Bussman #4051)	6			
28	173-015	. . . Lug, terminal, turret (Useco #1300B-8)	44			
29	162-017	. Cap, vacuum tube (Millen #36001)	1			
30	015-013	. Tube, thyratron (V104) (Taylor #C3J)	1			
31	471-061	. Screw, machine, 4-40 NC-2A by 5/16 in., pan hd Phillips, stl cad plt (MS24584-13)	1			
32	501-008	. Washer, #4 flat, stl cad plt (MS15795-204)	1			
33	493-026	. Nut, self-locking, hex, 4-40 NC-2B, brass cad plt, nylon insert (Esna #92-1660-40)	1			
34	300-001	. Clamp, tube (Birtcher #926C-2)	1			
35	034-105	. Capacitor, mica, 0.00047 µf, 1000 volt (C105) (Elmenco #VCM20D471J)	1			
36	041-031	. Resistor, fixed, composition, 1 meg, 1/2w, 10% (R106) (MIL-R-11:RC20GF105K)	1			
37	471-070	. Screw, machine, 6-32 NC-2A by 7/16 in., pan hd Phillips, stl cad plt (MS24584-26)	2			
38	502-003	. Washer, #6 spring lock, stl cad plt (MS35338-41)	2			
39	172-003	. Lug, soldering, int tooth (Shakeproof #2104-06)	1			
40	173-003	. Lug, terminal, turret (Useco #1417)	2			
41	150-094	. Socket, tube (E.F. Johnson #122-224-100)	1			
42	471-448	. Screw, machine, 6-32 NC-2A by 1-1/4 in., pan hd Phillips, stl cad plt (MS35208-32)	1			
43	502-003	. Washer, #6 spring lock, stl cad plt (MS35338-41)	1			
44	501-009	. Washer, #6 flat, stl cad plt (MS15795-206)	1			
45	3100330-10	. Choke Assembly, encapsulated (L101)	1			
46	471-078	. Screw, machine, 8-32 NC-2A by 3/8 in., pan hd Phillips, stl cad plt (MS35208-40)	4			
47	502-004	. Washer, #8 spring lock, stl cad plt (MS35338-42)	4			
48	3101654-10	. Bracket, thyratron	1			
49	471-078	. Screw, machine, 8-32 NC-2A by 3/8 in., pan hd Phillips, stl cad plt (MS35208-40)	4			

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
50	502-004	. Washer, #8 spring lock, stl cad plt (MS35338-42)	4			
	3101919-10	. Capacitor-Rectifier Assembly (SA-500)	1			
51	031-073	. . Capacitor, electrolyitc, 4 x 20 µf, 450 volt (C101, C102) (Astron #EYQ2025)	2			
52	290-004	. . Bracket, capacitor (Mallory #BP-6)	2			
53	3101850-10	. . Chassis, capacitor-rectifier	1			
54	471-078	. Screw, machine, 8-32 NC-2A by 3/8 in., pan hd Phillips, stl cad plt (MS35208-40)	2			
55	502-004	. Washer, #8 spring lock, stl cad plt (MS35338-42)	2			
	3101651-10	. Capacitor-Rectifier Assembly (AC-400)	1			
56	041-224	. . Resistor, fixed, composition, 100K, 2w, 10% (R103, R104) (MIL-R-11:RC42GF104K)	2			
57	031-039	. . Capacitor, electrolytic, 125 µf, 450 volt (C103, C104) (Sprague Type DEP)	2			
58	290-004	. . Bracket, capacitor (Mallory #BP-6)	2			
59	471-514	. . Screw, machine, 8-32 NC-2A by 2-1/2 in., rd hd slotted, stl cad plt	1			
60	502-004	. . Washer, #8 spring lock, stl cad plt (MS35338-42)	2			
61	506-003	. . Washer, centering (Ohmite #6000)	2			
62	503-007	. . Washer, insulating, mica (Ohmite #6011)	2			
63	492-010	. . Nut, plain hex, 8-32 NC-2B, stl cad plt (MS35649-82)	1			
64	040-023	. . Resistor, variable, wirewound, 150 ohm, 25w, 10% (R110) (Ohmite #0369)	1			
65	3101851-10	. . Chassis, capacitor-rectifier	1			
66	030-032	. Capacitor, ceramic disc, 0.1 µf, 500 volt (C109) (Sprague #5HK-P1)	1			
67	471-071	. Screw, machine, 6-32 NC-2A by 1/2 in., pan hd Phillips, stl cad plt (MS35208-27)	4			
68	502-003	. Washer, #6 spring lock, stl cad plt (MS35338-41)	4			
69	280-003	. Spacer, brass cad plt (Birnbach #1125)	4			
70	020-006	. Relay, 3 pole, double throw, 115 volt (K101) (Philtrol #33QA)	1			
71	471-063	. Screw, machine, 4-40 NC-2A by 7/16 in., pan hd Phillips, stl cad plt (MS24584-15)	2			
72	502-002	. Washer, #4 spring lock, stl cad plt (MS35338-40)	2			
73	501-008	. Washer, #4 flat, stl cad plt (MS15795-204)	2			

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
74	180-014	. Terminal Strip, 5 double terminals (TB103) (Jones #5-170)	1			
75	471-087	. Screw, machine, 10-32 NF-2A by 3/8 in., pan hd Phillips, stl cad plt (MS35209-53)	4			
76	501-011	. Washer, #10 flat, stl cad plt (MS15795-208)	4			
77	502-005	. Washer, #10 spring lock, stl cad plt (MS35338-43)	4			
78	492-011	. Nut, plain hex, 10-32 NF-2B, stl cad plt (MS35650-102)	4			
79	3101653-10	. Transformer, power (T101)	1			
80	471-087	. Screw, machine, 10-32 NF-2A by 3/8 in., pan hd Phillips, stl cad plt (MS35209-53)	2			
81	501-011	. Washer, #10 flat, stl cad plt (MS15795-208)	2			
82	502-005	. Washer, #10 spring lock, stl cad plt (MS35338-43)	2			
83	492-011	. Nut, plain hex, 10-32 NF-2B, stl cad plt (MS35650-102)	2			
84	471-090	. Screw, machine, 10-32 NF-2A by 5/8 in., pan hd Phillips, stl cad plt (MS35209-56)	1			
85	471-093	. Screw, machine, 10-32 NF-2A by 1 in., pan hd Phillips, stl cad plt (MS24584-59)	1			
86	502-027	. Washer, #10 lock, int tooth, stl cad plt (MS35333-39)	2			
87	492-011	. Nut, plain hex, 10-32 NF-2B, stl cad plt (MS35650-102)	4			
88	172-028	. Lug, soldering, brass (H.H. Smith #1493)	2			
89	501-011	. Washer, #10 flat, stl cad plt (MS15795-208)	2			
90	3101649-10	. Transformer, power (T102)	1			
91	492-011	. Nut, plain hex, 10-32 NF-2B, stl cad plt (MS35650-102)	4			
92	502-005	. Washer, #10 spring lock, stl cad plt (MS35338-43)	4			
93	501-011	. Washer, #10 flat, stl cad plt (MS15795-208)	4			
94	036-059	. Capacitor, paper, rectangular, 2 µf, 600 volt (C106, C107) (Sprague #CP70B1EF205K)	2			
95	031-211	. Capacitor, electrolytic, 35 µf, 25 volt (C108) (Sprague #TB1208)	1			
96	035-366	. Capacitor, tubular, 0.47 µf, 1000 volt (C110) (Gudeman #XFS26159-20)	1			
97	041-106	. Resistor, fixed, composition, 4300 ohm, 1w, 5% (R109) (MIL-R-11:RC32GF432J)	1			

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
98	041-536	. Resistor, fixed, composition, 200K, 2w, 5% (R113) (MIL-R-11:RC42GF204J)	1			
99	041-224	. Resistor, fixed, composition, 100K, 2w, 10% (MIL-R-11:RC42GF104K)	1			
100	173-041	. Lug, terminal, standoff (Cambridge Thermionic #X1995-A)	4			
101	502-003	. Washer, #6 spring lock, stl cad plt (MS35338-41)	4			
102	471-064	. Screw, machine, 4-40 NC-2A by 1/2 in., pan hd Phillips, stl cad plt (MS24584-16)	4			
103	502-002	. Washer, #4 spring lock, stl cad plt (MS35338-40)	4			
104	180-049	. Terminal Strip, barrier type, 22 terminal (TB101) (Kulka #410-3/4ST-22M)	1			
105	3101648-10	. Insulator, barrier strip	1			
106	471-063	. Screw, machine, 4-40 NC-2A by 7/16 in., pan hd Phillips, stl cad plt (MS24584-15)	4			
107	502-002	. Washer, #4 spring lock, stl cad plt (MS35338-40)	4			
108	180-082	. Terminal Strip, barrier type, 6 terminal (TB102) (Kulka #600-3/4ST-6 w/marker strip)	1			
109	260-005	. Grommet, neoprene (Rubbercraft #6)	1			
110	260-007	. Grommet, neoprene (MS35489-13)	2			
111	471-059	. Screw, machine, 4-40 NC-2A by 3/16 in., pan hd Phillips, stl cad plt (MS24584-11)	9			
112	3101652-10	. Track, circuit board	2			
113	3101662-10	. Track, circuit board	1			
114	3102051-10	. Cable Harness	1			
115	3101655-10	. Chassis Assembly	1			
116	431-010	. . Retainer, hairpin, external (Southco #82-32-101-17)	1			
117	310-061	. . Fastener, oval hd, 1/4 turn (Southco #2-0-140)	1			
118	3101800-10	. . Cover Assembly, hinged	1			

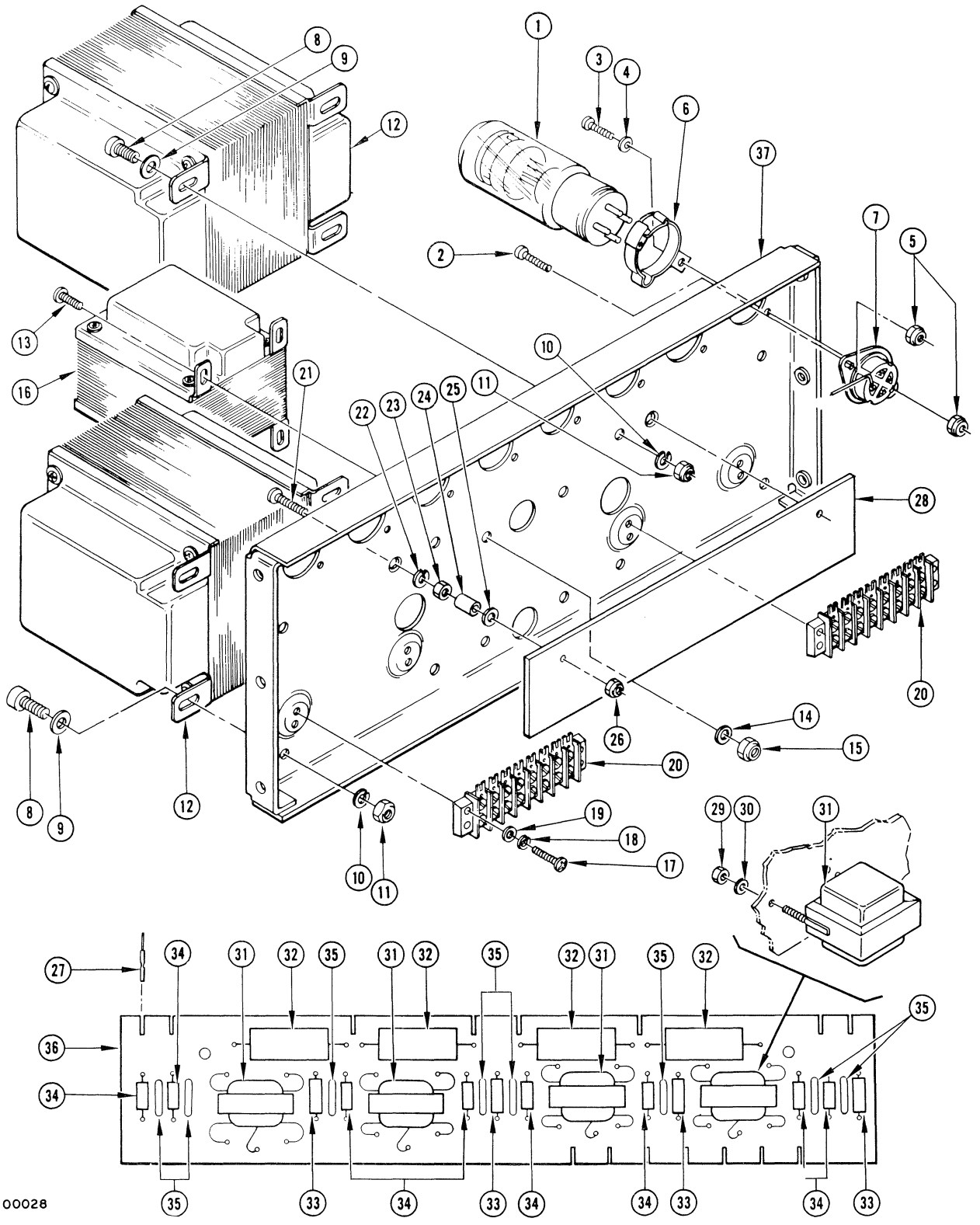


Figure 9-20
Servo Motor Power Supply PS-200

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
		SERVO MOTOR POWER SUPPLY PS-200				
	3101341-10	Power Supply Assembly, Servo Motor PS-200 (See Figure 9-18)	Ref			
1	015-012	. Tube, thyratron (V201 thru V208) (Electrons Inc #ELC1K, National Electronics #N16014/C1K12)	8			
2	471-069	. Screw, machine, 6-32 NC-2A by 3/8 in., pan hd Phillips, stl cad plt (MS24584-25)	8			
3	471-071	. Screw, machine, 6-32 NC-2A by 1/2 in., pan hd Phillips, stl cad plt (MS35208-27)	8			
4	501-009	. Washer, #6 flat, stl cad plt (MS15795-206)	8			
5	493-015	. Nut, self-locking, hex, 6-32 NC-2B, stl cad plt, nylon insert (Esna Type NM)	16			
6	300-001	. Clamp, tube (Birtcher #926C-2)	8			
7	150-058	. Socket, tube, ceramic (Millen #33004)	8			
8	470-045	. Screw, cap, 1/4-20 UNC-3A by 1/2 in., hex soc, stl cad plt (MS35457-33)	8			
9	501-012	. Washer, 1/4 flat, stl cad plt (AN960-416)	8			
10	502-006	. Washer, 1/4 spring lock, stl cad plt (MS35338-44)	8			
11	492-012	. Nut, plain hex, 1/4-20 UNC-2B, stl cad plt (MS35690-402)	8			
12	3101666-10	. Transformer, step-up (T206, T207)	2			
13	471-088	. Screw, machine, 10-32 NF-3A by 7/16 in., pan hd Phillips, stl cad plt (MS24584-54)	4			
14	501-011	. Washer, #10 flat, stl cad plt (MS15795-208)	4			
15	493-008	. Nut, self-locking, hex, 10-32 NF-3B, stl cad plt, nylon insert (Esna Type NM-26)	4			
16	3101667-10	. Transformer, step-down (T205)	1			
17	471-064	. Screw, machine, 4-40 NC-2A by 1/2 in., pan hd Phillips, stl cad plt (MS24584-16)	8			
18	502-002	. Washer, #4 spring lock, stl cad plt (MS35338-40)	8			
19	501-008	. Washer, #4 flat, stl cad plt (MS15795-204)	8			
20	180-183	. Terminal Strip (TB201, TB202) (Kulka #600-B)	2			
21	471-872	. Screw, machine, 6-32 by 1 in., flat hd Phillips, stl cad plt	2			
22	502-003	. Washer, #6 spring lock, stl cad plt (MS35338-41)	2			
23	492-009	. Nut, plain hex, 6-32 NC-2B, stl cad plt (MS35649-62)	2			

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
24	280-006	. Spacer, for #6 screw, brass cad plt (H. Smith #2101, Birnbach #1126)	2			
25	503-035	. Washer, flat, nonmetallic (Walsco #7836)	2			
26	493-015	. Nut, self-locking, hex, 6-32 NC-2B, stl cad plt, nylon insert (Esna Type NM)	2			
27	171-024	. Connector, solderless (AMP #32587-2)	15			
28	3101664-10	. Bias Assembly (PS-200)	1			
29	492-032	. . Nut, plain hex, special, 4-40 NC-2B, stl cad plt	8			
30	502-090	. . Washer, #4 spring lock, stl cad plt	8			
31	3101814-10	. . Transformer, bias (T1 thru T4)	4			
32	035-285	. . Capacitor, tubular, 0.68 µf, 200 volt (C1, C4, C7, C10) (Sprague #118P68492S4)	4			
33	043-514	. . Resistor, fixed, wirewound, 4700 ohm, 3w, 5% (R1, R4, R7, R10) (Ohmite #4441)	4			
34	041-027	. . Resistor, fixed, composition, 220K, 1/2w, 5% (R2, R3, R5, R6, R8, R9, R11, R12) (MIL-R-11:RC20GF224J)	8			
35	033-075	. . Capacitor, metallized, mylar, 0.015 µf, 200 volt (C2, C3, C5, C6, C8, C9, C11, C12) (Electron Products #D2-153E)	8			
36	3101813-10	. . Printed Circuit Board, bias	1			
37	3101663-10	. Chassis, servo power supply	1			

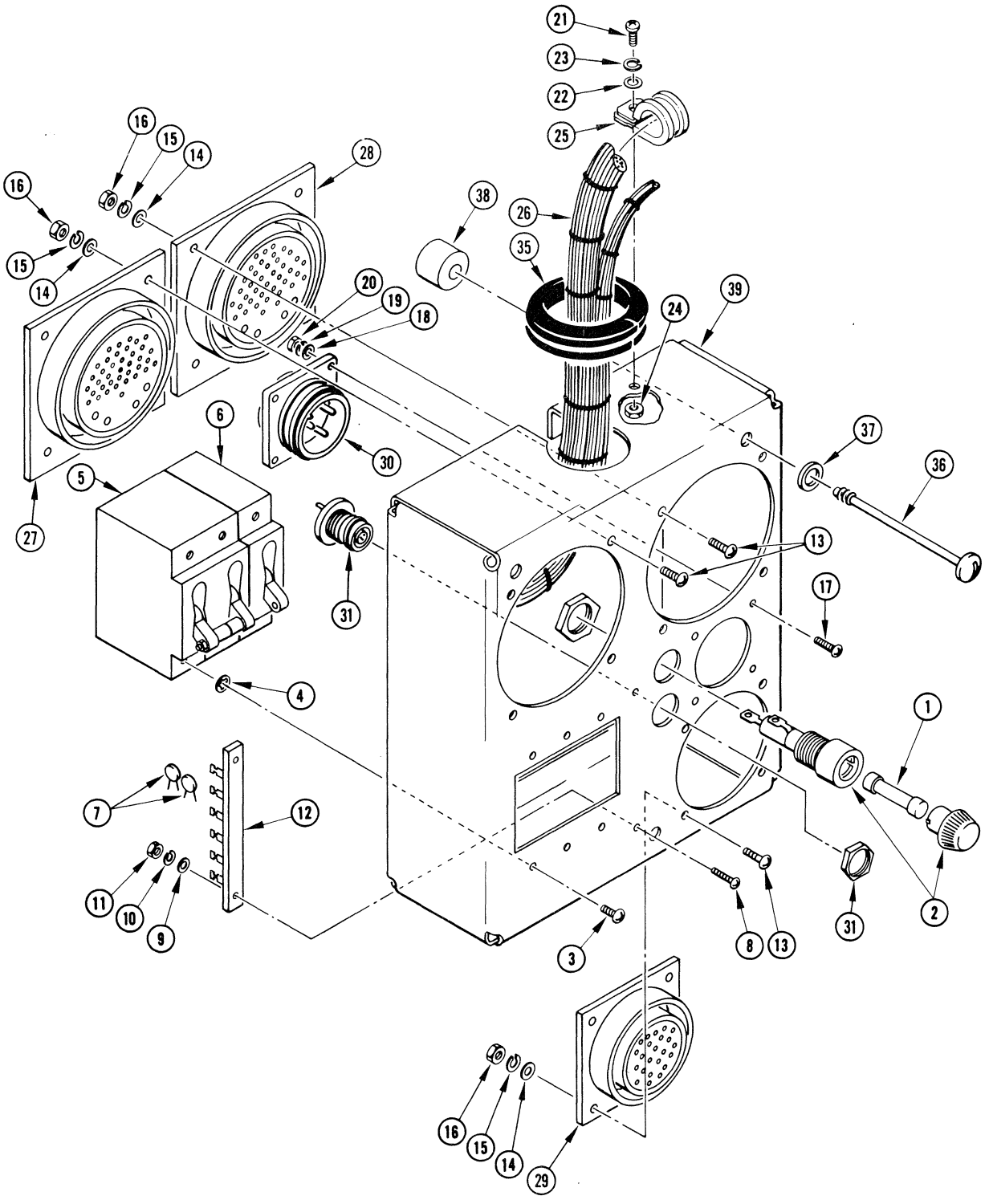


Figure 9-21
Connector Chassis CC-300 (Sheet 1 of 2)

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
		CONNECTOR CHASSIS CC-300				
	3102082-10	Chassis Assembly CC-300 (See Figure 9-18)	Ref			
1	070-008	. Fuse, cartridge, 6 amp, fast blow (F301) (Littelfuse #312006)	1			
2	130-013	. Holder, fuse, w/mounting hardware (Bussman #HKP)	1			
3	471-066	. Screw, machine, 6-32 NC-2A by 3/16 in., pan hd Phillips, stl cad plt (MS35208-22)	6			
4	502-025	. Washer, #6 lock, int tooth, stl cad plt (MS35333-37)	6			
5	126-018	. Circuit Breaker, 25 amp, 2 pole, companion series (CB302) (Heineman #XAM33-25)	1			
6	126-023	. Circuit Breaker, 7 amp, 115 volt ac, 60 cps (CB303) (Heineman #AM-12)	1			
7	030-129	. Capacitor, ceramic, 0.01 µf, 1000 volt (Cornell-Dubilier #BYA1051M)	2			
8	471-063	. Screw, machine, 4-40 NC-2A by 7/16 in., pan hd Phillips, stl cad plt (MS24584-15)	2			
9	501-008	. Washer, #4 flat, stl cad plt (MS15795-204)	2			
10	502-002	. Washer, #4 spring lock, stl cad plt (MS35338-40)	2			
11	492-008	. Nut, plain hex, 4-40 NC-2B, stl cad plt (MS35649-42)	2			
12	180-086	. Terminal Strip, solder lug (Jones #6-170)	1			
13	471-069	. Screw, machine, 6-32 NC-2A by 3/8 in., pan hd Phillips, stl cad plt (MS24584-25)	12			
14	501-009	. Washer, #6 flat, stl cad plt (MS15795-206)	12			
15	502-003	. Washer, #6 spring lock, stl cad plt (MS35338-41)	12			
16	492-009	. Nut, plain hex, 6-32 NC-2B, stl cad plt (MS35649-62)	12			
17	471-062	. Screw, machine, 4-40 NC-2A by 3/8 in., pan hd Phillips, stl cad plt (MS24584-14)	4			
18	501-008	. Washer, #4 flat, stl cad plt (MS15795-204)	4			
19	502-002	. Washer, #4 spring lock, stl cad plt (MS35338-40)	4			
20	492-008	. Nut, plain hex, 4-40 NC-2B, stl cad plt (MS35649-42)	4			
21	471-082	. Screw, machine, 8-32 NC-2A by 3/4 in., pan hd Phillips, stl cad plt (MS35208-44)	1			
22	501-010	. Washer, #8 flat, stl cad plt (MS15795-207)	1			
23	502-004	. Washer, #8 spring lock, stl cad plt (MS35338-42)	1			
24	492-010	. Nut, plain hex, 8-32 NC-2B, stl cad plt (MS35649-82)	1			

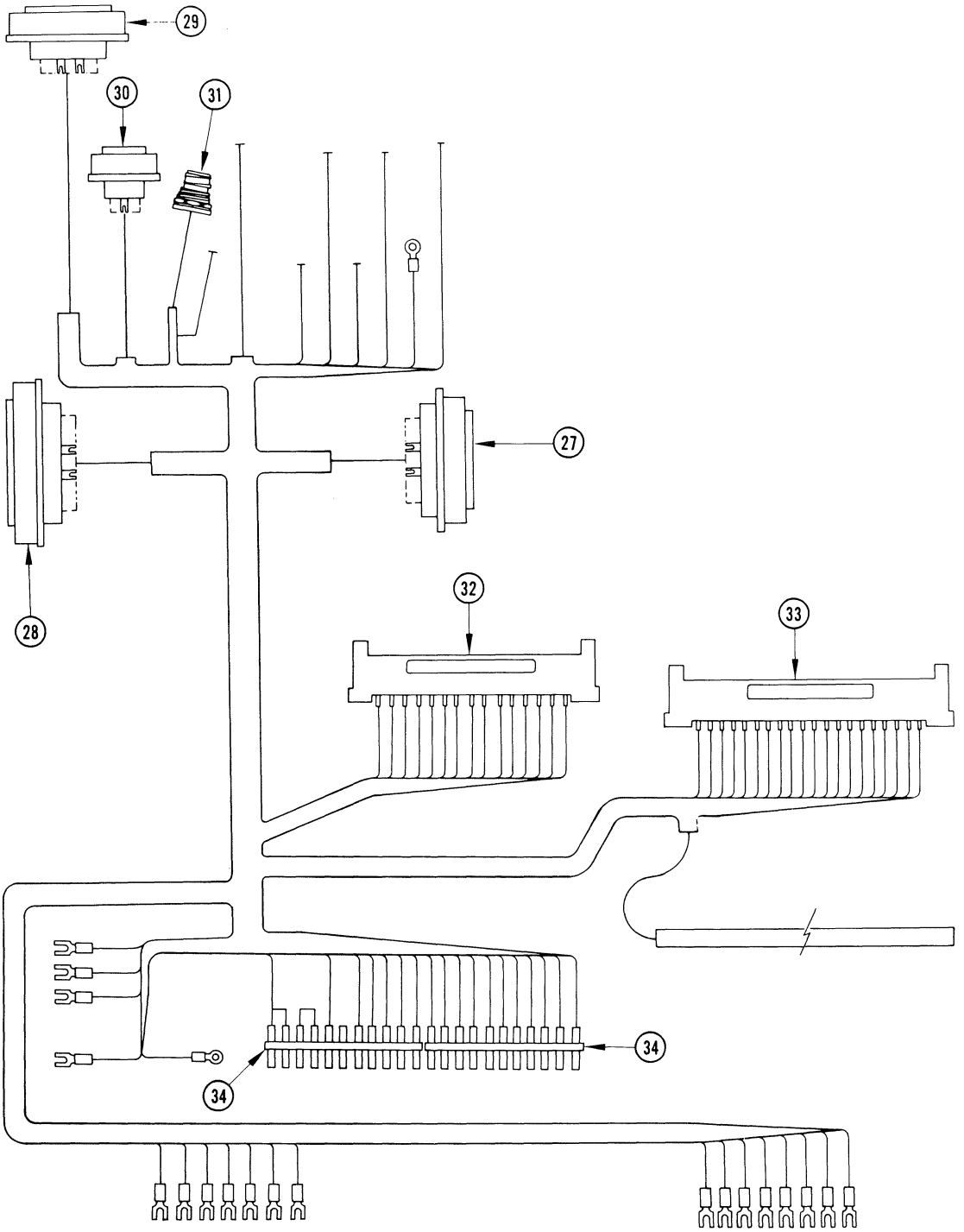


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Figure 9-21
Connector Chassis CC-300 (Sheet 2 of 2)

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
25	302-029	. Clamp, cable, 3/4 in. dia loop (AN742D14C)	1			
26	3101933-10	. Cable Assembly CC-300	1			
27	146-142	. . Connector, receptacle, female, 50 contacts (J303) (Cannon #RLK-A50-31SL)	1			
28	146-141	. . Connector, receptacle, female, 53 contacts (J301) (Cannon #RLK-A53-31SL)	1			
29	146-143	. . Connector, receptacle, female, 37 contacts (J304) (Cannon #RFK-37-31SL)	1			
30	147-105	. . Connector, receptacle, male, 3 contacts (J302) (Cannon #GK-S3-32S)	1			
31	146-042	. . Connector, receptacle, female, 3 contacts w/mounting hardware (J305) (Cannon #MC-14E-8-3SN)	1			
32	168-008	. . Connector, printed circuit board (J401) (Elco #5006-15-13-3-5-3/32)	1			
33	168-009	. . Connector, printed circuit board (J501) (Elco #5006-20-13-3-5-1/16)	1			
34	3101816-10	. . Fanning Strip (FS101)	2			
35	260-018	. . Grommet, neoprene, 1-1/4 in. ID (Rubbercraft #71)	1			
36	310-097	. Screw, fastener (Southco #12-99-180-111)	3			
37	503-045	. Washer, retaining, nonmetallic (Southco #12-11014-11)	3			
38	3101020-10	. Spacer, chassis	3			
39	3101669-10	. Chassis, connector	1			

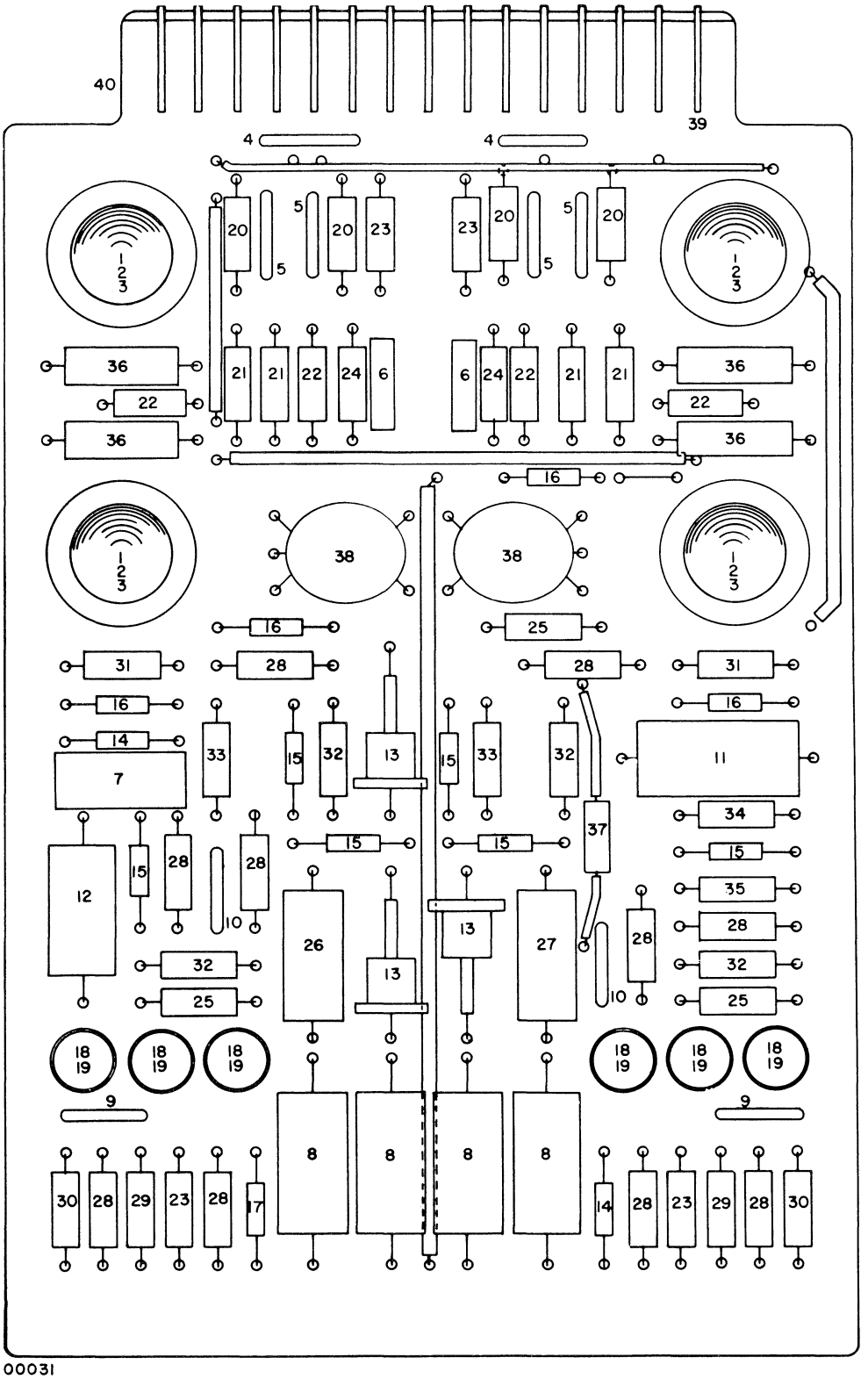

Figure 9-22
Actuator Control Unit AC-400

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
		ACTUATOR CONTROL UNIT AC-400				
	5103070-10	Actuator Board Assembly AC-400 (See Figure 9-18)	Ref			
1	160-007	. Shield, tube (Elco #120)	4			
2	012-154	. Tube, electron (V1, V2, V3, V4) (GE,Five Star #5727)	4			
3	150-097	. Socket, tube (Cinch #53P2434)	4			
4	030-004	. Capacitor, ceramic, 2 x 0.001 µf, 500 volt (C1A, C1B, C6A, C6B) (Centralab #DD2-102)	2			
5	030-043	. Capacitor, ceramic, 0.0022 µf, 500 volt, (C2, C4, C7, C9) (Erie #811-000-GP-222P)	4			
6	030-101	. Capacitor, ceramic, 0.47 µf, 25 volt (C3, C8) (Sprague #5C11)	2			
7	031-211	. Capacitor, electrolytic, 35 µf, 25 volt (C5) (Sprague #TE1208)	1			
8	037-110	. Capacitor, tantalum, 100 µf, 30V (C10 thru C13) (Sprague #109D107C2030T2)	4			
9	030-095	. Capacitor, ceramic, 0.1 µf, 25 volt (C14, C17) (Sprague #5C7)	2			
10	030-094	. Capacitor, ceramic, 1 µf, 25 volt (C15, C16) (Sprague #5C13)	2			
11	031-129	. Capacitor, electrolytic, 20 µf, 50 volt (C18) (Sprague #TE1305)	1			
12	031-135	. Capacitor, electrolytic, 30 µf, 15 volt (C19) (Sprague #TE1158)	1			
13	013-050	. Diode, silicon (CR1, CR3, CR4) (General Electric #1N537)	3			
14	013-162	. Diode, silicon (CR2, CR15) (Hoffman #1N718A)	2			
15	013-151	. Diode, germanium (CR5, CR6, CR11 thru CR14) (General Instrument #DR482)	6			
16	013-028	. Diode, silicon (CR7 thru CR10) (Hughes #1N462)	4			
17	013-102	. Diode, silicon (CR16) (Hoffman #1N716A)	1			
18	014-007	. Transistor, germanium (Q1 thru Q6) (CBS #2N438)	6			
19	280-030	. Spacer, transistor (Milton Ross #10012)	6			
20	041-089	. Resistor, fixed, composition, 4.7 meg, 1/2w, 10% (R1, R8, R10, R17) (MIL-R-11:RC20GF475K)	4			
21	041-065	. Resistor, fixed, composition, 27K, 1/2w, 10% (R2, R6, R11, R15) (MIL-R-11:RC20GF273K)	4			
22	041-072	. Resistor, fixed, composition, 100K, 1/2w, 10% (R3, R7, R12, R16) (MIL-R-11:RC20GF104K)	4			
23	041-038	. Resistor, fixed, composition, 100 ohm, 1/2w, 10% (R4, R13, R29, R37) (MIL-R-11:RC20GF101K)	4			

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
24	041-064	. Resistor, fixed, composition, 22K, 1/2w, 10% (R5, R14) (MIL-R-11:RC20GF223K)	2			
25	041-063	. Resistor, fixed, composition, 18K, 1/2w, 10% (R9, R26, R39) (MIL-R-11:RC20GF183K)	3			
26	041-527	. Resistor, fixed, composition, 390 ohm, 2w, 10% (R18) (MIL-R-11:RC42GF391K)	1			
27	041-199	. Resistor, fixed, composition, 470 ohm, 2w, 10% (R19) (MIL-R-11:RC42GF471K)	1			
28	041-052	. Resistor, fixed, composition, 2200 ohm, 1/2w, 10% (R20, R23, R25, R27, R30, R33, R36, R40, R41, R43) (MIL-R-11:RC20GF222K)	10			
29	041-001	. Resistor, fixed, composition, 5100 ohm, 1/2w, 5% (R21, R35) (MIL-R-11:RC20GF512J)	2			
30	041-056	. Resistor, fixed, composition, 4700 ohm, 1/2w, 10% (R22, R34) (MIL-R-11:RC20GF472K)	2			
31	041-031	. Resistor, fixed, composition, 1 meg, 1/2w, 10% (R24, R42) (MIL-R-11:RC20GF105K)	2			
32	041-058	. Resistor, fixed, composition, 6800 ohm, 1/2w, 10% (R28, R38, R50, R51) (MIL-R-11:RC20GF682K)	4			
33	041-054	. Resistor, fixed, composition, 3300 ohm, 1/2w, 10% (R31, R45) (MIL-R-11:RC20GF332K)	2			
34	041-044	. Resistor, fixed, composition, 470 ohm, 1/2w, 10% (R32) (MIL-R-11:RC20GF471K)	1			
35	041-041	. Resistor, fixed, composition, 270 ohm, 1/2w, 10% (R44) (MIL-R-11:RC20GF271K)	1			
36	041-091	. Resistor, fixed, composition, 4.7 ohm, 1w, 10% (R46 thru R49) (MIL-R-11:RC32GF4R7K)	4			
37	041-351	. Resistor, fixed, composition, 15 ohm, 1/2w, 10% (R52) (MIL-R-11:RC20GF150K)	1			
38	3101675-10	. Transformer, pulse (T8, T9)	2			
39	168-007	. Connector, printed circuit board (Elco CS-60-500/.1913-.200)	15			
40	3101674-10	. Card, printed wiring	1			

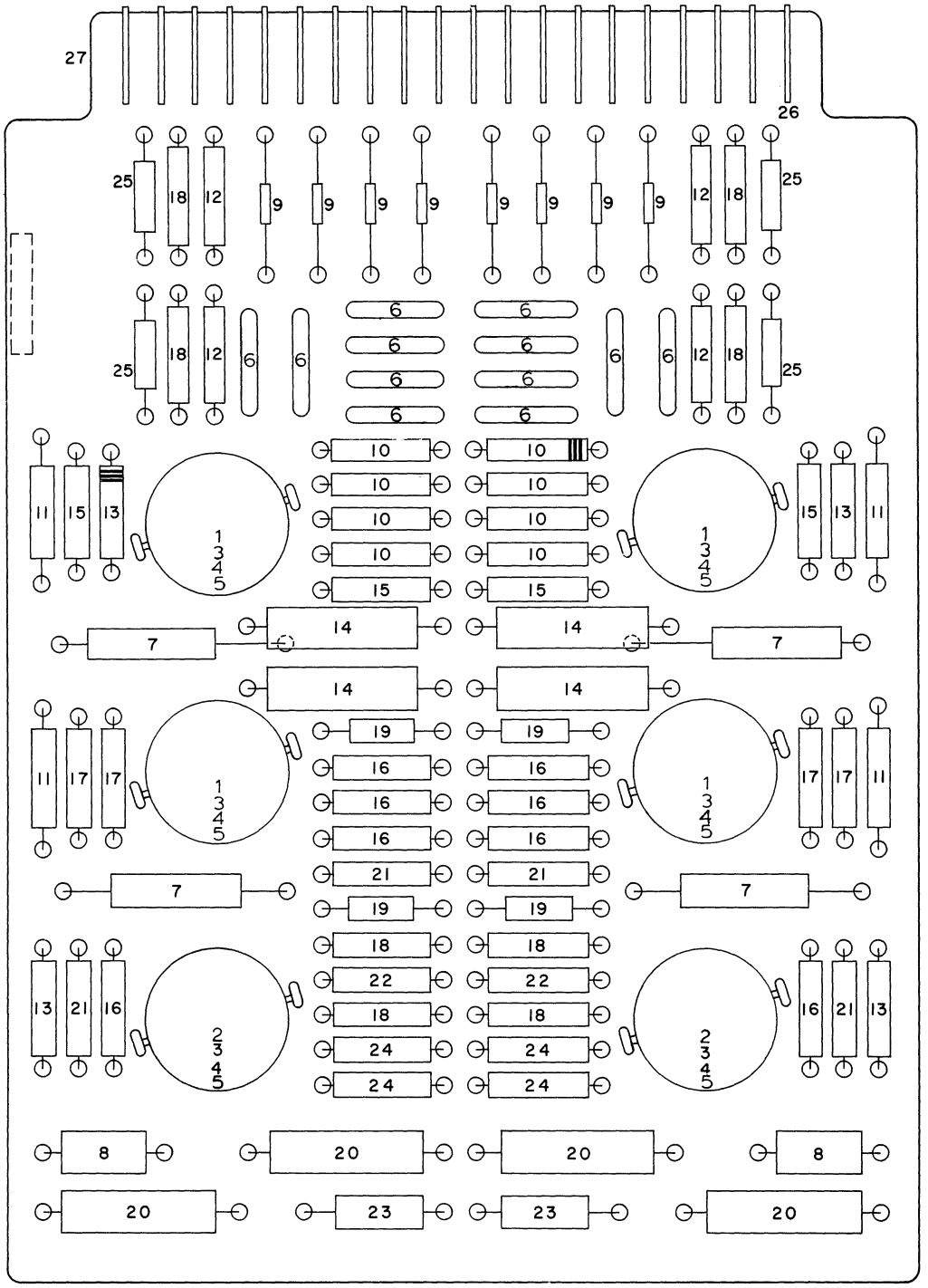

Figure 9-23
Servo Amplifier S. A-500

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
		SERVO AMPLIFIER SA-500				
	5103109-10	Servo Amplifier Assembly SA-500 (See Figure 9-18)	Ref			
1	012-068	. Tube, electron (V1, V2, V4, V5) (RCA, GE, Sylvania #5751)	4			
2	012-106	. Tube, electron (V3, V6) (RCA #5814A)	2			
3	150-213	. Socket, tube (Elco #04-930-02)	6			
4	503-007	. Washer, insulating, mica (Ohmite #6011)	6			
5	431-012	. Retainer Tube Lock	6			
6	030-145	. Capacitor, ceramic 0.1mf 50volt (C10 thru C13, C50 thru C53, C58 thru C61) (Sprague # 5C50)	12			
7	033-074	. Capacitor, metallized, mylar, 0.33 µf, 200 volt (C16, C17, C56, C57) (Electron Products #DE2-334)	4			
8	033-072	. Capacitor, metallized, mylar, 0.1 µf, 200 volt (C18, C62) (Electron Products #DE2-104)	2			
9	3201323-10	. Diode, silicon rectifier (CR10 thru CR13, CR50 thru CR53)	8			
10	042-221	. Resistor, fixed, film, 27.4K, 1/2w, 1% (R10 thru R13, R50 thru R53) (Electra #DC1/2A)	8			
11	042-113	. Resistor, fixed, film, 470K, 1/2w, 1% (R14, R17, R54, R57) (MIL-R-10509:RN15R4703F)	4			
12	041-059	. Resistor, fixed, film, 8.2K, 1/2w,10% (R15, R16, R55, R56)	4			
13	042-280	. Resistor, fixed, film, 220K, 1/2w, 1% (R19, R20, R59, R60) (Electra #DC1/2C)	4			
14	042-057	. Resistor, fixed, film, 200K, 1w, 1% (R21, R28, R61, R68) (Electra #DC-1)	4			
15	042-130	. Resistor, fixed, film, 392K, 1/2w, 1% (R22, R25, R62, R65) (MIL-R-10509:RN15X3923F)	4			
16	042-268	. Resistor, fixed, film, 1.2 meg, 1/2w, 1% (R23, R24, R29, R32, R63, R64, R69, R72) (MIL-R-10509:RN15X1204F)	8			
17	042-363	. Resistor, fixed, film, 243K, 1/2w, 1% (R26, R27, R66, R67) (Texas Instrument #CD1/2PR)	4			
18	042-119	. Resistor, fixed, film, 1 meg, 1/2w, 1% (R30, R31, R70, R71, R85 thru R88) (MIL-R-10509:RN15R1004F)	8			
19	041-254	. Resistor, fixed, composition, 15K, 1/2w, 5% (R33, R34, R73, R74) (MIL-R-11:RC20GF153J)	4			
20	042-054	. Resistor, fixed, film, 121K, 1w, 1% (R35, R36, R75, R76) (Electra #DC-1)	4			

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
21	042-269	. Resistor, fixed, film, 330K, 1/2w, 1% (R37, R40, R77, R80) (MIL-R-10509:RN15X3303F)	4			
22	042-924	. Resistor, fixed, film, 4990 ohm, 1/2w, 1% (R41, R81) (Electra #DC1/2A)	2			
23	043-509	. Resistor, fixed, wirewound, 20K, 3w, 1% (R42, R82) (Dalohm #RS-2)	2			
24	042-144	. Resistor, fixed, film, 10K, 1/2w, 1% (R43, R44, R83, R84) (MIL-R-10509:RN15X1002F)	4			
25	041-322	. Resistor, fixed, composition, 18K, 1/2w, 5% (R89 thru R92) (MIL-R-11:RC20GF183J)	4			
26	168-007	. Connector, printed circuit board (Elco #CS-60-5001.1913-.200)	20			
27	3101934-10	. Card, printed wiring	1			

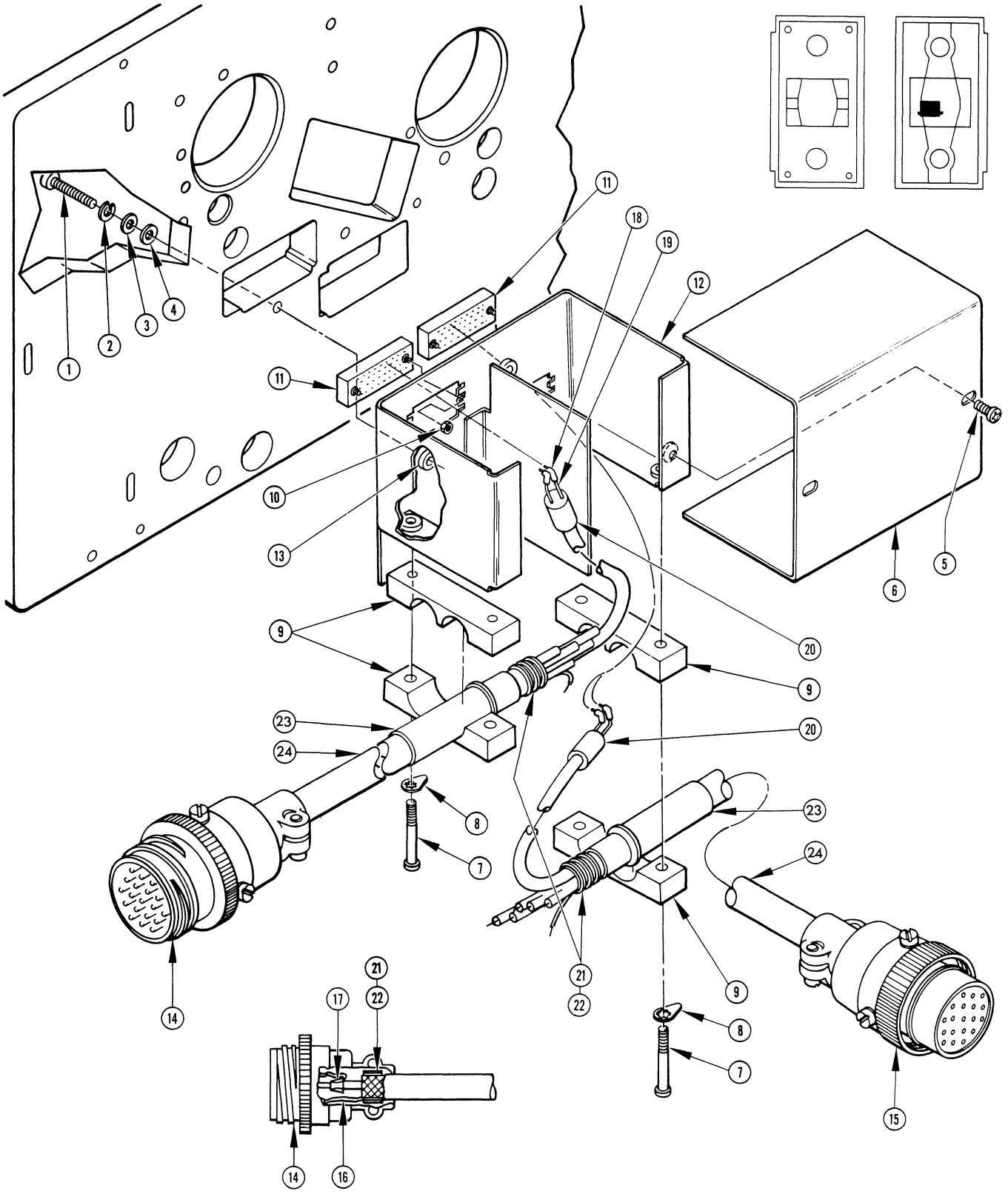

Figure 9-24
Head Cable and Box

FIG & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
		HEAD CABLE AND BOX ASSY.				
	5100856-10	Head cable & Box Assy, 1/2 in., (See Fig. 9-1)	Ref.			
1	470-023	. Screw, cap, 6-32 NC-3A by 7/8 in., hex soc hd, stl cad plt (MS35457-11)	2			
2	502-003	. Washer #6 Spring Lock, stl cad plt (MS35338-41)	2			
3	501-009	. Washer, #6 Flat, stl cad plt, (MS15795-206)	2			
4	503-012	. Washer, #6 Shoulder, nonmetallic (WALSCO # 7856)	2			
	3101135-10	. Box Assembly, Head Cable	1			
5	471-017	. . Screw, machine, 6-32 NC-2A by 1/4 in., pan hd. Phillips, brass cad plt, (MS35212)	2			
6	3101142-10	. . Cover Chassis	1			
7	471-074	. . Screw, machine, 6-32 NC-2A by 7/8 in., pan hd., Phillips, stl cad plt, (MS35208-30)	4			
8	172-003	. . Lug Soldering, #6 Internal Tooth (Shake proof #2104-6)	4			
9	3101144-10	. . Retainer, Electric Cable	4			
10	493-013	. . Nut, self-locking, hex, 2-56 NC-3B, stl cad plt, W/Nylon insert (ESNA Type NM)	4			
11	146-173	. . Connector, receptacle, female, 26 contacts, supplied W/mounting washer, (Winchester #MRE26S-J-30)	2			
12	3101141-10	. . Chassis welded	1			
13	490-011	. . . Nut, Anchor, 6-32 NC-2B, stl (Penn Engg. # WN-632)	8			
14	145-082	. Connector, plug, male, 19 contacts (Cannon # RSK-19-22C-1/2)	1			
15	144-061	. Connector, plug, female, 19 contacts (Cannon # SK-19-21C-1/2)	1			
16	611-001	. Wire stranded, insulated, #20GA (MIL-W-16878)	A/R			
17	600-017	. Tubing, nonmetallic, insulation #10 clear (MIL-1-631)	A/R			
18	600-023	. Tubing, nonmetallic, insulation #17 black (MIL-1-631)	A/R			
19	611-189	. Wire Stranded Insulated #26GA (MIL-W-16878)	A/R			

FIG & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
20	171-031	. Connector, solderless, cable termination (Burndy # YEC90)	16			
21	171-029	. Connector, solderless, cable termination, (Burndy # YIG297)	4			
22	171-030	. Connector, solderless, cable termination, (Burndy # YOC-250)	4			
23	262-004	. Bushing, Telescoping (AN3420-8)	2			
24	3100238-10	. Cable Assy, Electrical, Special Purpose, & Conductor	A/R			

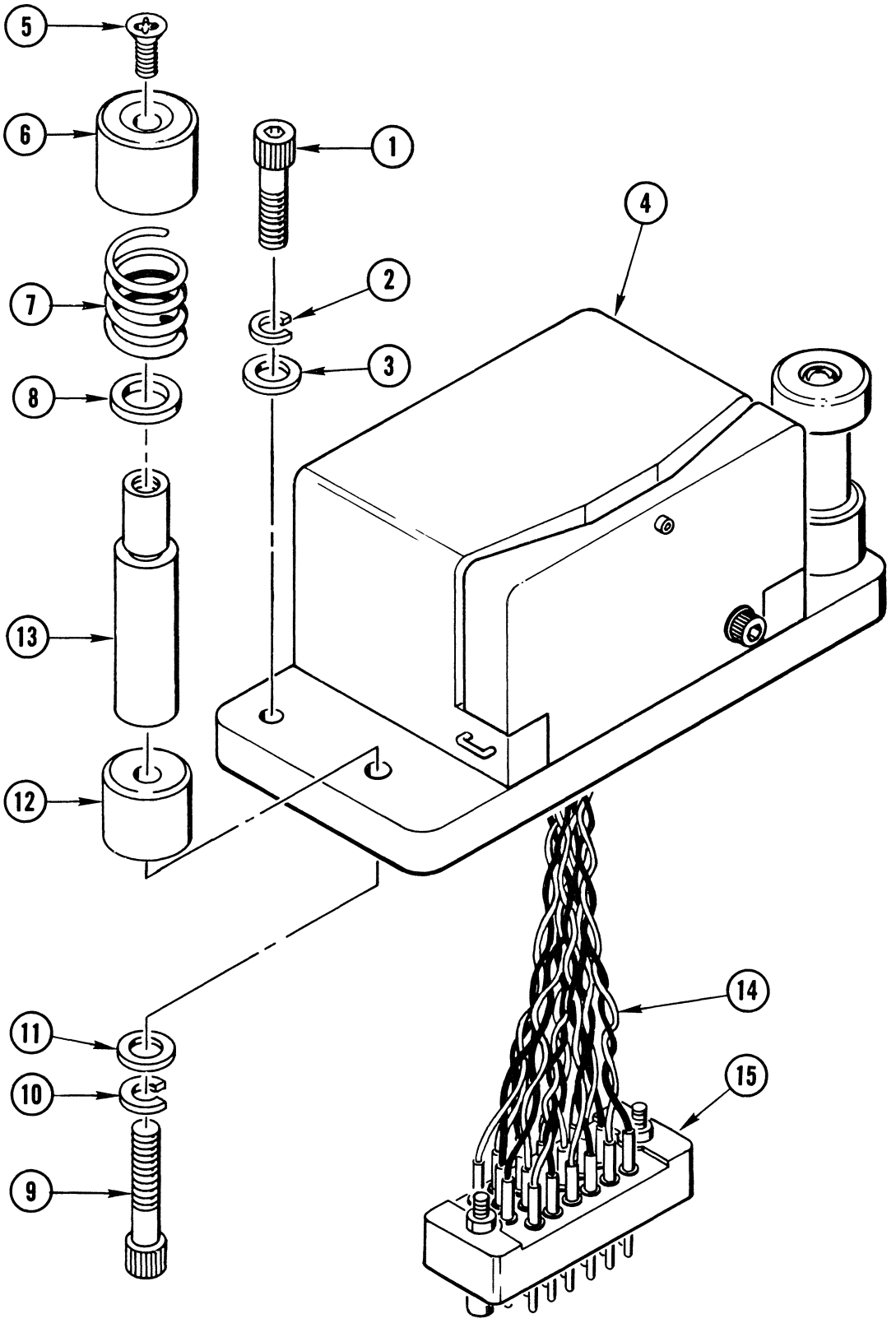

Figure 9-25
Read/Write Head Assembly

FIG & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
		READ/WRITE HEAD ASSEMBLY (see fig. 9-1)				
1	470-072	. Screw, cap, 6-32 NC-3A by 5/8 in., hex soc, sst	2			
2	502-009	. Washer, #6 spring lock, sst (MS35338-79)	2			
3	501-015	. Washer, #6 flat, sst (MS15795-306)	2			
4	3103486-10	. Head Assembly, read/write, 1/2 inch, 7 channel	1			
	3103462-10	. . Guide Assembly, ceramic, inner edge, 1/2 inch	2			
5	471-379	. . . Screw, machine, 4-40 NC-2A by 1/4 in., flat hd Phillips, sst (MS35200-12)	1			
6	3103008-10	. . . Cap, guide	1			
7	3102028-10	. . . Spring, compression	1			
8	3103488-10	. . . Ring, guide, ceramic	1			
9	470-023	. . . Screw, cap, 6-32 NC-3A by 7/8 in., hex soc, stl cad plt (MS35457-11)	1			
10	502-009	. . . Washer, #6 spring lock, sst (MS35338-79)	1			
11	501-020	. . . Washer, flat, 0.015 in. thk, brass cad plt	1			
12	3103489-10	. . . Base, guide, ceramic	1			
13	3103017-10	. . . Guide, post, 1/2 inch	1			
14	3103153-10	. . Cable Assembly, 7 channel	2			
15	145-155	. . . Connector, plug, male, 26 contact (Winchester #MRE-26P-JTC-30)	1			

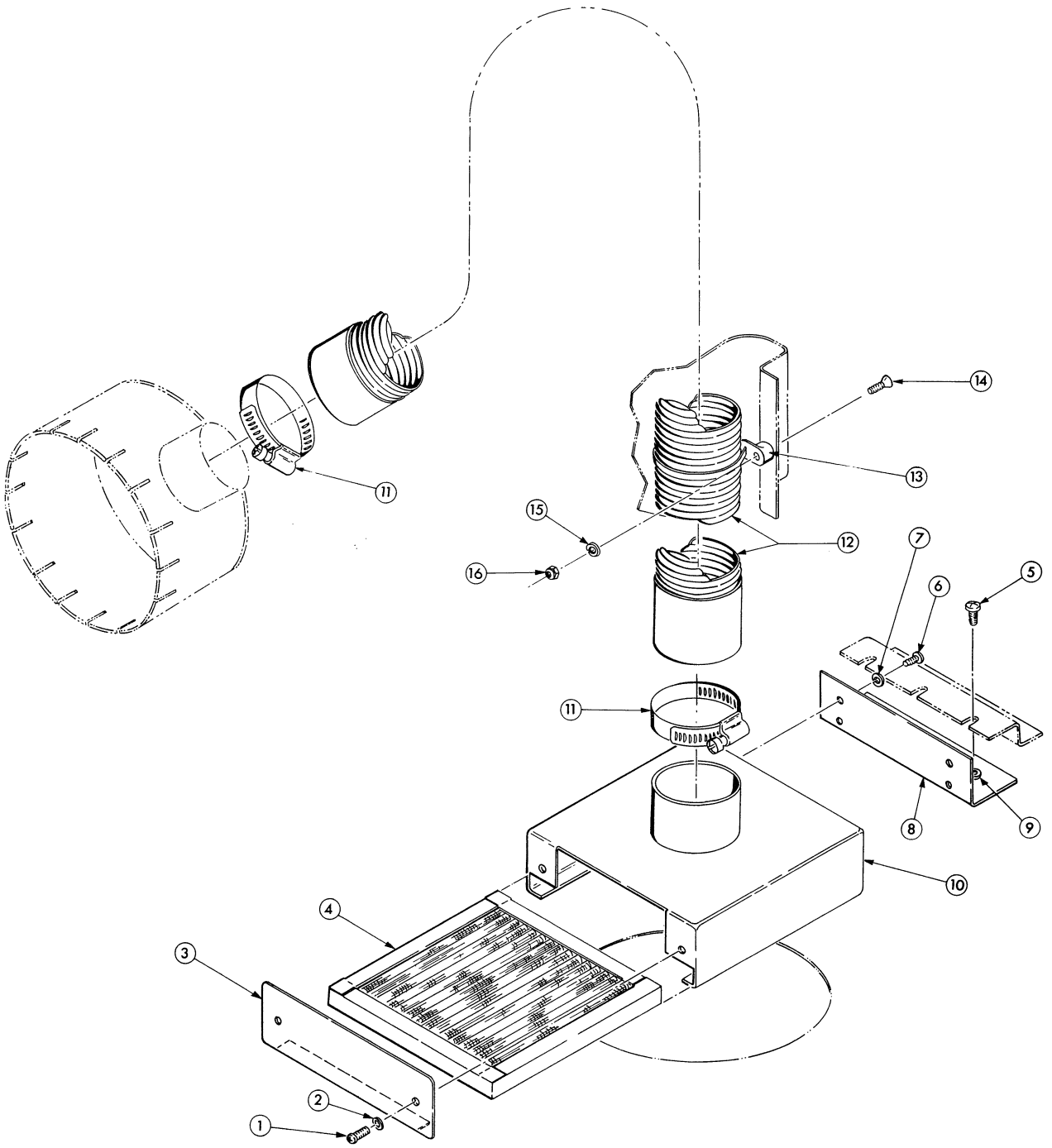

Figure 9-26
Positive Pressure Filter Assembly

FIG & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
		POSITIVE PRESSURE FILTER ASSEMBLY				
	510083010	Installation of Filter and Hose Assembly	Ref.			
	5100320-10	Filter Assembly (See Fig. 9-1)	Ref.			
1	471-068	. Screw, machine, 6-32 NC-2A by 5/16 in., pan hd Phillips, stl cad plt (MS35208-24	2			
2	502-025	. Washer, #6 lock, int tooth, stl cad plt (MS35333-37)	2			
3	3101215-10	. Cover	1			
4	370-018	. Filter (Air Maze #P61A)	1			
5	471-078	. Screw, machine, 8-32 NC-2A by 3/8 in., pan hd Phillips, stl cad plt (MS35208-40)	3			
6	471-086	. Screw, machine, 10-32 NF-2A by 5/16 in., pan hd Phillips, stl cad plt (MS35208-52)	4			
7	502-005	. Washer, #10 spring lock, stl cad plt (MS35338-43)	4			
8	3101211-10	. Bracket Assembly	1			
9	490-010	. . Nut, anchor, 8-32 NC-2B (Penn Engg. #W832)	3			
10	3101214-10	. Housing, filter, weldment	1			
11	300-050	. Clamp, hose (Cenco #12178 size 4)	2			
	5100828-10	. Hose Assembly	Ref.			
12	5100827-10	. . Hose detail	1			
13	302-207	. . Retainer adjustable	3			
14	471-358	. Screw, machine, 10-32NF-2A by 3/4 in., csk hd., stl cad plt.	3			
15	501-011	. Washer, #10 flat, round	3			
16	493-008	. Nut, self lock, 10-32NC-2B	3			

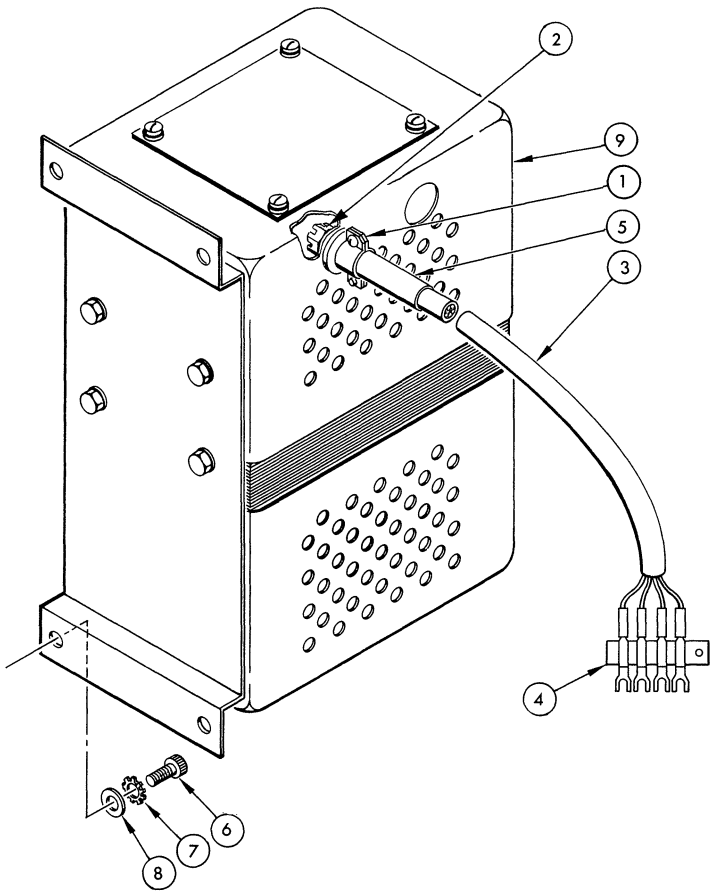

Figure 9-27
Transformer and Cable

FIG & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
		TRANSFORMER AND CABLE				
	5100458-10	Transformer and Cable Assembly, 50 cycle, (see fig. 9-1)				
1	000-604	. Gland, Cable, 3/4 in., ID. (Lewden Metal Products PD427)	1			
2	000-605	. Nut, Castellated (Metallic Seamless Tube Co. #1083)				
3	5100585-10	. Cable Assembly	1			
4	3102563-10	. . Fanning Strip, 4 Terminal	1			
5	262-003	. . Bushing, Telescoping, (AN3420-6)	1			
6	470-165	. Screw, cap, 1/4 - 28 by 1/2 in., hex soc, stl cad plt	4			
7	502-017	. Washer, 1/4 lock, external tooth, stl cad plt. (MS35335-33)	4			
8	501-106	. Washer, 1/4 flat, stl cad plt, (MS15795-210)	4			
9	5100434-10	. Transformer - 50 cycle	1			

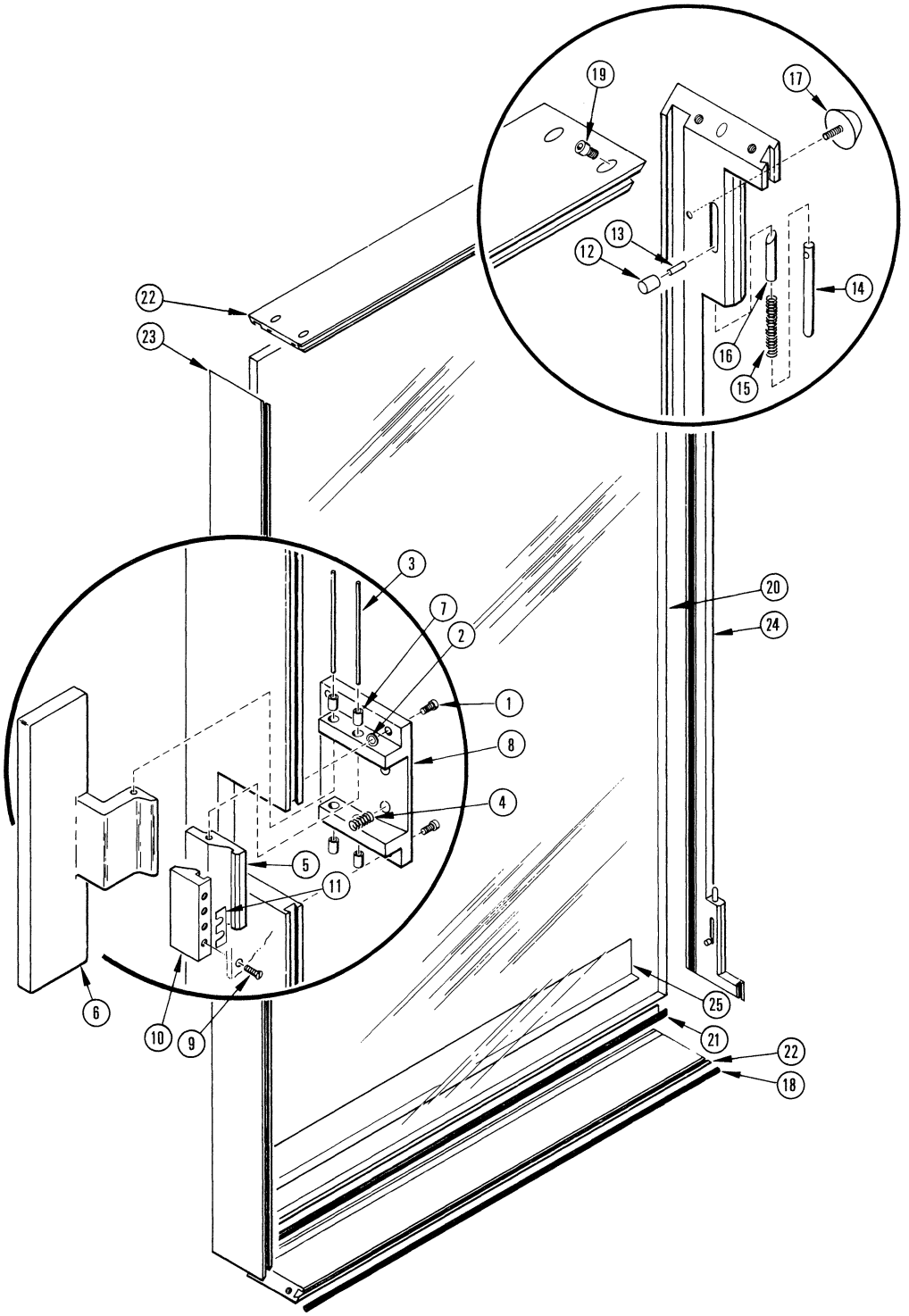

Figure 9-28
Transport Cover Door

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
		TRANSPORT COVER DOOR				
	3101077-10	Door Assembly, transport cover (See Figure 9-1)	Ref			
1	470-059	. Screw, cap, 4-40 NC-3A by 1/4 in., hex. sch sst, passivated	4			
2	501-047	. Washer, flat, 0.002 in. thk, brass white nickel plt	A/R			
3	402-022	. Pin, dowel, stl, 0.125 dia by 2 in. lg (Danley #7-0432-1)	2			
4	3101194-10	. Spring, latch	2			
5	3101192-10	. Latch	1			
6	3101193-10	. Handle, hook	1			
7	423-032	. Bushing, sleeve, plain, bronze (Chrysler Amplex #AA-110-2)	4			
8	3101190-10	. Plate, latch	1			
9	471-374	. Screw, machine, 2-56 NC-2A by 3/8 in., flat slotted hd, sst, passivated (MS35249-12)	4			
10	3101199-10	. Strike	1			
11	3108652-10	. Shim, 0.010 in. thk	A/R			
12	3101187-10	. Knob	2			
13	406-028	. Rollpin, sst (Esna #79-022-094-0562)	2			
14	3101186-10	. Pin, hinge	2			
15	3101185-10	. Spring, hinge	2			
16	3101184-10	. Stop, spring	2			
17	250-023	. Bumper, neoprene, 3/8-16 thd by 3/8 in. (Rubbercraft #3066)	2			
18	269-090	. Molding, rubber (Rubbercraft #1124)	A/R			
19	470-076	. Screw, cap, 8-32 NC-3A by 1/4 in., hex sch, stl cad plt	8			
20	3101188-10	. Glass Transport Door	1			
21	225-064	. Glazing Tape	A/R			
22	3101181-10	. Strip (top and bottom)	2			
23	3101182-10	. Strip Hinge Side	1			
24	3101183-10	. Strip Latch Side	1			
25	3101191-10	. Indentification Plate	1			

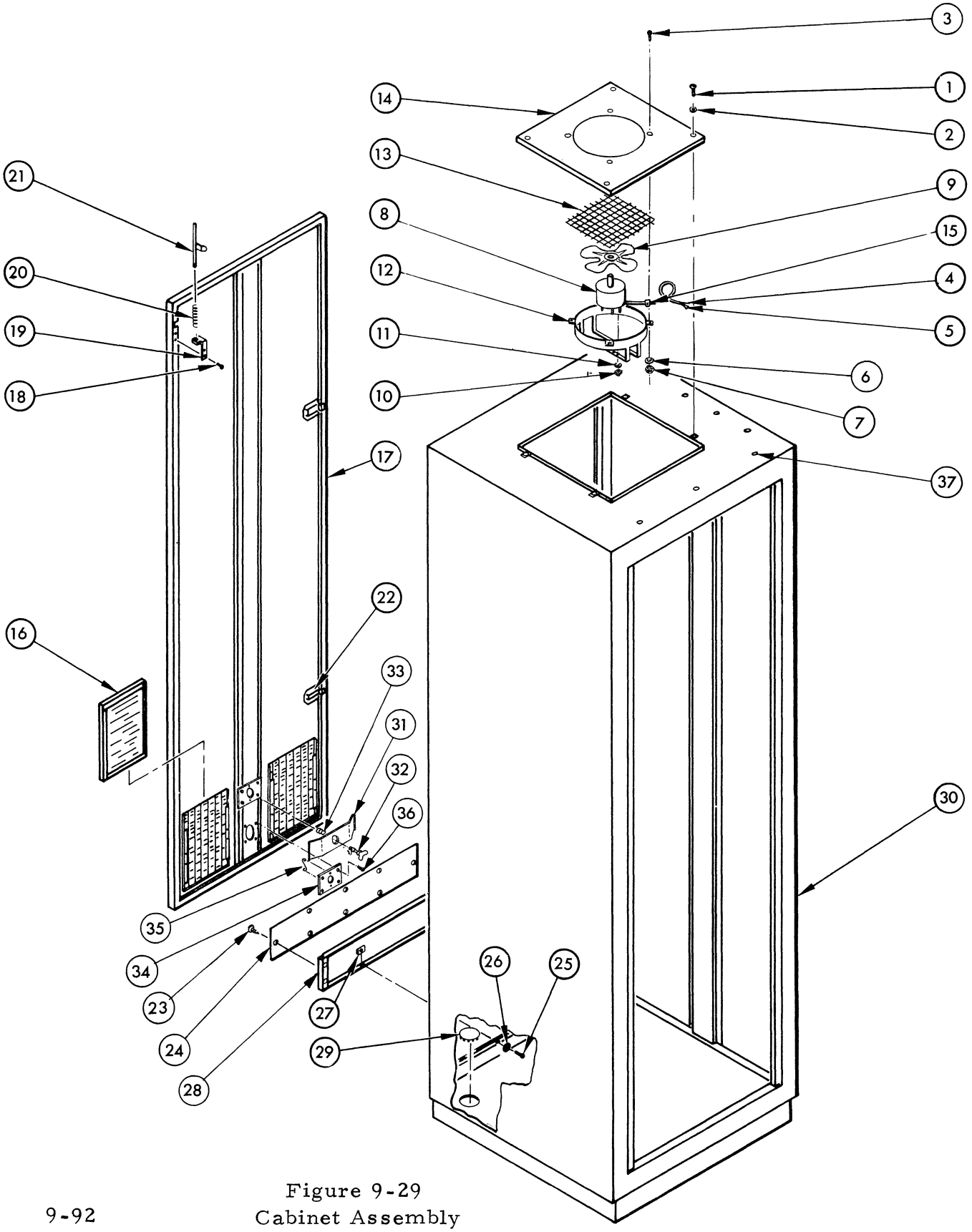

Figure 9-29
Cabinet Assembly

FIG & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
		CABINET ASSEMBLY				
	5100559-10	Cabinet Assembly (See Figure 9-1)	Ref			
1	471-076	. Screw, machine, 8-32 NC-2A by 1/4 in., pan hd Phillips, stl cad plt (MS35208-38)	4			
2	502-026	. Washer, #8 lock, int tooth, stl cad plt (MS35333-38)	4			
	5100562-10	. Fan Assembly	1			
3	472-643	. . Screw, machine, 1/4-20NC-2A by 5/8 in., pan hd Phillips, stl cad plt	4			
4	501-012	. . Washer, 1/4 Flat, stl cad plt	4			
5	493-012	. . Nut, plain hex, 1/4-20 NC-2B, stl cad plt	4			
6	171-001	. . Connector, Solderless	2			
7	171-069	. . Connector, solderless (AMP 34146)	1			
8	5100404-10	. . Fan Motor, 117 vac.	1			
9	591-070	. . Fan, 5 blades 10 in. OD.	1			
10	493-007	. . Nut, plain hex, 8-32 NC-2B, stl cad plt	2			
11	501-911	. . Washer, #8 spring lock, stl cad plt	2			
12	5100415-10	. . Frame Assy.	1			
13	5100328-40	. . Grille, Fan	1			
14	5100514-40	. . Cover Vent	1			
15	5100339-10	. . Clamp	1			
16	5100498-10	. Filter, Air	1			
17	5100454-40	. Door Assembly	1			
18	471-334	. . Screw, machine, 6-32 NC-2A by 1/4 in., flat hd Phillips, stl cad plt (MS35192-23)	2			
19	3101400-10	. . Retainer, spring	1			
20	3100566-10	. . Spring, door	1			
21	3100564-10	. . Pin Assembly, door	1			
22	311-043	. . Latch, flush (Hartwell #H4700-C064-125)	2			
23	476-002	. Screw, self-tapping, 6-32 by 1/4 in., pan hd Phillips, stl cad plt (Parker-Kalon)	8			
24	3101174-40	. Cover	1			
25	471-865	. Screw, machine, 10-24 by 5/8 in., pan hd Phillips, stl cad plt (MS35212-56)	6			

FIG & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
26	501-011	. Washer, #10 flat, stl cad plt (MS15795-208)	6			
27	497-028	. Speednut, U type, 10-24 screw size, zinc chromate stl (Tinnerman #C1152-1024-1)	6			
28	3101173-40	Frame Assy. Outlet	1			
29	251-028	. Button, plug (United Carr #48175)	4			
30	3101171-40	. Cabinet Assembly, weldment	1			
	5100518-40	. Clamp Assembly	2			
31	5100483-40	. . Clamp	2			
32	000-589	. . Stud	2			
33	000-591	. . Spring	2			
	5100543-40	. Plate Assembly	2			
34	5100542-10	. . Plate	2			
35	000-587	. . Spring	2			
36	476-020	. Screw, self tapping, "Z" Binder hd, slotted #6 by 3/16 lg,(Parker Kalon)	8			
37	251-018	. Button, Shakeproof 207-090241-00 (Nylon)	6			

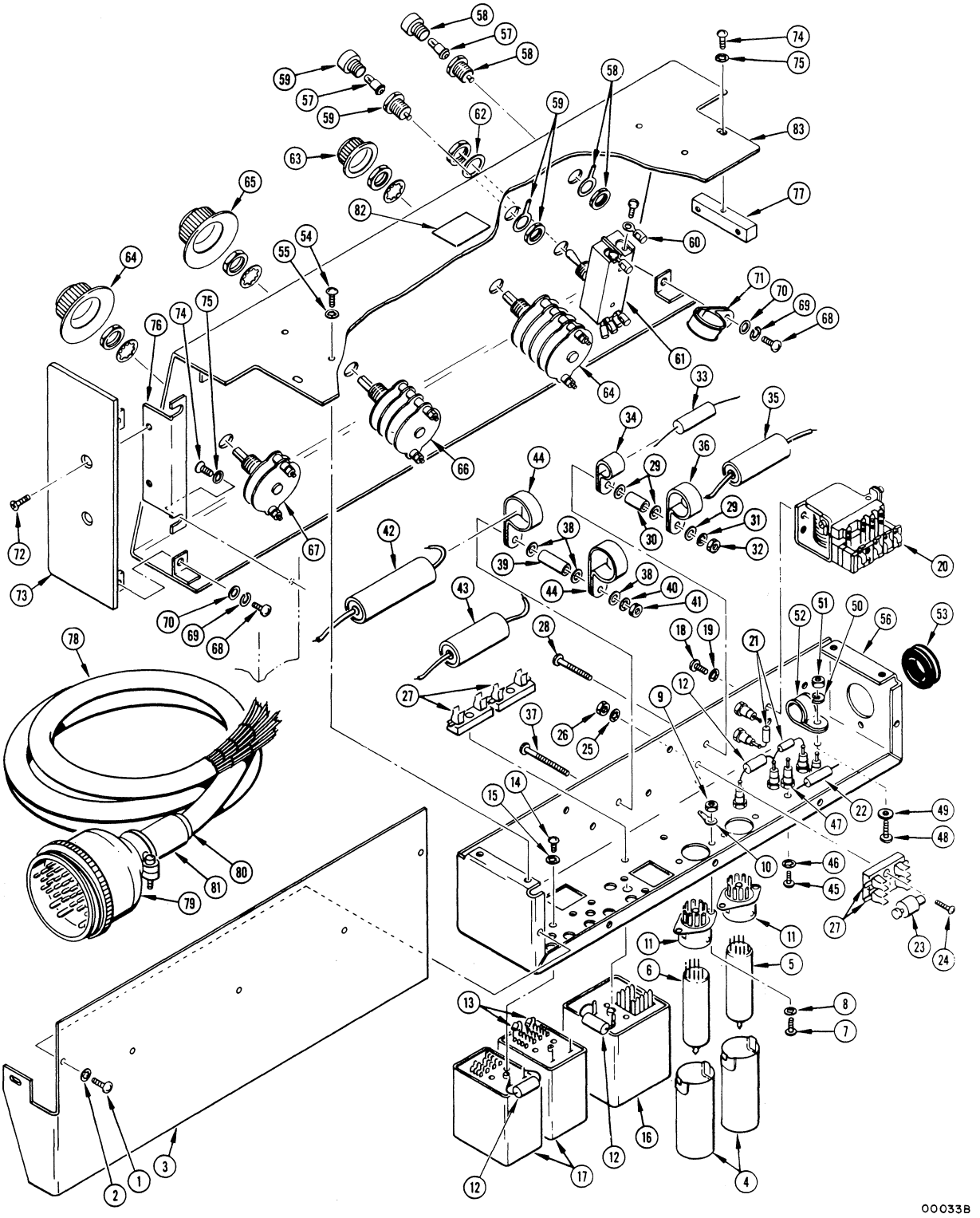

Figure 9-30
Manual Control Panel

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
		MANUAL CONTROL PANEL				
	3101064-10	Panel Assembly, manual control (See Figure 9-1)	Ref			
1	471-069	. Screw, machine, 6-32 NC-2A by 3/8 in., pan hd Phillips, stl cad plt (MS24584-25)	7			
2	502-025	. Washer, #6 lock, int tooth, stl cad plt (MS35333-37)	7			
3	3101153-10	. Cover, chassis	1			
4	160-020	. Shield, tube (JAN-S-28A: TS103U03)	2			
5	020-059	. Relay, time delay, 2 second (K801) (Amperite #26C2T)	1			
6	020-092	. Relay, time delay, 45 second (K805) (Amperite #115N045T)	1			
7	471-060	. Screw, machine, 4-40 NC-2A by 1/4 in., pan hd Phillips, stl cad plt (MS24584-12)	4			
8	502-024	. Washer, #4 lock, int tooth, stl cad plt (MS35333-36)	4			
9	492-008	. Nut, plain hex, 4-40 NC-2B, stl cad plt (MS35649-42)	4			
10	172-032	. Lug, soldering (Cinch #Y141)	1			
11	150-026	. Socket, noval (JAN: TS103P01)	2			
12	013-139	. Diode, silicon (CR801, CR802, CR807) (Texas Instrument #1N2069)	3			
13	041-057	. Resistor, fixed, composition, 5600 ohm, 1/2w, 10% (MIL-R-11:RC20GF562K)	2			
14	471-066	. Screw, machine, 6-32 NC-2A by 3/16 in., pan hd Phillips, stl cad plt (MS35208-22)	6			
15	502-025	. Washer, #6 lock, int tooth, stl cad plt (MS35333-37)	6			
16	020-122	. Relay, 24 volt coil (K803) (Philtrol #8QA-24-3C-24)	1			
17	020-103	. Relay, sealed (K802, K806) (Philtrol #8QA2Z16)	2			
18	471-067	. Screw, machine, 6-32 NC-2A by 1/4 in., pan hd Phillips, stl cad plt (MS35208-23)	4			
19	502-025	. Washer, #6 lock, int tooth, stl cad plt (MS35333-37)	4			
20	020-035	. Relay, 24 volt DC coil (K804) (Philtrol #33BDC-24-4C-13)	1			
21	041-041	. Resistor, fixed, composition, 270 ohm, 1/2w, 10% (R804, R805) (MIL-R-11:RC20GF271K)	2			
22	041-140	. Resistor, fixed, composition, 390 ohm, 1w, 10% (R803) (MIL-R-11:RC32GF391K)	1			

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
23	582-026	. Rectifier, selenium, single phase, half wave (CR803 thru CR806) (Sarkes Tarzian #20LA)	4			
24	471-559	. Screw, machine, 4-40 NC-2A by 3/8 in., binder hd slotted, stl cad plt	4			
25	502-024	. Washer, #4 lock, int tooth, stl cad plt (MS35333-36)	4			
26	492-008	. Nut, plain hex, 4-40 NC-2B, stl cad plt (MS35649-42)	4			
27	130-007	. Holder, rectifier (Littelfuse #099062)	4			
28	471-436	. Screw, machine, 6-32 NC-2A by 1-5/8 in., pan hd Phillips, stl cad plt	1			
29	501-009	. Washer, #6 flat, stl cad plt (MS15795-206)	3			
30	280-010	. Spacer, 3/4 in. lg, brass cad plt (H. Smith #2108, Birnbach #1133)	1			
31	502-025	. Washer, #6 lock, int tooth, stl cad plt (MS35333-37)	1			
32	492-009	. Nut, plain hex, 6-32 NC-2B, stl cad plt (MS35649-62)	1			
33	300312790	. Capacitor, electrolytic, 16 uf, 90 vdc (C801)	1			
34	302-049	. Clamp, cable, 1/2 in. (Commercial Plastics #742-8)	1			
35	031-118	. Capacitor, electrolytic, 100 uf, 50 vdc (C804) (Sprague #TVA1310)	1			
36	302-086	. Clamp, cable, 11/16 in. (Commercial Plastics #742-11)	1			
37	471-436	. Screw, machine, 6-32 NC-2A by 1-5/8 in., pan hd Phillips, stl cad plt	1			
38	501-009	. Washer, #6 flat, stl cad plt (MS15795-206)	3			
39	3101165-10	. Spacer, connector	1			
40	502-025	. Washer, #6 lock, int tooth, stl cad plt (MS35333-37)	1			
41	492-009	. Nut, plain hex, 6-32 NC-2B, stl cad plt (MS35649-62)	1			
42	035-302	. Capacitor, tubular, 1 uf, 600 vdc (C802) (Gudeman #XHF2508J-10)	1			
43	031-126	. Capacitor, electrolytic, 250 uf, 50 vdc (C803) (Sprague #TVA1312)	1			
44	302-091	. Clamp, cable, 1 in. (Commercial Plastics #742-16)	2			
45	471-066	. Screw, machine, 6-32 NC-2A by 3/16 in., pan hd Phillips, stl cad plt (MS35208-22)	11			

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
46	502-025	. Washer, #6 lock, int tooth, stl cad plt (MS35333-37)	11			
47	173-003	. Lug, terminal, turret, gold plt (Useco #1417)	11			
48	471-069	. Screw, machine, 6-32 NC-2A by 3/8 in., pan hd Phillips, stl cad plt (MS24584-25)	1			
49	501-009	. Washer, #6 flat, stl cad plt (MS15795-206)	1			
50	502-003	. Washer, #6 spring lock, stl cad plt (MS35338-41)	1			
51	492-009	. Nut, plain hex, 6-32 NC-2B, stl cad plt (MS35649-62)	1			
52	302-049	. Clamp, cable, 1/2 in. (Commercial Plastics #742-8)	1			
53	260-011	. Grommet, elastic, 11/16 in. ID (MS35489-19)	1			
54	471-069	. Screw, machine, 6-32 NC-2A by 3/8 in., pan hd Phillips, stl cad plt (MS24584-25)	4			
55	502-025	. Washer, #6 lock, int tooth, stl cad plt (MS35333-37)	4			
56	3101155-10	. Chassis, control panel	1			
57	060-019	. Lamp, incandescent, 28 volt, 0.04 amp (MS25237-327)	2			
58	060-056	. Light, indicator, green, w/mounting hardware (DS802) (Sloan #855S1-G-5-855-820)	1			
59	060-057	. Light, indicator, amber, w/mounting hardware (DS801) (Sloan #855S1-A-3-855-320)	1			
60	171-016	. Connector, solderless, ring tongue, #10 stud (AMP #34170)	6			
61	120-100	. Switch, toggle, 250 volt, 20 amp, w/mounting hardware (S806) (Arrow H&H #80421U)	1			
62	3105542-10	. Washer	1			
63	230-036	. Knob, dial, skirted (Raytheon #2420-1051G1)	1			
64	3101158-10	. Switch, rotary, w/mounting hardware (S801)	1			
65	230-039	. Knob, dial, skirted (Raytheon #2420-1081G1)	2			
66	3101157-10	. Switch, rotary, w/mounting hardware (S802)	1			
67	3101159-10	. Switch, rotary, w/mounting hardware (S803)	1			
68	471-080	. Screw, machine, 8-32 NC-2A by 1/2 in., pan hd Phillips, stl cad plt (MS35208-42)	4			
69	502-004	. Washer, #8 spring lock, stl cad plt (MS35338-42)	4			
70	501-010	. Washer, #8 flat, stl cad plt (MS15795-207)	4			
71	302-049	. Clamp, cable, 1/2 in. (Commercial Plastics #742-8)	1			

FIG. & INDEX NO.	AMPEX PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.	USE ON CODE	EFFECTIVE ON	EFFECTIVE THRU
72	471-345	. Screw, machine, 8-32 NC-2A by 3/8 in., 82° flat hd Phillips, stl cad plt (MS35192-40)	4			
73	3101148-10	. Side Assembly, control panel, welded	2			
74	471-069	. Screw, machine, 6-32 NC-2A by 3/8 in., pan hd Phillips, stl cad plt (MS24584-25)	6			
75	502-025	. Washer, #6 lock, int tooth, stl cad plt (MS35333-37)	6			
76	3101151-10	. Bracket, control	2			
77	3101161-10	. Bracket	2			
78	3101378-10	. Cable Assembly (CU800)	1			
79	145-128	. . Connector, plug, male, 50 contact (P303) (Cannon #RLK-A50-22C-1)	1			
80	262-006	. . Bushing, telescoping (AN3420-12)	1			
81	262-007	. . Bushing, telescoping (AN3420-16)	1			
82	3100249-10	. Identification Plate	1			
83	3101145-10	. Panel Assembly, control, welded	1			

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NUMERICAL INDEX

AMPEX PART NO.	FIG. & INDEX NO.	QTY. PER ASSY.
000-587	29-35	2
000-589	29-32	2
000-591	29-33	2
000-604	17-1	1
000 605	17-2	-
000-778	6-49	1
012-065	13-1	1
012-068	13-2	1
	23-1	4
012-106	23-2	2
012-154	22-2	4
013-015	9-30	1
013-021	17-10	2
013-028	22-16	4
013-050	22-13	3
013-102	22-17	1
013-132	17-21	1
	12-19	2
013-130	30-12	3
013-146	16-29	1
013-151	22-15	6
013-152	17-33	1
013-153	17-34	1
013-156	16-30	1
013-162	22-14	2
013-197	17-43	2
	17-50	2
	17-56	2
014-007	22-18	6
014-083	17-19	2
	17-30	1
014-097	17-31	1
015-012	20-1	1
015-013	19-30	1
020-006	19-69	4
020-035	30-20	1
020-059	30-5	1
020-092	30-6	1
020-103	30-17	2
020-113	9-24	1
020-122	30-16	1
022-009	2-29	2
030-004	22-4	2
030-032	19-66	1
030-043	22-5	4

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030-094	22-10	2
030-095	22-9	2
030-101	22-6	2
030-145	23-6	12
030-129	21-7	2
021-039	19-57	2
031-073	19-51	2
031-077	19-6	1
031-118	30-35	1
031-126	30-43	1
031-129	22-11	1
031-135	22-12	1
031-186	17-41	1
	17-48	1
031-187	17-47	2
	17-54	2
031-211	19-95	1
	22-7	1
031-220	17-42	1
	17-49	1
031-247	17-51	1
031-276	19-5	1
033-072	23-8	2
033-074	23-7	4
033-075	20-35	8
034-105	19-35	1
034-177	13-19	1
034-184	13-15	1
034-199	13-16	3
035-285	20-32	4
035-302	30-42	1
035-346	9-16	Ref
035-355	13-18	1
035-356	13-14	1
035-366	19-96	1
036-049	10-26	1
036-052	9-29	1
036-055	6-38	1
036-059	9-94	2
037-110	22-8	4
040-023	19-64	1
040-031	19-36	1
041-001	22-29	2
041-016	13-21	1

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AMPEX PART NO.	FIG. & INDEX NO.	QTY. PER ASSY.
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041-027	20-34	8
041-028	13-11	1
041-031	22-31	2
041-038	22-23	4
041-041	22-35	1
	30-21	2
041-044	22-34	1
041-052	22-28	10
041-054	22-33	2
041-056	22-30	2
041-057	30-13	2
041-058	22-32	4
041-059	23-12	4
041-063	22-25	3
041-064	22-24	2
041-065	22-21	4
041-072	22-22	4
041-089	22-20	4
041-091	22-36	4
041-106	19-97	1
041-140	30-22	1
041-199	22-27	1
041-224	19-56	2
	19-99	1
041-245	13-13	2
041-254	23-19	4
041-286	19-12	2
041-318	13-17	3
041-322	23-25	4
041-344	13-20	1
041-351	9-17	4
	22-37	1
041-398	13-22	1
041-406	17-9	1
041-407	17-22	1
	17-35	1
041-408	17-37	1
041-409	17-24	1
041-410	17-36	1
041-412	17-38	1
041-413	17-26	1
041-414	17-12	1
041-431	17-11	1
041-476	13-12	2
	19-25	20
041-496	17-13	1
041-511	17-14	1
041-518	17-25	1
041-520	17-23	1
041-527	22-26	1
041-536	19-98	1
042-054	23-20	4
042-057	23-14	4
042-113	23-11	4
042-119	23-18	8
042-130	23-15	4
042-144	23-24	4
042-221	23-10	8
042-268	23-16	8
042-269	23-21	4
042-280	23-13	4
042-363	23-17	4
042-924	23-22	2
043-280	19-4	2
043-313	19-11	1
043-514	20-33	4
043-508	19-10	1
043-509	23-23	2
044-297	12-18	2
	13-29	Ref
044-314	17-7	1
047-377	17-57	2
047-378	17-44	2
047-379	17-51	2
060-019	30-57	2
060-056	30-58	1
060-057	30-59	1
060-059	15-7	1
070-005	16-42	1
070-008	21-1	1
070-019	19-23	2
070-022	19-22	1
081-014	11-103	1
120-013	2-7	2
120-058	12-21	1
120-100	30-61	1
120-118	12-26	1
126-018	25-1	1
126-023	21-6	1
130-004	16-45	1

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130-013	21-2	1
144-106	1-16	1
145-042	1-17	1
145-082	24-14	1
145-127	1-18	1
145-128	1-19	1
145-129	12-9	1
145-150	15-12	1
145-155	25-15	1
146-042	21-31	1
	21-27	1
146-142	21-28	1
146-143	21-29	1
146-170	15-15	1
146-173	24-11	2
147-105	21-30	1
148-012	13-36	2
148-013	13-37	1
148-031	17-8	1
150-026	30-11	2
150-058	20-7	8
150-080	13-3	2
150-094	19-41	1
150-097	22-3	4
150-213	23-3	6
160-007	22-1	4
160-020	30-4	2
168-007	13-9	15
	22-39	15
	23-26	20
168-008	12-13	1
	13-18	Ref
	21-32	1
168-009	21-33	1
168-016	16-17	1
168-017	16-15	1
168-018	16-16	1
169-019	6-4	3
	12-11	3
169-987	6-5	1
169-988	12-10	1
171-001	2-27	2
	6-36	2
	29-6	1
171-009	11-83	4
171-016	30-60	6
171-024	20-27	15
171-029	24-21	4
171-030	24-22	4
171-031	24-20	16
171-069	6-3	1
	29-7	1
172-001	16-40	1
172-003	6-37	1
	19-39	1
	23-8	4
172-028	19-88	2
172-032	30-10	1
172-039	10-27	2
	30-47	11
173-012	17-15	1
173-015	9-20	16
	19-28	44
173-024	16-18	18
173-036	17-46	4
	17-53	4
	17-59	4
173-041	19-100	4
173-068	19-15	4
173-069	17-2	3
180-014	19-74	1
180-049	19-104	1
180-081	11-74	1
180-082	19-108	1
180-086	21-12	1
180-116	7-4	Ref
	8-4	Ref
	12-14	2
	16-50	3
180-117	7-7	Ref
	8-7	Ref
	12-15	2
180-118	4-4	1
180-119	9-35	1
	12-12	1
180-124	6-30	1
180-183	20-20	2
180-184	6-23	Ref
225-062	14-50	A/R
225-064	28-21	A/R
230-036	30-63	1

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250-023	28-17	2
251-018	29-37	6
251-028	29-29	4
260-004	10-31	1
260-005	16-31	1
	19-109	1
260-007	19-110	2
260-011	30-53	1
260-016	9-44	1
260-018	21-35	1
260-032	6-43	1
	9-45	1
262-003	27-5	1
262-004	24-23	2
262-007	12-8	1
269-090	28-18	A/R
269-099	7-21	A/R
	8-21	A/R
269-148	6-8	1
280-003	19-69	4
280-006	20-24	2
280-003	6-26	2
280-010	[illegible]4	1
	[illegible]-34	4
	30-30	4
280-019	16-54	4
280-030	17-6	2
	17-20	2
	17-32	2
	22-19	6
290-004	19-[illegible]9	1
	19-52	2
	19-58	2
290-014	9-27	2
300-001	19-34	1
	20-6	8
300-050	26-11	2
300-053	10-29	1
302-007	7-14	1
	8-14	1
	12-5	1
302-026	18-8	1
302-027	26-13	3
302-029	10-18	1
	18-13	1
	21-25	1
302-031	2-26	2
	12-6	2
302-036	9-43	1
	12-35	2
	15-3	1
302-037	6-35	2
302-049	30-71	1
	30-34	1
	30-52	1
302-076	18-7	1
302-086	12-4	1
	30-36	1
302-091	30-44	2
302-105	12-34	1
302-111	9-39	1
310-061	19-117	1
310-068	13-32	2
3100106-10	2-20	2
3100160-10	2-11	2
3100193-10	5-46	1
3100196-10	3-25	A/R
3100212-10	4-7	A/R
3100213-10	4-8	A/R
3100214-10	4-9	A/R
3100215-10	4-10	A/R
3100238-10	24-24	A/R
3100249-10	16-52	1
	18-30	1
3100287-10	16-7	1
	17-	Ref
3100288-10	17-	Ref
3100289-10	16-5	1
3100291-10	16-6	1
	16-41	1
	17-	Ref
3100507-10	17-3	1
3100508-10	17-17	1
3100564-10	29-21	1
3100566-10	29-20	1
3100589-10	16-4	2
	17-	Ref
3100594-10	15-8	2
3100618-10	4-5	1
3100640-10	12-16	2
3100669-10	17-16	1

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3100671-10	17-5	2
3100672-10	17-27	1
3100680-10	17-58	1
3100681-10	17-52	1
3100682-10	17-45	1
3100688-10	17-28	1
3100711-10	17-39	1
3100748-10	6-7	1
	9-21	1
3100792-10	3-27	1
3100901-10	19-21	1
3100902-10	19-26	1
3100904-10	19-20	1
3101020-10	21-38	3
3101035-10	3-	REF
3101036-10	3-14	1
3101037-10	3-9	1
3101040-10	3-1	1
3101043-10	1-13	1
3101064-10	1-10	1
	30-	REF
3101077-10	1-8	1
3101093-10	1-11	1
3101095-10	1-5	1
3101135-10	2-4	1
3101141-10	24-12	1
3101142-10	24-6	
3101144-10	24-9	4
3101153-10	30-3	1
3101155-10	30-56	1
3101157-10	30-66	1
3101158-10	30-64	1
3101159-10	30-67	1
3101165-10	30-39	1
3101166-10	1-1	1
	4-1	REF
	5-1	REF
	6-	REF
	7-	REF
	8-	REF
	9-	REF
	10-	REF
3101167-10	1-14	1
3101170-10	3-	REF

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3101171-40	29-30	1
3101173-40	29-28	1
3101174-10	29-24	1
3101181-10	28-22	2
3101182-10	28-23	1
3101183-10	28-24	1
3101184-10	28-16	2
3101185-10	28-15	2
3101186-10	28-14	2
3101187-10	28-12	2
3101188-10	28-20	1
3101190-10	28-8	1
3101191-10	28-25	1
3101192-10	28-5	1
3101193-10	28-6	1
3101194-10	28-4	2
3101199-10	28-10	1
3101203-10	15-18	1
	16-	REF
3101211-10	26-8	1
3101214-10	26-10	1
3101215-10	26-3	1
3101230-10	5-47	1
3101233-10	2-	2
3101247-10	6-15	1
3101248-10	6-	1
3101250-10	7-	1
3101251-10	8-10	1
3101254-10	9-	1
3101256-10	5-20	2
3101257-10	12-	1
3101265-10	13-	1
3101266-10	13-	1
3101268-10	4-	2
3101269-10	2-9	2
3101270-10	2-8	2
3101271-10	2-6	2
3101271-10	2-4	2
3101273-10	2-5	4
3101274-10	11-2	1
3101275-10	2-22	2
3101276-10	2-19	2
3101277-10	10-30	1
3101278-10	5-16	1

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3101280-10	5-29	1
3101281-10	5-26	1
3101283-10	9-4	3
3101284-10	6-12	3
3101285-10	6-13	1
3101286-10	5-14	1
3101287-10	5-19	4
3101291-10	5-28	1
3101292-10	2-33	2
3101293-10	5-24	1
3101294-10	12-29	1
3101295-10	2-10	2
	11-25	1
3101296-10	10-13	1
3101297-10	10-14	1
3101298-10	10-9	1
3101299-10	10-	1
3101301-10	12-33	1
3101306-10	6-24	2
3101307-10	6-29	1
3101308-10	5-15	1
3101312-10	4-11	A/R
3101315-10	14-16	1
3101320-10	5-45	1
3101326-10	14-3	6
3101328-10	5-10	7
3101329-10	5-11	7
3101330-10	5-9	1
3101331-10	5-4	1
3101332-10	5-5	1
3101341-10	18-32	1
	20-	REF
3101352-10	18-28	1
3101353-10	18-29	1
3101360-10	18-27	1
3101361-10	18-21	2
3101362-10	18-23	2
3101400-10	29-19	1
3101424-10	16-53	1
3101426-10	16-27	1
3101427-10	16-10	1
3101429-10	16-3	1
3101430-10	16-51	1
3101443-10	12-17	2
	15-14	1
3101455-10	11-101	2
3101463-10	3-3	1
3101464-10	3-12	1
3101465-10	3-17	1
3101466-10	3-16	1
3101467-10	3-18	1
3101468-10	3-4	1
3101469-10	3-19	1
3101470-10	3-22	1
3101472-10	3-22	1
3101473-10	3-15	1
3101474-10	3-6	1
3101475-10	3-7	2
3101476-10	3-5	1
3101477-10	3-2	1
3101483-10	14-6	1
3101484-10	14-7	1
3101485-10	14-10	1
3101487-10	14-51	1
3101488-10	14-52	1
3101490-10	14-53	1
3101500-10	6-20	1
3101502-10	14-49	1
3101509-10	14-42	1
3101512-10	14-21	1
3101514-10	14-22	1
3101515-10	14-24	1
3101519-10	14-19	1
3101520-10	14-20	2
3101521-10	14-8	A/R
3101524-10	14-18	1
3101532-10	6-19	1
3101533-10	6-1	1
3101534-10	6-6	1
3101535-10	7-22	1
3101536-10	7-20	1
	8-20	1
3101538-10	8-22	1
3101541-10	9-7	1
3101542-10	9-15	1
3101543-10	9-46	1
3101545-10	9-10	1
3101547-10	9-28	1
3101549-10	11-87	1
3101551-10	11-86	1
3101554-10	11-24	2

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3101556-10	11-47	1
3101557-10	11-48	1
3101558-10	11-42	2
3101559-10	11-33	1
3101560-10	11-27	1
3101561-10	11-35	1
3101562-10	11-39	1
3101564-10	11-84	2
3101569-10	11-67	2
3101570-10	11-46	2
3101571-10	11-64	2
3101573-10	11-78	1
3101574-10	11-	1
3101585-10	11-100	1
3101586-10	11-65	2
3101589-10	11-81	2
3101591-10	11-3	2
3101596-10	15-13	1
3101598-10	13-23	1
3101605-10	13-	1
3101606-10	13-41	2
3101617-10	10-28	1
3101619-10	6-48	2
3101620-10	6-42	1
3101648-10	19-105	1
3101649-10	19-90	1
3101651-10	19-	1
3101652-10	19-112	2
3101653-10	19-79	1
3101654-10	19-48	1
3101655-10	19-115	1
3101662-10	19-113	1
3101663-10	20-37	1
3101664-10	29-28	1
3101666-10	20-12	2
3101667-10	20-16	1
3101668-10	1-12	1
3101669-10	21-39	1
3101674-10	22-40	1
3101675-10	22-38	2
3101702-10	16-34	1
3101703-10	16-35	1
3101706-10	16-24	1
3101707-10	16-23	1
3101708-10	16-22	1
3101747-10	9-33	1
3101759-10	11-51	1
3101760-10	11-50	1
3101761-10	11-52	1
3101764-10	11-56	1
3101765-10	11-60	1
3101768-10	11-32	1
3101769-10	11-31	1
3101782-10	11-59	2
3101783-10	11-20	1
3101787-10	11-8	2
3101794-10	13-35	1
3101795-10	13-34	1
3101800-10	19-118	1
3101813-10	20-36	1
3101814-10	20-31	4
3101816-10	21-34	1
3101831-10	11-61	1
3101832-10	11-	
3101833-10	11-57	2
3101838-10	11-55	1
3101850-10	19-53	1
3101851-10	19-65	1
3101868-10	11-5	1
3101869-10	11-7	1
3101870-10	11-9	2
3101910-10	19-	1
3101911-10	19-16	1
3101917-10	18-31	1
	19-	Ref
3101919-10	19-50	1
3101930-10	15-6	1
3101933-10	21-26	1
3101934-10	23-27	1
3101935-10	14-	1
3101947-10	15-9	1
3102027-10	14-54	1
3101078-10	25-7	1
3102051-10	19-114	1
	18-33	1
3102082-10	21-	Ref
3102099-10	3-31	1
3102465-10	11-95	1
3102467-10	11-102	1
3102563-10	27-4	1

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3103008-10	25-6	1
3103017-10	25-13	1
3103153-10	25-14	2
3103488-10	25-8	1
3103489-10	25-12	1
3104017-10	14-46	2
3105408-10	11-23	2
3105542-10	30-62	1
3106019-10	4-6	4
3108652-10	28-11	A/R
3109238-10	7-17	1
	8-17	1
3109295-10	11-	1
3109300-10	11-14	1
3109331-10	11-12	1
3109334-10	11-11	1
311-043	29-22	2
3201323-10	23-9	8
	19-24	20
370-018	26-4	1
400-009	2-13	2
400-024	11-88	2
401-004	11-89	2
402-022	28-3	2
406-024	3-10	REF
406-026	2-21	2
	5-25	1
420-020	3-13	1
421-070	11-29	2
423-012	11-77	1
423-032	28-7	4
430-085	11-30	1
430-111	11-28	1
430-130	11-75	1
431-009	13-33	2
431-010	19-116	1
431-012	23-5	6
432-043	3-28	1
435-045	19-27	6
440-092	6-16	1
470-006	14-47	1
470-007	6-17	1
470-012	11-6	1
470-023	24-1	2
	25-9	1
470-027	16-18	2
470-029	11-69	4
470-031	11-62	4
470-032	5-30	2
470-039	6-9	4
470-040	11-21	6
470-041	9-1	3
	11-16	4
470-045	9-8	4
	20-8	8
470-059	28-1	4
470-061	15-4	2
470-062	14-15	1
470-063	14-43	2
470-064	14-4	4
470-068	16-32	2
470-070	14-12	1
470-072	25-1	2
470-074	15-1	1
470-076	28-19	8
470-120	4-1	8
470-151	11-40	2
470-165	27-6	4
470-175	14-6	6
470-176	11-43	2
470-235	11-53	2
470-236	11-54	2
470-999	11-15	1
	11-92	1
471-006	16-46	12
471-017	24-5	2
471-059	11-98	2
	17-1	3
	19-111	4
471-060	16-8	4
	18-1	3
	19-7	2
	19-13	4
	20-7	4
471-061	5-1	2
	11-44	4
	13-24	2
	13-38	6
	19-1	4
	19-31	1
471-062	19-2	1

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	21-8	2
471-064	6-21	4
	7-1	3
	7-5	4
	8-1	3
	8-5	4
	16-11	10
	18-4	1
	19-102	4
	20-17	8
471-066	30-14	6
	30-37	1
471-067	12-27	2
	16-25	4
	30-18	4
371-068	10-10	4
	11-36	2
	19-17	2
	26-1	2
471-060	5-6	1
	5-22	4
	7-11	1
	8-11	1
	10-15	1
	10-22	2
	12-1	6
	20-2	8
	21-13	12
	30-1	7
	30-48	1
	30-54	4
471-070	19-37	2
471-071	6-31	2
	6-45	2
	6-51	2
	10-4	4
	19-67	4
	20-3	8
471-072	9-40	1
	11-91	1
471-074	2-1	4
	9-11	4
	11-92	1

AMPEX PART NO.	FIG. & INDEX NO.	QTY. PER ASSY.
	24-7	4
471-075	9-31	4
	12-22	2
471-076	2-23	4
	29-1	4
471-077	13-4	2
471-078	5-17	4
	9-36	1
	10-1	2
	10-19	2
	13-30	3
	15-16	3
	16-1	2
	16-37	1
	19-7	2
	19-46	4
	19-49	4
	19-54	2
	26-5	3
471-079	18-9	1
471-080	2-30	4
	7-8	2
	8-8	2
	30-68	4
471-082	2-16	2
	21-21	1
471-086	7-18	1
	8-18	2
	26-6	4
471-087	6-2	2
	19-75	4
	19-80	2
471-088	20-13	4
471-089	3-20	3
	12-30	1
471-090	18-22	4
	19-84	1
471-093	3-29	3
	19-85	1
471-327	16-43	1
471-333	12-20	2
471-334	29-18	2
471-336	6-39	2
471-358	26-14	2
471-374	28-9	4
471-379	25-5	1

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AMPEX PART NO.	FIG. & INDEX NO.	QTY. PER ASSY.
471-436	30-28	1
	30-37	1
471-448	19-42	1
471-463	18-14	4
471-514	19-59	1
471-559	30-24	4
471-688	18-16	2
471-690	11-73	4
471-838	15-1	1
471-865	29-25	6
471-866	11-49	2
471-872	20-21	2
471-876	1-20	2
471-892	11-13	1
472-123	18-24	18
472-643	29-3	4
474-044	3-11	1
	3-26	1
474-281	4-12	8
476-002	29-23	8
476-020	29-36	8
	3-8	1
476-064	18-20	6
477-027	14-11	1
477-033	9-6	2
477-119	11-19	2
477-174	11-1	2
477-177	6-14	4
	9-5	3
490-011	24-13	8
492-001	16-49	12
492-008	7-3	3
	8-3	3
	13-27	2
	19-8	2
	21-11	4
	30-9	4
	30-26	4
492-009	6-28	2
	6-34	2
	6-41	2
	10-7	4
	10-25	2
	12-25	2
	20-23	2
	21-16	12
	30-32	1
	30-41	1
	30-51	1
492-010	5-32	2
	11-79	2
	11-85	2
	12-7	2
	18-12	1
	19-63	1
	21-24	1
	26-9	3
492-011	19-78	4
	19-83	2
	19-87	4
	19-91	4
492-012	18-19	2
	20-11	8
492-032	20-29	8
492-039	8-15	1
492-049	10-15	1
493-002	9-22	3
493-004	9-25	2
493-007	29-10	2
493-008	2-12	2
	11-34	1
	20-15	4
	26-16	3
493-012	11-26	1
	29-5	4
493-013	24-10	4
493-015	20-5	16
	20-26	2
493-026	19-33	1
494-016	16-55	4
496-002	16-33	2
	16-13	10
	16-22	2
496-004	16-44	1
	18-3	3
	18-6	1
496-006	16-39	4
497-028	29-27	6
501-007	16-47	12
501-008	2-14	2
	5-3	2
	6-18	2

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AMPEX PART NO.	FIG. & INDEX NO.	QTY. PER ASSY.
501-008	13-25	2
	13-40	6
	13-45	2
	16-12	10
	19-32	1
	19-73	2
	20-19	8
	21-9	2
	21-18	4
501-009	2-3	4
	5-8	1
	6-25	2
	6-47	2
	6-52	2
	10-5	4
	10-12	4
	10-23	2
	11-4	4
	11-38	2
	11-94	2
	12-23	2
	19-19	2
	19-44	1
	20-4	8
	21-14	12
	24-3	2
	25-2	2
	30-29	3
	30-38	3
	30-49	1
501-010	2-17	4
	2-25	4
	2-32	4
	5-31	2
	7-10	2
	8-10	2
	10-3	2
	10-21	2
501-010	11-71	4
	16-38	4
	18-10	1
	21-22	1
	30-70	4
501-011	6-11	4
	9-3	3
	11-18	4

AMPEX PART NO.	FIG. & INDEX NO.	QTY. PER ASSY.
	12-32	1
	19-76	4
	19-81	2
	19-89	2
	19-93	4
	20-14	4
	26-15	3
	29-26	6
501-012	18-17	4
	20-19	8
	29-4	4
501-014	11-41	2
501-015	8-19	2
	25-3	2
501-020	25-11	1
501-030	4-3	8
501-034	14-23	A/R
501-047	28-2	A/R
501-058	14-9	A/R
501-086	18-2	3
	18-5	1
501-106	27-8	4
501-188	9-13	4
	9-23	3
	9-42	1
501-190	9-38	1
	13-5	2
501-192	9-26	2
	18-26	18
501-911	29-11	2
502-001	16-48	1
	16-48	12
502-002	5-2	2
	6-22	4
	7-2	3
	7-6	4
	8-2	3
	8-6	4
	11-99	2
	13-26	2
	14-5	4
	14-44	2
	15-5	2
	19-3	5
	19-14	4
	19-72	2

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AMPEX PART NO.	FIG. & INDEX NO.	QTY. PER ASSY.
502-002	19-103	4
	19-107	4
	20-18	8
	21-10	2
	21-19	4
502-003	2-2	4
	5-7	1
	5-23	4
	6-27	2
	6-33	2
	6-40	2
	6-46	2
	7-12	1
502-003	8-12	1
	9-12	4
	9-32	4
	9-41	1
	10-6	1
	10-11	1
	10-16	4
	11-37	2
	11-93	2
	11-97	3
	12-2	6
	12-24	2
	12-28	2
	14-2	6
	15-2	1
	19-38	2
	19-43	1
	19-68	4
	19-101	4
	20-22	2
	21-15	12
	24-2	2
	30-50	1
502-004	2-24	2
	7-9	2
	8-9	2
	9-37	1
	10-2	2
	10-20	2
	11-63	4
	11-70	4
	11-80	2
	13-6	2

AMPEX PART NO.	FIG. & INDEX NO.	QTY. PER ASSY.
502-004	13-31	3
	15-17	3
	16-19	2
	18-11	1
	19-47	4
	19-50	4
	19-55	2
	19-60	2
	21-23	1
	30-69	4
502-005	2-31	4
	3-21	4
	3-30	3
	5-18	4
	6-10	4
	9-2	3
	11-17	4
	11-22	6
	12-31	1
	18-25	18
	19-77	4
502-005	19-82	2
	26-7	4
502-006	18-18	2
	20-10	8
502-007	19-86	2
502-008	11-45	4
502-009	14-13	1
	25-10	1
502-013	13-39	6
502-014	10-24	2
502-017	27-7	4
502-024	16-9	4
	30-8	4
	30-25	4
502-025	5-27	1
	11-76	1
	21-4	6
	26-2	2
	30-2	7
	30-15	6
	30-19	4
	30-31	1
	30-40	1
	30-46	11
	30-55	4

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AMPEX PART NO.	FIG. & INDEX NO.	QTY. PER ASSY.
502-066	4-2	8
502-083	8-16	1
502-090	20-30	8
502-097	11-66	2
503-007	19-62	2
	23-4	6
503-012	24-4	2
503-013	11-82	2
503-040	15-11	1
503-045	21-36	3
506-003	19-61	2
506-013	6-32	2
	7-13	1
	8-13	1
	10-17	1
	12-3	6
506-017	14-17	1
5100320-10	1-6	1
	26-	REF
5100328-40	29-13	1
5100339	29-15	1
5100404-10	29-8	1
5100406-10	11-91	1
5100415-10	29-12	1
5100434-10	27-9	1
5100454-10	29-17	1
5100458-10	1-7	1
	27-	REF
5100483-40	29-31	2
5100498-10	29-16	1
5100514-40	29-14	1
5100518-40	29-	2
5100542-10	29-34	2
5100543-40	29-	2
5100557-10	1-	1
5100559-10	1-9	1
	29-	REF
5100558-10	1-	REF
5100562-10	29-	1
5100585-10	27-3	1
5100594-10	11-90	1
5100697-10	6-44	1
5100698-10	6-	1
5100827-10	26-	1
5100828-10	26-	REF
5100830-10	26-	REF
5100856-10	1-3	1
	24-	REF
5100973-10	5-21	A/R
5100973-20	5-	A/R
5100973-30	5-	A/R
5103005-10	1-2	1
	18-	REF
5103070-10	18-34	1
	22-	REF
5103081-10	11-10	1
5103109-10	18-35	1
	23-	REF
5104036-10	1-22	1
563-020	13-8	1
582-026	30-23	4
591-028	10-8	1
591-070	29-9	1
600-009	9-19	A/R
600-010	2-28	2
600-017	24-17	A/R
600-023	24-18	A/R
600-024	9-18	A/R
600-107	5-12	A/R
611-001	24-16	A/R
611-189	24-19	A/R
650-150	1-15	3