SECTION V

MECHANICAL DESCRIPTION

5-1. GENERAL.

5-2. The tape transport is composed of the tape transport assembly, transport electronics assembly, transport access door, voltage regulator, head assembly, head cable and box assembly. A manual control panel, photo-sense system, cabinet, etc., may also be included in the system.

5-3. A schematic arrangement of a tape transport is shown in Figure 5-1. This illustration also shows the relationship of all connectors, terminal boards, and fanning strips used for interconnection purposes within the tape transport.

5-4. TAPE TRANSPORT.

5-5. The tape transport (Figures 5-2, 5-3) consists of a tape supply system, a tape drive system, a tape take-up 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 transport electronics assembly. In this discussion, the upper reel will be referred to as the file reel, and the lower reel as the take-up reel.

5-6. The tape supply system consists of a file reel drive assembly, a vacuum chamber, a transducer which provides signals for servo control of the reel drive assembly, and a loop warning switch which will momentarily interrupt operation if the tape loop in the vacuum chamber expands or contracts excessively.

5-7. The file 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 turntable and the reel retainer assembly are attached to the shaft.

5-8. The reel retainer assembly is a continuous contact rubber "doughnut" type, cam actuated, which provides a positive indication of a locked or unlocked position. Turning the reel retainer handle 120° clockwise locks the reel in position; depressing the serrated end of the reel retainer handle unlocks the reel retainer, collapsing the reel retainer tire, and permitting the removal of the reel.

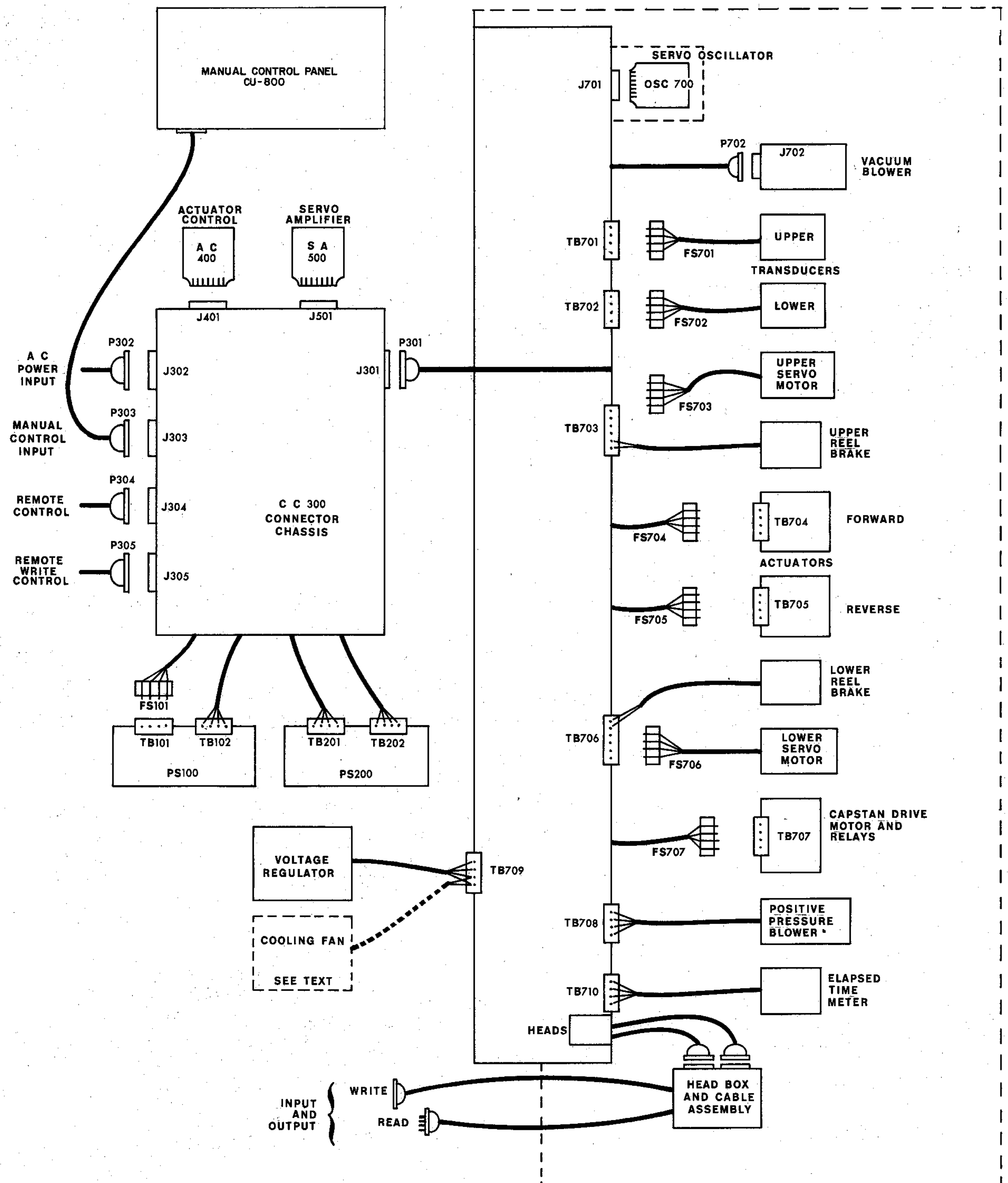

Figure 5-1
Interconnection of Units

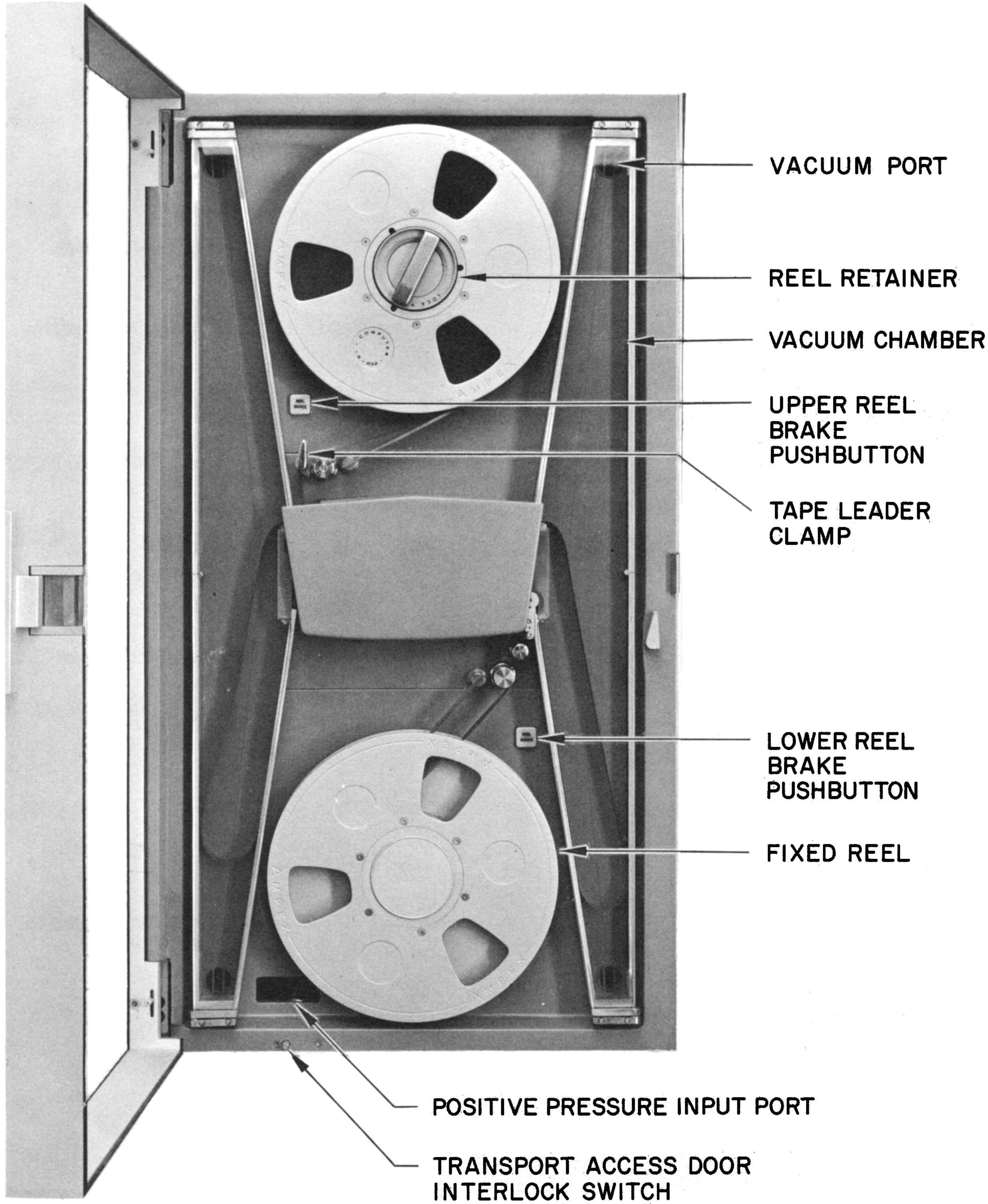

Figure 5-2
Tape Transport: Front View

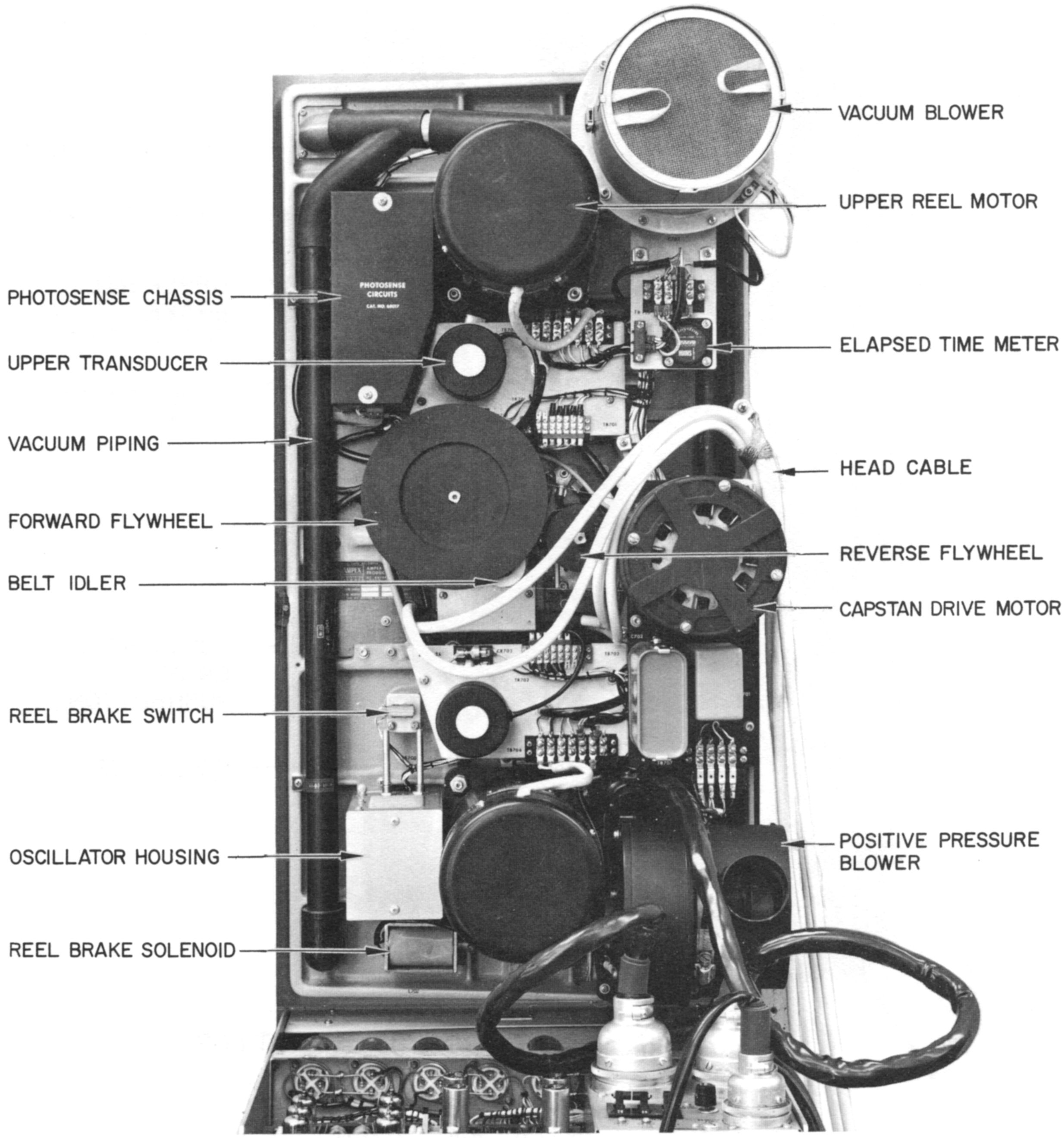

Figure 5-3
Tape Transport: Rear View

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 sub-assembly 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 rexervoir (typically the take-up system). The tape drive system also constols 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 dc 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 the tape guides, which are mounted at either side of the head stacks. The lower edge of the tape (that next to the tape transport face) is the guiding edge. This edge is accurately positioned to ensure interchangeability of tapes from machine to machine.

5-19. The leader clamp provides a convenient means of holding the permanent tape leader while attaching 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. If contact is made across all three sections, the end-of-tape relay is energized and tape motion is stopped.

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

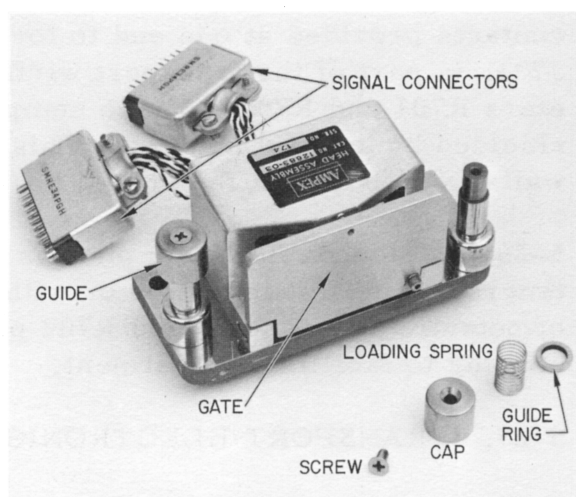

Figure 5-4
Head Assembly

by a universal-wound ac 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 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 precludes the introduction of 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. This housing has a pair of slides on its inner walls, which 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.

5-28. The Transport Electronics Assembly, packaged as one unit (Figure 5-5), consists of the Electronics Power Supply (PS-100), the Servo Motor Power Supply (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 dc and ac 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

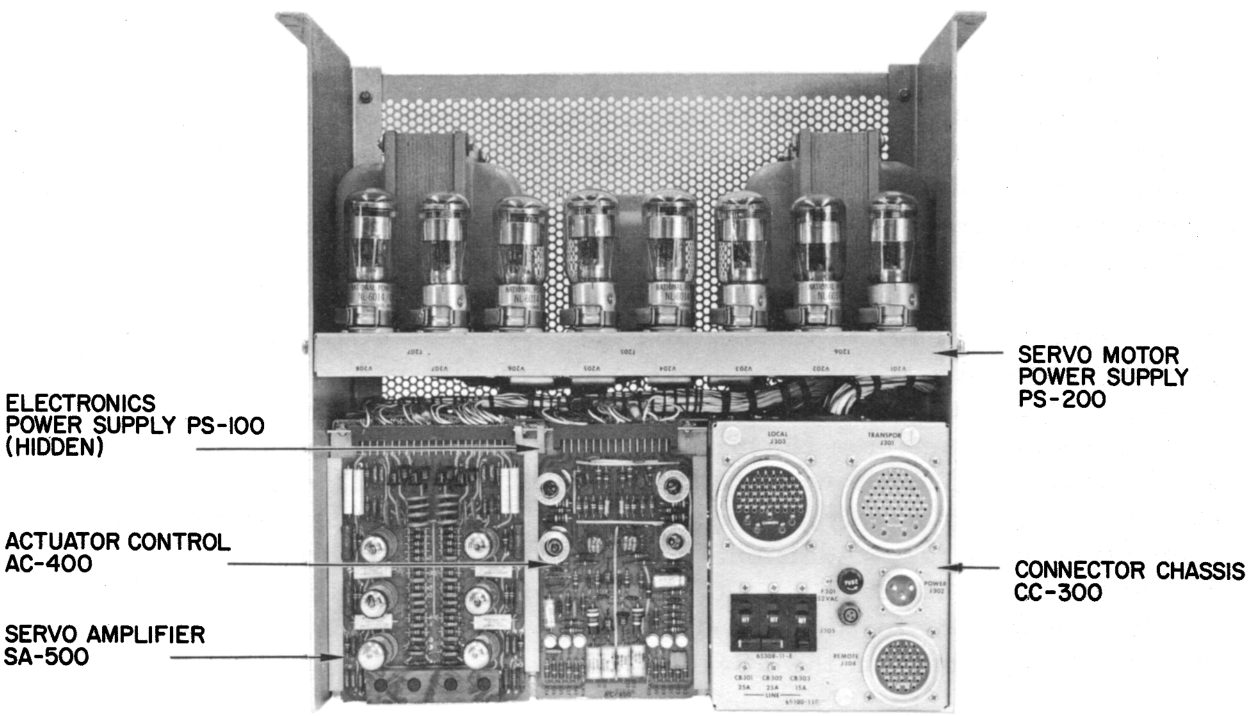

Figure 5-5
Transport Electronics Assembly

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 T101, located beneath the connector chassis, and T102, 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 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 as a "recharge electronics switch" for charging the actuator capacitors. The filament of the thyratron is supplied 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.

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 mounted on either side of the filament transformer, adjacent to the thyratrons with which they are associated. The primaries of 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 top panel 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. Portions of the below-chassis wiring are brought out in a cable for connection to the other sub-assemblies. Although an integral part of this cabling, connectors J401 and J501 are physically supported by the PS-100 electronics power supply and mate with the actuator control etched board and the servo amplifier etched board; similarly, fanning strip FS101 connects with terminal board TB101 on the PS-100 chassis. Another branch of the cabling provides leads for connection to TB102 on the PS-100, and to TB201 and TB202 on the PS-200 servo motor power supply. All ground circuits are brought to ground lug GL101 on the PS-100 chassis, which provides a common ground for the system.

5-38. 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.

5-39. 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.

5-40. MANUAL CONTROL PANEL, CU-800.

5-41. 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:

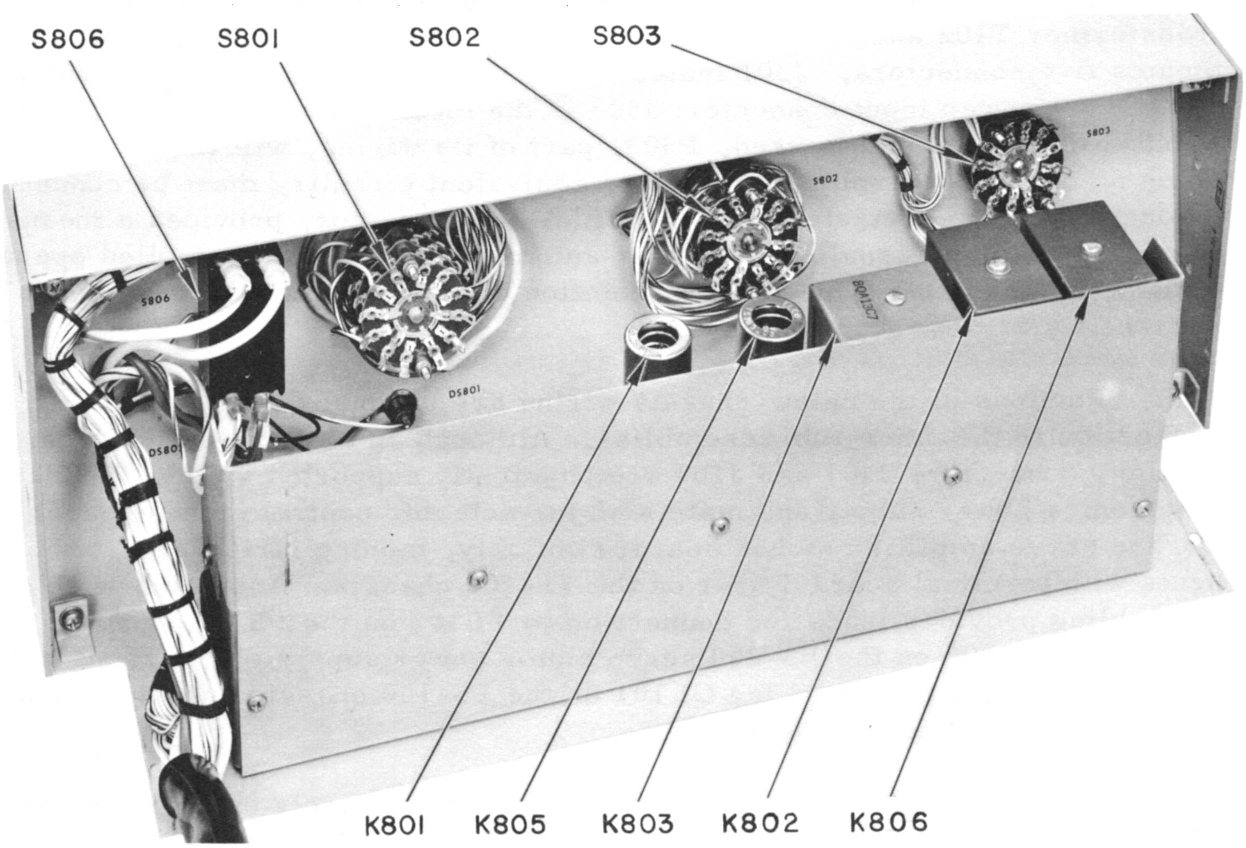

Figure 5-6
Manual Control Panel

CONTROL	POSITIONS	FUNCTION
POWER switch	OFF-ON	Controls power to equipment
MODE SELECTOR switch	AUTO-STANDBY-MANUAL	Selects automatic, standby, or manual modes of operation
MANUAL CONTROL switch	FAST REV-REV-STOP-FWD-FAST FWD	Selects direction and speed of tape motion (manual mode only)
MANUAL WRITE-LEADER DRIVE switch	MANUAL WRITE-OFF-LEADER DRIVE	Provides circuitry to energize writing function and enables operator to move tape when leader is contacting sensing posts (manual mode only)

INDICATORS

POWER - Indicates when power is supplied to equipment.

READY - Indicates when all interlocks, time delays, etc., are closed and equipment is ready for operation.

5-42. PHOTOSENSE UNIT.

5-43. The optional photosense unit is composed of an electronics chassis, which mounts on the rear of the tape transport, and a photosense head which mounts in the supply vacuum chamber.

5-44. The electronics chassis, which contains all of the circuitry for the photosense unit, uses a combination of terminal board construction with plug-in etched boards. Terminal board TB2, located on one end of the chassis, provides connection for the signal inputs from the head and for dc lamp power to the head. At the opposite end of the chassis are terminal boards TB3 and TB4, which provide connections through the transport wiring for the outputs of the photosense unit.

5-45. The top panel of the electronics chassis mounts five connectors, J1 through J5. Into these connectors are plugged the various etched boards.

Connectors J1 and J2 receive etched board composite assemblies consisting of a base card, and, mounted in a "piggy-back" fashion to it, etched boards containing, as required for the particular version, a combination of Schmitt trigger, phantastron, dc amplifier, or driver circuits. Receptacle J3 accepts the 12 vdc power supply; J4, the 10 vdc power supply; and J5, the 6 vdc power supply.

5-46. Below the electronics chassis is mounted T1, which supplies 32 vac to the -10 vdc and +12 vdc power supplies, and 16 vac to the +6 vdc power supply. Beside the transformer is a bracket which mounts diodes CR1, CR2, and CR3; terminal board TB1; and, when used, the output relays.

5-47. A cover is provided for the entire electronics chassis; cut-outs provide access to terminal boards TB1, TB2, and TB3.

5-48. The photosense head is mounted in a space provided in the file reel vacuum chamber. It consists of a light source, powered from the electronics unit, and the necessary photo-electric elements to sense light from that source when reflected by markers on the tape.