AMPEX

1802854

FR-3000
Tape Transport
Maintenance Manual

AMPEX

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FR-3000 Tape Transport Maintenance Manual

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Note: Asterisk denotes pages affected by latest change.

LIST OF EFFECTIVE PAGES

This manual consists of 312 pages, comprised as follows:

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*11-e/11-f	15 MAR 1978	Appendix A Divider/Blank	Original
11-1	Original	Title Page	1 DEC 1974
11-2	15 FEB 1976	A	1 DEC 1974
*11-3	15 MAR 1978	i/ii	1 DEC 1974
11-4 thru 11-7	Original	1-1/2	1 DEC 1974
*11-8	15 MAR 1978	1-3 thru 1-40	1 DEC 1974
11-9/11-10	Original	2-1/2	1 DEC 1974
12-a/12-b	Original	2-1 thru 2-11/12	1 DEC 1974
12-c/12-d	Original		

FIELD ENGINEERING BULLETIN/SYSTEM IDENTIFICATION NAMEPLATE

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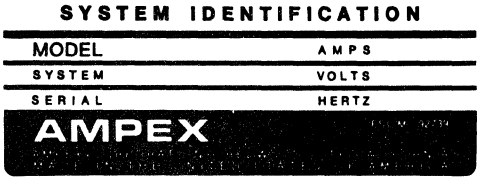

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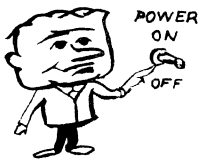
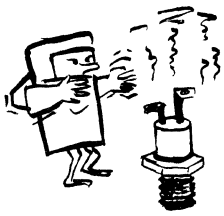
SAFETY AND FIRST AID

Because personnel working with electronic equipment are exposed to the hazard of high voltage, it is imperative that all safety regulations be consistently observed, and that each individual has a clear understanding of basic First Aid methods.

The following typical hazards must be avoided at all times:



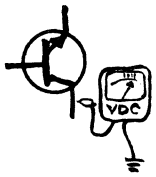
1 Do not attempt adjustment of unprotected circuit controls, or lead dress while the power is ON.



2 Do not change heavily loaded or overheated components without due precaution to avoid burns.

3 Do not assume that no dangerous voltage is present when the power is OFF. Charged capacitors may retain dangerous voltages for long periods, and should be discharged through a suitable resistor before any circuit points are touched.

4 At all times avoid placing any parts of the body in series between ground and circuit points, whether or not power is ON.



5 Do not assume that solid-state circuits and semiconductor cases carry only low voltages.

6 Be fully trained don't take chances.

7 Use power line isolation transformer.

For their own protection, and the protection of others, all electronic personnel should become thoroughly familiar with the approved First Aid treatment of burns and shock. There are three principal degrees of burns, recognizable as follows:

1. A first degree burn reddens the skin.
2. A second degree burn blisters the skin.
3. A third degree burn chars the flesh and frequently places the victim in a state of shock accompanied by respiratory paralysis.

Respiratory paralysis in the victim can cause death within seconds, by suffocation. For this reason it is imperative that the approved method of artificial respiration be initiated immediately and continued until the victim's breathing is normal.

A muscular spasm or unconsciousness may render the victim unable to free himself of the electric power. If this is the case, turn the power OFF immediately.

WARNING

DO NOT TOUCH HIM, OR YOU MAY SHARE HIS PREDICAMENT.

If the power cannot be turned OFF immediately, very carefully loop a dry rope, article of clothing, length of strong cloth, or a rolled-up newspaper around the victim and pull him free of the power. Carefully avoid touching him or his clothing.

The moment he is clear of the power, place him in a reclining position, cover him with a blanket (or newspapers) to keep him warm, and begin artificial respiration. At the first opportunity, enlist help in the summoning of a doctor. If a doctor cannot be summoned, transport the victim to the doctor, infirmary, or hospital. Be sure that the victim is kept well covered and warm while awaiting professional aid and treatment.

GOOD PRACTICES

In maintaining the tape recorder covered in this manual please keep in mind the following standard good practices:

1. When inserting or removing printed wiring assemblies, cable connectors, or fuses, always turn off the power to the affected portion of the equipment.

2. If replacing metal-oxide-semiconductor (mos) devices, follow standard practices to avoid introducing static charges onto their terminals.

WIRE IDENTIFICATION CODING

Identification of all insulated hookup wires used in a permanent application and harness wires shall be differentiated by (1) color coded insulation and/or by (2) printed numerical numbers representing the RETMA color code. Both methods are interchangeable substitutions throughout the assemblies.

1. COLOR CODING - Color coding shall be accomplished by use of solid colored insulation and/or helical striping on all white insulation in accordance with EIA STANDARD GEN-104.

2. NUMERICAL CODING - Number coding shall be printed numbers on all white insulation representing the applicable RETMA color code number, i.e., O-BLACK, 1-BROWN, 98-WT/GRY, etc.

CHANGED: 15 FEBRUARY 1976

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In addition to the overall table of contents, which follows directly, each of the sections of this manual includes its own table of contents. It is located directly behind the separator tab.

For the convenience of the user, an appendix containing part number cross reference index information has been placed at the rear of this manual.

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NUMERICAL LIST OF ASSEMBLY DRAWINGS (Cont)

GLOSSARY OF TERMS AND ABBREVIATIONS

Following is a brief glossary of terms and abbreviations which are special to instrumentation tape recording or to the FR-3000 series recorder/reproducers.

Note that in this manual, abbreviations are capitalized as they would be if the words were spelled out. Because of this, the same abbreviation may appear capitalized differently in different places. Abbreviations are not punctuated except:

a. Where they spell whole words (l-e-d, not led, for light-emitting diode).

b. In plurals made by adding "s," an apostrophe is used (pwa's, not pwas)

c. Nontechnical abbreviations that are customarily punctuated (e.g., i.e., etc.)

CAPSTAN
A rotational element of a tape transport that impels the tape along its intended path. The tape is usually coupled to the capstan (a shaft, roller, or puck) by friction, sometimes assisted by pressure from a roller or rollers (pinch-rollers).

CONTROL TRACK
A tape track (see "track") used for a signal which is employed in controlling the capstan speed during reproducing (see "tape sync"). Also used to describe the recording on the control track, or the signal as played back.

EOT
End-of-tape. Refers to either end of the tape, and usually refers not to the extreme physical end of the tape, but to a point at which an automatic stop takes place to prevent the tape from completely unwinding from the reel -- the end of the usable portion of the tape.

FAST
Usually the fastest speed at which a tape transport will move tape, a wind or rewind speed. Often not under synchronous capstan control. Also, an operating mode in which the tape is moved at the fast speed.

FLUTTER
Instantaneous tape-speed errors having frequencies of variation between 0.5 Hz and 10 kHz. (For instrumentation, the term "flutter" generally includes the lower-frequency errors sometimes called "wow.")

FORWARD
The direction of tape motion so designated for a tape transport. On a recorder/reproducer, usually that direction of motion in which a point on the tape passes the record head(s), then the reproduce head(s). On a vertically-mounted, coplanar-reel transport such as the FR-3000, usually means tape motion from the top reel to the bottom reel. Also, an operating mode in which the tape is moved forward.

HEAD
The electromagnetic transducer which converts electrical energy into magnetic fields for recording; or magnetic fields into electrical energy for reproducing, using magnetic tape. For instrumentation purposes the record and reproduce heads are usually separate transducers of significant difference in design.

HEAD ASSEMBLY

An assembly that usually includes all the record or all the reproduce heads for a tape machine. The heads are usually grouped in stacks (see "headstack," below), with one or two stacks per assembly. The stacks are mounted on a precision baseplate, often along with precision guides or other critical components. The headstacks and guides are precision aligned on the baseplate at the factory and if they are removed, moved, or loosened, they must be realigned at the factory.

For standard analog instrumentation recording there are two stacks of record heads on a record head assembly. All odd-numbered heads are in the first stack reached by the tape when it is moving forward, all the even numbered heads are in the other stack. The headstack geometry is such that the tracks made on the tape by the record heads are "interleaved" (odd-even-odd-even) and evenly spaced. The reproduce headstack reads the tracks in the same geometric arrangement. For pcm (pulse-code modulation, or digital) recording/reproducing, all the record or all the reproduce heads, both odd and even, are often in the same stack, so that there are only two stacks, one record, one reproduce, in a complete recorder/reproducer.

HEADSTACK

A set of heads, usually all record or all reproduce "stacked" into a permanent assembly with the magnetic gaps very accurately aligned. It is not possible to disassemble a headstack without destroying it, and, if it is part of a precision head assembly (see above), it must not be removed from or loosened on the assembly.

IRIG

Inter-Range Instrumentation Group. The association of Government organizations concerned with missile-range telemetry and other instrumentation functions. Groups within the IRIG publish documents which define instrumentation standards that determine many practices in instrumentation, including instrumentation magnetic tape recording. Document 106, "Telemetry Standards," and Document 118, "Test Methods for Telemetry Systems and Subsystems," as well as other IRIG documents, may be obtained from: Secretariat, Range Commanders Council, White Sands Missile Range, New Mexico 88002.

MDA

Motor-drive amplifier. An electronics circuit that controls drive current to a motor.

POST-AIR

Term applied to a -12V power line on the load side of a transistor switch which is controlled by power-sensing logic, following a vacuum operated (air) switch.

PRE-AIR

Term applied to a -12V power line on the load side of a vacuum operated (air) switch but before it is controlled by power-sensing logic.

PUCK

The wheel-like component that mounts on the end of the capstan shaft and is the part of the capstan servo that moves the tape. A polymer coating around its circumference helps give the puck positive control of the tape.

PWA

Printed-wiring assembly. A fully assembled circuit board with components installed.

PWB

Printed-wiring board. A circuit board before mounting of components.

GLOSSARY OF TERMS AND ABBREVIATIONS

RECORD

(Verb and adjective. The accent is on the second syllable.) That operating mode of a recorder or recorder/reproducer in which a recording is made. Requires record signal electronics as well as a tape transport. The legend RECORD, or equivalent, often appears on a control pushbutton of the transport, regardless of electronics capability.

REVERSE

That direction of tape motion which is opposite to forward (see "forward," above). Also, an operating mode in which the tape is moved in reverse.

SCAN

A tape speed higher than the highest standard record/reproduce tape speed. The tape is under synchronous capstan control, and is moved rapidly for scanning to locate a desired portion of a recording.

SEARCH

A mode of operation in which the tape transport is controlled by external equipment in order to search out locations on the tape through the use of an address track such as a time-code track.

SEQUENTIAL

A mode of operation in which two (or more) tape machines are interconnected to provide continuous recording over a longer period than a single (or lesser number of) machine(s) could accommodate. Control is arranged so that when the tape on a machine which is recording nears the end (see "eot"), the machine generates a signal which automatically starts another recorder. After a period of overlapped (redundant) recording, the first machine stops and the other carries on the recording.

SHUTTLE

A mode of operation in which the transport automatically shuttles back and forth between two preselected points on a reel of tape for repetitive playback of a desired portion of a recording. (Requires the use of an optional footage counter and shuttle assembly.)

SPEED LINE

An electrical line (conductor or bus) which is activated when a particular tape speed is selected or in effect.

SPOKING

A defect of tape packing produced by excessive tape tension. The pack buckles so as to produce a polygon shape and visual effect of "spokes" radiating from the reel hub to the "corners" of the polygonal pack.

STOP/READY

A transport operating mode or state in which tape is not being moved, but the transport is ready to move it, and only the actuation of the pushbutton for an active mode is required to initiate tape motion.

SYNC

Abbreviation for synchronization or synchronism. Used to refer to the state of capstan operation in which the capstan tachometer signal or the control track signal is at the same frequency as the capstan servo reference signal, and phase-differences are being sensed by the capstan servo phase comparator to control capstan speed. (See Section 5 of the tape transport manual, Ampex 1802854, for detailed descriptions of capstan servo functions.)

TACH SYNC

That mode of capstan operation in which a tachometer signal from within the capstan assembly is used for comparison with the reference signal to produce synchronization.

TAPE PACK

The roll of tape on a reel, or hub. Builds up radially as tape is wound onto the reel (hub).

TAPE PACKING

Reference to the quality of the layering of tape into a pack. On a transport which is correctly adjusted and is therefore packing tape well, the pack is very smooth to the eye and touch, without spoking patterns or slippage.

TAPE STACK

Synonym for tape pack. Has particular reference to the radial measurement (thickness) of the pack as regards setting of end-of-tape (eot) sensing.

TAPE TRACK

A longitudinal area along the tape on which signals of one data channel are recorded or from which they are reproduced. The width, spacing, and relative location of tape tracks is determined by head or headstack geometry. For instrumentation usage, these geometries are usually ones defined by the IRIG. Once defined, tape tracks are often regarded as existing whether or not they happen to have recordings on them. Once defined, the track identities remain the same regardless of what electronics channel they may be associated with, though normally track 1 is recorded and reproduced through electronics channel 1, etc.

INTRODUCTION TO THE MANUAL

GENERAL

This manual covers field maintenance of the Ampex FR-3000 Tape Section Assembly. (In the manual the shortened terms "FR-3000", "tape transport", and "transport" are used interchangeably in place of "tape section assembly.") The FR-3000 transport is covered separately here because it is used in more than one recorder/reproducer system. The different recorder/reproducer systems employ different signal electronics subsystems in order to provide maximum flexibility in recorder/reproducer bandwidth, number of channels, etc.

The details of system operation and maintenance are covered in separate operator/system manuals.

THIS MANUAL

This manual provides both overall and detailed descriptions of the FR-3000 tape transport and its subassemblies, plus procedures for all phases of field maintenance of the transport, except preventive (routine) maintenance. (Preventive maintenance is detailed in the operator/system manual for the particular recorder/reproducer in which the FR-3000 is being used. The operator/system manual also gives operating instructions which include all operating instructions for the tape transport.)

In most of the descriptive sections of the manual the schematic diagrams, assembly drawings, and lists of materials (lm's) for the FR-3000 transport and its subassemblies are located immediately following the applicable portion of the descriptive text. However, in certain instances, where several subassemblies are referred to or where one subassembly is referred to repeatedly, the drawings and lm's are placed at the end of the section. In all cases where lm coverage of an assembly requires breaking down any of its subassemblies, the drawings and lm's for the subassemblies follow immediately after the higher level drawing until all coverage is complete. Then the next major assembly is covered in the same way.

Certain of the schematic diagrams in the manual have their drawing numbers prefixed with the letters "TW". This designates that certain extra maintenance information or clarification has been added to the basic drawing. References to such drawings on other drawings or in the text are valid whether they include the "TW" or not.

Most of the manual is printed on 11 x 17 inch foldout pages. These oversize pages are used in order to make the maximum amount of related material visible at one time. (The pages are folded to 8-1/2 x 11 inches to make the manual fit into standard bookshelves, etc.)

A complete set of duplicate schematic diagrams is included at the end of the manual, along with information on the integrated circuit modules ("chips") used in the circuits of the FR-3000. Also appended is a cross reference index relating Ampex part numbers to true-manufacturer part numbers.

The numbering system used for pages, figures, and tables in this manual is the standard one in which each such number consists of two segments separated by a hyphen. The first segment identifies the section of the manual. The second segment indicates the particular item of its type. (E.g., "Figure 7-2" means Section 7, Figure 2.)

SECTION 1
EQUIPMENT IDENTIFICATION

SECTION 1

EQUIPMENT IDENTIFICATION

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OVERALL IDENTIFICATION OF TAPE TRANSPORT

GENERAL

The FR-3000 Tape Section Assembly (tape transport) is a precision transport for 1/2-inch or 1-inch wide magnetic tape. It includes a rack cabinet assembly which accepts appropriate signal electronics subsystems to make up laboratory-quality instrumentation tape recorder/reproducers. Complete recorder/reproducers are covered in operator/system manuals such as Ampex 1802852 for FR-3010, 1802853 for FR-3020, and 1802972 for FR-3030 Recorder/Reproducers.

The FR-3000 moves tape between two 16-inch reels, under capstan control, past magnetic record and reproduce heads for recording and reproducing multiple tracks of information on the tape. Both capstan and reels are servo controlled for precision tape movement.

Figures 1-1 through 1-14 show the transport and its major subassemblies. The transport is functionally described in Section 2, following.

TAPE SPEEDS

Standard record/reproduce tape speeds are available in two seven-speed ranges with each speed differing from the next higher and lower speeds by a factor of two:

a. Low range = 15/16 inches per second (ips) to 60 ips

b. High range = 1-7/8 ips to 120 ips

The speed ranges are associated with recorder/reproducers having different data-bandwidth capabilities. The higher speeds are used in wider-bandwidth (higher data rate) machines (e.g., FR-3010, FR-3030) and the lower speeds with the lower bandwidths (e.g., intermediate-band FR-3020).

The transport also provides fast wind speed (300+ ips) and scan speed (240 ips).

TAPE DIRECTION AND SHUTTLING

Tape can be moved at any of the speeds in a forward or a reverse direction. The forward direction is from upper reel to lower reel. (A point on the tape passes over the record heads before it passes over the reproduce heads.)

When a footage counter (optional) is installed, a shuttle mode is available. This allows an automatic tape cycling operation which moves the tape alternately in forward and reverse between two preselected points. In the forward shuttle mode, the tape can be moved at any one of the record/reproduce speeds, or at the scan speed. In the reverse shuttle mode, the tape can be moved at the same speed as the forward shuttle speed, at any one of the four highest record/reproduce speeds other than the forward shuttle speed, or at the scan or fast speeds.

SEQUENTIAL AND SEARCH

Provision is made for sequential operation of two recorders. In this mode, a recorder which is nearing the end of a reel of tape generates a signal that automatically starts a second recorder.

Also provided for is external control by a tape search control unit. In this mode of operation, the recorder can be made to search out an address on a time-code track at scan speed and then initiate reproduction of data from that point.

LOCAL AND REMOTE CONTROL

The control unit, located at the right center of the tape transport (see Figure 1-2), contains the operating controls, indicators (lamps), and switches necessary for operation of the tape transport in its various modes.

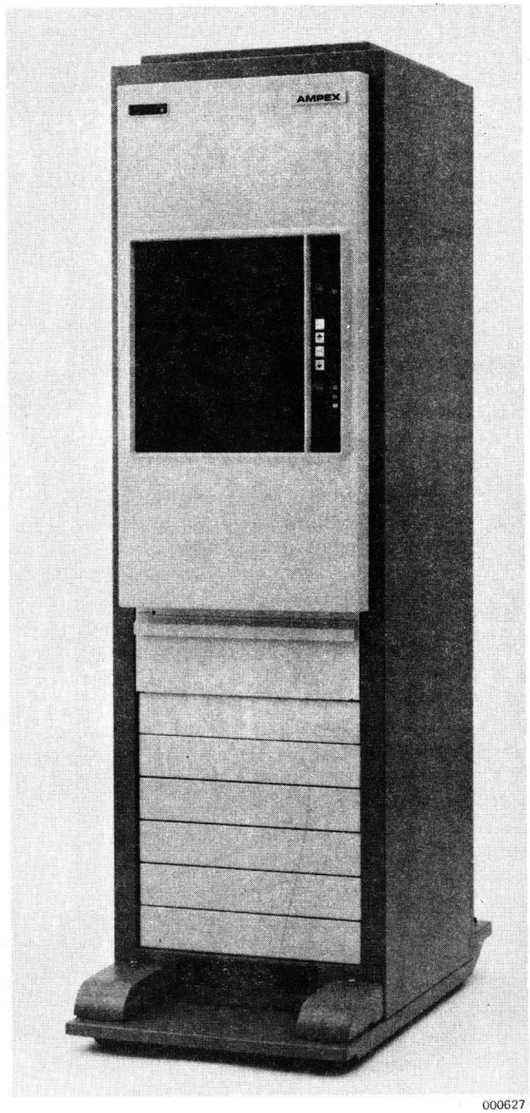
Among the options available is a remote control unit. When one is to be used, it is cabled to the power and servo chassis. The unit (local or remote) which is to be in control is then selected by use of a CONTROL (LOCAL/REMOTE) switch on the power and servo chassis test panel (see Figure 1-11).

MOUNTING

The tape transport baseplate is hinge-mounted at the right-hand edge (seen from the front) so that the tape-handling mechanism can be swung out toward the operator for access to those assemblies mounted on the rear of the baseplate and those mounted behind the baseplate on the inside of the rack cabinet.

UNITS SHOWN BUT NOT COVERED

Certain subassemblies which are parts of the signal electronics subsystem of a complete recorder/reproducer are mounted directly on the tape transport mechanism, and are therefore shown in some of the illustrations in this manual. These subassemblies include record headdriver and reproduce preamplifier housings, bias source, signal/bias mixer, and magnetic head assemblies. Such assemblies are covered in the manuals on signal electronics and in the operator/system manuals, and are therefore not covered in this manual.



000627

Figure 1-1. FR-3000 Tape Section Assembly in FR-3020 Recorder/Reproducer

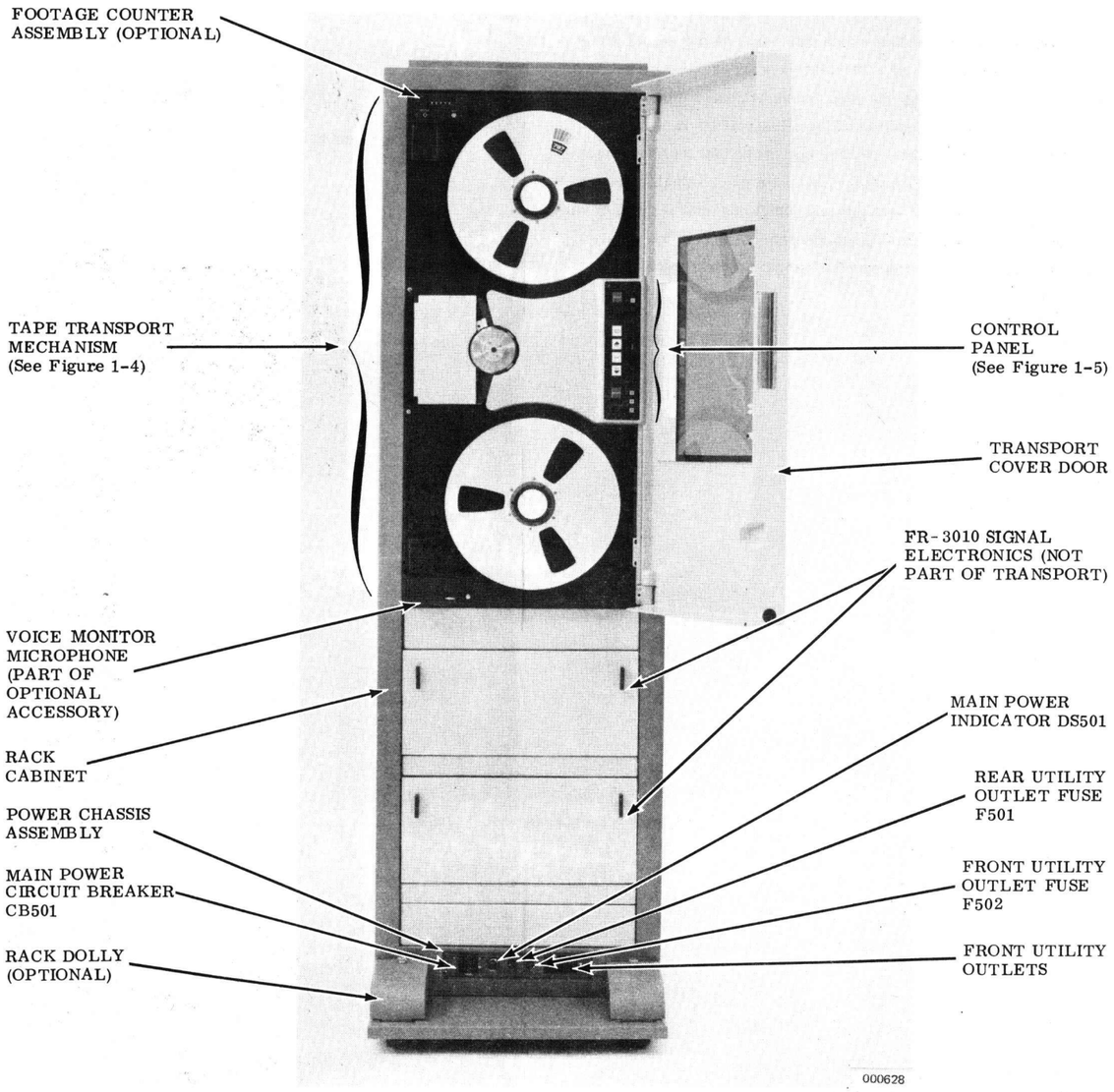


Figure 1-2. FR-3000 Overall Front View

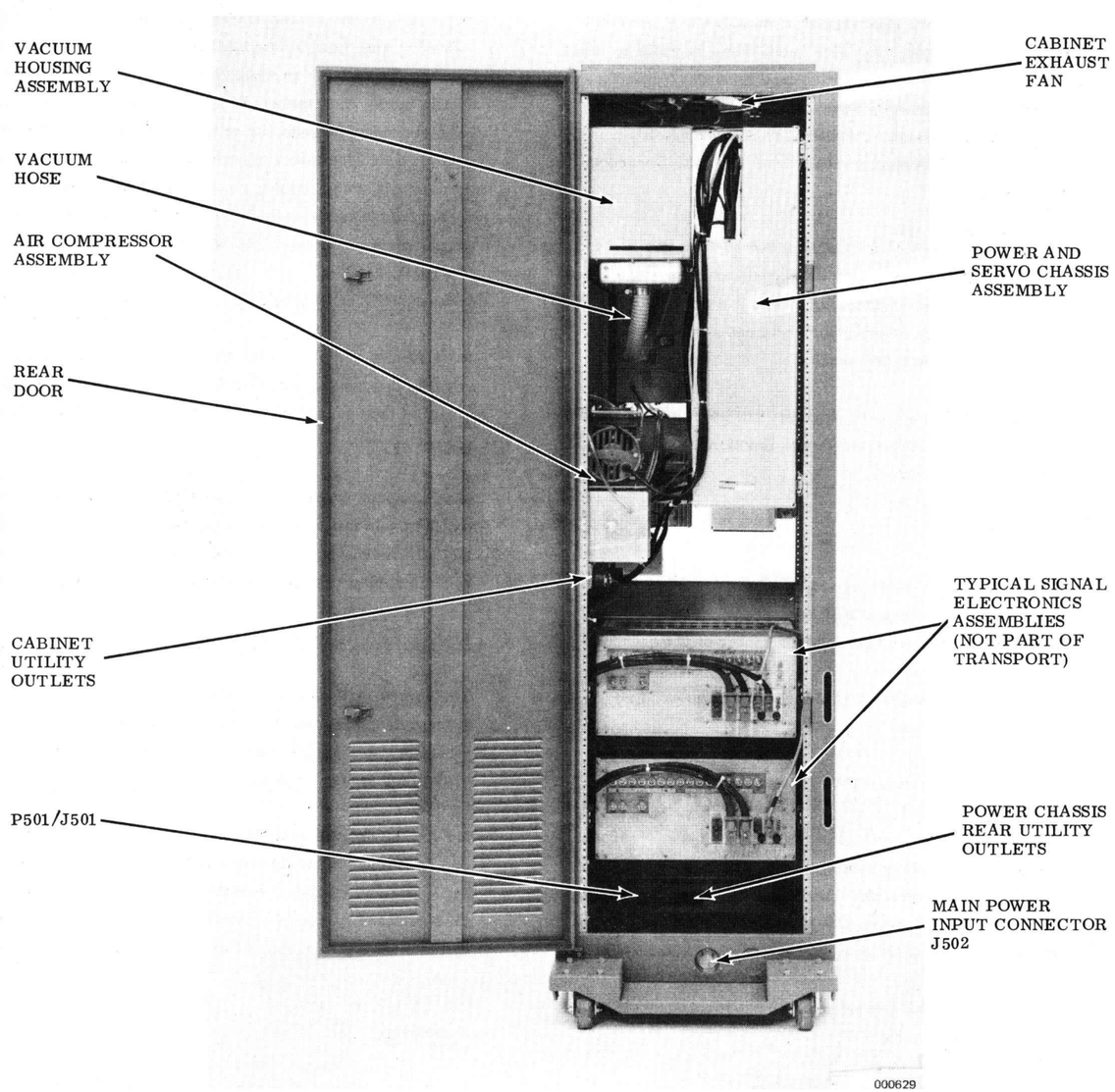


Figure 1-3. FR-3000 Overall Rear View

TRANSPORT MECHANISM

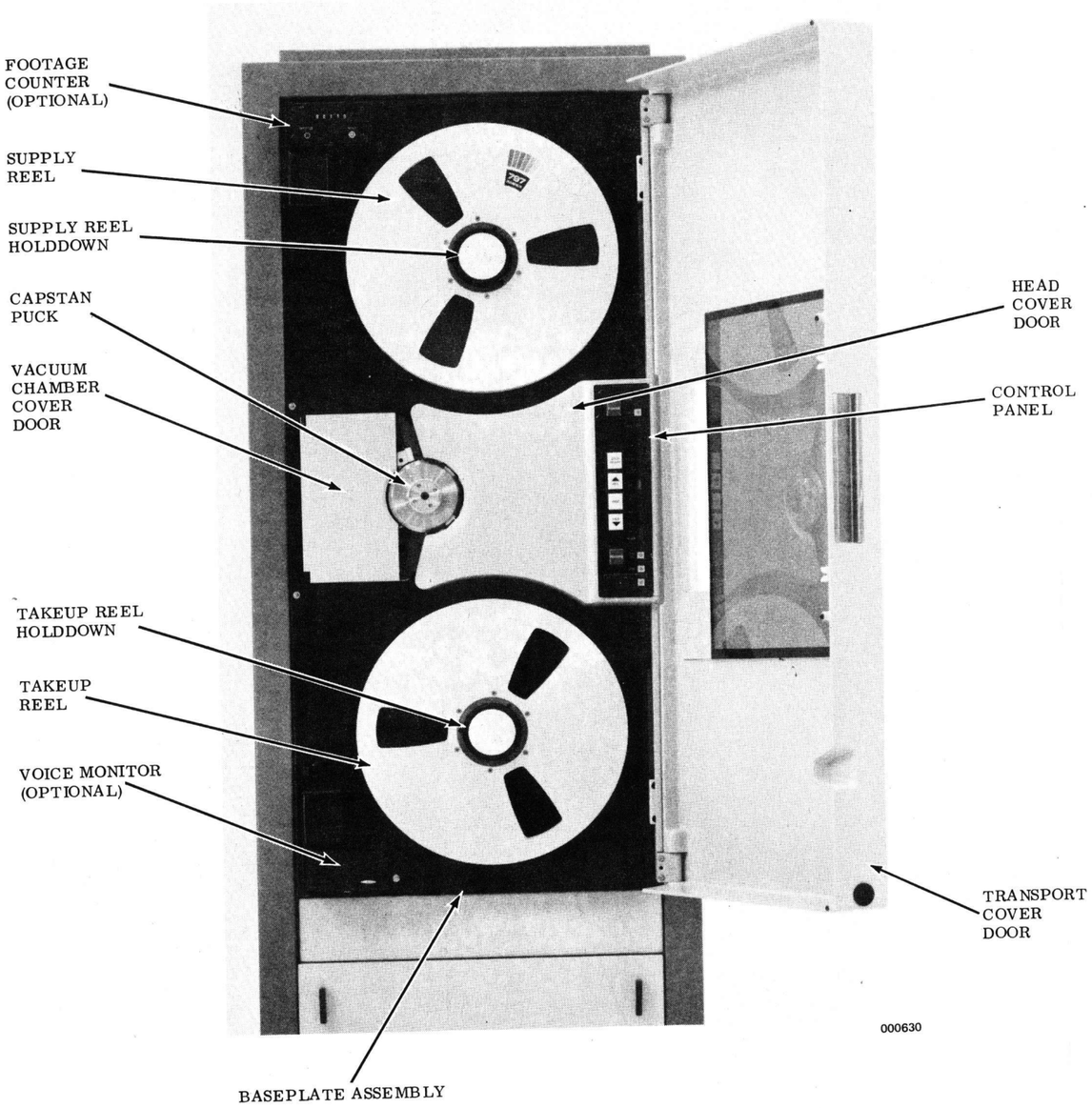


Figure 1-4. Tape Transport Mechanism Front View

CONTROL PANEL

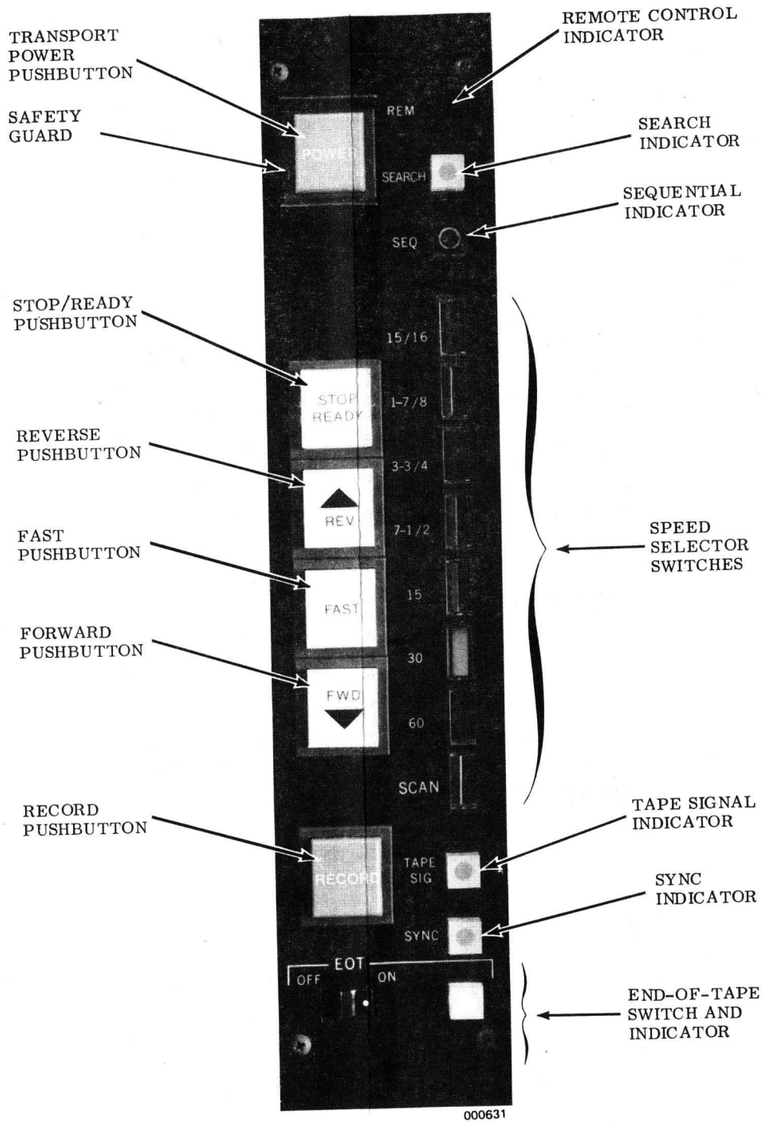


Figure 1-5. Typical Control Panel Assembly Front View

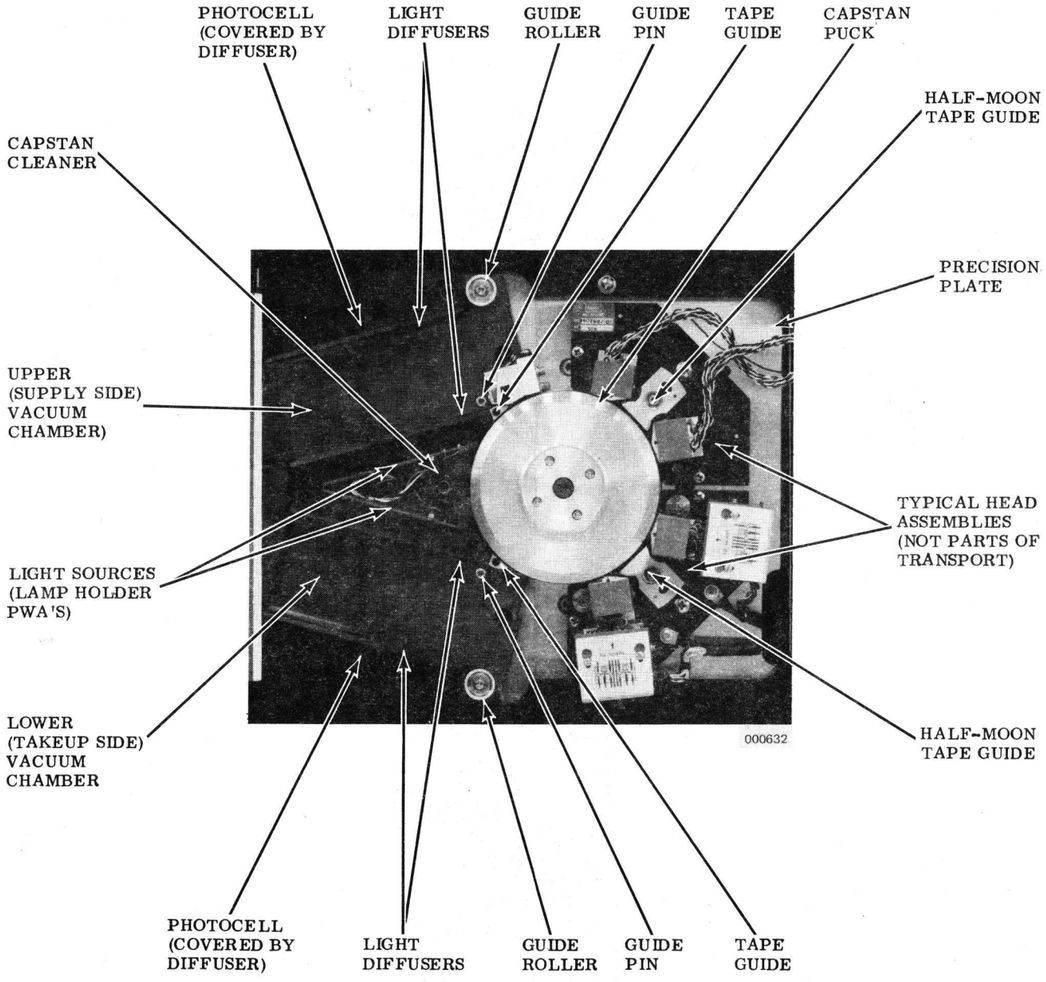


Figure 1-6. Vacuum Chamber and Heads

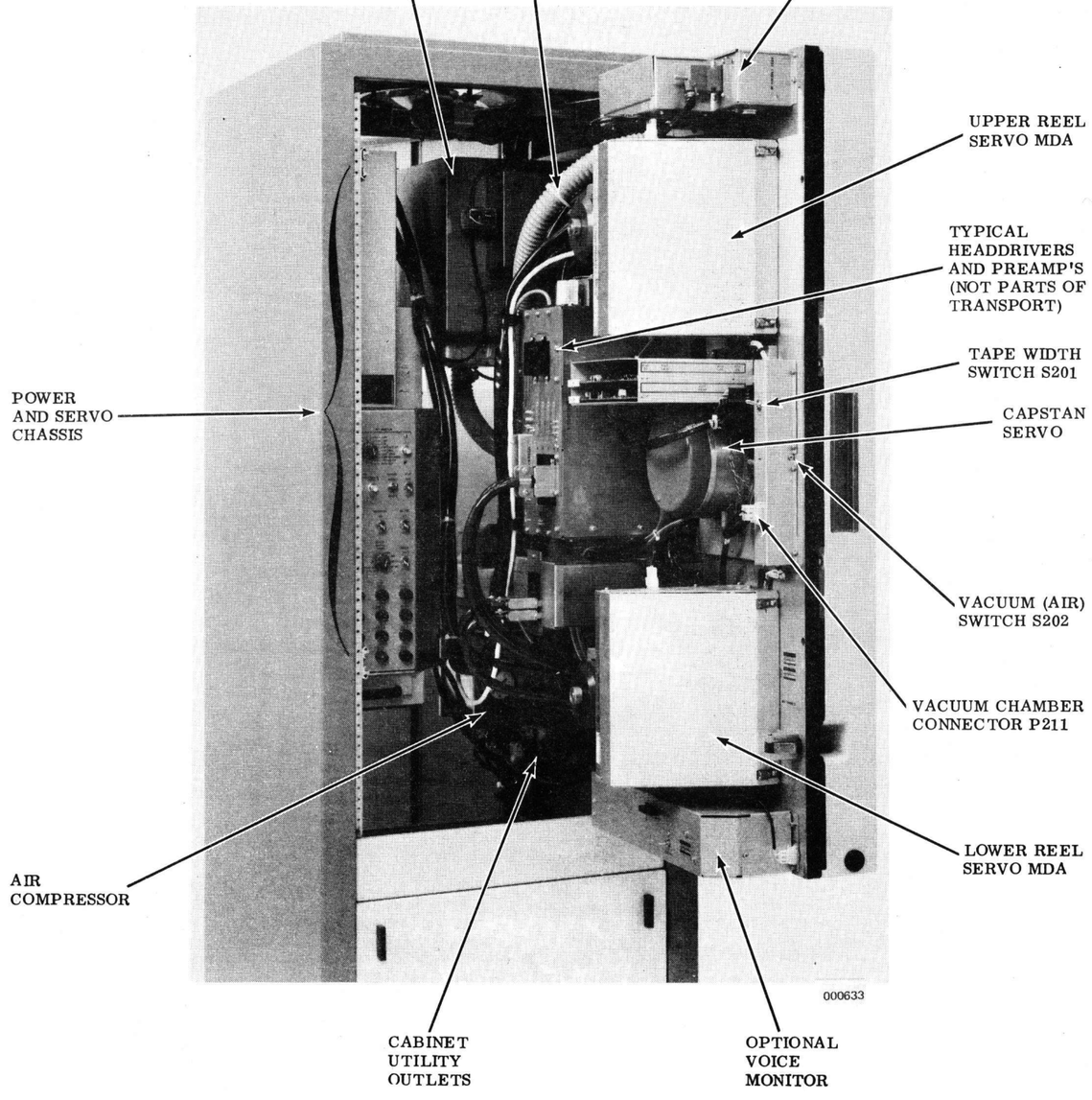


Figure 1-7. Cabinet Interior Assemblies

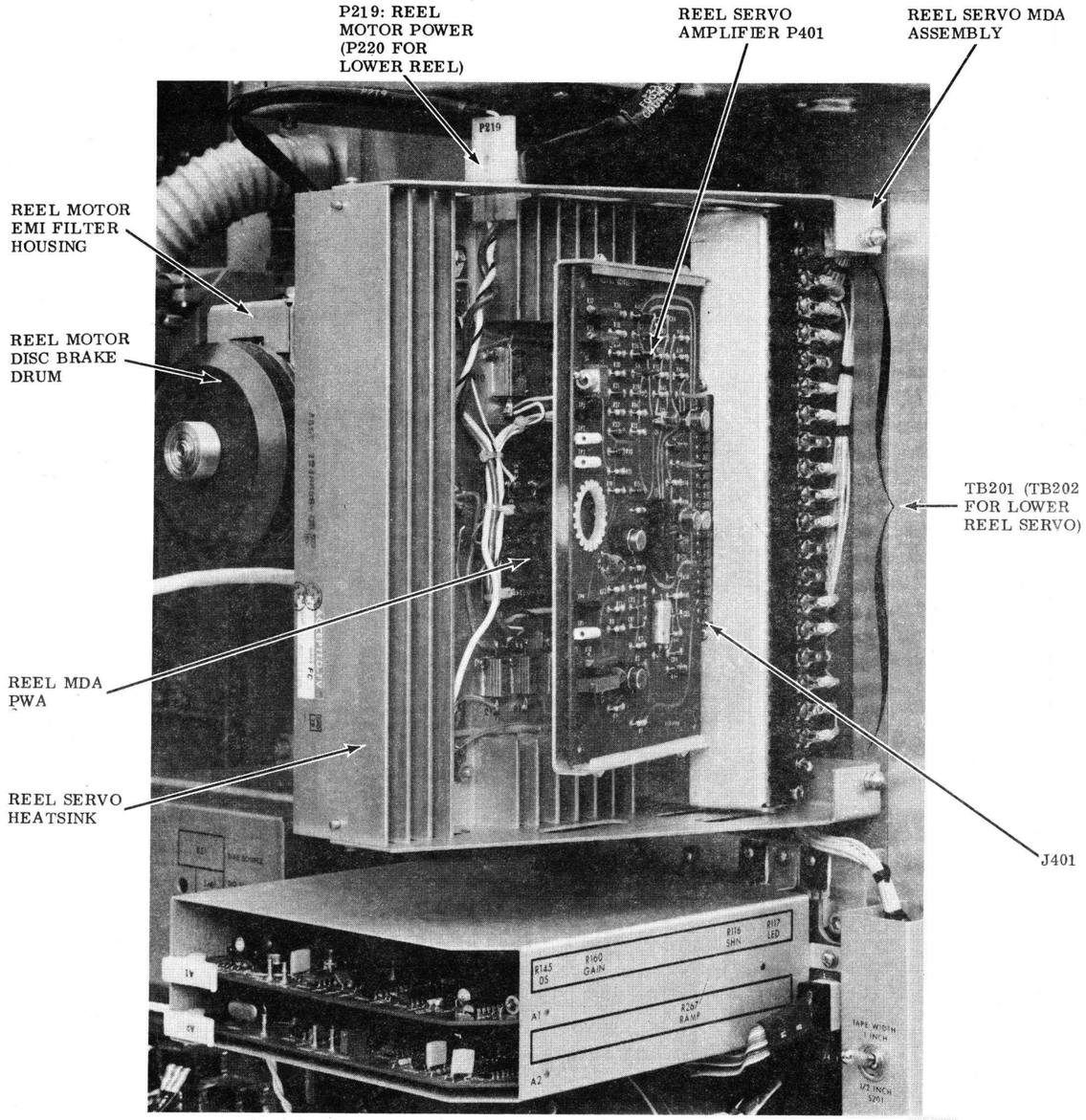


Figure 1-8. Reel Servo Components

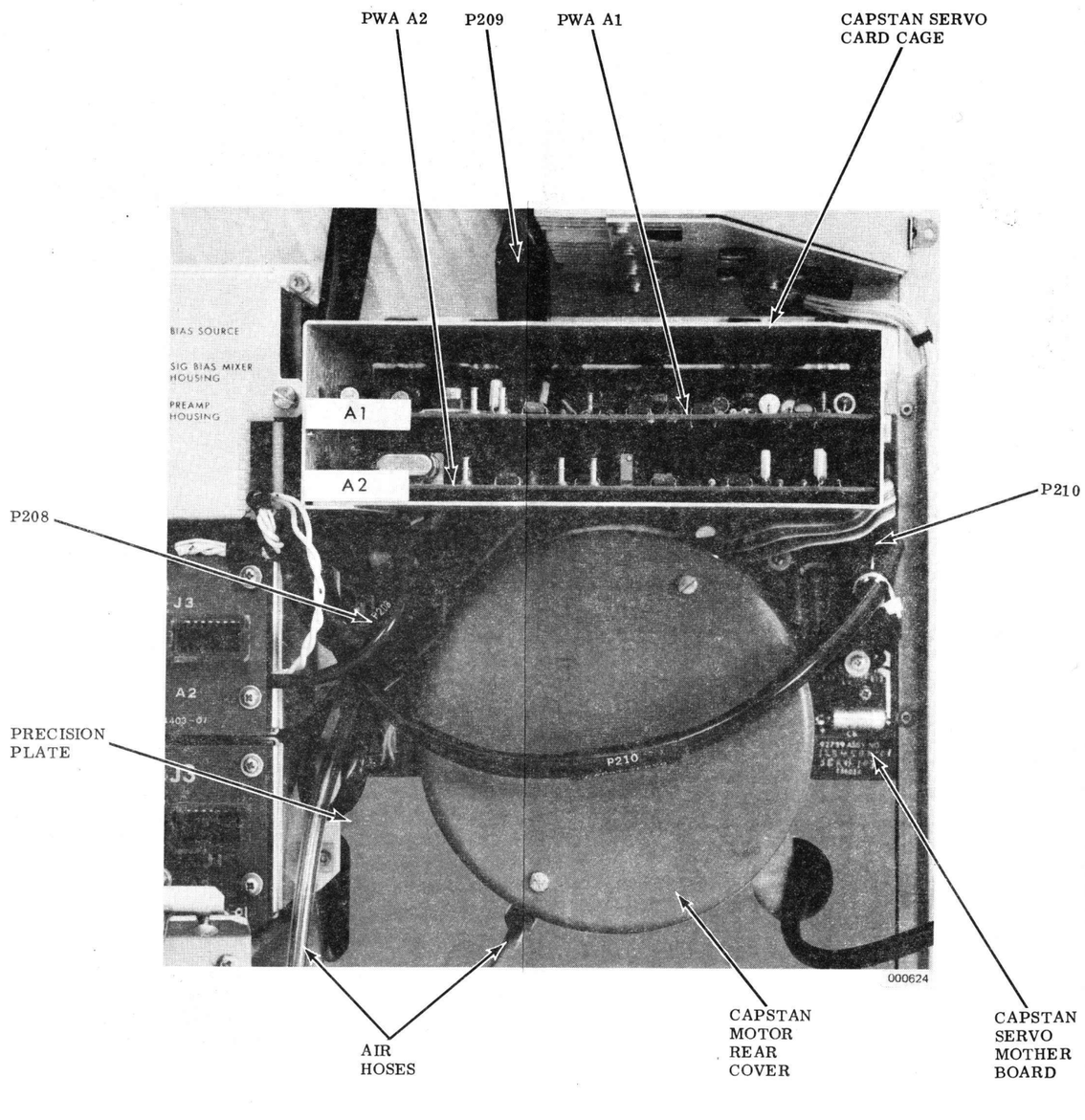


Figure 1-9. Capstan Servo Components Rear View

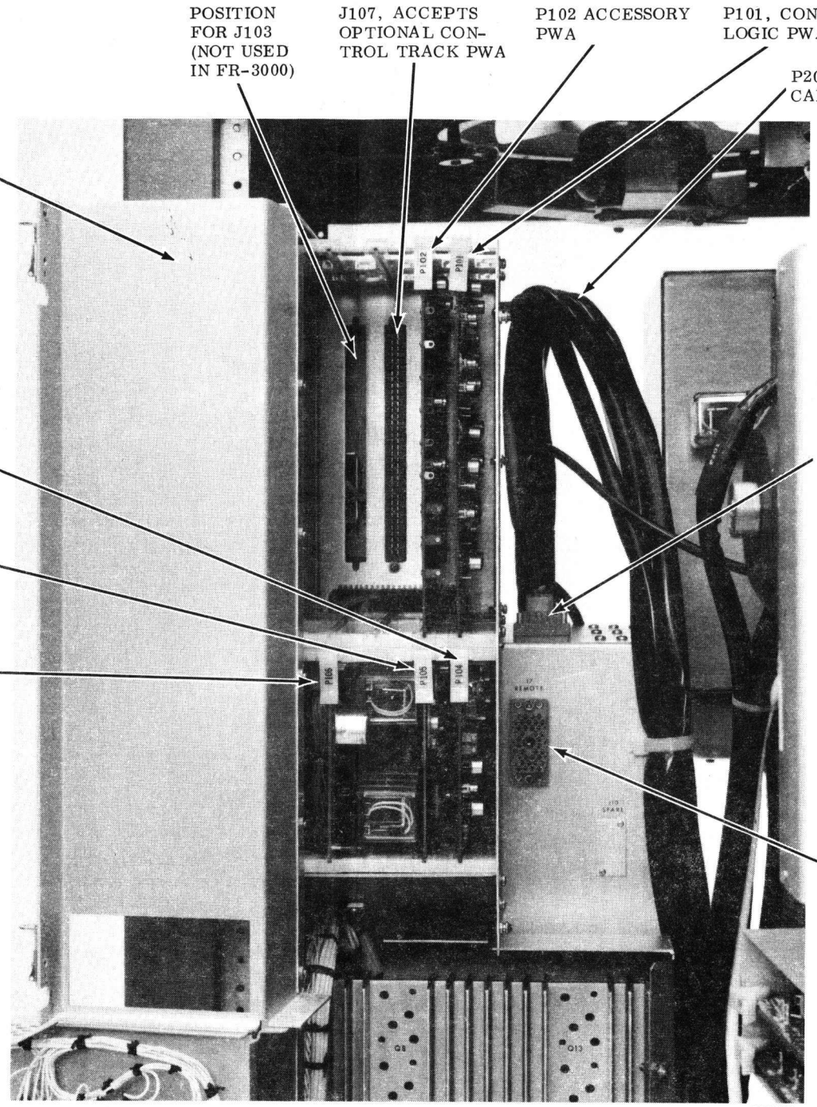


Figure 1-10. Power and Servo Chassis Connector and PWA Housing Assembly

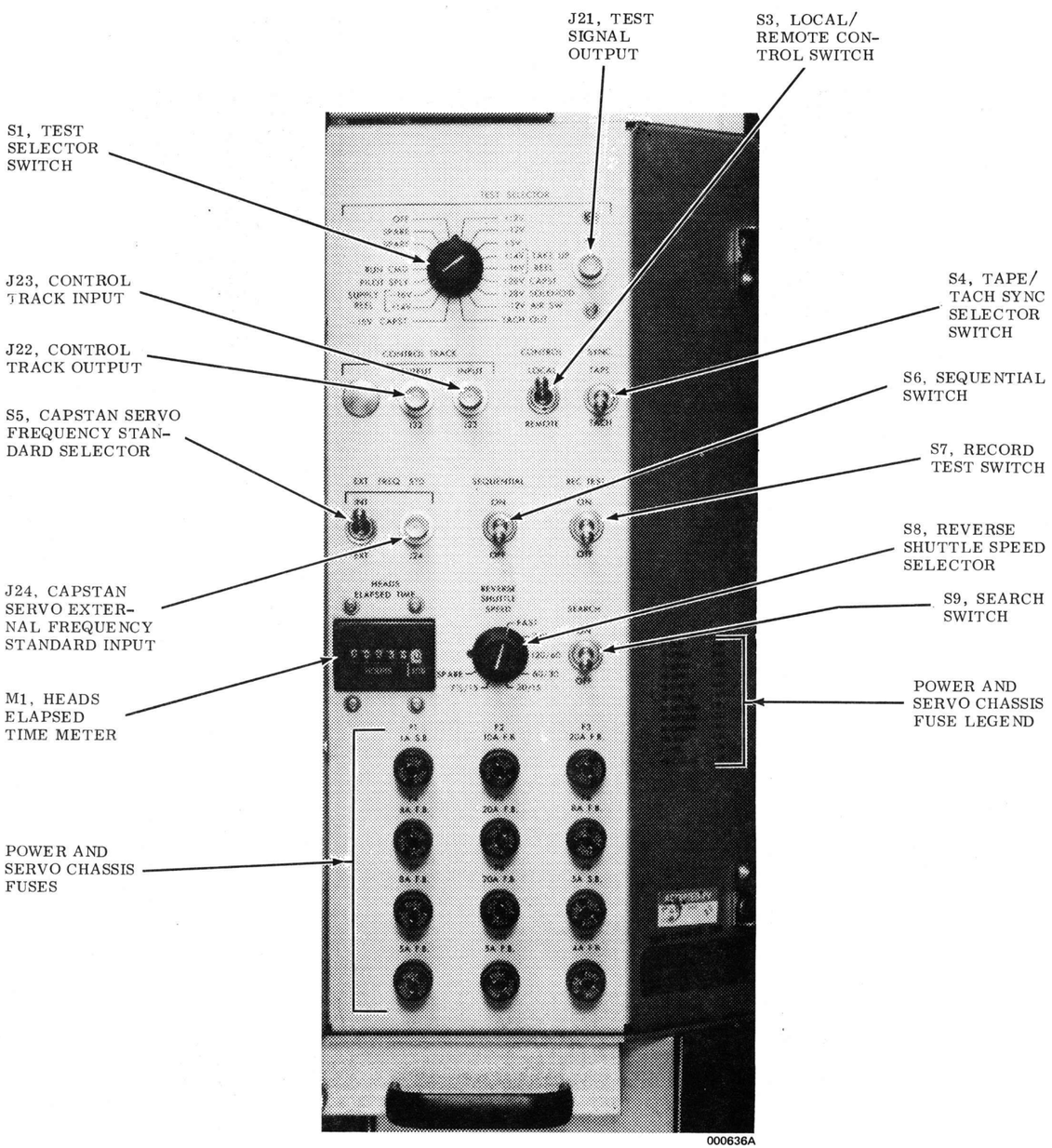


Figure 1-11. Power and Servo Chassis Test Panel

HEATSINK AND BACK OF TEST PANEL

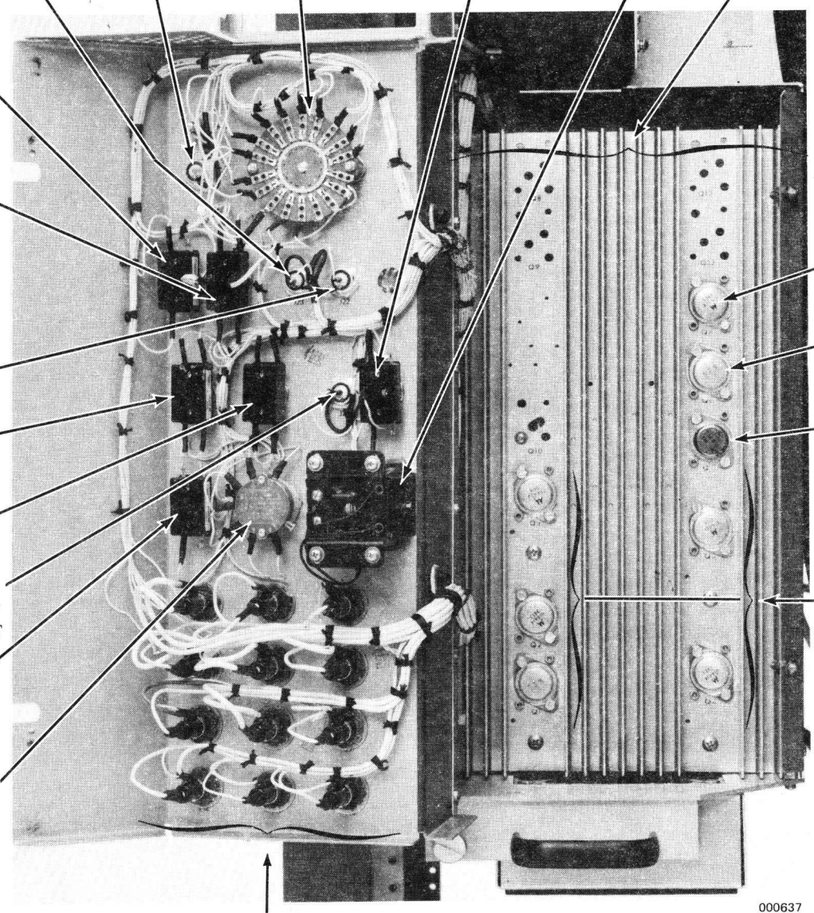


Figure 1-12. Power and Servo Chassis Heatsink Assembly and Back of Test Panel Assembly.

VACUUM HOUSING

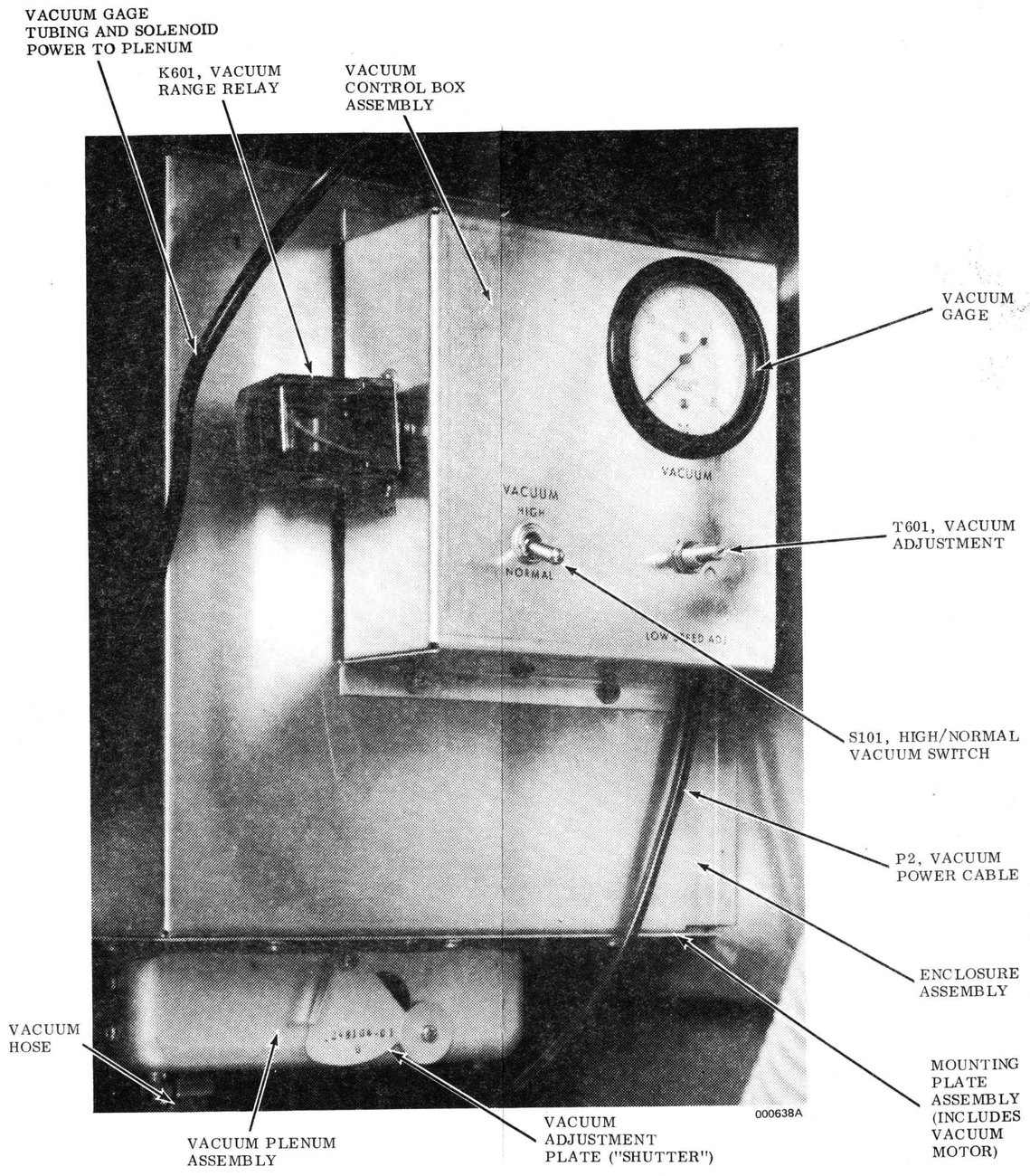


Figure 1-13. Vacuum Housing Assembly

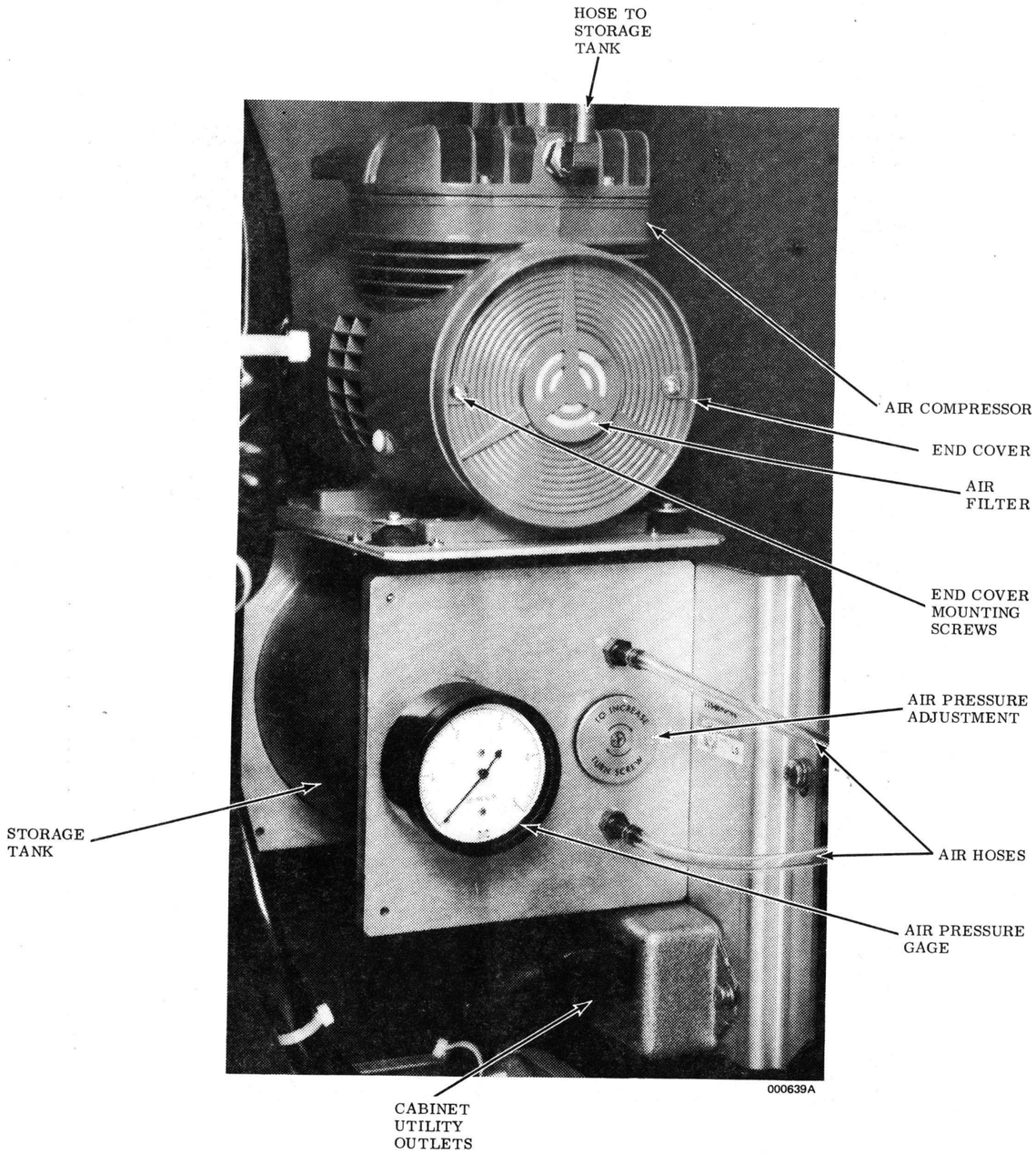


Figure 1-14. Air Compressor Assembly

SECTION 2
TRANSPORT DESCRIPTION

SECTION 2

TRANSPORT DESCRIPTION

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LIST OF ILLUSTRATIONS

LIST OF SCHEMATICS

NUMERICAL LIST OF ASSEMBLY DRAWINGS

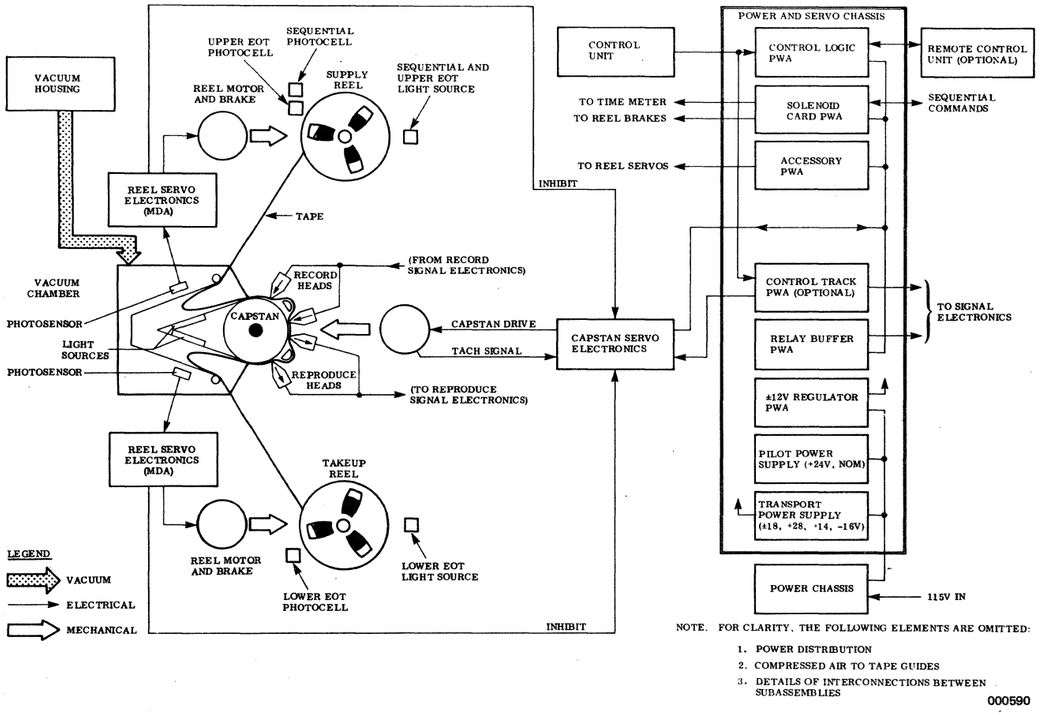


Figure 2-1. FR-3000 Tape Section (Transport) Simplified Block Diagram

GENERAL

This section of the manual gives an overall functional description of the FR-3000 Tape Section Assembly (Ampex 1802821). (Characteristics such as tape speeds, tape widths, etc., are given in Section 1.) The FR-3000 is a complete magnetic tape control system which is used as a subsystem in instrumentation magnetic tape recorder/reproducers. In this description, and in the detailed descriptions in the following sections of the manual, the components that make up the tape section are divided according to function (e.g., reel control, etc.). The components that perform these functions may be physically distributed among various of the subassemblies which make up the tape section assembly. The functional configuration of the FR-3000 is shown in Figure 2-1. The subassembly structure and the distribution into functional groups are indicated in Figure 2-2 (next page). The physical locations of the components are shown in the illustrations in Section 1.

Hereafter in this manual the tape section assembly, which includes all the elements of the FR-3000, is referred to as the tape transport, or the transport. These terms should not be confused with the 1802822 Tape Transport Assembly, which is a subassembly of the tape section assembly, as shown in Figure 2-2. It is a major subassembly, but is not a functional unit, and therefore is not covered as a unit in the text.

The tape section assembly (transport) includes:

a. The tape transport subassembly just mentioned

b. A capstan servo subassembly

c. A power and servo chassis subassembly

d. A rack subassembly

e. A vacuum housing subassembly

f. A vacuum chamber subassembly

g. An air compressor subassembly

h. A cover door subassembly

The functions covered (and the sections to see for detailed descriptions) are:

a. Control logic (Section 3)

b. Reel control (Section 4)

c. Capstan control (Section 5)

d. Power supplies and regulators (Section 6)

e. Interconnects (racks, bays, and cables) (Section 7)

OVERALL FUNCTIONAL DESCRIPTION

The essential purpose of the tape transport is to move tape from one reel to the other along a path that includes the magnetic heads. This function is required for all normal operations involving the transport: recording, reproducing, fast winding, and scanning. In order to perform these functions satisfactorily for instrumentation data processing, the tape speed, tape tension, and tape direction (guidance) must be controlled with great precision. To help meet these requirements, the FR-3000 tape-handling mechanism is built on a baseplate subassembly which establishes a rigid, precise reference plane to keep the various other subassemblies in the proper alignment. The most critical subassemblies (capstan, head assemblies, and vacuum chamber) are mounted on a precision plate which is a part of the capstan assembly, and which mounts on the back of the baseplate. The tape handling components project forward through a hole in the baseplate.

SECTION 2
TRANSPORT DESCRIPTION

CONTROL LOGIC

The functions of the tape transport, as well as some of the functions of the associated signal electronics, are controlled by logic circuits contained in the power and servo chassis. These circuits are controlled in turn by signals or switch closures from a control unit which mounts in an opening in the baseplate so that a control panel (or cluster) is accessible from the front of the transport.

The control logic also receives end-of-tape (stop) signals from photosensors associated with the tape reels. When sequential operation is selected, and the end of the tape is approached, a similar photosensor generates a signal which can be used to start a second recorder. The sequential signal is also generated if power fails or tape breaks in the first recorder. The control logic also receives broken-tape or missing-tape signals from the vacuum system, and shuttle-control signals from an optional footage counter assembly when it is installed and placed in the shuttle mode.

REEL CONTROL

The tape reels are controlled by reel motors which mount on the back of the baseplate. The shafts of these motors project through holes in the baseplate. On the shafts are mounted reel holddowns that hold the reels while they are in use. Included in the reel servos is a vacuum chamber assembly which is divided into two sections each of which maintains a loop of tape from its associated reel. These loops are forced into the chamber by ambient air moving in to fill a vacuum which is generated by a blower in the vacuum housing assembly located behind the transport.

Light sources and photosensors within the vacuum chamber sense the positions of the loops, and generate control signals that are used to adjust the position of the reel motors to keep the loop-lengths correct. This action results in servo control of tape tension (constant tape tension) in all modes of operation and in the tape being wound on and off the reels as required. The vacuum chamber also acts to isolate (buffer) the capstan/head area from tape-tension disturbances.

CAPSTAN CONTROL

The tape is moved, and therefore its speed is controlled, by a capstan. In operation, the tape is wrapped in contact with 110° of an elastomer-surfaced puck which is 1 foot in circumference. This gives the puck a non-slip grip on the tape. The puck is turned by a dc printed circuit motor which is part of a closed-loop servo. The functioning of the servo is based on a crystal-oscillator reference signal which, when tape is being moved, is compared to a signal representing either capstan speed or tape speed. Differences between the reference signal and the comparison signal are used to form an error signal which controls power from the power and servo chassis to the motor. This results in a high degree of speed-error correction.

In addition to its normal, wideband operating mode (approximately 500 Hz), the capstan servo is capable of conversion to a high-slew mode. This mode can be used to reduce tapes containing abnormally high-amplitude speed errors such as could be induced by recording under extreme vibration or shock conditions. The conversion is made by jumper placement on the servo electronics printed wiring assemblies.

POWER SUPPLIES AND REGULATORS

The power and servo chassis includes the power supplies and and a power regulator assembly required for operation of the tape transport. The main power supply (a multiple output supply) provides power which drives the capstan and reel motors and releases the reel brakes.

±18V power from the main power supply is also processed by a ±12V regulator assembly which includes a +5V regulator section. This assembly provides the power to operate the logic circuits which control the transport. Like the logic circuits, the ±12V regulator is a plug-in pwa in the power and servo chassis, which also mounts associated heat-sinked power-handling components.

INTERCONNECTS

The interconnects which join the elements of the tape transport are included in the wiring of the power and servo chassis, in the transport harness, and in the cabling between. Schematic and block diagrams covering the interconnects are included in Section 7 of this manual (also see Figure 2-2).

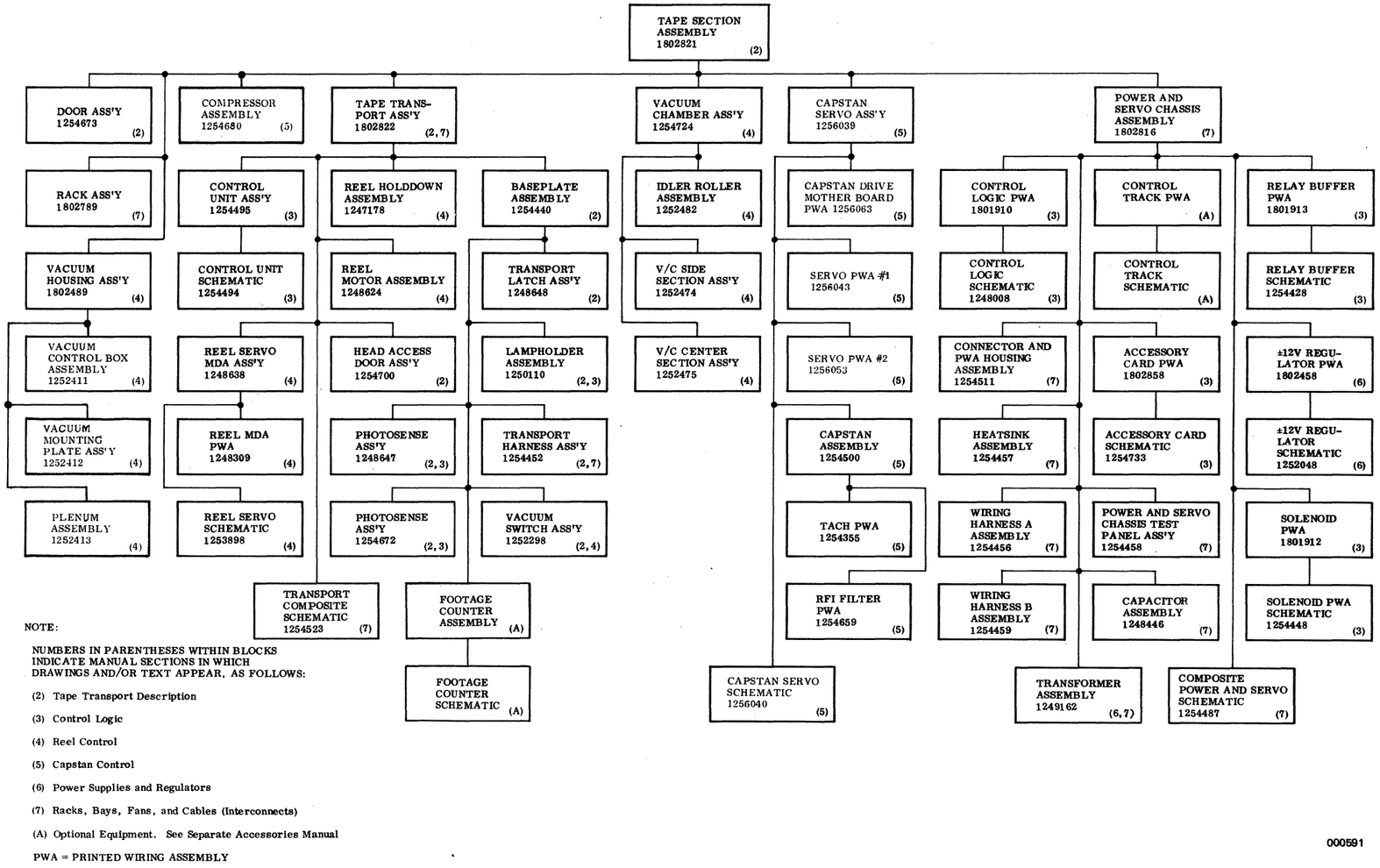


Figure 2-2. Tape Section (Transport) Subassemblies Simplified Block Diagram

DRAWINGS AND LISTS OF MATERIALS

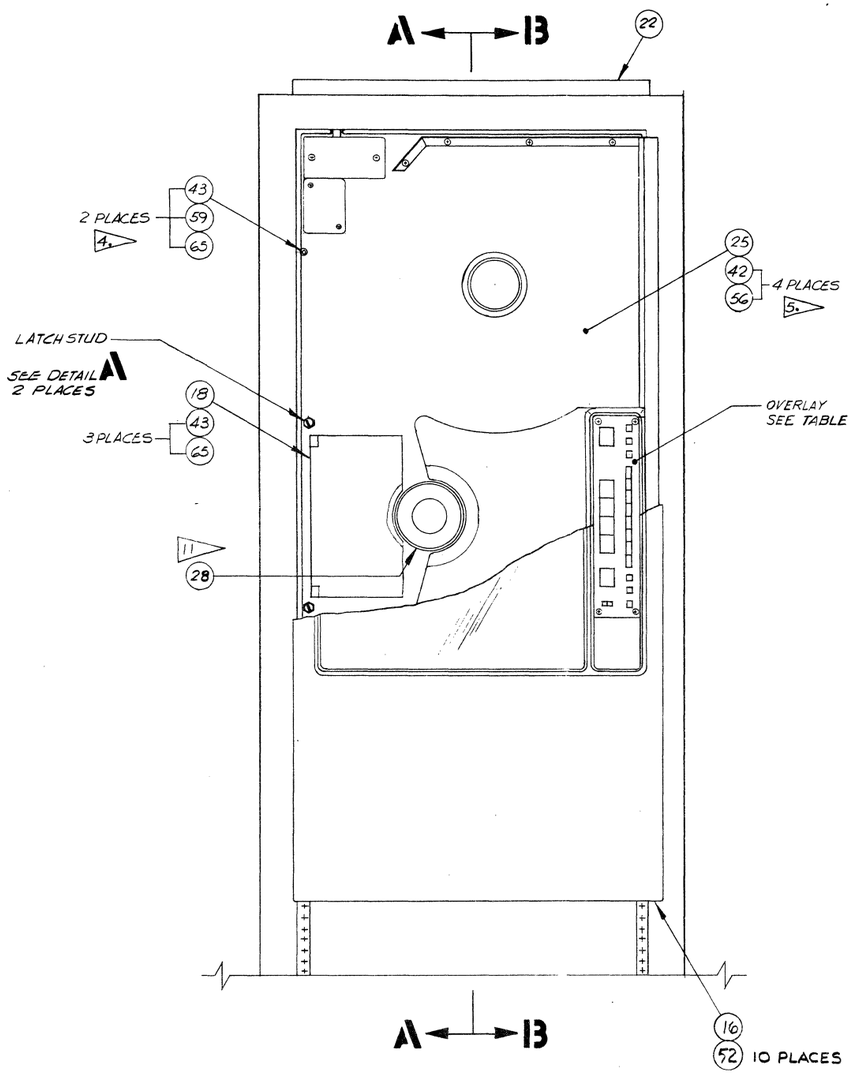
Drawings and lists of materials (lm's) covering portions of the transport not included in the specific functions described in Sections 3 through 6 are included in this section, and in Section 7.

NOTES:

1. CAT. NO. IS 1802821-04.
2. MARK I.D LABEL (ITEM 9) WITH CAT. NO. AND SERIAL NO PER MIL-STD-130.
   INSTALL LABEL ABOVE THE LABEL ON TAPE TRANSPORT ASSY (ITEM 25). NOT SHOWN.
3. SUB-ASSEMBLIES ON THE BACK OF THE TAPE TRANSPORT BASE PLATE ARE NOT SHOWN ON SECT A-A AND B-B FOR CLARITY.
4. ITEMS NOTED TO BE USED FOR SHIPPING.
5. TORQUE SCREWS NOTED (ITEM 42) TO 28±2 IN/LBS AND SECURE WITH NUT (ITEM 56).
6. USE CATCH (ITEMS 6,7 AND 8) AS REQUIRED TO ELIMINATE FREE PLAY ON THE TRANSPORT LATCH ASSY 1248648-01 (PART OF BASE PLATE ASSY 1254440-01).
7. ASSEMBLE CHASSIS HANGER BUTTON (ITEM 1) AS SHOWN ON UPPER SLIDE (ITEM 4) ONLY, PRIOR TO INSTALLATION. APPLY LOCTITE (ITEM 30) ON THREADS OF SCREWS (ITEM 49). COAT SCREW HEAD WITH RED LACQUER (ITEM 31).
8. AFTER INSTALLATION OF POWER AND SERVO ASSY (ITEM 74), PRESS GROOVE PIN (ITEM 37) INTO ROLL PIN AT THE TOP REAR END OF EACH SLIDE (ITEM 4) TO LIMIT SLIDE MOVEMENT.
9. CLAMP ALL CABLES OF POWER AND SERVO ASSY (ITEM 74) AS SHOWN WITH ITEM 36 (3 PLACES) AND SADDLE CLAMP(S) (PART OF HEAD DRIVER ASSY OR HEAD ELECTRONICS KIT).
10. INSTALL LATCH STUD AS SHOWN PER DETAIL "A". ADJUST HEIGHT FOR PROPER FIT OF COVER DOOR (ITEM 5) AND SECURE WITH KEP NUT.
11. FOR SPEED RANGE JUMPER POSITION, REFER TO JUMPER TABLE ON CAPSTAN SERVO ASSY SCHEMATIC DIAGRAM 1256040.
12. APPLICABLE CABLING DIAGRAMS:

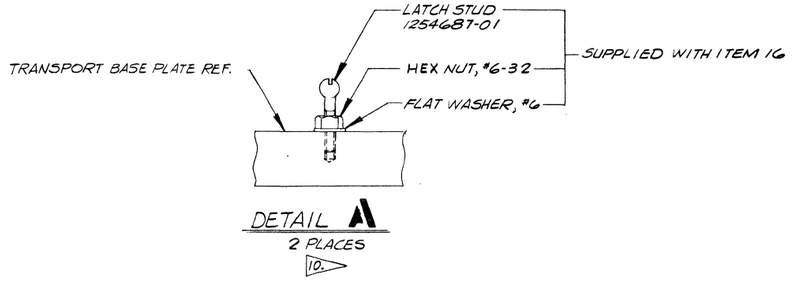
1254855	FR3000	TRANSPORT
1254848	FR3010	SIGNAL ELECTRONICS
1254870	FR3020	SIGNAL ELECTRONICS

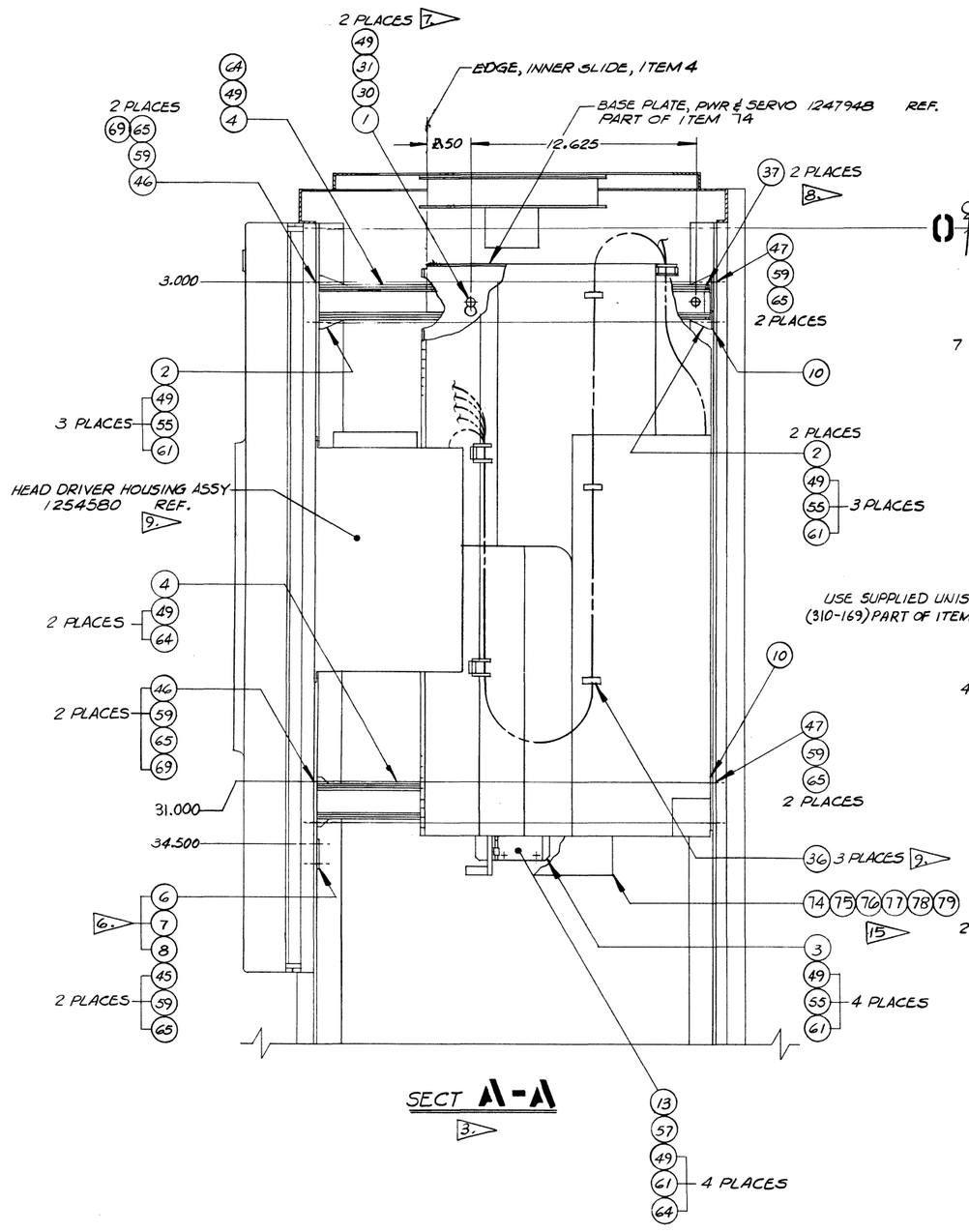
13. LOCATE ITEMS 71 & 72 AS SHOWN. RAISE ITEMS 71 & 72 1.75 INCHES IF THEY INTERFERE WITH A UNIT INSTALLED DIRECTLY BELOW THE TAPE TRANSPORT.
14. SPACER BLOCKS P/NO. 1251289-07 & -08, PART OF VACUUM CHAMBER ASSY ITEM 18, MAY BE STOWED ON ITEM 21 (AS SHOWN) WHEN NOT IN USE, WITH THEIR MOUNTING HARDWARE INSERTED ON THE SIDE OF EACH SPACER BLOCK.
15. INSTALL ITEMS 75 THRU 79 IN ITEM 74.

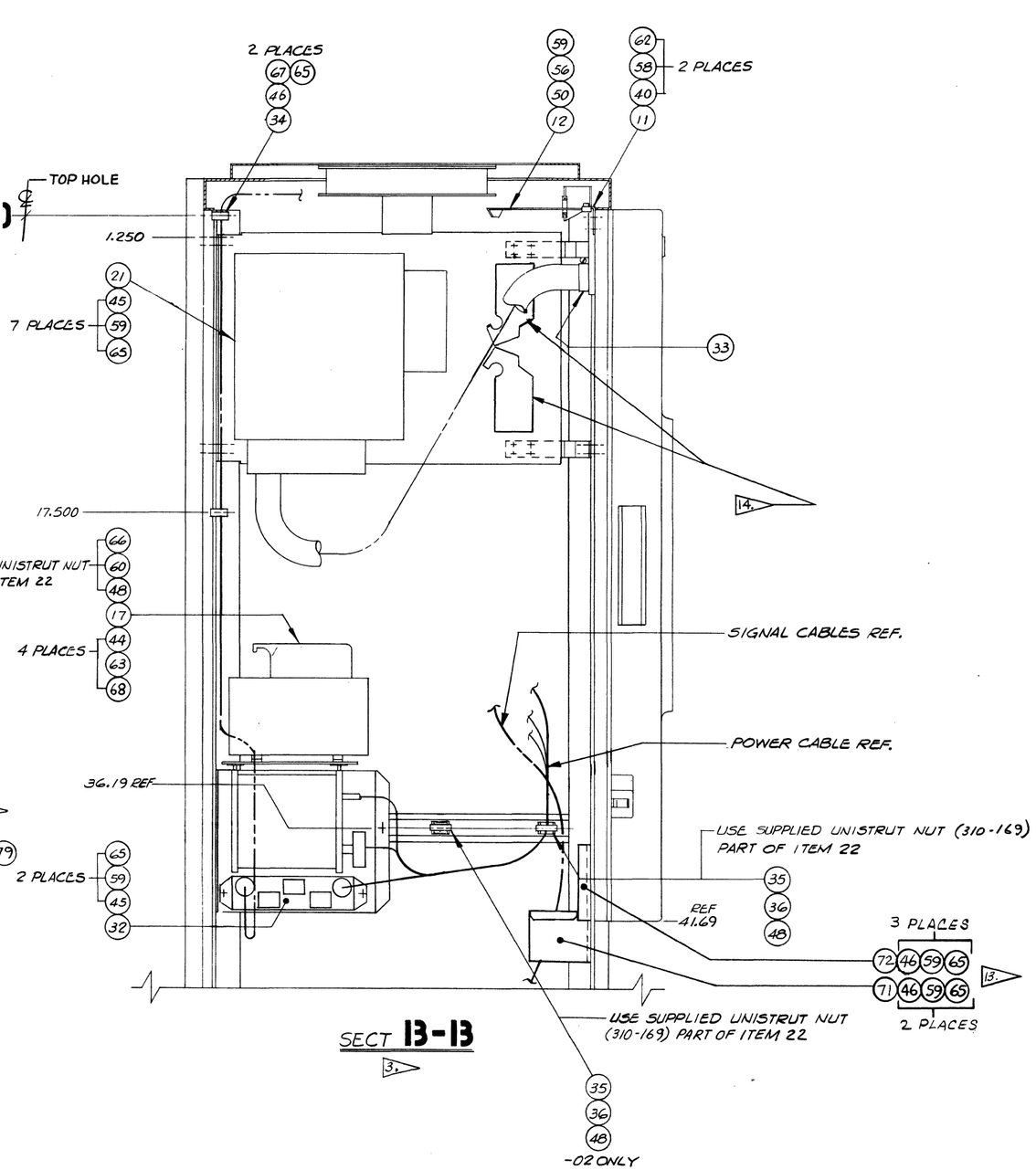


TABLE

DESCRIPTION - SPEED RANGE	P/N FOR CONTROL UNIT OVERLAY (REF)
1 7/8 — 120 IPS TAPE SPEED 11	1254669-01
15/16 — 60 IPS TAPE SPEED 11	1254669-02



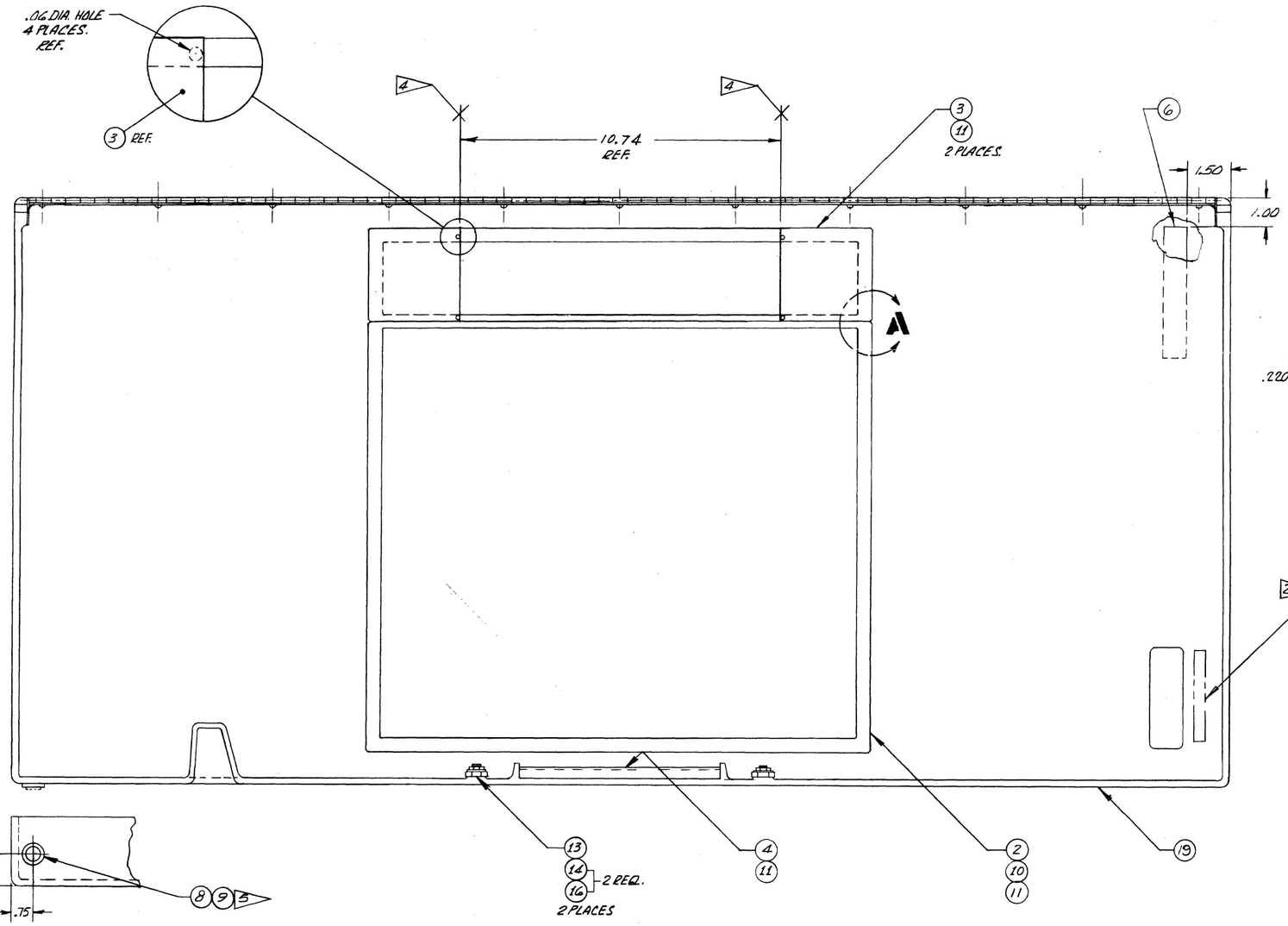


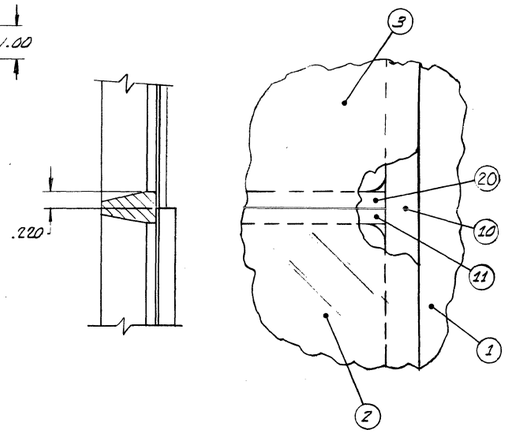


NOTES: SEE SHT 1.

LIST OF MATERIALS 1802821J

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -04		
1	1247949-01		Button, chassis hanger	2		
2	1248119-01		Bracket, slide mtg	3		
3	1248131-02		Bracket, latch mtg	1		
4	1248230-01		Slide specification	2		
6	1248894-01		Catch, .062 thk	a/r		
7	1248894-02		Catch, .032 thk	a/r		
8	1248894-03		Catch, .015 thk	a/r		
9	1251522-01		Label, identification (2)	1		
10	1251868-01		Brace, stop	2		
11	1252299-01		Bracket, stay, transport	1		
12	1252301-01		Bar, stay	1		
13	1252405-01		Bracket, nut mtg	1		
16	1254673-02		Door assy, transport	1		
17	1254680-01		Compressor assy	1		
18	1254724-01		Vacuum chamber assy	1		
19	1254523		Schematic diagram, tape transport	ref		
21	1802489-01		Vacuum housing assy	1		
22	1802789-01		Standard rack assy	1		
25	1802822-02		Tape transport assy	1		
28	1256089-01		Capstan servo assy	1		
30	018-030		Loctite, grade C	a/r		
31	087-028		Lacquer, touch-up, red	a/r		
32	149-056		Ac power outlet, 5 recp	1		
33	302-512		Clamp, band, gear, .812/1.500 i-d	1		
34	302-076		Clamp, cable, .375 i-d	2		
35	302-356		Mounting plate, strap	1		
36	302-366		Cable tie	4		
37	405-012		Groove pin, .094 dia x .50 lg	2		
40	470-009		Screw, cap, hex soc, #4-40 x .31 lg	2		
42	470-042		Screw, cap, hex soc, #10-32 x 1.00 lg	4		
43	470-415		Screw, cap, hex soc, #10-32 x 1.12 lg	5		
44	471-071		Screw, pan hd, xrec, #6-32 x .50 lg	4		
45	471-086		Screw, pan hd, xrec, #10-32 x .31 lg	11		
46	471-087		Screw, pan hd, xrec, #10-32 x .38 lg	11		
47	471-089		Screw, pan hd, xrec, #10-32 x .50 lg	4		
48	471-148		Screw, pan hd, xrec, 1/4-20 x .75 lg	3		
49	471-567		Screw, binder hd, slt, #8-32 x .38 lg	22		
50	476-499		Screw, cap, shoulder, #10-32 x .50 lg	1		
52	471-606		Screw, truss hd, xrec, #6-32 x .25 lg sst	10		
55	496-006		Nut, keps, #8-32	13		
56	496-009		Nut, keps, #10-32	5		
57	498-589		Nut, clip on, #7	1		
58	501-008		Washer, flat, #4	2		
59	501-011		Washer, flat, #10	27		
60	501-067		Washer, flat, 1/4	1		
61	501-205		Washer, flat, #8	17		
62	502-002		Washer, lock spring, #4	2		
63	502-003		Washer, lock spring, #6	4		
64	502-004		Washer, lock spring, #8	7		
65	502-005		Washer, lock spring, #10	31		
66	502-006		Washer, lock spring, 1/4	1		
67	506-014		Washer, "D", #10	2		
68	501-009		Washer, flat, #6	4		
69	501-019		Washer, flat, #10	4		
71	1254880-02		Guide, cable, lower	1		
72	1254881-02		Guide, cable, upper	1		
74	1256655-01		Power and servo chassis assy	1		
75	1801910-02	P101	Pwb assy, control logic	1		
76	1256013-01	P102	Pwb assy, accessory card	1		
77	1802458-02	P104	Pwb assy, +12V regulator	1		
78	1801912-03	P105	Pwb assy, solenoid	1		
79	1801913-04	P106	Pwb assy, relay buffer	1		
			Items not used: 5, 14, 15, 20, 23, 24, 26, 27, 29, 38, 39, 41, 51, 53, 54, 70, 73,			





DETAIL A
SCALE 1:1
(ALL ITEMS ARE REF.)

NOTES:

1 ASSY NO IS 1254673-02.

2. MARK ASSY NO ABOVE WINDOW ON ITEM 1, PER MIL-STD-130.

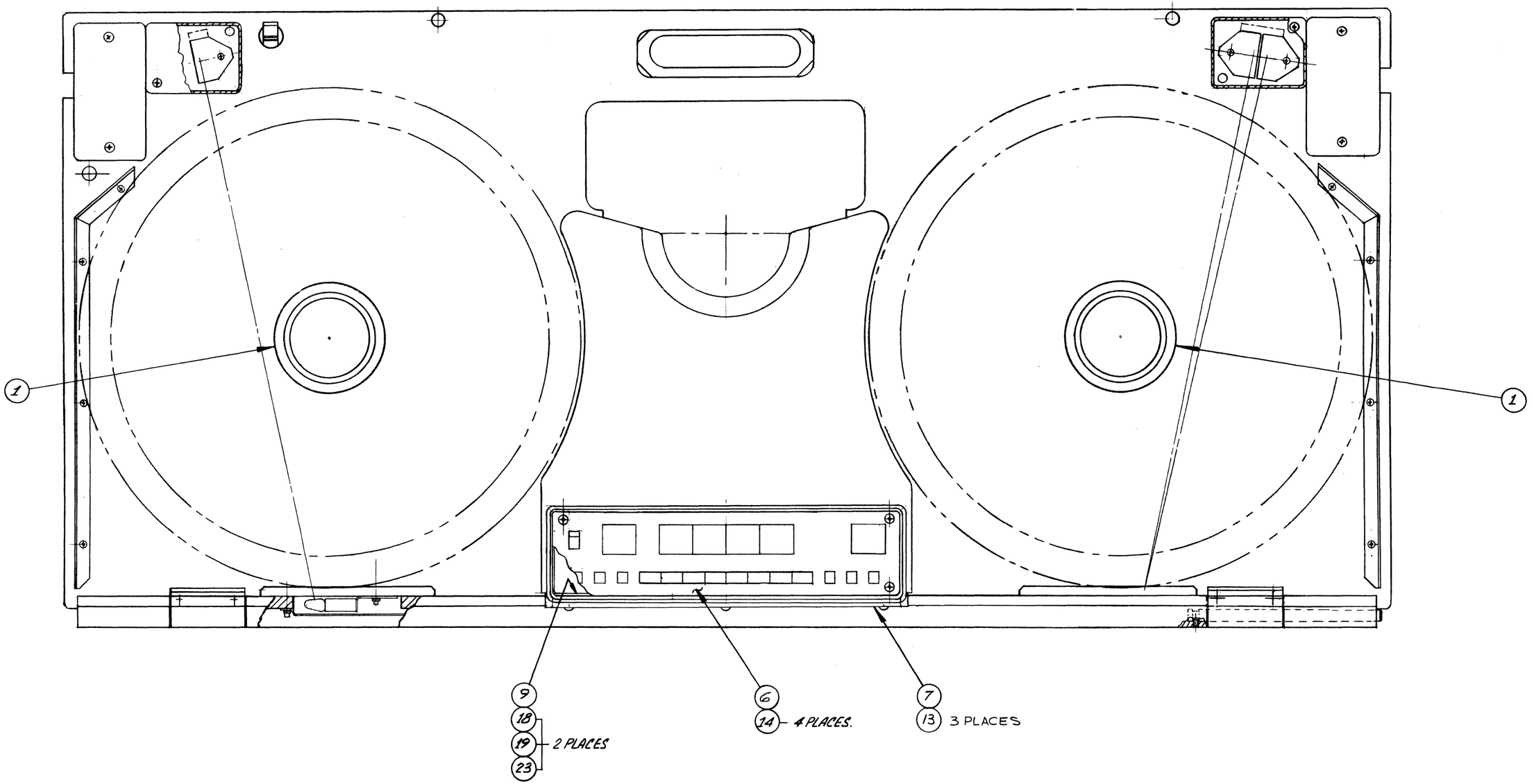
3. PACKAGE ITEMS 5, 17, AND 21 SEPARATELY AND SECURE TO ASSY.

4. MOUNT ITEM 3 WITH BLACK SURFACE FARSIDE AND ALIGN EDGE WITH .06 DIA. HOLES AS SHOWN.

5. REMOVE STUD FROM ITEM 3 AND MOUNT TO ITEM 1 WITH FILM OF ITEM 8.

LIST OF MATERIALS 1254673B

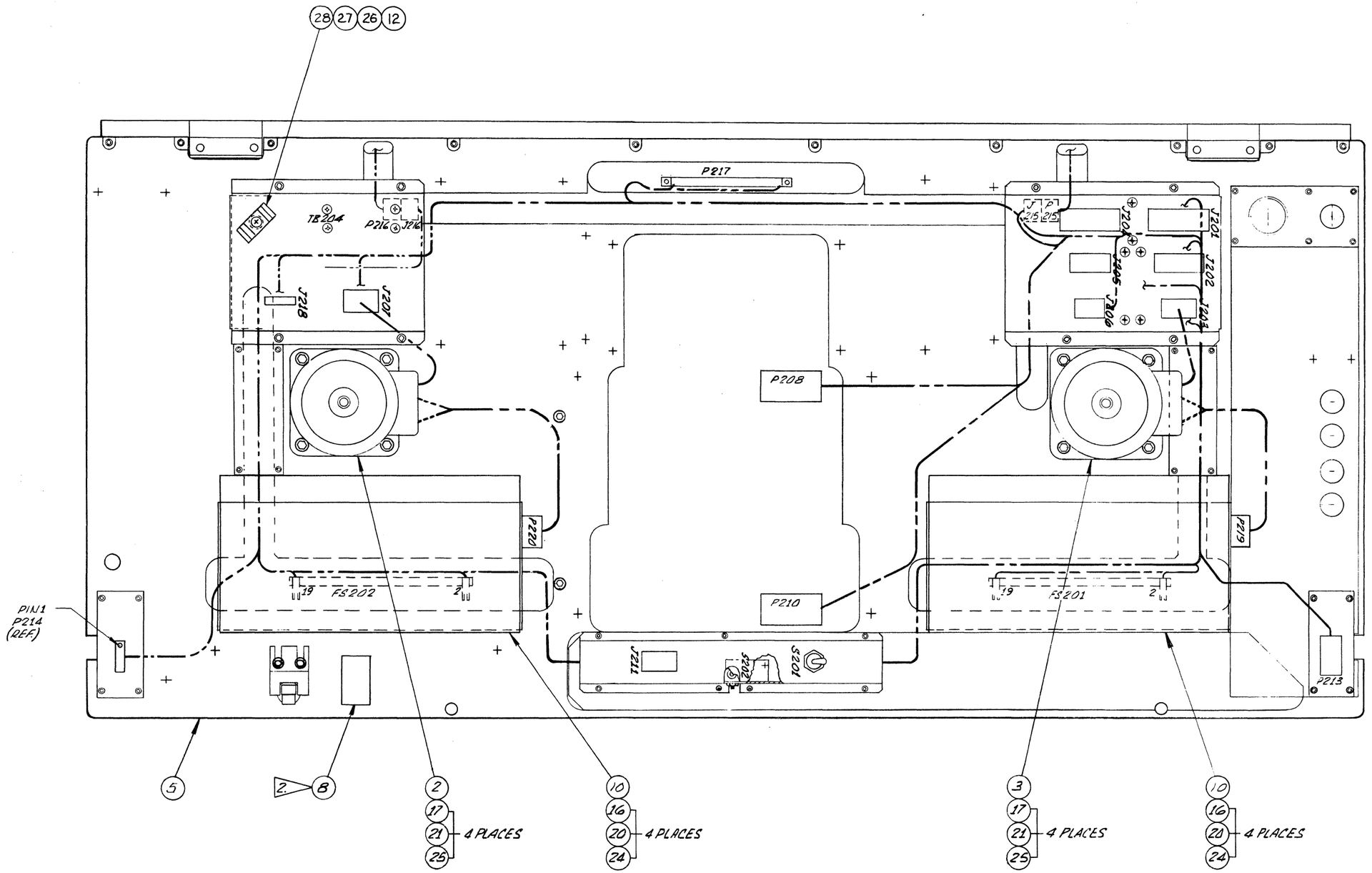
ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -02		
2	1254675-01		Glass, window	1		
3	1254676-01		Plate, cover	2		
4	1254677-01		Handle, cover door	1		
5	1254687-01		Stud, latch 3	2		
6	6000039-11		Ampex Logo	1		
8	018-392		Adhesive, epoxy	a/r		
9	310-825		Catch assembly, interlock	1		
10	225-410		Tape, adhesive,double side .50 wd	a/r		
11	225-443		Tape, adhesive, double side .25 wd	a/r		
13	311-065		Catch assembly, spring tension	2		
14	496-004		Nut, keps, 4-40	4		
16	501-008		Washer, flat, #4	4		
17	501-015		Washer, flat, #6, sst 3	2		
19	1254674-02		Cover door, transport	1		
20	225-453		Tape, adhesive, double side, .19 wd	a/r		
21	492-015		Nut, hex, 6-32, sst 3	2		
			Items not used: 1,7,12,15,18,			



NOTES:

1 CAT. NO IS 1802822-02.

2 MARK I.D. LABEL (ITEM 8) WITH CAT. NO, SERIAL NO, MODEL NO, ETC. PER MIL-STD-130, INSTALL APPROX. WHERE SHOWN.


28
27
26
12
P217
TB204
P216
J216
J218
J201
P208
J204
J202
J203
J205
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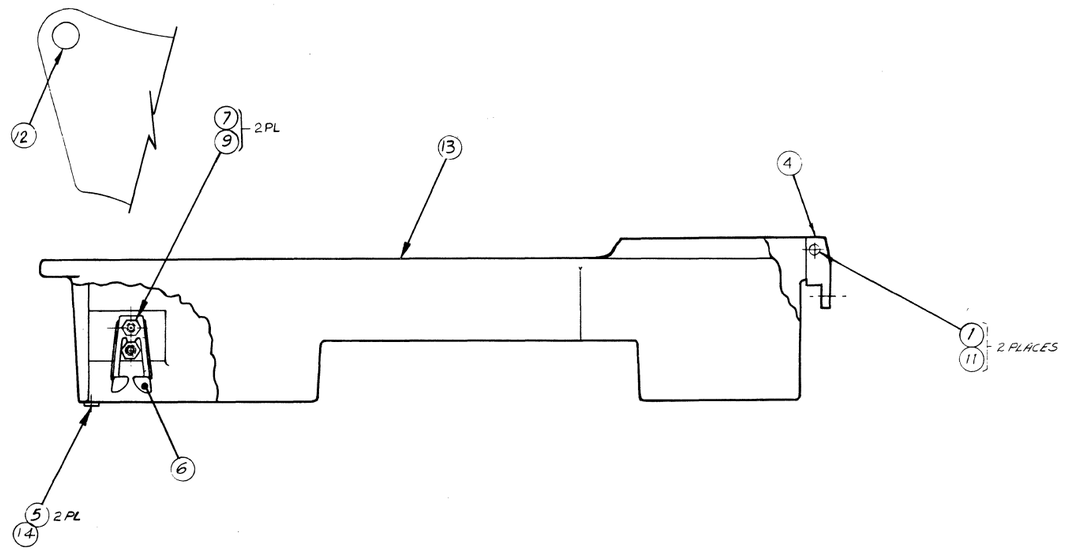
P220
P219
19
FS202
2
19
FS201
2
P210
J211
J225
S201
P213
PIN 1
P214
(REF)
5
8
2
17
21
25
4 PLACES
10
16
20
24
4 PLACES
3
17
21
25
4 PLACES
10
16
20
24
4 PLACES

BACKSIDE

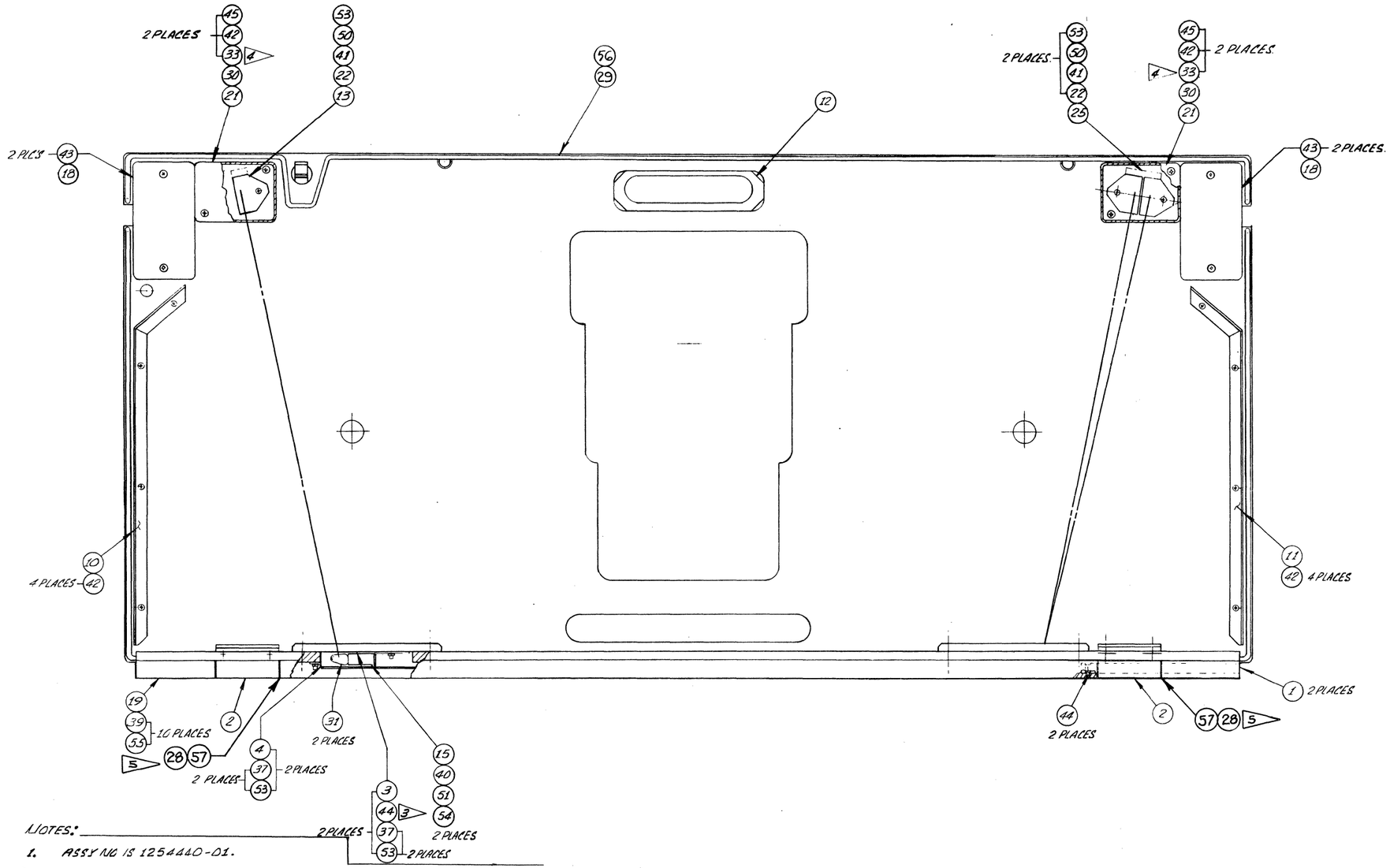
LIST OF MATERIALS 1802822E						
ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -02		
1	1247178-02		Reel holddown assy	2		
2	1248624-03		Reel motor assy	1		
3	1248624-04		Reel motor assy	1		
5	1254440-01		Baseplate assy	1		
6	1254495-01		Control unit assy	1		
7	1254700-02		Head access door assy	1		
8	1251523-01		Label, identification	1		
9	1254509-01		Enclosure, control cluster	1		
10	1255620-01		Reel servo, mda assy	2		
12	475-044		Screw, pan hd, assemb washer, xrec, #8-32 x .38 lg	1		
13	472-060		Screw, truss hd, xrec, #4-40 x .31	3		
14	473-819		Screw, truss hd, xrec, #4-40 x .25	4		
16	470-037		Screw, cap, hex soc, #10-32 x .44 lg	8		
17	470-049		Screw, cap, hex soc, 1/4-20 x 1.00 lg	8		
18	470-068		Screw, cap, hex soc, #6-32 x .31 lg	2		
19	501-009		Washer, flat, #6	2		
20	501-011		Washer, flat, #10	8		
21	501-012		Washer, flat, #1/4	8		
23	502-003		Washer, lock, spring, #6	2		
24	502-005		Washer, lock, spring, #10	8		
25	502-006		Washer, lock, spring, #1/4	8		
26	302-356		Mounting plate, strap	1		
27	302-366		Cable, tie	1		
28	501-205		Washer, plain, flat, #8, .188 i-d, .438 o-d	1		
			Items not used: 4,11,15,22			

HEAD ACCESS DOOR ASSEMBLY 1254700-02D



NOTES:
1. ASSY NO. IS 1254700-02.
2. MARK ASSY NO. ABOVE THE CAST PART NO. ON ITEM 13.
3. PACKAGE ITEM 2, 8 & 10 SEPARATELY AND SECURE TO ASSY.

LIST OF MATERIALS 1254700D						
ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -02		
1	1248434-01		Pin, hinge	2		
2	1254687-01		Stud, latch ▷3	1		
4	1254702-01		Bar, hinge	1		
5	250-007		Bumper, grommet, rubber	2		
6	311-065		Catch assembly	1		
7	496-004		Nut, keps, #4-40	2		
8	498-359		Nut, keps, #6-32 ▷3	1		
9	501-186		Washer, flat, #4, small patt	2		
10	501-015		Washer, flat, #6, sst ▷3	1		
11	018-030		Adhesive, thread locking	a/r		
12	250-188		Bumper pad, .450 dia, blk	1		
13	1254701-02		Door, head access	1		
14	087-646		Adhesive, silicon compound	a/r		
			Item not used: 3			



NOTES:

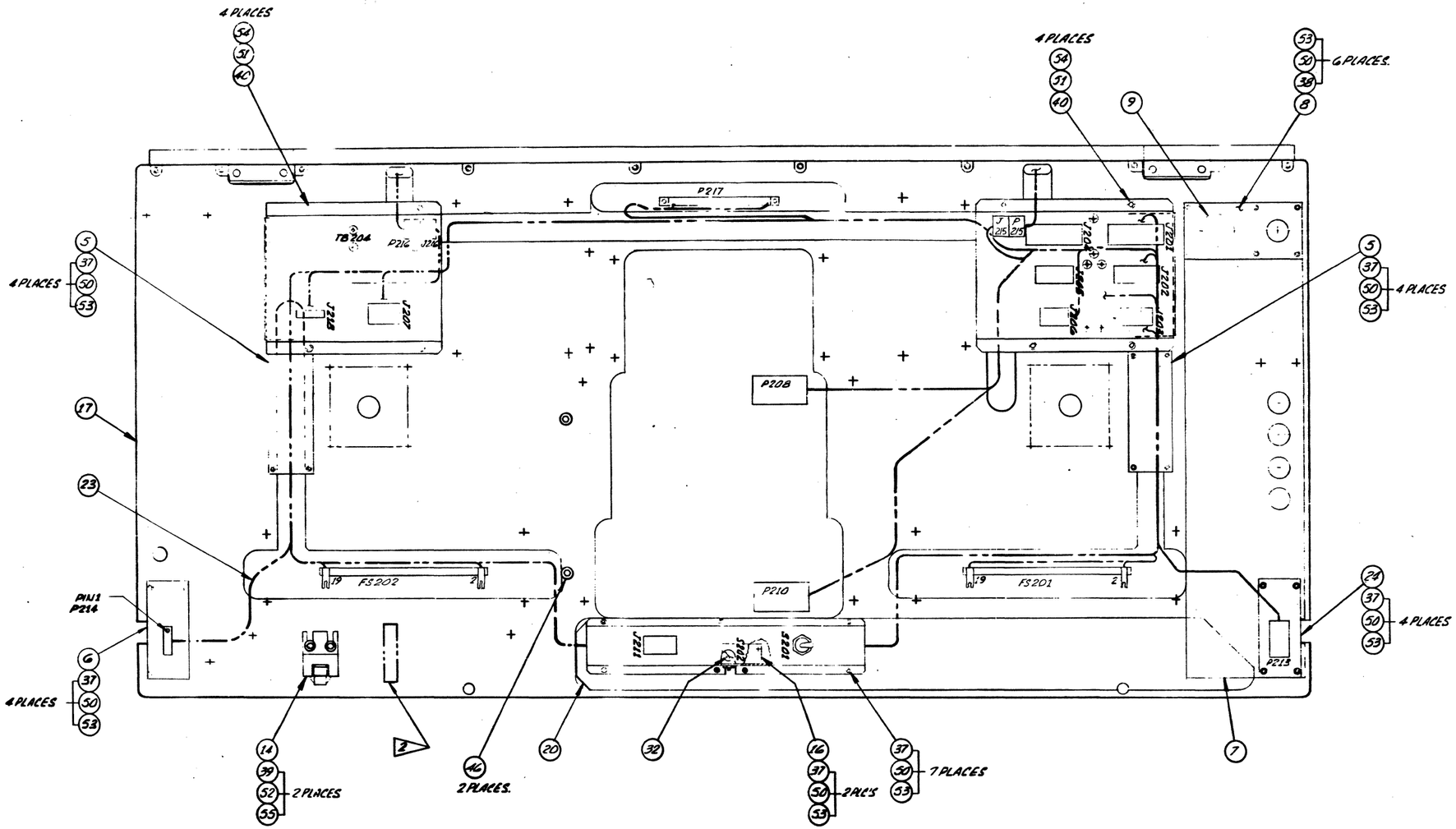
1. ASSY NO IS 1254440-01.

2 MARK ASSY NO APPROX. WHERE SHOWN PER MIL-STD-130.

3 ON HOUSING, LAMP (ITEM 3), PLUG 10-32 HOLE ON BASE PLATE SIDE ONLY USING ITEMS 44 & 30 (2 PLACES.)

4 PRE-ASSEMBLE SPACER (ITEM 33) AND SET SCREW (ITEM 45) PRIOR TO INSTALLATION. APPLY LOCTITE (ITEM 30) ON THREADS OF ITEM 45 AND INSTALL .25 INCH DP.

5 APPLY FILM OF ITEM 28 TO HINGE PIN, ITEM 1, AND TO WASHER, ITEM 57.

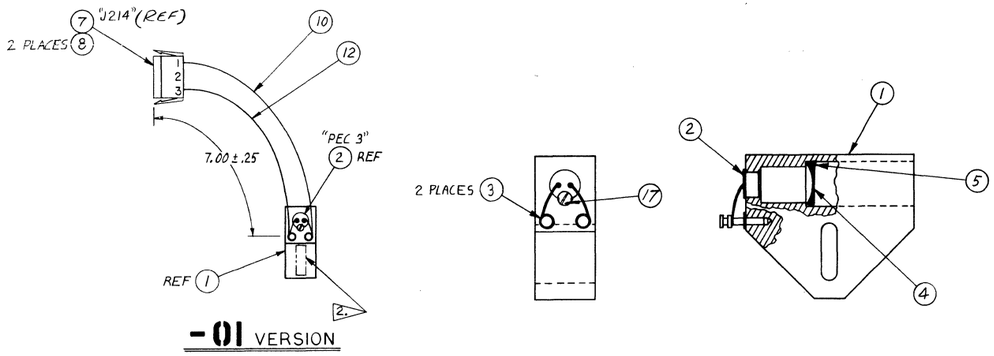

4 PLACES
54
31
40
4 PLACES
54
31
40
9
53
50
38
8
6 PLACES.
5
37
50
53
4 PLACES
5
37
50
53
4 PLACES
P217
TB204
P216
J216
J215
P215
J201
J202
J203
J204
J205
J206
P208
17
23
PIN 1
P214
FS202
19
2
FS201
19
2
P210
J211
J212
J213
P215
24
37
50
53
4 PLACES
6
37
50
53
4 PLACES
14
39
52
55
2 PLACES
2
42
2 PLACES.
20
32
16
37
50
53
2 PLC'S
37
50
53
7 PLACES
7

BACKSIDE

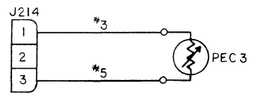
LIST OF MATERIALS 1254440D

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
1	1212808-03		Pin, hinge	2		
2	1247089-02		Hinge block	2		
3	1248100-02		Housing, lamp	2		
4	1248101-02		Shroud, lamp	2		
5	1248256-01		Cover, harness	2		
6	1248278-02		Adaptor, connector mtg	1		
7	1248425-01		Cover plate, through, top	1		
8	1248427-01		Block, adaptor	1		
9	1248428-01		Adaptor, hose, large	1		
10	1248437-03		Plate, tape stop	1		
11	1248437-04		Plate, tape stop	1		
12	1248450-01		Gasket, vacuum chamber	1		
13	1248647-01		Photo sense assembly	1		
14	1248648-01		Transport latch assembly	1		
15	1250110-01		Lamp holder assembly	2		
16	1252298-01	S202	Vacuum switch assembly	1		
17	1254375-01		Baseplate	1		
18	1254397-01		Plate, cover	2		
19	1254439-02		Bar, hinge	1		
20	1254441-01		Cover plate, through, side	1		
21	1254442-01		Enclosure, eot	2		
22	1254443-01		Washer, spacer, eot	3		
23	1254452-02		Harness assembly transport	1		
24	1254561-01		Connector, adaptor assembly	1		
25	1254672-01		Photo sense assembly	1		
26	1254523		Schematic diagram	Rev C		
28	087-059		Grease, aero shell, 7A	a/r		
29	225-453		Tape, adhesive, dbl side, .19 wd	a/r		
30	018-028		Adhesive, thd-lkg	a/r		
31	060-002		Lamp, incandescent, 28V	2		
32	260-010		Grommet, rubber, .125 i-d x .344 o-d	1		
33	280-048		Spacer, thd, #4-40 x 1.25 lg	4		
37	470-008		Screw, cap, hex soc, #4-40 x .25	33		
38	470-014		Screw, cap, hex soc, #4-40 x .75	6		
39	470-040		Screw, cap, hex soc, #10-32 x .75	12		
40	470-068		Screw, cap, hex soc, #6-32 x .31	10		
41	470-240		Screw, cap, hex soc, #4-40 x 1.25 lg	3		
42	473-819		Screw, truss hd, xrec, blk oxide, #4-40 x .25 lg	12		
43	473-820		Screw, truss hd, xrec, blk oxide, #6-32 x .31 lg	4		
44	477-127		Screw, set, hex soc, cup pt, #10-32 x .19 lg	4		
45	477-162		Screw, set, hex soc, cup pt, #4-40 x .50	4		
46	470-045		Screw, cap, hex soc, #1/4-20 x .50	2		
50	501-008		Washer, flat, #4	34		
51	501-009		Washer, flat, #6	10		
52	501-011		Washer, flat, #10	2		
53	502-002		Washer, lock, spring, #4	42		
54	502-003		Washer, lock, spring, #6	10		
55	502-005		Washer, lock, spring, #10	12		
56	600-583		Tubing, rubber, .188 o-d	a/r		
57	502-410		Washer, plain, .380 i-d, .630 o-d x .030 thk	2		
			Items not used: 27,34,35,36,47,48,49			

PHOTOSENSE ASSEMBLY 1248647 -01D



-01 VERSION



SCHEMATIC REFERENCE, -01 VERSION

NOTES:

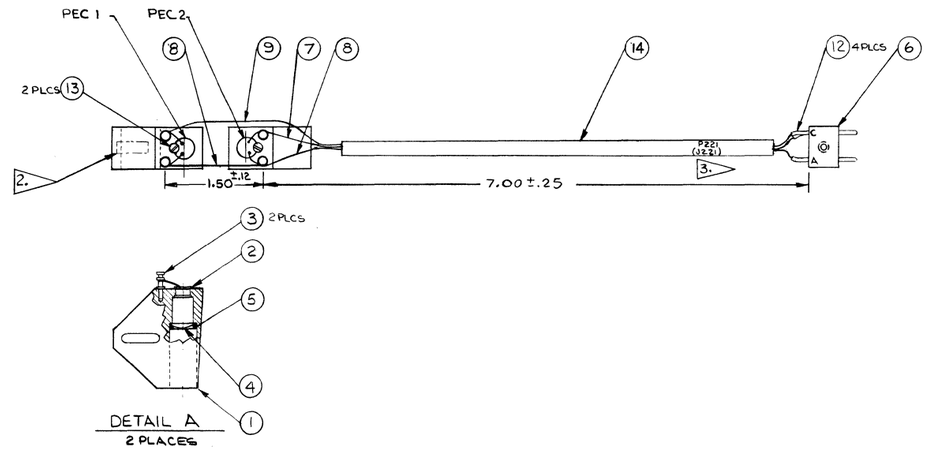
1. ASSY. NO. IS 1248647-01 OR -02.
2. MARK ASSY NO. & REF. DESIG. APPROXIMATELY WHERE SHOWN PER MIL-STD-130.

LIST OF MATERIALS 1248647

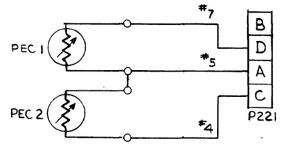
ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01	-02	
1	1247982-01		Housing, photo resistor	1	2	
2	015-035		Resistor, variable, photo sensitive, PEC 1, 2&3	1	2	
3	173-415		Terminal, stud turret, press fit, brass	2	4	
4	271-004		Lens, plano, convex	1	2	
5	430-365		Ring, retaining, external	1	2	
7	169-987		Body, rect, recp, connector, 3 socket, J214	1	-	
8	169-993		Contact, hermaphrodite	2	-	
9	169-872		Contact, hermaphrodite	-	3	
10	611-429		Wire, strand, insul, #24 AWG, #3	a/r	-	
11	611-348		Wire, strand, insul, #24 AWG, #4	-	a/r	
12	611-428		Wire, strand, insul, #24 AWG, #5	a/r	a/r	
13	611-503		Wire, strand, insul, #24 AWG, #7	-	a/r	
14	615-004		Wire, bare, buss, #24 AWG	-	a/r	
15	600-472		Sleeving, teflon, #24 AWG	-	a/r	
16	600-251		Sleeving, pvc, shrinkable, .062 dia	-	a/r	
17	471-875		Screw, machine, slotted, 2-56 x .125 lg	1	2	
			Item not used: 6			

CHANGED: 15 MARCH 1978

PHOTOSENSE ASSEMBLY 1254672-01D



DETAIL A
2 PLACES



SCHEMATIC

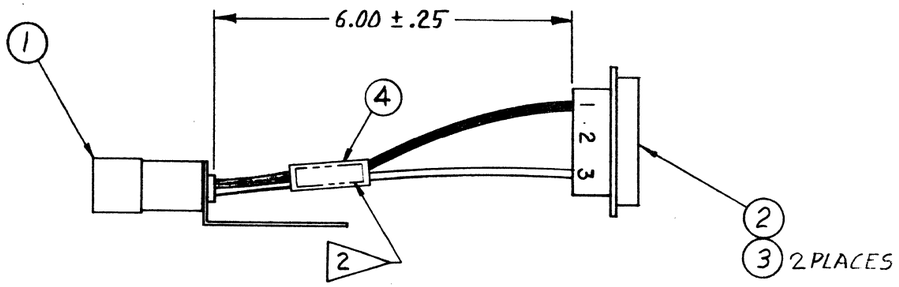
NOTES:

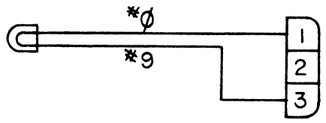
1. ASSY NO IS 1254672-01
2. MARK ASSY NO WHERE SHOWN PER MIL-STD-130.
3. MARK REF. DESIGNATION WHERE SHOWN; COLOR, WHITE.

LIST OF MATERIALS 1254672

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
1	1254787-01		Housing, photo resistor	2		
2	015-035	PEC1 & 2	Resistor, variable, photo sens	2		
3	173-415		Term, stud tur, press fit, brass	4		
4	271-004		Lens, plano, convex	2		
5	430-365		Ring, retaining, external	2		
6	139-340	P221	Connector, rect, plug, 3 pin, 1 soc	1		
7	611-348		Wire, strand, insul, #24 AWG, #4	a/r		
8	611-428		Wire, strand, insul, #24 AWG, #5	a/r		
9	611-503		Wire, strand, insul, #24 AWG, #7	a/r		
12	600-252		Sleeving, pvc, shrink, 0.093 i.d.	a/r		
13	471-875		Screw, mach, slotted, 2-56 x .125 lg	2		
14	600-014		Sleeving, flex, blk 0.133 i.d.	a/r		
			Items not Used: 10,11			

LAMPHOLDER ASSEMBLY 1250110 -01B





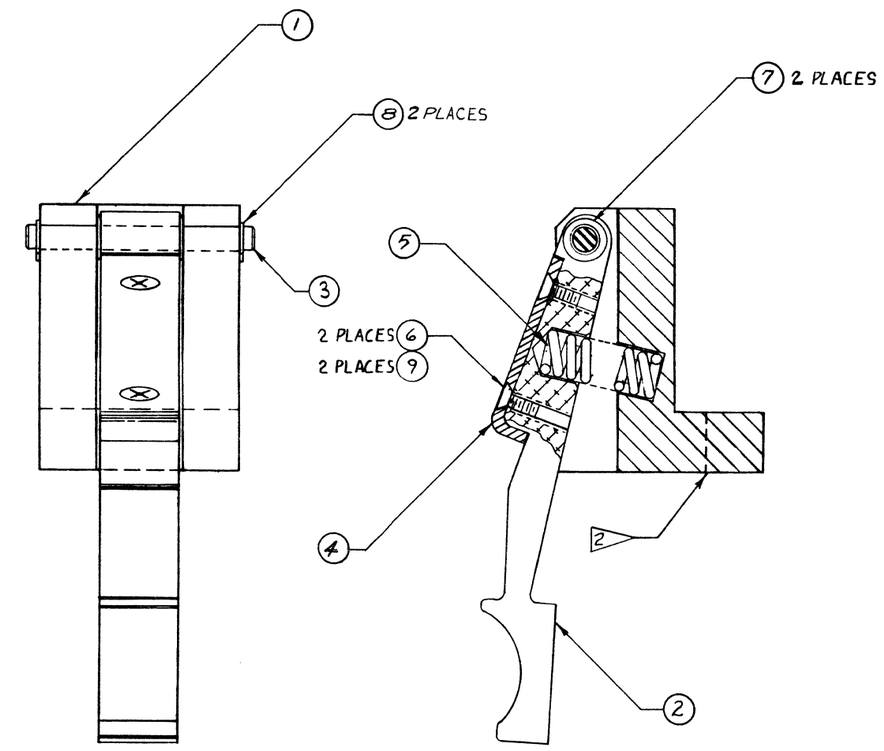
SCHEMATIC REFERENCE

NOTES:

1. ASSY. NO. IS 1250110-01.
2. MARK ASSY NO. APPROX WHERE SHOWN PER MIL-STD-130.

LIST OF MATERIALS 1250110						
ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
1	132-209		Lampholder, miniature, bayonet	1		
2	169-988		Body, rect, recp, connector, 3 pin	1		
3	169-993		Contact, hermaphrodite	2		
4	600-090		Sleeving, plastic, shrinkable (.19 i.d., blk)	a/r		

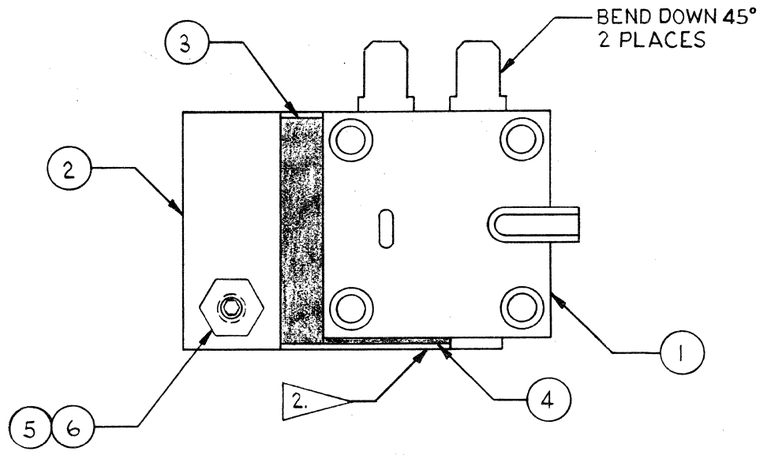
TRANSPORT LATCH ASSEMBLY 1248648 -01B



NOTES:

1. ASSEMBLY NUMBER IS 1248648-01.
2. MARK ASSEMBLY APPROXIMATELY WHERE SHOWN, PER MIL-STD-130.

LIST OF MATERIALS 1248648						
ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
1	1247256-01		Housing, latch	1		
2	1247482-01		Latch	1		
3	1247253-01		Pin, latch	1		
4	1248644-01		Striker plate	1		
5	352-196		Spring, compression	1		
6	471-326		Screw, mach, x rec 4-40 x 1 4 lg	2		
7	501-038		Washer, plain, .19 i.d. x .31 o.d. x .02 thk al	2		
8	430-003		Retaining ring	2		
9	018-030		Adhesive, thread-locking loctite grade C	a/r		

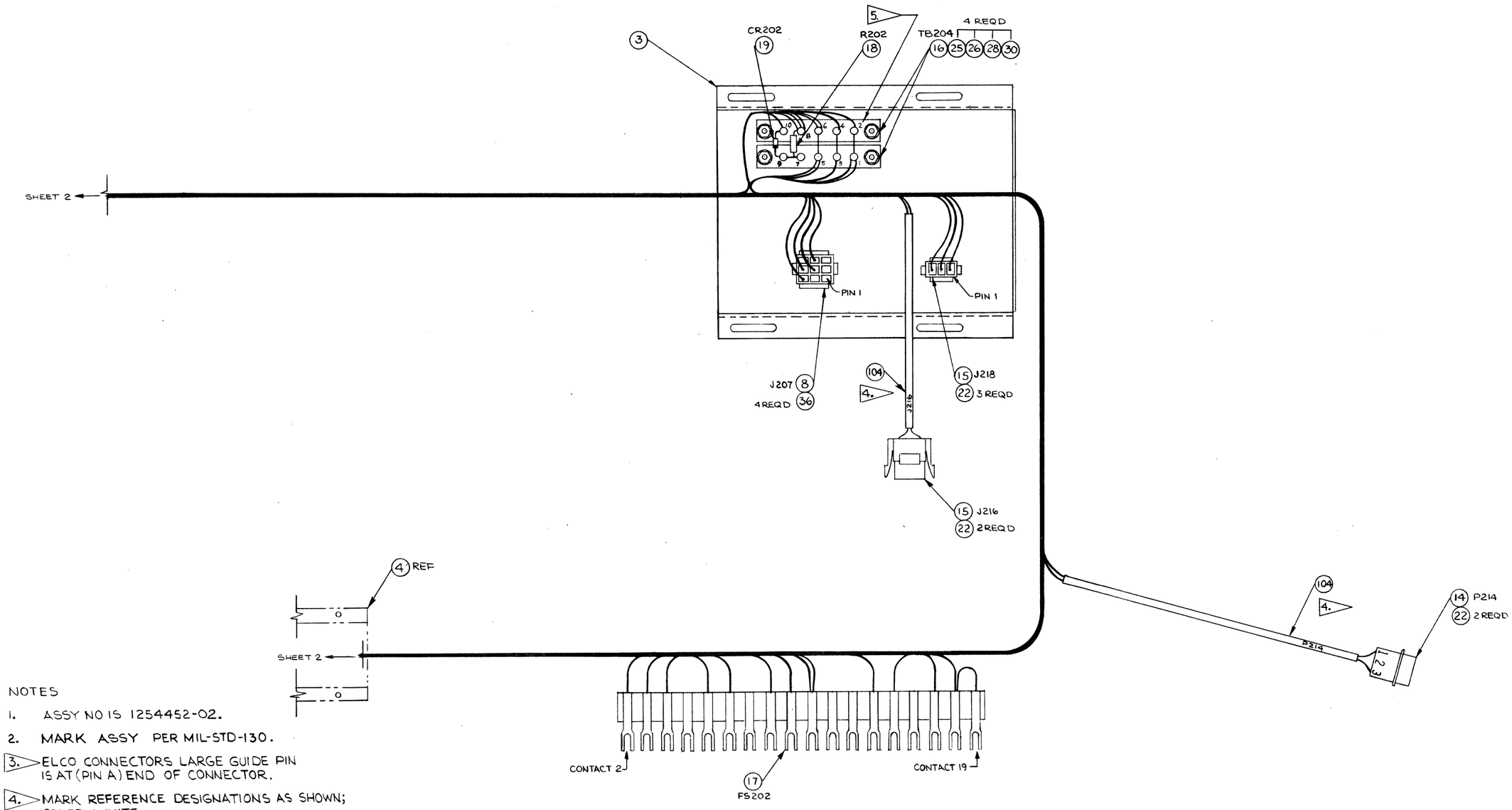


NOTES:

1. ASSY NO. IS 1252298-01.
2. MARK ASSY NO. APPROX WHERE SHOWN PER MIL-STD-130.

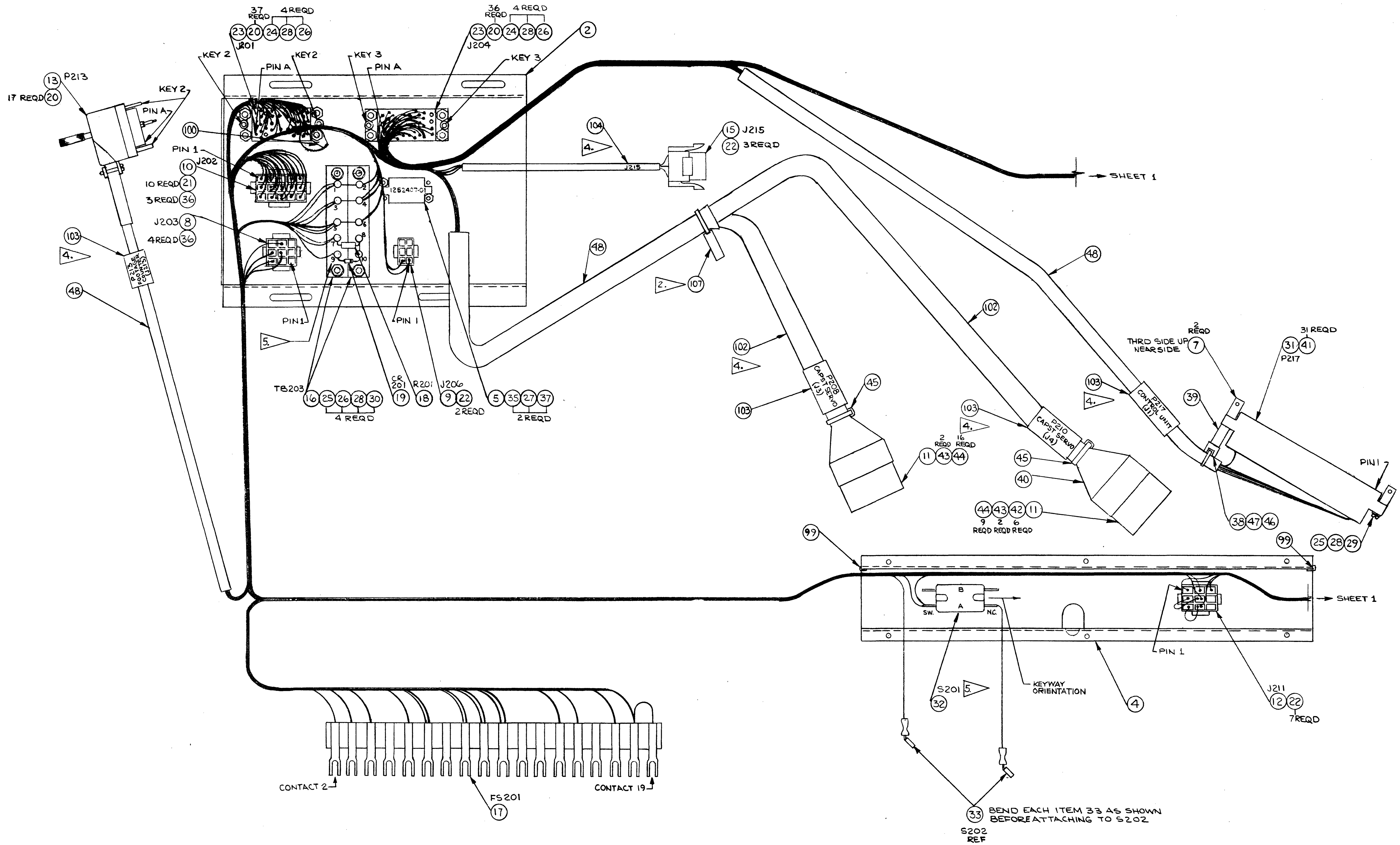
LIST OF MATERIALS 1252298

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
1	1252295-01		Switch, modified	1		
2	1252296-01		Valve, vacuum switch	1		
3	1252297-01		Pad, neoprene	1		
4	1252297-02		Pad, neoprene	1		
5	477-526		Screw, set, hex soc #6-32 x .44 lg	1		
6	492-034		Nut, plain, hex #6	1		



NOTES

1. ASSY NO IS 1254452-02.
2. MARK ASSY PER MIL-STD-130.
3. ELCO CONNECTORS LARGE GUIDE PIN IS AT (PIN A) END OF CONNECTOR.
4. MARK REFERENCE DESIGNATIONS AS SHOWN; COLOR, WHITE.
5. TERMINAL DESIGNATIONS SHOWN FOR REFERENCE ONLY.



37 REQD 4 REQD
J201
36 REQD 4 REQD
J204
KEY 2
PIN A
KEY 2
KEY 3
PIN A
KEY 3
P213
17 REQD
KEY 2
PIN A
PIN 1
J202
10 REQD
3 REQD
J203
4 REQD
1252407-01
J215
3 REQD
SHEET 1
4.
2.
5.
PIN 1
PIN 1
TB203
4 REQD
CR 201
R201
J206
2 REQD
2 REQD
P213 FOOTAGE COUNTER (J17)
P208 CAPST SERVO (J3)
P210 CAPST SERVO (J4)
P217 CONTROL UNIT (J1)
2 REQD 16 REQD
9 REQD 2 REQD 6 REQD
THRD SIDE UP NEARSIDE
2 REQD
31 REQD
P217
PIN 1
SHEET 1
SW.
N.C.
PIN 1
S201
KEYWAY ORIENTATION
J211
7 REQD
CONTACT 2
CONTACT 19
FS201
BEND EACH ITEM 33 AS SHOWN BEFORE ATTACHING TO S202
S202 REF

LIST OF MATERIALS 1254452E

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -02		
1	1254523		Schematic	Rev C		
2	1254570-01		Housing, upper reel motor	1		
3	1254571-01		Housing, lower reel motor	1		
4	1254450-01		Housing, capstan connector	1		
5	1252407-01		Plate, cover	1		
7	1253333-01		Support, connector	2		
8	169-437	J203,207	Connector body, 9 soc, rect, recp	2		
9	169-999	J206	Connector body, rect, recp, 6 pos	1		
10	169-595	J202	Connector body, rect, recp, 15 pos	1		
11	167-026	P208,210	Connector, rect, plug, 24 contacts	2		
12	169-145	J211	Connector body, 9 contact, rect, recp	1		
13	169-971	P213	Connector body, rect, recp, 20 pos	1		
14	169-988	P214	Connector body, rect, recp, 3 pin	1		
15	169-987	J215,216,218	Connector body, rect, recp, 3 pos	3		
16	180-772	TB203,204	Terminal board, 1 sect, 5 term	4		
17	180-773	FS201,202	Terminal strip, fanning 18 term	2		
18	041-421	R201,202	Resistor, comp, 22Ω, 1/2W, 5%	2		
19	013-678	CR201,202	Diode, silicon, (CD451)	2		
20	169-872		Connector, contact, hermaphrodite	96		
21	166-807		Connector, contact, soc, 14-20 AWG	10		
22	169-993		Connector, contact, hermaphrodite, 18-22 AWG	20		
23	166-046	J201,204	Connector body, rect, plug, 36 pos	2		
24	470-012		Screw, cap, hex soc, #4-40 x 1/2 lg	8		
25	471-064		Screw, mach, xrec, pan hd, #4-40 x 1/2 lg	9		
26	496-004		Nut, assembled washer, #4-40	16		
27	492-466		Nut, plain, hex, #2-56	2		
28	501-008		Washer, plain, #4	17		
29	502-002		Washer, spring lock, #4	1		
30	503-997		Spacer, unthd, plain nylon	8		
31	139-062	P217	Connector, pc, rect, 22 dual contact	1		
32	119-206	S201	Switch, toggle dpst	1		
33	187-046		Terminal	2		
34	471-062		Screw, pan head, #4-40 x 3/8 lg	1		
35	472-453		Screw, pan hd, #2-56 x 5/16 lg	2		
36	166-506		Connector, contact, soc, #18-22 AWG	11		
37	502-001		Washer, lock, spring #2	2		
38	472-121		Screw, mach, flat hd, #4-40 x 0.875 lg	1		
39	280-006		Spacer, unthd, plain, 0.25 o-d, 0.140 i-d, 0.38 lg	1		
40	167-200		Connector hood	2		
41	165-178		Connector contact, 24-26 AWG	31		
42	166-225		Connector contact, soc, 16-18 AWG	6		
43	166-199		Connector contact, soc, 20-22 AWG	4		
44	166-224		Connector contact, soc, 24-26 AWG	25		
45	302-388		Strap, cable	2		
46	302-335		Strap, cable	1		
47	302-344		Strap, mtg plate	1		

LIST OF MATERIALS 1254452E

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -02		
48	600-057		Sleeving, flex, blk, 0.500 i-d	a/r		
49	611-209		Wire, strd, ins, 24 AWG, brn	a/r		
50	611-268		Wire, strd, ins, 24 AWG, red	a/r		
51	611-429		Wire, strd, ins, 24 AWG, orn	a/r		
52	611-348		Wire, strd, ins, 24 AWG, yel	a/r		
53	611-428		Wire, strd, ins, 24 AWG, grn	a/r		
54	611-347		Wire, strd, ins, 24 AWG, blu	a/r		
55	611-503		Wire, strd, ins, 24 AWG, vio	a/r		
56	611-210		Wire, strd, ins, 24 AWG, gry	a/r		
57	611-427		Wire, strd, ins, 24 AWG, wht	a/r		
58	614-846		Wire, strd, ins, 24 AWG, wht/blk	a/r		
59	614-847		Wire, strd, ins, 24 AWG, wht/brn	a/r		
60	614-848		Wire, strd, ins, 24 AWG, wht/red	a/r		
61	614-849		Wire, strd, ins, 24 AWG, wht/orn	a/r		
62	614-874		Wire, strd, ins, 24 AWG, wht/yel	a/r		
63	611-504		Wire, strd, ins, 24 AWG, wht/grn	a/r		
64	614-875		Wire, strd, ins, 24 AWG, wht/blu	a/r		
65	614-876		Wire, strd, ins, 24 AWG, wht/vio	a/r		
66	614-877		Wire, strd, ins, 24 AWG, wht/gry	a/r		
67	614-850		Wire, strd, ins, 24 AWG, wht/blk/red	a/r		
68	611-533		Wire, strd, ins, 24 AWG, wht/blk/vio	a/r		
69	611-351		Wire, strd, ins, 24 AWG, wht/brn/red	a/r		
70	611-258		Wire, strd, ins, 24 AWG, wht/brn/yel	a/r		
71	611-212		Wire, strd, ins, 24 AWG, wht/brn/blu	a/r		
72	611-460		Wire, strd, ins, 24 AWG, wht/yel/red	a/r		
73	611-376		Wire, strd, ins, 24 AWG, wht/grn/blk	a/r		
74	611-256		Wire, strd, ins, 20 AWG, blk	a/r		
75	617-050		Wire, strd, ins, 20 AWG, red	a/r		
76	617-053		Wire, strd, ins, 20 AWG, grn	a/r		
77	617-057		Wire, strd, ins, 20 AWG, wht/brn	a/r		
78	617-064		Wire, strd, ins, 20 AWG, wht/gry	a/r		
79	611-225		Wire, strd, ins, 18 AWG, blk	a/r		
80	611-226		Wire, strd, ins, 18 AWG, red	a/r		
81	611-550		Wire, strd, ins, 18 AWG, yel	a/r		
82	611-538		Wire, strd, ins, 18 AWG, grn	a/r		
83	614-942		Wire, strd, ins, 18 AWG, wht/vio	a/r		
84	611-555		Wire, strd, ins, 18 AWG, wht/gry	a/r		
85	611-363		Wire, strd, ins, 14 AWG, red	a/r		
86	611-160		Wire, strd, ins, 14 AWG, wht	a/r		
87	611-365		Wire, strd, ins, 14 AWG, wht/blk	a/r		
88	611-513		Wire, strd, ins, 14 AWG, wht/orn	a/r		
89	611-366		Wire, strd, ins, 14 AWG, wht/vio	a/r		
90	611-161		Wire, strd, ins, 14 AWG, wht/gry/blk	a/r		
91	613-050		Wire, shld, ins, 26 AWG, wht/grn/blk	a/r		
92	613-045		Wire, shld, ins, 26 AWG, wht/grn/grn	a/r		
93	613-044		Wire, shld, ins, 26 AWG, wht/grn/blu	a/r		

LIST OF MATERIALS 1254452E

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -02		
94	613-047		Wire, shld, ins, 26 AWG, wht/grn/orn	a/r		
95	613-046		Wire, shld, ins, 26 AWG, wht/grn/yel	a/r		
96	615-012		Wire, bare, solid, 20 AWG	a/r		
97	600-161		Sleeving, Teflon, flexible	a/r		
98	615-004		Wire, bare, solid, 24 AWG	a/r		
99	260-052		Grommet, nylon, caterpillar	a/r		
100	172-004		Terminal lug, solder	1		
101	166-406		Key, polarizing	1		
102	600-043		Sleeving, flex, blk, 0.33 i-d	a/r		
103	600-257		Sleeving, shrink, blk, 0.50 i-d	a/r		
104	600-025		Sleeving, flex, blk, 0.106 i-d	a/r		
105	600-256		Sleeving, shrink, blk, 0.375 i-d	a/r		
106	611-537		Wire, strd, ins, 18 AWG, blu	a/r		
107	302-205		Strap, cable identification	1		
			Item not used: 6			

WIRE LEAD LIST 1254452E

WIRE NO.	AWG/ COLOR	FROM REF DES	FROM TERM	TO REF DES	TO TERM	REMARKS	LM ITEM NO. -02
1	24/1	J201	A	FS201	7	AIR-12	49
2	24/1	FS201	7	FS202	7		49
3	26/950	J201	B	P210	2	Tape signal	91
4	Shield		C	P210	6	Shield	91
5	24/4		D	J211	1	Upper vacuum lamp	52
6	24/94		E	J211	3	Lower vacuum lamp	62
9	24/8	J201	J	J203	5	Supply brake sw (use item 36 at J203)	56
10	24/942	J203	6	J207	5	Supply brake sw, take-up brake sw (use item 36 both ends)	72
11	24/9	J201	K	J207	6	Take-up brake sw, (use item 36 at J207)	57
12	24/90		L	P210	1	Tape logic cmd out	58
13	24/91		M	J213	K	Rec command +12V	59
14	24/92		N	P208	14	Fast cmd	60
15	24/98		H	J213	U	Shuttle command	66
16	20/0	J201	R	TB203	3-4	Gnd	74
17	20/0	TB203	3-4	P213	F		
18	20/0	TB203	3-4	FS201	10		
19	20/0	FS201	10	FS202	10		
20	20/0	TB203	3-4	J202	15	(Use item 36 at J202)	
21	20/0	TB203	3-4	TB204	3-4		
22	20/0	TB204	3-4	J218	2	Gnd	74
23	20/2	J201	S	TB203	1-2	+12 volts	75
24	24/2	TB203	1-2	P213	E		50
25	24/2	TB203	1-2	FS201	9		
26	24/2	FS201	9	FS202	9		
27	24/2	TB203	1-2	J215	1	Upper eot lamp	
28	24/2	TB203	1-2	TB204	1-2		
29	24/2	TB204	1-2	J216	1	Lower eot lamp	
30	24/2	TB204	1-2	J218	1	+12 volts Voice monitor	50
31	20/5	J201	T	TB203	5-6	-12 volts	76
32	24/5	TB203	5-6	P213	H	Common with wire #88	53
33	24/5	TB203	5-6	FS201	11		
34	24/5	FS201	11	FS202	11		
35	24/5	FS202	11	S201-A	Swing	Common with wire 134 1" - 1/2" switch	
36	24/5	TB203	5-6	J211	2	Vacuum lamps	
37	24/5	TB203	5-6	J215	3	Upper eot lamp	
38	24/5	TB203	5-6	TB204	5-6		
39	24/5	TB204	5-6	J216	3	Lower eot lamp	
40	24/5	TB204	5-6	J218	3	Voice monitor	
41	24/5	TB204	5-6	P214	3	-12 volts Lower eot cell	53
42	24/950	J201	U	P213	L	Rev memory in (shuttle sw)	73
43	24/912		V	P213	B	Upper eot cell	69
44	24/914		W	P213	C	Sequential cell	70
45	24/907		X	P214	1	Lower eot cell	68
46	24/93		Y	P213	M		61
47	24/93	J201	Y	P210	10	Rev memory	61

WIRE LEAD LIST 1254452E

WIRE NO.	AWG/ COLOR	FROM REF DES	FROM TERM	TO REF DES	TO TERM	REMARKS	LM ITEM NO. -02
48	24/94	J201	AA	P210	12	Run cmd	62
50	18/2		DD	P210	24	Capstan servo +12V	80
51	18/0		EE	P210	20	Capstan servo ±12V com	79
52	18/6		FF	P210	16	Capstan servo -12V	106
53	24/96		HH	J213	N	Output A (Fwd)	64
54	24/92		JJ	J213	P	Output B (Rev)	60
55	24/91		KK	P208	4	FM squelch	58
56	26/953		LL	P208	22	Ext. ref freq in	94
57	Shield		MM	P208	19	Shield	94
58	24/902		Z	P208	16	Reversing relay	67
59	18/5		NN	P210	23	Capstan servo +5V	82
60	24/90		PP	P210	4	Fwd memory	58
61	18/4		RR	P210	22	Capstan servo, +5V com	81
62	24/95		SS	P208	8	Tape cmd	63
63	18/0	J201	TT	Chassis	Grd	Overall shield	79
64	14/2	J202	1	FS201	2	+14 (Use Item 21 at J202) } Supply Reel Servo	85
65	14/90		2	FS201	3	Gnd Twisted (Use item 21 at J202) } Supply Reel Servo	87
66	14/9		3	FS201	4	-14 (Use item 21 at J202) } Supply Reel Servo	86
67	14/93		4	FS202	2	+14 (Use item 21 at J202) } Take-up Reel Servo	88
68	14/97		5	FS202	3	Gnd Twisted (Use item 21 at J202) } Take-up Reel Servo	89
69	14/980		6	FS202	4	-14 (Use item 21 at J202) } Take-up Reel Servo	90
70	20/91	J202	7	TB203	9	Supply (Use item 21 at J202) Brake solenoid return	77
71	20/91	TB203	9	J203	8	Supply (Use item 56 at J203)	
72	20/91	J202	7	TB204	10	Take-up (Use item 21 at J202)	
73	20/91	TB204	10	J207	8	Take-up (Use item 36 at J207) Brake solenoid return	77
74	20/98	J202	8	TB203	7	Solenoid +24V (Use item 21 at J202)	78
75	20/98	TB203	7	J203	7	Solenoid +24V (Use item 36 at J203) Supply Brake	
76	20/98	J202	8	TB204	8	Solenoid +24V (Use item 21 at J202) Take-up brake	
77	20/98	TB204	8	J207	7	Solenoid +24V (Use item 36 at J207) Take-up brake	78
78	24/97	J202	13	FS201	14	Supply motor line (booster) (Use item 36 at J202)	65
79	24/4	J202	14	FS202	14	Take-up motor line (booster) (Use item 36 at J202)	52
80	24/Bare	TB204	7	TB204	9		98
81	20/Bare	TB203	1	TB203	2		96
82	20/Bare	TB203	3	TB203	4		
83	20/Bare	TB203	5	TB203	6		
84	20/Bare	TB204	1	TB204	2		
85	20/Bare	TB204	3	TB204	4		
86	20/Bare	TB204	5	TB204	6		96
87	24/Bare	TB203	8	TB203	10		98
88	24/5	P213	H	P213	A	Common with wire #32	53
89	24/916	S201-A	N.C.	FS201	17	1" position	71

WIRE LEAD LIST 1254452E

WIRE NO.	AWG/ COLOR	FROM REF DES	FROM TERM	TO REF DES	TO TERM	REMARKS	LM ITEM NO. -02
90	24/95	S201-A	N.C.	FS202	17	1" position	63
91	26/954	P210	13	P213	W	Footage count	95
92	Shield	P210	9	P213	T	Shield	95
93	26/955	J211	4	FS201	19	Supply photocell +	92
94	Shield 955	J211	5	FS201	18	Supply photocell -	92
95	26/956	J211	7	FS202	19	Take-up photocell +	95
96	Shield	J211	8	FS202	18	Take-up photocell -	95
97	24/1	J204	A	P217	30	Local control	49
98	2		B		32		50
99	3		C		34		51
100	4		D		36		52
101	5		E		38		53
102	6		F		40		54
103	7		H		42		55
104	8		J		44		56
105	9		K		37		57
106	90		L		20		58
107	91		M		18		59
108	92		N		26		60
109	93		P	P217	22		61
110	96		T	J213	S		64
111	95		S	P217	10		63
112	96		T		3		64
113	97		U		2		65
114	98		V		33		66
115	1		W		12		49
116	2		X		24		50
117	3		Y		28		51
118	4		Z		23		52
119	5		AA		6		53
120	6		BB		14		54
121	7		CC		4		55
122	8		DD		35		56
124	90		FF		16		58
125	91		HH		5		59
127	93		KK		39		61
128	94		LL		41		62
129	95		MM		43		63
130	24/96		NN	P217	1	Local control	64
131	18/97		PP	P213	D	+8V unregulated (foot. coun.)	83
132	18/98		RR	P213	X	Unregulated common	84
133	24/9	J204	EE	S202	A	Air switch (-12 out)	57
134	24/5	S201-A	Swing	S202	B	Air switch (-12 in) Common with wire 35	53
135	26/950	J204	R	J213	V	Footage count out	91
136	Shield	J204	JJ	J213	T	Shield	91
137	24/96	J204	T	J213	S	Local enable	64

WIRE LEAD LIST 1254452E

WIRE NO.	AWG/ COLOR	FROM		TO		REMARKS	LM ITEM NO.		
		REF DES	TERM	REF DES	TERM		-02		
138	24/92	J204	SS	P208	20	Ext. ref. cmd	60		
139	18/0		TT	Chassis	Gnd		79		
140	24/1		A	P208	5	1-7/8 / 15/16 ips	49		
141	2		B		9	3-3/4 / 1-7/8 ips	50		
142	3		C		2	7-1/2 / 3-3/4 ips	51		
143	4		D		10	15 / 7-1/2 ips	52		
144	5		E		1	30 / 15 ips	53		
145	6		F		13	60 / 30 ips	54		
146	7		H		3	120 / 60 ips	55		
147	8		J	P208	17	240 ips	56		
148	1		W	J206	1		49		
149	6		BB	J206	2		62		
150	94	J204	LL	P208	24	Sync light	63		
151	2	FS-201	6	P210	3	Supply inhibit A	50		
152	3	FS-201	15		11	Supply inhibit B	51		
153	95	FS-202	6		7	Take-up inhibit A	63		
154	92	FS-202	15	P210	8	Take-up inhibit B	60		
155	97	J201	CC	J213	J	Limit set	65		
156	24/96		P	J213	R	Zero set	64		
157	26/955		F	P210	13	Tach sig logic	92		
	Shield		C	P210	9	Shield	92		
158	26/956		BB	P208	18	C. T. ref in	93		
	Shield	J201	MM	P208	21	Shield	93		
159	20/5	J202	11	P210	5	Tape signal cmd	76		
160	24/96	J202	12	P208	23	Sync cmd	64		
						Wires not used: 7, 8, 49, 123, 126			

SECTION 3
CONTROL LOGIC

SECTION 3

CONTROL LOGIC

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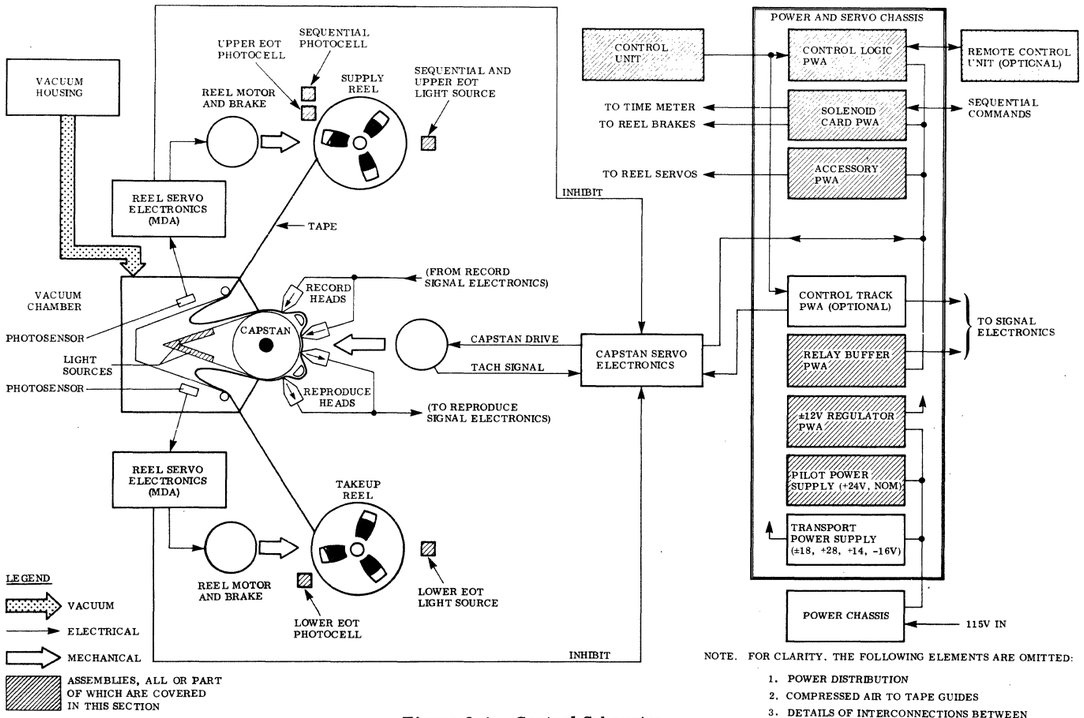


Figure 3-1. Control Subsystem

GENERAL

This section describes the subsystem that controls the functions and indicates the status of the FR-3000. See Figure 3-1. The functions controlled are:

a. Power turnon and turnoff

b. Mode control
   1. Stop/ready
   2. Forward (reproduce)
   3. Reverse (reproduce)
   4. Record and Record Test
   5. Fast (wind or rewind)

c. Automatic and semiautomatic commands
   1. End-of-tape (eot)
   2. Broken tape and power loss
   3. Vacuum chamber lamps out
   4. Reel brakes/booster
   5. Heads elapsed time meter
   6. Remote indicator
   7. Search control
   8. Shuttle control
   9. Sequential control

d. Tape speed selection

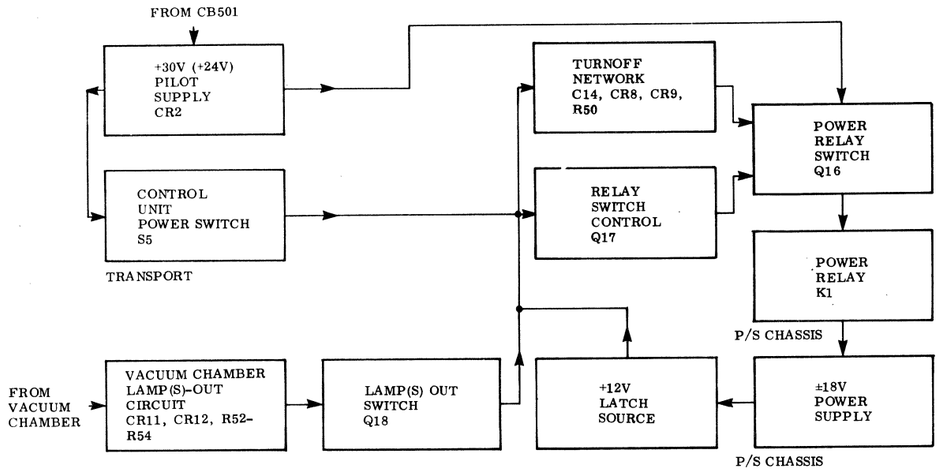
e. Tape/Tach (described in Section 5)

The subassemblies involved, their physical locations, plus the locations of applicable schematics in the manual, are given in Table 3-1. The engineering drawings in this section, referred to in several descriptions, are placed at the end of the section to make them more easily accessible regardless of which description they are being used with.

Table 3-1. Control Subsystem Components and Schematics

ASSEMBLY NAME	FUNCTIONS SERVED	SCHEMATIC, PAGE NO.	EQUIPMENT LOCATION
Accessory pwa* (P102)	Includes logic circuits for secondary and automatic functions plus fast, record, and power-failure switching.	TW1254733, p. 3-24	Plugs into the power and servo chassis, J102
Control logic pwa (P101)	Includes the logic circuits for major mode control and some of the automatic control functions.	TW1248008, p. 3-20	Plugs into the power and servo chassis, J101
Control unit	Includes the switches and indicators to perform manual control and mode-status indication for the transport	1254494 p. 3-17	Mounted in an opening in the righthand side of the baseplate (seen from front)
Power chassis	Includes circuit breaker CB501 which controls main power to the transport.	On assembly dwg. 1254747, p. 7-28	Mounted in lower front of the rack assembly
Power and servo chassis	Mounts the plug-in pwa's involved in the control functions, plus elements of the pilot and transport power supplies and the LOCAL/REMOTE, SEQUENTIAL, REC TEST, and SYNC (TAPE/TACH) switches.	1254487, p. 7-4	Mounted in the upper left-hand side of the cabinet, behind the transport mechanism
±12V Regulator pwa (P104)	Provides ±12V and +5V regulated power for operation of the logic circuits; includes circuits that control transport power through a pilot power supply, and circuits that defeat transport power when vacuum chamber lamps are out.	TW1252048, p. 6-4	Plugs into the power and servo chassis, J104; parts of the pilot power supply are permanently mounted on the power and servo chassis.
Relay buffer pwa (P106)	Includes relays used in speed selection; buffers control signals between the transport and the signal electronics	1254428, p. 3-15	Plugs into the power and servo chassis, J106
Solenoid pwa (P105)	Includes circuits that control the reel brakes and the head-time meter.	1254448, p. 3-26	Plugs into the power and servo chassis, J105
Tape transport	Includes end-of-tape (eot) and sequential lampholders and photosense assemblies which determine time for eot stop or sequential start; also vacuum chamber lamps which defeat transport power when too many are out.	1254523, p. 7-2	Mounted in the top front of the cabinet.
Transport cabling	Includes all cabling required for interconnection of the elements of the tape transport.	Figure 7-1 p. 7-1	Routed as required throughout the cabinet

*printed wiring assembly



NOTES:
1. NOTATIONS BELOW BLOCKS INDICATE LOCATIONS OF COMPONENTS
2. ALL BLOCKS NOT IDENTIFIED AS IN NOTE 1 ARE PARTS OF THE ±12V REGULATOR (P104) PWA PLUGGED INTO THE POWER AND SERVO (P/S) CHASSIS.

Figure 3-2. Transport Power On/Off Simplified Block Diagram

POWER CONTROL

Power control is described in the following paragraphs in terms of power-on/off states, and in later paragraphs of this section in terms of power-loss states. Details of power supply and regulation are given in Section 6. Details of power distribution are given in Section 6 and Section 7 (cabling).

MAIN POWER

Main power control is performed by circuit breaker CB501 of the power chassis assembly. This circuit breaker is accessible on the panel of the power chassis assembly at the bottom front of the cabinet. When this circuit breaker is in the OFF position, the transport is deenergized except for the power input wiring from connector J502 at the back of the cabinet to the circuit breaker.

When CB501 is switched to the ON position, power is applied to J501, which is the receptacle for P501 of the power and servo chassis power cable. In addition, power is applied to two dual utility outlets, one on the front and one on the back of the power chassis. The ac outlet strip located on the side of the cabinet (inside) just under the air compressor assembly, is normally plugged into one receptacle of the rear utility outlet. The cabinet fan and some signal electronics assemblies are powered from this outlet strip.

Within the power and servo chassis, ac power is supplied to the assembly cooling fan, and to the primary of the pilot power supply transformer T2. (See Section 7 for interconnect drawings showing the power and servo chassis components, etc.) The pilot power supply supplies +30V to the POWER pushbutton on the control unit.

Until the POWER pushbutton is pressed, the transport remains in this main-power-on state, and is not operable.

TRANSPORT POWER

The control unit POWER pushbutton activates an electronic latching circuit contained on the ±12V regulator printed wiring assembly (pwa) in the power and servo chassis.

This circuit is an alternate-action configuration so that each successive pulse changes the state of the latch. When power is removed from the power and servo chassis, the latch automatically drops out. This means that the transport power is off whenever main power is newly applied to the transport. When transport power is switched on, power relay K1 of the power and servo chassis is energized. This applies power to the transport power supply (which is also part of the power and servo chassis). Dc supplies powered by this transformer provide power to the control and servo circuits of the transport. The relay also applies ac power to the vacuum housing assembly via J2, and to the air compressor assembly via J1.

BLOCK DIAGRAM DESCRIPTION. Refer to Figure 3-2. When the +30V pilot power supply is energized (CB1 is turned on), the +30V is applied to the POWER pushbutton switch on the control unit. When the switch is pressed, a positive voltage is applied to the base of relay switch control transistor Q17 of the ±12V regulator pwa in the power and servo chassis. This voltage turns Q17 on, and Q17 acts to turn on power relay switch transistor Q16, which connects the output of the pilot power supply to power relay K1 of the power and servo chassis. (This loading drops the pilot voltage to approximately +24V.)

Relay K1, in turn, applies power to the main transport power supply (±18V). The ±18V is applied to the circuits of the ±12V regulator pwa. The +12V regulator supplies latching current to the base of Q17, and transport power is latched on.

If one or more vacuum chamber lamps are out (depending on circuit conditions, the transport may operate with one lamp out), the condition is detected by lamps-out circuits which turn on a lamps-out switching transistor (Q18). Q18 acts to defeat the latching current to the base of Q17, and transport power cannot latch on.

When the POWER pushbutton is pressed while the transport power is latched on, the voltage has no further effect on the base of Q17, but is applied to a turnoff network which applies a positive voltage to the base of Q16, turning it off, and thus deenergizing the power relay.

TRANSPORT POWER -- SCHEMATIC DETAILS. Refer to Figure 3-3, and to schematic 1254487 in Section 7. When the POWER pushbutton is pressed, +30V is applied through contacts on the pushbutton switch and the applicable interconnects to the junction of R50, R48, CR4, and C14. The voltage is applied through CR4, C11, and R43 to the base of Q17, turning it on. When Q17 turns on, a negative turn-on potential (ground) is applied to the base of Q16. The conduction of Q16 allows the +30V from the pilot supply to pass to relay K1 via CR10, Q16 and pin 16 of J104. (The voltage drops to approximately +24.)

When relay K1 is energized, its contacts apply ac primary input voltage to power supply transformer T1 of the power and servo chassis. This activates the dual 18V section of the power supply. The positive and negative outputs of this power supply are applied to the ±12V regulator circuits. The +12V is applied through R40 and R39 to the base of Q17, latching Q17 on.

If too many of the six lamps in either side of the vacuum chamber are out, negative lamp voltage no longer holds CR11 or CR12 off. When one of the diodes is turned on, positive voltage is applied, by R55 or R52, through R53 to the base of Q18. This turns Q18 on, causing Q17 and Q16 to shut off, thus deenergizing K1. Power to the transport is turned off.

When transport power is latched on, the voltage on the collector of Q16 maintains a charge of approximately +24V on capacitor C14, through CR8. The other side of C14 is tied to ground through R50. When the POWER pushbutton is pressed to turn power off, the +24V is applied to the negative side of C14 and raises its positive side to an effective +48V. This voltage is applied through CR9 to the base of Q16 and shuts the transistor off. This deenergizes relay K1. When K1 opens, the primary power to transformer T1 is removed and the supply to the voltage regulators is removed.

There are large filter capacitors in the outputs of the voltage regulators which would normally continue to supply power for some time. In order to cut off the latching current for transistor Q17 quickly and assure that transistor Q16 and relay K1 remain off, diode CR3 is used to provide a path to ground for the +12V supply. The cathode of diode CR3 is connected to the relay coil which is at ground potential when K1 is deenergized. This removes the latching current from Q17, keeping it off.

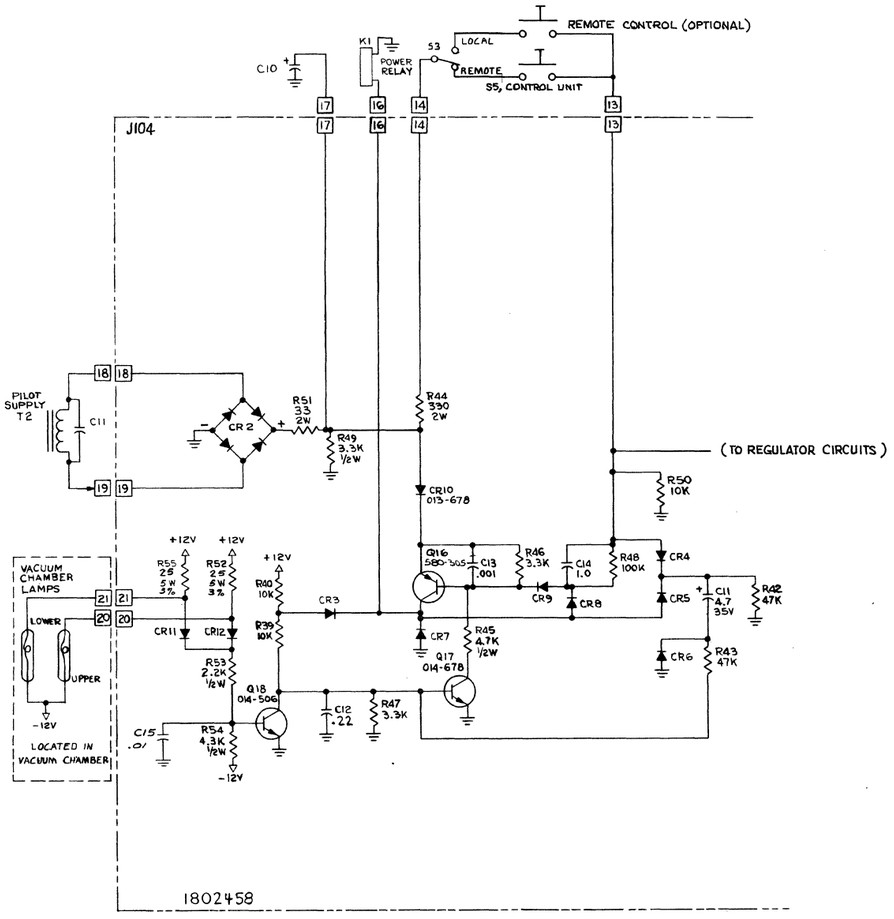


Figure 3-3. Partial Schematic of ±12V Regulator PWA (See Section 6 for Complete Schematic (TW1252048) and List of Materials).

SWITCHED -12V POWER. Negative 12V power to certain circuits on the control logic pwa is dependent on adequate vacuum being present in the vacuum chamber. This is sensed by air-switch S202 which is located at the outlet of the vacuum chamber. The current controlled by S202 (shown on transport wiring harness Schematic 1254523, Section 7) is amplified by transistor Q27 of the accessory pwa (Schematic 1254733, page 3-24), and called "pre-air -12V."

The current from Q27 is applied to the control logic pwa, pin 8 (Schematic TW1248008, page 3-20) and enables stop-lamp-driver Q47. The -12V power from Q27 is further processed on the accessory pwa by a power failure switching circuit (Q20 and Q21), and called "post-air -12V." This circuit senses the presence (or loss) of main transport power, and is described later in this section under "power loss."

Both of these switched -12V branches must be on before the control circuits go into stop/ready mode, enabling selection of other modes.

MODE CONTROL

The operating modes of the transport (stop, forward, reverse, fast forward, fast reverse, and record) are selected by the use of pushbutton switches on a control unit (local or remote). They are put into execution principally by the circuits of the control logic and accessory pwa's, which both plug into the power and servo chassis.

When a mode is selected, it is electronically latched on. In order to return to a stopped (standby) condition, this latch must be defeated. The basic (simplified) latch and stop circuits are shown in Figure 3-4. A mode switch transistor is pulsed on when a mode command (positive pulse) is applied to its base. This then turns on a latch transistor which applies a latching current to the base of the mode switch transistor. The turning on of the mode switch transistor also energizes other circuits which perform actual mode activation (described in following paragraphs). As can be seen from the foregoing, the mode-switch and latch transistors form a simple reset-set (rs) flip-flop which is set by the mode-command pulse.

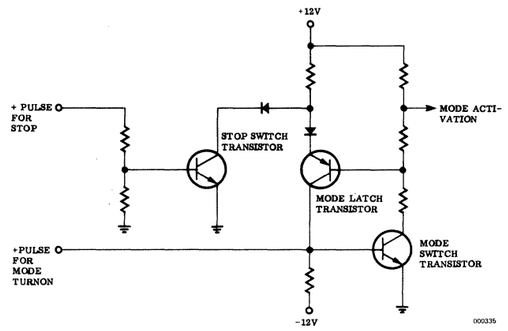


Figure 3-4. Simplified Schematic of Mode Latching and Stop Circuits

In order to return to the stop state, a stop switch transistor (Q8 in schematic TW1248008, page 3-20) is turned on by a positive pulse (stop command). This pulse may come from the STOP pushbutton (which gets voltage from the pilot power supply, previously described), or from one of the automatic circuits described farther on in this section.

When the stop command pulse is applied, it turns on the stop switch transistor which grounds the positive supply to the emitter of the latch transistor. This turns off the latch, which cuts off the latching current to the mode switch transistor and allows its base to be biased off by the voltage from the -12V supply. (The flip-flop is reset.) The transport is thus returned to the stop/ready condition.

CONTROL UNIT

The control unit assembly of the FR-3000 is shown in illustrations in Section 1, and is detailed in Schematic 1254494 and the accompanying assembly drawing and list of materials in this section (pp 3-17 through 3-19).

The control unit includes the pushbutton switches and indicator lamps for operator mode control. It also includes the POWER switch, a rocker switch to enable or disable the end-of-tape (eot) logic, the tape-speed selection switches covered later in this section, plus indicator lamps for sequential or search operation, capstan sync, presence of a tape reference signal for the capstan servo (see Section 5), selection of remote control, and eot (lights when eot sensing is enabled.)

REMOTE CONTROL

An optional remote control unit may be cabled to connector J7 of the power and servo chassis. Control by the remote unit may be selected by use of CONTROL switch S3 of the power and servo chassis.

When a remote control unit is connected and S3 is set to the REMOTE position, the local controls are disabled and all control of the transport is from the remote unit. When S3 is in the LOCAL position, only the local controls are effective.

Detailed coverage of remote control units is given in the applicable accessories manual (Ampex 1802902).

STOP/READY MODE

The stop/ready mode is the state in which main and transport power are on, tape is normally threaded, and vacuum is sufficient to close air switch S202 at the outlet of the vacuum chamber, but no active (tape-moving) mode is in effect.

The stop lamp (inside the STOP/READY pushbutton) is controlled by stop-lamp driver Q47 of the control logic pwa (Schematic TW1248008). When pre-air -12V is on pin 8 of the control logic pwa (this is when vacuum is up), Q47 is turned on and provides a ground for the stop lamp. The other side of the lamp receives -12V from pin 4 of the control unit assembly. Inputs from the mode selection circuits turn Q47 off when the transport is in an active mode, thus turning the stop lamp out when tape is being moved. These positive inputs are applied through diodes CR48 and CR49 when either forward or reverse is commanded. (Forward or reverse must be commanded for any active mode to be enabled.)

For the transport to be ready (stop mode), post-air -12V must also be present. It is applied from the power-failure switching circuit of the accessory pwa, P102 (Schematic TW1254733, page 3-24) to pin 25 of the control logic pwa. There it turns Q48 on and CR51 off, and prevents an automatic power-failure stop command from being applied. Power failure stop is described further on in this section (see page 3-10).

The way the logic returns to the stop/ready mode when a stop command is applied during active-mode operation, is part of the mode-latch-defeating action described above under "Mode Control."

FORWARD MODE

Refer to Figure 3-5 and schematic TW1248008. Pressing the forward pushbutton (S1 of the control unit, Schematic 1254494) applies a ground to the forward pulse generator made up of R79, R80, and C20. This action turns on forward switch transistor Q17. When Q17 conducts, it turns on Q16 which provides the latch for Q17. The conduction of Q17 performs two functions:

a. It turns on Q18.

b. It deactivates reverse latch circuit Q14, Q13.

Q18 in turn performs three further functions:

a. It provides +12 volts to light the forward light on the control unit.

b. It activates forward memory circuit Q20, Q19, Q21.

c. It activates run-command circuit Q42, Q41. Both the forward latch and the forward memory circuit must be activated before a run command can be generated. The run command is applied to J4, pin 12 of the capstan servo, and starts the capstan rotating (see Section 5).

As Figure 3-5 indicates, several conditions can cancel out the forward run command:

a. Selection of reverse mode. This deactivates the forward latch, via CR26.

b. A stop command, via CR24, CR26. This deactivates the forward latch.

c. A loss of tach signal. This permits Q25 to conduct, turning on Q27 which turns on Q26 (providing the loss of signal lasts 3 seconds or more). When Q26 conducts, an inhibiting signal (ground) is fed to Q42 and Q41 and the run command is cancelled. It should also be noted that Q25 is connected to CR33 and CR34. These two diodes are used to cancel the forward or reverse memory at the point of tape and tach zero velocity during a change of direction; i.e., the crossover point between forward and reverse tape motion (the tape is at zero velocity at this moment).

Referring to schematic diagram TW1248008, the functions of the circuits affected when the forward pushbutton is pressed are as follows: Prior to the forward pushbutton being pressed, transistor Q17 is off, due to a negative potential on its base derived from the voltage divider R80, R81 and R17 connected between the +12V and -12V supplies. Pressing the forward pushbutton applies a ground to the junction of CR38, CR40, and C20. Capacitor C20 has no charge and appears as a short circuit, momentarily applying a ground to the junction of R80 and R81. These two resistors, in conjunction with R17, form a voltage divider from +12 volts to ground and apply a positive potential to the base of transistor Q17, sending it into conduction.

When Q17 conducts, it causes current to flow through R18, R56, and R57, which puts onto the base of Q16 a voltage that is negative with respect to the positive potential on its emitter (through R15 and CR26). This causes Q16 to conduct, which latches Q17 into conduction. The resulting voltage drop across R18 causes Q18 to conduct, which puts approximately +11 volts at the junction of R16, R58, and R101. This lights the forward lamp. With the collector of Q17 at ground, current flows through R11 and CR22. This puts a ground on the anode of CR23, which keeps Q13 from conducting. In this manner, the reverse logic is deactivated when the forward pushbutton is pressed.

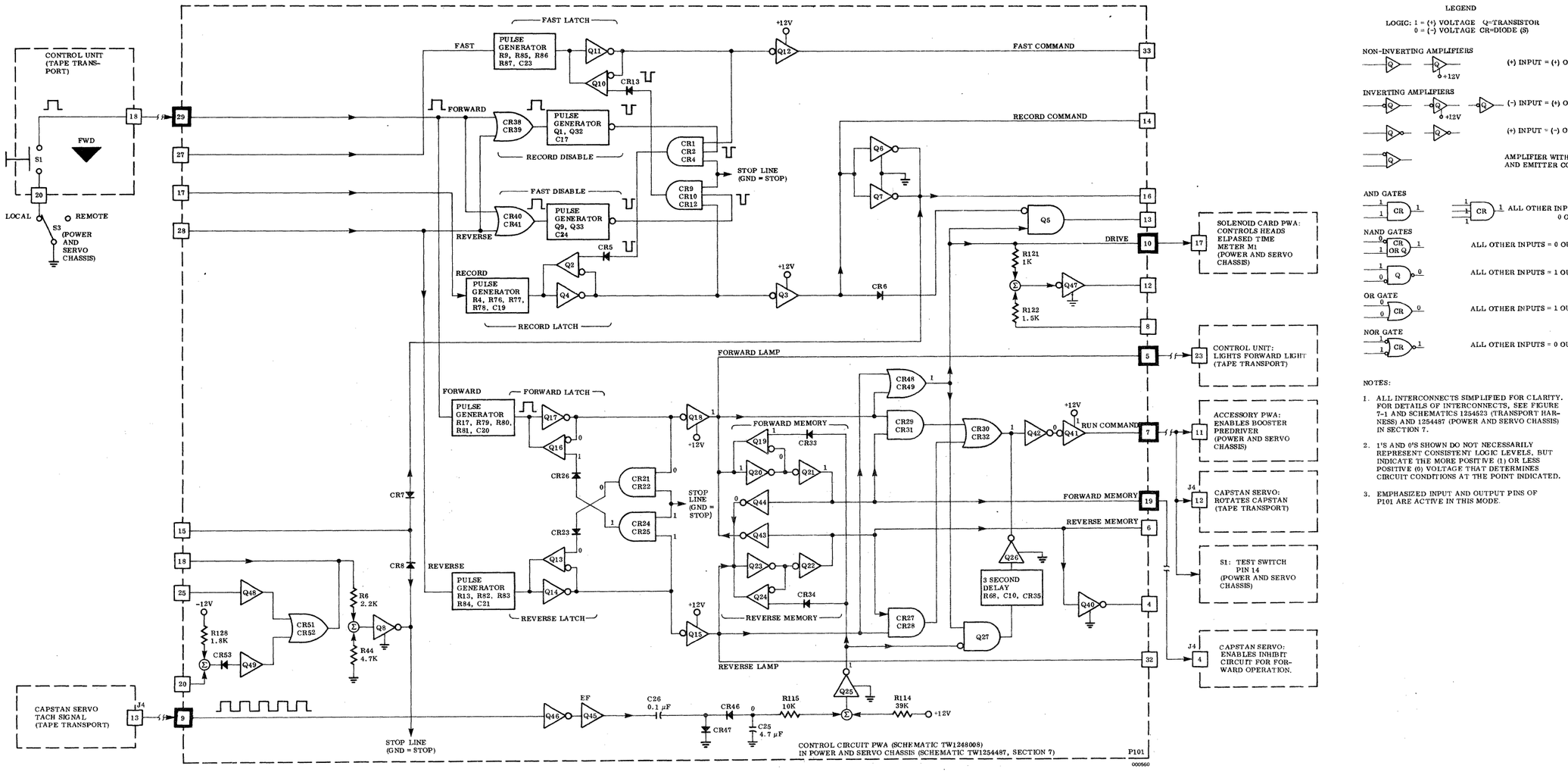
FORWARD MEMORY LOGIC. When Q18 conducts, the current through R58 and R101 places the junction of R58 and R101 at approximately +11 volts. The +11 volts is applied through R108 and R107 to the base of Q20, which conducts, causing Q19 to conduct also. When Q19 conducts, it latches Q20 into conduction. Q20 turns on Q21. When Q21 conducts, a positive potential appears at the base of Q44. Q44 conducts, placing a ground on the base of Q23, which turns it off. The reverse memory circuit is thus disabled. When Q21 conducts, the current through R61 and R62 sets the potential at the junction of R61 and R62 at +11 volts. This +11 volts is applied via pin 19 of J101 to the reverse memory inhibitor of the capstan servo circuit (schematic TW1254508, in Section 5). Additionally, the +11 volts is fed to diode CR31 which forms part of an AND gate with CR29. The output of this AND gate controls the run command. When the forward circuit and the forward memory circuit are both turned on at the same time, the run command is activated. If either one is off, there is no run command.

RUN COMMAND. In the run command, components R20, CR29 and CR31 form an AND gate. The voltage at the junction of R20,CR29, CR31 and CR32 is near ground level initially, due to the conduction of CR31 through R20 and R104. Thus when the forward latch is activated, CR29 is reverse biased. When the forward memory circuit is activated, CR31 is reverse biased. Under these conditions the junction of R20, CR29 and CR31 becomes approximately +11 volts and CR32 conducts. When this happens, the base potential of Q42 is raised to +11 volts and it conducts, turning on Q41. Q41 feeds a run command of approximately +10 volts to pin 7 of J101 which is interconnected to the capstan servo, pin Z.

TACH SIGNAL LOGIC. Refer to schematic 1248008 and Figure 3-5. When the capstan rotates after receiving the run command, a square wave signal derived from the tachometer is routed from the capstan servo pwa to pin 9 of J101. From here it is coupled through capacitor C27 to the base of Q46, where it is amplified and drives Q45. These two transistors amplify the ac component which is rectified by CR46, CR47, and C25. By this means, a negative voltage is maintained on the base of Q25, holding it in a nonconducting state.

If, for any reason, the tachometer signal is removed from the control circuit when the transport is moving tape in any mode or direction, the base of Q25 goes positive and it conducts, effectively grounding its collector. This puts zero volts on the base of Q27, making it negative with respect to its emitter which has approximately +5 volts on it. Q27 conducts, applying +5 volts to capacitor C10 via R68. (C10 was previously charged negative via CR35, R24, and R69.) It takes about 3 seconds for C10 charge to the positive level at which Q26 begins to conduct. (The 3 seconds of delay are allowed in order to make sure the tach signal has completely disappeared and that it was not just a momentary loss.) When Q26 conducts, its collector goes to 0V and Q42 is shut off. This also stops Q41 from conducting, which removes the run command from the capstan servo circuit.

The capstan stops and the tape movement ceases, but the forward latch remains on, and therefore the forward command is not removed. Although Q25 is on, and removes the positive voltage from the emitter of Q19 via CR33, the forward command on the base of Q20 via R108 and R107 keeps the forward memory enabled. If the capstan is spun after the tach-signal-loss circuit has completed its action, and this produces an adequate tach signal, Q26 is turned



NOTES:

1. ALL INTERCONNECTS SIMPLIFIED FOR CLARITY. FOR DETAILS OF INTERCONNECTS, SEE FIGURE 7-1 AND SCHEMATICS 1254523 (TRANSPORT HARNESS) AND 1254487 (POWER AND SERVO CHASSIS) IN SECTION 7.
2. 1'S AND 0'S SHOWN DO NOT NECESSARILY REPRESENT CONSISTENT LOGIC LEVELS, BUT INDICATE THE MORE POSITIVE (1) OR LESS POSITIVE (0) VOLTAGE THAT DETERMINES CIRCUIT CONDITIONS AT THE POINT INDICATED.
3. EMPHASIZED INPUT AND OUTPUT PINS OF P101 ARE ACTIVE IN THIS MODE.

Figure 3-5. Forward Mode Selection Functional Diagram

off again, and the transport resumes normal forward operation.

When a stop command is applied and cancels the forward command, and the loss of tach signal occurs, the conduction of Q25 acts to cancel the forward memory by grounding the emitter of Q19 via CR33.

DRIVE COMMAND. When Q18 conducts (forward latch activated), the +11 volts from the junction of R58 and R101 causes current flow through diode CR48 to pin 10 of J101 and onto pin 17 of the solenoid card (pwa P105). There it activates the circuits which drive the HEADS ELAPSED TIME meter on the power and servo chassis test panel.

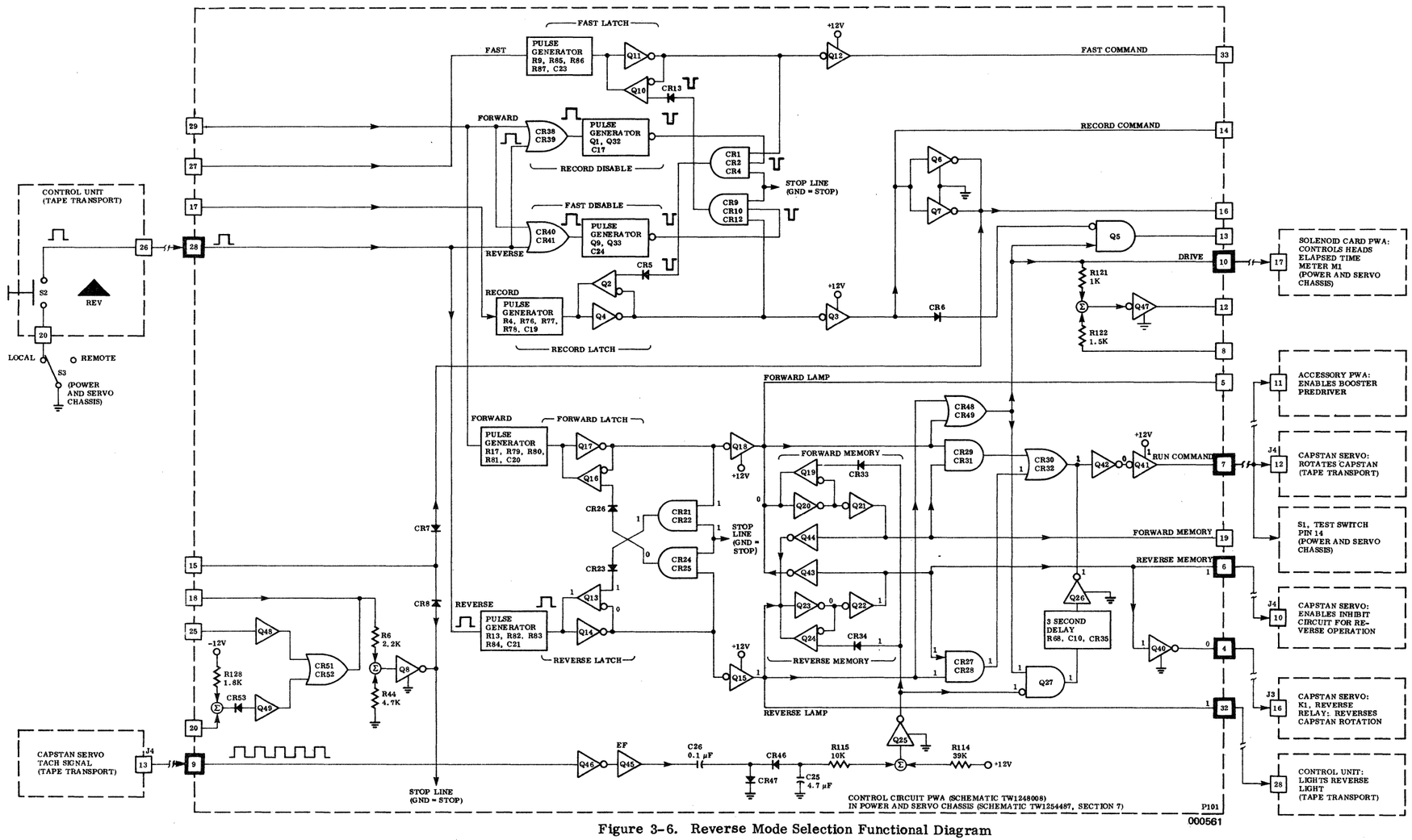


Figure 3-6. Reverse Mode Selection Functional Diagram

LEGEND

LOGIC: 1 = (+) VOLTAGE Q=TRANSISTOR
0 = (-) VOLTAGE CR=DIODE (S)

NON-INVERTING AMPLIFIERS

(+) INPUT = (+) OUTPUT

INVERTING AMPLIFIERS

(-) INPUT = (+) OUTPUT

(+) INPUT = (-) OUTPUT

AMPLIFIER WITH BASE AND EMITTER CONTROL

AND GATES

ALL OTHER INPUTS = 0 OUTPUT

NAND GATES

ALL OTHER INPUTS = 0 OUTPUT

ALL OTHER INPUTS = 1 OUTPUT

OR GATE

ALL OTHER INPUTS = 1 OUTPUT

NOR GATE

ALL OTHER INPUTS = 0 OUTPUT

NOTES:

1. ALL INTERCONNECTS SIMPLIFIED FOR CLARITY. FOR DETAILS OF INTERCONNECTS, SEE FIGURE 7-1 AND SCHEMATICS 1254523 (TRANSPORT HARNESS) AND 1254487 (POWER AND SERVO CHASSIS) IN SECTION 7.
2. 1'S AND 0'S SHOWN DO NOT NECESSARILY REPRESENT CONSISTENT LOGIC LEVELS, BUT INDICATE THE MORE POSITIVE (1) OR LESS POSITIVE (0) VOLTAGE THAT DETERMINES CIRCUIT CONDITIONS AT THE POINT INDICATED.
3. EMPHASIZED INPUT AND OUTPUT PINS OF P101 ARE ACTIVE IN THIS MODE.

REVERSE MODE

The logic and functional descriptions of the reverse circuits are similar to those of the forward circuits. An examination of Figure 3-6 and the schematic shows that the operation of the reverse circuits is parallel to that of the forward circuit with two exceptions. The first of these is that when the reverse memory circuit is activated, it not only powers the capstan servo forward inhibit circuit, but also activates the capstan reverse relay (K2) via transistor Q40. The second exception is that the same circuits instead of parallel ones are used for the run command.

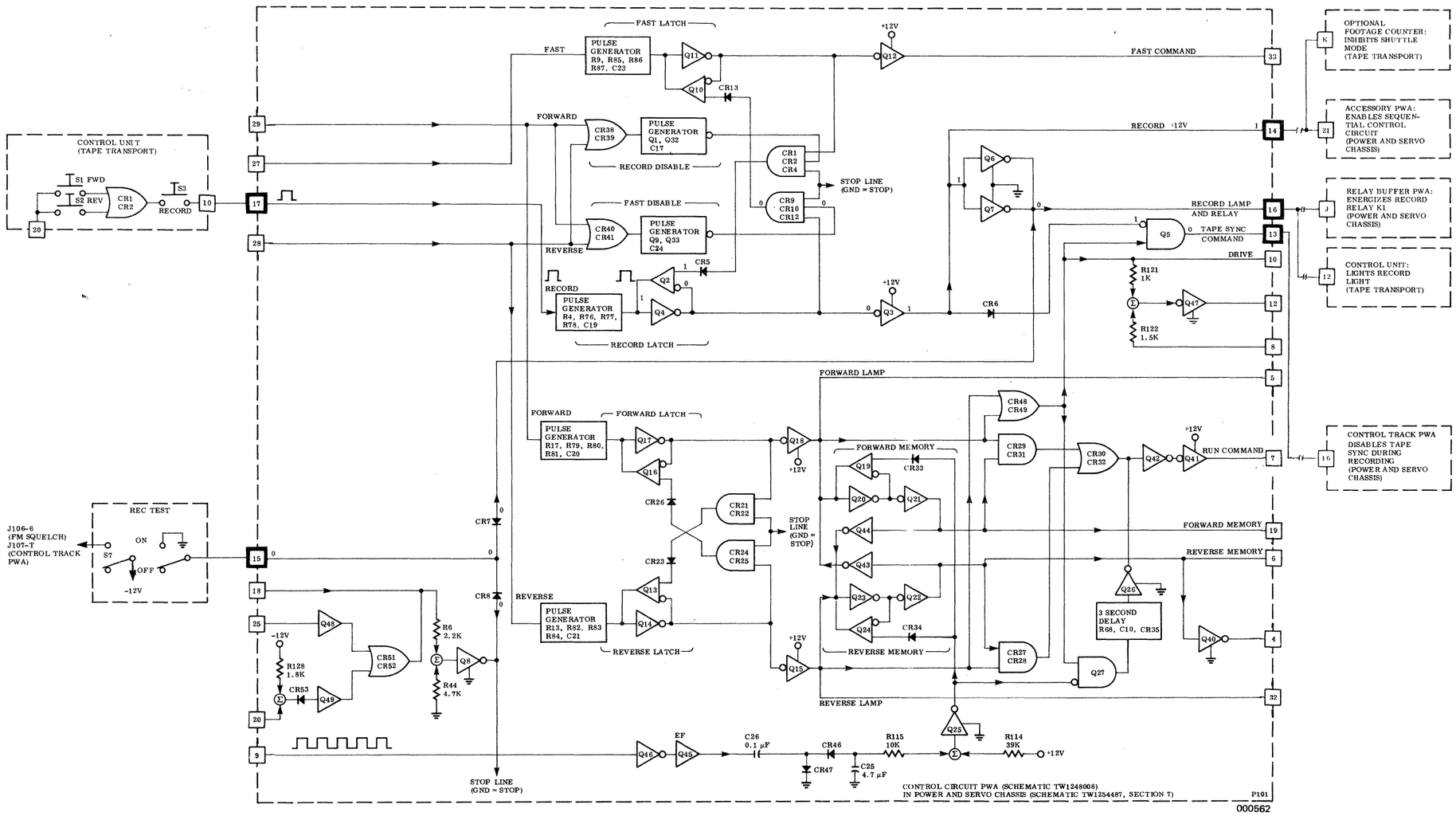
RECORD MODE

Referring to Figure 3-7, the logic of the record command is such that the RECORD pushbutton activates the record mode only when it is pressed simultaneously with either the forward or the reverse pushbutton. When this occurs, a ground, derived through OR gate CR1, CR2 is applied to the record pulse generator. This action turns on the record latch circuit consisting of Q4, Q2. The resulting positive output from Q3 is fed via pin 14 of J101 to two pwa's to perform the following functions:

a. Inhibits the shuttle mode

b. Enables the sequential logic circuits

Additionally, the positive output from Q3 passes through diode CR6 and shuts off transistor Q5 (tape sync command). This disables tape sync and shuts off the tape sync indicator light. This prevents the capstan servo system from using a tape sync signal when recording. Finally the positive output from Q3 is used to drive two parallel-connected transistors, Q6 and Q7. These transistors turn on and provide a ground which lights the record indicator light and energizes the record relay, located on the relay buffer pwa. The



LEGEND

LOGIC: 1 = (+) VOLTAGE Q=TRANSISTOR
0 = (-) VOLTAGE CR=DIODE (S)

NON-INVERTING AMPLIFIERS

(+) INPUT = (+) OUTPUT

INVERTING AMPLIFIERS

(-) INPUT = (+) OUTPUT

(+) INPUT (-) OUTPUT

AMPLIFIER WITH BASE AND EMITTER CONTROL

AND GATES

ALL OTHER INPUTS = 0 OUTPUT

NAND GATES

ALL OTHER INPUTS = 0 OUTPUT

ALL OTHER INPUTS = 1 OUTPUT

OR GATE

ALL OTHER INPUTS = 1 OUTPUT

NOR GATE

ALL OTHER INPUTS = 0 OUTPUT

NOTES:

1. ALL INTERCONNECTS SIMPLIFIED FOR CLARITY. FOR DETAILS OF INTERCONNECTS, SEE FIGURE 7-1 AND SCHEMATICS 1254523 (TRANSPORT HARNESS) AND 1254487 (POWER AND SERVO CHASSIS) IN SECTION 7.
2. 1'S AND 0'S SHOWN DO NOT NECESSARILY REPRESENT CONSISTENT LOGIC LEVELS, BUT INDICATE THE MORE POSITIVE (1) OR LESS POSITIVE (0) VOLTAGE THAT DETERMINES CIRCUIT CONDITIONS AT THE POINT INDICATED.
3. EMPHASIZED INPUT AND OUTPUT PINS OF P101 ARE ACTIVE IN THIS MODE.

Figure 3-7. Record Mode Selection (Omitting Run Mode) and Record Test Functional Diagram

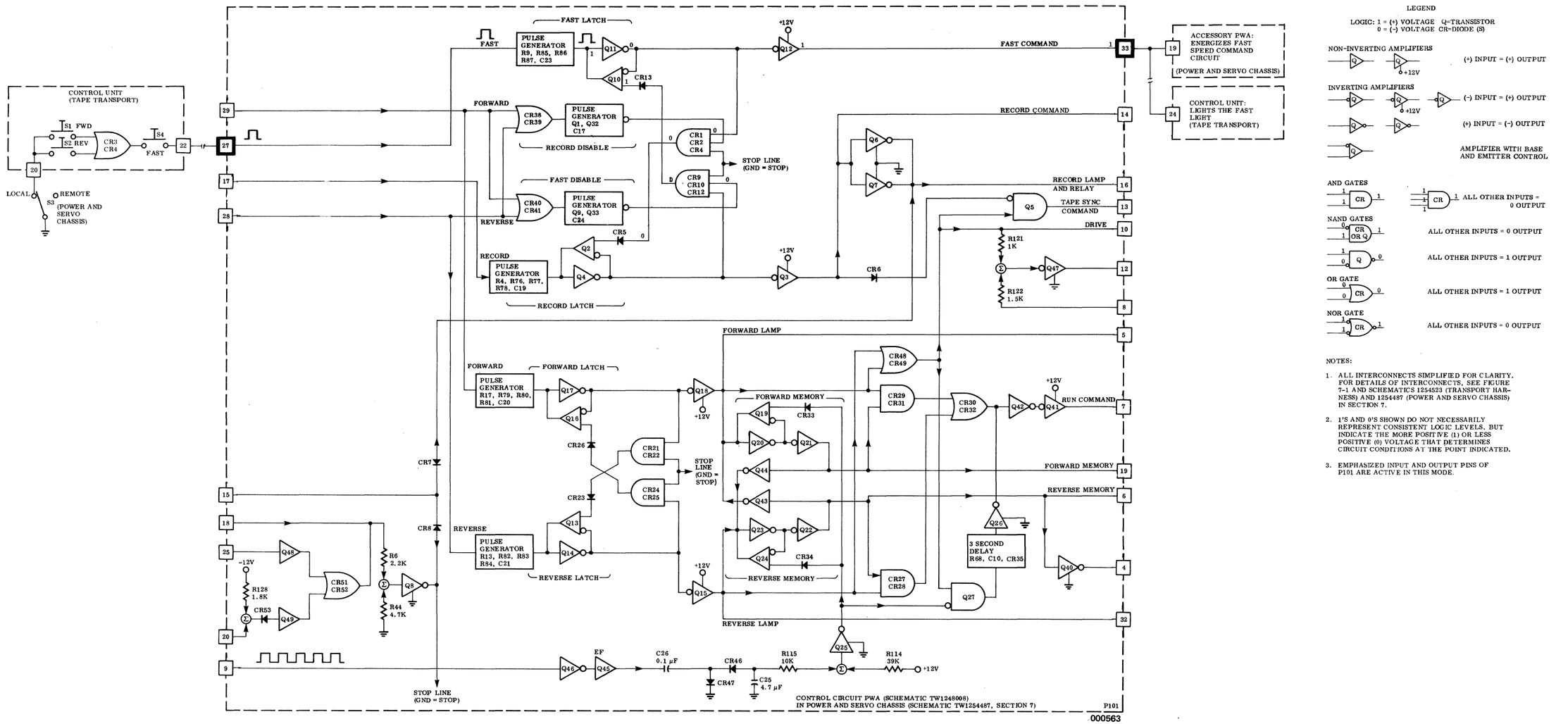
negative output (ground) from the collector of transistor Q4 is fed to AND gate CR9, CR10, and CR12, where it is used to inhibit the fast latch.

RECORD TEST

When the record test switch (S7 of the power and servo chassis) is placed in its ON position, a ground is fed to the junction of CR7 and CR8 (see Figure 3-7). Both of these diodes are forward biased. CR7 maintains the ground for the record indicator lamp and record relay K1. The record lamp is on and the record relay is energized. CR8, however, parallels the action of the stop command, inhibiting the forward, reverse, and record latch circuits. Tape motion is prohibited since there can be no run command. J7 applies -12V to the fm squelch circuit, cancelling no-sync squelch in the fm demodulators; as a result, the sync light on the control unit lights despite the absence of capstan motion.

RECORD DISABLE

Referring to schematic TW1248008 and Figure 3-7, when the recorder/reproducer is in the record mode, pressing the forward or reverse pushbutton activates the record disable circuit. When this occurs, a ground is applied to the record-disable pulse generator (C17, Q32, Q1) via OR gate CR38, CR39. Q32 turns on and supplies a short-duration positive pulse to Q1 via C17. Q1 turns on and supplies a negative-going pulse that inhibits Q2 of the record latch circuit (via CR4 and CR5). The record command is cancelled, but the tape continues to move in the direction selected, since the direction and memory latches remain enabled. The tape transport is now in the reproduce mode.



LEGEND

LOGIC: 1 = (+) VOLTAGE Q=TRANSISTOR
0 = (-) VOLTAGE CR=DIODE (S)

NON-INVERTING AMPLIFIERS
(+) INPUT = (+) OUTPUT

INVERTING AMPLIFIERS
(-) INPUT = (+) OUTPUT
(+) INPUT = (-) OUTPUT

AMPLIFIER WITH BASE AND EMITTER CONTROL

AND GATES
ALL OTHER INPUTS = 0 OUTPUT

NAND GATES
ALL OTHER INPUTS = 0 OUTPUT
ALL OTHER INPUTS = 1 OUTPUT

OR GATE
ALL OTHER INPUTS = 1 OUTPUT

NOR GATE
ALL OTHER INPUTS = 0 OUTPUT

NOTES:

1. ALL INTERCONNECTS SIMPLIFIED FOR CLARITY. FOR DETAILS OF INTERCONNECTS, SEE FIGURE 7-1 AND SCHEMATICS 1254523 (TRANSPORT HARNESS) AND 1254487 (POWER AND SERVO CHASSIS) IN SECTION 7.
2. 1'S AND 0'S SHOWN DO NOT NECESSARILY REPRESENT CONSISTENT LOGIC LEVELS, BUT INDICATE THE MORE POSITIVE (1) OR LESS POSITIVE (0) VOLTAGE THAT DETERMINES CIRCUIT CONDITIONS AT THE POINT INDICATED.
3. EMPHASIZED INPUT AND OUTPUT PINS OF P101 ARE ACTIVE IN THIS MODE.

Figure 3-8. Fast Selection (Omitting Forward or Reverse Mode) Functional Diagram

FAST FORWARD AND FAST REVERSE MODES

Referring to schematic TW1248008 and Figure 3-8, a fast mode is activated when the FAST pushbutton is pressed simultaneously with either the forward or reverse pushbutton. The fast control circuit is similar to the record control circuit. A ground potential is applied to the fast pulse generator and activates fast latch circuit Q11, Q10, Q12. A positive fast command signal is taken from the collector of Q12 and performs the following functions:

a. Energizes the fast indicator light

b. Enables the fast speed command circuit (located on P102, the accessory pwa.)

A ground potential from the collector of Q11 inhibits record latch circuit Q4, Q2, Q3 via CR1 and CR5.

FAST DISABLE. Referring to Figure 3-8 and schematic TW1248008, when the transport is in a fast mode, pressing either the forward or reverse pushbutton activates the fast disable circuit. This circuit is similar to the record disable circuit. When the forward or reverse pushbutton is pressed, a ground potential is applied to the fast disable pulse generator which consists of CR40, CR41, Q33, C24, and Q9. Q33 turns on and passes a short-duration positive-going pulse to Q9 via C24. Q9 turns on and supplies a negative-going pulse that inhibits Q10 via CR12 and CR13. The fast command signal is cancelled, and the fast indicator lamp goes out. The tape travels in the direction selected, at the speed selected on the tape speed selector switch of the control unit.

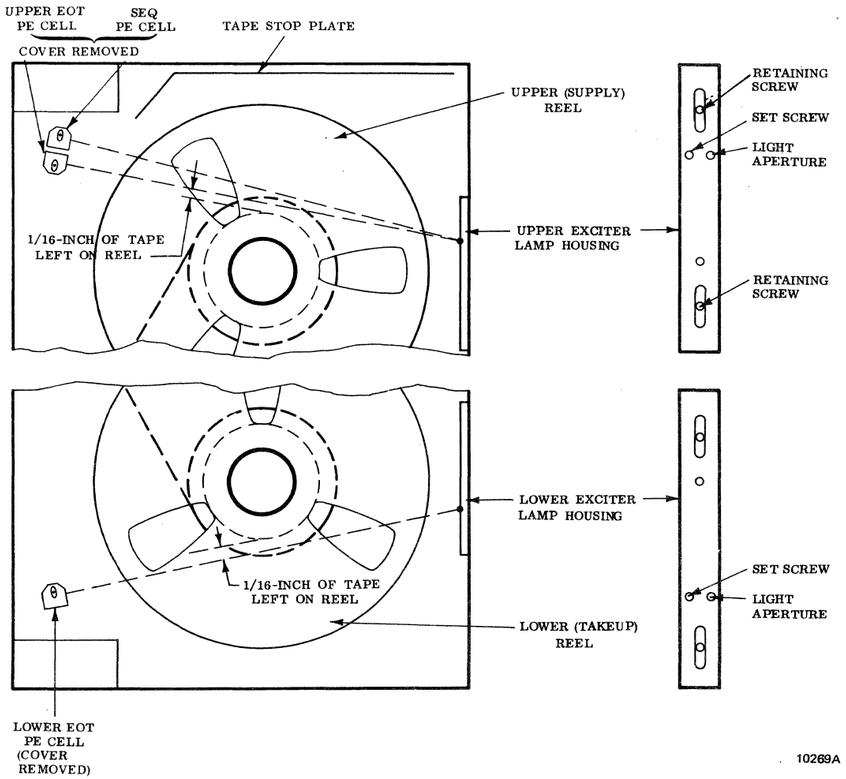


Figure 3-9. End-of-Tape and Sequential Sensors

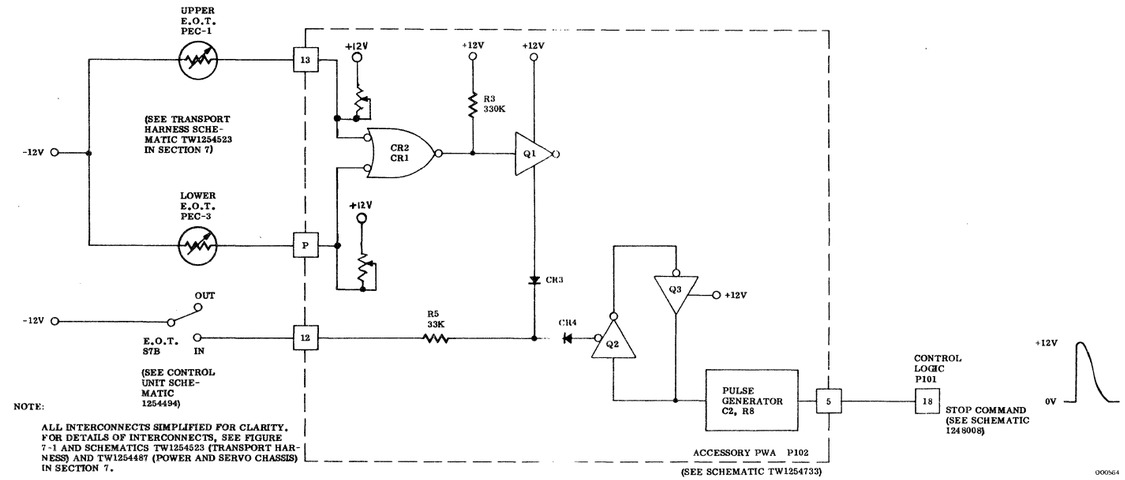


Figure 3-10. End-of-Tape Sensing Functional Diagram

FAST SPEED COMMON CIRCUIT. Refer to schematics TW1248008 and TW1254733 in this section, and power and servo chassis schematic 1254487 in Section 7. When a fast mode is selected, +11V is fed from pin 33 of the control logic pwa (P101), to pin 19 of J102, to the base of Q11 of the accessory pwa (P102). Q11 turns off, enabling Q10, which turns on transistors Q8 and Q9. These transistors provide the ground for the 300+ ips speed command logic in the capstan servo (see Section 4), via pin 32 of P102.

SPEED DEFEAT. The fast command (Q12, schematic TW1248008, switched on) applies a positive signal through CR14 to R51 and R2. This turns off transistors Q39 and Q36, which disables the local and remote speed common ground circuits. This prevents a speed change during fast mode operation.

AUTOMATIC AND SEMIAUTOMATIC COMMANDS

These types of commands include fully automatic commands such as those shutting down the transport when vacuum is lost, and semiautomatic commands such as those from the end-of-tape (eot) circuits that must be preconditioned by the setting of a control-unit switch.

END-OF-TAPE SENSING

Refer to Figures 3-9 and 3-10 and to Schematic TW1254733. The end-of-tape (eot) sensing circuits include transistors Q1, Q2, Q3, and their associated components. When tape has been properly threaded on the transport, the EOT switch (S7B of the control unit) set at ON, and transport power on, a positive potential is applied to the base of Q1 through R3, causing Q1 to conduct. With Q1 conducting, a positive potential (+11V) appears at the junction of CR3 and CR4. This prevents Q2 and Q3 from conducting.

When the end of the tape approaches, as determined by the adjustment of the photosense assemblies, light from one of the lamps falls on the associated photosensor. When the photocell conducts, -12V is applied through CR1 or CR2 to the base of Q1, shutting it off. This makes the junction of CR3 and CR4 negative, permitting Q2 to conduct and latch Q3 on. When Q3 conducts, a positive pulse is applied through the pulse generator (C2, R8) to pin 5 of P102. The positive pulse is fed to the stop circuit on the control logic pwa (P101), stopping the capstan and reel motors. Potentiometers R71 and R72 are adjusted to compensate for ambient light on the photocells.

Assembly drawings and lists of materials, including the eot sensors and light sources are included as parts of the baseplate assembly documentation in Section 2 of this manual.

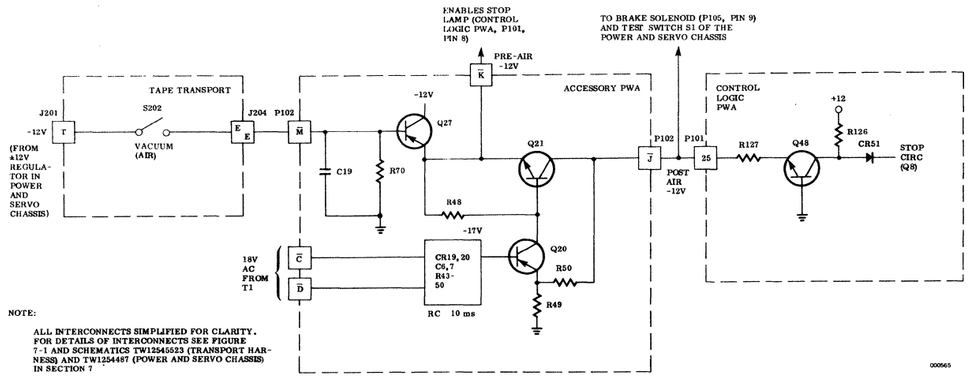


Figure 3-11. Broken-Tape and Power-Loss Control Simplified Schematic Diagram

BROKEN TAPE AND POWER LOSS

These automatic stop commands are generated on the control logic pwa by transistor Q48 based on information received from sources described below. (See Figure 3-11 and Schematic TW1248008.) When -12V (called post-air -12V) is present on pin 25, Q48 is biased on and puts a negative voltage on the anode of CR51, biasing it off. This isolates Q48 from the stop circuits. If the negative voltage is removed from pin 25, Q48 is biased off, its collector swings positive and biases CR51 on. A positive voltage is applied to the stop transistor (Q8). Normal stop action takes place, except that the stop command is held on until -12V is restored to pin 25. No active mode can be initiated. (In addition, when the -12V is absent, the reel brakes are applied.) Causes for the loss of -12V at pin 25 are described in following paragraphs.

BROKEN TAPE. When transport power is applied and tape is properly threaded, the vacuum blower draws enough vacuum to close vacuum switch S202 of the transport. (See Figure 3-11, and also transport harness schematic 1254523 in Section 7.) When S202 closes, -12V from the ±12V regulator in the power and servo chassis is applied via the interconnects to the base of transistor Q28 of the accessory pwa (Schematic 1254733). This turns Q27 on. The resulting voltage at the emitter of Q27 (called pre-air -12V) is connected to the emitter of transistor Q21 on the accessory pwa. (The same voltage also enables the stop-lamp circuit at pin 8 of the control logic pwa.)

If the power-loss circuit (described below) does not sense a power loss, Q21 is turned on and the -12V is coupled out to pin 25 of the control logic pwa as the post-air -12V, as described above. If tape breaks (or if vacuum is lost for any other reason) S202 opens, all the circuit conditions reverse, and an automatic stop command is generated, as described above.

POWER LOSS. The power loss control circuit (on the accessory pwa) is composed of transistor Q20, rectifier diodes CR19 and CR20, and a network composed of C6 and C7 plus R43 through R50. (See Figure 3-11 and schematic 1254733.) Q20 controls the base of transistor Q21 (described above). When Q20 is off, the base of Q21 is biased off (negative). When Q20 is on, the base of Q21 is swung positive (towards ground) and Q21 conducts.

The state of Q20 is determined by a negative voltage derived from a winding of the main transport power transformer of the power and servo chassis. (This is the winding that powers the +18V supply.) The negative dc voltage is derived by CR19 and CR20 and their associated components. When this voltage is present, it is rectified and applied as a negative voltage to the base of Q20. This turns Q20 on, which turns Q21 on. If the power is removed for more than approximately 10 milliseconds, Q20 and Q21 turn off, and a stop command is generated on the control circuit pwa as described above. (Refer to Section 4, page 4-15, for further description of the power loss states.)

VACUUM CHAMBER LAMPS OUT

As described under "Transport Power" (p. 3-2), Q18, shown in Figures 3-2 and 3-3, acts as a switch which automatically shuts off transport power in case too many lamps in the vacuum chamber are out. (Too many lamps may be one or more, depending on circuit conditions.)

REEL BRAKE CONTROL

Refer to Figure 3-12 and Schematic 1254448, solenoid pwa, P105. When power is off, the reel brakes are applied (see Section 4). When transport power is turned on, +12V is applied to pin 5 of J105, and from there through R17 and CR1 to the base of Q5. This causes Q5 to conduct, cutting off Q6 and Q11. (Q11 is located on the power and servo chassis heatsink.) The brake solenoids are deenergized and the brake solenoid plunger and asbestos lining remain forced against the disc brake drum on each reel motor assembly. (The brakes remain applied.)

When vacuum is sufficient, and air switch S202 closes, post-air -12V becomes available (see Figure 3-11). It is applied to pin 9 of J105, from where it is coupled via CR2 and R23 to the junction of R17 and R23. The existing positive potential at this junction is replaced with a negative one. This turns Q5 off, and permits Q6 and Q11 to conduct via R15. When Q11 is on, +28V is applied across the solenoid coils through Q11 and R27 to ground. The brake solenoids are energized and the brakes are released.

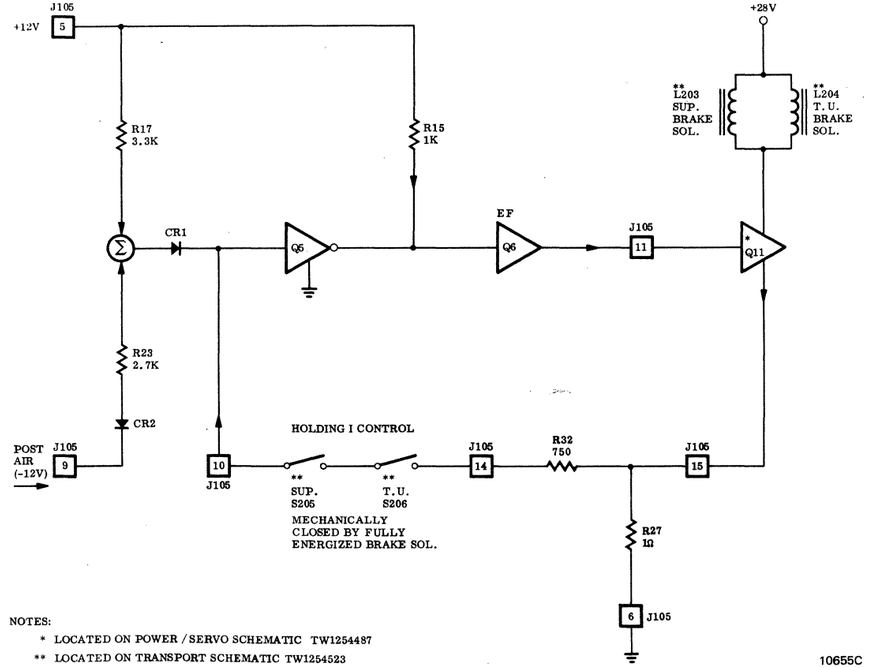


Figure 3-12. Brake Solenoid Control Logic

When the reel brake solenoids are energized and fully bottomed, normally open contacts on two switches (S205 and S206, one on each solenoid) close and complete the circuit between pins 10 and 14 of J105. This puts a slightly positive voltage on the base of Q5, which turns Q5 partially on, and turns Q6 and Q11 partially off. This reduces the current through the solenoids to a level just sufficient to hold them energized. R27 is the current-limiting device, and the current through it sets the current through Q5, Q6, and Q11.

If the vacuum in the chamber is reduced to an amount that is not sufficient to keep air switch S202 closed, the switch opens and the negative potential is removed from pin 9 of J105. The positive potential at pin 5 turns Q5 full on, Q6 and Q11 turn off, the brake solenoids are deenergized, and the brakes are mechanically applied to the reel motor assemblies.

BOOSTER

The booster section of the accessory pwa is involved in the operation of the reel servos, and is therefore covered in Section 4 of this manual.

HEADS ELAPSED TIME METER

As described under "Forward Mode" (page 3-6) and "Reverse Mode" (page 3-8), whenever one of these modes is selected, a positive voltage (drive command) is applied to pin 10 of the control logic pwa. This voltage is interconnected to pin 17 of the solenoid card pwa (Schematic 1254448).

When there is no drive command (0V is at pin 17), Q9 is biased on by the positive voltage applied to its emitter through VR2. This biases CR3 off, allowing positive voltage from R37 to bias CR4 and Q4 on. The collector of Q4 is at ground and biases Q3 off, leaving relay K2 deenergized. K2 controls power to the HEADS ELAPSED TIME meter (M1, shown on power and servo chassis Schematic 1254487).

When the drive command appears at pin 17, Q9 is biased off, CR3 is biased on, and CR4 is biased off. Q4 is turned off and as a result, Q3 is turned on and energizes relay K2.

REMOTE CONTROL INDICATOR

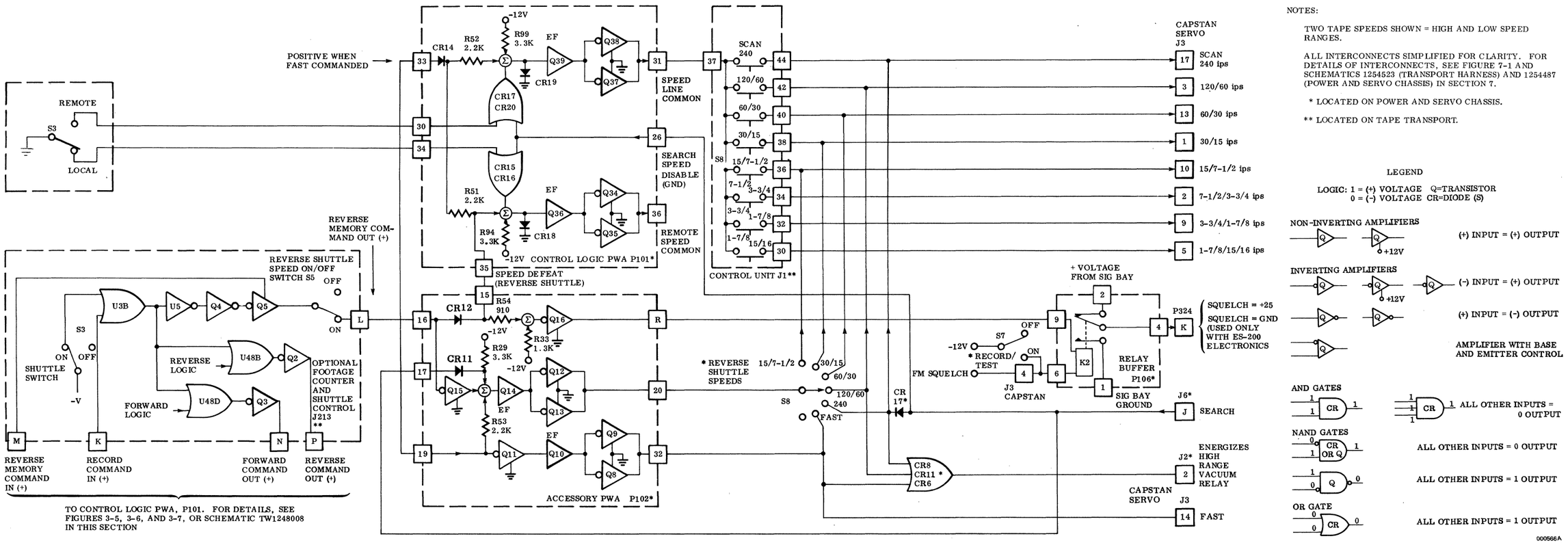
Referring to Schematic TW1254733 (accessory pwa, P102), the remote control indicator circuit consists of Q7, CR9, R16, and R17. When the CONTROL switch (S3) on the power and servo chassis test panel, is set at LOCAL, a positive potential (approximately +0.5V) is applied to the base of Q7 through R16, holding Q7 at cutoff. When the CONTROL switch is set to REMOTE, and a remote control unit is connected to the transport, -12V is applied to the base of Q7 through R17 as soon as transport power is turned on from the remote control unit. Q7 conducts and provides a ground for the REM indicator lamp on the local control unit, and the lamp lights.

SEARCH CONTROL

Search mode is normally part of operation in conjunction with an external control system involving a time code generator and a search control unit (scu). Refer to Figure 3-13, and to schematics 1248008 and TW1254733 in this section, and 1254487 in Section 7. Whenever search operation is required, the scu applies a ground to pin J of search connector J6. This ground is coupled to pin 26 of the control logic pwa (P101). The ground (positive with respect to the -12V reference) forward-biases diodes CR20 and CR15, and, through emitter followers Q39 and Q36, turns off the associated local and remote speed-common transistors. This inhibits the selection of tape speeds from the control unit of the transport when scu search is commanded.

Additionally, the ground signal from the scu feeds through pin 17 of the accessory pwa P102 and diode CR11 to the base of emitter follower Q14 (on P102). Q14 stops conducting, which cuts off the reverse shuttle speed common transistors, Q12 and Q13. Thus reverse shuttle speed selection is also inhibited.

The ground input from the scu is also fed through diode CR17 (located on TB2 of the power and servo chassis) to the SCAN (240 ips) speed positions of the speed selector switch on the control unit and S8, the reverse shuttle speed selector switch on the power and servo chassis. Thus, so long as the scu is searching for a location on the tape, the tape speed is scan (240 ips).



NOTES:

TWO TAPE SPEEDS SHOWN = HIGH AND LOW SPEED RANGES.

ALL INTERCONNECTS SIMPLIFIED FOR CLARITY. FOR DETAILS OF INTERCONNECTS, SEE FIGURE 7-1 AND SCHEMATICS 1254523 (TRANSPORT HARNESS) AND 1254487 (POWER AND SERVO CHASSIS) IN SECTION 7.

* LOCATED ON POWER AND SERVO CHASSIS.

** LOCATED ON TAPE TRANSPORT.

Figure 3-13. Search Control, Shuttle Control and Speed Selection Simplified Functional Diagram

Whenever the tcg removes the ground signal from these points, the transport reverts to standard operation, with speed and direction control from the control unit (local or remote, as selected) or reverse shuttle speed as selected by S8 on the power and servo chassis.

SHUTTLE CONTROL

The central functions in shuttle control (repeated reproduce passes over a preselected section of tape) are performed by an optional accessory, a footage counter and shuttle assembly. The details of operation, function, etc., of this assembly are covered in a separate accessories manual. Certain portions of the shuttle control logic are parts of the tape transport control logic, and are covered in the following paragraphs. Refer to Figure 3-13 and to Schematics TW1248008 and TW1254733 in this section, and 1254487 in Section 7.

SHUTTLE SPEED COMMON CIRCUIT. The shuttle speed common circuit is composed of Q12 through Q15 and their associated components on pwa P102, the accessory pwa. The circuit is similar to the fast speed command circuit, in that Q15 conducts when there is power on the transport, keeping Q14, Q12, and Q13 off. When a reverse memory signal is applied to the base of Q15, it turns off. This permits Q14, Q12, and Q13 to conduct, providing a ground for the reverse speed shuttle switch, S8.

SPEED DEFEAT. A positive speed defeat signal from the reverse shuttle speed circuit is applied to pin 35 of J101 via diode CR12 of the accessory pwa (P102). This +11V signal is fed through R52 and R51 to the bases of Q39 and Q36 of pwa P101. This disables the local and remote speed common ground circuits, and prevents a speed change during operation in the reverse shuttle mode.

CONTROL FUNCTIONS

SEQUENTIAL CONTROL

Refer to Figure 3-14 and Schematic TW1254733 (accessory pwa). The sequential control circuit includes transistors Q4, Q5, Q6, and Q22 through Q25 and their associated components. The SEQUENTIAL switch (S6) is located on the power and servo chassis test panel. When it is set to ON, one of its functions is to light the SEQ indicator lamp (DS3) on the control unit. Photocell PEC2, which activates the sequential control circuit during sequential operation, is mounted near the upper pe cell of the end-of-tape circuit. See Figure 3-9. When the tape on the upper reel is depleted to the point preset for sequential operation, light from the exciter lamp falls on the pe cell and it conducts. Potentiometer R73 is adjusted to compensate for ambient light falling on the pe cell. When the pe cell conducts, a negative potential is routed to pin 24 of P102. This starts the sequential action. Transistor Q24 provides the +12V command signal used to turn on the second recorder. Transistor Q6 forms the switch that permits the command signal to pass, and C14 and R56 form a pulse generator that shapes the signal into a fast-rise-time, positive-going pulse (0 to +12V) used to put the second tape transport into the forward-record mode.

A positive record signal (+11V) is applied via pin 21 of P102, through diode CR23 to C16 and the base of Q24. When capacitor C16 charges to a voltage that is approximately 0.5V greater than the emitter potential of Q24, that transistor conducts and the +12V on its collector is fed to the emitter of Q6. The charge time of C16 provides a delay before Q24 conducts, to ensure that transistors Q22, Q23, and Q25 are biased off and will not trigger the sequential control circuit incorrectly.

When the sequential pe cell conducts, a negative potential is passed to the base of Q4, shutting it off. When Q4 shuts off, Q5 turns on and latches Q6 on. Now the +12V command signal from Q24 is passed to the pulse generator (C14, R56), where it is shaped and sent to the second transport through pin 22 of P102.

When a recorder is in the stop/ready mode and connected via J3 for sequential operation, the second machine is activated into the forward-record mode by a signal sent from the first recorder. This signal is applied to pin 29 of P102 by way of the SEQUENTIAL switch. The signal is distributed to two destinations through isolating diodes. It passes

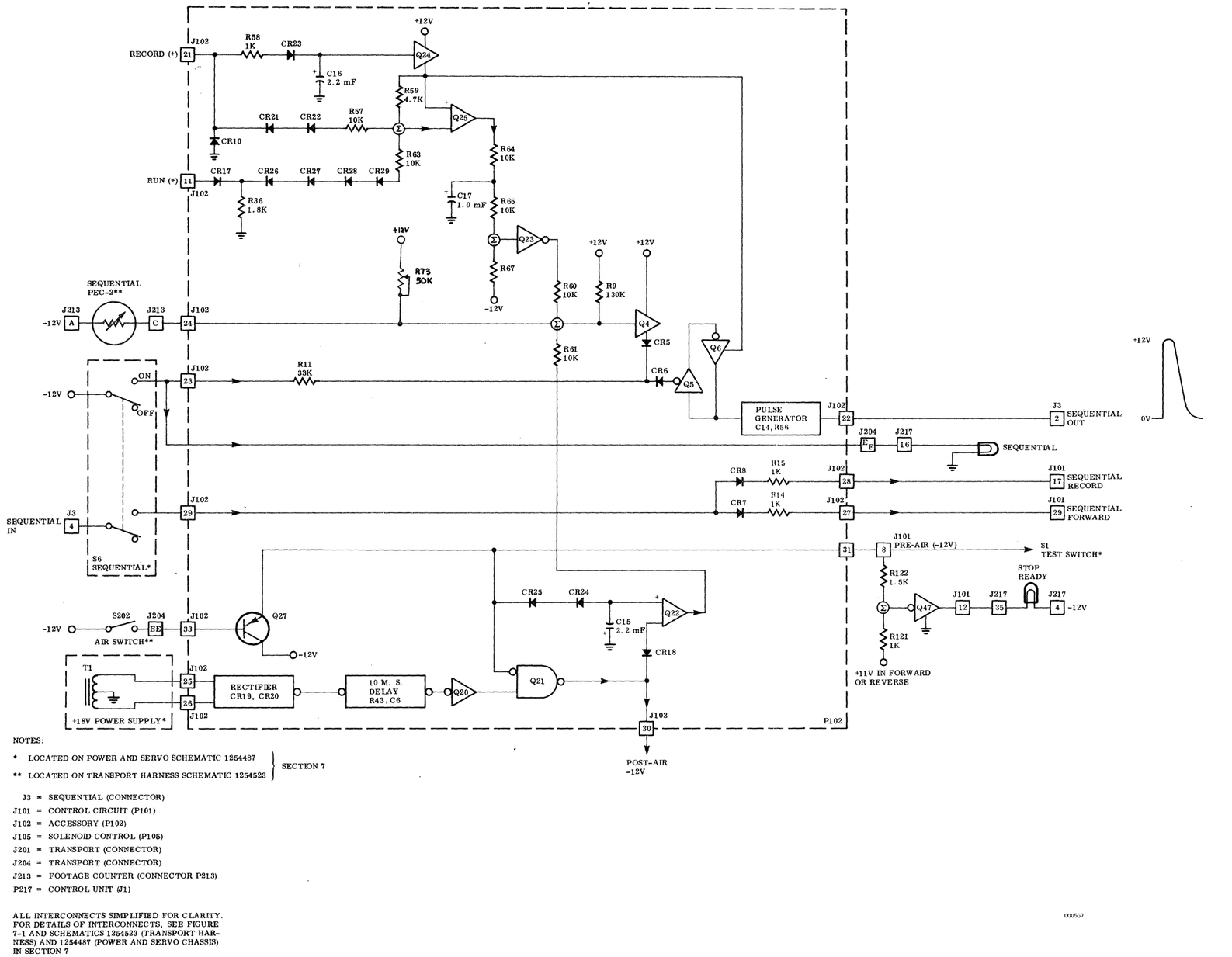


Figure 3-14. Sequential Control Logic

through CR7 and resistor R14 to pin 27 of P102 and from there to pin 29 of the control logic pwa (P101) where it initiates the forward mode. It also passes through CR8 and R15 to pin 28 of P102 and from there to pin 17 of P101, where it initiates the record mode.

Transistors Q22 through Q25 of P102, together with their associated components, provide a protective circuit to ensure that the second recorder in a sequential system receives the forward-record command if a malfunction occurs in the first recorder. Malfunctions that activate a command to the second tape transport include broken tape, power failure, momentary power failure, loss of run command, or loss of record command.

BROKEN TAPE. Refer to Figure 3-14 and Schematics TW1254733 and 1254523. When tape breaks, the vacuum is lost from the vacuum chambers, the air (vacuum) switch (S202) opens and -12V is no longer applied via Q27 to the emitter of Q21, which shuts off. CR18 is back-biased. The base of Q22 becomes positive (through its base resistor to ground) while its emitter is at -12V from the charge on C15, and it conducts. When Q22 conducts, it discharges C15 through R61, and applies the -12V (from C15) to the base of emitter-follower Q4. Q4 turns Q5 and Q6 on. The +12V sequential command signal is fed through Q6 to pulse generator C14, R56, and to the sequentially connected second recorder, which goes into operation.

POWER FAILURE. A full or a momentary power failure results in the loss of the ac input to T1, the transformer of the ±18V power supply. (Power failure does not necessarily mean the loss of an input to the recorder; it can mean pressing the POWER pushbutton, turning off transport power.) If the power is off for more than 10 ms, Q20 and Q21 stop conducting, which turns Q22 on. C16 holds Q24 on long enough to generate a sequential command. This results in the same sequence as described for broken tape. (A detailed description of the broken tape and power failure circuit appears on page 3-10.)

LOSS OF RUN OR RECORD COMMANDS. If someone inadvertently presses the STOP pushbutton, or if the capstan motor stops turning for any reason, the control logic senses it within 2 seconds, and the run command is lost. If, while the transport is in the sequential record mode, the forward, reverse, fast forward, or fast reverse modes are initiated, the record command is lost. In each of these situations, the sequential protection circuit transistors, Q23 and Q25, initiate the command signal to the second recorder to switch it into the forward-record mode.

Transistor Q25 is normally biased off because the record signal and the run signal are both holding the base at a positive potential compared to its emitter voltage. Both the record and run commands must be present at the base of Q25 to keep it from conducting. If either of these signals is lost, the potential at the base of Q25 goes towards ground, turning the transistor on. The +12V at its emitter is conducted through R64 and R65 to the base of Q23 (which was previously biased off by R67 between its base and -12V). Q23 now conducts and the -12V on its emitter is fed through R60 to the base of Q4 in the sequential control circuit. This initiates the command to the second recorder, and it operates.

DISABLING THE SEQUENTIAL CONTROL CIRCUIT. The sequential control circuit may be disabled at any time, whether recording is taking place or not, by setting the SEQUENTIAL switch to OFF. When the SEQUENTIAL switch is set to OFF, none of the sequential protective circuits previously described can be activated and a record command cannot be transferred to a second machine.

SPEED SELECTION

Mechanically interlocked pushbuttons, switch assembly S8 of the local control unit (see page 3-17), or on the optional remote control unit if used (see accessory manual 1802902 or 1802903), are pressed to select tape speeds. Each of these switches, when activated, grounds a speed line by connecting it to a speed common, and cancels any other selection. The local or remote speed common is selected and applied as described below.

SPEED COMMON SELECTION

The speed common to be used (local or remote) is selected by use of the CONTROL switch (S3) on the test panel of the power and servo chassis. According to the position (LOCAL or REMOTE) of this switch, either one of two transistor switch circuits on the control logic pwa (Schematic TW1248008, page 3-15) is turned on. The local speed common is switched by transistors Q37, Q38, and Q39; the remote speed common is switched by Q34, Q35, and Q36.

When S3 is in the LOCAL position, pin 30 of the control logic pwa is floating, and a negative voltage is applied by R99 to the base of Q39, turning it and Q37 and Q38 on, and thus connecting pin 31 (local speed common) to ground.

At the same time, pin 34 of the pwa is grounded, placing a relatively positive voltage on the base of Q36 via CR16. This turns Q36, Q34, and Q35 off. Thus the remote speed common (pin 36) is disconnected from ground. In this condition, speeds can be selected from the local control unit only.

When S3 is in the other (REMOTE) position, the situation is reversed, and the remote speed common is the one enabled. Speeds are selectable from the remote control only.

Both speed commons are disabled in fast modes, reverse shuttle mode, and search mode, as described under "Fast Mode," "Shuttle Control," and "Search Control," in this section.

SPEED COMMON APPLICATION

The speed line, following the necessary interconnects, applies the ground as indicated in Figures 3-13 and 3-14, and as follows:

a. To the capstan servo, where it determines the reference frequency, and therefore the capstan speed. (See Section 5.)

b. To the control track pwa (optional), where it selects the correct filter for the control track signal at the selected tape speed. (See Accessories manual 1802902 or 1802903.)

c. To the power and servo chassis search connector (J6) for use with optional, external search control electronics.

d. To the relay buffer pwa, which receives a power voltage from the signal electronics and routs it back to select the correct speed-sensitive components while maintaining ground isolation between the transport and the signal electronics. Action of the relay buffer is described as follows:

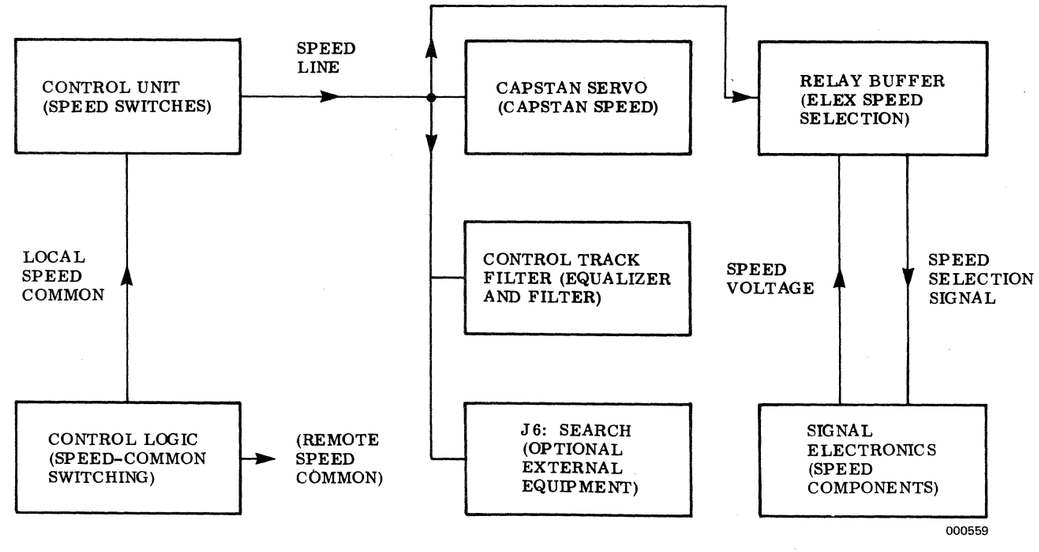


Figure 3-15. Speed Selection Simplified Block Diagram

RELAY BUFFER PWA(P106) SCHEMATIC DIAGRAM TW1254428

RELAY BUFFER IN SPEED SELECTION

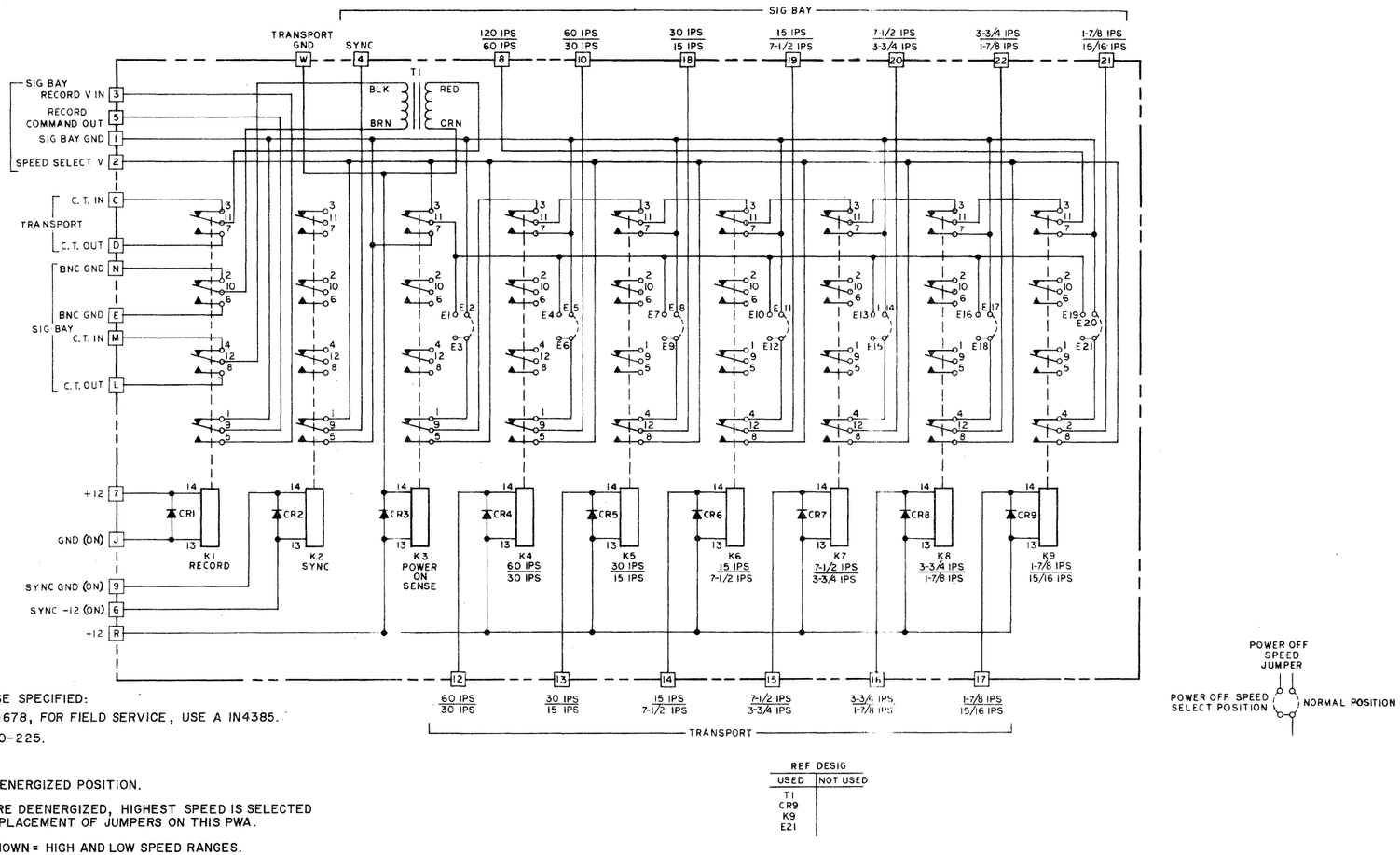
Refer to schematic TW1254428. The speed-selection circuits of the relay buffer card are based on relays K3 through K9. These relays are energized by the associated speed switch on the control unit, as indicated by the tape speeds shown on the schematic. Note that in this circuit, selection of the highest speed (120 ips or 60 ips) is represented as the selection of no other speed.

Two sets of contacts are used on each of the speed-selection relays. One set (those in the upper row on the schematic) are wired with the normally-closed contacts of all six relays in series between a speed-select voltage received from the signal electronics on pwa connector pin 2, and the 120 ips/60 ips output pin, pin 8. When none of the relays are energized, the highest tape speed is automatically selected. (If the power-off speed jumpers are in their normal positions.) If any other speed is selected, the normally closed contacts open, de-selecting the highest speed.

Also note that, through the action of K3, the power-on-sense relay, no speed selection in the signal electronics is possible until transport power is on.

When one of the speed-selection relays is energized, the second set of contacts (lower on the schematic) applies the speed-select voltage to the appropriate output pin for the selected tape speed.

The speed-select voltage is interconnected to the signal electronics bay(s) where it is used as described in the appropriate signal electronics manual.



NOTES, UNLESS OTHERWISE SPECIFIED:

1. ALL DIODES ARE 013-678, FOR FIELD SERVICE, USE A IN4385.
2. ALL RELAYS ARE 020-225.
3. SIMILAR TO 1248308.
4. RELAYS SHOWN IN DEENERGIZED POSITION.
5. WHEN ALL RELAYS ARE DEENERGIZED, HIGHEST SPEED IS SELECTED UNLESS CHANGED BY PLACEMENT OF JUMPERS ON THIS PWA.
6. TWO TAPE SPEEDS SHOWN = HIGH AND LOW SPEED RANGES.

REF DESIG	
USED	NOT USED
T1	
CR9	
K9	
E21	

RELAY BUFFER -- OTHER FUNCTIONS

The relay buffer operates in two other functions of the transport besides speed selection. These are: control track signal switching, and squelch-control for fm demodulators.

CONTROL TRACK SIGNAL SWITCHING

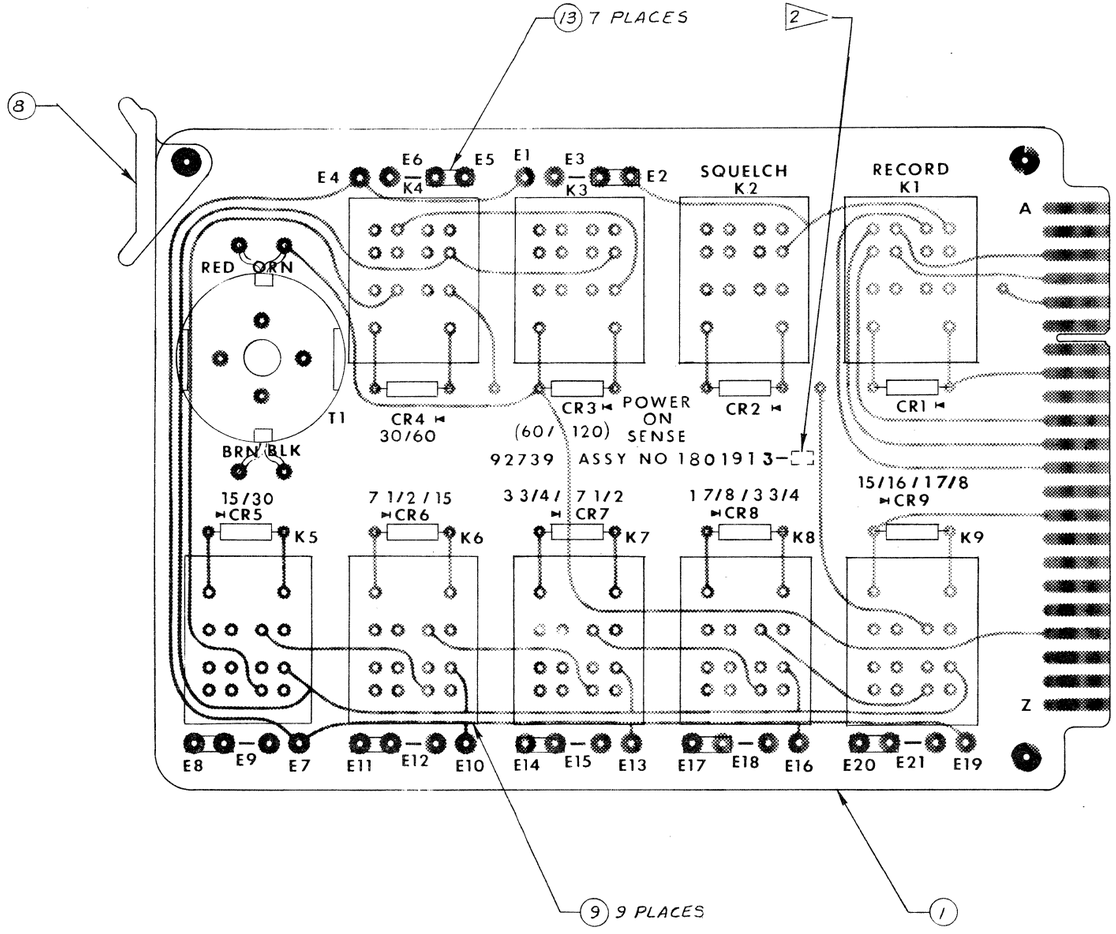
Relay K1 of the relay buffer pwa (see schematic TW1254428) is designated the record relay. It is energized when the equipment is in the record mode, and deenergized when it is not. When it is energized, the relay routes the control track signal from the control track pwa, pin 3, through pin D of the relay buffer to transformer T1. It applies the output of the transformer to the CONTROL TRACK OUTPUT connector, J22 on the test panel of the power and servo chassis, via pin D of the relay buffer. When the equipment is not in the record mode, the CONTROL TRACK INPUT connector, J23 of the power and servo chassis test panel, is coupled, via pin M, to the primary of T1. The secondary of T1 is coupled out via pin C to pin J of the control track pwa in the power and servo chassis. Transformer T1 serves to isolate the transport ground from signal electronics ground.

SQUELCH CONTROL (SYNC)

Relay K2 of the relay buffer (Schematic 1254428), controls a squelch signal for use in signal electronics bay(s) with fm demodulators that provide for externally controlled squelch. K2 is controlled by a sync signal from the capstan servo assembly. (This source of squelch control is used because a reproduced fm carrier is not at its correct frequency until the capstan is up to speed; i.e., in sync.)

When K2 is deenergized (capstan not in sync), pin 4 of the relay buffer is connected through normally-closed contacts to the speed-select voltage from the signal electronics bay. This signal is interconnected back to the electronics bay(s) for use in squelching the outputs of demodulators.

When K2 is energized, pin 4 is connected to the signal bay ground. In both cases the transport and signal grounds remain isolated.



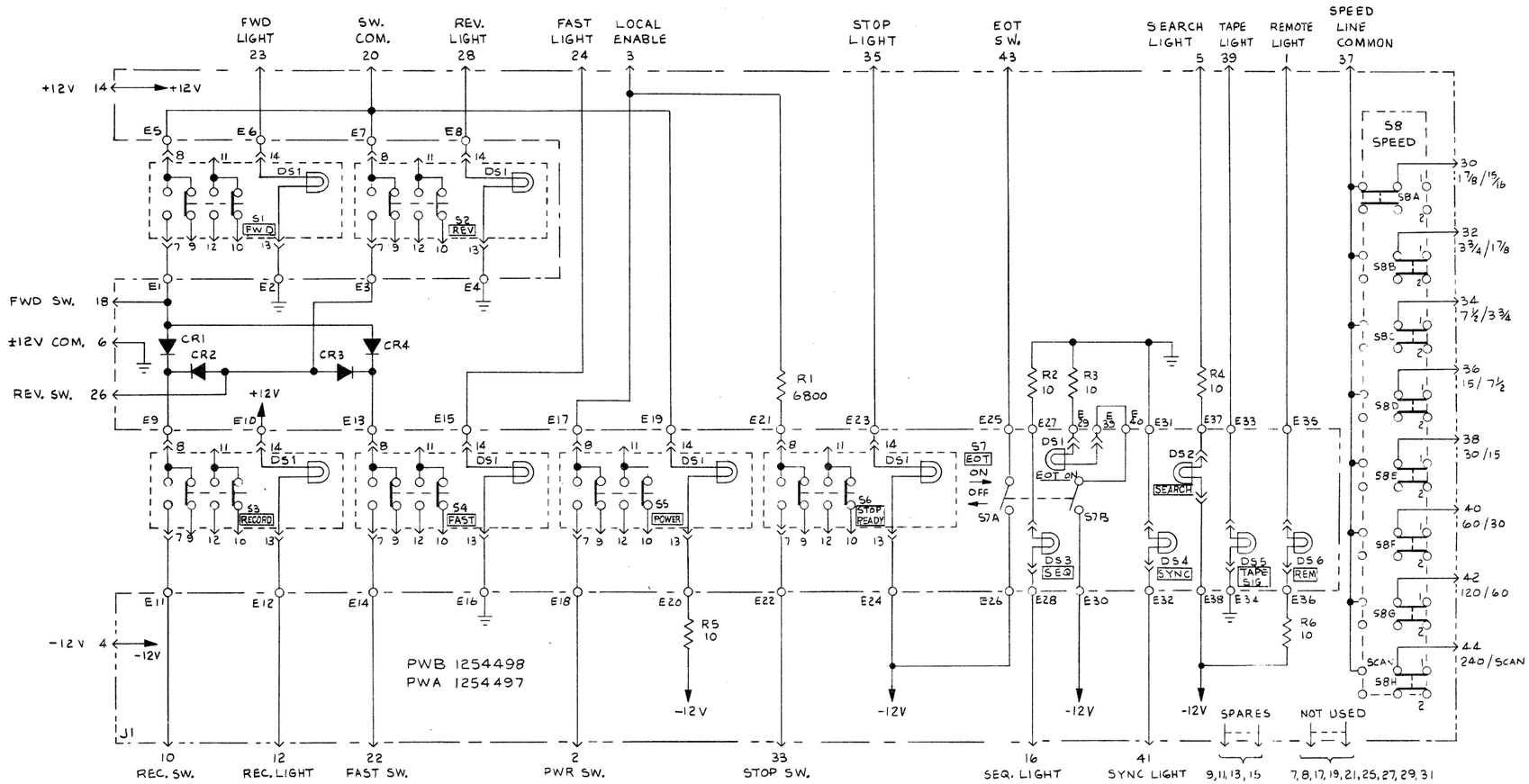
VERSION -04

NOTE

See relay buffer PWA schematic diagram TW1254428 on page 3-15 for proper power-off-speed-select jumper positioning.

LIST OF MATERIALS 1801913

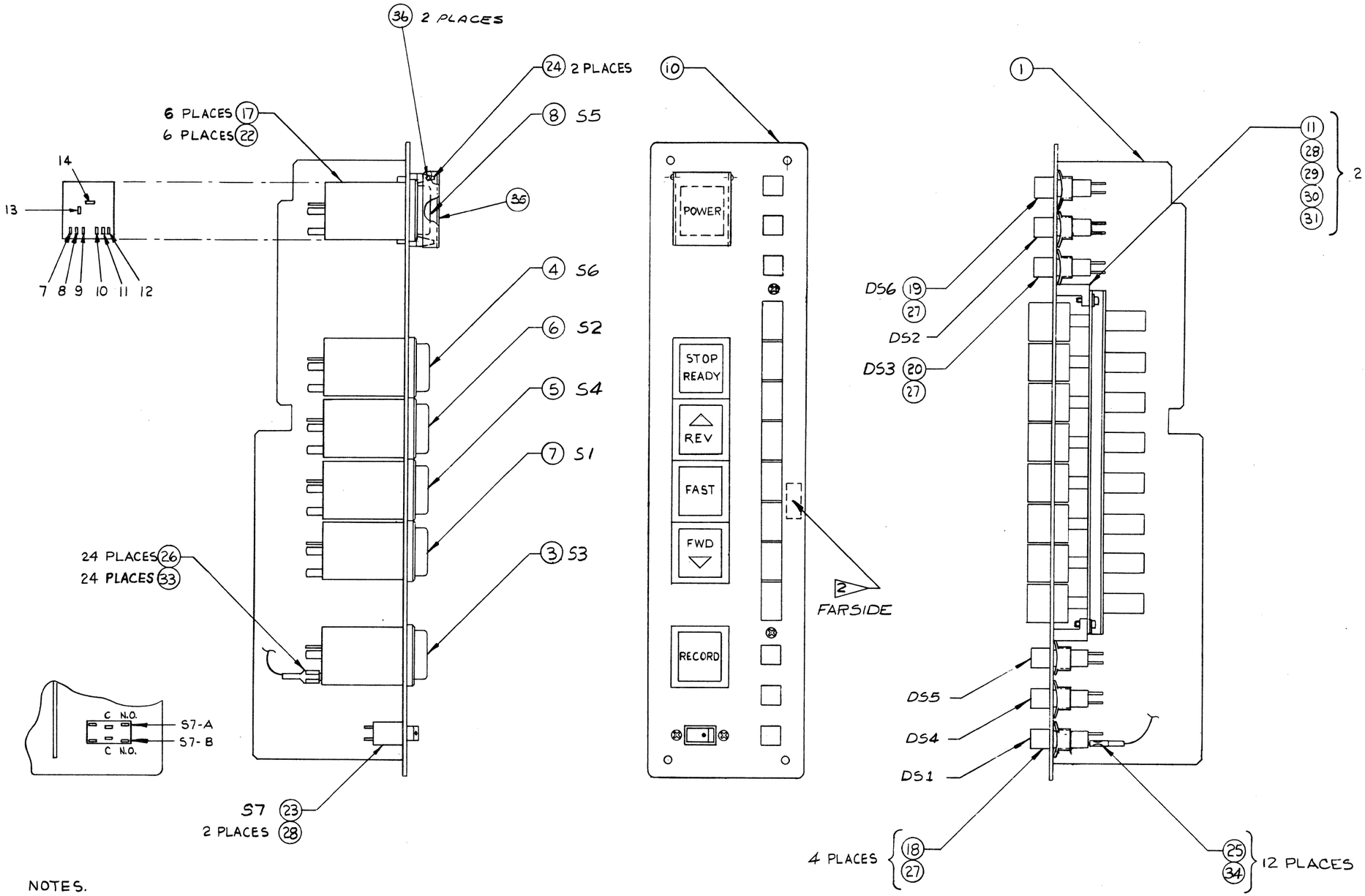
ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -04
3	020-225	K1-9	Relay, armature, 4P2T, 12V dc	9
4	013-678	CR1-9	Diode, silicon (CD451)	9
5	1248538-01	T1	Transformer	1
8	1249870-06	P106	Handle, card ejector	1
9	150-989		Socket, pc, 14 cont	9
11	1248304-03		Pwb, relay buffer	1
12	1254428		Schematic, relay buffer	ref
13	602-012		Shorting plug	7
			Items not used: 1, 2, 6, 7, 10	



NOTES:

1. UNLESS OTHERWISE SPECIFIED; ALL RESISTORS ARE IN OHMS, 1/2W, 5%, ALL DIODES ARE 013-599.
2. SWITCH S8 MECHANICALLY INTERLOCKED. OPERATION OF ANY SWITCH CANCELS SELECTION OF ANY OTHER SWITCH IN MECHANICALLY INTERLOCKED GROUP.
3. PINS 7 & 8 USED FOR KEYING. PIN NOS. REFER TO J1.
4. J1 MATES WITH P217 TRANSPORT HARNESS ASSY 1254452, SCHEMATIC 1254523.

LAST REF. DES.	REF. DES. NOT USED
CR4	
DS6	
E40	
R6	
S8	
J1	



NOTES.

1. ASSY NO. IS 1254495-01.
2. MARK DASH NO. AFTER ASSY NO. PER MIL-STD-130.

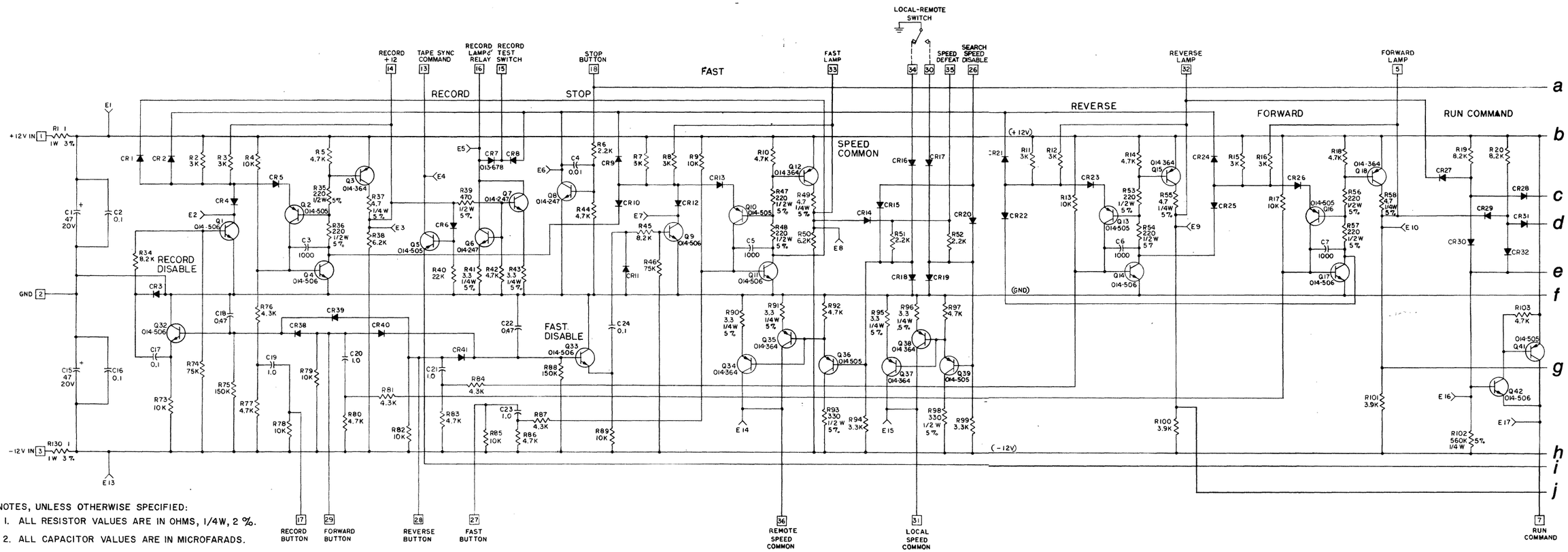
LIST OF MATERIALS 1254495C

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
1	1254497-01*		Pwa, control unit	1		
3	1254496-01	Ref S3	Lens, pushbutton, "RECORD"	1		
4	1254496-02	Ref S6	Lens, pushbutton, "STOP/READY"	1		
5	1254496-03	Ref S4	Lens, pushbutton, "FAST"	1		
6	1254496-04	Ref S2	Lens, pushbutton, "REV"	1		
7	1254496-05	Ref S1	Lens, pushbutton, "FWD"	1		
8	1254496-06	Ref S5	Lens, pushbutton, "POWER"	1		
10	1254499-01		Panel	1		
11	1254510-01		Support, switch	2		
14	1254494		Schematic, composite, control unit	ref		
16	018-030		Adhesive, thread locking, loctite grade C	a/r		
17	060-087	Ref S1,2,3,4,5,6	Lamp, incandescent, 14V, .08A	6		
18	060-514	DS1,2,4,5	Indicator lamp assy, wht	4		
19	060-515	DS6	Indicator lamp assy, red	1		
20	060-513	DS3	Indicator lamp assy, yel	1		
22	119-274	S1,2,3,4,5,6	Switch, pushbutton	6		
23	119-338	S7	Switch, rocker	1		
24	1255759-01	Ref S5	Barrier, switch	2		
25	169-260	Ref DS1-6	Terminal, quick disconnect, fem	12		
26	187-112	Ref S1-6	Terminal, quick disconnect, .110, 22-24 Ga	24		
27	435-069	Ref DS1-6	Clip, lamp	6		
28	471-679		Screw, flat hd, #4-40 x .25 lg	4		
29	472-113		Screw, pan hd, #2-56 x .25 lg	2		
30	501-155		Washer, flat, #2	2		
31	502-001		Washer, spring lock, #2	2		
33	600-253		Sleeving, shrink, blk, .125/.062	a/r		
34	600-251		Sleeving, shrink, blk, .062/.031	a/r		
35	1255760-01		Guard, switch	1		
36	474-007		Screw, drive, #00 x .187 lg	2		
37	611-268		Wire, strd, ins, 24 AWG, red	a/r		
38	611-347		Wire, strd, ins, 24 AWG, blu	a/r		
39	611-348		Wire, strd, ins, 24 AWG, yel	a/r		
40	611-427		Wire, strd, ins, 24 AWG, wht	a/r		
41	611-428		Wire, strd, ins, 24 AWG, grn	a/r		
42	611-429		Wire, strd, ins, 24 AWG, orn	a/r		
			Items not used: 2,9,12,13,15,21,32			

* Breakdown on page 3-28.

WIRE LEAD LIST 1254495C

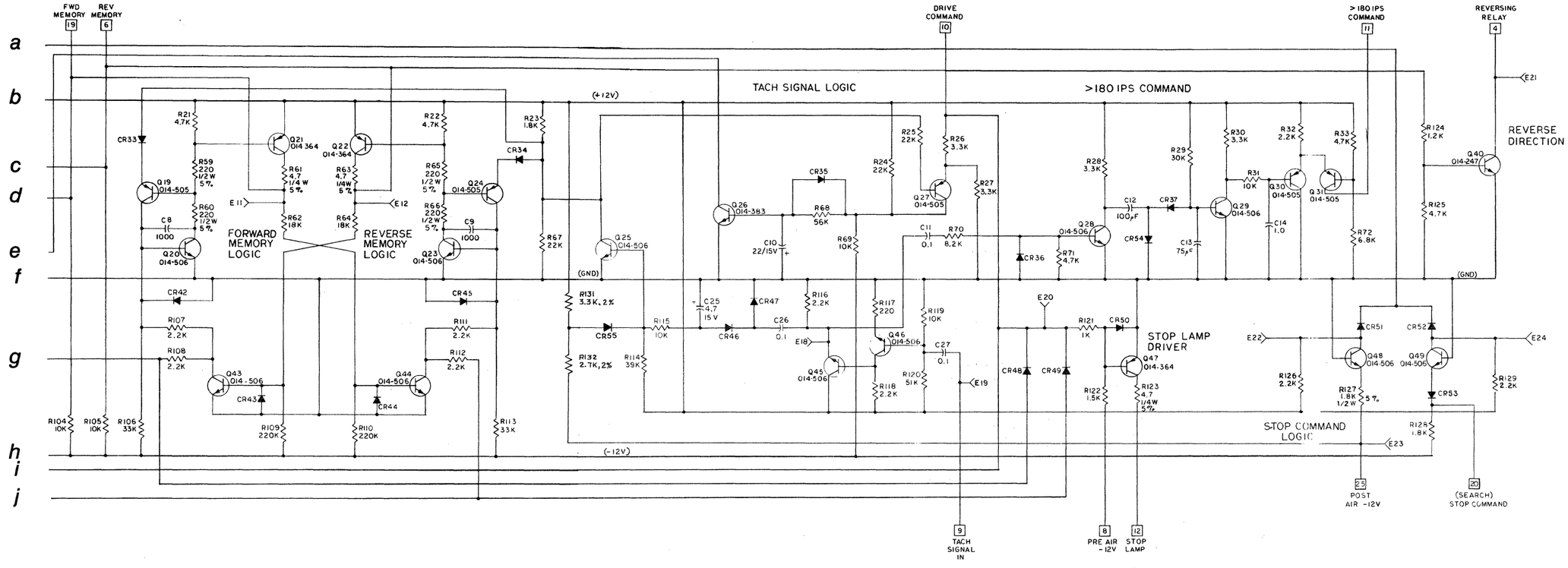
WIRE NO.	AWG/ COLOR	FROM REF DES	FROM TERM	TO REF DES	TO TERM	REMARKS	LM ITEM NO. -01
1	24/2	Item 1	E1	S1	7	Terminate at switch with item 26	37
2	24/4	↑	E2	S1	13	↑	39
4	24/2	↑	E3	S2	7	↑	37
5	24/4	↑	E4	S2	13	↑	39
7	24/3	↑	E5	S1	8	↑	42
8	24/5	↑	E6	S1	14	↑	41
9	24/3	↑	E7	S2	8	↑	42
10	24/5	↑	E8	S2	14	↑	41
11	24/3	↑	E9	S3	8	↑	42
12	24/5	↑	E10	S3	14	↑	41
13	24/2	↑	E11	S3	7	↑	37
14	24/4	↑	E12	S3	13	↑	39
16	24/3	↑	E13	S4	8	↑	42
17	24/2	↑	E14	S4	7	↑	37
18	24/5	↑	E15	S4	14	↑	41
19	24/4	↑	E16	S4	13	↑	39
21	24/3	↑	E17	S5	8	↑	42
22	24/2	↑	E18	S5	7	↑	37
23	24/5	↑	E19	S5	14	↑	41
24	24/4	↑	E20	S5	13	↑	39
26	24/3	↑	E21	S6	8	↑	42
27	24/2	↑	E22	S6	7	↑	37
28	24/5	↑	E23	S6	14	↑	41
29	24/4	↑	E24	S6	13	Terminate at switch with item 26	39
31	24/3	↑	E25	S7-A	C	↑	42
32	24/2	↑	E26	S7-A	N.O.	↑	37
33	24/6	↑	E27	DS3	1	Terminate at 'DS' end using item 25	38
34	24/9	↑	E28	DS3	2	Terminate at 'DS' end using item 25	40
35	24/6	↑	E29	DS1	1	Terminate at 'DS' end using item 25	38
36	24/6	↑	E30	S7-B	N.O.	↑	38
37	24/6	↑	E31	DS4	2	Terminate at 'DS' end using item 25	40
38	24/9	↑	E32	DS4	1	↑	38
39	24/6	↑	E33	DS5	1	↑	38
40	24/9	↑	E34	DS5	2	↑	40
41	24/6	↑	E35	DS6	2	↑	40
42	24/9	↑	E36	DS6	1	↑	38
43	24/6	↑	E37	DS2	2	↑	40
44	24/9	↑	E38	DS2	1	↑	38
45	24/9	↑	E39	DS1	2	↑	40
46	24/9	Item 1	E40	S7-B	C	Terminate at 'DS' end using item 25	40
						Wires not used: 3,6,15,20,25,30	



NOTES, UNLESS OTHERWISE SPECIFIED:

1. ALL RESISTOR VALUES ARE IN OHMS, 1/4W, 2 %.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS.
3. ALL DIODES ARE 013-599.
4. 180 IPS COMMAND NOT USED IN FR-3000. THEREFORE THE FOLLOWING COMPONENTS ARE NOT USED:

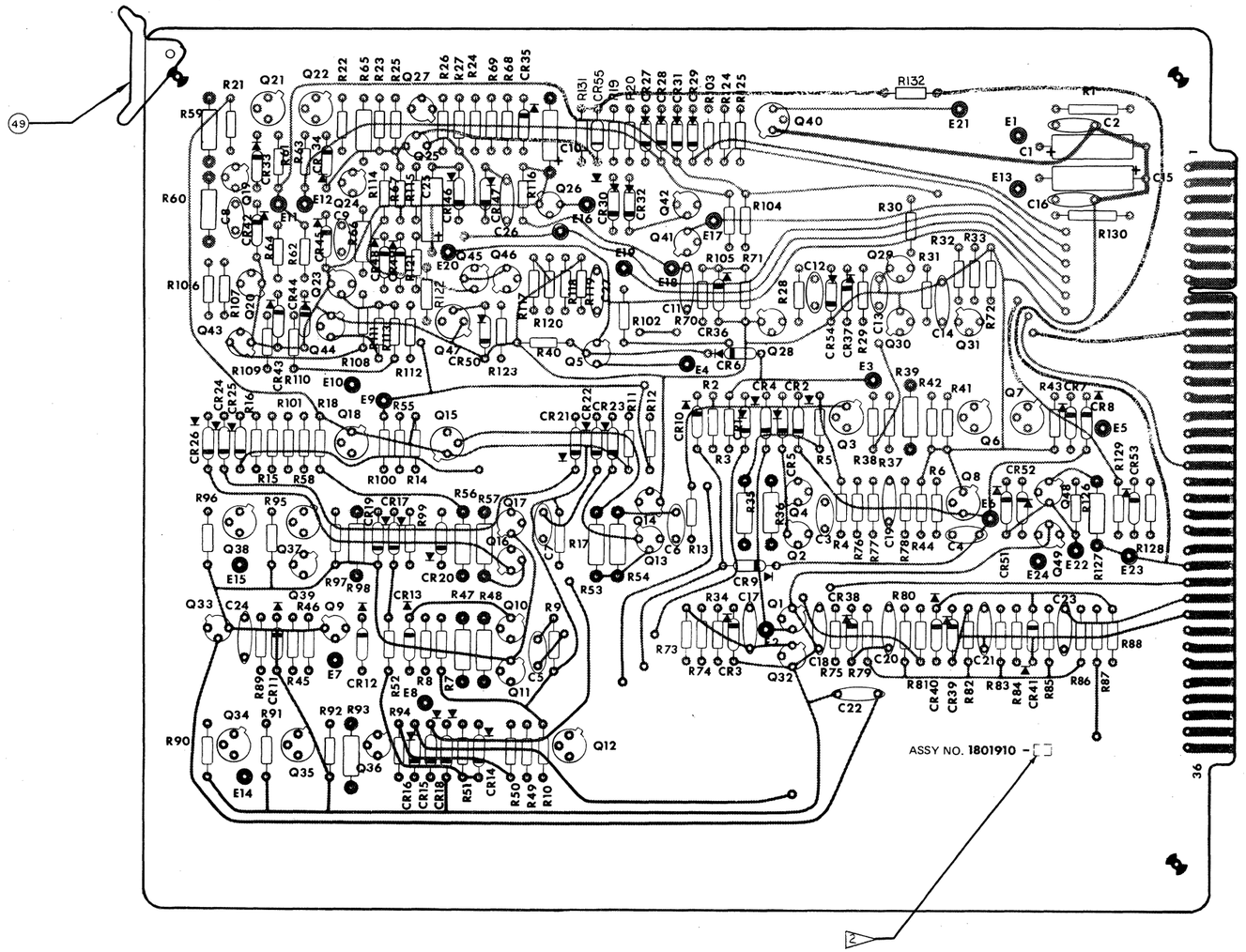
   Q28, Q29, Q30, Q31
   C11, C12, C13, C14
   R28, R29, R30, R31, R32, R33, R70, R71, R72
   CR36, CR37, CR54



FOR FIELD SERVICE USE ONLY

APPLIED JEDEC NO'S, ETC	
AMPEX PART NO.	JEDEC NO'S, ETC
014-247	2N2219
014-364	2N2905A
014-383	2N2484
014-505	2N3251
014-506	2N2501
013-599	1N914
013-678	1N4385

REF DESIG	
USED	NOT USED
C27	
CR55	
R132	
Q49	
E24	

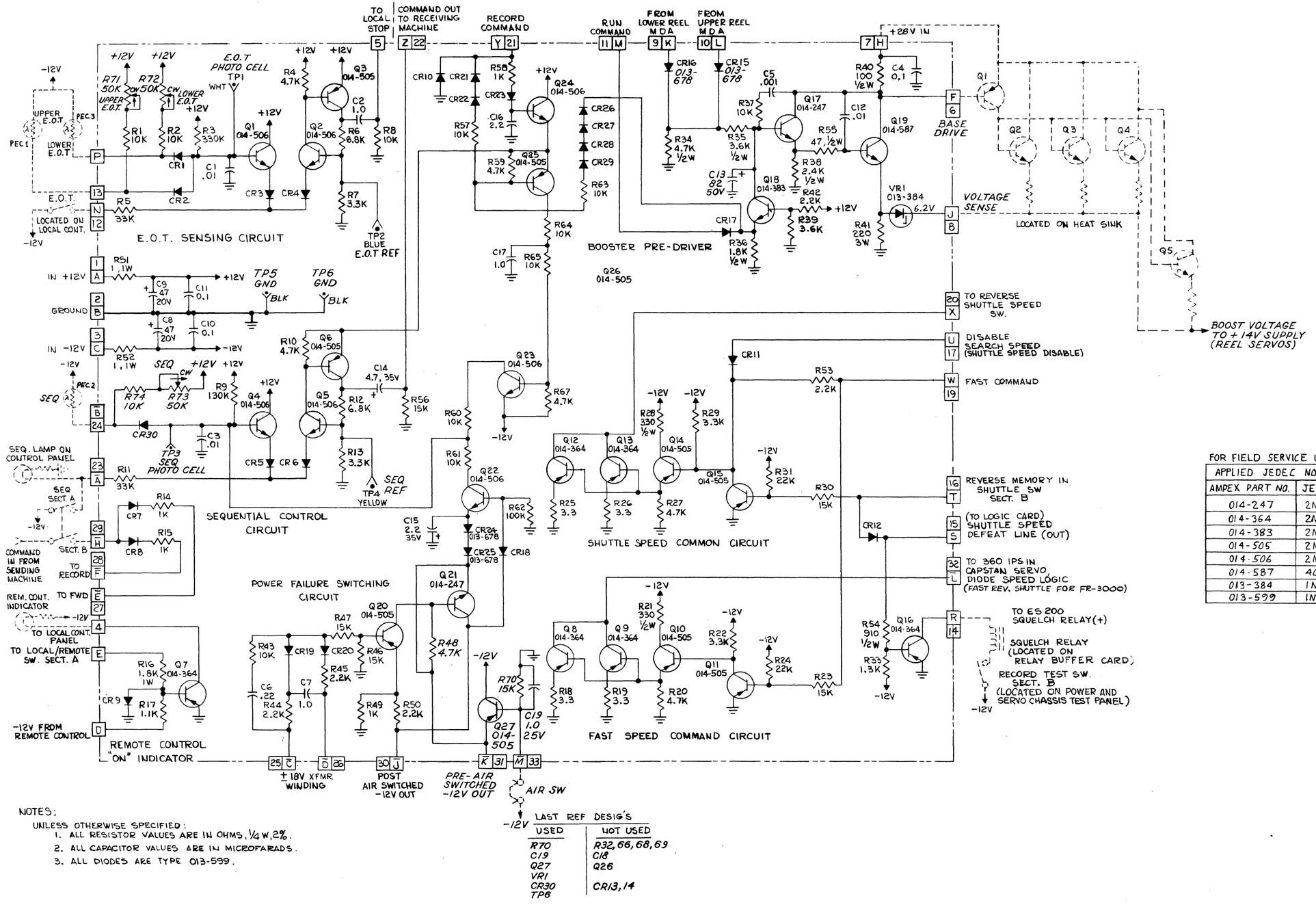


NOTES:

1. ASSEMBLY/CATALOG NUMBER IS 1801910-02.
2. MARK DASH NUMBER IN AREA SHOWN PER MIL-STD-130.

LIST OF MATERIALS 1801910E						
ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -02		
2	013-678	CR7	Diode, silicon (CD451)	1		
3	014-364	Q3,12,15,18,21,22,34,35,37,38,47	Transistor, silicon, npn (CD438)	11		
4	014-505	Q2,5,10,13,16,19,24,27,30,31,36,39,41	Transistor, silicon, pnp (CD445)	13		
5	014-506	Q1,4,9,11,14,17,20,23,25,28,29,32,33,42-46,48,49	Transistor, silicon, npn (CD446)	20		
6	014-383	Q26	Transistor, silicon, npn (CD441)	1		
7	014-247	Q6,7,8,40	Transistor, silicon, npn (CD38)	4		
8	030-094	C14,19,20,21,23	Capacitor, cer, 1 μF, 25V, 20%	5		
9	030-095	C2,11,16,17,24,26,27	Capacitor, cer, .1 μF, 25V	7		
10	030-101	C18,22	Capacitor, cer, .47 μF, 25V	2		
11	030-057	C4	Capacitor, cer, .01 μF, 50V	1		
12	030-133	C3,5,6,7,8,9	Capacitor, cer, .001 μF, 1000V, 20%	6		
13	037-746	C1,15	Capacitor, tant, .47 μF, 20V, 10%	2		
14	037-991	C10	Capacitor, tant, .22 μF, 15V, 20%	1		
15	037-070	C25	Capacitor, tant, 4.7 μF, 35V, 20%	1		
16	034-177	C12	Capacitor, mica, dipped, 100 pF, 500V, 5%	1		
17	041-336	R39	Resistor, comp, 470Ω, 1/2W, 5%	1		
18	041-009	R127	Resistor, comp, 1800Ω, 1/2W, 5%	1		
19	041-329	R93,98	Resistor, comp, 330Ω, 1/2W, 5%	2		
20	041-004	R35,36,47,48,53,54,56,57,59,60,65,66	Resistor, comp, 220Ω, 1/2W, 5%	12		
21	057-116	R72	Resistor, metal film, 6800Ω, 1/4W, 2%	1		
22	057-120	R4,9,13,17,31,69,73,78,79,82,85,89,104,105,115,119	Resistor, metal film, 10,000Ω, 1/4W, 2%	16		
23	057-112	R5,10,14,18,21,22,33,42,44,71,77,80,83,86,92,97,103,125	Resistor, metal film, 4700Ω, 1/4W, 2%	18		
24	057-107	R2,3,7,8,11,12,15,16	Resistor, metal film, 3000Ω, 1/4W, 2%	8		
26	057-118	R19,20,34,45,70	Resistor, metal film, 8200Ω, 1/4W, 2%	5		
27	057-104	R6,32,51,52,107,108,111,112,116,118,126,129	Resistor, metal film, 2200Ω, 1/4W, 2%	12		
28	057-115	R38,50	Resistor, metal film, 6200Ω, 1/4W, 2%	2		
29	057-111	R76,81,84,87	Resistor, metal film, 4300Ω, 1/4W, 2%	4		
30	057-134	R114	Resistor, metal film, 39,000Ω, 1/4W, 2%	1		
31	057-128	R24,25,40,67	Resistor, metal film, 22,000Ω, 1/4W, 2%	4		
32	057-141	R46,74	Resistor, metal film, 75,000Ω, 1/4W, 2%	2		
33	057-148	R75,88	Resistor, metal film, .15 MΩ, 1/4W, 2%	2		
34	057-137	R120	Resistor, metal film, 51,000Ω, 1/4W, 2%	1		
35	057-132	R106,113	Resistor, metal film, 33,000Ω, 1/4W, 2%	2		
36	057-152	R109,110	Resistor, metal film, .22 MΩ, 1/4W, 2%	2		
37	057-126	R62,64	Resistor, metal film, 18,000Ω, 1/4W, 2%	2		
38	057-102	R23,128	Resistor, metal film, 1,800Ω, 1/4W, 2%	2		
39	057-096	R121	Resistor, metal film, 1,000Ω, 1/4W, 2%	1		
40	057-100	R122	Resistor, metal film, 1,500Ω, 1/4W, 2%	1		
41	057-080	R117	Resistor, metal film, 220Ω, 1/4W, 2%	1		
42	057-110	R100,101	Resistor, metal film, 3,900Ω, 1/4W, 2%	2		

LIST OF MATERIALS 1801910E						
ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -02		
43	057-098	R124	Resistor, metal film, 1,200Ω, 1/4W, 2%	1		
44	043-380	R1,130	Resistor, ww, power, 1Ω, 1W, 3%	2		
45	049-354	R37,49,55,58,61,63,123	Resistor, comp, 4.7Ω, 1/4W, 5%	7		
46	049-511	R41,43,90,91,95,96	Resistor, comp, 3.3Ω, 1/4W, 5%	6		
47	041-766	R102	Resistor, comp, .56 MΩ, 1/4W, 5%	1		
48	057-131	R29	Resistor, metal film, 30,000Ω, 1/4W, 2%	1		
49	1249870-01	P101	Handle, card ejector	1		
50	280-131		Mounting pad, transistor (TO5)	15		
51	280-130		Mounting pad, transistor (TO18)	34		
53	1248008		Schematic, control logic	Rev B		
54	034-185	C13	Capacitor, mica, dipped, 75 pF, 500V, 5%	1		
55	057-138	R68	Resistor, metal film, 56 kΩ, 1/4W, 2%	1		
57	013-599	CR1-6, 8-55	Diode, sil	54		
58	057-106	R132	Resistor, metal film, 2.7 kΩ, 1/4W, 2%	1		
59	057-108	R26,27,28,30,94,99,131	Resistor, metal film, 3.3 kΩ, 1/4W, 2%	7		
60	1248026-03		Printed wiring board	1		
			Items not used: 1,25,52,56			



NOTES:

UNLESS OTHERWISE SPECIFIED:

1. ALL RESISTOR VALUES ARE IN OHMS, ¼ W, 2%.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS.
3. ALL DIODES ARE TYPE 013-599.

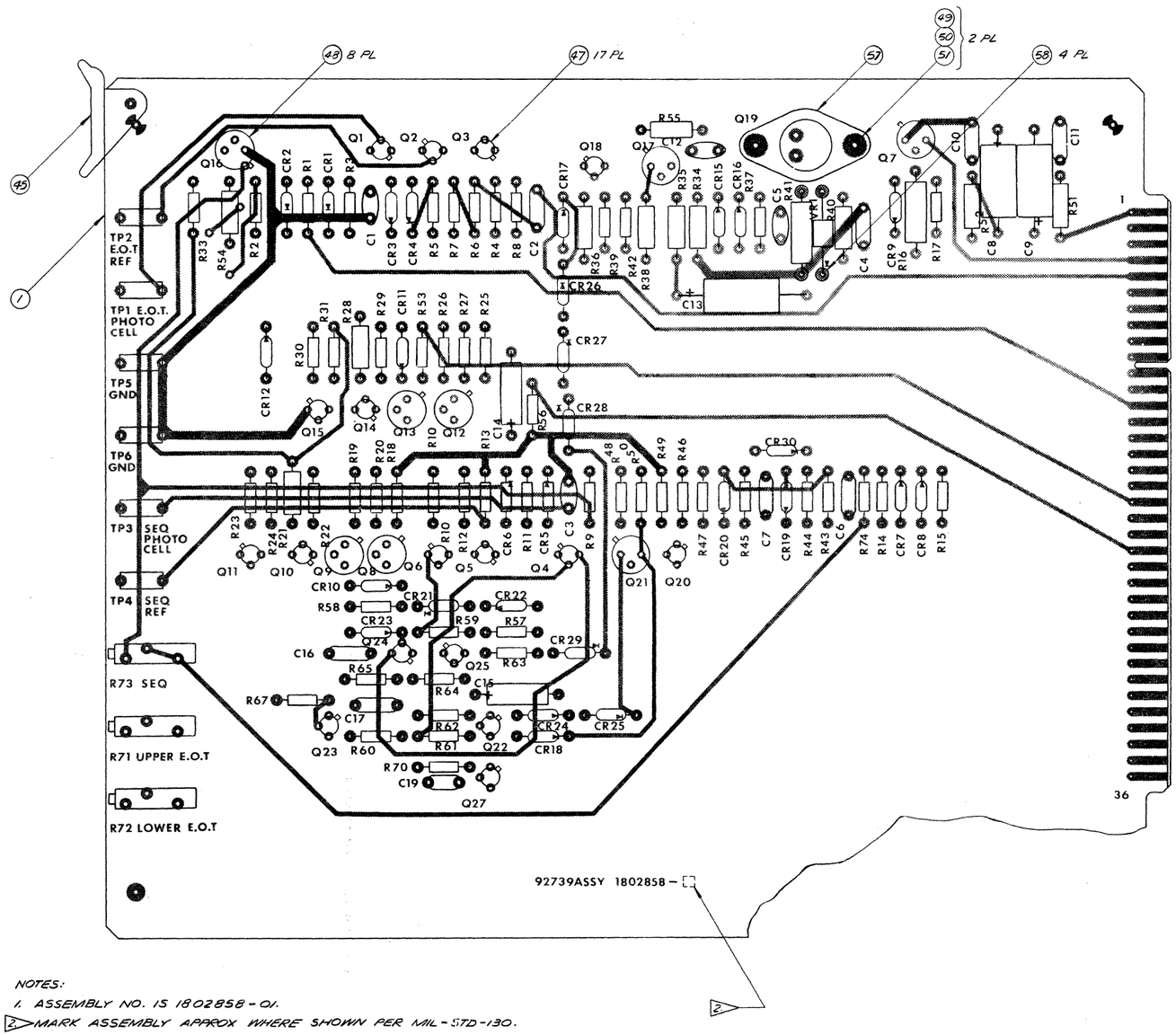
LAST REF DESIG'S	
USED	NOT USED
R70	R32, 66, 68, 69
C19	C18
Q27	Q26
VR1	
CR30	CR13, 14
TP6	

FOR FIELD SERVICE USE ONLY

APPLIED JEDEC NO'S, ETC	
AMPEX PART NO.	JEDEC NO., ETC
014-247	2N2219
014-364	2N2905A
014-383	2N2484
014-505	2N3251
014-506	2N2501
014-587	40250
013-384	1N1766
013-599	1N914

LIST OF MATERIALS 1802858

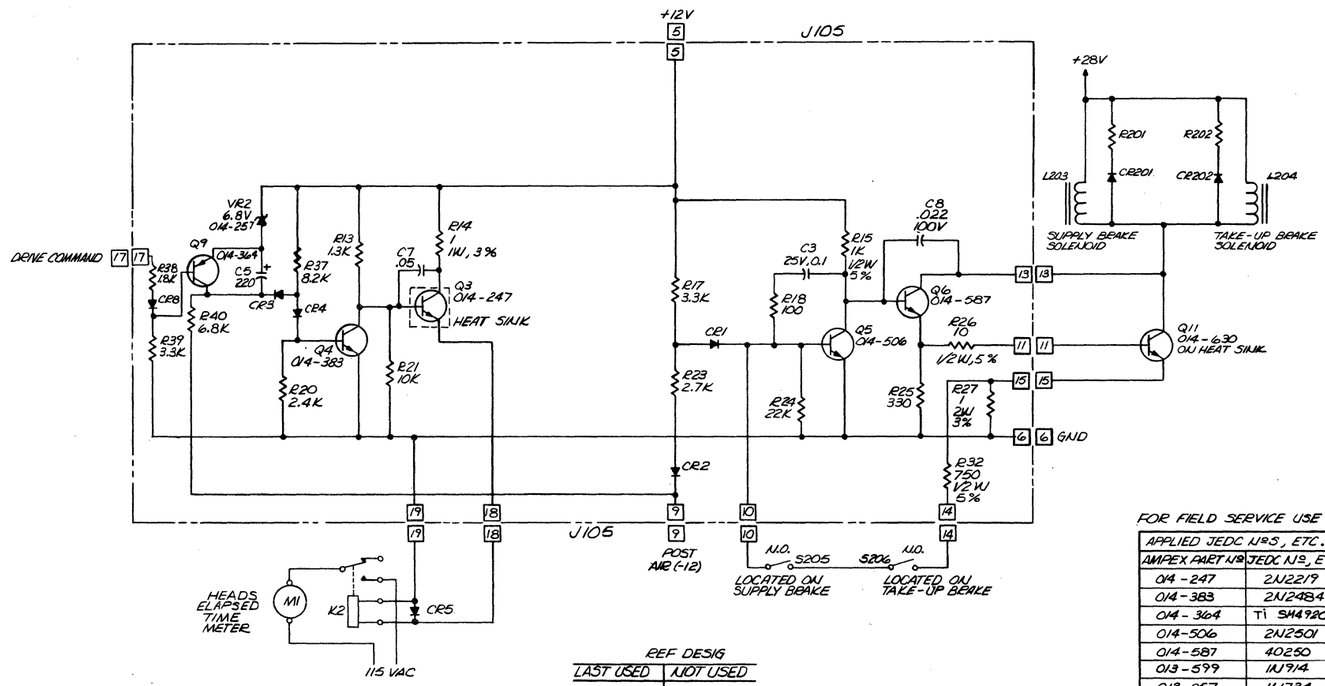
ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
1	1254734-01		Printed wiring board	1		
2	014-364	Q7,8,9,12,13,16	Transistor, silicon, pnp, (TO-5) (CD438)	6		
3	014-247	Q17,21	Transistor, silicon, npn (TO-5) (CD38)	2		
4	014-505	Q3,6,10,11,14,15,20, 25,27	Transistor, silicon, pnp (TO-18) (CD445)	9		
5	014-506	Q1,2,4,5,22,23,24	Transistor, silicon, npn (TO-18) (CD446)	7		
6	014-383	Q18	Transistor, silicon, npn (TO-18) (CD441)	1		
7	014-587	Q19	Transistor, silicon, npn (TO-66)	1		
8	013-599	CR1-12,17-23,26-30	Diode, silicon (CD458)	24		
9	013-384	VR1	Diode, silicon, zener, 6.2 Volt	1		
10	037-746	C8,9	Capacitor, ta, 47 μF, 20V, 10%	2		
11	030-094	C2,7,19	Capacitor, cer, 1 μF, 25V, 20%	3		
12	030-145	C4	Capacitor, cer, .1 μF, 50V, 20%	1		
13	030-057	C1,3,12	Capacitor, cer, .01 μF, 50V, 20%	3		
14	030-095	C10,11	Capacitor, cer, .1 μF, 25V, 20%	2		
15	030-133	C5	Capacitor, cer, .001 μF, 1000V	1		
16	030-310	C6	Capacitor, cer, .22 μF, 25V, 20%	1		
17	047-072	R41	Resistor, ww, 220, 3W, 3%	1		
18	057-112	R4,10,20,27,48,59,67	Resistor, metal film, 4,700Ω, 1/4W, 2%	7		
19	057-108	R7,13,22,29	Resistor, metal film, 3,300Ω, 1/4W, 2%	4		
20	057-120	R8,37,43,57,60,61,63-65,1,2,74	Resistor, metal film, 10,000Ω, 1/4W, 2%	12		
21	047-132	R5,11	Resistor, metal film, 33,000Ω, 1/4W, 2%	2		
22	057-116	R6,12	Resistor, metal film, 6,800Ω, 1/4W, 2%	2		
23	057-097	R17	Resistor, metal film, 1,100Ω, 1/4W, 2%	1		
24	057-096	R14,15,49,58	Resistor, metal film, 1,000Ω, 1/4W, 2%	4		
25	057-109	R39	Resistor, metal film, 3,600Ω, 1/4W, 2%	1		
26	057-104	R44,45,50,42,53	Resistor, metal film, 2,200Ω, 1/4W, 2%	5		
28	057-099	R33	Resistor, metal film, 1,300Ω, 1/4W, 2%	1		
29	057-124	R23,30,46,47,56,70	Resistor, metal film, 15,000Ω, 1/4W, 2%	6		
30	057-128	R24,31	Resistor, metal film, 22,000Ω, 1/4W, 2%	2		
32	057-147	R9	Resistor, metal film, .13 MΩ, 1/4W, 2%	1		
33	041-469	R3	Resistor, comp, .33 MΩ, 1/4W, 5%	1		
34	049-511	R18,19,25,26	Resistor, comp, 3.3Ω, 1/4W, 5%	4		
35	037-650	C13	Capacitor, ta, 82 μF, 50V, 20%	1		
36	041-329	R21,28	Resistor, comp, 330Ω, 1/2W, 5%	2		
37	041-013	R34	Resistor, comp, 4,700Ω, 1/2W, 5%	1		
38	041-316	R38	Resistor, comp, 2,400Ω, 1/2W, 5%	1		
39	041-009	R36	Resistor, comp, 1,800Ω, 1/2W, 5%	1		
40	041-003	R40	Resistor, comp, 100Ω, 1/2W, 5%	1		
41	041-525	R35	Resistor, comp, 3,600Ω, 1/2W, 5%	1		
42	041-104	R16	Resistor, comp, 1,800Ω, 1W, 5%	1		
43	041-522	R54	Resistor, comp, 910Ω, 1/2W, 5%	1		
44	043-380	R51,52	Resistor, ww, pwr, 1Ω, 1W, 3%	2		
45	1249870-02	P102	Handle, card ejector	1		
46	041-283	R55	Resistor, comp, 47Ω, 1/2W, 5%	1		
47	280-130		Mtg. pad, transistor, (TO-18)	17		



NOTES:
1. ASSEMBLY NO. IS 1802858-01.
2. MARK ASSEMBLY APPROX WHERE SHOWN PER MIL-STD-130.

LIST OF MATERIALS 1802858

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
48	280-131		Mtg. pad, transistor, (TO-5)	8		
49	471-061		Screw, mach, xrec, pan hd, #4-40 x 1/4 lg	2		
50	501-008		Washer, plain, #4	2		
51	492-008		Nut, plain hex #4-40	2		
52	1254733		Schematic	ref		
53	148-028	TP-1	Connector, pc, tip jack, wht	1		
54	148-030	TP-2	Connector, pc, tip jack, blue	1		
55	148-027	TP-3	Connector, pc, tip jack, red	1		
56	148-031	TP-4	Connector, pc, tip jack, yel	1		
57	580-143		Insulator, (tran. parts) (TO-66)	1		
58	103307-01		Standoff	4		
61	057-144	R62	Resistor, metal film, 1/4W, .1 MΩ, 2%	1		
62	030-946	C16	Capacitor, cer, 2.2 μF, 50V, 20%	1		
63	037-070	C14	Capacitor, tant, 4.7 μF, 35V, 10%	1		
64	037-238	C15	Capacitor, tant, 2.2 μF, 35V, 10%	1		
65	030-945	C17	Capacitor, cer, 1.0 μF, 50V, 20%	1		
67	013-678	C15,16,24,25	Diode, silicon (CD451)	4		
71	058-388	R71,72,73	Resistor, variable, 50 kΩ	3		
72	148-052	TP-5,6	Connector, pc, tip jack, blk	2		
			Items not used: 27,31,59,60,66,68,69,70			



REF DESIG

LAST USED	NOT USED
C8	C1,2,4,6
C28	C25,6,7
R40	R1-R12,16,19,22,28-31, 33-36
Q9	Q1,2,7,8
VR2	VR1

FOR FIELD SERVICE USE ONLY

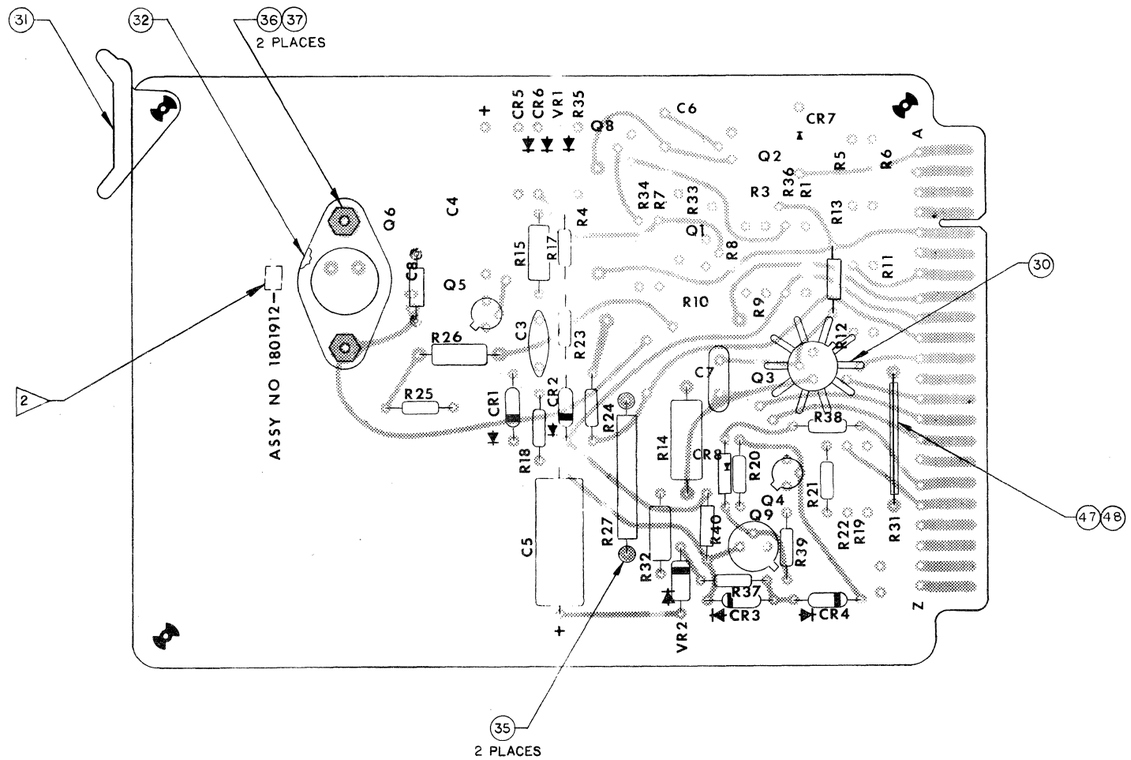
APPLIED JEDC NOS, ETC.	
AMPEX PART NO	JEDC NOS, ETC.
014-247	2N2219
014-383	2N2484
014-364	TI SM4920
014-506	2N2501
014-587	40250
013-599	1N914
013-257	1N1734

NOTES:

UNLESS OTHERWISE SPECIFIED:

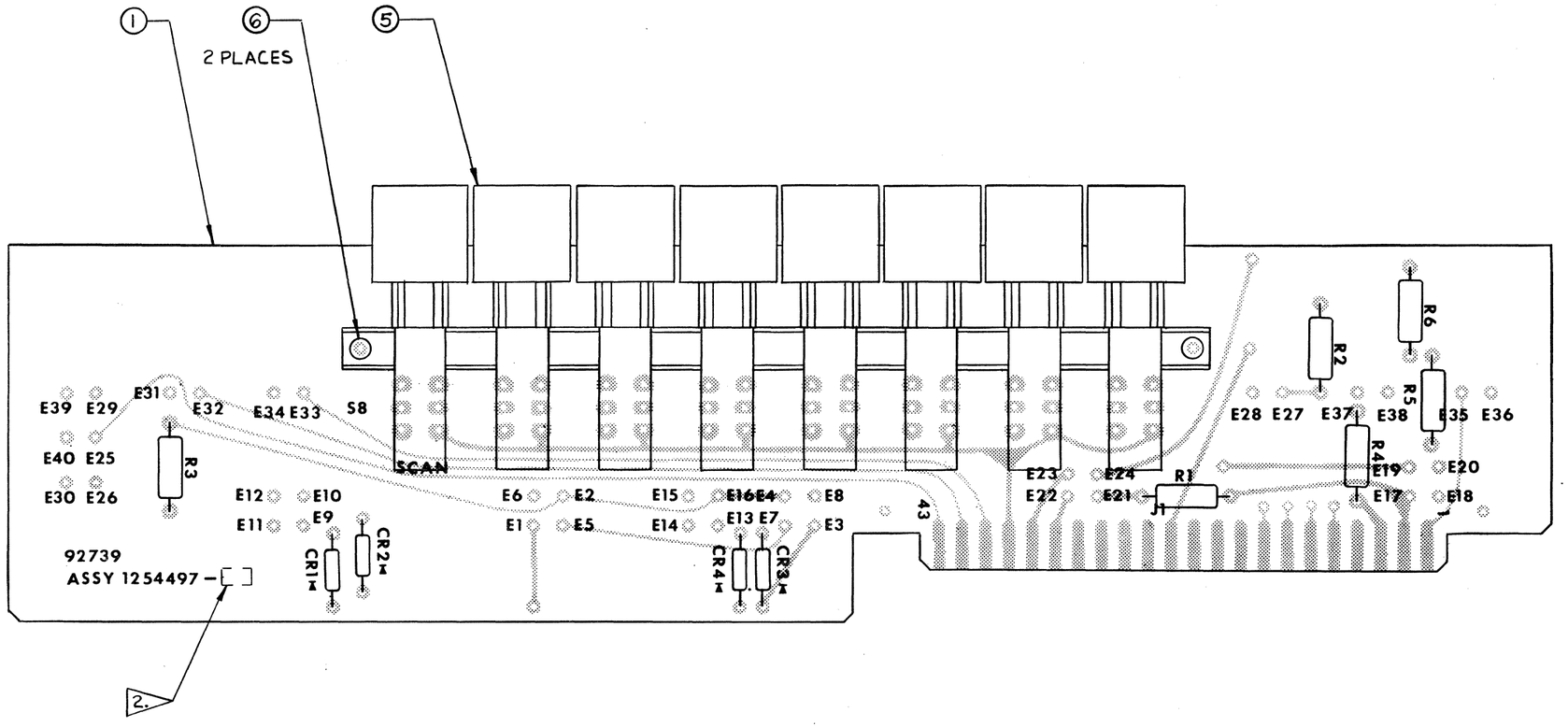
1. ALL RESISTOR VALUES ARE IN OHMS, 1/4W, 2%.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS.
3. ALL DIODES ARE 013-599.
4. SWITCHES CLOSE WHEN SOLENOIDS ENERGIZE.
5. USE NORMALLY OPEN CONTACTS ON MICRO SWITCHES.

LIST OF MATERIALS 1801912M						
ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -03		
4	1254448		Schematic	ref		
5	014-506	Q5	Transistor, sil, npn (TO-18) (CD446)	1		
6	014-587	Q6	Transistor, npn (TO-66)	1		
9	043-967	R27	Resistor, ww, pwr, 1Ω, 2W, 3%	1		
11	041-007	R32	Resistor, comp, 750Ω, 1/2W, 5%	1		
12	041-245	R15	Resistor, comp, 1000Ω, 1/2W, 5%	1		
21	057-099	R13	Resistor, metal film, 1300Ω, 1/4W, 2%	1		
23	057-106	R23	Resistor, metal film, 2700Ω, 1/4W, 2%	1		
24	057-072	R18	Resistor, metal film, 100Ω, 1/4W, 2%	1		
25	057-084	R25	Resistor, metal film, 330Ω, 1/4W, 2%	1		
26	057-128	R24	Resistor, metal film, 22,000Ω, 1/4W, 2%	1		
27	030-095	C3	Capacitor, cer, .1 μF, 25V, 20%	1		
29	041-002	R26	Resistor, comp, 10Ω, 1/2W, 5%	1		
30	014-327		Heatsink, transistor (TO-5)	1		
31	1249870-05		Handle, card ejector (P105)	1		
32	014-802	Ref Q6	Mounting pad, transistor (TO-66)	1		
33	280-131		Mounting pad, transistor (TO-5)	2		
34	280-130		Mounting pad, transistor (TO-18)	2		
35	103307-01		Spacer	4		
36	471-061		Screw, mach, xrec, pan hd, #4-40 x 5/16	2		
37	496-004		Nut, assembled washer, #4-40	2		
44	1248011-03		Printed wiring board	1		
46	064-300	C8	Capacitor, cer, .022 μF, 100V, 20%	1		
47	615-002		Wire, solid bare, 22 AWG	a/r		
48	600-234		Sleeving, Teflon	a/r		
49	043-380	R14	Resistor, ww, pwr, 1Ω, 3%	1		
50	014-247	Q3	Transistor, silicon, npn (TO-5) (CD38)	1		
51	014-383	Q4	Transistor, silicon, npn (TO-18) (CD441)	1		
52	013-599	CR1,2,3,4,8	Diode, silicon (CD458)	5		
53	057-120	R21	Resistor, metal film, 10 kΩ, 1/4W, 2%	1		
54	057-105	R20	Resistor, metai film, 2400Ω, 1/4W, 2%	1		
55	057-118	R37	Resistor, metal film, 8200Ω, 1/4W, 2%	1		
56	057-108	R17,39	Resistor, metal film, 3300Ω, 1/4W, 2%	2		
57	057-102	R38	Resistor, metal film, 1800Ω, 1/4W, 2%	1		
58	057-116	R40	Resistor, metal film, 6800Ω, 1/4W, 2%	1		
59	037-237	C5	Capacitor, tant, 220 μF, 10V, ±10%	1		
60	013-257	VR2	Diode, silicon, zener	1		
61	014-364	Q9	Transistor, silicon, pnp (TO-5) (CD438)	1		
62	030-144	C7	Capacitor, cer, 0.05 μF, 100V, 20%	1		
			Items not used: 1,2,3,7,8,10,13,14,15,16,17,18, 19,20,22,28,38,39,40,41,42,43,45			



-03
SHOWN

CHANGED: 15 MARCH 1978



NOTES:
1. ASSY NO. IS 1254497-01.
2. MARK DASH NO. WHERE SHOWN PER MIL-STD-130.

LIST OF MATERIALS 1254497-

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
1	1254498-01		Printed wiring board, control unit	1		
2	013-599	CR1-4	Diode, sil, switching	4		
3	041-002	R2-6	Resistor, comp, 1/2W, 10Ω, 5%	5		
4	041-330	R1	Resistor, comp, 1/2W, 6800Ω, 5%	1		
5	119-200	S8	Switch assy, 8 pushbutton	1		
6	460-499		Rivet, oval hd, tubular	2		
7	1254494		Schematic	ref		

SECTION 4
REEL CONTROL

SECTION 4

REEL CONTROL

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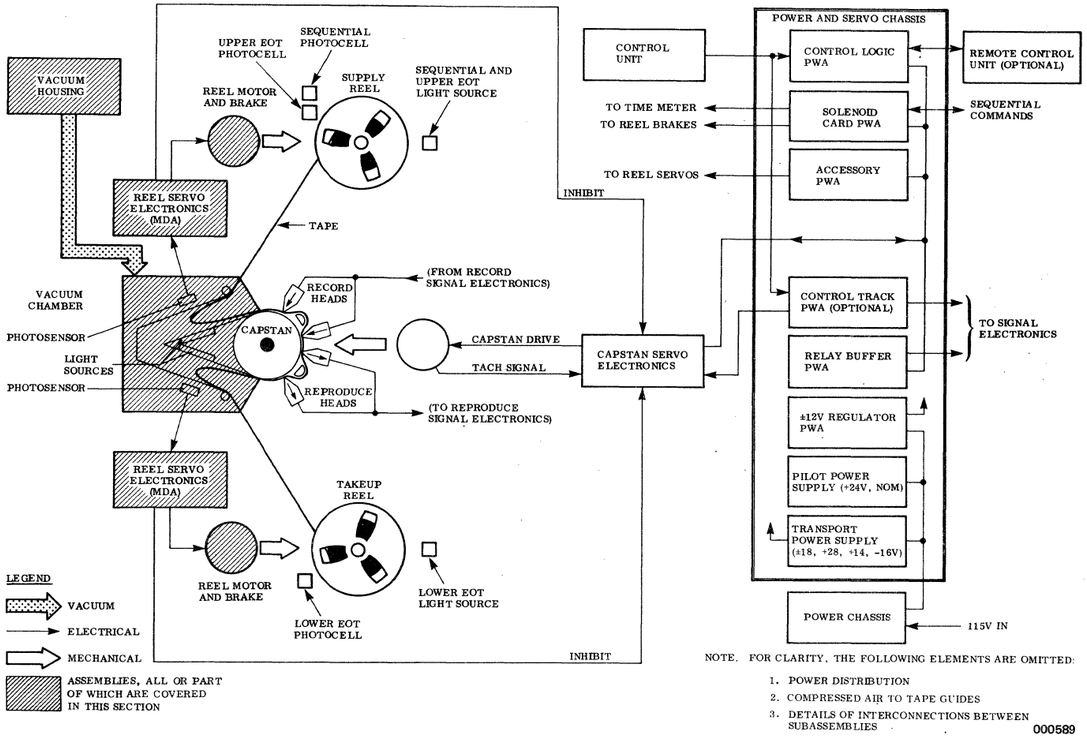


Figure 4-1. Reel Servo Subsystem

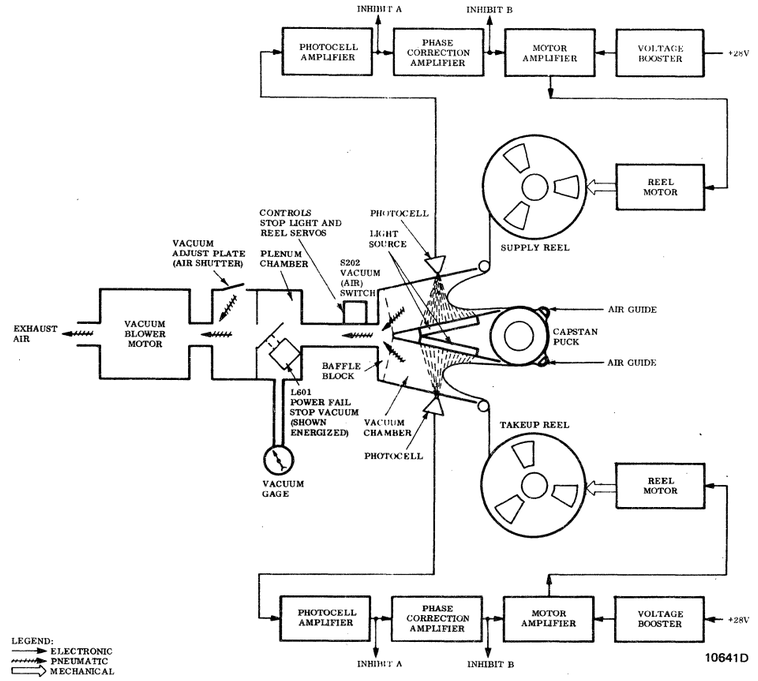


Figure 4-2. Reel Servo Functional Block Diagram

GENERAL

The FR-3000 tape transport includes two independent reel servos. One is for the supply (upper) reel, the other is for the takeup (lower) reel. (See block diagram Figure 4-1. For the physical appearance and location of components, see Section 1.) These servos are transport subsystems which maintain correct tension on the tape, and wind tape on and off the reels in response to the action of the capstan when it moves tape. Each of the reel servo motor assemblies includes an electromechanical brake that is applied by spring force when power is off, in order to prevent tape from being spilled. These brakes are electromechanically released when power is normally on. Each reel servo consists of the following components:

a. A reel motor and brake assembly

b. A reel holddown assembly (mounts on the reel motor and brake assembly)

c. A vacuum housing assembly (shared)

d. A vacuum chamber assembly (shared)

e. A reel servo motor drive amplifier (mda) assembly (includes all the servo electronics)

Following are an overall functional description and then more detailed descriptions of the components parts of the reel servos.

OVERALL FUNCTION AND CONFIGURATION

The actual, primary action of the reel servo is to maintain loops of tape of a correct size in the vacuum chambers next to the capstan. See Figure 4-2. The servos respond only to the position of the tape loops in the chambers. Other functions, such as maintaining tension and winding tape on and off the reels, although vital to the operation of the transport, are only side-effects of this action. Tape tension is a product of loop-positioning interacting with the effect of the vacuum. Tape reeling is a product of loop-positioning and tape motion caused by the capstan. The tape loops must be maintained under all conditions of operation. (Servo action under power loss is described later in this section.)

The 180° direction change in the tape path in each chamber provides almost ideal isolation and decoupling between the tape reels and the capstan. Consequently, disturbances in tape tension introduced by eccentric tape packing, bent reel flanges, or reel-motor cogging are greatly reduced in the tape passing across the magnetic heads.

When tape is threaded, power is applied, and the forward pushbutton is pressed, the capstan pulls tape from the upper vacuum chamber and pushes it into the lower one. Signals generated in the vacuum chambers are fed to the reel servo electronics causing them to drive the reel motors so that they maintain the tape loops near the centers of the vacuum chambers. As a result, the upper reel motor feeds tape into the chamber and the lower reel motor pulls tape from it. When tape is moved in reverse, opposite action takes place.

TAPE LOOP SENSING

The arrangement for sensing the positions of the tape loops is shown in Figure 4-2. If the tape loop in one of the vacuum chambers lengthens or shortens, a photocell senses a decrease or increase in the amount of light reaching it from a light source within the chamber. If the amount of light decreases, indicating a tape loop of excessive length in the chamber, the appropriate reel servo circuits cause the reel motor to adjust its relative position to shorten the loop. The complementary action occurs if the amount of light increases, indicating a tape loop which is too short.

REEL SERVO ELECTRONICS

The electrical output of the photocell in each reel servo is amplified, phase-corrected, and used to control a motor drive amplifier (mda). The output of the mda is current which drives the associated reel motor to a position to correct any error in loop length. (The current source is the transport power supply in the power and servo chassis. See Schematic 1254487 in Section 7.)

When demands for high speed are made on either reel motor (mostly in fast modes), the motors back emf may be sufficient to render the supply voltage inadequate. When this happens, a booster circuit is automatically switched on, and provides increased voltage to the leading motor.

When the demands for speed are too great for the reel servo to meet, and loop lengths go beyond allowable limits, (during acceleration), inhibiting signals are sent from the reel servo to the capstan servo and cause the capstan to slow down until the reels can recover (see Section 5). (This reaction is usually completed too quickly to be visible.)

COMPONENT DESCRIPTIONS

The following pages contain detailed descriptions of the components that make up the reel servo subsystems.

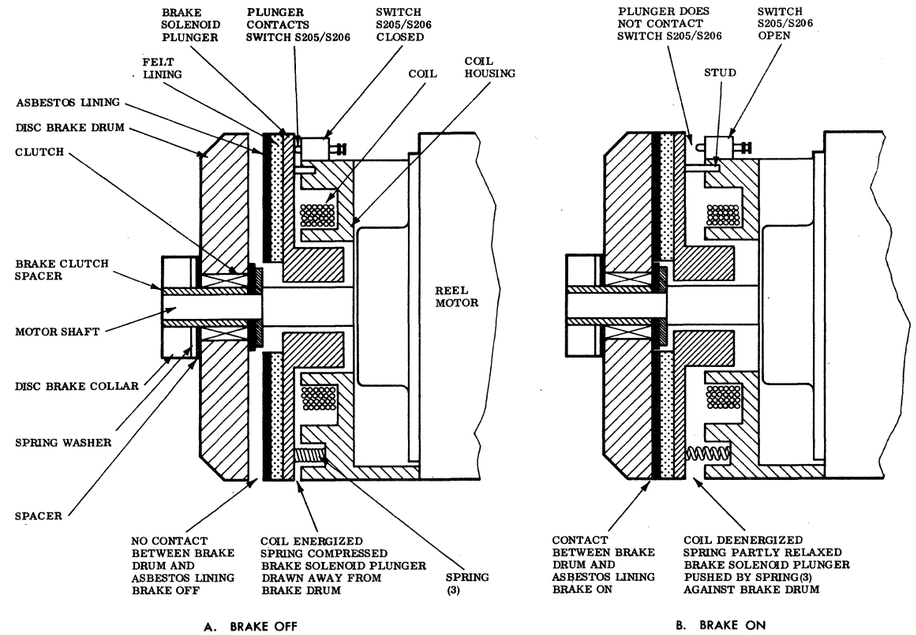


Figure 4-3. Reel-Motor Brakes

The dc reel motor assemblies of the FR-3000 (shown in Assembly Drawing 1248624, following) have torque output that is more than adequate to accelerate a 16-inch reel of 1-inch tape to a speed of 120 ips in 7 seconds. The upper and lower reel assemblies are mounted to the transport baseplate by four hex-head cap screws each.

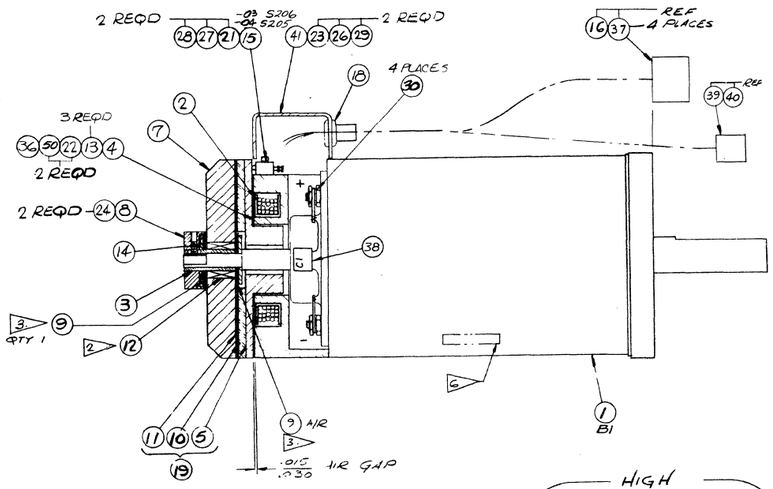
A disc brake assembly is mounted on the rear of each motor. The reel motor assembly, as it relates to the brakes is illustrated in Figure 4-3. When the power is turned off or when power fails, the brakes are applied to the motor by spring force. This prevents tape from unwinding in the power-off condition. A mechanical differential action is provided in the brake assembly so that there is more braking force applied to the reel supplying tape than to the one taking up tape. This always occurs, since the brake actions of the upper and lower motor assemblies are mirror images of each other. The result is that a smooth stop is obtained with no tape spillage when a power loss occurs.

Figure 4-3A illustrates the action within the brake assembly when power is applied to the brake solenoid (coil). The magnetic field developed in the coil draws the brake solenoid plunger away from the disc brake drum, compressing the three springs and separating the brake drum from the asbestos brake lining. This means that the disc brake drum (attached to the reel motor shaft via a clutch assembly) is free to rotate with the motor. In this way, the motor brake is off.

Figure 4-3B illustrates the action within the brake assembly when power is off. With the solenoid deenergized, the three springs force the brake solenoid plunger against the disc brake drum. The friction of the brake drum rotating against the asbestos lining creates the braking force. Dependent upon the direction of rotation of the drum, the clutch either clamps the brake drum tightly against the motor shaft or permits the drum to slip somewhat around the shaft. The ratio of braking under these conditions is 8:1, or 29 (±3) ounces to 3.5 (±1) ounces measured at the hub of an empty reel.

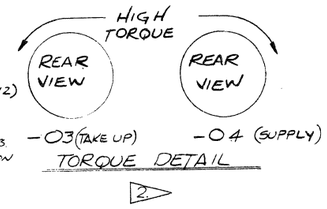
In order to reduce the total amount of current through the brake coil after it has been initially energized and pulled in, and thus prevent overheating, the amount of current is reduced to a holding value by the use of two microswitches (S205, supply, and S206, takeup). When the brake coil is energized (brake released), the brake solenoid plunger activates the microswitch. The microswitch in turn activates circuits on solenoid printed wiring assembly (pwa) P105 in the power and servo chassis. These circuits reduce current through the brake coil to a holding level. (See Section 3, pages 3-10 and 3-11.)

REEL MOTOR AND BRAKE ASSEMBLY 1248624-03,-04J

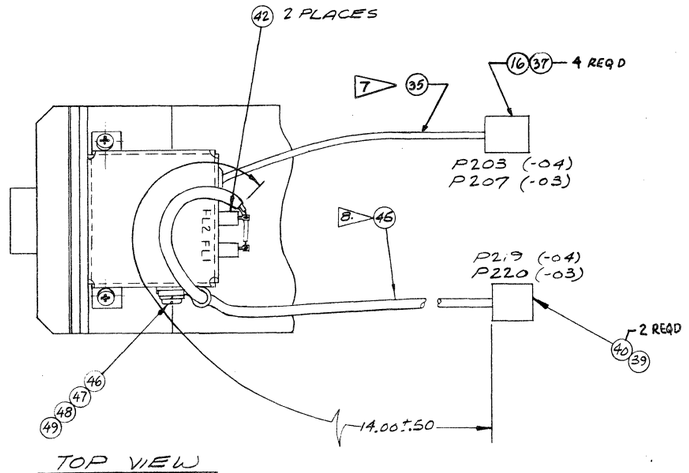


NOTES:

1. ASSY NO. PER TABLE 1.
2. VERSIONS DIFFER BY THE WAY THE CLUTCH (ITEM 12) IS INSERTED & WIRING POLARITY OF MOTOR.
3. INSTALL ONE SPACER (ITEM 9) ON EACH SIDE OF ITEM 7. INSTALL ADDITIONAL SPACERS (ITEM 9) BETWEEN ITEM 7 AND ITEM 3 AS REQUIRED TO MAINTAIN .015/.030 AIR GAP. ITEM 3 MUST SEAT ON SHOULDER OF SHAFT.
4. ADJUST SWITCH (ITEM 15) TO TRIP WHEN SOLENOID IS ENERGIZED.
5. TORQUE RATIO APPROX 8 OZ-IN : 65 OZ-IN. IF LOW, USE WASHERS (ITEM 25) BEHIND SPRINGS TO BRING UP TO DESIRED RATIO.
6. IDENTIFY ASSY PER MIL-STD-130 APPROX WHERE SHOWN.
7. MARK ITEM 35 PER TABLE 1.
8. MARK ITEM 45 PER TABLE 1.



TORQUE DETAIL 2



TOP VIEW

TABLE 1 2

MARKING ITEM 45	VERS	ASSY NO.	DESCRIPTION	MARKING ITEM 35
P220	-03	1248624-03	PER DETAIL	"P207"
P219	-04	1248624-04	PER DETAIL	"P203"

LIST OF MATERIALS 1248624J

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -03	QTY PER UNIT -04	
1	1247505-01	B1	Motor	1	1	
2	1247507-01	L203,204	Coil assy	1	1	
3	1247510-01		Spacer, brake clutch	1	1	
4	1248232-01		Housing, coil	1	1	
5	1248233-01		Plunger, brake solenoid	1	1	
7	1248235-01		Drum, disc brake	1	1	
8	1248236-01		Collar, disc brake	1	1	
9	1248237-01		Spacer, disc brake	a/r	a/r	
10	1248441-01		Lining, felt	1	1	
11	1248442-01		Lining, asbestos	1	1	
12	281-176		Clutch	1	1	
13	352-292		Spring, compression	3	3	
14	501-745		Washer, spring	1	1	
15	120-403	S205,206	Switch, spdt	1	1	
16	169-440	P207,203	Connector, recp, 9 pin	1	1	
18	260-014		Grommet, rubber, .250 i-d	1	1	
19	018-026		Adhesive	a/r	a/r	
21	470-006		Screw, hex socket, #2-56 x 1/2 lg	2	2	
22	471-339		Screw, flat head, #6-32 x 5/8 lg	2	2	
23	471-069		Screw, pan head, #6-32 x 3/8 lg	2	2	
24	477-476		Screw, set, hex soc, flat point, #8-32 x .25 lg	2	2	
25	501-156		Washer, flat, #6	a/r	a/r	
26	501-009		Washer, flat, #6	2	2	
27	501-155		Washer, flat, #2	2	2	
28	502-001		Washer, lock, #2	2	2	
29	502-003		Washer, lock, #6	2	2	
30	171-224		Terminal lug, #10	4	4	
31	611-366		Wire, 14 AWG, wht/vio	a/r	a/r	
32	611-513		Wire, 14 AWG, wht/orn	a/r	a/r	
33	611-268		Wire, 24 AWG, red	a/r	a/r	
34	611-208		Wire, 24 AWG, blk	a/r	a/r	
35	600-007		Tubing, black, .263 i-d	a/r	a/r	
36	018-081		Adhesive, loctite "H"	a/r	a/r	
37	166-507		Pin, connector	4	4	
38	030-945	C1	Capacitor, cer, 1.0 μF, 50V, ±20%	1	1	
39	166-059	J219,220	Connector, recp, 4 pin	1	1	
40	187-032		Pin, connector	2	2	
41	1248234-02		Housing, filter	1	1	
42	052-131	FL1,2	Filter, low pass	2	2	
43	617-057		Wire, 20 AWG, wht/brn	a/r	a/r	
44	617-062		Wire, 20 AWG, wht/blu	a/r	a/r	
45	600-011		Sleeving, flex, blk, #6	a/r	a/r	

LIST OF MATERIALS 1248624J

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -03	-04	
46	302-120		Clamp, cable, .125 i-d	1	1	
47	506-021		"D" washer, #4	1	1	
48	471-062		Screw, mach, pan hd, #4-40 x .375	1	1	
49	502-002		Washer, split, lock, #4	1	1	
50	406-273		Pin, spring, .19 dia x .50 lg	2	2	
			Items not used: 6,17,20			

WIRE LEAD LIST 1248624J

WIRE NO.	AWG/ COLOR	FROM REF DES	FROM TERM	TO REF DES	TO TERM	REMARKS	LM ITEM NO. -03	-04	
3	24 2	Item 15 (S1)	N-O	Item 16	5	Use Item 37	33	33	
4	24 0	Item 15 (S1)	SW	Item 16	6	Use Item 37	34	34	
5	22 90	Item 2		Item 16	7	Wires part of Item 2			
6	22 92	Item 2		Item 16	8	Wires part of Item 2			
7		Item 1	+	Item 1	-	Use item 30	38	38	
8	20 91	Item 1 (B1)	-	FL1	Thd End		43	-	
9	20 96	Item 1 (B1)	+	FL2	Thd End		44	-	
10	20 91	Item 1 (B1)	+	FL1	Thd End		-	43	
11	20 96	Item 1 (B1)	-	FL2	Thd End		-	44	
12	20 91	Item 39	2	FL1	Plain End	Twist together and cover with item 45. Use item 40	43	43	
13	20 96	Item 39	3	FL2	Plain End	Twist together and cover with item 45. Use item 40	44	44	
						Wires not used: 1,2			

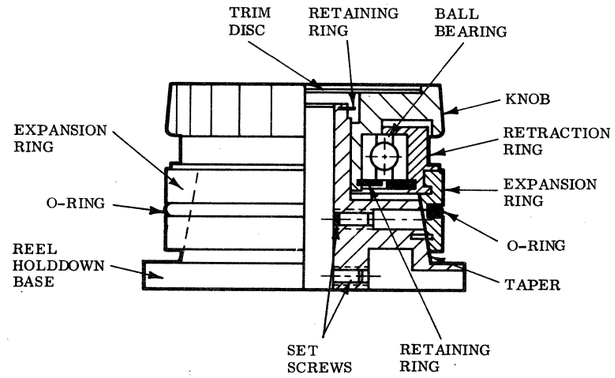


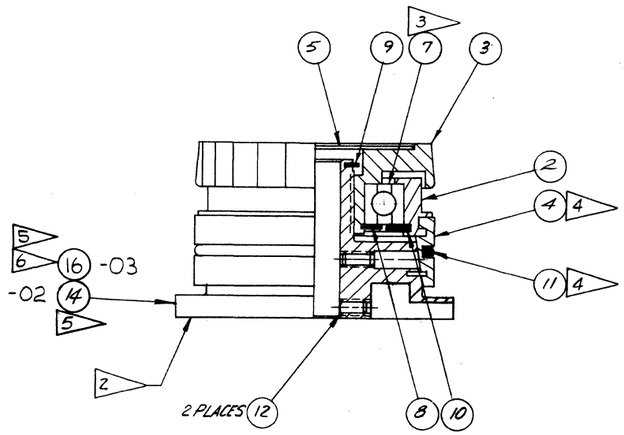
Figure 4-4. Reel Holddown Assembly

The reel holddown assembly secures the tape reel to the shaft of the reel motor. Clockwise rotation of the knob tightens the holddown assembly against the tape reel hub. Counterclockwise rotation loosens it.

Refer to Figure 4-4. As the knob is turned clockwise, the retraction ring is forced downwards along the reel holddown base. When this happens, the grooved expansion ring is forced down the taper of the holddown base and expands against the inside surface of the reel hub, providing a positive grip between the ring and the reel. When the knob is turned counterclockwise, the expansion ring is pulled back up the taper and is partially collapsed by the O-ring, releasing the reel hub.

Note that view A of Figure 4-4 shows two #10-32 hex socket set screws that secure the complete reel holddown assembly to the reel motor shaft. One of these screws is accessible through a cutout in the base of the reel holddown. The other is accessible through the gap in the expansion ring when the knob is turned cw.

REEL HOLDDOWN ASSEMBLY 1247178-02 D



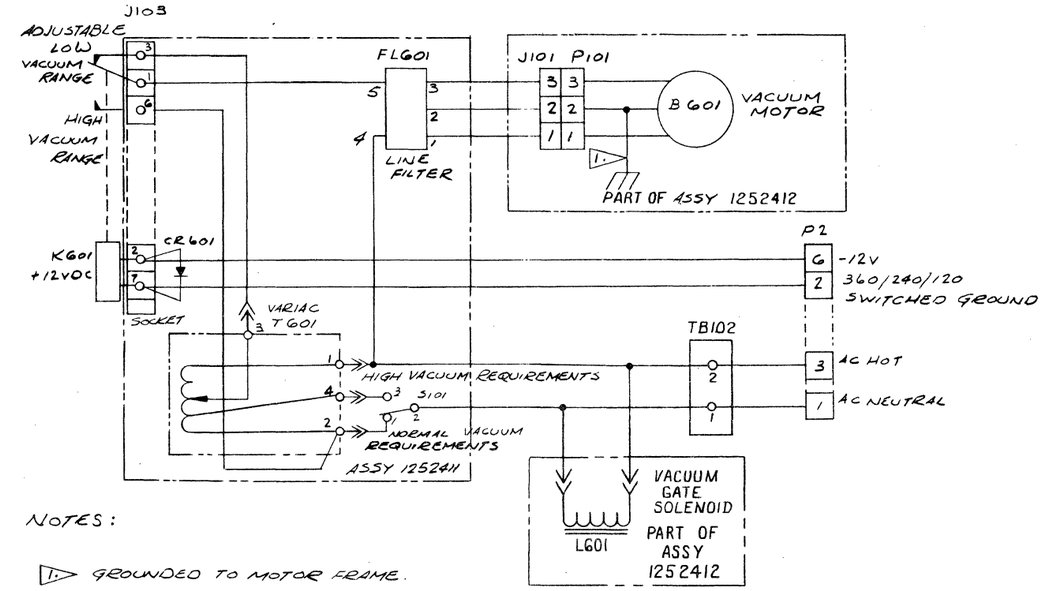
NOTES:

1. ASSEMBLY NO. IS 1247178-02 OR -03
2. MARK ASSEMBLY NO. APPROX WHERE SHOWN PER MIL-STD-130.
3. LUBRICATE BEARING (ITEM 7) WITH A THIN FILM OF GREASE (ITEM 13). INSTALL WITH SHIELD ORIENTED UP.
4. APPLY A THIN FILM OF GREASE (ITEM 13) TO THE TAPERED SURFACE OF THE EXPANSION RING (ITEM 4) AND I.D. OF O'RING (ITEM 11).
5. APPLY A THIN FILM OF GREASE (ITEM 15) TO THE THREADED PORTION OF THE BASE (ITEM 14)
6. VERSION -03 USED FOR FR600/1400 SPARES ONLY

LIST OF MATERIALS 1247178

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -02		
2	1247180-01		Ring, retraction	1		
3	1247181-02		Knob	1		
4	1247182-01		Ring, expansion	1		
5	1247254-02		Trim disc	1		
7	420-049		Bearing, ball, 1.250 i.d. x 2.250 o.d. x .500 wide	1		
8	430-449		Ring, retaining, 1.250 dia. shaft	1		
9	430-450		Ring, retaining, .812 dia shaft	1		
10	430-451		Ring, retaining, 2.250	1		
11	432-201		Seal, o-ring 2.520 o.d. x .141 wide	1		
12	477-511		Screw, set, 10-32 x .500 lg	2		
13	087-061		Grease, silicon (gen. purpose)	a/r		
14	1247179-02		Base, reel hold down	1		
15	087-685		Lubricant (grease) MIL-G-23827	a/r		
			Items not used: 1, 6			

VACUUM HOUSING ASSEMBLY SCHEMATIC 1252459B
VACUUM HOUSING ASSEMBLY



NOTES:

1. GROUNDED TO MOTOR FRAME.

Refer to Schematic 1252459, above, and to Assembly Drawings 1802489, 1252413, 1252412, and 1252411 on following pages. Figure 4-2 (page 4-1) shows the functional relationship of the vacuum housing and its mechanical and pneumatic controls. See Section 1 for illustrations showing the location and appearance of the vacuum housing.

Vacuum housing assembly 1802489 is mounted at the inside top of the rack cabinet behind the tape transport. A blower motor (M601) in the vacuum housing supplies the vacuum requirements of the vacuum chamber assembly. In operation, the blower motor draws air from the vacuum chamber, through a baffle block, through a channel in the baseplate, then by way of an adapter plate in the upper lefthand corner of the back of the baseplate through a hose to a plenum chamber on the bottom of the vacuum housing, before exhausting it through a slot in the back of the housing.

The plenum is divided into two sections. The first of these contains L601, a power-failure-stop solenoid. L601 is energized as soon as power is applied to the blower and deenergized as soon as power is removed. When energized, L601 opens an air gate which permits passage of air from the first to the second section of the plenum. The second section contains a triangular shaped foam air filter to remove foreign particles from the air before it is recirculated into the cabinet. When L601 is deenergized, a leaf spring closes the air gate and stops the passage of air in the plenum. This action cuts off the vacuum blower from the vacuum chamber and prevents tape from bottoming in the vacuum chamber. (Due to its inertia, the blower motor continues to rotate for a short time after power removal, and thus maintains vacuum.)

A variable transformer (T601) permits the speed of the blower motor to be adjusted for the amount of vacuum required to obtain optimum tape tension at the lower six record/reproduce tape speeds. The transformer control is accessible on the vacuum control box assembly, which is mounted on the side of the vacuum housing assembly toward the front of the transport. A tap on the transformer permits the selection of normal or high vacuum according to line-voltage and altitude requirements. This selection is made using VACUUM, HIGH/NORMAL switch S101, located near the transformer control. Selection of HIGH boosts the line

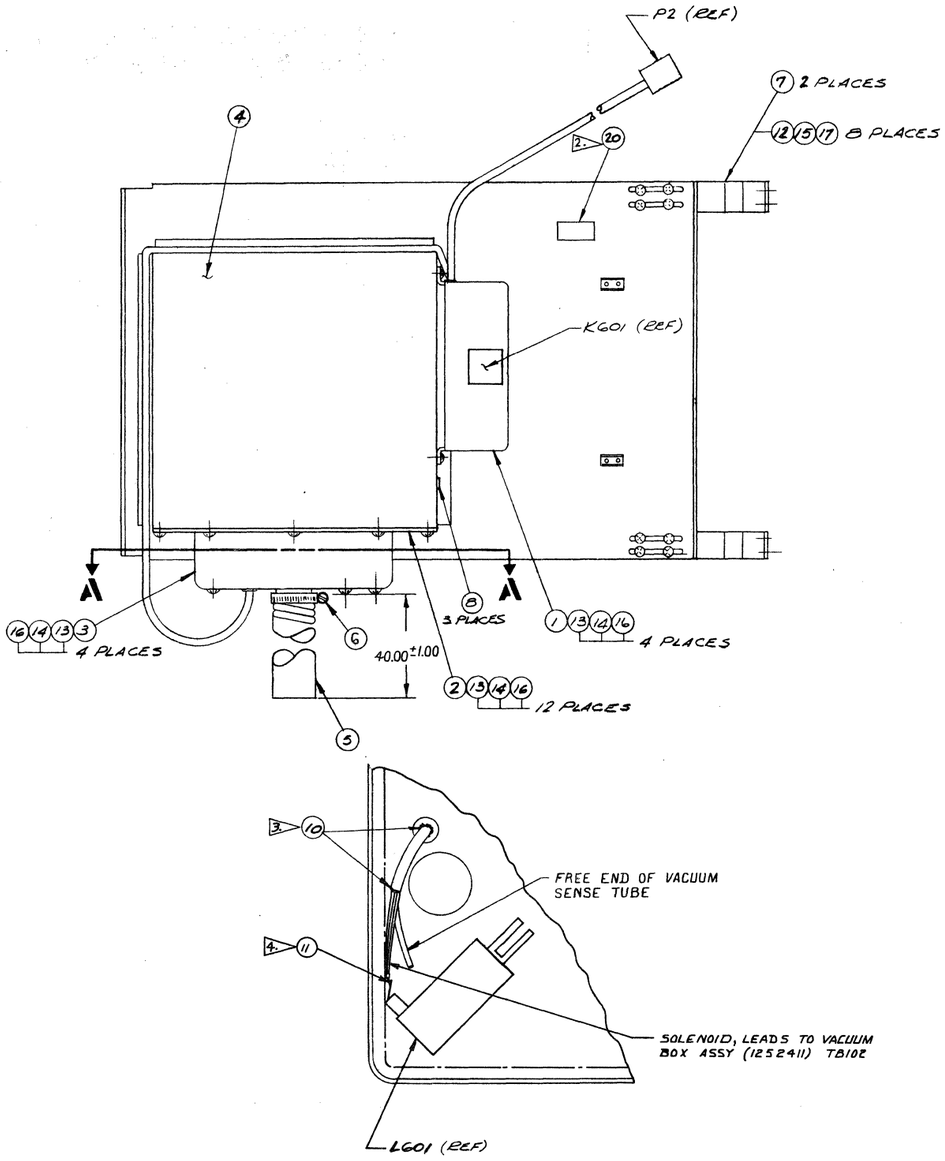
voltage by approximately 12V rms, and the record/reproduce vacuum voltage proportionally.

At the three highest tape speeds (300+ ips, fast; 240 ips, scan; and either 120 ips or 60 ips, record/reproduce, depending on the speed range in use) relay K601 of the vacuum control box assembly is energized. This is accomplished by a ground applied through the speed selection logic. (See Figure 3-13, page 3-12, Section 3.) When K601 is energized, it applies maximum voltage to the blower motor for maximun vacuum.

A vacuum adjustment plate, commonly called the air shutter, is mounted in the second section of the plenum. This shutter is used to adjust the amount of external air drawn in by the blower. The larger the opening, the less vacuum is developed in the vacuum chamber. The normal adjustment position is such that when full voltage is applied to the vacuum blower motor, the maximum vacuum that can be developed by the blower is 15.5 inches of water.

To facilitate the adjustment of the vacuum system, a vacuum gage, calibrated in inches of water, is mounted on the vacuum control box near T601 and S101. The gage is connected by a tube to the plenum chamber, measuring pressure in the first section.

In addition to the items described above, there is a sensitive air pressure switch (mounted on the transport baseplate, but part of the vacuum system) just behind the baffle block at the outlet of the vacuum chamber. This switch is S202, the function of which is described in Section 3, pages 3-3 and 3-10. The switch is included in the list of materials for the baseplate assembly in Section 2.



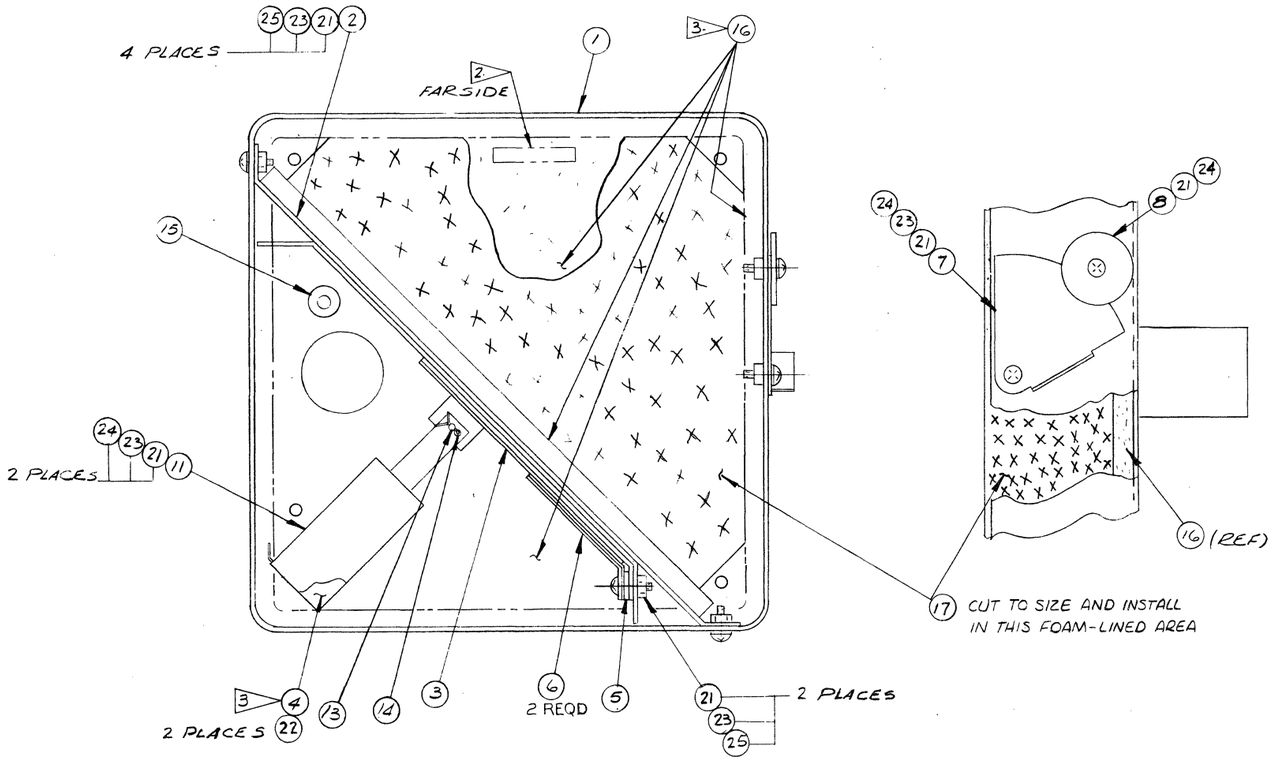
VIEW A-A

NOTES:

1. ASSY/CAT. NO. IS 1802489-01.
2. MARK IDENTIFICATION LABEL (ITEM 20) WITH CATALOG No. & SERIAL No. PER MIL-STD-130.
3. SEAL END OF SLEEVING AROUND WIRE & TUBING AND GROMMET & TUBING WITH ITEM 10.
4. BEND TABS AS SHOWN, COVER TERMINALS WITH ITEM 11.

LIST OF MATERIALS 1802489G

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01
1	1252411-01		Vacuum control box assy	1
2	1252412-01		Mounting plate assy	1
3	1252413-01		Plenum assy	1
4	1252414-01		Enclosure assy	1
5	601-001		Hose vacuum 1 1/4 i-d	a/r
6	302-512		Clamp, band, gear, .812/1.500 i-d	1
7	1248087-01		Bracket, adjustment	2
8	260-010		Grommet, 1/4	3
10	087-646		Adhesive, silicone, gray	a/r
11	600-038		Sleeving, 3/16 i-d	a/r
12	471-078		Screw, pan hd, xrec, #8-32 x 3/8	8
13	471-069		Screw, pan hd, xrec, #6-32 x 3/8	20
14	501-009		Washer, plain, #6	20
15	501-205		Washer, plain, #8	8
16	502-003		Washer, spring lock, #6	20
17	502-004		Washer, spring lock, #8	8
20	1251523-01		Identification plate	1
21	1252459		Schematic	Rev B
			Items not used: 9,18,19	

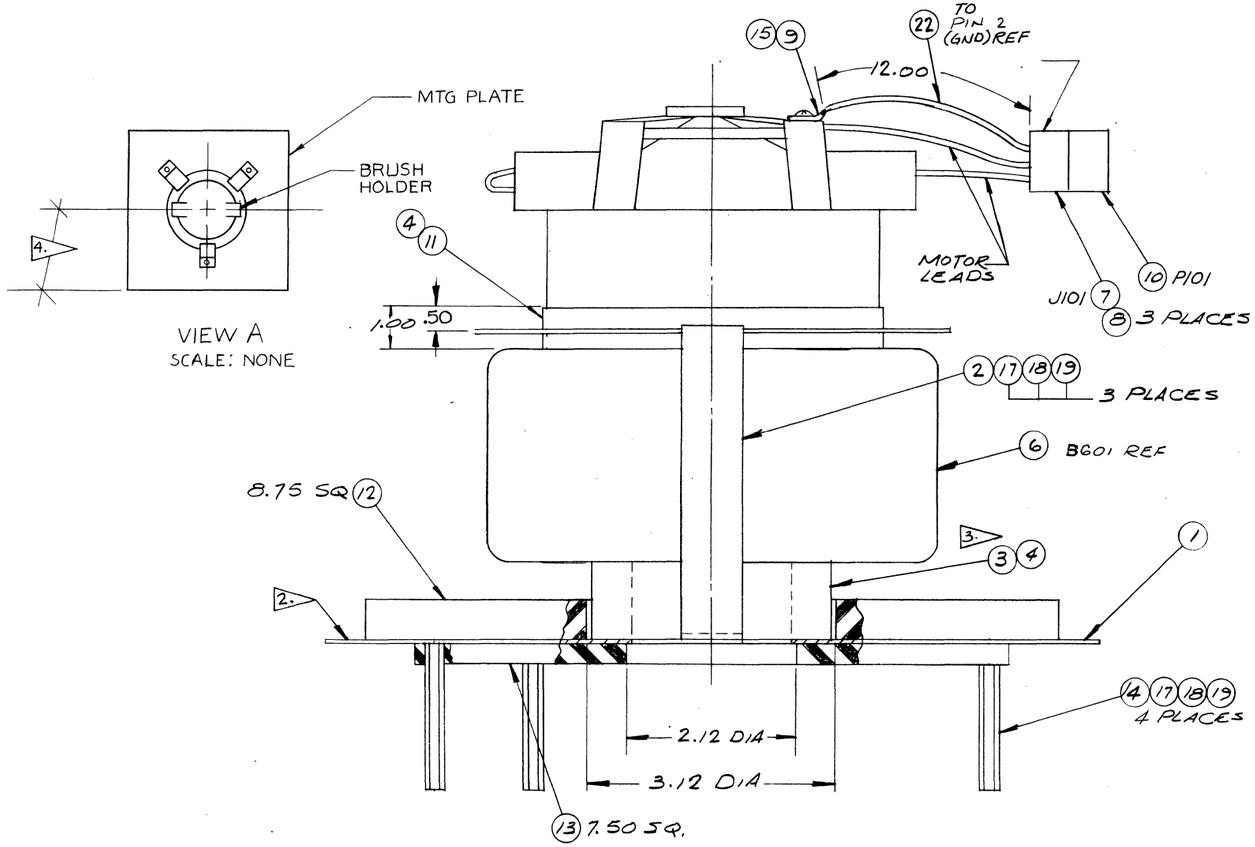


NOTES:

1. ASSY NO. IS 1252413-01.
2. MARK ASSY NO. APPROX WHERE SHOWN PER MIL-STD-130.
3. INSTALL ITEM 16 (SOUNDFOAM) TO ALL 4 SIDES & BOTTOM OF PLENUM & ONE SIDE OF BRACKET AS SHOWN. CUT FOAM TO CLEAR HOLES & ITEM 4.

LIST OF MATERIALS 1252413D

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
1	1252403-01		Plenum chamber	1		
2	1248266-01		Partition	1		
3	1248267-01		Vacuum stop	1		
4	1248268-02		Spacer, solenoid	1		
5	1248269-01		Bracket	1		
6	1248902-02		Spring, vacuum gate	2		
7	1248104-01		Plate, vacuum adjust	1		
8	1250348-01		Washer, special	1		
11	022-171	L601	Solenoid, 115V ac cont duty	1		
13	400-009		Pin, straight headed .124 dia	1		
14	401-004		Pin, cotter	1		
15	260-019		Grommet	1		
16	922-321		Sound foam 1/4 thk adhesive	a/r		
17	922-418		Foam, air filter	a/r		
21	471-069		Screw, pan hd, xrec 6-32 x 3/8	10		
22	471-338		Screw, flat hd xrec 6-32 x 1/2	2		
23	501-009		Washer, flat #6	9		
24	502-003		Washer, spring lock #6	4		
25	496-005		Nut, keps, 6-32	6		
			Items not used: 9,10,12,18,19,20			

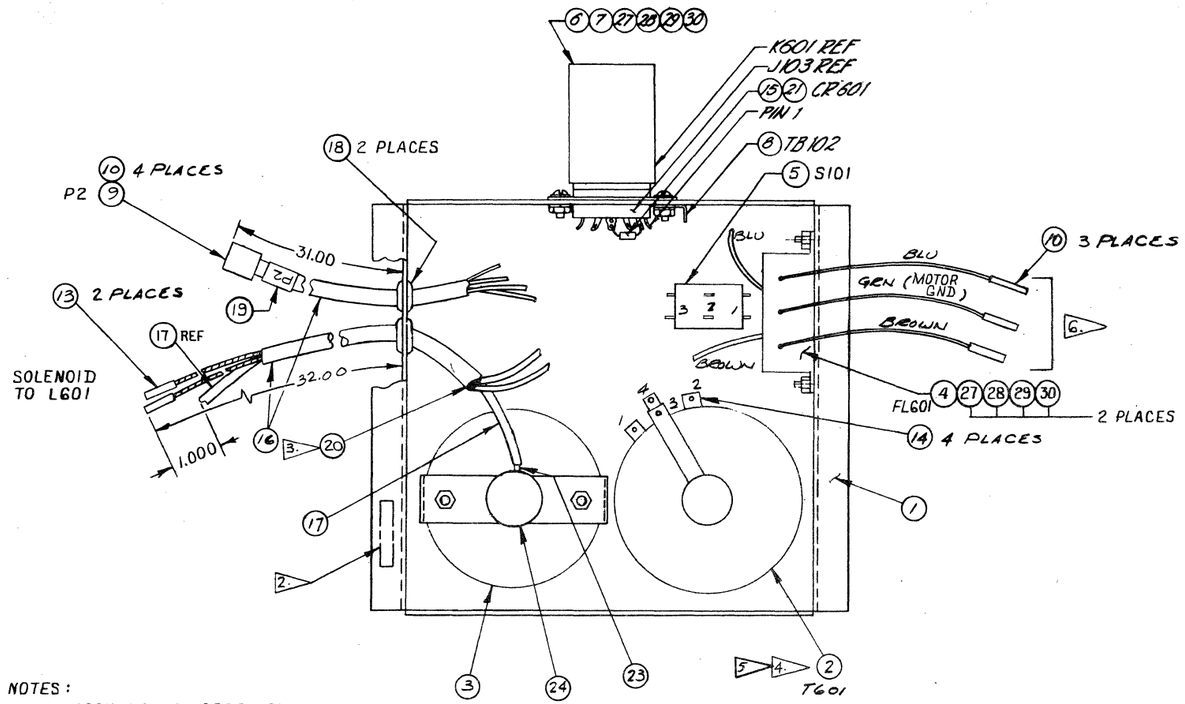


NOTES:

1. ASSY No. IS 1252412-01.
2. MARK ASSY No. APPROX WHERE SHOWN PER MIL-STD-130.
3. ATTACH ITEM 3 (GASKET) TO ITEMS 1 (PLATE) & 6 (MOTOR) WITH ITEM 4 (ADHESIVE).
4. BRUSH HOLDER ASSY TO BE PARALLEL TO EDGE OF MTG PLATE, ITEM 1. SEE VIEW A.

LIST OF MATERIALS 1252412E

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01
1	1252401-01		Plate, mounting	1
2	1252456-01		Retainer, motor	1
3	1252415-01		Gasket, sealing	1
4	018-011		Adhesive, Scotch 1300	a/r
6	591-235	B601	Motor, vacuum	1
7	169-136	J101	Body, recp plug	1
8	169-321		Contacts, connector	3
9	172-218		Terminal lug, crimp ring	1
10	169-137	P101	Connector, cable receptacle	1
11	269-140		Neoprene, .062 thk	a/r
12	922-330		Sound foam, 1/2 adh bk	a/r
13	922-321		Sound foam, 1/4 adh bk	a/r
14	280-507		Spacer, plain, #6-32 x 1 7/8	4
15	502-004		Washer, spring lock, #8	1
17	471-069		Screw, pan hd, xrec, #6-32 x 3/8	8
18	501-009		Washer, plain, #6	8
19	502-003		Washer, spring lock, #6	8
21	1252459		Schematic, vacuum control assy	Rev B
22	611-726		Wire, 16 AWG, grn	a/r
			Items not used: 5, 16, 20	



NOTES:

1. ASSY NO. IS 1252411-01.
2. MARK PART APPROX. WHERE SHOWN PER MIL-STD-130.
3. SEAL END OF SLEEVING AROUND WIRE, ITEMS 31 & 36, & VACUUM SENSE TUBE, ITEM 17, WITH ITEM 20.
4. MOUNT VARIAC ITEM 2 WITH PROJECTION IN .187 HOLE IN PANEL
5. DISCARD KNOB SUPPLIED WITH VARIAC, ITEM 2.
6. FILTER LEADS ARE INSTALLED IN CONNECTOR P101 AT NEXT ASSEMBLY.

LIST OF MATERIALS 1252411E

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
1	1252402-01		Housing, vacuum control	1		
2	560-043	T601	Transformer, variable	1		
3	090-177		Gauge, vacuum	1		
4	052-180	FL601	Line filter	1		
5	120-004	S101	Switch, spdt, 6 amp	1		
6	020-227	K601	Relay, spdt, 12V	1		
7	150-001	J103	Socket, relay	1		
8	180-023	TB102	Terminal strip, 2 term	1		
9	169-996	P2	Body, rect, plug, 6 pin	1		
10	169-321		Contact, conn	7		
11	502-086		Washer, lock, 7/16 int tooth	1		
13	187-046		Terminal, quick disconn	2		
14	173-089		Terminal, quick disconn, fem	4		
15	013-678		Diode	1		
16	600-038		Sleeving, 3/16 i-d	a/r		
17	600-567		Tubing, vacuum	a/r		
18	260-019		Grommet	2		
19	600-093		Sleeving, plastic, shrink, blk	a/r		
20	087-646		Adhesive, silicone, gray	a/r		
21	600-036		Sleeving, teflon, clear	a/r		
23	440-210		Hose coupling	1		
24	1252460-01		Pipe cap 1/4, hex BRS	1		
25	1252459		Schematic, vacuum cont assy	Rev B		
27	471-069		Screw, mach, pan hd, #6-32 x 3/8	4		
28	492-009		Nut, mach, #6-32	4		
29	501-009		Washer, plain, #6	4		
30	502-003		Washer, split lock, #6	4		
31	611-268		Wire, strd, insul, 24 AWG, red	a/r		
32	611-209		Wire, strd, insul, 24 AWG, brn	a/r		
33	611-429		Wire, strd, insul, 24 AWG, orn	a/r		
34	611-723		Wire, strd, insul, 16 AWG, blk	a/r		
35	611-725		Wire, strd, insul, 16 AWG, wht	a/r		
36	614-874		Wire, strd, insul, 24 AWG, wht/yel	a/r		
			Items not used: 12, 22, 26			

WIRE LEAD LIST 1252411E

WIRE NO.	AWG/ COLOR	FROM REF DES	FROM TERM	TO REF DES	TO TERM	REMARKS	LM ITEM NO. -01
1	#16/0	P-2	1	TB-102	1		35
2	#16/9	P-2	3	TB-102	2		34
3	24/1	P-2	2	J-103	7		32
4	24/3	P-2	6	J-103	2		33
5	24/2	TB-102	1	--	-	To item 13 - quick disconnect terminal	31
6	24/94	TB-102	2	--	-	To item 13 - quick disconnect terminal	36
8	--/1	FL-601	1	P-101 (6)	1	Wire pigtail on FL-601 (motor lead)	4
9	--/5	FL-601	2	P-101 (6)	2	Wire pigtail on FL-601 (gnd green)	4
10	--/6	FL-601	3	P-101 (6)	3	Wire pigtail on FL-601 (motor lead)	4
11	--/6	FL-601	4	TB-102	2	Wire pigtail on FL-601	4
12	--/1	FL-601	5	J-103	1	Wire pigtail on FL-601	4
13	#16/0	TB-102	1	S-101	2	To common of S.P.D.T. switch	35
14	#16/0	S-101	1	T-601	2	Item 14 disconnect terminal at T-601	35
15	#16/0	S-101	3	T-601	4	Item 14 disconnect terminal at T-601	35
16	#16/9	TB-102	2	T-601	1	Item 14 disconnect terminal at T-601	34
17	#16/9	T-601	3	J-103	3	Item 14 disconnect terminal at T-601	34
18	#16/0	T-601	2	J-103	6	Solder to terminal 2 on T-601	35
19	--	J-103	2	--	-	To anode of CR-601 } Cover leads with item 21	15
20	--	J-103	7	--	-	To cathode of CR-601 } Cover leads with item 21	15
						Item not used: 7	

VACUUM CHAMBER ASSEMBLY 1254724 -01C

WIRE LEAD LIST 1254724C

WIRE NO.	AWG/ COLOR	FROM REF DES	FROM TERM	TO REF DES	TO TERM	REMARKS	LM ITEM NO. -01
1	24/7	P211	1	J402	B	} Twisted	44
2	24/95	P211	2	J402	A	} Twisted	45
3	24/7	P211	3	J402	C		44
4	24/2	P211	4	TB101	1	} Twisted } Part of Item 14	
5	24/0	P211	5	TB101	2	} Twisted } Part of Item 14	
6	24/2	P211	7	TB102	1	} Twisted } Part of Item 14	
7	24/0	P211	8	TB102	2	} Twisted } Part of Item 14	

CHANGED: 15 MARCH 1978

In addition to tape-position sensing, the vacuum chamber assembly provides the means to isolate and decouple the reels from the capstan. It also performs edge-guiding of the tape and includes a capstan cleaner. Vacuum is maintained by a vacuum blower motor exhausting the air from the rear of the vacuum chamber via a baffle block. A light source, consisting of six small incandescent lamps is mounted in each arm of the center assembly. The combined light from each group of lamps shines through a faceted translucent glass plate into the vacuum chamber. A photocell (a self-generating silicon solar cell approximately 1 centimeter square) is mounted behind a similar translucent glass plate opposite the light sources. (As described at the beginning of this section, when the tape moves in or out of the vacuum chamber, it varies the amount of light reaching the photocell, and therefore the photocell current.) A hinged cover is attached to the front of the vacuum chamber. The inner surface of the cover is ground smooth so that it forms an effective seal with the mating surfaces of the vacuum chamber. This causes the vacuum to hold the cover closed during operation. The cover is slightly larger than the vacuum chamber so that small flanges are formed at the top and bottom to assist in opening the cover.

NOTE

If an excessive number of vacuum chamber lamps burns out, a power interlock shuts down the transport by deenergizing power relay K1. (See Section 3, page 3-2, under "Transport Power -- Schematic Details"). Depending on manufacturing tolerances, circuit conditions, etc., an excessive number of lamps may be one or more (usually two or more).

LIST OF MATERIALS 1254724C

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01
1	1247519-05		Pin, guide	2
2	1247520-01		Guide, vacuum chamber (r.h.)	1
3	1247520-02		Guide, vacuum chamber (l.h.)	1
4	1248091-01		Connector, mounting	1
5	1252467-01		Cover, vacuum chamber	1
6	1257975-01		Glass panel	2
7	1252476-01		Spacer, capstan cleaner	1
8	1252482-01		Roller assembly	2
9	1251289-07		Block	1
10	1251289-08		Block	1
11	1254725-01		Base, vacuum chamber	1
12	1252471-02		Hinge bar	2
13	1252473-03		Block, baffle	1
14	1252474-03		Side sect, (rh) assembly	1
15	1252474-04		Side sect, (lh) assembly	1
16	1252475-02		Center sect, assembly	1
17	1255009-01		Pad assy, capstan cleaner	2
18	172-038		Terminal, lug solder	1
20	018-081		Adhesive loctite, grade "H" brn	a/r
22	087-647		Silicone compound, rtv 3140	a/r
23	143-113	J402	Connector, cir, recp, 3 socket	1
24	169-146	P211	Body, rect plug connector	1
25	169-993		Contact, hermaphrodite	7
26	225-332		Tape, foam	a/r
27	269-334		Rubber sheet synthetic 1/8" thk w/adhesive backing	a/r
28	470-558		Screw, cap, hex soc, #2-56 x 3/4 lg 300 cres	2
29	470-059		Screw, cap, hex soc, #4-40 x 1/4 lg	2

NOTES:

1. ASSY NO. IS 1254724-01

2. MARK ASSY NO. APPROX. WHERE SHOWN PER MIL-STD-130.

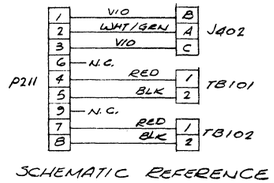
3. CUT ITEM 27 TO FIT GENERAL SHAPE OF ITEM 13.

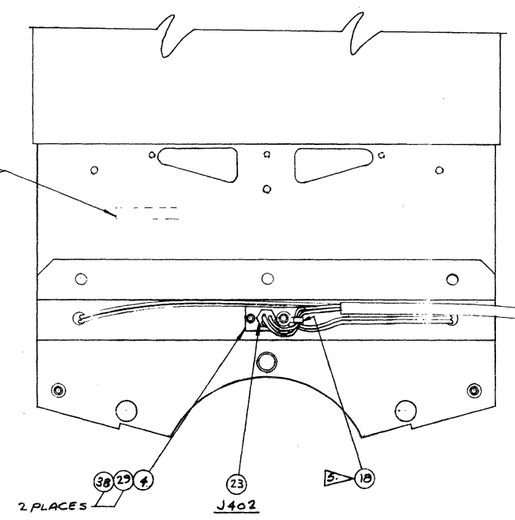
4. WIRE LENGTH BETWEEN ITEMS 18 (SOLDER LUG) AND 24 (CONNECTOR - P211) TO BE 7.00 ± 1.00 LONG.

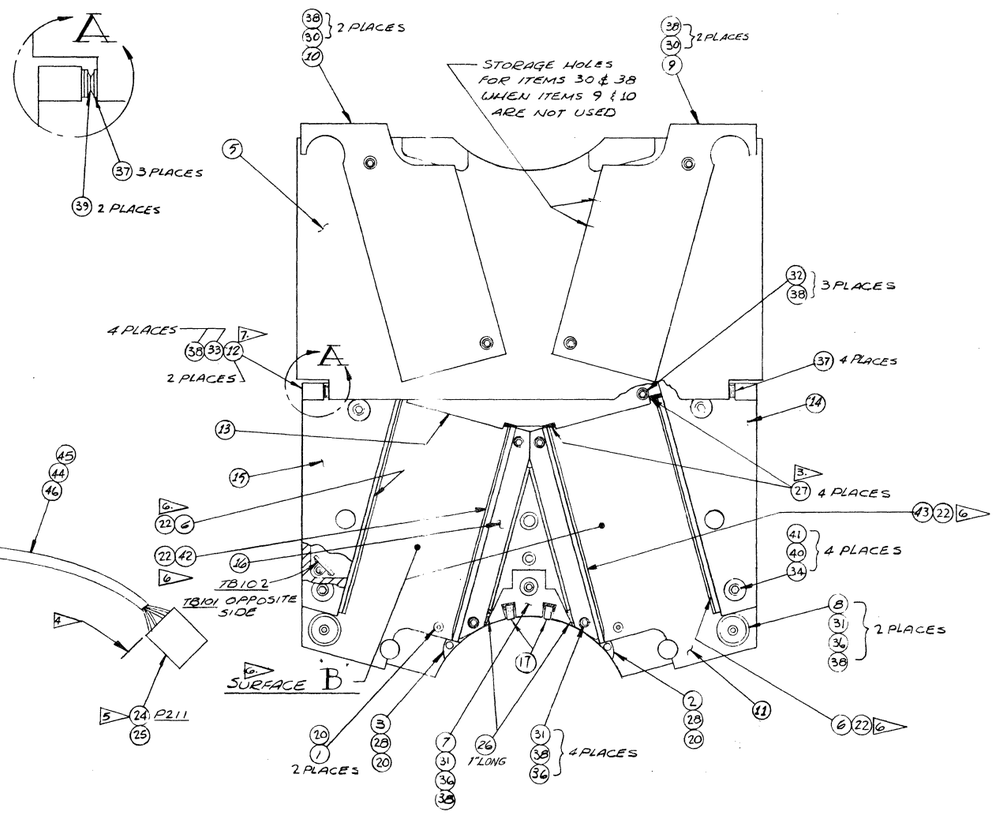
5. TIE WIRES OF ITEM 24 TO ITEM 18 USING LACING CORD.

6. BOND GLASS (ITEM 6, 43, 42) TO ITEMS 14, 15, 16 WITH A THIN FILM OF ITEM 22 (RTV) AT TOP EDGE ONLY. GLASS MUST SIT FIRMLY ON TOP OF SURFACE "B".

7. POSITION HINGE BARS (ITEM 12) SO THAT WASHERS (ITEM 39) ARE COMPRESSED FOR FRICTIONAL TORQUE OF 7-10 OZ IN. ON COVER (ITEM 5).

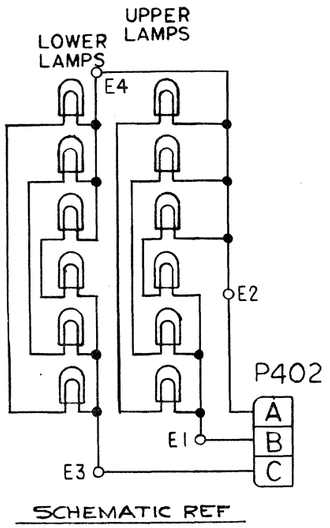






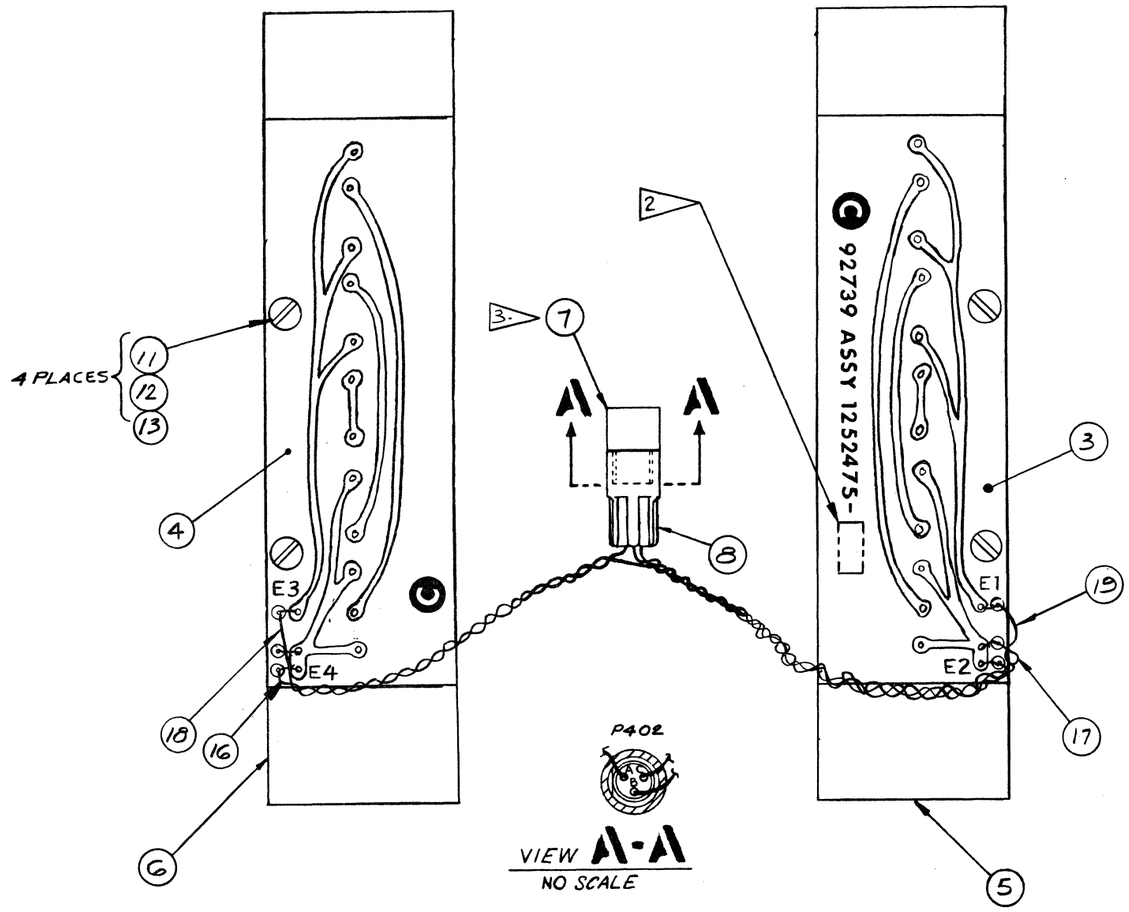
LIST OF MATERIALS 1254724C						
ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
30	470-063		Screw, cap, hex soc, #4-40 x 1/2 lg	4		
31	470-064		Screw, cap, hex soc, #4-40 x 5/8 lg	7		
32	470-461		Screw, cap, hex soc, #4-40 x 7/8 lg	3		
33	470-061		Screw, cap, hex soc, #4-40 x 3/8 lg	4		
34	470-071		Screw, cap hex soc, 6-32 x 1/2 lg cres	4		
36	501-014		Washer, plain, #4 cres	7		
37	501-584		Washer, plain #4, cres, blk ox	7		
38	502-008		Washer, spring lock, sst, #4	20		
39	501-717		Washer, belleville	2		
40	501-015		Washer, spring lock #6 cres	4		

LIST OF MATERIALS 1254724C						
ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
41	502-009		Washer, spring lock #6 cres	4		
42	1257975-02		Glass panel	1		
43	1257975-03		Glass panel	1		
44	611-503		Wire, insul, stranded, #24 AWG vio	a/r		
45	611-504		Wire, insul, stranded, #24 AWG wht/grn	a/r		
46	600-007		Sleeving, plastic, flex, #2 blk	a/r		
			Items not used: 19, 21, 35			



SCHEMATIC REF

NOTE:
1. ASSY NO. IS 1252475-02
2. MARK ASSY DASH NO. WHERE SHOWN ON ITEM 3, PER MIL-STD-130.
3. INSULATE CONNECTIONS TO ITEM 7 WITH ITEM 14.



NOTE

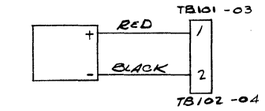
LAMPS IN VACUUM CHAMBER ARE CHICAGO MINIATURE LAMP WORKS CM2162, OR GE 2162D (GREEN DOT).

LIST OF MATERIALS 1252475

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -02		
3	1252481-01		Lamp holder assy, r. h.	1		
4	1252481-02		Lamp holder assy, l. h.	1		
5	1252468-03		Center section, r. h.	1		
6	1252468-04		Center section, l. h.	1		
7	143-112	P402	Connector, cir, plug 3 pin	1		
8	169-014		Shield, conn, (Hood)	1		
11	472-107		Screw, mach, pan hd, 2-56 x 1/4	4		
12	502-007		Washer, spring lock #2	4		
13	501-081		Washer, plain, .095 i. d.	4		
14	600-120		Sleeving, plastic, shrink, .063 i.d. yel	a/r		
16	611-427		Wire, strd, ins, #24 AWG wht	a/r		
17	611-347		Wire, strd, ins, #24 AWG blu	a/r		
18	611-208		Wire, strd, ins, #24 AWG blk	a/r		
19	611-268		Wire, strd, ins, #24 AWG red	a/r		
			Items not used: 1, 2, 9, 10, 15			

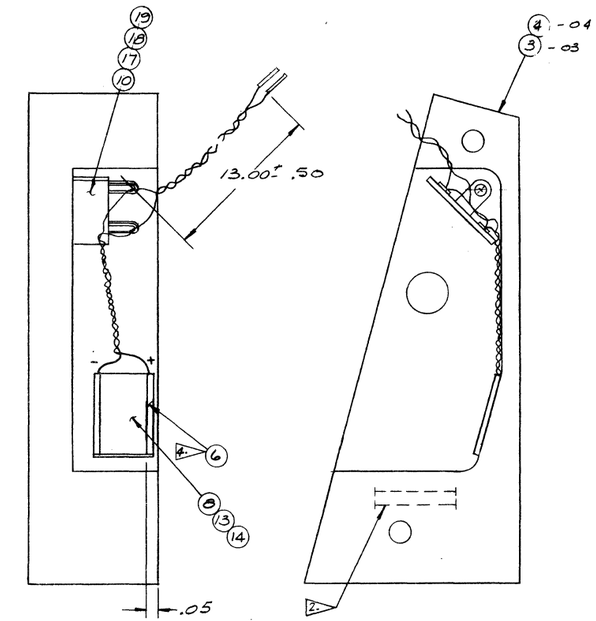
WIRE LEAD LIST 1252475

WIRE NO.	AWG/ COLOR	FROM REF DES	FROM TERM	TO REF DES	TO TERM	REMARKS	LM ITEM NO. -02		
1	24/9	P402	A	Upper P.C.B.	E2	3.5 in lg	16		
2	24/8	Upper P.C.B.	E2	Lower P.C.B.	E4	7.0 in lg	18		
3	24/6	P402	B	Upper P.C.B.	E1	3.5 in lg	17		
4	24/2	P402	C	Lower P.C.B.	E3	3.5 in lg	19		



WIRING DIAGRAM

-03 AS SHOWN (RH)
-04 OPPOSITE (LH)



NOTES:

1. PART No. IS 1252474-03 OR -04
2. MARK PART No. APPROX WHERE SHOWN PER MIL-STD-130.
4. CENTER SOLAR CELL & FISH PAPER ON SLOPING SURFACE OF SIDE SECTION APPROX AS SHOWN. CEMENT FISH PAPER TO SIDE SECTION AND SOLAR CELL TO FISH PAPER.

LIST OF MATERIALS 1252474

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -03	QTY PER UNIT -04	
3	1252470-03		Side section, r. h.	1	-	
4	1252470-04		Side section, l. h.	-	1	
6	267-008		Fish paper, .015 thk	a/r	a/r	
8	013-909		Diode, photo sensitive, solar cell	1	1	
10	180-274		Terminal strip	1	1	
13	232-007		Plastic resin	a/r	a/r	
14	232-008		Plastic, curing agent	a/r	a/r	
17	471-059		Screw, mach, xrec, pan hd, 4-40 x .19 lg	1	1	
18	502-002		Washer, lock spring #4	1	1	
19	501-008		Washer, plain #4	1	1	
23	611-268		Wire, strd, ins #24 AWG red	a/r	a/r	
24	611-208		Wire, strd, ins #24 AWG blk	a/r	a/r	
			Items not used: 1,2,5,7,9,11,12,15,16,20,21,22			

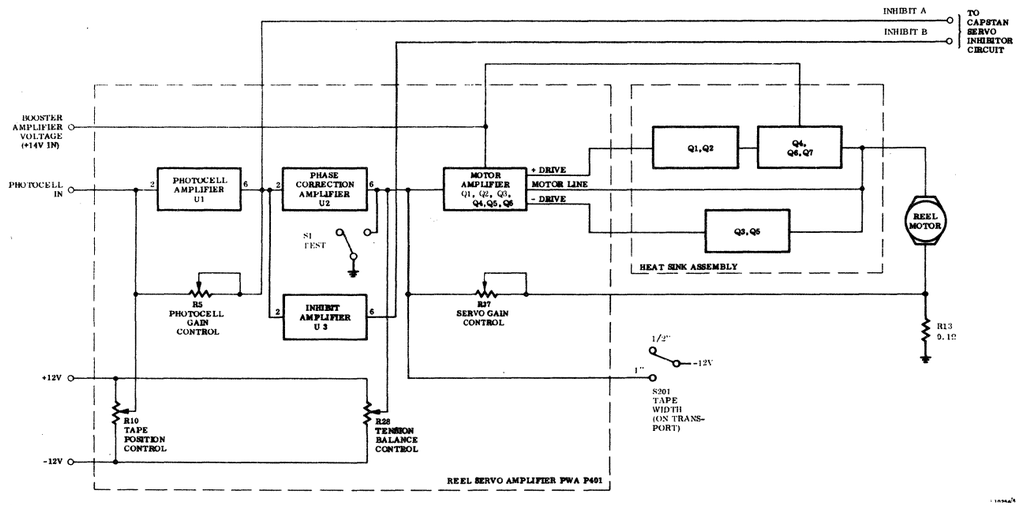


Figure 4-5. Reel MDA Block Diagram

GENERAL

Two reel servo mda assemblies (1255620) are used on each FR-3000 tape transport. Each mda assembly mounts on the back of the transport baseplate adjacent to its associated reel motor. The mda assembly contains all the electronics circuits required to convert the output of the photocell in the vacuum chamber into controlling current for the reel motor. The circuits are shown in block form in Figure 4-5, and in detail in Composite Schematic Diagram 1256130. The electronics components are contained on three subassemblies: a heatsink, a wired-in mda pwa (1248309), and a plug-in servo amplifier pwa (P401, assembly 1255618). (Since 1248309 contains no active or adjustable components, it is not shown in Figure 4-5.)

PHOTOCELL AMPLIFIER (on P401)

The current generated by the photocell feeds the input of the (inverting) photocell amplifier, operational amplifier U1. The current in this virtual-ground input circuit is converted to a voltage by the amplifier. Photocell gain control R5, located in the feedback path of the stage allows the output voltage to be adjusted to set points of +8 and -8 volts. These voltages represent positions of the tape either fully in the vacuum chamber or fully withdrawn. When the tape is positioned at its normal operating point (the middle of the chamber), the amplifier output voltage is zero.

The position of the tape in the vacuum chamber can be varied by adjusting tape position control R10. R10 applies an adjustable dc bias to the input of U1. This adjustment allows the static-state position of the tape to be placed at the center of the vacuum chamber.

The photocell amplifier has three output connections: one goes to a phase-correction amplifier, another goes to a capstan inhititor circuit (inhibit A), and the third goes to inhibitor U3.

PHASE CORRECTION AMPLIFIER (on P401)

The phase correction amplifier consists of an inverting operational amplifier, U2, and its associated phase-lead circuit components R11, R14, and C3. This network provides phase lead in the servo response required to overcome lags in the system which would otherwise result in unstable operation. The output of the phase correction amplifier is connected to a capstan inhibitor line (inhibit B) and to the motor amplifier.

INHIBIT AMPLIFIER (ON P401)

The inhibit amplifier U3, and components R48, R49, R51, R52 and C13 are used to invert and add phase lead to the inhibit B signal. This results in a smooth inhibit function.

The inhibit B signal from the inhibit correction amplifier is 180° out of phase with the inhibit A signal from the photocell amplifier. Use of the adjustment potentiometers, test switch S1, and assocoated test points is covered in Section 9.

MOTOR AMPLIFIER

The motor amplifier includes differential amplifier Q1, Q2; drive-control amplifiers Q3 and Q4; current-source Q5; and current-source-switch Q6 on P401; power amplifiers Q1 through Q7 on the heatsink; and mda pwa 1248309, accessible under P401. The motor amplifier provides the current to operate the reel motor. The current that is delivered to the reel motor is independent of the motor speed and motor terminal voltage. The base bias at the input of the motor amplifier is adjusted by tension balance control R28. This adjustment sets the motor current so that the motor torque balances the opposite torque which is developed by the vacuum in the chamber pulling on the tape. Switch S1 (test switch) is provided on the circuit board to ground the signal from the previous stage and prevent its interference with the proper balance adjustment. When the adjustment is completed, S1 must be opened so that the servo controls the reel motor.

The amplifier output is arranged so that the output current is limited to a positive 15 amperes and a negative 7 amperes. This prevents the amplifier from overheating, even under abnormal conditions. The gain of the amplifier can be varied by adjusting servo gain control R37. This establishes the overall servo loop gain.

Refer to Schematic 1256130. Consider the state where there is too little tape in the upper vacuum chamber. The output of the upper vacuum chamber photocell is a positive current. This current is converted to a voltage by the photocell amplifier and passed to the phase correction amplifier. From there it is passed to the base of Q1 (of the differential amplifier). The collector of Q2 (of the differential amplifier) is positive and turns Q3 off. With Q3 off, heatsink transistors Q1 and Q2 and parallel-connected current amplifiers Q4, Q6 and Q7 are also off. The current from current source Q5 turns Q4 on. This applies a relatively positive voltage to the base of power emitter follower Q3 on the heatsink. This turns Q3 on, which turns current amplifier Q5 on. Q5 supplies negative current to the reel motor. A reverse torque is generated. The reel motor thus tends to turn counterclockwise, paying tape into the vacuum chamber to reposition the tape loop to the center position.

If the tape is positioned too much into the vacuum chamber, the output signal from the photocell is a negative current. This is converted to a voltage by the photocell amplifier and passed via the phase correction amplifier to the differential amplifier. The output of the differential amplifier turns Q3 on. The output of Q3 turns Q4 off, and therefore cuts off the negative current to the reel motor via Q3 and Q5 of the heatsink. At the same time, the output of Q3 turns Q1 and Q2 of the heatsink on. The output of Q2 drives current amplifiers Q4, Q6, and Q7, which apply positive current to the reel motor. Positive torque tends to turn the motor clockwise, pulling the tape loop against the vacuum, decreasing the loop length, and centering the tape.

If the tape is very much out of position (out of the normal operating range of the reel servo), the outputs of the photocell amplifier and inhibit amplifier are greater than ±1.2 volts. This is the case in which the inhibit signals (A or B) are used in the capstan servo circuit (schematic diagram 1256040 in Section 5) to inhibit the capstan.

The current through the reel motor is fed through series resistor R31 to ground. A feedback signal is taken across the resistor and used to control the drive to the differential amplifier via a feedback loop, thus effecting linear E-to-I conversion in the motor-amplifier section of the reel servo.

When the transport is in the ready state, post-air -12V is applied through diode CR5 to the emitter circuit of the differential amplifier and to the base of current-source-switch Q6. This enables the differential amplifier and turns on the current source (Q5). When the transport is not ready, the post-air -12V is absent. This effectively disables the drive that can apply either positive or negative current to the reel motor, and therefore disables the motor.

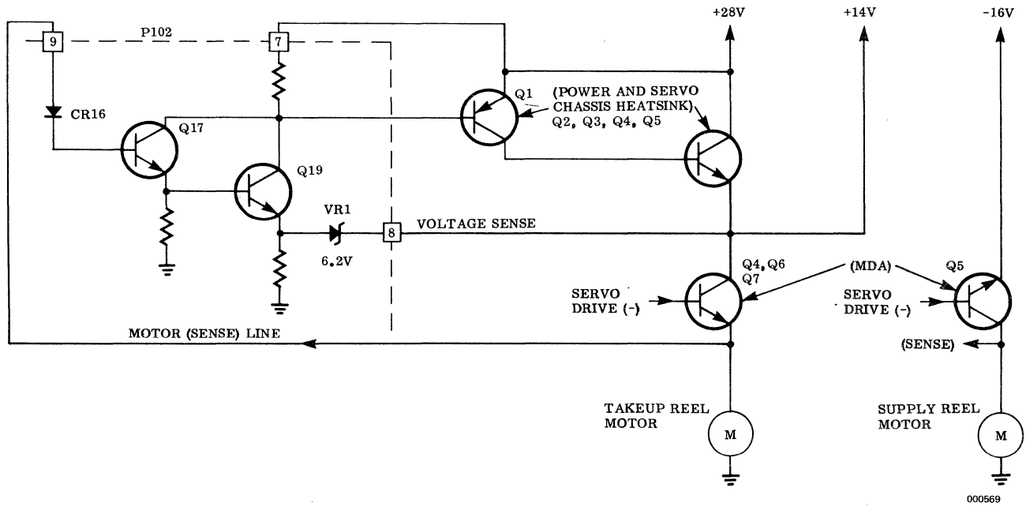


Figure 4-6 Reel Voltage Booster Simplified Schematic

VOLTAGE BOOSTING AMPLIFIER

The voltage boosting amplifier is used when the normal reel motor supply voltage is inadequate for the demands on the motor. This is mainly during fast winding modes of operation. Its function is to raise the voltage of the positive supply to both reel amplifiers. The reel amplifiers are designed for more efficient operation at the normal record/reproduce speed. They are supplied with a low voltage to increase efficiency and keep the heat generated within the components down to a level that can be safely dissipated by the heatsink. However, during fast winding, the speed required by the motors is such that the back emf of the pulling motor approaches the normal supply voltage. If this occurred without the voltage-boosting amplifier, the associated motor amplifier would be fully turned on, yet unable to drive the motor to full speed due to voltage limiting.

To overcome this difficulty, the reel motor voltages are sensed, and if either motor voltage rises above a certain level, it turns on the booster amplifier to raise the positive voltage supplied to the reel motor amplifiers. The result is that the supply voltage follows the motor voltage but remains approximately 4 volts above it. The 4 volt difference allows the motor amplifier to remain in its linear region and provide tape-position control.

The operation of the voltage booster amplifier is as follows. (Refer to Figure 4-6, a simplified schematic diagram of portions of accessory pwa P102 of the power and servo chassis, the power and servo chassis heatsink, and the reel mda. For the complete circuit of P102, see Schematic TW1254733 in Section 3; for a reel servo composite schematic diagram, see drawing 1256130 in this section; for interconnect schematics, see Section 7.) Pin 14 (motor line) of reel-servo pwa P401 connects with pins 9 and 10 of the accessory pwa (P102). Pin 9 is used for the lower or takeup reel servo and pin 10 for the upper or supply reel servo. During tape-moving operation, the leading motor has a positive voltage at pin 14, and the trailing motor has a negative voltage. Assume that the mode selected is fast forward.

The takeup motor terminal voltage is approximately +14 volts at pin 14 of TB202. This forward-biases diode CR16 on accessory card pwa P102 and turns on Q17 (which is enabled when a run command turns Q18 off). Q17 and Q19 in a Darlington configuration invert the signal and turn on Q1 (on the power and servo chassis heatsink). When Q1 is on, it turns on series regulator transistors Q2, Q3, Q4, and Q5, and applies a boosted voltage from the +28V source to the reel mda.

In order to keep the boost voltage at the required level, the following circuit action takes place. Both Q17 and Q19 have base-emitter drops of approximately 0.8 volt, and the diode has an approximately 0.6 volt drop. Therefore, the 14 volts at pin 9 is dropped by 2.2 volts. The anode of zener diode VR1 (a 6.2 volt zener) is held at 14.0 - 2.2 = 11.8 volts. The common output of series regulator transistors Q2, Q3, Q4, and Q5 is applied to pin 8 of the accessory card and thus to the cathode of VR1. When the boosted output voltage exceeds 18V, VR1 conducts and reduces the conduction of Q17 and Q19.

This reduces the conduction of Q1 which in turn reduces the conduction by Q2, Q3, Q4 and Q5 and limits any further increase. Thus the output voltage from the voltage booster (pin 8 of J102) is maintained at a value 4 volts higher than the reel motor voltage on pin 14 of the reel servo pwa (P401). This voltage is supplied to the reel servo motor amplifier on pin 20 of J401, providing a power source that is 4 volts greater than the back emf of the reel motor.

POWER-LOSS OPERATION

The reel servos are designed so that, in the event of a power loss, the tape is brought to a controlled stop from any tape speed, and destructive tape-tension transients are prevented. Two conditions of power loss, long-term and momentary, activate a power-loss-sensing circuit, Q20, Q21, and associated components on the accessory card (P102 in the power and servo chassis). See Section 3 for a detailed description of the accessory card, including a complete schematic diagram.

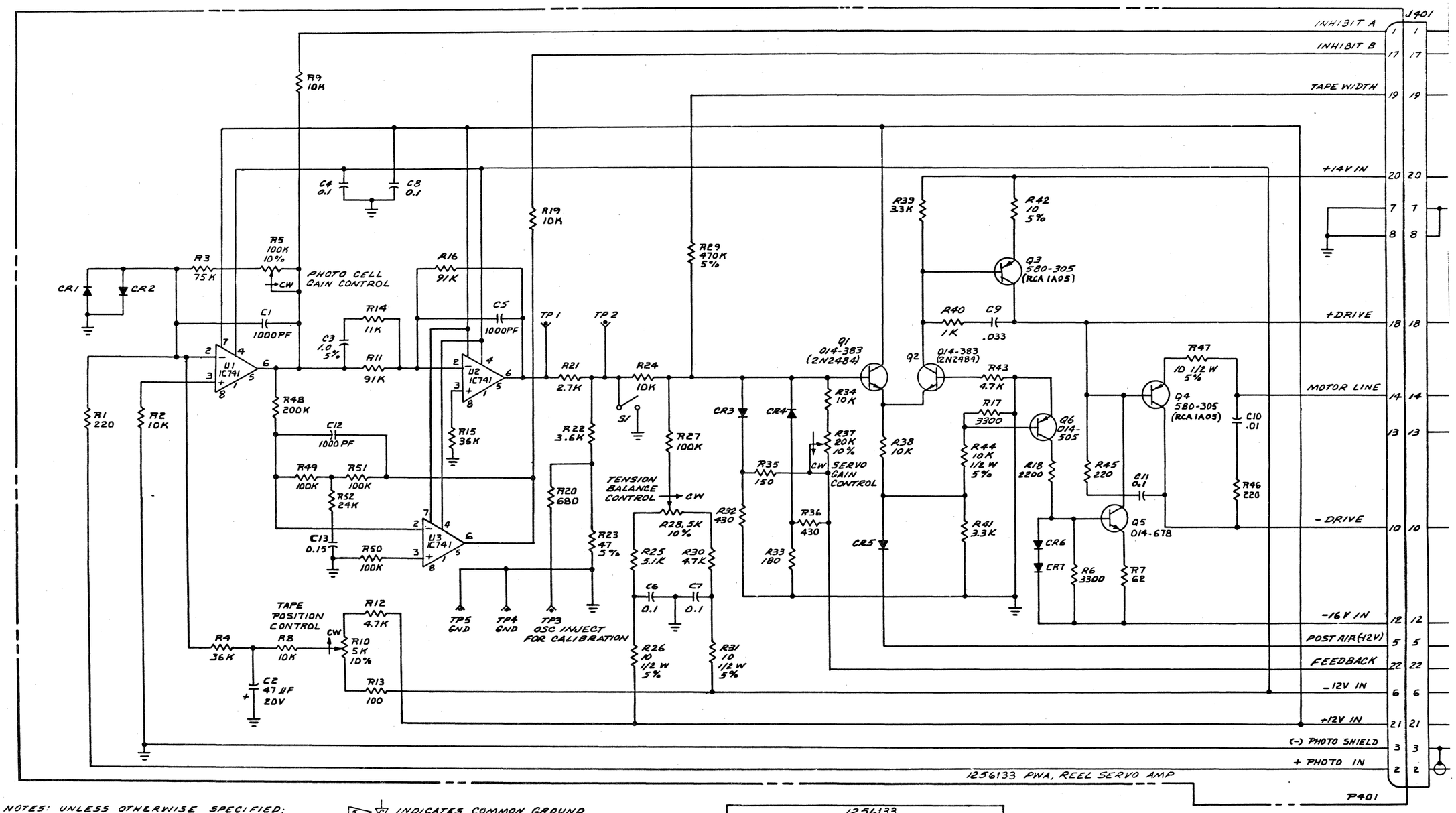
LONG-TERM POWER LOSS

Long-term power loss implies that both reel and capstan servos are disabled. The energy in the low-inertia capstan is quickly dissipated in frictional losses and the capstan stops almost immediately. The energy stored in a 16-inch reel full of tape when the tape is moving in fast mode (300 + ips) is considerable. This stored energy must be dissipated in a manner that is gentle to the tape.

The power-loss-sensing circuit on the accessory card detects the loss of the line voltage in about 10 milliseconds and sends a turn-off signal to the brake solenoid circuit, also located on the accessory card. The brakes are applied to the reel motors, and the differential action of the brakes assures that no tape spillage occurs. The loss of power also causes the solenoid-operated air valve, located in the vacuum blower assembly, to close, cutting off the air flow from the vacuum chamber. This releases the tape from the chamber as the brakes stop the reels.

MOMENTARY POWER LOSS

A momentary loss of power is sensed as described in the preceding paragraphs, and the brakes are applied. A command is also sent to the control logic to cancel the existing mode of operation. The energy stored in the ±12-volt regulator filter capacitors is sufficient to meet this requirement. If power were reapplied without cancelling the previous mode, the capstan would resume its speed; however, the state of the reel servos would be undetermined after the loss of the lamp voltage and reel amplifier power. Under such circumstances, violent tape-tension transients might occur. With the operating mode cancelled, the capstan is disabled when power does return. When power returns, the brakes release, the reel servos recover, and a smooth deceleration to the stop mode is accomplished.

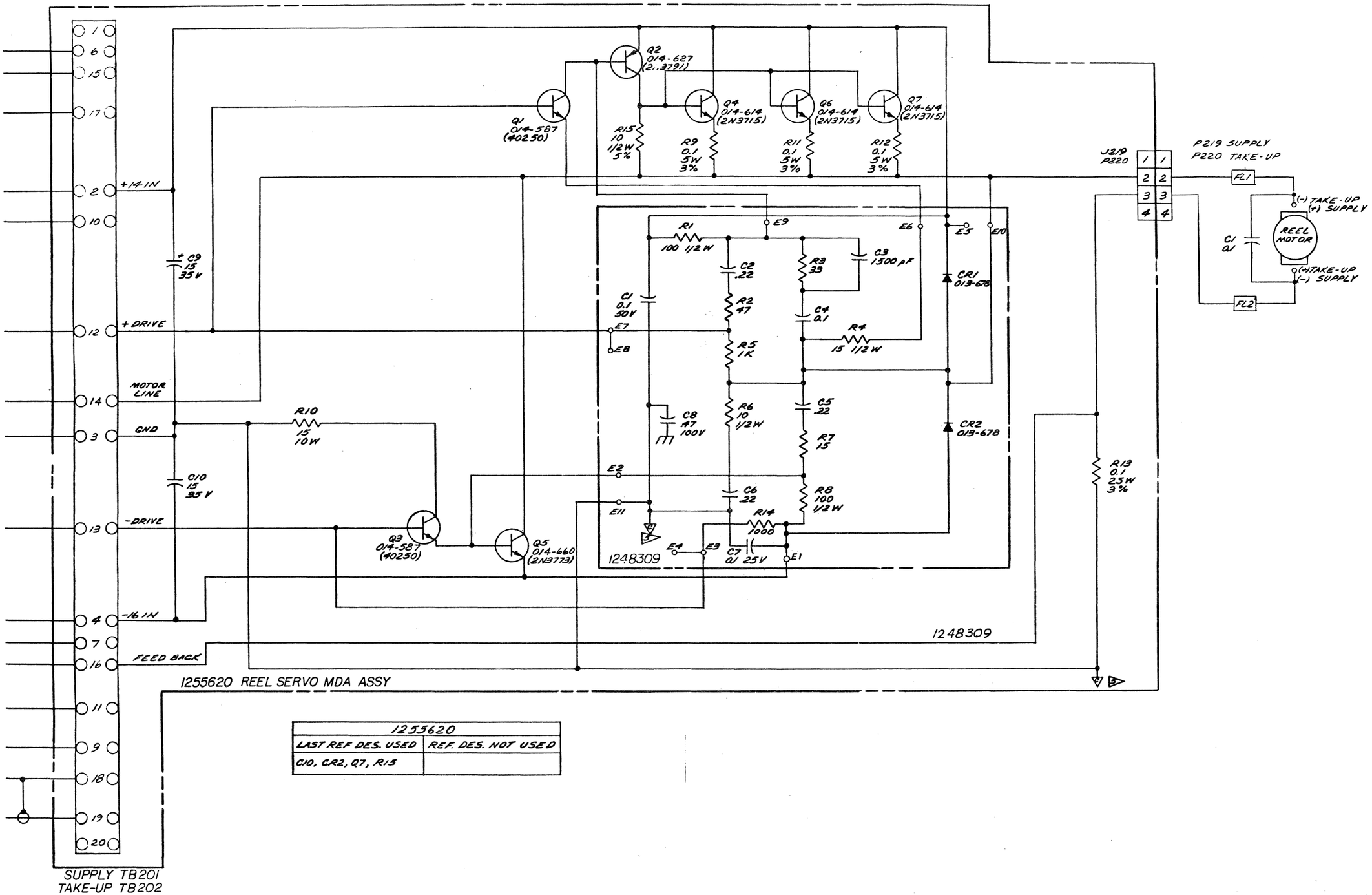


NOTES: UNLESS OTHERWISE SPECIFIED;
1. ALL RESISTOR VALUES ARE IN OHMS, 1/4W, 2%.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS.
3. CLOSE S-1 TO ADJUST MOTOR AMP BIAS.
4. ALL DIODES ARE 013-599, FOR FIELD SERVICE USE, USE A IN914 ONLY.

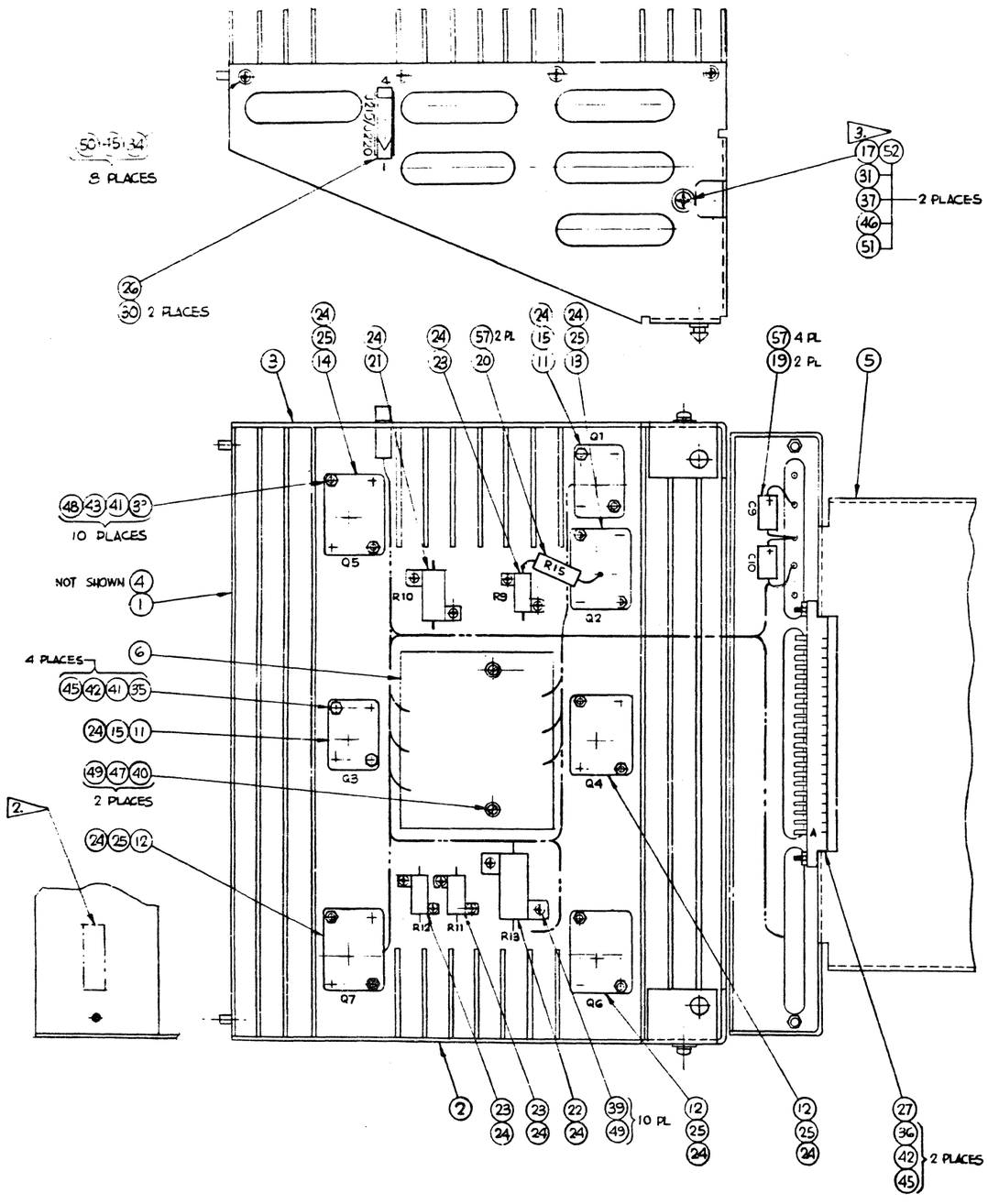
⏚ INDICATES COMMON GROUND.

6. JEDEC NO.S SHOWN IN PARENTHESIS ARE FOR FIELD SERVICE USE ONLY.

1256133	
LAST REF DES. USED	REF DES NOT USED
R52, CR7, C13, Q6, U3	

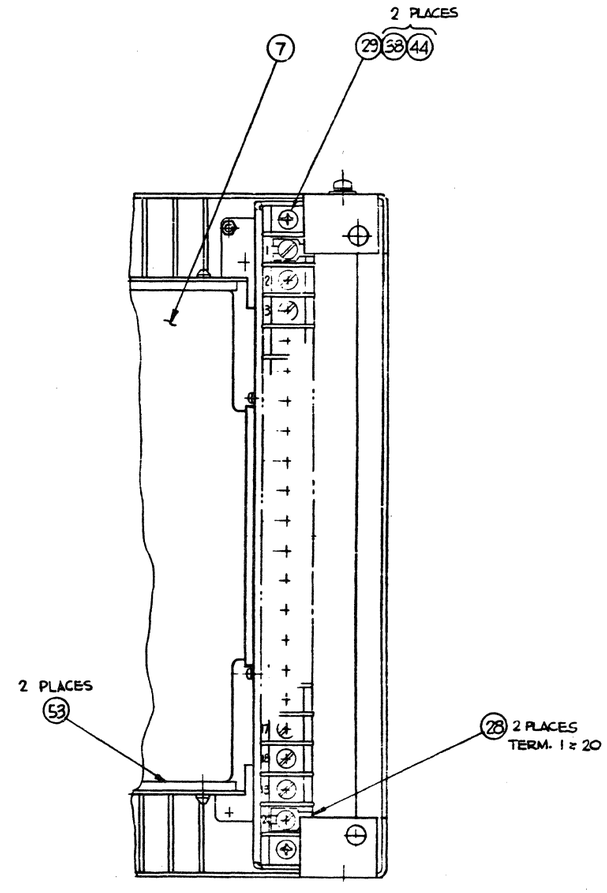


1255620	
LAST REF DES. USED	REF. DES. NOT USED
C10, CR2, Q7, R15	



NOTES:

1. ASSY NO. IS 1255620-01.
2. MARK ASSY APPROX WHERE SHOWN PER MIL-STD-130.
3. APPLY ITEM 17 TO SHOULDER OF ITEM 52.
4. INSULATE ITEMS 66-68 WITH ITEMS 57-59, AS REQUIRED.
5. APPLY ITEMS 55-56 WHERE REQUIRED TO MEET WORKMANSHIP STANDARDS.
6. REF DESIG. OF ITEM 29 AT NEXT ASSY IS: TB201 - SUPPLY, TB202 - TAKEUP.



CHANGED: 15 MARCH 1978

LIST OF MATERIALS 1255620A						
ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
1	1247969-02		Heatsink	1		
2	1247970-02		Side panel, left hand	1		
3	1247970-03		Side panel, right hand	1		
4	1247971-01		Cover	1		
5	1247972-01		Mount, terminal block	1		
6	1248309-01		Pwa, reel mda	1		
7	1256133-01	P401	Pwa, reel servo amplifier	1		
8	1256130		Schematic, composite	Rev -		
11	014-587	Q1,3	Transistor, silicon, npn	2		
12	014-614	Q4,6,7	Transistor, silicon, npn	3		
13	014-627	Q2	Transistor, silicon, pnp	1		
14	014-660	Q5	Transistor, silicon, npn	1		
15	014-833		Mounting kit, transistor (TO-66)	2		
17	018-019		Adhesive	a/r		
19	037-437	C9,10	Capacitor, tant, 15 μF, 35V, 10%	2		
20	041-002	R15	Resistor, comp, 10Ω, 1/2W, 5%	1		
21	043-338	R10	Resistor, 15Ω, 10W, 3%	1		
22	043-387	R13	Resistor, 0.1Ω, 25W, 3%	1		
23	059-186	R9,11,12	Resistor, 0.1Ω, 5W, 3%	3		
24	087-388		Silicon compound, heatsink	a/r		
25	150-142		Mounting kit, transistor (TO-3)	5		
26	166-755	J219 or J220	Connector, recp, 4 soc	1		
27	168-081	J401	Connector, recp, pc, 22 pin	1		
28	171-005		Terminal lug, crimp #6	2		
29	180-770	TB201 or TB202	Terminal block, 20 term	1		
30	187-031		Contact, soc, 14-20 AWG	2		
31	280-343		Spacer, plain, #6-32 x .562 lg	2		
33	470-020		Screw, hex soc dr, #6-32 x .50 lg	10		
34	471-061		Screw, pan hd, xrec, #4-40 x .31 lg	8		
35	471-063		Screw, pan hd, xrec, #4-40 x .44 lg	4		
36	471-064		Screw, pan hd, xrec, #4-40 x .50 lg	2		
37	471-069		Screw, pan hd, xrec, #6-32 x .38 lg	2		
38	471-081		Screw, pan hd, xrec, #8-32 x .62 lg	2		
39	472-107		Screw, pan hd, #2-56 x .25 lg	10		
40	472-456		Screw, pan hd, #2-56 x .50 lg	2		
41	476-202		Screw, thd forming, #6 x .50 lg	14		
42	496-004		Nut, keps, #4-40	6		
43	496-005		Nut, keps, #6-32	10		
44	496-006		Nut, keps, #8-32	2		
45	501-008		Washer, flat, #4	10		
46	501-009		Washer, flat, #6	2		
47	501-155		Washer, flat, #2	2		
48	501-188		Washer, flat, #6 small pattern	10		
49	502-001		Washer, spring lock #2	12		
50	502-002		Washer, spring lock #4	8		
51	502-003		Washer, spring lock #6	2		

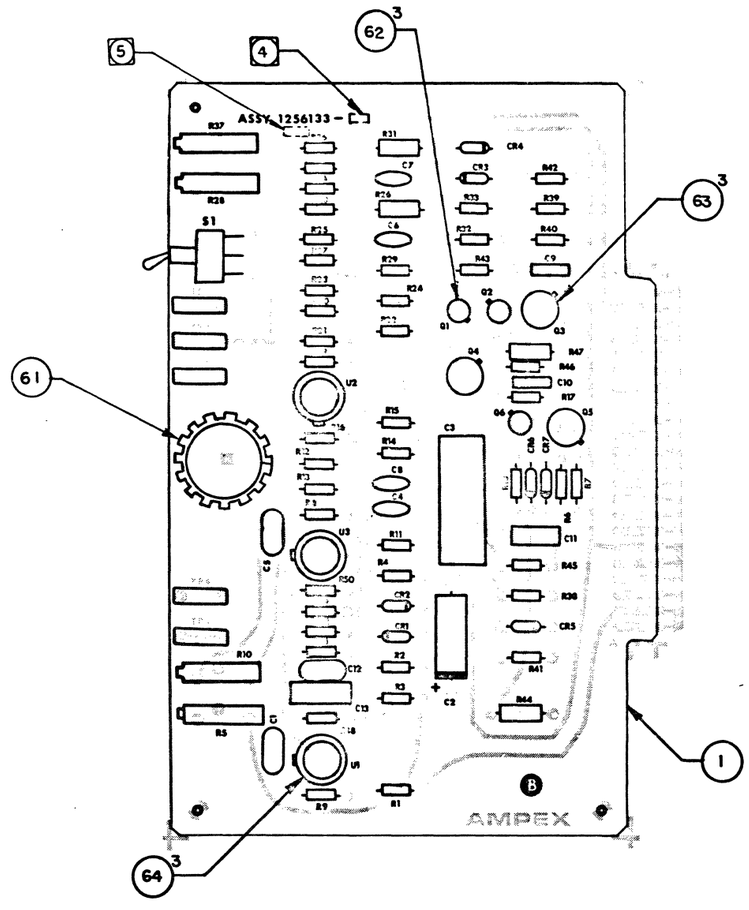
LIST OF MATERIALS 1255620A						
ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
52	503-064		Washer, shoulder, .319 i-d, phenolic	2		
53	530-196		Guide, pcb	2		
55	600-130		Sleeving, shrinkable, .093/.046 i-d, clear	a/r		
56	600-131		Sleeving, shrinkable, .125/.062 i-d, clear	a/r		
57	600-161		Sleeving, Teflon, .028 i-d	a/r		
58	600-196		Sleeving, Teflon, .042 i-d	a/r		
59	600-237		Sleeving, Teflon, .053 i-d	a/r		
61	611-160		Wire, strd, insul, 14 AWG, wht	a/r		
62	611-553		Wire, strd, insul, 18 AWG, wht	a/r		
63	611-607		Wire, strd, insul, 20 AWG, wht	a/r		
64	611-427		Wire, strd, insul, 24 AWG, wht	a/r		
65	613-045		Cable, coax	a/r		
66	615-011		Wire, solid, 16 AWG	a/r		
67	615-012		Wire, solid, 20 AWG	a/r		
68	615-019		Wire, solid, 18 AWG	a/r		
			Items not used: 9,10,16,18,32,54,60			

WIRE LEAD LIST 1255620A

WIRE NO.	AWG/ COLOR	FROM		TO		REMARKS	LM ITEM NO.		
		REF DES	TERM	REF DES	TERM		-01		
1	24	J401	20	TB201/202	2		64		
2			13		3				
3			12		4				
4			1		6				
5			5		7				
6			21		9				
7			7-8		10				
8			6		11				
9			18		12				
10			10		13				
11			14		14				
12			17		15				
13			22		16				
14	24		19		17		64		
15	Shield		3		18		65		
16	Ctr	J401	2		19				
17	14	Q5	Em		4		61		
18	14	Q7	Col		2		61		
19	24	Item 6	E4		13		64		
20	24	Item 6	E8		12		64		
21	14	R13	B		3		61		
22	24	R13	A		16		64		
23	24	R12	A		14		64		
24	C9	TB201/202	2		3	Utilize comp leads pos to 2	19		
25	C10	TB201/202	3	TB201/202	4	Utilize comp leads pos to 3	19		
26	R15	Q2	Col	R9	A	Utilize comp leads	20		
27	20	Q1	Col	Q2	Base		67		
28		Q2	Col	Q4	Base		67		
29		Q4	Base	Q6	Base		67		
30	20	Q6	Base	Q7	Base		67		
31	16	Q2	Em	Q4	Col		66		
32	16	Q4	Col	Q6	Col		66		
33	16	Q6	Col	Q7	Col		66		
34	20	Q4	Em	R9	B		67		
35	20	Q6	Em	R11	B		67		
36	20	Q7	Em	R12	B		67		
37	18	Q3	Col	R10	A		68		
38	16	Q5	Col	R9	A		66		
39	20	Q3	Em	Q5	Base		67		
40	20	Q1	Em	Item 6	E6		63		
41	24	Q1	Base		E7		64		
42	20	Q2	Em		E5		63		
43	24	Q1	Col		E9		64		
44	24	R12	A		E10		64		
45	24	Q3	Base		E3		64		
46	24	Q5	Base	Item 6	E2		64		

WIRE LEAD LIST 1255620A

WIRE NO.	AWG/ COLOR	FROM		TO		REMARKS	LM ITEM NO.		
		REF DES	TERM	REF DES	TERM		-01		
47	20	Q5	Em	Item 6	E1		63		
48	20	R13	B	Item 6	E11		63		
49	18	R10	B	TB201/202	3		62		
50	16	Q5	Col	R12	A		66		
51	14	R12	A	J219/220	2		61		
52	14	R13	A	J219/220	3		61		
53	18	R11	A	R12	A		68		



5. MARK ASSY REVISION LETTER.

4. MARK -01 PER MIL-STD-130.

NOTES:

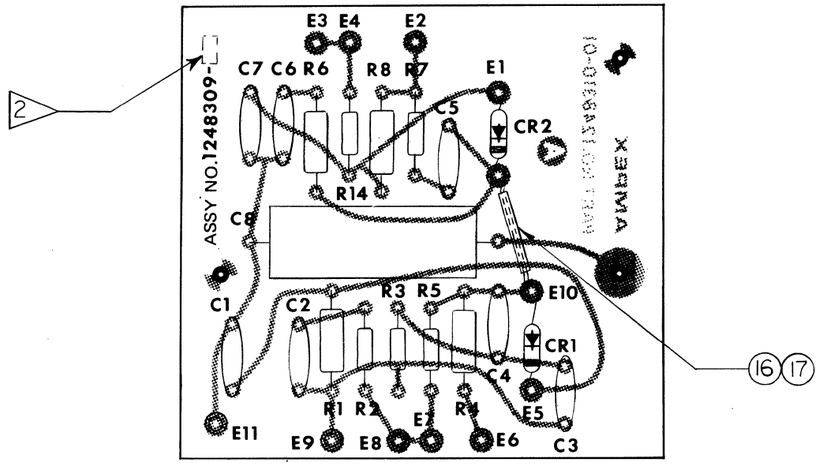
3. ASSEMBLE PER AMPEX STANDARDS.
2. REFERENCE SCHEMATIC 1256130-01.
1. LOCATE COMPONENTS BY MATCHING REFERENCE DESIGNATIONS IN PL.

LIST OF MATERIALS 1256133A1

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
1	1256132-01		Pwb, reel servo amplifier	1		
2	1256130-01		Schematic diagram, composite, reel servo	ref		
5	034-950	C1,5,12	Capacitor, .001 μF, 5%, 100V, mica	3		
6	037-746	C2	Capacitor, 47 μF, 10%, 20V, tant	1		
7	055-855	C3	Capacitor, 1 μF, 5%, 100V, pyc	1		
8	030-095	C4,6,7,8	Capacitor, 0.1 μF, 20%, 25V, cer	4		
9	035-814	C9	Capacitor, .033 μF, 5%, 50V, mylar	1		
10	035-734	C10	Capacitor, .01 μF, 5%, 50V, mylar	1		

LIST OF MATERIALS 1256133A1

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
11	035-893	C11	Capacitor, .10 μF. 5%, 50V, mylar	1		
12	055-712	C13	Capacitor, 0.15 μF, 5%, 50V, mylar	1		
14	013-599	CR1-7	Diode, switching	7		
16	014-383	Q1,2	Transistor, npn	2		
17	580-305	Q3,4	Transistor, pnp	2		
18	014-678	Q5	Transistor, npn	1		
19	014-505	Q6	Transistor, pnp	1		
21	057-080	R1,45,46	Resistor, fixed, 220Ω, 2%, 1/4W	3		
22	057-120	R2,8,9,19,24,34,38	Resistor, fixed, 10 kΩ, 2%, 1/4W	7		
23	057-141	R3	Resistor, fixed, 75 kΩ, 2%, 1/4W	1		
24	057-133	R14,15	Resistor, fixed, 36 kΩ, 2%, 1/4W	2		
25	058-696	R5	Resistor, variable, 100 kΩ, 10%, 3/4W	1		
26	057-108	R6,17,39,41	Resistor, fixed, 3.3 kΩ, 2%, 1/4W	4		
27	057-067	R7	Resistor, fixed, 62Ω, 2%, 1/4W	1		
28	058-342	R10,28	Resistor, variable, 5 kΩ, 10%, 3/4W	2		
29	057-143	R11,16	Resistor, fixed, 91 kΩ, 2%, 1/4W	2		
30	057-112	R12,30,43	Resistor, fixed, 4.7 kΩ, 2%, 1/4W	3		
31	057-072	R13	Resistor, fixed, 100Ω, 2%, 1/4W	1		
32	057-121	R14	Resistor, fixed, 11 kΩ, 2%, 1/4W	1		
34	057-104	R18	Resistor, fixed, 2.2 kΩ, 2%, 1/4W	1		
35	057-092	R20	Resistor, fixed, 680Ω, 2%, 1/4W	1		
36	057-106	R21	Resistor, fixed, 2.7 kΩ, 2%, 1/4W	1		
37	057-109	R22	Resistor, fixed, 3.6 kΩ, 2%, 1/4W	1		
38	041-425	R23	Resistor, fixed, 47Ω, 5%, 1/4W	1		
39	057-113	R25	Resistor, fixed, 5.1 kΩ, 2%, 1/4W	1		
40	041-002	R26,31,47	Resistor, fixed, 10Ω, 5%, 1/2W	3		
41	057-144	R27,49,50,51	Resistor, fixed, 100 kΩ, 2%, 1/4W	4		
42	041-512	R29	Resistor, fixed, .47 MΩ, 5%, 1/4W	1		
43	057-087	R32,36	Resistor, fixed, 430Ω, 2%, 1/4W	2		
44	057-078	R33	Resistor, fixed, 180Ω, 2%, 1/4W	1		
46	057-076	R35	Resistor, fixed, 150Ω, 2%, 1/4W	1		
47	058-668	R37	Resistor, variable, 20 kΩ, 10%, 3/4W	1		
48	057-096	R40	Resistor, fixed, 1 kΩ, 2%, 1/4W	1		
49	057-396	R42	Resistor, fixed, 10Ω, 5%, 1/4W	1		
50	041-014	R44	Resistor, fixed, 10 kΩ, 5%, 1/2W	1		
51	057-151	R48	Resistor, fixed, 200 kΩ, 2%, 1/4W	1		
52	057-129	R52	Resistor, fixed, 24 kΩ, 2%, 1/4W	1		
54	120-967	S1	Switch, toggle, 1 pdt	1		
56	148-028	TP1,2,3	Connector, recpt, jack (wht)	3		
57	148-052	TP4,5	Connector, recept, jack (blk)	2		
59	586-269	U1,2,3	Ic, 741, op amp, TO-5	3		
61	260-052		Grommet, cat X 2.25 lg	1		
62	280-130	Ref Q1,2,6	Mounting pad, transistor, TO-18	3		
63	280-131	Ref Q3-5	Mounting pad, transistor, TO-5	3		
64	014-740	Ref U1-3	Mounting pad, ic, 8 pins	3		
			Items not used: 3,4,13,15,20,33,45,53,55,58,60,			



NOTES:

1. ASSEMBLY NUMBER IS 1248309-01.
2. MARK DASH NUMBER IN AREA SHOWN PER MIL-STD-130.

LIST OF MATERIALS 1248309

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
1	1248310-01		Printed wiring board	1		
2	1253898		Schematic	RevD		
3	041-410	R5	Resistor, comp, 1,000Ω, 1/4W, 5%	1		
4	041-651	R3	Resistor, comp, 33Ω, 1/4W, 5%	1		
5	041-425	R2	Resistor, comp, 47Ω, 1/4W, 5%	1		
6	041-530	R7	Resistor, comp, 15Ω, 1/4W, 5%	1		
7	041-410	R14	Resistor, comp, 1,000Ω, 1/4W, 5%	1		
8	041-003	R1,R8	Resistor, comp, 100Ω, 1/2W, 5%	2		
9	041-513	R4	Resistor, comp, 15Ω, 1/2W, 5%	1		
10	041-002	R6	Resistor, comp, 10Ω, 1/2W, 5%	1		
11	030-145	C1	Capacitor, cer, .1 μF, 50V, 20%	1		
12	030-095	C4,C7	Capacitor, cer, .1 μF, 25V, 20%	2		
13	030-310	C2,5,6	Capacitor, cer, .22 μF, 25V, 20%	3		
14	034-970	C3	Capacitor, mica dipped, 1,500 pF, 500V, 5%	1		
15	013-678	CR1,CR2	Diode, silicon (CD451)	2		
16	615-012		Wire, bare, solid, 20 AWG	a/r		
17	600-161		Sleeving, teflon, flexible #22	a/r		
18	035-014	C8	Capacitor, PA, .47 μF, 200V	1		

SECTION 5
CAPSTAN CONTROL

SECTION 5

CAPSTAN CONTROL

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont)

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (Cont)

SCHEMATIC DIAGRAM

NUMERICAL LIST OF ASSEMBLY DRAWINGS

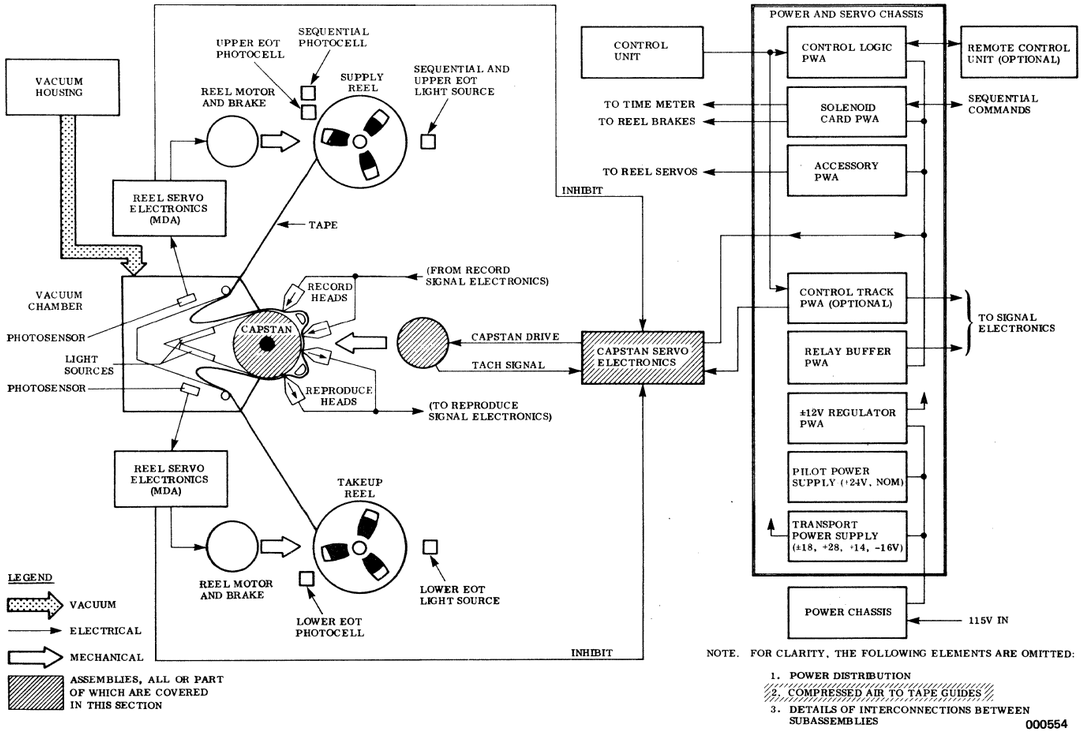


Figure 5-1. Capstan Control Subsystem

CAPSTAN SERVO SUBSYSTEM

The purpose of the capstan servo subsystem is to control tape motion in all modes of operation. The capstan servo can operate in either a normal slew or high slew mode, as jumper selected on the servo electronics pwa's. High slew mode provides the ability to correct speed errors of abnormally high amplitude.

CAPSTAN SUBSYSTEM MECHANICS

GENERAL

Reference Figure 5-2. The capstan assembly mounts to a precision plate, which in turn, mounts in the transport baseplate assembly. The capstan assembly (shown in heavy lines in Figure 5-2) is held to the precision plate by four 10-32 socket head cap screws. It contains a modified dc printed circuit motor mounted to the rear end of the capstan motor shaft and a capstan puck mounted to the front end. Tachometer preamplifier, tachometer disc, and optics assemblies are mounted behind the capstan puck. The tachometer disc is fixed to the motor shaft and rotates with it. The optics assembly is mounted inboard of the tachometer disc and the preamplifier mounted outboard. Neither of these latter two assemblies rotate. These assemblies are used to provide a signal representative of the capstan speed. It is phase-compared with a reference frequency in the capstan servo. There an error signal is developed which is used to control the capstan motor speed.

The speed of the capstan is controlled by the servo system so that it has a tape speed accuracy in the tape sync mode of 0.10% maximum long term error. The system has two speed ranges. The first of these is called the high speed range and provides tape speeds of 120, 60, 30, 15, 7 1/2, 3 3/4, and 1 7/8 ips. The second is called the low speed range. It provides tape speeds of 60, 30, 15, 7 1/2, 3 3/4, 1 7/8 and 15/16 ips. Both of these speed ranges are available for forward and reverse directions. The time base error in the system in the tape sync mode at 120 ips is no greater than 0.25 μs. The capstan drive system has sufficient power to meet flutter and speed specifications in the high range at 120 ips within four seconds after the start command has been given. In the low range it meets flutter and speed specifications at 60 ips within three seconds after start command. It stops within four seconds after the stop command has been given from the top speed of either speed range.

The system has, in addition to the seven tape speeds at each speed range, a servo controlled scan speed (240 ips). In either speed range it has fast forward and fast reverse speeds that are greater than 300 ips (not servo controlled).

The two speed ranges are selectable by a jumper-switch (S201) on printed wiring assembly (pwa) A2 of the capstan servo. Normally, the speed range is not changed unless a change in the signal electronics (including heads) is made.

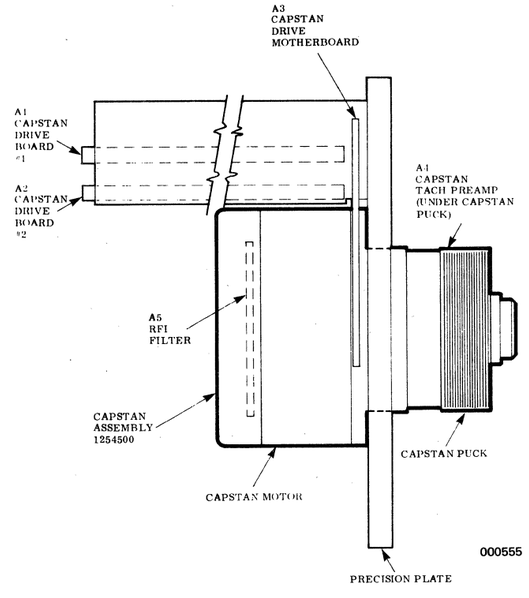


Figure 5-2. Capstan Servo Subsystem Components

SECTION 5
CAPSTAN CONTROL

CAPSTAN PUCK

The capstan puck is constructed with an aluminum alloy body coated with a layer of urethane. The urethane surface is grooved along its 12-inch circumference with 20 8-mil-wide grooves. These provide an air escape path between the capstan surface and the tape. The grooves prevent an air bearing being formed which would cause tape slippage.

The capstan puck may be cleaned without being removed from the capstan shaft. A lint-free tissue dampened with isopropyl alcohol should be used for this purpose. If, however, the puck is damaged and requires replacement, it may be removed by loosening the 10-32 hex socket head retainer screw from the center of the puck and pulling the puck off the capstan motor shaft. A spring-loaded dowel pin (not visible from the outside) keys the capstan puck to the correct position on the motor shaft. This pin must engage a mating hole in the capstan puck. A replacement procedure for the capstan puck is included in Section 11 of this manual.

When the capstan puck is removed, the tachometer preamplifier pwa is exposed. Behind the preamplifier are the critically aligned tachometer disc and optics assemblies. These latter two items should not be touched in the field. Extreme care should be taken not to damage any of the exposed components when replacing the capstan puck or working on the preamplifer. Except for puck replacement or work on the preamplifier, the entire capstan assembly should be returned to the factory for repair and/or adjustment unless the operating personnel have had factory training and are certified for this type of maintenance.

AIR COMPRESSOR AND AIR GUIDE ASSEMBLIES

The halfmoon guides between the odd and even headstacks of both the record and reproduce head assemblies are air-lubricated. Air is supplied to orifices in the surfaces of the guides. This creates an air bearing between the guide surfaces and the tape in order to reduce the tension on the tape and the wear on both the tape and the guide.

AIR COMPRESSOR OUTPUT FILTER

The cartridge-type filter in the air line from the compressor output to the air tank may be removed and replaced as follows:

Refer to Figures 5-3 through 5-6. An air compressor (assembly 1254680) consisting of a 115V 50/60 Hz split-phase motor equipped with a diaphragm type compressor provides the air. The air is filtered at the intake by a replaceable paper filter, and at the output by a 25 micron gas filter. (Note that air flow is against the arrow on the output filter). The output of the compressor is fed to an air tank which is equipped with a pressure adjustment and an air pressure gage. Air from the tank is fed through two 3/16-inch i.d. pvc hoses to fittings on the capstan precision plate. Holes through the precision plate mate with holes in the head-mounting baseplates. The holes in the head-mounting baseplates form ducts to the air guides. Care must be taken to keep the air-guide orifices clean. See the applicable operator/system manual for preventive maintenance instructions.

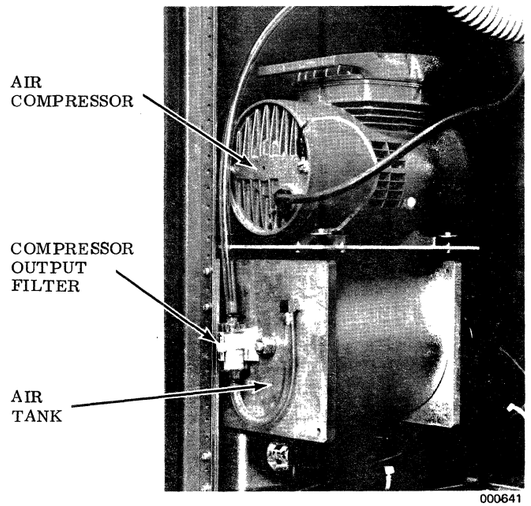


Figure 5-4. Air Compressor Assembly Side View

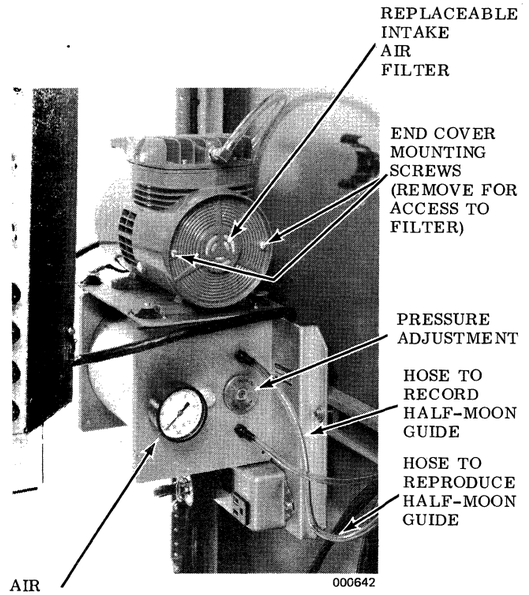


Figure 5-5. Air Compressor Assembly Front View

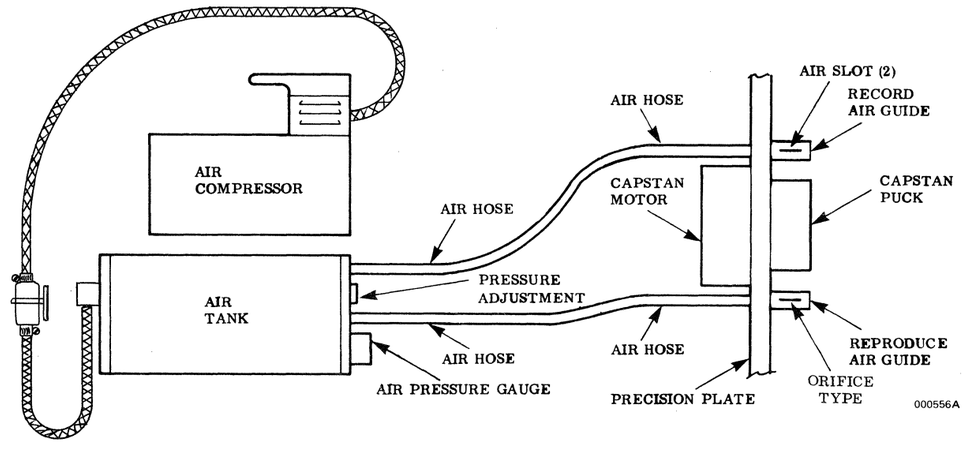


Figure 5-3. Air Supply Subsystem for the Air Guides

CAPSTAN CLEANER

Refer to Figure 5-7. The capstan cleaner is part of the vacuum chamber. (The vacuum chamber itself is part of the reel servo subsystem.) The capstan cleaner consists of a spacer block holding two polyurethane foam pads that contact the circumference of the capstan puck. Each pad is a strip of foam mounted in a U-shaped beryllium copper clip that fits into a channel in the spacer block. The pads brush foreign particles from the surface of the puck as it turns. The pads may be removed for cleaning or replacement by sliding them out of their channels from the front when the vacuum chamber door is open.

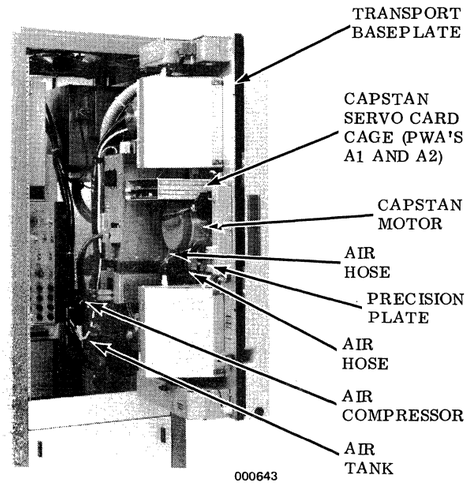


Figure 5-6. Air Supply System Location Detail

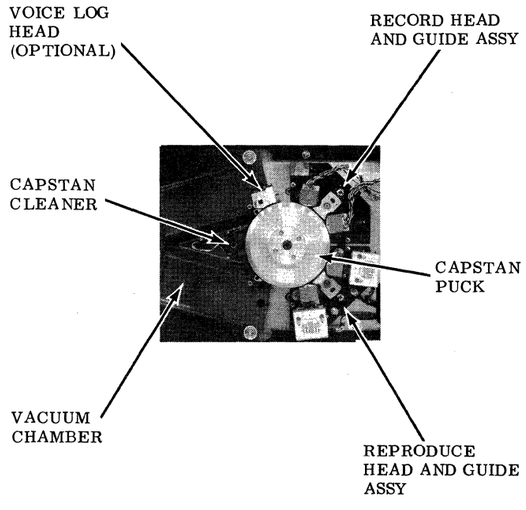


Figure 5-7. Capstan Cleaner Assembly

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CAPSTAN SERVO SUBSYSTEM ELECTRONICS

Refer to Figure 5-8: Basic Capstan Servo Subsystem. The capstan servo subsystem operates in the following fashion:

a. A reference signal is passed through a series of binary dividers. Each speed command selects the proper binary divider output and feeds it to the phase comparator.

b. In the tach mode, a signal from an optical tachometer, which is attached to the capstan motor shaft, is frequency multiplied by four, and fed to the phase comparator. There it is compared with the reference signal.

c. In the tape mode, a reproduced signal from tape (a previously recorded reference called the control track signal, derived from the frequency dividers) is fed to the phase comparator. There it is compared with the reference frequency.

d. The phase comparator, in combination with the sample-and-hold circuit, produces a dc voltage level representative of the phase relationship between the reference and the tape or tach signal. When the phase relationship is correct, the system is in sync and the dc voltage level is such that, when it is fed to the motor drive amplifier (mda), the amount of positive current supplied to the capstan motor is determined by the load torque. Under this condition the capstan motor speed is nominal (i.e., correct for the tape speed chosen). If, however, the phase relationship between the reference and the tape or tach signal is not correct, (tape too slow or too fast) the dc level is above or below the nominal value. More or less than nominal current is fed to the capstan motor as determined by the load.

e. In the tape mode, if the signal from tape disappears (due to a long signal dropout, etc.) the tape-signal-presence detector stage automatically switches the system to the tach mode of operation. If the tape signal is restored, the servo automatically switches back to the tape mode.

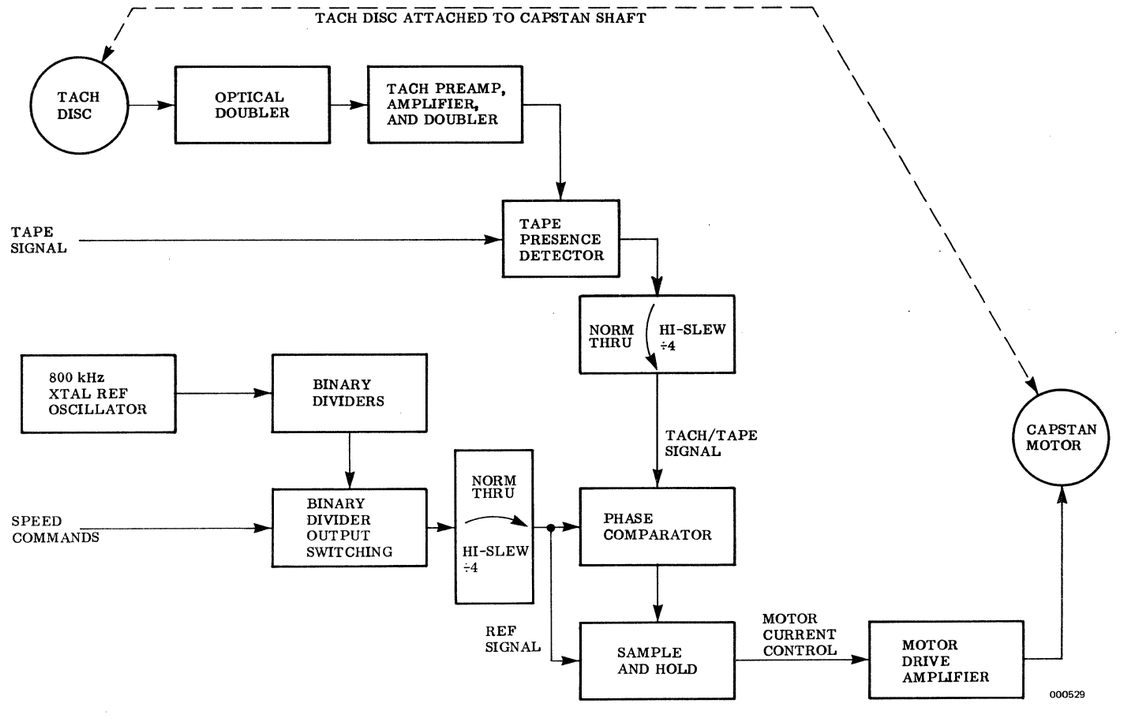

Figure 5-8. Basic Capstan Servo Subsystem

The basic reference frequency is supplied from either an internal or an external source. The internal source supplies a basic frequency of 800 kHz from a crystal oscillator. The external source supplies a basic frequency of 400 kHz. Both basic frequencies are divided by a series of binary dividers to derive reference frequencies for particular tape speeds. At the phase comparator, the frequencies are:

a. 400 kHz for a speed of 120 ips

b. 200 kHz for a speed of 60 ips

c. 100 kHz for a speed of 30 ips

d. 50 kHz for a speed of 15 ips

e. 25 kHz for a speed of 7-1/2 ips

f. 12.5 kHz for a speed of 3-3/4 ips

g. 6.25 kHz for a speed of 1-7/8 ips

h. 3.125 kHz for a speed of 15/16 ips

i. 800 kHz for a fast wind speed greater than 300 ips

j. 800 kHz for a scan speed of 240 ips

The reference frequencies are fed to the phase comparator for normal operation. The frequencies are divided by four by a binary divider when high slew operation is selected. High slew is not used below 7-1/2 ips.

BASIC REFERENCE FREQUENCY SELECTION LOGIC

Refer to Figure 5-9 and Schematic Diagram TW1256040. Selection of the basic reference frequency is accomplished in selection logic gates under the control of the external reference command and the external reference divide signal.

The 800 kHz basic frequency from internal source U205 is applied directly to fast and scan line gating logic but it is divided by 2 in divider U211 before it is applied to internal selector gate U209C. If the external reference command is not present, the 400 kHz internal reference is applied to the divider chain. Frequency divider outputs are selected by speed line gates so that each frequency output represents a tape speed.

If an external reference command (0) is applied, it disables gate U209C, blocking the internal reference. Inverted by U209B, it enables gates U209D and U216C. If the external reference source frequency is applied, it is buffered by U224 and passes through U216C. It is inverted by U210B and applied to divide/direct gates U207A and U207B.

Application of the external-reference-direct signal enables passage of the external reference frequency through gate U207A. The external reference frequency is then applied to external selector gate U209D. Therefore, if the external reference and the external reference command are active, the external reference of 400 kHz is passed through U209D and applied to the divider chain.

For some special applications the reference frequency can be other than 400 kHz. Additionally it can be gated more directly through to the phase comparator by applying an external-reference-direct command (0), (ext ref dir = 0). This disables gate U207A and enables gate U207B. A logic 1 from U210D inhibits dividers U211 and U212.

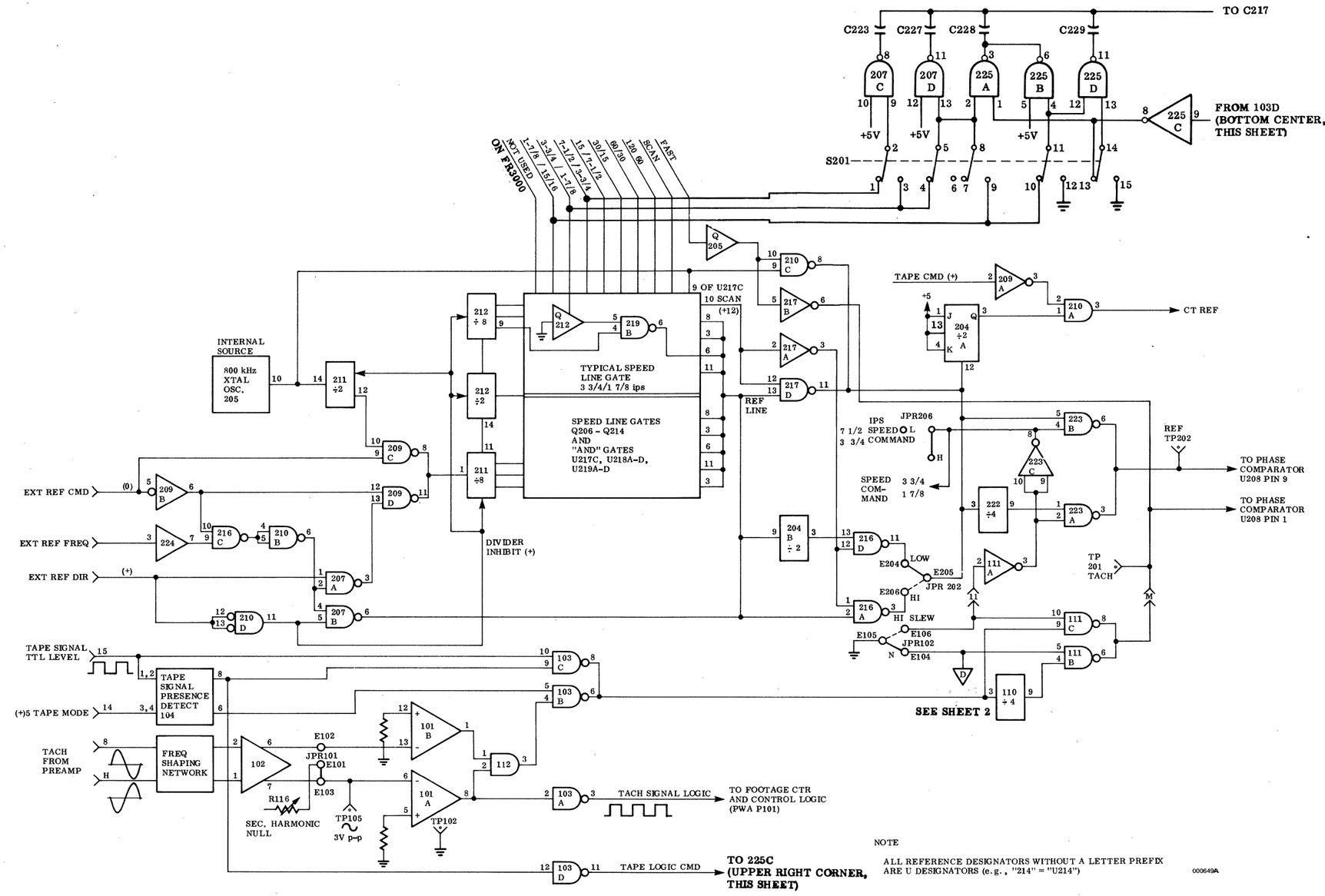

Figure 5-9. Overall Capstan Control Block Diagram (Sheet 1 of 2)

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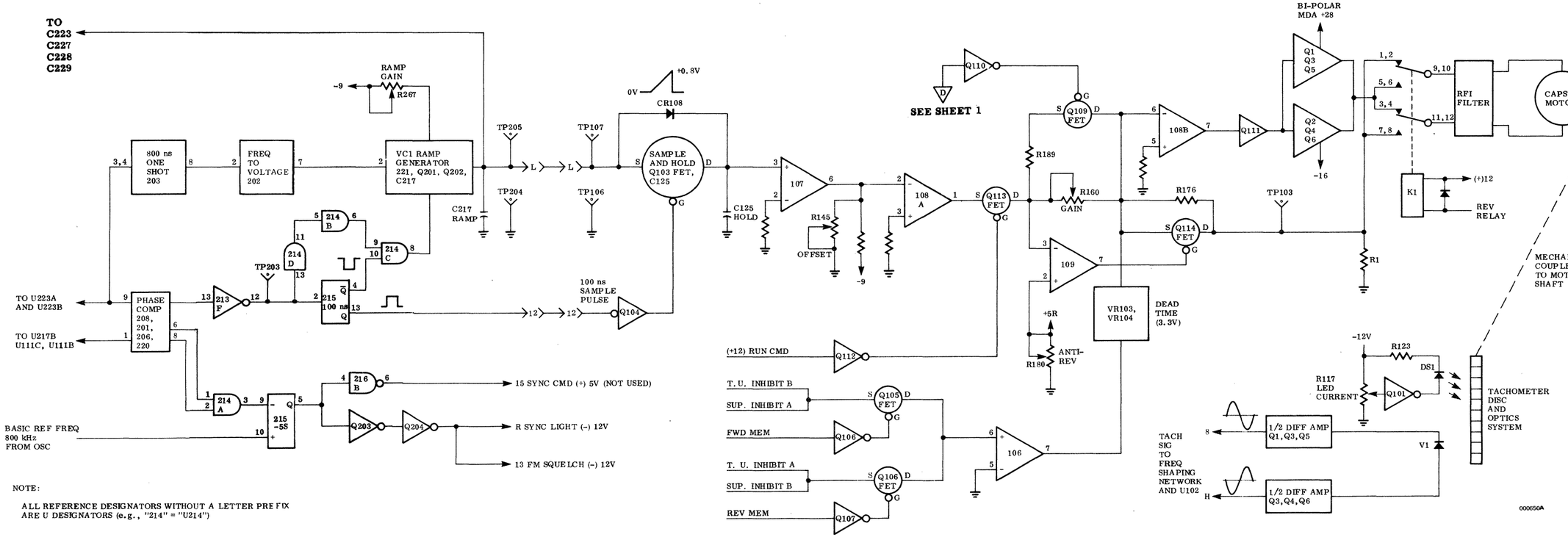

Figure 5-9. Overall Capstan Control Block Diagram (Sheet 2 of 2)

SPEED LINE GATING

Refer to Figure 5-9 and Schematic Diagram TW1256040. Each binary divider output is connected to a logic gate which is enabled by the selection of a particular tape speed. When 120 ips operation is selected, the 120 ips speed line is grounded, shutting off speed line switch Q207 (in the "Speed Line Gate" block of Figure 5-9). The collector potential of Q207 rises to +5V, enabling U218A (which is also included in the "Speed Line Gate" block.) U218A passes the 400 kHz reference frequency from the top pin 3 on the right side of the "Speed Line Gate" block (Figure 5-9), to the "Ref" line. Each combination of a speed line switch (transistor) and a speed line gate (ic) in the "Speed Line Gate" block in Figure 5-9 transfers a reference frequency representing a selected speed in the same manner, except the fast speed line. The fast line transistor switch output enables U210C which passes the 800 kHz internal reference to the phase comparator gating circuits. The fast speed line switch also is inverted by U217B and then used to inhibit the tach/tape input to the phase comparator. In this condition, the transport moves tape in excess of 300 ips.

For scan speed operation, the 800 kHz reference frequency is routed through U217D from pin 10 on the top right side of the "Speed Line Gate" block of Figure 5-9 to the phase comparator gating circuits. The scan line potential is inverted by U217A and is used to inhibit high/low speed gates U216A and U216D. Tach is used during scan speed operation as an input to the phase comparator, and tape moves at 240 ips.

Selection of any running mode switches the proper reference frequency onto the reference line. If the machine is jumpered for the low speed range, the reference frequency is divided by 2 by U204B and then applied to the phase comparator gating circuits via JPR202 from E204 to E205. If the machine is jumpered for the high speed range the reference frequency is passed directly to the phase comparator gating circuits via JPR202 from E206 to E205. As the reference is applied to the phase comparator gating circuits, it is also applied to binary divider U204A. The divide-by-two output of U204A is applied to U210A, which is enabled during (and only during) record mode operation in order to put a control track on tape (via an optional control track pwa in J107 of the power and servo chassis).

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PHASE COMPARATOR GATING CIRCUITS

Refer to Figure 5-9 and Schematic Diagram TW1256040. Jumper JPR102 controls the selection of normal or high slew mode of operation of the phase comparator. When the jumper is placed from E105 to E104 (normal operation), the tach/tape signal is routed directly to the phase comparator via U111C. When the jumper is placed between E105 and E106 (high slew operation), the tach/tape signals are divided by four in U110 and passed via U111B to the phase comparator.

Jumper JPR202 controls the selection of the high or low speed range reference frequency (in low speed the reference frequency is divided by two, whereas in high speed it is not.

The reference signal is passed via U223B to the phase comparator in the normal slew mode. In the high slew mode, the reference frequency is further divided by four in U222 and passed via U223A to the phase comparator.

Because control track reference frequencies are divided by two in U204A during record mode operation, they are multiplied by two in playback on the optional control track pwa. In this fashion, the reference and the control track (tape) frequencies fed to the phase comparator are the same frequency (when in sync). During scan speed operation, frequencies applied to the phase comparator from the reference and tach signal sources are also equal; the transport moves tape at 240 ips.

PHASE COMPARATOR

Refer to Figures 5-9, 5-10, and 5-11 and Schematic Diagram TW1256040. The phase comparator (U201, U206, U220 and U213) compares the reference signal to either the tachometer (tach) or control track (ct) signal. When frequency and phase relationships of the compared signals are correct, the phase comparator output is a pulse-width modulated waveform. The negative duty cycle (portion) of the wave occupies approximately 30% of the waveform period as seen at TP203. U213B, C, D, and E provide approximately 30 ns delays, as well as inversions, needed to allow the phase comparator to "lock up" in sync.

At start-up, two reference frequency pulses in sequence switch the output of the phase comparator to a low level

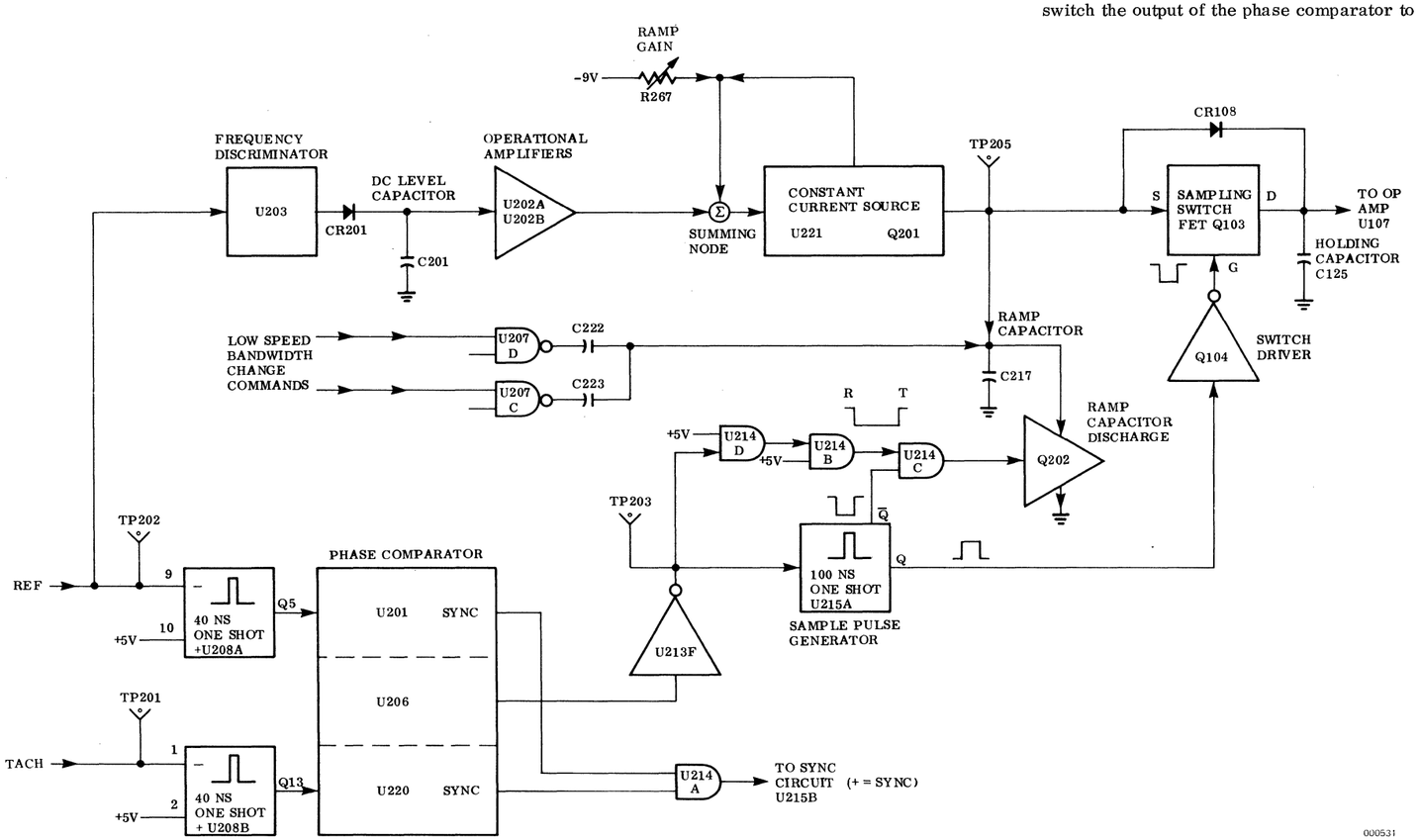


Figure 5-10. Phase Comparator and Sample Hold Stages Simplified Diagram

state. This initial state sets the servo circuits to provide full drive for the capstan motor. Until the capstan motor is up to operating speed, tach or control track (tach/ct) pulses occur at a slower rate than reference pulses and the comparator output remains at the low level. To switch the comparator output to a high level requires two tach/ct pulses to occur consecutively in the period between reference pulses. This phase comparator switching requirement means that the capstan must rotate slightly faster than normal operating speed before achieving sync. When the phase comparator output is switched by the tach/ct pulses, the capstan slows down. When the capstan slows enough to make a single tach/ct pulse occur in the period between reference pulses, the output of the phase comparator again switches. From this time on, the sequence of pulses is ref, tach/ct, ref, tach/ct and the machine is running in sync (i.e.: correct speed).

The output of the comparator switches levels each time a pulse occurs, unless loss of sync takes place. Small disturbances in the tach signal frequency cause the duty cycle to change. This is not a loss of sync but is an indication of minor speed variations. During the time that the capstan is coming up to speed, flip-flop U201 toggles because of the sequence of reference and tach/ct pulses. However, U206 is not affected until two consecutive tach/ct pulses occur in sequence. At that time U206 is reset. During over-speed capstan operation, U220 toggles but U201 and U206 do not. When speed decreases to normal, and both signals arrive in alternate sequence, U220 is set and U201 is reset, and U206 toggles. The servo is in sync, and the output of U214A is high.

The output of the phase comparator is used in three ways: first, it is used to start a ramp waveform; second, it is used to sample a ramp to obtain a dc level; third, it is used to discharge the ramp capacitor so that another ramp can be generated. These repetitive events modify the dc level stored in a hold circuit and furnish speed information for control of the capstan motor-drive current.

SAMPLE AND HOLD

The purpose of the sample and hold circuit is to generate a dc level that is proportional to the phase error between the reference frequency and the tape or tach signal. The dc level is used to control the amount of current fed to the capstan motor and thus its speed. Refer to Figures 5-10 and 5-11.

The sample and hold circuit is comprised of the following sections:

a. Ramp generator - Its function is to generate a linear waveform which starts with reference frequency time and stops at tach tape time. Therefore, the ramp waveform is coincident with the phase comparator output at TP203 and it is shown on the waveforms of Figure 5-11 (#3).

The controlled constant current source acts to automatically adjust the slope of this ramp for each reference frequency as required for each selected tape speed. The ramp slope remains constant for each individual speed selected. If an external reference is used, the slope of the ramp varies according to the frequency of an external source. Ramp duration varies directly with duty cycle duration.

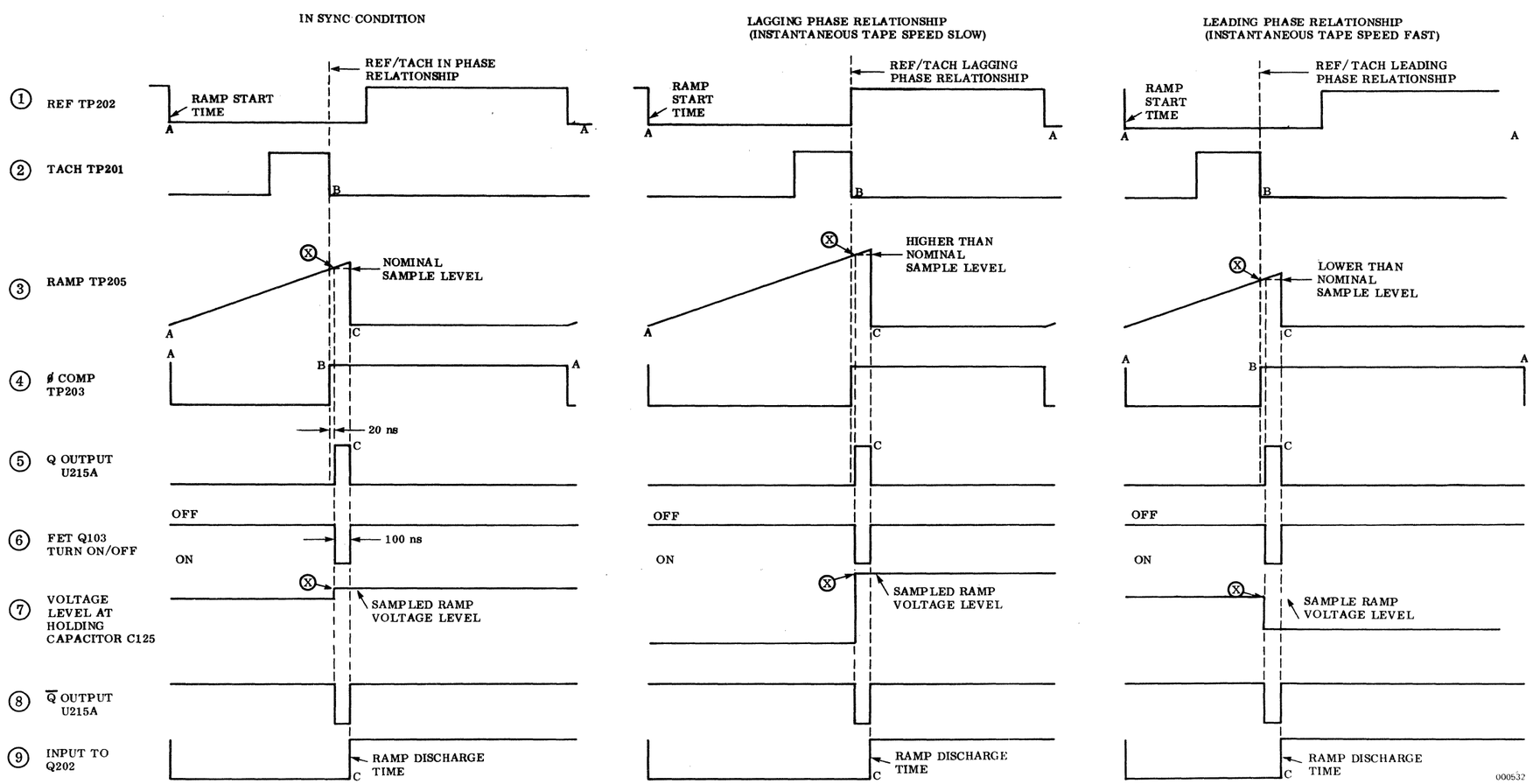


Figure 5-11. Waveforms for the Phase Comparator and Sample and Hold Stages

b. A sample pulse generator. This 100 ns one-shot pulse generator is used to provide the sampling time of the ramp. The pulse start is a function of the tape or tach signal.

c. The sample-and-hold circuit. This is essentially an fet switch which, when triggered, permits the dc level that the ramp has reached to pass to a holding capacitor. The shorter the period of time between the start of the ramp and its sampling, the lower the resulting dc level in the holding capacitor. Conversely, the longer the time between the start of the ramp and its sampling, the higher the dc level. Since the time of sampling is a function of the relationship between the reference and the tape or tach signals, the dc level held by the holding capacitor is also representative of that relationship. See waveforms of Figure 5-11.

d. Bandwidth control circuit. When the system is operated at the lower speeds, the servo bandwidth is limited or reduced, partly influenced by tape or tach mode selection. This is done by switching additional capacitors in parallel with the basic ramp generator capacitor.

RAMP GENERATOR

Reference Figures 5-10 and 5-11, the ramp generator consists of:

a. Frequency discriminator U203, CR201, R203, and dc level capacitor C201.

b. Operational amplifiers U202A and U202B.

c. Current source U221, Q201, and ramp gain potentiometer R267.

d. Ramp generator capacitor C217.

e. Ramp generator capacitor discharge transistor Q202.

The reference frequency signal is fed to the ramp generator frequency discriminator at the same time it is fed to the phase comparator. This signal is a square wave which is converted into positive pulses ($\approx$ 800 ns) by one-shot multivibrator U203. These positive pulses are fed via steering diode CR201 to dc level capacitor C201. C201 integrates these pulses into a positive dc level which is proportional to the input frequency. Since the dc level is proportional to the reference frequency, it is used to automatically adjust the current to the ramp capacitor so that proper ramp amplitude is achieved for any speed selected, including non-standard tape speeds.

Constant current source Q201 and U221 operates as a current operational amplifier. Current from Q201 charges up ramp generator capacitor C217. The amount of current through Q201 is sensed across its emitter resistor R225. The signal thus developed is fed back to a summing node consisting of the junction of R208 (output of operational amplifier U202B), pin 2 of U221 and ramp gain potentiometer R267. At the summing node (Σ) the signal representing the amount of current supplied by Q201 to ramp generator capacitor C217 is compared with the dc level coming from operational amplifier U202B pin 7 (representing reference frequency). In order to maintain the summing node at a 0V reference level, ramp generator gain potentiometer R267 is adjusted to provide any additional negative dc required. The voltages that are compared are:

a. A positive dc level representing reference frequency (U202B).

b. A negative dc level representing ramp generator capacitor charge current through Q201.

c. A negative dc level from ramp generator gain potentiometer R267.

Using the system described above, current source transistor Q201 provides current to the ramp generator capacitor proportional to the reference frequency. Thus the charge slope of the ramp generator capacitor remains constant for each speed selected. As the amount of current required increases (at the higher reference frequencies), the effect of ramp gain potentiometer R267 and resistor R264 is minimized.

The ramp gain potentiometer is adjusted at 1-7/8 ips tape speed. This establishes minimum current requirements for the system.

The start of the charging slope (ramp) of capacitor C217 is triggered by a reference frequency pulse. The point at which the capacitor is discharged is controlled by the tape or tach signal plus a 100 ns sample pulse. Thus, the time between the start and the stop (discharge) of the ramp is a function of the phase relationship between the reference and tape or tach signals. The waveforms of Figure 5-11 illustrate these relationships.

When Q202 is switched on, ramp capacitor C217 is discharged. Q202 is turned on by the phase-comparator signal representative of the tape or tach input delayed 100 nanoseconds by sample pulse generator U215A and 20 additional nanoseconds by the internal propagation time of NAND gates U214B and U214D. The delay is necessary to permit the amplitude of the ramp to be sampled before discharging the capacitor.

SAMPLE PULSE GENERATOR

Refer to Schematic Diagram TW1256040, sheet 1 of 3, and Figures 5-10 and 5-11. The sample pulse generator is a 100 nanosecond, positive-edge-triggered one-shot consisting of ic U215A and timing components capacitor C215 and resistor R221. Its output at Q (pin 13) is a positive-going 100 nanosecond pulse with a repetition rate equal to the reference frequency. This pulse is inverted by Q104 and used to turn on fet switch Q103 of the sample-and-hold circuit. At the end of the 100 nanoseconds the $\overline{Q}$ output at pin 4 becomes positive. This enables AND gate U214C, which permits the positive level from the phase comparator and the positive-going trailing edge of the 100 ns pulse to turn on discharge transistor Q202. The ramp capacitor is discharged to ground through Q202.

SAMPLE AND HOLD STAGE

Refer to Schematic Diagram TW1256040, sheet 2 of 3, and Figures 5-10 and 5-11. The ramp from capacitor C217 is fed to fet sampling switch Q103. The 100 nanosecond positive sample pulse from U215A turns off transistor Q104. This permits -12V to be fed through resistors R186 and R156 to the gate (G) of fet Q103. Q103 turns full on and permits the attained potential of the ramp to be fed to holding capacitor C125. Capacitor C125 is charged to a level representative of the sampled portion of the ramp. After 100 nanoseconds, Q104 turns on and fet Q103 turns off. The charge on C125 is held for a considerable period due to the very high impedance of operational amplifier U107. CR108 across Q103 allows fast mode operation, since in fast mode the phase comparator is inoperative and no sample pulses are generated.

BANDWIDTH REDUCTION

In certain conditions, the bandwidth of the servo must be limited or reduced. This is done by U207C and D, and U U225A, B, and D. When turned on, these gates add capacitors in parallel with ramp capacitor C217. The gates are controlled by speed range switch S201, the tape = 0 signal inverted by U225C, and by the speed-select signals for the three lowest speed pairs. Capacitors are added as follows: C223 at 3-3/4 ips, either speed range, tape or tach mode. C227 at 1-7/8 ips, either range, tape or tach. C228 in the low range at 1-7/8 ips in tape mode; and at 15/16 ips, tach or tape. C228 also in high speed range at 1-7/8 tape mode. C229 is added in low speed range at 15/16 ips, tape mode.

DC OFFSET

Refer to Schematic TW1256040, sheet 2 of 3, and Figure 5-12. The dc offset stage controls the duration of the nominal duty cycle of the capstan servo system. That is, it controls nominal drive to the motor drive amplifier. The capstan servo error signal, the dc level from the sample and hold circuit, adds or subtracts from the nominal drive level. The resultant change of drive level to the mda results in instantaneous speed-up or slow-down of the capstan motor. The nominal drive level is set by offset adjust potentiometer R145. It fixes the nominal operating current of the capstan motor when there is no phase error in the system (no time variation of the trailing edge of the phase comparator output at TP203).

The dc offset stage consists of:

a. Low-leakage, low-input-current operational amplifier U107 which has a dc gain of 3.

b. Inverter U108A

c. Feedback network components CR109, CR111, CR102.

d. Offset adjustment potentiometer R145.

The dc level from holding capacitor C125 is amplified by U107 and fed to U108A. The input of U108A (at pin 2) acts as a summing node (Σ) for the following signals:

a. A dc level from U107, pin 6.

b. Dc offset. The value of this negative-going signal is set by offset adjust potentiometer R145.

c. Positive or negative feedback as limited by diode CR102 (positive) or diodes CR111 and CR109 (negative). The feedback signals limit the output of inverter U108A. This limits mda drive and prevents excessive motor current.

When a tape speed is first selected and the capstan is getting up to speed, the signal from U107 pin 6 is such that it provides maximum drive to the summing node. This results in the maximum permissible drive to the mda and maximum permissible capstan motor current. When the system has come up to speed (in-sync condition), the signal level from U107 pin 6 is sharply reduced. This results in reduced drive current to the capstan motor (that amount of current necessary to maintain capstan speed).

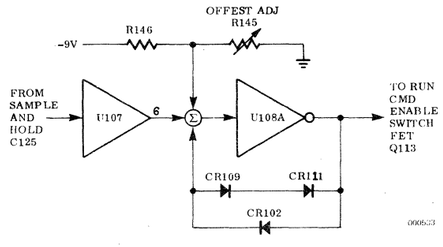


Figure 5-12. Simplified Diagram of DC Offset Stage

The output of the inverter U108A is fed to the capstan mda stage via the run command switch Q113, the gain control R160, and the high-slew gain circuit Q110 and Q109. R160 is used to optimize the gain of the system, when it is in the tach mode, for minimum flutter. The functions of the run command switch and the high-slew gain circuits are given below. A negative output from U108A results in positive motor current.

RUN COMMAND SWITCH

Refer to Schematic Diagram TW1256040, sheet 2 of 3, and Figure 5-9. The run command switch, fet Q113, is inserted into the error signal line between the output of U108A and gain control R160. Q113 is controlled by the run command from the control logic, by way of transistor Q112. In the absence of a run command, Q112 is biased on and applies +5V to the gate of Q113, holding Q113 off. Whenever a run command (+10V) is present at pin 12 of A3, it is applied to the base of Q112. This turns Q112 off and allows -12V by way of R167 to turn Q113 on. This applies the output of U108A to the gain control circuits, normal gain control R160 and high-slew gain circuit Q110, Q109. The signal activates the mda, and the capstan runs. When the capstan is running and the run command is removed, Q113 is immediately turned off, and removes the error signal from the subsequent circuits. This removes power from the capstan and it quickly stops.

HIGH-SLEW GAIN CIRCUIT

Refer to Schematic Diagram TW1256040, sheet 2 of 3, and Figure 5-9. As previously stated, when high-slew mode is selected, the number of sample pulses is reduced by a factor of four. This reduces the output of the sample-and-hold circuit and therefore the capstan drive by a factor of four. To compensate for this, and provide full capstan drive in high-slew operation, a gain compensation circuit consisting of Q109 and Q110 is used. When normal slew is selected, jumper JPR102 applies a ground to the base of Q110. This holds Q110 on, and it applies +5V to the gate of Q109, holding it off. When high-slew mode is selected, JPR102 allows +5V to reach the base of Q110, turning it off. This biases Q109 on and places R189 in parallel with gain control R160 and fixed limiting resistor R159. This increases the drive to the mda by a factor of four so that full power is supplied to the capstan. C137 provides phase lead for stabilization.

MOTOR DRIVE AMPLIFIER (MDA)

Refer to Schematic Diagram TW1256040, sheets 2 and 3 of 3, and Figure 5-9. The motor drive amplifier applies drive power to the capstan motor in response to the input it receives from the dc offset stage. The direction the motor turns is dependent on the direction the current flows through the motor. In the forward mode, drive current enters the motor via terminal E1 and exits via terminal E3. In the reverse mode, reverse relay K1 is energized and the drive current enters the motor via terminal E3 and exits via terminal E1.

In either the forward or reverse mode positive drive current is used to maintain or speed up the capstan motor. If the capstan is overspeed, negative current is supplied to the motor which tends to reverse its direction, thus slowing it down. A reverse direction inhibit circuit is used to prevent the motor from actually going beyond zero velocity into the reverse direction.

The motor drive amplifier consists of:

a. Operational amplifier U108 and transistor Q111.

b. Bias diodes CR103 and CR104.

c. High-current, class B, positive and negative current supplies (Q1, Q5, Q3, positive and Q2, Q6, Q4, negative) for bi-polar control of the capstan motor.

d. Capstan motor current sensing resistor R1.

e. Feedback resistor R176.

f. Anti-reverse circuit consisting of U109, Q114 and R180.

The mda drive signal from the dc offset stage is fed to a summing node consisting of the juncture of gain potentiometer R160, feedback resistor R176 and pin 6 of U108B. U108B amplifies this signal and passes it through emitter follower Q111 which drives the class B current stages.

Diodes CR103 and CR104 provide a constant voltage drop to bias and isolate input transistors Q1 and Q2 of the class B stages. Since the diodes are biased on from the +28V source, they provide no steering effect for the drive signal from Q111. A negative signal from the dc offset stage is positive at the emitter of Q111. This turns off Q2 of the negative class B amplifier, which turns off Q6 and Q4. The positive signal turns on Q1 of the positive class B amplifier, and it turns on Q5 and Q3 (high current transistors). These provide positive current from the +28V source to the capstan motor via pins 3, 4, and 11, 12 of reverse relay K1. The current through the capstan motor (via K1 pins 9, 10 and 1, 2) is sensed across resistor R1. A positive potential is developed across R1 and fed back to the summing node at the input (pin 6) of operational amplifier U108B. Resistor R176 and the anti-reverse circuit (to be discussed later) are in the feedback path. This negative feedback provides linear E-to-I conversion, and prevents the system from going into oscillation. For example, with a large negative signal coming from the dc offset stage, a large amount of positive current is fed to the motor. This tends to make a rapid increase in motor speed. However, the increase in current causes an increase in positive potential across current-sensing resistor R1. This in turn counteracts the large negative drive signal at the summing node. Thus the total amount of current to the motor is reduced. In other words, the speed-up of the capstan motor is slowed, resulting in a more gradual change.

Normal slow-down is accomplished by reduction of positive drive current. However, if a large outside disturbance tends to make the capstan speed up, the input to the mda becomes positive. The negative-current class B stages (Q2, 6, 4) supply negative current to the capstan motor which then tends to go in the reverse direction, and thus slows down more quickly.

In the reverse mode, reverse relay K1 is energized, and thus the direction of current flow through the motor is reversed. All servo functions are the same, but the motor rotates in a counterclockwise direction.

ANTI-REVERSE CIRCUIT

Under certain circumstances, when the system is not in sync, a positive error voltage can appear at the output of U108A. Applied to the input of U108B, this would produce reverse rotation of the capstan. In order to prevent this, anti-reverse circuit Q114, U109A is included.

U109A is a voltage comparator which has its output connected so as to control fet switch Q114. Q114 is connected across feedback resistor R176 coming from motor-current-sensing resistor R1. The noninverting input of U109A is biased (adjustable by potentiometer R180) to a threshold level that keeps Q114 switched off under all normal conditions. The inverting input of U109A is connected to the drain of Q113 which carries the error signal when a run command is present. If the normally negative error signal swings positive enough to overcome the threshold set by R180, the output of U109A is driven negative and switches Q114 on. This shorts out feedback resistor R176, greatly increasing feedback and reducing servo gain to unity. Under this condition, very little power is available, and the capstan cannot be driven backward. When the error signal returns to its normal (negative) polarity, Q114 is automatically switched off and normal operation is restored.

TACHOMETER PREAMPLIFIER

The tachometer preamplifier assembly consists of:

a. A tachometer disc having 10,000 opaque and 10,000 translucent segments.

b. A light emitting diode (l-e-d DS1).

c. A fibre optics conduit.

d. A photo diode (V1).

e. A tachometer preamplifier printed wiring assembly (pwa).

Refer to Schematic Diagram TW1256040, sheets 2 and 3 of 3, and Figures 5-9 and 5-13. The tachometer (tach) disc is mounted permanently to the front end of the capstan motor shaft. It is located inside the capstan housing, behind the tachometer preamplifier which is behind the capstan puck. Light-emitting diode DS1 is mounted in the preamplifier pwa facing the tachometer disc. 180° away, photo diode V1 is mounted. It also faces the tachometer disc. On the opposite side of the tachometer disc a fibre optics bundle provides a conduit for the projection of an image produced by the opaque segments of the tachometer disc and the l-e-d. Light from the l-e-d projects the image of an opaque segment into the fibre optics conduit. This image is projected on to the tachometer disc 180° away, between two real opaque lines. By this method the number of opaque segments is effectively doubled. The photo diode picks up both the image and the real opaque and translucent segments and converts them into positive- and negative-going signals. These are amplified by two differential amplifiers to become sine waves with a frequency of two times the number of opaque segments on the disc, i. e. 2 X 10,000 equal 20,000 per revolution.

Refer to assembly A4 on Schematic Diagram TW1256040 sheets 2 and 3 and Figure 5-15. Constant current for l-e-d DS1 is provided by current source Q101 (located on servo board A1). The amount of current which is supplied may be adjusted by l-e-d current potentiometer R117. It is adjusted so that the signal seen at test point TP105 is 3V peak-to-peak. (TP105 is located downstream from the tachometer preamplifier.)

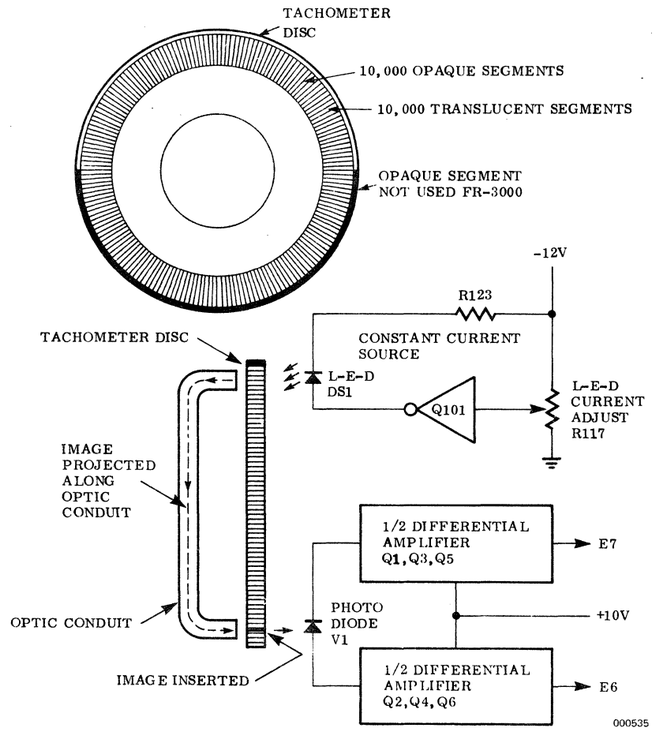


Figure 5-13. Simplified Drawing of Tachometer Preamplifier

The pulses from the tachometer optical system are converted into electrical signals by two amplifier stages (Q1, Q3, Q5 and Q2, Q4, Q6). These amplifiers are connected as a conventional differential amplifier whose output is fed to a high gain amplifier on the A1 servo board. These signals are more or less sinusoidal at this point. The output of the tachometer preamplifier board A4 is fed to servo board A1.

TACHOMETER AMPLIFIER

Refer to Schematic Diagram TW1256040, sheet 2 of 3, and Figures 5-9 and 5-14. The tachometer amplifier, located on servo board A1, receives its differential input from tachometer preamplifier assembly A4. The two signals coming in on Pin H and Pin 8 are 180° out of phase. They represent the 10,000 opaque and translucent segments of the tachometer disc optically doubled. These differential signals are amplified, shaped, and used to drive a zero-crossing detector consisting of two Schmitt triggers, U101A and U101B. The outputs of the Schmitt triggers are added together to provide frequency doubling. The output of the tachometer amplifier stage is a series of asymmetrical square waves with a frequency of 4X the original opaque segments of the tachometer disc (40,000 cycles per revolution).

The output of the zero-crossing detector is fed to the phase comparator where it is compared to the reference frequency.

Provision is made for inhibiting the tach signal at the output of the zero-crossing detector when a tape mode is selected. This is done by the use of retriggerable one-shot U104, which inhibits the NAND gate output of the tachometer amplifier. Additionally, provision is made to switch to tach mode if the tape signal disappears.

Refer to Schematic Diagram TW1256040 sheet 2 of 3 and Figures 5-9, 5-14 and 5-15. The differential output from the tachometer preamplifier is fed to the tachometer amplifier on Pins H and 8. It is then ac coupled to frequency shaping networks consisting of C116, R128 and C115, R127. The two signals are then fed to high gain amplifier U102 (X10). U102 provides two sinusoidal outputs 180° out of phase. See waveforms A and B of Figure 5-15.

A filter comprised of R187, L101, and C113 across the outputs of high gain amplifier U102 reduces external noise interference in the system. The differential sinusoidal outputs from U102 are fed to the zero crossing detector comprised of Schmitt triggers U101B and U101A. The asymmetrical square wave outputs of the Schmitt triggers are fed to AND gate U112A. There they are added and the resultant output is a series of positive-going pulses at 2X the input frequencies to the Schmitt triggers. See waveforms C, D, and E of Figure 5-15. Thus waveform E represents 4X the tachometer disc output frequency.

Null adjust R116 is used to change the triggering point of the Schmitt triggers slightly in order to minimize the time base error due to asymmetry of tach pulses. R116 is adjusted so that there are minimum second order components of the optically-doubled tach frequency in the error signal.

Additionally, provision is made for wide variation of Schmitt trigger characteristics by permitting the null adjust potentiometer to be connected to either Schmitt trigger input. This is done by means of jumper JPR101 which may be connected between terminals E101 and E103 or E101 and E102 (see Figure 5-14).

In order to accommodate the high frequencies involved with the tachometer system at the higher tape speeds, diodes CR105 and CR106 are used to increase the hysteresis of the Schmitt triggers.

TAPE SIGNAL PRESENCE DETECTOR

Reference Figure 5-14. In the tape mode, a control track signal from tape is used in place of the tachometer signal.

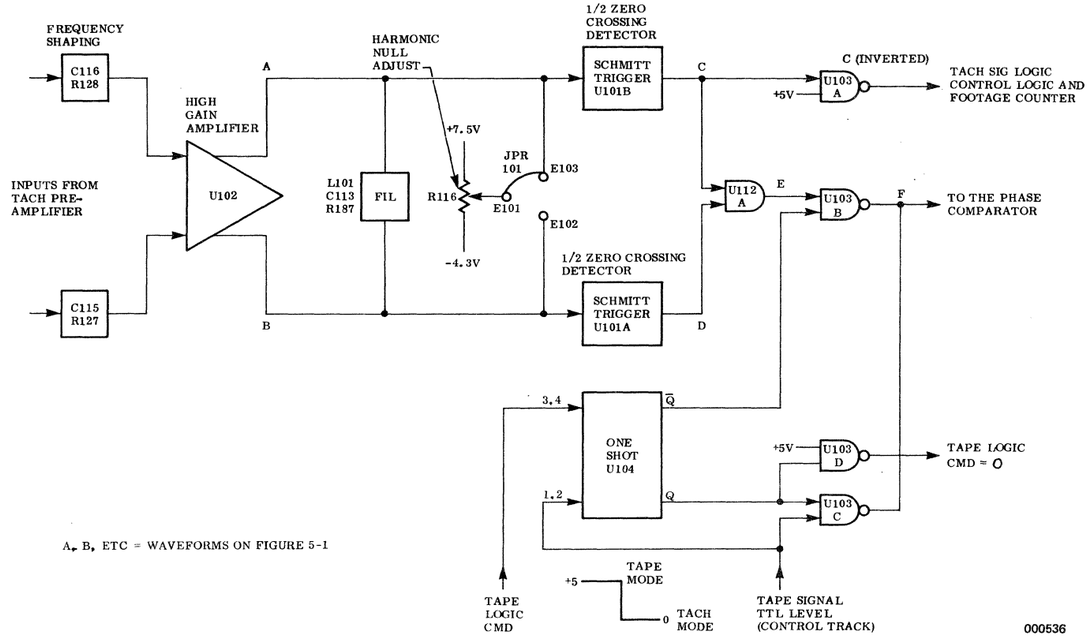


Figure 5-14. Simplified Diagram of Tachometer Amplifier

This control track signal is fed into NAND gate U103C where it is inverted and passed to the phase comparator. Additionally, the control track signal is fed to pins 1 and 2 of retriggerable one-shot U104. The $\overline{Q}$ output of U104 is negative, inhibiting NAND gate U103B. U103B inhibits the passage of the tach signal to the phase comparator. On the other hand, the Q output of U104 enables U103C and U103D. U103C permits the passage of the control track signal to the phase comparator. U103D provides a tape-logic command of 0 level output which is used in the speed-range switch circuit.

If the control track signal (tape signal) should disappear, one-shot U104 resets. The Q output becomes negative and inhibits NAND gates U103C and U103D. The $\overline{Q}$ output becomes positive and enables NAND gate U103B. The tach signal from the zero-crossing detector is permitted to pass to the phase comparator while the nonexistent or interrupted control track signal is inhibited.

If the operator wishes to manually change from the tape to the tach mode, he throws the TAPE/TACH switch to the TACH position. A logic 0 signal is fed to one-shot U104 via its pins 3 and 4. The $\overline{Q}$ output becomes positive, the Q output becomes negative and the system changes to the tach mode. In the tape mode the signal level at Pins 3 and 4 of U104 is a logic 1 (+5V).

CONTROL LOGIC AND FOOTAGE COUNTER OUTPUT

The output to the control logic and (optional) footage counter is obtained from Schmitt trigger U101A via NAND gate U103A.

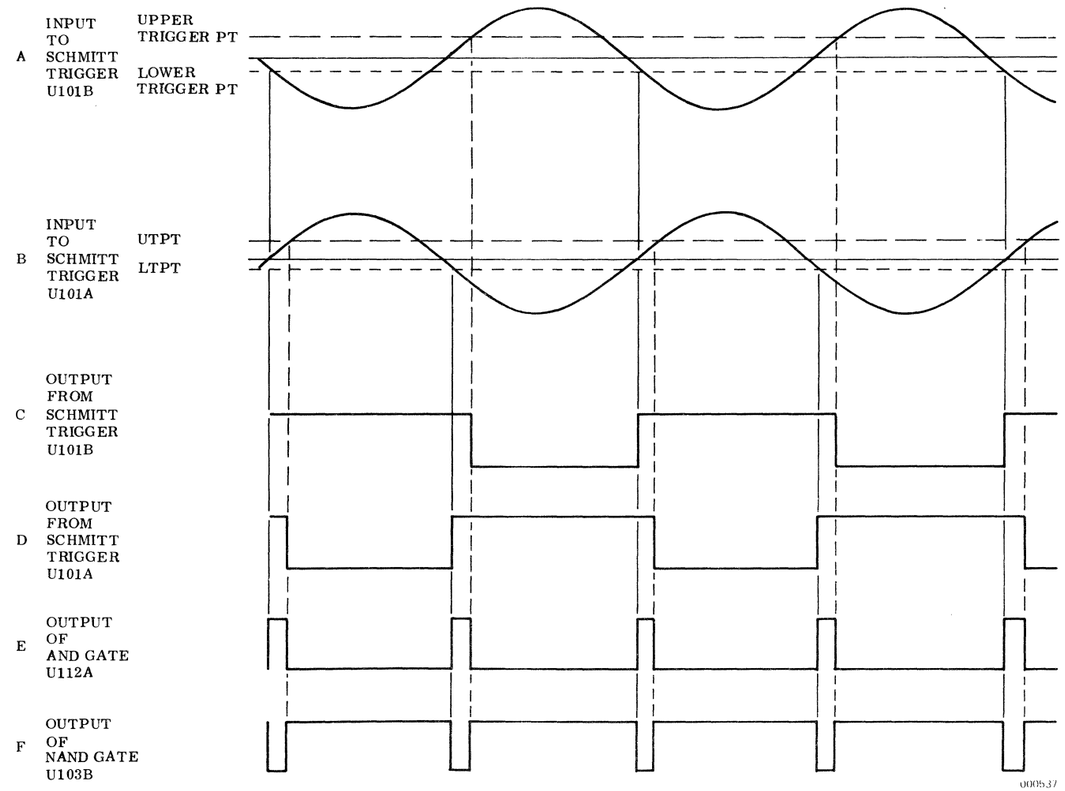


Figure 5-15. Waveforms for Tachometer Amplifier

This signal is an asymmetrical square wave, one half the frequency of the signal fed to the phase comparator. On Schematic Diagram TW1256040, sheet 2 of 3, this signal is called the "tach sig logic" and appears at Pin 13 of assembly A3. For its use in the control logic, see Section 3, page 3-4. For its use in the footage counter, see the applicable accessories manual for your recorder.

MISCELLANEOUS CIRCUITS

REEL INHIBITOR

The reel inhibit circuit is used to prevent the capstan from exceeding the acceleration or deceleration capabilities of the reel servo system during times of speed change. This prevents loss of the tape storage loop in each vacuum chamber. The inhibit circuit is active only when the tape position in the vacuum chamber exceeds a preset amount on either side of the normal steady-state running position. At such times the offset voltage produced by the photocell amplifiers in the reel servos (takeup and supply inhibit signals) exceeds a threshold of ±1.2V.

Refer to Schematic Diagram TW1256040, sheet 2 of 3, and Figure 5-9. The inhibit signals, takeup inhibit B, supply inhibit A, and takeup inhibit A, supply inhibit B are fed to fet Q105 and Q106 respectively. The fet's act as switches that permit the inhibit signals from the takeup and supply reel servos to pass to amplifier U106B. The signal from U106B adds to or subtracts from the negative feedback to the summing node of the mda (due to the capstan motor current). This results in a speed-up or slow-down of the capstan motor in order to bring the tape within the operating range of the reel servos.

When a forward or reverse command is activated, the memory circuits, fwd mem or rev mem, feed a positive signal to the base of transistors Q108 or Q107 (these transistors are normally on). The positive signal turns off Q108 or Q107 and its associated fet turns on. With the fet on, the inhibit signal at its source (S) is passed to amplifier U106B. The output of amplifier U106B is fed to dead-zone diodes VR103 and VR104. These diodes are used to create an area of control where the inhibit signals are not effective, that is, the area in the vacuum chamber where the tape is normally positioned, plus or minus a buffer area. The signals from the reel inhibit circuits, after amplification by U106B, are less than approximately ±6V in such an area. When the tape is outside the established boundaries, the inhibit signal from U106B (at TP101) is greater than ±6V. The difference between ±6V and the error signal is passed to the capstan mda feedback network.

SYNC DETECTOR

Refer to Schematic Diagram TW1256040, sheet 1 of 3, and Figures 5-9 and 5-16. The sync detector circuit is made up of ic's U215B and U216B, and transistors Q203 and Q204. U215B is an edge- or dc-triggered, retriggerable one-shot. When the Q output of U215B is low (circuit not triggered), Q203 and Q204 conduct. This causes the SYNC indicator to light, and also causes the fm squelch circuit to allow signal output from fm demodulators. (The Q output of U215B is also inverted by NAND gate U216B; but this command, "sync cmd = 1," is not used in the FR-3000.) When the Q output of U215B goes high (circuit triggered), the situation reverses. The SYNC light goes out, and fm output is squelched.

Each time the circuit is triggered, the Q output of U215B goes positive for 0.5 second. If the circuit is retriggered before the 0.5 second is up, the positive output is extended. This may be continued indefinitely.

In order to trigger U215B and turn out the SYNC light, both its noninverting (+) input and its inverting (-) input must be satisfied. The output of the reference oscillator (U205) is applied to the (+) input, supplying continuous positive trigger pulses. The output of AND gate U214A is applied to the (-) input. When the servo goes out of sync, the signal from U201 or U220 switches back and forth between 1 and 0. This causes the output of U214A to switch. So long as the reference oscillator is providing positive trigger pulses, when the output of U214A goes low, the one-shot is retriggered.

Although the output of U214A toggles when the servo goes out of sync, and would provide retriggering, the reference oscillator signal is used as the (+) input because it is possible at power turnon or in fast modes for the phase comparator to come on in a steady state that would allow the SYNC indicator to light. In that case the reference signal retriggers U215B and its Q output remains high. (Note that if the SYNC light should remain on in an out-of-sync condition, it may indicate a fault in the reference oscillator.)

±9V AND +5V REGULATORS

Refer to Schematic Diagram TW1256040 sheet 2 of 3. In order to provide a regulated ±9V for use in the ramp generator, circuits Q102 and U105 provide +9V regulation. VR102 and U106A provide -9V regulation. Neither of these two regulators is adjustable.

In addition the regulated +5V (+5V REG) used in the sample-and-hold circuit is provided by components VR101 and C122. The +5V is re-regulated from the regulated +9V source. This +5V source is designated "+5R" on the schematic.

POWER LINE FILTERS

Refer to sheet 1 of 3 of Schematic Diagram TW1256040. The ±12V and +5V input power to the capstan servo is filtered via inductors L1 and L2 and capacitors C1 through C6. This prevents outside noise from entering the capstan servo via the power sources.

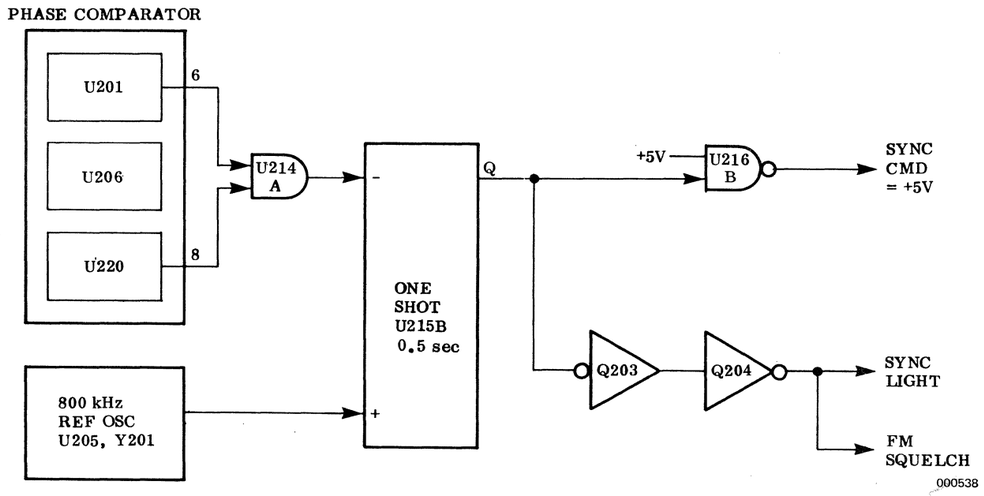
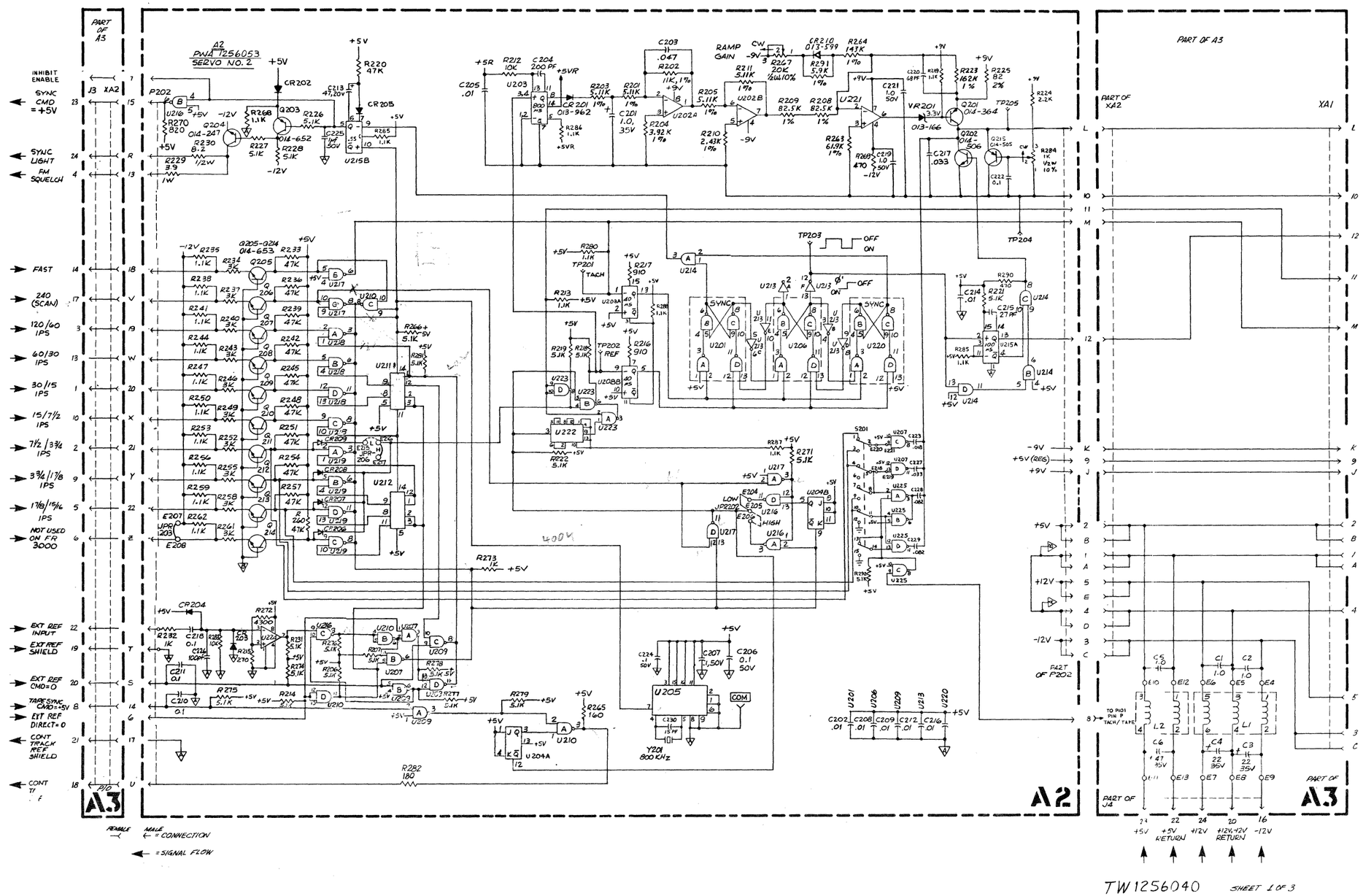
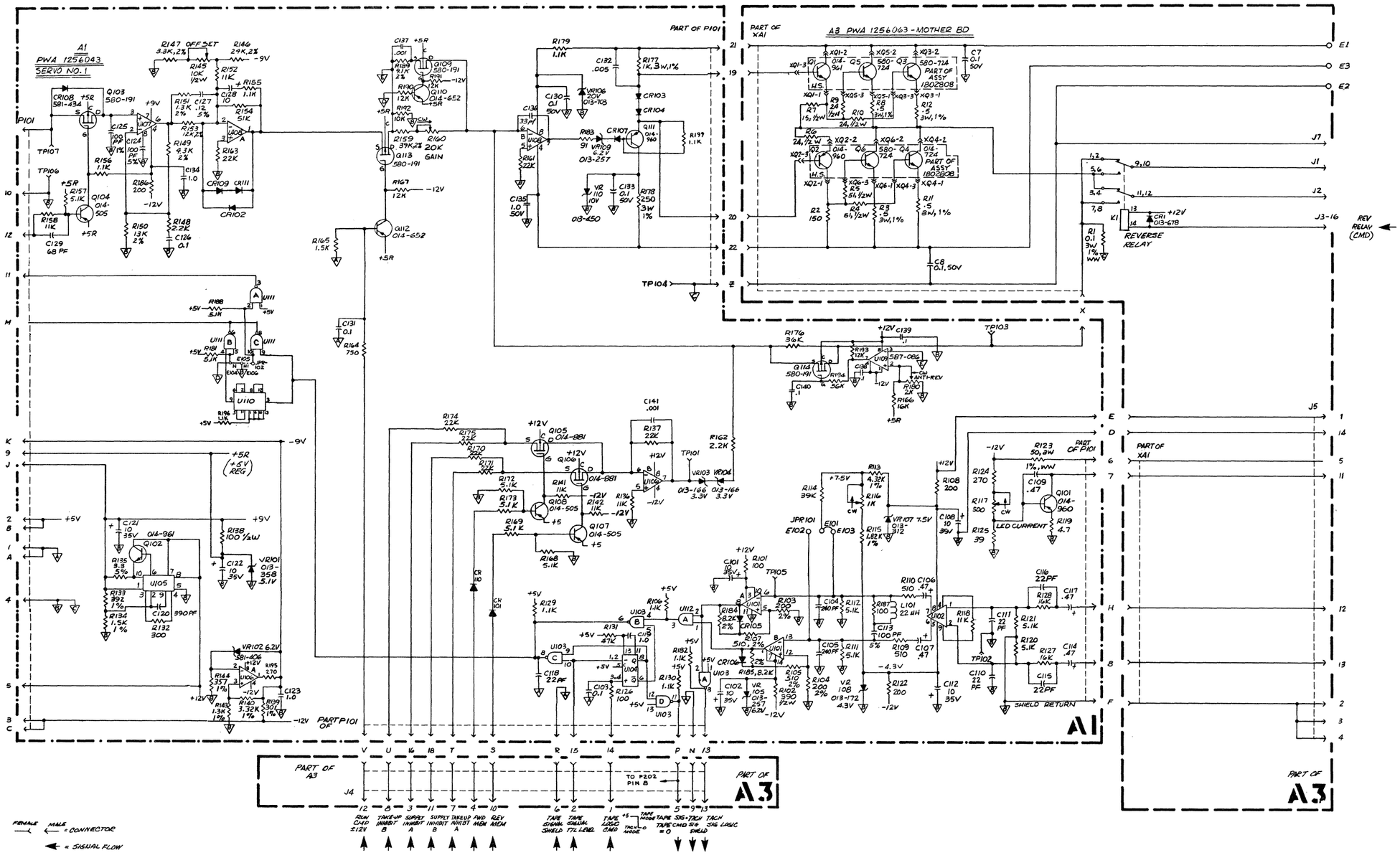


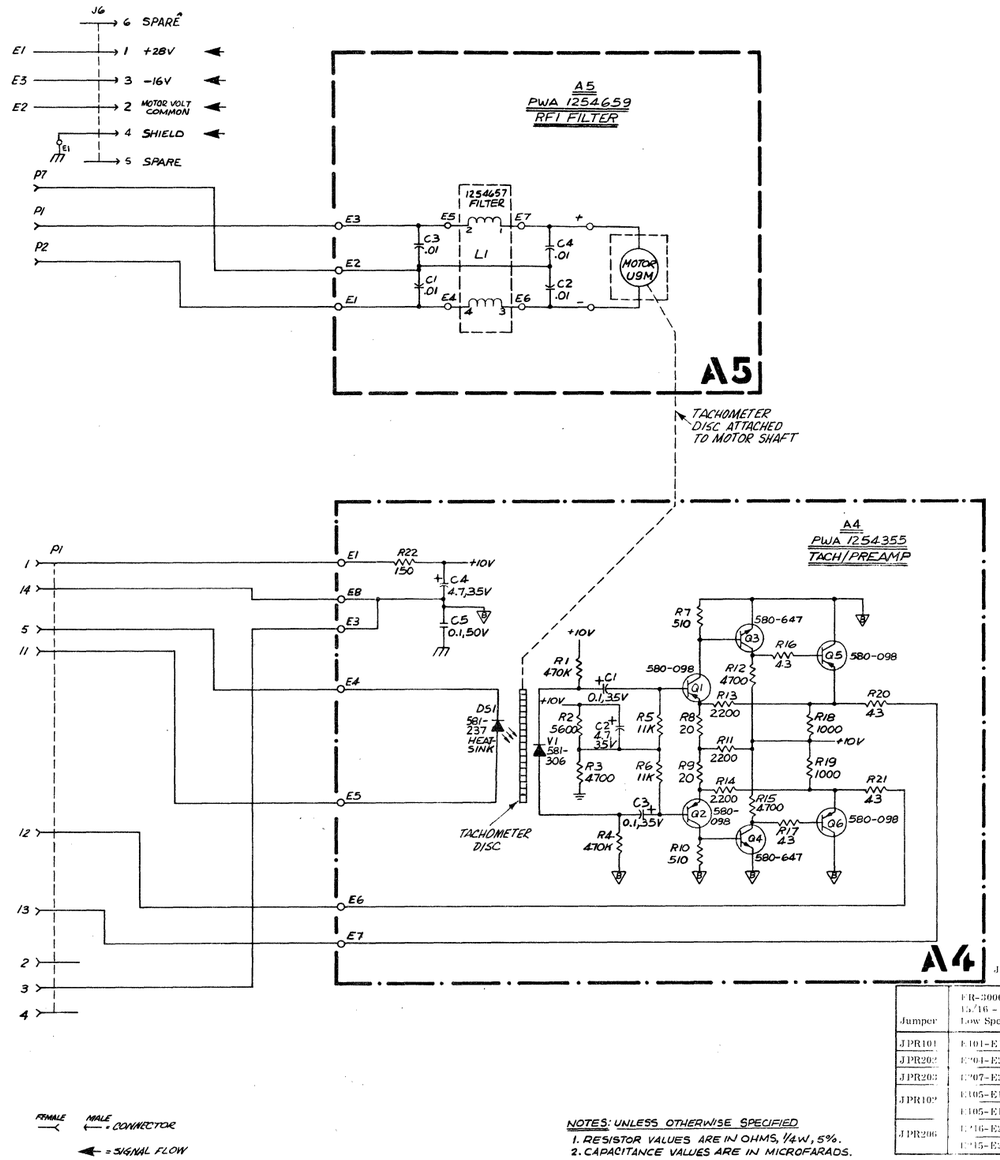
Figure 5-16. Simplified Diagram of Sync Detector



TW1256040 SHEET 1 OF 3



TW 1256040 SHEET 2 OF 3



FOR FIELD SERVICE
APPLICABLE JEDEC NO

Ampex Part No.	JEDEC No.	Ref. Designation	V_{CC}	GND
586-317	μA733	U102	–	–
586-321	μA723	U105	–	–
586-549	MC1414	U101	–	–
586-581	SN7403	U103, U111	14	7
586-905	MC1458	U106, U108		
586-911	SN74122	U104	14	7
587-249	SN7409	U112	14	7
587-696	LM308N	U107	–	–
586-108	SN7474N	U110, U222	14	7
587-086	LM311N	U109, 224		
586-075	SN7400N	U201, 206, 220	14	7
586-283	SN7493	U211, 212	5	10
586-326	SN7404N	U213	14	7
586-581	SN7403N	U207, 209, 216-219, 223, 225	14	7
586-647	SN74107N	U204	14	7
586-759	SN7408N	U214	14	7
586-797	SN74123N	U215	16	8
586-911	SN74122N	U203	14	7
586-905	MC1458CP1	U202	–	–
587-973	SN74LS124N	U205	–	–
587-656	LM318N	U221	–	–
587-784	SN7438N	U210	14	7
587-431	SN74221N	U208	16	8
013-599	CD458	CR101-107, CR109-111, CR202-210		
014-653	2N3904	Q205-214		
581-406	1N3496	VR102		
581-237	SSL-55C	DS1		
581-306	MRD500	V1		

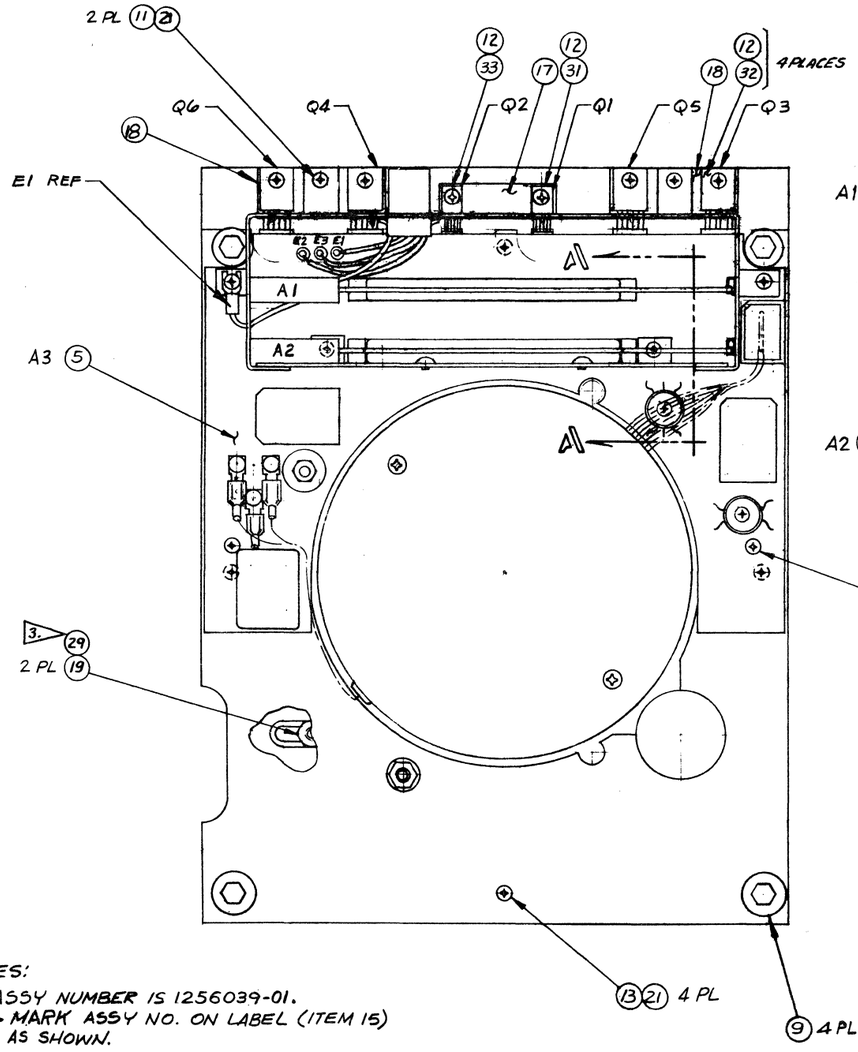
Board Designation	Last Ref. Desig. Used	Not Used
A1	R199 C141 VR110 CR111 Q114 U112 TP107 E106 JPR102	R197, R198
A2	R292 C230 VR201 CR210 Q215 U225 TP205 S201 E221 JPR206 Y201	E201-203 E209-214 JPR201, 204, 205
A3	R12 C8 Q6 E12 K1 L2 CR1	
A4	R21 C5 DS1 V1 Q6 E8	E2
A5	C4 L1 E7	

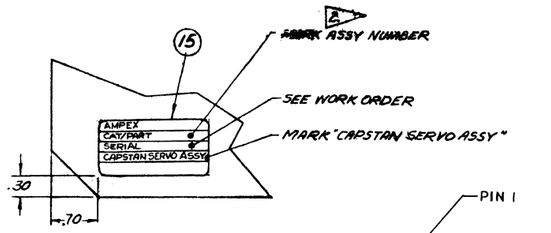
JUMPER TABLE

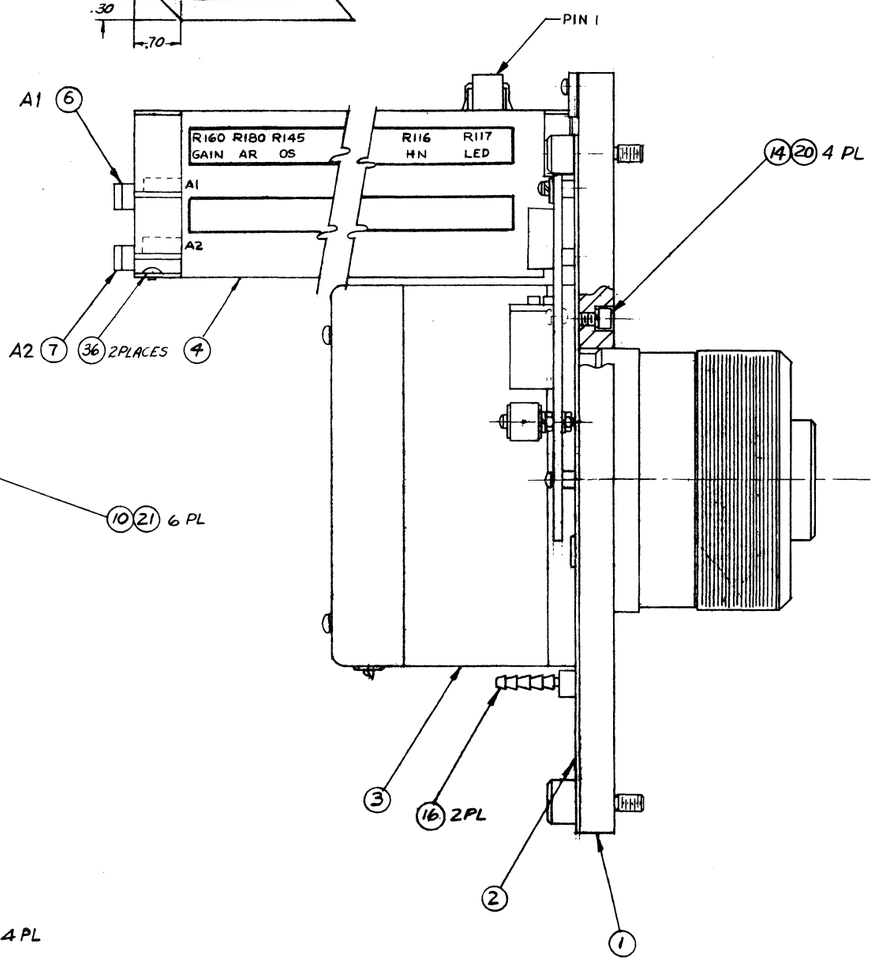
Jumper	FR-3000 15/16 – 60 IPS Low Speed	FR-3000 1-7/8 – 120 IPS High Speed	Slew Option
JPR101	E101-E103	E104-E103	N/A
JPR202	E201-E205	E205-E206	N/A
JPR203	E207-E208	E207-E208	N/A
JPR102	E105-E104		
	E105-E106	E105-E106	High
JPR206	E216-E217	E216-E217	Normal
	E215-E216	E216-E217	High

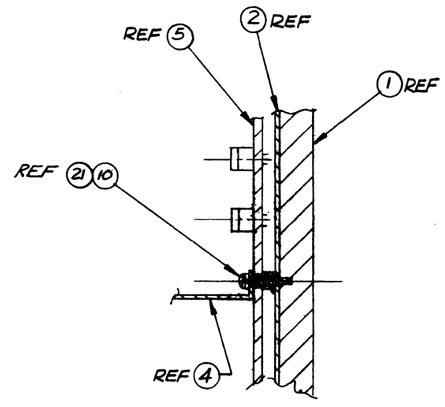
NOTES: UNLESS OTHERWISE SPECIFIED
1. RESISTOR VALUES ARE IN OHMS, 1/4W, 5%.
2. CAPACITANCE VALUES ARE IN MICROFARADS.

TW 1256040 SHEET 3 OF 3









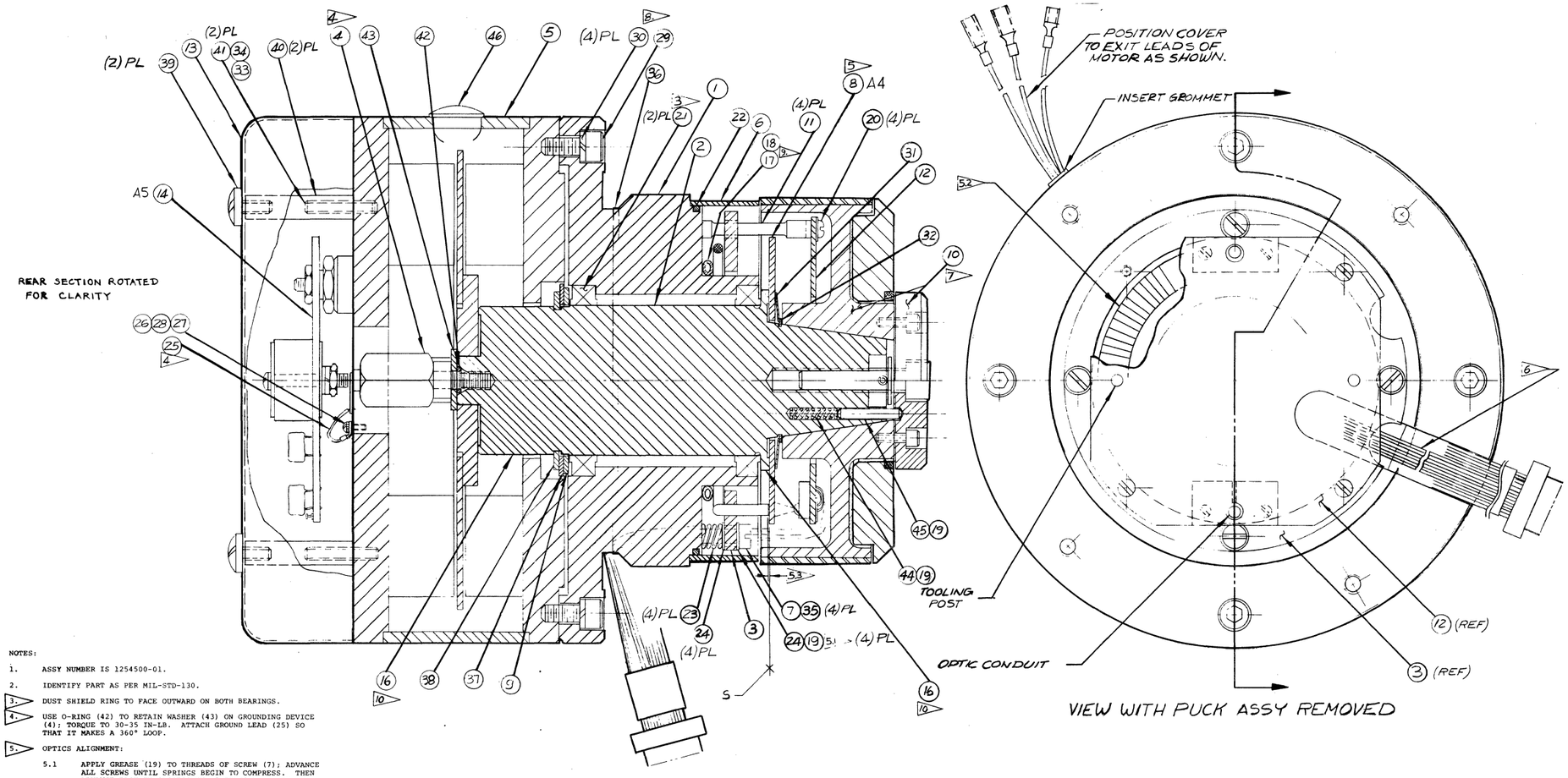
SECT A - A

NOTES:

1. ASSY NUMBER IS 1256039-01.
2. MARK ASSY NO. ON LABEL (ITEM 15) AS SHOWN.
3. NUT, ITEM 19, TO SLIDE FREELY IN SLOT. SAND OPPOSING SIDES OF NUT ON FINE EMERY CLOTH, AS REQ, AND APPLY THIN FILM OF ITEM 29 TO WALLS OF SLOT.

LIST OF MATERIALS 1256039A

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
1	1254350-01		Precision plate	1		
2	1254371-01		Shield, mag, prec plate	1		
3	1254500-01		Capstan assy	1		
4	1254501-01		Card cage, capstan servo	1		
5	1256063-01	A3	Pwa, mother board	1		
6	1256043-01	A1	Pwa, servo no. 1	1		
7	1256053-01	A2	Pwa, servo no. 2	1		
9	1254434-01		Screw, captive	4		
10	471-065		Screw, pan hd, xres, #4-40 x .625 lg	6		
11	471-061		Screw, pan hd, xres, #4-40 x .312 lg	2		
12	471-060		Screw, pan hd, xres, #4-40 x .250 lg	6		
13	471-059		Screw, pan hd, xres, #4-40 x .187 lg	4		
14	470-038		Screw, cap, hex soc, #10-32 x .500 lg	4		
15	1251522-01		Nameplate, ident	1		
16	440-313		Fitting, hose	2		
17	1255062-01	Ref Q1, Q2	Insulator, transistor, inner	1		
18	1255068-01	Ref Q3, 4, 5, 6	Insulator, transistor, outer	2		
19	492-017		Nut, hex, #10-32 sst	2		
20	502-006		Washer, lock, #10	4		
21	502-002		Washer, lock, #4	12		
29	087-057		Grease	a/r		
30	1256040		Schematic, capstan servo	ref		
31	014-961	Q1	Transistor, npn	1		
32	580-724	Q3-6	Transistor, npn	4		
33	014-960	Q2	Transistor, pnp	1		
36	251-017		Button, plug	2		
			Items not used: 8, 22, 23, 24, 25, 26, 27, 28, 34, 35			



NOTES:

1. ASSY NUMBER IS 1254500-01.

2. IDENTIFY PART AS PER MIL-STD-130.

3. DUST SHIELD RING TO FACE OUTWARD ON BOTH BEARINGS.

4. USE O-RING (42) TO RETAIN WASHER (43) ON GROUNDING DEVICE (4); TORQUE TO 30-35 IN-LB. ATTACH GROUND LEAD (25) SO THAT IT MAKES A 360° LOOP.

5. OPTICS ALIGNMENT:

   5.1 APPLY GREASE (19) TO THREADS OF SCREW (7); ADVANCE ALL SCREWS UNTIL SPRINGS BEGIN TO COMPRESS. THEN ADVANCE EACH IN SUCCESSION, 2 TURNS AT A TIME, UNTIL ENDS OF OPTIC CONDUIT LIE BELOW SURFACE "S".

   5.2 INSTALL DISC (8) WITH PATTERN SIDE TOWARD OPTICS. POLISH THE DISC-CONTACTING EDGE OF WASHER (31) WITH #600 ABRASIVE PAPER TO REMOVE BURRS. INSTALL WASHER RING (32) USING TOOL 1254762-01. OPTICALLY CENTER DISC WITHIN .0003 TIR BY OBSERVING LOCUS OF PATTERN AS IT IS TURNED THRU ONE REVOLUTION. TAP EDGE OF DISC ONLY WITH A NON-METALLIC MATERIAL.

   5.3 BACK OFF ADJ. SCREW (7) TO OBTAIN A GAP OF .0009/.0014 AT EACH OF THE 2 OPTIC CONDUITS AND THE 2 TOOLING POSTS. USE A PLASTIC GAGE TO SET GAP.

   5.4 ILLUMINATE ONE END OF OPTIC CONDUIT AND OBSERVE IMAGE AT OTHER END. SLIDE OPTIC ASSY ALONG DIRECTIONS SHOWN TO OBTAIN A MOIRE' BAND IMAGE THAT APPEARS AS A SECTION OF A CONCENTRIC CIRCLE. NOT MORE THAN ONE DARK OR ONE LIGHT BAND SHOULD BE VISIBLE.

   5.5 APPLY LAQUER (35) TO FIX SCREWS (7) TO RING.

6. DRESS TACH PREAMP CABLE SO THAT IT DOES NOT CONTACT DISC OR PUCK RIM. INSTALL RING (6) OVER CABLE; SEAT AGAINST SHOULDER. TIE CABLE TO HOUSING WITH ITEM 36 SO THAT IT LIES BELOW THE MOUNTING SURFACES.

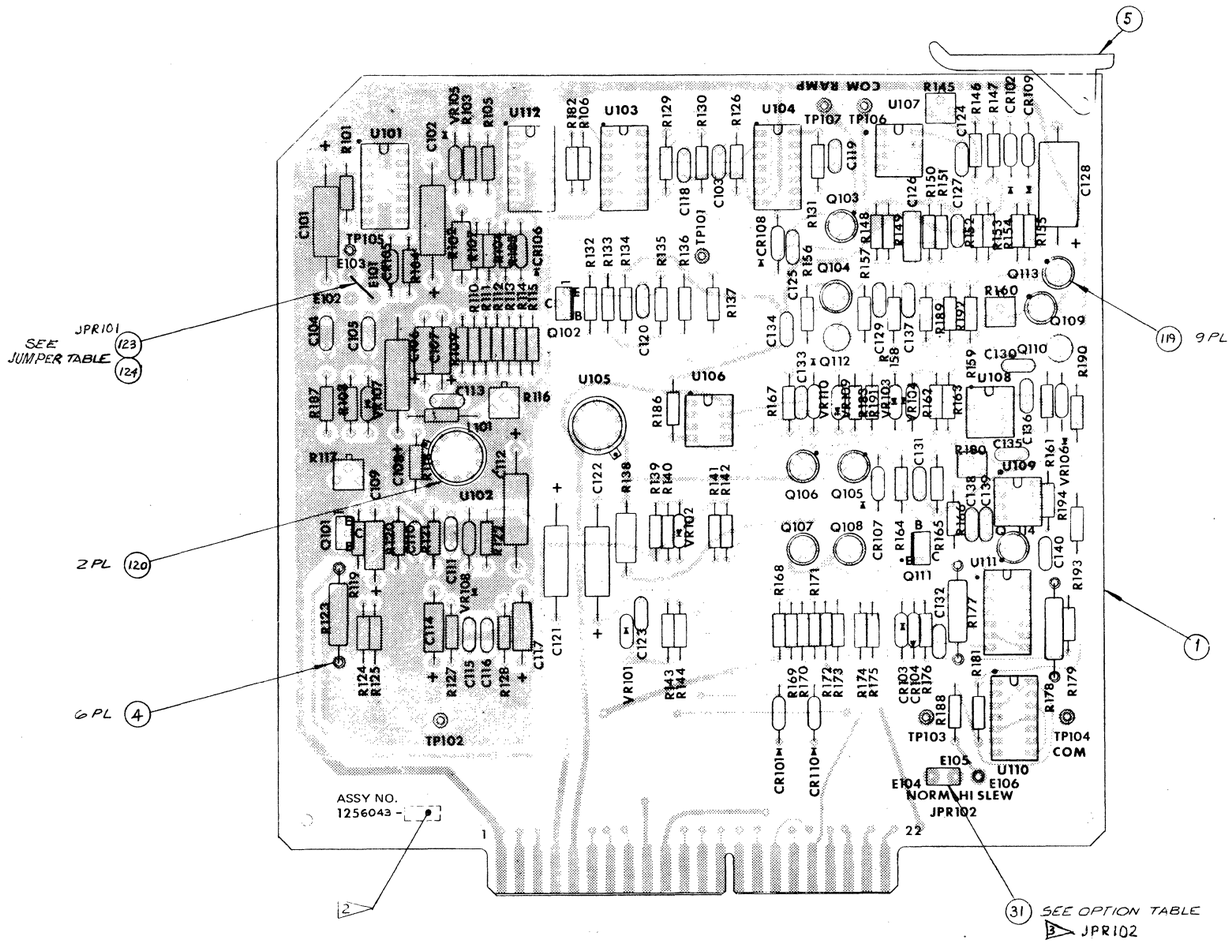
7. BEFORE SCREW IN PUCK IS TIGHTENED COMPLETELY, ROTATE PUCK ON SHAFT TO ALLOW PIN (45) TO SEAT IN PUCK RETAINER. TORQUE SCREW TO 30-35 IN-LB.

8. ALIGN SCRIBE MARK ON MOTOR APPROX. WITH TACH CABLE GROOVE IN HOUSING.

9. CUT TUBING (ITEM 18) TO 7.68/7.74 IN. LG. JOIN ENDS WITH ADHESIVE (ITEM 17). INSTALL PRIOR TO NOTE 5.1 SEPARATION OF JOINT PERMISSIBLE AFTER INSTALLATION OF OPTIC RING.

10. APPLY ITEM 16 TO BOTH SIDES AND EDGE OF SHAFT FLANGE. AND TO REAR PORTION OF SHAFT. AVOID HANDLING OF COATED SURFACES. CAUTION: SOLVENT FUMES ARE TOXIC.

LIST OF MATERIALS 1254500D						
ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT		
				-01		
1	1254332-01		Housing, bearing	1		
2	1254331-01		Shaft, capstan	1		
3	1254330-01		Optics assy	1		
4	1252480-01		Grounding device, shaft	1		
5	1254327-01	B1	Modified motor	1		
6	1254340-01		Ring, tach shield	1		
7	1254339-01		Screw, optics adjust	4		
8	1254338-01		Disc, tach	1		
9	1254661-01		Washer, bearing	1		
10	1254663-02		Puck assy	1		
11	1254660-01		Post, tach pwa	4		
12	1254355-01	A4	Pwa, tach	1		
13	1254399-01		Cover, filter	1		
14	1254659-01	A5	Rfi filter assy	1		
16	087-776		Barrier film	a/r		
17	018-019		Adhesive, cyanoacrylate	a/r		
18	600-595		Tubing, pvc, .250 o-d, .187 i-d	a/r		
19	087-057		Lubricant, MoS_2/grease	a/r		
20	471-574		Screw, binder hd, #2-56 x .19 lg	4		
21	420-080		Bearing, ball	2		
22	432-227		Seal, O-ring	1		
23	352-040		Spring, compression	4		
24	501-173		Washer, brass	8		
25	611-256		Wire, insul, 20 AWG, blk	a/r		
26	172-220		Lug, crimp, spade, #4	1		
27	471-109		Screw, pan hd, #4-40 x .18 lg	1		
28	502-013		Washer, lock, ext tooth, #4	1		
29	470-037		Screw, socket hd, #10-32 x .44 lg	4		
30	502-005		Washer, split lock, #10	4		
31	506-988		Washer, bellville spring	1		
32	430-367		Ring, ret	1		
33	018-003		Primer	a/r		
34	018-030		Adhesive	a/r		
35	087-023		Paint, lacquer, red	a/r		
36	296-004		Cord, lacing	a/r		
37	501-980		Washer, wave spring	1		
38	430-511		Ring, retaining, ext	1		
39	471-486		Screw, binder hd, #6-32 x .31 lg	2		
40	280-380		Spacer, thd, #6-32 x 1.125 lg	2		
41	477-143		Screw, set, #6-32 x .75 lg	2		
42	432-017		Seal, O-ring	1		
43	502-392		Washer, flat	1		
44	352-391		Spring, comp, .120 dia x .50 lg	1		
45	408-037		Pin, dowel, .125 dia x .62 lg	1		
46	251-004		Button, plug	1		
52	1256040		Schematic, capstan servo (high slew)	ref		
			Items not used: 15,47,48,49,50,51			



HEATSINK SIDE

TRANSISTOR ORIENTATION DETAIL

Q101, Q101 & Q111.

NOTES:

1. ASSEMBLY NUMBER IS 1256043-01.
2. MARK DASH NUMBER APPROX WHERE SHOWN PER MIL-STD-130.
3. SEE OPTION TABLE ASSY 1254506-02 (BD # 2).

JUMPER TABLE

JUMPER	FR-3000
JPR-101	E101 - E103 (NORMAL)
	E101 - E102 (OPTIONAL)

OPTION TABLE 3

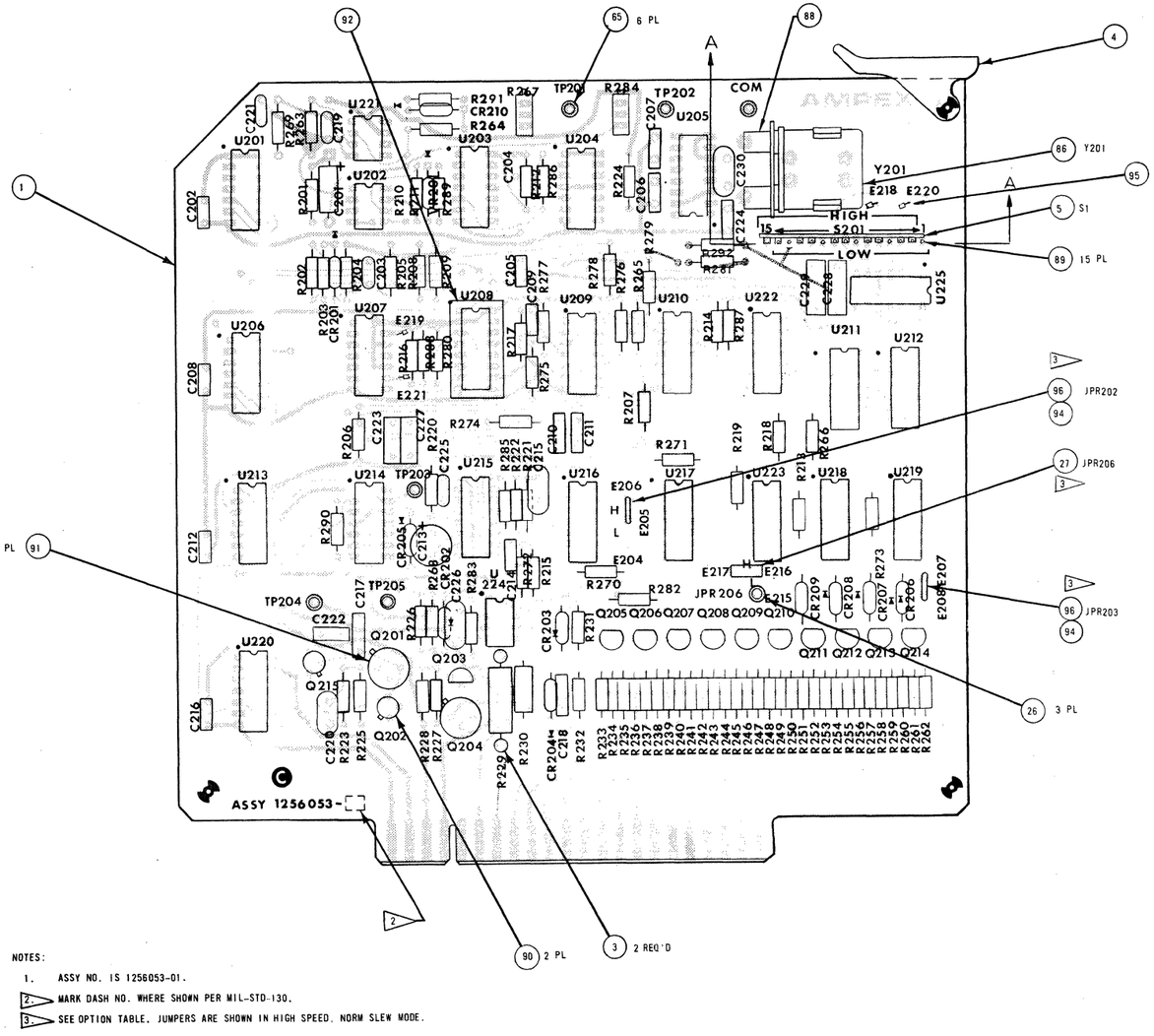
JUMPER	NORMAL SLEW	HI SLEW
JPR-102	E105 - E104	E105 - E106

LIST OF MATERIALS 1256043B1

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
1	1256042-01		Printed wiring board	1		
4	103307-01	Ref R123,177,178	Standoff	6		
5	1254796-01	A1	Extender, pwb, A1 marking	1		
6	1256040		Schematic diagram, high slew	ref		
8	037-996	C101,102,108,112,121, 122,128	Capacitor, 10 µF, 10%, 35V, tant	7		
9	064-062	C103,130,131,133,138, 139,140	Capacitor, 0.1 µF, 20%, 50V, cer	7		
10	034-935	C104,105	Capacitor, 240 pF, 5%, 500V, mica	2		
11	037-097	C106,107,109,114,117	Capacitor, 0.47 µF, 10%, 35V, tant	5		
12	034-269	C110,111,115,116,118	Capacitor, 22 pF, 5%, 500V, mica	5		
13	034-177	C113,124	Capacitor, 100 pF, 5%, 500V, mica	2		
14	064-149	C119,123,134,135	Capacitor, 1.0 µF, 20%, 50V, cer	4		
15	034-288	C120	Capacitor, 390 pF, 5%, 500V, mica	1		
16	034-222	C125	Capacitor, 100 pF, 1%, 500V, mica	1		
17	035-893	C126	Capacitor, 0.1 µF, 5%, 50V, mylar	1		
18	035-865	C127	Capacitor, 0.12 µF, 5%, 50V, mylar	1		
19	034-184	C129	Capacitor, 68 pF, 5%, 500V, mica	1		
20	055-168	C132	Capacitor, .0056 µF, 5%, 50V, mylar	1		
21	034-962	C136	Capacitor, 33 pF, 5%, 500V, mica	1		
22	034-950	C137,141	Capacitor, .001 µF, 5%, 100V, mica	2		
24	013-599	CR101-107,110,111	Diode, switching	9		
25	581-434	CR108	Diode, 1N659	1		
26	013-962	CR109	Diode, hot carrier	1		
28	139-430	E104-106	Connector, jack	3		
30	540-011	L101	Inductor, 22 µH, 10%	1		
31	143-741	JPR102	Connector part, shorting block	1		
33	014-960	Q101,111	Transistor, pnp, 2N4918	2		
34	014-961	Q102	Transistor, npn, 2N4921	1		
35	580-191	Q103,105,106,109,113, 114	Transistor, fet, MEM511C	6		
37	014-505	Q104-107,108	Transistor, pnp	3		
38	014-652	Q110,112	Transistor, pnp, 2N3906	2		
40	066-812	R101,126	Resistor, fixed, 100Ω, 5%, 1/4W	2		
41	062-223	R102	Resistor, fixed, 390Ω, 5%, 1/2W	1		
42	057-079	R103,104	Resistor, fixed, 200Ω, 2%, 1/4W	2		
43	057-089	R105,107	Resistor, fixed, 510Ω, 2%, 1/4W	2		
44	066-662	R108,122,186	Resistor, fixed, 200Ω, 5%, 1/4W	3		
45	066-664	R109,110	Resistor, fixed, 510Ω, 5%, 1/4W	2		
46	066-842	R111,112,120,121,157, 168,169,172,173,188	Resistor, fixed, 5.1 kΩ, 5%, 1/4W	10		
47	062-963	R113	Resistor, fixed, 4.32 kΩ, 1%, 1/4W	1		
48	066-860	R114	Resistor, fixed, 39 kΩ, 5%, 1/4W	1		
49	062-937	R115	Resistor, fixed, 1.82 kΩ, 1%, 1/4W	1		
50	058-038	R116	Resistor, variable, 1 kΩ, 20%, 1/2W	1		
51	058-498	R117	Resistor, variable, 500Ω, 20%, 1/2W	1		
52	066-831	R118,136,141,142,152, 158	Resistor, fixed, 11 kΩ, 5%, 1/4W	6		
53	066-678	R119	Resistor, fixed, 4.7Ω, 5%, 1/4W	1		

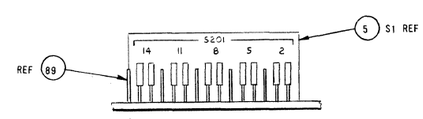
LIST OF MATERIALS 1256043B$_1$

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
54	043-300	R123	Resistor, fixed, 50Ω, 1%, 3W, ww	1		
55	066-814	R124,195	Resistor, fixed, 270Ω, 5%, 1/4W	2		
56	066-855	R125	Resistor, fixed, 39Ω, 5%, 1/4W	1		
57	066-844	R127,128	Resistor, fixed, 16 kΩ, 5%, 1/4W	2		
58	066-823	R106,129,130,155,156, 179,182,196,199	Resistor, fixed, 1.1 kΩ, 5%, 1/4W	9		
59	066-717	R131	Resistor, fixed, 47 kΩ, 5%, 1/4W	1		
60	062-884	R132,139	Resistor, fixed, 301Ω, 1%, 1/4W	2		
61	062-893	R133	Resistor, fixed, 392Ω, 1%, 1/4W	1		
62	062-932	R134	Resistor, fixed, 1.5 kΩ, 1%, 1/4W	1		
63	049-511	R135	Resistor, fixed, 3.3Ω, 5%, 1/4W	1		
64	066-712	R137,161,163,170,171, 174,175	Resistor, fixed, 22 kΩ, 5%, 1/4W	7		
65	062-205	R138	Resistor, fixed, 100Ω, 5%, 1/2W	1		
66	062-955	R140	Resistor, fixed, 3.32 kΩ, 1%, 1/4W	1		
67	062-599	R143	Resistor, fixed, 1.3 kΩ, 1%, 1/4W	1		
68	062-889	R144	Resistor, fixed, 357Ω, 1%, 1/4W	1		
69	058-043	R145	Resistor, variable, 10 kΩ, 20%, 1/2W	1		
70	057-129	R146	Resistor, fixed, 24 kΩ, 2%, 1/4W	1		
71	057-108	R147	Resistor, fixed, 3.3 kΩ, 2%, 1/4W	1		
72	066-689	R148,162	Resistor, fixed, 2.2 kΩ, 2%, 1/4W	2		
73	057-111	R149	Resistor, fixed, 4.3 kΩ, 2%, 1/4W	1		
74	057-123	R150	Resistor, fixed, 13 kΩ, 2%, 1/4W	1		
75	057-099	R151	Resistor, fixed, 1.3 kΩ, 2%, 1/4W	1		
76	057-122	R153	Resistor, fixed, 12 kΩ, 2%, 1/4W	1		
77	066-867	R154	Resistor, fixed, 51 kΩ, 5%, 1/4W	1		
78	057-134	R159	Resistor, fixed, 39 kΩ, 2%, 1/4W	1		
79	058-973	R160	Resistor, variable, 20 kΩ, 20%, 1/2W	1		
80	066-820	R164	Resistor, fixed, 750Ω, 5%, 1/4W	1		
81	066-824	R165	Resistor, fixed, 1.5 kΩ, 5%, 1/4W	1		
82	066-844	R166	Resistor, fixed, 16 kΩ, 5%, 1/4W	1		
83	066-865	R167,190,191,193	Resistor, fixed, 12 kΩ, 5%, 1/4W	4		
84	076-046	R176	Resistor, fixed, 36 kΩ, 5%, 1/4W	1		
85	059-540	R177	Resistor, fixed, 1 kΩ, 1%, 3W, ww	1		
86	059-539	R178	Resistor, fixed, 250Ω, 1%, 3W, ww	1		
87	058-044	R180	Resistor, variable, 2 kΩ, 20%, 1/2W	1		
88	066-842	R181	Resistor, fixed, 5.1 kΩ, 5%, 1/4W	1		
89	066-836	R183	Resistor, fixed, 91Ω, 5%, 1/4W	1		
90	057-118	R184,185	Resistor, fixed, 8.2 kΩ, 2%, 1/4W	2		
91	066-812	R187	Resistor, fixed, 100Ω, 5%, 1/4W	1		
92	057-119	R189	Resistor, fixed, 9.1 kΩ, 2%, 1/4W	1		
93	066-830	R192	Resistor, fixed, 10 kΩ, 5%, 1/4W	1		
94	066-833	R194	Resistor, fixed, 56 kΩ, 5%, 1/4W	1		
97	173-071	TP101-107	Terminal stud, turret	7		
99	586-549	U101	Ic, 1414, dual comp	1		
100	586-317	U102	Ic, 733, ampl	1		
101	586-581	U103,111	Ic, 7403, 4 x 2 NAND	2		
102	586-911	U104	Ic, 74122, single	1		
103	586-321	U105	Ic, 723, volt reg	1		
104	586-905	U106,108	Ic, 1458, dual op amp	2		
105	587-696	U107	Ic, 308, op amp	1		
106	587-086	U109	Ic, 311, volt comp	1		
107	586-108	U110	Ic, 7474, dual	1		
108	587-249	U112	Ic, 7409, 4 x 2 AND	1		
110	013-358	VR101	Diode, zener, 1N751A, 5.1V	1		
111	581-406	VR102	Diode, zener, 1N3496, 6.2V	1		
112	013-166	VR103,104	Diode, zener, 1N746A, 3.3V	2		
113	013-257	VR105,109	Diode, zener, 1N753A, 6.2V	2		
114	013-703	VR106	Diode, zener, 1N968B, 20V	1		
115	013-312	VR107	Diode, zener, 1N755A, 7.5V	1		
116	013-172	VR108	Diode, zener, 1N749A, 4.3V	1		
117	013-450	VR110	Diode, zener, 1N961B, 10V	1		
119	280-130	Ref Q103-109,113,114	Pad, xstr mtg, TO-18	9		
120	586-129	Ref U102,105	Pad, ic mtg, 10 pin	2		
123	600-234		Sleeving, .034 i-d, Teflon, flex	a/r		
124	614-588		Wire, solid, tnd, 22G	a/r		
			Items not used: 2,3,7,23,27,29,32,36,39,95,96,98, 109,118,121,122			

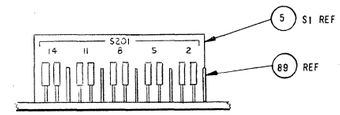


NOTES:

1. ASSY NO. IS 1256053-01.
2. MARK DASH NO. WHERE SHOWN PER MIL-STD-130.
3. SEE OPTION TABLE. JUMPERS ARE SHOWN IN HIGH SPEED, NORM SLEW MODE.



SECT A-A
SHOWING S201 (ITEM 5) IN LOW SPEED RANGE



SECT A-A
SHOWING S201 (ITEM 5) IN HIGH SPEED RANGE

OPTION TABLE . 3

JUMPER	NORMAL SLEW		HIGH SLEW	
	LOW SPEED	HIGH SPEED	LOW SPEED	HIGH SPEED
	15/16 IPS	120 IPS	15/16 IPS	120 IPS
JPR202	E204,205	E205,206	E204,205	E205,206
JPR203	E207,208	E207,208	E207,208	E207,208
JPR206	E216,217	E216,217	E215,216	E216,217

LIST OF MATERIALS 1256053C

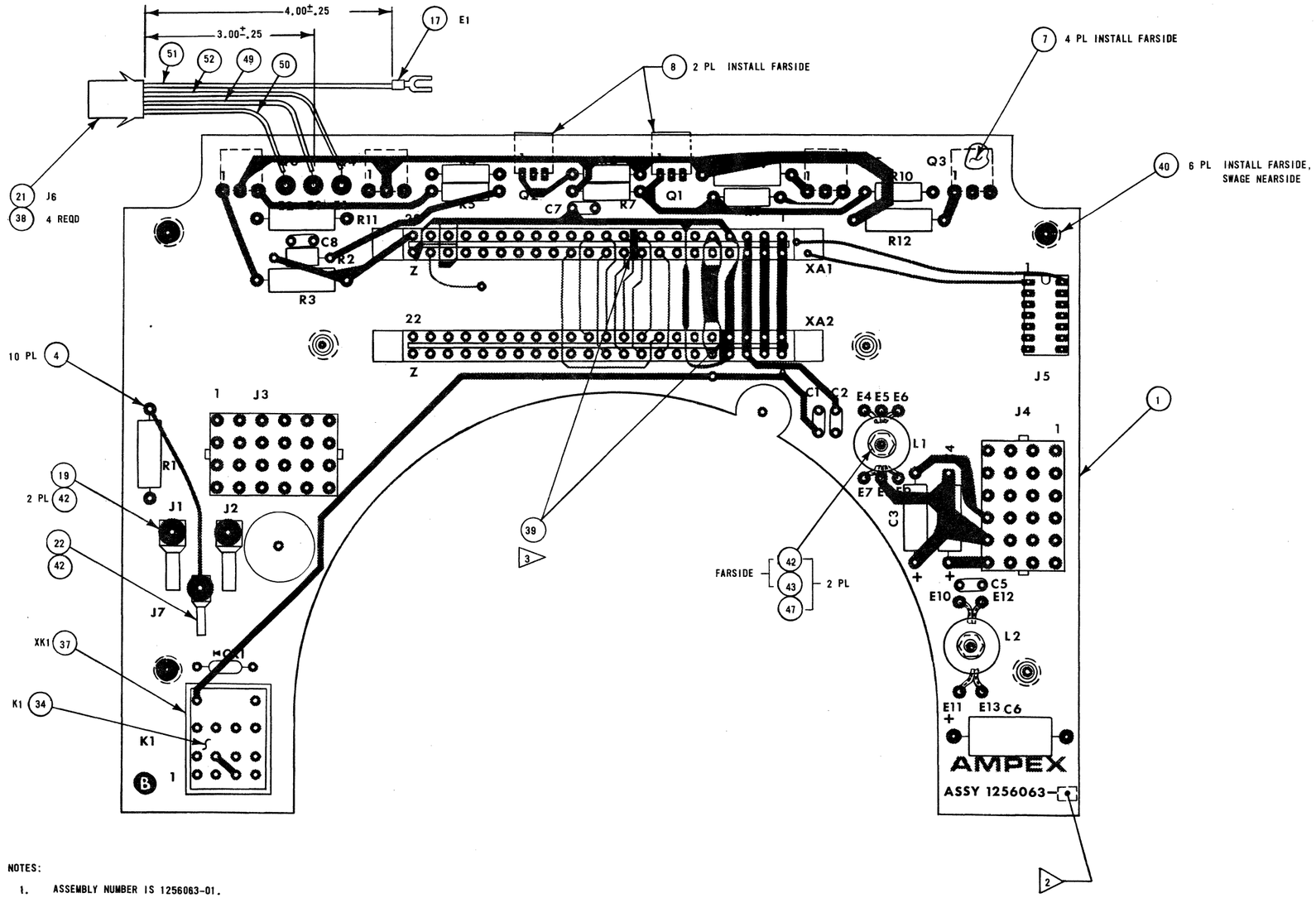
ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
1	1256052-01		Printed wiring board	1		
3	103307-01	Ref R229	Standoff	2		
4	1254796-02		Extender, pwb, A2 marking	1		
5	1255867-01	S1	Switch, high and low speed range	1		
6	1256040		Schematic diagram, high slew	ref		
7	037-164	C201	Capacitor, 1.0 μF, 10%, 35V, tant	1		
8	030-966	C202,205,208,209,212, 214,216	Capacitor, 0.01 μF, 20%, 50V, cer	7		
9	064-303	C203	Capacitor, 0.47 μF, 20%, 50V, cer	1		
10	034-286	C204	Capacitor, 200 pF, 5%, 500V, mica	1		
11	030-939	C206,207,210,211,218, 222,224	Capacitor, 0.1 μF, 20%, 50V, cer	7		
12	037-892	C213	Capacitor, 47 μF, 20%, 20V, tant	1		
13	034-943	C215	Capacitor, 27 pF, 5%, 500V, mica	1		
14	035-814	C217,227	Capacitor, .033 μF, 5%, 50V, mylar	2		
15	064-149	C219,221	Capacitor, 1.0 μF, 20%, 50V, cer	2		
16	034-184	C220	Capacitor, 68 pF, 5%, 500V, mica	1		
17	035-816	C223	Capacitor, .018 μF, 5%, 50V, mylar	1		
18	064-149	C225	Capacitor, 1.0 μF, 20%, 50V, cer	1		
19	034-177	C226	Capacitor, 100 pF, 5%, 500V, mica	1		
21	035-596	C228,229	Capacitor, .082 μF, 5%, 50V, mylar	2		
22	034-963	C230	Capacitor, 15 pF, 5%, 500V, mica	1		
23	013-962	CR201	Diode, hot carrier	1		
24	013-599	CR202-210	Diode, switching	9		
26	139-430	E215-217	Connector, jack	3		
27	143-741	JPR206	Connector part, shorting block	1		
28	014-364	Q201	Transistor, pnp, 50212	1		
29	014-506	Q202	Transistor, npn	1		
30	014-652	Q203	Transistor, pnp, 2N3906	1		
31	014-247	Q204	Transistor, npn, 2N2219	1		
32	014-653	Q205-214	Transistor, npn, 2N3904	10		
33	014-505	Q215	Transistor, pnp	1		
35	062-969	R201,203,205,211	Resistor, fixed, 5.11 kΩ, 1%, 1/4W	4		
36	062-600	R202	Resistor, fixed, 11 kΩ, 1%, 1/4W	1		
37	062-961	R204	Resistor, fixed, 3.92 kΩ, 1%, 1/4W	1		
38	066-842	R206,207,214,218,219, 221,222,226,227,228, 231,266,271,274,275, 276,277,278,279,281	Resistor, fixed, 5.1 kΩ, 5%, 1/4W	20		
39	076-347	R208,209	Resistor, fixed, 82.5 kΩ, 1%, 1/4W	2		
40	062-945	R210	Resistor, fixed, 2.43 kΩ, 1%, 1/4W	1		
41	066-830	R212,283	Resistor, fixed, 10 kΩ, 5%, 1/4W	2		
42	066-665	R213,232,273	Resistor, fixed, 1 kΩ, 5%, 1/4W	3		
43	066-814	R215	Resistor, fixed, 270Ω, 5%, 1/4W	1		
44	066-822	R216,217	Resistor, fixed, 910Ω, 5%, 1/4W	2		
45	066-717	R220,233,236,239, 242,245,248,251,254, 257,260	Resistor, fixed, 47 kΩ, 5%, 1/4W	11		
46	066-876	R223	Resistor, fixed, 162 kΩ, 1%, 1/4W	1		
47	066-689	R224	Resistor, fixed, 2.2 kΩ, 5%, 1/4W	1		

LIST OF MATERIALS 1256053C

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
48	057-070	R225	Resistor, fixed, 82Ω, 2%, 1/4W	1		
49	041-805	R229	Resistor, fixed, 3.9Ω, 5%, 1W	1		
50	066-964	R230	Resistor, fixed, 8.2Ω, 5%, 1/2W	1		
51	066-667	R234,237,240,243,246, 249,252,255,258,261	Resistor, fixed, 3 kΩ, 5%, 1/4W	10		
52	066-823	R235,238,241,244,247, 250,253,256,259,262, 268,280,285-289	Resistor, fixed, 1.1 kΩ, 5%, 1/4W	17		
53	062-561	R263	Resistor, fixed, 61.9 kΩ, 1%, 1/4W	1		
54	066-755	R264	Resistor, fixed, 143 kΩ, 1%, 1/4W	1		
55	066-984	R265	Resistor, fixed, 160Ω, 5%, 1/4W	1		
56	058-903	R267	Resistor, var, 20 kΩ, 10%, 1/2W	1		
57	066-818	R269,290	Resistor, fixed, 470Ω, 5%, 1/4W	2		
58	062-131	R270	Resistor, fixed, 820Ω, 5%, 1/4W	1		
59	066-828	R272	Resistor, fixed, 4.3 kΩ, 5%, 1/4W	1		
61	076-004	R282	Resistor, fixed, 180Ω, 5%, 1/4W	1		
62	058-539	R284	Resistor, var, 1 kΩ, 10%, 1/2W	1		
63	042-379	R291	Resistor, fixed, 5.9 kΩ, 1%, 1/4W	1		
65	173-071	TP201-205	Terminal stud, turret	6		
67	586-075	U201,206,220	Ic, 7400, 4 x 2 NAND	3		
68	586-905	U202	Ic, 1458, dual op amp	1		
69	586-911	U203	Ic, 74122, single mv	1		
70	586-647	U204	Ic, 74107, dual j-k ff	1		
71	587-973	U205	Ic, 74LS124, dual mv	1		
72	586-581	U207,209,216-219,223, 225	Ic, 7403, 4 x 2 NAND	8		
73	587-431	U208	Ic, 74221, dual mv	1		
75	586-784	U210	Ic, 7438, 4 x 2 NAND	1		
76	586-283	U211,212	Ic, 7493, 4-bit cntr	2		
77	586-326	U213	Ic, 7404, hex inv	1		
78	586-759	U214	Ic, 7408, 4 x 2 AND	1		
79	586-797	U215	Ic, 74123, dual mv	1		
80	587-656	U221	Ic, 318, op amp	1		
81	586-108	U222	Ic, 7474, dual d-type ff	1		
82	587-086	U224	Ic, 311, volt comp	1		
84	013-166	VR201	Diode, zener, 1N746A, 3.3V	1		
86	017-118	Y201	Crystal, 800 kHz	1		
88	150-106	Ref Y201	Holder, crystal	1		
89	187-077	Ref S1-15	Terminal, wire wrap	15		
90	280-130	Ref Q202,215	Pad, xstr mtg, TO-18	2		
91	280-998	Ref Q201,204	Pad, xstr mtg, TO-5	2		
92	586-625	Ref U208	Socket, ic, 16 pin	1		
94	600-234		Sleeving, .034 i-d, tfe, flex	a/r		
95	611-427		Wire, 24G, strd, wht	a/r		
96	614-588		Wire, solid, tnd, 22G	a/r		
			Items not used: 2,20,25,34,60,64,66,74,83,85,87,93			

WIRE LEAD LIST 1256053C

WIRE NO.	AWG/ COLOR	FROM REF DES	FROM TERM	TO REF DES	TO TERM	REMARKS	LM ITEM NO. -01		
1	24	E219		E218			96		
2	24	E221		E220			95		



NOTES:

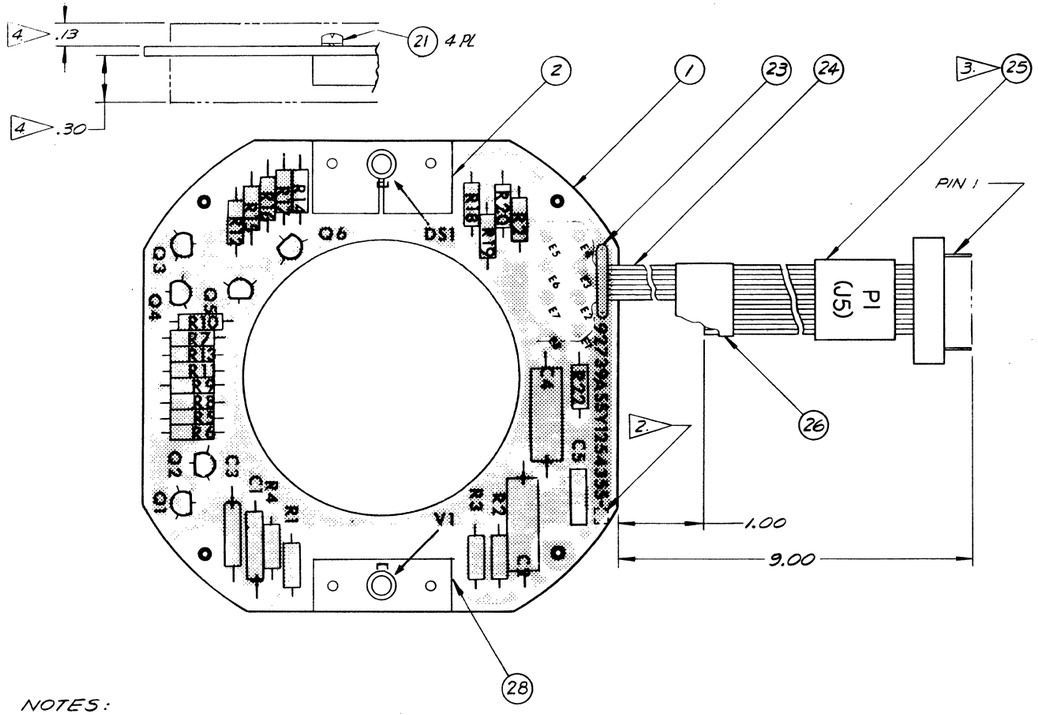
1. ASSEMBLY NUMBER IS 1256063-01.
2. MARK DASH NO. WHERE SHOWN, PER MIL-STD-130.
3. INSTALL KEY BETWEEN PIN 9 AND 10 AT XA1, AND 4 & 5 AT XA2.

LIST OF MATERIALS 1256063A

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
1	1256062-01		Printed wiring board	1		
3	1256040		Schematic diagram, cap servo, high slew	ref		
4	103307-01	Ref R1,3,8,11,12	Spacer	10		
5	1254696-01	L2	Inductor assy	1		
6	1254696-02	L1	Inductor assy	1		
7	1254735-01	Ref Q3-6	Socket, transistor	4		
8	1254736-01	Ref Q1,2	Socket, transistor	2		
10	064-149	C1,2,5	Capacitor, 1.0 μF, 20%, 100V, cer	3		
11	037-736	C3,4	Capacitor, 22 μF, 10%, 35V, tant	2		
12	037-181	C6	Capacitor, 47 μF, 10%, 35V, tant	1		
13	064-062	C7,8	Capacitor, 0.1 μF, 20%, 50V, cer	2		
15	013-678	CR1	Diode, pwr rect, 1N4005	1		
17	171-037	E1	Terminal, lug, 14-16G, crimp	1		
19	187-237	J1,2	Terminal, quick disconnect, male	2		
20	139-802	J3,4	Connector, receptacle, 24 pin	2		
21	167-023	J6	Connector, receptacle, 6 pin	1		
22	180-899	J7	Terminal, quick disconnect, male	1		
24	059-481	R1	Resistor, fixed, 0.1Ω, 1%, 3W, ww	1		
25	066-813	R2	Resistor, fixed, 150Ω, 5%, 1/4W	1		
26	059-573	R3,8,11,12	Resistor, fixed, 0.5Ω, 1%, 3W, ww	4		
27	062-050	R4,5	Resistor, fixed, 51Ω, 5%, 1/2W	2		
28	041-533	R6	Resistor, fixed, 24Ω, 5%, 1/2W	1		
29	066-956	R7	Resistor, fixed, 15Ω, 5%, 1/2W	1		
30	066-957	R9,10	Resistor, fixed, 24Ω, 5%, 1/2W	2		
32	168-062	XA1,2	Connector, receptacle, 22 pin, dual	2		
34	020-225	K1	Relay, 4 pdt, 12V	1		
37	150-989	XK1	Socket, 14 pin relay	1		
38	166-227	Ref J6	Contact pin, conn	4		
39	166-438	Ref XA1,2	Key, polarizing, conn	2		
40	280-903		Spacer, .129 i-d, .25 lg	6		
42	460-088		Rivet, ovh, tblr, .094 dia	3		
43	498-512		Nut, #4-40, hex, cad pld	2		
44	502-008		Washer, #4 spring lock, sst	2		
45	582-072	Ref J5	Socket, ic mtg, 14 pin	1		
47	600-036		Sleeving, .035 i-d, tef, flex	a/r		
49	611-723		Wire, 16G, strd, blk	a/r		
50	611-724		Wire, 16G, strd, blu	a/r		
51	611-726		Wire, 16G, strd, grn	a/r		
52	611-727		Wire, 16G, strd, gray	a/r		
			Items not used: 2,9,14,16,18,23,31,33,35,36,41,46, 48			

WIRE LEAD LIST 1256063A

WIRE NO.	AWG/ COLOR	FROM REF DES	FROM TERM	TO REF DES	TO TERM	REMARKS	LM ITEM NO. -01		
1	16/0	A3	E3	J6	3		49		
2	16/6	A3	E2	J6	2		50		
3	16/5	-	E1	J6	4	E1 is item 17	51		
4	16/8	A3	E1	J6	1		52		



NOTES:

1. ASSY NO. IS 1254355-01.
2. MARK DASH NO. APPROX WHERE SHOWN PER MIL-STD-130.
3. MARK REF DES APPROX WHERE SHOWN ON ITEM 25 PER MIL-STD-130.
4. MAXIMUM COMPONENT HEIGHT.

LIST OF MATERIALS 1254355

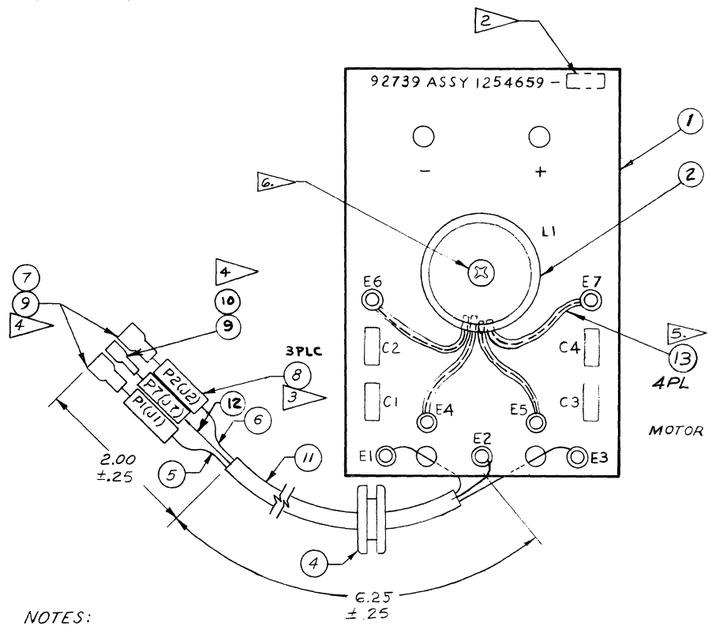
ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
1	1254348-01		Printed wiring board	1		
2	1254346-01	Ref DS1	Heatsink	1		
3	1254508		Schematic, composite, capstan servo	ref		
4	030-939	C5	Capacitor, cer, 50V, 20%, 0.1 μF	1		
5	037-070	C2,4	Capacitor, tant, 35V, 10%, CD594, 4.7 μF	2		
6	037-165	C1,3	Capacitor, tant, 35V, 10%, CD594, 0.1 μF	2		
7	041-512	R1,4	Resistor, carbon comp, 1/4W, 5%, CD387, 470 kΩ	2		
8	057-055	R8,9	Resistor, metal film, 1/4W, 2%, CD521, 20Ω	2		
9	057-063	R16,17,20,21	Resistor, metal film, 1/4W, 2%, CD521, 43Ω	4		

LIST OF MATERIALS 1254355

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
10	057-076	R22	Resistor, metal film, 1/4W, 2%, CD521, 150Ω	1		
11	057-089	R7,10	Resistor, metal film, 1/4W, 2%, CD521, 510Ω	2		
12	057-096	R18,19	Resistor, metal film, 1/4W, 2%, CD521, 1000Ω	2		
13	057-104	R11,13,14	Resistor, metal film, 1/4W, 2%, CD521, 2200Ω	3		
14	057-112	R3,12,15	Resistor, metal film, 1/4W, 2%, CD521, 4700Ω	3		
15	057-114	R2	Resistor, metal film, 1/4W, 2%, CD521, 5600Ω	1		
16	057-121	R5,6	Resistor, metal film, 1/4W, 2%, CD521, 11 kΩ	2		
17	580-098	Q1,2,5,6	Transistor, silicon, pnp	4		
18	580-647	Q3,4	Transistor, silicon, npn	2		
19	581-237	DS1	Light emitting diode, infrared	1		
20	581-306	V1	Diode, photosensitive	1		
21	473-791		Screw, mach binder hd, slotted drive, 2-56 x .25 lg, cres	4		
23	302-395		Strap, cable, rubber, blk	1		
24	616-937		Cable, flat, w/14 pin conn	1		
25	600-097		Sleeving, polyolefin, shrinkable, blk	a/r		
26	600-092		Sleeving, polyolefin, shrinkable, blk	a/r		
27	1255059		Schematic, composite, capstan servo (high slew)	ref		
28	1255413-01	Ref V1	Block, support	1		
29	1255468		Schematic, composite, capstan servo (high slew)	ref		
			Item not used: 22			

WIRE LEAD LIST 1254355

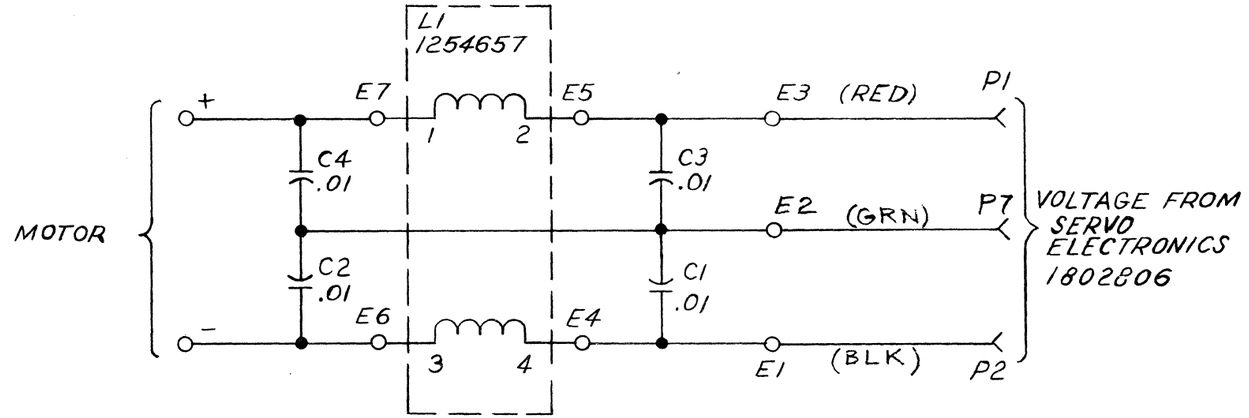
WIRE NO.	AWG/ COLOR	FROM REF DES	FROM TERM	TO REF DES	TO TERM	REMARKS	LM ITEM NO. -01		
1	22/1	P1	1	Item 1	E1		24		
2	22/3	P1	2				24		
3	22/5	P1	3	Item 1	E3		24		
4	22/7	P1	4				24		
5	22/9	P1	5	Item 1	E4		24		
6	22/1	P1	6				24		
7	22/3	P1	7				24		
8	22/4	P1	8				24		
9	22/2	P1	9				24		
10	22/0	P1	10				24		
11	22/8	P1	11	Item 1	E5		24		
12	22/6	P1	12	Item 1	E6		24		
13	22/4	P1	13	Item 1	E7		24		
14	22/2	P1	14	Item 1	E8		24		



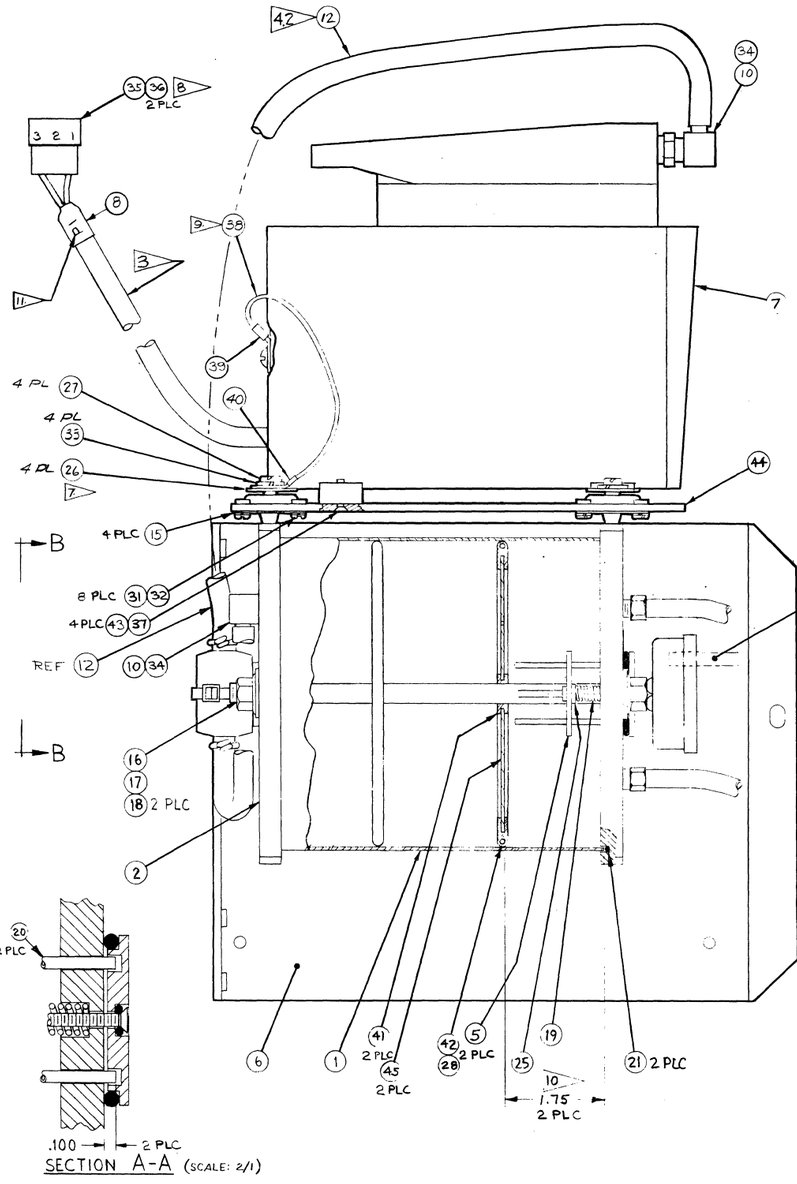
NOTES:

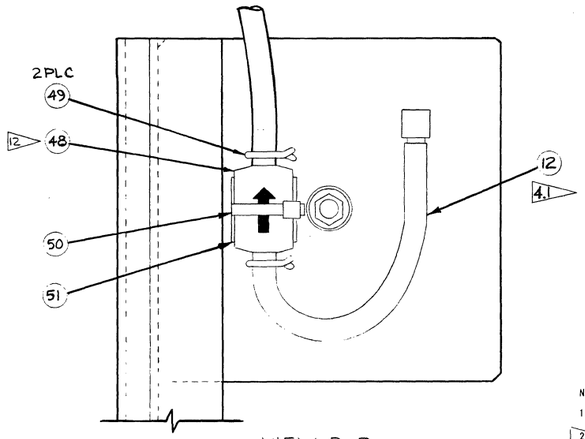
1. ASSY NO. IS 1254659-01.
2. MARK DASH NO. WHERE SHOWN PER MIL-STD-130.
3. MARK REF. DES. AS SHOWN, COLOR, WHITE.
4. INSULATE LUG (ITEM 7) WITH SHRINK SLEEVING (ITEM 9).
5. PUSH SLEEVING ALL THE WAY AGAINST BOBBIN, IN ORDER TO PREVENT ELECTRICAL SHORT WITH CORE IRON.
6. POSITION LOWER LARGE FLAT WASHER AND OTHER RETAINING HARDWARE (PART OF L1 INDUCTOR ASSY) ON FAR SIDE OF PWB (ITEM 1). TIGHTEN SCREW TO 12 ± 2 IN-OZ TORQUE.

SCHEMATIC DIAGRAM

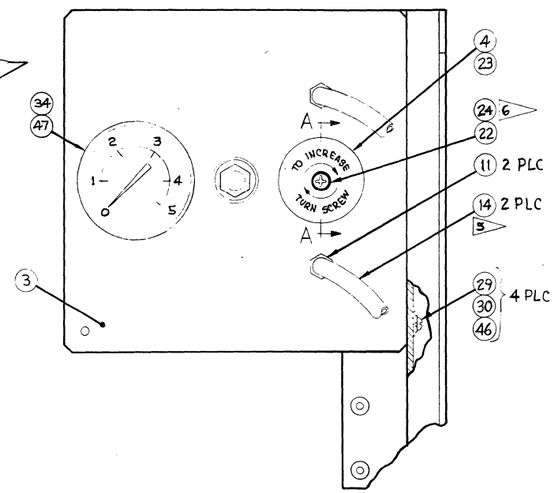


LIST OF MATERIALS 1254659C						
ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
1	1254658-01		Printed wiring board	1		
2	1254657-01	L1	Inductor assembly	1		
3	030-966	C1, 2, 3, 4	Capacitor, cer, .01 μF, ±10%, 100V	4		
4	260-014		Grommet, 1/4 i-d	1		
5	611-722		Wire, insul, 16 AWG, red	a/r		
6	611-723		Wire, insul, 16 AWG, black	a/r		
7	187-238		Lug, quick connect, female	2		
8	600-515		Sleeving, shrink, blk, .046 dia, .093 dia.	a/r		
9	600-255		Sleeving, shrink, blk, .25 dia.	a/r		
10	187-195		Lug, quick connect, female	1		
11	600-009		Tubing, pvc	a/r		
12	617-053		Wire, insul, 20 AWG, grn	a/r		
13	600-196	Ref L1	Sleeving, #18 ga	a/r		
14	1255059		Schematic, composite, capstan servo	ref		
15	1255468		Schematic, capstan servo (high slew)	ref		





VIEW B-B



NOTES:

1. ASSY NO IS 1254680-01.
2. MARK ASSEMBLY NO APPROX WHERE SHOW PER MIL-STD-130.
3. CUT POWER CORD TO 32± 1 INCHES LONG.
4. CUT ITEM 12:
   - 4.1 7±1 INCHES LONG.
   - 4.2 19±1 INCHES LONG.
5. CUT ITEM 14 TO 42±1 INCHES LONG.
6. SET PRESSURE:
   - 6.1 PLUG BOTH HOSES (ITEM 14).
   - 6.2 START COMPRESSOR.
   - 6.3 TURN SCREW IN VALVE (ITEM 4) AS REQUIRED. TO OBTAIN A GAGE READING OF 2 5 TO 3.0 PSI MAKE SURE VALVE IS SEATED FREELY ON PINS (ITEM 20) AND CAN CLOSE FULLY.
   - 6.4 REMOVE PLUGS FROM BOTH HOSES.
7. PREVENT WASHER FROM ROTATING WHEN TIGHTENING SCREW.
8. CONNECT WHITE WIRE TO PIN 1. BLACK TO PIN 3.
9. CUT ITEM 38 TO 7±1 INCHES LONG.
10. INSTALL GROMMET (41) AND GASKET (42) ON BULKHEAD (45). JOIN ENDS OF GASKET AND CEMENT WITH ADHESIVE (28). INSTALL BULKHEAD IN SHELL (1) TO DEPTH SHOWN, 2 PLACES. TOOL 1254795 MAY BE USED TO AID ASSEMBLY. CEMENT GASKET TO SHELL.
11. MARK REF DES APPROX. WHERE SHOWN.
12. MOUNT ITEM 51 WHERE SHOWN AND CLAMP ITEM 48 IN PLACE WITH ARROW IN DIRECTION SHOWN USING ITEM 50. ITEM 48 IS TO BE REMOVABLE FOR SERVICE; DO NOT OVERTIGHTEN ITEM 50.

LIST OF MATERIALS 1254680F						
ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
1	1254681-01		Shell, tank	1		
2	1254682-01		Cap, tank	1		
3	1254683-01		Base, tank	1		
4	1254684-01		Valve, relief	1		
5	1254685-01		Nut retainer, valve	1		
6	1254686-01		Frame, mounting	1		
7	592-407		Compressor, 115V ac, 50/60 Hz	1		
8	600-095		Sleeving, plastic, blk, shrink	a/r		
9	440-074		Bushing, reducer, 1/4 mpt x 1/8 fpt	1		
10	440-314		Fitting, elbow, 1/4 hose x 1/8 mpt	2		
11	440-313		Fitting, 3/16 hose x 1/8 mpt	2		
12	600-582		Hose, pvc, 1/4 i-d, 19.0 in lg	a/r		
14	600-304		Hose, pvc, 3/16 i-d	a/r		
15	250-197		Isolator, elastomeric	4		
16	480-140		Bolt, hex hd, 3/8-16 x 7.00 lg	1		
17	492-056		Nut, hex, 3/8-16	1		
18	501-981		Washer, sealing, 3/8 i-d	2		
19	352-429		Spring, comp, .300 o-d x 1.50 lg	1		
20	408-231		Pin, spring, .125 dia x 2.0 lg	2		
21	432-229		O-ring seal, 5.239 i-d x .070 thk	2		
22	432-017		O-ring seal, .156 i-d x .0625 thk	1		
23	432-230		O-ring seal, 1.234 i-d x .139 thk	1		
24	472-152		Screw, flat hd, #6-32 x 2.0 lg, sst	1		
25	506-001		Washer, finishing, #6	1		
26	501-609		Washer, .156 i-d x .750 o-d x .047	4		

LIST OF MATERIALS 1254680F						
ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
27	471-153		Screw, pan hd, #6-32 x 1.12 lg	4		
28	018-019		Adhesive, alpha cyanoacrylate	a/r		
29	471-089		Screw, pan hd, #10-32 x .50 lg	4		
30	502-005		Washer, lock, #10	4		
31	471-062		Screw, pan hd, #4-40 x .31 lg	8		
32	502-002		Washer, lock, #4	8		
33	502-003		Washer, lock, #6	4		
34	440-111		Tape, thread sealant, tfe	a/r		
35	169-988	P1	Connector, 3 pin	1		
36	169-993		Contact, hermaphrodite	2		
37	018-030		Adhesive, anaerobic	a/r		
38	618-011		Wire, braid, .125 wd, 18 AWG	a/r		
39	171-212		Lug, term, crimp, spade #10	1		
40	171-005		Lug, term, crimp, ring #6	1		
41	260-013		Grommet, rubber	2		
42	269-016		Gasket, rubber	a/r		
43	471-734		Screw, flat hd, #10-24 x .50 lg	4		
44	1254728-01		Frame, isolator	1		
45	1254793-01		Bulkhead	2		
46	501-019		Washer, .203 i-d x .438 o-d x .032 thk	4		
47	090-230		Gauge, pressure, 0-5 psi	1		
48	052-225		Filter, gas, 25 micron	1		
49	440-397		Clamp, hose, .375 i-d	2		
50	302-388		Strap, cable, .190 wd x 6.75 lg	1		
51	302-451		Strap mtg plate, adh backed	1		
			Item not used: 13			

SECTION 6
POWER SUPPLIES

SECTION 6

POWER SUPPLIES AND REGULATORS

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

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NUMERICAL LIST OF ASSEMBLY DRAWINGS

SECTION 6
POWER SUPPLIES AND REGULATORS

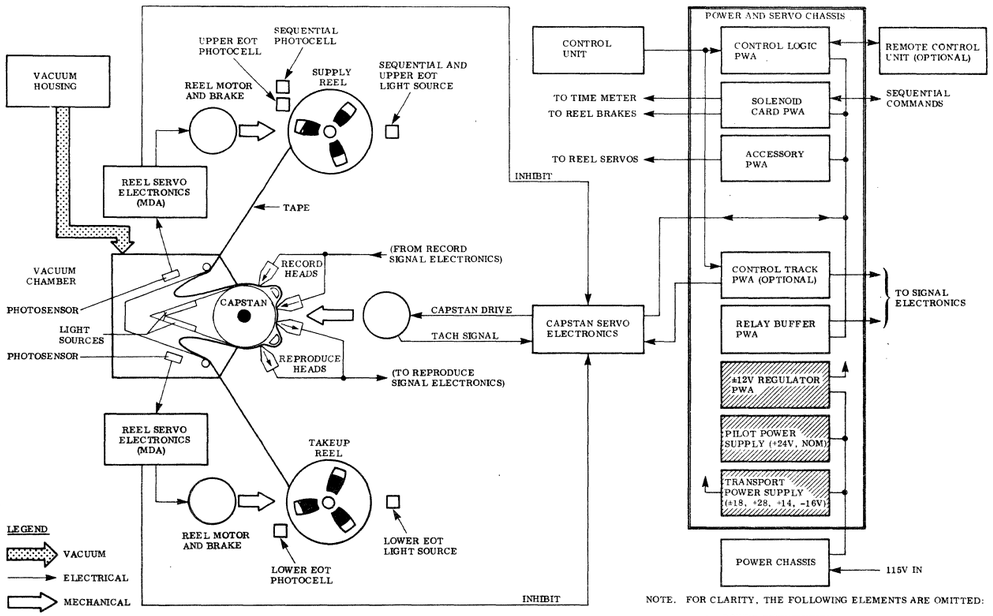


Figure 6-1. Transport Power Supplies and Regulators

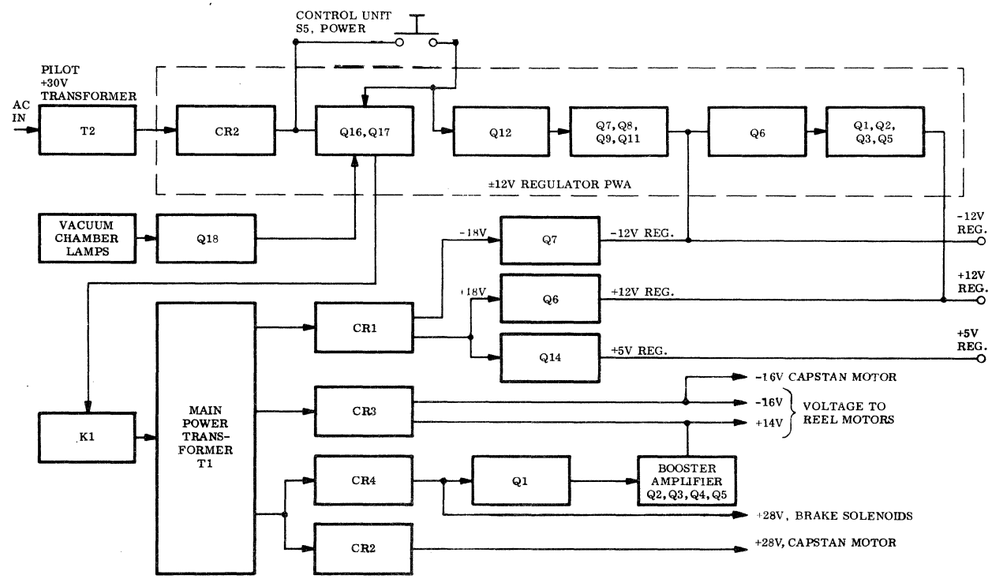


Figure 6-2. Power Supply and Regulator Block Diagram

10240E

GENERAL

This section describes the power supplies and regulators of the FR-3000 tape transport. See Figure 6-1. These circuits are all housed in or mounted on the power and servo chassis, located inside the cabinet, behind the transport mechanism. Figure 6-2 is a block diagram showing the interrelationship of the power supplies and regulators. Power distribution through the tape transport may be traced by reference to the interconnect diagram, Figure 7-1, plus the tape transport and power and servo chassis schematic diagrams in Section 7.

The power supplies and regulators of the FR-3000 are:

a. Pilot power supply

b. ±18V power supply

c. Capstan motor power supply

d. Reel motor power supply

e. Solenoid/booster power supply

f. ±12V regulator, a plug-in printed wiring assembly (pwa) that includes a +12V regulator, a -12V regulator, and a +5V regulator.

PILOT POWER SUPPLY

The pilot power supply is located partially on the power and servo chassis and partially on the ±12V regulator pwa which plugs into the chassis. The pilot supply provides a nominal +30V unloaded, and a nominal +24V loaded. It is used to energize power relay K1 which controls the ac input to the rest of the transport power supplies. (See Figure 6-1, Schematic TW1252048, and the portion of Schematic 1254487 on page 6-3. Also refer to the "Power Control" description in Section 3.) The components of the power and servo chassis are shown and identified in Section 7 of this manual.

The pilot power supply consists of transformer T2 of the power and servo chassis, bridge rectifier CR2 of the ±12V regulator assembly, capacitor C11 across the secondary of the transformer, and voltage divider/bleeder-resistor/filter-capacitor network R49, R51, C10 across the output of the rectifier.

Primary power is applied to pilot power supply transformer T2 when system power circuit breaker CB501, located on the power chassis assembly at the bottom front of the cabinet, is set to ON. In this manner, +30V is available at the POWER pushbutton on the control unit.

When the POWER pushbutton is pressed to turn transport power on, power relay K1 is energized. (The pilot power supply is loaded by the coil of K1, and the voltage drops to a nominal +24V.) Contacts of K1 supply ac power to transformer T1, and its four power supplies are turned on. (See the following descriptions and the portion of Schematic 1254487 shown on page 6-3. The complete schematic is included in Section 7.)

±18V POWER SUPPLY

Refer to partial Schematic 1254487. The ±18V power supply consists of bridge rectifier CR1 fed from a secondary of transformer T1, filter capacitors C1 and C2, and bleeder resistors R15 and R16.

The ±18V supply provides power for the ±12V regulator, through R6 to the +5V regulator of the ±12V regulator assembly, and through R3 to the transport for use in the (optional) footage counter.

POWER SUPPLIES AND REGULATORS

+28V CAPSTAN MOTOR POWER SUPPLY

Refer to partial Schematic 1254487. The +28V capstan motor power supply consists of full-wave rectifier CR2 fed from a secondary winding of transformer T1, filter capacitor C5, and bleeder resistor R18. This supply provides a nominal +28V to the capstan motor through connector P209, and by way of the capstan servo circuits (see Section 5).

+14V, -16V POWER SUPPLY

Refer to partial Schematic 1254487. The +14V, -16V power supply consists of bridge rectifier CR3 fed from a secondary of transformer T1, capacitors C6 through C9, and bleeder resistors R19 and R20. This supply provides positive and negative voltages to the reel motors and negative voltage to the capstan motor. Because of different loading, the positive and negative sides of the supply have different nominal voltages. These voltages are supplied to the motors they drive by way of the appropriate servo circuits. (See Section 4 for reel servos, Section 5 for capstan servo.)

SOLENOID/BOOSTER POWER SUPPLY

Refer to partial Schematic 1254487. The solenoid/booster power supply consists of full-wave rectifier CR4 fed from a secondary of T1, filter capacitors C3 and C4, and bleeder resistor R17. This power supply provides the voltage for the brake solenoids (one on each reel motor assembly), and is also used as the source for the reel servo booster voltage as described in Section 4.

±12V REGULATOR PWA (P104)

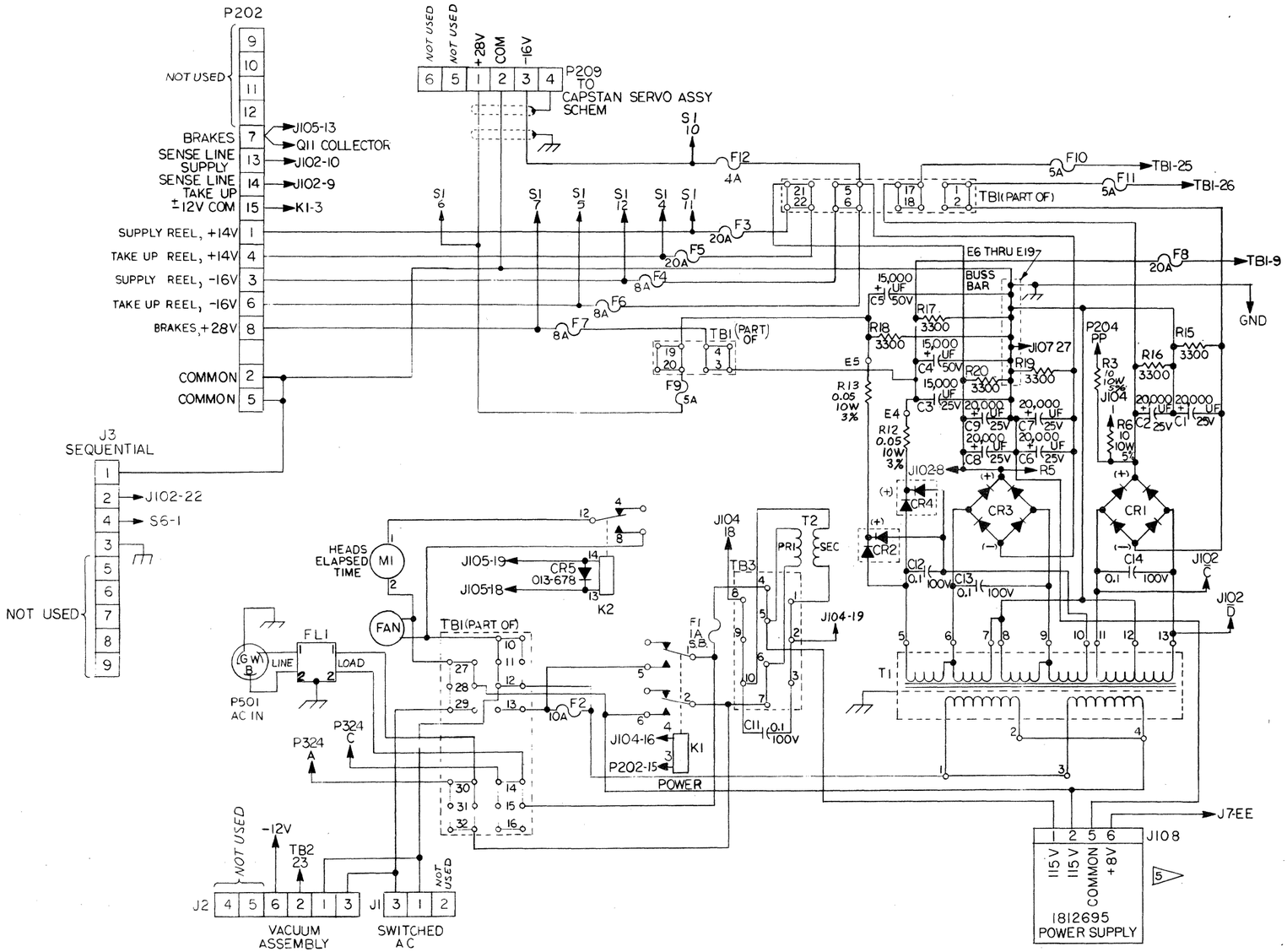
Refer to Schematic diagram TW1252048. The lefthand end of the schematic shows the circuits of the pilot power supply, described above, and the power latching circuits described in Section 3 under "Power Control." The regulator circuits described here are shown at the righthand end of the schematic. Transistors Q1, Q2, Q3, Q5, Q6, Q7, Q8, Q9, Q11, Q12, and Q14 and their associated components, plus heatsink transistors Q6 and Q7 of the power and servo chassis, comprise the ±12V regulator, including a +5V regulator.

As stated previously, the ±18V power supply is the source of power to these regulators. The -18V is applied to the emitter of heatsink transistor Q7, which is the pass element of the -12V regulator. A sample of the output voltage of the regulator is applied through variable resistor R23 and fixed resistor R22 to one base of dual transistor Q12. Q12 is a differential amplifier operating as a voltage comparator, with the second base referred to ground. Variations in the output voltage are amplified by Q12 and coupled to cascaded voltage and current amplifiers Q11, Q9, Q8, and Q7. The output of Q7 is the control voltage to the base of heatsink transistor Q7, the current-pass element. Thus, once the operating output voltage is set by the adjustment of R23, variations are amplified and applied to the base of heatsink Q7 in a phase to return the output voltage to its nominal value. To assure proper turnon of the regulator, a portion of the pilot supply voltage from the POWER pushbutton is applied to the emitters of Q12 by way of R41 and CR13. This provides an emitter bias source for Q12 before the +12V regulator has turned on.

A sample of the -12V output is also applied as a reference to one base of dual transistor Q6. Q6 is the voltage comparator for the +12V regulator, which is very similar to the -12V circuit. A sample of the +12V output is also applied to the same base of Q6. The resulting signal is amplified and applied to the base of heatsink transistor Q6, which is the current-pass element. Because of this arrangement, the +12V regulator both tracks the -12V setting (R23) and corrects variations in its own output.

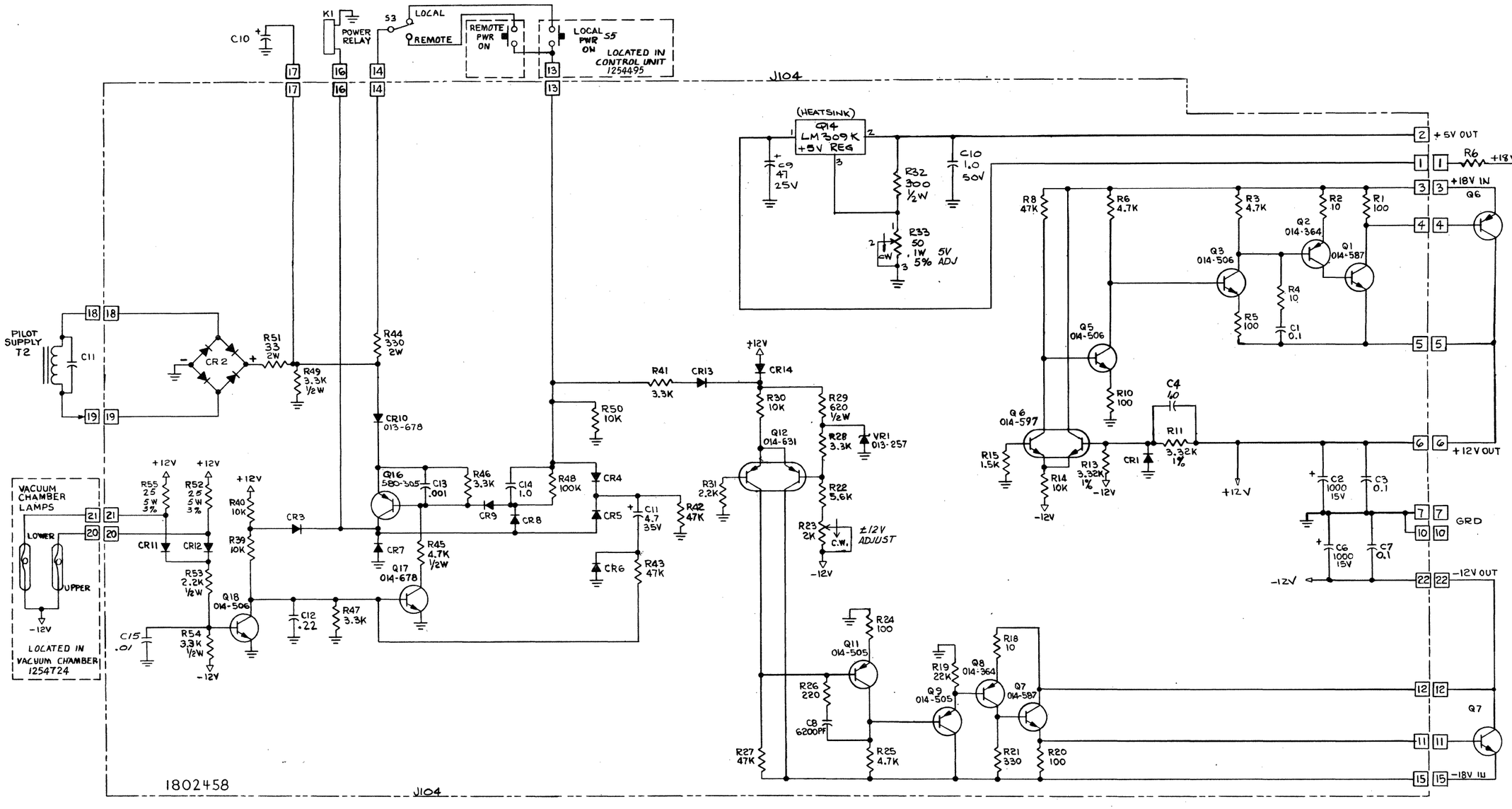
In addition, the +18V from the ±18V power supply is passed through resistor R6 of the power and servo chassis and applied to the +5V regulator made up of Q14 and its associated components. Variable resistor R33 provides a means of adjusting the output voltage of this regulator.

POWER AND SERVO CHASSIS SCHEMATIC DIAGRAM 1254487E (PARTIAL) *



*COMPLETE SCHEMATIC, ASSEMBLY DRAWING, AND LIST OF MATERIALS ARE IN SECTION 7.

CHANGED: 15 MARCH 1978



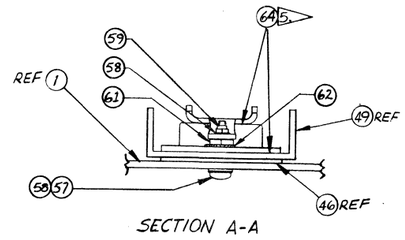
NOTES:

UNLESS OTHERWISE SPECIFIED:

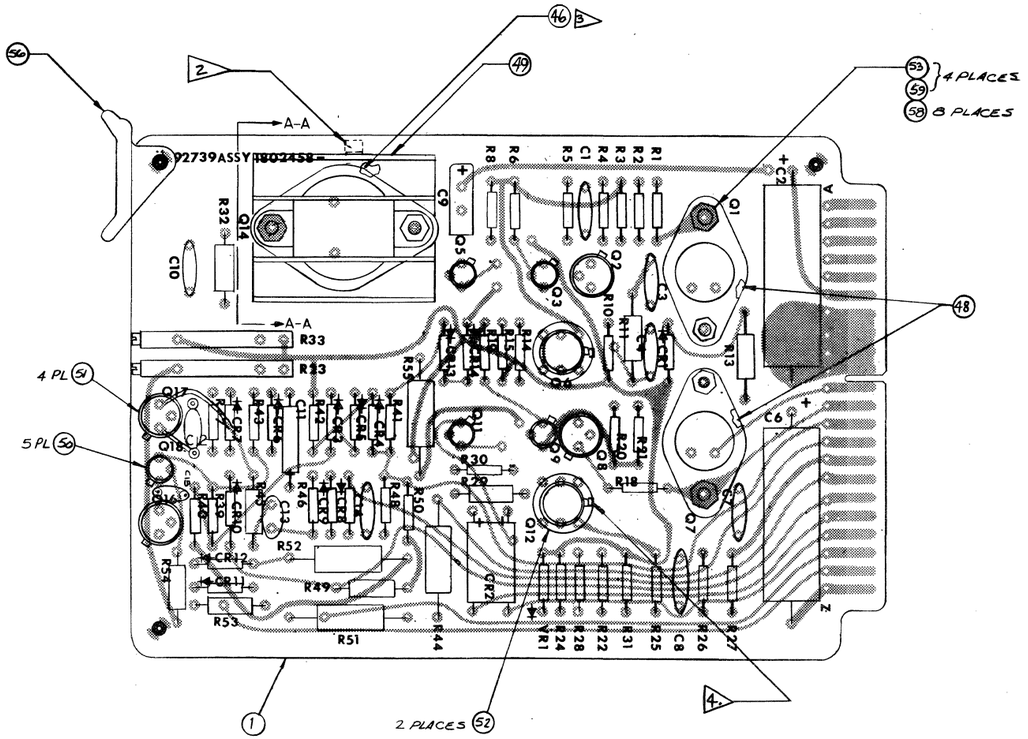
1. ALL RESISTOR VALUES ARE IN OHMS, 1/4 W, 5%.
2. ALL CAPACITOR VALUES ARE IN MICROFARDS
3. ALL DIODES ARE 013-599.
4. ALL COMPONENTS OUTSIDE OF P.W. BOARD, LOCATED IN POWER/SERVO UNIT, 1802816

LAST REF DESIGS. USED	NOT USED
R55	R7,9,12,16,17,34
C15	R35,36,37,38
CR14	C5
Q17	Q4,10,13,15

±12V REGULATOR PRINTED WIRING ASSEMBLY (P104) I802458-02J



SECTION A-A



NOTES:

1. ASSEMBLY NUMBER IS 1802458-02.
2. MARK DASH NUMBER APPROX WHERE SHOWN PER MIL-STD-130.
3. INSTALL ITEM 46 BETWEEN ITEM 1 & ITEM 49.
4. Q6 & Q12 ARE KEYED BETWEEN PINS 1 & 6.
5. APPLY ITEM 64 (SILICONE COMPOUND) BETWEEN ITEM 49 & TRANSISTOR TOP & BOTTOM.

LIST OF MATERIALS 1802458J

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -02		
2	013-678	CR10	Diode, silicon (CD451)	1		
3	013-599	CR1,3,4,5,6,7,8,9,11,12,13,14	Diode, silicon, switching (CD458)	12		
4	013-257	VR1	Diode, silicon, zener 6.2V	1		
5	014-631	Q12	Transistor, dual pnp (CD515)	1		
6	014-597	Q6	Transistor, dual npn (CD474)	1		
7	014-505	Q9,11	Transistor, pnp (CD445)	2		
8	014-506	Q3,5,18	Transistor, npn (CD446)	3		
9	014-364	Q2,8	Transistor, pnp (CD438)	2		
10	586-756	Q14	Integrated circuit	1		
11	014-587	Q1,7	Transistor, power npn	2		
12	014-678	Q17	Transistor, npn (CD513)	1		
13	580-305	Q16	Transistor, npn	1		
14	013-600	CR2	Diode assembly, silicon, quad	1		
15	030-094	C4,14,10	Capacitor, cer, 1.0 µF, 25V, 20%	3		
16	030-095	C1,3,7	Capacitor, cer, .1 µF, 25V, 20%	3		
17	034-952	C8	Capacitor, mica, 6200 pF, 300V, 5%	1		
18	031-936	C2,6	Capacitor, electrolytic, 1000 µF, 15V	2		
19	030-133	C13	Capacitor, cer, disc, 1000 pF, 1000V	1		
20	037-436	C9	Capacitor, tant, 47 µF, 25V, 10%	1		
21	037-070	C11	Capacitor, 4.7 µF, 35V, 10%	1		
22	044-439	R23	Resistor, variable, ww, 2 kΩ, 1W, 5%	1		
23	042-485	R11,13	Resistor, metal film, 3.32 kΩ, 1/4W, 1%	2		
24	044-443	R33	Resistor, variable, 50Ω, 1W, 5%	1		
25	043-307	R52,55	Resistor, ww, 25Ω, 5W, 3%	2		
27	041-586	R44	Resistor, comp, 330Ω, 2W, 5%	1		
28	041-006	R29	Resistor, comp, 620Ω, 1/2W, 5%	1		
29	041-331	R49	Resistor, comp, 3.3 kΩ, 1/2W, 5%	1		
30	041-013	R45	Resistor, comp, 4.7 kΩ, 1/2W, 5%	1		
31	041-239	R53	Resistor, comp, 2.2 kΩ, 1/2W, 5%	1		
33	041-528	R32	Resistor, comp, 300Ω, 1/2W, 5%	1		
34	057-120	R14,30,39,40,50	Resistor, metal film, 10 kΩ, 1/4W, 2%	5		
35	057-136	R8,27,42,43	Resistor, metal film, 47 kΩ, 1/4W, 2%	4		
36	057-112	R3,6,25	Resistor, metal film, 4.7 kΩ, 1/4W, 2%	3		
37	057-104	R31	Resistor, metal film, 2.2 kΩ, 1/4W, 2%	1		
38	057-108	R28,41,46,47	Resistor, metal film, 3.3 kΩ, 1/4W, 2%	4		
39	057-080	R26	Resistor, metal film, 220Ω, 1/4W, 2%	1		
40	057-072	R1,5,10,20,24	Resistor, metal film, 100Ω, 1/4W, 2%	5		
41	057-114	R22	Resistor, metal film, 5.6 kΩ, 1/4W, 2%	1		
42	057-084	R21	Resistor, metal film, 330Ω, 1/4W, 2%	1		
43	057-100	R15	Resistor, metal film, 1.5 kΩ, 1/4W, 2%	1		
44	057-048	R2,4,18	Resistor, metal film, 10Ω, 1/4W, 2%	3		
45	057-128	R19	Resistor, metal film, 22 kΩ, 1/4W, 2%	1		
46	014-703	Q14 Ref	Mounting pad transistor (TO-3)	1		
47	057-144	R48	Resistor, metal film, 100 kΩ, 1/4W, 2%	1		
48	014-802		Mounting pad, transistor (TO-66)	2		

CHANGED: 15 MARCH 1978

LIST OF MATERIALS 1802458J

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -02		
49	580-239		Heatsink, transistor (TO-3)	1		
50	280-130		Mounting pad, transistor (TO-18)	5		
51	280-131		Mounting pad, transistor (TO-5)	3		
52	014-911		Mounting pad, transistor (dual)	2		
53	471-061		Screw, mach, xrec, pan hd, #4-40 x .312 lg	4		
56	1249870-04	P104	Handle, card ejector	1		
57	473-328		Screw, machine assembled washer, xrec, 4-40 x .625 lg	2		
58	501-186		Washer, plain, s.p., #4	12		
59	493-018		Nut. self locking	6		
60	1252048		Schematic, ±12 regulator	Rev G		
61	492-019		Nut, hex, #4-40, .188 AF	2		
62	502-018		Washer, external tooth, #4	2		
63	103307-01	R52,53, ref	Standoff, .250 lg	4		
64	087-388	Q14 ref	Silicone compound, heat cond	a/r		
65	030-310	C12	Capacitor, cer, .22 µF, 25V, 20%	1		
66	030-057	C15	Capacitor, cer, disc, .01 µF, 100V	1		
67	1252049-02		Printed wiring board	1		
68	041-671	R51	Resistor, comp, 33Ω, 2W, 5%	1		
69	041-331	R54	Resistor, comp, 3.3 kΩ, 1/2W, 5%	1		
			Items not used: 1,26,32,54,55			

SECTION 7
RACKS, BAYS, FANS AND CABLES

SECTION 7

RACKS, BAYS, FANS, AND CABLES

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

NUMERICAL LIST OF SCHEMATIC DIAGRAMS

NUMERICAL LIST OF ASSEMBLY DRAWINGS

*Schematic reference on assembly drawing

LIST OF ASSEMBLY DRAWINGS (Cont)

SECTION 7
RACKS, BAYS, FANS, AND CABLES

GENERAL

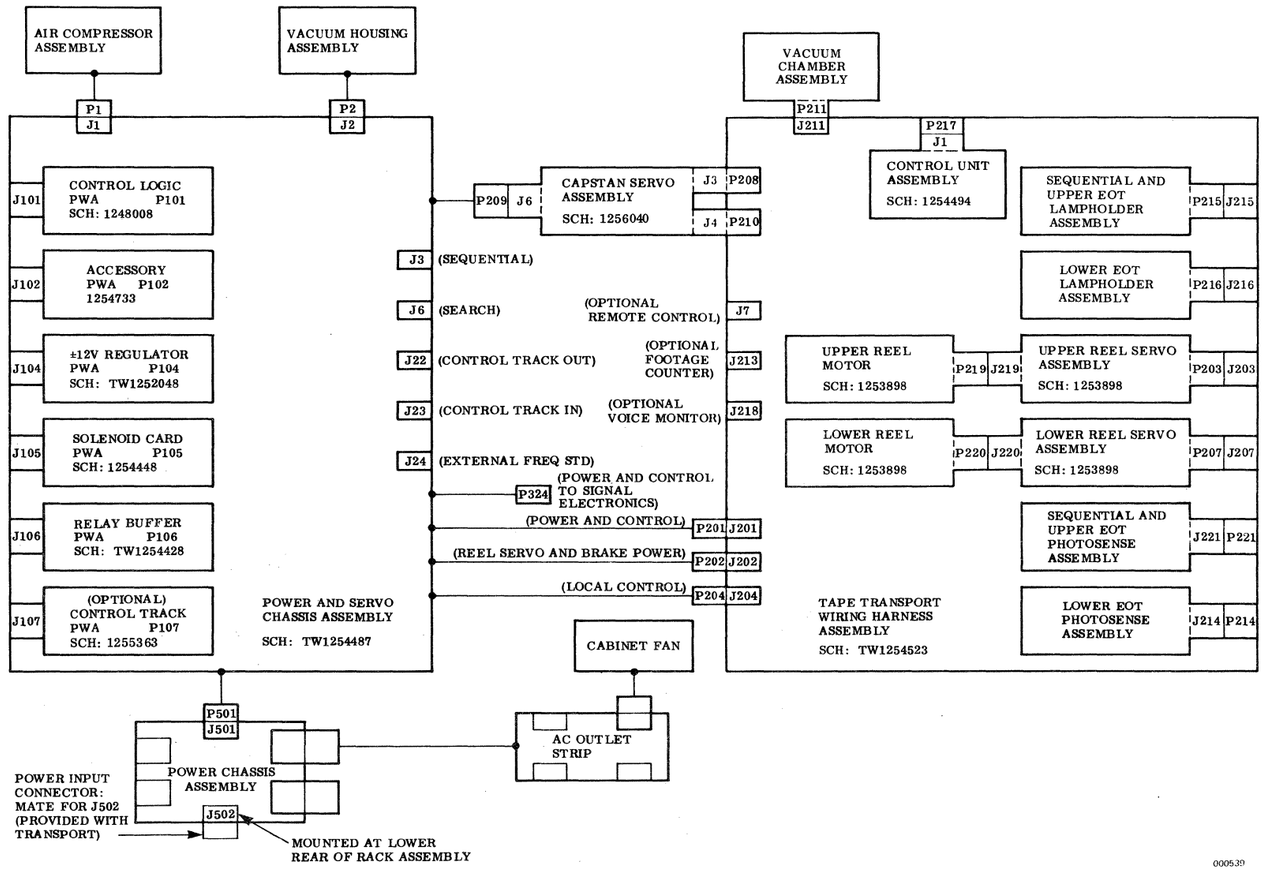
This section covers assemblies that do not fall directly into the functional groups (e.g., control logic, etc.) covered in Sections 2 through 6. Many (though not all) of the assemblies covered here serve to physically support or electrically interconnect the elements of the tape transport.

INTERCONNECTIONS

Figure 7-1 is a block interconnection diagram of the tape transport. The next two drawings are interconnect schematic diagrams: transport harness Schematic Diagram TW1254523 and power and servo chassis Schematic Diagram TW1254487. By the use of these three drawings, interconnections between the subassemblies of the tape transport can be traced. All three drawings call out the numbers of the schematics for the subassemblies which are interconnected. To locate any of these subassembly schematics, refer to the complete list at the front of this book. The list is in drawing number order, and gives the page number where each schematic (near its associated circuit description and parts information) may be found.

To trace a circuit between subassemblies within either the transport harness or the power and servo chassis, simply follow the connector pin number on the subassembly schematic through its mating connector on the interconnect schematic, through the interconnect circuits and from there into the circuits of the second subassembly.

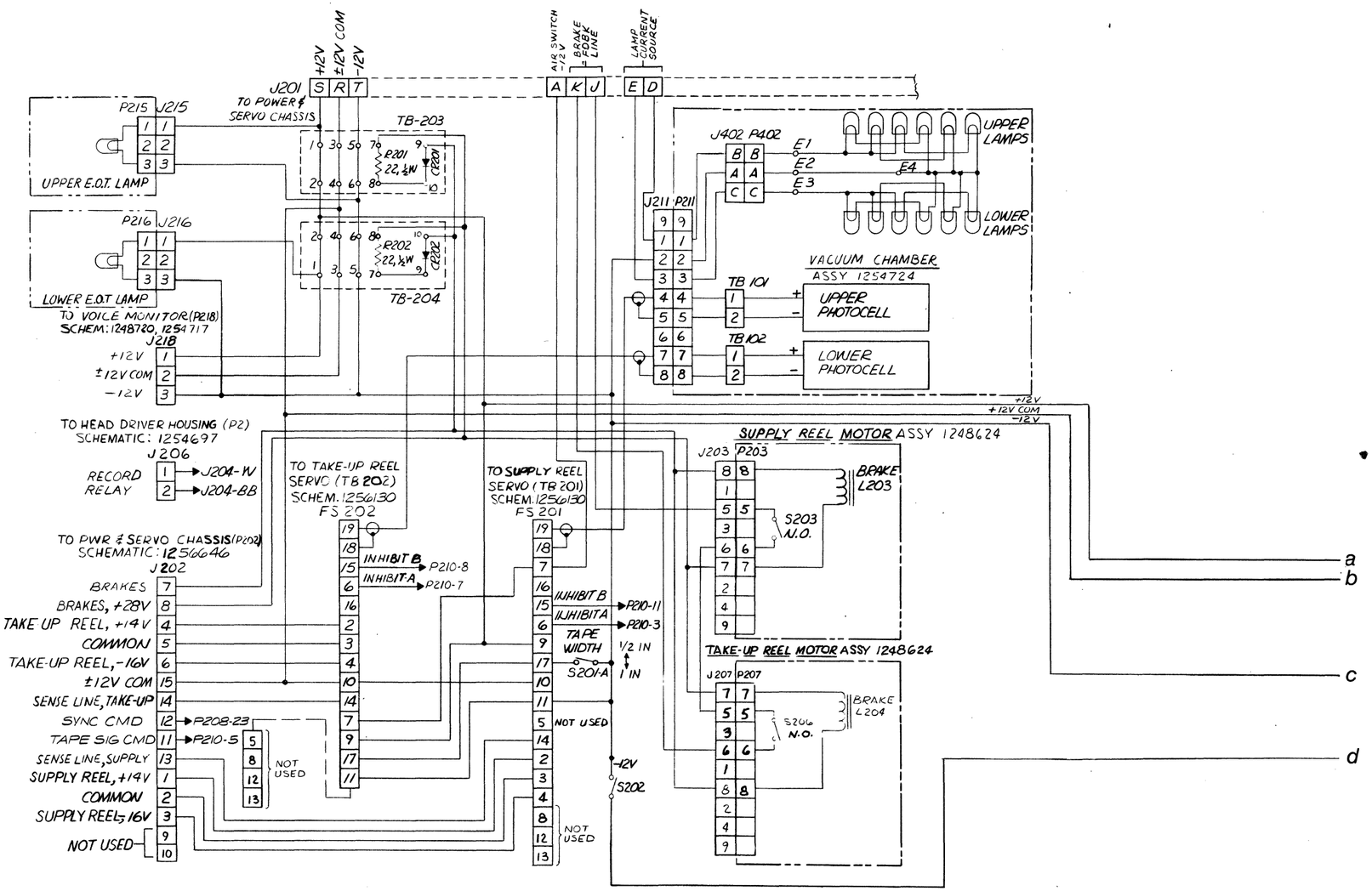
All the interconnect cables of the basic tape transport are captive at one end. The connectors with which the free ends of the cables mate are shown in Figure 7-1. To trace a circuit from a subassembly within the transport harness to one within the power and servo chassis, or vice-versa, follow the same procedure as in the previous paragraph, but in addition, use Figure 7-1, as necessary, to determine cable destinations.

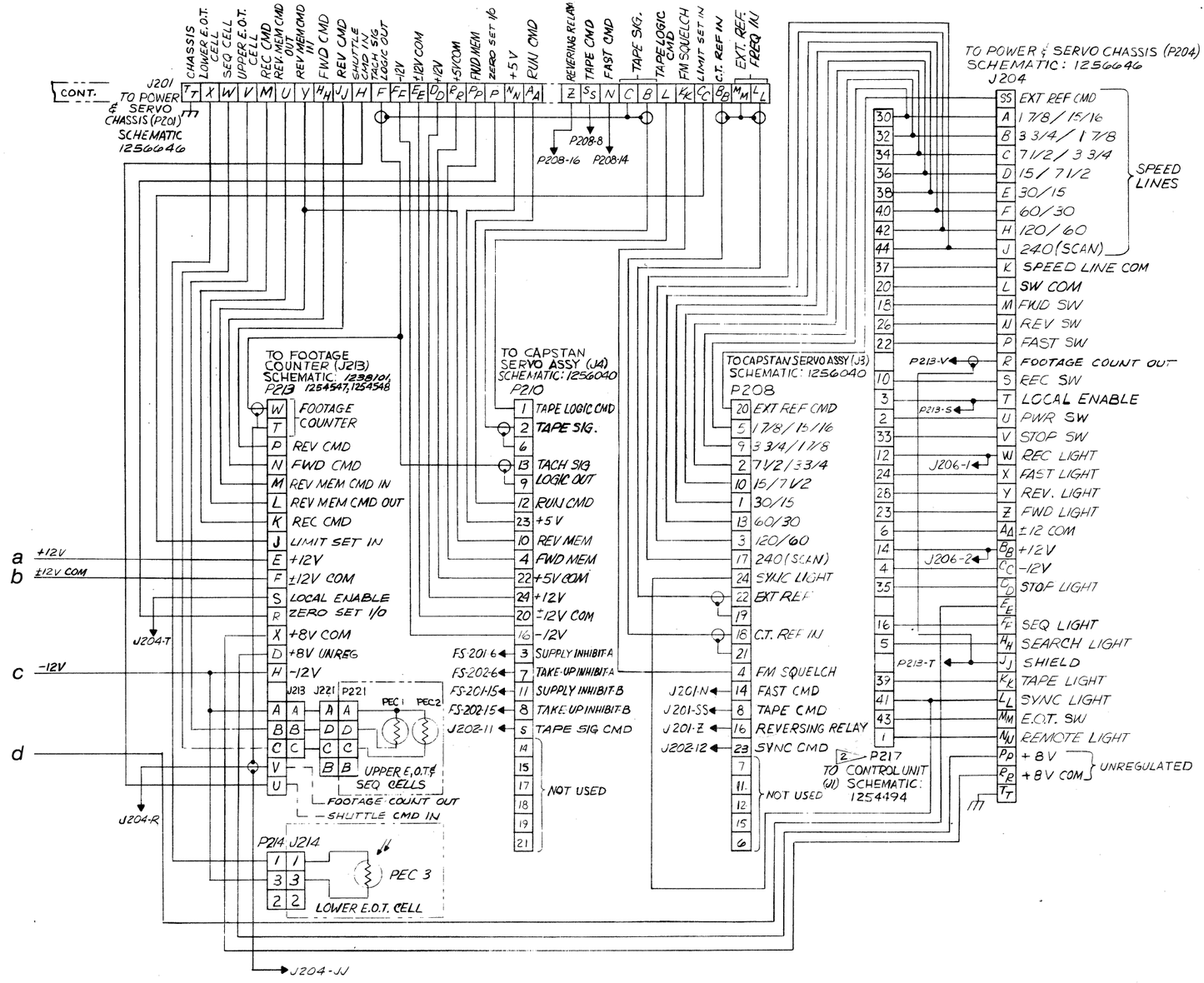


NOTES:

1. SCH = SCHEMATIC DIAGRAM
2. DOTTED CONNECTION POINTS INDICATE CAPTIVE CABLES
3. ITEMS SHOWN WITHIN POWER AND SERVO CHASSIS AND TAPE TRANSPORT ASSEMBLY BLOCKS ARE PARTS OF THOSE ASSEMBLIES
4. ASSEMBLIES WITHIN THE TAPE TRANSPORT BLOCK WITHOUT SCHEMATIC NUMBERS, PLUS THE VACUUM CHAMBER, ARE SHOWN ON WIRING HARNESS SCHEMATIC TW1254523
5. SCHEMATIC REFERENCES FOR THE FOLLOWING ASSEMBLIES ARE SHOWN IN THE APPLICABLE ASSEMBLY DRAWING:
   A. VACUUM HOUSING (SECTION 4)
   B. POWER CHASSIS (SECTION 7)

Figure 7-1. FR-3000 Interconnect Block Diagram

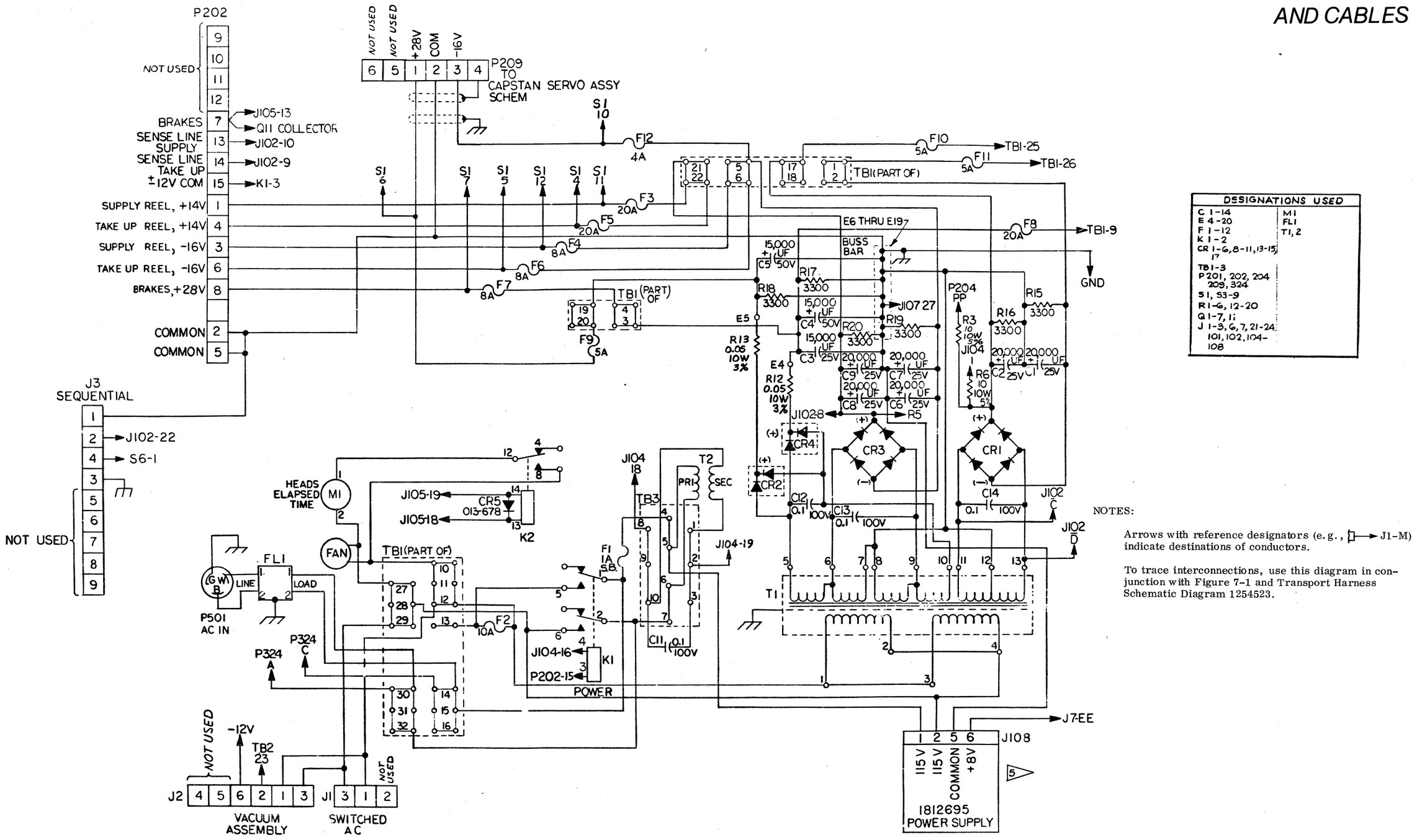

+12V
±12V COM
-12V
AIR SWITCH 12V
BRAKE FAIL LINE
LAMP CURRENT SOURCE
J201
S R T
A K J
E D
TO POWER & SERVO CHASSIS
P215 J215
UPPER E.O.T. LAMP
P216 J216
LOWER E.O.T. LAMP
TB-203
TB-204
R201 22,½W
R202 22,½W
C201
C202
J402 P402
E1
E2
E3
E4
UPPER LAMPS
LOWER LAMPS
J211 P211
VACUUM CHAMBER ASSY 1254724
TB 101
TB 102
UPPER PHOTOCELL
LOWER PHOTOCELL
TO VOICE MONITOR (P218)
SCHEM: 1248720, 1254717
J218
+12V
±12V COM
-12V
TO HEAD DRIVER HOUSING (P2)
SCHEMATIC: 1254697
J206
RECORD RELAY
J204-W
J204-BB
TO PWR & SERVO CHASSIS (P202)
SCHEMATIC: 1256646
J202
BRAKES
BRAKES, +28V
TAKE-UP REEL, +14V
COMMON
TAKE-UP REEL, -16V
±12V COM
SENSE LINE, TAKE-UP
SYNC CMD
TAPE SIG CMD
SENSE LINE, SUPPLY
SUPPLY REEL, +14V
COMMON
SUPPLY REEL, -16V
NOT USED
P208-23
P210-5
TO TAKE-UP REEL SERVO (TB 202) SCHEM. 1256130 FS 202
INHIBIT B
INHIBIT A
P210-8
P210-7
TO SUPPLY REEL SERVO (TB 201) SCHEM. 1256130 FS 201
INHIBIT B
INHIBIT A
P210-11
P210-3
TAPE WIDTH
½ IN
1 IN
S201-A
-12V
S202
SUPPLY REEL MOTOR ASSY 1248624
J203 P203
BRAKE L203
S203 N.O.
TAKE-UP REEL MOTOR ASSY 1248624
J207 P207
BRAKE L204
S206 N.O.
a
b
c
d



NOTES:

1. UNLESS OTHERWISE SPECIFIED ALL DIODES ARE 013-678. FOR FIELD SERVICE USE A IN4385. ALL RESISTOR VALUES ARE IN OHMS, 5%.
2. P217 PINS 7,8,9,11,13,15,17,19,21,25,27,29,31 NOT USED.

POWER AND SERVO CHASSIS SCHEMATIC DIAGRAM TWI254487E (SHEET 1 OF 4)

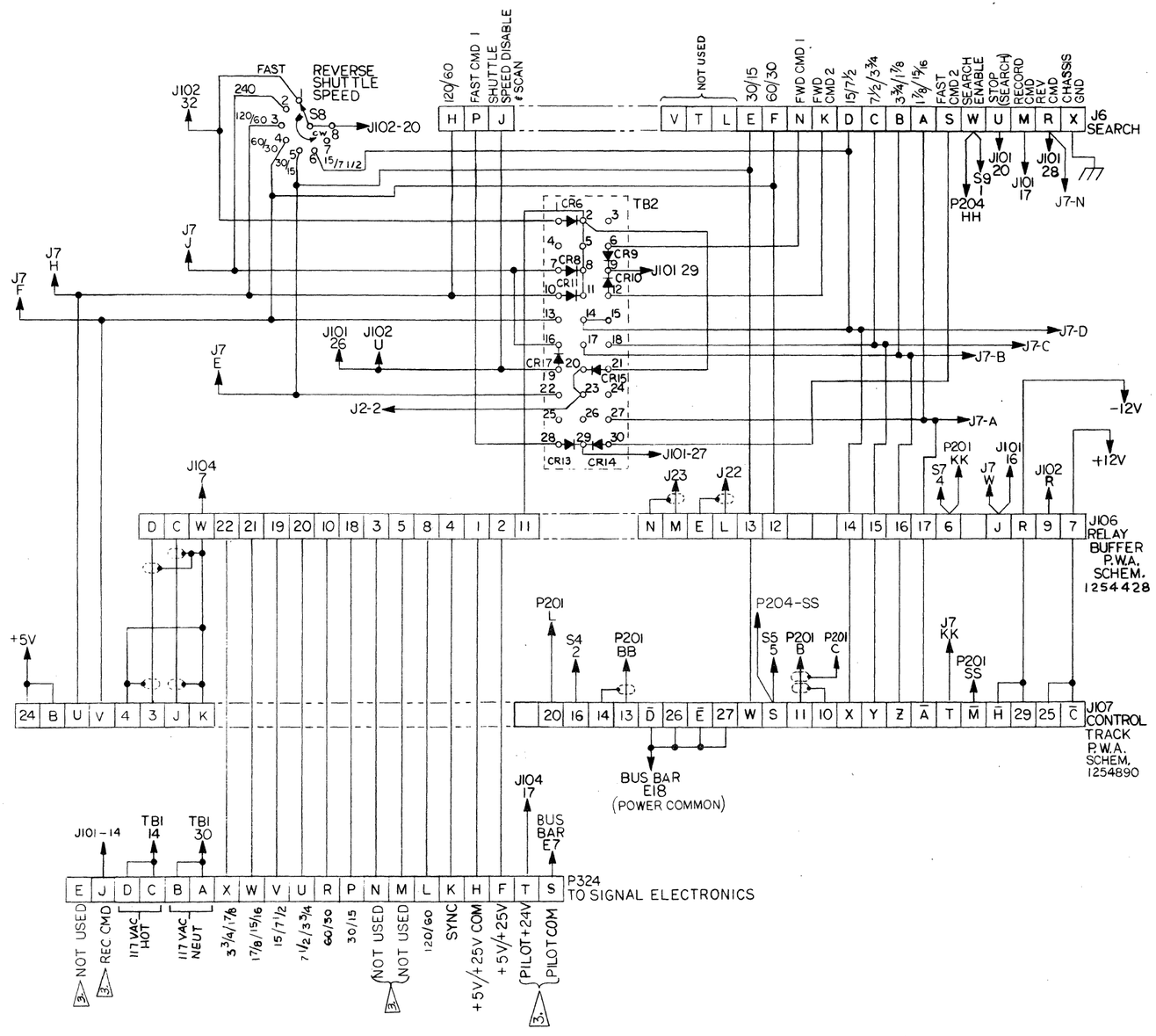


DESIGNATIONS USED	
C 1-14	M1
E 4-20	FL1
F 1-12	T1, 2
K 1-2	
CR 1-6, 8-11, 13-15, 17	
TB 1-3	
P 201, 202, 204 209, 324	
S 1, S3-9	
R 1-6, 12-20	
Q 1-7, 11	
J 1-3, 6, 7, 21-24, 101, 102, 104-108	

NOTES:

Arrows with reference designators (e.g., ⊏→ J1-M) indicate destinations of conductors.

To trace interconnections, use this diagram in conjunction with Figure 7-1 and Transport Harness Schematic Diagram 1254523.



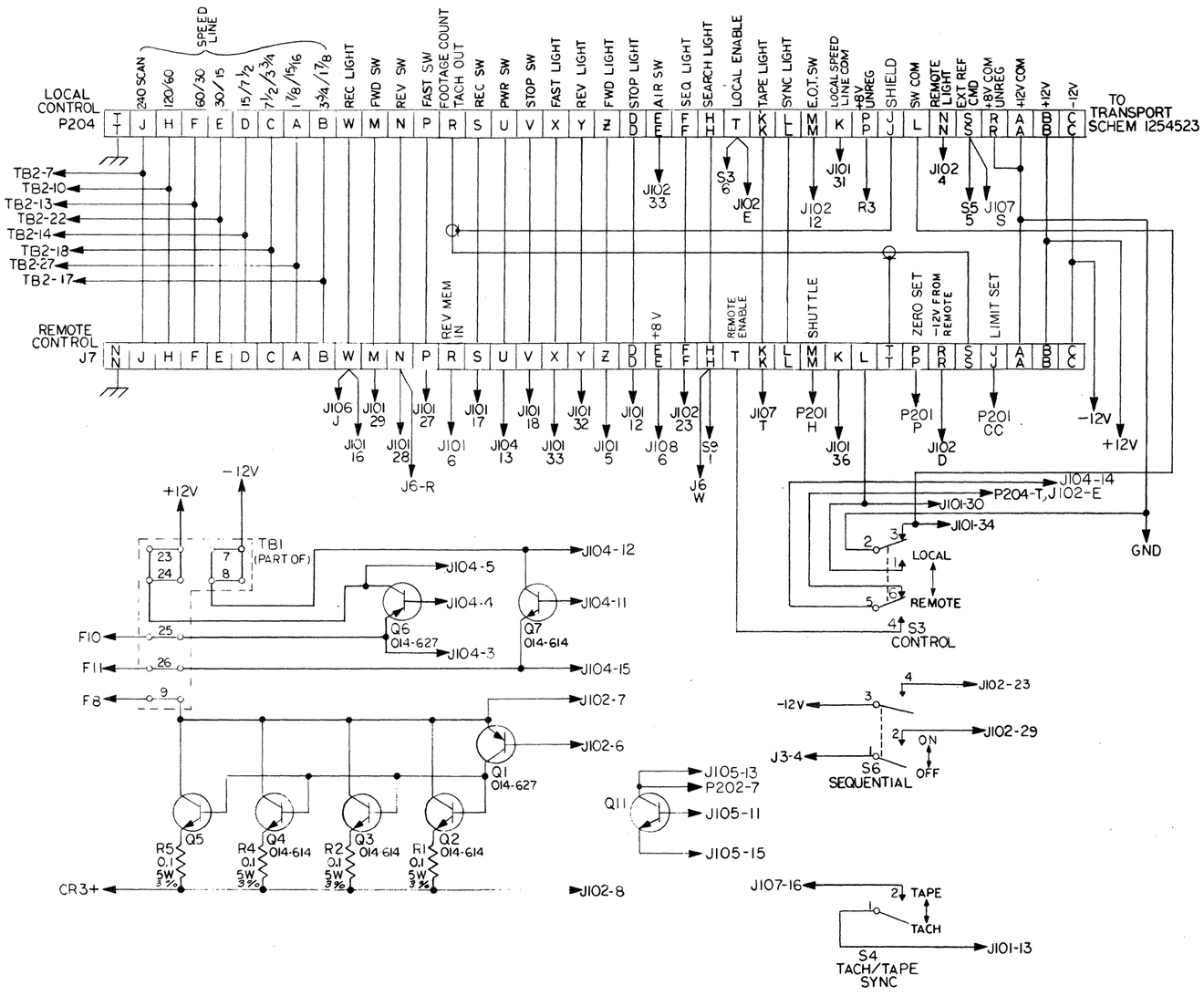
NOTES:

Arrows with reference designators (e.g., → J1-M) indicate destinations of conductors.

To trace interconnections, use this diagram in conjunction with Figure 7-1 and Transport Harness Schematic Diagram 1254523.

For schematics and parts information on the pwa's that plug into this chassis, refer as follows:

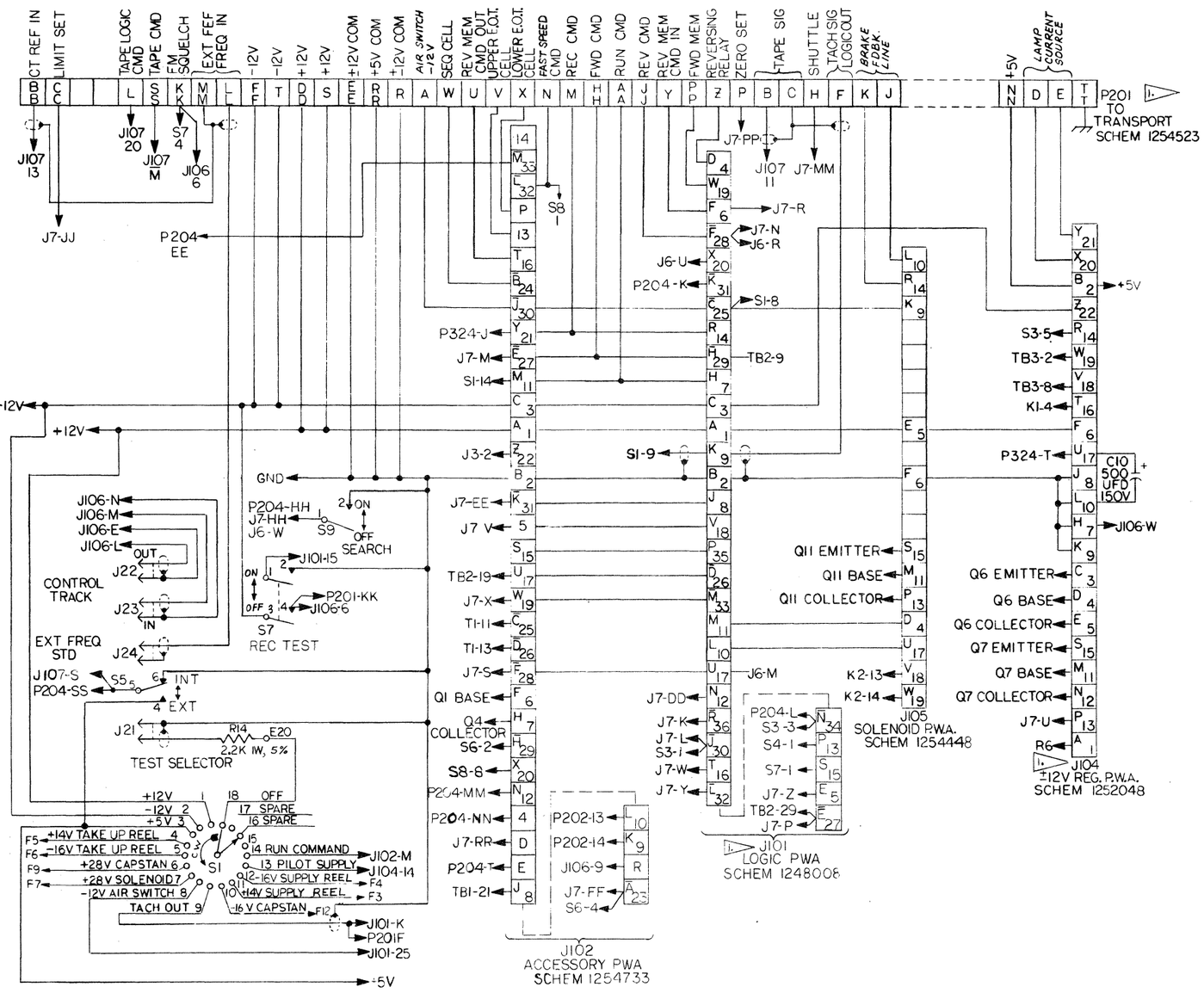
P106, Relay Buffer Pwa: Section 3
P107, Control Track Pwa: Accessories Manual



NOTES:

Arrows with reference designators (e.g., J1-M) indicate destinations of conductors.

To trace interconnections, use this diagram in conjunction with Figure 7-1 and Transport Harness Schematic Diagram 1254523.



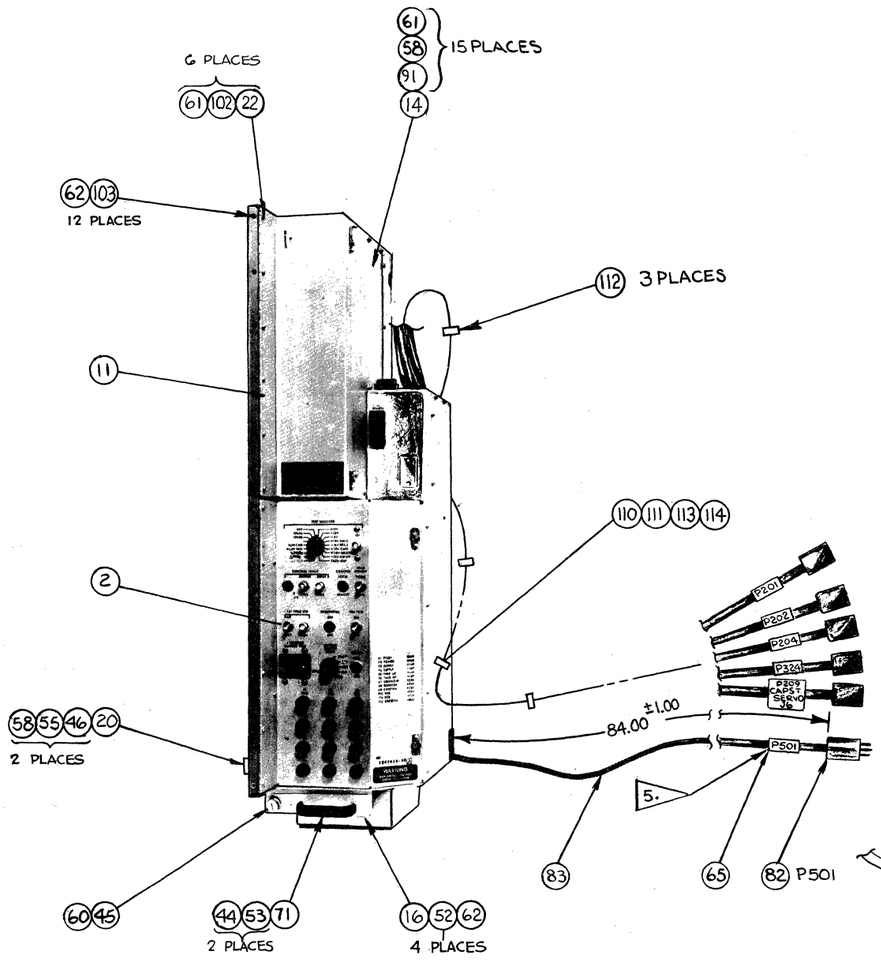
NOTES:

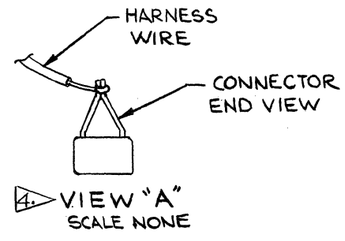
1. ALPHA & NUMERICAL CONNECTOR DESIGNATION APPEARING TOGETHER IN ONE BLOCK INDICATE THE TWO PINS ARE CONNECTED BY A JUMPER WIRE.
2. USE INTERCONNECT WIRING DIAGRAM AS A CIRCUIT TRACING GUIDE.
3. USED WITH FR-3020 & FR-3030 ELECTRONICS.
4. UNLESS OTHERWISE NOTED; ALL RESISTORS ARE 1/2W, 5%, ALL FUSES ARE FAST BLOW.
5. OPTIONAL 8V POWER SUPPLY.

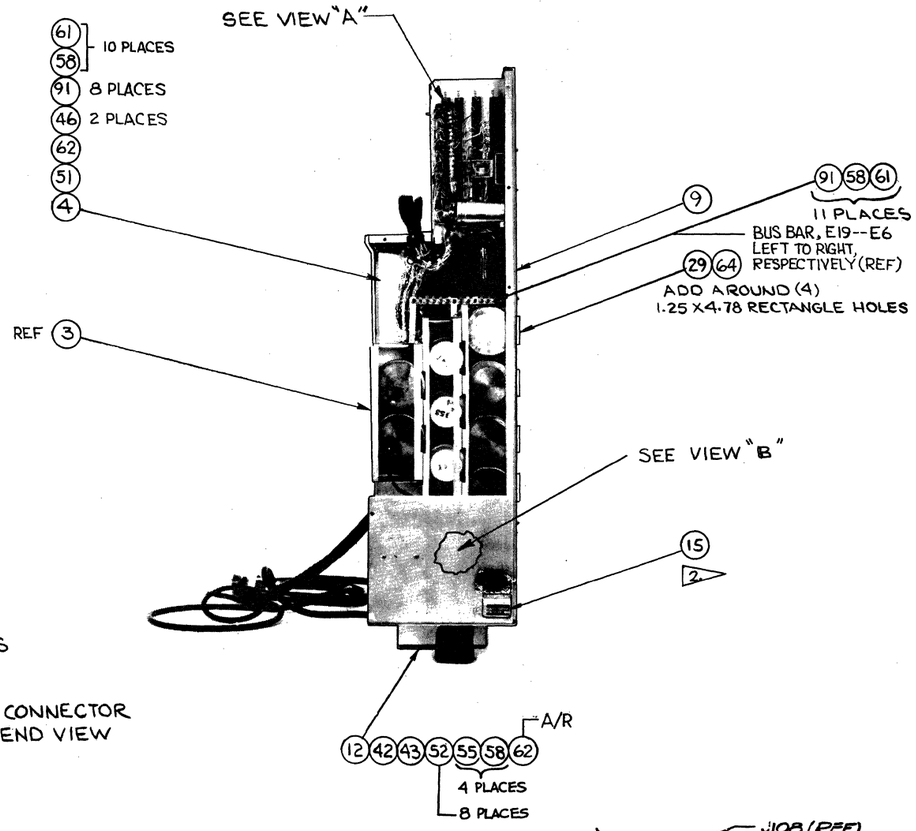
Arrows with reference designators (e.g., →J1-M) indicate destinations of conductors.

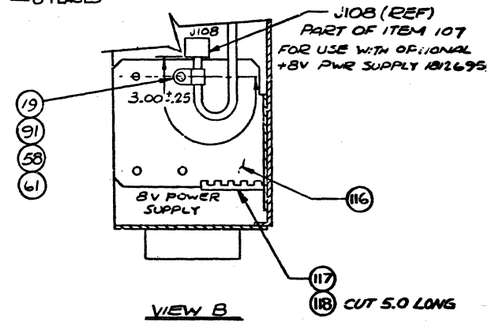
For schematics and parts information on the pwa's that plug into this chassis, refer as follows:

P101, Control Logic PWA:	Section 3
P102, Accessory PWA:	
P105, Solenoid PWA:	
P104, ±12V Regulator PWA:	Section 6





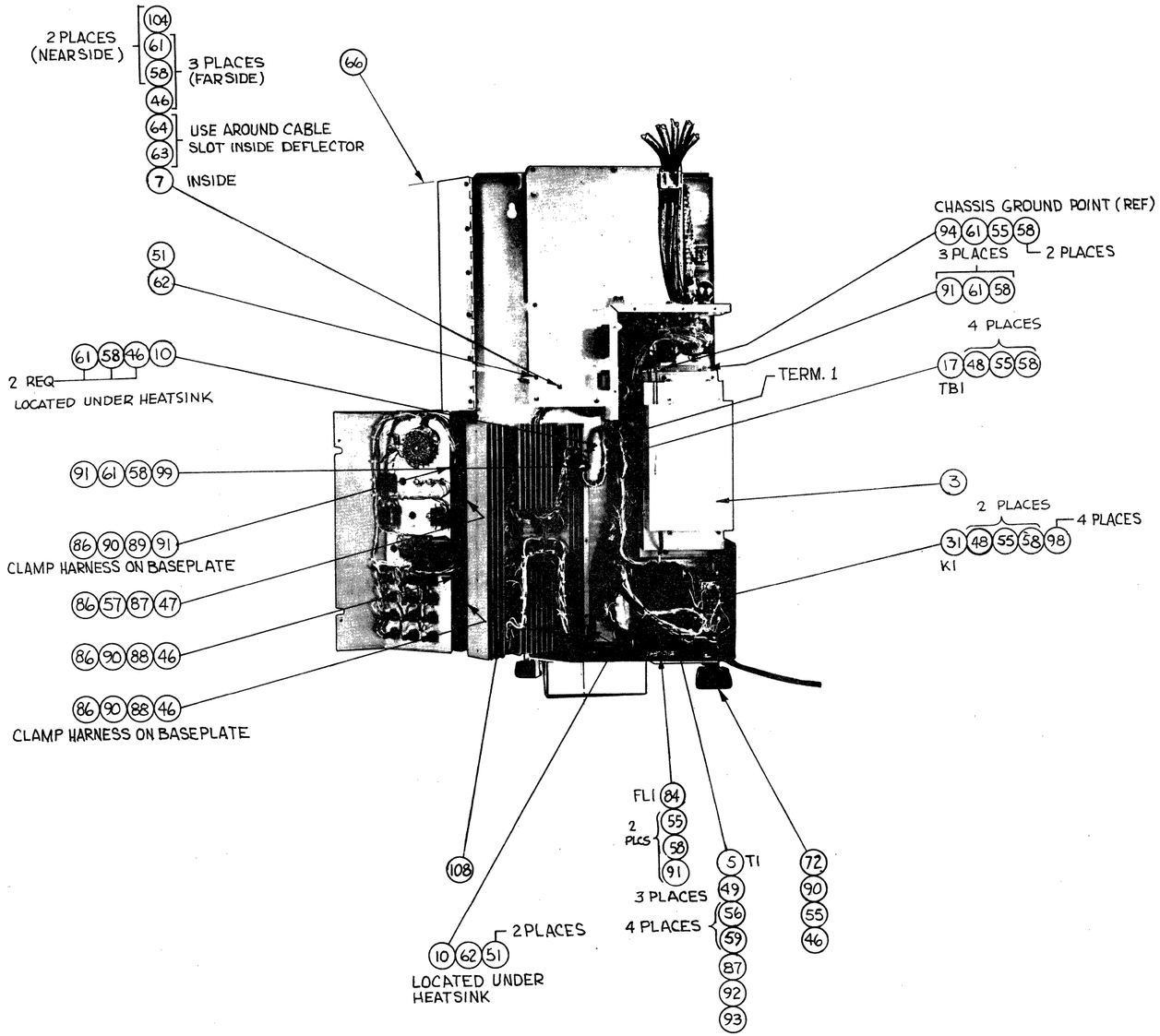


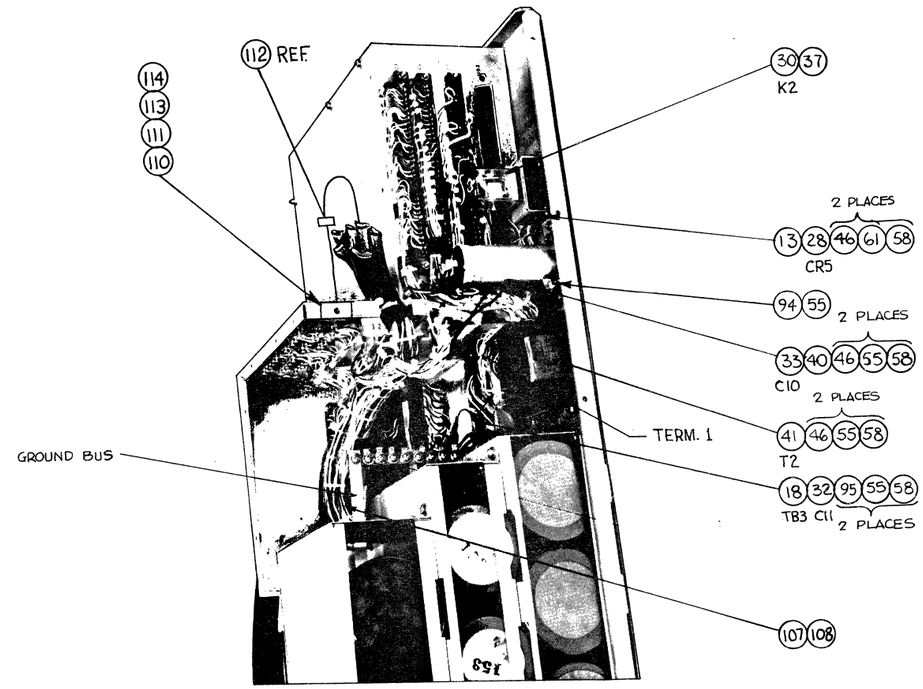


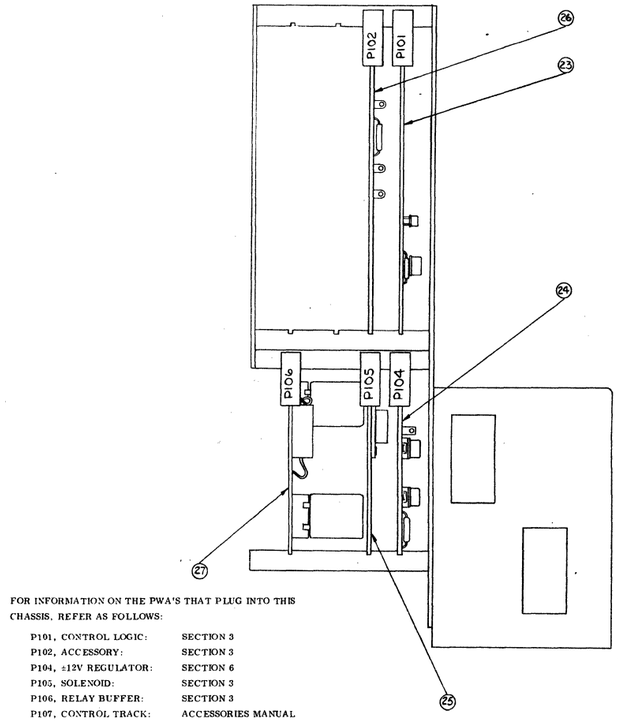
NOTES:

1. ASSEMBLY NO. IS 1802816-02.
2. MARK LABEL, ITEM 15, WITH CAT. NO. AND SERIAL NO., PER MIL-STD-130.
3. PERMANENTLY MARK SEPARATE INSULATED WIRES WITH WIRE NUMBER. WIRE NUMBER NOT REQUIRED ON PERMANENT COMPONENT LEADS.
4. DUAL PINS OF CONNECTORS J101 THRU J106 MAY BE JUMPERED AS SHOWN, PER WIRE LIST.
5. MARK REF DESIG APPROX WHERE SHOWN.

CHANGED: 15 MARCH 1978


2 PLACES (NEARSIDE)
104
61
58
3 PLACES (FARSIDE)
46
64
63
USE AROUND CABLE SLOT INSIDE DEFLECTOR
7
INSIDE
66
51
62
61 58 46 10
2 REQ
LOCATED UNDER HEATSINK
91 61 58 99
86 90 89 91
CLAMP HARNESS ON BASEPLATE
86 57 87 47
86 90 88 46
86 90 88 46
CLAMP HARNESS ON BASEPLATE
CHASSIS GROUND POINT (REF)
94 61 55 58
3 PLACES
2 PLACES
91 61 58
4 PLACES
17 48 55 58
TB1
TERM. 1
3
2 PLACES
4 PLACES
31 48 55 58 98
K1
108
FL1 84
2 PLCS
55
58
91
3 PLACES
5 T1
49
56
59
87
92
93
4 PLACES
72
90
55
46
10 62 51
2 PLACES
LOCATED UNDER HEATSINK


112 REF
114
113
111
110
30 37
K2
2 PLACES
13 28 46 61 58
CR5
94 55
2 PLACES
33 40 46 55 58
C10
2 PLACES
41 46 55 58
T2
18 32 95 55 58
TB3 C11
2 PLACES
TERM. 1
GROUND BUS
107 108



FOR INFORMATION ON THE PWA'S THAT PLUG INTO THIS CHASSIS, REFER AS FOLLOWS:

P101, CONTROL LOGIC:	SECTION 3
P102, ACCESSORY:	SECTION 3
P104, ±12V REGULATOR:	SECTION 6
P105, SOLENOID:	SECTION 3
P106, RELAY BUFFER:	SECTION 3
P107, CONTROL TRACK:	ACCESSORIES MANUAL

LIST OF MATERIALS 1802816D

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -02		
3	1248446-01		Capacitor assy, pwr and servo chassis	1		
5	1249162-01	T1	Transformer assy	1		
7	1247942-01		Deflector	1		
9	1247948-02		Baseplate	1		
10	1247951-01		Hinge block	2		
11	1247953-01		Hinge, pwb cover	1		
12	1247954-01		Housing, fan	1		
13	1247955-01		Bracket, relay mtg	1		
14	1250116-01		Cover, power and servo chassis	1		
15	1251523-01		Label identification	1		

CHANGED: 15 MARCH 1978

LIST OF MATERIALS 1802816D

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -02		
16	1252406-01		Plate handle mtg	1		
17	1248891-01	TB1	Terminal block, 64 term	1		
18	1248892-01	TB3	Terminal block, 10 term	1		
19	302-120		Clamp, cable	1		
20	1248133-01		Lockout	1		
21	1254487		Composite schematic	Rev E		
22	1247944-02		Cover, pwb	1		
23	1801910-02	P101	Control logic pwb assembly	1		
24	1802458-02	P104	±12V regulator pwb assembly	1		
25	1801912-03	P105	Solenoid pwb assembly	1		
26	1802858-01	P102	Accessory pwb assembly	1		
27	1801913-04	P106	Relay buffer pwb assembly	1		
28	013-678	CR5	Diode, silicon, CD541	1		
29	260-062		Grommet, caterpillar, .131 i-d	a/r		
30	020-225	K2	Relay, 12V dc, 4 pdt	1		
31	020-524	K1	Relay, power dpdt	1		
32	030-300	C11	Capacitor, ceramic, .1 μF, 500V	1		
33	031-654	C10	Capacitor, alum, 500 μF, 150V	1		
34	171-238		Terminal, quick disconnect, female, 18-22 ga	8		
36	169-872		Contact, hermaphrodite	2		
37	150-992		Socket, relay	1		
38	171-007		Terminal, lug, crimp, ring tongue, #10, 14-16 ga	6		
39	171-006		Terminal, lug, crimp, ring tongue, #8, 18-22 ga	4		
40	290-107		Retainer, capacitor	1		
41	560-070	T2	Transformer, power	1		
42	591-125		Fan, unit, 1 phase, 50-60 cps	1		
43	591-126		Filter, fan	1		
44	502-005		Washer, spring lock, #10	2		
45	310-738		Screw, captive,#5/16-14 x 1.251 lg	1		
46	471-070		Screw, pan hd, #6-32 x 7/16 lg	19		
48	471-073		Screw, pan hd, #6-32 x 3/4 lg	2		
49	471-089		Screw, pan hd, #10-32 x 1/2 lg	3		
50	169-993		Contact, hermaphrodite	1		
51	471-336		Screw, flat hd, #6-32 x 3/8 lg	4		
52	471-337		Screw, flat hd, #6-32 x 7/16 lg	10		
53	472-123		Screw, pan hd, #10-24 x 1/2 lg	2		
55	496-005		Nut, keps, #6-32	23		
56	496-007		Nut, keps, #10-32	4		
57	506-013		Washer, "D", #6	1		
58	501-009		Washer, plain, #6	73		
59	501-070		Washer, plain, #10	4		
60	503-042		Washer, retainer	1		
61	502-003		Washer, spring lock, #6	58		
62	018-030		Adhesive, loctite, grade C	a/r		
63	269-008		Molding, rubber, U channel, .031 i-d	a/r		
64	018-009		Adhesive	a/r		

LIST OF MATERIALS 1802816D

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -02		
65	600-095		Sleeving, plastic shrink, black, .375 i-d	a/r		
66	225-084		Tape, teflon, 1/4 in	a/r		
70	600-093		Sleeving, plastic, shrink, .250/.125 i-d	a/r		
71	089-103		Handle	1		
72	302-200		Clamp, cable, 3/8 i-d	1		
81	615-002		Wire, solid, bare, #22 AWG	a/r		
82	145-578	P501	Connector, power circuit, plug cap, 3 male contacts	1		
83	616-037		Cable, jacketed, 3 cond, rubber ins, #14 AWG	a/r		
84	052-203	FL1	Filter	1		
85	173-492		Terminal, quick disconnect, 14-16 ga	4		
86	498-233		Nut, cap, lock, #6-32	4		
87	302-078		Clamp, cable, loop, .62 i-d	2		
88	302-088		Clamp, cable, loop, .50 i-d	2		
89	302-429		Clamp, cable, loop, .44 i-d	1		
90	506-027		Washer, "D", #6, .44 wd	4		
91	471-069		Screw, pan hd, #6-32 x .38 lg	42		
92	471-090		Screw, pan hd, #10-32 x .625 lg	3		
93	506-014		Washer, "D", #10, .58 wd	1		
94	471-071		Screw, pan hd, #6-32 x .50 lg	2		
95	471-074		Screw, pan hd, #6-32 x .88 lg	6		
96	171-044		Terminal, ring tongue, 6 stud, 14-16 ga	1		
97	600-234		Sleeving, tfe, .034 i-d	a/r		
98	502-026		Washer, lock, #8, int tooth	4		
99	302-016		Clamp, cable, loop, .44 i-d	1		
100	172-218		Terminal, ring tongue, 8 stud, 14-16 ga	1		
101	171-178		Terminal, ring tongue, 10 stud, 18-22 ga	1		
102	471-067		Screw, pan hd, #6-32 x .25 lg	6		
103	471-335		Screw, flat hd, #6-32 x .31 lg	12		
104	471-068		Screw, pan hd, #6-32 x .31 lg	2		
105	290-059		Terminal, ring tongue, solder, 4 stud	1		
106	1254459-01		Wiring harness "B"	1		
107	1254456-02		Wiring harness "A"	1		
108	1254457-02		Heatsink assy	1		
109	1254511-02		Connector and pwb housing assy	1		
110	302-356		Mounting plate, strap	2		
111	302-366		Cable tie	2		
112	302-388		Cable tie	3		
113	473-331		Screw, pan hd, assemb wash, xrec, #6-32 x .50 lg	2		
114	501-625		Washer, plain, #6, .156 i-d x .438 o-d	2		
115	1254458-02		Test panel assy	1		
116	1255871-01		Bracket, power supply mounting	1		
117	018-004		Adhesive	a/r		
118	260-052		Grommet, caterpillar	a/r		
119	471-091		Screw, pan hd, #10-32 x .750 lg	1		
			Items not used: 1,2,4,6,8,35,47,54,67,68,69,73, 74,75,76,77,78,79,80			

WIRE LEAD LIST 1802816D

WIRE NO.	AWG/ COLOR	FROM REF DES	FROM TERM	TO REF DES	TO TERM	REMARKS	LM ITEM NO. -02
-	-	CR5	Cath	K2	13	Use component lead	
-	-	CR5	AN	K2	14	Use component lead	Ref 28
-	20-0	T2	PRI	TB3	5		Ref 41
-	20-0	T2	PRI	TB3	6	Use component leads Use item 34 at TB3	
-	20-2	T2	SEC	TB3	1		
-	20-2	T2	SEC	TB3	8		Ref 41
-	-	C11	-	TB3	3	Utilize component lead — Use item 34 at TB3	Ref 32
-	-	C11	-	TB3	10	Utilize component lead — Sleeve with item 97	
-	22 Bare	J102	1	J102	A	4	81
-			2		B		
-			3		C		
-			6		F		
-			7		H		
-			8		J		
-			9		K		
-			10		L		
-			11		M		
-			12		N		
-			15		S		
-			16		T		
-			17		U		
-			18		V		
-			19		W		
-			20		X		
-			21		Y		
-			22		Z		
-			23		A		
-			24		B		
-			25		C		
-			26		D		
-			27		E		
-			28		F		
-			29		H		
-			30		J		
-			31		K		
-		J102	32	J102	L		
-		J101	1	J101	A		
-			2		B		
-			3		C		
-			4		D		
-			5		E		
-			6		F		
-			7		H		
-			8		J		
-			9		K		
-	22 Bare	J101	10	J101	L	4	81

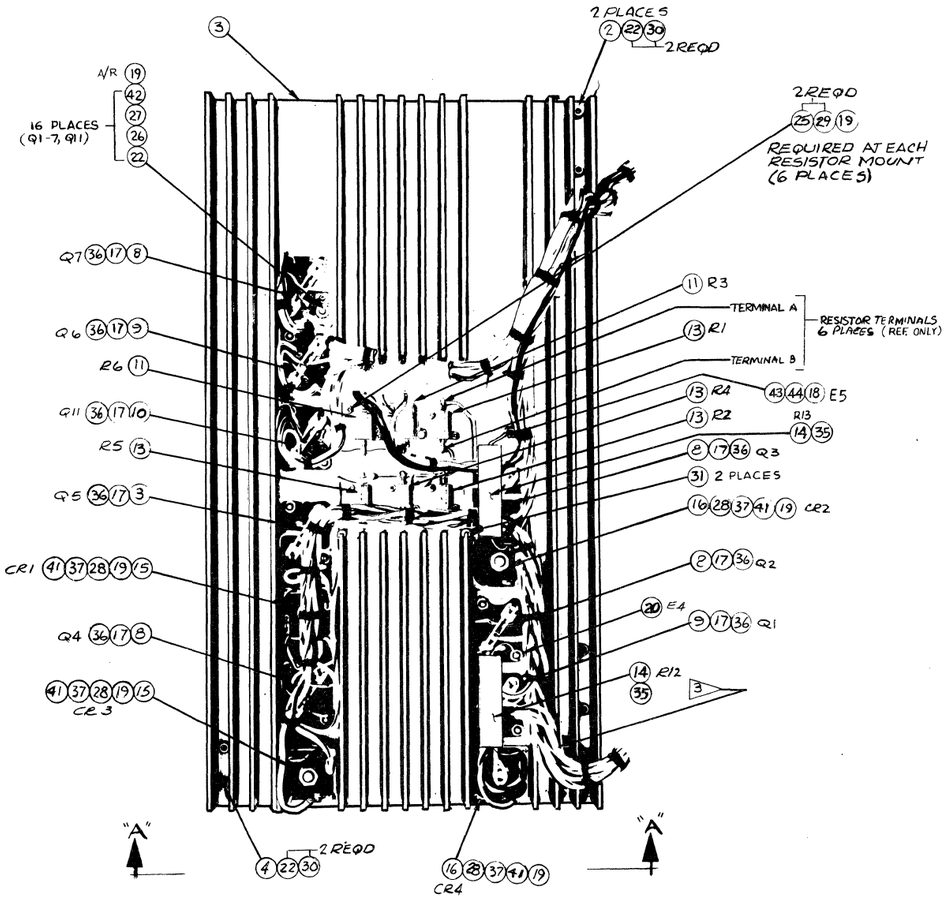
WIRE LEAD LIST 1802816D

WIRE NO.	AWG/ COLOR	FROM REF DES	FROM TERM	TO REF DES	TO TERM	REMARKS	LM ITEM NO. -02
-	22 Bare	J101	11	J101	M	4	81
-			12		N		
-			13		P		
-			14		R		
-			15		S		
-			16		T		
-			17		U		
-			18		V		
-			19		W		
-			20		X		
-			25		C		
-			26		D		
-			27		E		
-			28		F		
-			29		H		
-			30		J		
-			31		K		
-			32		L		
-			33		M		
-			34		N		
-			35		P		
-		J101	36	J101	R		
-		J104	1	J104	A		
-			2		B		
-			3		C		
-			4		D		
-			5		E		
-			6		F		
-			7		H		
-			8		J		
-			9		K		
-			10		L		
-			11		M		
-			12		N		
-			13		P		
-			14		R		
-			15		S		
-			16		T		
-			17		U		
-			18		V		
-			19		W		
-			20		X		
-			21		Y		
-			22		Z		
-			H/7		J/8		
-	22 Bare	J104	J/8	J104	K/9	4	81

WIRE LEAD LIST 1802816D

WIRE NO.	AWG/ COLOR	FROM REF DES	FROM TERM	TO REF DES	TO TERM	REMARKS	LM ITEM NO. -02
-	22 Bare	J104	K/9	J104	L/10	4	81
-		J105	5	J105	E		
-			6		F		
-			9		K		
-			10		L		
-			11		M		
-			13		P		
-			14		R		
-			15		S		
-			17		U		
-			18		V		
-			19		W		
-			21		Y		
-		J105	22	J105	Z		
-		J107	E	J107	27		
-			D		26		
-			H		29		
-			B		24	4	
-			E/27		D/26		
-	22 Bare	J107	C	J107	25		81
-	14-0	P501	Uncoded	FL1	Line 2		
-	14-9	P501	W	FL1	Line 1		83
-	14-5	P501	G	FL1	Gnd		
-	22 Bare	J105	4	J105	D		81
-	22 Bare	J102	33	J102	$\overline{M}$		81

POWER AND SERVO CHASSIS HEATSINK ASSEMBLY 1254457-02C

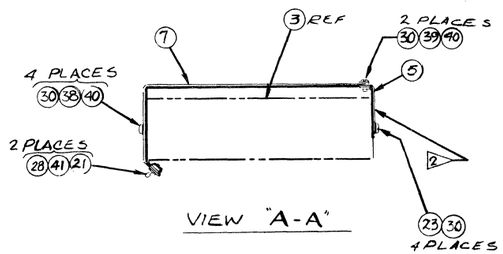


NOTES:

1. ASSEMBLY NUMBER IS 1254457-02.

2 MARK ASSY NO. IN AREA SHOWN PER MIL-STD-130.

3 WIRING SHOWN FOR REFERENCE ONLY.



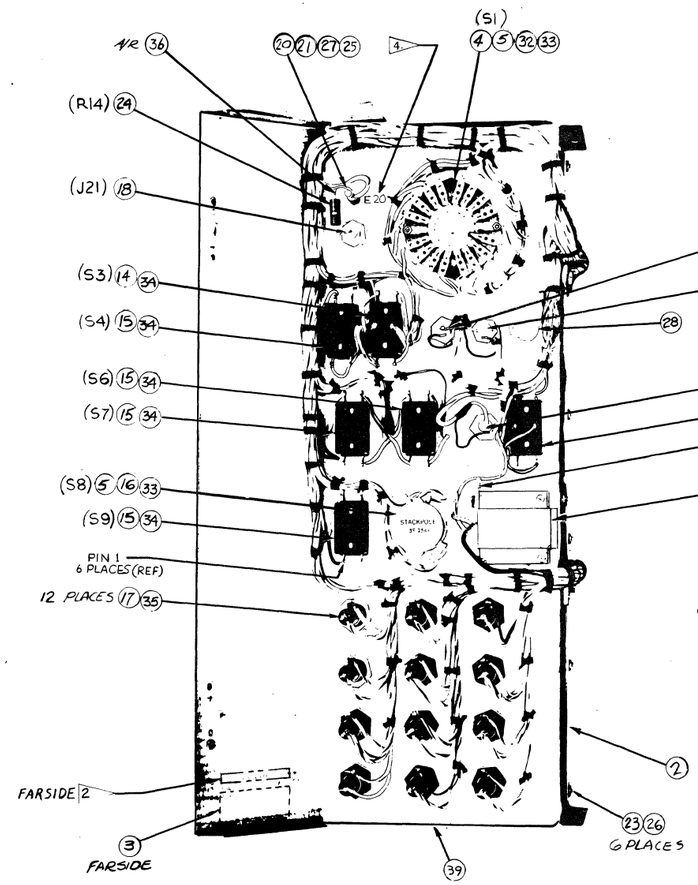
VIEW "A-A"

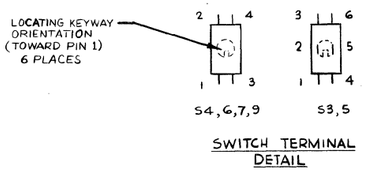
LIST OF MATERIALS 1254457C

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -02		
2	1247950-01		Pivot	2		
3	1254885-01		Heatsink	1		
4	1247965-01		Lock	1		
5	1248432-01		Adaptor	1		
6	1254487		Schematic, composite	Rev E		
7	1247943-02		Flue	1		
8	014-614	Q2-5,7	Transistor, silicon, npn, CD461	5		
9	014-627	Q1,6	Transistor, silicon, pnp, CD522	2		
10	014-630	Q11	Transistor, silicon, npn, CD526	1		
11	047-863	R6	Resistor, ww, 10Ω, 10W, 5%	1		
12	047-165	R3	Resistor, ww, 5Ω, 10W, 5%	1		
13	059-186	R1,2,4,5	Resistor, ww, .1Ω, 5W, 3%	4		
14	043-601	R12,13	Resistor, ww, 0.05Ω, 10W, 3%	2		
15	581-251	CR1,3	Diode assembly	2		
16	581-086	CR2,4	Diode assembly	2		
17	150-142		Mounting kit, transistor	8		
18	173-068	E5	Terminal, turret, #4-40 int thd	1		
19	087-388		Silicone compound	a/r		
20	173-003	E4	Terminal, turret, #6-32 int thd	1		
21	310-572		Stud, turnloc (fastener)	2		
22	470-020		Screw, cap, hex soc hd, #6-32 x .500	22		
23	471-067		Screw, pan hd, #6-32 x .25 lg	4		
25	470-002		Screw, hex soc hd, #2-56 x .25	12		
26	476-202		Screw, thrd forming, #6-32 x .50	16		
27	496-005		Nut, assembled washer, #6-32	16		
28	496-007		Nut, assembled washer, #10-32	6		
29	502-001		Washer, lock, #2	12		
30	502-003		Washer, lock, #6	16		
31	260-052		Grommet, nylon, (caterpillar)	a/r		
32	615-011		Wire, bare, 16 AWG	a/r		
33	600-237		Sleeving, Teflon, 16 AWG	a/r		
34	615-019		Wire, bare, 18 AWG	a/r		
35	600-270		Sleeving, Teflon, 18 AWG	a/r		
36	014-703		Washer, mica	8		
37	471-092		Screw, mach pan hd, #10-32 x .875 lg	4		
38	471-068		Screw, mach pan hd, #6-32 x .312 lg	4		
39	471-069		Screw, mach pan hd, #6-32 x .375 lg	2		
40	501-009		Washer, plain, #6	6		
41	501-011		Washer, plain, #10	6		
42	501-188		Washer, flat, #6	16		
43	471-061		Screw, mach pan hd, #4-40 x .312 lg	1		
44	502-002		Washer, lock, #4	1		
			Items not used: 1,24			

WIRE LEAD LIST 1254457C

WIRE NO.	AWG/ COLOR	FROM REF DES	FROM TERM	TO REF DES	TO TERM	REMARKS	LM ITEM NO. -02
1	18 Bare	Q1	Coll	Q2	Base	Sleeve with item 35	34
2	18	Q2	Base	Q3	Base		34
3	18	Q3	Base	Q5	Base		34
4	18	Q5	Base	Q4	Base	35	34
5	16	Q1	EM	Q2	Coll	33	32
6		Q2	Coll	Q3	Coll		
7		Q3	Coll	Q5	Coll		
8		Q5	Coll	Q4	Coll		
9		Q2	EM	R1	A		
10		Q3	EM	R2	B		
11		Q4	EM	R4	B		
12		Q5	EM	R5	B		
13		R1	B	R2	A		
14		R2	A	R4	A		
15		R4	A	R5	A	Sleeve with item 33	
16		R1	B	R2	A	Sleeve with item 33	
17		R2	A	R4	A	bus with item 32	
18		R4	A	R5	A		
19	16 Bare	CR1	Pos	R6	B	Sleeve with item 33	32
20	---	R12	A	CR4	Pos		Ref 14
21	---	R12	B	E4	-	Use component leads	-
22	---	R13	A	CR2	Pos	Sleeve with item 35	Ref 14
23	---	R13	B	E5	-		-
24	18 Bare	R3	B	R6	B	Sleeve with item 35	34





SWITCH TERMINAL DETAIL

NOTES:

1. ASSEMBLY NUMBER IS 1254458-02.
2. MARK ASSY NUMBER IN AREA SHOWN PER MIL-STD-130.
3. INSULATE ALL SOLDER TERMINALS WITH SHRINK TUBING.
4. "E" NUMBERS ARE SHOWN FOR REFERENCE ONLY AND DO NOT APPEAR ON THE PART.
5. ITEM 19 TO BE PROVIDED FOR USE IN THE INSTALLATION OF WIRING HARNESS "A" (1254456) AT ASSEMBLY LEVEL 1802816.

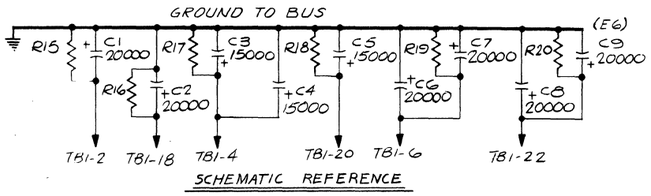
FUSE TABLE		
ITEM NO.	RATING AMPS	REF DES
38	1A, S.B.	F1
9	5A, F.B.	F10, F11
10	8A, F.B.	F4, 6, 7
11	10A, F.B.	F2
12	20A, F.B.	F3, 5, 8
13	5A, S.B.	F9
37	4A, F.B.	F12

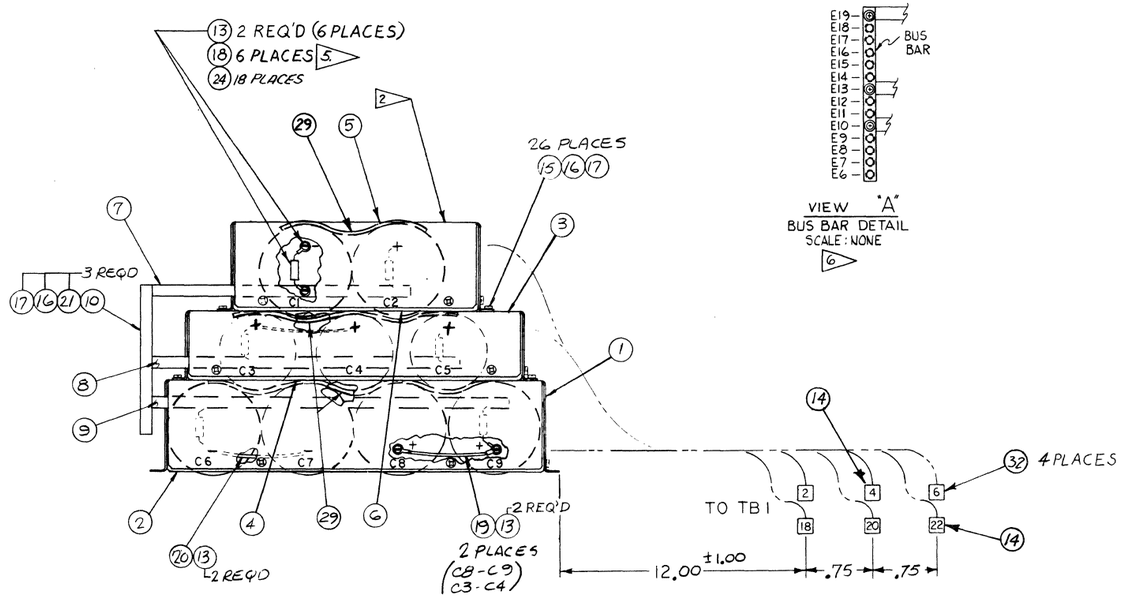
LIST OF MATERIALS 1254458C

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -02		
2	1247952-01		Hinge	1		
3	1213679-01		Label warning	1		
4	1248231-01	S1	Test switch	1		
5	6000006-20		Knob, skirted	2		
6	1254487		Schematic	Rev E		
9	070-007	F10,11	Fuse, 5A, 250V, f.b.	2		
10	070-009	F4,6,7	Fuse, 8A, 125V, f.b.	3		
11	070-041	F2	Fuse, 10A, 250V, f.b.	1		
12	070-303	F3,5,8	Fuse, 20A, 250V, f.b.	3		
13	070-020	F9	Fuse, 5A, 125V, s.b.	1		
14	120-004	S3,5	Switch, toggle, dpdt	2		
15	119-206	S4,6,7,9	Switch, toggle, dpst	4		
16	122-330	S8	Switch, rotary, 7 pos	1		
17	130-013		Fuse holder	12		
18	143-174	J21,22,23,24	Connector, rf, recpt	4		
19	171-041		Terminal, splice	2		
20	173-068	E20	Terminal, stud, turret	1		
21	471-060		Screw, xrec, pan hd, #4-40 x 1/4 lg	1		
22	471-062		Screw, xrec, pan hd, #4-40 x 3/8 lg	8		
23	471-067		Screw, xrec, pan hd, #6-32 x 1/4 lg	6		
24	041-263	R14	Resistor, comp, 1W, 2.2 kΩ, 5%	1		
25	501-008		Washer, plain, #4	9		
26	502-003		Washer, lock, spring, #6	6		
27	502-024		Washer, lock, int tooth, #4	1		
28	251-004		Plug, button	1		
29	090-181	M1	Elapsed time meter	1		
30	280-739		Spacer, threaded	4		
31	502-002		Washer, lock, spring, #4	8		
32	502-083		Washer, lock, int tooth, 3/8 i-d	1		
33	503-005		Washer, plain, non-met, .375 i-d	2		
34	502-089		Washer, lock, int tooth, 7/16 i-d	6		
35	502-060		Washer, lock, int tooth, 1/2 i-d	12		
36	600-036		Sleeving, Teflon, .035 i-d	a/r		
37	070-042	F12	Fuse, 4A, 250V, f.b.	1		
38	070-004	F1	Fuse, 1A, 125V, s.b.	1		
39	1254703-02		Panel, test	1		
			Items not used: 1, 7, 8			

WIRE LEAD LIST 1254458C

WIRE NO.	AWG/ COLOR	FROM REF DES	FROM TERM	TO REF DES	TO TERM	REMARKS	LM ITEM NO. -02		
1	---	R14		J21	Ctr	Utilize component leads	ref 24		
2	---	R14		E20	---	Utilize component leads			





NOTES:
UNLESS OTHERWISE SPECIFIED,

1. ASSY NUMBER IS 1248446-01
2. MARK ASSY NUMBER IN AREA SHOWN PER MIL-STD-130.
3. RESISTOR VALUES ARE 3.3K, 1/2W, 5%.
4. CAPACITOR VALUES ARE IN MICROFARADS.
5. USE ITEM 30 ON ALL RESISTOR LEADS.
6. BUS BAR "E" NO'S ARE FOR REF ONLY AND DO NOT APPEAR ON PART.

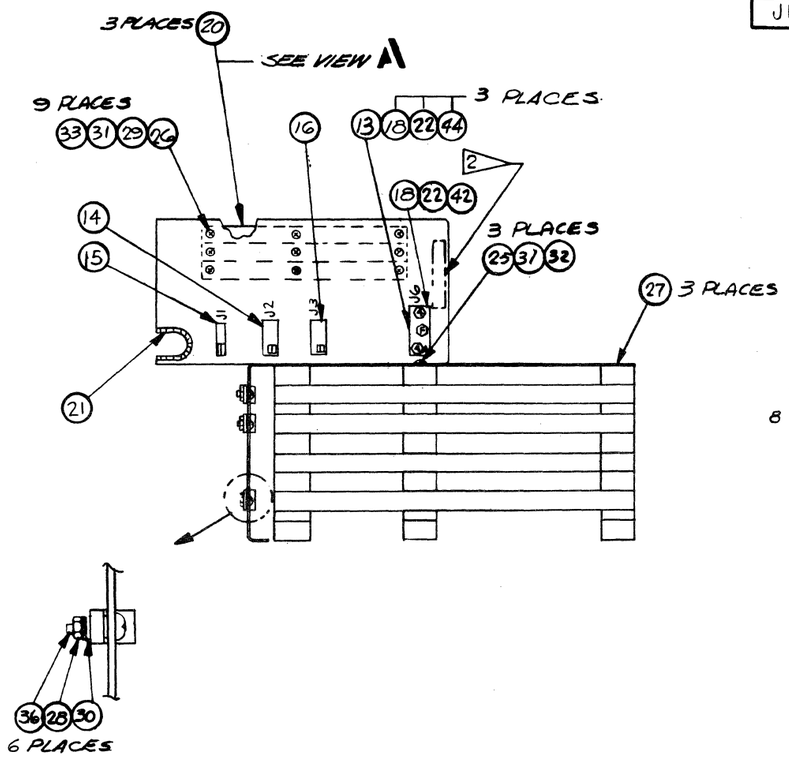
LIST OF MATERIALS 1248446

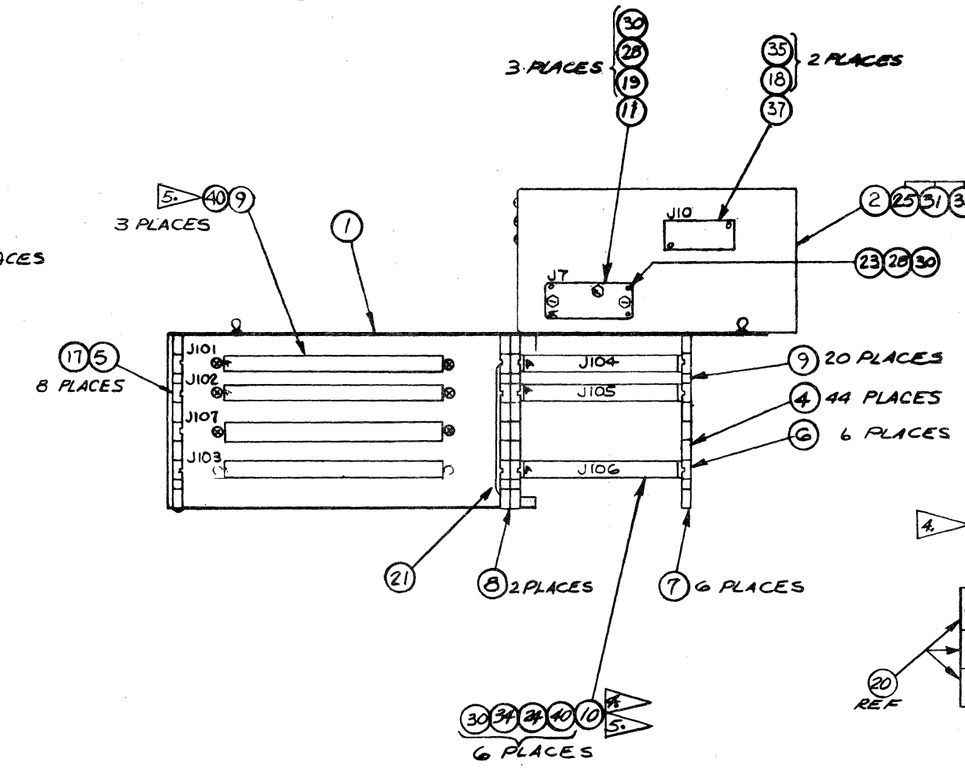
ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
1	1247935-01		Housing	1		
2	1247936-01		Base	1		
3	1247937-01		Housing	1		
4	1247938-01		Base	1		
5	1247939-01		Housing	1		
6	1247940-01		Base	1		
7	1247956-01		Ground strap	1		
8	1247956-02		Ground strap	1		
9	1247956-03		Ground strap	1		
10	1247958-01		Termination, grd	1		
11	063-110	C1, 2, 6, 7, 8, 9	Capacitor, 20,000 μF, 25V	6		
12	031-832	C3, 4, 5	Capacitor, 15,000 μF, 50V	3		
13	171-007		Term lug, crimp, ring tongue #10	18		
14	173-492		Term, quick disconnect	2		
15	471-067		Screw, mach, pan hd, #6-32 x 1/4	26		
16	501-003		Washer, plain, #6	29		
17	502-002		Washer, lock, spring, #6	29		
18	041-331	R15-20	Resistor, comp, 1/2W, 5%, 3300Ω	6		
19	611-722		Wire, insul, 16 AWG, red	a/r		
20	611-726		Wire, insul, 16 AWG, grn	a/r		
21	471-068		Screw, mach, xrec, pan hd, 6-32 x 5/16	3		
22	611-160		Wire, strd, insul, #14 AWG, 9	a/r		
23	611-365		Wire, strd, insul, #14 AWG, 90	a/r		
24	502-005		Washer, lock, spring #10	18		
25	617-057		Wire, strd, insul, #18 AWG, 91	a/r		
26	617-059		Wire, strd, insul, #18 AWG, 93	a/r		
27	611-484		Wire, strd, insul, #18 AWG, 95	a/r		
28	617-062		Wire, strd, insul, #18 AWG, 96	a/r		
29	225-267		Tape, foam, single side	a/r		
30	600-088		Sleeving, teflon, flex, #17 clear	a/r		
31	1252409		Schematic composite	ref		
32	171-238		Terminal, quick disconnect, 22/18 AWG	4		
33	1254487		Schematic, composite (FR-3000)	ref		

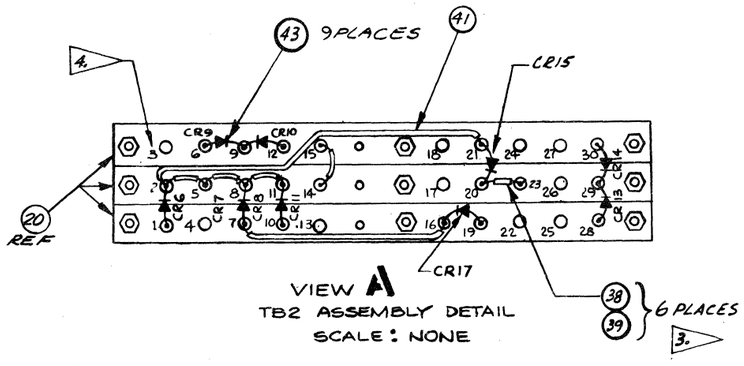
WIRE LEAD LIST 1248446

WIRE NO.	AWG/ COLOR	FROM REF DES	FROM TERM	TO REF DES	TO TERM	REMARKS	LM ITEM NO. -01		
1	18/93	C1	(-)	TB1	2	Utilize Item 32	26		
2	18/91	C2	(+)	TB1	18	Utilize Item 32	25		
3	14/90	C4	(+)	TB1	4	Utilize Item 14	23		
4	18/96	C5	(+)	TB1	20	Utilize Item 32	28		
5	18/95	C7	(-)	TB1	6	Utilize Item 32	27		
6	14/9	C9	(+)	TB1	22	Utilize Item 14	22		
7	---	R15		C1	(+)	Utilize Item 13			
8	---	R15		C1	(-)				
9	---	R16		C2	(+)				
10	---	R16		C2	(-)				
11	---	R17		C3	(+)				
12	---	R17		C3	(-)				
13	---	R18		C5	(+)				
14	---	R18		C5	(-)				
15	---	R19		C6	(+)				
16	---	R19		C6	(-)				
17	---	R20		C9	(+)				
18	---	R20		C9	(-)	Utilize Item 13			

CONNECTOR KEYING TABLE	
DESIG	KEYED BETWEEN
J101	PINS 8 & 9
J102	PINS 10 & 11
J104	PINS 10 & 11
J105	PINS 4 & 5
J106	PINS 6 & 7
J107	PINS 14 & 15







NOTES:

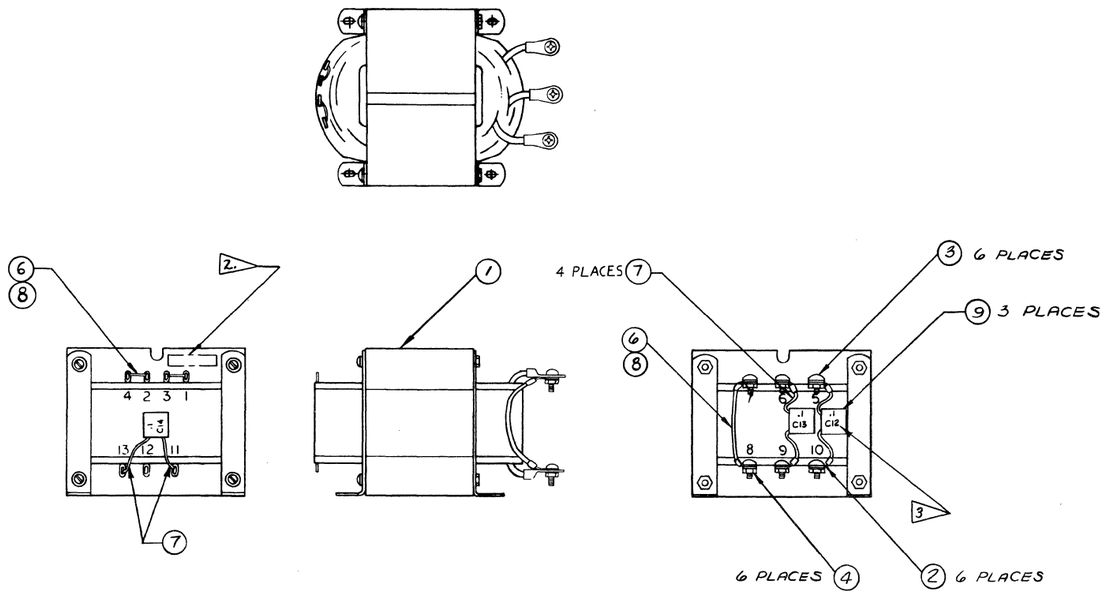
1. ASSY No. IS 1254511-02.
2. MARK ASSY No: IN AREA SHOWN PER MIL-STD-130.
3. INSTALL ITEMS 38, 41, & 43 PER VIEW A & WIRE LEAD LIST, SLEEVING ITEM 38 WITH ITEM 39 AS REQUIRED.
4. COMPONENT DESIGNATIONS & NUMBERING ARE SHOWN FOR REFERENCE ONLY & DO NOT NECESSARILY APPEAR ON THE PART.
5. FOR CONNECTOR KEYING SEE TABLE.

LIST OF MATERIALS 1254511B

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -02		
2	1247947-02		Bracket, conn mtg	1		
3	1254487		Schematic, composite	Rev E		
4	530-201		Spacer	44		
5	530-197		Guide	8		
6	530-198		Guide	6		
7	530-199		Rod	6		
8	530-200		Rod	2		
9	530-104		Spacer	20		
10	168-055	J104,105,106	Connector, pc, recp, 22 dual pin	3		
11	166-035	J7	Connector, recpt, 38 contact	1		
12	139-145	J101,102,107	Connector, pc, 36 dual pin	3		
13	169-946	J6	Connector, recpt, 20 pin	1		
14	169-999	J2	Connector, recpt, 6 pin	1		
15	169-987	J1	Connector, recpt, 3 pin	1		
16	169-145	J3	Connector, recpt, 9 pin	1		
17	530-283		Guide	8		
18	493-013		Nut, locking, #2-56	2		
19	470-011		Screw, cap, hex socket, #4-40 x 7/16 lg	3		
20	180-771	TB2	Terminal board	3		
21	260-052		Grommet, nylon	a/r		
22	470-006		Screw, cap, hex socket, #2-56 x 1/2 lg	4		
23	470-012		Screw, cap, hex socket, #4-40 x 1/2 lg	1		
24	471-064		Screw, pan hd, #4-40 x 1/2 lg	15		
25	471-069		Screw, pan hd, #6-32 x 3/8 lg	7		
27	471-336		Screw, flat hd, #6-32 x 3/8 lg	3		
28	496-004		Nut, keps, #4-40	19		
30	501-008		Washer, plain, #4	34		
31	501-009		Washer, plain, #6	7		
32	502-003		Washer, spring lock, #6	7		
33	503-997		Spacer, non-metallic, 1/8 thk	9		
34	502-002		Washer, spring lock, #4	6		
35	472-453		Screw, pan hd, #2-56 x 5/16 lg	2		
36	471-065		Screw, pan hd, #4-40 x 5/8 lg	6		
37	1252407-01		Plate, cover	1		
38	615-004		Wire, bare, solid, 24 AWG	a/r		
39	600-232		Insulation, Teflon, #24	a/r		
40	169-318		Key, polarizing	6		
41	614-847		Wire, 24 AWG (CD569) wht/brn	a/r		
42	172-020		Terminal lug, solder, ring tongue #2	1		
43	013-678	CR6,8-11,13-15,17	Diode, silicon (CD451)	9		
44	501-155		Washer, plain, #2	3		
45	493-168		Nut, locking, #2-56, sm pattern	4		
46	1252092-02		Housing	1		
			Items not used: 1,26,29			

WIRE LEAD LIST 1254511B

WIRE NO.	AWG/ COLOR	FROM REF DES	FROM TERM	TO REF DES	TO TERM	REMARKS	LM ITEM NO. -02
1	-	CR6	Cath	TB2	2	Utilize comp lead	43
2	-	CR6	An		1		
3	-	CR8	Cath		8		
4	-	CR8	An		7		
5	-	CR9	Cath		9		
6	-	CR9	An		6		
7	-	CR10	Cath		9		
8	-	CR10	An		12		
9	-	CR11	Cath		11		
10	-	CR11	An		10		
11	-	CR13	Cath		29		
12	-	CR13	An		28		
13	-	CR14	Cath		29		
14	-	CR14	An		30	Utilize comp lead	43
15	24 Bare	TB2	2		5	3	38
16			5		8		
17			8		11		
18	24 Bare		14		15	3	38
19	24/91	TB2	2		21		41
20	-	CR15	Cath		20	Utilize comp lead	43
21	-	CR15	An		21	Utilize comp lead	43
22	24 Bare	TB2	20		23	3	38
23	-	CR17	Cath		16	Utilize comp lead	43
24	-	CR17	An		19	Utilize comp lead	43
25	24 Bare	TB2	16	TB2	7		38



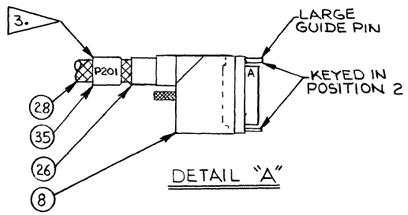
NOTES:

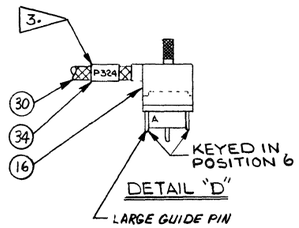
1. ASSEMBLY NO. IS 1249162-01.
2. MARK ASSEMBLY APPROXIMATELY WHERE SHOWN, PER MIL-STD-130.
3. REF DESIG ARE FOR REF ONLY AND DO NOT APPEAR ON PART.

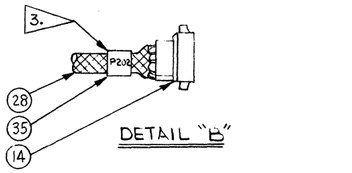
LIST OF MATERIALS 1249162						
ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
1	1247514-01		Transformer	1		
2	171-006		Terminal lug, crimp, ring tongue, #8	6		
3	471-078		Screw, mach, xrec, pan head, #8-32 x 3/8	6		
4	496-001		Nut, assembled washer, #8-32	6		
6	600-158		Sleeving, teflon, flexible, #20 AWG	a/r		
7	600-232		Sleeving, teflon, flexible, #24 AWG	a/r		
8	611-001		Wire, stranded ins, 20 AWG, blk	a/r		
9	030-300		Capacitor, cer disc, .1 μF, 500V, 20%	3		
			Item not used: 5			

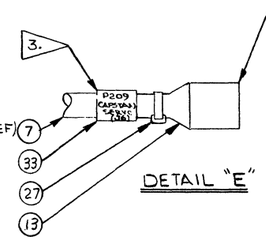
NOTES:

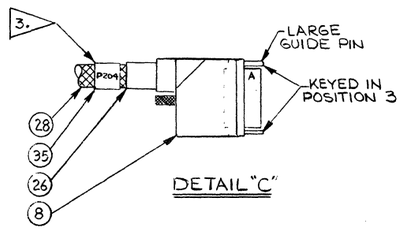
1. ASSY NO. IS 1254459-03.
2. MARK ASSY NO. ON ITEM 36 PER MIL-STD-130.
3. MARK REF. DESIG APPROX WHERE SHOWN.
4. ITEM 17 USED ON J1, J2 & J3 (INSTALL NEXT ASSY).
5. ITEM 15 USED ON P324, J6, J7, P204, P201 (J6 & J7 INSTALLED N/A).
6. ITEM 11 USED ON P202.
7. ITEM 10 USED ON P202.
8. ITEM 9 USED ON P209.
9. PERMANENTLY MARK SEPARATE INSULATED WIRES WITH WIRE NUMBER (SEE WIRE LEAD LIST).
10. IDENTIFY LEADS TO J10, WITHOUT CONNECTION, FOR OPTIONAL USE.

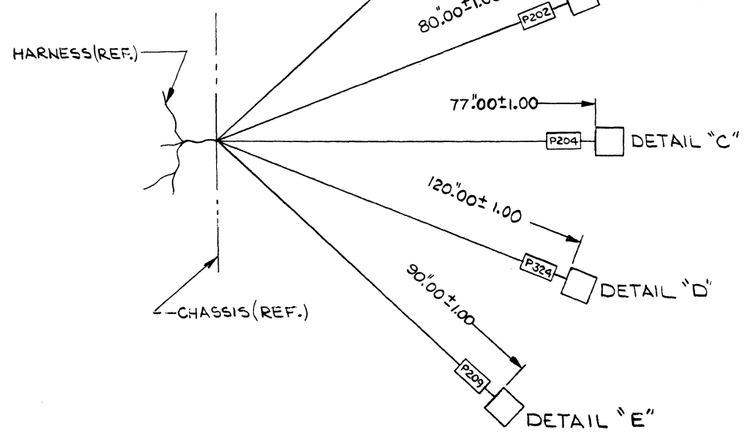












LIST OF MATERIALS 1254459H

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -03		
1	611-160		Wire, stranded, insul, AWG 14, wht	a/r		
2	611-725		Wire, stranded, insul, AWG 16, wht	a/r		
3	611-553		Wire, stranded, insul, AWG 18, wht	a/r		
4	611-607		Wire, stranded, insul, AWG 20, wht	a/r		
5	611-427		Wire, stranded, insul, AWG 24, wht	a/r		
6	616-644		Wire, shielded, insul, AWG 26, wht	a/r		
7	616-323		Cable, shielded, and jack, 3 cond, 16 AWG	a/r		
8	166-045	P201,204	Body, rect plug, 38 pos, male shell	2		
9	166-225	8	Contact, connector, soc	4		
10	166-507	7	Contact, pin, 22-18 AWG	5		
11	166-806	6	Contact, pin, 20-14 AWG	8		
12	167-022	P209	Connector, body, 6 pos	1		
13	167-199	Ref P209	Hood, connector	1		
14	169-596	P202	Body, rect plug, 15 pin shell-less	1		
15	169-872	5	Contact, hermaphrodite	149		
16	169-971	P324	Body, rect, recp, 20 pos, male shell	1		
17	169-993	4	Contact, hermaphrodite	9		
18	171-006	Ref T1,K1	Terminal, ring tongue, 8 stud, 18-22 ga	4		
19	171-007	Ref E6-19	Terminal, ring tongue, 10 stud, 14-16 ga	16		
21	171-178	Ref E6-19,C10	Terminal, ring tongue, 10 stud, 18-22 ga	4		
22	171-238	Ref TB1,3	Terminal, quick disc, 22-18 ga	17		
23	172-218	Ref T1,K1	Terminal, ring tongue, 8 stud, 14-16 ga	7		
24	173-492	Ref TB1	Terminal, quick disc, 16-14 AWG	20		
26	262-004		Bushing, sleeved, flanged	2		
27	302-379		Tie wrap	1		
28	600-056		Sleeving, plastic, flex, blk, .625 i-d	a/r		
29	600-061		Sleeving, plastic, flex, blk, .313 i-d	a/r		
30	600-063		Sleeving, plastic, flex, blk, .438 i-d	a/r		
31	600-090		Sleeving, plastic, shrink, blk, .191 i-d	a/r		
32	600-092		Sleeving, plastic, shrink, blk, .250 i-d	a/r		
33	600-093		Sleeving, plastic, shrink, blk, .375 i-d	a/r		
34	600-095		Sleeving, plastic, shrink, blk, .500 i-d	a/r		
35	600-097		Sleeving, plastic, shrink, blk, .75 i-d	a/r		
36	600-117	2	Sleeving, plastic, shrink, blk, 2.0 i-d	a/r		
37	600-153		Sleeving, plastic, shrink, blk, .125 i-d	a/r		
39	613-989		Cable, coax, 75Ω, RG187 a/u	a/r		
40	171-044		Terminal lug	1		
41	171-148		Terminal lug	5		
42	173-498		Terminal lug	2		
44	616-037		Cable, jacketed, 3 cond, 14 AWG	a/r		
45	618-001		Wire, braid, flat, .250 wide	a/r		
46	1256646-01		Schematic, composite	Rev A		
			Items not used: 20, 25, 38, 43			

WIRE LEAD LIST 1254459H

WIRE NO.	AWG/ COLOR	FROM REF DES	FROM TERM	TO REF DES	TO TERM	REMARKS	LM ITEM NO. -03		
1	24	P201	A	J102	J	5	5		
2	26		B	J107	11		6		
-	Shield		C	J107	10				
3	24		D	J104	20		5		
4	24		E	J104	21		5		
5	26		F	J101	9		6		
-	Shield		C	J101	2				
6	24		J	J105	10		5		
7	24		K	J105	14		5		
8	24		L	J107	20		5		
9	24		M	J101	14		5		
10	24		N	TB2	1		5		
11	20		R	Bus Bar	E15-17		4		
12	20		S	TB1	24		4		
13	20		T	TB1	8		4		
14	24		U	J102	T		5		
15	24		V	J102	13		5		
16	24		W	J102	B		5		
17	24		X	J102	P		5		
18	24		Y	J101	6		5		
19	24		Z	J101	4		5		
20	24		AA	J101	7		5		
21	26		BB	J107	13		6		
-	Shield		MM	J107	14				
22	20		DD	TB1	24		4		
335	20		EE	Bus Bar	E15-17		4		
23	20		FF	TB1	8		4		
24	24		HH	J101	29		5		
25	24		JJ	J101	28		5		
26	24		KK	J106	6		5		
27	26		LL	J24	Ctr		6		
-	Shield		MM	J24	Shld				
28	20		NN	J104	2		4		
29	24		PP	J101	19		5		
30	20		RR	Bus Bar	E15-17		4		
31	24		SS	J107	M		5		
32	18	P201	TT	J7	Chassis Gnd	5	3		
33	14	P202	1	F3	Side	6	1		
34	14		2	Bus Bar	E7		1		
35	14		3	F4	Side		1		
36	14		4	F5	Side		1		
37	14		5	Bus Bar	E8		1		
38	14		6	F6	Side		1		
39	20		7	Q11	Col		4		
40	18		8	F7	Side	6	3		
41	24	P202	13	J102	L	7	5		

WIRE LEAD LIST 1254459H

WIRE NO.	AWG/ COLOR	FROM REF DES	FROM TERM	TO REF DES	TO TERM	REMARKS	LM ITEM NO. -03
42	24	P202	14	J102	K	7	5
43		P202	15	K1	3	7	
44		P204	A	J7	A	5	
45			B	J7	B		
46			C	J7	C		
47			D	J7	D		
48			E	J7	E		
49			F	J7	F		
50			H	J7	H		
51			J	J7	J		
52			K	J101	31		
54			M	J7	M		
55			N	J7	N		
56			P	J7	P		
57			S	J7	S		
59			T	J102	E		
60			U	J7	U		
61			V	J7	V		
62			W	J7	W		
63			X	J7	X		
64			Y	J7	Y		
65	24		Z	J7	Z		5
66	20		AA	Bus Bar	E15-17		4
67	24		BB	J7	BB		5
68			CC	J7	CC		
69			DD	J7	DD		
70			EE	J102	$\bar{M}$		
71			FF	J7	FF		
72			HH	J7	HH		
73			KK	J7	KK		
74			LL	J7	LL		
76	24		NN	J102	4		5
77	18		PP	R3	A		3
78	18		RR	Bus Bar	E11		3
79	24		SS	S5	5		5
80	18	P204	TT	J7	Chassis Gnd	5	3
81	16-2	P209	1	F9	Side	8 Part of Item 7 See Wire No. 83	-
82	16-9	P209	3	F12	Side	8 Twist Together	7
83	16-0	P209	2	Bus Bar	E9	8 Part of Item 7 See Wire Nos. 81, 82	-
-	Overall Shield	P209	4	J7	Chassis Ground	8	-
84	16	P324	A	TB1	32	5	2
85	16		B	TB1	32		2
86	16		C	TB1	16		2
87	16		D	TB1	16		2
88	18	P324	F	J106	2	5	3

WIRE LEAD LIST 1254459H

WIRE NO.	AWG/ COLOR	FROM REF DES	FROM TERM	TO REF DES	TO TERM	REMARKS	LM ITEM NO. -03
89	24	P324	H	J106	1	5	5
90	24		J	J101	14		5
91	24		K	J106	4		5
92	18		L	J106	8		3
93	24		M	J106	5		5
94	24		N	J106	3		5
95	18		P	J106	18		3
96	18		R	J106	10		3
97	20		S	Bus Bar	E12		4
98	20		T	J104	17		4
99	18		U	J106	20		3
100	18		V	J106	19		3
101	18		W	J106	21		3
102	18	P324	X	J106	22	5	3
103	24	J101	1	J104	6		5
104			1	J102	A		
105			2	J104	8		
106			2	J102	B		
108			3	J2	6	4	
109			3	J104	22		
110			3	J102	C		
111			5	J7	Z	5	
112			7	J102	M		
114			8	J102	$\bar{K}$		
115			10	J105	17		
116			11	J105	4		
117			12	J7	DD		
119			6	J7	R	5	
120			14	J102	Y		
122			16	J7	W	5	
123			16	J106	J		
124			17	J6	M		
125			17	J7	S	5	
126			17	J102	$\bar{F}$		
127			18	J7	V	5	
128			18	J102	5		
129			20	J6	U	5	
130			25	J102	$\bar{J}$		
132			26	TB2	19		
133			26	J102	U		
134			27	J7	P	5	
135			27	TB2	29		
136			28	J7	N		
137			29	J7	M	5	
138			29	J102	$\bar{E}$		
139	24	J101	29	TB2	9		5

WIRE LEAD LIST 1254459H

WIRE NO.	AWG/ COLOR	FROM REF DES	FROM TERM	TO REF DES	TO TERM	REMARKS	LM ITEM NO. -03
140	24	J101	30	J7	L	5	5
142			32	J7	Y		
143			33	J102	W		
144			33	J7	X	5	
145			34	P204	L		
146			35	J102	S		
147		J101	36	J7	K	5	
148		J102	A	J107	25		
149			C	J107	29		
150			D	J7	RR	5	
152			F	Q1	Base		
153			H	Q1	EM		
154			J	TB1	21		
156			12	P204	MM		
157			R	J106	9		
159			Z	J3	2	4	
161			$\overline{A}$	J7	FF	5	
162			$\overline{C}$	T1	11		
163			$\overline{D}$	T1	13		
165			$\overline{J}$	J105	9		
166	24	J102	$\overline{L}$	TB2	1		5
167	20	J104	1	R6	(A)		4
168	24		2	J107	24		5
170	20		3	TB1	25		4
171	24		4	Q6	Base		5
172	20		5	Q6	Col		4
173	20		6	J105	5		4
174	20		6	TB1	23		4
175	20		7	J106	W		4
176	20		10	C10	(-)		4
177	24		11	Q7	Base		5
178	20		12	Q7	Col		4
179	24		13	J7	U	5	5
181	20		15	TB1	26		4
182	20		16	K1	4		4
183	20		17	C10	(+)		4
184	20		18	TB3	10		4
185	20		19	TB3	3		4
186	20		22	J106	R		4
187	20	J104	22	TB1	7		4
188	20	J105	6	Bus Bar	E12		4
189	24	J105	11	Q11	Base		5
190	24	J105	13	Q11	Col		5
191	20	J105	15	Q11	EM		4
192	24	J105	19	K2	14		5
193	26	J106	C	J107	J		6

WIRE LEAD LIST 1254459H

WIRE NO.	AWG/ COLOR	FROM REF DES	FROM TERM	TO REF DES	TO TERM	REMARKS	LM ITEM NO. -03
-	Shield	J106	W	J107	K		-
194	26		D	J107	3		6
-	Shield		W	J107	4		-
197	24		11	TB2	11		5
198			12	TB2	13		
199			13	TB2	22		
200			14	TB2	14		
201			15	TB2	18		
202			16	TB2	17		
203		J106	17	TB2	27		
205		J107	$\overline{A}$	TB2	27		
206			Z	TB2	17		
209			T	J7	KK	5	
210			U	TB2	10		
211			V	TB2	13		
212			W	TB2	22		
213			X	TB2	15		
214			Y	TB2	18		
336	24	J107	S	S5	5		5
215	20	TB1	1	CR1	(-)		4
217	14		3	E4	-		1
221	18		5	CR3	(-)		3
225	20		7	Q7	Coll		4
226	20		8	J7	CC	5	4
228	14		9	Q2	Coll		1
229	20		10	J1	1	4	4
230	20		10	K2	8		4
231	20		11	J2	1	4	4
234	16		13	K1	5		2
235	16		15	K1	1		2
238	20		17	CR1	(+)		4
239	18		19	E5	-		3
241	14		21	R2-R4	Junction (Bus)		1
245	20		23	Q6	Coll		4
246			24	J7	BB	5	4
248			25	Q6	EM		4
250			26	Q7	EM		4
251			27	J1	3	4	4
252	20		27	J2	3		4
254	16		29	K1	6		2
255	16		31	K1	2		2
256	20	TB1	31	TE3	7		4
258	24	TB2	6	J6	N	5	5
259			7	J7	J		5
261			10	J6	H		5
263	24	TB2	12	J6	K	5	5

WIRE LEAD LIST 1254459H

WIRE NO.	AWG/ COLOR	FROM REF DES	FROM TERM	TO REF DES	TO TERM	REMARKS	LM ITEM NO. -03
264	24	TB2	13	J6	F	5	5
266			14		D		
268			17		B		
269			18		C		
270			19		J		
271			22	J6	E	5	
273			23	J2	2	4	
274			27	J6	A	5	
275			28	J6	P	5	
276	24	TB2	30	J6	S	5	5
278	20	J3	1	Bus Bar	E15-17	4	4
280	24	J6	A	J7	A	5	5
281			B		B		
282			C		C		
283			D		D		
284			E		E		
285			F		F		
286			H		H		
287			R		N		
288	24	J6	W	J7	h	5	5
290	14	CR3	(+)	R4-5	Junction (Bus)		1
292	20	J7	a	Bus Bar	E15-17	5	4
294	18	T1	5	CR2	AC	Twist 4 turns/inch	3
295	18	T1	10	CR2	AC		3
296	14	T1	5	CR4	AC	Twist together	1
297	14	T1	10	CR4	AC		1
298	14	T1	6	CR3	AC	Twist together	1
299	14	T1	9	CR3	AC		1
300	20	T1	11	CR1	AC	Twist 4 turns/inch	4
301	20	T1	13	CR1	AC		4
318	24	J105	18	K2	13		5
319	20	TB1	11	Fan	-	Use item 22 at TB1	4
320	20	TB1	28	Fan	-		4
321	20	J3	3	J6	Chassis Gnd	Use item 17 at J3 & solder lug at GND	4
322	20	J6	X	J6	Chassis Gnd	Use item 15 at J6 & item 42 at GND	4
323	20	J7	n	J7	Chassis Gnd	Use item 15 at J7 & item 42 at GND	4
324	14	T1	7	Buss Bar	E9	Use item 23 at T1 & item 19 at Buss Bar	1
325	16	TB1	12	T1	1	Twist 2 turns/inch; Use item 18 at T1	2
326	16	TB1	28	T1	2	Use item 19 at Buss Bar	2
327	14	T1	8	Buss Bar	E11	Use item 24 at TB1	1
328	16	T1	12	Buss Bar	E15-17	Use item 18 at T1	2
329	Braid	J104	8	Buss Bar	E14	Sleeve w/item 34, use item 19 at Buss Bar	45

WIRE LEAD LIST 1254459H

WIRE NO.	AWG/ COLOR	FROM REF DES	FROM TERM	TO REF DES	TO TERM	REMARKS	LM ITEM NO. -03
330	Braid	Bus Bar	E6	Chassis Gnd	-	Sleeve w/item 34, use item 19 at both ends	45
333	14-0	TB1	16	FL1	Load 2	Use item 24 at TB1	44
	14-9	TB1	32	FL1	Load 1	Use item 24 at TB1	
	14-5	TB1	Gnd	FL1	Gnd	Use item 40 near TB1	
334	20	J107	27	Bus Bar	E18	Use item 19 at Bus Bar	4
337	24	J105	5	J106	7		5
338	24	P201	CC	J7	j		5
339	24	P201	H	J7	m		5
340	24	P201	P	J7	p		5
341	Ctr	P204	R	J7	s		39
-	Shield	P204	JJ	J7	t		
346	24	J7	u	J102	$\overline{R}$		5
347		J7	v	J102	$\overline{P}$		
348		J107	5	P202	12		
349			6	J10	10		
350			7				
351			30				
352			36	J10	10		
353			7	J106	5		
354			32	S5	2		
355			34	TB2	16		
356			35	J102	19		
357			31	P202	H		
358	24	J107	1	J10	10		5

LIST OF MATERIALS 1254456D

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -02
1	611-160		Wire, strd, ins, AWG 14, wht	a/r
2	611-725		Wire, strd, ins, AWG 16, wht	a/r
3	611-553		Wire, strd, ins, AWG 18, wht	a/r
4	611-607		Wire, strd, ins, AWG 20, wht	a/r
5	611-427		Wire, strd, ins, AWG 24, wht	a/r
6	616-644		Wire, shielded, ins, AWG 26, wht	a/r
7	600-090	6	Sleeving, plastic, shrink, .191 i-d	a/r
8	600-092	6	Sleeving, plastic, shrink, .250 i-d	a/r
9	600-153	6	Sleeving, plastic, shrink, .125 i-d	a/r
10	200-002	6 2	Marker, band, plain	a/r
11	171-238	3	Terminal, quick-disc, fem, 18-22 AWG	15
12	173-492	3	Terminal, quick-disc, fem, 14-16 AWG	5
13	169-993	4	Contact, hermaphrodite	1
14	169-872	5	Contact, hermaphrodite	2
15	171-178	7	Terminal, ring tongue, 10 stud, 22-18 AWG	3
16	171-041	(Ref M1)	Terminal, splice	2
17	169-999	J108	Connector body, 6 contact	1
18	1254487		Schematic, composite	Rev E
19	169-993	10	Contact, hermaphrodite	4

1. Harness assembly part no. is 1254456-02.
2. Mark assembly no. on item 10 per MIL-STD-130.
3. Items 11 and 12 used at TB1, TB3.
4. Item 13 used on J3. Installed next assembly.
5. Item 14 used on J6 and J7. Installed next assembly.
6. Items 7 thru 10 to be assembled as required per HC2-4 and HC2-5.
7. Item 15 used at bus bar.
8. Mark reference designation on insulating sleeve.
9. Permanently mark separate insulated wires with wire number.
10. Item 19 used on J108.

WIRE LEAD LIST 1254456D

WIRE NO.	AWG/ COLOR	FROM REF DES	FROM TERM	TO REF DES	TO TERM	REMARKS	LM ITEM NO. -02
107	26	J101	K	S1	9		6
	Shield	J101	2	J21	Shield		
118	24	J101	13	S4	1		5
121	24	J101	15	S7	1		5
131	24	J101	25	S1	8		5
141	24	J101	30	S3	1		5
332	24	J101	34	S3	3		5
151	24	J102	E	S3	6		5
155	24	J102	M	S1	14		5
158	24	J102	X	S8	Swgr		5
160	24	J102	A	S6	4		5
164	24	J102	H	S6	2		5
169	24	J104	2	S1	3		5
180	24	J104	14	S3	5		5
195	26	J106	L	J22	Ctr		6
	Shield	J106	E	J22	Shld		
196	24	J106	6	S7	4		5
204	26	J106	M	J23	Ctr		6
	Shield	J106	N	J23	Shld		
208	24	J107	16	S4	2		5
216	20	TB1	2	F11	End		4
218	14	TB1	3	F8	End		1
219	18	TB1	4	F7	End		3
220	18	TB1	5	F4	End		3
222	16	TB1	5	F12	End		2
223	18	TB1	6	F6	End		3
224	24	TB1	7	S6	3		5
227	14	TB1	9	F8	Side		1
232	18	TB1	12	F2	Side		3
233	18	TB1	13	F2	End		3
236	20	TB1	15	F1	End		4
237	20	TB1	17	F10	End		4
240	18	TB1	19	F9	End		3
242	14	TB1	21	F3	End		1
243	14	TB1	22	F5	End		1
244	24	TB1	23	S1	1		5
247	20	TB1	25	F10	Side		4
249	20	TB1	26	F11	Side		4
253	20	TB1	28	M1	2	Twist together with wire no. 293 8	4
257	24	TB2	1	S8	1		5
260	24	TB2	7	S8	2		5
262	24	TB2	10	S8	3		5
265	24	TB2	13	S8	4		5
267	24	TB2	15	S8	6		5
272	24	TB2	22	S8	5		5
277	24	TB3	5	F1	Side		5

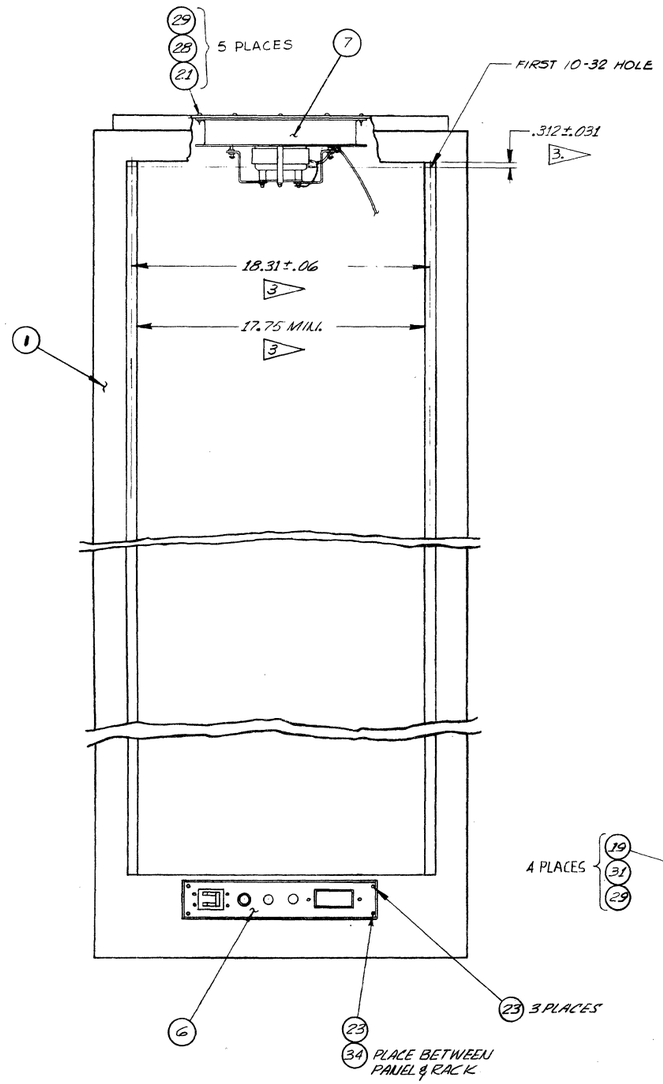
WIRE LEAD LIST 1254456D

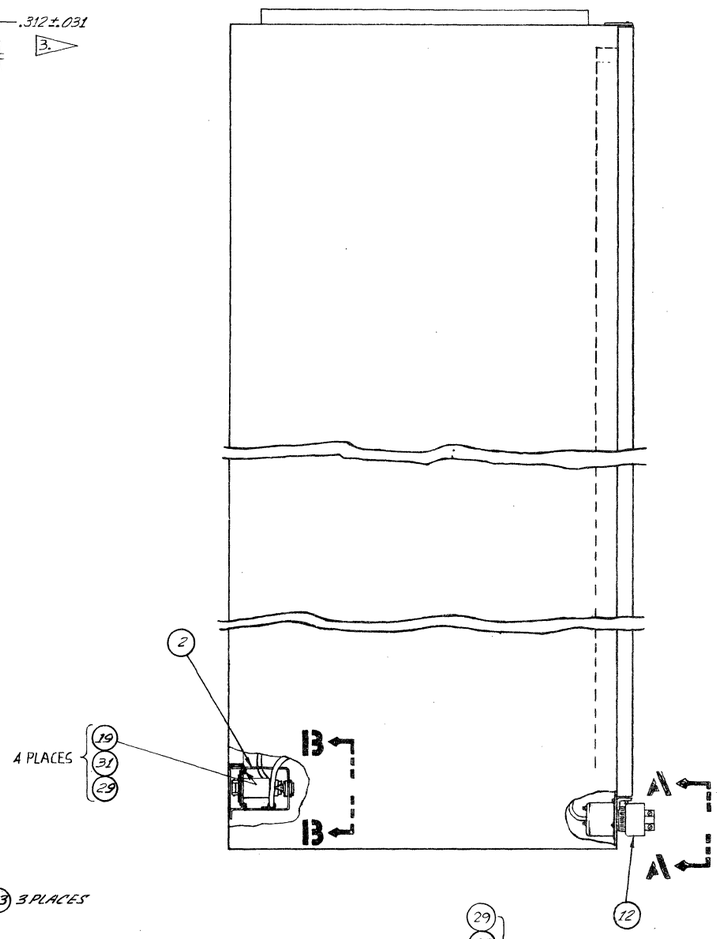
WIRE NO.	AWG/ COLOR	FROM REF DES	FROM TERM	TO REF DES	TO TERM	REMARKS	LM ITEM NO. -02
279	24	J3	4	S6	1		5
289	24	J6	W	S9	1		5
291	24	J7	T	S3	4		5
293	20	K2	12	M1	1	Twist together with wire no. 253 ▷8	4
302	24	S1	2	S6	3		5
303	24	S1	4	F5	Side		5
304	24	S1	5	F6	Side		5
305	24	S1	6	F9	Side		5
306	24	S1	7	F7	Side		5
307	24	S1	10	F12	Side		5
308	24	S1	11	F3	Side		5
309	24	S1	12	F4	Side		5
310	24	S1	13	S3	5 Swgr		5
311	24	S1	18 Swgr	R14	E20		5
312	24	S3	2	Bus bar	E $\frac{15}{17}$		5
313	24	S3	2	S7	2		5
314	24	S5	6	Bus bar	E18		5
315	24	S5	4	S1	3		5
316	24	S7	3	S6	3		5
317	20	Bus bar	E $\frac{15}{17}$	J21	Shld		4
331	24	S7	2	S9	2		5
342	18	J108	5	Bus bar	E $\frac{6}{19}$	▷10	3
343	18	J108	6	J7	EE	↕	3
344	20	J108	1	TB3	4	} Twist together	4
345	20	J108	2	TB1	27	▷10	4

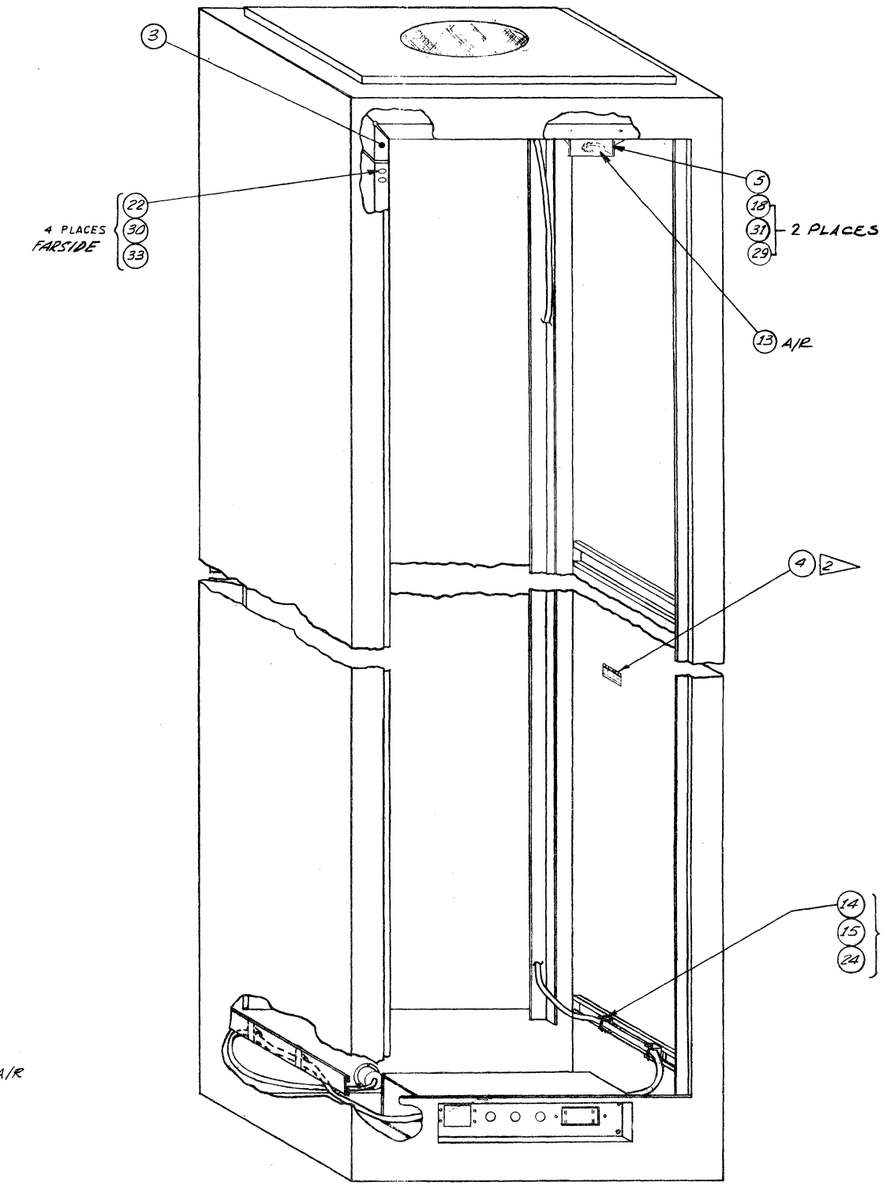
CHANGED: 15 MARCH 1978

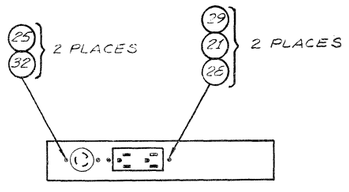
LIST OF MATERIALS 1802789

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01
1	1247259-04		Rack, system mtg	1
2	1248099-02		Power chassis cover	1
3	1250763-01		Brace, rack cabinet	1
4	1251523-01		Label, identification	1
5	1252300-01		Bracket, stay	1
6	1254747-01		Power chassis assembly	1
7	1802795-01		Fan assembly	1
12	145-637		Connector, pwr plug, 3 soc	1
13	260-052		Grommet, caterpillar	a/r
14	302-356		Mtg plate, strap	4
15	302-366		Cable tie	4
18	470-017		Screw, cap, hex soc, 6-32 x .31	2
19	470-019		Screw, cap, hex soc, 6-32 x .44	4
20	471-069		Screw, pan hd, xrec, 6-32 x .38	3
21	471-070		Screw, pan hd, xrec, 6-32 x .44	7
22	471-087		Screw, pan hd, xrec, 10-32 x .38	4
23	471-606		Screw, truss hd, xrec, 6-32 x .25	4
24	472-487		Screw, pan hd, xrec, 1/4-20 x .50	4
25	475-044		Screw, pan hd, xrec, 8-32 x .38	2
28	496-005		Nut, hex, keps, 6-32	10
29	501-009		Washer, flat, #6	16
30	501-011		Washer, flat, #10	4
31	502-003		Washer, lock, spring, #6	6
32	502-004		Washer, lock, spring, #8	2
33	502-005		Washer, lock, spring, #10	4
34	502-014		Washer, lock, ext tooth, #6	1
			Items not used: 8,9,10,11,16,17,26,27	

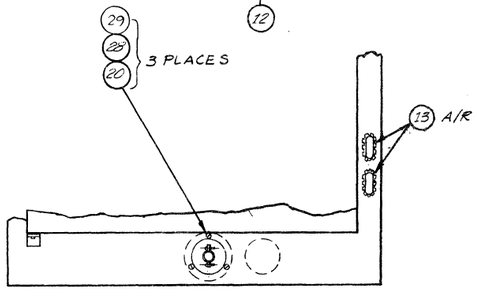








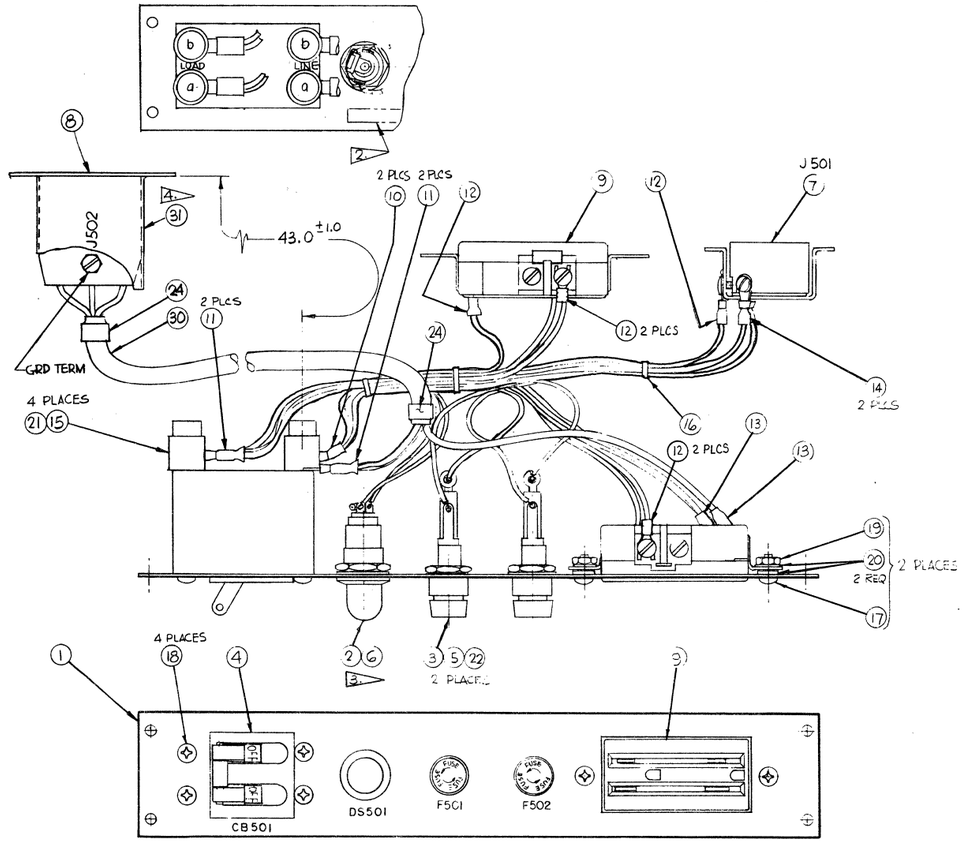
VIEW **B-B**



VIEW **A-A**

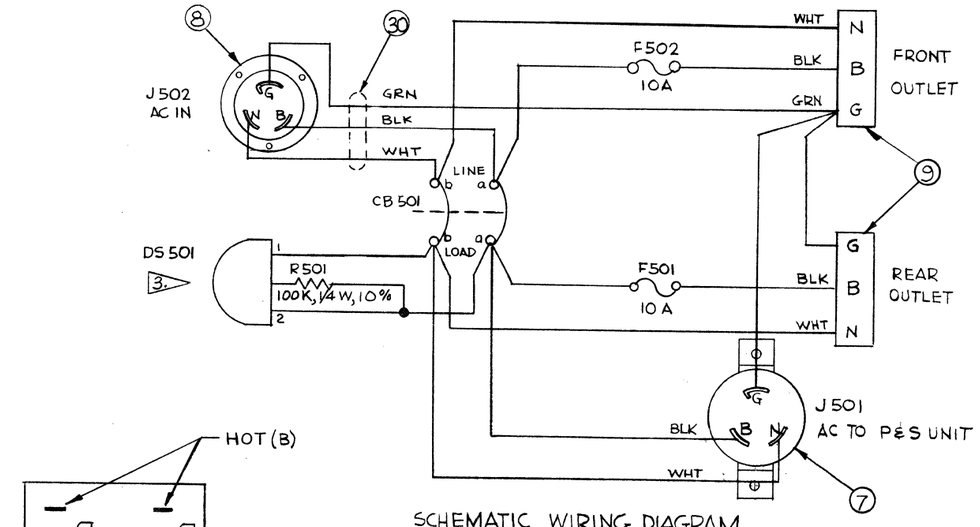
NOTES:

1. ASSY/CATALOG NO. IS 1802789-01.
2. MARK IDENTIFICATION LABEL (ITEM 4) WITH CATALOG NUMBER, SERIAL NUMBER, MODEL NUMBER ETC., PER MIL-STD-130, AND INSTALL APPROX. WHERE SHOWN.
3. ON BOTH FRONT AND REAR RAILS, CONFIRM DIMENSIONS SHOWN.

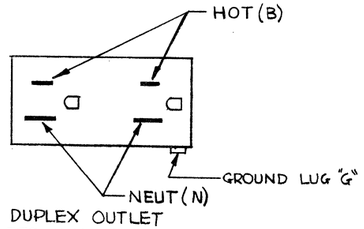


NOTES:

1. ASSY NO. IS 1254747-01.
2. MARK ASSY APPROX WHERE SHOWN PER MIL-STD-130.
3. RESISTOR R501 IS SUPPLIED WITH LIGHT FIXTURE, ITEM 6.
4. CUT 2.0 LG. PIECE OF SLEEVING, ITEM 31, MARK "J502" AND SLIP OVER ITEM 8, DO NOT SHRINK IN PLACE.



SCHEMATIC WIRING DIAGRAM
(ALL ITEM NO'S ARE REFERENCE)



DUPLEX OUTLET
TERMINAL DIAGRAM

LIST OF MATERIALS 1254747A

ITEM NO.	AMPEX PART NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QTY PER UNIT -01		
1	1248622-03		Panel, front	1		
2	060-008	DS501	Lamp, neon	1		
3	070-041	F501,502	Fuse, cartridge, 10A fast blow	2		
4	126-018	CB501	Circuit breaker, 25 amp, 2 pole	1		
5	130-013		Fuseholder	2		
6	132-044		Light fixture, indicator, neon	1		
7	145-581	J501	Connector, recp outlet, 3 female cont	1		
8	145-640	J502	Connector, recp, 3 male contacts	1		
9	149-055		Outlet, duplex recp, 3 female cont	2		
10	171-007		Terminal lug, crimp #10 stud, 16-14 AWG	2		
11	171-016		Terminal lug, crimp #10 stud, 12-10 AWG	4		
12	171-018		Terminal lug, crimp #8 stud, 16-14 AWG	6		
13	171-082		Terminal lug, crimp #8 stud, 12-10 AWG	2		
14	172-218		Terminal lug, crimp #8 stud, 16-14 AWG	2		
15	267-023		Insulator cap, binding post	4		
16	296-004		Cord, lacing, black	a/r		
17	471-452		Screw, truss hd, xrec drive, #6-32 x .375 lg, scp	2		
18	471-606		Screw, truss hd, xrec drive, #6-32 x .250 lg, sst	4		
19	496-005		Nut, hex, captive washer, #6-32, scp	2		
20	501-009		Washer, plain, #6, scp	4		
21	502-027		Washer, lock, int tooth, #10, scp	4		
22	502-064		Washer, lock, int tooth, 1/2" wnp	2		
24	600-097		Sleeving, shrink, .750/.375 blk	a/r		
25	611-010		Wire, strd, ins, 20 AWG, wht	a/r		
26	611-158		Wire, strd, ins, 14 AWG, blk	a/r		
27	611-160		Wire, strd, ins, 14 AWG, wht	a/r		
28	611-256		Wire, strd, ins, 20 AWG, blk	a/r		
29	611-498		Wire, strd, ins, 14 AWG, grn	a/r		
30	616-042		Cable, 3 cond, 12 AWG, neo jkt	a/r		
31	600-117		Sleeving, shrink, 2.00/1.00 blk	a/r		

Item not used: 23

WIRE LEAD LIST 1254747A

WIRE NO.	AWG/ COLOR	FROM REF DES	FROM TERM	TO REF DES	TO TERM	REMARKS	LM ITEM NO. -01		
1	14/5	J501	G	Ac outlet front	G		29		
2	14/9	J501	N	CB501	Load b		27		
3	14/0	J501	B	CB501	Load a		26		
4	12/5	J502	G	Ac outlet front	G		30		
5	12/0	J502	B	CB501	Line a		30		
6	12/9	J502	N	CB501	Line b		30		
7	14/0	Ac outlet rear	B	F501	Side		26		
8	14/0	F501	Tip	CB501	Load a		26		
9	14/0	CB501	Line a	F502	Tip		26		
10	14/0	F502	Side	Ac outlet front	B		26		
11	14/9	CB501	Line b	Ac outlet front	N		27		
12	20/9	CB501	Load b	DS501	1		25		
13	20/0	CB501	Load a	DS501	2		28		
14	14/5	Ac outlet rear	G	Ac outlet front	G		29		
15	14/9	Ac outlet rear	N	CB501	Load b		27		

SECTION 8
PREVENTIVE MAINTENANCE

SECTION 8

PREVENTIVE MAINTENANCE

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SECTION 8
PREVENTIVE MAINTENANCE

Complete preventive maintenance procedures for the FR-3000 Tape Transport are included in Section 6 of the applicable operator/system manual. See Ampex manual 1802852 for the FR-3010, or 1802853 for the FR-3020.

SECTION 9
ADJUSTMENT PROCEDURES

SECTION 9

ADJUSTMENT PROCEDURES

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LIST OF ILLUSTRATIONS

LIST OF TABLES

GENERAL

This section gives procedures for the adjustment of the FR-3000 tape transport. When any non-catastrophic malfunction of the transport is noted, the applicable adjustment procedure(s) should be performed before assuming the presence of defective components.

±12V, +5V REGULATOR ADJUSTMENT

The ±12V regulator and its included +5V regulator are the only adjustable power supplies in the FR-3000 transport. To adjust the output of the regulators, proceed as follows:

a. Connect a digital voltmeter to the TEST SELECTOR output jack (bnc connector) on the power and servo chassis test panel.

b. Turn the TEST SELECTOR switch to the -12V position.

c. Press the POWER pushbutton on the control unit to turn power on.

d. Adjust R23 on the ±12V regulator pwa P104 (see Figure 9-1) for -12 (±0.2)V. (If the regulator will not adjust to within tolerance, use normal troubleshooting techniques to solve the problem).

e. When the -12V is adjusted to within tolerance, turn the TEST SELECTOR switch to the +12V position. Since the +12V tracks the -12V, the reading should be +12(±0.5)V. (A slight readjustment of R23 may be made to bring the +12V within tolerance, so long as it does not put the -12V out of tolerance.) If the +12V is not within tolerance, but the -12V is, troubleshoot the +12V circuit of the regulator. If both measurements are within tolerance, this adjustment is completed.

f. Turn TEST SELECTOR switch to the +5V position.

g. Adjust R33 on the ±12V regulator pwa (see Figure 9-1) to read +5(±0.25)V.

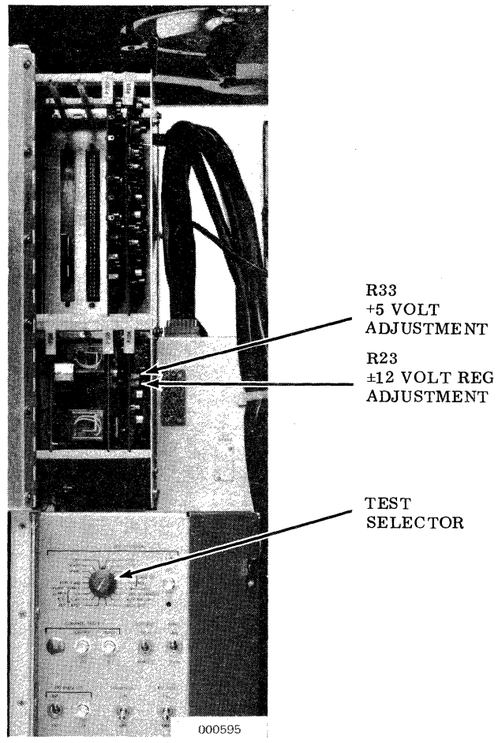

Figure 9-1. Voltage Regulator Adjustment Points

REEL SERVO ADJUSTMENT

The reel servo should be adjusted before the capstan servo is adjusted. This is necessary because of the interconnection of the two servo systems.

TENSION BALANCE ADJUSTMENT

To adjust the tension balance control of the reel servo, proceed as follows:

a. Load and thread a full reel of tape on the transport. Turn power on.

b. Each reel of tape must be half full for this adjustment. Move the tape in fast mode so that each reel is half full.

c. Remove the dust cover from the upper reel servo mda assembly.

d. With a tape speed of 3-3/4 ips selected, check the vacuum gage (inside the transport cabinet) for a reading of 11 to 12 inches of water. If necessary, adjust T601 so that this reading is obtained.

e. In the stop/ready mode, while visually observing the upper reel, move switch S1 on the upper reel servo pwa (see Figure 9-2) down and up several times. If the tension balance adjustment potentiometer (R28) is set correctly, there is no movement of the tape reel; i.e., motor torque is equal and opposite to the effect of the vacuum drawing tape into the chamber. If no movement is observed, no adjustment is necessary. Set S1 to the up position and proceed to step g. If there is movement, proceed to step f.

f. If movement is observed, adjust R28 until there is no movement while switching S1 down and up several times. When the adjustment is complete, set S1 to the up position.

g. Repeat steps a through e or f for the lower reel servo mda assembly. Then proceed to the photocell amplifier adjustment.

PHOTOCELL AMPLIFIER ADJUSTMENT

To adjust the photocell amplifier of the reel servo, proceed as follows (refer to Figure 9-2):

a. To be sure to achieve satisfactory results from this procedure, clean the vacuum chamber first. Refer to the applicable operator/system manual (e.g., Ampex 1802852 or 1802853) for the cleaning procedure.

b. Connect the oscilloscope to TP1 and to ground (TP4) on one of the reel amplifier boards (P401). Set the vertical gain on the oscilloscope to 5V/cm and switch it to the dc position. Set S1 to the down position.

c. Manually move the reel associated with the amplifier being tested, and observe that the trace varies vertically as the depth of the tape loop in the vacuum chamber changes. Maximum tape in the chamber should result in a maximum negative excursion of the trace; minimum tape in the cham-

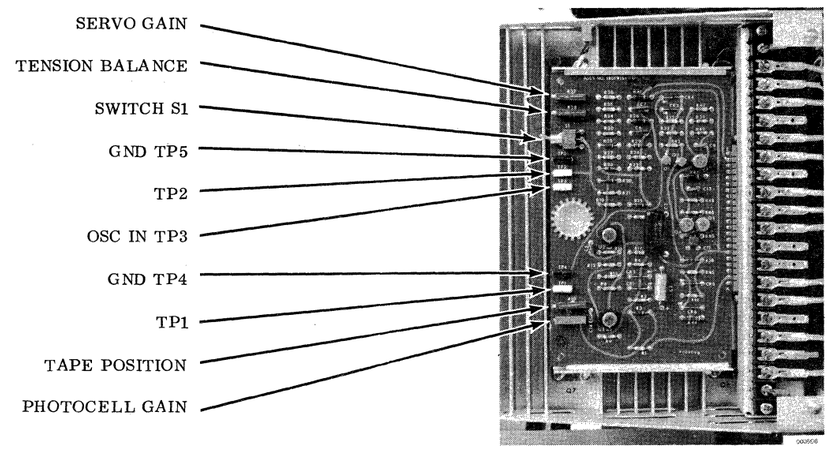

Figure 9-2. Reel Servo Adjustment Points

SECTION 9
ADJUSTMENT PROCEDURES

ber should result in a maximum positive excursion of the trace. Check for a +8V to -8V(±1.0V) excursion. If the levels are correct, set S1 to the up position and then check the other servo board by doing steps a, b and c. If the levels are not correct, proceed with steps d, e and f.

d. Adjust tape position control R10 on the reel amplifier board to make the positive and negative excursions of the trace equal on either side of the 0V reference.

e. Adjust photocell gain control R5 so that the excursion of the trace is from +8V to -8V(±1.0V).

f. Open shorting switch S1 on the reel amplifier board (toggle in up position).

g. Repeat the procedure on the other reel servo board.

If all the adjustments performed on the two reel servo boards were satisfactory, both reel servos should now be operating with the tape loops near the center of the vacuum chamber.

REEL SERVO LOOP GAIN ADJUSTMENT

To adjust the servo loop gain to its proper setting, proceed as follows:

a. For this adjustment 14 inch reels are required, each reel half full of tape.

b. Connect an oscillator to the oscillator input test point TP3 on one of the reel servo boards. Ground is available at TP5.

c. Turn the power on. When the vacuum pressure in the vacuum chambers is adequate, initiate the forward reproduce mode at a tape speed of 3-3/4 ips.

d. With an oscilloscope connected to TP1, monitor and adjust the oscillator for an 8 Hz signal for 1 inch tape or an 12 Hz signal for 1/2 inch tape at an output level of 1-2V rms.

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e. Note the voltage swing at TP1. Connect the oscilloscope to TP2. The voltage swing at TP1 should be twice that at TP2. If it is not, adjust servo gain control R37 until a 2:1 ratio is reached. The voltage values may change during this adjustment, but the object of the adjustment is the 2:1 ratio.

f. Repeat the above procedure for the other reel servo board.

g. Replace the dust cover on each reel servo mda assembly.

CAPSTAN SERVO ADJUSTMENT

In order to adjust the capstan servo, the following test equipment is required:

a. An oscilloscope with 15 MHz response and 5.0 mV/division sensitivity.

b. A capstan servo extender card, Ampex 1254600.

This procedure assumes a working system. Only misadjustment of R267 (ramp gain) and R180 (anti-reverse) can cause malfunctioning at 1-7/8 ips or below. Therefore, these adjustments are made first. For a schematic diagram, assembly drawings, etc., of the capstan servo, see Section 5 of this manual. See Figures 9-3, 9-4, and 9-5 in this section for location of components.

PRELIMINARY ADJUSTMENTS

On capstan servo printed wiring assembly (pwa) A1 (Figure 9-3) adjust potentiometer R117 (l-e-d current) fully cw (Figure 9-4). Adjust R180 (anti-reverse) fully cw. Place jumper JPR102 in the N position (between E104 and E105).

RAMP SOURCE VOLTAGE ADJUSTMENT

a. With transport power off, remove capstan servo pwa A2 from the servo card cage. Place the pwa on the extender card (Ampex 1254600) and plug the extender into the connector for A2.

b. With the transport in stop mode, use a dc voltmeter or oscilloscope to monitor between TP205 and COM (Figure 9-5).

c. Adjust potentiometer R284 for a reading of +2V.

d. Turn off transport power. Remove the extender and pwa. Replace the pwa in its position.

RAMP GAIN ADJUSTMENT

a. With transport power off, put pwa A1 on the extender and plug the extender into the position for A1.

b. Put the transport into the stop mode.

c. Monitor TP107 (signal) and TP106 (ground) with an oscilloscope.

d. Set the oscilloscope sweep rate to 5 μs/division, and vertical sensitivity to 100 mV/division.

e. Select 1-7/8 ips and switch into forward mode.

f. Until R180 (anti-reverse) is correctly adjusted, this command may cause the capstan to run slowly in the reverse direction. To obtain normal operation, stop the capstan puck with your hand. Then release it. The capstan should now run in the correct direction, but not necessarily in sync until R267 (ramp gain) is correctly adjusted. If R267 is at one of its extreme positions, the capstan may not run at all in the correct direction at the selected tape speed. In this case, switch successively to higher tape speeds until sync is achieved. Then slightly readjust R267 to obtain sync at successively lower tape speeds until 1-7/8 ips is reached.

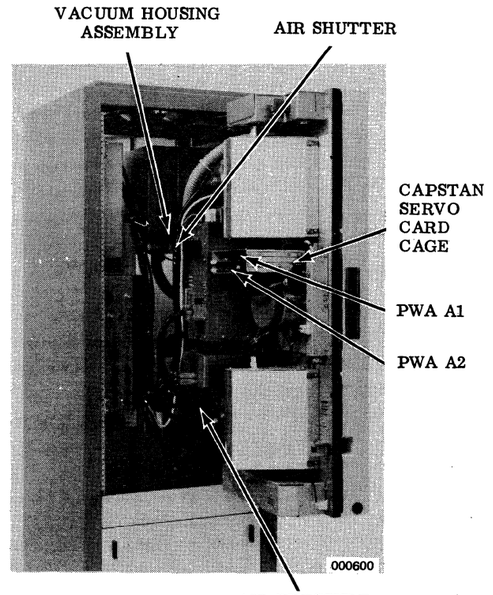

Figure 9-3. Component Locations

g. With the oscilloscope set as in step d, adjust the setting of R267 (ramp gain) on pwa A2 to obtain the display indicated in Figure 9-6. (The figure does not indicate either the total ramp amplitude or duration. The object of the adjustment is to assure that the ramp reaches an amplitude of 400 mV in 25 μs.)

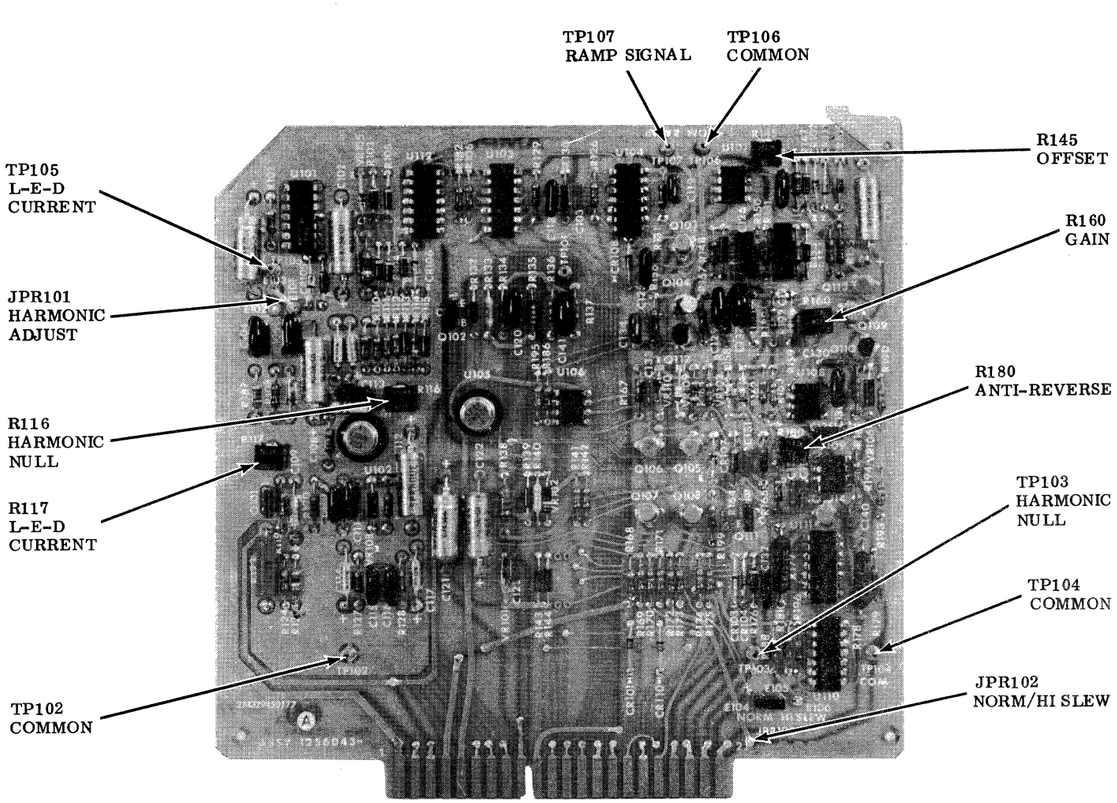

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Figure 9-4. PWA A1

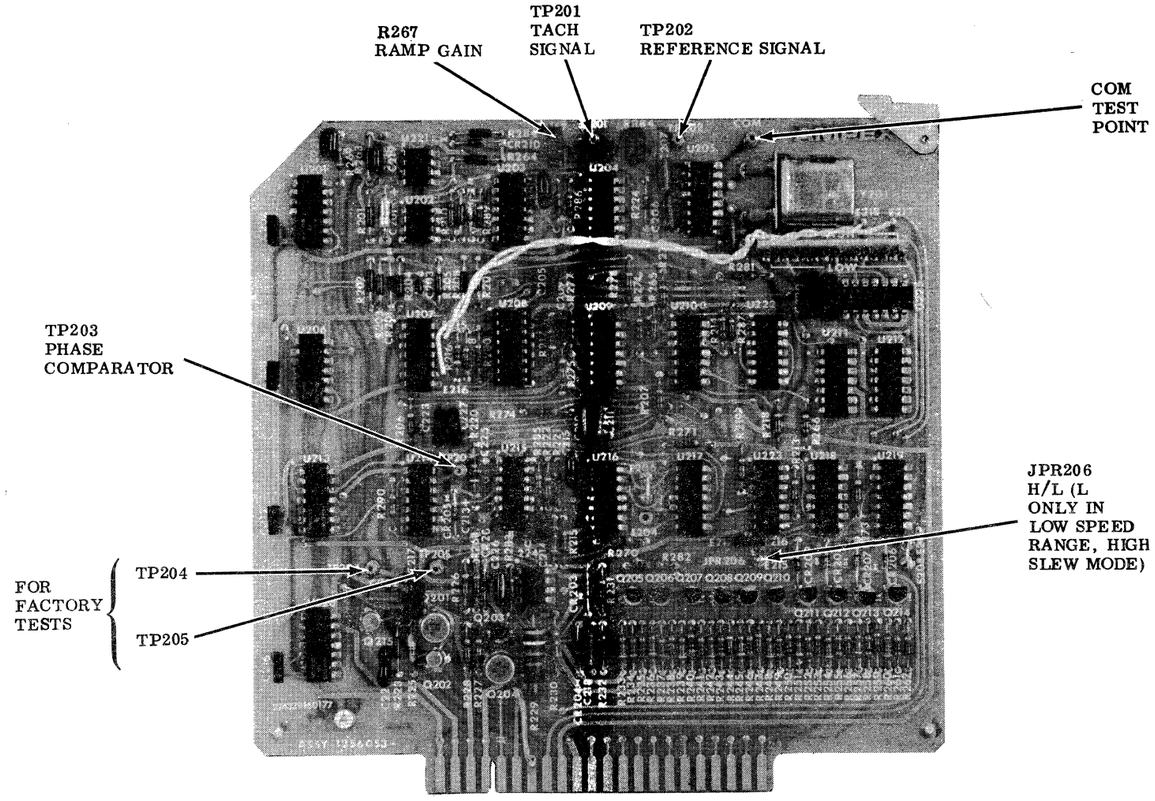

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Figure 9-5. PWA A2

ANTI-REVERSE ADJUSTMENT

a. Extend pwa A1. Turn on transport power.

b. Select the second lowest tape speed (3-3/4 ips in high range, 1-7/8 ips in low range). Select forward mode.

c. If the capstan runs forward, turn it in the reverse direction by hand until it runs in the reverse direction.

d. When the capstan is running in the reverse direction, slowly turn R180 ccw until the capstan stops and then runs forward. Advance R180 1/8 turn ccw from the point at which the capstan starts to run forward. This completes the procedure.

OFFSET ADJUSTMENT

a. With the oscilloscope, monitor test points TP107 (signal) and TP106 (ground).

b. Select forward mode at 60 ips. As necessary, adjust potentiometer R145 (offset) for a ramp height of 600 mV 0-to-peak. Stop the tape. Leave A1 on the extender.

L-E-D CURRENT ADJUSTMENT

a. With A1 still on the extender, use the oscilloscope to monitor test points TP105 (signal) and TP102 (ground).

b. Select forward mode at 1-7/8 ips.

c. As necessary, adjust potentiometer R117 (l-e-d current) for a 3V p-p sine wave. Leave the transport in forward mode at 1-7/8 ips, and perform the following harmonic null adjustment.

HARMONIC NULL ADJUSTMENT

a. With the transport still in forward mode at 1-7/8 ips, monitor test points TP103 (signal) and TP104 (ground).

b. As necessary, adjust potentiometer R116 (harmonic null) for the correct waveform as shown in Figure 9-7.

NOTE

If this adjustment cannot be made to produce the correct waveform, remove jumper JPR101 from its position between terminals E101 and E103, and install it between E101 and E102. Then perform step b, above, again.

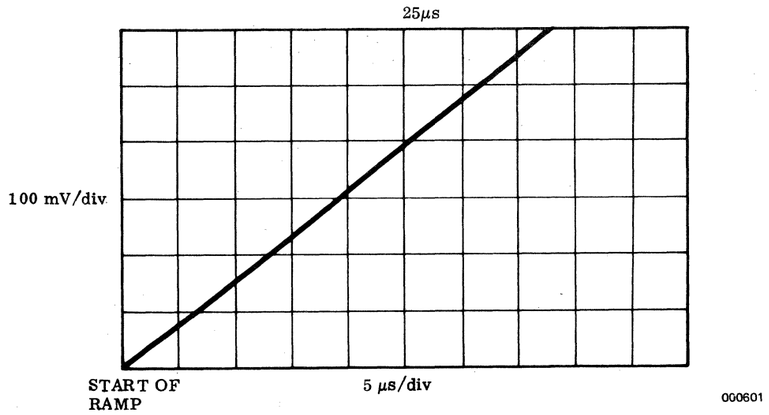
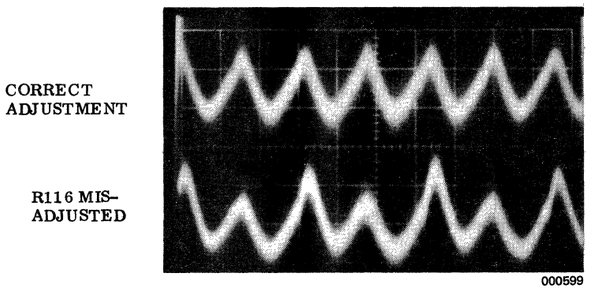


Figure 9-6. Ramp Gain Waveform



V = 20 mV/div H = 200 μs/div

Figure 9-7. Harmonic Null Adjustment Waveforms

TACH MODE GAIN ADJUSTMENT

a. Extend pwa A2. With the oscilloscope, monitor test point TP203 (phase comparator) and the test point marked COM (common).

b. Select the lowest tape speed and forward mode. Employing negative sync, adjust the oscilloscope to view one phase-comparator waveform.

c. Observe the trailing edge of the phase-comparator waveform. Adjust R160 (gain) on board A1 for minimum time variation of the trailing edge of the waveform. This completes the capstan servo adjustment procedure.

TAPE MODE GAIN ADJUSTMENT

For gain adjustment in tape-sync mode, set R160 either for minimum flutter or minimum time-base error (tbe), according to the requirements of the data to be reproduced.

HIGH SLEW MODE

No special adjustments are required in the high-slew mode. However, to check for operation in this mode, move jumper JPR102 on board A1 to the HI SLEW position (between terminals E105 and E106). If the low speed range, 15/16 ips to 60 ips, is selected, place jumper JPR206 on board A2 in the L position (between E215 and E216). (If the high speed range 1-7/8 ips to 120 ips, is selected, leave JPR206 in the H position -- between E216 and E217.) In the high-slew mode, the capstan should go into sync at tape speeds of 7-1/2 ips to the highest speed selectable. Speeds below 7-1/2 are locked out.

VACUUM (TAPE TENSION) ADJUSTMENT

Tape tension is a function of the vacuum; therefore, it is important to obtain the correct vacuum setting. Tape tension is correct when the tape pack is correct in all modes of operation, i.e., neither too loose or too tight. Too loose a pack may be defined as one which will slip when a pull of less than 30 ounces is applied to the tape end. A pack which is too tight is one which shows signs of edge curl or spoking.

When the vacuum is adjusted to obtain the 6 speed nominal reading on the vacuum gage (see Table 9-1 or Table 9-2), the tape tension is set at a nominal value for tape speeds from 1-7/8 to 60 ips. If the equipment is to be operated exclusively at a specific tape speed, refer to Table 9-1 or 9-2 for the amount of vacuum required to obtain optimum tape tension at the tape speed desired. Table 9-1 or 9-2 also lists the vacuum required to obtain nominal tape tension for a group of two or three adjacent tape speeds. If such a group of speeds is to be used predominantly, set the vacuum accordingly. If the tape pack is too tight or too loose (this could be caused by equipment being moved to a radically different altitude, or by severe power-source voltage changes), optimization of tape tension may be obtained by increasing the amount of vacuum (if tape packing is too loose) or by decreasing the amount of vacuum (if tape packing is too tight).

The vacuum system should be adjusted properly before the transport pulls tape. To adjust the vacuum system, proceed as follows:

a. Check that the vacuum hose is clamped securely to the vacuum housing and to the transport.

b. Set the HIGH-NORMAL VACUUM switch (S101) on the vacuum housing to NORMAL.

NOTE

With S101 set at NORMAL, full ac line voltage is applied to the vacuum blower motor. For the highest record/reproduce tape speed (120 ips or 60 ips) plus scan and fast, vacuum pressure is adjusted by setting the air valve shutter. At lower tape speeds, the ac voltage is applied through variable autotransformer T601, which sets the vacuum pressure. With S101 set at HIGH, line voltage to the blower motor is boosted for extra vacuum capability (as required for high altitude locations or other conditions that require additional vacuum).

c. Set the air valve shutter, on the vacuum plenum chamber beneath the blower, to the approximate position shown in Figure 9-8A.

d. Thread tape on the transport and position tape loops in the vacuum chambers as shown in Figure 9-8B. The loops will not stay in position, but after power is turned on and vacuum develops, the loops will pull into position.

e. Set variable autotransformer T601 to 80 as indicated on its dial.

f. Vacuum switch S202 is mounted directly behind the vacuum chamber on the rear of the tape transport, and is adjusted from the transport edge. Loosen the locknut and turn the adjustment screw ccw until it is held in the switch by only a few threads. (See Figure 9-8C.)

g. The STOP/READY pushbutton lamp should light when power is turned on and the nominal vacuum level is reached.

h. Select the highest record/reproduce tape speed on the local control unit.

i. Set the air valve shutter (see Figure 9-8A) for a vacuum gage reading equal to the maximum reading given in Table 9-1 (low speed range transports) or Table 9-2 (high speed range transports).

j. Select the next lower tape speed. The STOP/READY lamp should be on.

k. Adjust variable autotransformer T601 for a

vacuum gage reading of 8-1/2 inches of water. The STOP/READY light may be on or off.

1. If the STOP/READY lamp is on, turn the adjustment screw on S202 clockwise until the STOP/READY lamp just goes out.

2. If the STOP/READY lamp is out, turn the adjustment screw on S202 counterclockwise until the lamp comes on, then readjust it clockwise until the lamp just goes out.

l. To check the setting of S202, readjust transformer T601 for a vacuum reading of 11-1/2 inches of water (the STOP/READY light should be on). Slowly reduce the vacuum (by adjusting T601) until the STOP/READY light goes out. Vacuum reading should be 8-1/2(±1/2) inches of water. A slight readjustment of S202 may be necessary to achieve these results. Repeat this step as required.

m. Tighten the locknut on S202 and reset T601 to the applicable vacuum setting of Table 9-1 or 9-2.

NOTE

For convenience and correctness in making future adjustments and in making performance checks, it is recommended that the column of values chosen for use with your machine be marked. (The tables provide for such marking.) This should be done both here, and in the applicable operator/system manual (e.g., Ampex 1802852 for the FR-3010, and 1802853 for the FR-3020).

Table 9-1. Recommended Vacuum Settings for Low Speed Range

Tape Speed (ips)	VACUUM (Inches of Water)		
	1 Speed	2 or 3 Speed Nominal	6 Speed Nominal
15/16	11	11	11-1/2
1-7/8	11		
3-3/4	11-1/2	12	
7-1/2	12		
15	13	13	
30	13-1/2		
60	14	14	14
MARK (X or ✓) COLUMN TO BE USED			

Table 9-2. Recommended Vacuum Settings for High Speed Range

Tape Speed (ips)	VACUUM (Inches of Water)		
	1 Speed	2 or 3 Speed Nominal	6 Speed Nominal
1-7/8	11	11	11-1/2
3-3/4	11-1/2		
7-1/2	12	12	
15	13		
30	13-1/2	14	
60	14		
120	15-1/2	15-1/2	15-1/2
MARK (X or ✓) COLUMN TO BE USED			

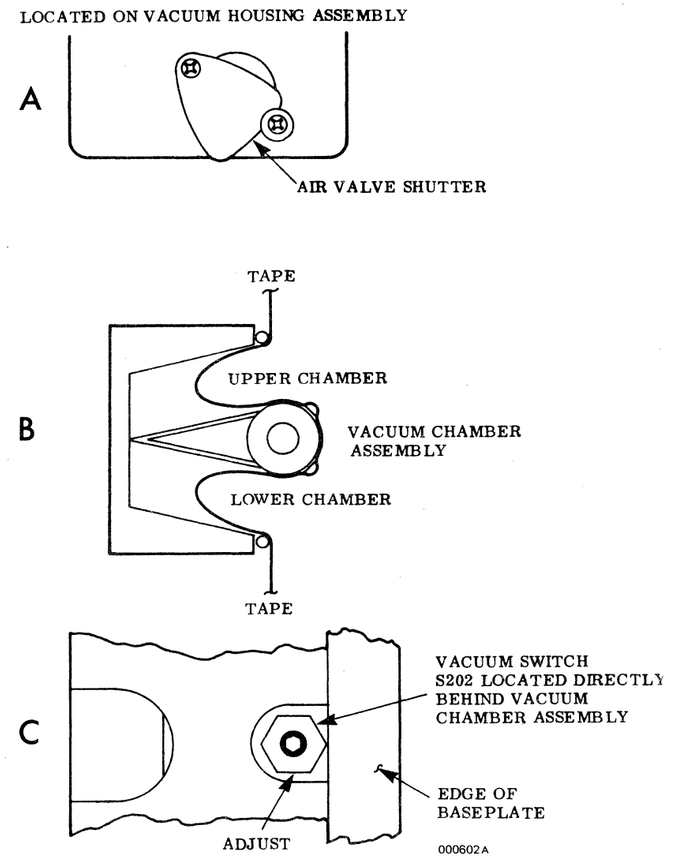


Figure 9-8. Vacuum Adjustments

AIR COMPRESSOR
END-OF-TAPE AND SEQUENTIAL

AIR COMPRESSOR ADJUSTMENT

Use the following procedure to adjust the air compressor. (See Figure 9-3.)

a. Thread tape in the normal pattern. Turn on transport power.

b. Allow a moment for the air pressure to build up and stabilize.

c. Set the air pressure adjustment screw next to the air pressure gage for a reading of 1.5 to 2 psi on the gage. This completes the procedure.

END-OF-TAPE AND SEQUENTIAL ADJUSTMENT

There are two end-of-tape (eot) photosense assemblies and one sequential photosense assembly. The sequential photosense assembly and one of the eot photosense assemblies are mounted on the upper lefthand corner of the tape transport just below the footage counter compartment. The other eot photosense assembly is mounted on the lower lefthand corner of the tape transport just above the voice monitor compartment. The exciter lamp housings (one upper and one lower) are mounted on the hinge side of the tape transport. The housings are identical, but the lower one is inverted as compared to the upper one (see Figure 9-9).

NOTE

If the exciter lamps have not been replaced since the last adjustment of the eot sensors, no adjustment of the lamp in its housing should be necessary. However, if a lamp is being replaced, or if light seems to be insufficient, perform the lamp adjustment which is given as part of the lamp replacement procedure in Section 11 of this manual.

LOWER END-OF-TAPE ADJUSTMENT

Align the lower end-of-tape (eot) lamp assembly and photosensor as follows:

a. Adjust the lower lamp assembly plate so that the retaining screws are centered in the slots. (See Figure 9-9.) Tighten the retaining screws lightly.

b. Remove the lower eot photosense assembly (photosensor) cover (two screws). Loosen the mounting screw of the photosensor and move the sensor so that the mounting screw is centered in the slot. Tighten the screw lightly. (The sensor will be adjusted further.)

c. Install a full reel of tape in the upper (supply-reel) position. Thread the tape, turn on power, select fast forward mode, and wind a pack of tape approximately 1/16-inch thick onto the take-up reel, as shown in Figure 9-9, then select stop mode.

d. Connect an oscilloscope to monitor TP1 (white, eot photocell) and TP5 (black, ground) on P102 (the accessory pwa) located in the power and servo chassis.

e. Adjust potentiometer R72 (lower eot) of P102 fully ccw.

f. While monitoring TP1, adjust the photosensor for maximum negative voltage while maintaining the position of the mounting screw in the center of the slot. Tighten the mounting screw.

g. Reinstall the lower eot housing cover (two screws).

h. Monitor TP1 and adjust R72 (lower eot) on P102 for approximately -0.1V on the oscilloscope.

i. Check eot operation: Set the EOT switch on the control unit to ON. Wind approximately 1/2 inch of tape onto the takeup reel. Then select fast reverse mode. The transport should stop with a sufficient amount of tape still on the takeup reel to positively prevent unintentional unwinding of the tape from the reel.

j. If more tape is required on the takeup reel, loosen the lower lamp assembly plate and move it down approximately 1/16-inch. Repeat step i to check for proper operation.

k. Be sure the lamp assembly mounting screws are securely tightened.

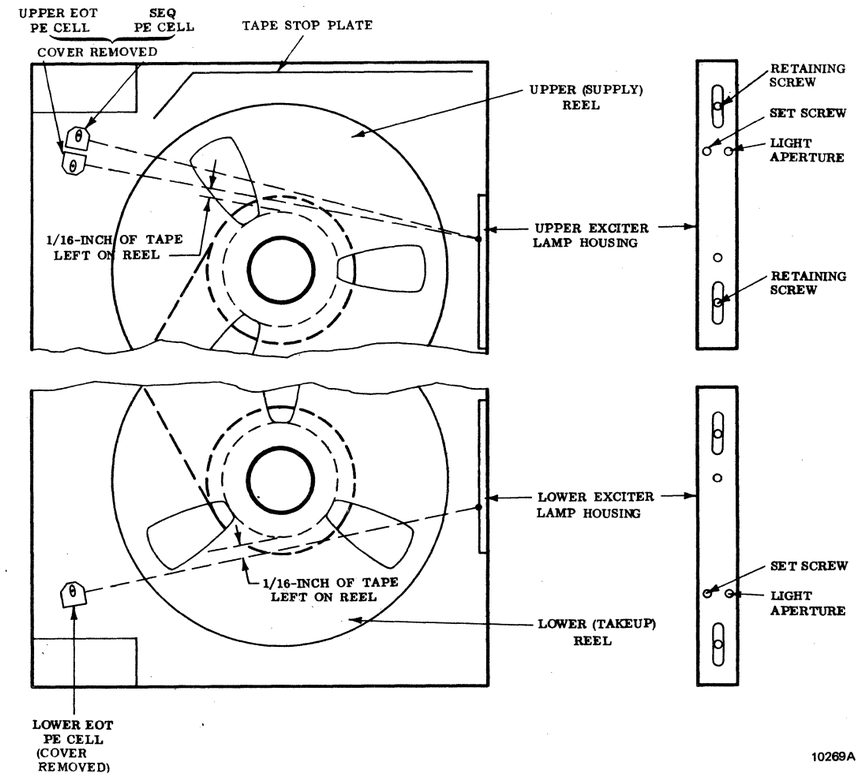


Figure 9-9. EOT and Sequential Sensor Adjustment

UPPER END-OF-TAPE ADJUSTMENT

Align the upper eot lamp assembly and photosensor as follows:

a. Adjust the upper lamp assembly plate so that the retaining screws are centered in the slots. (See Figure 9-9.) Lightly tighten the retaining screws.

b. Remove the upper eot photosensor cover, and loosen the mounting screws of the eot and sequential sensors. Move the sequential sensor fully up and lightly tighten the mounting screw. Move the eot sensor so that the mounting screw is centered in the slot. Lightly tighten the mounting screw.

c. Install a full reel of tape in the takeup (lower) reel position and use fast reverse mode to wind approximately a 1/16-inch pack of tape onto the empty reel in the supply-reel position, as shown in Figure 9-9. Stop the tape.

d. Connect an oscilloscope to monitor TP1 (white, eot photocell) and TP5 (black, ground) on P102 (accessory pwa) in the power and servo chassis.

e. Adjust potentiometer R71 (upper eot) on P102 fully ccw.

f. While monitoring TP1, adjust the photosensor for maximum negative voltage while maintaining the position of the mounting screw in the center of the slot. Tighten the mounting screw. Move the sequential photosensor down to touch the eot sensor. Tighten the mounting screw.

g. Reinstall the upper eot sensor cover.

h. Monitor TP1 and adjust R71 (upper eot) for a reading of approximately -0.1V on the oscilloscope.

i. Check eot operation: Set the EOT switch on the control unit to ON. Wind a pack of tape approximately 1/2 inch thick onto the supply (upper) reel. Select fast forward mode. The transport should stop with a sufficient amount of tape on the supply reel to positively prevent unintentional unwinding of the tape from the reel.

j. If more tape is required on the supply reel, loosen the upper lamp assembly plate and move it up approximately 1/16 inch. Repeat step i to check for proper operation.

k. Be sure the lamp assembly mounting screws are securely tightened.

SEQUENTIAL ADJUSTMENT

Align the sequential photosensor as follows:

a. The upper eot photosensor must be aligned prior to alignment of the sequential photosensor. See step f of the upper eot photosensor adjustment procedure (preceding) for the proper positioning of the sequential photosensor.

b. Install and thread a full reel of tape in the takeup (lower) reel position and wind approximately 1/2 inch of tape onto the empty reel in the supply reel position.

c. With the control unit EOT switch in the ON position, select fast forward mode. The transport should stop with enough tape on the supply reel to positively prevent unintentional unwinding of the tape from the reel. (If this action does not take place, see the upper eot photosensor alignment procedure, above.)

d. Connect an oscilloscope to monitor TP3 (red, sequential photocell) and TP6 (black, ground) on P102 (the accessory pwa) in the power and servo chassis. Adjust R73 (sequential), located on P102, fully ccw.

e. Select 60 ips tape speed at the control unit. Run tape in the reverse mode for 2 minutes (±5 seconds), then select stop mode.

f. Monitor TP3 and adjust R73 (sequential) for a reading of approximately -0.1V on the oscilloscope.

g. Check the operation of the sequential circuit: Connect the oscilloscope to monitor TP4 (yellow, sequential reference) and TP6 (black, ground) on P102.

h. Set the SEQUENTIAL switch on the power and servo chassis to the ON position. Monitor TP4 of P102 and select reverse record mode. TP4 should initially be at approximately +4V. When the voltage changes to 0(±0.1)V, select stop mode. The sequential command is now reset.

i. Time the interval between the generation of the sequential command and the eot stop command: While monitoring TP4, select forward record mode, still at 60 ips. When TP4 swings from 0V to +4V, start timing. When the transport stops (eot command), stop timing. The interval should be approximately 2 minutes. This represents the redundant recording time in sequential recording at 60 ips.

j. If more time is required between the sequential command and the eot command, remove the upper eot photosensor cover (two screws). Loosen the sequential photosensor mounting screw and move the sensor up approximately 1/16 inch. Tighten the mounting screw and replace the cover. Repeat steps g through i.

SECTION 10
TROUBLESHOOTING

SECTION 10

TROUBLESHOOTING

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SECTION 10
TROUBLESHOOTING

GENERAL

This section of the manual covers troubleshooting of the FR-3000 tape transport. The purpose of troubleshooting is to find and readjust, repair, or replace a malfunctioning component in order to return a "down" transport to full service as rapidly as possible. Because of this, troubleshooting is given in this section in terms of locating blown fuses, malfunctioning circuit modules, etc., in order to identify the item that needs readjustment repair, or replacement. Valuable assistance in this phase of troubleshooting can be gained by using the power and servo chassis TEST SELECTOR switch. A complete procedure for performing checks with this switch is given in the performance check section of the applicable operator/system manual. (E.g., Section 7 of either Ampex 1802852 for the FR-3010, or 1802853 for the FR-3020.)

Table 10-1 is a general guide to troubleshooting the tape transport. It is not complete or comprehensive, but should suggest approaches to locating faults not specifically covered. In any case of trouble where it is applicable, checking of cables and other interconnects should be carefully carried out, even though not mentioned in the table.

Troubleshooting of individual modules, cables, etc., is to be done by standard circuit tracing, signal tracing, etc., and standard repair techniques, and is not detailed here. Such repairs should be supported, as required, by reference to the circuit descriptions, schematic diagrams, etc., in the descriptive sections of this manual.

Whenever possible, when a module is believed to be malfunctioning, before assuming that it is defective, perform any applicable adjustment procedures. (See Section 9 for adjustment procedures.) This eliminates the accidental misadjustment of controls or the normal aging of components as causes of fault symptoms.

FUSE REPLACEMENT

Table 10-2 lists the circuit breaker and the fuses of the FR-3000, giving the value, type, and function of each. If a fuse is replaced, it must be replaced with a fuse of the same type and rating. If a fuse blows or the circuit breaker trips, and there are obvious signs of catastrophic failure (smoke, visible or audible arcing, etc.), find and remedy the fault before replacing the fuse or resetting the circuit breaker.

If there are no signs of catastrophic failure, replace a blown fuse (or reset the tripped circuit breaker) once. If it blows (or trips) again, the defective component which is causing the overload should be identified and readjusted, repaired, or replaced before replacing the fuse (or resetting the circuit breaker) a second time.

Table 10-1. Troubleshooting Guide

SYMPTOM	POSSIBLE CAUSE	REMEDY
System power on, transport power goes off or will not turn on. Pushbuttons not lit, no vacuum, or not enough vacuum	1. One or more lamps in vacuum chamber burned out.	1. Replace lamp(s) according to procedure in Section 11
	2. Power/servo fuse F1	1. Replace fuse once
		2. Check for short on load side of F1
	3. Pilot power lost	1. Check out pilot power supply
	4. Power/servo fuse F2	1. Replace fuse once
		2. Check for short on load side of F2
	5. Main power to power/servo T1 lost	1. Check out ac power circuits to primary of T1
	6. +18V power to ±12V regulator lost	1. Replace fuse F10 once
		2. Check for short on load side of F10
		3. Check out entire +18V circuit
	7. -18V power to ±12V regulator lost	1. Replace fuse F11 once
		2. Check for short on load side of F11
		3. Check out entire -18V circuit
	8. ±12V regulator defective	1. Repair or replace ±12V regulator (P104)
	9. Vacuum housing malfunctioning	1. Adjust vacuum level setting according to procedure in Section 9
		2. Repair or replace defective vacuum housing assembly
	10. Vacuum switch S202 (on tape transport) misadjusted	1. Follow adjustment procedure in Section 9
Capstan stops (or won't start). Transport POWER light on, vacuum normal	1. Power/servo fuse F9	1. Replace fuse once
		2. Check for short on load side of F9
	2. +28V capstan power lost	1. Check out entire +28V capstan supply
Capstan "runs away," other indications normal	1. Power/servo fuse F12	1. Replace fuse F12 once
		2. Check for short on load side of F12
	2. -16V power to capstan lost	1. Check out entire capstan -16V circuit

Table 10-1. Troubleshooting Guide (Continued)

SYMPTOM	POSSIBLE CAUSE	REMEDY
Upper reel motor runs away (may happen in stop state or while tape is moving). Upper reel and vacuum may chatter	1. Power/servo fuse F3	1. Replace fuse once
		2. Check for short on load side of F3
	2. +14V power to upper reel mda missing	1. Check out entire +14V circuit
	3. Faulty upper reel mda	1. Repair or replace upper reel mda
Lower reel motor runs away (may happen in stop state or while tape is moving). Lower reel and vacuum may chatter	1. Power/servo fuse F5	1. Replace fuse once
		2. Check for short on load side of F5
	2. +14V power to lower reel mda missing	1. Check out entire +14V circuit
	3. Faulty lower reel mda	1. Repair or replace lower reel mda
Incorrect tape tension on supply side	1. Power/servo fuse F4	1. Replace fuse once
		2. Check for short on load side of F4
	2. -16V power to upper reel mda missing	1. Check out entire -16V circuit
	3. Upper reel mda faulty	1. Repair or replace mda
Incorrect tape tension on takeup side	1. Power/servo fuse F6	1. Replace fuse once
		2. Check for short on load side of F6
	2. -16V power to lower reel mda missing	1. Check out entire -16V circuit
	3. Lower reel mda faulty	1. Repair or replace mda
Transport stops while running, or fails to start when commanded, with all other indications normal	1. Power/servo fuse F7	1. Replace fuse once
		2. Check for short on load side of F7
	2. +28V power to reel brakes missing	1. Check out entire solenoid/booster +28V circuit
Tape fails to run smoothly or up to speed in fast state	1. Power/servo fuse F8	1. Replace fuse once
		2. Check for short on load side of F8
	2. +28V power to reel boost circuit missing	1. Check out entire solenoid/booster +28V circuit
	3. Accessory pwa defective	1. Repair or replace accessory pwa (P102)

Table 10-2. FR-3000 Circuit Breaker and Fuses*

LOCATION	REF	AMPS	SPEED	CIRCUIT
Power chassis panel	CB501	25		Two-pole main-power circuit breaker. All loads within the transport, plus utility outlets.
Power and servo test panel	F1	1	Slow-blow	Pilot power to primary of T2
	F2	10	Fast-blow	Main power to T1, M1, and fan
	F3	20	Fast-blow	+14V to upper reel servo mda
	F4	8	Fast-blow	-16V to upper reel servo mda
	F5	20	Fast-blow	+14V to lower reel servo mda
	F6	8	Fast-blow	-16V to lower reel servo mda
	F7	8	Fast-blow	+28V to reel motor brakes
	F8	20	Fast-blow	+28V to reel-servo boost circuit
	F9	5	Slow-blow	+28V to capstan servo mda
	F10	5	Fast-blow	+18V to ±12V regulator
	F11	5	Fast-blow	-18V to ±12V regulator
	F12	4	Fast-blow	-16V to capstan motor

*All fuses in the FR-3000 are 1/4" x 1-1/4" tubular

SECTION 11
REMOVAL AND REPLACEMENT

SECTION 11

REMOVAL AND REPLACEMENT

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LIST OF ILLUSTRATIONS

SECTION 11
REMOVAL AND REPLACEMENT

VACUUM CHAMBER

GENERAL

This section gives the procedures for field removal and replacement of components (other than plug-in items such as circuit boards and cables) of the FR-3000. Further disassembly of precision assemblies, particularly the capstan assembly, should never be performed in the field. Repair of such assemblies requires factory equipment and personnel. See Section 1 for identification of components.

INDICATOR LAMPS

CONTROL UNIT PUSHBUTTON LAMPS

There are two miniature lamps within each of the control pushbuttons. If it becomes necessary to replace one or both of these, proceed as follows:

a. Turn off transport power.

b. Remove the lens from the front of the pushbutton by pulling it straight forward. (Two small recesses in the sides of the lens give purchase for grasping it. When the lens is new, it requires considerable force to overcome the detent which holds it in place.)

c. Remove the lamp carrier by squeezing the metal prongs together vertically until the carrier is released. Take care not to drop it as it comes free.

d. Check the lamps with an ohmmeter and remove defective ones by pushing them back out of the carrier.

e. Install good #330 lamps by pushing them forward into the carrier.

f. Reinstall the carrier and lens by the reverse of the removal procedure.

OTHER CONTROL UNIT LAMPS

The fixed indicator lamps of the control unit are assemblies which must be removed and replaced from the back of the panel. Proceed as follows:

a. See Section 3, page 3-19 for the control unit list of materials identifying replacement lamp assemblies.

b. Turn off main power (CB501) and remove the four cross-recessed screws from the front of the control unit. Move the unit forward out of its housing, still connected to its cable.

c. Pull the quick-disconnect terminals from the contacts of the lamp assembly to be changed.

d. Using long-nose pliers, remove the metal clip which holds the lamp assembly in the panel hole.

e. Remove the lamp assembly from the panel.

f. Install the new lamp assembly and reinstall the control unit by reversing the above procedure.

MAIN POWER INDICATOR DS501

Main power indicator DS501 is located on the power chassis assembly front panel at the bottom front of the cabinet. This indicator is a bayonet-base NE51 neon bulb in a jeweled fixture. To replace the bulb, turn off main power (CB501) and remove the jewel from DS501 by unscrewing it. Change bulbs, and replace the jewel.

EOT LAMPS

If one of the end-of-tape (eot) lamps should require replacement, proceed as follows:

a. Turn off transport power.

b. Note the position in their slots of the two screws that hold the lamp housing assembly in place. (See Figure 9-9 on page 9-6, Section 9, of this manual.) Remove the screws.

c. Pull the lamp housing assembly out of the baseplate as far as the wires permit.

d. Remove the defective bulb (bayonet base). Make sure the light aperture is clean. Then install a known-good type 313 bulb.

e. Orient the bulb as follows:

1. Visually inspect the lamp housing assembly and ascertain that a set screw is installed in the hole on the baseplate side, adjacent to the light aperture. (See Figure 9-9.)

2. Press the POWER pushbutton to turn transport power on. Observe the lamp filament to see if the brightest part of it is next to the light aperture. If not, remove the lamp, rotate it 180°, and reinsert it into the lamp holder.

3. Loosen the lampholder mounting screw and adjust the lampholder position while observing through the light aperture. Adjust the position of the lampholder to get the greatest amount of light through the aperture. Tighten the mounting screw, taking care not to change the position of the lampholder. Turn off transport power.

f. Replace the lamp housing assembly in its place in the baseplate, and replace the mounting screws. Before tightening the screws, reposition the lamp housing assembly to the position noted in step b. Then fully tighten the screws.

g. Perform the eot performance check given in step i on page 9-6, Section 9, (lower eot) or step i on page 9-7/9-8 (upper eot).

h. If the eot performance is not satisfactory, recheck the orientation of the newly installed lamp. Then, if necessary, perform the applicable adjustment procedure in Section 9.

i. When the eot performance is satisfactory, tighten the lamp-housing mounting screws. This completes the procedure.

VACUUM CHAMBER LAMPS

To remove and replace vacuum chamber lamps, proceed as follows. (Refer to Figure 11-1 on the next page.)

a. Turn off transport power and remove the center section assembly from the vacuum chamber. (Four #4-40 hex-socket cap screws.) Unplug P402 to free the center section assembly from the vacuum chamber assembly. (See Figure 11-1 for location of the mounting screws and the connector. The assembly drawing of center section assembly 1252475 is on page 4-12 in Section 4.)

b. Remove the two pan-head screws holding the lamp-holder pwa which carries the bulb(s) that are to be replaced.

c. Unsolder the leads of the bulb(s) from the board. Be sure the holes in the board are clear of solder.

d. Insert the leads of the new bulb(s) into the vacant holes and solder them into place.

e. Replace the pwa and the center section assembly by reversing the removal procedure above.

VACUUM CHAMBER ASSEMBLY

In order to remove the vacuum chamber assembly, proceed as follows:

a. Turn off transport power. Unplug connector P211 from the back of the baseplate assembly, just behind the vacuum chamber assembly.

b. Supporting the assembly before removing the last screw, remove the three mounting screws

that hold the vacuum chamber in place. (See Figure 11-1.)

c. Pass the cable and connector P211 through the hole in the precision plate.

d. To replace the vacuum chamber assembly, reverse the above procedure.

CONTROL UNIT

To remove and replace the control unit, proceed as follows:

a. Turn off main power (CB501).

b. Remove the four cross-recessed screws from the front of the control unit. Move the unit forward out of its housing. (It is still connected to its cable at this time.)

c. To disconnect the unit, unscrew the two cross-recessed screws that hold the connector retainer blocks to the printed wiring assembly. Unplug the connector.

d. To install a control unit, reverse the above procedure.

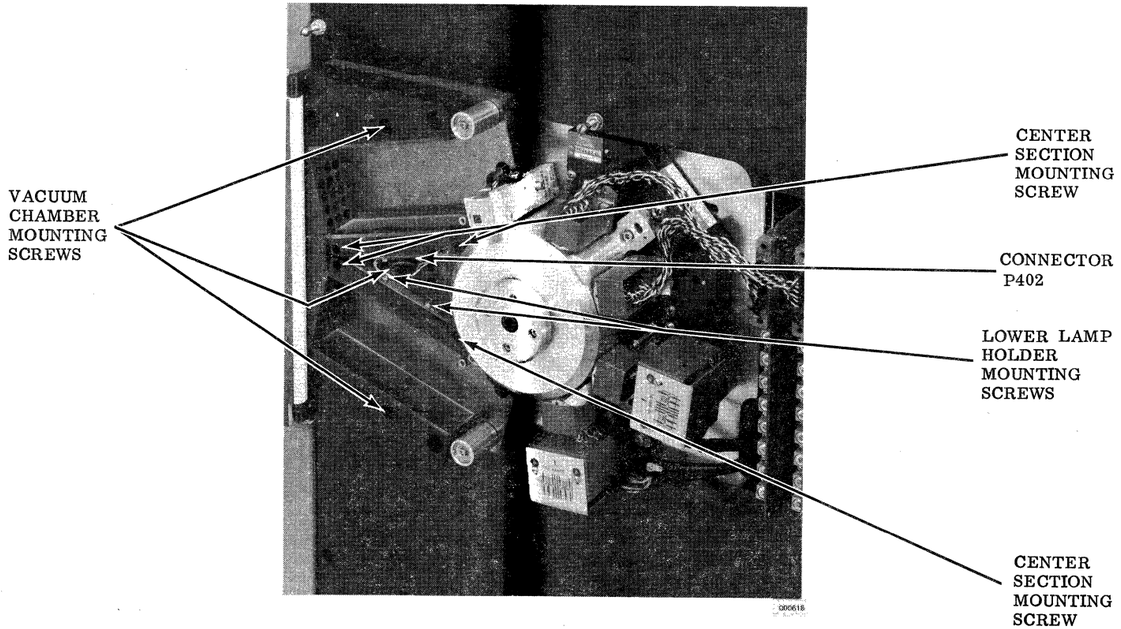

Figure 11-1. Vacuum Chamber Details

FR-3010 HEAD ASSEMBLIES

CAUTION

NEVER REMOVE OR LOOSEN INDIVIDUAL HEADSTACKS OR TAPE GUIDES ON A HEAD ASSEMBLY. THESE COMPONENTS ARE PRECISION ALIGNED ON THE HEAD ASSEMBLY BASEPLATE. IF THEY ARE LOOSENED OR REMOVED, THE ASSEMBLY MUST BE RETURNED TO THE FACTORY FOR REALIGNMENT.

FR-3010 RECORD HEAD ASSEMBLY

Refer to Figure 11-2.

a. Turn transport power off.

b. Disconnect the head cables from the headdriver pwa's.

c. Unscrew the two end mounting screws (Figure 11-2) of the head assembly. (They are captive in the assembly.)

d. Loosen the center mounting screw and slide the head assembly away from the capstan puck. While supporting the head assembly, disengage the center screw (also captive) and lift the head assembly away from the precision plate.

e. To install an FR-3010 record head assembly, reverse the above procedure, noting the following points:

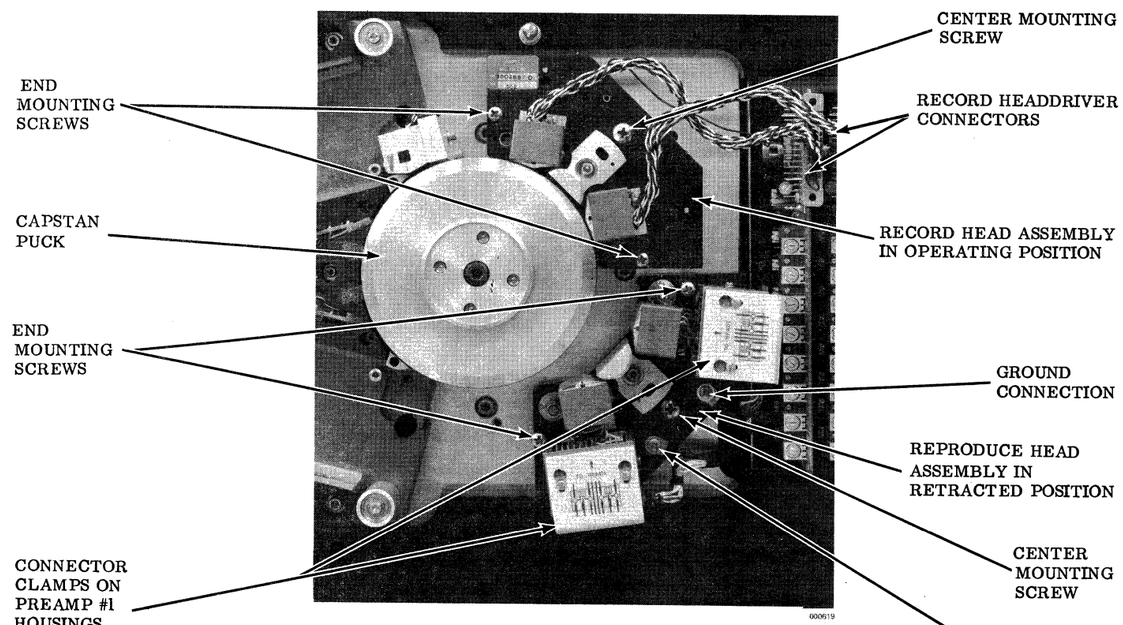

Figure 11-2. Typical FR-3010 Head Assemblies

1. Be sure that the surface of the precision plate and the head assembly baseplate are completely clean before mounting the head assembly.

2. The record head cable connectors are designated "P1", "P2", etc. They should be connected to the headdriver pwa's in numerical order from left to right. Pin-number matching is indicated on the head connectors and on the headdriver pwa's, adjacent to the edge connector.

FR-3010 REPRODUCE HEAD ASSEMBLY

Refer to Figures 11-2 and 11-3.

a. Turn transport power off.

b. Disconnect the two ground leads from the head assembly baseplate.

c. Remove the connector clamps from the preamplifier #1 housings. (Loosen two screws per clamp.) Note the orientation of the cables from the preamplifier #2 housing to the connectors on the preamplifier #1 pwa's. Tag or otherwise mark each connector to clearly identify it. Then carefully pull the cable connectors, still holding the pwa's, straight out of the preamplifier #1 housings, so that the preamplifier pwa's are removed from the housing and remain attached to the cables.

d. Unscrew the two end mounting screws (Figure 11-2) of the head assembly. (They are captive in the assembly.)

e. Loosen the center mounting screw and slide the head assembly away from the capstan puck. While supporting the head assembly disengage the center screw (also captive) and lift the head assembly away from the precision plate.

f. To install an FR-3010 reproduce head assembly, reverse the above procedure, noting the following points:

1. Be sure that the surface of the precision plate and the head assembly baseplate are completely clean before mounting the head assembly.

2. After the head assembly is mounted on the transport, install the preamplifier #1 pwa's into the housings on the head assembly. Insert each pair of pwa's, attached to the cable connector, into the appropriate guide slots, according to the identification made in step c, above. Slide the pwa's in until the inner connectors are fully seated. Be careful not to bend the pins of the pwa's.

FR-3020 AND FR-3030
HEAD ASSEMBLIES (Figure 11-4)

CAUTION

NEVER REMOVE OR LOOSEN INDIVIDUAL HEADSTACKS OR TAPE GUIDES ON A HEAD ASSEMBLY. THESE COMPONENTS ARE PRECISION ALIGNED ON THE HEAD ASSEMBLY BASEPLATE. IF THEY ARE LOOSENED OR REMOVED, THE ASSEMBLY MUST BE RETURNED TO THE FACTORY FOR REALIGNMENT.

a. Turn off transport power.

b. Unplug the head cable connector(s) from the signal/bias mixer or preamplifier pwa's.

c. Unscrew the two captive end mounting screws (Figure 11-4) of the head assembly.

d. Loosen the center mounting screw and slide the head assembly away from the capstan puck. While supporting the head assembly, disengage the center screw (also captive) and lift the head assembly away from the precision plate.

e. To install an FR-3020 head assembly, reverse the above procedure. Noting the following points:

1. Be sure that the surface of the precision plate and the head assembly baseplate are completely clean before mounting the head assembly.

2. The head cable connectors are designated "P1," "P2," etc. They should be connected to the appropriate pwa's in the numerical order from top to bottom. Orient each connector with pin 1 at the left.

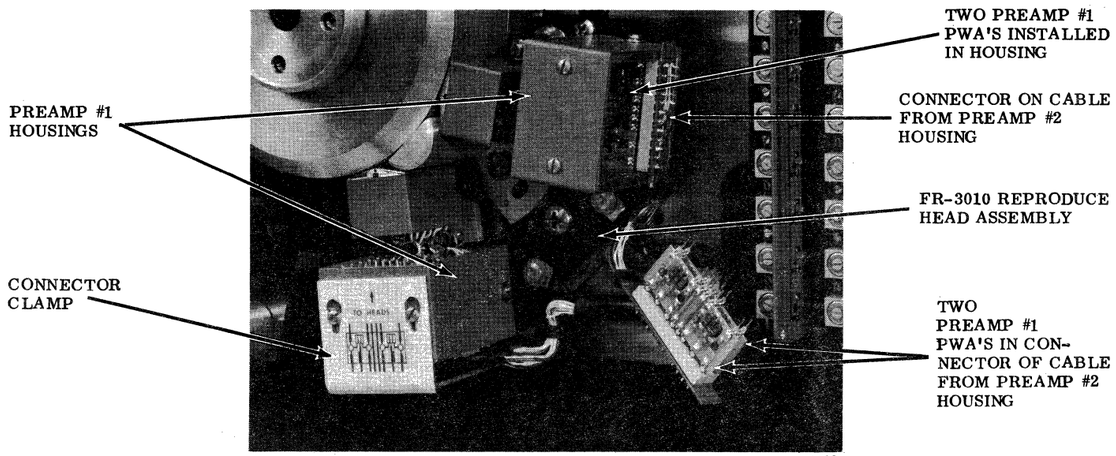

Figure 11-3. Preamplifiers #1 Unplugged for Head Assembly Removal

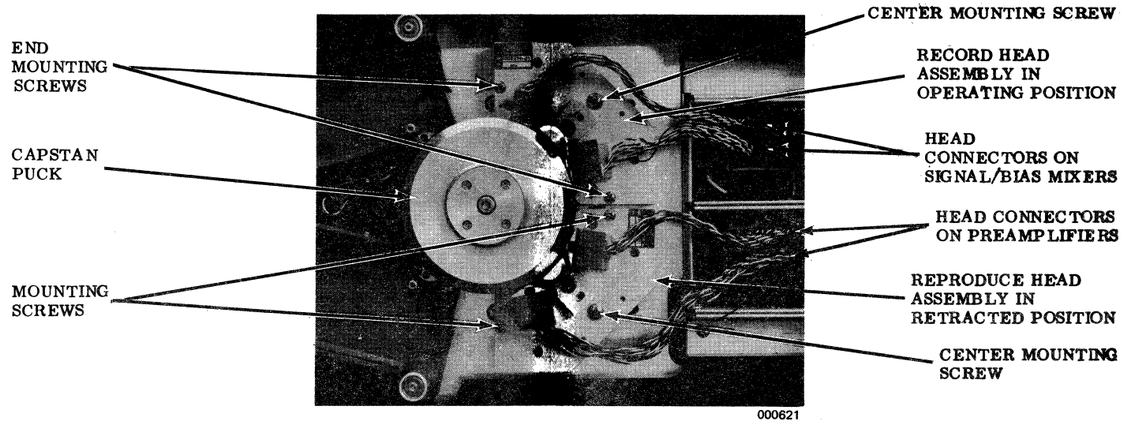

Figure 11-4. Typical FR-3020 Head Assemblies

TAPEWIDTH CONVERSION

The FR-3000 will operate with either 1/2-inch wide or 1-inch wide tape. The transport is easily converted to handle either width. See Figures 11-5 and 11-6.

1-INCH TO 1/2-INCH CONVERSION

To convert a tape transport which is using 1-inch wide tape to operate with 1/2-inch wide tape, proceed as follows:

a. Switch the main circuit breaker (CB501) off.

b. Remove the 1/2-inch vacuum chamber conversion blocks from their storage clips inside the cabinet on the front of the vacuum housing assembly mount, at the side of the cabinet.

c. Remove the two cap screws from their storage places in the side of each conversion block.

d. Swing the vacuum chamber cover open.

e. Using the cap screws, mount the conversion blocks on the inside of the vacuum chamber cover, hollow side of the block against the cover. The blocks must be oriented so that they fit into the tape-loop spaces when the vacuum chamber cover is closed. (The hook-shaped projection fits around the guide roller.) Tighten the cap screws until they just hold, but allow movement of the conversion blocks.

CAUTION

IN THE FOLLOWING STEP, IF INTERFERENCE IS ENCOUNTERED, DO NOT FORCE THE COVER. DAMAGE TO THE GLASS DIFFUSER PANELS MAY RESULT.

f. Carefully swing the vacuum chamber cover toward its closed position.

g. If the cover will not seat, carefully move the conversion blocks to allow proper fit before proceeding with the next step.

h. Ascertain that the conversion blocks clear the tape guides.

i. Open the cover and tighten the cap screws.

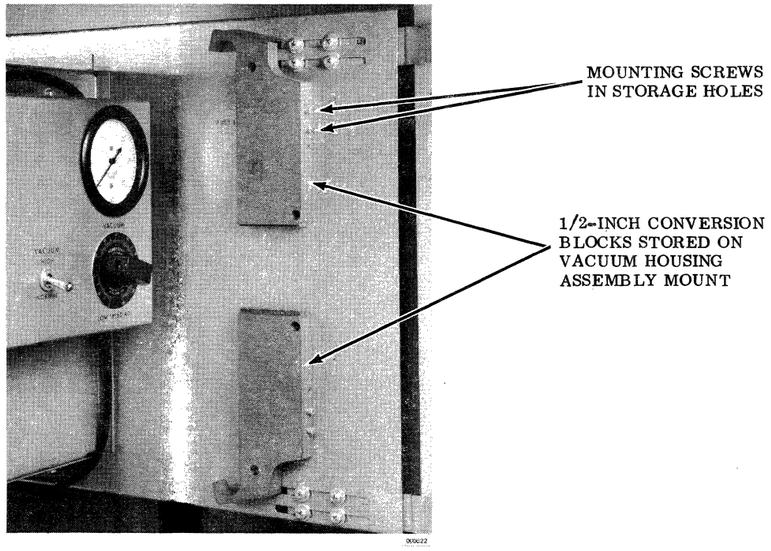

Figure 11-5. 1/2-Inch Conversion Blocks Stored

j. Set switch S201 to 0.5. This switch is on the capstan connector housing on the back of the transport, behind the vacuum chamber assembly.

k. Open the head cover and remove the 1-inch head assemblies. Replace them with 1/2-inch head assemblies. See the procedures on pages 11-2 and 11-3 in this section of the manual.

l. If, when power is turned on, the STOP/READY lamp does not light, the vacuum system adjustment procedures may have to be performed (S202 readjusted). Refer to pages 9-4 and 9-5 in Section 9.

1/2-INCH TO 1-INCH CONVERSION

To convert a tape transport which is using 1/2-inch wide tape to operate with 1-inch wide tape, proceed as follows:

a. Switch the main circuit breaker (CB501) off.

b. Open the vacuum chamber cover and remove the two cap screws that hold each of the vacuum chamber conversion blocks, being careful not to drop the blocks.

c. Screw the two cap screws into the storage holes in the side of each conversion block.

d. Open the tape transport, and snap the 1/2-inch conversion blocks into their storage clips on the vacuum housing assembly mount at the side of the cabinet. (The round bar in the hollow of the block fits into the clip.)

e. Set switch S201 to 1.0. The switch is on the capstan connector housing near the edge of the tape transport baseplate, behind the vacuum chamber.

f. Remove the 1/2-inch head assemblies and replace them with 1-inch head assemblies. See the procedures on pages 11-2 and 11-3 in this section of the manual.

g. If, when the transport power is turned on, the STOP/READY lamp does not light, the vacuum system adjustment procedures may have to be performed (S202 readjusted). Refer to pages 9-4 and 9-5 in Section 9.

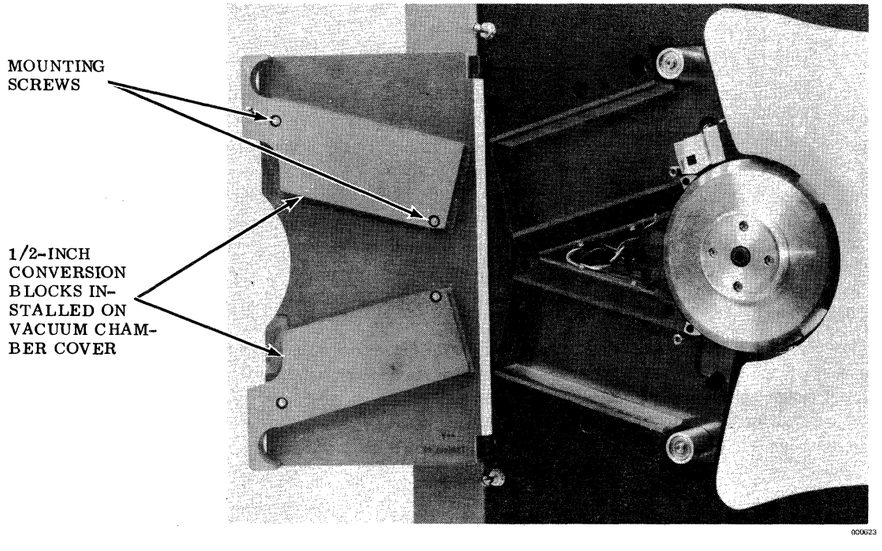

Figure 11-6. 1/2-Inch Conversion Blocks Installed

CAPSTAN SERVO ASSEMBLY

To remove the complete capstan servo assembly, proceed as follows. See Figure 11-7.

a. Turn main power off (CB501).

b. Remove the head assemblies. (Refer to the procedures on pages 11-2 and 11-3 of this section of the manual.)

c. Remove the vacuum chamber. (Refer to the procedure starting on page 11-1.)

d. Disconnect the following items:

1. Connectors P208, P209, P210.

2. If a voice log assembly is installed, the voice log head lead must be disconnected from J4 from the voice log assembly.

3. Both air hoses. (Disconnect these from the nipples on the back of the precision plate of the capstan servo assembly.)

e. Carefully support the capstan assembly and remove the four #10-32 hex-socket cap screws that hold the capstan servo assembly to the back of the baseplate.

f. Move the capstan servo assembly straight back from the baseplate until it is clear.

g. To install the capstan servo assembly, reverse the above procedure.

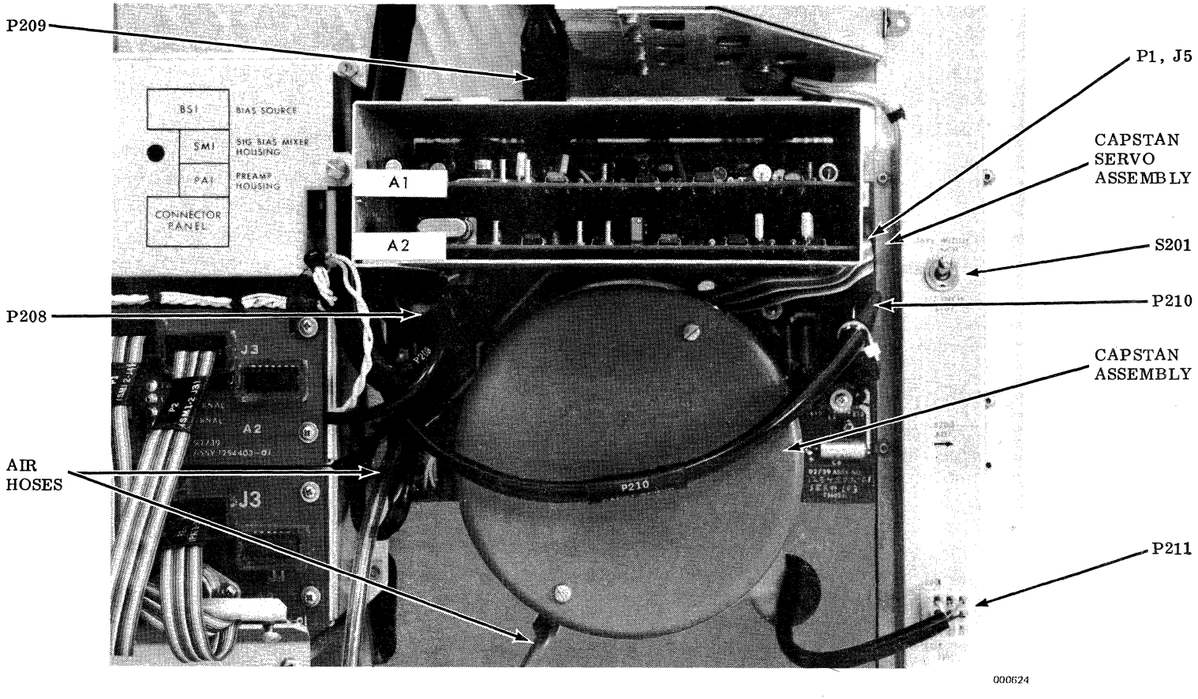

Figure 11-7. Back of Capstan Servo Assembly

CAPSTAN ASSEMBLY

To remove the capstan assembly from the capstan servo assembly, it is not necessary to remove the capstan servo assembly from the transport. Proceed as follows:

a. Turn off main power (CB501). Unplug P1 from J5 of the capstan servo assembly. (See Figure 11-7.) Disconnect the capstan motor power leads from J1, J2, and J7. (These are quick disconnects adjacent to P208. See Figure 11-7.)

b. Remove tape from the transport and retract both head assemblies as for cleaning. (See Figure 11-8 and the applicable operator/system manual.)

c. Remove the vacuum chamber. (See the procedure starting on page 11-1 of this section.)

d. Carefully support the capstan assembly from behind the transport, and remove the four #10-32 mounting screws from the front of the precision plate. (Figure 11-8)

e. Move the capstan assembly straight back from the precision plate, taking care not to damage the capstan puck.

f. Install a capstan assembly by reversing the above procedure.

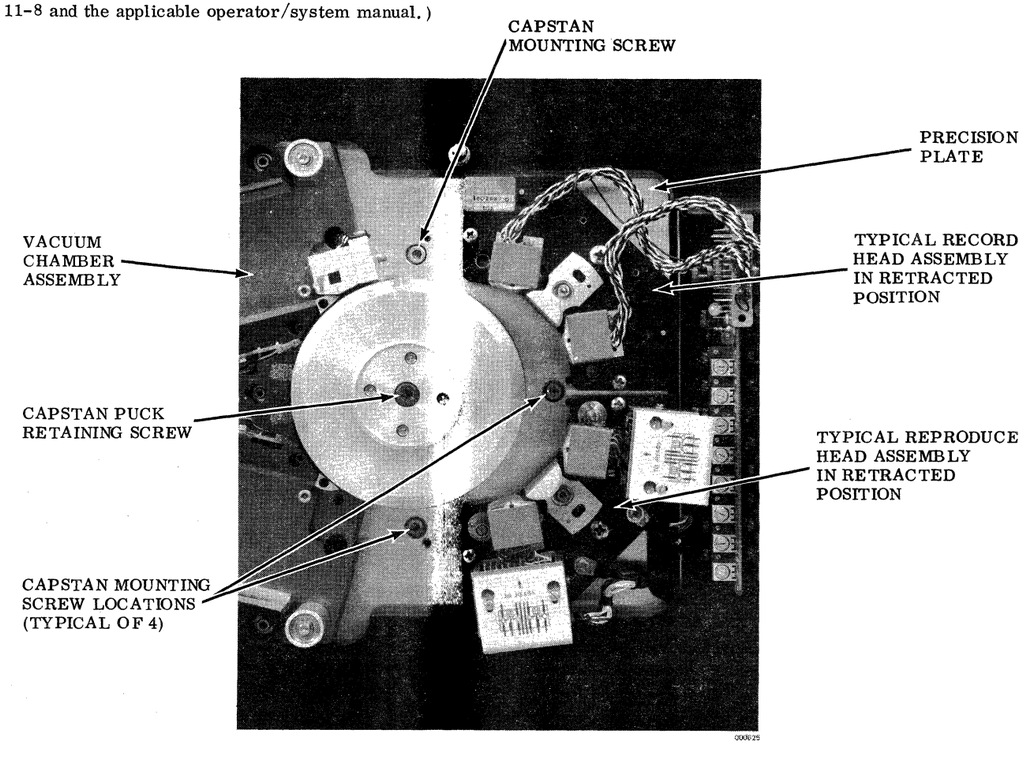

Figure 11-8. Capstan and Capstan Puck Mounting Details

CAPSTAN PUCK
TACHOMETER PREAMPLIFIER

CAPSTAN PUCK ASSEMBLY

To remove the capstan puck assembly from the capstan assembly, proceed as follows: Refer to Figure 5-8.

a. Turn off transport power.

b. Unthread tape and retract both head assemblies, as if for cleaning.

c. While restraining the puck from turning with one hand, use a 1/4-inch hex key to unscrew the hex-socket retaining screw at the center of the puck. There will be resistance as the screw, which is captive, frees the puck from the capstan shaft. Back the screw out until it disengages from the end of the capstan shaft.

d. Gently take the puck off the capstan shaft. Note that a spring-loaded pin keeps the puck from rotating on the shaft while it is in or near its installed position.

e. To install a puck, place it on the shaft, engage the retaining screw, and run it in until it bottoms lightly. Back it off one or two turns, and rotate the puck on the shaft until the spring-loaded pin engages the matching hole in the back of the puck. Then tighten the screw down to 30-35 inch-pounds of torque.

TACHOMETER PREAMPLIFIER

The tachometer preamplifier (tach preamp) is contained within the capstan assembly. Access to it is gained by removing the capstan puck. (See the procedure above.) For servicing, it may be dismounted (four #2-56 binder-head screws) while the capstan is in place and the puck removed. There is sufficient service loop in the cable that both sides of the pwa can be reached for soldering, etc., when the pwa is in this condition.

CAUTION

DO NOT TOUCH OR IN ANY WAY CONTAMINATE THE TACHOMETER DISC WHICH IS UNDER THE PREAMP. ALSO, DO NOT MOVE OR LOOSEN THE OPTICS ASSEMBLY, WHICH IS UNDER THE TACHOMETER DISC. FAULTY CAPSTAN OPERATION MAY RESULT. IN THIS CASE, FACTORY REPAIR/REALIGNMENT IS NECESSARY.

If complete removal and replacement of the tach preamp is required, proceed as follows:

a. Turn main power off (CB501).

b. Remove the capstan assembly from the capstan servo assembly. (See the procedure on this page.)

c. Set the capstan assembly on its back cover, with the puck up, on a clean, level work surface.

d. Remove the puck. (See the procedure on this page.) Throughout the rest of this procedure observe the caution given above.

e. Remove the tachometer shield ring (the metal collar directly behind the puck on the capstan assembly). It is held in place by friction with an O-ring which is in a groove around the bearing housing of the capstan. (Refer to assembly drawing 1254500 in Section 5 of this manual.)

f. Note the position and dressing of the tach preamp cable. It is held in place by lacing cord that passes around the bearing housing. Cut the lacing cord.

g. Remove the four #2-56 binder-head screws that hold the tach preamp in place and remove the preamp.

h. To reinstall the preamp, reverse the above procedure, taking note of the following points:

1. Dress the cable as was noted in step f. Before tying the cable with lacing cord, be sure the cable does not contact the tachometer disc, and will not contact the rim of the puck when it is installed.

2. When installing the tachometer shield ring, lightly moisten the O-ring and the mating inner surface of the shield ring with water to facilitate working the shield into place. It must be snugly in contact with the shoulder of the bearing housing at all points of its circumference.

3. Do not reinstall the capstan puck (but reinstall the capstan assembly). Do not reinstall tape on the transport.

4. The preamplifier must be aligned as instructed in the following steps.

i. Align the tachometer preamplifier as follows:

1. Extend the transport, remove the covers from the reel servo mda assemblies, and unplug reel servo amplifier pwa P104 in each assembly.

2. Open the vacuum chamber and block off the holes in the baffle blocks with masking tape.

NOTE

Steps 1 and 2, above, are performed so that the transport may be put into run mode without tape being installed.

3. Set up for the l-e-d current adjustment as given on page 9-3 in this manual. (Requires putting capstan pwa A1 on extender card 1254600.)

REMOVAL AND REPLACEMENT
REEL HOLDDOWN

4. Loosen the tachometer preamp mounting screws just enough to allow the assembly to be moved.

5. Turn transport power on. Select 1-7/8 ips and switch into forward mode.

6. Position the tachometer preamp to produce the greatest output, as observed on the oscilloscope.

7. When the preamp is positioned for greatest output, tighten the mounting screws. Be sure the assembly does not shift position and reduce the output as the screws are tightened.

8. Turn off transport power. Reinstall the capstan puck according to the procedure on the preceding page. Plug the reel servo amplifiers in and replace the mda covers. Do not change capstan pwa A1 or the oscilloscope connection.

9. Remove the masking tape from the vacuum chamber. Install and thread magnetic tape in the normal manner.

10. Perform the l-e-d current adjustment as given on page 9-3.

11. Stop the tape. Turn off transport power. Disconnect the oscilloscope and return A1 to its normal position. This completes the procedure.

REEL HOLDDOWN

To remove and replace a reel holddown, proceed as follows. Refer to Section 4, pages 4-4 and 4-5 for illustrations and a parts list.

a. Turn transport power off. If a reel is on the holddown, remove it.

REEL BRAKE

b. Tighten the knob of the holddown until it spreads the gap in the expandable ring enough to allow a hex key to enter and loosen the hex socket set screw.

c. Loosen the hex socket set screw located in the flange of the holddown.

d. Pull the holddown off the shaft.

e. To reinstall the holddown, reverse the above procedure. However, the elevation of the holddown with respect to the vacuum chamber must be precisely set. It must be set so that tape moves between reel and vacuum chamber without rubbing on the reel flanges or curling at the edges on the vacuum chamber tape guides. This can be done visually by threading tape and observing it as it moves on and off the reel. Several readjustments of the holddown on the motor shaft may be necessary. Although rough, initial alignment may be made with old tape, correct, final adjustment can only be made with tape that has no edge curl or stretching.

REEL BRAKE ASSEMBLY

Removal of the reel brake of the reel drive motor should be undertaken only when the brake is not operating properly. Removal and replacement may be performed with the reel motor assembly mounted on the tape transport. Refer to Section 4, pages 4-2 and 4-3 for information on the reel brake. Proceed as follows:

a. Loosen the two hex socket set screws that are recessed into the disc brake collar at the rear of the reel motor assembly.

b. Slide the brake drum, spacer, and collar off the motor shaft.

c. Slide the brake solenoid plunger (with the brake lining attached) off the motor shaft. Check that the three compression springs are in their holes in the solenoid coil housing.

REEL MOTOR

REEL MDA

d. Install a replacement brake plunger, with brake lining attached, by sliding it onto the motor shaft and into the recess in the center of the solenoid coil housing.

e. Slide the brake drum and collar onto the shaft. Check for a minimum circumferential measurement of 0.020(±0.005) inch air gap (nominal) between the plunger and the solenoid coil housing. Tighten the two hex socket screws in the collar.

REEL MOTOR ASSEMBLY

To remove a reel motor assembly, proceed as follows. Refer to Section 4, pages 4-2 and 4-3 for information on the reel motor and brake assembly.

a. Turn off transport power.

b. Remove the reel holddown. (Refer to the procedure on this page.)

c. Unplug the reel motor captive cable from its receptacle (J206 for the upper reel motor and J207 for the lower reel motor.)

d. Support the reel motor assembly and remove the four hex-socket screws that hold the motor to the back of the transport baseplate.

e. When all four screws are removed, move the motor assembly straight back until it is clear of the baseplate.

f. To reinstall a reel motor assembly, reverse the above procedure.

REEL MDA ASSEMBLY

To remove and replace a reel mda assembly, proceed as follows:

a. Turn off transport power.

VACUUM AIR FILTER

b. Disconnect the reel-motor connector from J219/J220 on the top of the reel mda to be removed.

c. Loosen the screws that hold the terminal lugs of fanning strip FS201/FS202 to terminal board TB201/TB202. Do not attempt to disengage the lugs of the fanning strip from the terminals at this time. They will slip free when the mda assembly is moved away from the baseplate.

d. Swing the terminal block mount, which also holds reel amplifier pwa P401, on its pivots to give access to two hex-socket cap screws that are behind P401. These are two of the mounting screws for the mda assembly. Remove the screws.

e. While supporting the mda assembly, remove the two hex-socket cap screws at the outboard corners of the assembly.

f. Lift the assembly away from the baseplate, making sure that the lugs of the fanning strip come free from the terminal board.

g. To install a reel servo mda, reverse the above procedure.

VACUUM PLENUM FOR AIR FILTER SERVICE

To remove and replace the vacuum plenum assembly from the bottom of the vacuum housing assembly for purposes of cleaning or replacing the air filter, proceed as follows. Refer to Section 4, pages 4-5, 4-6, and 4-7 for information on the vacuum housing and vacuum plenum assemblies:

a. Turn off transport power.

b. Disconnect the flexible vacuum hose from the underside of the vacuum plenum assembly.

c. While holding the plenum assembly in place, remove the four cross-recessed screws from the corners of the vacuum plenum chamber.

REMOVAL AND REPLACEMENT

SOLENOID L601

d. Carefully (so as not to strain the captive cable connections) allow the vacuum plenum assembly, with the captive cable, to drop down from the enclosure assembly far enough to gain access to the plenum interior.

e. Remove the coarse-core polyurethane filter (1-3/4-inch thick, triangular-shaped pad located in the section of the plenum chamber that contains the air shutter).

f. Loosely secure the vacuum plenum assembly to the enclosure assembly.

g. Clean the polyurethane filter by blowing compressed air through it, or by washing it in alcohol or lukewarm water. Dry it thoroughly. If replacement of the filter is desired, use Scott Paper Company 1-3/4-inch thick polyurethane foam, 20 ppi, or Ampex part number 922-418, and cut it to the shape of the old filter.

h. Carefully lower the plenum assembly enough to allow replacement of the filter, then securely reinstall the plenum assembly, reconnecting the vacuum hose.

SOLENOID L601

To remove and replace vacuum-gate solenoid L601 of the plenum assembly, proceed as follows. For information on the vacuum housing assembly and its subassemblies, refer to Section 4, pages 4-5 to 4-10.

a. Turn off transport power.

b. Disconnect the flexible vacuum hose from the plenum chamber.

c. Support the plenum assembly and remove the four screws at the corners of the plenum chamber. Lower the plenum assembly to allow access to the solenoid.

d. Disconnect the quick-disconnect terminals from the solenoid (TB201). Withdraw the cable (which

VACUUM MOTOR

VACUUM HOUSING

includes the vacuum tubing for the vacuum gage) from the plenum assembly.

e. Disconnect the solenoid linkage to the vacuum gate. Remove the solenoid by removing the two screws that hold it to the bottom of the plenum chamber.

f. Reinstall the solenoid and the plenum assembly by reversing the above procedure. When reinstalling the captive cable, be sure the end of the vacuum tubing is not blocked in any way.

VACUUM MOUNTING PLATE ASSEMBLY (VACUUM MOTOR)

The mounting plate assembly of the vacuum housing assembly includes the vacuum motor. To remove and replace the mounting plate assembly, proceed as follows. Refer to Section 4, pages 4-5 to 4-10 for information on the vacuum housing assembly and its subassemblies.

a. Turn off transport power.

b. Remove the plenum assembly as detailed in steps b through d of the procedure for removing and replacing solenoid L601 (preceding page).

c. Support the mounting plate assembly and remove the 12 cross-recessed pan-head screws that hold the mounting plate assembly to the enclosure assembly.

d. Disconnect the motor leads at the connector (P101), and remove the mounting plate assembly.

e. The mounting plate assembly including the blower motor can be replaced as a unit. Install the assembly by the reverse of the above procedure.

VACUUM HOUSING ASSEMBLY

The entire vacuum housing assembly may be removed from the cabinet according to the following procedure. Refer to Section 4, pages 4-5 and 4-6 for information on the vacuum housing assembly.

AIR COMPRESSOR FILTER

a. Turn off transport power.

b. Disconnect connector P2 from its receptacle (J2) in the power and servo chassis. (Be sure the cable is clear of other cables, etc.)

c. Disconnect the flexible vacuum hose from the plenum assembly.

d. Support the vacuum housing assembly and remove the eight #10-32 screws that hold the assembly to the cabinet rails. Remove the assembly from the cabinet.

e. To reinstall the vacuum housing assembly, reverse the above procedure.

AIR COMPRESSOR INPUT FILTER

The paper filter in the air compressor assembly intake may be removed and replaced as follows. For information on the air compressor, refer to Section 5.

a. Turn off transport power.

b. Remove the two screws that hold the end cover on the end of the air compressor assembly toward the front of the cabinet. Remove the end cover.

c. Remove the screw that holds a wire screen over the paper filter at the center of the cover.

d. Replace the filter with Thomas Industries, Power Air Division, 1419 Illinois Avenue, Sheboygan, Wisconsin 53081, part number 641-007.

e. Reassemble the air compressor by reversing the above procedure.

AIR COMPRESSOR OUTPUT FILTER

The cartridge-type filter in the air line from the compressor output to the air tank may be removed and replaced as follows: follows:

AIR COMPRESSOR

TRANSPORT COVER DOOR

a. Turn off the transport power.

b. Release the two hose clamps that hold the air tubing on the nipples of the filter unit. Pull the tubing off the nipples.

c. Slide the filter unit upward out of the plastic strap that holds it in place.

d. Replace the filter by reversing the above procedure. Note that the arrow on the filter cartridge must point against the air flow.

AIR COMPRESSOR ASSEMBLY

a. Turn off the main power (CB501).

b. Unplug all plugs from the receptacles in the utility outlet strip at the bottom of the air compressor assembly (below the air tank).

c. Remove the outlet strip (two screws).

d. Unplug the air compressor assembly cable connector P1 from J1 of the power and servo chassis. (Be sure the cable is clear of other cables, etc.)

e. Support the air compressor assembly, and remove the three screws that hold it in place. (Two are in the rear rail of the cabinet, one is in a unistrut nut in the strut on the righthand wall of the cabinet, as viewed from the front.)

f. Remove the assembly. To reinstall it, reverse the above procedure.

TAPE TRANSPORT COVER DOOR ASSEMBLY

To remove and replace the transport cover door, proceed as follows:

a. Shut the cover door tight.

b. Remove the 10 cross-recessed screws that hold the hinge to the baseplate of the transport. As the last screw is removed, the cover door may

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POWER AND SERVO CHASSIS

drop slightly. Support the door and pull it straight away from the transport to disengage the latch. The door should now be free of the baseplate.

c. To install a transport cover door, reverse the above procedure.

POWER AND SERVO CHASSIS ASSEMBLY

To remove and replace the complete power and servo chas-'s, proceed as follows:

a. Turn off main power (CB501).

b. Extend the transport and disconnect all cabling to and from the power and servo chassis.

c. In order to allow full extension of the power and servo chassis on its slides, drive the groove pin out of the roll pin at the top rear end of each of the two slide assemblies that support the power and servo chassis assembly.

d. Also to allow full extension of the power and servo chassis, it is necessary to extend the transport beyond its normal limit. On FR-3020 recorder/reproducers, and possibly on some others, it is necessary to remove the transport cover door according to the procedure given above. If the cover door is not removed, be sure it is closed. Then, with or without the transport cover door, proceed as follows:

1. Extend the transport to its normal limit and disengage the transport stay (at the top of the baseplate) from the stay bracket on the cabinet.

2. Slowly and carefully swing the transport beyond its normal limit far enough to allow full extension of the power and servo chassis assembly. Be sure not to extend the transport so far that there is damage to the cover door (if it is still in place) or the control unit (if the cover door is removed).

CAUTION

IN THE NEXT STEP, TO AVOID POSSIBLE DAMAGE TO THE EQUIPMENT, DO NOT REMOVE THE TWO SCREWS COATED WITH RED LAQUER WHICH MOUNT HANGER BUTTONS TO THE TOP SLIDE ASSEMBLY. ALSO, BE SURE TO HAVE ONE PERSON SUPPORT PART OF THE WEIGHT OF THE ASSEMBLY WHILE ANOTHER REMOVES THE MOUNTING SCREWS.

e. While one person supports part of the weight of the assembly, remove the three screws that secure the power and servo chassis to the slides. (One screw is in the top slide, two in the bottom slide.) Extend the assembly varying amounts as necessary to allow access to the screws. To achieve maximum extension to reach the back screw on the bottom slide, release the lockout catch on the lower left side of the assembly as viewed from the front.

f. The power and servo chassis may now be lifted off the hanger buttons on the top slide. Two people should handle it in order to maintain control and avoid damage to it or to adjacent assemblies.

g. To install a power and servo chassis, reverse the above procedure.

SECTION 12
SPECIAL TOOLS AND TEST EQUIPMENT

SECTION 12
TEST EQUIPMENT AND SPECIAL TOOLS

LIST OF TABLES

SECTION 12
TEST EQUIPMENT AND SPECIAL TOOLS

Test equipment and extender cards required for maintenance of the FR-3000 tape transport are listed in Table 12-1, below. No other special tools or materials are listed here, because any that are used with the FR-3000 are required only for preventive maintenance, which is covered in Section 6 in the applicable operator/system manual. (Ampex 1802852 for the FR-3010, or 1802853 for the FR-3020.) Note that the specific instruments cited in the table are examples, only. Any other instrument of equivalent capability is equally suitable.

Table 12-1. Test Equipment for FR-3000 Maintenance

ITEM	TYPE
Oscilloscope	Tektronix Model 465 or equivalent
Digital voltmeter	Fluke 8000A, or equivalent
4 x 6 transport and control extender card	Ampex 1801768
8 x 10 transport and control extender card	Ampex 1801769
Capstan servo extender card	Ampex 1254600

APPENDIX A

AMPEX

ERRATA

Date 3-10-82

PUBLICATION 1802854-03: FR-3000 Tape Transport Maintenance Manual

No. Errata #1

REASON FOR ERRATA To change compressor air pressure setting for improved dynamic skew.

Page Reference	Nature of Errata
9-6	Under "AIR COMPRESSOR ADJUSTMENT," step c, change the third line to read: "air pressure gage for a reading of 1.0 psi"