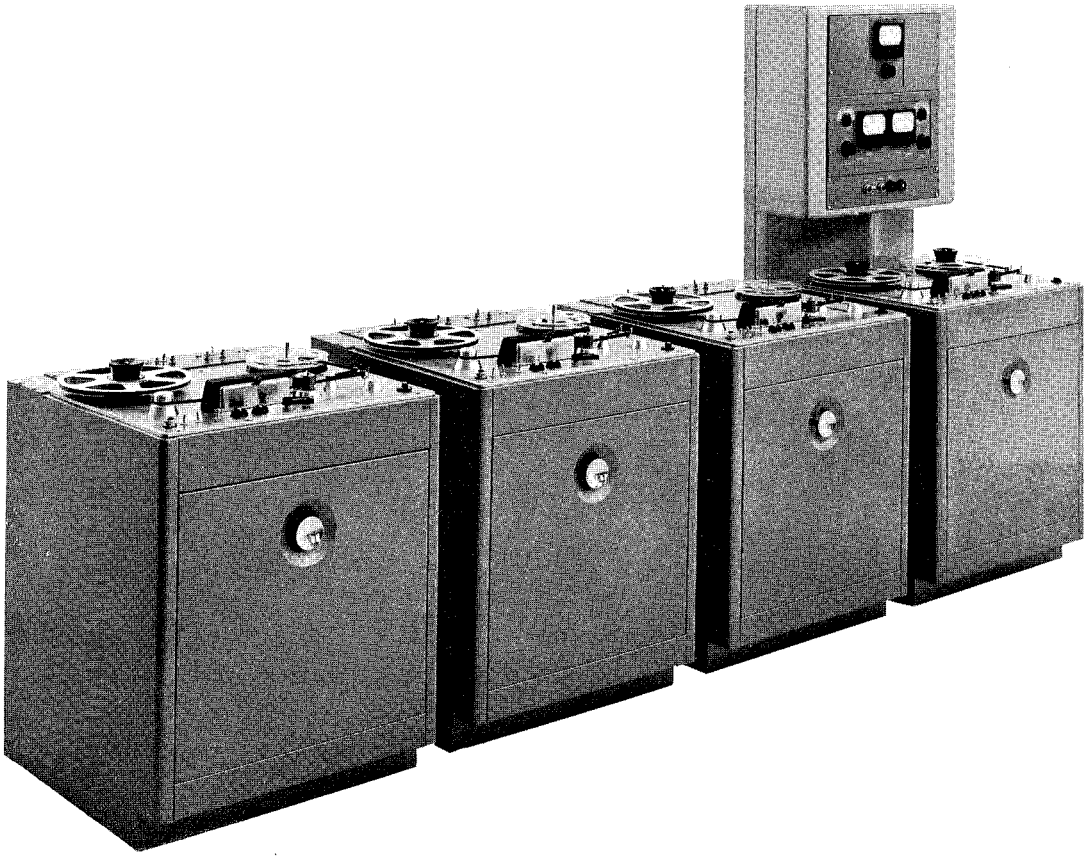
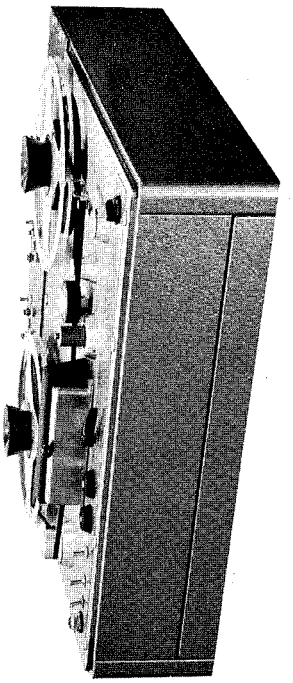
MODEL 3200D

July 1960
TM-2008

TAPE DUPLICATOR SYSTEM





OPERATION
AND MAINTENANCE
MANUAL

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Section 1

Description and Performance Characteristics

GENERAL

The Ampex Series S-3200D Tape Duplicator Systems provide the finest and latest techniques for high speed, mass duplication of previously recorded magnetic tapes.

The S-3200D Master Reproduce unit feeds an output to Slave duplicators in any desired number to a maximum of ten Slaves. Convenient central control is accomplished through a Master Control panel above which are mounted a Master Record Electronic assembly and a Master Bias Oscillator. The latest designs in electronic components have been introduced through the system.

The duplication process takes place at either 60 or 30 ips. Any audio recording made on 1/4-inch tape at speeds of 7-1/2, 3-3/4, 30 or 15 ips can be duplicated including full track, half track and two-channel stereophonic. From master recordings, duplicate copies can be made that will reproduce at the original speed of the master tape -- a one-to-one ratio; or, with the exception of stereophonic tapes* which must be duplicated at a 1:1 ratio, the duplication process can be accomplished at a two-to-one ratio (for example, a 7-1/2 ips duplicate can be made from a 15 ips master). Masters originally recorded at 7-1/2 ips can be duplicated so that the tapes copies will reproduce at 3-3/4 ips; and 15 ips master tapes, can be made into 7-1/2 ips copies. Both tracks of a dual track tape can be duplicated simultaneously or individually as either upper or lower track, or as full track recordings. If more than one Slave Duplicator is used, it is possible to produce simultaneously from one master tape, a set of tapes with differing track arrangements.

The S-3200D will produce as many as ten copies at one time, depending upon the number of slaves in the system. When ten slaves are used, ten copies of a half hour 7-1/2 ips master tape can be made in less than four minutes. Such a duplicator installation is capable of producing approximately 120 half hour copies per hour, a production speed-up ratio of more than 60:1 compared to a conventional dubbing arrangement.

PERFORMANCE CHARACTERISTICS

	Master	Slave
Tape Speed (ips)	60-30	60-30
	Master	Slave
Tape Width (inches)	1/4	1/4

Frequency Response (cps)

	Duplicating Master to Copy
±2 db, 50 to 5,000	
±4 db, 50 to 7,500	3-3/4 ips to 3-3/4 ips
±2 db, 50 to 5,000	
±4 db, 50 to 7,500	7-1/2 ips to 3-3/4 ips
±2 db, 50 to 10,000	
±4 db, 50 to 15,000	7-1/2 ips to 7-1/2 ips
±2 db, 70 to 10,000	
±4 db, 50 to 15,000	15 ips to 7-1/2 ips
±2 db, 70 to 10,000	
±4 db, 50 to 15,000	15 ips to 15 ips
±2 db, 100 to 30,000	
±4 db, 50 to 60,000	30 ips to 30 ips

Signal-to-Noise Ratio

Exceeds 55 db in 7-1/2 or 3-3/4 duplicates made at either 60 or 30 ips duplicating on a 1:1 basis; or 50 db if made on a 2:1

* If it is desired to use a 15 ips master to make 2:1 7-1/2 ips copies, in-line heads, available on special order through Ampex Contract Engineering, must be used.

basis, as referred to peak record level. (Peak record level is defined as that level at which the total rms harmonic distortion is 3 percent when measured on a 400 cycle tone reproduced from the tape at normal playing speed.)

Flutter and Wow

Will not introduce more than 0.2 percent rms in duplicates measuring all components up to 300 cps at any duplicating speed.

Stable Tape Motion Time

Using 10-1/2 inch NAB reels, or 60 ips, the tape attains stable tape motion in approximately 2-1/2 seconds (12-15 foot leader), in fast start mode.

Duplicating Time

NAB (in.)		At 30 ips	At 60 ips
7	(1200 ft)	8 min	4 min
10-1/2	(2400 ft)	16 min	8 min
14	(4800 ft)	32 min	16 min

Stopping Time

Reel Size	Duplicating Speed (ips)	Tape passing through head housing after STOP button is pressed (in.)
7" EIA	60	15
10-1/2" NAB	60	18
14" NAB	30	15

Rewind Time Master Tape

Reel Size	Time (sec)
7" EIA (1200 ft)	54
10-1/2" NAB (2400 ft)	55
14" NAB (4800 ft)	100

Power Requirements 117 volts, 50 or 60 cycle, as ordered

Master Tape Transport 7870-01 transport with two 30637-01 or 30637-03 Reproduce Amplifiers, one 30639-01 Record Amplifier and one 30638-01 Bias Oscillator	5 amp
Each slave tape transport	1.5 amp

SYSTEM COMPONENTS

The only differences among the ten systems in the series are in the number of slave duplicators, and the number of interconnecting cables required. In console systems, a cooling fan is supplied with the console containing the master reproduce unit. The list below covers the components for the basic system.

Component	Rack Space Required (in.) (19" wide)	Ampex Catalog No.	Schematic No.
Master Reproduce and Slave Tape Transports (Rack mounting is optional)	24-1/2 ------	7870-01 (60 cps power) 7870-02 (50 cps power)	
Master Reproduce Head Assembly (Staggered heads)	------	475-26	
Slave Record Head Assembly	------	475-28	
Master Reproduce Electronics (Two supplied)	5-1/4	30637-01	30640
Master Record Electronics	8-1/2	30639-01	30857
Master Bias Oscillator	8-1/2	30638-01	30641
Master Control Panel	3-1/2	5993-00	30923
Slave Switch Panel	5-1/4	5997-00	5997
Master Reproduce Console (optional)	------	565-07	
Slave Duplicator Console (optional)	------	565-05	
Cabinet Rack for Duplicator Electronics	------	17731-101	

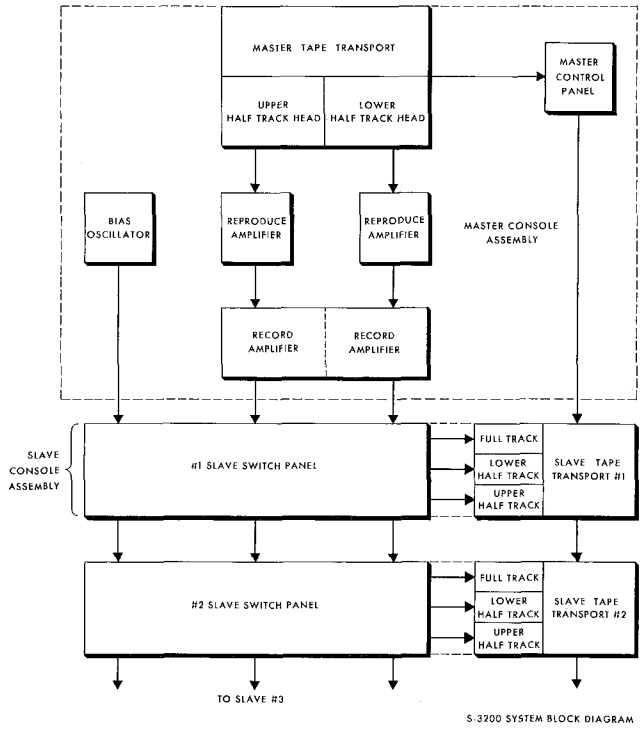


Fig. 1-1 SYSTEM BLOCK DIAGRAM

DESCRIPTION

The system employs 7-inch, 10-1/2-inch, or 14-inch reels; tape tension can be adjusted permitting simultaneous use of different sized reels on any tape transport in the system. A pair of toggle switches on each tape transport is used to adjust the torque of the takeup and rewind motors to provide holdback tape tension appropriate to the diameter of the reels used on each turntable.

All tape transports in the system are of identical construction. Hysteresis synchronous motors are used for capstan drive, and induction motors for the turntables. All tape transports operate at either 30 or 60 ips, and are controlled by a two-position selector switch. The speed switch on the master reproduce tape transport controls a relay, which changes the equalization in the master reproduce electronic assembly appropriate for the tape speed selected.

The operating modes of all tape transports -- PLAY, REWIND, and FAST FORWARD, are determined by a three-position selector switch. Two pushbuttons, START, and STOP, control tape motion. The start and stop functions for all the tape transports in the system are carried on a control buss to the master control panel; but any single tape transport in the system can be controlled individually with its own controls; or all can be controlled simultaneously from the master control panel.

The master reproduce tape transport is equipped with two half-track reproduce heads; one for an upper, and one for a lower track. The upper half track head is adjusted to reproduce properly a full track tape, and is used interchangeably to reproduce either the upper half track of a double track (dual track) or full track tape. Each of these two heads feeds an individual reproduce amplifier. These amplifiers are equalized to afford uniform reproduction from a constant flux tape when reproduced at 60 ips or 30 ips, thus insuring copies which have the same flux versus frequency characteristics as the original recording.

The output of each master reproduce amplifier is fed to the master record amplifier, consisting of two power amplifiers and a power supply. A four-position selector switch on each input section of the master record amplifier is used to provide proper pre-emphasis (equalization) appropriate to the speeds at which the master and slave tape transports will be run.

The signal from the upper half track head in the master reproduce unit feeds AUDIO No. 1 buss and the signal from the lower half track reproduce head feeds AUDIO No. 2 buss. Each slave has three heads: full track, lower half track and upper half track, from left to right facing the machine. The two audio busses are connected to the record heads of each slave duplicator through the individual slave head switch panels. These switches, on each

slave recorder, are used to select the appropriate head configuration to record the desired type of copy: full track, half track, double track (dual track) or two track stereophonic.

Another buss carries the bias signal from the master bias oscillator to the slave duplicator record heads. The bias signal is controlled by the START-RECORD pushbutton on the master control panel. The bias oscillator will supply the bias required for twenty record heads.

NOTE

There are no erase heads in the system. All tapes upon which duplicates are to be made, must be bulk degaussed before using; but make certain that the master tapes are not degaussed before the duplicating process.

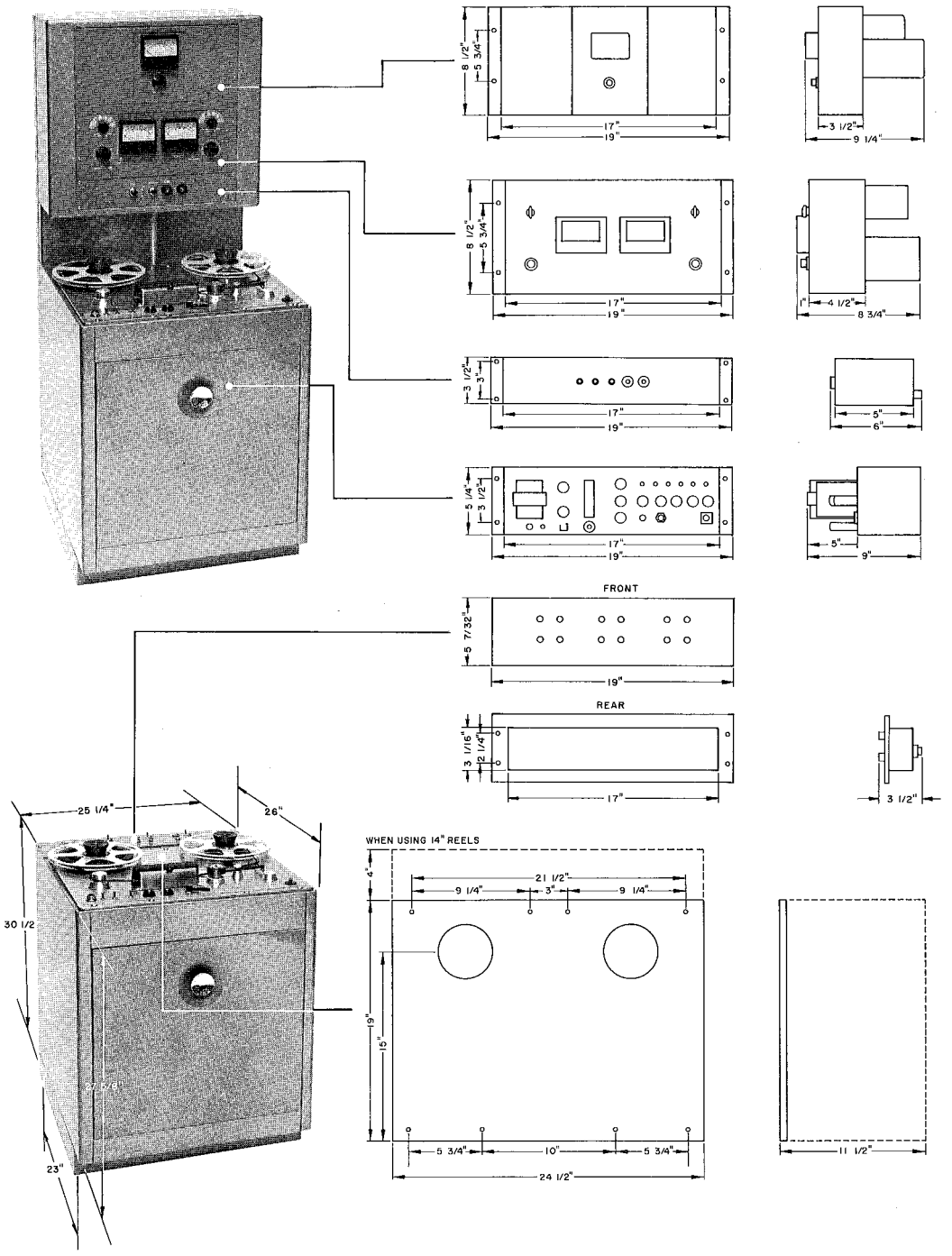


Figure 1-2 SYSTEM COMPONENTS AND DIMENSIONS

Section 2

Installation and System Checkout

NOTE

Read SECTION 3, OPERATION, before attempting checkout procedures which require tape motion.

GENERAL

All console systems are shipped with internal cabling already connected. Cable connections between consoles and the rack-mounted units -- master control panel, master record amplifier, and master bias oscillator are detailed in the illustrations of this section.

IMPORTANT

All tape transports, console or rack-mount, are shipped with a special lock that holds the capstan drive motor away from the rubber-tired capstan flywheel. Release the lock retaining ring, and disengage the lock arm. Always be sure to lock the capstan motor when preparing the equipment for shipping or the flywheel tire may be damaged beyond repair.

PLACEMENT OF UNITS

Although slave duplicators may be placed on both sides of the master reproduce console, placement of the slaves to the left of the master reproduce console simplifies performance measurements. With this positioning, tape can be threaded from any slave to the master for the alignment procedures described in section 2.

For rack installations, mount the two master reproduce amplifiers, the master tape transport, the master bias oscillator and the master control panel in descending order from top to bottom. To the left of the master rack, mount the slave number 1 tape transport and switching panel, then slave number two tape transport and switching panel. Any additional slave duplicator units can be mounted two to a rack in this same manner to the left of the preceding rack.

When rack mounting the equipment, the springs for the capstan drive system should be heavier than for console mounting; (see Tape Transport Section - page 4-5) also, adjustments must be made on the tape take up tension arm spring, brakes, and other mechanisms. Because the tape transport is operated in the vertical position, reels must be secured by hold down knobs Cat. No. 9093.

CABLE CONNECTIONS

Make all cable connections as shown in Figure 2-1 of this section. In this equipment the head cables are marked individually. The master reproduce head assembly unit, the lower half track head cable is marked "LOWER". The upper half track head cable reads "UPPER". In the slave duplicators, the lower half-track head cable reads "LOWER", the full track head cable reads "FULL", and the upper half track head cable is marked "UPPER".

PERFORMANCE CHECKS

a. General

All adjustments are made at the factory immediately before shipment, and adjustment controls are locked. Certain adjust-

ments, however, are dependent upon the characteristics of the magnetic recording tape to be used on the slave tape transports. To insure proper operation, the capstan speed adjustment and overall system performance should be checked before placing the equipment into service. Overall system performance should also be checked weekly to maintain proper operation throughout the life of the equipment. If either of the aforementioned checks indicate unsatisfactory operation, the system can be realigned using the procedures in this section.

b. Minimum Test Equipment Required

1) An audio oscillator that covers the frequency range from at least 100 to 120,000 cps such as the Hewlett-Packard Model 200C or its equivalent.

2) An a-c vacuum tube voltmeter that is accurate to 350,000 cps such as the Hewlett-Packard Model 400C or its equivalent. (Two vtvms are desirable but one is sufficient.

3) A distortion meter such as the Donner Model 2100 or its equivalent.

4) A tape reproducer such as the Ampex Model 352-2.

5) An Ampex Duplicator Standard Test Tape, Catalog No. 6878 (or 31300-01).

6) An Ampex 3-3/4 IPS Reproducer Standard Test Tape, Catalog No. 31331-01.

7) An Ampex 7-1/2 IPS Reproducer Standard Test Tape, Catalog No. 5563 (or 31321-01).

8) An Ampex 15 IPS Reproducer Standard Test Tape, Catalog No. 4494 (or 31311-01).

9) A pair of headphones or a speaker-amplifier.

10) A 7/16-inch hexagonal socket wrench.

11) A screwdriver with a 1/8-inch wide blade.

12) A screwdriver with a 1/4-inch wide blade.

13) An Ampex head demagnetizer #704.

c. Capstan Speed Check

Check the capstan speed on all tape transports after completing the installation. A strobosticker is provided for this purpose. Strobostickers for 60 cps bear the number 6, and for 50 cps the number 5.

Step 1: Place the strobosticker gum side down on top of the capstan shaft setscrew and center it.

Step 2: Place the POWER switch in the ON position.

Step 3: Place the speed selector in the LOW position.

Step 4: Place the MODE SELECTOR switch in the PLAY position.

Step 5: Push the takeup tension arm toward its turntable. A microswitch coupled to the arm shaft will close. The closing of this switch is audible.

Step 6: Press the START button, causing the capstan to rotate (in FAST START the capstan will be rotating already).

Step 7: View the rotating shaft under a 60 cycle flourescent light, such as a 2 watt neon lamp (50 cycle for 50 cycle machine). The capstan speed is correct when the bars of the strobosticker appear motionless. The capstan speed is too high when the strobosticker bars appear to move clockwise. The capstan speed is too low when the bars appear to rotate counterclockwise.

Speed adjustments can be made by the pressure spring locknut on the drive motor solenoid plunger. Adjust the locknut till the strobosticker bars appear motionless.

IMPORTANT

There are two settings of the adjustment nut at which the bars will appear motionless. To be certain the correct setting is chosen, tighten the locknut an additional 1/4 to 1/2 turn after stopping the apparent motion of the strobosticker bars. The bars should then appear to rotate in the direction opposite the capstan rotation. If this occurs, back off to the original setting and make no further adjustment. If tightening the locknut makes the strobosticker bars rotate clockwise, the original setting was incorrect. Continue to tighten the locknut and the strobosticker bars will stop once more. This will be the correct setting and can be checked by the above procedure.

d. Head Demagnetization

Residual magnetization in the heads may cause an increase of 5 to 10 db in noise level and, in the case of reproduce heads, will gradually erase the high frequencies on tapes played across them. Ampex Catalog No. 704 Head Demagnetizer is available as accessory equipment. Periodic noise level checks will determine frequency of demagnetizing. It is good practice to demagnetize heads after disconnecting and reconnecting head cables.

Step 1: Remove any tape from the recorder.

Step 2: Place a piece of electrical tape over the tips of the demagnetizer.

Step 3: Plug the Ampex Catalog No. 704 Head Demagnetizer into any 117v a-c source.

Step 4: Be sure that all power in the duplicator system is turned off.

Step 5: Open the head gate assembly.

Step 6: Run the tips of the demagnetizer up and down the length of the head stack several times.

Step 7: Remove the demagnetizer slowly, allowing the influence of its a-c field to die gradually.

Step 8: Repeat this procedure on all heads.

Step 9: Unplug the demagnetizer only when it is well away from the heads.

e. Overall System Check

The overall system can be checked using the following procedure. If performance does not meet specifications, the procedures following the "Overall System Check" should be used to locate and correct the trouble.

CABLE	CATALOG NO.	QUANTITY	FROM		TO	
			RECEPTACLE	CHASSIS	RECEPTACLE	CHASSIS
A-C	084-005	1 Per Transport	J801P	Tape Transport	A-C Source	
A-C	2413-01	1	J201P	Master Control Panel	A-C Source	
A-C Interconnecting	2413-00	1	A-C TO BIAS J206S	Master Control Panel	A-C POWER J501P	Master Bias Oscillator
A-C Interconnecting	2413-00	1	A-C TO RECORD J207S	Master Control Panel	RECORD POWER J405P	Master Record Electronics
Interconnecting	30885-02	1	CONTROL TO MASTER RELAY J203S	Master Control Panel	MASTER TO SLAVE J103S	Fast Start Relay Box (Master Transport)
Interconnecting	30885-01	1	CONTROL TO SLAVE RELAY J202S	Master Control Panel	MASTER TO SLAVE J103S	Fast Start Relay Box (Slave Transport)
Interconnecting	30886-01	1	BIAS RELAY BUSS J209S	Master Control Panel	RELAY BUSS (J406S) and BIAS RELAY BUSS (J503P)	Master Record Electronics and Master Bias Oscillator
Interconnecting	3584-01	1	POWER CABLE TO ELECTRONICS J802S	Power Panel Tape Transport	POWER TO TOP PLATE J2702P (to both reproduce electronics)	Master Reproduce Electronics
Interconnecting	30885-01	1 Per Slave Transport	SLAVE TO SLAVE J104S	Fast Start Relay Box (Slave Transport)	MASTER TO SLAVE J103S	Next Slave Tape Transport (Fast Start Relay Box)
Interconnecting	6013-01	1	OUTPUT J2703P	Master Reproduce Electronics	INPUT J403S	Master Record Electronics
Interconnecting	6013-01	1	OUTPUT J2703 P	Master Reproduce Electronics	INPUT J401S	Master Record Electronics

Figure 2-2 CABLE INTERCONNECTING DIAGRAM

CABLE	CATALOG NO.	QUANTITY	FROM		TO	
			RECEPTACLE	CHASSIS	RECEPTACLE	CHASSIS
Interconnecting	6006-00	1	LOWER TRACK AUDIO NO. 2 OUT J404P	Master Record Electronics	RECORD AUDIO No.2 J308P	Slave Switch Panel
Interconnecting	6008-00	1	FULL AND UPPER AUDIO NO. 1 OUT J402P	Master Record Electronics	RECORD AUDIO No. 1 J307P	Slave Switch Panel
Interconnecting	3730-04	1	BIAS BUSS J502P	Master Bias Oscillator	BIAS BUSS J309P	Slave Switch Panel
Interconnecting	6012-00	1	RECORD TO SLAVE NO. 2 J311P	Slave Switch Panel	RECORD AUDIO NO. 2 J308P	Next Slave Switch Panel
Interconnecting	6014-00	1	RECORD TO SLAVE NO. 1 J310P	Slave Switch Panel	RECORD AUDIO NO. 1 J307P	Next Slave Switch Panel
Interconnecting	3730-04	1	BIAS TO SLAVE J312P	Slave Switch Panel	BIAS TO SLAVE J312P	Next Slave Switch Panel
Head Cable	UPPER 475-26 (Master)	1	Captive Upper Track Head	Tape Transport	INPUT J2701P	Master Reproduce Electronics No. 1
Head Cable	LOWER 475-26 (Master)	1	Captive Lower Track Head	Tape Transport	INPUT J2701P	Master Reproduce Electronics No. 2
Head Cable	FULL 475-28 (Slave)	1	Captive Full Track Head	Tape Transport	FULL TRACK HEAD J302P	Slave Head Switch Panel
Head Cable	LOWER 475-28 (Slave)	1	Captive Lower Track Head	Tape Transport	LOWER TRACK HEAD J303P	Slave Head Switch Panel
Head Cable	UPPER 475-28 (Slave)	1	Captive Upper Track Head	Tape Transport	UPPER TRACK HEAD J301P	Slave Head Switch Panel

CABLE INTERCONNECTING DIAGRAM

Step 1: Using the 3-3/4 ips tape (Catalog number 31331-01), calibrate the tape reproducer for a known output level (such as 0 dbm) and plot a frequency response curve.

Step 2: Place a standard tape of the speed of the master tape to be duplicated on the master transport. Set the tape speed switch in the proper position. Thread bulk degaussed tape on the slave or slaves to be checked. Set the slave transport(s) to the proper speed. Set the record amplifier speed switch to the speed combination being checked. Start the system so that duplicates of the standard tape will be made. Record level should be set so that the normal operating level of the standard tape in use, indicates Ø on the record level meter, for 15 ips copies. For 7-1/2 and 3-3/4 ips copies the level should be reduced 10 db to avoid possible tape saturation.

Step 3: Measure the output level and frequency response of the duplicate made in Step 2 and compare the results with the measured output level and frequency response of the Reproducer Standard Test Tape measured in Step 2. If the output level and frequency response of the copy is within ±2 db of the Reproducer Standard Test Tape, the system can be considered to be operating properly. With care, the system can be adjusted to ±1 db of the standard tape response.

NOTE

If the output level and frequency response of the copy is not within ±2 db of the Reproduce Standard Test Tape, make the "Bias Current Adjustment", the "Record Current Adjustment", the "Reproduce Alignment", and "Record Alignment": in the order mentioned.

IMPORTANT

Since operation of duplicator system is dependent upon the accuracy of the Standard Test Tapes, it is of utmost importance that the Standard Test Tapes be properly cared for. Proper care consists of: (1) cleaning and demagnetizing heads and guides before use of the Standard Test Tapes; (2) do not rewind Standard Test Tape after use (it should be stored "tail out" and be rewound just before use); and (3) store the Standard Test Tapes at room temperature, avoid storage in or near magnetic fields.

f. Bias Current Adjustment

The individual bias controls for each head are mounted on the slave switch panels at the rear of each slave console. These controls are factory adjusted for optimum results with typical "Long Play" (1 mil base) tape. The controls should be checked and, if necessary, adjusted for optimum results with the user's normal tape. Differences in high frequency response (3 db) are compensated for by varying the individual head bias controls.

Step 1: Terminate the output of the upper and full track master reproduce amplifier in 600 ohms, and connect this output to an a-c vtvm, and set the audio oscillator to 2000 cps.

Step 2: Place the TAPE SPEED selector switches in the LOW position.

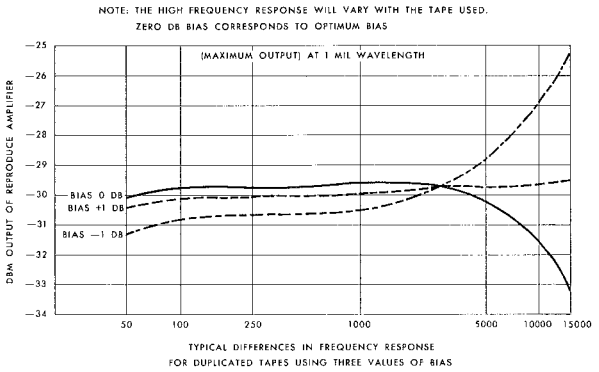


Figure 2-3

Step 3: Thread the tape to be used along the path shown in the illustration, "TAPE THREADING PATHS".

Step 4: Terminate the output of the full and upper track Master Reproduce Amplifier in 600 ohms and connect this to a vtvm.

Step 5: Press the START RECORD button, and adjust BIAS control on the front panel so that its meter reads zero v-u.

Step 6: Place the FULL TRACK record head switch in the ON position.

Step 7: Adjust the full track BIAS vernier for maximum output on the vtvm.*

Step 8: Place the FULL TRACK head switch in the OFF position.

Step 9: Place the UPPER HALF TRACK head switch in the ON position.

Step 10: Adjust the upper half track BIAS vernier for maximum output.*

* The peak output level versus bias current curve may be so broad that consistent adjustments will be difficult to obtain. It is suggested that an a-c vtvm such as a HP 400C be used to measure the bias current at the record current jack while the 2 kc signal is being recorded. A consistent setting will be the bias current which is the medium value between the points where the output begins to drop. Typical values of bias currents (measured across 10 ohm resistor with an a-c vtvm at slave head monitoring jacks of Slave Switch panel) are -db .78v 7.0 ma for half track heads and -db .78v 9.0 ma for full track type 475-28R head assemblies.

Step 11: Terminate the output of the lower track Master Reproduce Amplifier in 600 ohms and connect this output to a vtvm.

Step 12: Place the UPPER HALF TRACK head switch in the OFF position.

Step 13: Place the LOWER TRACK head switch in the ON position.

Step 14: Adjust the lower track BIAS vernier for maximum output.*

Step 15: To determine the ultimate bias setting, duplicate copy of an Ampex Standard tape as noted in "e" "Overall System Check" and compare the response of the duplicate with that of the Reproducer Standard Test Tape, Cat. No. 5563 (or 31321-01) or 31331-01 (3-3/4 ips, 120 u sec). The response of the duplicate will vary approximately as shown in the graph and can be adjusted accordingly.

NOTE

If, after adjusting the bias current, the response of the system (disregarding level) is not within 2 db of the Reproducer Standard Test Tape, perform

*See footnote for Step 7.

the "Overall Response by Induction Loop". If the response of the system is within the desired tolerance of the test tape, perform the "Record Current Adjustment".

g. Reproduce Alignment with Standard Tape

Reproduce alignment consists of adjusting the azimuth of the reproduce heads, setting reproduce level and, if necessary, adjusting reproduce equalization. Each procedure must be carried out twice -- once for each reproduce head and reproduce amplifier.

Step 1: Remove the top cover on the master reproduce tape transport head assembly by removing the two socket head screws that hold it and pulling gently up and back. The two heads, from left to right, are the lower half track reproduce head and the upper half track reproduce head. The nut on the top left side of each head can is used for azimuth adjustment. NEVER ATTEMPT TO ADJUST ANY OTHER NUT OR SCREW ON THESE HEADS.

Step 2: Thread an Ampex alignment tape (Cat. No. 6878 or 31300-01) on the master.

Step 3: Terminate the output of the UPPER AND FULL TRACK master amplifier in a 600-ohm resistive load.

Step 4: Connect an a-c vtvm and a pair of headphones or a speaker amplifier across this output.

Step 5: Place the master tape transport mode selector switch in the PLAY position.

Step 6: Place the master tape transport TAPE SPEED selector switch in the LOW position.

Step 7: Place the master POWER toggle switch in the ON position.

Step 8: Press the START button on the tape transport.

Step 9: The first tone on the tape will be for head azimuth adjustment. Adjust the azimuth nut on the UPPER HALF TRACK head for maximum output as seen on the vtvm.

Step 10: The next tone on the tape is recorded at normal operating level for adjusting reproduce level. Adjust the reproduce level control (PLAYBACK LEVEL) on the upper and full track master reproduce amplifier for a vtvm reading of 1.23 volts rms (+4 dbm) on this tone.

Step 11: Next is a sequence of tones used for checking overall reproduce response. Check the response observed on the vtvm as the tone sequence is played. If the response is satisfactory, rewind the standard tape, and repeat the entire procedure on the lower track head and master reproduce amplifier.

h. Record Alignment

Record channel alignment consists of adjusting the azimuth of all record heads, and setting the record level for each record head. The procedures outlined below must be repeated for each of the two record channels.

If the system contains more than one Slave Duplicator, each slave must be adjusted as described below:

Record head azimuth is adjusted while recording a signal on a slave and simultaneously playing it back on the Master Reproduce unit.

Step 1: Remove the top cover of the Slave Duplicator head assembly. The heads, from left to right facing the machine are: full track, lower left track, upper half track. The azimuth adjustment is the nut on the top left side of each head can. Make this adjustment using a 1/4 inch Spintite socket wrench.

Step 2: Place the TAPE SPEED switch in the LOW position on both Master and Slave Tape Transports.

Step 3: Be certain all POWER switches on the master control panel are in the ON position.

Step 4: Place the upper half track and lower half track head switches on the Slave Switch Panel in the OFF position.

Step 5: Place the tape transport mode selector in the PLAY position.

Step 6: Set an audio oscillator to 1000 cps at 1.23 volts rms, and feed this signal into the AUDIO NO. 1 input of the Master Record Amplifier.

Step 7: Terminate the output of the upper and full track Master Reproduce Amplifier in 600 ohms, and connect this output to an a-c vtvm.

Step 8: Set RECORD LEVEL for the FULL AND UPPER TRACK section of the Master Record Amplifier to zero on its v-u meter.

Step 9: Advance the Audio Oscillator to 40,000 cps.

Step 10: Press the START RECORD button.

Step 11: Adjust the BIAS control on the front panel to obtain zero v-u on the bias meter.

Step 12: Adjust the full track record head azimuth to a maximum reading on the vtvm.

Step 13: Place the FULL TRACK head switch in the OFF position.

Step 14: Place the UPPER TRACK head switch in the ON position.

Step 15: Adjust the upper track record head for maximum output.

Step 16: Place the UPPER TRACK head switch in the OFF position.

Step 17: Set an audio oscillator to 1000 cps at 1.23 volts rms, and feed this signal into the AUDIO NO. 2 input of the Master Record Amplifier.

Step 18: Terminate the output of the lower and full track Master Reproduce Amplifier in 600 ohms, and connect this output to an a-c vtvm.

Step 19: Place the LOWER TRACK head switch in the ON position.

Step 20: Terminate the output of the lower track Master Reproduce Amplifier in 600 ohms, and connect this output to an a-c vtvm.

Step 21: Adjust lower track record head for maximum output.

NOTE

While recording, replace the head cover and tighten the screws, making certain that the azimuth adjustment does not change.

i. Record Level Setting

Step 1: Terminate the output of the upper track Master Reproduce Amplifier

in 600 ohms and connect this output to a vtvm. (The Reproduce Amplifier gains should have been previously set for +4 dbm output at the 1kc reference level of a 6878 standard tape.)

Step 2: Set the audio oscillator to 500 cps and feed this signal into the audio No. 1 input of the Master Record Amplifier.

Step 3: Set the gain vernier for the upper and full track channel to maximum clockwise.

Step 4: Adjust the upper and full track channel gain attenuator so that the v-u meter reads between zero v-u and +2 v-u.

Step 5: Adjust the gain vernier so that v-u meter reads exactly zero v-u.

Step 6: Thread the tape to be used along the prescribed path.

Step 7: Place the full track record head switch in the ON position and the upper half track and lower half track head switches in the OFF position.

Step 8: Place the TAPE SPEED switches in the LOW position, and press the START RECORD button, making certain the bias meter still reads zero v-u.

Step 9: Adjust the full track record level vernier on the Slave Head Switch Panel for a reading of 1.23 volts rms (+4 dbm) on the vtvm.

Step 10: Place the full track head switch in the OFF position.

Step 11: Place the upper track head switch in the ON position.

Step 12: Adjust the upper track record level vernier for 1.23 volts rms (4 dbm) on the vtvm.

Step 13: Place the lower track head switch in the ON position.

Step 14: Place the upper and full track head switches in the OFF position.

Step 15: Feed the 500 cps signal from the audio oscillator to AUDIO NO. 2 input of the Master Record Amplifier.

Step 16: Terminate the output of the lower track master reproduce amplifier in 600 ohms and connect this output to a vtvm.

Step 17: Set the gain vernier for the lower track channel to maximum clockwise.

Step 18: Adjust the lower track channel gain attenuator so that the v-u meter reads between zero v-u and +2 v-u

Step 19: Adjust the gain vernier so that the v-u meter reads exactly zero v-u.

Step 20: Repeat steps 6 and 8 and adjust the lower track record level vernier on the Slave head switch panel for a reading of 1.23 volts rms (4 dbm) on the vtvm.

j. Record Current Adjustment

After bias current and/or reproduce equalization has been adjusted for optimum frequency response, the record current for each head should be adjusted.

Step 1: Duplicate the operating level section of the 15 ips, Standard Tape, with the duplicator gain controls set for normal record levels.

Step 2: Measure the output level and third harmonic distortion of the tone on the copy at the output of the calibrated tape reproducer. If the level of the respective tracks vary more than 1 db from each other or from the required level, the individual head current control for the track in question must be readjusted. Also, if the third harmonic distortion is greater than 1%, the record current must be readjusted. If a distortion level meter is not available, the Ampex 5563 (or 31321-01), 7-1/2 ips reference level, will correspond to 1% distortion level.

k. Overall Noise Measurements

Noise levels of duplicated tapes can be measured by three techniques:

1. Noise can be measured broadband, by connecting a vtvm across the output of a suitable reproducer. This is usually not satisfactory because it measures noise outside of the useful spectrum.

2. Selective filters may be placed between the reproducer and the vtvm. This affords precise measurements that can be easily repeated but involves costly equipment.

3. An ASA 40 phon A curve filter may be placed between the output of the reproducer and a vtvm. This filter is easily built and affords good results with low impedance output reproduce systems.

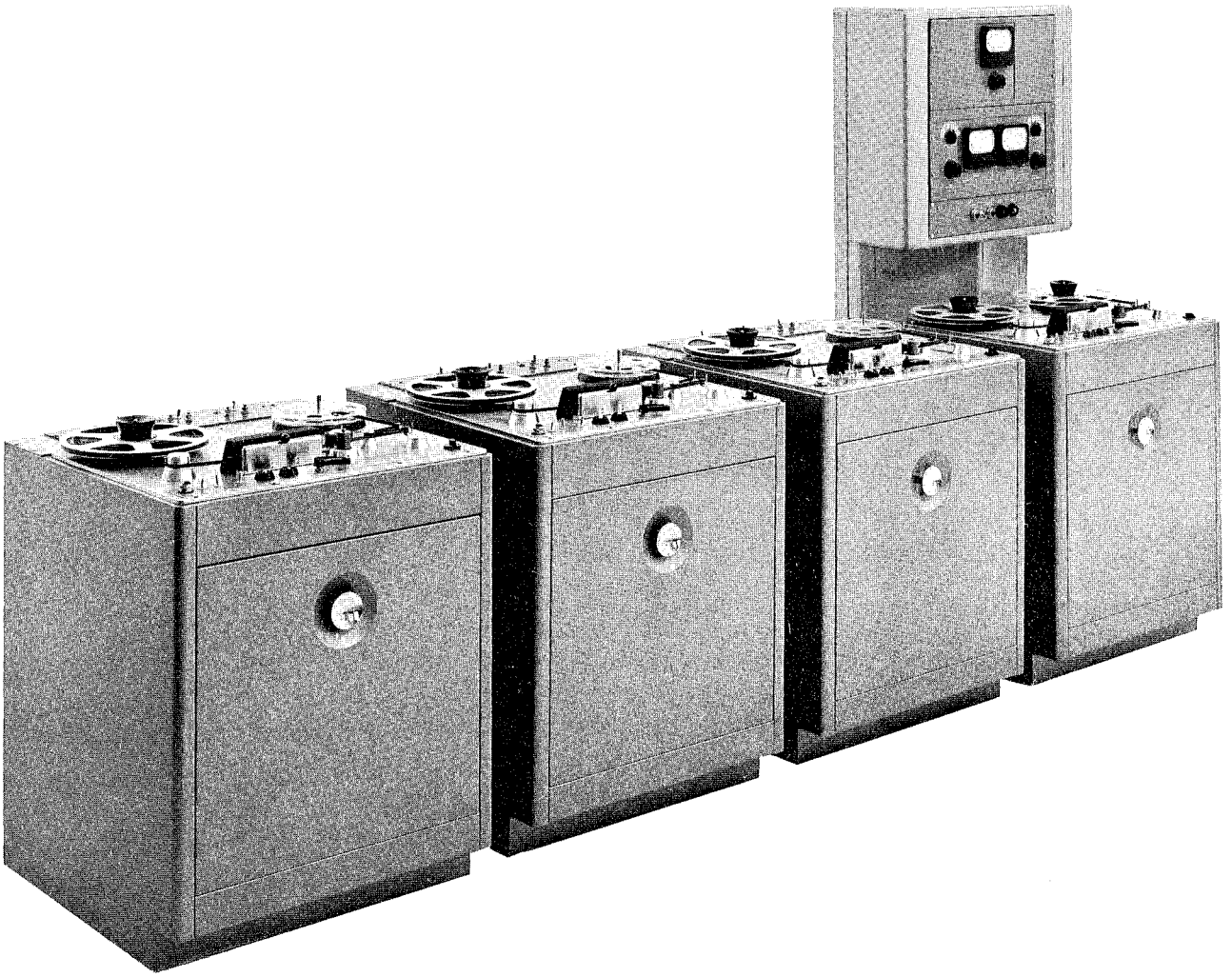


Figure 2-4 DUPLICATOR SYSTEM

Section 3

Operation

GENERAL

The equipment is intended for making 7-1/2 ips (NAB) or 3-3/4 ips duplicate copies, using a 15 ips or 7-1/2 ips master tape. The response curve of the master tape will be closely approximated by the response recorded on the duplicate copies. If the reproduce amplifiers are on the curve (see the appropriate curve applicable on the equipment), the reproduce head is normal and in correct adjustment, the record amplifiers are on the proper curve, and the recording to be duplicated is acceptable, the only variable will be the type of tape chosen. Record bias may be adjusted for differing tape characteristics.

In tape, a number of factors can differ such as the magnetic properties of the oxide, the manner of it's milling, processing of binders and coating, and tolerances imposed for specifications. Recognizing that these variations in tape exist, the Ampex system permits the achievement of a uniform end product.

When the master tape is deemed satisfactory from the standpoint of good signal-to-noise ratio, uniform frequency response, low distortion -- which imply that the recording was made at a proper level -- the system can be adjusted for the characteristics of the tape chosen.

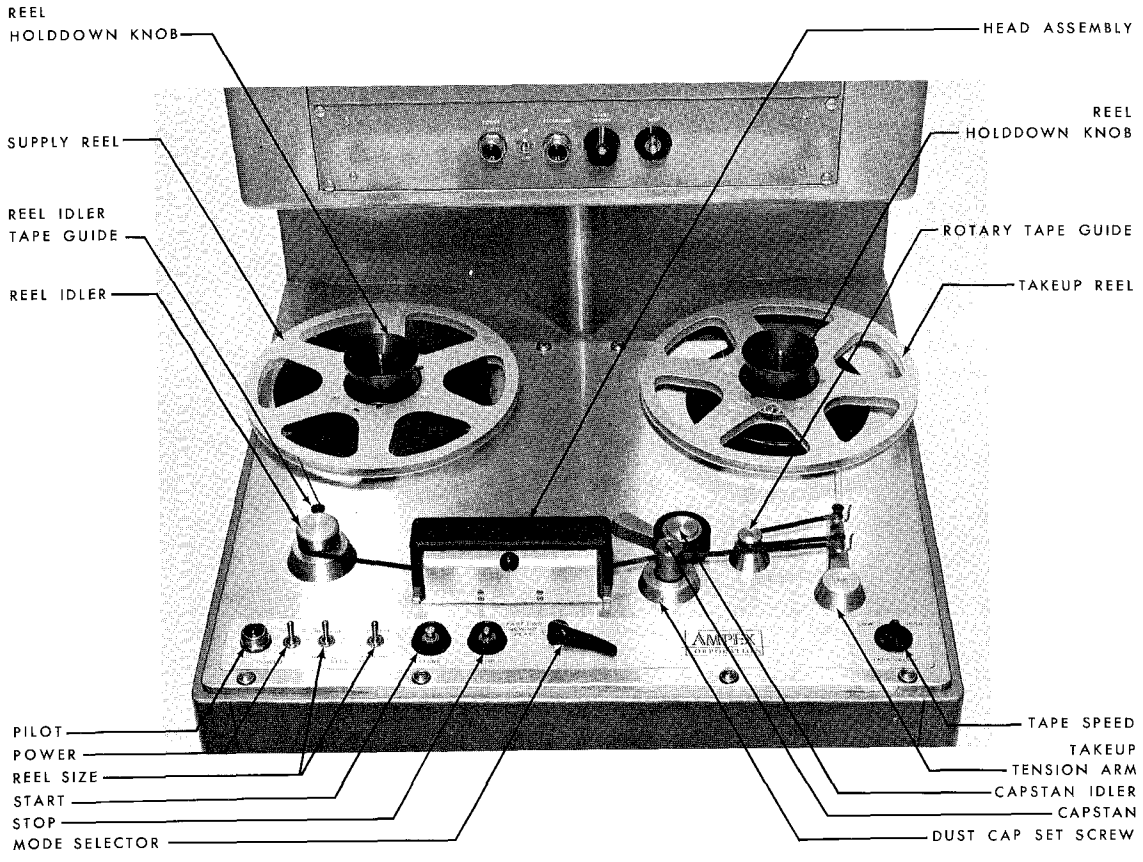
Pre-operational procedures are described immediately following this general discussion. There are two ways to make duplicates: the master tape can be run forward or it can be run backward. The operators requirements will determine how he wishes to make his copies. A number of advantages present themselves in using reverse duplication. If a master tape has been wound to run backwards, and placed on the supply reel of the master tape transport, the duplicates do not have to be rewound, and can be lifted from the machines ready for reproduction. Obviously, time is saved for filing or packaging. Routine lifting of finished copies can be done while the master is being rewound. When the tapes are copied backwards, the transient response from steep wave fronts is less; therefore distortion is slightly decreased. The speed of the duplication is a matter to be determined by the requirements of the master speed and the usage of the copy. Another factor to be considered is choosing the correct tape speeds for the tape being utilized. Delicate tapes may require slower speed operation. Because there are no erase heads and since a residual signal may exist on even new tape, it is important to bulk erase all tape before recording.

NOTE

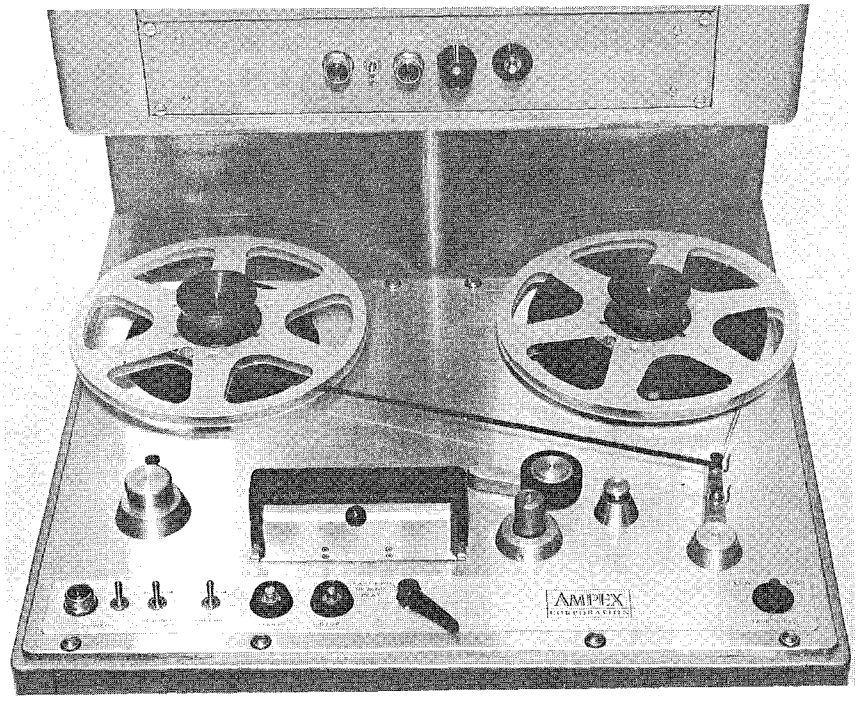
When duplicating stereophonic tapes a 1:1 ratio speed combination must be utilized because of the configuration of the head assemblies.

TAPE THREADING

Tape threading is shown in the tape threading illustrations (Figs. 3-1 and 3-2). For fast forward or rewind the tape should be threaded in such a matter that the takeup arm is in the operating position and the tape does not contact the heads.

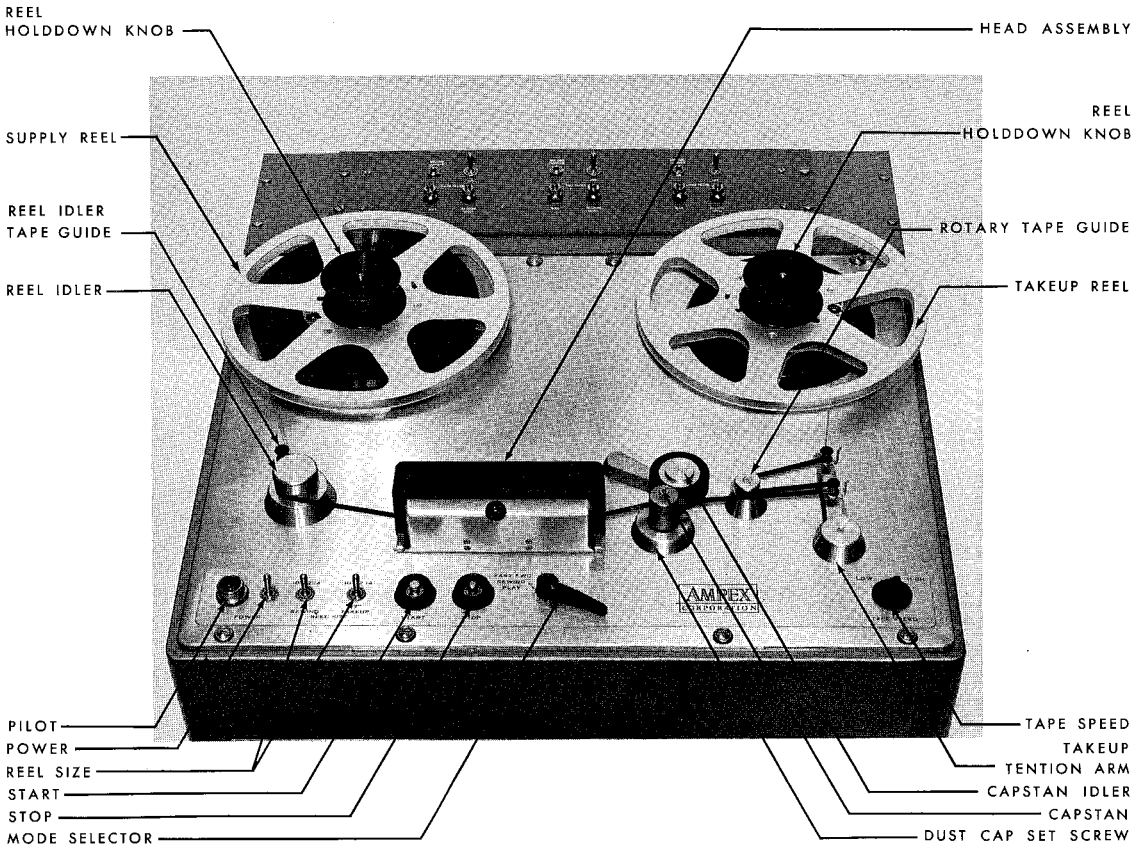


PLAY

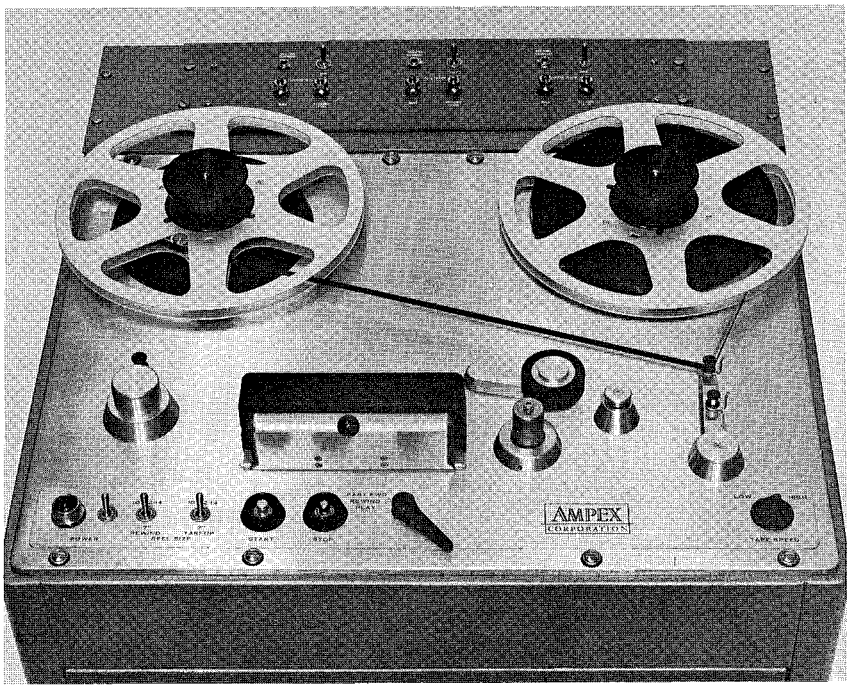


FAST FORWARD OR REWIND

Figure 3-1 TAPE THREADING PATH (MASTER)



PLAY



FAST FORWARD OR REWIND

Figure 3-2 TAPE THREADING PATH (SLAVE)

CONTROLS

a. Fast Start Switch

The FAST START switch is located on the power panel mounted on the underneath side of the tape transport. This switch should be placed and left in the FAST START position at all times except when operating with delicate tapes.

b. Speed Selector

The TAPE SPEED selector on the slave transport determines the speed of the capstan drive motor. With the capstan bushing in place, the HIGH speed position provides 60 ips speed and the LOW speed position provides 30 ips speed. Removing the capstan bushing halves the tape speed so that HIGH speed position gives 30 ips speed and LOW speed position gives 15 ips speed.

c. Mode Selector

The three-position mode selector should be set in the desired mode before pressing the START button. This selector can be switched back and forth between FAST FWD and REWIND, permitting direction changes without stopping the tape. When the machine is in either of these modes, placing the selector in PLAY position will automatically stop the tape, making it necessary to press the START button again. This safety feature prevents tape breakage. The START button should not be pressed until the tape has come to a complete stop.

d. Reel Size Selectors

These selectors are on all the tape transports, located to the left of the START and STOP buttons. Make certain these toggle switches are in the appropriate positions. The 7 inch position should be used for EIA hub reels; the 10-1/2 inch position should be used for NAB hub reels (10-1/2 or 14 inch).

e. Power Switch

There are two POWER switches associated with the Master, one on the tape transport, another on the master control panel.

Each slave has its own tape transport POWER switch.

f. Gain Controls

Two step attenuator controls are located on the master record panel. The master record panel GAIN, on the left as the user faces the equipment, should be so connected that it serves track 1 (upper and fulltrack) and the right hand control GAIN should serve track 2 (lower).

Normal program level peaks should not exceed zero v-u.

Attenuator controls are usually set at calibration 28 for normal levels. These adjustments should not be changed unless the level of the master recording is low or high. Normally, all record channels should be set for the same level (zero v-u on their respective meters), while duplicating or reproducing a full track tape having a tone at normal program level using 250-1000 cycles.

g. Bias Level Setting

On the master control assembly, the BIAS control provides an adjustment for bias current to all slaves in the system. The output meter indicates bias voltage, and is calibrated to read zero v-u while supplying the proper bias to the slave head switch panels. The scale readings are arbitrary, a v-u meter was used to simplify spare parts procurement.

Assuming bias of each slave has been properly adjusted with a median tape (a tape having average coercive characteristics), variation in tape bias characteristics can be

compensated for by varying the BIAS control on the control panel. Increasing bias will result in decreased high-frequency response; conversely decreasing bias will accentuate high-frequency response. It is desirable to set up the system for optimum response with the type of tape to be used on the equipment.

SLAVE EQUIPMENT

a. Head Switches and Track Characteristics

Three double pole single throw toggle switches, one for each head, provide a means to disconnect bias and record current to any head. Individual screw driver adjustment controls for bias and record currents are available for each of the three heads.

b. Record Level Setting

On the slave switch panel there are three RECORD LEVEL vernier controls, one for each head. A phone jack is provided to afford means for measuring record current or bias at each head.

OPERATING PROCEDURE

IMPORTANT

BECAUSE THERE ARE NO ERASE HEADS IN DUPLICATOR SYSTEMS, PREVIOUSLY USED TAPE MUST BE ERASED WITH A BULK TAPE DEGAUSSER.

Step 1: Thread bulk erased blank tape into each slave duplicator. Place the head switches on the slave head switching panel to the ON position for the tracks to be duplicated.

Step 2: Place the MODE SELECTOR for the master and each slave in PLAY position.

Step 3: Set the TAPE SPEED table above the RECORD EQUALIZATION knob on the front panel indicates LOW-HIGH speed setting for the required duplication .

Step 4: Make certain that FAST START switches, located on the connector panels mounted under the tape transports, are in the proper positions on master and slaves.

Step 5: Place all POWER switches on the master control panel, and tape transports to the ON position.

Step 6: Thread the master tape to be duplicated on the master reproduce tape transport.

Step 7: Set the RECORD level control to the proper setting; normally 28. (See RECORD LEVEL SETTING.)

Step 8: Press the START-RECORD button on the master control panel. This is the only switch on the entire equipment that will start the complete system.

Step 9: Set the BIAS level control on the master bias oscillator to a reading of zero on the v-u meter (or to suit the characteristics of tape being used).

Step 10: When recording has been completed press the STOP button on the master control panel. Rewind the master tape.

Duplication may be stopped at any time by pressing the STOP button on the master control panel.

REMOTE CONTROL

A suggested remote control wiring diagram may be found on the Master Control Panel Schematic (Figure 4-13).

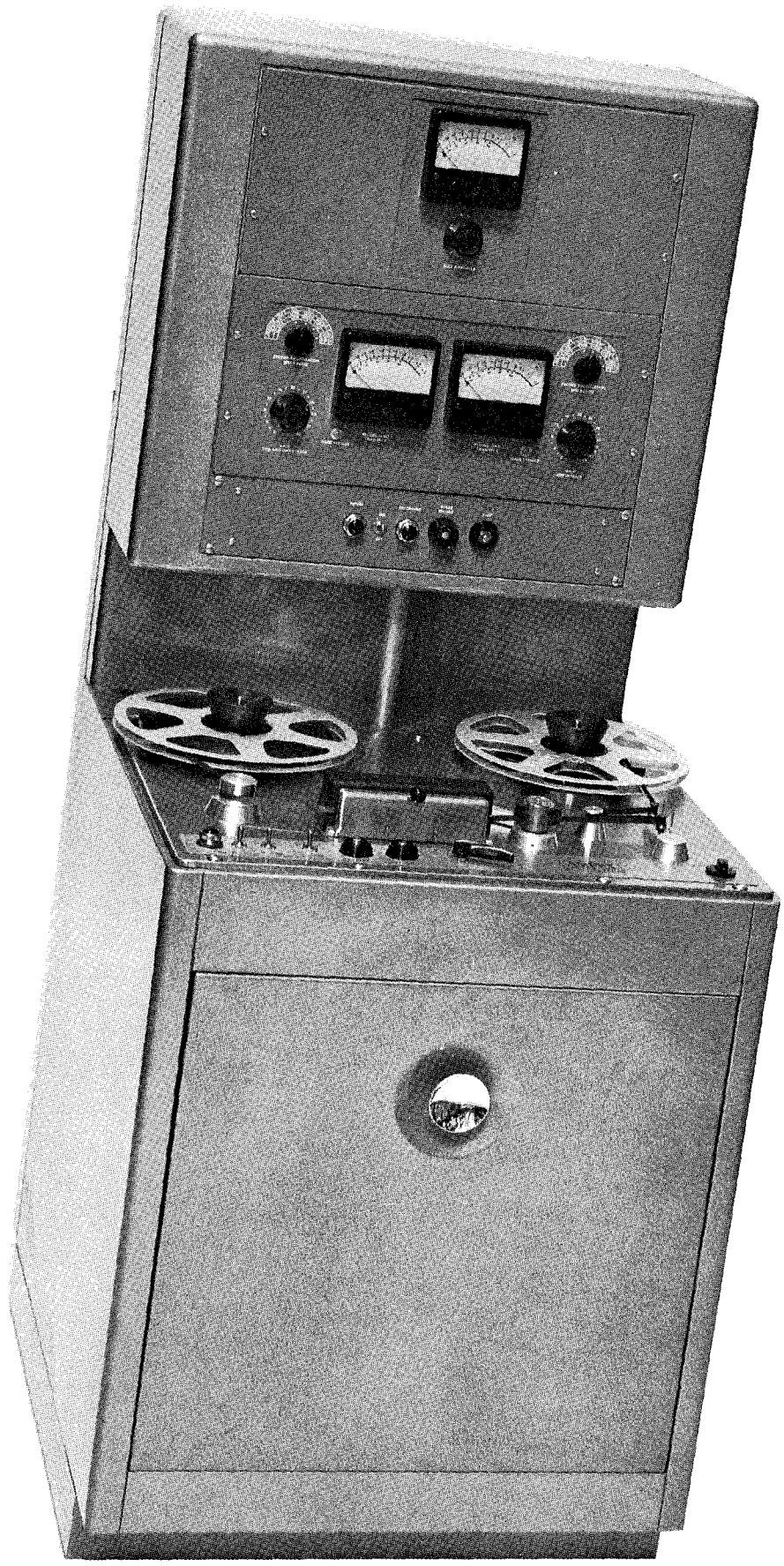


Figure 3-3 MASTER DUPLICATOR CONSOLE

Section 4

Tape Transport Mechanism

GENERAL

The tape transport mechanism provides the tape motion for all modes of operation. Basic functions of the various assemblies are described in full and specifications of each are given throughout this manual. The assemblies and their associated components -- the tape supply system, the tape takeup system, the tape drive system and control circuit -- insure smooth, positive movement of the tape across the head assembly and proper tape tensioning when the equipment is in the record or play modes. All tape motion controls, a Low-High tape speed switch, a takeup tension arm (safety microswitch) and the head assembly are located on the tape transport.

CAUTION

WHEN LOADING THE TAPE FROM THE LEFT HAND REEL HOLDER BE SURE THE TAPE HAS THE OXIDE-COATED SIDE TOWARD THE HEAD FACES.

TAPE SUPPLY AND TAKEUP SYSTEMS

From the supply reel, on the left side of the tape transport as the operator faces the equipment, tape is delivered to the takeup reel when the PLAY or FAST FORWARD mode is selected. Tape is rewound onto this supply reel when the REWIND button is selected. Proper tape tensioning is maintained during the record and reproduce modes by means of two reel induction torque motors, the takeup tension arm, and reel idler guide arm. See Fig. 3-2 and 3-3 (Tape Threading Path).

The reel idler assembly on the supply side of the tape transport is composed of a pulley and flywheel used to smooth out transient speed variations in the tape system. A spring-pivot mounted arm is affixed to the base of the assembly and assures relief of starting tensions. This pivot arm has been damped with Dow Corning type 200 silicon fluid (15000 centistokes).

On the takeup side of the tape transport, the tension arm assembly with a spring-pivot-mounted arm forms a safety feature. Near the base of the shaft on which the tension arm is mounted, a spring bracket with two leaf springs actuates the safety switch (S501) stopping tape motion if the tape tension is lost. Another function of the leaf springs is to provide a cushioning of the arm before it strikes the stop due to high tape tension.

Both the tape supply and takeup assemblies are composed of induction torque motors (B601 Supply (Rewind), B701 Takeup), a turntable mounted directly on each motor shaft, a brake housing assembly and a flange for mounting the entire assembly. Because the brake housings are mirror images of each other, these assemblies are not interchangeable. The brakes are solenoid operated, remaining in the braking position until the brake solenoids K601 and K701 are energized at which time the brakes are released.

During the play or record modes, the two induction torque motors B601 and B701 act as tensioning devices (see TAPE TENSIONING in this section) and in the fast forward and rewind modes the proper motor responds to the commands from either pushbutton by operating at maximum torque to provide the selected function.

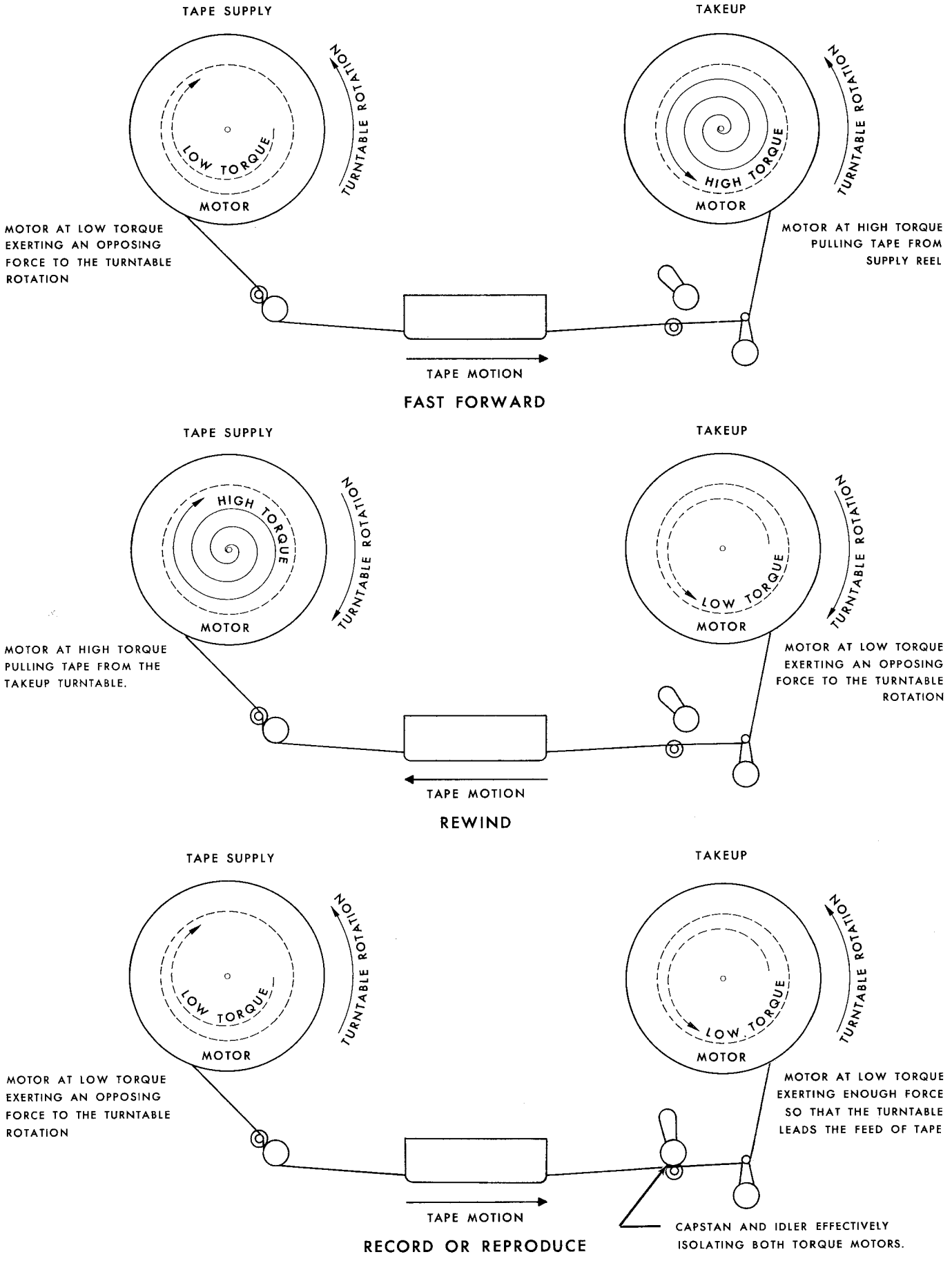


Figure 4-1 **TAPE TENSIONING**

TAPE TENSIONING

The purpose of the Tape Tension System is to provide proper tape tension in all modes of operation.

The supply (rewind) and takeup induction torque motors are so connected that when power is applied with no tape threaded, the turntables, fixed to their shafts, will rotate in opposite directions. The tape supply turntable will rotate clockwise, the tape takeup turntable will rotate counterclockwise.

Motor torque in the play/record mode is adjusted by the position of sliders on tensioning resistors R801, R802, and R803. Since the torque required for NAB hub (10-1/2 or 14) inch reels is different than that required for EIA hub (7 inch) reels individual sliders are selected by switches S807 and S808.

The following table shows approximate torque obtained when using NAB hubs in various modes of operation.

In the fast forward mode, the torque of the supply (rewind) motor is reduced considerably by introduction of a series resistance (R802). In the rewind mode R802 is in series with the take-up motor. Basic tape tensioning operation is shown in the illustration.

In the fast forward mode, the take-up motor thus operates at full torque, the supply motor at reduced torque, and the tape is pulled from the tape supply reel. Because the torque of the tape supply turntable motor (rewind motor) is applied in the opposite direction to the turntable rotation, the tape is held under continuous tension as it is pulled from the reel.

In the rewind mode, the supply motor operates at full torque and the take-up motor holds the tape under continuous tension by its opposite and reduced torque.

In the play or record modes, both torque motors operate at reduced torque. The tape drive capstan and the capstan idler, between which the tape is clamped, then determines the tape speed, and the tensioning system supplies tape or takes it up as metered by the capstan drive.

From the point of view of the tape supply turntable, the capstan and idler action exerts sufficient pull on the tape to overcome the opposing torque of the supply motor, which constitutes the hold back tension. From the point of view of the tape take-up turntable, the capstan and idler action is feeding the tape to it. The tape is held under tension here, because the take-up rate exceeds the feed rate (a tape loop will be thrown on the right side of the capstan whenever and malfunction causes the feed rate to exceed the take-up rate).

If a tape loop is thrown, or the tape breaks, the take-up tension arm will actuate the safety switch S501 and stop the equipment. Its function provides tape storage loop to take up tape slack, especially when starting, and to operate the safety switch.

The reel idler assembly smooths out transients in the tension system. For example, when starting the tape in the play mode, the momentary strain transmitted through the tape to the tape supply turntable, when the capstan idler forces the tape against the capstan, is considerable. Under some circumstances, this impulse tends to stretch or break the tape. A monentary decrease in hold-back tension might be sufficient to start a transient oscillation in the tape tension system which would be reflected as a periodic variation in the distance of the tape from the heads. This variation might be of sufficient magnitude to appear as an undesirable fluctuation in the signal level at the start of recording or playback. The reel idler arm

absorbs most of the starting strain, and prevents or minimizes this type of oscillation. The reel idler pulley and flywheel provide additional stability in the tape tension system, by smoothing out such transients as motor torque fluctuations and irregularities due to faulty tape wrap on the supply reel. This is accomplished because the high inertia of the reel idler pulley and flywheel effectively isolate the reel assembly from the heads.

TAPE DRIVE SYSTEM

The tape drive system is composed of the drive motor, the capstan assembly, the capstan idler arm and idler.

The purpose of the tape drive system is to transport the tape across the heads at a uniform speed during the record and playback processes. By means of a hysteresis synchronous capstan drive motor (B501), the tape drive capstan assembly and a capstan idler, the magnetic tape is driven at constant speed after power has been applied to the equipment and the PLAY button is pressed. (The drive motor has two windings to provide two tape speeds either of which can be selected at the TAPE SPEED toggle switch (S502 and S503).

After the POWER switch (S801) at the electronics assembly and tape transport has been placed in the ON position the FAST or SLOW start switch (S806) is at this time operated. In the SLOW start position the capstan drive motor is out of the circuit at this time but in FAST start the capstan drive motor solenoid energizes and the motor pulley engages the capstan flywheel. When the PLAY position is selected, followed by pressing the START button, (provided the tape is properly threaded), the capstan solenoid (K501) and the brake solenoids K601 and K701 are energized. The capstan solenoid pulls the rubber tired capstan idler

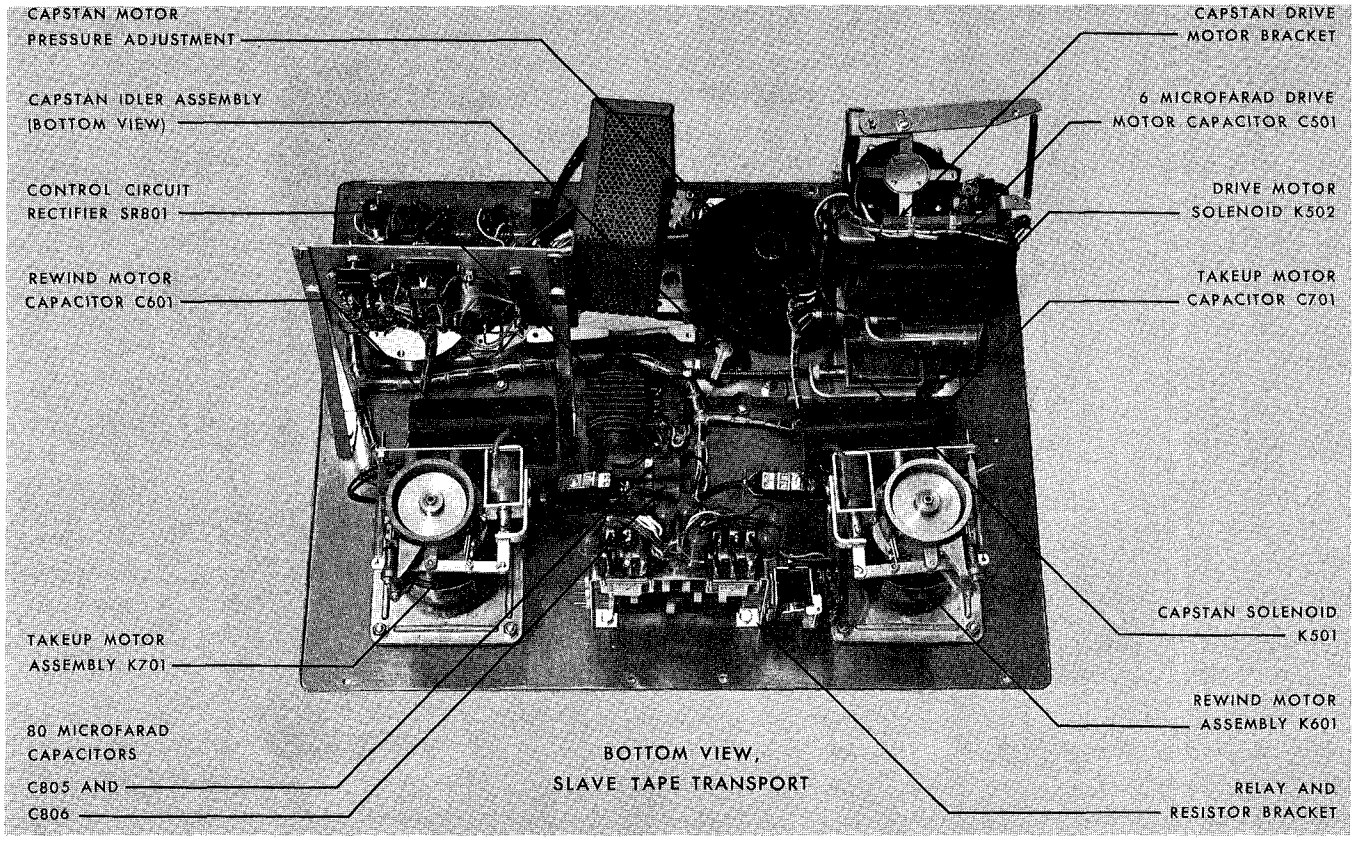


Figure 4-2 **TAPE TRANSPORT PART CALLOUTS**

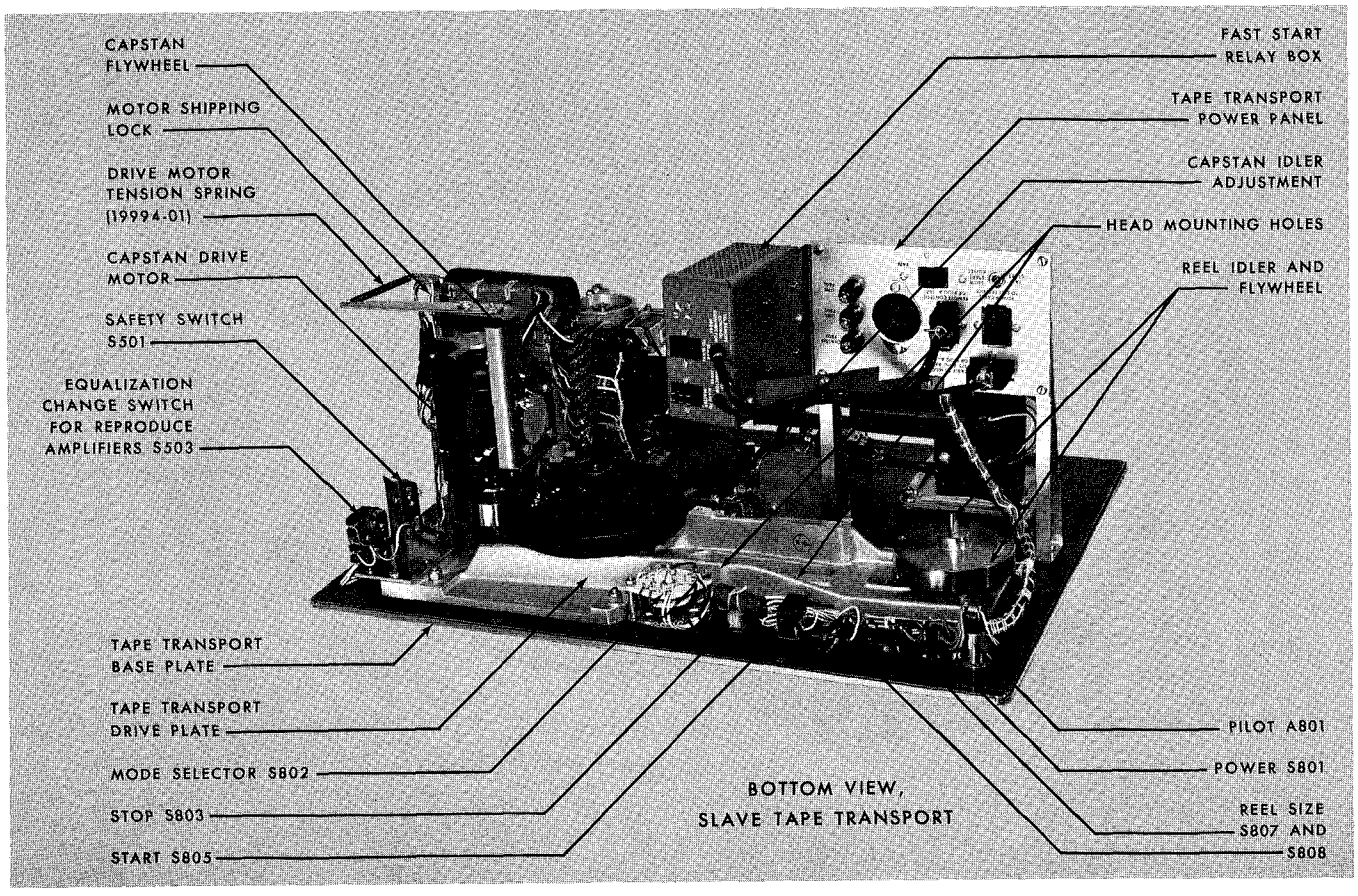


Figure 4-3 TAPE TRANSPORT PART CALLOUTS

wheel, which is mounted on a swivel type arm, against the tape causing the tape to make firm positive contact with the capstan. The tape is then moved at a constant speed across the head assembly.

The capstan drive motor assembly is mounted on a sturdy motor bracket held to the underneath side of the tape transport with three 1/4-20 x 5/8 socket head cap screws. Mounted on top of the motor is the spring arm with a hole for the drive motor return spring and variable holes for the shipping lock. The purpose of the spring is to provide a means to keep the motor pulled away from the capstan in the de-energized position.

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The capstan drive motor is mounted on a hinge which is moved by a solenoid to engage the motor and capstan flywheel. Extending from the solenoid draw bar is an adjustment point listed on Figure 4-2.

The capstan speed should be checked with the stick-on strobosticker provided. Before checking, let drive unit run for at least five minutes to warm up lubricant in the capstan assembly. If the lubricant is stiff, the additional drag will cause greater compression of the rubber tire and the capstan will therefore run slightly slow until warmed up. Place strobosticker on capstan shaft with the sticky side down and view rotating shaft under 60 cps light. If the speed is not correct the spokes will appear to rotate. Slight speed changes can be realized by change in capstan drive motor pressure. IF THE ADJUSTMENT IS IN THE PROPER RANGE, INCREASING PRESSURE WILL

SLOW THE CAPSTAN, DECREASING PRESSURE WILL SPEED THE CAPSTAN. (See Adjustment Point in Figure 4-3.) Adjust for no rotation of the strobosticker spokes. (If drive motor pressure is too light, increasing pressure will speed the capstan. In this range the tire pressure is inadequate for stable operation, and the pressure should be increased until increase in pressure reduces capstan speed.)

BRAKE OPERATION

Smooth brake operation is extremely important in maintaining proper tape tension when stopping the tape. Because the holdback tension, supplied by the trailing turntable motor torque, is lost after the STOP button is pressed, maintenance of tape tension then becomes a function of brake operation. THE BRAKING FORCE ACTING ON THE TURNTABLE FROM WHICH THE TAPE IS BEING PULLED (TRAILING TURNTABLE) IN ANY OF THE MODES OF OPERATION MUST EXCEED THE BRAKING FORCE ACTING ON THE TURNTABLE TAKING UP THE TAPE (THE LEADING TURNTABLE) TO PREVENT THE THROWING OF TAPE LOOPS.

One end of the brake band is fixed to the cross head by a roll pin (1/8 inch x 3/4 inch) and two 4-40 x 1/4 inch socket head cap screws which is attached to the anchor mounted of the brake housing. The other end is linked to the brake lever by a 1/8 inch x 1/2 inch drive lock pin and is free to move. When the brake solenoid is de-energized, the brake tension spring acting on the brake lever draws the brake band against the brake drum.

For example if the brake drum of the supply motor, as viewed from the brake housing end, is rotating clockwise when the brake band is applied, the frictional force will cause the band to wrap itself tightly around the brake drum, the brake lever end of the band moving to the right thus increasing braking force. When the drum is rotating counterclockwise, the process is reversed, causing the band to pull away from the drum, and decreasing the braking force.

The ratio of the braking force in one direction to the braking force in the other -- the brake differential -- is approximately two to one on this equipment.

In all modes of operation, the greater braking force always acts on the trailing turntable, maintaining the tape under tension as the system is stopped.

CONTROL CIRCUIT

The control circuit contains all switches and relays which control the operation of the tape transport in all modes. Located underneath the transport, between the supply and takeup motor assemblies, is the bracket supporting rewind resistor (R803) and series resistor (R802). Also mounted on this bracket are three relays -- PLAY relay (K801), TAPE MOTION relay (K802), and DRIVE MOTOR relay (K803). All electronic components such as capacitors and resistors are shown in the foldout illustration, Tape Transport Control Circuits. There are three motor capacitors, the capstan solenoid, the brake solenoids, and the safety microswitch mounted adjacent to the assemblies they serve.

Located underneath the tape transport is the panel which provides a connector for AC line voltage, in, fuses, receptacles for electronic assemblies, and AC line voltage outlet, and "fast start-slow start" switch.

NOTE

Fast start relay box cables plug into receptacles J804S and J805S.

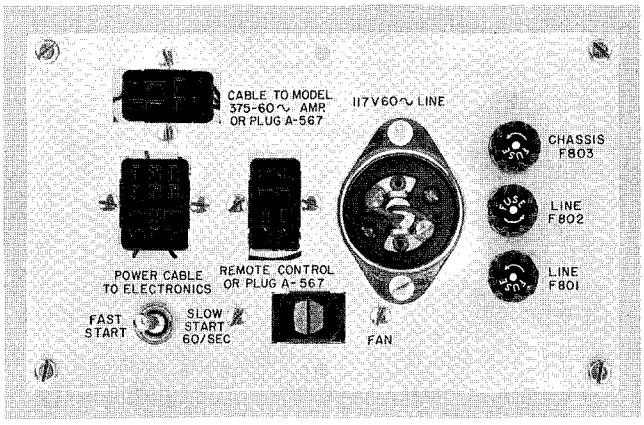


Figure 4-4 POWER PANEL

FUSE REQUIREMENTS
TAPE TRANSPORT
POWER PANEL

Fuse F803	--	-3.2 amp. slowblow
Fuse F802	--	-5 amp
Fuse F801	--	5 amp

FAST START RELAY BOX

The FAST START relay box provides a high initial torque to the takeup motor to quickly take up the loop thrown by the capstan in fast start. This is accomplished by relay K103 which is actuated by the current drawn by capacitor C101 at the moment the start button is pressed. As soon as capacitor C101 becomes charged, no further current is drawn, K103 drops out and normal voltage is applied to the take-up motor. K101 provides remote starting from the Master Control Panel and K102 serves the same purpose for stopping the machine (See Figure 4-13, Schematic Diagram, Master Control Panel for a suggested wiring schematic for Remote Control.

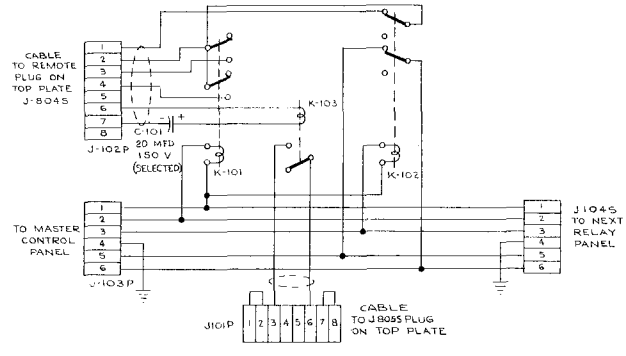


Figure 4-5 SCHEMATIC DIAGRAM, FAST START RELAY BOX

All function control of the tape transport, with one exception, takes place at the control switch assembly comprising two push buttons, START and STOP; three position selector switch choosing one of three modes at a time: PLAY, REWIND and FAST FORWARD. Four toggle switches, POWER, TAPE SPEED (selector type knob), and for REEL SIZE (Rewind and Takeup). The safety switch (not an operating control) is mounted under the tape transport.

REWIND

Power has been applied by Power Switch (S801) and Indicator Light (I801) is lighted. When REWIND mode S802-B is selected and the START button pressed MODE relay K802 is energized and held in this condition by relay contact sets K802-B and the normally closed STOP button S803. Contact set K802A connects full ac power directly to the rewind (supply) motor. The rewind motors operates at full torque and the takeup motor at reduced torque, thus tape is pulled at a maximum speed from the takeup to the rewind reel assembly, contact set K802C completes the DC circuit to the brake solenoids at each reel assembly, thus releasing the brakes.

FAST FORWARD

Power has been applied by Power Switch (S801) and Indicator Light (I801) is lighted. When FAST FORWARD mode S802C is selected and the START button pressed, (S805), MODE relay K802 is energized and held in this condition by relay contact sets K802-B and the normally closed STOP button S803. Contact K802A connects

full ac power directly to the takeup motor. The takeup motor now operates at full torque, causing the tape to be pulled at a maximum speed from the rewind to the takeup reel. Contact set K802-C completes the dc circuit to the brake solenoids at each reel assembly, thus releasing the brakes.

STOP

When the tape is moving in any mode and the STOP button (S803) is pressed, the brake solenoids, and all relays are de-energized. The brakes are applied to both turntable motors. The capstan drive motor, however, will continue to operate so long as the tape remains properly threaded.

PLAY

Power has been applied by Power Switch (S801) and Indicator Light (I801) is lighted. When PLAY mode (S802-A) is selected and start button (S805) is pressed PLAY relay (K801), MODE relay (K802) and FAST START relay K803 (only in Fast Start Position) are energized. Contact sets K802B, K801B and normally closed STOP button (S803) form a holding circuit. Power is connected to the turntable reel motors through contact K802A through contact K802C power reaches the brake solenoids K701 and K601. The reel motors are powered and the brakes are released simultaneously, causing the equipment to operate in the reproduce mode at the speed sleected by the TAPE SPEED SWITCH (S503).

FAST START

When power has been applied to the tape transport by turning POWER SWITCH (S801) to the ON position and safety switch (S501) energized, the TAPE SPEED switch (S502) in the FAST START position (S806), the capstan solenoid (501) has been energized and effectively engages the capstan motor pulley with the capstan flywheel. By this engagement, the capstan will rotate continuously in all modes of operation until the safety switch (S501) is de-energized.

SLOW START

When power has been applied to the tape transport by turning POWER SWITCH (S801) to the ON position, and switch S806 to the SLOW START position, the capstan solenoid K501 and drive solenoid K501 and drive solenoid K502 are de-energized which leaves the capstan motionless. The PLAY position is then selected and the START button pressed which provides ac power to the capstan motor. The capstan solenoid K501 and drive solenoid K502 are then energized and engages the capstan motor pulley with the capstan flywheel and the capstan idler to the capstan. Applications using a tape speed of 60 inches per second and delicate tape may require SLOW START.

REEL SIZE SWITCH

For operation procedures see Figure 4-6.

This switching arrangement selects taps on resistors R801, R802, and R803 and provides proper torque for the takeup and rewind motors in the PLAY mode of operation.

SAFETY INTERLOCKS

When the tape is moving in either of the high speed modes (fast forward or rewind), it is not possible to switch to the play mode without stopping the tape transport. This may be accomplished in two ways; the function switch may be returned

to the PLAY position or the STOP button pressed. The START button S805 must then be pressed to start tape motion again.

CAUTION

If the STOP and PLAY buttons are pressed in too rapid a sequence when the tape is in either high speed mode, tape will almost invariably be broken or deformed. Always allow time for the tape to stop completely when switching from either of the fast modes to PLAY.

CONDITIONS OF OPERATIONAL CIRCUITRY

A. Power switch (S801) in the ON position.

1. Tape not threaded: The Playback Amplifiers receive power.

2. Tape threaded: Fast Start -- Slow Start switch S806 in Fast Start position.

   a. Safety switch (S501) activated.

   b. DC supply activated.

   c. Drive motor relay (K803) activated. Voltage applied to capstan drive motor through contact set K803A.

   d. DC voltage applied to drive solenoid (K502) energizes which allows motor pulley and capstan flywheel to come into contact.

3. Tape threaded: Fast Start -- Slow Start switch (S806) in Slow Start position.

   a. Safety switch (S501) activated.

   b. DC supply activated.

B. Press Start Button (S805)

1. Function switch (S802) in Play (A) position.

   a. Play mode relay (K801) energized through contact set S802-A; held through contact set K802-B.

   b. Tape motion relay (K802) energized through contact set K801-A; held through contact set K802-B.

   c. Contacts K802-C and K801-C energizes capstan solenoid K501 which allows motor pulley and capstan flywheel to come into contact.

NOTE

With Fast Start -- Slow Start switch (S806) in Slow Start position, the drive solenoid (K502) and Drive Motor Relay (K803) are actuated at this time.

   d. Brake solenoids (K601 and K701) energizes through contact set K802-C and releases the brake bands on the rewind and takeup motors.

   e. Reduced AC voltage is applied to rewind motor (B601) through contact set. S802-B and RESISTOR R801.

f. Reduced AC voltage is applied to takeup motor (B701) through contact set S802-C and resistor R803.

2. Function switch (S802) in REWIND (B) position.

a. Tape motion relay (K802) energizes through contact sets S802A and S802C; held through contact set K802-B.

b. Brake solenoids (K601 and K701) energizes through contact set K802-C and releases the brake bands on the rewind and takeup motors.

c. Full AC voltage is applied to rewind motor B601 through contact sets S802B and K802A. This voltage is reduced through resistors R801, R802, R803, and then applied to takeup motor (B701).

3. Function switch (S802) in Fast Forward (C) position.

a. Same as 2a.

b. Same as 2b.

c. Full AC voltage is applied to takeup motor (B701) through contact sets S802-C and K802-A. This voltage is reduced through resistors R803, R802, R803 and then applied to rewind motor (B601).

C. Condition B1 existing.

1. Function switch (S802) changed to REWIND (B) position.

a. PLAY mode relay de-energized. Opening of contact set K801-C deactivates capstan solenoid (K501).

D. Condition B2 existing.

1. Function switch (S802) changed to FAST FORWARD (C) position.

a. B2C condition only changed to B3C.

E. Condition B3 existing.

1. Function switch (S802) changed to REWIND (B) position.

a. B3C condition only changed to B2C.

F. Condition B2 existing.

1. Function switch (S802) changed to PLAY (A) position.

a. Tape motion relay de-energized. AC voltage removed from both torque motors (B601 and B701) and brake solenoids are de-energized, applying brakes to both motors. Tape transport returns to condition A2, or A3.

G. Press STOP button (Function switch in any mode of operation).

1. All relays deactivated and tape transport returns to condition A2.

H. Safety switch (S501) opens (if by tape breakage, take loop thrown or empty reel).

1. Drive motor de-energized with all dc power removed. Tape transport returns to conditions A-1.

ROUTINE MAINTENANCE

Carefully follow the routine maintenance program outlined below if proper performance is expected of the equipment at all times. Keep an Operation and Maintenance Log.

CLEANING

Clean the capstan, the head faces and tape guides daily. Clean the capstan idler wheel and capstan flywheel weekly. Great care must be taken to see that oil does not reach the rubber tire of either assembly. Avoid, as much as possible, touching the tire with fingers.

The agent for cleaning Ampex head assemblies is a mixture of Xylene and 0.1% Aerosol, and is available in 4 oz. bottles (Ampex Catalog No. 087-007). Other solvents can have detrimental effects on these precision parts. To clean any head assembly, wind a clean, lintless cloth on a wooden swab-stick and moisten with this mixture. Swab the heads to remove all dirt and accumulated oxide deposited from tape.

CAUTION

Do not use any other solvents as there are some which may leave a deposit on the laminations of the head assembly. Do not use metal swab-sticks.

Cleanliness of all parts of the tape drive mechanism is required for consistent optimum performance. Clean all parts except the head assembly using a lintless cloth moistened with denatured alcohol. This cleaning is of particular importance because most tape manufacturers lubricate their tapes, and the lubricant will gradually form a coating on the components in the tape threading path which will result in a loss of positive drive at the capstan, flutter and wow, signal drop-outs or poor high frequency response.

LUBRICATION

The following parts of the tape transport mechanism require lubrication every three months, or every thousand hours of operation, whichever occurs first.

CAPSTAN DRIVE MOTOR LUBRICATION

Tape transports utilizing ball bearing type motors require no lubrication of these motors as they employ permanently lubricated sealed bearings.

NOTE

This type motor has no oil cups or oil holes.

Lubricate the upper sleeve bearing of the capstan drive motor with this oil or its equivalent.

Caloil OC-11 (Ampex Catalog Number 087-005)
Standard Oil Company, San Francisco, California.

Class "C"

Medium turbine oil, petroleum base with inhibitor additives to increase oxidation and corrosion preventive properties. Essential characteristics are as follows:

Characteristics:	Required (Limit)
Viscosity in Centistokes at 130° F	40.0-48.0

Pour Point	25° F (max.)
Flash Point	370° (min) ± 20° F

To lubricate the drive motor locate the two oil cups extended from each motor end bell. Place into each oil cup not more than 4 drops of the recommended lubricant (Ampex No. 087-005).

CAUTION

Do not over lubricate. Wipe off excess oil.

CAPSTAN IDLER LUBRICATION

Gently pry the dust cap from the wheel hub (a knife blade can be used), and oil with not more than 3 drops of Ampex No. 087-005 oil, on the felt washer. Failure to perform capstan idler lubrication can result in the felt washer becoming completely dry, and a dragging idler can contribute to flutter.

CAUTION

Do not overlubricate or the wheel will throw oil in operation. If oil spills on rubber tire, clean it immediately with ethyl alcohol.

NOTE

The reel idler assembly, the takeup tension arm assembly and the takeup and rewind motors contain permanently lubricated bearings, and require no further lubrication.

CAPSTAN ASSEMBLY LUBRICATION

When lubricating the Capstan Assembly a note of caution should be made in regard to an overload of lubricant. The capstan is one of the most important functioning assemblies on the tape transport, and its smooth operation will ensure long life of the machine.

To lubricate, remove the capstan idler by loosening the set screw in the capstan idler arm. Loosen the set screw and remove the dust cap, bowed holddown washer, and the felt washer. The allen head set screw, located in the bronze bearing, must be removed to lubricate. Fill this hole with the prescribed oil, OC-11 (Ampex Catalog Number 087-005), until the oil overflows through the small vent hole on the opposite side of the bronze bearing. Replace the allen head set screw from the bearing and wipe off all excess oil. Reinstall the felt washer, bowed holddown washer, dust cap, and capstan idler. Retighten the set screws in both the dust cap and capstan idler.

NOTE

This lubricating process is imperative at least once every three months using the oil prescribed above. If an excess of oil has been added wipe off to prevent the throwing of oil in operation.

HEAD DEMAGNETIZATION

Occasionally, the heads may become permanently magnetized through electrical faults in the amplifiers, improper use of the equipment, or by contact with magnetized objects. Magnetized heads will cause an increase of 5 to 10 db in background noise level, and can impair good recordings by partially erasing high frequencies. The full dynamic range of the equipment cannot be realized if the heads are magnetized.

Any phenomena that tend to put large

unbalanced pulses through the record head will magnetize it. Observe the following precautions and no difficulty should be experienced.

Do not remove any tube from the record amplifier while the equipment is recording. Do not connect or disconnect the input leads or the head leads while recording.

Do not saturate the record amplifiers with abnormally high input signals. Such signals would be 10 db greater than tape saturation or approximately 30 db greater than normal operating level.

If it becomes necessary to check the continuity of the playback or record heads with an ohmmeter they must be demagnetized after checking.

If the heads become magnetized, proceed as follows, using an Ampex Demagnetizer, Catalog No. 704:

Step 1: Place the equipment power switch in the OFF position.

Step 2: Plug the demagnetizer into a 117-volt ac source.

NOTE

If the plastic coating wears off, place one layer of electrical friction tape on the demagnetizer tips. Scratching heads will then be prevented.

Step 3: Bring the tips of the demagnetizer to within approximately 1/8 inch (if the demagnetizer tips are taped or covered, contact with the heads can be made) by straddling the record gap and draw the demagnetizer tips up and down the length of the core stack three or four times.

Step 4: Remove the demagnetizer slowly from the head stack to a distance of 1 or 2 feet, thus allowing its ac field to diminish gradually. This slow removal is extremely important.

CAUTION

Do not unplug the demagnetizer while it is near the heads: the collapse of its magnetic field will re-magnetize the head.

Step 5: Repeat Steps 3 and 4 at the reproduce head.

Step 6: If necessary, repeat the process till complete demagnetization is effected in each case.

If the capstan, tape guides or other metal parts become magnetized, a few passes of the demagnetizer along their lenghts and the slow withdrawing technique should be adequate.

ADJUSTMENTS

The mechanical assembly is shipped from the factory with all adjustment before putting the equipment into service, unless shipping damage has occured. In the course of wear in normal service, or in the event of components failure, and replacement of parts, some readjustments may be necessary.

Equipment Required:

Spring Scale 0-16 oz.
Spring Scale 0-32 oz.
3/8 Inch Nut Driver
3/16 Inch Screwdriver
Nylon Lacing Twine or Strong String
7/16 Inch Socket Wrench
5/64 Inch Allen Wrench

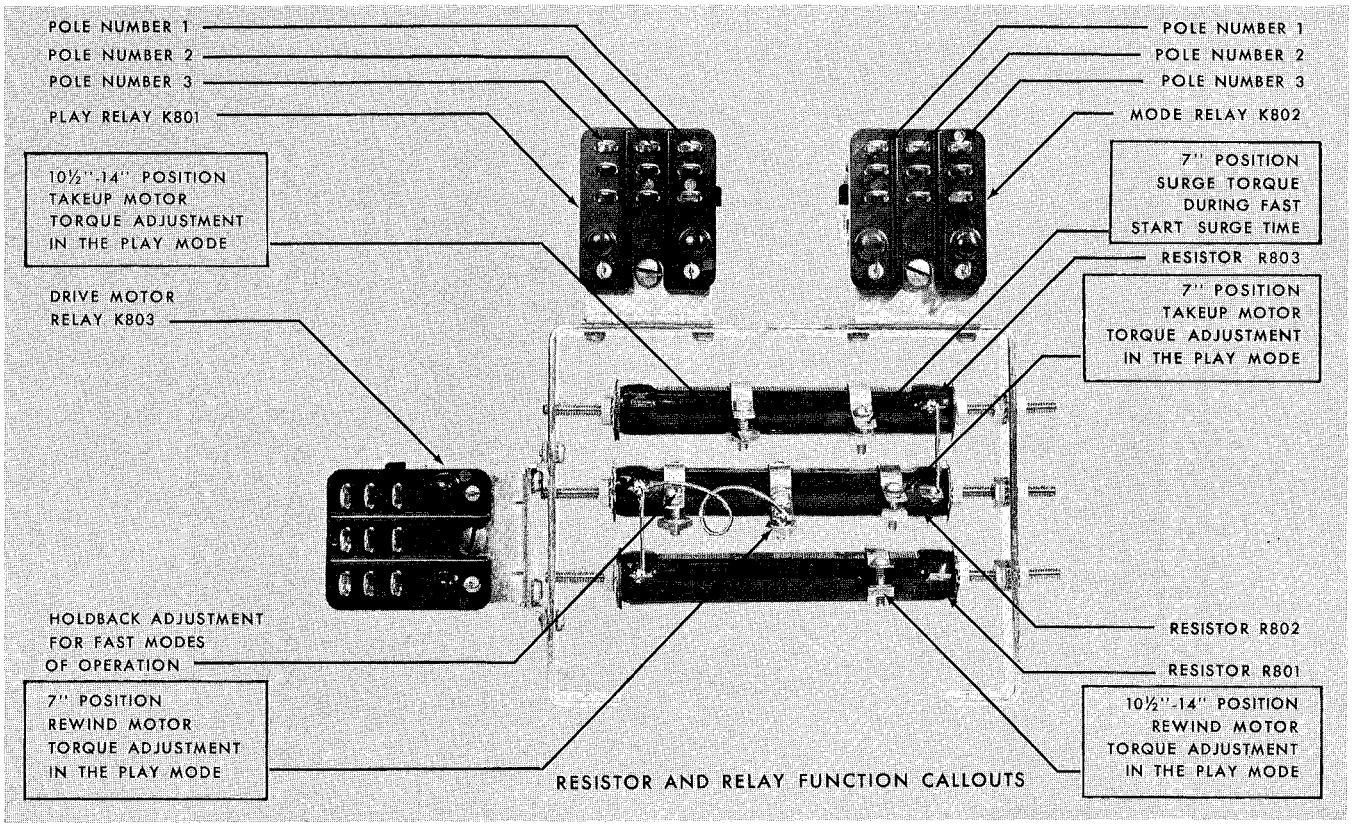


Figure 4-6 **RELAY RESISTOR BRACKET**

TAKEUP AND SUPPLY (REWIND) TENSION

Takeup and Supply tensions are determined by the position of the sliders on resistors R801, R802, and R803 located on the relay and resistor bracket on the underneath side of the tape transport mechanism. All resistance settings and torque adjustments can be found in illustration labeled Figure 4-6.

Torque adjustments are made with a 16 ounce spring scale at NAB reel hub diameter.

With the following step by step methods of measuring the torque of the takeup and rewind motors no problems should arise in obtaining perfect functioning of tape motion. Included with these methods are illustrations and step by step procedures of adjusting the brakes of the takeup and rewind assemblies. Both of these are important in obtaining smooth performance from the tape transport at all times.

Step 1: Place an empty 10-1/2 inch NAB reel on the tape supply turntable.

Step 2: Place the POWER switch in the ON position.

Step 3: Hold the takeup tension arm so that the safety switch is activated (a rubber band or piece of masking tape will hold the arm as though the tape were threaded on the equipment.)

Step 4: Make small loops at both ends of a thirty inch piece of nylon lacing twine.

Step 5: Attach one loop to the tape anchor on the reel hub and the other to a

I-PLAY/RECORD MODE

	REWIND MOTOR		TAKEUP MOTOR	
	LARGE REEL	SMALL REEL	LARGE REEL	SMALL REEL
REEL SIZE SWITCH	NAB (10½ OR 14 INCH)	EIA (7 INCH)	NAB (10½ OR 14 INCH)	EIA (7 INCH)
RESISTOR REF. NO.	ADJUST R801	ADJUST R802	ADJUST R803	ADJUST R802
TORQUE MEASUREMENT	6½ TO 8 OUNCES HOLDBACK	2½-4 OUNCES HOLDBACK	6½ TO 8 OUNCES TAKEUP	2½-4 OUNCES TAKEUP

II-REWIND MODE

	LARGE REEL	SMALL REEL	LARGE REEL	SMALL REEL
REEL SIZE SWITCH	NAB (10½ OR 14 INCH)	EIA (7 INCH)	NAB (10½ OR 14 INCH)	EIA (7 INCH)
RESISTOR REF. NO.	117 VOLTS LINE (FULL TORQUE)	117 VOLTS LINE (FULL TORQUE)	ADJUST R802	ADJUST R802
TORQUE MEASUREMENT	APPROXIMATELY 11-13 OUNCES TAKEUP	APPROXIMATELY 11-13 OUNCES TAKEUP	½ TO 1 OUNCE HOLDBACK	½ TO 1 OUNCE HOLDBACK

III-FAST FORWARD MODE

	LARGE REEL	SMALL REEL	LARGE REEL	SMALL REEL
REEL SIZE SWITCH	NAB (10½ OR 14 INCH)	EIA (7 INCH)	NAB (10½ OR 14 INCH)	EIA (7 INCH)
RESISTOR REF. NO.	ADJUST R802	ADJUST R802	117 VOLTS LINE (FULL TORQUE)	117 VOLTS LINE (FULL TORQUE)
TORQUE MEASUREMENT	½ TO 1 OUNCE HOLDBACK	½ TO 1 OUNCE HOLDBACK	APPROXIMATELY 11-13 OUNCES TAKEUP	APPROXIMATELY 11-13 OUNCES TAKEUP

NOTE:
ALL TORQUE MEASUREMENTS ARE MADE USING NAB HUB.

TAKEUP AND HOLDBACK MEASUREMENTS FOR DUPLICATOR (3200 D) USING ¼-INCH MAGNETIC TAPE.

Figure 4-7 TAKEUP AND HOLDBACK MEASUREMENTS

0 to 16 ounce spring scale or equivalent.

Step 6: Depress the PLAY button and allow the clockwise motion of the supply reel (torque motor tension) to draw a turn of twine onto the hub.

Step 7: Make certain that the twine is now parallel to the plane of the top of the tape transport and that the twine is centered and not touching either reel flange.

Step 8: Now let the torque motor pull the twine slowly onto the hub by following the torque motor force with the scale.

Step 9: Using this "following" technique, observe the readings on the scale until a constant reading is obtained.

Step 10: If necessary adjust the slides on resistor R801 on the resistor and relay bracket until the desired reading is obtained.

Step 11: Use the procedures in the preceding steps to check and adjust the takeup tension which is set at R803 (note that the reel on this side will move counterclockwise.)

BRAKE ADJUSTMENT

Brake adjustment is made (with no power applied to the equipment) at the points shown in Figure 4-8.

Step 1: Place an empty 10-1/2 inch NAB reel on the tape supply turntable.

Step 2: Make small loops at both ends of a thirty inch piece of nylon lacing twine.

Step 3: Attach one loop to the tape anchor on the reel hub and the other to a

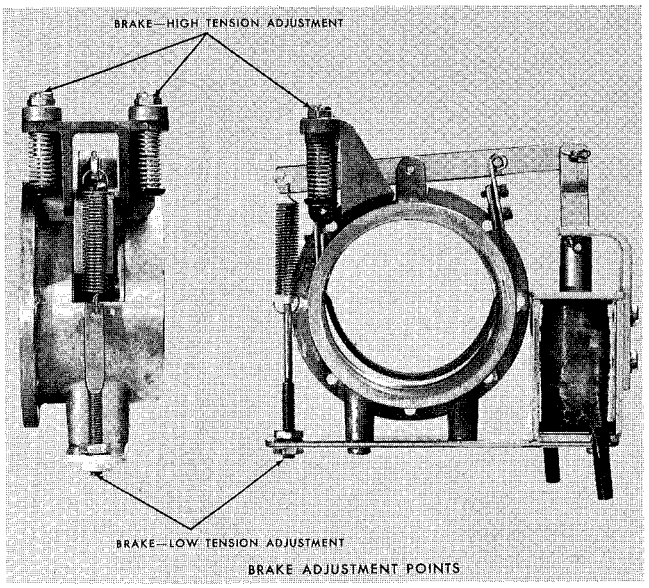


Figure 4-8 BRAKE ADJUSTMENT

0-16 oz. spring scale for 1/4 inch machines and 0-32 oz. spring scale for 1/2 inch machines.

Step 4: Manually rotate the reel clockwise to wind several turns of twine onto the hub.

Step 5: Pull the scale, making certain that the twine does not touch either flange of the reel. The turntable will rotate counterclockwise. Take a reading only when the turntable is in steady motion, because the force required to overcome the static friction will produce a false and excessively high initial reading.

Step 6: Adjust the supply and takeup motors brakes for scale readings listed below. Points of adjustment are shown by illustration in Figure 4-8.

Step 7: Now wind the twine on the hub by rotating the reel counterclockwise; pull, and take a reading. The turntable will rotate clockwise.

Step 8: Repeat the entire process on the takeup turntable.

SPRING SCALE READING

Tape Width	Direction of Most Resistance Supply Counterclockwise, Takeup Clockwise	Direction of Lease Resistance Supply Clockwise, Takeup Counterclockwise
1/4 Inch	12 to 16 ounces	2:1 ratio ±1 ounce in accordance with the High Side
1/2 Inch	16 to 20 ounces	2:5:1 ratio ±1 ounce, etc.

CAPSTAN IDLER PRESSURE

The capstan idler is forced against the capstan by the action of the capstan solenoid spade bolt. See the illustration (Pressure Measurement, Capstan Idler). Tightening the lock nut increases idler pressure until a point is reached where the solenoid will not bottom. At this point, idler pressure drops to a value which is inadequate to permit the capstan to drive the tape, and slippage will occur unless the nut is backed off. Excessive pressure also throws an unnecessary load on the upper sleeve bearing of the drive motor and causes a considerable lax in that speed being operated. The recommended procedure for adjusting idler pressure is as follows:

Step 1: Hold the takeup tension arm so that the safety switch is activated.

Step 2: With the POWER switch in the ON position, press the PLAY button, and note whether the capstan solenoid is bottomed. (The capstan

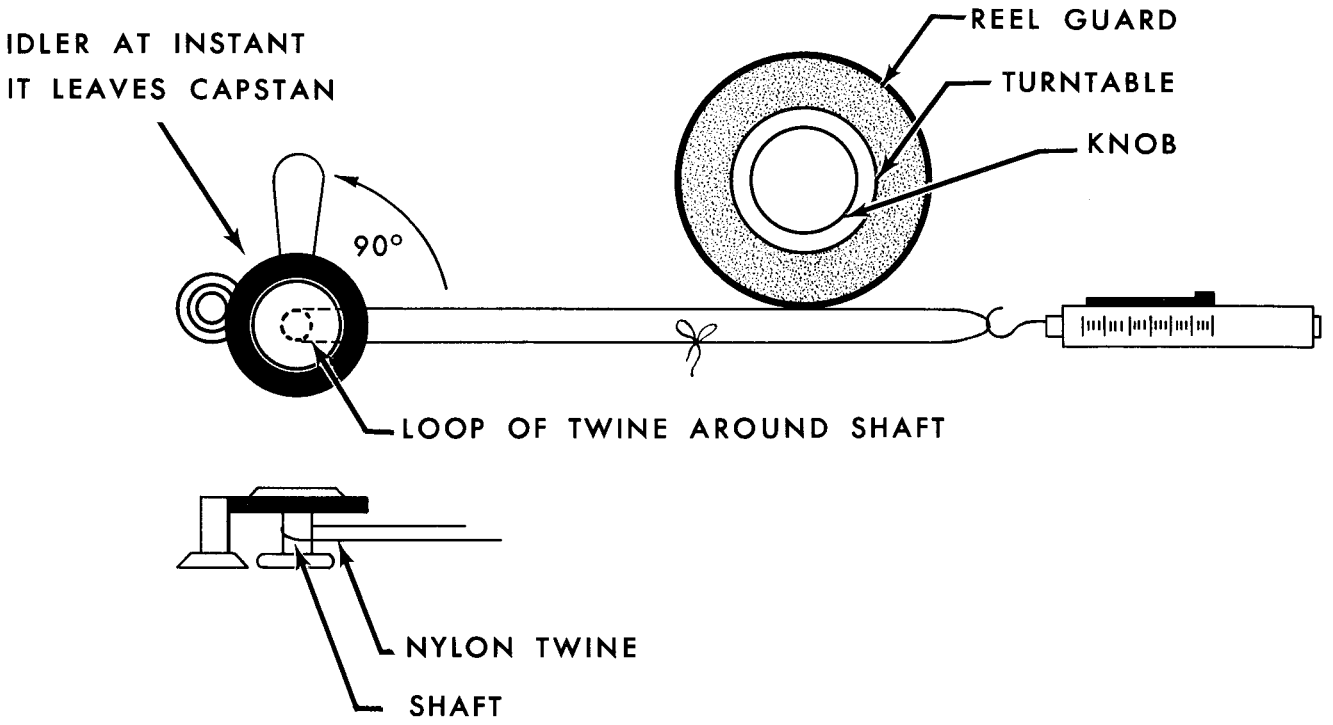


Figure 4-9 PRESSURE MEASUREMENT, CAPSTAN IDLER

idler can be pushed off the capstan easily by pushing on the idler arm, if the solenoid is not bottomed). If necessary, back off the lock nut until the solenoid does bottom at 90 volts ac when cold, or 105 volts when warm (after 1/2 hour running). The pressure ("dig") against the capstan shaft should be 5 ± 1/2 pounds.

NOTE

In the course of normal operation in the reproduce or record modes, the temperature of the capstan solenoid will rise, and its dc resistance will increase. Therefore, the minimum line voltage required to bottom the solenoid when it is hot will be greater than that required when it is cold. If the equipment is operating on unusually low line voltage (below 110 volts), sometimes encountered in areas where regulation is poor, the solenoid may fail to bottom after it has reached normal operating temperature. It is advisable, therefore, to allow the equipments to operate in the reproduce mode for about half an hour before making any necessary solenoid adjustments. This will allow the widest margin of safety with respect to line voltage variations. The solenoid is factory adjusted to bottom at 90 line volts cold and 105 line volts hot.

Step 3: If it is desired to measure capstan dig, press the STOP button at this point and select a piece of nylon lacing twine about 30 inches long and tie the ends together.

Step 4: Slip the twin loop just formed between the idler and idler arm so that the nylon rests against the idler shaft.

Step 5: Attach the other side of the loop to a 10 pound scale, letting the nylon twine remain slack.

Step 6: Press the PLAY pushbutton, causing the capstan idler to clamp against the capstan.

Step 7: Pull the scale away so that the nylon twine is taut and makes a 90 degree angle with the idler arm.

Step 8: Now, slowly pull the scale away with sufficient power to cause the capstan idler to leave the capstan, reading the scale at the instant the capstan idler leaves the capstan. The scale reading should be 5 pounds ± 1/2 pound. If necessary, adjust the capstan dig at the point shown in the illustration.

REPLACEMENT OF PARTS

All sub-assemblies of the tape transport mechanism can be easily dismounted with the use of a screw driver and a few small socket head screw keys.

CAUTION

Do not attempt complete disassembly of any of the sub-assemblies. The list of individually replaceable parts under each assembly listing in the parts list should be used. as a guide to disassembly limits Replacement of parts other than those listed calls for precision work which should not be attempted in the field. Assemblies with defects in parts other than those listed as replaceable should be returned to the factory or to an Ampex Franchised Dealer for repair or replacement. Contact the Service Department for a proper authorized equipment return tag. DO NOT ship unidentified parts to factory. Ampex can assume no responsibility for their proper care or return under such circumstances. Removal of the complete torque motor assembly from the tape transport is sometimes necessary or desired depending on the accessibility to the brake housing assembly.

BRAKE BAND REPLACEMENT

NOTE

Brake bands may be replaced without removing motor from tape transport on rackmount machines and deleting the first two steps.

Step 1: With a 7/16 socket wrench remove the four mounting screws and washers at the motor mounting plate. If shims have been used, be sure not to lose them and replace in the exact place of removal. Carefully hold the motor with one hand to prevent it from falling.

Step 2: Take motor to a convenient work area.

Step 3: Unhook the brake tension spring from the brake lever.

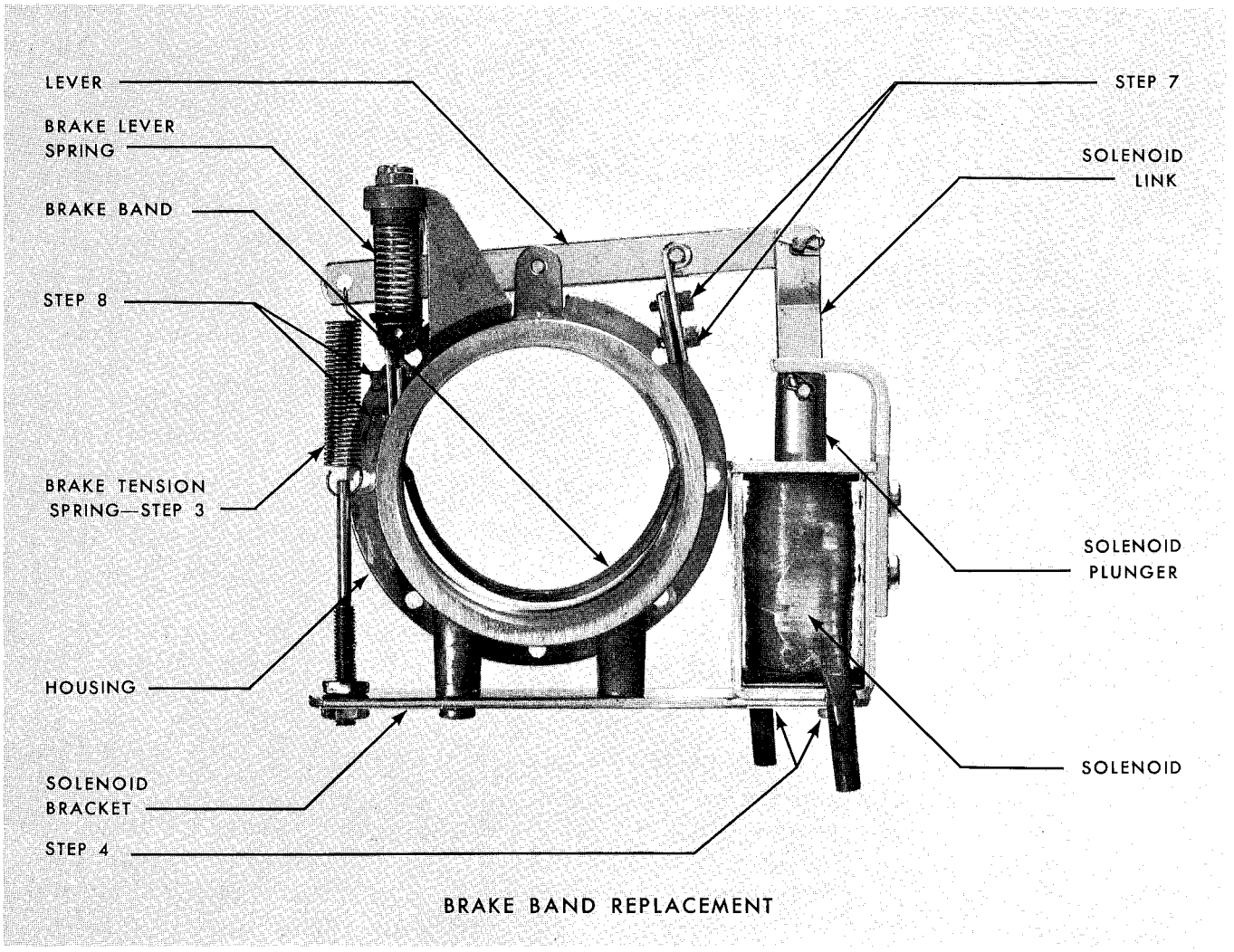


Figure 4-10

BRAKE BAND REPLACEMENT

Step 4: Remove the two screws holding the capacitor to the solenoid bracket. (On some models the capacitor is mounted on the side of the motor which makes this step unnecessary). Let capacitor hang free of brake housing. Replace one of the screws temporarily to keep the solenoid bracket tight on the housing.

Step 5: Disconnect the solenoid wires at knife disconnects.

Step 6: Remove the screws that hold the brake housing to the motor, noting the position of the washers and spacers and remove the entire housing.

Step 7: Loosen (do not remove) the two cap screws at the end of the brake band next to the solenoid.

Step 8: Remove the two cap screws holding one end of the brake band between the brake lever spring and the housing using a 5/16 inch Allen wrench.

Step 9: The brake band may now be removed taking caution not to lose

the band leaf on the solenoid side. There is only one band leaf per assembly. Before installing the new brake band, clean the inside of the brake housing and the brake drum surface with a non-oil base solvent.

Step 10: Position the new brake band through the hole in the housing. Follow the curvature of the housing and place between the clamp and the link. Replace the two cap screws and tighten.

Step 11: Insert the other end of the band between the band link and clamp, making certain that small band leaf is also positioned at this point on inside of band next to the clamp. Do not tighten the two cap screws at this time.

Step 12: Replace the brake housing assembly on the motor, making certain that the spacers, housing, lock washers and the screws are replaced in that order, and tighten the screws.

Step 13: Push the solenoid plunger in by hand until it bottoms. Adjust the depth of insertion of the brake band between the link and the clamp so that there is no buckling of the band and so that the brake drum rotates freely with no drag. Then tighten the two cap screws.

CAUTION

If the band is set too far forward in the link it will buckle when the solenoid plunger is bottomed by hand. If this condition continued to exist the band would eventually break at the point of buckling.

Step 14: Interconnect the wires at the knife disconnects and replace the capacitor to the bracket with the two screws removed in Step 4.

Step 15: Hook the brake spring to the brake lever. Step 3.

Step 16: Replace the motor assembly, if removed in Step 1, tightening the four screws securely.

Step 17: Run the torque motors for approximately ten minutes. Energize and de-energize the brake solenoid several times to seat the brake bands against the drums.

Step 18: Adjust the brake tensions to the correct settings as called for in "Brake tension adjustments".

PACKING PRECAUTIONS FOR MOTORS

The packing motors for return to the factory; take particular care to prevent the bending of their shafts in transit.

MODEL 3200-D DUPLICATOR SYSTEM
COMPLETE EQUIPMENT
CATALOG NUMBER 7870

Handles up to 14-inch reels.

Ampex Part No.	Cycles Per Second	Inches Per Second	Tape Width
7870-01	60 cps	30/60 ips	1/4 inch
7870-02	50 cps	30/60 ips	1/4 inch
7870-07	60 cps	15/30 ips	1/4 inch
7870-08	50 cps	15/30 ips	1/4 inch

3200-D
TAPE TRANSPORT PARTS LIST
CATALOG NUMBER 7870

PART DESCRIPTION	1/4-Inch
CAPSTAN ASSEMBLY: 15-30-60 IPS	7518-01
Capstan Dust Cap	2326-00
Capstan Felt Washer - Dust Seal	494-00
CAPSTAN IDLER ASSEMBLY:	30945-01
Capstan Idler Arm	372-01
Capstan Idler Arm Bearing	374-00
Capstan Solenoid	670-00
Capstan Idler Adjusting Spring	676-00
Capstan Idler Return Spring	400-00
DRIVE MOTOR ASSEMBLY:	
For 60 Cycles	1030-07
For 50 Cycles	1030-11
Drive Motor Return Spring (Console and Portable)	19994-01

When ordering replacement parts always include the following information: Equipment Type; Equipment Serial Number; Ampex Part or Catalog Number; and Description of Part. DO NOT simply use the schematic reference number.

PART DESCRIPTION	1/4-Inch
Drive Motor Return Spring (Rack)	19995-01
Drive Motor Mounting Hinge	7815-00
Drive Motor Shield (Bodine Motors Only)	1905-00
Drive Motor Solenoid	670-00
Felt Washer (Solenoid Assembly)	503-015
Drive Motor Pressure Adjusting Spring	389-00
TAPE SPEED SWITCH ASSEMBLY: (Includes S501, S502 and S503)	364-02
TAKEUP ASSEMBLY: Complete	5704-04
TAKEUP BRAKE ASSEMBLY	17327-01
REWIND ASSEMBLY: Complete	5705-04
REWIND BRAKE ASSEMBLY	17327-02

PARTS COMMON TO TAKEUP AND REWIND ASSEMBLIES

MOTOR ASSEMBLY (Motor, Flange, Brakedrum and Turntable)	6768-00
BRAKE BAND ASSEMBLY	17612-01
Brake Band Leaf	61460-01
Brake Solenoid	337-00
Brake Adjusting Spring	322-00
Compression Spring	17323-00
Turntable	61462-01
Housing, Brake	17614-01
Eye Bolt	396-06
Crosshead	17324-01
Anchor	17325-01
Spacer	17322-01
Roll Pin - 1/8 inch x 3/4 inch	406-031
Screw, Socket head cap stl. cad. pl.	470-008
Brake Band Link	330-00
Brake Band Clamp	331-00
Brake Lever	332-00
Drivelock Pin - 1/8 inch x 1/2 inch	403-008
Cotter Pin - 1/16 inch x 1/2 inch	401-005
Clevis Pin - 1/8 inch x 9/32 inch	400-002

When ordering replacement parts always include the following information: Equipment Type; Equipment Serial Number; Ampex Part or Catalog Number; and Description of Part. DO NOT simply use the schematic reference number.

PART DESCRIPTION	1/4-Inch
Connector: J601P, 8 contact Jones Part No. P-308-CCT-L	145-013
REEL GUARD (14 Inch)	5708-00
TAKEUP TENSION ARM ASSEMBLY	425-06
Tape Guide	675-00
Tape Guide Hook	355-00
Takeup Tension Spring	30946-01
BASE, Rotary Tape Guide (Takeup)	17720-01
DISC, Rotary Tape Guide (Takeup)	17719-01
CAP, Rotary Tape Guide (Takeup)	17718-00
BEARING, Rotary Tape Guide (Takeup)	421-029.
REEL IDLER ASSEMBLY:	4459-12
BASE ASSEMBLY, Reel Idler	30840-01
PULLEY, Reel Idler	5893-00
FLYWHEEL, Reel Idler	30941-01
TAPE GUIDE	257-00
SPEED CHANGE KNOB	230-010
MODE SELECTOR KNOB	230-002
FUSE HOLDER	085-001
PILOT BASE LAMP	132-011

TAPE TRANSPORT
CATALOG NUMBER 7870

Electronic Parts Common to all Tape Transports Except as Noted

REF. NO.	PART DESCRIPTION	AMPEX PART NO.
A801	LAMP: 120 volts, 6 watts, candelabra screw base; G.E. Part No. 6T4 1/2/1	060-006
A802	Same as A801	
C501	CAPACITOR, Drive Motor: 5 mfd; 330 vacw	7464-00
	CAPACITOR, Drive Motor: 6 mfd; 330 vacw; 10%; Cornell Dubilier Part No. MKK3060C	035-245

When ordering replacement parts always include the following information: Equipment Type; Equipment Serial Number; Ampex Part or Catalog Number; and Description of Part. DO NOT simply use the schematic reference number.

REF. NO.	PART DESCRIPTION	AMPEX PART NO.
C601	CAPACITOR, Rewind Motor (60 cps): 3.75 mfd; 330 vacw; 10%: General Electric Part No. 21F525	035-111
	CAPACITOR, Rewind Motor (50 cps only): 4.00 mfd; 330 vacw; 10%: General Electric Part No. 21F526	035-116
C701	CAPACITOR, Takeup Motor (60 cps) 3.75 mfd; 330 vacw; 10%: General Electric Part No. 21F525	035-111
C801	CAPACITOR, Fixed: paper tubular; .01 uf -10 +20%; 600 vdcw; Sangamo Part No. 330601	035-074
C802	Same as C801	035-074
C803	Same as C801	035-074
C804	Same as C801	035-074
C805	CAPACITOR, Fixed: electrolytic; 80 uf; 150 vdcw: C.D. Part No. BRM-8015	031-016
C806	Same as C805	031-016
C807	Same as C801	035-074
C808	Same as C801	035-074
C809	Same as C801	035-074
C810	Same as C801	035-074
F801	FUSE, cartridge: 5 amperes; 250 volt; Fast blow: Littelfuse Part No. 312005	070-007
F802	Same as F801	070-007
F803	FUSE, cartridge: 3.2 amperes; 120 volt; Slow blow: Littelfuse Part No. 31303.2	070-014
	FUSE POST: Finger operated, short body: Littelfuse Part No. 342003	085-001

When ordering replacement parts always include the following information: Equipment Type; Equipment Serial Number; Ampex Part or Catalog Number; and Description of Part. DO NOT simply use the schematic reference number.

REF. NO.	PART DESCRIPTION	AMPEX PART NO.
J601P	CONNECTOR, Plug: male; 8 contact, 730 volts rms; 10 amp contacts: Jones Part No. P-308-CCT-L	147-013
J701P	Same as J601P	147-013
J801P	CONNECTOR, receptacle: male; 2 contact, 250 volts, 10 amp contacts: Hubbel Part No. 4897	147-010
J802S	CONNECTOR, receptacle: female; 12 contacts; 730 volts rms, 10 amp contacts: Jones Part No. S-312-AB	146-009
J804S	CONNECTOR, receptacle: female, 8 contacts; 730 volts rms, 10 amp contacts: Jones Part No. S-308-AB	146-003
J805S	Same as J804S	146-003
J806S	CONNECTOR, receptacle: female; 2 contacts; 250 volts, 10 amp contacts: P and S Des Pard Part No. 1320 and 1354	146-014
J807S	CONNECTOR, receptacle: female; 8 contacts; 730 volts rms, 10 amp contacts: Jones Part No. S308 CCT-K	144-019
J808S	Same as J807S	144-019
K801	RELAY, PLAY: 3PDT; 115 volt dc coil std; 10 ampere contact: Philtrol Part No. 33QA	020-006
K802	Same as K801	020-006
K803	Same as K801	020-006
R801	RESISTOR, adjustable: wirewound; 150 ohm; 5%; 50 watts: Tru-Ohm Part No. AR-50 Type 0566	040-011
R802	RESISTOR, adjustable: wirewound; 500 ohm; 5%; 50 watts: Tru-Ohm Part No. AR-50 Type 0569	040-014

When ordering replacement parts always include the following information: Equipment Type; Equipment Serial Number; Ampex Part or Catalog Number; and Description of Part. DO NOT simply use the schematic reference number.

REF. NO.	PART DESCRIPTION	AMPEX PART NO.
R803	Same as R801	040-011
R804	RESISTOR, fixed: wirewound; 10 ohm; 10%; 5 watts: Tru-Ohm Part No. FRL-5	043-156
S501	SWITCH, safety: SPST; normally closed: Unimax Part No. 2HBT-215-1W	120-001
S502	SWITCH, speed, rotary: Dual DPDT: Arrow H and H part No. 21490-CA	122-014
S503	Same as S502: (SPEED)	122-014
S801	SWITCH, toggle, ON-OFF: DPST Carling Part No. 2BK62-73	120-003
S802	SWITCH, rotary: 3 pole, 3 position: Centralab Part No. CRL-PA-230-028	122-010
S803	PUSHBUTTON: Stop; SPST, normally closed, 1 pole: Arrow H and H Part No. 3391BSA	120-014
S804	PUSHBUTTON: Record; SPST, normally open, 1 pole: Arrow H and H Part No. 3391EPA	120-013
S805	PUSHBUTTON: Play; normally open, 2 pole: Arrow H and H Part No. 80913-0	120-006
S806	SWITCH, toggle, SPDT, normally open, 1 pole: Arrow H and H Part No. 81021-81021AV	120-011
S807	SWITCH, toggle, DPDT, 2 pole: Jan Part No. ST52N	120-016
S808	Same as S807	120-016
SR801	RECTIFIER; Selenium: single phase, half wave: General Electric Part No. 6RS5CHB21	582-001
TS501	TERMINAL STRIP: 9 one-sided solder terminals: Cinch Part No. 9-141-3/4W	180-045

When ordering replacement parts always include the following information: Equipment Type; Equipment Serial Number; Ampex Part or Catalog Number; and Description of Part. DO NOT simply use the schematic reference number.

CABLE ASSEMBLIES FOR THE 3200-D DUPLICATOR SYSTEM

CONNECTOR PART NO.	PART DESCRIPTION	AMPEX PART NO.
	CORD SET, power; ac	084-005
PL-105S	CABLE, power cable - master record panel	2413-00
	CABLE, Interconnecting - long (48"x48"on each leg)	3584-00
	short (20"x26"on each leg)	3584-01
140-007	CABLE, bias buss	3730-04
144-003 and 140-008	CABLE, Audio to record (audio #1 and #2) (10' long)	6006-00
144-011 and	CABLE, Control, Interconnecting (10' long)	30885-01
145-004	CABLE, Control, Interconnecting (5' long)	30885-02
PL-43-S	CABLE, Audio to Record lower track	6012-00
PL-44-S	CABLE, Audio to Record upper track	6014-00
PL-105-S	CABLE, Power line	2413-01
145-004	CABLE ASSEMBLY, Control interconnecting (15' long)	6005-02
140-008 and 144-003	CABLE ASSEMBLY, Audio duplicator (15' long)	6006-01
144-003 and	CABLE, Input, Audio to Record full track (10' long)	6013-00
145-009	CABLE, Input, Audio to Record full track (5' long)	6013-01
140-009 and 144-003	CABLE ASSEMBLY, Audio to Record upper track (10' long)	6008-00
144-011 and 145-004	CABLE, Control interconnecting	30885-02
144-018 and 145-018	CABLE, Relay buss	30886-01

When ordering replacement parts, always include the following information: Ampex type; equipment serial number; Ampex part or catalog number; and description of part. DO NOT SIMPLY USE THE SCHEMATIC REFERENCE NUMBER.

FAST START RELAY BOX ASSEMBLY
FOR
3200-D
CATALOG NUMBER 5995

REF NO.	PART DESCRIPTION	AMPEX PART NO.
C101	CAPACITOR, electrolytic: tubular; 16 mfd; -10 +150%; 85° C: Cornell Dubilier: BRM-1615	031-018
J101P	CONNECTOR, Plug; male; 8 contacts; 730 volts rms; 10 amp contacts: Jones Part No. P-308-CCT	145-008
J102P	Same as J101P	145-008
J103P	CONNECTOR, receptacle: male; 6 contacts; 730 volts rms; 10 amp contacts: Jones Part No. P-306-AB	147-011
J104S	CONNECTOR, receptacle: female; 6 contacts; 730 volts rms; 10 amp contacts: Jones Part No. S-306-AB	146-004
K101	RELAY: DPDT; 115 volt dc coil; 4000 ohm; 10 amp contacts: Advance Part No. PC2115VD	202-014
K102	Same as K101	202-014
K103	RELAY: 3 PDT; 115 volt dc coil; 10K ohm	5760-00
	COVER, Relay Box	5983-01

When ordering replacement parts always include the following information: Equipment Type; Equipment Serial Number; Ampex Part or Catalog Number; and Description of Part. DO NOT simply use the schematic reference number.

ACCESSORIES FOR 3200-D

AMPEX alignment tape: 30 inches per second for 1/4-inch application	6878-00
AMPEX head demagnetizer	704-00
Head Cleaner	087-007
Lubricating Oil (Caloil - OC - 11)	087-005
Reel hold-down knob (rack mount)	9093-00
Reel Knob, editing (console)	1917-00
Reel, Centering adaptor	976-00
Bushing extractor	1514-00
Strobosticker, 24 bar (60 cycles per second)	575-00
Strobosticker, 20 bar (50 cycles per second)	1453-00
Panel, blank: 7 inches x 19 inches; gray	6889-04
Panel, blank: 8-3/4 inches x 19 inches; gray	6889-05

When ordering replacement parts, always include the following information: Ampex type; equipment serial number; Ampex part or catalog number; and description of part. DO NOT SIMPLY USE THE SCHEMATIC REFERENCE NUMBER.

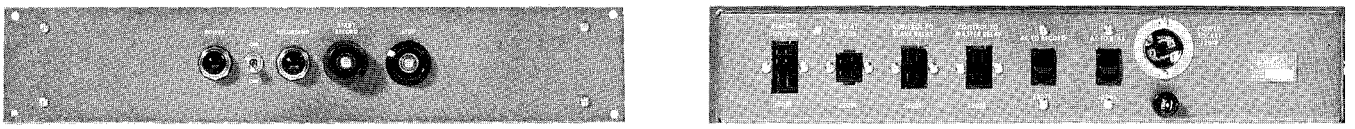


Figure 4-11 MASTER CONTROL PANEL PARTS LOCATION (EXTERIOR VIEW)

MASTER CONTROL PANEL

Theory of operation

Power is supplied to the panel through (Power Socket) J201P. Refer to Figure 2-3, interconnecting diagram. Placing Switch S203 in the "ON" position supplies power to J206S (AC to Bias) and J207S (AC to Record) thence through interconnecting cables to the Bias Oscillator (and Bias Amplifier if used) and the record amplifiers.

Voltage is supplied to POWER indicator lamp I202 and through current limiting resistor R201 to half wave rectifier SR201. Pulsating DC voltage from the rectifier is smoothed by capacitor C201. Bleeder resistor R202 provides a load for the rectifier system to prevent excessive peak voltage during standby periods. Figure 4-11

When "START-RECORD" button is pressed one section of Switch S201 supplies DC voltage to J202S, J203S and remote control connector J208S. The DC voltage from J202S and J203S is carried by interconnecting cables to the fast start boxes of all transports including the master transport and momentarily energizes all start relays K101, the contacts of which are paralleled with the "START" switch in each transport. Holding contacts are not required on start relay K101 as the play relay in each transport carries its own holding contact.

The second section of "START-RECORD" switch S201 supplies DC voltage to "RECORDING" lamp I201, remote control connector J208S and relay K201. When Relay K201 energizes one set of its contacts removes bleeder resistor R202 from the DC supply and supplies DC voltage to "BIAS RELAY BUSS" connector J209S. Voltage from this connector is taken to the BIAS OSCILLATOR (and bias amplifier if used) through interconnecting cables and energizes relay K501 in that assembly. The second set of contacts on K201 provides a holding circuit through J203S, an interconnecting cable, and de-energized contacts of K102 in the master transport fast start box.

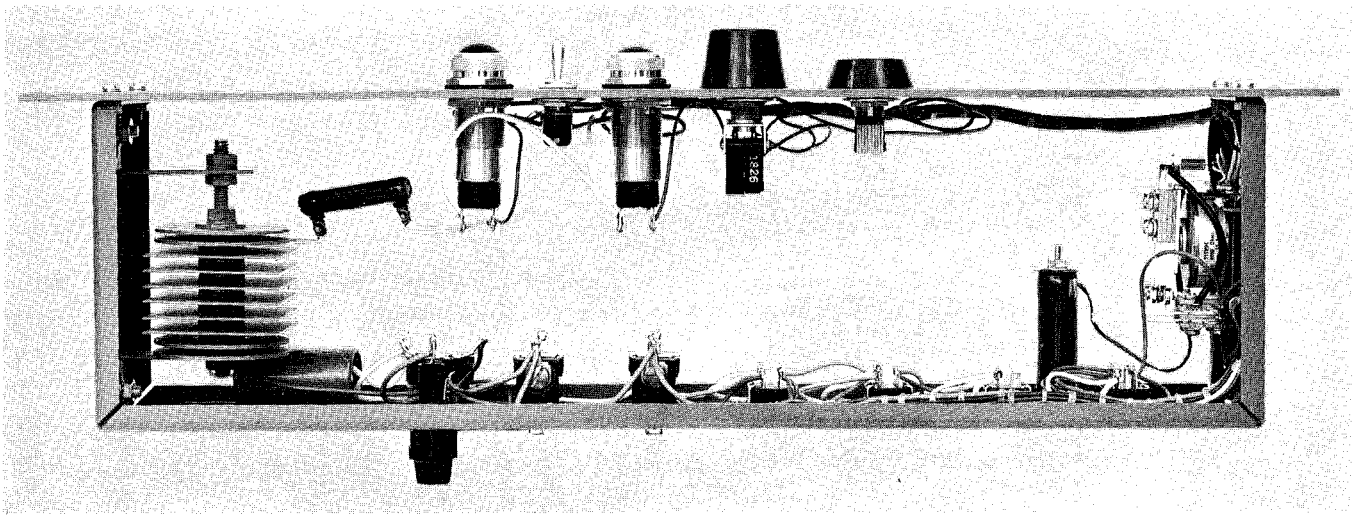


Figure 4-12 MASTER CONTROL PANEL PARTS LOCATION (INTERIOR VIEW)

Depressing the "STOP" button of Switch S202 supplies DC voltage to J202S, J203S and "Remote Control" connector J208S. Interconnecting cables to the "FAST START" boxes on each transport carry the DC voltage to relay K102 in each box and momentarily energizes this relay. One set of K102 contacts opens the circuit of "Tape Motion Relay" holding contact in its associated transport causing the transport to stop. A second set of contacts on K102 opens the circuit holding relay K201 in the energizes and the system returns to standby condition.

The remote control connector J208S may be used when remote or multiple controls for the system may be desirable. A suggested circuit for the remote control is shown on schematic diagram 30923 Figure 4-13. The remote "START" and "RECORD" switches may be combined into a double pole switch if convenient.

Maintenance

Inspect and clean relay contacts with a burnishing tool at regular intervals. Visually inspect interconnecting cable plugs periodically to assure that all latches are secure and the plugs firmly seated.

DC voltage from pins 5 (positive) and pin 7 (negative) of the remote control connector (J2085) should be measured occasionally to check condition of rectifier SR201 and capacitor C201. The voltage should read at least 115 volts DC.

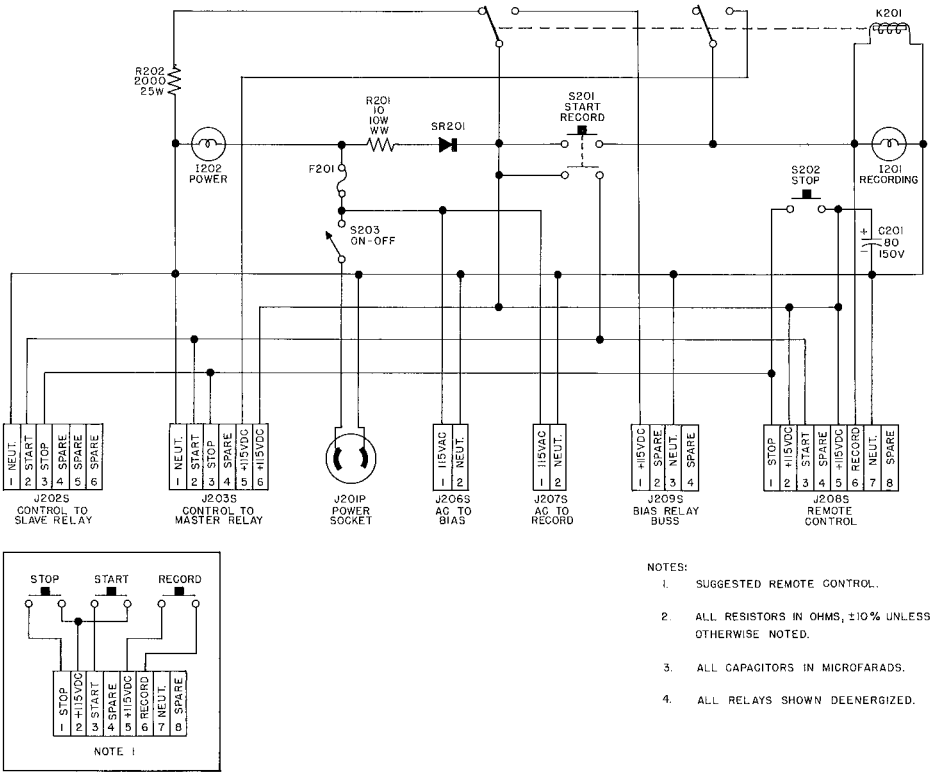


Figure 4-13 SCHEMATIC DIAGRAM, MASTER CONTROL PANEL

MASTER CONTROL PANEL
FOR
3200-D
CATALOG NUMBER 5993

REF. NO.	PART DESCRIPTION	AMPEX PART NO.
C201	CAPACITOR, electrolytic: tubular; 80 mfd; -10 +150%; 85° C: Cornell Dubilier BRM-8015	031-016
F201	FUSE, cartridge: fast blow; 250 volt; 3 amp: Littelfuse Part No. 312003	070-001
I201	PILOT LIGHT ASSEMBLY: red Dialco Part No. 721515-111	132-006
I202	PILOT LIGHT ASSEMBLY: amber Dialco Part No. 721515-113	132-011
J201P	CONNECTOR, Plug: male; 8 contacts; 730 volts rms; 10 amp contacts: Jones Part No. P-308-CCT-L	147-013
J202S	CONNECTOR, receptacle: female; 6 contacts; 730 volts rms; 10 amp contacts; Jones Part No. S-306-AB	146-004
J203S	Same as J202S	146-004
J206S	CONNECTOR, receptacle: female; 2 contacts; 250 volts; 10 amp contacts; P and S DesPart Part No. 1320 and 1354	146-014
J207S	Same as J206S	146-014
J208S	CONNECTOR, receptacle: female; 8 contacts; 730 volts rms; 10 amp contacts: Jones Part No. S-308-AB	146-003
J209S	CONNECTOR, receptacle: female; 730 volts rms; 10 amp contacts: Jones Part No. S-304-AB	146-005

When ordering replacement parts always include the following information: Equipment Type; Equipment Serial Number; Ampex Part or Catalog Number; and Description of Part. DO NOT simply use the schematic reference number.

REF. NO.	PART DESCRIPTION	AMPEX PART NO.
K201	RELAY: DPDT; 115 volt dc coil; 4000 ohm; 10 amp contacts: Advance Part No. PC2115VD	020-014
R201	RESISTOR, Fixed: wirewound; 10 ohm; 5%; 10 watt: Tru-Ohm Part No. Type FRL-10	043-089
R202	RESISTOR, Fixed: wirewound; 2000 ohm; 5%; 25 watt: Tru-Ohm Part No. Type FR-25	043-064
S201	SWITCH, toggle: Pushbutton; DPDT; 12-20 oz. operating pressure, 10 amp rating: Arco Electric Co., Part No. 2 ea. 2MD3-1A and 1 ea. A-14 mtg. brkt.	120-025
S202	PUSHBUTTON: record; SPST; normally open, 1 pole: Arrow H and H Part No. 3391EPA	120-013
S203	SWITCH, toggle: SPST; 3 and 6 amp rating: Arrow H and H Part No. 86994-N	120-005
SR201	RECTIFIER, selenium: single phase; half wave; 270 volts ac rms: General Electric Part No. 6RS25PH6BBD1 or 6RS5CHB21	582-001
	FUSE EXTRACTOR POST: Littelfuse Part No. 442001	085-002
	ESCUTCHEON: Pushbutton	361-00
	ESCUTCHEON: Pushbutton; record	463-00
	LAMP: 6 watt; 120 volt; candelabra screw base T-4-1/2: General Electric Part No. 6T4-1/2/1	060-006
	WASHER: Mica, insulating: Ohmite Part No. 6011	503-007
	WASHER: centering: Ohmite Part No. 6000	506-003

When ordering replacement parts always include the following information: Equipment Type; Equipment Serial Number; Ampex Part or Catalog Number; and Description of Part. DO NOT simply use the schematic reference number.

Section 5

Head Assembly

GENERAL

The head assembly of an Ampex magnetic tape recorder is the heart of the equipment. The technical and detailed know-how required for the fabrication of these head assemblies has made Ampex the foremost manufacturer of magnetic recording equipment in the world today.

In theory, a tape recorder head assembly is a simple device. In practice however, building a head assembly is a complicated task requiring extremely precise manufacturing techniques. There are two playback head stacks in the master head assembly and two record head stacks in the slave head assembly. The magnetic flux in the moving tape of the master tape reproducer induces a voltage in the playback head. The record head puts the signals on the tape by magnetizing the iron oxide particles in the coating on the tape.

The design and construction of these heads is extremely critical. Their surfaces are lapped to finishes so smooth that variations are measured in wave lengths of light. In typical playback heads the gap is 0.00025 inch, which give an indication of the precision required in building the heads.

Each of these heads is designed for a specific function with no compromise in the overall head assembly. Professional use demands top performance and there is no room for design compromise.

The superb design, engineering and manufacturing are built into Ampex head assemblies assures dependable long life and economical operation at the lowest cost per operating hours.

HEAD ASSEMBLIES

The head assembly is housed in a die cast housing. The master head assembly contains two reproduce heads (an upper halftrack and a lower halftrack). The slave head assembly contains three record heads (an upper halftrack, lower halftrack, and full track. Orientation of these heads can be found in Figure 5-2.

The head gate should never be allowed to spring shut, but should be allowed to close gently.

When operating in the REWIND or FAST FORWARD modes, see Tape Threading Paths in SECTION 3 (OPERATION).

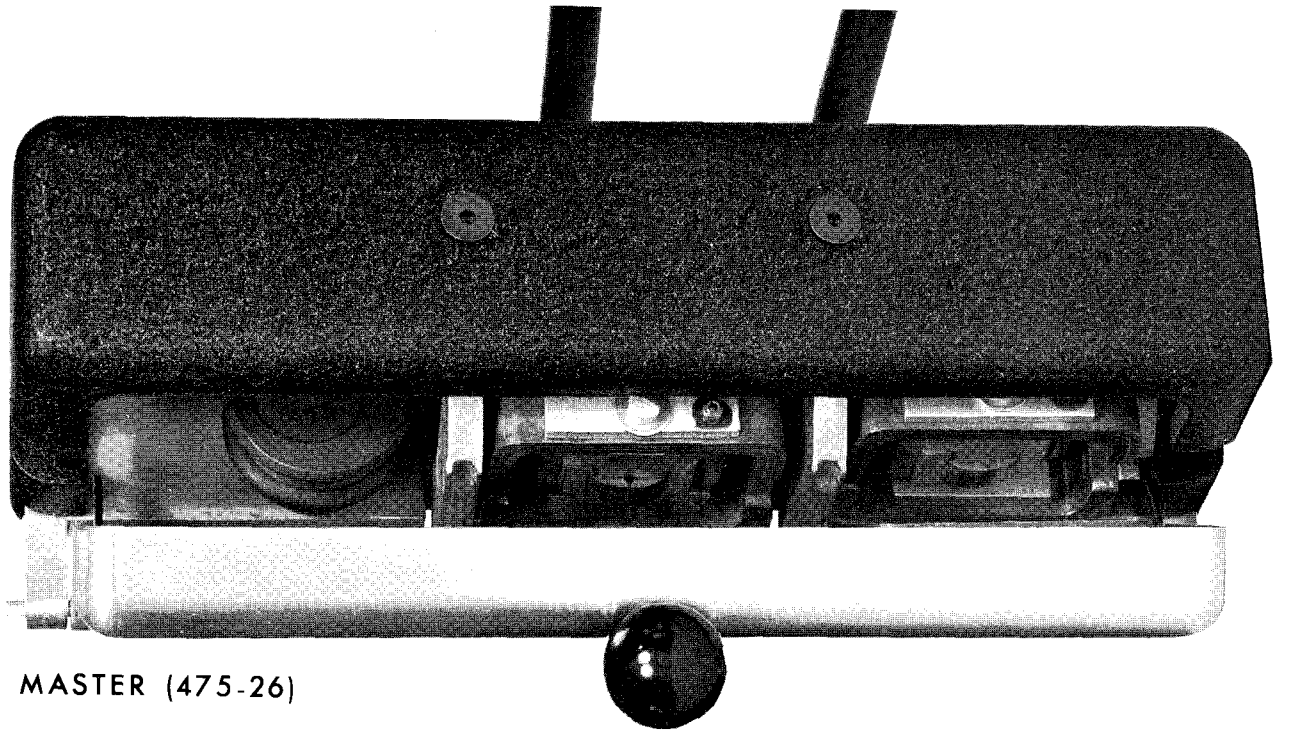
STEPS OF CAUTION

1. When removing or installing head assemblies, the plastic inserts of the cable assembly connectors should be protected from damage. These connectors are easily chipped if hit on any hard surface. A plastic cover is provided when shipped.

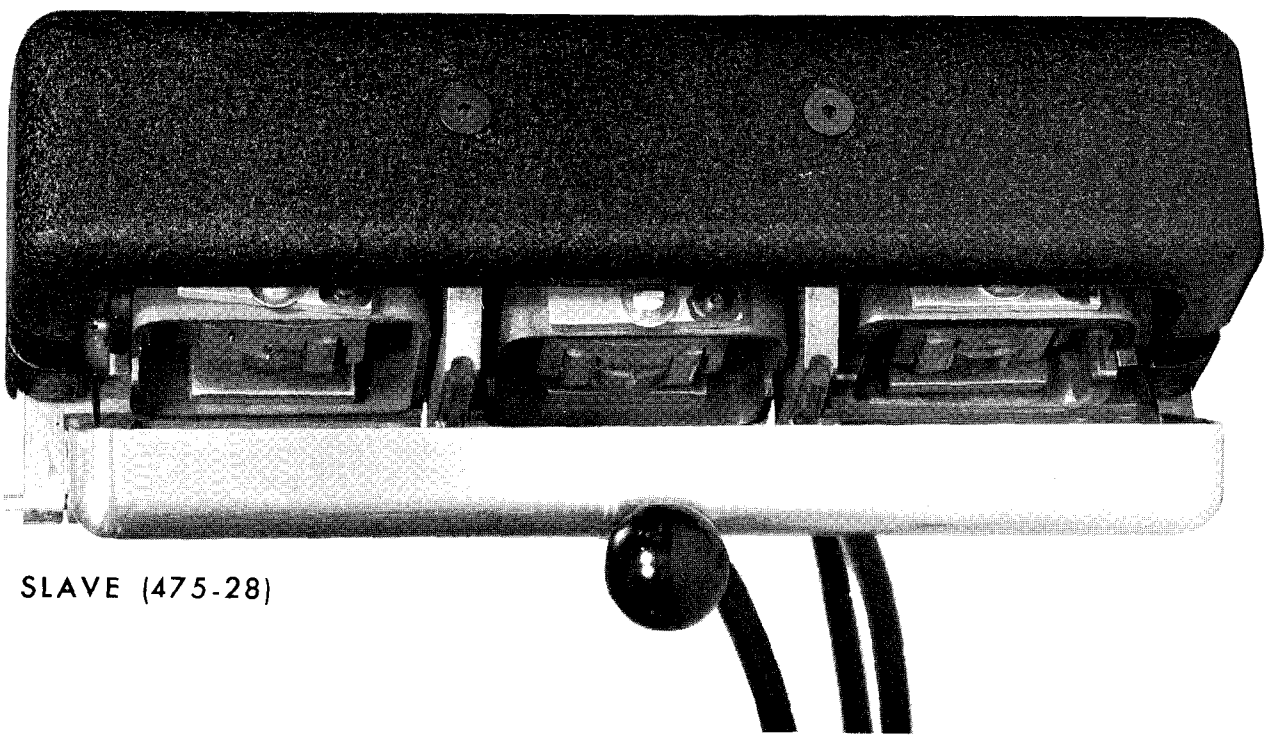
2. See SECTION 4 (TAPE TRANSPORT MECHANISM) for demagnetization procedures for head assemblies.

3. For exact tape height, a measurement of 0.75 inch is taken from the bottom edge of the tape to the tape transport proper.

4. The head assemblies have been adjusted at the factory for tape height, in reference to the head and overall

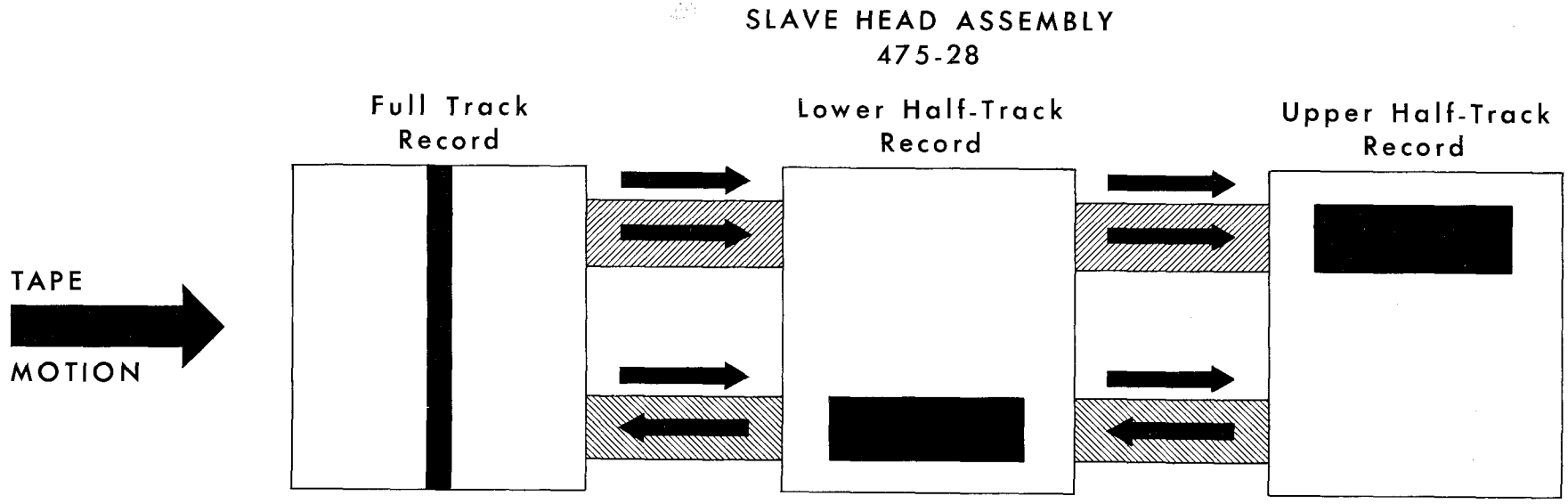


MASTER (475-26)



SLAVE (475-28)

FIGURE 5-1 HEAD ASSEMBLIES



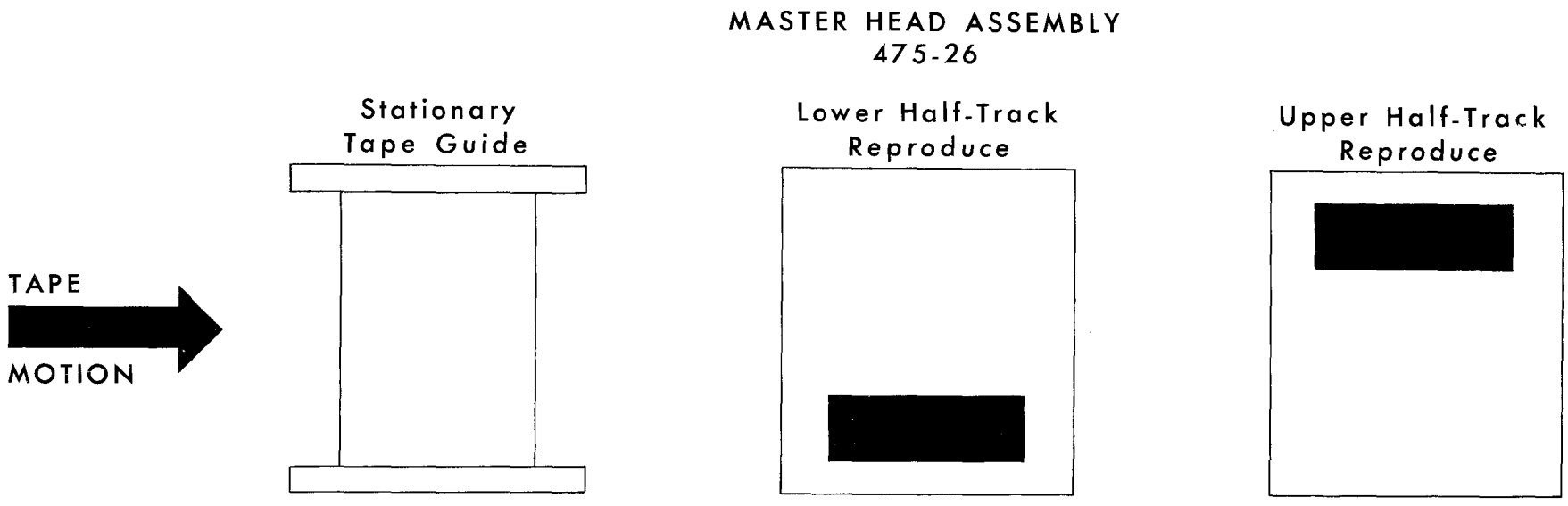


FIGURE 5-2

HEAD CONFIGURATIONS

tape threading. If a new head is required and removed for any reason, caution must be taken. To reinstall, cinch the two screws holding the head assembly to the tape transport with care; too tight a fit may tend to "buckle" the transport and may require realignment or adjustments at the factory.

CLEANING

Most tape manufacturers lubricate their tapes, and this lubricant (plus oxide) from the tape will gradually be deposited on the head assembly. These deposits cause the loss of high frequencies, therefore the head assembly must be cleaned frequently. To clean the head assembly use a solution of Xylene and 0.1% Aerosol (Ampex Catalog Number 087-007). A cotton swab on a stick can be used to accomplish this cleaning.

CAUTION

Do not use any other solvent on the head assembly, as some will damage the material which binds the head laminations together. Also do not use any metallic device which will scratch the head.

The head assemblies are shown in figure 5-1 and the track configuration of each head assembly is shown in figure 5-2.

PARTS LIST
FOR
MODEL 3200D
HEAD ASSEMBLIES

PART DESCRIPTION	AMPEX PART NO.
HEAD ASSEMBLY, reproduce: 1/4-inch	475-26
HEAD ASSEMBLY, record: 1/4-inch	475-28

Individual Replaceable Parts

CABLE ASSEMBLY, reproduce	80098-01
CABLE ASSEMBLY, record	810-02
GATE ASSEMBLY	479-00
GATE SPRING (2 required)	438-01
GATE PIN (2 required)	403-006
GLASS ROD, tape guide: 3/16-inch long (2 required)	457-00
GLASS ROD, tape lifter: 1/2-inch long (2 required)	1372-00
HEAD HOUSING	433-01
NUT, head alignment: fiber insert	493-005
SCREW, allen head: black, 6-32 x 3/8 (2 required)	471-476
SCREW, head stack mounting: 4-40 x 5/8	471-481
TAPE GUIDE POST	6163-00

When ordering replacement parts always include the following information: Equipment Type; Equipment Serial Number; Ampex Part or Catalog Number; and Description of Part. DO NOT simply use the schematic reference number.

Section 6

Electronic Assemblies

MASTER REPRODUCE AMPLIFIER

GENERAL

Two master reproduce amplifier assemblies are provided, each containing a seven stage, resistance-coupled amplifier and an unregulated power supply. These assemblies, which amplify the signal from the reproduce head, are identical. The alignment procedures are detailed in Section 2.

THEORY OF OPERATION

A magnetic flux pattern, proportional to the signal originally recorded, exists on the master duplicator tape. As this tape passes over the reproduce head a voltage is induced in the coil of the head by the moving magnetic flux.

The voltage in the reproduce head coil is introduced into the assembly at INPUT connector J2701P, and is impressed on the grid of V2701, a conventional amplifier stage employing a 12SJ7 vacuum tube. From this tube, the signal passes to the grid of V2702, which uses a 12SJ7 vacuum tube, where it is amplified and fed to the grid of V2703. Stage V2703 uses a 6C5 vacuum tube connected as a cathode follower. Equalizing feedback circuits for the two available speeds are connected from the cathode of V2703 back to the cathode circuit of the first stage through the contacts of relay K2701. The signal is also fed to the grid of V2704 through level control R2714 which provides a means of controlling signal strength.

The next three stages (V2704, V2705, and V2706) all use 6C5 vacuum tubes as conventional resistance-coupled amplifiers which amplify the signal and deliver it to the grid of the cathode follower output stage V2707, which employs a 6F6 vacuum tube. Degen-

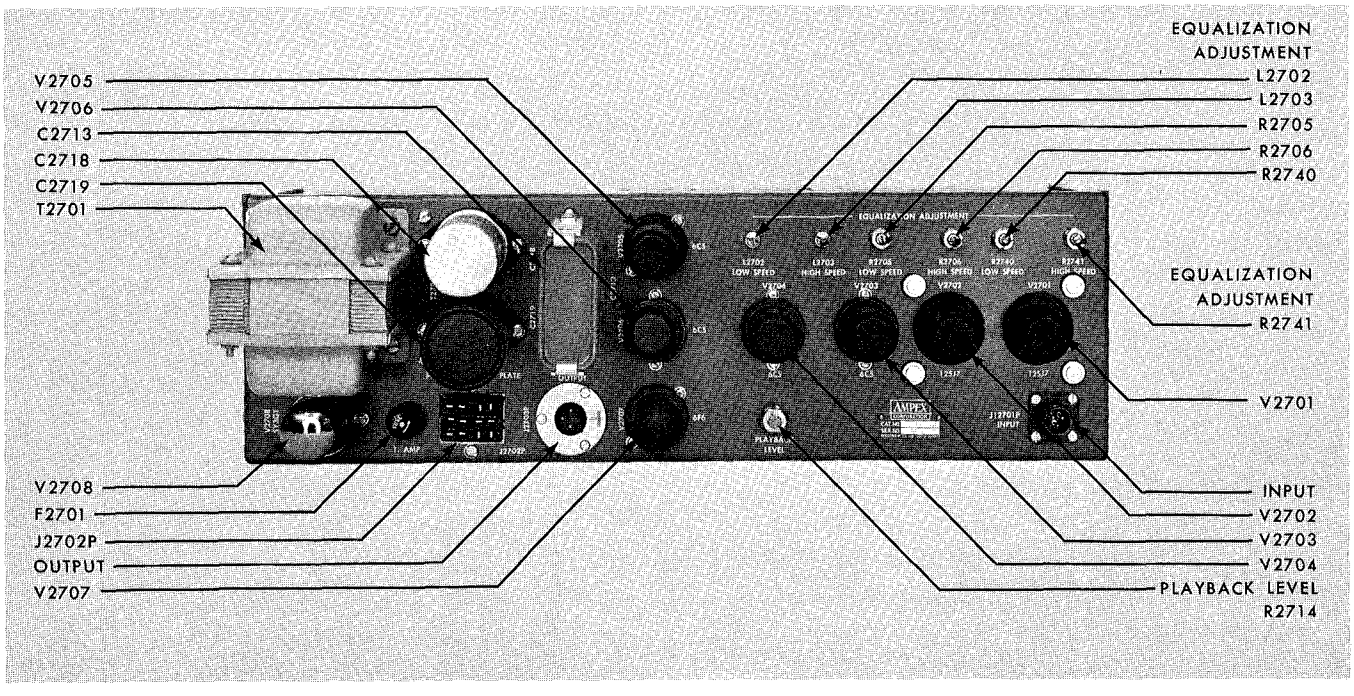


Figure 6-1
MASTER REPRODUCE ASSEMBLY PARTS LOCATION (EXTERIOR VIEW)

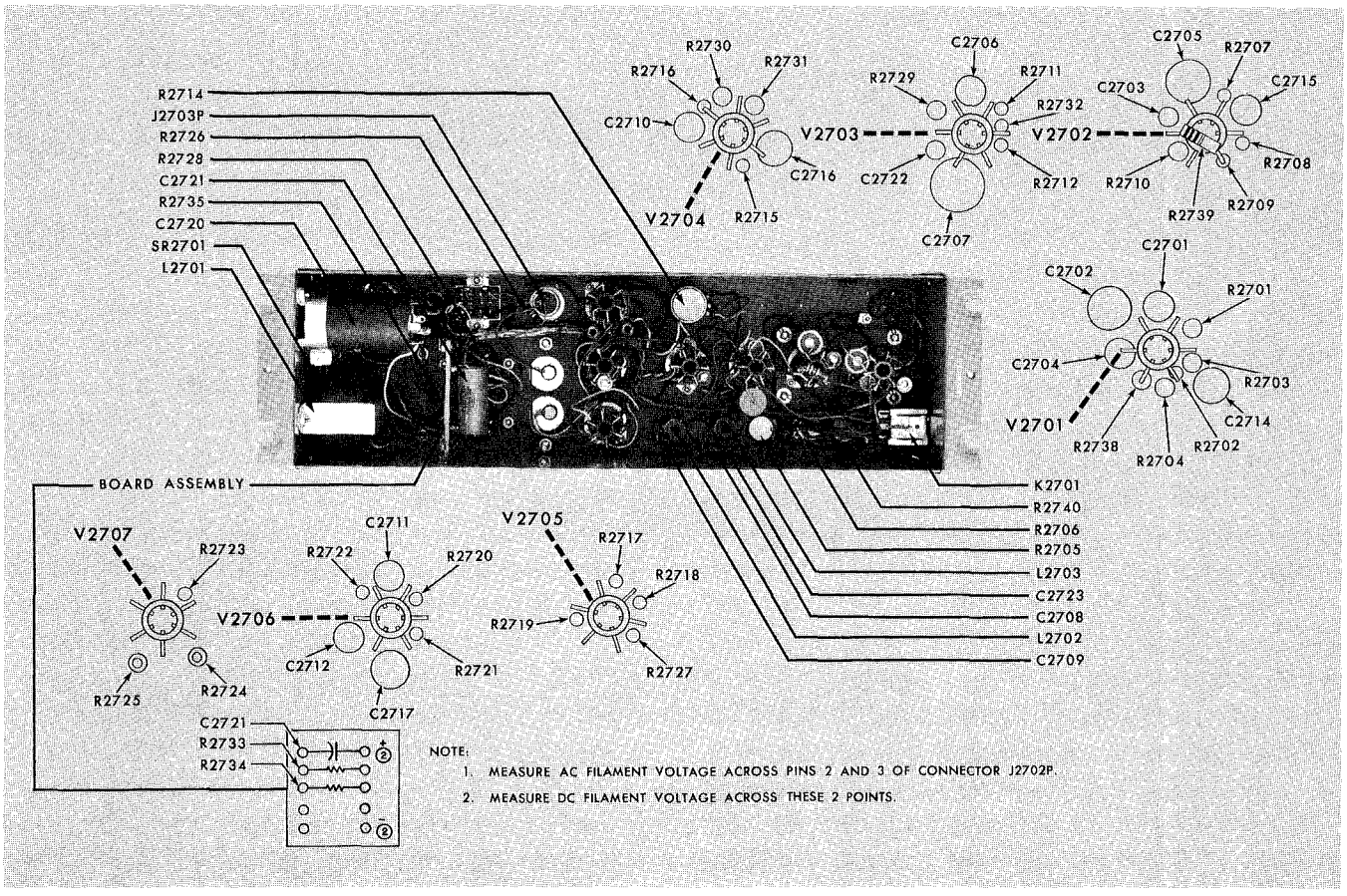


Figure 6-2 MASTER REPRODUCE PARTS LOCATION (INTERIOR VIEW)

erative feedback is achieved through resistor R2727 connected from the output circuit back to the cathode circuit of V2705. The output signal is available across the 600-ohm OUTPUT connector J2703P.

Decoupling networks are provided by resistors R2728, R2729, R2730, and R2731 in conjunction with the four sections of capacitor C2719.

The high voltage d-c power supply uses a conventional full wave rectifier, employing a 5Y3GT vacuum tube. Unregulated plate voltage for all tubes in the amplifier, and actuating power for relay K2701, is provided. Filtering is accomplished by choke L2701, resistor R2734, and the three sections of capacitor C2718.

Full wave selenium rectifier SR2701 provides 12.6 vdc filtered by C2720 and R2735 -- for V2701 and V2702 filaments. A-c filament voltage for the balance of the amplifier tubes is provided by a 6.3 volt center-tapped winding of transformer T2701.

Actuation of relay K2701 is controlled by the position of the TAPE SPEED switch on the master tape transport. When this switch is in its HIGH position the relay is actuated whenever power is applied to the assembly, and its contacts select the high speed equalizing circuit. In its LOW position the TAPE SPEED switch shorts out the coil of K2701 through terminals 9 and 10 of J2702P; the relay is de-energized and its contacts select the low speed equalizing circuit.

PREVENTIVE MAINTENANCE

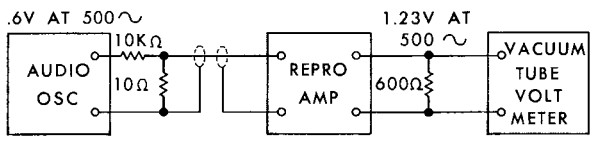
Once each month remove the assembly from the console or rack, disconnecting all cables. Visually inspect it for loose or broken connections, potting material leaking from capacitors or transformers, etc. Clean all dirt and dust from the chassis by using a vacuum cleaner or air blower. Clean the relay contacts by using clean bond paper or a burnishing tool (Western Electric Part No.) between the normally closed contacts and pulling it back and forth several times; then manually actuate the relay and follow the procedure on the normally open contacts. Reinstall the assembly in the system. Check the tubes.

CAUTION

Never remove any tube, connector plug, or fuse while power is applied to the assembly. To do so may magnetize reproduce heads or record heads if they are energized. Use Ampex Catalog Number 704-00 head demagnetizer to demagnetize heads.

CORRECTIVE MAINTENANCE

When trouble shooting procedures have isolated a system malfunction to one of the master reproduce amplifiers, the following corrective maintenance schedule should aid the operator in quickly determining the faulty part. Corrective maintenance should be performed as a bench operation.



EQUALIZATION ADJUSTMENT SET-UP

Figure 6-3
TEST SET-UP, REPRODUCE AMPLIFIER

WARNING

DURING THE FOLLOWING PROCEDURES DANGEROUS VOLTAGES EXIST AT MANY POINTS ON THE UNDER SIDE OF THE CHASSIS. ONLY QUALIFIED PERSONNEL, ACCUSTOMED TO WORKING WITH LIVE CIRCUITS, SHOULD ATTEMPT THIS WORK.

Step 1: Check that power is applied and that fuse F2701 is not faulty.

Step 2: Disconnect power and remove the assembly from the console or rack.

Step 3: Connect 117 volts 60 cps power to pins 5 and 6 of POWER FROM TOP PLATE connector J2702P. The safest way to accomplish this is to fabricate a test cable using a power plug at one end and a matching receptacle for the 12-contact Jones plug at the other end. A single pole single throw switch, activates the speed equalization relay and should be connected to pins 9 and 10 of the J2702P connector.

Step 4: Allow sufficient time for the power supply to reach operating potential. The filaments of tube V2708 should light, and the other tubes gradually become warm. Disconnect the power and replace any tube which does not react in this manner. Also, relay K2701 should energize when the single pole single throw switch is open; if it does not it is an indication of a malfunction in the high voltage power, see Step 5.

Step 5: If tube filaments light (or tubes become warm), but the relay does not actuate, disconnect the

power and replace tube V2708. If neither of these actions occur, recheck fuse F2701 and transformer T2701 after disconnecting power.

Step 6: Check the a-c filament voltage with an a-c voltmeter at the terminal board as indicated in Fig. 6-1. This reading should be 6.3 volts, a-c, ±0.2 volt.

Step 7: Check the d-c filament voltage with a d-c voltmeter at the terminal board as indicated in Fig. 6-1. This reading should be 12.5 volts, d-c, ±1 volt.

Step 8: Check the high voltage at the power supply filter capacitor, using a d-c voltmeter set to safely read voltages up to 425 volts. These readings should be 400 volts ±10 volts, at the triangle, square, and half-moon terminals on the capacitor respectively. These readings should be made to any convenient circuit ground. Low readings might indicate a leaky filter capacitor, an excessive drain in the supply, or a poor 5Y3GT tube. High readings might indicate that portions of the circuit were not drawing sufficient current.

Step 9: Check the plate voltages of all amplifier tubes using a d-c voltmeter.

V2701 pin 8 -- 65 volts ±5 volts
V2702 pin 8 -- 80 volts ±5 volts
V2703 pin 3 -- 135 volts ±10 volts
V2704 pin 3 -- 75 volts ±5 volts
V2705 pin 3 - 150 volts ±10 volts
V2706 pin 3 - 185 volts ±10 volts
V2707 pin 3 - 315 volts ±10 volts

Low voltages might indicate a gassy tube, a shorted or leaky bypass or decoupling capacitor, excessive resistance in the plate lead, or insufficient resistance in the cathode lead. High voltage readings would normally indicate a poor tube or excessive cathode lead resistance.

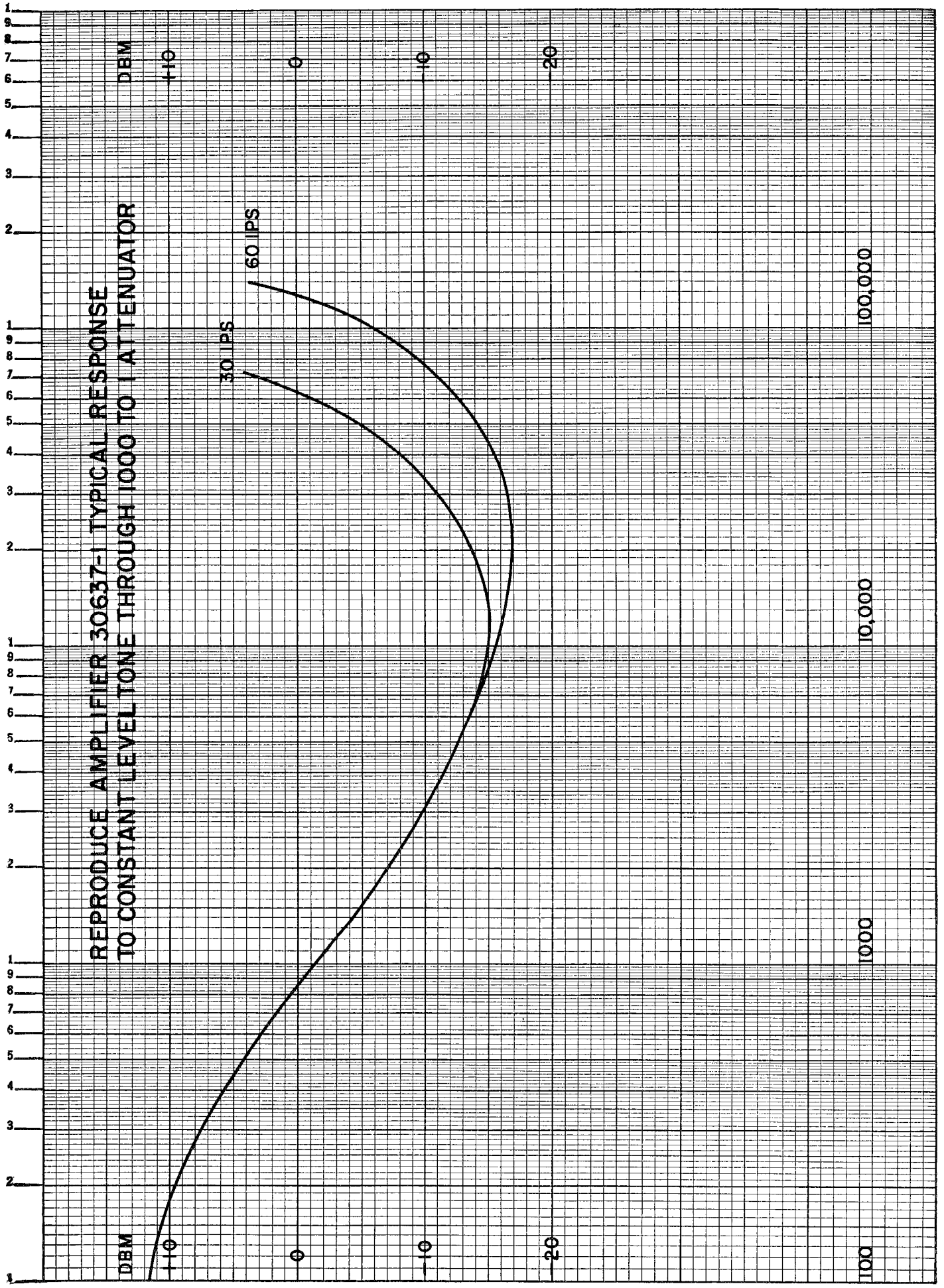
Step 10: If the frequency response or gain of the amplifier is abnormal, check for dirty contacts of relay K2701. Clean by using burnishing tool or regular piece of bond paper.

Step 11: Hum or microphonics may be noticed above the bias level at the output of the amplifier, when connected to the head assembly (cover closed). Low frequency hum may be recorded as low frequency background noise. This will be noticeable when duplicated tapes are reproduced in the REWIND or FAST FORWARD modes of operation. If these troubles occur two remedies may improve this situation.

A. Try selected 12SJ7 and 6C5 amplifier tubes for minimum hum and microphonics.

B. Check the ground circuit of input capacitor filter C2718. The red/yellow high voltage center tap lead should connect to this capacitor.

Step 12: Follow normal audio amplifier trouble shooting techniques using a signal generator to trace the trouble to the malfunctioning stage.



MASTER REPRODUCE EQUALIZATION CURVE

Figure 6-4

REPRODUCE ELECTRONICS
FOR
3200-D
CATALOG NUMBER 30637

REF. NO.	PART DESCRIPTION	AMPEX PART NO.
C2701	CAPACITOR, paper: tubular; .100000 mfd ±20%; 200 vdcw; Sprague Part No. 67P10402	035-135
C2702	CAPACITOR, electrolytic: tubular; -10 +50%; 85° C; 4 mfd; 450 vdcw: Sangamo Part No. MT-4504	031-009
C2703	CAPACITOR, paper: tubular; 85° C; .022 mfd ±10%; 200 vdcw: MIL-C-25A: CPO5A3EC223K	035-043
C2704	CAPACITOR, paper: tubular; 85° C; .047 mfd ±10%; 400 vdcw; MIL-C-25:CPO5A3EE473K	035-057
C2705	Same as C2702	031-009
C2706	Same as C2704	035-057
C2707	CAPACITOR, paper: tubular; .25 mfd -10 +20%; 600 vdcw: Sprague Part No. 109P	035-097
C2708	CAPAICTOR, mica: axial; .0006 mfd ±2%; 1000 vdcw: Elmenco Part No. Type VCM20	034-065
C2709	CAPACITOR, mica: axial; .0005 mfd ±20%; 500 vdcw: Elmenco Part No. CM20C501G	034-062
C2710	Same as C2704	035-057
C2711	Same as C2704	035-057
C2712	Same as C2704	035-057
C2713	CAPACITOR, paper: rectangular; .5 mfd -0 +10%; 40° C; 330 vac/600 vdc rating; 600 vdcw: General Electric Part No. 23F875G103	036-017

When ordering replacement parts always include the following information: Equipment Type; Equipment Serial Number; Ampex Part or Catalog Number; and Description of Part. DO NOT simply use the schematic reference number.

REF. NO.	PART DESCRIPTION	AMPEX PART NO.
C2714	CAPACITOR, electrolytic: tubular; 50 mfd -10 +250%; 85° C; 6 vdcw: Sprague Part No. TVA1100	031-123
C2715	Same as C2714	031-123
C2716	Same as C2714	031-123
C2717	Same as C2714	031-123
C2718	CAPACITOR, electrolytic: twist tab; 20-30-30 mfd. -10 +50%; 85° C; 475 vdcw: Sprague: Type DFP	031-082
C2719	CAPACITOR, electrolytic: twist tab; 20-20-20-20 mfd. -10 +50%; 85° C; 450 vdcw: Cornell Dubilier: UPT222245	031-073
C2720	CAPACITOR, electrolytic: twist tab; 2000 mfd. -10 +250%; 85° C; 15 vdcw: Sprague Part No. Type DFP	031-085
C2721	CAPACITOR, electrolytic: tubular; 8 mfd. -10 +100%; 85° C; 350 vdcw: Sprague Part No. Type DEE	031-011
C2722	Same as C2703	035-043
F2701	FUSE, cartridge: Slow blow; 125 volt; 1 amp: Littelfuse Part No. 313001	070-004
J2701P	CONNECTOR, receptacle: male; 3 contact; MS3102A-10S-3P	143-008
J2702P	CONNECTOR, receptacle: male; 730 volt rms; 10 amp contacts; 12 contacts: Jones Part No. P-312-AB	147-008
J2703P	CONNECTOR, receptacle: male; 3 contact: Cannon Part No. XL-3-14	147-004
K2701	RELAY: 3PDT; 115 volt dc coil; 10K ohm	5760-00

When ordering replacement parts always include the following information: Equipment Type; Equipment Serial Number; Ampex Part or Catalog Number; and Description of Part. DO NOT simply use the schematic reference number.

REF. NO.	PART DESCRIPTION	AMPEX PART NO.
L2701	FILTER CHOKE: 8-10 Henry; 80 ma. dc 250 ohm resistance	1155-00
L2702	COIL, variable: inductor, 2.0-14 mh. R.A.M. Part No. 201R15	051-011
L2703	COIL, variable: inductor; .44-3.1 mh. R.A.M. Part No. 201R13A	051-012
R2701	RESISTOR, fixed: axial; carbon; .47 meg ohm; 1%; 1 watt: Electra Part No. Type DC-1	042-061
R2702	RESISTOR, fixed: axial; carbon; 68 ohms; 1%; 1 watt: Electra Part No. Type DC-1	042-164
R2703	RESISTOR, fixed: axial; carbon; 680 ohm; 1%; 1 watt: Electra Part No. DC-1	042-025
R2704	RESISTOR, fixed: axial; carbon; .1 meg ohm; 10%; 1 watt: MIL-R-11A:RC32GF104K	041-170
R2705	RESISTOR, variable: carbon; 5,000 ohm; 20%; 1/2 watt: Chicago Telephone Supply Part No. Type 65 (TPR D)	044-073
R2706	RESISTOR, variable: carbon; 2,000 ohm; 20%; 1/2 watt: Chicago Telephone Supply Part No. type 65 (TPR D)	044-072
R2707	RESISTOR, fixed: carbon; 1 meg ohm; 10%; 1 watt: MIL-R-11A:RC32GF105K	041-182
R2708	RESISTOR, fixed: carbon; axial; 680 ohms; 10%; 1 watt: MIL-R-11A:RC32GF681K	041-143
R2709	Same as R2704	041-170
R2710	RESISTOR, fixed: axial; carbon; 22K ohms; 1%; 1 watt: Electra Part No. Type DC-1	042-045
R2711	Same as R2707	041-182
R2712	RESISTOR, fixed: carbon; axial; 2700 ohms; 10%; 1 watt: MIL-R-11A:RC32GF272K	041-151

When ordering replacement parts always include the following information: Equipment Type; Equipment Serial Number; Ampex Part or Catalog Number; and Description of Part. DO NOT simply use the schematic reference number.

REF. NO.	PART DESCRIPTION	AMPEX PART NO.
R2714	RESISTOR, variable: carbon; .1 meg ohm; 10%; 2 watts: Allen Bradley Part No. JA1041, SD3056	044-015
R2715	Same as R2708	041-143
R2716	RESISTOR, fixed: carbon; axial; 15K ohms; 10%; 1/2 watt: MIL-R-11A:RC20GF153K	041-162
R2717	Same as R2707	041-182
R2718	Same as R2708	041-143
R2719	Same as R2716	041-162
R2720	Same as R2707	041-182
R2721	Same as R2708	041-143
R2722	Same as R2716	041-162
R2723	Same as R2704	041-170
R2724	RESISTOR, fixed: wirewound; 600 ohms; 5%; 10 watts: Tru-ohm Part No. Type FRL-10	043-108
R2725	Same as R2724	043-108
R2726	Same as R2716	041-162
R2727	RESISTOR, fixed: carbon; axial; 6.8K ohms; 10%; 1 watt: MIL-R-11A:RC32GF682K	041-156
R2728	RESISTOR, fixed: carbon; axial; 6.8K ohms; 10%; 2 watts: MIL-R-11A:RC42GF682K	041-211
R2729	RESISTOR, fixed: carbon; axial; 10K ohms; 10%; 2 watts: MIL-R-11A:RC42GF103K	041-213
R2730	Same as R2728	041-211
R2731	Same as R2729	041-213
R2732	RESISTOR, fixed: carbon; axial; 10K ohms; 10%; 1 watt: MIL-R-11A:RC32GF103K	041-158

When ordering replacement parts always include the following information: Equipment Type; Equipment Serial Number; Ampex Part or Catalog Number; and Description of Part. DO NOT simply use the schematic reference number.

REF. NO.	PART DESCRIPTION	AMPEX PART NO.
R2733	RESISTOR, fixed: wirewound; 25K ohms; 5%; 10 watts: Tru-ohm Part No. Type FRL-10	043-134
R2734	RESISTOR, fixed: wirewound; 12.5K ohms; 5%; 10 watts: Tru-Ohm Part No. Type FRL-10	043-114
R2735	RESISTOR, fixed: carbon; axial; 4.7 ohms; 10%; 1 watt; Ohmite Part No.	041-091
R2736	RESISTOR, fixed: axial; carbon; 18K ohms; 1%; 1 watt: Electra Part No. Type DC-1	042-043
R2737	RESISTOR, fixed: axial; carbon; 27K ohms; 1%; 1 watt: Electra Part No. Type DC-1	042-046
R2738	Same as R2704	035-057
R2739	RESISTOR, fixed: carbon; axial; 330 ohms; 10%; 1 watt: MIL-R-11A:RC32GF331K	041-139
R2740	RESISTOR, variable: carbon; 500 ohms; 20%; 1/2 watt: Chicago Telephone Supply Part No. Type 65 (TPR D)	044-071
R2741	Same as R2740	044-071
SR2701	RECTIFIER, selenium: single phase; centertap; max. in 26 vac rms; max. out 1.2 amp dc: General Electric Part No. 6RS5WH5	581-001
T2701	TRANSFORMER, power: primary 115 volts; 50/60 cycle; secondary No. 1, 22 volts rms; center tapped at 750 ma dc.; secondary No. 2, 690 volts rms, center tapped at 60 ma. dc.; secondary No. 3, 6.3 volts center tapped at 2 amps ac.; secondary No. 4, 5 volts at 2 amps ac.	3953-00
V2701	TUBE, electron: 12SJ7; octal base: R.C.A. Part No.	012-087
V2702	Same as V2701	012-087

When ordering replacement parts always include the following information: Equipment Type; Equipment Serial Number; Ampex Part or Catalog Number; and Description of Part. DO NOT simply use the schematic reference number.

REF. NO.	PART DESCRIPTION	AMPEX PART NO.
V2703	TUBE, electron: 6C5; octal base: R.C.A. and General Electric Part No.	012-002
V2704	Same as V2703	012-002
V2705	Same as V2703	012-002
V2706	Same as V2703	012-002
V2707	TUBE, electron: 6F6; octal base: R.C.A. and General Electric Part No.	012-007
V2708	TUBE, electron: 5Y3GT; octal base: R.C.A., Raytheon, Sylvania, Tungsol or General Electric Part Nos.	012-013
	OCTAL TURRET SOCKET	1208-00
	OCTAL SOCKET	2317-00
	FUSE EXTRACTOR POST: Littelfuse Part No. 342003	085-001
	NUT, shaftlock: 3/8-32; For 1/4 inch shaft w/7/16 hex locking nut: Millen Part No. 10061	498-014
	CLAMP, capacitor mounting: 1-1/2 inch dia.; vertical mounting: Cornell Dubilier Part No.	301-008
	SHOCKMOUNT, Barrymount (orange): Barry Part No. 275-1	350-003
	PIN, clevis: flat head; 3/16 inch dia; 21/32 inches long: MS20392	400-013
	PIN, cotter; extended prong; mitre end; 1/16 inch dia.; 1/2 inch long: ASA Part No.	401-005

When ordering replacement parts always include the following information: Equipment Type; Equipment Serial Number; Ampex Part or Catalog Number; and Description of Part. DO NOT simply use the schematic reference number.

MASTER RECORD AMPLIFIER

GENERAL

One master record amplifier assembly is provided, consisting of a power supply, two record amplifiers, two pre-emphasis equalizer bracket assemblies and two VU output meters mounted on an 8-3/4 by 19-inch rack mounting chassis.

THEORY OF OPERATION

The schematic diagram of the record assembly is shown as a foldout. The two record amplifiers are identical and the following circuit description for channel one also applies to channel two. An input signal from the master reproduce amplifier is introduced at J401S which is terminated in a 560 ohm resistor R401 and a four position pre-emphasis equalizer assembly mounted on switch S401. This equalizer section provides the pre-emphasis necessary for making either 3-3/4 or 7-1/2 ips copies of 15 ips or 7-1/2 ips masters. Additional fixed pre-emphasis in the record amplifier compensates for certain losses present in the recording process. The control switch S401 is located on the record amplifier panel and is labeled RECORD EQUALIZATION - SPEED RATIO. This label acts as an operational check list indicating the speed relationship between master and slave tape transports, and the normal speeds of the master and duplicate tapes.

When the desired speed ratios and appropriate equalization have been selected,

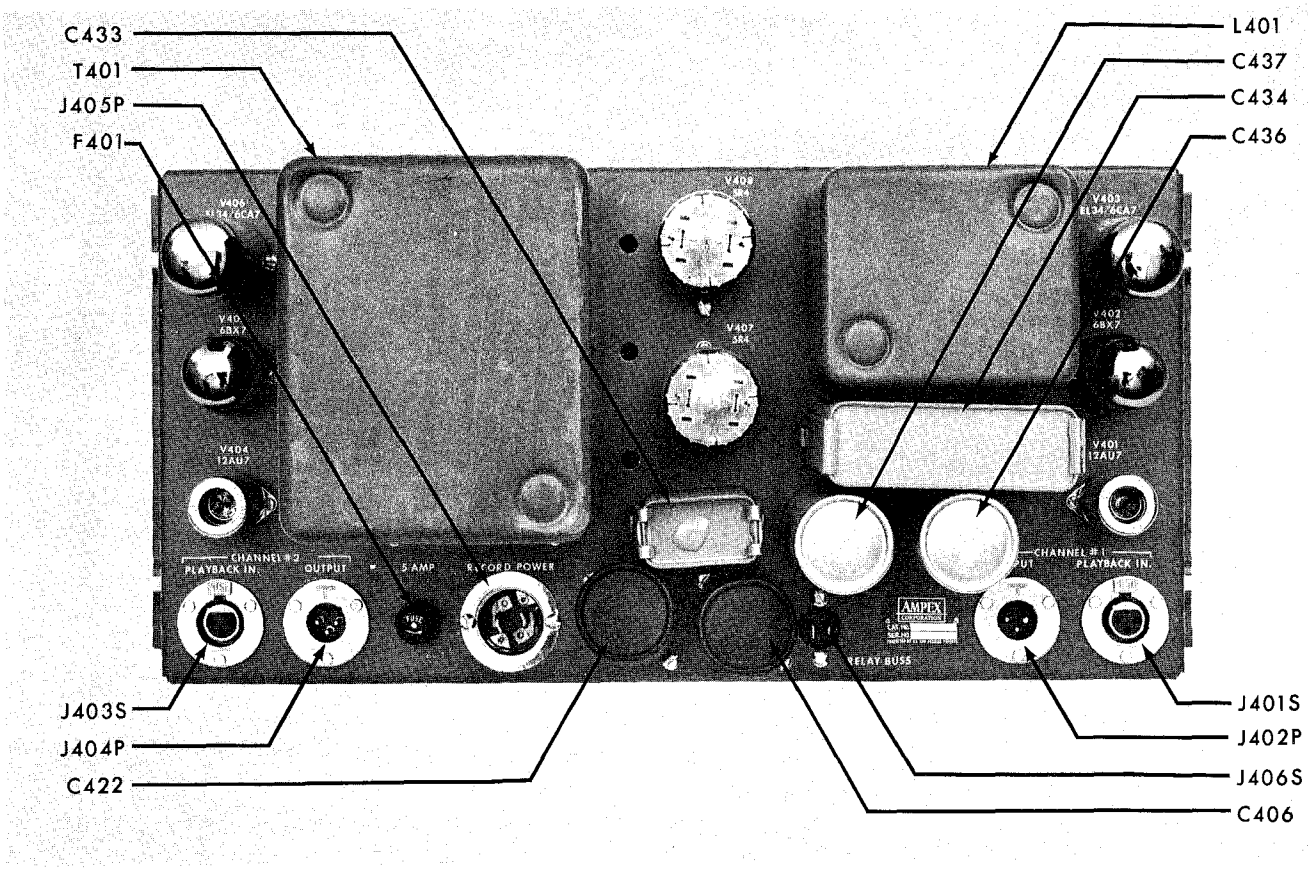


Figure 6-5
MASTER RECORD ASSEMBLY PARTS LOCATION (EXTERIOR VIEW)

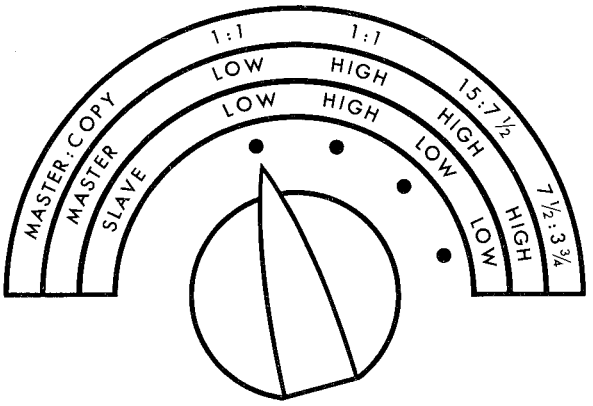


Figure 6-6 RECORD EQUALIZATION

the signal is impressed on the 600 ohm twenty step attenuator, a 2 db per step gain control. The output of this attenuator feeds the 20,000 ohm potentiometer R403, providing a means to calibrate the gain of the four record amplifier channels. Control R403 is a screwdriver adjustment on the front panel below the vu meter, and should be set near the high side (maximum output).

The first four stages are resistance-coupled amplifiers, comprising V401 (12AU7) and V402 (6BX7GT). The EL34/6CA7 output tube is cathode follower V403. Two feedback loops are provided in the amplifier to compensate for certain losses within the system. Partial equalization is accomplished in the feedback loop from the grid of V402A to the cathode of V401A by the bypass capacitor C407. The other compensation network is contained in the feedback loop from the output of V403 to the cathode of V402A by R417 and C411. The cathode follower stage V403 provides a low impedance driving source for the slave heads which are fed from the output connector J402P through the slave switching panels. A VU meter (M401) is shunted across the amplifier output.

The output of the record amplifier is normally short circuited by relay K402. This relay is energized when the system has been started by the record start button on the master control panel. The function of the relay is to short the slave record heads whenever the system is not actually recording, thus preventing transient power on and power off signals from magnetizing the slave record heads or damaging the output meter.

Plate power is supplied by parallel full wave rectifiers, vacuum tubes, V407 and V408, the filtering consisting of capacitor C433, inductance L401 and capacitor C434. Two isolation filters, inductance L402 and capacitor C437, inductance L403 and capacitor C436, feed respective record channels.

Two separate filament windings are used. One winding supplies 6.3 vac to V401, V402, V404, V405 and meter illumination. This winding is balanced to ground return by R463 and R465. The second winding provides 6.3 vac to the output tubes V403 and V406. This winding is balanced to a dc voltage somewhat above ground potential to prevent excessive potential between the cathode and the filament of the output tubes.

A 47,000 ohm resistor, R471, is used to limit the output voltage of the power supply until the tubes have warmed up. The thermal time delay relay K401, short circuits this resistor fifteen seconds after power is applied.

PREVENTIVE MAINTENANCE

Routine dusting and cleaning of the chassis can be scheduled as required by operating conditions. Tubes should be checked for emission and gain once a month. Overall response measurements can be made according to the diagram in Figure 6-5. Noise level of the entire system can be measured at the record current jacks of the slave switch panel and will indicate noisy tubes etc. The attenuator contacts may be cleaned if they be-

come noisy. Alcohol applied with a lint free cloth is usually sufficient. Clock oil or Daven attenuator oil can be used to lubricate the contacts. The amount of oil that will remain on the head of a pin is usually adequate if distributed uniformly over the contacts.

CORRECTIVE MAINTENANCE

Typical operating voltages are indicated on the schematic diagram (Fig. 6-6) for audio channel No. 1; similar voltages exist at corresponding points for audio channel No. 2.

1) Gain Measurement

Step 1: Terminate the output of one of the record amplifier channels (J402P or J404P) in 600 ohms and connect an a-c vtvm across this load.

Step 2: Connect an audio oscillator to the input of the amplifier being tested.

Step 3: Set the oscillator level at 1.23 volts (+4 dbm) at 500 cycles.

Step 4: Set the GAIN of the amplifier being tested to 40 on the engraved scale (maximum position).

Step 5: Turn the vernier gain control R445 or R446 (screwdriver adjustment) full clockwise. Output level reading on the vtvm should be 29 volts ±2 volts rms.

Step 6: Back off the step attenuator GAIN control until the meter reads zero VU, or between zero and +2 VU.

Step 7: Using the vernier adjustment, set the level to exactly zero VU. Output voltage on the vtvm should now read 6.9 volts rms (±0.5 volt rms).

2) Signal to Noise Ratio

Step 1: Short the input.

Step 2: Set the gain controls to normal operating level.

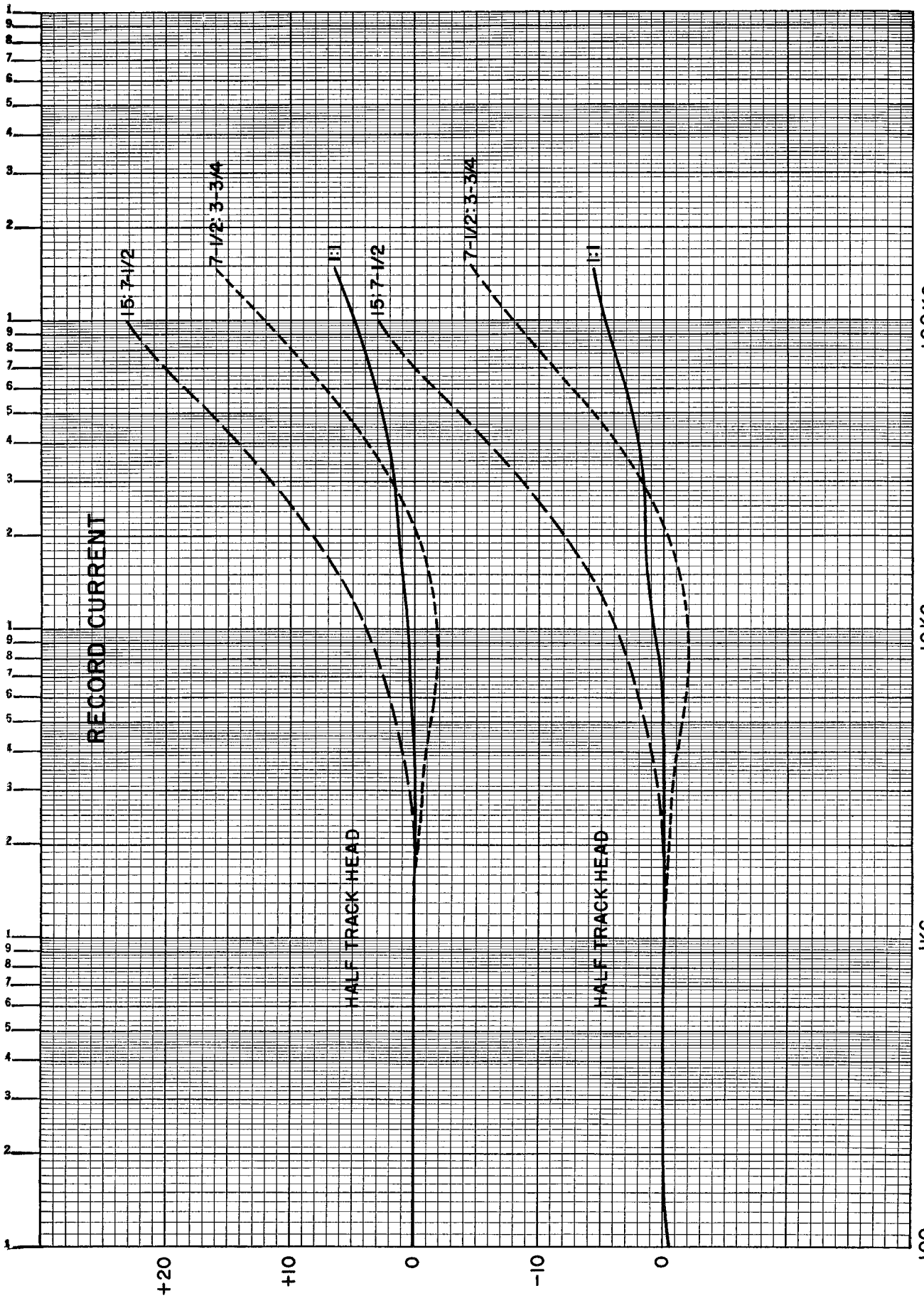
Step 3: Terminate the output in 600 ohms. The signal-to-noise ratio should be 60 db with respect to 6.9 volts rms output (+19 dbm).

3) Overall Frequency Response

Make this measurement at the RECORD CURRENT jack of one of the slave switch panels by plugging in an a-c vtvm such as the Hewlett-Packard 400C or its equivalent. Set input level at -6 dbm (0.39 volt rms). Record current should correspond within ±1 db of the values shown in figure 6-5.

4) Distortion Measurement

Use the same set up described in Steps 1 and 2 of the Gain Measurement. Connect a distortion meter to the output circuit. Harmonic distortion should be less than 0.5% to 500 cps with 6.6 volts output into the 600 ohm termination.



MASTER RECORD EQUALIZATION CURVE

Figure 6-8

RECORD AMPLIFIER
FOR
3200-D
CATALOG NUMBER 30639

REF. NO.	PART DESCRIPTION	AMPEX PART NO.
C401	CAPACITOR, mica: axial; .002 mfd; 1%; 500 vdcw: Elmenco Part No. CM20C202F	034-071
C403	CAPACITOR, mica: axial; .00068 mfd; 5%; 500 vdcw: MIL-C-5A:CM25D681J	034-013
C404	CAPACITOR, paper: tubular; .020 mfd; 5%; 600 vdcw: Sprague Part No. 109P	035-102
C405	CAPACITOR, paper: tubular; .047 mfd; 10%; 400 vdcw; Goodall El Part No. 663-UW	035-214
C406	CAPACITOR, electrolytic: twist tab; 20-30-30 mfd; -10 +50%; 85° C; 475 vdcw: Sprague Part No. Type DFP	031-082
C407	CAPACITOR, mica: axial; .0033 mfd; 5%; 500 vdcw: MIL-C-5A:CM30D332J	034-023
C408	CAPACITOR, paper: tubular; .10 mfd; 10%; 400 vdcw: Goodall El Part No. 663-UW	035-215
C409	CAPACITOR, electrolytic: tubular; 50 mfd; -10 +250%; 85° C; 25 vdcw: Cornell Dubilier Part No. BRM-502	031-030
C410	CAPACITOR, paper: tubular; .10 mfd; 20%; 600 vdcw: Sprague Part No. 73P10406	035-140
C411	Same as C401	034-071
C412	Same as C410	035-140
C413	CAPACITOR, electrolytic: tubular; 50 mfd; -10 +150%; 85° C; 50 vdcw; Sprague Part No. Type DEE	031-024

When ordering replacement parts always include the following information: Equipment Type; Equipment Serial Number; Ampex Part or Catalog Number; and Description of Part. DO NOT simply use the schematic reference number.

REF. NO.	PART DESCRIPTION	AMPEX PART NO.
C414	CAPACITOR, paper: tubular; .220 mfd; 20%; 400 vdcw; Sprague Part No. 96P22404S4	035-085
C415	CAPACITOR, paper: rectangular; 2.0 mfd; -10 +50%; 85° C; 600 vdcw: Cornell Dubilier Part No. DYR6200	036-004
C416	CAPACITOR, mica: axial; .000750 mfd.; 5%; 300 vdcw: MIL-C-5A:CM20D751J	034-014
C417	Same as C401	034-071
C418	Same as C404	035-102
C420	Same as C403	034-013
C421	Same as C405	035-214
C422	Same as C406	031-082
C423	Same as C407	034-023
C424	Same as C408	035-215
C425	Same as C409	031-030
C426	Same as C410	035-140
C427	Same as C401	034-071
C428	Same as C410	035-140
C429	Same as C413	031-024
C430	Same as C414	035-085
C431	Same as C415	035-004
C432	Same as C416	034-014
C433	CAPACITOR, paper: rectangular; 2 mfd; -10 +20%; 1000 vdcw: Sprague Part No. 0030-34	036-033

When ordering replacement parts always include the following information: Equipment Type; Equipment Serial Number; Ampex Part or Catalog Number; and Description of Part. DO NOT simply use the schematic reference number.

REF. NO.	PART DESCRIPTION	AMPEX PART NO.
C434	CAPACITOR, paper: rectangular; 10 mfd; 10%; 85° C; 600 vdcw: Cornell Dubilier Part No. TJH6100; Painted gray; Color 1640 Per Fed TT-C-695	036-012
C435	Same as C408	035-215
C436	CAPACITOR, electrolytic: threaded neck; 16 mfd; -10 +50%; 600 vdcw: Sprague Part No. AP-16	031-100
C437	Same as C436	031-100
C438	CAPACITOR, mica: axial; .0015 mfd; 5%; 500 vdcw: Elmenco Part No. CM20E152J	034-103
C439	CAPACITOR, mica: axial; .002 mfd; 5%; 500 vdcw: Elmenco Part No. CM20E202J	034-072
C441	CAPACITOR, paper: tubular; .056 mfd; 5%; 125° C; 200 vdcw: Sprague Part No. 65P56352	035-202
C442	Same as C438	034-103
C443	Same as C439	034-072
C445	Same as C441	035-202
C446	CAPACITOR, paper: tubular; .0033 mfd; 10%; 85° C; 400 vdcw: MIL-C-25: CPO5A1EE332K	035-171
C447	Same as C446	035-171
F401	FUSE, cartridge: 5 amperes; 250 volt; Fastblow: Littelfuse Part No. 312005	070-007
J401S	CONNECTOR, receptacle: female; 3 contact: Cannon Part No. XL-3-13	146-007
J402P	CONNECTOR, receptacle: male; 3 contact: Cannon Part No. XL-3-14	147-004
J403S	Same as J401S	146-007

When ordering replacement parts always include the following information: Equipment Type; Equipment Serial Number; Ampex Part or Catalog Number; and Description of Part. DO NOT simply use the schematic reference number.

REF. NO.	PART DESCRIPTION	AMPEX PART NO.
J404P	Same as J402P	147-004
J405P	CONNECTOR, plug: male; 8 contact; 730 volts rms; 10 amp contacts: Jones Part No. P-308-CCT-L	147-013
K401	RELAY: 15 second time delay; 6.3 volt heater octal base; 3 amp contacts rating: Amperite Part No. 6N015	020-071
K402	RELAY: 3 PDT; 115 volt dc coil; 10 amp contacts; Philtrol Part No. 33QA	020-006
L401	CHOKE, filter: 300 ma dc; 90 ohms with an inductance of 6.5 henrys: U.T.C. Part No. H75	541-012
L402	CHOKE, filter: 160 ma dc; 165 ohms with an inductance of 6 henrys: Triad Part No. C12X	541-013
L403	Same as L402	541-013
L404	COIL, rf choke: 2.5 mh: Miller Part No. 640	051-024
L405	Same as L404	051-024
M401	METER, vu: frosted lamps; 6.3 volts; .3 amperes; 4 inch	30667-01
M402	Same as M401	30667-01
R401	RESISTOR, fixed: axial; carbon; 560 ohms; 1%; 1 watt: Electra Part No. Type DC-1	042-024
R402	RESISTOR, fixed: axial; carbon; 8.2K ohms; 1%; 1 watt: Electra Part No. Type DC-1	042-040
R403	RESISTOR, variable: carbon; 20K ohms; 20%; 1/4 watt: Centralab Part No. MOD 3 (TPR C1)	044-036
R404	RESISTOR, fixed: carbon; axial; 33K ohms; 10%; 2 watts: MIL-R-11A:RC42GF333K	041-218

When ordering replacement parts always include the following information: Equipment Type; Equipment Serial Number; Ampex Part or Catalog Number; and Description of Part. DO NOT simply use the schematic reference number.

REF. NO.	PART DESCRIPTION	AMPEX PART NO.
R405	RESISTOR, fixed: axial; carbon; 820 ohms; 1%; 1 watt: Electra Part No. Type DC-1	042-027
R406	RESISTOR, fixed: carbon; axial; 8.2K; 10%; 1 watt: MIL-R-11A:RC32GF822K	041-157
R407	RESISTOR, fixed: carbon; 1 meg ohm; 10%; 1/2 watt: MIL-R-11A:RC20GF105K	041-031
R408	RESISTOR, fixed: carbon; axial; 22K ohms; 10%; 2 watts; MIL-R-11A:RC42GF223K	041-216
R409	RESISTOR, fixed: carbon; axial; 1.2K ohms; 10%; 1/2 watt: MIL-R-11A:RC20GF122K	041-049
R410	RESISTOR, fixed: carbon; axial; 56K ohms; 1%; 1/2 watt: Electra Part No. Type DC-1/2	042-108
R411	RESISTOR, fixed: carbon; axial; 4.7K ohms; 10%; 2 watts: MIL-R-11A:RC42GF472K	041-209
R412	Same as R407	041-031
R413	RESISTOR, fixed: wirewound; 30K ohms; 5%; 5 watts: Dalohm Part No. Type RS-5	043-245
R414	RESISTOR, fixed: axial; carbon; 1.8K ohms: 1%; 1 watt: Electra Part No. Type DC-1	042-111
R415	RESISTOR, fixed: wirewound; radial leads; 4K ohms; 5%; 5 watts: Tru-Ohm Part No. Type FRL-5	043-169
R416	RESISTOR, fixed: carbon; axial; .47 meg ohms; 10%; 1 watt: MIL-R-11A:RC32GF474K	041-178
R417	RESISTOR, fixed: axial; carbon; 15K ohms; 1%; 1/2 watt: Electra Part No. Type DC-1/2	042-082
R418	RESISTOR, fixed: wirewound; axial; 20K ohms; 5%; 5 watts; Dalohm Part No. Type RS-5	043-244

When ordering replacement parts always include the following information: Equipment Type; Equipment Serial Number; Ampex Part or Catalog Number; and Description of Part. DO NOT simply use the schematic reference number.

REF. NO.	PART DESCRIPTION	AMPEX PART NO.
R419	RESISTOR, fixed: carbon; axial; 2.7K ohms; 10%; 1 watt: MIL-R-11A:RC32GF272K	041-151
R420	RESISTOR, fixed: carbon; axial; .1 meg ohm; 10%; 1 watt: MIL-R-11A:RC32GF104K	041-170
R423	RESISTOR, fixed: wirewound; radial leads; 200 ohms; 5%; 5 watts: Tru-Ohm Part No. Type FRL-5	043-162
R424	RESISTOR, fixed: wirewound; lug; 2K ohms; 5%; 50 watts; Tru-Ohm Part No. Type FR-50	043-012
R425	RESISTOR, fixed: axial; carbon; 22K ohms; 1%; 1 watt; Electra Part No. Type DC-1	042-045
R428	RESISTOR, fixed: axial; carbon; 39K ohms; 1%; 1 watt: Electra Part No. Type DC-1	042-048
R430	Same as R405	042-027
R431	RESISTOR, fixed: axial; carbon; 1.2K ohms; 1%; 1 watt: Electra Part No. Type DC-1	042-029
R432	Same as R401	042-024
R433	Same as R402	042-040
R435	Same as R405	042-027
R436	Same as R431	042-029
R437	Same as R403	044-036
R438	Same as R404	041-218
R439	Same as R405	042-027
R440	Same as R406	041-157
R441	Same as R407	041-031
R442	Same as R408	041-216
R443	Same as R409	041-049

When ordering replacement parts always include the following information: Equipment Type; Equipment Serial Number; Ampex Part or Catalog Number; and Description of Part. DO NOT simply use the schematic reference number.

REF. NO.	PART DESCRIPTION	AMPEX PART NO.
R444	Same as R410	042-108
R445	Same as R411	041-209
R446	Same as R407	041-031
R447	Same as R413	043-245
R448	Same as R414	042-111
R449	Same as R415	043-169
R450	Same as R416	041-178
R451	Same as R417	042-082
R452	Same as R418	043-244
R453	Same as R419	041-151
R454	Same as R420	041-170
R457	Same as R423	043-162
R458	Same as R424	043-012
R459	Same as R425	042-045
R462	Same as R428	042-048
R463	RESISTOR, fixed: carbon; axial; 100 ohms; 10%; 1/2 watt: MIL-R-11A:RC20GF101K	041-038
R464	Same as R463	041-038
R465	Same as R463	041-038
R466	Same as R463	041-038
R467	RESISTOR, fixed: carbon; axial; .15 meg ohm; 10%; 2 watts: MIL-R-11A:RC42GF154K	041-226
R468	RESISTOR, fixed: carbon; axial; 68K ohms; 10%; 1 watt: MIL-R-11A:RC32GF683K	041-168

When ordering replacement parts always include the following information: Equipment Type; Equipment Serial Number; Ampex Part or Catalog Number; and Description of Part. DO NOT simply use the schematic reference number.

REF. NO.		PART DESCRIPTION	AMPEX PART NO.
R469		RESISTOR, fixed: carbon; axial; .22 meg ohm; 10%; 2 watts: MIL-R-11A:RC42GF224K	041-228
R470		Same as R469	041-228
R471		RESISTOR, fixed: carbon; axial; 47K ohms; 10%; 1 watt: MIL-R-11A:RC32GF473K	041-166
R472		RESISTOR, fixed: axial; carbon; 270 ohms; 1%; 1/2 watt: Electra Part No. Type DC-1/2	042-169
R473		Same as R472	042-169
S401		SWITCH, rotary: 3 pole, 5 position; 1 section non-shorting; ceramic: Centralab Part No. PA2007	122-031
S402		Same as S401	122-031
R401		TRANSFORMER, power: primary; 115 volts, 50/60 cycles; secondary-1st 460 volts, center tapped at 320 ma dc.; 2nd, 600 volts, center tapped at 300 ma dc.; 3rd 6.3 volts 8 amps; 4th, 6.3 volts-4 amps; 5th, 5 volts 6 amps.	560-011
V401		TUBE, electron: 5Y3GT; octal base: RCA Part No.	012-013
V402		TUBE, electron: 6BX7; cotal base: General Electric Part No.	012-083
V403		TUBE, electron: 6CA7: Amperex Part No. EL34/6CA7	012-113
V404		Same as V401	012-012
V405		Same as V402	012-083
V406		Same as V403	012-113
V407		TUBE, electron: 5R4GYA; octal base: General Electric Part No.	012-063

When ordering replacement parts always include the following information: Equipment Type; Equipment Serial Number; Ampex Part or Catalog Number; and Description of Part. DO NOT simply use the schematic reference number.

REF. NO.	PART DESCRIPTION	AMPEX PART NO.
V408	Same as V407	012-063
	OCTAL TUBE SOCKET, modified turret	1208-00 -4 PCS
	RELAY, plate adaptor	5608-00
	ATTENUATOR, variable carbon potentiometer: 20 step; 2.3 DB/STEP; tapered to infinity on last steps: Hycor Part No. Type 100	045-013
	SOCKET, Noval turret: 9 pin: Vector Part No. 8-N-9TU	150-004 -2 PCS
	SOCKET, capacitor; for twist - prong electrolytics: Cinch Part No. 54A11897 or 2CT	150-006
	SOCKET, octal: 1 inch dia. chassis hole 1-1/2 inch mounting centers: Methode Part No. SMJ-257-140	150-012
	BASE, tubeshield: 9 pin min. sockets (noval) WNP per JAN S-28A; Elco Corp. Part No. 179	160-006
	SHIELD, tube: noval; WNP, per JAN S-28A: Elco Corp. Part No. 191	160-008
	KNOB: 1-3/4 inch skirt; 1-3/8 inch wide Harry Davies Part No. 4107-E	230-004
	KNOB: 1-1/4 inch skirt; raised pointer For 1/4 inch shaft: Rogan Bros. Part No. RB-31	230-010

When ordering replacement parts always include the following information: Equipment Type; Equipment Serial Number; Ampex Part or Catalog Number; and Description of Part. DO NOT simply use the schematic reference number.

GENERAL

The bias oscillator assembly provides the high frequency a-c bias current required to record on the linear portion of the tape characteristic. It consists of an oscillator, an amplifier stage, and a regulated d-c power supply. The bias oscillator assembly will supply sufficient current to operate twenty record head channels.

OSCILLATOR CIRCUIT DESCRIPTION

The oscillator section (V501) employs a 5687 vacuum tube connected as a push-pull colpitts oscillator. Nominal oscillation frequency of this circuit is 350 kc; the absolute frequency is not critical. The output of the oscillator is fed to the grids of two 6L6 vacuum tubes, V502 and V503, connected as a push-pull amplifier. In the plate circuit of this stage is a tuned circuit, resonant at the oscillator frequency. This circuit is tuned to resonance by variable capacitor C507, across which is connected a 680 pf capacitor (C508). If resonance cannot be achieved in the mid-range of C507 (with bias cables connected to the slave heads) it may be necessary to change the value of the padding capacitor. Use a silver mica capacitor rated at 1000 vdcw; if C507 is close to its maximum capacity increase the value of the paralleled capacitor, and if C507 is close to

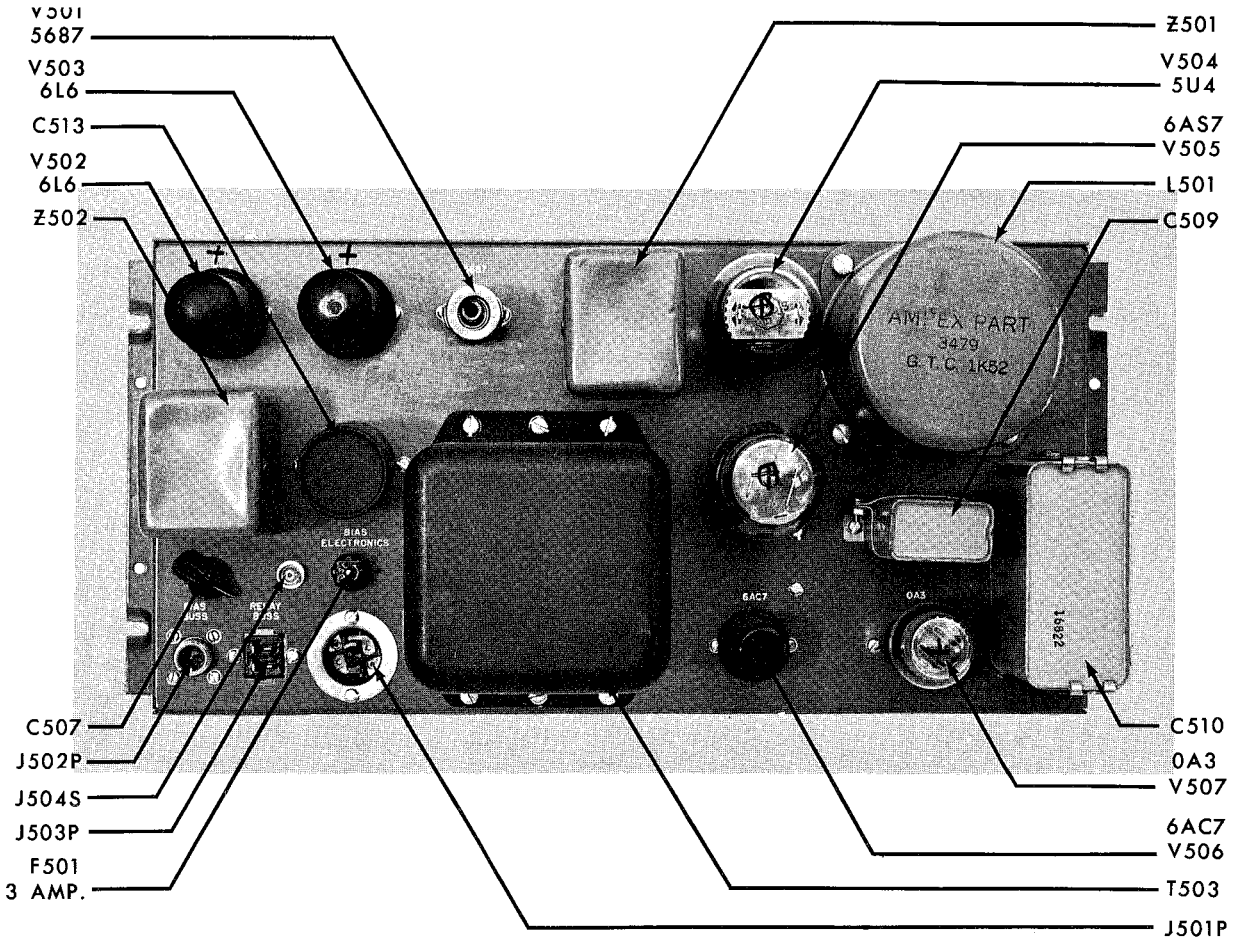


Figure 6-10 MASTER BIAS OSCILLATOR PARTS LOCATION (EXTERIOR VIEW)

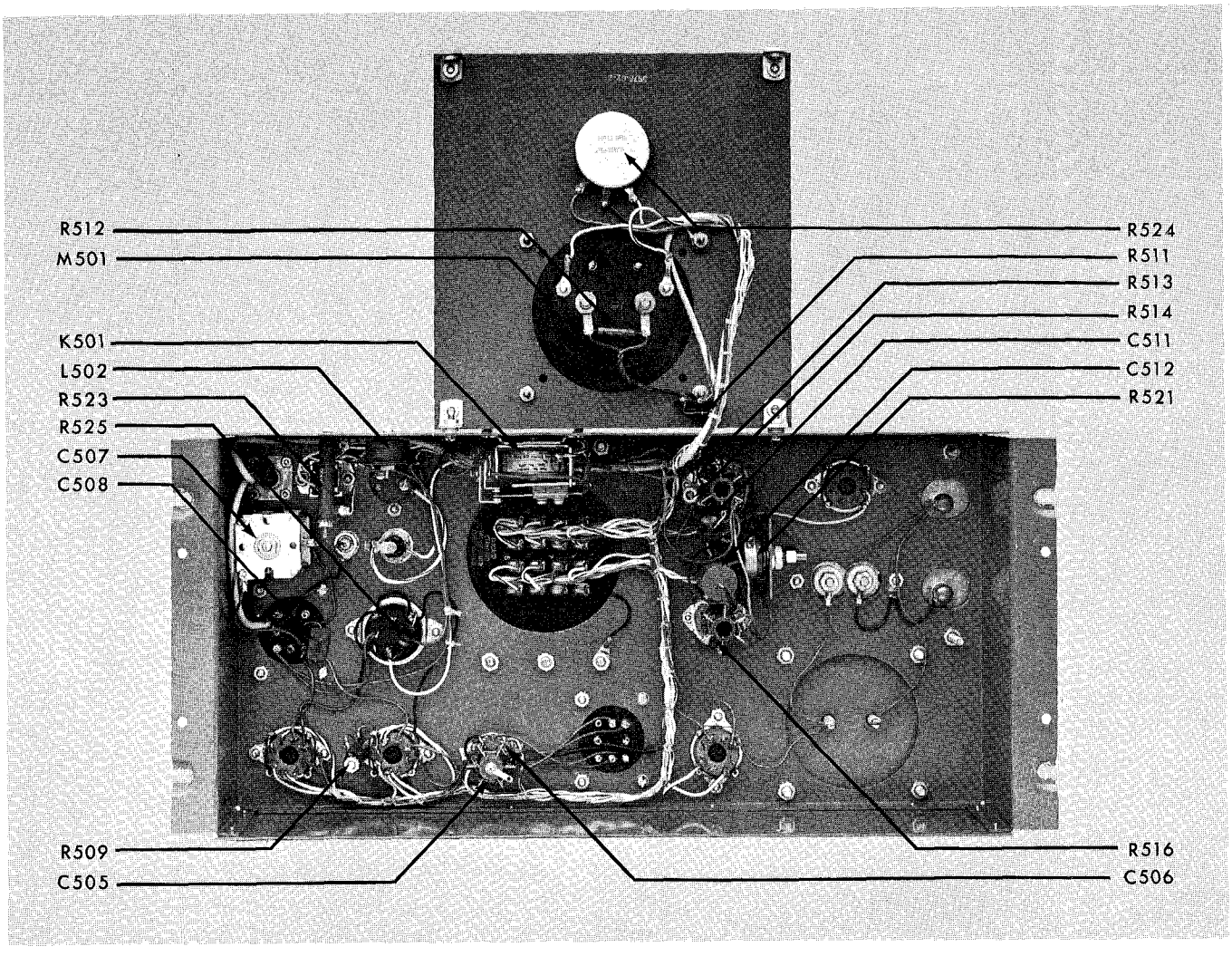


Figure 6-11 MASTER BIAS OSCILLATOR PARTS LOCATION (INTERIOR VIEW)

its minimum capacity decrease the value of the paralleled capacitor.

The power supply uses a 5U4G vacuum tube as a full wave rectifier (V504), and a conventional regulating circuit consisting of a 6AS7 vacuum tube (V505), a 6AC7 vacuum tube (V506), and a VR75 vacuum tube (V507).

Filament voltage for V501 (5687) is provided by a single 6.3 volt a-c secondary winding of transformer T503; a second winding provides 6.3 volts a-c for the filament of tube V505 (6AS7); a third winding provides 6.3 volts a-c for the filament of tube V506 (6AC7) and meter illumination lamp I501; a fourth winding provides 6.3 volts a-c for the filaments of the two 6L6's (V502 and V503).

PREVENTIVE MAINTENANCE

Remove the assembly from the console or rack, disconnecting all cables. Visually inspect it for loose or broken connections, potting material leaking from capacitors or transformers, etc. Clean the relay contacts with a burnishing tool between the normally closed contacts by pulling it back and forth several times. Clean all dirt and dust from the chassis by using a vacuum cleaner or air blower, and reinstall the assembly in the sys-

MASTER BIAS OSCILLATOR (3200-D)
CATALOG NO. 30638-01

REF. NO.	PART DESCRIPTION	AMPEX PART NO.
C505	CAPACITOR, mica: axial; .002 mfd; 5%; 500 vdcw: Elmenco Part No. CM20E202J	034-072
C506	Same as C505	034-072
C507	CAPACITOR, variable: 1200 volts ac; 7.5-100 mmfd; air gap of .030; 180° effective rotation: Hammerlund Part No. HFA-100-B	038-010
C508	CAPACITOR, mica: axial; 680 mmfd; 5%; 1000 vdcw: Elmenco Part No. VCM-2013-681J	034-152
C509	CAPACITOR, paper: rectangular; .2 mfd; 10%; 85° C; 600 vdcw: Cornell Dubilier Part No. TJU6020 Paint gray, color 1640 Per Fed. TT-C-595	036-013
C510	CAPACITOR, paper: rectangular; 10 mfd; -10 +20%; 85° C; 600 vdcw: Sprague Part No. CP70B1EF106V	036-022
C511	CAPACITOR, paper: tubular; .10 mfd; -10 +20%; 85° C; 600 vdcw: Sprague Part No. 109P10496	035-074
C512	CAPACITOR, paper: tubular; .25 mfd; -15 +40%; 85° C; twist-tab; Sprague Part No. Type DFP	035-097
F501	FUSE, cartridge: Fast blow; 250 volts; 3 amps: Littelfuse Part No. 312003	070-001
J501P	CONNECTOR, receptacle: male; 250 volts; 10 amps; twist-lock; 2 contacts: Hubbell Part No. 7466	147-013
J502P	CONNECTOR, receptacle: male; 1 contact; MS3102A-10S-2P	143-010
J503P	CONNECTOR, receptacle: male; 730 volts rms; 10 amps; 4 contacts: Jones Part No. P-304-AB	147-036

When ordering replacement parts, always include the following information: Ampex type; equipment serial number; Ampex part or catalog number; and description of part. DO NOT SIMPLY USE THE SCHEMATIC REFERENCE NUMBER.

REF. NO.	PART DESCRIPTION	AMPEX PART NO.
J504S	CONNECTOR, receptacle: female; 1 contact: UG-1094/U	142-026
K501	RELAY: 115 dc coil; 4000 ohm; 10 amp contacts; DPDT: Advance Part No. PC2C115VD	020-014
L501	CHOKE: 12 Henrys; 150 ma dc; 120 ohm dc resistance: UTC-CG-100.	3479-00
L502	COIL, R. F. Choke: 20 mh.; Miller Part No. 691	051-018
M501	METER, vu: frosted lamps; 6.3 volts; 3 amp	30667-01
R505	RESISTOR, fixed: carbon; axial; 2.2K ohms; 10%; 1/2 watt: MIL-R-11A:RC20GF222K	041-052
R506	RESISTOR, fixed: axial; carbon; .27 meg ohm; 1%; 1/2 watt: Electra Part No. Type DC-1/2	042-098
R507	Same as R506	042-098
R508	RESISTOR, fixed: carbon; axial; 47 ohms; 10%; 1/2 watt: MIL-R-11A:RC20GF470K	041-034
R509	RESISTOR, fixed: wirewound; radial leads; 125 ohms: 5%; 10 watts: Tru-Ohm Part No. Type FRL-10	043-100
R510	Same as R508	041-034
R511	Same as R506	042-098
R512	RESISTOR, fixed: axial; carbon; 10K ohms; 1%; 1/2 watt: Electra Part No. Type DC-1/2	042-081
R513	RESISTOR, fixed: wirewound; radial leads; 15K ohms; 5%; 10 watts: Tru-Ohm Part No. Type FRL-10	043-131
R514	RESISTOR, fixed: wirewound; radial leads; 7.5K ohms; 5%; 10 watts: Tru-Ohm Part No. Type FRL-10	043-125

When ordering replacement parts, always include the following information: Ampex type; equipment serial number; Ampex part or catalog number; and description of part. DO NOT SIMPLY USE THE SCHEMATIC REFERENCE NUMBER.

REF. NO.	PART DESCRIPTION	AMPEX PART NO.
R515	RESISTOR, fixed: carbon; axial; 56 ohms; 10%; 1/2 watt: MIL-R-11A:RC20GF560K	041-035
R516	Same as R515	041-035
R517	RESISTOR, fixed: carbon; axial; 1 meg ohm; 10%; 1/2 watt: MIL-R-11A:RC20GF105K	041-031
R518	RESISTOR, fixed: carbon; axial; 2.7K ohms; 10%; 1/2 watt: MIL-R-11A:RC20GF272K	041-053
R519	Same as R518	041-053
R520	RESISTOR, fixed: carbon; axial; .1 meg ohm; 10%; 1 watt: MIL-R-11A:RC32GF104K	141-170
R521	RESISTOR, variable: carbon; 25K ohms; 10%; 2 watts: Allen Bradley Part No. JU2531, SD3056	044-002
R522	RESISTOR, fixed: carbon; axial; 27K ohms; 10%; 1 watt: MIL-R-11A:RC32GF273K	041-163
R523	RESISTOR, fixed: wirewound; radial leads; 5K ohms; 5%; 10 watts: Tru-Ohm Part No. Type FRL-10	043-122
R524	RESISTOR, variable: wirewound; 50K ohms; 10%; 4 watts: Mallory Part No. M50MPK (TPR 4)	044-085
R525	RESISTOR, fixed: carbon; axial; 2K ohms; 5%; 2 watts: MIL-R-11A:RC42GF202J	041-231
R526	RESISTOR, fixed: carbon; axial; 12K ohms; 10%; 1/2 watt: MIL-R-11A:RC20GF123K	041-061
R527	RESISTOR, fixed: carbon; axial; 47K ohms; 10%; 1/2 watt: MIL-R-11A:RC20GF473K	041-068
T503	TRANSFORMER; power: 440 volts ac; 60 cycles; 6.3 volts at 3 amps; 6.3 volts at 7.5 amps; 5 volts at 3 amps: CTC Part No. PSC-165	560-006

When ordering replacement parts, always include the following information: Ampex type; equipment serial number; Ampex part or catalog number; and description of part. DO NOT SIMPLY USE THE SCHEMATIC REFERENCE NUMBER.

REF. NO.	PART DESCRIPTION	AMPEX PART NO.
V501	TUBE, electron: 5687; miniature; 9 pin; Tungsol Part No.	012-031
V502	TUBE, electron: 6L6; octal base: R. C. A. Part No.	021-005
V503	Same as V502	012-005
V504	TUBE, electron: 5U4G; octal base: R.C.A. Part No.	012-001
V505	TUBE, electron: 6AS7G; octal base: R.C.A. Part No.	012-016
V506	TUBE, electron: 6AC7; octal base: R.C.A. Part No.	012-003
V507	TUBE, voltage regulator: OA3; 75 volts dc; octal base: R.C.A. Part No.	011-003
	TURRET, octal modified socket	1208-00
	OUTPUT TANK ASSEMBLY	17796-01
	TOROID, output tank assembly	16392-01
	TURRET SOCKET, noval: 9 pin Vector Part No. 8-N-9TU	150-004
	SOCKET, capacitor: For twist-prong electrolytics, Cinch Part No. 54A11897 or 2CT	150-006
	SOCKET, octal: 1 inch dia. chassis hole; 1-1/2 inch mounting centers: Methode Part No. SMJ-257-140	150-012
	KNOB, black skirt: 1-3/4 inch skirt; 1-3/8 inch wide: Harry Davies Part No. 4107-E	230-004
	KNOB, raised pointer: 1-1/4 inch dia. skirt for 1/4-inch shaft: Rogan Bros. Part No. RB-31	230-010

When ordering replacement parts, always include the following information: Ampex type; equipment serial number; Ampex part or catalog number; and description of part. DO NOT SIMPLY USE THE SCHEMATIC REFERENCE NUMBER.

REF. NO.	PART DESCRIPTION	AMPEX PART NO.
	TUBE SHIELD, base: 9 pin; miniature; noval; WNP, per JAN S-28A: Elco Corp. Part No. 179	160-006
	TUBE SHIELD, noval: 1-15/16 inches high; fits 160-006; WNP, per JAN S-28A: Elco Corp. Part No. 191	160-008
	NUT, shaft lock: For 1/4 inch shaft; 3/8-32; Millen Part No. 10061	498-014
	OSCILLATOR COIL ASSEMBLY	17795-01
	COVER, oscillator coil	806-01
	TRANSFORMER, toroidal: 3.5 mh	16393-01
	CAPACITOR, mica: axial; .002 mfd; 5%; 500 vdcw: MIL-C-5A:CM30E202J	034-022
	CAPACITOR, mica: axial; .0003 mfd.; 1%; 500 vdcw: Elmenco Part No. CM20D301F	034-151
	RESISTOR, fixed: carbon; axial; 100 ohms; 10%; 1 watt: MIL-R-11A:RC32GF101K	041-137
	RESISTOR, fixed: carbon; axial; 10K ohms; 10%; 1 watt: MIL-R-11A:RC32GF103K	041-158

When ordering replacement parts, always include the following information: Ampex type; equipment serial number; Ampex part or catalog number; and description of part. DO NOT SIMPLY USE THE SCHEMATIC REFERENCE NUMBER.

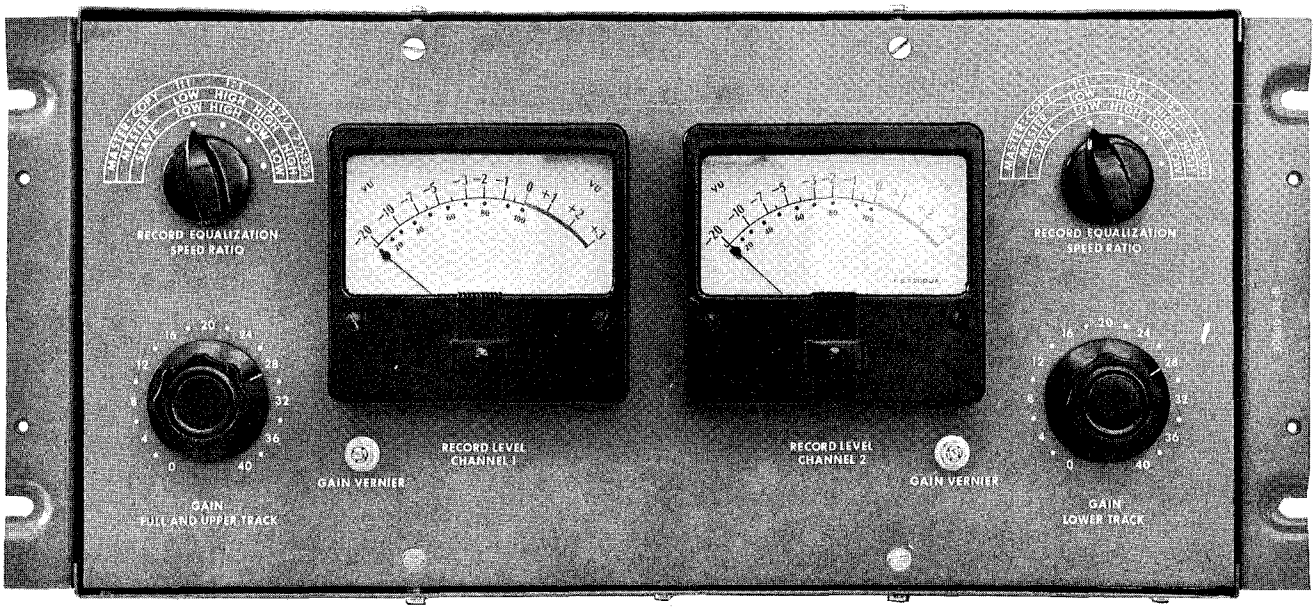


Figure 6-9 RECORD AMPLIFIER (FRONT VIEW)

tem. Check the tubes.

CORRECTIVE MAINTENANCE

If it becomes necessary to adjust the bias oscillator, proceed as follows:

Step 1: Adjust the B+ voltage on the master bias oscillator to 300 volts d-c measured at the relay side of r-f choke L502. This voltage is adjusted by a slotted shaft control behind the front panel (see Figure 6-10).

Step 2: Tune capacitor C507 for maximum output as seen on the bias panel meter. Maximum output should occur between 350 and 380 kc.

Step 3: If desired, check the oscillator frequency by Lissajous pattern.

Step 4: Connect a 250-ohm 50-watt resistor across the master bias oscillator output. Set the BIAS LEVEL control to maximum. The voltage across the resistor should be 64 volts rms.

Step 5: Disconnect the 250 ohm load and reconnect the bias oscillator output to the slave units.

Step 6: Reset the BIAS LEVEL control so that the bias output meter reads zero VU.

Step 7: If the output of the bias oscillator cannot be peaked by adjusting capacitor C507, it may be necessary to change the value of the 680 pf fixed mica capacitor (C508).

Step 8: If the Bias Oscillator output meter does not indicate +2VU when the output control is maximum, check and adjust B+ voltage as described in Step 1. Check tubes. Check bias currents at the jacks of the slave head switch panel; if they have been maladjusted the load on the bias oscillator may be excessive. This can be checked by operating the slave head switches. If everything appears to be normal, check the value of resistor R511, that is connected in series with the output meter. This 270 K, 1%, resistor is shunted by a 500K, 1%, 1/2 watt resistor (R528), to make the meter reading adequate for long cables and the maximum number of heads being used.

SLAVE SWITCH PANEL

THEORY OF OPERATION

Bias current from the master bias oscillator is fed to the heads through bias INPUT receptacle J309, capacitors C301, C302, and C303: variable resistors R302, R305, and R308; head switches S301, S302, and S303; receptacles J301, J302, and J303. The bias cable is a specially fabricated low capacity cable.

Record current is fed to the heads as follows: INPUT receptacle J307P feeds the UPPER TRACK head through variable resistor R310, fixed resistor R301, head switch S301, and receptacle J301P; FULL TRACK head through R311, R304, S302, and J302P. INPUT receptacle J308P feeds the LOWER TRACK head through variable resistor R312, fixed resistor R307, head switch S303, and receptacle J303P.

The return path of each head to circuit ground continues through the 10-ohm resistors R303, R309, and respective record current jacks J304S, J305S, and J306S.

An a-c vtvm can be used to measure the record and bias currents. To measure bias

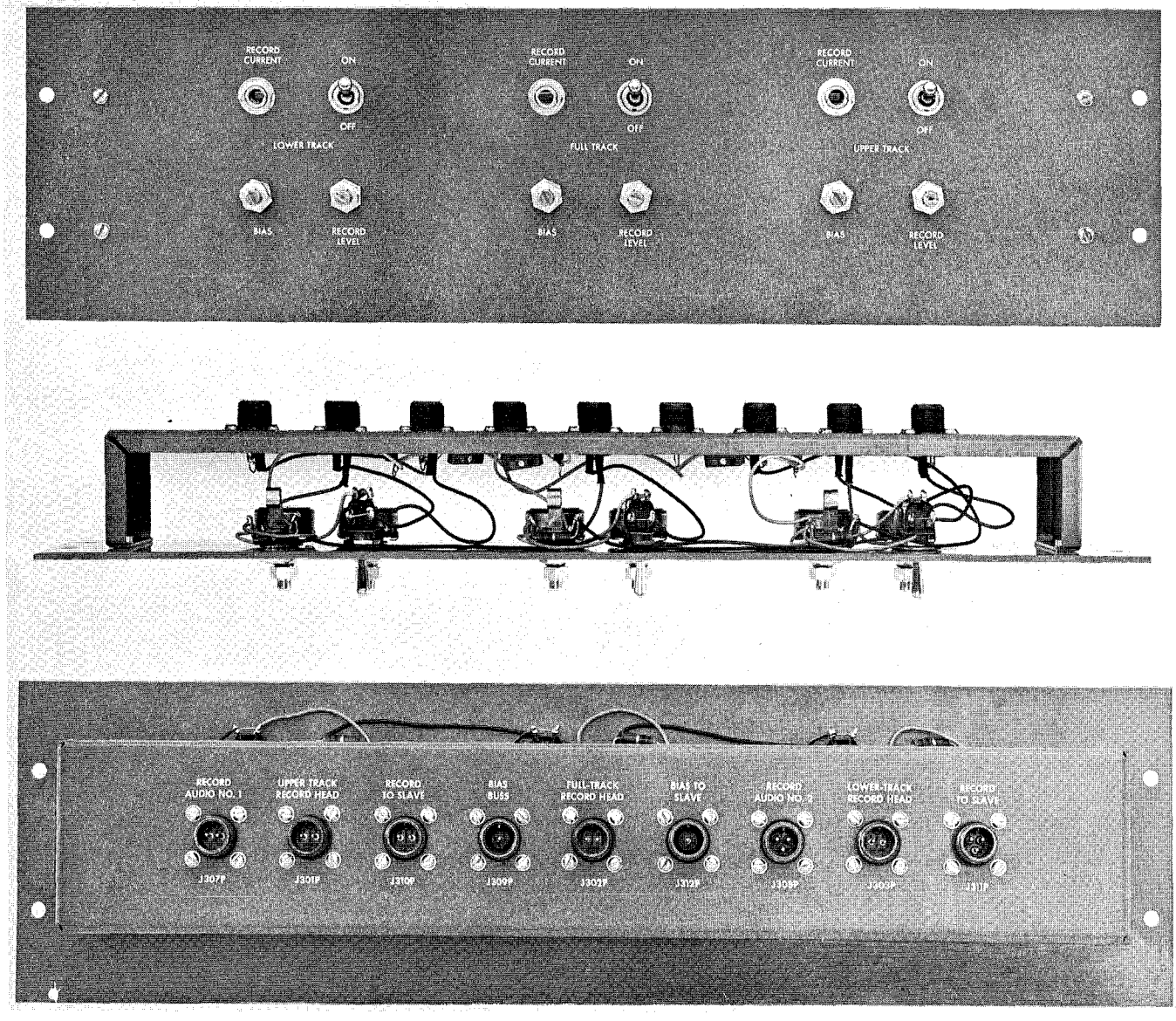


Figure 6-12 SLAVE SWITCH PANEL ASSEMBLY

current, connect the vtvm to the appropriate head current jack J304S, J305S, or J306S. Turn the level controls of the record amplifiers to zero and energize the bias oscillator, by pressing the RECORD button on the master control panel. Set the bias oscillator vu meter to read zero. Energize the appropriate head switch S301, S302, or S303. The reading on the vtvm should be approximately -18 dbm (which corresponds to 10 milliamperes of bias current). To measure record current, connect the vtvm to the appropriate head current jack (J304S, J305S, or J306S) and disconnect the bias relay plug (P503S) from the rear of the master bias oscillator. Connect an oscillator to INPUT jack J401S or J403S to the appropriate record amplifier. Set the oscillator at a frequency of 2000 cycles with an output of +4 dbm. Set the record amplifier LEVEL CONTROL to provide 0 vu level on the record amplifier meter. The vtvm reading should be approximately -42 dbm (which corresponds to 0.62 milliamperes of record current).

MAINTENANCE

If troubleshooting is required, refer to the slave switch panel schematic diagram foldout, and use a continuity meter.

SLAVE HEAD SWITCHING PANEL FOR 3200-D
CATALOG NUMBER 5997

REF. NO.	PART DESCRIPTION	AMPEX PART NO.
C301	CAPACITOR, mica: axial; .001 mfd; 10%; 500 vdcw: MIL-C-5A:CM25D102K	034-019
C302	Same as C301	034-019
C303	Same as C301	034-019
J301P	CONNECTOR, receptacle: male; 2 contacts: MS3102A-10SL-4P	143-009
J302P	Same as J301P	143-009
J303P	Same as J301P	143-009
J304S	JACK, open circuit type jack; 2 conductor: Switchcraft Part No. C-11	148-003
J305S	Same as J304S	148-003
J306S	Same as J304S	148-003
J307P	Same as J301P	143-009
J308P	CONNECTOR, receptacle: male; 3 contacts: MS3102A-10S-3P	143-008
J309P	CONNECTOR, receptacle: male; 1 contact: MS3102A-10S-2P	143-010
J310P	Same as J301P	143-009
J311P	Same as J308P	143-008
J312P	Same as J309P	143-010
R301	RESISTOR, fixed: carbon; axial; 4.7K; 10%; 1/2 watt: MIL-R-11A:RC20GF472K	041-056
R302	RESISTOR, variable: carbon; 10K ohms; 10%; 2 watts: Allen Bradley Part No. JU1031, SD3056	044-003

When ordering replacement parts, always include the following information: Ampex type; equipment serial number; Ampex part or catalog number; and description of part. DO NOT SIMPLY USE THE SCHEMATIC REFERENCE NUMBER.

REF. NO.	PART DESCRIPTION	AMPEX PART NO.
R303	RESISTOR, fixed: carbon; axial; 10 ohms; 5%; 1 watt: MIL-R-11A:RC32GF100J	041-095
R304	Same as R301	041-056
R305	Same as R302	044-003
R306	Same as R303	041-095
R307	Same as R301	041-056
R308	Same as R302	044-003
R309	Same as R303	041-095
R310	RESISTOR, variable: carbon; 25K ohms; 10%; 2 watts: Allen Bradley Part No JU2531, SD3056	044-002
R311	Same as R310	044-002
R312	Same as R310	044-002
S301	SWITCH, toggle: 6 amp, 125 volts; 3 amp, 250 volts; DPDT: Arrow H and H Part No. 81027-CB	120-004
S302	Same as S301	120-004
S303	Same as S301	120-004
	PANEL, front	5986-00
	NUT, shaftlock: 3/8-32; for 1/4-inch shaft; Millen Part No. 10061	498-014

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